Trumpet Mouthpiece Backbores: An Investigation of Interior Volume and Timbre

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Abstract

Trumpet Mouthpiece Backbores: An Investigation of Interior Volume and Timbre

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In the trumpet playing community, the total interior volume of the trumpet mouthpiece backbore is generally thought to be a major component in the timbre a trumpet produces. Generally, a backbore with a larger interior volume is thought to sound darker and a backbore with a smaller interior volume is thought to sound brighter. As defined in this research, the total interior volume of the trumpet mouthpiece backbore does not have a strong correlation to the timbre a trumpet produces. However, the shape of the backbore does have a strong correlation to the timbre of the trumpet. Exploring the relationship of trumpet mouthpiece backbores and the timbre of the trumpet is the basis of this research.

Many mouthpiece manufacturers describe backbores with larger interior volumes as sounding darker than backbores with smaller interior volumes. Twelve different backbores from trumpet mouthpieces currently in production and available from various manufacturers were copied for testing and discussion in this study. Five different trumpet players with varying areas of specialization and degrees of development were used for the testing. Three frequencies were tested: 233 Hertz, 466 Hertz, and 932 Hertz. Each frequency was tested at three dynamics as perceived by the players: *piano, mezzo forte*, and *forte*. Other than changing backbores, all the testing was done with the same equipment and method.

The harmonic components, or spectrum, of the trumpet sound for each test was analyzed to describe timbre. An oscilloscope was used to convert the sound waves into harmonic spectrums. In this study, the method of describing timbre uses the harmonic spectrums in three ways. The first description of timbre uses the ratio of the peak harmonic to the total harmonics in the sound. The second description of timbre uses the ratio of the odd harmonics to even harmonics in the sound. The third description of timbre presents the harmonics in a line graph. Each method of describing timbre was compared to total interior volume of the backbores and analyzed for any correlations. There were moderate correlations of the total interior volume and the odd to even harmonic ratio on the 233 Hertz frequencies at *mezzo forte* and *forte* and on the 466 Hertz frequencies at *piano* and *mezzo forte*. These correlations were not strong correlations.

The interior shape of the backbores was also compared to the timbre. The shape of the backbores was described by dividing the backbores into five segments of the same length and finding the interior volume of each segment. Comparing the interior volumes of each segment generally describes the rate of taper, or shape, of the backbore. The shape of the first three segments (small end) had a strong correlation to timbre. The middle of the backbore, segment three, had a strong correlation to the timbre as described as a ratio of peak harmonic to total harmonics at the 233 Hertz and 932 Hertz frequency at *mezzo forte*. The middle-small end of the backbore, segment two, has strong correlations at the 466Hz frequency at *piano* and *mezzo forte*. The small end of the backbore, segment one, has strong correlations at the 466 Hertz frequency at *piano* and *mezzo forte*. In general, as the rate of taper in the middle section of a backbore increases the timbre gets darker; conversely, as the taper decreases the timbre gets brighter, in the lower and upper registers. When the rate of taper of the small-middle end of the backbore is increased, the timbre of the trumpet gets brighter in the middle register. When the rate of taper of the small-middle end of the backbore is decreased, the timbre of the trumpet gets darker in the middle register. When the rate of taper of the small end of the backbore is increased, the timbre gets brighter in the middle register. When the rate of taper of the small end of the backbore is decreased, the timbre gets darker in the middle register. The shape of the backbore has a strong correlation to timbre.

The information in this study differs from the general belief in the trumpet community that larger trumpet mouthpiece backbores have a darker timbre, and smaller backbores a brighter timbre. The information begins to specify what aspects of backbore design are responsible for timbre. Also, the methodology is a departure from only using audio descriptors as a means to communicate about and describe timbre, and trial and error as a means to select and design equipment.

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Dedication

I would like to dedicate this work to the inspiration of creative and original work throughout my entire life from my father, Michael G. Frost.

Chapter I

Introduction / Problem / Purpose

The purpose of this research is to investigate if the interior volume of the trumpet mouthpiece backbore correlates to the timbre of the trumpet. This research will also introduce a methodology of how the trumpet community could begin communicating and understanding trumpet timbre as related to equipment choice. In this study, the timbre of the trumpet is measured in three ways: by the ratio of the peak harmonic to the total harmonics, the ratio of the odd to even harmonics, and by line graphs of the harmonics.

The trumpet mouthpiece backbore is not a well-researched and understood component of the mouthpiece, or of the mouthpiece-trumpet system. The General Manager of Marcinkiewicz Co. Inc., Zack Marcinkiewicz, in a phone interview[1] with the author used auditory descriptors to describe the changes in timbre that would be the result of changing the interior volume of the backbore. In his opinion, the interior physical volume of the backbore related to the timbre of the trumpet. He also placed an importance on the interior shape of the backbore in relation to timbre. He went on to clarify that manufacturers use auditory descriptors in describing their products even though they may be interpreted differently by different people. He expressed that the auditory descriptors are more or less consistent within a single manufacturer, but not necessarily from one to another.[2] There is an opportunity to investigate if the interior volume and the interior shape of the backbore correlate to the trumpet timbre or if the interior volume or interior shape alone are most responsible for timbre. Also, there is an opportunity to introduce a methodology of describing timbre based on analysis of the

[1] Other manufacturers were inquired, but did not comment.
[2] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

harmonic components of the trumpet sound. The methodology introduced in this study could be the beginning of finding a way for players and manufacturers to more accurately communicate about timbre and about how timbre is created in relation to the backbore.

Different opinions of the effect of the backbore interior volume are expressed from different mouthpiece manufacturers. The most generally accepted concept is that a larger total interior volume creates a darker timbre and a smaller interior volume a brighter timbre. As measured in this study, the author found the total interior volume of the backbore has a slight, but not significant, correlation to timbre and that the interior shape of the backbore does have a significant correlation to timbre.

Trumpet Mouthpiece Backbore

The trumpet mouthpiece backbore is the interior of the shank end of the mouthpiece, which inserts into the trumpet leadpipe receiver. The backbore (interior taper) transitions the throat of the mouthpiece to the leadpipe of the trumpet. The throat is the narrowest, in diameter, internal section of the mouthpiece (in this study 0.144 inches), see Figure 1. It is cylindrical, and relatively short in comparison with the length of the backbore. The leadpipe has an interior taper that is, in effect, a continuation of the backbore taper. The leadpipe, in most trumpets, reaches the full bore size (final diameter of the tubing) of the trumpet (0.459 inches in this study). The mouthpiece backbore contains the greatest rate of taper of the backbore-leadpipe overall taper. The leadpipe receiver has an interior straight taper that matches the exterior taper of the mouthpiece shank (morse taper). The leadpipe receiver and shank of the mouthpiece mate the internal tapers of the backbore and leadpipe.

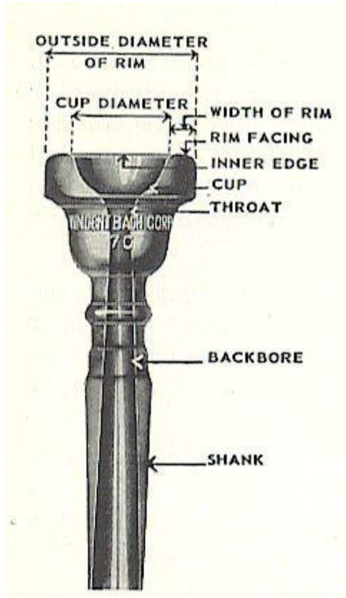

Figure 1
A labeled mouthpiece[3]

The backbore is generally thought to influence the timbre of the trumpet. The backbore also affects other characteristics of the trumpet, but this discussion focuses on timbre. This is general knowledge evident from the materials of various manufacturers who have literature about their products.[4] The information presented by mouthpiece manufactures, however, is general and based primarily on auditory descriptors that may mean different things to different people. There are also some correlations drawn, such as interior volume to timbre. Currently, a trumpet player wishing to make backbore equipment choices has broad general descriptors and advice based on trial and error with which to guide his or her choices. There is an opportunity to investigate the backbore

[3] Vincent Bach, *Embouchure and Mouthpiece Manual* (Mount Vernon, N.Y.: Vincent Bach Corporation, 1954), 26.

[4] Manufacturers such as: Greg Black Mouthpieces, Warburton Music Products, Vincent Bach Mouthpieces, Curry Mouthpieces, Laskey Mouthpieces, Karl Hammond Mouthpieces, Monette Corp., Kanstul, Marcinkeiwicz, GR Mouthpieces, among others.

and discuss how it affects timbre in terms that are more definitive and universal to all trumpet players and mouthpiece manufacturers.

Greg Black Mouthpieces uses the following descriptions for their backbores:

> #1 A tight backbore that provides a brilliant sound.
> #2 A backbore that provides resistance yet provides a lively sound.
> #3 Can be used for different situations. Very even from top to bottom.
> #4* A tighter version of the #4.
> #4 Open enough to give a full, broad sound.
> #4*O A more open version of the #4.
> #5* A tighter version of the #5.
> #5 Has power with less resistance to provide a bright tone.
> #5*O A more open version of the #5.
> #6 A medium sized, full sounding backbore. Excellent for a variety of styles.
> #7 Provides full, warm sound for all around work.
> #8 A smaller, yet dark, symphonic sound. "Schmidt" style.
> #8*O A more open version of the #8 backbore. The upper part of the backbore is altered/opened by introducing a partial “#87” shape.
> #9 A medium sized symphonic backbore that is centered and dark. (a downsized “#24” style)
> #9*0 A more open version of the #9, sized right in between the #9 and #10.
> #10 A bigger, darker symphonic sound. Excellent for orchestral work. (a full “#24” style)
> #11 Big and free blowing to help in the upper register. Designed for piccolo use. (“#117” Style)
> #12 Very open and free blowing. Sounds extremely dark. (“#87” Style)[5]

The descriptors and correlations that can be drawn from the literature are general and could be interpreted in a variety of ways by different people. The association that “more open” backbores are “darker” sounding is made. Greg Black states, “#12 Very open and free blowing. Sounds extremely dark.” And conversely, “tighter” backbores are more “brilliant.” He also states, “#1 A tight backbore that provides a brilliant sound.” In this instance, it seems to the author that “more open” indicates a larger interior volume and darker timbre, and “tight” indicates a smaller interior volume and brighter (brilliant)

[5] *Greg Black Mouthpieces* [Web site] (2012); available from www.gregblackmouthpieces.com; Internet; accessed 21 July 2012.

timbre. It is possible that “more open” and “tight” refer only to resistance when a player blows through the mouthpiece, but it is not made clear.

Warburton Music Products describes the process of finding a suitable backbore once a cup has been selected:

> Using the cup selected, try a tighter backbore (one with a lower number), then one that is more open (one with a higher number). There will be a noticeable difference in the way it blows as well as in the way it sounds. This will give you a good idea of which direction to move to find a backbore that will suit your needs. While the Star (*) series backbores may feel more free blowing, depending on the player, these backbores may not focus as well as the standard series. This will be a personal choice.[6]

In the author’s phone interview with Zack Marcinkiewicz, Marcinkiewicz discussed his philosophy that different backbores will produce different timbre characteristics based on what cup and throat they are matched to. For example, a larger interior volume backbore will have a more pronounced affect on making timbre darker on a large cupped mouthpiece than it will on a shallow cupped mouthpiece. In his opinion, the cup, throat, and backbore relationship are such that they must be considered as an integral unit.[7] Marcinkiewicz Co. Inc. does not offer mouthpiece parts that work with the Warburton Music Products Modular System of interchanging parts for this reason. The philosophies of these two manufacturers differ in how a mouthpiece should be chosen, but they share the same general view that interior volume of the backbore affects timbre. This research is not to diminish the value of the trial and error method of finding an appropriate mouthpiece or backbore, or to strictly identify descriptors used. It does intend to investigate if the internal volume of the backbore significantly correlates to the timbre of

[6] *Warburton Mouthpieces* [Web site] (2012); available from www.warburton-usa.com; Internet; accessed 21 July 2012.

[7] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

the trumpet and to introduce a methodology that could quicken the process of trial and error in selecting mouthpieces or mouthpiece components.

The David G. Monette Corp. also uses similar terminology in their descriptors: "Appropriately named, Prana mouthpieces provide more brilliance and color in the sound, a more open, centered and effortless response, and a noticeably easier upper register! They also provide improved intonation and an overall ease of playing not found in even standard Monette mouthpieces."[8] This wording "more brilliance and color in the sound, a more open…response" suggests that a more open mouthpiece can also have more brilliance. This opposes the correlations taken from Greg Black Mouthpieces and Marcinkiewicz Co. Inc. indicating that "more open" would correlate to "darker," and not having "more brilliance." It also suggests that a mouthpiece or backbore could be designed in a way that the timbre is independent (or less reliant on) the blow resistance. Discussing and finely correlating timbre to descriptors is beyond the scope of this research. This research will investigate timbre as described from analyzing harmonic components. Analyzing harmonic components is a way to measure and compare timbre that is less reliant on the perception of people.

Some research on timbre and categorizing audio descriptors has already been done. Peeters *et al.* published a research paper, "The Timbre Toolbox: Extracting audio descriptors from musical signals," about establishing a basis of musical timbre perception.[9] The author of this study's research is aiming to correlate the relative level of

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[8] *Monette Corp*. [Web site] (2012); available from www.monette.net; Internet; accessed 21 July 2012.

[9] Geoffry Peeters, *et al*., "The Timbre Toolbox: Extracting audio descriptors from musical signals" *The Journal of the Acoustical Society of America, Vol. 130, no. 5* (November 2011): 2902.

harmonics in the sound to interior volume of the backbore, a way of correlating interior volume to timbre, and not to define audio descriptors. Timbre is complex in how it is perceived. The term 'timbre' encompasses a set of auditory attributes of sound events in addition to pitch, loudness, duration, and spatial position. Psychoacoustic research has modeled timbre as a multidimensional phenomenon and represents its perceptual structure in terms of 'timbre spaces.'"[10] This research discusses timbre as the level of the peak harmonic in relation to the total harmonics and the odd to even harmonics. It holds pitch, loudness, and duration as a perceived constant to the tester. Thus, the results may or may not align exactly to what a human ear may perceive because the research is only comparing harmonics and interior volume. Additionally, the ear and brain are not as sensitive, or sensitive in a different way, as the test equipment used, particularly above the 6^{th} or 7^{th} harmonic.

On their web site, Marcinkiewicz Co. Inc., uses the discussion of harmonics in describing the sound of backbores,

> Perhaps the second most critical area of a mouthpiece, the backbore either spreads the sound or channels it depending on how tight or open the design. The backbore influences the color, nuance and timbre of the mouthpiece. If you put a large backbore with a large cup mouthpiece the result will be a very warm, compassionate mouthpiece with feeling and depth of sound. The same mouthpiece with a tighter backbore will focus the sound that is being created, equalizing the lower end and accenting the upper end of upper harmonics. Our backbore designs enhance the player's ability to move easily throughout all registers of the instrument with uniformity of timbre and feel. Please note that the wrong backbore can make the mouthpiece play sharp or flat.[11]

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[10] Peeters, Geoffry, *et al.*, "The Timbre Toolbox: Extracting audio descriptors from musical signals" *The Journal of the Acoustical Society of America Vol. 130, no. 5* (November 2011): 2902.

[11] *Marcinkiewicz* [Web site] (2012); available from www.marcinkiewicz.com; Internet; accessed 21 July 2012.

Marcinkiewicz used the terms "spread" and "channel" when referring to the timbre change of the backbore when the interior volume differs. "Channel" was correlated to a tighter backbore, or smaller interior volume, that would increase the upper harmonics in the sound in relation to the lower harmonics. In the author's interview with Marcinkiewicz, he compared the term "channel" to "brighter."[12] From this information the author would correlate a timbre made up of many harmonics that are close in power to be a bright or channeled sound. Likewise, the author would correlate a timbre made up of fewer harmonics that have much of the harmonic power in the lower harmonics to be dark or spread. This research aims to describe the presence of harmonics as a comparable number, a ratio, and how that relates to Marcinkiewicz's, and others', description of backbore interior volume relating to timbre.

Mouthpiece maker, Vincent Bach, created a manual to assist in the use of his mouthpieces. The early Bach manual does not discuss how timbre directly relates to the backbore,

> The back-bore of a mouthpiece is also very important and bears a certain relationship to the rim, cup shape, and throat and even more to the make and bore of the instrument on which the mouthpiece is to be used. We have hundreds of different back-bore reamers of which each one will enable the player to produce a different tone quality, also a different intonation. While we have certain standard bores which are suitable for most instruments, we generally prefer to have our customers tell us what make of instrument they use so we can not only supply them with a mouthpiece having the correct size of shank, but also one which will offer the best intonation. Some instruments may be very flat in the high register and we can, to a certain extent, compensate for that by supplying a bore which will "stretch" the register, making the high tones a little sharper against the lower octave. If the back-bore of a mouthpiece is too small, the high register will not respond easier but will be "stuffy" and generally too flat. If the back-bore of a

[12] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

> mouthpiece is too large, the mouthpiece will not have sufficient resistance and the player's embouchure will become exhausted after a brief period of playing.[13]

With this information, while it is apparent that the backbore changes the sound, there is no information in how it changes the sound. Marcinkiewicz discussed with the author the effect of the trumpet when comparing backbores. He felt that, like his opinion on the relationship of the cup, throat and backbore, that the relationship of the backbore (and mouthpiece) with the trumpet was integral. He feels that a mouthpiece or backbore will behave differently when used in different trumpets. At the same time however, he also agreed with the author that to get specific information about one component of the system, keeping all the components of the system constant, other than the component being tested, is important. He did add that further work could be done, including multiple trumpets in a study to get further results that would apply more to the real world.[14] This research investigates the harmonic components of the timbre while using one trumpet and interchanging backbores, and does not measure or factor in blow resistance or pitch.

These mouthpiece manufacturers' methods are perfectly suitable ways of finding an equipment set-up that works for a player, but they are seemingly based on trial and error. While it may work well, it could work better and use a methodology that would allow easier and more accurate communication within the trumpet playing community. The methodology of using more quantifiable information from this study is perhaps leading to a new way to more accurately select equipment and to design it. The problem as Thomas Moore, associate professor of physics at Rollins College, describes it is that, "When two different players use a term, they may not mean the same thing. But right

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[13] Vincent Bach, *Embouchure and Mouthpiece Manual* (Mount Vernon, N.Y.: Vincent Bach Corporation, 1954), 33.

[14] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

now, we have no way of knowing that. In fact, since the same horn can be described differently by different people, there is currently no way for scientists to actually communicate with artists, and I often think that, in reality, there is no way for artists to communicate among themselves."[15] In this study, researching timbre as expressed through analyzing harmonics, and looking for correlations to the interior volume of the backbore, is investigated. This study also introduces a methodology that could begin to change how the trumpet community communicates about timbre.

[15] Thomas Moore, "The Vocabulary of Response" *International Trumpet Guild Journal* (January 2004): 54.

Chapter II

Background

In general, musical instruments have identifying timbres or tone qualities associated with them. In more detail, like instruments have slight variations within their characteristic timbre. The relationship of the harmonic components to each other in a sound are important in the timbre. The harmonic components of an instrument's sound and the relationship of those harmonics to the peak harmonic (the strongest) are important in the variations of an instrument's sound. Kenneth Berger wrote, "Timbre is usually said to be determined by the relative strengths of that instrument's partials."[1] While other components of a musical sound are important; for example, attack and decay, this study will only be discussing the strength of harmonics and their relationship to each other.

The harmonics in the sound of the trumpet are most often larger in amplitude than the fundamental. John Backus explains, "When the trumpet is blown, its radiated sound output has a complex waveform in which the amplitudes of some harmonics may be as large or larger than the amplitude of the fundamental."[2] The timbre of the trumpet relies mostly on the harmonics because there are so many present in the sound, and they are often larger than the fundamental. The analysis of a trumpet sound reveals that it is easy to detect up to the fifteenth harmonic, and often more. Above the eighth harmonic, though, the power of the harmonics is very small, hardly registering in comparison to the

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[1] Kenneth W Berger, "Some Factors in the Recognition of Timbre" *The Journal of the Acoustical Society of America*, *Vol. 36, no. 10* (October 1964): 1888.

[2] John Backus, and Hundley, T.C., "Harmonic Generation in the Trumpet" *The Journal of the Acoustical Society of America, Vol. 49, no. 2* (1971): 509.

largest harmonics. The presence and balance of these harmonics is what gives the trumpet its sound.[3] The harmonics often carry more power than the fundamental; there are many of them and some are larger in amplitude than the fundamental. This is primarily in the middle and lower frequencies of the trumpet. Thomas Moore states, "One generalization that can confidently be made is that there is always more sound power contained in the harmonics than there is in the fundamental frequency. Furthermore, except in very rare instances, the fundamental is not the most powerful frequency component in the spectrum."[4] Analyzing the harmonics, beyond the fundamental, is important in comparing timbre because much of the power of the sound is contained in the harmonics.

The harmonic spectrum of the trumpet, however, is such that the notes in the staff, and below the staff, result with the most harmonics. The upper notes, above the staff, in general, contain fewer harmonics. Moore states, "We have studied the sound of several trumpet players playing above the staff, it is almost universally true that the majority of the sound power is found in the fundamental frequency, not in the harmonics. Thus an E5 in the staff and an E6 above the staff have completely different timbres. The lack of power in the harmonics for very high notes gives these notes less "body" than the lower notes, so in addition to being harder to play,

[3] Thomas Moore, "What Note Are You Really Playing?" *International Trumpet Guild Journal* (June 2008): 70.

[4] Ibid.

they are much harder to play well."[5] Figure 2 is a typical spectrum of a trumpet, indicating the strength of the harmonics in the middle register and the weakening of the harmonics in the upper register.

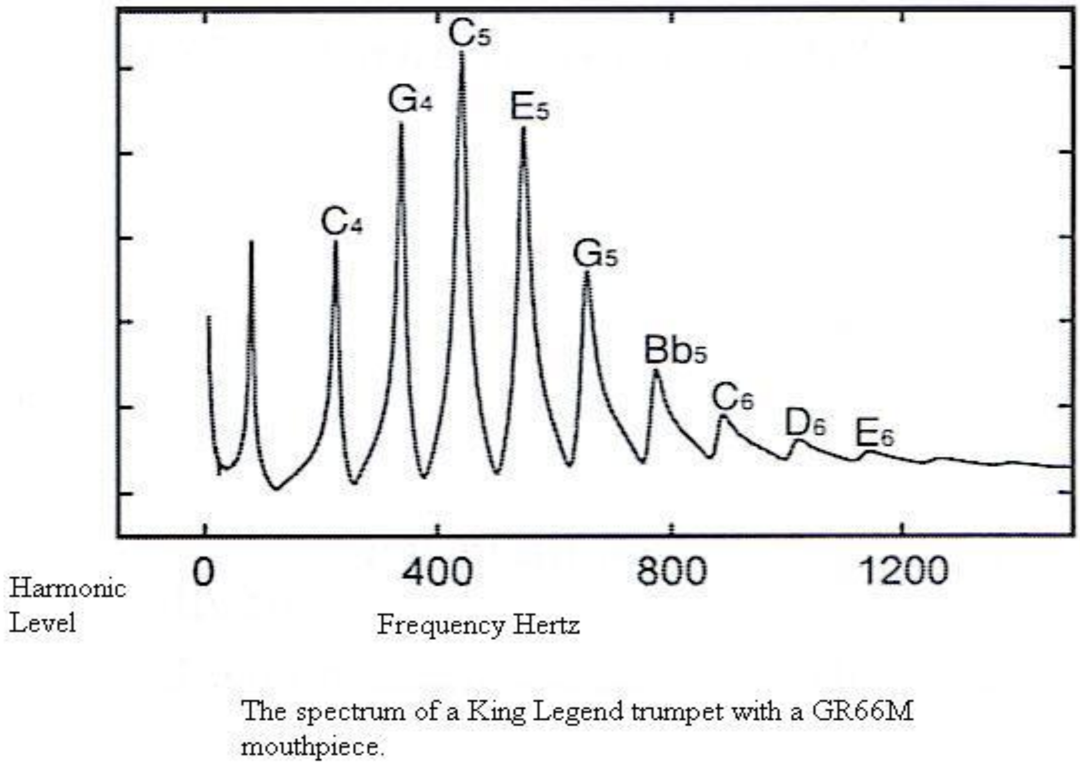

Figure 2
Trumpet Spectrum[6]

To best compare timbre from a trumpet while changing one component of the mouthpiece-trumpet system, the same frequencies must be compared. Strictly comparing timbre between different frequencies is not useful, due to the natural change in timbre with register in the trumpet. Moore's statements held true in this study. On the 932Hz

[5] Thomas Moore, "The Science of Playing Above the Staff" *International Trumpet Guild Journal* (October 2008): 76.

[6] Thomas Moore, "What is Impedance and Why Do We Care?" *International Trumpet Guild Journal* (October 2002): 71.

frequency, with all of the backbores tested, the fundamental was the strongest, as opposed to the 233Hz frequency, where the fundamental was not the strongest with any of the backbores.

The trumpet has a natural harmonic spectrum, which can be influenced to some degree by the player. The player is an important variable in the timbre of a trumpet. Moore states, "While I cannot give you a scientific explanation for the fact, our experiments have shown that an amateur player plays high notes with almost all of the power in the fundamental and very little power in any of the harmonics. On the other hand, when a semi-professional player plays notes above the staff, the fundamental contains the most power, but there is a significant amount of power in the first four harmonics. The interesting thing, however, is that when a world-class trumpet player plays above the staff, most of the power is in the harmonics, and the second harmonic can have more power than the fundamental."[7] The author found in this study that the more advanced players had more harmonics in their sound, as Moore states. However, on the 932Hz frequency, the fundamental was the strongest on all but one backbore. 932Hz is a fifth above the top of the staff; it is possible the notes below 932Hz (C above the staff) could contain harmonics stronger than the fundamental. While register has an impact on the harmonics of a frequency, the player also does. In this research, the author chose to use five trumpet players with varying levels of focus and in various levels of development, and averaged the results in an effort to best represent the broad trumpet playing community.

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[7] Thomas Moore, "The Science of Playing Above the Staff" *International Trumpet Guild Journal* (October 2008): 83.

A main component in the variance of trumpet players is the embouchure, in particular the lips that vibrate in the mouthpiece cup. Research by Yoshikawa has shown that the lips change motion with register. In the low register the lips move primarily outward, and in the higher register the lips move primarily upward. This is supported by the generally believed thought that shallow cup mouthpieces do not play as well in the low register. The lip has less room to move outward and can bottom out or touch the bottom of the cup, restricting movement. There is a "change in waveform when the oscillation shifts from the lowest (second) mode to higher modes."[8] Both the oscillation of the lips and the waveform in the trumpet change with register. Yoshikawa adds that mouthpiece pressure is also a possible contributor in the use of the embouchure, narrowing the lip opening and affecting the Bernoulli Effect.[9] The Bernoulli principle states that in a fluid flow situation (such as water or air), the pressure in the moving fluid is lower at places where the speed of flow is greater than at places where the flow is slower. An example is the inward movement of a shower curtain during a shower. Hot air from the hot shower water rises, moving quickly, creating low pressure while the cold air outside the shower curtain is nearly stagnant, creating relatively higher pressure. The result is the shower curtain is pushed inward towards the hot air. Similarly, an airfoil works the same way. The bottom of an airplane wing is flat (in general) and the top is curved. Air moves faster over the top of the wing than under the bottom. The faster air has less pressure, and the wing has lift. Whatever the contributor, the result is that the lips move primarily outward in the low register and upwards in the upper register. The

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[8] Shigeru Yoshikawa, "Acoustical behavior of brass player's lips" *The Journal of the Acoustic Society of America, Vol. 97, no. 3* (March 1995): 1937.

[9] Ibid.

strict cause of change of lip motion is not known. Marcinkiewicz discussed with the author the varieties of players and their embouchures. He felt that the embouchure is one of the reasons why the rim, cup, and throat are so important in a mouthpiece design. He agreed that having the same rim, cup, and throat in the study standardized the variables as best that could be done in a real-world setting, but that additional work could be done with different rims, cups, and throats.[10] The author accepts that each trumpeter doing the testing has a unique sound, embouchure, and lip engagement. The averaging of the five players helps minimize bias of one player's particular sound.

Research by Adachi and Sato follows Yoshikawa's research in the motion of the lips, and thus the importance of embouchure in the timbre of the trumpet. "A player's embouchure drastically varies the constraints on the lips for the frequency, sound level and spectrum of sound."[11] As frequency rises, the Bernoulli Effect seems to happen and be a factor in the transition of the lips changing movement. As the register being played is changed, the movement of the lips changes. Adachi and Sato suggest that the embouchure has an impact on the rate of transition of the outward movement of lips in the cup in the low register to the upward movement of the lips in the high register.[12] To specifically compare the timbre of the trumpet in a way applicable to most players, multiple players were used and the results averaged. Using multiple players in comparing trumpet sounds prevents the uniqueness of one player's embouchure having an overwhelming effect on the results. This research aims to have as few variables as

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[10] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

[11] Seiji Adachi, and Masa-aki Sato, "Trumpet sound simulation using a two-dimensional lip vibration model" *The Journal of the Acoustical Society of America, Vol. 99, no. 2* (February 1996): 1200.

[12] Ibid., 1200-1201.

possible while being as specific as possible in the comparison, and at the same time being applicable to the trumpet playing community.

For a direct comparison of trumpet mouthpiece backbores, the same trumpet mouthpiece cup must be used. The amount that the lips penetrate into the mouthpiece cup varies. Additional research by Charles Macaluso states, "When the trumpet is played, the player's lips penetrate into the mouthpiece cup. The magnitude and detailed configuration of such lip penetration vary with the player and the mouthpiece."[13] This is important because the amount of lip penetration dictates the volume of the cup, or the volume "free" in the cup that the lips do not occupy. "All harmonics of all fundamental tones can resonate in an air column with perfect harmonicity only when each fundamental tone is produced using the same value of average lip penetration."[14] Using the same mouthpiece cup with multiple players helps produce a representational amount of lip penetration of the trumpet playing community when comparing different backbores. "The magnitude of the lip penetration effect is very significant."[15] This study uses a mouthpiece cup that is on the larger end of the spectrum of trumpet mouthpieces in terms of diameter and interior volume. As Marcinkiewicz discussed, continuing to do further work with other cups would be valuable, but starting with one cup is a

[13] Charles A. Macaluso, and Jean-Pierre Dalmont, "Trumpet with near-perfect harmonicity: Design and acoustic results" *The Journal of the Acoustical Society of America, Vol. 129, no. 1* (January 2011): 405.

[14] Ibid.

[15] Ibid., 406.

beginning.[16] Reducing the lip/cup variable as much as possible and averaging the sounds from the five players produces a truer result of the effect of the backbore.

The overall tube shape of a trumpet is important in the harmonics produced. A tube without a bell produces mainly odd harmonics when buzzed in one end. As an example, the clarinet, which has a "hollow woody" sound, is primarily cylindrical over its length and its sound is primarily made up of odd harmonics. The trumpet, which is mostly cylindrical, produces even and odd harmonics primarily because of the shape of the bell, and to a lesser extent, the shape of the mouthpiece. The shape of the bell allows the trumpet to effectively be many lengths at the same time. The opening of the bell controls how far, along the shape, a particular frequency travels. Thus, the harmonics, both odd and even, can exist in the same tube. The specifics of the bell taper influences where the harmonics resonate and how in tune they are.[17] Due to the sudden and quick diameter change in the bell, the sound wave is reflected. Each length of wave is reflected at a different spot along the shape of the bell due to the correlating wave length and rate of change in bell diameter. Figure 3 illustrates how far varying wave lengths travel out the bell before they are reflected. Higher frequencies travel further out the bell than lower frequencies.

[16] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

[17] Thomas Moore, "The Lowly Pedal Tone" *International Trumpet Guild Journal* (January 2008): 64.

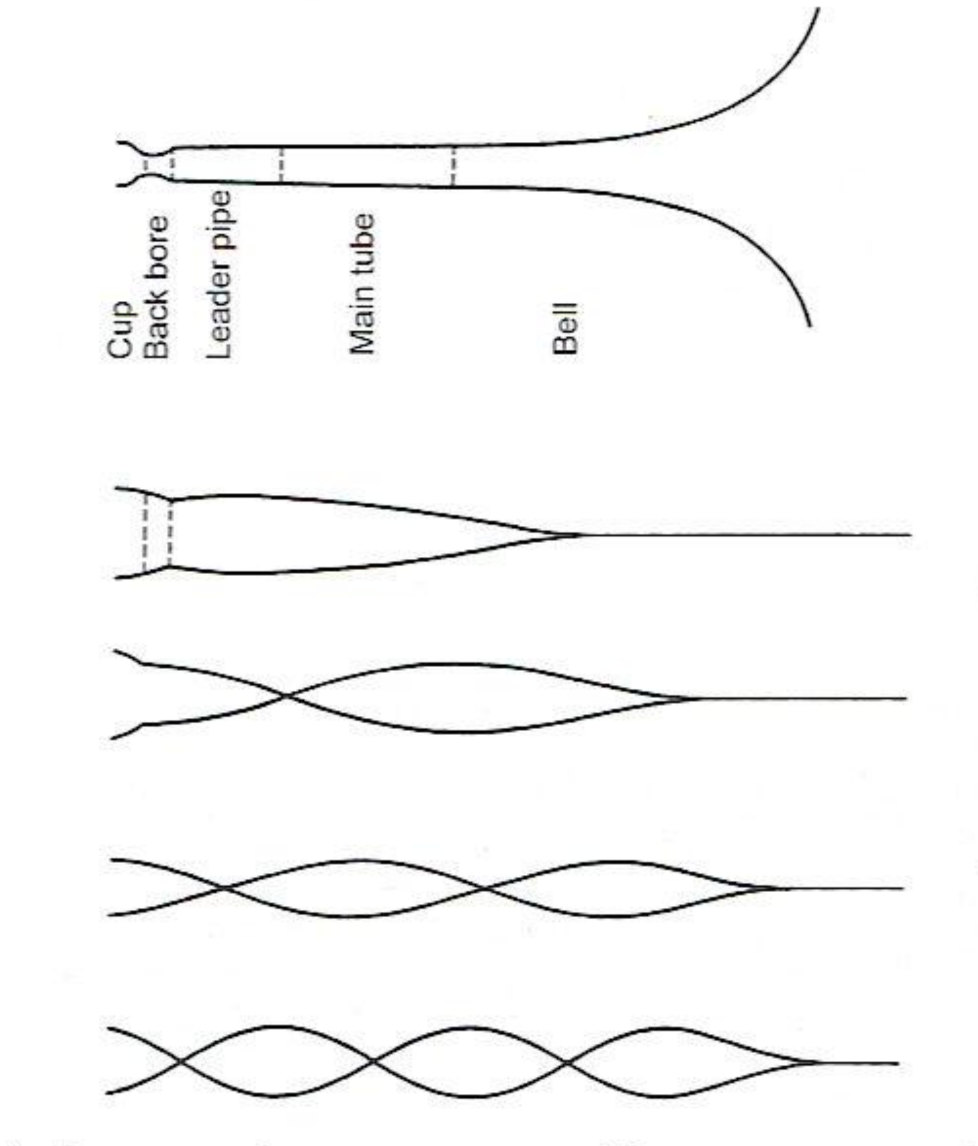

Figure 3
Higher frequencies have shorter wave lengths and they travel further out the end of the bell. Lower frequencies have longer wave lengths and do not travel as far out of the end of the bell.[18]

The bell primarily determines the harmonics in the sound and the pitch of the instrument.

The mouthpiece, because it is a separate resonating component, emphasizes

[18] Donald E. Hall, *Musical Acoustics, 3rd Edition* (Pacific Grove, CA: Brooks/Cole, 2002), 270.

an area of the trumpet spectrum. The emphasized notes are easier to play. A trumpet player can buzz a mouthpiece alone forming a continuum, buzzing so any pitch is produced. The trumpet, however, only allows discrete pitches to be sounded. This demonstrates that the mouthpiece is not the primary factor in determining how in-tune you play. It is important to notice that low notes and high notes are more difficult to play on the mouthpiece alone than those in the mid-range, just as they are when you play a trumpet. The mouthpiece determines where the easiest notes to play will occur on the trumpet because the mouthpiece resonance emphasizes those notes. It also explains why a trombone plays in the trumpet range when used with a trumpet mouthpiece.[19] The emphasis the mouthpiece creates greatly affects the frequency range of the trumpet. Moore states, "The mouthpiece generally controls the range. It does this by providing a resonance within the desired pitch range."[20] The resonance the mouthpiece has is in the playing frequency range of the trumpet and emphasizes that range; this is important because it counteracts the effect of the bell on pitch.

The shape of the bell has an effective length that varies significantly over the playing frequency range of the trumpet. "For a 66cm-long bell, the effective length changes by some 20cm over the playing range, a large fractional change that must be compensated for by the action of the mouthpipe-mouthpiece combination."[21] This allows all the harmonics to be present in the sound of the trumpet, but it also makes the

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[19] Thomas Moore, "To Understand the Trumpet, Build a Hosaphone" *International Trumpet Guild Journal* (March 2009): 87-88.

[20] Ibid.

[21] Robert W. Pyle Jr., "Effective length of horns" *The Journal of the Acoustical Society of America, Vol. 57, no. 6* (June 1975): 1313.

pitch rise as the player moves up in frequency. The mouthpipe-mouthpiece combination lowers the upper register of the trumpet range. Between the bell and the mouthpipe-mouthpiece combination, the trumpet has a relatively in-tune harmonic spectrum. Figure 4 graphically shows the effect of the bell and mouthpiece.

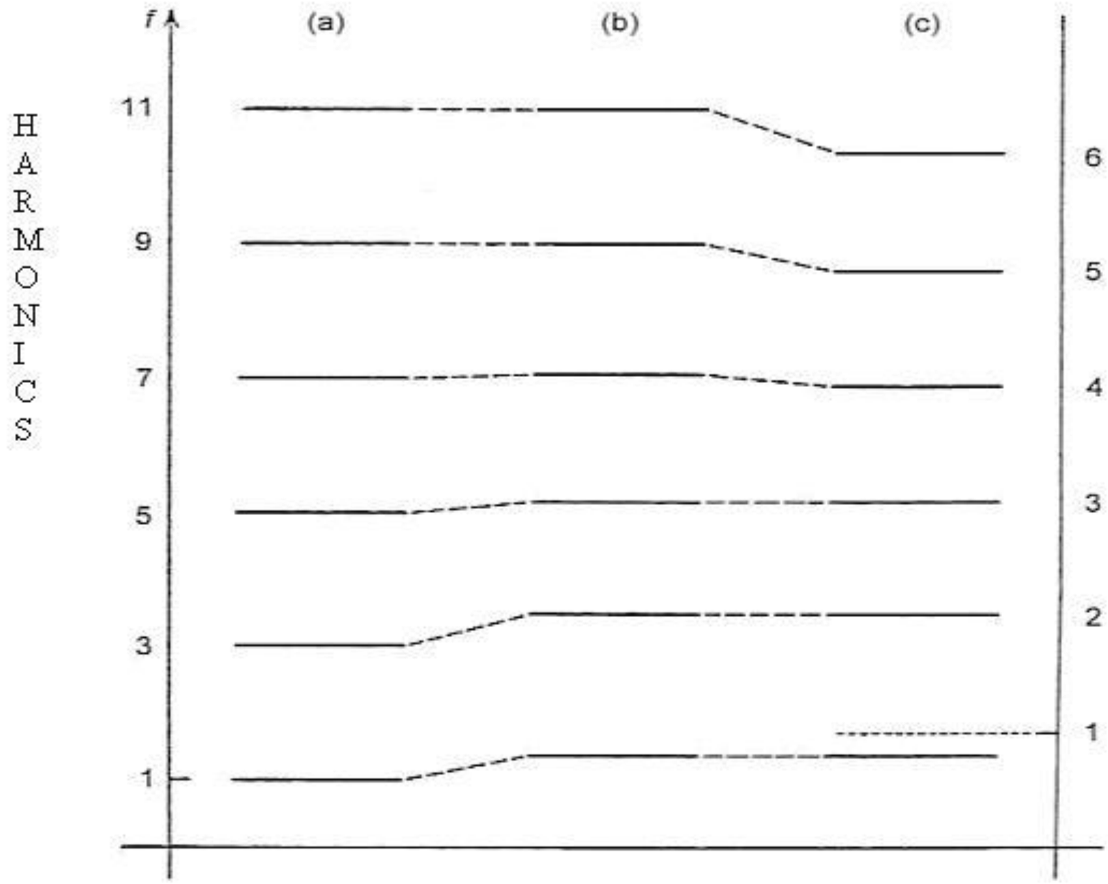

Figure 4

(a). Natural mode frequencies of a cylindrical tube closed at one end, primarily only odd harmonics are produced. (b). The upward shift of frequencies for the lower modes caused by replacing an appropriate portion of the tube by a bell. (c). The downward shift for the higher modes caused by replacing another portion on the opposite end by a mouthpiece. The dotted line on the right connected to 1 shows the missing fundamental of the newly formed harmonic series. This explains why trumpets do not play their fundamental.[22]

[22] Donald E. Hall, *Musical Acoustics, 3rd Edition* (Pacific Grove, CA: Brooks/Cole, 2002), 271.

The bell is significant in the production of harmonics and thus the timbre of the trumpet. Using the same trumpet, along with the same mouthpiece cup, helps eliminate variables when testing different backbores.

The timbre is also affected from the area that is emphasized in the trumpet spectrum from the mouthpiece. Robert Chapman states, "The most important factor concerning mouthpiece resonance frequency is what it does to the tone quality. A higher resonance frequency will make for a brighter tone quality, while a lower mouthpiece resonance will result in a darker tone."[23] According to Chapman, if a mouthpiece resonates at a higher frequency the trumpet will sound brighter, and if it resonates at a lower frequency it will sound darker. From that statement, a mouthpiece's resonant frequency is not related to its interior volume. Since two mouthpieces can have the same interior volume with different resonance frequencies, that would mean that interior volume is not directly related to resonance frequency and therefore to timbre. Arthur Benade has written in his book that indeed interior volume is not directly related to resonance frequency as illustrated by Figure 5.

[23] Robert C. Chapman, "Mouthpiece Throats, Cups and Calculations" *International Trumpet Guild Journal* (January 2002): 40.

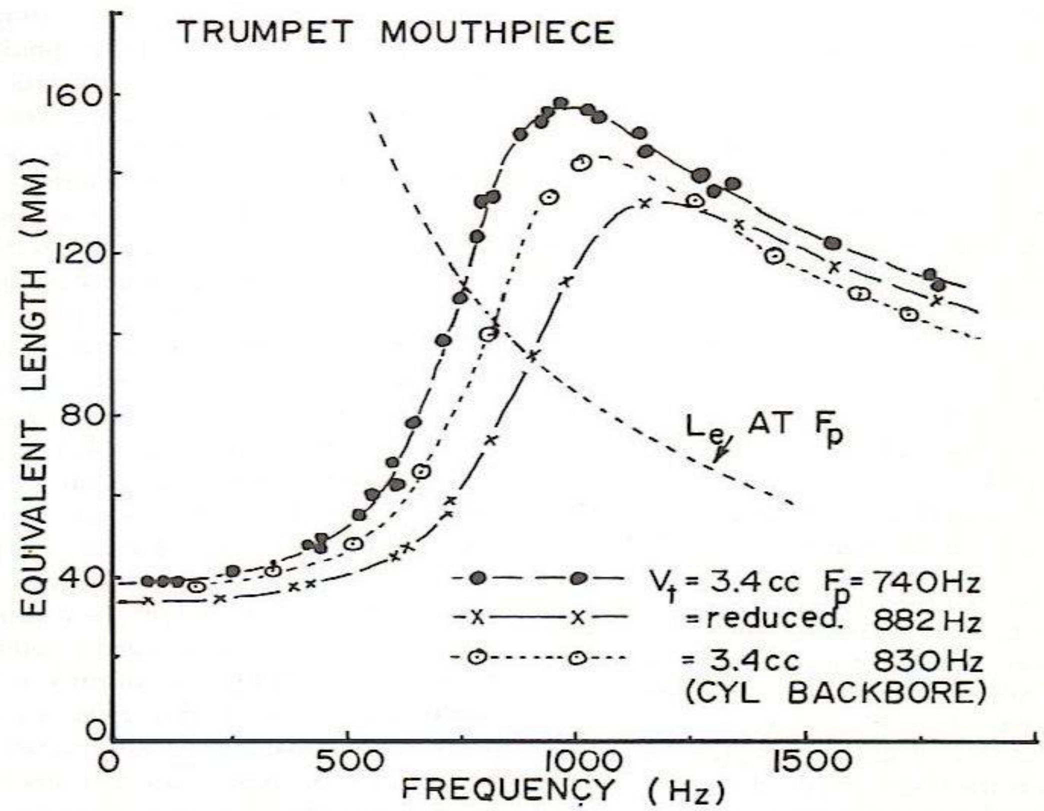

Figure 5

Three mouthpieces are represented in Figure 5: Two mouthpieces, solid dots and hollow dots, both have the same volume, but have different resonant frequencies. The third mouthpiece, the line with "x," is the same as the solid dots but with a reduced cup volume. The dotted line intersecting is the popping frequency (resonance) of each mouthpiece.[24]

This information and both Benade's and Chapman's conclusions are based on the entire mouthpiece. This study isolates the backbore and directly compares timbre to interior volume of the backbore alone. In general, this information provides exceptions to the information from some mouthpiece manufactures that larger interior volume backbores sound darker and smaller interior volume backbores sound brighter.

[24] Arthur H. Benade, *Fundamentals of Music Acoustics* (New York. Oxford University Press, 1976), 415.

Internal pressure, or blowing pressure a trumpet player feels while playing, is correlated to the spectrum of the trumpet timbre. Above the basic minimum threshold for pressure required to produce a note, the note grows in loudness faster than the blowing pressure increases. As loudness increases, a higher percentage of harmonics are present in the sound. A balance of higher harmonics in a sound seems louder to a listener. Fletcher *et al.* state, "It is well known that the upper partials of the trumpet sound increase in level relative to the fundamental at high loudness levels."[25] This is true to a certain point, at which the power falls back off. "Below the radiation cutoff of the bell, typically about 1000Hz, the radiate power rose slowly with frequency, typically at 2 to 4 dB/octave, while above cutoff the envelope fell at 15 to 25 dB/octave."[26] Figure 6 displays the upward trend, plateau, and downward trend of dynamic volume related to blowing pressure and frequency.

[25] N.H. Fletcher, and A. Tarnopolsky, "Blowing pressure, power, and spectrum in trumpet playing" *The Journal of the Acoustical Society of America, Vol. 105, no. 2* (February 1999): 875-876.

[26] Ibid.

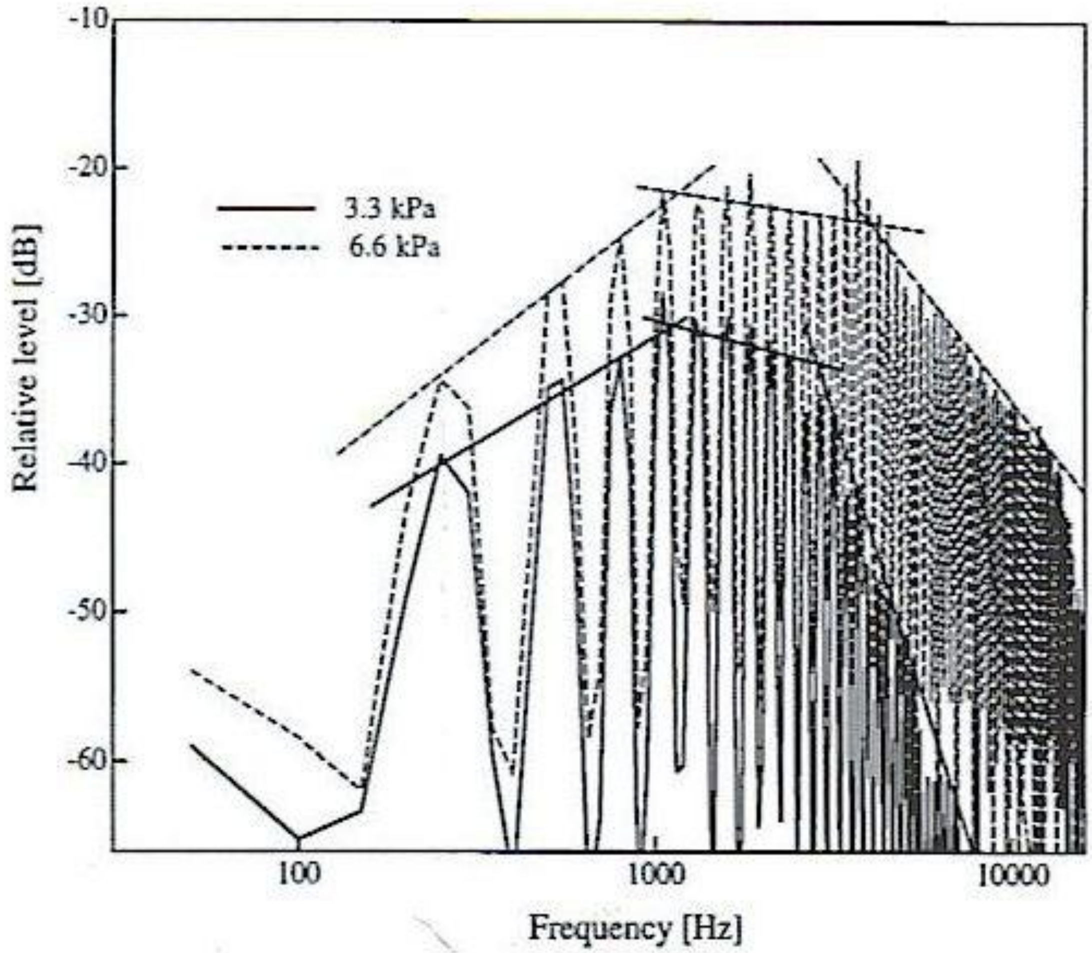

Figure 6[27]
The vertical axis is loudness (dB) and the horizontal axis Frequency (Hz). The lines connecting the peaks, both dotted (6.6kPa blowing pressure) and solid (3.3kPa blowing pressure) indicate an increase in loudness as frequency increases and blow pressure remains the same. Following the increase in loudness the loudness plateaus and then falls off quickly as frequency continues to rise.

As discussed previously, the harmonic content changes with frequency. In Figure 6, it is shown that harmonic content changes with dynamics. "For very soft playing the waveform is reasonably sinusoidal [fewer harmonics], but at higher levels it has a markedly distorted shape [more harmonics]…the general conclusion is that there is a cut-

[27] N.H. Fletcher, and A. Tarnopolsky, "Blowing pressure, power, and spectrum in trumpet playing" *The Journal of the Acoustical Society of America, Vol. 105, no. 2* (February 1999): 875-876.

off frequency, around 1 kHz, below which the radiated sound level rises at 6 dB/octave relative to the internal sound pressure, and above which the relation is flat."[28] Due to the fact that timbre changes with dynamic volume, playing solely by how it feels when a player plays could produce different results if an experiment was conducted based only on blowing pressure. The author chose to use player-perceived dynamic volume to set the volume levels played. This choice was also made to allow the players to play within their comfort zones. If the players were asked to play louder or softer than they were capable of, their sound production would not be typical of what they would use in the real world. It is understood this method is not exact, but the resulting data that was collected is very similar to what an audience would hear in a real-world performance.

Due to the long cylindrical section of tubing in the trumpet and the high pressure formed from the mouthpiece, "the result is a steepening of the leading edge of this wave that increases as the pressure amplitude increases. In extreme cases a shock wave may even develop."[29] In the cylindrical section of the trumpet, the steepening of the sound wave is nonlinear, and as the steepening happens, energy is transferred from low-frequency components to high-frequency components. When a brass instrument is played loudly and a "brassy" quality to the sound is produced, this is the effect of the steepening of the leading edge of the wave. As the blowing pressure increases, this effect increases. Additionally, the gain in power seems stronger as the process continues, due to the way the ear hears the sound. "The result of this nonlinear propagation behavior is a

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[28] N.H. Fletcher, and A. Tarnopolsky, "Blowing pressure, power, and spectrum in trumpet playing" *The Journal of the Acoustical Society of America, Vol. 105, no. 2* (February 1999), 879.

[29] Ibid.

transfer of energy from the low-frequency components of the mouthpiece waveform to higher harmonics, the extent of this transfer increasing as the blowing pressure is increased. Because of the initial rise of radiation resistance below cutoff, this transfer increases the radiated sound energy as well as providing an apparent power gain at high frequencies. This leads to an even greater increase in the subjectively perceived loudness, because the wider sound spectrum has less auditory masking."[30] As the sound spectrum is represented over a larger area, the ear is better able to discern that there are more harmonics present; the harmonics do not cover or mask each other as much. The ear also can hear the sum of the smaller and higher frequencies that are spread out as a single unit and discern a change in the overall sound. Also, in the higher frequencies of the trumpet range the ear hears critical bands, a lumping of harmonics together that are within a certain distance (about 15% of each other). The ear hears this combined strength of the components. The higher harmonics are at low levels in relation to the lower harmonics, but are spread over a large region and seem represented more by the ear, sounding louder. In the musical world, dynamics are judged by how they are perceived. All people do not hear with the same sensitivity nor does each trumpet player perceive their sound the same way. To get a real-world application of comparing the timbre of backbores in the trumpet system, testing them at the same perceived volume as controlled by the player is applicable.

Furthermore, research by Fabiani *et al.* shows that timbre and loudness can be interchangeable in the perception of dynamics. "The subjects were asked to indicate the

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[30] N.H. Fletcher, and A. Tarnopolsky, "Blowing pressure, power, and spectrum in trumpet playing" *The Journal of the Acoustical Society of America, Vol. 105, no. 2* (February 1999): 879.

perceived dynamics of each stimulus on a scale from pianissimo to fortissimo. Statistical analysis showed that for the instruments included timbre and loudness had equally large effects…"[31] Odd harmonics are generally responsible for sounding harsher or brighter than even harmonics. It is known that timbre will sound brighter with more harmonics in the upper frequencies, as opposed to lower, but there is no mention in this literature of the *balance* of even and odd harmonics in the sound. "The sound of the brass instrument is characterized by a spectrum which is relatively weak in upper harmonics in quiet playing, becoming gradually enriched in upper harmonics during a crescendo. At very high dynamic levels the brightness of the sound increases dramatically. The changes in tonal color are among the most basic elements in the performer's palette of musical expression."[32] The author's research found that the general harmonic makeup of some of the backbores changed far more than others as the dynamic volume increased. In particular, the B24 backbore changed from an even peak harmonic to an odd peak harmonic as dynamic volume increased. Perhaps this is why the Bach 24 backbore is popular among orchestral trumpet players who want a warm timbre when playing soft and a timbre that is relatively brighter when playing loud.

Changes of the internal wall in the trumpet, such as ridges from mating tubes, create discontinuities that cause reflections back to the lips. Capturing the trumpet sound without attack or decay removes the possibility of different gaps affecting the results.

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[31] Marco Fabiani, and Anders Friberg, "Influence of pitch, loudness, and timbre on the perception of instrument dynamics" *The Journal of the Acoustical Society of America, Vol. 130, no. 4* (October 2011): 193.

[32] Arnold Myers, *et al.*, "Effects of nonlinear sound propagation on the characteristic timbres of brass instruments" *The Journal of the Acoustical Society of America*, *Vol. 131, no. 1* (January 2012): 678.

The gap is the small section between the end of the backbore and the wall of the leadpipe. The size of this gap is significant in how attacks are on the trumpet. "Trouble can be caused by a small change in cross section, a sharp bend, or an ill-chosen change in taper. Such discontinuities return a pre-mature echo of significant size to the mouthpiece, an echo that is not even a replica of the original disturbance. Such ill-timed, ill-shaped return echoes can upset the best-trained of lips, and, having spoiled the steadiness of their initial vibration, will ruin the attack."[33] Capturing the sound of the trumpet during a long-sustained tone removes any possibility of the attack influencing the data, which would be significant. The gap is also believed to have an effect on pitch, dynamic volume, and the "concentration" of the sound.[34] The shank end diameter was consistent (0.385") on all the shanks of the backbores tested in this study to standardize the gap and its effects.

For the purpose of this research, the trumpet sound is analyzed from a held tone, at the same relative dynamics, on the same frequencies, with the same instrument, mouthpiece cup, and same location. The intent is to compare backbores in a controlled, constant, yet real-world system.

[33] Charles A. Macaluso, and Jean-Pierre Dalmont, "Trumpet with near-perfect harmonicity: Design and acoustic results" *The Journal of the Acoustical Society of America, Vol. 129, no. 1* (January 2011): 404.

[34] David Gordon, "GAP," e-mail to author, 11 November 2012.

Chapter III

Method

Selection of Backbores

Twelve trumpet mouthpieces were selected that were stock and in unaltered condition. Each mouthpiece was selected because they each had a distinct backbore that the manufacturer had labeled or made available through their literature, except for the mouthpiece that will be labeled “G7C,” which was the only unmarked backbore and thus discernable from the others. In the Schilke labeling nomenclature, the second letter after the number indicates the backbore in the mouthpiece. For example 14A4A has an “A” backbore. The Yamaha labeling nomenclature is the same as Schilke. When there is no letter to label the backbore it is a “C” backbore. For example, 14C4 has a “C” backbore. In the Vincent Bach labeling nomenclature, the letter following the number indicates the cup size of the mouthpiece. For example, 7A has an “A” cup. A cups have Number 24 backbores, B cups Number 7 backbores, C cups Number 10 backbores, and D cups Number 76 backbores. The Yamaha Mark Gould backbore does not have a labeled backbore and will be referred to as “YMG” backbore.

1. A Schilke 16C4 trumpet mouthpiece – will be referred to as “SC” backbore.
2. A Bach 7E trumpet mouthpiece – will be referred to as “B117” backbore.
3. A trumpet mouthpiece marked “7C” with no additional markings – will be referred to as “G7C” backbore.
4. A Schilke 11AX trumpet mouthpiece – will be referred to as “SX” backbore.
5. A Yamaha 14C4 trumpet mouthpiece – will be referred to as “YC” backbore.
6. A Vincent Bach 5A trumpet mouthpiece – will be referred to as “B24” backbore.
7. A Vincent Bach 5B trumpet mouthpiece – will be referred to as “B7” backbore
8. A Vincent Bach 7D trumpet mouthpiece – will be referred to as “B76” backbore
9. A Vincent Bach 7C trumpet mouthpiece – will be referred to as “B10” backbore
10. A Yamaha 13A4A trumpet mouthpiece – will be referred to as “YA” backbore
11. A Yamaha Mark Gould trumpet mouthpiece – will be referred to as “YMG” backbore.
12. A Schilke 14A4A trumpet mouthpiece – will be referred to as “SA” backbore.

Each backbore of the selected mouthpieces was measured, and a backbore section was machined. The backbores were machined to be used in the Warburton Modular System. The Warburton Modular System is the industry standard for modular systems, allowing a player to customize and interchange the backbore on his or her mouthpiece. Utilization of this modular system allowed the author to use the same cup, rim, and throat, and interchange backbores.

Measuring of Backbores

Each mouthpiece was milled in half along the shank section of the mouthpiece. Care was taken to machine in small passes to prevent distortion of the shank. The rim section was left intact to provide a holding place by the lathe later in the process, see Figure 7.

Figure 7
Milled mouthpieces with corresponding reamers.

The milled mouthpiece was chucked (held) into a lathe, and a dial indicator with accuracy +/- 0.001 inches was used to level the mouthpiece horizontally. Prior to milling the mouthpiece, the inside diameter of the shank end of the backbore (B) was measured, and that measurement was divided by two to arrive at the backbore radius (BR). Measuring was done by digital indicators with accuracy +/- 0.001 inches. Similarly, the throat section of the mouthpiece was measured (T) and divided by two to arrive at the throat radius (TR). TR was subtracted from the BR to arrive at the difference between the inside end of the backbore and the inside of the throat (S). The dial indicator was used to horizontally align the backbore, so the difference between the throat and the end of the backbore was equal to S. See figure 8.

$$B / 2 = BR \qquad T / 2 = TR \qquad BR - TR = S$$

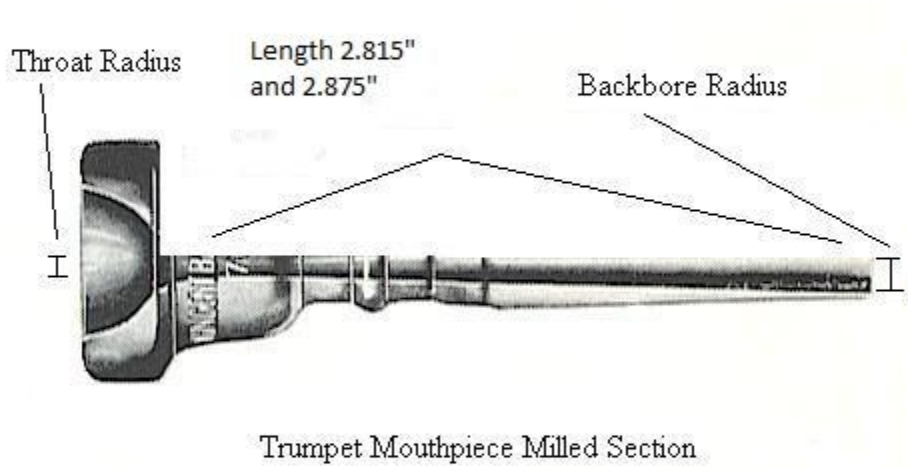

Figure 8
The trumpet mouthpiece after it was milled in half. The rim was retained to be able to hold the mouthpiece in the lathe chuck. The backbore measurements were taken from each milled mouthpiece.

The Vincent Bach and Yamaha mouthpieces were 3.4375 inches long. In the Warburton Modular System, the tops (rim and cup) are 0.875 inches long and the threading 0.25 inches in the throat end. To arrive at the length of the backbore (BB), the threading length (THL) was subtracted from the length of the top (TL) and then subtracted from the length of a Bach mouthpiece (VBL).

VBL – (TL-THL) = BB 3.4375 – (0.875 – 0.25) = 2.8125 inches

This is different than the length of the Warburton backbore in their Modular System, of 2.8 inches. The overall length of Warburton mouthpieces is less than both Bach and Yamaha mouthpieces. The top length of the Warburton Modular System (industry standard) was used. It was decided to measure the Bach and Yamaha backbores at 2.815 inches and not 2.8125 inches because on the measured backbores the backbore slope did not stop, or reach the throat, until 2.815 inches on the B24, B7, YC, B10, and B76 backbores. To standardize the length of those backbores, they were all measured to 2.815 inches.

Two backbores, the SX and SA, were measured at 2.875 inches because Schilke mouthpieces are 4.5 inches long, as opposed to 3.4375 for Bach and Yamaha, and 3.425 for Warburton. The length of the Modular System top was kept the same and the extra length added to the backbore. The SC backbore was also measured at 2.875 inches, but was altered in the machining process by using the same measurements as the full 2.875 inches but on a backbore that was 2.815 inches long. This results in a backbore with less volume than the stock Schilke C backbore. The G7C mouthpiece matched the dimensions of the Bach and Yamaha backbores. The length component of the backbores was measured with the digital readout (DRO) on the lathe with accuracy +/- 0.0002 inches. Along the length of the backbore, a measurement point was taken every 0.001 inches in decrease in radius. The YMG mouthpiece had a stock #24 throat and the measurements were altered, or shrunk, to line up with a #27 throat. Therefore, the YMG backbore created and used in this test is smaller in volume, but with the same shape, as the stock YMG backbore. Measurement for all backbores is in Appendix A.

Machining of Backbores

For each backbore, a reamer was machined out of oil-hardening tool steel to the coordinates from the measuring process, see Figure 9.

Figure 9
Top: oil hardening tool steel. Middle: machined to coordinates. Bottom: finished reamer.

The lathe with the digital read out with accuracy +/- 0.0002 inches was used. The reamers were then milled in half horizontally, and hardened by being heated and quenched in oil. The reamers were machined with a straight non-tapered initial section of 0.05 inches in length and 0.144 inches in diameter to assist in the reamer tracking correctly during the reaming process.

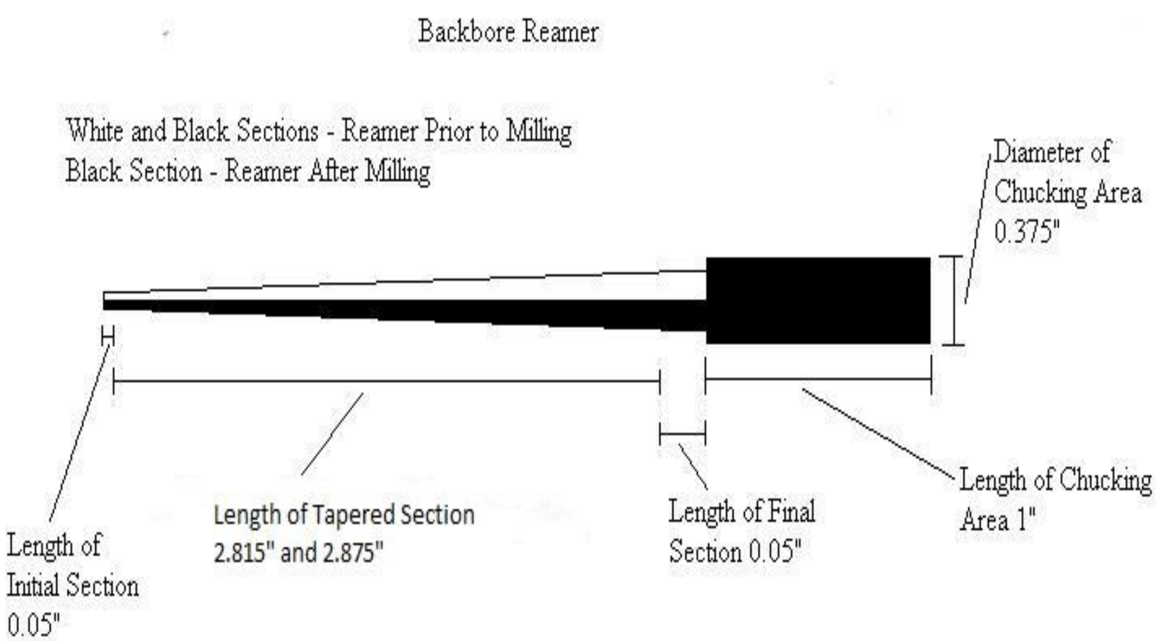

Figure 10
Backbore reamer with specifications. The large end is chucked in the tail stock on the lathe and inserted into the pre-drilled brass, cutting the shape of the backbore.

The backbores are copies, machined by the author, and were machined from C360 free machining brass, an easily machined type of brass. 0.5 inch round bar stock was used and machined on the same lathe as before. Original backbores from the manufacturers were not used to standardize as many variables as possible for this study. Also, the exact machining methods of each manufacturer is not known and therefore could not be taken into consideration.

Figure 11
Top: brass bar stock. Bottom: finished backbore.

Each backbore was first faced (machined flat) on one end and threaded to be used in the Warburton Modular System 3/8” 40TPI (threads per inch) threads. While still chucked, the throat was machined by first pre-drilling with a centering tool, then with a #30 drill bit, then a final pass with a four fluted #27 reamer (0.144 inches diameter). Each backbore throat and threading was machined without re-chucking to maintain concentricity of the threads to throat.

The outside body of the backbore was machined at 0.46 inches while in the initial chucking. The backbore was then turned 180 degrees and re-chucked to machine the tapered end. The backbore was pre-drilled with a centering tool, then partially with a #10 drill bit, then a final pass with the appropriate backbore reamer. The reamer was inserted the appropriate length, either 2.865 (B,Y, and G7C) or 2.925 (S) (2.815 + 0.05 or 2.875 + 0.05) inches, and measured with a digital scale on the tail stock of the lathe, accuracy +/-

0.001 inches. Care was taken to insert the reamers the appropriate amount, as inserting the reamer too far or not far enough changes the interior shape of the backbore.

The shank taper of 0.05” per inch was machined with the end diameter of the backbore shank at 0.385 inches.

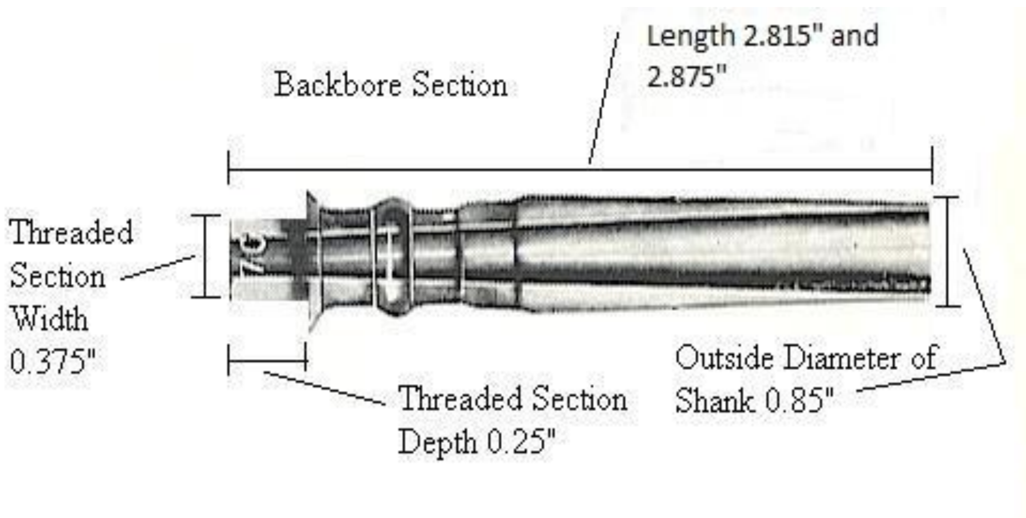

Figure 12
Diagram of a trumpet mouthpiece backbore with specifications. The threaded end threads into a top section (the rim and cup) making a complete mouthpiece.

Interior Volume of the Backbores

The volume of each backbore was calculated from the measurement data. The author found the interior volume by using the generally accepted formula for finding the volume of a cylinder. The formula was used to find the volume of approximately 100 sections (correlating to each data point of measurement) and adding them together. In more detail this was done by adding the radius of the throat (RT) to the measurement of the backbore (B) from the dial indicator, squaring, multiplying by π to find the area (A), and then multiplying by the length (L) of the segment. Each segment length was found by subtracting the previous length measurement (LP) from the current length measurement (LC). Each segment was added to find the total volume of the backbore.

$$(\pi R^{2})L = \text{total volume} \qquad \text{Where } L = LC - LP \text{ and } R = RT + B$$

See Appendix A for backbore measurements. The total volumes for each of the backbores are listed below in Table 1.

Backbore	Volume Cubic Inches
SC	0.1538
B117	0.1438
SX	0.1379
G7C	0.1369
YC	0.1358
B24	0.1326
B7	0.1307
B76	0.1237
B10	0.1236
YA	0.1228
YMG	0.1181
SA	0.1096

Table 1
Volumes of the backbores in cubic inches

Selection of Top

The mouthpiece selected to make the top portion was a Vincent Bach 1 1/2C. This mouthpiece was selected due to its general popularity in the trumpet community; it is believed to be one of the most used sizes in trumpet playing. The mouthpiece top was machined at 0.875 inches long and threaded to accept the backbores in the same Warburton Modular System.

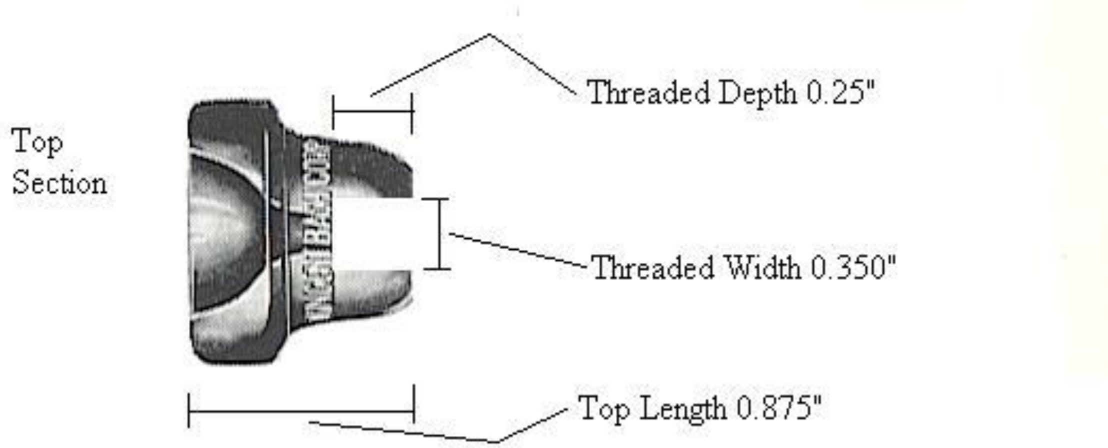

Figure 13
Diagram of a trumpet mouthpiece top. The threaded end accepts threaded backbores and makes a complete mouthpiece.

Selection of Trumpet / Player

A Vincent Bach Stradivarius Bb trumpet with a 37 bell, 0.459" Medium Large bore, and 25 reverse leadpipe was used. This instrument was constructed in 1996.

Five trumpet players were used for the testing, representing different focuses in playing and different levels of development:

1. Player 1 – Bachelor of Music in Trumpet Performance Student
2. Player 2 – Professional Orchestral Player and University Professor
3. Player 3 – Doctor of Musical Arts Student
4. Player 4 – Jazz Recording Artist
5. Player 5 – Professional Orchestral Player

Microphone / Construction of Amplifier

A Zoom H2 recorder was used to capture the trumpet sound. See Appendix C for specifications. The amplifier construction and set up was contributed by Frost Electronic Design, LLC. See Appendix B.

Oscilloscope / FFT Application Module / Machinery

The oscilloscope used for the test was a Tektronix TDS3054B, which is a four channel color digital phosphor oscilloscope. The oscilloscope contained a TDS3FFT Application Module.

The TDS3FFT Application Module adds FFT (Fast Fourier Transform) measurement capabilities to the oscilloscope. The FFT process mathematically converts the signal from the recording device and amplifier into its frequency components, providing spectrum analysis capabilities (ability to view the harmonics). The Module was used to take a spectrum analysis of the trumpet sound with each backbore.

The lathe used was a Grizzly Industrial G0602 10" x 22," a Shars digital read out (DRO), and glass scales with an accuracy rated at 0.0002". The mill used was a Grizzly Industrial G9901 9" x 42" and a Shars digial read out with an accuracy rated at 0.001".

Test Set-Up

The tests were performed on January 12, 13, and 19, 2013 between 10:00 am and 2:00 pm at the University of Washington in the trumpet studio room, Seattle, Washington. Temperature during the testing was 72 degrees F. The microphone was placed directly in front of the trumpet bell at approximately 8 feet. There were two people in the room, the recorder and the tester.

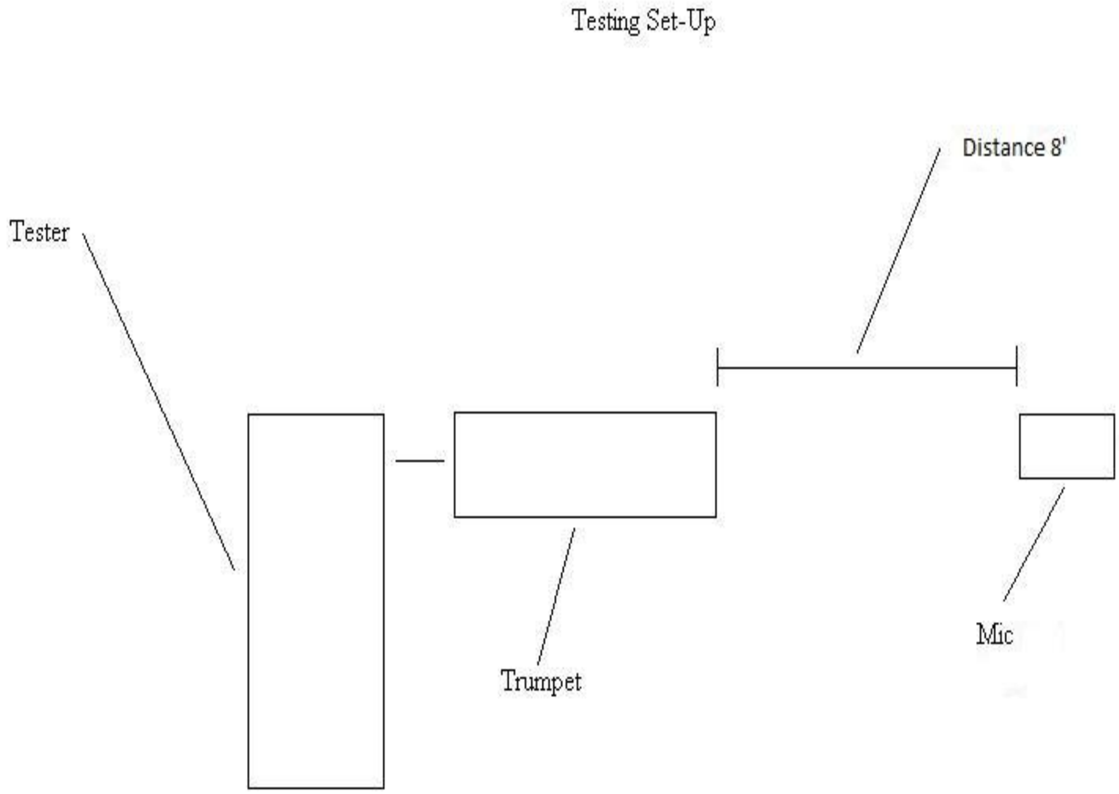

Figure 14
Diagram of the testing set-up.

Capturing the Note

Each tester arrived to the testing having already played that day. Each backbore was screwed into the mouthpiece top section of the test equipment and played at a perceived *piano*, *mezzo forte*, and *forte* dynamic at the frequencies of 233Hz, 466Hz, and 932Hz. Each note was played and held by the tester for approximately 5 seconds. A total of nine notes were played by each tester for each backbore, totaling of 108 notes per person. Each test with each different backbore was played “cold,” without playing a note on the system prior to the test. The players were instructed to not adjust pitch, but to let the sound “sit” where it landed. This was done to get a true sound without the player bending or straining and altering the timbre of the note to obtain an “in-tune” frequency. The frequencies of 233Hz, 466Hz, and 932Hz are approximate in this study. Appendix E contains the actual recorded frequencies the players produced. This was also done to prevent the players from getting used to getting their “sound” out of the equipment, but to get the sound “raw.” The tuning slide of the trumpet remained fixed for all of the tests.

Capturing of Data on Oscilloscope

The tests recorded on the H2 were fed into the amplifier and then into the oscilloscope. See Appendix B for amp specifications and Appendix C for H2 specifications. As the H2 fed into the amplifier and into the oscilloscope, the oscilloscope screen displayed the harmonics in real-time. When the harmonics were stable on the oscilloscope screen, the author paused the screen, in effect taking a snap shot of the real-time display. This “snap shot” was used to collect the data for the study.

The magnitude of each harmonic was measured in dBV, where 0 dB equals the reference of 1 V RMS (root mean square). Two cursors were used to take the measurement, with the fundamental retaining a cursor while another cursor measured each harmonic from the initial capturing of the note. See Appendix D.

Converting Decibels to a Voltage Ratio

From the harmonic spectrums measured on the oscilloscope, the dB of each harmonic (up to the 30th harmonic was present) was recorded (See Appendix E). Each harmonic was converted from dB to voltage. To find the voltage ratio the generally accepted equation was used:

$$V2/V1 = 10^{\wedge(A/20)} \qquad \text{Where A is dB and V2/V1 is the voltage ratio.}$$ [1]

The total harmonic voltage was found by squaring the voltage ratio for each decibel measurement, adding them, and finding the square root of the sum. A ratio was then found between the harmonics and the total voltage. When the harmonics are converted as a ratio to the total harmonics present, then they are comparable to each other, regardless of which player they were produced by or how loud the actual playing was. This process "standardized" the data so it could be compared.

Appendix E contains all of the ratios for each backbore, frequency, dynamic and players and highlighted peak harmonics.

Background Information for Analyzing the Results from the Oscilloscope

As defined in this research, the total interior volume of the trumpet mouthpiece backbore does not strongly correlate to the timbre a trumpet produces. However, the shape of the backbore does strongly correlate to the timbre of the trumpet. Prior to investigating the results from the oscilloscope, some concepts of how sound is created in the trumpet and mouthpiece must first be discussed. The following information will serve as a point of departure for the investigation of the data taken from the oscilloscope

[1] Based on Michael Faraday's principles from the 1830's and dealing with alternating current.

results. This background information is important in how timbre is being defined in this study.

Sound Waves

Sound waves are changes in air pressure occurring at frequencies in the audible range. The audible range is approximately 20 Hertz (Hz) to 20,000 Hz (20 kHz). The notes tested on the trumpet in this study are 233Hz, 466Hz, and 932Hz, approximately. These three frequencies are comfortably in the hearing range. Air pressure variation associated with a quietly played musical instrument is about 0.002 Pascals (Pa), while pressure variation that produces pain in the ear is about 20 Pa. Pa is a unit of pressure, where pressure is defined as force per unit area. Atmospheric pressure on the surface of the earth is about 14.7 lb/in^2 or about 100,000 Pa. The smallest pressure variation that can be heard is about 0.00002 Pa.[2] Our bodies can interpret sound waves, or physical changes in air pressure, with our perception of pitch, loudness, and timbre.

Periodic motion is any type of motion that repeats itself exactly over successive and equal time intervals. Sound waves are a type of periodic motion producing a constant sound. Simple harmonic motion is a specific type of periodic motion in which the wave shape is smooth. Simple harmonic motion waves are called sine, or sinusoidal waves. A tone without any harmonics, a pure tone, is strictly sinusoidal.

Waves with short wave lengths sound higher in pitch, having a higher frequency, than waves with long wave lengths. The pitch often tuned to in an orchestra is 440 Hz, or a frequency of 440 wave lengths per second. Generally speaking, the same pitch an

[2] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 3.

octave higher would be 880 Hz. Mathematically strict definitions of frequency do not always correspond to being "in-tune" as a musician would hear. Wave frequency is independent of wave amplitude (wave height); the sound wave with a larger amplitude is louder dynamically.

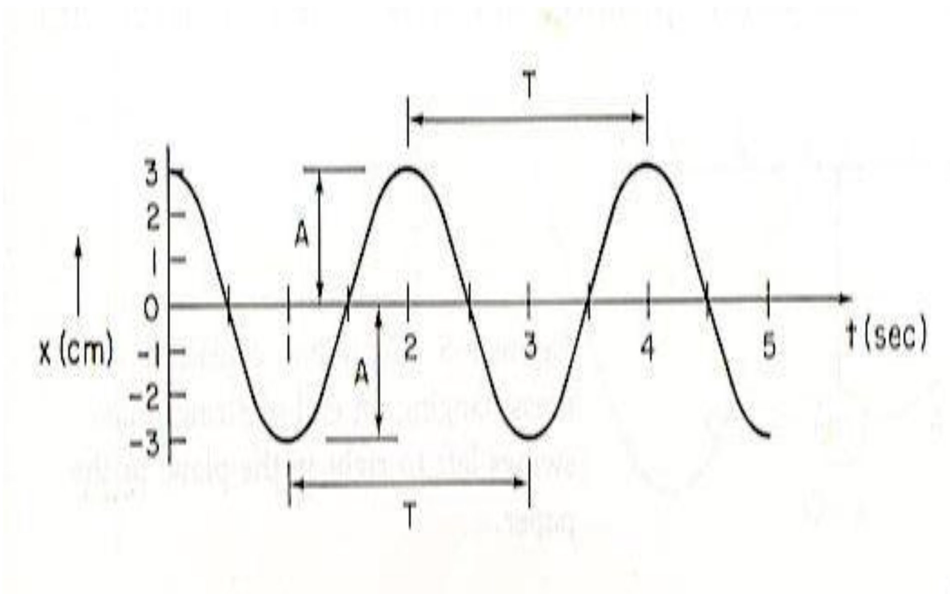

Figure 15
A sinusoidal wave with an amplitude, A, of 3 cm and a wave length, or period, T, of 2 sec. This sinusoidal wave would not have any harmonics.[3]

Waves may take forms other than sinusoidal, and these other forms are important in the study of musical sound. The following waves, in Figure 16, all have different shapes, but have the same period and will have the same frequency or pitch. The important difference is each will have a different timbre or sound.

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[3] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 5.

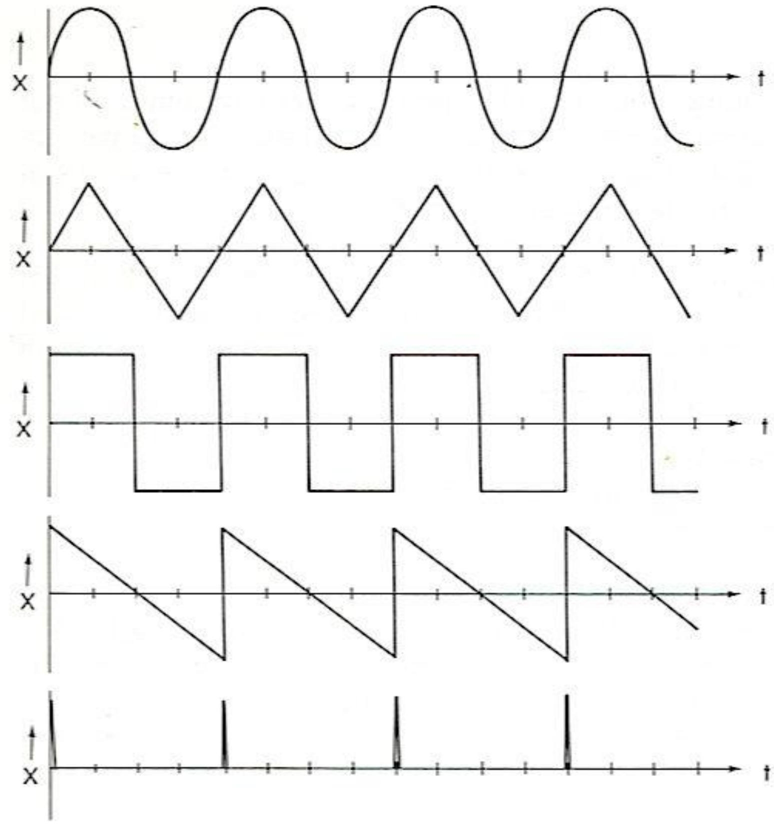

Figure 16
From the top down: sine wave, triangular wave, square wave, sawtooth wave, and pulse train of the same frequency.[4]

Each note played on a musical instrument has a unique timbre and wave shape, and the particular wave is called a wave form. To capture and graph the wave form of a musical tone, the periodic oscillations of air pressure are converted to an electrical signal through a microphone. The electrical signal, or voltage, which is now an electrical version of the physical oscillations of air pressure, can be displayed with an oscilloscope as a graph of voltage verses time. The result is a graphical representation of the musical

[4] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 10.

sound or wave form. Wave forms of musical sound are all periodic, but may have different shapes.

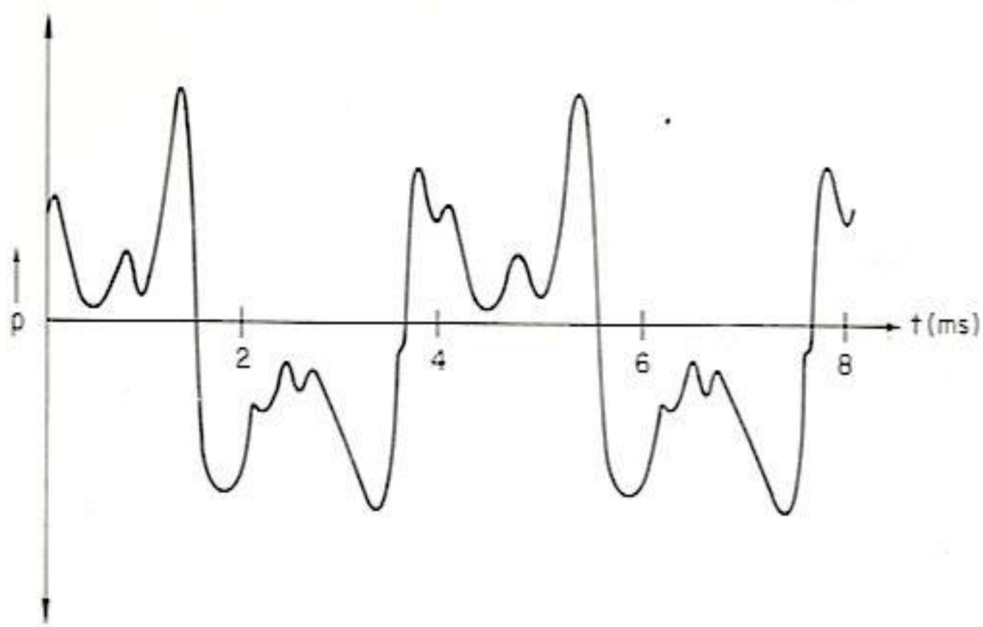

Figure 17
A wave form of a clarinet playing the lowest C on the instrument. The wave form is periodic and has a unique shape.[5]

Resonance

Resonance is the tendency of a system to oscillate with greater amplitude at certain frequencies. Resonance can occur whenever the frequency of the driving force is the same as the natural frequency of the oscillating system.[6] For example, with a trumpet mouthpiece the lips are the driving force. When they buzz at a frequency that is in the

[5] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 11.

[6] Robert C. Chapman, "Mouthpiece Throats, Cups and Calculations" *International Trumpet Guild Journal* (January 2002): 40.

resonance of the system, the mouthpiece, sound is produced. Trumpet mouthpieces are resonant over a range of frequencies, which is why a trumpet player can buzz over a continuous frequency range. The mouthpiece resonates greatest and easiest in the middle register, making it harder for a player to buzz the higher and lower notes, while the middle register is easier. The trumpet, aside from the mouthpiece, also has a resonance. The trumpet with the mouthpiece has a resonance where vibrational energy moves from one to another. In this system, generally, the mouthpiece controls the range, and the trumpet the pitch. The mouthpiece does so by providing a resonance in the resonance range of the trumpet.[7] A mouthpiece that resonates at a higher range of frequencies will make it easier for the player to play notes in the upper register and more difficult to play notes in the lower register.[8] The trumpet has a long cylindrical section, allowing fewer frequencies to resonate in comparison with the mouthpiece alone. The frequencies that do resonate are similar to the harmonic series. The differences are discussed under the effect of the bell in Chapter 2.

Standing Waves and the Overtone Series

When a trumpet is being played, a standing wave is created inside the trumpet between the lips and the bell. A wave is created by the lips, which travels the length of the trumpet, and some of that wave is then reflected back towards the lips when it reaches the bell. When the returning wave meets the outgoing wave, the outgoing wave is

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[7] Thomas Moore, "To Understand the Trumpet, Build a Hosaphone" *International Trumpet Guild Journal* (March 2009): 88.

[8] Robert C. Chapman, "Mouthpiece Throats, Cups and Calculations" *International Trumpet Guild Journal* (January 2002): 40.

changed. When two identical waves moving in opposite directions meet (on the way to the bell and back), their amplitude (as they meet) is added. The resultant sum wave depends on how they line up, or their phase. The resultant wave will share the same period as the two waves, but the shape of the wave will change, thus the timbre of the wave as a sound would change. Figure 18 shows two of the same sinusoidal wave meeting in opposite directions and their sum, with each successive example rotated an eighth of a period.

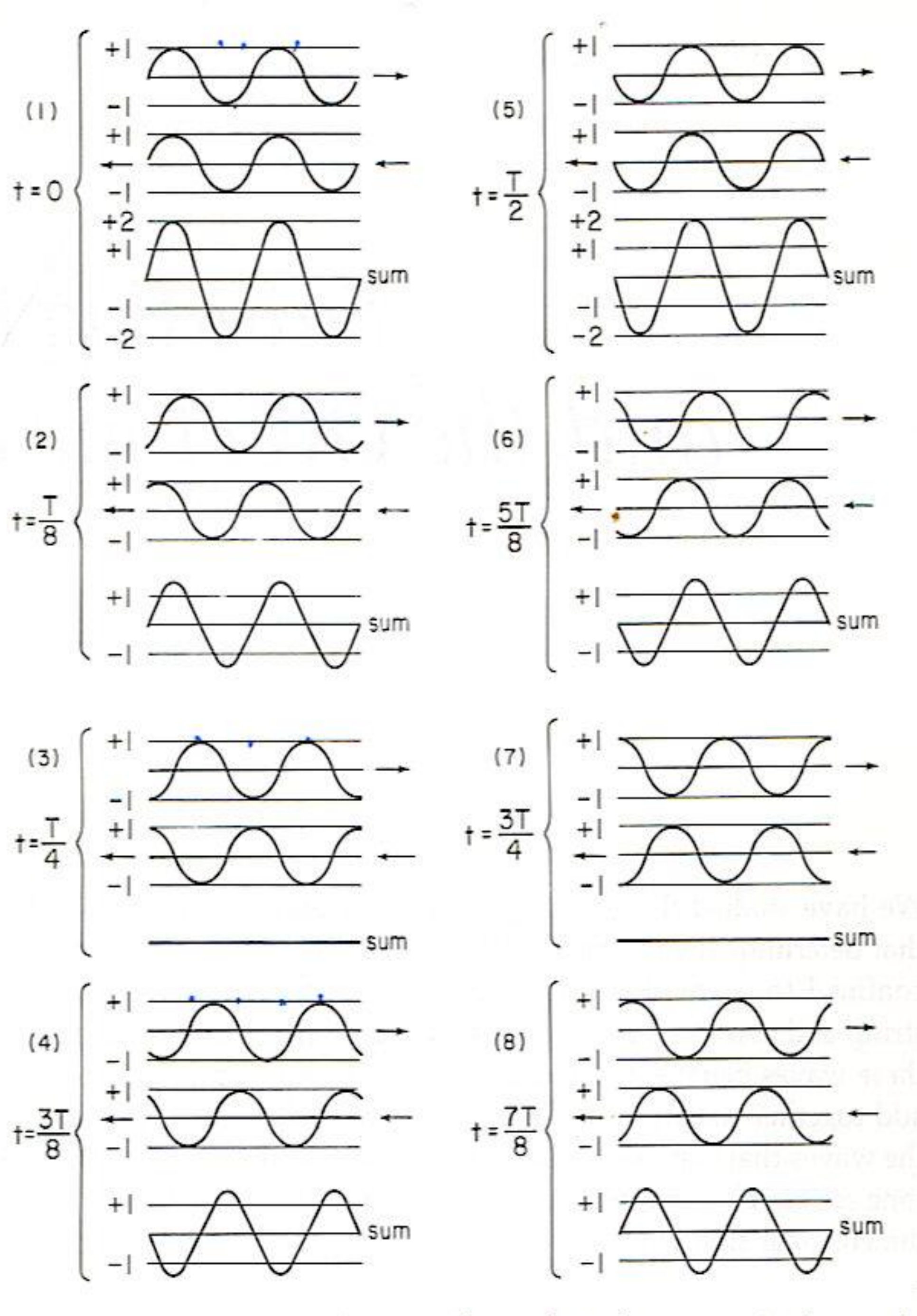

Figure 18

Two of the same sinusoidal wave meeting in opposite directions and their sum, with each successive example rotated an eighth of a period.[9]

[9] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 64.

The resulting wave from Figure 18 would continually oscillate back and forth between the two end points, creating a standing wave. When a standing wave is formed, the system it is formed in becomes resonant. In a trumpet, when a standing wave is formed a note is produced. When a trumpet is being played with a clear and resonant characteristic trumpet timbre, a large percentage of the harmonic components match the length of the trumpet, creating a complex standing wave. When a trumpet is played with a poor timbre, a smaller percentage of the harmonic components match the length of the trumpet, creating a different complex standing wave that has a less characteristic trumpet sound. When a trumpet player feels and hears a note being centered on the trumpet, he/she is feeling and hearing a characteristic standing wave of the trumpet timbre.

Along the standing wave are nodes and antinodes, the node being where there is no movement of the oscillation, and the antinode the fastest movement of the oscillation. Figure 19 shows a simple standing wave with an end point on each end of the wave and the nodes (N) and antinodes (A).

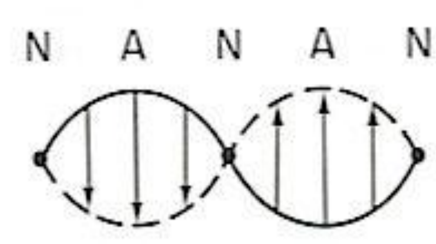

Figure 19
A simple standing wave with an end point on each end of the wave and the nodes and antinodes.[10] The arrows and dotted line show the returning wave.

[10] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 70.

Standing waves must equally fit between the two ends they oscillate or reflect between. Generally, there is no limit to the number of oscillations that can be present between two end points; however, a standing wave must be made up of complete oscillations. In the graph below, Figure 20, there is a stretched string, then the first possible oscillation, then the second, etc. These oscillations that grow in frequency are labeled as the fundamental and the harmonics.

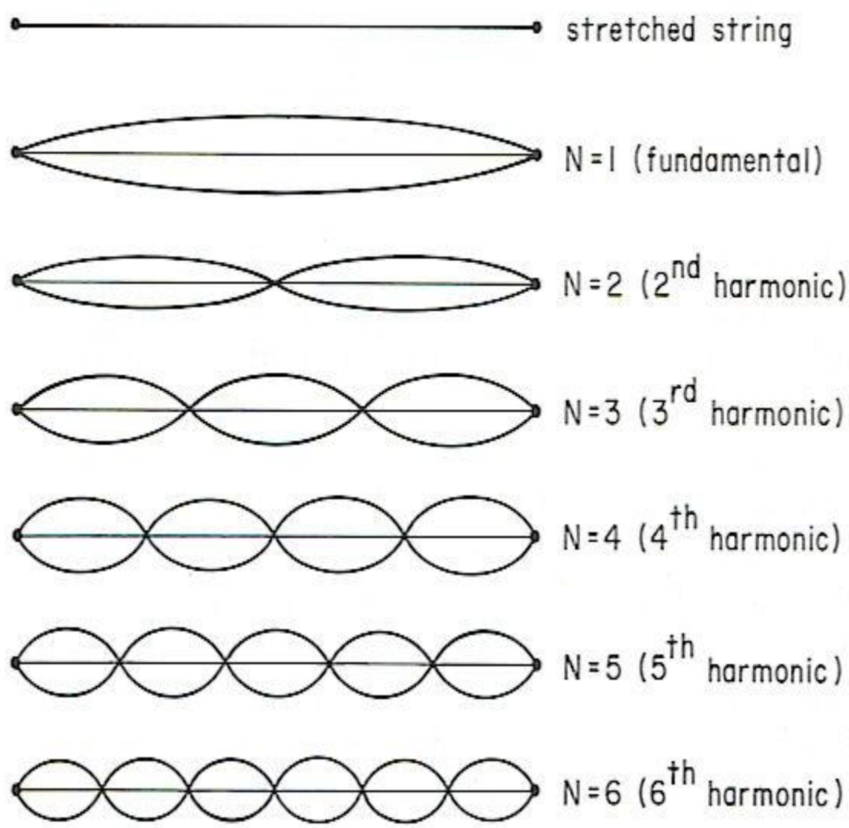

Figure 20
Oscillation of harmonics.[11]

[11] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 71.

The harmonics are related to the fundamental in that each harmonic is a multiple of the fundamental. If the fundamental was 440 Hz, the familiar tuning note in the orchestra, then the second harmonic would be 880 Hz, the 3rd 1,320 Hz, and so on. The set of sinusoidal standing waves with frequencies related by being multiples of the fundamental is known as the overtone series.[12] Transverse (movement perpendicular to the medium) standing waves have a direct comparison to longitudinal (movement along the medium) standing waves as the same principles can be applied. The oscillations of the string in Figure 20 are transverse standing waves; the oscillations of air in a tube of a trumpet are longitudinal standing waves.

Open End System

In the graphs above, the standing wave was oscillating along a string with fixed ends, or similarly, in a tube with closed ends. The trumpet has one closed end, the lips, and one open end, the bell. The lips function as a valve sending vibration (oscillations) or waves down the tube. With an open end, instead of a complete reflection, there is a partial reflection of the wave. When a wave transitions from a constant diameter tube to an open space, or much larger tube (the bell), there is some reflection and some continuation of the wave. When a sound wave reaches the bell of a trumpet, some of the wave is reflected back down the tube and some continues out. Figure 21 is a graphic representation of the change in reflection from a closed end (a) and open end (b). With the closed end, the entire wave (direction shown by arrows) returns (is reflected). With the open end, some of the energy of the wave returns and is reflected, while some

[12] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 72.

continues on. A visual example that is similar to this would be a slinky. If you hold the end of a slinky on a flat hardwood floor and thrust it forward while retaining hold onto the end of it, it will extend out. Even though the non-held end of the slinky does not hit anything, part of the wave going out, from your thrust, will return to your hand. That would be an open ended system. In a closed end system, the thrust end of the slinky would hit a wall and the energy, the outgoing wave, would return to your hand.

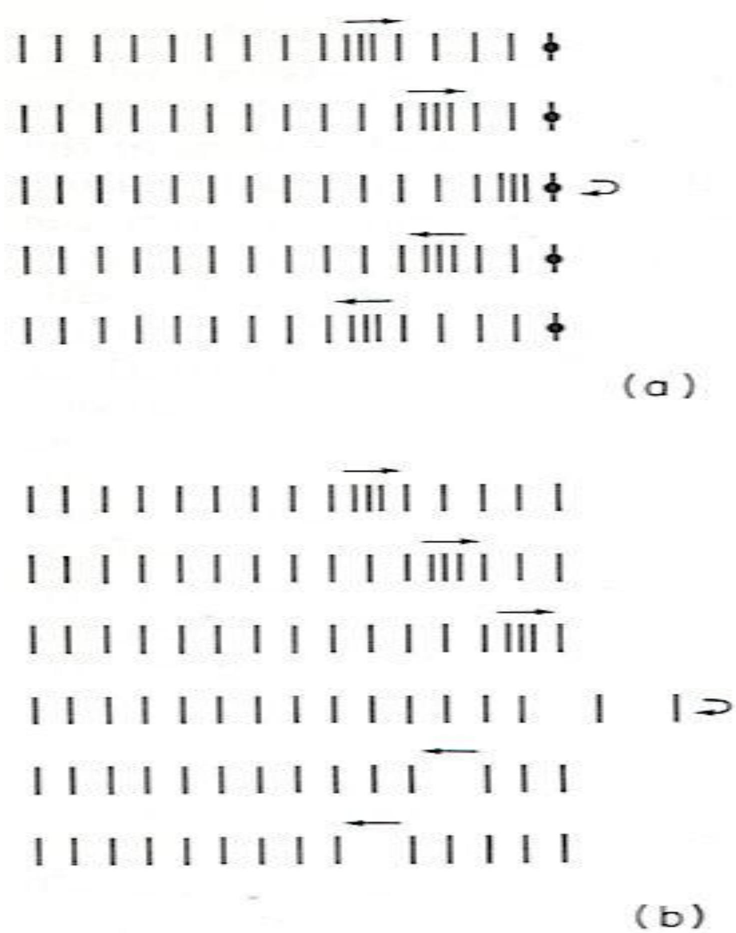

Figure 21
A graphic representation of the change in reflection from a closed end (a) and open end (b)[13]

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[13] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 78.

Complex Waves and Fourier Synthesis

The process of combining harmonics to form a complex wave is called Fourier synthesis. The Fourier analysis is the inverse process of mathematically determining the harmonic content of complex waves. The content of the fundamental and harmonics, or makeup, of a complex wave from a musical sound are responsible for the timbre of the sound. Figure 22 contains the Fourier synthesis of a square wave with the successive addition of harmonics on the left and the sum on the right.

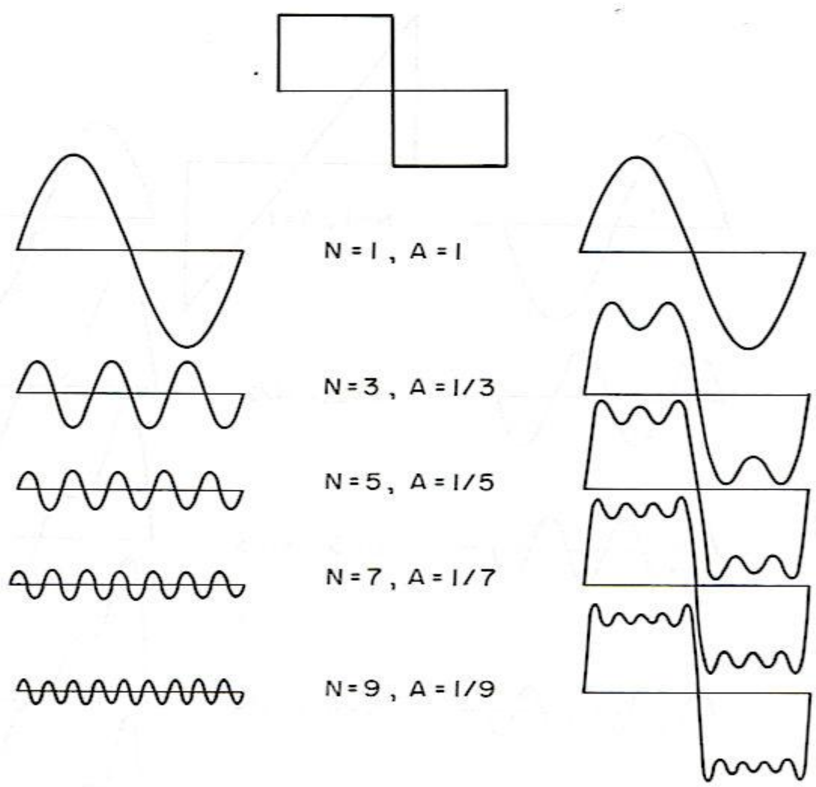

Figure 22
N is the number of cycles, A is the amplitude relative to the original amplitude. The diagram contains the Fourier synthesis of a square wave with the successive addition of harmonics on the left and the sum on the right.[14]

[14] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 93.

With a Fourier analyzer or spectrum analyzer, a general correlation can be made between harmonic structure as observed in the Fourier spectrum and timbre.[15] Below are three different complex waves on the left and the waves broken down into their Fourier components on the right.[16]

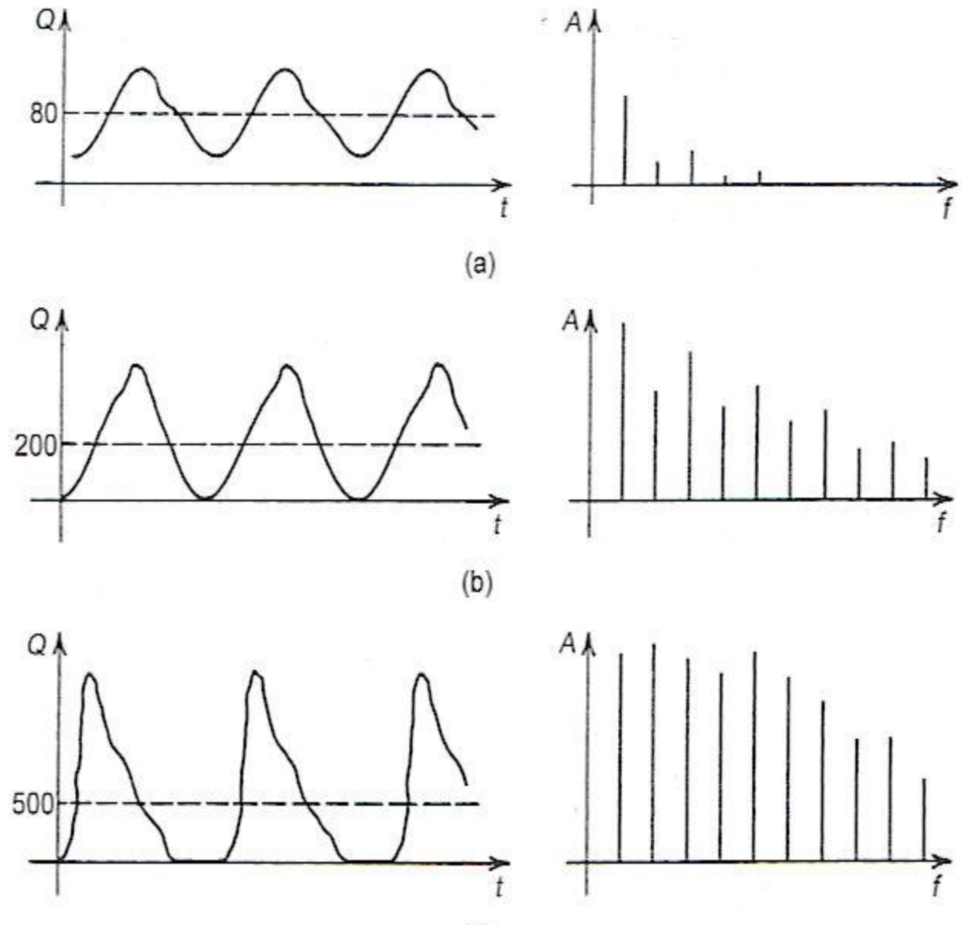

Figure 23
Three different complex waves on the left and the waves broken down into their Fourier components on the right.[17]

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[15] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 100.

[16] Donald E. Hall, *Musical Acoustics, 3rd Edition* (Pacific Grove, CA: Brooks/Cole, 2002), 302.

[17] Ibid.

The timbre for each wave is different and can, generally, be represented by two ratios. One ratio is the peak harmonic to total harmonics ratio, the other, the odd to even harmonics ratio. The first wave (a) is broken down into its Fourier components on the right, or the harmonics. The shape of the harmonics has a large peak harmonic (first) in relation to the other harmonics. This wave would have a large peak harmonic to total harmonics ratio. The first wave would also have a large odd harmonic to even harmonic ratio as the majority of the strength is in the first harmonic, or fundamental. The timbre of the sound for this wave would rely heavily on the first harmonic. The third wave (c) has multiple harmonics that are similar in amplitude and would have a low peak harmonic to total harmonics ratio. Also, the third wave (c) would have a low odd harmonic to even harmonic ratio as there are the same amount of odd and even harmonics and they are similar amplitudes. The timbre would be different than the first wave (a). The second wave (b) would have a large odd to even harmonic ratio and fall between the first (a) and third (c) waves in size of the peak harmonic to total harmonic ratio. When discussing and defining timbre in this study, timbre is expressed in these two ratios in the manner done with the waves in Figure 23.

The Human Ear

The human ear has an extreme range of sensitivity, both in amplitude and frequency. The ear responds to vibrations over a range of approximately 20 Hz to 20 kHz, a factor of about 1,000 in frequency. In comparison, the eye is sensitive with a factor of less than 2 to 1.[18] The ear can sense pressure variations from 1 part in

[18] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 137.

10,000,000,000 of atmospheric pressure (threshold of hearing), to an oscillation of 1 part in 10,000 atmospheric pressure (threshold of pain). In the frequency range of 100 to 5000 Hz, an average person can notice a difference in loudness between a value of 5 to 20 percent.[19] In this study, the author chose to measure the dynamics the players played as they perceived them. It is understood that this is not an exact method of controlling dynamic volume, but it does represent how loud the players felt their playing was in a real-world setting. This choice was made in an effort to analyze the sound the players use in their everyday playing.

Decibels

Amplitude in sound is often measured in decibels (dB), due to the extreme range of hearing and the resultant cumbersomeness of dealing directly with intensities. Decibels are structured on a logarithmic scale of 10; by every increase of sound intensity level of a factor of 10, decibels increases by a factor of 10. Similarly, an increase in a factor of 100 is an increase in 20 dB.[20] In this investigation, decibels were the system used for measuring amplitude on the oscilloscope. When looking at the oscilloscope graphs, the observer needs to remember that the visual differences between amplitudes of the harmonics seem less than they actually are due to the use of decibels.

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[19] John Askill, *Physics of Musical Sounds (*New York, N.Y.: D. Van Nostrand Company, 1979), 51.

[20] Richard E. Berg, and David G. Stork, *The Physics of Sound* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982), 146.

Formant Region and Critical Bands

If a series of Fourier spectra were plotted for every note for a particular instrument, and all harmonics that lie within a specific range of frequency are emphasized in relation to other harmonics, that frequency region is called a formant region.[21] An instrument may have a different Fourier spectrum of each note, to some degree, but there would be a certain frequency range where the harmonics are emphasized on each note. The characteristic sound of that instrument is believed to be linked to the formant region. The ear is sensitive to formant regions and can identify an instrument's timbre despite small changes of each note of the Fourier spectrum. However, the ear does not identify the time alignment, or phase, of the Fourier components (harmonics) well. It "hears" the summation of wave fronts (harmonics) well in terms of amplitude, but not phase. For example, when people hear a trumpet play, the tone sounds constant and steady and people do not perceive a pulsing sound. The shape of the formant region is generally described by the ratio of the peak harmonic to total harmonics. A large peak harmonic to total harmonic ratio corresponds to a narrow formant region (Figure 23 (a)), and a low peak harmonic to total harmonic ratio corresponds to a wide formant region (Figure 23 (c)). This study also analyzes the general shapes of the harmonics as they appear in a line graph and the formant region of the timbre produced with different backbores is compared.

Critical bands are frequency ranges within a certain distance where the ear lumps harmonics together if it hears more than one. If several spectral components all fall within a critical band, the ear hears the combined strength of the components and not

[21] Donald E. Hall, *Musical Acoustics, 3rd Edition* (Pacific Grove, CA: Brooks/Cole, 2002), 301.

each individually. At about the 7^{th} harmonic, a significant overlap begins where the ear starts grouping harmonics together. This means that when comparing timbre, we are dealing with fewer groups of influence on timbre rather than many. Donald Hall notes that "Several experiments indicate that components up through the sixth or seventh each make an independent contribution to tone perception, while higher components merge together."[22] For example, there would be no great timbre difference, or noticeable difference, if harmonic numbers 8 or 9 are strong, as each are in the same critical band.[23] When analyzing the spectral components, the harmonics above the 6^{th} or 7^{th} harmonic are less important individually. How we hear harmonics is important overall because a large importance on timbre and pitch is placed on the harmonics.

[22] Donald E. Hall, *Musical Acoustics, 3rd Edition* (Pacific Grove, CA: Brooks/Cole, 2002), 401.

[23] Johan Sundberg, *The Science of Musical Sounds* (San Diego, CA: Academic Press, Inc., 1991), 71.

Chapter IV

Findings / Conclusions

The total interior volume of the trumpet mouthpiece backbore does not strongly correlate to the timbre produced on the trumpet, as measured in this study. The interior shape of the trumpet mouthpiece backbore does strongly correlate to the timbre of the trumpet. There were moderate correlations, not strong, of the total interior volume and the odd to even harmonic ratio on the 233 Hertz frequencies at *mezzo forte* and *forte* and on the 466 Hertz frequencies at *piano* and *mezzo forte*. A strong correlation of total interior volume to timbre was not found.

The interior shape of the backbores was also compared to the timbre. The shape of the backbores was described by dividing the backbores into five segments of the same length and finding the interior volume of each segment. Comparing the interior volumes of each segment generally describes the rate of taper, or shape, of the backbore. The shape of the first three segments (small end) strongly correlated to timbre. The middle of the backbore, segment three, strongly correlated to the timbre as described as a ratio of peak harmonic to total harmonics at the 233 Hertz and 932 Hertz frequency at *mezzo forte*. The middle-small end of the backbore, segment two, has strong correlations at the 466Hz frequency at *piano* and *mezzo forte*. The small end of the backbore, segment one, has strong correlations at the 466 Hertz frequency at *piano* and *mezzo forte*. In general, as the rate of taper in the middle section of a backbore increases the timbre gets darker, conversely as the taper decreases the timbre gets brighter, in the low and upper registers. When the rate of taper of the small-middle end of the backbore is increased, the timbre of the trumpet gets brighter in the middle register. When the rate of taper of the small-middle end of the backbore is decreased, the timbre of the trumpet gets darker in the middle register. When the rate of taper of the small end of the backbore is increased, the timbre gets brighter in the middle register. When the rate of taper of the small end of the backbore is decreased, the timbre gets darker in the middle register. The shape of the backbore strongly correlates to timbre.

The methodology of describing timbre from analyzing harmonic components of timbre has potential, with more studies, to become increasingly valid as a method of designing, understanding, and communicating about trumpet equipment. This could be a departure from using only trial and error and lead to a new way trumpeters and manufacturers communicate with each other, and select and design equipment. The author hopes this is just a starting point in exploring trumpet design and that these ideas lead to musicians being better equipped to explore and communicate their craft.

Backbores with the Same or Similar Interior Volume and Different Harmonic Structures

The YC backbore is very consistent with itself, see Figure 24. The third harmonic is the peak harmonic on the 233 Hz frequency at *piano*, *mezzo forte*, and *forte*, and on the 466 Hz frequency at *mezzo forte*, and *forte.* The first harmonic is the peak harmonic on the 932 Hz frequency at the *piano*, *mezzo forte*, and *forte* dynamics. The timbre of the YC backbore remains similar throughout the ranges and dynamics tested. The B24 backbore is not consistent with itself, see Figure 25. On the 233 Hz frequency the peak harmonic moves from the first at the *piano* dynamic, to the third at *mezzo forte*, and the third and fourth at *forte*. A characteristic of the B24 backbore is that as the dynamic increases the peak harmonic moves to a higher harmonic. The timbre of the of B24 backbore changes, it gets brighter, as the dynamics are increased. The YC and B24 backbores have similar total interior volumes, 0.1358 and 0.1326 cubic inches respectively. The YC and B24 backbores demonstrate how different the timbre can be with two backbores with nearly the same interior volume.

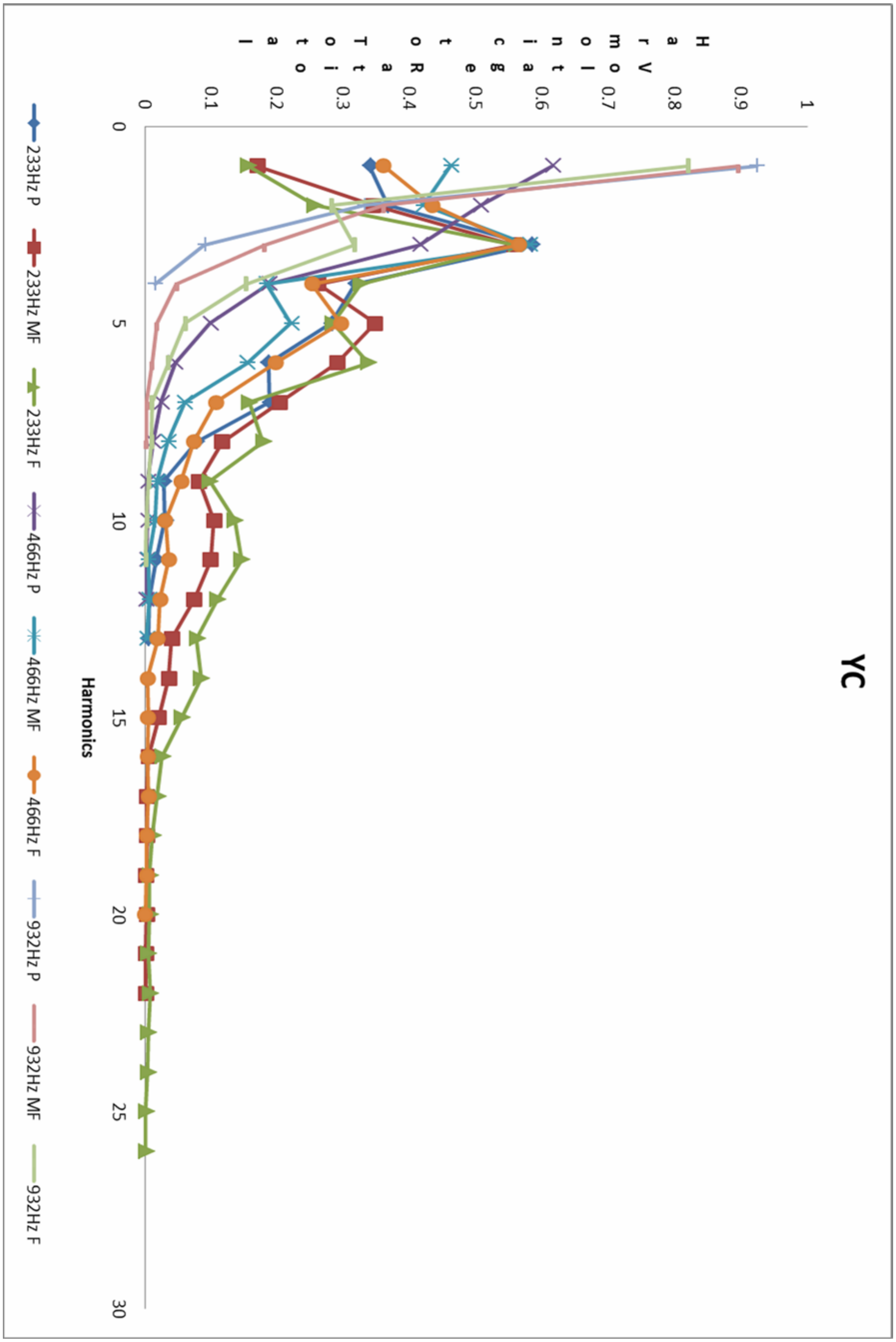

Figure 24
The YC backbore is consistent.

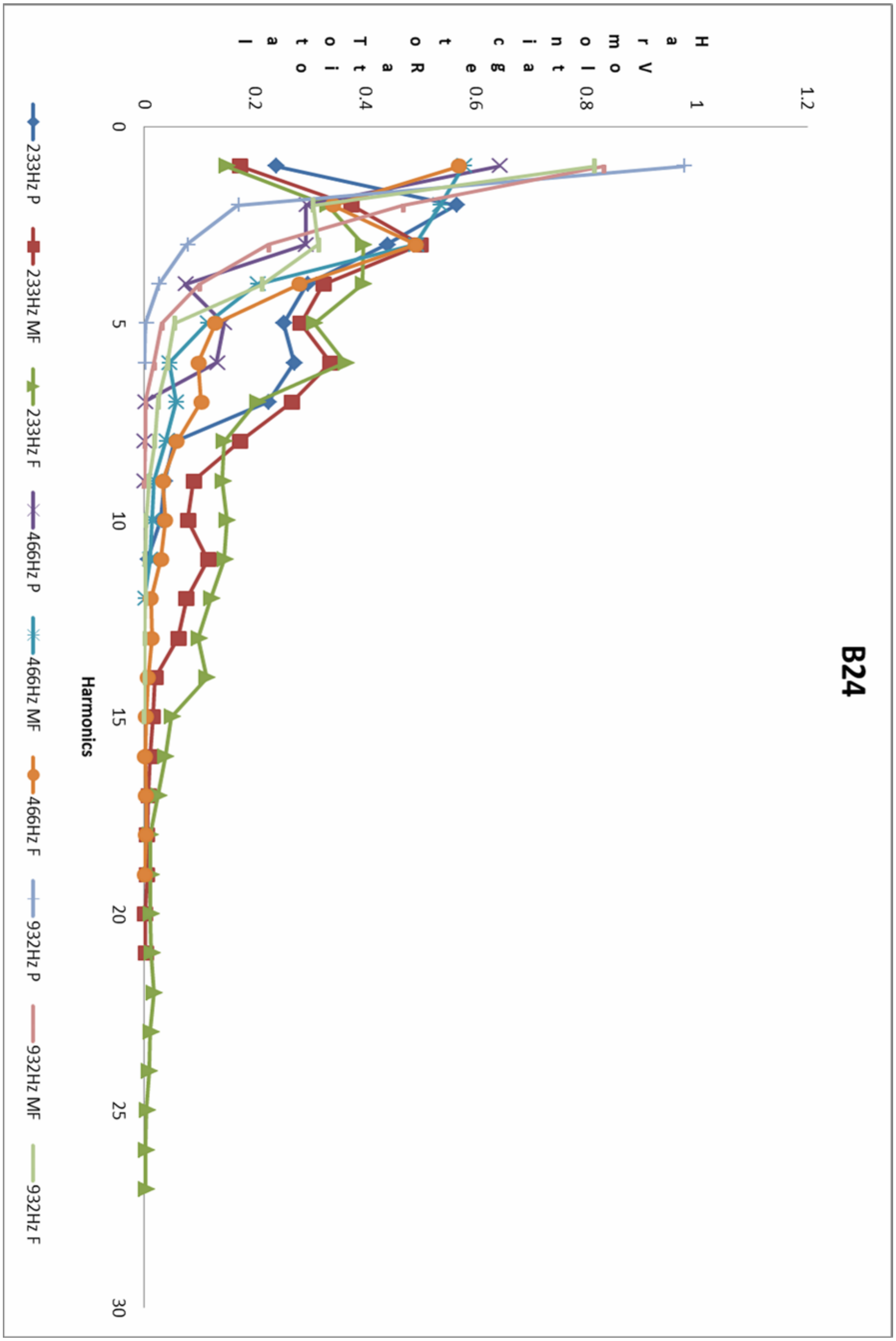

Figure 25
The B24 backbore is not consistent.

The B10 and B76 backbores have essentially the same interior volume, only a difference of 0.001 cubic inches. The B10 interior volume is 0.1236 cubic inches and the B76 is 0.1237 cubic inches. A significant difference in the harmonic shapes exists at the 932 Hz frequency at forte. The first harmonic is the B10's peak harmonic and the second is the B76's peak harmonic. This is notable because all of the other backbores have the first harmonic as their peak harmonic on the 932 Hz frequency, except the B76. The B10 and B76 backbores demonstrate how different the harmonic shapes can be with backbores with essentially the same interior volume. The difference of harmonic shapes between backbores with very similar interior volumes indicates that interior volume of trumpet mouthpiece backbores is not likely the primary contributor to timbre.

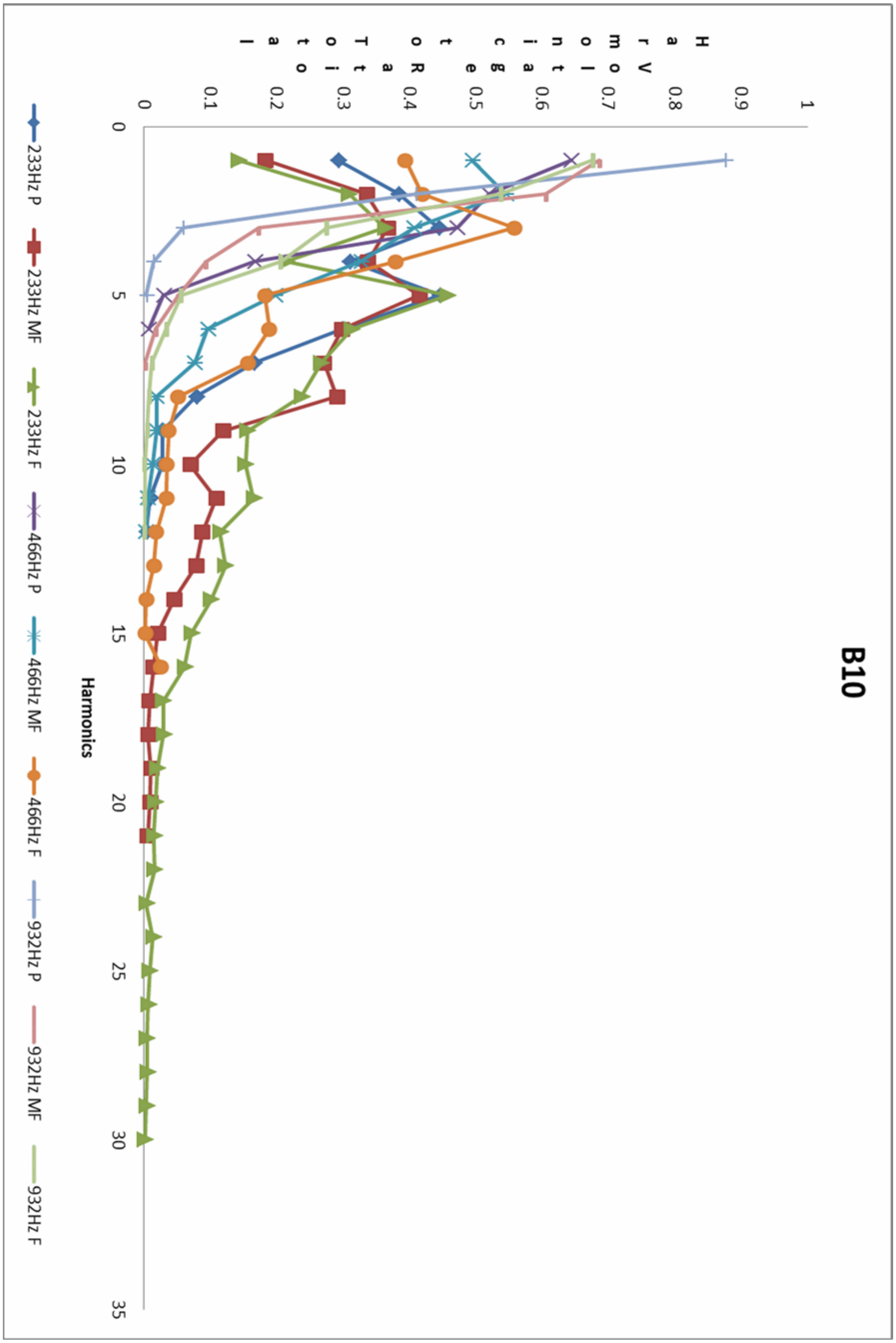

Figure 26
The B10 backbore has a very different harmonic shape at the 932 Hz frequency than the B76 backbore, yet essentially the same interior volume.

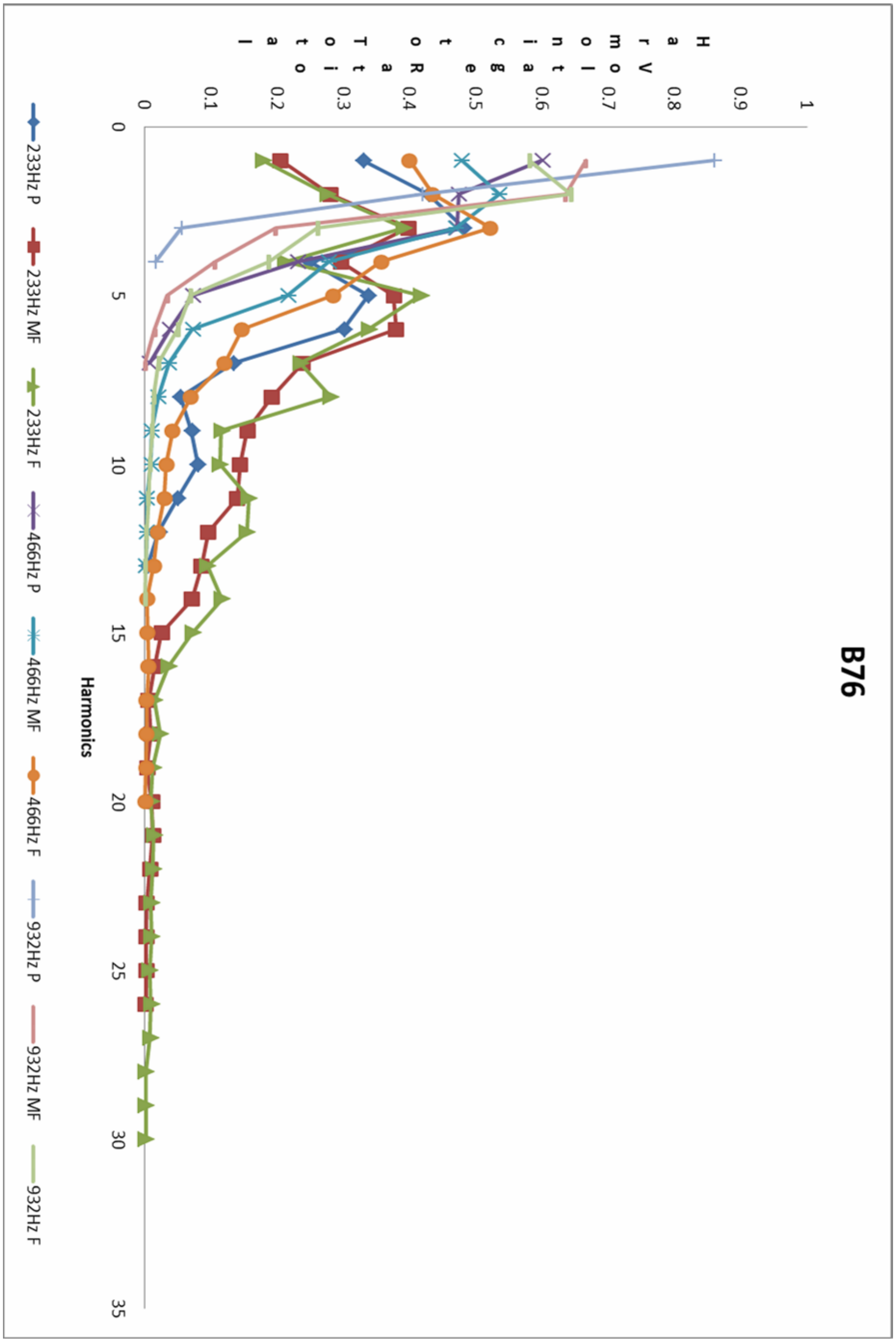

Figure 27
The B76 backbore on the 932 Hz frequency at *forte* has the second harmonic as strongest, as opposed to the B10 backbore that has the first harmonic. Both backbores are essentially the same interior volume.

Correlating Timbre to Total Interior Volume – Peak Harmonic to Total Harmonic Ratio

Timbre is related to the strength and allocation of the harmonics in the sound. Viewed in a general sense, a minimal correlation of the ratio of the peak harmonic to the total harmonics and interior volume indicates that interior volume is not strongly related to timbre. Correlations were calculated using the Pearson product-moment correlation coefficient to measure the dependence between the two variables (interior volume and the ratio). In Table 2 there is not a strong correlation between total interior volumes and the peak harmonic to total harmonic ratios. A positive correlation value indicates both values (total interior volume and the peak harmonic ratio) increase together. A negative correlation value indicates one value increases and one decreases. A positive correlation means that the peak harmonic increases as total interior volume increases, or the timbre becomes darker. A negative correlation means that the peak harmonic decreases as the total interior volume increases, or the timbre becomes brighter.

Dynamic	233 Hertz	466 Hertz	932 Hertz
P	-0.2785	-0.3684	-0.1202
MF	0.2128	-0.3429	0.0074
F	0.0387	0.1355	0.2550

Table 2

Total interior volume and peak harmonic to total harmonic ratio correlations.

In Table 2, the correlation for each frequency and dynamic was found from the data of all twelve of the backbores. When timbre is described as a ratio of the peak harmonic to total harmonics, there is not a strong correlation to total interior volume.

Total interior volumes and the peak harmonic to total harmonic ratios were also graphed. Visually analyzing graphs allows unique cases to be spotted that may be overlooked with analyzing data in a table alone. When interpreting the graphs, a small ratio indicates a broad shape or makeup of the harmonics being spread evenly over many harmonics. A large ratio indicates a narrow shape, with much of the power of the sound contained in one harmonic (Refer to Figure 23). A correlation exhibits itself in a diagonal line across the graph, either trending up or down. If the points on the graph trend horizontally, then there is minimal correlation of timbre to interior volume.

Figure 28 through Figure 36 graphically demonstrates a lack of strong correlations of total interior volume to the ratio of the peak harmonic to total harmonics. Each graph supports a lack of strong correlation, as did Table 2, that total interior volume is not strongly correlated to timbre.

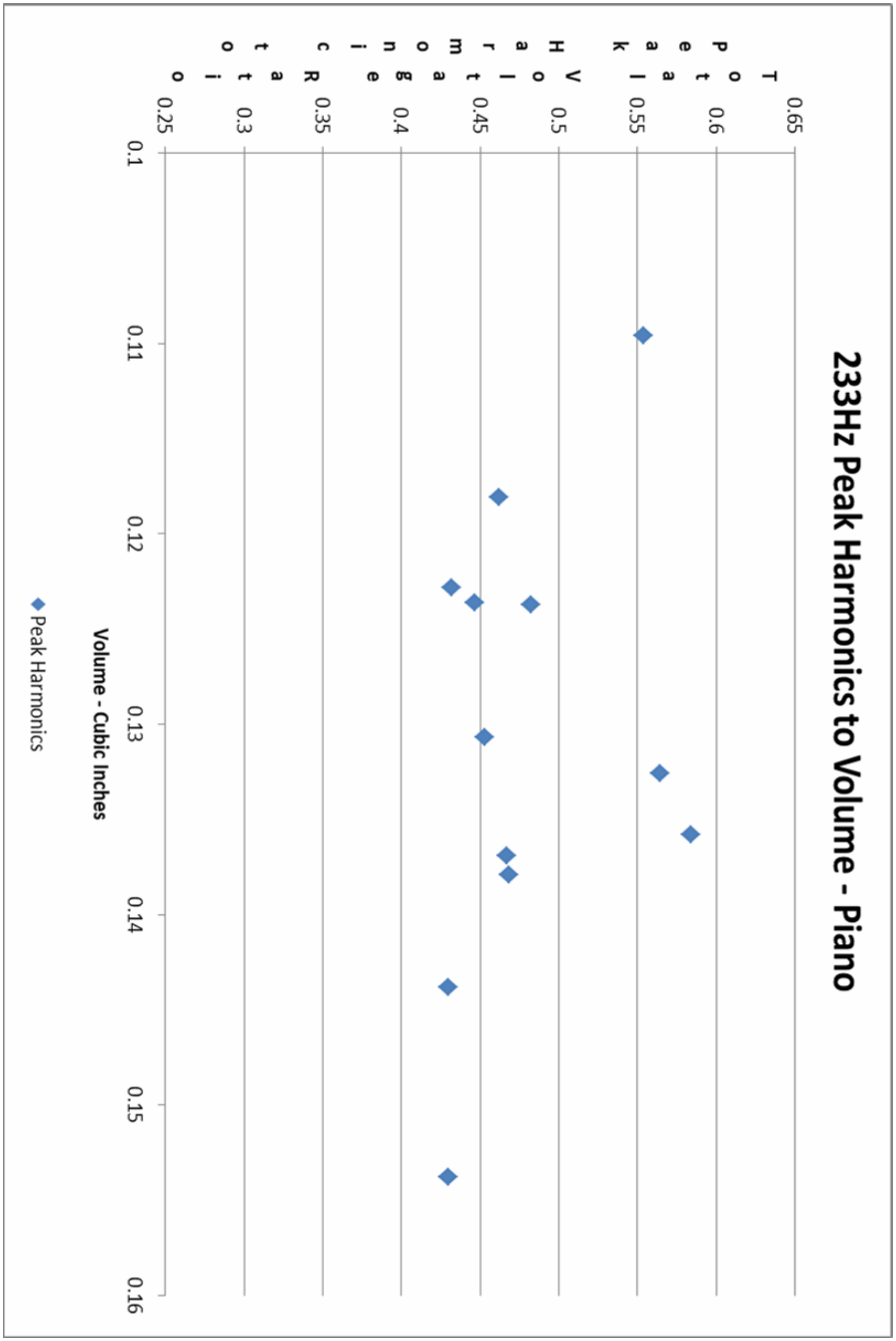

Figure 28
233Hz peak harmonics to volume – *piano* (r = -0.2785).

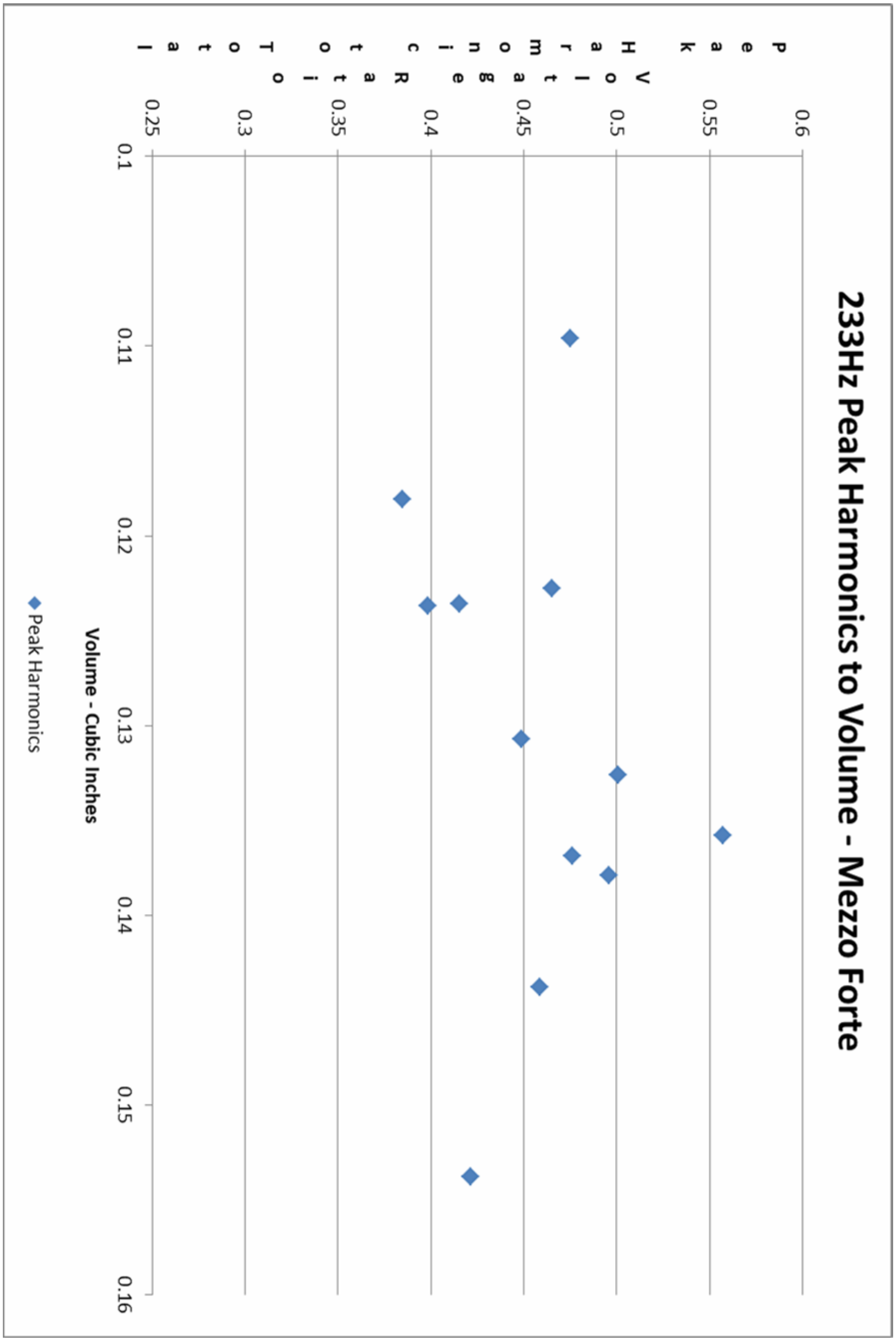

Figure 29
233Hz peak harmonics to volume – *mezzo forte* (r = 0.2128).

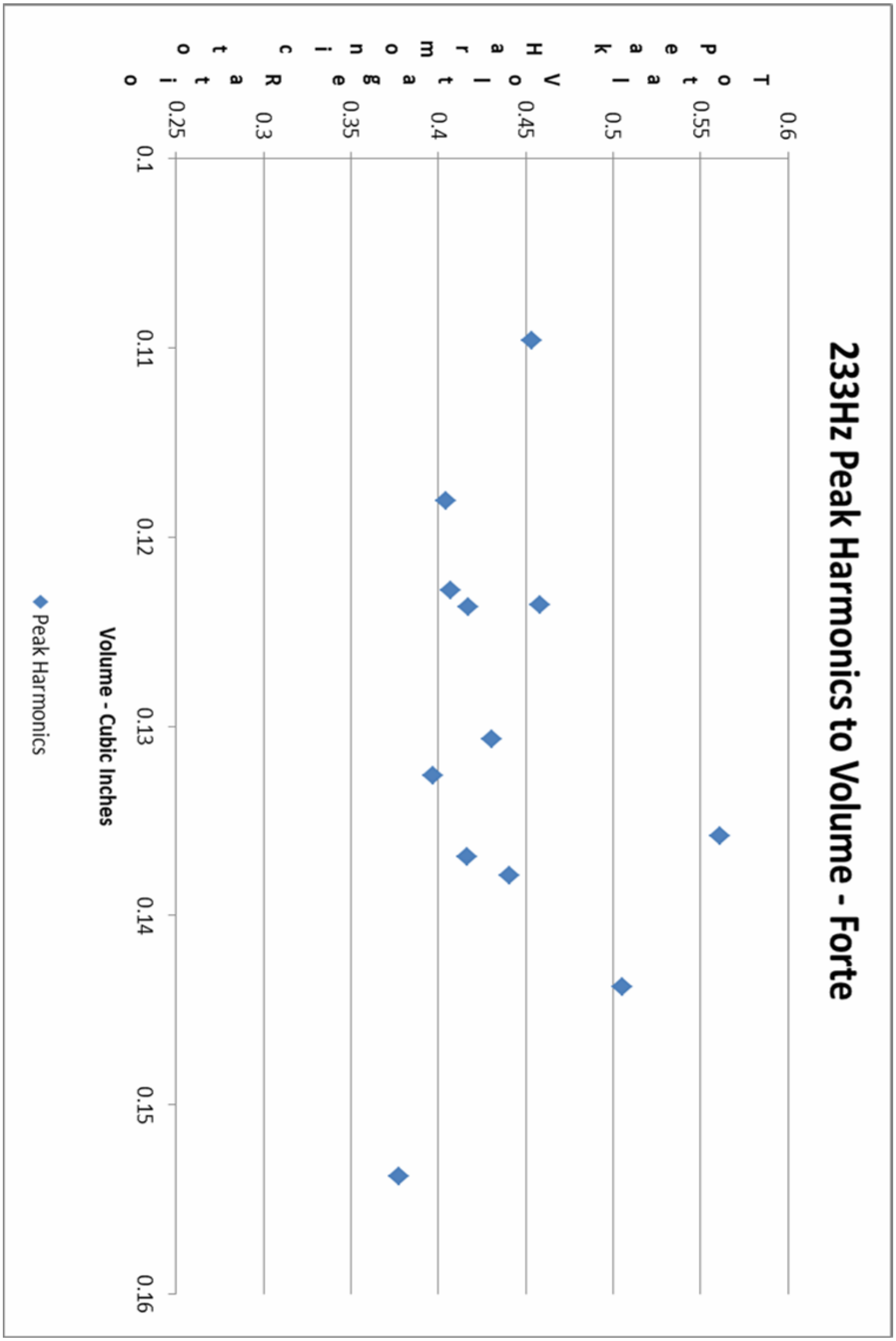

Figure 30
233Hz peak harmonics to volume – *forte* (r = 0.0387).

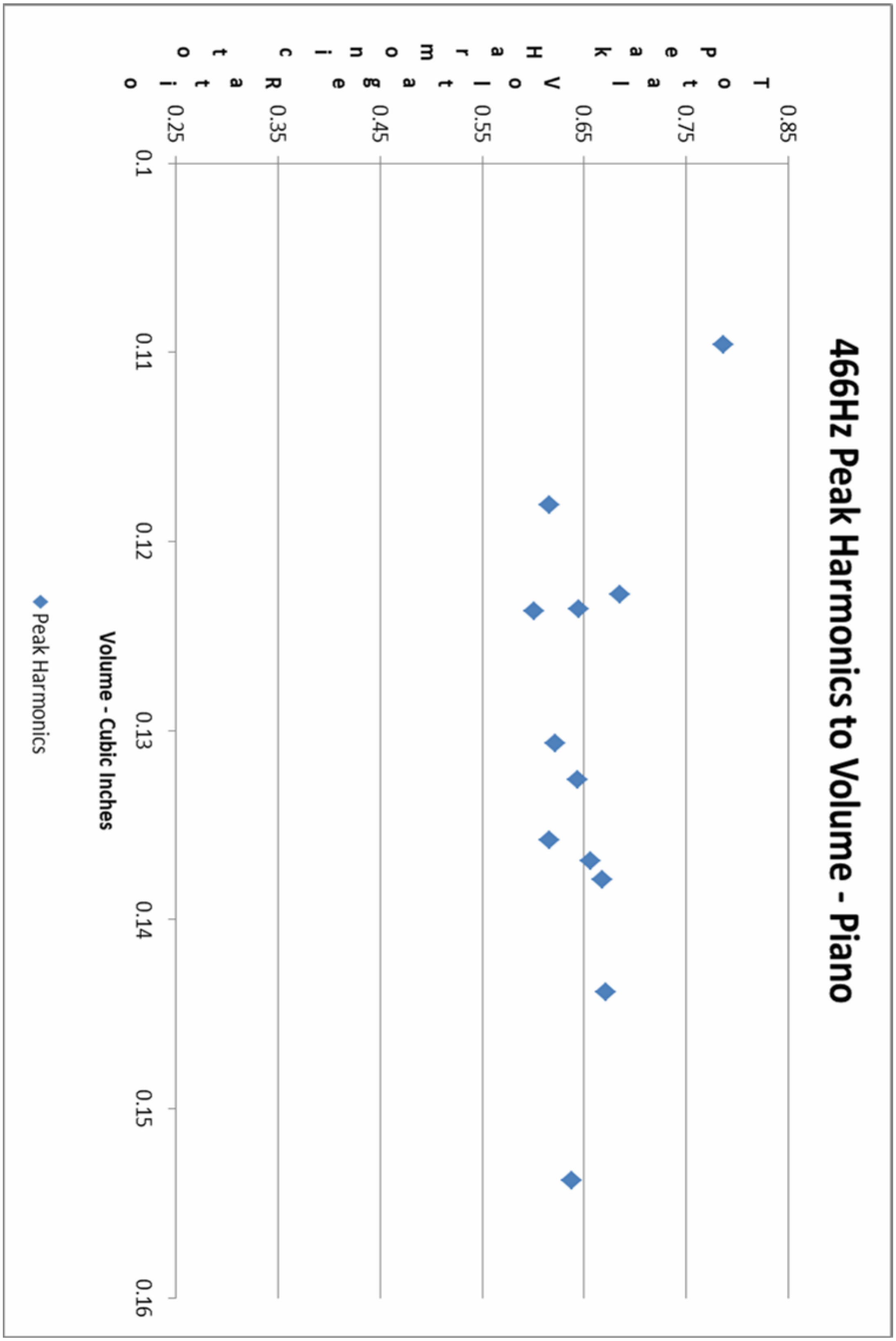

Figure 31
466Hz peak harmonics to volume – *piano* (r = -0.3684)

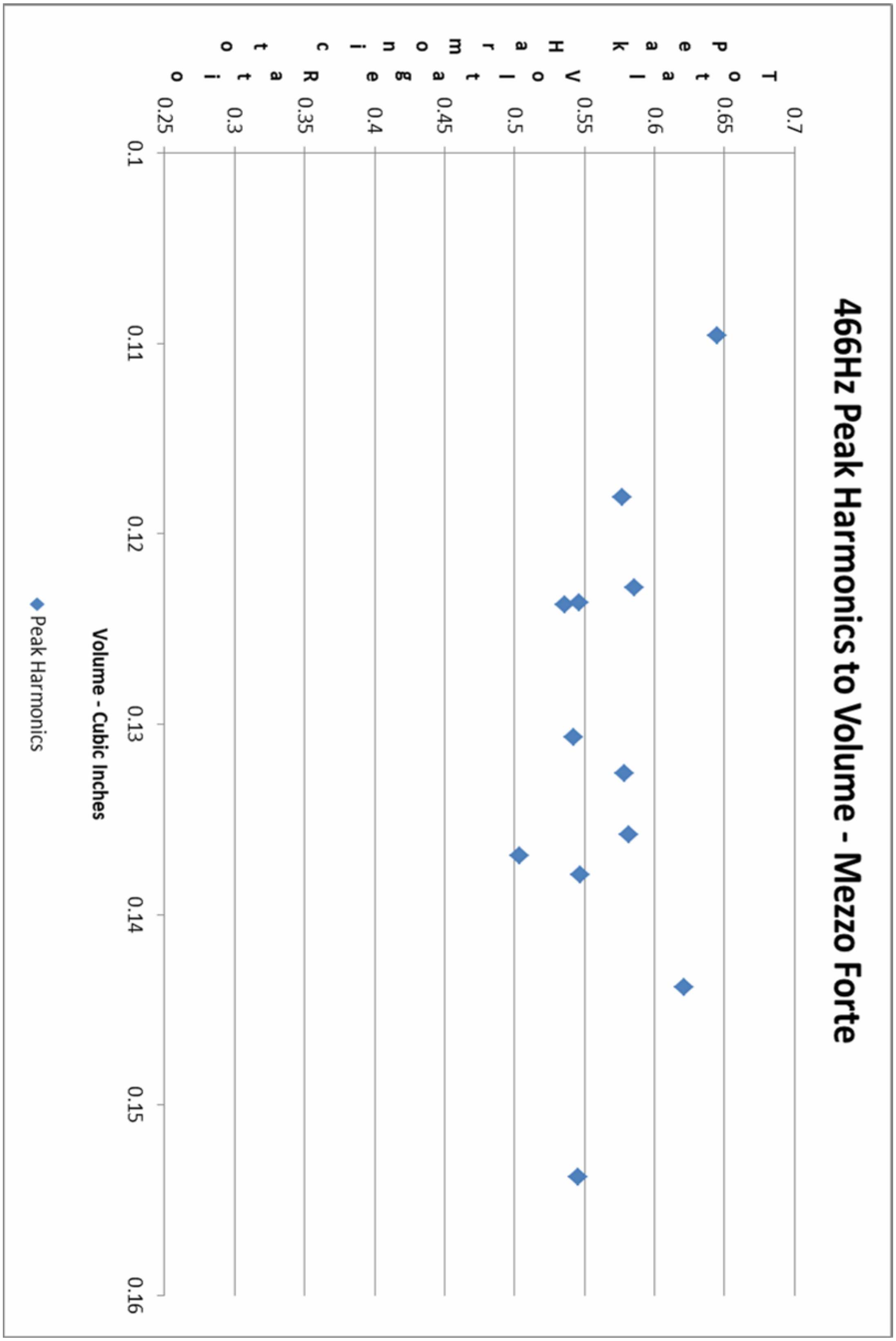

Figure 32
466Hz peak harmonics to volume – *mezzo forte* (r = -0.3429).

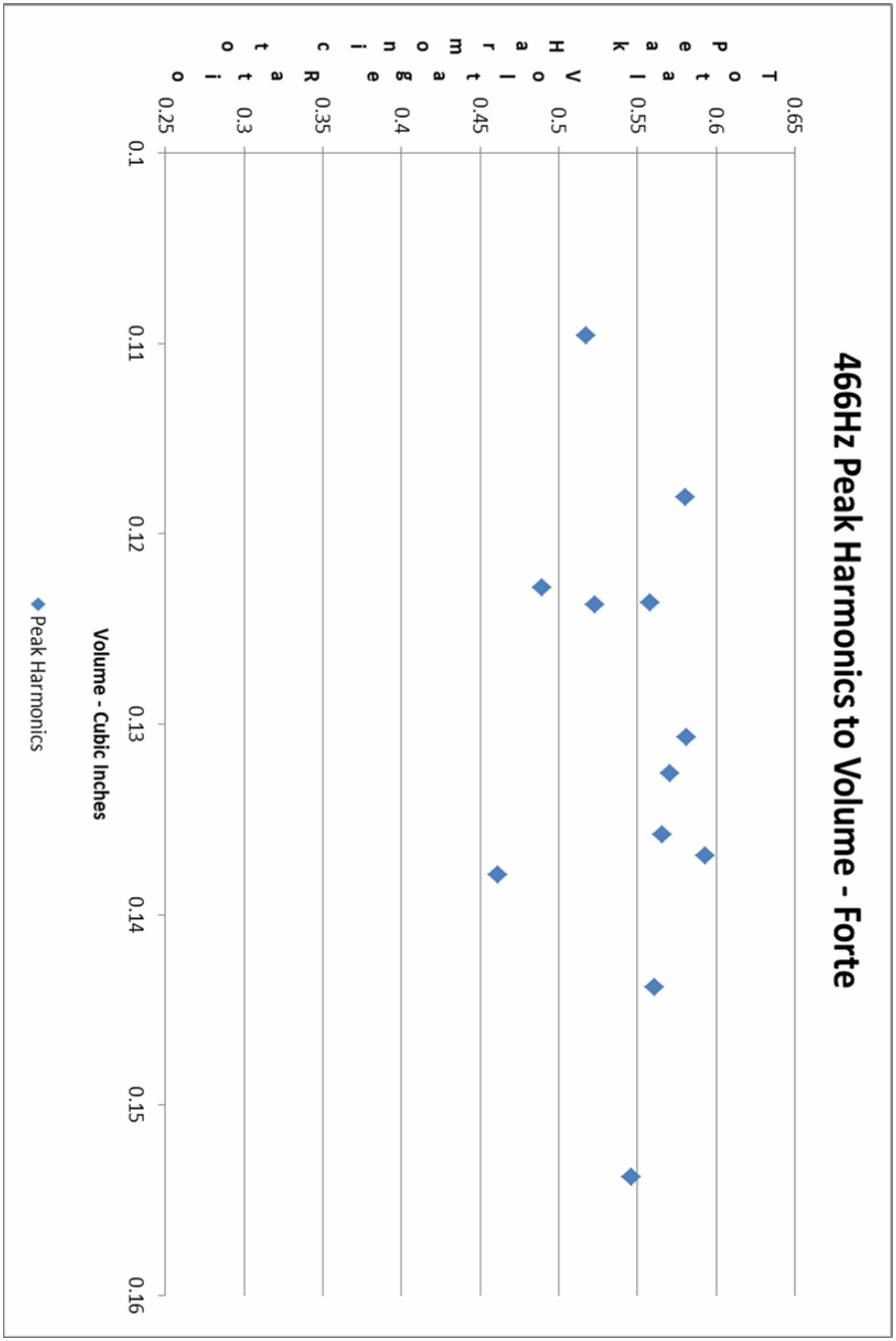

Figure 33
466Hz peak harmonic to volume – *forte* (r = 0.1355).

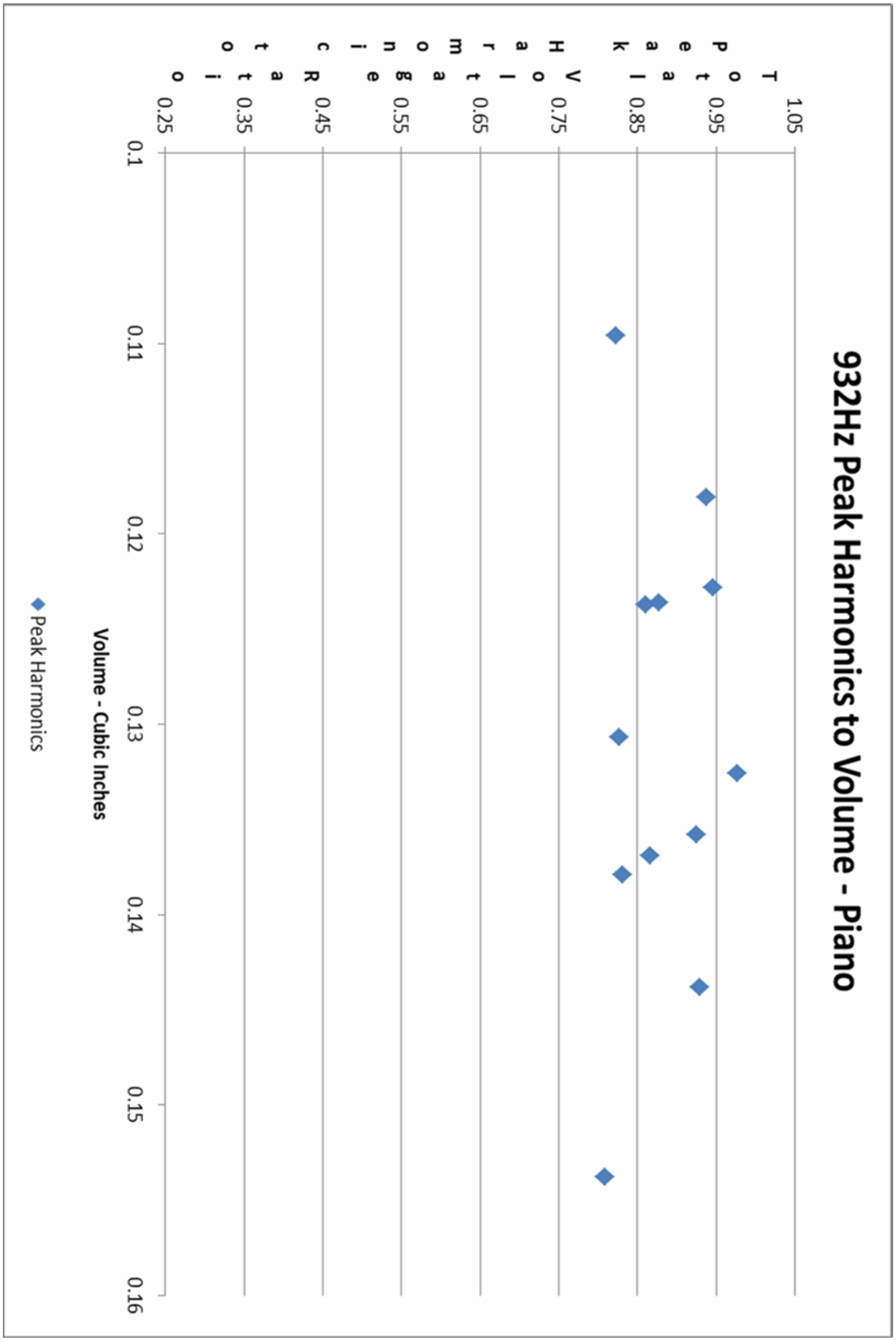

Figure 34
932Hz peak harmonics to volume – *piano* (r = -0.1202).

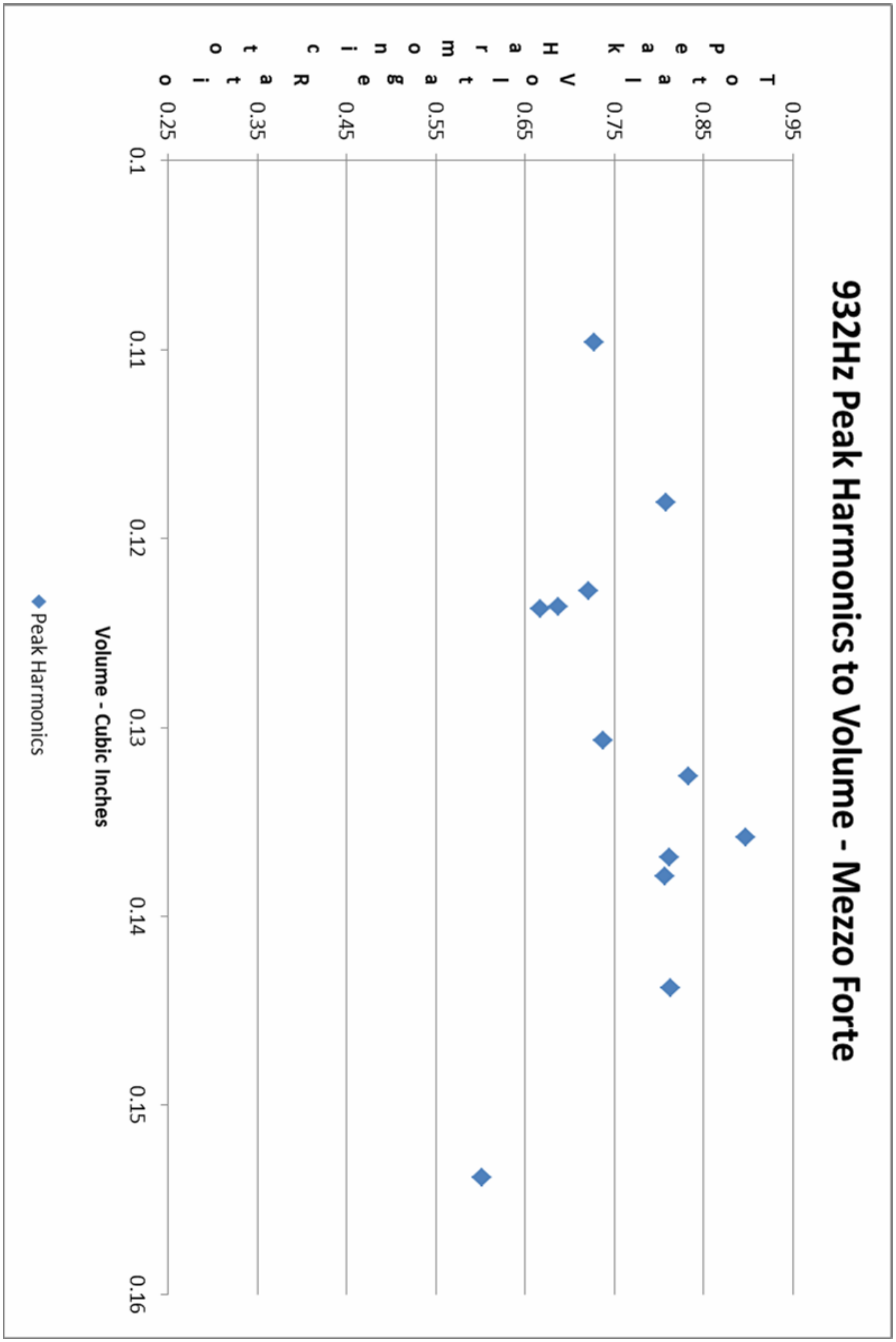

Figure 35
932Hz peak harmonics to volume – *mezzo forte* (r = 0.0074).

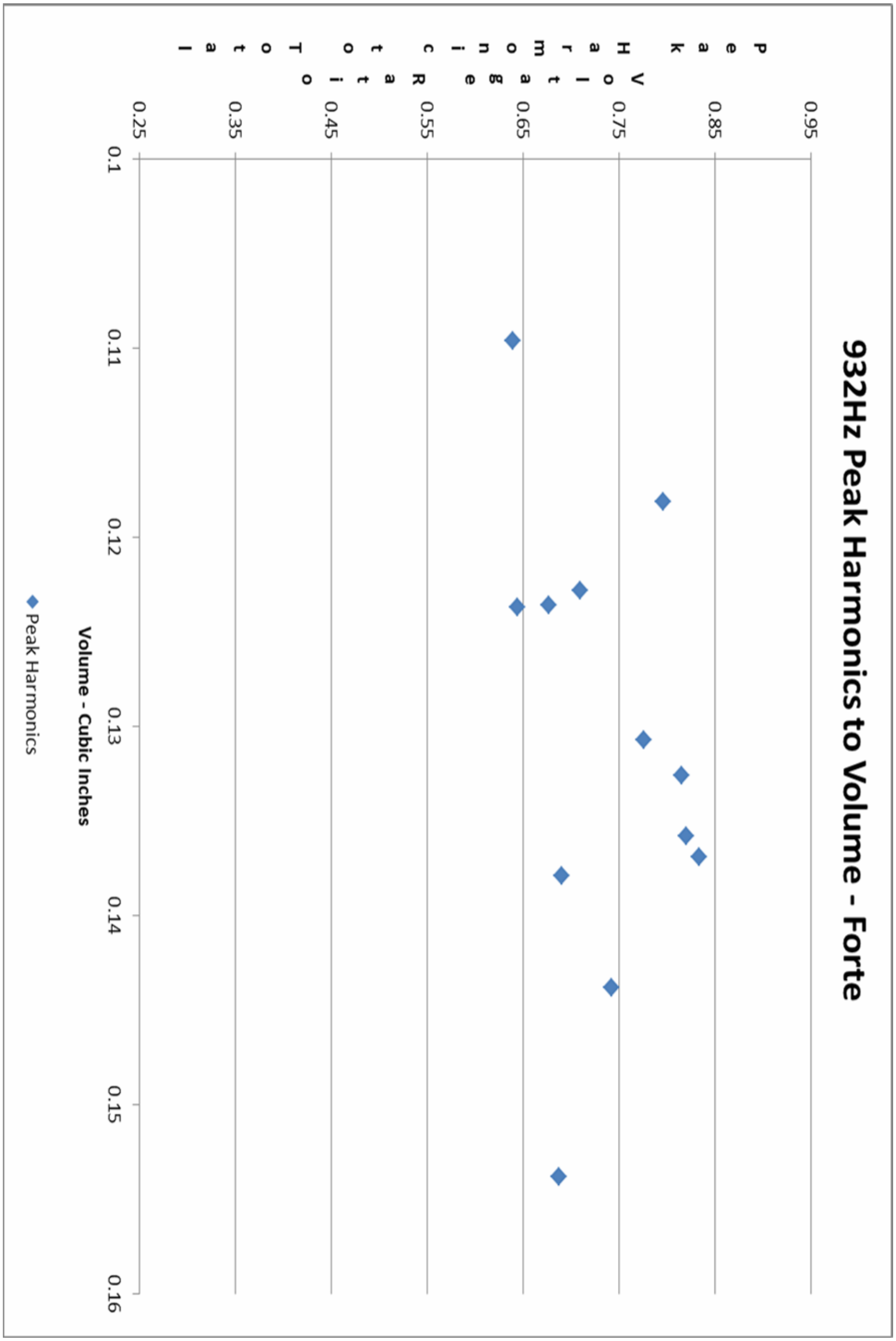

Figure 36
932Hz peak harmonics to volume – *forte* (r = 0.2550).

For each frequency and dynamic, there is not a strong correlation of the peak harmonic to total harmonics and total interior volume in the backbores. A correlation would exhibit itself by the plotted dots lining up in a line, or close to it, diagonally (up or down) across the graph. The lack of strong correlations seems to suggest that the harmonic spectrum of the trumpet timbre is not related to the total interior volume of the trumpet mouthpiece backbore.

Correlating Timbre to Total Interior Volume – Odd to Even Harmonics Ratio and Volume

Odd and even harmonics have different auditory characteristics. Odd harmonics are brighter and hollow sounding, and even harmonics mellow or warmer. Comparing odd harmonics to even harmonics compares the general overall sound of a set of harmonics. Table 3, below, contains the correlation of each total interior volume to the odd to even ratio. A positive correlation means both values increase together; total interior volume and the ratio increase at the same time. A negative correlation means one value increases and the other decreases; if total interior volume increases then the ratio decreases. At the 233 Hertz frequency at *mezzo forte*, and the 466 Hertz frequency at *piano* and *mezzo forte,* there is a moderate correlation. When total interior volume increases, there is a decrease in odd harmonics or an increase in even harmonics; the timbre gets darker. This information suggests that total interior volume is related to the timbre of the trumpet; however, the correlations are only moderate and not strong. The total interior volume of the trumpet mouthpiece backbore does affect the timbre of the trumpet, but not as much as the interior shape of the backbore.

Dynamic	233 Hertz	466 Hertz	932 Hertz
P	0.0622	-0.5148	-0.0931
MF	-0.5277	-0.4987	0.1742
F	-0.3008	-0.3072	0.3010

Table 3

Correlation of total interior volume and the odd to even harmonic ratio.

Figures 37 and 38 are graphs of the total interior volume of the backbores and the ratio of odd to even harmonics. A larger number (ratio) on the vertical axis indicates a larger makeup of odd harmonics; a smaller number indicates a larger makeup of even harmonics. A correlation would exhibit itself as a line, or close to it, diagonally across (up or down) the graph.

On the 233 Hertz frequency at *mezzo forte* (Figure 38) there is a moderate correlation. As the total interior volume increases, there is a decrease in odd harmonics; the timbre becomes darker. On the 466 Hertz frequency at the *piano* (Figure 40) and *mezzo forte* (Figure 41) dynamics, there is also a moderate correlation. As the total interior volume increases, there is a decrease in odd harmonics; the timbre becomes darker. When viewing the graphs, the plots appear somewhat scattered, but in a slight diagonally downward trend.

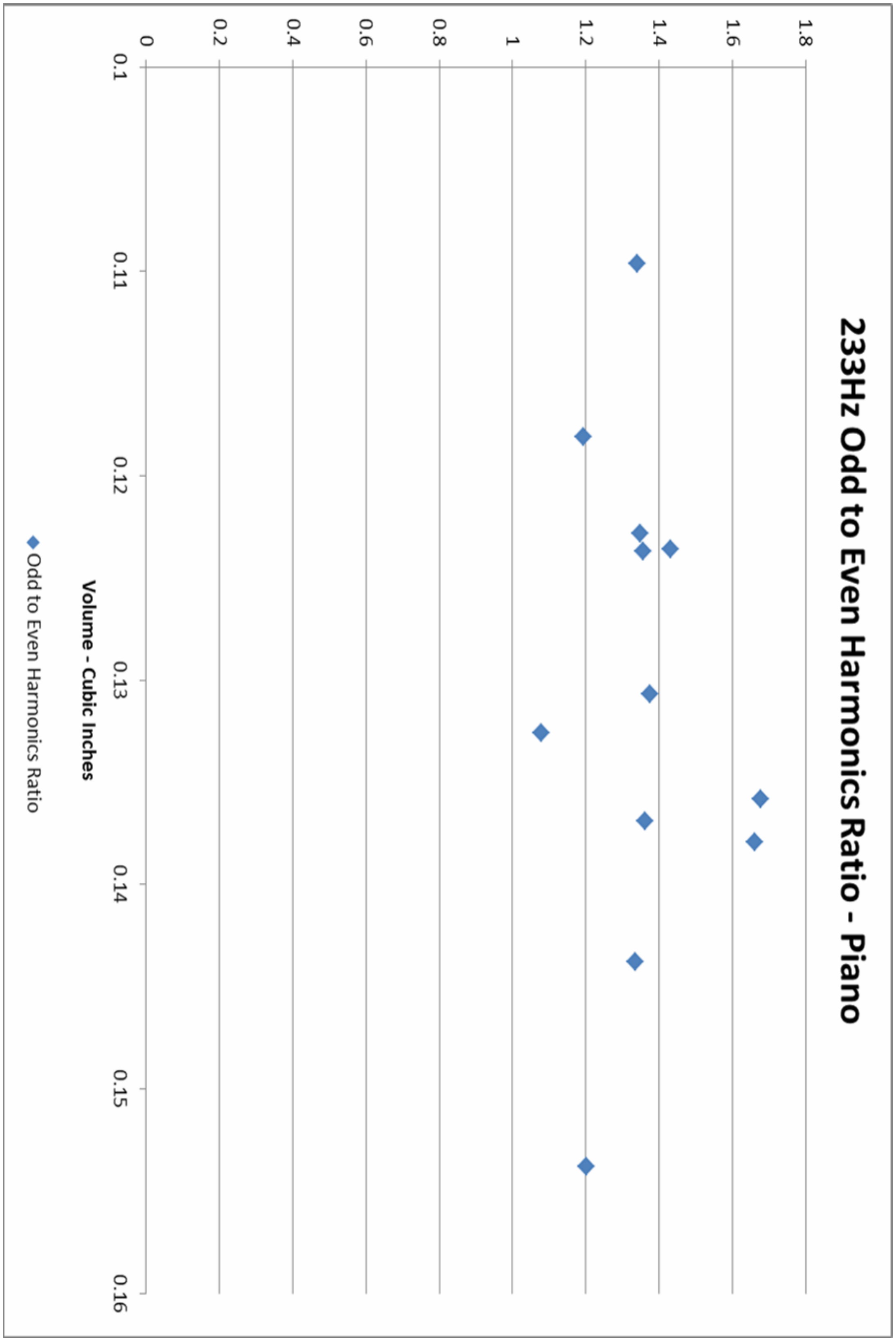

Figure 37
233Hz odd to even harmonics ratio – *piano* (r = 0.0622).

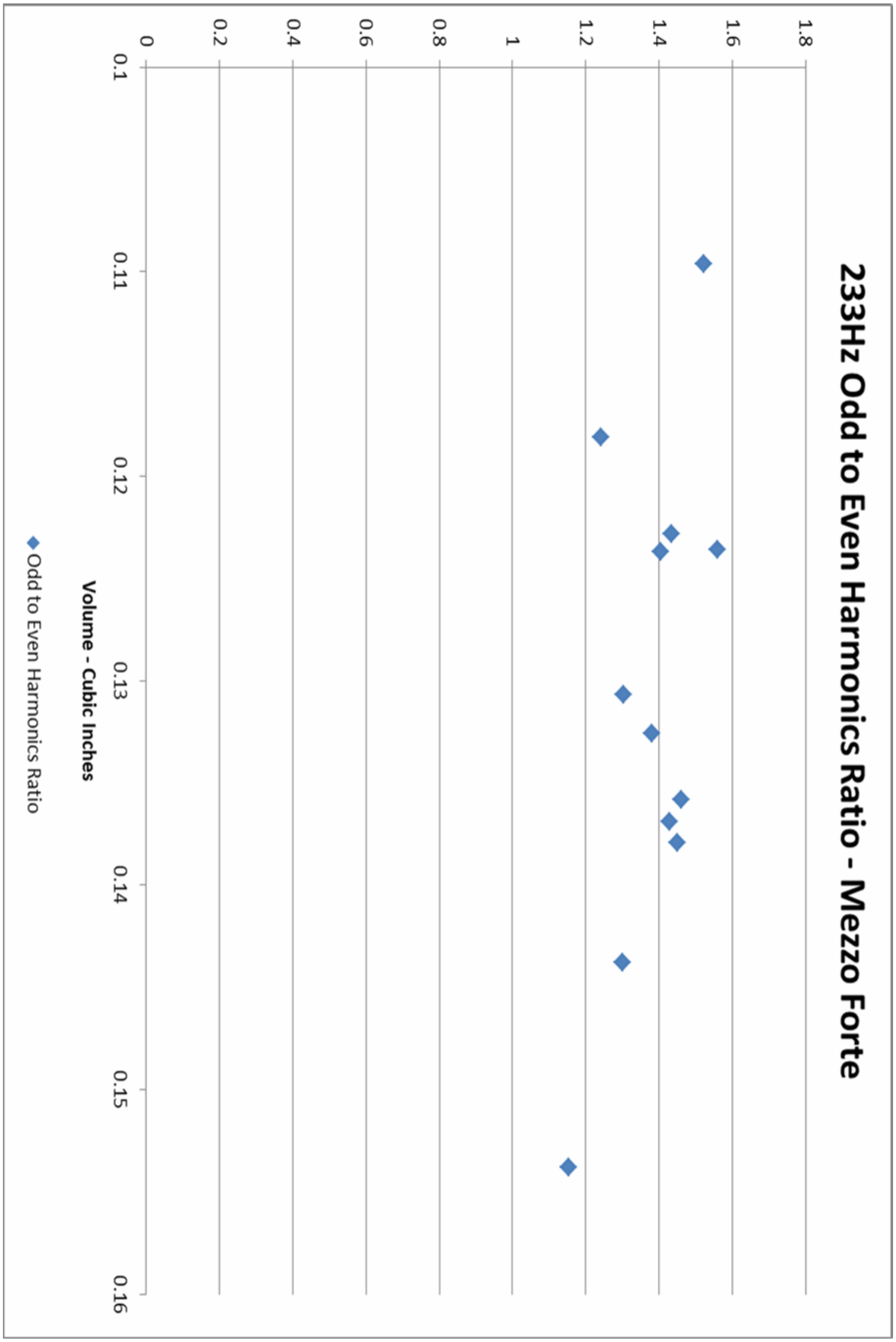

Figure 38
233Hz odd to even harmonics ratio – *mezzo forte* (r = -0.5277).
Weak correlation, as interior volume increases there is a decrease in odd harmonics, a darker timbre.

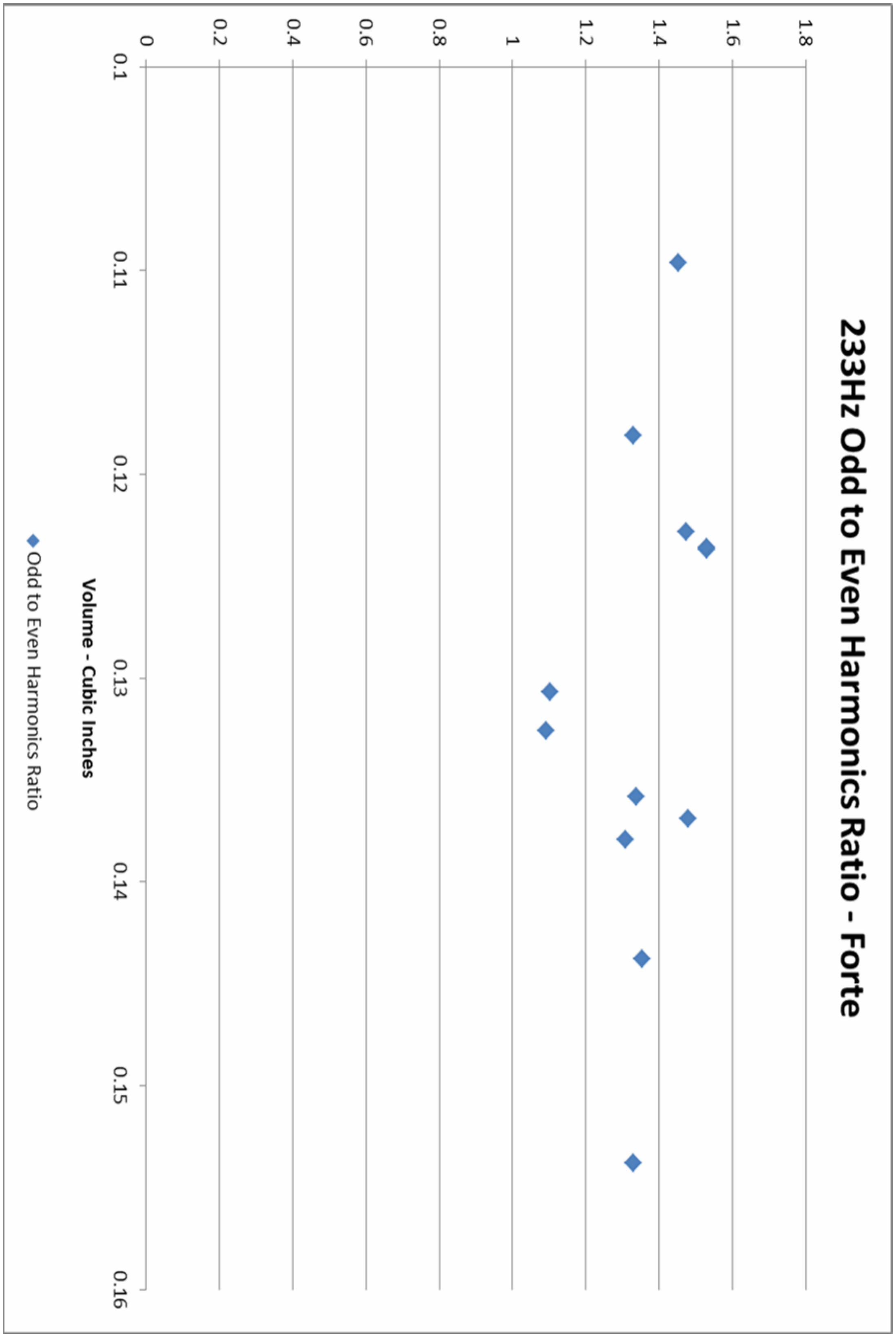

Figure 39
233Hz odd to even harmonics ratio – *forte* (r = -0.3008).

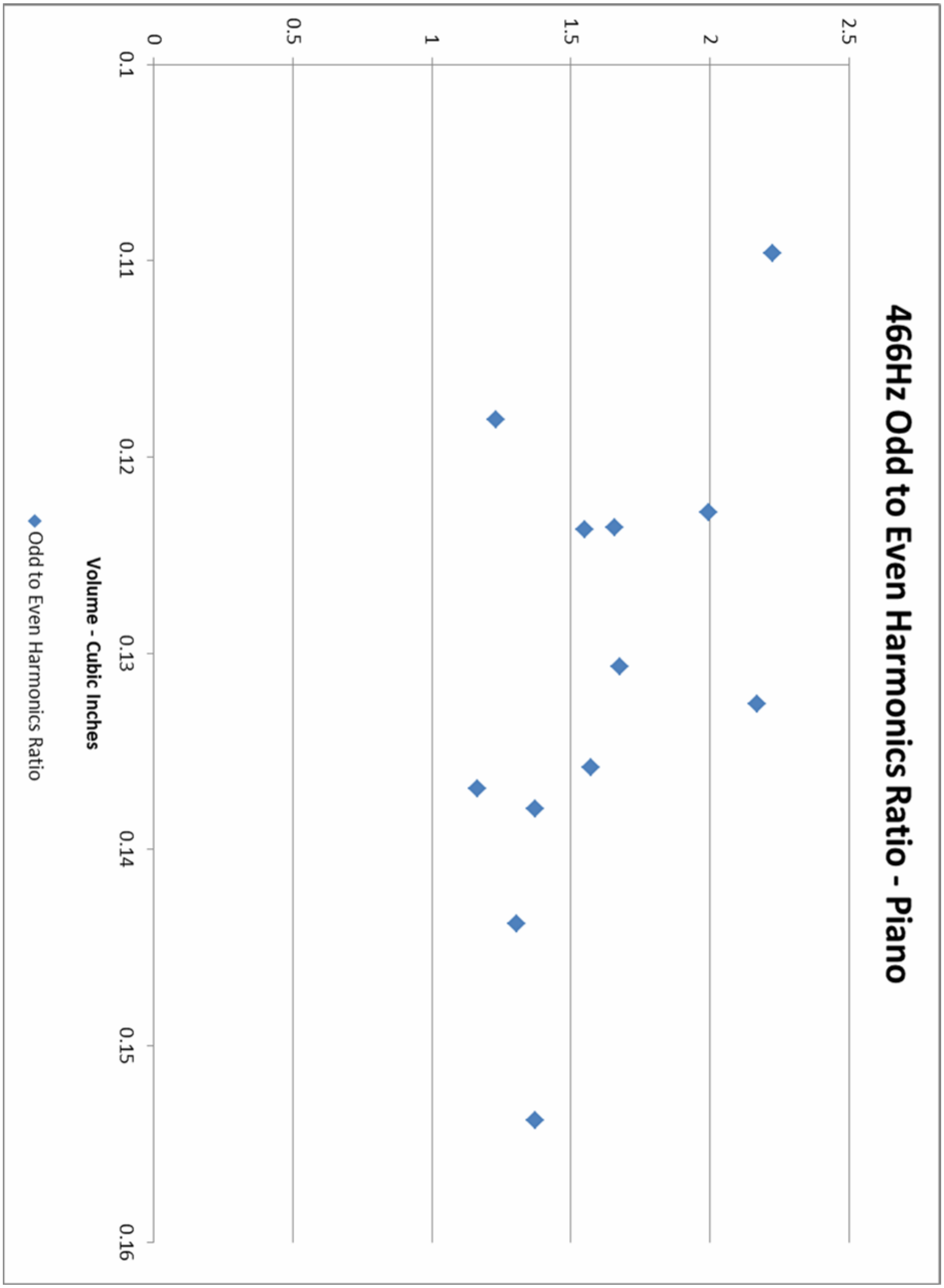

Figure 40
466Hz odd to even harmonics ratio – *piano* (r = -0.5148).
Weak correlation, as interior volume increases there is a decrease in odd harmonics, a darker timbre.

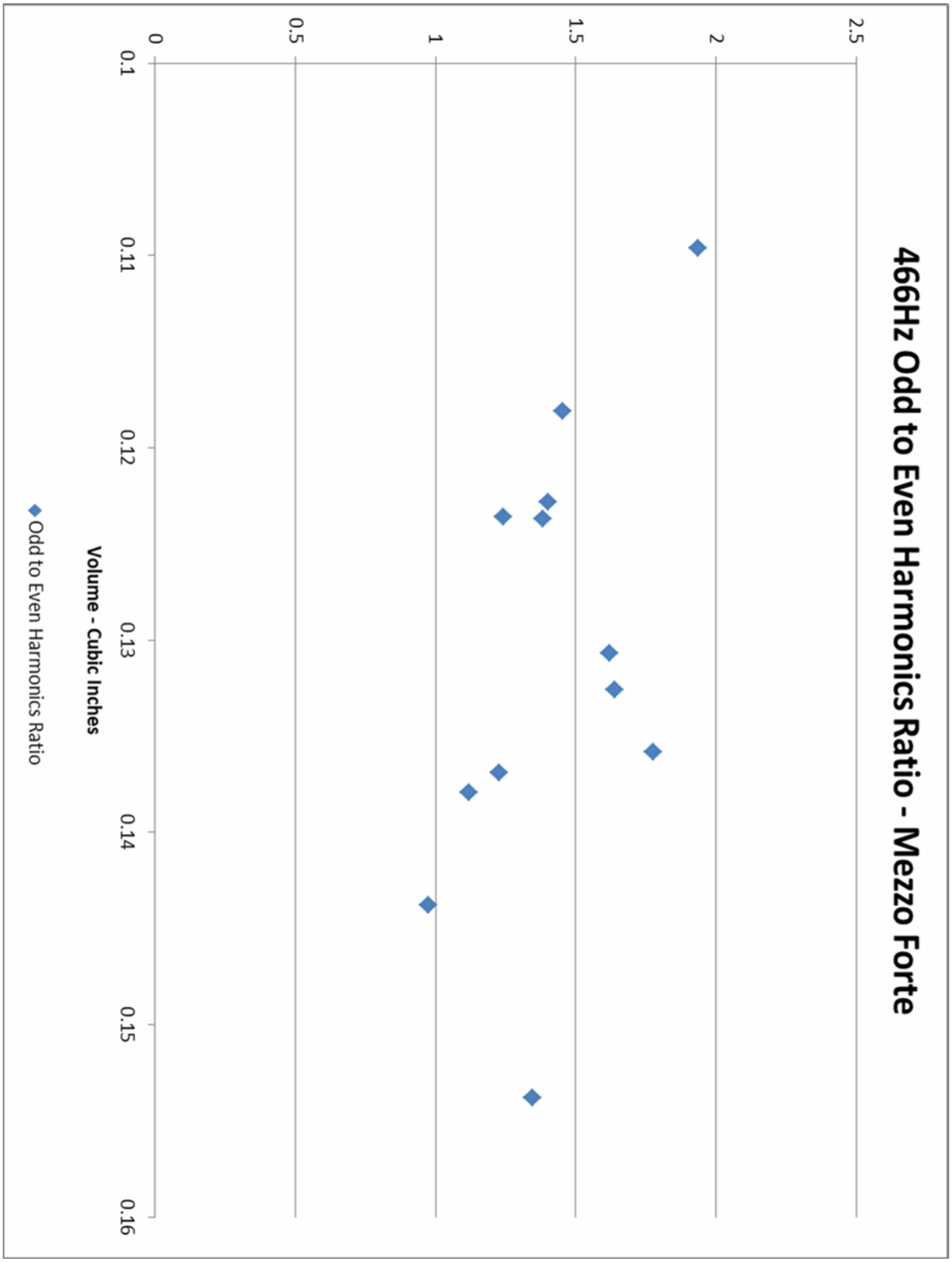

Figure 41
466Hz odd to even harmonics ratio – *mezzo forte* (r = -0.4987).
Weak correlation, as interior volume increases there is a decrease in odd harmonics, a darker timbre.

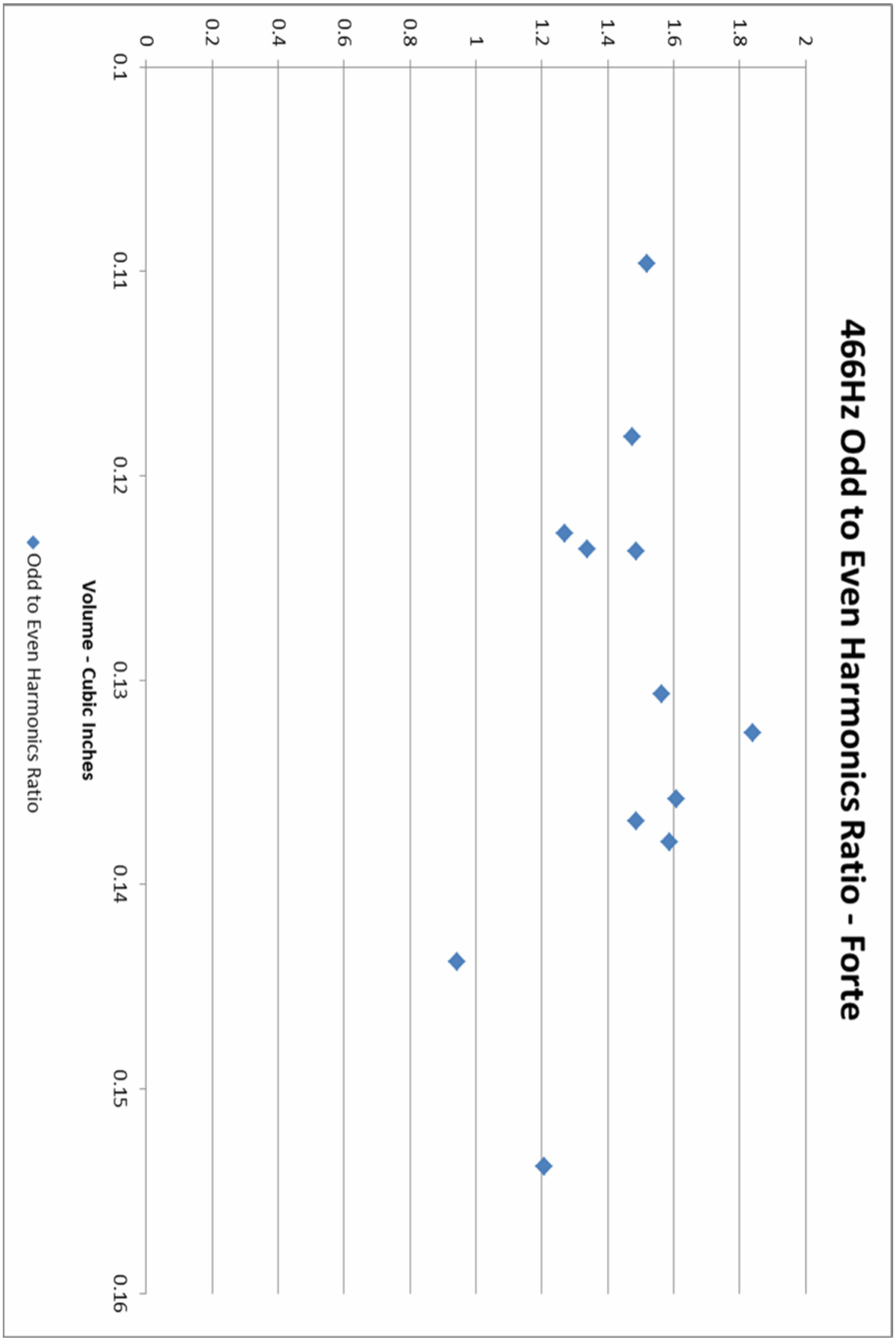

Figure 42
466Hz odd to even harmonics ratio – *forte* (r = -0.3072).

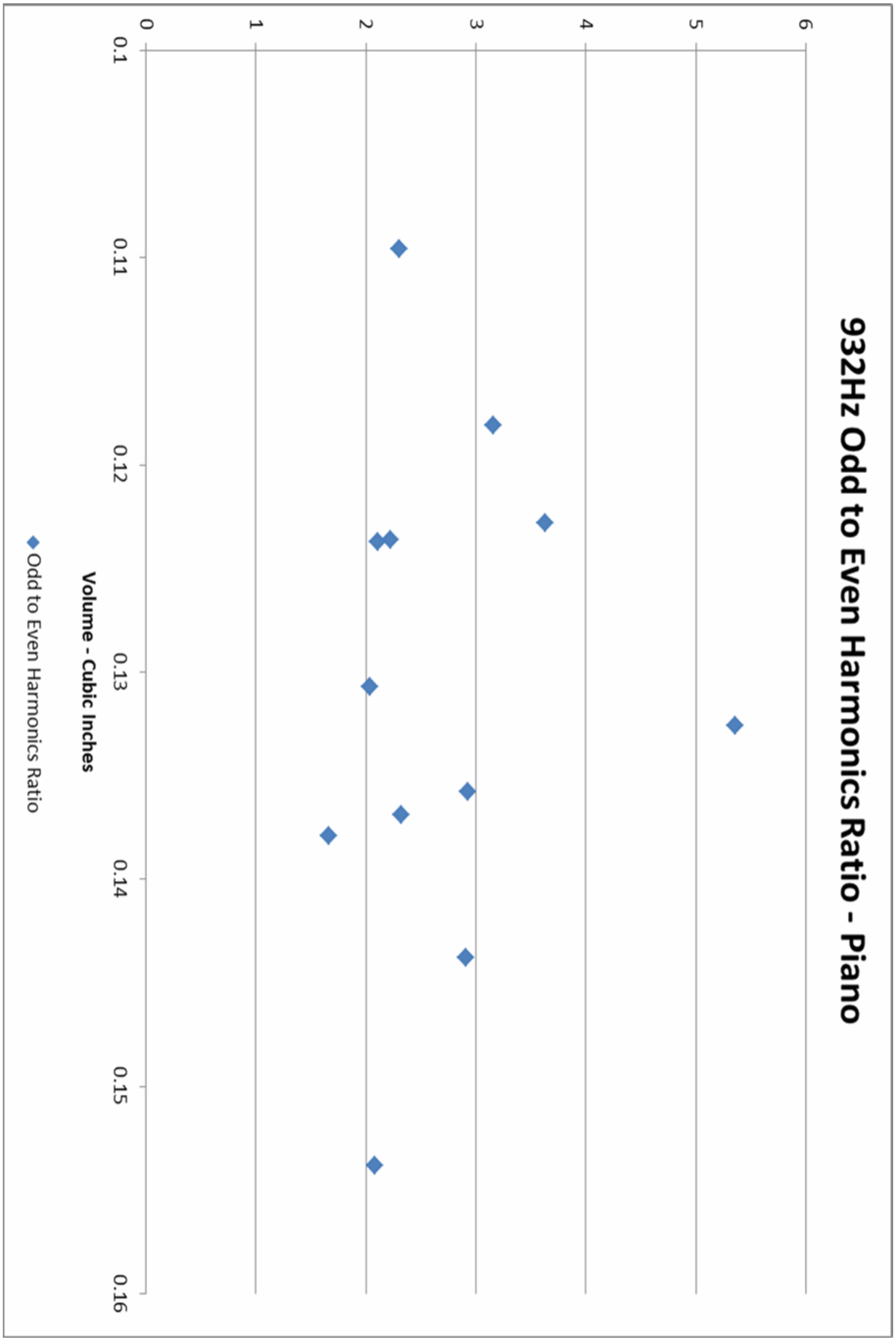

Figure 43
932Hz odd to even harmonics ratio – *piano* (r = -0.0931).

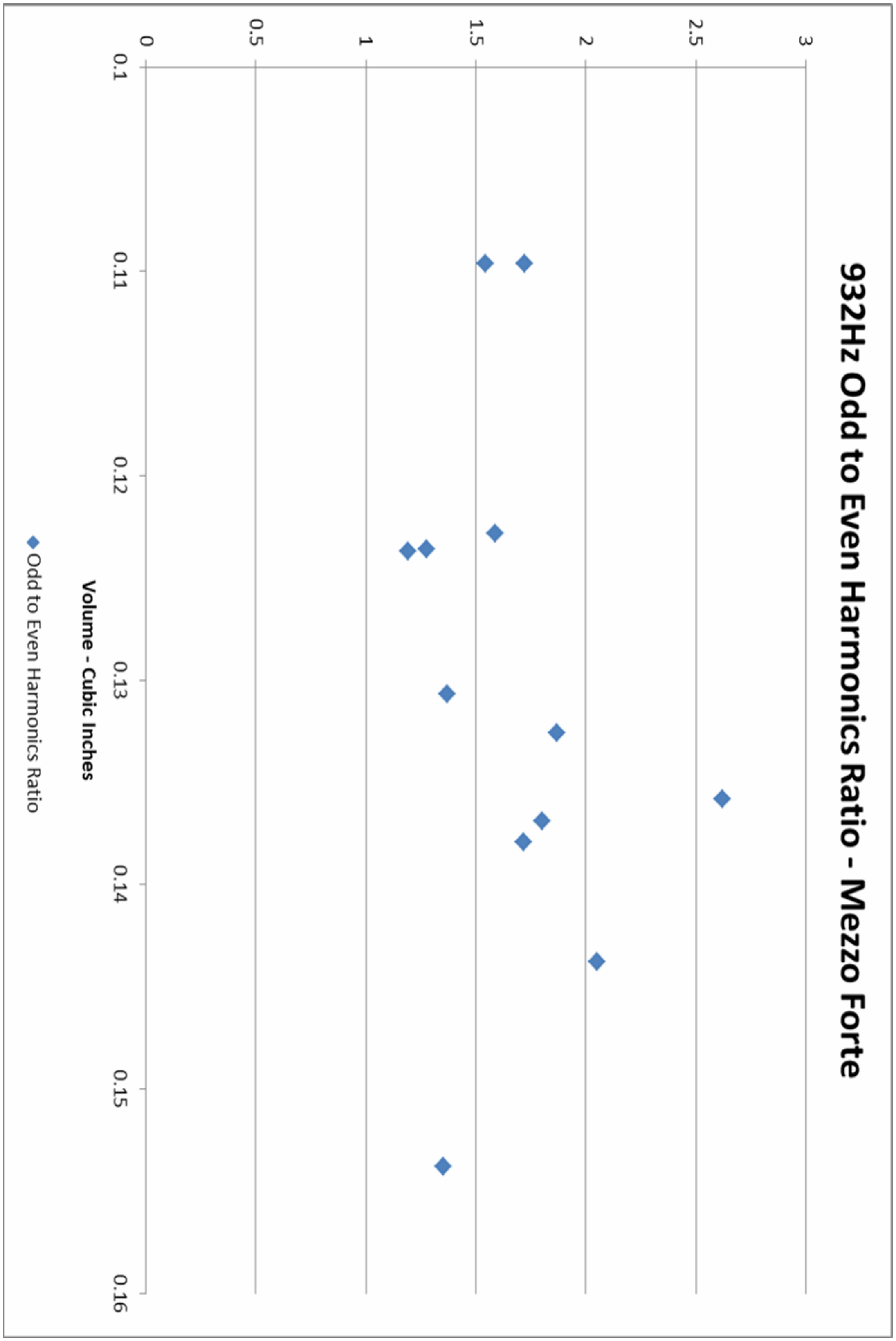

Figure 44
932Hz odd to even harmonics ratio – *mezzo forte* (r = 0.1742).

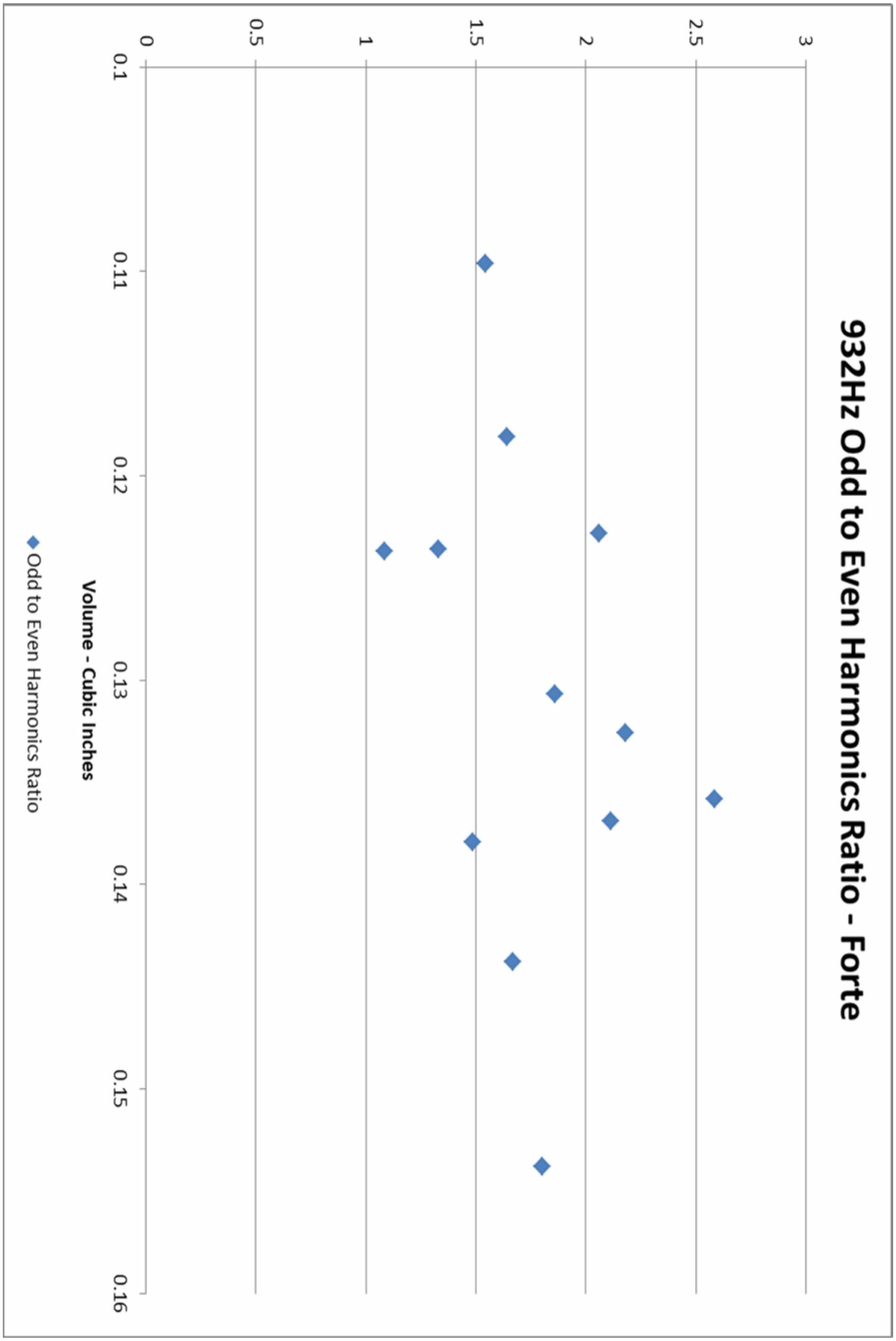

Figure 45
932Hz odd to even harmonics ratio – *forte* (r = 0.3010).

There is not a strong correlation of the total interior volume and ratio of odd to even harmonics. This indicates that total interior volume of the trumpet mouthpiece backbore is not a major factor responsible for the timbre. The ratio of odd to even harmonics is another way to analyze the makeup of the timbre, and like the ratio of peak harmonics to total harmonics and total interior volume, there are no strong correlations.

Correlating Timbre to Total Interior Volume – Line Graphs

The average ratios of the harmonics to total harmonics were used to graph the shape of the harmonics. Each backbore with each frequency and dynamic has a unique shape within the overall characteristic shape (formant region). Below are graphs of the specific shapes for each backbore, frequency, and dynamic from the results of this test. Some general observations can be made about sound, visually, from the graphs. Mainly, while the shapes are similar, they are all different, and the differences do not seem to correlate to a change in interior volume.

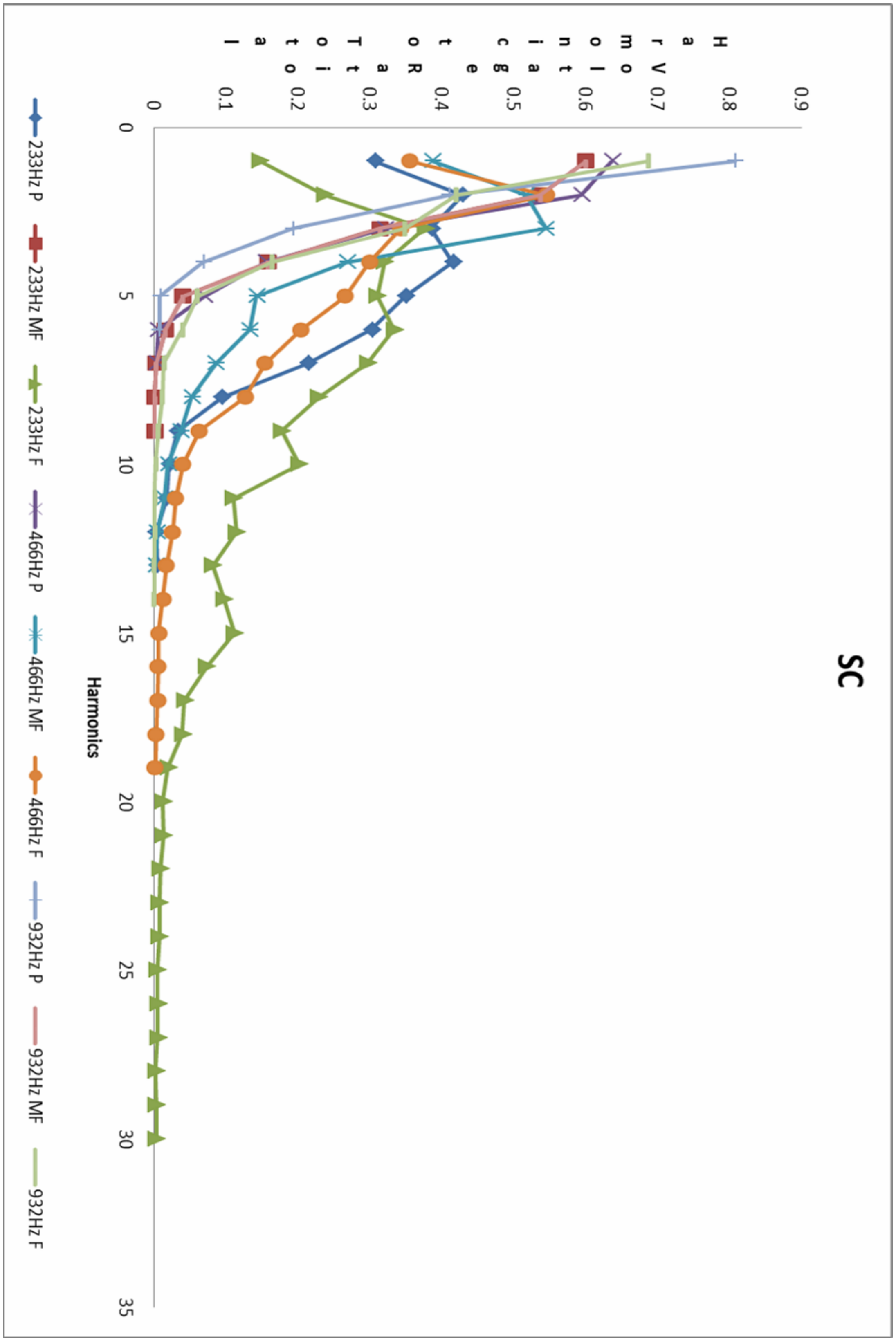

Figure 46
SC backbore – shape of harmonics.

When the dynamic volume on the SC backbore increases across all frequencies, the number of harmonics present increases. Also, the harmonics increase relative to the fundamental. The *piano* dynamic at 932Hz has very few harmonics beyond the fundamental, as opposed to the *forte* dynamic at 233Hz, which has a large number of harmonics. Some of the frequencies and dynamics have an odd harmonic as the strongest; with some it's an even harmonic. The sound of the SC backbore seems to not be consistent with itself across all frequencies and dynamics (not necessarily a negative thing). On the 233Hz frequency, the amplitude of the first five harmonics is less at the *forte* dynamic than *piano*. The perception of an increase in dynamic volume seems to come from the increase in harmonics above the fifth harmonic.

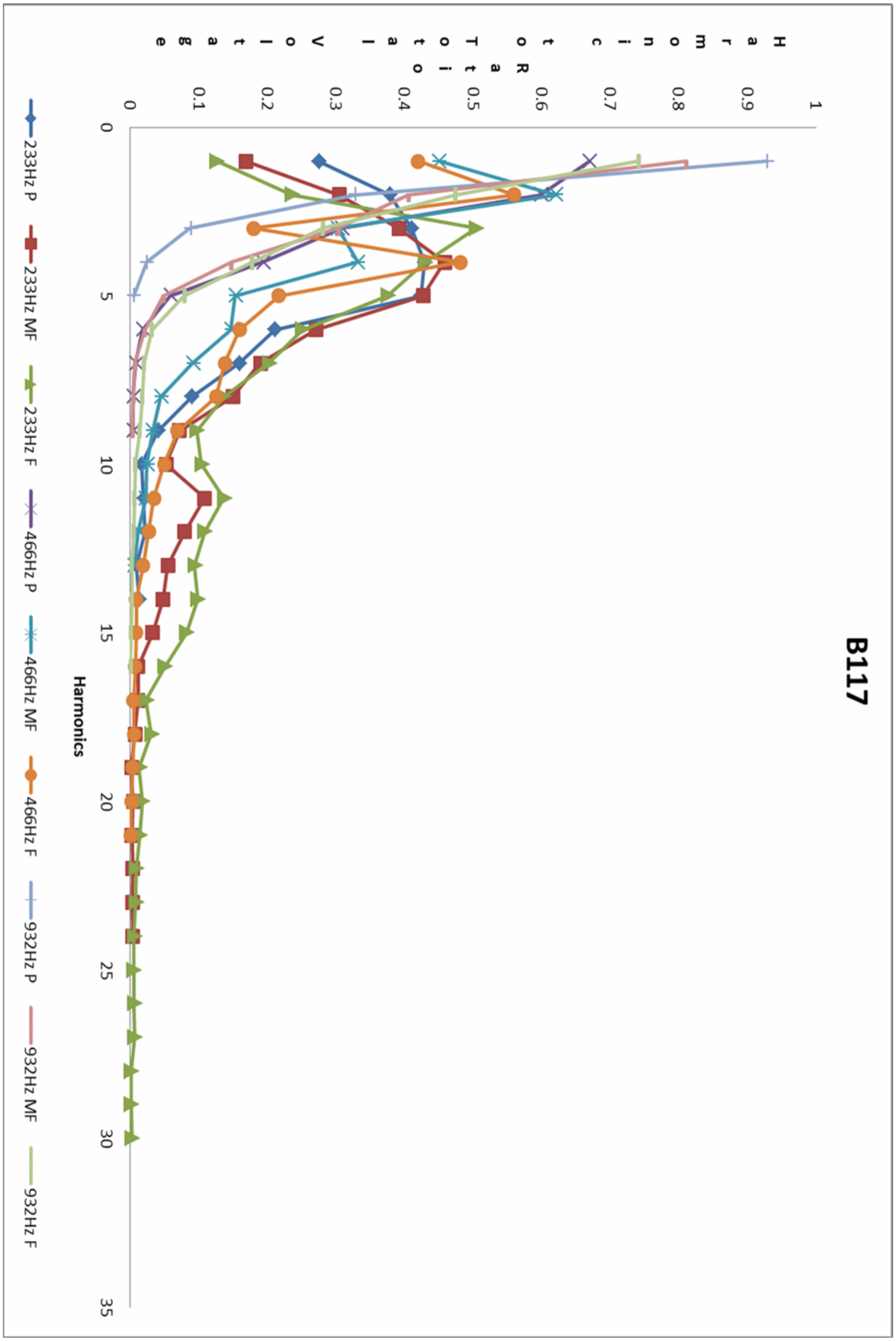

Figure 47
B117 backbore – shape of harmonics.

The B117 backbore has similar characteristic shapes as the SC backbore, but the shapes are more jagged. Specifically, the *mezzo forte* dynamic 233Hz and *mezzo forte* and *forte* dynamic at 466Hz, where even harmonics are strongest. Even harmonics characteristically have mellow or warm sounds. From the harmonic shapes of the B117 backbore, it would seem it produces a trumpet sound that is mellow or warmer within the characteristic sound of the trumpet. Of particular note is the decrease of the third harmonic in the 466Hz frequency at both *mezzo forte* and *forte*, when compared to the 233Hz frequency.

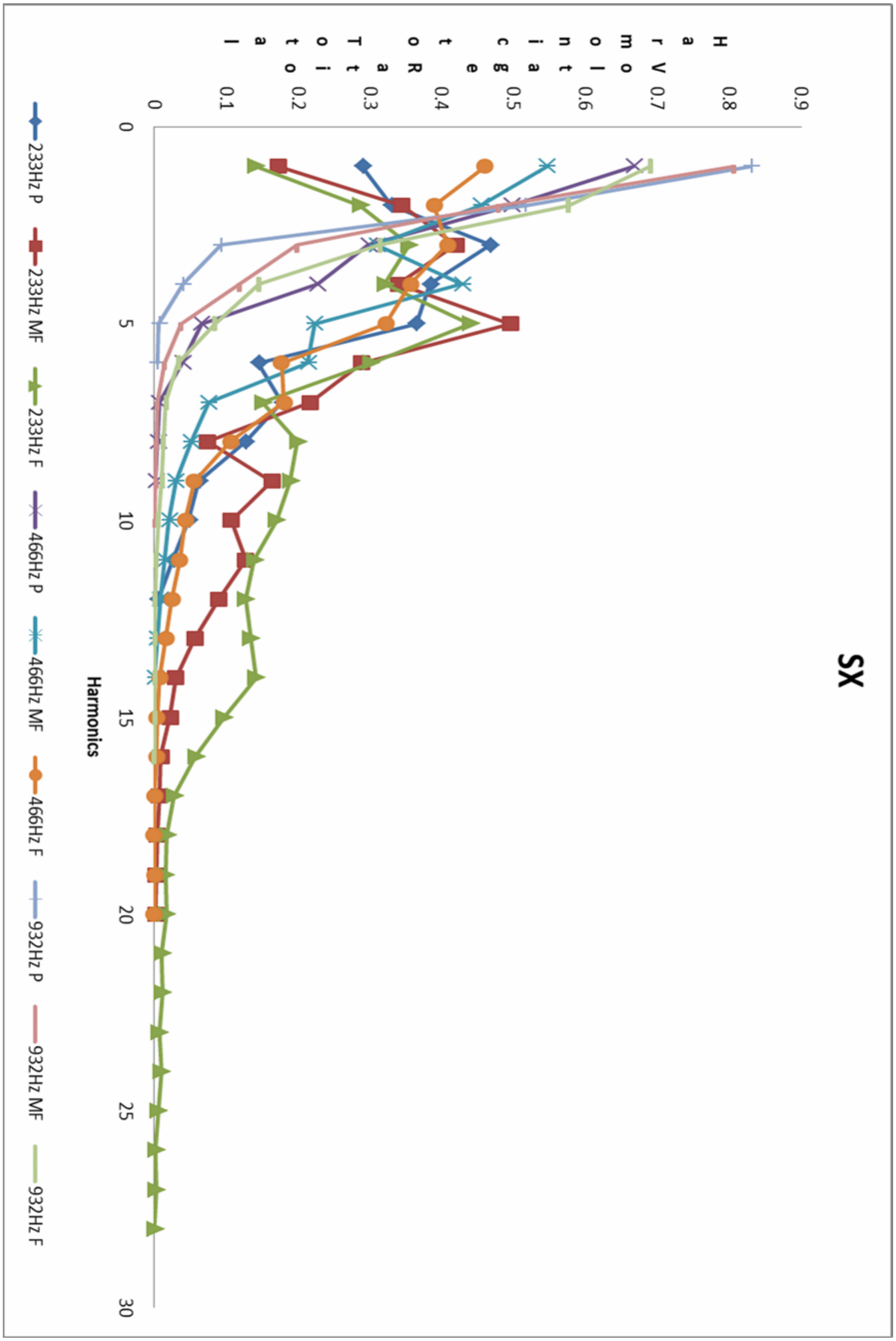

Figure 48
SX backbore – shape of harmonics.

The SX backbore, like the others, has a characteristic shape of the harmonics in general. With the 233Hz frequency, the harmonics of three, four, and particularly five are strong along with more presence of the harmonics further out. Unlike many of the other backbores, the fundamental is strongest on the 466Hz and 932Hz frequencies, as opposed to only the 932Hz frequency. In a similar fashion to the SC backbore, the SX gains strength in the outer harmonics as the volume increases.

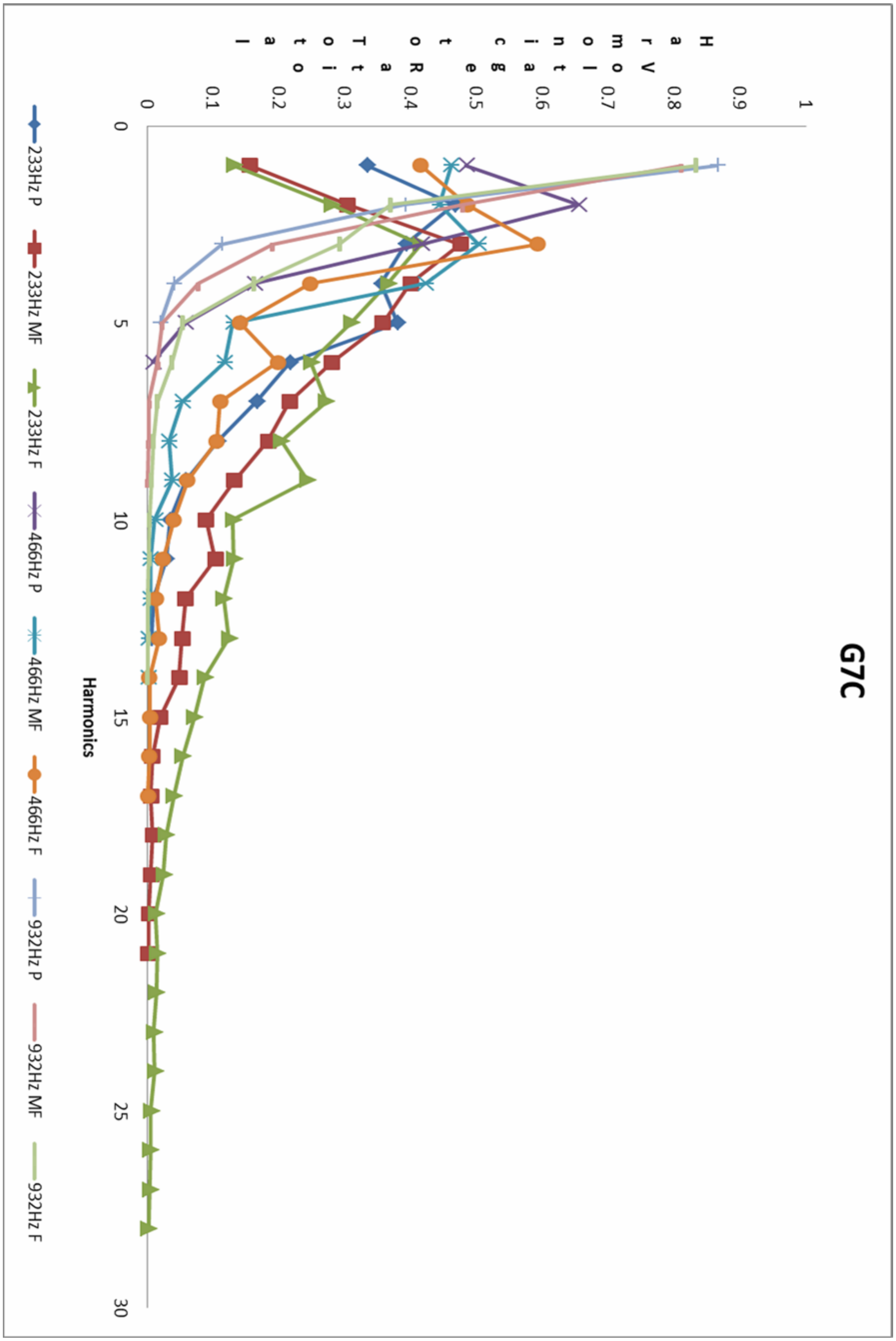

Figure 49
G7C backbore – shape of harmonics.

The G7C backbore is strongest on the third harmonic on most all of the frequencies and dynamics, except the 932Hz and *piano* of the 466Hz. Also, on the 932Hz frequency, the ratio of the fundamental to total harmonics is nearly the same level at each dynamic. This is an unusual characteristic compared to the other backbores. The G7C backbore would seem to have a brighter or more brilliant sound than the B117 backbore.

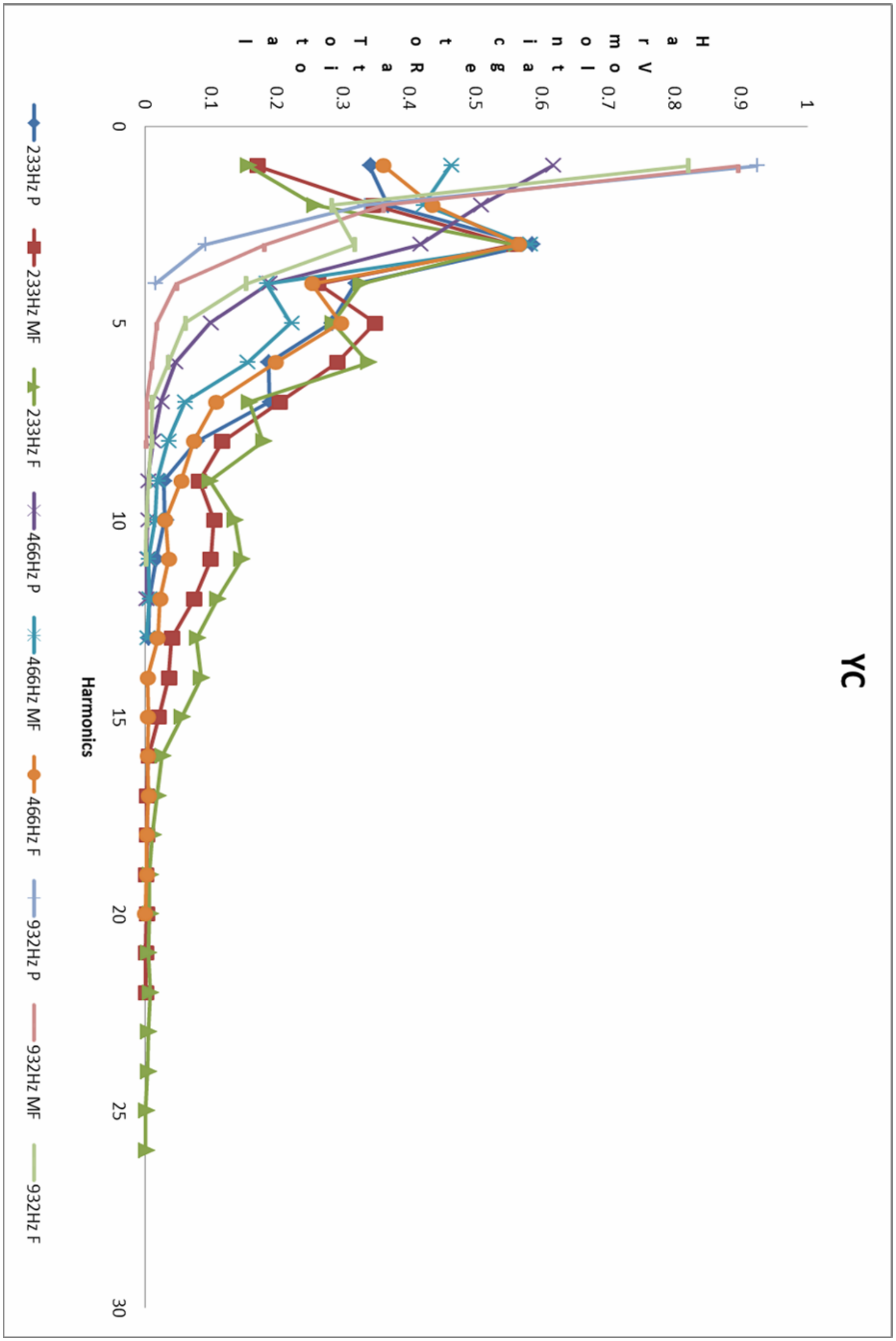

Figure 50
YC backbore – shape of harmonics.

The YC backbore is the most consistent with itself among the backbores tested. The shapes on each frequency and dynamic are similar. This backbore retains its shape (sound) the most consistently from soft to loud and from low to high (frequency) more than the others. The third harmonic is strong and would seem to contribute to this backbore having a more brilliant sound. However, it also has a significant amount of upper harmonics that would contribute it to having complexity in the sound.

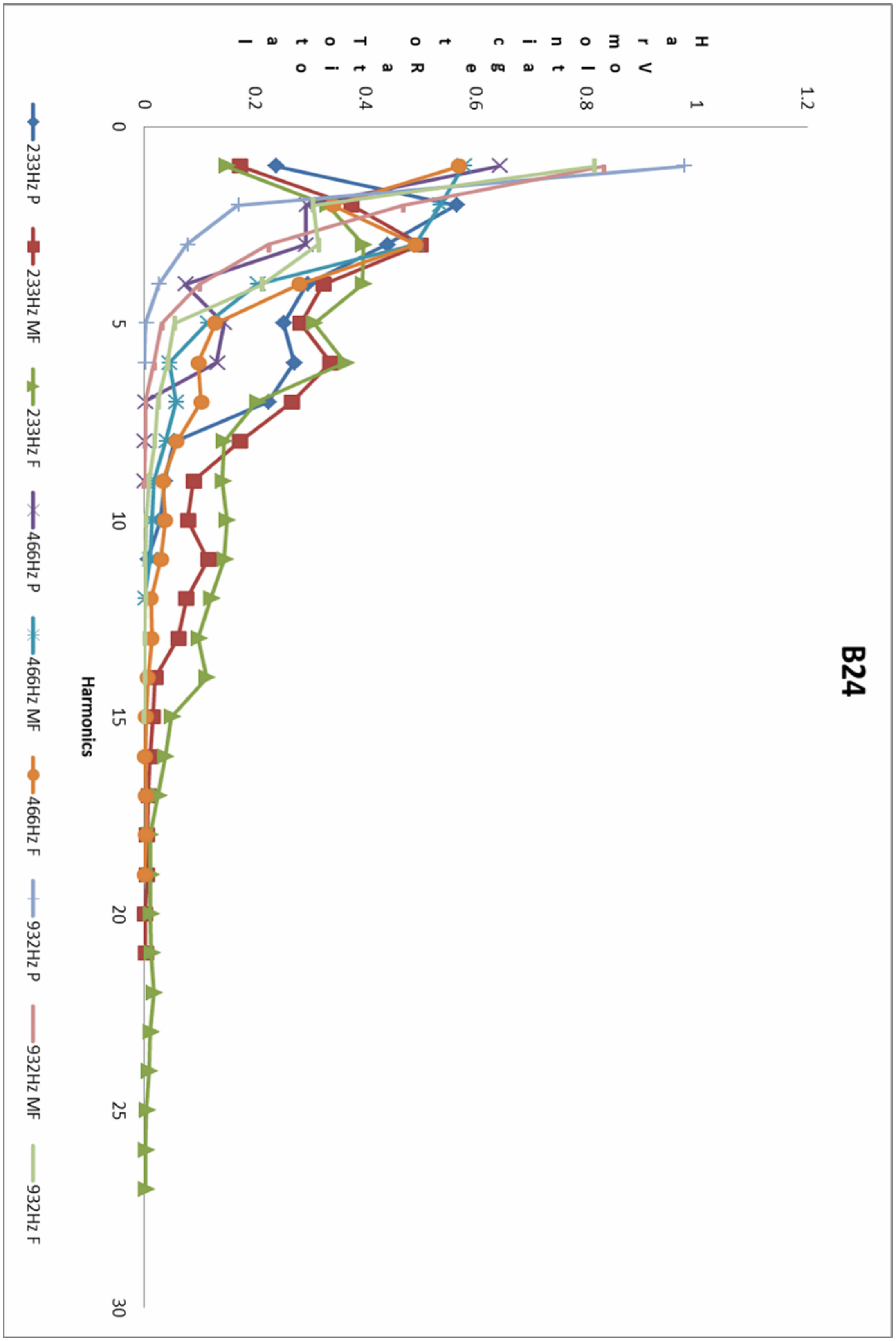

Figure 51
B24 backbore – shape of harmonics.

The B24 backbore is not consistent with itself in the 233Hz and 466Hz frequencies. On the *forte* dynamic at both the 233Hz and 466Hz frequencies, the third harmonic significantly increases compared to the other dynamics. This would attribute the sound of this backbore changing to become brighter or more brilliant when played soft to loud. When played soft to loud, this backbore would seem louder to the listener or player more quickly, with the same amount of physical dynamic increase (blowing pressure), as opposed to the YC backbore which is consistent with itself. The increasing third harmonic characteristic is also shared with the forte dynamic on the 932Hz frequency, which is unusual compared to the other backbores tested.

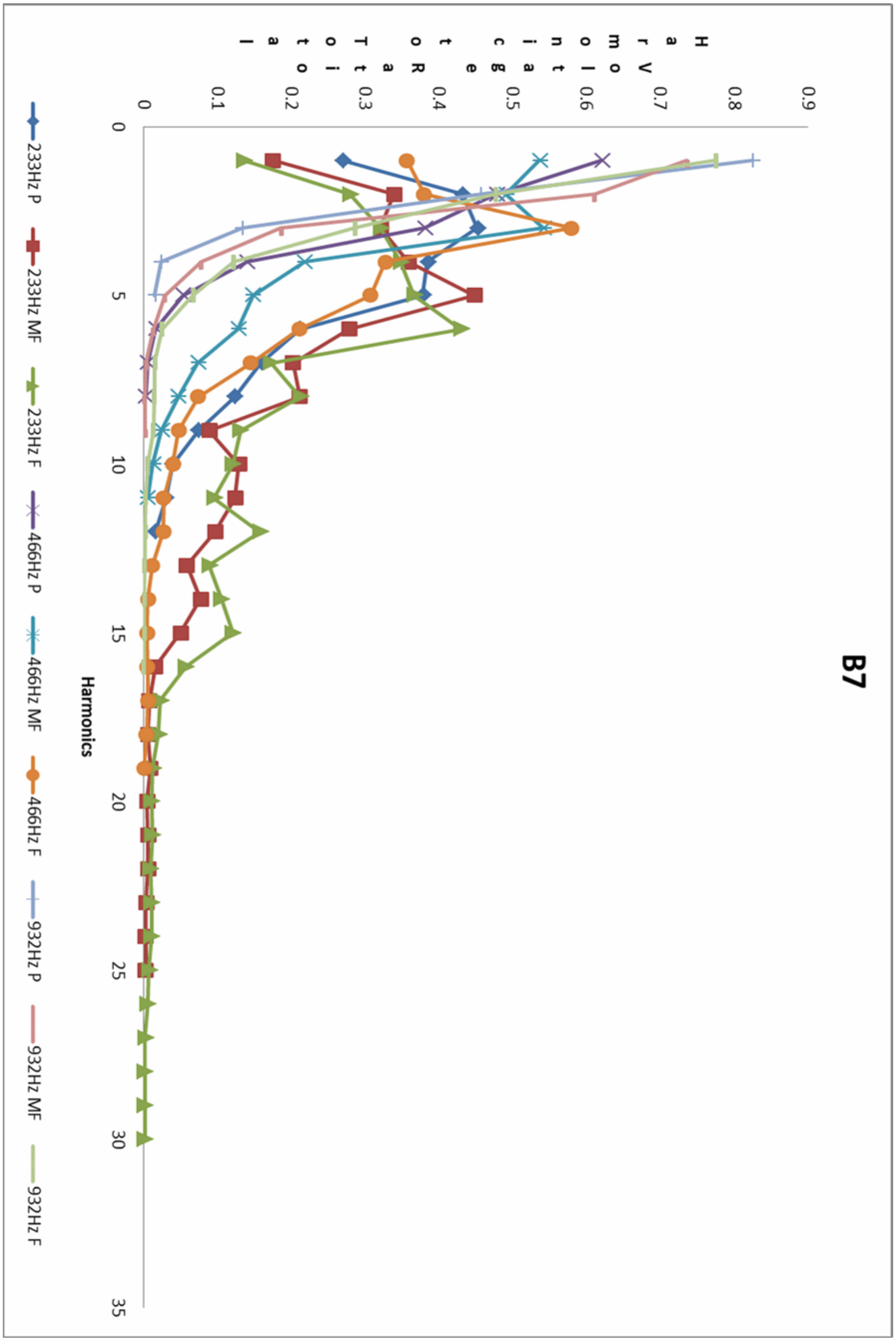

Figure 52
B7 backbore – shape of harmonics.

The B7 backbore harmonic shapes are similar to the YC in that it is somewhat consistent with itself. There are differences with the amount of outer harmonics in the 466Hz dynamics; additionally, the strength of the fifth and sixth harmonic for the 233Hz frequency at *mezzo forte* and *forte* is different. However, the SX backbore shares a similar shape of those frequencies and dynamics.

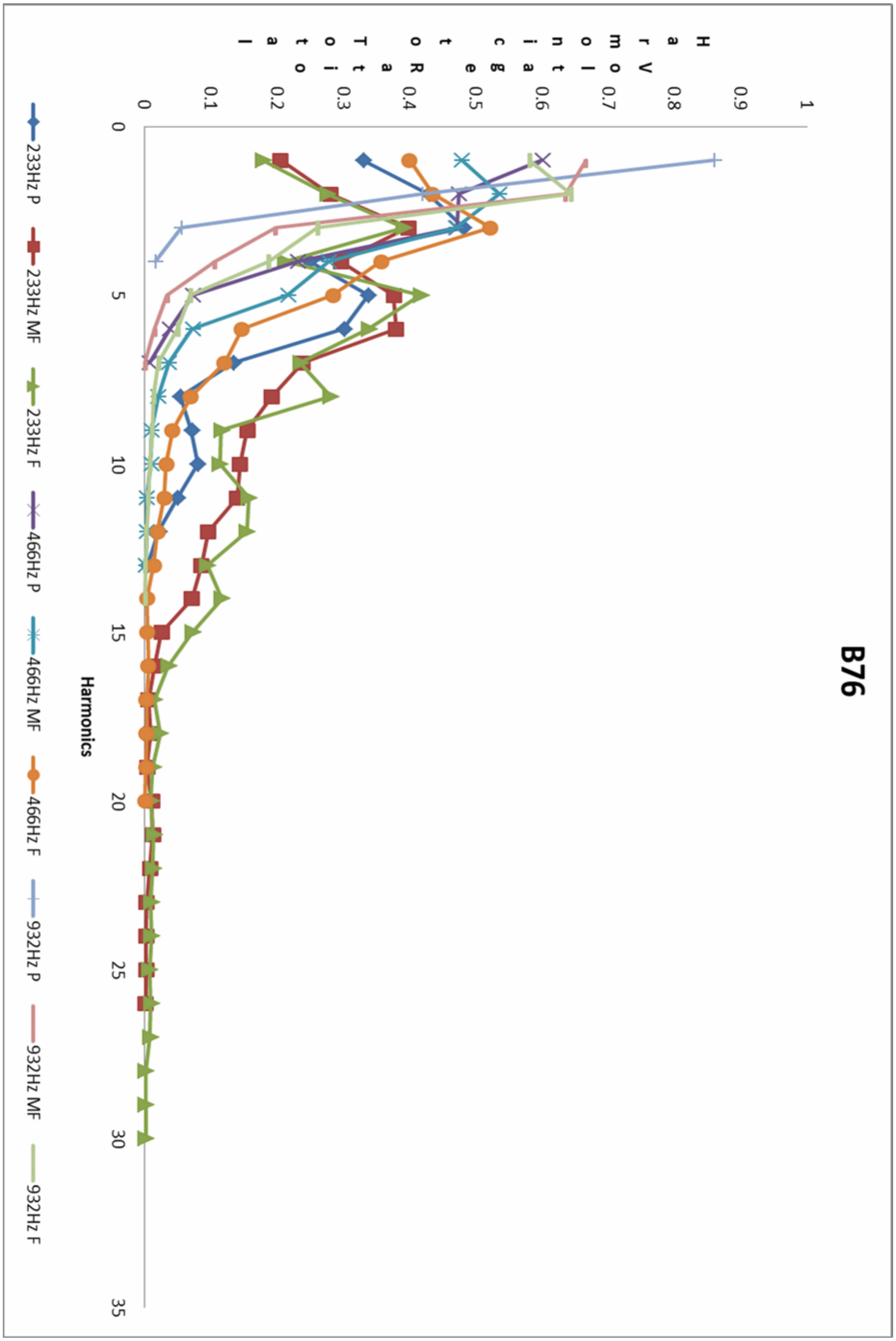

Figure 53
B76 backbore – shape of harmonics.

The B76 backbore on the 932Hz frequency at *piano* has a nearly sinusoidal wave form, as only three harmonics are present. The second and third harmonics are extremely small relative to the fundamental. Also, unlike most of the other backbores, the second harmonic is much more present at the 932Hz frequency at the *mezzo forte* and *forte* dynamic, which is even stronger than the fundamental at *forte*. This shows a change as it is played louder. The 233Hz frequency at *mezzo forte* and *forte* are almost identical in shape, otherwise the B76 backbore is consistent with itself.

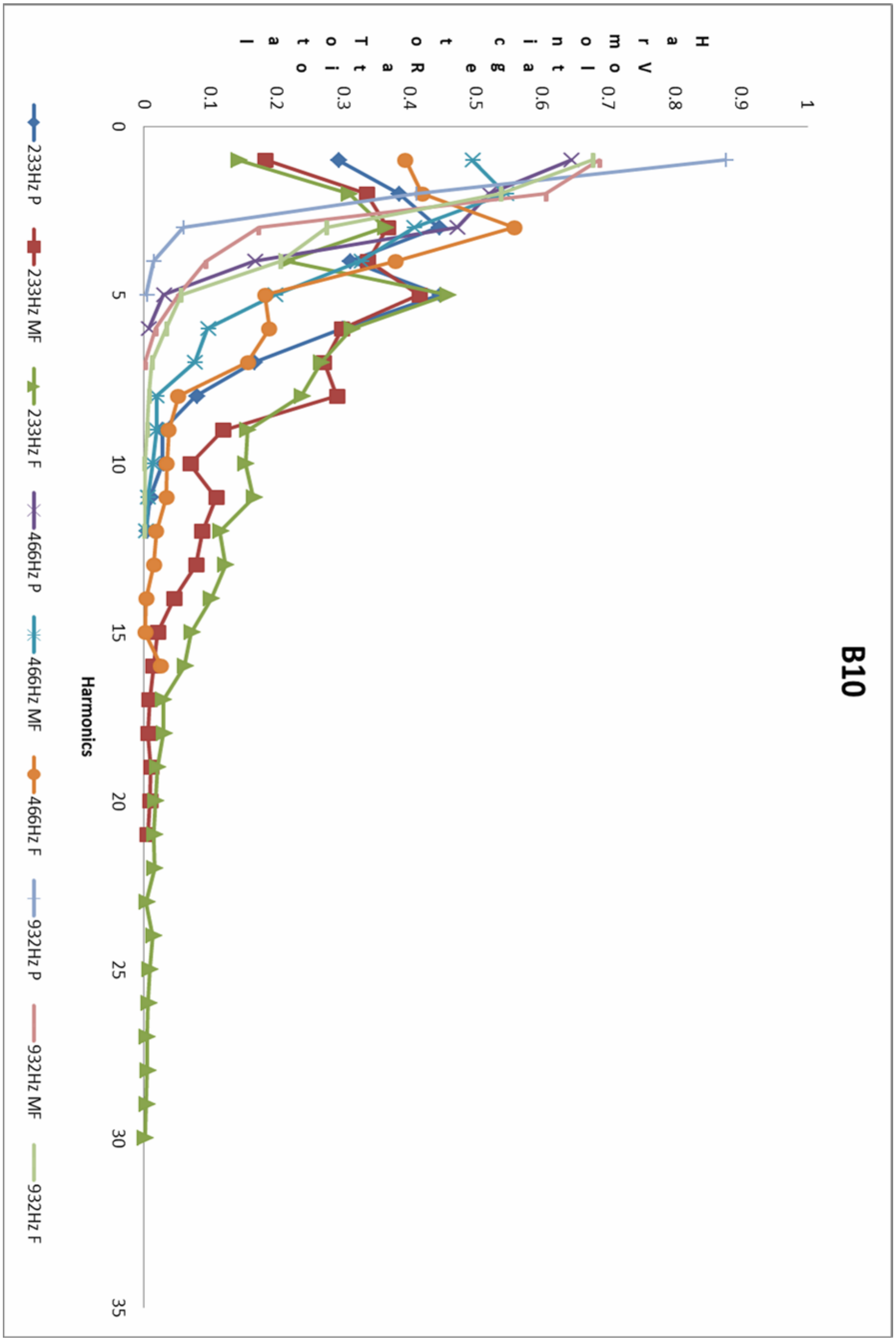

Figure 54
B10 backbore – shape of harmonics.

The B10 backbore is very similar to the B76 backbore. The most notable difference is the behavior of the second harmonic at the 932Hz frequency at *mezzo forte* and *forte*. On the 466Hz frequency, the peak harmonic changes from the second at *mezzo forte* to the third at *forte*. On that frequency the backbore sounds brighter as it is played louder. On the 233Hz frequency, the harmonic shape is similar from *mezzo forte* to *forte*. With the B10 backbore, it seems that as the frequency increases the timbre gets brighter as dynamic volume increases.

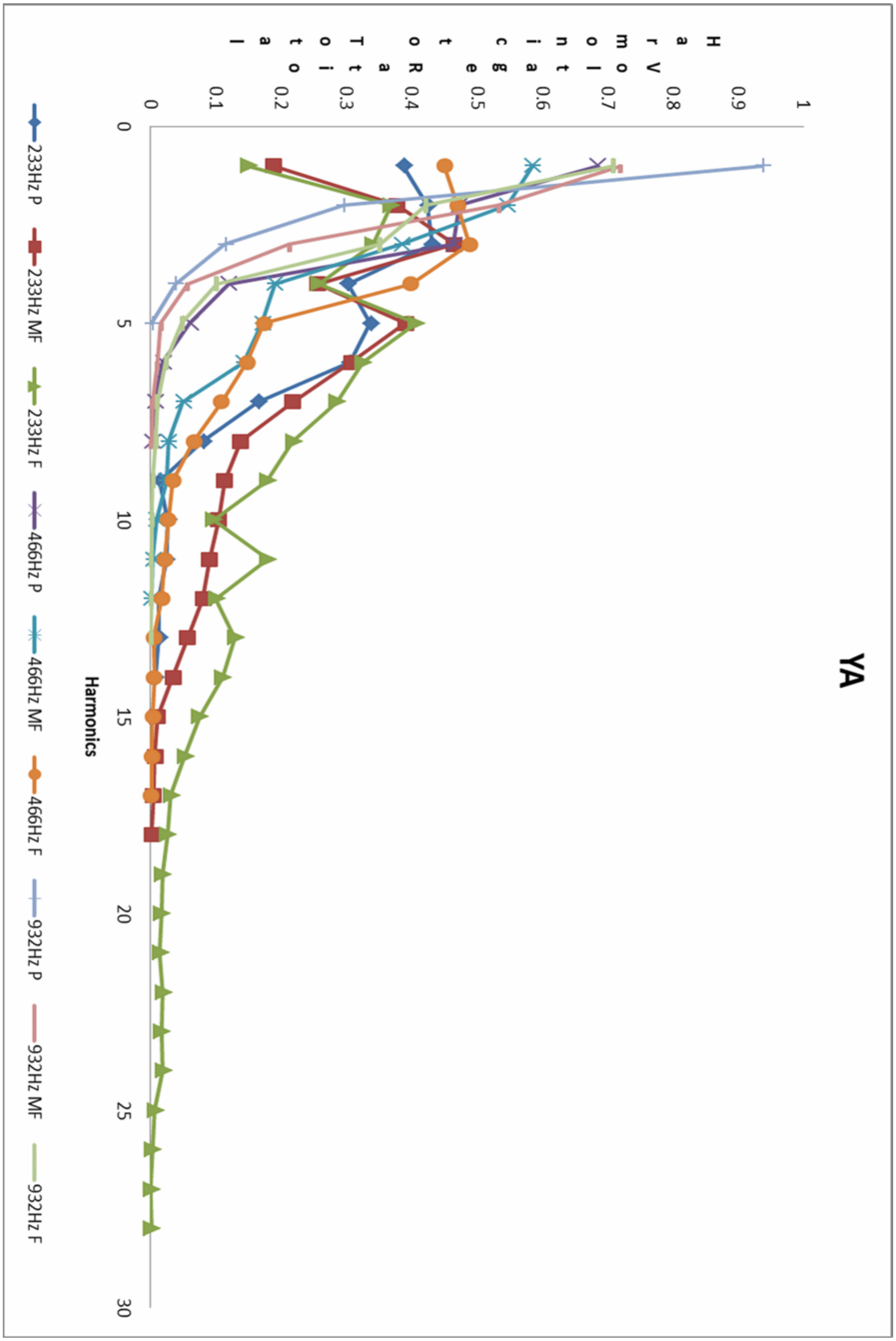

Figure 55
YA backbore – shape of harmonics.

The YA backbore shares similar shapes to the B76 and B10 backbores, yet appears to be slightly less consistent with itself. The upper harmonics are also stronger in amplitude relative to the lower harmonics. The YA backbore would seem to sound a little brighter then the B76 or B10.

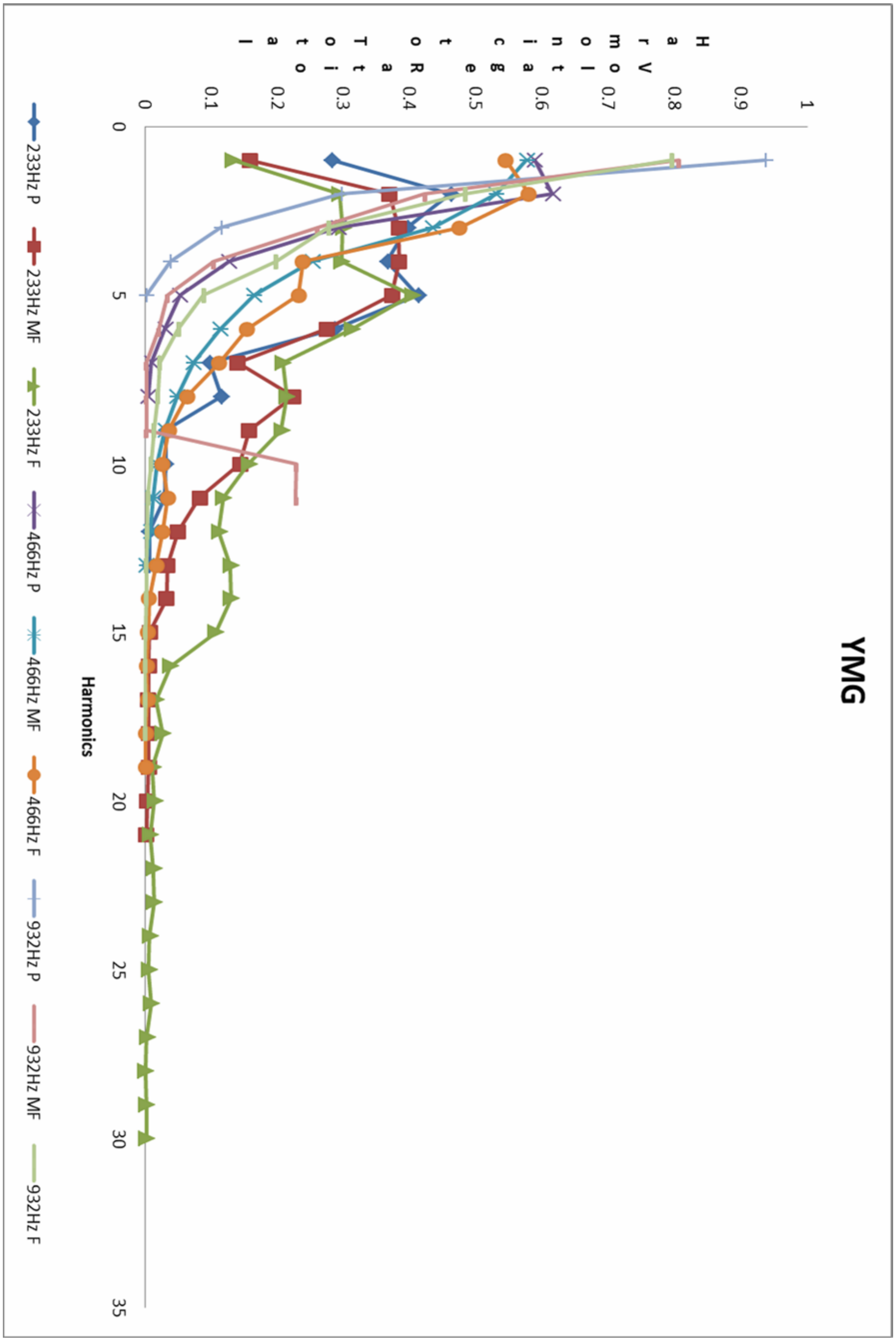

Figure 56
YMG backbore – shape of harmonics.

The YMG backbore is the only backbore that has the second harmonic as the strongest more than once, this being on the 466Hz frequency at *piano* and *forte*. It is also the least consistent with itself. The shapes of the harmonics on the 233Hz and 466Hz frequencies almost all differ. Another characteristic difference from any of the other backbores is the spike in the tenth and eleventh harmonic of the 932Hz frequency at *mezzo forte*.

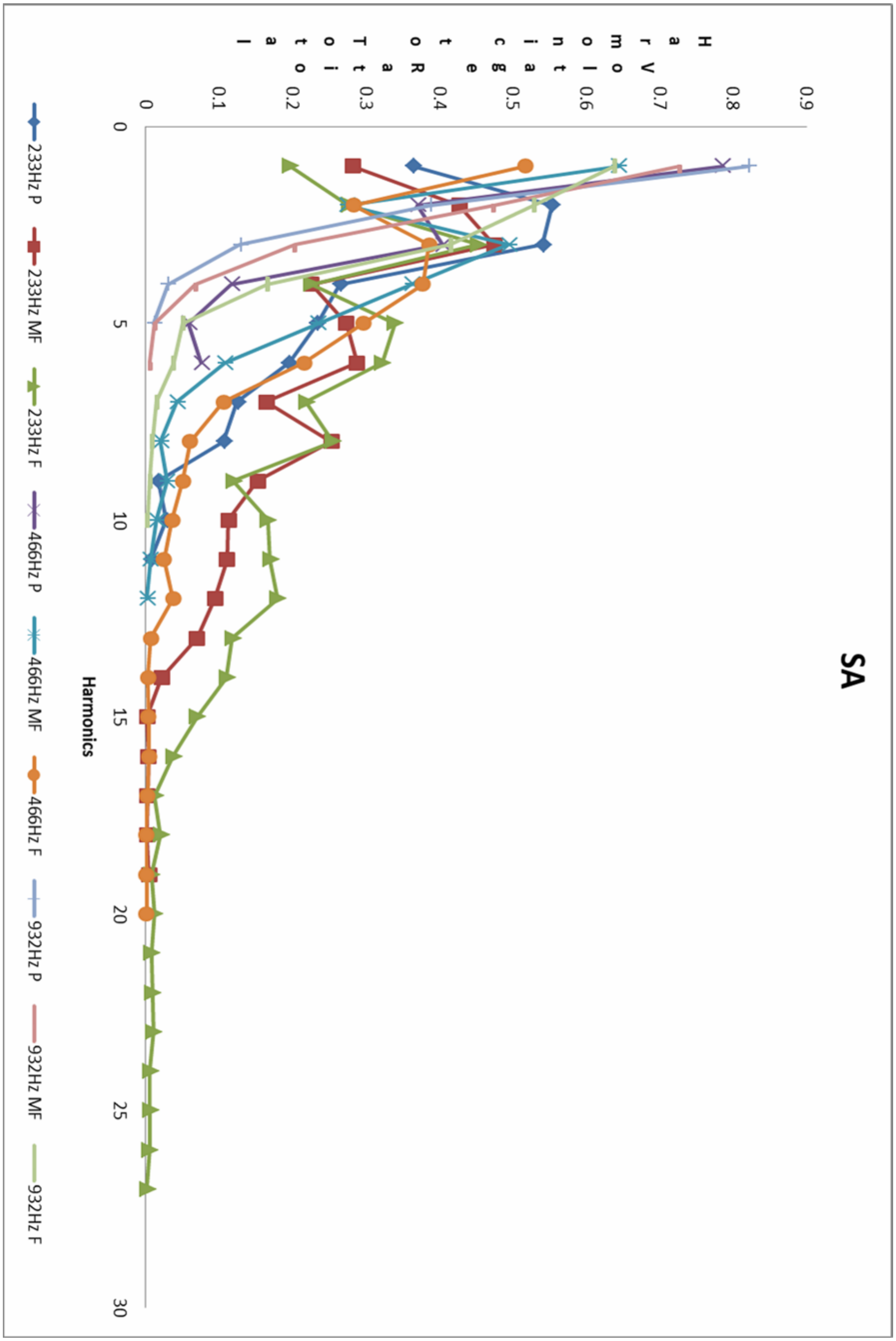

Figure 57
SA backbore – shape of harmonics.

The SA backbore has a large presence of upper harmonics. Beyond the lower frequencies, the 932Hz frequency has more harmonics than most all of the other backbores tested. This backbore would seem to have a brighter quality to the sound, especially in the upper frequency range of the trumpet.

The general comparison of the line graph shapes of the harmonics seems to indicate that some of the backbores do share similar harmonics shapes (timbres), but some also differ. It is important to note that the similarities and differences, consistencies and inconsistencies, do not seem related to the total interior volume of the backbores. The backbores discussed in this section begin with the largest interior volume first (SC) and finish with the smallest interior volume (SA). If there were a correlation to the harmonic shapes, the characteristics of the shapes would be similar to the backbores listed near each other and slowly change as the discussion moved from larger backbores to smaller. The characteristics of the harmonic shapes (timbre) do not seem to strongly correlate to total interior volume.

General Timbre – Formant Region – Dynamics

In a general sense, the graphic representations of the harmonics allow some comparisons or profiling of the sound a specific backbore shape produces. Comparing all of the backbores directly on a single graph helps reduce it to a single frequency and dynamic. The general shape for all the backbores fall into a characteristic formant region, but there are differences within the general shape. The harmonic differences do not seem to strongly correlate to the total interior volume of the backbores. Rather, they appear scattered and random. If the harmonic shapes did strongly correlate to interior volume they would appear more organized on the graphs.

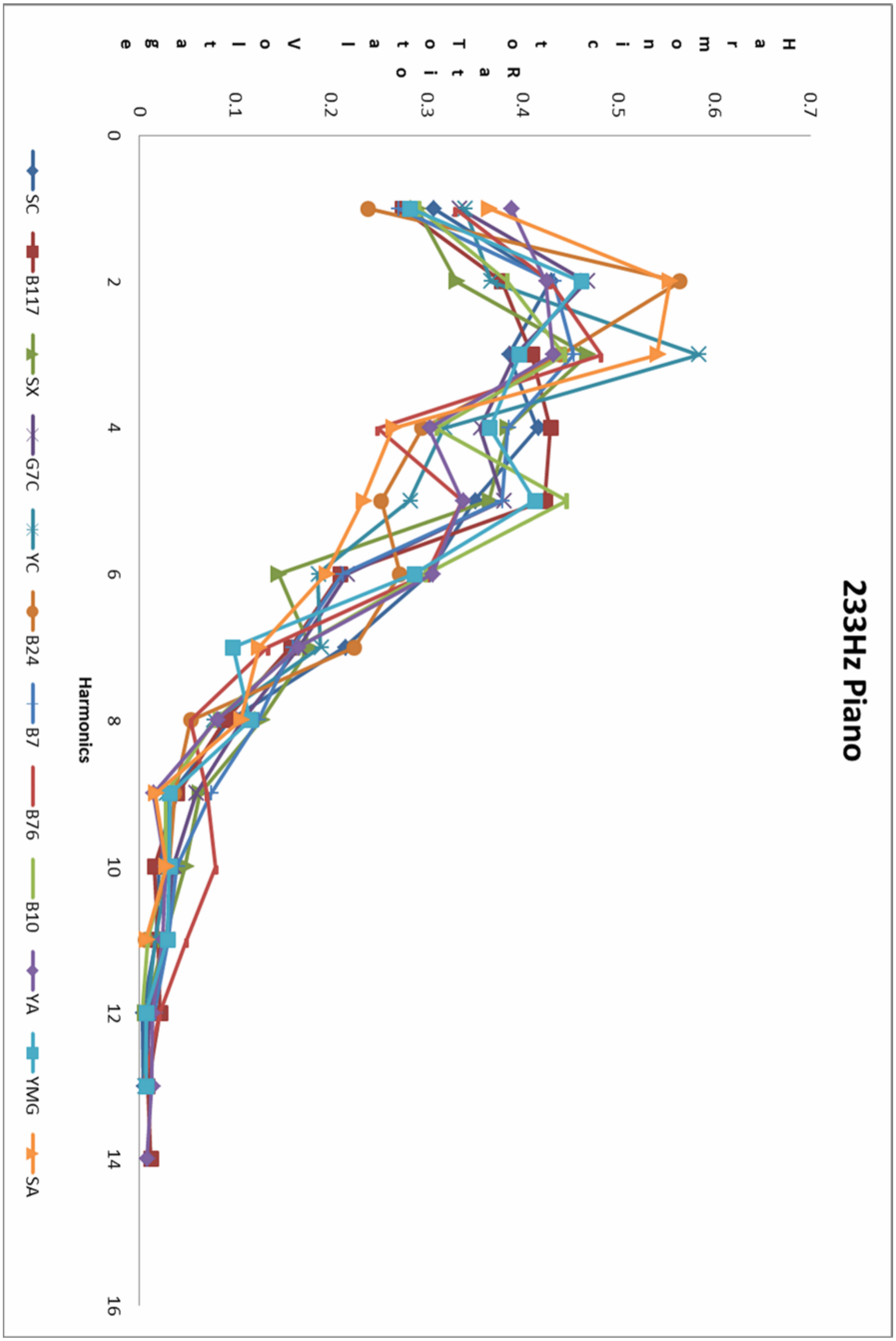

Figure 58
233Hz *piano*.

In Figure 58 three of the backbores stand out: the B24, YC, and B117. The B24 and YC backbores both have a large peak harmonic to total harmonic ratio, they both have a single harmonic that is much larger than the rest of the harmonics, and the shape of the graph is steep. In contrast to the B24 and YC backbores, the B117 backbore has a smaller peak harmonic to total harmonic ratio, and it has a flat graph shape in comparison. The timbre of the B117 backbore is different than the B24 and YC. The B24 and YC backbores, while having similar peak harmonic to total harmonic ratios, differ in that the B24 has a lower odd to even harmonic ratio (the second harmonic is the strongest) and the YC has a higher odd to even harmonic ratio (the third harmonic is the strongest). The timbre of the B24 backbore seems to be influenced primarily by the second harmonic, the YC by the third, and the B117 the first five harmonics.

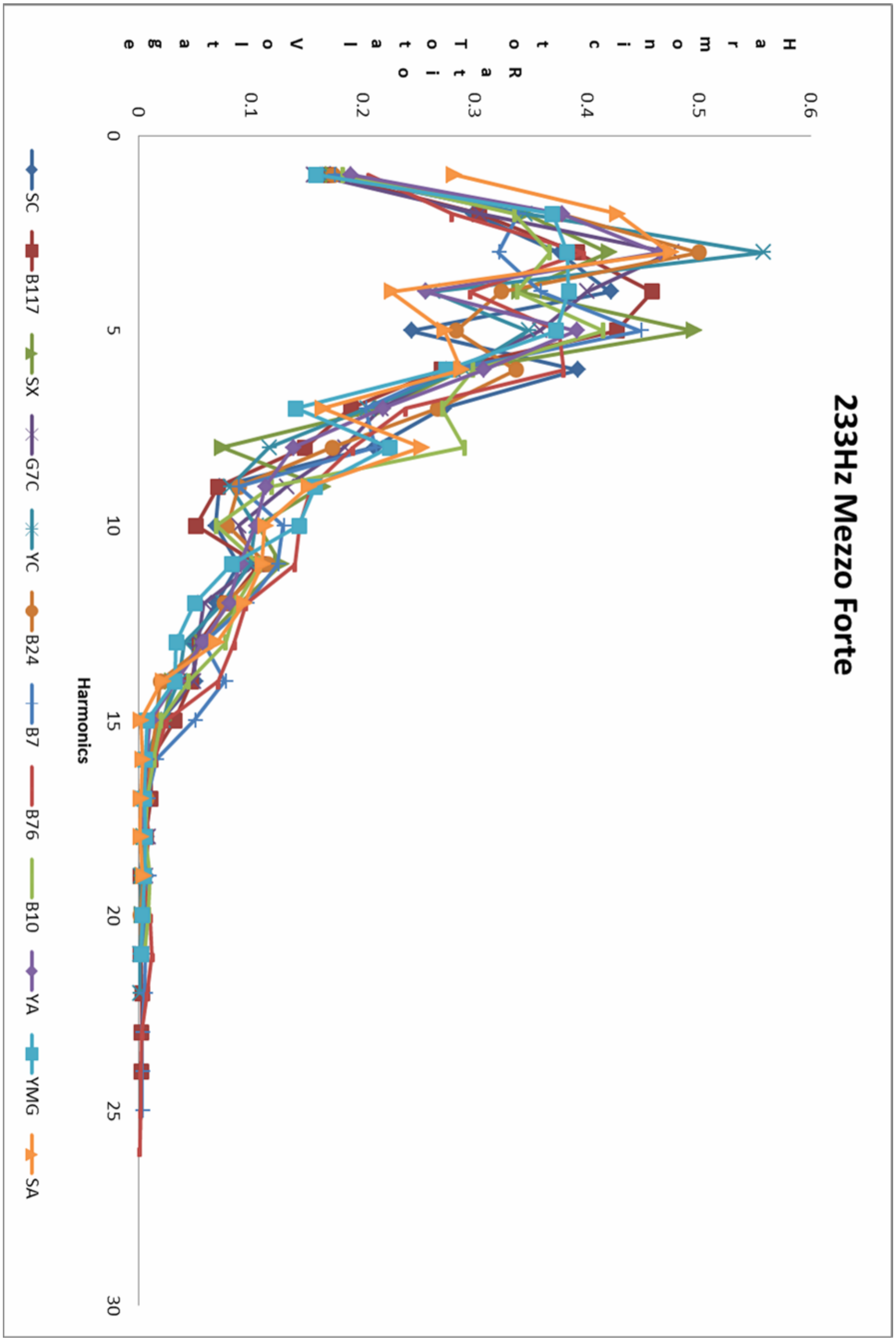

Figure 59
233Hz mezzo forte.

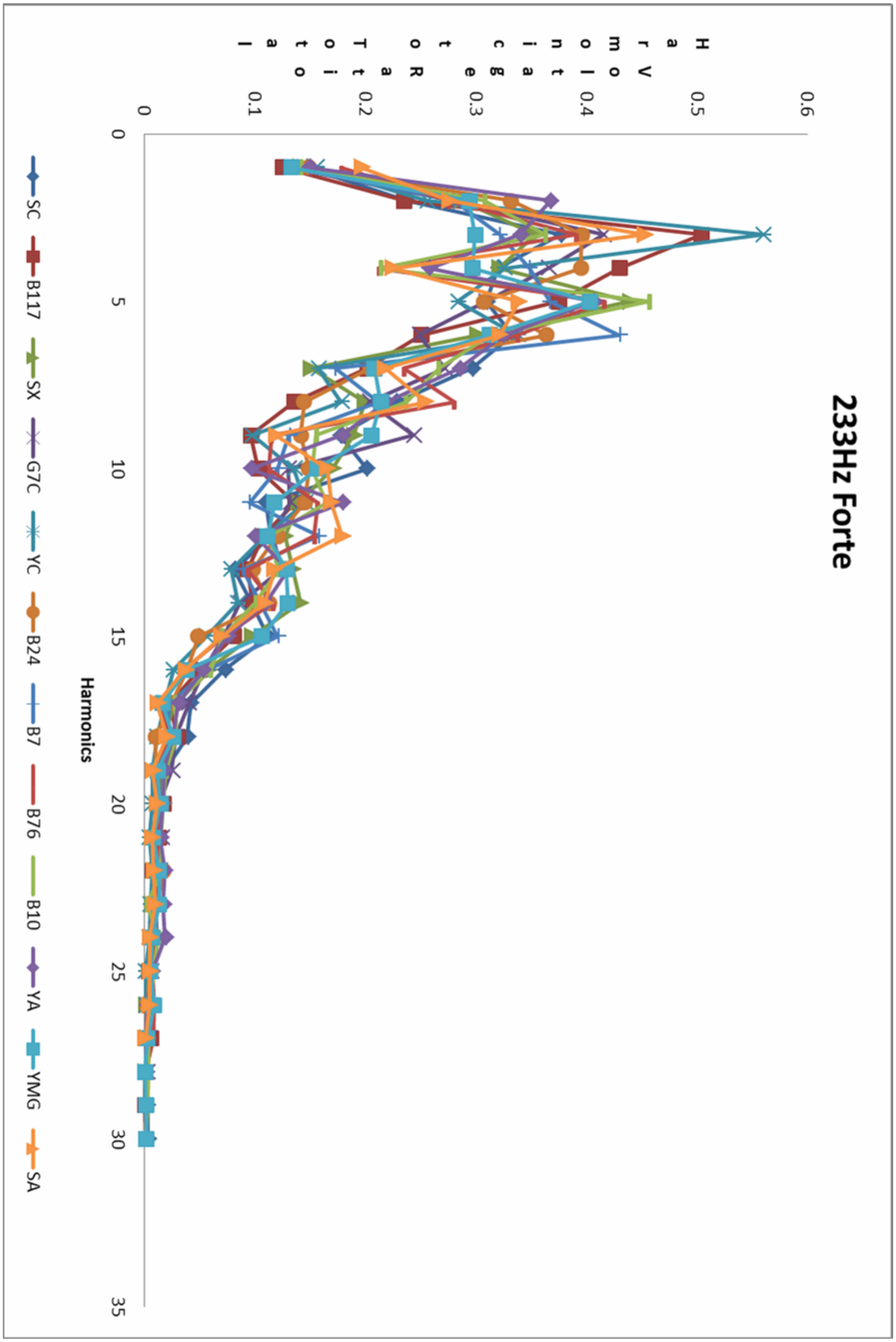

Figure 60
233Hz *forte*.

As the backbores are played with greater dynamic volume on the 233Hz frequency, the peak harmonics seem to increase in relation to the other harmonics. This is particularly true for the backbores that have a somewhat flat graph shape at the *piano* dynamic, the B117 backbore for example. This trend is evident in Figures 58, 59, and 60.

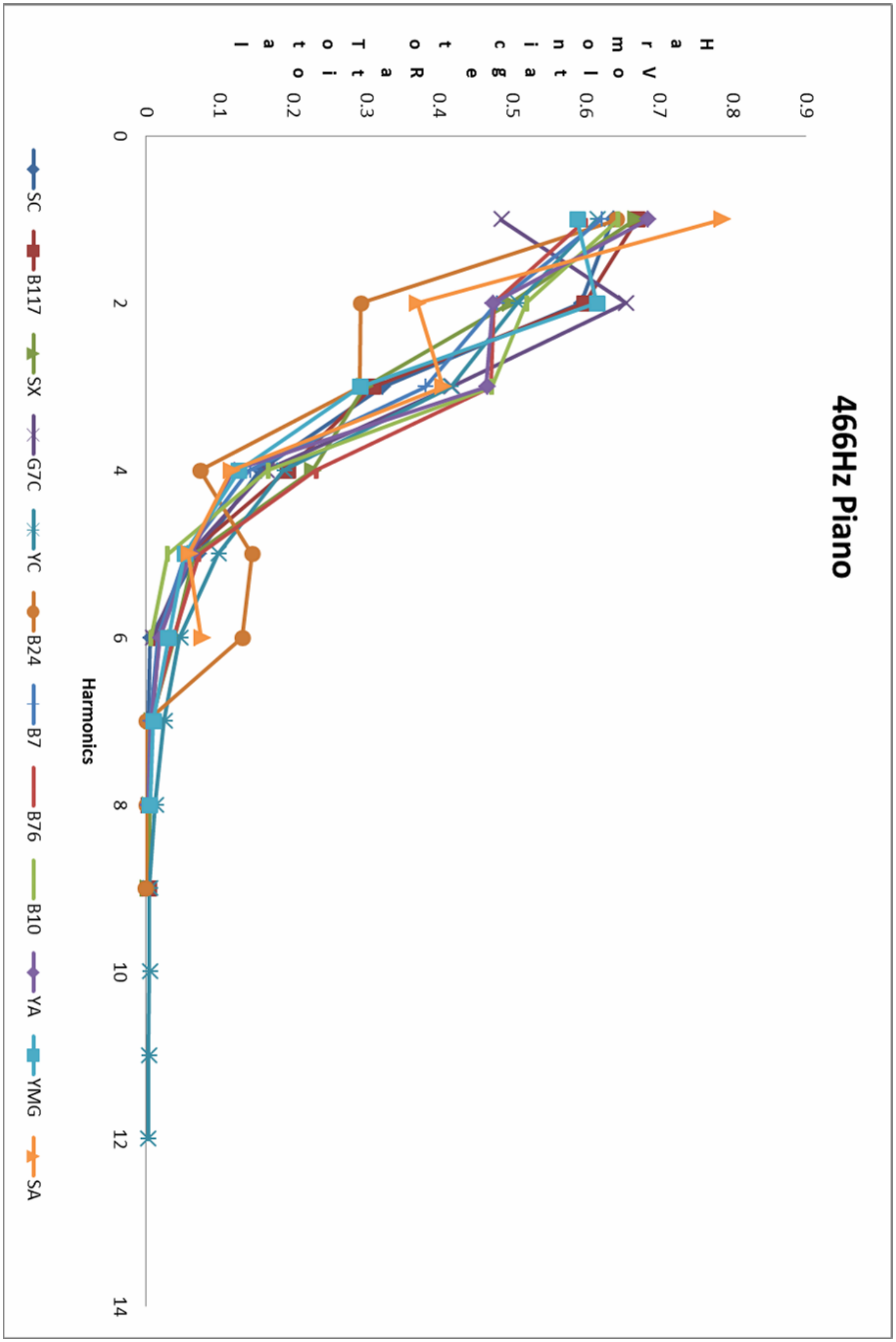

Figure 61
466Hz *piano*.

The YMG and the G7C backbores are the only two where the fundamental (first harmonic) is not the strongest at the 466Hz frequency and piano dynamic, Figure 61. It is interesting to note that all of the testers informally commented after the testing (prior to knowing the backbore labels) that they did not prefer the sound of these two backbores.

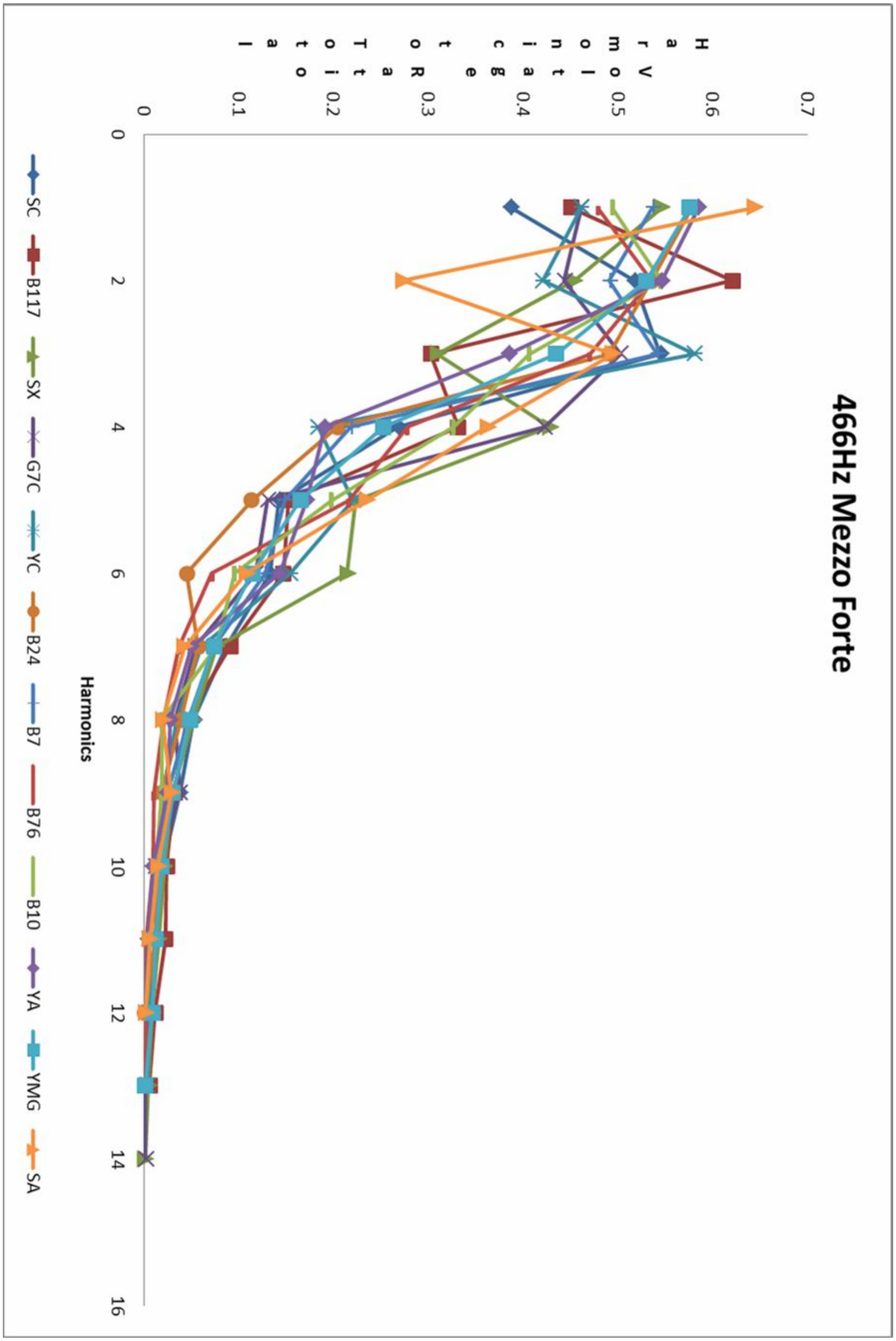

Figure 62
466Hz *mezzo forte*.

The backbore with the most unique harmonic behavior at the 466Hz frequency at *mezzo forte* and *forte* dynamics, Figure 62 and Figure 63, is the B117. The B117 has a significantly lower third harmonic, in contrast with many of the other backbores that have the third harmonic the strongest. This information is important to comparing timbre to interior volume. The B117 backbore is smaller in interior volume than the SC and larger than the rest, yet even though its interior volume is not extreme in relation to the other backbores, the timbre is much different (as represented graphically with harmonics).

In Figure 62, the B24 backbore has the strongest fundamental and also the weakest second harmonic. In Figure 62, at *mezzo forte* as opposed to *piano* of Figure 61, the B24 backbore has a similar overall shape, but the fundamental is weaker in relation to the other harmonics. The behavior of the harmonic shape of the B24 backbore is significantly different than the B76, B7, B10, and to a lesser extent the YA. The extent that the harmonic shapes of the B76, B7, B10, B24 and YA change does not strictly correlate to their total interior volumes. If the harmonic shape changes in the same way for each backbore as the total interior volume increases or decreases, a correlation could be made for volume affecting timbre, but that is not the case in this example.

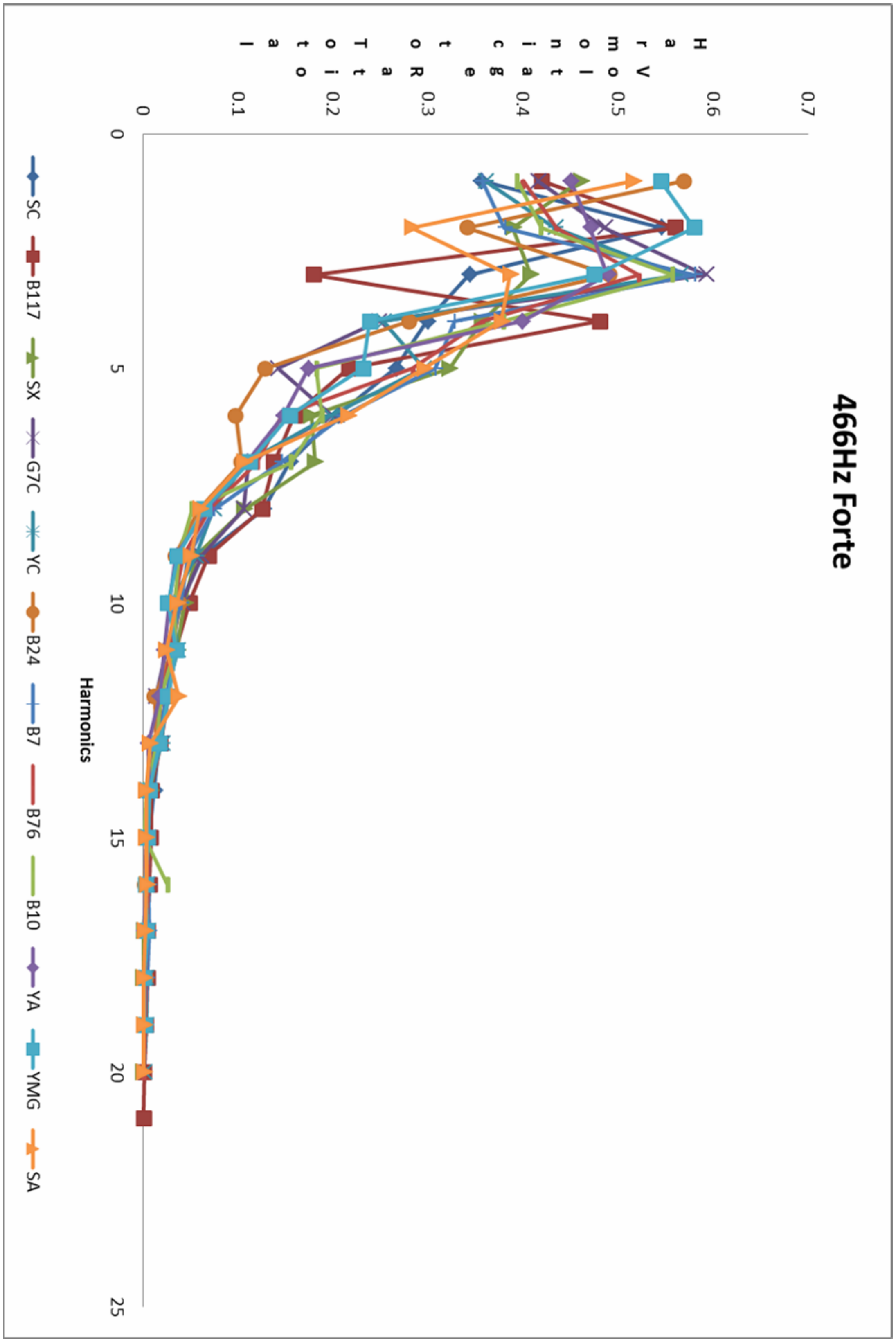

Figure 63
466Hz *forte*.

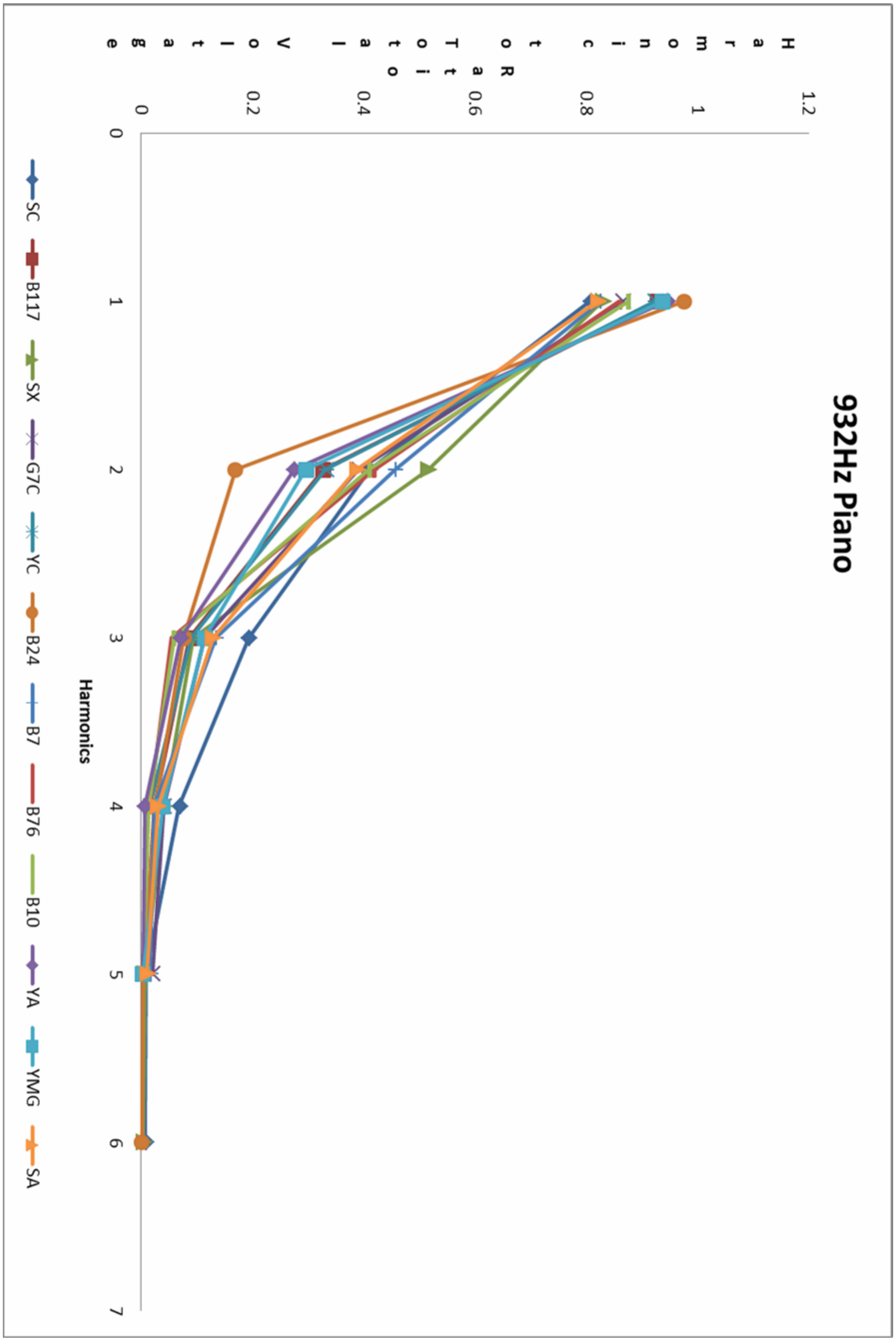

Figure 64
932Hz *piano*.

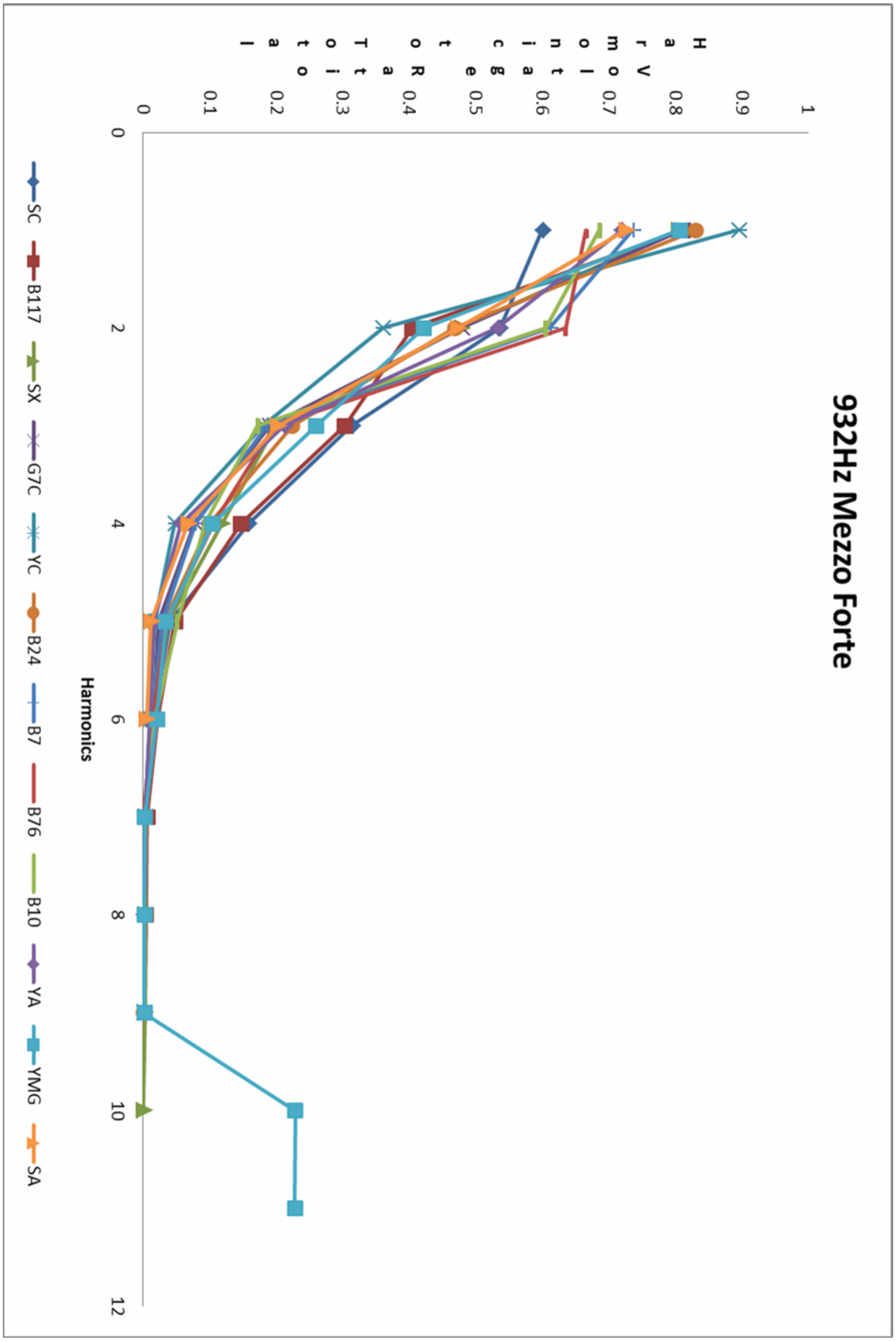

Figure 65
932Hz mezzo forte.

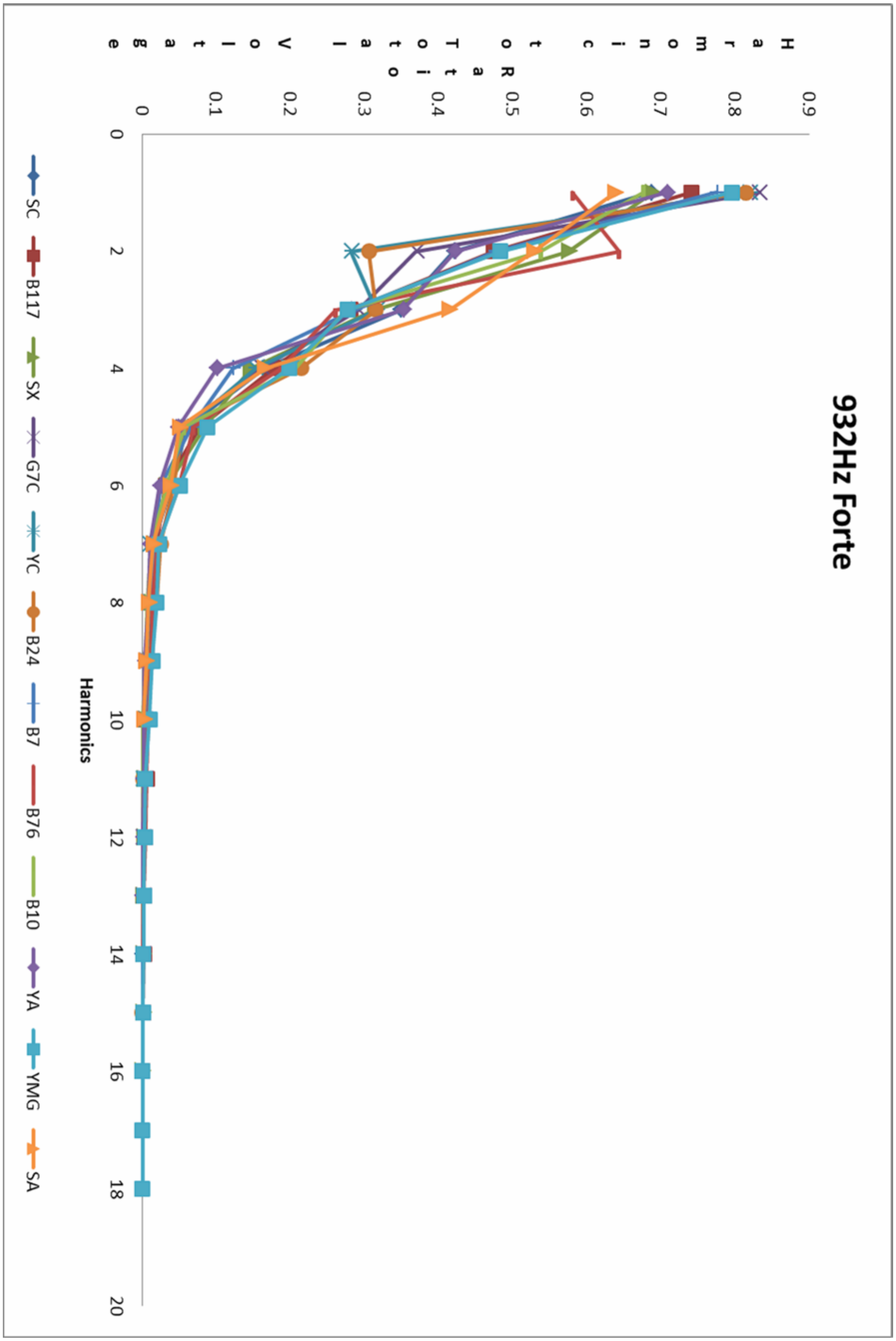

Figure 66
932Hz *forte*.

The B76 backbore is the only backbore to not have the fundamental as the strongest harmonic at the 932Hz frequency and *forte* dynamic, Figure 66. This is an example demonstrating that interior volume does not strongly correlate to timbre. The volume of the B76 and B10 backbores varies only by 0.001 cubic inches (Table 1), yet the B76 backbore has a significantly different timbre. It is interesting to note that a "classical" player in the test commented (post testing and pre-knowledge of labeling) that the B76 backbore would be a nice commercial backbore. The author suggests that the player made this comment because the B76 backbore "feels" small in terms of blow resistance, yet it does not "sound small." The backbores with smaller interior volumes (SA, YA, YMG) feel similar to the B76, yet they all have more relative strength in the fundamental than the B76 (they all seem loud, but have different tone qualities). The B10 and B7 backbores at the 932Hz frequency and *forte* dynamic also have fairly strong second harmonics, though not as strong as the B76, but feel different to play than the B76. Also, the B76 has more harmonic strength in the lower harmonics, perhaps seeming louder in the upper register for less effort. The feeling of being louder and slightly brighter from a strong second harmonic and not just a stronger fundamental, combined with less perceived playing effort, is likely the reason the comment was made.

The *mezzo forte* and *forte* dynamics have the most variance in the harmonics. This is where the influence of the backbores on the timbre seems most noticeable. The *piano* dynamic of the 932Hz frequency has the least variation, followed by the *piano* dynamic of the 466Hz and 233Hz frequencies.

When comparing the harmonic shapes for the backbores at the same frequency and dynamic, there does not seem to be any strong correlations among the backbores in relation to total interior volume. This indicates that the total interior volume of trumpet mouthpiece backbores is not a primary contributor to the timbre of the trumpet.

Timbre and Interior Backbore Shape – Peak Harmonic to Total Harmonic Ratio and Volume Segments

There is a lack of a strong correlation indicating that the total interior volume of the trumpet mouthpiece backbore is related to timbre of the trumpet. However, the shape, or contour, of the inside of the backbore does strongly correlate to the timbre of the trumpet. The backbore was divided into five segments, all equal, of 0.563 inches. There are two exceptions, the SX and SA backbores. With these two backbores, the fifth segment is larger due to a longer shank. This was done to keep the first four segments matching on all of the backbores. Segment one to segment five is the throat end to shank end, respectively, of the backbore. The backbore was divided into segments to investigate the possibility of a correlation between specific segments and the timbre. A correlation of a particular segment indicates that it is the rate of interior volume increase (or decrease) that is responsible for timbre. This is a way at looking at the shape as affecting the timbre, but using interior volume to measure it.

Table 4 contains each segment, dynamic, and frequency, and the correlation of the interior volume of each segment, and the ratios of the peak harmonic to total harmonics. A positive correlation value indicates both values (interior volume of the segment and the peak harmonic ratio) increase together. A negative correlation value indicates one value increases and one decreases. A positive correlation means that the peak harmonic increases as the segment interior volume increases, or the timbre becomes darker. A negative correlation means that the peak harmonic decreases as the segment interior volume increases, or the timbre becomes brighter.

Segment one contains strong correlations on the 466 Hertz frequency at *piano* and *mezzo forte*. These strong correlations indicate that as the segment one interior volume increases, the timbre becomes brighter. Segment one contains moderate correlations at the 932 Hertz frequency at *forte* and on the 233 Hertz frequency at *piano*. These moderate correlations indicate that as the segment one interior volume increases the timbre becomes darker. Segment two contains strong correlations on the 466 Hertz frequency at *piano* and *mezzo forte*. These strong correlations indicate that as the segment two interior volume increases the timbre becomes brighter. Segment three contains strong correlations on the 233 Hertz frequency at *mezzo forte* and on the 932 Hertz frequency at *mezzo forte*. These strong correlations indicate that as the segment three interior volume increases the timbre becomes darker. Segment three contains moderate correlations on the 233 Hertz frequency at *forte* and on the 932 Hertz frequency at *forte*. These moderate correlations indicate that as the segment three interior volume increases the volume becomes darker. Segment four and segment five both do not have moderate or strong correlations of segment interior volume and timbre. Segments one, two, and three have the most correlations of all of the segments and are the most responsible for timbre, as measured in this study. It can be concluded that interior shape is the primary component in the influence of the trumpet mouthpiece on the timbre of the trumpet.

Segment	Dynamic	233 Hertz	466 Hertz	932 Hertz
1	P	-0.4128	-0.7923	0.2301
	MF	-0.0307	-0.6705	0.1179
	F	-0.0282	0.2915	0.4541
2	P	-0.3542	-0.6907	-0.0865
	MF	-0.0978	-0.7361	-0.2006
	F	-0.0321	0.1140	0.0720
3	P	0.2245	-0.0630	0.1176
	MF	0.6457	0.0077	0.6481
	F	0.4311	0.1944	0.5452
4	P	-0.2756	0.0184	-0.3720
	MF	0.0132	-0.0987	-0.3190
	F	-0.2177	-0.0167	-0.0757
5	P	-0.2298	-0.2955	-0.0624
	MF	0.2938	-0.1388	0.0751
	F	0.2121	0.0743	0.2220

Table 4
Correlation of segments and peak harmonic ratios.

Figures 67 through 111 contain graphs of each of the five segments, each dynamic, and each frequency. A correlation of the interior volume of a segment and timbre is exhibited by a diagonal line (or nearly diagonal). A non-correlation of the interior volume of a segment and timbre is exhibited by a horizontal line, vertical line, a bunched group of plots, or a scattered group of plots.

When calculated, there is a moderate correlation of segment one on the 233 Hertz frequency at *piano*. However, when the graph is viewed (Figure 67), it is evident that the SA backbore is unique and far different than the other backbores, possibly skewing the calculated result. The graph seems to support a lack of a strong correlation, but with the SA backbore calculated in, a moderate correlation. The YC and B24 backbores are also plotted far from the other group of backbores. There are twelve backbores in this study, a further study could have a broader scope and test more backbores in an effort to decrease the effect that one backbore has on the results.

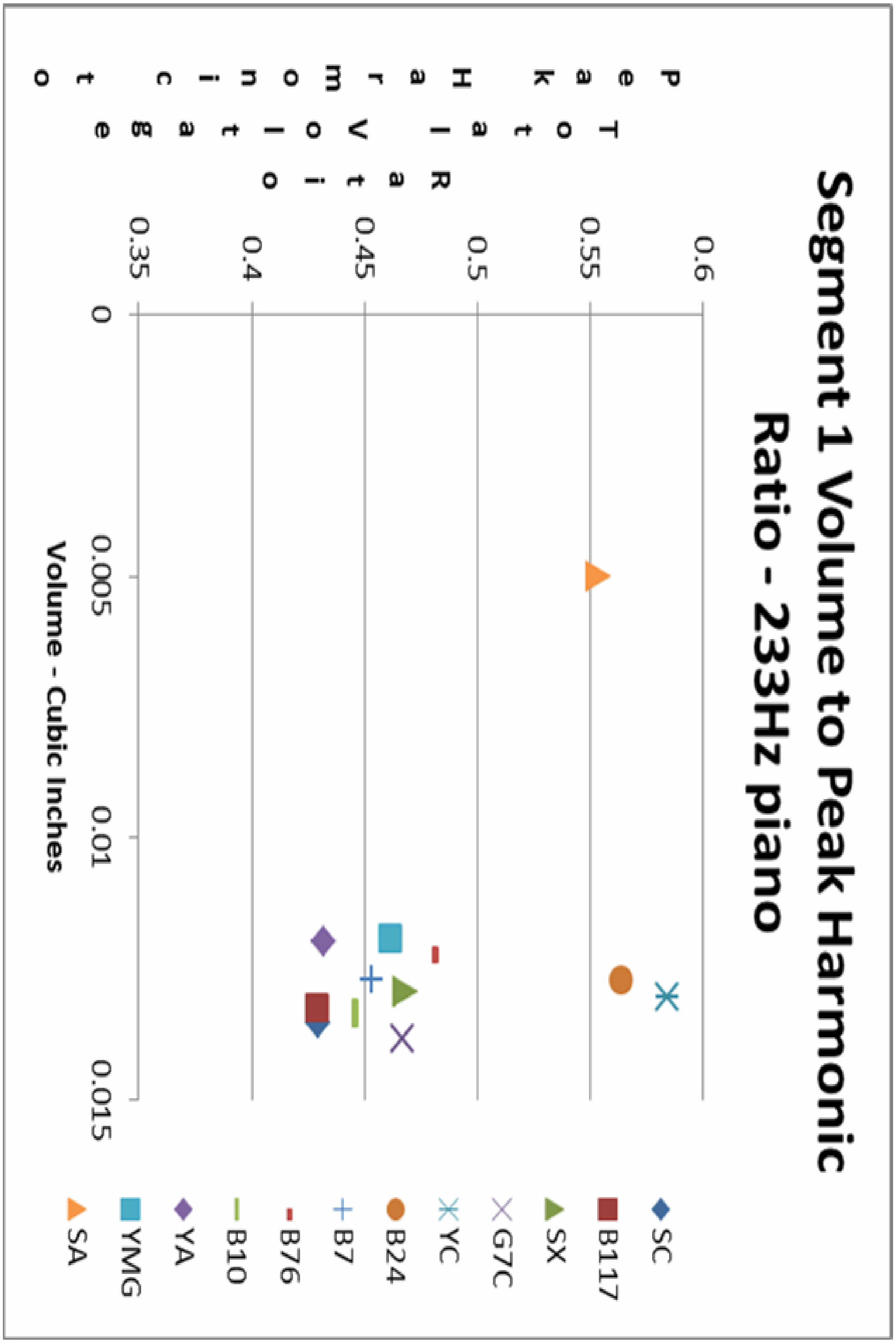

Figure 67
Segment one volume to peak harmonic ratio – 233Hz *piano*.
Moderate correlation (r = -0.4128).

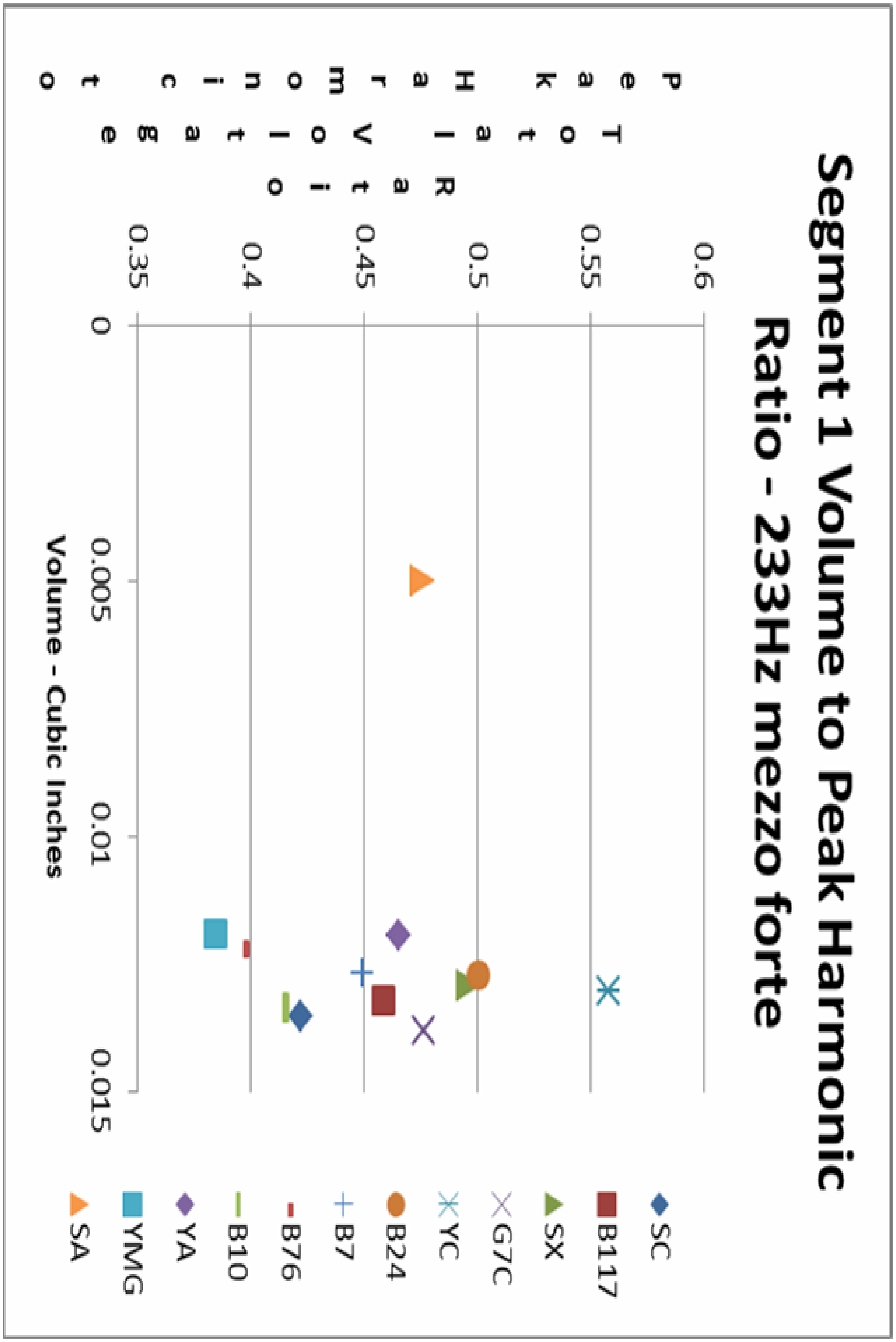

Figure 68
Segment one volume to peak harmonic ratio – 233Hz *mezzo forte*.
Minimal correlation (r = -0.0307).

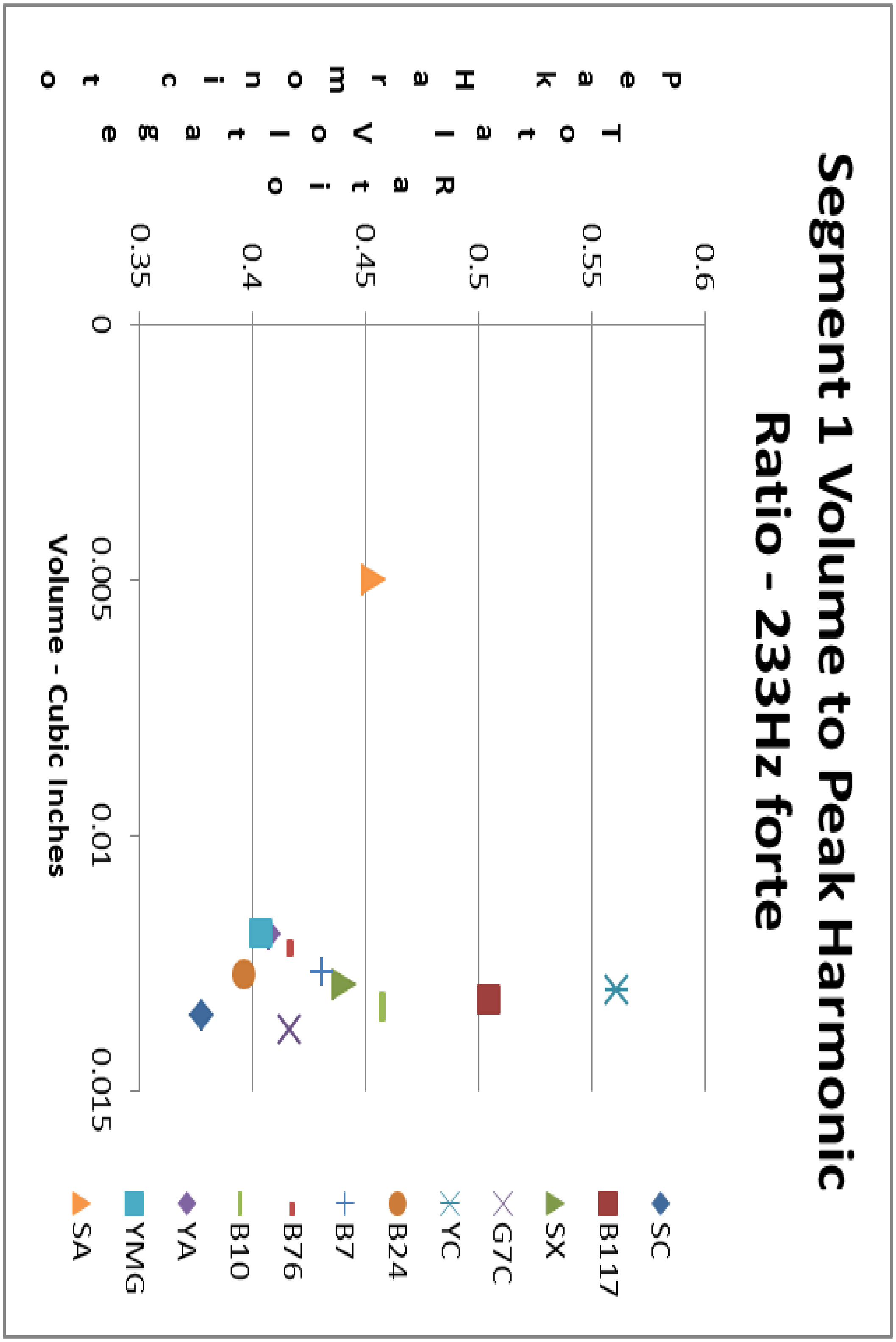

Figure 69
Segment one volume to peak harmonic ratio – 233Hz *forte*.
Minimal correlation (r = -0.0282).

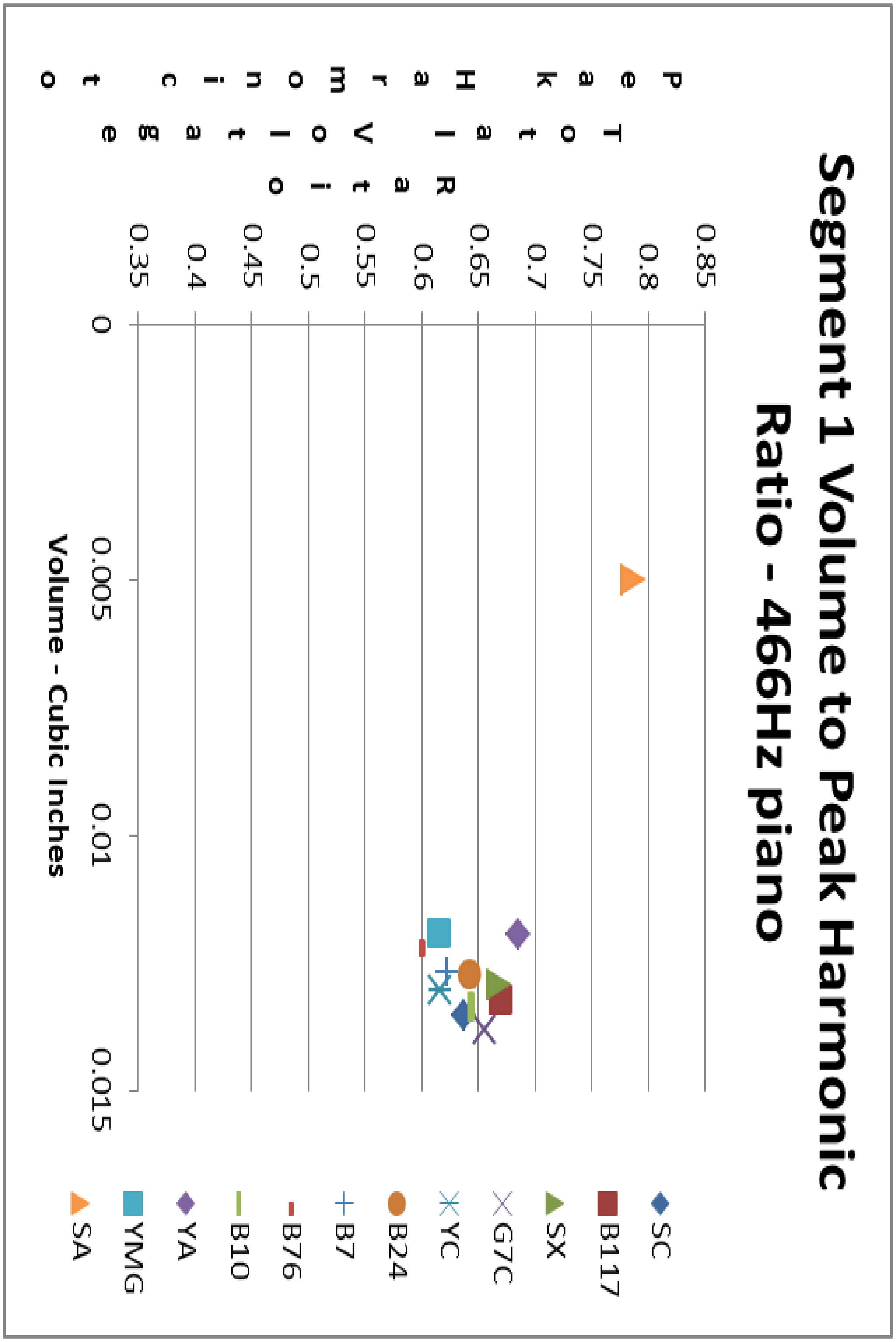

Figure 70
Segment one volume to peak harmonic ratio – 466Hz *piano*.
Strong correlation (r = -0.7923).

Figure 71 contains the graph of the 466 Hertz frequency at *piano*. Like Figure 67, 68, 69, and 70 the calculation of correlation may be misleading. As Figure 71 indicates, the SA backbore is unique compared to the other backbores and strongly influences the data.

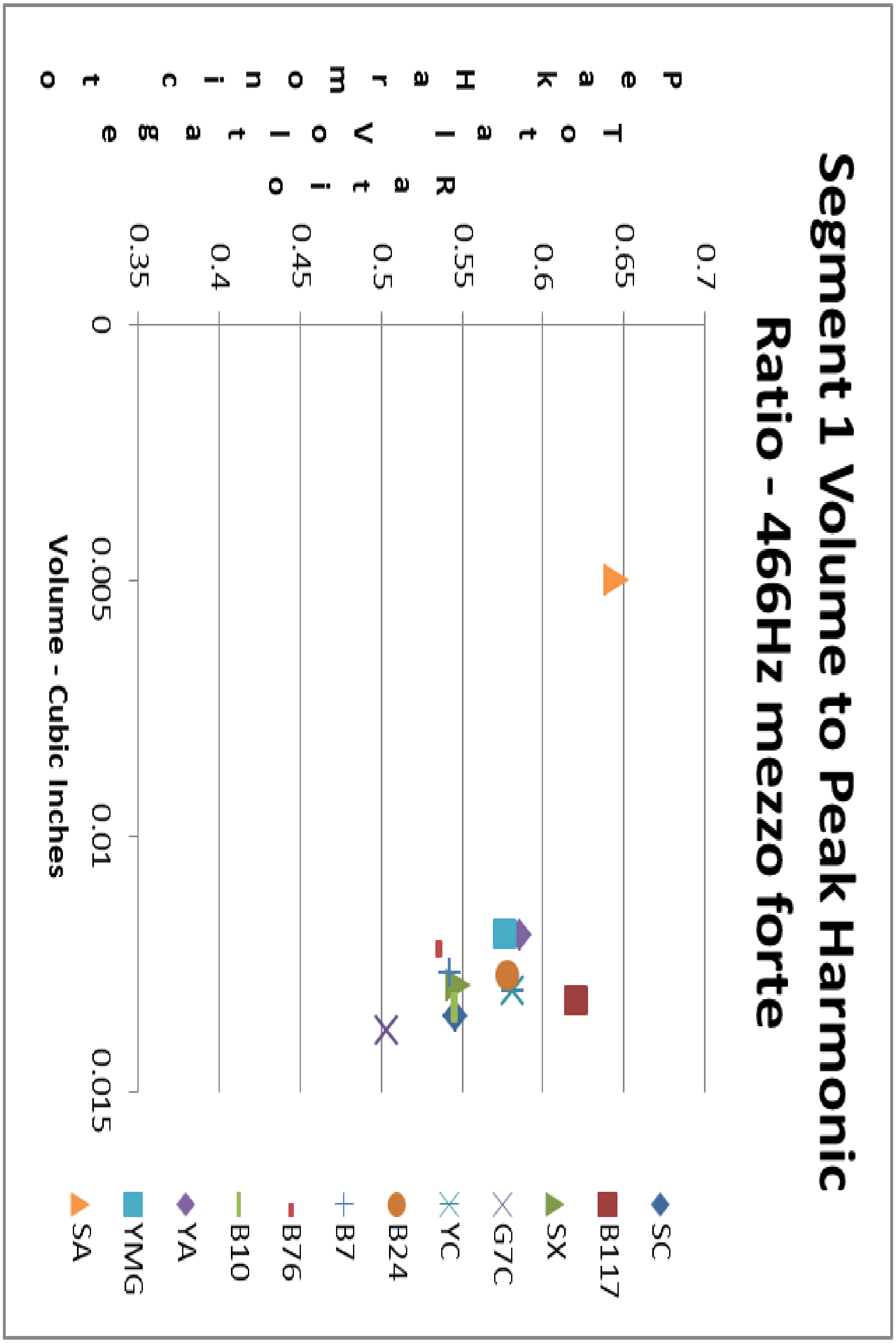

Figure 71
Segment one volume to peak harmonic ratio – 466Hz *mezzo forte*.
Strong correlation (r = -0.6705 correlation).

Figure 71 indicates a strong correlation. As segment one interior volume increases, the timbre becomes brighter. This graph supports the calculated correlation more than Figures 66 and 70.

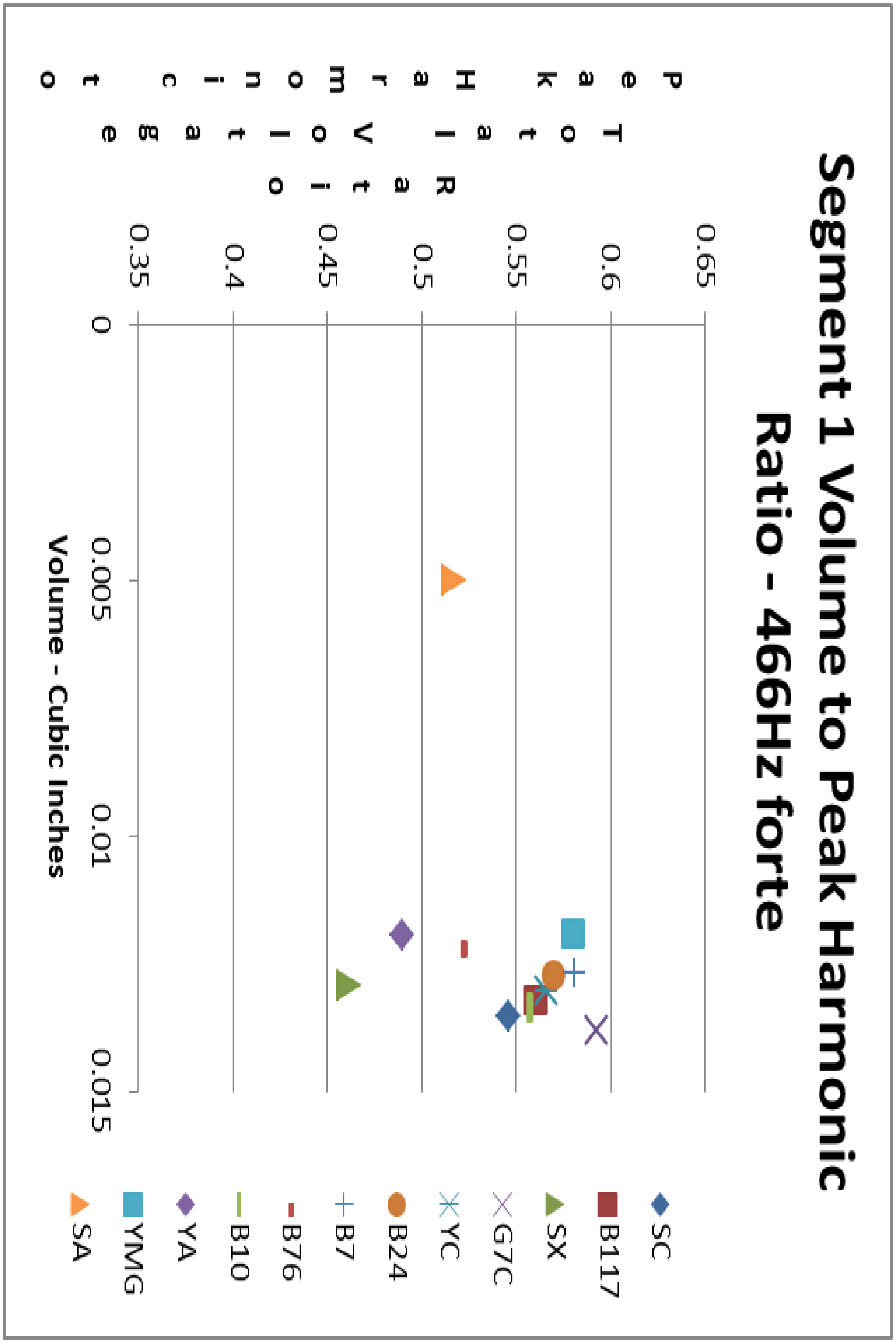

Figure 72
Segment one volume to peak harmonic ratio – 466Hz *forte*.
Minimal correlation (r = 0.2915).

The plots in Figure 72 are bunched and do not form a diagonal line. The SA backbore is, again, unique to the other backbores.

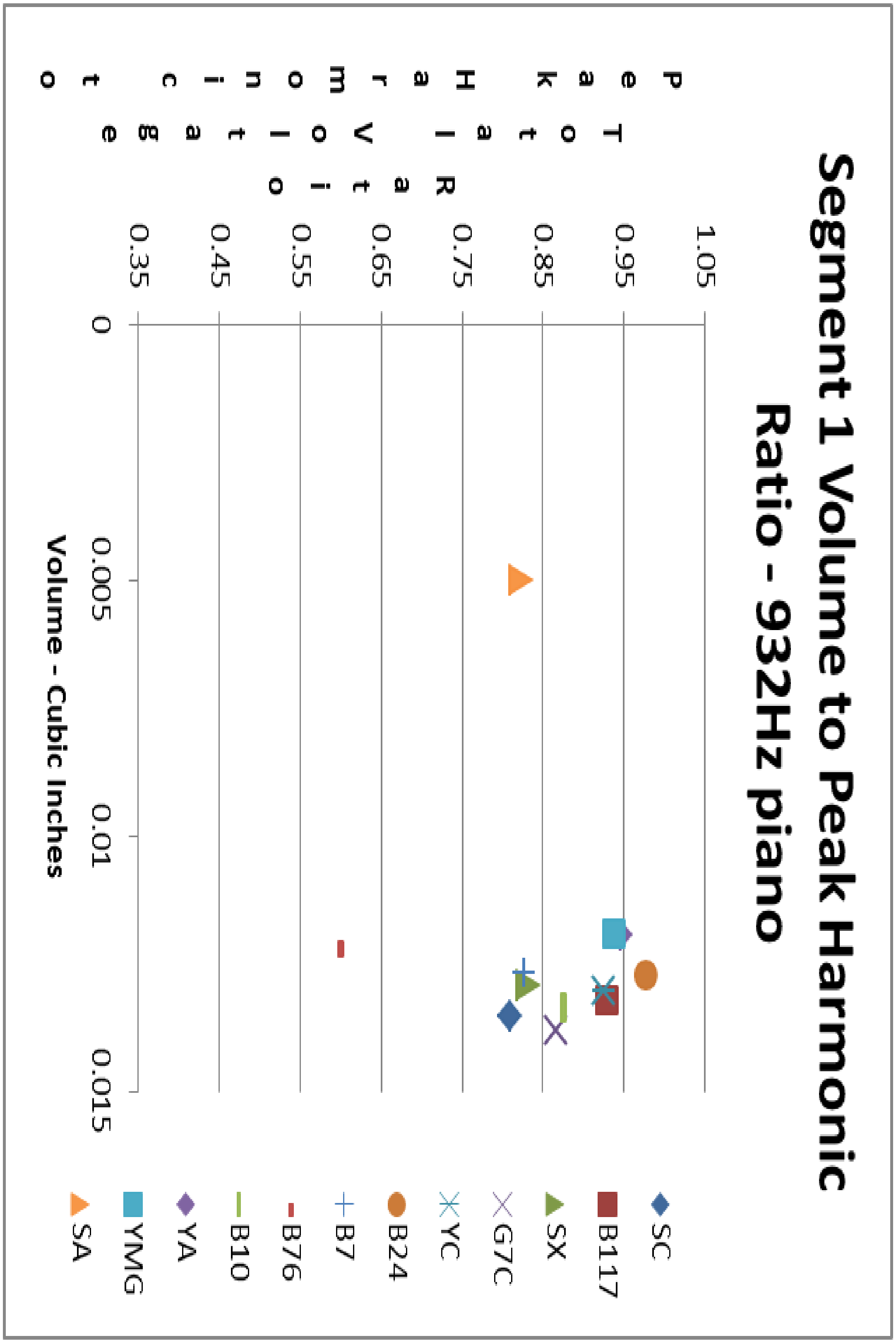

Figure 73
Segment one volume to peak harmonic ratio – 932Hz *piano*.
Minimal correlation (r = 0.2301).

In Figure 73 the plots are bunched with the exception of the B76 and SA backbores. It is interesting that the B76 backbore has a similar volume to the YA and B7 backbores, yet has a significantly different ratio. This relationship could be further researched in additional studies.

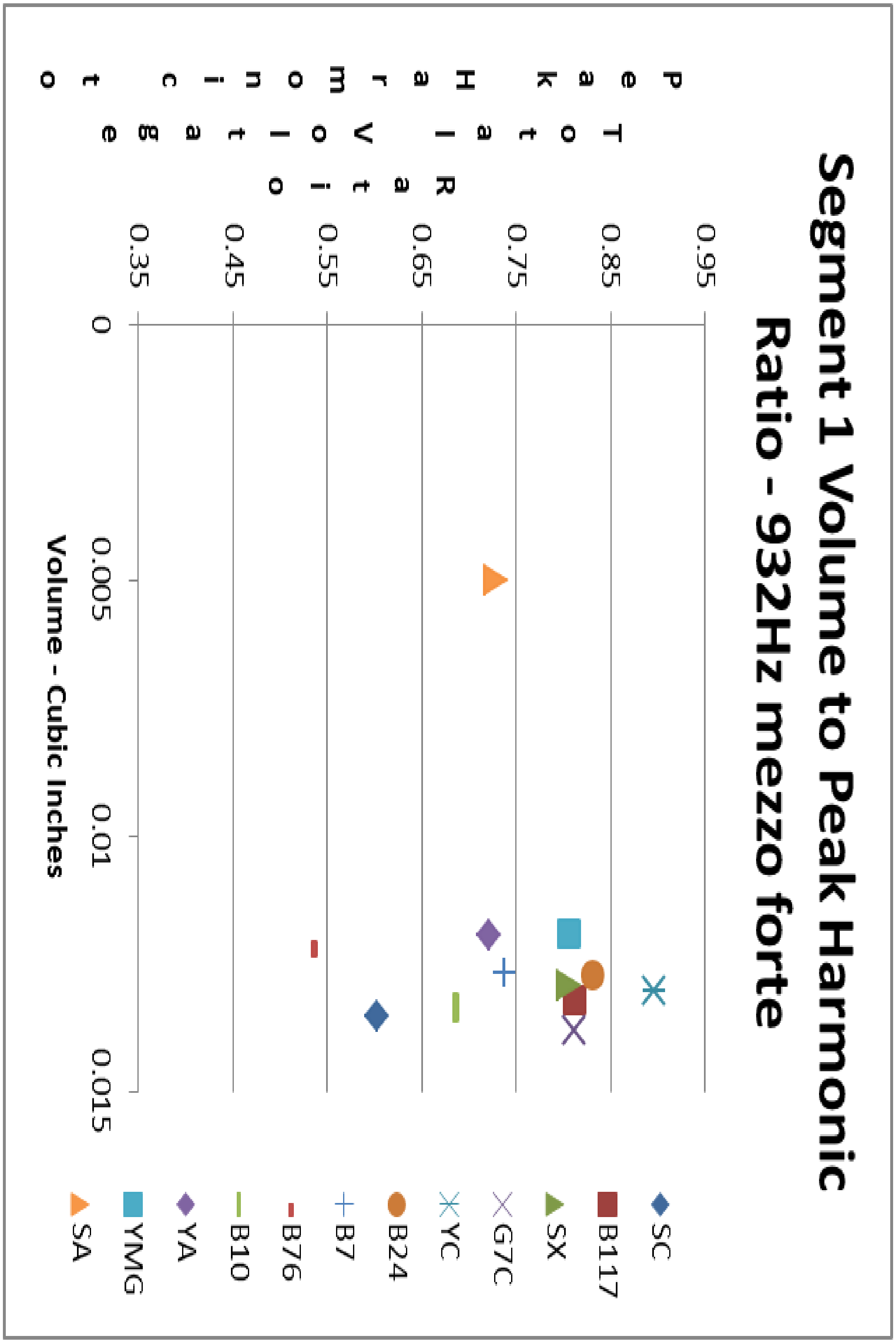

Figure 74
Segment one volume to peak harmonic ratio – 932Hz *mezzo forte*.
Minimal correlation (r = 0.1179).

Figure 74 indicates that there is a minimal correlation. With the exception of the SA backbore, there is a wide range of ratios while the interior volumes are similar on the other eleven backbores.

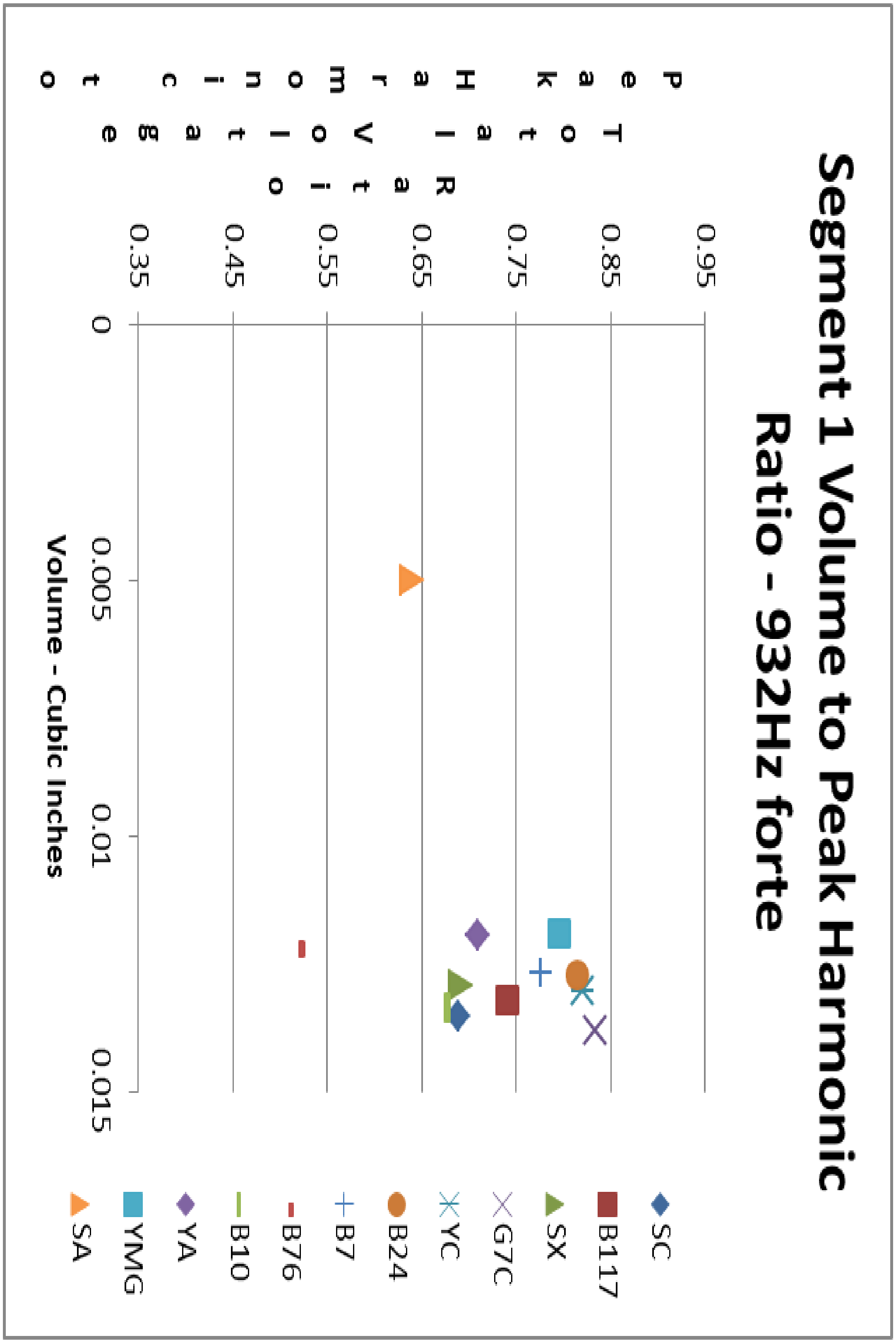

Figure 75
Segment one volume to peak harmonic ratio – 932Hz *forte*.
Moderate correlation (r = 0.4541).

Figure 75 indicates a moderate correlation. On the 932 Hertz frequency at *forte*, when segment one interior volume increases, the timbre becomes darker. The graph visually supports the correlation calculation.

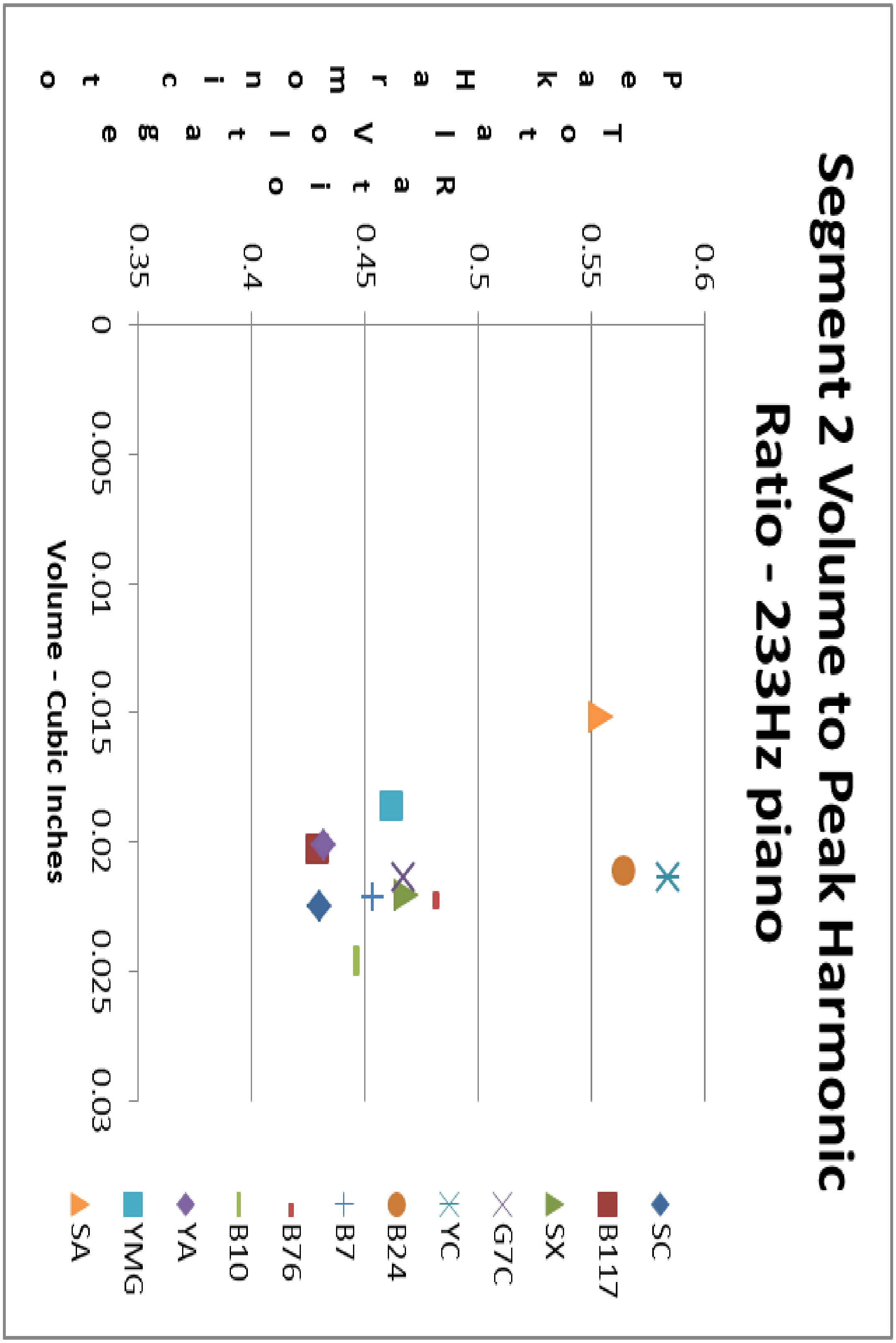

Figure 76
Segment two volume to peak harmonic ratio – 233Hz *piano*.
Minimal correlation (r = -0.3542).

The SA backbore in segment two, Figure 76, is less unique to the other backbores than it is in segment one, Figures 67 through 75. The plots in Figure 76 are random, supporting the calculated minimal correlation.

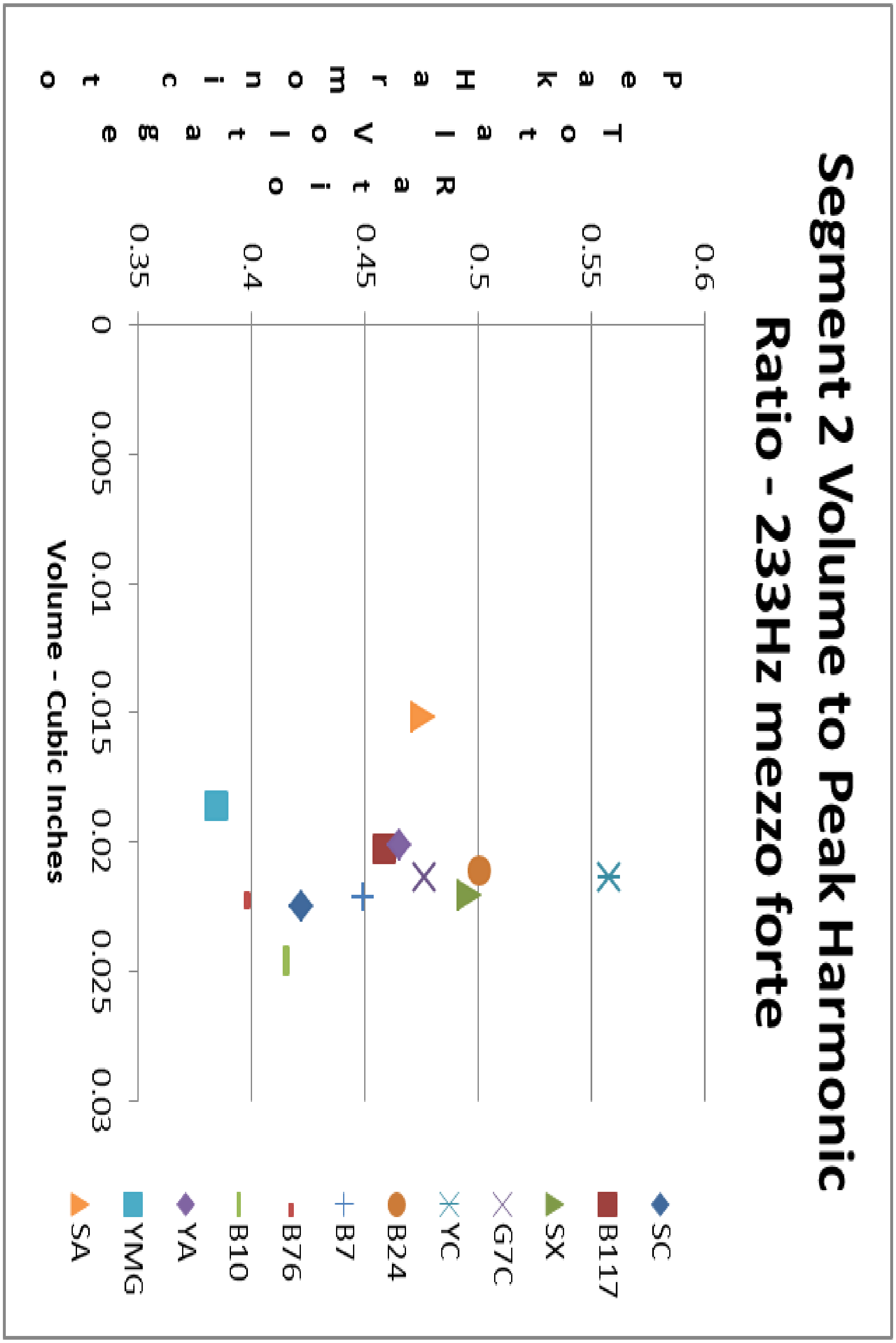

Figure 77
Segment two volume to peak harmonic ratio – 233Hz *mezzo forte*.
Minimal correlation (r = -0.0978).

Figure 77 supports the calculated minimal correlation. The plots are scattered and there is no visual correlation of interior volume and the ratio.

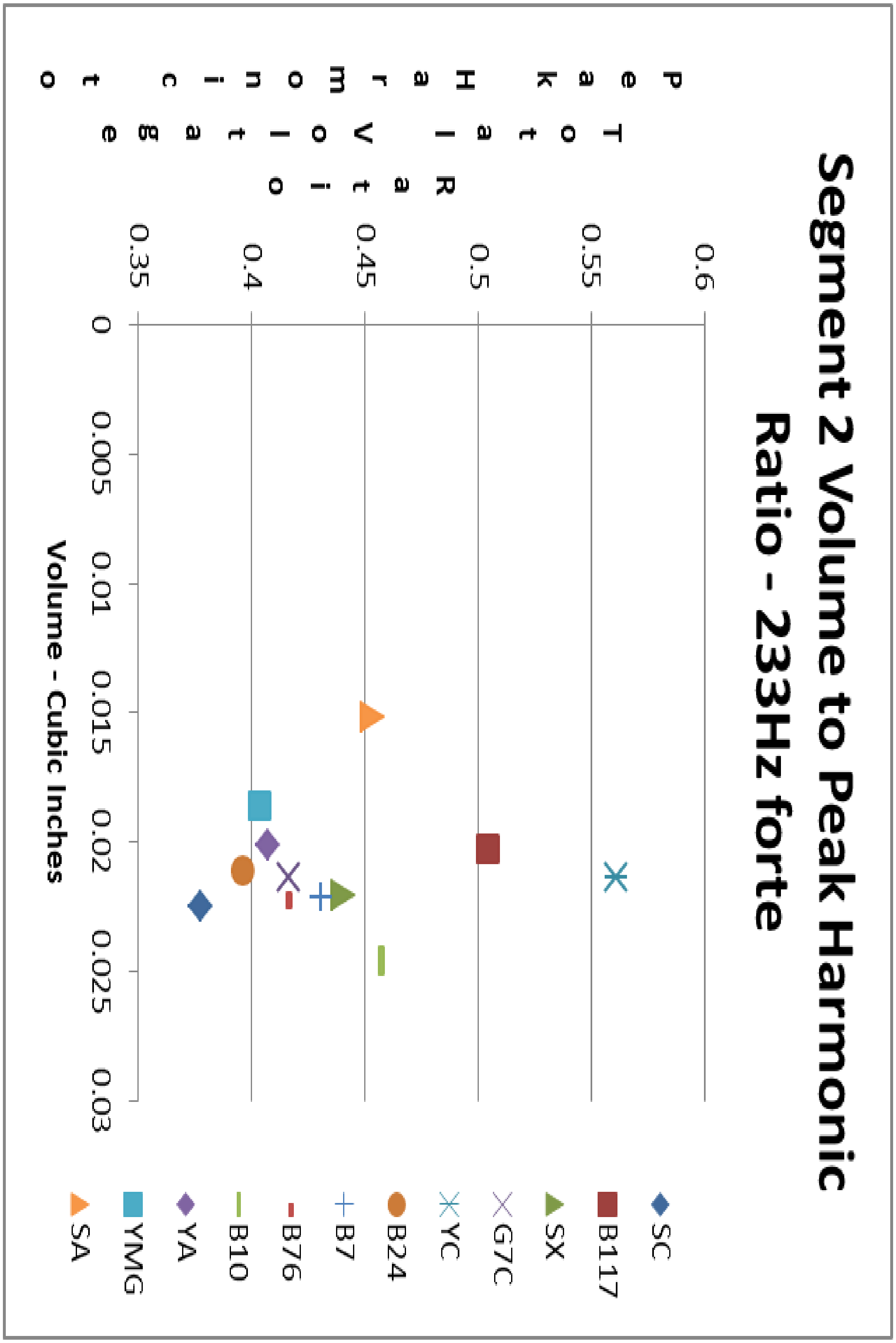

Figure 78
Segment two volume to peak harmonic ratio – 233Hz *forte*.
Minimal correlation (r = -0.0321).

Like Figure 77, Figure 78, displays scattered plots and no visually detectable correlation.

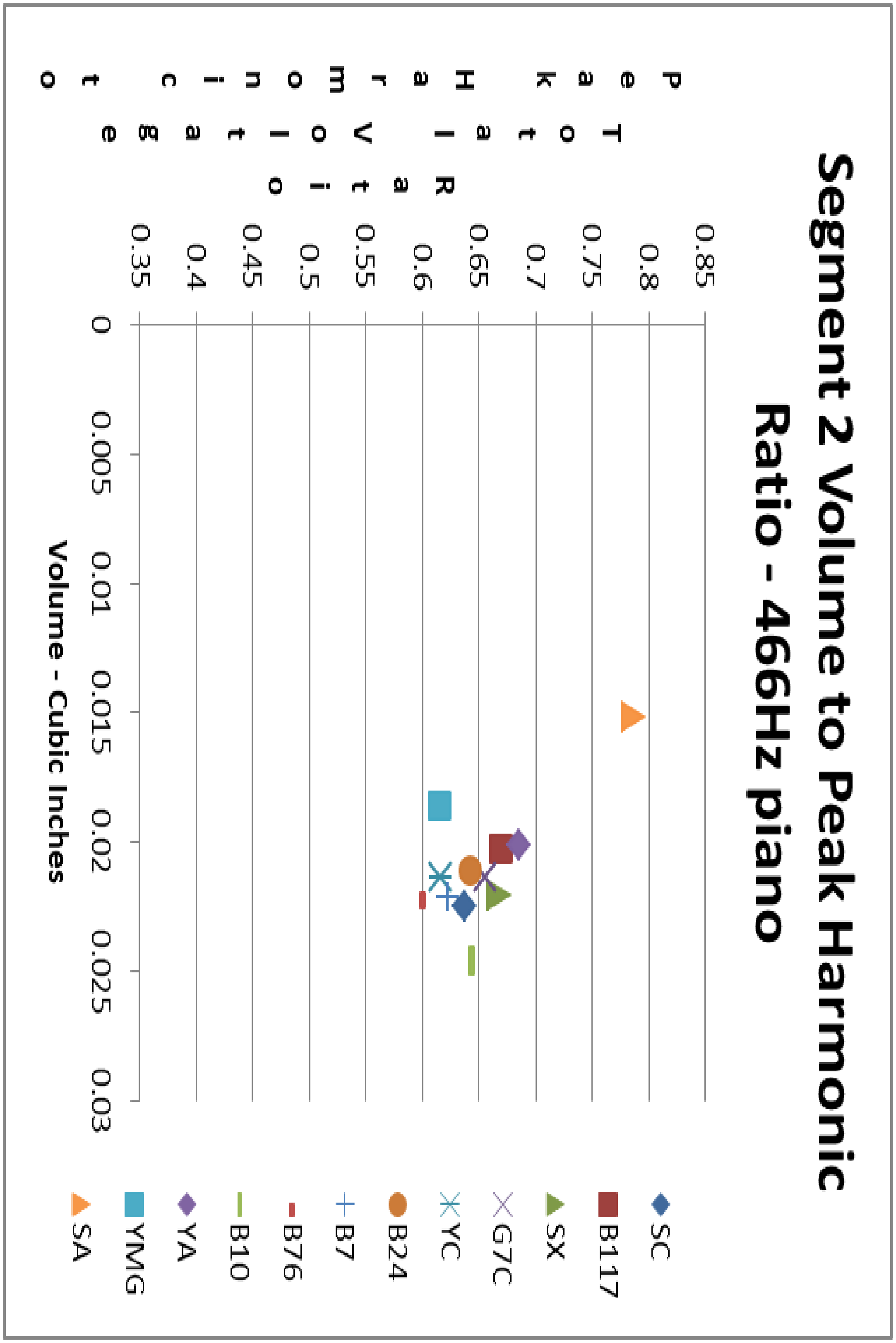

Figure 79
Segment two volume to peak harmonic ratio – 466Hz *piano*.
Strong correlation (r = 0.6907).

Figure 79 indicates a strong correlation. On the 466 Hertz frequency at *piano*, when the interior volume of segment two increases, the timbre becomes brighter. The graph visually supports the correlation calculation.

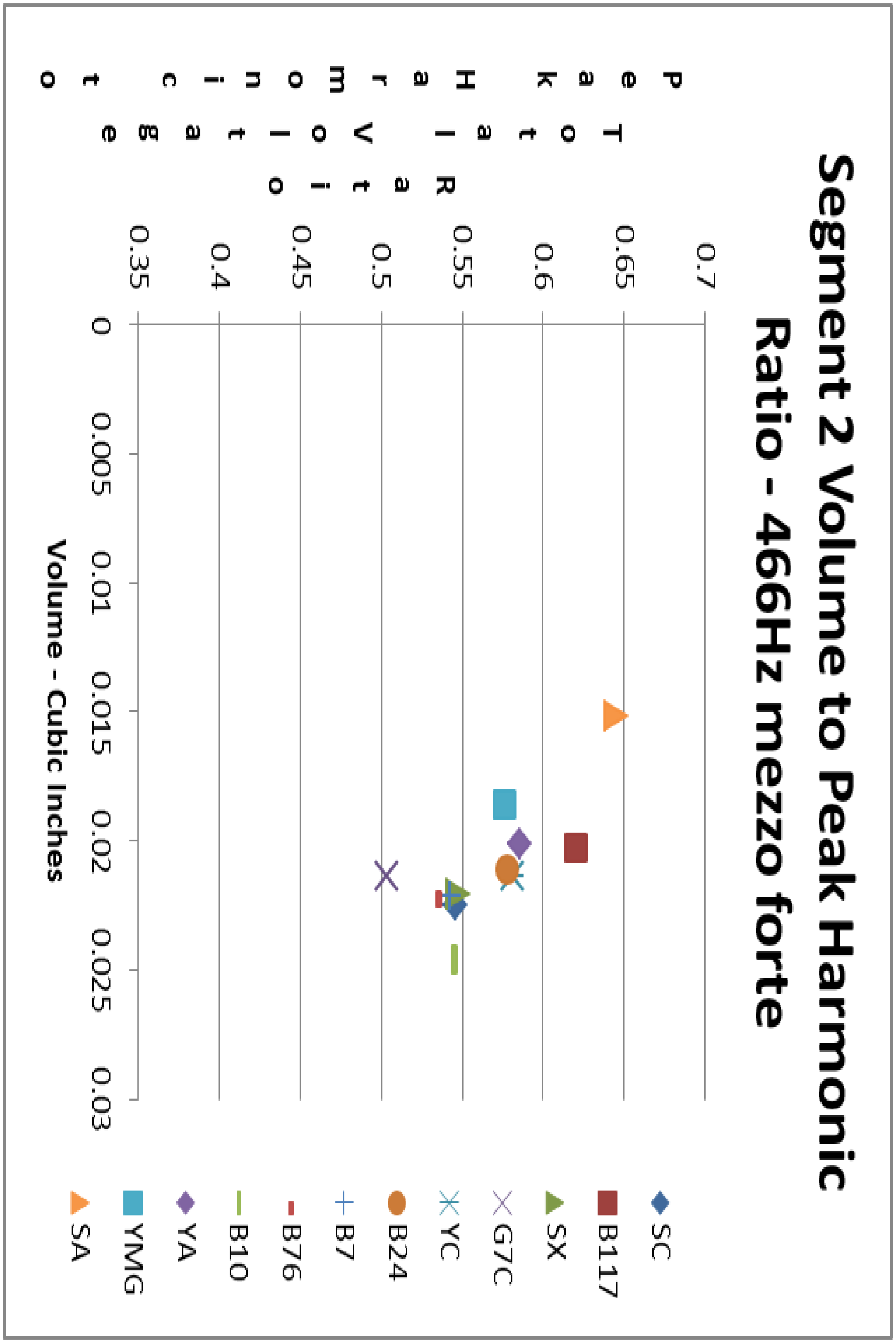

Figure 80
Segment two volume to peak harmonic ratio – 466Hz *mezzo forte*.
Strong correlation (r = -0.7361).

Figure 80 indicates a strong correlation. On the 466 Hertz frequency at *mezzo forte*, when the interior volume of segment two increases, the timbre becomes brighter. The graph visually supports the correlation calculation well. The plots nearly line up in a descending diagonal line.

Figure 81
Segment two volume to peak harmonic ratio – 466Hz *forte*.
Minimal correlation (r = 0.1140).

Figure 81 displays scattered plots, supporting the calculated minimal correlation. While it is beyond this research, it is interesting that there is a strong correlation on the 466 Hertz frequency at *mezzo forte*, yet not at *forte*.

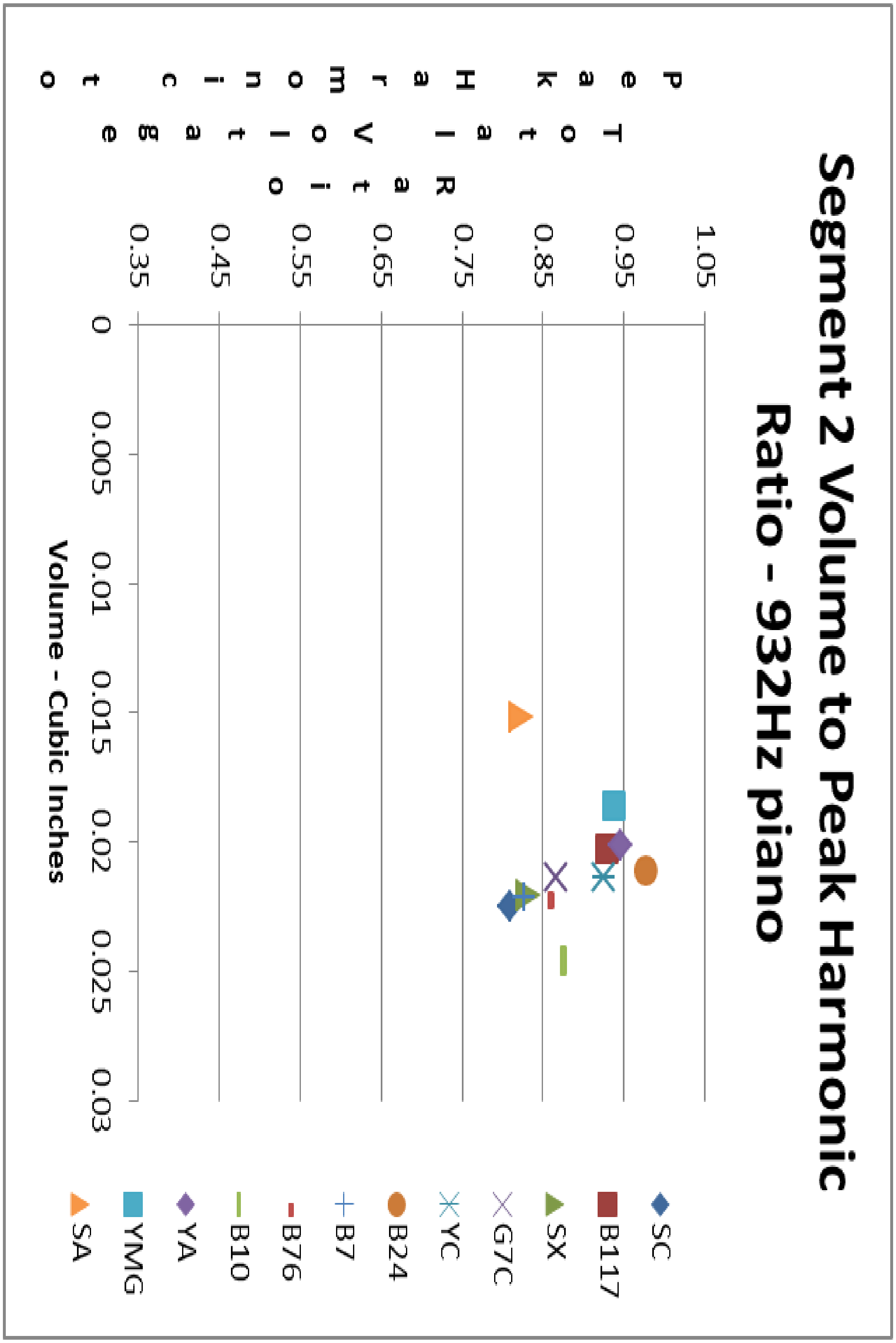

Figure 82
Segment two volume to peak harmonic ratio – 932Hz *piano*.
Minimal correlation (r = -0.0865).

Figure 82 supports the calculated minimal correlation. Visually, of the SA backbore was removed there would be a correlation. Excluding the SA backbore, if the interior volume increases the peak harmonic ratio decreases, the timbre becomes brighter.

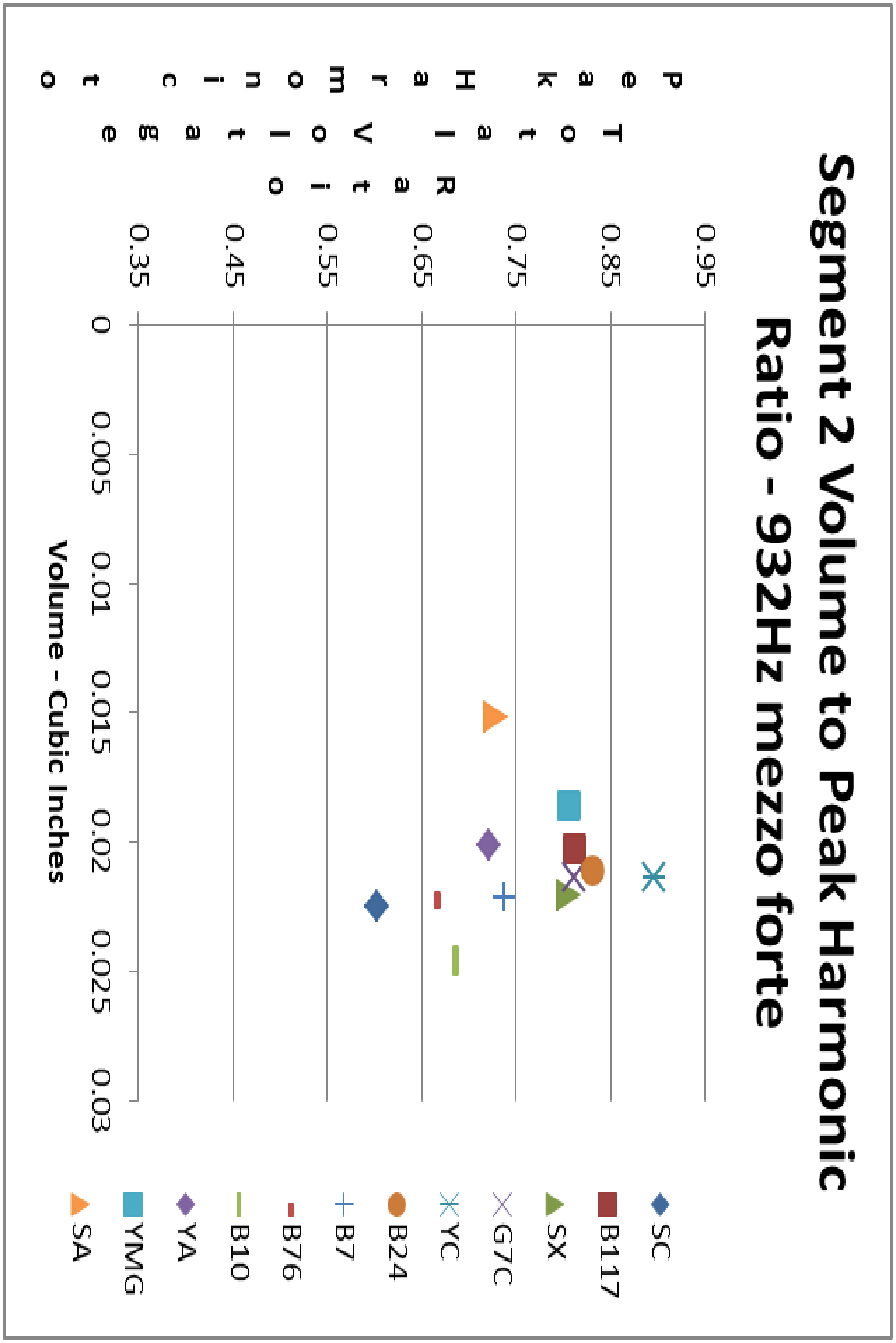

Figure 83
Segment 3 volume to peak harmonic ratio – 932Hz *mezzo forte*.
Minimal correlation (r = -0.2006).

Figure 83 contains a scattered group of plots, indicating minimal correlation. If the SA backbore was removed there could be a moderate correlation.

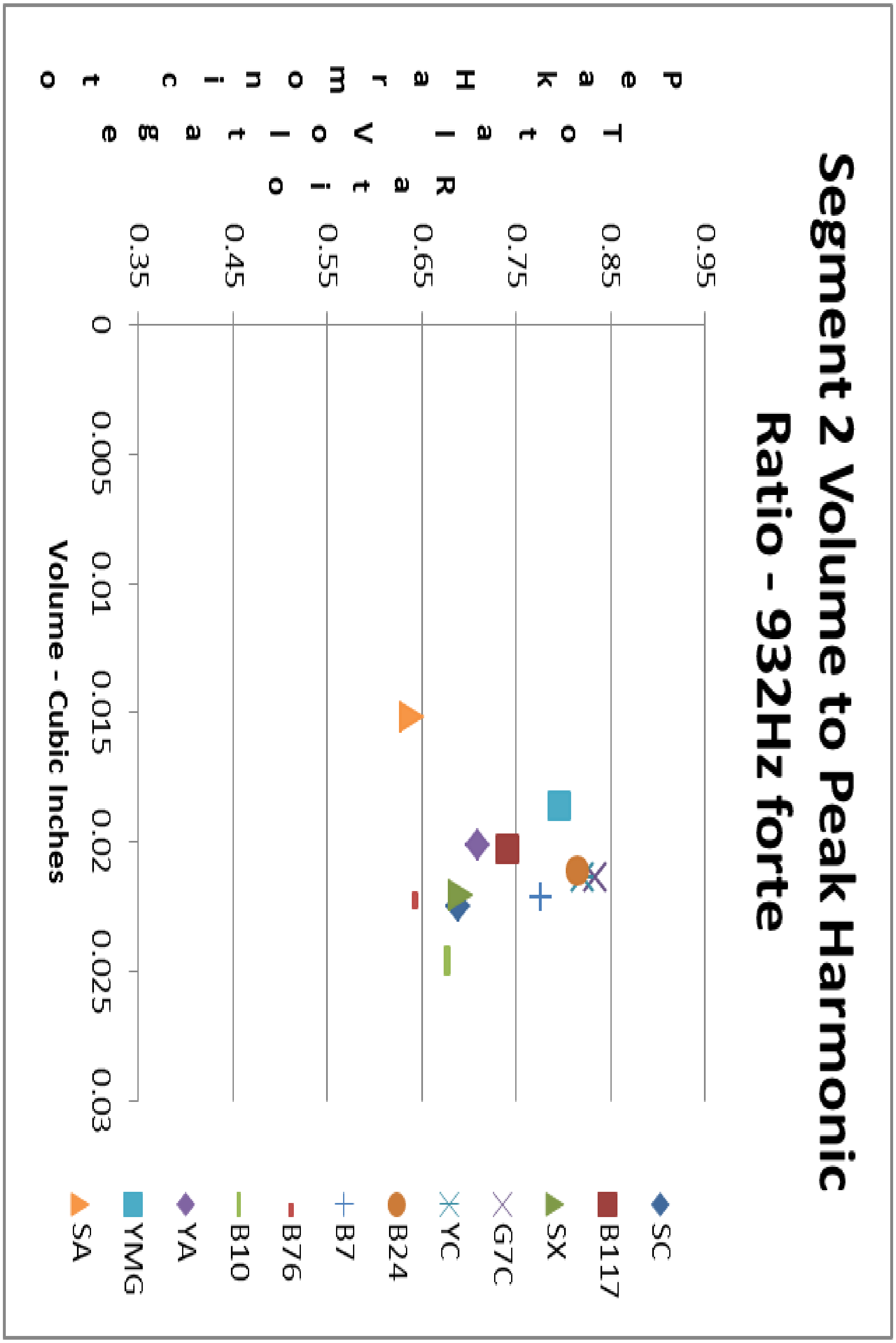

Figure 84
Segment two volume to peak harmonic ratio – 932Hz *forte*.
Minimal correlation (r = 0.0720).

Figure 84 indicates minimal correlation. However, if the SA backbore was removed, there would be a strong correlation. The SA backbore seems to have a unique behavior. It is beyond the scope of this research, but presents an opportunity to research why its shape is producing such unique results.

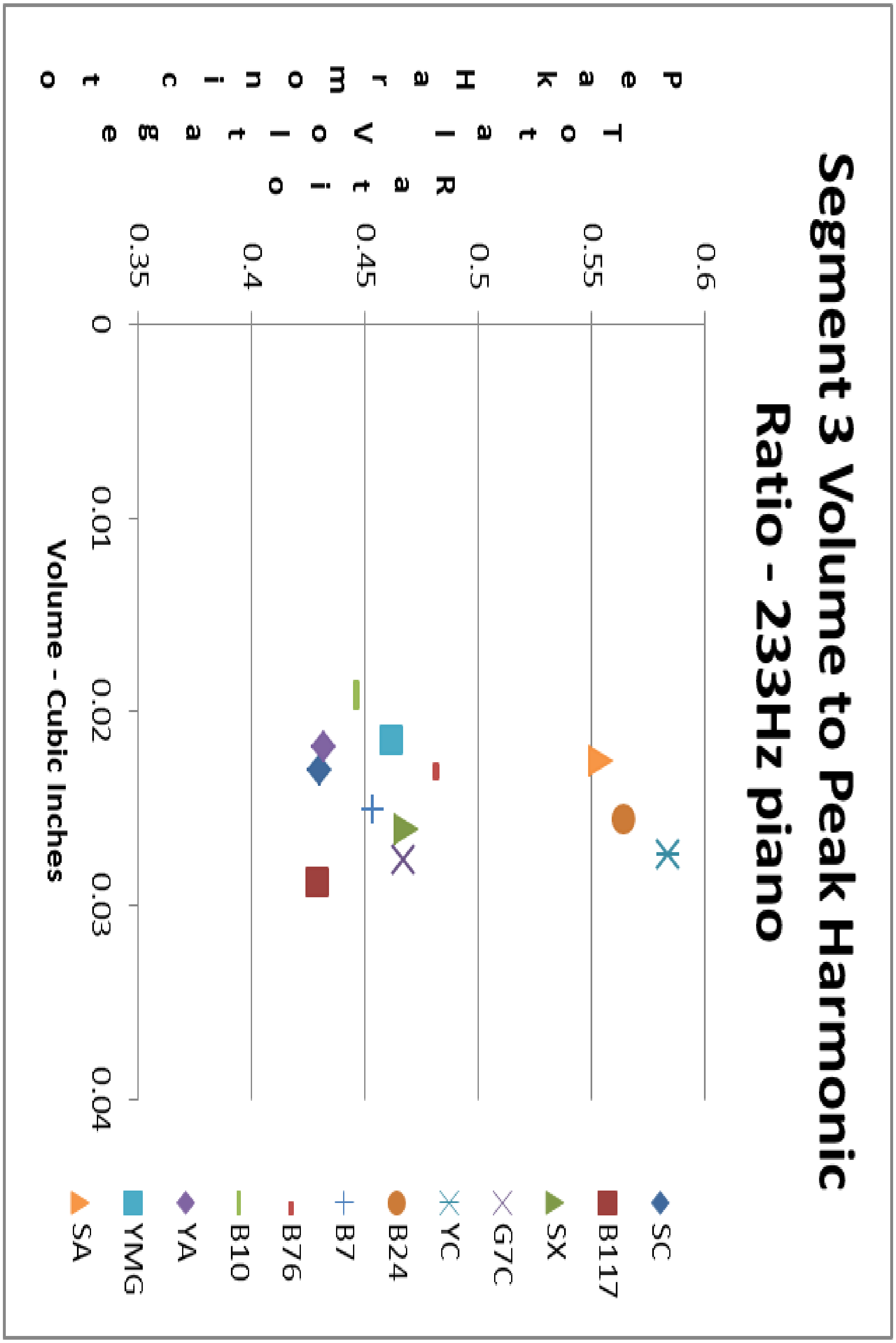

Figure 85
Segment three volume to peak harmonic ratio – 233Hz *piano*.
Minimal correlation (r = 0.2245).

Figure 85 is a good example of a minimal correlation. The plots are scattered, and the SA backbore is closer to the grouping of the other backbores.

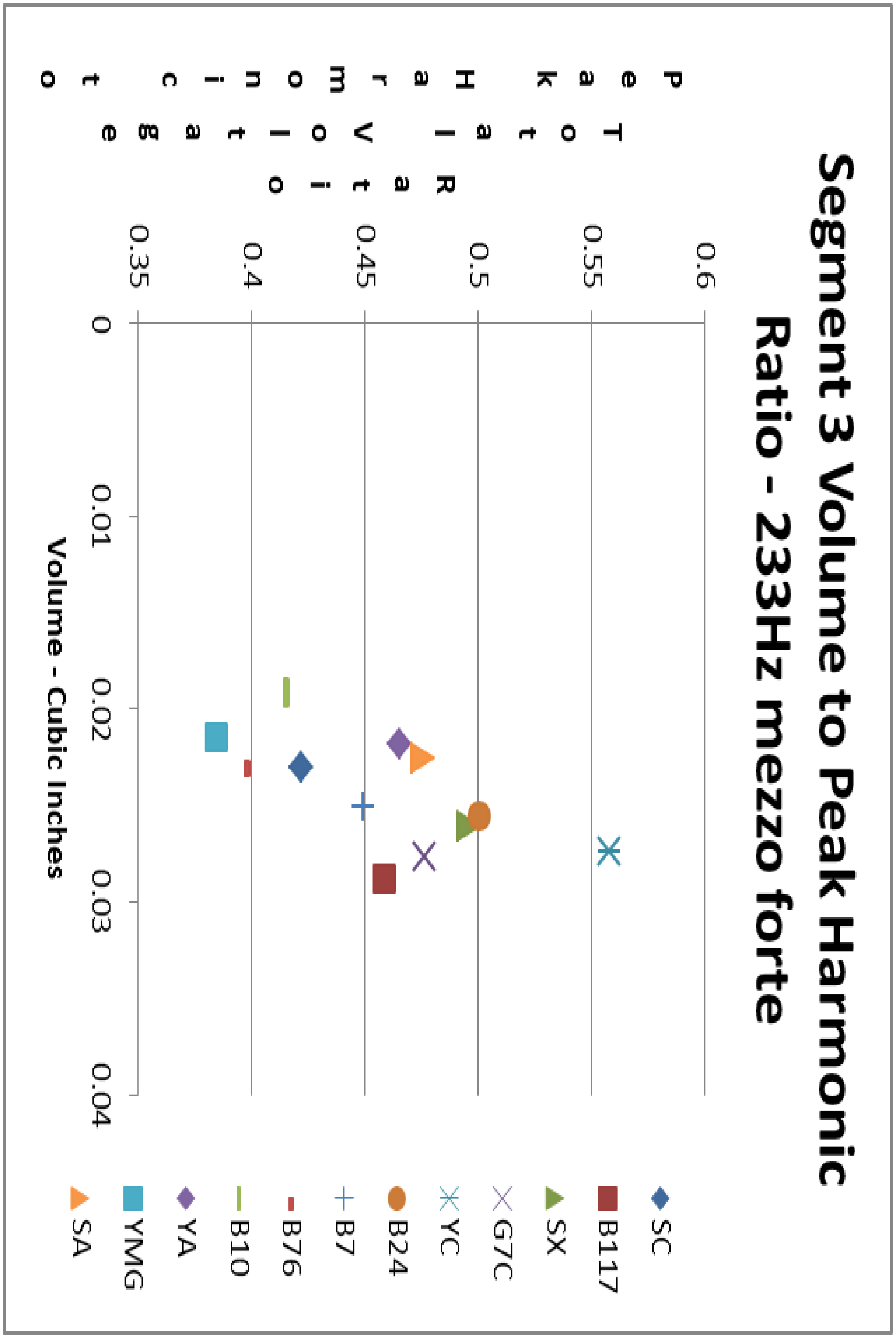

Figure 86
Segment three volume to peak harmonic ratio – 233Hz *mezzo forte*.
Strong correlation (r = 0.6457).

Figure 86 indicates a strong correlation. On the 233 Hertz frequency at *mezzo forte*, when the interior volume of segment three increases, the timbre becomes darker. The graph supports the correlation calculation well.

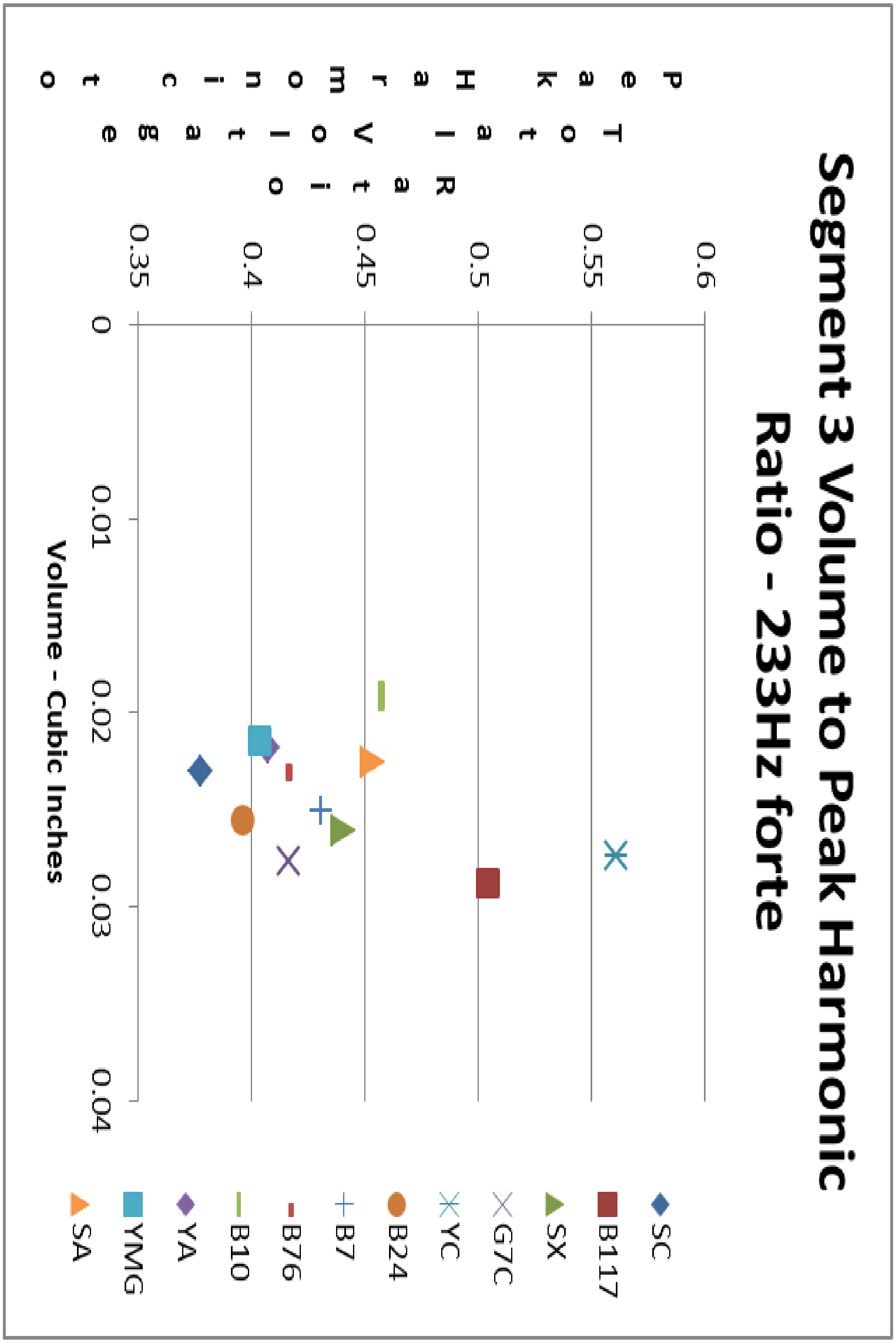

Figure 87
Segment three volume to peak harmonic ratio – 233Hz *forte*.
Moderate correlation (r = 0.4311).

Figure 87 indicates a moderate correlation. On the 233 Hertz frequency at *forte*, when the interior volume of segment three increases, the timbre becomes darker. Figure 86 and 87 indicate that segment three of the trumpet mouthpiece backbore has a major influence on the timbre of the trumpet in the low register. When the volume or taper of this section is bigger, the timbre is darker.

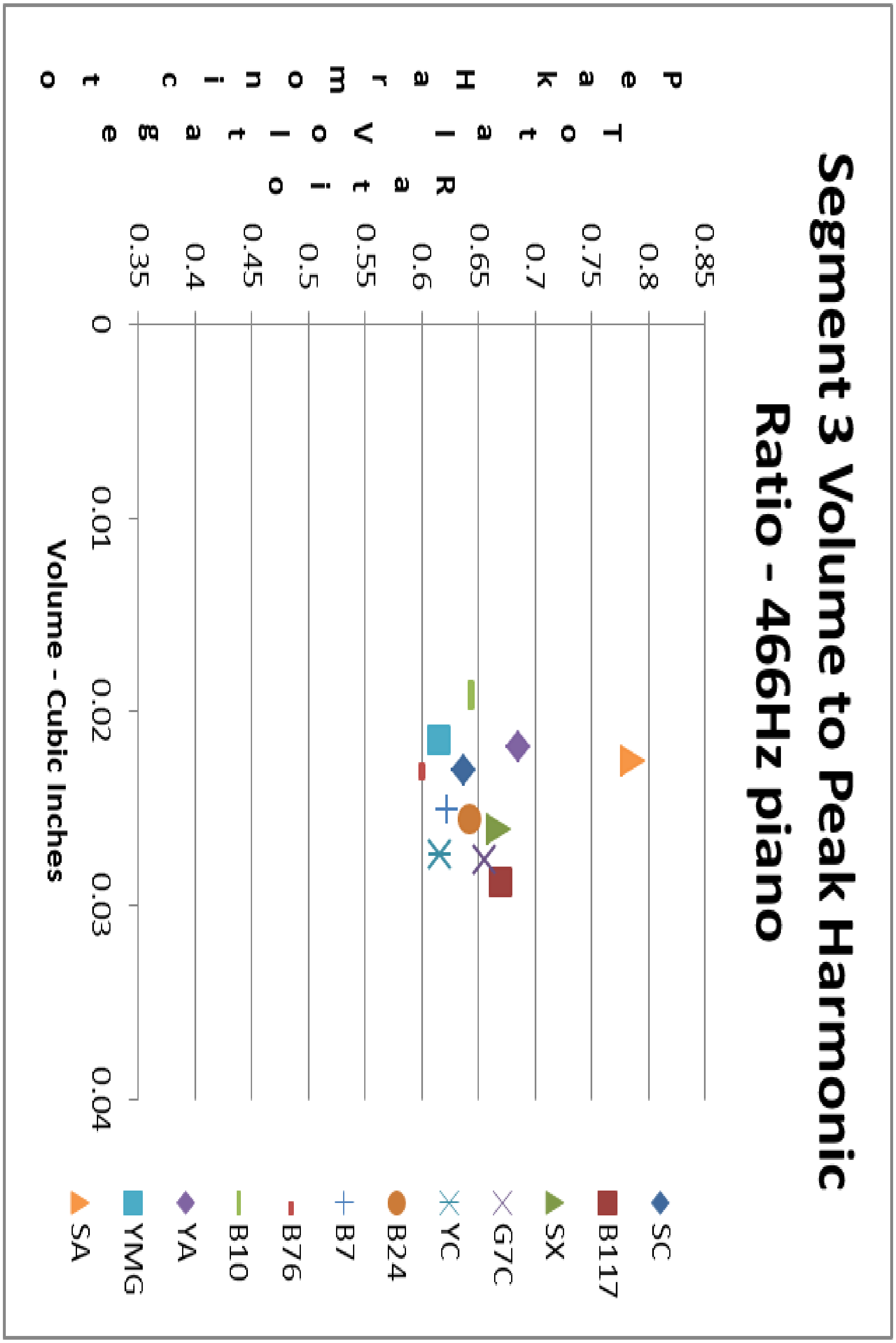

Figure 88
Segment three volume to peak harmonic ratio – 466Hz *piano*.
Minimal correlation (r = -0.0630).

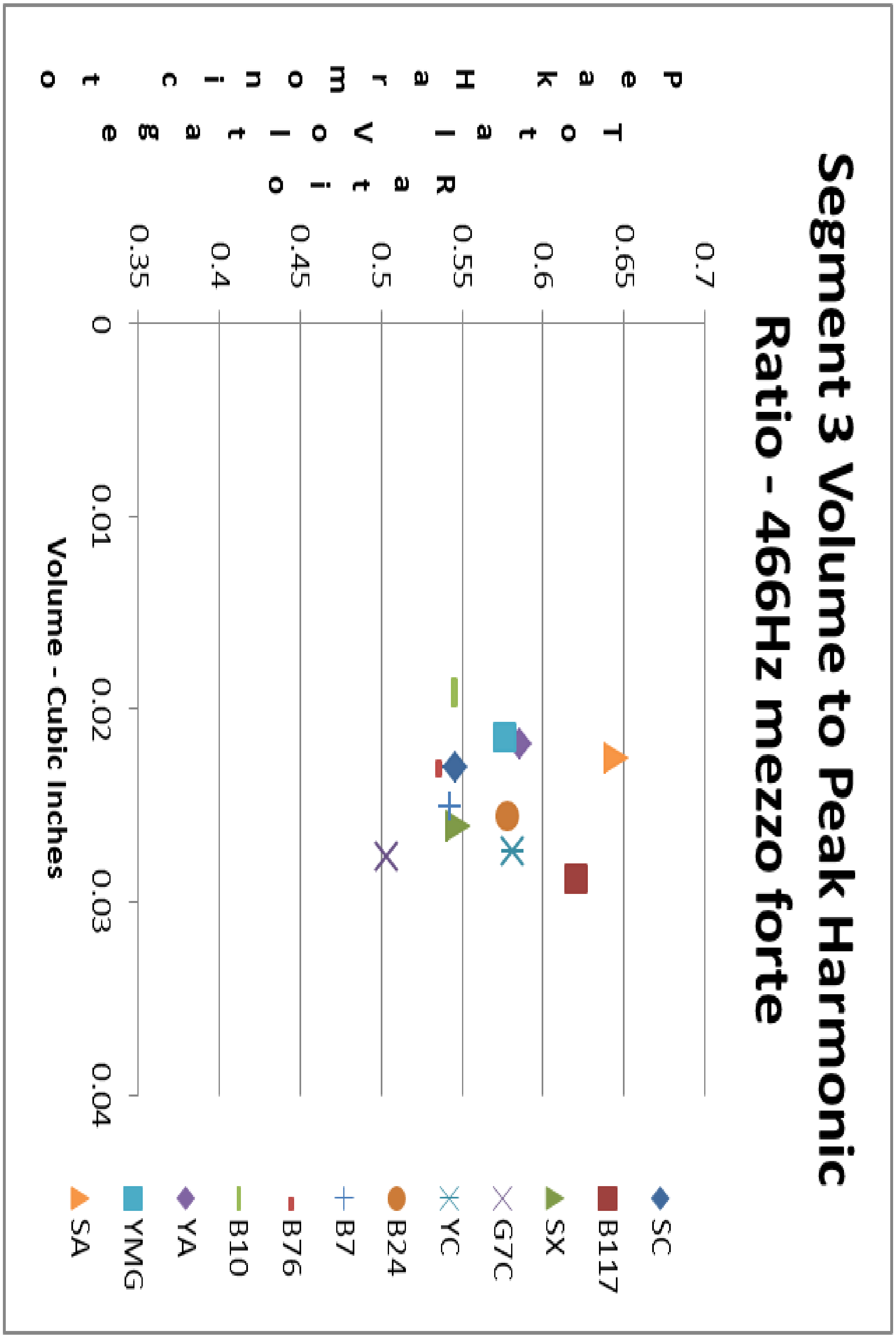

Figure 89
Segment three volume to peak harmonic ratio – 466Hz *mezzo forte*.
Minimal correlation (r = 0.0077).

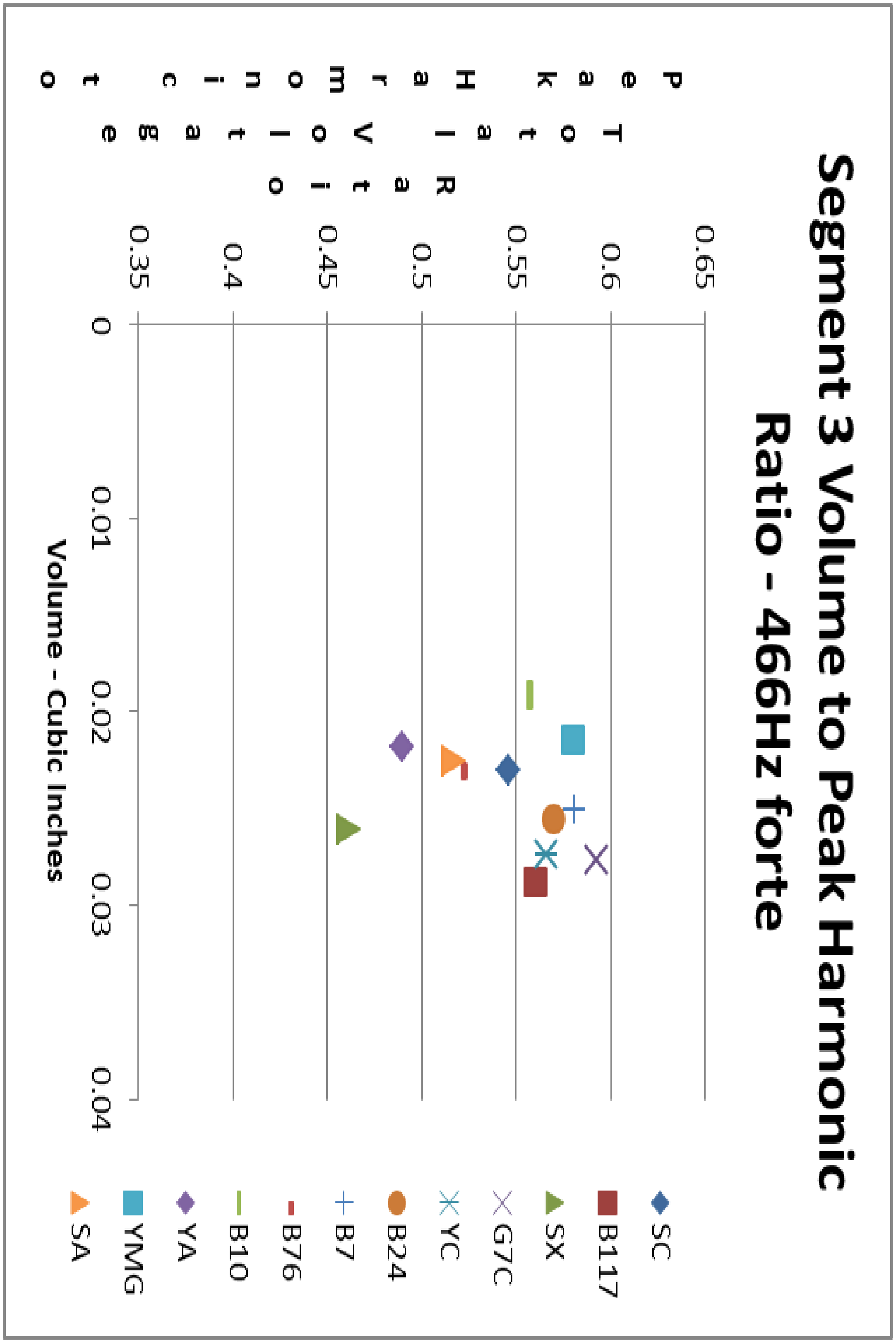

Figure 90
Segment three volume to peak harmonic ratio – 466Hz *forte*.
Minimal correlation (r = 0.1944).

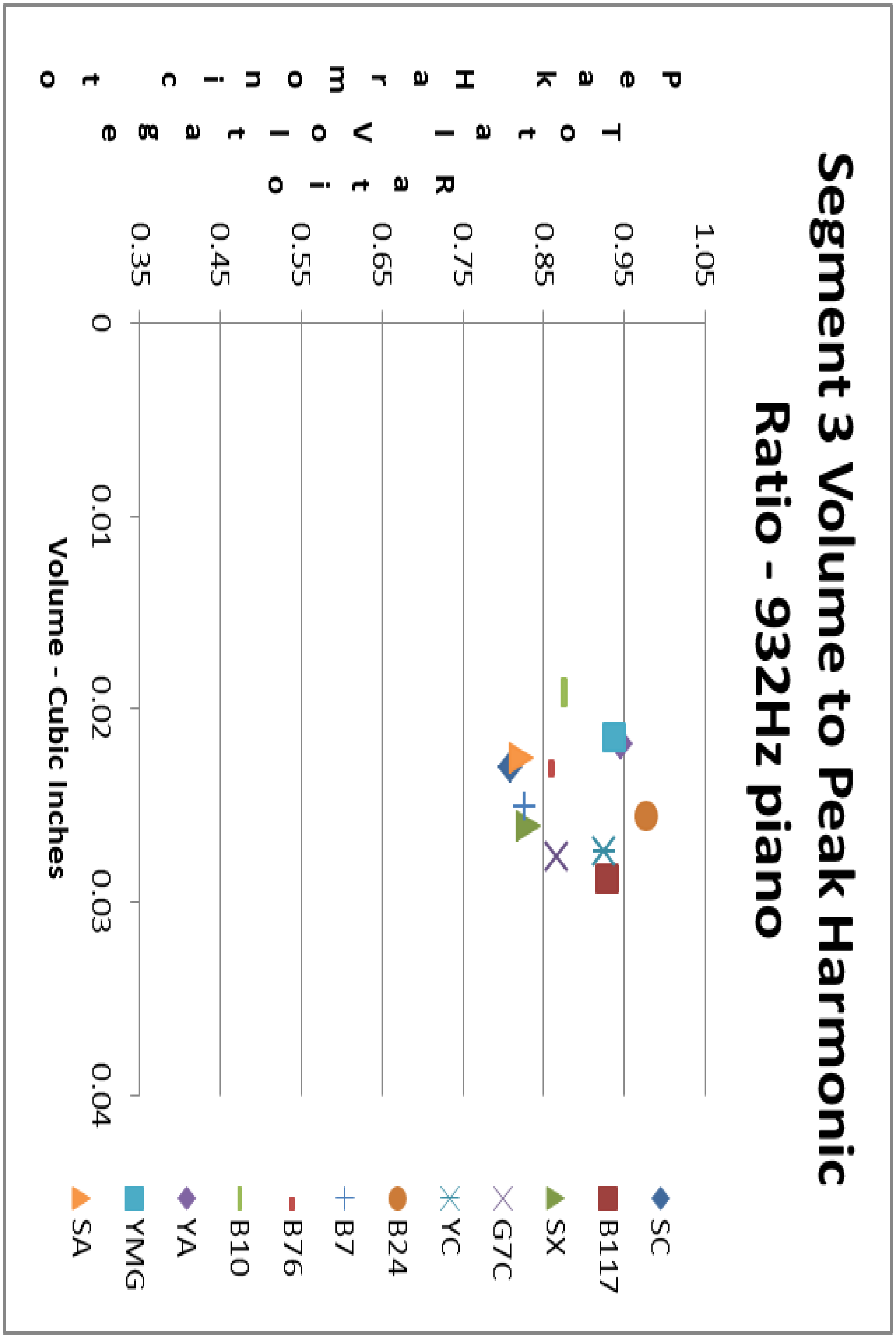

Figure 91
Segment three volume to peak harmonic ratio – 932Hz *piano*.
Minimal correlation (r = 0.1176).

Figures 88 through 91 contain scattered groups of plots supporting the minimal calculated correlation well.

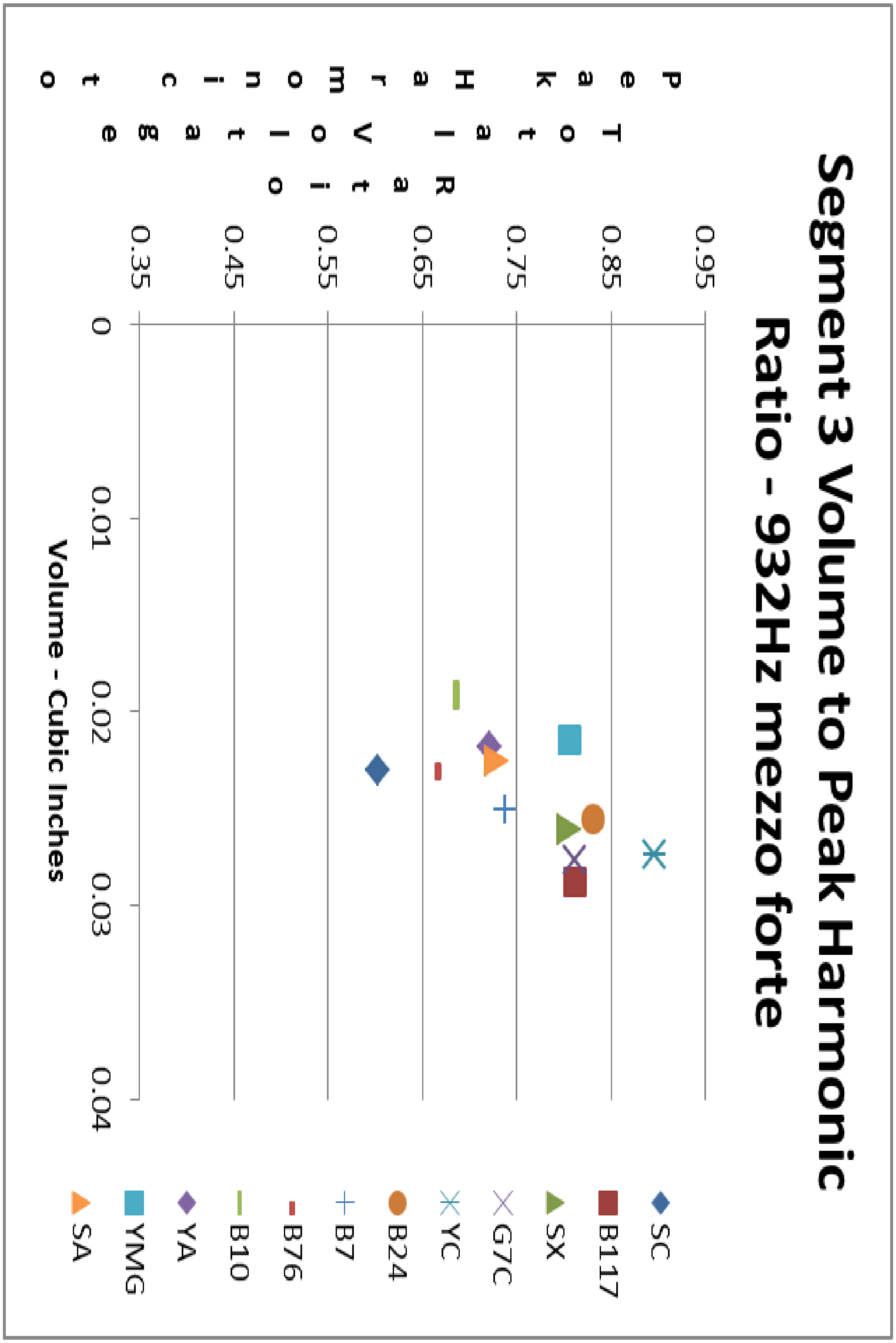

Figure 92
Segment three volume to peak harmonic ratio – 932Hz *mezzo forte*.
Strong correlation (r = 0.6481).

Figure 92 indicates a strong correlation. On the 932 Hertz frequency at *mezzo forte*, when the interior volume of segment three increases, the timbre becomes darker. The graph supports the correlation calculation well. Figure 86, 87, and 92 indicate that segment three influences timbre the most in the low and high register of the trumpet.

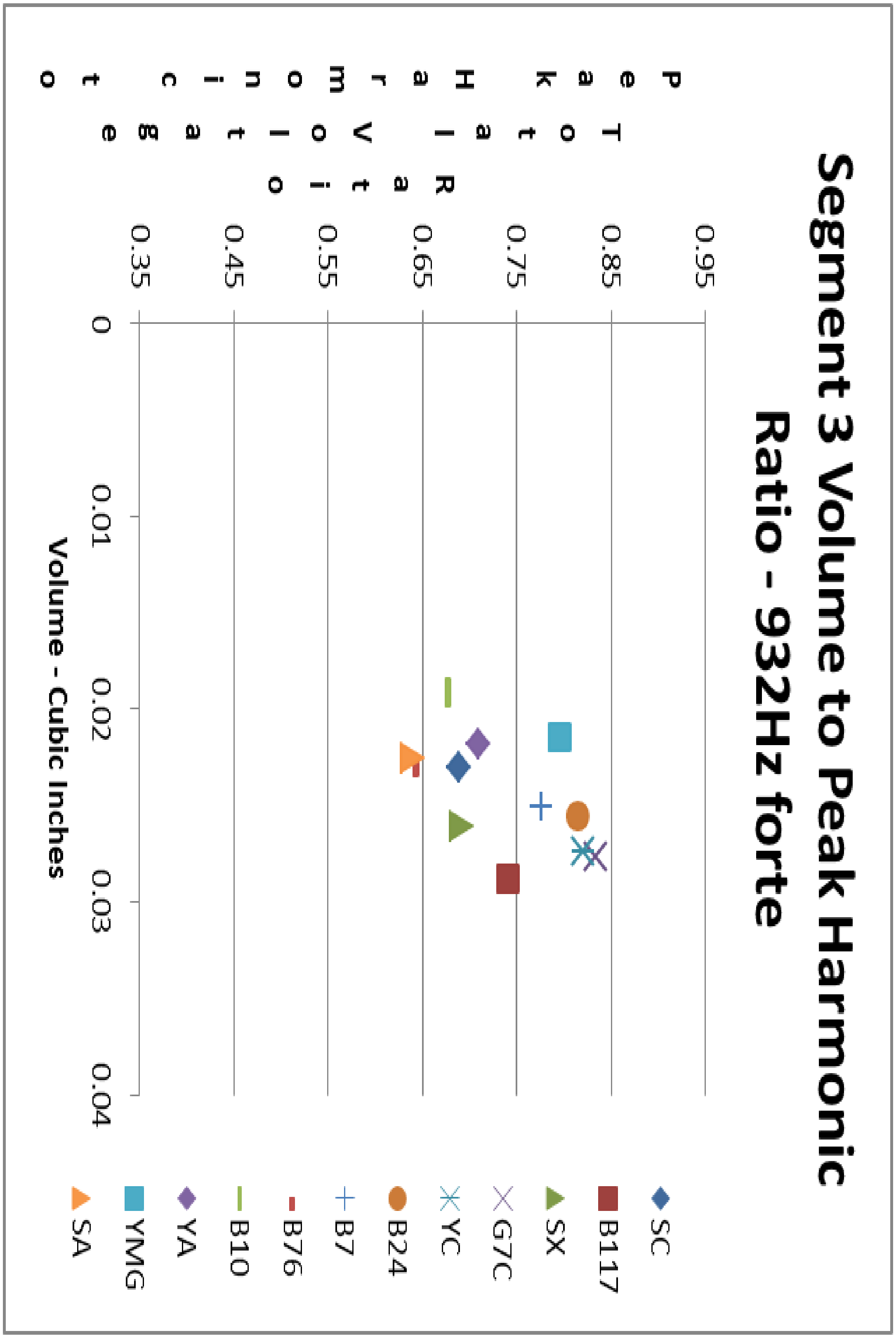

Figure 93
Segment three volume to peak harmonic ratio – 932Hz *forte*.
Moderate correlation (r = 0.5452).

Figure 93 indicates a moderate correlation. On the 932 Hertz frequency at *forte,* when the interior volume of segment three increases, the timbre becomes darker. The graph supports the correlation calculation as well.

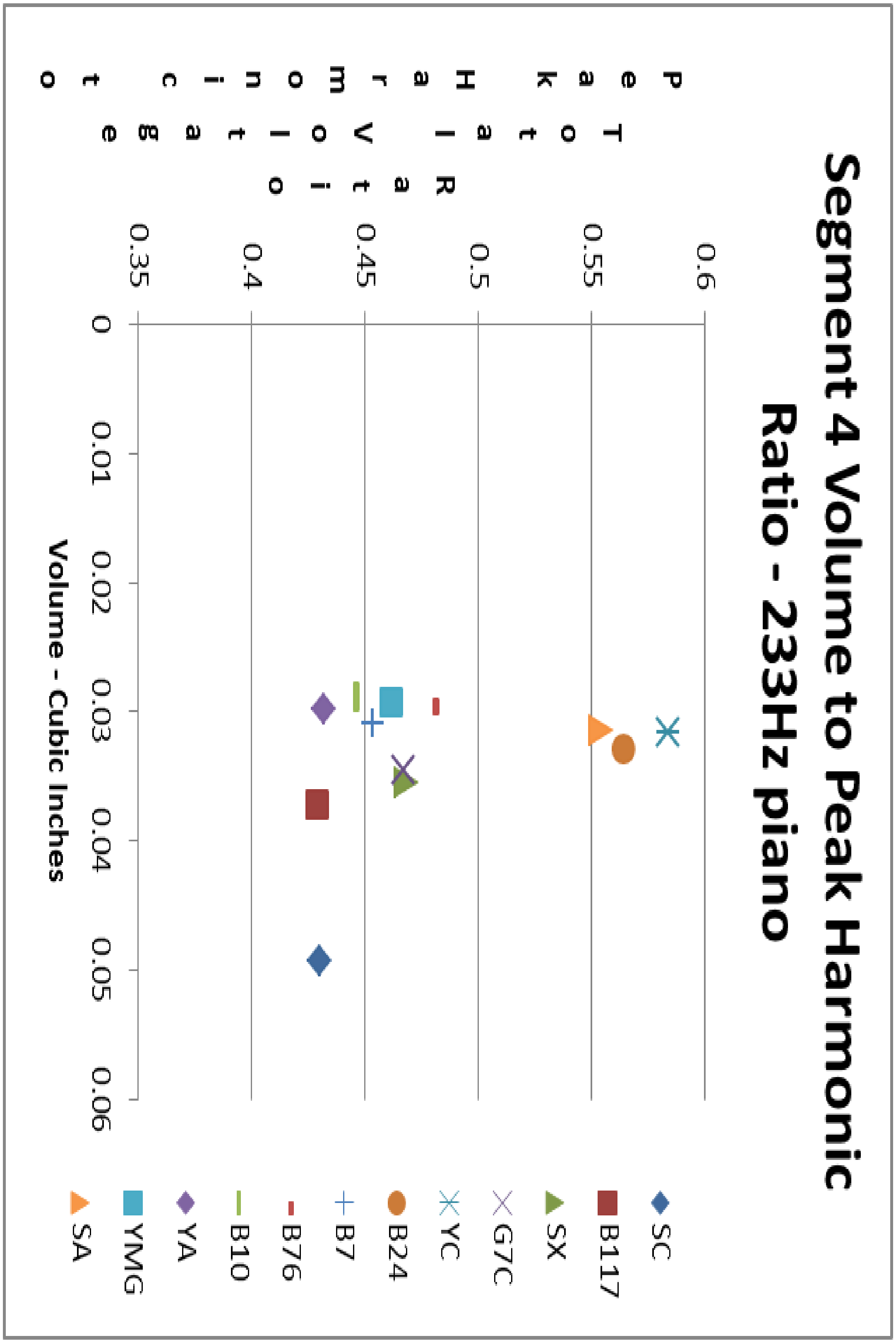

Figure 94
Segment four volume to peak harmonic ratio – 233Hz *piano*.
Minimal correlation (r = -0.2756).

Figure 94 contains a scattered group of plots supporting the minimal calculated correlation well. It is interesting that this graph perhaps has the largest spread of the plots.

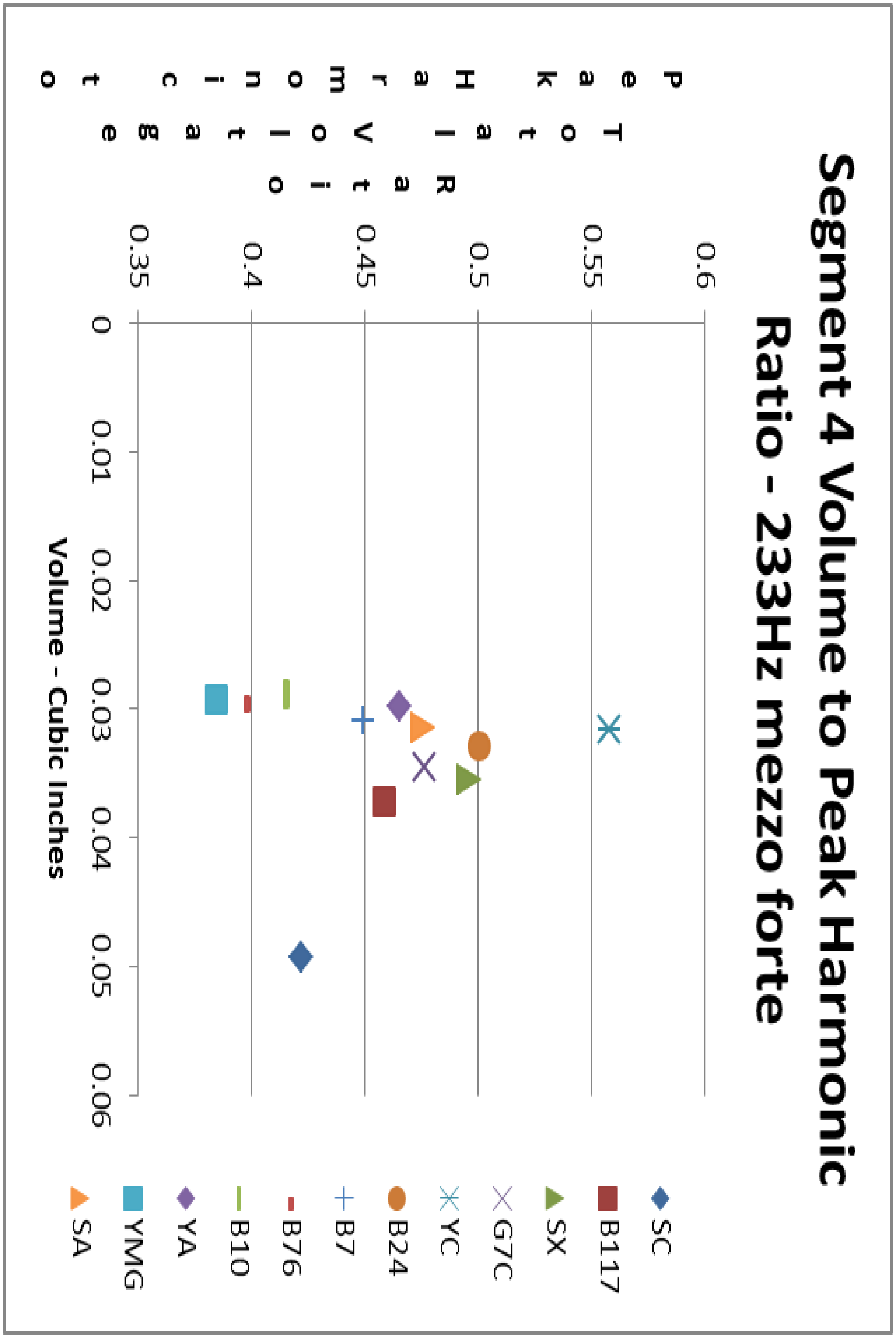

Figure 95
Segment four volume to peak harmonic ratio – 233Hz *mezzo forte*.
Minimal correlation (r = 0.0132).

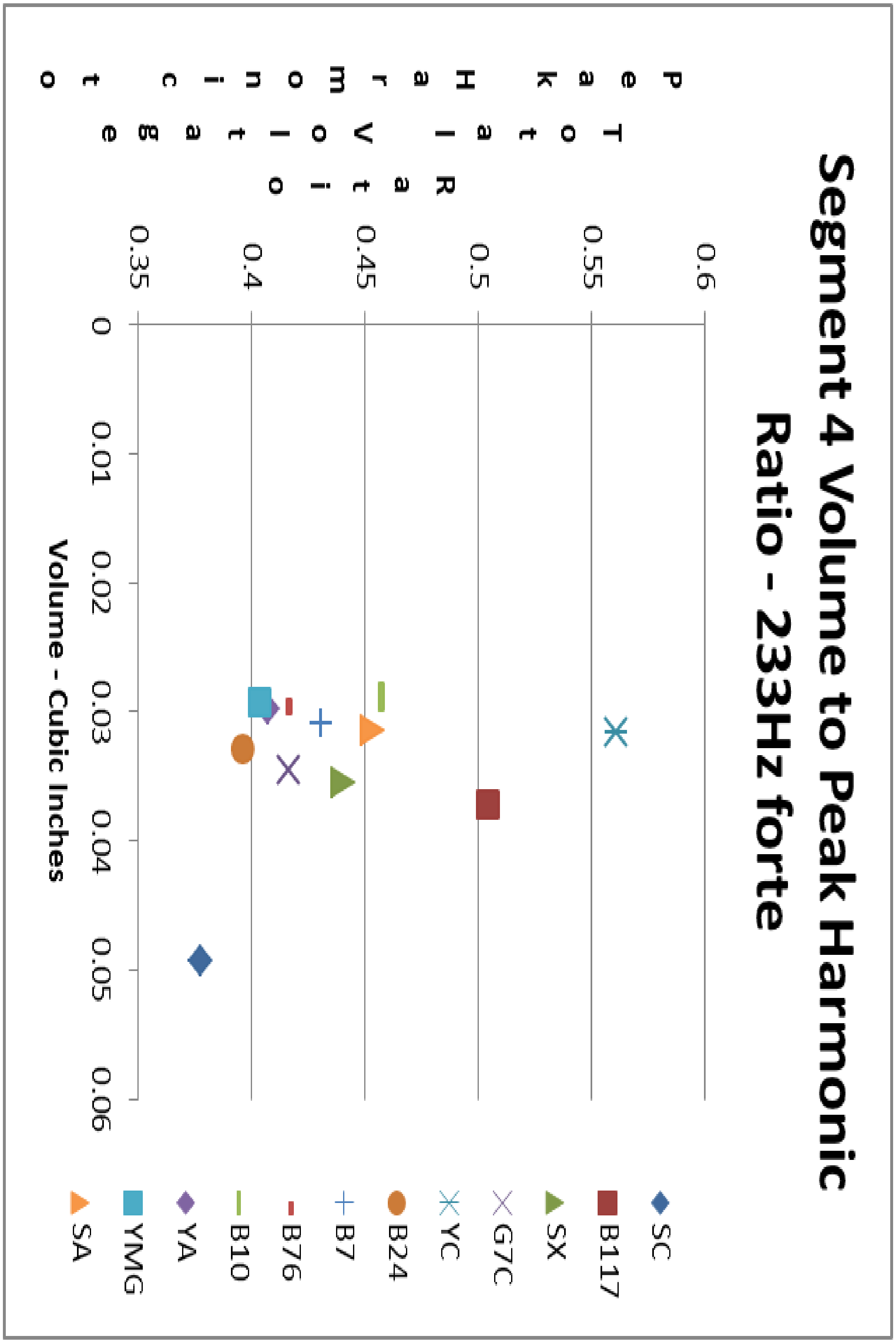

Figure 96
Segment four volume to peak harmonic ratio – 233Hz *forte*.
Minimal correlation (r = -0.2177).

Figures 95 and 96 contain scattered groups of plots supporting the minimal calculated correlation well.

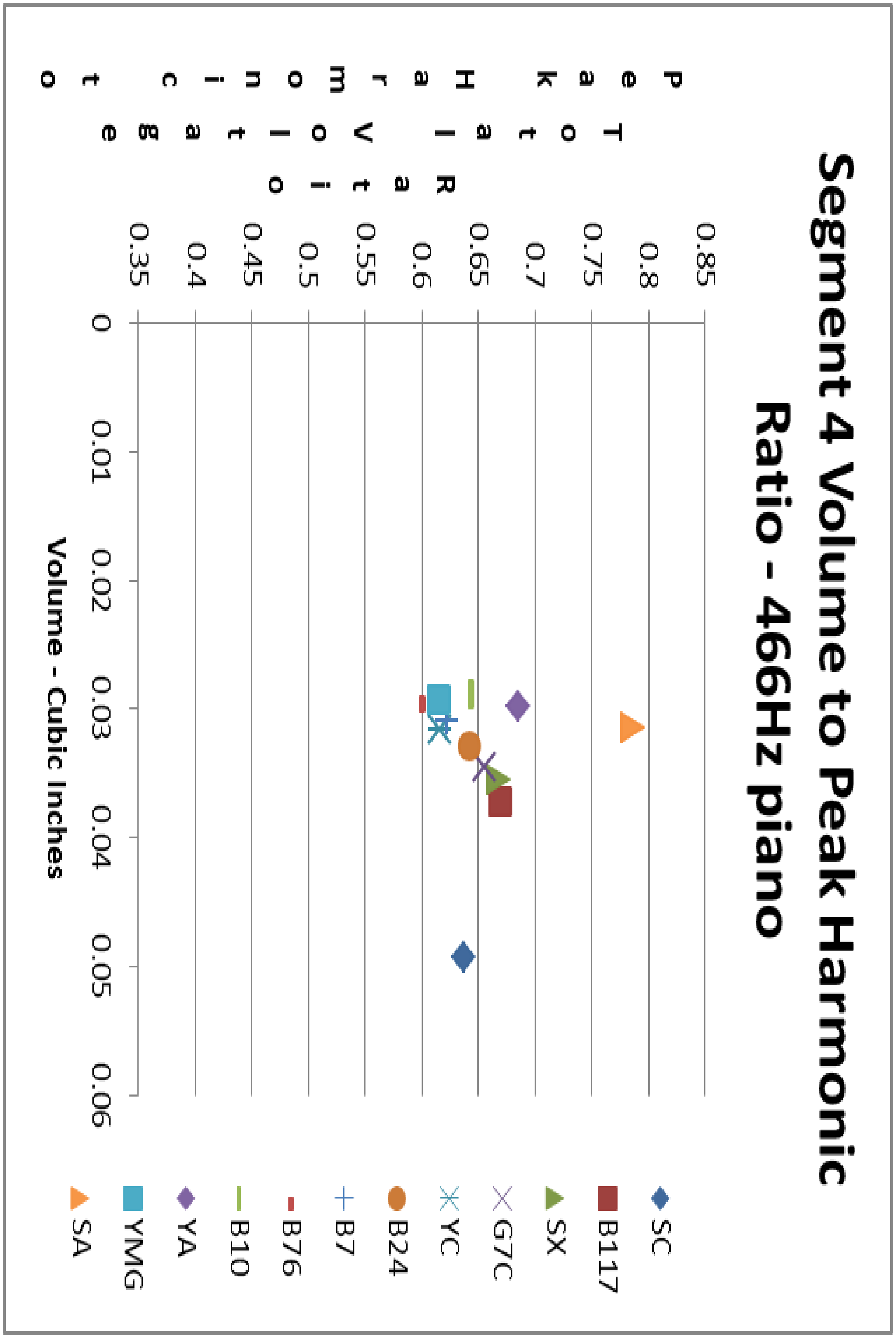

Figure 97
Segment four volume to peak harmonic ratio – 466Hz *piano*.
Minimal correlation (r = 0.0184).

Figure 97 contains a scattered group of plots supporting the minimal calculated correlation well. The SC backbore has the largest volume in segment four, yet the harmonic ratio is comparable to the other backbores. This indicates that segment four is not a major factor in the timbre of the trumpet.

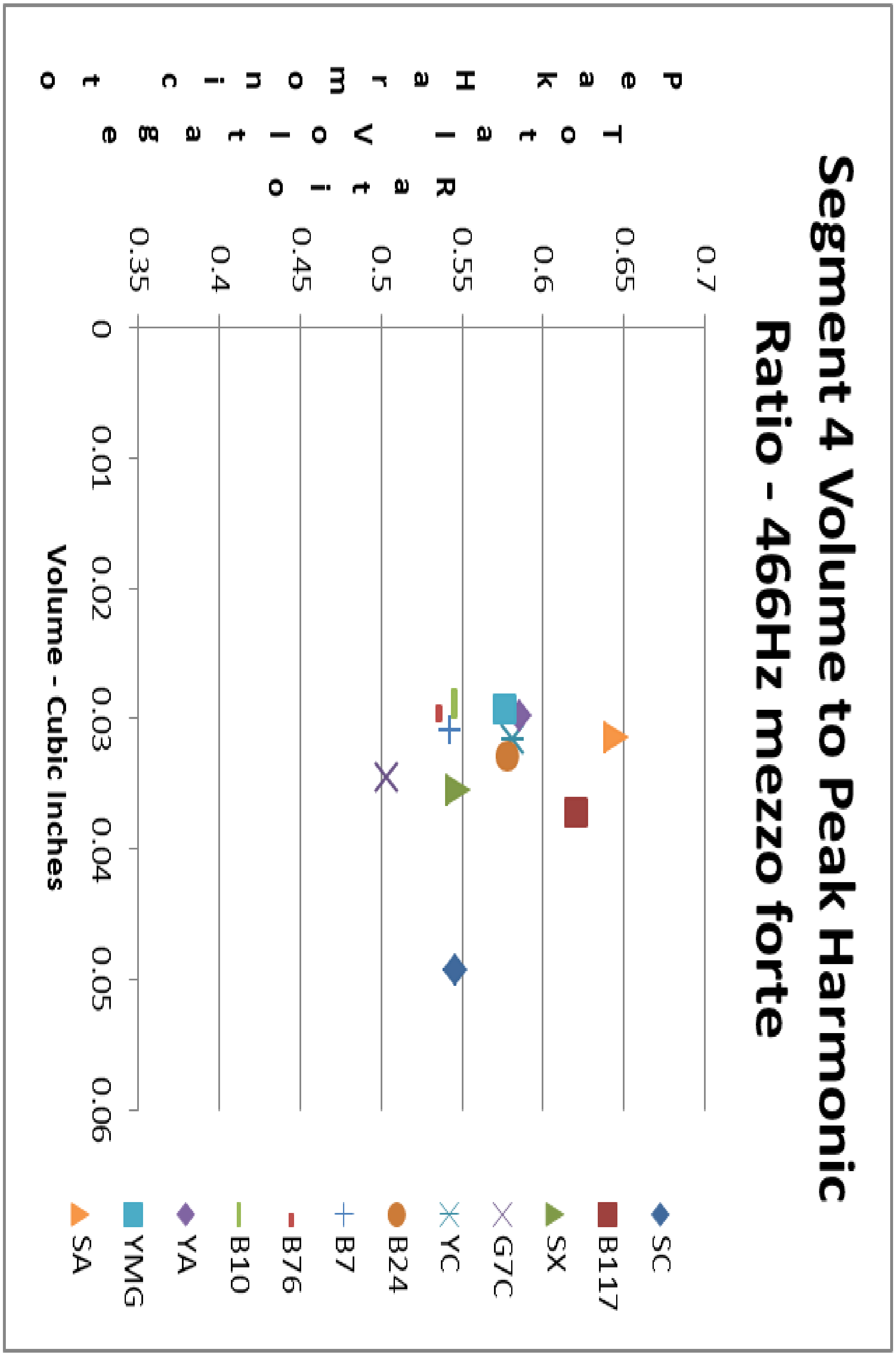

Figure 98
Segment four volume to peak harmonic ratio – 466Hz *mezzo forte*.
Minimal correlation (r = -0.0987).

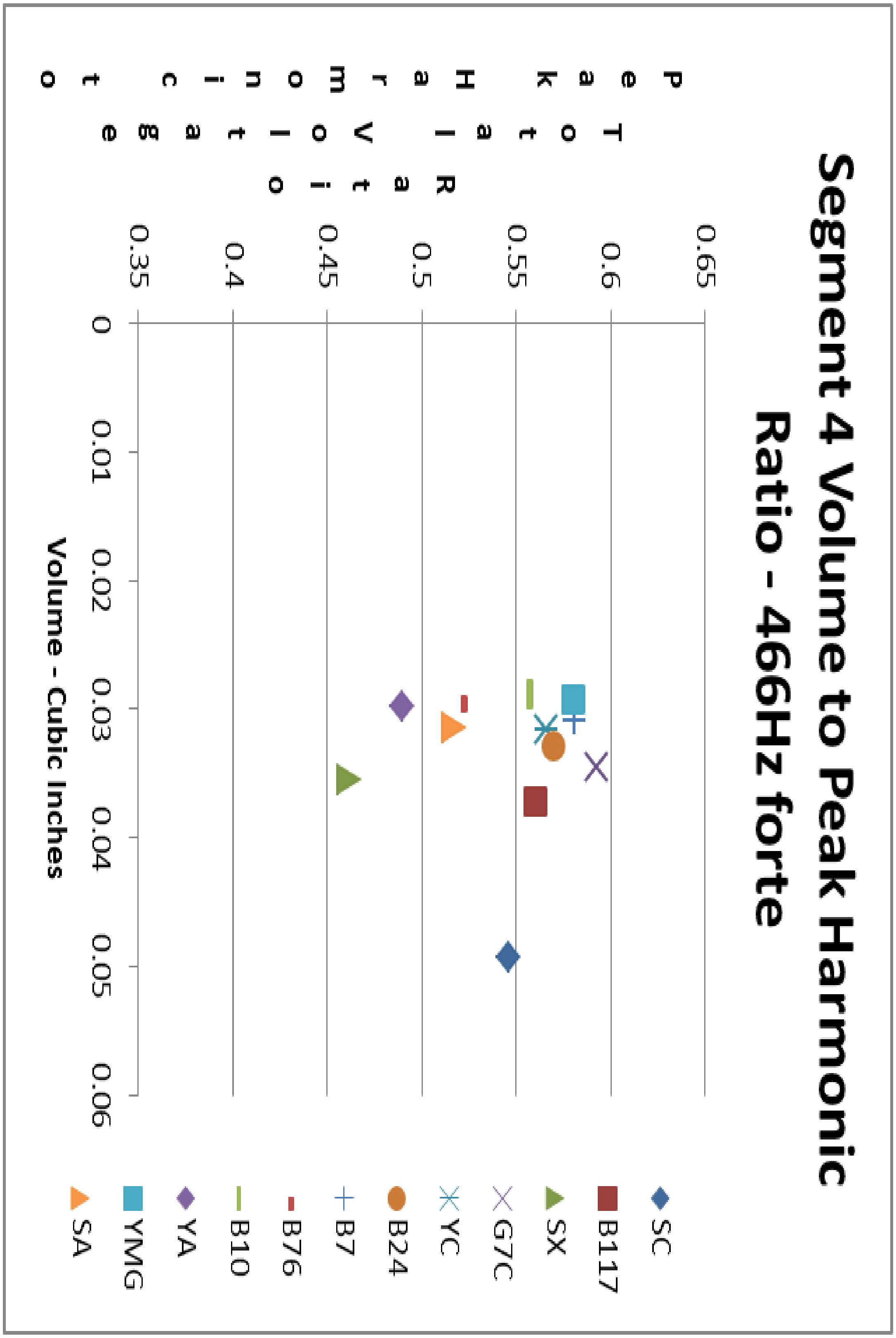

Figure 99
Segment four volume to peak harmonic ratio – 466Hz *forte*.
Minimal correlation (r = -0.0167).

Figures 98 and 99 contain scattered groups of plots supporting the minimal calculated correlation well.

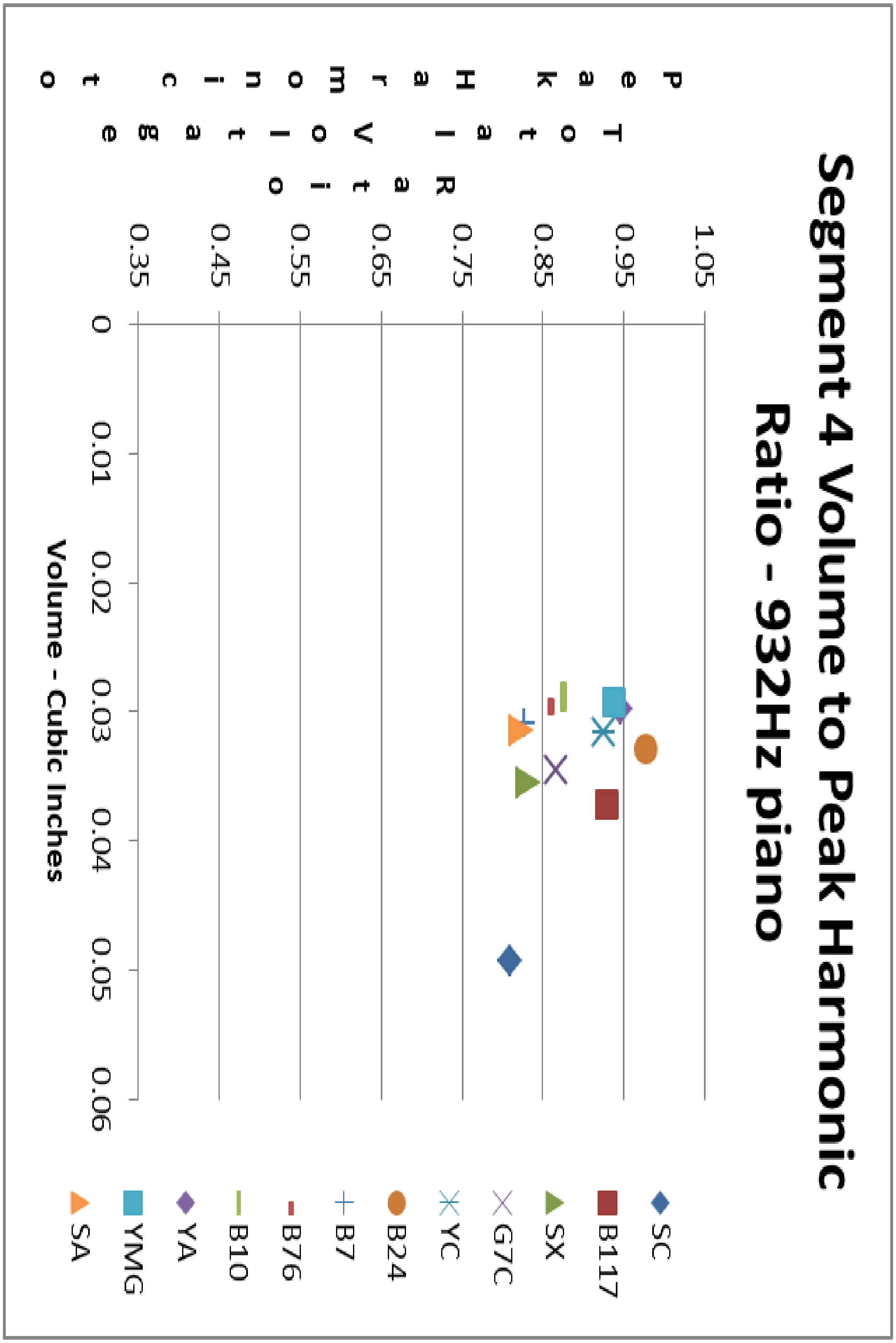

Figure 100
Segment four volume to peak harmonic ratio – 932Hz *piano*.
Minimal correlation (r = -0.3720).

Figure 100 contains a scattered group of plots supporting the minimal calculated correlation well. It is interesting that the SA backbore is close to the other backbores in the graph, yet the SC backbore is unique and far away from the other backbores. Studying why the smallest interior volume backbore, the SA, is unique in segments one and two and why the largest interior volume backbore, the SC, is unique in segment four could be further researched.

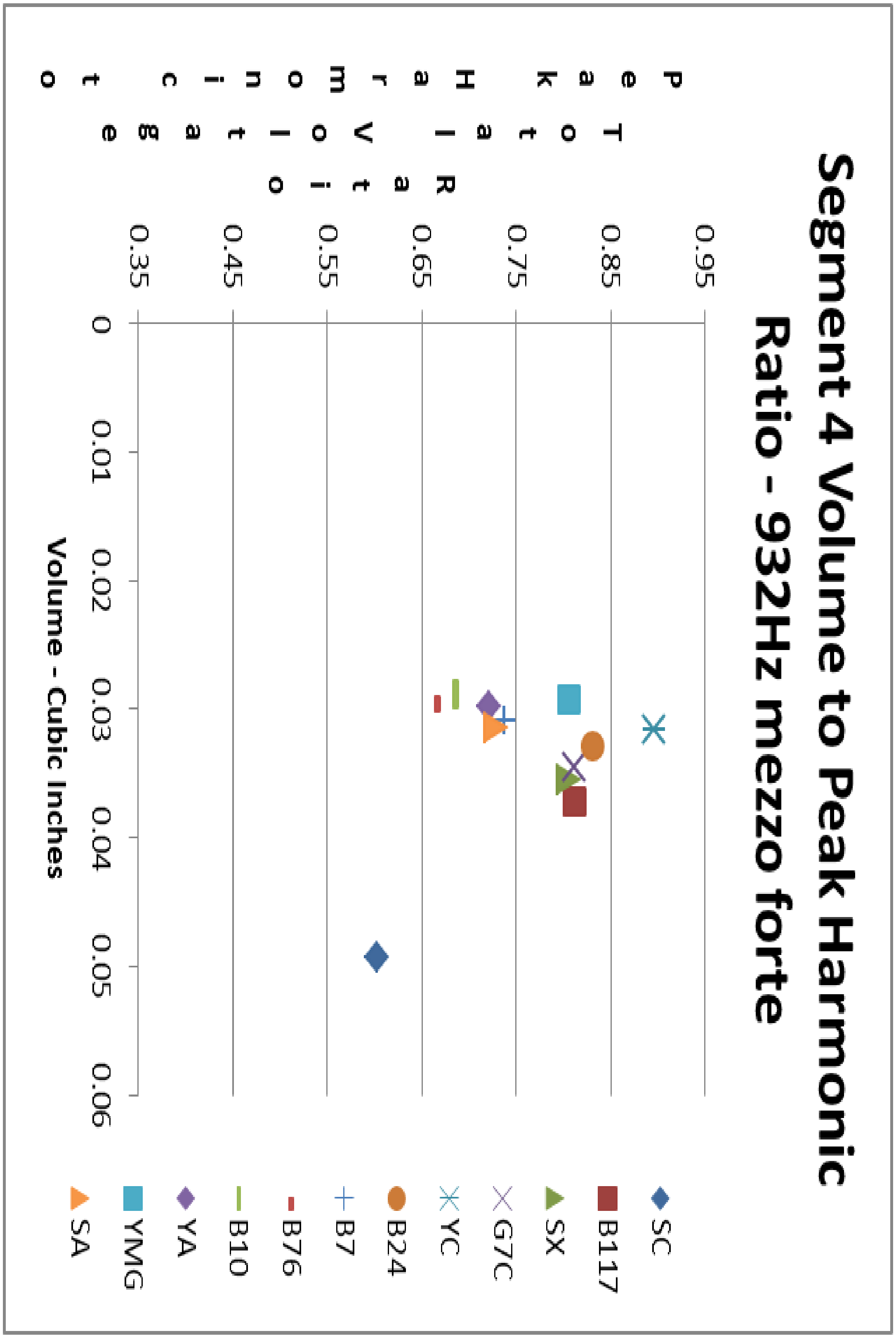

Figure 101
Segment four volume to peak harmonic ratio – 932Hz *mezzo forte*.
Minimal correlation (r = -0.3190).

Figure 101 contains a scattered group of plots supporting the minimal calculated correlation well. Like most of segment four, the SC backbore is unique.

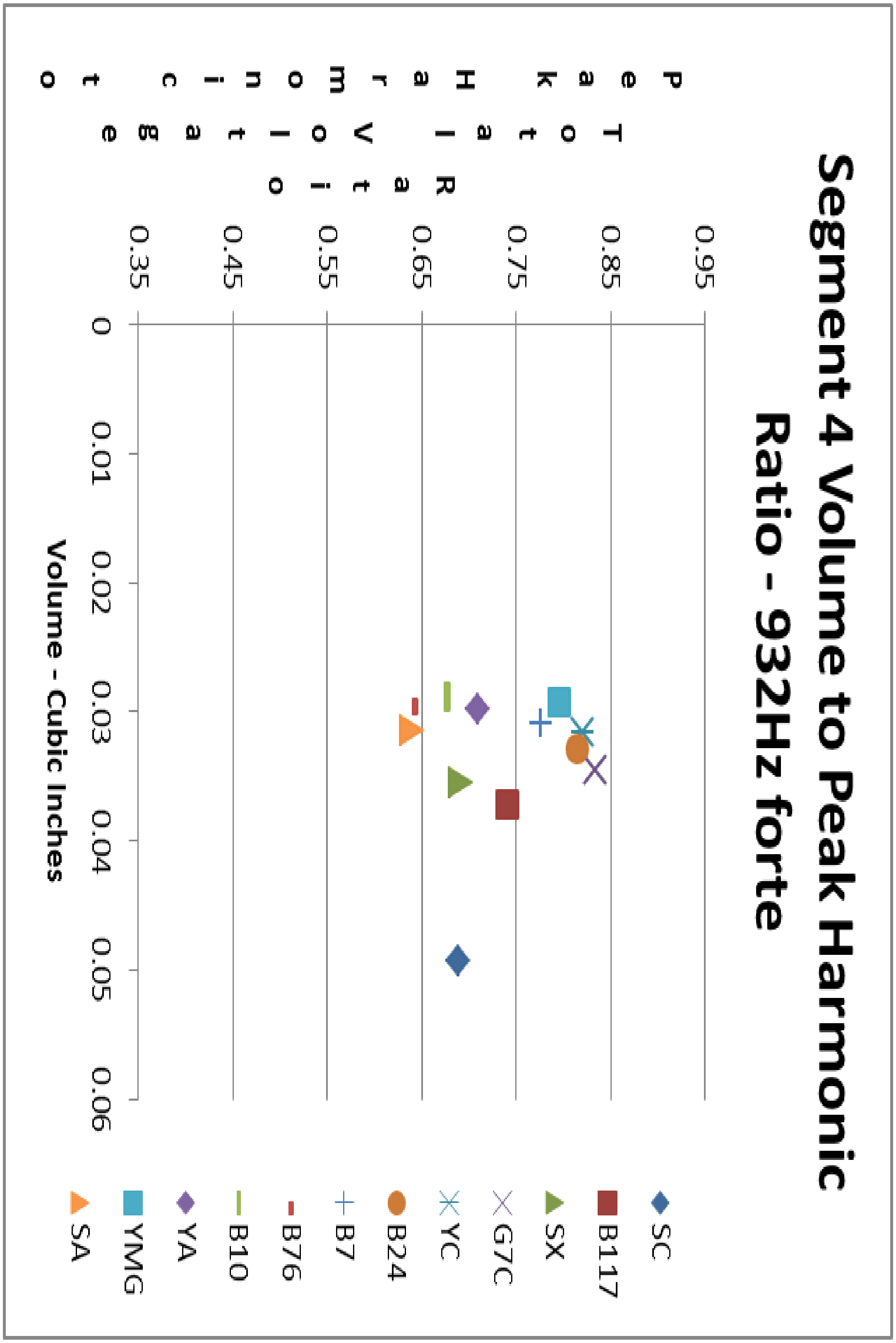

Figure 102
Segment four volume to peak harmonic ratio – 932Hz *forte*.
Minimal correlation (r = -0.0757).

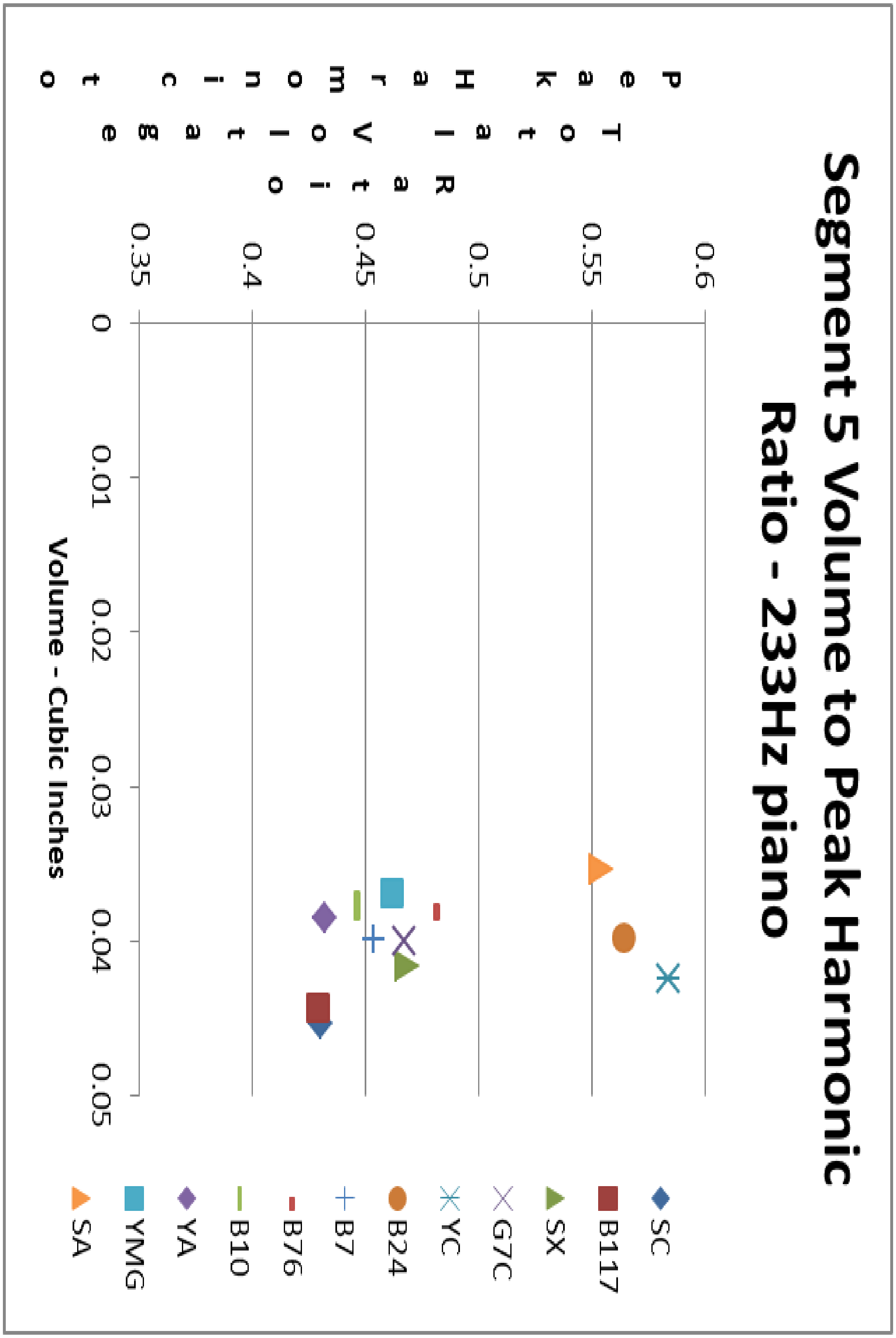

Figure 103
Segment five volume to peak harmonic ratio – 233Hz *piano*.
Minimal correlation (r = -0.2298).

Figures 102 and 103 contain scattered groups of plots supporting the minimal calculated correlation well.

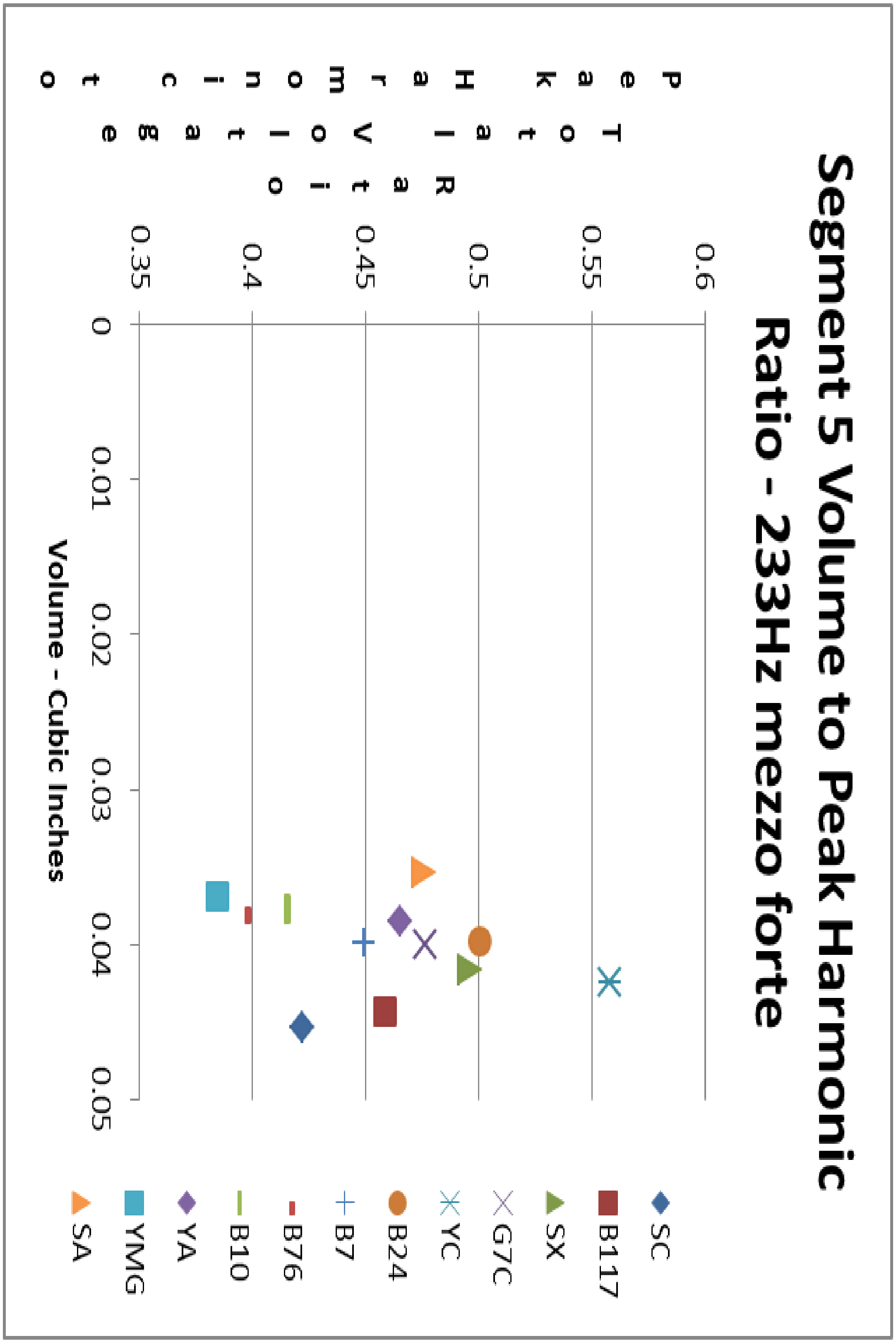

Figure 104
Segment five volume to peak harmonic ratio – 233Hz *mezzo forte*.
Minimal correlation (r = 0.2938).

Figure 104 contains a scattered group of plots supporting the minimal calculated correlation well. Segment five is the segment with the interior volumes being the closest.

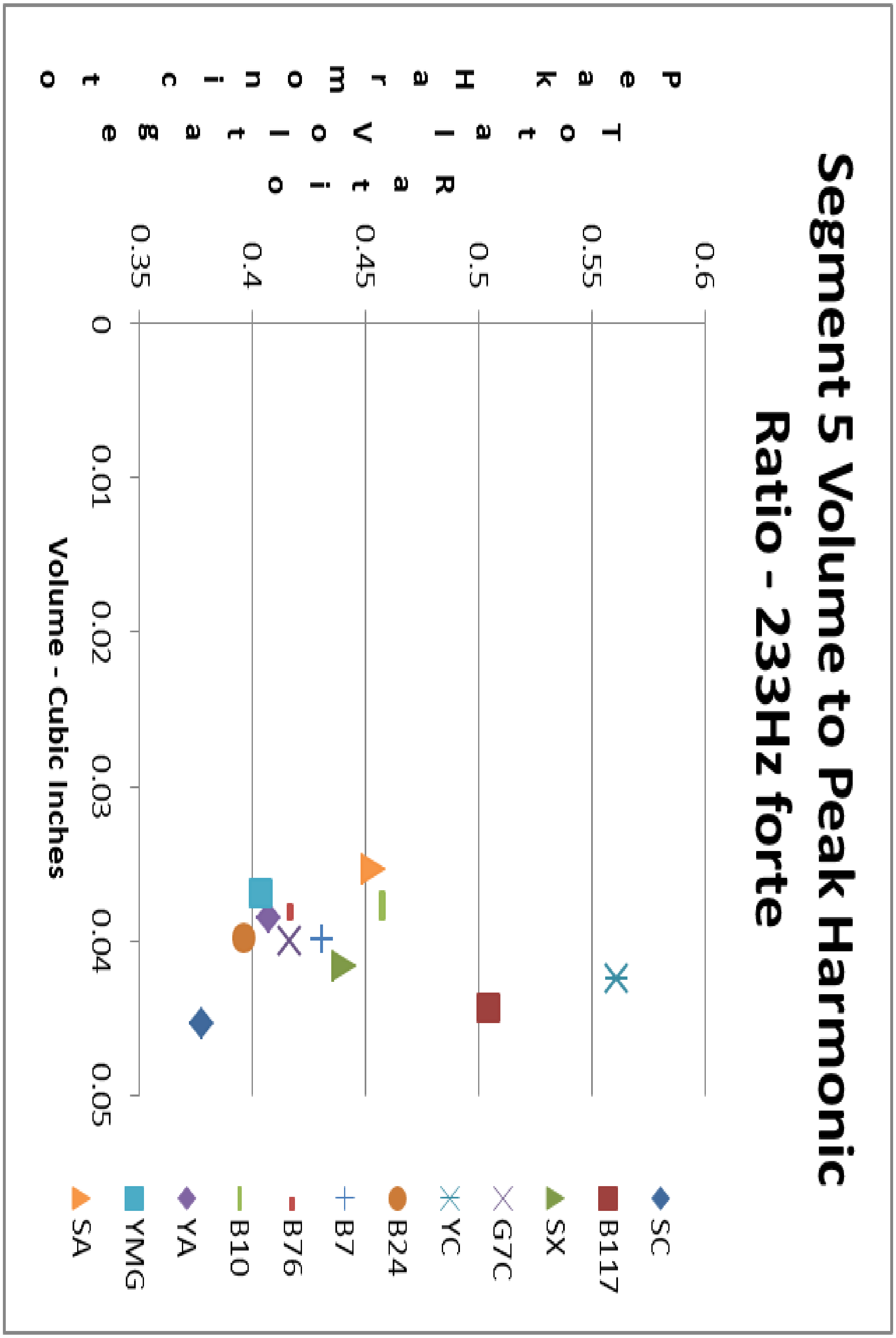

Figure 105
Segment five volume to peak harmonic ratio – 233Hz *forte*.
Minimal correlation (r = 0.2121).

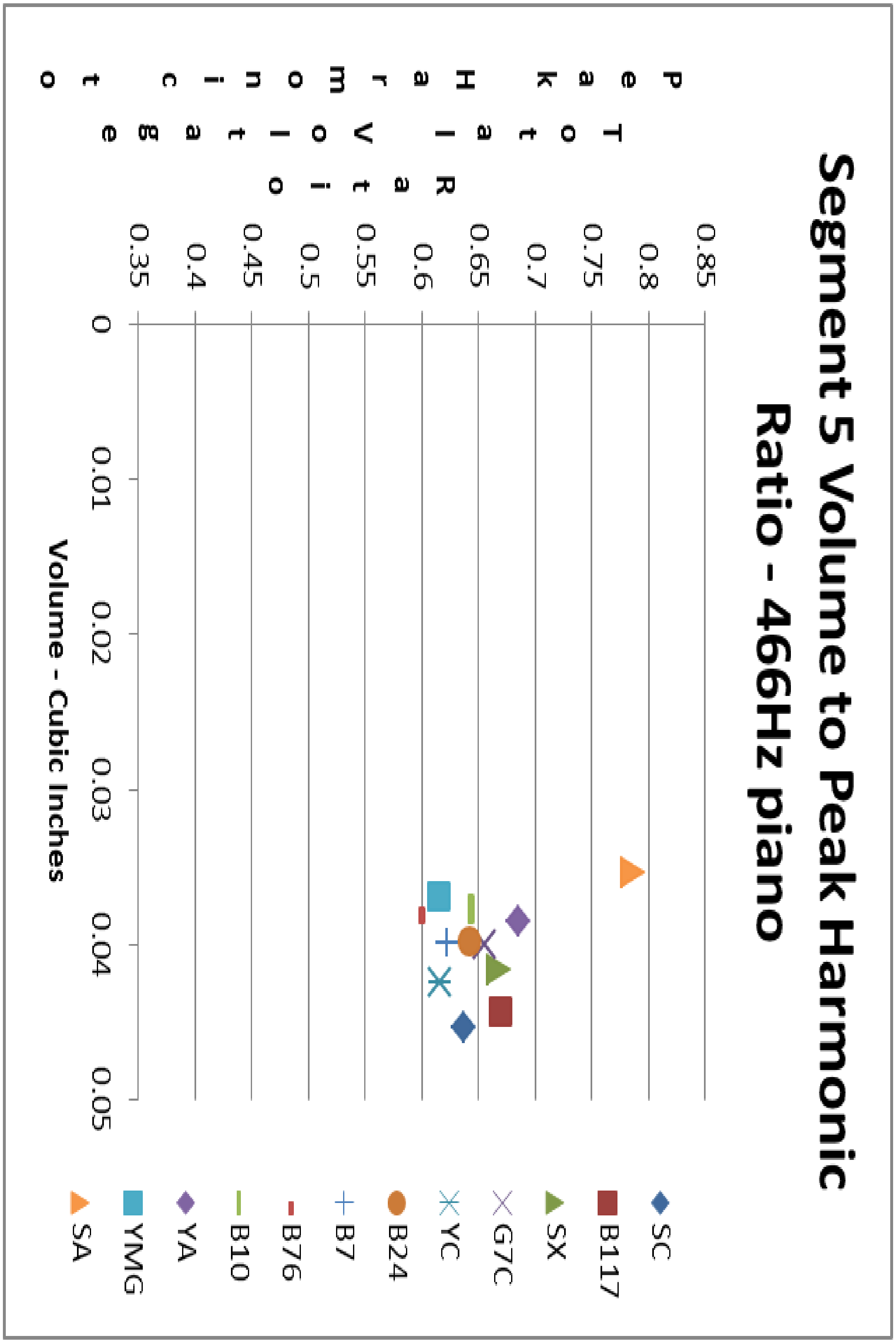

Figure 106
Segment five volume to peak harmonic ratio – 466Hz *piano*.
Minimal correlation (r = -0.2955).

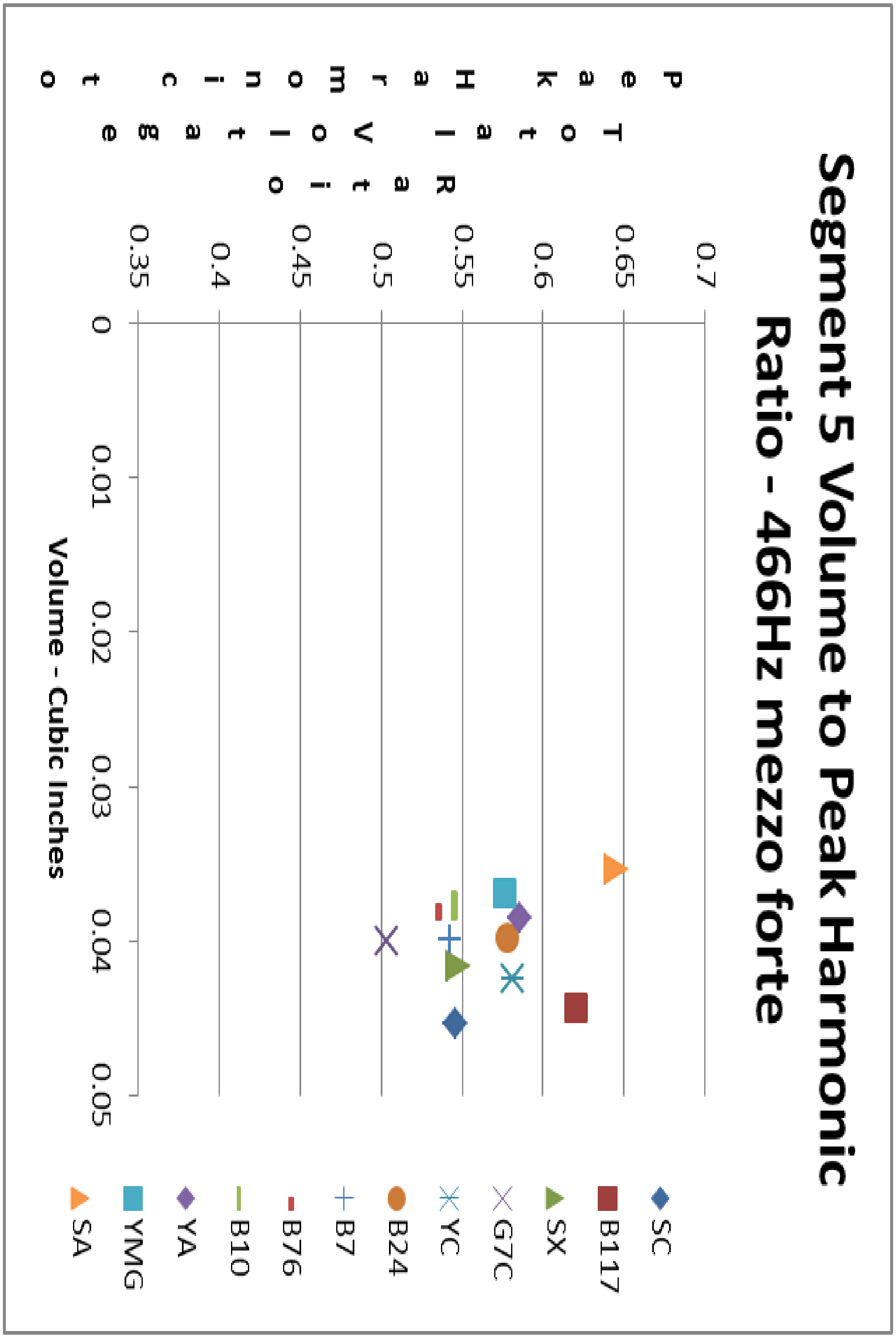

Figure 107
Segment five volume to peak harmonic ratio – 466Hz *mezzo forte*.
Minimal correlation (r = -0.1388).

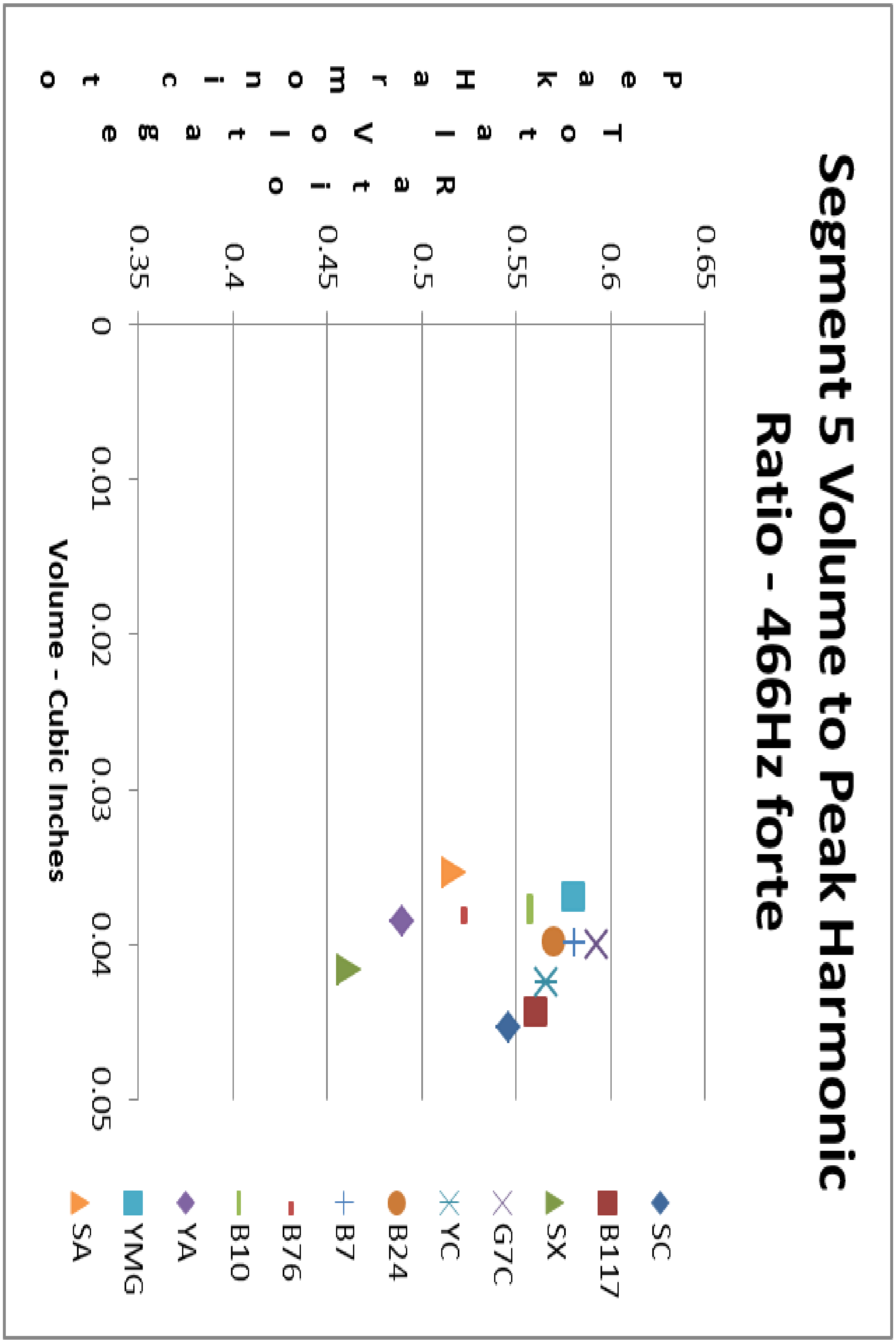

Figure 108
Segment five volume to peak harmonic ratio – 466Hz *forte*.
Minimal correlation (r = 0.0743).

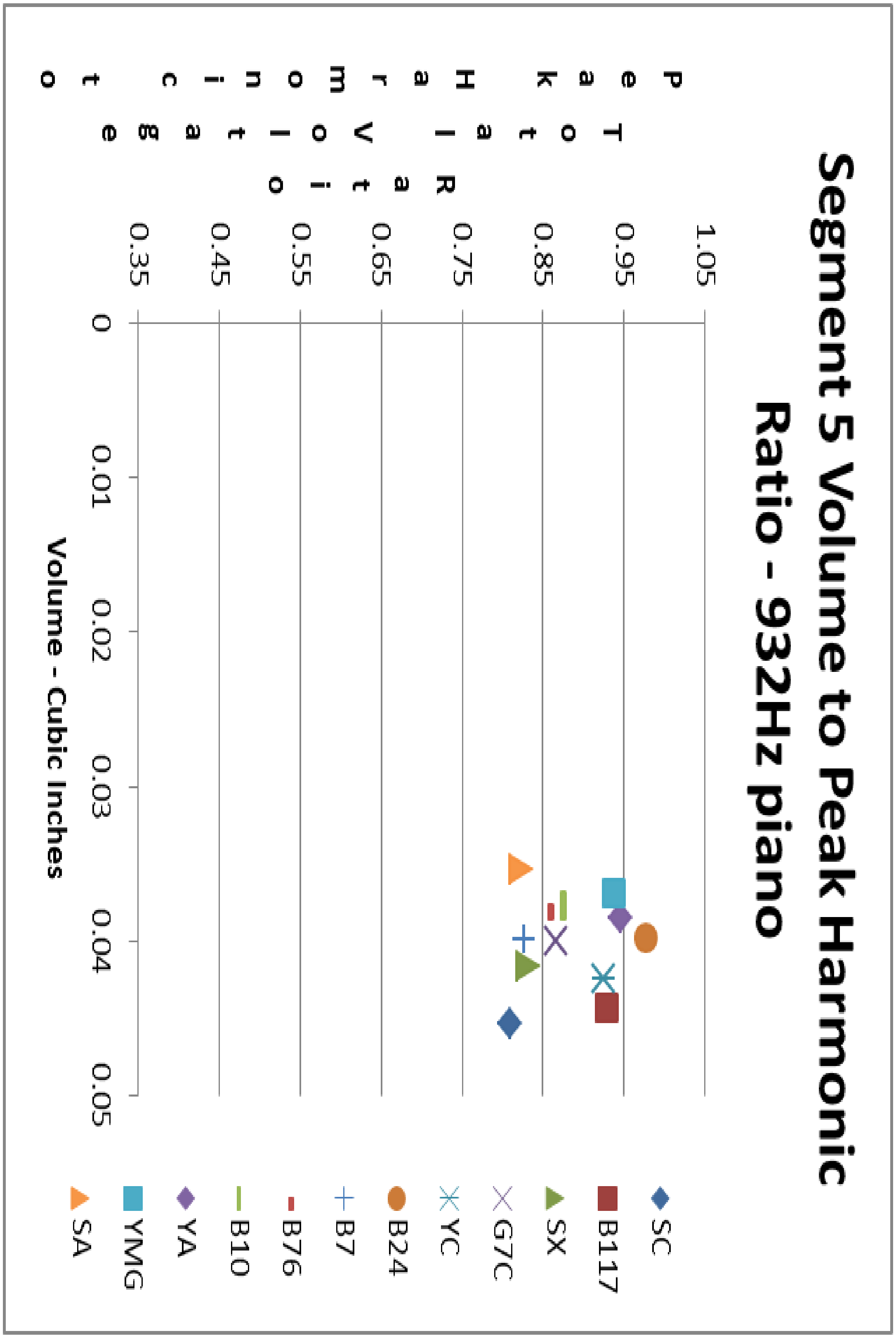

Figure 109
Segment five volume to peak harmonic ratio – 932Hz *piano*.
Minimal correlation (r = -0.0624).

Figures 105 through 109 contain scattered groups of plots supporting the minimal calculated correlation well.

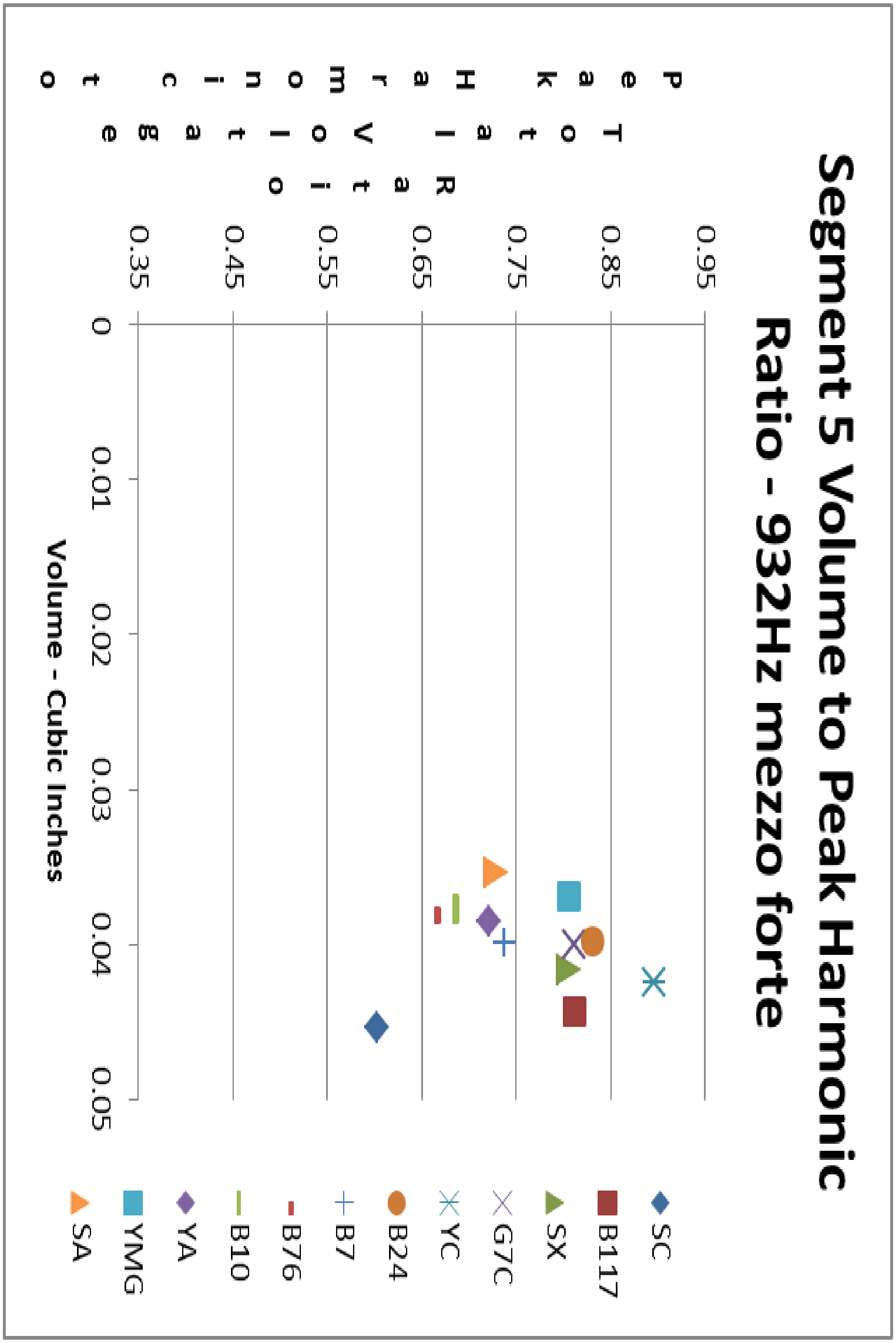

Figure 110
Segment five volume to peak harmonic ratio – 932Hz *mezzo forte*.
Minimal correlation (r = 0.0751).

With the exception of the SC backbore, Figure 110 indicates a correlation. When the SC backbore is included in the calculation, there is only a minimal correlation. Like the SA backbore in segments one and two, the SC backbore in segment five could be a further researched shape to understand why it produces a unique response.

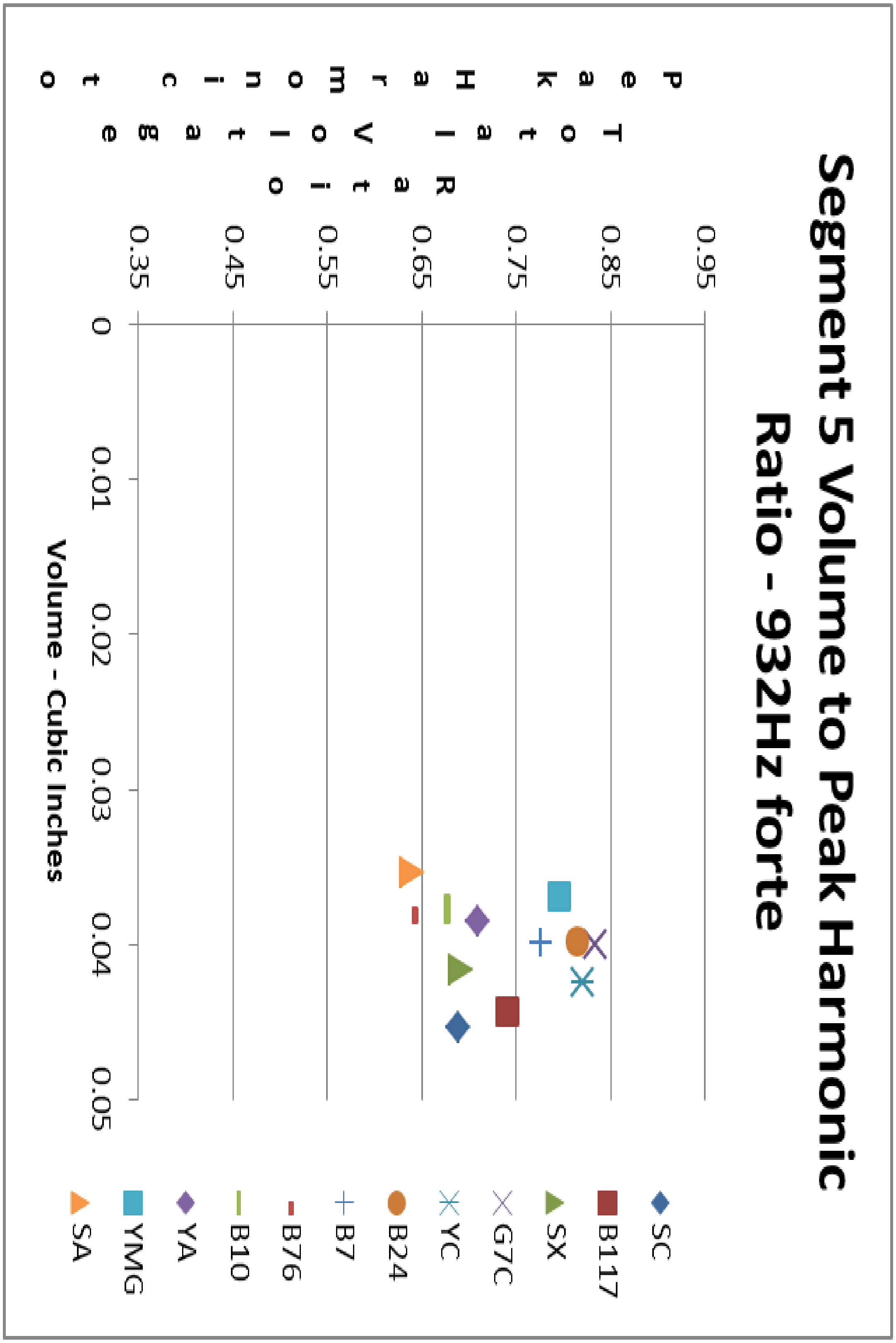

Figure 111
Segment five volume to peak harmonic ratio – 932Hz *forte*.
Minimal correlation (r = 0.2220).

Figure 111 contains a scattered group of plots supporting the minimal calculated correlation well.

It is notable that there is a correlation of the timbre (peak harmonic to total harmonics) to the segments one, two, and three. As the volume of segment three increases, the timbre changes, and the ratio of the peak harmonic to total harmonics increases. When the ratio of the peak harmonic to total harmonics increases, the timbre contains more and more of the peak harmonic and less and less of the other harmonics. The harmonic shape moves from the harmonics being closer in strength to being smaller in comparison to the peak harmonic. In this research, a larger peak harmonic ratio is associated with a darker timbre. As the volume of segment three increases, the timbre becomes more and more reliant on the peak harmonic. Segments one and two are notable because an increase in interior volume in this segment has an opposite effect on timbre as it does in segment three. In segments one and two, as the interior volume increases, the peak harmonic is reduced in relation to the other harmonics. A reduction of the peak harmonic to other harmonics creates a broader harmonic shape. Overall, this indicates that segments one, two, and three, the small to middle sections of trumpet mouthpiece backbores, seem to have the strongest influence on the timbre of the trumpet.

Segments one and two have correlations on the 466 Hertz frequency, and segment three has correlations on the 233 Hertz and 932 Hertz frequencies. The relationships of the interior volume of segment one and two to segment three to timbre are opposite. When the segments one and two are increased in interior volume, the timbre becomes brighter in the middle register. When segment three is increased in interior volume, the timbre becomes darker in the lower and upper register. In this study, it can be generalized that a backbore that has a slow taper in segments one and two and a quick taper in segment three will have a darker timbre in the low and high registers and a brighter timbre in the middle register. Alternatively, a backbore that has a quick taper in segments one and two and a slow taper in segment three will have a brighter timbre in the low and high registers and a darker timbre in the middle register.

When a segment has a larger interior volume, it means it has a greater rate of taper; it opens faster from narrow to wide. When segment three, the middle of the backbore, has a greater taper, the sound has more presence from the peak harmonic. In general, as referenced from Marcinkiewicz, a brighter sound is the result of more upper harmonics and a suppression of the lower harmonics. Also, the harmonic shape is wider, the harmonics are closer to being equal in strength, and the ratio of the peak harmonic to total harmonics is lower. Conversely, if the lower harmonics are emphasized in relation to the upper harmonics, then the timbre would be darker. The harmonic shape is narrower when a darker timbre is produced. In this study, all of the peak harmonics from all of the backbores, regardless of frequency or dynamic, are between the first and sixth harmonic. There is only one backbore that has the sixth harmonic as its peak, the B7 backbore at 233Hz frequency at forte; most of the backbores have peaks at the first to fourth harmonic. As with the B7 backbore, when all of the backbores are played louder in the low register (233Hz), the peak harmonic moves to a higher harmonic, the timbre gets brighter. At the *piano* dynamic and at the 233Hz frequency, the B7 backbore has a peak harmonic on the third harmonic. All of the backbores share a similar behavior. When the rate of taper of the middle of the backbore is increased, the timbre of the trumpet is gets darker. When the rate of taper of the middle of the backbore is decreased, the timbre of the trumpet gets brighter. Additionally, when the rate of taper of the second section from the throat (segment two) increases the timbre is brighter, when it is decreased the timbre is darker. If the behavior of segments one, two, and three is consolidated, it generally indicates that for a dark sounding backbore, the small-medium end of the backbore should have a slow taper and the middle a fast taper. Conversely, for a bright sounding backbore, the small-medium end of the backbore should have a fast taper, the middle a slow taper, and the large end also a slow taper.

The backbore shapes are in Figures 116 through 127 below; segment one is between 2.815 and 2.252, segment two is between 2.252 and 1.689 (small-medium end), segment three is between 1.689 and 1.126 (middle), segment four between 1.126 and 0.563, and segment five between 0.563 and 0 (large end) on the horizontal axis.

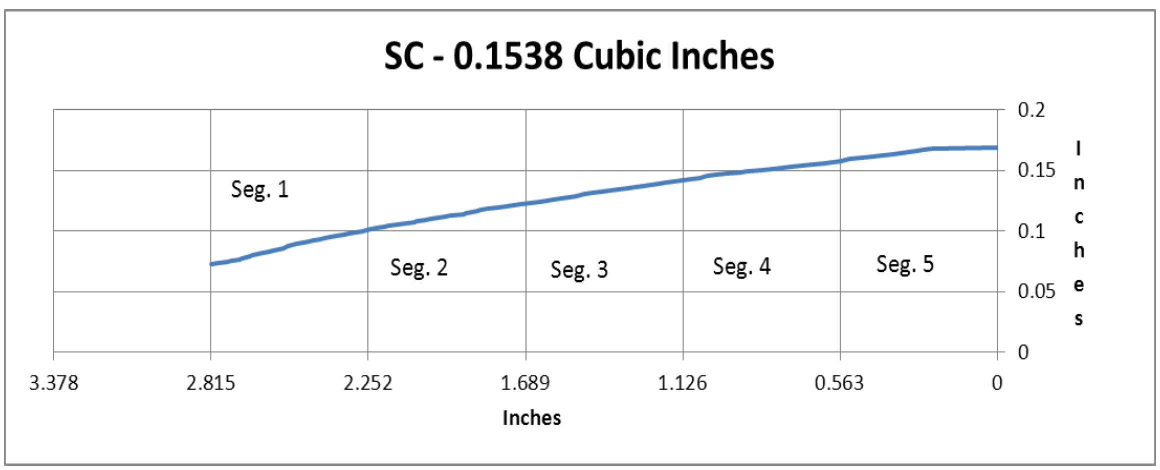

Figure 112
SC – 0.1538 cubic inches.

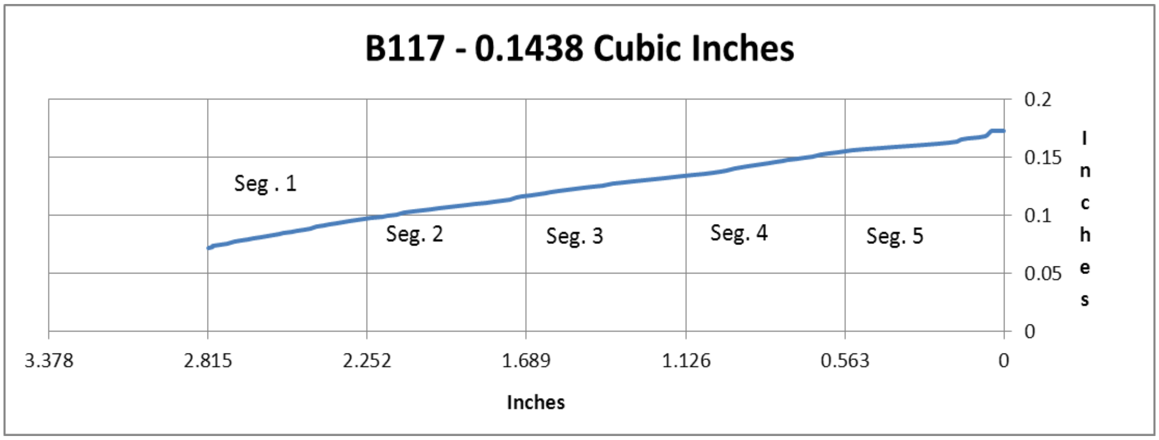

Figure 113
B117 – 0.1438 cubic inches.

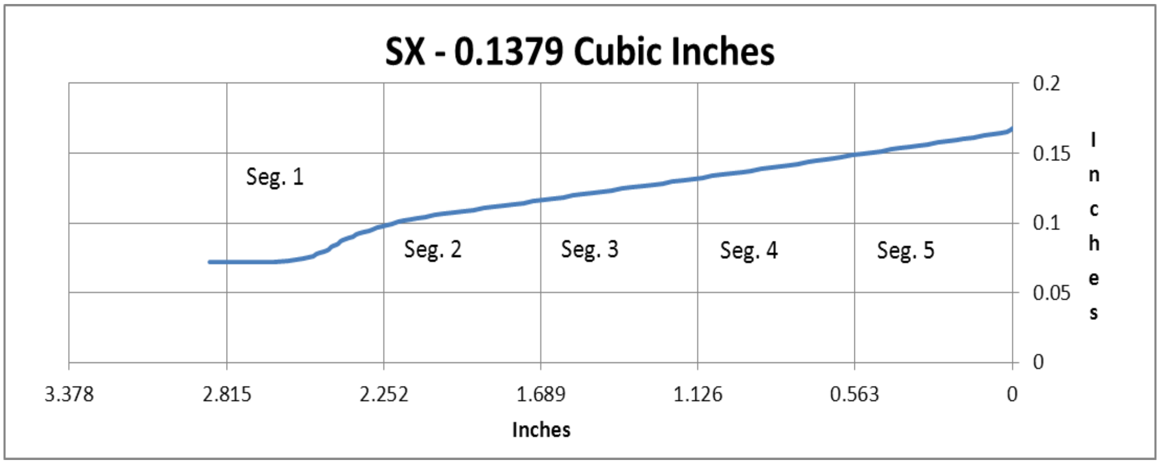

Figure 114
SX – 0.1379 cubic inches.

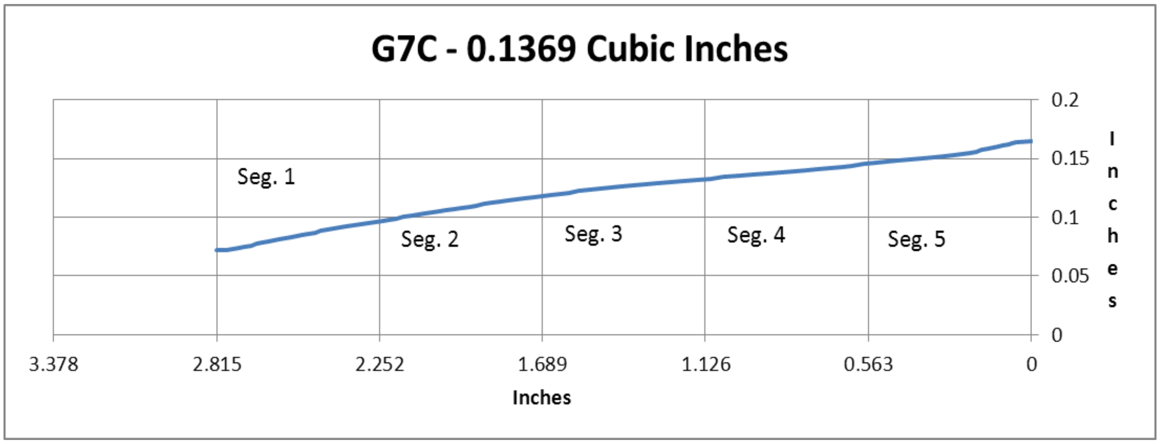

Figure 115
G7C – 0.1369 cubic inches.

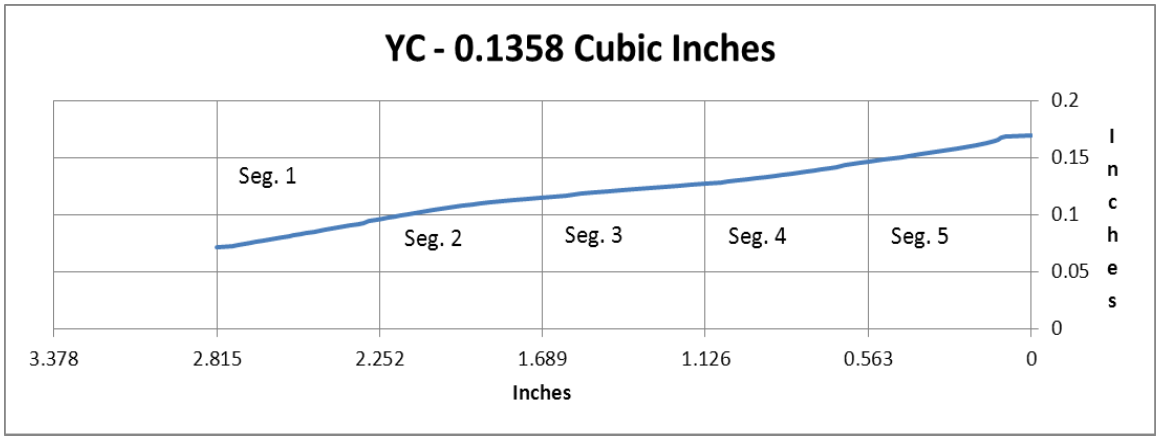

Figure 116
YC – 0.1358 cubic inches.

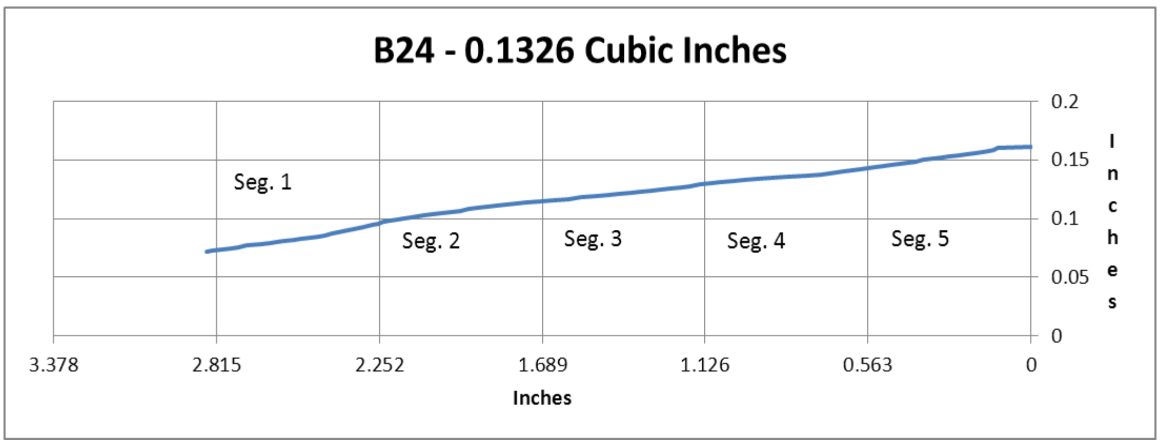

Figure 117
B24 – 0.1326 cubic inches.

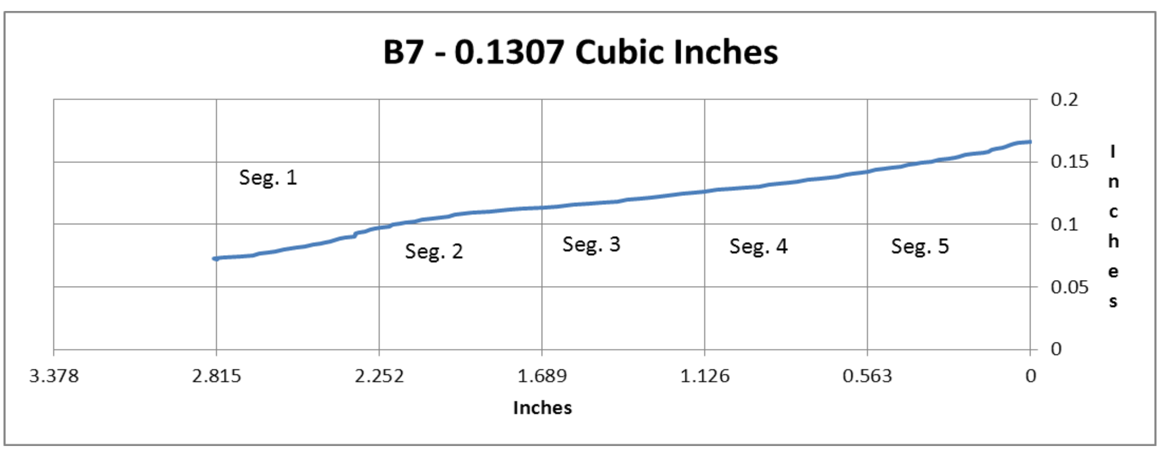

Figure 118
B7 – 0.1307 cubic inches.

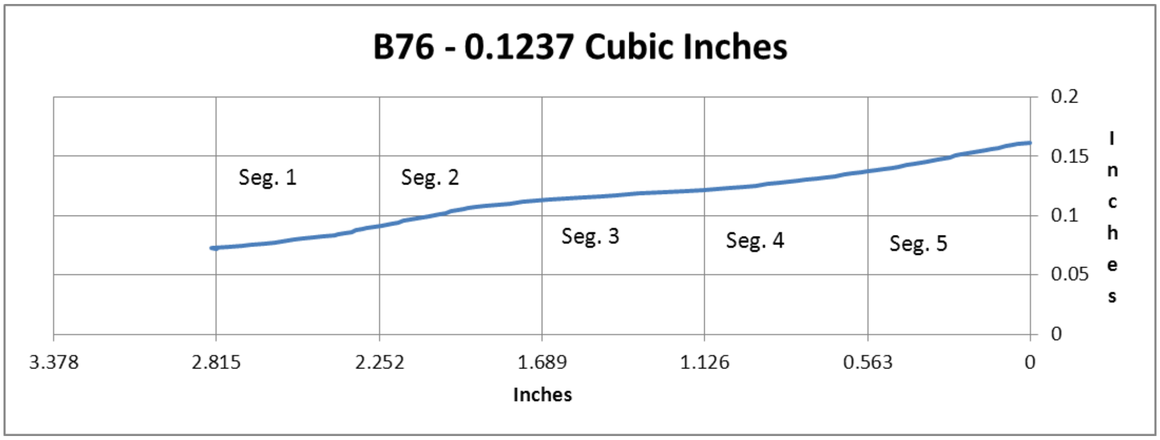

Figure 119
B76 – 0.1237 cubic inches.

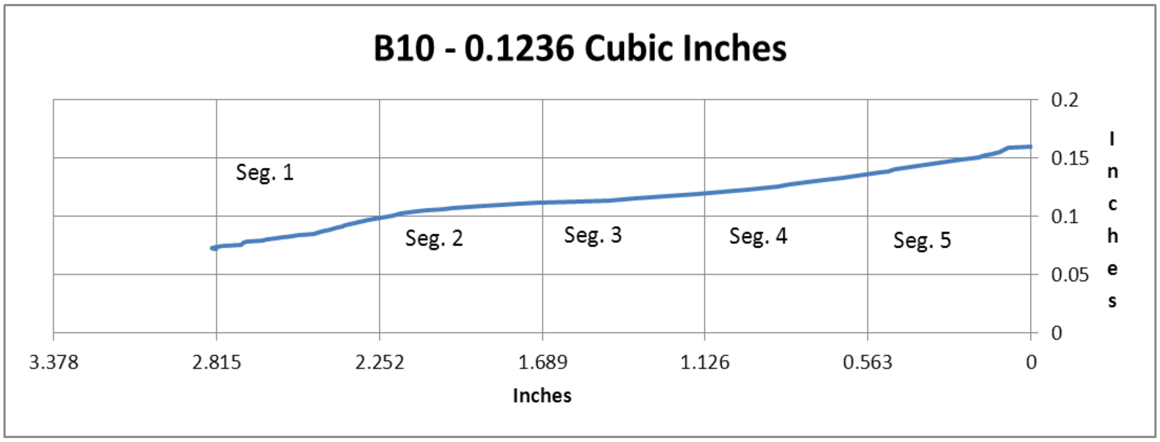

Figure 120
B10 – 0.1236 cubic inches.

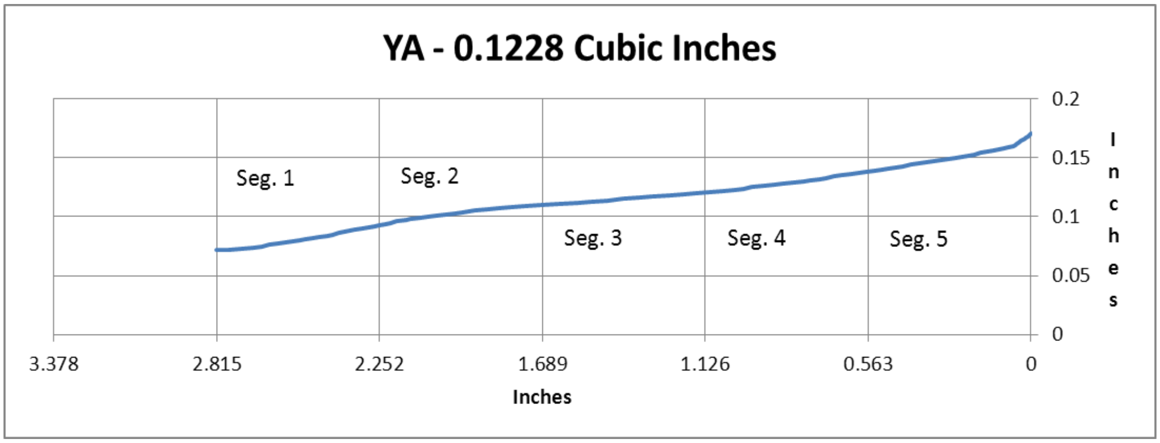

Figure 121
YA – 0.1228 cubic inches.

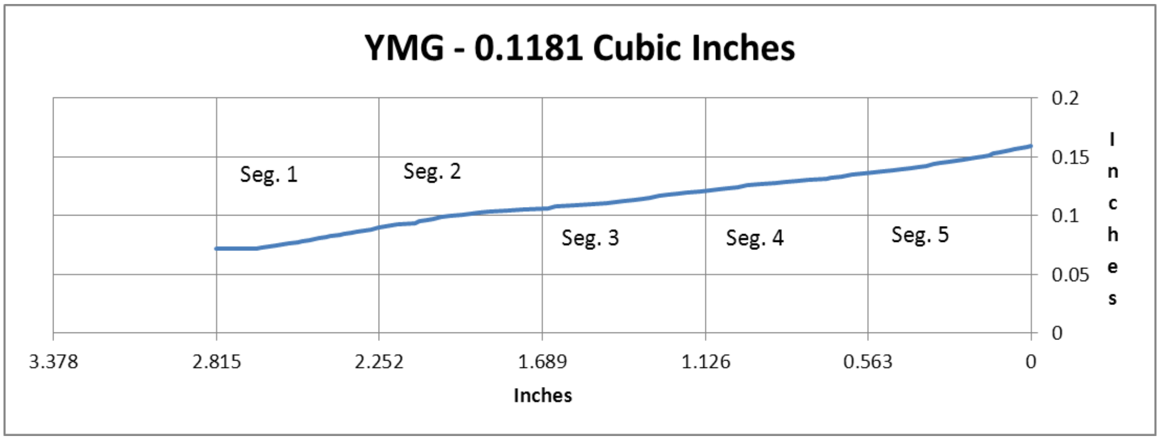

Figure 122
YMG – 0.1181 cubic inches.

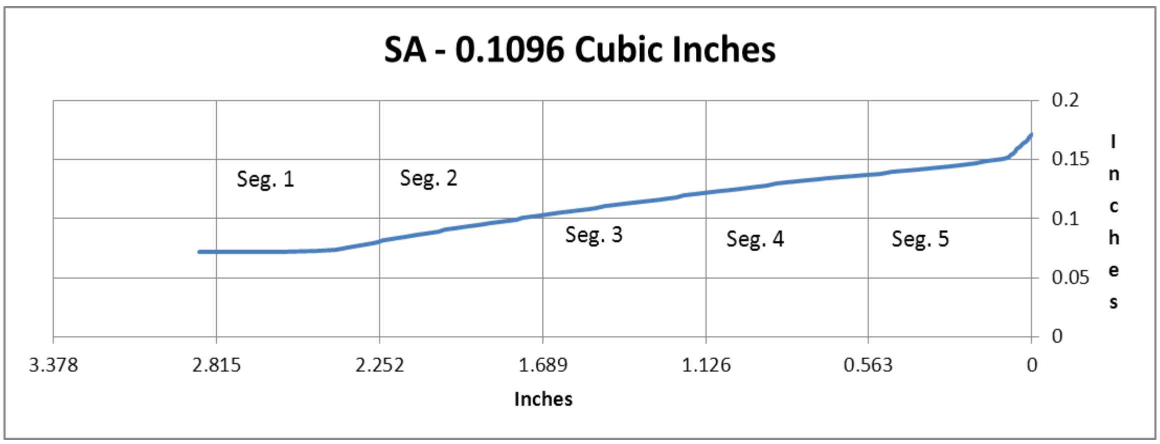

Figure 123
SA – 0.1096 cubic inches.

Segment three does not seem to have, in general, a major taper difference (visually) than could be said about other segments. A small difference, though, can be a major difference, as the changes compared here are measured in thousandths of an inch. The author believes it is probable that the sound wave interacts with this section in this manner because of the size of the wave and the size and diameter of the taper, or some combination that is related. The relationship is perhaps similar to the behavior of the sound waves and how they interact with the bell. Also, the steepening of the waves as the dynamic increases and the resulting change in interaction with this segment of the taper is likely responsible for the increase of correlation at the *mezzo forte* and *forte* dynamics and not the *piano* dynamics. Discussing these ideas further is beyond the scope of this research and intentions of investigating correlations of total internal volume and timbre. The correlation of timbre change and shape however, further supports that total interior volume of the trumpet mouthpiece backbore is not a primary factor in the timbre of a trumpet, but that interior shape is.

Final Conclusions

The total interior volume of the trumpet mouthpiece backbore does not strongly correlate to the timbre produced on the trumpet, as measured in this study. The interior shape of the trumpet mouthpiece backbore does strongly correlate to the timbre of the trumpet. Broadly described, when the rate of taper of the middle of the backbore is increased, the timbre of the trumpet gets darker in the low and upper registers. When the rate of taper of the middle of the backbore is decreased, the timbre of the trumpet gets brighter in the low and upper registers. Also, when the rate of taper of the small-middle end of the backbore is increased, the timbre of the trumpet gets brighter in the middle register. When the rate of taper of the small-middle end of the backbore is decreased, the timbre of the trumpet gets darker in the middle register. The methodology of describing timbre from analyzing harmonic components of timbre has potential, with more studies, to become increasingly valid as a method of designing, understanding, and communicating about trumpet equipment. This could be a departure from using only trial and error and lead to a new way trumpeters and manufacturers communicate with each other, and select and design equipment. The author hopes this is just a starting point in exploring trumpet design and that these ideas lead to musicians being better equipped to explore and communicate their craft.

Previous studies have shown that the popping frequency, or resonant frequency, of a mouthpiece is related to the volume of the cup. Moore states, "In the case of the cup volume, the popping frequency changes inversely with the square root of the volume. In other words, increasing the cup volume by a factor of four decreases the mouthpiece resonance by a factor of two (i.e. one octave)."[1] An increased mouthpiece resonance (in frequency) results in a mouthpiece that sounds brighter, as discussed earlier. It should be noted, in Thomas Moore's study (above), the cup volume relationship to mouthpiece resonance was calculated without the backbore. The same relationships do not seem to be true for the trumpet mouthpiece backbore. Total interior volume is not related to harmonic content allocation in this study.

This research counteracts the generally accepted belief that trumpet mouthpiece backbores affect trumpet timbre based on their total interior volume. In general, backbores with large interior volumes do not sound darker than backbores with smaller interior volumes solely because of their total interior volume. Instead, this research supports the concept that the interior shape of the backbore is responsible for the timbre. The author believes that trial and error in trumpet mouthpiece backbore design has led to the general belief of total interior volume being a primary factor in timbre. Backbore designs produced by manufacturers consider pitch and blow resistance, and this study does not. It is likely that for backbores to work well with all of the variables,

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[1] Thomas Moore, "The Science of the Mouthpiece: What is and isn't Known" *International Trumpet Guild Journal* (January 2006): 58.

manufacturers consider that mouthpieces that sound darker generally end up with backbores with larger interior volumes. After the author shared the results of this study with Zack Marcinkiewicz, he discussed that with further research incorporating more variables, such as other cup shapes and other trumpets, this methodology could help players find suitable mouthpieces faster and add to the knowledge of mouthpiece design. At this point however, with only one study, and with the constraints of the study, the information from this work is not yet completely applicable to being used by his company.[2] The conversation with Zack Marcinkiewicz enlightened the author as to how much thought and effort manufacturers put into their products, and how they strive to design and offer the best products that they know how to produce. While manufacturers have a significant breadth of knowledge, there is always an opportunity to continue to add to it. This study introduces a methodology that may contribute to manufacturers' understanding of design and improve communication.

This study intends to discern if the total interior volume of the trumpet mouthpiece backbore was strongly correlated to the timbre of the trumpet. Additionally, this research introduces a methodology that could begin to improve mouthpiece backbore design and the manner of communication between trumpet players and manufacturers. The intentions of the study were achieved, with more research needed to cover more variables. Follow up studies could further the investigation of internal backbore shape and trumpet timbre. Further studies could be done to build on and clarify the role of interior volume and interior shape of backbores on trumpet timbre.

[2] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

It is also worth noting that perhaps players who prefer less blow resistance and/or the pitch characteristics of larger interior volume backbores also tend to have warmer sounds and/or warmer sound concepts (the sound they try to achieve). Orchestral players would be an example. The same could be said of commercial or lead-type players who often prefer more blow resistance. The pitch characteristics of smaller interior volume backbores often balance better with shallower cups, which have a brighter sound, and often work for players with a brighter sound concept. This study contained players with a variety of experience, levels of development, and performance genre in an effort to minimize any one sound concept dominating the data. It is reasonable to understand how the association of bigger interior volume backbores sounding darker and smaller interior volume backbores sounding brighter has come about with the multiple variables involved to organize in design through trial and error. While this study is not definitive, as Marcinkiewicz discussed, by not having a broad enough scope to be applicable in the 'real-world,' it is a worthwhile first step.[3]

The challenge of the generally accepted belief that the total interior backbore volume correlates to timbre is useful to further mouthpiece design and understanding, and in selecting of equipment. Possibly even more important, however, is the methodology of discussing timbre in terms of harmonic structures. This could be the beginning of a departure from trial and error and lead to a new way trumpeters and manufacturers communicate with each other, and select and design equipment. The author hopes this is just a starting point in exploring trumpet design and that these ideas lead to musicians being better equipped to explore and communicate their craft.

[3] Marcinkiewicz, Zack. Interview by author, 23 October 2013.

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Appendix A - Backbore Measurements

The table of backbore volumes on page 38 was calculated from this data.

Each backbore measurements table has six columns. What is contained in each column is listed below:

Indicator – the measurement taken off the dial indicator.

Indicator + throat – this is the indicator measurement added to the throat radius.

Area square in – this is the area of the circular cross section of the backbore.

Length coordinate – this is the length measurements from the lathe digital read out.

Length of segment – this is the length between measurements.

Volume coordinate – this is the volume of the segment (based on the radius and segment length.

The backbore listed in the upper left corner of each table corresponds to the data in the table.

The total volume is listed at the bottom of each table.

SC					
indicator	indicator + throat	area square in	length coordinate	length for segment	Volume coordinate
		0	0		
		0	0	0.0000	0
		0	0	0.0000	0
		0	0	0.0000	0
		0	0	0.0000	0
0.097	0.169	0.089726952	0	0.0000	0
0.096	0.168	0.088668236	0.2328	0.2328	0.020641965
0.095	0.167	0.087615804	0.2672	0.0344	0.003013984
0.094	0.166	0.086569654	0.292	0.0248	0.002146927
0.093	0.165	0.085529788	0.3198	0.0278	0.002377728
0.092	0.164	0.084496205	0.3454	0.0256	0.002163103
0.091	0.163	0.083468905	0.3782	0.0328	0.00273778
0.09	0.162	0.082447888	0.4162	0.0380	0.00313302
0.089	0.161	0.081433154	0.4494	0.0332	0.002703581
0.088	0.16	0.080424704	0.4912	0.0418	0.003361753
0.087	0.159	0.079422537	0.5302	0.0390	0.003097479
0.086	0.158	0.078426653	0.56	0.0298	0.002337114
0.085	0.157	0.077437052	0.5914	0.0314	0.002431523
0.084	0.156	0.076453734	0.6212	0.0298	0.002278321
0.083	0.155	0.0754767	0.6652	0.0440	0.003320975
0.082	0.154	0.074505948	0.7042	0.0390	0.002905732
0.081	0.153	0.07354148	0.7402	0.0360	0.002647493
0.08	0.152	0.072583295	0.7758	0.0356	0.002583965
0.079	0.151	0.071631394	0.8074	0.0316	0.002263552
0.078	0.15	0.070685775	0.84678	0.0394	0.002783606
0.077	0.149	0.06974644	0.8974	0.0506	0.003530565
0.076	0.148	0.068813387	0.9224	0.0250	0.001720335
0.075	0.147	0.067886618	0.972	0.0496	0.003367176
0.074	0.146	0.066966132	1.009	0.0370	0.002477747
0.073	0.145	0.06605193	1.0406	0.0316	0.002087241
0.072	0.144	0.06514401	1.0682	0.0276	0.001797975
0.071	0.143	0.064242374	1.1018	0.0336	0.002158544
0.07	0.142	0.063347021	1.1306	0.0288	0.001824394
0.069	0.141	0.062457951	1.159	0.0284	0.001773806
0.068	0.14	0.061575164	1.189	0.0300	0.001847255
0.067	0.139	0.06069866	1.2138	0.0248	0.001505327
0.066	0.138	0.05982844	1.2424	0.0286	0.001711093
0.065	0.137	0.058964503	1.2696	0.0272	0.001603834
0.064	0.136	0.058106849	1.2982	0.0286	0.001661856

0.063	0.135	0.057255478	1.3266	0.0284	0.001626056
0.062	0.134	0.05641039	1.3598	0.0332	0.001872825
0.061	0.133	0.055571586	1.3878	0.0280	0.001556004
0.06	0.132	0.054739064	1.4204	0.0326	0.001784493
0.059	0.131	0.053912826	1.4532	0.0328	0.001768341
0.058	0.13	0.053092871	1.4786	0.0254	0.001348559
0.057	0.129	0.052279199	1.5106	0.0320	0.001672934
0.056	0.128	0.051471811	1.5342	0.0236	0.001214735
0.055	0.127	0.050670705	1.5652	0.0310	0.001570792
0.054	0.126	0.049875883	1.5912	0.0260	0.001296773
0.053	0.125	0.049087344	1.6136	0.0224	0.001099557
0.052	0.124	0.048305088	1.6412	0.0276	0.00133322
0.051	0.123	0.047529115	1.6752	0.0340	0.00161599
0.05	0.122	0.046759426	1.7078	0.0326	0.001524357
0.049	0.121	0.045996019	1.7334	0.0256	0.001177498
0.048	0.12	0.045238896	1.7598	0.0264	0.001194307
0.047	0.119	0.044488056	1.79	0.0302	0.001343539
0.046	0.118	0.043743499	1.8276	0.0376	0.001644756
0.045	0.117	0.043005226	1.8496	0.0220	0.000946115
0.044	0.116	0.042273235	1.8634	0.0138	0.000583371
0.043	0.115	0.041547528	1.9024	0.0390	0.001620354
0.042	0.114	0.040828104	1.9124	0.0100	0.000408281
0.041	0.113	0.040114963	1.9576	0.0452	0.001813196
0.04	0.112	0.039408105	1.9792	0.0216	0.000851215
0.039	0.111	0.03870753	2.005	0.0258	0.000998654
0.038	0.11	0.038013239	2.0289	0.0239	0.000908516
0.037	0.109	0.037325231	2.0508	0.0219	0.000817423
0.036	0.108	0.036643506	2.0788	0.0280	0.001026018
0.035	0.107	0.035968064	2.0874	0.0086	0.000309325
0.034	0.106	0.035298905	2.1214	0.0340	0.001200163
0.033	0.105	0.03463603	2.1512	0.0298	0.001032154
0.032	0.104	0.033979437	2.181	0.0298	0.001012587
0.031	0.103	0.033329128	2.1958	0.0148	0.000493271
0.03	0.102	0.032685102	2.224	0.0282	0.00092172
0.029	0.101	0.03204736	2.2454	0.0214	0.000685813
0.028	0.1	0.0314159	2.2742	0.0288	0.000904778
0.027	0.099	0.030790724	2.2992	0.0250	0.000769768
0.026	0.098	0.03017183	2.3232	0.0240	0.000724124
0.025	0.097	0.02955922	2.3426	0.0194	0.000573449
0.024	0.096	0.028952893	2.367	0.0244	0.000706451
0.023	0.095	0.02835285	2.3902	0.0232	0.000657786

0.022	0.094	0.027759089	2.4082	0.0180	0.000499664
0.021	0.093	0.027171612	2.4258	0.0176	0.00047822
0.02	0.092	0.026590418	2.449	0.0232	0.000616898
0.019	0.091	0.026015507	2.4652	0.0162	0.000421451
0.018	0.09	0.025446879	2.4888	0.0236	0.000600546
0.017	0.089	0.024884534	2.5094	0.0206	0.000512621
0.016	0.088	0.024328473	2.525	0.0156	0.000379524
0.015	0.087	0.023778695	2.5416	0.0166	0.000394726
0.014	0.086	0.0232352	2.5556	0.0140	0.000325293
0.013	0.085	0.022697988	2.5752	0.0196	0.000444881
0.012	0.084	0.022167059	2.5944	0.0192	0.000425608
0.011	0.083	0.021642414	2.6082	0.0138	0.000298665
0.01	0.082	0.021124051	2.6302	0.0220	0.000464729
0.009	0.081	0.020611972	2.6486	0.0184	0.00037926
0.008	0.08	0.020106176	2.6676	0.0190	0.000382017
0.007	0.079	0.019606663	2.6764	0.0088	0.000172539
0.006	0.078	0.019113434	2.6914	0.0150	0.000286702
0.005	0.077	0.018626487	2.7038	0.0124	0.000230968
0.004	0.076	0.018145824	2.7118	0.0080	0.000145167
0.003	0.075	0.017671444	2.7442	0.0324	0.000572555
0.002	0.074	0.017203347	2.757	0.0128	0.000220203
0.001	0.073	0.016741533	2.7936	0.0366	0.00061274
0	0.072	0.016286003	2.815	0.0214	0.00034852
					0.153819515
					Total Volume

B117					
indicator	indicator + throat	area square in	length coordinate	length for segment	Volume coordinate
0.1005	0.1725	0.093481937	0		
0.1005	0.1725	0.093481937	0.045	0.0450	0.004206687
0.1	0.172	0.092940799	0.049	0.0040	0.000371763
0.099	0.171	0.091863233	0.052	0.0030	0.00027559
0.098	0.17	0.090791951	0.056	0.0040	0.000363168
0.097	0.169	0.089726952	0.061	0.0050	0.000448635
0.096	0.168	0.088668236	0.069	0.0080	0.000709346
0.095	0.167	0.087615804	0.09	0.0210	0.001839932
0.094	0.166	0.086569654	0.132	0.0420	0.003635925
0.093	0.165	0.085529788	0.151	0.0190	0.001625066
0.092	0.164	0.084496205	0.168	0.0170	0.001436435
0.091	0.163	0.083468905	0.196	0.0280	0.002337129
0.09	0.162	0.082447888	0.2372	0.0412	0.003396853
0.089	0.161	0.081433154	0.2854	0.0482	0.003925078
0.088	0.16	0.080424704	0.3374	0.0520	0.004182085
0.087	0.159	0.079422537	0.3904	0.0530	0.004209394
0.086	0.158	0.078426653	0.44	0.0496	0.003889962
0.085	0.157	0.077437052	0.4954	0.0554	0.004290013
0.084	0.156	0.076453734	0.5374	0.0420	0.003211057
0.083	0.155	0.0754767	0.5658	0.0284	0.002143538
0.082	0.154	0.074505948	0.5914	0.0256	0.001907352
0.081	0.153	0.07354148	0.622	0.0306	0.002250369
0.08	0.152	0.072583295	0.649	0.0270	0.001959749
0.079	0.151	0.071631394	0.6782	0.0292	0.002091637
0.078	0.15	0.070685775	0.707	0.0288	0.00203575
0.077	0.149	0.06974644	0.7332	0.0262	0.001827357
0.076	0.148	0.068813387	0.7644	0.0312	0.002146978
0.075	0.147	0.067886618	0.7846	0.0202	0.00137131
0.074	0.146	0.066966132	0.812	0.0274	0.001834872
0.073	0.145	0.06605193	0.8338	0.0218	0.001439932
0.072	0.144	0.06514401	0.8582	0.0244	0.001589514
0.071	0.143	0.064242374	0.884	0.0258	0.001657453
0.07	0.142	0.063347021	0.91	0.0260	0.001647023
0.069	0.141	0.062457951	0.9298	0.0198	0.001236667
0.068	0.14	0.061575164	0.955	0.0252	0.001551694
0.067	0.139	0.06069866	0.9814	0.0264	0.001602445
0.066	0.138	0.05982844	1.006	0.0246	0.00147178
0.065	0.137	0.058964503	1.0312	0.0252	0.001485905
0.064	0.136	0.058106849	1.0602	0.0290	0.001685099

0.063	0.135	0.057255478	1.1004	0.0402	0.00230167
0.062	0.134	0.05641039	1.1364	0.0360	0.002030774
0.061	0.133	0.055571586	1.1708	0.0344	0.001911663
0.06	0.132	0.054739064	1.2034	0.0326	0.001784493
0.059	0.131	0.053912826	1.239	0.0356	0.001919297
0.058	0.13	0.053092871	1.2766	0.0376	0.001996292
0.057	0.129	0.052279199	1.315	0.0384	0.002007521
0.056	0.128	0.051471811	1.3478	0.0328	0.001688275
0.055	0.127	0.050670705	1.3838	0.0360	0.001824145
0.054	0.126	0.049875883	1.421	0.0372	0.001855383
0.053	0.125	0.049087344	1.4582	0.0372	0.001826049
0.052	0.124	0.048305088	1.4892	0.0310	0.001497458
0.051	0.123	0.047529115	1.52	0.0308	0.001463897
0.05	0.122	0.046759426	1.551	0.0310	0.001449542
0.049	0.121	0.045996019	1.5792	0.0282	0.001297088
0.048	0.12	0.045238896	1.6028	0.0236	0.001067638
0.047	0.119	0.044488056	1.6242	0.0214	0.000952044
0.046	0.118	0.043743499	1.649	0.0248	0.001084839
0.045	0.117	0.043005226	1.6744	0.0254	0.001092333
0.044	0.116	0.042273235	1.7062	0.0318	0.001344289
0.043	0.115	0.041547528	1.7268	0.0206	0.000855879
0.042	0.114	0.040828104	1.7486	0.0218	0.000890053
0.041	0.113	0.040114963	1.7772	0.0286	0.001147288
0.04	0.112	0.039408105	1.8058	0.0286	0.001127072
0.039	0.111	0.03870753	1.8326	0.0268	0.001037362
0.038	0.11	0.038013239	1.871	0.0384	0.001459708
0.037	0.109	0.037325231	1.9028	0.0318	0.001186942
0.036	0.108	0.036643506	1.9358	0.0330	0.001209236
0.035	0.107	0.035968064	1.9676	0.0318	0.001143784
0.034	0.106	0.035298905	1.9996	0.0320	0.001129565
0.033	0.105	0.03463603	2.0284	0.0288	0.000997518
0.032	0.104	0.033979437	2.0598	0.0314	0.001066954
0.031	0.103	0.033329128	2.0934	0.0336	0.001119859
0.03	0.102	0.032685102	2.1232	0.0298	0.000974016
0.029	0.101	0.03204736	2.15	0.0268	0.000858869
0.028	0.1	0.0314159	2.1798	0.0298	0.000936194
0.027	0.099	0.030790724	2.2004	0.0206	0.000634289
0.026	0.098	0.03017183	2.2386	0.0382	0.001152564
0.025	0.097	0.02955922	2.265	0.0264	0.000780363
0.024	0.096	0.028952893	2.2904	0.0254	0.000735403
0.023	0.095	0.02835285	2.3164	0.0260	0.000737174

0.022	0.094	0.027759089	2.3398	0.0234	0.000649563
0.021	0.093	0.027171612	2.3634	0.0236	0.00064125
0.02	0.092	0.026590418	2.3864	0.0230	0.00061158
0.019	0.091	0.026015507	2.4074	0.0210	0.000546326
0.018	0.09	0.025446879	2.4324	0.0250	0.000636172
0.017	0.089	0.024884534	2.454	0.0216	0.000537506
0.016	0.088	0.024328473	2.476	0.0220	0.000535226
0.015	0.087	0.023778695	2.4996	0.0236	0.000561177
0.014	0.086	0.0232352	2.5214	0.0218	0.000506527
0.013	0.085	0.022697988	2.5478	0.0264	0.000599227
0.012	0.084	0.022167059	2.5652	0.0174	0.000385707
0.011	0.083	0.021642414	2.586	0.0208	0.000450162
0.01	0.082	0.021124051	2.6064	0.0204	0.000430931
0.009	0.081	0.020611972	2.6304	0.0240	0.000494687
0.008	0.08	0.020106176	2.654	0.0236	0.000474506
0.007	0.079	0.019606663	2.673	0.0190	0.000372527
0.006	0.078	0.019113434	2.6994	0.0264	0.000504595
0.005	0.077	0.018626487	2.7234	0.0240	0.000447036
0.004	0.076	0.018145824	2.7462	0.0228	0.000413725
0.003	0.075	0.017671444	2.7716	0.0254	0.000448855
0.002	0.074	0.017203347	2.7982	0.0266	0.000457609
0.001	0.073	0.016741533	2.8	0.0018	3.01348E-05
0	0.072	0.016286003	2.815	0.0150	0.00024429
					0.143844641
					Total Volume

SX					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume coordinate
0	0.1675	0.088141	0		
0.001	0.1665	0.087092	0.0044	0.0044	0.000383
0.002	0.1655	0.086049	0.0206	0.0162	0.001394
0.003	0.1645	0.085012	0.0412	0.0206	0.001751
0.004	0.1635	0.083982	0.0716	0.0304	0.002553
0.005	0.1625	0.082958	0.102	0.0304	0.002522
0.006	0.1615	0.08194	0.1392	0.0372	0.003048
0.007	0.1605	0.080928	0.175	0.0358	0.002897
0.008	0.1595	0.079923	0.201	0.026	0.002078
0.009	0.1585	0.078924	0.2338	0.0328	0.002589
0.01	0.1575	0.077931	0.2672	0.0334	0.002603
0.011	0.1565	0.076945	0.3028	0.0356	0.002739
0.012	0.1555	0.075964	0.336	0.0332	0.002522
0.013	0.1545	0.074991	0.3678	0.0318	0.002385
0.014	0.1535	0.074023	0.4042	0.0364	0.002694
0.015	0.1525	0.073062	0.4368	0.0326	0.002382
0.016	0.1515	0.072107	0.4698	0.033	0.00238
0.017	0.1505	0.071158	0.504	0.0342	0.002434
0.018	0.1495	0.070215	0.5368	0.0328	0.002303
0.019	0.1485	0.069279	0.5744	0.0376	0.002605
0.02	0.1475	0.068349	0.6136	0.0392	0.002679
0.021	0.1465	0.067426	0.6398	0.0262	0.001767
0.022	0.1455	0.066508	0.6728	0.033	0.002195
0.023	0.1445	0.065597	0.7058	0.033	0.002165
0.024	0.1435	0.064692	0.733	0.0272	0.00176
0.025	0.1425	0.063794	0.7678	0.0348	0.00222
0.026	0.1415	0.062902	0.799	0.0312	0.001963
0.027	0.1405	0.062016	0.8318	0.0328	0.002034
0.028	0.1395	0.061136	0.8668	0.035	0.00214
0.029	0.1385	0.060263	0.9	0.0332	0.002001
0.03	0.1375	0.059396	0.9364	0.0364	0.002162
0.031	0.1365	0.058535	0.9692	0.0328	0.00192
0.032	0.1355	0.05768	1.0034	0.0342	0.001973
0.033	0.1345	0.056832	1.0416	0.0382	0.002171
0.034	0.1335	0.05599	1.0758	0.0342	0.001915
0.035	0.1325	0.055155	1.1086	0.0328	0.001809
0.036	0.1315	0.054325	1.1432	0.0346	0.00188
0.037	0.1305	0.053502	1.1782	0.035	0.001873
0.038	0.1295	0.052685	1.2186	0.0404	0.002128

0.039	0.1285	0.051875	1.2524	0.0338	0.001753
0.04	0.1275	0.051071	1.2874	0.035	0.001787
0.041	0.1265	0.050273	1.3238	0.0364	0.00183
0.042	0.1255	0.049481	1.3636	0.0398	0.001969
0.043	0.1245	0.048695	1.3966	0.033	0.001607
0.044	0.1235	0.047916	1.435	0.0384	0.00184
0.045	0.1225	0.047144	1.4692	0.0342	0.001612
0.046	0.1215	0.046377	1.5032	0.034	0.001577
0.047	0.1205	0.045617	1.5394	0.0362	0.001651
0.048	0.1195	0.044863	1.575	0.0356	0.001597
0.049	0.1185	0.044115	1.61	0.035	0.001544
0.05	0.1175	0.043374	1.644	0.034	0.001475
0.051	0.1165	0.042638	1.681	0.037	0.001578
0.052	0.1155	0.04191	1.7172	0.0362	0.001517
0.053	0.1145	0.041187	1.7508	0.0336	0.001384
0.054	0.1135	0.040471	1.7866	0.0358	0.001449
0.055	0.1125	0.039761	1.8218	0.0352	0.0014
0.056	0.1115	0.039057	1.858	0.0362	0.001414
0.057	0.1105	0.03836	1.8932	0.0352	0.00135
0.058	0.1095	0.037668	1.9316	0.0384	0.001446
0.059	0.1085	0.036984	1.9678	0.0362	0.001339
0.06	0.1075	0.036305	2.0032	0.0354	0.001285
0.061	0.1065	0.035633	2.0384	0.0352	0.001254
0.062	0.1055	0.034967	2.0702	0.0318	0.001112
0.063	0.1045	0.034307	2.1032	0.033	0.001132
0.064	0.1035	0.033654	2.1318	0.0286	0.000962
0.065	0.1025	0.033006	2.1564	0.0246	0.000812
0.066	0.1015	0.032365	2.1806	0.0242	0.000783
0.067	0.1005	0.031731	2.1992	0.0186	0.00059
0.068	0.0995	0.031103	2.222	0.0228	0.000709
0.069	0.0985	0.030481	2.2404	0.0184	0.000561
0.07	0.0975	0.029865	2.2572	0.0168	0.000502
0.071	0.0965	0.029255	2.2752	0.018	0.000527
0.072	0.0955	0.028652	2.294	0.0188	0.000539
0.073	0.0945	0.028055	2.3072	0.0132	0.00037
0.074	0.0935	0.027465	2.323	0.0158	0.000434
0.075	0.0925	0.02688	2.3394	0.0164	0.000441
0.076	0.0915	0.026302	2.352	0.0126	0.000331
0.077	0.0905	0.02573	2.3624	0.0104	0.000268
0.078	0.0895	0.025165	2.3764	0.014	0.000352
0.079	0.0885	0.024606	2.3864	0.01	0.000246

0.08	0.0875	0.024053	2.3978	0.0114	0.000274
0.081	0.0865	0.023506	2.407	0.0092	0.000216
0.082	0.0855	0.022966	2.4154	0.0084	0.000193
0.083	0.0845	0.022432	2.422	0.0066	0.000148
0.084	0.0835	0.021904	2.4322	0.0102	0.000223
0.085	0.0825	0.021382	2.4406	0.0084	0.00018
0.086	0.0815	0.020867	2.448	0.0074	0.000154
0.087	0.0805	0.020358	2.4566	0.0086	0.000175
0.088	0.0795	0.019856	2.4672	0.0106	0.00021
0.089	0.0785	0.019359	2.4814	0.0142	0.000275
0.09	0.0775	0.018869	2.4928	0.0114	0.000215
0.091	0.0765	0.018385	2.503	0.0102	0.000188
0.092	0.0755	0.017908	2.5218	0.0188	0.000337
0.093	0.0745	0.017437	2.5416	0.0198	0.000345
0.094	0.0735	0.016972	2.566	0.0244	0.000414
0.095	0.0725	0.016513	2.5936	0.0276	0.000456
0.0955	0.072	0.016286	2.645	0.0514	0.000837
0.0955	0.072	0.016286	2.875	0.23	0.003746
					0
					0.137931
					Total Volume

G7C					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume Coordinate
0	0.165	0.08553	0		
0.001	0.164	0.084496	0.0538	0.0538	0.004546
0.002	0.163	0.083469	0.0662	0.0124	0.001035
0.003	0.162	0.082448	0.0794	0.0132	0.001088
0.004	0.161	0.081433	0.0988	0.0194	0.00158
0.005	0.16	0.080425	0.1154	0.0166	0.001335
0.006	0.159	0.079423	0.132	0.0166	0.001318
0.007	0.158	0.078427	0.1494	0.0174	0.001365
0.008	0.157	0.077437	0.1732	0.0238	0.001843
0.009	0.156	0.076454	0.19	0.0168	0.001284
0.01	0.155	0.075477	0.2134	0.0234	0.001766
0.011	0.154	0.074506	0.2408	0.0274	0.002041
0.012	0.153	0.073542	0.2692	0.0284	0.002089
0.013	0.152	0.072583	0.3038	0.0346	0.002511
0.014	0.151	0.071631	0.3386	0.0348	0.002493
0.015	0.15	0.070686	0.38	0.0414	0.002926
0.016	0.149	0.069746	0.4228	0.0428	0.002985
0.017	0.148	0.068813	0.4648	0.042	0.00289
0.018	0.147	0.067887	0.504	0.0392	0.002661
0.019	0.146	0.066966	0.538	0.034	0.002277
0.02	0.145	0.066052	0.5782	0.0402	0.002655
0.021	0.144	0.065144	0.622	0.0438	0.002853
0.022	0.143	0.064242	0.6556	0.0336	0.002159
0.023	0.142	0.063347	0.6966	0.041	0.002597
0.024	0.141	0.062458	0.7416	0.045	0.002811
0.025	0.14	0.061575	0.779	0.0374	0.002303
0.026	0.139	0.060699	0.8204	0.0414	0.002513
0.027	0.138	0.059828	0.87	0.0496	0.002967
0.028	0.137	0.058965	0.9162	0.0462	0.002724
0.029	0.136	0.058107	0.9678	0.0516	0.002998
0.03	0.135	0.057256	1.0116	0.0438	0.002508
0.031	0.134	0.05641	1.0632	0.0516	0.002911
0.032	0.133	0.055572	1.1092	0.046	0.002556
0.033	0.132	0.054739	1.1584	0.0492	0.002693
0.034	0.131	0.053913	1.2064	0.048	0.002588
0.035	0.13	0.053093	1.2474	0.041	0.002177
0.036	0.129	0.052279	1.2954	0.048	0.002509
0.037	0.128	0.051472	1.3372	0.0418	0.002152
0.038	0.127	0.050671	1.3786	0.0414	0.002098

0.039	0.126	0.049876	1.4202	0.0416	0.002075
0.04	0.125	0.049087	1.4548	0.0346	0.001698
0.041	0.124	0.048305	1.4924	0.0376	0.001816
0.042	0.123	0.047529	1.527	0.0346	0.001645
0.043	0.122	0.046759	1.5632	0.0362	0.001693
0.044	0.121	0.045996	1.5964	0.0332	0.001527
0.045	0.12	0.045239	1.6296	0.0332	0.001502
0.046	0.119	0.044488	1.6626	0.033	0.001468
0.047	0.118	0.043744	1.6922	0.0296	0.001295
0.048	0.117	0.043005	1.7206	0.0284	0.001221
0.049	0.116	0.042273	1.752	0.0314	0.001327
0.05	0.115	0.041548	1.7822	0.0302	0.001255
0.051	0.114	0.040828	1.8126	0.0304	0.001241
0.052	0.113	0.040115	1.838	0.0254	0.001019
0.053	0.112	0.039408	1.8658	0.0278	0.001096
0.054	0.111	0.038708	1.8906	0.0248	0.00096
0.055	0.11	0.038013	1.9192	0.0286	0.001087
0.056	0.109	0.037325	1.943	0.0238	0.000888
0.057	0.108	0.036644	1.9714	0.0284	0.001041
0.058	0.107	0.035968	1.996	0.0246	0.000885
0.059	0.106	0.035299	2.0252	0.0292	0.001031
0.06	0.105	0.034636	2.0474	0.0222	0.000769
0.061	0.104	0.033979	2.0714	0.024	0.000816
0.062	0.103	0.033329	2.0964	0.025	0.000833
0.063	0.102	0.032685	2.1192	0.0228	0.000745
0.064	0.101	0.032047	2.1412	0.022	0.000705
0.065	0.1	0.031416	2.1702	0.029	0.000911
0.066	0.099	0.030791	2.197	0.0268	0.000825
0.067	0.098	0.030172	2.2196	0.0226	0.000682
0.068	0.097	0.029559	2.2438	0.0242	0.000715
0.069	0.096	0.028953	2.2674	0.0236	0.000683
0.07	0.095	0.028353	2.293	0.0256	0.000726
0.071	0.094	0.027759	2.3178	0.0248	0.000688
0.072	0.093	0.027172	2.3428	0.025	0.000679
0.073	0.092	0.02659	2.3704	0.0276	0.000734
0.074	0.091	0.026016	2.391	0.0206	0.000536
0.075	0.09	0.025447	2.4128	0.0218	0.000555
0.076	0.089	0.024885	2.434	0.0212	0.000528
0.077	0.088	0.024328	2.4556	0.0216	0.000525
0.078	0.087	0.023779	2.4744	0.0188	0.000447
0.079	0.086	0.023235	2.4984	0.024	0.000558

0.08	0.085	0.022698	2.523	0.0246	0.000558
0.081	0.084	0.022167	2.541	0.018	0.000399
0.082	0.083	0.021642	2.5594	0.0184	0.000398
0.083	0.082	0.021124	2.5806	0.0212	0.000448
0.084	0.081	0.020612	2.5996	0.019	0.000392
0.085	0.08	0.020106	2.6206	0.021	0.000422
0.086	0.079	0.019607	2.6362	0.0156	0.000306
0.087	0.078	0.019113	2.66	0.0238	0.000455
0.088	0.077	0.018627	2.6774	0.0174	0.000324
0.089	0.076	0.018146	2.6972	0.0198	0.000359
0.09	0.075	0.017671	2.7198	0.0226	0.000399
0.091	0.074	0.017203	2.7392	0.0194	0.000334
0.092	0.073	0.016742	2.7598	0.0206	0.000345
0.093	0.072	0.016286	2.7808	0.021	0.000342
0.093	0.072	0.016286	2.815	0.0692	0.001127
					0.136845
					Total Volume

YC					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume coordinate
0	0.1695	0.090259	0		
0.001	0.1685	0.089197	0.0882	0.0882	0.007867
0.002	0.1675	0.088141	0.1024	0.0142	0.001252
0.003	0.1665	0.087092	0.1156	0.0132	0.00115
0.004	0.1655	0.086049	0.127	0.0114	0.000981
0.005	0.1645	0.085012	0.1416	0.0146	0.001241
0.006	0.1635	0.083982	0.1548	0.0132	0.001109
0.007	0.1625	0.082958	0.1728	0.018	0.001493
0.008	0.1615	0.08194	0.1918	0.019	0.001557
0.009	0.1605	0.080928	0.2142	0.0224	0.001813
0.01	0.1595	0.079923	0.236	0.0218	0.001742
0.011	0.1585	0.078924	0.2544	0.0184	0.001452
0.012	0.1575	0.077931	0.2828	0.0284	0.002213
0.013	0.1565	0.076945	0.3078	0.025	0.001924
0.014	0.1555	0.075964	0.332	0.0242	0.001838
0.015	0.1545	0.074991	0.3586	0.0266	0.001995
0.016	0.1535	0.074023	0.3834	0.0248	0.001836
0.017	0.1525	0.073062	0.4042	0.0208	0.00152
0.018	0.1515	0.072107	0.425	0.0208	0.0015
0.019	0.1505	0.071158	0.449	0.024	0.001708
0.02	0.1495	0.070215	0.481	0.032	0.002247
0.021	0.1485	0.069279	0.5124	0.0314	0.002175
0.022	0.1475	0.068349	0.539	0.0266	0.001818
0.023	0.1465	0.067426	0.5648	0.0258	0.00174
0.024	0.1455	0.066508	0.5926	0.0278	0.001849
0.025	0.1445	0.065597	0.6172	0.0246	0.001614
0.026	0.1435	0.064692	0.6454	0.0282	0.001824
0.027	0.1425	0.063794	0.6712	0.0258	0.001646
0.028	0.1415	0.062902	0.6966	0.0254	0.001598
0.029	0.1405	0.062016	0.7268	0.0302	0.001873
0.03	0.1395	0.061136	0.75	0.0232	0.001418
0.031	0.1385	0.060263	0.7768	0.0268	0.001615
0.032	0.1375	0.059396	0.8032	0.0264	0.001568
0.033	0.1365	0.058535	0.8304	0.0272	0.001592
0.034	0.1355	0.05768	0.8596	0.0292	0.001684
0.035	0.1345	0.056832	0.8854	0.0258	0.001466
0.036	0.1335	0.05599	0.9166	0.0312	0.001747
0.037	0.1325	0.055155	0.9518	0.0352	0.001941
0.038	0.1315	0.054325	0.9808	0.029	0.001575

0.039	0.1305	0.053502	1.0172	0.0364	0.001947
0.04	0.1295	0.052685	1.0496	0.0324	0.001707
0.041	0.1285	0.051875	1.0716	0.022	0.001141
0.042	0.1275	0.051071	1.1294	0.0578	0.002952
0.043	0.1265	0.050273	1.1798	0.0504	0.002534
0.044	0.1255	0.049481	1.222	0.0422	0.002088
0.045	0.1245	0.048695	1.2708	0.0488	0.002376
0.046	0.1235	0.047916	1.3222	0.0514	0.002463
0.047	0.1225	0.047144	1.3716	0.0494	0.002329
0.048	0.1215	0.046377	1.42	0.0484	0.002245
0.049	0.1205	0.045617	1.4624	0.0424	0.001934
0.05	0.1195	0.044863	1.5152	0.0528	0.002369
0.051	0.1185	0.044115	1.559	0.0438	0.001932
0.052	0.1175	0.043374	1.6068	0.0478	0.002073
0.053	0.1165	0.042638	1.6568	0.05	0.002132
0.054	0.1155	0.04191	1.7006	0.0438	0.001836
0.055	0.1145	0.041187	1.744	0.0434	0.001788
0.056	0.1135	0.040471	1.7918	0.0478	0.001935
0.057	0.1125	0.039761	1.8342	0.0424	0.001686
0.058	0.1115	0.039057	1.8726	0.0384	0.0015
0.059	0.1105	0.03836	1.906	0.0334	0.001281
0.06	0.1095	0.037668	1.929	0.023	0.000866
0.061	0.1085	0.036984	1.9662	0.0372	0.001376
0.062	0.1075	0.036305	1.9936	0.0274	0.000995
0.063	0.1065	0.035633	2.0186	0.025	0.000891
0.064	0.1055	0.034967	2.0434	0.0248	0.000867
0.065	0.1045	0.034307	2.0666	0.0232	0.000796
0.066	0.1035	0.033654	2.0914	0.0248	0.000835
0.067	0.1025	0.033006	2.1122	0.0208	0.000687
0.068	0.1015	0.032365	2.1342	0.022	0.000712
0.069	0.1005	0.031731	2.1562	0.022	0.000698
0.07	0.0995	0.031103	2.179	0.0228	0.000709
0.071	0.0985	0.030481	2.2006	0.0216	0.000658
0.072	0.0975	0.029865	2.2238	0.0232	0.000693
0.073	0.0965	0.029255	2.2432	0.0194	0.000568
0.074	0.0955	0.028652	2.2656	0.0224	0.000642
0.075	0.0945	0.028055	2.2886	0.023	0.000645
0.076	0.0935	0.027465	2.3082	0.0196	0.000538
0.077	0.0925	0.02688	2.327	0.0188	0.000505
0.078	0.0915	0.026302	2.3536	0.0266	0.0007
0.079	0.0905	0.02573	2.376	0.0224	0.000576

0.08	0.0895	0.025165	2.3972	0.0212	0.000533
0.081	0.0885	0.024606	2.4186	0.0214	0.000527
0.082	0.0875	0.024053	2.441	0.0224	0.000539
0.083	0.0865	0.023506	2.4616	0.0206	0.000484
0.084	0.0855	0.022966	2.4772	0.0156	0.000358
0.085	0.0845	0.022432	2.5066	0.0294	0.000659
0.086	0.0835	0.021904	2.5268	0.0202	0.000442
0.087	0.0825	0.021382	2.5492	0.0224	0.000479
0.088	0.0815	0.020867	2.5662	0.017	0.000355
0.089	0.0805	0.020358	2.592	0.0258	0.000525
0.09	0.0795	0.019856	2.6116	0.0196	0.000389
0.091	0.0785	0.019359	2.6354	0.0238	0.000461
0.092	0.0775	0.018869	2.6564	0.021	0.000396
0.093	0.0765	0.018385	2.6822	0.0258	0.000474
0.094	0.0755	0.017908	2.7004	0.0182	0.000326
0.095	0.0745	0.017437	2.7202	0.0198	0.000345
0.096	0.0735	0.016972	2.742	0.0218	0.00037
0.097	0.0725	0.016513	2.7608	0.0188	0.00031
0.0975	0.072	0.016286	2.815	0.0892	0.001453
					0.135812
					Total Volume

B24					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume coordinate
0	0.161	0.081433	0		
0.001	0.16	0.080425	0.1138	0.1138	0.009152
0.002	0.159	0.079423	0.1308	0.017	0.00135
0.003	0.158	0.078427	0.1472	0.0164	0.001286
0.004	0.157	0.077437	0.1698	0.0226	0.00175
0.005	0.156	0.076454	0.1958	0.026	0.001988
0.006	0.155	0.075477	0.2232	0.0274	0.002068
0.007	0.154	0.074506	0.2508	0.0276	0.002056
0.008	0.153	0.073542	0.2838	0.033	0.002427
0.009	0.152	0.072583	0.3086	0.0248	0.0018
0.01	0.151	0.071631	0.3402	0.0316	0.002264
0.011	0.15	0.070686	0.372	0.0318	0.002248
0.012	0.149	0.069746	0.4	0.028	0.001953
0.013	0.148	0.068813	0.4258	0.0258	0.001775
0.014	0.147	0.067887	0.4548	0.029	0.001969
0.015	0.146	0.066966	0.4864	0.0316	0.002116
0.016	0.145	0.066052	0.5126	0.0262	0.001731
0.017	0.144	0.065144	0.5408	0.0282	0.001837
0.018	0.143	0.064242	0.5642	0.0234	0.001503
0.019	0.142	0.063347	0.5912	0.027	0.00171
0.02	0.141	0.062458	0.6194	0.0282	0.001761
0.021	0.14	0.061575	0.649	0.0296	0.001823
0.022	0.139	0.060699	0.6744	0.0254	0.001542
0.023	0.138	0.059828	0.7244	0.05	0.002991
0.024	0.137	0.058965	0.7754	0.051	0.003007
0.025	0.136	0.058107	0.8474	0.072	0.004184
0.026	0.135	0.057256	0.8992	0.0518	0.002966
0.027	0.134	0.05641	0.9498	0.0506	0.002854
0.028	0.133	0.055572	0.9942	0.0444	0.002467
0.029	0.132	0.054739	1.0328	0.0386	0.002113
0.03	0.131	0.053913	1.0746	0.0418	0.002254
0.031	0.13	0.053093	1.107	0.0324	0.00172
0.032	0.129	0.052279	1.1442	0.0372	0.001945
0.033	0.128	0.051472	1.1814	0.0372	0.001915
0.034	0.127	0.050671	1.2096	0.0282	0.001429
0.035	0.126	0.049876	1.2478	0.0382	0.001905
0.036	0.125	0.049087	1.2808	0.033	0.00162
0.037	0.124	0.048305	1.312	0.0312	0.001507
0.038	0.123	0.047529	1.3524	0.0404	0.00192

0.039	0.122	0.046759	1.385	0.0326	0.001524
0.04	0.121	0.045996	1.427	0.042	0.001932
0.041	0.12	0.045239	1.4614	0.0344	0.001556
0.042	0.119	0.044488	1.5024	0.041	0.001824
0.043	0.118	0.043744	1.5534	0.051	0.002231
0.044	0.117	0.043005	1.6	0.0466	0.002004
0.045	0.116	0.042273	1.6532	0.0532	0.002249
0.046	0.115	0.041548	1.6956	0.0424	0.001762
0.047	0.114	0.040828	1.7468	0.0512	0.00209
0.048	0.113	0.040115	1.7808	0.034	0.001364
0.049	0.112	0.039408	1.8166	0.0358	0.001411
0.05	0.111	0.038708	1.8498	0.0332	0.001285
0.051	0.11	0.038013	1.8804	0.0306	0.001163
0.052	0.109	0.037325	1.9152	0.0348	0.001299
0.053	0.108	0.036644	1.9426	0.0274	0.001004
0.054	0.107	0.035968	1.9748	0.0322	0.001158
0.055	0.106	0.035299	2.005	0.0302	0.001066
0.056	0.105	0.034636	2.038	0.033	0.001143
0.057	0.104	0.033979	2.0704	0.0324	0.001101
0.058	0.103	0.033329	2.1006	0.0302	0.001007
0.059	0.102	0.032685	2.1238	0.0232	0.000758
0.06	0.101	0.032047	2.1442	0.0204	0.000654
0.061	0.1	0.031416	2.171	0.0268	0.000842
0.062	0.099	0.030791	2.193	0.022	0.000677
0.063	0.098	0.030172	2.216	0.023	0.000694
0.064	0.097	0.029559	2.2374	0.0214	0.000633
0.065	0.096	0.028953	2.2562	0.0188	0.000544
0.066	0.095	0.028353	2.2768	0.0206	0.000584
0.067	0.094	0.027759	2.2942	0.0174	0.000483
0.068	0.093	0.027172	2.309	0.0148	0.000402
0.069	0.092	0.02659	2.325	0.016	0.000425
0.07	0.091	0.026016	2.3428	0.0178	0.000463
0.071	0.09	0.025447	2.3612	0.0184	0.000468
0.072	0.089	0.024885	2.3796	0.0184	0.000458
0.073	0.088	0.024328	2.397	0.0174	0.000423
0.074	0.087	0.023779	2.4174	0.0204	0.000485
0.075	0.086	0.023235	2.4414	0.024	0.000558
0.076	0.085	0.022698	2.4646	0.0232	0.000527
0.077	0.084	0.022167	2.492	0.0274	0.000607
0.078	0.083	0.021642	2.5262	0.0342	0.00074
0.079	0.082	0.021124	2.5494	0.0232	0.00049

0.08	0.081	0.020612	2.5846	0.0352	0.000726
0.081	0.08	0.020106	2.611	0.0264	0.000531
0.082	0.079	0.019607	2.6322	0.0212	0.000416
0.083	0.078	0.019113	2.663	0.0308	0.000589
0.084	0.077	0.018627	2.7096	0.0466	0.000868
0.085	0.076	0.018146	2.7398	0.0302	0.000548
0.086	0.075	0.017671	2.7664	0.0266	0.00047
0.087	0.074	0.017203	2.7992	0.0328	0.000564
0.088	0.073	0.016742	2.8318	0.0326	0.000546
0.089	0.072	0.016286	2.85	0.0182	0.000296
					0.132549
					Total Volume

B7					
indicator	indicator + throat	area square in	length coordinate	length segment	Volume coordinate
0	0.1665	0.087092	0		
0.001	0.1655	0.086049	0.0426	0.0426	0.003666
0.002	0.1645	0.085012	0.057	0.0144	0.001224
0.003	0.1635	0.083982	0.07	0.013	0.001092
0.004	0.1625	0.082958	0.088	0.018	0.001493
0.005	0.1615	0.08194	0.0986	0.0106	0.000869
0.006	0.1605	0.080928	0.1218	0.0232	0.001878
0.007	0.1595	0.079923	0.1342	0.0124	0.000991
0.008	0.1585	0.078924	0.1464	0.0122	0.000963
0.009	0.1575	0.077931	0.1644	0.018	0.001403
0.01	0.1565	0.076945	0.2	0.0356	0.002739
0.011	0.1555	0.075964	0.2248	0.0248	0.001884
0.012	0.1545	0.074991	0.2472	0.0224	0.00168
0.013	0.1535	0.074023	0.2608	0.0136	0.001007
0.014	0.1525	0.073062	0.2838	0.023	0.00168
0.015	0.1515	0.072107	0.3184	0.0346	0.002495
0.016	0.1505	0.071158	0.3442	0.0258	0.001836
0.017	0.1495	0.070215	0.3782	0.034	0.002387
0.018	0.1485	0.069279	0.3962	0.018	0.001247
0.019	0.1475	0.068349	0.424	0.0278	0.0019
0.02	0.1465	0.067426	0.4498	0.0258	0.00174
0.021	0.1455	0.066508	0.4808	0.031	0.002062
0.022	0.1445	0.065597	0.5092	0.0284	0.001863
0.023	0.1435	0.064692	0.5376	0.0284	0.001837
0.024	0.1425	0.063794	0.5612	0.0236	0.001506
0.025	0.1415	0.062902	0.5872	0.026	0.001635
0.026	0.1405	0.062016	0.6178	0.0306	0.001898
0.027	0.1395	0.061136	0.64	0.0222	0.001357
0.028	0.1385	0.060263	0.6676	0.0276	0.001663
0.029	0.1375	0.059396	0.6968	0.0292	0.001734
0.03	0.1365	0.058535	0.731	0.0342	0.002002
0.031	0.1355	0.05768	0.7716	0.0406	0.002342
0.032	0.1345	0.056832	0.8084	0.0368	0.002091
0.033	0.1335	0.05599	0.8362	0.0278	0.001557
0.034	0.1325	0.055155	0.8722	0.036	0.001986
0.035	0.1315	0.054325	0.9052	0.033	0.001793
0.036	0.1305	0.053502	0.94	0.0348	0.001862
0.037	0.1295	0.052685	0.9882	0.0482	0.002539
0.038	0.1285	0.051875	1.0338	0.0456	0.002365
0.039	0.1275	0.051071	1.084	0.0502	0.002564

0.04	0.1265	0.050273	1.1282	0.0442	0.002222
0.041	0.1255	0.049481	1.1638	0.0356	0.001762
0.042	0.1245	0.048695	1.2058	0.042	0.002045
0.043	0.1235	0.047916	1.233	0.0272	0.001303
0.044	0.1225	0.047144	1.287	0.054	0.002546
0.045	0.1215	0.046377	1.3148	0.0278	0.001289
0.046	0.1205	0.045617	1.3532	0.0384	0.001752
0.047	0.1195	0.044863	1.394	0.0408	0.00183
0.048	0.1185	0.044115	1.4282	0.0342	0.001509
0.049	0.1175	0.043374	1.4834	0.0552	0.002394
0.05	0.1165	0.042638	1.528	0.0446	0.001902
0.051	0.1155	0.04191	1.5814	0.0534	0.002238
0.052	0.1145	0.041187	1.6368	0.0554	0.002282
0.053	0.1135	0.040471	1.6834	0.0466	0.001886
0.054	0.1125	0.039761	1.7606	0.0772	0.00307
0.055	0.1115	0.039057	1.8042	0.0436	0.001703
0.056	0.1105	0.03836	1.8706	0.0664	0.002547
0.057	0.1095	0.037668	1.9322	0.0616	0.00232
0.058	0.1085	0.036984	1.9632	0.031	0.001146
0.059	0.1075	0.036305	1.993	0.0298	0.001082
0.06	0.1065	0.035633	2.0118	0.0188	0.00067
0.061	0.1055	0.034967	2.0416	0.0298	0.001042
0.062	0.1045	0.034307	2.072	0.0304	0.001043
0.063	0.1035	0.033654	2.104	0.032	0.001077
0.064	0.1025	0.033006	2.1316	0.0276	0.000911
0.065	0.1015	0.032365	2.1618	0.0302	0.000977
0.066	0.1005	0.031731	2.1804	0.0186	0.00059
0.067	0.0995	0.031103	2.2066	0.0262	0.000815
0.068	0.0985	0.030481	2.2176	0.011	0.000335
0.069	0.0975	0.029865	2.2488	0.0312	0.000932
0.07	0.0965	0.029255	2.2698	0.021	0.000614
0.071	0.0955	0.028652	2.2826	0.0128	0.000367
0.072	0.0945	0.028055	2.302	0.0194	0.000544
0.073	0.0935	0.027465	2.324	0.022	0.000604
0.074	0.0925	0.02688	2.3366	0.0126	0.000339
0.075	0.0915	0.026302	2.3368	0.0002	0.000005
0.076	0.0905	0.02573	2.3372	0.0004	0.00001
0.077	0.0895	0.025165	2.3726	0.0354	0.000891
0.078	0.0885	0.024606	2.3898	0.0172	0.000423
0.079	0.0875	0.024053	2.3994	0.0096	0.000231
0.08	0.0865	0.023506	2.4226	0.0232	0.000545
0.081	0.0855	0.022966	2.4404	0.0178	0.000409
0.082	0.0845	0.022432	2.4564	0.016	0.000359

0.083	0.0835	0.021904	2.4824	0.026	0.00057
0.084	0.0825	0.021382	2.511	0.0286	0.000612
0.085	0.0815	0.020867	2.538	0.027	0.000563
0.086	0.0805	0.020358	2.5616	0.0236	0.00048
0.087	0.0795	0.019856	2.5842	0.0226	0.000449
0.088	0.0785	0.019359	2.6132	0.029	0.000561
0.089	0.0775	0.018869	2.6376	0.0244	0.00046
0.09	0.0765	0.018385	2.6664	0.0288	0.000529
0.091	0.0755	0.017908	2.6906	0.0242	0.000433
0.092	0.0745	0.017437	2.7322	0.0416	0.000725
0.093	0.0735	0.016972	2.7954	0.0632	0.001073
0.094	0.0725	0.016513	2.825	0.0296	0.000489
0.0945	0.072	0.016286	2.815	0.025	0.000407
					0.130743
					Total Volume

B76					
indicator	indicator + throat	area square in	length coordinate	length segment	Volume coordinate
0	0.1615	0.08194	0		
0.001	0.1605	0.080928	0.0448	0.0448	0.003626
0.002	0.1595	0.079923	0.0634	0.0186	0.001487
0.003	0.1585	0.078924	0.086	0.0226	0.001784
0.004	0.1575	0.077931	0.1114	0.0254	0.001979
0.005	0.1565	0.076945	0.1352	0.0238	0.001831
0.006	0.1555	0.075964	0.1558	0.0206	0.001565
0.007	0.1545	0.074991	0.1778	0.022	0.00165
0.008	0.1535	0.074023	0.199	0.0212	0.001569
0.009	0.1525	0.073062	0.2204	0.0214	0.001564
0.01	0.1515	0.072107	0.241	0.0206	0.001485
0.011	0.1505	0.071158	0.26	0.019	0.001352
0.012	0.1495	0.070215	0.2794	0.0194	0.001362
0.013	0.1485	0.069279	0.3022	0.0228	0.00158
0.014	0.1475	0.068349	0.3214	0.0192	0.001312
0.015	0.1465	0.067426	0.3426	0.0212	0.001429
0.016	0.1455	0.066508	0.3602	0.0176	0.001171
0.017	0.1445	0.065597	0.3808	0.0206	0.001351
0.018	0.1435	0.064692	0.402	0.0212	0.001371
0.019	0.1425	0.063794	0.4272	0.0252	0.001608
0.02	0.1415	0.062902	0.456	0.0288	0.001812
0.021	0.1405	0.062016	0.4794	0.0234	0.001451
0.022	0.1395	0.061136	0.507	0.0276	0.001687
0.023	0.1385	0.060263	0.5356	0.0286	0.001724
0.024	0.1375	0.059396	0.5624	0.0268	0.001592
0.025	0.1365	0.058535	0.5868	0.0244	0.001428
0.026	0.1355	0.05768	0.6166	0.0298	0.001719
0.027	0.1345	0.056832	0.6432	0.0266	0.001512
0.028	0.1335	0.05599	0.6758	0.0326	0.001825
0.029	0.1325	0.055155	0.7098	0.034	0.001875
0.03	0.1315	0.054325	0.7398	0.03	0.00163
0.031	0.1305	0.053502	0.7774	0.0376	0.002012
0.032	0.1295	0.052685	0.806	0.0286	0.001507
0.033	0.1285	0.051875	0.8384	0.0324	0.001681
0.034	0.1275	0.051071	0.8714	0.033	0.001685
0.035	0.1265	0.050273	0.9098	0.0384	0.00193
0.036	0.1255	0.049481	0.9512	0.0414	0.002049
0.037	0.1245	0.048695	0.9954	0.0442	0.002152
0.038	0.1235	0.047916	1.0434	0.048	0.0023
0.039	0.1225	0.047144	1.0904	0.047	0.002216

0.04	0.1215	0.046377	1.1312	0.0408	0.001892
0.041	0.1205	0.045617	1.197	0.0658	0.003002
0.042	0.1195	0.044863	1.2756	0.0786	0.003526
0.043	0.1185	0.044115	1.3568	0.0812	0.003582
0.044	0.1175	0.043374	1.4366	0.0798	0.003461
0.045	0.1165	0.042638	1.4858	0.0492	0.002098
0.046	0.1155	0.04191	1.5514	0.0656	0.002749
0.047	0.1145	0.041187	1.6106	0.0592	0.002438
0.048	0.1135	0.040471	1.6688	0.0582	0.002355
0.049	0.1125	0.039761	1.7112	0.0424	0.001686
0.05	0.1115	0.039057	1.7556	0.0444	0.001734
0.051	0.1105	0.03836	1.7998	0.0442	0.001695
0.052	0.1095	0.037668	1.8444	0.0446	0.00168
0.053	0.1085	0.036984	1.8862	0.0418	0.001546
0.054	0.1075	0.036305	1.9202	0.034	0.001234
0.055	0.1065	0.035633	1.9446	0.0244	0.000869
0.056	0.1055	0.034967	1.9604	0.0158	0.000552
0.057	0.1045	0.034307	1.9824	0.022	0.000755
0.058	0.1035	0.033654	2.0056	0.0232	0.000781
0.059	0.1025	0.033006	2.0234	0.0178	0.000588
0.06	0.1015	0.032365	2.044	0.0206	0.000667
0.061	0.1005	0.031731	2.0634	0.0194	0.000616
0.062	0.0995	0.031103	2.083	0.0196	0.00061
0.063	0.0985	0.030481	2.1048	0.0218	0.000664
0.064	0.0975	0.029865	2.1254	0.0206	0.000615
0.065	0.0965	0.029255	2.1482	0.0228	0.000667
0.066	0.0955	0.028652	2.169	0.0208	0.000596
0.067	0.0945	0.028055	2.1864	0.0174	0.000488
0.068	0.0935	0.027465	2.2096	0.0232	0.000637
0.069	0.0925	0.02688	2.2288	0.0192	0.000516
0.07	0.0915	0.026302	2.2466	0.0178	0.000468
0.071	0.0905	0.02573	2.2712	0.0246	0.000633
0.072	0.0895	0.025165	2.2958	0.0246	0.000619
0.073	0.0885	0.024606	2.31	0.0142	0.000349
0.074	0.0875	0.024053	2.3328	0.0228	0.000548
0.075	0.0865	0.023506	2.3484	0.0156	0.000367
0.076	0.0855	0.022966	2.375	0.0266	0.000611
0.077	0.0845	0.022432	2.3958	0.0208	0.000467
0.078	0.0835	0.021904	2.4074	0.0116	0.000254
0.079	0.0825	0.021382	2.4502	0.0428	0.000915
0.08	0.0815	0.020867	2.4846	0.0344	0.000718
0.081	0.0805	0.020358	2.5206	0.036	0.000733
0.082	0.0795	0.019856	2.5494	0.0288	0.000572

0.083	0.0785	0.019359	2.5906	0.0412	0.000798
0.084	0.0775	0.018869	2.6152	0.0246	0.000464
0.085	0.0765	0.018385	2.6496	0.0344	0.000632
0.086	0.0755	0.017908	2.6972	0.0476	0.000852
0.087	0.0745	0.017437	2.728	0.0308	0.000537
0.088	0.0735	0.016972	2.776	0.048	0.000815
0.089	0.0725	0.016513	2.8322	0.0562	0.000928
0.0895	0.072	0.016286	2.815	0.0178	0.00029
					0.123733
					Total Volume

B10					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume coordinate
0	0.16	0.080425	0		
0.001	0.159	0.079423	0.0796	0.0796	0.006322
0.002	0.158	0.078427	0.0848	0.0052	0.000408
0.003	0.157	0.077437	0.0924	0.0076	0.000589
0.004	0.156	0.076454	0.0988	0.0064	0.000489
0.005	0.155	0.075477	0.1064	0.0076	0.000574
0.006	0.154	0.074506	0.1204	0.014	0.001043
0.007	0.153	0.073542	0.136	0.0156	0.001147
0.008	0.152	0.072583	0.1572	0.0212	0.001539
0.009	0.151	0.071631	0.1808	0.0236	0.001691
0.01	0.15	0.070686	0.2092	0.0284	0.002007
0.011	0.149	0.069746	0.2406	0.0314	0.00219
0.012	0.148	0.068813	0.2656	0.025	0.00172
0.013	0.147	0.067887	0.2942	0.0286	0.001942
0.014	0.146	0.066966	0.3198	0.0256	0.001714
0.015	0.145	0.066052	0.3454	0.0256	0.001691
0.016	0.144	0.065144	0.3698	0.0244	0.00159
0.017	0.143	0.064242	0.3952	0.0254	0.001632
0.018	0.142	0.063347	0.4218	0.0266	0.001685
0.019	0.141	0.062458	0.4462	0.0244	0.001524
0.02	0.14	0.061575	0.4728	0.0266	0.001638
0.021	0.139	0.060699	0.4936	0.0208	0.001263
0.022	0.138	0.059828	0.5238	0.0302	0.001807
0.023	0.137	0.058965	0.5494	0.0256	0.001509
0.024	0.136	0.058107	0.575	0.0256	0.001488
0.025	0.135	0.057256	0.602	0.027	0.001546
0.026	0.134	0.05641	0.6292	0.0272	0.001534
0.027	0.133	0.055572	0.653	0.0238	0.001323
0.028	0.132	0.054739	0.6852	0.0322	0.001763
0.029	0.131	0.053913	0.7172	0.032	0.001725
0.03	0.13	0.053093	0.7464	0.0292	0.00155
0.031	0.129	0.052279	0.7756	0.0292	0.001527
0.032	0.128	0.051472	0.8066	0.031	0.001596
0.033	0.127	0.050671	0.8364	0.0298	0.00151
0.034	0.126	0.049876	0.8732	0.0368	0.001835
0.035	0.125	0.049087	0.9102	0.037	0.001816
0.036	0.124	0.048305	0.9484	0.0382	0.001845
0.037	0.123	0.047529	0.9852	0.0368	0.001749
0.038	0.122	0.046759	1.0296	0.0444	0.002076
0.039	0.121	0.045996	1.0726	0.043	0.001978

0.04	0.12	0.045239	1.1152	0.0426	0.001927
0.041	0.119	0.044488	1.1576	0.0424	0.001886
0.042	0.118	0.043744	1.2116	0.054	0.002362
0.043	0.117	0.043005	1.2674	0.0558	0.0024
0.044	0.116	0.042273	1.32	0.0526	0.002224
0.045	0.115	0.041548	1.3716	0.0516	0.002144
0.046	0.114	0.040828	1.4572	0.0856	0.003495
0.047	0.113	0.040115	1.5718	0.1146	0.004597
0.048	0.112	0.039408	1.706	0.1342	0.005289
0.049	0.111	0.038708	1.7754	0.0694	0.002686
0.05	0.11	0.038013	1.834	0.0586	0.002228
0.051	0.109	0.037325	1.8962	0.0622	0.002322
0.052	0.108	0.036644	1.9512	0.055	0.002015
0.053	0.107	0.035968	2.0026	0.0514	0.001849
0.054	0.106	0.035299	2.0314	0.0288	0.001017
0.055	0.105	0.034636	2.0914	0.06	0.002078
0.056	0.104	0.033979	2.1274	0.036	0.001223
0.057	0.103	0.033329	2.1544	0.027	0.0009
0.058	0.102	0.032685	2.1804	0.026	0.00085
0.059	0.101	0.032047	2.204	0.0236	0.000756
0.06	0.1	0.031416	2.2276	0.0236	0.000741
0.061	0.099	0.030791	2.2488	0.0212	0.000653
0.062	0.098	0.030172	2.273	0.0242	0.00073
0.063	0.097	0.029559	2.2916	0.0186	0.00055
0.064	0.096	0.028953	2.3084	0.0168	0.000486
0.065	0.095	0.028353	2.3268	0.0184	0.000522
0.066	0.094	0.027759	2.3402	0.0134	0.000372
0.067	0.093	0.027172	2.3578	0.0176	0.000478
0.068	0.092	0.02659	2.3716	0.0138	0.000367
0.069	0.091	0.026016	2.3816	0.01	0.00026
0.07	0.09	0.025447	2.3998	0.0182	0.000463
0.071	0.089	0.024885	2.4246	0.0248	0.000617
0.072	0.088	0.024328	2.4426	0.018	0.000438
0.073	0.087	0.023779	2.4552	0.0126	0.0003
0.074	0.086	0.023235	2.4664	0.0112	0.00026
0.075	0.085	0.022698	2.4834	0.017	0.000386
0.076	0.084	0.022167	2.5326	0.0492	0.001091
0.077	0.083	0.021642	2.5564	0.0238	0.000515
0.078	0.082	0.021124	2.587	0.0306	0.000646
0.079	0.081	0.020612	2.6118	0.0248	0.000511
0.08	0.08	0.020106	2.6428	0.031	0.000623
0.081	0.079	0.019607	2.6568	0.014	0.000274
0.082	0.078	0.019113	2.7126	0.0558	0.001067

0.083	0.077	0.018627	2.7208	0.0082	0.000153
0.084	0.076	0.018146	2.7286	0.0078	0.000142
0.085	0.075	0.017671	2.7966	0.068	0.001202
0.086	0.074	0.017203	2.8164	0.0198	0.000341
0.087	0.073	0.016742	2.8314	0.015	0.000251
0.088	0.072	0.016286	2.815	0.0186	0.00030292
					0.12356492
					Total Volume

YA					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume coordinate
0	0.171	0.091863	0		
0.001	0.17	0.090792	0.0044	0.0044	0.000399
0.002	0.169	0.089727	0.0076	0.0032	0.000287
0.003	0.168	0.088668	0.0122	0.0046	0.000408
0.004	0.167	0.087616	0.0176	0.0054	0.000473
0.005	0.166	0.08657	0.023	0.0054	0.000467
0.006	0.165	0.08553	0.029	0.006	0.000513
0.007	0.164	0.084496	0.0356	0.0066	0.000558
0.008	0.163	0.083469	0.0392	0.0036	0.0003
0.009	0.162	0.082448	0.0492	0.01	0.000824
0.01	0.161	0.081433	0.0558	0.0066	0.000537
0.011	0.16	0.080425	0.0636	0.0078	0.000627
0.012	0.159	0.079423	0.0804	0.0168	0.001334
0.013	0.158	0.078427	0.0946	0.0142	0.001114
0.014	0.157	0.077437	0.1122	0.0176	0.001363
0.015	0.156	0.076454	0.1324	0.0202	0.001544
0.016	0.155	0.075477	0.1528	0.0204	0.00154
0.017	0.154	0.074506	0.1752	0.0224	0.001669
0.018	0.153	0.073542	0.1952	0.02	0.001471
0.019	0.152	0.072583	0.2194	0.0242	0.001757
0.02	0.151	0.071631	0.2392	0.0198	0.001418
0.021	0.15	0.070686	0.2626	0.0234	0.001654
0.022	0.149	0.069746	0.2866	0.024	0.001674
0.023	0.148	0.068813	0.3116	0.025	0.00172
0.024	0.147	0.067887	0.3398	0.0282	0.001914
0.025	0.146	0.066966	0.3654	0.0256	0.001714
0.026	0.145	0.066052	0.391	0.0256	0.001691
0.027	0.144	0.065144	0.4158	0.0248	0.001616
0.028	0.143	0.064242	0.4432	0.0274	0.00176
0.029	0.142	0.063347	0.471	0.0278	0.001761
0.03	0.141	0.062458	0.4964	0.0254	0.001586
0.031	0.14	0.061575	0.5184	0.022	0.001355
0.032	0.139	0.060699	0.543	0.0246	0.001493
0.033	0.138	0.059828	0.5722	0.0292	0.001747
0.034	0.137	0.058965	0.5972	0.025	0.001474
0.035	0.136	0.058107	0.6234	0.0262	0.001522
0.036	0.135	0.057256	0.6568	0.0334	0.001912
0.037	0.134	0.05641	0.6818	0.025	0.00141
0.038	0.133	0.055572	0.71	0.0282	0.001567
0.039	0.132	0.054739	0.7322	0.0222	0.001215

0.04	0.131	0.053913	0.765	0.0328	0.001768
0.041	0.13	0.053093	0.7884	0.0234	0.001242
0.042	0.129	0.052279	0.8224	0.034	0.001777
0.043	0.128	0.051472	0.8586	0.0362	0.001863
0.044	0.127	0.050671	0.8886	0.03	0.00152
0.045	0.126	0.049876	0.926	0.0374	0.001865
0.046	0.125	0.049087	0.9646	0.0386	0.001895
0.047	0.124	0.048305	0.9934	0.0288	0.001391
0.048	0.123	0.047529	1.0266	0.0332	0.001578
0.049	0.122	0.046759	1.0686	0.042	0.001964
0.05	0.121	0.045996	1.1146	0.046	0.002116
0.051	0.12	0.045239	1.162	0.0474	0.002144
0.052	0.119	0.044488	1.2032	0.0412	0.001833
0.053	0.118	0.043744	1.2506	0.0474	0.002073
0.054	0.117	0.043005	1.3126	0.062	0.002666
0.055	0.116	0.042273	1.3566	0.044	0.00186
0.056	0.115	0.041548	1.4108	0.0542	0.002252
0.057	0.114	0.040828	1.4646	0.0538	0.002197
0.058	0.113	0.040115	1.5228	0.0582	0.002335
0.059	0.112	0.039408	1.5678	0.045	0.001773
0.06	0.111	0.038708	1.6372	0.0694	0.002686
0.061	0.11	0.038013	1.6962	0.059	0.002243
0.062	0.109	0.037325	1.751	0.0548	0.002045
0.063	0.108	0.036644	1.8006	0.0496	0.001818
0.064	0.107	0.035968	1.842	0.0414	0.001489
0.065	0.106	0.035299	1.879	0.037	0.001306
0.066	0.105	0.034636	1.9234	0.0444	0.001538
0.067	0.104	0.033979	1.9668	0.0434	0.001475
0.068	0.103	0.033329	1.9926	0.0258	0.00086
0.069	0.102	0.032685	2.0252	0.0326	0.001066
0.07	0.101	0.032047	2.057	0.0318	0.001019
0.071	0.1	0.031416	2.0884	0.0314	0.000986
0.072	0.099	0.030791	2.1136	0.0252	0.000776
0.073	0.098	0.030172	2.1444	0.0308	0.000929
0.074	0.097	0.029559	2.1616	0.0172	0.000508
0.075	0.096	0.028953	2.1916	0.03	0.000869
0.076	0.095	0.028353	2.213	0.0214	0.000607
0.077	0.094	0.027759	2.2344	0.0214	0.000594
0.078	0.093	0.027172	2.2534	0.019	0.000516
0.079	0.092	0.02659	2.2702	0.0168	0.000447
0.08	0.091	0.026016	2.291	0.0208	0.000541
0.081	0.09	0.025447	2.3128	0.0218	0.000555
0.082	0.089	0.024885	2.337	0.0242	0.000602

0.083	0.088	0.024328	2.3552	0.0182	0.000443
0.084	0.087	0.023779	2.3754	0.0202	0.00048
0.085	0.086	0.023235	2.3926	0.0172	0.0004
0.086	0.085	0.022698	2.4165	0.0239	0.000542
0.087	0.084	0.022167	2.4338	0.0173	0.000383
0.088	0.083	0.021642	2.4636	0.0298	0.000645
0.089	0.082	0.021124	2.4832	0.0196	0.000414
0.09	0.081	0.020612	2.5086	0.0254	0.000524
0.091	0.08	0.020106	2.5282	0.0196	0.000394
0.092	0.079	0.019607	2.5526	0.0244	0.000478
0.093	0.078	0.019113	2.5806	0.028	0.000535
0.094	0.077	0.018627	2.604	0.0234	0.000436
0.095	0.076	0.018146	2.6344	0.0304	0.000552
0.096	0.075	0.017671	2.6596	0.0252	0.000445
0.097	0.074	0.017203	2.6896	0.03	0.000516
0.098	0.073	0.016742	2.7312	0.0416	0.000696
0.099	0.072	0.016286	2.7758	0.0446	0.000726
0.099	0.072	0.016286	2.815	0.0742	0.001208421
					0.122792421
					Total Volume

YMG					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume coordinate
0	0.1595	0.079923	0		
0.001	0.1585	0.078924	0.0154	0.0154	0.001215
0.002	0.1575	0.077931	0.0368	0.0214	0.001668
0.003	0.1565	0.076945	0.0572	0.0204	0.00157
0.004	0.1555	0.075964	0.0732	0.016	0.001215
0.005	0.1545	0.074991	0.093	0.0198	0.001485
0.006	0.1535	0.074023	0.1108	0.0178	0.001318
0.007	0.1525	0.073062	0.1296	0.0188	0.001374
0.008	0.1515	0.072107	0.1466	0.017	0.001226
0.009	0.1505	0.071158	0.1688	0.0222	0.00158
0.01	0.1495	0.070215	0.192	0.0232	0.001629
0.011	0.1485	0.069279	0.2138	0.0218	0.00151
0.012	0.1475	0.068349	0.2358	0.022	0.001504
0.013	0.1465	0.067426	0.2616	0.0258	0.00174
0.014	0.1455	0.066508	0.2876	0.026	0.001729
0.015	0.1445	0.065597	0.3138	0.0262	0.001719
0.016	0.1435	0.064692	0.3386	0.0248	0.001604
0.017	0.1425	0.063794	0.3642	0.0256	0.001633
0.018	0.1415	0.062902	0.3906	0.0264	0.001661
0.019	0.1405	0.062016	0.4186	0.028	0.001736
0.02	0.1395	0.061136	0.448	0.0294	0.001797
0.021	0.1385	0.060263	0.4772	0.0292	0.00176
0.022	0.1375	0.059396	0.5142	0.037	0.002198
0.023	0.1365	0.058535	0.5486	0.0344	0.002014
0.024	0.1355	0.05768	0.585	0.0364	0.0021
0.025	0.1345	0.056832	0.6192	0.0342	0.001944
0.026	0.1335	0.05599	0.6556	0.0364	0.002038
0.027	0.1325	0.055155	0.6918	0.0362	0.001997
0.028	0.1315	0.054325	0.7056	0.0138	0.00075
0.029	0.1305	0.053502	0.7716	0.066	0.003531
0.03	0.1295	0.052685	0.8072	0.0356	0.001876
0.031	0.1285	0.051875	0.8496	0.0424	0.002199
0.032	0.1275	0.051071	0.8838	0.0342	0.001747
0.033	0.1265	0.050273	0.9376	0.0538	0.002705
0.034	0.1255	0.049481	0.9798	0.0422	0.002088
0.035	0.1245	0.048695	1.0154	0.0356	0.001734
0.036	0.1235	0.047916	1.0506	0.0352	0.001687
0.037	0.1225	0.047144	1.0824	0.0318	0.001499
0.038	0.1215	0.046377	1.1112	0.0288	0.001336
0.039	0.1205	0.045617	1.143	0.0318	0.001451

0.04	0.1195	0.044863	1.1896	0.0466	0.002091
0.041	0.1185	0.044115	1.2204	0.0308	0.001359
0.042	0.1175	0.043374	1.2548	0.0344	0.001492
0.043	0.1165	0.042638	1.2836	0.0288	0.001228
0.044	0.1155	0.04191	1.3172	0.0336	0.001408
0.045	0.1145	0.041187	1.3434	0.0262	0.001079
0.046	0.1135	0.040471	1.3716	0.0282	0.001141
0.047	0.1125	0.039761	1.4069	0.0353	0.001404
0.048	0.1115	0.039057	1.4362	0.0293	0.001144
0.049	0.1105	0.03836	1.4662	0.03	0.001151
0.05	0.1095	0.037668	1.5196	0.0534	0.002011
0.051	0.1085	0.036984	1.58	0.0604	0.002234
0.052	0.1075	0.036305	1.6424	0.0624	0.002265
0.053	0.1065	0.035633	1.6684	0.026	0.000926
0.054	0.1055	0.034967	1.7564	0.088	0.003077
0.055	0.1045	0.034307	1.811	0.0546	0.001873
0.056	0.1035	0.033654	1.8746	0.0636	0.00214
0.057	0.1025	0.033006	1.9102	0.0356	0.001175
0.058	0.1015	0.032365	1.9372	0.027	0.000874
0.059	0.1005	0.031731	1.9672	0.03	0.000952
0.06	0.0995	0.031103	2.0108	0.0436	0.001356
0.061	0.0985	0.030481	2.0379	0.0271	0.000826
0.062	0.0975	0.029865	2.066	0.0281	0.000839
0.063	0.0965	0.029255	2.0904	0.0244	0.000714
0.064	0.0955	0.028652	2.1132	0.0228	0.000653
0.065	0.0945	0.028055	2.1224	0.0092	0.000258
0.066	0.0935	0.027465	2.127	0.0046	0.000126
0.067	0.0925	0.02688	2.1888	0.0618	0.001661
0.068	0.0915	0.026302	2.2114	0.0226	0.000594
0.069	0.0905	0.02573	2.2328	0.0214	0.000551
0.07	0.0895	0.025165	2.2564	0.0236	0.000594
0.071	0.0885	0.024606	2.2804	0.024	0.000591
0.072	0.0875	0.024053	2.3058	0.0254	0.000611
0.073	0.0865	0.023506	2.3294	0.0236	0.000555
0.074	0.0855	0.022966	2.35	0.0206	0.000473
0.075	0.0845	0.022432	2.3732	0.0232	0.00052
0.076	0.0835	0.021904	2.3898	0.0166	0.000364
0.077	0.0825	0.021382	2.4228	0.033	0.000706
0.078	0.0815	0.020867	2.4372	0.0144	0.0003
0.079	0.0805	0.020358	2.463	0.0258	0.000525
0.08	0.0795	0.019856	2.493	0.03	0.000596
0.081	0.0785	0.019359	2.5184	0.0254	0.000492
0.082	0.0775	0.018869	2.5324	0.014	0.000264

0.083	0.0765	0.018385	2.565	0.0326	0.000599
0.084	0.0755	0.017908	2.5868	0.0218	0.00039
0.085	0.0745	0.017437	2.6088	0.022	0.000384
0.086	0.0735	0.016972	2.6338	0.025	0.000424
0.087	0.0725	0.016513	2.6588	0.025	0.000413
0.0875	0.072	0.016286	2.68	0.0212	0.000345
0.0875	0.072	0.016286	2.815	0.17	0.00276862
					0.11808362
					Total Volume

SA					
indicator	indicator + throat	area square in	length coordinate	length of segment	Volume coordinate
0	0.1715	0.092401	0		
0.001	0.1705	0.091327	0.004	0.004	0.000365
0.002	0.1695	0.090259	0.0072	0.0032	0.000289
0.003	0.1685	0.089197	0.011	0.0038	0.000339
0.004	0.1675	0.088141	0.0145	0.0035	0.000308
0.005	0.1665	0.087092	0.018	0.0035	0.000305
0.006	0.1655	0.086049	0.022	0.004	0.000344
0.007	0.1645	0.085012	0.0266	0.0046	0.000391
0.008	0.1635	0.083982	0.0304	0.0038	0.000319
0.009	0.1625	0.082958	0.0352	0.0048	0.000398
0.01	0.1615	0.08194	0.0392	0.004	0.000328
0.011	0.1605	0.080928	0.0436	0.0044	0.000356
0.012	0.1595	0.079923	0.0482	0.0046	0.000368
0.013	0.1585	0.078924	0.0526	0.0044	0.000347
0.014	0.1575	0.077931	0.057	0.0044	0.000343
0.015	0.1565	0.076945	0.0612	0.0042	0.000323
0.016	0.1555	0.075964	0.066	0.0048	0.000365
0.017	0.1545	0.074991	0.071	0.005	0.000375
0.018	0.1535	0.074023	0.0754	0.0044	0.000326
0.019	0.1525	0.073062	0.0798	0.0044	0.000321
0.02	0.1515	0.072107	0.0854	0.0056	0.000404
0.021	0.1505	0.071158	0.0992	0.0138	0.000982
0.022	0.1495	0.070215	0.1304	0.0312	0.002191
0.023	0.1485	0.069279	0.1576	0.0272	0.001884
0.024	0.1475	0.068349	0.1936	0.036	0.002461
0.025	0.1465	0.067426	0.2224	0.0288	0.001942
0.026	0.1455	0.066508	0.2504	0.028	0.001862
0.027	0.1445	0.065597	0.286	0.0356	0.002335
0.028	0.1435	0.064692	0.3238	0.0378	0.002445
0.029	0.1425	0.063794	0.36	0.0362	0.002309
0.03	0.1415	0.062902	0.3978	0.0378	0.002378
0.031	0.1405	0.062016	0.4416	0.0438	0.002716
0.032	0.1395	0.061136	0.4826	0.041	0.002507
0.033	0.1385	0.060263	0.523	0.0404	0.002435
0.034	0.1375	0.059396	0.5748	0.0518	0.003077
0.035	0.1365	0.058535	0.616	0.0412	0.002412
0.036	0.1355	0.05768	0.664	0.048	0.002769
0.037	0.1345	0.056832	0.708	0.044	0.002501
0.038	0.1335	0.05599	0.7408	0.0328	0.001836

0.039	0.1325	0.055155	0.7808	0.04	0.002206
0.04	0.1315	0.054325	0.817	0.0362	0.001967
0.041	0.1305	0.053502	0.8528	0.0358	0.001915
0.042	0.1295	0.052685	0.885	0.0322	0.001696
0.043	0.1285	0.051875	0.9166	0.0316	0.001639
0.044	0.1275	0.051071	0.9492	0.0326	0.001665
0.045	0.1265	0.050273	0.9766	0.0274	0.001377
0.046	0.1255	0.049481	1.0088	0.0322	0.001593
0.047	0.1245	0.048695	1.0408	0.032	0.001558
0.048	0.1235	0.047916	1.0758	0.035	0.001677
0.049	0.1225	0.047144	1.1098	0.034	0.001603
0.05	0.1215	0.046377	1.1386	0.0288	0.001336
0.051	0.1205	0.045617	1.1708	0.0322	0.001469
0.052	0.1195	0.044863	1.2018	0.031	0.001391
0.053	0.1185	0.044115	1.228	0.0262	0.001156
0.054	0.1175	0.043374	1.255	0.027	0.001171
0.055	0.1165	0.042638	1.2828	0.0278	0.001185
0.056	0.1155	0.04191	1.3144	0.0316	0.001324
0.057	0.1145	0.041187	1.3476	0.0332	0.001367
0.058	0.1135	0.040471	1.3774	0.0298	0.001206
0.059	0.1125	0.039761	1.4114	0.034	0.001352
0.06	0.1115	0.039057	1.4396	0.0282	0.001101
0.061	0.1105	0.03836	1.4736	0.034	0.001304
0.062	0.1095	0.037668	1.5038	0.0302	0.001138
0.063	0.1085	0.036984	1.5326	0.0288	0.001065
0.064	0.1075	0.036305	1.5624	0.0298	0.001082
0.065	0.1065	0.035633	1.5924	0.03	0.001069
0.066	0.1055	0.034967	1.6256	0.0332	0.001161
0.067	0.1045	0.034307	1.6494	0.0238	0.000817
0.068	0.1035	0.033654	1.675	0.0256	0.000862
0.069	0.1025	0.033006	1.7014	0.0264	0.000871
0.07	0.1015	0.032365	1.7288	0.0274	0.000887
0.071	0.1005	0.031731	1.7594	0.0306	0.000971
0.072	0.0995	0.031103	1.7808	0.0214	0.000666
0.073	0.0985	0.030481	1.8114	0.0306	0.000933
0.074	0.0975	0.029865	1.84	0.0286	0.000854
0.075	0.0965	0.029255	1.8692	0.0292	0.000854
0.076	0.0955	0.028652	1.891	0.0218	0.000625
0.077	0.0945	0.028055	1.918	0.027	0.000757
0.078	0.0935	0.027465	1.9456	0.0276	0.000758
0.079	0.0925	0.02688	1.9712	0.0256	0.000688

0.08	0.0915	0.026302	1.9964	0.0252	0.000663
0.081	0.0905	0.02573	2.0262	0.0298	0.000767
0.082	0.0895	0.025165	2.0474	0.0212	0.000533
0.083	0.0885	0.024606	2.073	0.0256	0.00063
0.084	0.0875	0.024053	2.0988	0.0258	0.000621
0.085	0.0865	0.023506	2.1224	0.0236	0.000555
0.086	0.0855	0.022966	2.1466	0.0242	0.000556
0.087	0.0845	0.022432	2.1662	0.0196	0.00044
0.088	0.0835	0.021904	2.1914	0.0252	0.000552
0.089	0.0825	0.021382	2.2134	0.022	0.00047
0.09	0.0815	0.020867	2.2394	0.026	0.000543
0.091	0.0805	0.020358	2.259	0.0196	0.000399
0.092	0.0795	0.019856	2.2802	0.0212	0.000421
0.093	0.0785	0.019359	2.301	0.0208	0.000403
0.094	0.0775	0.018869	2.3218	0.0208	0.000392
0.095	0.0765	0.018385	2.3424	0.0206	0.000379
0.096	0.0755	0.017908	2.3638	0.0214	0.000383
0.097	0.0745	0.017437	2.382	0.0182	0.000317
0.098	0.0735	0.016972	2.4044	0.0224	0.00038
0.099	0.0725	0.016513	2.4706	0.0446	0.000726
0.0995	0.072	0.016286	2.603	0.0742	0.001208
0.0995	0.072	0.016286	2.875		
				Volume Square in	0.10961

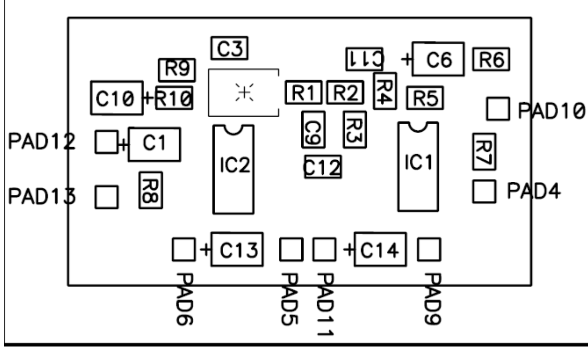
Appendix B – Amplifier Schematic

The amplifier takes the output from the H2 recorder and strengthens the level and inputs it into the oscilloscope. This was needed because the level of the output coming out of the H2 was relatively low, as it was intended for use with ear phones. The design of the amplifier did not alter the information being transferred from the H2 to the oscilloscope. The first schematic below is the circuit board layout of the parts of the amplifier and the second and third schematics are the top and underside of the circuit board and how the copper was etched. The fourth schematic is the drill pattern where the parts were inserted or where mounting holes for the circuit board were drilled. The fifth schematic is a representation of what is happening electrically in the amplifier.

FROST ELECTRONIC DESIGN LLC
104 FARIS ST. N.E.
COUPEVILLE,WA. 98239
H2 PREAMP
REV A

TOP SILK LAYER

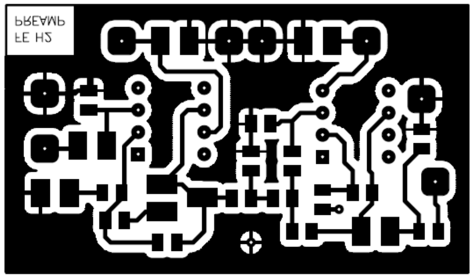
TOP ASY LAYER



MAT. 0.031 THK G10 GLASS EPOXY
FR4 94V0 REQUIRED, MARK PER UL REQ.
COPPER CLAD (2 SIDES)
1 OZ. FINISH COPPER

FIN. LEAD FREE
S.M.O.B.C. FOR SMT
SOLDERMASK (PC–401) (2 SIDES)
C.I.D. WHT EPOXY INK (TOP SIDE)

Drill Table			
Hole Dia (inch)	Symbol	Quantity	Plated
0.010	×	26	Yes



TOP LAYER

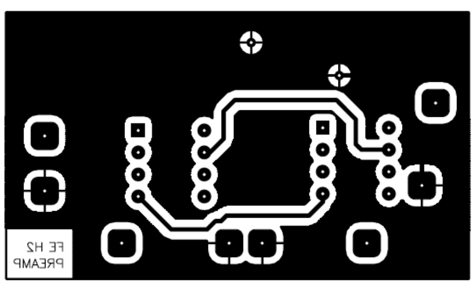
REV A
H2 PREAMP
COUPEVILLE,WA. 98239
104 FARIS ST. N.E.
FROST ELECTRONIC DESIGN LLC

Hole Dia (inch)	Symbol	Quantity	Plated
0.010	X	26	Yes

Drill Table

C.I.D. WHT EPOXY INK (TOP SIDE)
SOLDERMASK (PC−401) (2 SIDES)
S.M.O.B.C. FOR SMT
FIN. LEAD FREE
1 OZ. FINISH COPPER
COPPER CLAD (2 SIDES)
FR4 94V0 REQUIRED, MARK PER UL REQ.
MAT. 0.031 THK G10 GLASS EPOXY

FROST ELECTRONIC DESIGN LLC BOTTOM LAYER
104 FARIS ST. N.E.
COUPEVILLE,WA. 98239
H2 PREAMP
REV A



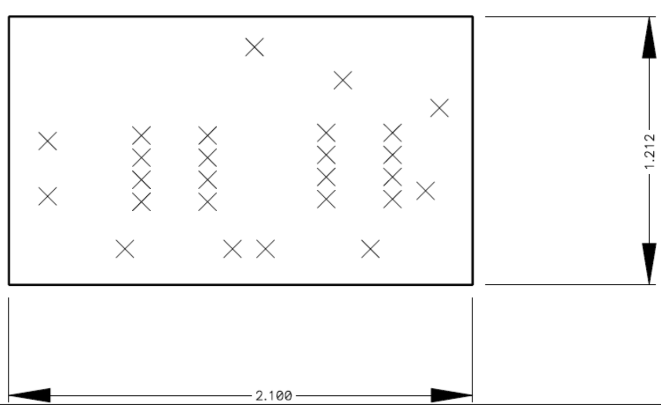
MAT. 0.031 THK G10 GLASS EPOXY
FR4 94V0 REQUIRED, MARK PER UL REQ.
COPPER CLAD (2 SIDES)
1 OZ. FINISH COPPER

FIN. LEAD FREE
S.M.O.B.C. FOR SMT
SOLDERMASK (PC–401) (2 SIDES)
C.I.D. WHT EPOXY INK (TOP SIDE)

Drill Table			
Hole Dia (inch)	Symbol	Quantity	Plated
0.010	X	26	Yes

FROST ELECTRONIC DESIGN LLC
104 FARIS ST. N.E.
COUPEVILLE,WA. 98239
H2 PREAMP
REV A

DIM LAYER



MAT. 0.031 THK G10 GLASS EPOXY
FR4 94V0 REQUIRED, MARK PER UL REQ.
COPPER CLAD (2 SIDES)
1 OZ. FINISH COPPER

FIN. LEAD FREE
S.M.O.B.C. FOR SMT
SOLDERMASK (PC–401) (2 SIDES)
C.I.D. WHT EPOXY INK (TOP SIDE)

Drill Table			
Hole Dia (inch)	Symbol	Quantity	Plated
0.010	X	26	Yes

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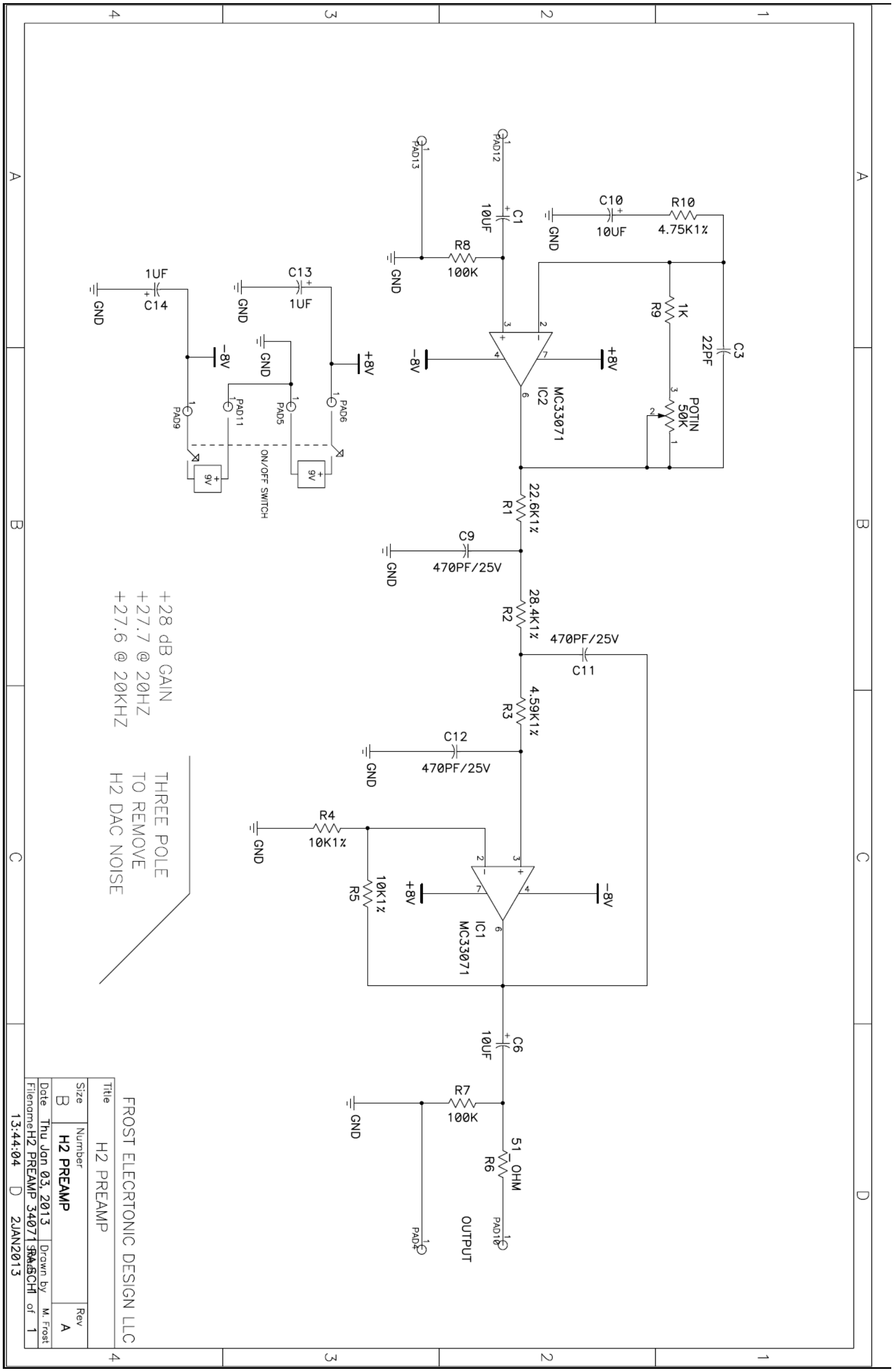
The information contained on this drawing shall be used only for record and reference purposes. Shall not be used in any way contrary to our intrest, reporduced or copied in whole of in part, used for making parts or apparatus except with the written approval of FROST ELECTRONIC DESIGN LLC and shall be returned upon request.



FROST ELECRTONIC DESIGN LLC
Title
H2 PREAMP
Size
B
Number
H2 PREAMP
Rev
A
Date Thu Jan 03, 2013
Drawn by M. Frost
13:44:04
2JAN2013
+28 dB GAIN
+27.7 @ 20HZ
+27.6 @ 20KHZ
THREE POLE
TO REMOVE
H2 DAC NOISE
ON/OFF SWITCH
OUTPUT
MC33071
IC2
IC1
POTIN
50K
22.6K1%
28.4K1%
4.59K1%
470PF/25V
10UF
100K
4.75K1%
22PF
1UF
10K1%
51_OHM
GND
+8V
-8V
9V

Appendix C – H2 Specifications

Information on the H2 is below and contains the digital specifications for which the H2 recorder was set during data collection. "24 bit" refers to the "depth" of the audio. For example, 24 bit has more depth than 16 bit. Oversampling is the process of sampling a signal with a sampling frequency significantly higher than twice the highest frequency being sampled. A higher number improves resolution. The sampling frequency is also listed. A/D is the analog to digital conversion and D/A is the digital to analog conversion.

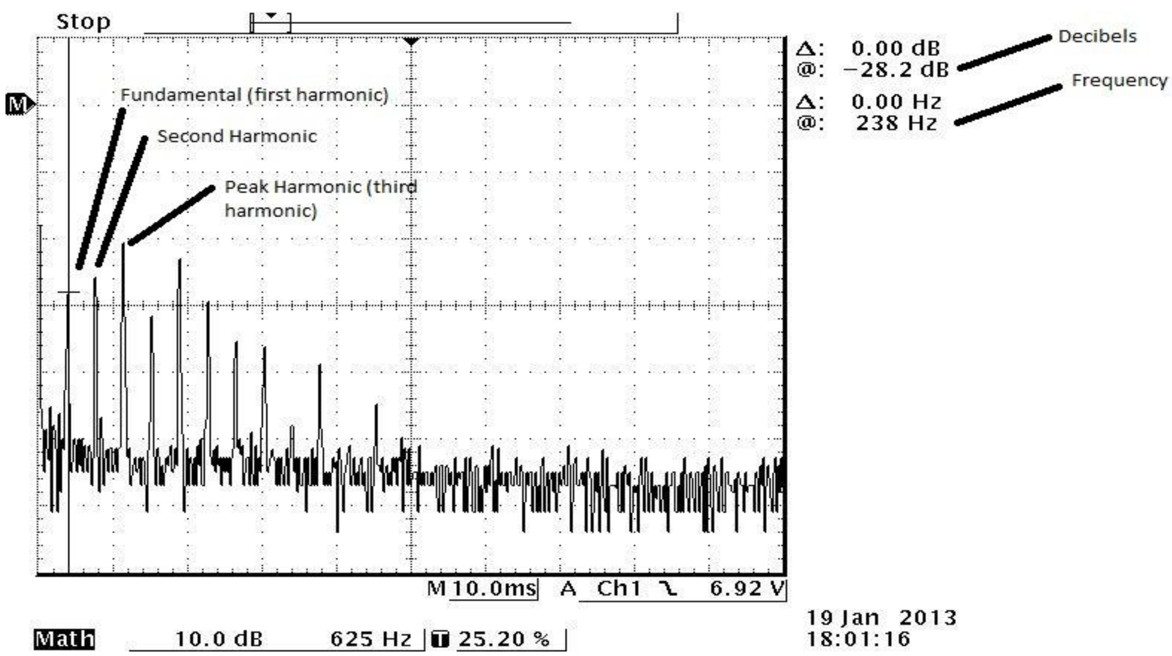
A/D Conversion:	24 bit 128 times oversampling
D/A Conversion:	24 bit 128 times oversampling
Sampling Frequency:	96kHz

Appendix D – Oscilloscope Readings

Appendix D is referred from: *Capturing of Data on Oscilloscope* on page 42.

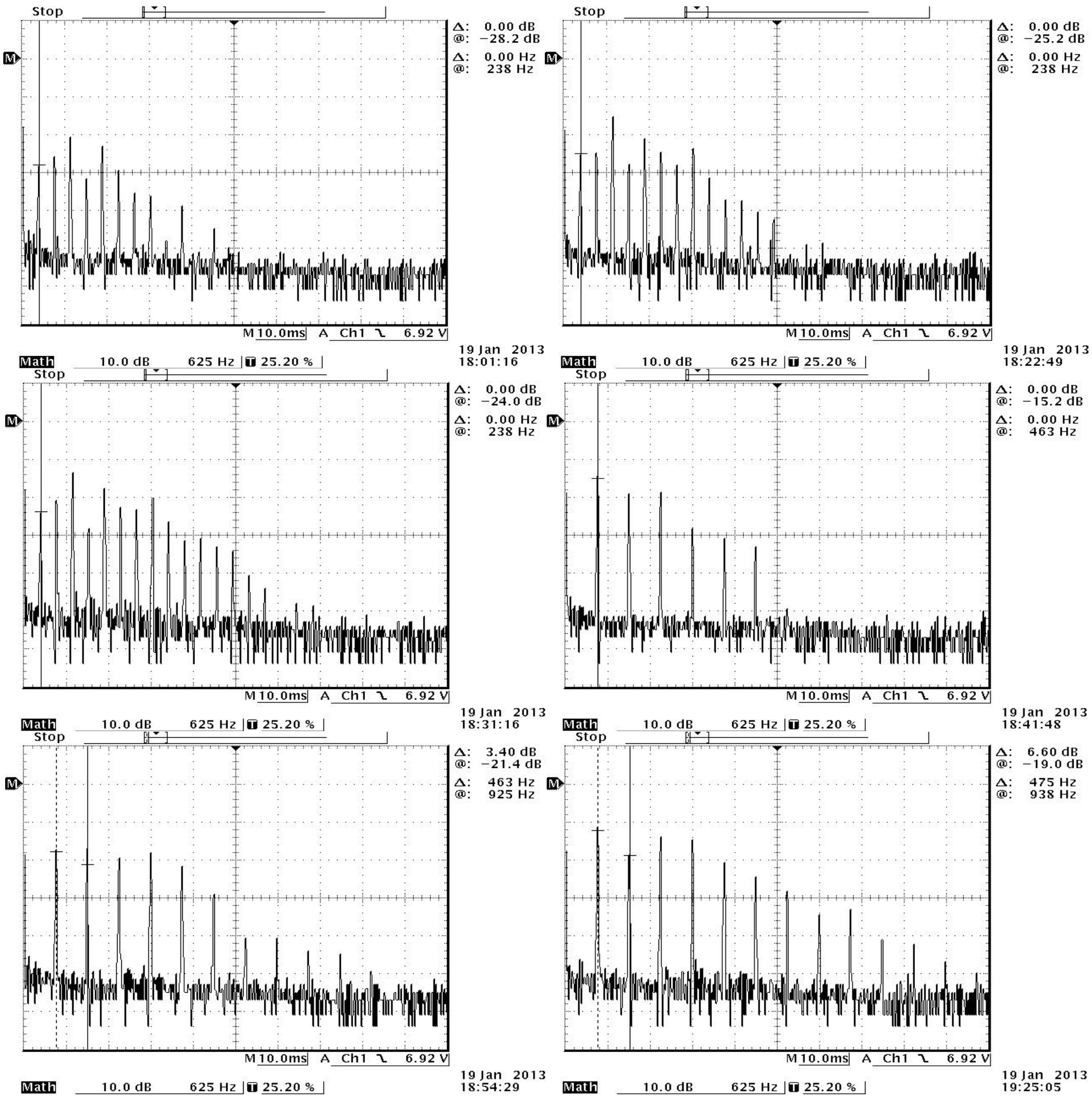
The figure below contains labels of the information used to collect data for this research. The first three harmonics are labeled. This example has eleven harmonics that would have been measured if it was a sample used in this study. The harmonics are the spikes in the graph and are displayed in decibels. Decibels are expressed in a logarithmic scale of 10. The visual differences seen in the graph are not linear. For example, the ninth harmonic appears to be about half as strong as the peak harmonic, yet it actually contains much less power than half. If the peak harmonic was 20dB and the ninth harmonic 10dB, the peak harmonic would be 100 times stronger. A cursor was used to measure the strength of each harmonic and recorded. The frequency of each note being analyzed was displayed, but not used in this research. The actual frequencies of the notes the players produced audibly passed for the correct note, but were not exact frequencies. For example, the figure below is measuring the frequency at 238 Hertz, and this graph would have been used for the 233 Hertz classification in this research. The 238 Hertz would sound to the listener as being sharp. The minute differences of the actual frequencies used in this research does not affect the data collection and scope of the research.

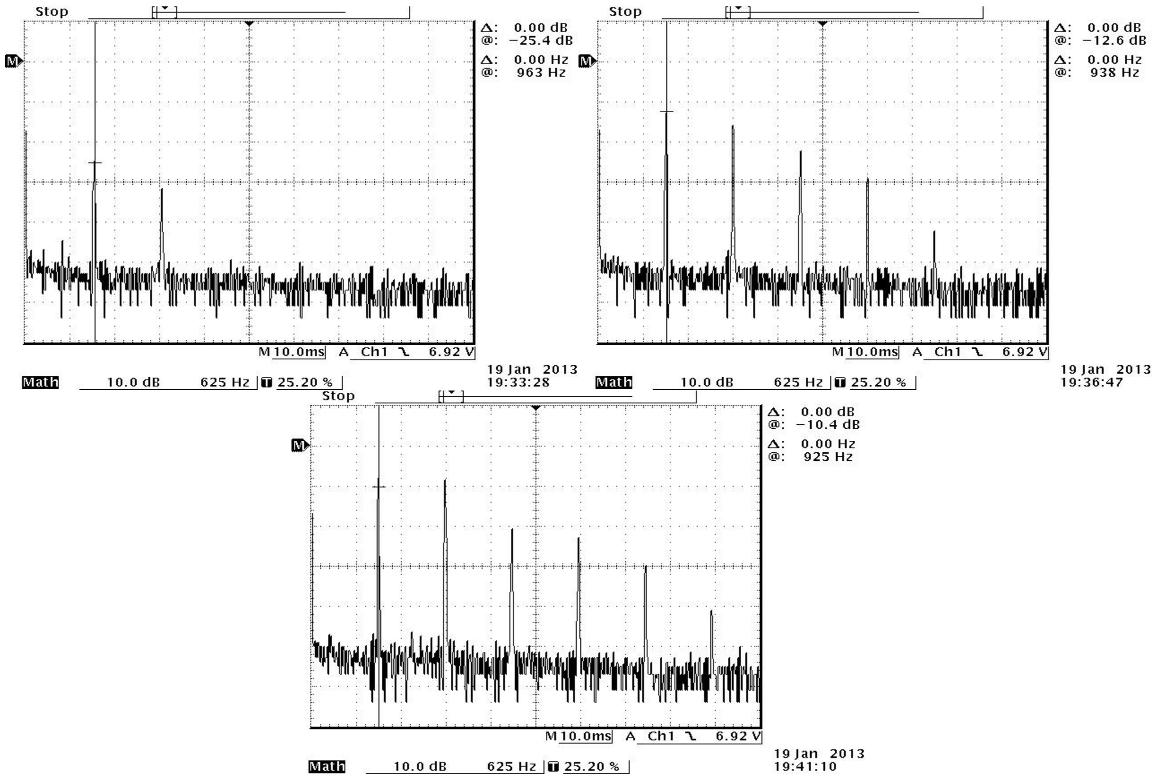
Below is a labeled example of the oscilloscope readings:



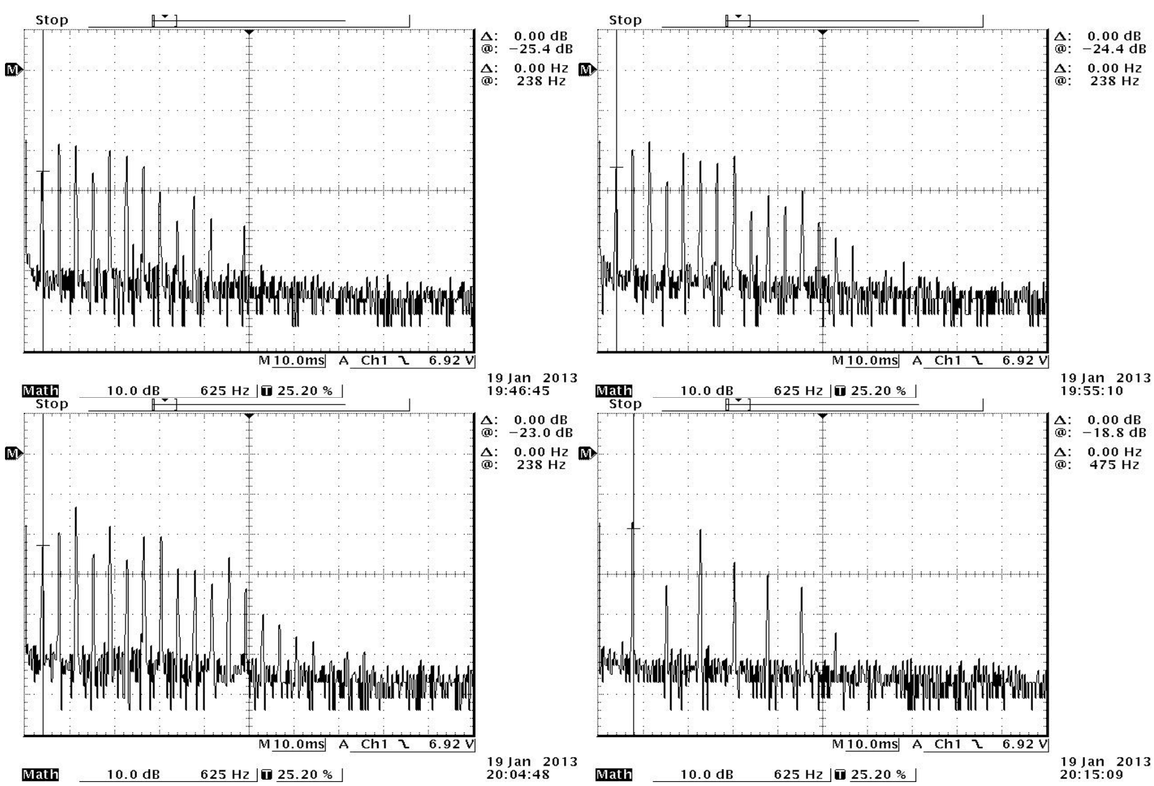
Player 1

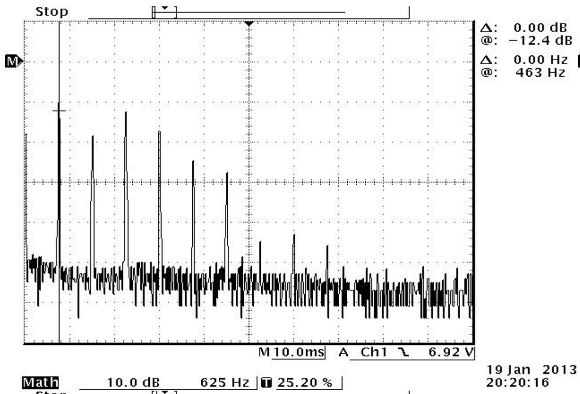
SA

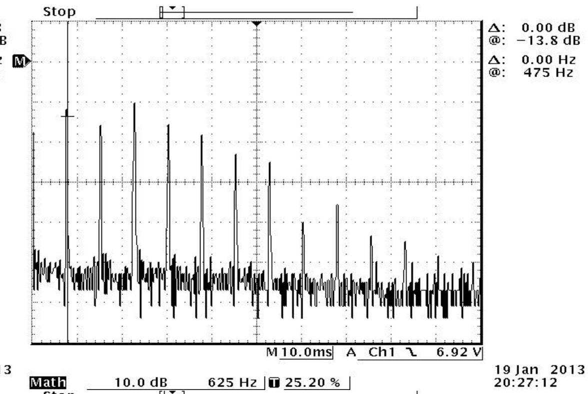

Stop
Δ: 0.00 dB
@: −28.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
18:01:16
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −25.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
18:22:49
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −24.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
18:31:16
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −15.2 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
18:41:48
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 3.40 dB
@: −21.4 dB
Δ: 463 Hz
@: 925 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
18:54:29
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 6.60 dB
@: −19.0 dB
Δ: 475 Hz
@: 938 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
19:25:05
Math 10.0 dB 625 Hz 25.20 %

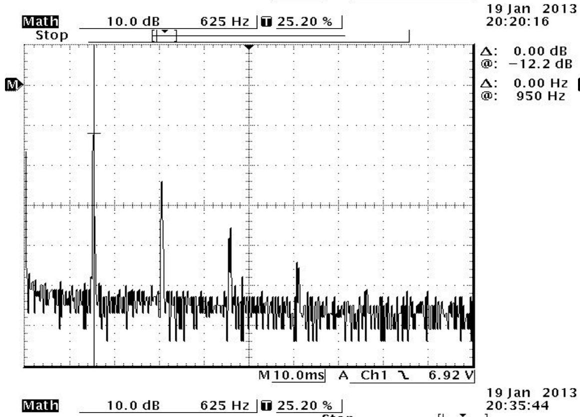

Stop
Δ: 0.00 dB
@: −25.4 dB
Δ: 0.00 Hz
@: 963 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
19:33:28
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −12.6 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
19:36:47
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −10.4 dB
Δ: 0.00 Hz
@: 925 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
19:41:10
Math 10.0 dB 625 Hz 25.20 %

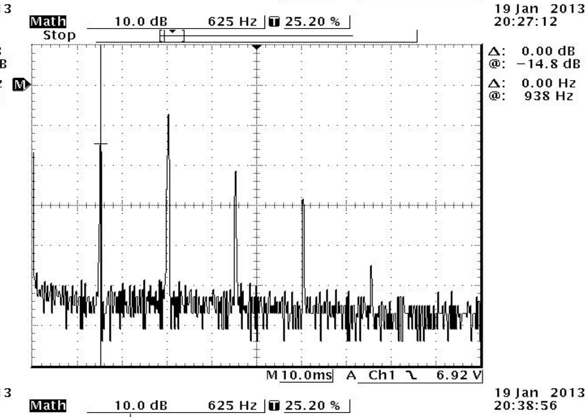
B76

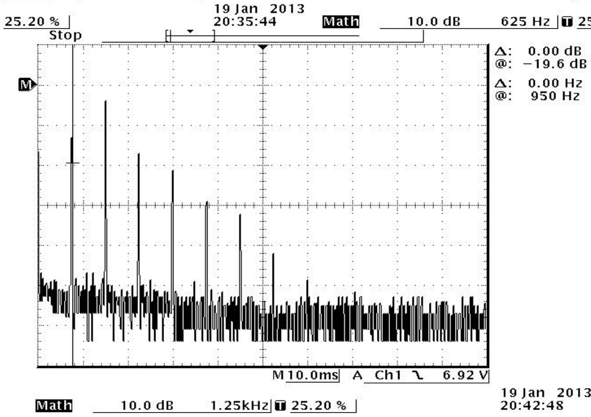

Stop
Δ: 0.00 dB
@: −25.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
19:46:45
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −24.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
19:55:10
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −23.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:04:48
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −18.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:15:09
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −12.4 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:20:16
Math 10.0 dB 625 Hz 25.20 %

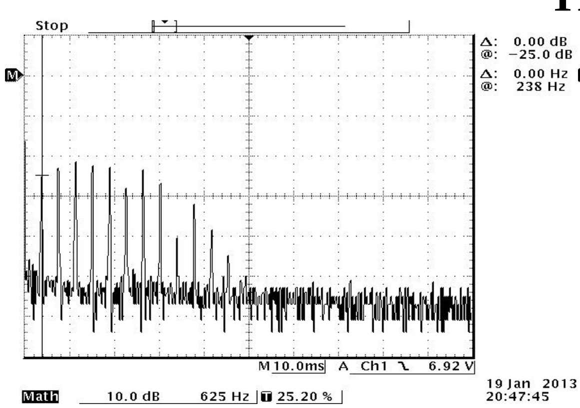

Stop
Δ: 0.00 dB
@: −13.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:27:12
Math 10.0 dB 625 Hz 25.20 %

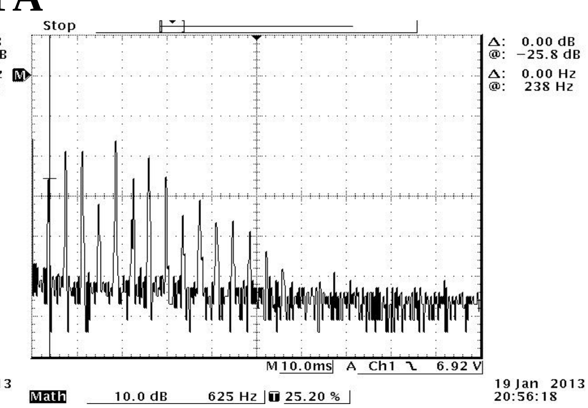

Stop
Δ: 0.00 dB
@: −12.2 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:35:44
Math 10.0 dB 625 Hz 25.20 %

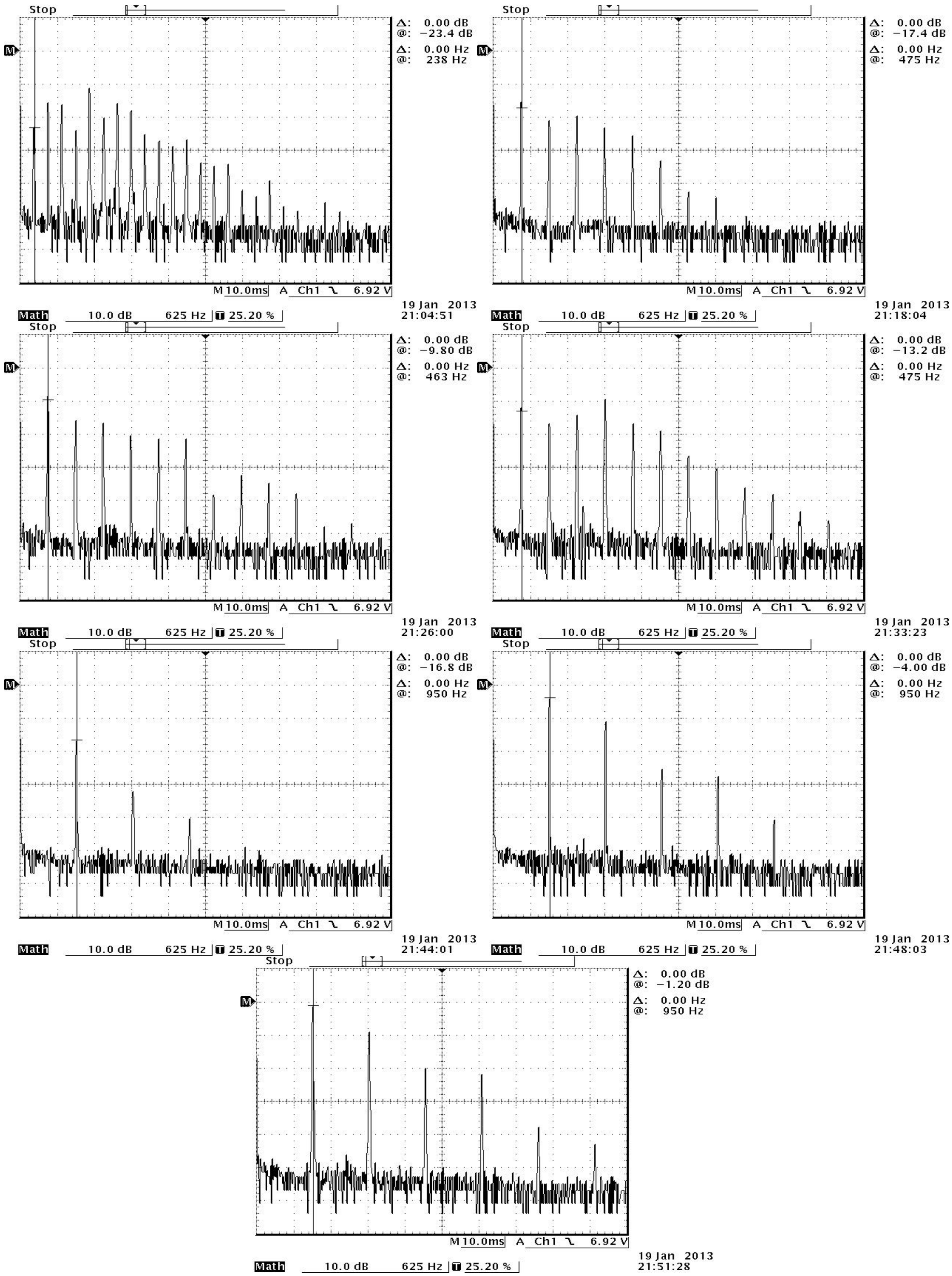

Stop
Δ: 0.00 dB
@: −14.8 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:38:56
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −19.6 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:42:48
Math 10.0 dB 1.25kHz 25.20 %

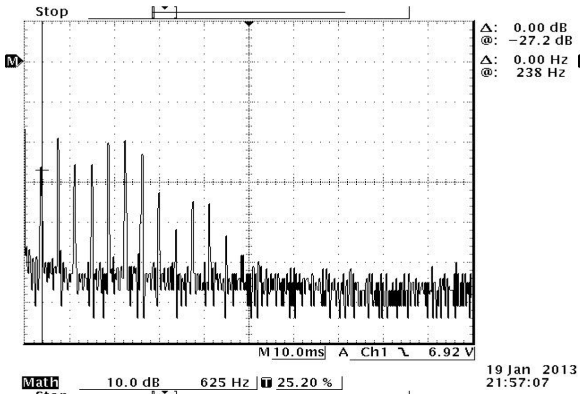
YA

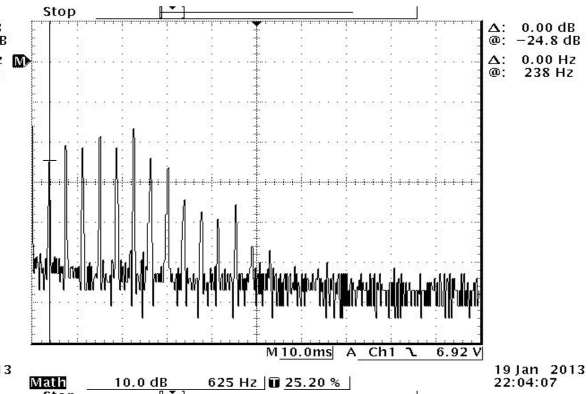

Stop
Δ: 0.00 dB
@: −25.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:47:45
Math 10.0 dB 625 Hz 25.20 %

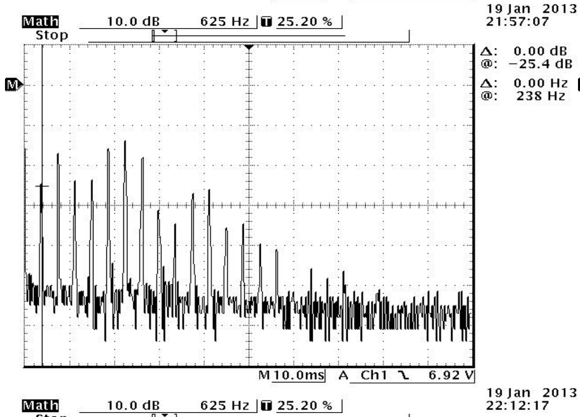

Stop
Δ: 0.00 dB
@: −25.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
20:56:18
Math 10.0 dB 625 Hz 25.20 %

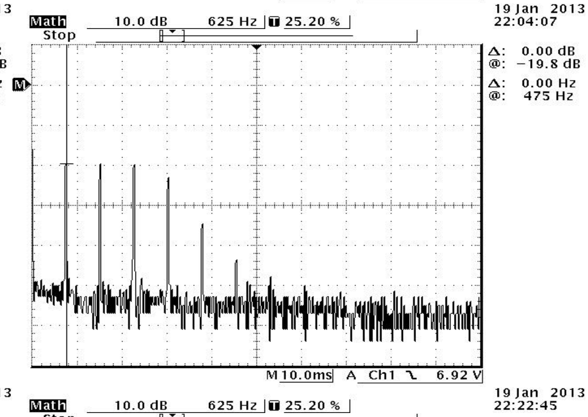

Stop
Δ: 0.00 dB
@: −23.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⏷ 6.92 V
19 Jan 2013
21:04:51
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −17.4 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⏷ 6.92 V
19 Jan 2013
21:18:04
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −9.80 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⏷ 6.92 V
19 Jan 2013
21:26:00
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −13.2 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⏷ 6.92 V
19 Jan 2013
21:33:23
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −16.8 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⏷ 6.92 V
19 Jan 2013
21:44:01
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −4.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⏷ 6.92 V
19 Jan 2013
21:48:03
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −1.20 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⏷ 6.92 V
19 Jan 2013
21:51:28
Math 10.0 dB 625 Hz 25.20 %

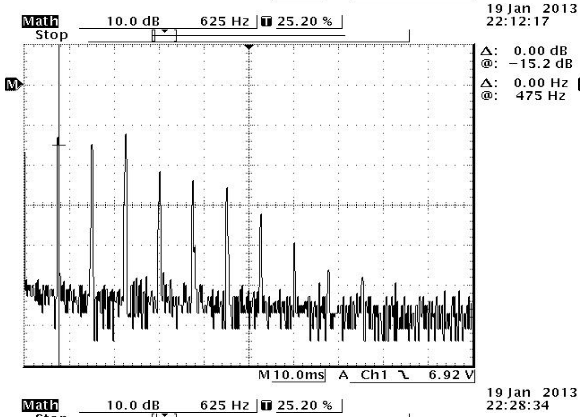
B10

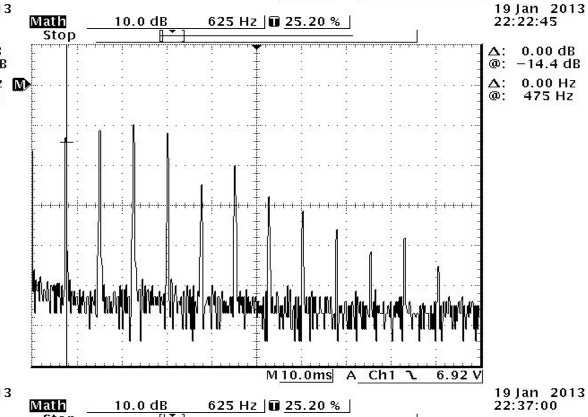

Stop
Δ: 0.00 dB
@: −27.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
21:57:07
Math 10.0 dB 625 Hz 25.20 %

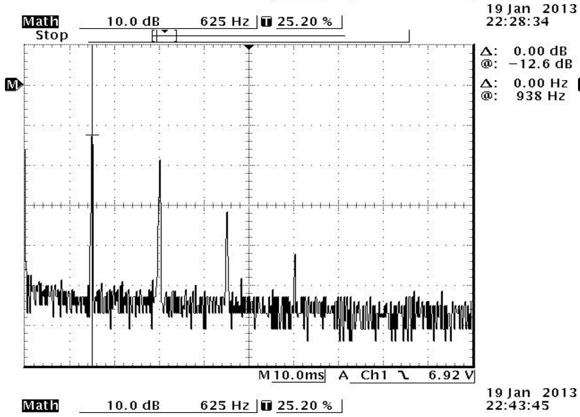

Stop
Δ: 0.00 dB
@: −24.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
22:04:07
Math 10.0 dB 625 Hz 25.20 %

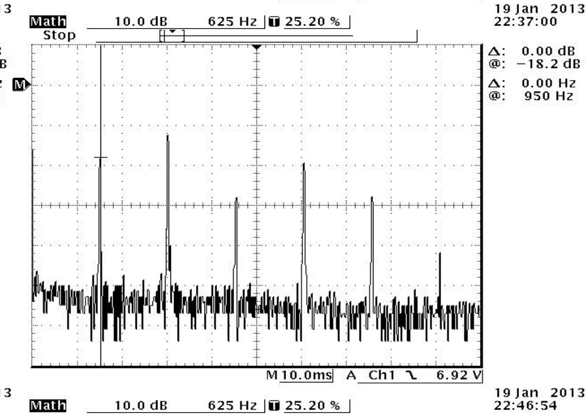

Stop
Δ: 0.00 dB
@: −25.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
22:12:17
Math 10.0 dB 625 Hz 25.20 %

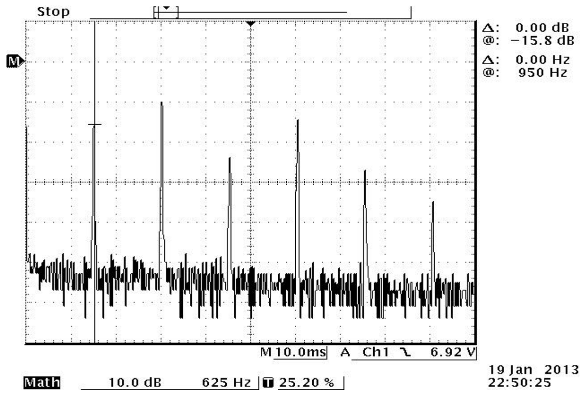

Stop
Δ: 0.00 dB
@: −19.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
22:22:45
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −15.2 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
22:28:34
Math 10.0 dB 625 Hz 25.20 %

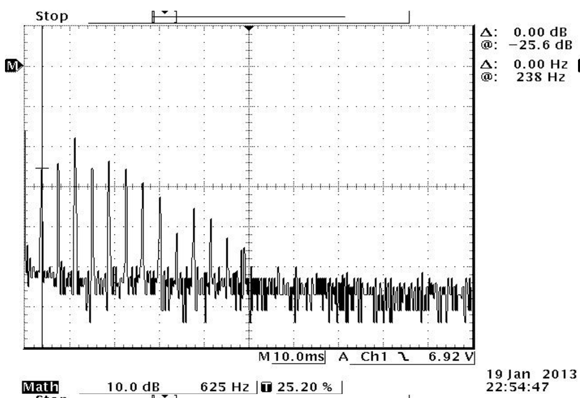

Stop
Δ: 0.00 dB
@: −14.4 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
22:37:00
Math 10.0 dB 625 Hz 25.20 %

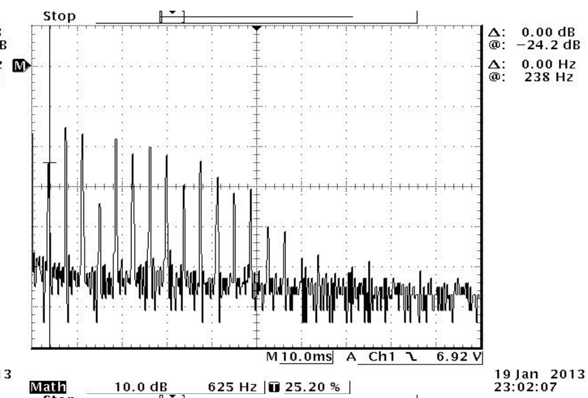

Stop
Δ: 0.00 dB
@: −12.6 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
22:43:45
Math 10.0 dB 625 Hz 25.20 %

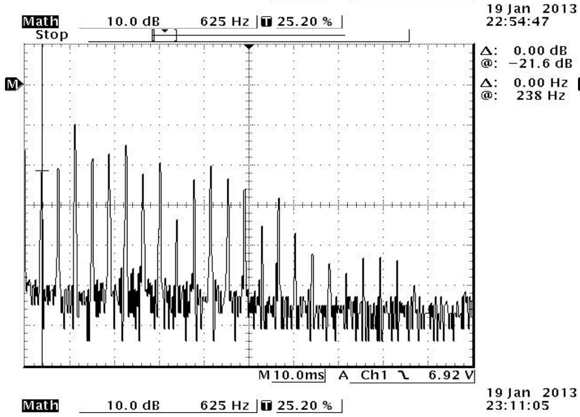

Stop
Δ: 0.00 dB
@: −18.2 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
19 Jan 2013
22:46:54
Math 10.0 dB 625 Hz 25.20 %

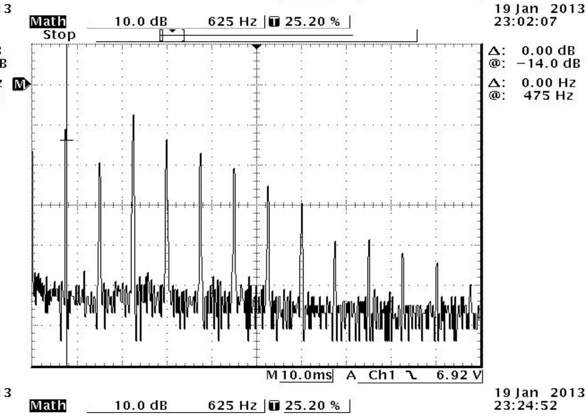

Stop
Δ: 0.00 dB
@: −15.8 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 625 Hz 25.20 %
19 Jan 2013
22:50:25

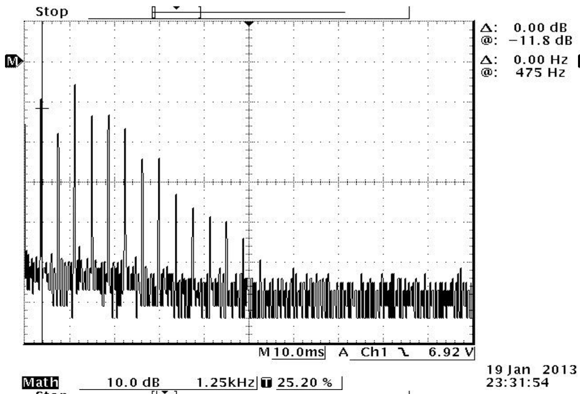
YC

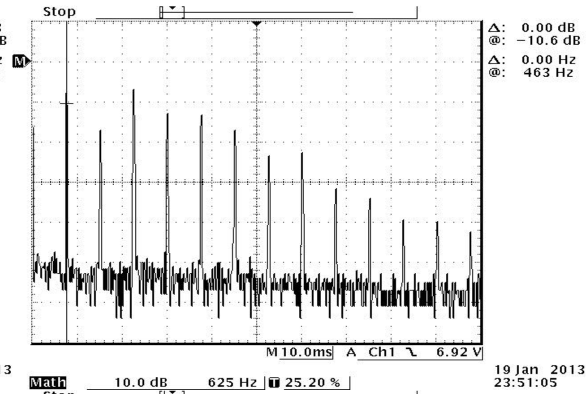

Stop
Δ: 0.00 dB
@: −25.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 625 Hz 25.20 %
19 Jan 2013
22:54:47

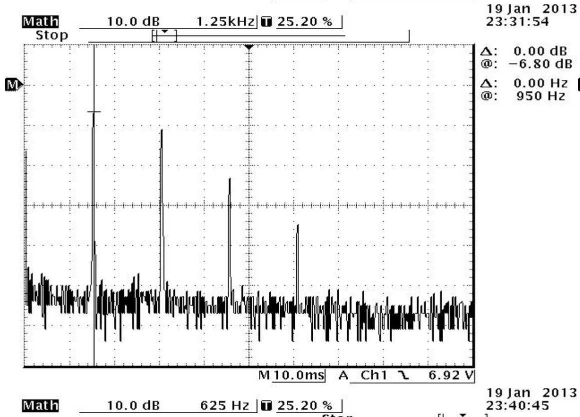

Stop
Δ: 0.00 dB
@: −24.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 625 Hz 25.20 %
19 Jan 2013
23:02:07

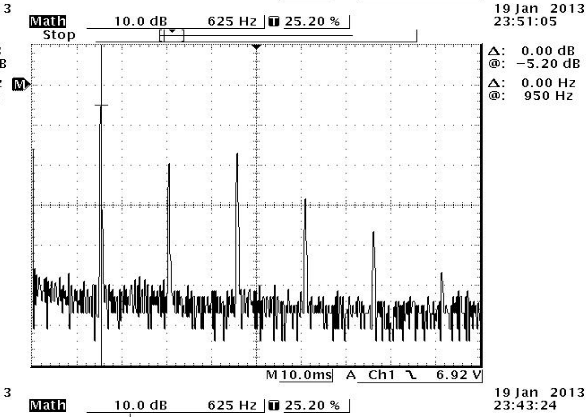

Stop
Δ: 0.00 dB
@: −21.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 625 Hz 25.20 %
19 Jan 2013
23:11:05

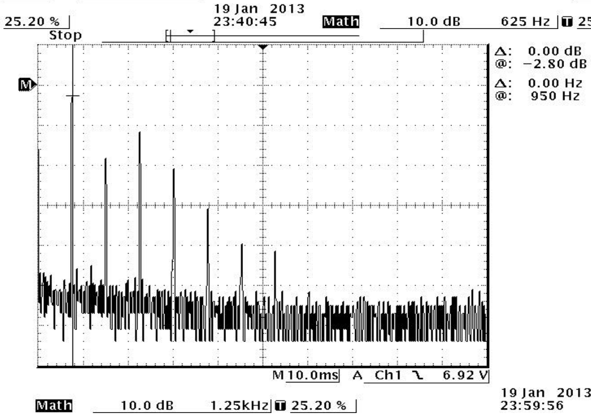

Stop
Δ: 0.00 dB
@: −14.0 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 625 Hz 25.20 %
19 Jan 2013
23:24:52


Stop
Δ: 0.00 dB
@: −11.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
23:31:54
Math 10.0 dB 1.25kHz 25.20 %

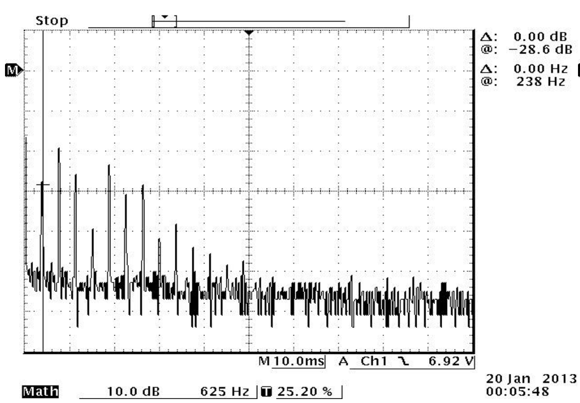

Stop
Δ: 0.00 dB
@: −10.6 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
23:51:05
Math 10.0 dB 625 Hz 25.20 %

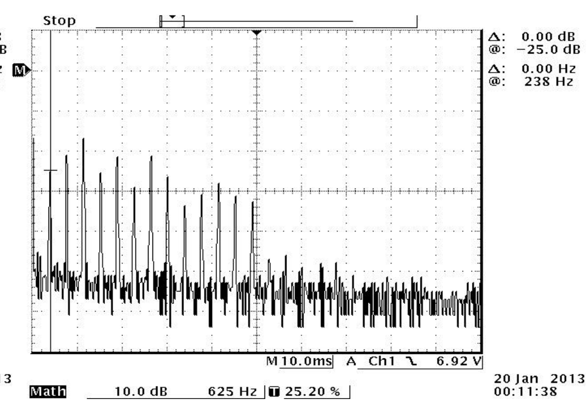

Stop
Δ: 0.00 dB
@: −6.80 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
23:40:45
Math 10.0 dB 625 Hz 25.20 %

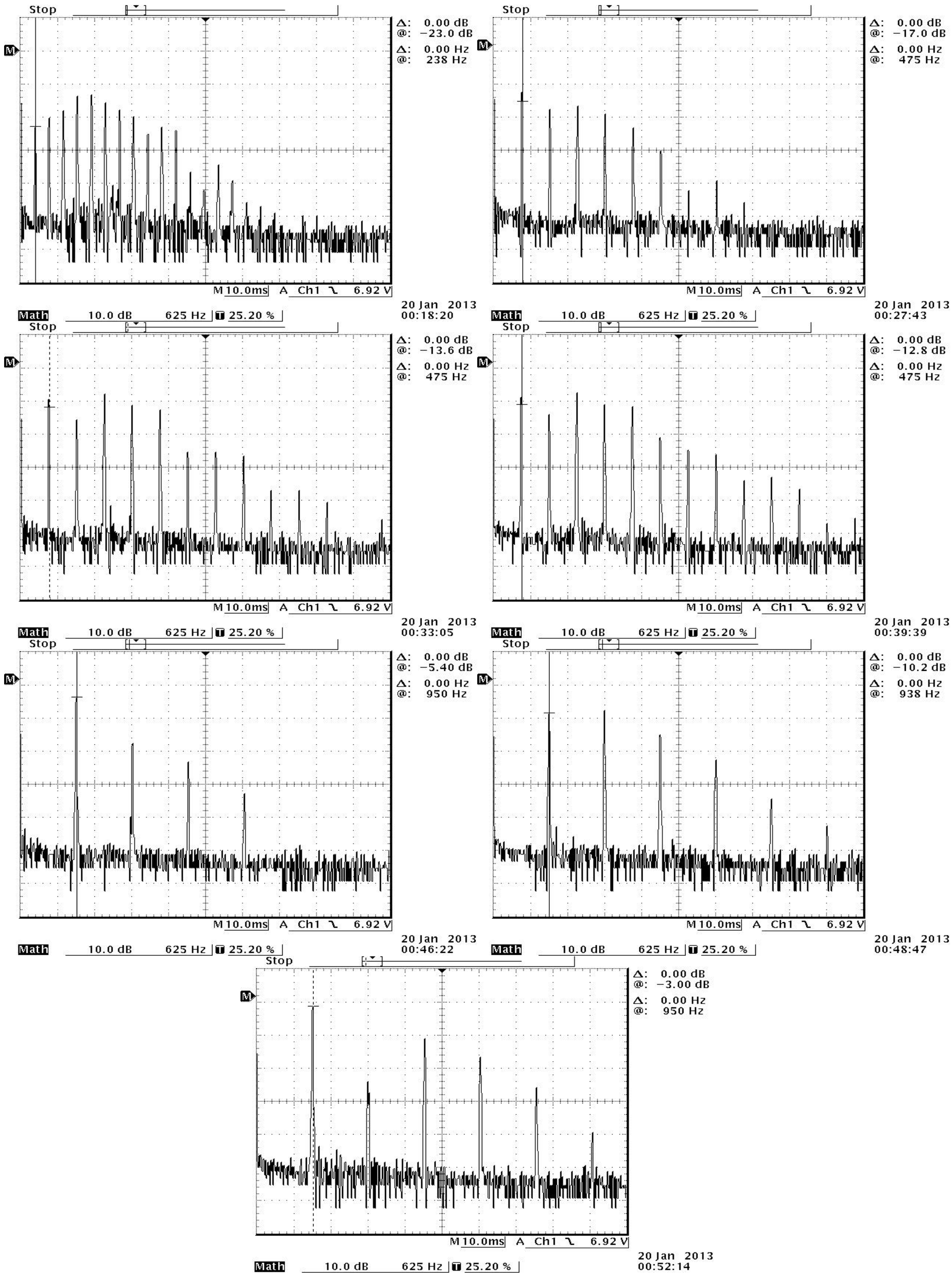

Stop
Δ: 0.00 dB
@: −5.20 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
23:43:24
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −2.80 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
19 Jan 2013
23:59:56
Math 10.0 dB 1.25kHz 25.20 %

B24

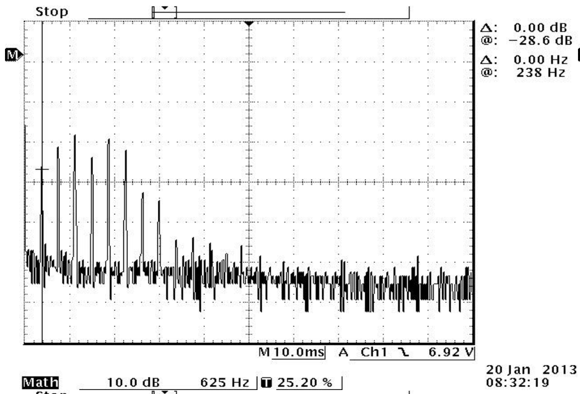

Stop
Δ: 0.00 dB
@: −28.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
00:05:48
Math 10.0 dB 625 Hz 25.20 %

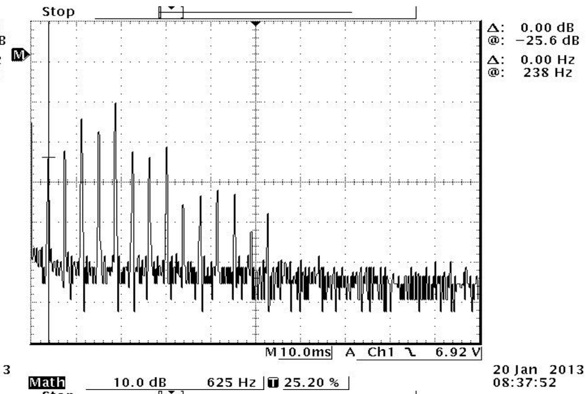

Stop
Δ: 0.00 dB
@: −25.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
00:11:38
Math 10.0 dB 625 Hz 25.20 %

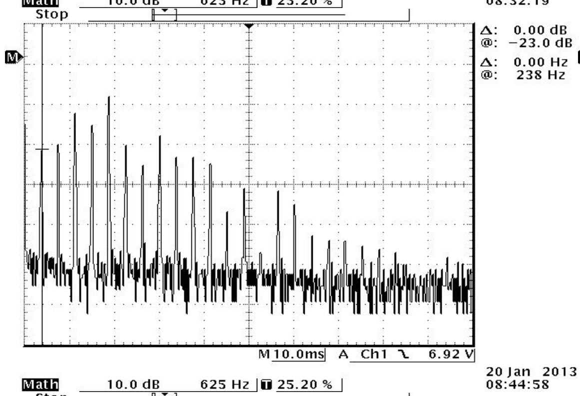


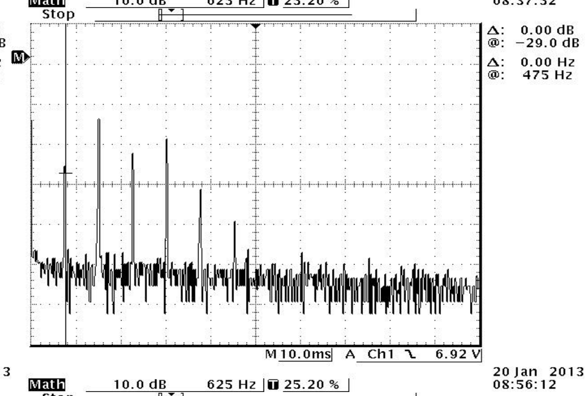
Stop
Δ: 0.00 dB
@: −23.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
00:18:20
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −17.0 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
00:27:43
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −13.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
00:33:05
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −12.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
00:39:39
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −5.40 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
00:46:22
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −10.2 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
00:48:47
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −3.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
00:52:14
Math 10.0 dB 625 Hz 25.20 %

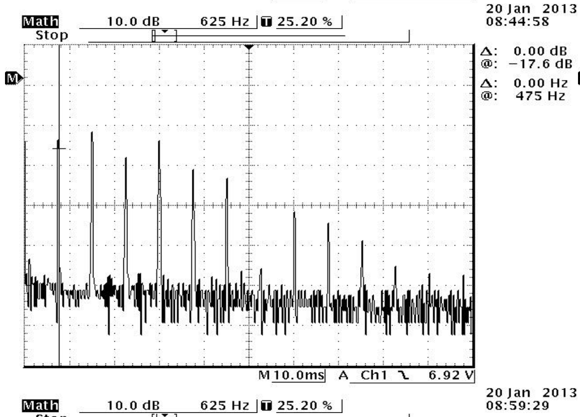
G7C

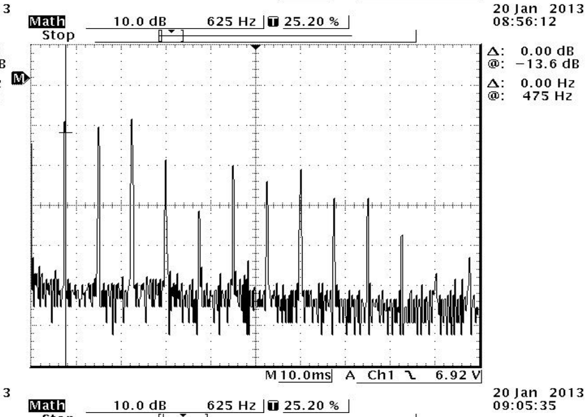

Stop
Δ: 0.00 dB
@: −28.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
08:32:19
Math 10.0 dB 625 Hz 25.20 %

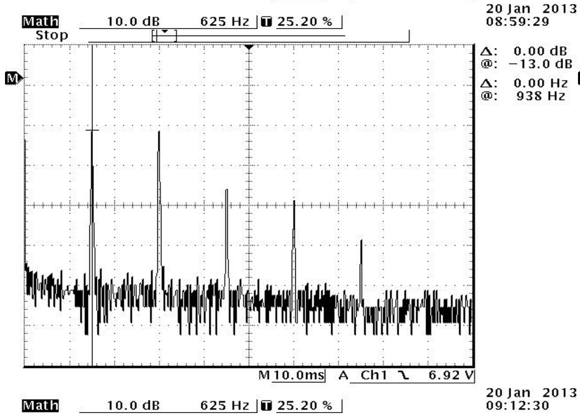

Stop
Δ: 0.00 dB
@: −25.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
08:37:52
Math 10.0 dB 625 Hz 25.20 %

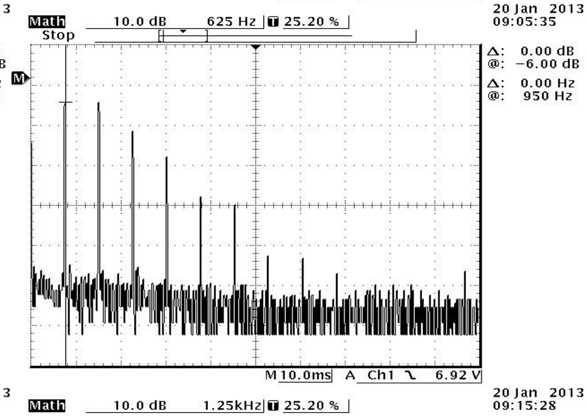

Stop
Δ: 0.00 dB
@: −23.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
08:44:58
Math 10.0 dB 625 Hz 25.20 %

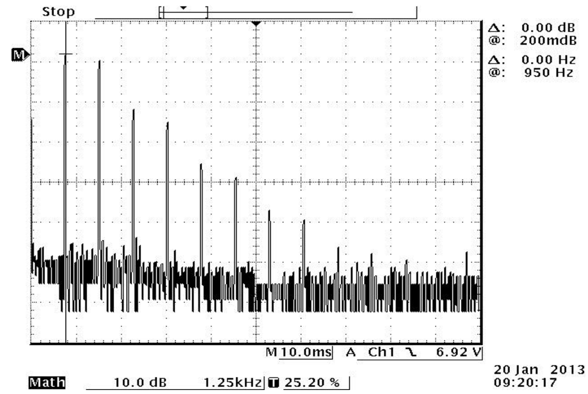

Stop
Δ: 0.00 dB
@: −29.0 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
08:56:12
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −17.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
08:59:29
Math 10.0 dB 625 Hz 25.20 %

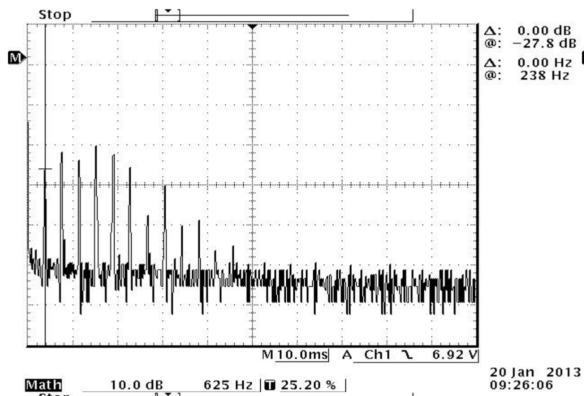

Stop
Δ: 0.00 dB
@: −13.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
09:05:35
Math 10.0 dB 625 Hz 25.20 %

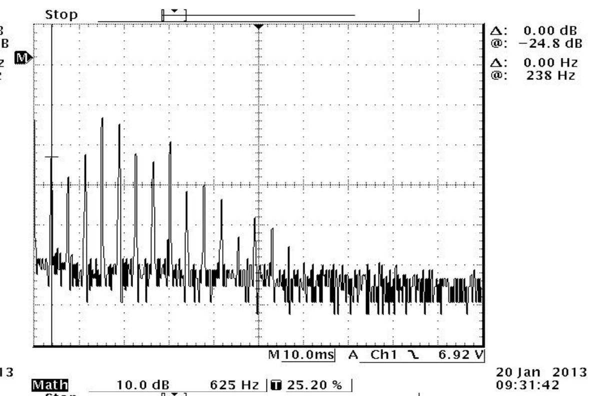

Stop
Δ: 0.00 dB
@: −13.0 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
09:12:30
Math 10.0 dB 625 Hz 25.20 %

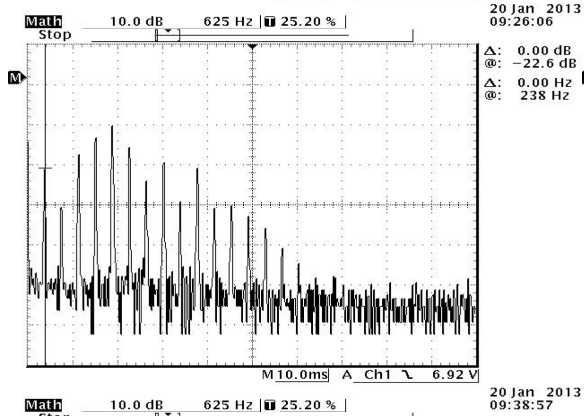

Stop
Δ: 0.00 dB
@: −6.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
09:15:28
Math 10.0 dB 1.25kHz 25.20 %

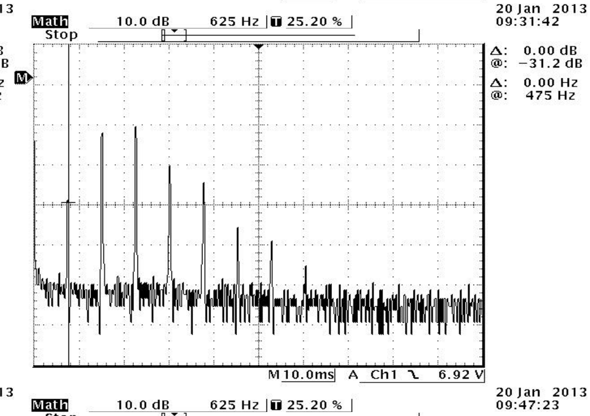

Stop
Δ: 0.00 dB
@: 200mdB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
09:20:17

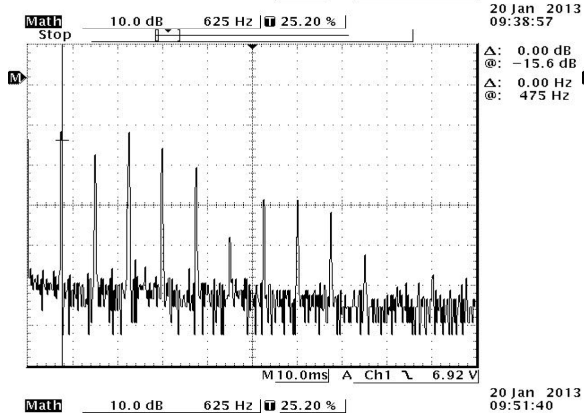
B7

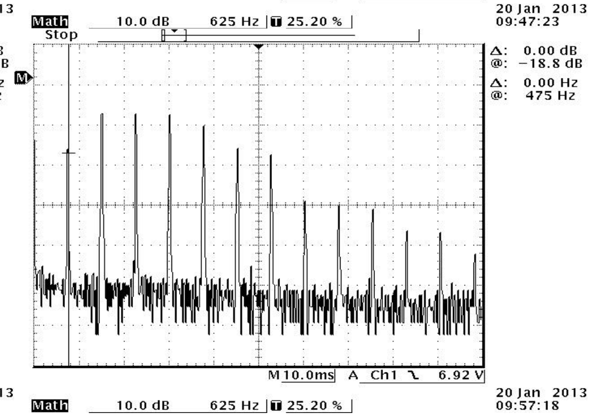

Stop
Δ: 0.00 dB
@: −27.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
09:26:06

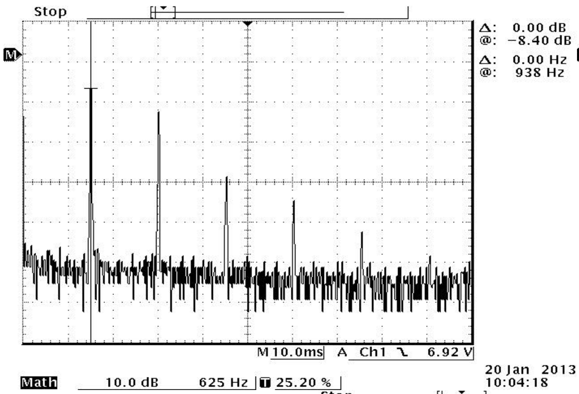

Stop
Δ: 0.00 dB
@: −24.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
09:31:42


Stop
Δ: 0.00 dB
@: −22.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
09:38:57

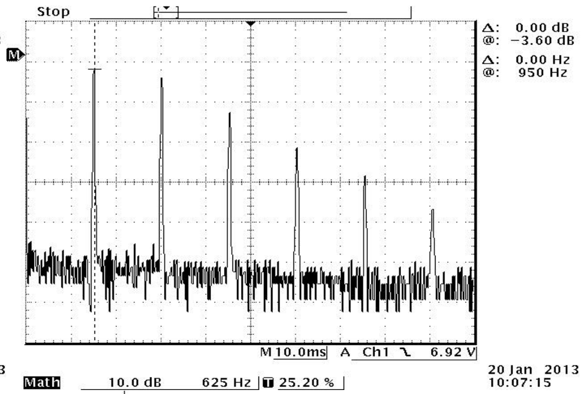

Stop
Δ: 0.00 dB
@: −31.2 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
09:47:23


Stop
Δ: 0.00 dB
@: −15.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
09:51:40

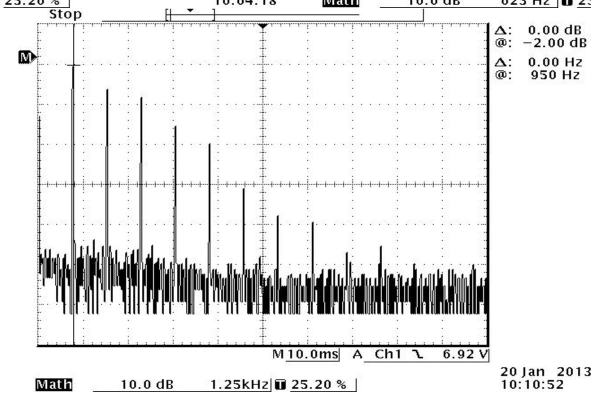

Stop
Δ: 0.00 dB
@: −18.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
09:57:18



Stop
Δ: 0.00 dB
@: −8.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
10:04:18

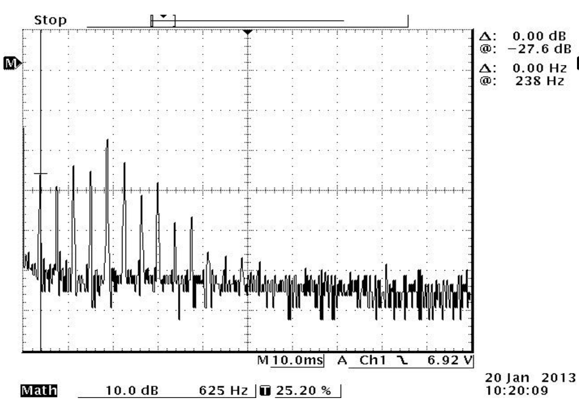


Stop
Δ: 0.00 dB
@: −3.60 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
10:07:15

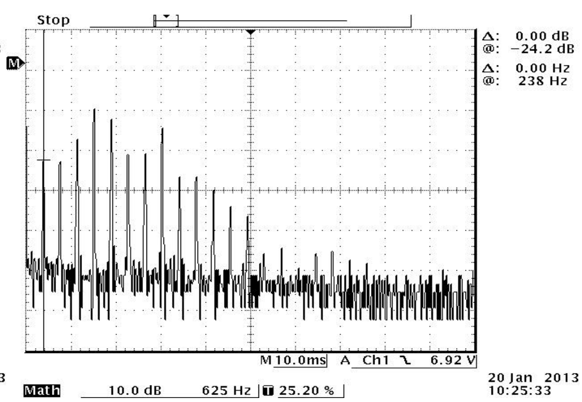


Stop
Δ: 0.00 dB
@: −2.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
10:10:52

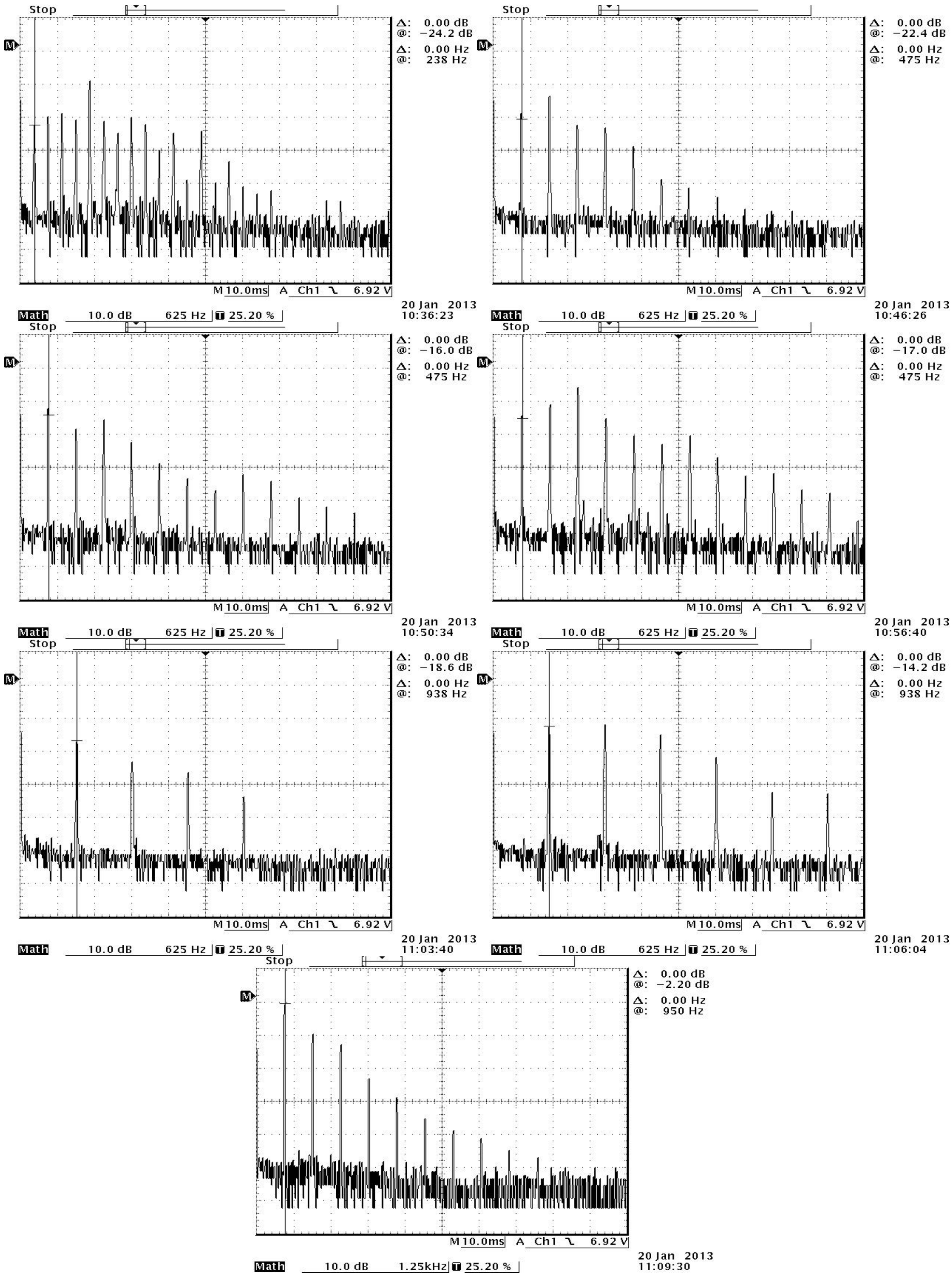
YMG



Stop
Δ: 0.00 dB
@: −27.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
10:20:09

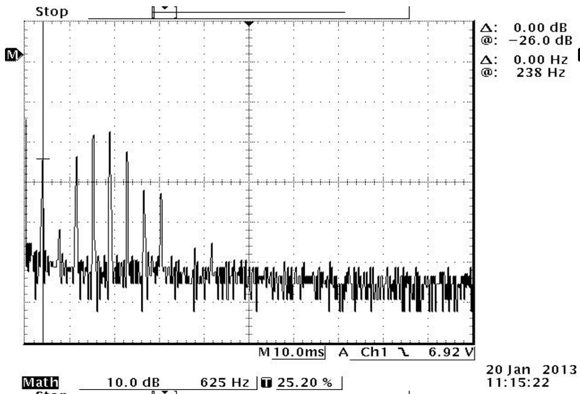


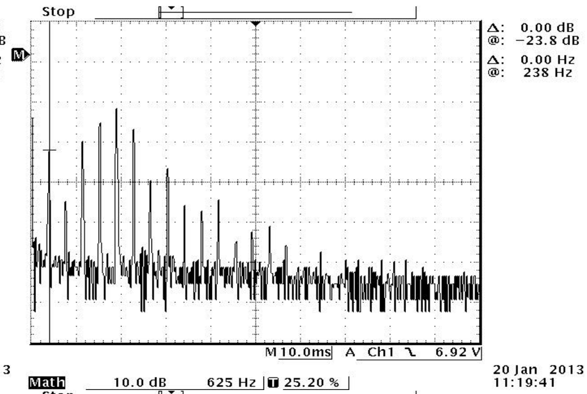
Stop
Δ: 0.00 dB
@: −24.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
10:25:33

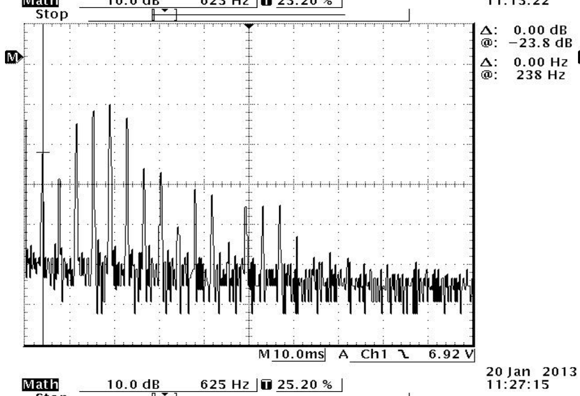


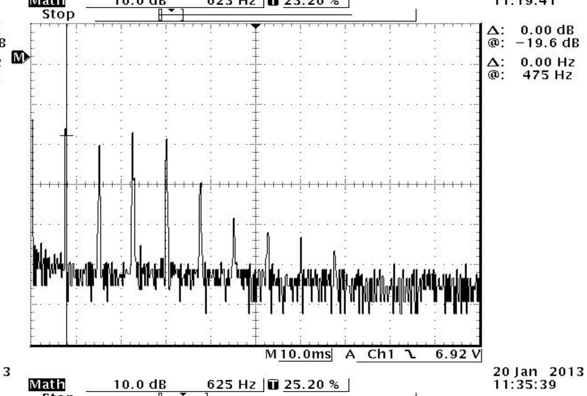
Stop
Δ: 0.00 dB
@: −24.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
10:36:23
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −22.4 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
10:46:26
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −16.0 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
10:50:34
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −17.0 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
10:56:40
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −18.6 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:03:40
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −14.2 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:06:04
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −2.20 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:09:30
Math 10.0 dB 1.25kHz 25.20 %

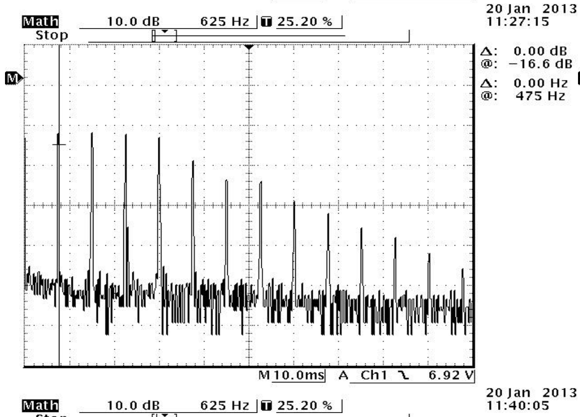
B117

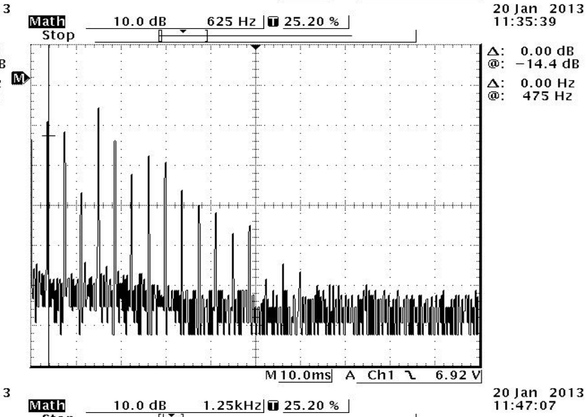

Stop
Δ: 0.00 dB
@: −26.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:15:22
Math 10.0 dB 625 Hz 25.20 %

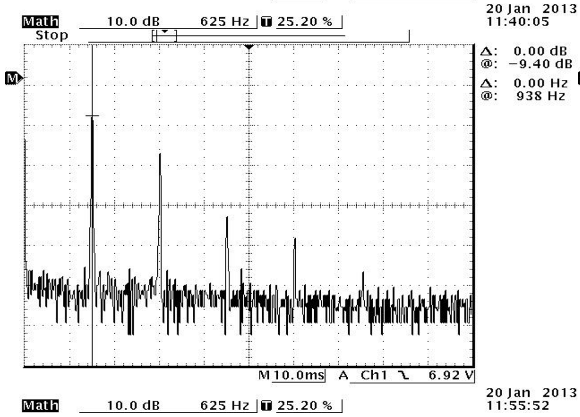

Stop
Δ: 0.00 dB
@: −23.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:19:41
Math 10.0 dB 625 Hz 25.20 %

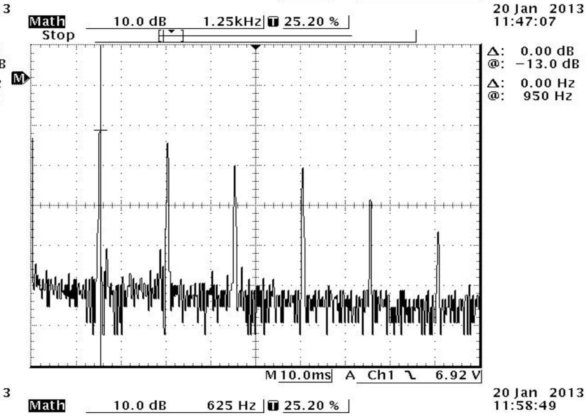

Stop
Δ: 0.00 dB
@: −23.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:27:15
Math 10.0 dB 625 Hz 25.20 %

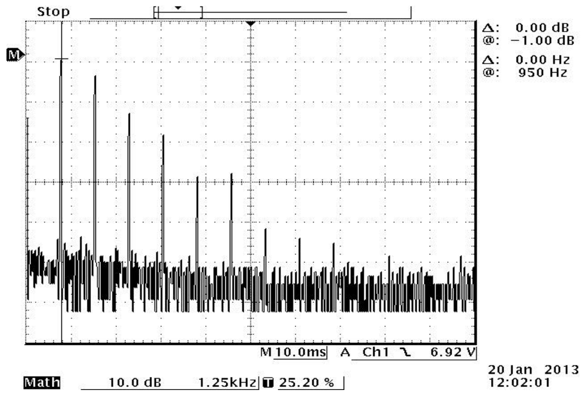

Stop
Δ: 0.00 dB
@: −19.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:35:39
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −16.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:40:05
Math 10.0 dB 625 Hz 25.20 %

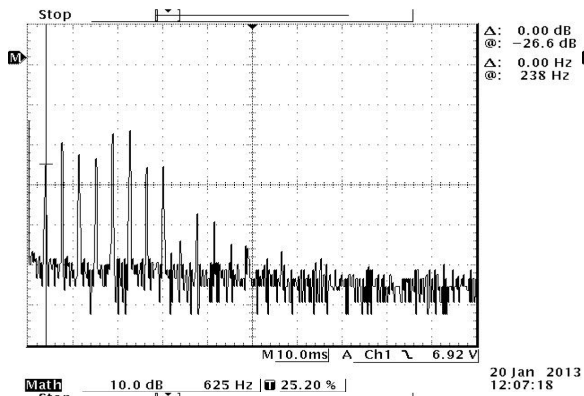

Stop
Δ: 0.00 dB
@: −14.4 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:47:07
Math 10.0 dB 1.25kHz 25.20 %

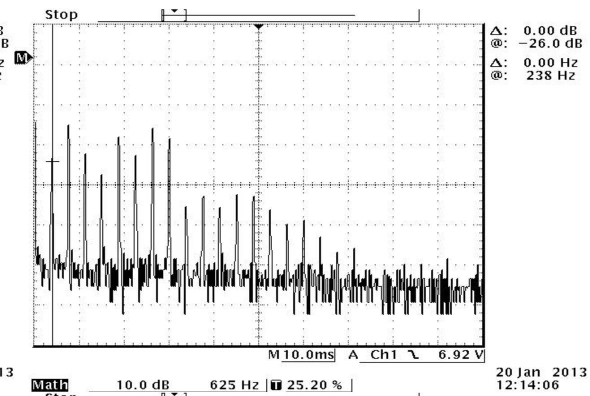

Stop
Δ: 0.00 dB
@: −9.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:55:52
Math 10.0 dB 625 Hz 25.20 %

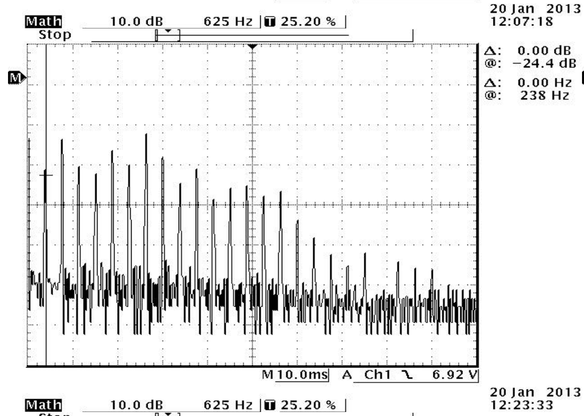

Stop
Δ: 0.00 dB
@: −13.0 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
11:58:49
Math 10.0 dB 625 Hz 25.20 %

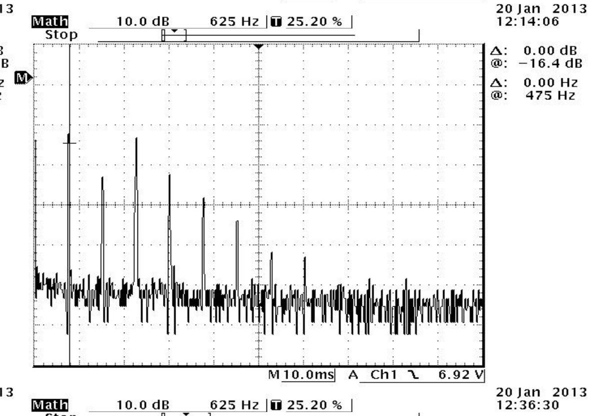

Stop
Δ: 0.00 dB
@: −1.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ℷ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
12:02:01

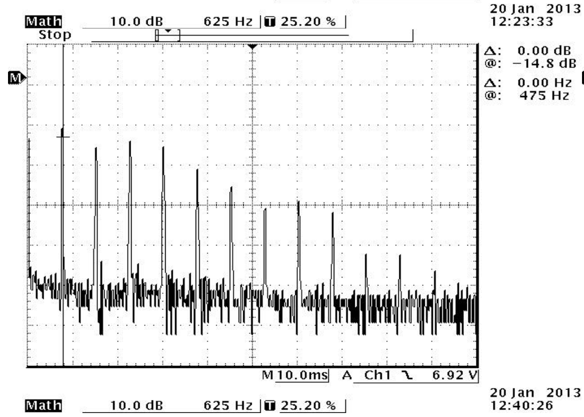
SC

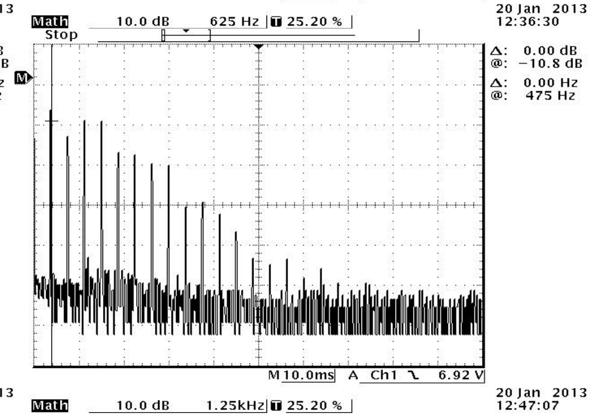

Stop
Δ: 0.00 dB
@: −26.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ℷ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
12:07:18

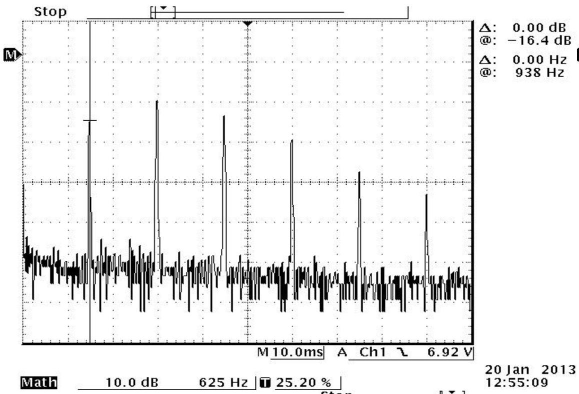

Stop
Δ: 0.00 dB
@: −26.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ℷ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
12:14:06

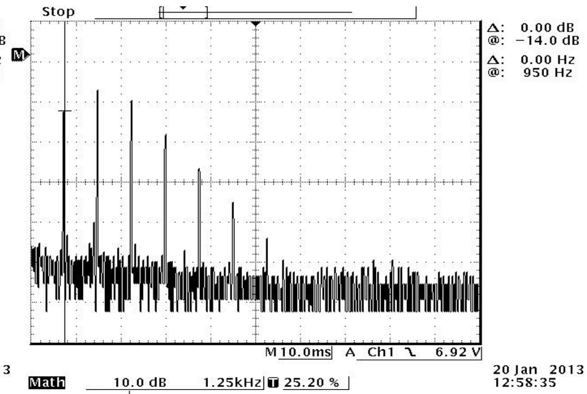

Stop
Δ: 0.00 dB
@: −24.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ℷ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
12:23:33

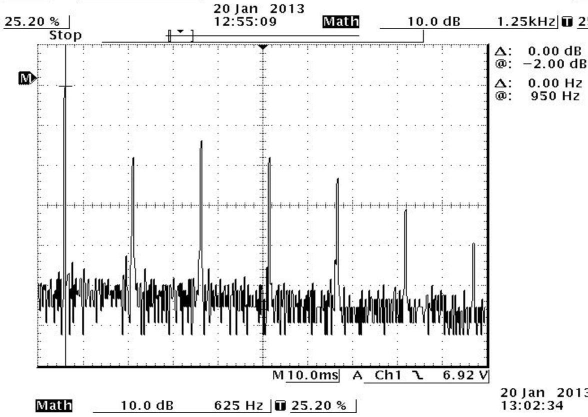

Stop
Δ: 0.00 dB
@: −16.4 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ℷ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
12:36:30


Stop
Δ: 0.00 dB
@: −14.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ℷ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
12:40:26

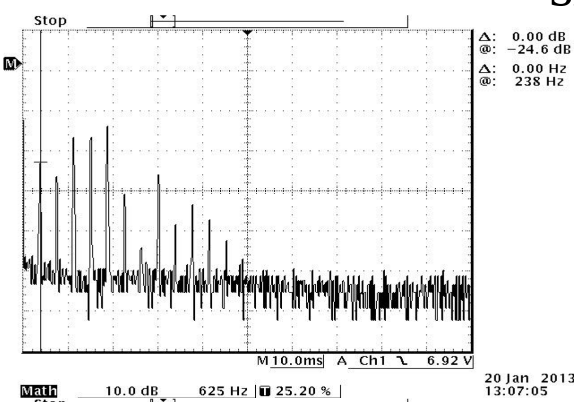

Stop
Δ: 0.00 dB
@: −10.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ℷ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
12:47:07

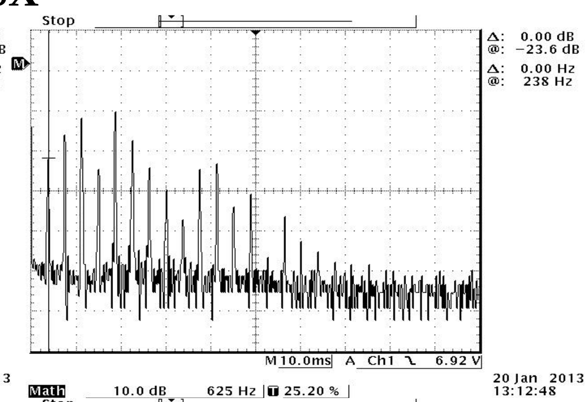

Stop
Δ: 0.00 dB
@: −16.4 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
12:55:09

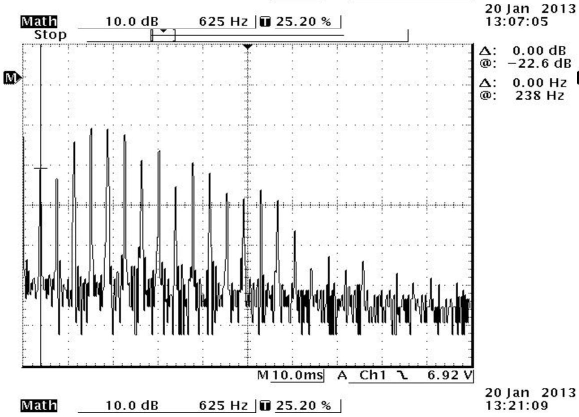

Stop
Δ: 0.00 dB
@: −14.0 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
12:58:35

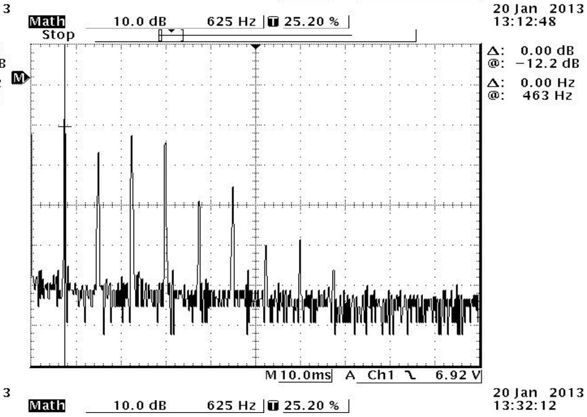

Stop
Δ: 0.00 dB
@: −2.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
13:02:34

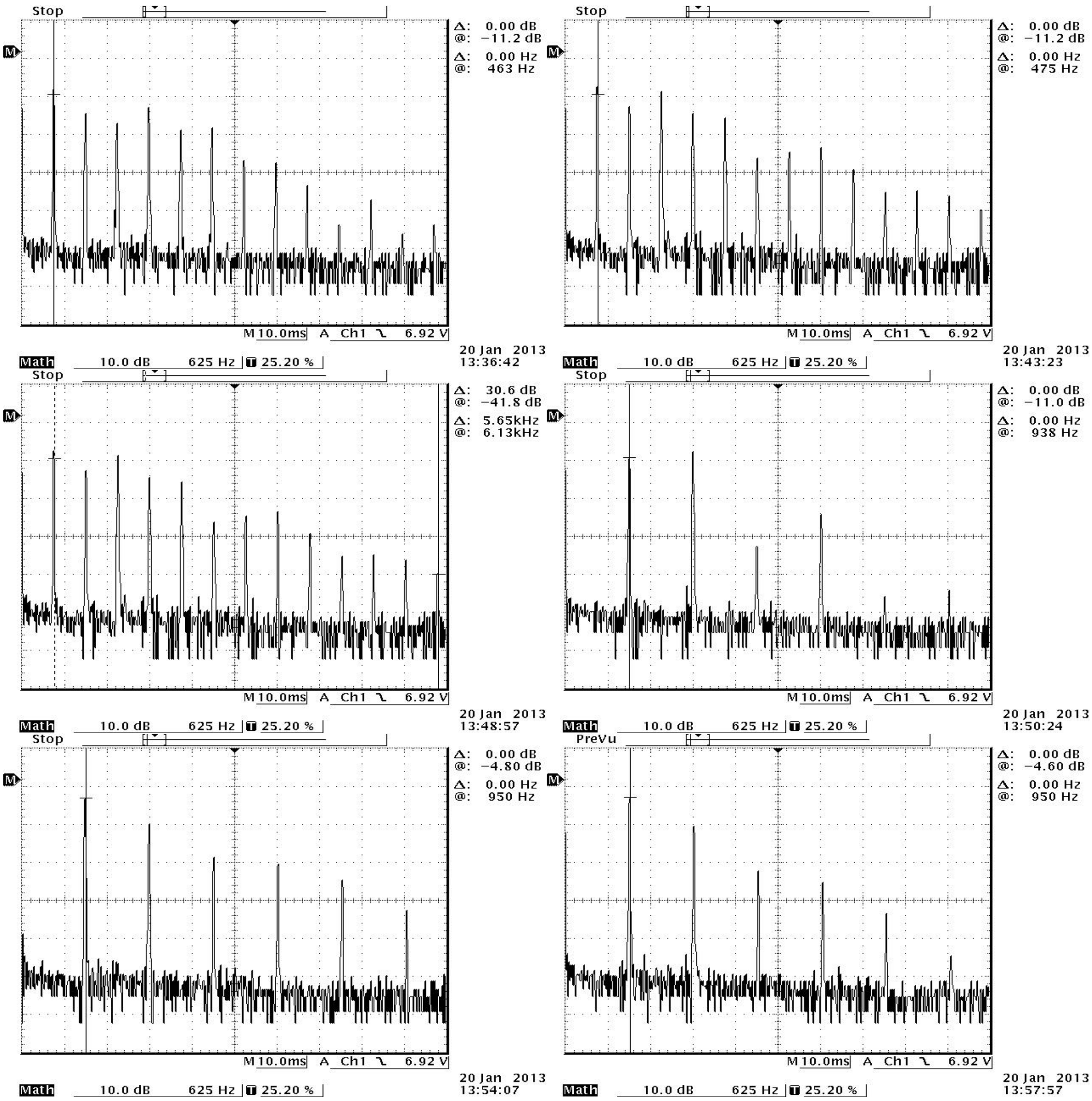
SX


Stop
Δ: 0.00 dB
@: −24.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
13:07:05


Stop
Δ: 0.00 dB
@: −23.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
13:12:48

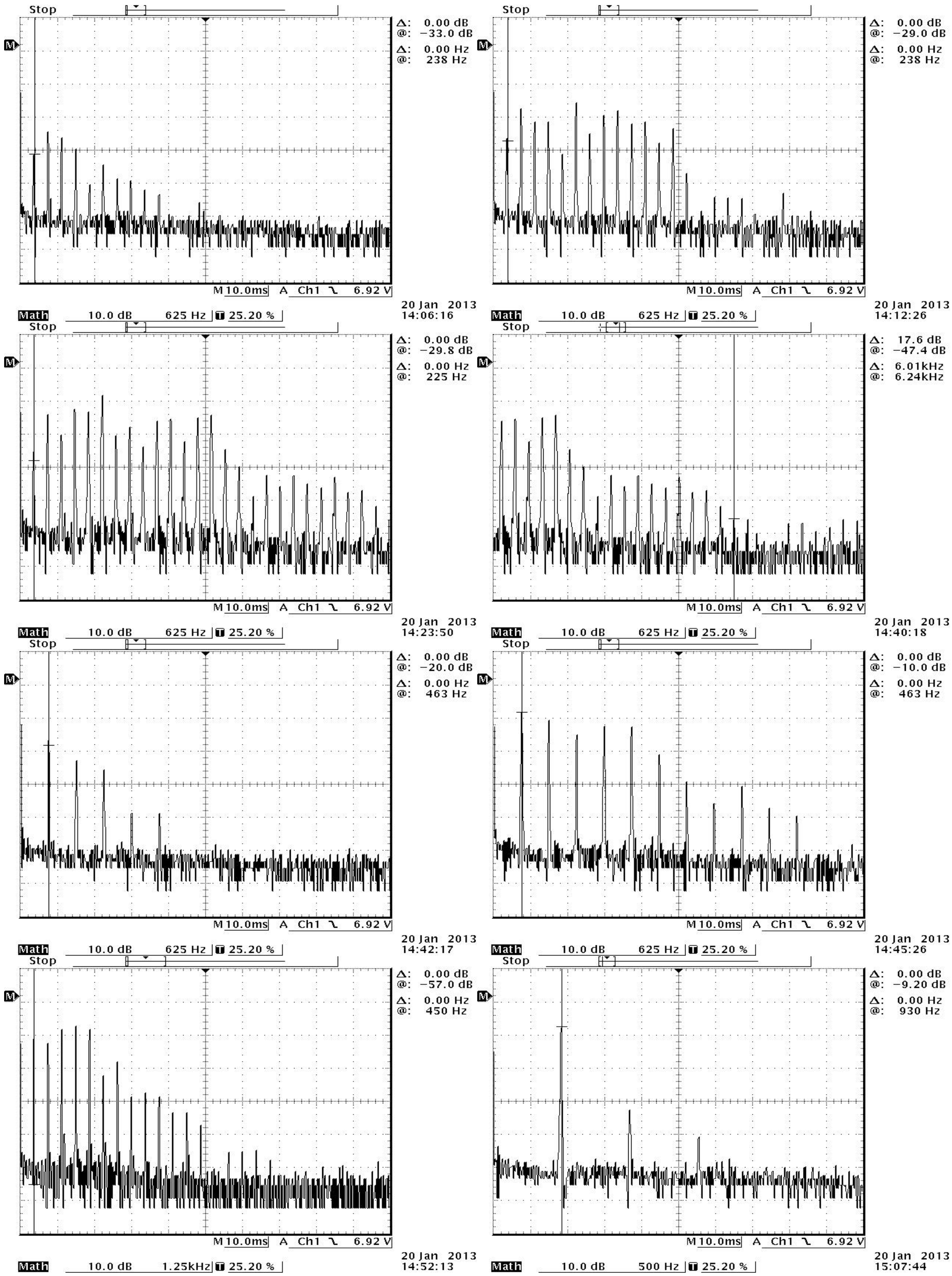

Stop
Δ: 0.00 dB
@: −22.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
13:21:09

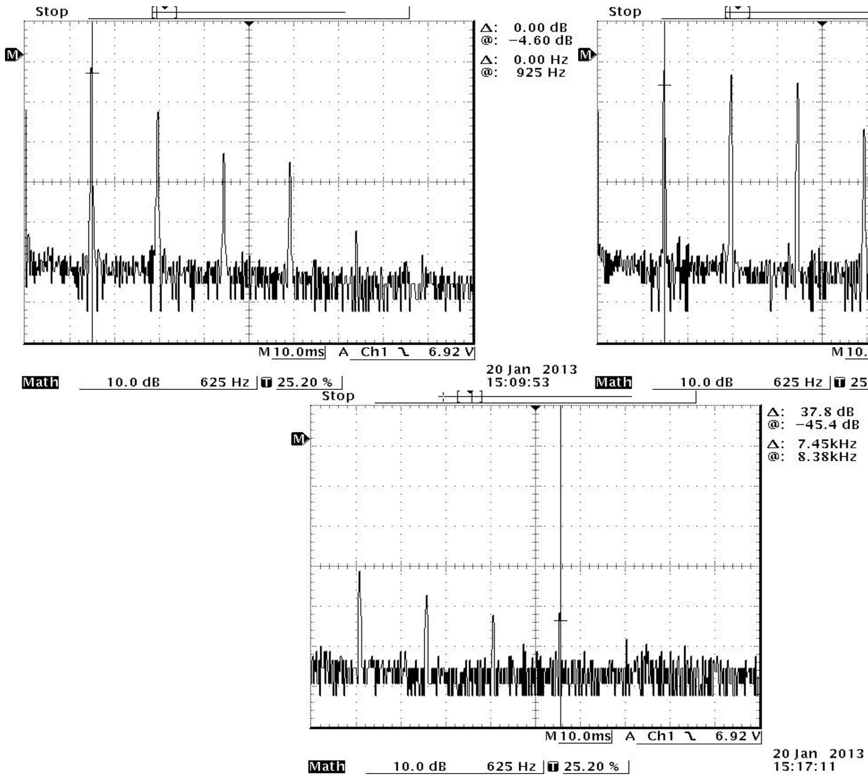

Stop
Δ: 0.00 dB
@: −12.2 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
13:32:12


Stop
Δ: 0.00 dB
@: −11.2 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
13:36:42
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −11.2 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
13:43:23
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 30.6 dB
@: −41.8 dB
Δ: 5.65kHz
@: 6.13kHz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
13:48:57
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −11.0 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
13:50:24
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −4.80 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
13:54:07
Math 10.0 dB 625 Hz 25.20 %
PreVu
Δ: 0.00 dB
@: −4.60 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
20 Jan 2013
13:57:57
Math 10.0 dB 625 Hz 25.20 %

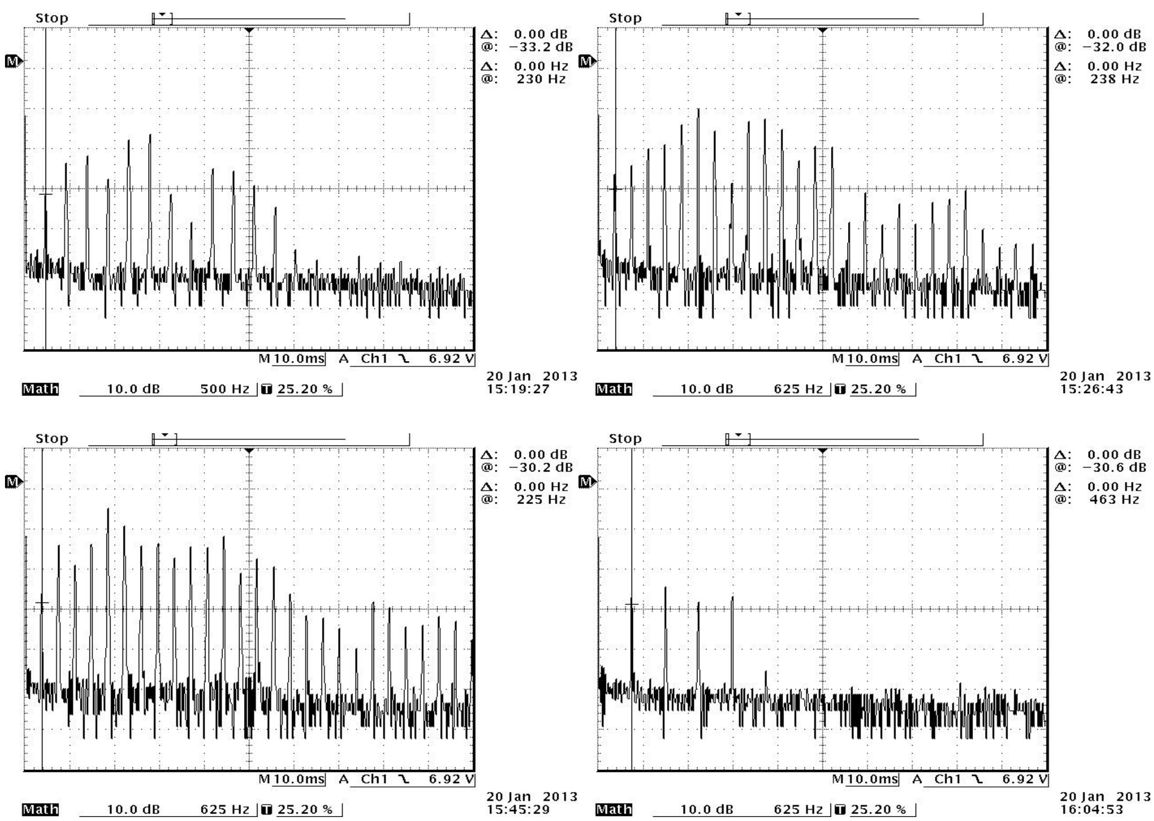
Player 2

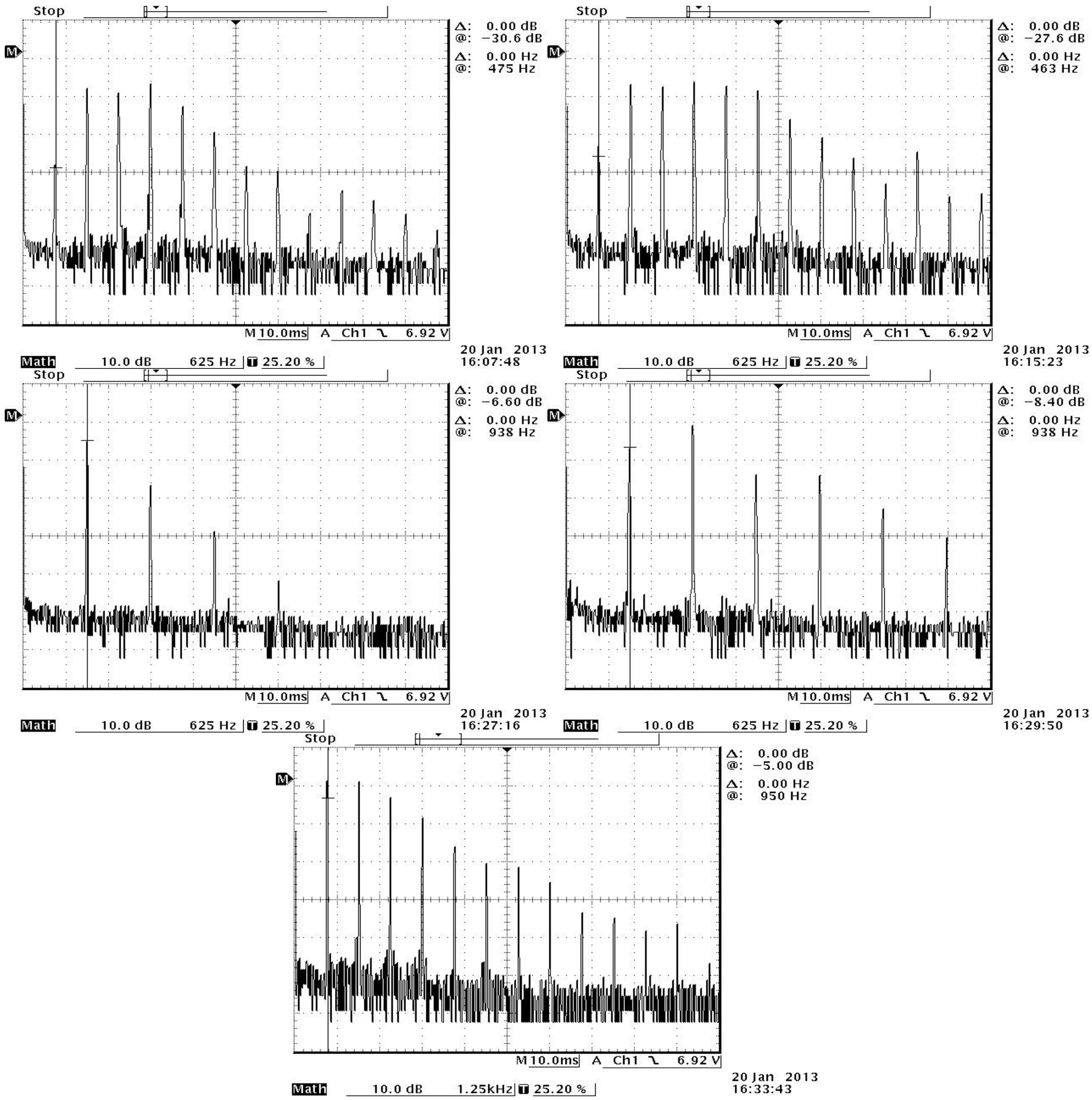
SA


Stop
Δ: 0.00 dB
@: −33.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
14:06:16
Stop
Δ: 0.00 dB
@: −29.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
14:12:26
Stop
Δ: 0.00 dB
@: −29.8 dB
Δ: 0.00 Hz
@: 225 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
14:23:50
Stop
Δ: 17.6 dB
@: −47.4 dB
Δ: 6.01kHz
@: 6.24kHz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
14:40:18
Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
14:42:17
Stop
Δ: 0.00 dB
@: −10.0 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
14:45:26
Stop
Δ: 0.00 dB
@: −57.0 dB
Δ: 0.00 Hz
@: 450 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
14:52:13
Stop
Δ: 0.00 dB
@: −9.20 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
15:07:44

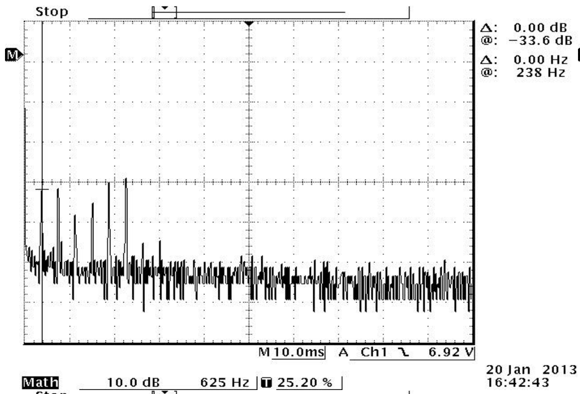

Stop
Δ: 0.00 dB
@: −4.60 dB
Δ: 0.00 Hz
@: 925 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
15:09:53
Stop
Δ: 0.00 dB
@: −7.60 dB
Δ: 0.00 Hz
@: 925 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
15:13:19
Stop
Δ: 37.8 dB
@: −45.4 dB
Δ: 7.45kHz
@: 8.38kHz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
15:17:11

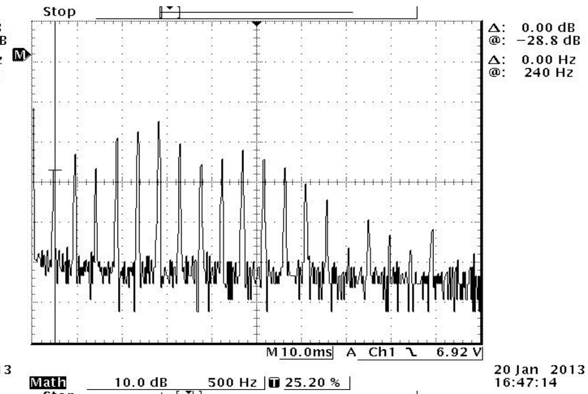
B76

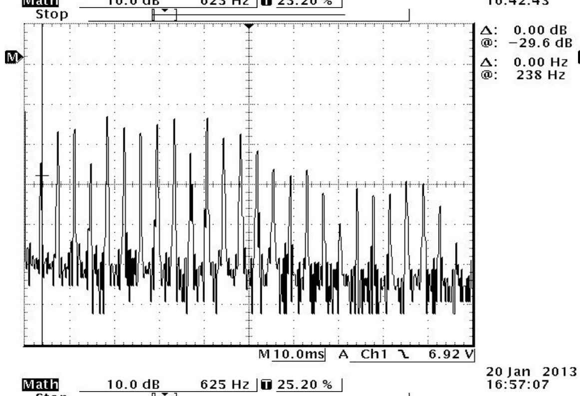

Stop
Δ: 0.00 dB
@: −33.2 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
15:19:27
Stop
Δ: 0.00 dB
@: −32.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
15:26:43
Stop
Δ: 0.00 dB
@: −30.2 dB
Δ: 0.00 Hz
@: 225 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
15:45:29
Stop
Δ: 0.00 dB
@: −30.6 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
16:04:53

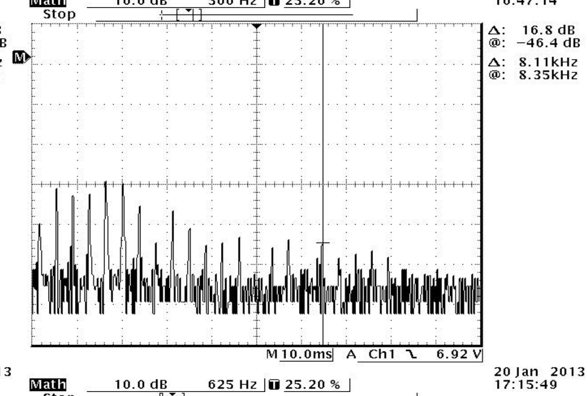

Stop
Δ: 0.00 dB
@: −30.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
16:07:48
Stop
Δ: 0.00 dB
@: −27.6 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
16:15:23
Stop
Δ: 0.00 dB
@: −6.60 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
16:27:16
Stop
Δ: 0.00 dB
@: −8.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
16:29:50
Stop
Δ: 0.00 dB
@: −5.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
16:33:43

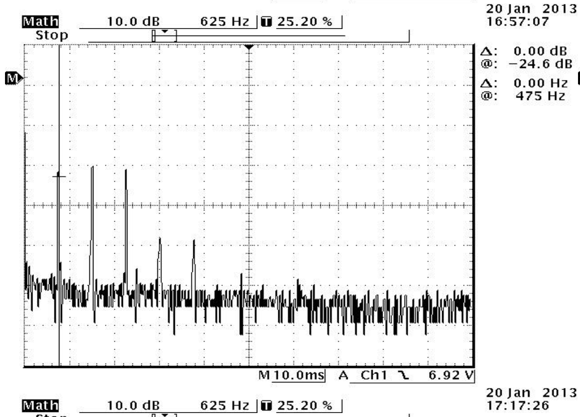
YA

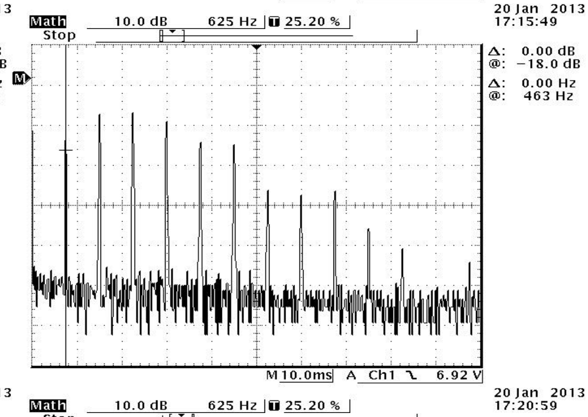

Stop
Δ: 0.00 dB
@: −33.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
16:42:43
Math 10.0 dB 625 Hz 25.20 %

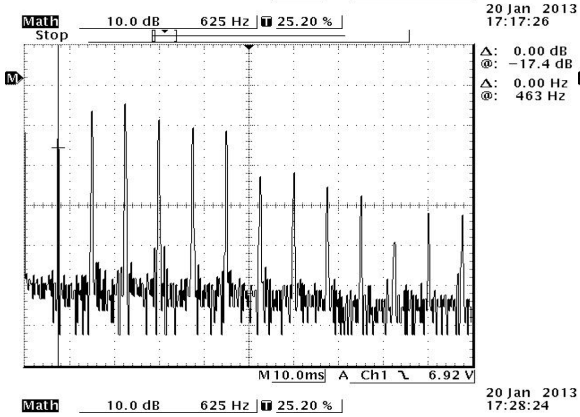

Stop
Δ: 0.00 dB
@: −28.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
16:47:14
Math 10.0 dB 500 Hz 25.20 %

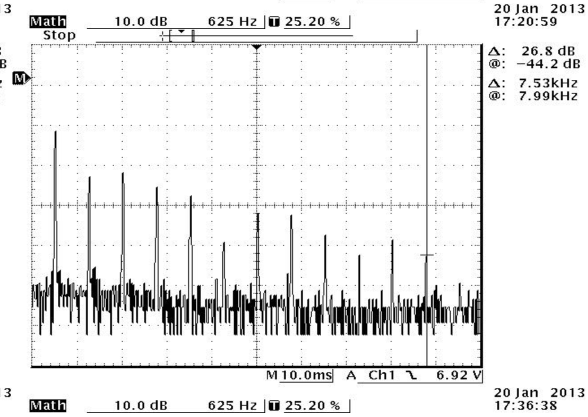

Stop
Δ: 0.00 dB
@: −29.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
16:57:07
Math 10.0 dB 625 Hz 25.20 %

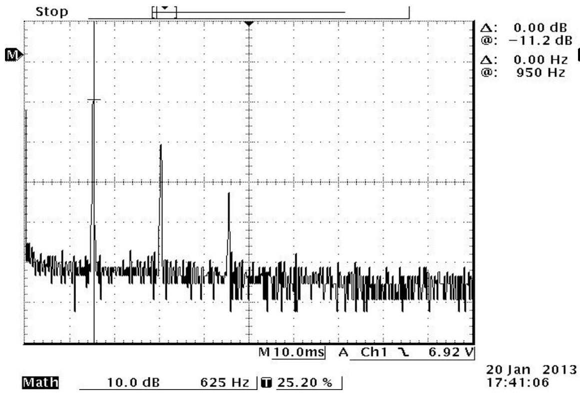

Stop
Δ: 16.8 dB
@: −46.4 dB
Δ: 8.11kHz
@: 8.35kHz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
17:15:49
Math 10.0 dB 625 Hz 25.20 %

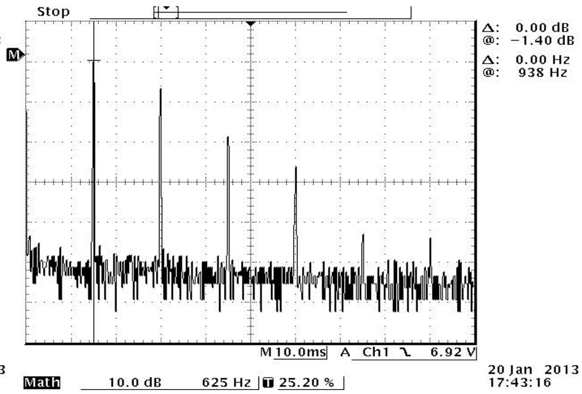

Stop
Δ: 0.00 dB
@: −24.6 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
17:17:26
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −18.0 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
17:20:59
Math 10.0 dB 625 Hz 25.20 %

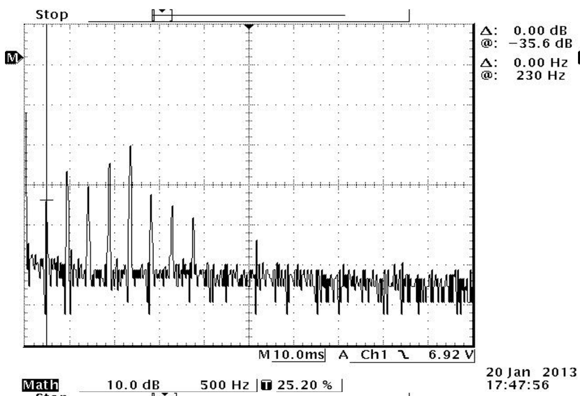

Stop
Δ: 0.00 dB
@: −17.4 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
17:28:24
Math 10.0 dB 625 Hz 25.20 %

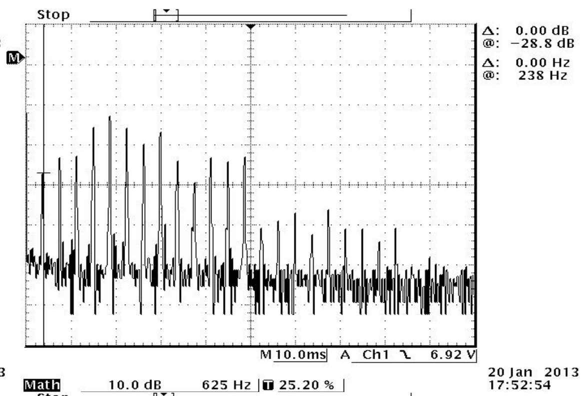

Stop
Δ: 26.8 dB
@: −44.2 dB
Δ: 7.53kHz
@: 7.99kHz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
17:36:38
Math 10.0 dB 625 Hz 25.20 %

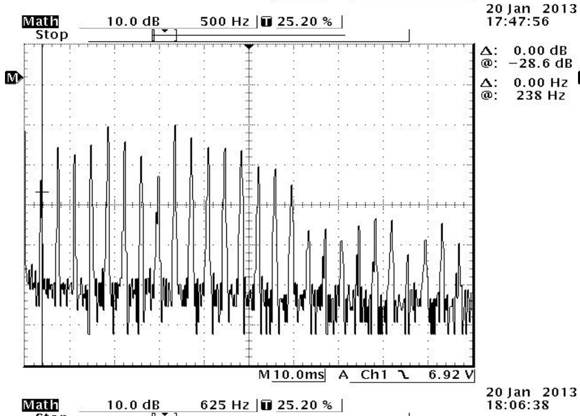

Stop
Δ: 0.00 dB
@: −11.2 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
17:41:06

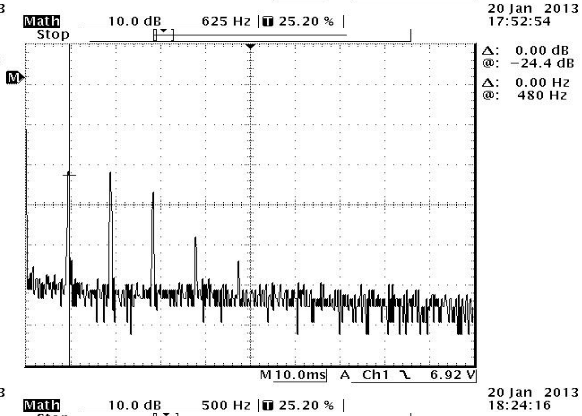

Stop
Δ: 0.00 dB
@: −1.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
17:43:16

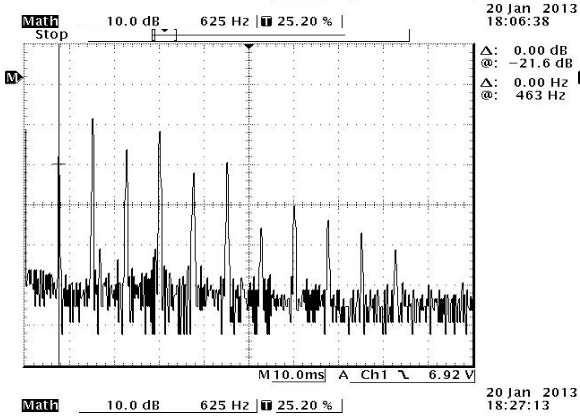
B10

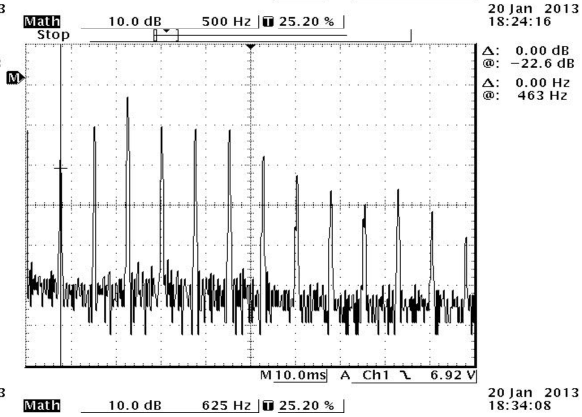

Stop
Δ: 0.00 dB
@: −35.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
17:47:56

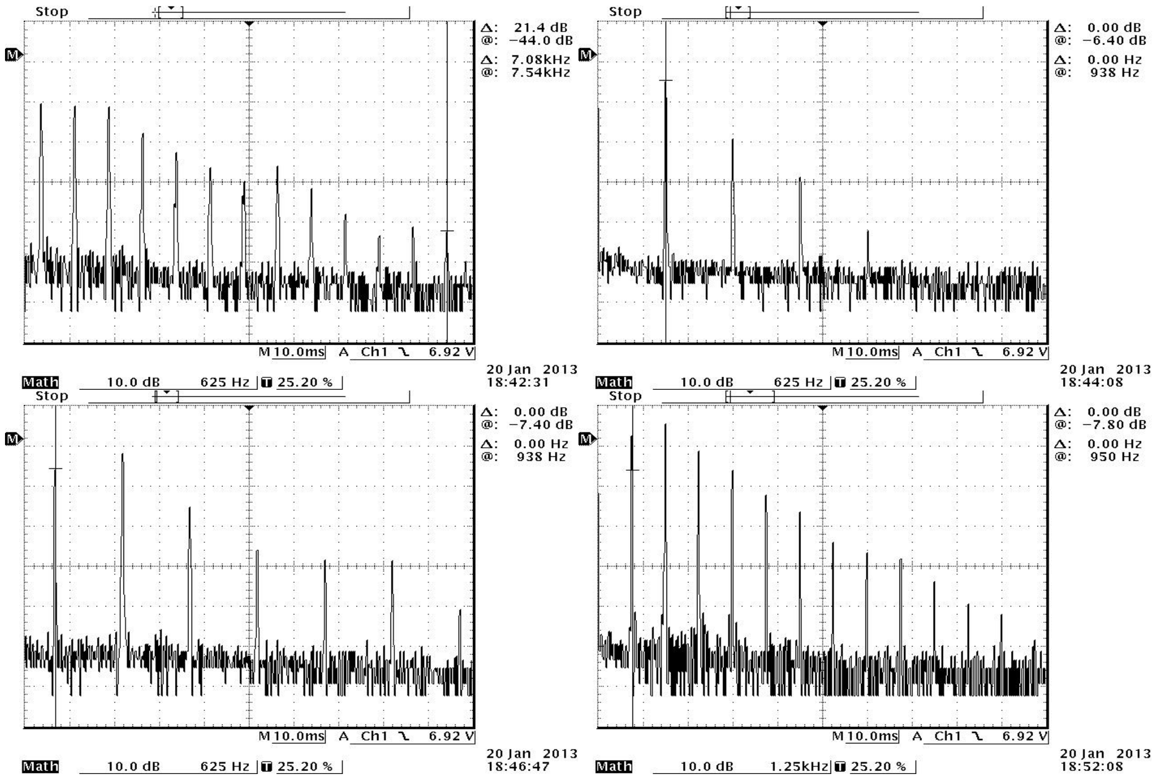

Stop
Δ: 0.00 dB
@: −28.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
17:52:54


Stop
Δ: 0.00 dB
@: −28.6 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
18:06:38

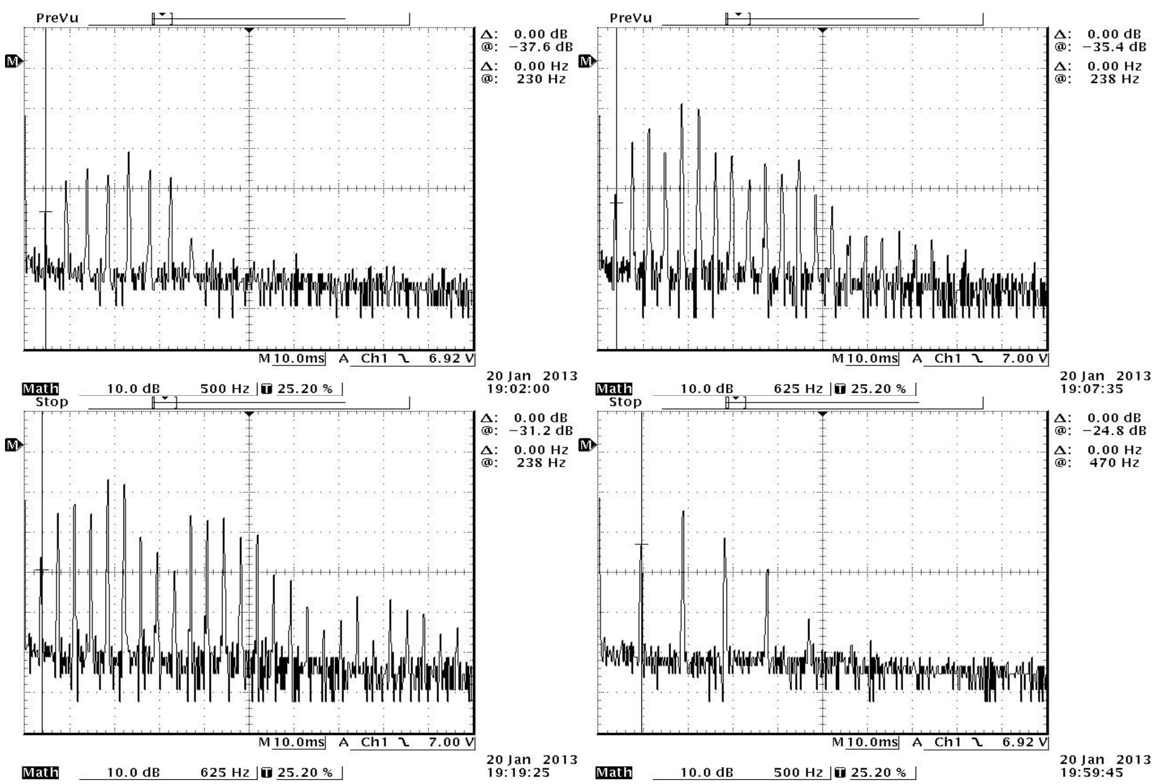

Stop
Δ: 0.00 dB
@: −24.4 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
18:24:16

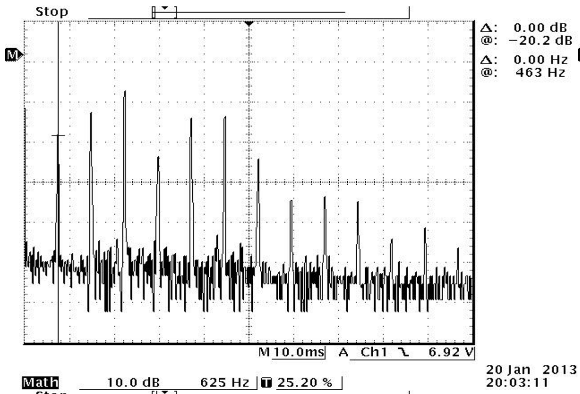

Stop
Δ: 0.00 dB
@: −21.6 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
18:27:13

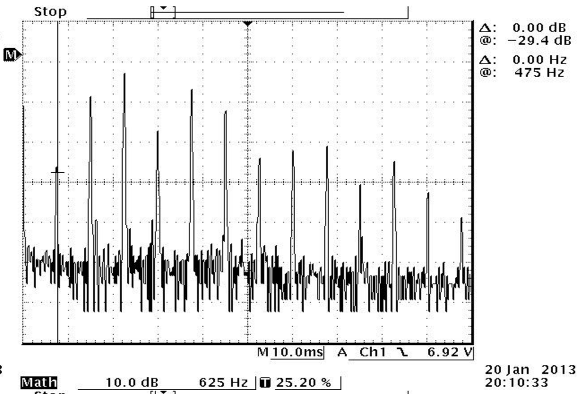

Stop
Δ: 0.00 dB
@: −22.6 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ↘ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
18:34:08

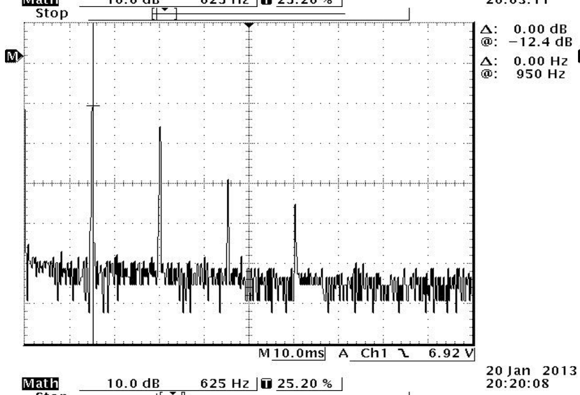

Stop
Δ: 21.4 dB
@: −44.0 dB
Δ: 7.08kHz
@: 7.54kHz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
18:42:31
Stop
Δ: 0.00 dB
@: −6.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
18:44:08
Stop
Δ: 0.00 dB
@: −7.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
18:46:47
Stop
Δ: 0.00 dB
@: −7.80 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 1.25kHz 25.20 %
20 Jan 2013
18:52:08

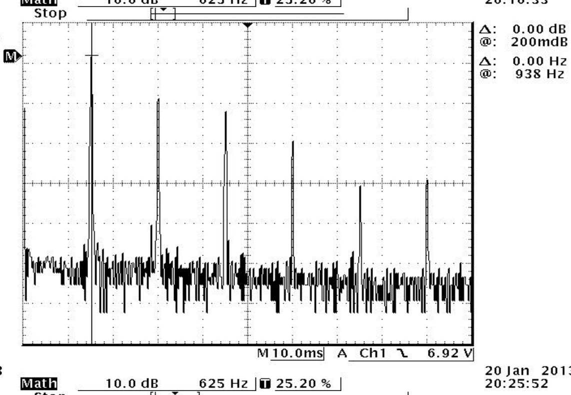
YC

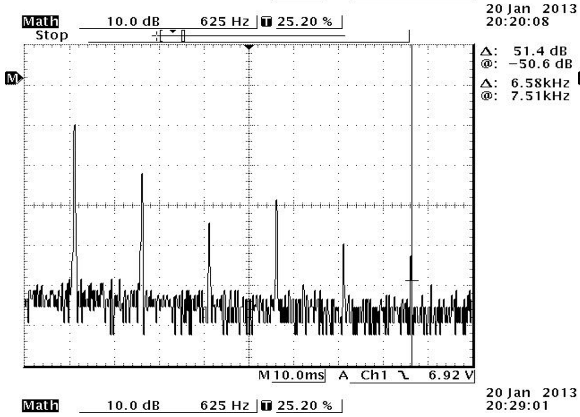

PreVu
Δ: 0.00 dB
@: −37.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
19:02:00
PreVu
Δ: 0.00 dB
@: −35.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤥ 7.00 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
19:07:35
Stop
Δ: 0.00 dB
@: −31.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤥ 7.00 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
19:19:25
Stop
Δ: 0.00 dB
@: −24.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
19:59:45

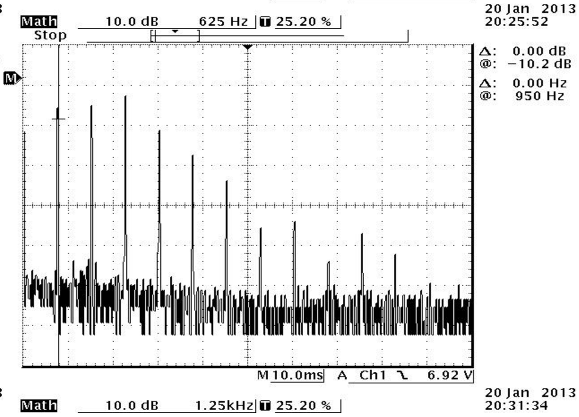

Stop
Δ: 0.00 dB
@: −20.2 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:03:11
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −29.4 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:10:33
Math 10.0 dB 625 Hz 25.20 %

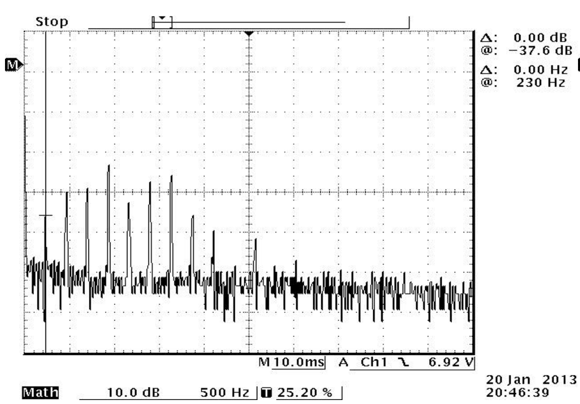

Stop
Δ: 0.00 dB
@: −12.4 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:20:08
Math 10.0 dB 625 Hz 25.20 %

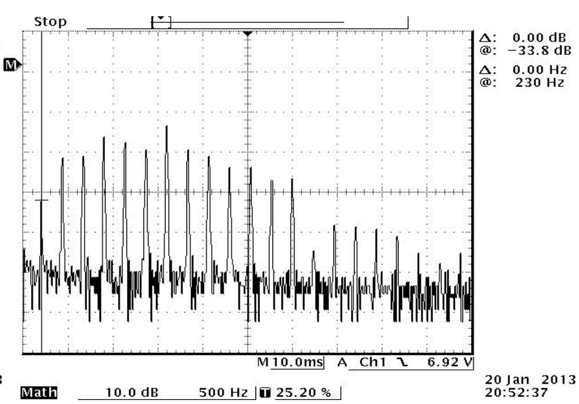

Stop
Δ: 0.00 dB
@: 200mdB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:25:52
Math 10.0 dB 625 Hz 25.20 %

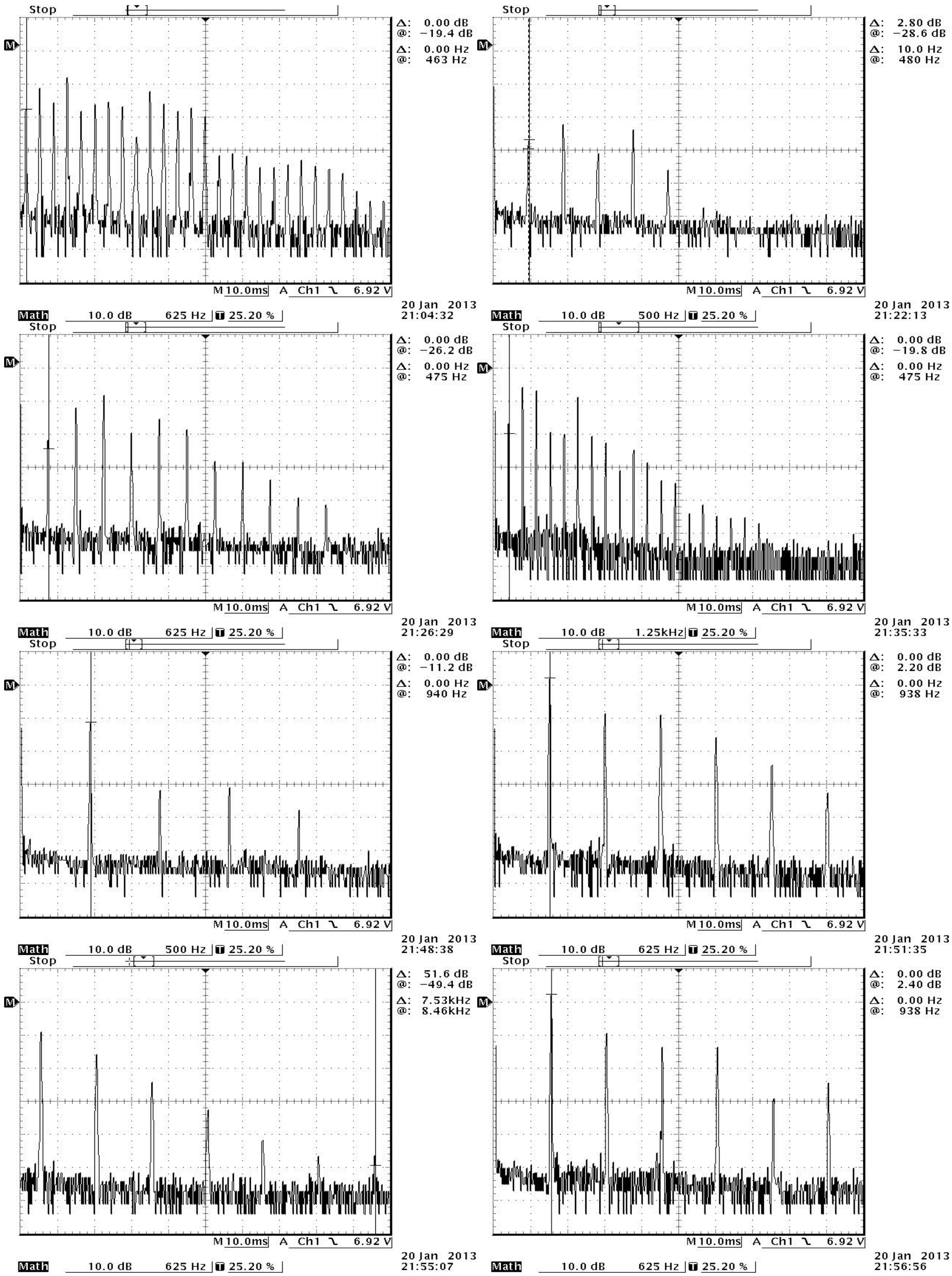

Stop
Δ: 51.4 dB
@: −50.6 dB
Δ: 6.58kHz
@: 7.51kHz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:29:01
Math 10.0 dB 625 Hz 25.20 %

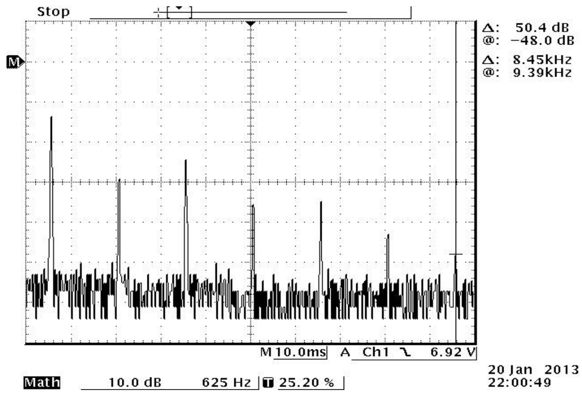

Stop
Δ: 0.00 dB
@: −10.2 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:31:34
Math 10.0 dB 1.25kHz 25.20 %

B24

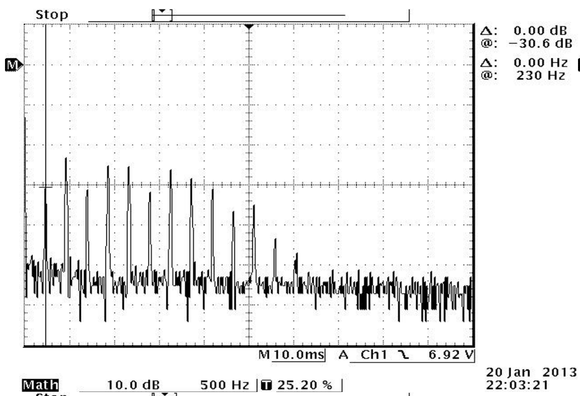

Stop
Δ: 0.00 dB
@: −37.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:46:39
Math 10.0 dB 500 Hz 25.20 %

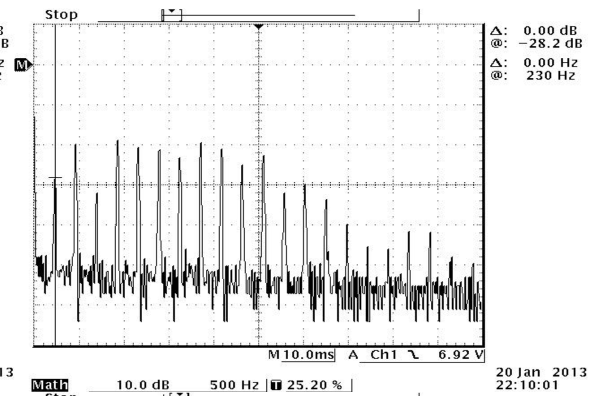

Stop
Δ: 0.00 dB
@: −33.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
20:52:37
Math 10.0 dB 500 Hz 25.20 %

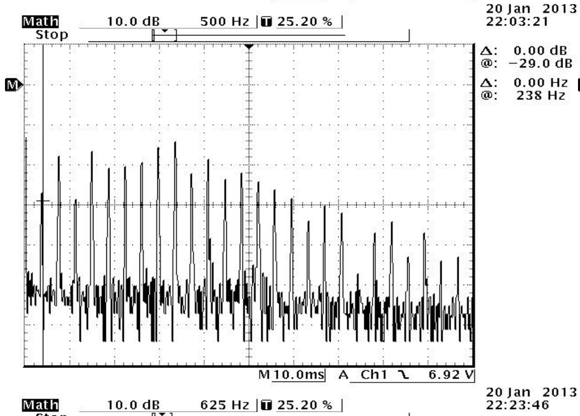

Stop
Δ: 0.00 dB
@: −19.4 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:04:32
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 2.80 dB
@: −28.6 dB
Δ: 10.0 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:22:13
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −26.2 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:26:29
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −19.8 dB
Δ: 0.00 Hz
@: 475 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:35:33
Math 10.0 dB 1.25kHz 25.20 %
Stop
Δ: 0.00 dB
@: −11.2 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:48:38
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: 2.20 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:51:35
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 51.6 dB
@: −49.4 dB
Δ: 7.53kHz
@: 8.46kHz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:55:07
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: 2.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
20 Jan 2013
21:56:56
Math 10.0 dB 625 Hz 25.20 %

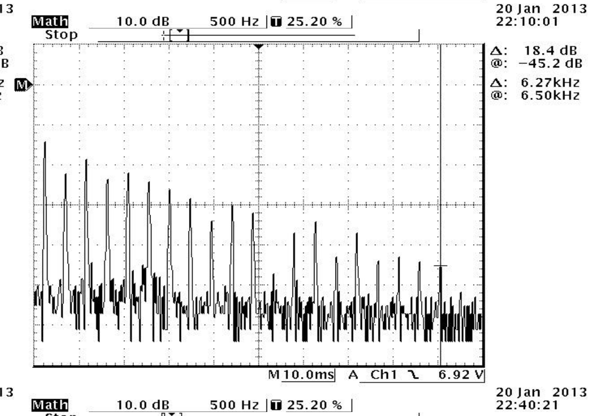

Stop
Δ: 50.4 dB
@: −48.0 dB
Δ: 8.45kHz
@: 9.39kHz
M 10.0ms A Ch1 ⦣ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
22:00:49

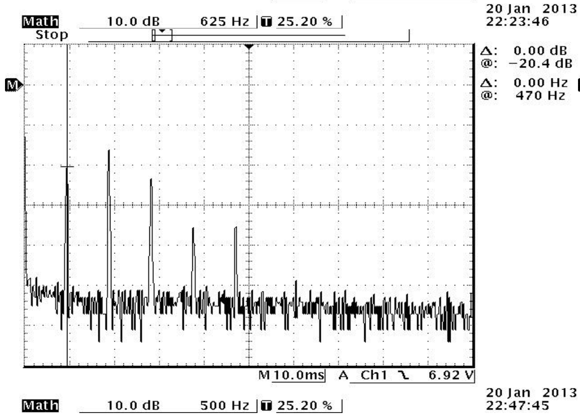
G7C

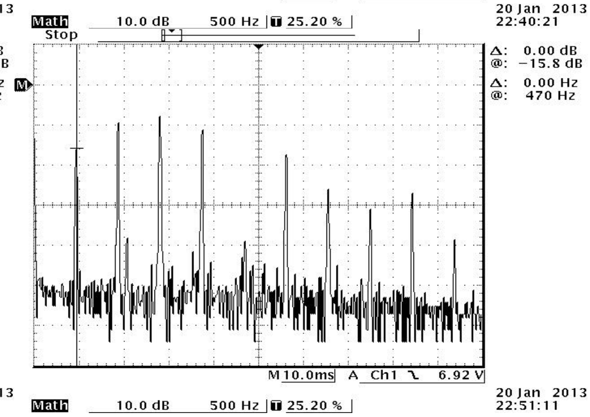

Stop
Δ: 0.00 dB
@: −30.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⦣ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
22:03:21

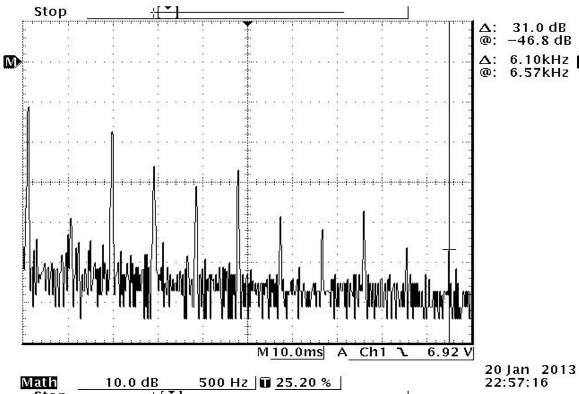

Stop
Δ: 0.00 dB
@: −28.2 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⦣ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
22:10:01

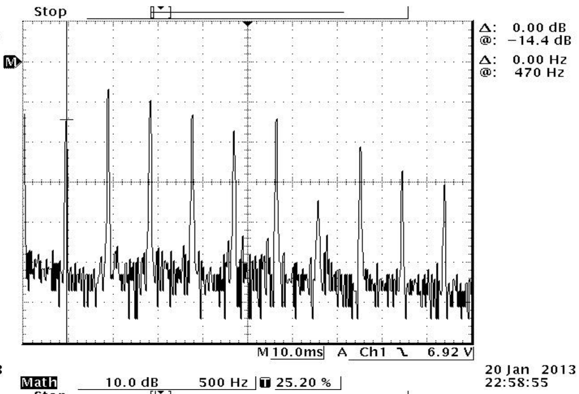

Stop
Δ: 0.00 dB
@: −29.0 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⦣ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
20 Jan 2013
22:23:46

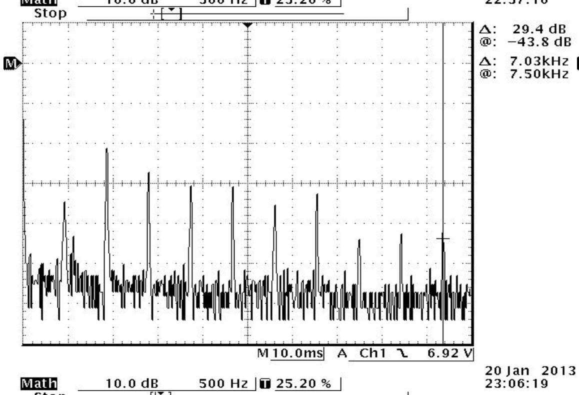

Stop
Δ: 18.4 dB
@: −45.2 dB
Δ: 6.27kHz
@: 6.50kHz
M 10.0ms A Ch1 ⦣ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
22:40:21

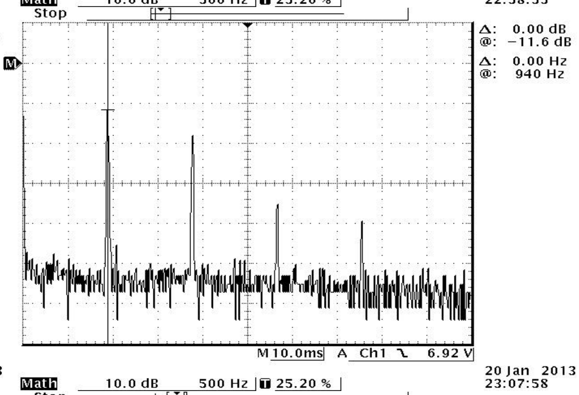

Stop
Δ: 0.00 dB
@: −20.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⦣ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
22:47:45

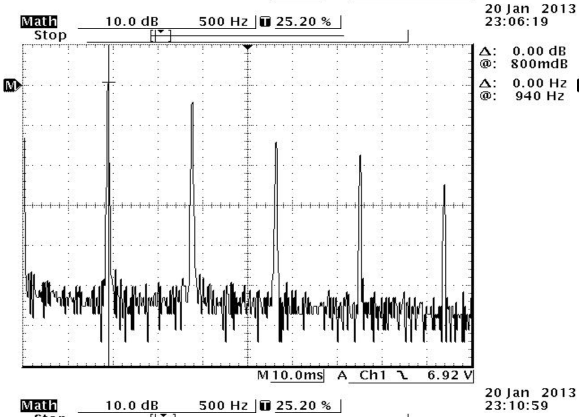

Stop
Δ: 0.00 dB
@: −15.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⦣ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
20 Jan 2013
22:51:11

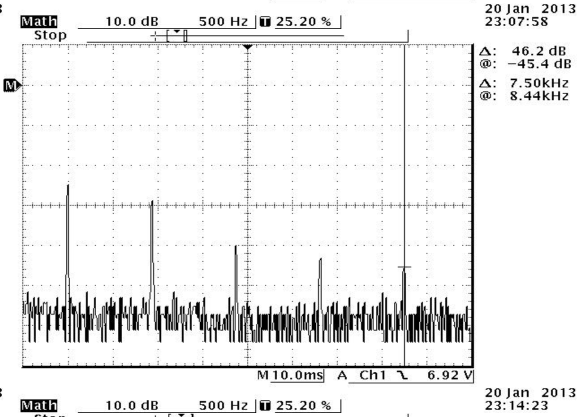

Stop
Δ: 31.0 dB
@: −46.8 dB
Δ: 6.10kHz
@: 6.57kHz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
22:57:16
Math 10.0 dB 500 Hz 25.20 %

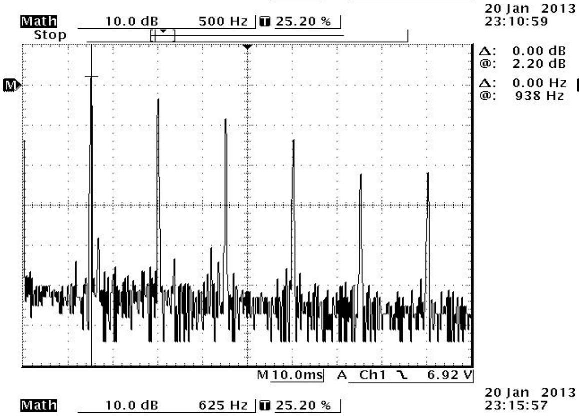

Stop
Δ: 0.00 dB
@: −14.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
22:58:55
Math 10.0 dB 500 Hz 25.20 %

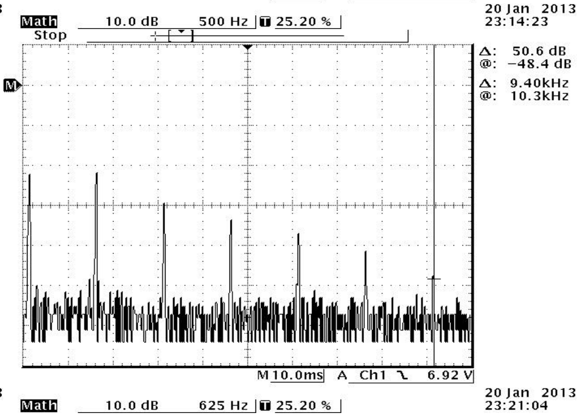

Stop
Δ: 29.4 dB
@: −43.8 dB
Δ: 7.03kHz
@: 7.50kHz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
23:06:19
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −11.6 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
23:07:58
Math 10.0 dB 500 Hz 25.20 %

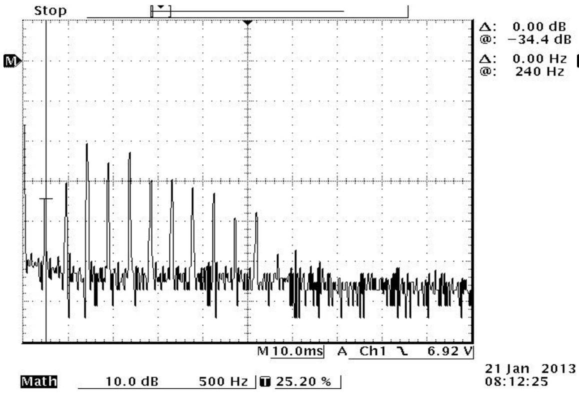

Stop
Δ: 0.00 dB
@: 800mdB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
23:10:59
Math 10.0 dB 500 Hz 25.20 %

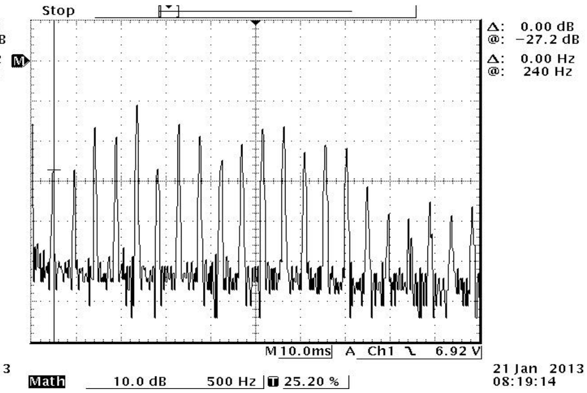

Stop
Δ: 46.2 dB
@: −45.4 dB
Δ: 7.50kHz
@: 8.44kHz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
23:14:23
Math 10.0 dB 500 Hz 25.20 %

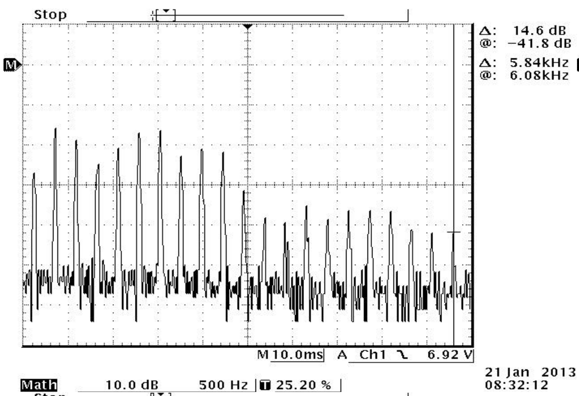

Stop
Δ: 0.00 dB
@: 2.20 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
23:15:57
Math 10.0 dB 625 Hz 25.20 %

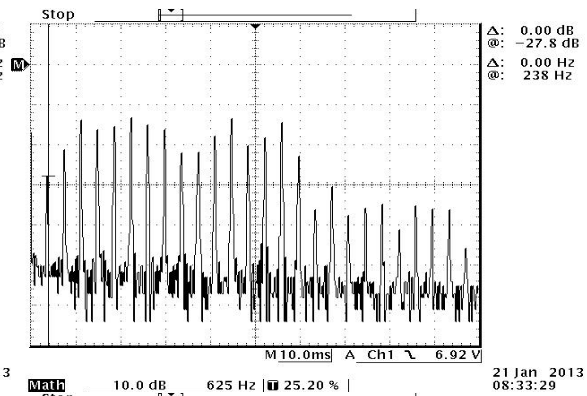

Stop
Δ: 50.6 dB
@: −48.4 dB
Δ: 9.40kHz
@: 10.3kHz
M 10.0ms A Ch1 ∖ 6.92 V
20 Jan 2013
23:21:04
Math 10.0 dB 625 Hz 25.20 %

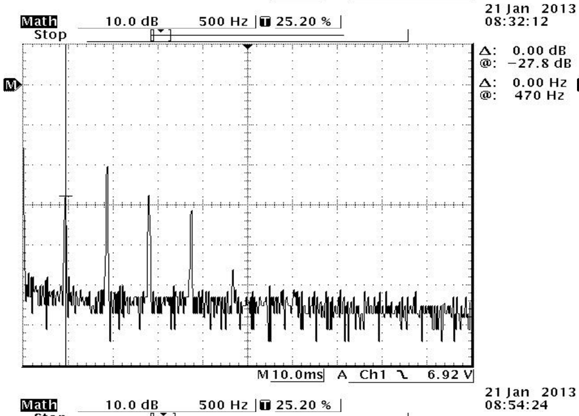
B7

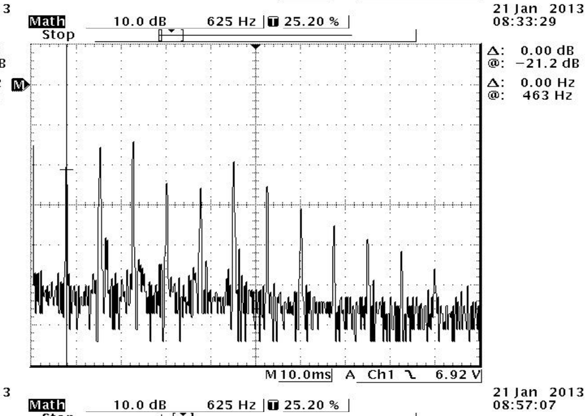

Stop
Δ: 0.00 dB
@: −34.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
08:12:25

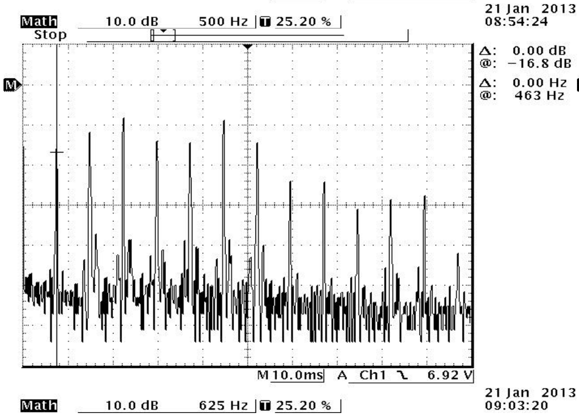

Stop
Δ: 0.00 dB
@: −27.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
08:19:14

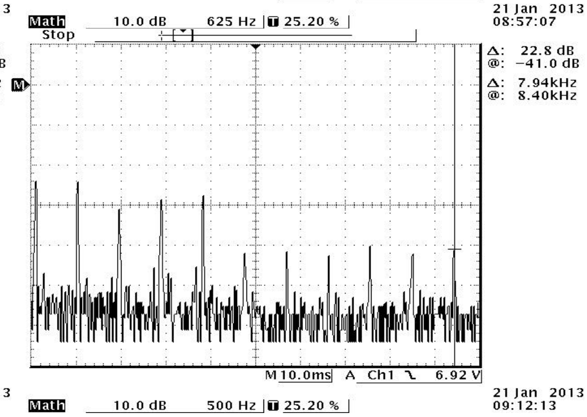

Stop
Δ: 14.6 dB
@: −41.8 dB
Δ: 5.84kHz
@: 6.08kHz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
08:32:12

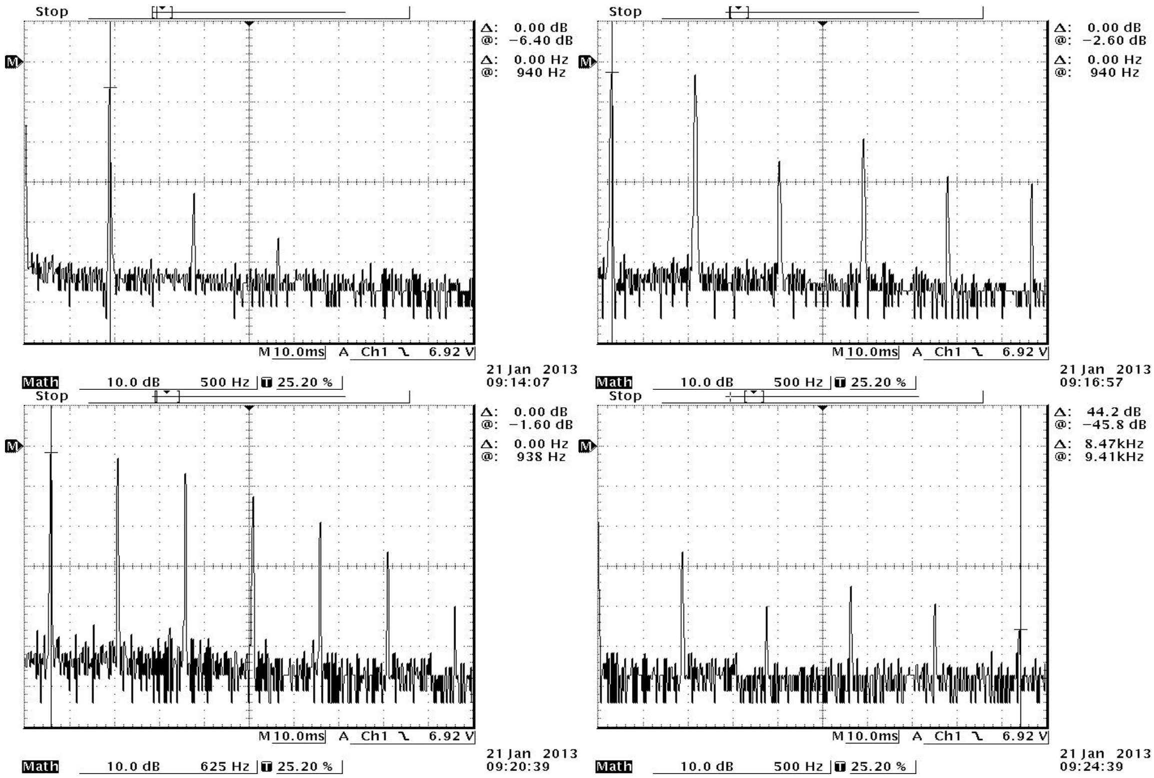

Stop
Δ: 0.00 dB
@: −27.8 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
08:33:29


Stop
Δ: 0.00 dB
@: −27.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
08:54:24

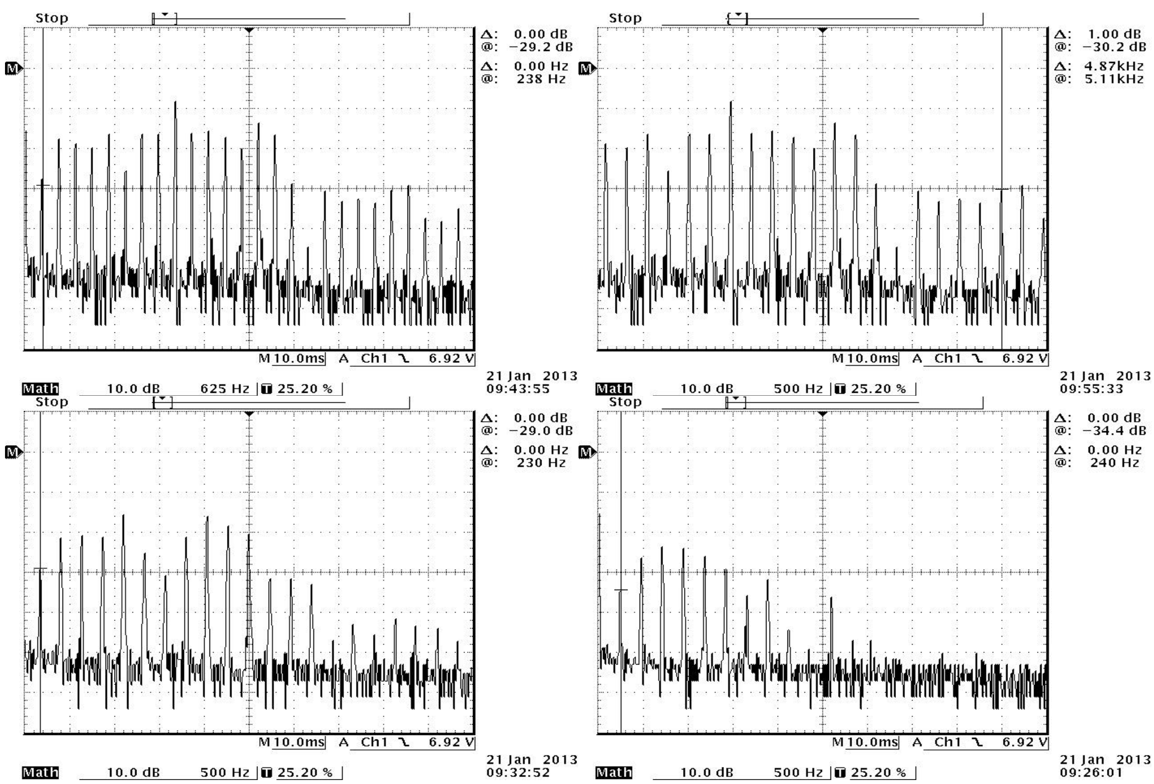

Stop
Δ: 0.00 dB
@: −21.2 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
08:57:07

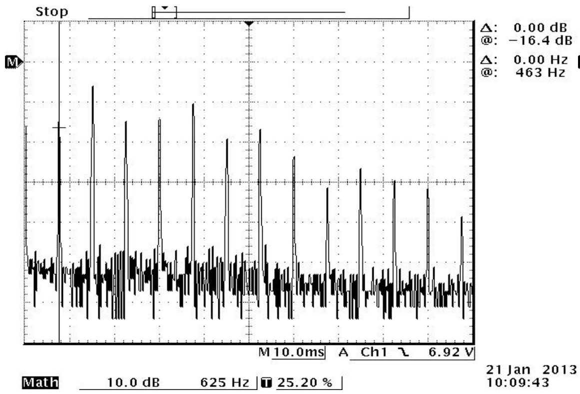

Stop
Δ: 0.00 dB
@: −16.8 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
09:03:20

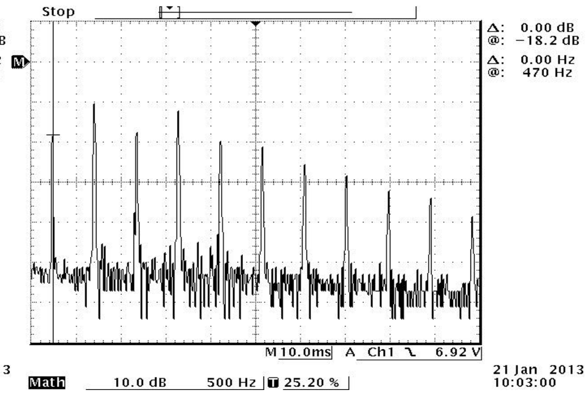

Stop
Δ: 22.8 dB
@: −41.0 dB
Δ: 7.94kHz
@: 8.40kHz
M 10.0ms A Ch1 ⌝ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
09:12:13

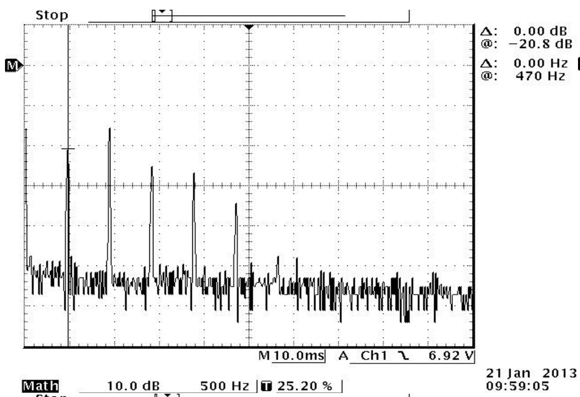

Stop
Δ: 0.00 dB
@: −6.40 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:14:07
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −2.60 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:16:57
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −1.60 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:20:39
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 44.2 dB
@: −45.8 dB
Δ: 8.47kHz
@: 9.41kHz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:24:39
Math 10.0 dB 500 Hz 25.20 %

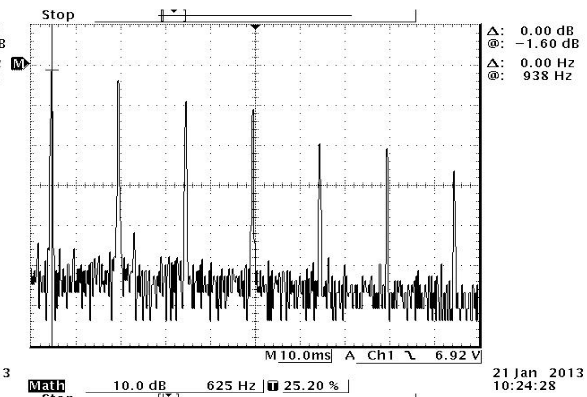
YMG

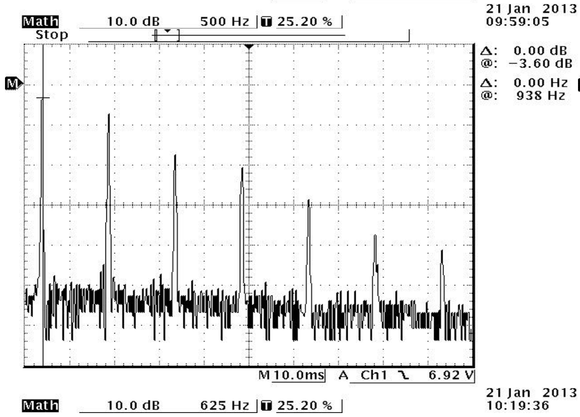

Stop
Δ: 0.00 dB
@: −29.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:43:55
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 1.00 dB
@: −30.2 dB
Δ: 4.87kHz
@: 5.11kHz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:55:33
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −29.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:32:52
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −34.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
21 Jan 2013
09:26:01
Math 10.0 dB 500 Hz 25.20 %

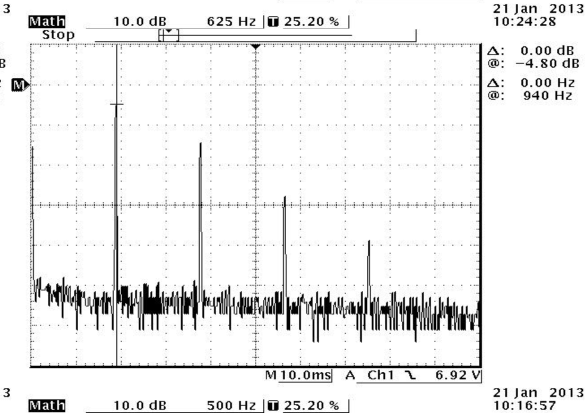

Stop
Δ: 0.00 dB
@: −16.4 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:09:43
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −18.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:03:00
Math 10.0 dB 500 Hz 25.20 %

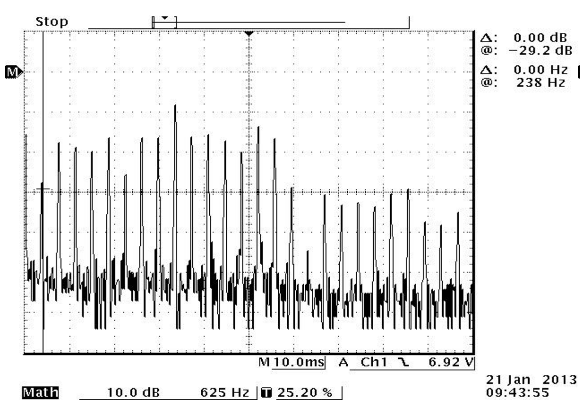

Stop
Δ: 0.00 dB
@: −20.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
09:59:05
Math 10.0 dB 500 Hz 25.20 %

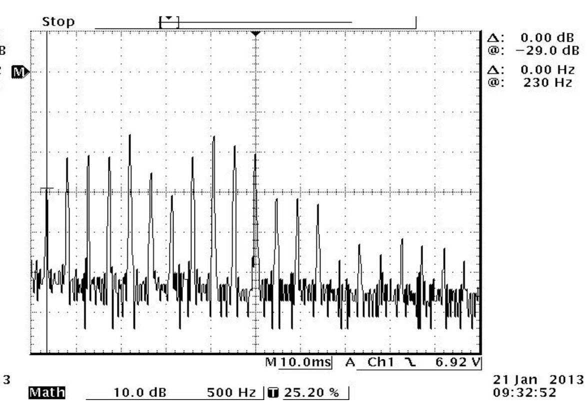

Stop
Δ: 0.00 dB
@: −1.60 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:24:28
Math 10.0 dB 625 Hz 25.20 %

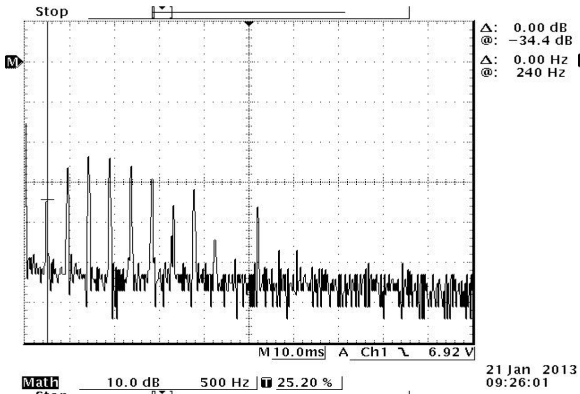

Stop
Δ: 0.00 dB
@: −3.60 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:19:36
Math 10.0 dB 625 Hz 25.20 %

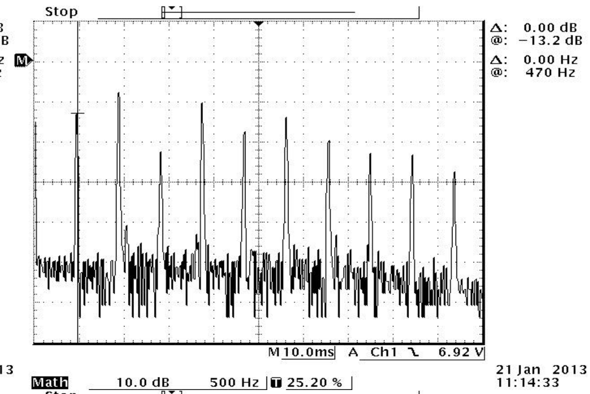

Stop
Δ: 0.00 dB
@: −4.80 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:16:57
Math 10.0 dB 500 Hz 25.20 %

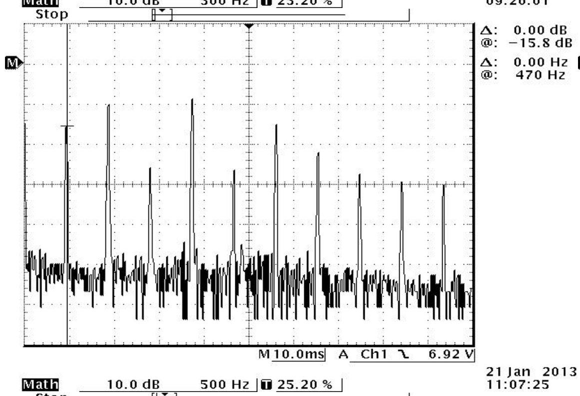
B117

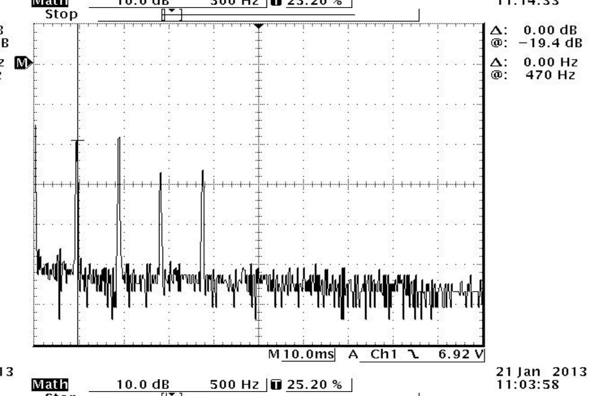

Stop
Δ: 0.00 dB
@: −29.2 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
09:43:55
Math 10.0 dB 625 Hz 25.20 %

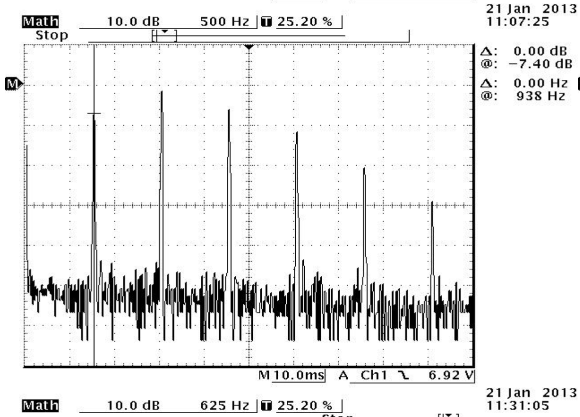

Stop
Δ: 0.00 dB
@: −29.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
09:32:52
Math 10.0 dB 500 Hz 25.20 %

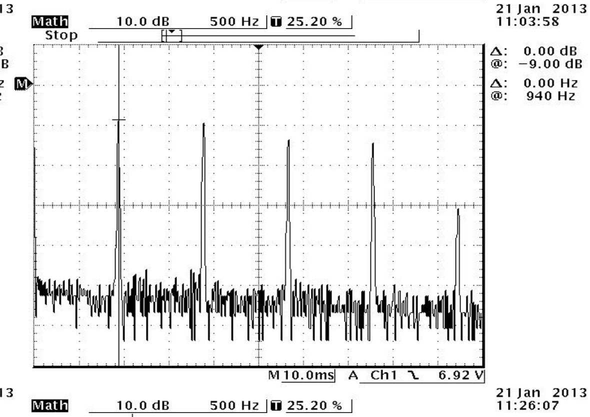

Stop
Δ: 0.00 dB
@: −34.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
09:26:01
Math 10.0 dB 500 Hz 25.20 %

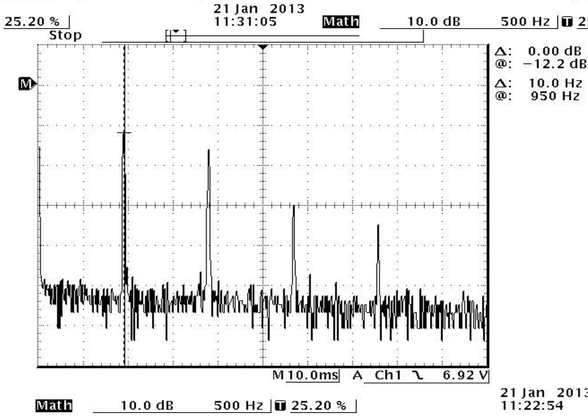

Stop
Δ: 0.00 dB
@: −13.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
11:14:33
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −15.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
11:07:25
Math 10.0 dB 500 Hz 25.20 %

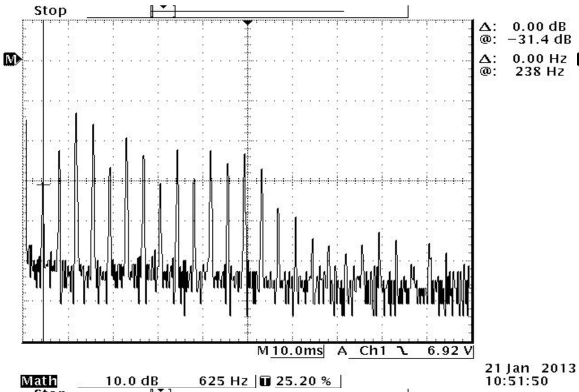

Stop
Δ: 0.00 dB
@: −19.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
11:03:58
Math 10.0 dB 500 Hz 25.20 %

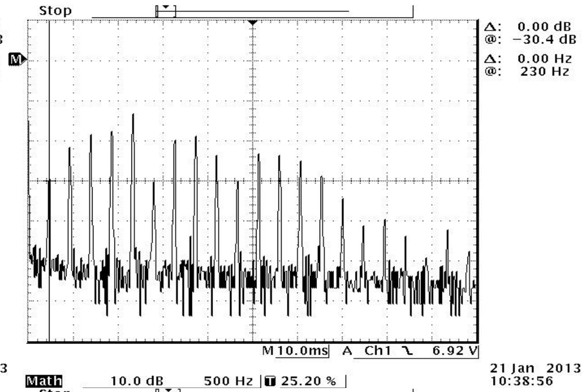

Stop
Δ: 0.00 dB
@: −7.40 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
11:31:05
Math 10.0 dB 625 Hz 25.20 %

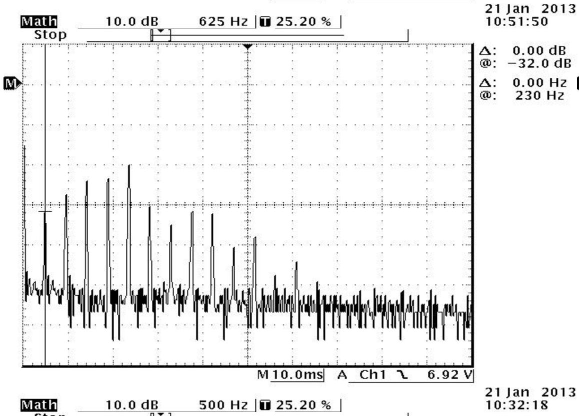

Stop
Δ: 0.00 dB
@: −9.00 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
11:26:07
Math 10.0 dB 500 Hz 25.20 %

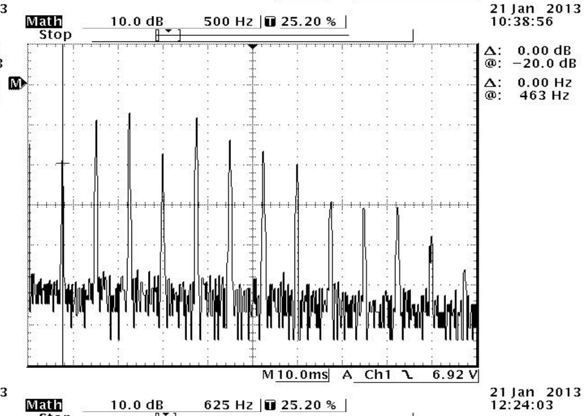

Stop
Δ: 0.00 dB
@: −12.2 dB
Δ: 10.0 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
11:22:54
Math 10.0 dB 500 Hz 25.20 %

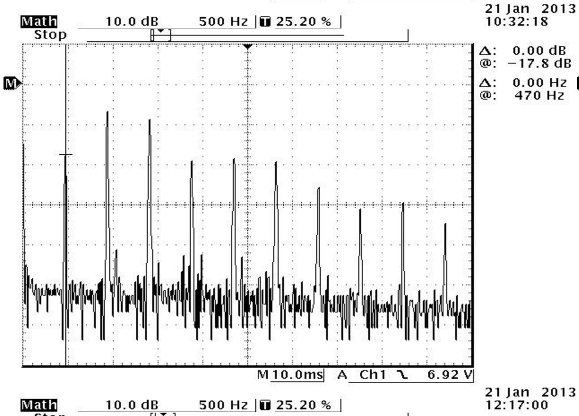
SC

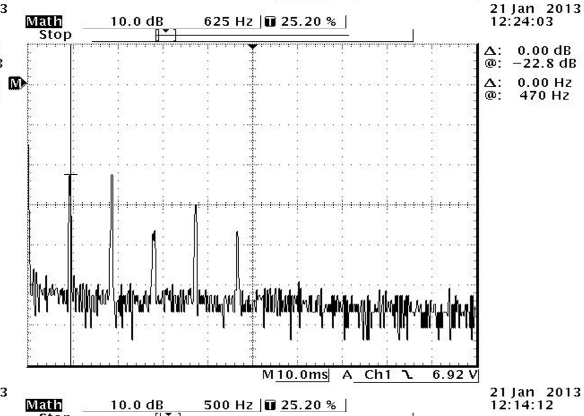

Stop
Δ: 0.00 dB
@: −31.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:51:50
Math 10.0 dB 625 Hz 25.20 %

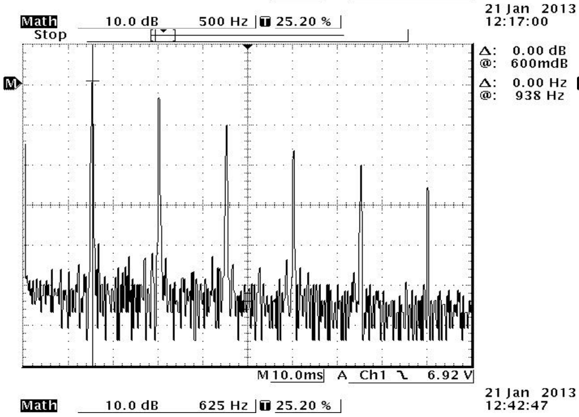

Stop
Δ: 0.00 dB
@: −30.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:38:56
Math 10.0 dB 500 Hz 25.20 %

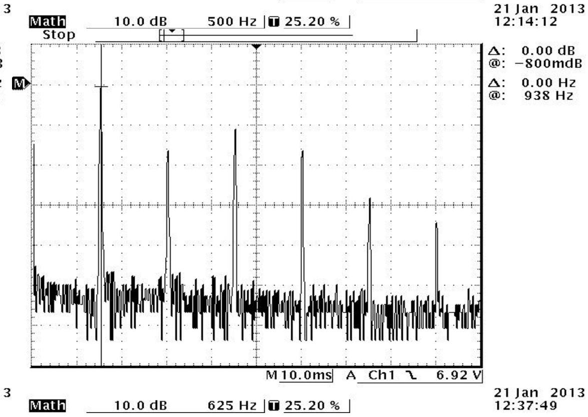

Stop
Δ: 0.00 dB
@: −32.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
10:32:18
Math 10.0 dB 500 Hz 25.20 %

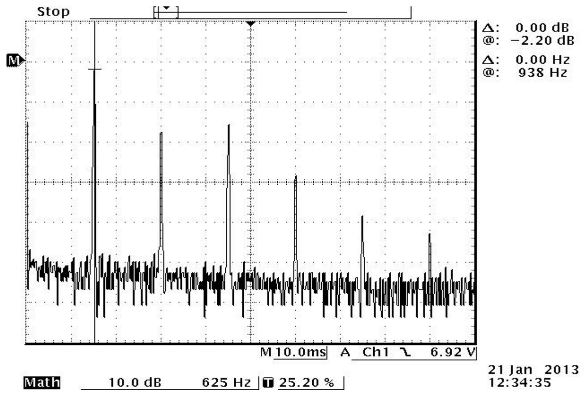

Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
12:24:03
Math 10.0 dB 625 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −17.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
12:17:00
Math 10.0 dB 500 Hz 25.20 %

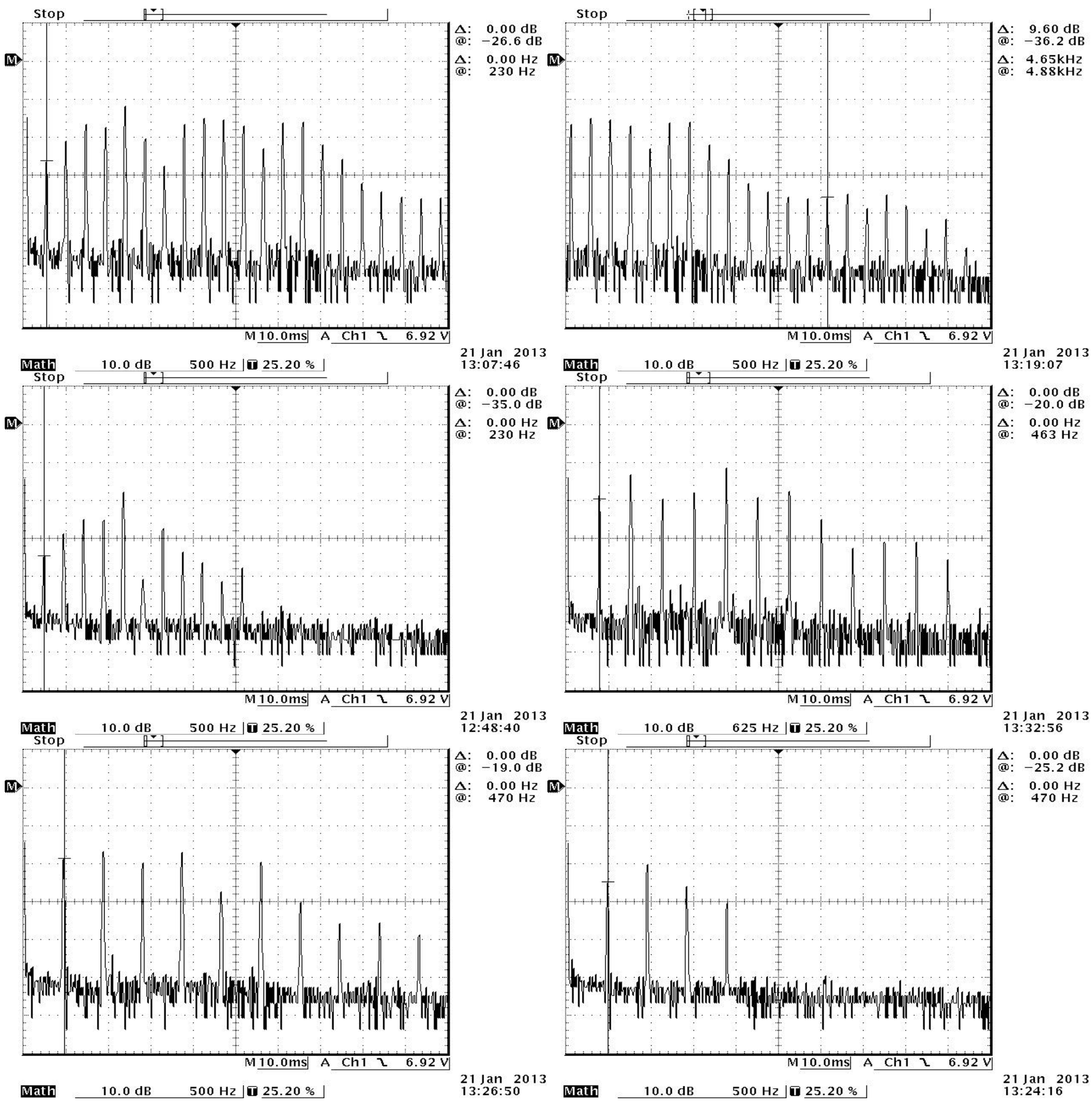

Stop
Δ: 0.00 dB
@: −22.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
12:14:12
Math 10.0 dB 500 Hz 25.20 %

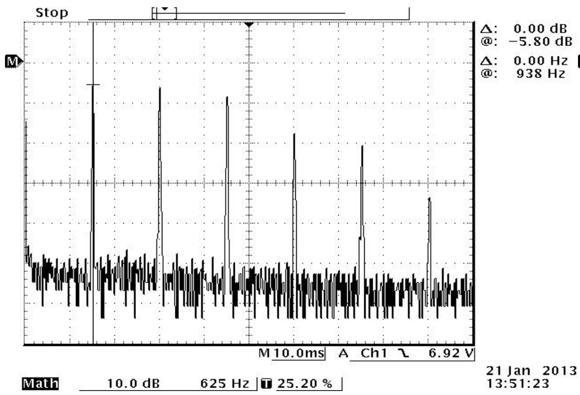

Stop
Δ: 0.00 dB
@: 600mdB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
12:42:47
Math 10.0 dB 625 Hz 25.20 %

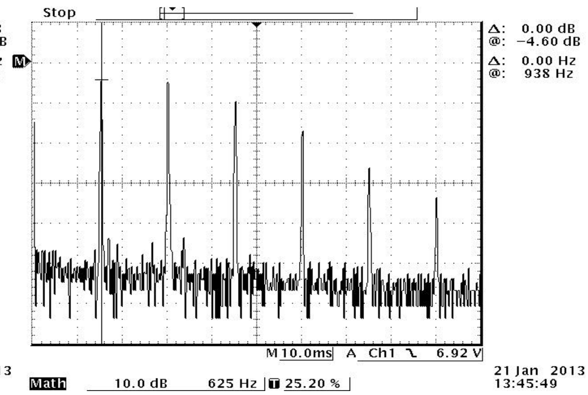

Stop
Δ: 0.00 dB
@: −800mdB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
12:37:49
Math 10.0 dB 625 Hz 25.20 %

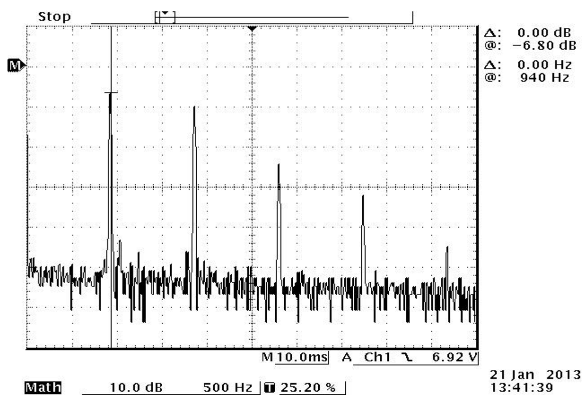

Stop
Δ: 0.00 dB
@: −2.20 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
12:34:35
Math 10.0 dB 625 Hz 25.20 %

SX


Stop
Δ: 0.00 dB
@: −26.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
13:07:46
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 9.60 dB
@: −36.2 dB
Δ: 4.65kHz
@: 4.88kHz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
13:19:07
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −35.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
12:48:40
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
13:32:56
Math 10.0 dB 625 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −19.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
13:26:50
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −25.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
21 Jan 2013
13:24:16
Math 10.0 dB 500 Hz 25.20 %

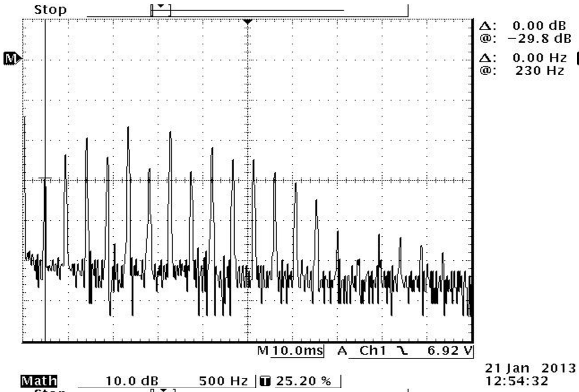

Stop
Δ: 0.00 dB
@: −5.80 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⌞ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
13:51:23

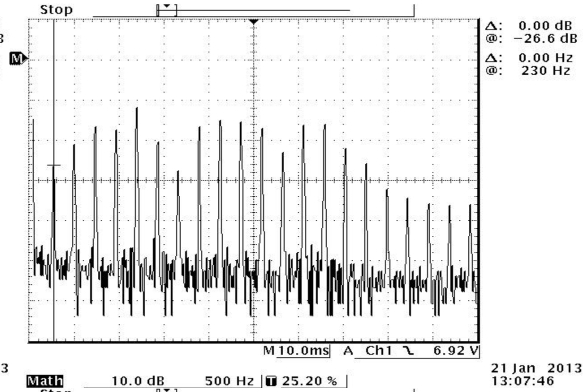

Stop
Δ: 0.00 dB
@: −4.60 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⌞ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
13:45:49

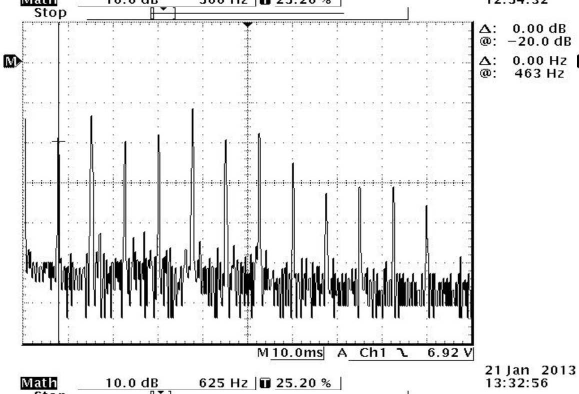

Stop
Δ: 0.00 dB
@: −6.80 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌞ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
13:41:39

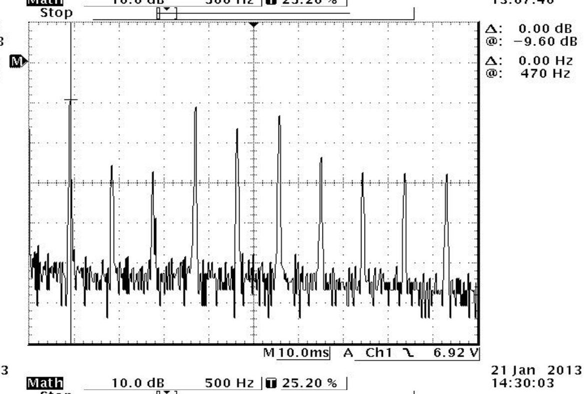
Player 3

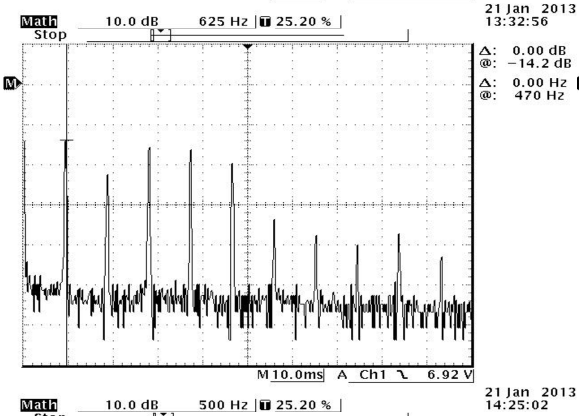
SA

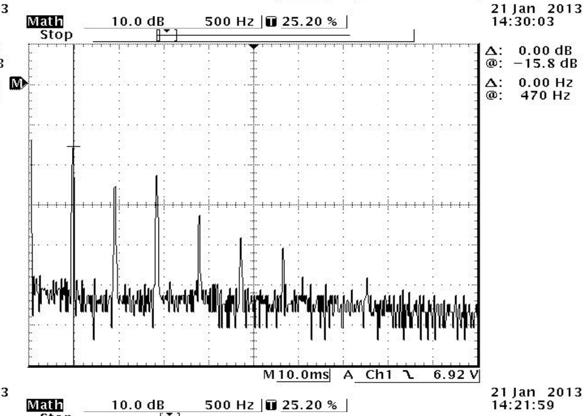

Stop
Δ: 0.00 dB
@: −29.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
12:54:32

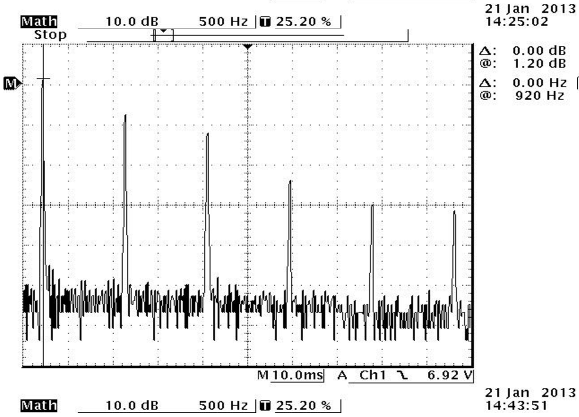

Stop
Δ: 0.00 dB
@: −26.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
13:07:46

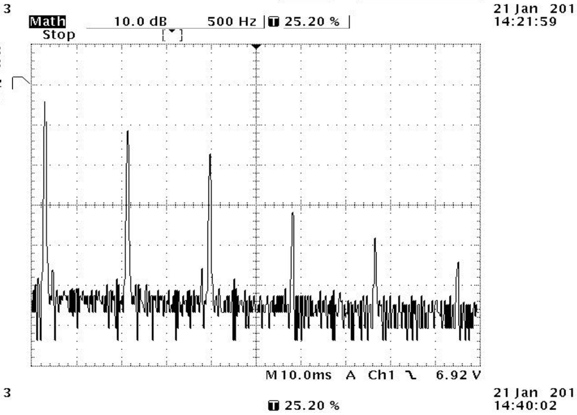

Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
13:32:56

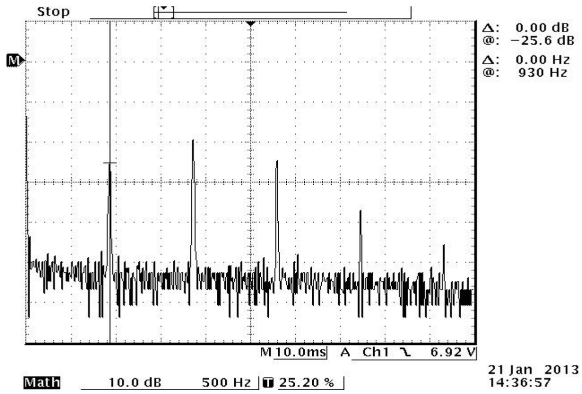

Stop
Δ: 0.00 dB
@: −9.60 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
14:30:03


Stop
Δ: 0.00 dB
@: −14.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
14:25:02

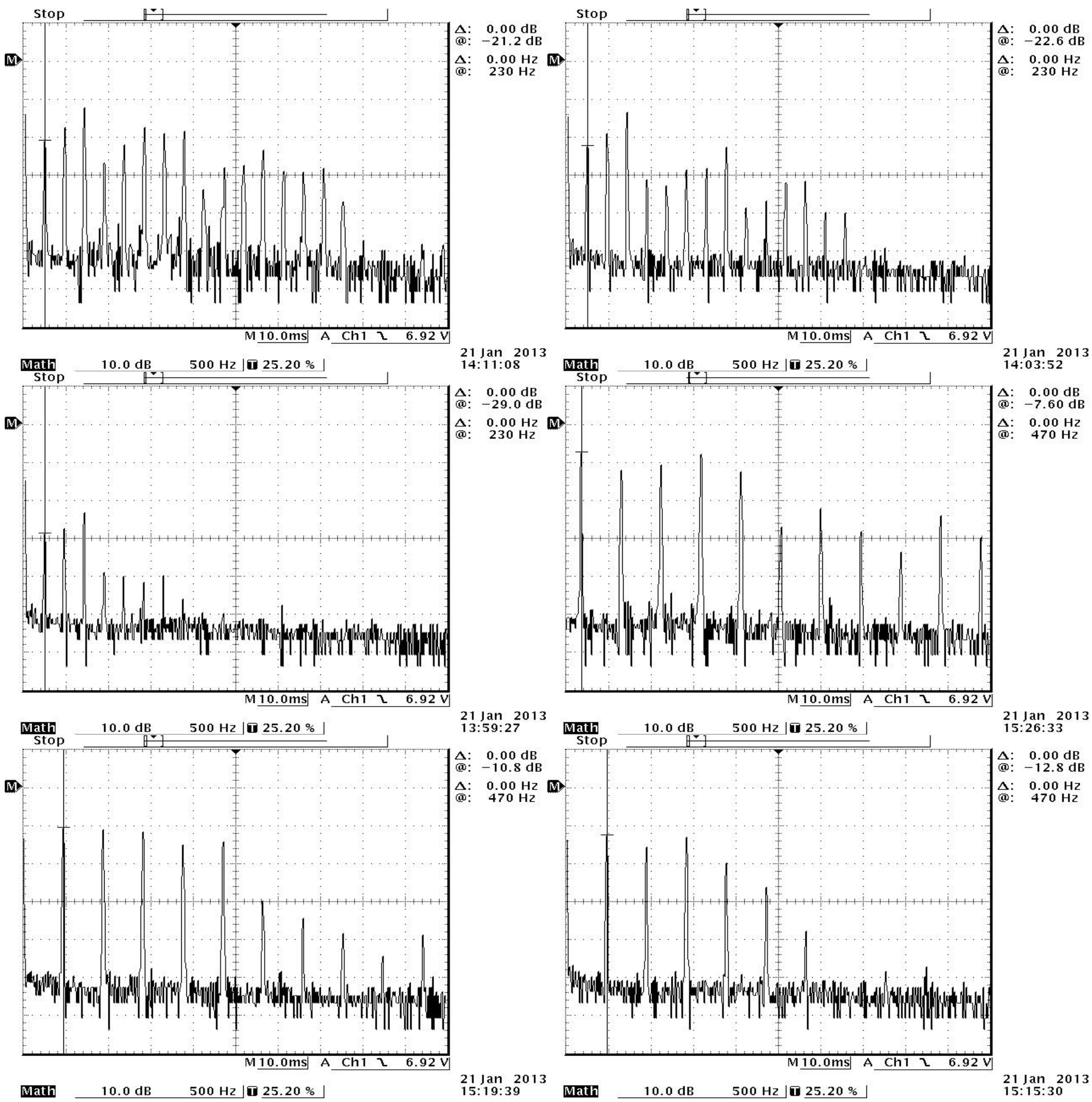

Stop
Δ: 0.00 dB
@: −15.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
14:21:59

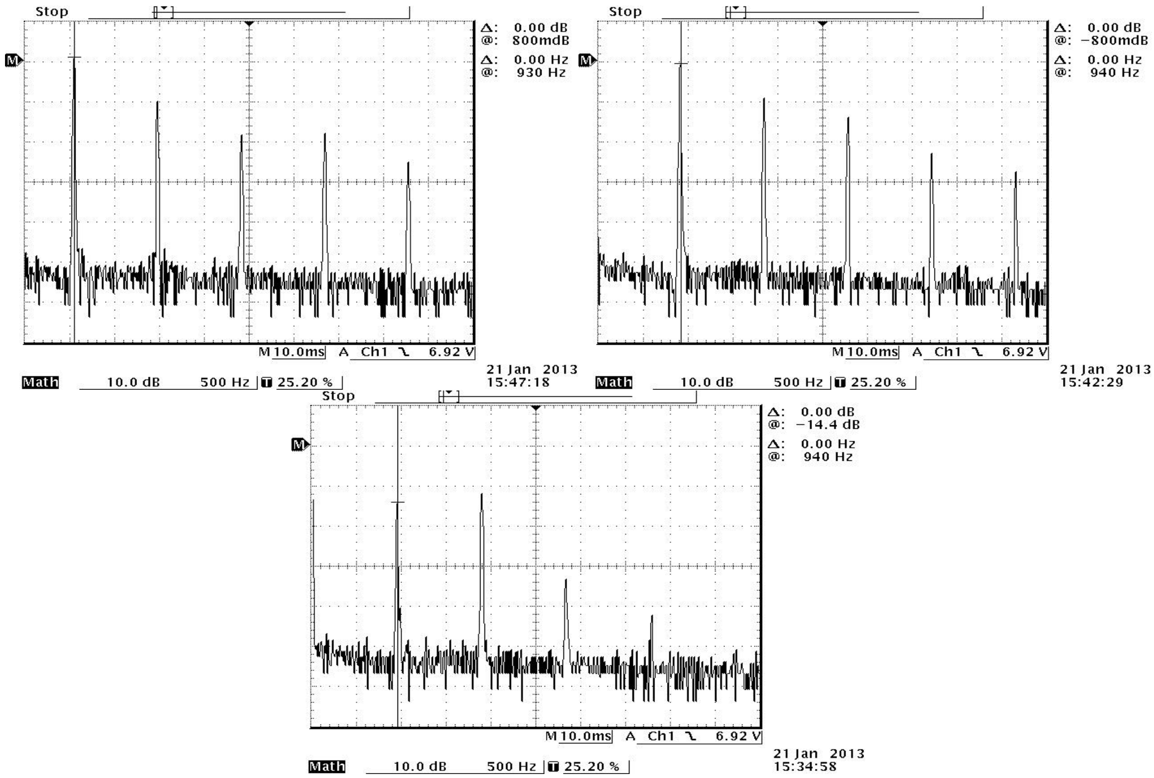

Stop
Δ: 0.00 dB
@: 1.20 dB
Δ: 0.00 Hz
@: 920 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
14:43:51


Stop
M 10.0ms A Ch1 ⌐ 6.92 V
25.20 %
21 Jan 2013
14:40:02

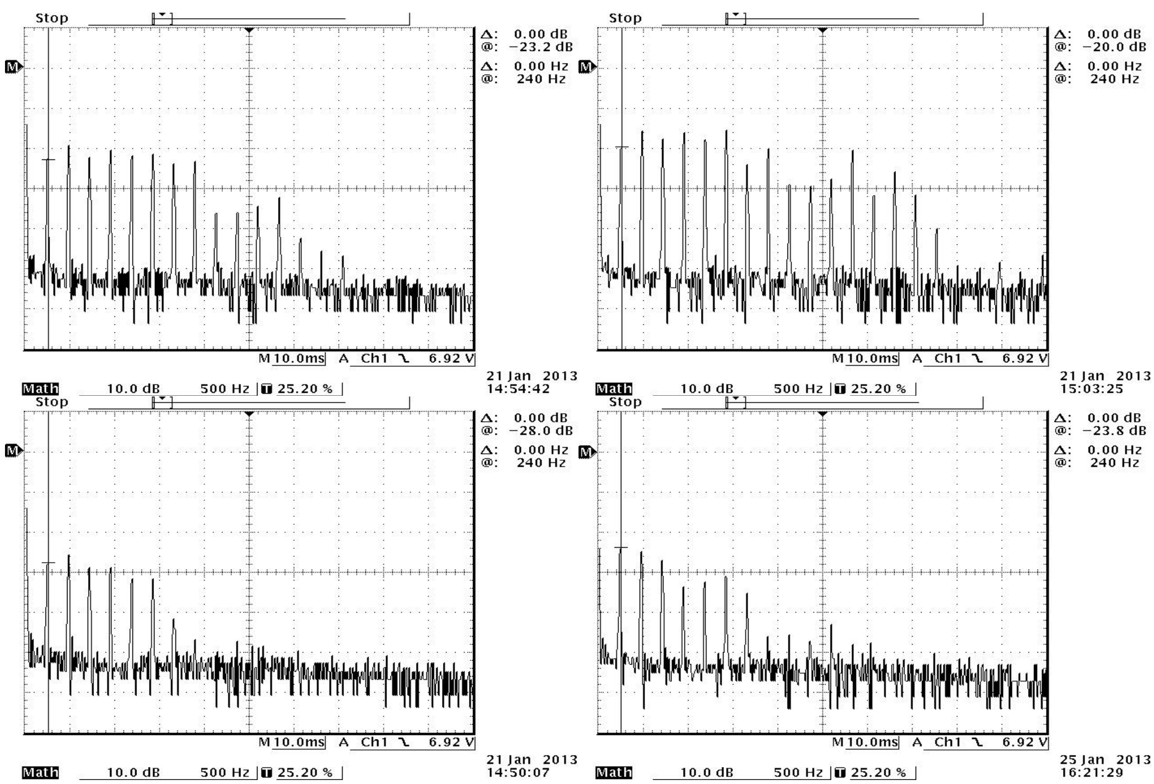

Stop
Δ: 0.00 dB
@: −25.6 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
14:36:57

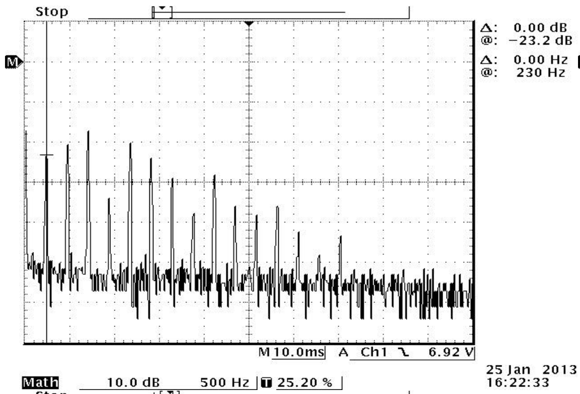
B76

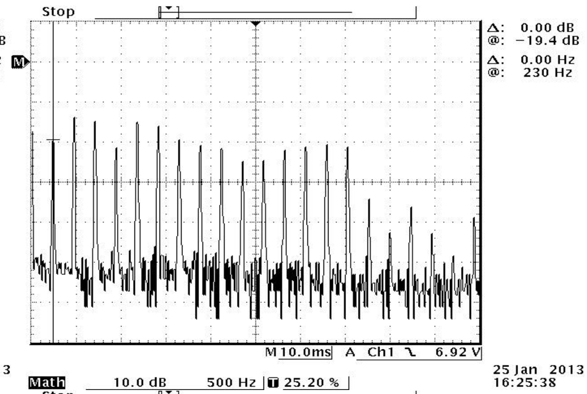

Stop
Δ: 0.00 dB
@: −21.2 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
14:11:08
Stop
Δ: 0.00 dB
@: −22.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
14:03:52
Stop
Δ: 0.00 dB
@: −29.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
13:59:27
Stop
Δ: 0.00 dB
@: −7.60 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
15:26:33
Stop
Δ: 0.00 dB
@: −10.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
15:19:39
Stop
Δ: 0.00 dB
@: −12.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
15:15:30

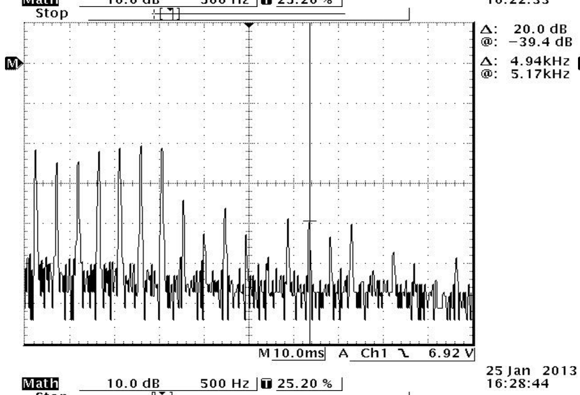

Stop
Δ: 0.00 dB
@: 800mdB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
21 Jan 2013
15:47:18
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −800mdB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
21 Jan 2013
15:42:29
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −14.4 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
21 Jan 2013
15:34:58
Math 10.0 dB 500 Hz 25.20 %

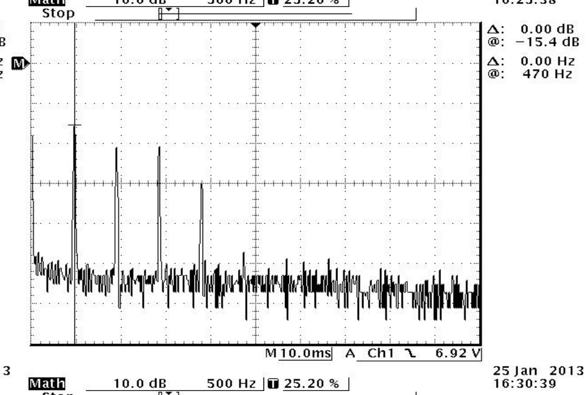
YA

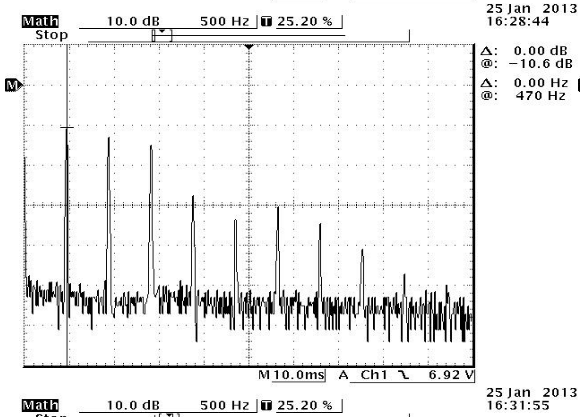

Stop
Δ: 0.00 dB
@: −23.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
21 Jan 2013
14:54:42
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
21 Jan 2013
15:03:25
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −28.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
21 Jan 2013
14:50:07
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −23.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
16:21:29
Math 10.0 dB 500 Hz 25.20 %

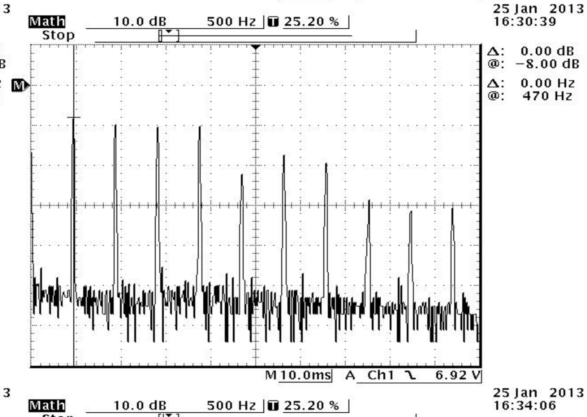

Stop
Δ: 0.00 dB
@: −23.2 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:22:33
Math 10.0 dB 500 Hz 25.20 %

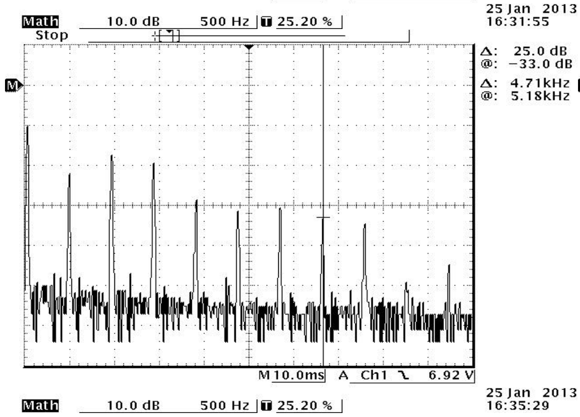

Stop
Δ: 0.00 dB
@: −19.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:25:38
Math 10.0 dB 500 Hz 25.20 %

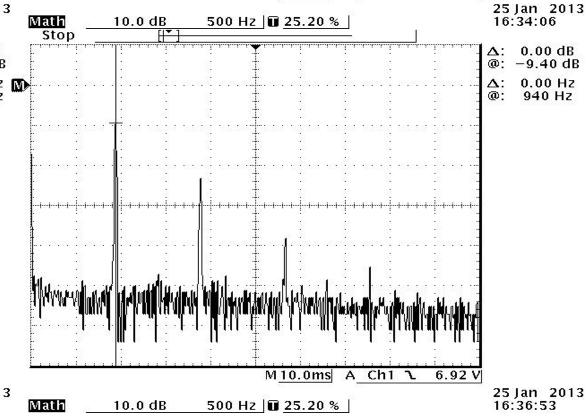

Stop
Δ: 20.0 dB
@: −39.4 dB
Δ: 4.94kHz
@: 5.17kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:28:44
Math 10.0 dB 500 Hz 25.20 %

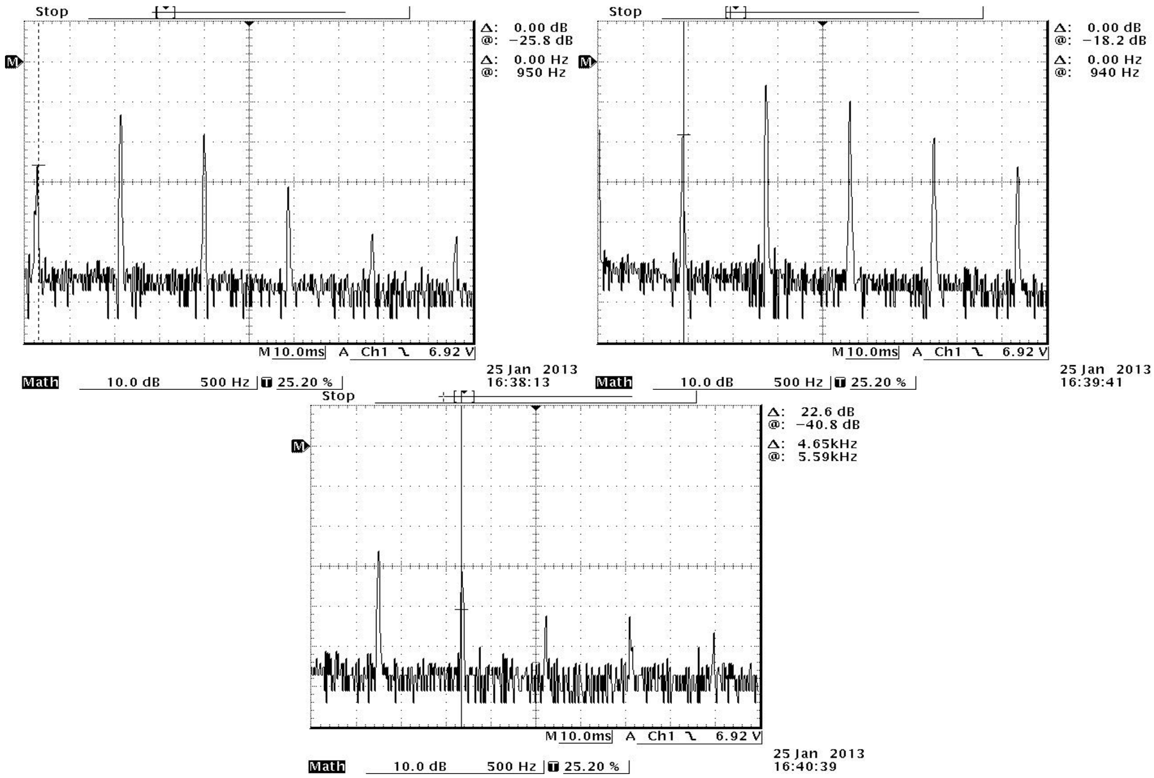

Stop
Δ: 0.00 dB
@: −15.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:30:39
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −10.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:31:55
Math 10.0 dB 500 Hz 25.20 %

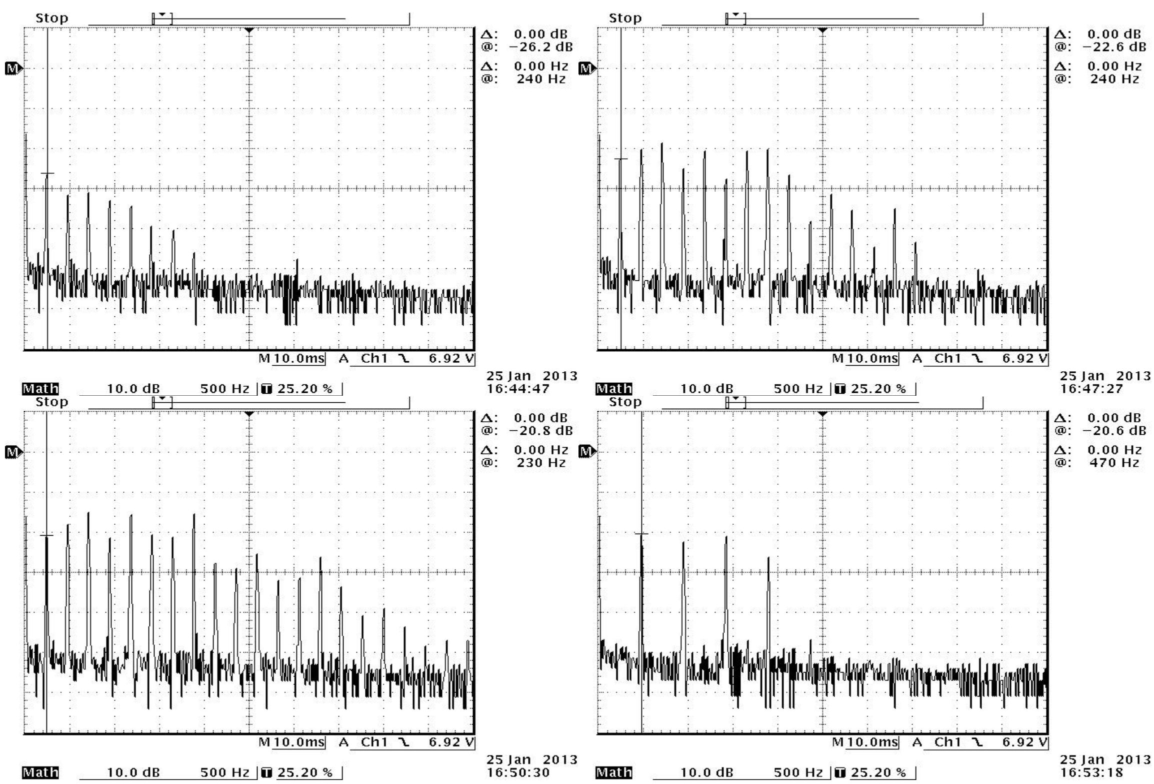

Stop
Δ: 0.00 dB
@: −8.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:34:06
Math 10.0 dB 500 Hz 25.20 %

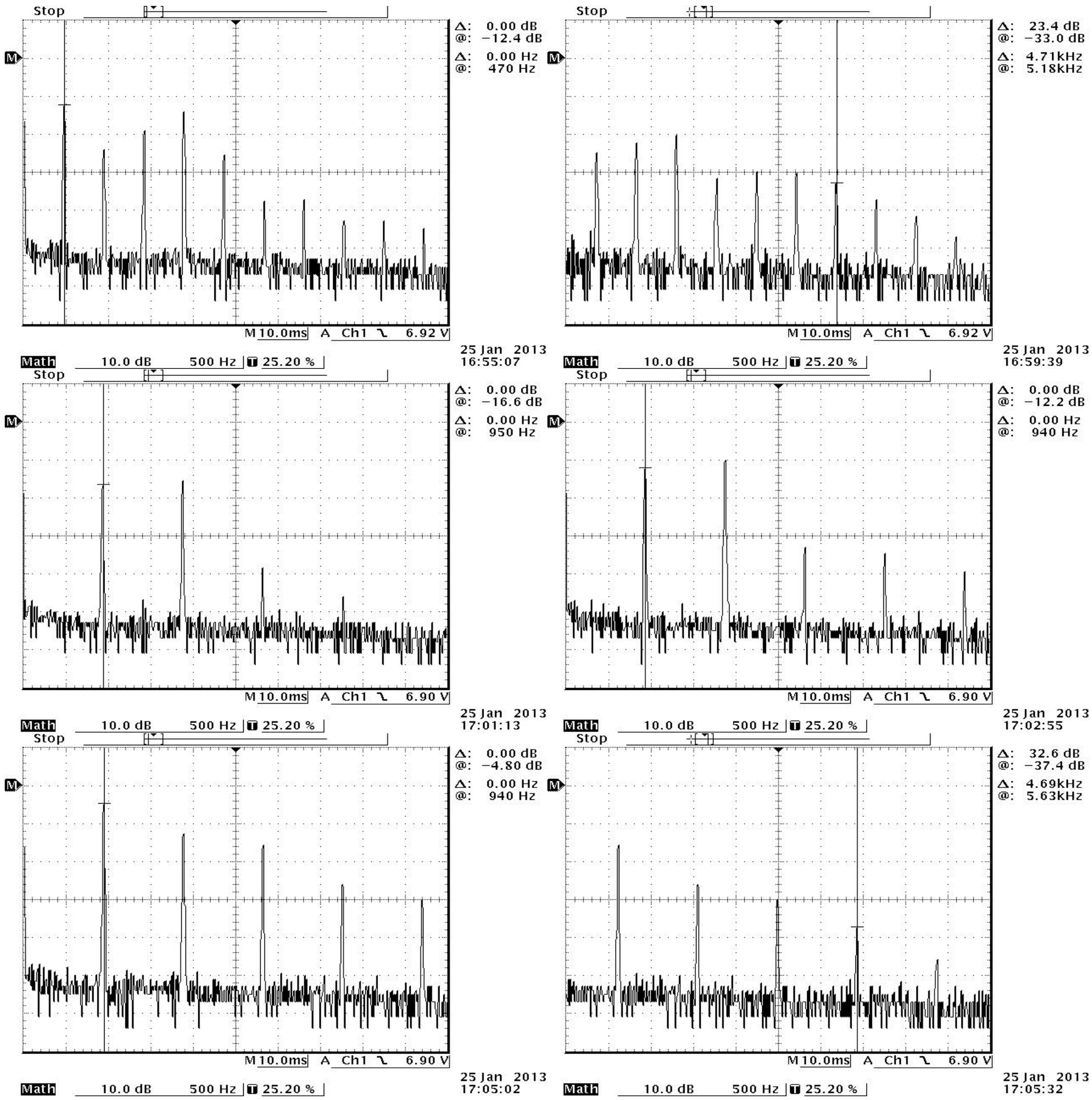

Stop
Δ: 25.0 dB
@: −33.0 dB
Δ: 4.71kHz
@: 5.18kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:35:29
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −9.40 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
16:36:53
Math 10.0 dB 500 Hz 25.20 %

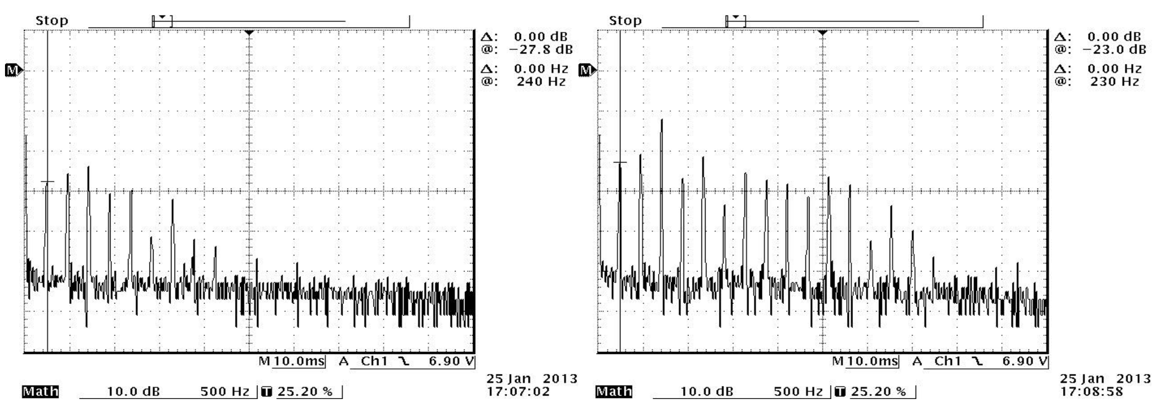

Stop
Δ: 0.00 dB
@: −25.8 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
16:38:13
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −18.2 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
16:39:41
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 22.6 dB
@: −40.8 dB
Δ: 4.65kHz
@: 5.59kHz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
16:40:39
Math 10.0 dB 500 Hz 25.20 %

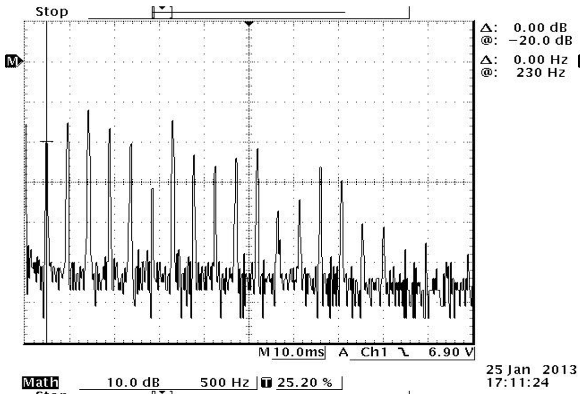
B10

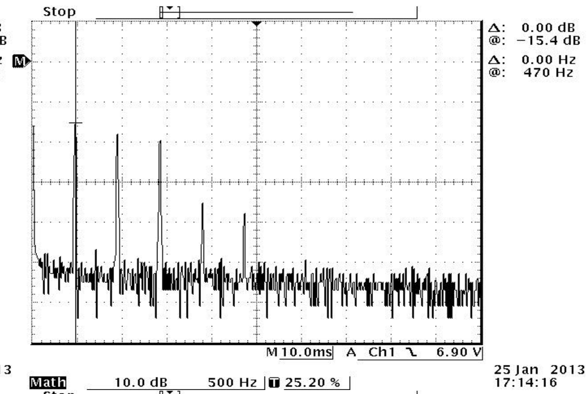

Stop
Δ: 0.00 dB
@: −26.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
16:44:47
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −22.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
16:47:27
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −20.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
16:50:30
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −20.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
16:53:18
Math 10.0 dB 500 Hz 25.20 %

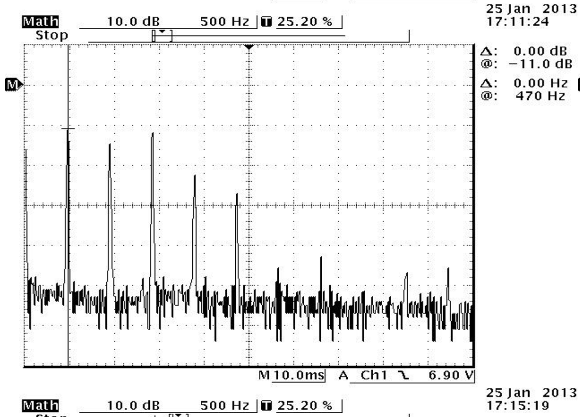

Stop
Δ: 0.00 dB
@: −12.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ∖ 6.92 V
25 Jan 2013
16:55:07
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 23.4 dB
@: −33.0 dB
Δ: 4.71kHz
@: 5.18kHz
M 10.0ms A Ch1 ∖ 6.92 V
25 Jan 2013
16:59:39
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −16.6 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ∖ 6.90 V
25 Jan 2013
17:01:13
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −12.2 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ∖ 6.90 V
25 Jan 2013
17:02:55
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −4.80 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ∖ 6.90 V
25 Jan 2013
17:05:02
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 32.6 dB
@: −37.4 dB
Δ: 4.69kHz
@: 5.63kHz
M 10.0ms A Ch1 ∖ 6.90 V
25 Jan 2013
17:05:32
Math 10.0 dB 500 Hz 25.20 %

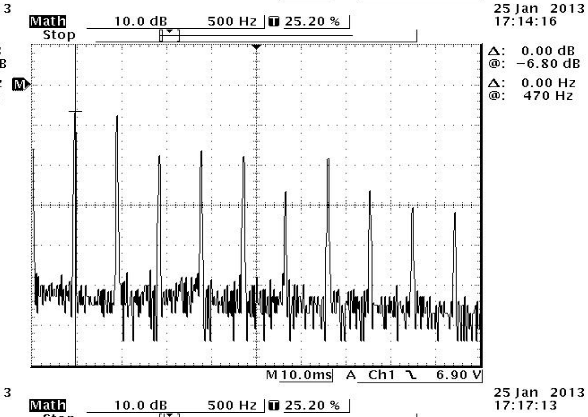
YC

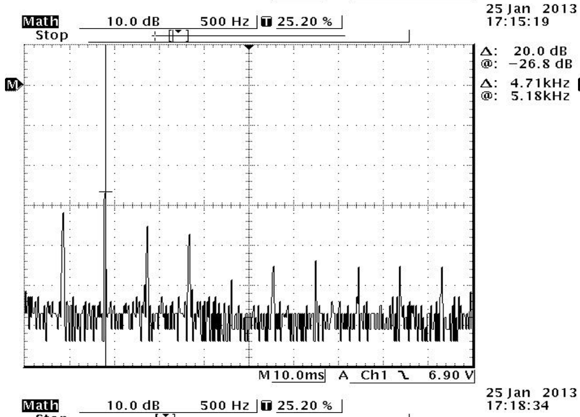

Stop
Δ: 0.00 dB
@: −27.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ∖ 6.90 V
25 Jan 2013
17:07:02
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −23.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ∖ 6.90 V
25 Jan 2013
17:08:58
Math 10.0 dB 500 Hz 25.20 %

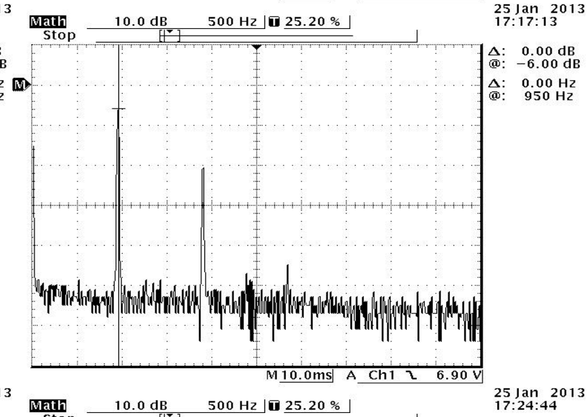

Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:11:24

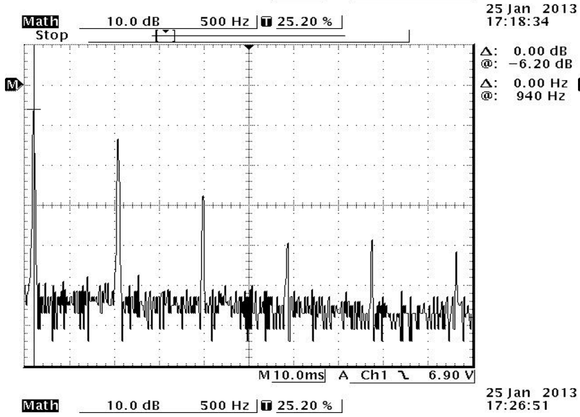

Stop
Δ: 0.00 dB
@: −15.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:14:16

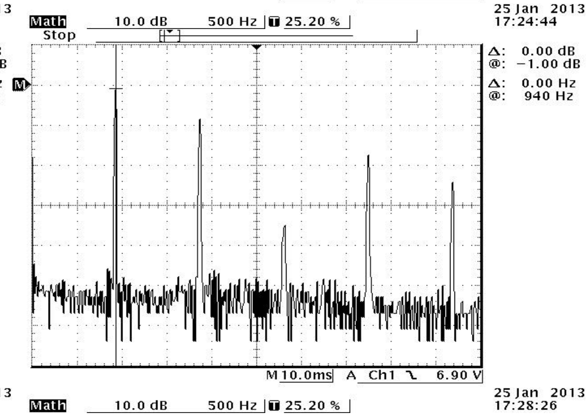

Stop
Δ: 0.00 dB
@: −11.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:15:19

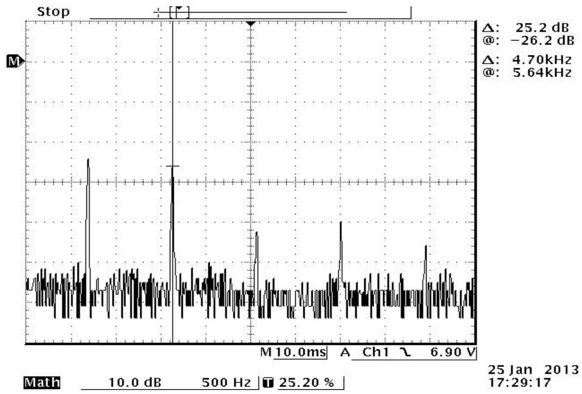

Stop
Δ: 0.00 dB
@: −6.80 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:17:13


Stop
Δ: 20.0 dB
@: −26.8 dB
Δ: 4.71kHz
@: 5.18kHz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:18:34

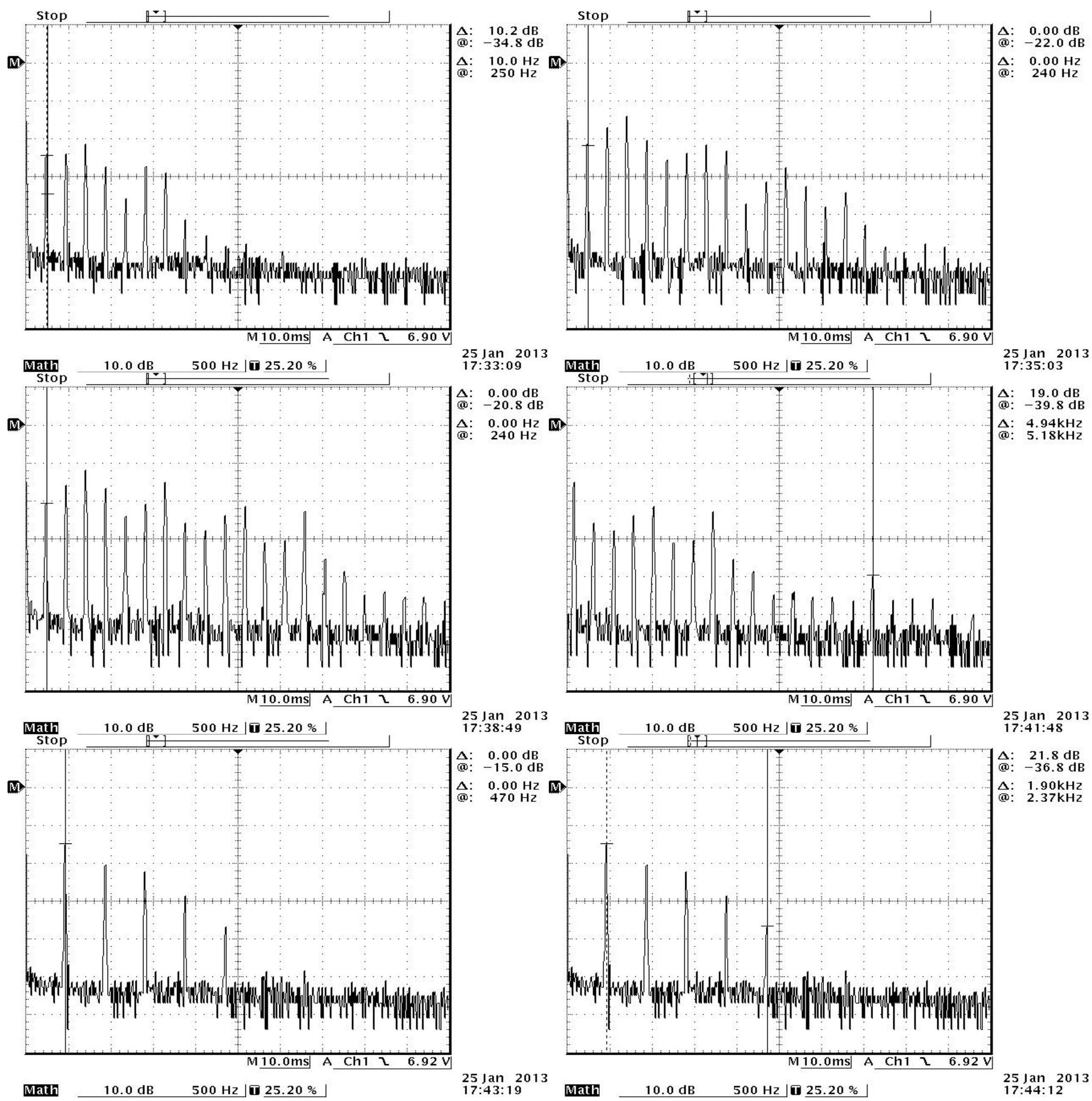

Stop
Δ: 0.00 dB
@: −6.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:24:44

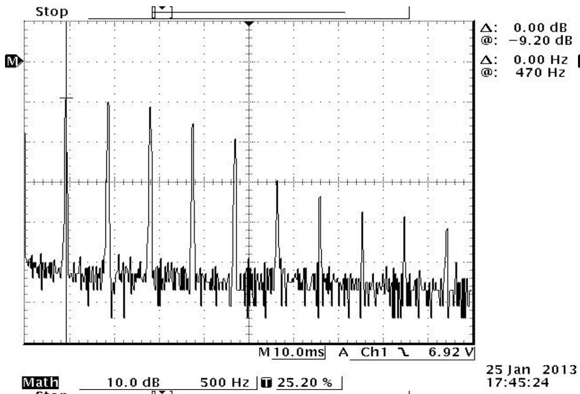

Stop
Δ: 0.00 dB
@: −6.20 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:26:51

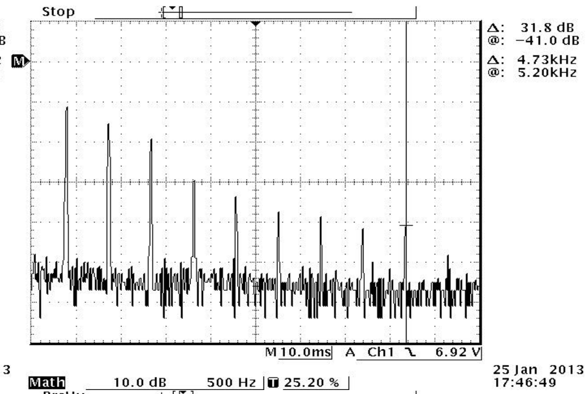

Stop
Δ: 0.00 dB
@: −1.00 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:28:26

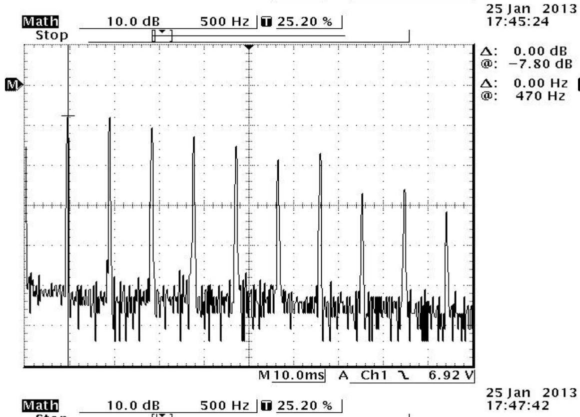

Stop
Δ: 25.2 dB
@: −26.2 dB
Δ: 4.70kHz
@: 5.64kHz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:29:17

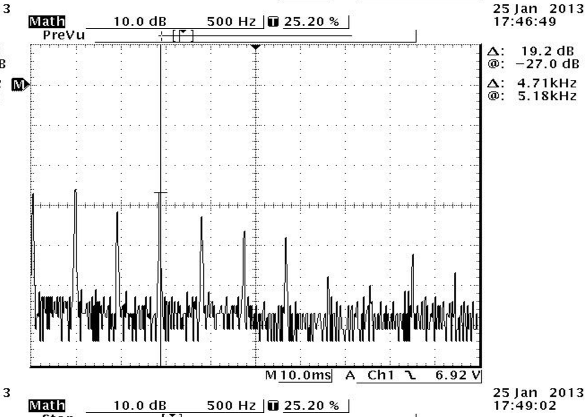
B24

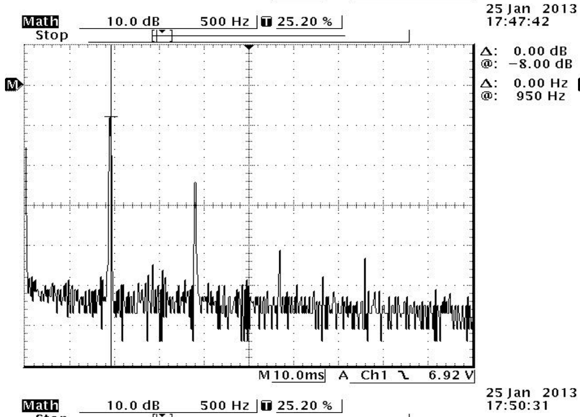

Stop
Δ: 10.2 dB
@: −34.8 dB
Δ: 10.0 Hz
@: 250 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:33:09
Stop
Δ: 0.00 dB
@: −22.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:35:03
Stop
Δ: 0.00 dB
@: −20.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:38:49
Stop
Δ: 19.0 dB
@: −39.8 dB
Δ: 4.94kHz
@: 5.18kHz
M 10.0ms A Ch1 6.90 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:41:48
Stop
Δ: 0.00 dB
@: −15.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:43:19
Stop
Δ: 21.8 dB
@: −36.8 dB
Δ: 1.90kHz
@: 2.37kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
17:44:12

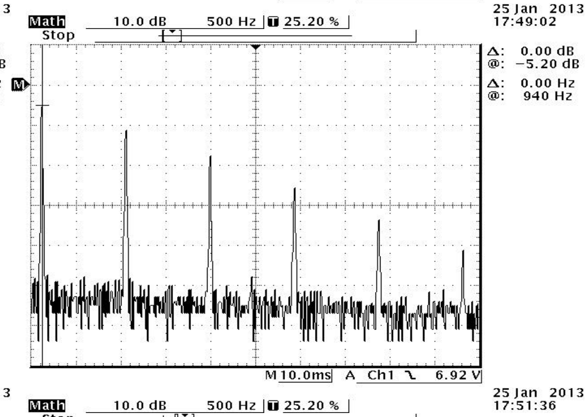

Stop
Δ: 0.00 dB
@: −9.20 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:45:24
Math 10.0 dB 500 Hz 25.20 %

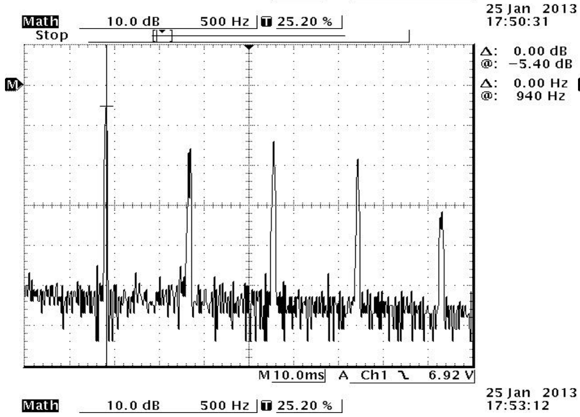

Stop
Δ: 31.8 dB
@: −41.0 dB
Δ: 4.73kHz
@: 5.20kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:46:49
Math 10.0 dB 500 Hz 25.20 %

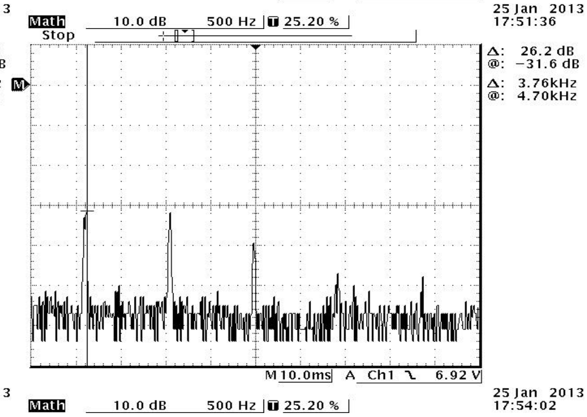

Stop
Δ: 0.00 dB
@: −7.80 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:47:42
Math 10.0 dB 500 Hz 25.20 %


PreVu
Δ: 19.2 dB
@: −27.0 dB
Δ: 4.71kHz
@: 5.18kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:49:02
Math 10.0 dB 500 Hz 25.20 %

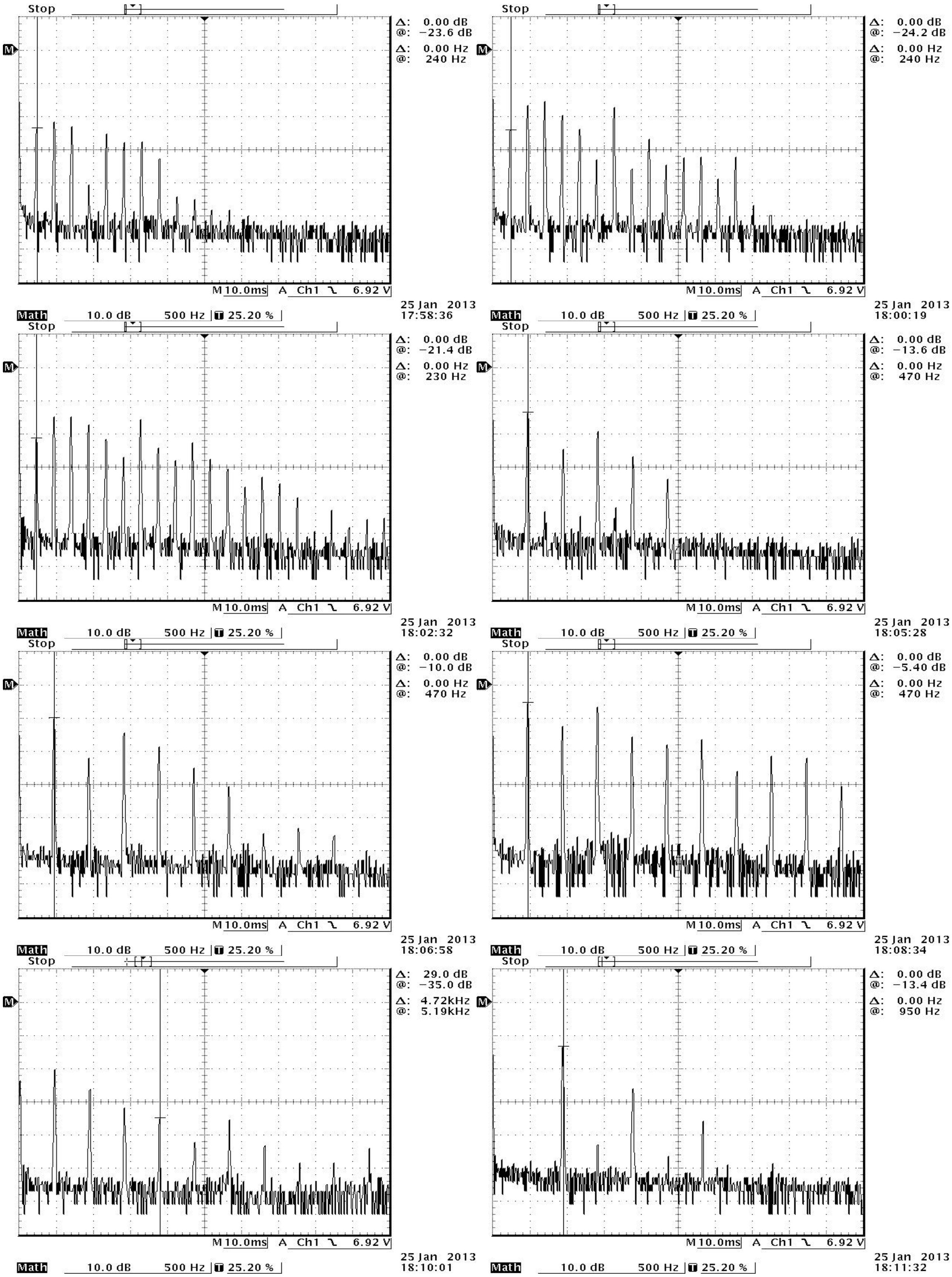

Stop
Δ: 0.00 dB
@: −8.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:50:31
Math 10.0 dB 500 Hz 25.20 %

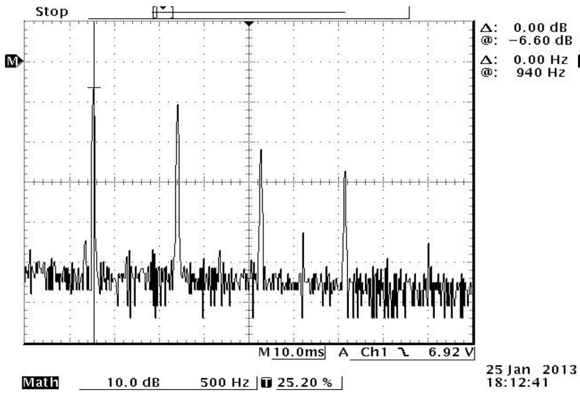

Stop
Δ: 0.00 dB
@: −5.20 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:51:36
Math 10.0 dB 500 Hz 25.20 %

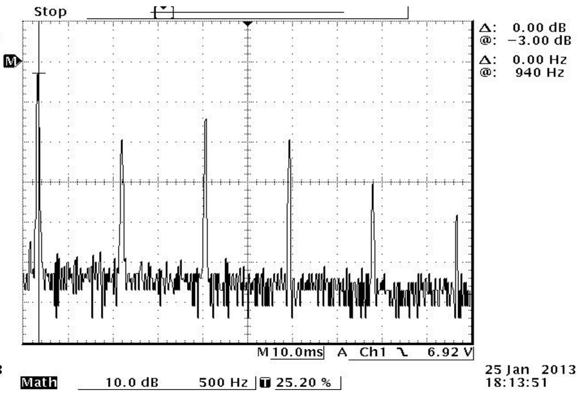

Stop
Δ: 0.00 dB
@: −5.40 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:53:12
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 26.2 dB
@: −31.6 dB
Δ: 3.76kHz
@: 4.70kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
17:54:02
Math 10.0 dB 500 Hz 25.20 %

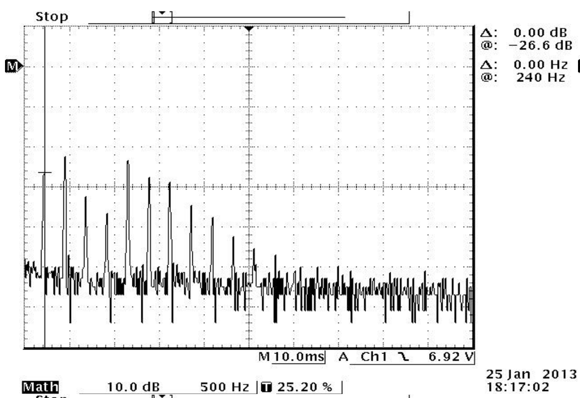
G7C

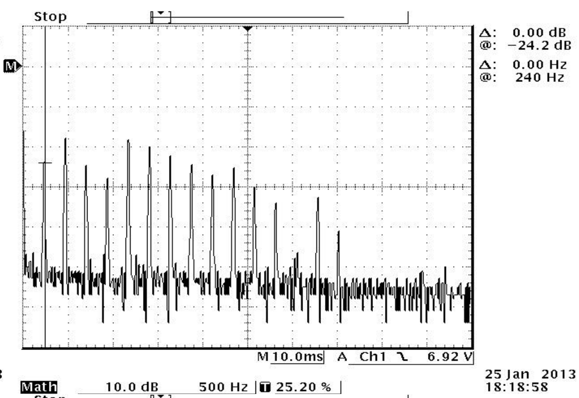

Stop
Δ: 0.00 dB
@: −23.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
17:58:36
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −24.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:00:19
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −21.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:02:32
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −13.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:05:28
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −10.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:06:58
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −5.40 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:08:34
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 29.0 dB
@: −35.0 dB
Δ: 4.72kHz
@: 5.19kHz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:10:01
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −13.4 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:11:32
Math 10.0 dB 500 Hz 25.20 %

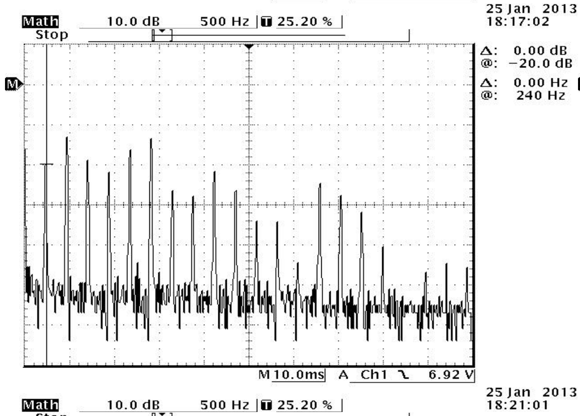

Stop
Δ: 0.00 dB
@: −6.60 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:12:41
Math 10.0 dB 500 Hz 25.20 %

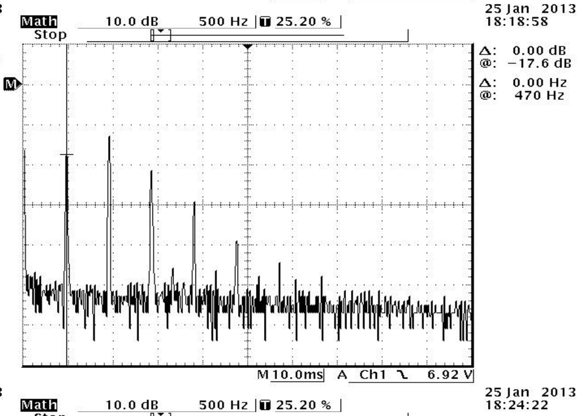

Stop
Δ: 0.00 dB
@: −3.00 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:13:51
Math 10.0 dB 500 Hz 25.20 %

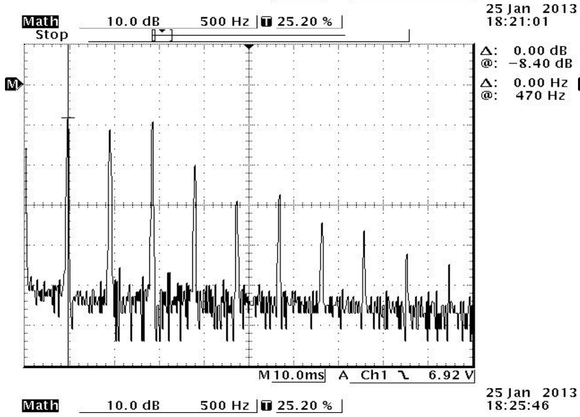
B7

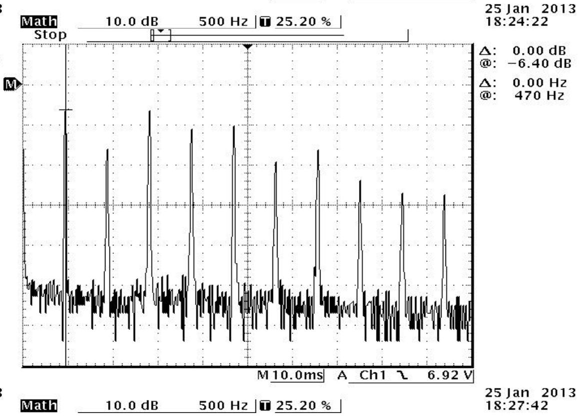

Stop
Δ: 0.00 dB
@: −26.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:17:02
Math 10.0 dB 500 Hz 25.20 %

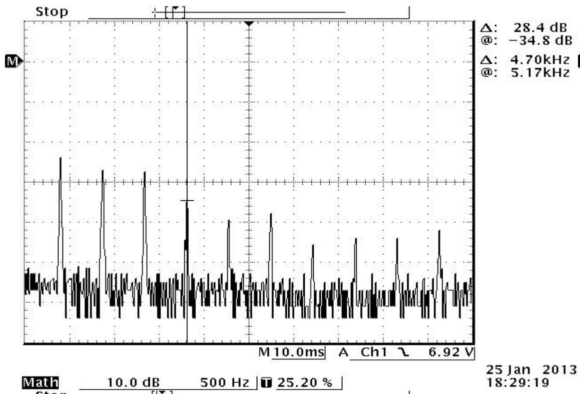

Stop
Δ: 0.00 dB
@: −24.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:18:58
Math 10.0 dB 500 Hz 25.20 %

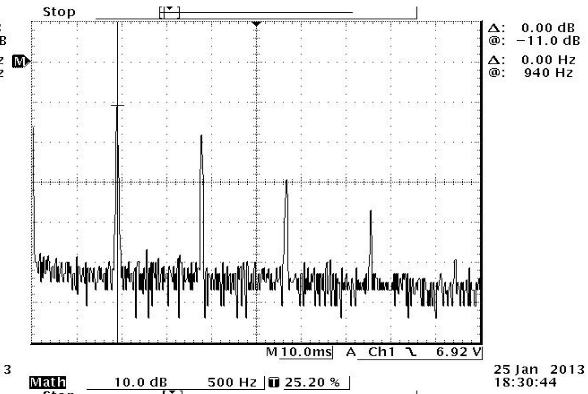

Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:21:01
Math 10.0 dB 500 Hz 25.20 %

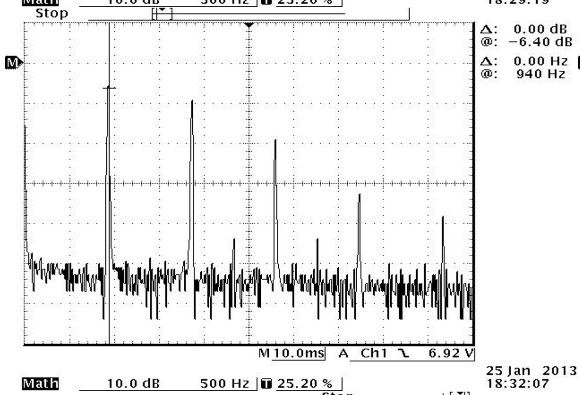

Stop
Δ: 0.00 dB
@: −17.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:24:22
Math 10.0 dB 500 Hz 25.20 %

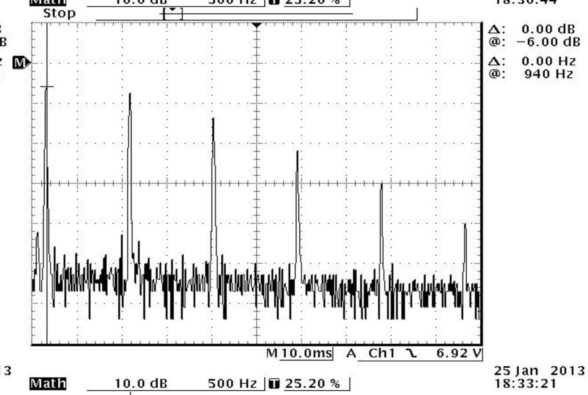

Stop
Δ: 0.00 dB
@: −8.40 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:25:46
Math 10.0 dB 500 Hz 25.20 %

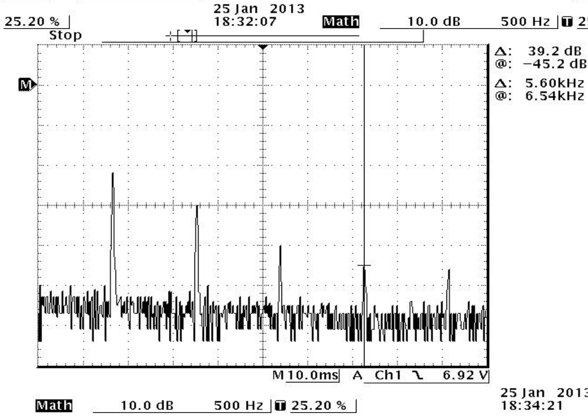

Stop
Δ: 0.00 dB
@: −6.40 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:27:42
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 28.4 dB
@: −34.8 dB
Δ: 4.70kHz
@: 5.17kHz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:29:19
Math 10.0 dB 500 Hz 25.20 %

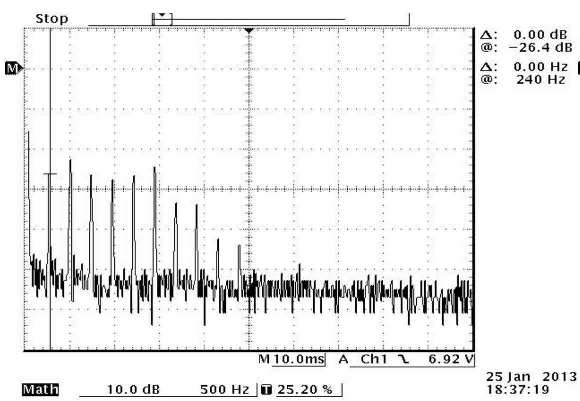

Stop
Δ: 0.00 dB
@: −11.0 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:30:44
Math 10.0 dB 500 Hz 25.20 %

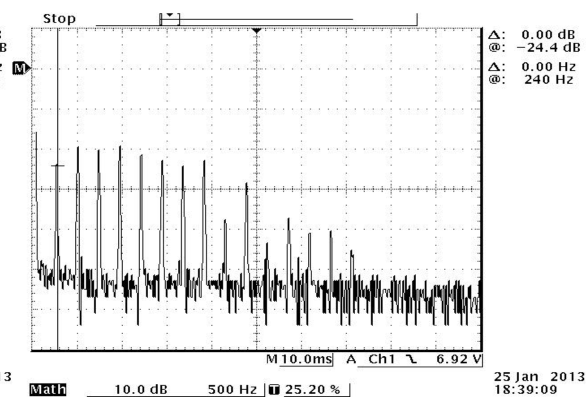

Stop
Δ: 0.00 dB
@: −6.40 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:32:07
Math 10.0 dB 500 Hz 25.20 %

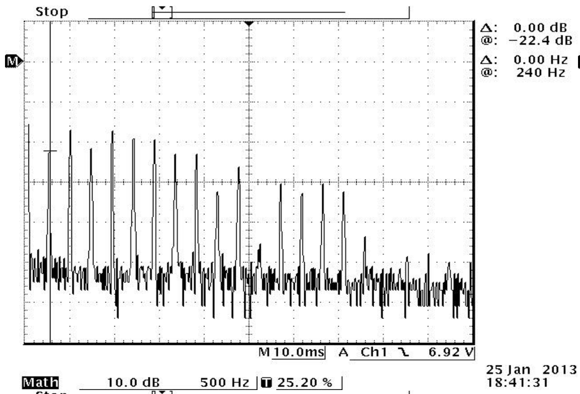

Stop
Δ: 0.00 dB
@: −6.00 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:33:21
Math 10.0 dB 500 Hz 25.20 %

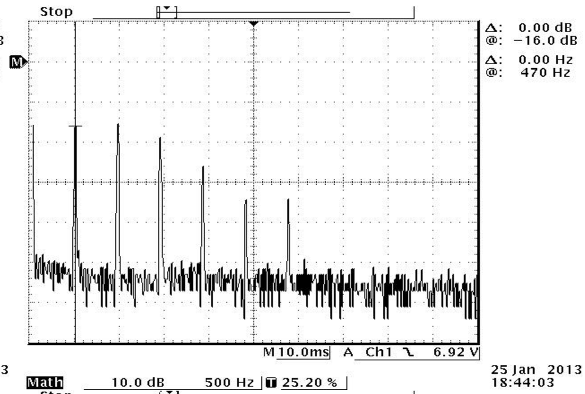

Stop
Δ: 39.2 dB
@: −45.2 dB
Δ: 5.60kHz
@: 6.54kHz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:34:21
Math 10.0 dB 500 Hz 25.20 %

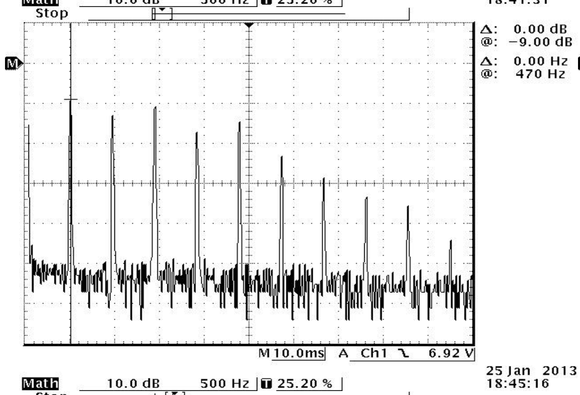
YMG

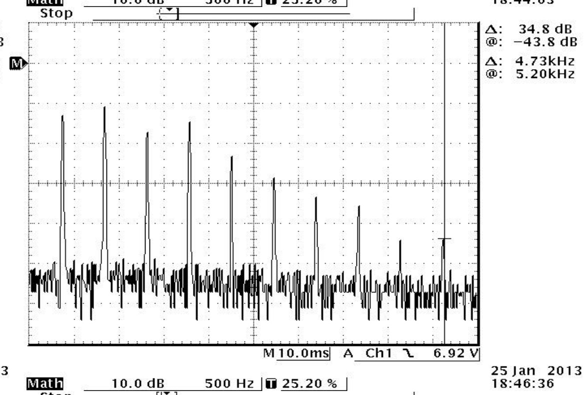

Stop
Δ: 0.00 dB
@: −26.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:37:19
Math 10.0 dB 500 Hz 25.20 %

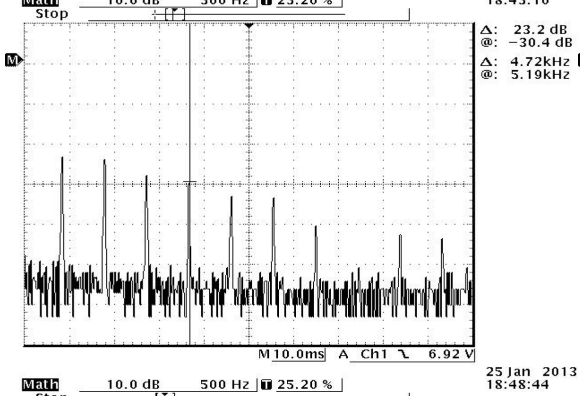

Stop
Δ: 0.00 dB
@: −24.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
25 Jan 2013
18:39:09
Math 10.0 dB 500 Hz 25.20 %

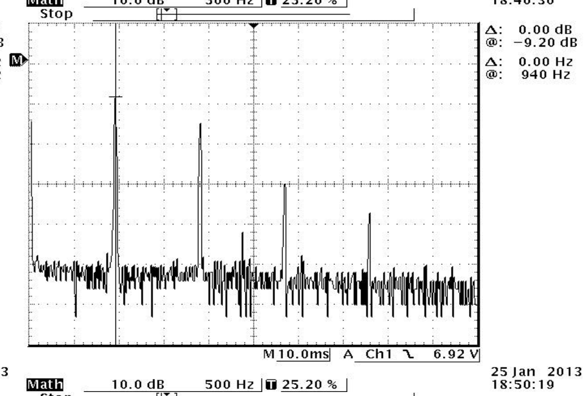

Stop
Δ: 0.00 dB
@: −22.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:41:31
Math 10.0 dB 500 Hz 25.20 %

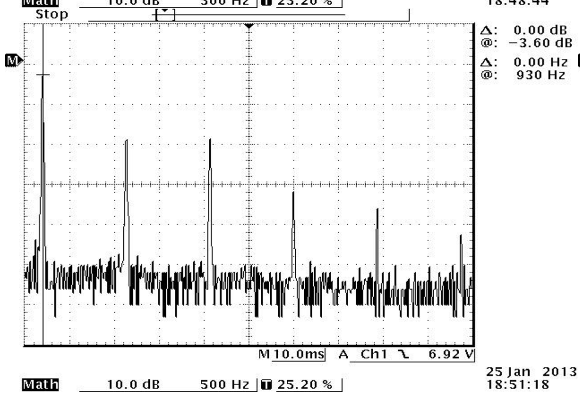

Stop
Δ: 0.00 dB
@: −16.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:44:03
Math 10.0 dB 500 Hz 25.20 %

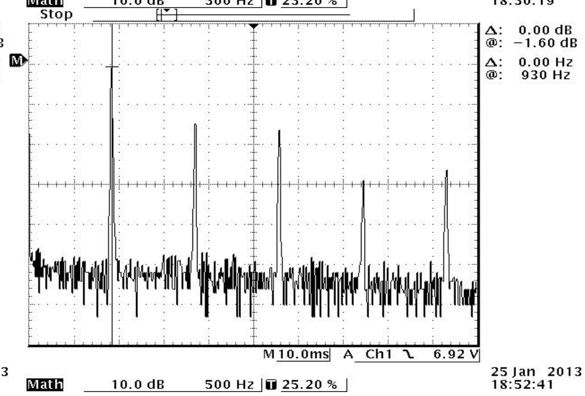

Stop
Δ: 0.00 dB
@: −9.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:45:16
Math 10.0 dB 500 Hz 25.20 %

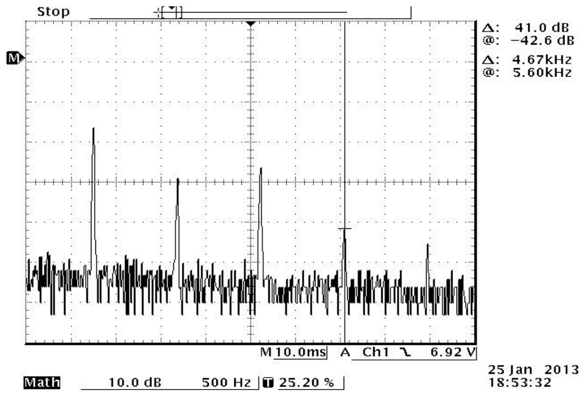

Stop
Δ: 34.8 dB
@: −43.8 dB
Δ: 4.73kHz
@: 5.20kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:46:36
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 23.2 dB
@: −30.4 dB
Δ: 4.72kHz
@: 5.19kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:48:44
Math 10.0 dB 500 Hz 25.20 %

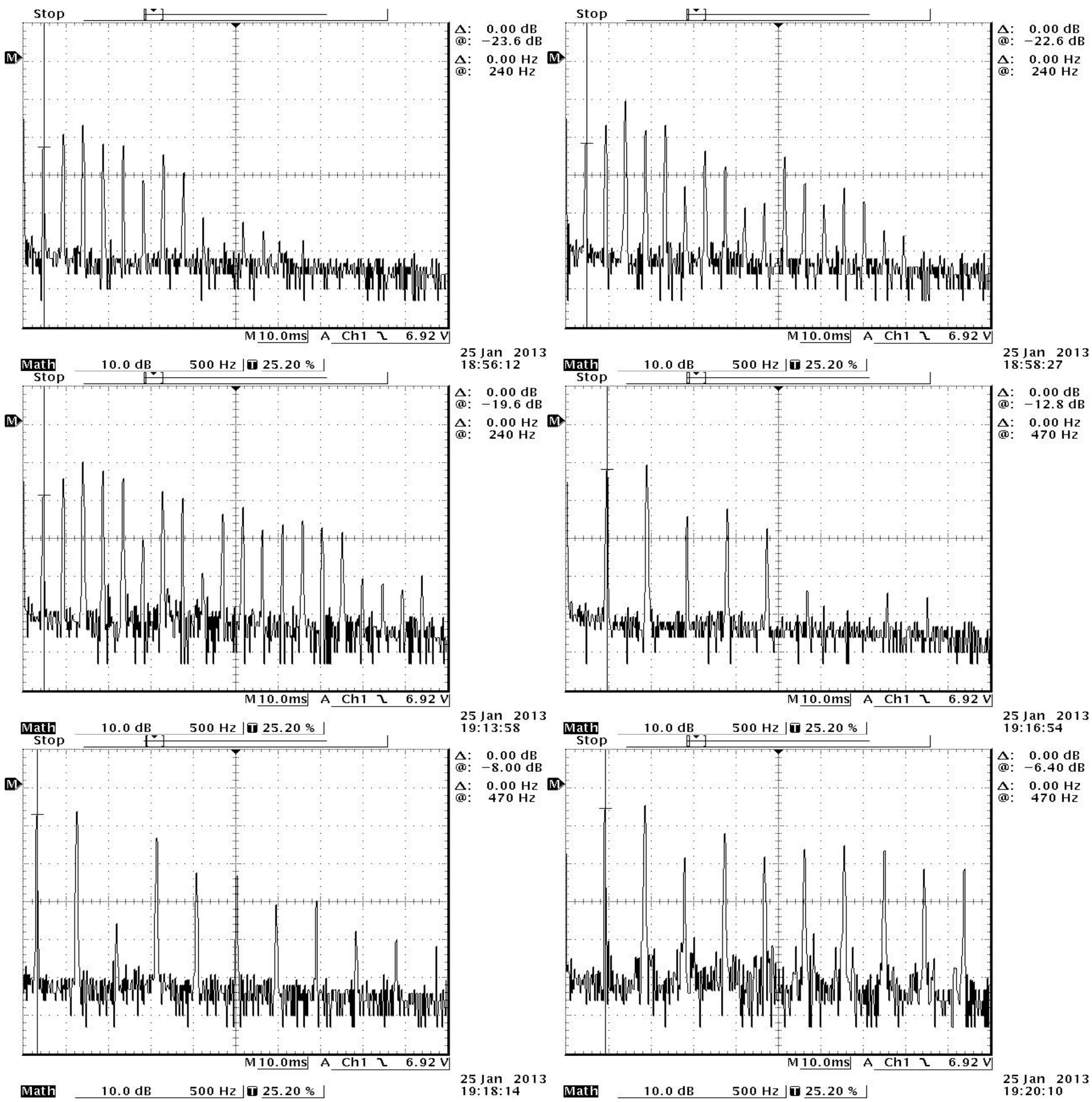

Stop
Δ: 0.00 dB
@: −9.20 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:50:19
Math 10.0 dB 500 Hz 25.20 %

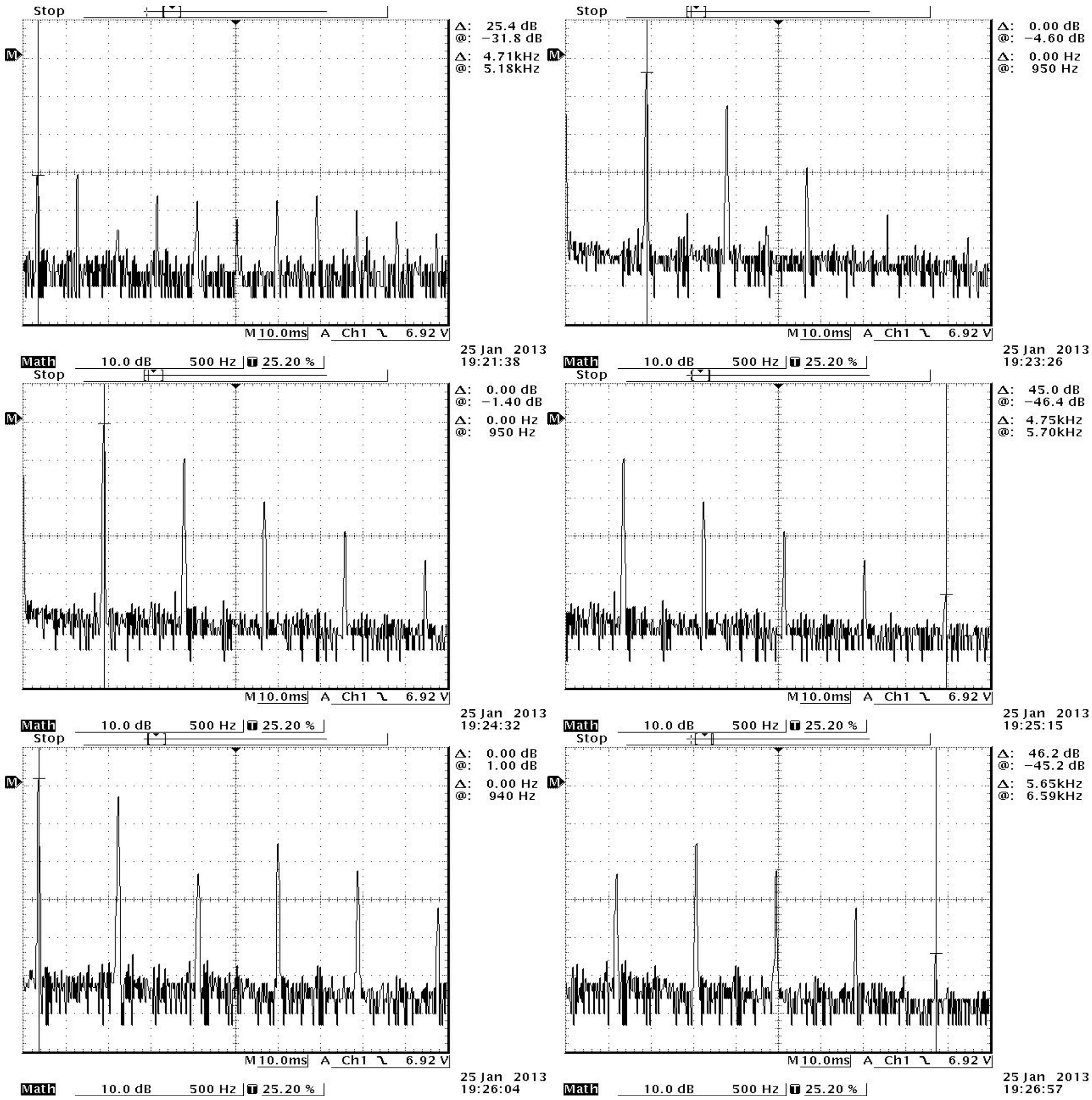

Stop
Δ: 0.00 dB
@: −3.60 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:51:18
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −1.60 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:52:41
Math 10.0 dB 500 Hz 25.20 %

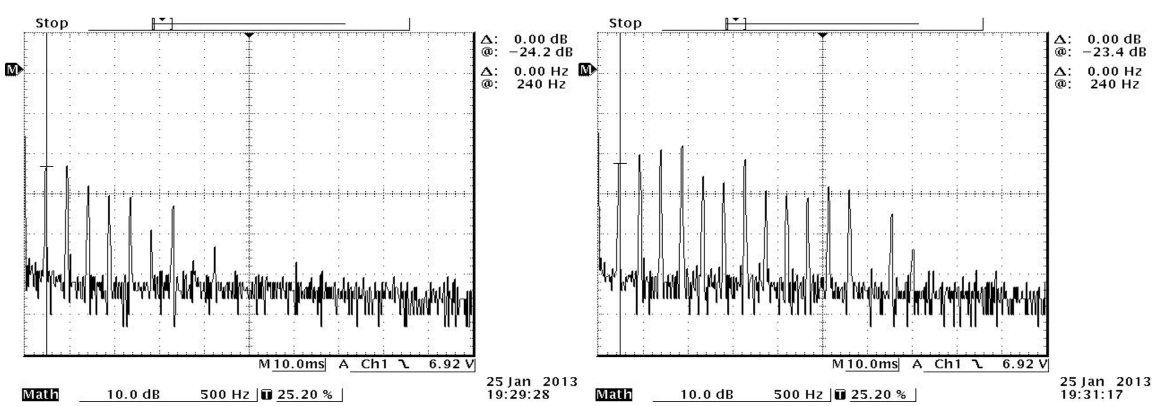

Stop
Δ: 41.0 dB
@: −42.6 dB
Δ: 4.67kHz
@: 5.60kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:53:32
Math 10.0 dB 500 Hz 25.20 %

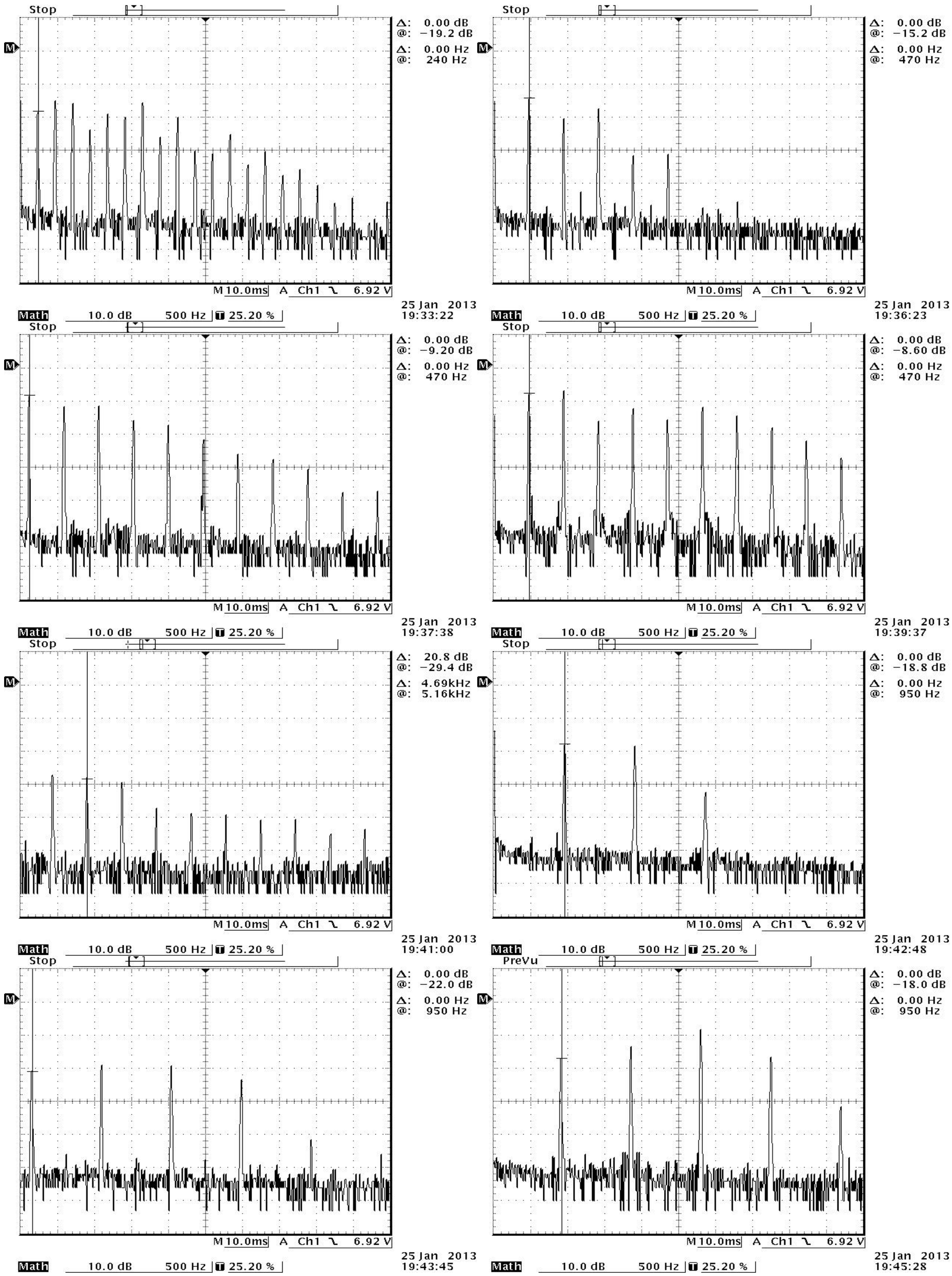
B117

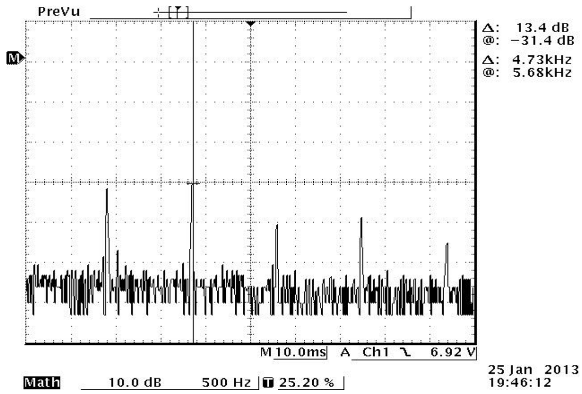

Stop
Δ: 0.00 dB
@: −23.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:56:12
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −22.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
18:58:27
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −19.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:13:58
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −12.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:16:54
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −8.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:18:14
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −6.40 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:20:10
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 25.4 dB
@: −31.8 dB
Δ: 4.71kHz
@: 5.18kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:21:38
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −4.60 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:23:26
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −1.40 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:24:32
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 45.0 dB
@: −46.4 dB
Δ: 4.75kHz
@: 5.70kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:25:15
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: 1.00 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:26:04
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 46.2 dB
@: −45.2 dB
Δ: 5.65kHz
@: 6.59kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:26:57
Math 10.0 dB 500 Hz 25.20 %

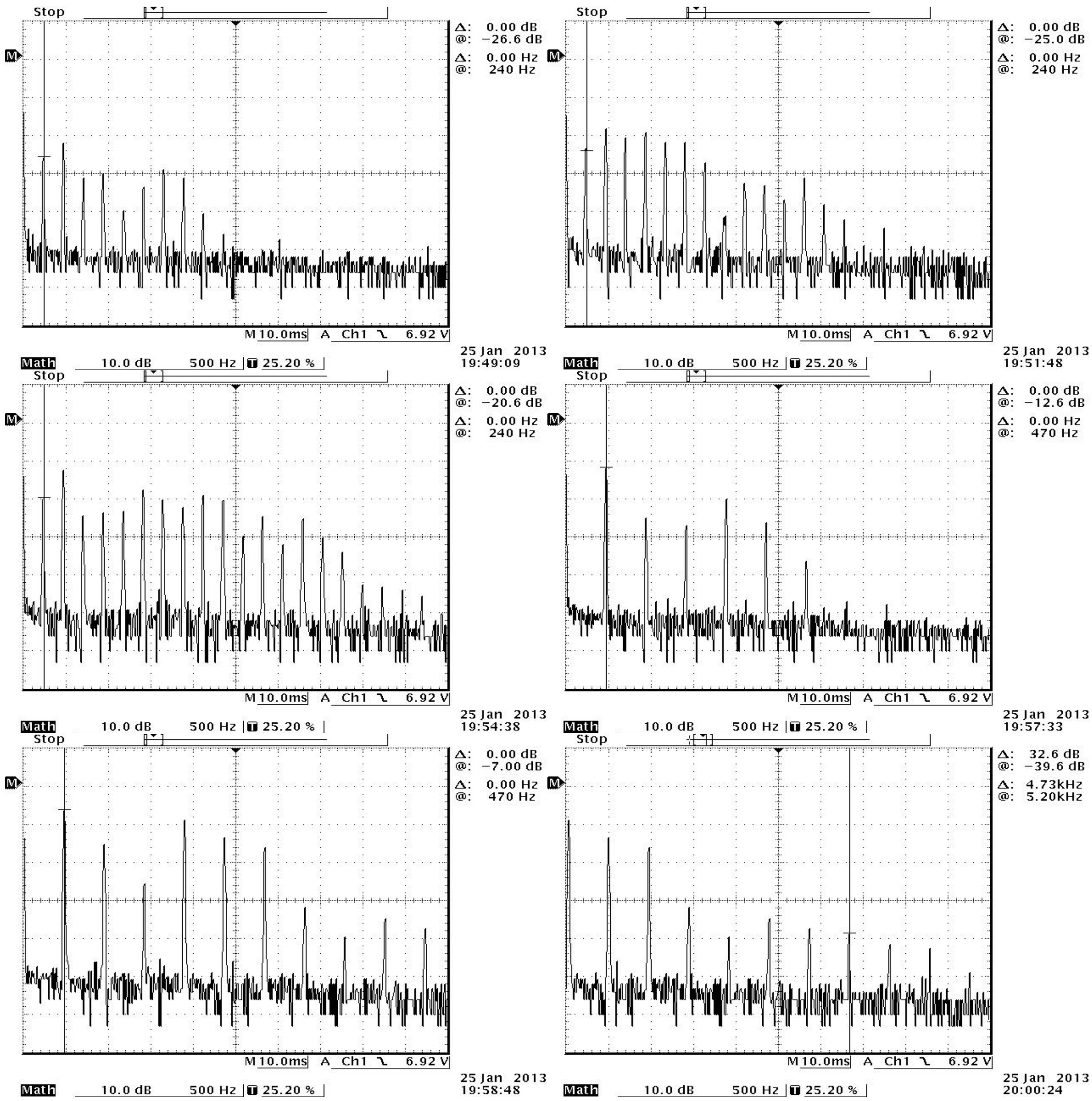
SC

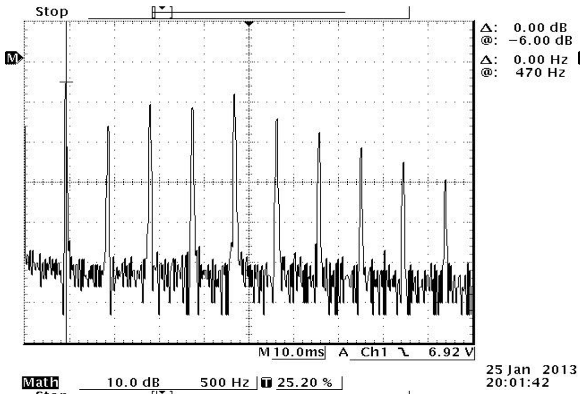

Stop
Δ: 0.00 dB
@: −24.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:29:28
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −23.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
19:31:17
Math 10.0 dB 500 Hz 25.20 %

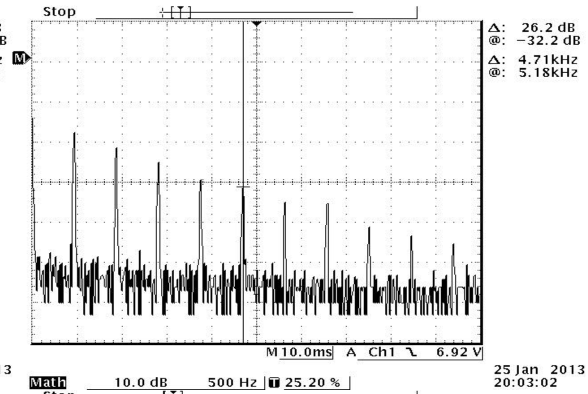

Stop
Δ: 0.00 dB
@: −19.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:33:22
Stop
Δ: 0.00 dB
@: −15.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:36:23
Stop
Δ: 0.00 dB
@: −9.20 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:37:38
Stop
Δ: 0.00 dB
@: −8.60 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:39:37
Stop
Δ: 20.8 dB
@: −29.4 dB
Δ: 4.69kHz
@: 5.16kHz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:41:00
Stop
Δ: 0.00 dB
@: −18.8 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:42:48
Stop
Δ: 0.00 dB
@: −22.0 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:43:45
PreVu
Δ: 0.00 dB
@: −18.0 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ٦ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
19:45:28

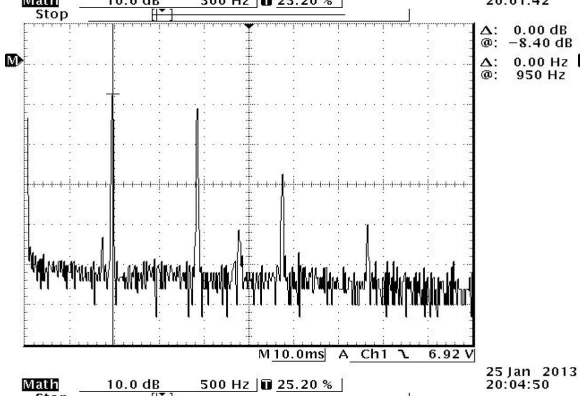

PreVu
Δ: 13.4 dB
@: −31.4 dB
Δ: 4.73kHz
@: 5.68kHz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
19:46:12
Math 10.0 dB 500 Hz 25.20 %

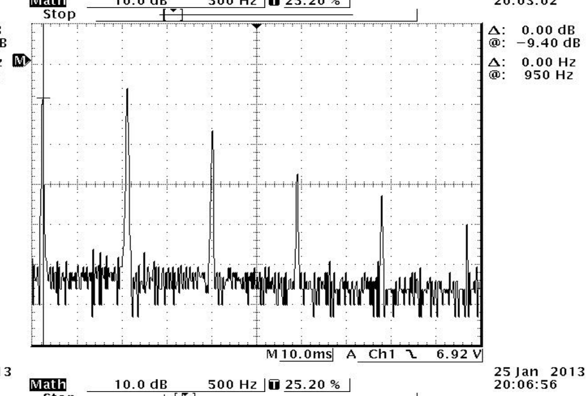
SX

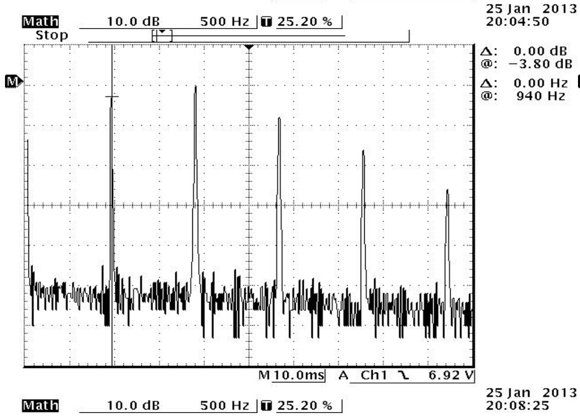

Stop
Δ: 0.00 dB
@: −26.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
19:49:09
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −25.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
19:51:48
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −20.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
19:54:38
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −12.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
19:57:33
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −7.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
19:58:48
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 32.6 dB
@: −39.6 dB
Δ: 4.73kHz
@: 5.20kHz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
20:00:24
Math 10.0 dB 500 Hz 25.20 %

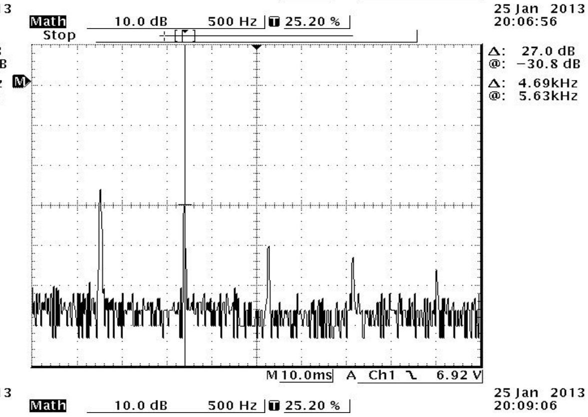

Stop
Δ: 0.00 dB
@: −6.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
25 Jan 2013
20:01:42
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 26.2 dB
@: −32.2 dB
Δ: 4.71kHz
@: 5.18kHz
M 10.0ms A Ch1 ⤵ 6.92 V
25 Jan 2013
20:03:02
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −8.40 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
25 Jan 2013
20:04:50
Math 10.0 dB 500 Hz 25.20 %

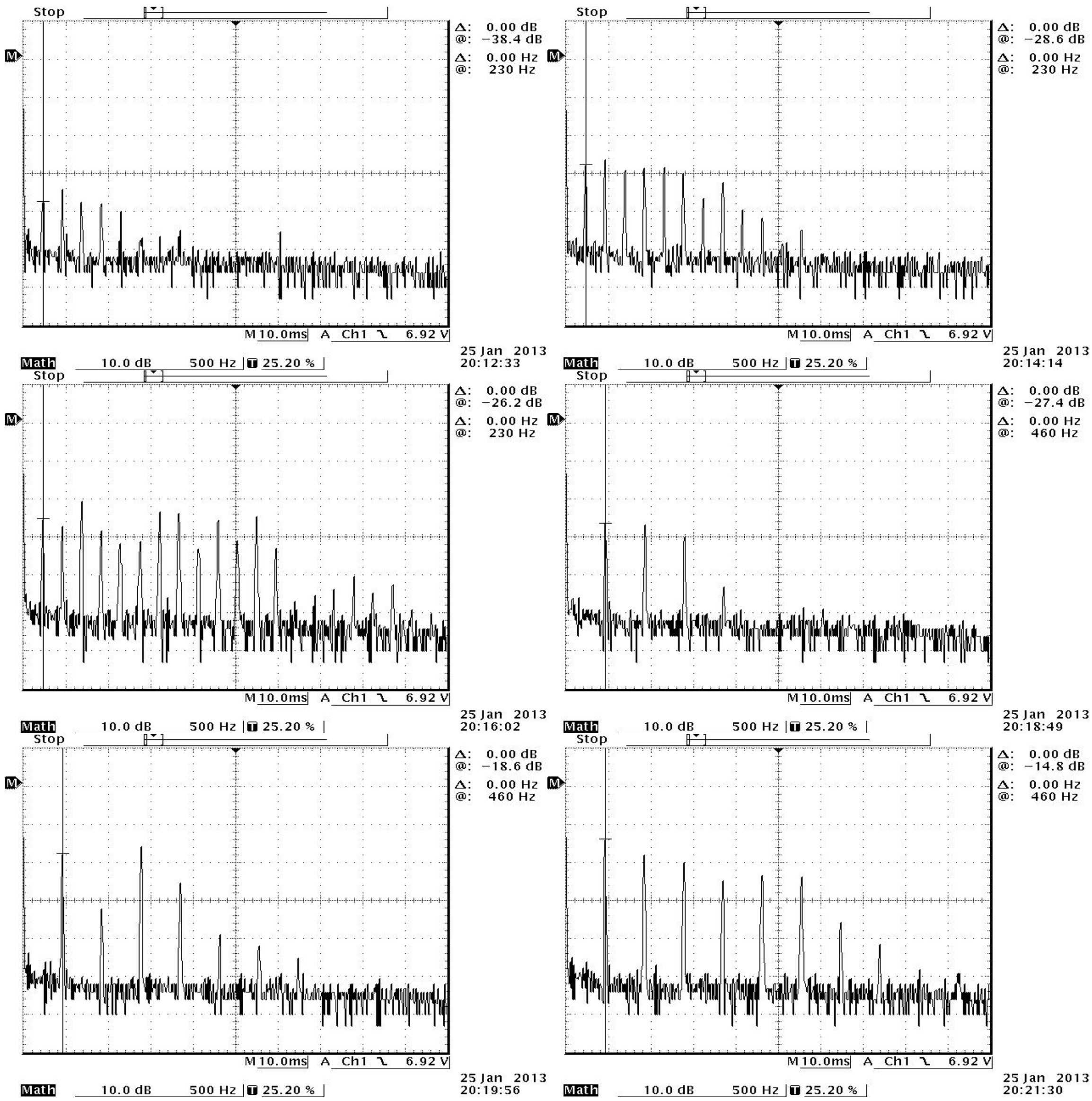

Stop
Δ: 0.00 dB
@: −9.40 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
25 Jan 2013
20:06:56
Math 10.0 dB 500 Hz 25.20 %

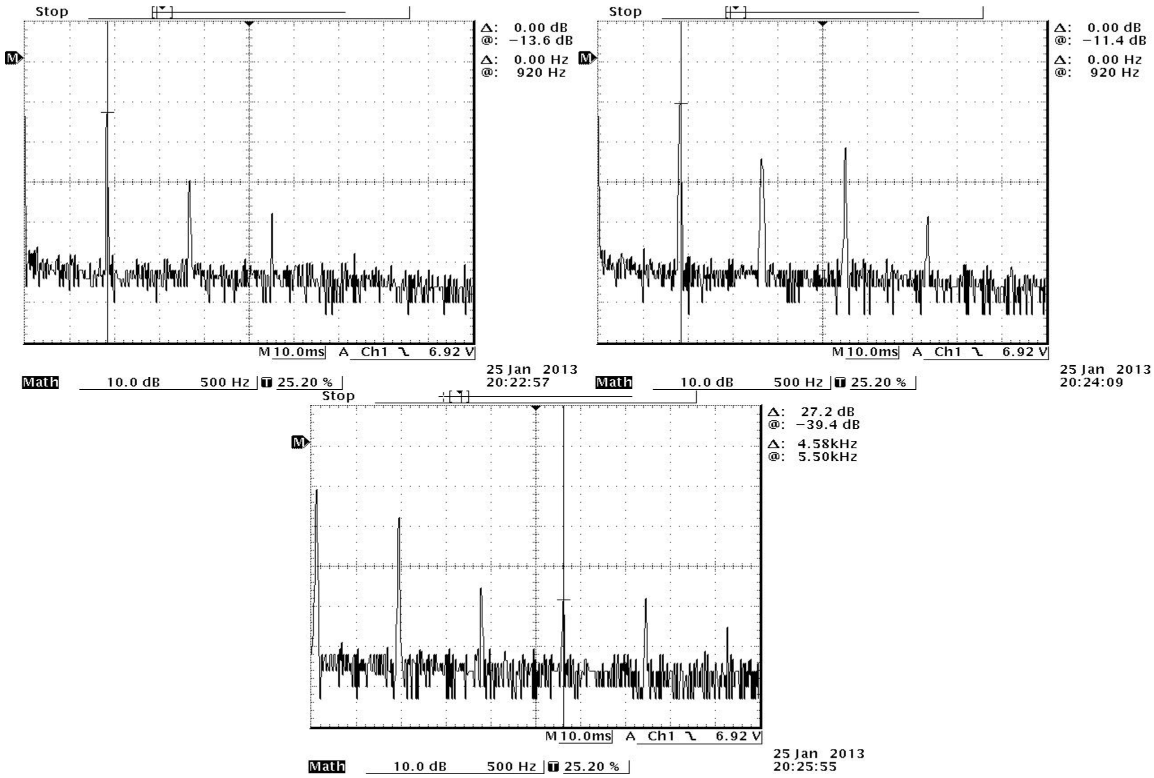

Stop
Δ: 0.00 dB
@: −3.80 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
25 Jan 2013
20:08:25
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 27.0 dB
@: −30.8 dB
Δ: 4.69kHz
@: 5.63kHz
M 10.0ms A Ch1 ⤵ 6.92 V
25 Jan 2013
20:09:06
Math 10.0 dB 500 Hz 25.20 %

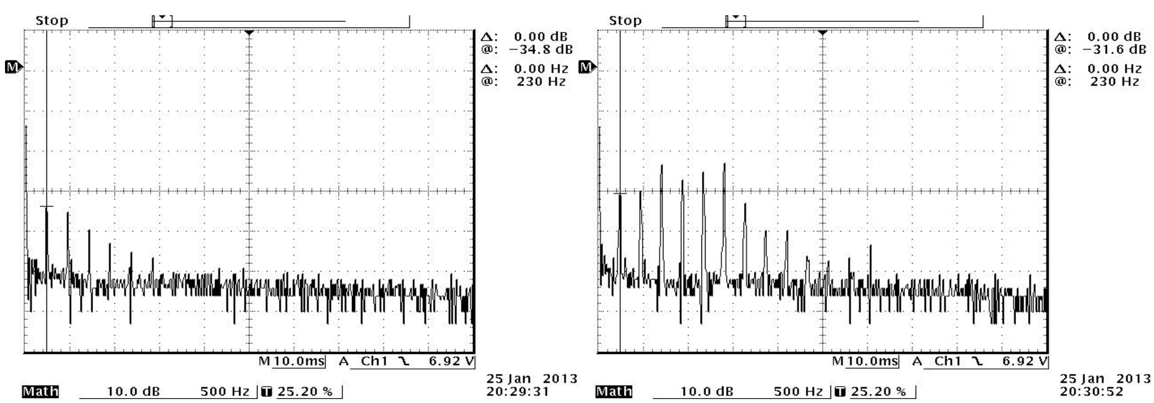
Player 4

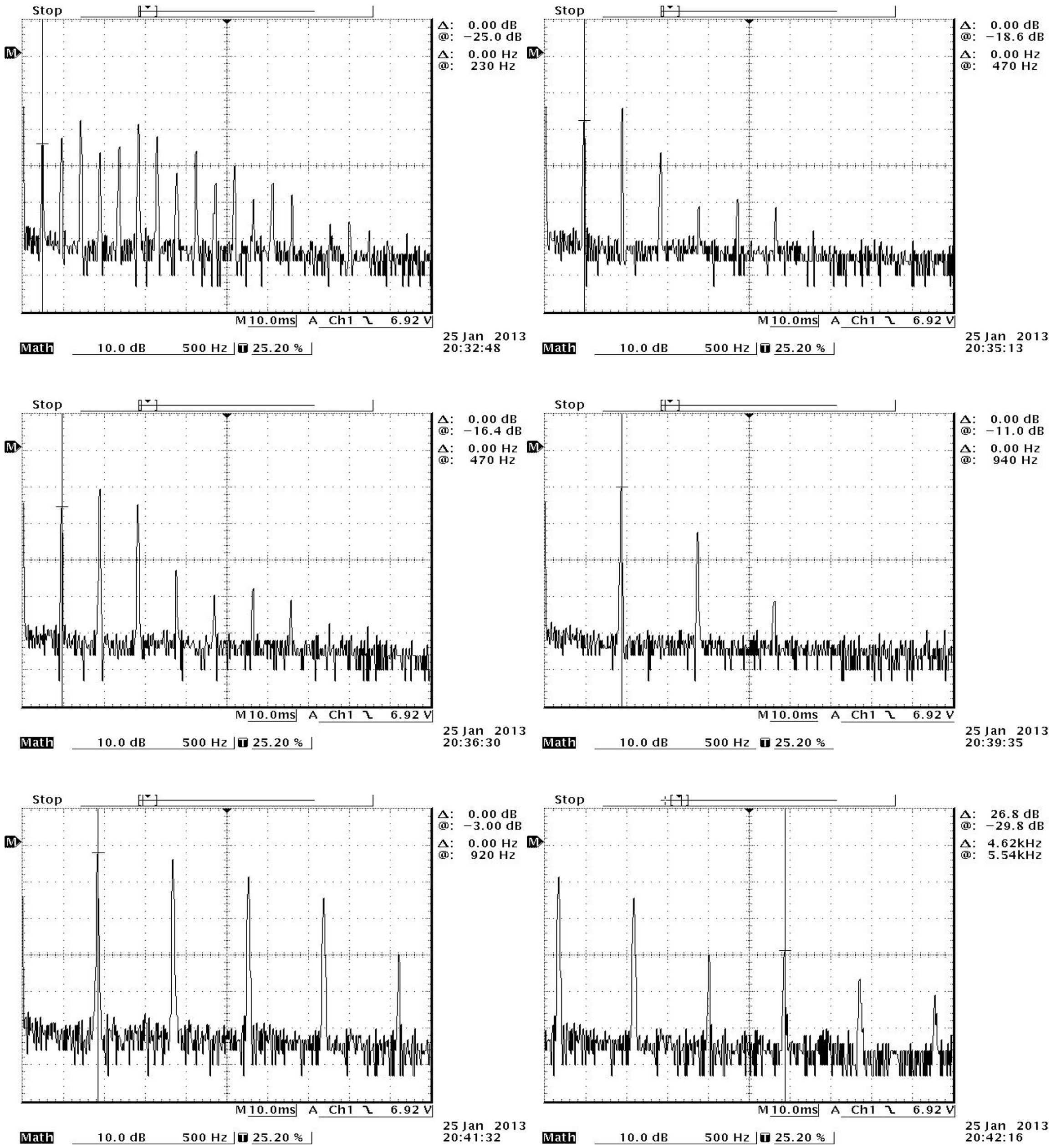
SA


Stop
Δ: 0.00 dB
@: −38.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:12:33
Stop
Δ: 0.00 dB
@: −28.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:14:14
Stop
Δ: 0.00 dB
@: −26.2 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:16:02
Stop
Δ: 0.00 dB
@: −27.4 dB
Δ: 0.00 Hz
@: 460 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:18:49
Stop
Δ: 0.00 dB
@: −18.6 dB
Δ: 0.00 Hz
@: 460 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:19:56
Stop
Δ: 0.00 dB
@: −14.8 dB
Δ: 0.00 Hz
@: 460 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:21:30

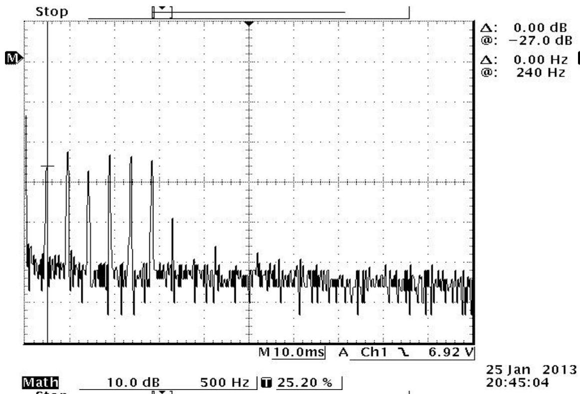

Stop
Δ: 0.00 dB
@: −13.6 dB
Δ: 0.00 Hz
@: 920 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:22:57
Stop
Δ: 0.00 dB
@: −11.4 dB
Δ: 0.00 Hz
@: 920 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:24:09
Stop
Δ: 27.2 dB
@: −39.4 dB
Δ: 4.58kHz
@: 5.50kHz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:25:55

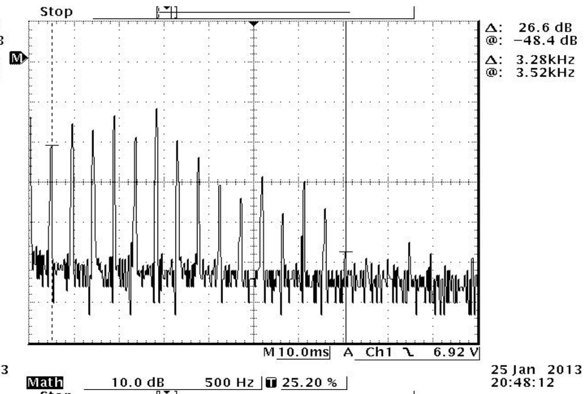
B76

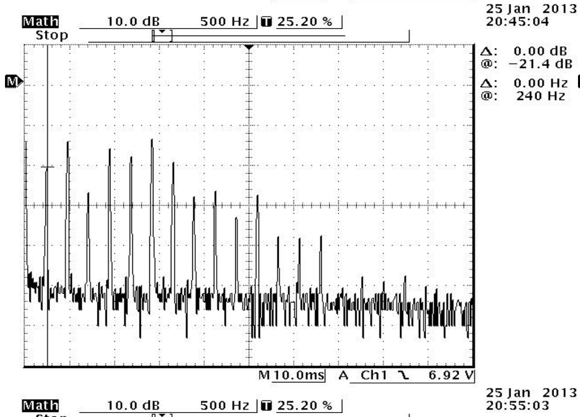

Stop
Δ: 0.00 dB
@: −34.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:29:31
Stop
Δ: 0.00 dB
@: −31.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌄ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:30:52

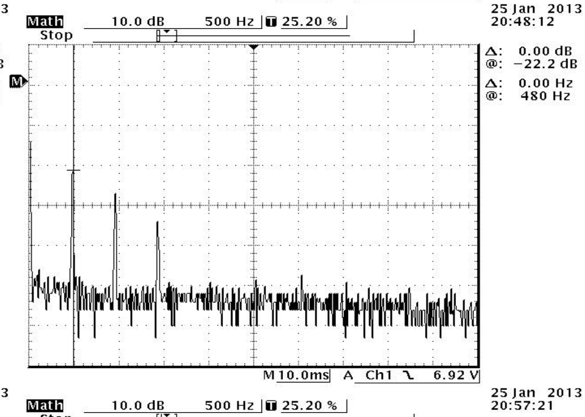

Stop
Δ: 0.00 dB
@: −25.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:32:48
Stop
Δ: 0.00 dB
@: −18.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:35:13
Stop
Δ: 0.00 dB
@: −16.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:36:30
Stop
Δ: 0.00 dB
@: −11.0 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:39:35
Stop
Δ: 0.00 dB
@: −3.00 dB
Δ: 0.00 Hz
@: 920 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:41:32
Stop
Δ: 26.8 dB
@: −29.8 dB
Δ: 4.62kHz
@: 5.54kHz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
20:42:16

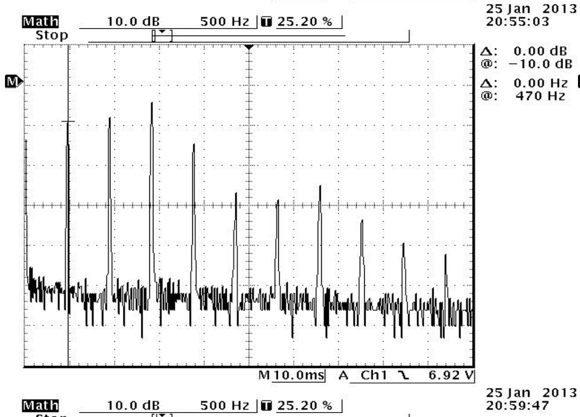
YA

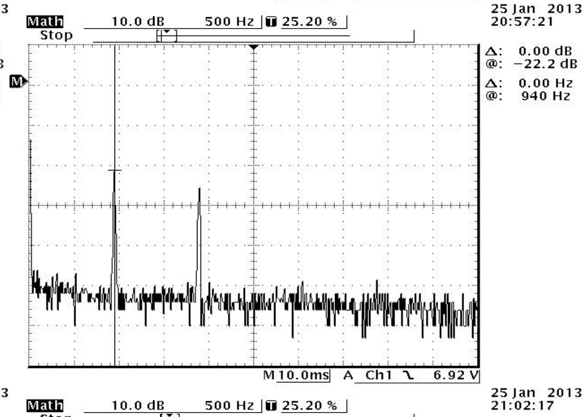

Stop
Δ: 0.00 dB
@: −27.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
20:45:04
Math 10.0 dB 500 Hz 25.20 %

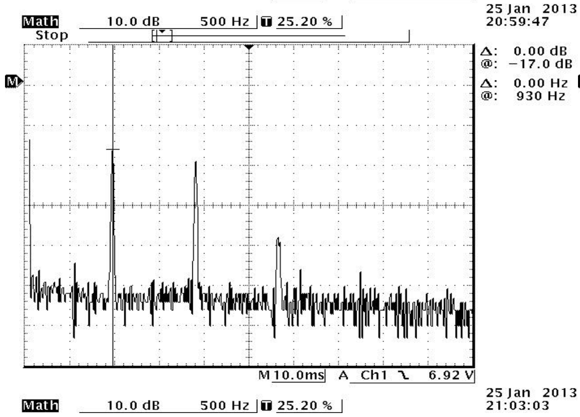

Stop
Δ: 26.6 dB
@: −48.4 dB
Δ: 3.28kHz
@: 3.52kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
20:48:12
Math 10.0 dB 500 Hz 25.20 %

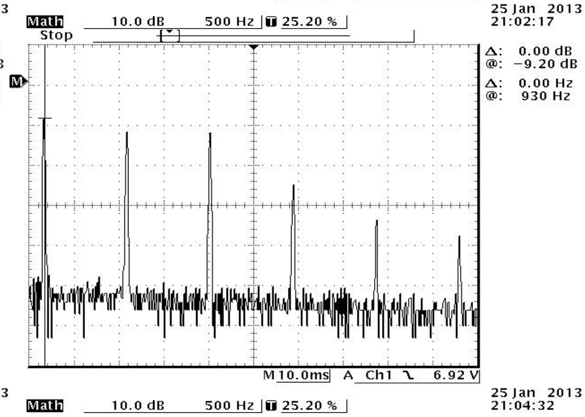

Stop
Δ: 0.00 dB
@: −21.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
20:55:03
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −22.2 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
20:57:21
Math 10.0 dB 500 Hz 25.20 %

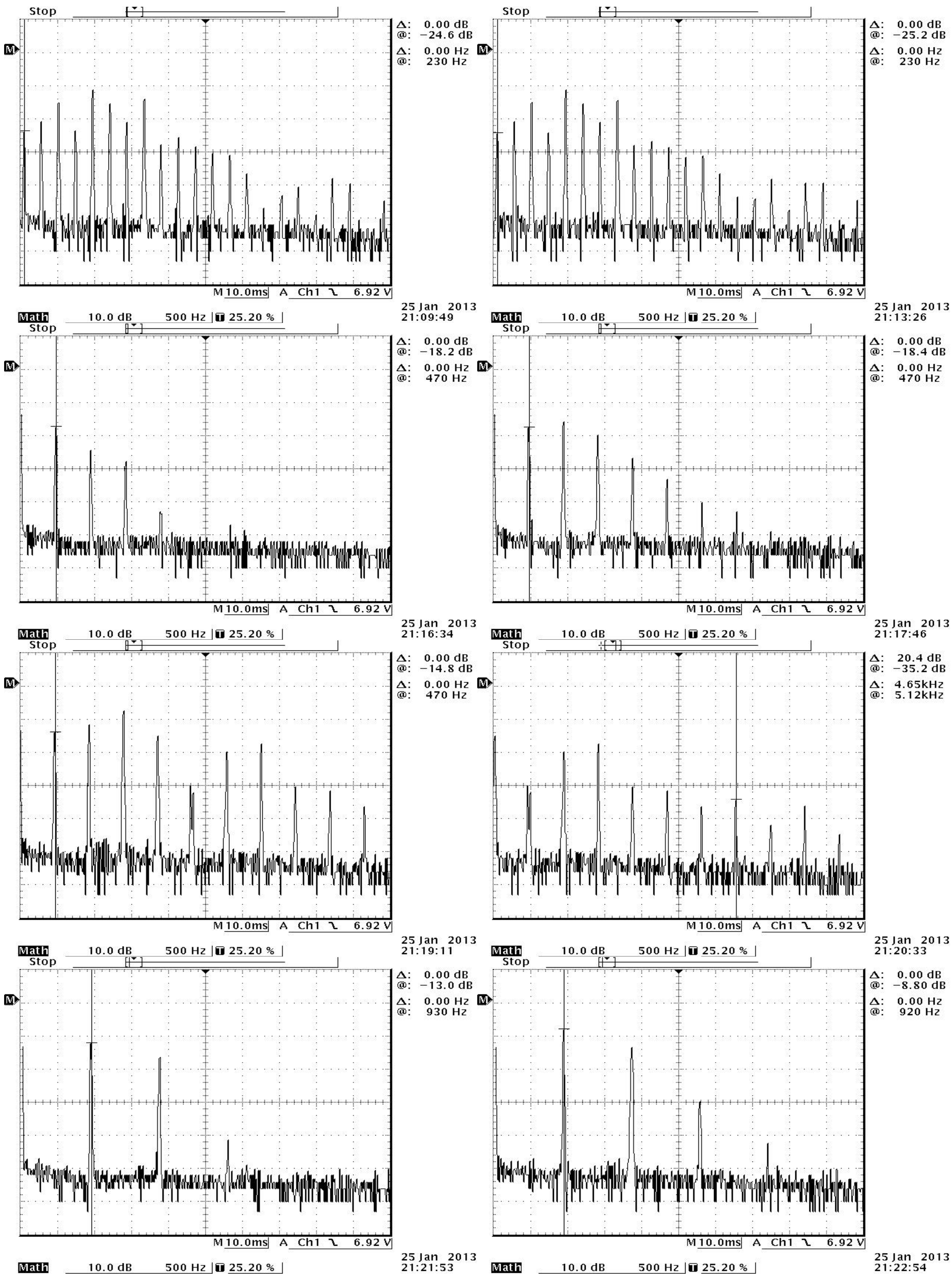

Stop
Δ: 0.00 dB
@: −10.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
20:59:47
Math 10.0 dB 500 Hz 25.20 %

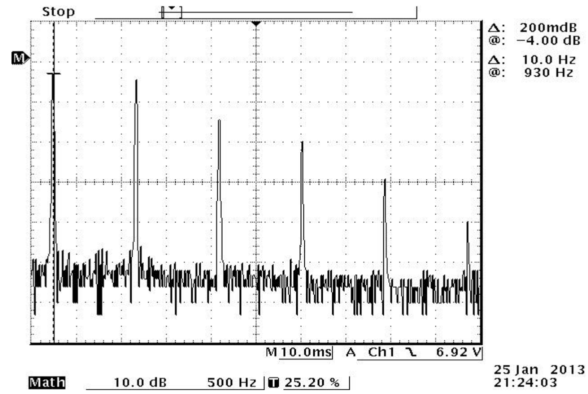

Stop
Δ: 0.00 dB
@: −22.2 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
21:02:17
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −17.0 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
21:03:03
Math 10.0 dB 500 Hz 25.20 %

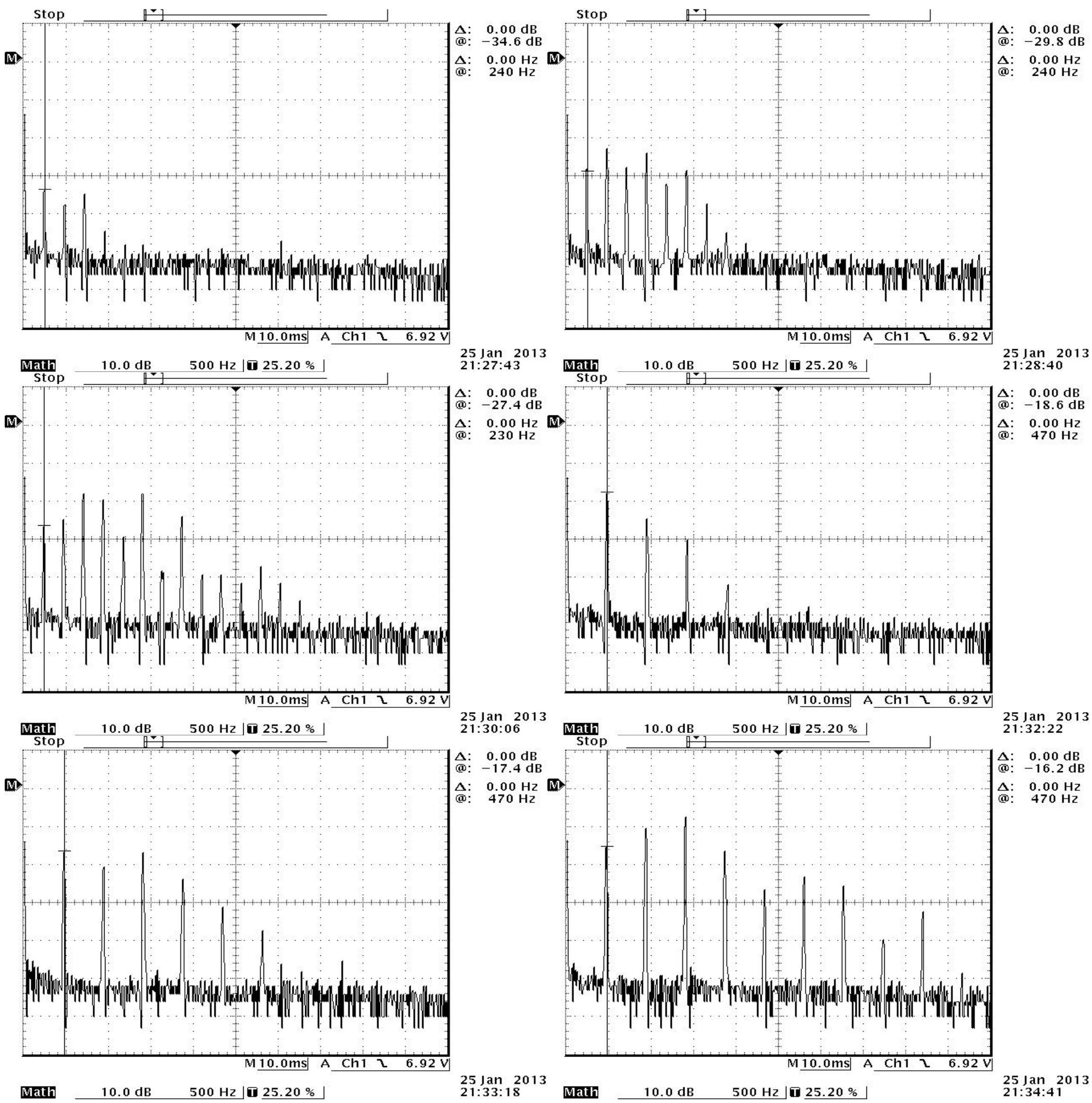

Stop
Δ: 0.00 dB
@: −9.20 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
21:04:32
Math 10.0 dB 500 Hz 25.20 %

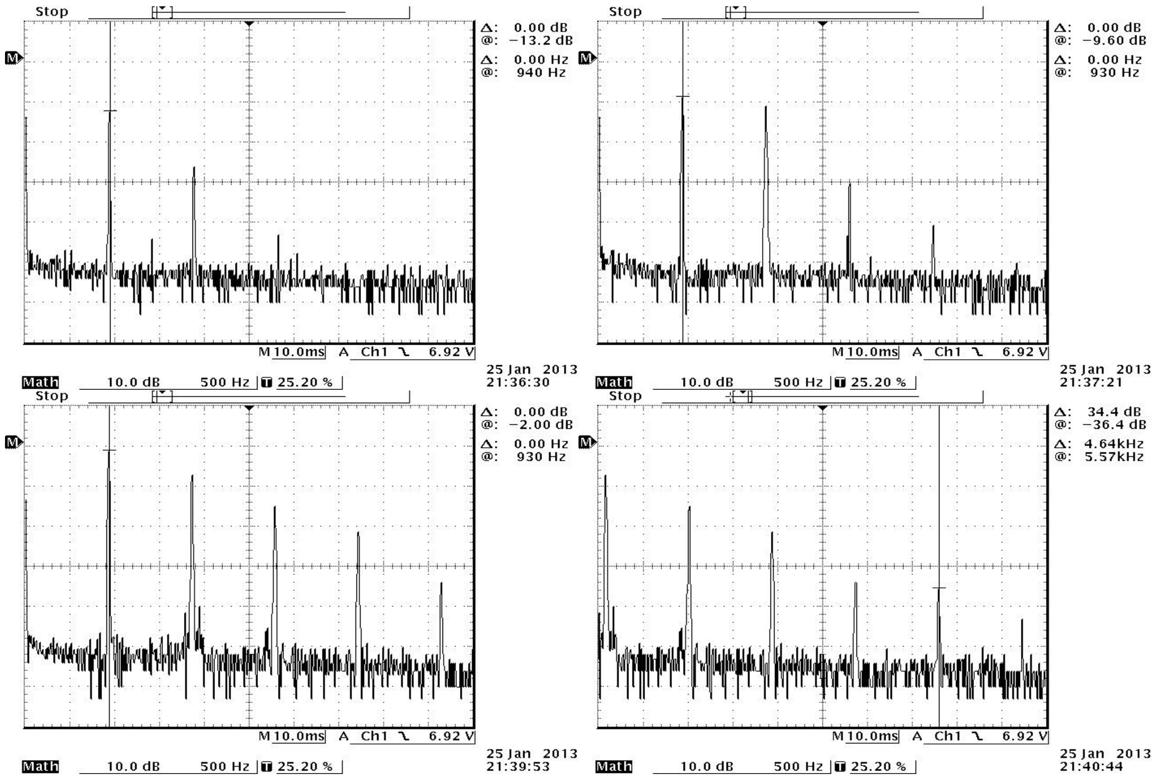
B4


Stop
Δ: 0.00 dB
@: −24.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:09:49
Stop
Δ: 0.00 dB
@: −25.2 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:13:26
Stop
Δ: 0.00 dB
@: −18.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:16:34
Stop
Δ: 0.00 dB
@: −18.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:17:46
Stop
Δ: 0.00 dB
@: −14.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:19:11
Stop
Δ: 20.4 dB
@: −35.2 dB
Δ: 4.65kHz
@: 5.12kHz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:20:33
Stop
Δ: 0.00 dB
@: −13.0 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:21:53
Stop
Δ: 0.00 dB
@: −8.80 dB
Δ: 0.00 Hz
@: 920 Hz
M 10.0ms A Ch1 ⌍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:22:54

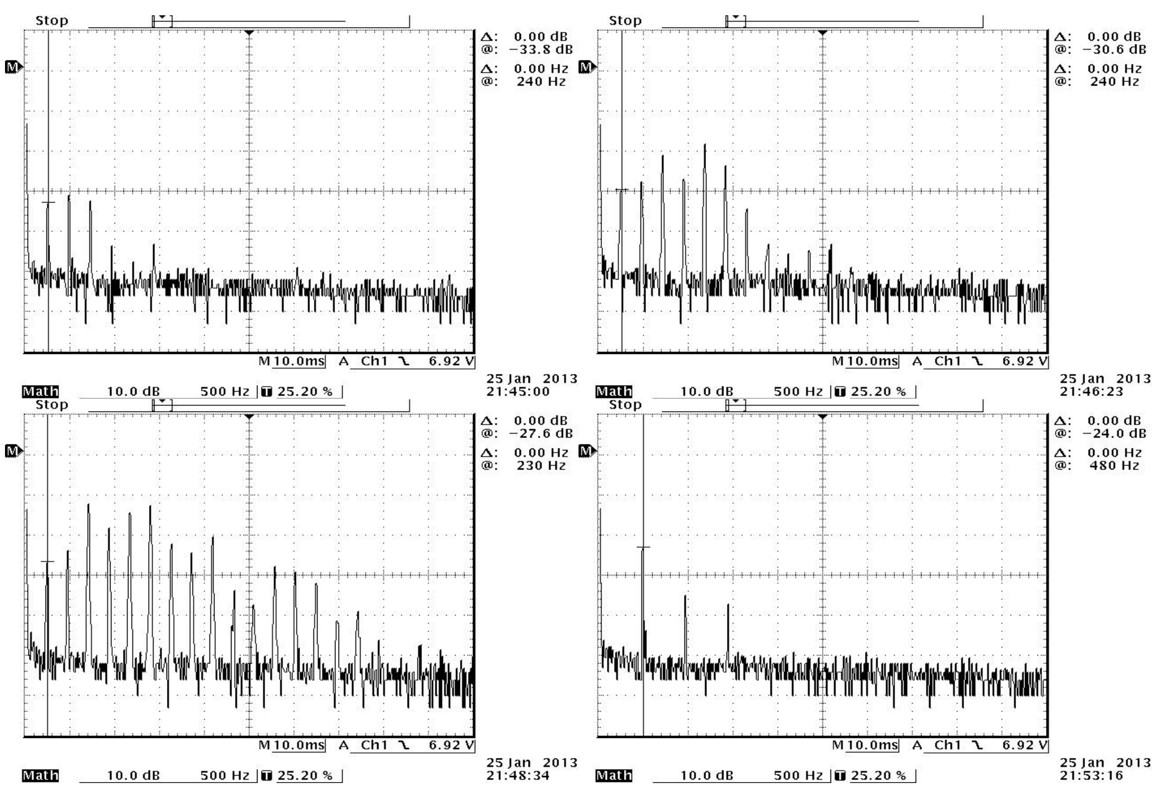

Stop
Δ: 200mdB
@: −4.00 dB
Δ: 10.0 Hz
@: 930 Hz
M 10.0ms A Ch1 ╲ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:24:03

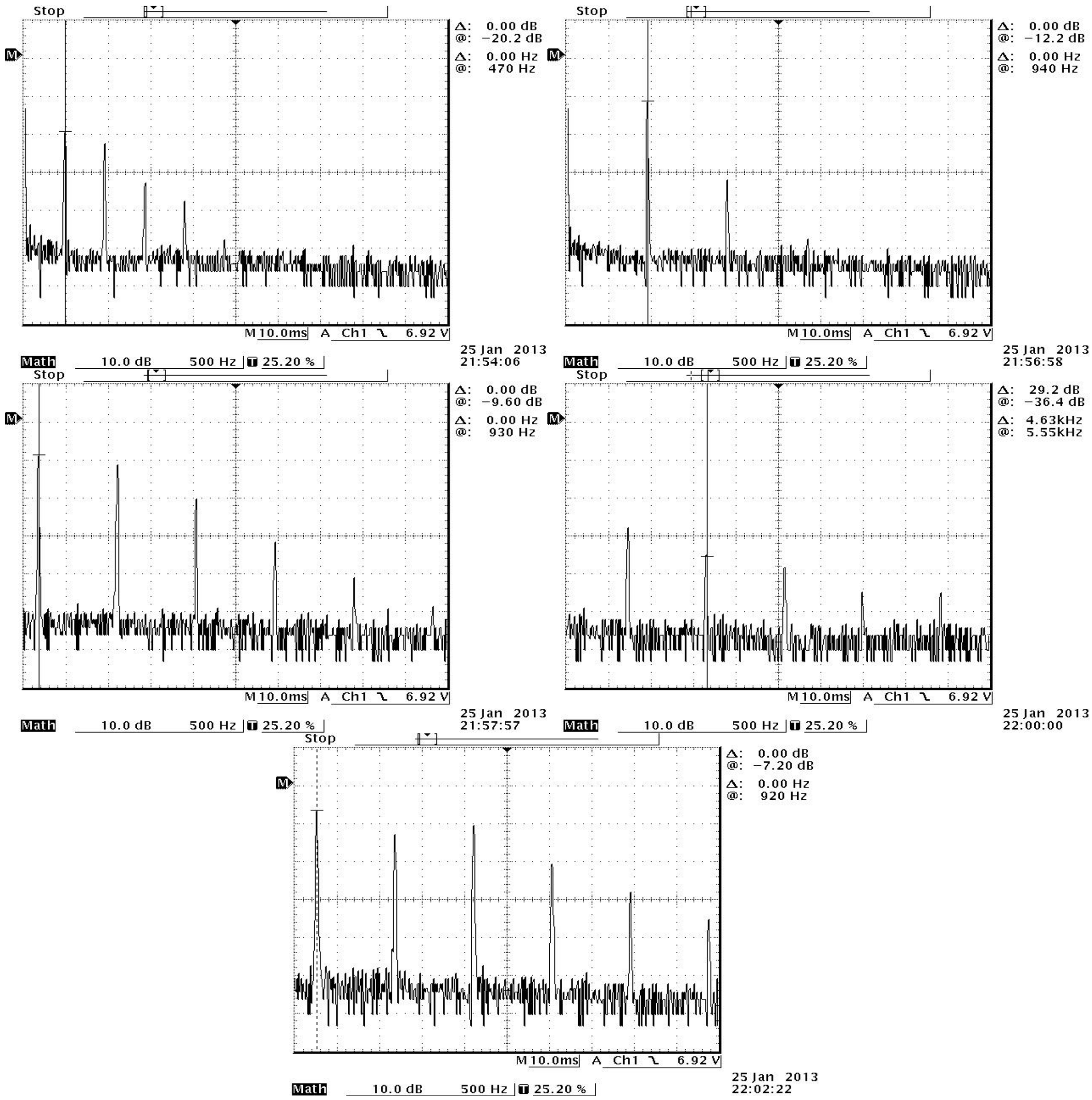
YC


Stop
Δ: 0.00 dB
@: −34.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ╲ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:27:43
Stop
Δ: 0.00 dB
@: −29.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ╲ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:28:40
Stop
Δ: 0.00 dB
@: −27.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ╲ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:30:06
Stop
Δ: 0.00 dB
@: −18.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ╲ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:32:22
Stop
Δ: 0.00 dB
@: −17.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ╲ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:33:18
Stop
Δ: 0.00 dB
@: −16.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ╲ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:34:41

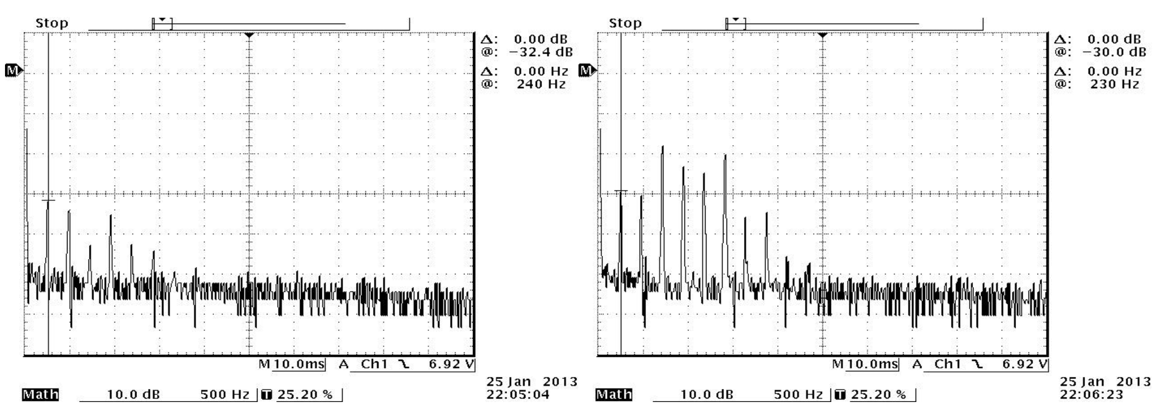

Stop
Δ: 0.00 dB
@: −13.2 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:36:30
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −9.60 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:37:21
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −2.00 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:39:53
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 34.4 dB
@: −36.4 dB
Δ: 4.64kHz
@: 5.57kHz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:40:44
Math 10.0 dB 500 Hz 25.20 %

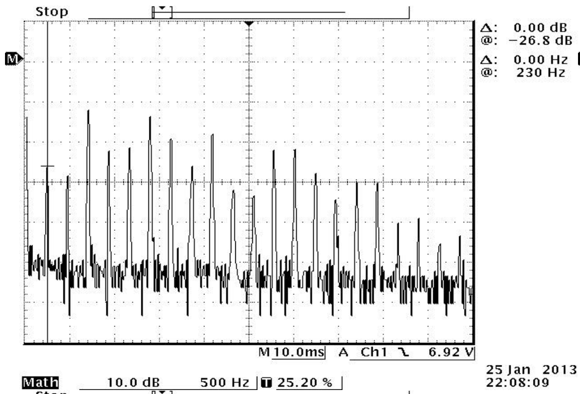
B24

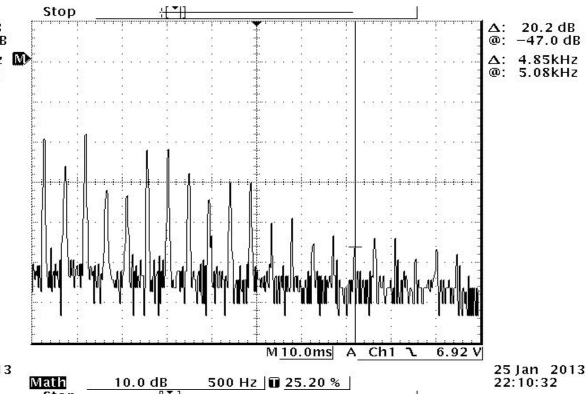

Stop
Δ: 0.00 dB
@: −33.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:45:00
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −30.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:46:23
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −27.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:48:34
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −24.0 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
25 Jan 2013
21:53:16
Math 10.0 dB 500 Hz 25.20 %

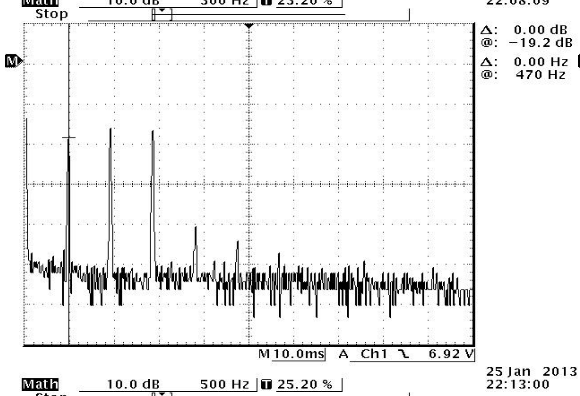

Stop
Δ: 0.00 dB
@: −20.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⁊ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:54:06
Stop
Δ: 0.00 dB
@: −12.2 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⁊ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:56:58
Stop
Δ: 0.00 dB
@: −9.60 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⁊ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
21:57:57
Stop
Δ: 29.2 dB
@: −36.4 dB
Δ: 4.63kHz
@: 5.55kHz
M 10.0ms A Ch1 ⁊ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:00:00
Stop
Δ: 0.00 dB
@: −7.20 dB
Δ: 0.00 Hz
@: 920 Hz
M 10.0ms A Ch1 ⁊ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:02:22

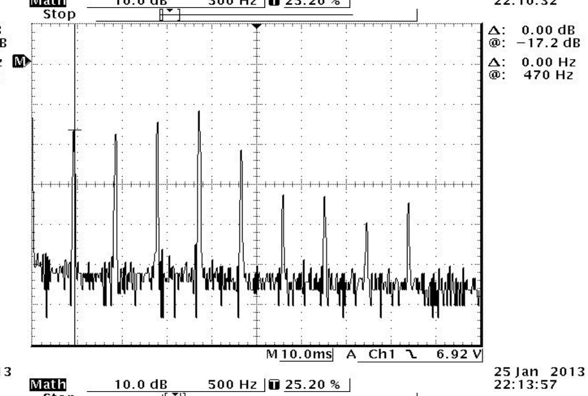
G7C

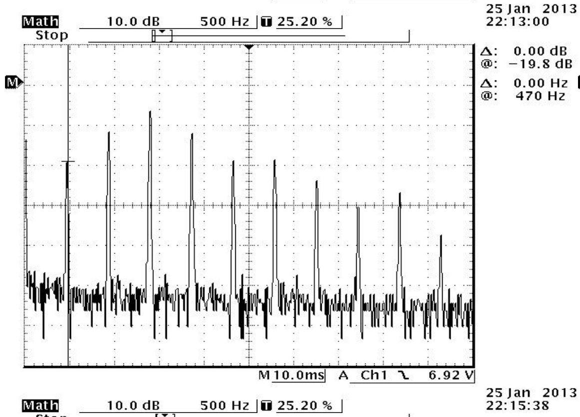

Stop
Δ: 0.00 dB
@: −32.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⁊ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:05:04
Stop
Δ: 0.00 dB
@: −30.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⁊ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:06:23

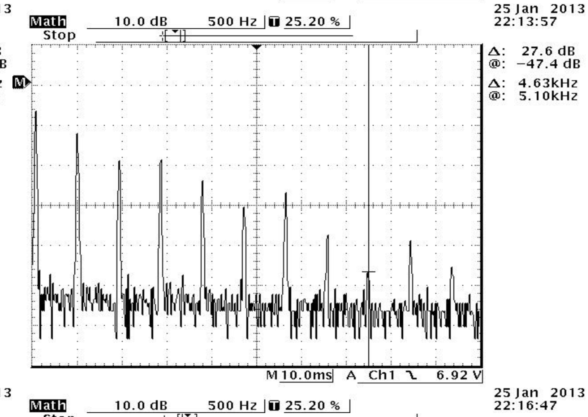

Stop
Δ: 0.00 dB
@: −26.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:08:09
Math 10.0 dB 500 Hz 25.20 %

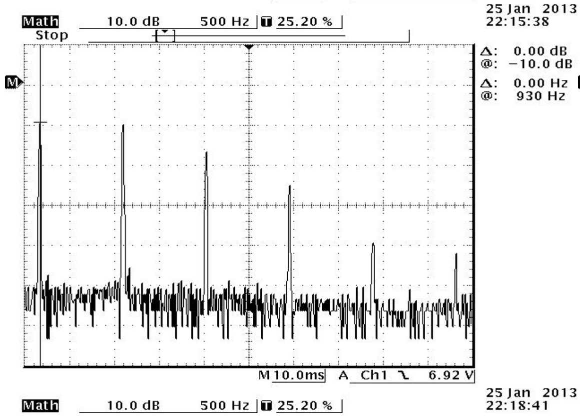

Stop
Δ: 20.2 dB
@: −47.0 dB
Δ: 4.85kHz
@: 5.08kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:10:32
Math 10.0 dB 500 Hz 25.20 %

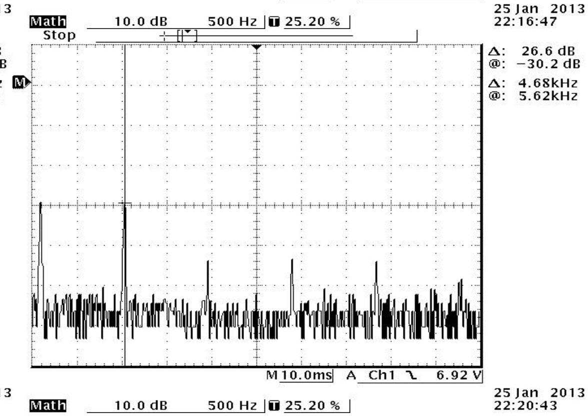

Stop
Δ: 0.00 dB
@: −19.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:13:00
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −17.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:13:57
Math 10.0 dB 500 Hz 25.20 %

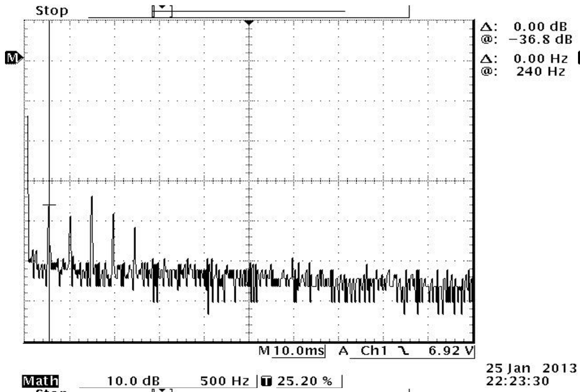

Stop
Δ: 0.00 dB
@: −19.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:15:38
Math 10.0 dB 500 Hz 25.20 %

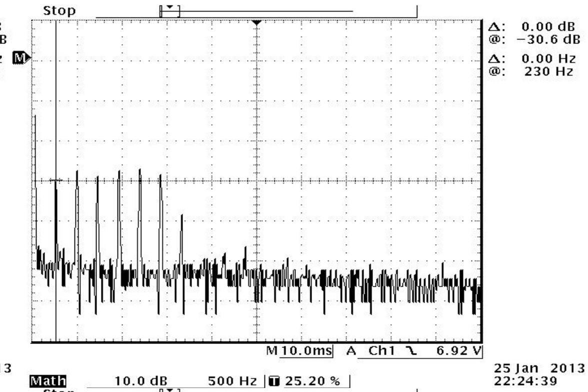

Stop
Δ: 27.6 dB
@: −47.4 dB
Δ: 4.63kHz
@: 5.10kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:16:47
Math 10.0 dB 500 Hz 25.20 %

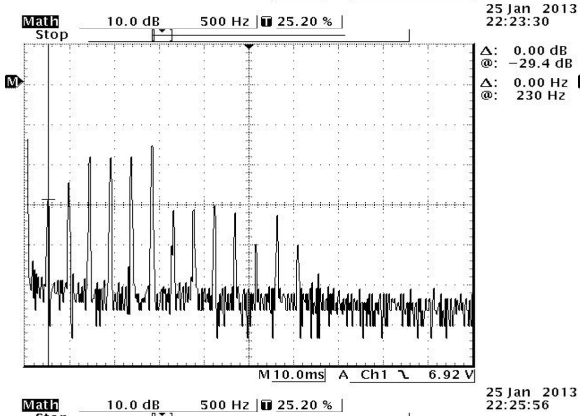

Stop
Δ: 0.00 dB
@: −10.0 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:18:41
Math 10.0 dB 500 Hz 25.20 %

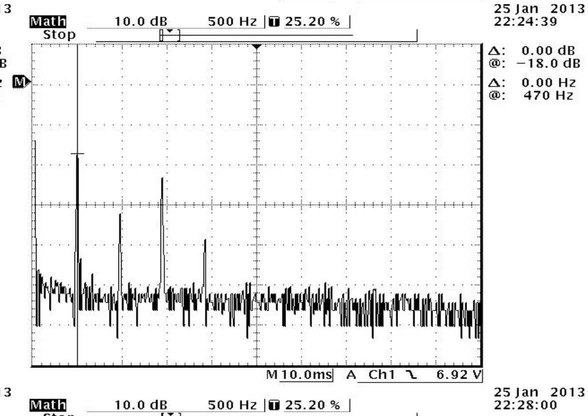

Stop
Δ: 26.6 dB
@: −30.2 dB
Δ: 4.68kHz
@: 5.62kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:20:43
Math 10.0 dB 500 Hz 25.20 %

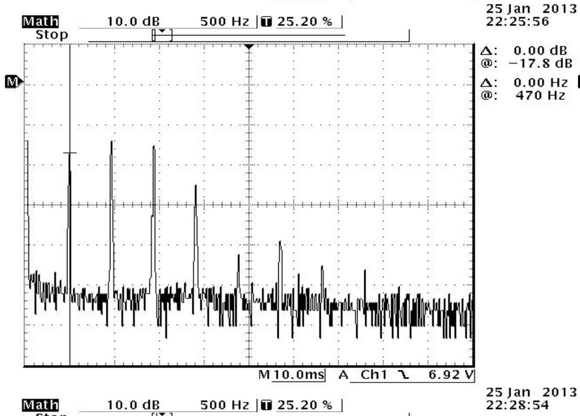
B7

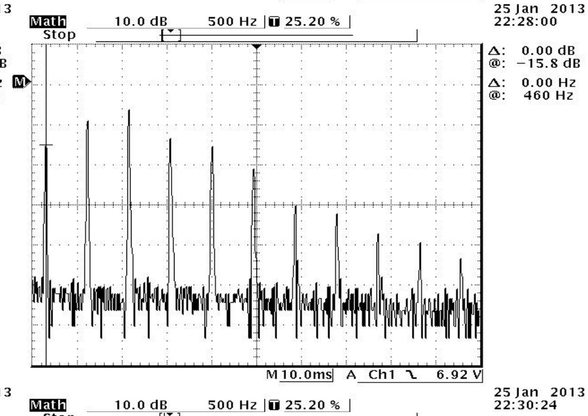

Stop
Δ: 0.00 dB
@: −36.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:23:30
Math 10.0 dB 500 Hz 25.20 %

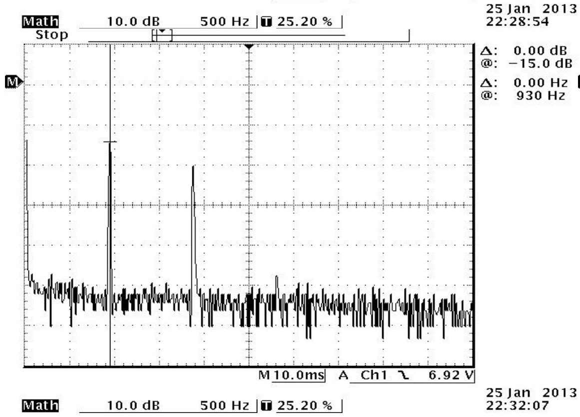

Stop
Δ: 0.00 dB
@: −30.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:24:39
Math 10.0 dB 500 Hz 25.20 %

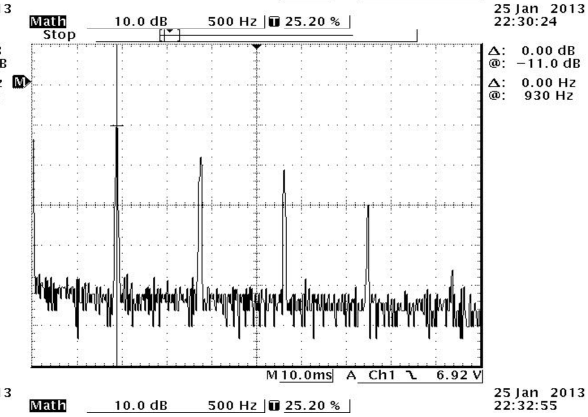

Stop
Δ: 0.00 dB
@: −29.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:25:56
Math 10.0 dB 500 Hz 25.20 %

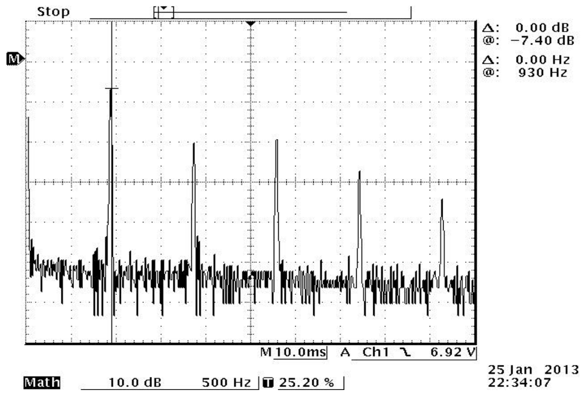

Stop
Δ: 0.00 dB
@: −18.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:28:00
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −17.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:28:54
Math 10.0 dB 500 Hz 25.20 %

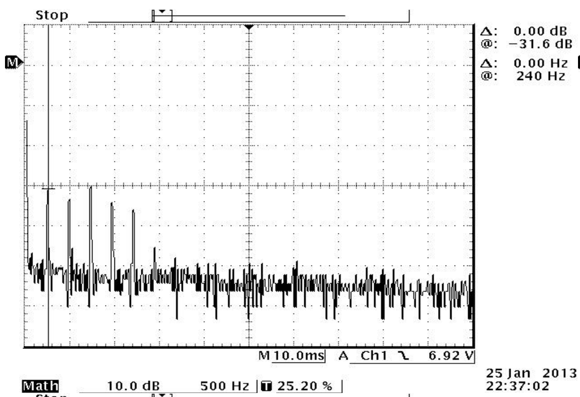

Stop
Δ: 0.00 dB
@: −15.8 dB
Δ: 0.00 Hz
@: 460 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:30:24
Math 10.0 dB 500 Hz 25.20 %

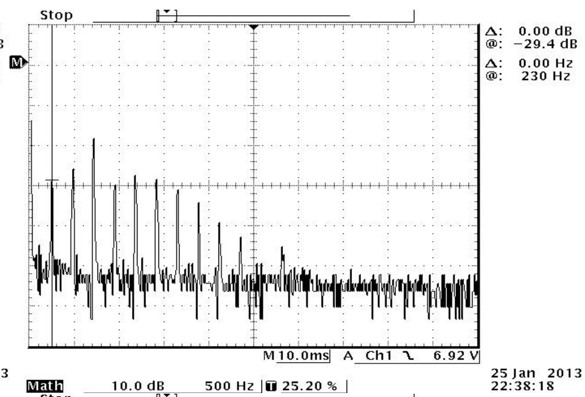

Stop
Δ: 0.00 dB
@: −15.0 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:32:07
Math 10.0 dB 500 Hz 25.20 %

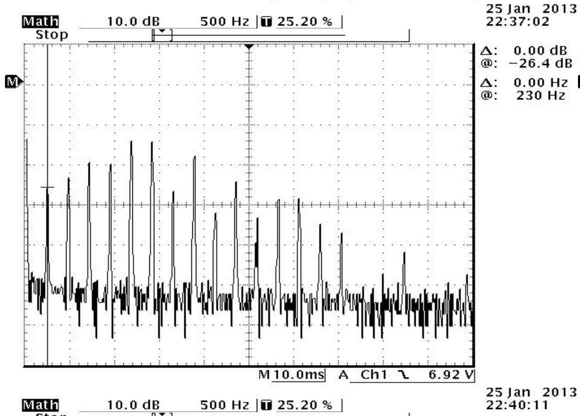

Stop
Δ: 0.00 dB
@: −11.0 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:32:55
Math 10.0 dB 500 Hz 25.20 %

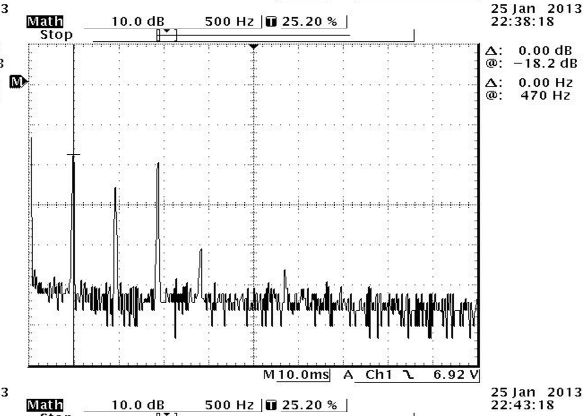

Stop
Δ: 0.00 dB
@: −7.40 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:34:07
Math 10.0 dB 500 Hz 25.20 %

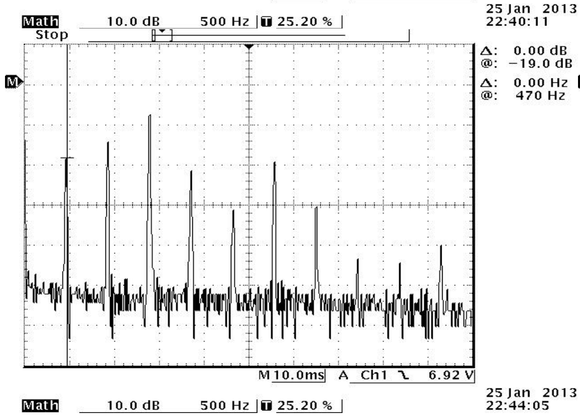
YMG

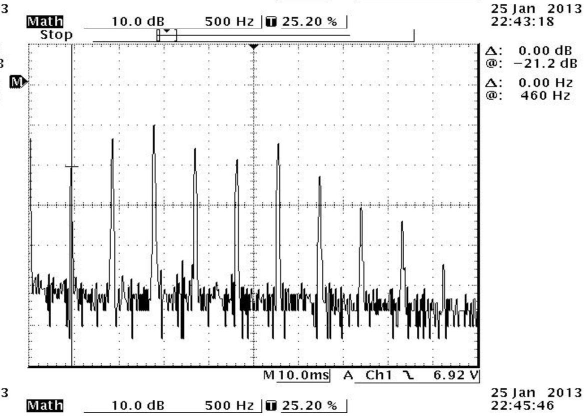

Stop
Δ: 0.00 dB
@: −31.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:37:02
Math 10.0 dB 500 Hz 25.20 %

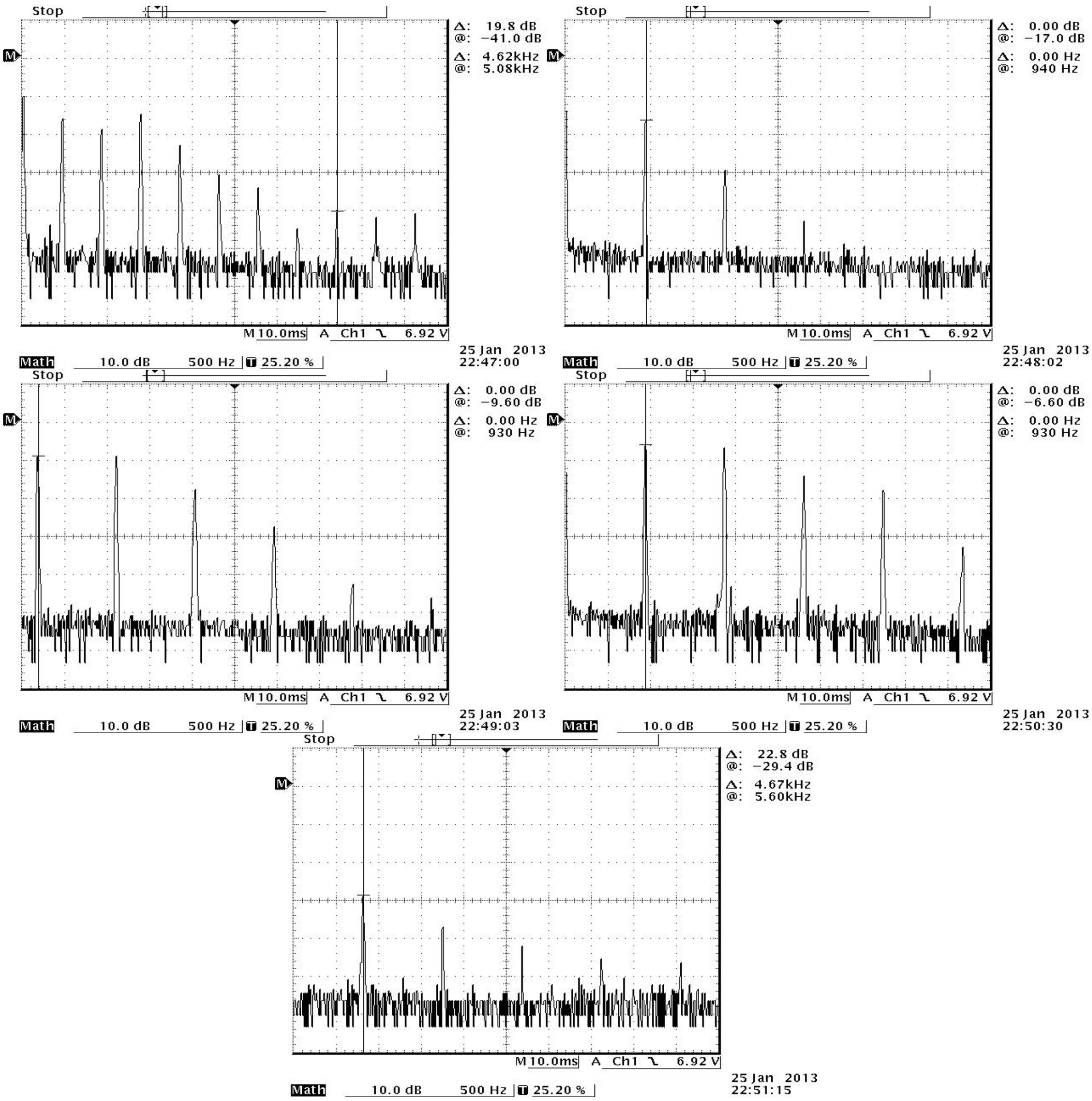

Stop
Δ: 0.00 dB
@: −29.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:38:18
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −26.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:40:11
Math 10.0 dB 500 Hz 25.20 %

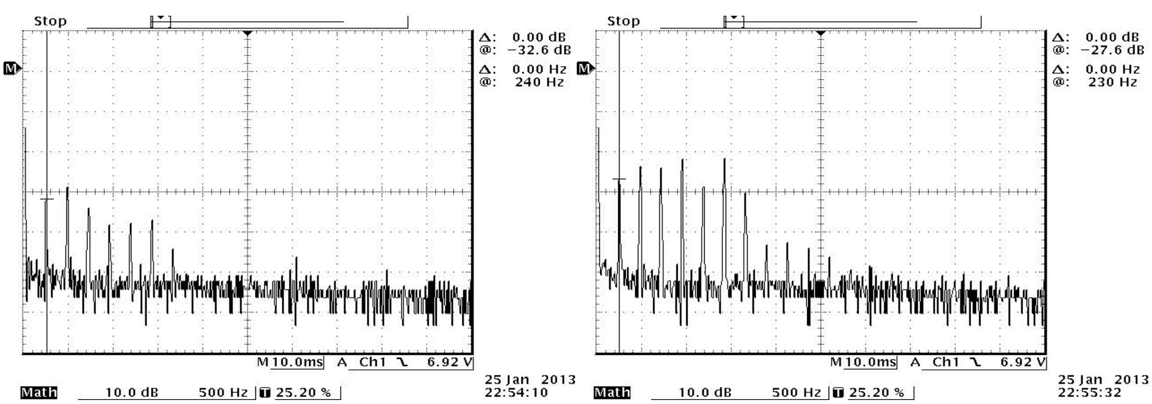

Stop
Δ: 0.00 dB
@: −18.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:43:18
Math 10.0 dB 500 Hz 25.20 %

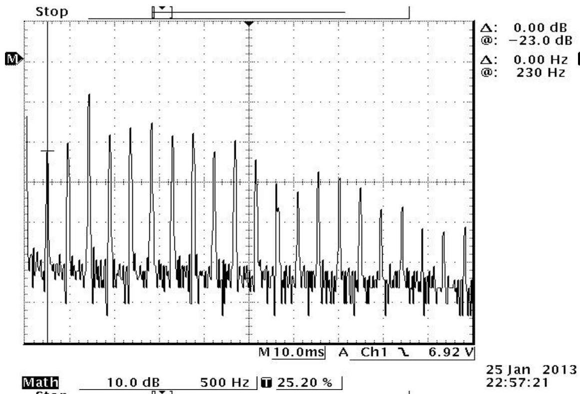

Stop
Δ: 0.00 dB
@: −19.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:44:05
Math 10.0 dB 500 Hz 25.20 %

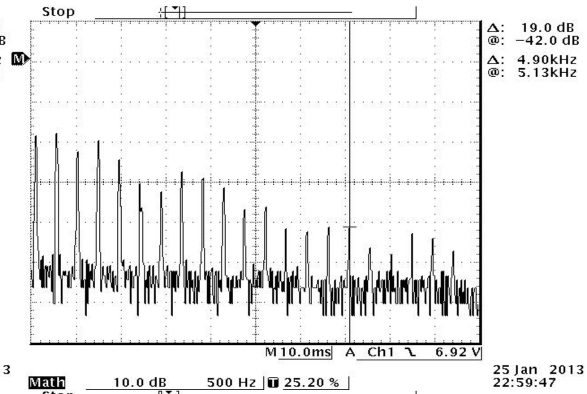

Stop
Δ: 0.00 dB
@: −21.2 dB
Δ: 0.00 Hz
@: 460 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:45:46
Math 10.0 dB 500 Hz 25.20 %

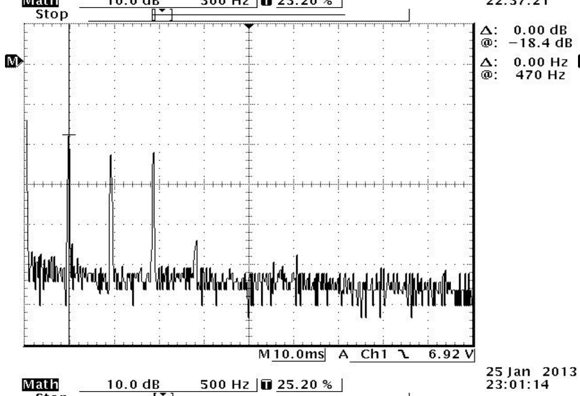

Stop
Δ: 19.8 dB
@: −41.0 dB
Δ: 4.62kHz
@: 5.08kHz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:47:00
Stop
Δ: 0.00 dB
@: −17.0 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:48:02
Stop
Δ: 0.00 dB
@: −9.60 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:49:03
Stop
Δ: 0.00 dB
@: −6.60 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:50:30
Stop
Δ: 22.8 dB
@: −29.4 dB
Δ: 4.67kHz
@: 5.60kHz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:51:15

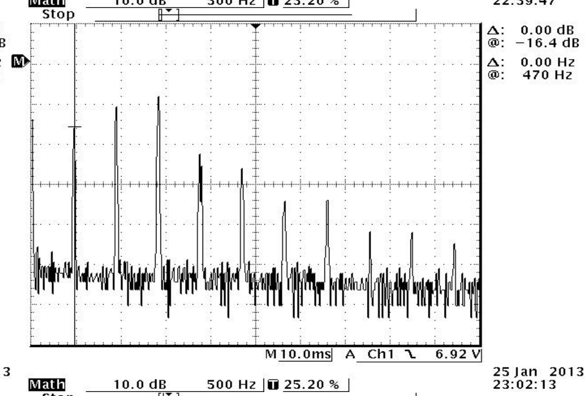
B117

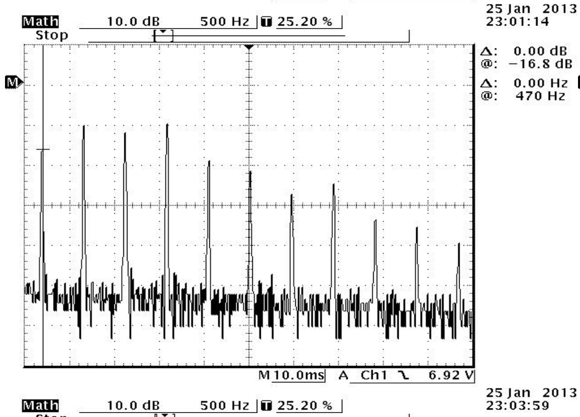

Stop
Δ: 0.00 dB
@: −32.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:54:10
Stop
Δ: 0.00 dB
@: −27.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
22:55:32

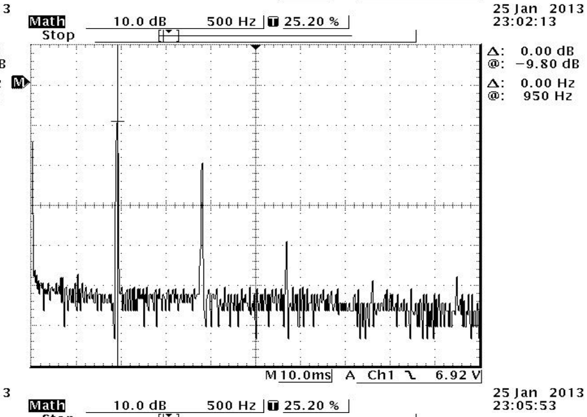

Stop
Δ: 0.00 dB
@: −23.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:57:21
Math 10.0 dB 500 Hz 25.20 %

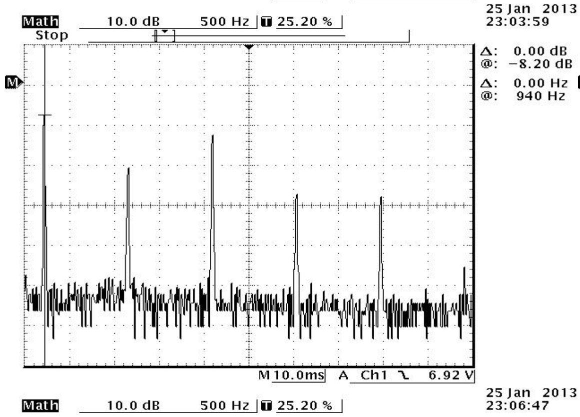

Stop
Δ: 19.0 dB
@: −42.0 dB
Δ: 4.90kHz
@: 5.13kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
22:59:47
Math 10.0 dB 500 Hz 25.20 %

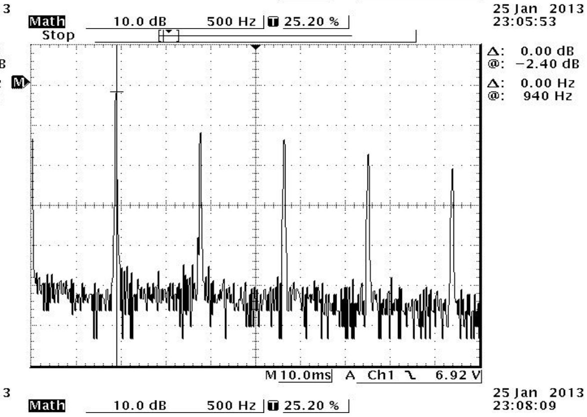

Stop
Δ: 0.00 dB
@: −18.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:01:14
Math 10.0 dB 500 Hz 25.20 %

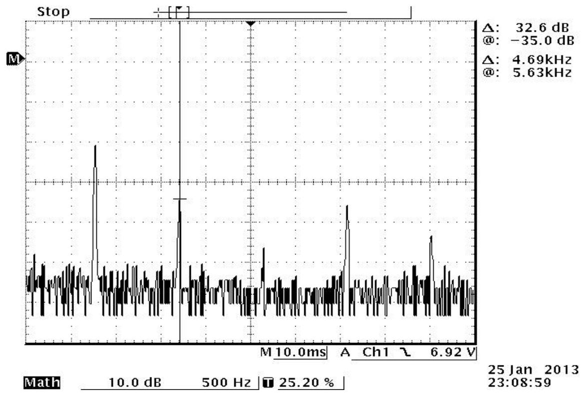

Stop
Δ: 0.00 dB
@: −16.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:02:13
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −16.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:03:59
Math 10.0 dB 500 Hz 25.20 %

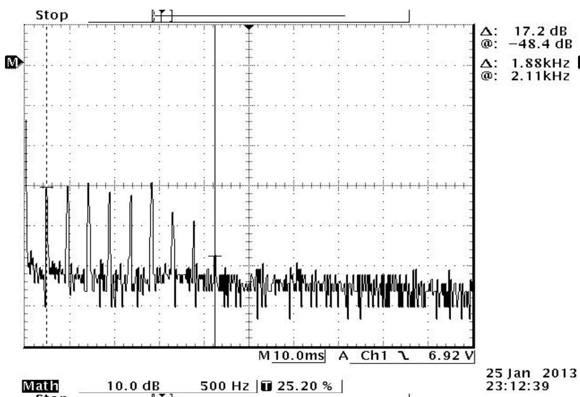

Stop
Δ: 0.00 dB
@: −9.80 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:05:53
Math 10.0 dB 500 Hz 25.20 %

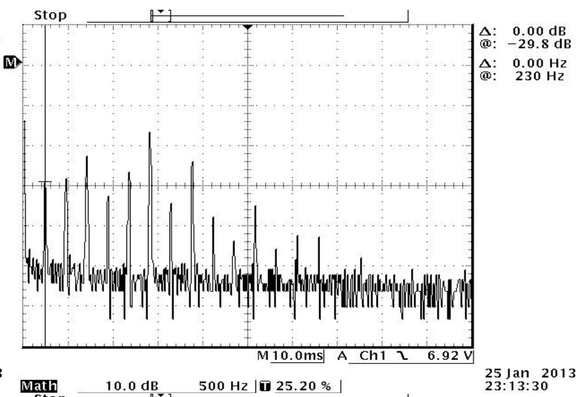

Stop
Δ: 0.00 dB
@: −8.20 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:06:47
Math 10.0 dB 500 Hz 25.20 %

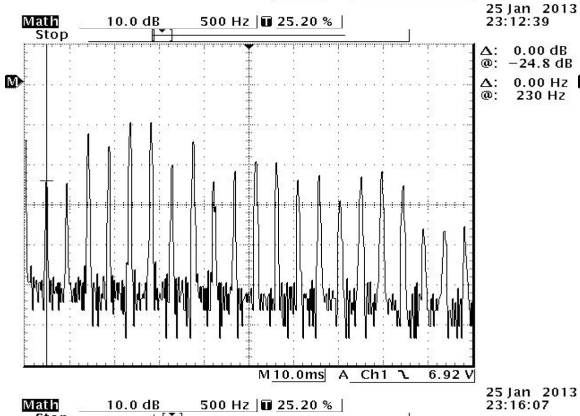

Stop
Δ: 0.00 dB
@: −2.40 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:08:09
Math 10.0 dB 500 Hz 25.20 %

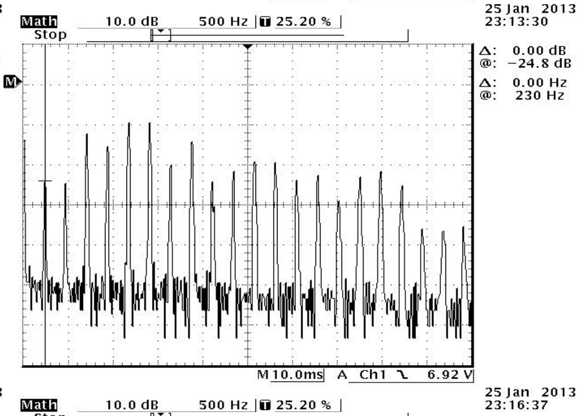

Stop
Δ: 32.6 dB
@: −35.0 dB
Δ: 4.69kHz
@: 5.63kHz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:08:59

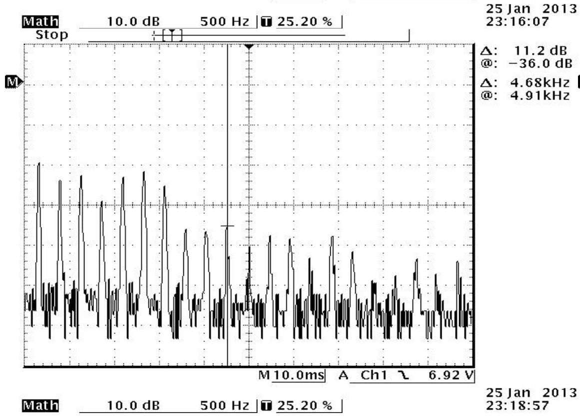
SC

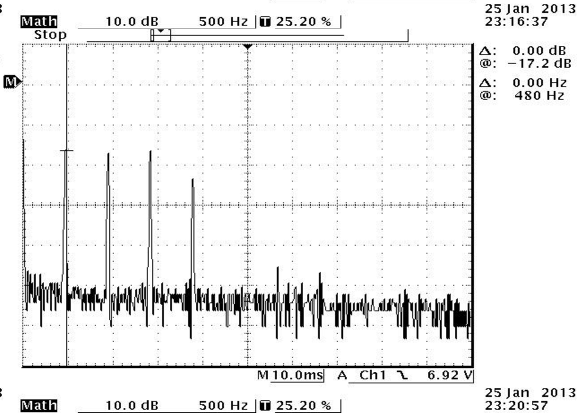

Stop
Δ: 17.2 dB
@: −48.4 dB
Δ: 1.88kHz
@: 2.11kHz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:12:39

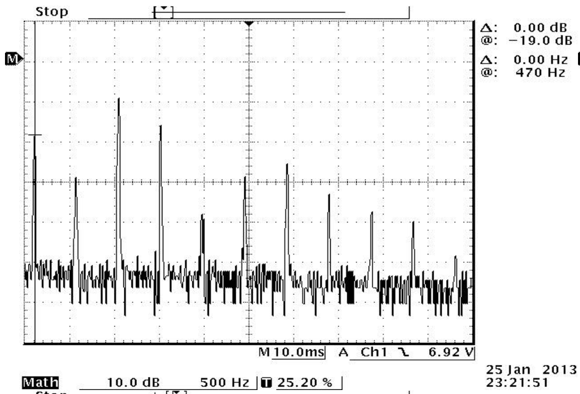

Stop
Δ: 0.00 dB
@: −29.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:13:30

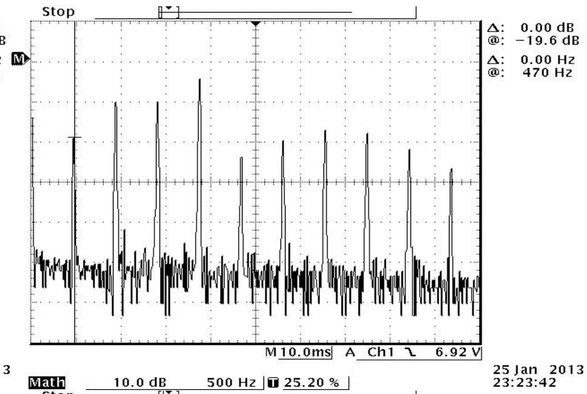

Stop
Δ: 0.00 dB
@: −24.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:16:07

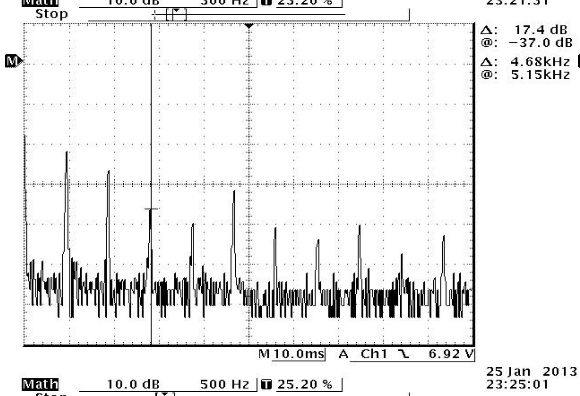

Stop
Δ: 0.00 dB
@: −24.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:16:37

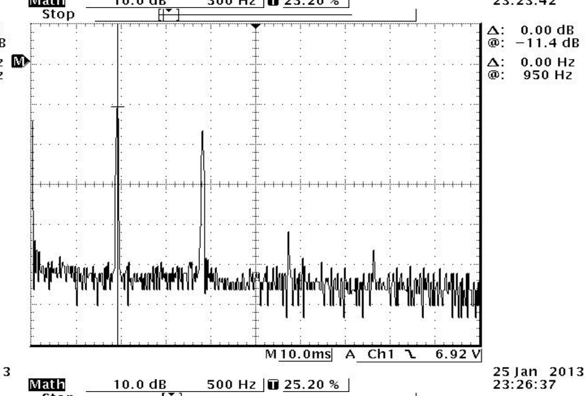

Stop
Δ: 11.2 dB
@: −36.0 dB
Δ: 4.68kHz
@: 4.91kHz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:18:57

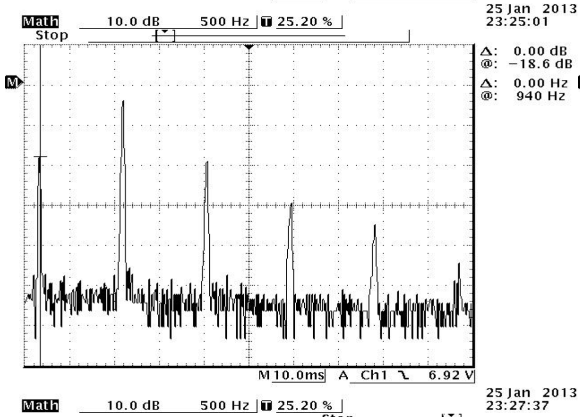

Stop
Δ: 0.00 dB
@: −17.2 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:20:57

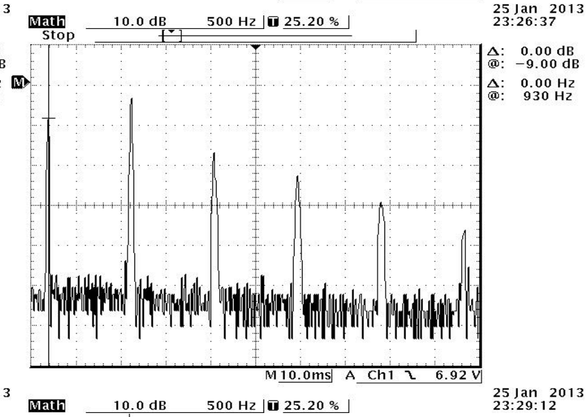

Stop
Δ: 0.00 dB
@: −19.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:21:51
Math 10.0 dB 500 Hz 25.20 %

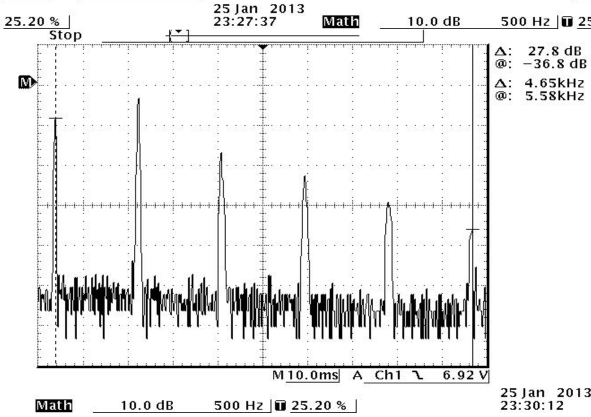

Stop
Δ: 0.00 dB
@: −19.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:23:42
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 17.4 dB
@: −37.0 dB
Δ: 4.68kHz
@: 5.15kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:25:01
Math 10.0 dB 500 Hz 25.20 %

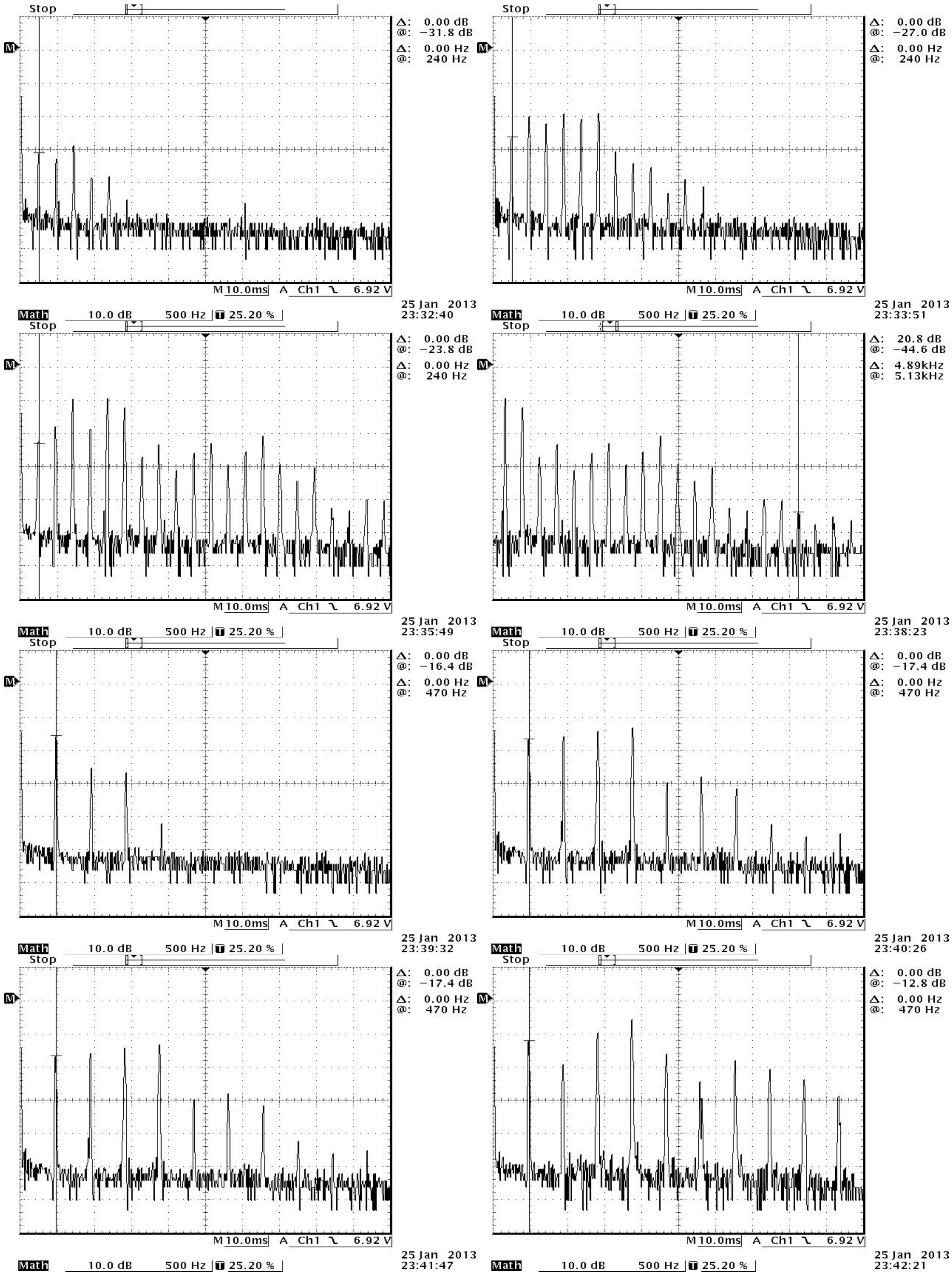

Stop
Δ: 0.00 dB
@: −11.4 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:26:37
Math 10.0 dB 500 Hz 25.20 %

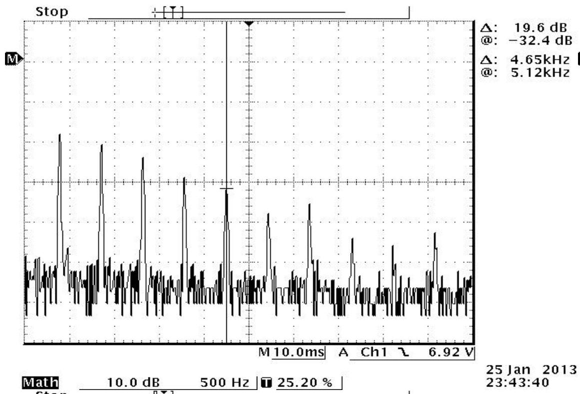

Stop
Δ: 0.00 dB
@: −18.6 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:27:37
Math 10.0 dB 500 Hz 25.20 %

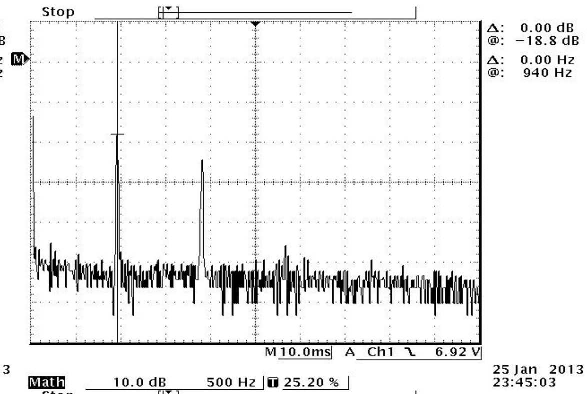

Stop
Δ: 0.00 dB
@: −9.00 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:29:12
Math 10.0 dB 500 Hz 25.20 %

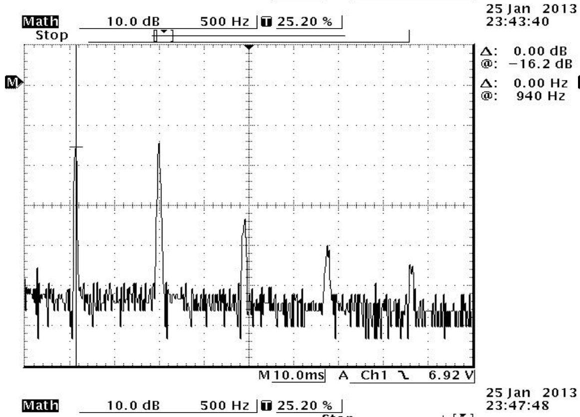

Stop
Δ: 27.8 dB
@: −36.8 dB
Δ: 4.65kHz
@: 5.58kHz
M 10.0ms A Ch1 6.92 V
25 Jan 2013
23:30:12
Math 10.0 dB 500 Hz 25.20 %

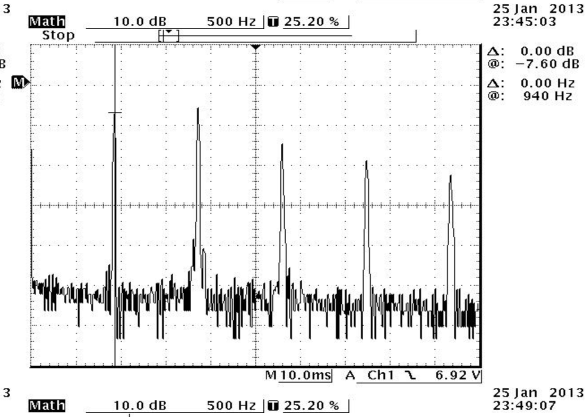
SX

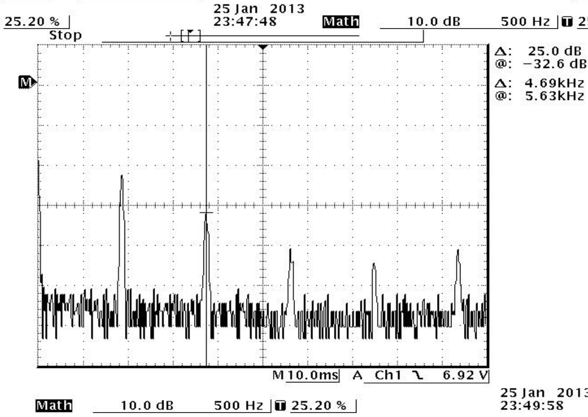

Stop
Δ: 0.00 dB
@: −31.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:32:40
Stop
Δ: 0.00 dB
@: −27.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:33:51
Stop
Δ: 0.00 dB
@: −23.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:35:49
Stop
Δ: 20.8 dB
@: −44.6 dB
Δ: 4.89kHz
@: 5.13kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:38:23
Stop
Δ: 0.00 dB
@: −16.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:39:32
Stop
Δ: 0.00 dB
@: −17.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:40:26
Stop
Δ: 0.00 dB
@: −17.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:41:47
Stop
Δ: 0.00 dB
@: −12.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:42:21


Stop
Δ: 19.6 dB
@: −32.4 dB
Δ: 4.65kHz
@: 5.12kHz
M 10.0ms A Ch1 ℓ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:43:40


Stop
Δ: 0.00 dB
@: −18.8 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ℓ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:45:03

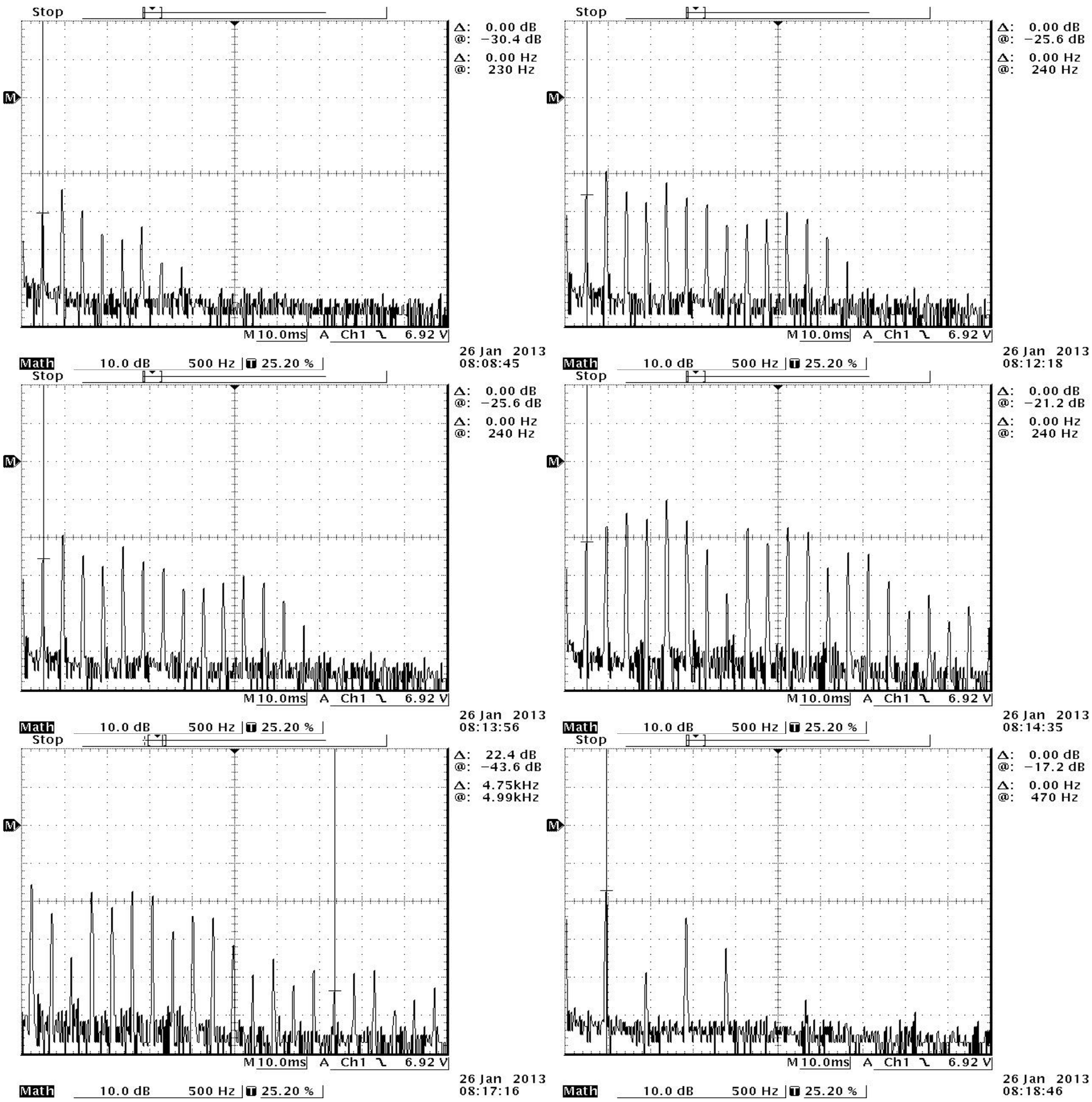

Stop
Δ: 0.00 dB
@: −16.2 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ℓ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:47:48

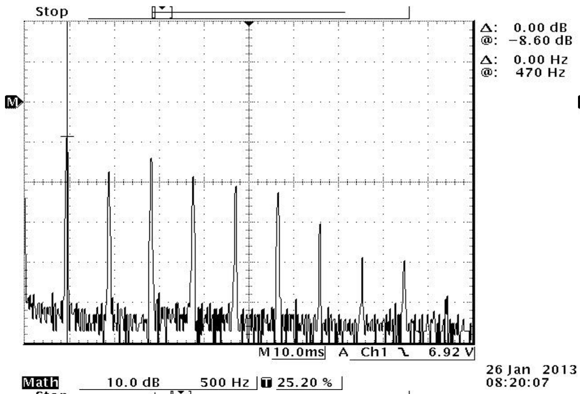

Stop
Δ: 0.00 dB
@: −7.60 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ℓ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:49:07

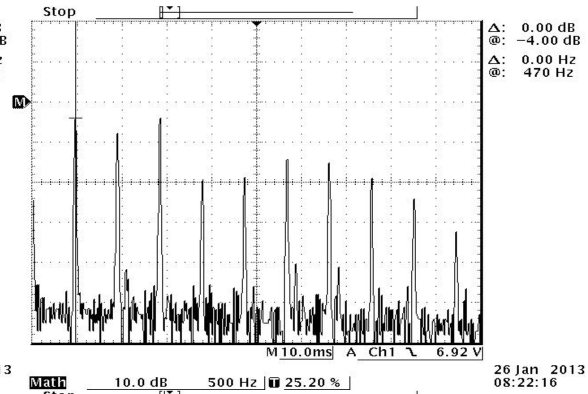

Stop
Δ: 25.0 dB
@: −32.6 dB
Δ: 4.69kHz
@: 5.63kHz
M 10.0ms A Ch1 ℓ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
25 Jan 2013
23:49:58

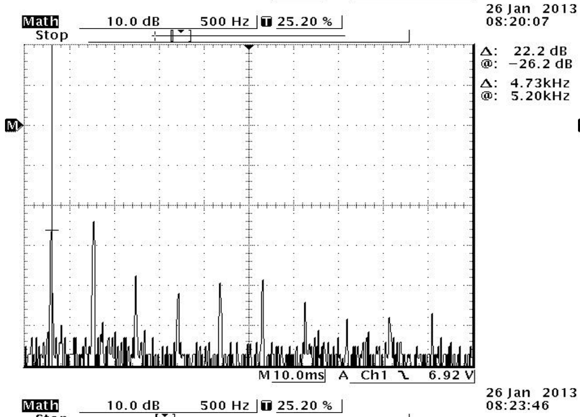
Player 5

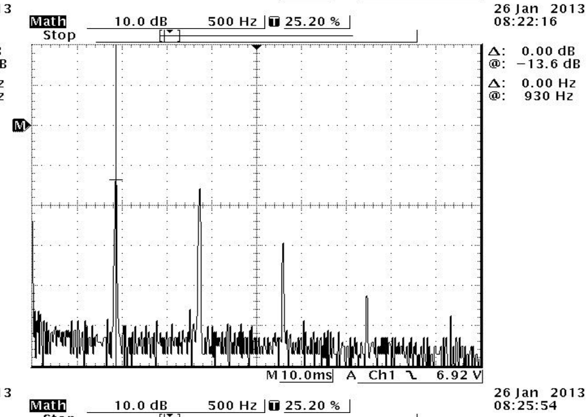
SA

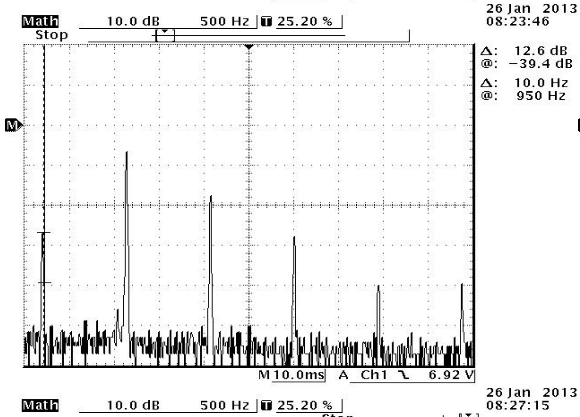

Stop
Δ: 0.00 dB
@: −30.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
26 Jan 2013
08:08:45
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −25.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
26 Jan 2013
08:12:18
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −25.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
26 Jan 2013
08:13:56
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −21.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
26 Jan 2013
08:14:35
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 22.4 dB
@: −43.6 dB
Δ: 4.75kHz
@: 4.99kHz
M 10.0ms A Ch1 ⌐ 6.92 V
26 Jan 2013
08:17:16
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −17.2 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌐ 6.92 V
26 Jan 2013
08:18:46
Math 10.0 dB 500 Hz 25.20 %

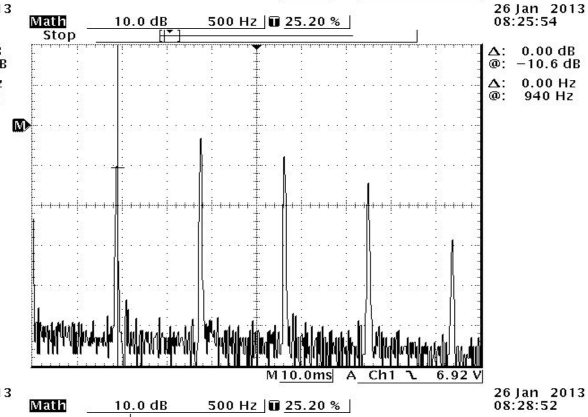

Stop
Δ: 0.00 dB
@: −8.60 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
08:20:07

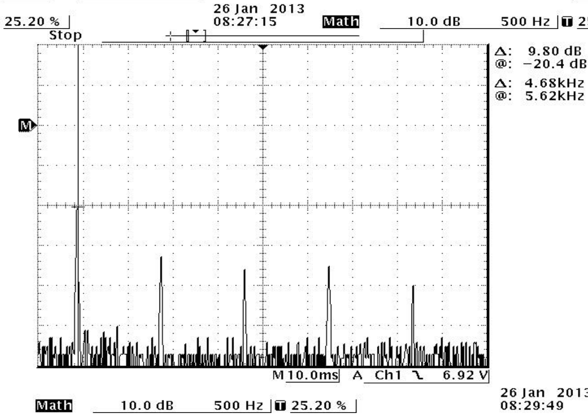

Stop
Δ: 0.00 dB
@: −4.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
08:22:16


Stop
Δ: 22.2 dB
@: −26.2 dB
Δ: 4.73kHz
@: 5.20kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
08:23:46

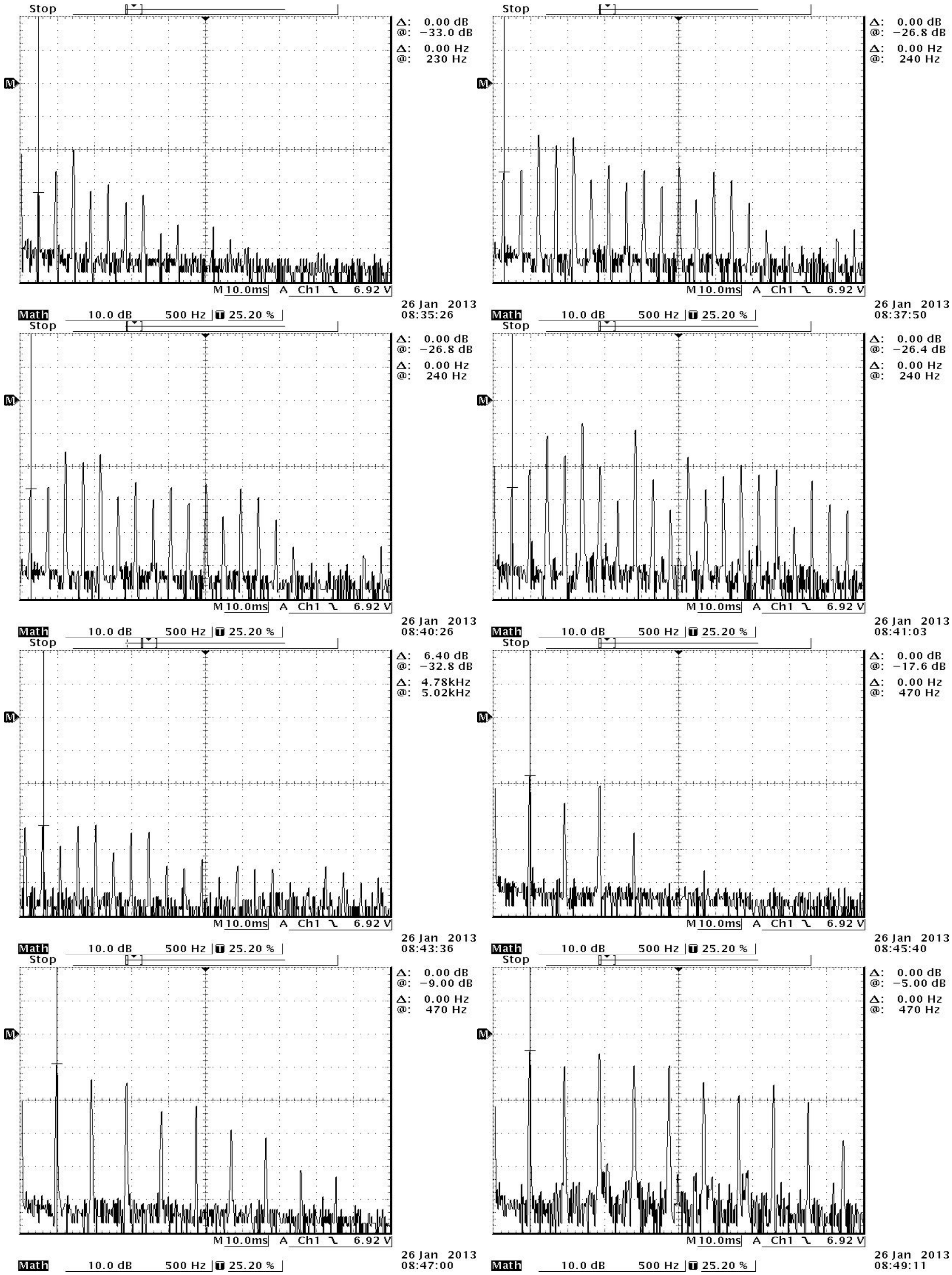

Stop
Δ: 0.00 dB
@: −13.6 dB
Δ: 0.00 Hz
@: 930 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
08:25:54

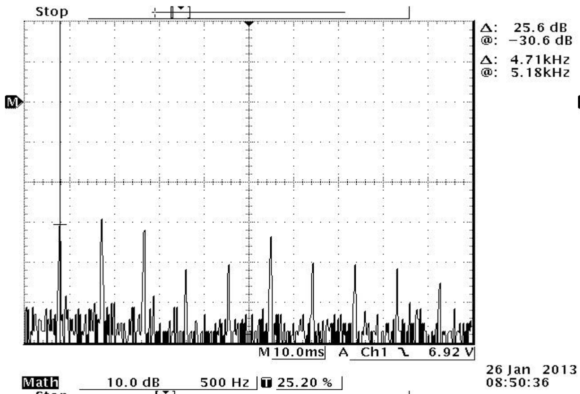

Stop
Δ: 12.6 dB
@: −39.4 dB
Δ: 10.0 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
08:27:15

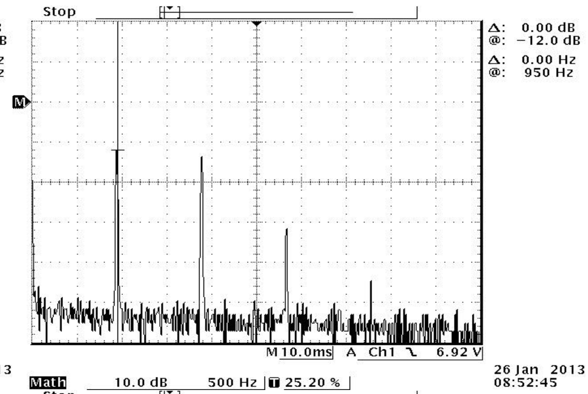

Stop
Δ: 0.00 dB
@: −10.6 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
08:28:52

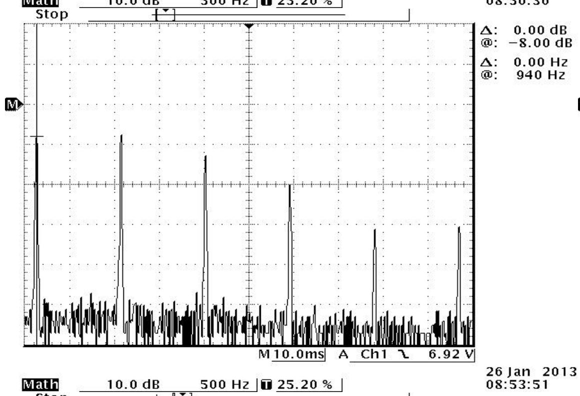

Stop
Δ: 9.80 dB
@: −20.4 dB
Δ: 4.68kHz
@: 5.62kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
08:29:49

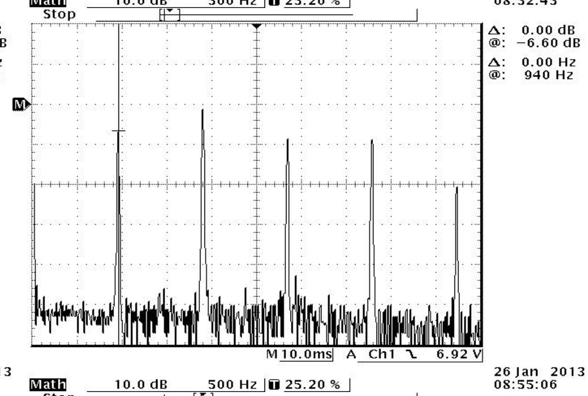
B76

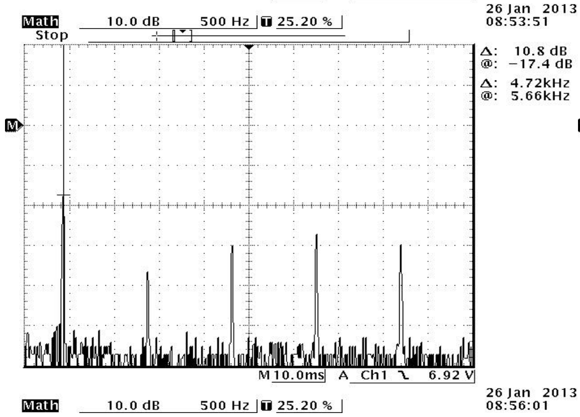

Stop
Δ: 0.00 dB
@: −33.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:35:26
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −26.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:37:50
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −26.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:40:26
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −26.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:41:03
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 6.40 dB
@: −32.8 dB
Δ: 4.78kHz
@: 5.02kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:43:36
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −17.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:45:40
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −9.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:47:00
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −5.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
08:49:11
Math 10.0 dB 500 Hz 25.20 %

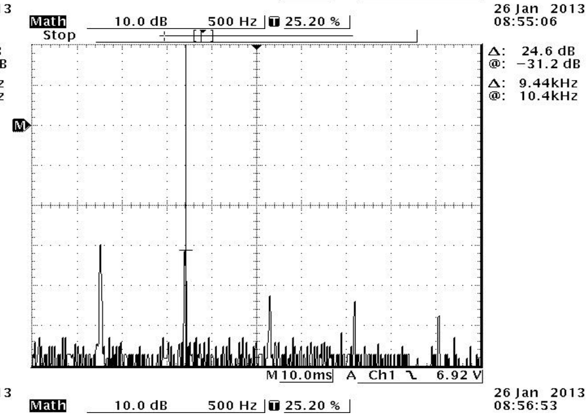

Stop
Δ: 25.6 dB
@: −30.6 dB
Δ: 4.71kHz
@: 5.18kHz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
08:50:36
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −12.0 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
08:52:45
Math 10.0 dB 500 Hz 25.20 %

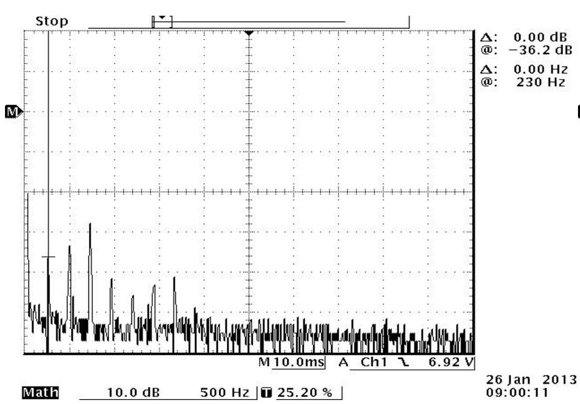

Stop
Δ: 0.00 dB
@: −8.00 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
08:53:51
Math 10.0 dB 500 Hz 25.20 %

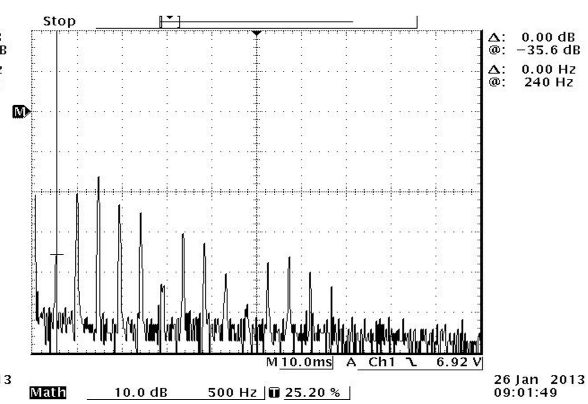

Stop
Δ: 0.00 dB
@: −6.60 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
08:55:06
Math 10.0 dB 500 Hz 25.20 %

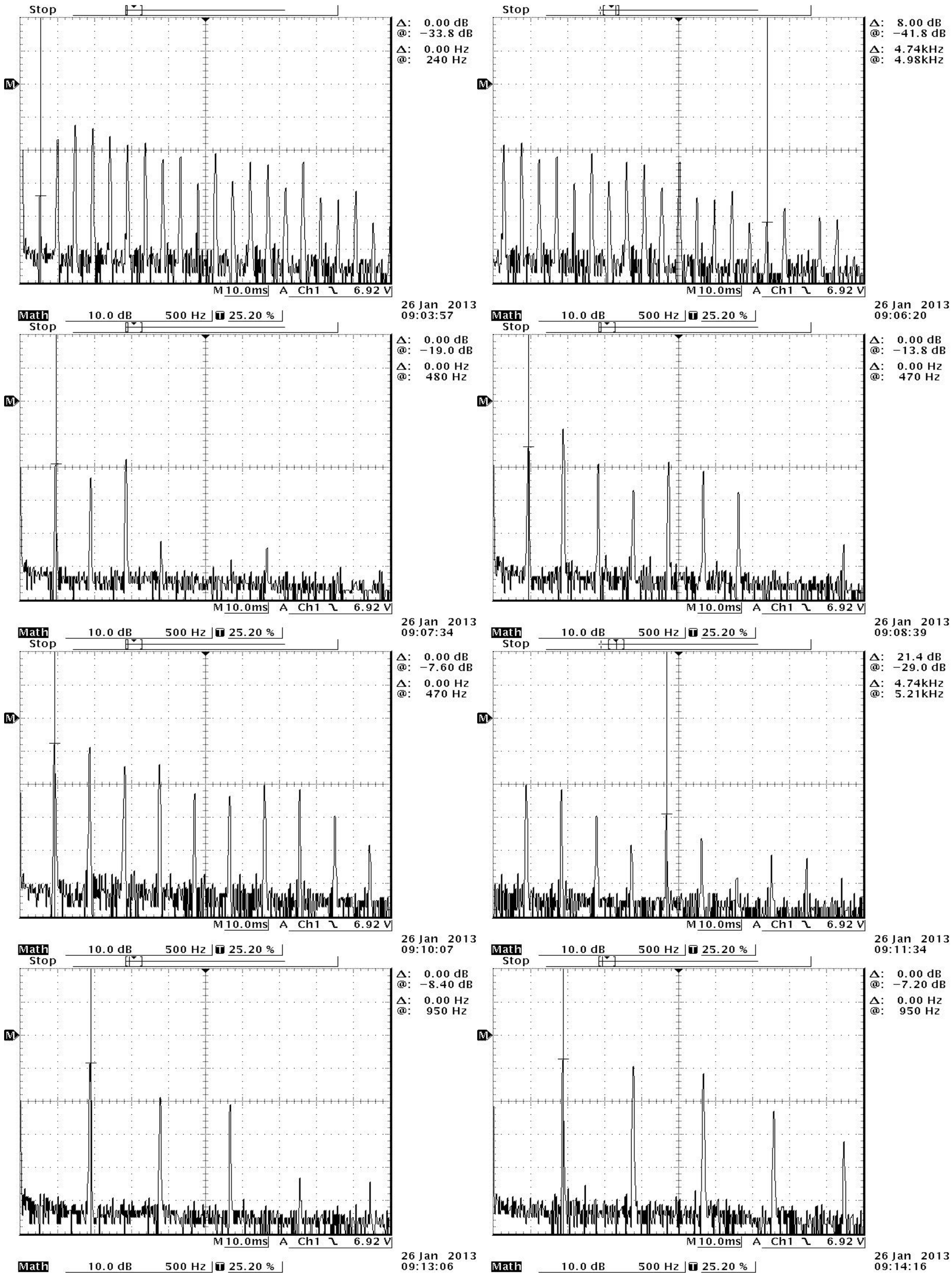

Stop
Δ: 10.8 dB
@: −17.4 dB
Δ: 4.72kHz
@: 5.66kHz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
08:56:01
Math 10.0 dB 500 Hz 25.20 %

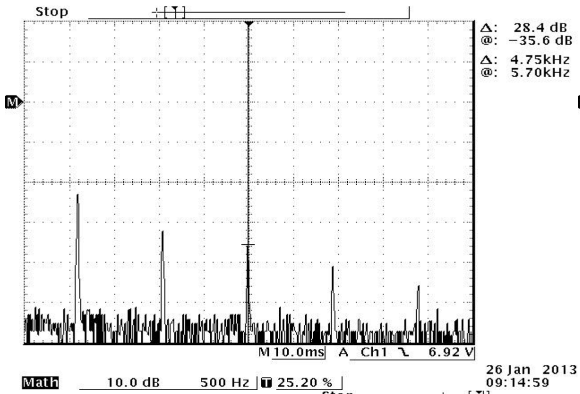

Stop
Δ: 24.6 dB
@: −31.2 dB
Δ: 9.44kHz
@: 10.4kHz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
08:56:53
Math 10.0 dB 500 Hz 25.20 %

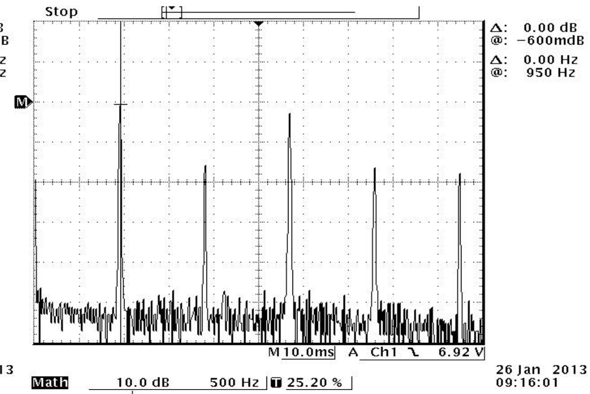
YA

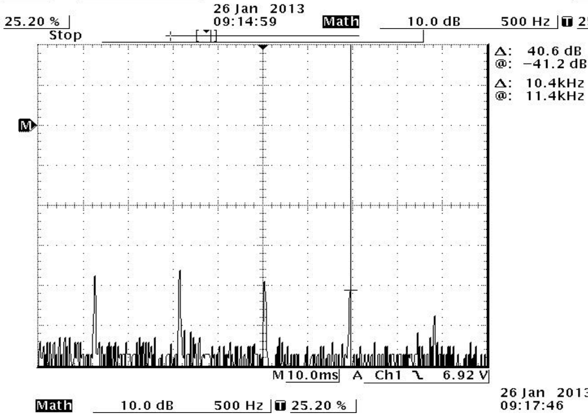

Stop
Δ: 0.00 dB
@: −36.2 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
09:00:11
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −35.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⌡ 6.92 V
26 Jan 2013
09:01:49
Math 10.0 dB 500 Hz 25.20 %

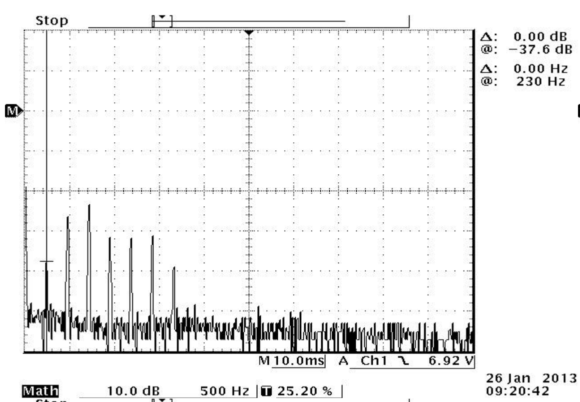

Stop
Δ: 0.00 dB
@: −33.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:03:57
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 8.00 dB
@: −41.8 dB
Δ: 4.74kHz
@: 4.98kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:06:20
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −19.0 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:07:34
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −13.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:08:39
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −7.60 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:10:07
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 21.4 dB
@: −29.0 dB
Δ: 4.74kHz
@: 5.21kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:11:34
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −8.40 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:13:06
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −7.20 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:14:16
Math 10.0 dB 500 Hz 25.20 %

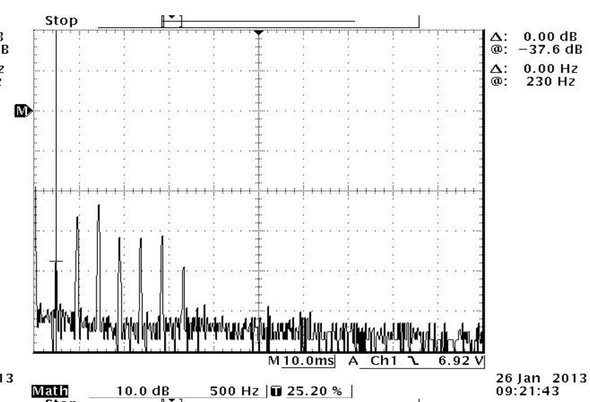

Stop
Δ: 28.4 dB
@: −35.6 dB
Δ: 4.75kHz
@: 5.70kHz
M 10.0ms A Ch1 ⟍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
09:14:59

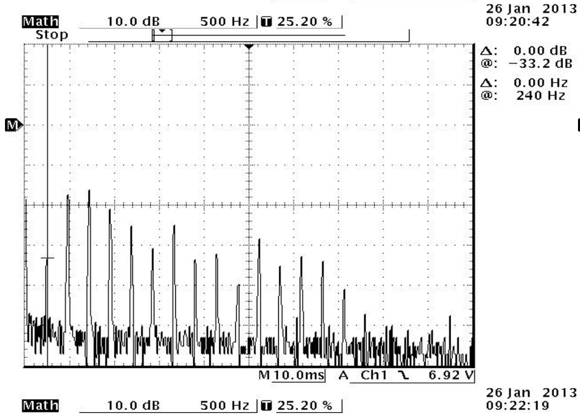

Stop
Δ: 0.00 dB
@: −600mdB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⟍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
09:16:01

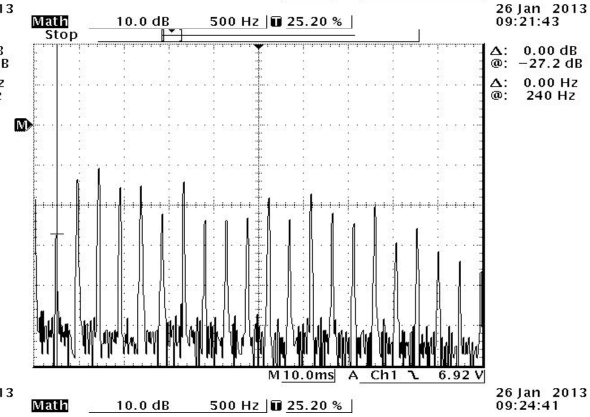

Stop
Δ: 40.6 dB
@: −41.2 dB
Δ: 10.4kHz
@: 11.4kHz
M 10.0ms A Ch1 ⟍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
09:17:46

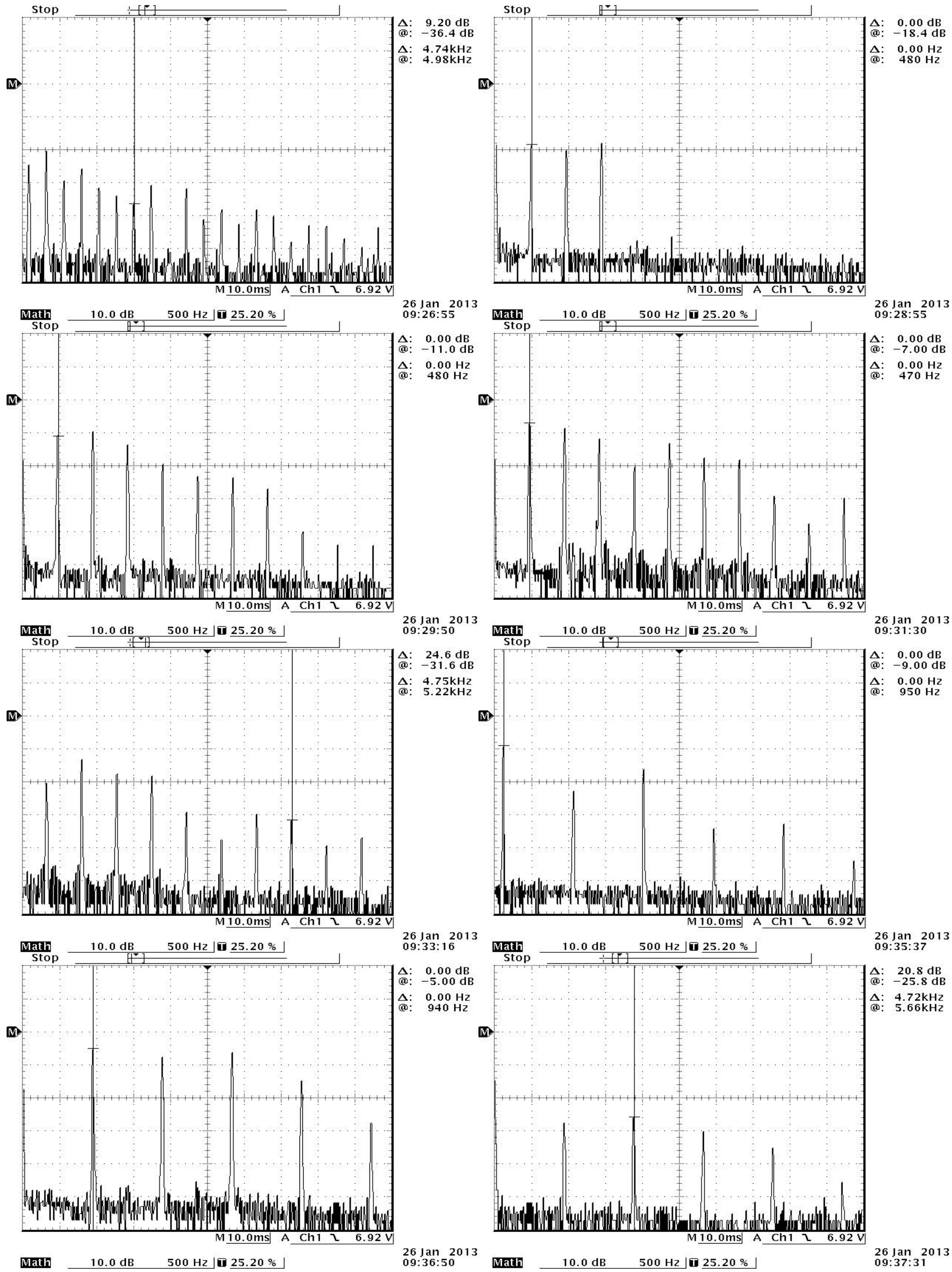
B10


Stop
Δ: 0.00 dB
@: −37.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⟍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
09:20:42

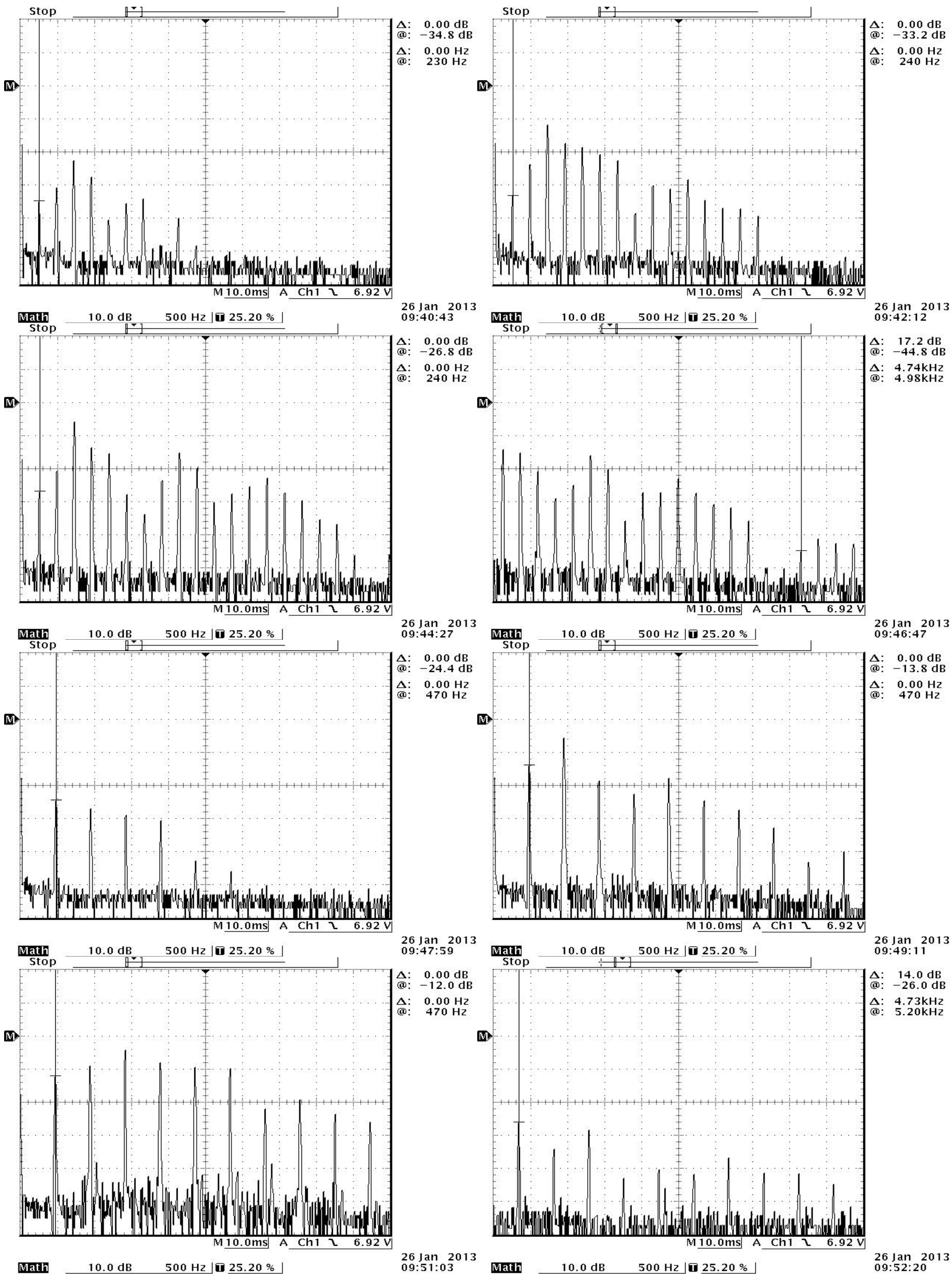

Stop
Δ: 0.00 dB
@: −37.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⟍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
09:21:43


Stop
Δ: 0.00 dB
@: −33.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⟍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
09:22:19

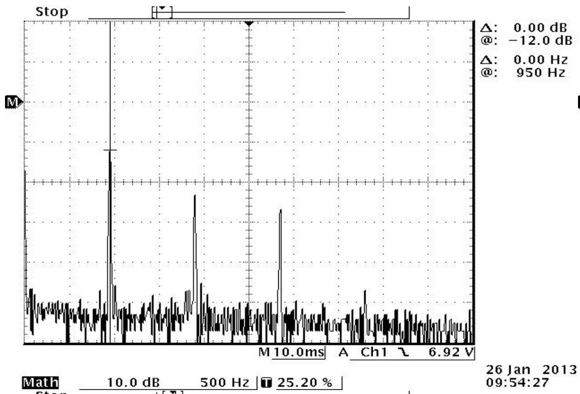

Stop
Δ: 0.00 dB
@: −27.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⟍ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
09:24:41

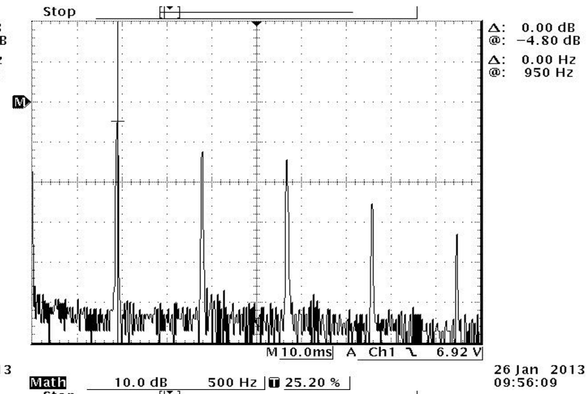

Stop
Δ: 9.20 dB
@: −36.4 dB
Δ: 4.74kHz
@: 4.98kHz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:26:55
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −18.4 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:28:55
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −11.0 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:29:50
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −7.00 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:31:30
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 24.6 dB
@: −31.6 dB
Δ: 4.75kHz
@: 5.22kHz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:33:16
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −9.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:35:37
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −5.00 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:36:50
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 20.8 dB
@: −25.8 dB
Δ: 4.72kHz
@: 5.66kHz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
09:37:31
Math 10.0 dB 500 Hz 25.20 %

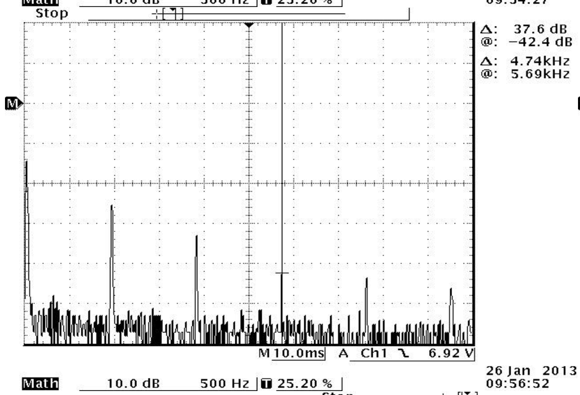
YC

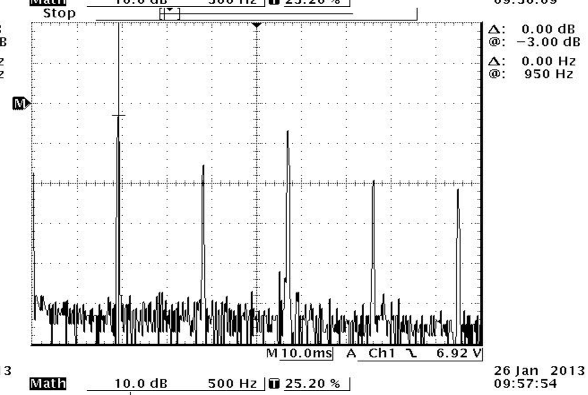


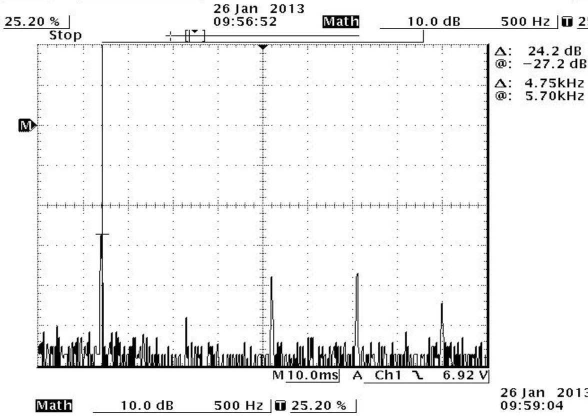
Stop
Δ: 0.00 dB
@: −34.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:40:43
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −33.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:42:12
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −26.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:44:27
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 17.2 dB
@: −44.8 dB
Δ: 4.74kHz
@: 4.98kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:46:47
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −24.4 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:47:59
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −13.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:49:11
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −12.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:51:03
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 14.0 dB
@: −26.0 dB
Δ: 4.73kHz
@: 5.20kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
09:52:20
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −12.0 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:54:27
Math 10.0 dB 500 Hz 25.20 %

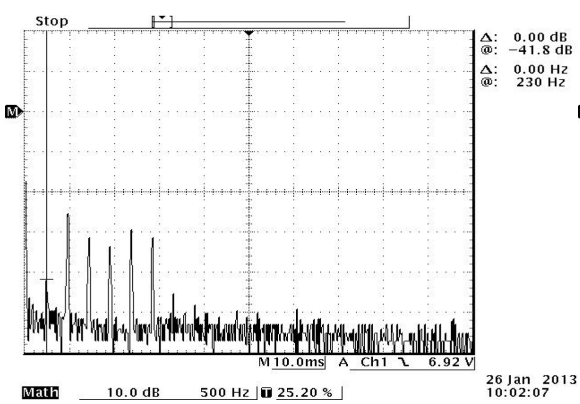

Stop
Δ: 0.00 dB
@: −4.80 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:56:09
Math 10.0 dB 500 Hz 25.20 %

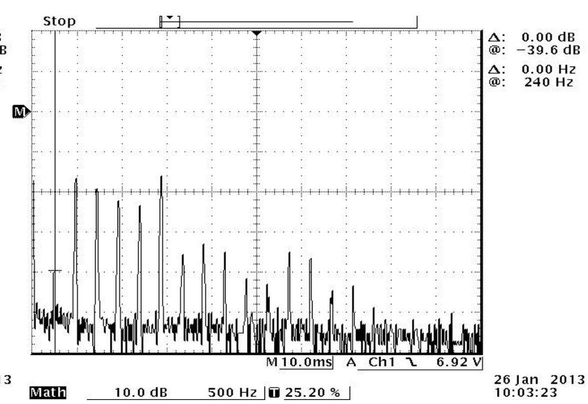

Stop
Δ: 37.6 dB
@: −42.4 dB
Δ: 4.74kHz
@: 5.69kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:56:52
Math 10.0 dB 500 Hz 25.20 %

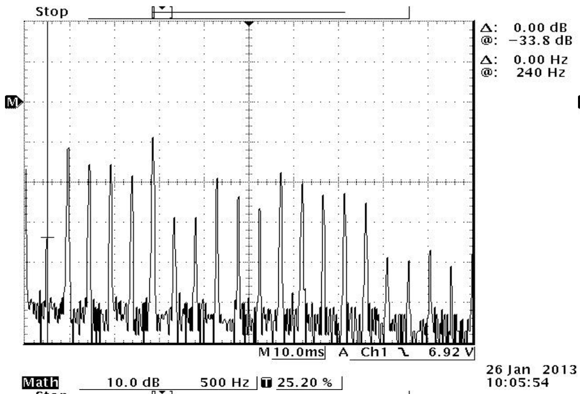

Stop
Δ: 0.00 dB
@: −3.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:57:54
Math 10.0 dB 500 Hz 25.20 %

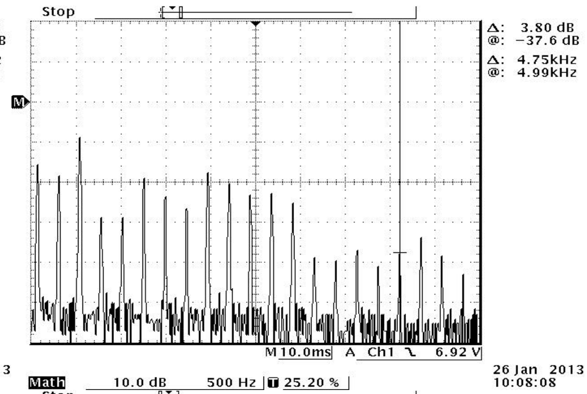

Stop
Δ: 24.2 dB
@: −27.2 dB
Δ: 4.75kHz
@: 5.70kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
09:59:04
Math 10.0 dB 500 Hz 25.20 %

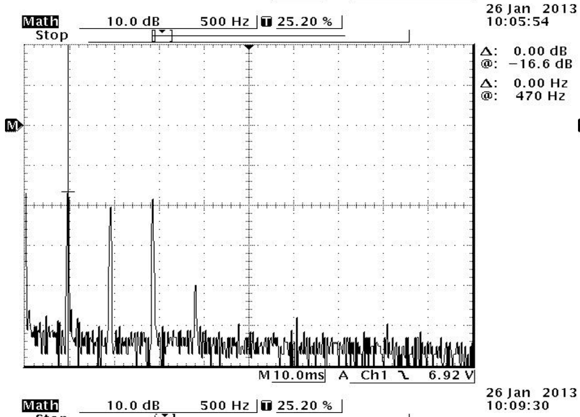
B24

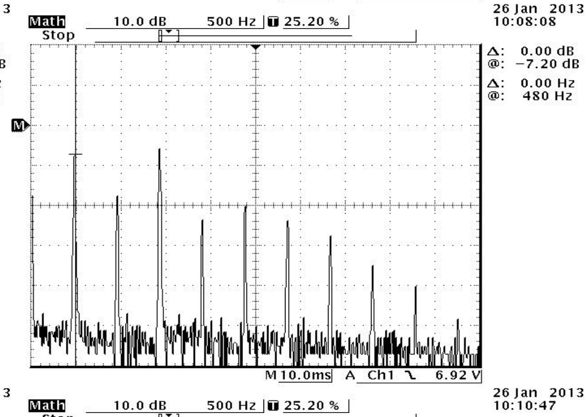

Stop
Δ: 0.00 dB
@: −41.8 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
10:02:07
Math 10.0 dB 500 Hz 25.20 %

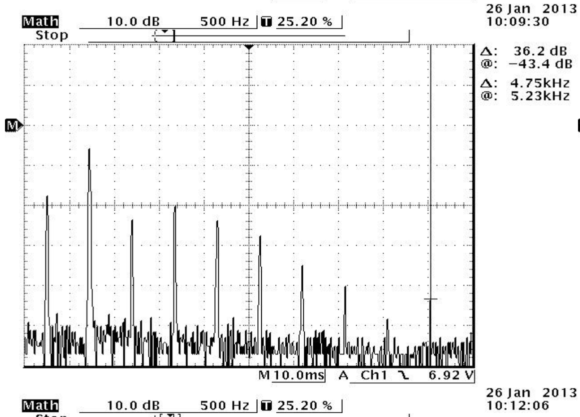

Stop
Δ: 0.00 dB
@: −39.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
10:03:23
Math 10.0 dB 500 Hz 25.20 %

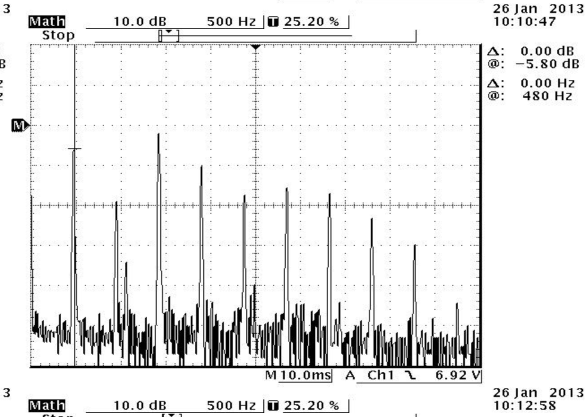

Stop
Δ: 0.00 dB
@: −33.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:05:54
Math 10.0 dB 500 Hz 25.20 %

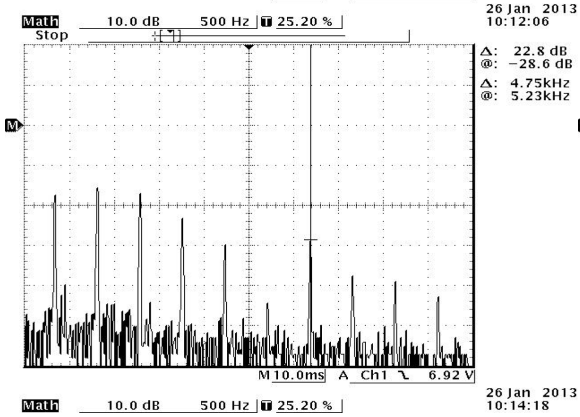

Stop
Δ: 3.80 dB
@: −37.6 dB
Δ: 4.75kHz
@: 4.99kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:08:08
Math 10.0 dB 500 Hz 25.20 %

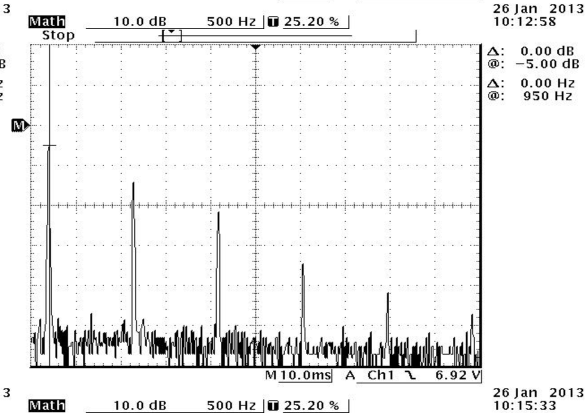

Stop
Δ: 0.00 dB
@: −16.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:09:30
Math 10.0 dB 500 Hz 25.20 %

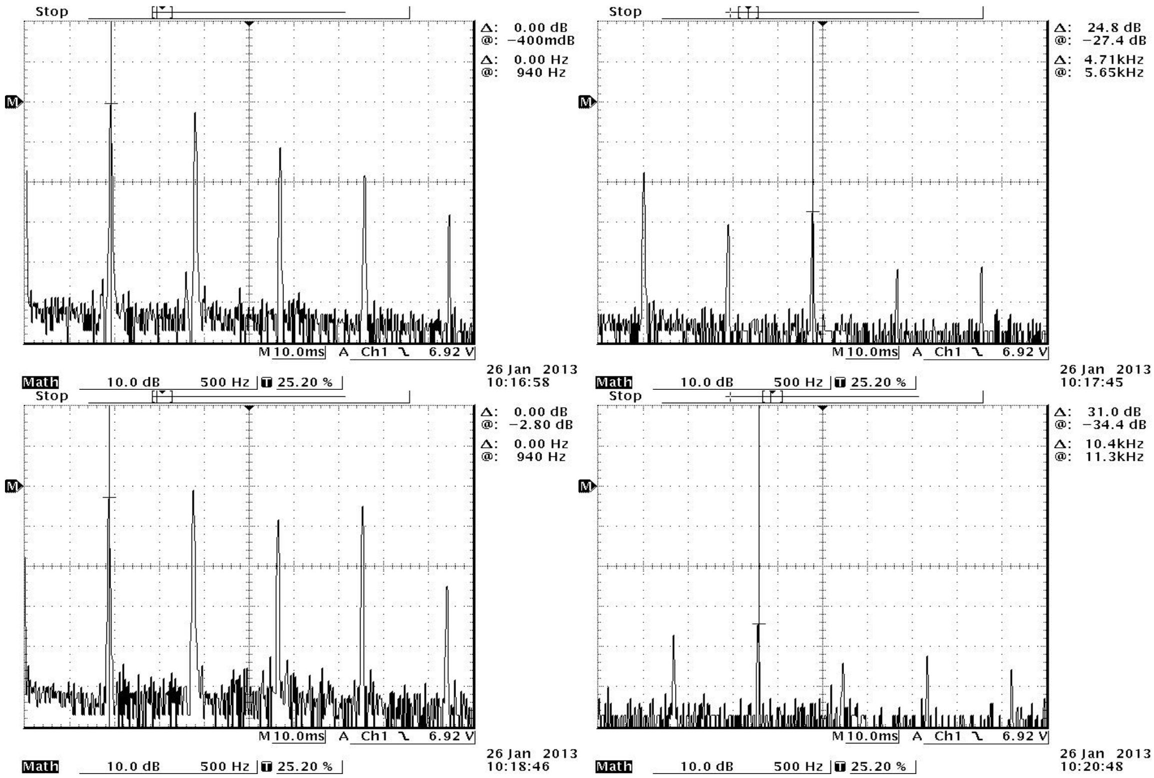

Stop
Δ: 0.00 dB
@: −7.20 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:10:47
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 36.2 dB
@: −43.4 dB
Δ: 4.75kHz
@: 5.23kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:12:06
Math 10.0 dB 500 Hz 25.20 %

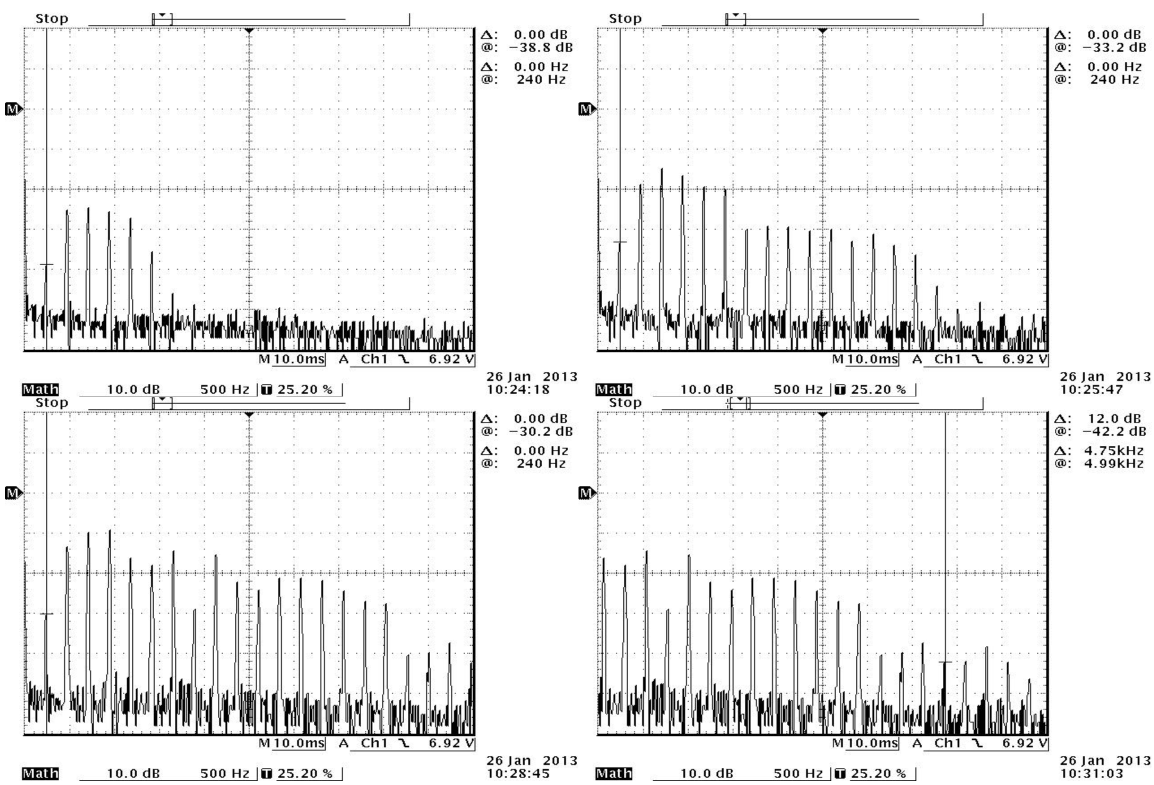

Stop
Δ: 0.00 dB
@: −5.80 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:12:58
Math 10.0 dB 500 Hz 25.20 %

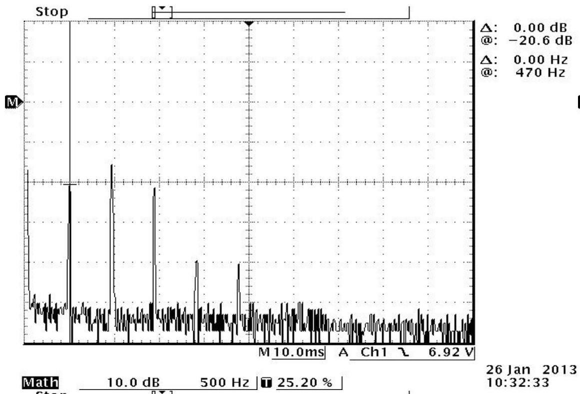
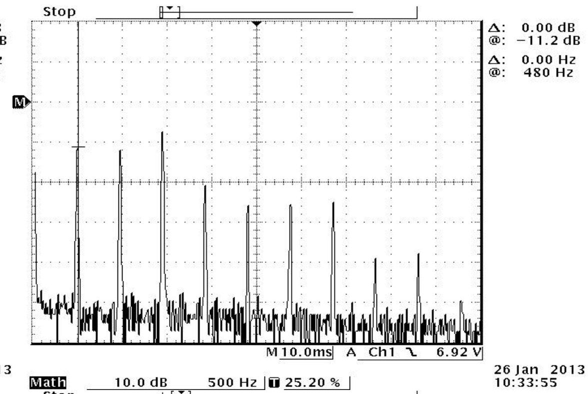
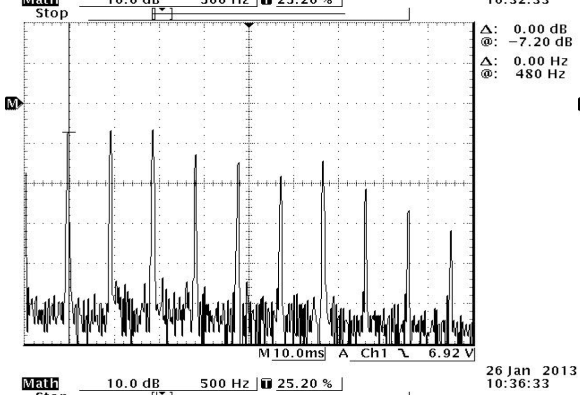
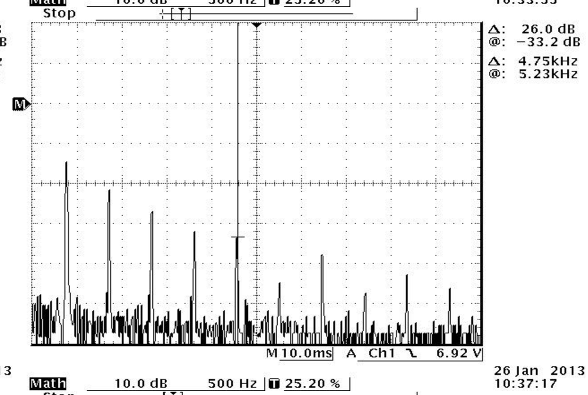
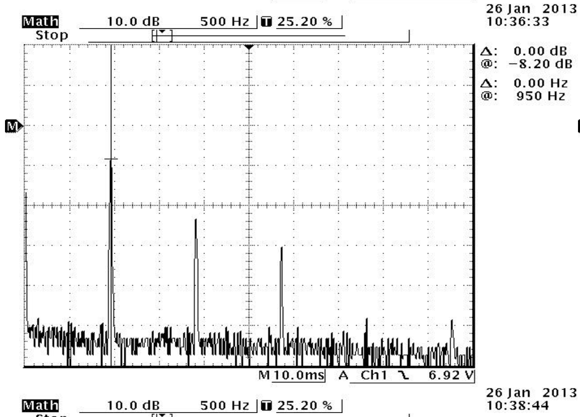
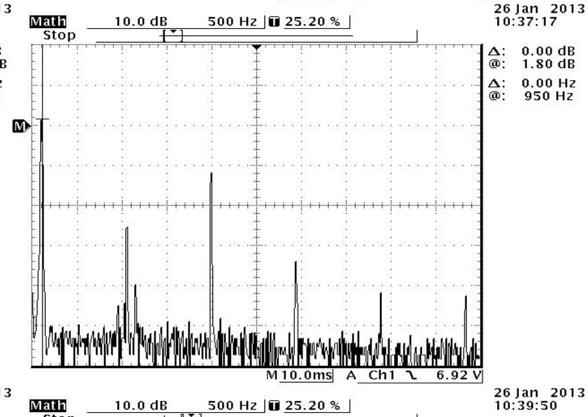
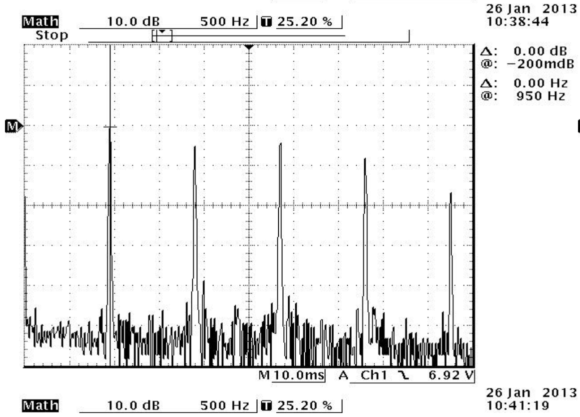
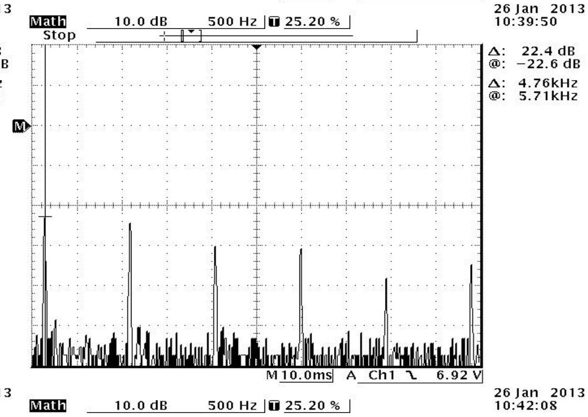

Stop
Δ: 22.8 dB
@: −28.6 dB
Δ: 4.75kHz
@: 5.23kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:14:18
Math 10.0 dB 500 Hz 25.20 %

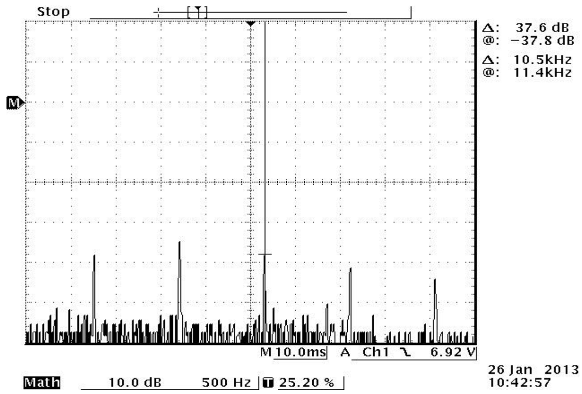

Stop
Δ: 0.00 dB
@: −5.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:15:33
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −400mdB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:16:58
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 24.8 dB
@: −27.4 dB
Δ: 4.71kHz
@: 5.65kHz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:17:45
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −2.80 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:18:46
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 31.0 dB
@: −34.4 dB
Δ: 10.4kHz
@: 11.3kHz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:20:48
Math 10.0 dB 500 Hz 25.20 %

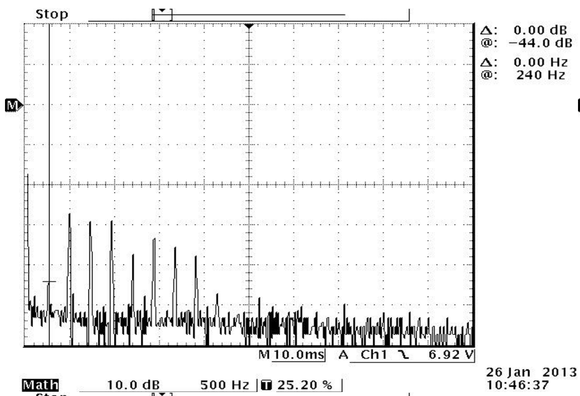
G7C

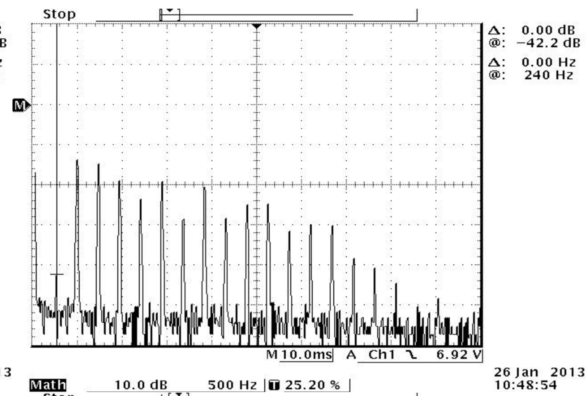

Stop
Δ: 0.00 dB
@: −38.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:24:18
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −33.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:25:47
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −30.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:28:45
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 12.0 dB
@: −42.2 dB
Δ: 4.75kHz
@: 4.99kHz
M 10.0ms A Ch1 ↘ 6.92 V
26 Jan 2013
10:31:03
Math 10.0 dB 500 Hz 25.20 %

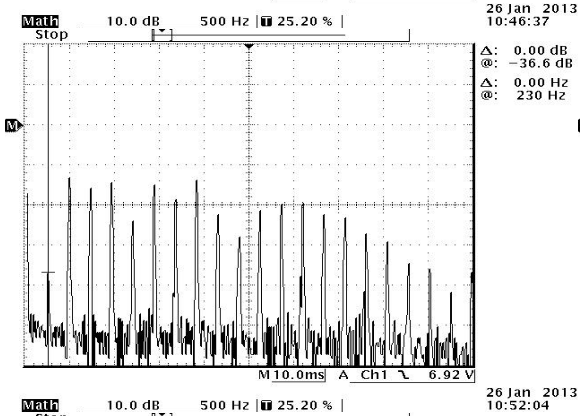

Stop
Δ: 0.00 dB
@: −20.6 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:32:33
Math 10.0 dB 500 Hz 25.20 %

Stop
Δ: 0.00 dB
@: −11.2 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:33:55
Math 10.0 dB 500 Hz 25.20 %

Stop
Δ: 0.00 dB
@: −7.20 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:36:33
Math 10.0 dB 500 Hz 25.20 %

Stop
Δ: 26.0 dB
@: −33.2 dB
Δ: 4.75kHz
@: 5.23kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:37:17
Math 10.0 dB 500 Hz 25.20 %

Stop
Δ: 0.00 dB
@: −8.20 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:38:44
Math 10.0 dB 500 Hz 25.20 %

Stop
Δ: 0.00 dB
@: 1.80 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:39:50
Math 10.0 dB 500 Hz 25.20 %

Stop
Δ: 0.00 dB
@: −200mdB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:41:19
Math 10.0 dB 500 Hz 25.20 %

Stop
Δ: 22.4 dB
@: −22.6 dB
Δ: 4.76kHz
@: 5.71kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:42:08
Math 10.0 dB 500 Hz 25.20 %

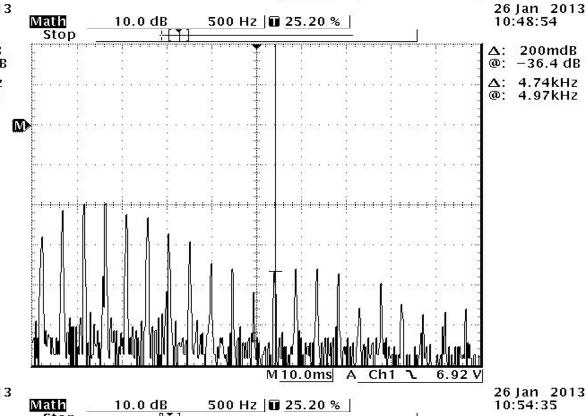

Stop
Δ: 37.6 dB
@: −37.8 dB
Δ: 10.5kHz
@: 11.4kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:42:57
Math 10.0 dB 500 Hz 25.20 %

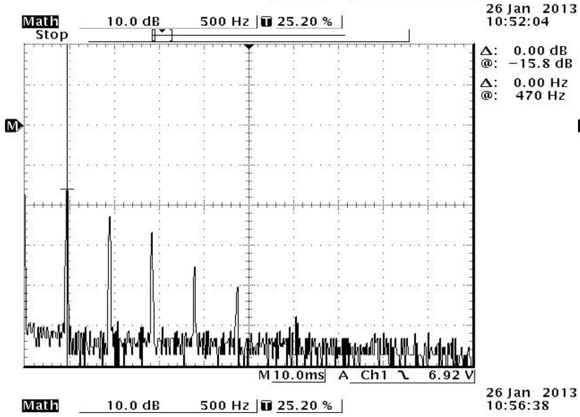
B7

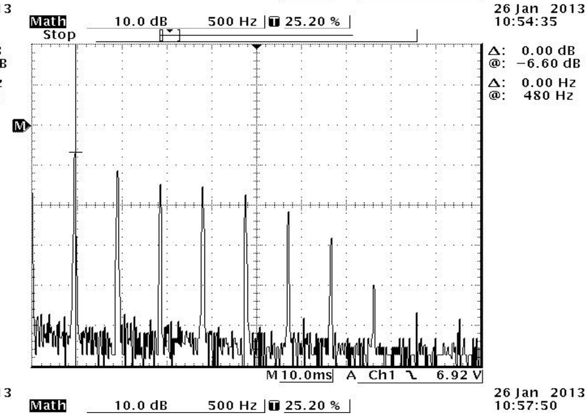

Stop
Δ: 0.00 dB
@: −44.0 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:46:37
Math 10.0 dB 500 Hz 25.20 %

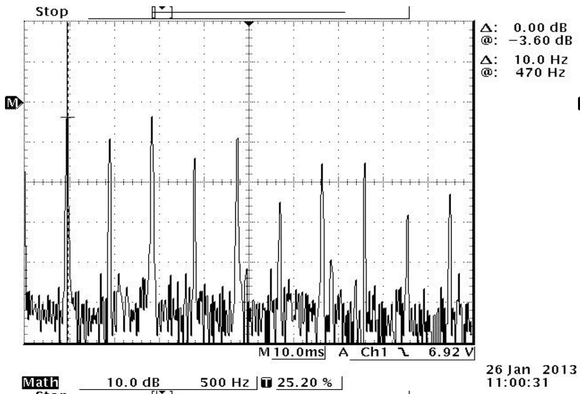

Stop
Δ: 0.00 dB
@: −42.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:48:54
Math 10.0 dB 500 Hz 25.20 %

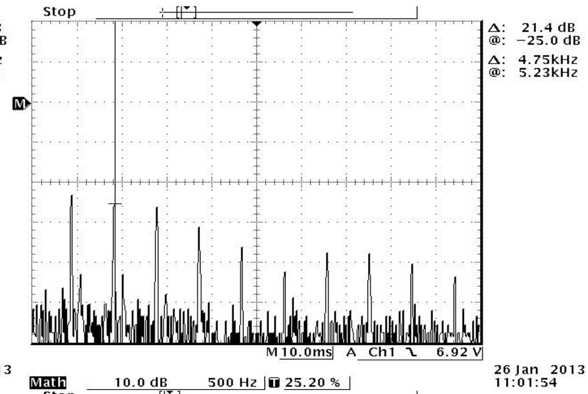

Stop
Δ: 0.00 dB
@: −36.6 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:52:04
Math 10.0 dB 500 Hz 25.20 %

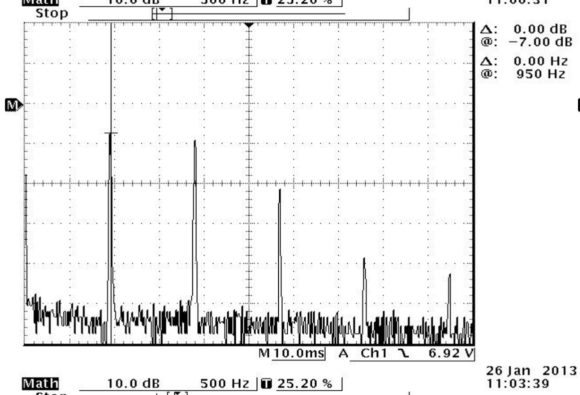

Stop
Δ: 200mdB
@: −36.4 dB
Δ: 4.74kHz
@: 4.97kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:54:35
Math 10.0 dB 500 Hz 25.20 %

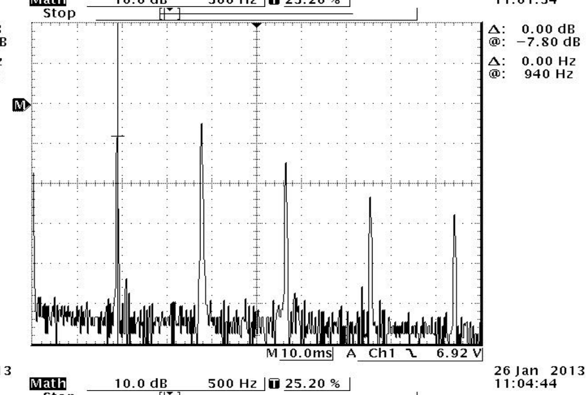

Stop
Δ: 0.00 dB
@: −15.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:56:38
Math 10.0 dB 500 Hz 25.20 %

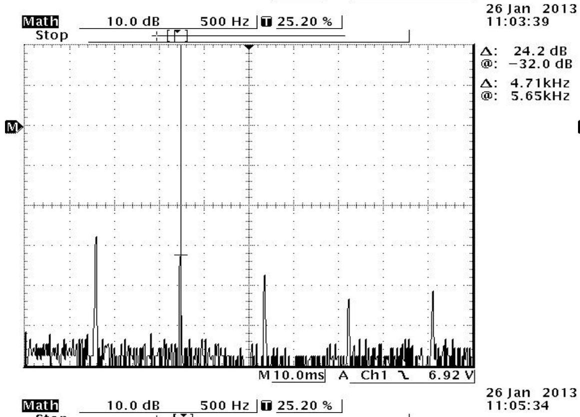

Stop
Δ: 0.00 dB
@: −6.60 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
10:57:50
Math 10.0 dB 500 Hz 25.20 %

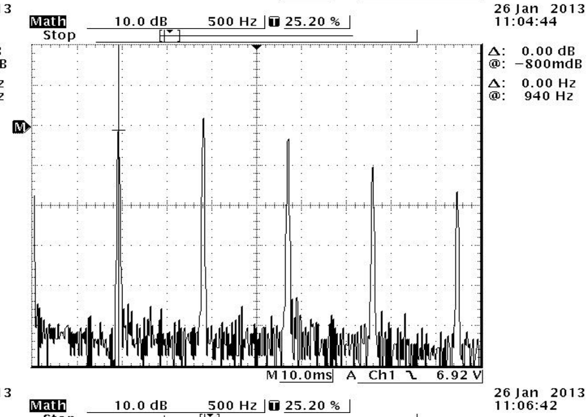

Stop
Δ: 0.00 dB
@: −3.60 dB
Δ: 10.0 Hz
@: 470 Hz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:00:31
Math 10.0 dB 500 Hz 25.20 %

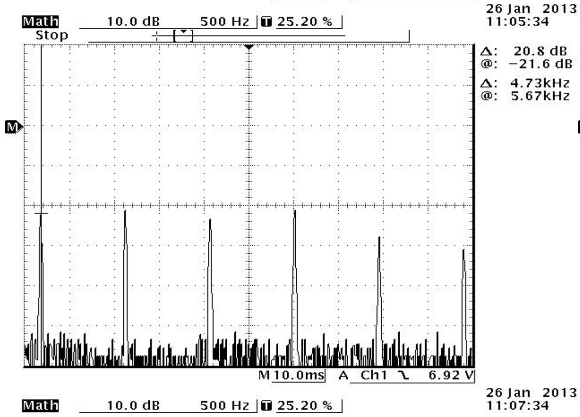

Stop
Δ: 21.4 dB
@: −25.0 dB
Δ: 4.75kHz
@: 5.23kHz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:01:54
Math 10.0 dB 500 Hz 25.20 %

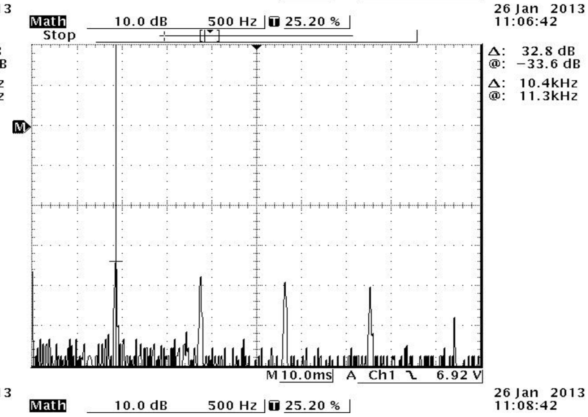

Stop
Δ: 0.00 dB
@: −7.00 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:03:39
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −7.80 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:04:44
Math 10.0 dB 500 Hz 25.20 %

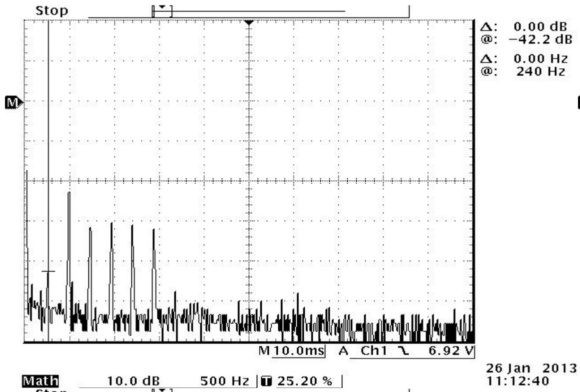

Stop
Δ: 24.2 dB
@: −32.0 dB
Δ: 4.71kHz
@: 5.65kHz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:05:34
Math 10.0 dB 500 Hz 25.20 %

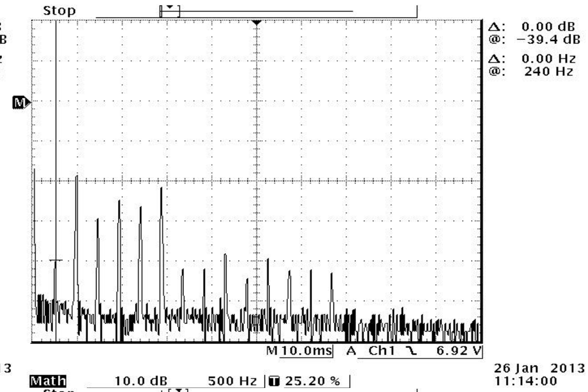

Stop
Δ: 0.00 dB
@: −800mdB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:06:42
Math 10.0 dB 500 Hz 25.20 %

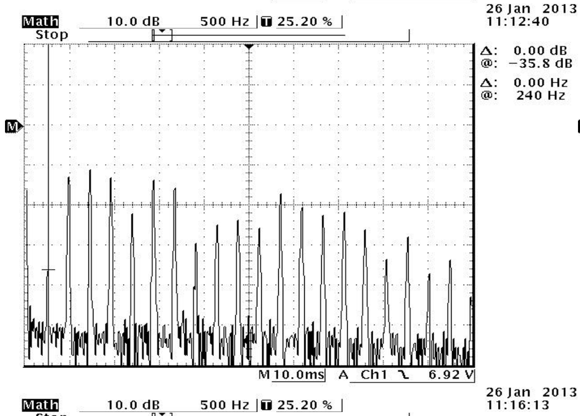

Stop
Δ: 20.8 dB
@: −21.6 dB
Δ: 4.73kHz
@: 5.67kHz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:07:34
Math 10.0 dB 500 Hz 25.20 %

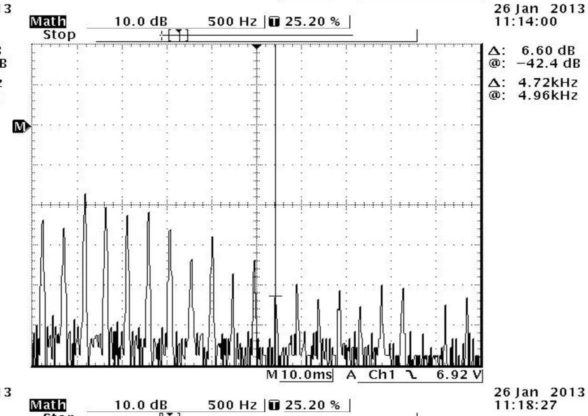

Stop
Δ: 32.8 dB
@: −33.6 dB
Δ: 10.4kHz
@: 11.3kHz
M 10.0ms A Ch1 ⌒ 6.92 V
26 Jan 2013
11:08:42
Math 10.0 dB 500 Hz 25.20 %

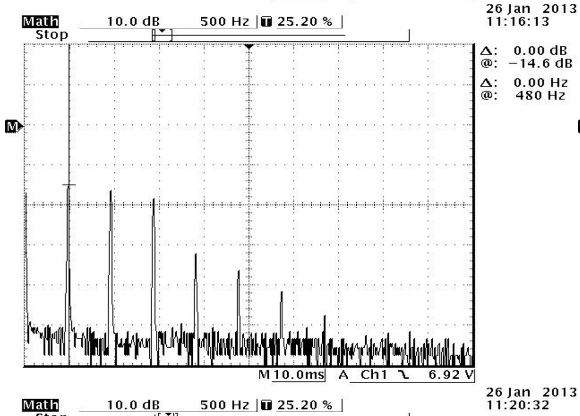
YMG

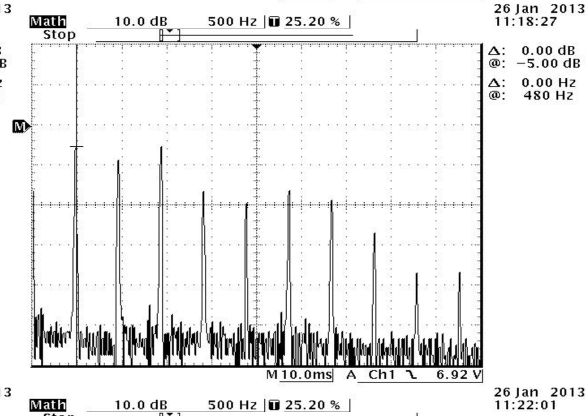

Stop
Δ: 0.00 dB
@: −42.2 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:12:40

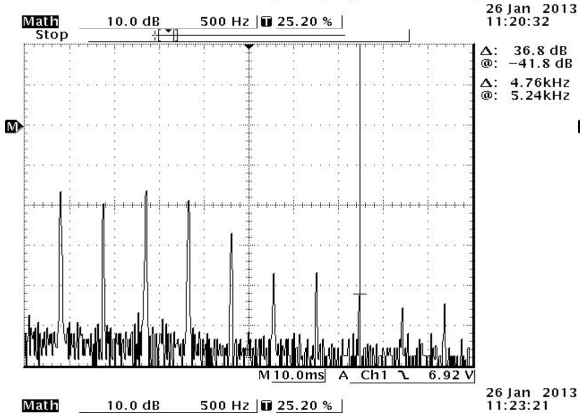

Stop
Δ: 0.00 dB
@: −39.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:14:00

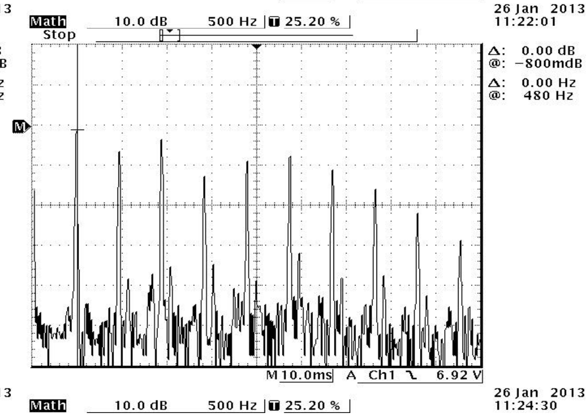

Stop
Δ: 0.00 dB
@: −35.8 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:16:13

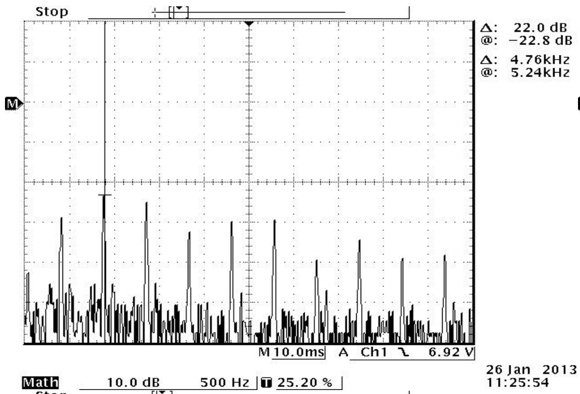

Stop
Δ: 6.60 dB
@: −42.4 dB
Δ: 4.72kHz
@: 4.96kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:18:27

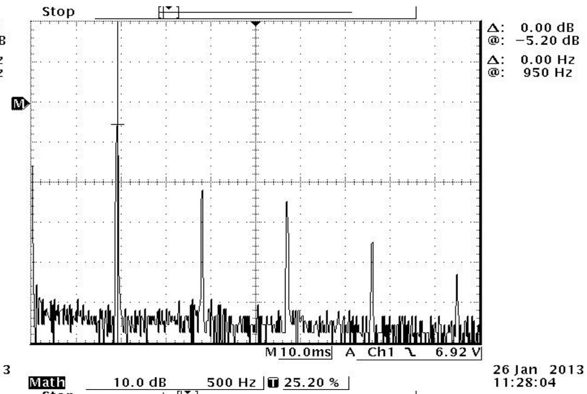

Stop
Δ: 0.00 dB
@: −14.6 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:20:32

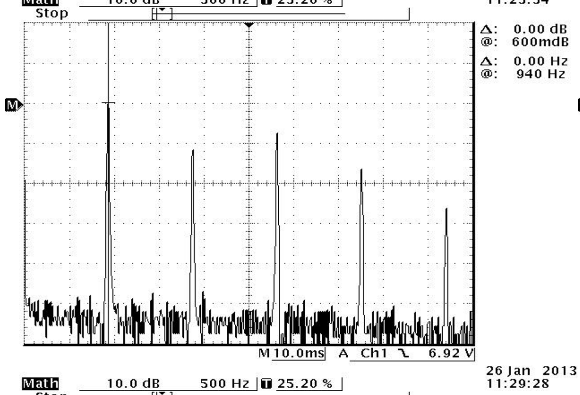

Stop
Δ: 0.00 dB
@: −5.00 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:22:01

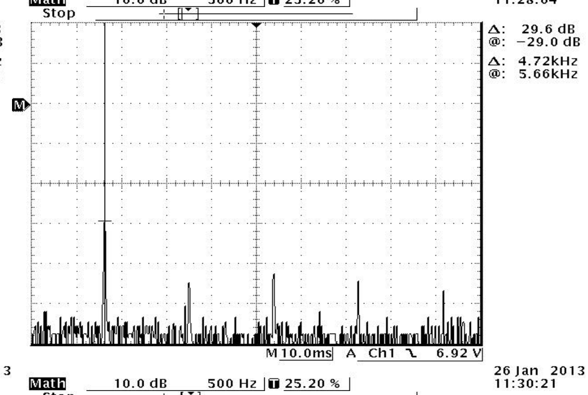

Stop
Δ: 36.8 dB
@: −41.8 dB
Δ: 4.76kHz
@: 5.24kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:23:21

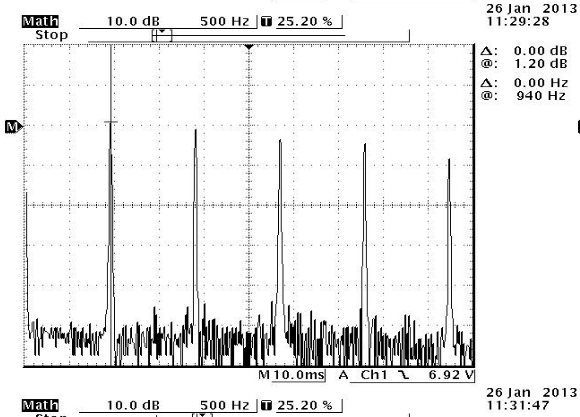

Stop
Δ: 0.00 dB
@: −800mdB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:24:30

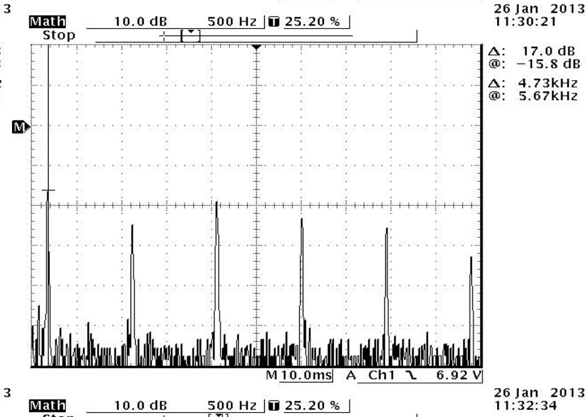

Stop
Δ: 22.0 dB
@: −22.8 dB
Δ: 4.76kHz
@: 5.24kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:25:54
Math 10.0 dB 500 Hz 25.20 %

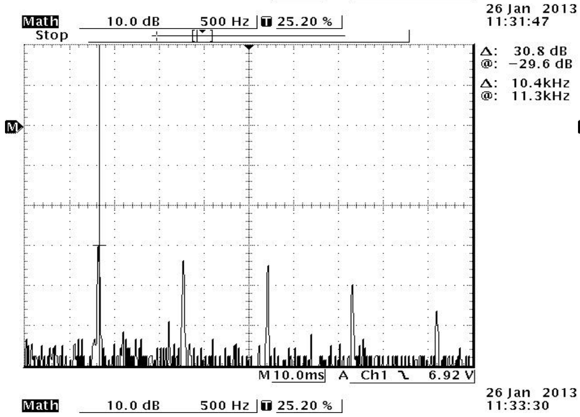

Stop
Δ: 0.00 dB
@: −5.20 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:28:04
Math 10.0 dB 500 Hz 25.20 %

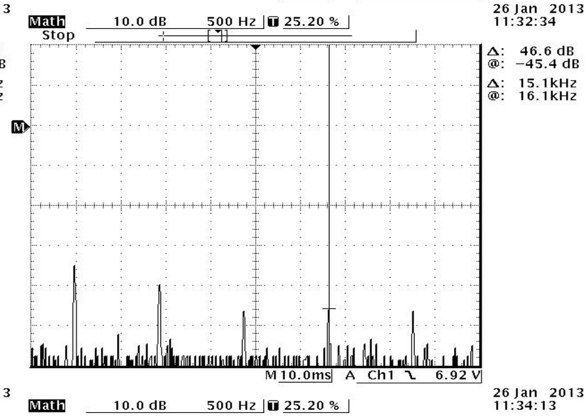

Stop
Δ: 0.00 dB
@: 600mdB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:29:28
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 29.6 dB
@: −29.0 dB
Δ: 4.72kHz
@: 5.66kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:30:21
Math 10.0 dB 500 Hz 25.20 %

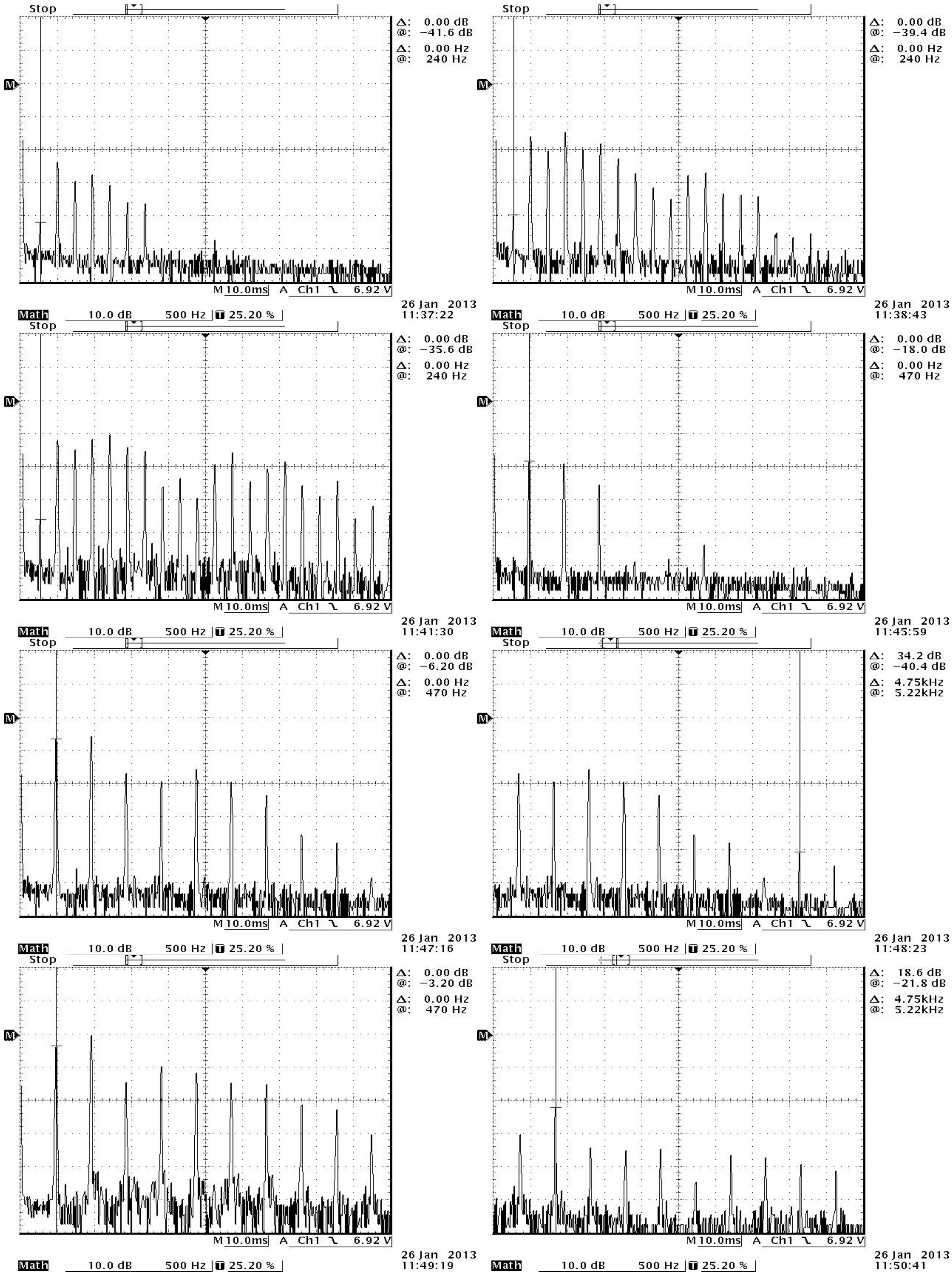

Stop
Δ: 0.00 dB
@: 1.20 dB
Δ: 0.00 Hz
@: 940 Hz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:31:47
Math 10.0 dB 500 Hz 25.20 %

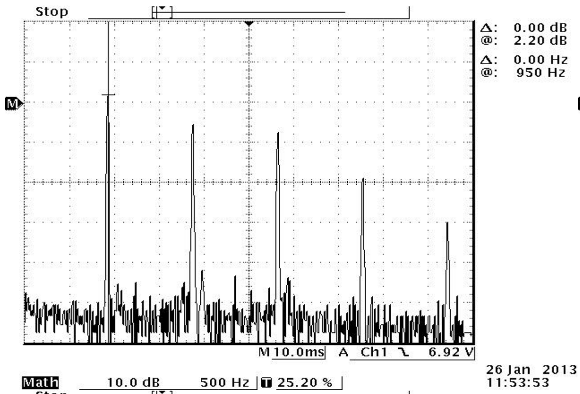

Stop
Δ: 17.0 dB
@: −15.8 dB
Δ: 4.73kHz
@: 5.67kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:32:34
Math 10.0 dB 500 Hz 25.20 %

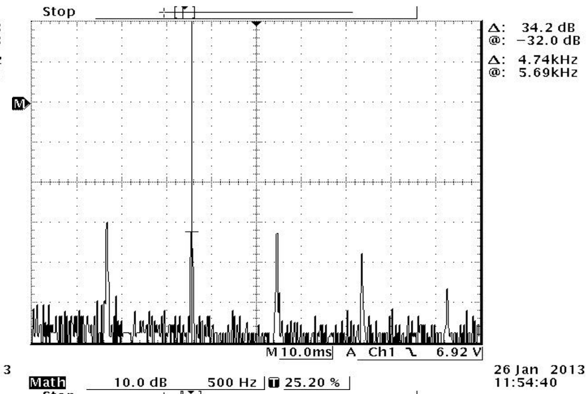

Stop
Δ: 30.8 dB
@: −29.6 dB
Δ: 10.4kHz
@: 11.3kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:33:30
Math 10.0 dB 500 Hz 25.20 %

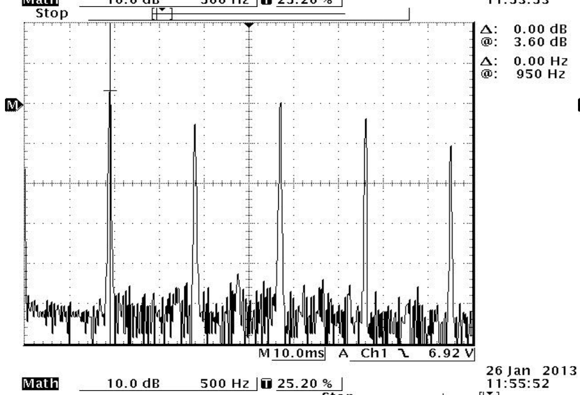

Stop
Δ: 46.6 dB
@: −45.4 dB
Δ: 15.1kHz
@: 16.1kHz
M 10.0ms A Ch1 ⤥ 6.92 V
26 Jan 2013
11:34:13
Math 10.0 dB 500 Hz 25.20 %

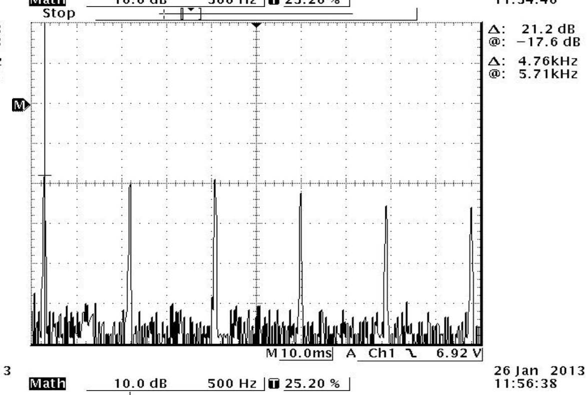
B117

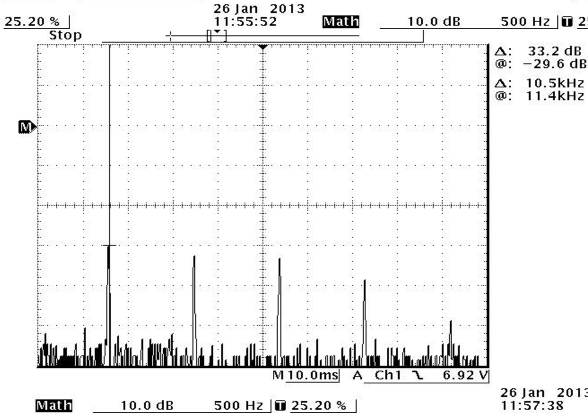

Stop
Δ: 0.00 dB
@: −41.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:37:22
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −39.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:38:43
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −35.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:41:30
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −18.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:45:59
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −6.20 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:47:16
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 34.2 dB
@: −40.4 dB
Δ: 4.75kHz
@: 5.22kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:48:23
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −3.20 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:49:19
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 18.6 dB
@: −21.8 dB
Δ: 4.75kHz
@: 5.22kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
11:50:41
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: 2.20 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:53:53

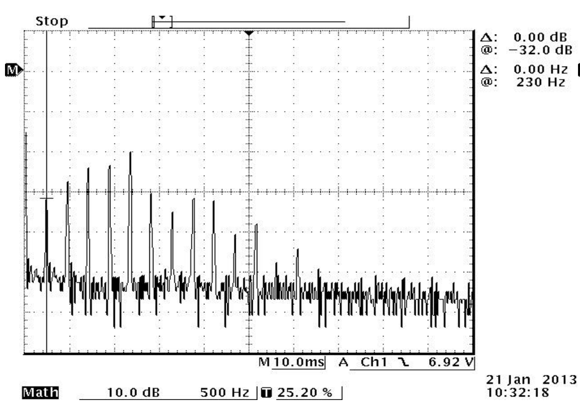

Stop
Δ: 34.2 dB
@: −32.0 dB
Δ: 4.74kHz
@: 5.69kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:54:40

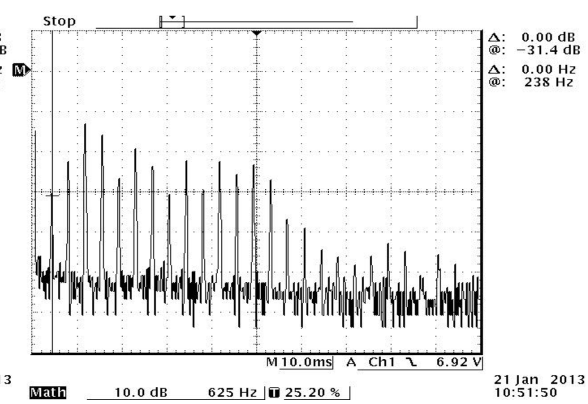

Stop
Δ: 0.00 dB
@: 3.60 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:55:52

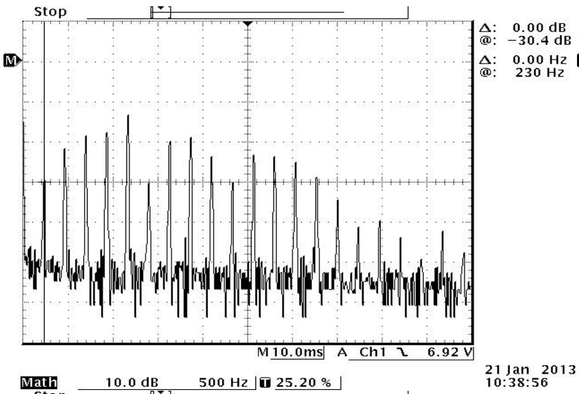

Stop
Δ: 21.2 dB
@: −17.6 dB
Δ: 4.76kHz
@: 5.71kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:56:38

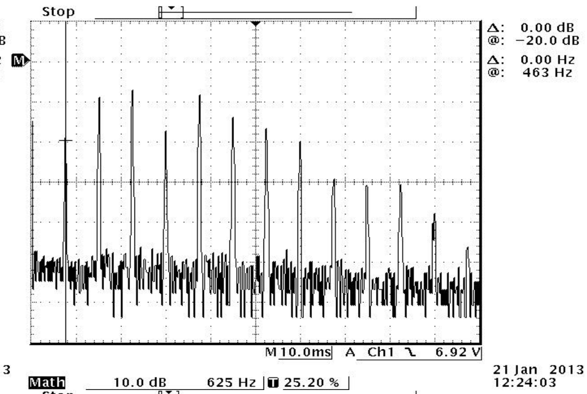

Stop
Δ: 33.2 dB
@: −29.6 dB
Δ: 10.5kHz
@: 11.4kHz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
26 Jan 2013
11:57:38

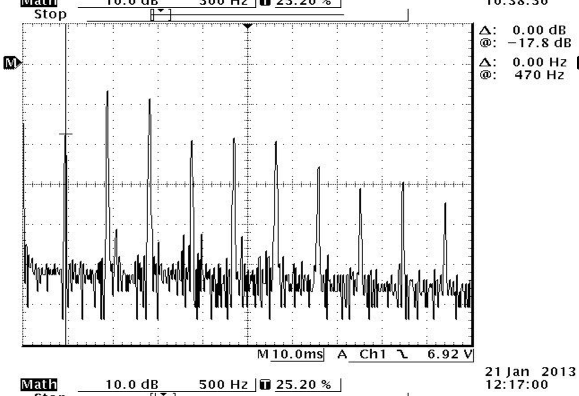
SC

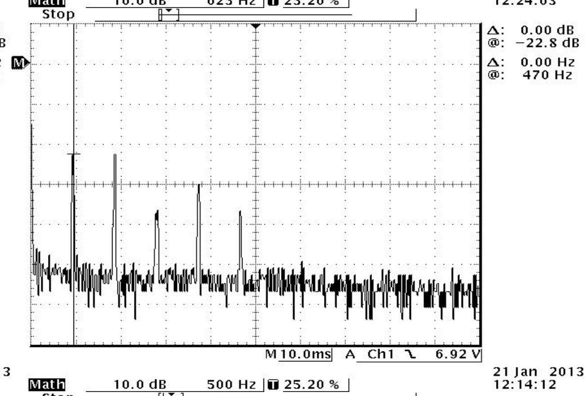

Stop
Δ: 0.00 dB
@: −32.0 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
10:32:18

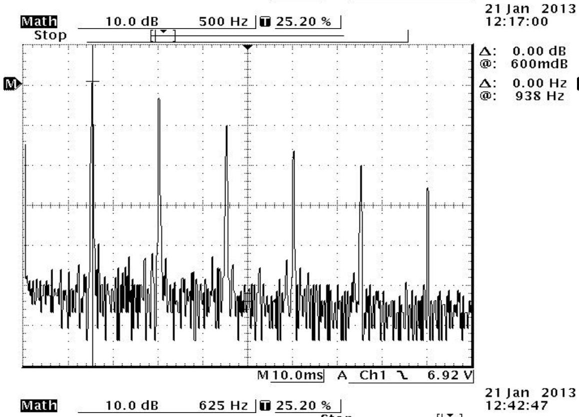

Stop
Δ: 0.00 dB
@: −31.4 dB
Δ: 0.00 Hz
@: 238 Hz
M 10.0ms A Ch1 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
10:51:50

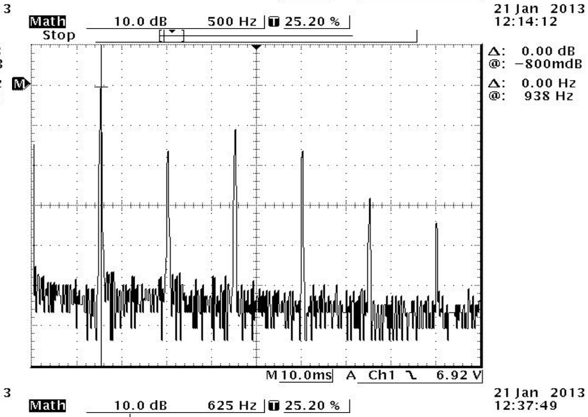

Stop
Δ: 0.00 dB
@: −30.4 dB
Δ: 0.00 Hz
@: 230 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
10:38:56

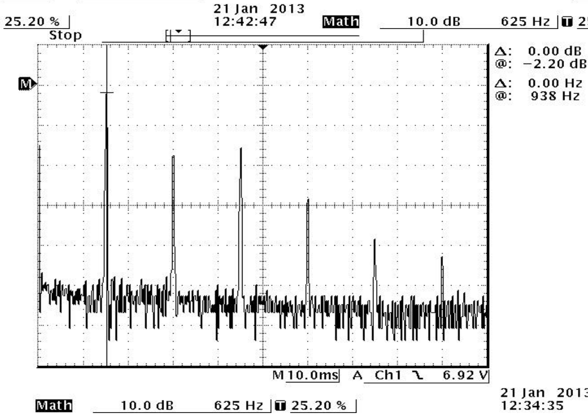

Stop
Δ: 0.00 dB
@: −20.0 dB
Δ: 0.00 Hz
@: 463 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
12:24:03


Stop
Δ: 0.00 dB
@: −17.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
12:17:00

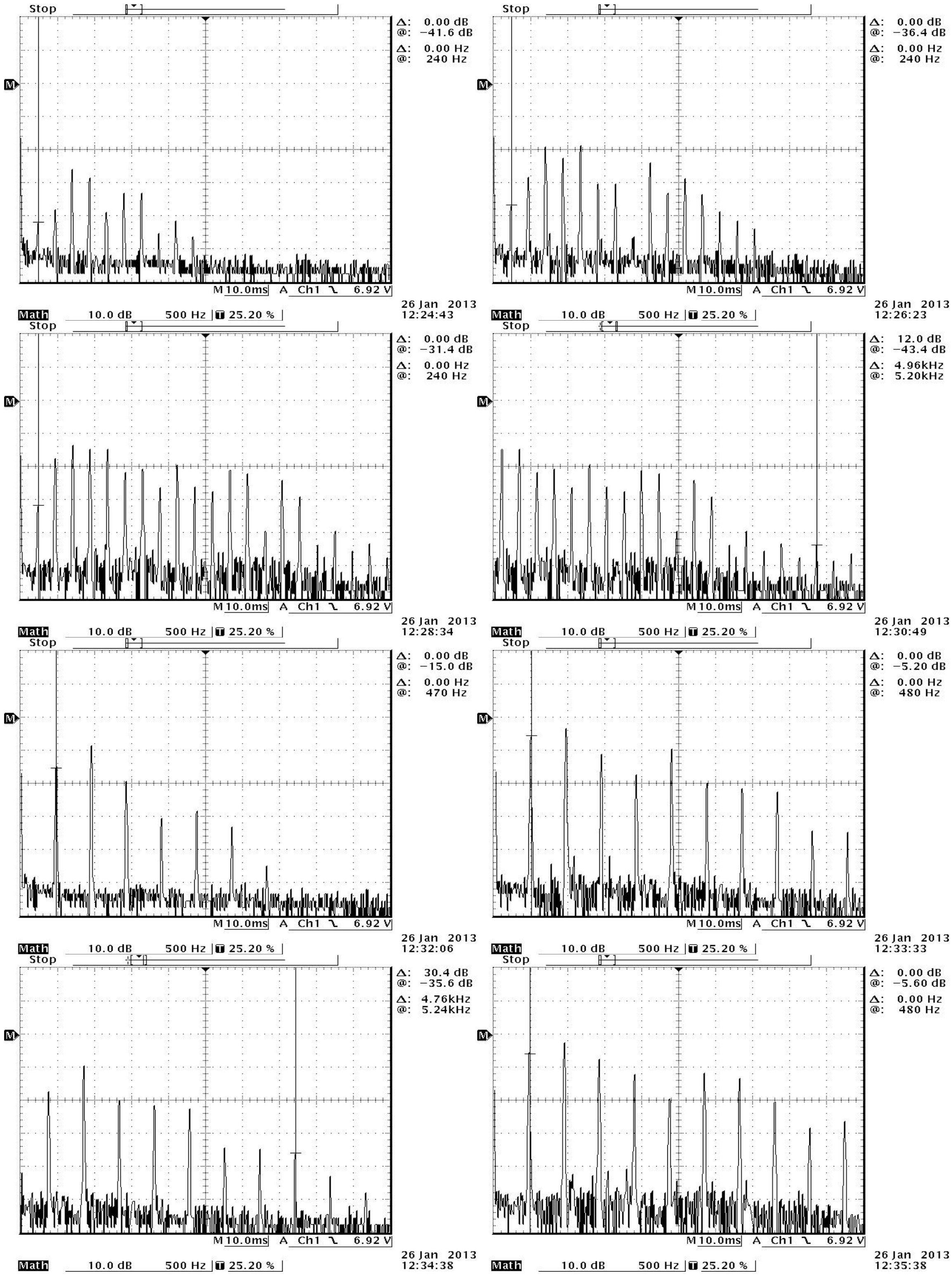

Stop
Δ: 0.00 dB
@: −22.8 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 500 Hz 25.20 %
21 Jan 2013
12:14:12

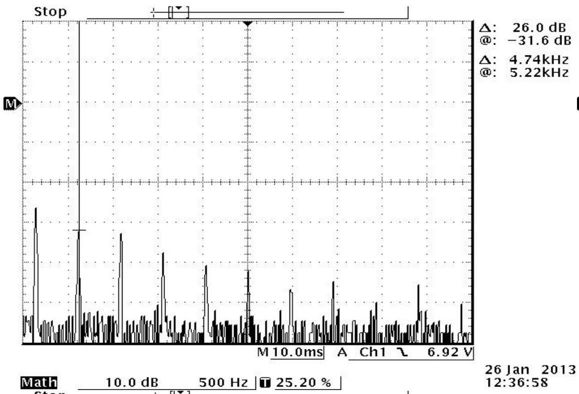

Stop
Δ: 0.00 dB
@: 600mdB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
12:42:47

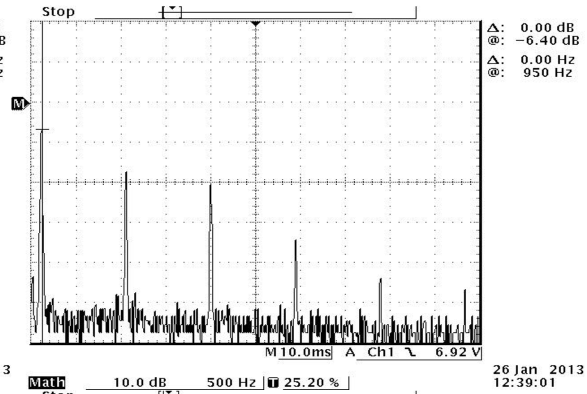

Stop
Δ: 0.00 dB
@: −800mdB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
12:37:49

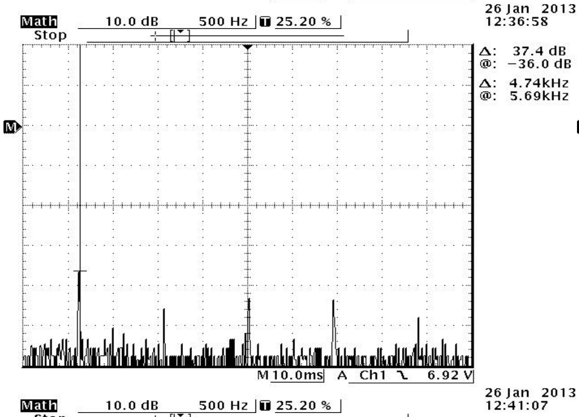

Stop
Δ: 0.00 dB
@: −2.20 dB
Δ: 0.00 Hz
@: 938 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
Math 10.0 dB 625 Hz 25.20 %
21 Jan 2013
12:34:35

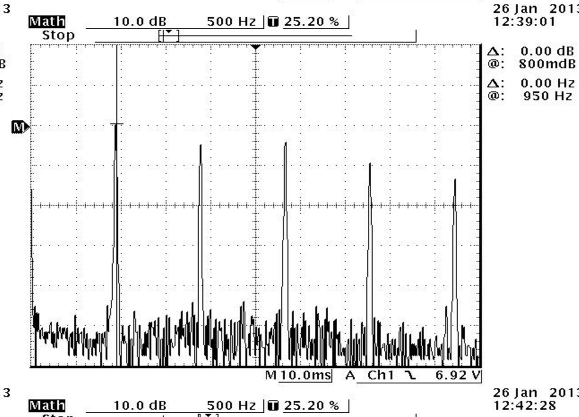
SX

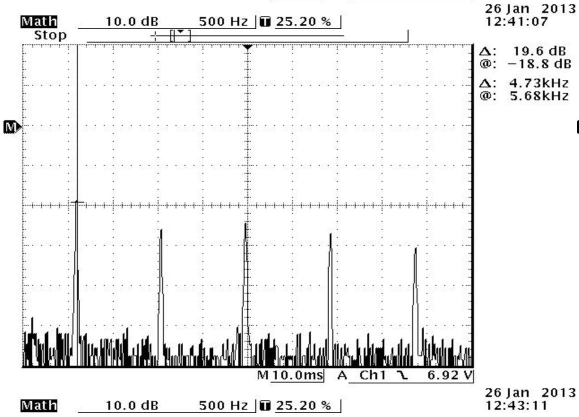

Stop
Δ: 0.00 dB
@: −41.6 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:24:43
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −36.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:26:23
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −31.4 dB
Δ: 0.00 Hz
@: 240 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:28:34
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 12.0 dB
@: −43.4 dB
Δ: 4.96kHz
@: 5.20kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:30:49
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −15.0 dB
Δ: 0.00 Hz
@: 470 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:32:06
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −5.20 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:33:33
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 30.4 dB
@: −35.6 dB
Δ: 4.76kHz
@: 5.24kHz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:34:38
Math 10.0 dB 500 Hz 25.20 %
Stop
Δ: 0.00 dB
@: −5.60 dB
Δ: 0.00 Hz
@: 480 Hz
M 10.0ms A Ch1 6.92 V
26 Jan 2013
12:35:38
Math 10.0 dB 500 Hz 25.20 %

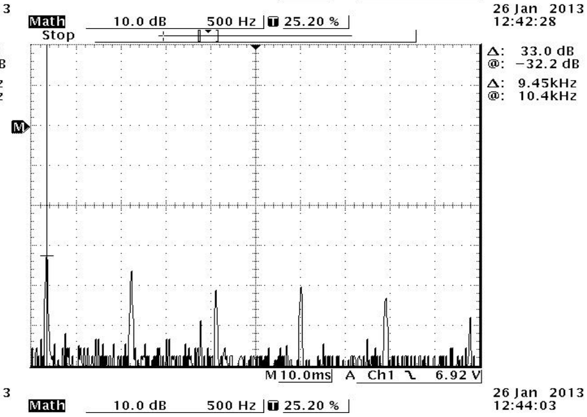

Stop
Δ: 26.0 dB
@: −31.6 dB
Δ: 4.74kHz
@: 5.22kHz
M 10.0ms A Ch1 ⤵ 6.92 V
26 Jan 2013
12:36:58
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: −6.40 dB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
26 Jan 2013
12:39:01
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 37.4 dB
@: −36.0 dB
Δ: 4.74kHz
@: 5.69kHz
M 10.0ms A Ch1 ⤵ 6.92 V
26 Jan 2013
12:41:07
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 0.00 dB
@: 800mdB
Δ: 0.00 Hz
@: 950 Hz
M 10.0ms A Ch1 ⤵ 6.92 V
26 Jan 2013
12:42:28
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 19.6 dB
@: −18.8 dB
Δ: 4.73kHz
@: 5.68kHz
M 10.0ms A Ch1 ⤵ 6.92 V
26 Jan 2013
12:43:11
Math 10.0 dB 500 Hz 25.20 %


Stop
Δ: 33.0 dB
@: −32.2 dB
Δ: 9.45kHz
@: 10.4kHz
M 10.0ms A Ch1 ⤵ 6.92 V
26 Jan 2013
12:44:03
Math 10.0 dB 500 Hz 25.20 %

Appendix E – Harmonics, Backbore Ratios, Total Voltage

The example table below contains the heading for the first table for each of the players. The first column is labeled "Backbore" and contains the corresponding backbore used in the study. The second column is labeled "Dynamic" and contains the dynamic the backbore was played to get the data for that row. The third column labeled "Note" contains the frequency the player intended to play, the fourth column labeled "Actual Freq" contains the actual frequency that was played. The fifth through thirty fifth columns labeled "1" through "30" contain the harmonic strength in dB.

Backbore	Dynamic	Note	Actual Freq	1	2	3	4	5	6	....	30

The example table below contains the heading for the second table for each of the players. The first column is labeled "Total Voltage" and contains the total voltage produced for the corresponding note, which is color coded to the first table. The second column is the ratio of the first harmonic to the total voltage (from column one). The third column is the ratio of the second harmonic to the total voltage (from column one). The remaining columns continue on in the same manner as columns two and three. For each set of data the peak harmonic ratio is highlighted.

TOTAL VOLTAGE	Ratio to 1	2	3	4	5	6	7	....	30

These tables contain the data for each player and each backbore. The tables are included because each player produced different data. The unique data from each player was averaged in this study for a real-world application of each backbore's performance.

Player 1

Backbore	Dynamic	Note	Actual Freq	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
SC	p	233.08Hz	238Hz	-26.6	-23.2	-25	-25	-20	-19.4	-27.2	-30.2	-47	-42.2	-40.8	-49.6	-47.4																	
SC	mf	233.08Hz	238Hz	-26	-19.2	-23.8	-29	-21.8	-25.5	-17.4	-21.2	-39	-35.4	-38.6	-34.6	-34.4	-41	-41.8	-40.4	-50.8	-49.2	-47.4											
SC	f	233.08Hz	238Hz	-24.4	-17.8	-22	-23.8	-21.2	-21.6	-13.8	-20.4	-29	-22.6	-31	-30.2	-30.6	-31.6	-29.6	-35.4	-43.6	-46.6	-47	-43.6	-47	-47.4								
SC	p	466.16Hz	475Hz	-16.4	-16.2	-29.2	-29.8	-35.6	-43.4	-47.8																							
SC	mf	466.16Hz	475Hz	-14.8	-17.2	-16.8	-17.6	-24.2	-27.6	-32.4	-33.2	-37.8	-47	-47	-49.4																		
SC	f	466.16Hz	475Hz	-10.8	-16.4	-19.4	-27.8	-17.4	-28.6	-31	-26.6	-33	-38.4	-41.6	-34.4	-41.6	-42.4																
SC	p	932.33Hz	938Hz	-16.4	-13.6	-15.4	-21.4	-42.8	-40.2																								
SC	mf	932.33Hz	950Hz	-14	-10.6	-13.2	-21.4	-29	-40.8	-55																							
SC	f	932.33Hz	950Hz	-2	-19.6	-15.4	-19.6	-24.8	-32.6	-41																							
B117	p	233.08Hz	238Hz	-26	-45	-28.6	-19.8	-21	-26.6	-34.2	-34.4																						
B117	mf	233.08Hz	238Hz	-23.8	-38.8	-24.8	-16.8	-15.2	-21.6	-33	-28.2	-44.4	-38.8	-36	-46.4	-46	-43.6	-47.8															
B117	f	233.08Hz	238Hz	-23.8	-30.4	-19	-13.2	-12.4	-17.8	-30.4	-28.6	-44	-34	-34.2	-46	-37.2	-37.2	-36.8	-44.6														
B117	p	466.16Hz	475Hz	-19.6	-21.8	-24.6	-22.8	-31.2	-44.4	-43.6	-49.4	-50																					
B117	mf	466.16Hz	475Hz	-16.6	-13.4	-15.6	-16.8	-20.4	-25.6	-25.6	-32.4	-34.6	-38.2	-42.2	-43.6	-47.8																	
B117	f	466.16Hz	475Hz	-14.4	-21	-31	-7.8	-15.6	-33	-24	-20.8	-31	-36.2	-37.2	-40.2	-36.6	-54	-52.2	-50														
B117	p	932.33Hz	938Hz	-9.4	-18.6	-36.4	-41.2	-50.6																									
B117	mf	932.33Hz	950Hz	-13	-16	-22	-24.8	-30.6	-39.6																								
B117	f	932.33Hz	950Hz	-1	-5	-14.4	-20	-33.8	-31	-45.8	-57	-51.6																					
SX	p	233.08Hz	238Hz	-24.6	-29.6	-21.6	-18.2	-18.2	-33.4	-46.2	-27.6	-45	-35.6	-38.8	-44																		
SX	mf	233.08Hz	238Hz	-23.6	-19.4	-15.8	-26.2	-14.2	-19.6	-25.8	-31.4	-40.6	-30.4	-27.4	-36.4	-33.6	-49.8	-38	-49.2	-46.8													
SX	f	233.08Hz	238Hz	-22.6	-25.2	-18.4	-12.4	-12.8	-15.8	-24	-18	-31.2	-24	-25	-28.6	-34.8	-28.6	-30.4	-38	-49.6	-47	-47.8	-45.6										
SX	p	466.16Hz	463Hz	-12.2	-18.4	-16.4	-16.2	-32	-28.6	-41.6	-40.2	-48																					
SX	mf	466.16Hz	463Hz	-11.2	-16.4	-18.6	-16.4	-20.4	-19.8	-30.2	-29	-37.6	-45.8	-38.8	-48.4	-48.4																	
SX	f	466.16Hz	475Hz	-10.8	-14.2	-11	-17.6	-18.6	-29.4	-26.2	-28.2	-34.4	-38.6	-38.8	-37.8	-41.8																	
SX	p	932.33Hz	938Hz	-11	-10.2	-34.4	-27.8	-47.4	-45.8																								
SX	mf	932.33Hz	950Hz	-4.8	-11.4	-25.6	-22	-28.2	-37.2																								
SX	f	932.33Hz	950Hz	-4.6	-12	-23.8	-26.8	-40.4	-46.2																								
G7C	p	233.08Hz	238Hz	-28.6	-25.8	-21.4	-25.4	-21.4	-26.6	-34.2	-36.8	-46.2	-49	-46.8																			
G7C	mf	233.08Hz	238Hz	-25.6	-26	-17.4	-19	-15.2	-25.8	-25.4	-22.8	-38.2	-35.6	-33.6	-37.4	-44.8	-44.4																
G7C	f	233.08Hz	238Hz	-23	-22.8	-16.4	-16.8	-12	-22.2	-26.8	-19.4	-27.2	-29.2	-26.4	-43.4	-33	-48.6	-33.2	-39.4	-52.8	-45.6	-45.8	-48.4	-47.8									
G7C	p	466.16Hz	475Hz	-29	-15.2	-25	-20.2	-33.4	-44.4																								
G7C	mf	466.16Hz	475Hz	-17.6	-13.2	-20.4	-15.4	-24.2	-27.2	-47.4	-34.8	-40.8	-41.4	-46.8	-48.6																		
G7C	f	466.16Hz	475Hz	-13.6	-12	-13.2	-23.2	-33	-23.8	-25.6	-25.2	-32.2	-29.8	-39	-48.6	-45.6																	
G7C	p	932.33Hz	938Hz	-13	-15.6	-27.6	-31.6	-42.8																									
G7C	mf	932.33Hz	950Hz	-6	-6.2	-19.8	-25.4	-33	-33.6	-45.4	-47.4																						
G7C	f	932.33Hz	950Hz	0.2	-1.2	-13.4	-16.6	-28.6	-30.4	-41.4	-41	-47.8																					
YC	p	233.08Hz	238Hz	-25.6	-26	-21.6	-25.4	-24.8	-26.6	-29.4	-32.6	-44	-35.6	-38	-44.8	-47.6																	
YC	mf	233.08Hz	238Hz	-24.2	-18.2	-16.8	-35.2	-18.2	-25.6	-20.2	-25	-30.2	-23.6	-27.6	-34.6	-32.4	-40	-42.6															
YC	f	233.08Hz	238Hz	-21.6	-21.2	-13	-18.4	-19.2	-17.8	-26.6	-19.4	-36.4	-24.8	-20.2	-23.4	-26.2	-37.6	-28.2	-37.2	-45	-44.6	-47	-50.6	-47.4	-54								
YC	p	466.16Hz	475Hz	-14	-19.4	-10	-17.2	-17	-22.2	-25.2	-31	-39.2	-39.2	-43.2	-44.4																		
YC	mf	466.16Hz	475Hz	-11.8	-21.4	-8	-17.2	-13.2	-18.2	-24.2	-25.4	-33.8	-36.4	-40.6	-39.4	-44.8																	
YC	f	466.16Hz	463Hz	-10.6	-17	-10	-16	-13.2	-19.2	-23.4	-26	-33.4	-34	-42	-39.8	-42.4																	
YC	p	932.33Hz	950Hz	-6.8	-11	-23.2	-34.8																										
YC	mf	932.33Hz	950Hz	-5.2	-19.6	-17.2	-29.2	-38.6	-46.8																								
YC	f	932.33Hz	950Hz	-2.8	-24.8	-19.6	-24.2	-31.6	-39.8	-41.8																							
B24	p	233.08Hz	238Hz	-28.6	-21.2	-25.8	-39.4	-26.2	-34.2	-28.4	-42.8	-44.6	-44																				
B24	mf	233.08Hz	238Hz	-25	-23.2	-18.8	-24.4	-22.6	-31.6	-23.8	-26.8	-36.8	-32.4	-28	-32	-34.6																	
B24	f	233.08Hz	238Hz	-23	-21.6	-18.2	-13.6	-13.2	-19.4	-20.2	-21	-25.2	-24	-24.2	-38.8	-42.2	-34.4	-39.4	-47.4														
B24	p	466.16Hz	475Hz	-17	-19.2	-20.2	-24	-24.8	-32.8	-43.8	-45.4	-52.2																					
B24	mf	466.16Hz	475Hz	-13.6	-17.2	-11.4	-15.2	-14.2	-28.8	-27	-29.2	-39.6	-38.6	-44.6																			
B24	f	466.16Hz	475Hz	-12.8	-15.6	-10.6	-14.6	-13.2	-23.6	-26.4	-28	-37	-34.6	-40.4	-48.6	-49.2																	
B24	p	932.33Hz	950Hz	-5.4	-20.2	-24.8	-34.4																										
B24	mf	932.33Hz	938Hz	-10.2	-12.4	-17.4	-25	-36	-44.2																								
B24	f	932.33Hz	950Hz	-3	-29.6	-12.6	-18.4	-27.2	-42.6																								
B7	p	233.08Hz	238Hz	-27.8	-24.6	-26.8	-21.8	-24.4	-29	-40.6	-35.2	-41.8	-40.4	-50.4	-52																		
B7	mf	233.08Hz	238Hz	-24.8	-31.6	-25.4	-14.8	-16.4	-24.4	-27.2	-20.8	-37.4	-32.2	-37.2	-44.6	-39.8	-42.6	-47															
B7	f	233.08Hz	238Hz	-22.6	-33	-21.2	-14.8	-12.6	-20	-26	-21.8	-34.6	-24	-36.4	-32	-40.4	-37.8	-43.4	-51.4														
B7	p	466.16Hz	475Hz	-31.2	-13.6	-13	-21.8	-26.4	-37.2	-41	-46.8																						
B7	mf	466.16Hz	475Hz	-15.6	-19	-15	-20.4	-22.2	-41	-30.2	-32	-36.2	-44																				
B7	f	466.16Hz	475Hz	-18.8	-9	-10.8	-9	-12.6	-17.4	-23.2	-35	-31.8	-34.2	-38	-40.6	-43.8																	
B7	p	932.33Hz	938Hz	-8.4	-14	-30.2	-39	-46																									
B7	mf	932.33Hz	950Hz	-3.6	-5.6	-14.2	-26.2	-31.2	-38.4																								
B7	f	932.33Hz	950Hz	-2	-9.8	-15.2	-27.6	-26.6	-36.2	-42.8	-42	-50.2																					
B76	p	233.08Hz	238Hz	-25.4	-21.2	-19.4	-25.6	-20.6	-23.8	-24	-31.6	-37.6	-31.4	-37	-44																		
B76	mf	233.08Hz	238Hz	-24.4	-21.4	-21.6	-27.8	-24.6	-24	-23.2	-21.4	-36.4	-31.4	-34	-30	-40	-41.8	-43.8	-47.8														
B76	f	233.08Hz	238Hz	-23	-20.4	-17	-25	-19.8	-27.8	-20.6	-20.6	-32.4	-29.2	-32.4	-25.8	-34	-40.8	-42.6	-48.8	-48.8													
B76	p	466.16Hz	475Hz	-18.8	-32.8	-18.8	-27	-34.6	-36.2	-49																							
B76	mf	466.16Hz	463Hz	-12.4	-18.4	-12.4	-17.4	-24.6	-31.4	-51	-43	-46.4																					
B76	f	466.16Hz	475Hz	-13.8	-15.8	-10.4	-15.6	-22	-27.6	-25	-43.2	-35.8	-44.6	-44.8	-52																		
B76	p	932.33Hz	950Hz	-12.2	-24	-37.4	-44.2																										
B76	mf	932.33Hz	938Hz	-14.8	-7.2	-24.4	-29.8	-45.2																									
B76	f	932.33Hz	950Hz	-19.6	-6	-21.4	-23.4	-29	-40.4	-43																							
B10	p	233.08Hz	238Hz	-27.2	-22	-25.8	-25.6	-20.8	-20.6	-23	-34.4	-45.8	-34.8	-41.4	-50.8																		
B10	mf	233.08Hz	238Hz	-24.8	-22	-25.2	-19.2	-23.2	-19	-24.8	-26.8	-35.8	-38	-39.2	-35.6	-47.2	-47.8																
B10	f	233.08Hz	238Hz	-25.4	-19.4	-24	-23.6	-16.6	-17.2	-18	-33.6	-44.6	-27	-29.2	-36.4	-40.8	-39.6	-41.6	-45.8														
B10	p	466.16Hz	475Hz	-19.8	-19.6	-20.2	-23	-35	-43.6																								
B10	mf	466.16Hz	475Hz	-15.2	-14.8	-12.2	-21.6	-23.8	-27.2	-32.2	-42.4	-46.6																					
B10	f	466.16Hz	475Hz	-14.4	-11.2	-11	-12	-26	-20.8	-30.4	-33.3	-36	-42	-38.4	-46.4																		
B10	p	932.33Hz	938Hz	-12.6	-18.6	-34	-45																										
B10	mf	932.33Hz	950Hz	-18.2	-12.4	-28	-21.4	-27.8	-41.8																								
B10	f	932.33Hz	950Hz	-15.8	-10	-23.8	-14.4	-27.8	-37.4																								
YA	p	233.08Hz	238Hz	-25	-24.6	-22.2	-22.4	-22.8	-30.2	-24.8	-26.8	-47.4	-35.6	-40	-46.8																		
YA	mf	233.08Hz	238Hz	-25.8	-20.8	-18.8	-37.2	-18.2	-29	-24.8	-27	-34.8	-31.4	-39	-36.2	-38.8	-44.2																
YA	f	233.08Hz	238Hz	-23.4	-18	-16.2	-24	-12.8	-22.6	-15.8	-18.2	-29.8	-27.6	-28.8	-28.2	-33.8	-37.4	-34.8	-42.2	-45.8	-43.2	-52	-49.4										
YA	p	466.16Hz	475Hz	-17.4	-21	-20.8	-23.8	-27.6	-34.2	-42.6	-51.2																						
YA	mf	466.16Hz	463Hz	-9.8	-15.8	-16.8	-22.4	-21.4	-21.4	-39.2	-32.4	-37.2	-39.8	-48	-49.6																		
YA	f	466.16Hz	475Hz	-13.2	-16.8	-14.8	-9.4	-18	-22	-27.2	-30.8	-36.2	-39.4	-43.4	-46.8																		
YA	p	932.33Hz	950Hz	-16.8	-33	-41.2																											
YA	mf	932.33Hz	950Hz	-4	-11	-25.4	-27.6	-40.8																									
YA	f	932.33Hz	950Hz	-1.2	-9	-22.8	-25.2	-38.8	-43.8																								
YMG	p	233.08Hz	238Hz	-27.6	-31.8	-27.6	-26.8	-19.8	-26.2	-32.8	-29.8	-41.6	-38.4	-48.6																			
YMG	mf	233.08Hz	238Hz	-24.2	-24.6	-20	-11.2	-13.8	-22.8	-23.4	-16	-28.2	-28.8	-32	-35.6	-50.8	-49	-51	-47.4	-47	-51.4	-49.8											
YMG	f	233.08Hz	238Hz	-24.2	-23.8	-22.2	-22.4	-12	-23	-26.4	-22.2	-26.2	-31.6	-26.4	-41.8	-27.4	-41.4	-39	-48.4	-44.8	-47												
YMG	p	466.16Hz	475Hz	-22.4	-15.8	-25.4	-24.8	-31.6	-40.4	-43.2	-45.8																						
YMG	mf	466.16Hz	475Hz	-16	-20	-19	-24.2	-30.8	-36	-38.6	-36.2	-38.4	-46.4	-49.2	-45.4																		
YMG	f	466.16Hz	475Hz	-17	-14	-10.2	-16.8	-22.4	-24.6	-24.2	-29.2	-37.2	-35.2	-40.6	-40.6	-48																	
YMG	p	932.33Hz	938Hz	-18.6	-26.4	-28.8	-37																										
YMG	mf	932.33Hz	938Hz	-14.2	-13.6	-18.8	-25.6	-34.8	-37.2																								
YMG	f	932.33Hz	950Hz	-2.2	-11.2	-14.4	-24.8	-35	-37.2	-40.4	-44.4	-46.6	-48.6																				
SA	p	233.08Hz	238Hz	-28.2	-27.8	-23.8	-31.6	-25.2	-30	-35.4	-36.5	-48.6	-43	-48																			
SA	mf	233.08Hz	238Hz	-25.2	-26	-18.2	-27.8	-22.2	-26.8	-32	-23.6	-34.8	-40.2	-39.2	-40.4	-50																	
SA	f	233.08Hz	238Hz	-24	-21.8	-16.4	-28.2	-18.2	-25.6	-25.8	-20.2	-30.6	-33.4	-31.8	-33	-38.8	-42	-44															
SA	p	466.16Hz	463Hz	-15.2	-20.6	-18.6	-29.8	-31	-33																								
SA	mf	466.16Hz	463Hz	-18	-21.4	-19.4	-18.6	-24.8	-31.2	-40.6	-46.2	-44	-47.2																				
SA	f	466.16Hz	463Hz	-12.4	-19	-13.8	-16.6	-20.6	-24.4	-31.8	-34.4	-34.8	-41.2	-42.2	-34.4																		
SA	p	932.33Hz	963Hz	-25.4	-34.6																												
SA	mf	932.33Hz	938Hz	-12.6	-16.8	-24.8	-30.4	-47																									
SA	f	932.33Hz	925Hz	-10.4	-12	-20.6	-23	-29.8	-42.4																								

TOTAL VOLTAGE	Ratio to 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
0.194507466	0.240472	0.355684	0.28911	0.28911	0.514119	0.550889	0.224421	0.158878	0.022965	0.039908	0.046888	0.017024	0.021931								
0.238133663	0.210465	0.460447	0.271131	0.148998	0.341334	0.222935	0.566473	0.365746	0.047117	0.071315	0.049338	0.078195	0.080016	0.037426	0.034133	0.040103	0.012111	0.014561	0.017913		
0.328077221	0.183664	0.392667	0.242116	0.196799	0.265475	0.253527	0.622335	0.291088	0.108149	0.225956	0.085906	0.094194	0.089955	0.080172	0.100931	0.051764	0.020138	0.014257	0.013615	0.020138	0.013615
0.222450278	0.680404	0.696253	0.155872	0.145468	0.074605	0.030393	0.018313														
0.311849001	0.58352	0.442645	0.463506	0.422723	0.197722	0.133677	0.076923	0.070155	0.04131	0.014324	0.014324	0.010866									
0.378140687	0.762687	0.400264	0.283365	0.107732	0.356736	0.098253	0.074533	0.123693	0.059203	0.031794	0.021996	0.05039	0.021996	0.020061							
0.320613341	0.472083	0.651656	0.529686	0.265472	0.022595	0.03048															
0.428205218	0.465959	0.689204	0.510914	0.198769	0.082861	0.021298	0.004153														
0.828050426	0.959275	0.126457	0.205089	0.126457	0.069493	0.02831	0.010763														
0.158963802	0.315284	0.035375	0.233723	0.643727	0.560663	0.29424	0.12266	0.119868													
0.26108421	0.247297	0.043976	0.220404	0.55363	0.665609	0.318581	0.085747	0.149011	0.023079	0.043976	0.060704	0.018332	0.019196	0.025306	0.015603						
0.378725689	0.170481	0.07974	0.296262	0.577664	0.633396	0.340154	0.07974	0.098101	0.01666	0.052684	0.051484	0.013234	0.036448	0.036448	0.038166	0.015548					
0.164764007	0.635532	0.49333	0.357386	0.439681	0.167162	0.036571	0.040099	0.020565	0.019193												
0.363103684	0.407352	0.588802	0.457056	0.398079	0.263008	0.144534	0.144534	0.066065	0.051283	0.033882	0.021378	0.018196	0.011219								
0.502896938	0.378897	0.177223	0.056043	0.810067	0.330005	0.044516	0.125465	0.181351	0.056043	0.030798	0.027449	0.019432	0.029412	0.003968	0.004881	0.006288					
0.35907222	0.943666	0.327204	0.042152	0.024256	0.008219																
0.292983078	0.764113	0.54095	0.271117	0.196407	0.10073	0.03574															
1.076155296	0.828181	0.522547	0.177062	0.092923	0.018973	0.026189	0.004766	0.001313	0.002444												
0.210833917	0.279293	0.157058	0.394511	0.583525	0.583525	0.101405	0.023231	0.197724	0.026672	0.078715	0.054458	0.029927									
0.317132338	0.208334	0.337878	0.511399	0.15444	0.614836	0.330187	0.161718	0.084871	0.029428	0.095227	0.134512	0.047726	0.065881	0.010204	0.039697	0.010934	0.014413				
0.437340329	0.169504	0.125655	0.274904	0.548505	0.523818	0.370835	0.144271	0.287859	0.062977	0.144271	0.128582	0.084953	0.041608	0.084953	0.069053	0.028786	0.007571	0.010214	0.009315	0.012	
0.351851155	0.697655	0.341697	0.430171	0.440191	0.071391	0.105594	0.02364	0.027774	0.011315												
0.397045441	0.693681	0.381206	0.29591	0.381206	0.240525	0.257727	0.077832	0.089363	0.033202	0.012917	0.028917	0.009575	0.009575								
0.487581285	0.591498	0.399901	0.578033	0.270367	0.240964	0.069495	0.100451	0.079791	0.03908	0.024096	0.023548	0.026421	0.016671								
0.420712784	0.669907	0.734538	0.045291	0.096831	0.010139	0.01219															
0.643694514	0.893964	0.418139	0.081531	0.123401	0.060439	0.021445															
0.645140112	0.912738	0.389355	0.10008	0.070851	0.014803	0.007592															
0.155620545	0.238744	0.329559	0.546932	0.345091	0.546932	0.300561	0.125295	0.092882	0.031473	0.0228	0.029372										
0.279515572	0.187756	0.179306	0.482607	0.401415	0.621719	0.183482	0.192129	0.259176	0.044014	0.059374	0.074747	0.048261	0.020587	0.021557							
0.378677473	0.186952	0.191307	0.399697	0.381707	0.663331	0.204989	0.120706	0.282964	0.115274	0.091565	0.126395	0.017854	0.059119	0.009811	0.057774	0.028296	0.00605	0.013859	0.013543	0.01004	0.010758
0.211338691	0.167889	0.822282	0.266085	0.462403	0.101163	0.028512															
0.330829927	0.39847	0.661295	0.288666	0.513328	0.186378	0.131946	0.012894	0.055004	0.027567	0.025727	0.013816	0.01123									
0.414315841	0.504276	0.606273	0.528042	0.166982	0.054034	0.155836	0.126668	0.132638	0.059247	0.078103	0.027081	0.008967	0.012667								
0.283095607	0.7908	0.586228	0.147254	0.092911	0.02559																
0.710923338	0.704981	0.688933	0.143939	0.07554	0.03149	0.029388	0.007554	0.006													
1.369581478	0.747157	0.635934	0.156103	0.107997	0.027128	0.02205	0.006215	0.006507	0.002974												
0.150961709	0.347643	0.331996	0.550977	0.35574	0.381183	0.309837	0.224457	0.155286	0.041796	0.109934	0.083394	0.038118	0.027614								
0.280837302	0.219556	0.438072	0.514689	0.061879	0.438072	0.186872	0.347973	0.200237	0.110039	0.235258	0.148438	0.066305	0.085417	0.035608	0.026396						
0.378708438	0.219632	0.229983	0.591146	0.317464	0.289531	0.340169	0.123508	0.28294	0.039966	0.151948	0.258045	0.178523	0.129329	0.034809	0.102729	0.03645	0.014849	0.015549	0.011795	0.007793	0.011264
0.447732044	0.445638	0.239322	0.706288	0.308306	0.315487	0.173373	0.122739	0.062948	0.02449	0.02449	0.015452	0.013458									
0.566941936	0.453379	0.150128	0.702201	0.243479	0.385888	0.217001	0.108758	0.094724	0.036013	0.026697	0.016461	0.0189	0.01015								
0.547920447	0.53862	0.2578	0.577142	0.289256	0.399285	0.200116	0.123391	0.091471	0.03902	0.036415	0.014497	0.018676	0.013845								
0.541737823	0.843744	0.520249	0.127706	0.03359																	
0.577387008	0.951772	0.181356	0.239074	0.060053	0.020349	0.007916															
0.737392745	0.982429	0.078037	0.142004	0.083618	0.03567	0.013877	0.011023														
0.126738592	0.293151	0.687213	0.404661	0.084546	0.386448	0.153848	0.299979	0.05716	0.046461	0.049784											
0.201380518	0.279243	0.343544	0.570141	0.299214	0.368114	0.130612	0.320614	0.226977	0.071777	0.119119	0.197689	0.124733	0.092466								
0.398805994	0.177516	0.208564	0.308488	0.523888	0.548578	0.268682	0.245041	0.22348	0.137797	0.158212	0.15461	0.02879	0.019464	0.047779	0.026868	0.010696					
1.517136783	0.353977	0.064413	0.037929	0.01256	0.659136	0.659136	0.004256	0.00354	0.001618												
0.422103818	0.732117	0.568304	0.319581	0.133223	0.037547	0.014608	0.105823	0.082145	0.024807	0.027834	0.01395										
0.760389152	0.931031	0.043548	0.308293	0.158112	0.057407	0.009749	0.062945	0.052356	0.018577	0.024489	0.012559	0.004886	0.00456								
0.549206214	0.977833	0.177936	0.104777	0.034695																	
0.417961417	0.739373	0.573936	0.322748	0.134544	0.03792	0.014752															
0.757398582	0.934707	0.04372	0.309511	0.158736	0.057634	0.009788															
0.138833294	0.293431	0.424137	0.329235	0.585472	0.434017	0.255568	0.067221	0.125172	0.058547	0.068787	0.021752	0.018093									
0.279199231	0.206104	0.094208	0.192347	0.651757	0.542108	0.215817	0.156346	0.326652	0.048315	0.08792	0.049441	0.02109	0.036651	0.026551	0.015999						
0.355339778	0.20862	0.063002	0.245107	0.512102	0.659715	0.281421	0.141045	0.228747	0.052403	0.177565	0.042595	0.07069	0.026875	0.036254	0.019026	0.007575					
0.322052105	0.085521	0.648745	0.695143	0.252391	0.148619	0.042862	0.027674	0.014193													
0.29806895	0.55678	0.376429	0.5966	0.320393	0.260425	0.029901	0.103677	0.084272	0.051962	0.021168											
0.654007498	0.175557	0.542522	0.440978	0.542522	0.358441	0.206261	0.105783	0.027191	0.039302	0.029814	0.019249	0.01427	0.009872								
0.430651481	0.882824	0.463313	0.071759	0.026054	0.011638																
0.867905292	0.761251	0.604683	0.224661	0.056432	0.031734	0.013852															
0.877587767	0.905127	0.368731	0.19802	0.047502	0.053298	0.017649	0.008255	0.009051	0.003521												
0.208313124	0.2578	0.418103	0.514379	0.251932	0.448006	0.309944	0.302889	0.126265	0.063282	0.129206	0.067808	0.030289									
0.203735416	0.295756	0.417766	0.408257	0.199956	0.289024	0.309694	0.339573	0.417766	0.074291	0.132109	0.097934	0.155215	0.049083	0.039896	0.031691	0.019996					
0.268966617	0.26321	0.35506	0.525172	0.209075	0.380454	0.151461	0.346978	0.346978	0.089187	0.128914	0.089187	0.190678	0.074183	0.033908	0.027561	0.013499	0.013499				
0.171710262	0.668658	0.133415	0.668658	0.260138	0.108444	0.090199	0.020663														
0.38988738	0.615263	0.308362	0.615263	0.345988	0.151029	0.069034	0.007229	0.018158	0.012276												
0.445339901	0.458467	0.364174	0.678123	0.372656	0.178364	0.093607	0.126272	0.015535	0.036417	0.013222	0.012921	0.00564									
0.25388387	0.966863	0.248522	0.053133	0.024286																	
0.477877905	0.380788	0.913446	0.126091	0.067715	0.0115																
0.52475605	0.199546	0.955086	0.162197	0.128838	0.067615	0.018199	0.013491														
0.190892509	0.228671	0.416113	0.268665	0.274923	0.477761	0.48889	0.370861	0.099819	0.026867	0.095326	0.044587	0.015108									
0.219755453	0.261855	0.36146	0.250069	0.498954	0.314819	0.510576	0.261855	0.207999	0.073801	0.057288	0.049895	0.07552	0.019864	0.018538							
0.289273341	0.185649	0.370418	0.218118	0.228398	0.511319	0.47719	0.435203	0.072226	0.020356	0.154416	0.119865	0.052323	0.031528	0.036199	0.028754	0.017729					
0.19067707	0.536663	0.549163	0.512509	0.37128	0.093261	0.03465															
0.370463269	0.469089	0.491196	0.662605	0.22452	0.174283	0.11783	0.066261	0.020476	0.012626												
0.517092959	0.368495	0.532637	0.545044	0.485771	0.096924	0.176373	0.058402	0.041825	0.03065	0.015361	0.02325	0.009256									
0.263035473	0.891222	0.446669	0.075855	0.021379																	
0.288503926	0.426431	0.831473	0.13799	0.295018	0.141204	0.028174															
0.410634553	0.394952	0.770095	0.157233	0.464028	0.099208	0.032851															
0.174435744	0.322377	0.337571	0.445005	0.434875	0.415302	0.17716	0.329886	0.262038	0.024455	0.09514	0.057328	0.026204									
0.218204762	0.235037	0.417961	0.526182	0.063261	0.563814	0.162606	0.263716	0.204708	0.083394	0.123349	0.05142	0.07098	0.052618	0.028258							
0.393068178	0.172001	0.320282	0.394033	0.160521	0.582817	0.188596	0.412603	0.312991	0.082325	0.106055	0.09237	0.098977	0.051944	0.034319	0.046295	0.019748	0.013048	0.017601	0.00639	0.00862	
0.202007803	0.667778	0.441196	0.451473	0.319618	0.206363	0.096523	0.036697	0.013634													
0.41613622	0.777615	0.389731	0.347348	0.182291	0.204534	0.204534	0.026349	0.057645	0.033171	0.02459	0.009567	0.007957									
0.491936454	0.444724	0.293827	0.369906	0.688797	0.255912	0.16147	0.088734	0.058626	0.031484	0.021782	0.013743	0.009292									
0.14652647	0.98647	0.152786	0.059441																		
0.694438624	0.908586	0.405851	0.077333	0.06003	0.013133																
0.944940027	0.921713	0.375488	0.076665	0.058156	0.012151	0.006833															
0.14455164	0.288388	0.177819	0.288388	0.316211	0.707908	0.338826	0.158481	0.22386	0.057541	0.083172	0.025703										
0.416622962	0.147998	0.141337	0.240025	0.661084	0.490069	0.173883	0.162277	0.380414	0.093381	0.087148	0.060292	0.039834	0.006922	0.008516	0.006765	0.010239	0.010722	0.00646	0.007767		
0.322036972	0.191467	0.200491	0.241043	0.235556	0.779999	0.219834	0.148626	0.241043	0.152088	0.081676	0.148626	0.02524	0.132463	0.02643	0.034841	0.011806	0.017869	0.013871			
0.197761522	0.383582	0.820084	0.271555	0.290977	0.133002	0.04829	0.034983	0.025933													
0.230606162	0.687273	0.43364	0.486552	0.26738	0.125063	0.068727	0.050948	0.067163	0.052135	0.020755	0.015036	0.023288									
0.437108761	0.323155	0.456468	0.706985	0.330682	0.040683	0.03158	0.021848	0.013785	0.010701	0.0085	0.021351	0.021351	0.009108								
0.132712069	0.885298	0.360653	0.273583	0.106436																	
0.313255481	0.622445	0.666962	0.366523	0.167533	0.05809	0.044066															
0.847765548	0.915639	0.324881	0.224763	0.067877	0.020976	0.016283	0.011265	0.007108	0.005517	0.004383											
0.112452974	0.345963	0.362267	0.574155	0.233899	0.488685	0.281209	0.151018	0.133054	0.033039	0.062955	0.035402										
0.189963426	0.289288	0.263834	0.647635	0.214452	0.40863	0.240619	0.13223	0.3478	0.095792	0.051443	0.05772	0.050272	0.016647								
0.260393824	0.242309	0.312154	0.581259	0.149406	0.472465	0.201544	0.196956	0.375292	0.113336	0.082105	0.098712	0.085974	0.044093	0.030505	0.024231						
0.234639382	0.740626	0.39774	0.500725	0.137911	0.120116	0.095411															
0.229387247	0.548821	0.371049	0.467122	0.51219	0.25086	0.120069	0.040685	0.021352	0.027506	0.01903											
0.384567697	0.623774	0.291761	0.530918	0.384616	0.242676	0.156685	0.066839	0.049548	0.047318	0.022648	0.020185	0.049548									
0.056839848	0.944816	0.327602																			
0.283002338	0.828343	0.510752	0.203334	0.106711	0.015784																
0.411245668	0.734343	0.610799	0.226934	0.172147	0.078686	0.018446															

Player 2

Backbore	Dynamic	Note	Actual Fre	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
SC	p	233.08Hz	240Hz	-32.2	-26.6	-21.8	-23.6	-29.2	-35.4	-34	-36.2	-48	-41.8	-45.8																			
SC	mf	233.08Hz	240Hz	-27.2	-26.6	-15.6	-14	-19	-14.4	-35	-23.8	-30.8	-27.8	-27.4	-31.6	-31	-30.4	-36.4	-43.6	-37	-42.2	-44	-44.8	-48.6									
SC	f	233.08Hz	238Hz	-28	-26.2	-18.6	-14.6	-17.2	-13.2	-30	-16.2	-18.4	-12.6	-22	-26	-24.6	-21.2	-17	-24.6	-41.4	-29.6	-36	-48	-37	-40.4	-40.6	-40.4	-43.4	-51	-43.2	-51	-46.8	-49
SC	p	466.16Hz	470Hz	-22.8	-22.6	-36.6	-30.2	-36.8																									
SC	mf	466.16Hz	470Hz	-17.8	-6.8	-9	-19.2	-18.6	-19.4	-25.8	-31.2	-29.6	-34.8	-35.8	-41.6	-43.2																	
SC	f	466.16Hz	463Hz	-20	-9	-7.2	-18.4	-8.4	-14.2	-18.8	-20	-29.8	-31.4	-30.8	-38.6	-47	-40.6	-46.6	-44.8	-44.4	-45.4												
SC	p	932.33Hz	938Hz	-2.2	-17.8	-17.6	-30.2	-41.4	-45.4																								
SC	mf	932.33Hz	938Hz	-0.8	-18	-13.4	-16.6	-28.4	-36	-39.4	-44.6	-47																					
SC	f	932.33Hz	938Hz	0.8	-4	-12	-16.6	-20.2	-26.6	-36	-33	-33.6	-43.4																				
B117	p	233.08Hz	230Hz	-32	-27.6	-24.2	-23.6	-20.2	-30.6	-35.2	-31.8	-32.4	-40.8	-38.2	-47.8	-44.4																	
B117	mf	233.08Hz	230Hz	-30.4	-21.8	-18.6	-17.8	-13.4	-31.4	-20	-19	-24	-30.2	-23.4	-23.8	-25.2	-29.4	-34.6	-41.4	-39.8	-44	-49.4	-42.4	-47.8	-44.6	-45	-44.8						
B117	f	233.08Hz	238Hz	-31.4	-25.2	-13.2	-16	-27.8	-22.4	-23.8	-32.8	-23.4	-29.8	-23.6	-26.8	-23.4	-27.2	-38.4	-39.2	-44.6	-46.4	-48.6	-46.2	-43	-45								
B117	p	466.16Hz	470Hz	-19.4	-18.8	-27.2	-26.6																										
B117	mf	466.16Hz	470Hz	-15.8	-10.2	-26	-8.8	-26.6	-15.2	-22.2	-27.8	-29.6	-30.2	-28.6	-34.8	-39.8																	
B117	f	466.16Hz	470Hz	-13.2	-7.8	-22.6	-10.6	-17.6	-15	-19.8	-23	-23.4	-27.6	-29.4	-27.8	-31.4	-45.6	-39.4	-45.4														
B117	p	932.33Hz	950Hz	-12.2	-16.2	-30.2	-35																										
B117	mf	932.33Hz	940Hz	-9	-9.8	-13.8	-14.6	-31	-33.6	-40.8	-44.6	-43.8																					
B117	f	932.33Hz	938Hz	-7.4	-1.6	-6.8	-13.4	-22.6	-29.8	-28.2	-39.6	-34.2	-39.2	-44.2	-42.4																		
SX	p	233.08Hz	230Hz	-35	-29	-25.2	-25.4	-18	-41.2	-27.6	-33.8	-36.6	-41.6	-38																			
SX	mf	233.08Hz	230Hz	-29.8	-23.8	-19.6	-24.4	-16.8	-27.2	-18	-28	-22	-25	-25	-28.2	-30.8	-35	-42.8	-50	-43.6	-44.4	-46.4	-48.4										
SX	f	233.08Hz	238Hz	-26.6	-21.6	-16.8	-17.6	-12	-20.6	-30.2	-16.8	-15.2	-17.4	-17.2	-23.2	-16.4	-16.2	-22.2	-26	-32.4	-38	-36	-36.4	-36.2	-35.2	-39	-35.4	-38.4	-44.4	-41.8	-49.4		
SX	p	466.16Hz	470Hz	-25.2	-20.4	-26.2	-30.6																										
SX	mf	466.16Hz	470Hz	-19	-17	-20	-17.2	-28.4	-19.8	-30.4	-36	-35.8	-39	-46.8	-47.4																		
SX	f	466.16Hz	463Hz	-20	-13.4	-19.8	-19.6	-11.6	-19.4	-19	-25.2	-34.4	-31.6	-31.2	-35.8	-48.6	-44.4																
SX	p	932.33Hz	940Hz	-6.8	-10	-24.8	-32.2	-45																									
SX	mf	932.33Hz	938Hz	-4.6	-5.4	-12.4	-17.2	-26.2	-33.8	-36.8	-43.2	-45.2																					
SX	f	932.33Hz	938Hz	-5.8	-6.4	-8.6	-17.8	-20.8	-33.8	-33	-38.2	-43.8	-44																				
G7C	p	233.08Hz	230Hz	-30.6	-24.8	-31	-25	-25.8	-31.6	-26	-28.2	-30.8	-36.4	-36.6	-43.2	-46.8																	
G7C	mf	233.08Hz	230Hz	-28.2	-20.8	-31.8	-18.6	-21.4	-21.4	-23	-19.2	-20.8	-24.8	-22.8	-31.8	-29.6	-33.4	-39.6	-45.2	-45.8	-41.4	-41.6	-47.8	-49.4									
G7C	f	233.08Hz	238Hz	-29	-17.8	-28.6	-16.4	-20.6	-20.2	-19.8	-15.4	-14	-22	-18.4	-23.4	-21.8	-24	-26	-30.4	-33.8	-30	-31.8	-47	-39.2	-34	-42.8	-36.8	-43.8	-42.8	-44	-45.2		
G7C	p	466.16Hz	470Hz	-20.4	-16	-23.2	-35.4	-35.6																									
G7C	mf	466.16Hz	470Hz	-15.8	-9.2	-10	-11	-38.8	-17.2	-25.8	-30.8	-26.8	-38.4	-41.6	-41.2	-46.2	-46.8																
G7C	f	466.16Hz	470Hz	-14.4	-6.6	-9.4	-13	-19	-14	-34.6	-21	-27	-30.4	-30.6	-35.2	-32.4	-43.8	-42.4	-43.8														
G7C	p	932.33Hz	940Hz	-11.6	-17.8	-35	-39.2																										
G7C	mf	932.33Hz	940Hz	0.8	-4	-14	-17.2	-24.6	-28.6	-39.8	-43	-45.4																					
G7C	f	932.33Hz	938Hz	2.2	-5.2	-10.6	-16.4	-22	-21.6	-31.8	-35.2	-53.4	-41.2	-48.4																			
YC	p	233.08Hz	230Hz	-37.6	-29.6	-26.6	-28.2	-22.4	-27.2	-28.8	-44	-46.8																					
YC	mf	233.08Hz	238Hz	-35.4	-20.4	-16.6	-22.8	-13.4	-12	-23.2	-23.4	-29.4	-26.2	-29.4	-24.4	-33.2	-36	-43.4	-45.2	-44.8	-42.2	-47	-44.4	-51.2	-50								
YC	f	233.08Hz	238Hz	-31.2	-17.6	-14.6	-19	-11.4	-9.6	-24	-26.6	-34.4	-20.2	-18.6	-18.2	-24	-22.2	-35.2	-34.6	-40.2	-47	-46.8	-37.6	-50.8	-38.4	-41	-43.4	-47.4	-45.4				
YC	p	466.16Hz	470Hz	-24.8	-16.2	-23.8	-30.8	-43.2																									
YC	mf	466.16Hz	463Hz	-20.2	-18	-8.8	-27	-18	-15.2	-26.8	-36.2	-35.2	-40	-46.2	-43	-49.8																	
YC	f	466.16Hz	475Hz	-29.4	-10.2	-5.8	-23.6	-8.4	-14	-25.6	-24.4	-23.8	-35	-28.2	-28	-34.2	-42	-45.4	-50	-47.4													
YC	p	932.33Hz	950Hz	-12.4	-17.4	-30.6	-42.6																										
YC	mf	932.33Hz	938Hz	0.2	-11	-12.2	-24.2	-36.2	-33	-44.8	-50.6																						
YC	f	932.33Hz	950Hz	-10.2	-14.8	-7.6	-14.2	-24.2	-30.6	-37.2	-35.6	-45.6	-46.2	-45.4																			
B24	p	233.08Hz	230Hz	-37.6	-31.6	-30.6	-24.8	-34.2	-29.6	-27.4	-37.6	-41.2	-43.4																				
B24	mf	233.08Hz	230Hz	-33.8	-23	-22.6	-17.8	-19.2	-21	-15	-21	-22.6	-28.4	-25.4	-28.6	-28.2	-46.2	-39.8	-40.2	-40.8	-42.6	-46.8	-49.4	-46.8									
B24	f	233.08Hz	230Hz	-19.4	-12.8	-19.2	-11.4	-19.8	-20.8	-19	-20.2	-29.6	-17.2	-17.6	-20.4	-22	-21.4	-34.8	-34.4	-33.4	-39.4	-40.4	-36	-35.6	-36.4	-37.4	-39.6	-44	-48.6	-47.4			
B24	p	466.16Hz	480Hz	-28.6	-24.6	-32.6	-25.4	-37.6																									
B24	mf	466.16Hz	475Hz	-26.2	-13.6	-11.6	-27.6	-17	-22.2	-29.8	-31.8	-37.4	-40.8	-44																			
B24	f	466.16Hz	475Hz	-19.8	-12.4	-11.4	-21.2	-19.8	-13.2	-30	-25.4	-32.2	-24.6	-33.8	-44	-36.2	-44	-44	-50.8	-48.4	-45	-52.4											
B24	p	932.33Hz	940Hz	-11.2	-31.6	-30.8	-37.6																										
B24	mf	932.33Hz	938Hz	2.2	-10.4	-10.2	-16.4	-24	-32.4	-41.6	-49.6	-49.4																					
B24	f	932.33Hz	938Hz	2.4	-11	-14.8	-13.8	-29	-26.6	-36.2	-38.4	-42.8	-48																				
B7	p	233.08Hz	240Hz	-34.4	-30.4	-20.4	-25.2	-22.6	-30.4	-29.4	-31.4	-32.8	-39.6	-37.6	-48																		
B7	mf	233.08Hz	240Hz	-27.2	-27	-16.4	-18.8	-10.8	-26.8	-15.6	-18.6	-24.6	-20.6	-16.8	-16.2	-22.6	-20.8	-21.6	-31.2	-38	-39.2	-35	-38.4	-36.2	-36.4	-41	-41.8	-41.8					
B7	f	233.08Hz	238Hz	-27.8	-21.6	-13.6	-17.6	-17.4	-13	-16	-17.6	-21.8	-21.6	-19.8	-13.2	-20.8	-19.8	-14.2	-22.6	-37.4	-30.4	-40	-37	-34.6	-41	-38	-36	-36	-48.2				
B7	p	466.16Hz	470Hz	-27.8	-20.2	-27.4	-31.2	-46																									
B7	mf	466.16Hz	463Hz	-21.2	-15.6	-14	-27.4	-25.6	-19	-26.8	-30.8	-36.4	-39.6	-41.4																			
B7	f	466.16Hz	463Hz	-16.8	-12.6	-8	-14.6	-15.6	-8.6	-15.4	-25.8	-24	-31.4	-31.2	-27.4	-43.2	-41.4	-42.4	-43.8	-42.8	-41												
B7	p	932.33Hz	940Hz	-6.4	-32.6	-44.4																											
B7	mf	932.33Hz	940Hz	-2.6	-2.4	-28.8	-18.8	-33	-33.4																								
B7	f	932.33Hz	938Hz	-1.6	-6.2	-9.8	-14.6	-18.8	-26.2	-39.8	-34.8	-39.2	-45.8																				
B76	p	233.08Hz	230Hz	-33.2	-28	-23.4	-29.2	-19.4	-18	-33	-40	-26.6	-27.2	-30.8	-36.2	-46.8																	
B76	mf	233.08Hz	238Hz	-32	-26	-21.6	-23.6	-16.6	-11.6	-20.2	-31	-14.8	-14.8	-17	-24.6	-23.2	-21.6	-40	-36.2	-41.8	-35.4	-48	-35	-34.2	-34.4	-42	-46.2	-45.8	-50				
B76	f	233.08Hz	225HZ	-30.2	-19.4	-20.4	-17	-9.6	-10	-14.2	-17.8	-23.6	-15.8	-15.2	-16.4	-19.6	-16.8	-19.4	-31.6	-31.2	-34	-35.8	-38.4	-32.4	-30.6	-40.4	-38	-35.4	-37.2	-39.6			
B76	p	466.16Hz	463Hz	-30.6	-26	-31.8	-29	-47																									
B76	mf	466.16Hz	475Hz	-30.6	-9.4	-13.8	-11.4	-14.2	-24	-30	-32.8	-42.8	-36.4	-42.6	-43	-46.8																	
B76	f	466.16Hz	463Hz	-27.6	-8.4	-12.2	-10.8	-8.8	-13	-17.6	-24.8	-29.4	-35.2	-28.4	-38	-38.2	-43.8	-41.4	-43.4	-46.8	-47.2	-50.8											
B76	p	932.33Hz	938Hz	-6.6	-21	-33.2	-44.6																										
B76	mf	932.33Hz	938Hz	-8.4	-5	-16	-15.6	-25.8	-35.6																								
B76	f	932.33Hz	950Hz	-3	-3.2	-7.8	-13	-17.6	-24	-24.2	-30	-36	-36.4	-45.2	-38.8	-51.4																	
B10	p	233.08Hz	230Hz	-35.6	-30	-32	-26.2	-21.8	-34	-36.8	-39.8	-45.4																					
B10	mf	233.08Hz	238Hz	-28.8	-26.2	-24.4	-17.2	-15.6	-20.2	-21.4	-18.8	-27.6	-31	-27.2	-26.4	-24.6	-45.2	-41.6	-38.6	-44	-43	-42.6	-42.6	-47									
B10	f	233.08Hz	238Hz	-28.6	-18	-19	-20.8	-14	-15.8	-22.8	-24.6	-13.2	-17	-17.4	-17.4	-20	-22	-22.6	-28.4	-38.6	-37.6	-40.6	-38	-35	-36.8	-45.8	-40.4	-38	-48.4	-48.2			
B10	p	466.16Hz	480Hz	-24.4	-23.4	-28.4	-39.6	-45.6																									
B10	mf	466.16Hz	463Hz	-21.6	-10	-18.6	-14.6	-14.4	-23.6	-23.2	-37.4	-33.6	-36.4	-38.6	-45.4																		
B10	f	466.16Hz	463Hz	-22.6	-12	-7.2	-12.6	-12.6	-14.4	-19.4	-26.4	-31.2	-32.8	-31.4	-33.2	-40.4	-46	-45.6	-21.4														
B10	p	932.33Hz	938Hz	-6.4	-23.6	-31.6	-46																										
B10	mf	932.33Hz	938Hz	-7.4	-5.6	-17.2	-27.6	-33.6	-30.2	-42.4																							
B10	f	932.33Hz	950Hz	-0.2	3.2	-5.4	-7.6	-18.2	-20.4	-30.8	-30	-30.2	-38.4	-42.2	-43.6																		
YA	p	233.08Hz	238Hz	-33.6	-35.6	-39.8	-36.8	-31.6	-30.6	-46.8	-46.2																						
YA	mf	233.08Hz	240Hz	-28.8	-24.6	-28.2	-22	-19	-18.4	-22	-27.2	-25.8	-23.6	-26	-28	-34.2	-36	-48	-41	-44.8	-49.8												
YA	f	233.08Hz	238Hz	-29.6	-18.4	-17.8	-28.8	-15	-17.4	-19.6	-16.6	-16	-24.6	-15	-24.4	-19.4	-23.2	-28.2	-30.8	-28	-34.4	-41.4	-32.6	-36.8	-34	-32.6	-32	-37	-50				
YA	p	466.16Hz	475Hz	-24.6	-22.2	-24.4	-39.8	-41																									
YA	mf	466.16Hz	463Hz	-18	-8.8	-12.8	-12.6	-15.8	-17.8	-27.8	-30.6	-29	-38.2	-44																			
YA	f	466.16Hz	463Hz	-17.4	-8	-7	-11.8	-12.2	-15.2	-24.4	-26.2	-30.2	-29.2	-41.6	-33.6	-37.6	-43.2	-44	-44.4	-44.2													
YA	p	932.33Hz	950Hz	-11.4	-25	-39.8																											
YA	mf	932.33Hz	950Hz	-11.2	-22.2	-34.2																											
YA	f	932.33Hz	938Hz	-1.4	-11.6	-22.6	-30	-44.6	-45.6																								
YMG	p	233.08Hz	240Hz	-34.4	-26.2	-23.4	-23.8	-25.8	-29	-35.6	-31.6	-44.2	-49	-36	-46.8	-46.8																	
YMG	mf	233.08Hz	230Hz	-29	-21.2	-20.6	-21	-16	-25	-30.6	-21	-15.8	-18.2	-21.6	-31.4	-31.4	-32.8	-46.8	-42.8	-45.4	-41.4	-43.2	-43.8	-47									
YMG	f	233.08Hz	238Hz	-29.2	-17.8	-18.6	-22.8	-18.2	-25.4	-16.6	-18.8	-8	-16	-15.4	-25.8	-19.8	-13.4	-16.4	-28.6	-44.4	-30.4	-33	-32.4	-34.6	-30.2	-29	-37.2	-38.2	-34.8				
YMG	p	466.16Hz	470Hz	-20.8	-15.4	-25	-31	-34.2	-47.4	-47.8																							
YMG	mf	466.16Hz	470Hz	-18.2	-10.2	-17.4	-13	-19.6	-21	-25.4	-28.2	-32	-33.8	-38.4	-42.8																		
YMG	f	466.16Hz	463Hz	-16.4	-5.8	-15.8	-14.2	-10.2	-20.8	-18.4	-23.4	-33.4	-30.2	-29.4	-33.8	-38.4																	
YMG	p	932.33Hz	940Hz	-4.8	-14.2	-27.6	-38.6																										
YMG	mf	932.33Hz	938Hz	-3.6	-9.8	-17.6	-20.8	-30	-39.4	-43	-46.4	-47																					
YMG	f	932.33Hz	938Hz	-1.6	-4.8	-11.8	-11.2	-21	-23.2	-29.6	-39.6	-38	-45.6	-44																			
SA	p	233.08Hz	238Hz	-33	-27.6	-27.8	-31.2	-43.2	-36	-40.2	-43.2	-48.8	-45																				
SA	mf	233.08Hz	238Hz	-29	-20.2	-23	-24	-36.2	-17.2	-26.6	-22.6	-19.6	-23.8	-25.8	-29.4	-25	-41.4	-51.4	-45.8	-50	-51.6	-44.6											
SA	f	233.08Hz	225Hz	-29.8	-18.2	-21.8	-15	-15.6	-9.8	-23	-19.4	-27.8	-19.2	-17	-25.6	-16.8	-16.2	-26.8	-31.4	-40.4	-35.2	-37.4	-34.2	-37	-37.8	-36.4	-39.2	-40.4	-44	-47.4			
SA	p	466.16Hz	463Hz	-20	-24.4	-28	-40.4	-40.4																									
SA	mf	466.16Hz	463Hz	-10	-15.6	-16.6	-16	-15.6	-22.6	-34.2	-39.2	-32.2	-38.8	-43.4																			
SA	f	466.16Hz	450Hz	-57	-20.6	-14.8	-9.2	-9.8	-26.4	-24.6	-34.6	-31	-30.2	-38	-35	-43.4	-47	-48.4	-46.4	-49.4													
SA	p	932.33Hz	930Hz	-9.2	-34.2	-42.4																											
SA	mf	932.33Hz	925Hz	-4.6	-14	-26.8	-26.6	-45.4																									
SA	f	932.33Hz	925Hz	-5.8	-6	-6.8	-21.6	-24.4	-35.4	-39	-43.8	-45.4																					

TOTAL VOLTAGE	Ratio to 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0.126488312	0.194066	0.369785	0.642619	0.522336	0.274126	0.134261	0.157743	0.122447	0.031474	0.064261	0.040546																			
0.363533594	0.120076	0.128664	0.456515	0.548882	0.308642	0.52415	0.048917	0.177605	0.079333	0.112061	0.117343	0.072353	0.077527	0.083072	0.041635	0.018174	0.038856	0.021353	0.017356	0.015829	0.01022									
0.509036546	0.078208	0.096217	0.230808	0.365806	0.271176	0.429785	0.062123	0.304264	0.236184	0.460523	0.156045	0.098458	0.115678	0.1711	0.277492	0.115678	0.016721	0.065051	0.031135	0.007821	0.027749	0.018761	0.018334	0.018761	0.013282	0.005537	0.013591	0.005537	0.008979	0.00697
0.110118943	0.657867	0.67319	0.134319	0.280632	0.131262																									
0.627632515	0.205255	0.728274	0.56532	0.174701	0.187195	0.170724	0.081714	0.043883	0.052759	0.028993	0.02584	0.013252	0.011023																	
0.741354874	0.134888	0.478601	0.588808	0.162171	0.512831	0.263011	0.154872	0.134888	0.043649	0.036306	0.038902	0.015848	0.006025	0.012588	0.006309	0.007762	0.008128	0.007244												
0.798492166	0.972141	0.161335	0.165093	0.038702	0.010659	0.006726																								
0.957635217	0.952357	0.131462	0.223254	0.154454	0.039701	0.01655	0.011189	0.006149	0.004664																					
1.282266131	0.835645	0.492064	0.195894	0.115351	0.076212	0.036477	0.01236	0.017459	0.016294	0.005273																				
0.15093795	0.166418	0.276186	0.408509	0.437725	0.647443	0.195525	0.115133	0.170295	0.158928	0.060423	0.060423	0.081508	0.02699	0.039921																
0.354307277	0.085235	0.229414	0.331604	0.363597	0.60342	0.075966	0.282241	0.316679	0.178082	0.087221	0.190818	0.18223	0.155103	0.095636	0.052556	0.024023	0.028882	0.017808	0.009564	0.02141	0.011498	0.01662	0.015872	0.016241						
0.328366324	0.081967	0.167356	0.666256	0.48266	0.124063	0.231016	0.196626	0.069766	0.205893	0.098547	0.201206	0.139201	0.205893	0.132936	0.036614	0.033392	0.017933	0.014576	0.011315	0.014916	0.02156	0.017125								
0.169579851	0.631867	0.677058	0.25741	0.27582																										
0.547795271	0.296061	0.564133	0.091492	0.662799	0.085385	0.317235	0.141704	0.074367	0.060448	0.056413	0.067824	0.033219	0.01868																	
0.617178635	0.354478	0.660069	0.120113	0.478177	0.213594	0.28813	0.165802	0.114707	0.109544	0.067544	0.054902	0.066007	0.04361	0.008503	0.017362	0.008701														
0.292430348	0.839417	0.529636	0.105676	0.06081																										
0.555298479	0.63896	0.582738	0.367683	0.335331	0.050754	0.037625	0.016424	0.010604	0.011627																					
1.066396368	0.40002	0.779976	0.428629	0.200485	0.069515	0.030345	0.036482	0.009819	0.018284	0.010282	0.005782	0.007113																		
0.161260798	0.110274	0.220025	0.340778	0.333021	0.780677	0.05401	0.258506	0.126611	0.091722	0.051579	0.078068																			
0.274807418	0.117753	0.234948	0.381041	0.219266	0.525983	0.158844	0.458112	0.144868	0.289049	0.204631	0.204631	0.14157	0.104947	0.06471	0.026362	0.011507	0.024042	0.021927	0.017417	0.013835										
0.520702476	0.089828	0.159739	0.277594	0.253169	0.482403	0.17923	0.059349	0.277594	0.333742	0.259066	0.2651	0.132865	0.290677	0.297448	0.149077	0.096252	0.046069	0.024177	0.030438	0.029068	0.029745	0.033374	0.021548	0.032614	0.023089	0.011572	0.01561	0.006507		
0.124136444	0.442691	0.769309	0.394549	0.237739																										
0.274051854	0.409418	0.515427	0.364894	0.503695	0.138729	0.373394	0.110196	0.057832	0.059179	0.040942	0.016679	0.015566																		
0.418981325	0.238674	0.510276	0.244234	0.249922	0.627777	0.255744	0.267797	0.131161	0.045478	0.062778	0.065736	0.038708	0.008868	0.014382																
0.559352399	0.817174	0.565346	0.102876	0.043885	0.010053																									
0.845482877	0.696458	0.635178	0.283723	0.163266	0.057929	0.024149	0.017096	0.008183	0.0065																					
0.810071854	0.633106	0.590849	0.458645	0.159029	0.112584	0.025204	0.027636	0.015187	0.00797	0.007789																				
0.129749027	0.227455	0.443502	0.217218	0.433407	0.395272	0.20272	0.386274	0.299844	0.222278	0.116653	0.113998	0.053321	0.035229																	
0.274310241	0.141827	0.332474	0.093704	0.42831	0.310283	0.310283	0.258082	0.399722	0.332474	0.209777	0.264094	0.093704	0.120714	0.07794	0.038173	0.020034	0.018696	0.031028	0.030322	0.014851	0.012353									
0.426513691	0.083189	0.302042	0.08711	0.354868	0.21881	0.229122	0.23992	0.398169	0.467807	0.186237	0.281882	0.158514	0.190575	0.147934	0.117508	0.070806	0.04787	0.074142	0.060265	0.010473	0.025708	0.046781	0.016985	0.03389	0.015138	0.016985	0.014793	0.012884		
0.198970097	0.479968	0.796548	0.347706	0.085352	0.083409																									
0.59248137	0.273732	0.585228	0.533735	0.475691	0.019379	0.232984	0.086562	0.048677	0.077148	0.020292	0.014039	0.0147	0.008267	0.007715																
0.696781625	0.273466	0.671279	0.486299	0.321295	0.161029	0.286354	0.026724	0.12791	0.064107	0.043341	0.042355	0.02494	0.034427	0.009266	0.010887	0.009266														
0.293624625	0.895793	0.43874	0.060563	0.037343																										
1.290065252	0.84994	0.489089	0.154664	0.107001	0.045644	0.0288	0.007932	0.005488	0.004163																					
1.444255022	0.891982	0.380501	0.204341	0.104799	0.054999	0.057591	0.017797	0.012033	0.00148	0.006031	0.002632																			
0.118365543	0.111372	0.279753	0.395162	0.328681	0.640877	0.368786	0.306743	0.053306	0.038617																					
0.404962716	0.041936	0.235822	0.365246	0.17889	0.52794	0.620276	0.170838	0.166949	0.083673	0.120944	0.083673	0.148794	0.054024	0.039137	0.016695	0.01357	0.01421	0.019168	0.01103	0.014879	0.006801	0.007809								
0.551183089	0.049969	0.239169	0.337835	0.203565	0.48832	0.600764	0.114473	0.08486	0.03457	0.177298	0.213159	0.223205	0.114473	0.140833	0.031529	0.033783	0.01773	0.008104	0.008293	0.023917	0.005232	0.021812	0.01617	0.012266	0.007739	0.009743				
0.179855389	0.319946	0.861146	0.358985	0.160353	0.038466																									
0.456162247	0.21423	0.275982	0.795941	0.097922	0.275982	0.380961	0.100203	0.033953	0.038096	0.021922	0.010737	0.01552	0.007094																	
0.750241809	0.045165	0.411907	0.683595	0.088064	0.506756	0.265949	0.069952	0.080315	0.086059	0.023703	0.051856	0.053064	0.02599	0.010588	0.007158	0.004215	0.005686													
0.27688792	0.866355	0.487187	0.106585	0.026773																										
1.091513682	0.937499	0.258209	0.22489	0.05649	0.01419	0.02051	0.005272	0.002704																						
0.587903556	0.525647	0.309524	0.709078	0.331661	0.10488	0.050199	0.02348	0.028229	0.008927	0.008331	0.009135																			
0.092949454	0.141825	0.282978	0.317507	0.619089	0.209775	0.356249	0.458937	0.141825	0.093703	0.072737																				
0.316522399	0.064505	0.223664	0.234205	0.407001	0.346414	0.281576	0.561818	0.281576	0.234205	0.120115	0.169666	0.11738	0.122912	0.015474	0.032329	0.030874	0.028813	0.02342	0.014441	0.010705	0.014441									
0.502032073	0.213436	0.456319	0.218408	0.536128	0.20383	0.181664	0.223495	0.194656	0.065958	0.274959	0.262584	0.190225	0.158223	0.169539	0.036247	0.037955	0.042586	0.021344	0.019023	0.03157	0.033057	0.030149	0.02687	0.020858	0.012568	0.007401	0.008497			
0.091951646	0.404055	0.286049	0.313647	0.143364																										
0.380739166	0.128639	0.793181	0.811657	0.397532	0.165719	0.063005	0.084991	0.067511	0.03543	0.023954	0.016572																			
0.463863384	0.220602	0.607589	0.392292	0.440159	0.076491	0.100835	0.068173	0.115774	0.052919	0.126943	0.044016	0.013602	0.033389	0.013602	0.013602	0.006217	0.008196	0.012123	0.005171											
0.278487221	0.988996	0.094448	0.103561	0.047336																										
1.368884242	0.941095	0.220614	0.225753	0.110569	0.046093	0.017524	0.006076	0.002419	0.002475																					
1.376928882	0.957389	0.204686	0.132156	0.148282	0.025768	0.033969	0.011248	0.008731	0.005261	0.002891																				
0.150064128	0.126976	0.201244	0.63639	0.366204	0.493996	0.201244	0.2258	0.179359	0.152659	0.069779	0.087846	0.026529																		
0.496560195	0.087908	0.089956	0.304809	0.231221	0.580802	0.092051	0.334217	0.236607	0.118585	0.187944	0.291091	0.311909	0.149289	0.183666	0.167505	0.055466	0.025353	0.022081	0.035812	0.024212	0.031191	0.030481	0.017948	0.016369	0.016369					
0.563097311	0.072346	0.147712	0.371036	0.234108	0.239561	0.397573	0.28146	0.234108	0.14435	0.147712	0.181726	0.388523	0.161963	0.181726	0.346271	0.131649	0.023956	0.053631	0.017759	0.025085	0.033069	0.015828	0.022357	0.028146	0.028146	0.006909				
0.117528337	0.346623	0.831491	0.362959	0.234346	0.042644																									
0.308924265	0.281934	0.537215	0.645874	0.138085	0.169882	0.363202	0.147961	0.093357	0.048995	0.033896	0.027552																			
0.688256193	0.210015	0.340604	0.578429	0.270551	0.241129	0.539821	0.246746	0.074516	0.091675	0.039107	0.040017	0.06198	0.010052	0.012367	0.011022	0.009381	0.010526	0.012949												
0.479241707	0.998724	0.048915	0.012573																											
1.067913812	0.694167	0.710336	0.033999	0.107514	0.020964	0.02002																								
1.042719797	0.797687	0.469713	0.310336	0.17858	0.110111	0.046971	0.009814	0.017451	0.010516	0.004918																				
0.202371162	0.108106	0.196721	0.334081	0.171337	0.529482	0.622087	0.110625	0.049414	0.231127	0.215701	0.142512	0.076533	0.022587																	
0.46805469	0.053667	0.107079	0.177707	0.141157	0.316012	0.561957	0.208787	0.060215	0.38878	0.38878	0.301789	0.125807	0.14781	0.177707	0.021365	0.033091	0.017366	0.036283	0.008506	0.037993	0.041658	0.04071	0.016971	0.010464	0.010957	0.006756				
0.661383382	0.046725	0.162012	0.144393	0.213573	0.500664	0.478131	0.294813	0.194781	0.099896	0.245215	0.262752	0.228848	0.158324	0.218548	0.162012	0.039769	0.041643	0.030168	0.024521	0.018178	0.03627	0.044622	0.014439	0.019035	0.025677	0.020871	0.015832			
0.072954928	0.404525	0.686982	0.352327	0.486346	0.061227																									
0.523210486	0.056406	0.647625	0.390233	0.514427	0.372669	0.120593	0.06044	0.043785	0.013846	0.028928	0.014168	0.013531	0.008736																	
0.704103237	0.059206	0.539963	0.348629	0.409603	0.51566	0.317954	0.187225	0.081727	0.048124	0.024681	0.053996	0.01788	0.017473	0.00917	0.012088	0.009602	0.006492	0.0062	0.004096											
0.476689363	0.981216	0.186967	0.045895	0.012353																										
0.718567036	0.529094	0.782587	0.220563	0.230958	0.071373	0.023096																								
1.105760037	0.640235	0.625661	0.368417	0.20246	0.119217	0.057061	0.055762	0.028598	0.014333	0.013688	0.00497	0.010383	0.002434																	
0.107947847	0.15374	0.292945	0.232694	0.453718	0.752984	0.184836	0.133902	0.094795	0.049749																					
0.307529925	0.118063	0.159262	0.195935	0.448862	0.539651	0.31777	0.276766	0.373347	0.135554	0.091646	0.141943	0.155637	0.191475	0.01787	0.027047	0.038204	0.020517	0.02302	0.024105	0.024105	0.014525									
0.491745121	0.075554	0.256012	0.228171	0.185464	0.405751	0.329807	0.147319	0.119746	0.444897	0.28725	0.274322	0.274322	0.203357	0.161533	0.150751	0.077314	0.023892	0.026808	0.018978	0.025601	0.036163	0.029394	0.010429	0.01942	0.025601	0.007731	0.007912			
0.098915582	0.609165	0.683495	0.384357	0.105861	0.053056																									
0.449298958	0.185125	0.703825	0.261496	0.414443	0.424096	0.14705	0.15398	0.030024	0.046501	0.033687	0.02615	0.011953																		
0.654981123	0.11318	0.383505	0.666456	0.357908	0.357908	0.290918	0.163595	0.073075	0.042051	0.034976	0.041093	0.033402	0.01458	0.007652	0.008013	0.129948														
0.483909985	0.989089	0.136532	0.054354	0.010357																										
0.692556436	0.615949	0.757783	0.199317	0.060193	0.030168	0.044622	0.010953																							
1.879830545	0.519854	0.76892	0.285681	0.221759	0.065446	0.050802	0.015342	0.016822	0.016439	0.006396	0.004129	0.003515																		
0.051315271	0.407149	0.32341	0.199413	0.281678	0.51257	0.575113	0.089074	0.095445																						
0.244397005	0.148561	0.240937	0.159186	0.325016	0.459097	0.491931	0.325016	0.178609	0.209848	0.270336	0.205071	0.162894	0.079782	0.064849	0.016289	0.036467	0.023545	0.01324												
0.450718487	0.073467	0.266744	0.285821	0.080555	0.394543	0.299292	0.232324	0.328167	0.351637	0.130646	0.394543	0.133689	0.237736	0.153495	0.086317	0.063987	0.088327	0.042276	0.018884	0.052011	0.03207	0.044268	0.052011	0.055731	0.03134	0.007016				
0.115359831	0.510441	0.672892	0.522331	0.088704	0.077258																									
0.549534922	0.229089	0.660701	0.416874	0.426584	0.295124	0.234425	0.074132	0.053704	0.064566	0.022387	0.011482																			
0.736047369	0.183271	0.540872	0.606868	0.349216	0.333499	0.236099	0.081864	0.066542	0.041985	0.047108	0.0113	0.028385	0.01791	0.009399	0.008572	0.008186	0.008377													
0.275155568	0.978187	0.204372	0.03719																											
0.286816218	0.960276	0.270643	0.067982																											
0.894525954	0.951496	0.29404	0.082872	0.035351	0.006583	0.005867																								
0.129234348	0.147442	0.378985	0.523145	0.4996	0.396846	0.27455	0.128417	0.203527	0.047711	0.027455	0.122637	0.035369	0.035369																	
0.336463147	0.105454	0.258859	0.277372	0.264888	0.471045	0.167133	0.087713	0.264888	0.482017	0.365647	0.247208	0.079995	0.079995	0.068087	0.013585	0.021531	0.015961	0.025297	0.020562	0.019189	0.013276									
0.625089149	0.05547	0.206091	0.187957	0.115893	0.196815	0.085913	0.236624	0.183678	0.636881	0.253547	0.27168	0.082046	0.163704	0.342025	0.242135	0.059437	0.00964	0.048312	0.035814	0.038376	0.029789	0.049438	0.056762	0.022083	0.019681	0.029111				
0.20378798	0.447529	0.833338	0.275944	0.057653																										
0.451110975	0.27272	0.685041	0.299031	0.496268	0.232122	0.197568	0.119046	0.086242	0.055682	0.04526	0.026651	0.016059																		
0.690087617	0.219329	0.743183	0.235015	0.28255	0.447812	0.132159	0.174219	0.097971	0.030981	0.044781	0.049102	0.029587	0.017422																	
0.609118954	0.944709	0.320109	0.068438	0.019288																										
0.7537454	0.876547	0.369169	0.150392	0.104046	0.036077	0.012224	0.008077	0.00546	0.005096	1.14084	1.14084																			
1.085841032	0.766009	0.751218	0.335557	0.359556	0.11635	0.090316	0.043228	0.01367	0.016435	0.006851	0.008237																			
0.071724276	0.312129	0.581211	0.567981	0.384002	0.096457	0.22097	0.136249	0.096457	0.050621	0.078403																				
0.262699855	0.135064	0.371998	0.269488	0.240182	0.058958	0.525461	0.178049	0.282189	0.398603	0.245776	0.195227	0.128985	0.214062	0.0324	0.010246	0.019523	0.012038	0.010012	0.022415											
0.537647162	0.060187	0.228825	0.151183	0.330752	0.308676	0.60187	0.131675	0.199298	0.075771	0.20394	0.262726	0.097612	0.268845	0.288073	0.085016	0.050061	0.017762	0.032322	0.02509	0.036266	0.026273	0.023961	0.028152	0.020394	0.017762	0.011736	0.007934			
0.124088984	0.805873	0.485587	0.320824	0.07696	0.07696																									
0.457008723	0.691951	0.363141	0.32365	0.346797	0.363141	0.162209	0.042665	0.023993	0.053713	0.025123	0.014794																			
0.524602286	0.002693	0.177897	0.346872	0.660952	0.616836	0.091237	0.112246	0.035495	0.053724	0.058907	0.023998	0.033898	0.012888	0.008515	0.007247	0.009124	0.006459													
0.347367495	0.998185	0.056132	0.021838																											
0.625182746	0.941874	0.319149	0.073113	0.074816	0.00859																									
0.856842441	0.598548	0.584923	0.533457	0.097073	0.070323	0.01982	0.013095	0.007535	0.006268																					

Player 3

Backbore	Dynamic	Note	Actual Fre	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
SC	p	233.08Hz	240Hz	-24.2	-23.8	-28.8	-31.2	-31.6	-39.8	-33.8	-47.4	-44																			
SC	mf	233.08Hz	240Hz	-23.4	-21	-19.8	-18.8	-26.4	-28	-22.2	-30	-32.2	-31.8	-29	-29.8	-49.4	-35.8	-44.6													
SC	f	233.08Hz	240Hz	-19.2	-15.8	-16.6	-24.6	-19.8	-20.8	-16.4	-26.8	-20.8	-31	-31.8	-26	-35.2	-31.2	-38.4	-36.6	-41.4	-46.8	-45.2	-46.4								
SC	p	466.16Hz	470Hz	-15.2	-26.4	-18	-38.2	-32.6																							
SC	mf	466.16Hz	470Hz	-9.2	-12.4	-12.2	-16.6	-18	-22.4	-27.6	-28.4	-31.4	-38.4	-38																	
SC	f	466.16Hz	470Hz	-8.6	-7.6	-16.8	-13	-16.4	-12.6	-15.2	-18.8	-22.8	-28	-29.4	-30.2	-39.8	-39.6	-40	-41.6	-41.4	-46.4	-44.4									
SC	p	932.33Hz	950Hz	-18.8	-19.2	-33.2																									
SC	mf	932.33Hz	950Hz	-22	-19.8	-20	-24.2	-42.4	-46.8																						
SC	f	932.33Hz	950Hz	-18	-14.2	-9	-17.4	-32.4	-31.4	-41.4	-39.6	-46																			
B117	p	233.08Hz	240Hz	-23.6	-28.2	-17.8	-22.6	-23	-32.2	-25.4	-30.2	-42	-48.6	-43.2	-45.6	-49.8	-48														
B117	mf	233.08Hz	240Hz	-22.6	-17.6	-11.2	-19	-17.6	-33.8	-24.4	-28.6	-39.4	-38.2	-26	-33.4	-38.6	-34.2	-37.8	-45.4	-46.8											
B117	f	233.08Hz	240Hz	-19.6	-15	-11.4	-13	-15	-31.2	-18.4	-20.2	-40	-24.4	-22.6	-28.6	-27.2	-26.2	-28	-29.2	-41.4	-43.4	-44.4	-40.8								
B117	p	466.16Hz	470Hz	-12.8	-11.4	-25.2	-23	-28.6	-44.6																						
B117	mf	466.16Hz	470Hz	-8	-7	-36.6	-14	-23.8	-24.4	-31.6	-30.6	-38.6	-41	-42.6																	
B117	f	466.16Hz	470Hz	-6.4	-5.4	-19.2	-12.8	-19	-17	-16.2	-17.6	-23	-22.2	-31.8	-31.4	-46	-37	-38.4	-43.2	-38.2	-37	-40.8	-43.8	-47							
B117	p	932.33Hz	950Hz	-4.6	-13.2	-29	-42	-58																							
B117	mf	932.33Hz	950Hz	-1.4	-10.4	-21.8	-29.6	-37.2	-46.4																						
B117	f	932.33Hz	940Hz	1	-3.6	-24	-16.6	-23.2	-33	-45.2																					
SX	p	233.08Hz	240Hz	-26.6	-22.8	-32	-30.8	-40.6	-34.4	-29.8	-32	-41.4	-46.8																		
SX	mf	233.08Hz	240Hz	-25	-19	-21.4	-20	-22.6	-23.4	-28	-42.4	-33.4	-34	-37.8	-32	-39	-43	-49.8	-45.2												
SX	f	233.08Hz	240Hz	-20.6	-13.4	-25.2	-24.4	-24	-18.4	-21	-23	-19.8	-21.4	-30.6	-25.4	-32.8	-26	-31	-34.8	-43.4	-44	-44.8	-46.4								
SX	p	466.16Hz	470Hz	-12.6	-25.8	-27.8	-20.8	-27	-39.4																						
SX	mf	466.16Hz	470Hz	-7	-16.4	-26.4	-9.6	-14.2	-16.8	-32.6	-40.4	-35.6	-38.2	-39.6	-42.4	-43.4	-49.8														
SX	f	466.16Hz	470Hz	-6	-16.8	-11.4	-12.2	-10	-15	-18.4	-22.2	-25.8	-30.2	-32.2	-35.8	-36.2	-42.8	-44.2	-46.4												
SX	p	932.33Hz	950Hz	-8.4	-11.8	-28.2	-40.8																								
SX	mf	932.33Hz	950Hz	-9.4	-6.8	-17.4	-28.2	-33.6	-40.8																						
SX	f	932.33Hz	940Hz	-3.8	-1	-8.8	-17	-26.8	-30.8	-42	-44.4	-47																			
G7C	p	233.08Hz	240Hz	-23.6	-21.6	-23	-40.6	-25.2	-27.8	-27.6	-33	-44.2	-45																		
G7C	mf	233.08Hz	240Hz	-24	-16.6	-15.4	-19.6	-23.8	-33	-17.2	-36	-26.8	-34.8	-32.4	-32.2	-38.8	-32.2	-46.8													
G7C	f	233.08Hz	230Hz	-21.4	-14.8	-14.8	-17.2	-21.6	-27	-15.6	-24.2	-28	-22.6	-27.6	-30.6	-36	-33.8	-35.2	-39.2	-49.4	-43	-48.4	-45.8	-45.4							
G7C	p	466.16Hz	470Hz	-13.6	-24.6	-19.2	-26.8	-33.6																							
G7C	mf	466.16Hz	470Hz	-10	-22	-14.4	-18.6	-25	-30.6	-44.8	-43.4	-45.4	-50																		
G7C	f	466.16Hz	470Hz	-6	-15.6	-5.6	-22.6	-21.8	-14.2	-23.6	-20.2	-26.4	-31.8	-35	-42.2	-35.4	-43.2	-48.4	-48.4	-44											
G7C	p	932.33Hz	950Hz	-13.4	-43.2	-26	-46.4	-35.8																							
G7C	mf	932.33Hz	940Hz	-6.4	-10.6	-21.8	-27.2	-45.2																							
G7C	f	932.33Hz	940Hz	-3	-19.4	-15	-19.4	-31.8	-38.2																						
YC	p	233.08Hz	240Hz	-27.6	-25.6	-23.8	-30.6	-30.2	-41.4	-32	-42	-43.8	-46.8																		
YC	mf	233.08Hz	230Hz	-23	-22	-12	-26.8	-21.4	-33.4	-25.4	-27.2	-28.2	-31.4	-26.4	-28.4	-42.4	-33.6	-39.8	-46.4												
YC	f	233.08Hz	230Hz	-20	-15.2	-13.2	-16.6	-20.4	-31.6	-14.6	-23.2	-26	-24	-21.6	-37.2	-34.4	-26.2	-29.6	-40.8	-41.2	-46.8	-45.2									
YC	p	466.16Hz	470Hz	-15.2	-18	-20.8	-35.2	-37.8																							
YC	mf	466.16Hz	470Hz	-10.8	-14.6	-11.8	-22.4	-27	-45.6	-42.8	-51.4	-46.8	-45.6																		
YC	f	466.16Hz	470Hz	-6.8	-7.6	-17.6	-16.4	-17.8	-26.6	-18.6	-26.4	-30.6	-31.8	-26.8	-35.2	-37.2	-48.6	-45.2	-43.8	-45.4	-45.2	-45.4									
YC	p	932.33Hz	950Hz	-6	-20.6	-44.8																									
YC	mf	932.33Hz	940Hz	-6.2	-13.4	-27.6	-39.4	-38.6	-41.6																						
YC	f	932.33Hz	940Hz	-1	-8.4	-35	-17.4	-24.2	-26.2	-42.4	-39.8	-45.8																			
B24	p	233.08Hz	250Hz	-34.8	-24	-23	-27.4	-35.8	-27.6	-29	-41.4	-45.6	-48.4	-47.8																	
B24	mf	233.08Hz	240Hz	-22	-17	-14	-20.6	-25.6	-24	-22	-23.2	-37.2	-31.4	-27.6	-32.6	-38	-34.2	-42.8	-48.6	-50	-57	-48.6									
B24	f	233.08Hz	240Hz	-20.8	-15.8	-11.8	-16.6	-24.2	-20.8	-17.4	-25.8	-27.8	-23.8	-21.4	-31	-30.4	-22.8	-35.4	-39.4	-47	-44.4	-45.4	-45.4	-46.4	-39.8	-46.2	-45.8	-45.8	-50	-50	
B24	p	466.16Hz	470Hz	-14.8	-20.6	-22.2	-28.6	-36.8																							
B24	mf	466.16Hz	470Hz	-9.2	-10	-12.6	-15.4	-19.2	-30	-33.6	-37.4	-38.6	-41.6	-41	-48.4																
B24	f	466.16Hz	470Hz	-7.8	-8	-10.6	-12.8	-15.2	-18.6	-17	-27	-26	-31.6	-27	-33	-36.4	-38	-47.8	-50	-42.2	-46.8										
B24	p	932.33Hz	950Hz	-8	-24.2	-41.2	-43.4																								
B24	mf	932.33Hz	940Hz	-5.2	-11.2	-17.6	-25.6	-33.6	-41.2																						
B24	f	932.33Hz	940Hz	-5.4	-15.8	-14	-18.4	-31.6	-31.8	-39.4	-47	-47.8																			
B7	p	233.08Hz	240Hz	-26.6	-22.4	-32.4	-36.6	-23.4	-27.6	-28.8	-34.6	-37.6	-42.4	-45.4	-47																
B7	mf	233.08Hz	240Hz	-24.2	-17.8	-24.8	-27.8	-18.2	-20	-22.2	-24.4	-27	-25.2	-30	-34	-46.4	-32.6	-41													
B7	f	233.08Hz	240Hz	-20	-13	-20.2	-21.8	-16.2	-13.4	-26.4	-27.8	-21.6	-26.4	-34	-34.2	-44.4	-24.6	-27.6	-31.8	-40.4	-46.8	-44.6	-45.6								
B7	p	466.16Hz	470Hz	-12.8	-21.4	-29.2	-39	-44.4	-47.8																						
B7	mf	466.16Hz	470Hz	-8.4	-11.8	-9.2	-20.2	-29	-27.4	-34.4	-36.4	-42.2	-44.8																		
B7	f	466.16Hz	470Hz	-6.4	-16	-6.4	-11	-10.2	-19.2	-16.2	-23.8	-27	-27.4	-34.8	-39.4	-37.8	-46.8	-44	-44	-42											
B7	p	932.33Hz	940Hz	-19.8	-18.6	-23	-38	-40.8																							
B7	mf	932.33Hz	940Hz	-6.4	-9.2	-19	-32.6	-38.2																							
B7	f	932.33Hz	940Hz	-6	-7.4	-13.6	-21.8	-30	-40	-45.2	-46																				
B76	p	233.08Hz	240Hz	-28	-25.8	-29	-29	-31.8	-31.8	-41.8	-47																				
B76	mf	233.08Hz	240Hz	-23.2	-19.4	-23	-20.6	-22	-21.6	-24	-23.4	-36.4	-36.2	-34.6	-32.4	-42.6	-45.8	-47													
B76	f	233.08Hz	240Hz	-20	-15.8	-18	-16.2	-18	-15.6	-24.2	-20.2	-29.2	-29.6	-27.8	-20.6	-32	-26	-31.8													
B76	p	466.16Hz	470Hz	-12.8	-15.8	-13.2	-20	-26.4	-38																						
B76	mf	466.16Hz	470Hz	-10.8	-11.2	-11.8	-15.2	-14.4	-30	-34.6	-38.6	-44.6	-39																		
B76	f	466.16Hz	470Hz	-7.6	-12.2	-10.8	-8	-13	-27.2	-22.4	-28.4	-33.8	-24.2	-30	-30.8	-34.2															
B76	p	932.33Hz	940Hz	-14.4	-12.4	-33.4	-42.4																								
B76	mf	932.33Hz	940Hz	-0.8	-9.2	-14	-23	-26.8	-44.2	-48																					
B76	f	932.33Hz	930Hz	0.8	-10	-18.4	-18	-25.2	-29.8	-39.8	-43.8	-44.6																			
B10	p	233.08Hz	240Hz	-26.2	-31.4	-30.8	-32.8	-35	-39.4	-40.2	-45.8																				
B10	mf	233.08Hz	240Hz	-22.6	-20	-20.6	-24.8	-20.4	-27.4	-20.4	-21.4	-26.4	-39.2	-31.2	-35.2	-44.4	-34.8	-43.2													
B10	f	233.08Hz	230Hz	-20.8	-17.8	-15.2	-21.4	-15.4	-20.4	-22.2	-15.2	-27.6	-28.8	-26.2	-31.8	-32	-26	-33.4	-40.6	-38.8	-43.4	-48.4									
B10	p	466.16Hz	470Hz	-20.4	-22.4	-21	-26.2																								
B10	mf	466.16Hz	470Hz	-12.4	-24	-20.8	-14	-25.4	-37.6	-37.2	-42.8	-42.8	-44.8																		
B10	f	466.16Hz	470Hz	-9.6	-17.8	-10.2	-8.2	-24.8	-22.2	-20.2	-31.6	-29.8	-30.2	-33	-37.2	-41.6	-47														
B10	p	932.33Hz	950Hz	-16.4	-15.4	-38.4	-46																								
B10	mf	932.33Hz	940Hz	-12.2	-10	-33	-34.6	-39.4																							
B10	f	932.33Hz	940Hz	-4.8	-12.6	-15.6	-26	-30	-37.4	-45.8																					
YA	p	233.08Hz	240Hz	-23.8	-24.6	-26.8	-33.4	-32.2	-30.8	-35	-45.8	-45.4	-47	-42.8	-47	-42.8	-47.4														
YA	mf	233.08Hz	230Hz	-23.2	-20.4	-17	-33.8	-20	-23.8	-28.8	-37.6	-28	-35.8	-38	-35.8	-42.2	-48.6	-43.2													
YA	f	233.08Hz	230Hz	-19.4	-13.6	-14.6	-21.2	-14.8	-15.8	-19.2	-20.6	-21.8	-24.6	-25.4	-21.8	-21	-20.4	-21	-34	-42.4	-36	-42.6	-49.8	-38.6	-39.4	-43.2	-40	-51.6	-47	-49.8	-48.4
YA	p	466.16Hz	470Hz	-15.4	-20.8	-20.6	-29.8	-47																							
YA	mf	466.16Hz	470Hz	-10.6	-12.8	-14.8	-28.2	-33.4	-30.2	-34.4	-40.8	-47																			
YA	f	466.16Hz	470Hz	-8	-9.6	-10.2	-10	-22	-17.2	-19.2	-28.4	-31.2	-30.4	-33	-34.4	-51.6	-44.6														
YA	p	932.33Hz	940Hz	-9.4	-23	-38	-45.2																								
YA	mf	932.33Hz	950Hz	-25.6	-13	-19.4	-31	-43	-43.4																						
YA	f	932.33Hz	940Hz	-18	-5.6	-9.6	-18.8	-26	-40.8	-49.8	-42.4	-46.4																			
YMG	p	233.08Hz	240Hz	-26.4	-22.6	-26.4	-27.6	-26.6	-24.4	-33.4	-33.8	-42.4	-44																		
YMG	mf	233.08Hz	240Hz	-24.4	-19.4	-20	-19.4	-21.6	-23.2	-25.2	-22.6	-35.4	-27	-40.4	-38.2	-41	-39.4	-46.8													
YMG	f	233.08Hz	240Hz	-22.4	-17	-21.6	-17.2	-19.4	-19.4	-23	-23	-33.4	-26.2	-45.4	-30.4	-32.8	-30.4	-33.4	-43.6												
YMG	p	466.16Hz	470Hz	-16	-15.2	-19.2	-25.8	-34.2	-34																						
YMG	mf	466.16Hz	470Hz	-9	-12.8	-10.6	-17	-14.4	-23	-28.4	-33.2	-35.4	-44	-43.8																	
YMG	f	466.16Hz	470Hz	-7.2	-8.8	-7	-18.2	-10.4	-14.2	-19	-24	-24.6	-28.8	-30.4	-33.8	-34.2	-41.2	-51.6	-43.4	-44.4											
YMG	p	932.33Hz	940Hz	-9.2	-15.6	-30.8	-38																								
YMG	mf	932.33Hz	930Hz	-3.6	-19.6	-19.4	-32.6	-36.8	-43.4																						
YMG	f	932.33Hz	930Hz	-1.6	-15.6	-17.2	-29.8	-27.2	-42.6	-46.2																					
SA	p	233.08Hz	230Hz	-29	-27.6	-23.4	-39.2	-40.2	-41.8	-40	-46.2																				
SA	mf	233.08Hz	230Hz	-22.6	-19.2	-13.6	-31.4	-33	-28.8	-28.4	-22.8	-39.8	-37	-32.6	-31.8	-40	-40.2														
SA	f	233.08Hz	230Hz	-21.2	-17.6	-12.4	-27	-22.2	-17.6	-20	-18.6	-34	-28.2	-30	-23.6	-30.2	-29.4	-28.4	-37.2												
SA	p	466.16Hz	470Hz	-15.8	-25.6	-22.8	-32.8	-38.4	-25.2																						
SA	mf	466.16Hz	470Hz	-14.2	-22.6	-15.8	-16.4	-19.8	-33.8	-37.8	-40.2	-37.6	-43.2																		
SA	f	466.16Hz	470Hz	-9.6	-25.8	-27.4	-11.2	-17.2	-13.4	-23.8	-27.6	-27.8	-28	-35.4	-33.2	-45															
SA	p	932.33Hz	930Hz	-25.6	-19.6	-24.8	-37.2	-45.8																							
SA	mf	932.33Hz	920Hz	-4.2	-11.6	-17.4	-32	-38.4	-44.4																						
SA	f	932.33Hz	920Hz	1.2	-7.6	-12.2	-24	-30.6	-31.6	-41.8	-42.6	-48.4																			

TOTAL PO	Ratio to 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0.10635	0.579561	0.606875	0.341271	0.25888	0.247229	0.096183	0.191911	0.040096	0.059306
0.225716	0.299528	0.394854	0.453354	0.508676	0.212049	0.176375	0.343904	0.1401	0.108752	0.113877	0.157194	0.143363	0.015012	0.071852	0.026088
0.348299	0.31481	0.465638	0.424666	0.169063	0.293797	0.261847	0.434558	0.131234	0.261847	0.080919	0.073799	0.143896	0.049894	0.079077	0.034518	0.042467	0.024437	0.013123	0.015778	0.013742
0.22145	0.784735	0.216134	0.568491	0.055555	0.105858
0.534526	0.648685	0.448778	0.459231	0.276714	0.235522	0.141916	0.077989	0.071126	0.050354	0.022492	0.023552
0.716608	0.518464	0.581726	0.201706	0.312405	0.211212	0.327129	0.242504	0.160221	0.101092	0.055554	0.047284	0.043124	0.01428	0.014612	0.013955	0.011607	0.011877	0.006679	0.008409
0.160262	0.716424	0.684179	0.136512
0.175103	0.453634	0.584394	0.571091	0.352132	0.043322	0.026104
0.446614	0.281882	0.436583	0.794451	0.302042	0.053711	0.060265	0.019058	0.023446	0.011222
0.195919	0.337228	0.198575	0.672858	0.378376	0.361346	0.125292	0.274109	0.157733	0.040544	0.018964	0.035312	0.026787	0.016517	0.02032
0.371612	0.199485	0.35474	0.741157	0.301933	0.35474	0.054943	0.162147	0.099979	0.028834	0.033106	0.134868	0.057532	0.031616	0.05247	0.034667	0.014451	0.0123
0.489358	0.21398	0.36339	0.550013	0.457481	0.36339	0.056282	0.245682	0.199698	0.020435	0.123133	0.151486	0.075923	0.089202	0.100086	0.081353	0.070855	0.017393	0.013816	0.012313	0.018637
0.366567	0.624952	0.734255	0.149916	0.193129	0.101355	0.016064
0.638498	0.623506	0.699585	0.023165	0.312493	0.101121	0.094371	0.041195	0.046221	0.018401	0.013959	0.01161
0.818069	0.585073	0.656463	0.134032	0.280034	0.137155	0.172667	0.189326	0.161142	0.086539	0.094888	0.03142	0.032901	0.006126	0.017267	0.014696	0.008457	0.015039	0.017267	0.011148	0.007892	0.00546
0.629224	0.935824	0.347692	0.056389	0.012624	0.002001
0.907499	0.937894	0.332778	0.089568	0.036488	0.015211	0.005274
1.314008	0.85389	0.502808	0.048018	0.112565	0.05265	0.017037	0.004182
0.105452	0.443552	0.686981	0.238202	0.273492	0.0885	0.180694	0.306863	0.238202	0.080713	0.043346
0.215809	0.260574	0.519913	0.394395	0.463373	0.343503	0.313279	0.184472	0.03515	0.099067	0.092455	0.059694	0.116394	0.051991	0.032804	0.014994	0.025464
0.343852	0.271412	0.621768	0.159819	0.175238	0.183497	0.349646	0.259196	0.205887	0.297597	0.24753	0.085828	0.156181	0.066624	0.145757	0.081965	0.052921	0.019662	0.01835	0.016735	0.01392
0.263954	0.888121	0.1943	0.154338	0.345519	0.169228	0.040595
0.628153	0.711106	0.240954	0.076196	0.52715	0.310409	0.230109	0.037319	0.015203	0.02642	0.019585	0.01667	0.012076	0.010763	0.005152
0.749459	0.668732	0.192865	0.359131	0.327531	0.421942	0.237275	0.160418	0.103574	0.068431	0.041234	0.032753	0.02164	0.020666	0.009666	0.008227	0.006386
0.460663	0.82531	0.557978	0.084453	0.019798
0.586494	0.577745	0.779357	0.230005	0.066334	0.035623	0.01555
1.168767	0.552423	0.762557	0.31065	0.120857	0.039109	0.024676	0.006796	0.005156	0.003822
0.152874	0.43218	0.544083	0.46309	0.061047	0.359472	0.26648	0.272687	0.146442	0.040333	0.036785
0.306583	0.205803	0.482449	0.553926	0.341548	0.210597	0.073022	0.450248	0.051695	0.149091	0.059354	0.078244	0.080067	0.03745	0.080067	0.014909
0.379069	0.224534	0.480044	0.480044	0.364151	0.219423	0.117837	0.437806	0.16266	0.105022	0.195561	0.109972	0.077854	0.04181	0.053862	0.045844	0.028926	0.008939	0.018676	0.01003	0.013529	0.014167
0.248329	0.841341	0.237122	0.441542	0.184065	0.084134
0.400715	0.78916	0.198228	0.475516	0.293201	0.140335	0.073649	0.01436	0.016872	0.013402	0.007892
0.788621	0.635524	0.210442	0.665475	0.094001	0.10307	0.247247	0.083778	0.123917	0.060692	0.032594	0.022549	0.009843	0.021534	0.008773	0.004821	0.004821	0.008001
0.220351	0.970254	0.031397	0.22745	0.021721	0.073601
0.569847	0.839927	0.517895	0.14264	0.076602	0.009644
0.746046	0.94893	0.143626	0.23836	0.143626	0.034454	0.016491
0.106376	0.391885	0.493353	0.606957	0.277433	0.290508	0.080013	0.236134	0.074672	0.060696	0.042969
0.309182	0.228974	0.256913	0.81243	0.147838	0.275287	0.069149	0.173694	0.141184	0.125831	0.087053	0.154805	0.122966	0.024535	0.067575	0.033097	0.015481
0.420574	0.23777	0.413198	0.520185	0.351688	0.227069	0.06254	0.442749	0.164497	0.119167	0.150023	0.197769	0.032821	0.045306	0.116455	0.078733	0.021685	0.020709	0.010868	0.013066
0.234167	0.742121	0.537619	0.389471	0.074212	0.055014
0.437955	0.658522	0.425178	0.586908	0.173209	0.101993	0.011983	0.016541	0.006146	0.010437	0.011983
0.679825	0.672362	0.613201	0.193911	0.22264	0.189497	0.068802	0.172824	0.070405	0.043411	0.03781	0.067236	0.025562	0.020305	0.005465	0.008084	0.009497	0.0079	0.008084	0.0079
0.509835	0.983039	0.18305	0.011287
0.536332	0.913201	0.398627	0.077726	0.019979	0.021906	0.015508
0.98172	0.907846	0.387269	0.018114	0.137408	0.062808	0.04989	0.007727	0.010423	0.005224
0.120559	0.150938	0.523358	0.587217	0.353834	0.134524	0.345779	0.294306	0.070599	0.043531	0.031535	0.033791
0.310559	0.255774	0.454837	0.642475	0.300508	0.168988	0.203168	0.255774	0.22277	0.044448	0.086667	0.134232	0.075484	0.040537	0.062785	0.023327	0.011963	0.010183	0.004548	0.011963
0.41986	0.217218	0.386274	0.612203	0.352286	0.146857	0.217218	0.321289	0.122151	0.097028	0.153778	0.202719	0.067127	0.071928	0.172542	0.040448	0.025521	0.010639	0.014351	0.012791	0.012791	0.0114	0.024372	0.011665	0.012215	0.012215	0.007532	0.007532	
0.222346	0.81841	0.419731	0.349117	0.167098	0.065009
0.563882	0.61491	0.560805	0.41573	0.30117	0.194452	0.05608	0.037052	0.023923	0.020836	0.014751	0.015806	0.006742
0.732238	0.55635	0.543686	0.40304	0.312859	0.237327	0.160453	0.192907	0.061003	0.068446	0.035921	0.061003	0.030574	0.02067	0.017193	0.005563	0.004319	0.010601	0.006242
0.403005	0.987847	0.152999	0.021612	0.016776
0.631267	0.870537	0.436302	0.208827	0.083136	0.033097	0.013797
0.608666	0.882309	0.266453	0.327809	0.197524	0.043214	0.04223	0.017604	0.007339	0.006693
0.130346	0.35884	0.581971	0.184035	0.113475	0.518682	0.319817	0.278549	0.142857	0.101135	0.058197	0.0412	0.034269
0.259279	0.237811	0.496857	0.221938	0.15712	0.474495	0.385684	0.299386	0.232398	0.172279	0.211949	0.121964	0.076954	0.01846	0.090413	0.034374
0.407415	0.24545	0.549494	0.239863	0.199509	0.380157	0.524762	0.11748	0.099991	0.204156	0.11748	0.048974	0.047859	0.01479	0.144532	0.102321	0.06309	0.02344	0.011219	0.014453	0.012881
0.247197	0.926739	0.344316	0.140268	0.04539	0.024376	0.01648
0.586646	0.648073	0.438151	0.591049	0.16658	0.060482	0.072715	0.032481	0.0258	0.013232	0.009809
0.838448	0.570853	0.189027	0.570853	0.336143	0.368573	0.130775	0.184724	0.077006	0.053275	0.050877	0.021703	0.01278	0.015365	0.005452	0.007525	0.007525	0.009474
0.171839	0.595495	0.68372	0.411982	0.073262	0.053074
0.602166	0.794848	0.575816	0.186331	0.03893	0.020431
0.696112	0.71998	0.612803	0.300138	0.116767	0.045428	0.014365	0.007894	0.0072
0.090224	0.441242	0.568429	0.393257	0.393257	0.28489	0.28489	0.09009	0.049508
0.230785	0.299773	0.464294	0.306756	0.404383	0.344186	0.360407	0.273397	0.29295	0.065583	0.067111	0.080685	0.103942	0.032121	0.022223	0.019355
0.386464	0.258756	0.419654	0.325755	0.400766	0.325755	0.429429	0.159548	0.252866	0.08972	0.085682	0.105412	0.241485	0.064997	0.129685	0.066511
0.372955	0.614247	0.434854	0.586601	0.268129	0.128334	0.033755
0.541531	0.53257	0.5086	0.474653	0.320905	0.351865	0.058395	0.034386	0.021696	0.010874	0.020719
0.735769	0.566576	0.333625	0.391975	0.541076	0.304269	0.059328	0.1031	0.051672	0.02775	0.083803	0.042979	0.039197	0.026501
0.307191	0.620285	0.780892	0.069597	0.024694
0.999478	0.912487	0.346918	0.19963	0.070832	0.045733	0.006169	0.003983
1.156208	0.94834	0.273504	0.103983	0.108884	0.04753	0.027988	0.00885	0.005584	0.005093
0.070941	0.690399	0.379402	0.406537	0.322924	0.250669	0.151043	0.137753	0.072294
0.242297	0.305952	0.412717	0.38517	0.237494	0.394142	0.176057	0.394142	0.35128	0.197539	0.045254	0.113672	0.071722	0.024869	0.075102	0.028553
0.382802	0.238246	0.336531	0.453968	0.222344	0.443635	0.249474	0.20278	0.453968	0.108899	0.094847	0.127946	0.067147	0.065618	0.130926	0.05585	0.02438	0.029993	0.017661	0.009932
0.158797	0.60139	0.477701	0.56125	0.30843
0.336214	0.713484	0.187665	0.271259	0.59345	0.159729	0.039209	0.041057	0.021547	0.021547	0.017115
0.628857	0.526561	0.204856	0.491415	0.618655	0.091506	0.123438	0.155399	0.041826	0.051457	0.049141	0.0356	0.021951	0.013227	0.007103
0.227857	0.66426	0.745312	0.052764	0.021996
0.40152	0.611353	0.787576	0.055756	0.046376	0.026687
0.646025	0.89074	0.36287	0.256892	0.07758	0.04895	0.020881	0.007939
0.110233	0.58572	0.534183	0.414658	0.19395	0.222685	0.261632	0.161321	0.046525	0.048718	0.040522	0.065719	0.040522	0.065719	0.038698
0.243307	0.284345	0.392505	0.580557	0.083916	0.411003	0.265366	0.149226	0.054181	0.163623	0.066657	0.051742	0.066657	0.031904	0.01527	0.028434
0.472586	0.226735	0.442099	0.394021	0.184297	0.385052	0.343178	0.232017	0.197478	0.171996	0.1246	0.113637	0.171996	0.18859	0.202078	0.18859	0.04222	0.016052	0.033537	0.015686	0.006847	0.024861	0.022674	0.014639	0.02116	0.005566	0.009452	0.006847	0.008045
0.216644	0.783886	0.420972	0.430778	0.149366	0.020618
0.419621	0.703303	0.545937	0.433653	0.092713	0.05095	0.073645	0.045409	0.021734	0.010645
0.710665	0.560189	0.465945	0.434845	0.444974	0.111772	0.194238	0.154289	0.053498	0.038756	0.042495	0.031502	0.026812	0.003701	0.008286
0.346433	0.978094	0.204353	0.03634	0.015863
0.25543	0.20546	0.876451	0.419496	0.110339	0.027716	0.026468
0.645591	0.195003	0.81291	0.512911	0.177845	0.077632	0.014127	0.005012	0.01175	0.007414
0.136399	0.350903	0.543485	0.350903	0.305624	0.342916	0.441761	0.156743	0.149688	0.055614	0.046258
0.244039	0.246911	0.439077	0.40977	0.439077	0.340832	0.283492	0.225185	0.303767	0.069589	0.183038	0.039133	0.050413	0.036521	0.043908	0.01873
0.300668	0.252298	0.4698	0.276639	0.459106	0.35638	0.35638	0.235458	0.235458	0.071107	0.162897	0.017861	0.100441	0.076193	0.100441	0.071107	0.021974
0.265988	0.595851	0.653338	0.412229	0.192814	0.073306	0.075013
0.573617	0.618555	0.399373	0.514492	0.246251	0.332184	0.123418	0.066279	0.03814	0.029606	0.011	0.011256
0.830351	0.5257	0.437258	0.537945	0.148162	0.363696	0.234822	0.135126	0.075987	0.070915	0.043726	0.03637	0.024589	0.023482	0.010489	0.003168	0.008142	0.007257
0.385693	0.898997	0.430287	0.074775	0.032641
0.678061	0.974387	0.15443	0.158027	0.034573	0.021317	0.009971
0.86108	0.965954	0.192733	0.160308	0.03758	0.050694	0.008609	0.005688
0.089294	0.397355	0.466851	0.757144	0.122794	0.109441	0.091029	0.11199	0.05485
0.268546	0.276046	0.408302	0.778003	0.100226	0.083365	0.135201	0.141573	0.269762	0.038105	0.052599	0.087293	0.095715	0.037238	0.03639
0.377792	0.230541	0.348938	0.634962	0.118235	0.20547	0.348938	0.264696	0.310991	0.052814	0.102979	0.083704	0.174883	0.081799	0.089691	0.100635	0.036538
0.194921	0.832034	0.269241	0.371656	0.117528	0.06168	0.28193
0.322641	0.604339	0.229763	0.502668	0.469117	0.317162	0.063282	0.039928	0.030289	0.040858	0.021443
0.51446	0.643649	0.099689	0.082918	0.535364	0.268317	0.415574	0.125501	0.081031	0.079186	0.077384	0.03301	0.042525	0.010931
0.131328	0.399614	0.797335	0.438168	0.105109	0.039052
0.684384	0.900949	0.384326	0.197106	0.036703	0.017567	0.008804
1.248188	0.919857	0.33398	0.196662	0.05055	0.023644	0.021073	0.006512	0.005939	0.003046

Player 4

Backbore	Dynamic	Note	Actual Fre	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
SC	p	233.08Hz	230Hz	-31.2	-30.6	-30	-32.2	-33	-29.8	-38.2	-39.4	-48.4																					
SC	mf	233.08Hz	230Hz	-29.8	-28.8	-23.6	-33.2	-27.2	-17.2	-35	-24.6	-38.4	-44.4	-35.6	-46.4	-43	-43.4																
SC	f	233.08Hz	230Hz	-24.8	-25.2	-12.8	-16	-10	-10.2	-20.6	-14.8	-24.8	-22.2	-19.8	-21.2	-24.6	-23.2	-29.6	-23.6	-22.2	-25.8	-36.6	-37.4	-36	-41	-38.4	-39.4	-43.8	-38.4	-42.8	-49.4	-48.4	-44
SC	p	466.16Hz	480Hz	-17.2	-17.6	-17	-24																										
SC	mf	466.16Hz	470Hz	-19	-29.4	-9.6	-16.4	-38.6	-29.2	-26	-33.6	-38	-40.4	-49																			
SC	f	466.16Hz	470Hz	-19.6	-10.6	-10.6	-4.8	-24.4	-20.2	-17.6	-18.4	-22.4	-27.2	-37	-42	-32.2	-42.4	-44.4	-40.8	-48	-52.8												
SC	p	932.33Hz	950Hz	-11.4	-17.2	-42.4	-47																										
SC	mf	932.33Hz	940Hz	-18.6	-4.4	-19.8	-30	-35.4	-45																								
SC	f	932.33Hz	930Hz	-9	-3.8	-17.4	-23.2	-29.8	-36.8																								
B117	p	233.08Hz	240Hz	-32.6	-29.4	-34.6	-38.8	-38.4	-37.6	-44.8																							
B117	mf	233.08Hz	230Hz	-27.6	-24.2	-25.2	-22.4	-29.4	-22.2	-30.8	-43.8	-43.2	-44.6	-46.8																			
B117	f	233.08Hz	230Hz	-23	-20.8	-8.6	-18.8	-17	-15.8	-19	-18.4	-23	-20.2	-25	-31	-33	-28	-29.6	-32	-37.4	-36.8	-42.2	-43	-41.8	-42	-47	-48.6	-43.4	-44.6	-47.8			
B117	p	466.16Hz	470Hz	-18.4	-23.2	-22.6	-44.6																										
B117	mf	466.16Hz	470Hz	-16.4	-11.2	-8.6	-23	-26.6	-34.8	-34.6	-42.4	-42.6	-45.4																				
B117	f	466.16Hz	470Hz	-16.8	-10.6	-12.6	-10.2	-19.4	-22	-28.2	-25.2	-34.2	-36	-40																			
B117	p	932.33Hz	950Hz	-9.8	-20	-39.6																											
B117	mf	932.33Hz	940Hz	-8.2	-21.2	-13	-27.8	-32.6	-46																								
B117	f	932.33Hz	940Hz	-2.4	-12.4	-14.2	-17.8	-21.4	-35	-47	-36.4	-44																					
SX	p	233.08Hz	240Hz	-31.8	-33.4	-29.4	-39.2	-38.8	-45.8																								
SX	mf	233.08Hz	240Hz	-27	-20.6	-22.8	-19.8	-21.4	-19.6	-31.2	-34.8	-36	-43.8	-39.6	-41.8																		
SX	f	233.08Hz	240Hz	-23.8	-18.6	-10.2	-19.4	-10	-12.8	-27.8	-24	-31.8	-26.6	-23.6	-30.2	-26.2	-21.4	-30	-35.2	-31	-43.4	-44	-40.8	-41	-44.6	-48.4	-45.8	-47					
SX	p	466.16Hz	470Hz	-16.4	-26	-27.4	-42.8																										
SX	mf	466.16Hz	470Hz	-17.4	-16.4	-14.8	-13.8	-30.4	-28.6	-32.2	-43	-46.8	-45.8																				
SX	f	466.16Hz	470Hz	-12.8	-19.8	-10.2	-6.6	-16.6	-25	-18.6	-21.2	-24.4	-30	-32.4	-38.4	-36	-44.6	-46.4	-43.4														
SX	p	932.33Hz	940Hz	-18.8	-25	-46.4																											
SX	mf	932.33Hz	940Hz	-6.2	-15.2	-18.6	-22.2	-73.4																									
SX	f	932.33Hz	940Hz	-7.6	-6.2	-15.2	-20.6	-23	-32.6	-41.4	-45.2	-41.6																					
G7C	p	233.08Hz	240Hz	-32.4	-34.8	-43.4	-35.8	-43.2	-44.8																								
G7C	mf	233.08Hz	230Hz	-30	-31	-18.6	-23.8	-25.4	-20.8	-36.4	-35.2	-46.2	-47.8																				
G7C	f	233.08Hz	230Hz	-26.8	-29	-12.6	-22.8	-22	-14.2	-19.8	-26.6	-19.2	-32.8	-34.8	-22.6	-22.4	-28.4	-35	-30.8	-30.8	-40.8	-39.6	-46	-44	-47	-44.6	-44.6	-49.8	-47.4	-48.6			
G7C	p	466.16Hz	470Hz	-19.2	-16.6	-17.2	-41.2	-44.8	-47.8																								
G7C	mf	466.16Hz	470Hz	-17.2	-18.2	-15.2	-12.2	-22	-33.2	-33.6	-40.2	-35.2																					
G7C	f	466.16Hz	470Hz	-19.8	-12.2	-7	-12.6	-19.4	-20.4	-24.4	-31	-27.4	-38	-47.4	-39.4	-46																	
G7C	p	932.33Hz	930Hz	-22.4	-22	-44.8	-47																										
G7C	mf	932.33Hz	930Hz	-10	-10.4	-17.2	-25.6	-40	-42.6																								
G7C	f	932.33Hz	940Hz	-3.6	-12	-10.4	-18.8	-29.8	-30.3	-44.4	-44	-44.6	-49																				
YC	p	233.08Hz	240Hz	-34.6	-38.4	-35.6	-45.4																										
YC	mf	233.08Hz	240Hz	-29.8	-23.6	-28.6	-24.8	-33	-29.4	-38.4	-47																						
YC	f	233.08Hz	230Hz	-27.4	-25.6	-18.8	-20.4	-30.2	-18.8	-39.2	-24.8	-40.2	-40.2	-42.4	-38	-42.4	-47																
YC	p	466.16Hz	470Hz	-18.6	-25.4	-31	-42.8																										
YC	mf	466.16Hz	470Hz	-17.4	-21.4	-17.6	-24.6	-32.6	-38.2																								
YC	f	466.16Hz	470Hz	-16.2	-11.2	-8.2	-17.4	-27.4	-24	-26.4	-40.6	-33.2	-49.4																				
YC	p	932.33Hz	940Hz	-13.2	-27	-44																											
YC	mf	932.33Hz	930Hz	-9.6	-12.2	-31.2	-41.6																										
YC	f	932.33Hz	930Hz	-2	-8	-15.8	-22.2	-34.8	-36.4	-44																							
B24	p	233.08Hz	240Hz	-33.8	-31.8	-33.2	-44.4	-48.4	-44																								
B24	mf	233.08Hz	240Hz	-30.6	-28.4	-21.8	-27.8	-29	-24.4	-35.2	-44	-46.4	-45.6	-44																			
B24	f	233.08Hz	230Hz	-27.6	-24.6	-13	-19	-15.2	-13.4	-23.2	-26.2	-21.2	-34.6	-39.4	-28.6	-30	-32.8	-42.2	-39.8	-47													
B24	p	466.16Hz	480Hz	-24	-35.8	-38																											
B24	mf	466.16Hz	470Hz	-20.2	-23.2	-33.6	-38.8	-48.6																									
B24	f	466.16Hz	470Hz	-15.4	-19.6	-16.4	-26	-28.6	-36.4	-36.4																							
B24	p	932.33Hz	940Hz	-12.2	-32.8	-48.4																											
B24	mf	932.33Hz	930Hz	-9.6	-12	-21	-32.4	-41.8	-49.4																								
B24	f	932.33Hz	920Hz	-7.2	-13.4	-11	-21.2	-28.6	-36.4	-39.2	-45.6	-46.8																					
B7	p	233.08Hz	240Hz	-36.8	-39.4	-34.4	-38.8	-42.2																									
B7	mf	233.08Hz	230Hz	-30.6	-28	-29.4	-28	-27.6	-29	-39																							
B7	f	233.08Hz	230Hz	-29.4	-25	-18.6	-18.8	-18.6	-15.8	-32	-31.8	-30.8	-32.8	-40.4	-33.2	-40.6	-47.8																
B7	p	466.16Hz	470Hz	-18	-32.8	-23.8	-39.2																										
B7	mf	466.16Hz	470Hz	-17.8	-14.6	-15.8	-25.6	-43	-40	-45.8	-46.8																						
B7	f	466.16Hz	460Hz	-15.8	-9.6	-6.8	-14	-16	-21.6	-30.8	-32.8	-37.8	-40	-44																			
B7	p	932.33Hz	930Hz	-15	-20.8	-48.4																											
B7	mf	932.33Hz	930Hz	-11	-18.6	-22.8	-30.6	-46.8																									
B7	f	932.33Hz	930Hz	-7.4	-20.8	-20	-27.8	-34.8																									
B76	p	233.08Hz	230Hz	-34.8	-36	-40.4	-43.8	-46	-47.4																								
B76	mf	233.08Hz	230Hz	-31.6	-30.8	-24.2	-28	-26.4	-23.8	-33.8	-40.6	-40.6	-47	-48.4	-47.4	-44.2																	
B76	f	233.08Hz	230Hz	-25	-23.2	-18.4	-27.2	-25.6	-19.4	-22.8	-32.8	-26.8	-35.6	-30.8	-40	-35.6	-38.8																
B76	p	466.16Hz	470Hz	-18.6	-15	-27.2	-42	-40	-42.2	-48.6																							
B76	mf	466.16Hz	470Hz	-16.4	-11.4	-15.6	-33.6	-40.4	-38.6	-41.8																							
B76	f	466.16Hz	470Hz	-12	-7.4	-6.4	-21	-24.4	-25.8	-26.6	-34.6	-48.6	-37.4	-44																			
B76	p	932.33Hz	940Hz	-10.8	-23.2	-42.2																											
B76	mf	932.33Hz	930Hz	-6.6	-12.2	-28.2	-38.4																										
B76	f	932.33Hz	920Hz	-3	-4.6	-9.4	-15.2	-30.8	-29.8	-37.4	-41.8																						
B10	p	233.08Hz	230Hz	-30.8	-28.4	-23.2	-31.6	-25.2	-27.2	-42	-36.8	-43.4	-46.2																				
B10	mf	233.08Hz	230Hz	-24.6	-21.6	-16	-24.4	-12	-16.2	-21.8	-14.8	-28.6	-26.4	-29.2	-31.2	-31.8	-37.4	-47.8	-44	-41.4	-49.8	-38.8	-40.4	-45.6									
B10	f	233.08Hz	230Hz	-25.2	-21.6	-15.8	-25	-12	-16.4	-21.8	-15.2	-28.8	-27.6	-29.4	-32.4	-32	-37.4	-44.4	-45.8	-39	-48.4	-40.2	-40.2	-45.4									
B10	p	466.16Hz	470Hz	-18.2	-25.2	-28.6	-43.8																										
B10	mf	466.16Hz	470Hz	-18.4	-16.6	-20.8	-27.6	-34	-41	-43.8																							
B10	f	466.16Hz	470Hz	-14.8	-12.4	-8.2	-15.8	-30.8	-20.6	-18.2	-31.2	-32.4	-37.2	-35.2	-42.8	-37	-57																
B10	p	932.33Hz	930Hz	-13	-17.6	-42.2																											
B10	mf	932.33Hz	920Hz	-8.8	-14.4	-30.6	-43.4																										
B10	f	932.33Hz	920Hz	3.8	-5.2	-15.2	-20.6	-30	-40.6																								
YA	p	233.08Hz	240Hz	-27	-23.2	-28	-24	-24.4	-25.4	-39.8																							
YA	mf	233.08Hz	240Hz	-21.8	-16.2	-17.8	-14.2	-19.6	-12.4	-21.4	-24.6	-31.6	-34.8	-29.4	-38.6	-30.6	-37.4	-48.4															
YA	f	233.08Hz	240Hz	-21.4	-14.8	-27.6	-16.6	-18.6	-14.2	-20	-28.6	-27.2	-33.8	-28.2	-38.6	-39	-38.4																
YA	p	466.16Hz	480Hz	-22.2	-27.8	-34.8																											
YA	mf	466.16Hz	470Hz	-11.8	-19.4	-16	-25.8	-35.4	-44.4	-43.4																							
YA	f	466.16Hz	470Hz	-10	-8.8	-5	-15.4	-27.6	-29.4	-25.8	-34.4	-40.8	-43																				
YA	p	932.33Hz	940Hz	-22.2	-26.4																												
YA	mf	932.33Hz	930Hz	-17	-20.4	-38.8																											
YA	f	932.33Hz	930Hz	-9.2	-12.4	-12.6	-25.6	-34.4	-38.4																								
YMG	p	233.08Hz	240Hz	-31.6	-34	-31.8	-34.8	-36.6	-46																								
YMG	mf	233.08Hz	230Hz	-29.4	-26.4	-18.8	-30.4	-28	-29	-31.6	-34.8	-39.8	-43.4	-64	-45.8																		
YMG	f	233.08Hz	230Hz	-26.4	-23.8	-20	-20.4	-14.6	-14.8	-27.2	-18.4	-32.6	-24.8	-33.8	-29.2	-29	-35.6	-37.8	-47.8	-42.4													
YMG	p	466.16Hz	470Hz	-18.2	-26.2	-20	-41.6																										
YMG	mf	466.16Hz	470Hz	-19	-14.8	-8	-22	-31.8	-19.8	-31.4	-44	-45	-40.6																				
YMG	f	466.16Hz	460Hz	-21.2	-14	-10.6	-16.4	-19.2	-15.2	-23.4	-31.2	-34.6	-45.4	-41	-42.4	-41.4																	
YMG	p	932.33Hz	940Hz	-17	-30	-43.4																											
YMG	mf	932.33Hz	930Hz	-9.6	-9.4	-18.2	-28	-43.2	-46.8																								
YMG	f	932.33Hz	930Hz	-6.6	-7.6	-14.6	-18.4	-33.4	-29.4	-37.8	-42.6	-46	-47																				
SA	p	233.08Hz	230Hz	-38.4	-35	-38.4	-38.8	-40.8	-47.8	-47.4	-45.8																						
SA	mf	233.08Hz	230Hz	-28.6	-27.2	-30	-30.4	-29.2	-32.4	-37.4	-33.2	-40.4	-42.6	-49	-46																		
SA	f	233.08Hz	230Hz	-26.2	-28	-21.4	-29.2	-32.6	-32	-24.2	-24.6	-34.6	-26.4	-31.8	-25.4	-33.8	-47.8	-46.2	-41.2	-47.8	-44												
SA	p	466.16Hz	460Hz	-27.2	-27.6	-30.8	-44.4																										
SA	mf	466.16Hz	460Hz	-18.6	-33	-16.6	-26.2	-39.8	-42.8	-46																							
SA	f	466.16Hz	460Hz	-14.8	-18.8	-20.8	-25.6	-24.2	-24.6	-36.6	-43.2	-49																					
SA	p	932.33Hz	920Hz	-13.6	-30.4	-38.6	-48.6																										
SA	mf	932.33Hz	920Hz	-11.4	-25	-22.2	-39.4																										
SA	f	932.33Hz	920Hz	-12.2	-17.6	-11.6	-18.6	-36.2	-39.4	-38.8	-46																						

TOTAL PO	Ratio to 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0.071141	0.387151	0.414839	0.444508	0.345048	0.314688	0.454863	0.172934	0.150619	0.053442																					
0.180355	0.179421	0.201313	0.36633	0.121303	0.242032	0.765172	0.098599	0.326492	0.066661	0.03341	0.092018	0.026538	0.039253	0.037486																
0.610175	0.094307	0.090063	0.375445	0.259744	0.518258	0.506461	0.152949	0.298226	0.094307	0.127217	0.167705	0.14274	0.096504	0.113382	0.054268	0.108279	0.127217	0.084052	0.024241	0.022108	0.025974	0.014606	0.019704	0.017561	0.010581	0.019704	0.011873	0.005553	0.006231	0.010341
0.245696	0.561827	0.536541	0.574914	0.256805																										
0.388188	0.288891	0.087244	0.857579	0.389704	0.030251	0.089276	0.129043	0.053794	0.032414	0.024589	0.009136																			
0.755	0.138693	0.390889	0.390889	0.762177	0.079809	0.129435	0.174604	0.15924	0.100474	0.057817	0.018709	0.010521	0.032513	0.010047	0.007981	0.01208	0.005273	0.003034												
0.302615	0.889426	0.456152	0.025067	0.014761																										
0.623437	0.188455	0.966513	0.164137	0.050723	0.02724	0.00902																								
0.752995	0.471203	0.857448	0.179146	0.091877	0.042974	0.019196																								
0.050276	0.46627	0.673966	0.370372	0.228369	0.239132	0.262203	0.114456																							
0.149882	0.278131	0.411386	0.366649	0.506116	0.226074	0.517905	0.19242	0.043077	0.046158	0.039287	0.030496																			
0.510825	0.138589	0.178537	0.727323	0.224764	0.276521	0.317488	0.219648	0.235357	0.138589	0.191306	0.110085	0.055173	0.043826	0.077934	0.064823	0.049173	0.026408	0.028296	0.015196	0.013859	0.015912	0.01555	0.008744	0.007273	0.013235	0.011527	0.007975			
0.157387	0.763889	0.439572	0.47101	0.037414																										
0.494797	0.305896	0.556639	0.750885	0.143078	0.094531	0.036777	0.037633	0.015331	0.014982	0.010854																				
0.530564	0.272434	0.55624	0.441837	0.582454	0.201958	0.149714	0.073327	0.103577	0.03675	0.029872																				
0.338855	0.954963	0.295112	0.030902																											
0.459668	0.846361	0.189477	0.48703	0.088625	0.050998	0.010903																								
0.833935	0.909636	0.287652	0.233812	0.154478	0.102063	0.021324	0.005356	0.01815	0.007566																					
0.050441	0.509585	0.423854	0.671764	0.217379	0.227623	0.101676																								
0.214923	0.207835	0.434228	0.337068	0.476122	0.396021	0.487212	0.12815	0.084668	0.073743	0.030041	0.048721	0.03782																		
0.550751	0.117232	0.213327	0.561106	0.194556	0.574176	0.415954	0.073968	0.114563	0.046671	0.084927	0.119962	0.056111	0.088929	0.154541	0.057418	0.031553	0.051173	0.012276	0.011456	0.016559	0.016182	0.010692	0.006903	0.009312	0.00811					
0.165205	0.916171	0.303373	0.258212	0.043851																										
0.344816	0.391212	0.438948	0.527731	0.592124	0.087582	0.107749	0.071189	0.020531	0.013256	0.014873																				
0.655257	0.349613	0.156167	0.471616	0.713819	0.225729	0.08582	0.179303	0.132919	0.091958	0.04826	0.036609	0.018348	0.024187	0.008986	0.007304	0.010318														
0.127937	0.89744	0.439547	0.037412																											
0.538435	0.909634	0.32275	0.218206	0.144167	0.000397																									
0.676983	0.615775	0.723473	0.256698	0.137855	0.104574	0.034628	0.012573	0.008118	0.012286																					
0.036004	0.66627	0.505417	0.18778	0.450454	0.192154	0.159827																								
0.177596	0.178061	0.158697	0.661558	0.363553	0.30239	0.513532	0.085225	0.097852	0.027578	0.022939																				
0.385332	0.118622	0.09208	0.608365	0.188003	0.206141	0.506016	0.265561	0.121385	0.284554	0.059452	0.047224	0.192382	0.196863	0.098665	0.046149	0.074845	0.074845	0.023668	0.027175	0.013007	0.016374	0.011592	0.015281	0.015281	0.008398	0.01107	0.009642			
0.230392	0.475919	0.641997	0.599146	0.037804	0.024977	0.017682																								
0.363687	0.379553	0.338277	0.477829	0.674952	0.21841	0.060155	0.057448	0.02687	0.047783																					
0.593608	0.172385	0.413523	0.752489	0.394912	0.18051	0.160879	0.101508	0.047479	0.071862	0.021208	0.007186	0.018051	0.008443																	
0.110077	0.689131	0.721609	0.052276	0.040579																										
0.461698	0.684924	0.654097	0.29898	0.113669	0.021659	0.016056																								
0.778524	0.848649	0.322647	0.387908	0.147478	0.041565	0.03924	0.00774	0.008105	0.007564	0.004558																				
0.028205	0.660188	0.426253	0.588394	0.1904																										
0.109169	0.296416	0.605204	0.340331	0.52711	0.20507	0.310386	0.110129	0.040917																						
0.211968	0.201248	0.247589	0.541665	0.450537	0.145791	0.541665	0.051729	0.271476	0.046103	0.046103	0.035787	0.059392	0.035787	0.021073																
0.132419	0.88726	0.405556	0.212839	0.054708																										
0.216766	0.622312	0.392652	0.608146	0.271649	0.108145	0.056756																								
0.527322	0.293714	0.522305	0.737776	0.255814	0.080896	0.119653	0.090766	0.017698	0.041488	0.006426																				
0.223379	0.979395	0.199967	0.028246																											
0.413197	0.801389	0.594078	0.066657	0.02013																										
0.906849	0.875921	0.439001	0.17884	0.085598	0.020066	0.01669	0.006958																							
0.04058	0.503134	0.633409	0.539118	0.148486	0.093688	0.155483																								
0.126114	0.234012	0.301465	0.644521	0.323026	0.281344	0.47779	0.137796	0.050031	0.037952	0.041614	0.050031																			
0.402671	0.103526	0.146234	0.555968	0.278644	0.431568	0.530945	0.17181	0.121632	0.216296	0.046243	0.02661	0.092268	0.078533	0.056892	0.019277	0.025413	0.011093													
0.066352	0.950924	0.244425	0.189734																											
0.122141	0.800091	0.566421	0.171056	0.094002	0.030419																									
0.258968	0.655775	0.404347	0.58446	0.193533	0.143468	0.058446	0.058446																							
0.246567	0.995555	0.092911	0.015419																											
0.42584	0.777595	0.589866	0.209292	0.056332	0.019088	0.007957																								
0.570133	0.765639	0.374994	0.494338	0.152765	0.065166	0.026548	0.019232	0.009205	0.008017																					
0.029646	0.487561	0.361434	0.642731	0.387284	0.261836																									
0.091168	0.323713	0.436676	0.371672	0.436676	0.457256	0.389188	0.123072																							
0.273359	0.123956	0.205715	0.4298	0.420017	0.4298	0.59329	0.09189	0.09403	0.105503	0.083804	0.034935	0.080033	0.03414	0.014903																
0.143745	0.875804	0.15937	0.449166	0.076279																										
0.283767	0.453981	0.656203	0.571529	0.184943	0.024948	0.03524	0.018073	0.016108																						
0.646831	0.250732	0.511928	0.706658	0.308467	0.245024	0.128591	0.044587	0.035417	0.019916	0.01546	0.009755																			
0.199887	0.889642	0.456263	0.01902																											
0.315241	0.894042	0.372699	0.229804	0.093618	0.0145																									
0.449754	0.948473	0.20278	0.222344	0.090579	0.04046																									
0.027541	0.660717	0.57546	0.346749	0.234431	0.181977	0.154887																								
0.11854	0.221889	0.243297	0.52016	0.335843	0.403772	0.544674	0.172241	0.078729	0.078729	0.037682	0.032073	0.035986	0.052016																	
0.219137	0.256617	0.315708	0.548637	0.199198	0.239489	0.488973	0.330587	0.104541	0.208586	0.075733	0.131609	0.045634	0.075733	0.052394																
0.218104	0.538688	0.815337	0.200141	0.03642	0.04585	0.035591	0.017035																							
0.351605	0.430472	0.765499	0.472003	0.059422	0.027161	0.033415	0.023118																							
0.700805	0.358429	0.6087	0.682972	0.127175	0.085981	0.073182	0.066743	0.026571	0.005302	0.019249	0.009003																			
0.296687	0.97208	0.233186	0.026164																											
0.529802	0.882849	0.463326	0.073432	0.022693																										
0.99753	0.709699	0.590302	0.339683	0.17421	0.028912	0.032439	0.013523	0.008148																						
0.114116	0.252728	0.33316	0.606252	0.230491	0.481563	0.382519	0.069607	0.126664	0.059245	0.042919																				
0.415697	0.141652	0.200089	0.381262	0.144952	0.604259	0.372583	0.195534	0.437747	0.089376	0.115139	0.083411	0.066256	0.061833	0.032451	0.0098	0.015178	0.020475	0.007784	0.02762	0.022973	0.012625									
0.410158	0.133983	0.202791	0.395411	0.137104	0.612419	0.369019	0.198175	0.423691	0.088522	0.101636	0.082613	0.058486	0.061242	0.032889	0.014691	0.012504	0.027356	0.009269	0.023826	0.023826	0.013093									
0.13992	0.879265	0.392753	0.265534	0.046144																										
0.216579	0.555115	0.68294	0.421097	0.192479	0.092126	0.041151	0.029811																							
0.543207	0.334992	0.441606	0.716201	0.298562	0.053093	0.171805	0.226483	0.050703	0.044161	0.025412	0.031992	0.013336	0.026004	0.0026																
0.259917	0.861321	0.507183	0.029865																											
0.411157	0.883064	0.463439	0.071778	0.016443																										
1.655544	0.935534	0.33194	0.104969	0.056371	0.019101	0.005637																								
0.137721	0.32434	0.502343	0.289068	0.458142	0.437522	0.389942	0.074302																							
0.409643	0.198424	0.37809	0.314481	0.475987	0.25562	0.585592	0.207776	0.143746	0.064209	0.044422	0.082717	0.028681	0.072044	0.03293	0.009281															
0.36252	0.234784	0.501959	0.114992	0.408008	0.324092	0.537859	0.275847	0.102487	0.120412	0.056321	0.107317	0.032409	0.030951	0.033164																
0.089534	0.866987	0.455001	0.203242																											
0.32507	0.790721	0.329627	0.487555	0.15777	0.052242	0.018536	0.020798																							
0.763483	0.414191	0.475555	0.736547	0.222434	0.054601	0.044381	0.067174	0.024957	0.011945	0.009273																				
0.091195	0.851198	0.524845																												
0.170893	0.826561	0.558824	0.067185																											
0.485784	0.713767	0.493806	0.482566	0.108033	0.039224	0.024749																								
0.048225	0.545415	0.41374	0.533	0.377335	0.306709	0.103927																								
0.146893	0.230674	0.325836	0.781627	0.205589	0.271019	0.241546	0.17906	0.123879	0.069663	0.046026	0.004295	0.034914																		
0.342024	0.13994	0.188774	0.292377	0.279218	0.544431	0.532038	0.127627	0.351514	0.06854	0.168245	0.059696	0.101378	0.103739	0.048522	0.037665	0.011911	0.022179													
0.166143	0.850192	0.190334	0.040693																											
0.471716	0.701971	0.718322	0.260807	0.084395	0.014666	0.00969																								
0.453363	1.031701	0.919504	0.410727	0.265188	0.047158	0.07474	0.028415	0.016351	0.011055	0.009853	0.019659	0.016732	0.018774																	
0.144908	0.974782	0.218227	0.046656																											
0.491175	0.674162	0.689865	0.250475	0.081052	0.014085	0.009306																								
0.666	0.702305	0.62593	0.279593	0.18052	0.032102	0.050878	0.019343	0.011131	0.007525	0.006707																				
0.029689	0.404958	0.598977	0.404958	0.386732	0.307192	0.137218	0.143685	0.172747																						
0.088431	0.420142	0.493624	0.357599	0.341504	0.392099	0.271266	0.152544	0.247398	0.107993	0.083829	0.040123	0.056676																		
0.166289	0.294534	0.239406	0.511841	0.208514	0.140973	0.151055	0.370796	0.354108	0.111979	0.28783	0.154574	0.32295	0.122782	0.024498	0.029453	0.052376	0.024498	0.037943												
0.067166	0.649902	0.620651	0.429386	0.089711																										
0.196885	0.596742	0.113707	0.751254	0.248764	0.051974	0.036795	0.025456																							
0.254786	0.714207	0.450634	0.357951	0.20598	0.242005	0.231113	0.058053	0.027153	0.013926																					
0.21146	0.988033	0.142814	0.055561	0.01757																										
0.285913	0.941382	0.196683	0.271498	0.037477																										
0.401413	0.611517	0.328404	0.655252	0.29269	0.038584	0.026694	0.028603	0.012486																						

Player 5

Backbore	Dynamic	Note	Actual Fre	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
SC	p	233.08Hz	230Hz	-41	-31.4	-37	-27	-31.4	-34.6	-33.2
SC	mf	233.08Hz	240Hz	-40.2	-23.6	-23	-15.6	-32.4	-24.8	-23.8	-41	-38	-50	-42.6	-45	-43.8	-45.4
SC	f	233.08Hz	240Hz	-30	-23.4	-10.8	-10.8	-20.4	-19.8	-20	-25	-21	-25.4	-30	-27	-31.4	-33.8	-27.2	-33	-39.4	-40.2	-44.8
SC	p	466.16Hz	480Hz	-20	-15.4	-29	-42.2	-42
SC	mf	466.16Hz	480Hz	-17.8	-5.4	-12.6	-26.4	-28.4	-22	-28	-36.8	-43	-44.6
SC	f	466.16Hz	480Hz	-13	-1.2	-12	-16.4	-15.4	-13.8	-18	-24.8	-39.8	-34.4	-32.4	-38.2	-39	-48.6	-44.8
SC	p	932.33Hz	960Hz	-1.2	-21.2	-20.2	-34	-43.4
SC	mf	932.33Hz	950Hz	-0.4	-10	-19.8	-28.4	-42.6	-43
SC	f	932.33Hz	950Hz	4.6	-8.8	-3	-9	-18.6	-19.6	-25.2	-29.2	-45.8	-35.4	-38	-39.6	-45.2	-47
B117	p	233.08Hz	240Hz	-41.6	-23.2	-29	-27	-30.4	-35.4	-35.8
B117	mf	233.08Hz	240Hz	-39.4	-15.6	-19.8	-14.2	-20.2	-17.6	-22.2	-26.6	-31	-34.4	-27.4	-26.4	-32.8	-33.2	-33.6	-44.6	-46	-44.8
B117	f	233.08Hz	250Hz	-35.6	-11.6	-14.4	-11.2	-9.8	-13.6	-14.8	-25.6	-23.2	-29	-18.8	-15.2	-24	-20.2	-18	-25.2	-28.6	-23.8	-35.2	-31.4	-34	-44	-34	-37.8	-43.2	-39.8	-36.2	-48	-51	-43.4
B117	p	466.16Hz	470Hz	-18	-18.6	-25	-48.4	-47.4	-43.2
B117	mf	466.16Hz	470Hz	-6.2	-5.2	-16.4	-19	-15.2	-19	-23	-35.6	-37.6	-48	-40.4	-44.4
B117	f	466.16Hz	470Hz	-3.2	0.2	-14	-9.2	-11.2	-14.2	-14.6	-20.8	-22.2	-29.8	-21.8	-33.8	-34.6	-34.2	-44.2	-36	-38	-38.8	-40.8
B117	p	932.33Hz	950Hz	-3.8	-20.6	-17.4	-37.8	-41.2
B117	mf	932.33Hz	950Hz	2.2	-5	-7	-18.4	-29.6	-32	-32.2	-37.2	-46
B117	f	932.33Hz	950Hz	3.6	-4.6	0.8	-3.2	-10	-17.6	-19.6	-18.4	-21.8	-25	-25.4	-29.6	-32	-32.6	-38	-48.4
SX	p	233.08Hz	240Hz	-41.6	-37.8	-25.4	-28	-39	-33	-32.6	-44.8	-41	-45.8
SX	mf	233.08Hz	240Hz	-36.4	-27.8	-20.2	-22	-18.2	-29.8	-29.8	-46.2	-23.4	-32.6	-28.2	-33	-38.2	-41	-43.4
SX	f	233.08Hz	240Hz	-31.4	-17	-13	-14.2	-14.2	-21.2	-20.2	-25.8	-20.6	-25.6	-27	-20.6	-21.6	-39	-24.6	-28.6	-43.4	-39	-45	-42.8	-47	-43.2	-48	-45.8
SX	p	466.16Hz	470Hz	-15	-8	-18.8	-30	-27.8	-32.6	-44.4
SX	mf	466.16Hz	480Hz	-5.2	-2.8	-10.6	-16.8	-9	-19.4	-21	-22	-33.8	-34.2	-35.6	-42.4	-47.4
SX	f	466.16Hz	480Hz	-5.6	-2	-7	-11.8	-19	-11.2	-12.8	-20	-27.8	-25.8	-31.6	-32.2	-37	-41.4	-41.6	-46.2	-44.2	-49.4	-45	-49.8
SX	p	932.33Hz	950Hz	-6.4	-16.8	-20	-33.8	-43.4	-46.2
SX	mf	932.33Hz	950Hz	1.4	-10.6	-13	-18.4	-27.8	-36	-42.4	-38.8	-41.8	-44
SX	f	932.33Hz	950Hz	0.8	-4.2	-3.6	-8.8	-12.8	-18.8	-25.4	-24.8	-26.4	-30	-32.2	-35.8	-42.4	-39.8	-42.6	-47.4
G7C	p	233.08Hz	240Hz	-38.8	-25	-24.4	-25.4	-27	-35.4	-45.8
G7C	mf	233.08Hz	240Hz	-33.2	-18.6	-14.6	-16.6	-19.2	-19.8	-30.2	-29	-29.2	-30.2	-29.8	-32.8	-31	-33.8	-36.2	-44	-49.8	-48
G7C	f	233.08Hz	240Hz	-30.2	-13.2	-9.6	-9	-16	-18.2	-14.2	-29	-15.8	-22	-24	-21	-21	-21.6	-24.2	-26.8	-27.4	-40.2	-39.6	-37.2	-42.2	-41.8	-38.2	-42	-46.2
G7C	p	466.16Hz	470Hz	-20.6	-16	-21.2	-40	-40.2
G7C	mf	466.16Hz	480Hz	-11.2	-11.8	-7.2	-20.6	-25.6	-25.4	-24.8	-38.8	-37.8	-49.4
G7C	f	466.16Hz	480Hz	-7.2	-6.6	-6.6	-12.6	-14.6	-18	-14.4	-21.2	-26.6	-31.6	-33.2	-44.4	-37.4	-59.8	-42.4	-45.8
G7C	p	932.33Hz	950Hz	-8.2	-23	-30	-47.8
G7C	mf	932.33Hz	950Hz	1.8	-25	-11.4	-33.6	-41.4	-42.2
G7C	f	932.33Hz	950Hz	-0.2	-6.2	-4	-7.8	-16.4	-22.6	-24	-30	-30.4	-37.8	-34.4	-37.8	-41	-43.8
YC	p	233.08Hz	230Hz	-34.8	-30.6	-22.4	-27.4	-40.4	-35.4	-35.2	-39.8
YC	mf	233.08Hz	240Hz	-33.2	-23.6	-11.6	-17.2	-19.8	-20.6	-22.4	-38.4	-30	-31	-28.2	-37.8	-36.8	-37	-39.2
YC	f	233.08Hz	240Hz	-26.8	-20.2	-5.6	-14	-15.2	-20.6	-28.8	-24.8	-15.8	-20	-35.6	-28.8	-27	-22.8	-27.2	-31.6	-31.6	-35.6	-49.8	-50	-44.8	-41	-42.4	-42.6
YC	p	466.16Hz	470Hz	-24.4	-27.2	-28.8	-30.4	-42.6	-45.8
YC	mf	466.16Hz	470Hz	-13.8	-6.2	-18.4	-22.4	-17.6	-24.4	-27.2	-32.8	-43	-39.8
YC	f	466.16Hz	470Hz	-12	-8.8	-4	-7.8	-10.4	-9.6	-21.8	-19	-23.4	-25.8	-26	-34	-28.2	-42.8	-40.2	-41.6	-36.6	-41.2	-41.4	-44.6
YC	p	932.33Hz	950Hz	-12	-23	-26.6	-46.8
YC	mf	932.33Hz	950Hz	-4.8	-12.2	-14.2	-25.2	-32.8	-42.4	-43.4	-46
YC	f	932.33Hz	950Hz	-3	-15.2	-6.6	-19	-22.8	-27.2	-47.8	-37.8	-38	-44.2
B24	p	233.08Hz	230Hz	-41.8	-25.2	-31.2	-33.4	-29.2	-31.2	-45.2
B24	mf	233.08Hz	240Hz	-39.6	-16.4	-19	-22	-23.2	-15.8	-35.4	-32.8	-35.6	-41.4	-42.8	-34.8	-36.4	-44.4	-43.2	-48.6
B24	f	233.08Hz	240Hz	-33.8	-11.2	-15.4	-15.4	-18.2	-8.6	-28.6	-28.6	-18.8	-23.4	-26.4	-17.4	-20.2	-23	-22.6	-25	-28.6	-39.4	-36.8	-40.8	-37.6	-33.6	-38.4	-42.8
B24	p	466.16Hz	470Hz	-16.6	-20.2	-18.2	-39.8
B24	mf	466.16Hz	480Hz	-7.2	-17.4	-5.6	-23.4	-20	-23.6	-27.4	-36.2	-40	-48.4	-43.4
B24	f	466.16Hz	480Hz	-5.8	-18.8	-1.8	-10	-17.2	-15.4	-16.8	-23	-29.6	-44.2	-28.6	-37.4	-38.8	-42.6
B24	p	932.33Hz	950Hz	-5	-14	-21.4	-34.4	-41.6	-47
B24	mf	932.33Hz	940Hz	-0.4	-4.4	-14.8	-17.4	-30.4	-27.4	-41.6	-41
B24	f	932.33Hz	940Hz	-2.8	-1.2	-7.4	-5	-18.8	-17.2	-19.4	-20.2	-29	-32.6	-37	-34.2	-44	-42.2	-45.6
B7	p	233.08Hz	240Hz	-44	-26.8	-28.8	-28.8	-37	-33.2	-35.2	-37.6	-46.8
B7	mf	233.08Hz	240Hz	-42.2	-13.4	-14.4	-18.6	-23.2	-18.8	-28.6	-20.2	-28	-24.6	-24.6	-31.2	-29.6	-29.9	-38	-40.4	-44.2	-50	-48
B7	f	233.08Hz	230Hz	-36.6	-12.8	-15.4	-14	-23.6	-14.6	-18.2	-13.4	-22	-27.6	-21	-19.4	-19.2	-22	-22.8	-26.8	-28.8	-34.2	-35.6	-41.4	-36.4	-35.6	-35.6	-36.8	-45.4	-39.2	-44.4	-47	-46.4	-45.6
B7	p	466.16Hz	470Hz	-15.8	-22.4	-26.4	-35	-40	-47.4
B7	mf	466.16Hz	480Hz	-6.6	-11	-14.4	-15	-17	-21.2	-27.8	-39.6	-46.4
B7	f	466.16Hz	470Hz	-3.6	-8.8	-3.2	-13.6	-8.6	-24.6	-15.6	-14.8	-27.8	-22.6	-25	-25.6	-30.8	-35.6	-41.8	-37	-37.2	-39.2	-43
B7	p	932.33Hz	950Hz	-7	-8.6	-20.8	-38.2	-42
B7	mf	932.33Hz	940Hz	-7.8	-4.4	-14.2	-22.8	-27.2	-32	-36.8	-42.8	-40.8
B7	f	932.33Hz	940Hz	-0.8	2.4	-2.8	-9.8	-16	-21.6	-20.6	-22.8	-20.6	-27.2	-30.4	-33.6	-37.2	-39.2	-39.8	-47.4
B76	p	233.08Hz	230Hz	-33	-26.4	-19.8	-32.4	-30.4	-35.8	-33.6	-45.2	-42.6	-43.4	-47
B76	mf	233.08Hz	240Hz	-26.8	-26.2	-15.4	-18.6	-16.2	-29	-24.6	-29.8	-26.2	-31	-25.2	-35	-27.2	-29.2	-36	-44.2	-49	-49	-49.4	-46.8	-44
B76	f	233.08Hz	240Hz	-26.4	-20.8	-10.6	-30.6	-6.8	-19.8	-30.2	-8.8	-23.8	-33	-17	-26.8	-23	-19.4	-22.4	-20.8	-38.2	-24.2	-31.4	-33.2	-32.8	-38.8	-32.8	-32.4	-40.8	-34.8	-34.6	-44.8	-45.6	-46.8
B76	p	466.16Hz	470Hz	-17.6	-25.8	-20.6	-34.8	-50	-46.2
B76	mf	466.16Hz	470Hz	-9	-13.6	-14.6	-23.2	-21.6	-28.8	-31.2	-41	-43
B76	f	466.16Hz	470Hz	-5	-9.6	-5.8	-9.4	-9.4	-14.4	-18.4	-15.2	-20.4	-32	-30.6	-29	-31.8	-41.6	-40.4	-33.4	-40	-40.4	-41.4	-45
B76	p	932.33Hz	950Hz	-12	-13.4	-31.4	-44.4
B76	mf	932.33Hz	940Hz	-8	-7.4	-12.6	-21	-31	-30.4
B76	f	932.33Hz	940Hz	-6.6	-1	-8.4	-8.6	-20.4	-17.4	-36.4	-29.8	-27	-30.2	-31.2	-42.4	-43.8	-47.4
B10	p	233.08Hz	230Hz	-37.6	-26.2	-23.2	-31.6	-31.6	-31	-38.8
B10	mf	233.08Hz	240Hz	-33.2	-17.2	-16	-20.8	-25	-30.6	-24.8	-33.4	-32	-40	-28.2	-35	-32.6	-33.8	-40.8	-47
B10	f	233.08Hz	240Hz	-27.2	-13.4	-10.6	-15.4	-15	-22	-14	-23.6	-23.6	-23	-18	-23.4	-17	-21.8	-24.4	-20.2	-29.2	-25.6	-31.4	-33.8	-36.4	-31.4	-49.8	-31.6	-41	-38	-42.4	-38	-40	-47.8
B10	p	466.16Hz	480Hz	-18.4	-20	-17.8
B10	mf	466.16Hz	480Hz	-11	-9.4	-13.4	-19.4	-23	-23.4	-26.8	-39.8	-43.8	-44
B10	f	466.16Hz	470Hz	-7	-8.4	-11.6	-20.2	-13	-17.8	-18	-29	-37.4	-29.6	-31.6	-39.2	-36.8
B10	p	932.33Hz	950Hz	-10.4	-23.6	-32	-46.4	-46.2
B10	mf	932.33Hz	950Hz	-9	-22.6	-16	-34	-32.6	-43.8
B10	f	932.33Hz	940Hz	-5	-8	-6	-14.6	-27.4	-25.8	-30	-35	-45.4
YA	p	233.08Hz	230Hz	-36.2	-33.2	-27.6	-42.6	-46	-43.8	-41
YA	mf	233.08Hz	240Hz	-35.6	-20.2	-16	-23	-25	-42.8	-30.2	-32.6	-40.2	-47.8	-37.4	-36	-39.8	-43.4
YA	f	233.08Hz	240Hz	-33.8	-16.6	-12.2	-13.2	-15.6	-18.2	-17.6	-22.6	-21.8	-30	-20.8	-30	-23.4	-24.2	-31.2	-23.4	-34.2	-34.8	-32.2	-41.8	-41.8	-37.4	-40.2	-40.8
YA	p	466.16Hz	480Hz	-19	-23	-17.4	-42.2
YA	mf	466.16Hz	470Hz	-13.8	-8.2	-18.8	-26.8	-18.2	-21	-28	-51.4	-43.2
YA	f	466.16Hz	470Hz	-7.6	-8.6	-14.4	-14.6	-22.6	-23.4	-20	-21.4	-29.8	-38.2	-29	-36.2	-48.4	-41.2	-42.2	-48.4
YA	p	932.33Hz	950Hz	-8.4	-18.6	-20.8	-43	-44.2
YA	mf	932.33Hz	950Hz	-7.2	-9.2	-11.4	-22.8	-32	-35.6	-40.8	-45.6
YA	f	932.33Hz	950Hz	-0.6	-15.6	-2.6	-16.2	-17.6	-21.6	-24.6	-28	-37.4	-36	-38.8	-41.2	-47.4
YMG	p	233.08Hz	240Hz	-42.2	-22.2	-31	-29.8	-30.4	-31.4	-47
YMG	mf	233.08Hz	240Hz	-39.4	-18.4	-28.8	-24.2	-25.8	-21	-41.4	-41.4	-37.6	-43.8	-38.8	-41.8	-41.6	-42.4
YMG	f	233.08Hz	240Hz	-35.8	-12.4	-10.6	-12.6	-21.6	-13.2	-15.2	-29	-24.4	-23.2	-25.2	-16.6	-20	-22	-21.2	-25.6	-33.8	-27.4	-36.6	-33.2	-42.4	-39.2	-43	-40.8	-44.8	-39.4	-40.2	-51.6	-44.4	-42.6
YMG	p	466.16Hz	480Hz	-14.6	-15.8	-17.8	-31.6	-35.8	-41	-47
YMG	mf	466.16Hz	480Hz	-5	-8.2	-4.8	-16	-19	-15.8	-18.2	-26.4	-36.4	-36.2	-41.8	-45	-44
YMG	f	466.16Hz	480Hz	-0.8	-6	-3	-12.2	-8.4	-7.2	-10.6	-15.4	-21.4	-28.2	-22.8	-24.4	-31.8	-29.2	-28.8	-38.8	-33.8	-38.4	-37.8
YMG	p	932.33Hz	950Hz	-5.2	-21.4	-24.2	-34.4	-42.4
YMG	mf	932.33Hz	940Hz	0.6	-11	-6.8	-15.8	-25.6	-29	-44.2	-42	-43.8	-46.2
YMG	f	932.33Hz	940Hz	1.2	-0.4	-3	-4	-7.8	-15.8	-24.2	-18.4	-22.8	-25	-32.2	-29.6	-33.2	-34.4	-39.2	-45.8	-45.4	-45.8
SA	p	233.08Hz	230Hz	-30.4	-24	-29.6	-35.8	-37.2	-33.8	-43.4	-44.4
SA	mf	233.08Hz	240Hz	-25.6	-19.2	-24.6	-27.4	-22.2	-26.2	-28	-33.4	-33.2	-32.4	-30	-31.8	-36.6	-43
SA	f	233.08Hz	240Hz	-21.2	-17	-13.4	-15	-10	-15.4	-23	-34.6	-17.4	-21.4	-17.2	-18.4	-27.8	-23.8	-24.2	-31.4	-39.2	-35	-42	-38	-43.6	-38.8	-38	-48.6	-45.8	-42.6
SA	p	466.16Hz	470Hz	-17.2	-38.6	-24.2	-32.2	-45.8
SA	mf	466.16Hz	470Hz	-8.6	-17.2	-13.8	-19	-20.8	-22.4	-30.2	-38.6	-39.4	-48.4	-42.4	-46.8
SA	f	466.16Hz	470Hz	-4	-7.6	-3.8	-19.4	-18.6	-14.2	-15	-18.8	-24	-32.6	-26.2	-23.8	-37.4	-41.8	-39.2	-38.4	-44	-48.4	-47.8	-46.8
SA	p	932.33Hz	930Hz	-13.6	-15.6	-29.2	-42.4	-47.4
SA	mf	932.33Hz	950Hz	-39.4	-6.4	-17.4	-27.6	-39.8	-39.4
SA	f	932.33Hz	940Hz	-10.6	-3	-7.6	-14.2	-28.6	-20.4	-32.6	-35.8	-35	-39.8

TOTAL PO	Ratio to 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0.067442	0.13215	0.399087	0.209444	0.66231	0.399087	0.276101	0.32439																							
0.213249	0.045826	0.309822	0.33198	0.778298	0.11249	0.269844	0.30277	0.041794	0.059035	0.014829	0.034763	0.02637	0.030277	0.025183																
0.471478	0.067072	0.143397	0.6117	0.6117	0.202553	0.21704	0.212099	0.119272	0.189034	0.113904	0.067072	0.094741	0.057087	0.043305	0.092585	0.047483	0.022727	0.020727	0.012205											
0.200556	0.498615	0.846769	0.176915	0.038705	0.039606																									
0.609818	0.211252	0.880643	0.384415	0.078487	0.062345	0.130257	0.065283	0.023703	0.011609	0.009656																				
0.992852	0.225484	0.877234	0.252997	0.152446	0.171047	0.205644	0.126799	0.057958	0.010307	0.019192	0.024161	0.012391	0.011301	0.003742	0.005796															
0.380998	0.98861	0.098861	0.110924	0.022648	0.007674																									
1.011945	0.94372	0.312495	0.101121	0.03757	0.007326	0.006996																								
1.916393	0.886162	0.189459	0.369416	0.185146	0.061308	0.054641	0.028676	0.018093	0.002676	0.008862	0.006569	0.005464	0.002868	0.002331																
0.097842	0.085011	0.707088	0.362638	0.456534	0.308655	0.17357	0.165758																							
0.343641	0.031181	0.482941	0.297779	0.567407	0.284377	0.383614	0.225889	0.136111	0.082015	0.055449	0.124135	0.139282	0.066664	0.063664	0.060799	0.017135	0.014585	0.016745												
0.575072	0.024584	0.389628	0.28226	0.40799	0.479347	0.309492	0.269556	0.077741	0.102483	0.052559	0.170079	0.257424	0.093465	0.14476	0.186488	0.081405	0.055036	0.095642	0.025742	0.03987	0.029556	0.009347	0.029556	0.019083	0.010248	0.015158	0.022943	0.005897	0.004175	0.010015
0.181371	0.694115	0.647786	0.31005	0.020962	0.02352	0.038144																								
0.791056	0.619146	0.694693	0.191334	0.141838	0.219681	0.141838	0.089494	0.020979	0.016665	0.005033	0.012072	0.007617																		
1.36314	0.507528	0.750688	0.146373	0.254366	0.20205	0.143041	0.136603	0.066905	0.056946	0.023739	0.059629	0.014978	0.01366	0.014304	0.004523	0.011627	0.009235	0.008423	0.006691											
0.666347	0.968948	0.140055	0.202442	0.019333	0.013071																									
1.480656	0.870053	0.379792	0.30168	0.081198	0.022364	0.016965	0.016579	0.009323	0.003385																					
2.11575	0.715378	0.278314	0.518246	0.326991	0.149464	0.062307	0.049492	0.056824	0.038418	0.026579	0.025383	0.015651	0.011872	0.01108	0.00595	0.001797														
0.077586	0.107206	0.166042	0.692179	0.513119	0.144617	0.288548	0.302147	0.074168	0.114873	0.066103																				
0.205946	0.073493	0.197809	0.474512	0.385698	0.597375	0.157126	0.157126	0.023782	0.328282	0.113827	0.188907	0.108704	0.059737	0.043276	0.032828															
0.448359	0.060031	0.315046	0.499314	0.434884	0.434884	0.194256	0.217959	0.114386	0.208149	0.117051	0.099626	0.208149	0.185513	0.025025	0.131333	0.082866	0.015079	0.025025	0.012542	0.016157	0.009963	0.01543	0.008879	0.011439						
0.454467	0.391289	0.875987	0.252637	0.069582	0.089639	0.051582	0.013259																							
1.042865	0.526953	0.694659	0.282991	0.138603	0.34023	0.102748	0.085462	0.076168	0.019578	0.018697	0.015914	0.007274	0.00409																	
1.152799	0.455246	0.689043	0.387478	0.22297	0.09733	0.238917	0.198722	0.086745	0.035338	0.044488	0.022816	0.021293	0.012253	0.007383	0.007215	0.004249	0.005349	0.002939	0.004878	0.002807										
0.510359	0.93783	0.28322	0.195941	0.040006	0.013247	0.009597																								
1.238652	0.948529	0.23826	0.180738	0.097062	0.032889	0.012795	0.006124	0.009269	0.006562	0.005094																				
1.492329	0.734743	0.413176	0.442726	0.243296	0.15351	0.076937	0.035986	0.03856	0.032073	0.02119	0.016449	0.010868	0.005083	0.006857	0.004967	0.002858														
0.110086	0.104296	0.510821	0.547355	0.48783	0.405759	0.154265	0.046587																							
0.317471	0.068912	0.37008	0.586537	0.465903	0.345379	0.322326	0.097341	0.111762	0.109218	0.097341	0.101928	0.07216	0.088776	0.064313	0.048786	0.019874	0.010193	0.01254												
0.657085	0.04703	0.33295	0.50394	0.539981	0.241201	0.187231	0.296742	0.053998	0.246819	0.120887	0.096024	0.135637	0.135637	0.126584	0.093838	0.069563	0.06492	0.014872	0.015936	0.021008	0.011814	0.01237	0.018723	0.012089	0.007454					
0.203985	0.457512	0.776967	0.426975	0.049023																										
0.591981	0.465256	0.434202	0.737381	0.157649	0.088653	0.090718	0.097206	0.019395	0.021762	0.005724																				
0.883816	0.493899	0.529223	0.529223	0.26524	0.210687	0.142442	0.215595	0.098546	0.052922	0.02976	0.024754	0.006818	0.015263	0.001158	0.008583	0.005803														
0.396717	0.980661	0.178451	0.079711	0.010269																										
1.260847	0.975748	0.0446	0.21347	0.016571	0.006751	0.006157																								
1.339423	0.729595	0.365664	0.471066	0.304146	0.113001	0.055345	0.047107	0.023609	0.022547	0.009618	0.014226	0.009618	0.006654	0.00482																
0.097788	0.186086	0.301796	0.775736	0.436229	0.097659	0.173666	0.177711	0.104644																						
0.34952	0.062593	0.189029	0.752538	0.394938	0.292771	0.267011	0.217034	0.034398	0.090475	0.080636	0.111309	0.036858	0.041355	0.040414	0.031371															
0.647581	0.070584	0.150906	0.810412	0.30811	0.268353	0.144114	0.056067	0.08886	0.250441	0.154421	0.025627	0.056067	0.068977	0.111868	0.067407	0.040617	0.040617	0.025627	0.004997	0.004883	0.008886	0.013763	0.011714	0.011447						
0.088588	0.680185	0.49275	0.409852	0.3409	0.083681	0.057893																								
0.570415	0.357939	0.858636	0.21077	0.132987	0.231105	0.105635	0.076526	0.040161	0.012411	0.017939																				
0.995628	0.252292	0.364672	0.633728	0.409169	0.303321	0.332585	0.08164	0.112694	0.067905	0.051511	0.050339	0.02004	0.039075	0.007276	0.009815	0.008354	0.014856	0.008748	0.008549	0.005914										
0.265172	0.947266	0.266976	0.176389	0.017237																										
0.658087	0.874413	0.373006	0.29629	0.083506	0.034811	0.011527	0.010273	0.007616																						
0.877659	0.80663	0.198004	0.532935	0.127842	0.082542	0.049736	0.004642	0.014678	0.014344	0.007025																				
0.079327	0.102466	0.692756	0.347201	0.269513	0.4371	0.347201	0.069276																							
0.273638	0.038267	0.553125	0.410037	0.290284	0.252827	0.592684	0.062062	0.083719	0.060649	0.031104	0.026474	0.0665	0.055312	0.02202	0.025283	0.013578														
0.594933	0.034319	0.462948	0.285451	0.285451	0.206791	0.624499	0.06245	0.06245	0.192989	0.11364	0.080451	0.226742	0.16426	0.118996	0.124604	0.094522	0.06245	0.018011	0.024296	0.01533	0.022158	0.035118	0.020208	0.012177						
0.216027	0.684685	0.452367	0.569496	0.047369																										
0.71086	0.614067	0.189765	0.738271	0.095108	0.140675	0.092943	0.060009	0.021788	0.014067	0.005348	0.009511																			
1.055266	0.486002	0.108802	0.770261	0.299666	0.130809	0.16093	0.136974	0.067087	0.031379	0.005843	0.035208	0.012783	0.01088	0.007025																
0.603105	0.932411	0.330832	0.141126	0.031594	0.013791	0.007406																								
1.152944	0.828308	0.522627	0.157831	0.117002	0.026193	0.036999	0.007214	0.00773																						
1.355495	0.534444	0.642543	0.314704	0.41486	0.084704	0.101836	0.07905	0.072094	0.026176	0.017294	0.010421	0.014385	0.004655	0.005727	0.003872															
0.077074	0.081864	0.593049	0.471075	0.471075	0.18327	0.283851	0.225471	0.171037	0.059305																					
0.369447	0.021011	0.578692	0.51576	0.318015	0.187261	0.310776	0.100565	0.264513	0.107757	0.159385	0.159385	0.07455	0.089629	0.086586	0.034076	0.025849	0.01669	0.008559	0.010776											
0.526941	0.02807	0.434749	0.322284	0.37865	0.125383	0.353377	0.233474	0.405731	0.150743	0.079111	0.169137	0.203347	0.208084	0.150743	0.13748	0.086744	0.068903	0.037003	0.031495	0.016152	0.028724	0.031495	0.031495	0.027431	0.010192	0.020808	0.011435	0.008477	0.009083	0.00996
0.1865	0.869602	0.406743	0.256638	0.09535	0.053619	0.022873																								
0.628864	0.743778	0.44817	0.303	0.282776	0.224617	0.138498	0.06478	0.016651	0.007611																					
1.143499	0.577782	0.317515	0.605012	0.182711	0.324911	0.051495	0.145132	0.159134	0.035626	0.064828	0.049177	0.045895	0.025221	0.014513	0.007108	0.012353	0.012072	0.009589	0.006191											
0.5883	0.759279	0.631541	0.155025	0.020912	0.013502																									
0.758409	0.537151	0.794504	0.257097	0.09552	0.057557	0.03312	0.019059	0.009552	0.012025																					
1.804848	0.505312	0.730398	0.401383	0.179291	0.087813	0.046085	0.051708	0.040138	0.051708	0.024186	0.016732	0.011576	0.007648	0.006075	0.00567	0.002364														
0.124905	0.179235	0.383197	0.81926	0.192053	0.241781	0.129844	0.167271	0.043997	0.05935	0.054128	0.035762																			
0.294818	0.155041	0.166129	0.576031	0.398516	0.525347	0.12035	0.199731	0.10976	0.166129	0.095597	0.1864	0.060318	0.148063	0.11761	0.053758	0.020914	0.012035	0.012035	0.011493	0.015504	0.021402									
0.718186	0.066644	0.126988	0.410926	0.041093	0.636449	0.142483	0.043029	0.505549	0.089901	0.031172	0.196681	0.063645	0.098574	0.149198	0.105624	0.126988	0.01713	0.085855	0.037477	0.030462	0.031898	0.015987	0.031898	0.033401	0.012699	0.025337	0.025928	0.008012	0.007307	0.006364
0.170537	0.773001	0.300732	0.547243	0.106704	0.018543	0.02872																								
0.467043	0.759702	0.447346	0.398697	0.14813	0.178092	0.07774	0.058972	0.019083	0.015158																					
1.006454	0.558735	0.329008	0.509573	0.336671	0.336671	0.189324	0.119456	0.172666	0.094887	0.024958	0.029323	0.035254	0.025539	0.008264	0.009489	0.021243	0.009936	0.009489	0.008457	0.005587										
0.331006	0.758863	0.645897	0.081314	0.018204																										
0.636446	0.625516	0.670253	0.368331	0.140036	0.044283	0.04745																								
1.152435	0.405867	0.773363	0.329901	0.322391	0.082867	0.117053	0.013134	0.028079	0.03876	0.026815	0.023899	0.006582	0.005603	0.003702																
0.09833	0.134065	0.498099	0.703583	0.267495	0.267495	0.286626	0.116766																							
0.253775	0.086209	0.543941	0.624527	0.359378	0.221591	0.116292	0.226752	0.084246	0.098981	0.039405	0.153303	0.070073	0.092374	0.080455	0.035938	0.017602														
0.567909	0.076864	0.376462	0.519662	0.299035	0.313128	0.139869	0.351335	0.116338	0.116338	0.124658	0.221677	0.119048	0.248726	0.143127	0.106101	0.172076	0.061055	0.092411	0.047394	0.035952	0.026651	0.047394	0.005698	0.046315	0.015694	0.022168	0.013357	0.022168	0.017608	0.007173
0.202609	0.593392	0.493562	0.635831																											
0.513125	0.549259	0.660355	0.416656	0.208822	0.137968	0.131758	0.089079	0.019942	0.012583	0.012296																				
0.71339	0.626142	0.532934	0.3687	0.136985	0.313815	0.180581	0.176471	0.049736	0.018909	0.046417	0.03687	0.01537	0.020262																	
0.310232	0.973448	0.212967	0.080968	0.015428	0.015787																									
0.396858	0.894057	0.186795	0.39936	0.050276	0.05907	0.016269																								
0.875428	0.642361	0.454757	0.572505	0.212706	0.048728	0.058584	0.036123	0.020313	0.006135																					
0.051551	0.300443	0.424388	0.808654	0.143801	0.097222	0.125246	0.172887																							
0.213005	0.077913	0.458786	0.744064	0.332361	0.264004	0.03401	0.145081	0.110055	0.045879	0.019125	0.06333	0.074406	0.048041	0.03174																
0.47791	0.042722	0.309495	0.513634	0.457777	0.347259	0.257427	0.275838	0.155115	0.17008	0.066169	0.190833	0.066169	0.141467	0.129019	0.057631	0.141467	0.040799	0.038076	0.051363	0.017008	0.017008	0.028226	0.020448	0.019083						
0.189363	0.592522	0.373856	0.712368	0.040993																										
0.482736	0.422951	0.805917	0.237843	0.094687	0.254853	0.184625	0.082469	0.005576	0.014331																					
0.64263	0.648693	0.578148	0.29651	0.289761	0.115356	0.105206	0.155611	0.132446	0.050355	0.019144	0.055213	0.024101	0.005916	0.013553	0.012079	0.005916														
0.408355	0.931027	0.287715	0.223338	0.017337	0.015099																									
0.624084	0.69945	0.555593	0.431277	0.11608	0.040249	0.026592	0.014614	0.008409																						
1.225579	0.761481	0.135413	0.604866	0.126374	0.107562	0.067867	0.048046	0.032483	0.011007	0.012932	0.009368	0.007107	0.003481																	
0.097896	0.079293	0.792927	0.287894	0.330547	0.308484	0.274937	0.045628																							
0.17592	0.060909	0.683415	0.206388	0.350497	0.291531	0.506623	0.048382	0.048382	0.074935	0.036702	0.065266	0.046205	0.047281	0.043121																
0.59131	0.027427	0.405681	0.499096	0.396446	0.140664	0.369985	0.29389	0.060005	0.101902	0.117	0.092936	0.250141	0.169116	0.134334	0.147294	0.088753	0.034529	0.072141	0.025014	0.036999	0.012829	0.018543	0.011972	0.015424	0.009732	0.018121	0.016527	0.004448	0.01019	0.012537
0.280404	0.664073	0.578383	0.459426	0.093803	0.057838	0.031785	0.01593																							
0.938487	0.5992	0.414545	0.613157	0.168877	0.119556	0.172811	0.131091	0.051	0.016128	0.016503	0.008661	0.005992	0.006723																	
1.455026	0.626801	0.344453	0.486552	0.168706	0.261294	0.300006	0.202829	0.116716	0.058496	0.026738	0.049789	0.041412	0.017666	0.02383	0.024953	0.007891	0.014032	0.008263	0.008854											
0.559877	0.981539	0.152022	0.11013	0.034034	0.013549																									
1.211197	0.884678	0.232694	0.377385	0.133901	0.04333	0.029294	0.005091	0.006558	0.005331	0.004044																				
1.830637	0.627188	0.521672	0.386721	0.344665	0.222535	0.088593	0.033682	0.065675	0.039573	0.030718	0.013409	0.018088	0.011951	0.010409	0.00599	0.002802	0.002934	0.002802												
0.083319	0.362457	0.757281	0.397427	0.194651	0.165675	0.245051	0.081144	0.07232																						
0.183068	0.286673	0.598945	0.321652	0.233017	0.42402	0.267539	0.217464	0.116785	0.119505	0.131035	0.172738	0.140406	0.080795	0.038671																
0.556292	0.156566	0.25392	0.384324	0.319666	0.568456	0.305279	0.127262	0.033473	0.242492	0.153002	0.24814	0.216121	0.073231	0.116064	0.11084	0.048383	0.01971	0.031967	0.014279	0.022631	0.011877	0.020639	0.022631	0.006679	0.009219	0.013326				
0.153699	0.898108	0.076441	0.40117	0.159709	0.033368																									
0.476174	0.78025	0.289891	0.428779	0.235632	0.191529	0.159307	0.064898	0.024674	0.022503	0.007984	0.015931	0.009599																		
1.052886	0.599265	0.39593	0.613223	0.10177	0.111588	0.18519	0.168896	0.109048	0.059926	0.022265	0.046518	0.061322	0.012812	0.00772	0.010414	0.011419	0.005993	0.003611	0.003869	0.004341										
0.269206	0.776096	0.616475	0.1288	0.028178	0.015846																									
0.499356	0.021458	0.958496	0.270141	0.083481	0.020492	0.021458																								
0.901009	0.327545	0.785726	0.46267	0.216407	0.041235	0.105991	0.026018	0.018	0.019737	0.011357																				

Vitae

Matthew Russell Frost graduated with a Doctor of Musical Arts in Trumpet Performance from the University of Washington in 2014, a Master of Music in Trumpet Performance from the Chicago College of Performing Arts at Roosevelt University in 2009, and a Bachelor of Music in Music Education from the University of Idaho in 2004. His primary teachers are David Gordon, Channing Philbrick, Robert McCurdy, and Allen Vizzutti.