RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

Class II Permissive Change Report

Harris Corporation
221 Jefferson Ridge Parkway
Lynchburg, VA 24501

Model: XG-100M Mobile Radio
FCC ID: AQZ-XG-100M00

November 20, 2013

Standards Referenced for this Report	
Part 2: 2012	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 22: 2012	Public Portable Services
Part 80: 2012	Stations in the Maritime Services
TIA-102.CCAA August 2011	Two-Slot Time Division Multiple Access Transceiver Measurement Methods
TIA-102.CCAB October 2011	Two - Slot Time Division Multiple Access Transceiver Performance Recommendations
TIA-EIA-603-C August 2004	Land Portable FM or PM Communications Equipment – Measurement and Performance Standards

FCC Rule Parts	Frequency Range (MHz)	Rated Transmit Power (W) (Conducted)	Frequency Tolerance (ppm)	Transmit Mode	Emission Designator
22, 80	136 – 174	1 – 52.5	0.5	Analog Voice; WB	16K0F3E
22, 80, 90	136 – 174	1 – 52.5	0.5	Analog Voice; NB	11K0F3E
22, 80, 90	136 – 174	1 – 52.5	0.5	4-level C4FM; P25	8K40F1D/E
22, 80, 90	136 – 174	1 – 52.5	0.5	H-CPM TDMA	8K10DXW
22	380-520	1 – 52.5	0.5	Analog Voice; WB	16K0F3E
22, 90	380-520	1 – 52.5	0.5	Analog Voice; NB	11K0F3E
22, 90	380-520	1 – 52.5	0.5	4-level C4FM; P25	8K40F1D/E
22, 90	380-520	1 – 52.5	0.5	H-CPM TDMA	8K10DXW

Report Prepared by Test Engineer: Daniel W. Baltzell

Document Number: 2013232

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANSI-ASQ National Accreditation Board/ACLASS. Refer to certificate and scope of accreditation AT-1445.

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1 Test Result Summary

Test	FCC References	Result
RF Power Output	2.1046(a), 22.565(f); 80.215	Complies
Spurious Emissions at Antenna Terminals	2.1051, 22.359(a), 80.211(f)	Complies
Field Strength of Spurious Radiation	2.1053(a), 22.359(a), 80.211(f)	Complies
Occupied Bandwidth/Emission Limitations	2.1049(c)(1), 22.359(b); 80.211(f)	Complies
Modulation Characteristics	2.1047, 80.213(a)(2)	Complies

2 General Information

The following Class II Permissive Change Report is prepared on behalf of Harris Corporation. in accordance with the Federal Communications Commission. The Equipment Under Test (EUT) was the XG-100M VHF, UHF Mobile Radio, FCC ID: AQZ-XG-100M00.

The purpose of this Class 2 Permissive Change is to add Part 22 and Part 80 operations.

All measurements contained in this application were conducted in accordance with the applicable FCC Rules and Regulations in CFR 47. 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)

The original FCC grant was issued May 24, 2011; permissive change grants were issued October 24, 2011, December 5, 2011, November 13, 2012, and May 21, 2013.

2.3 Grant Notes

Power is 52.5 W for VHF and UHF

2.4 Tested System Details

The test sample was received on April 3, 2013. The identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this test are list below.

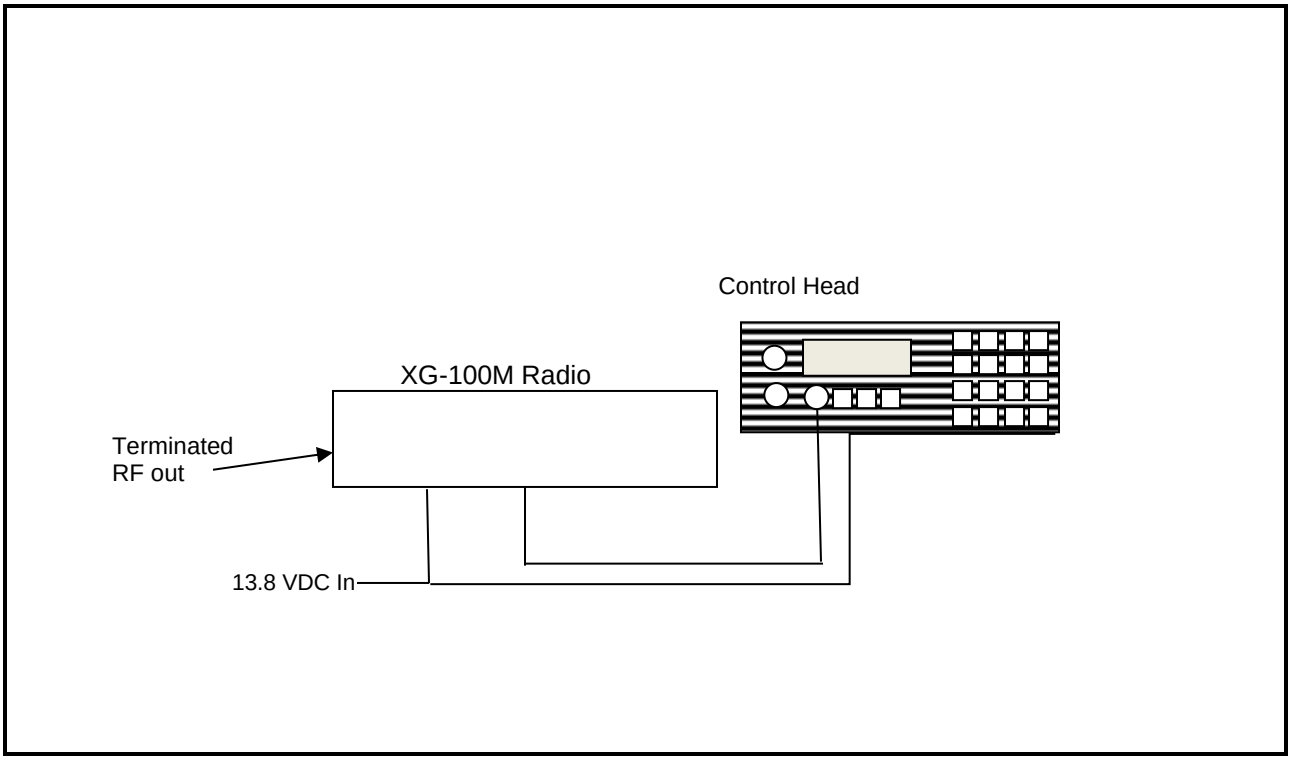
Table 2-1: Equipment under Test (EUT)

Part	Manufacturer	Model	PN/SN	FCC ID	Cable Description	RTL Bar Code
XG-100M Transceiver	Harris Corporation.	XG-100M	N/A	AQZ-XG-100M00	0.5m unshielded power	20881

Table 2-2: Support Equipment

Part	Manufacturer	Model	PN/SN	FCC ID	Cable Description	RTL Bar Code
Control Head	Harris Corporation	CH721 CU23218-004	96025894 Rev J	N/A	1.5 m unshielded I/O	20952

Figure 2-1: Configuration of Tested System



3 FCC Part 2.1046(a), 22.565(f), 80.215: RF Power Output

3.1 Test Procedure

ANSI TIA-603-C-2004, section 2.2.1

The EUT was connected with a power sensor/meter through an appropriate 50 ohm attenuator. Attenuator loss was accounted for.

3.2 Test Data

Table 3-1: RF Power Output (High Power): Carrier Output Power (Unmodulated)

Frequency (MHz)	RF Power Measured (dBm)*	RF Power Measured (Watt)*
152.0150	47.1	51.3
154.0125	47.1	51.3
156.8000	47.1	51.3
158.7100	47.1	51.3
173.0125	47.2	52.5
406.1125	47.0	50.4
418.0000	47.0	50.4
453.9875	47.1	51.3
454.1000	47.0	50.1
456.0125	47.1	51.3
459.1000	47.1	51.3
469.9875	47.1	51.3
511.9875	47.1	50.7

* Measurement accuracy: +/-.02 dB (logarithmic mode)

Table 3-2: Test Equipment Used for Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14
901536	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	12/14/13

Test Personnel:

Daniel Baltzell		November 8, 2013
EMC Test Engineer	Signature	Date of Test

4 FCC Part 2.1051, 22.359(a), 80.211(f): Spurious Emission

4.1 Test Procedure

TIA-102.CCAA August 2011, section 2.2.7, TIA-102.CCAB October 2011, section 3.2.7

The transmitter was interfaced with a spectrum analyzer through an appropriate 50 ohm attenuator. The transmitter was operated at maximum power. Attenuator losses were accounted for.

Frequency range of measurement per Part 2.1057: 9 kHz to 10xFc.

22.359(a) *Out of band emissions:* The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB.

80.211(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:
(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

4.2 Test Data

Per FCC 2.1051, the magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

No spurious emissions were found to be within 20 dB of the limit; therefore, no data is reported.

Table 4-1: Test Equipment Used for Testing Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14
901536	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	12/14/13
901131	Par Electronics	118-174 (25W)	VHF Notch Filter	N/A	2/29/14
901135	Par Electronics	400-512 (25W)	UHF Notch Filter	N/A	2/29/14

Test Personnel:

Daniel Baltzell		November 1, 2013
EMC Test Engineer	Signature	Date of Test

5 FCC Part 2.1049(c)(1): Occupied Bandwidth; 22.359(b), 80.211(f): Emission Limitations

5.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.11, TIA-102.CCAA August 2011, section 2.2.5, TIA-102.CCAB October 2011, section 3.2.5

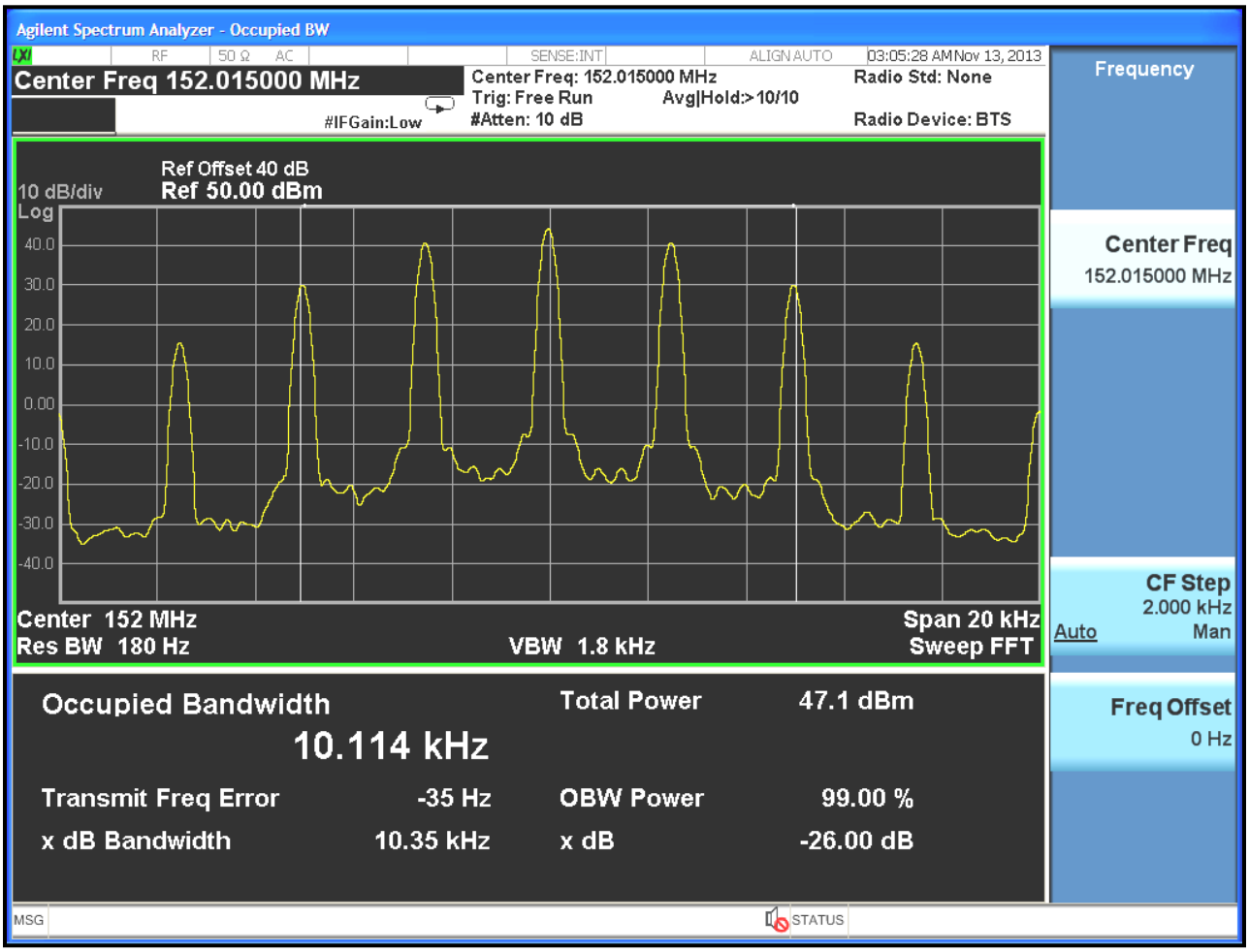
The transmitter was interfaced with a spectrum analyzer through an appropriate 50 ohm attenuator and a notch filter. The transmitter was operated at maximum power. Attenuator losses were accounted for.

22.359*(b) Measurement procedure:* In the 60 kHz bands immediately outside and adjacent to the authorized frequency range or channel, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 30 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

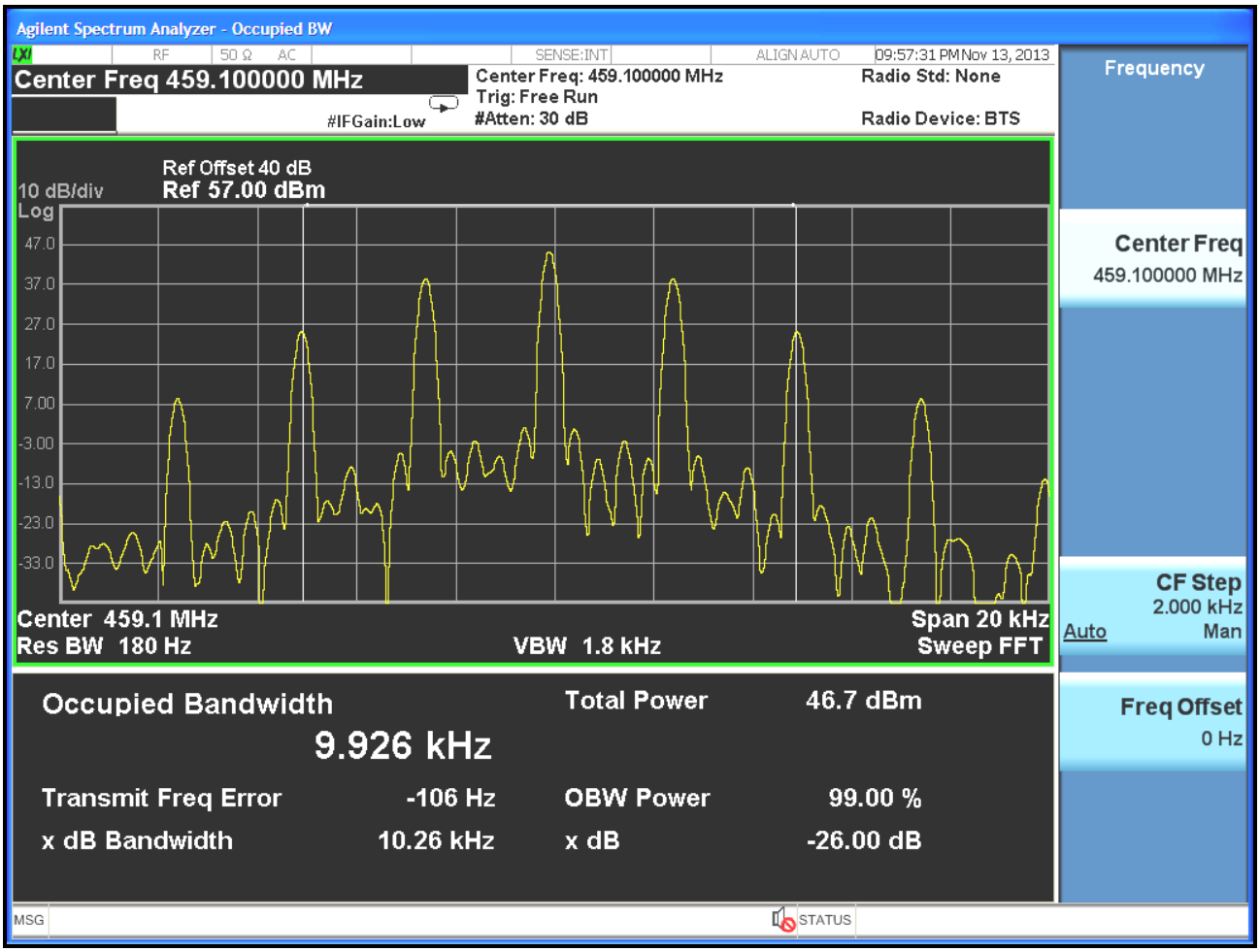
Part 80.211(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:
(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

5.2 Test Data

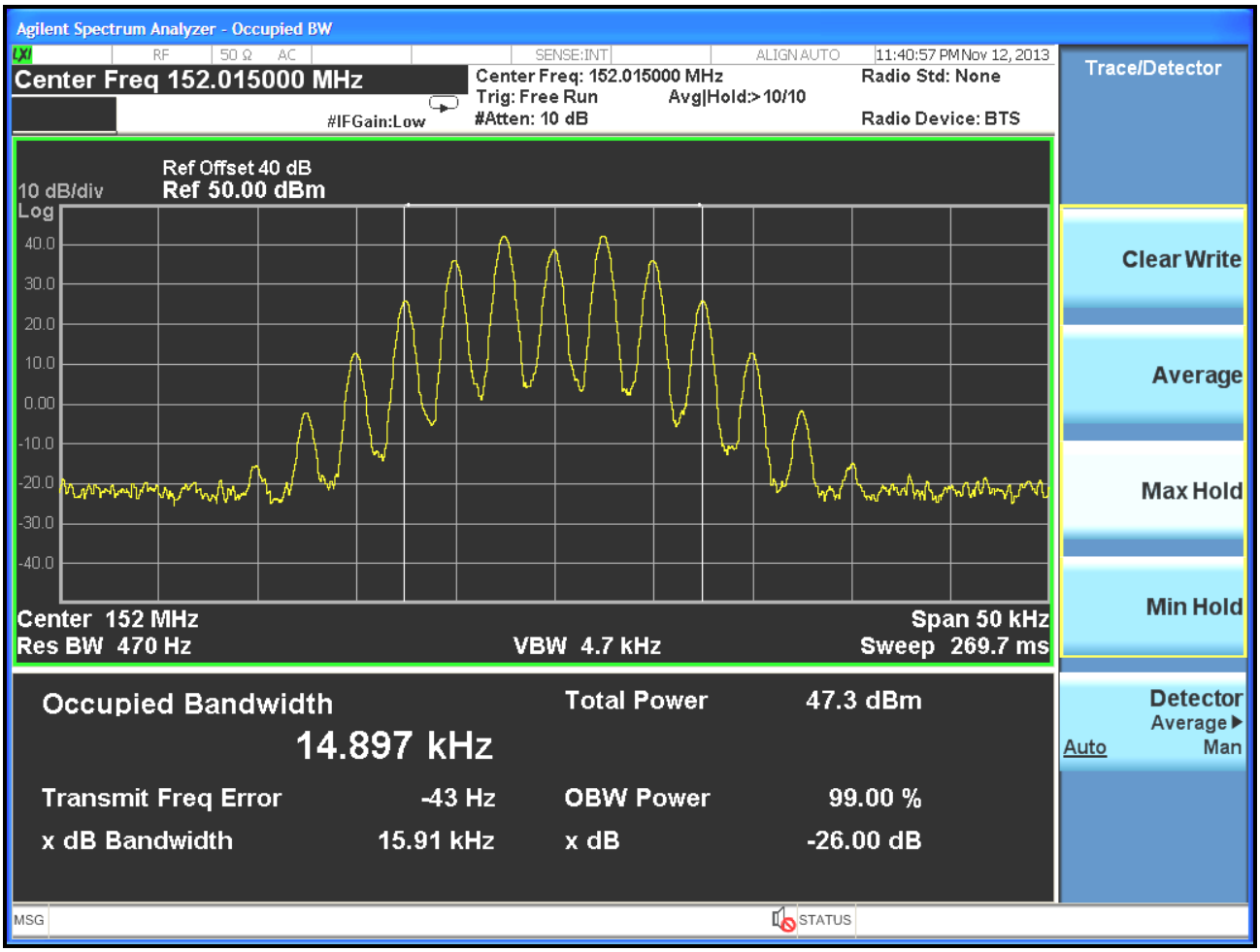
Plot 5-1: Occupied Bandwidth – NB Analog; 152.015 MHz



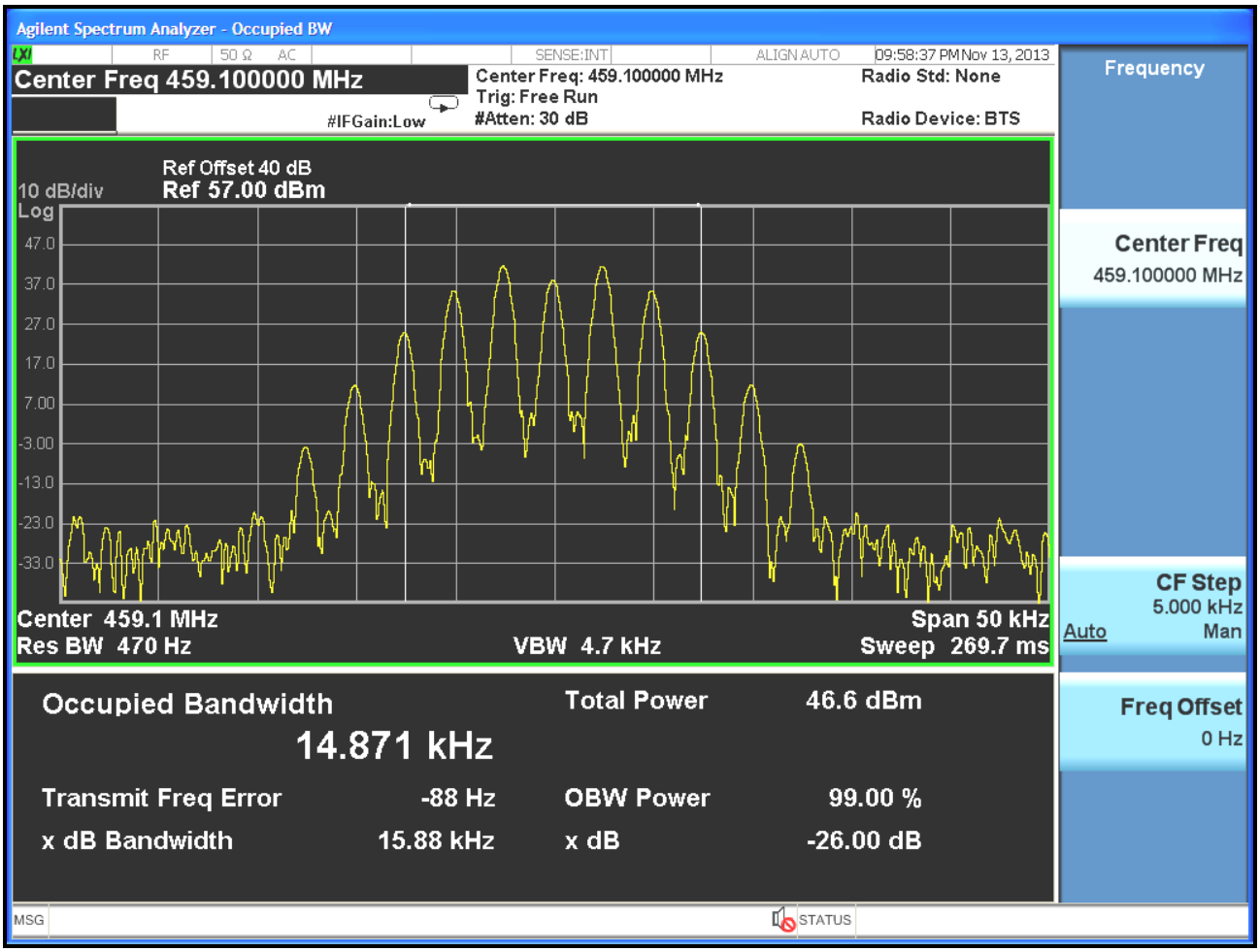
Plot 5-2: Occupied Bandwidth – NB Analog; 459.1 MHz



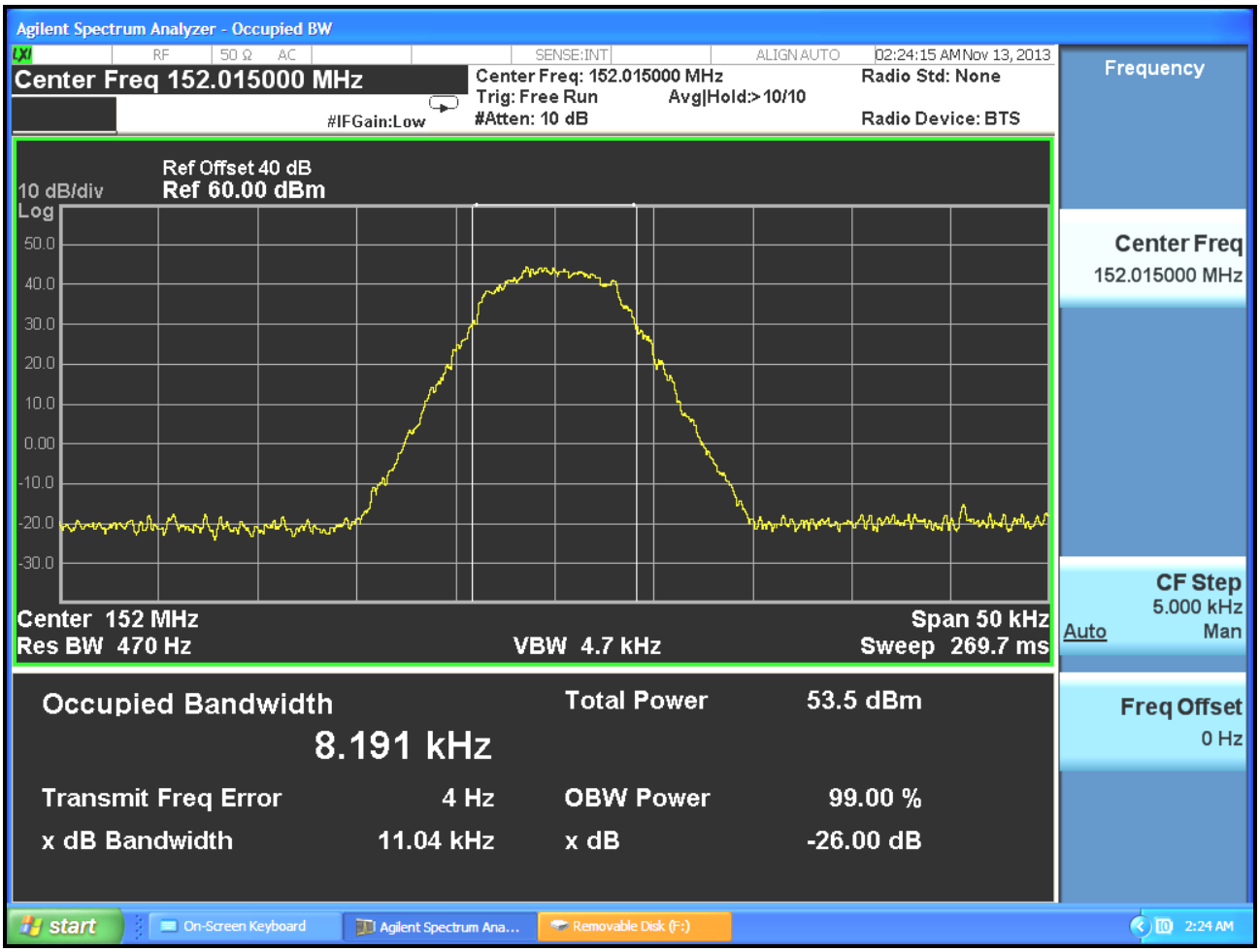
Plot 5-3: Occupied Bandwidth – WB Analog; 152.015 MHz



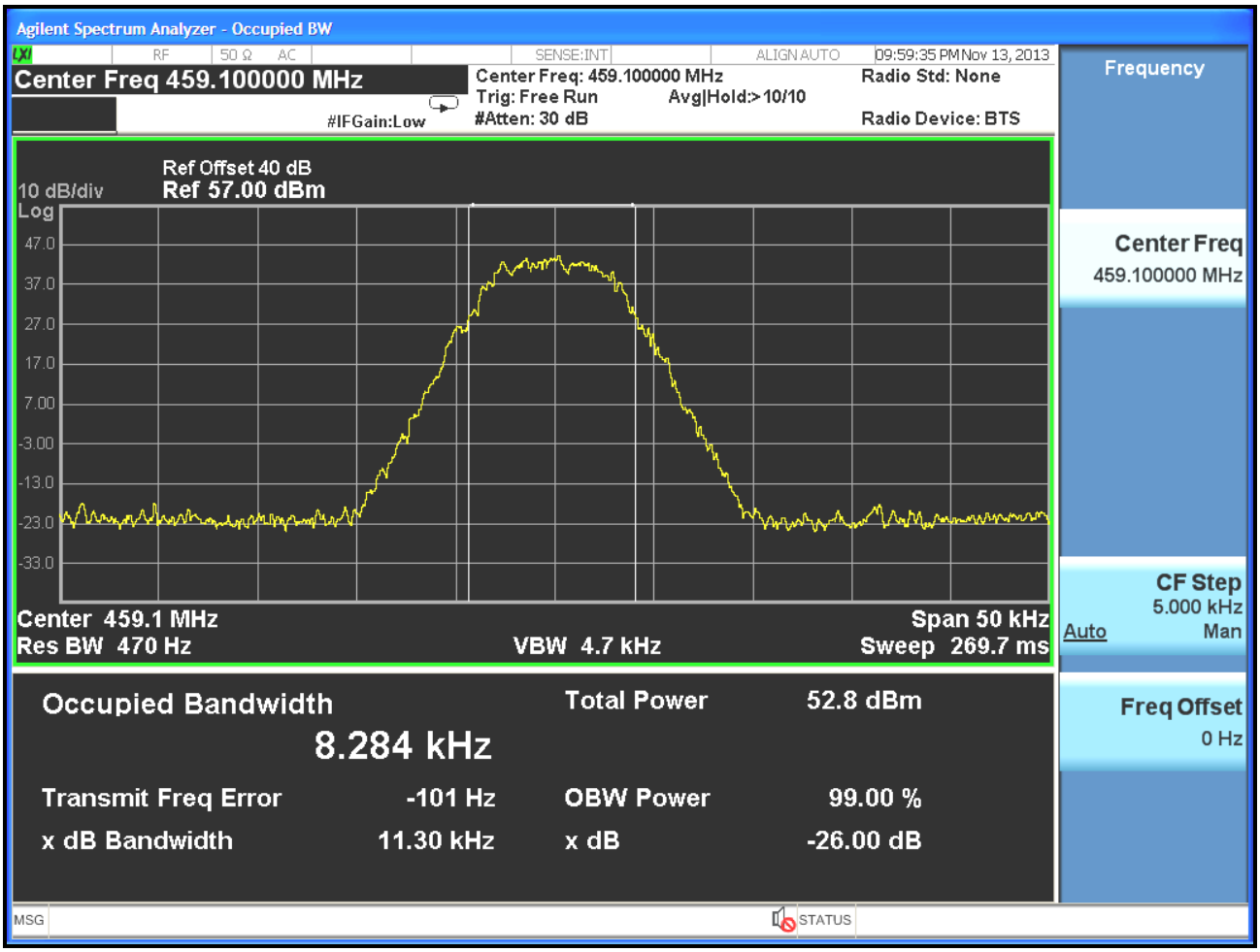
Plot 5-4: Occupied Bandwidth – WB Analog; 459.1 MHz



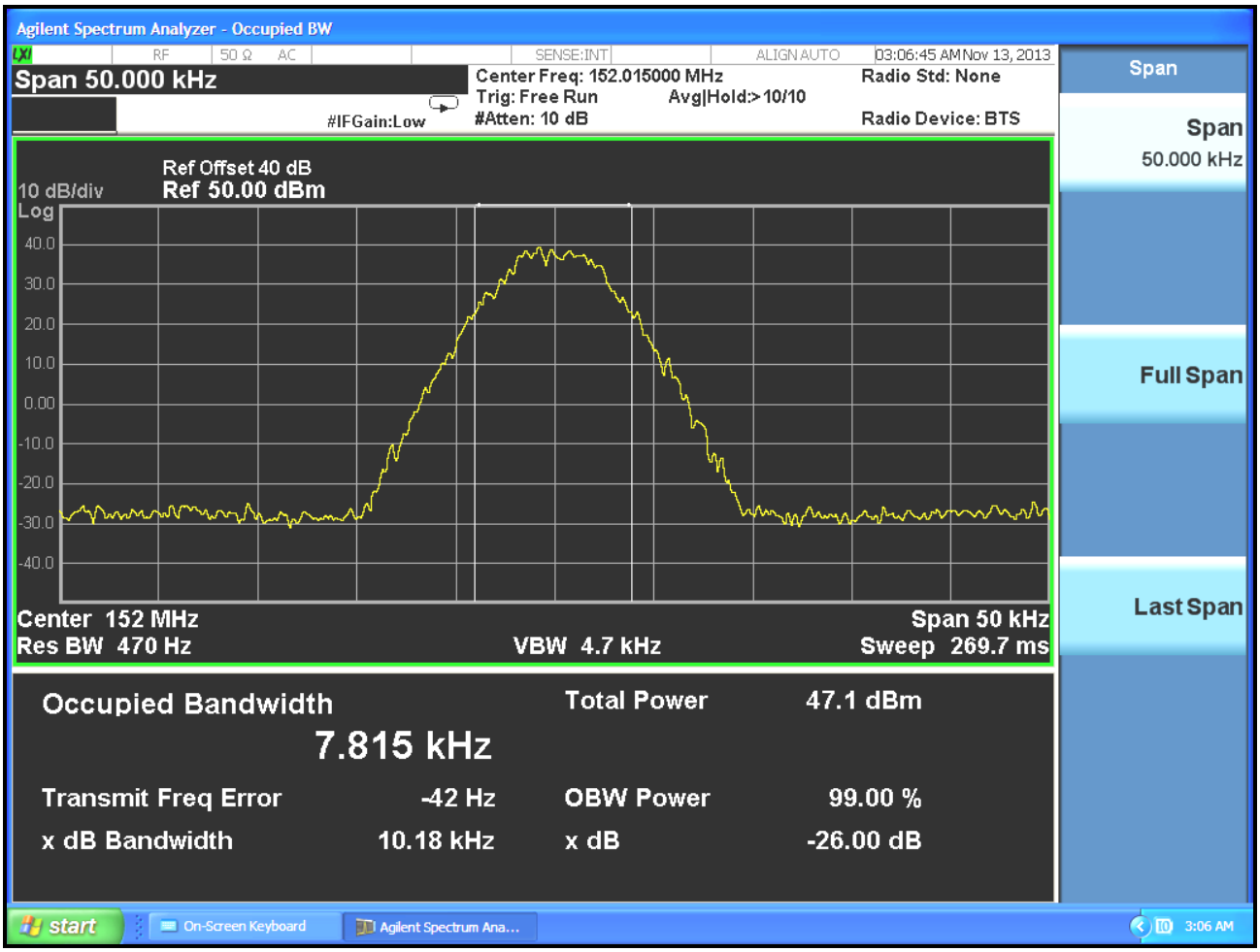
Plot 5-5: Occupied Bandwidth – H-CPM; 152.015 MHz



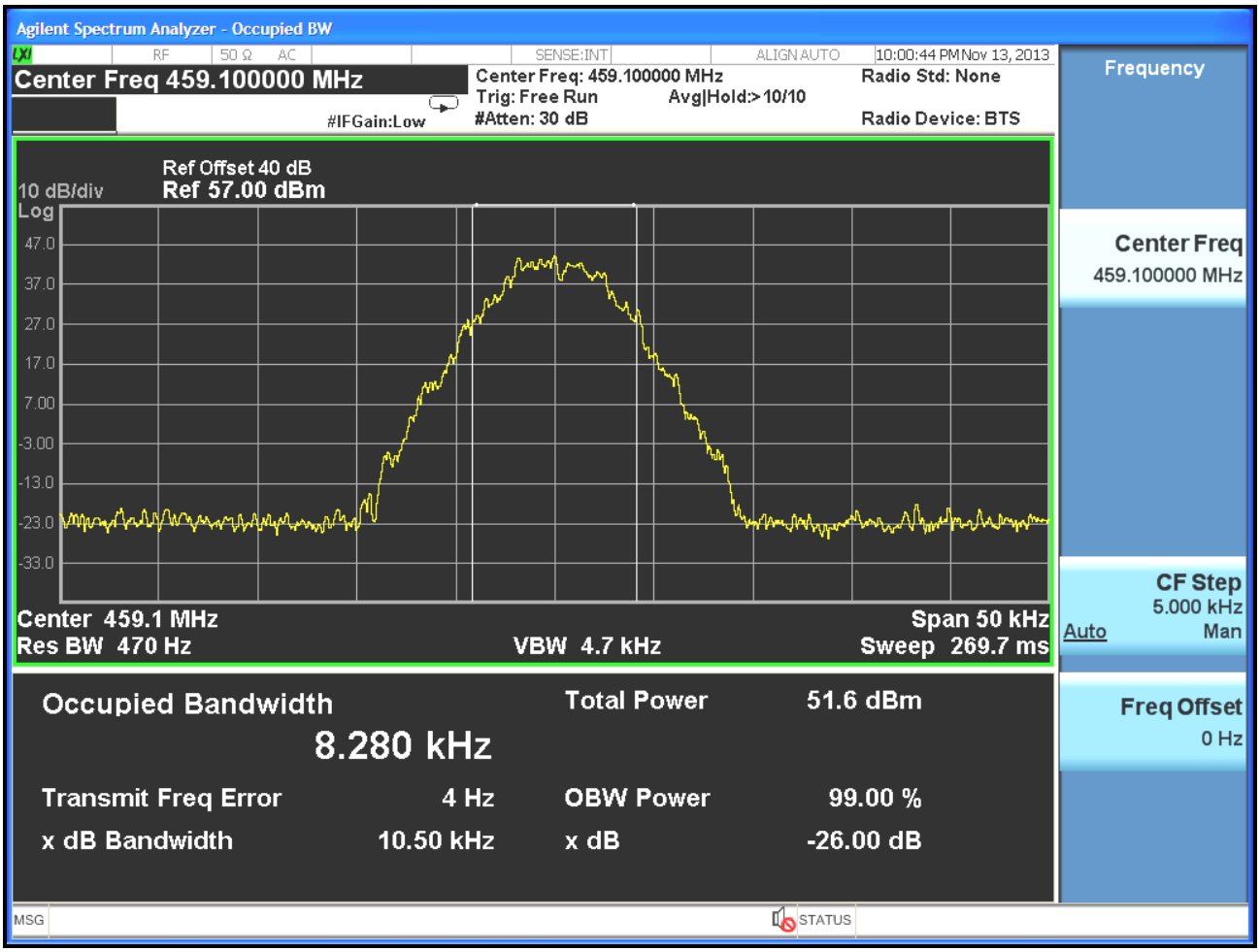
Plot 5-6: Occupied Bandwidth – H-CPM; 459.1 MHz



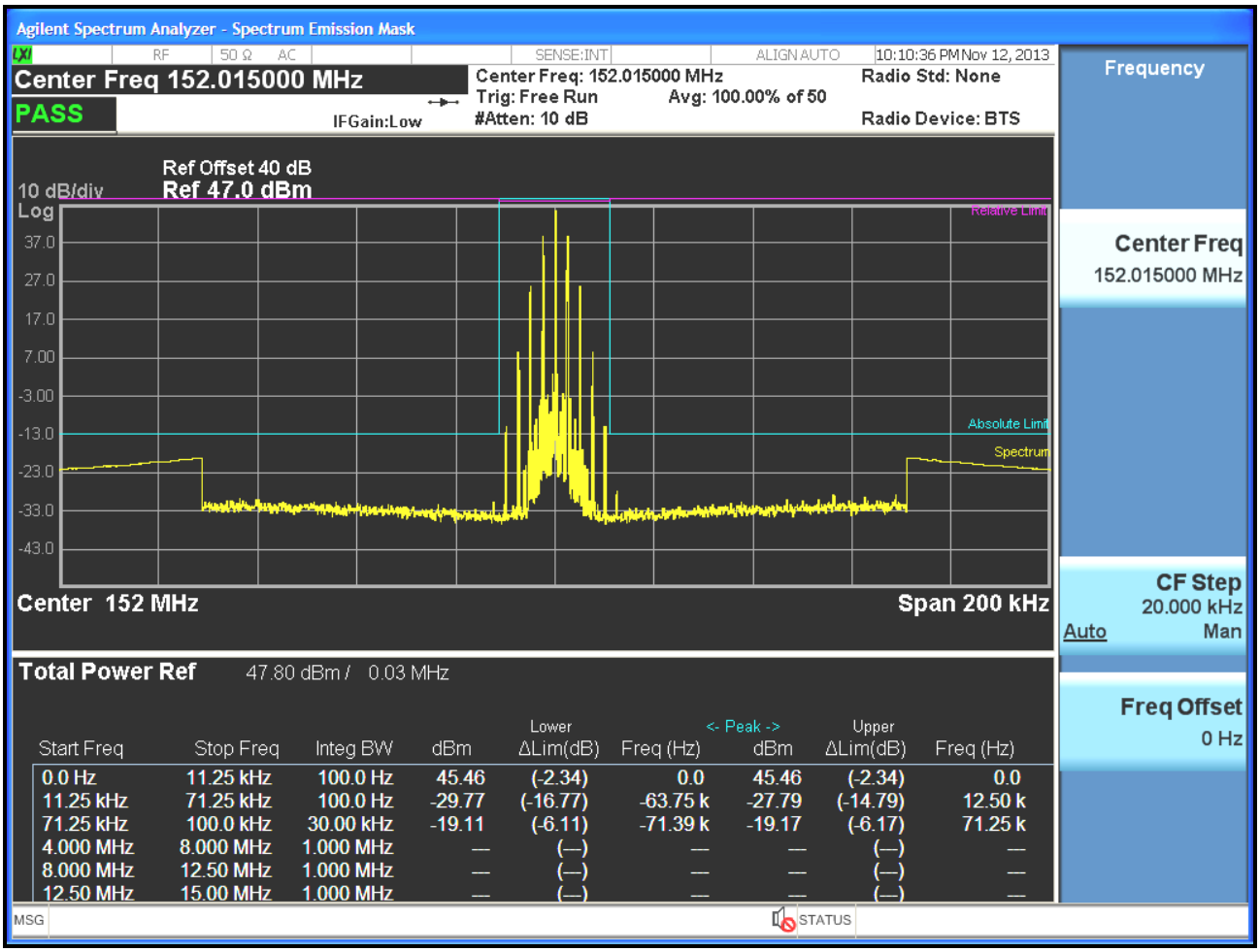
Plot 5-7: Occupied Bandwidth – P25; 152.015 MHz



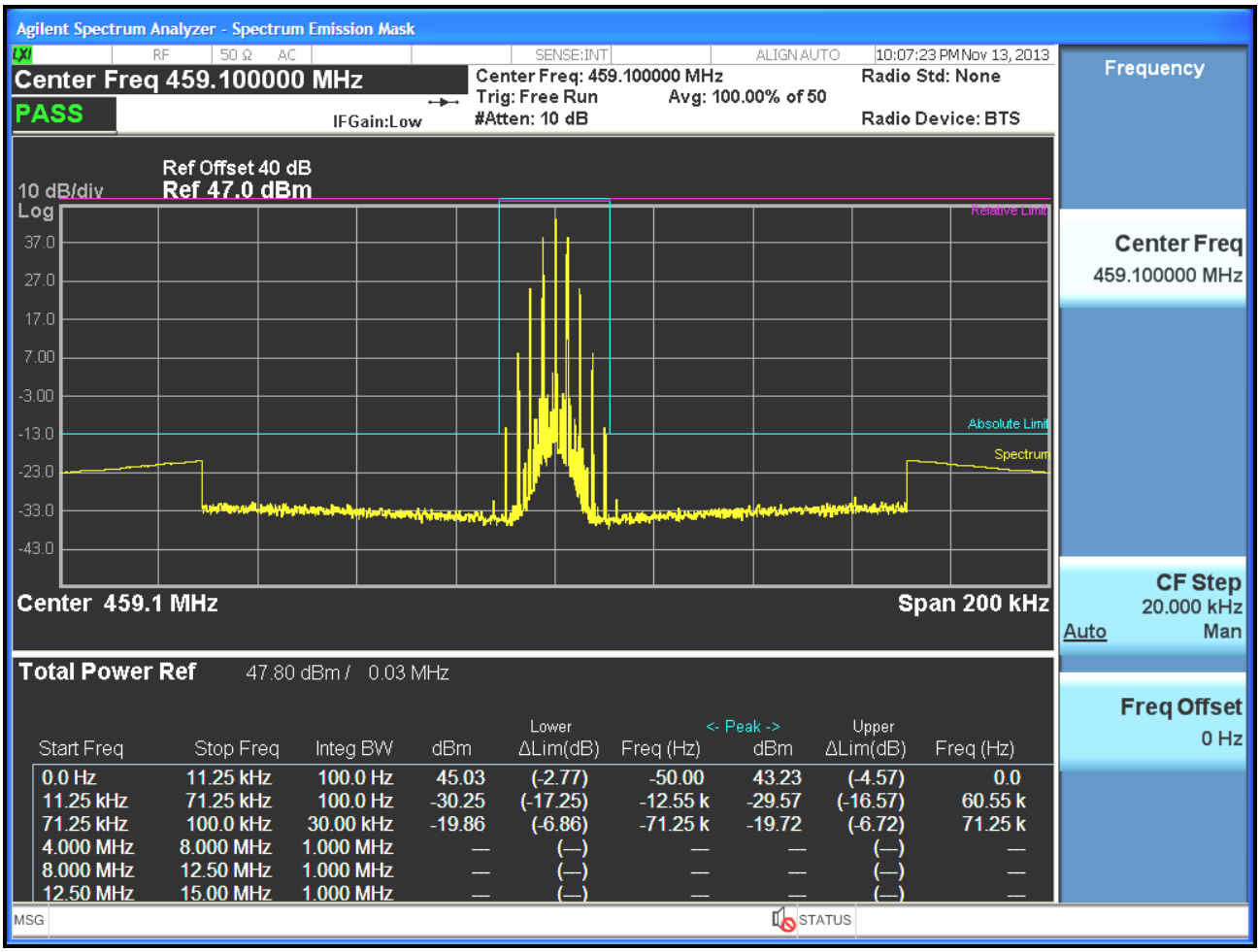
Plot 5-8: Occupied Bandwidth – P25; 459.1 MHz



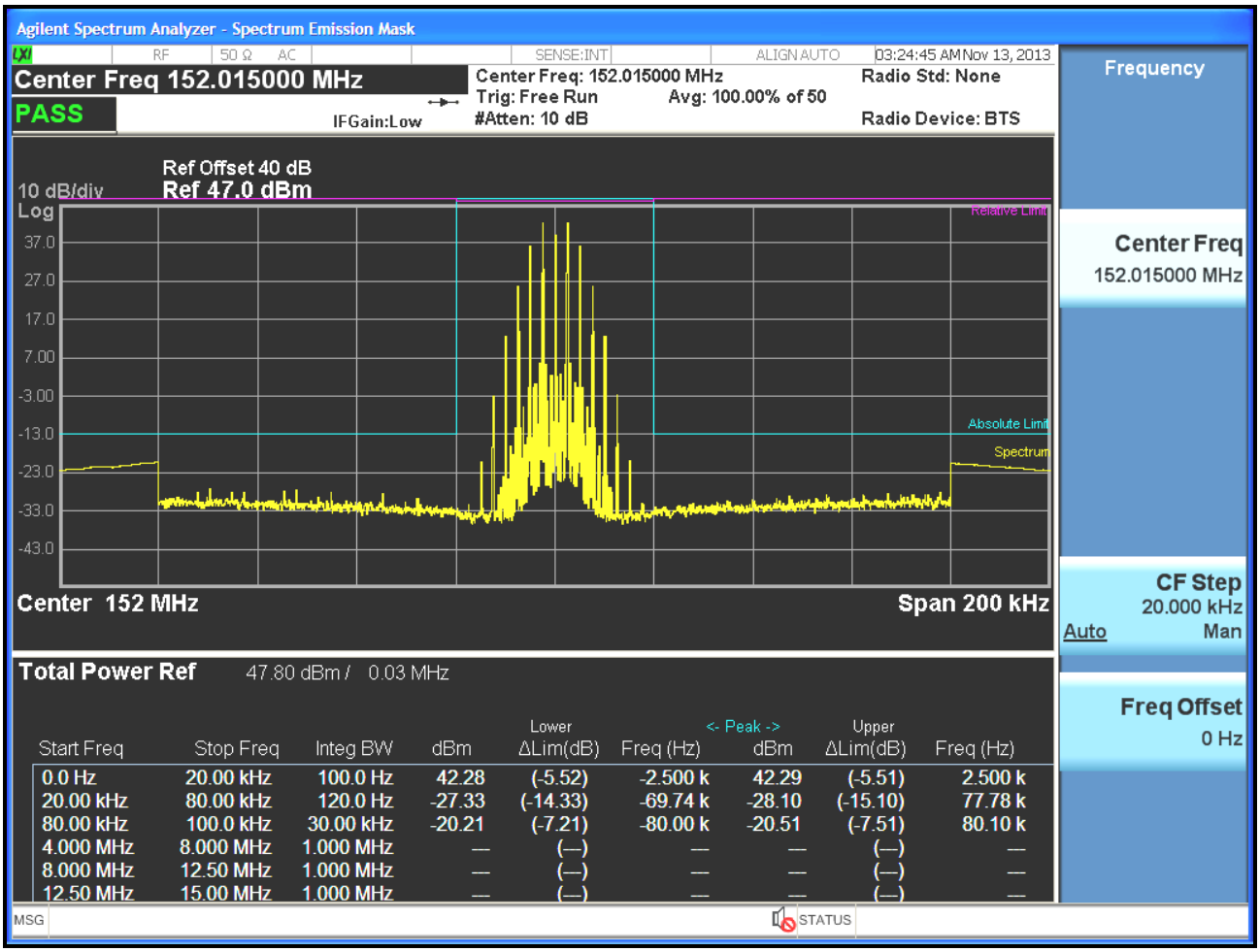
Plot 5-9: Occupied Bandwidth – 152.015 MHz; Part 22 Mask; NB Analog Voice



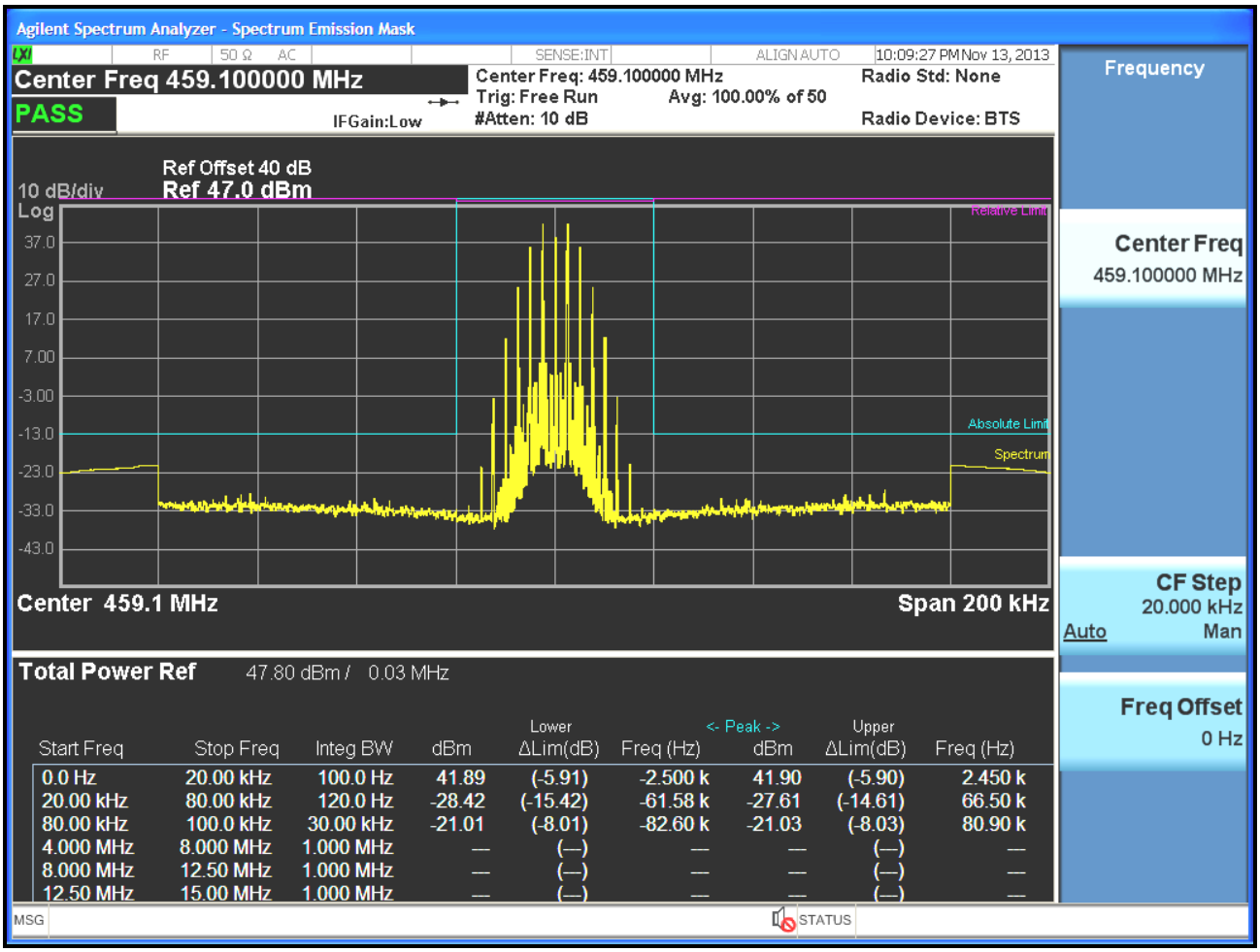
Plot 5-10: Occupied Bandwidth – 459.1 MHz; Part 22 Mask; NB Analog Voice



Plot 5-11: Occupied Bandwidth – 152.015 MHz; Part 22 Mask; WB Analog Voice

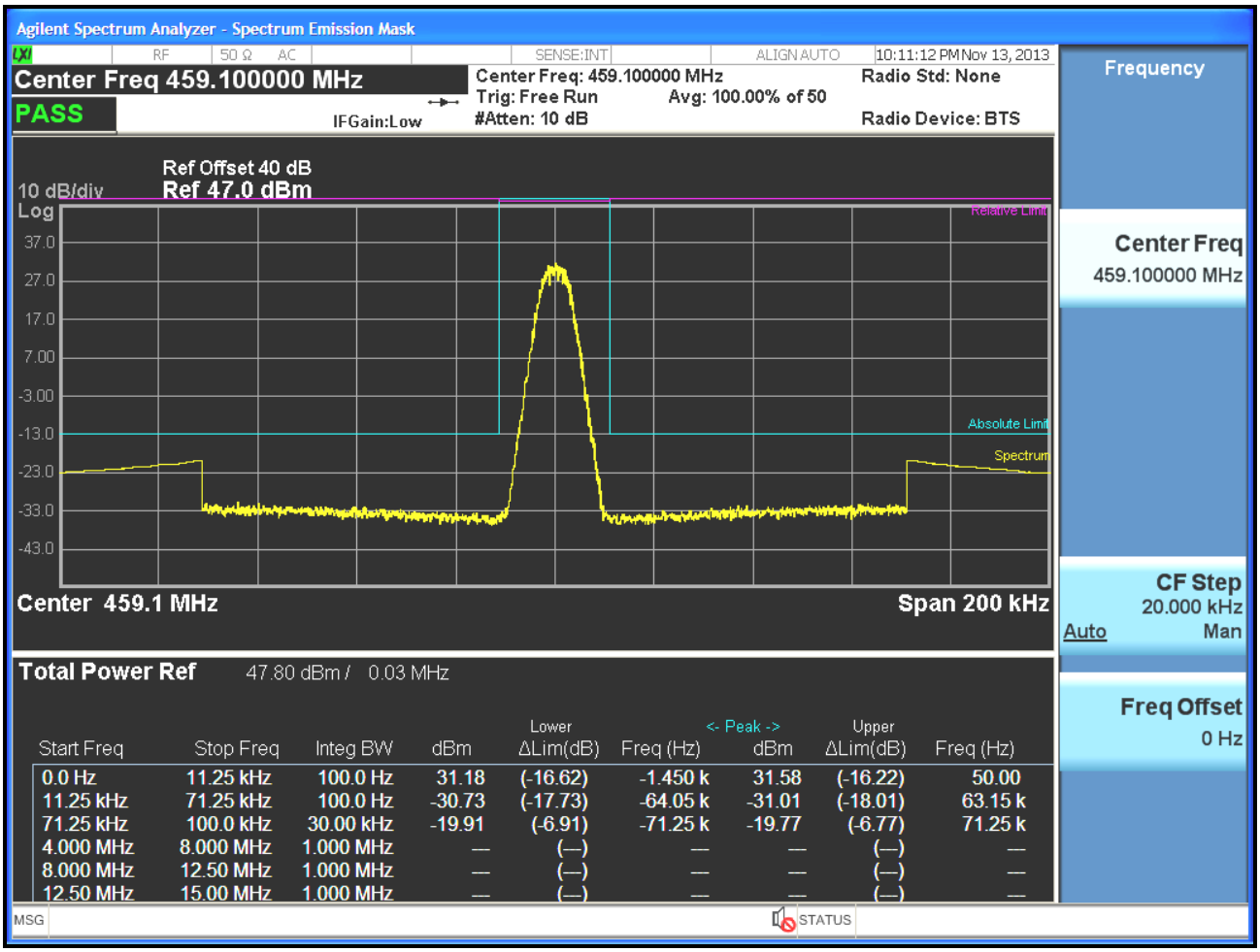


Plot 5-12: Occupied Bandwidth – 459.1 MHz; Part 22 Mask; WB Analog Voice



Plot 5-13: Occupied Bandwidth – 152.015 MHz; Part 22 Mask; H-CPM

Plot 5-14: Occupied Bandwidth – 459.1 MHz; Part 22 Mask; H-CPM

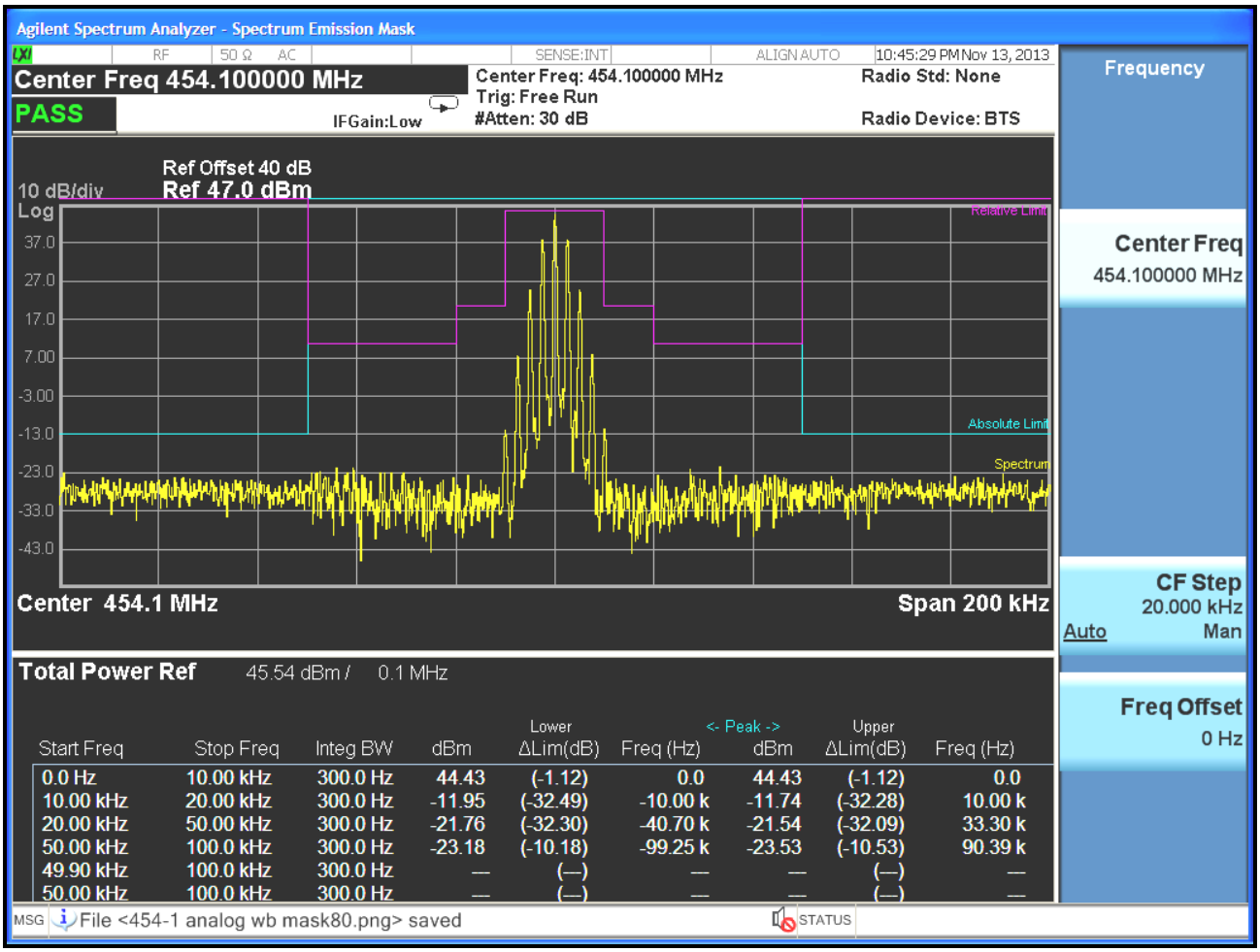


Plot 5-15: Occupied Bandwidth – 152.015 MHz; Part 22 Mask; P25

Plot 5-16: Occupied Bandwidth – 459.1 MHz; Part 22 Mask; P25

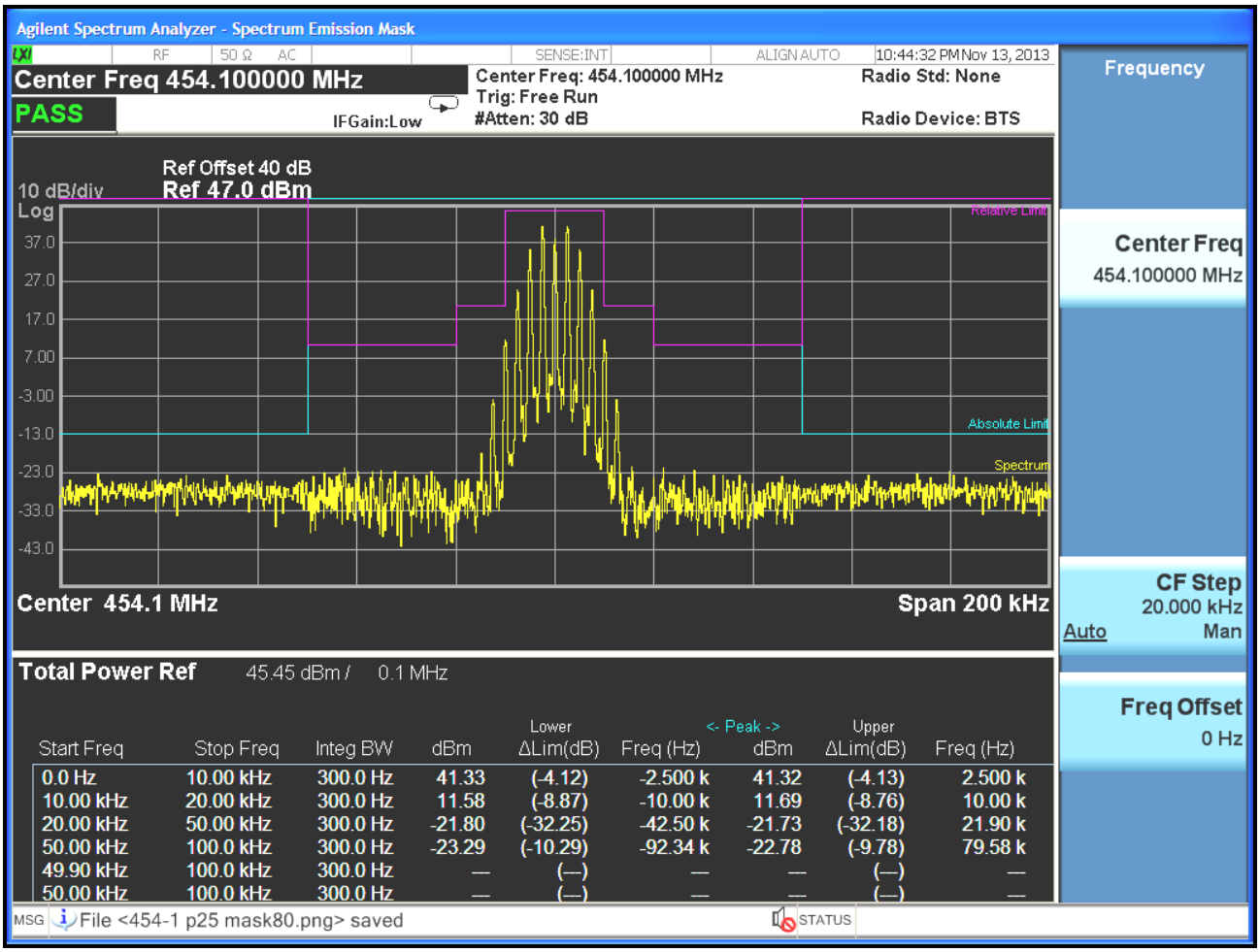
Plot 5-17: Occupied Bandwidth – 156.8 MHz; Part 80 Mask; NB

Plot 5-18: Occupied Bandwidth – 454.1 MHz; Part 80 Mask; NB



Plot 5-19: Occupied Bandwidth – 156.8 MHz; Part 80 Mask; WB

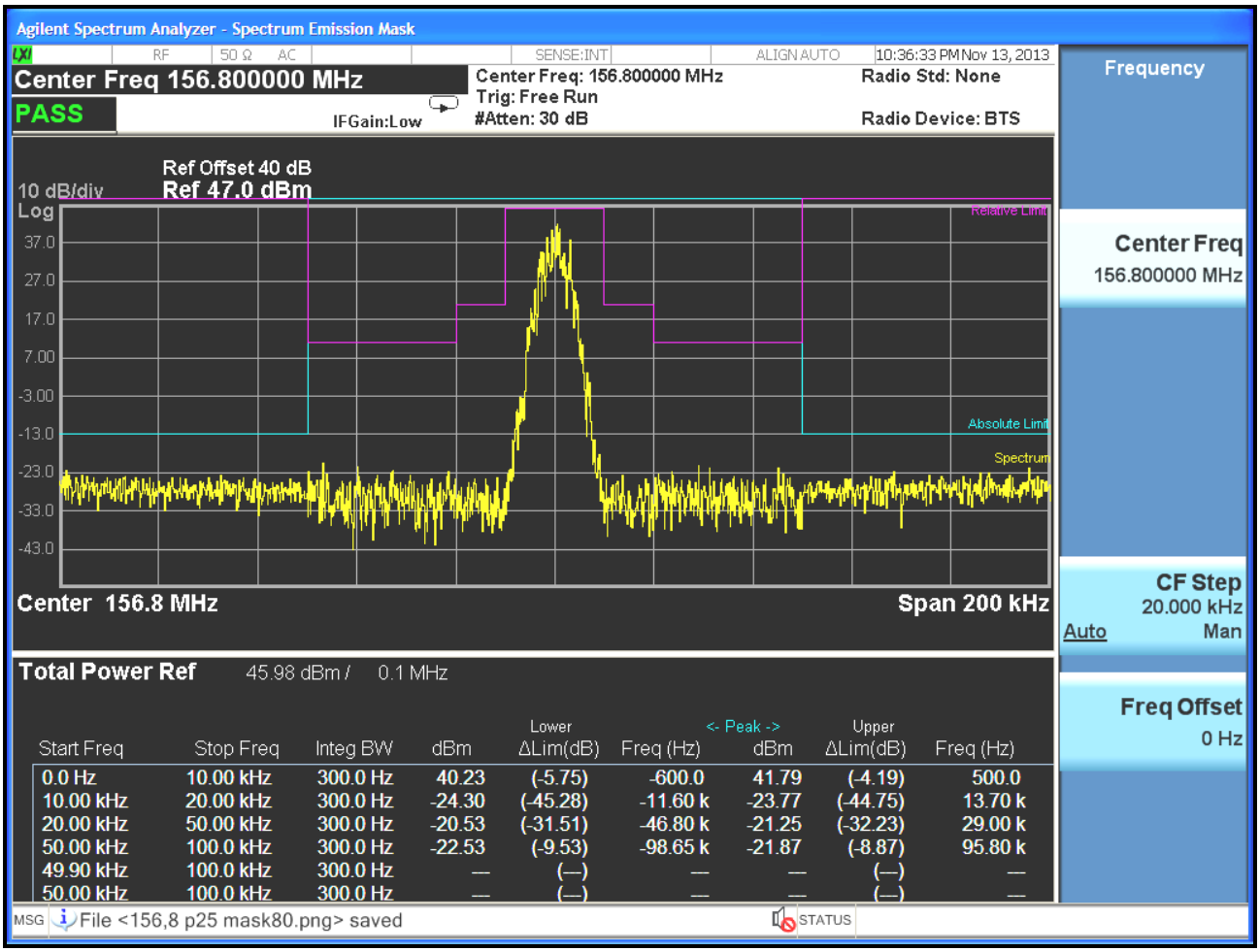
Plot 5-20: Occupied Bandwidth – 454.1 MHz; Part 80 Mask; WB



Plot 5-21: Occupied Bandwidth – 156.8 MHz; Part 80 Mask; P25

Plot 5-22: Occupied Bandwidth – 454.1 MHz; Part 80 Mask; P25

Plot 5-23: Occupied Bandwidth – 156.8 MHz; Part 80 Mask; H-CPM



Plot 5-24: Occupied Bandwidth – 454.1 MHz; Part 80 Mask; H-CPM

Table 5-1: Test Equipment Used for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	4/16/14
901536	Weinschel Corp.	48-40-34 DC-18GHz	Attenuator, 100W 40dB	BK5883	12/14/13

Test Personnel:

Daniel Baltzell		November 12-13, 2013
Test Engineer	Signature	Dates of Test

6 FCC Part 2.1053(a), 22.359(a), 80.211(f): Radiated Spurious Emissions

6.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.12

Analog Modulation: The transmitter is terminated with a 50 ohm 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.

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 was further corrected to a half wave dipole.

P_d(dBm) = P_g(dBm) – cable loss (dB) + antenna gain (dB)

where: P_d is the dipole equivalent power; P_g is the generator output power into the substitution antenna

6.2 Test Data

Limit = 43 + 10 Log (P) dB or 70 dB, whichever is greater. The worst case emissions test data are shown

The EUT transmitting at high power was determined to be the worst case emissions level and is reported in the following tables.

Table 6-1: Field Strength of Spurious Radiation – 152.015 MHz

60.1 dBc = Limit

Frequency (MHz)	Measured Level (dBuv)	Signal Gen. Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Margin (dB)
304.0300	89.4	-39.2	0.1	1.4	85.0	-24.9
456.0450	68.1	-56.3	0.1	1.7	101.8	-41.7
608.0600	28.0	-93.5	0.2	1.3	139.5	-79.4
760.0750	27.3	-88.6	0.2	0.9	135.0	-74.9
912.0900	26.1	-90.7	0.3	0.9	137.2	-77.1
1064.1050	33.2	-83.2	0.2	3.0	127.5	-67.4
1216.1200	30.6	-85.4	0.2	3.3	129.4	-69.3
1368.1350	35.3	-80.3	0.2	4.6	123.0	-62.9
1520.1500	41.8	-75.9	0.2	5.6	117.6	-57.5

Table 6-2: Field Strength of Spurious Radiation – 156.8 MHz

60.1 dBc = Limit

Frequency (MHz)	Measured Level (dBuv)	Signal Gen. Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Margin (dB)
313.6000	84.4	-40.1	0.1	1.5	85.8	-25.7
470.4000	63.4	-58.7	0.1	1.6	104.3	-44.2
627.2000	40.5	-78.2	0.2	1.3	124.2	-64.1
784.0000	29.8	-86.9	0.2	0.7	133.5	-73.4
940.8000	39.7	-77.0	0.3	1.1	123.3	-63.2
1097.6000	28.4	-90.7	0.2	2.9	135.1	-75.0
1254.4000	31.8	-84.1	0.2	3.7	127.7	-67.6
1411.2000	28.7	-86.8	0.2	4.8	129.3	-69.2
1568.0000	31.4	-83.7	0.3	6.3	124.8	-64.7

Table 6-3: Field Strength of Spurious Radiation – 454.1 MHz

60.0 dBc = Limit

Frequency (MHz)	Measured Level (dBuv)	Signal Gen. Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Margin (dB)
908.2000	74.3	-42.5	0.3	0.9	88.9	-28.9
1362.3000	61.8	-56.4	0.2	4.5	99.0	-39.0
1816.4000	60.2	-56.5	0.3	7.4	96.4	-36.4
2270.5000	72.8	-42.5	0.3	7.6	82.2	-22.2
2724.6000	60.0	-53.8	0.4	7.9	93.3	-33.3
3178.7000	39.4	-72.9	0.4	7.4	112.9	-52.9
3632.8000	46.9	-64.0	0.4	7.4	104.0	-44.0
4086.9000	28.3	-77.9	0.4	8.0	117.3	-57.3
4541.0000	32.9	-73.5	0.8	8.9	112.4	-52.4

Table 6-4: Field Strength of Spurious Radiation – 459.1 MHz

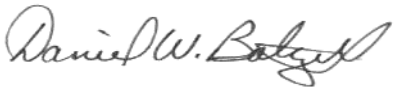
60.1 dBc = Limit

Frequency (MHz)	Measured Level (dBuv)	Signal Gen. Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Margin (dB)
918.2000	75.3	-41.5	0.3	1.0	88.0	-27.9
1377.3000	64.0	-54.2	0.2	4.6	96.9	-36.8
1836.4000	56.7	-60.0	0.3	7.2	100.2	-40.1
2295.5000	73.5	-41.7	0.3	7.7	81.4	-21.3
2754.6000	61.1	-50.9	0.4	8.0	90.4	-30.3
3213.7000	44.0	-68.2	0.4	7.4	108.4	-48.3
3672.8000	47.0	-63.8	0.6	7.3	104.2	-44.1
4131.9000	29.9	-76.4	0.5	8.3	115.7	-55.6
4591.0000	19.8	-87.0	0.4	9.0	125.5	-65.4

Table 6-5: Test Equipment Used for Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	1/31/14
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14
900905	Rhein Tech Laboratories	PR-1040	OATS 1 Preamplifier 40dB (30 MHz – 2 GHz)	1006	8/20/14
901158	Compliance Design, Inc.	Roberts Dipole Antenna	Adjustable Elements Dipole Antennas (25 - 1000 MHz)	00401	3/6/14
901262	ETS	3160-9	Double ridged Guide Antenna (1 - 18 GHz)	6748	5/11/14
900928	Hewlett Packard	83752A	Synthesized Sweeper (0.01 - 20 GHz)	3610A00866	3/20/15
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20’	NA	8/16/14
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	8/16/14
901594	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	8/16/14

Test Personnel:



Daniel Baltzell		November 1, 2013
Test Engineer	Signature	Date of Test

7 FCC Part 2.1047, 80.213(a)(2): Modulation Characteristics

Part 80.213(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 Part 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.

7.1 Test Procedures

7.1.1 Audio Frequency Response

ANSI/TIA-603-C-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)

7.1.2 Audio Low Pass Filter Response

ANSI/TIA-603-C-2004 Section 2.2.15

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

7.1.3 Modulation Limiting

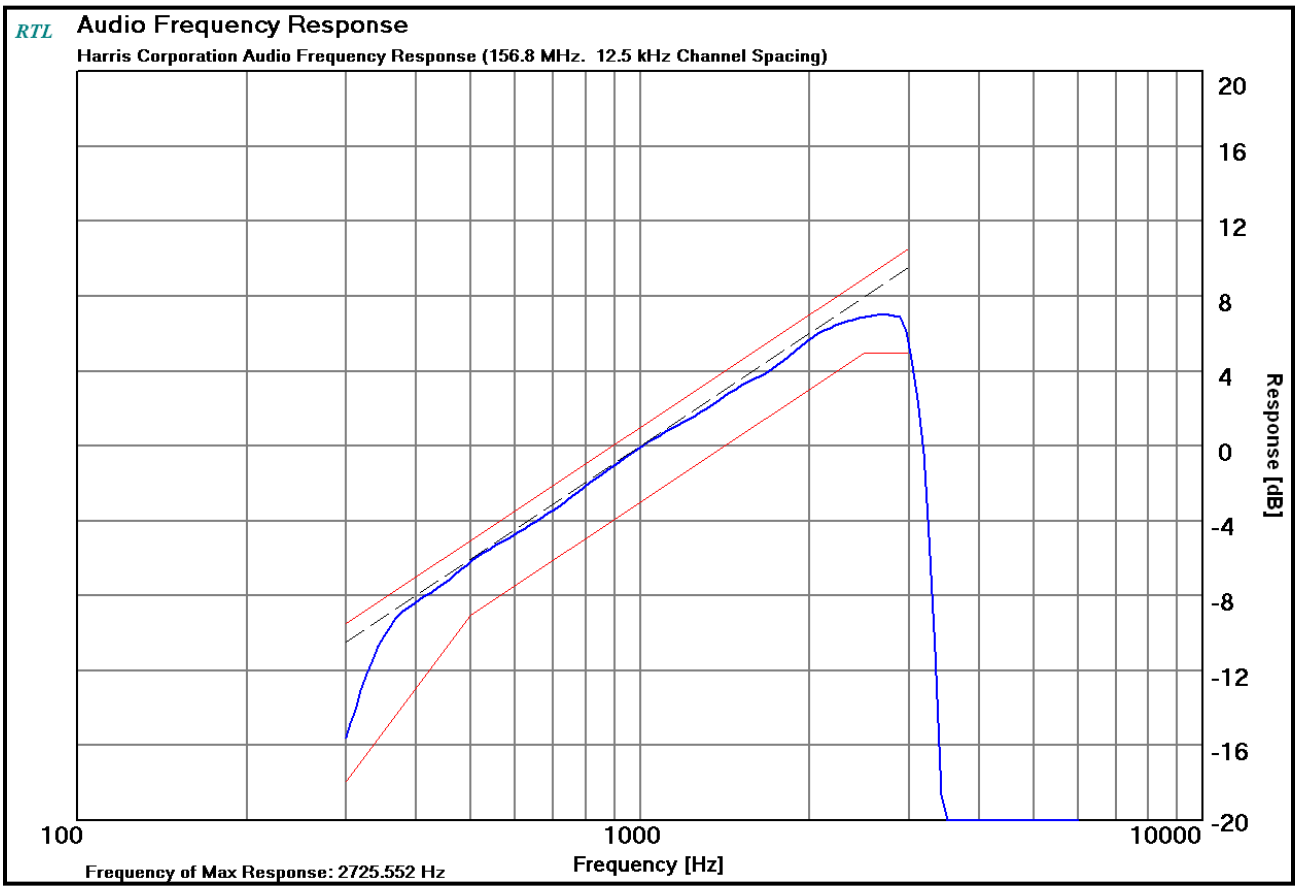
ANSI/TIA-603-C-2004 Section 2.2.3

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.

7.2 Test Data

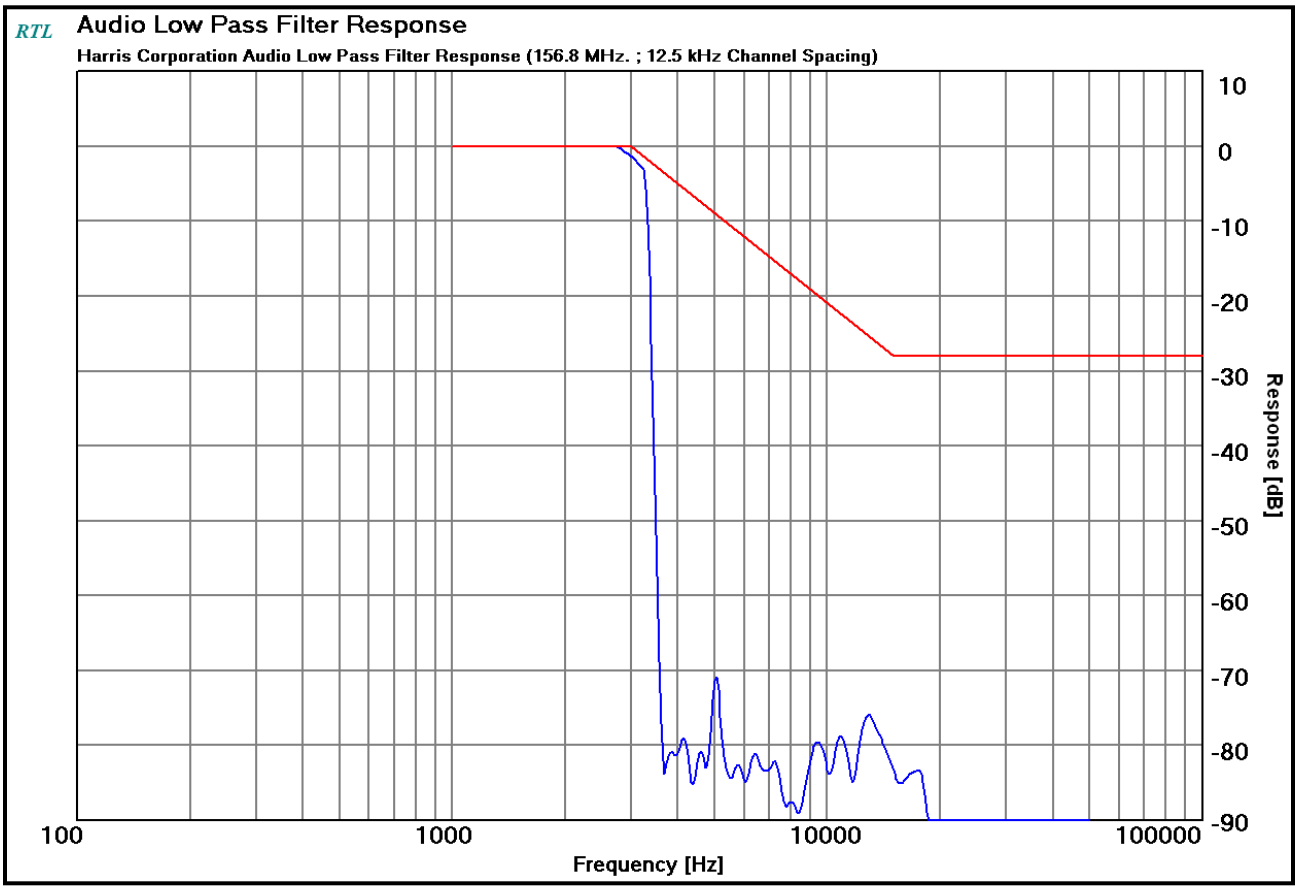
7.2.1 Audio Frequency Response

Plot 7-1: Modulation Characteristics – Audio Frequency Response – 156.8 MHz



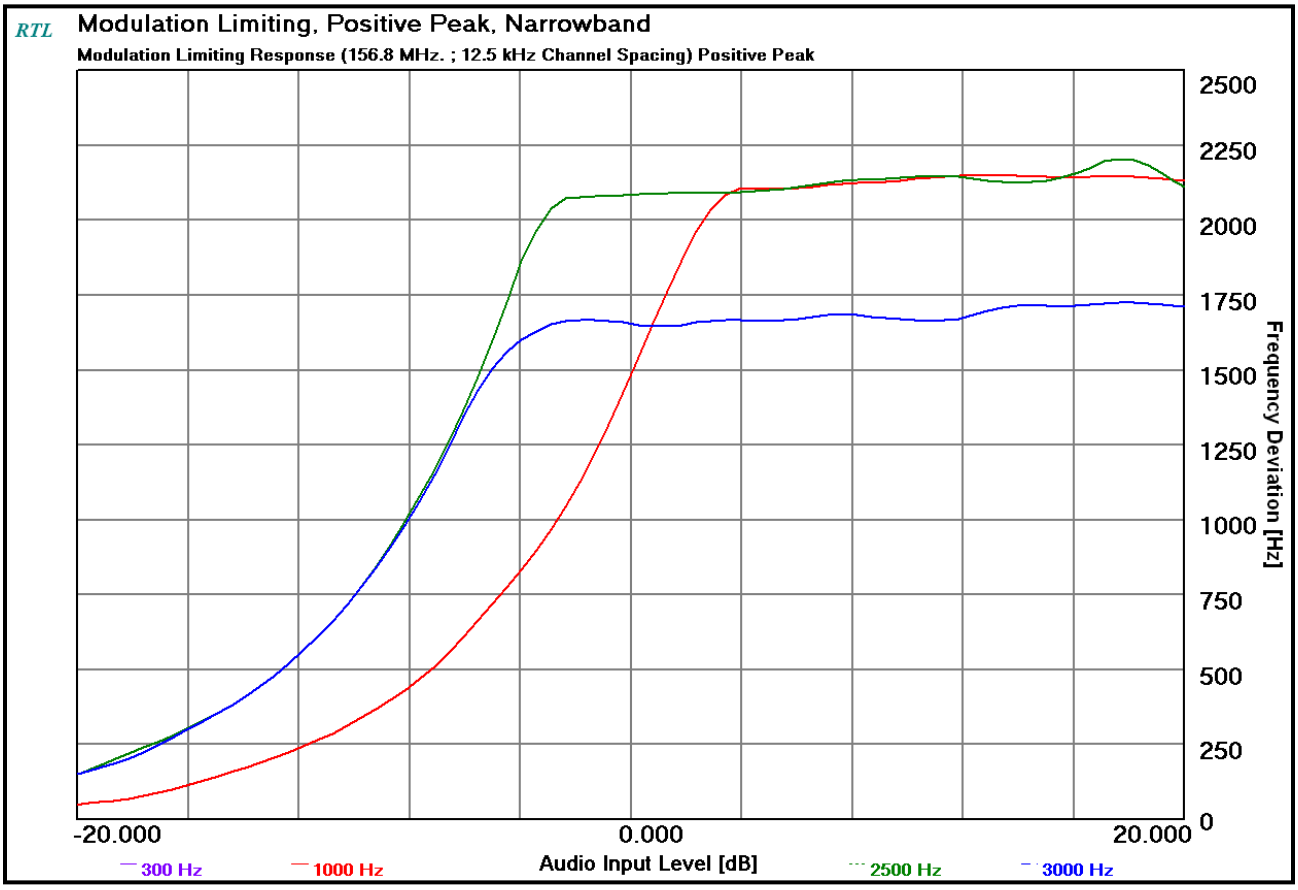
7.2.2 Audio Low Pass Filter Response

Plot 7-2: Modulation Characteristics – Audio Low Pass Filter – 156.8 MHz

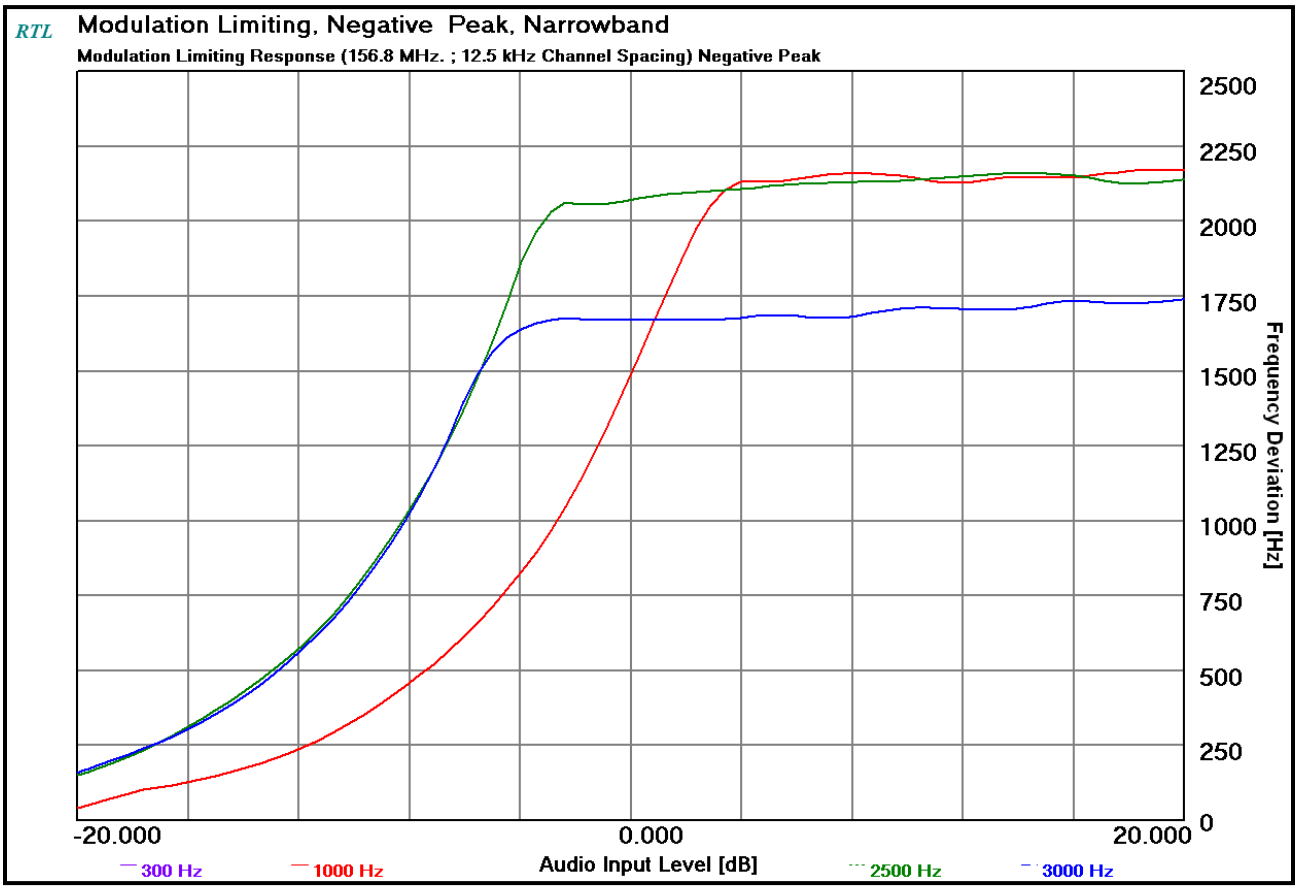


7.2.3 Modulation Limiting

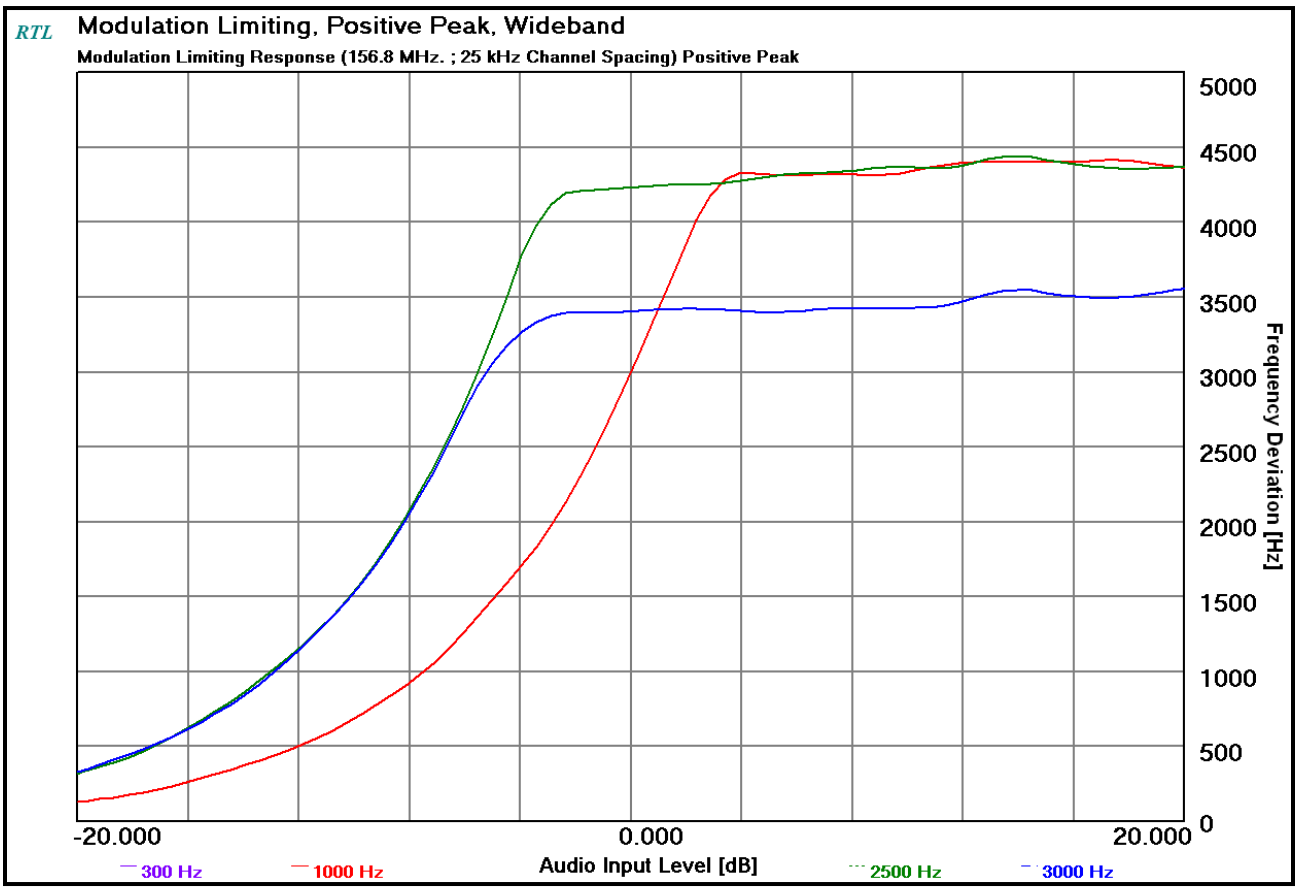
Plot 7-3: Modulation Characteristics – Modulation Limiting – 156.8 MHz; NB; Positive Peak



Plot 7-4: Modulation Characteristics – Modulation Limiting – 156.8 MHz; NB; Negative Peak



Plot 7-5: Modulation Characteristics – Modulation Limiting – 156.8 MHz; WB; Positive Peak



Plot 7-6: Modulation Characteristics – Modulation Limiting – 156.8 MHz; WB; Negative Peak

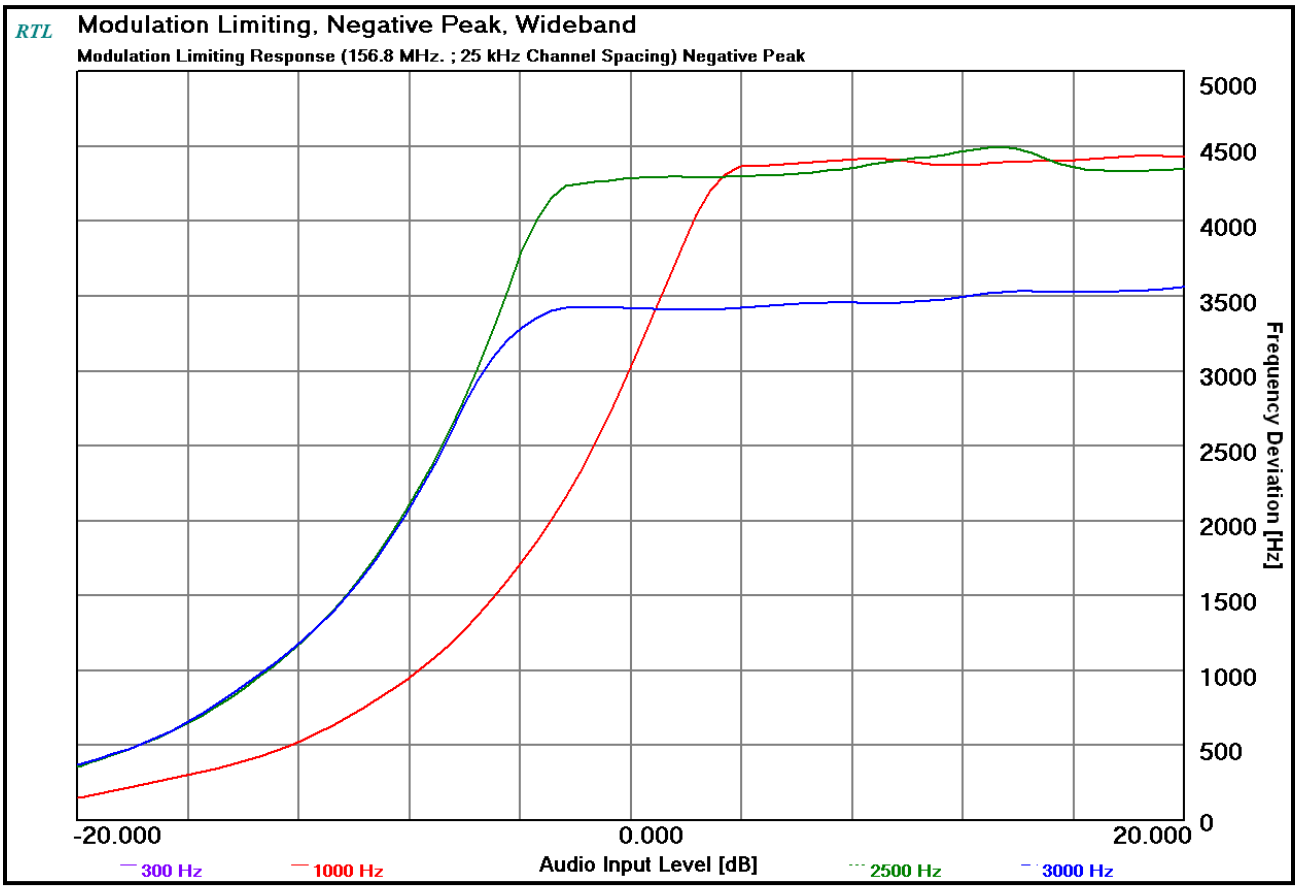


Table 7-1: Test Equipment Used for Testing Modulation Characteristics

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901057	Hewlett Packard	3336B	Synthesizer/ Level Generator	2514A02585	4/17/15
901118	Hewlett Packard	HP8901B	Modulation Analyzer (150 kHz – 1300 MHz)	2406A00178	4/1/15
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892	4/9/15
901537	Aeroflex	48-40-34	40 dB Attenuator	CB6628	12/14/13

Test Personnel:

Daniel Baltzell	Signature	November 13, 2013
Test Engineer		Date of Test

8 Conclusion

The data in this measurement report shows that the Harris Corporation. Model XG-100M VHF, UHF Mobile Radio, FCC ID: AQZ-XG-100M00, complies with all the applicable requirements of FCC Parts 2, 22 and 80.