9 FCC Part 2.1055: Frequency Stability; Part 22.355: Frequency Tolerance; Part 74.464; Frequency Tolerance; Part 80.209: Frequency Stability; Part 90.213, Part 90.539: Frequency Stability; ISED RSS-119 5.3: Transmitter Frequency Stability

9.1 Test Procedure

ANSI C63.26, section 5.6

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 AFC was not locked to the base station.

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.

Part 80.209: 10 ppm. 400-466 MHz 5 ppm

Part 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]	....	....	....

Part 90.213: Mobile stations over 2 W operating power - 1.5 ppm (806-809 MHz, 851-854 MHz, 896-901 MHz, and 935-940 MHz); 2.5 ppm (809-824 MHz, and 854-869 MHz)

Part 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).

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 0.13 ppm.

9.2 Test Data

Table 9-1: Temperature Frequency Stability – 33.0125 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	33.012500	0.00
-20	33.012500	0.00
-10	33.012500	0.00
0	33.012500	0.00
10	33.012500	0.00
20 (reference)	33.012500	0.00
30	33.012500	0.00
40	33.012500	0.00
50	33.012500	0.00
60	33.012500	0.00

Table 9-2: Temperature Frequency Stability – 40.0125 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	40.012500	0.00
-20	40.012500	0.00
-10	40.012500	0.00
0	40.012500	0.00
10	40.012500	0.00
20 (reference)	40.012500	0.00
30	40.012500	0.00
40	40.012500	0.00
50	40.012500	0.00
60	40.012500	0.00

Table 9-3: Temperature Frequency Stability – 48.9875 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	48.987500	0.00
-20	48.987500	0.00
-10	48.987500	0.00
0	48.987500	0.00
10	48.987500	0.00
20 (reference)	48.987500	0.00
30	48.987500	0.00
40	48.987500	0.00
50	48.987500	0.00
60	48.987500	0.00

Table 9-4: Temperature Frequency Stability – 136.0125 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	136.012500	0.00
-20	136.012500	0.00
-10	136.012500	0.00
0	136.012500	0.00
10	136.012500	0.00
20 (reference)	136.012500	0.00
30	136.012500	0.00
40	136.012500	0.00
50	136.012500	0.00
60	136.012500	0.00

Table 9-5: Temperature Frequency Stability – 155.0125 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	155.012500	0.00
-20	155.012500	0.00
-10	155.012500	0.00
0	155.012500	0.00
10	155.012500	0.00
20 (reference)	155.012500	0.00
30	155.012500	0.00
40	155.012500	0.00
50	155.012500	0.00
60	155.012500	0.00

Table 9-6: Temperature Frequency Stability – 173.9875 MHz

Temperature (°C)	Measured Frequency (MHz))	ppm
-30	173.987099	-2.30
-20	173.987500	0.00
-10	173.987500	0.00
0	173.987500	0.00
10	173.987500	0.00
20 (reference)	173.987500	0.00
30	173.987500	0.00
40	173.987500	0.00
50	173.987500	0.00
60	173.987500	0.00

Table 9-7: Temperature Frequency Stability – 378.0125 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	378.012500	0.00
-20	378.012500	0.00
-10	378.012500	0.00
0	378.012500	0.00
10	378.012500	0.00
20 (reference)	378.012500	0.00
30	378.012500	0.00
40	378.012500	0.00
50	378.012500	0.00
60	378.012500	0.00

Table 9-8: Temperature Frequency Stability – 450.0125 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-30	450.012500	0.00
-20	450.012500	0.00
-10	450.012500	0.00
0	450.012500	0.00
10	450.012500	0.00
20 (reference)	450.012500	0.00
30	450.012500	0.00
40	450.012500	0.00
50	450.012500	0.00
60	450.012500	0.00

Table 9-9: Temperature Frequency Stability – 511.9875 MHz

Temperature (°C)	Measured Frequency (MHz))	ppm
-30	511.987500	0.00
-20	511.987500	0.00
-10	511.987500	0.00
0	511.987500	0.00
10	511.987500	0.00
20 (reference)	511.987500	0.00
30	511.987500	0.00
40	511.987500	0.00
50	511.987500	0.00
60	511.987500	0.00

Table 9-10: Temperature Frequency Stability – 772 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	772.000004	0.01
-20	772.000000	0.00
-10	772.000051	0.07
0	771.999992	-0.01
10	771.999945	-0.07
20 (reference)	772.000000	0.00
30	772.000004	0.01
40	772.000043	0.06
50	772.000070	0.09
55	772.000070	0.09
60	772.000027	0.04

Table 9-11: Temperature Frequency Stability – 815 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	815.000008	0.01
-20	815.000000	0.00
-10	815.000000	0.00
0	815.000004	0.00
10	814.999945	-0.07
20 (reference)	815.000000	0.00
30	814.999996	0.00
40	815.000039	0.05
50	815.000089	0.11
55	815.000059	0.07
60	815.000043	0.05

Table 9-12: Temperature Frequency Stability – 937.5 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	937.500031	0.03
-20	937.500000	0.00
-10	937.500016	0.02
0	937.500027	0.03
10	937.499949	-0.05
20 (reference)	937.500000	0.00
30	937.500031	0.03
40	937.500051	0.05
50	937.500125	0.13
55	937.500086	0.09
60	937.500063	0.07

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz

Results: Pass

Table 9-13: Test Equipment Used For Testing Temperature Frequency Stability

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901627	Amprobe	34XR-A	DMM	13041385A	2/21/21
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	4/25/22
901724	API Weinschel, Inc.	48-40-34	40 dB 100W Attenuator	CJ8921	9/9/20
901124	Alinco	DM-33MVT 32A	Power Supply	1638	Not Required

Test Personnel:

Daniel Baltzell	[signature]	August 7, 2019 September 3, 2018
EMC Test Engineer	Signature	Dates of Test

9.2.1 Frequency Stability/Voltage Variation

Table 9-14: Frequency Stability/Voltage Variation –136.0125 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.73	136.012500	0.00
13.8(reference)	136.012500	0.00
15.87	136.012500	0.00

Table 9-15: Frequency Stability/Voltage Variation – 155.0125 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.73	155.012500	0.00
13.8(reference)	155.012500	0.00
15.87	155.012500	0.00

Table 9-16: Frequency Stability/Voltage Variation – 173.9875 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.73	173.987500	0.00
13.8(reference)	173.987500	0.00
15.87	173.987500	0.00

Table 9-17: Frequency Stability/Voltage Variation –378.0125 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.73	378.012500	0.00
13.8(reference)	378.012500	0.00
15.87	378.012500	0.00

Table 9-18: Frequency Stability/Voltage Variation – 450.0125 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.73	450.012500	0.00
13.8(reference)	450.012500	0.00
15.87	450.012500	0.00

Table 9-19: Frequency Stability/Voltage Variation – 511.9875 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.73	511.987500	0.00
13.8(reference)	511.987500	0.00
15.87	511.987500	0.00

Table 9-20: Frequency Stability/Voltage Variation – 772 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.56	772.000004	0.01
13.6(reference)	772.000000	0.00
15.64	772.000000	0.00

Table 9-21: Frequency Stability/Voltage Variation – 815 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.56	815.000008	0.01
13.6(reference)	815.000000	0.00
15.64	815.000000	0.00

Table 9-22: Frequency Stability/Voltage Variation – 937.5 MHz

Voltage (VDC)	Measured Frequency (Hz)	ppm
11.56	937.500031	0.03
13.6(reference)	937.500000	0.00
15.64	937.500000	0.00

Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz

Results: Pass

Table 9-23: Test Equipment Used For Testing Frequency Stability/Voltage Variation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901627	Amprobe	34XR-A	DMM	13041385A	2/21/21
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	4/25/22
901724	API Weinschel, Inc.	48-40-34	40 dB 100W Attenuator	CJ8921	9/9/20
901124	Alinco	DM-33MVT 32A	Power Supply	1638	Not Required
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber	11380	4/7/22

Test Personnel:

Daniel W. Baltzell	Daniel W. Baltzell	August 7, 2019 September 3, 2018
EMC Test Engineer	Signature	Dates of Test

10 FCC §2.1047(a)(b): Modulation Characteristics; Part 74.463: Modulation Requirements; Part 80.213: Modulation Requirements; RSS-119 5.2: Types of Modulation

Part 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.

10.1 Test Procedures

10.1.1 Audio Frequency Response

ANSI C63.26 2015, section 5.3.3

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)

10.1.2 Audio Low Pass Filter Response

ANSI C63.26 2015, section 5.3

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

10.1.3 Modulation Limiting

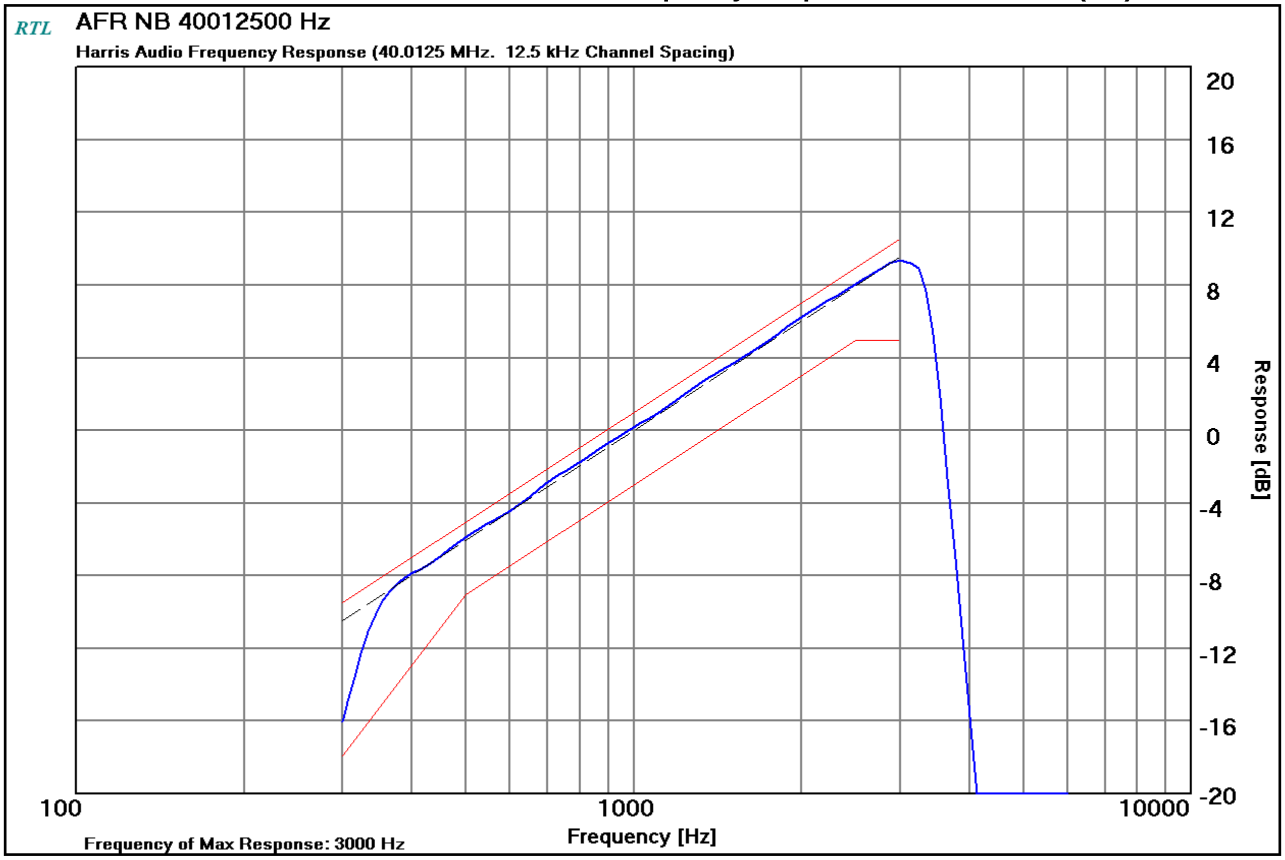
ANSI C63.26 2015, section 5.3.2

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.

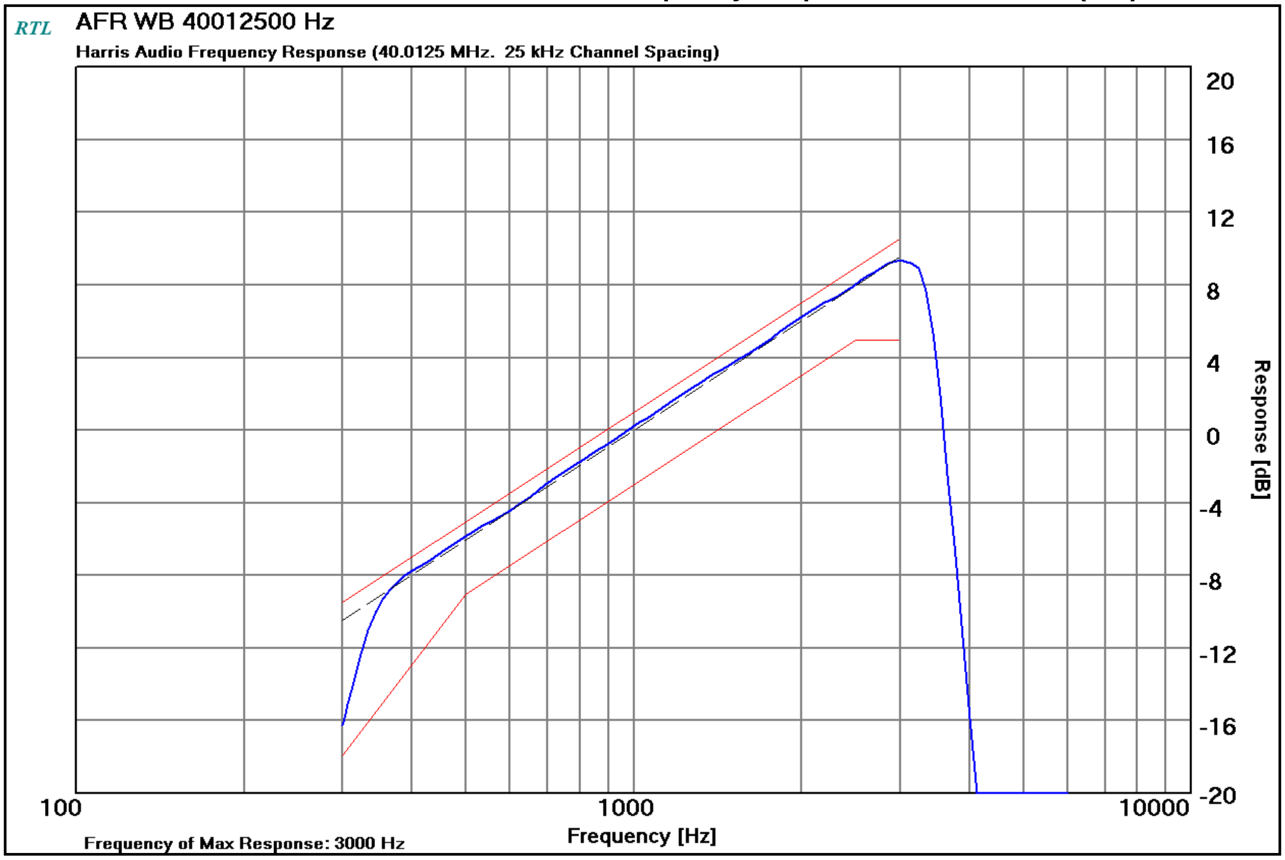
10.2 Test Data

10.2.1 Audio Frequency Response

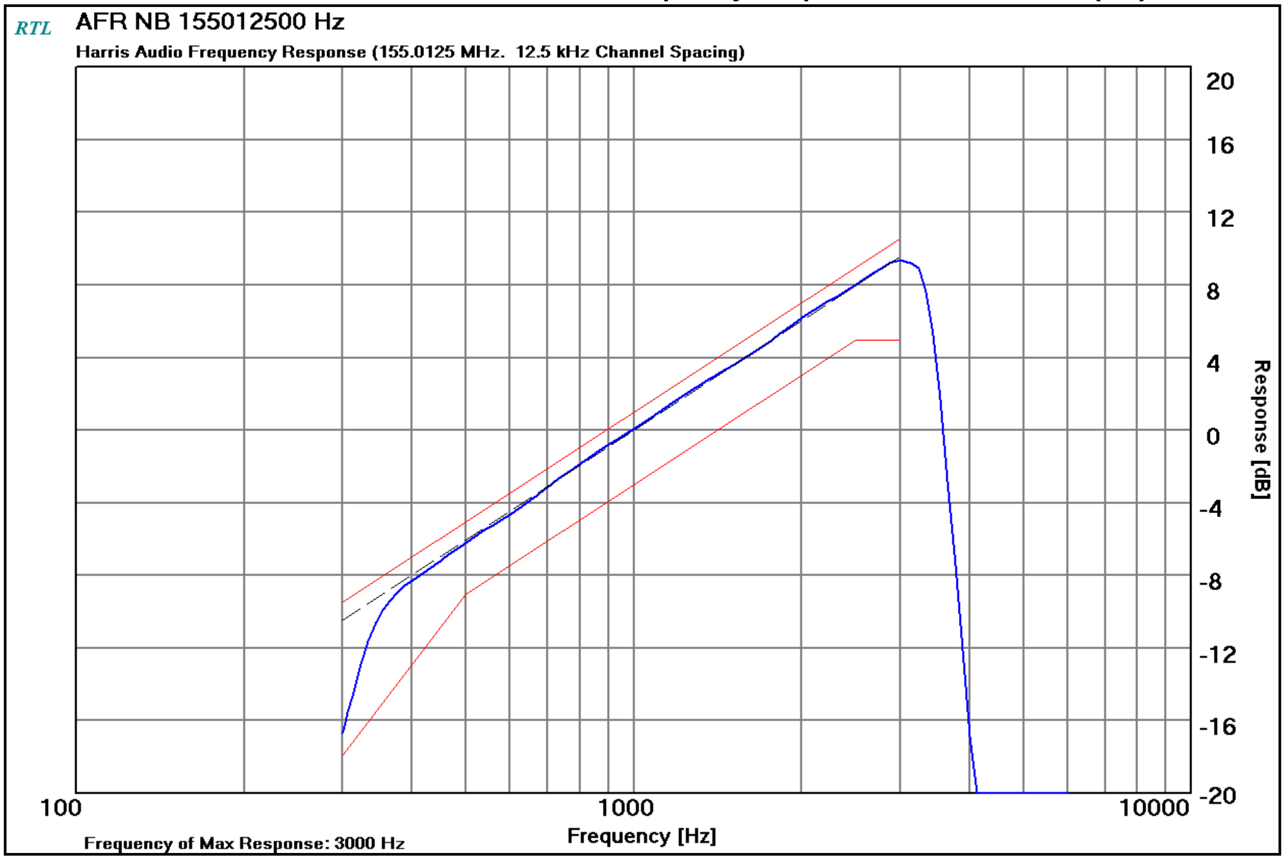
Plot 10-1: Modulation Characteristics - Audio Frequency Response – 40.0125 MHz (NB)



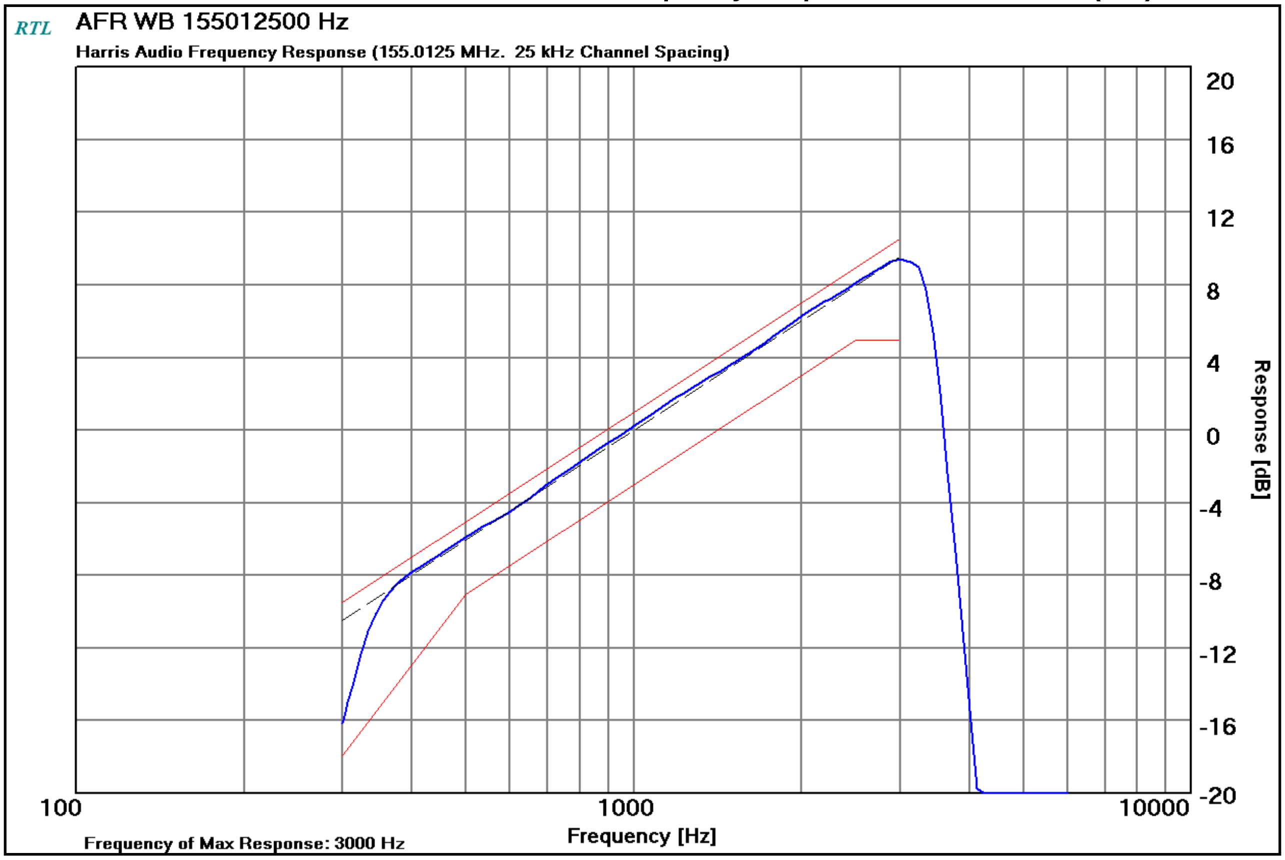
Plot 10-2: Modulation Characteristics - Audio Frequency Response – 40.0125 MHz (WB)



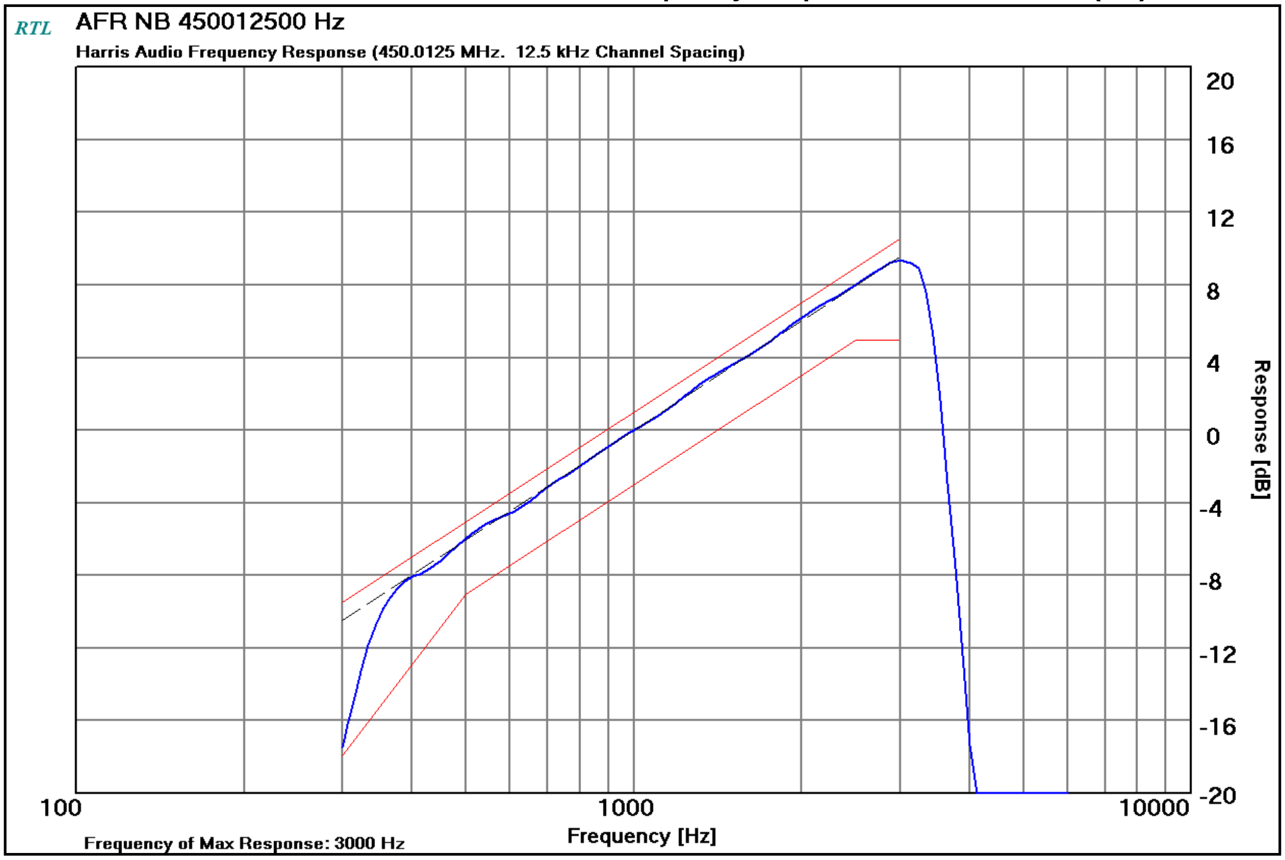
Plot 10-3: Modulation Characteristics - Audio Frequency Response – 155.0125 MHz (NB)



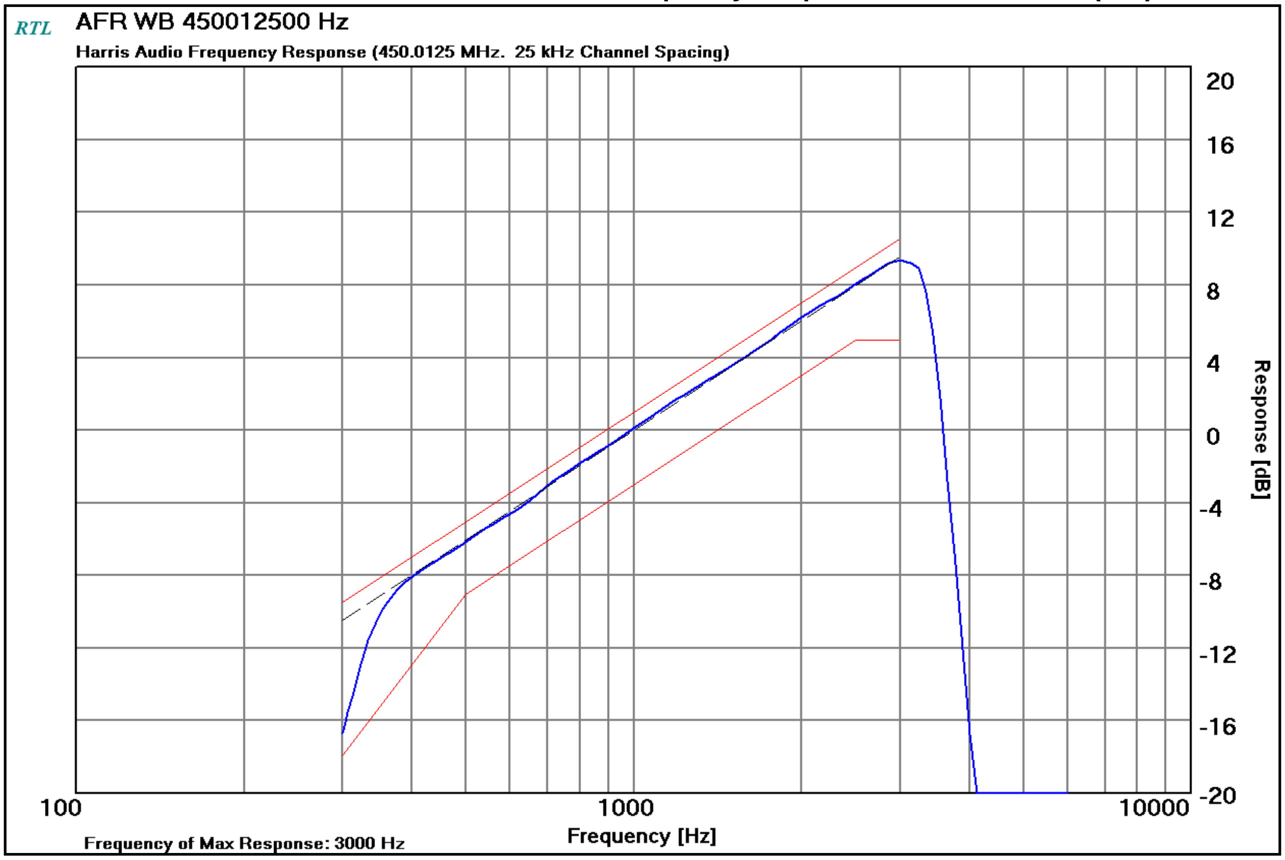
Plot 10-4: Modulation Characteristics - Audio Frequency Response – 155.0125 MHz (WB)



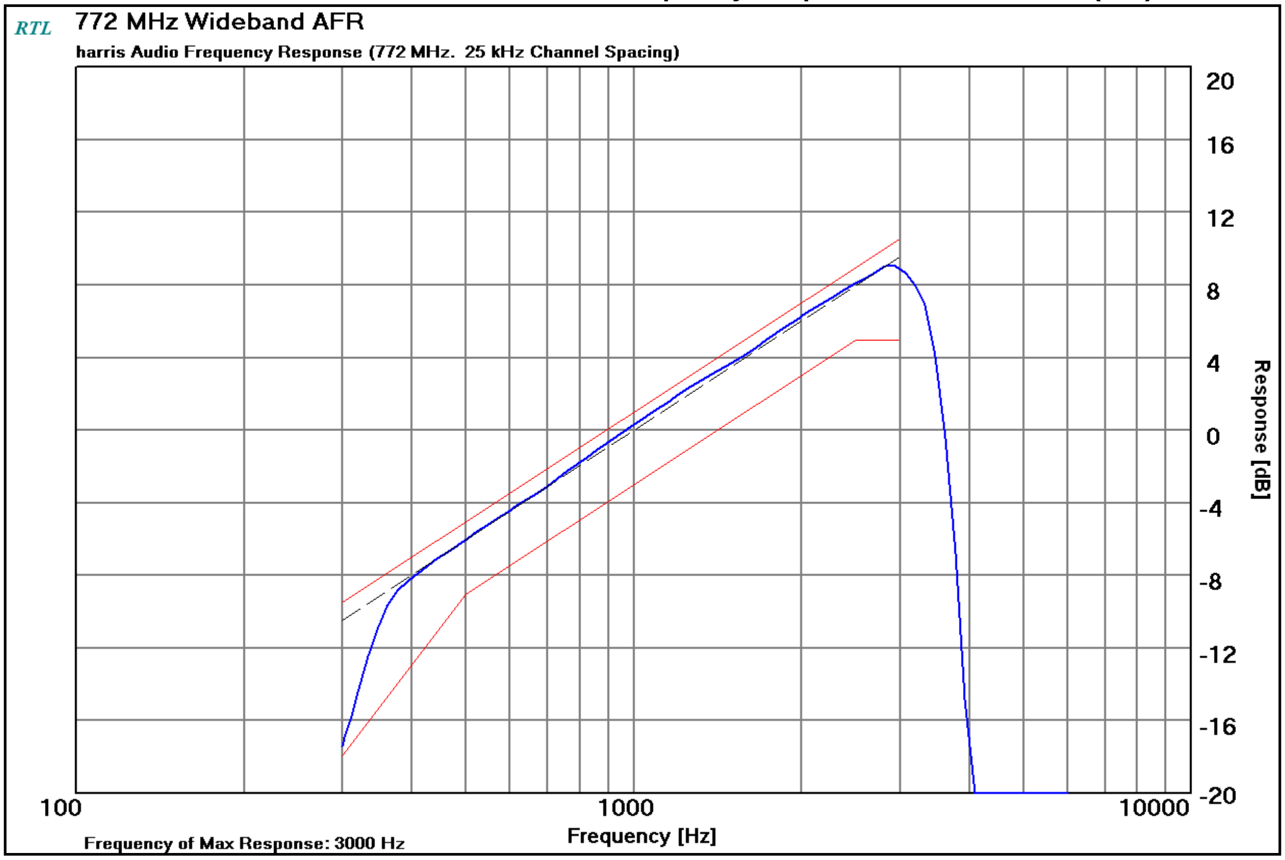
Plot 10-5: Modulation Characteristics - Audio Frequency Response – 450.0125 MHz (NB)



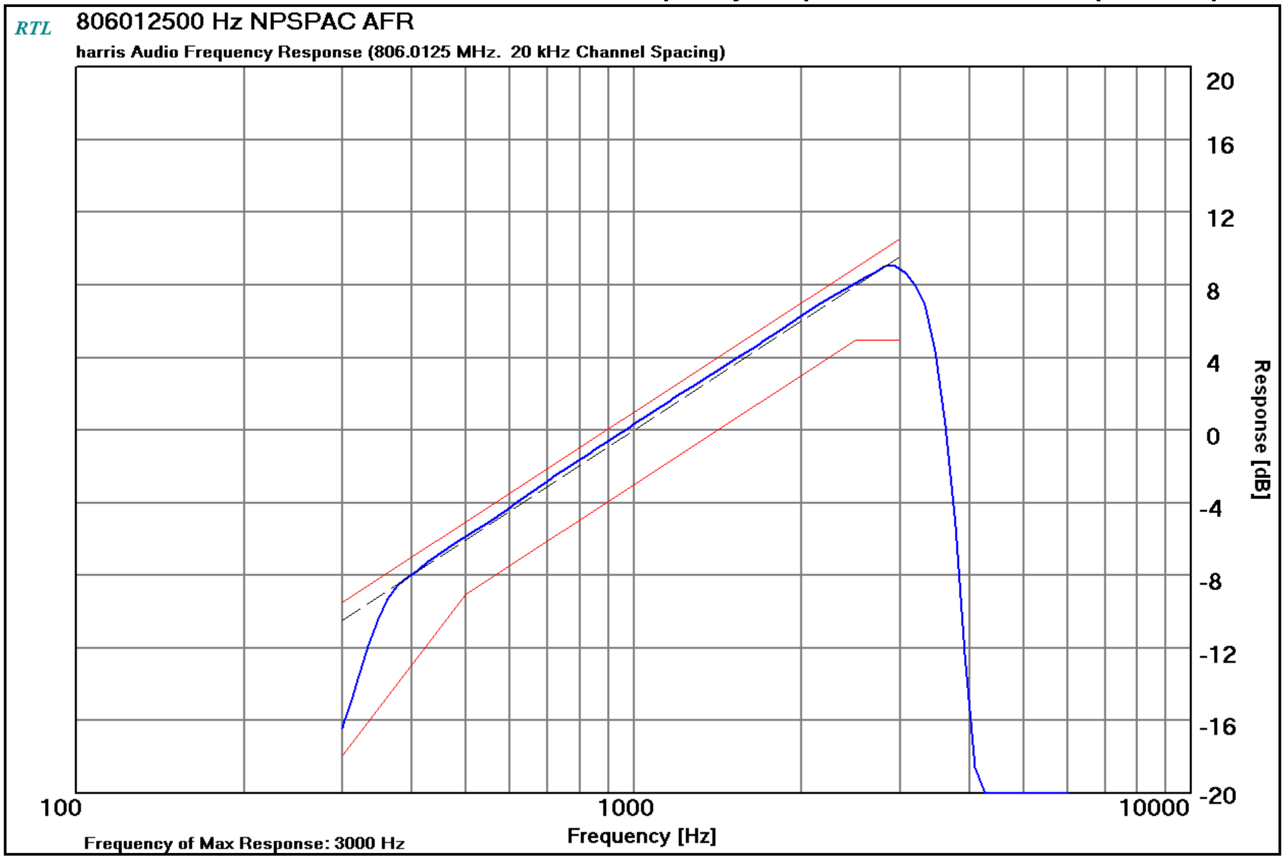
Plot 10-6: Modulation Characteristics - Audio Frequency Response – 450.0125 MHz (WB)



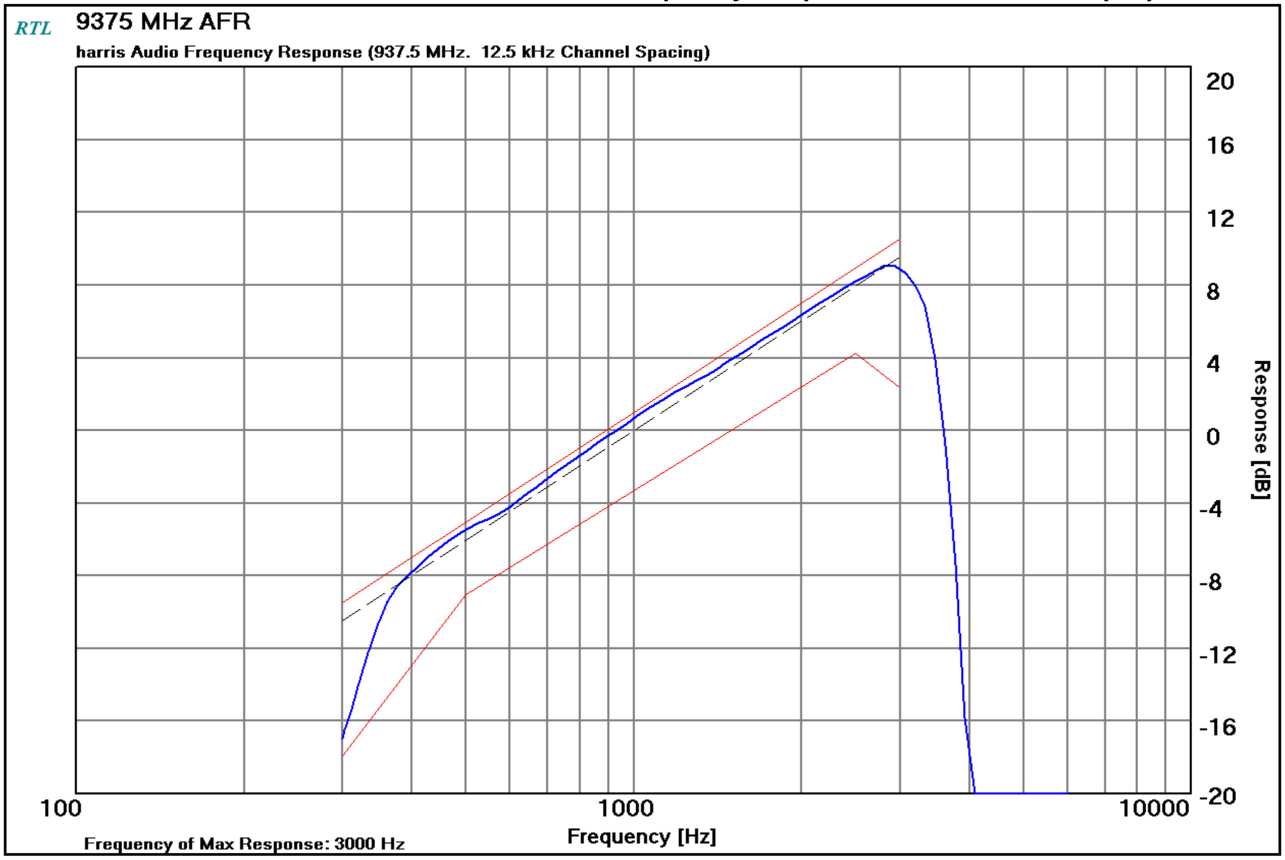
Plot 10-7: Modulation Characteristics - Audio Frequency Response – 772.0000 MHz (WB)



Plot 10-8: Modulation Characteristics - Audio Frequency Response – 806.0125 MHz (NPSPAC)

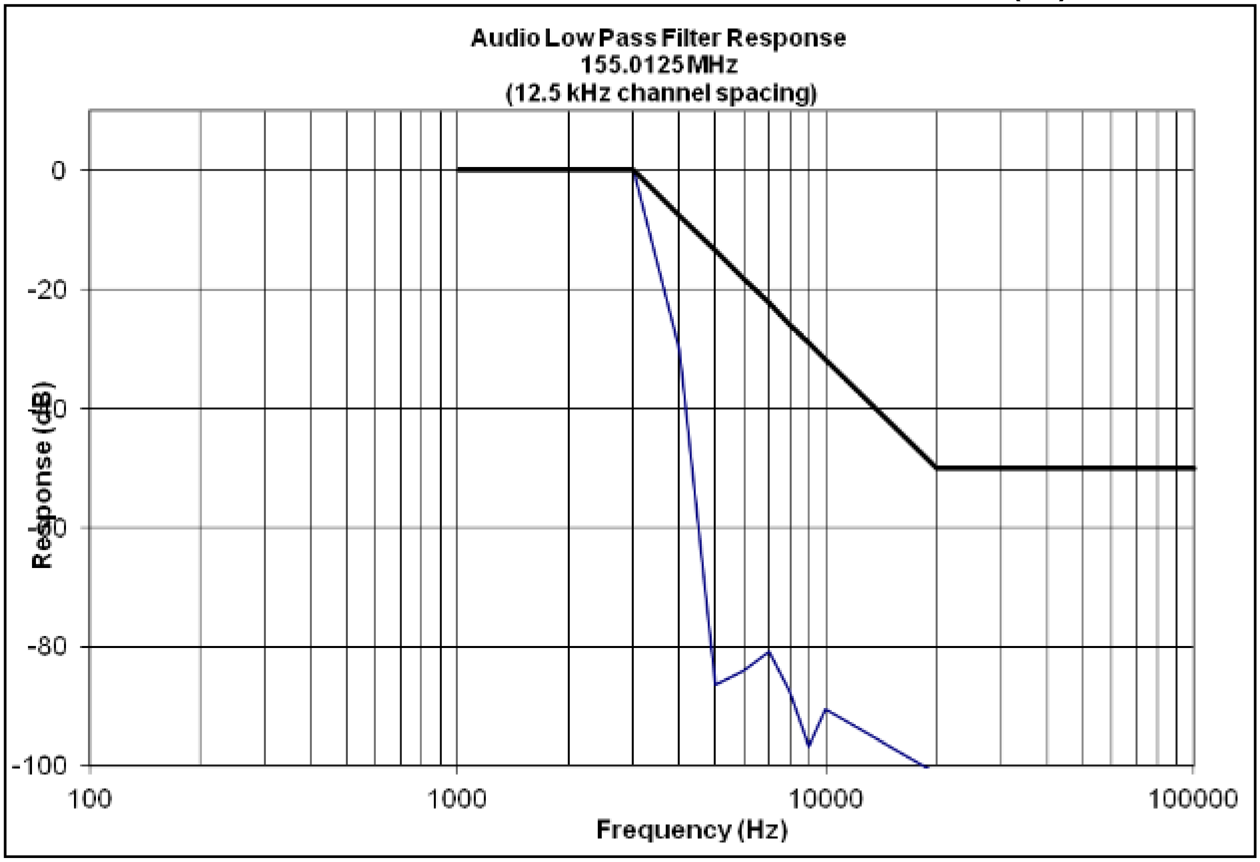


Plot 10-9: Modulation Characteristics - Audio Frequency Response – 937. 5000 MHz (NB)

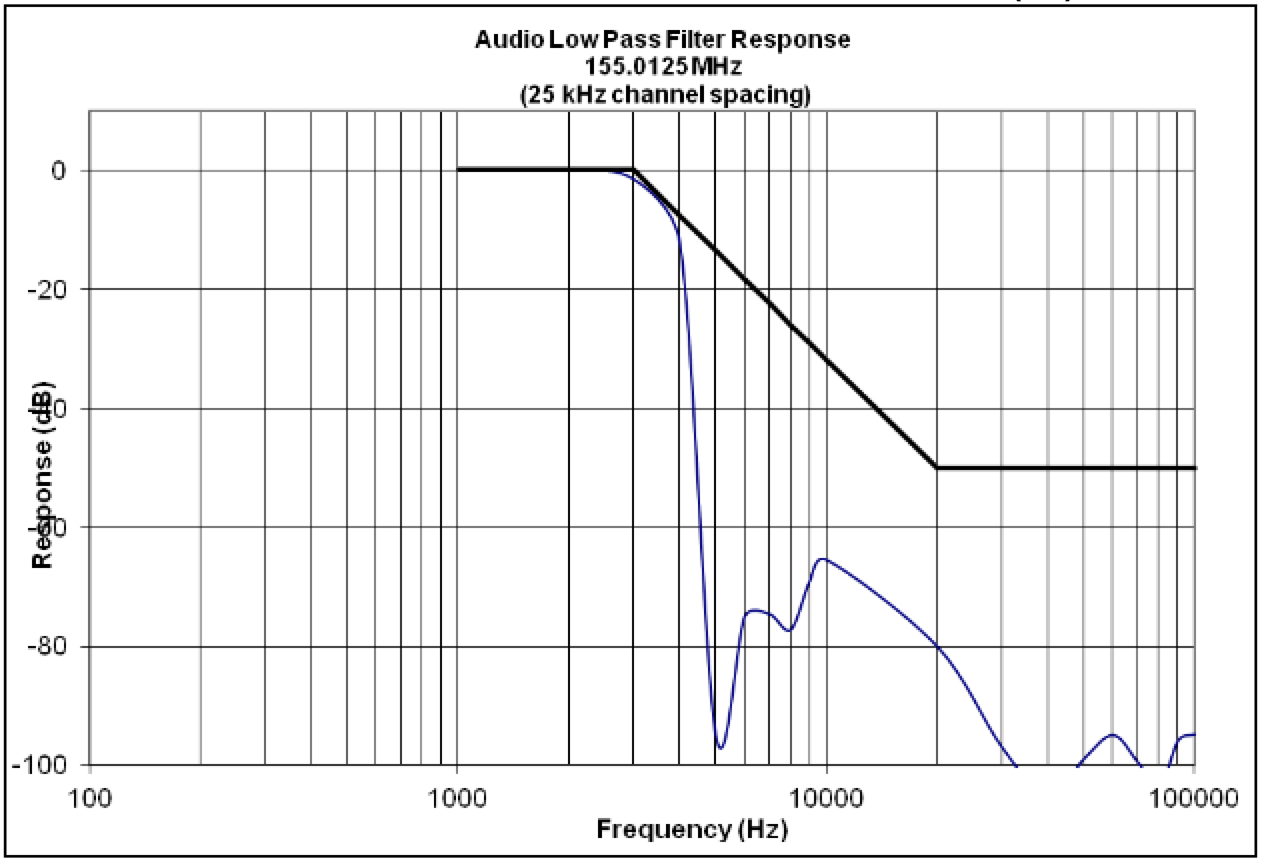


10.2.2 Audio Low Pass Filter Response

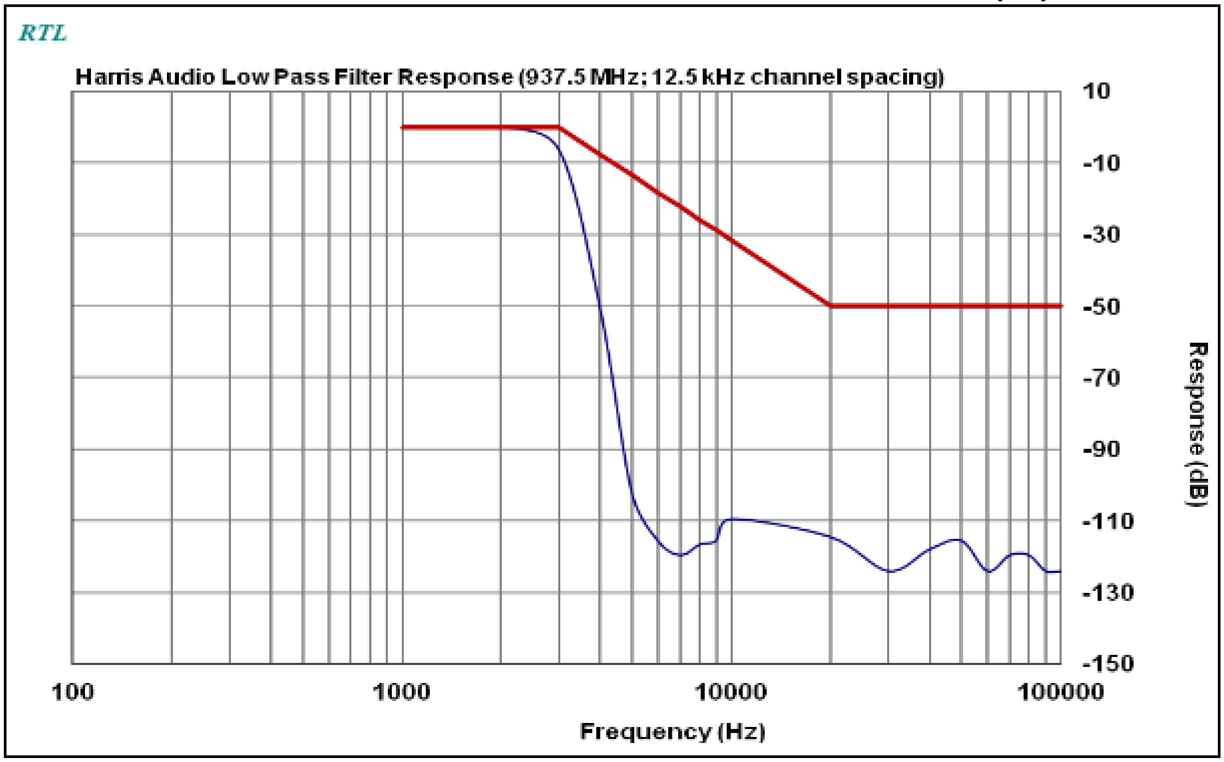
Plot 10-10: Modulation Characteristics – Audio Low Pass Filter – 155.0125 MHz (NB)



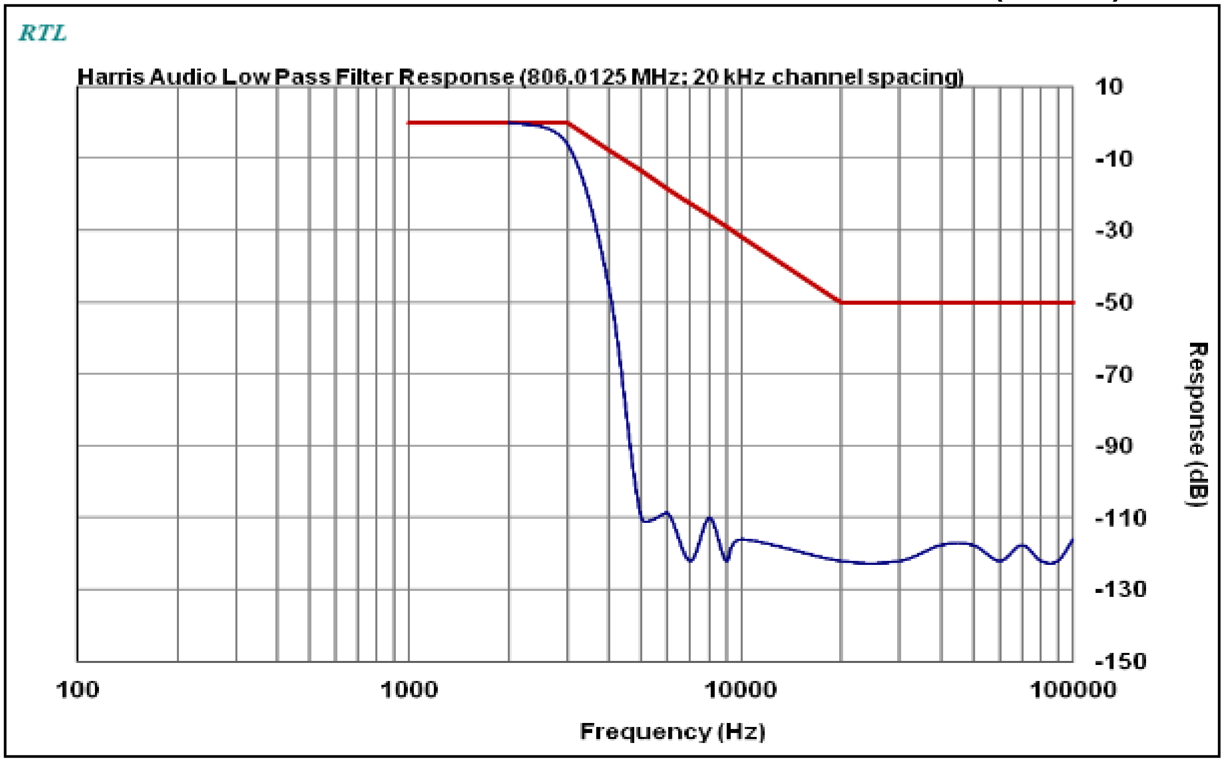
Plot 10-11: Modulation Characteristics – Audio Low Pass Filter – 155.0125 MHz (WB)



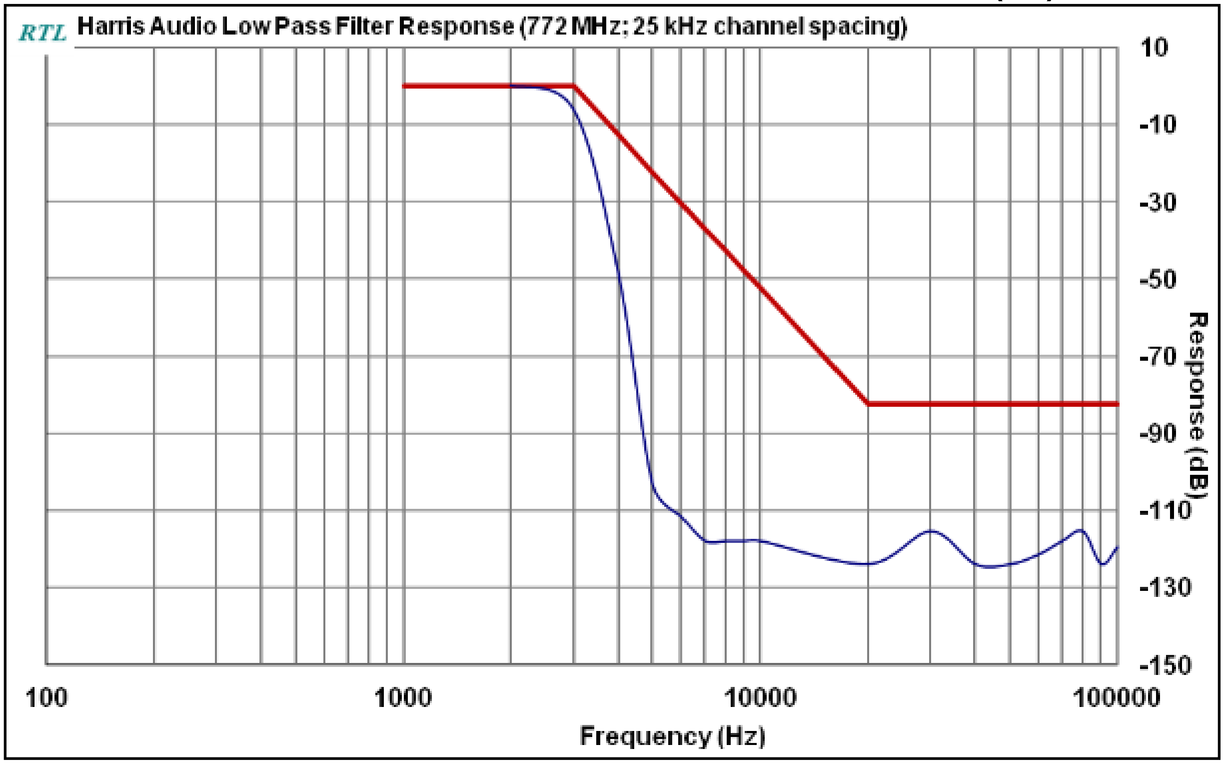
Plot 10-12: Modulation Characteristics – Audio Low Pass Filter – 937.5000 MHz (NB)



Plot 10-13: Modulation Characteristics – Audio Low Pass Filter – 806.0125 MHz (NPSPAC)

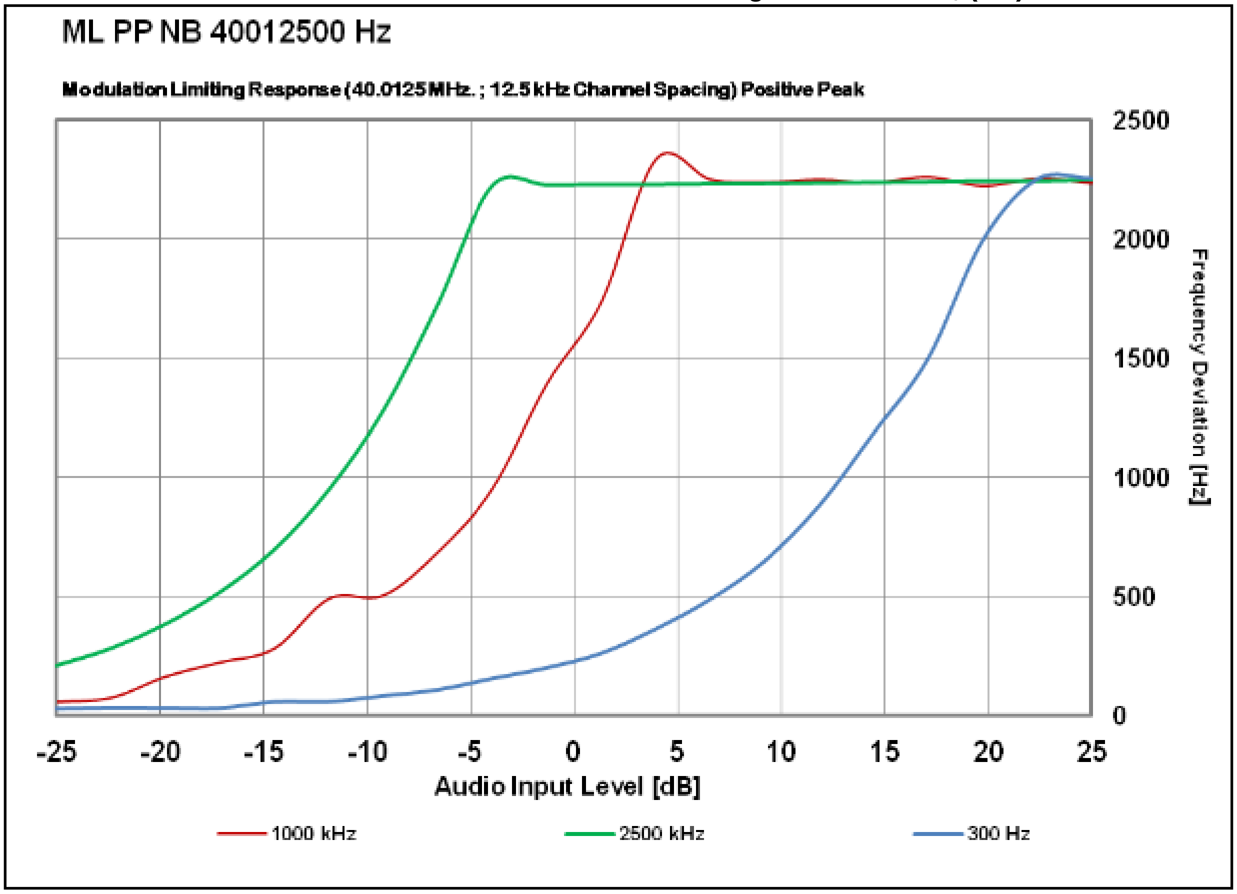


Plot 10-14: Modulation Characteristics – Audio Low Pass Filter – 772.0000 MHz (WB)

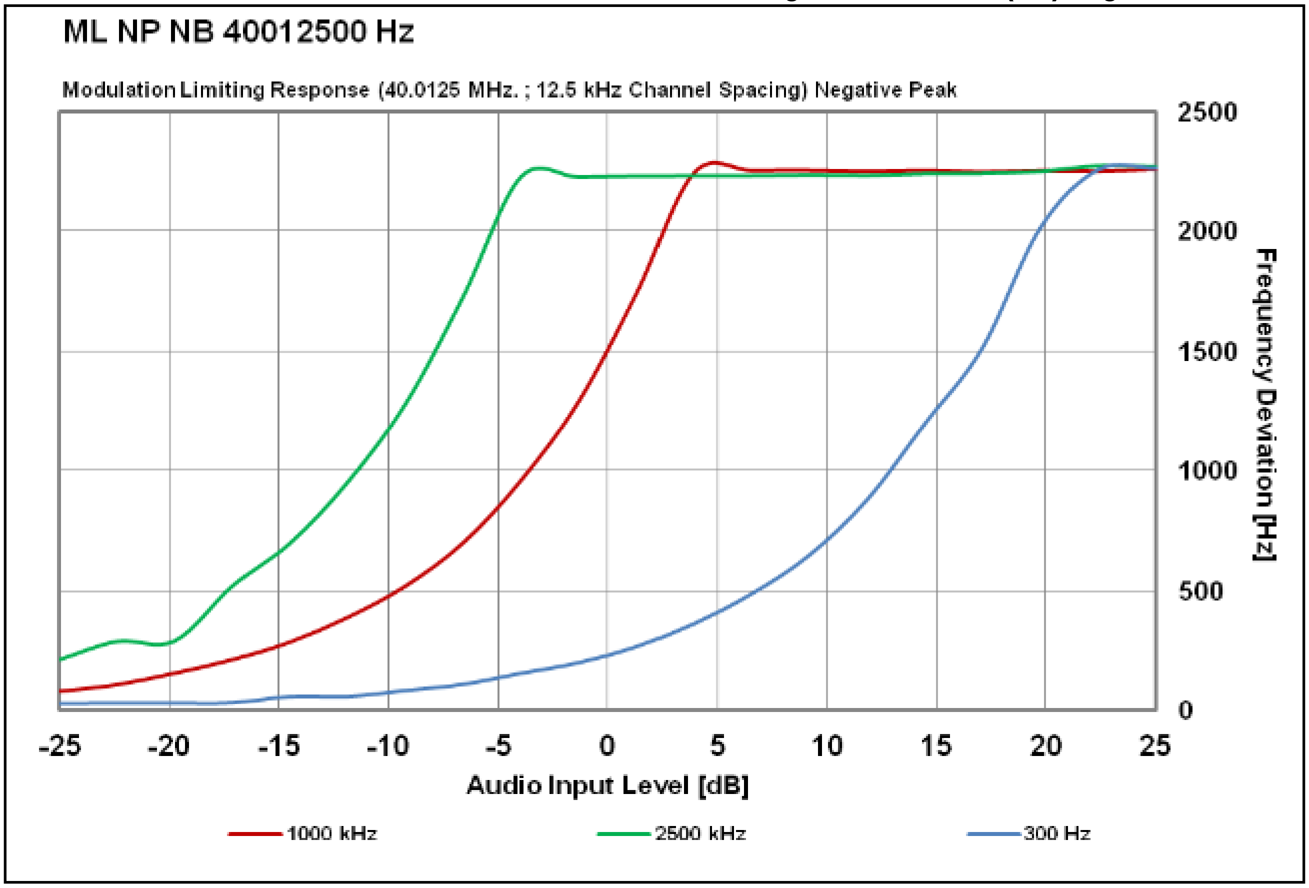


10.2.3 Modulation Limiting

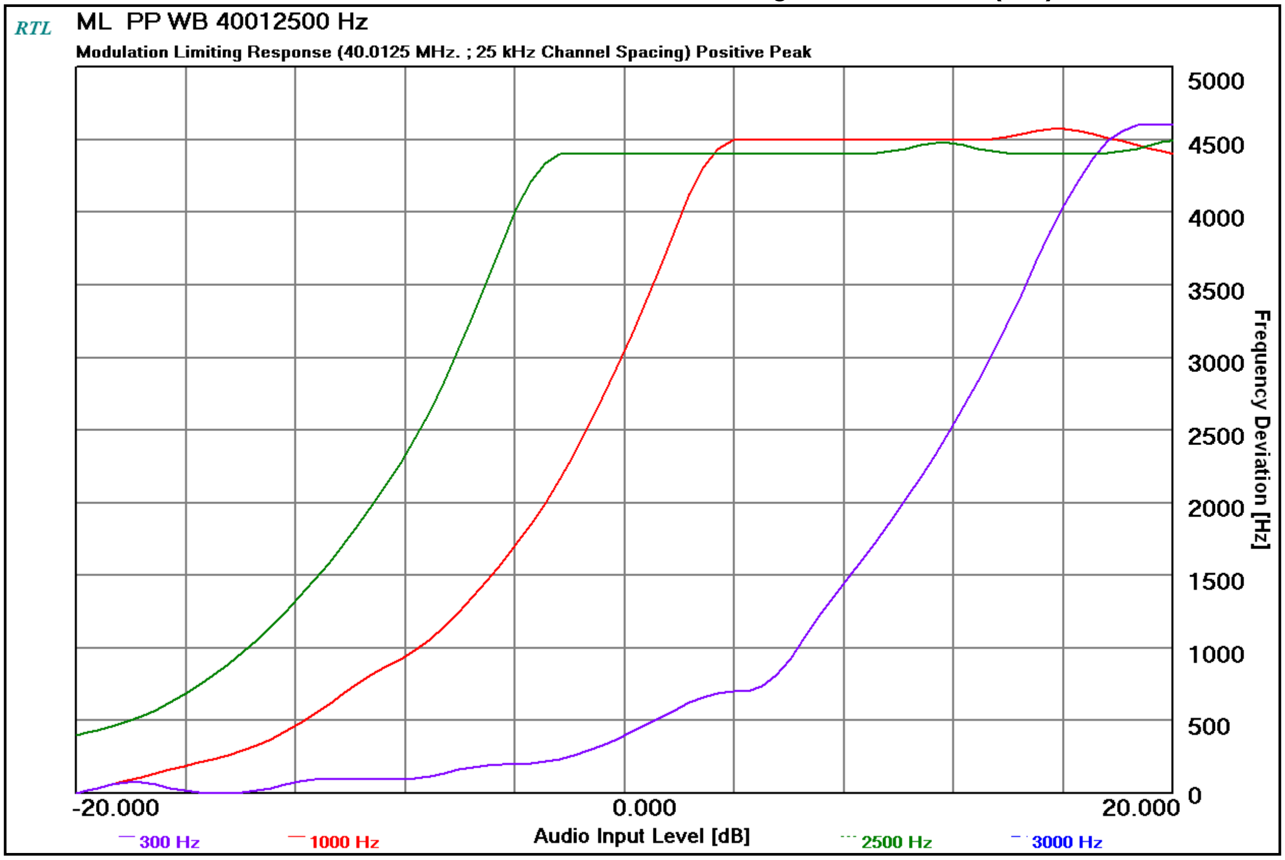
Plot 10-15: Modulation Characteristics – Modulation Limiting – 40.0125 MHz; (NB) Positive Peak



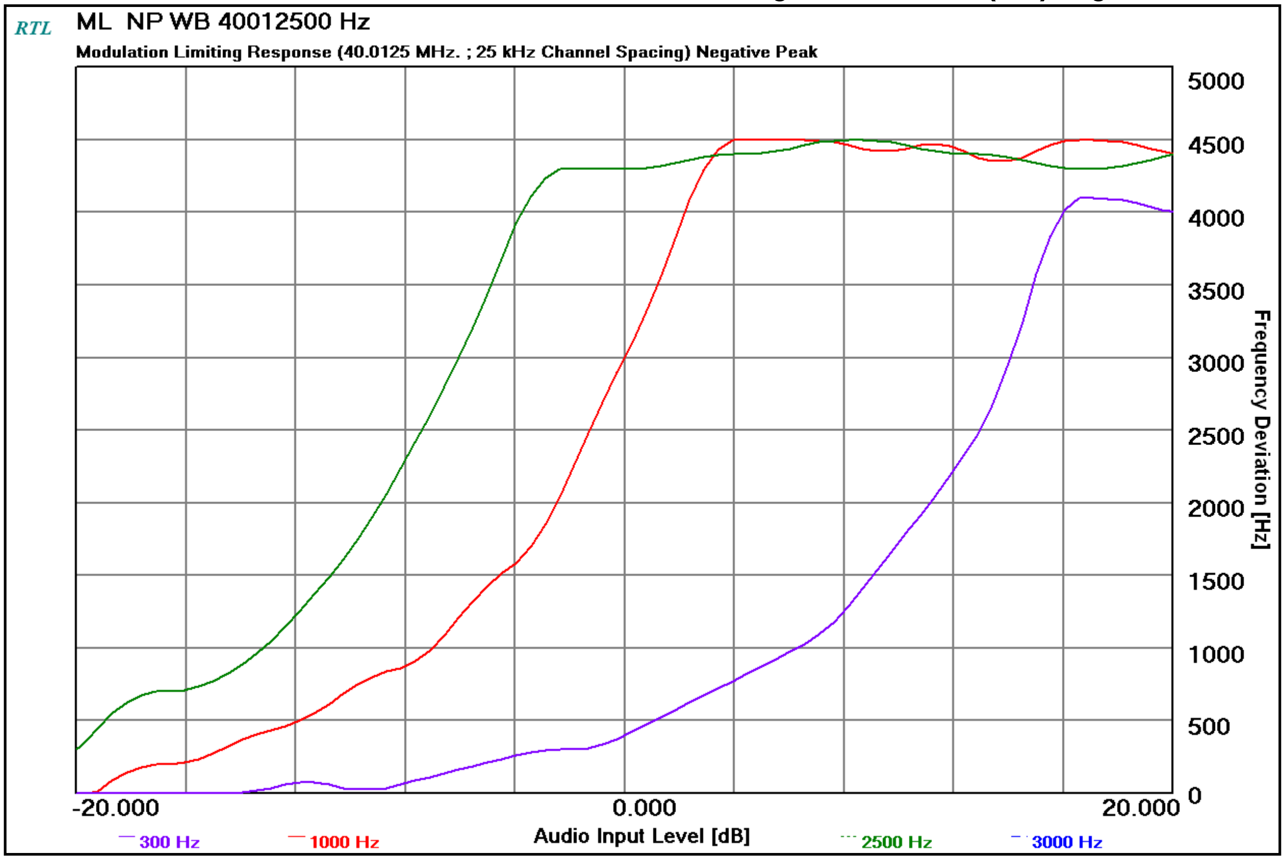
Plot 10-16: Modulation Characteristics – Modulation Limiting – 40.0125 MHz; (NB) Negative Peak



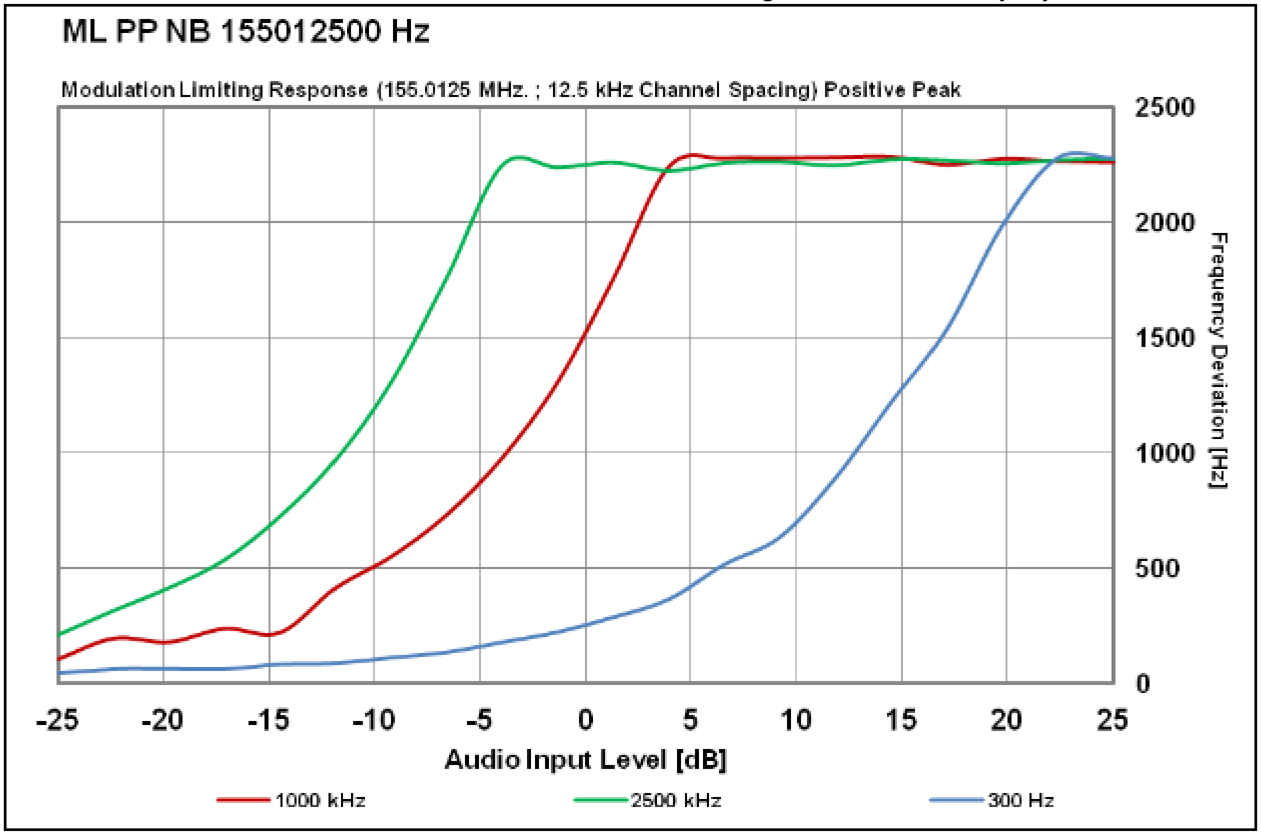
Plot 10-17: Modulation Characteristics – Modulation Limiting – 40.0125 MHz; (WB); Positive Peak



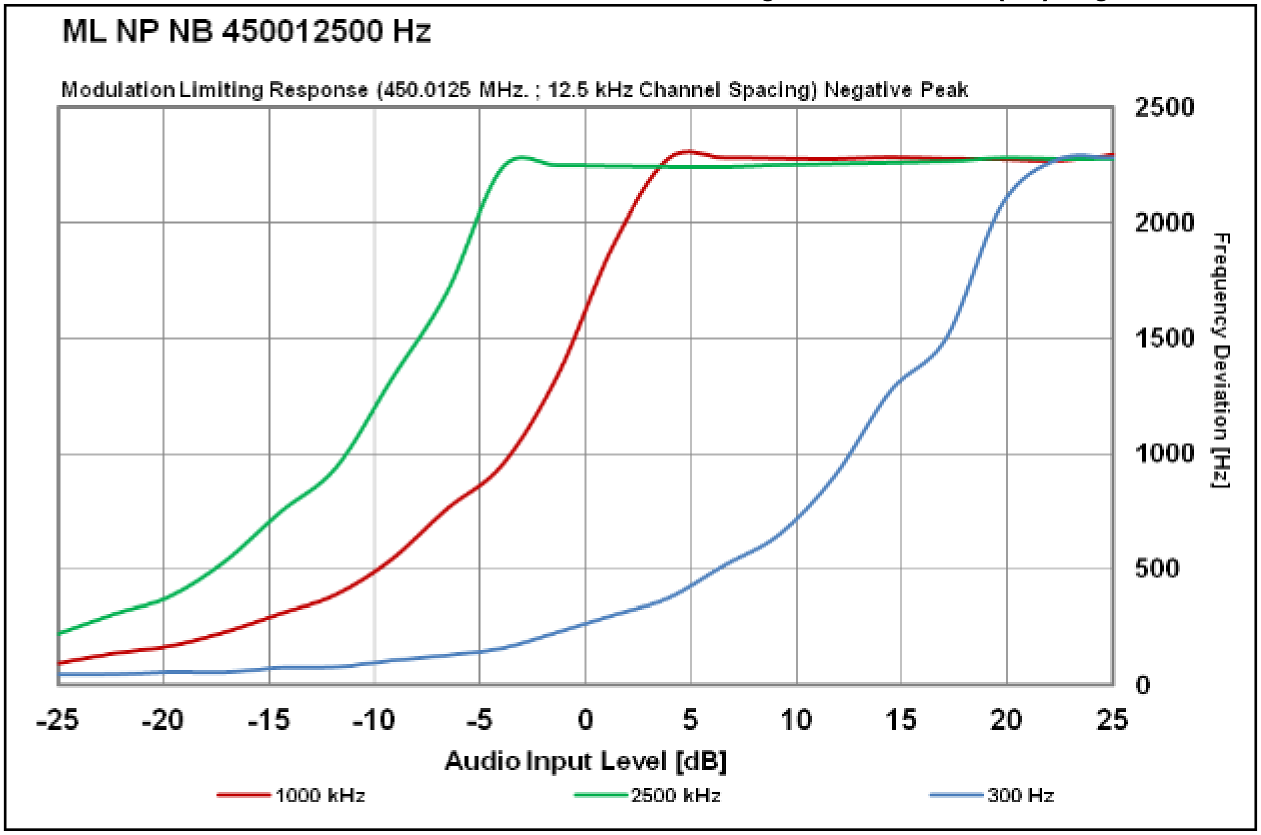
Plot 10-18: Modulation Characteristics – Modulation Limiting - 40.0125 MHz; (WB) Negative Peak



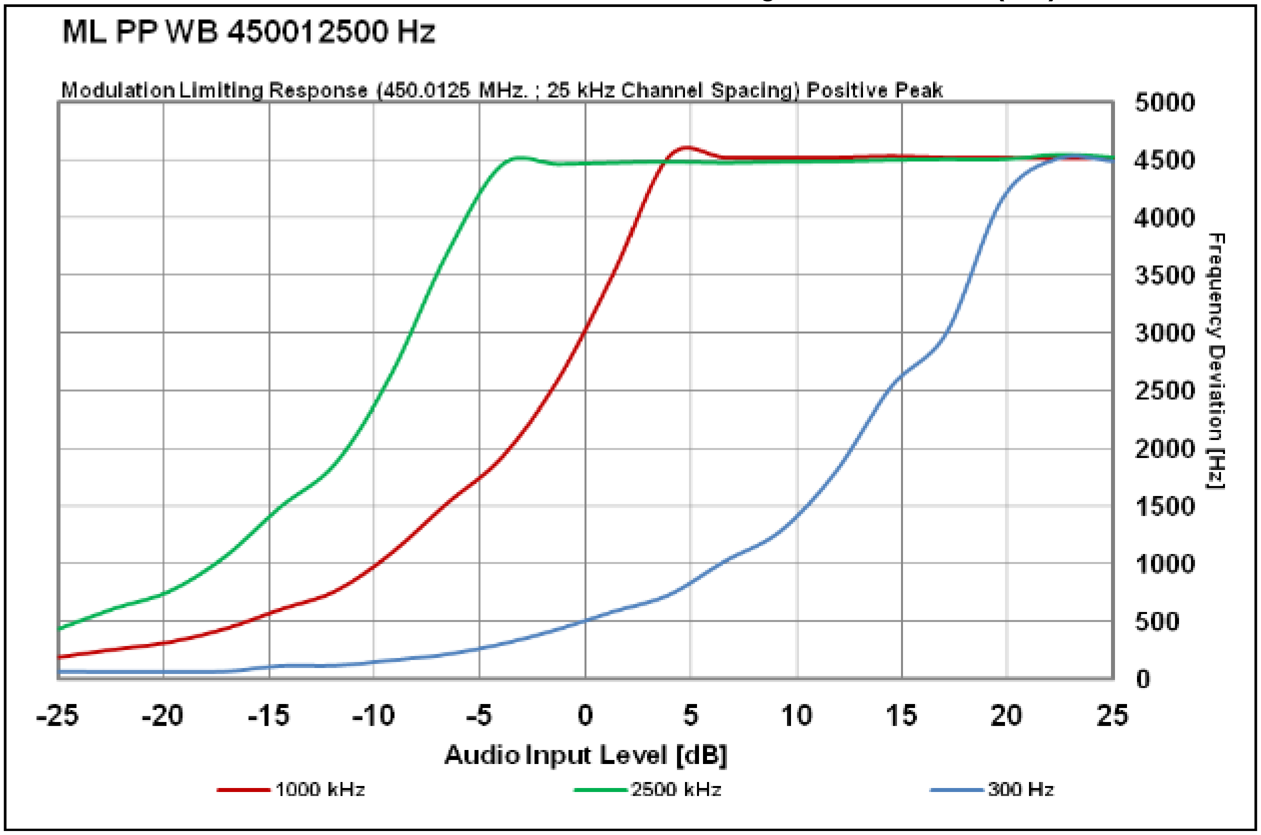
Plot 10-19: Modulation Characteristics – Modulation Limiting – 155.0125 MHz; (NB) Positive Peak



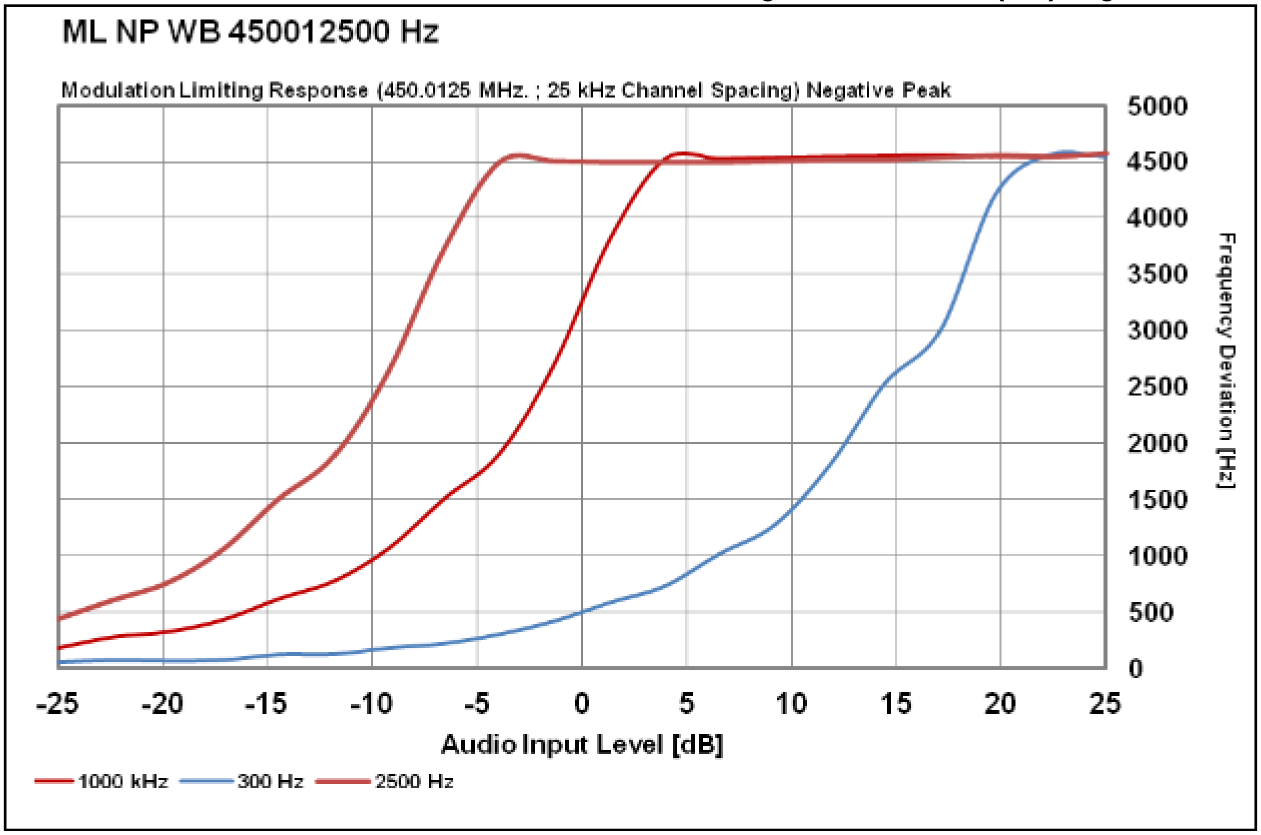
Plot 10-20: Modulation Characteristics – Modulation Limiting – 155.0125 MHz; (NB) Negative Peak



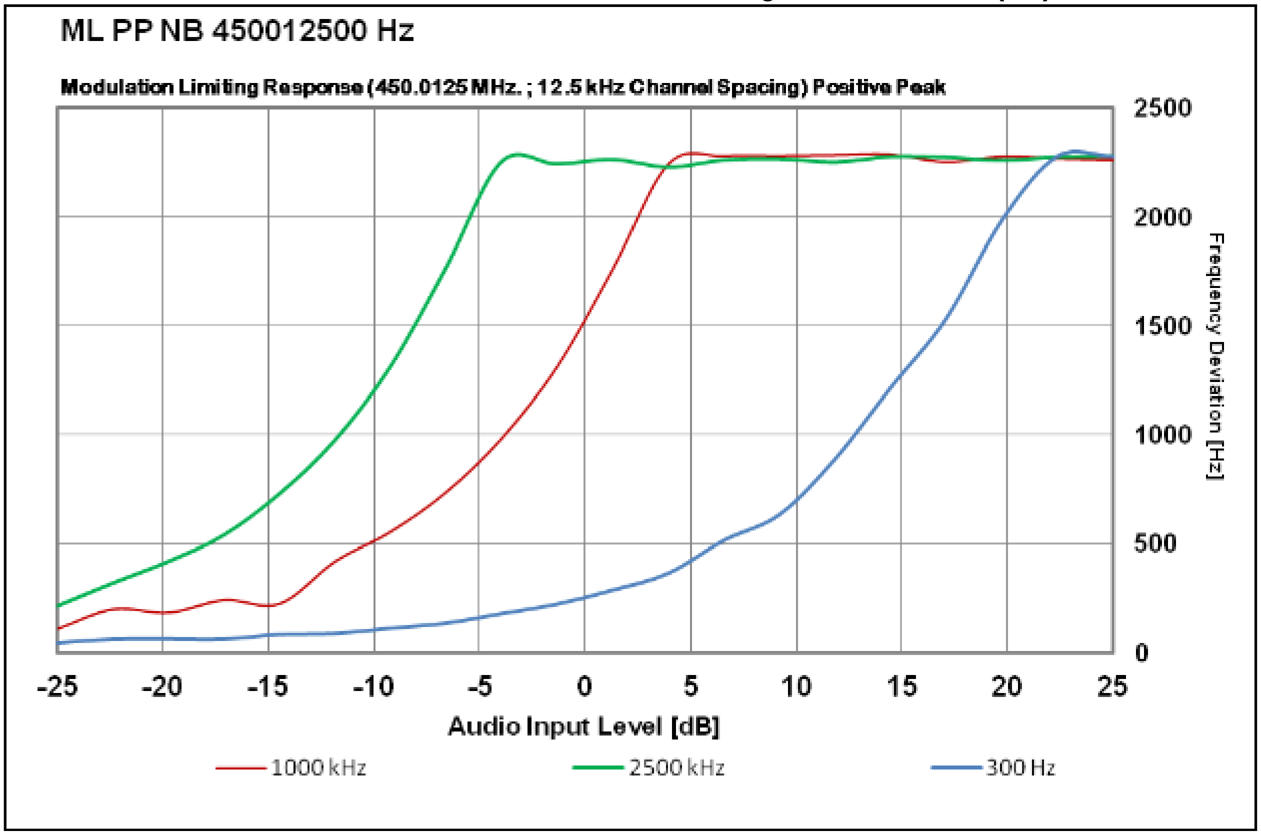
Plot 10-21: Modulation Characteristics – Modulation Limiting – 155.0125 MHz; (WB) Positive Peak



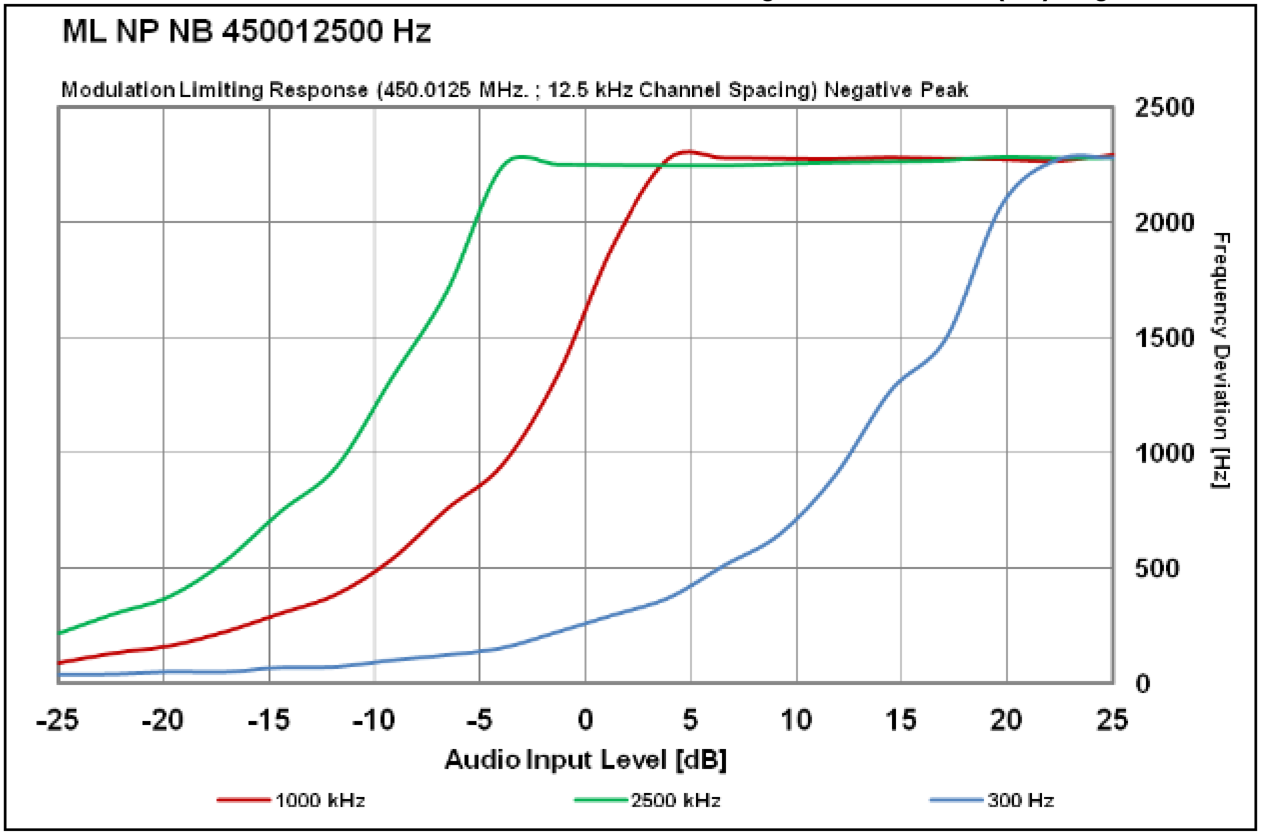
Plot 10-22: Modulation Characteristics – Modulation Limiting – 155.0125 MHz; (WB) Negative Peak



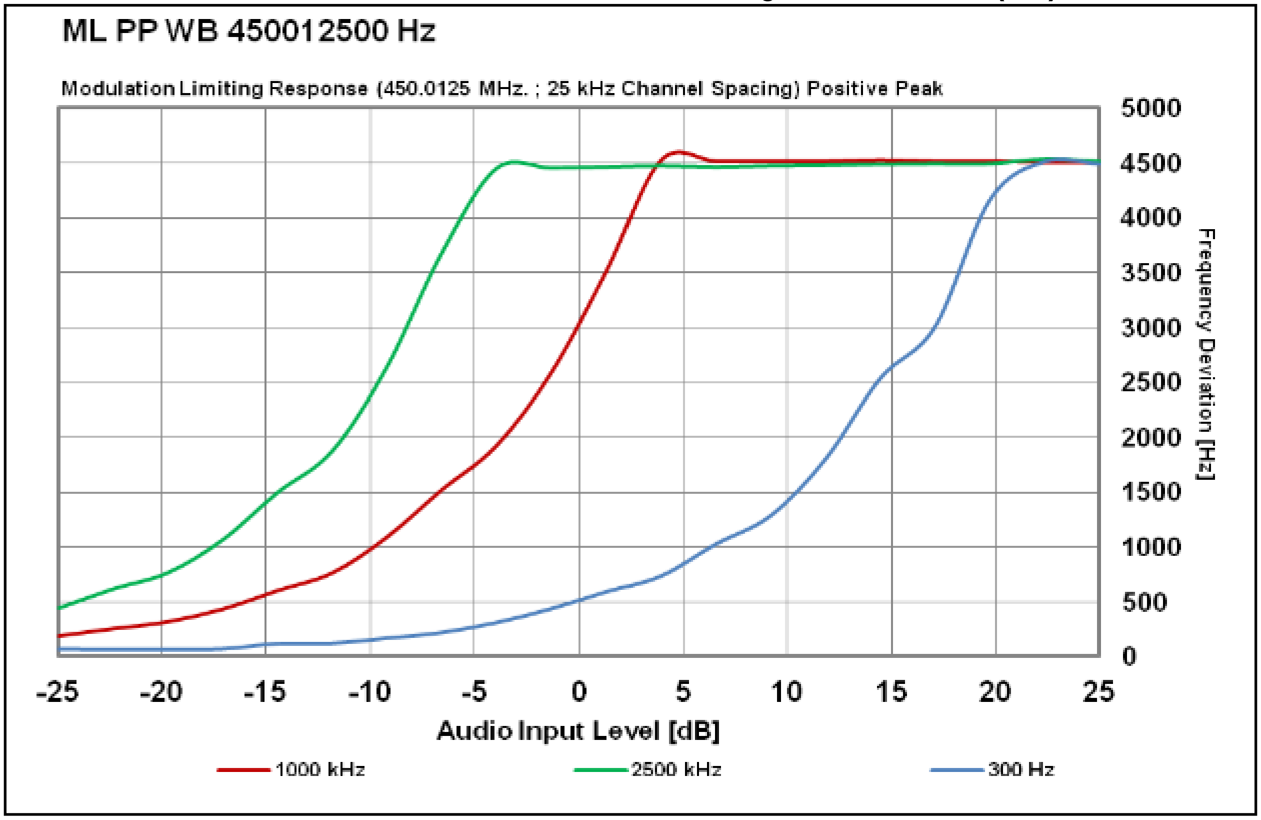
Plot 10-23: Modulation Characteristics – Modulation Limiting – 450.0125 MHz; (NB) Positive Peak



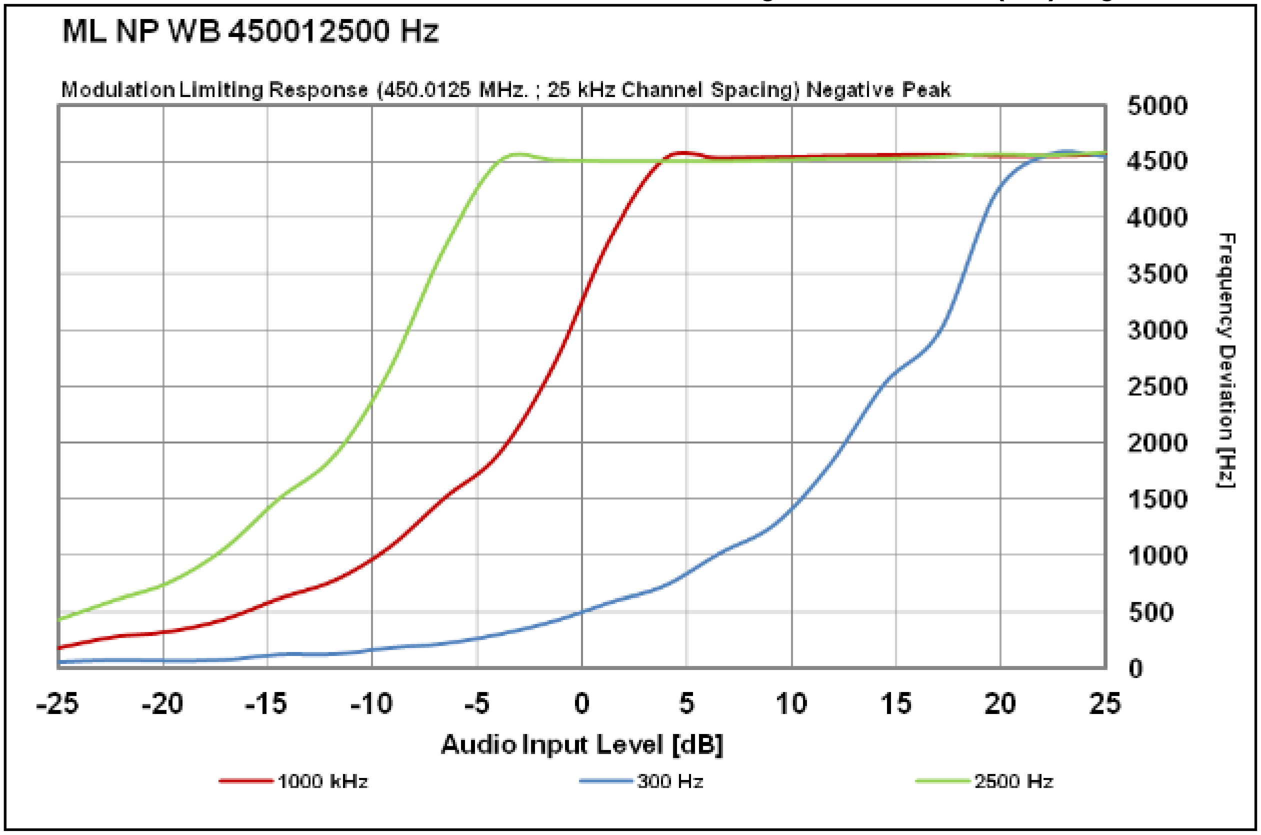
Plot 10-24: Modulation Characteristics – Modulation Limiting – 450.0125 MHz; (NB) Negative Peak



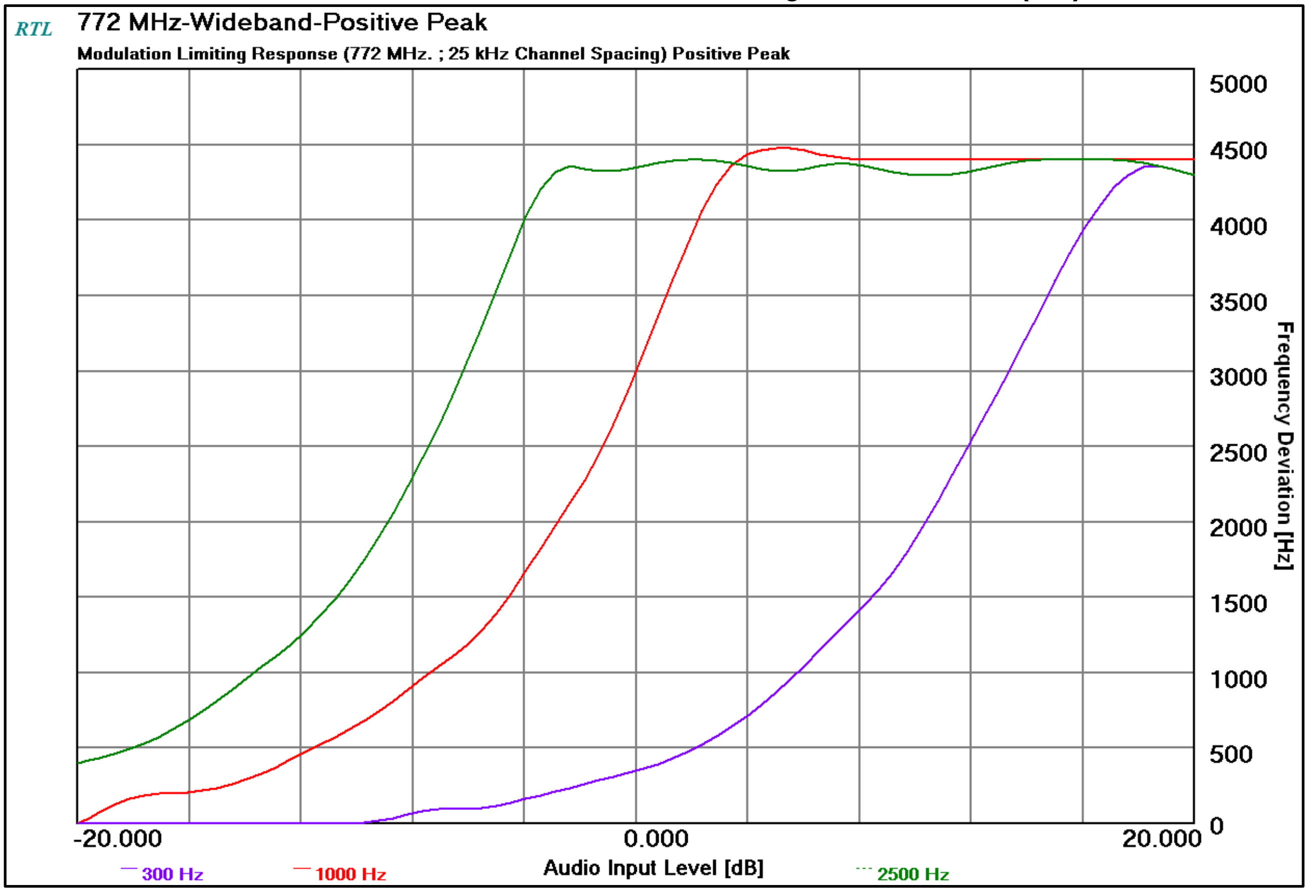
Plot 10-25: Modulation Characteristics – Modulation Limiting – 450.0125 MHz; (WB) Positive Peak



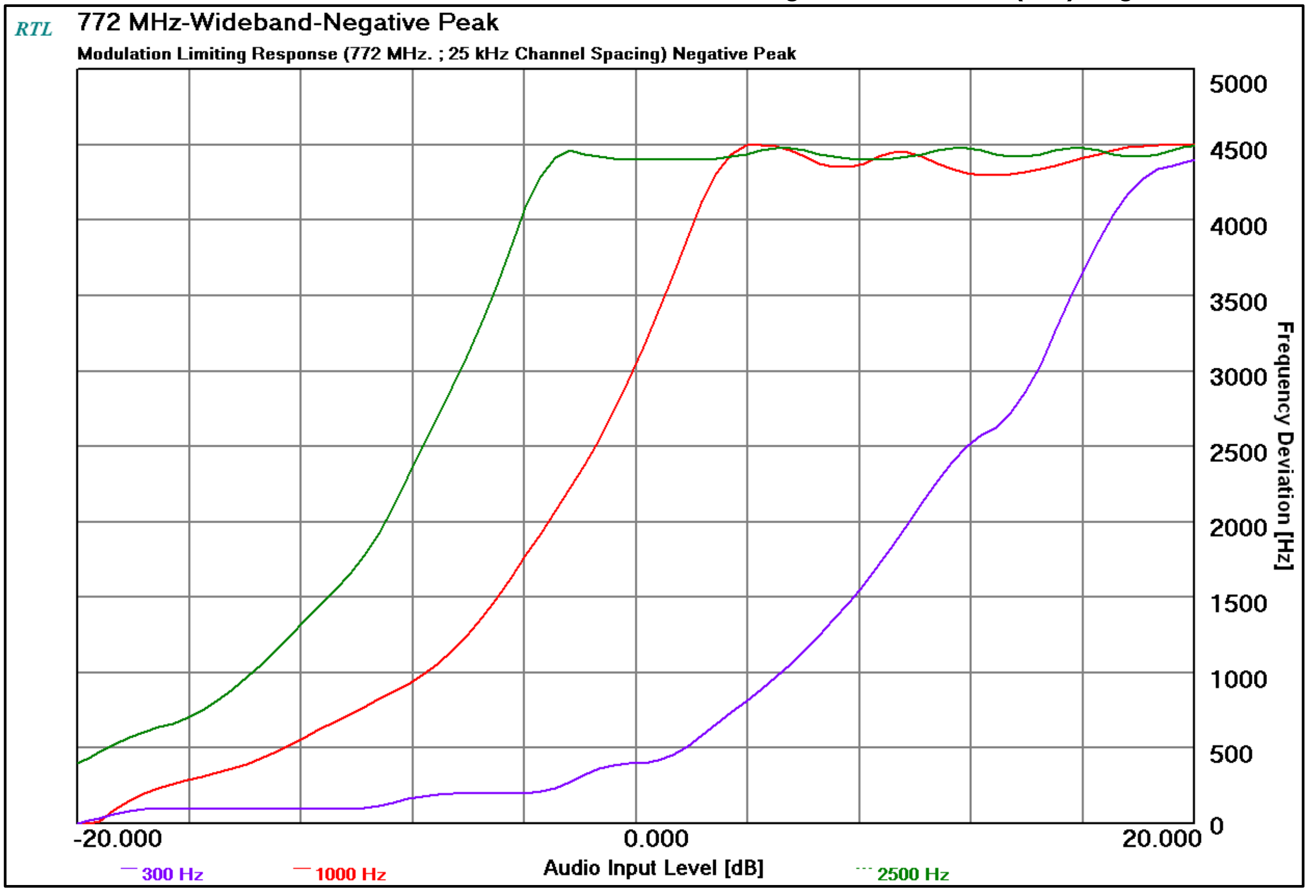
Plot 10-26: Modulation Characteristics – Modulation Limiting – 450.0125 MHz; (WB) Negative Peak



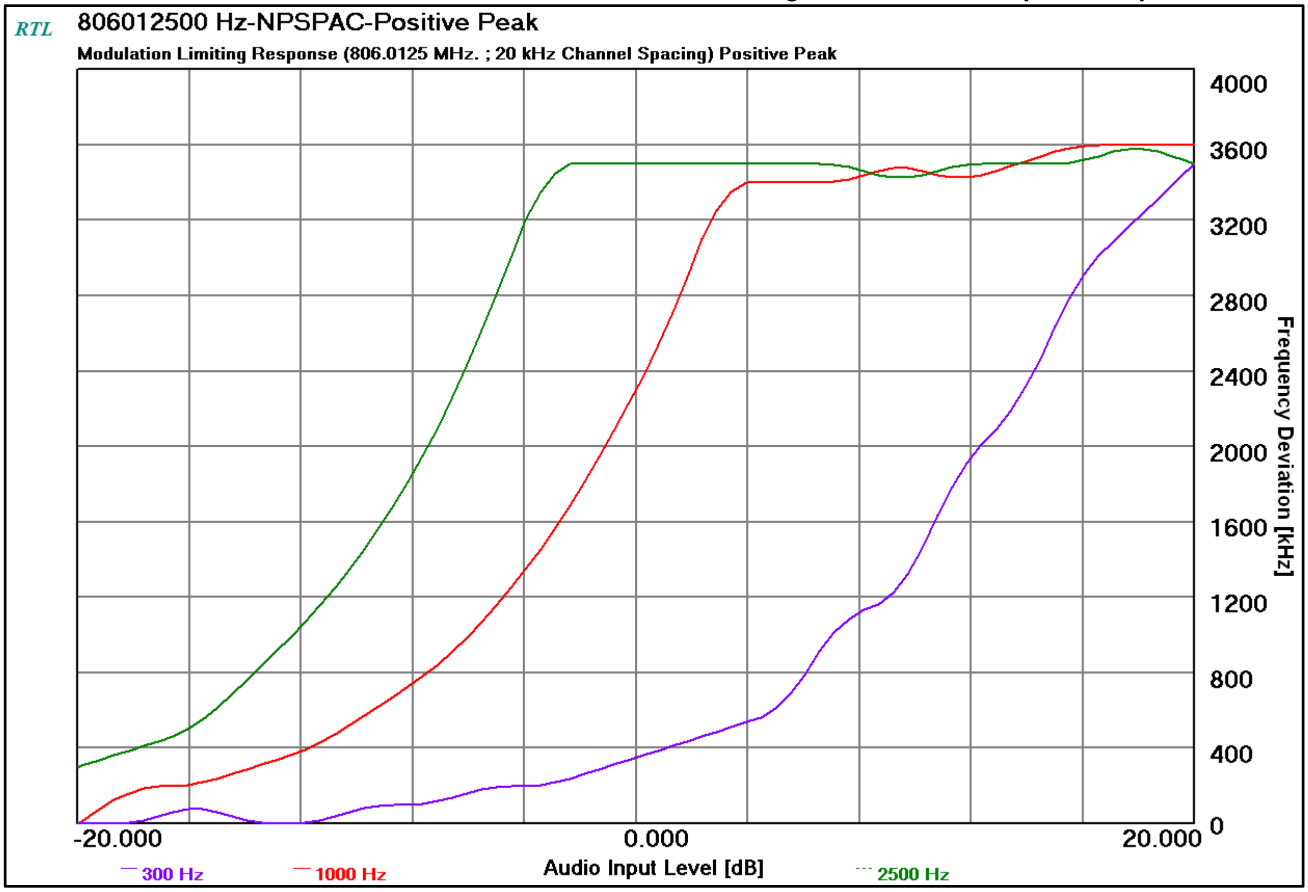
Plot 10-27: Modulation Characteristics – Modulation Limiting – 772.0000 MHz; (WB); Positive Peak



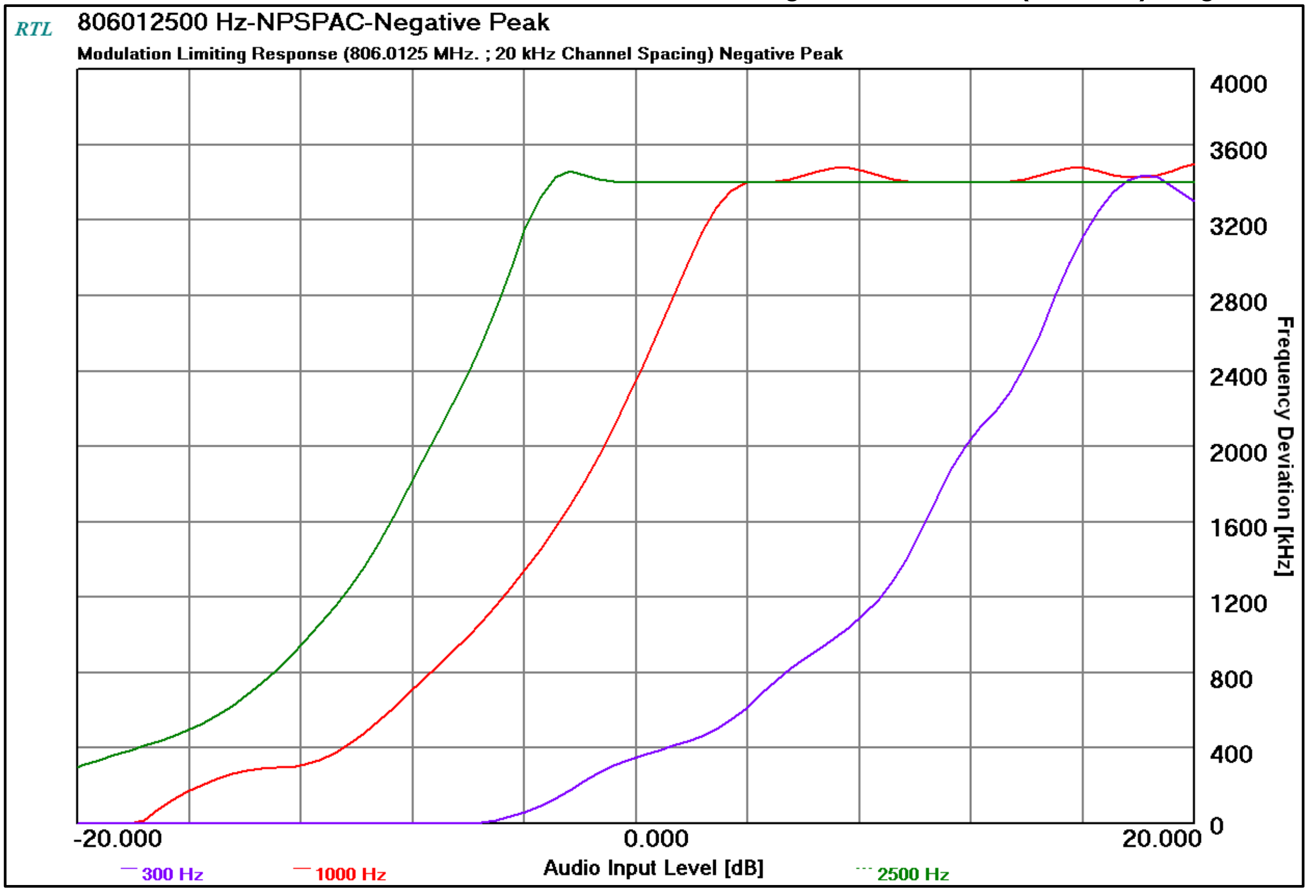
Plot 10-28: Modulation Characteristics – Modulation Limiting - 772.0000 MHz; (WB) Negative Peak



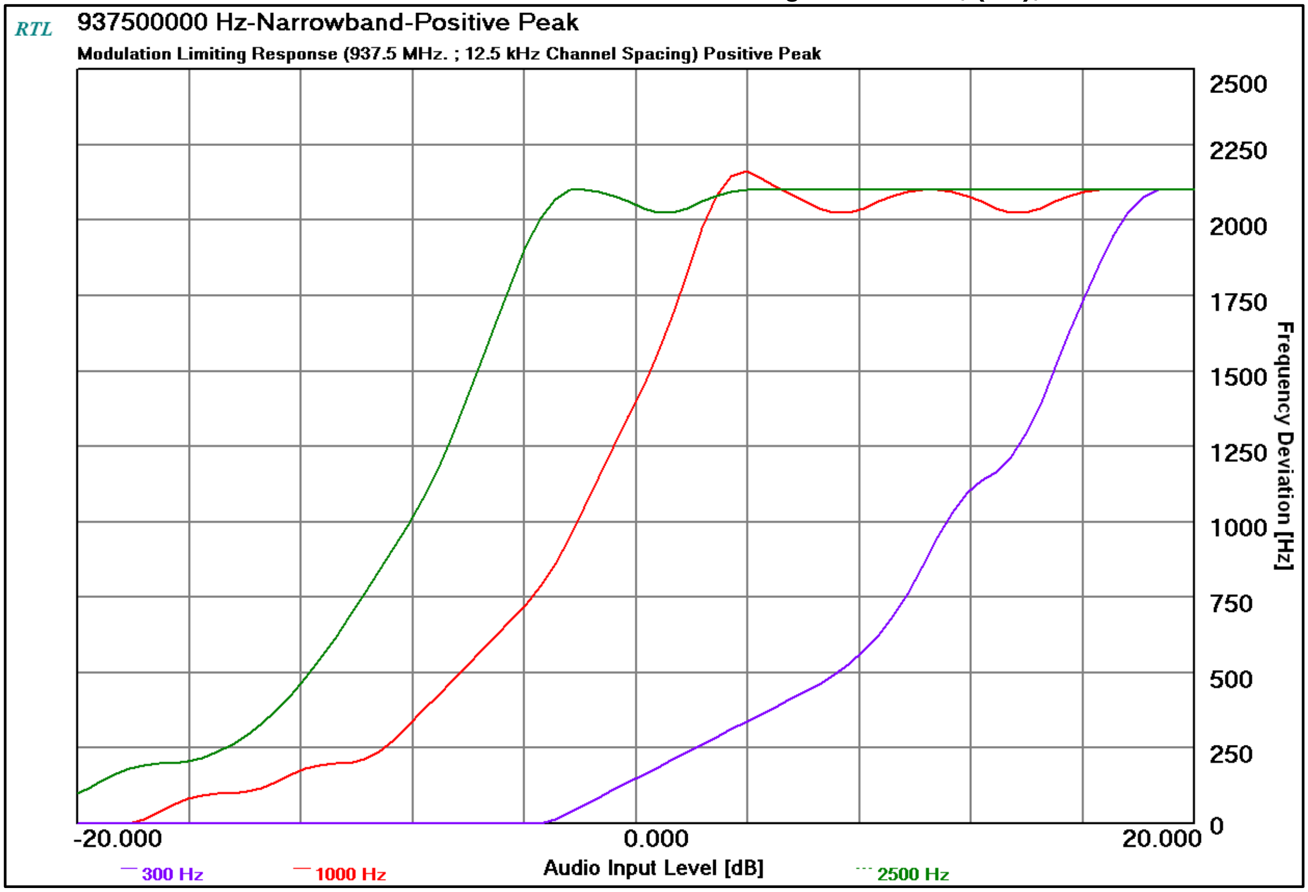
Plot 10-29: Modulation Characteristics – Modulation Limiting – 806.0125 MHz; (NPSPAC); Positive Peak



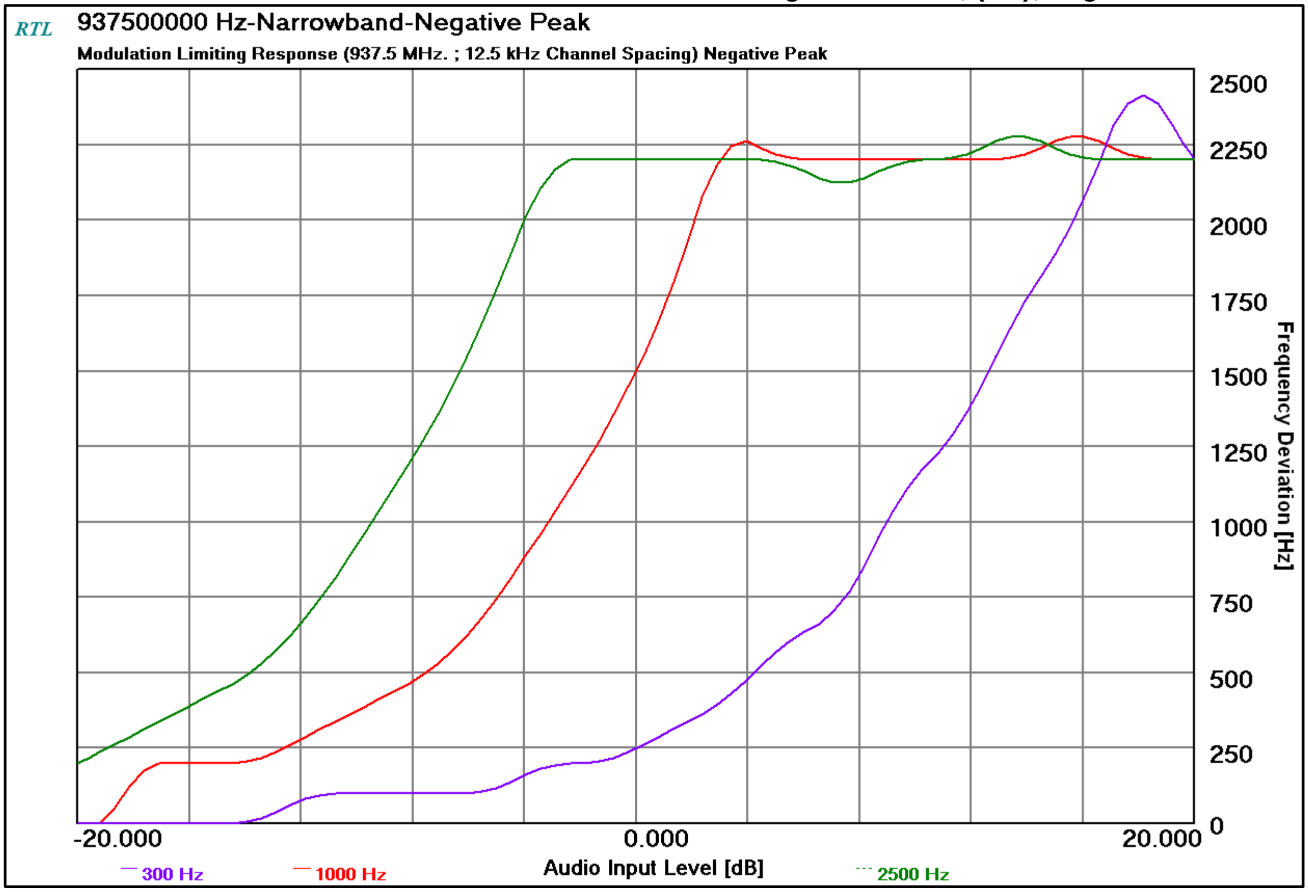
Plot 10-30: Modulation Characteristics – Modulation Limiting – 806.0125 MHz; (NPSPAC); Negative Peak



Plot 10-31: Modulation Characteristics – Modulation Limiting – 937.5 MHz; (NB); Positive Peak



Plot 10-32: Modulation Characteristics – Modulation Limiting – 937.5 MHz; (NB); Negative Peak



Measurement uncertainties shown for these tests are expanded uncertainties expressed at the 95% confidence level using a coverage factor K=2. Measurement uncertainty: ±0.5 Hz/±0.5 dB

Results: Pass

Table 10-1: Test Equipment Used For Testing Modulation Requirements

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/ Level Generator	2514A02585	1/31/20
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	1/31/20
901724	Weinschel Corporation	47-20-34	Attenuator DC-18 GHz 20 dB 100W	BK5859	8/7/20

Test Personnel:

Daniel Baltzell	*[signature]*	August 18, 2019 September 11, 2018
EMC Test Engineer	Signature	Dates of Test

11 FCC Rules and Regulations Part 90.214: Transient Frequency Response; Part 74.462(c): Authorized Bandwidth and Emissions; RSS-119 5.9: Transient Frequency Behavior

11.1 Test Procedure

TIA-EIA-603-C 2004, section 2.2.3. Transmitter plots were taken with the radio set at high power.

§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	All equipment: 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] 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.

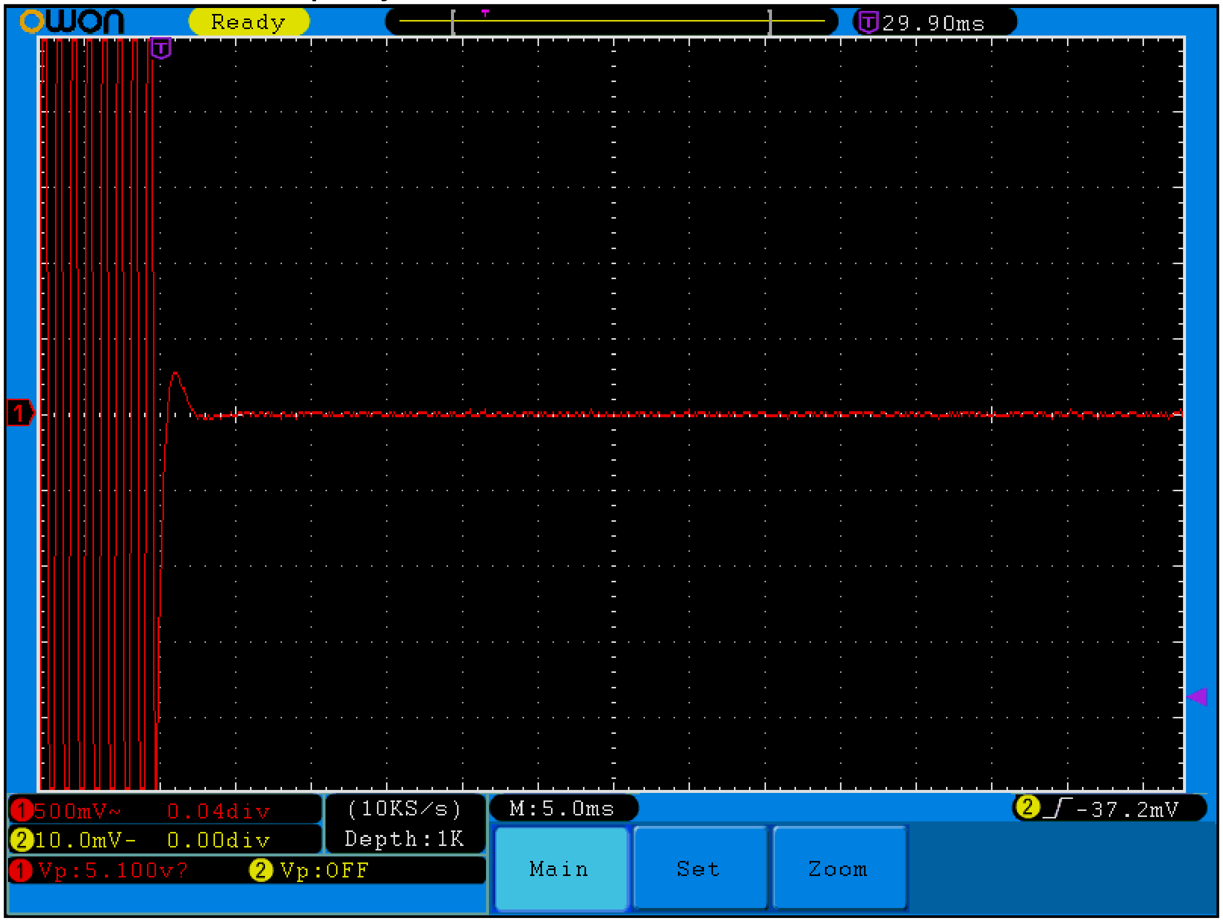
[2] During the time from the end of t_2 to the beginning of t_3, the frequency difference must not exceed the limits specified in §90.213.

[3] Difference between the actual transmitter frequency and the assigned transmitter frequency.

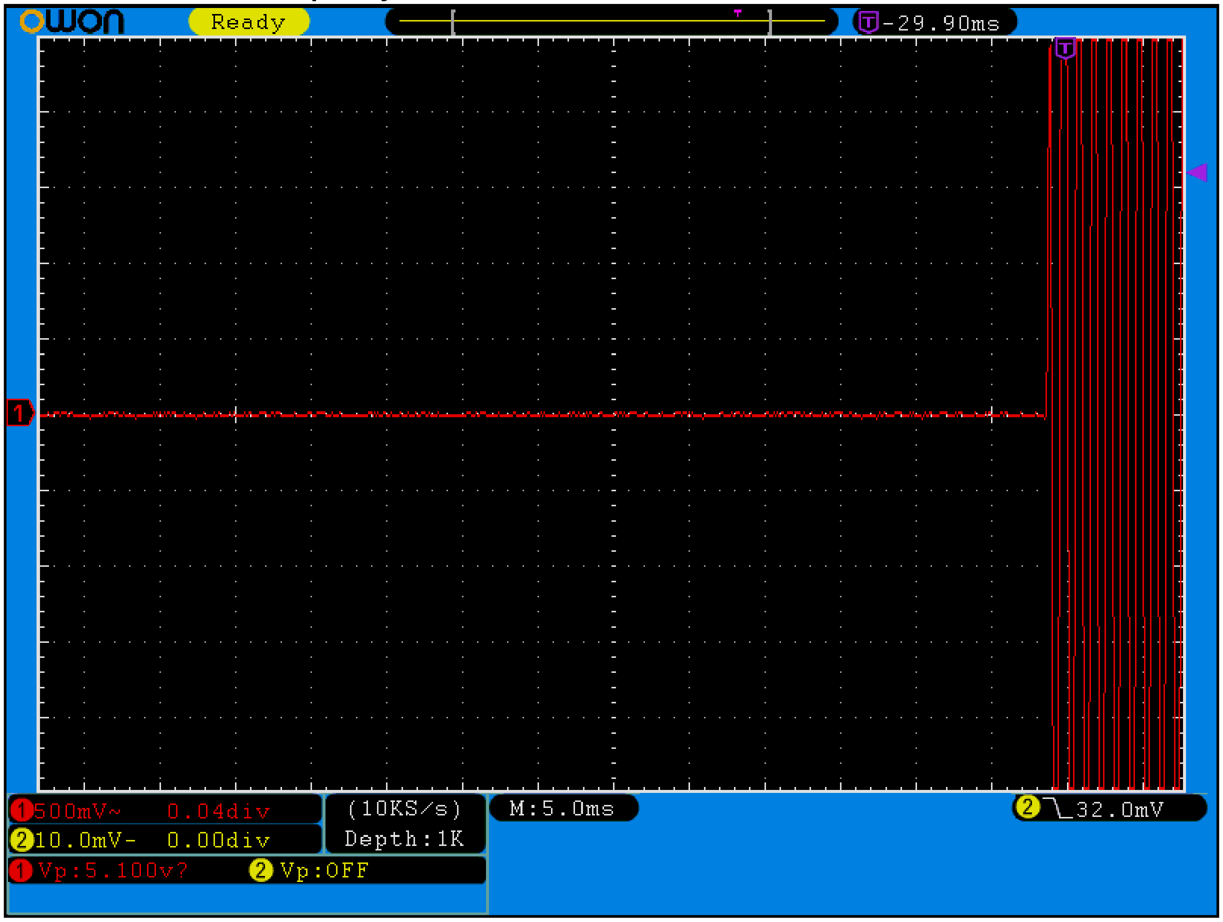
[4] If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

11.2 Test Data

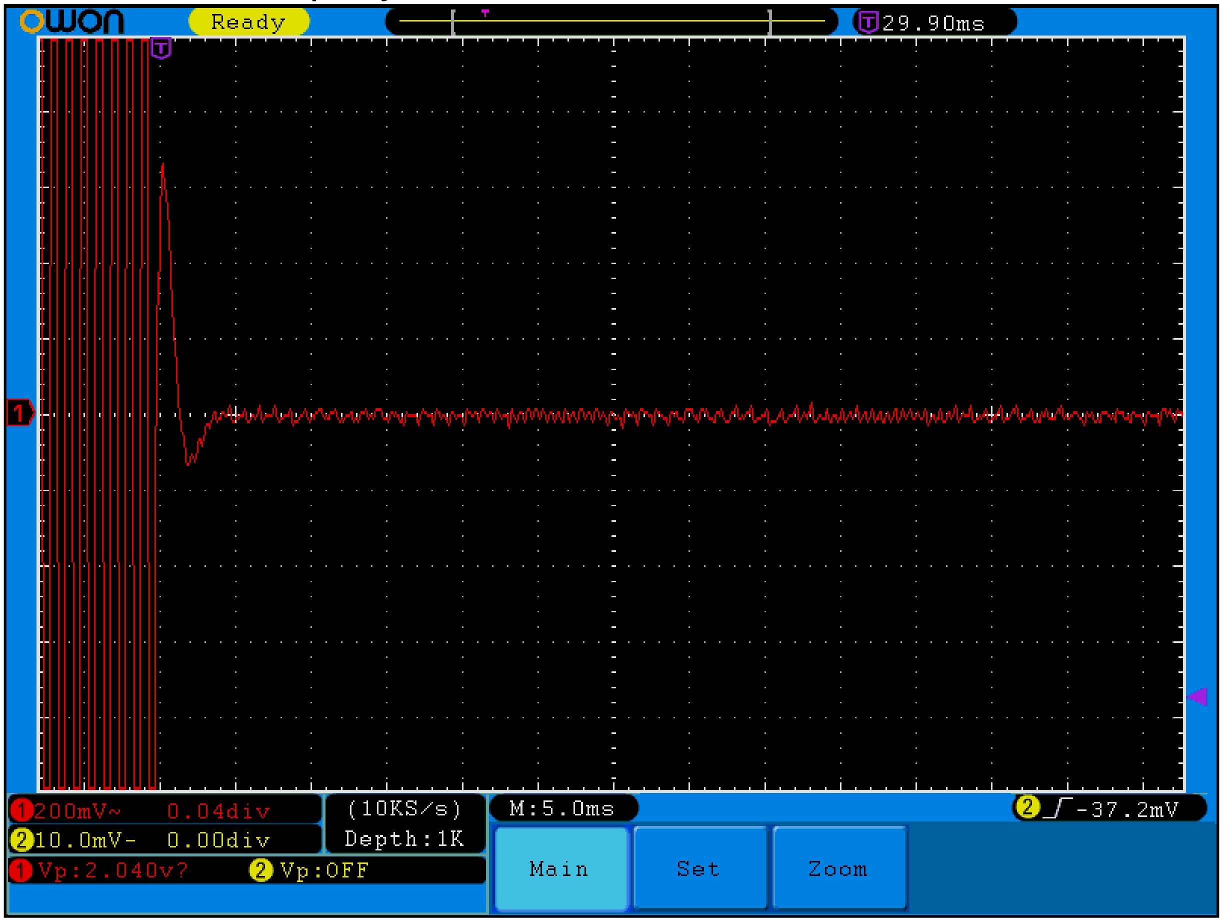
Plot 11-1: Transient Frequency Behavior – 150.0125 MHz; Wide Band; Carrier ON Time



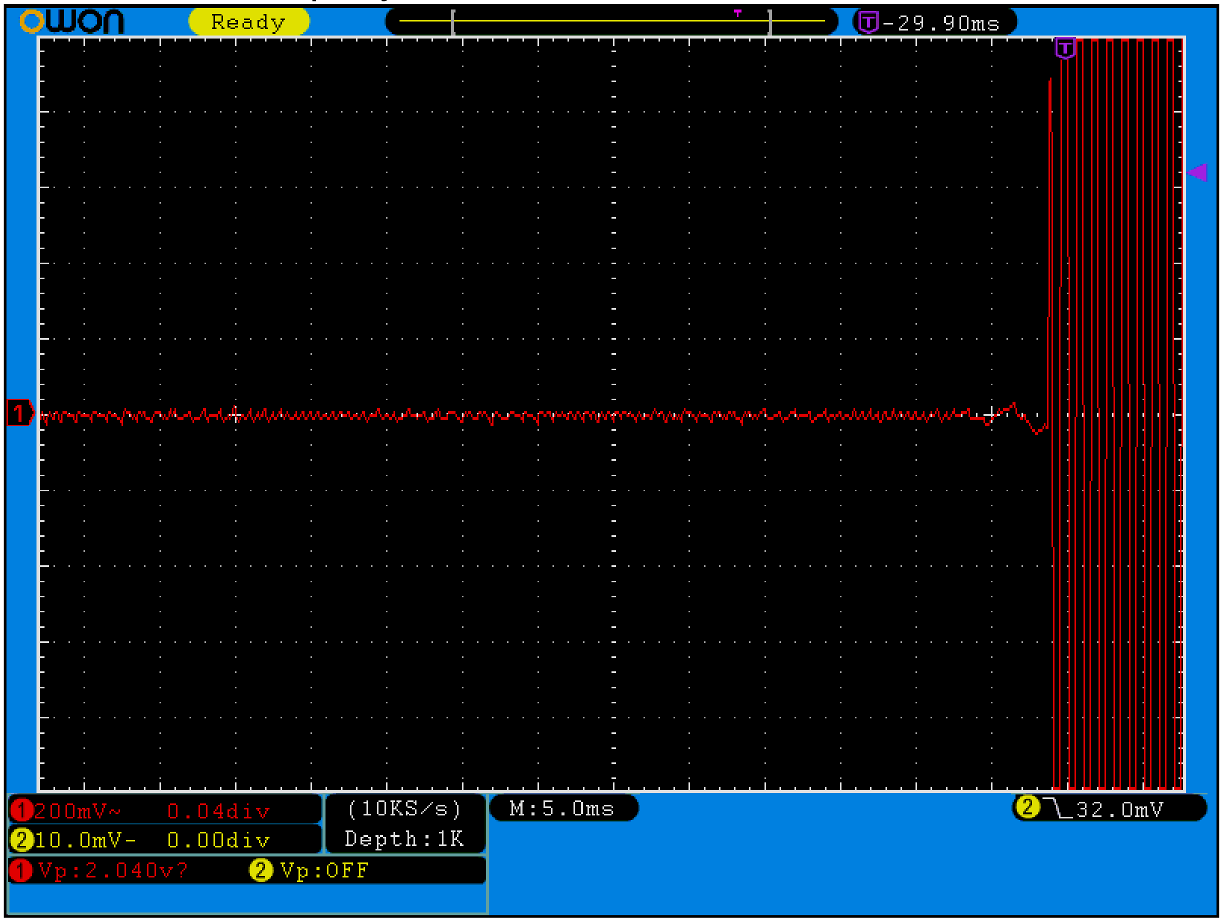
Plot 11-2: Transient Frequency Behavior – 150.0125 MHz; Wide Band; Carrier OFF Time



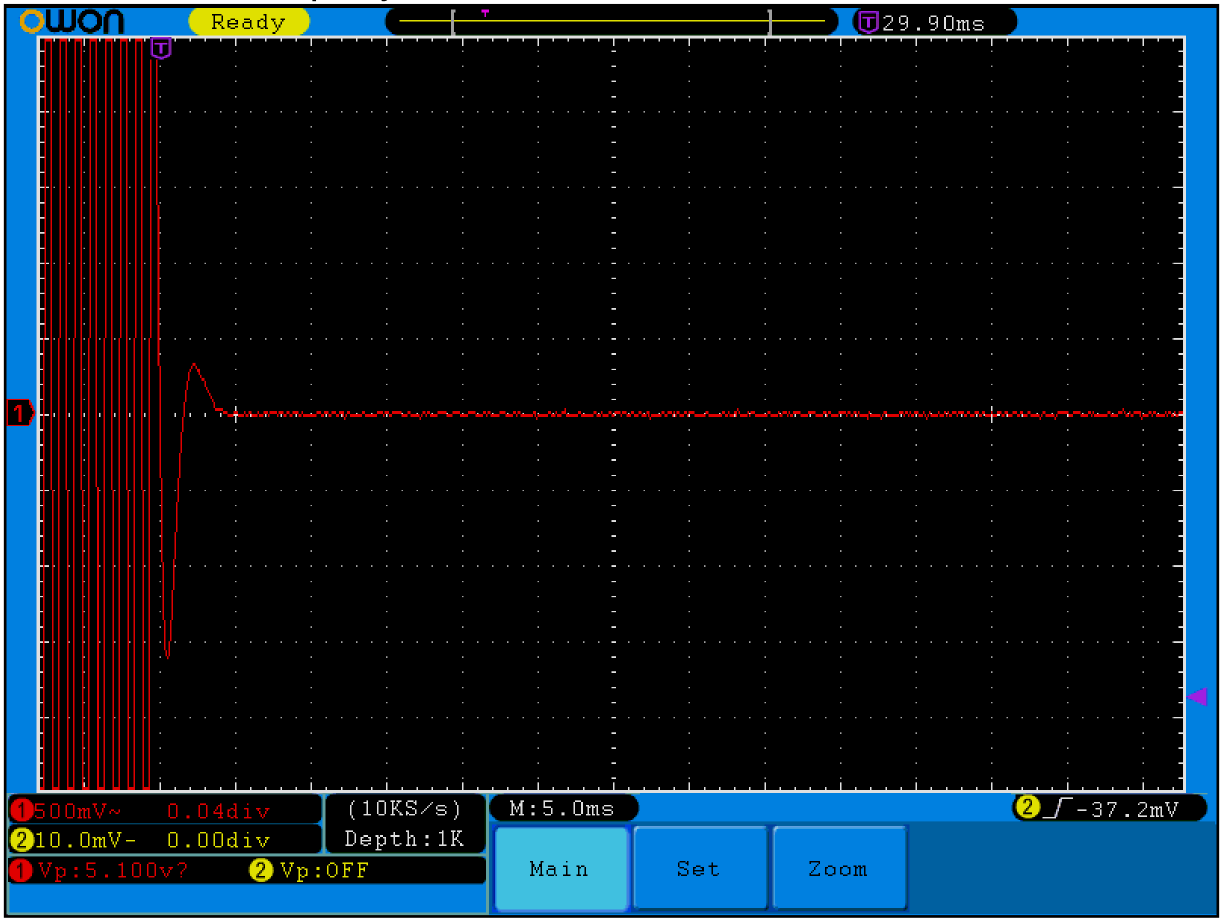
Plot 11-3: Transient Frequency Behavior – 150.0125 MHz; Narrow Band; Carrier ON Time



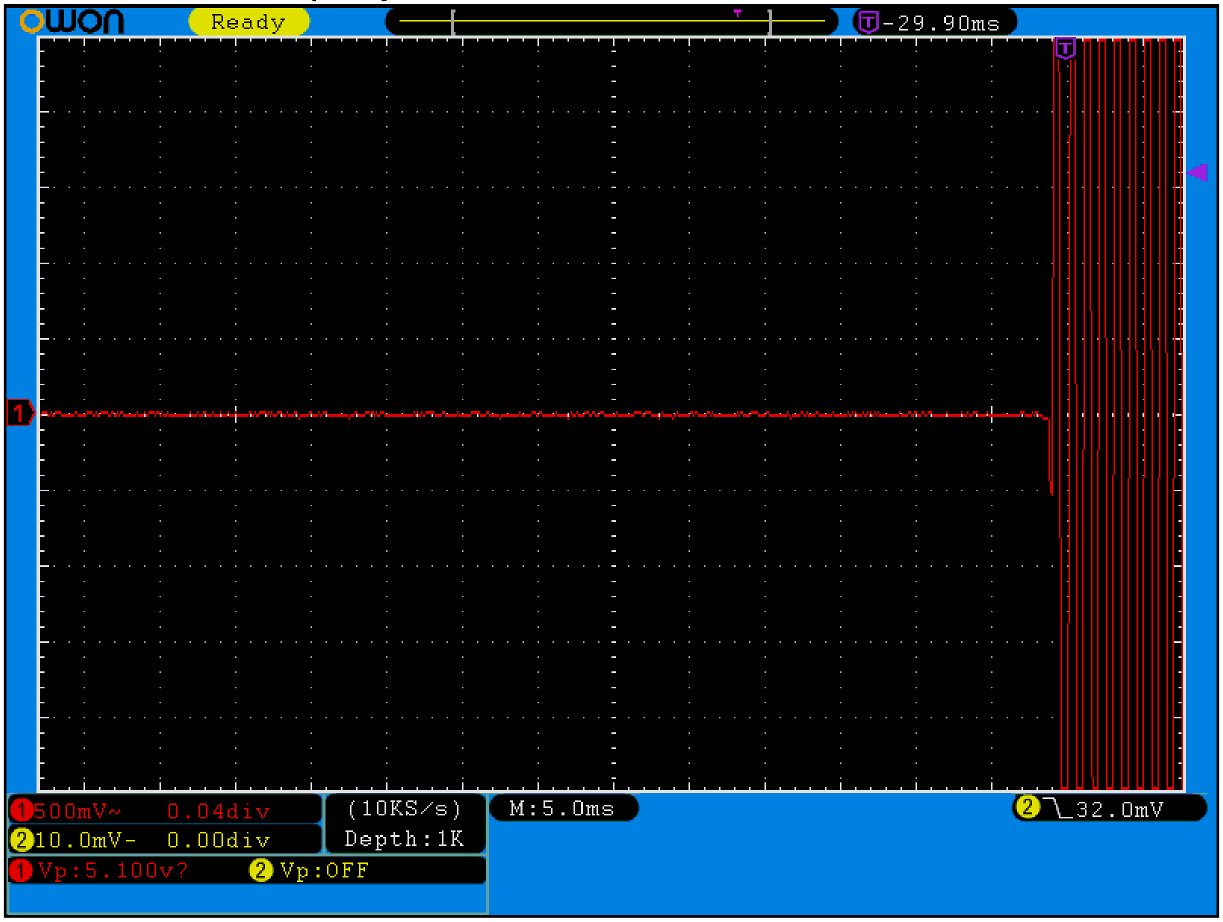
Plot 11-4: Transient Frequency Behavior – 150.0125 MHz; Narrow Band; Carrier OFF Time



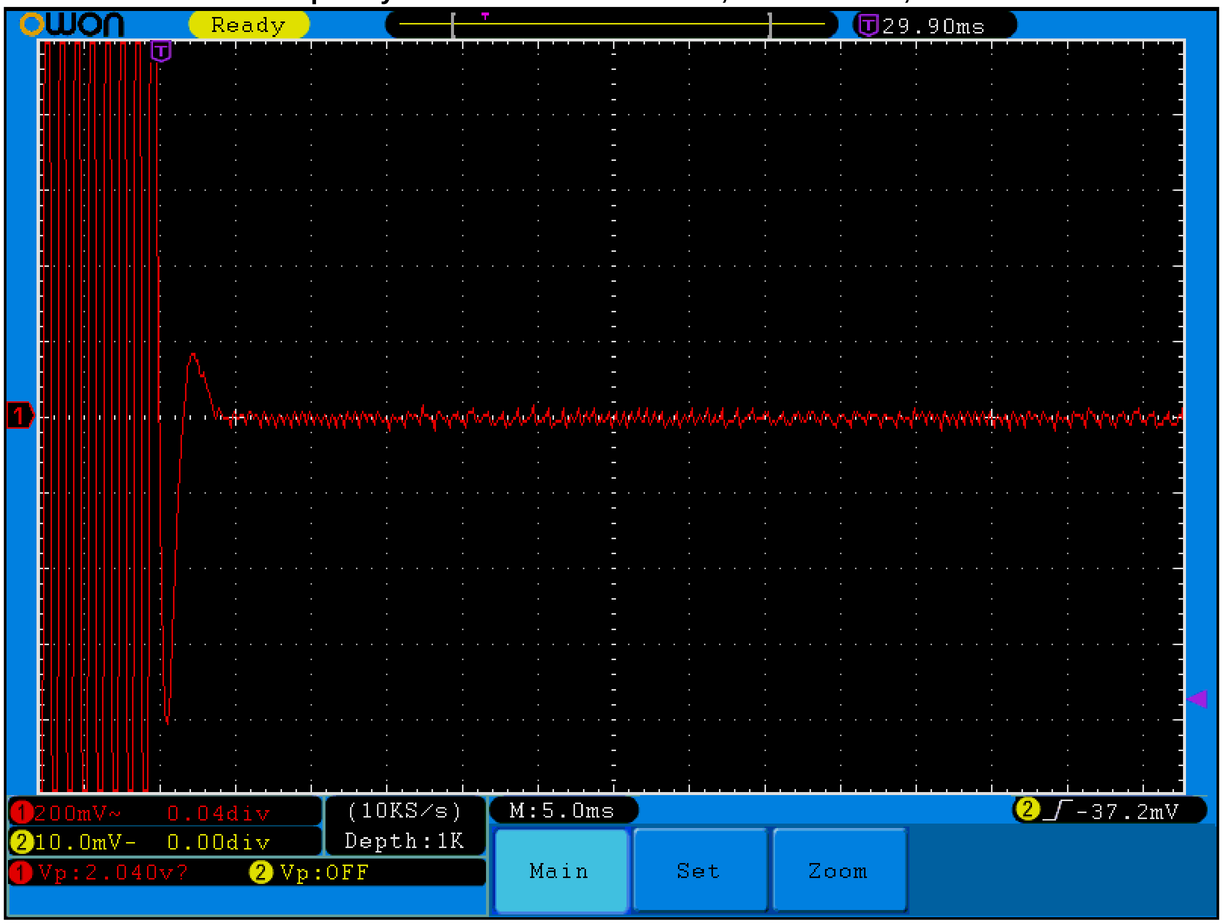
Plot 11-5: Transient Frequency Behavior – 162.0000 MHz; Wide Band; Carrier ON Time



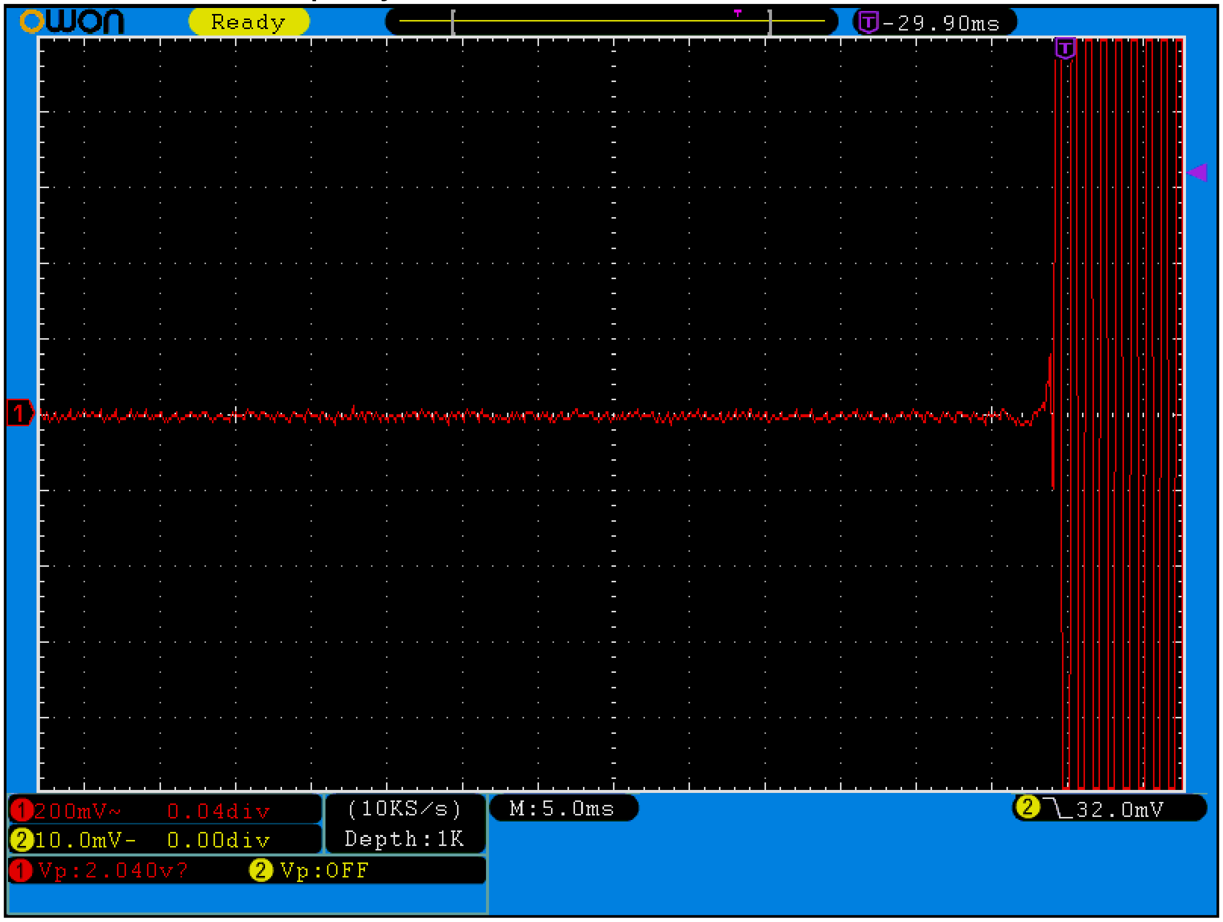
Plot 11-6: Transient Frequency Behavior – 162.0000 MHz; Wide Band; Carrier OFF Time



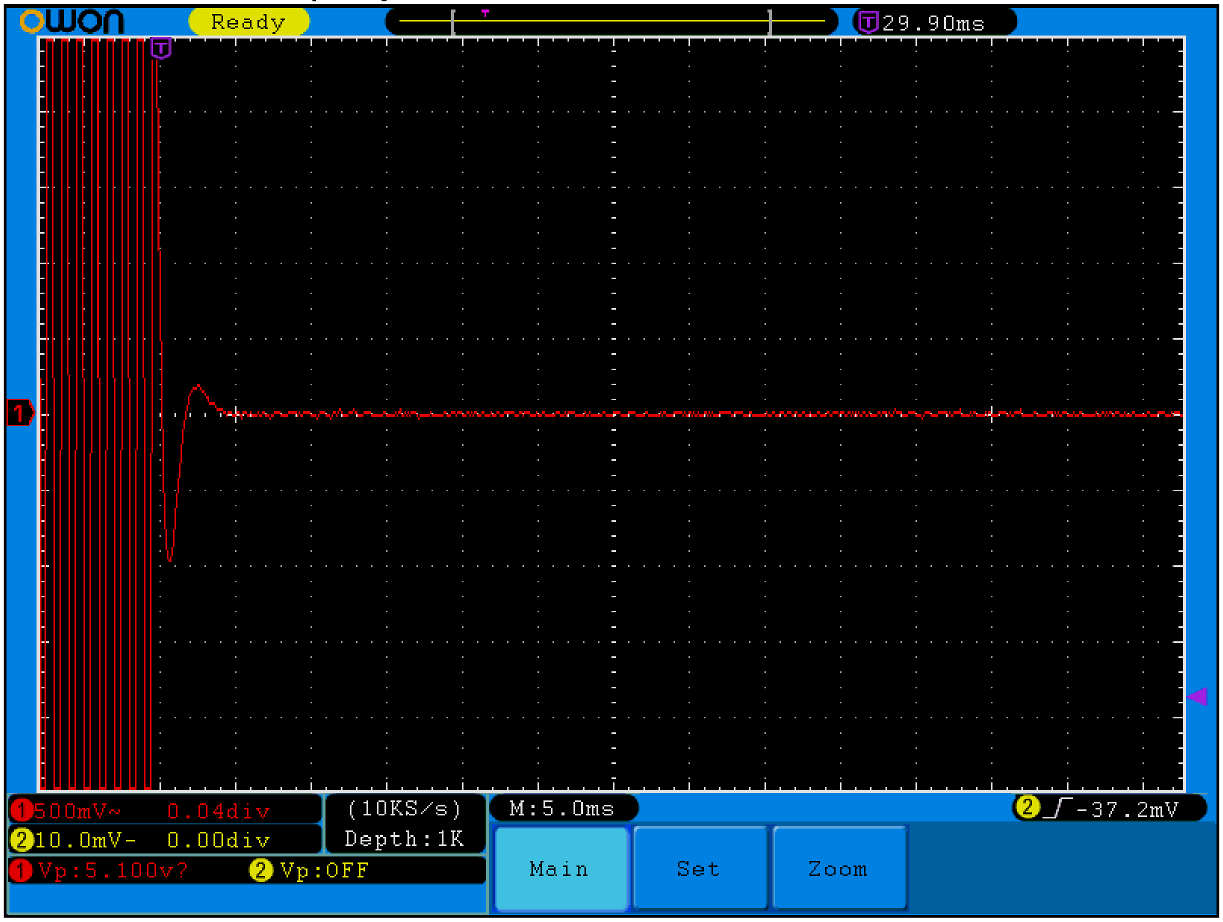
Plot 11-7: Transient Frequency Behavior – 162.0125 MHz; Narrow Band; Carrier ON Time



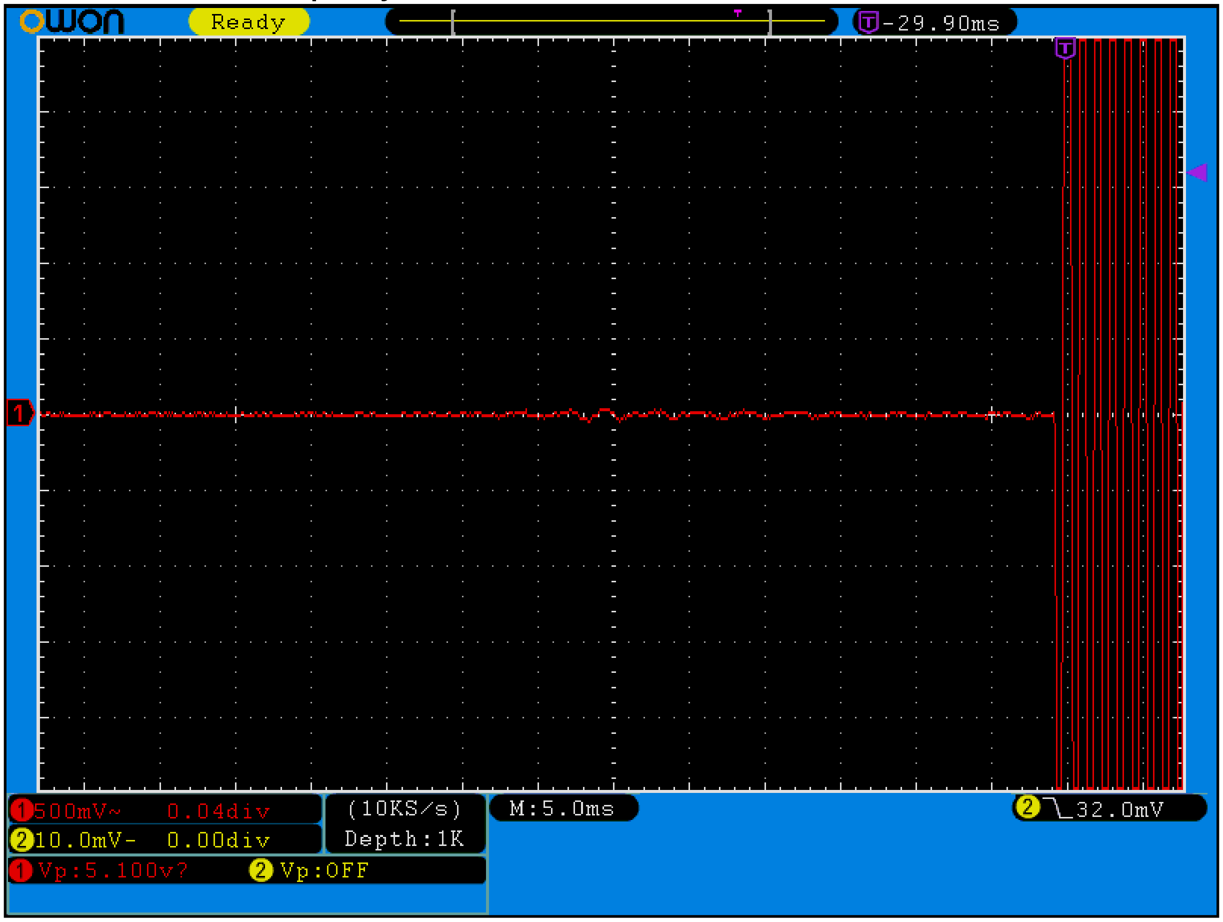
Plot 11-8: Transient Frequency Behavior – 162.0000 MHz; Narrow Band; Carrier OFF Time



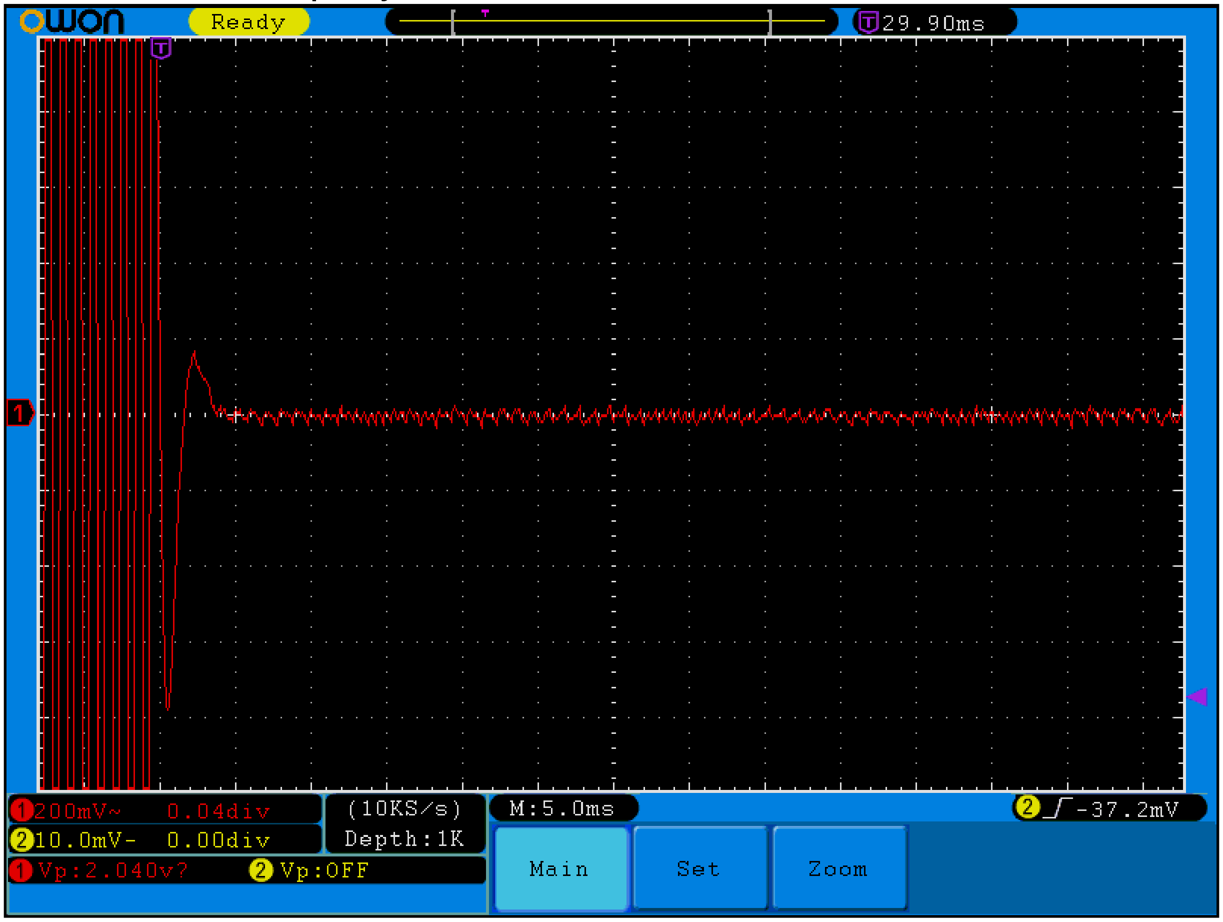
Plot 11-9: Transient Frequency Behavior – 173.9875 MHz; Wide Band; Carrier ON Time



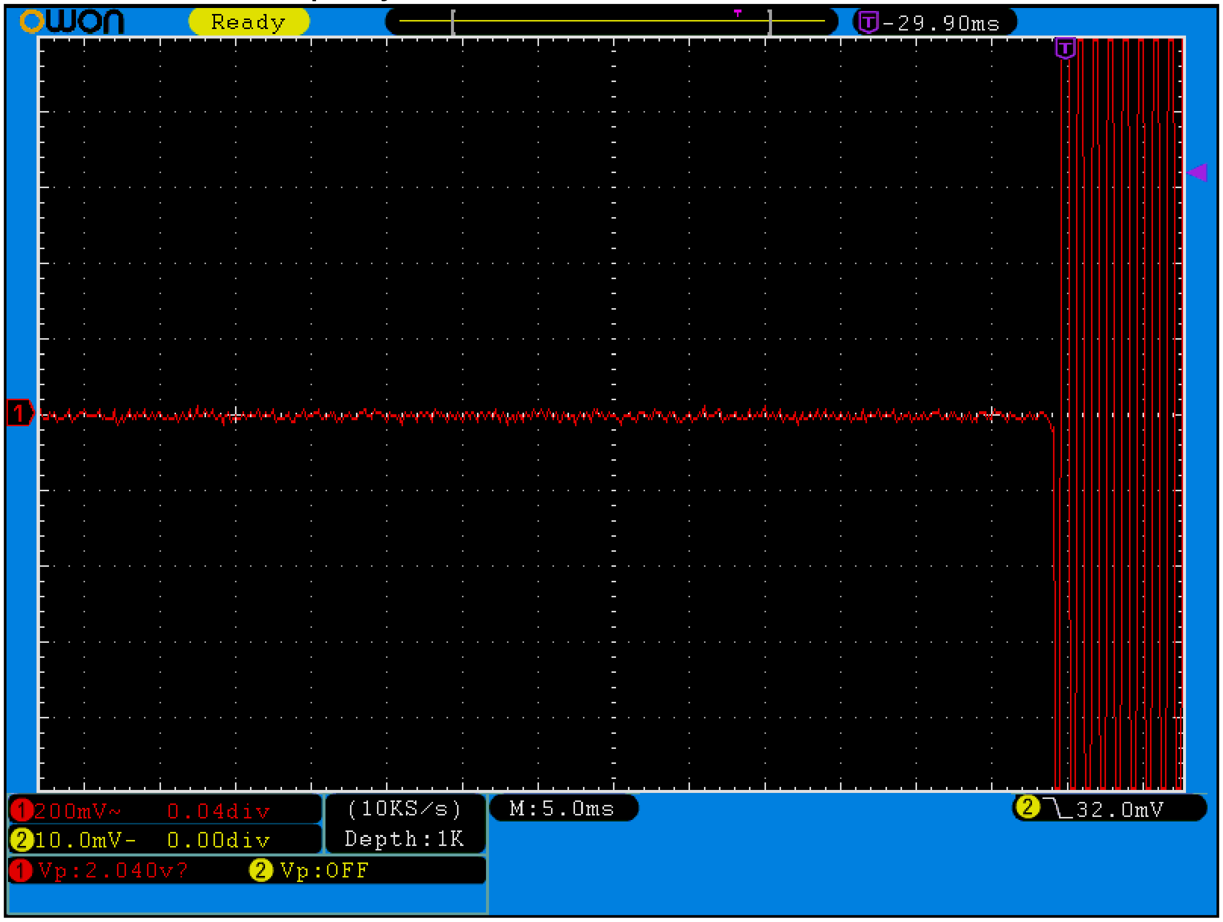
Plot 11-10: Transient Frequency Behavior – 173.9875 MHz; Wide Band; Carrier OFF Time



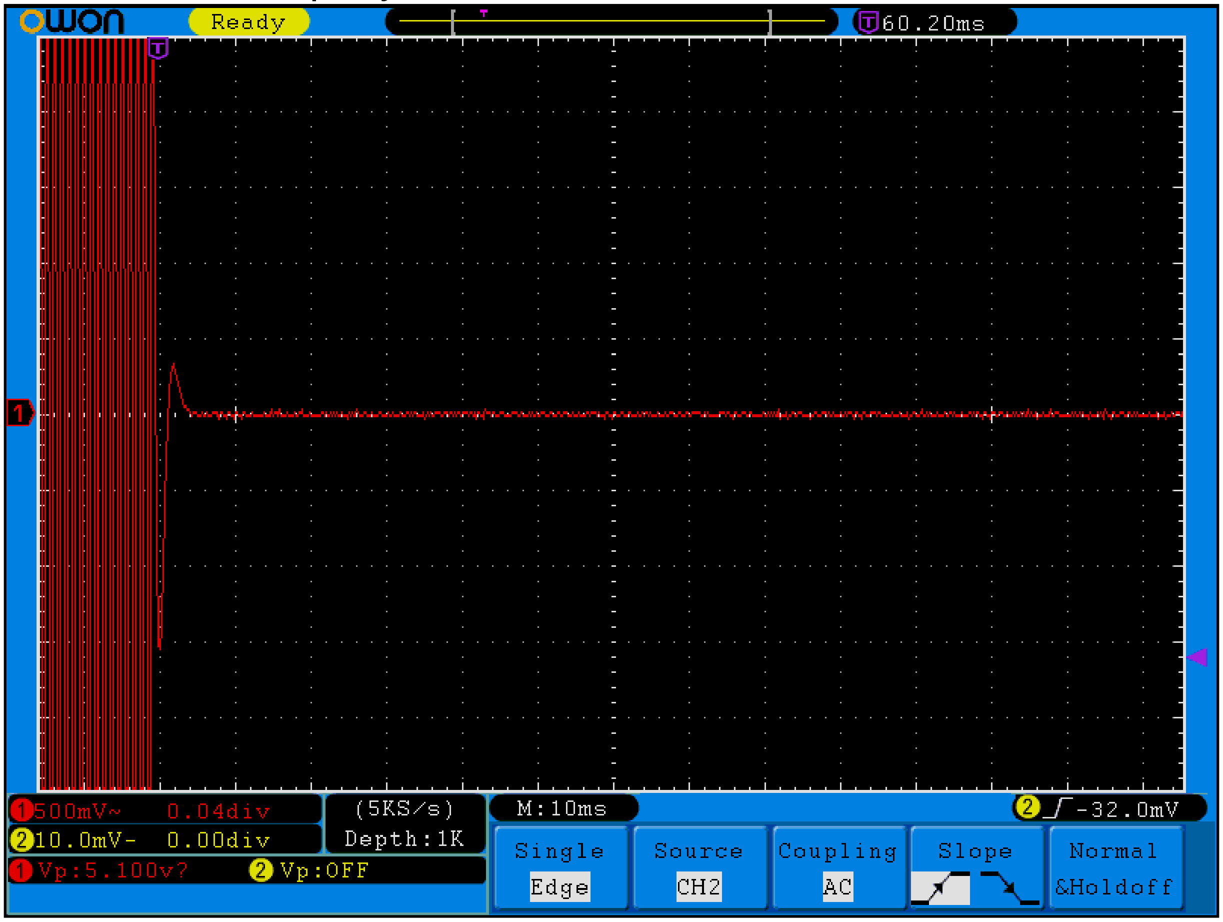
Plot 11-11: Transient Frequency Behavior – 173.9875 MHz; Narrow Band; Carrier ON Time



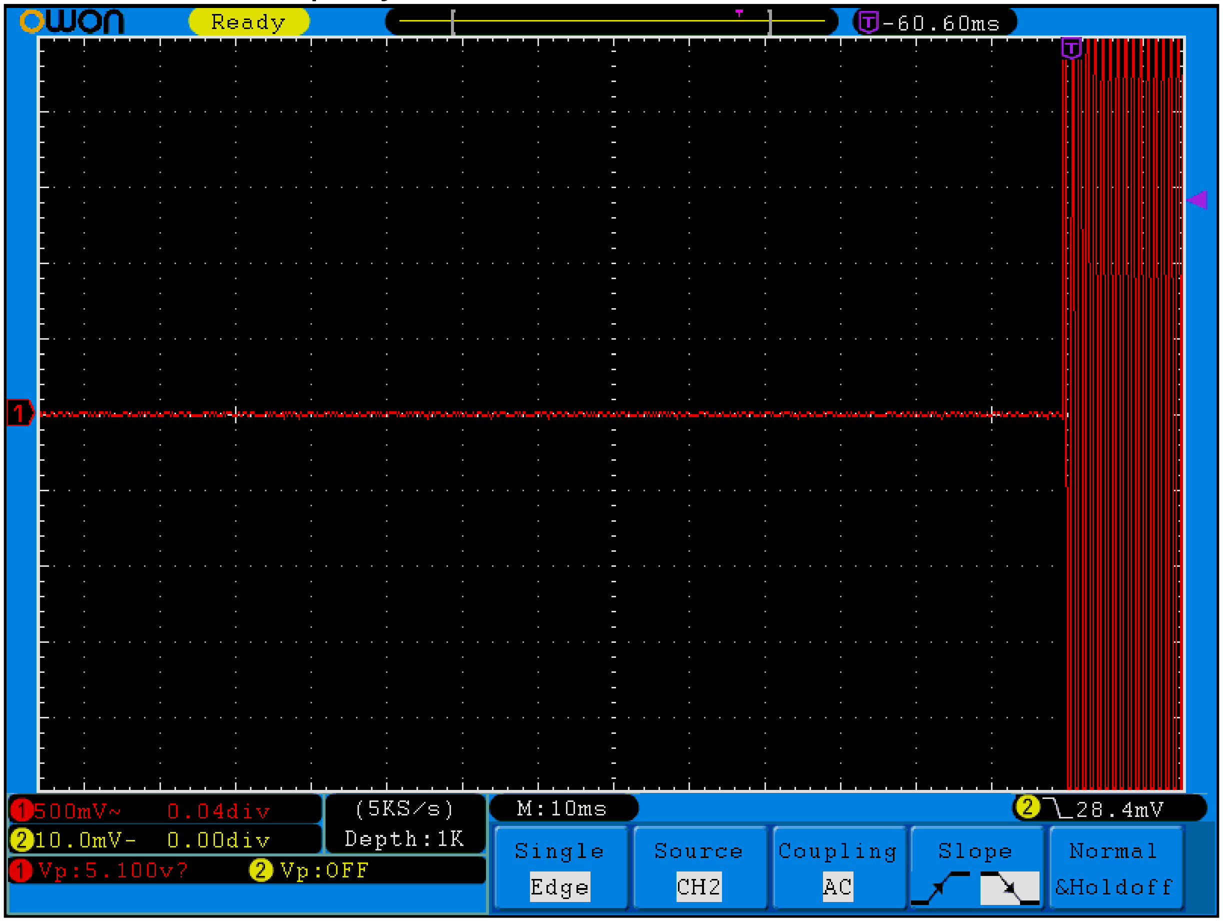
Plot 11-12: Transient Frequency Behavior – 173.9875 MHz; Narrow Band; Carrier OFF Time



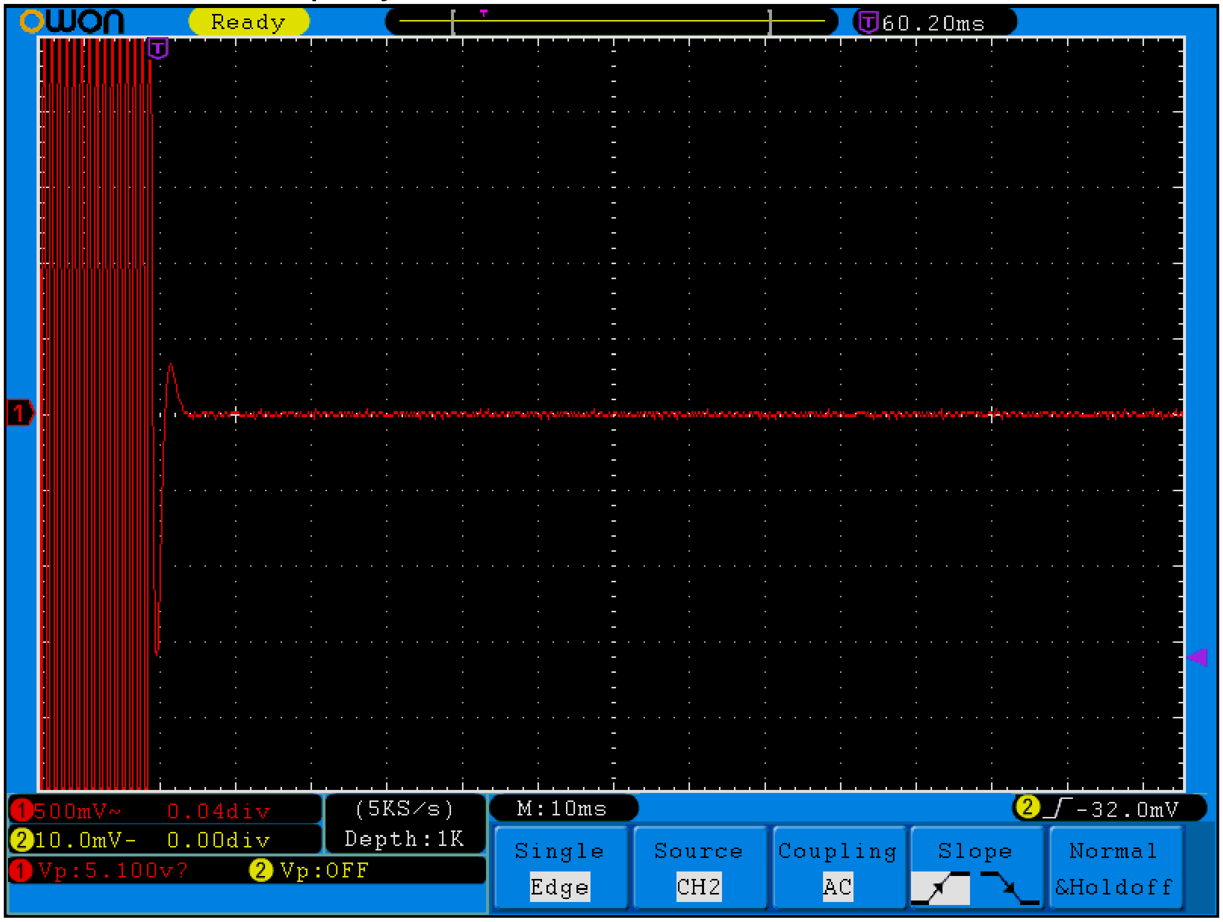
Plot 11-13: Transient Frequency Behavior – 429.9875 MHz; Wide Band; Carrier ON Time



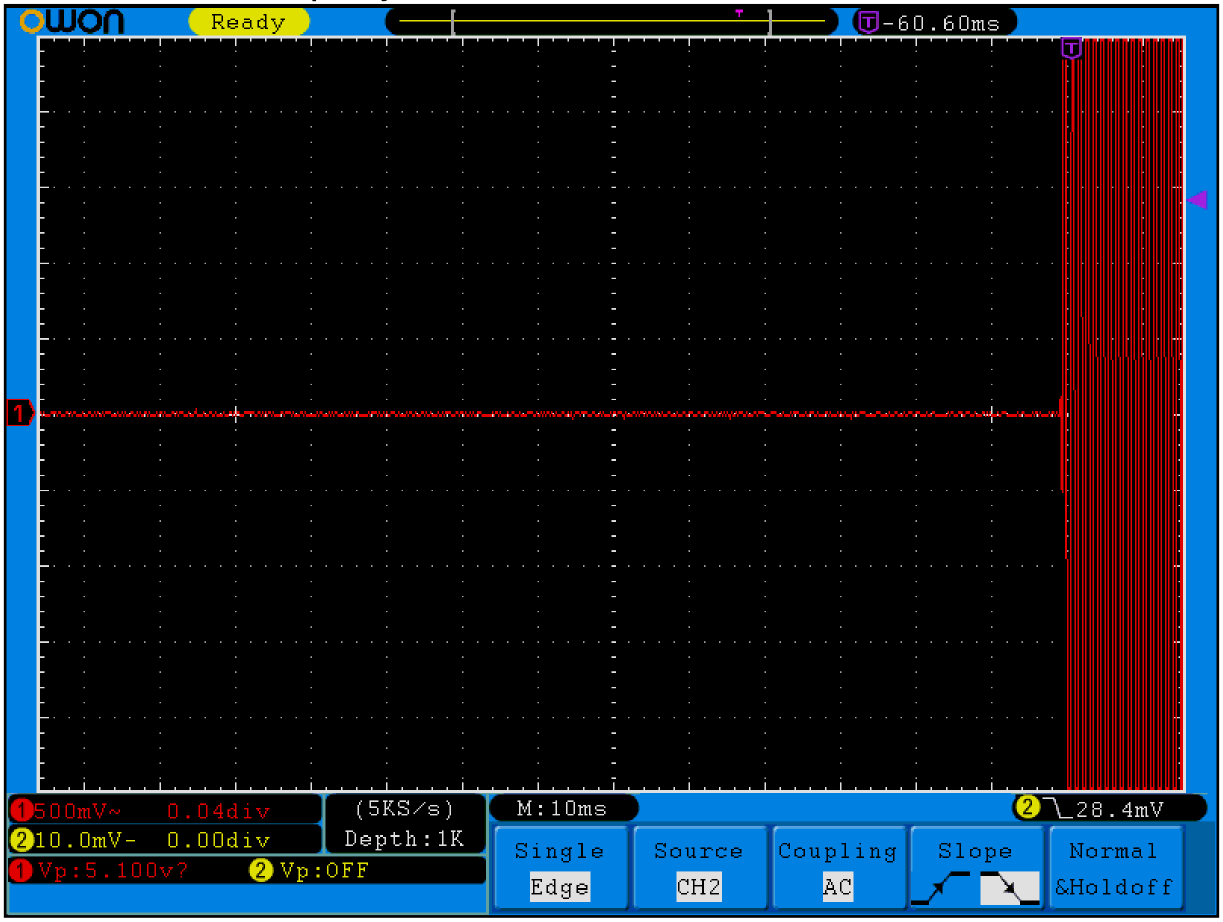
Plot 11-14: Transient Frequency Behavior – 429.9875 MHz; Wide Band; Carrier OFF Time



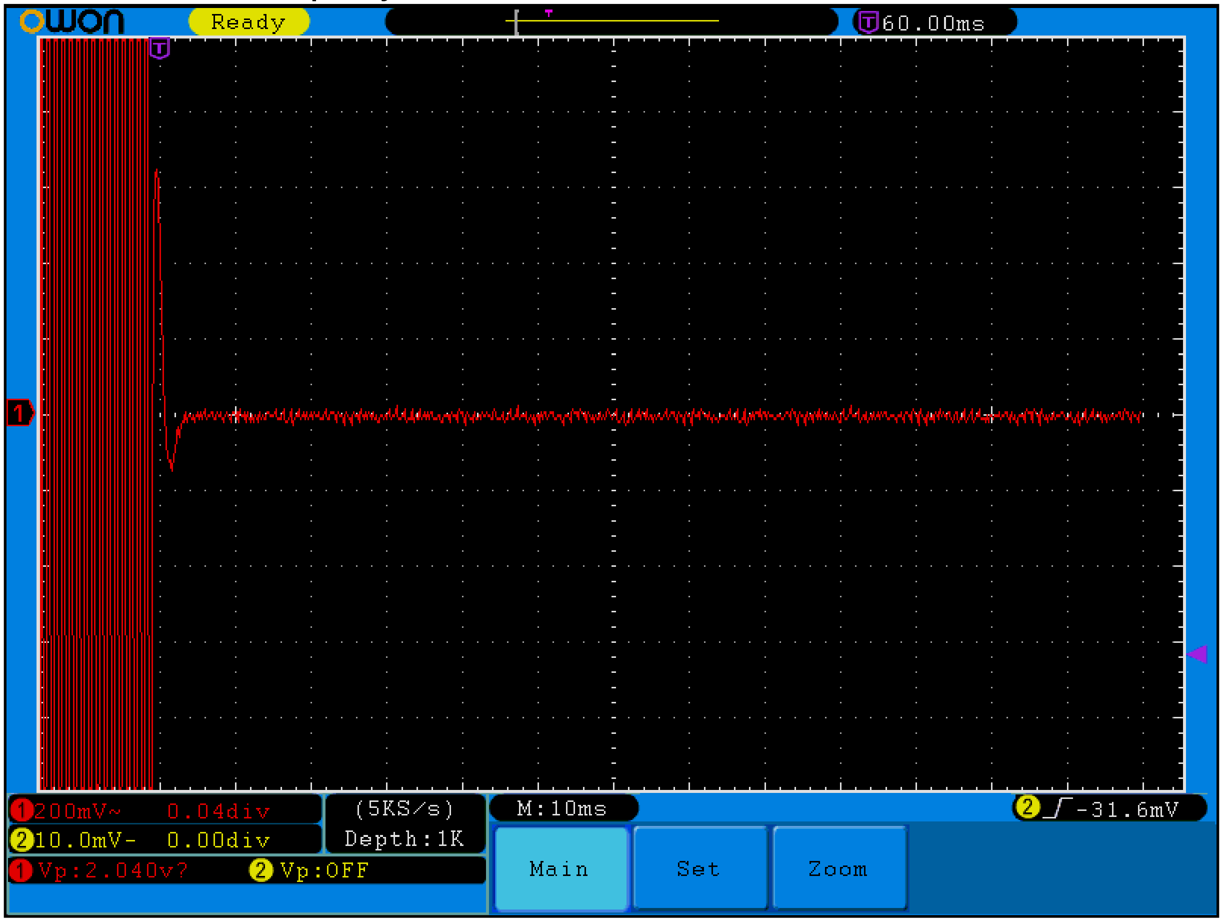
Plot 11-15: Transient Frequency Behavior – 469.9875 MHz; Wide Band; Carrier ON Time



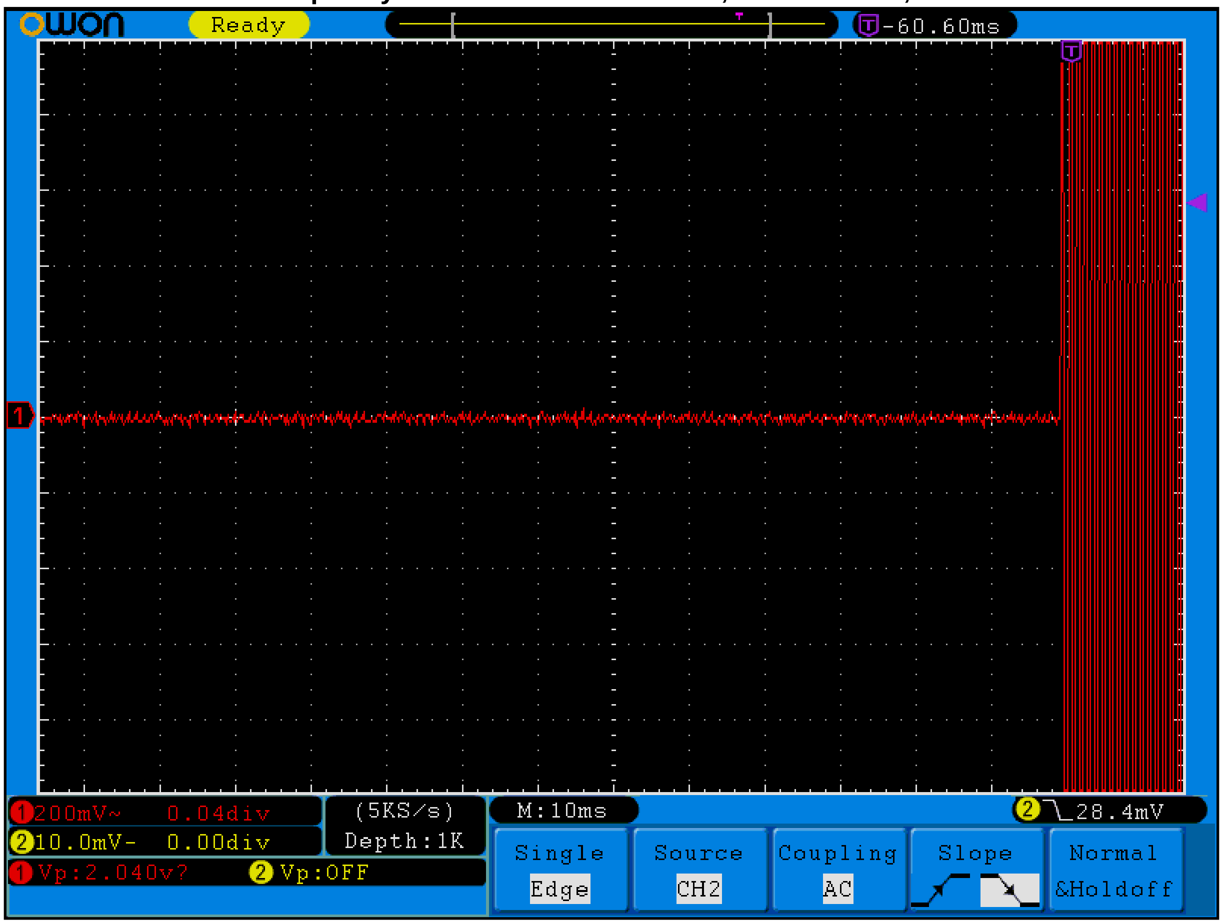
Plot 11-16: Transient Frequency Behavior – 469.9875 MHz; Wide Band; Carrier OFF Time



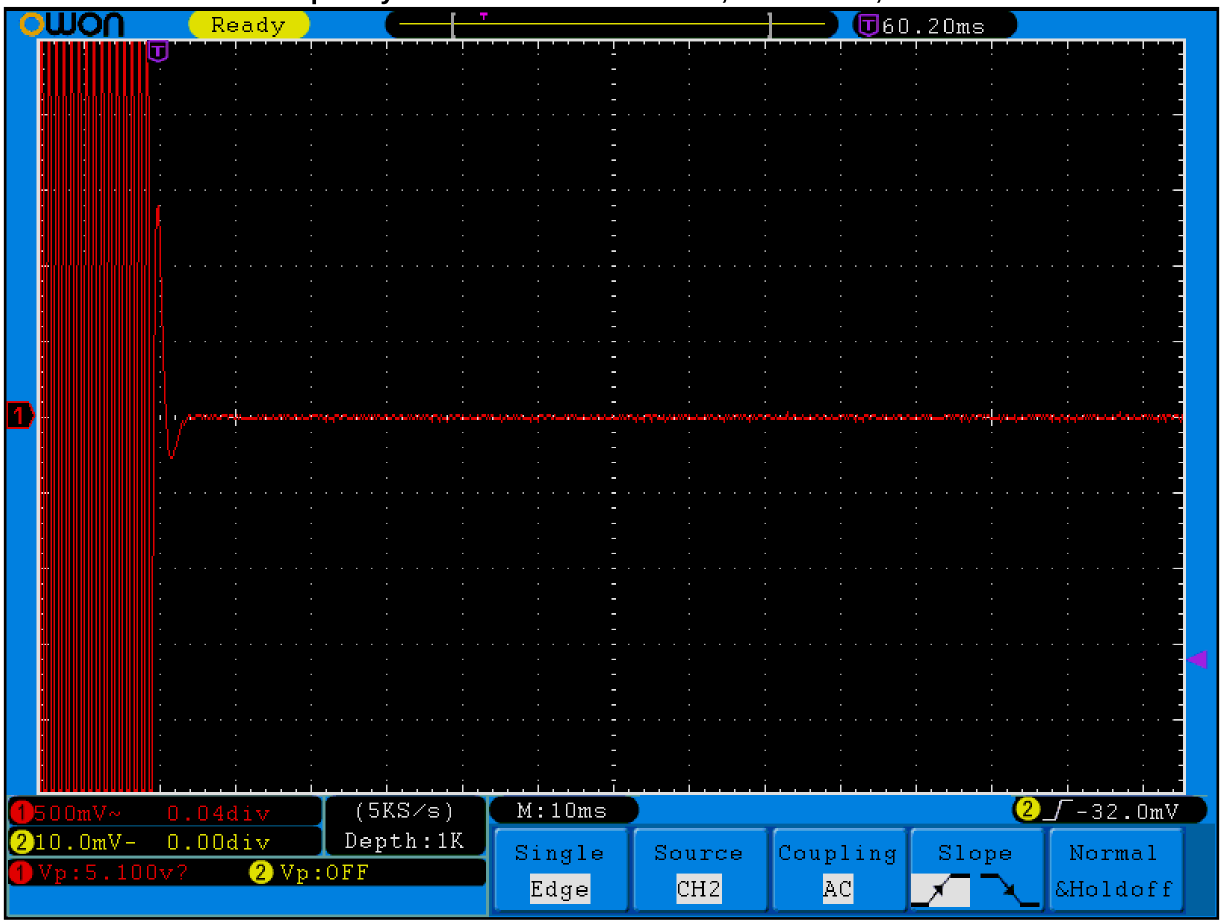
Plot 11-17: Transient Frequency Behavior – 469.9875 MHz; Narrow Band; Carrier ON Time



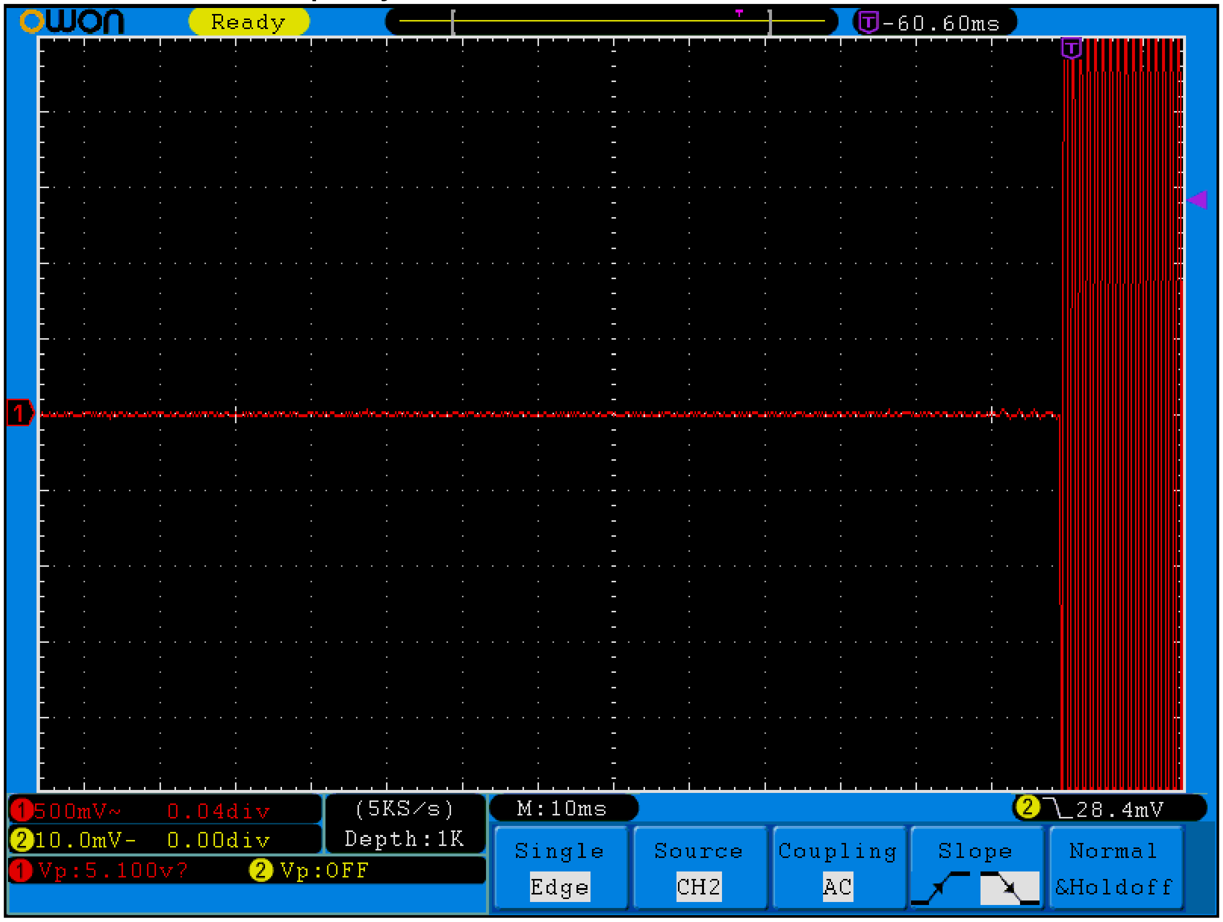
Plot 11-18: Transient Frequency Behavior – 469.9875 MHz; Narrow Band; Carrier OFF Time



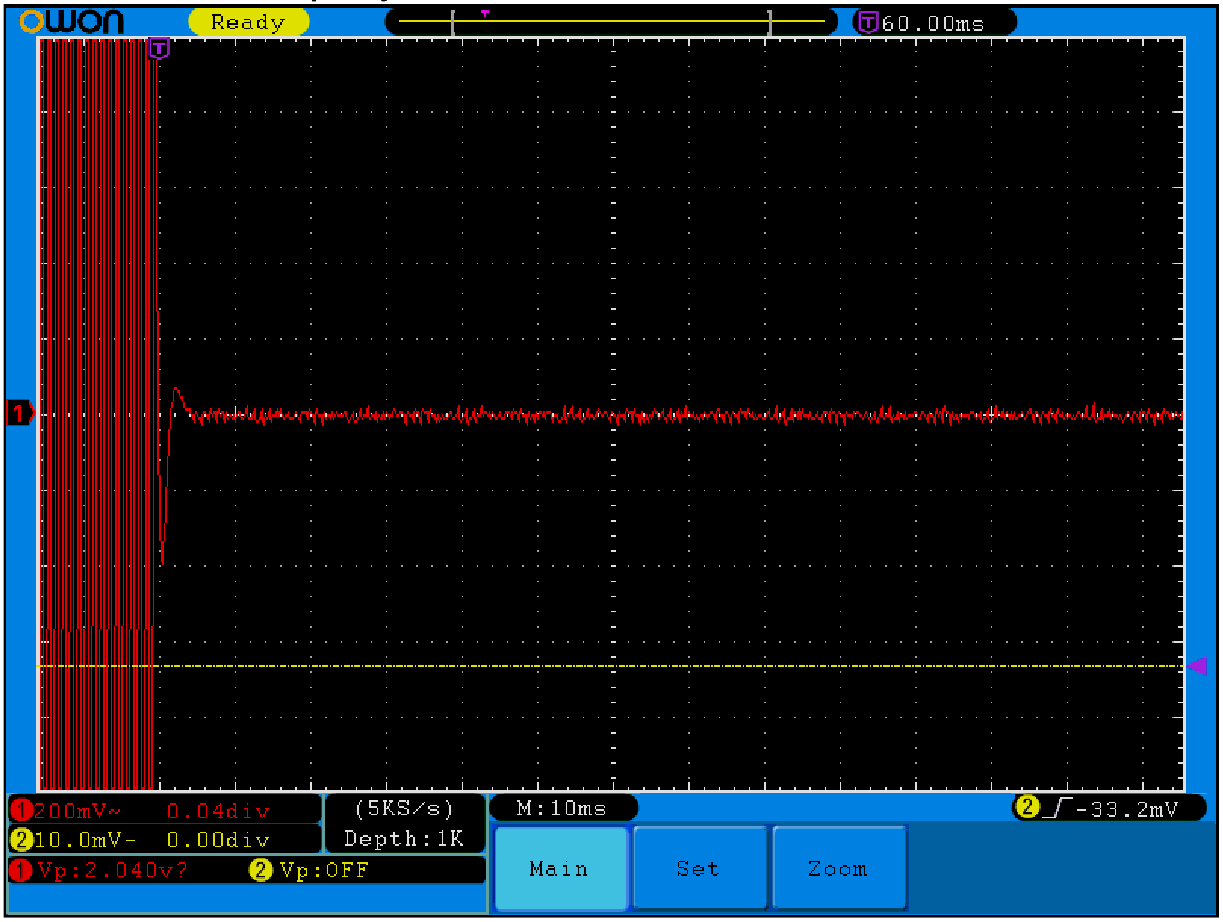
Plot 11-19: Transient Frequency Behavior – 511.9875 MHz; Wide Band; Carrier ON Time



Plot 11-20: Transient Frequency Behavior – 511.9875 MHz; Wide Band; Carrier OFF Time



Plot 11-21: Transient Frequency Behavior – 511.9875 MHz; Narrow Band; Carrier ON Time



Plot 11-22: Transient Frequency Behavior – 511.9875 MHz; Narrow Band; Carrier OFF Time

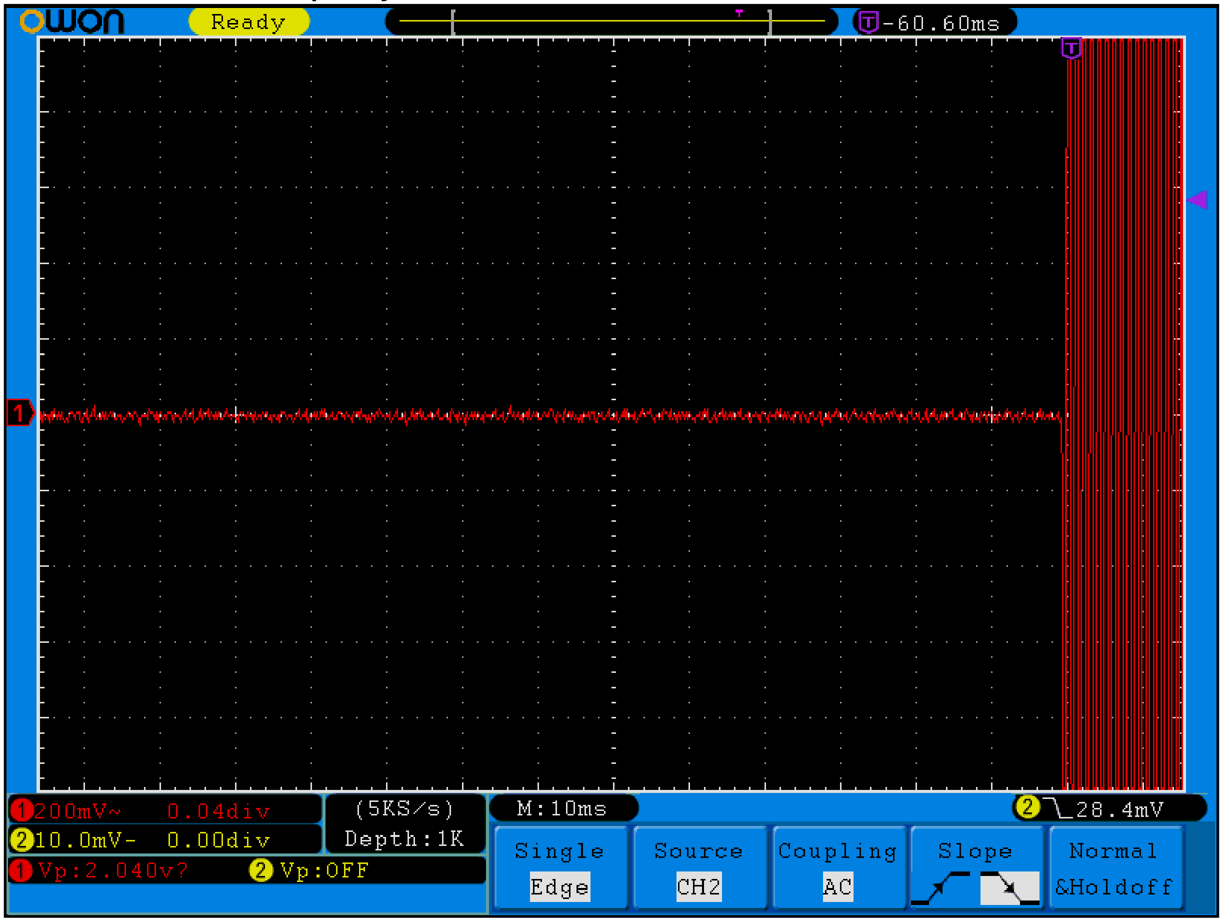


Table 11-1: Test Equipment Used For Testing Transient Frequency Behavior

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901582	Rhode & Schwarz	SMF 100A	Signal Generator	1167.0000.02	4/24/21
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz–1300 MHz)	2406A00178	1/30/20
901651	OWON	SDS7102V	Oscilloscope	B020129	4/2/21

Test Personnel:

Daniel Baltzell		August 20, 2019
Test Engineer	Signature	Date of Tests

12 FCC Part 2.202: Necessary Bandwidth and Emission Bandwidth

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

Voice – 25 kHz channel separation (NPSPAC)
Calculation:
Max modulation (M) in kHz: 3.0
Max deviation (D) in kHz: 4
Constant factor (K): 1 (assumed)
Bn = 2xM+2xDK = 14.0 kHz
Emission designator: 14K0F3E

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 = 2M+2DK = 16.0 kHz
Emission designator: 16K0F3E

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: 8K40F1D, 8K40F1E

P25 Phase 2 Data/Voice (H-CPM TDMA)
Calculation:
Data rate in bps (R) =12000
Peak deviation of carrier (D) = 1050
Bn = [12000/$\log_2$(4) + 2 (1050) (1) = 8.1 kHz
Emission designator: 8K10DXW

2-level FSK 9600 Data/Digital Voice (NB)
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 3450
Bn = [9600/log2(4) + 2 (3450) (1) = 11.700 kHz
Emission designator: 11K7F1D, 11K7F1E

2-level FSK 9600 Data/Digital Voice (WB)
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 5600
Bn = [9600/log2(4) + 2 (5600) (1) = 16.000 kHz
Emission designator: 16K0F1D, 16K0F1E

2-level FSK 9600 Data/Digital Voice (NPSPAC)
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 4600
Bn = [9600/log2(4) + 2 (4600) (1) = 14.000 kHz
Emission designator: 14K0F1D, 14K0F1E

2-level FSK 4800 Data/Digital Voice (XNB)
Calculation:
Data rate in bps (R) = 4800
Peak deviation of carrier (D) = 1800
Bn = [4800/log2(4) + 2 (2350) (1) = 7.100 kHz
Emission designator: 7K10F1D, 7K10F1E

HVD SMR
Calculation:
Data rate in bps (R) = 19200
Signaling states (S) = 4
$B_n = 2(19200)(.96)/\log_2(4) = 18.5$ kHz
Emission designator: 18K5F1W

HVD NPSPAC
Calculation:
Data rate in bps (R) = 19200
Signaling states (S) = 4
$B_n = 2(19200)(.67)/\log_2(4) = 12.9$ kHz
Emission designator: 12K9F1W

13 Conclusion

The data in this measurement report shows that the Harris Corporation XL-200M Multi-Band Mobile, VL/V/U/7/8/9, FCC ID: OWDTR-0161-E, IC: 3636B-0161, complies with the applicable requirements of Parts 2, 22, 74, 80, 90 and 101 of the FCC Rules and Industry Canada RSS-119.