Engineering and Testing for EMC and Safety Compliance

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FCC Certification Report

Harris Corporation
RF Communications Division
1680 University Avenue
Rochester, NY 14610

MODEL: Unity XG-100P Multiband Portable Radio

FCC ID: AQZ-XG-100P00

December 24, 2009

Standards Referenced for this Report	
Part 2: 2008	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 80: 2008	Stations in the Maritime Services
Part 90: 2008	Private Land Mobile Radio Services
TIA-EIA-603-C August 2004	Land Mobile FM or PM Communications Equipment – Measurement and Performance Standards
ANSI/TIA/EIA – 102.CAAA; 2002	Digital C4FM/CQPSK Transceiver Measurement Methods
ANSI/TIA/EIA– 102.BAAA–1998	Project 25 FDMA Common Air Interface—New Technology Standards Project—Digital Radio Technical Standards

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Document Number: 2009287

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Frequency Range (MHz)	Rated Transmit Power (W) (Conducted)	Frequency Tolerance (ppm)	Transmit Mode/Emission Designator
136–174	1-6.3	0.5	16K0F3E (Analog Voice; WB)
136–174	1-6.3	0.5	11K0F3E (Analog Voice; NB)
136–174	1-6.3	0.5	8K40F1D/E (4-level C4FM; P25)
136–174	1-6.3	0.5	12K0G1D/E (H-CPM)
380-520	1-5.25	0.5	16K0F3E (Analog Voice; WB)
380-520	1-5.25	0.5	11K0F3E (Analog Voice; NB)
380-520	1-5.25	0.5	8K40F1D/E (4-level C4FM; P25)
380-520	1-5.25	0.5	12K0G1D/E (H-CPM)
763-775[1]	0.5-2.6	0.5	16K0F3E (Analog Voice; WB)
763-775[1]	0.5-2.6	0.5	11K0F3E (Analog Voice; NB)
763-775[1]	0.5-2.6	0.5	8K40F1D/E (4-level C4FM; P25)
763-775[1]	0.5-2.6	0.5	12K0G1D/E (H-CPM)
793-805[1]	0.5-2.6	0.5	16K0F3E (Analog Voice; WB)
793-805[1]	0.5-2.6	0.5	11K0F3E (Analog Voice; NB)
793-805[1]	0.5-2.6	0.5	8K40F1D/E (4-level C4FM; P25)
793-805[1]	0.5-2.6	0.5	12K0G1D/E (H-CPM)
806-824	0.5-3.2	0.5	16K0F3E (Analog Voice; WB)
806-824	0.5-3.2	0.5	11K0F3E (Analog Voice; NB)
806-824	0.5-3.2	0.5	8K40F1D/E (4-level C4FM; P25)
806-824	0.5-3.2	0.5	12K0G1D/E (H-CPM)
806-809	0.5-3.2	0.5	14K0F3E (Analog Voice; NPSPAC)
821-824	0.5-3.2	0.5	14K0F3E (Analog Voice; NPSPAC)
851-869	0.5-3.2	0.5	16K0F3E (Analog Voice; WB)
851-869	0.5-3.2	0.5	11K0F3E (Analog Voice; NB)
851-869	0.5-3.2	0.5	8K40F1D/E (4-level C4FM; P25)
851-869	0.5-3.2	0.5	12K0G1D/E (H-CPM)

[1]Compliance with the 2 Watt ERP maximum requirement in the itinerant frequencies of the 700 MHz band is being met without reducing conducted power due to antenna losses that reduce the ERP. See the Subpart R attestation statement. Grant power for these should be 2.6W. ERP, given the antenna losses, is less than 2W.

700 MHz Band Low Power Channels

Channel No. (6.25 kHz)	Channel No. (12.5 kHz)	12.5 kHz Channel Spaced Tx Center Frequencies	
		Original 700 MHz Band Plan (MHz)	Revised 700 MHz Band Plan (MHz)
1	1-2	764.006250	769.006250
2			
3	3-4	764.018750	769.018750
4			
5	5-6	764.031250	769.031250
6			
7	7-8	764.043750	769.043750
8			
9	9-10	764.056250	769.056250
10			
11	11-12	764.068750	769.068750
12			
949	949-950	775.931250	774.931250
950			
951	951-952	775.943750	774.943750
952			
953	953-954	775.956250	774.956250
954			
955	955-956	775.968750	774.968750
956			
957	957-958	775.981250	774.981250
958			
959	959-960	775.993750	774.993750
960			
961	961-962	794.006250	799.006250
962			
963	963-964	794.018750	799.018750
964			
965	965-966	794.031250	799.031250
966			
967	967-968	794.043750	799.043750
968			
969	969-9700	794.056250	799.056250
970			
971	971-972	794.068750	799.068750
972			
1909	1909-1910	805.931250	804.931250
1910			
1911	1911-1912	805.943750	804.943750
1912			

Channel No. (6.25 kHz)	Channel No. (12.5 kHz)	12.5 kHz Channel Spaced Tx Center Frequencies	
		Original 700 MHz Band Plan (MHz)	Revised 700 MHz Band Plan (MHz)
1913	1913-1914	805.956250	804.956250
1914			
1915	1915-19166	805.968750	804.968750
1916			
1917	1917-1918	805.981250	804.981250
1918			
1919	1919-19200	805.993750	804.993750
1920			

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1 Test Result Summary

Test	FCC Reference	Result
RF Power Output	2.1046(a), 90.541(b), 90.542(a)(6), 80.215	Complies
Spurious Emissions at Antenna Terminals	2.1051, 90.210, 80.217	Complies
Field strength of spurious radiation	2.1053(a), 90.543(c)	Complies
Occupied Bandwidth/Emission Masks	2.1049(c)(1), 90.543(d)	Complies
Adjacent Channel Power	90.543	Complies
Frequency Stability vs. Temperature and Voltage	2.1055, 90.213, 90.539, 80.209	Complies
Modulation Characteristics	2.1047(a)(b), 80.213	Complies
Transient Frequency Response	90.214	Complies

2 General Information

The following Certification Report is prepared on behalf of **Harris Corporation** in accordance with the Federal Communications Commission Rules and Regulations. The Equipment Under Test (EUT) was the **Unity XG-100P Multiband Radio; FCC ID: AQZ-XG-100P00.**

The radio is subject to FCC DoC. DoC testing was performed and the data is contained in a separate DoC report. There is a GPS in the Unity radio; it is not subject to receiver testing.

All measurements contained in this application were conducted in accordance with the applicable sections of FCC Rules and Regulations CFR 47 Parts 2, 80 and 90. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

2.1 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report submitted to, and approved by, the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

2.2 Related Submittal(s)/Grant(s)

N/A

2.3 Grant Notes

Power is 6.3W for VHF, 5.25W for UHF, 2.6W for 700 Band, and 3.2W for the 800 Band.

3 Tested System Details

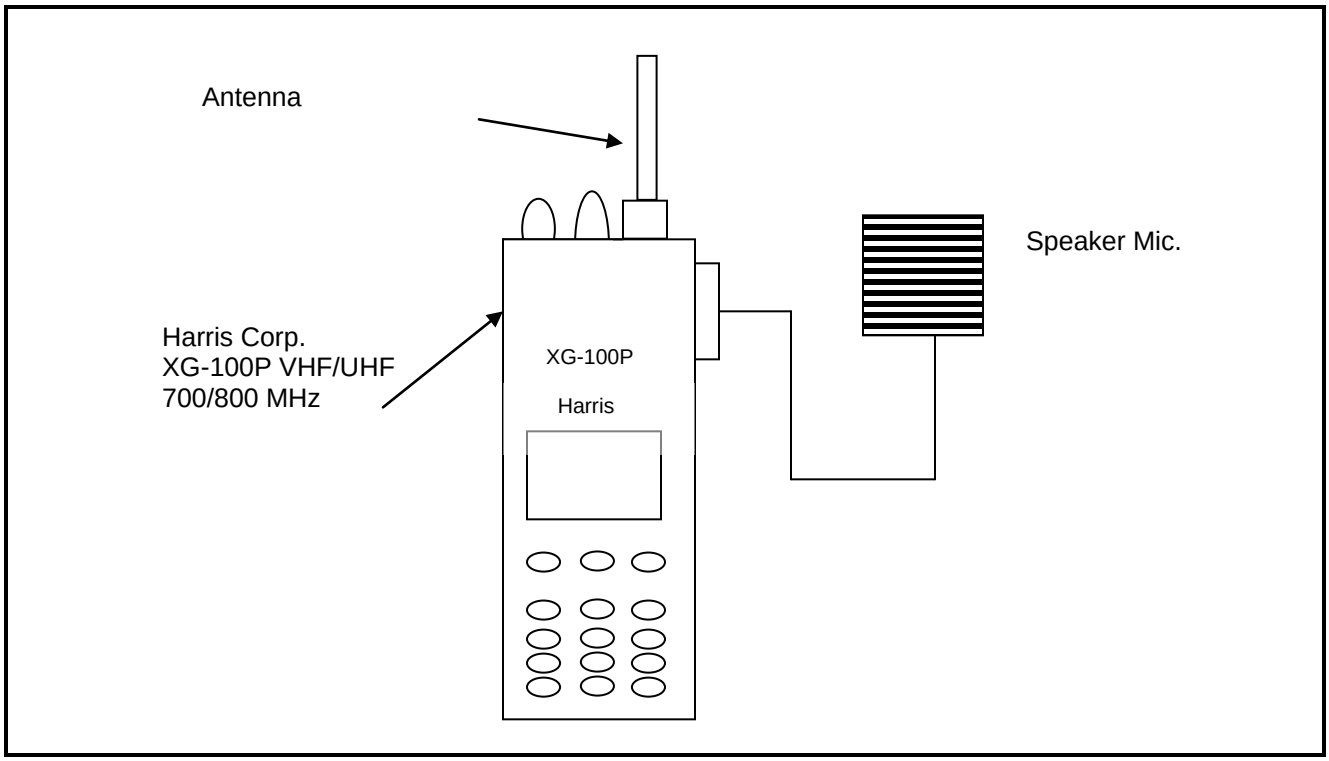
The test sample was received on November 11, 2009. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test, as applicable.

The device was programmed for multiple modes of operation and modulation types.

Table 3-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	RTL Bar Code
Radio	Harris Corporation	XG-100P	12082-1000-01/EM010	AQZ-XG-100P00	19311
Radio	Harris Corporation	XG-100P	12082-1000-01/W00000082	AQZ-XG-100P00	19283
Speaker/ Microphone	Harris Corporation	D12082-0600 XXXX 0933	N/A	N/A	19292
Full-Spectrum Multiband Antenna	Harris Corporation	12082-0250-01	N/A	N/A	19283
AC Adapter	FP	SAW36-12.0-3000	N/A	N/A	19291
Charger	Harris Corporation	12082-0310-01	DUT0000031	N/A	19290
Li-Ion Rechargeable Battery	Harris Corporation	N/A	12082-0308-01//01244	N/A	19287
Li-Ion Rechargeable Battery	Harris Corporation	N/A	12082-0308-01/01248	N/A	19288
AC Adapter	GME	GFP 361DA-1230EW	N/A	N/A	19309

Figure 3-1: Configuration of Tested System



4 FCC Rules and Regulations Part 2.1033(C)(8) Voltages and Currents Through The Final Amplifying Stage

7.5 V / 1.7 A VHF
7.5 V / 1.6 A UHF
7.5 V / 1.3 A 700 MHz
7.5 V / 1.4 A 800 MHz

5 FCC Rules and Regulations Part 2.1046(a): RF Power Output: Conducted, Part 90.541(b)/90.542(a)(6): Transmitting Power Limits; Part 80.215: Transmitter Power

5.1 Test Procedure

ANSI/TIA/EIA-603-2004, section 2.2.1

The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

§ 80.215 Transmitter Power

(a) Transmitter power shown on the radio station authorization is the maximum power the licensee is authorized to use. Power is expressed in the following terms:
(5) For all other emissions: the carrier power multiplied by 1.67.

(e) Ship stations frequencies above 27500 kHz:
The maximum power must not exceed the values listed below.
(1) Ship stations 156–162 MHz: 25W
(2) Marine utility stations and hand-held portable transmitters: 156–162 MHz: 10W

Maximum Power Authorized to use: 10.02W for VHF, 8.35W for UHF

Manufacturer's Rated Power: 6.3W for VHF, 5.3W for UHF, 2.6W for 700 Band, and 3.2W for 800 Band

5.2 Test Data

Table 5-1: RF Conducted Output Power - Measured

Frequency (MHz)	Power (dBm)	Power (W)
136.0000	38.0	6.3
150.0000	37.9	6.2
154.0000	37.9	6.2
162.0000	37.9	6.2
173.2000	37.8	6.0
174.0000	37.8	6.0
380.0000	37.2	5.2
406.1000	37.2	5.2
418.0000	37.1	5.1
454.0000	37.1	5.1
456.0000	37.0	5.0
470.0000	37.2	5.2
512.0000	37.1	5.1
520.0000	37.1	5.1
763.0125	34.0	2.5
767.1025	34.0	2.5
774.9875	34.0	2.5
793.0125	34.1	2.6
797.1025	34.1	2.6
804.9875	34.1	2.6
806.0125	35.0	3.2
815.0000	35.1	3.2
823.9875	34.9	3.1
851.0125	34.9	3.1
860.0000	35.0	3.2
868.9875	35.1	3.2

Notes: Data presented is for Analog mode. All other modes were investigated and found to have equivalent power within measurement tolerances.

Table 5-2: Test Equipment Used For Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	11/5/10
901356	Agilent Technologies	E9323A	Power Sensor	31764-264	11/5/10
901396	MCE Weinschel	48-40-34	Attenuator, 40 dB, DC-18 GHz, 100 W	93453	12/3/10

Test Personnel:

Daniel Baltzell		November 20, 2009
EMC Test Engineer	Signature	Date Of Test

6 FCC Rules and Regulations Part 2.1051: Spurious Emissions at Antenna Terminals; Part 90.210: Emission Limitations; Part 80.217: Suppression of Interference Aboard Ships

6.1 Test Procedure

ANSI/TIA/EIA-603-2004, Section 2.2.13

The transmitter is terminated with a 50 Ω load and interfaced with a spectrum analyzer.

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

§ 80.217 Suppression of Interference Aboard Ships

(a) A voluntarily equipped ship station receiver must not cause harmful interference to any receiver required by statute or treaty.
(b) The electromagnetic field from receivers required by statute or treaty must not exceed the following value at a distance over sea water of one nautical mile from the receiver:

Frequency of Interfering Emissions	Power to Artificial Antenna in Microwatts
Below 30 MHz	0.1
30 to 100 MHz	3
100 to 300 MHz	1.0
Over 300 MHz	3.0

or

Deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

Frequency of Interfering Emissions	Power to Artificial Antenna in Microwatts
Below 30 MHz	400 (4 dBm)
30 to 100 MHz	4,000 (6 dBm)
100 to 300 MHz	40,000 (16 dBm)
Over 300 MHz	400,000 (26 dBm)

6.2 Test Data

Frequency range of measurement per Part 2.1057: 9 kHz to 10 x Fc

Limits: (43 + 10 LOG P(W)) for wideband and 50 + 10 LOG P(W)) for narrowband

The following channels (in MHz) were investigated:

VHF: 136, 150, 154, 162, 173.2, and 174
UHF: 380, 406.1, 418, 454, 456, 470, and 512
700 MHz: 753.0125, 767.1025, 774.9875, 793.0125, 797.1025, and 804.9875
800 MHz: 806.0125, 815, 823.9875, 851.0125, 860, and 868.9875

Both high and low power settings were checked; high power was found to be worst case. All modes were investigated and analog mode is presented as representative data.

All frequencies were found to be greater than 20 dB below the limit except the following.

Table 6-1: Spurious Emissions at Antenna Terminals - 136 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 58 dBc; Conducted Power = 38 dBm = 6.3 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
271.884	-31.8	69.8	-11.8

Table 6-2: Spurious Emissions at Antenna Terminals - 150 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.9 dBc; Conducted Power = 37.9 dBm = 6.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
300.008	-38.8	76.7	-18.8

Table 6-3: Spurious Emissions at Antenna Terminals - 154 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.9 dBc; Conducted Power = 37.9 dBm = 6.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
308.133	-38.5	76.4	-18.5

Table 6-4: Spurious Emissions at Antenna Terminals - 162 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.9 dBc; Conducted Power = 37.9 dBm = 6.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
323.758	-39.9	77.8	-19.9

Table 6-5: Spurious Emissions at Antenna Terminals - 380 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.2 dBc; Conducted Power = 37.2 dBm = 5.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
760.008	-33.7	70.9	-13.7
1140.010	-38.9	76.1	-18.9

Table 6-6: Spurious Emissions at Antenna Terminals - 406.1 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.2 dBc; Conducted Power = 37.2 dBm = 5.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
812.508	-39.5	76.7	-19.5

Table 6-7: Spurious Emissions at Antenna Terminals - 418 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.1 dBc; Conducted Power = 37.1 dBm = 5.1 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
836.257	-38.8	75.9	-18.8

Table 6-8: Spurious Emissions at Antenna Terminals - 454 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.0 dBc; Conducted Power = 37.0 dBm = 5.0 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
908.132	-38.0	75.0	-18.0

Table 6-9: Spurious Emissions at Antenna Terminals - 456 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.0 dBc; Conducted Power = 37.0 dBm = 5.0 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
911.882	-38.2	75.2	-18.2

Table 6-10: Spurious Emissions at Antenna Terminals - 512 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.1 dBc; Conducted Power = 37.1 dBm = 5.1 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
1023.760	-34.6	71.7	-14.6

Table 6-11: Spurious Emissions at Antenna Terminals - 520 MHz; Narrowband; High Power

Limit = 50 + 10 Log P = 57.1 dBc; Conducted Power = 37.1 dBm = 5.1 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
1040.010	-34.7	71.8	-14.7

Table 6-12: Spurious Emissions at Antenna Terminals - 851.0125 MHz; Narrowband; High Power

Limit = 43 + 10 Log P = 47.9 dBc; Conducted Power = 34.9 dBm = 3.1 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
1702.130	-29.9	64.8	-16.9

Table 6-13: Spurious Emissions at Antenna Terminals - 860 MHz; Narrowband; High Power

Limit = 43 + 10 Log P = 48 dBc; Conducted Power = 35 dBm = 3.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
1720.130	-28.8	63.8	-15.8

Table 6-14: Spurious Emissions at Antenna Terminals - 868.9875 MHz; Narrowband; High Power

Limit = 43 + 10 Log P = 48.1 dBc; Conducted Power = 35.1 dBm = 3.2 W

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Corrected Signal Generator Level (dBc)	Margin (dB)
1738.130	-31.1	66.2	-18.1

Table 6-15: Test Equipment Used For Testing Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/10/10
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	12/3/10
901129	Par Electronics	188-174 (25W)	VHF Notch Filters	N/A	3/10/12
901135	Par Electronics	400-512 (25W)	UHF Notch Filter	N/A	2/1/10
901128	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	3/10/12

Test Personnel:

Daniel Baltzell		November 19, 2009
EMC Test Engineer	Signature	Date Of Test

7 FCC Rules and Regulations Part 90.543(a): Emission Limitations: ACP Requirements

Effective October 23, 2007, transmitters designed to operate in the 769–775 MHz and 799–805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Transmitters operating in the 763–768 MHz and 793–798 MHz bands must meet the emission limitations in (e) of this section.

7.1 Test Procedure

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

For a Portable transmitter designed to operate with a 12.5 kHz channel bandwidth, the ACP shall be in accordance with the values in the following table:

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Maximum ACP Relative (dBc)
(+/-)9.375	6.25	-40
(+/-)15.625	6.25	-60
(+/-)21.875	6.25	-60
(+/-)37.5	25	-60
(+/-)62.5	25	-65
(+/-)87.5	25	-65
(+/-)150	100	-65
(+/-)250	100	-65
(+/-)350	100	-65
>400 kHz to 12 MHz	30(s)	-75
12 MHz to paired receive band	30(s)	-75
In the paired receive band	30(s)	-100

For a Portable transmitter designed to operate with a 25 kHz channel bandwidth, the ACP shall be in accordance with the values in the following table:

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	Maximum ACP Relative (dBc)
(+/-)15.625	6.25	-40
(+/-)21.875	6.25	-60
(+/-)37.5	25	-60
(+/-)62.5	25	-65
(+/-)87.5	25	-65
(+/-)150	100	-65
(+/-)250	100	-65
(+/-)350	100	-65
>400 kHz to 12 MHz	30(s)	-75
12 MHz to paired receive band	30(s)	-75
In the paired receive band	30(s)	-100

FCC Rules and Regulations Part 90 §90.543(b)

Setting Reference Level - Part 90 §90.543(b)(1): Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth to the channel size. Set the frequency offset of the measurement to zero and adjust the center frequency of the spectrum analyzer to give the power level in the measurement bandwidth. Record this power as the reference power level.

Measuring the power level at the frequency offset <600 kHz - Part 90 §90.543(b)(2): Using a spectrum analyzer capable of adjacent channel power (ACP) measurements, set the measurement bandwidth as shown in table. Measure ACP in dBm. These measurements are made at maximum power. Calculate the coupled power by subtracting the measurements made in this step from the reference power level. The absolute ACP values must be less than the values given in the table for each condition.

Measuring the power level at the frequency offset >600 kHz - Part 90 §90.543(b)(3): Set the spectrum analyzer to 30 kHz resolution bandwidth, 1 MHz video bandwidth and sample detection mode. Sweep +/-6 MHz from the carrier frequency. Set the reference level to the RMS value of the transmitter power and note the power. The response at frequencies >600 kHz must be less than the values listed in the table.

7.2 Test Data

Transmission at 767.1025 MHz must meet 90.543(e)(2) for portable and mobile stations of 65 + 10 log P attenuation between 769 MHz and 775 MHz or 69 dBc. Power in this band was measured in P25 mode to be 86.7 dBc and H-CPM mode to be 88.3 dBc. Transmission of 797.1025 MHz between 799 MHz and 805 MHz was found for P25 mode to be 88.1 dBc and H-CPM mode to be 87.4 dBc.

Table 7-1: Adjacent Channel Power - 774.9875 MHz; P25 Mode; 12.5 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)9.375	6.25	-40	-41.5	-41.0
(+/-)15.625	6.25	-60	-73.4	-73.7
(+/-)21.875	6.25	-60	-75.0	-73.2
(+/-)37.5	25	-60	-71.7	-71.6
(+/-)62.5	25	-65	-75.2	-75.9
(+/-)87.5	25	-65	-75.2	-75.9
(+/-)150	100	-65	-79.8	-72.9
(+/-)250	100	-65	-79.6	-80.4
(+/-)350	100	-65	-84.4	-85.0

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s)	-75	-87.8
12 MHz to receive band	30(s)	-75	-105.1
In receive band	30(s)	-100	-106.1

Table 7-2: Adjacent Channel Power - 804.9875 MHz; P25 Mode; 12.5 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)9.375	6.25	-40	-44.5	-50.6
(+/-)15.625	6.25	-60	-69.7	-70.9
(+/-)21.875	6.25	-60	-71.6	-73.3
(+/-)37.5	25	-60	-68.9	-69.6
(+/-)62.5	25	-65	-72.7	-72.3
(+/-)87.5	25	-65	-75.3	-75.4
(+/-)150	100	-65	-72.1	-72.1
(+/-)250	100	-65	-80.4	-79.7
(+/-)350	100	-65	-86.3	-85.7

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s)	-75	-88.4
12 MHz to receive band	30(s)	-75	-103.1
In receive band	30(s)	-100	-104.0

Table 7-3: Adjacent Channel Power - 774.9875 MHz; H-CPM Mode; 25 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)15.625	6.25	-40	-73.4	-73.3
(+/-)21.875	6.25	-60	-75.6	-77.2
(+/-)37.5	25	-60	-71.0	-72.2
(+/-)62.5	25	-65	-76.7	-76.8
(+/-)87.5	25	-65	-77.6	-78.9
(+/-)150	100	-65	-70.8	-70.0
(+/-)250	100	-65	-76.6	-77.3
(+/-)350	100	-65	-80.8	-80.6

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s)	-75	-88.1
12 MHz to receive band	30(s)	-75	-107.9
In receive band	30(s)	-100	-105.8

Table 7-4: Adjacent Channel Power - 804.9875 MHz; H-CPM Mode; 25 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)15.625	6.25	-40	-71.6	-72.8
(+/-)21.875	6.25	-60	-72.1	-72.9
(+/-)37.5	25	-60	-69.8	-69.1
(+/-)62.5	25	-65	-73.2	-73.3
(+/-)87.5	25	-65	-76.1	-76.2
(+/-)150	100	-65	-70.8	-69.0
(+/-)250	100	-65	-76.8	-75.2
(+/-)350	100	-65	-79.4	-79.6

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s)	-75	-90.0
12 MHz to receive band	30(s)	-75	-106.0
In receive band	30(s)	-100	-104.7

Table 7-5: Adjacent Channel Power - 774.9875 MHz; Analog Mode; 12.5 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)9.375	6.25	-40	-52.2	-53.8
(+/-)15.625	6.25	-60	-79.4	-79.5
(+/-)21.875	6.25	-60	-82.1	-82.7
(+/-)37.5	25	-60	-84.7	-84.3
(+/-)62.5	25	-65	-86.7	-87.1
(+/-)87.5	25	-65	-89.2	-89.9
(+/-)150	100	-65	-93.6	-93.6
(+/-)250	100	-65	-96.8	-97.2
(+/-)350	100	-65	-102.9	-100.8

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s) 775.3875	786.9875 -75	-86.1
12 MHz to receive band	30(s) 786.9875	793 -75	-102.6
In receive band	30(s) 793	805 -100	-102.9

Table 7-6: Adjacent Channel Power - 804.9875 MHz; Analog Mode; 12.5 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)9.375	6.25	-40	-53.5	-53.6
(+/-)15.625	6.25	-60	-78.9	-78.7
(+/-)21.875	6.25	-60	-81.0	-80.9
(+/-)37.5	25	-60	-80.4	-81.2
(+/-)62.5	25	-65	-79.4	-79.9
(+/-)87.5	25	-65	-77.7	-77.8
(+/-)150	100	-65	-85.0	-85.0
(+/-)250	100	-65	-95.0	-95.1
(+/-)350	100	-65	-98.9	-99.2

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s) 792.9875	804.5875 -75	-82.7
12 MHz to receive band	30(s) 775	792.9875 -75	-104.7
In receive band	30(s) 763	775 -100	-103.7

Table 7-7: Adjacent Channel Power - 774.9875 MHz; Analog Mode; 25 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)15.625	6.25	-40	-63.9	-66.0
(+/-)21.875	6.25	-60	-73.4	-73.9
(+/-)37.5	25	-60	-74.6	-74.5
(+/-)62.5	25	-65	-74.3	-73.7
(+/-)87.5	25	-65	-73.3	-73.5
(+/-)150	100	-65	-81.4	-81.3
(+/-)250	100	-65	-89.9	-89.7
(+/-)350	100	-65	-93.9	-94.0

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s)	-75	-82.7
12 MHz to receive band	30(s)	-75	-103.3
In receive band	30(s)	-100	-102.5

Table 7-8: Adjacent Channel Power - 804.9875 MHz; Analog Mode; 25 kHz Channel Spacing

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP Low Offset (dBc)	Max ACP High Offset (dBc)
(+/-)15.625	6.25	-40	-58.7	-64.4
(+/-)21.875	6.25	-60	-72.5	-72.5
(+/-)37.5	25	-60	-73.0	-72.9
(+/-)62.5	25	-65	-71.7	-71.9
(+/-)87.5	25	-65	-70.5	-71.9
(+/-)150	100	-65	-79.9	-80.1
(+/-)250	100	-65	-89.7	-89.8
(+/-)350	100	-65	-93.8	-94.0

Offset from Center Frequency (kHz)	Measurement BW (kHz)	Max ACP (dBc)	Max ACP (dBc)
>400 to 12 MHz	30(s) 792.9875	804.5875 -75	-82.7
12 MHz to receive band	30(s) 775	792.9875 -75	-105.4
In receive band	30(s) 763	775 -100	-102.5

Table 7-9: Test Equipment Used For Testing ACP Requirements

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/10/10
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	12/3/10

Test Personnel:

Daniel Baltzell		November 19 & December 10, 2009
EMC Test Engineer	Signature	Dates Of Tests

8 FCC Rules and Regulations Part 90 §90.210(g) and Part 2 §2.1053(a): Field Strength of Spurious Radiation; Part 90 90.543(f): Out of Band Emissions Limit

8.1 Test Procedure

ANSI/TIA/EIA-603-2004, section 2.2.12

Analog Modulation: The transmitter is terminated with a 50 Ω load and is modulated with a 2,500 Hz sine wave at an input level 16 dB greater than that required to produce 50% of the rated system deviation at 1,000 Hz.

Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence – 19,200 bps for OTP and 9,600 bps for P25 and EDACS modes.

The spurious emissions levels were measured, and the device under test was replaced by a substitution antenna connected to a signal generator. This signal generator level was then corrected by subtracting the cable loss from the substitution antenna to the signal generator, and the gain of the antenna (dBi) was added to achieve the EIRP level, then converted from the corrected signal generator level (dBm) to dBW and compared to the limit.

For emissions in the 1559-1610 band, Part 15.543(f) states: "For operations in the 763–775 MHz and 793–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation."

8.2 Test Data

8.2.1 CFR 47 Part 90.210 Requirements

The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

No emissions were found to be within a 20 dB margin of the limit; therefore, no emissions are listed.

8.2.2 CFR 47 Part 90.543(f) Requirements

The worst-case emissions test data are shown.

Limit: -80 dBW EIRP for discrete emissions

Table 8-1: Field Strength of Spurious Radiation

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Antenna Gain (dBi)	Corrected Signal Generator Level (dBW)	Margin (dB)
1586.026	3.9	-66.0	1.1	8.9	-88.2	-8.2
1588.026	10.4	-69.1	1.1	8.9	-81.3	-1.3
1594.206	4.8	-64.9	1.1	8.9	-87.1	-7.1
1599.976	10.1	-60.0	1.1	8.9	-82.2	-2.2
1609.976	9.9	-60.3	1.1	8.9	-82.5	-2.5

Table 8-2: Test Equipment Used For Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901365	MITEQ	JS4-00102600-41-5P	Amplifier, 0.1-26 GHz, 30dB gain	N/A	3/4/10
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter antenna mast, polarizing	OATS1	N/A
901516	Insulated Wire Inc.	KPS-1503-2400-KPS	RF cable, 20'	NA	10/19/10
901517	Insulated Wire Inc.	KPS-1503-360-KPS	RF cable 36"	NA	10/19/10
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	N/A
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9 kHz - 12.8 GHz)	3826A00144	10/23/10
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	12/12/10
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	6/14/10
900323	EMCO	3160-07	Horn Antennas (8.2 – 12 GHz)	9605-1054	6/14/10
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	6/14/10
901517	Insulated Wire Inc.	KPS-1503-360-KPS-09302008	RF cable 36"	NA	10/19/10
900928	Hewlett Packard	83752A	Synthesized Sweeper, 0.01 to 20 GHz	3610A00866	2/9/10
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	8/26/10
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	8/26/10

Test Personnel:

Daniel Baltzell		December 4-17, 2009
Test Engineer	Signature	Dates Of Tests

9 FCC Rules and Regulations Part 2.1049(c)(1): Occupied Bandwidth; Part 90.210 Authorized Bandwidth

Occupied Bandwidth - Compliance with the Emission Masks

9.1 Test Procedure

ANSI/TIA/EIA-603-2004, section 2.2.11 and TIA/EIA-102.CAAA-2002 section 2.2.5

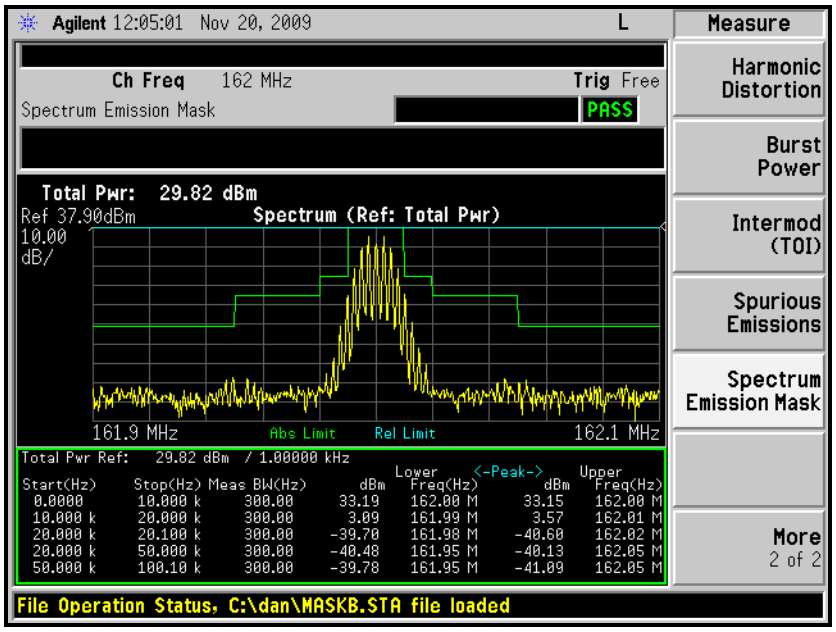
Device with digital modulation: Modulated to its maximum extent using a pseudo-random data sequence.

Applicable Emission Masks		
Frequency Band (MHz)	**Mask for Equipment with Audio Low Pass Filter**	**Mask for Equipment Without Audio Low Pass Filter**
Below 25 [1]	A or B	A or C
25–50.....	B	C
72–76.....	B	C
150–174 [2]	B, D, or E	C, D, or E
150 Paging-only	B	C
220–222	F	F
421–512 [2]	B, D, or E	C, D, or E
450 Paging-only	B	G
806–809/851–854	B	H
809–824/854–869 [3]	B	G
896–901/935–940	I	J
902–928	K	K
929–930	B	G
4940–4990 MHz ……	L or M	L or M
5850–5925 [4]		
All other bands	B	C

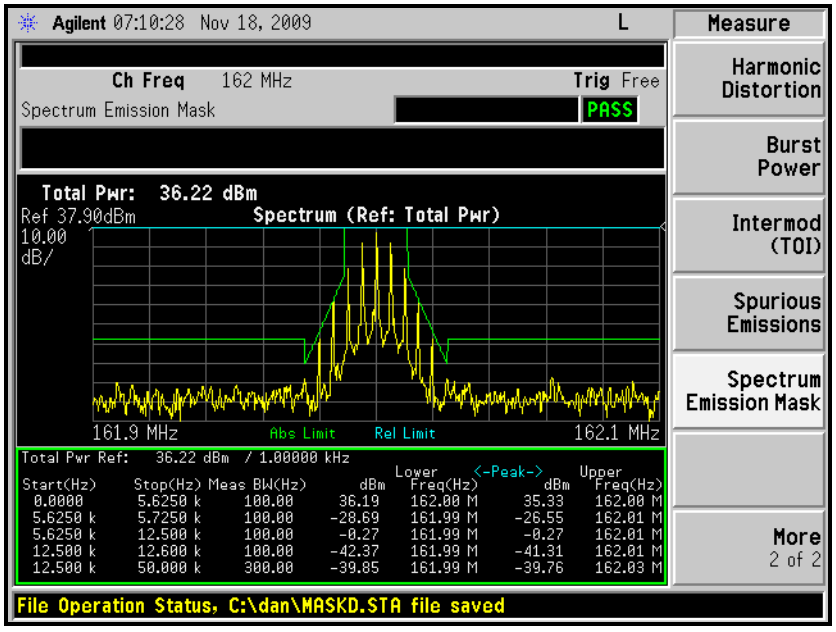
1 Equipment using single sideband J3E emission must meet the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.
2 Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth must meet the requirements of Emission Mask E.
3 Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of § 90.691.
4 DSRCS Roadside Units equipment in the 5850–5925 MHz band is governed under subpart M of this part.

9.2 Test Data

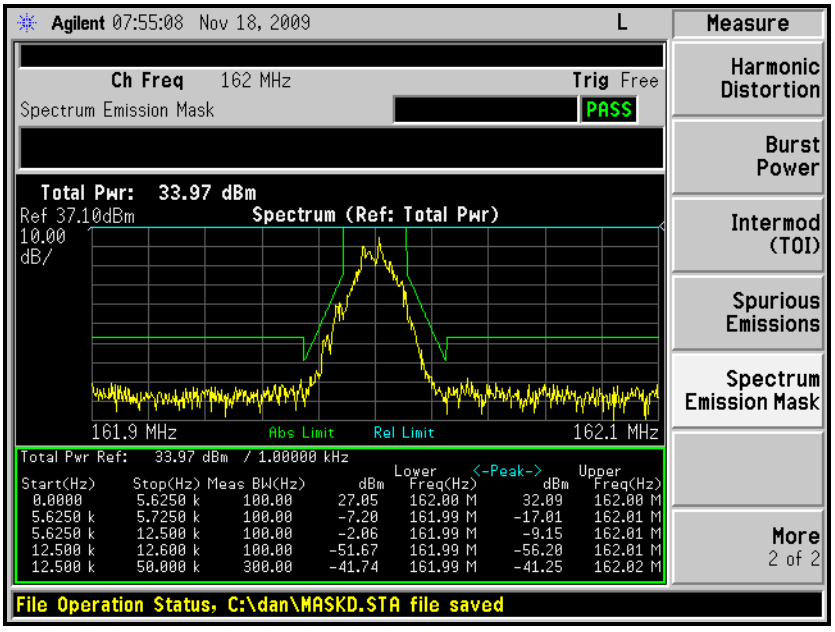
Plot 9-1: Occupied Bandwidth – 162 MHz; Analog (Mask B)



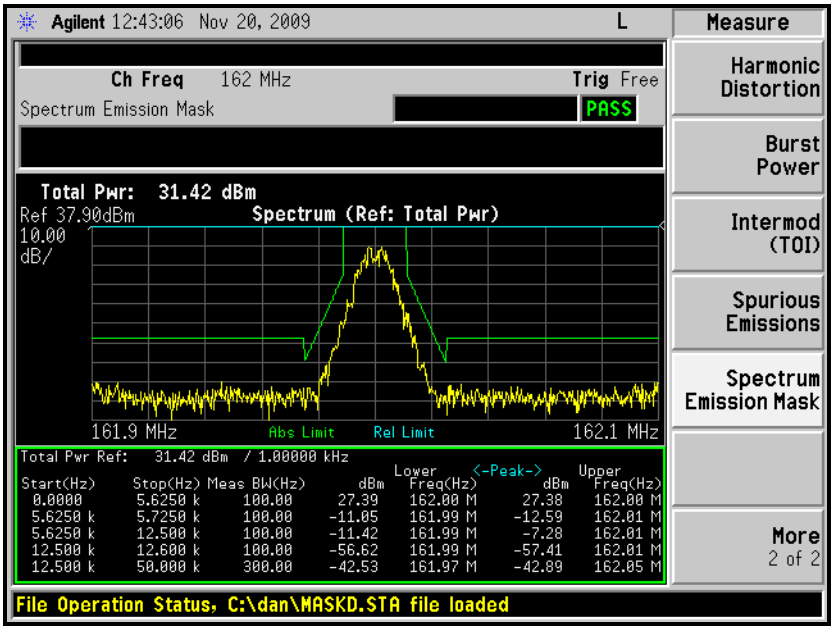
Plot 9-2: Occupied Bandwidth – 162 MHz; Analog (Mask D)



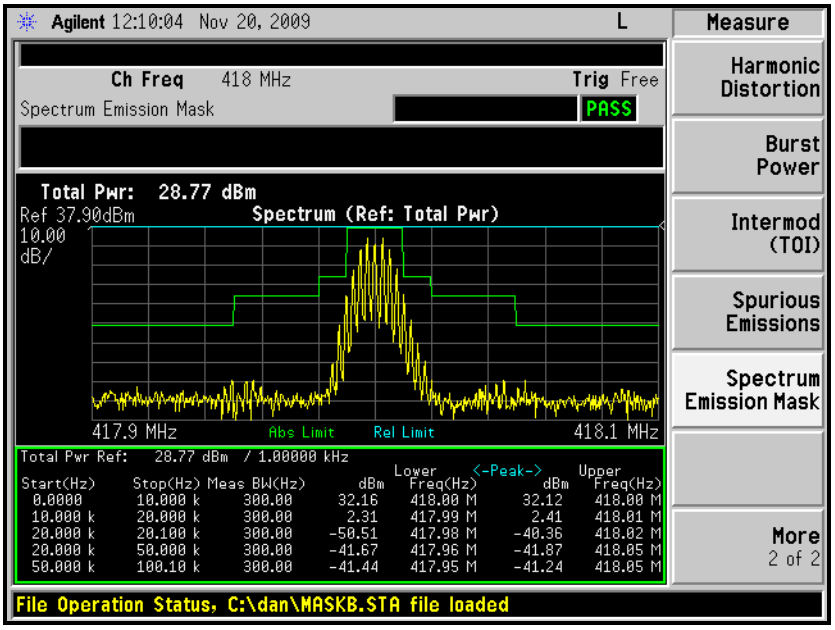
Plot 9-3: Occupied Bandwidth – 162 MHz; P25; (Mask D)



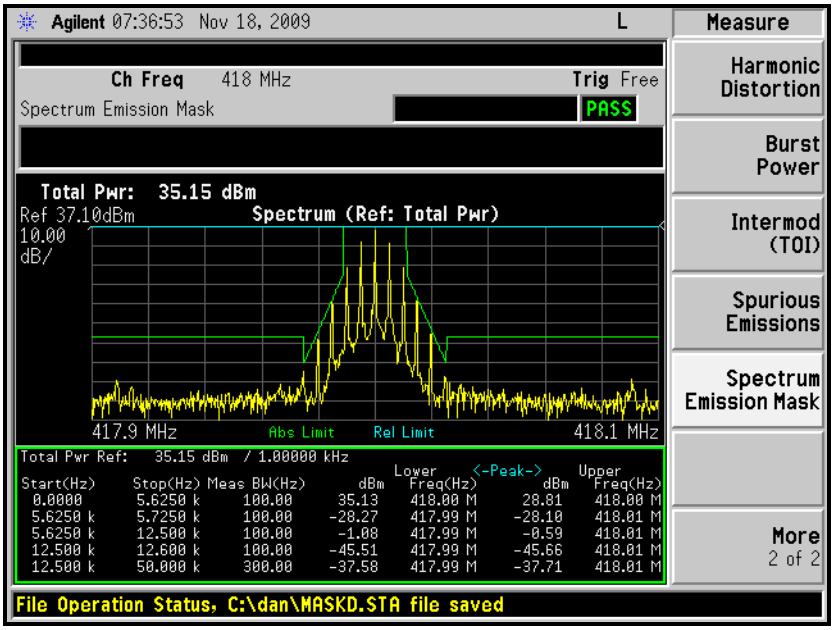
Plot 9-4: Occupied Bandwidth – 162 MHz; CPM; (Mask D)



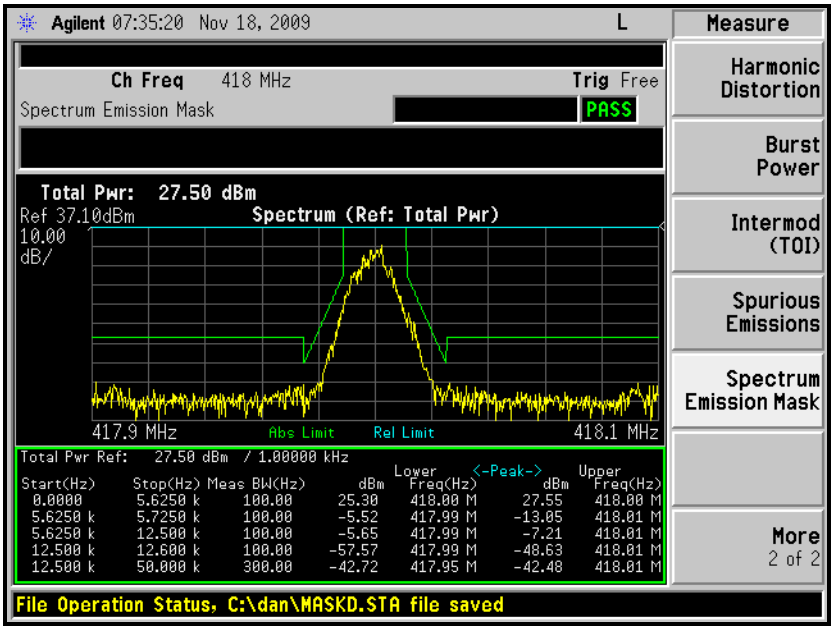
Plot 9-5: Occupied Bandwidth – 418 MHz; Wideband Analog; Mask B



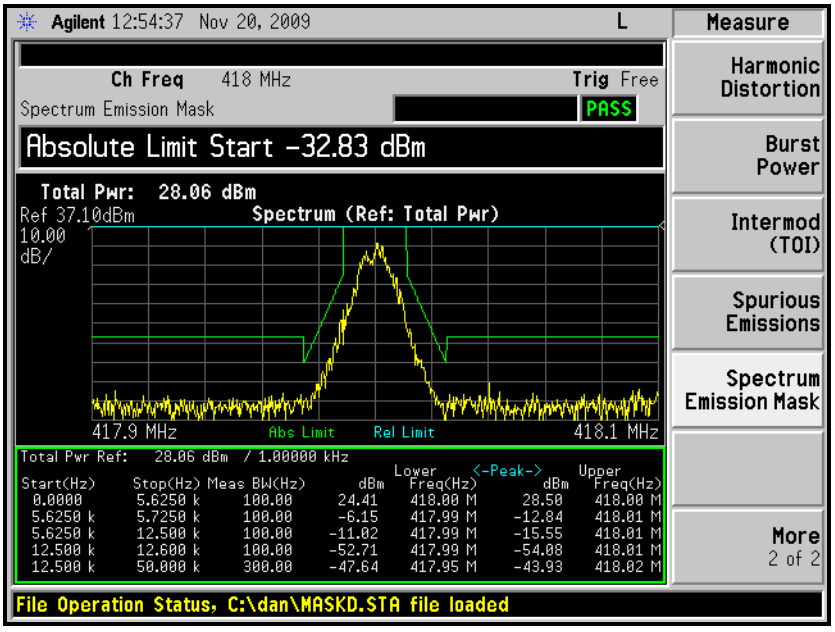
Plot 9-6: Occupied Bandwidth – 418 MHz; Narrowband Analog; Mask D



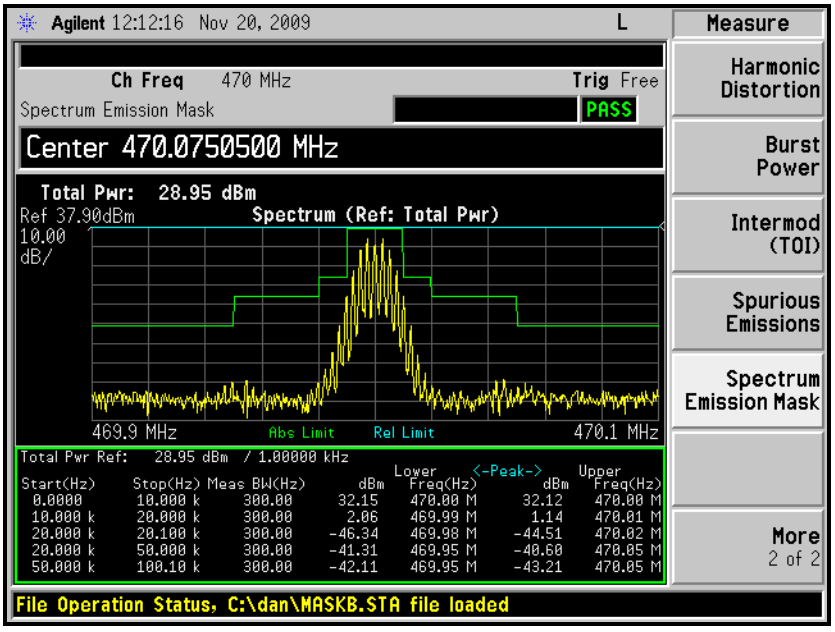
Plot 9-7: Occupied Bandwidth – 418 MHz; P25; Mask D



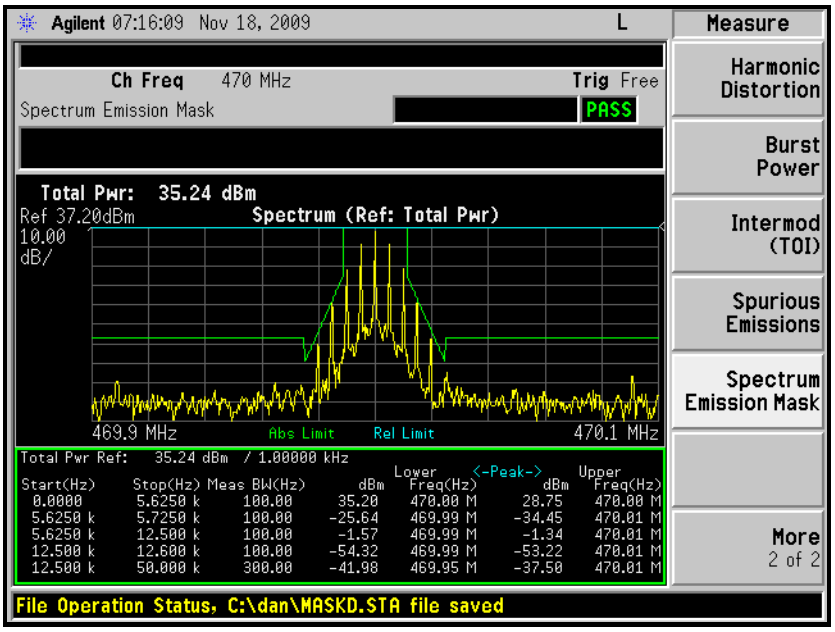
Plot 9-8: Occupied Bandwidth – 418 MHz; CPM; Mask D



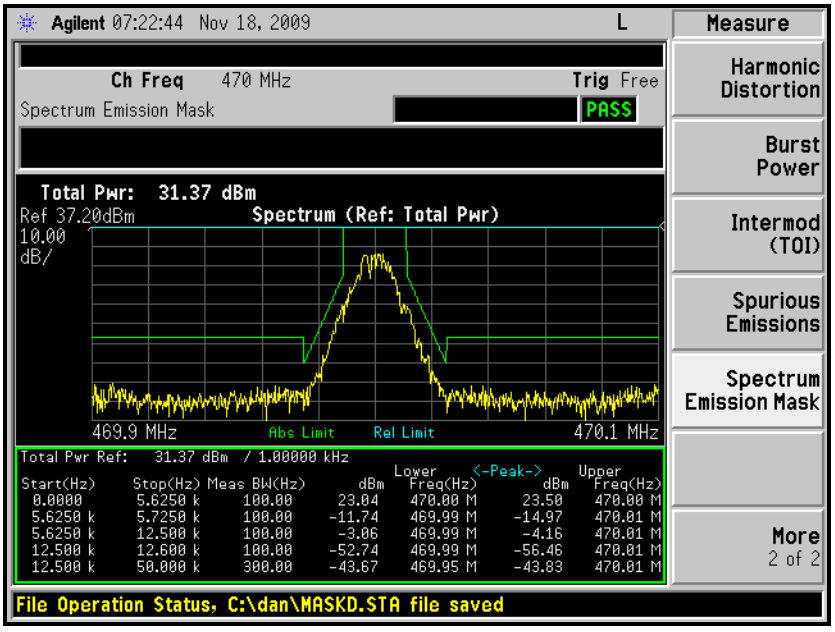
Plot 9-9: Occupied Bandwidth – 470 MHz; Wideband Analog; Mask B



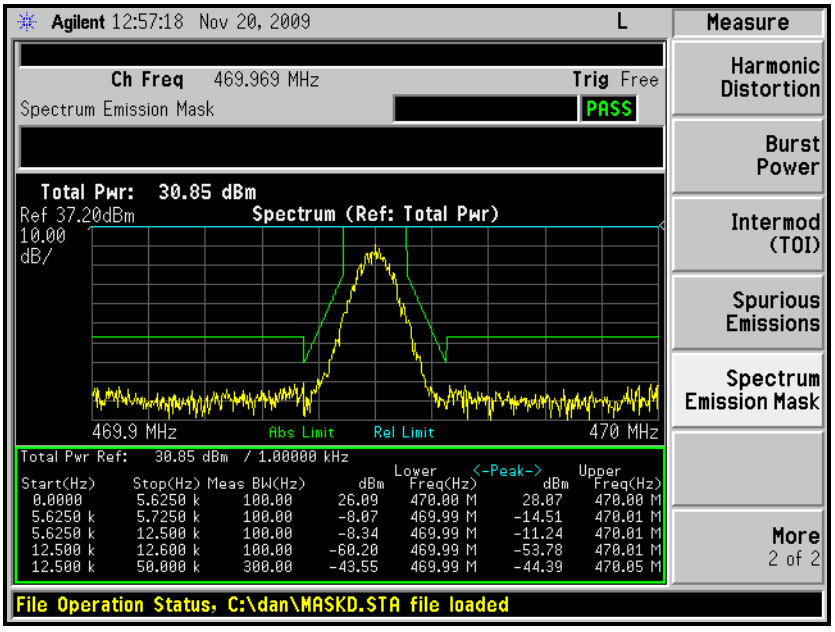
Plot 9-10: Occupied Bandwidth – 470 MHz; Narrowband Analog; Mask D



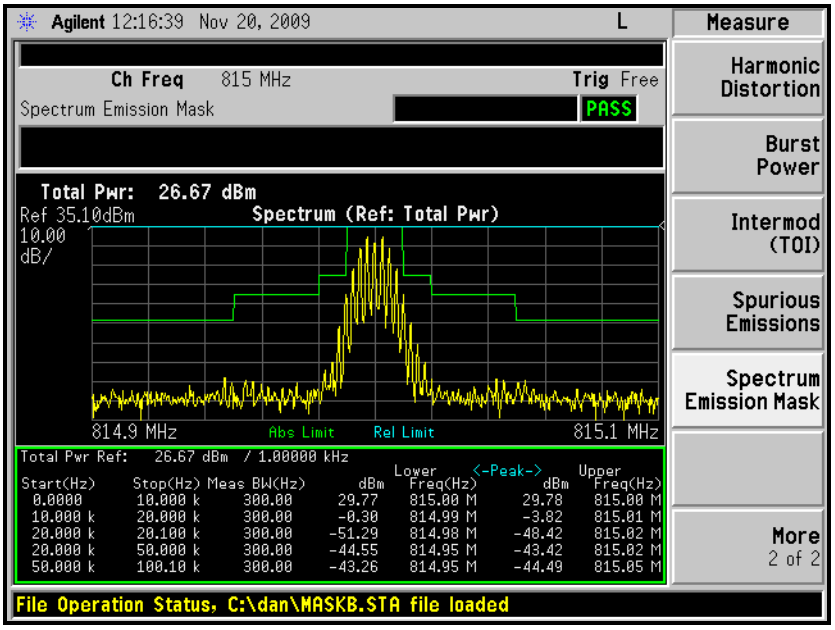
Plot 9-11: Occupied Bandwidth – 470 MHz; P25; Mask D



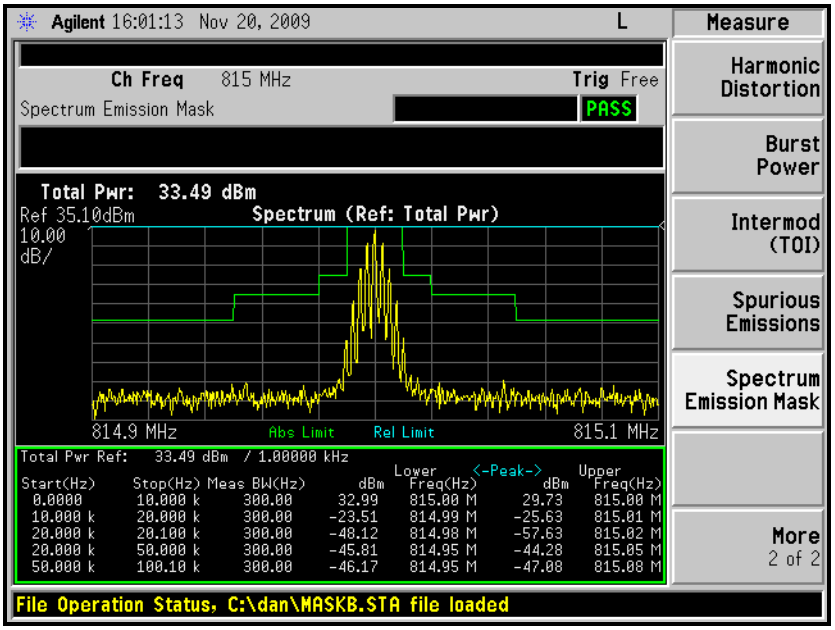
Plot 9-12: Occupied Bandwidth – 470 MHz; CPM; Mask D



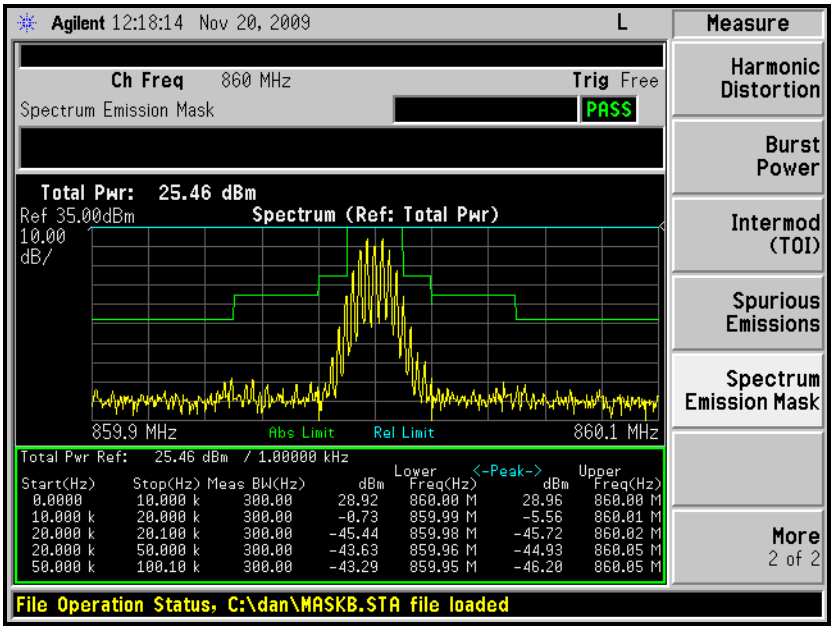
Plot 9-13: Occupied Bandwidth – 815 MHz; Wideband Analog; Mask B



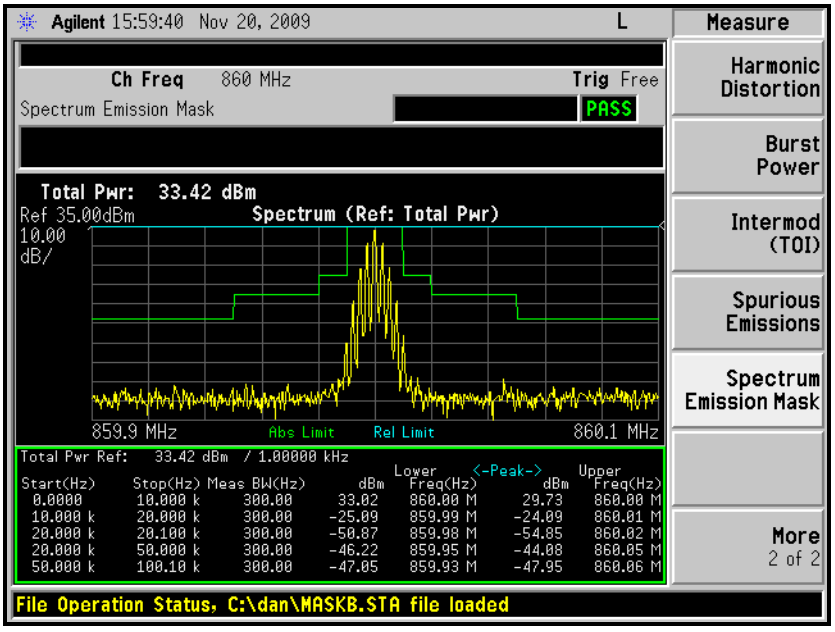
Plot 9-14: Occupied Bandwidth – 815 MHz; Narrowband Analog; Mask D



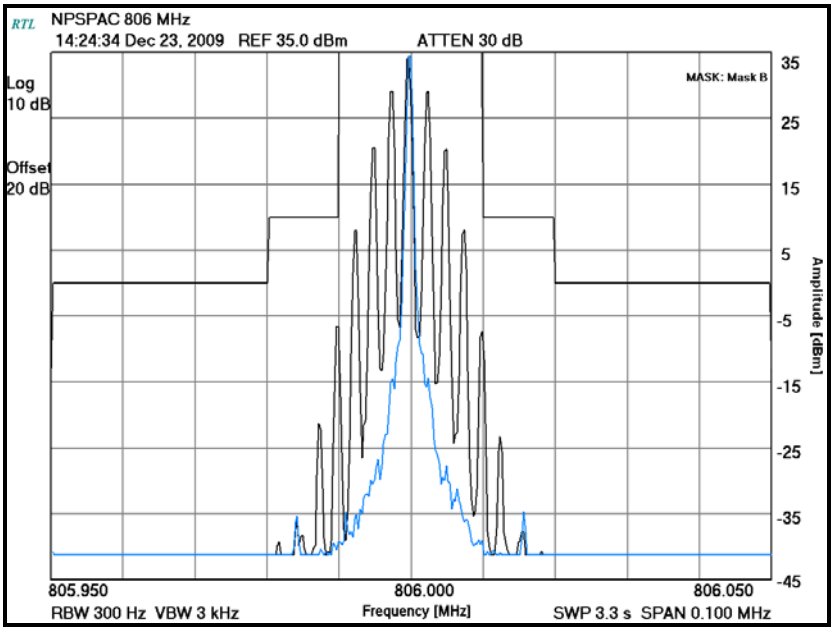
Plot 9-15: Occupied Bandwidth – 860 MHz; Wideband Analog; Mask B



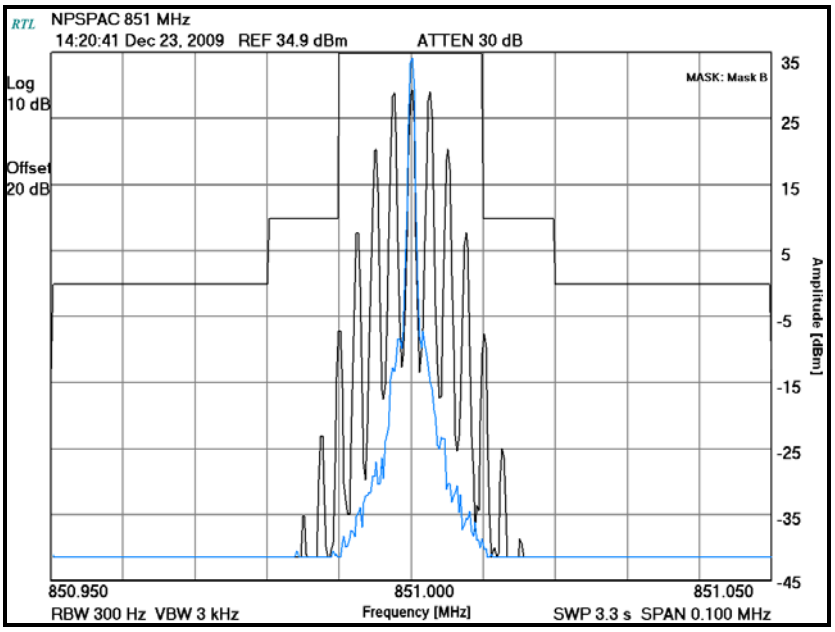
Plot 9-16: Occupied Bandwidth – 860 MHz; Narrowband Analog; Mask D



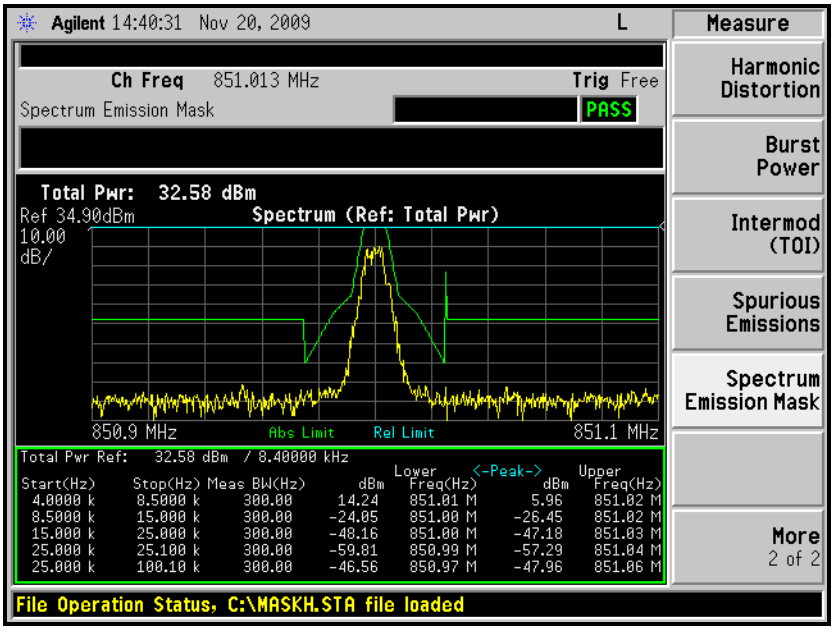
Plot 9-17: Occupied Bandwidth – 806 MHz; NPSPAC; Mask B



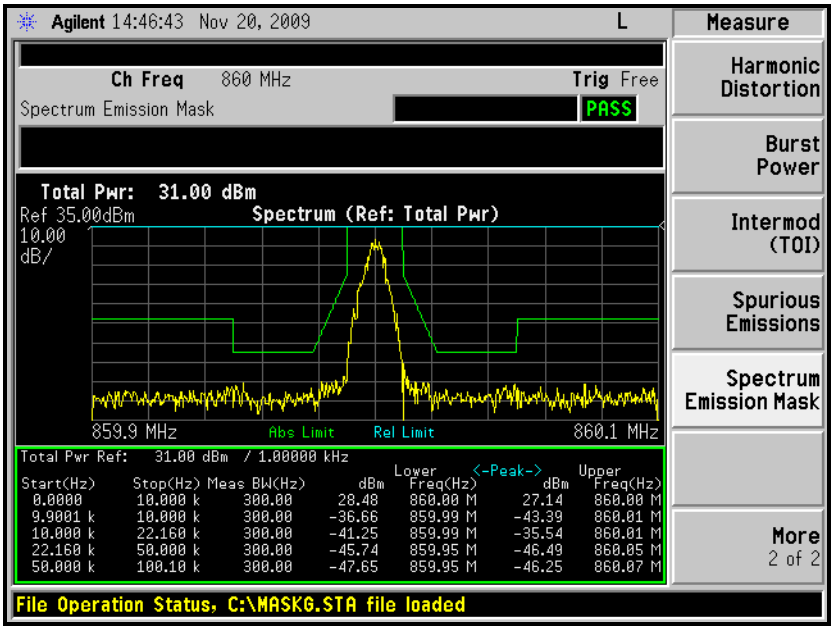
Plot 9-18: Occupied Bandwidth – 851 MHz; NPSPAC; Mask B



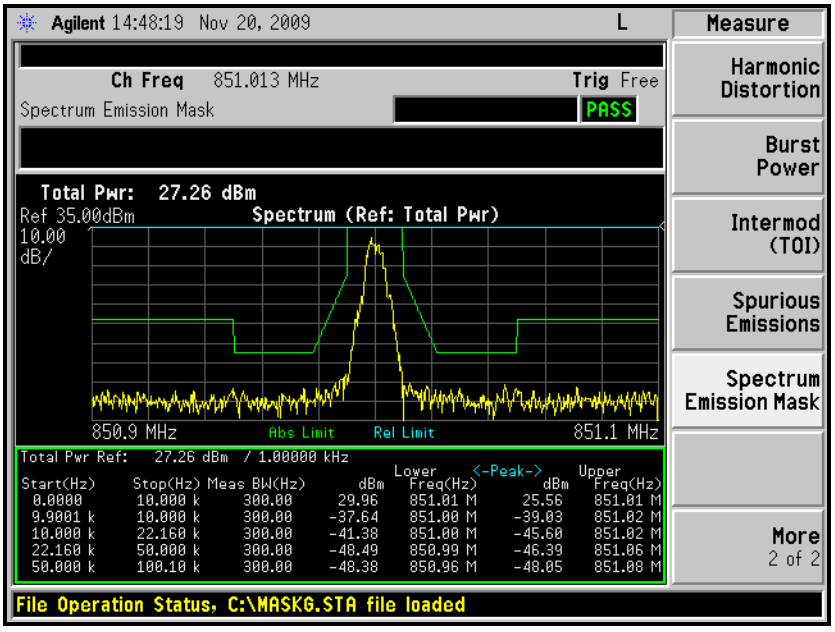
Plot 9-19: Occupied Bandwidth – 851.0125 MHz; P25 RND; Mask H



Plot 9-20: Occupied Bandwidth – 860 MHz; P25 RND; Mask G



Plot 9-21: Occupied Bandwidth – 851.0125 MHz; CPM; Mask H



Plot 9-22: Occupied Bandwidth – 860 MHz; CPM; Mask G

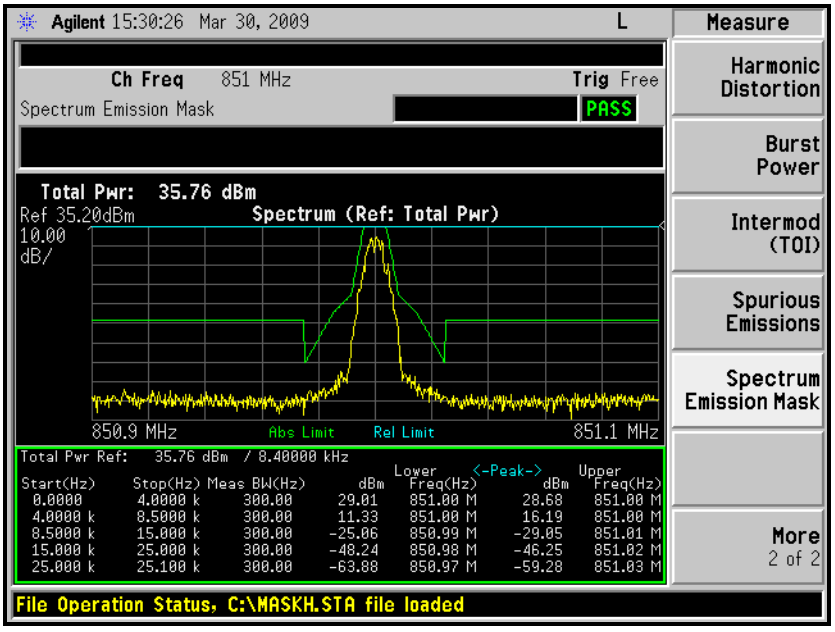


Table 9-1: Test Equipment Used For Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901413	Agilent Technologies	E4448A	Spectrum Analyzer	US44020346	11/10/10
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	12/3/10
900948	Weinschel Corporation	47-10-43	Attenuator DC-18 GHz 10 dB 50W	BH1487	12/3/10
901215	Hewlett Packard	8596EM	Spectrum Analyzer (9kHz-12.8GHz)	3826A00144	11/23/10

Test Personnel:

Daniel Baltzell		November 20 and December 23, 2009
Test Engineer	Signature	Dates Of Tests

10 FCC Rules and Regulation Part 2.1055: Frequency Stability; Part 90.213, 90.539: Frequency Stability; Part 80.209: Frequency Stability

10.1 Test Procedure

ANSI/TIA/EIA-603-2004, section 2.2.2

The carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The EUT was evaluated over the temperature range -30°C to +60°C.

The temperature was initially set to -30°C and a 1-hour period was observed for stabilization of the EUT. The frequency stability was measured within one minute after application of primary power to the transmitter. The temperature was raised at intervals of 10 degrees centigrade through the range. A ½-hour period was observed to stabilize the EUT at each measurement step and the frequency stability was measured within one minute after application of primary power to the transmitter. Additionally, the power supply voltage of the EUT was varied +/-15% nominal input voltage.

§80.209: 10 ppm. 400-466 MHz 5 ppm

§90.213: Mobile stations over 2 W operating power - 1.5 ppm.

§ 90.213 Frequency Stability
(a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

MINIMUM FREQUENCY STABILITY
[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3] 100	100	200
25–50	20	20	50
72–76	5	.....	50
150–174	[5,11] 5	[6] 5	[4,6] 50
216–220	1.0	.....	1.0
220–222 [12]	0.1	1.5	1.5
421–512	[7,11,14] 2.5	[8] 5	[8] 5
806–809	[14] 1.0	1.5	1.5
809–824	[14] 1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	[14] 0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928 [13]	2.5	2.5	2.5
929–930	1.5	.....	.....
935–940	0.1	1.5	1.5
1427–1435	[9] 300	300	300
Above 2450 [10]	.....	.....	.....

§ 90.539 Frequency Stability

Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the frequency stability requirements in this section.
(a) Mobile, portable and control transmitters must normally use automatic frequency control (AFC) to lock on to the base station signal.
(b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.
(c) The frequency stability of mobile, portable, and control transmitters operating in the narrowband segment must be 400 parts per billion or better when AFC is locked to the base station. When AFC is not locked to the base station, the frequency stability must be at least 1.0 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2 channel aggregate), and 2.5 ppm for 25 kHz (4 channel aggregate).
(d) The frequency stability of base transmitters operating in the wideband segment must be 1 part per million or better.
(e) The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

The EUT was tested while the AFC was not locked, therefore, the limit is 1.5 ppm. The worst-case deviation was found to be 0.4 ppm.

10.2 Test Data

Table 10-1: Temperature Frequency Stability – 162 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	161.9999529	0.3
-20	161.9999405	0.4
-10	161.9999745	0.2
0	161.9999738	0.2
10	161.9999766	0.1
20 (reference)	161.9999656	0.2
30	161.9999480	0.3
40	161.9999371	0.4
50	161.9999294	0.4
60	161.9999455	0.3

Table 10-2: Temperature Frequency Stability – 418 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	417.9998779	0.3
-20	417.9998461	0.4
-10	417.9999352	0.2
0	417.9999327	0.2
10	417.9999397	0.1
20 (reference)	417.9999121	0.2
30	417.9998666	0.3
40	417.9998368	0.4
50	417.9998179	0.4
60	417.9998606	0.3

Table 10-3: Temperature Frequency Stability – 470 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	469.9998619	0.3
-20	469.9998253	0.4
-10	469.9999275	0.2
0	469.9999241	0.2
10	469.9999319	0.1
20 (reference)	469.9999017	0.2
30	469.9998506	0.3
40	469.9998161	0.4
50	469.9997948	0.4
60	469.9998442	0.3

Table 10-4: Temperature Frequency Stability – 767.1025 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	767.1022740	0.3
-20	767.1022159	0.4
-10	767.1023838	0.2
0	767.1023772	0.2
10	767.1023903	0.1
20 (reference)	767.1023419	0.2
30	767.1022582	0.3
40	767.1021989	0.4
50	767.1021653	0.4
60	767.1022492	0.3

Table 10-5: Temperature Frequency Stability – 797.1025 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	797.1022610	0.3
-20	797.1022016	0.4
-10	797.1023808	0.1
0	797.1023720	0.2
10	797.1023863	0.1
20 (reference)	797.1023359	0.2
30	797.1022496	0.3
40	797.1021845	0.4
50	797.1021509	0.4
60	797.1022416	0.3

Table 10-6: Temperature Frequency Stability – 815 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	814.9997206	0.3
-20	814.9996929	0.4
-10	814.9998785	0.1
0	814.9998692	0.2
10	814.9998832	0.1
20 (reference)	814.9998334	0.2
30	814.9997475	0.3
40	814.9996759	0.4
50	814.9996431	0.4
60	814.9997386	0.3

Table 10-7: Temperature Frequency Stability – 860 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	859.9996964	0.4
-20	859.9996737	0.4
-10	859.9998720	0.1
0	859.9998610	0.2
10	859.9998770	0.1
20 (reference)	859.9998245	0.2
30	859.9997343	0.3
40	859.9996559	0.4
50	859.9996219	0.4
60	859.9997255	0.3

Result: The EUT is compliant.

10.2.1 Frequency Stability/Voltage Variation

Table 10-8: Frequency Stability/Voltage Variation – 162 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
5.54 (Battery End Point)	161.9999623	0.2
6.375	161.9999624	0.2
7.5	161.9999625	0.2
8.625	161.9999627	0.2

Table 10-9: Frequency Stability/Voltage Variation – 418 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
5.54 (Battery End Point)	417.9999023	0.2
6.375	417.9999019	0.2
7.5	417.9999020	0.2
8.625	417.9999018	0.2

Table 10-10: Frequency Stability/Voltage Variation – 470 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
5.53 (Battery End Point)	469.9998864	0.2
6.375	469.9998874	0.2
7.5	469.9998878	0.2
8.625	469.9998880	0.2

Table 10-11: Frequency Stability/Voltage Variation – 767.1025 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
5.59 (Battery End Point)	767.1023140	0.2
6.375	767.1023133	0.2
7.5	767.1023133	0.2
8.625	767.1023128	0.2

Table 10-12: Frequency Stability/Voltage Variation – 797.1025 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
5.58 (Battery End Point)	797.1023025	0.2
6.375	797.1023028	0.2
7.5	797.1023035	0.2
8.625	797.1023041	0.2

Table 10-13: Frequency Stability/Voltage Variation – 815 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
5.55 (Battery End Point)	814.9997977	0.2
6.375	814.9997981	0.2
7.5	814.9997971	0.2
8.625	814.9997973	0.2

Table 10-14: Frequency Stability/Voltage Variation – 860 MHz

Voltage (VDC)	Measured Frequency (Hz)	Ppm
5.54 (Battery End Point)	859.9997851	0.2
6.375	859.9997849	0.3
7.5	859.9997851	0.2
8.625	859.9997856	0.2

Table 10-15: Test Equipment Used For Testing Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	7/23/10
901300	Agilent Technologies	53131A	Frequency Counter	MY40001345	6/18/10
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	12/3/10

Test Personnel:

Daniel Baltzell		November 23, 2009
EMC Test Engineer	Signature	Date Of Test

11 FCC Part 2.1047: Modulation Characteristics; Part 80.213 Modulation Requirements

§ 80.213 Modulation requirements.

(a)(2) When phase or frequency modulation is used in the 156–162 MHz band, the peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ±5 kHz is defined as 100 percent peak modulation.
(b) Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent. This requirement does not apply to survival craft transmitters, to transmitters that do not require a license, or to transmitters whose output power does not exceed 3 watts.
(d) Ship and coast station transmitters operating in the 156–162 MHz and 216–220 MHz bands must be capable of proper operation with a frequency deviation that does not exceed ±5 kHz when using any emission authorized by §80.207.
(e) Coast station transmitters operating in the 156–162 MHz band must be equipped with an audio low-pass filter. The filter must be installed between the modulation limiter and the modulated radio frequency stage. At frequencies between 3 kHz and 20 kHz it must have an attenuation greater than at 1 kHz by at least 60log10(f/3) dB where ‘‘f’’ is the audio frequency in kilohertz. At frequencies above 20 kHz the attenuation must be at least 50 dB greater than at 1 kHz.

11.1 Test Procedures

11.1.1 Audio Frequency Response

ANSI/TIA/EIA-603-2004, section 2.2.6

The audio frequency response is the degree of closeness to which the frequency deviation of the transmitter follows a prescribed characteristic.

The input audio level at 1000 Hz was set to produce 20% of the rated system deviation. This point is shown as the 0 dB reference level, noted DEVref. The audio signal generator was varied from 100 Hz to 5 kHz with the input level held constant. The deviation in kHz was recorded using a modulation analyzer as DEVfreq. The response in dB relative to 1 kHz was calculated as follows:

Audio Frequency Response = 20 LOG (DEVfreq/DEVref)

11.1.2 Audio Low Pass Filter Response

ANSI/TIA/EIA-603-2004, 2.2.15

The Audio Low Pass Filter Response is the frequency response of the post limiter low pass filter circuit above 3000 Hz.

11.1.3 Modulation Limiting

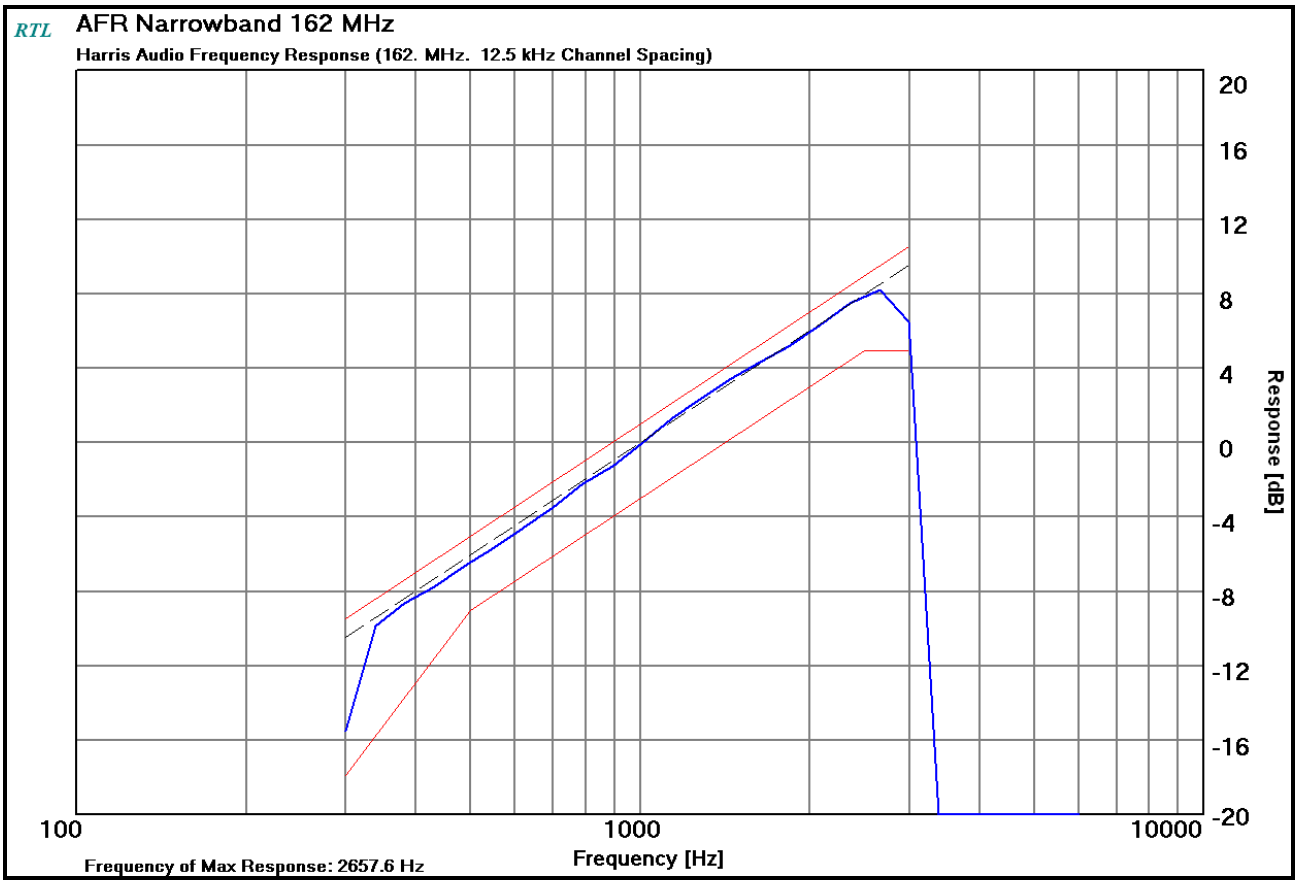
ANSI/TIA/EIA-603-2004, section 2.2.3

The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level (0 dB) as a reference, the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1,000 Hz, and 2,500 Hz. The system deviation obtained as a function of the input level was recorded. Both positive and negative peak deviations were recorded.

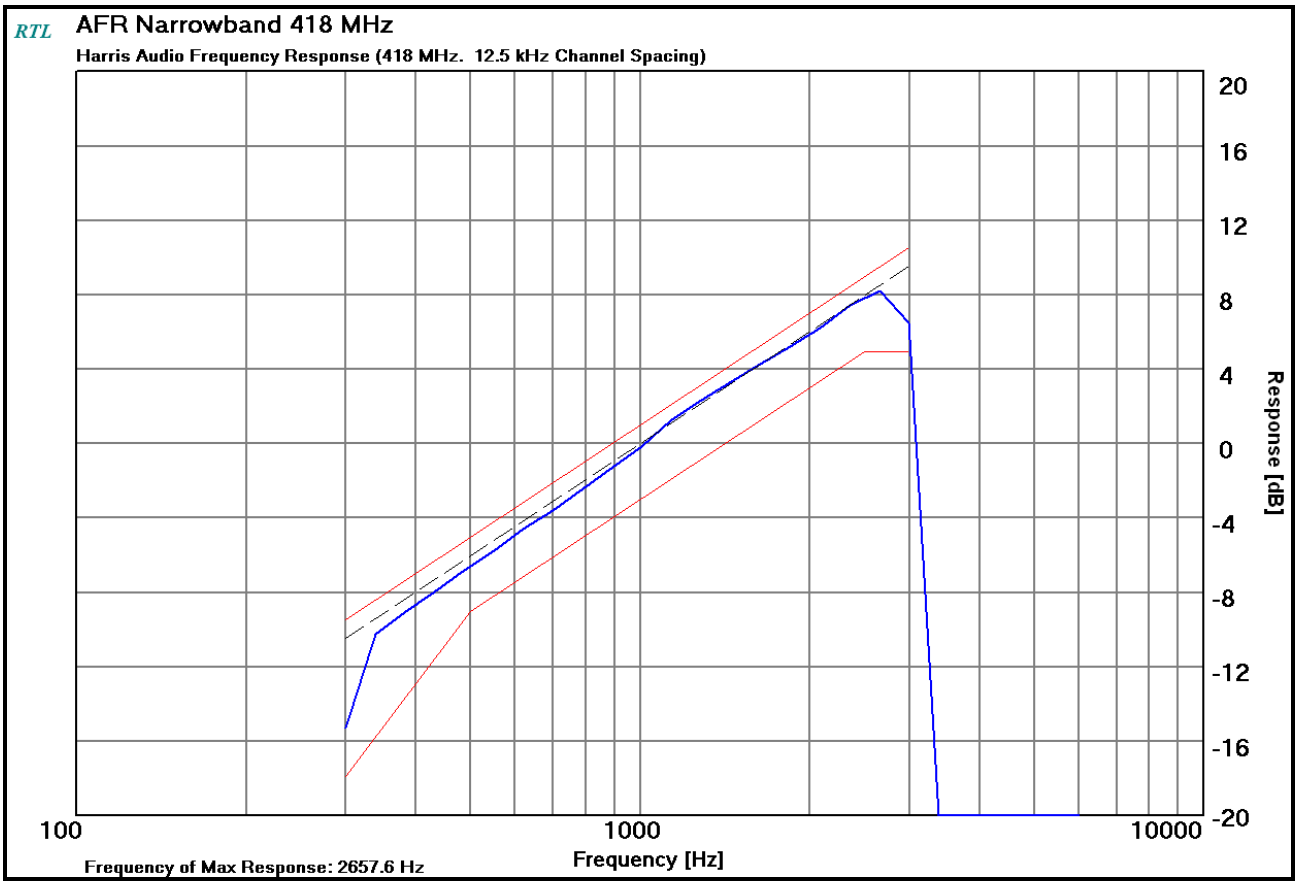
11.2 Test Data

11.2.1 Audio Frequency Response

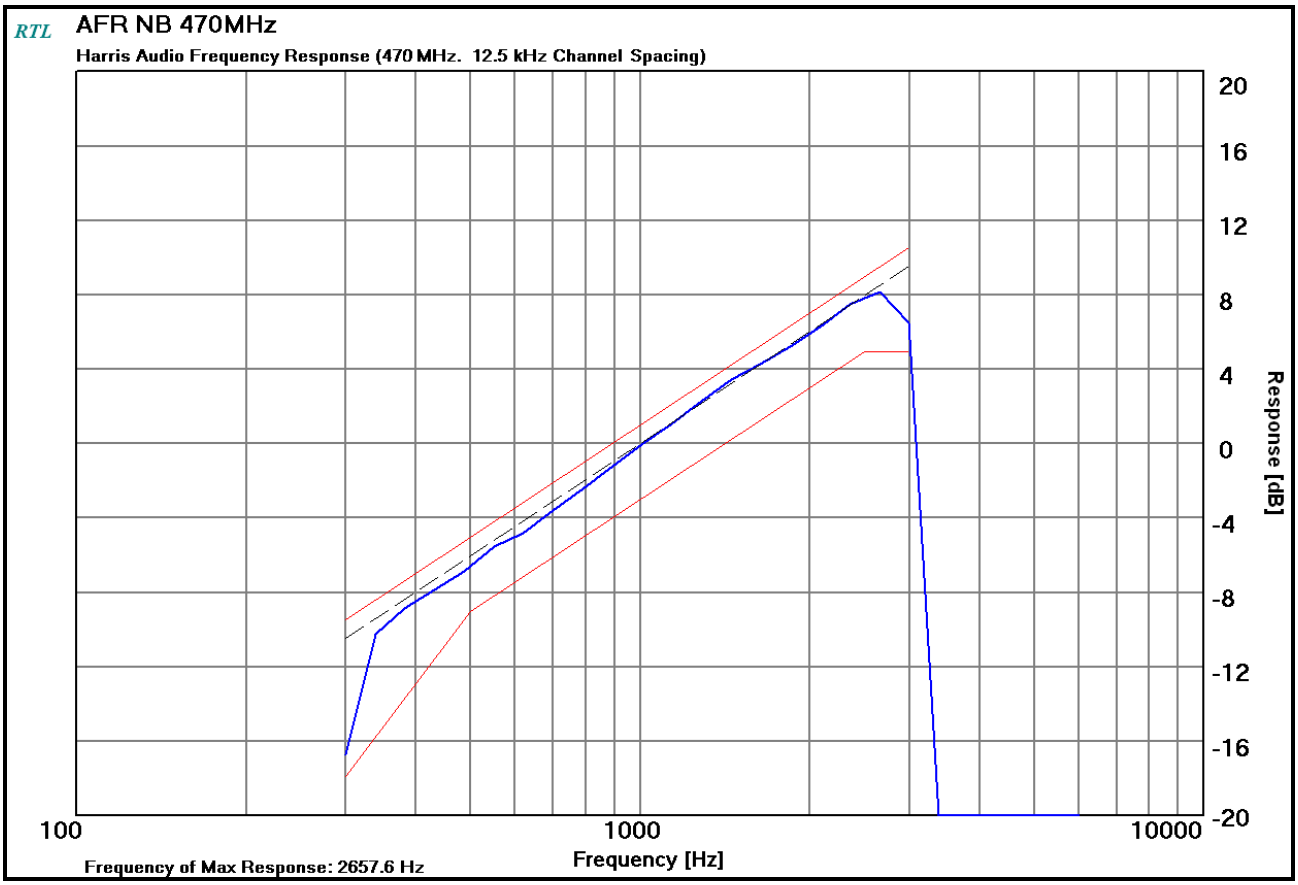
Plot 11-1: Modulation Characteristics - Audio Frequency Response - 162 MHz



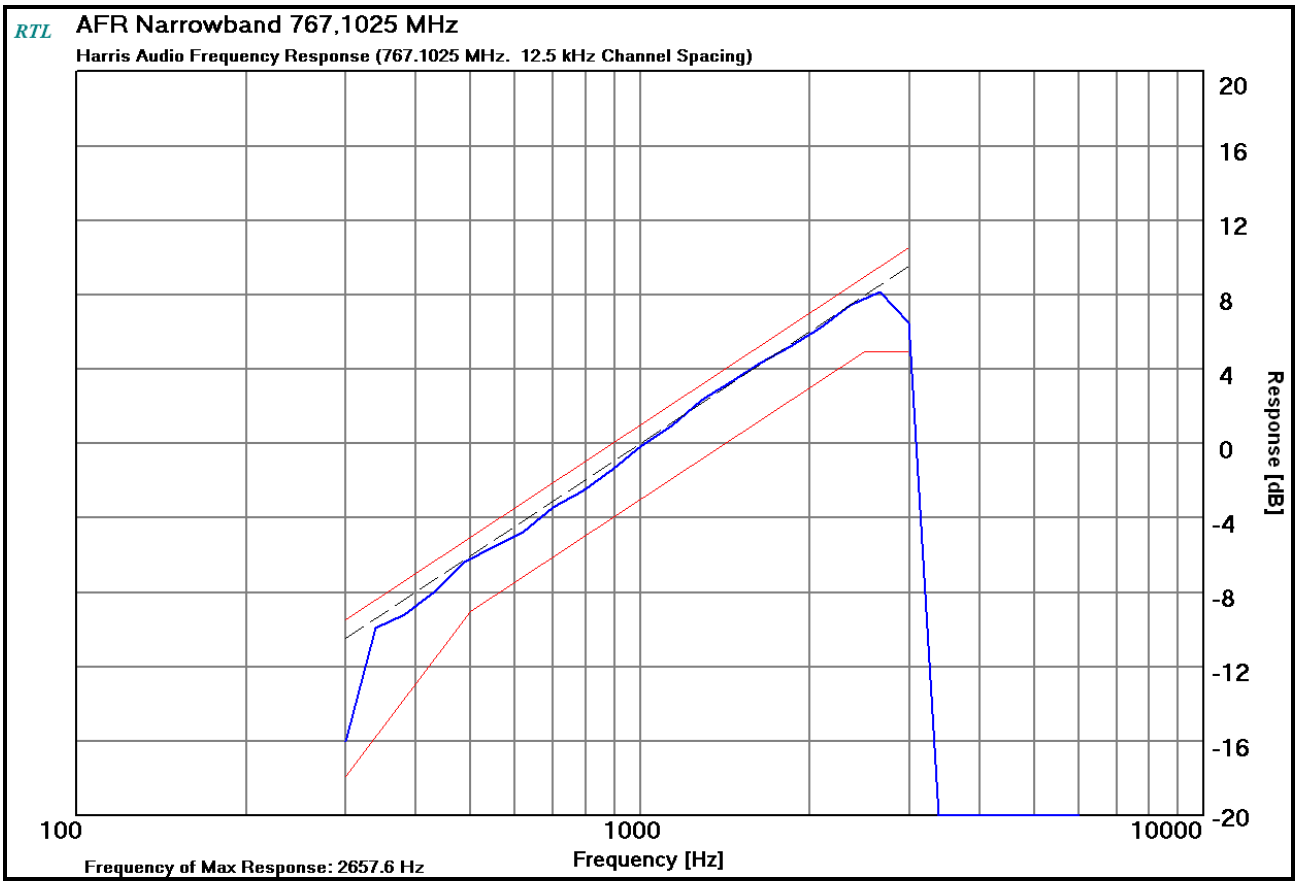
Plot 11-2: Modulation Characteristics - Audio Frequency Response - 418 MHz



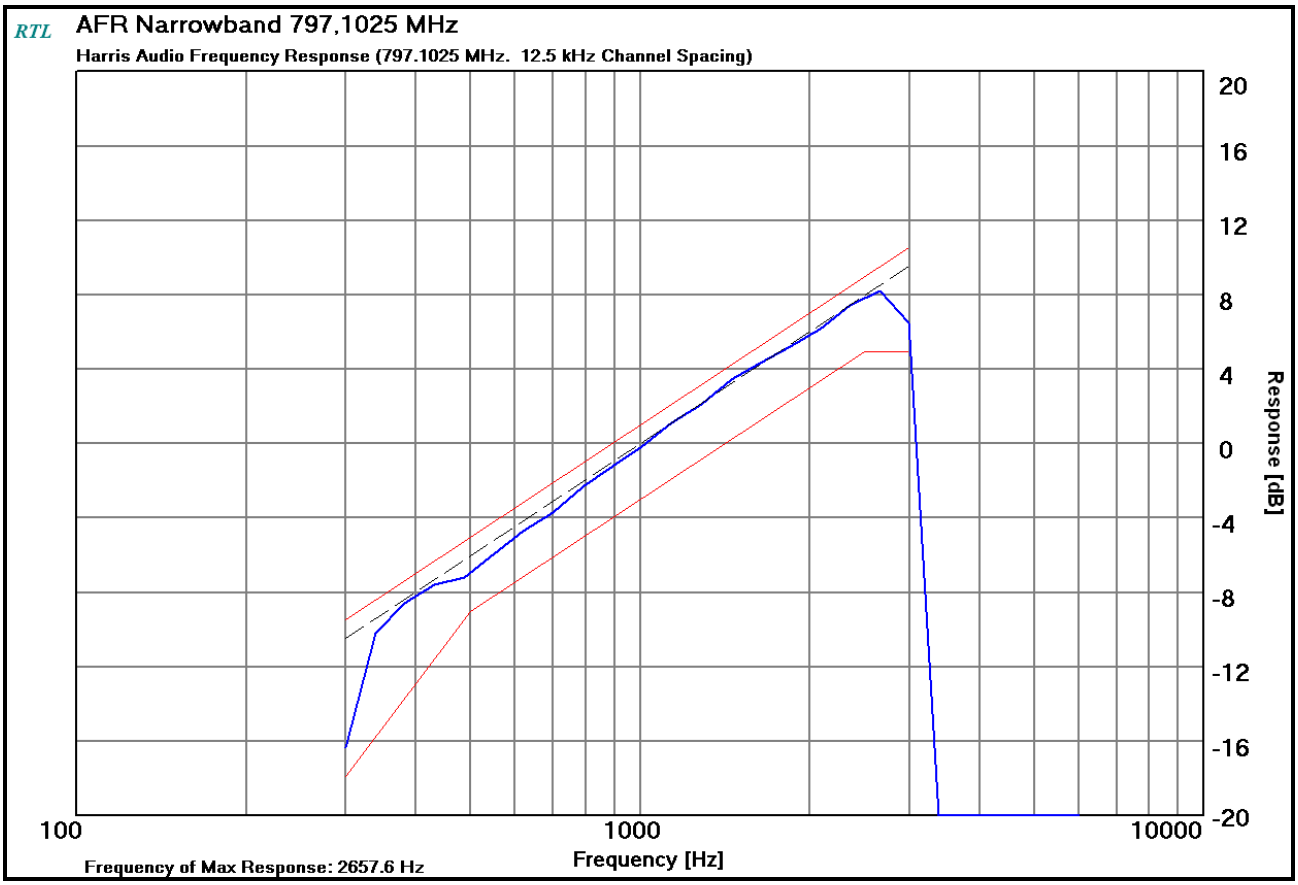
Plot 11-3: Modulation Characteristics - Audio Frequency Response - 470 MHz



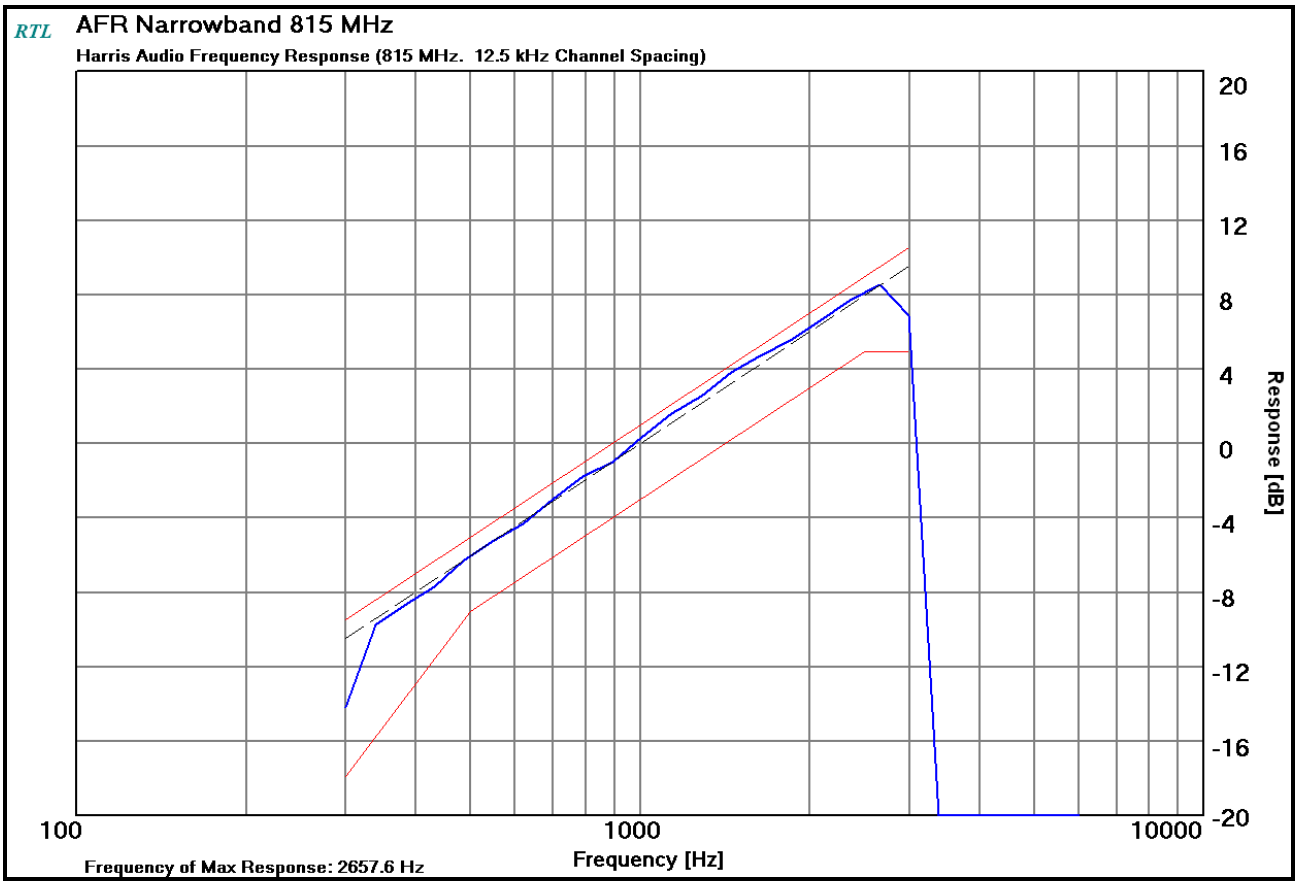
Plot 11-4: Modulation Characteristics - Audio Frequency Response - 767.1025 MHz



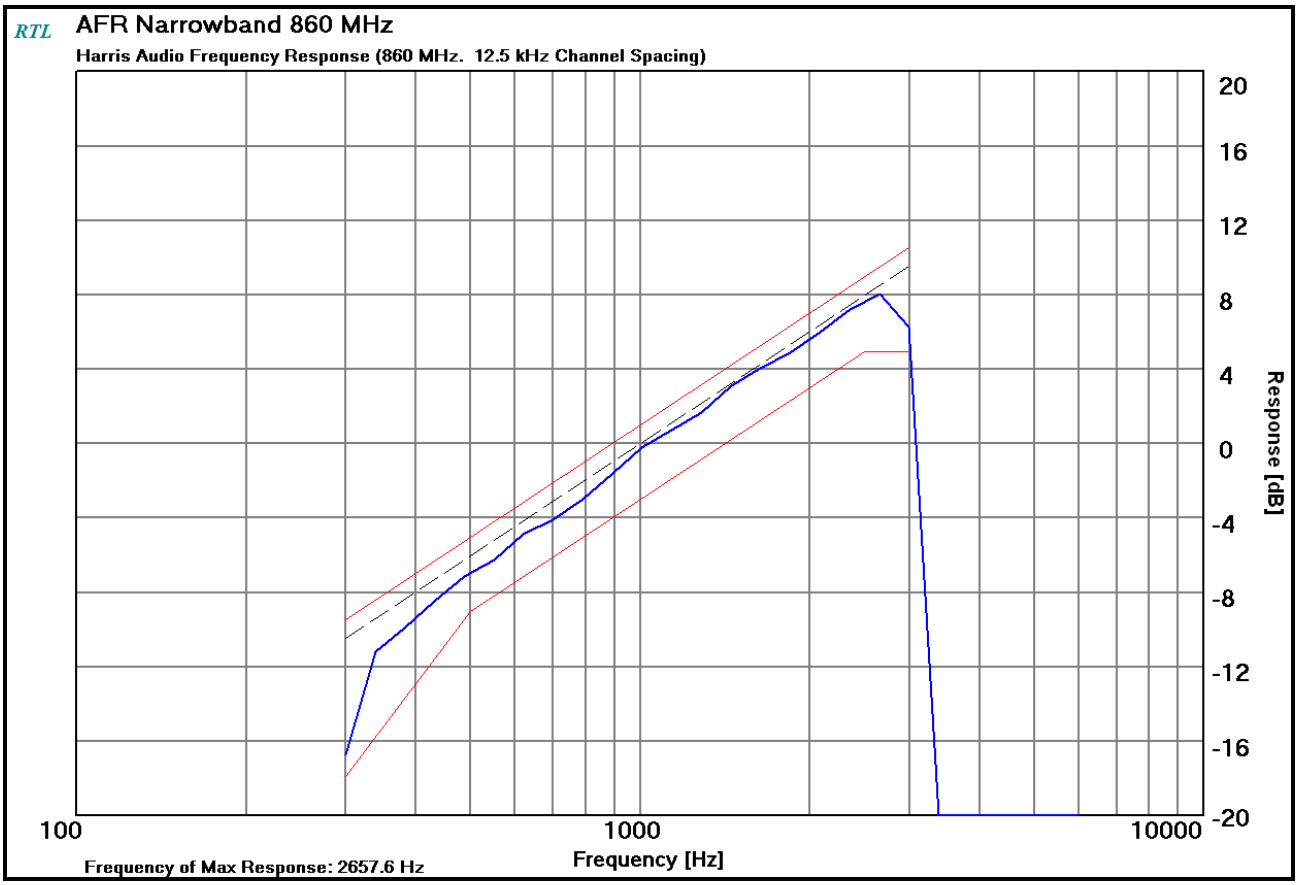
Plot 11-5: Modulation Characteristics - Audio Frequency Response - 797.1025 MHz



Plot 11-6: Modulation Characteristics - Audio Frequency Response - 815 MHz

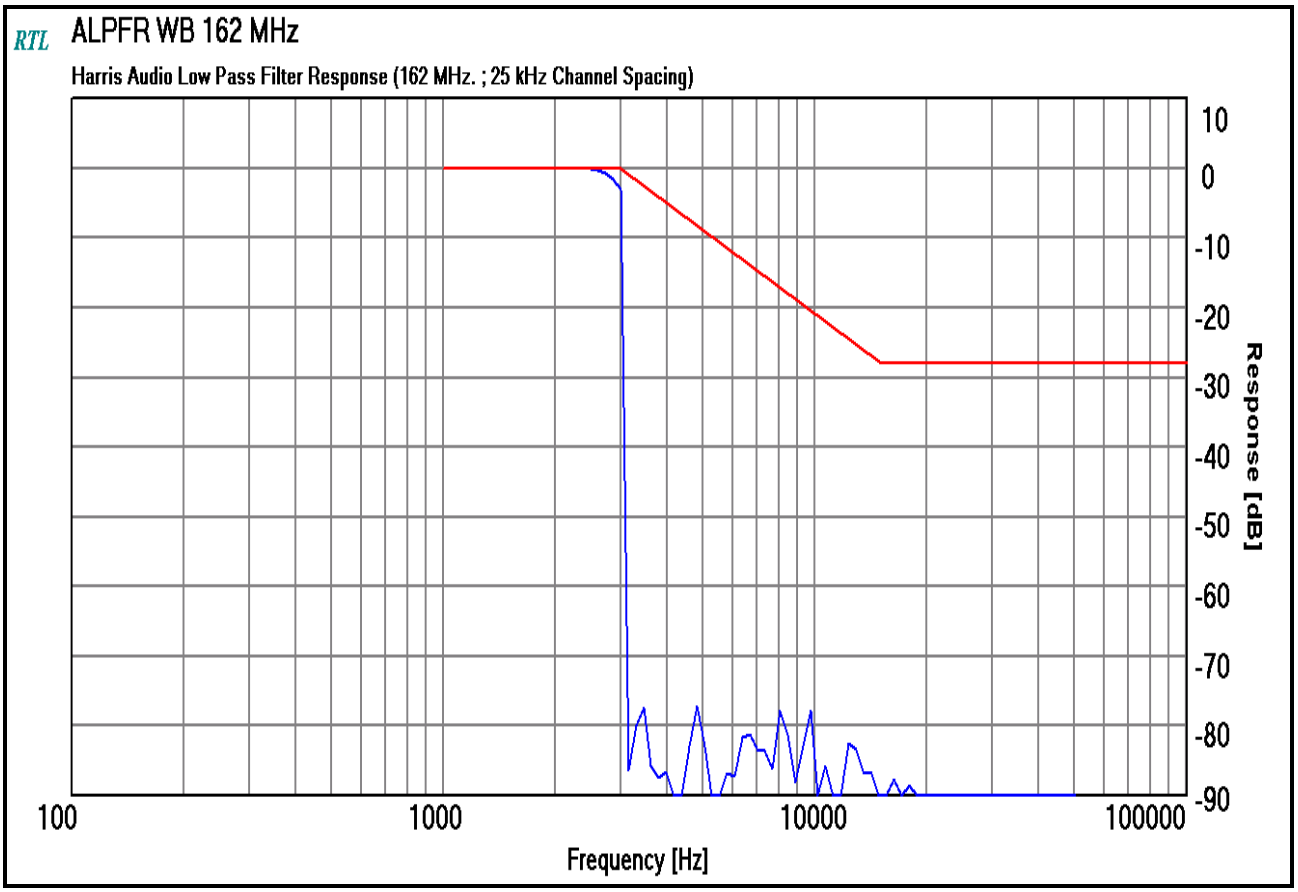


Plot 11-7: Modulation Characteristics - Audio Frequency Response - 860 MHz

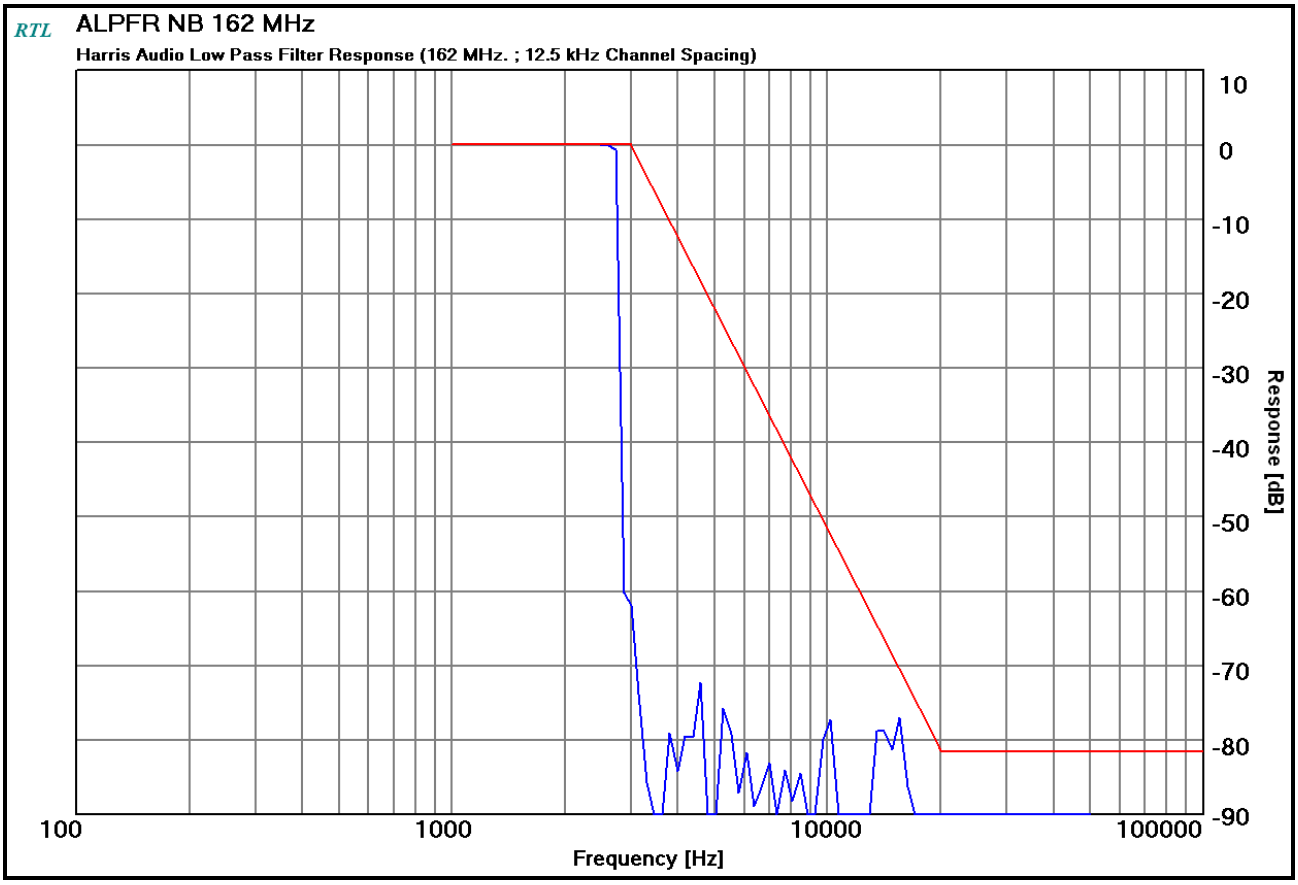


11.2.2 Audio Low Pass Filter Response

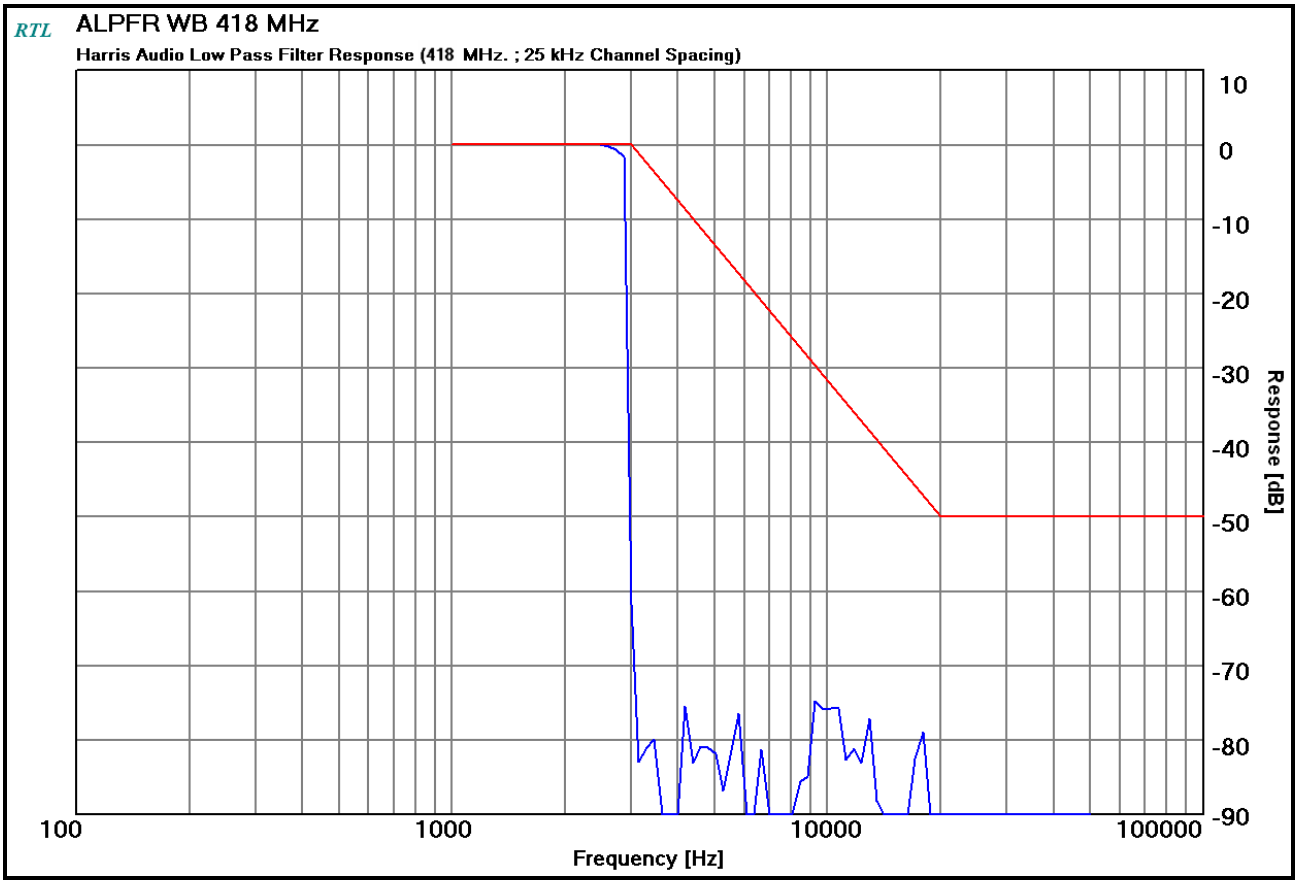
Plot 11-8: Modulation Characteristics – Audio Low Pass Filter - 162 MHz (WB)



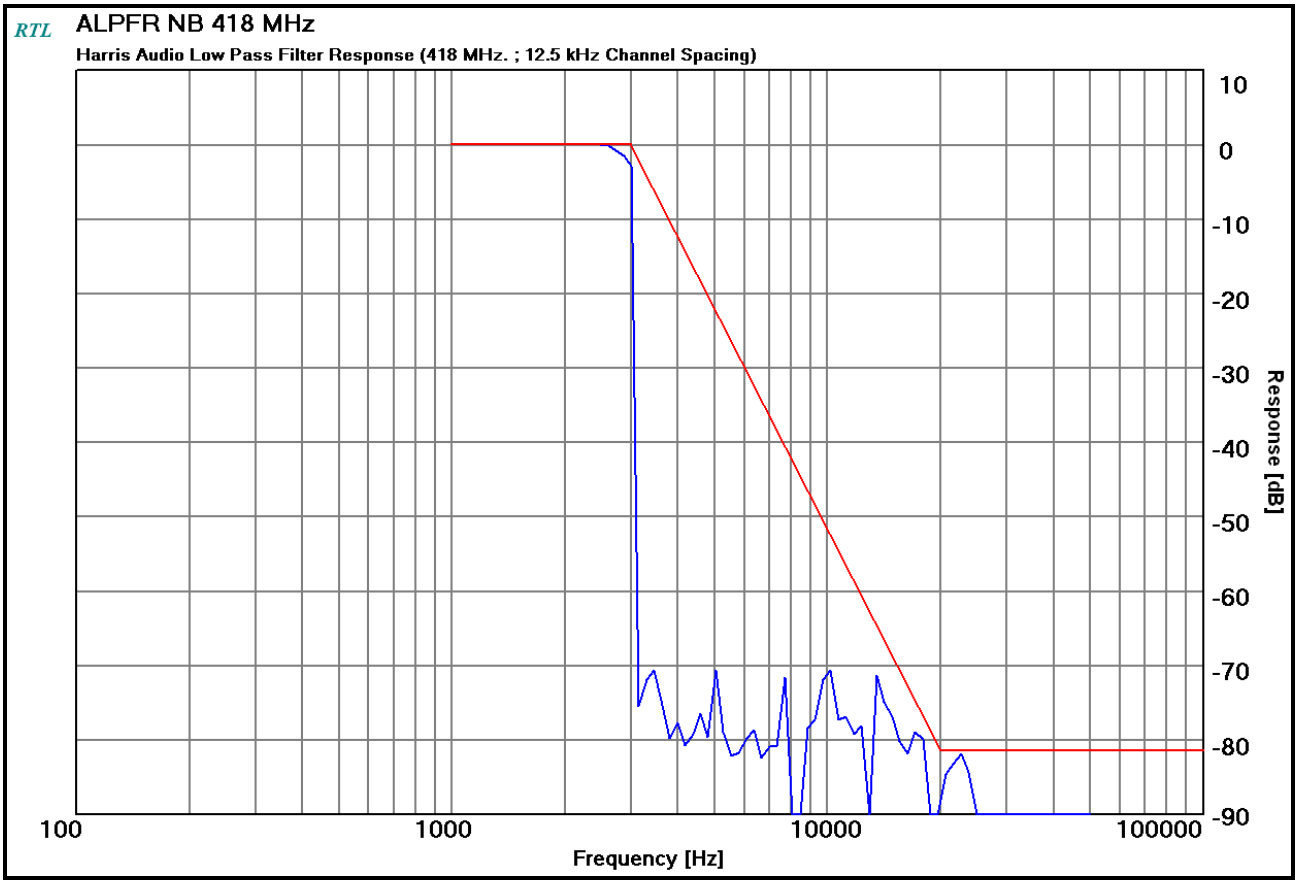
Plot 11-9: Modulation Characteristics – Audio Low Pass Filter - 162 MHz (NB)



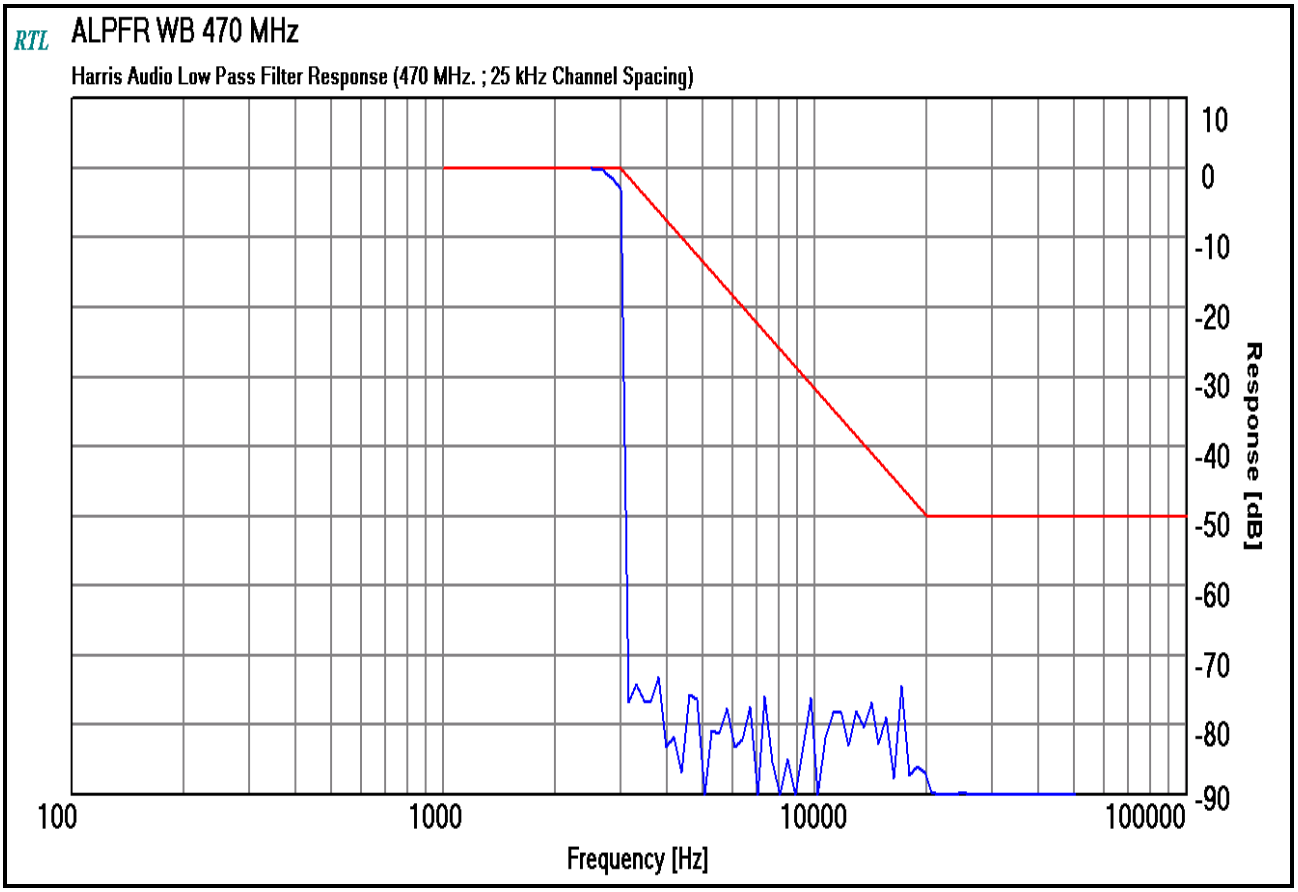
Plot 11-10: Modulation Characteristics – Audio Low Pass Filter - 418 MHz (WB)



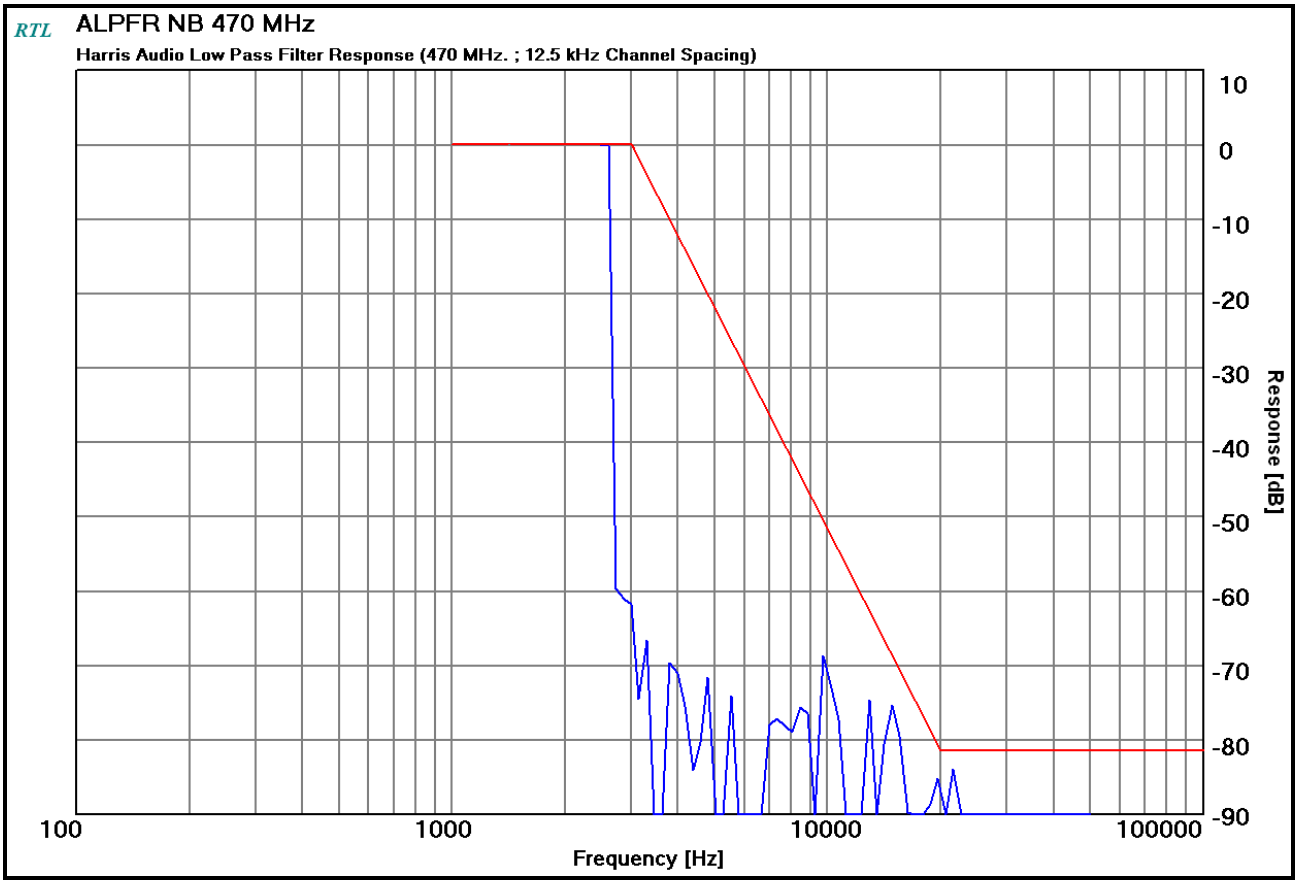
Plot 11-11: Modulation Characteristics – Audio Low Pass Filter - 418 MHz (NB)



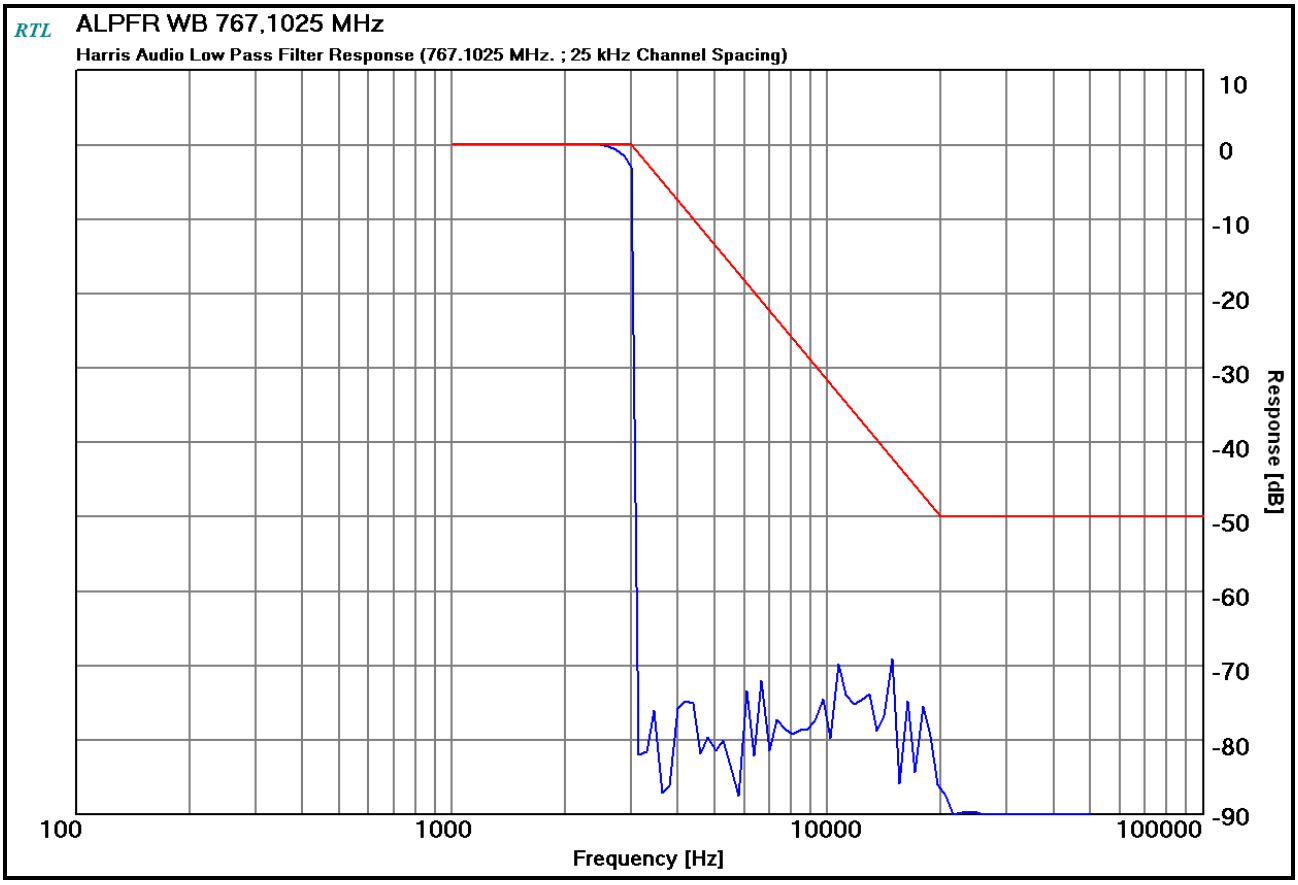
Plot 11-12: Modulation Characteristics – Audio Low Pass Filter - 470 MHz (WB)



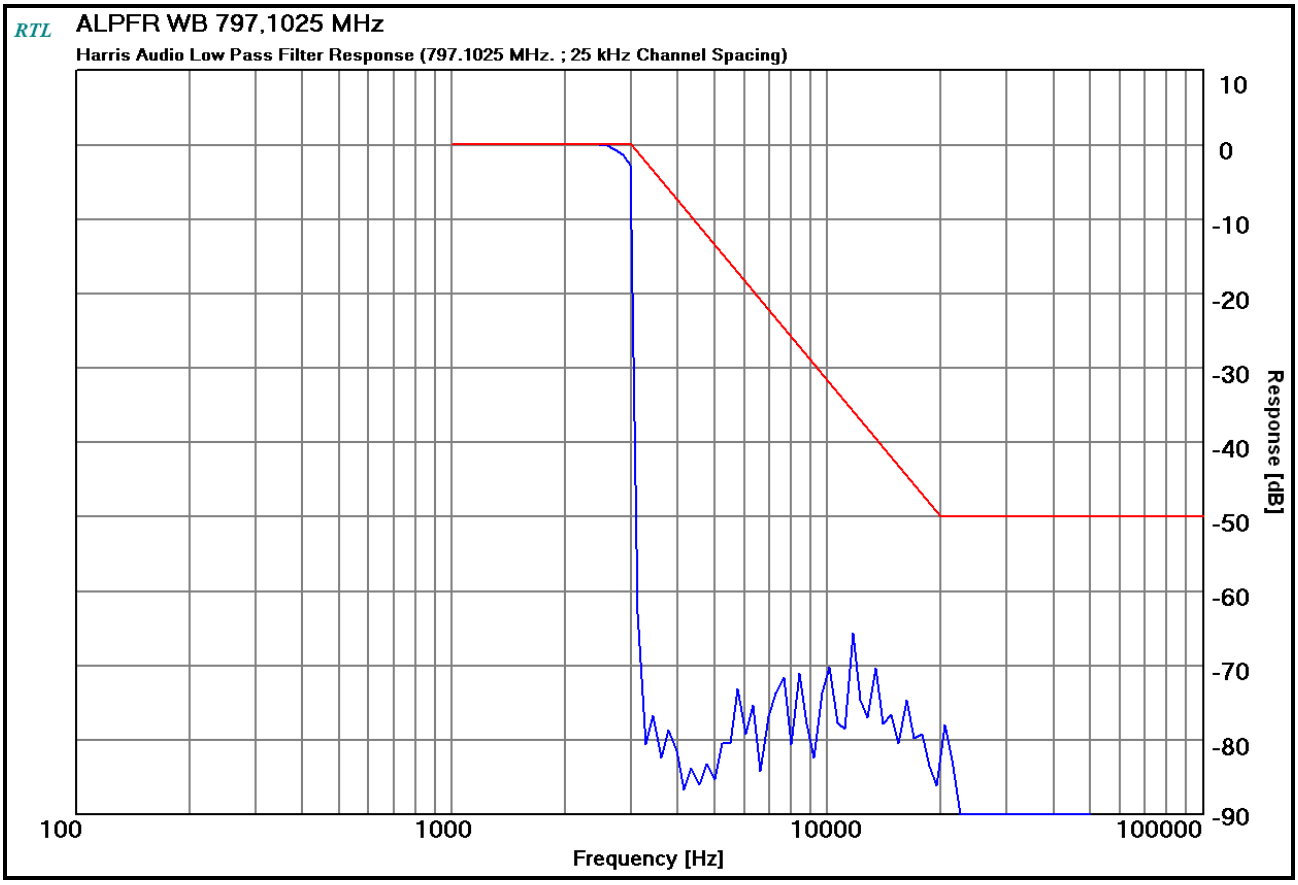
Plot 11-13: Modulation Characteristics – Audio Low Pass Filter - 470 MHz (NB)



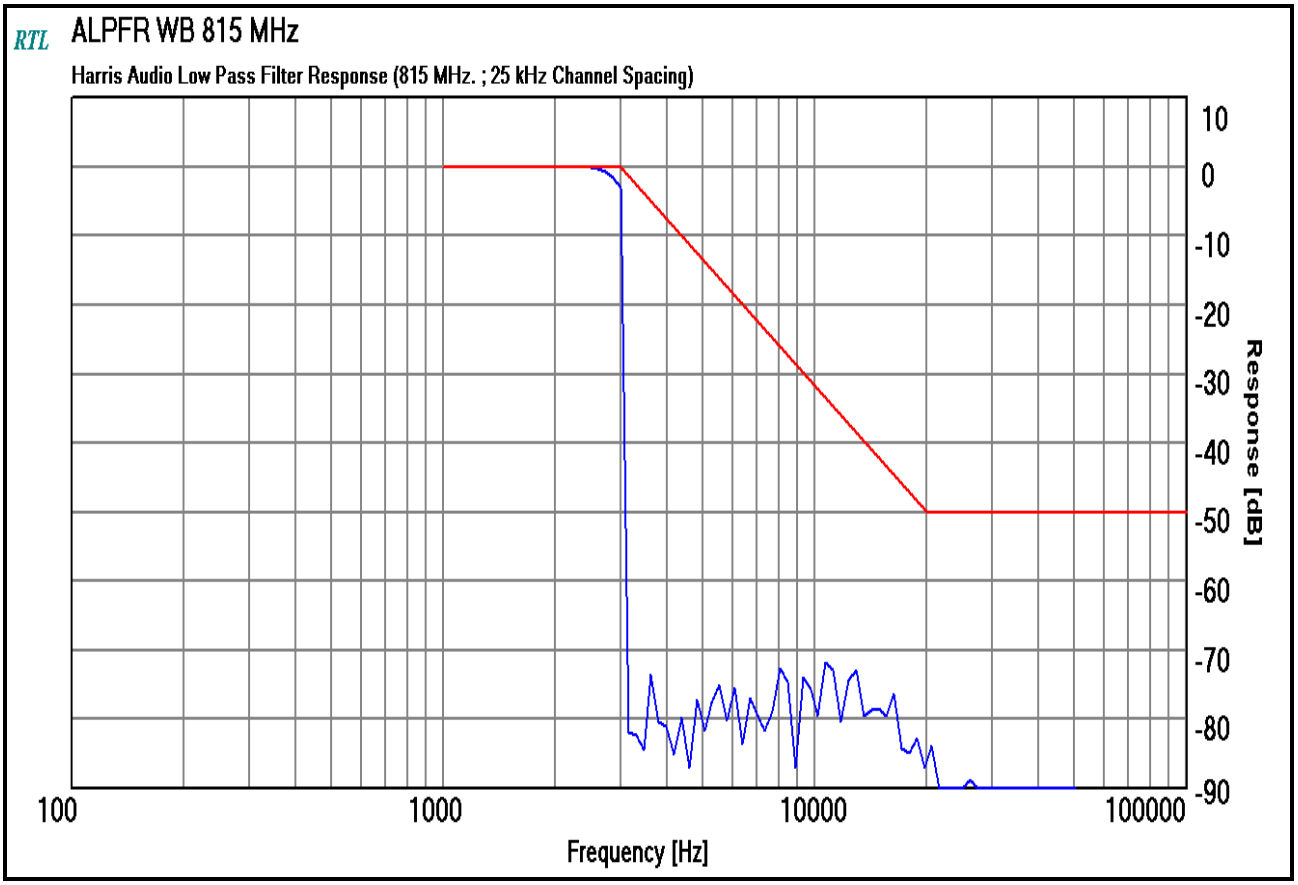
Plot 11-14: Modulation Characteristics – Audio Low Pass Filter - 767.1025 MHz



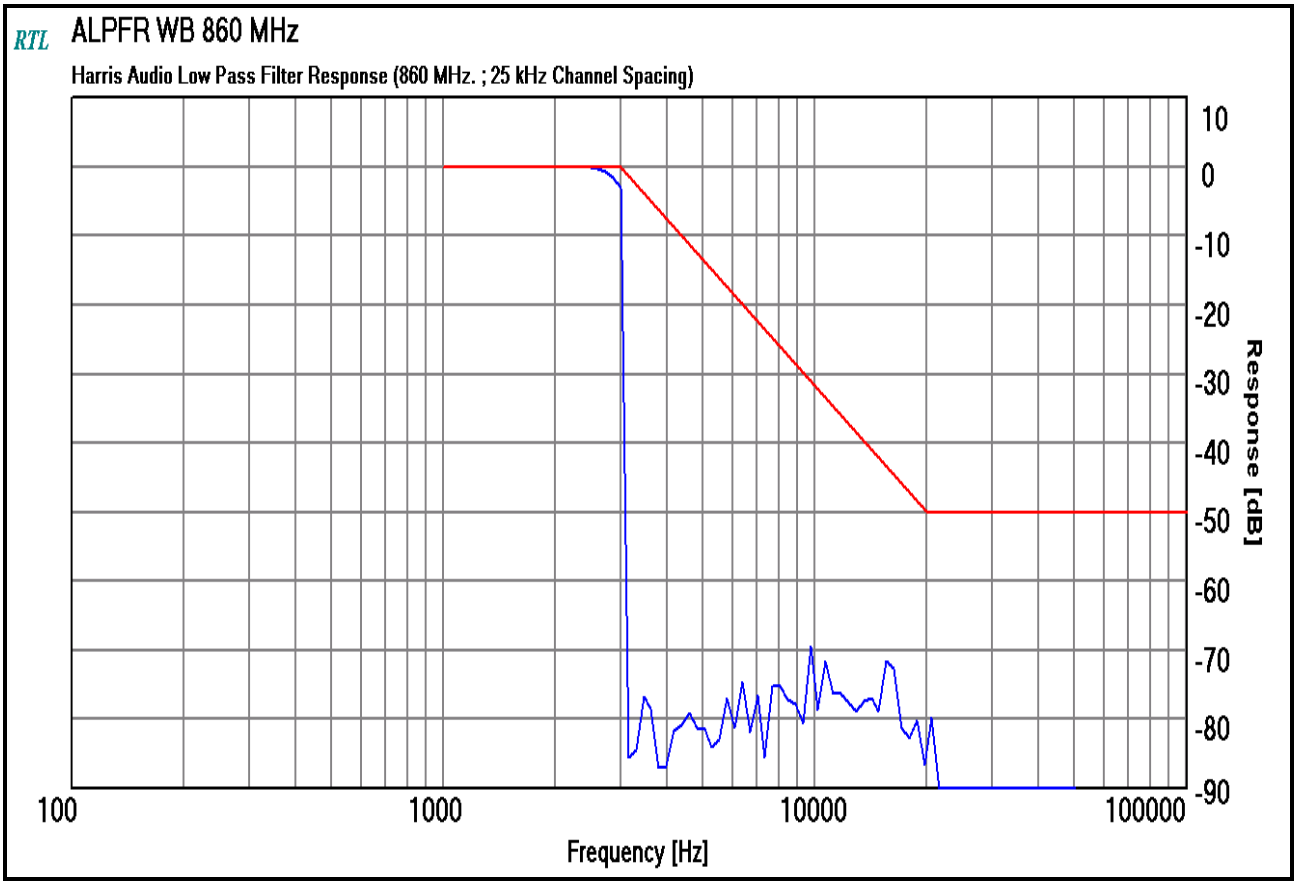
Plot 11-15: Modulation Characteristics – Audio Low Pass Filter - 797.1025 MHz



Plot 11-16: Modulation Characteristics – Audio Low Pass Filter - 815 MHz

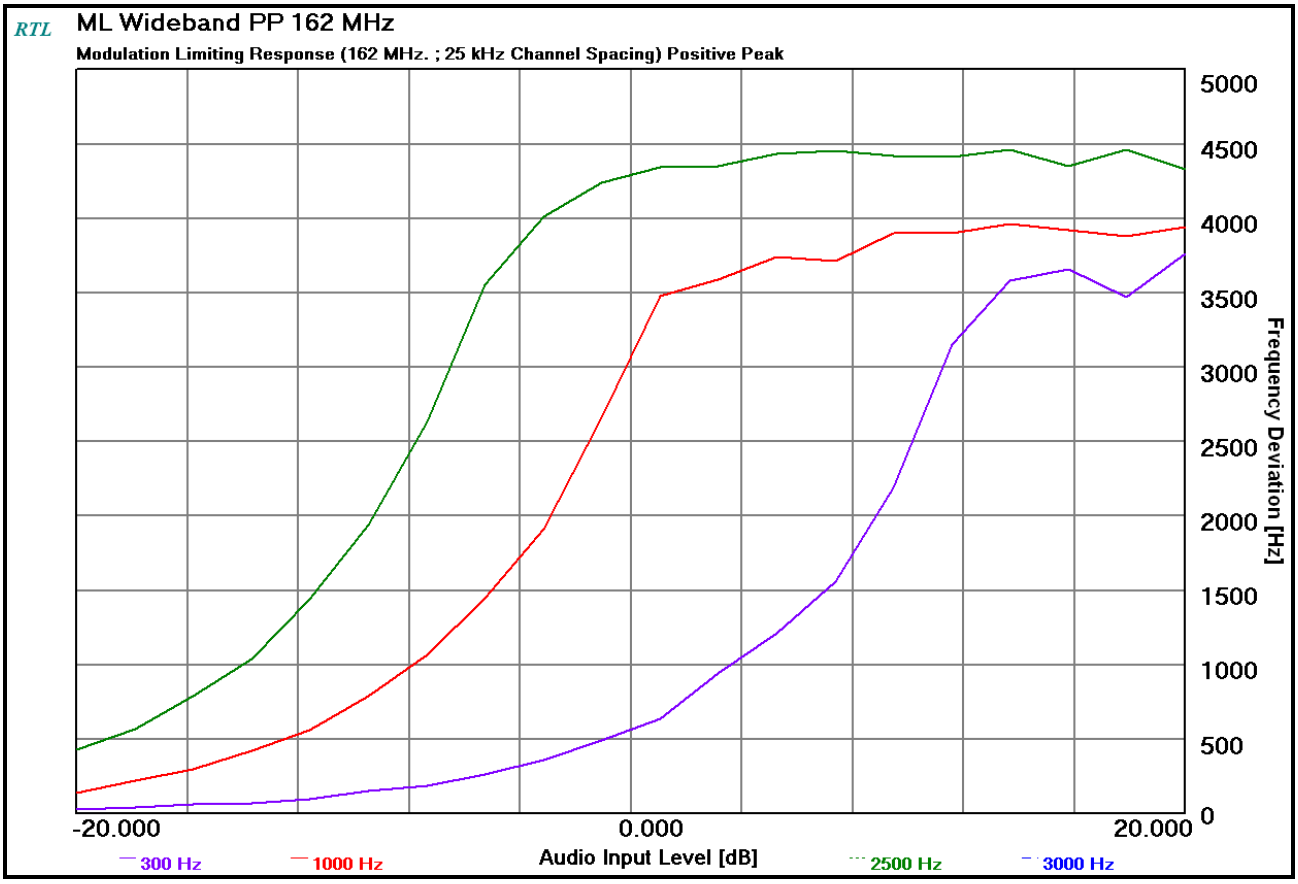


Plot 11-17: Modulation Characteristics – Audio Low Pass Filter - 860 MHz

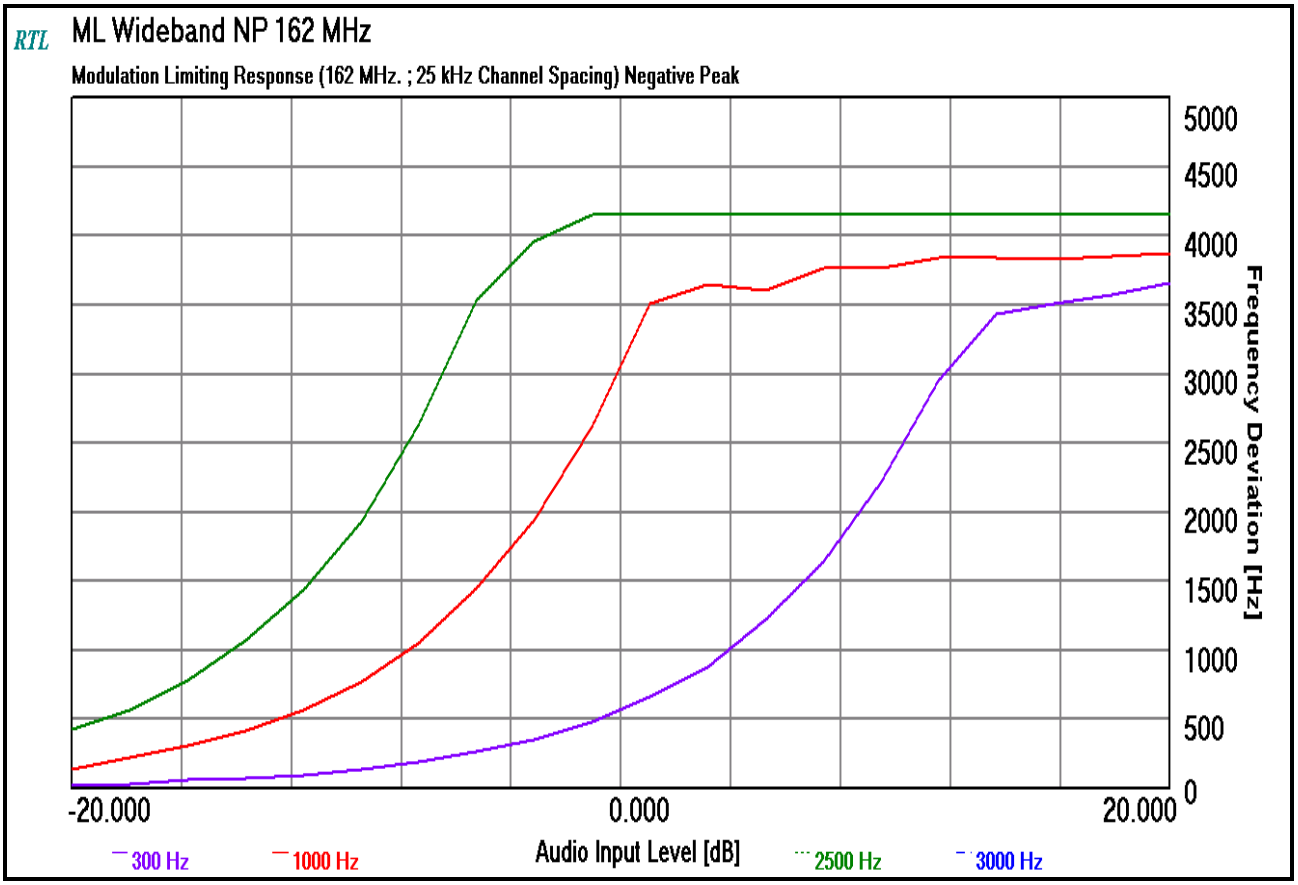


11.2.3 Modulation Limiting

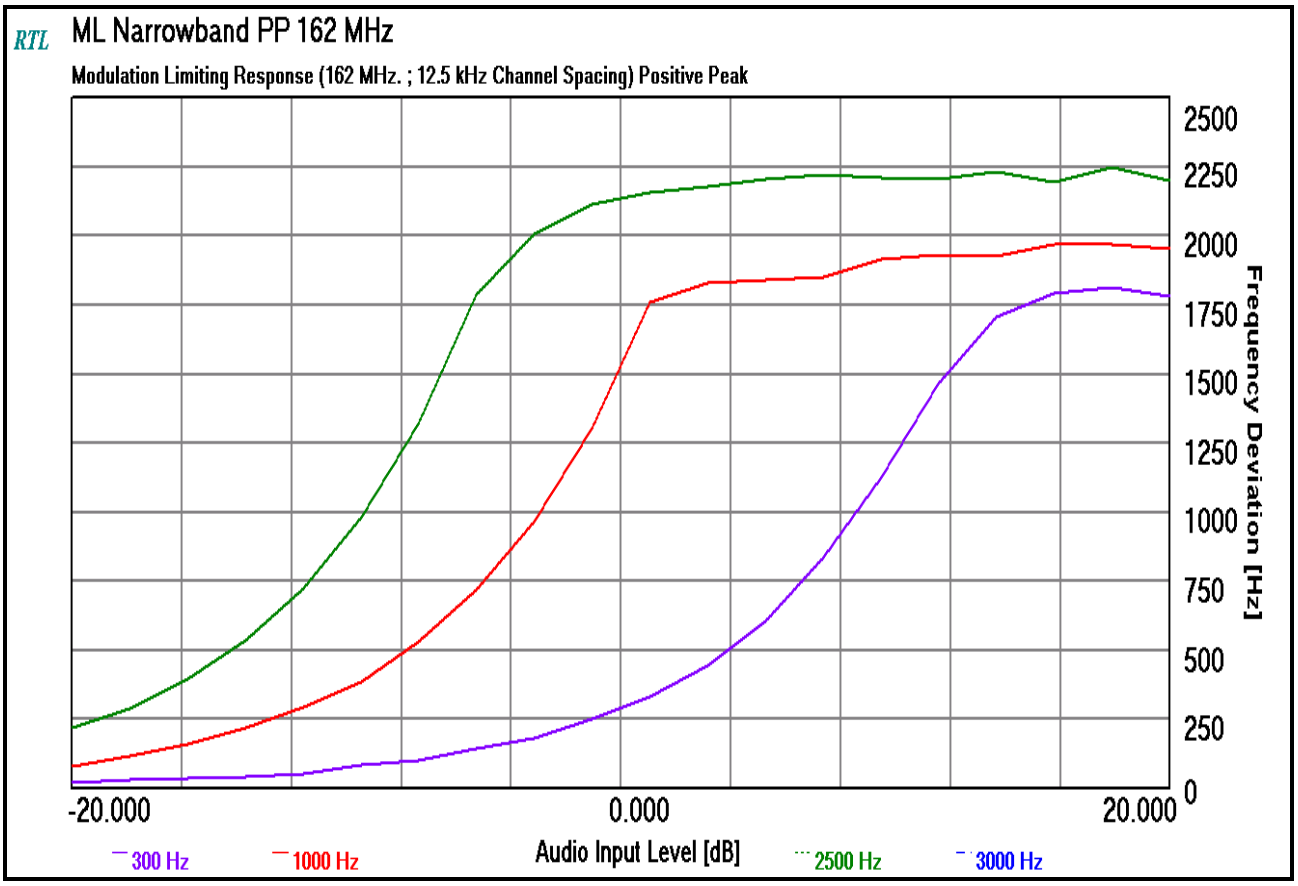
Plot 11-18: Modulation Characteristics – Modulation Limiting - 162 MHz; Positive Peak; WB



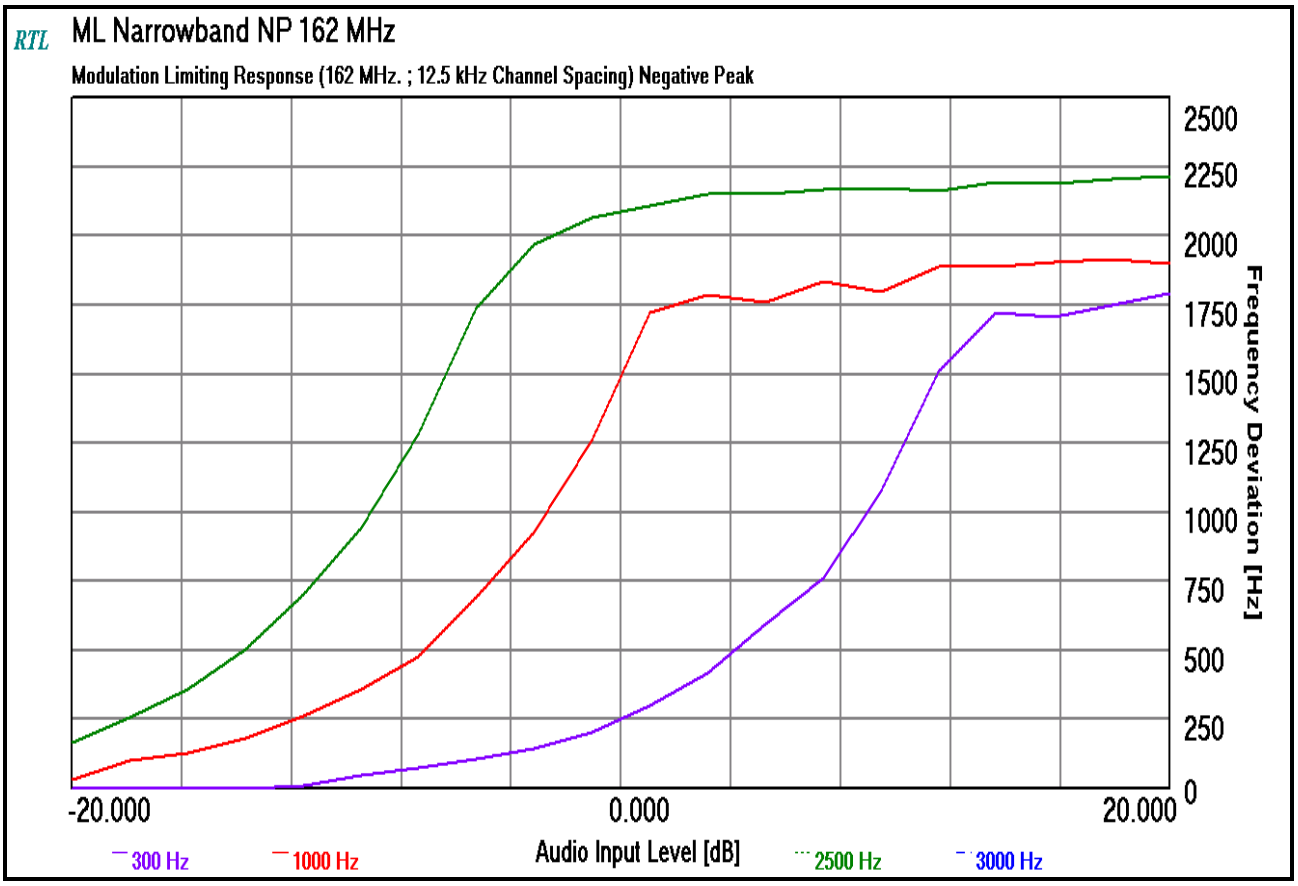
Plot 11-19: Modulation Characteristics – Modulation Limiting - 162 MHz; Negative Peak; WB



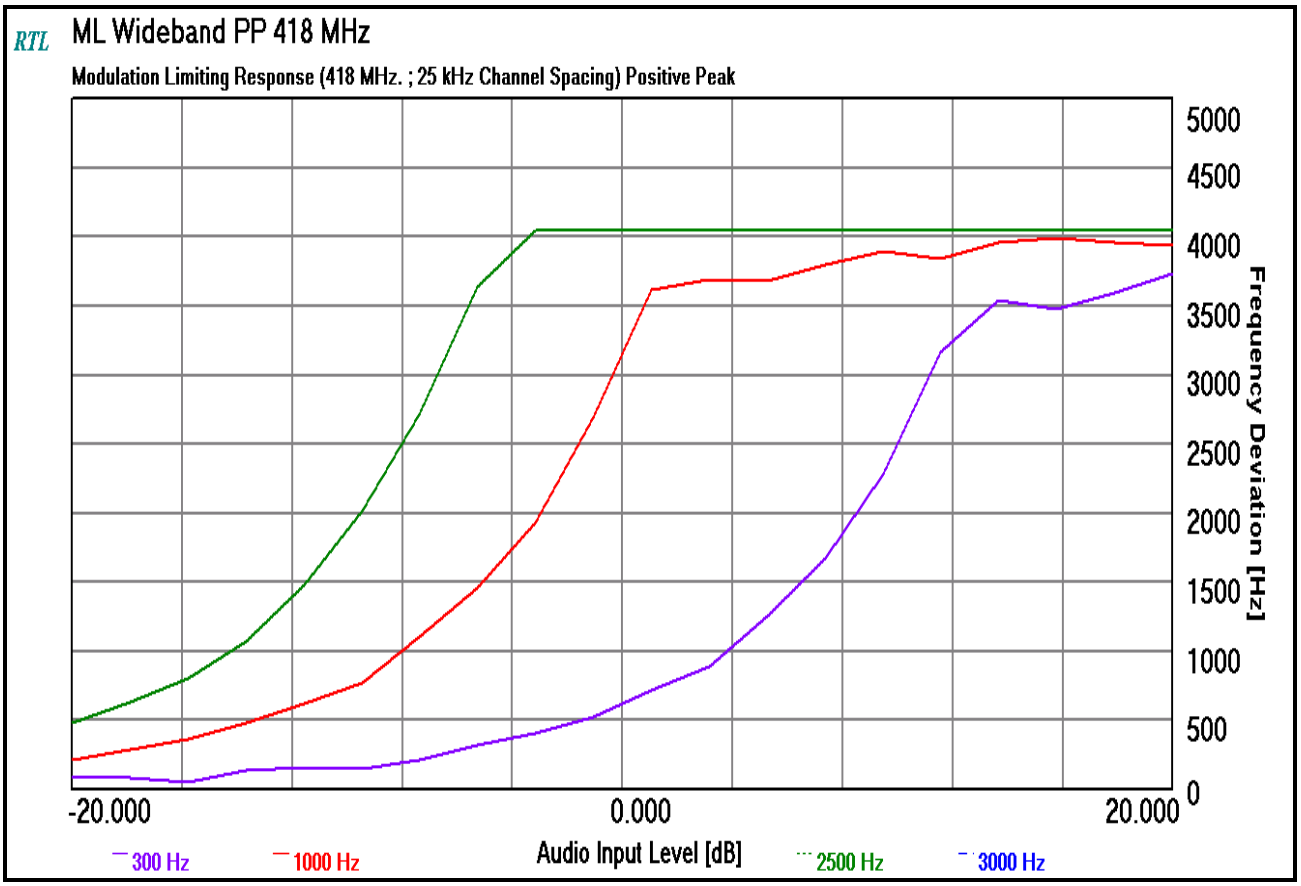
Plot 11-20: Modulation Characteristics – Modulation Limiting - 162 MHz; Positive Peak; NB



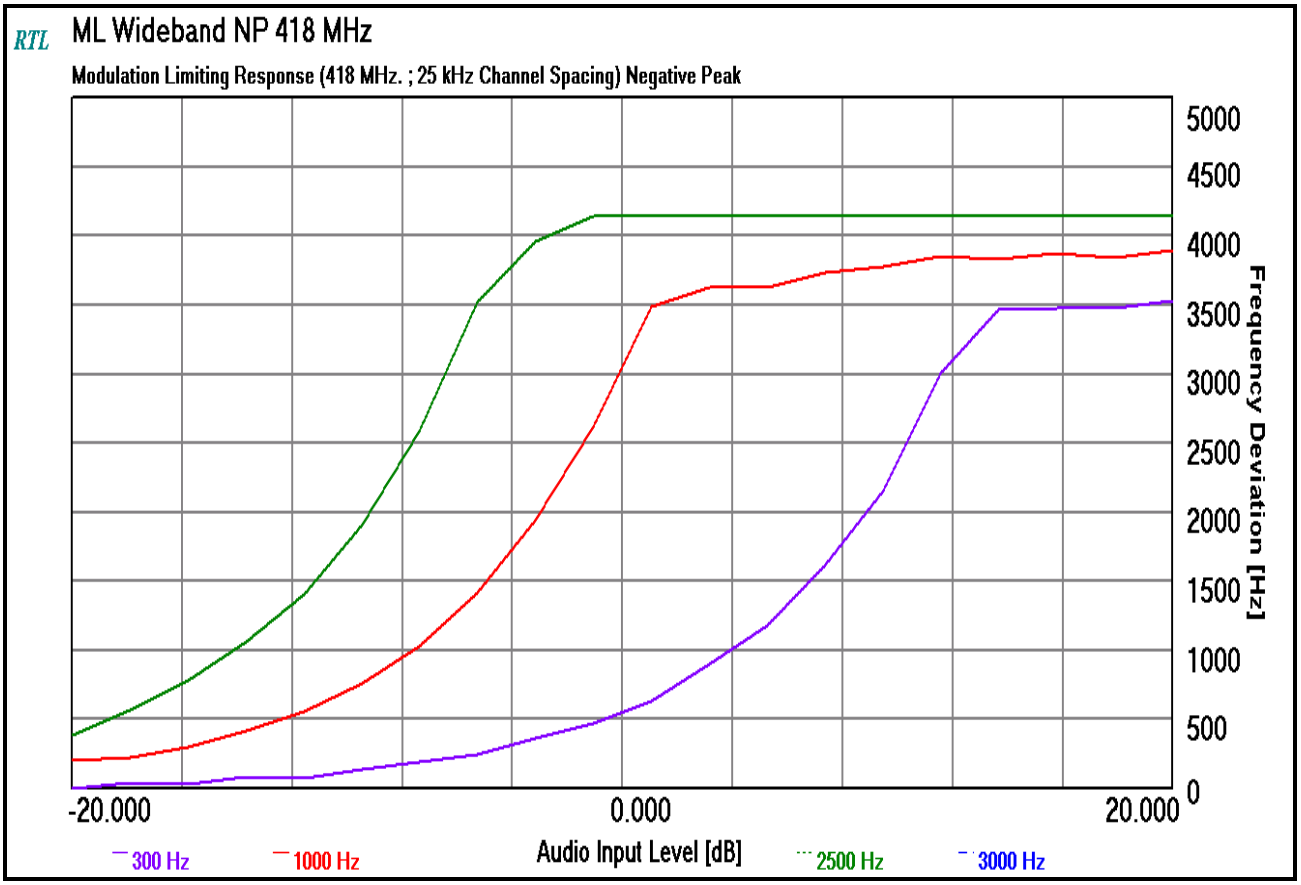
Plot 11-21: Modulation Characteristics – Modulation Limiting - 162 MHz; Negative Peak; NB



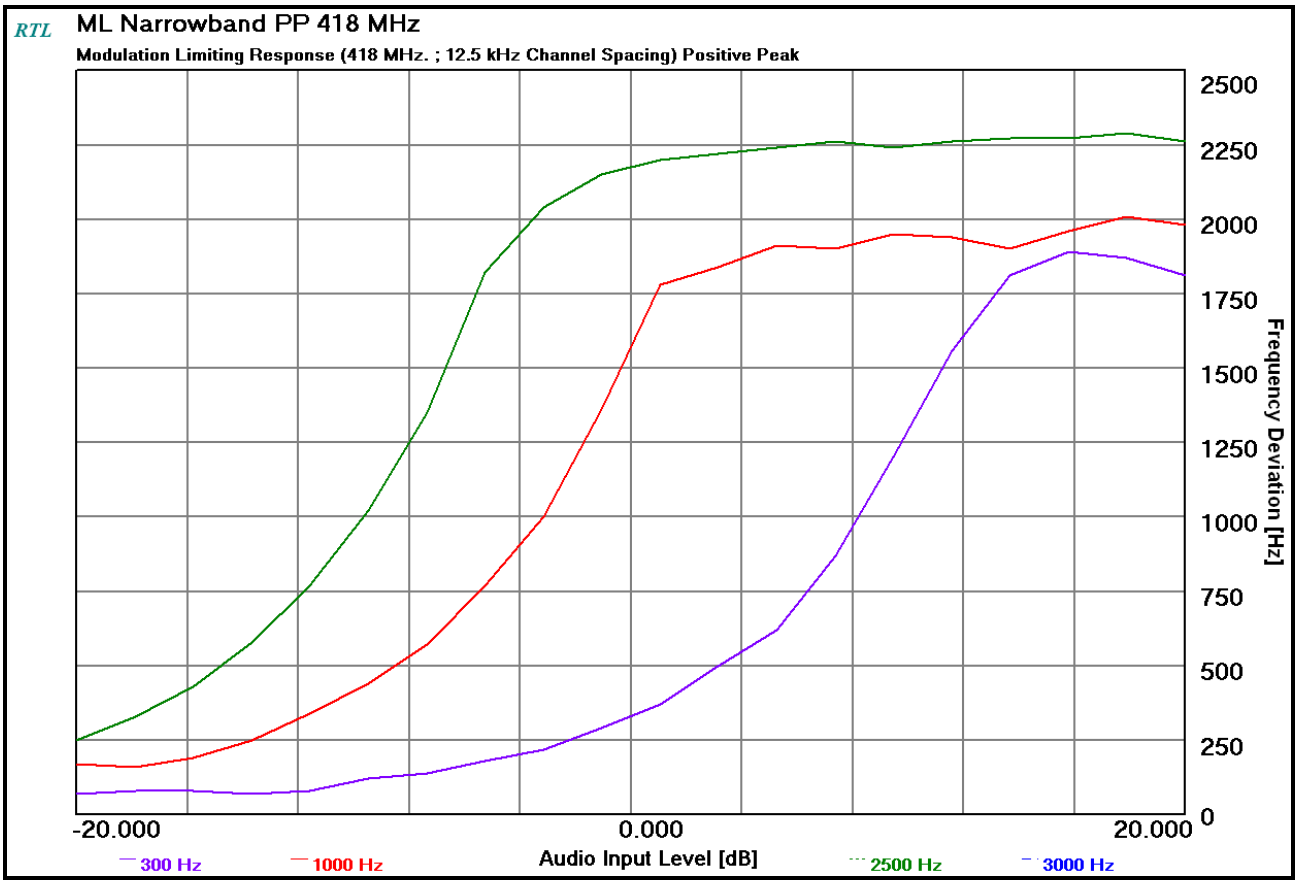
Plot 11-22: Modulation Characteristics – Modulation Limiting - 418 MHz; Positive Peak; WB



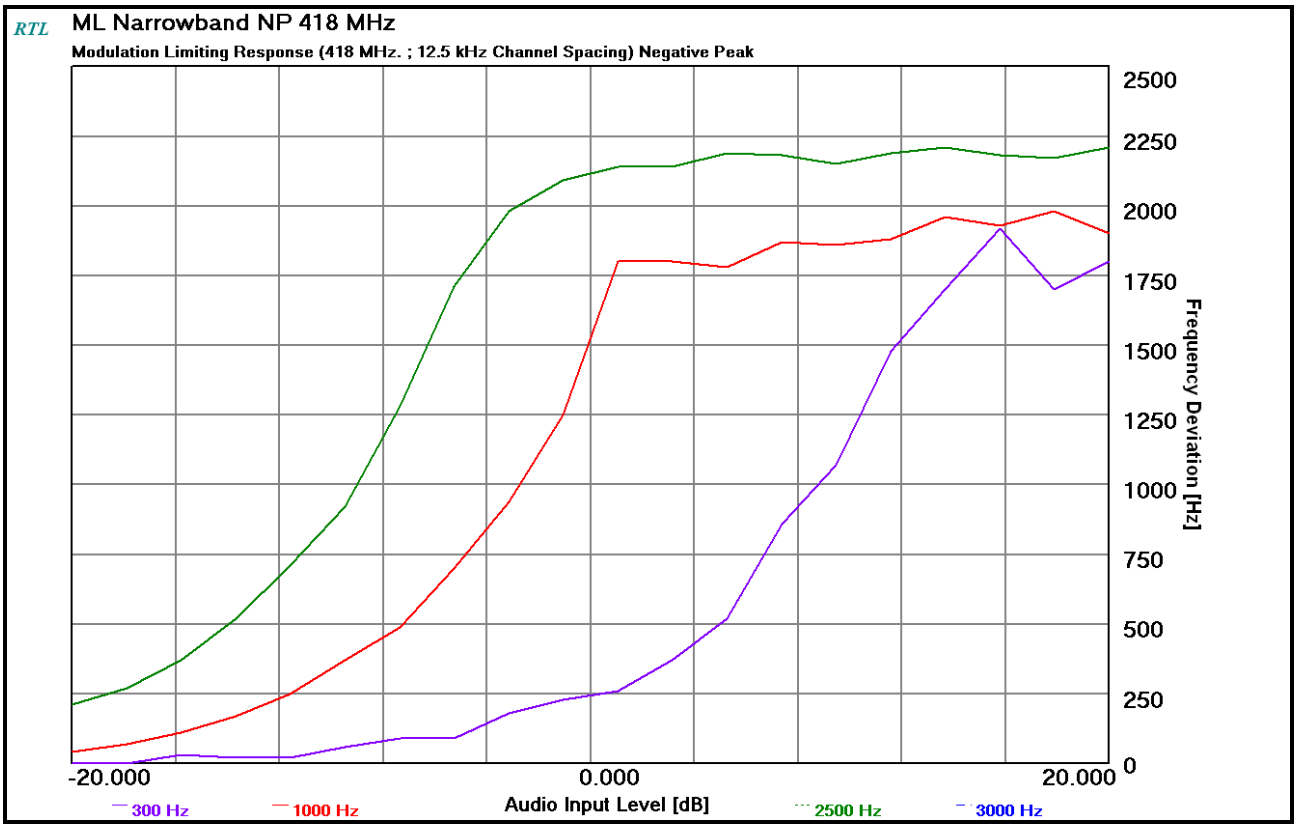
Plot 11-23: Modulation Characteristics – Modulation Limiting - 418 MHz; Negative Peak; WB



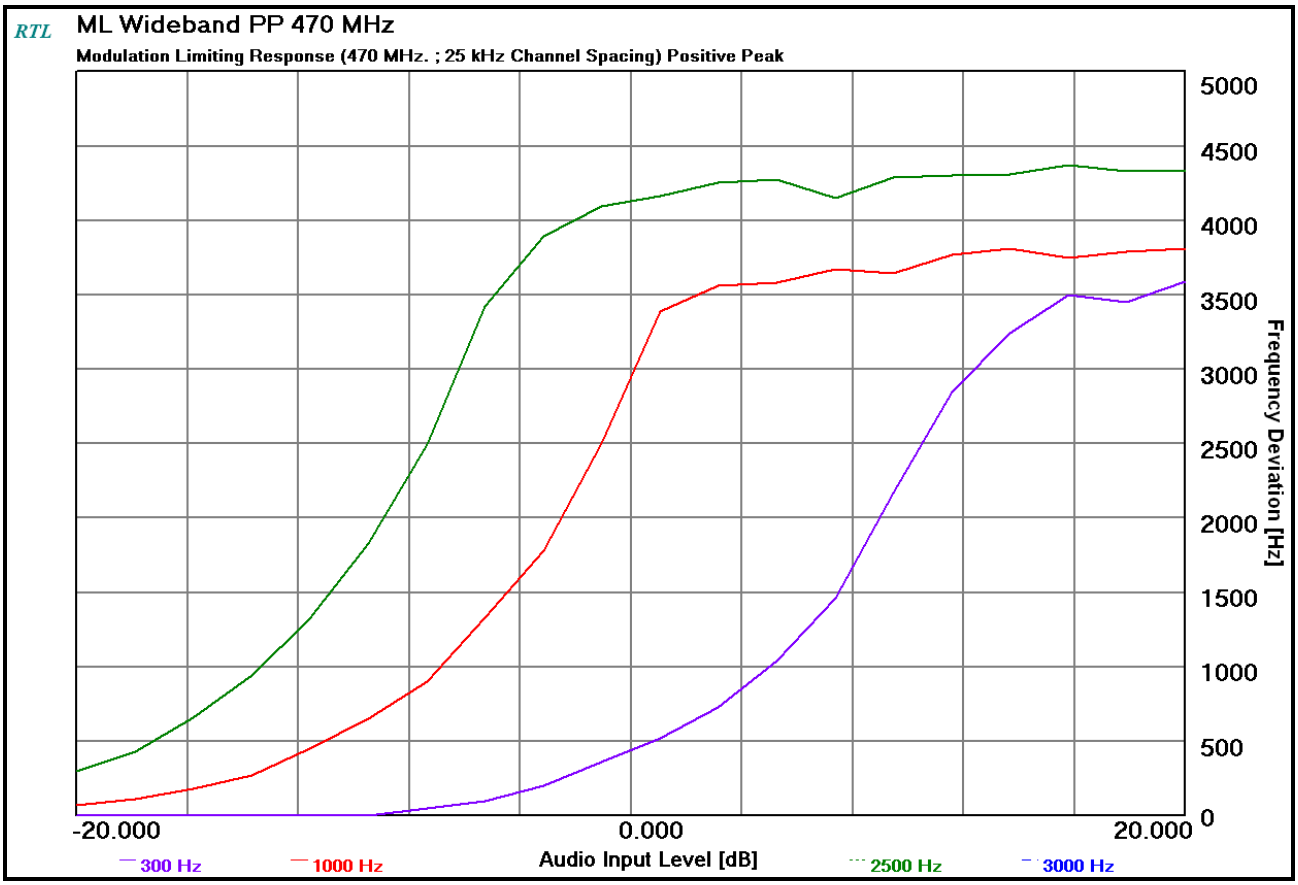
Plot 11-24: Modulation Characteristics – Modulation Limiting - 418 MHz; Positive Peak; NB



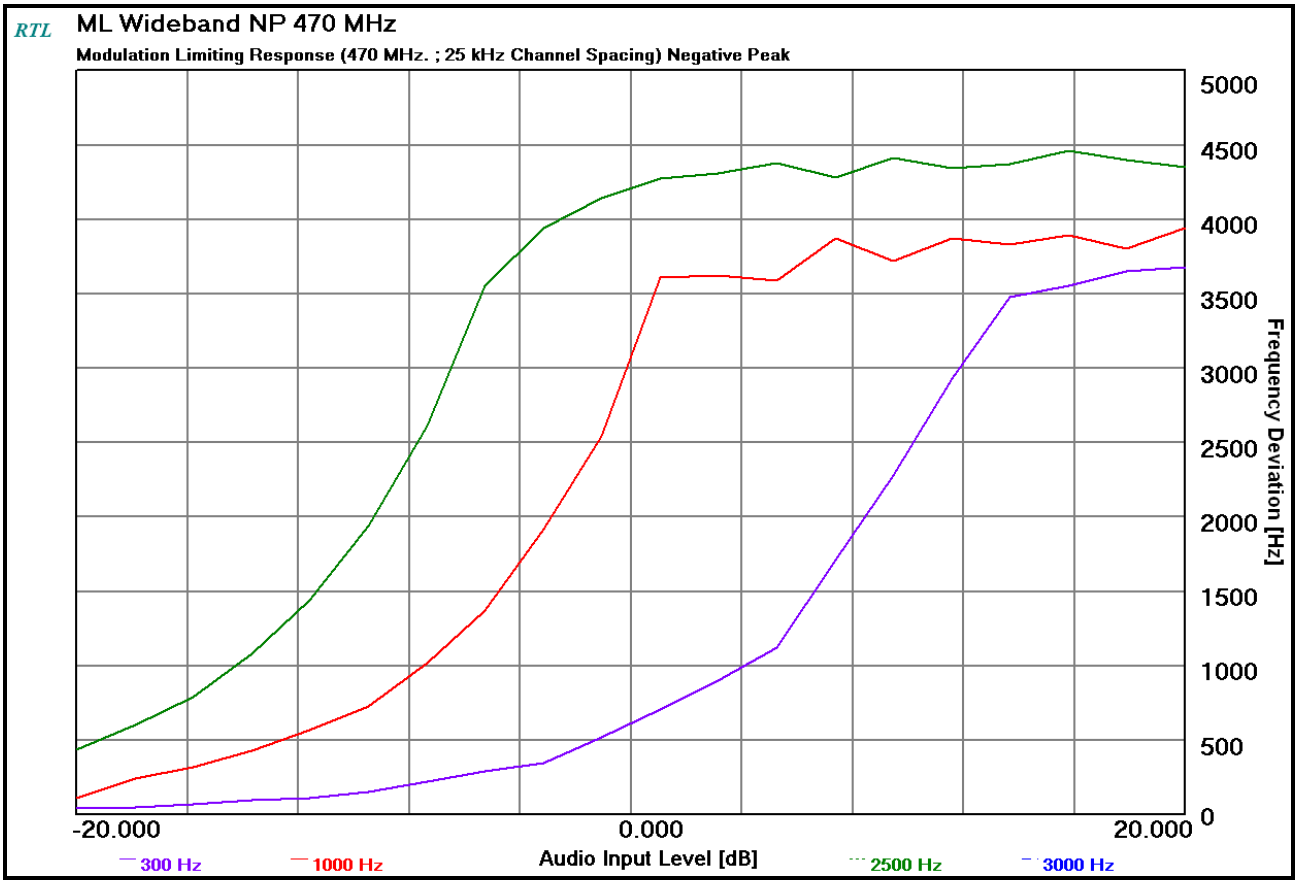
Plot 11-25: Modulation Characteristics – Modulation Limiting - 418 MHz; Negative Peak; NB



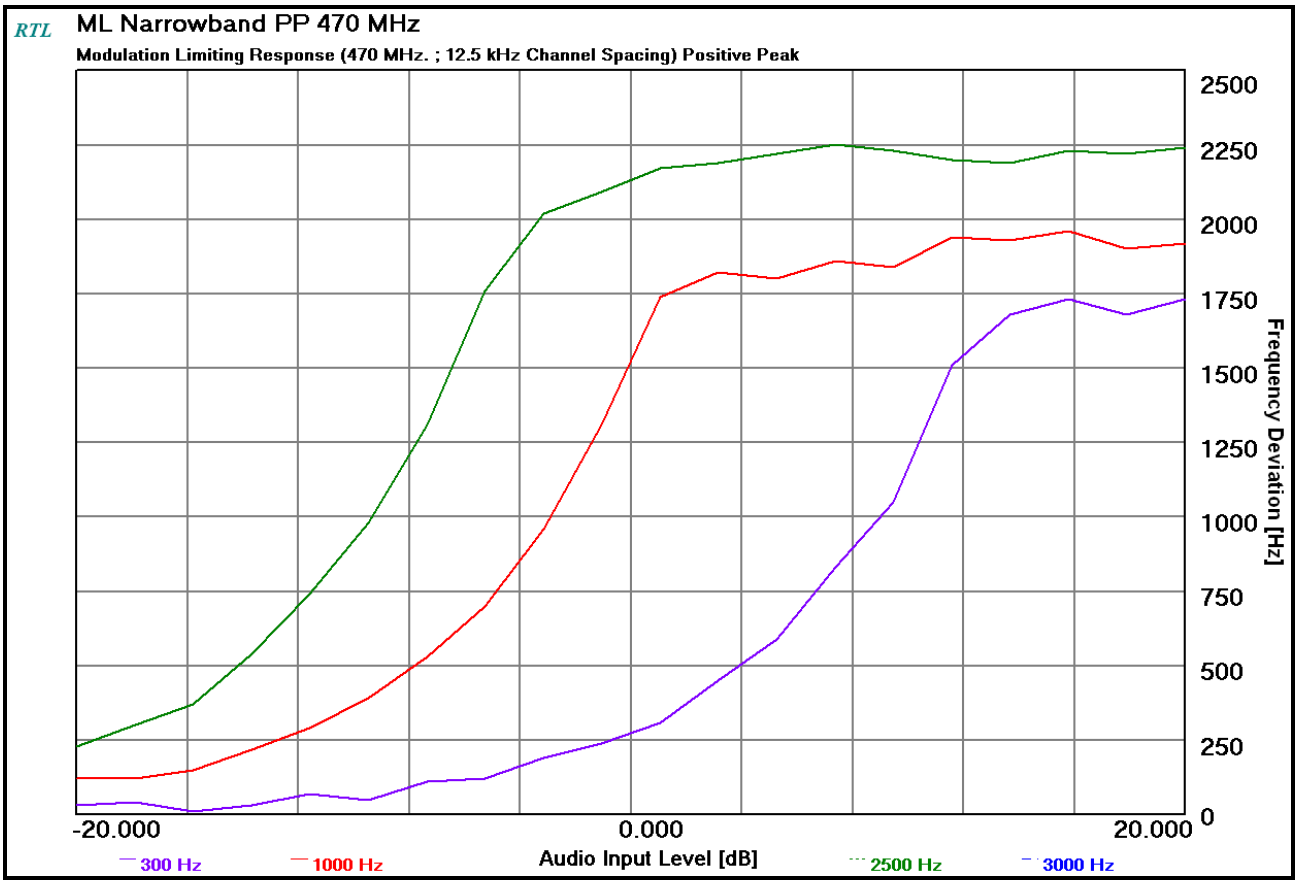
Plot 11-26: Modulation Characteristics – Modulation Limiting - 470 MHz; Positive Peak; WB



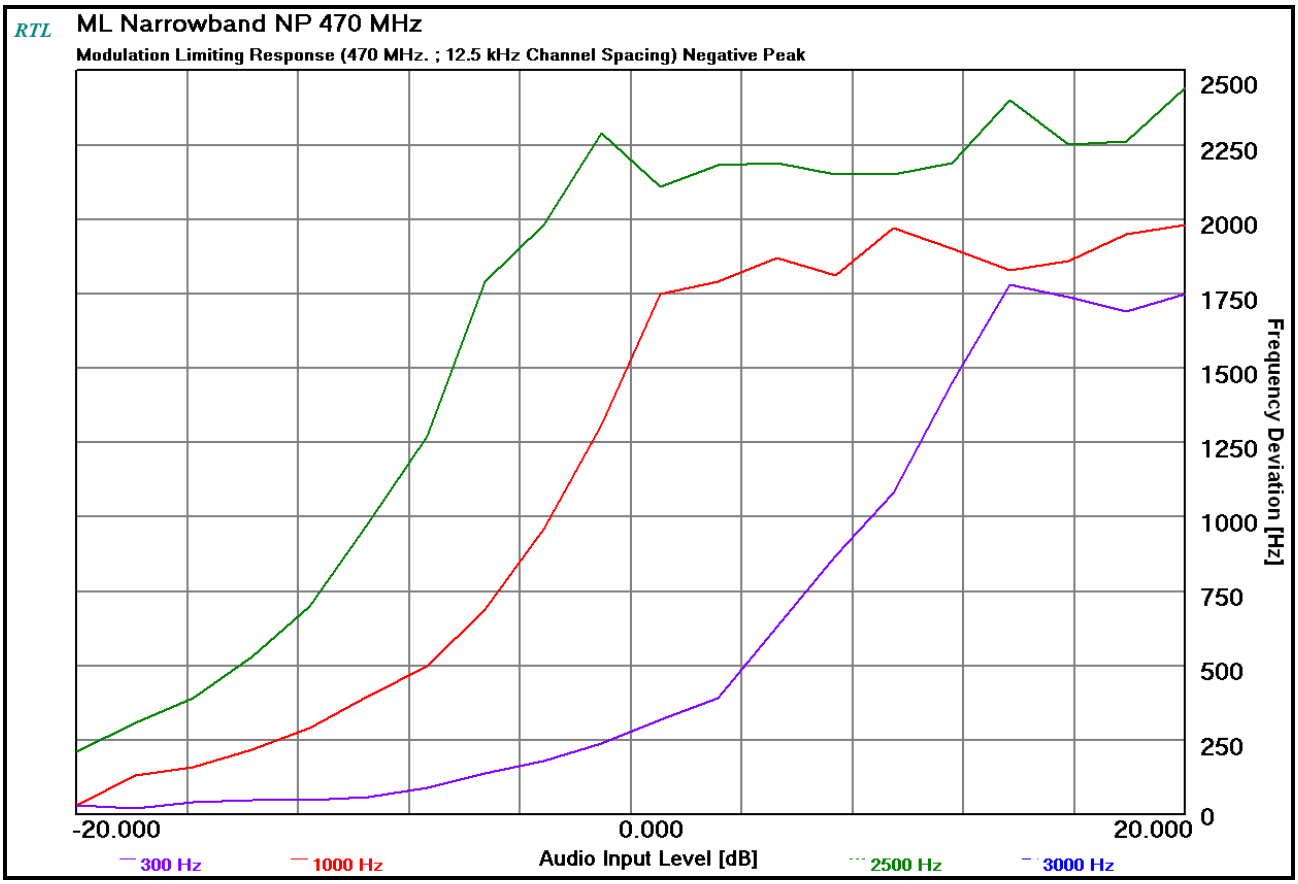
Plot 11-27: Modulation Characteristics – Modulation Limiting - 470 MHz; Negative Peak; WB



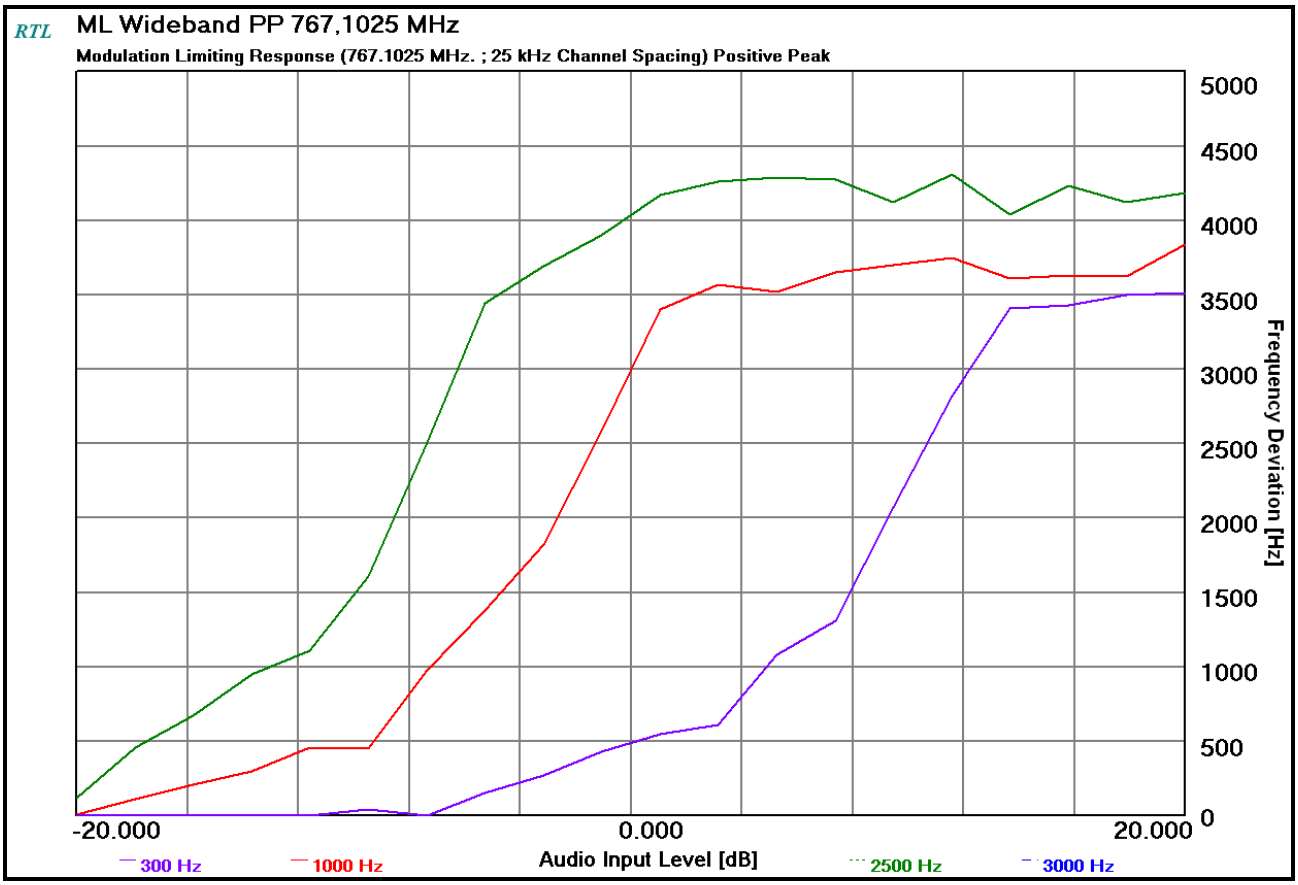
Plot 11-28: Modulation Characteristics – Modulation Limiting - 470 MHz; Positive Peak; NB



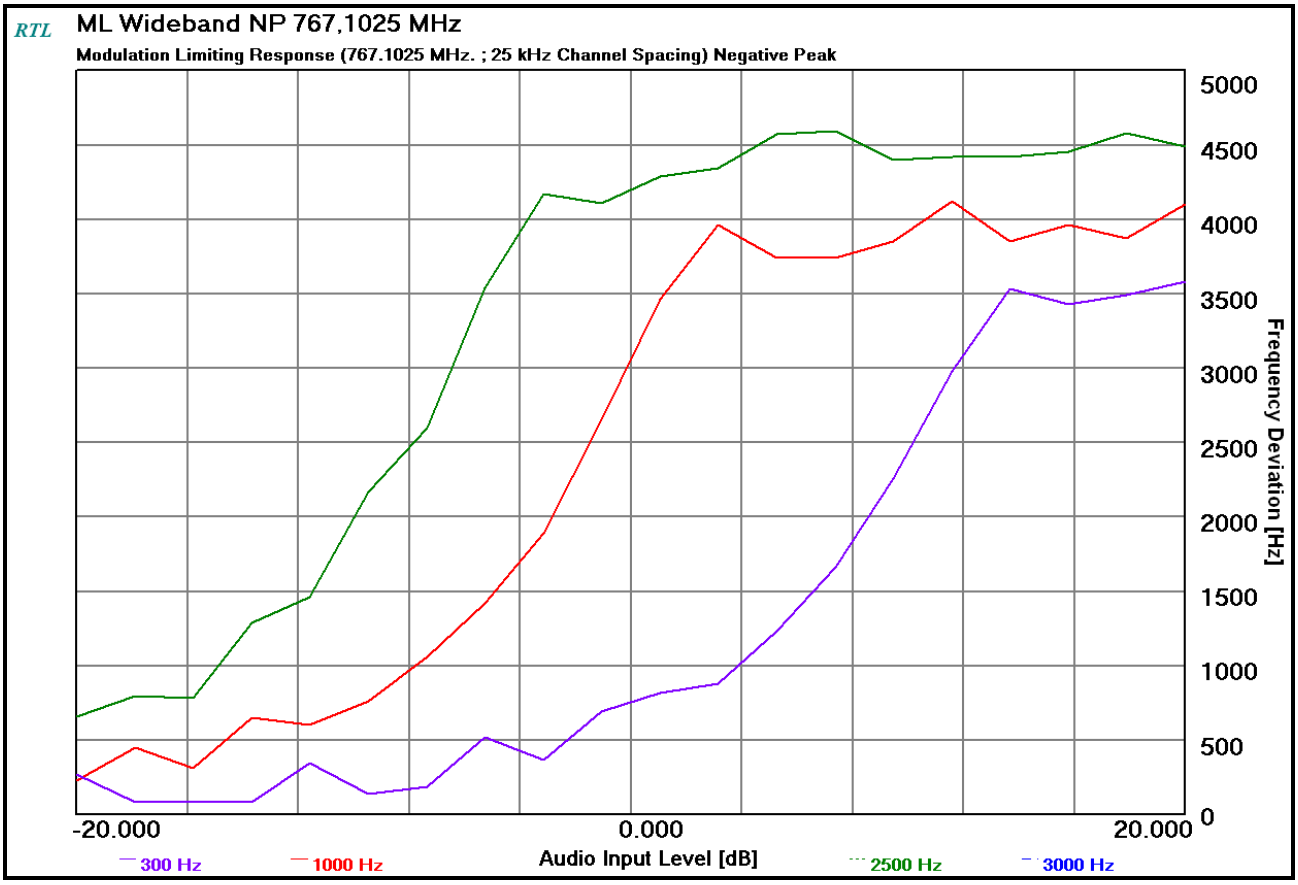
Plot 11-29: Modulation Characteristics – Modulation Limiting - 470 MHz; Negative Peak; NB



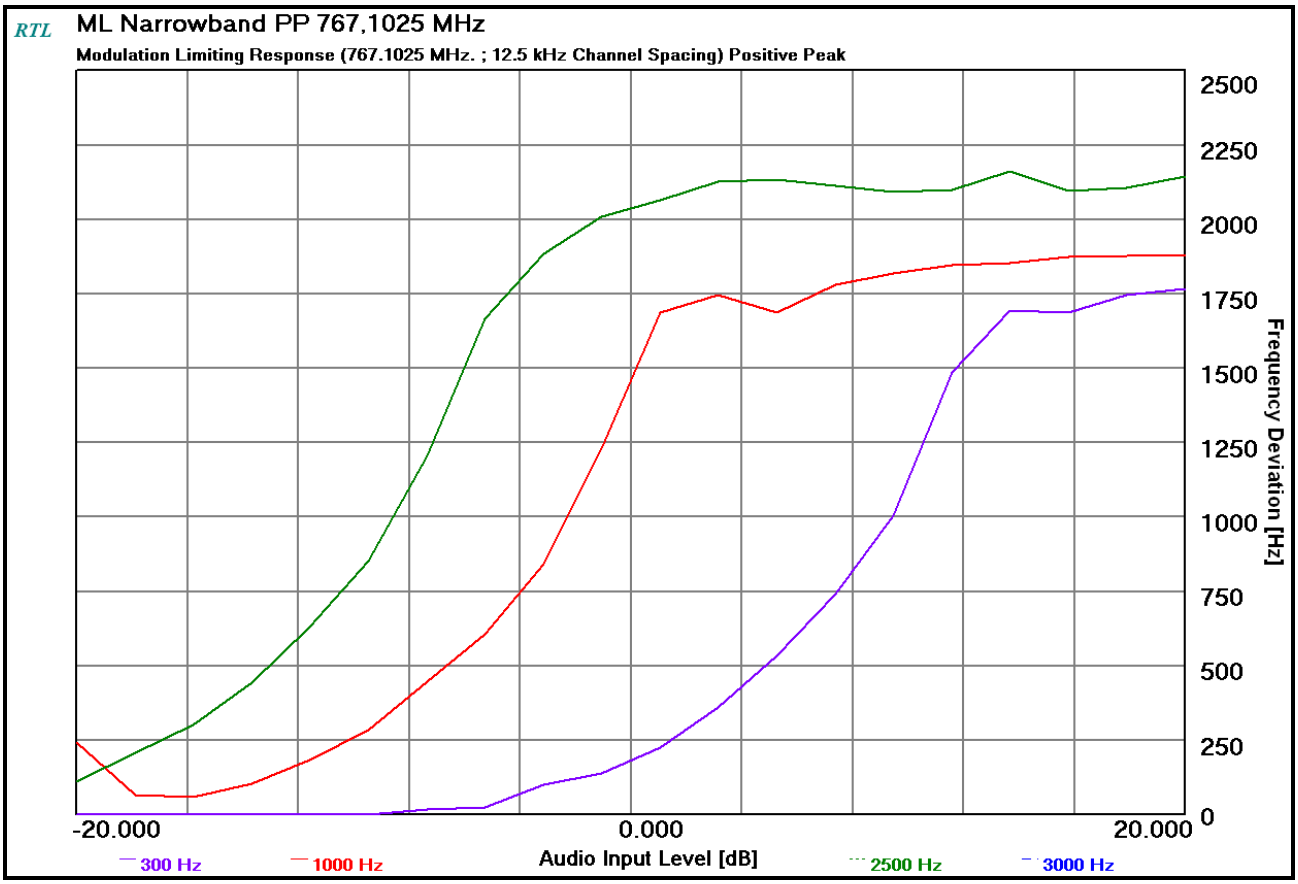
Plot 11-30: Modulation Characteristics – Modulation Limiting - 767.1025 MHz; Positive Peak; WB



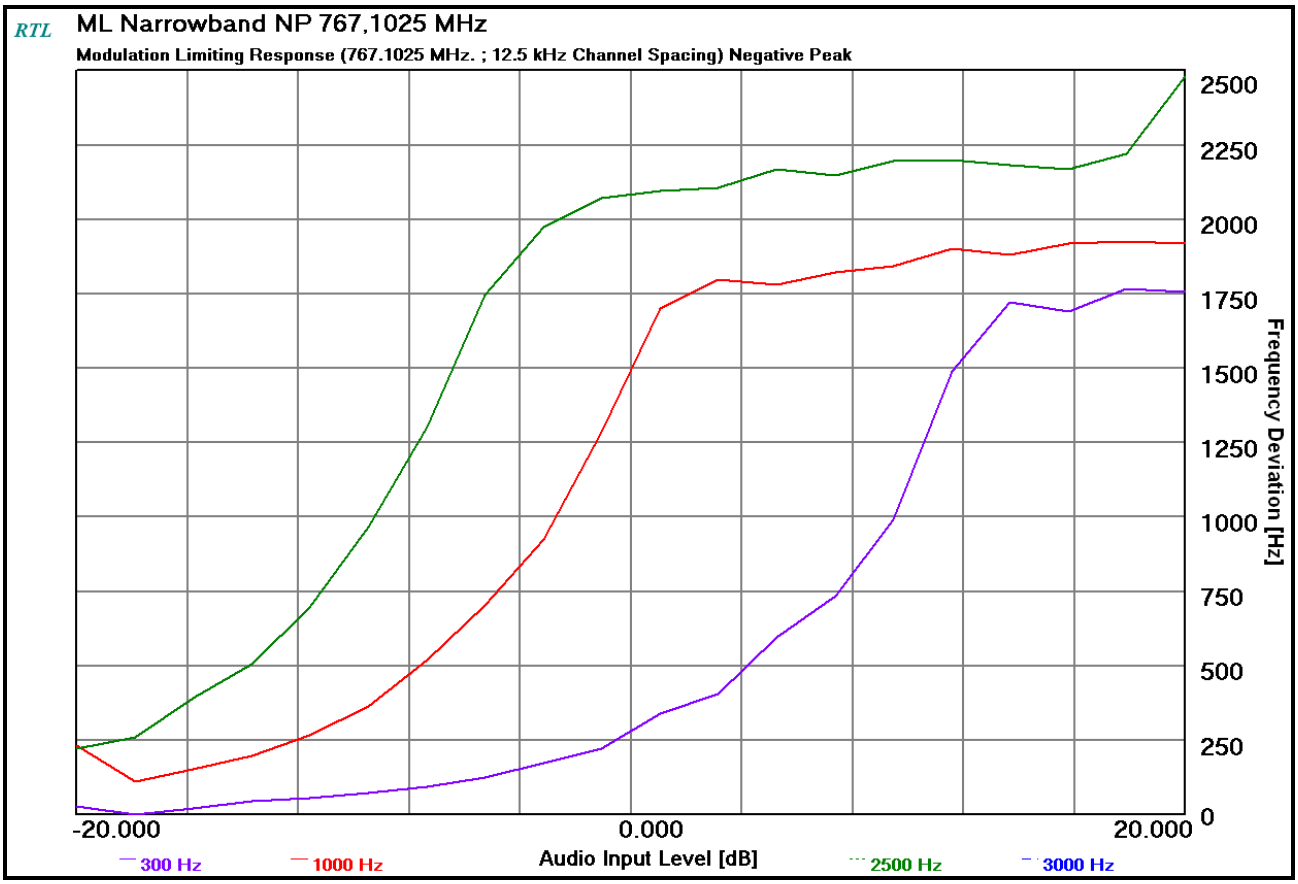
Plot 11-31: Modulation Characteristics – Modulation Limiting - 767.1025 MHz; Negative Peak; WB



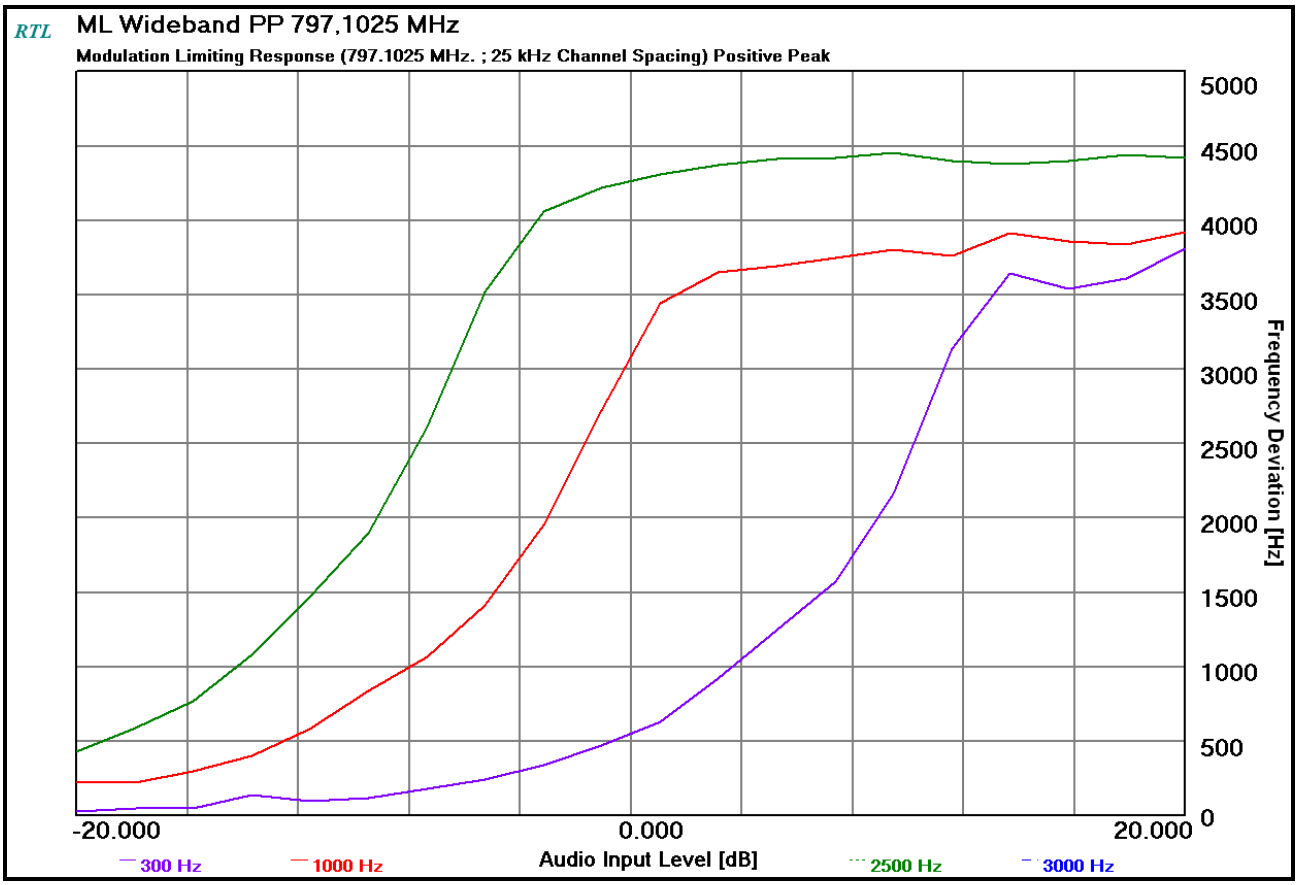
Plot 11-32: Modulation Characteristics – Modulation Limiting - 767.1025 MHz; Positive Peak; NB



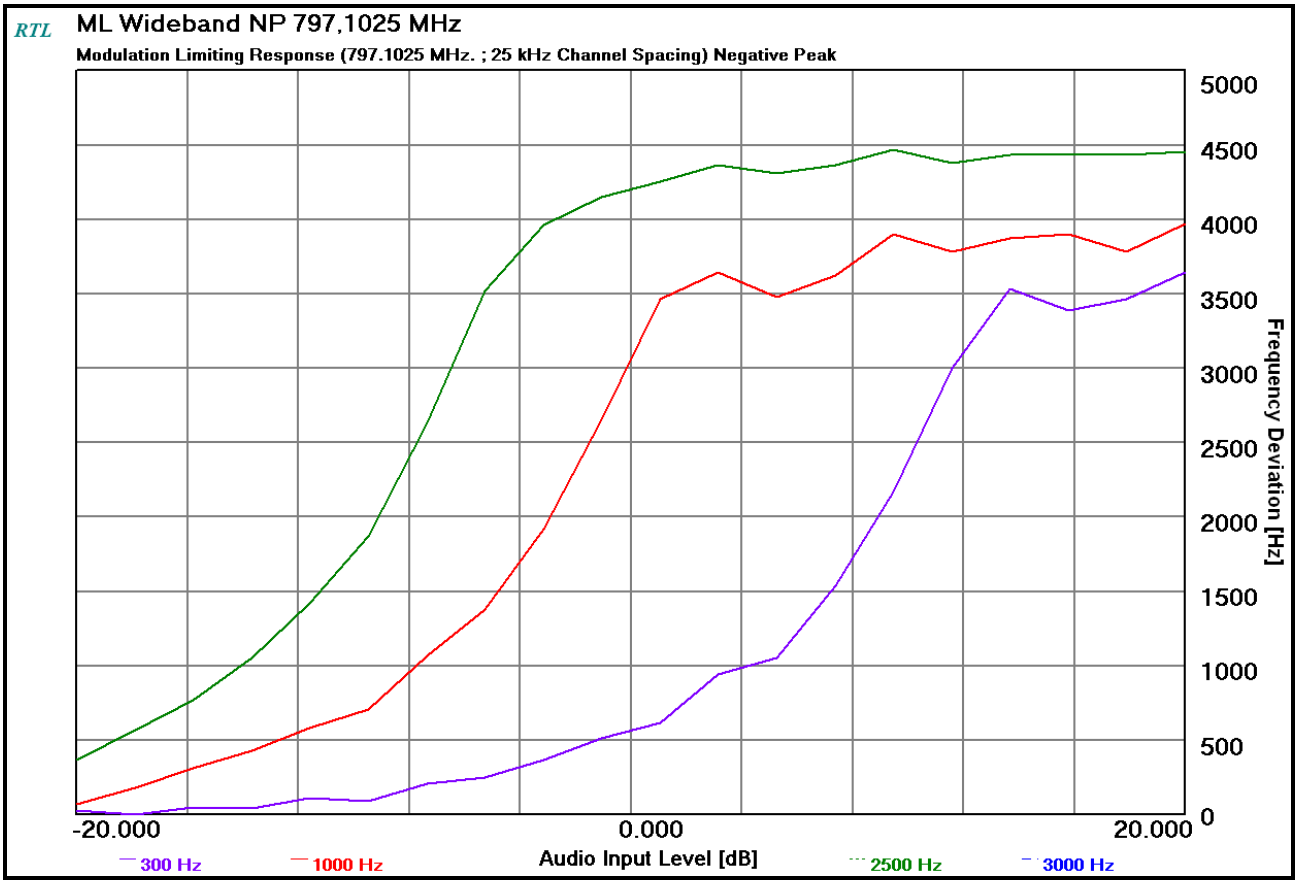
Plot 11-33: Modulation Characteristics – Modulation Limiting - 767.1025 MHz; Negative Peak; NB



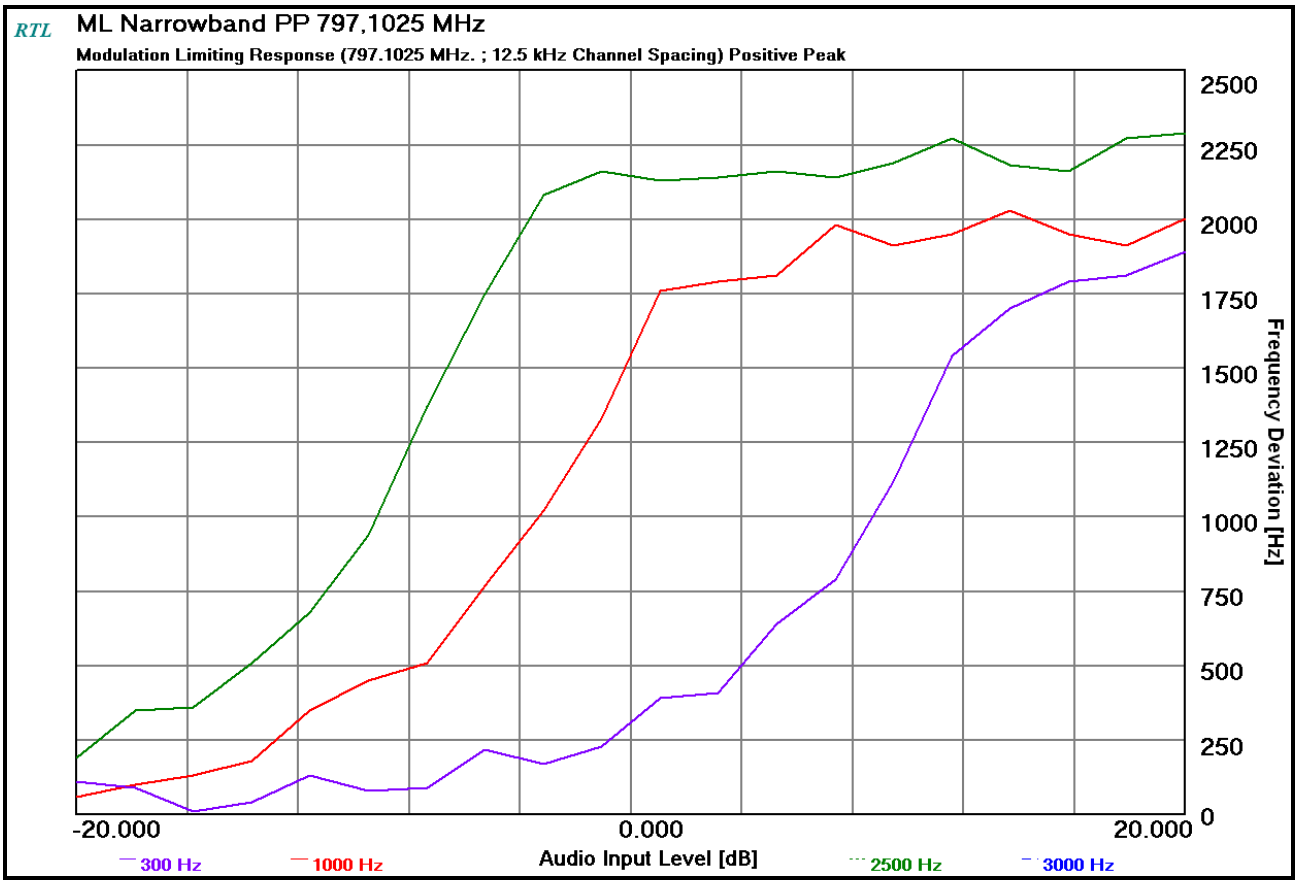
Plot 11-34: Modulation Characteristics – Modulation Limiting - 797.1025 MHz; Positive Peak; WB



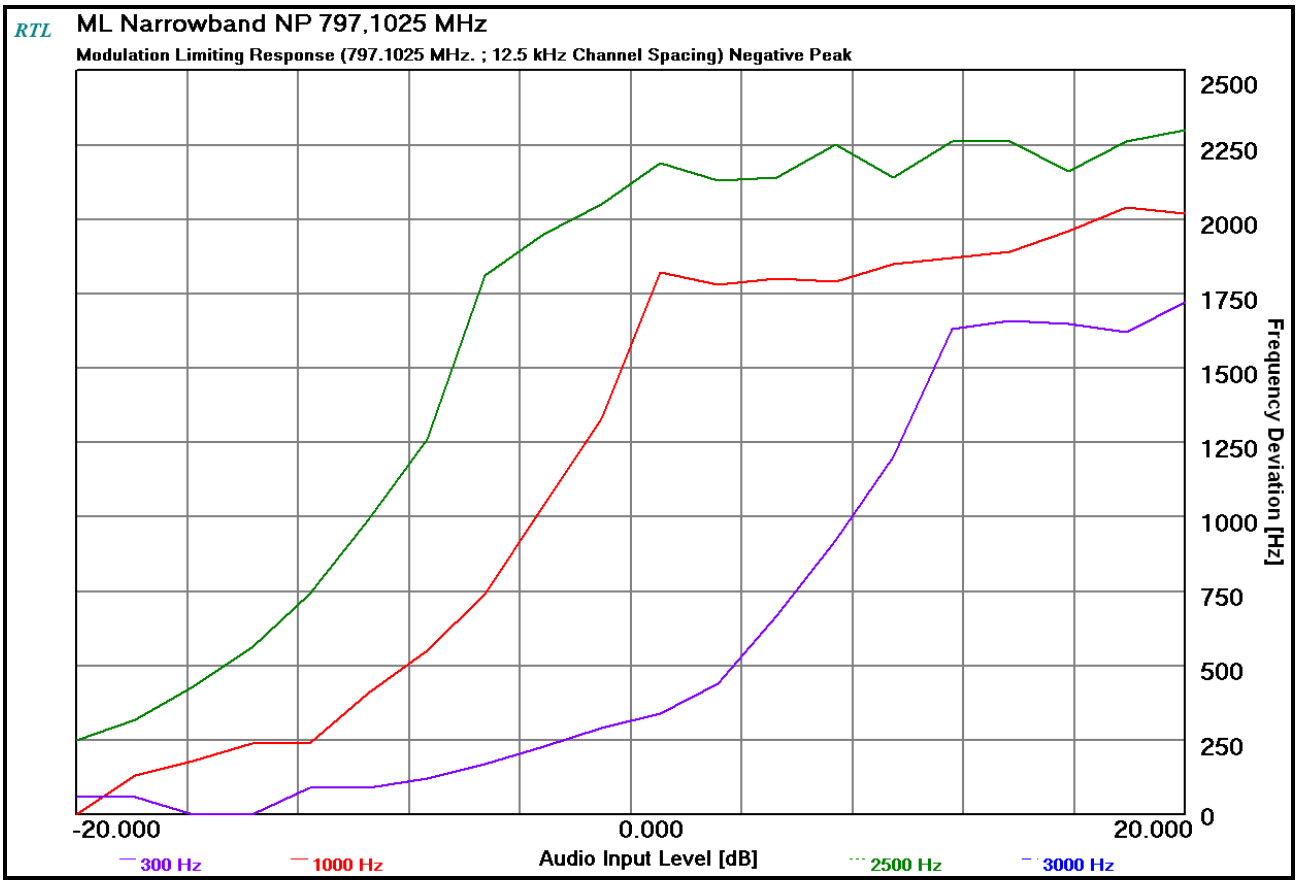
Plot 11-35: Modulation Characteristics – Modulation Limiting - 797.1025 MHz; Negative Peak; WB



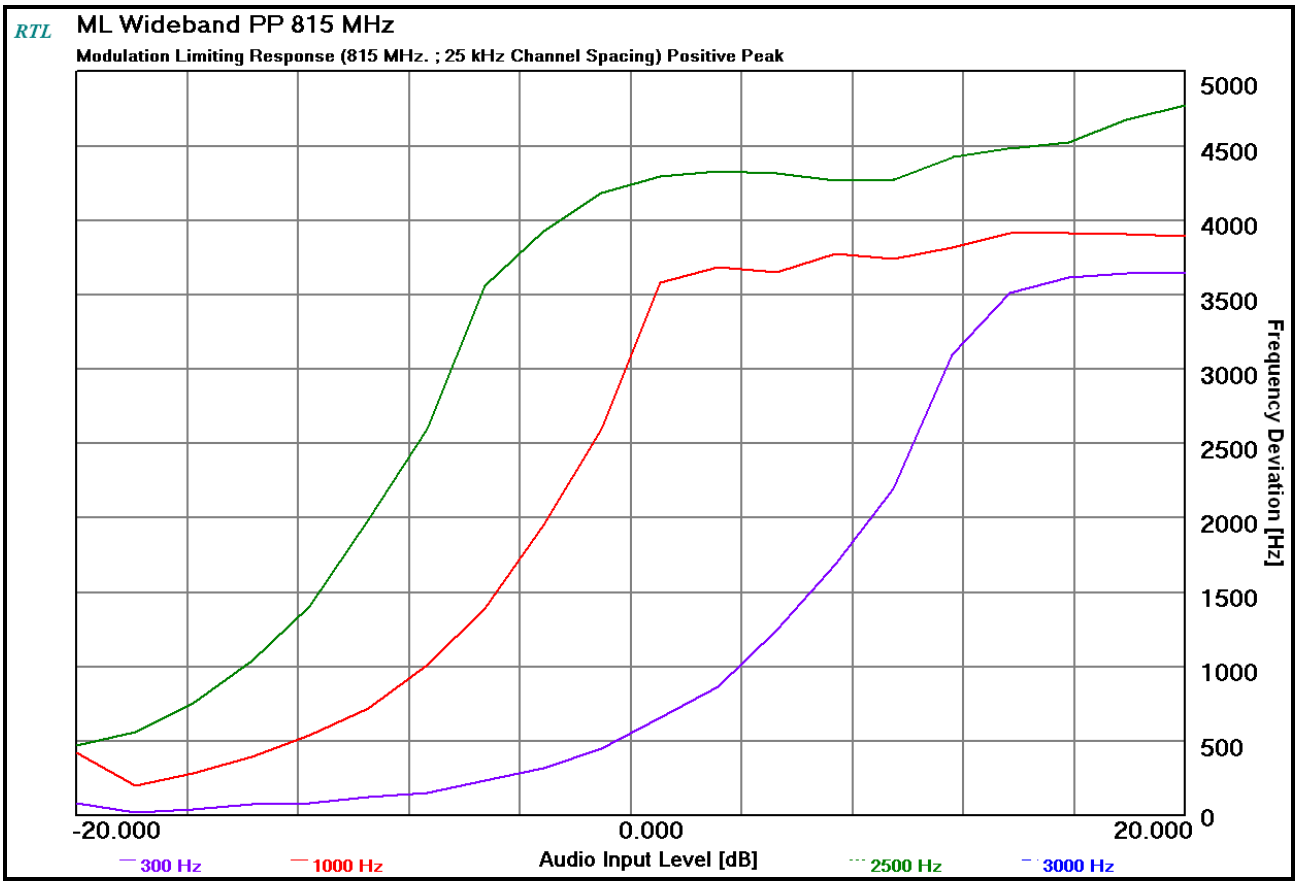
Plot 11-36: Modulation Characteristics – Modulation Limiting - 797.1025 MHz; Positive Peak; NB



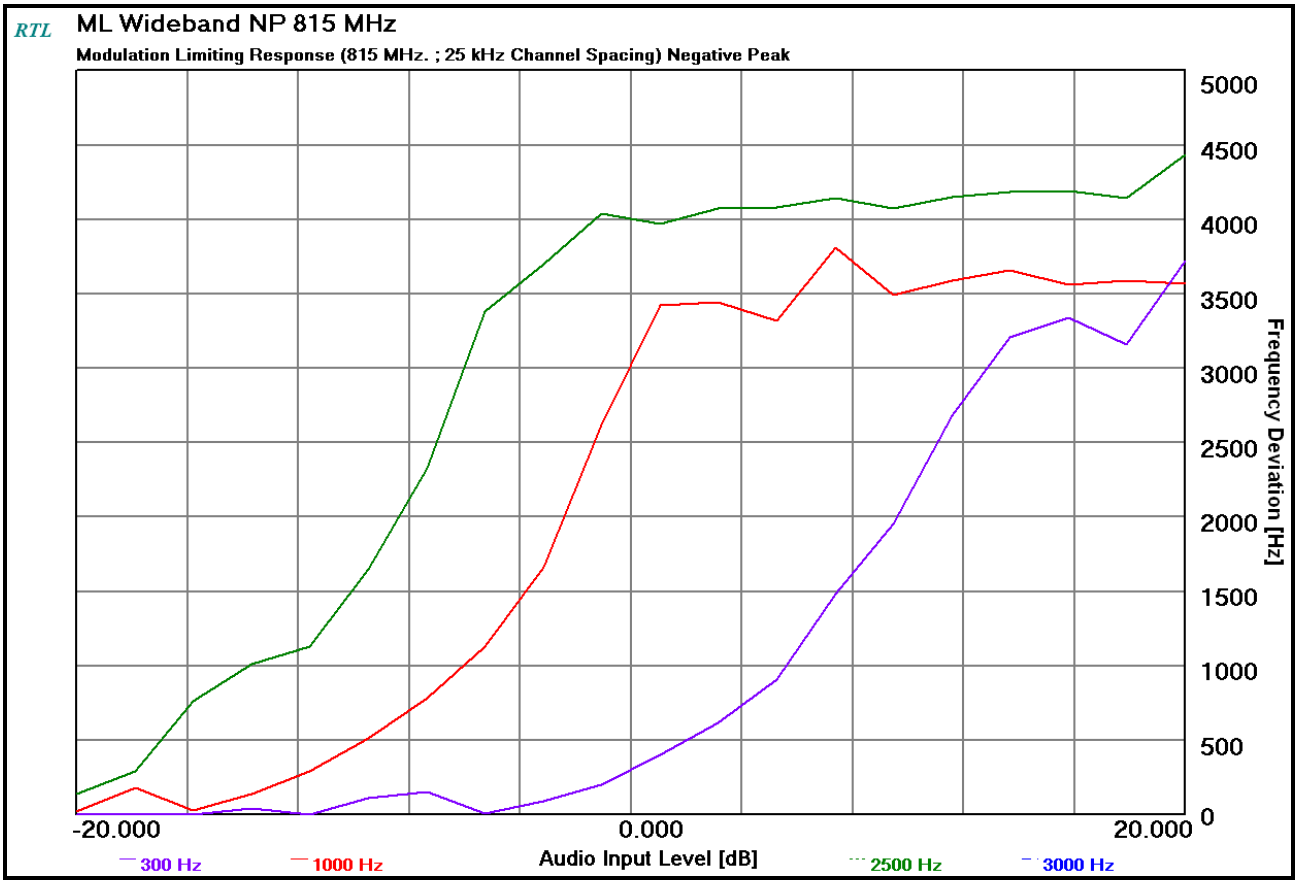
Plot 11-37: Modulation Characteristics – Modulation Limiting - 797.1025 MHz; Negative Peak; NB



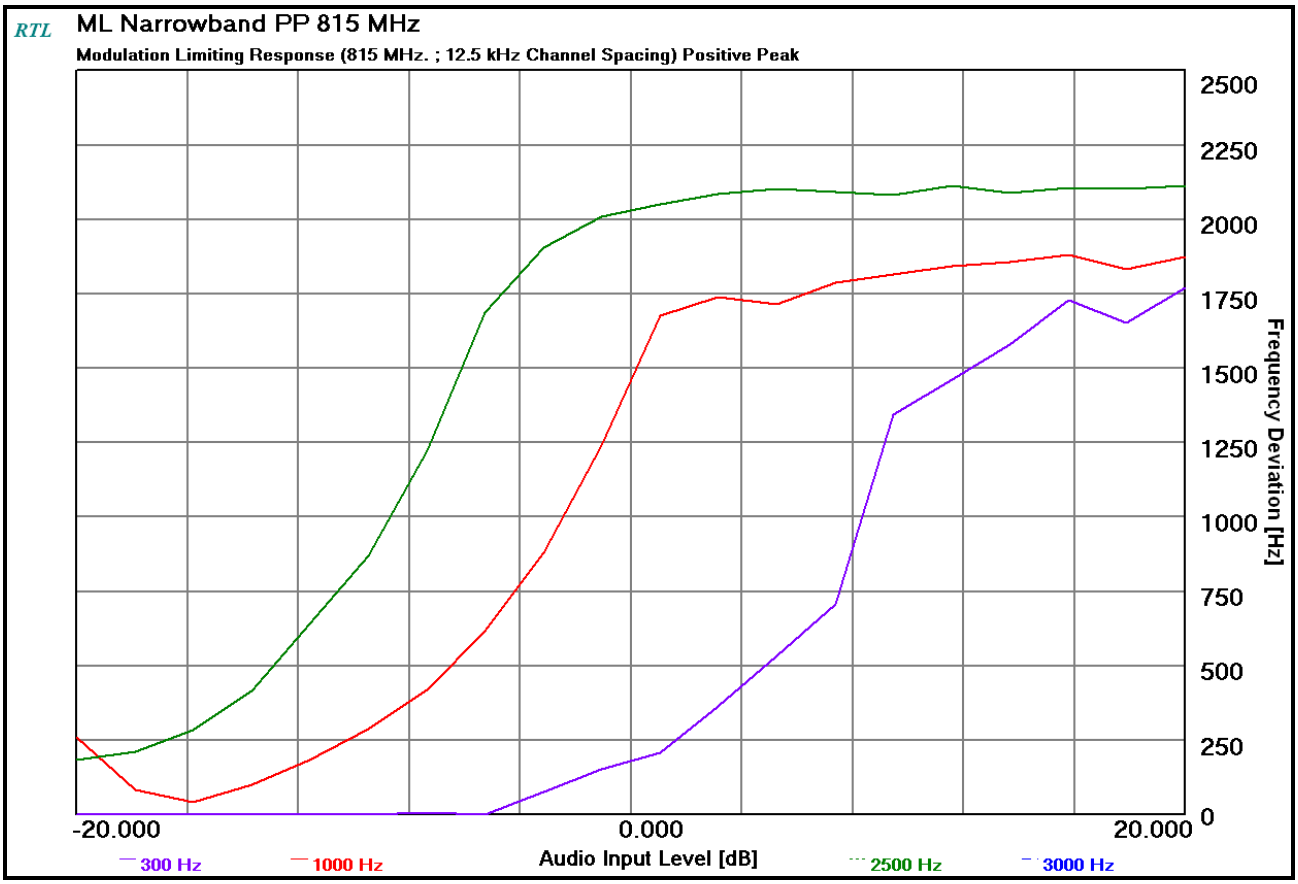
Plot 11-38: Modulation Characteristics – Modulation Limiting - 815 MHz; Positive Peak; WB



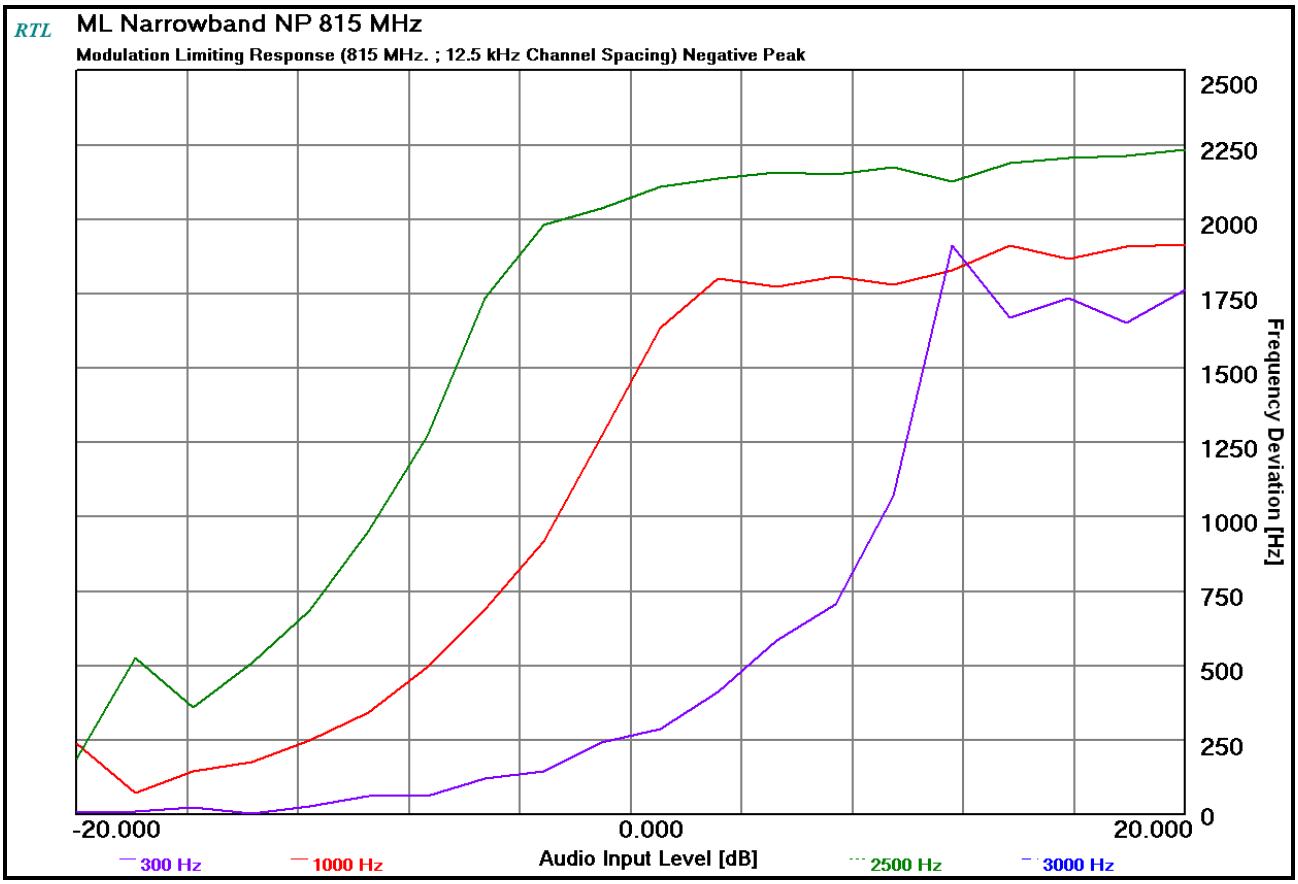
Plot 11-39: Modulation Characteristics – Modulation Limiting - 815 MHz; Negative Peak; WB



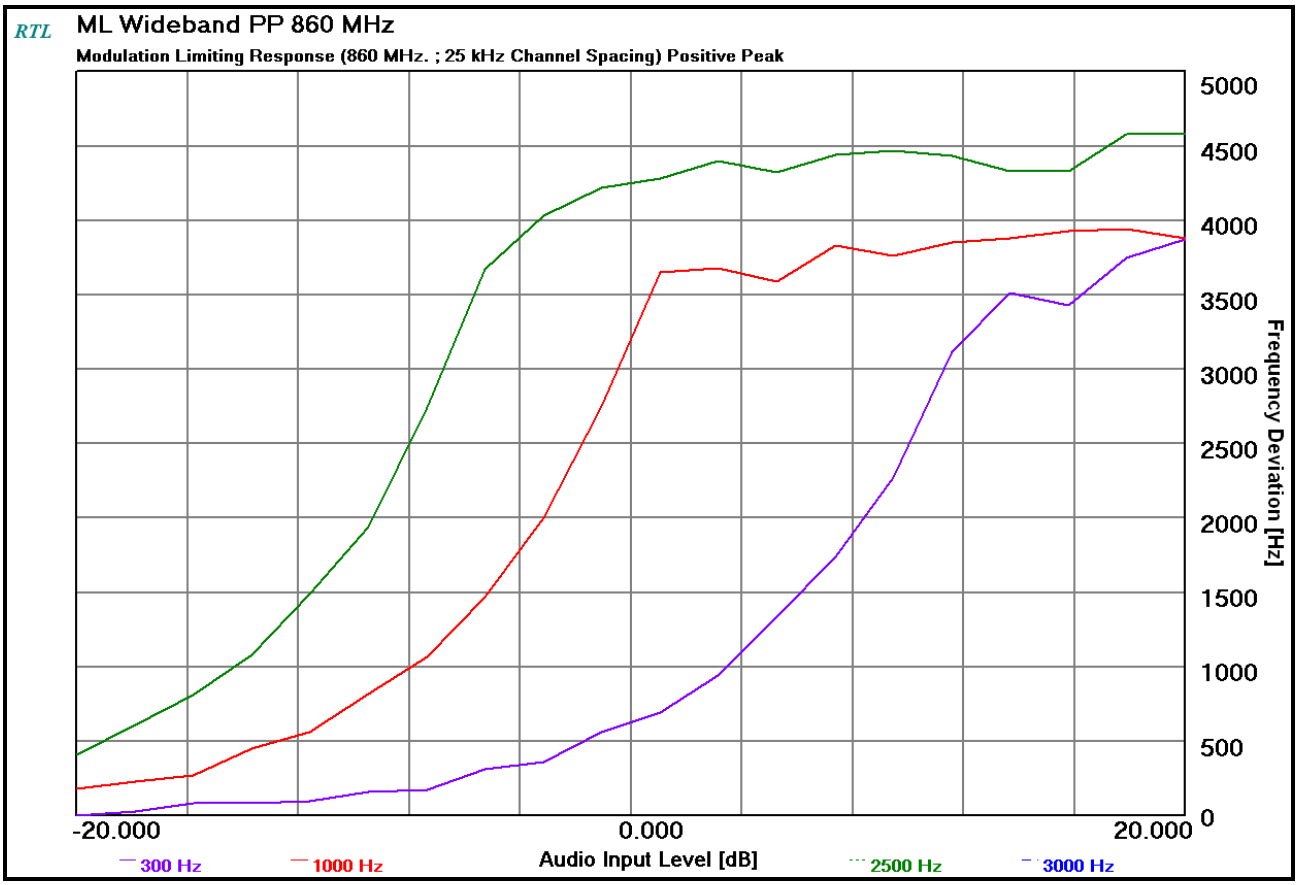
Plot 11-40: Modulation Characteristics – Modulation Limiting - 815 MHz; Positive Peak; NB



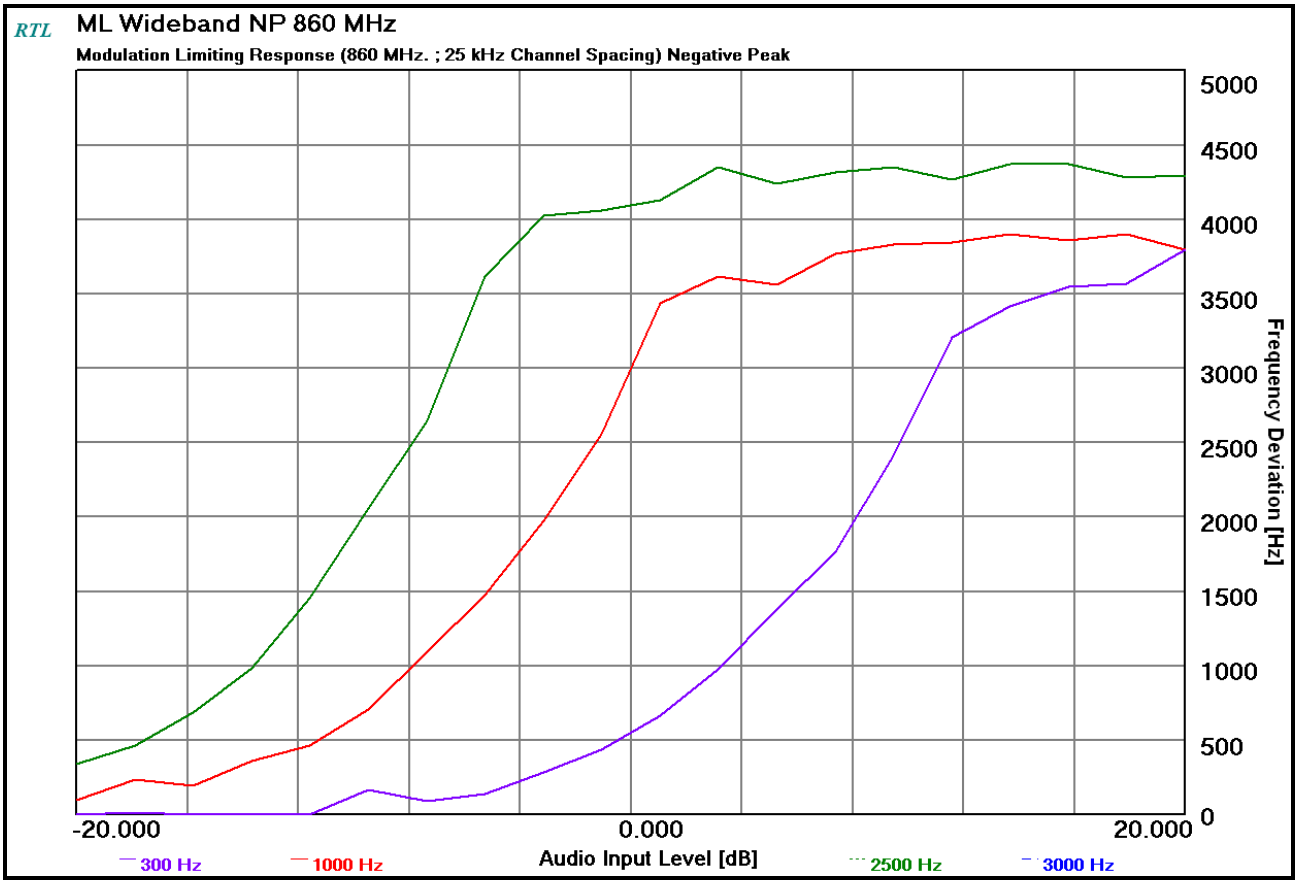
Plot 11-41: Modulation Characteristics – Modulation Limiting - 815 MHz; Negative Peak; NB



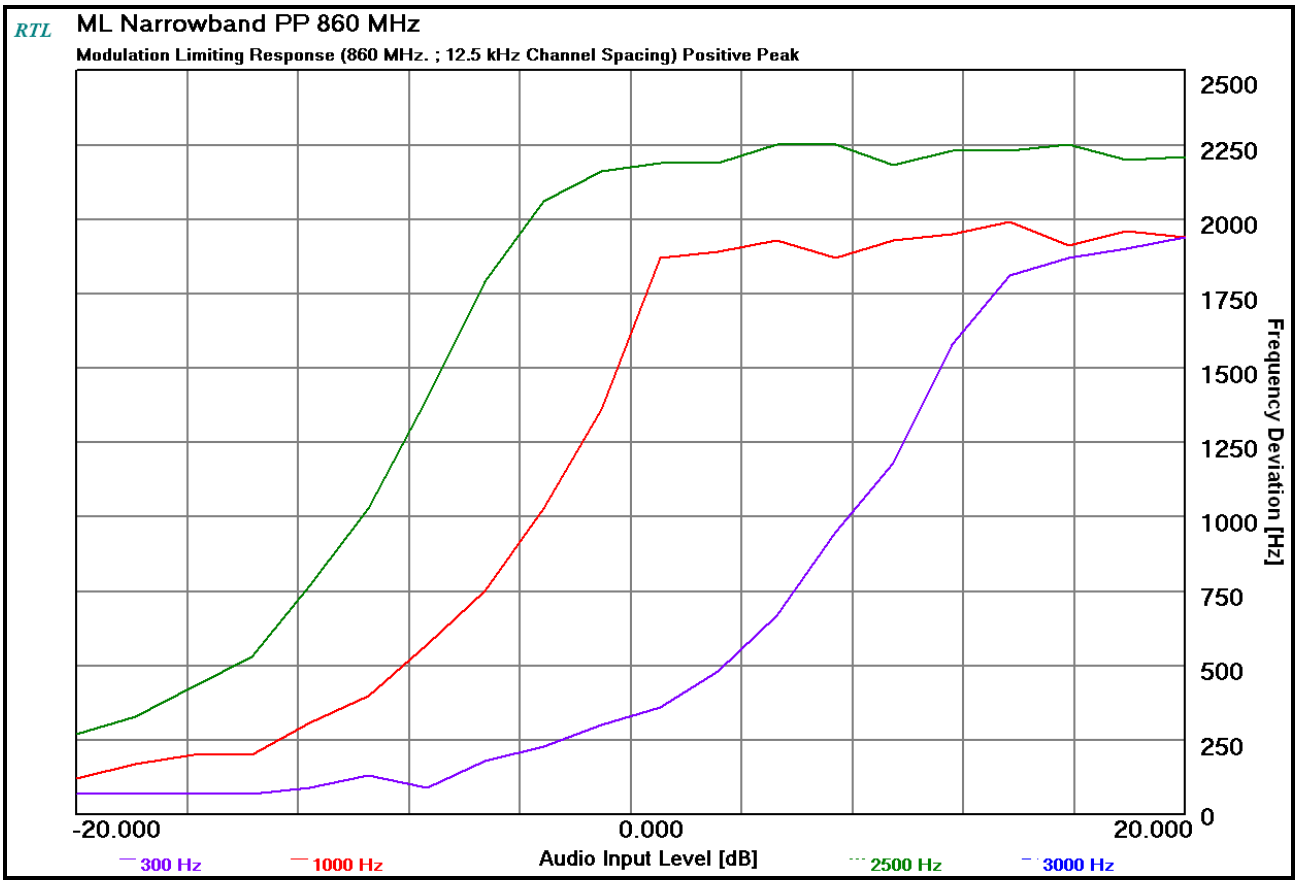
Plot 11-42: Modulation Characteristics – Modulation Limiting - 860 MHz; Positive Peak; WB



Plot 11-43: Modulation Characteristics – Modulation Limiting - 860 MHz; Negative Peak; WB



Plot 11-44: Modulation Characteristics – Modulation Limiting - 860 MHz; Positive Peak; NB



Plot 11-45: Modulation Characteristics – Modulation Limiting - 860 MHz; Negative Peak; NB

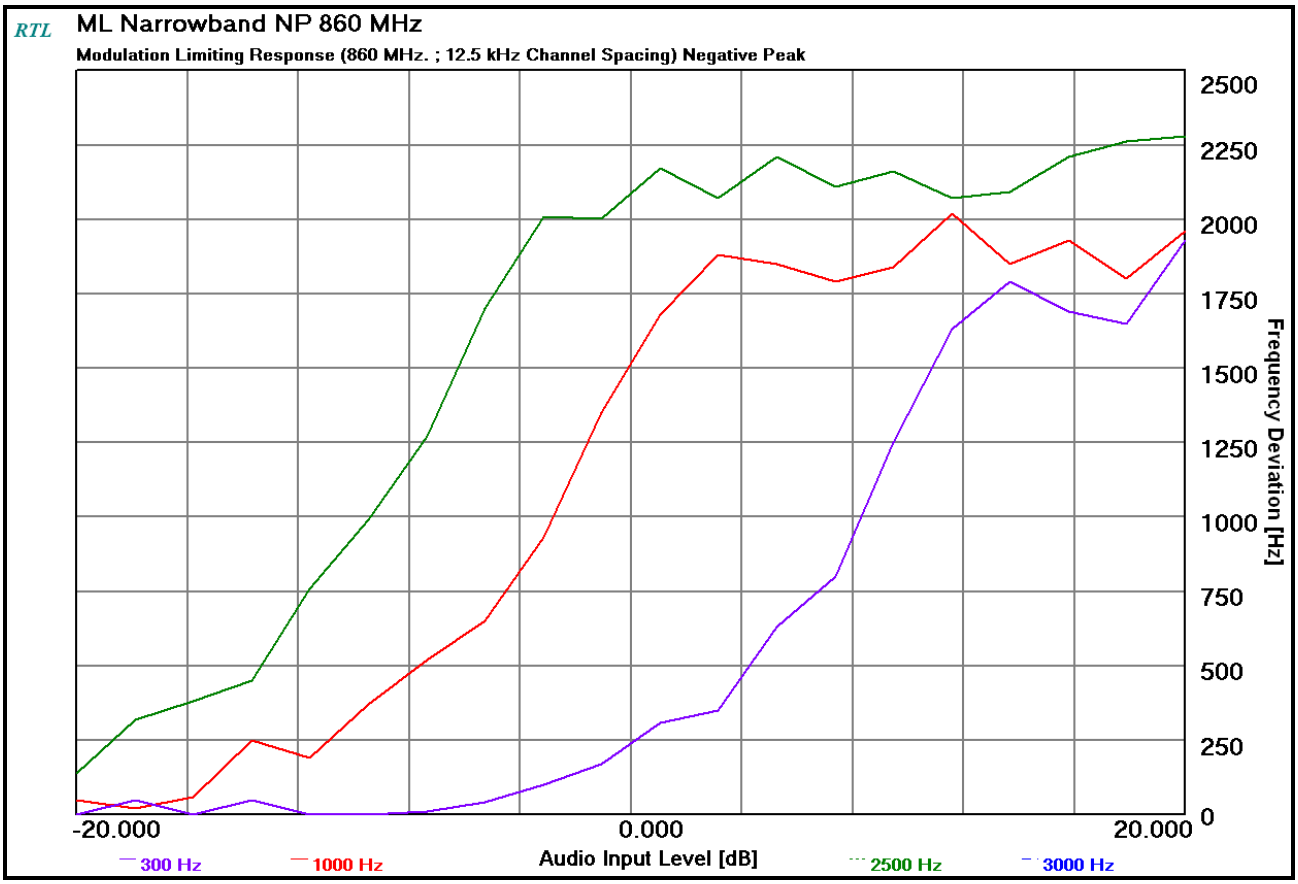


Table 11-1: Test Equipment Used For Modulation Requirements

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/Level Generator	2514A02585	1/15/10
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	8/29/10
901054	Hewlett Packard	3586B	Selective Level Meter	1928A01892	11/10/10
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	12/3/10

Test Personnel:

Daniel Baltzell	Daniel W. Baltzell	December 4-10, 2009
Test Engineer	Signature	Dates Of Tests

12 FCC Rules and Regulations Part §90.214: Transient Frequency Response

12.1 Test Procedure

TIA-EIA-603-C 2004, section 2.2.3

§ 90.214 Transient Frequency Behavior

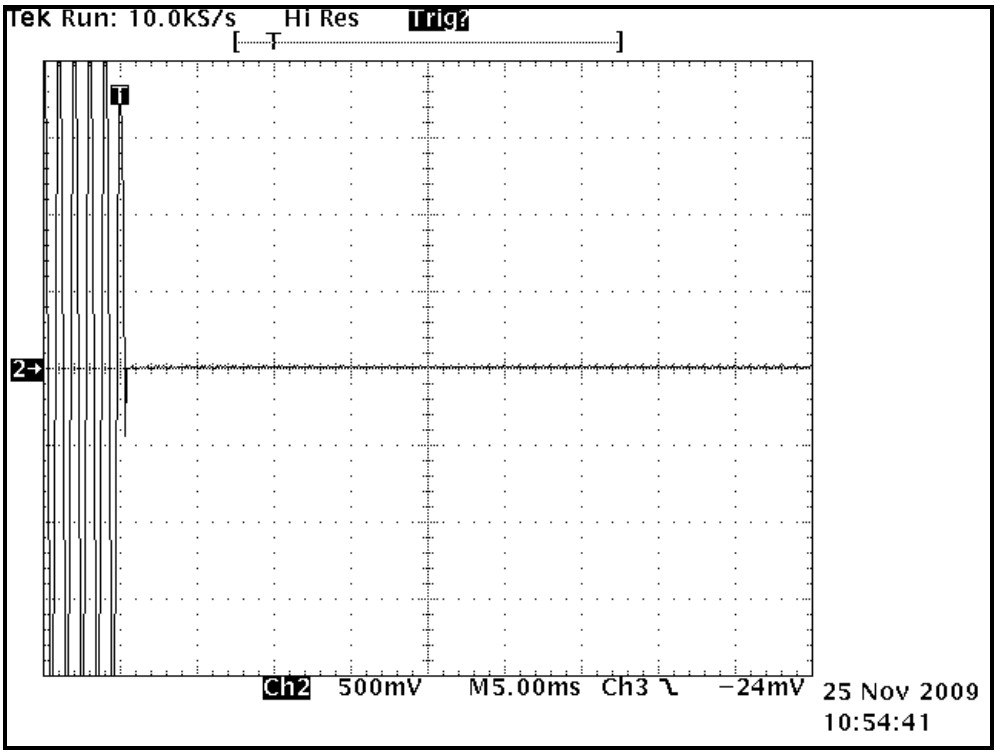
Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals [1,2]	Maximum frequency difference [3]	All equipment	
		150 to 174 MHz	421 to 512 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels			
t_1 [4]	±25.0 kHz	5.0 ms	10.0 ms
t_2	±12.5 kHz	20.0 ms	25.0 ms
t_3 [4]	±25.0 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels			
t_1 [4]	±12.5 kHz	5.0 ms	10.0 ms
t_2	±6.25 kHz	20.0 ms	25.0 ms
t_3 [4]	±12.5 kHz	5.0 ms	10.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels			
t_1 [4]	±6.25 kHz	5.0 ms	10.0 ms
t_2	±3.125 kHz	20.0 ms	25.0 ms
t_3 [4]	±6.25 kHz	5.0 ms	10.0 ms

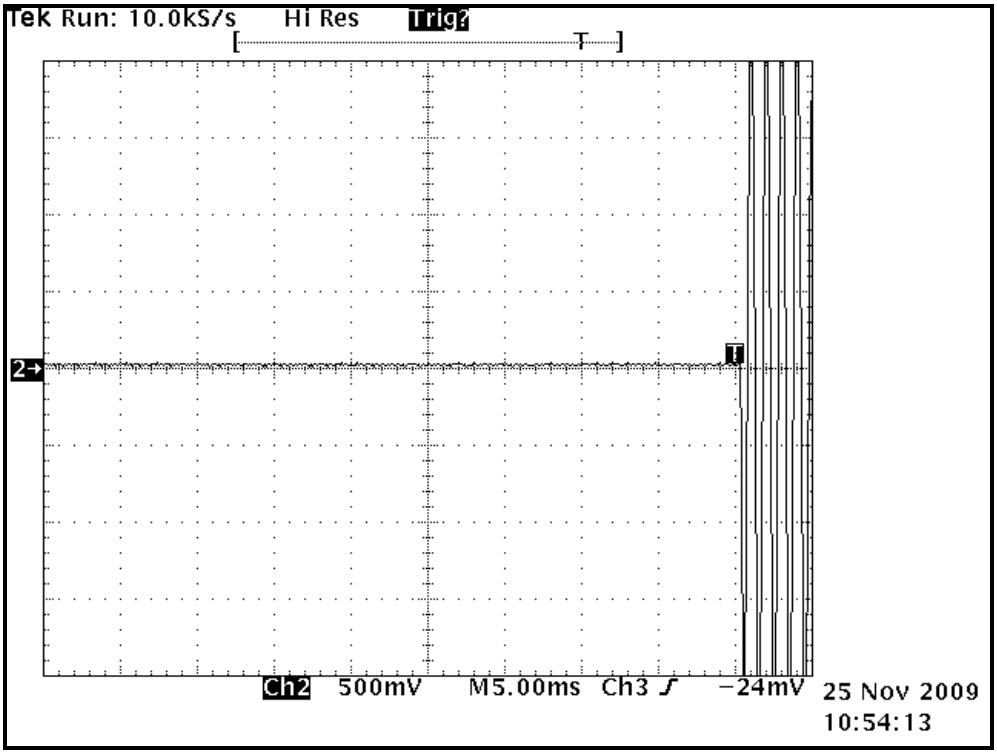
[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
t_1 is the time period immediately following t_{on}.
t_2 is the time period immediately following t_1.
t_3 is the time period from the instant when the transmitter is turned off until t_{off}.
t_{off} is the instant when the 1 kHz test signal starts to rise.
[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in § 90.213.
[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.
[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

12.2 Test Data

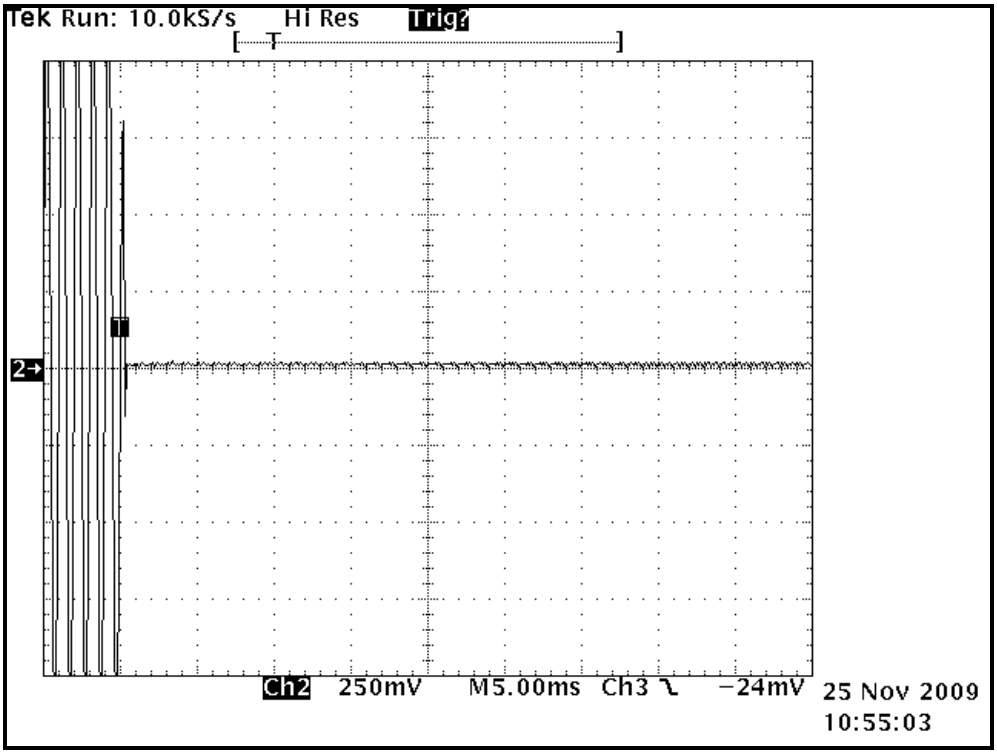
Plot 12-1: Transient Frequency Behavior – 162 MHz; High Power; Wide Band; Carrier ON Time



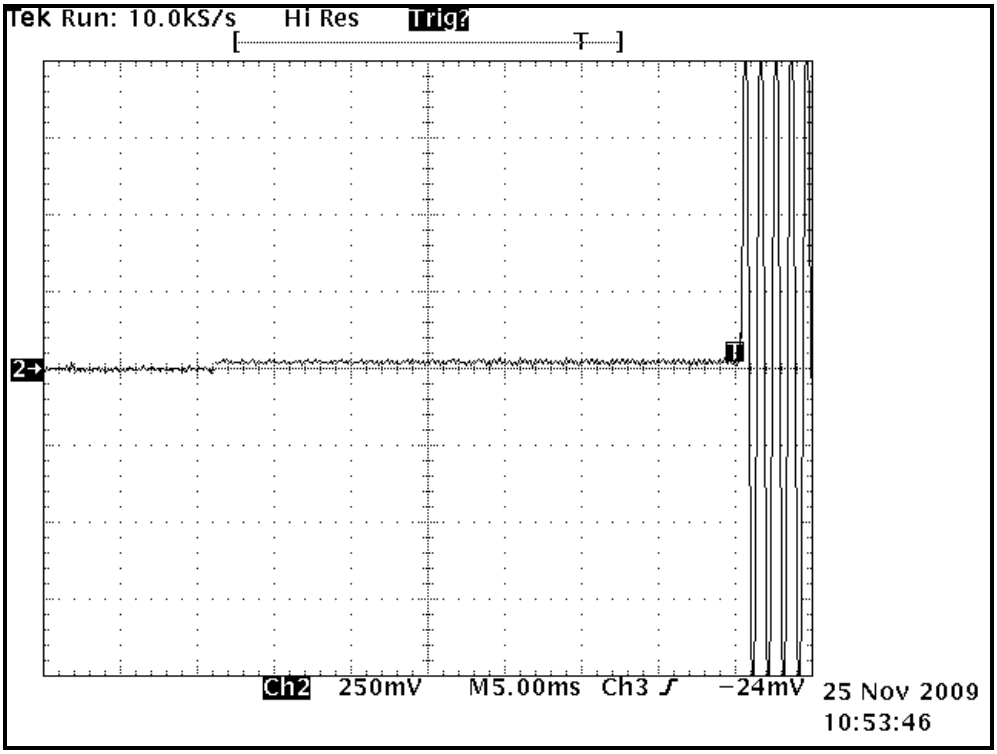
Plot 12-2: Transient Frequency Behavior – 162 MHz; High Power; Wide Band; Carrier OFF Time



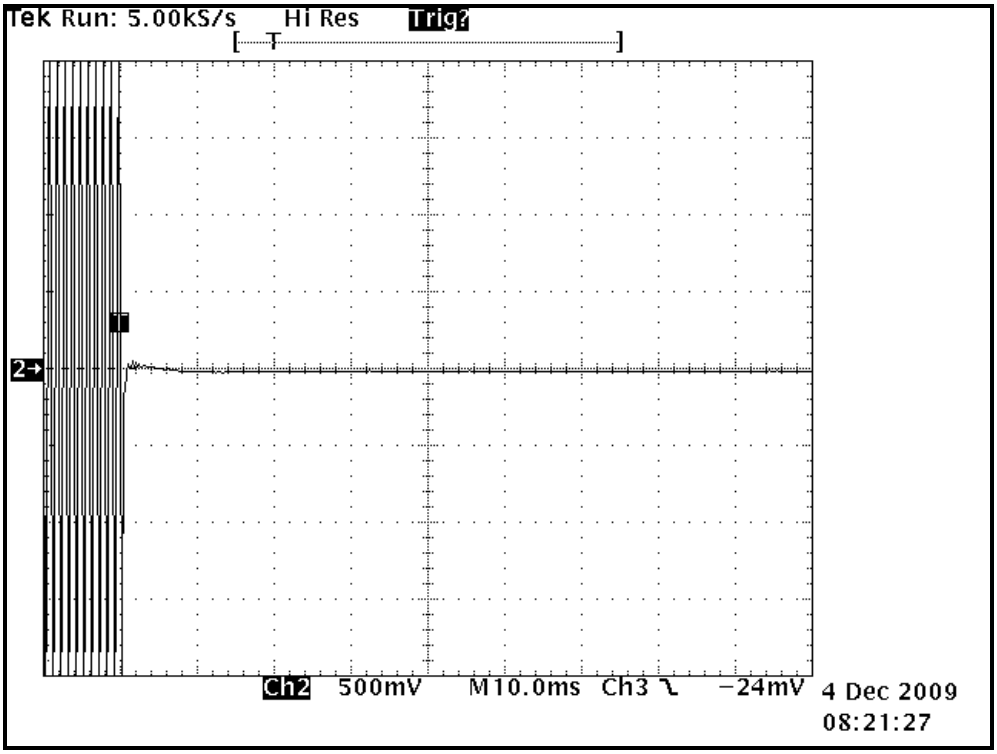
Plot 12-3: Transient Frequency Behavior – 162 MHz; High Power; Narrow Band; Carrier ON Time



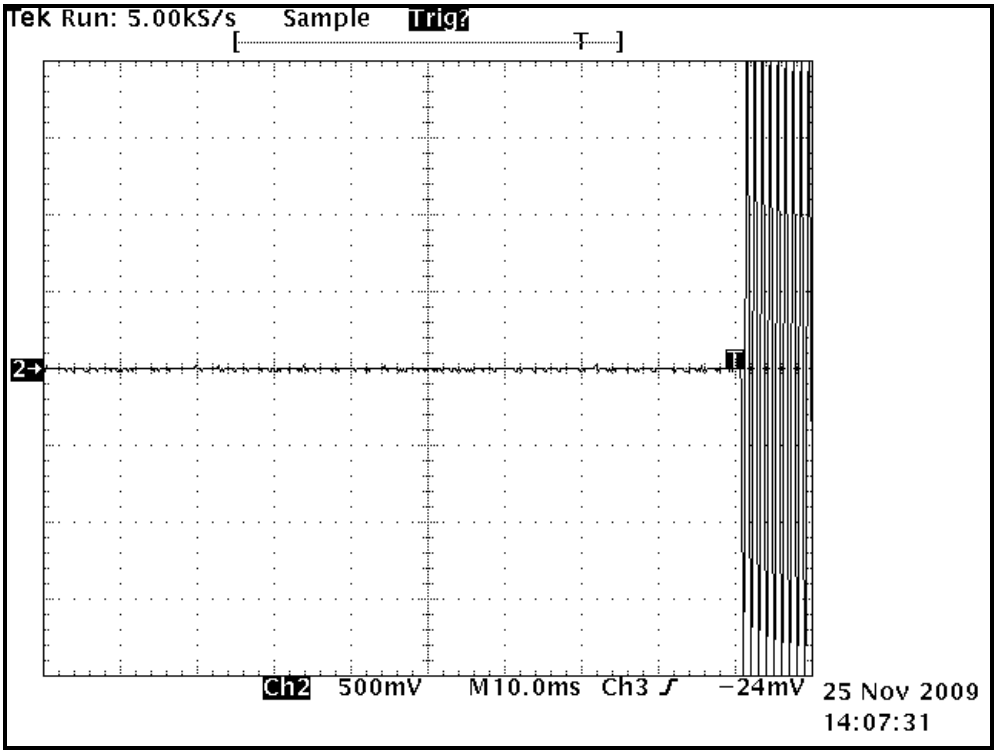
Plot 12-4: Transient Frequency Behavior – 162 MHz; High Power; Narrow Band; Carrier OFF Time



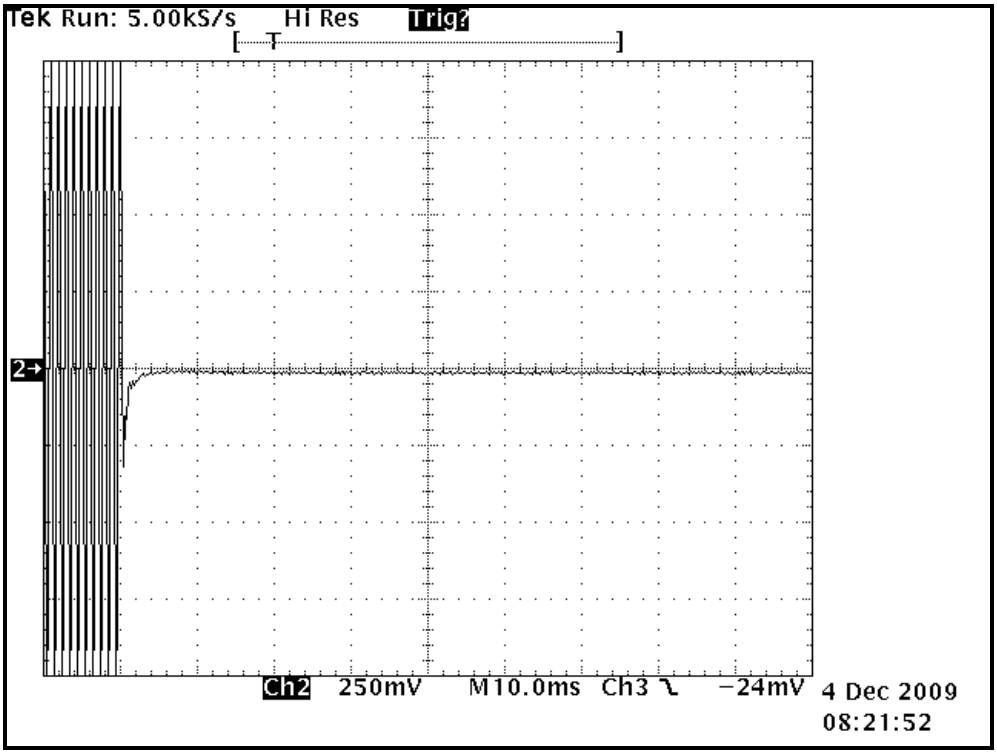
Plot 12-5: Transient Frequency Behavior – 418 MHz; High Power; Wide Band; Carrier ON Time



Plot 12-6: Transient Frequency Behavior – 418 MHz; High Power; Wide Band; Carrier OFF Time



Plot 12-7: Transient Frequency Behavior – 418 MHz; High Power; Narrow Band; Carrier ON Time



Plot 12-8: Transient Frequency Behavior – 418 MHz; High Power; Narrow Band; Carrier OFF Time

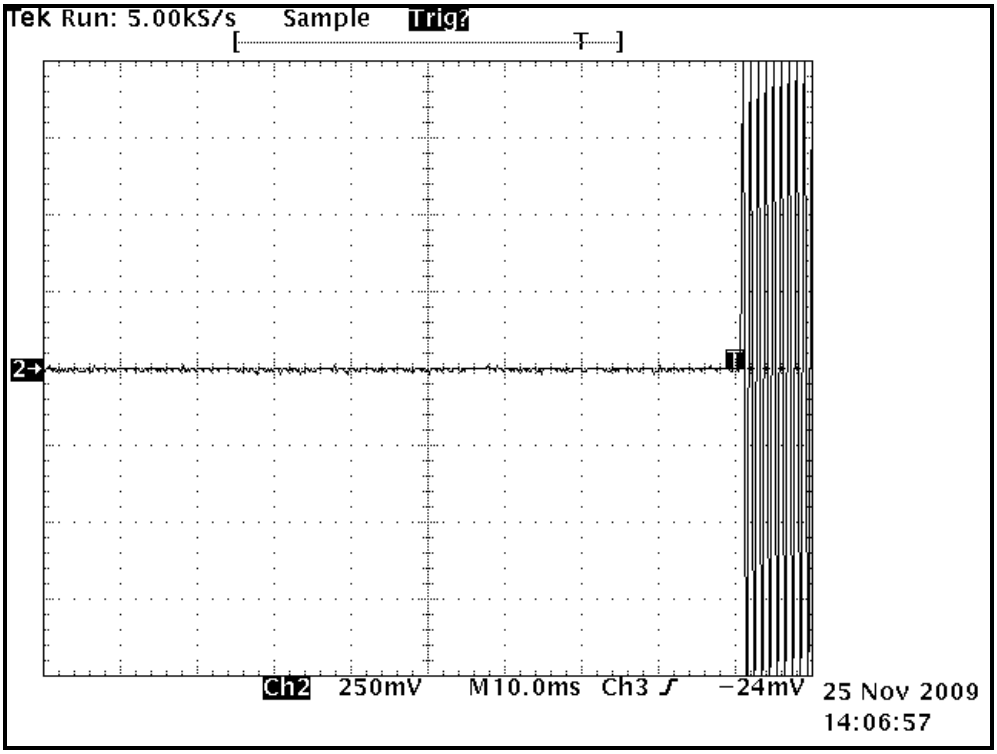


Table 12-1: Test Equipment Used For Testing Transient Frequency Behavior

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900917	Hewlett Packard	8648C	Synthesized Signal Generator (9 KHz - 3200 MHz)	3537A01741	10/7/10
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz – 1300 MHz)	2406A00178	9/29/10
900561	Tektronix	TDS540B	Oscilloscope	B020129	3/20/10
900352	Werlatone	Directional Coupler	Coupler	C1795/4989	7/9/10

Test Personnel:

Daniel Baltzell		November 25 and December 4, 2009
Test Engineer	Signature	Dates Of Tests

13 FCC Rules and Regulations Part 2 §2.202: Necessary Bandwidth and Emission Bandwidth

Type of Emission: F3E, F1D, F1E

Voice – 25 kHz channel separation
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 5
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 16.0 kHz
Emission designator: 16K0F3E

Voice – 12.5 kHz channel separation
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 2.5
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 11.0 kHz
Emission designator: 11K0F3E

P25 – 9600 bps:
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800
Bn = $[9600/\log_2(4) + 2\ (1800)\ (1) = 8.400$ kHz
Emission designator: 8K4F1D, 8K4F1E

806-809 MHz Trunked/Conventional; 821-824 MHz Talkaround on NPSPAC Channels
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 4.0
Constant factor (K): 1 (default)
Bn = 2xM+2xDK = 14.0 kHz
Emission designator: 14K0F3E

14 Conclusion

The data in this measurement report shows that the **Harris Corporation** Model **Unity XG-100P Multiband Portable Radio, FCC ID: AQZ-XG-100P00,** complies with all the applicable requirements of Parts 80, 90, 15 and 2 of the FCC Rules.