



- [Systems](#)
- [Drivers](#)
- [Articles](#)
- [Testing Methods](#)
- [Forums](#)
- [Legacy dB Site](#)

- [Login](#)

- [Top](#)
- [Input Comparison](#)
- [Low Pass Filter Settings](#)
- [Low Pass Filter Toggle Switch Settings](#)
- [Low Damping Settings](#)
- [Mid Damping Settings](#)
- [High Damping Settings](#)
- [12Hz Extension Settings](#)
- [14Hz Extension Settings](#)
- [18Hz Extension Settings](#)
- [Toggle Settings Comparison](#)
- [Response as Tested](#)
- [Extended Frequency Response \(On Axis\)](#)
- [Long Term Output Sweeps](#)

- [Compression Magnitude](#)
- [Total Harmonic Distortion](#)
- [100dB Distortion by Component 100dB Sweep](#)
- [105dB Distortion by Component 105dB Sweep](#)
- [110dB Distortion by Component 110dB Sweep](#)
- [115dB Distortion by Component 115dB Sweep](#)
- [Maximum Long Term Output 115dB Sweep](#)
- [CEA2010](#)
- [Max Output](#)

F18

by **Rythmik Audio**

October 13, 2017

Josh



Manufacturer	Rythmik Audio
Enclosure Type	Sealed
Driver	Proprietary to system
Dimensions (width, height, depth)	20.5 in, 20.5 in, 23 in,
Total Volume	5.59 ft ³
Tuning Frequency	N/A
Amplifier	Internal
Power (RMS)	900 w

Cost	\$1530
Custom Design	No

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Overview

The F18 subwoofer is currently one of Rythmik Audio's most powerful sealed subwoofers, sitting just below the even larger and more powerful F25HP. The F18 is a sealed design based around an 18 inch forward firing driver with the companies patented servo control system. I will not go into the operation of the servo system here. For more information on that I recommend reading the documentation available at the Rythmik website here, or for an even better understanding, a perusal of the patent documentation. The F18 is compact for an 18 based unit with dimensions of just 20.5x20.5x23 inches including the grille and amplifier heatsink. The unit does weigh in at a chunky 115lbs. Available finishes include: Matte black, black oak and gloss black. Additionally most of the Rythmik subwoofers are available with a silver driver cone, which is the finish of the raw spun aluminum. The F18 sells for \$1530 shipped to the continental 48 US states. The gloss black finish carries an upcharge of \$200 and the raw aluminum look cone adds an additional \$100. The standard Rythmik warranty is 5 years on the cabinet and driver and 3 years on the electronics.



DS1820 Driver

The driver inside of the F18 and FV18 subwoofers is Rythmik's proprietary DS1820 driver. The driver features a spun aluminum cone, rubber half roll surround with the Rythmik logo molded into the mounting flange area and the familiar 12 spoke frame. Interestingly the frame has a 12 bolt pattern instead of the usual 8 bolts. The spider system appears to be a single 8 inch diameter high excursion unit. The motor system consists of a large double stack of ferrite magnets that are about 8.5 inches in diameter and 1 inch thick. The back plate features a generous bump out to clear high incursion levels and a large pole vent for

cooling. The top plate appears to be about 12mm thick. The frame also features large under spider vents to help facilitate cooling. The motor design incorporates multiple shorting rings to combat inductive distortions. The voice coil is nominally a 3 inch diameter unit with a secondary smaller coil for the servo circuit. The coils are labeled and also keyed by manner of smaller spade terminals and lead gauge for the servo coil connection. Xmax for the unit is said to be 20mm one way. The DS1820 is a weighty and substantial driver.



RYTHMIK



Amplifier and Controls

The amplifier for the F18 and FV18 subwoofers is Rythmik's HX1000XLR3, which is rated as a 900w rated amplifier. In keeping with Rythmik tradition it has a veritable buffet of control knobs and toggles on the face plate. There are stereo balanced XLR inputs which are switchable via a toggle to operate as a matched pair or with the R source in XLR operating as an unfiltered LFE input. There are also 2 sets of unbalanced RCA style inputs. One set for LFE and one set for use in systems without a dedicated external low pass filter. The power switch is able to be set for Auto/On/Off. There is a 12v trigger available as well as a switch to enable the amplifier to be connected to either 120v or 240v AC. The usual volume, phase and on board low pass filter controls are included as well as a single band parametric EQ, which can be enabled or bypassed via a toggle switch. Towards the bottom of the amplifier there is a series of 4 toggle switches used for tailoring the subwoofers response shape and behavior. The left

most switch enables a fixed low pass filter at 50, 80 or 100Hz when not using the LFE input. Of note is that this toggle switch also interacts with the typical low pass filter knob provided, which further increases the range of adjustment of the internal low pass filter. Next to the low pass filter toggle there is a high pass filter toggle labeled Rumble Filter. This is toggle is an On/Off switch for a high pass filter that rolls off the extreme deep bass frequencies for added protection of the subwoofer. The right 2 toggle switches at the bottom of the amplifier are for tailoring the deep bass extension of the subwoofer and the amount of damping provided by the servo system between Low/Mid/High. There is even a switch to turn on or off the amplifier limiter. Rythmik is the only company I am aware of that provides an option to defeat the limiter. Needless to say the amount of controls provided, what each does, how they interact and when to use each could be overwhelming to some users even after reading the guides provided by Rythmik. Removing the amplifier from the cabinet revealed that these are not SMPS based or switching amps, but are analog based with a large, old school, transformer. These Rythmik amplifiers are a serious hunk of equipment. The HX1000XLR3 probably weighs 20lbs or more and the HX2000XLR3 is even heavier.





Cabinet

The cabinet of the F18 is constructed of MDF material and is cross braced internally. Additionally there is a generous amount of damping material placed inside of the cabinet. The top and bottom corners are rounded over. The cabinet proved to be quite inert and solidly built during testing.

F18 Summary

The sum of the F18 parts is a sub that does a lot right. The available amplifier controls allow the subwoofer response to be tailored to almost any shape needed. The F18 exhibits low distortion behavior at low to moderate playback levels and overloads gracefully. With the limiter on I was unable to get the F18 to make an offensive noise. At its output limits the harmonic distortion below 30Hz increases, but without any vent noises or obvious mechanical sounds from the driver accompanying it, it was only noticed as an increased warmth or heaviness to the sound. This was outdoors. Indoors, where there is often a generous amount of deep bass distortion reduction, it sounded even cleaner. Turning the limiter off would allow the F18 to produce a bit more output but with greatly increased distortion and the possibility of clearly audible overload sounds or clipping if driven hard enough. I would have to imagine that pushing the driver and amplifier that much further also increases the likelihood of damage, though even while maximum output testing with the limiter off, the F18 survived everything thrown at it. The tiny amount of extra output headroom available from operating it with the limiter off doesn't seem worth the increased distortions and stress on the system. I'd recommend leaving the limiter on. The F18 exhibits good deep bass headroom for a sealed design of this size, which also allows it to be placed into a lot of rooms that truly large subs may not fit well. In general the behavior of the F18 was tightly behaved and predictable in the best way. The slew of F18 measurements back this up and show it to be a well rounded performer in all of the critical metrics.

Measurements and Performance

Settings as tested: Volume: Maximum, Input: XLR LFE, PEQ: Bypassed, Damping: Mid, Extension: 18Hz, Rumble Filter: Off, Limiter: On

Input Comparison

Measurements for the Rythmik Audio F18 start off with testing the plethora of controls available on the amplifier. Each of the inputs were tested. There are negligible differences between the XLR and unbalanced RCA connections amounting to just a slight reduction in the input sensitivity when using the RCA inputs. The difference is less than 1dB.

Low Pass Filter Settings

Moving on to the low pass filter settings we see that there is a wide range of adjustment from the 100Hz to 25Hz indicated settings. The toggle operated low pass filter settings are fairly close to their indicated values and this somewhat depends on the other settings configured for the subwoofer anyway. Additionally the low pass knob and the low pass toggle can be combined to create even further low pass options.

Parametric Equalizer Settings

In an effort to save time, the PEQ settings were tested for the FV18 subwoofer in the 12Hz tuning only. The controls will have the same range of operation on any Rythmik subwoofer. Please see the Parametric EQ Settings graph for the FV18 subwoofer in the 12Hz tuning.

Damping Settings

The damping, extension and rumble filter settings produce a variety of predictable effects on the response but with just those 3 toggle switches there are 18 different response shapes to choose from! All were measured. To summarize... The damping toggle produces a more nuanced effect than the rumble filter or extension toggles. In general the low damping setting produces the flattest response down to the corner frequency but then exhibits a much sharper roll off below that point. The high damping setting isn't as boosted as the low damping setting down to the corner but has a much shallower roll off below that point. The mid damping setting is in between.

Extension and Rumble Filter Settings

The rumble filter produces a steeper roll off below 18Hz with a -3dB point at 12.5Hz, relative to the response with the filter off, no matter what the other settings are. The extension toggle has settings of 18Hz, 14Hz and 12Hz. The 18Hz setting produces the least amount of deep bass extension. The 12Hz setting dramatically boosts the response below 25Hz. 14Hz is in between the 18Hz and 12Hz settings.

Frequency Response as Tested

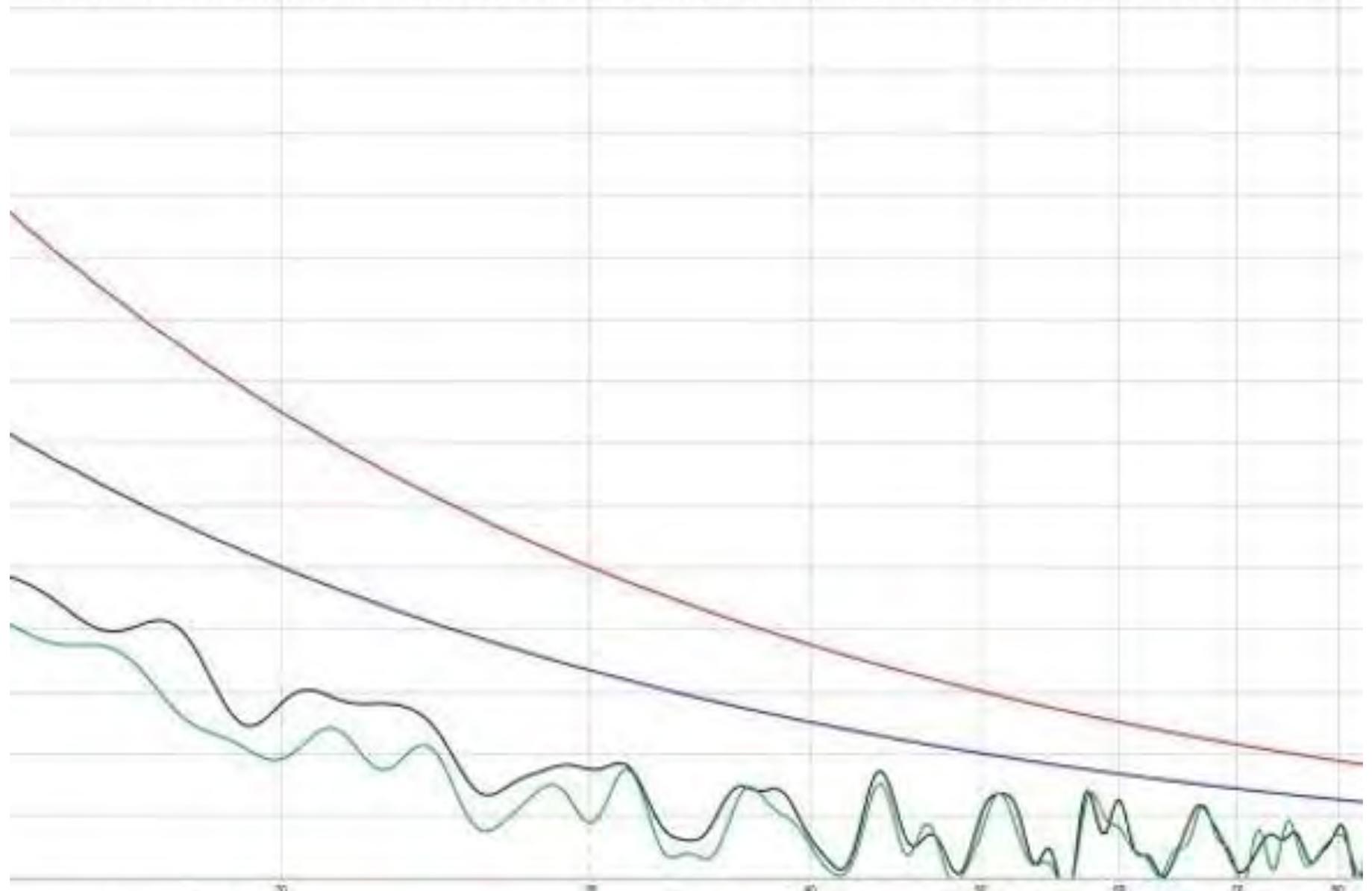
After measuring the 18 different combinations and examining the resulting response shapes, it was decided to test the F18 configured for mid damping, 18Hz extension with the rumble filter off. Additionally the XLR LFE input was used to bypass the low pass filtering. This combination appeared to produce a response shape that was closest to the natural constant voltage response of the DS1820 driver in a sealed cabinet of this size. This is the response that would usually produce the best results for the high output testing. In this configuration the response fits within an 8dB total window from 20.5-310Hz. The flattest response is with low damping, 12Hz extension and the rumble filter off. In this configuration the F18 fits within the same 8dB window from 15-310Hz. The F18 response looks like it could be used up to 250Hz if properly configured, so matching up to bass limited main speakers shouldn't be a problem.

Group Delay and Spectral Decay

The measurements in the time domain show that the F18 is clean and free from any issues that would likely be audible. The configuration of the subwoofers controls will have an effect of the decay and group delay of the sub. Even when configuring the F18 for the highest amount of group delay it remains at or below 1 cycle. Configuring it for the lowest group delay with high damping and the rumble filter off did show a reduction in delay in the group delay and spectrogram charts. In this configuration it is well below 1 cycle of group delay throughout the entire 10-120Hz bandwidth. The group delay as configured for high output testing is shown in comparison to the minimal group delay with high damping in the group delay chart. There is a slight difference but neither is likely to be audible.

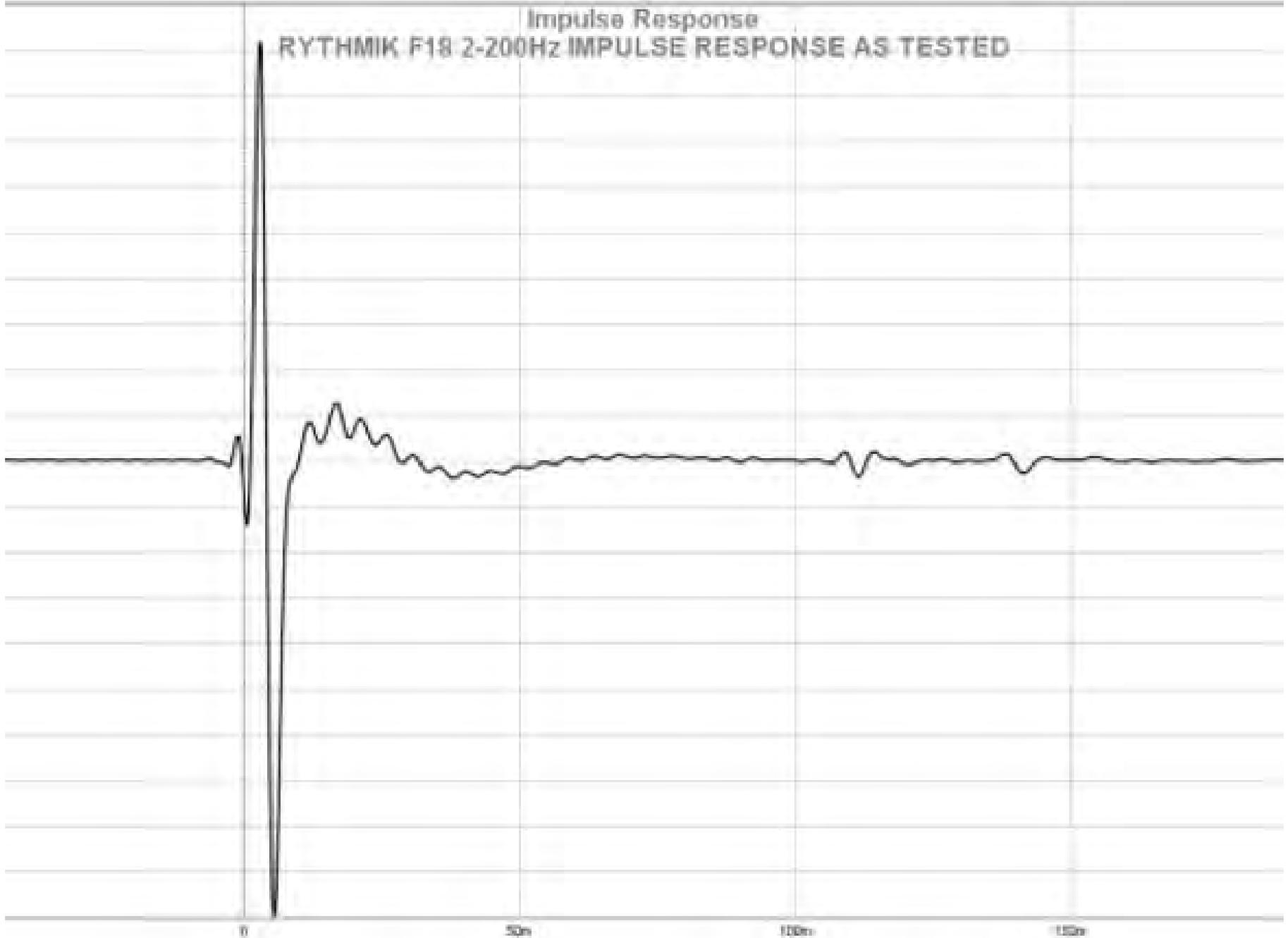
Group Delay

RYTHMIK AUDIO F18 GROUP DELAY AS TESTED VS WITH HIGH DAMPING / 12HZ EXTENSION / RUMBLE FILTER OFF

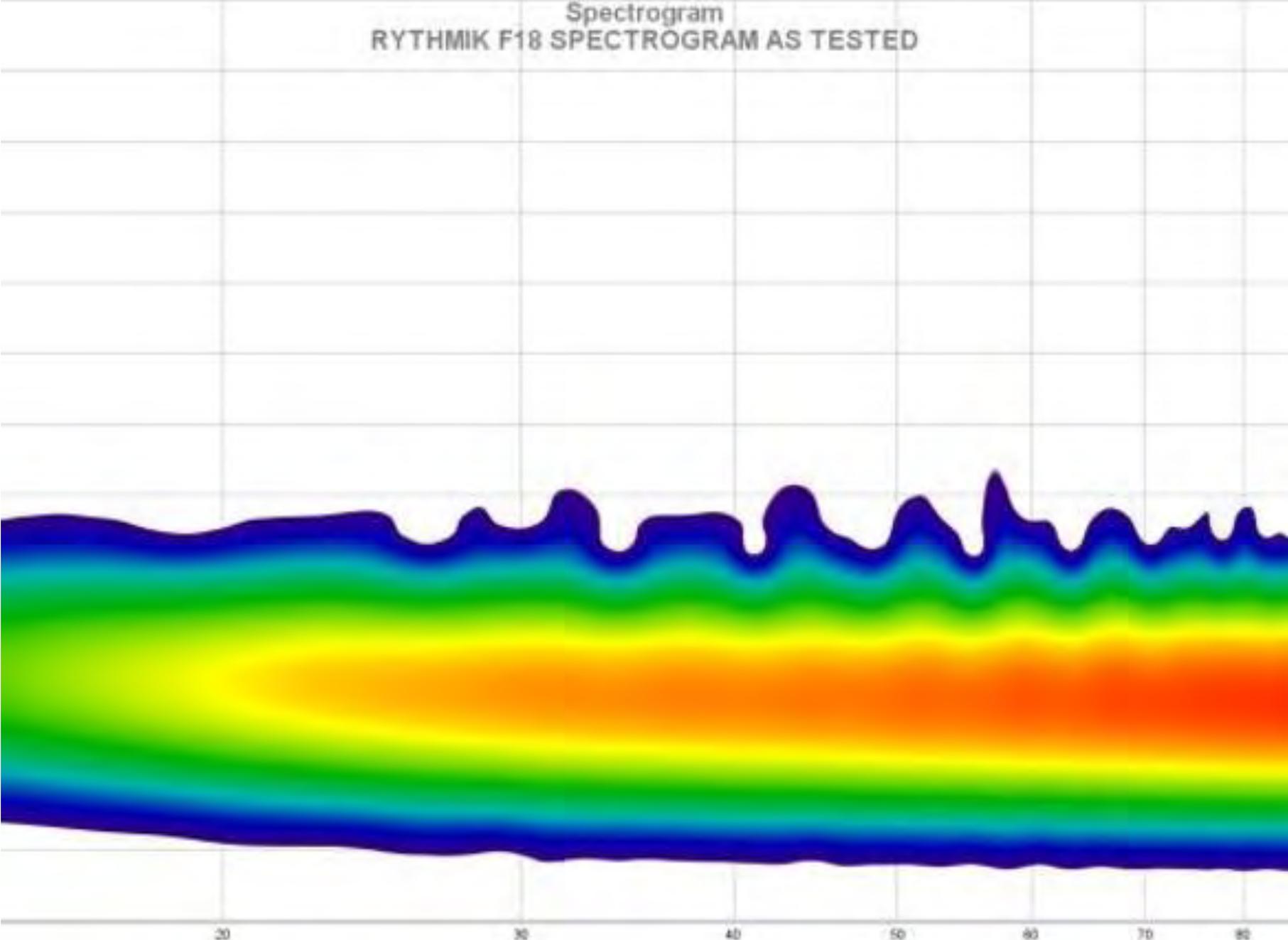


— 24.6 ms 2: F18 W/12HZVORF — 20.7 ms 3: GROUP DELAY 1CYCLE 41.1 ms 4: GROUP DELAY

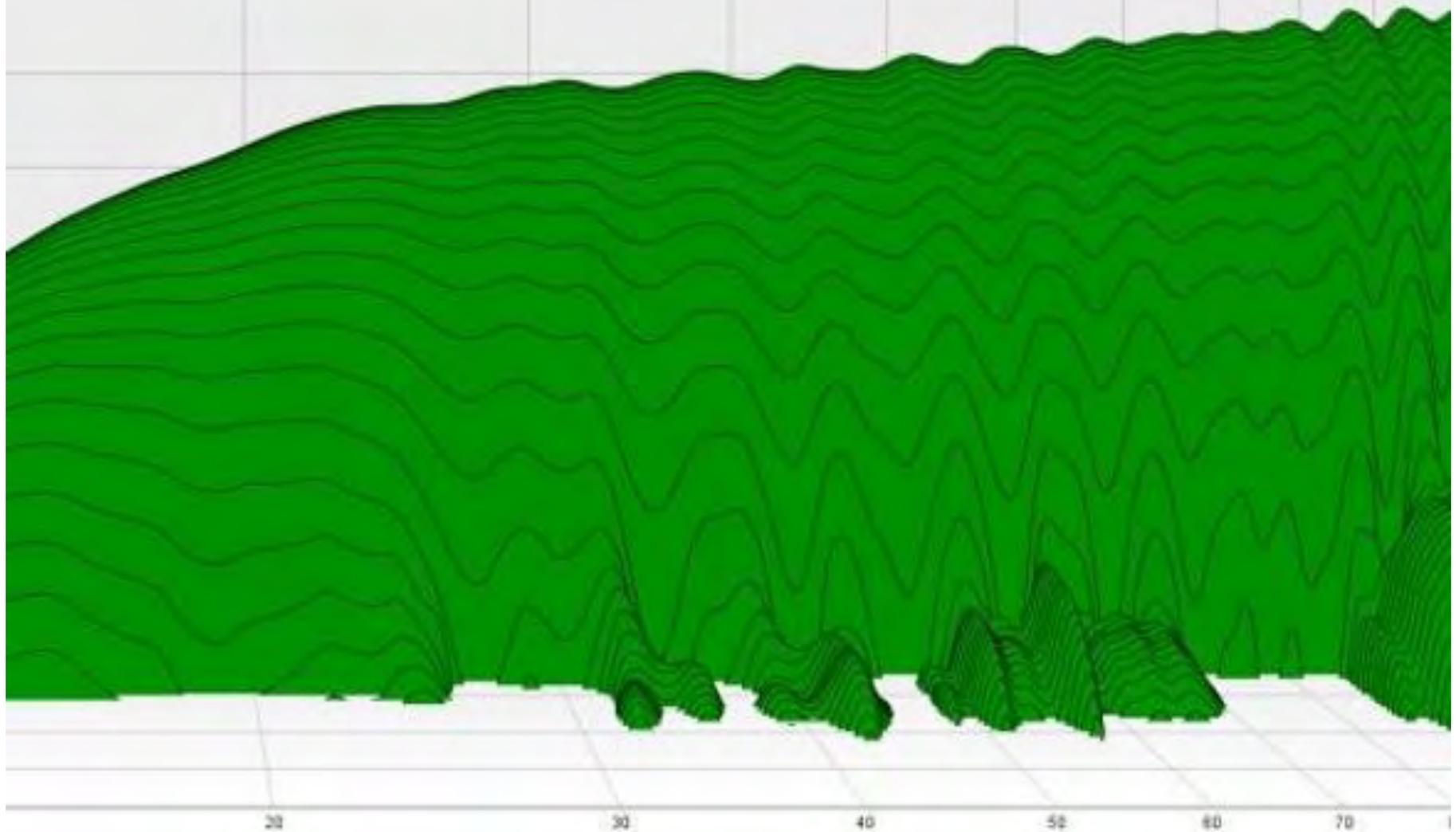
Impulse Response
RYTHMIK F18 2-200Hz IMPULSE RESPONSE AS TESTED



Spectrogram
RYTHMIK F18 SPECTROGRAM AS TESTED



Waterfall
RYTHMIK F18 WATERFALL DECAY AS TESTED



Long Term Sine Wave Sweeps

Long term output testing for the F18 starts at the usual level that produces roughly 90dB at 50Hz when measured at a 2m distance outdoors ground-plane. The F18 behaves in a linear manner through the 105dB sweep. During the 110dB sweep we finally start to see some output limiting in the deep bass. A further increase to a 115dB sweep pushed the F18 to its maximum output over the entire bandwidth. The F18 sounded relatively composed and in control during the 115dB sweep.

Long Term Output Compression

When looking at the amount of compression occurring in the output during the long term sweeps we see that there is virtually none until the 110dB sweep where the F18 starts to reach its output limits below 25Hz. This shows up as compression of 2 to 3.8dB in the deep bass. The 115dB sweep shows that the sub is now being driven to maximum output over the full bandwidth as compression now balloons over the whole bandwidth. The repeat 100dB sweep conducted after the 115dB measurements showed zero thermal induced memory effects in the F18's output. This is thanks to the servo system.

Distortion Results

Looking at the distortion results shows that the F18 is below 10% THD over the 10-200Hz bandwidth during the 100dB sweep. The 105dB sweep increases the deep bass THD a bit to about 20% below 20Hz with less than 10% above 23Hz. The 110dB sweep again increases THD as expected with more than 35% below 20Hz but it remains below 10% above 27Hz. Remember that the F18 is near its deep bass maximum output already during the 110dB sweep. The 115dB sweep doesn't do much to increase the deep bass THD because of this. The distortion above 30Hz barely increases. It is still at 5% or below from 33-150Hz.

Harmonic Distortion Components

Looking at the harmonic makeup of the distortion shows that the 3rd harmonic dominates below 30Hz. The second harmonic has the main contribution above 45Hz as long as the limiter is on.

Maximum Long Term Output Sweep

During the maximum output sweep with the limiter on the F18 was able to produce 95dB at 13Hz, 100dB at 17Hz, 105dB at 22Hz, 110dB at 29Hz and reaches about 114dB above 43Hz. A good showing for a sealed sub this size.

Short Term Burst Output

Distortion limited burst testing of the F18 showed it to have good dynamic reserves. The F18 was able to produce a passing result of over 90dB at 10Hz, over 94dB at 12.5Hz, 99dB at 16Hz and 103.2dB at 20Hz. The output at these bands was 3rd harmonic distortion limited. The F18 would produce about 1.5dB more output at maximum over the 10-20Hz octave with 30-40% THD. Output continues to rise above 20Hz and reaches 114dB by 40Hz before leveling off at about 118dB over the 63-125Hz octave.

CEA2010 Max Passing SPL(dB) REFERENCED TO 2 METERS GROUNDPLANE RMS

UNIT TESTED: RYTHMIK F18

CENTER FREQ HERTZ	MAX PASS SPL (2 meter GP rms)	CEA2010 THD+N(%)	NOTES	MAX SPL (THD) NO THD LIMIT
10	90.7	19.8%	3RD HARMONIC LIMITED	92.2 (34%)
12.5	94.4	18.5%	3RD HARMONIC LIMITED	96.1 (39%)
16	99	19.7%	3RD HARMONIC LIMITED	100.2 (37%)
20	103.2	17.3%	3RD HARMONIC LIMITED	104.5 (33%)
25	107.9	15.4%		N/A
31.5	111.3	6.6%		N/A
40	114.1	4.9%		N/A
50	116.1	3.0%		N/A
63	117.5	3.8%		N/A
80	118.2	4.6%		N/A
100	118.4	4.2%		N/A
125	118.4	2.7%		N/A
THD LIMITED	CANNOT PASS CEA2010			
AMP LIMITED	MAX SPL (NO THD LIMIT)			

Created with Highcharts 6.2.0
Frequency SPL CEA-2010 Max Burst Rythmik Audio - F18 All time
maxAverage 10 20 30 40 50 60 70 80 90 100 80 90 100 110 120 130 140 150

Created with Highcharts 6.2.0
Frequency SPL Max Output Burst (No THD% Limit) Rythmik Audio - F18 All time
maxAverage 10 20 30 40 50 60 70 80 90 100 80 90 100 110 120 130 140 150

IN ROOM Max Passing SPL(dB) MIC @ HEAD POSITION

UNIT TESTED: RYTHMIK AUDIO F18HP LIMITER ON

CENTER FREQ HERTZ	MAX PASS SPL (2 meter GP rms)	CEA2010 THD+N(%)	NOTES	MAX SPL (THD) NO THD LIMIT
10	107.1	7.2%		N/A
12.5	105.7	11.4%	6TH HARMONIC LIMITED	107.2 (45%)
16	103	19.7%	3RD HARMONIC LIMITED	106.1 (94%)
20	108	9.8%	4TH HARMONIC LIMITED	109.9 (26%)
25	111.3	9.4%	6TH HARMONIC LIMITED	114 (12%)
31.5	113	3.1%	8TH HARMONIC LIMITED	115.3 (28%)
40	119.8	3.3%		N/A
50	119.1	10.1%		N/A
63	115.8	11.7%		N/A
80	123.1	3.9%		N/A
100	117.6	2.5%		N/A
125	112.2	1.5%		N/A
THD LIMITED	CANNOT PASS CEA2010			
AMP LIMITED	MAX SPL (NO THD LIMIT)			

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