RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

Class II Permissive Change Test Report

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Model: P5400 VHF Portable Radio

FCC ID: OWDTR-0044-E

October 11, 2013

Standards Referenced for this Report	
Part 2: 2012	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 22: 2012	Public Mobile Services
Part 80: 2012	Stations in the Maritime Services
TIA-EIA-603-C 2004	Land Portable FM or PM Communications Equipment - Measurement and Performance Standards

Frequency Range (MHz)	Rated Transmit Power (W) (Conducted)	Frequency Tolerance (ppm)	Emission Designator
136 – 174	5.0/0.5	0.55	11K0F3E (Analog Voice; NB)
136 – 174	5.0/0.5	0.55	10K8F1D (Digital 2-FSK; 9600 Data; NB)
136 – 174	5.0/0.5	0.55	10K8F1E (Digital 2-FSK; 9600 Data Voice; NB)
136 – 174	5.0/0.5	0.55	7K80F1D (Digital 2-FSK; 4800 Data; NB)
136 – 174	5.0/0.5	0.55	7K80F1E (Digital 2-FSK; 4800 Data Voice; NB)
136 – 174	5.0/0.5	0.55	8K40F1D (Digital C4FM; 9600 Data; NB)
136 – 174	5.0/0.5	0.55	8K40F1E (Digital C4FM; 9600 Data Voice; NB)

Report Prepared by Test Engineer: Dan Baltzell

Document Number: 2013164

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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 General Information

This Class II Permissive Change 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 **P5400 VHF Portable; FCC ID: OWDTR-0044-E**. The test results reported in this document relate only to the item that was tested.

All measurements contained in this application were conducted in accordance with FCC Rules and Regulations CFR 47 Part 22 and Part 80. Calibration checks are performed regularly on the instruments, and all accessories including high pass filter, coaxial attenuator, preamplifier and cables.

1.1 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.

1.2 Related Submittal(s)/Grant(s)

The original grant was issued on March 2, 2008, with a Class II permissive change granted on July 29, 2010.

This is a Class II Permissive Change to add Part 22 and Part 80 operation. There have been no hardware changes.

1.3 Grant Notes

Conducted power shown is rated power. Actual measured conducted power is shown in the test report.

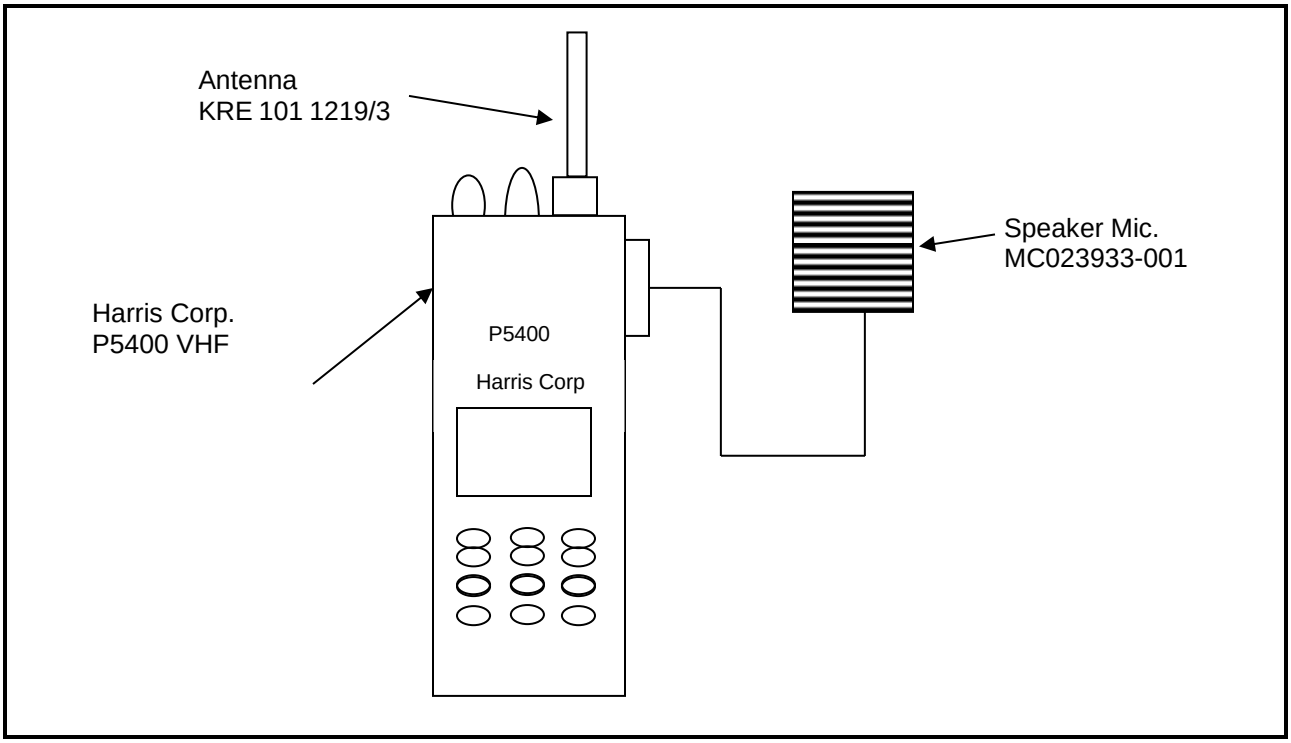
2 Tested System Details

The test sample was received on September 27, 2013. Listed below are the identifiers and descriptions of all equipment, cables, and internal devices used with the EUT for this testing, as applicable.

Table 2-1: Equipment under Test (EUT)

Part	Manufacturer	Model	Serial Number	FCC ID	Cable Description	RTL Bar Code
VHF Portable Radio	Harris Corp.	P5400	A40113000628	OWDTR-0044-E	N/A	20664
VHF Portable Radio	Harris Corp.	P5400	A4011300062A	OWDTR-0044-E	N/A	20665
VHF Portable Radio	Harris Corp.	P5400	A401130005E0	OWDTR-0044-E	N/A	21305
Antenna	Harris Corp.	KRE 101 1219/3	N/A	N/A	N/A	20650
7.5V NiCd Battery	Harris Corp.	BT-023406-001 Rev D	N/A	N/A	N/A	20659
7.5V NiMH Battery	Harris Corp.	BT023406-004 Rev D	BRFM	N/A	N/A	20660
7.5V NiMH Battery	Harris Corp.	BT023406-005 Rev E	FSAM	N/A	N/A	21306
Microphone	Harris Corp.	MC023933-001	N/A	N/A	0.7m unshielded I/O	18157

Figure 2-1: Configuration of Tested System



3 FCC Rules and Regulations Part §2.1046(a): RF Power Output: Conducted; Part 80.215 Transmitter Power

3.1 Test Procedure

ANSI TIA-603-C-2004, section 2.2.1

The EUT was connected with 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 (W)*
156.00	5.2
156.80	5.2
157.77	5.5
157.80	5.5
157.83	5.5
157.86	5.5
157.89	5.5
157.92	5.5
157.95	5.5
157.98	5.5
158.01	5.5
158.04	5.5
158.07	5.5
158.49	5.5
158.52	5.5
158.55	5.5
158.58	5.5
158.61	5.5
158.64	5.5
158.67	5.5
162.00	5.2

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

Table 3-2: RF Power Output (Rated Power)

Rated Power (W)
5

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

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	12/14/13
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 20dB	BK5859	3/25/16
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14

Test Personnel:

Daniel Baltzell		May 7, 2012/October 8, 2013
Test Engineer	Signature	Dates of Test

4 FCC Rules and Regulations Part §2.1051: Spurious Emissions at Antenna Terminals; Part §22.359: Emissions Limitations; Part 80.211 Emission Limitations

4.1 Test Procedure

ANSI TIA-603-C-2004, Section 2.2.13.

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.

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.

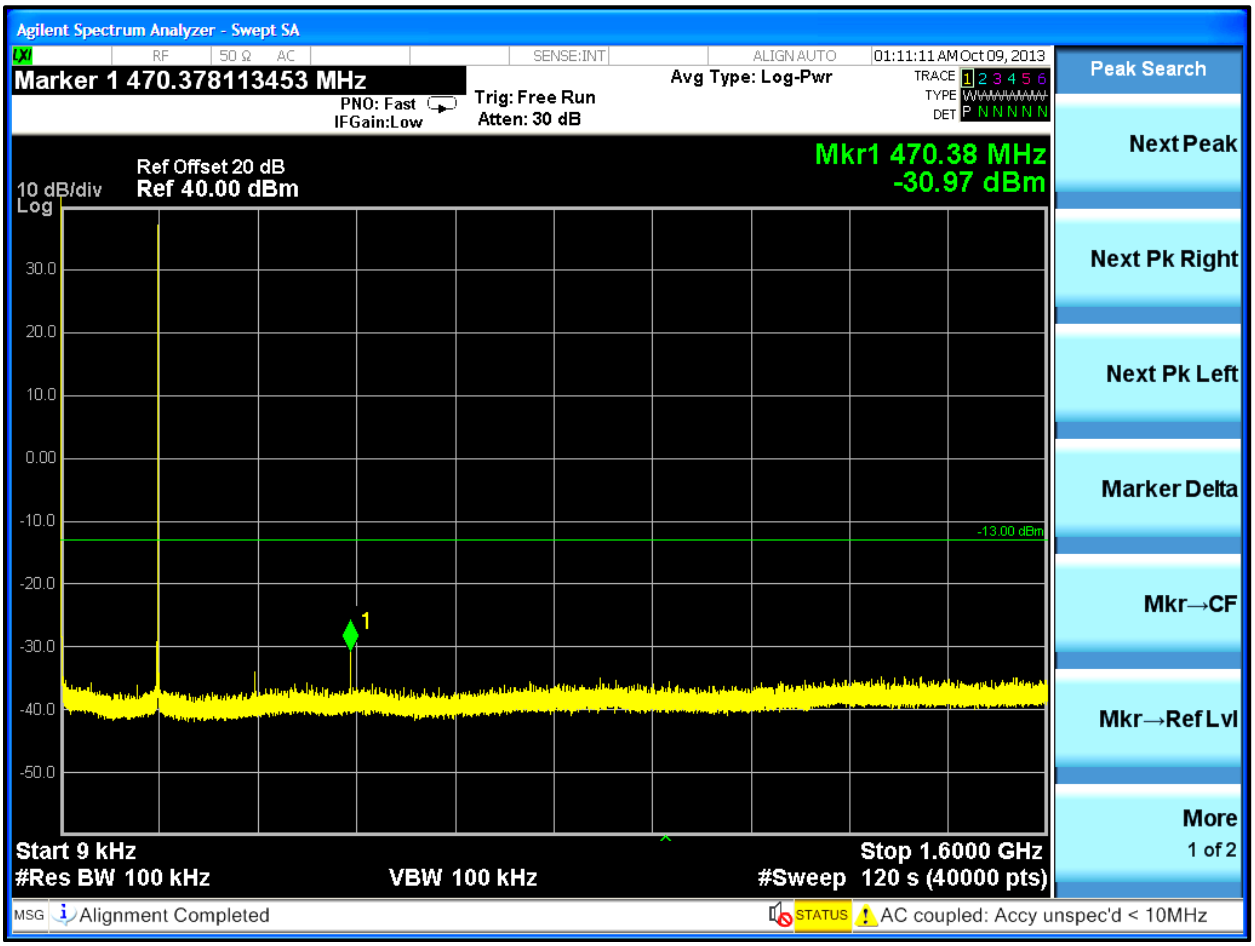
4.2 Test Data

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

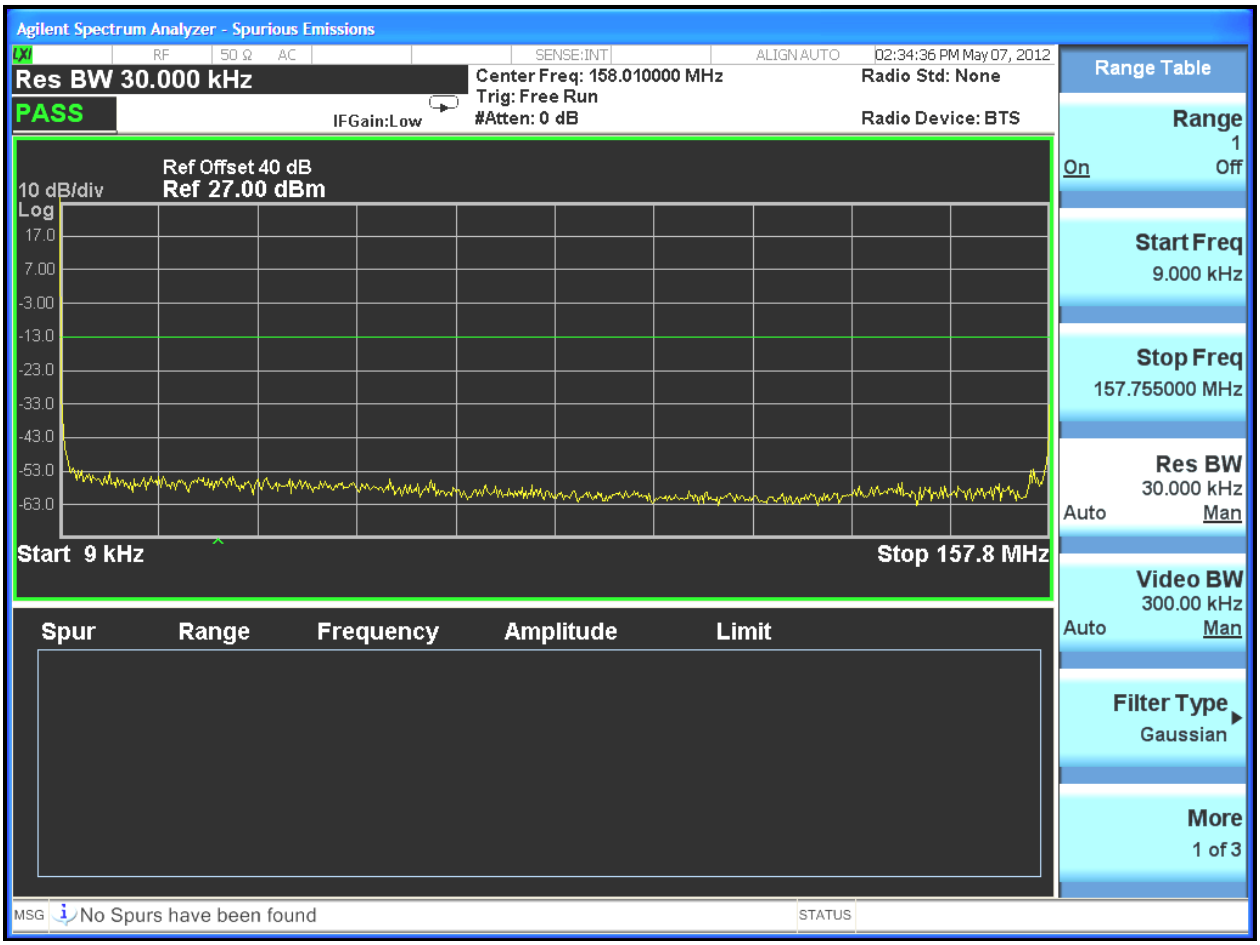
Limit = 43 + 10 Log (P) dB or 70 dB, whichever is greater.

The worst case (unwanted emissions) channels are shown.

Plot 4-1: Spurious Emissions at Antenna Terminals – 156.8 MHz



Plot 4-2: Spurious Emissions at Antenna Terminals - 158.01 MHz; 9 kHz - 157.8 MHz



Plot 4-3: Spurious Emissions at Antenna Terminals - 158.01 MHz; 158.7 MHz – 1.6 GHz

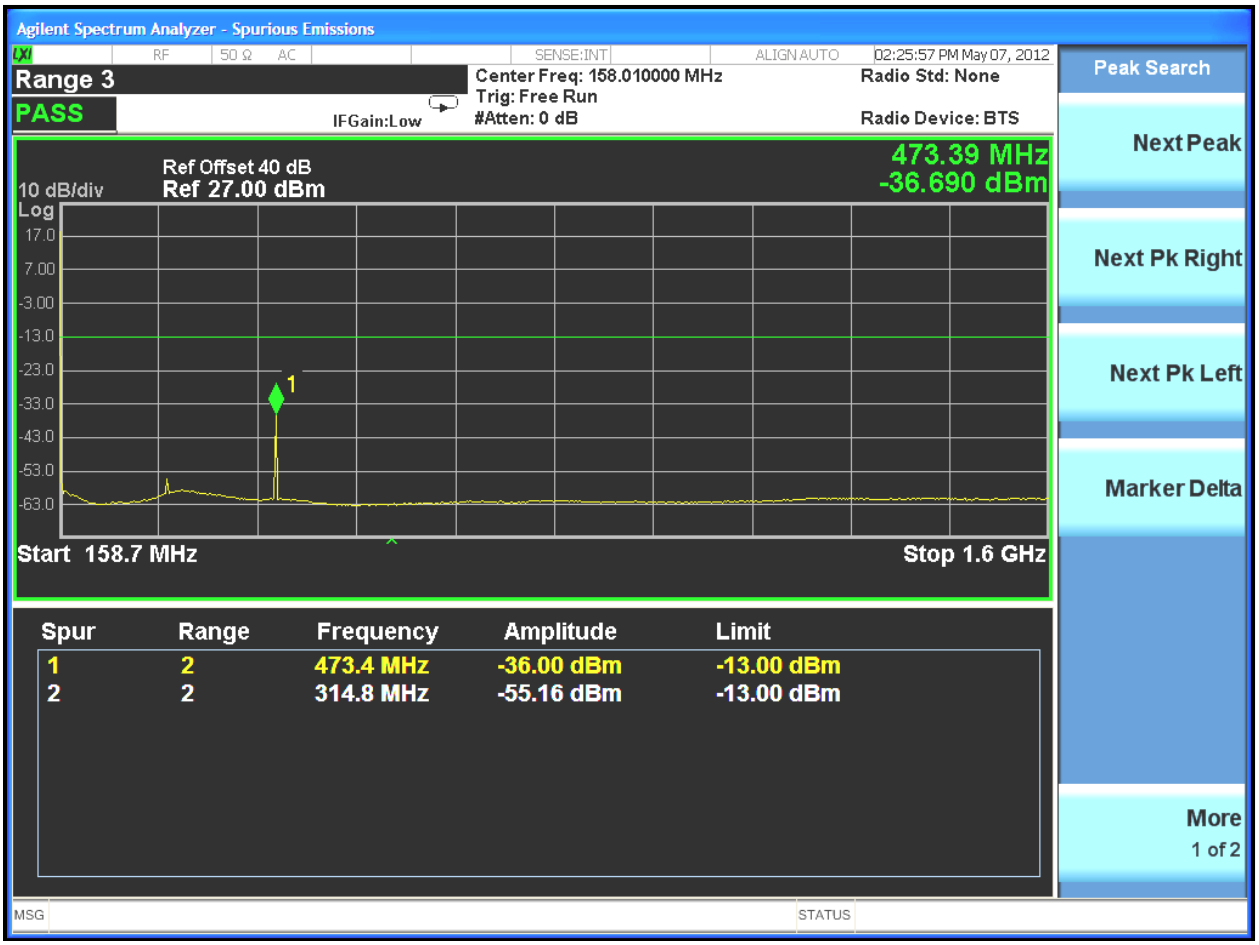


Table 4-1: Test Equipment for Testing Conducted Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	12/14/13
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 20dB	BK5859	3/25/16
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14

Test Personnel:

Daniel Baltzell		May 7, 2012/October 8, 2013
Test Engineer	Signature	Dates of Test

5 FCC Rules and Regulations Part §2.1053(a): Field Strength of Spurious Radiation; Part 80.211 Emission Limitations

5.1 Test Procedure

ANSI TIA-603-C-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.

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

5.2 Test Data

5.2.1 CFR 47 Part §22.359: Emissions Limitations

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 5-1: Field Strength of Spurious Radiation – 156.8 MHz; Narrow Band; High Power

50.2 dBc = Limit

Frequency (MHz)	Measured Level (dBuv)	Signal Gen. Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Margin (dB)
313.6	36.5	-91.7	0.1	1.5	127.5	-77.3
470.4	44.4	-77.7	0.1	1.6	113.4	-63.2
627.2	45.3	-73.4	0.2	1.3	109.5	-59.3
784.0	41.9	-74.8	0.2	0.7	111.5	-61.3
940.8	36.7	-80.0	0.3	1.1	116.4	-66.2
1097.6	26.2	-90.1	0.2	2.9	124.6	-74.4
1254.4	24.3	-91.6	0.2	3.7	125.3	-75.1
1411.2	32.0	-86.0	0.2	4.8	118.6	-68.4
1568.0	32.8	-84.7	0.3	6.3	115.9	-65.7

Table 5-2: Field Strength of Spurious Radiation – 158.01 MHz; Narrow Band; High Power

50.4 dBc = Limit

Frequency (MHz)	Measured Level (dBuv)	Signal Gen. Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd)	Corrected Level (dBc)	Margin (dB)
316.020	75.6	-40.5	0.4	1.5	76.8	-26.4
474.030	79.5	-27.9	0.4	1.6	64.1	-13.7
632.040	51.2	-58.3	0.5	1.3	94.9	-44.5
790.050	58.6	-45.1	0.5	0.7	82.3	-31.9
948.060	43.7	-56.2	0.6	1.2	93.0	-42.6
1106.070	52.8	-47.6	0.6	6.4	79.2	-28.8
1264.080	36.7	-60.9	0.6	7.2	91.7	-41.3
1422.090	44.3	-48.3	0.7	8.1	78.3	-27.9
1580.100	34.2	-58.0	0.7	8.8	87.3	-36.9

Table 5-3: Test Equipment 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	2/2/14
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
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 kHz - 3200 MHz)	3537A01741	2/2/14
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20’	NA	8/27/14
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	8/27/14
901594	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	8/27/14
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14
901629	Teledyne Cougar	A4C2123	Amplifier	003-003	9/4/14

Test Personnel:

Daniel Baltzell		May 7, 2012/October 8, 2013
Test Engineer	Signature	Dates of Test

6 FCC Rules and Regulations Part §2.1049: Occupied Bandwidth; Part §22.359(b): Emission Limitations; Part 80.205 Occupied Bandwidth

6.1 Test Procedure

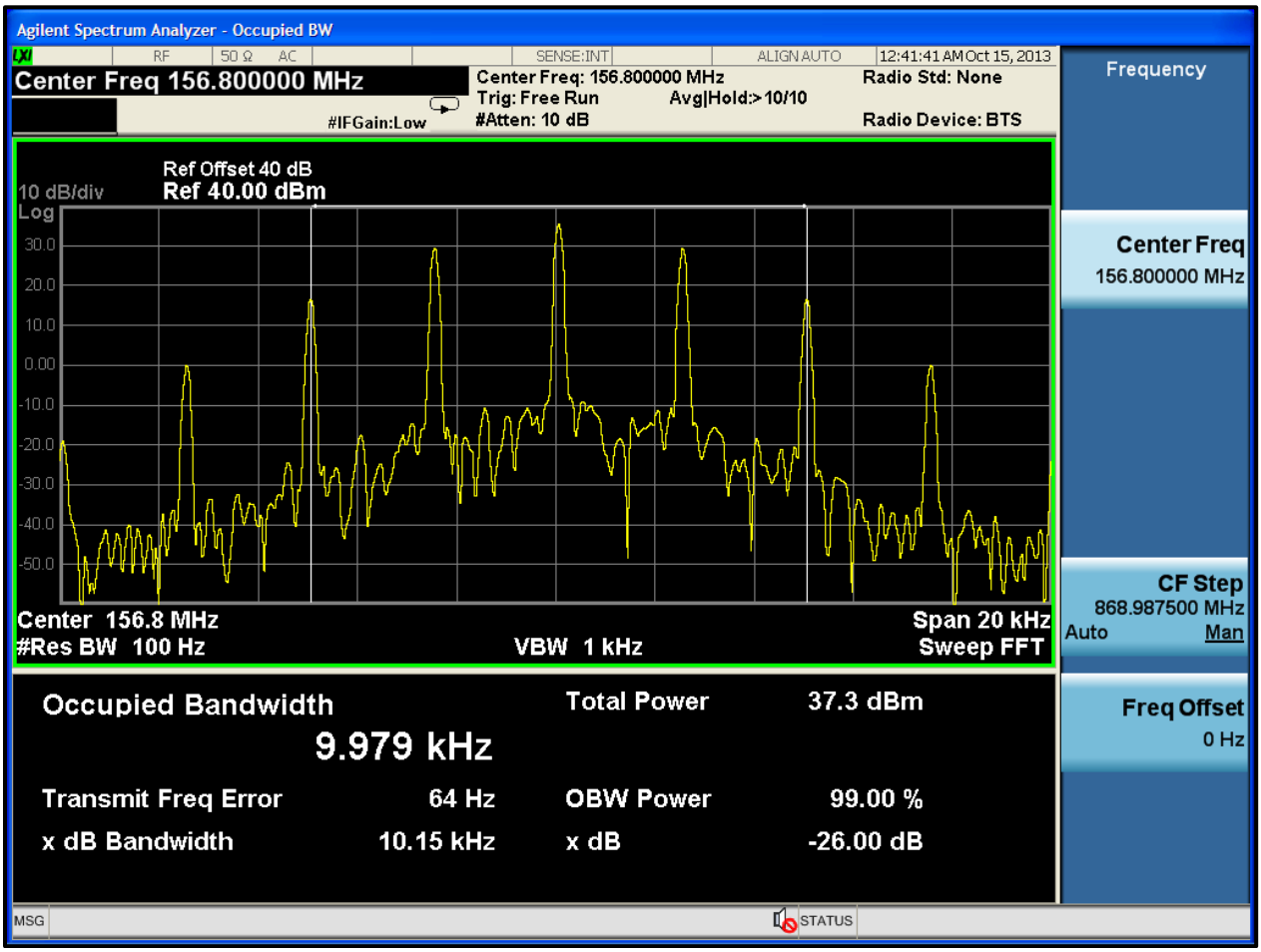
ANSI TIA-603-C-2004, Section 2.2.11.

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.

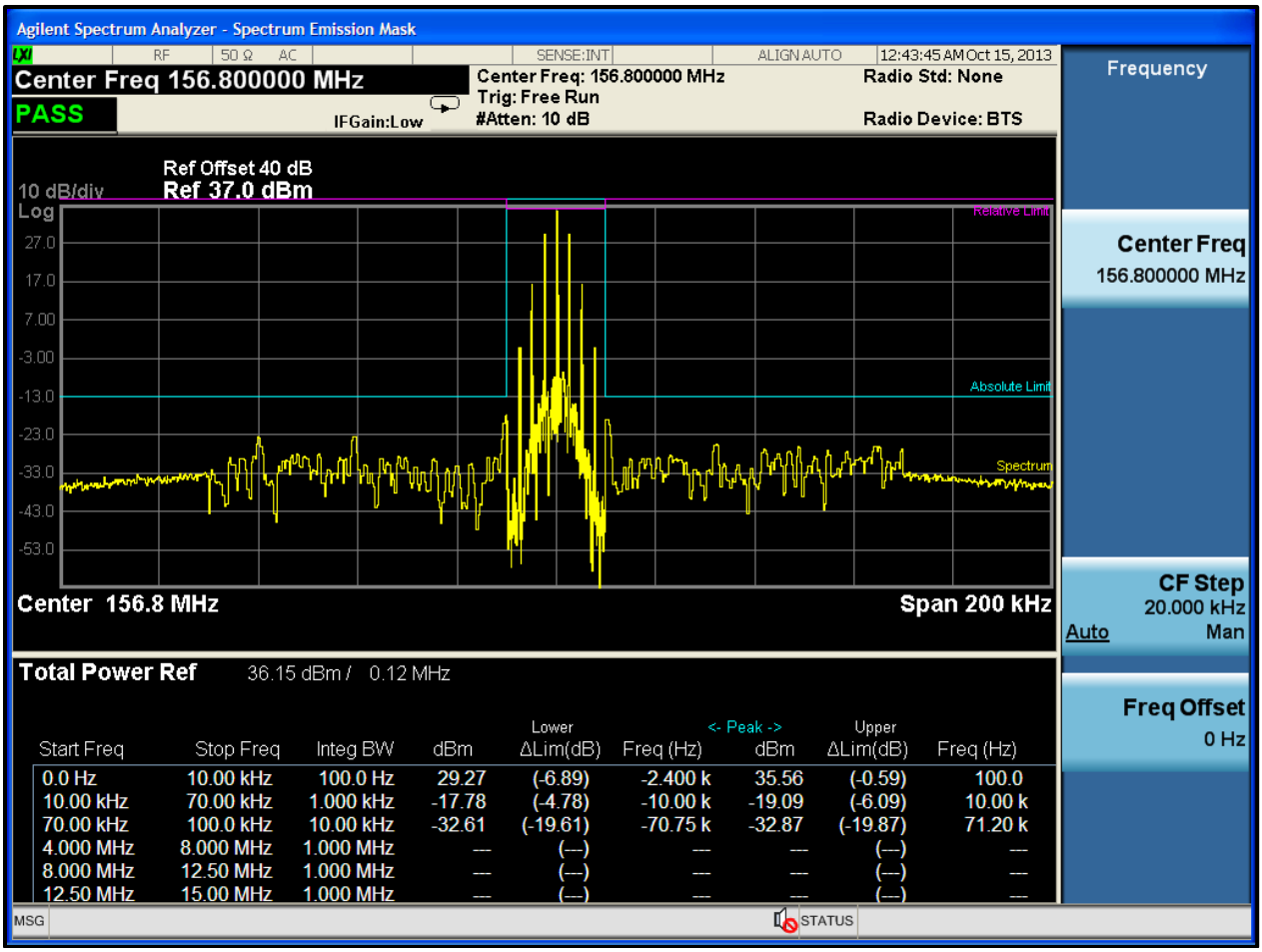
§22.359 (b) Measurement procedure: Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 30 kHz or more. In the 60 kHz bands immediately outside and adjacent to the authorized frequency range or channel, a resolution bandwidth of at least one 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.

6.2 Test Data

Plot 6-1: Occupied Bandwidth – 156.8 MHz; Analog



Plot 6-2: Occupied Bandwidth – 156.8 MHz; Analog; Mask (Part 22)

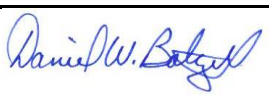


Plot 6-3: Occupied Bandwidth – 158.01 MHz; Analog; Mask (Part 80)

Table 6-1: Test Equipment for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	12/14/13
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz - 26.5 GHz)	MY51250846	4/16/14

Test Personnel:

Daniel Baltzell		May 11, 2012/October 15, 2013
Test Engineer	Signature	Dates of Test

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

7.1 Test Procedures

7.1.1 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)

7.1.2 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.

7.1.3 Modulation Limiting

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

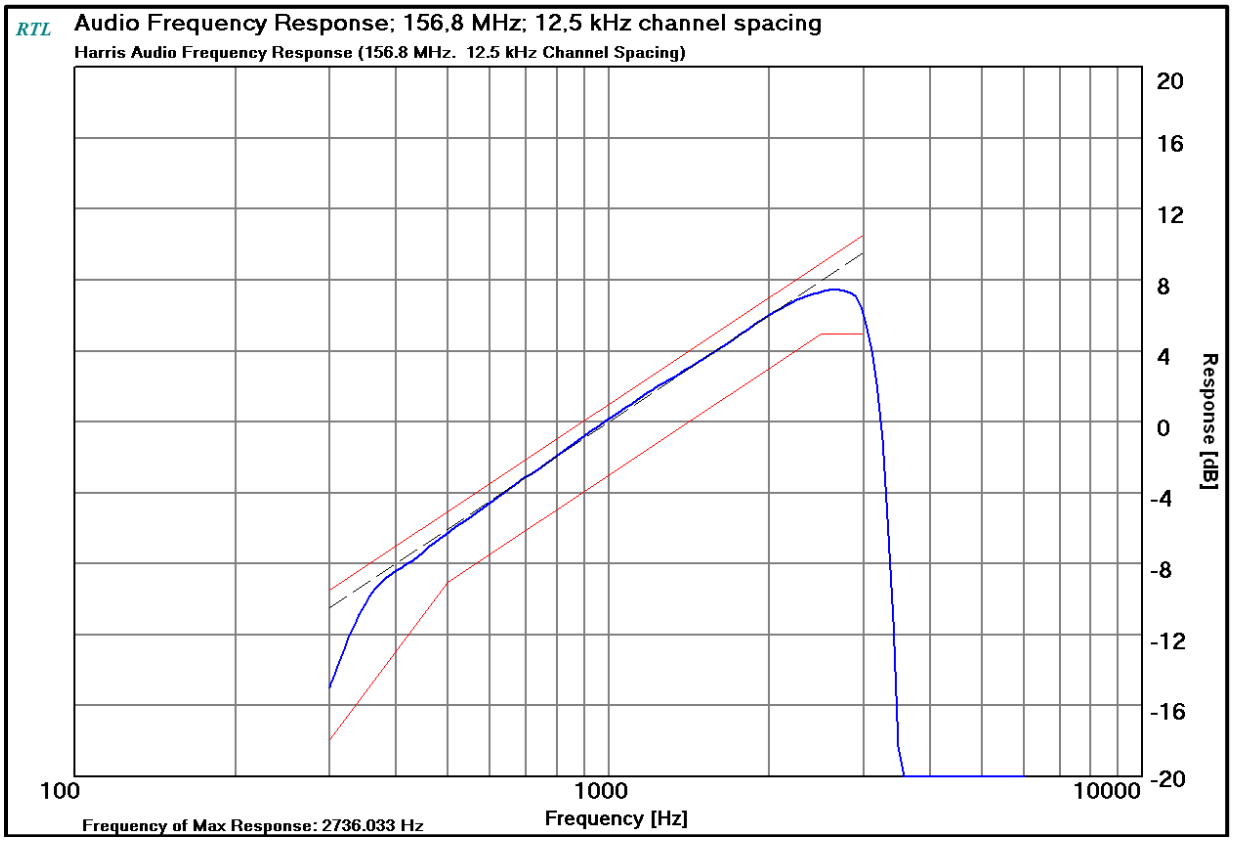
The transmitter was adjusted for full rated system deviation. The audio input level was adjusted for 60% of rated system deviation at 1000 Hz. Using this level (0 dB) as a reference, the audio input level was varied from the reference +/-20 dB for modulation frequencies of 300 Hz, 1000 Hz, and 2500 Hz. The system deviation obtained as a function of the input level was recorded. Both positive and negative peak deviations were recorded.

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.

7.2 Test Data

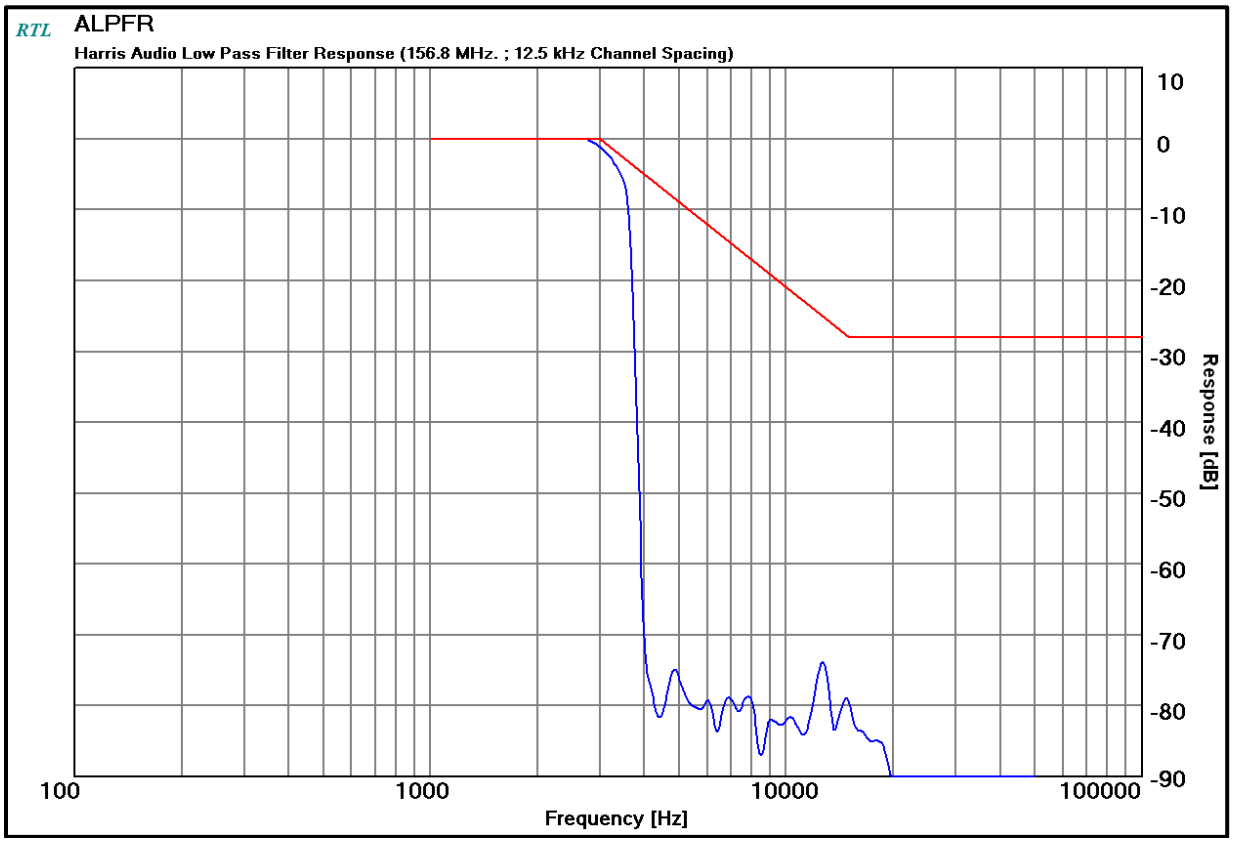
7.2.1 Audio Frequency Response

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



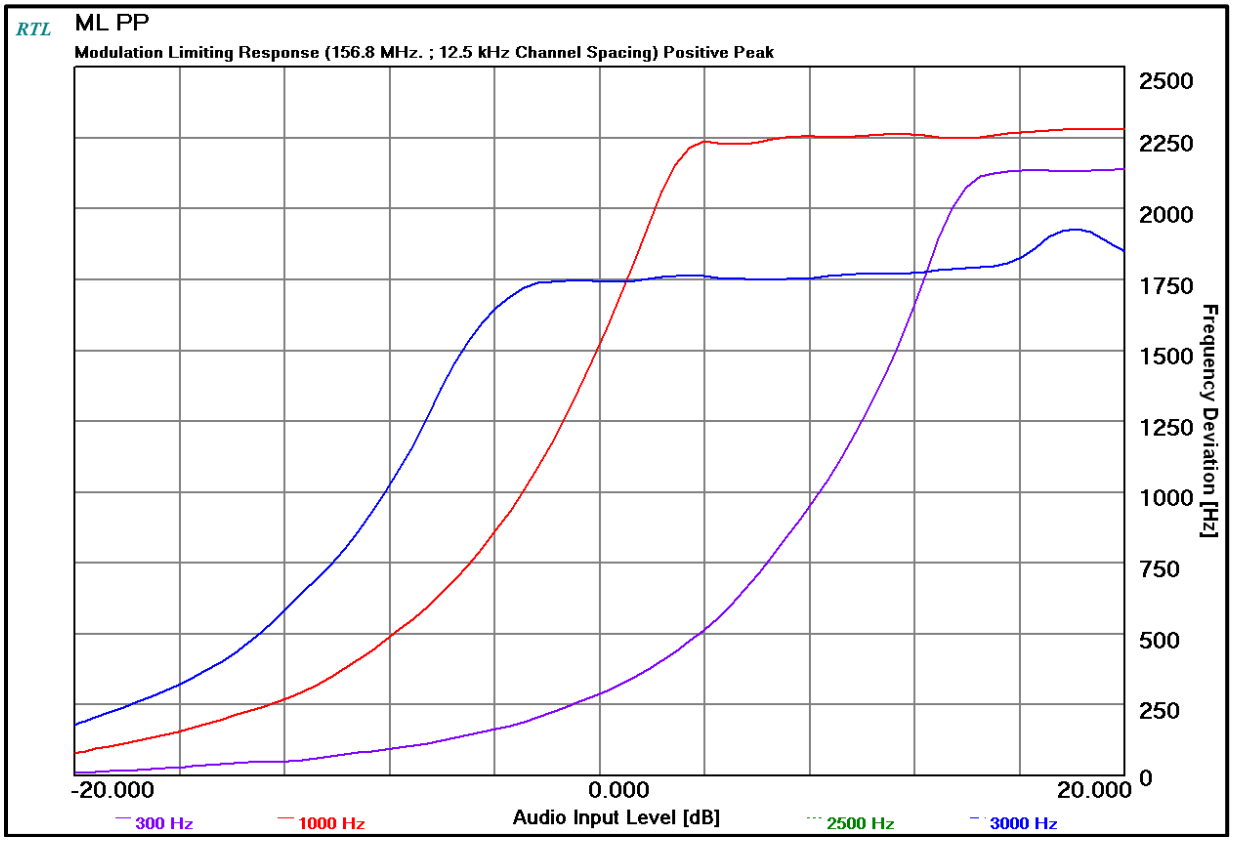
7.2.2 Audio Low Pass Filter Response

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

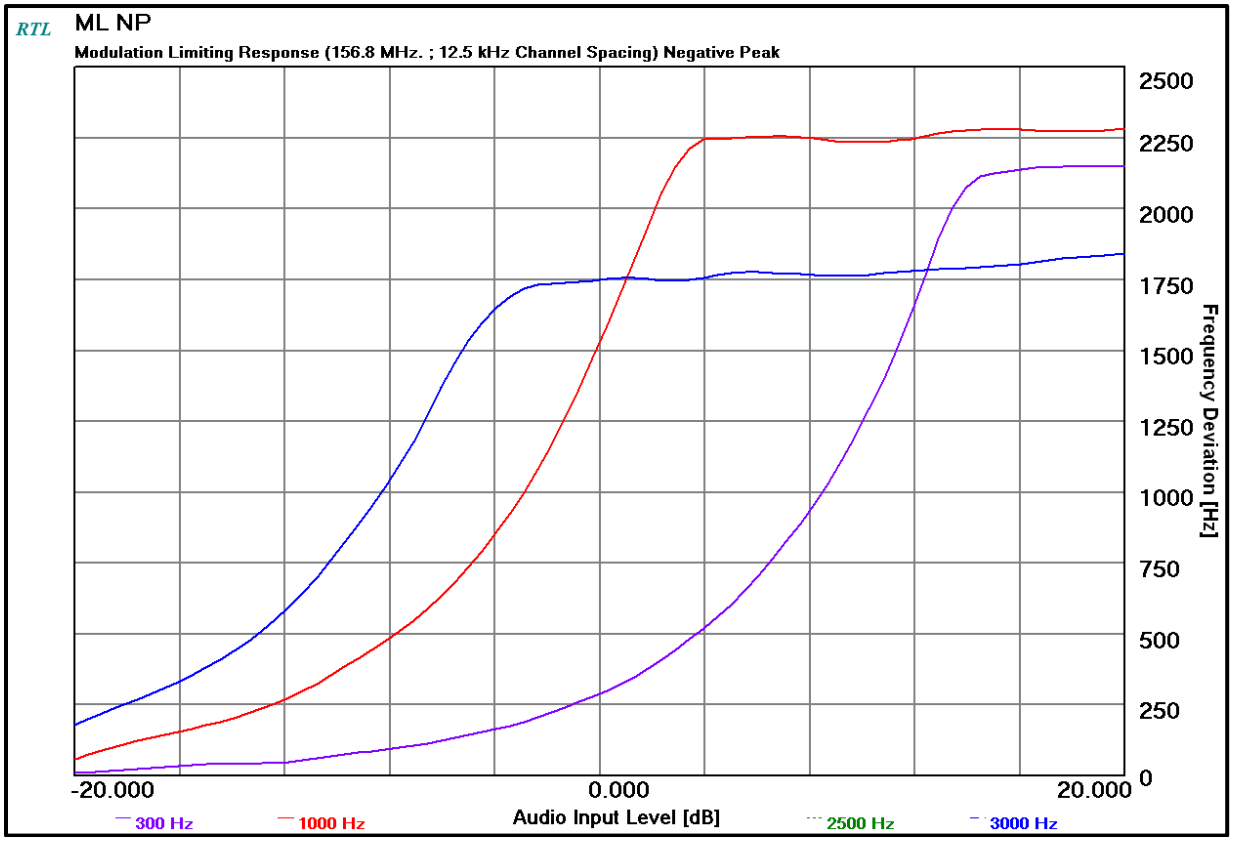


Table 7-1: Test Equipment Used For Testing Field Strength of Spurious Radiation

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
901139	Weinschel Corp.	48-20-34 DC-18GHz	Attenuator, 100W 20dB	BK5859	3/25/16

Test Personnel:

Daniel Baltzell		October 8, 2013
Test Engineer	Signature	Date of Tests

8 Conclusion

The data in this measurement report shows that the **Harris Corporation**. Model **P5400 VHF Portable, FCC ID: OWDTR-0044-E**, complies with all the applicable requirements of Parts 2, 22, and 80 of the FCC Rules and qualifies for a Class II permissive change.