RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

FCC & IC Certification Report

Harris Corporation
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Model: XG-15P UHF-H
Portable Radio

FCC ID: OWDTR-0136-E
IC: 3636B-0136

September 18, 2015

Standards Referenced for this Report	
Part 2: 2014	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
Part 22: 2014	Public Mobile Services
Part 74: 2014	Experimental Radio, Auxiliary, Special Broadcast and Other Program Distributional Services
Part 80: 2014	Stations in the Maritime Services
Part 90: 2014	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-102.CAAB-A-2002	Land Mobile Radio Transceiver Performance Recommendations - Project 25 - Digital Radio Technology, C4FM/CQPSK Modulation
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
RSS-119 Issue 11	Land Mobile and Fixed Radio Transmitters and Receivers 27.41 to 960.0 MHz
SRSP-501	Technical Requirements for Land Mobile and Fixed Radio Services Operating in the Bands 406.1-430 MHz and 450-470 MHz

Report Prepared By: Daniel Baltzell
Document Number: 2015156

These test(s) are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation AT-1445.

FCC Rule Parts	Frequency Range (MHz)	Rated Conducted Output Power (W)	Frequency Tolerance (ppm)	Transmit Mode	Emission Designator
22, 74, 80, 90	440-512 (FCC/Federal) 450-470 (IC)	5.0	0.2	2-level FSK 9600 Data/ Digital Voice FM	11K7F1D 11K7F1E
22, 74, 80, 90	440-512 (FCC/Federal) 450-470 (IC)	5.0	0.2	Analog FM Narrowband	11K0F3E
22, 74, 80, 90	440-512 (FCC/Federal) 450-470 (IC)	5.0	0.2	H-CPM Data & Voice	8K10DXW
22, 74, 80, 90	440-512 (FCC/Federal) 450-470 (IC)	5.0	0.2	C4FM Data/Voice	8K40F1D 8K40F1E

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1 Test Result Summary

Test	FCC Reference	IC Reference	Result
RF Power Output	2.1046(a), 22.659, 80.215, 90.205	RSS-119 5.4	Pass
Spurious Emissions at Antenna Terminals	2.1051, 22.359, 80.217, 90.210	RSS-119 5.8	Pass
Field Strength of Spurious Radiation	2.1053(a), 80.211, 90.210	RSS-119 5.8	Pass
Occupied Bandwidth/Emission Masks	2.1049(c)(1), 22.359(b), 74.462(c), 80.205, 80.211(f), 90.210	RSS-119 5.5	Pass
Frequency Stability vs. Temperature and Voltage	2.1055, 22.355, 74.464, 80.209, 90.213	RSS-119 5.3	Pass
Modulation Characteristics	2.1047(a)(b), 74.463, 80.213	RSS-119 5.8	Pass
Transient Frequency Response (421-512 MHz)	74.462(c), 90.214	RSS-119 5.9	Pass

2 General Information

The following Certification Report is prepared on behalf of Harris Corporation in accordance with the Federal Communications Commission and Industry Canada rules and regulations. The Equipment Under Test (EUT) was the XG-15P UHF-H portable radio, Model # XR-PFU1B, FCC ID: OWDTR-0136-E, IC: 3636B-0136.

The radio is subject to FCC DoC. DoC testing was performed and the data is contained in a separate DoC report.

All measurements contained in this application were conducted in accordance with the applicable sections of FCC Rules and Regulations CFR 47 Parts 2, 22, 74, 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)

This is a new certification application for FCC and Industry Canada, with one model number, XR-PFU1B.

2.3 Grant Notes

Power is continuously variable from 0.5 - 5 W. The grant listed power is rated power and actual measured power is shown in the test report.

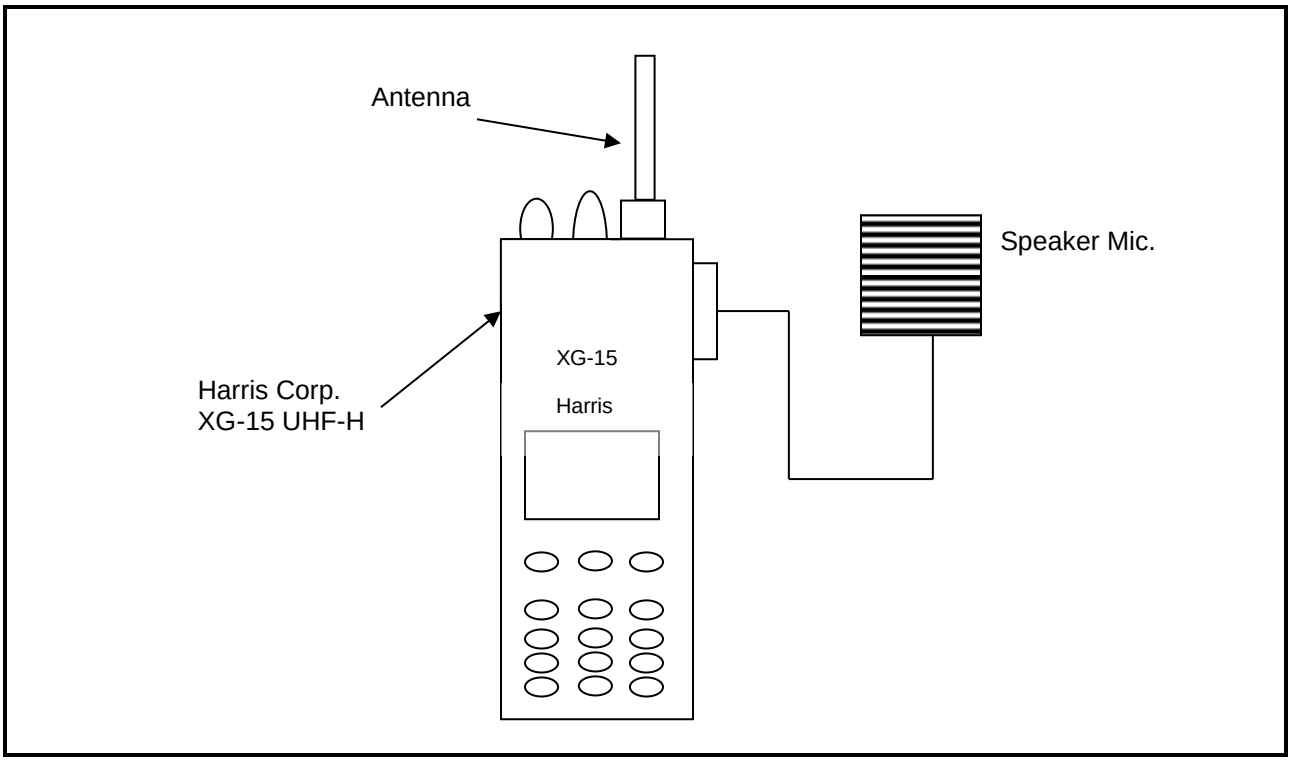
2.4 Tested System Details

The test sample was received on September 8, 2015. 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 2-1: Equipment Under Test (EUT)

Part	Manufacturer	Model	Part Number	Serial Number	FCC ID	RTL Bar Code
XG-15P SYS 440-512 GRY Portable Radio	Harris Corporation	XR-PFU1B	RU-144772-001	H1-X1H-001	OWDTR-0136-E	21887
Antenna	Harris Corporation	Helical Stub, 0 dBi Gain (440-494 MHz)	KRE1011219/12	N/A	N/A	21889
Antenna	Harris Corporation	Helical Stub, 0 dBi Gain (440-494 MHz)	KRE1011219/12	N/A	N/A	21890
Antenna	Harris Corporation	Helical Stub, 0 dBi Gain (470-512 MHz)	KRE1011219/14	N/A	N/A	21891
Antenna	Harris Corporation	Helical Stub, 0 dBi Gain (470-512 MHz)	KRE1011219/14	N/A	N/A	21892
Antenna	Harris Corporation	Quarter-Wave Whip, 0 dBi Gain (440-512 MHz)	KRE1011223/12	N/A	N/A	21893
Antenna	Harris Corporation	Quarter-Wave Whip, 0 dBi Gain (440-512 MHz)	KRE1011223/12	N/A	N/A	21894
GPS Speaker-Microphone	Harris Corporation	GPS Speaker-Microphone	MC-009104-002	F2LQ5159	N/A	20172
NiMH Battery	Harris Corporation	7.5V 2400mAH, Nickel-Metal Hydride	BT-023406-003	N/A	N/A	21667
NiMH Battery	Harris Corporation	7.5V 2400mAH, Nickel-Metal Hydride	BT-023406-003	N/A	N/A	21668
Li-Ion Battery	Harris Corporation	7.4 V, 18Wh, 2400 MAh,	14002-0214-01	N/A	N/A	21669
Li-Ion Battery	Harris Corporation	7.4 V, 18Wh, 2400 MAh,	14002-0214-01	N/A	N/A	21670
Li-Polymer Battery	Harris Corporation	7.4 V, 26Wh, 3600 MAh	BT-023436-001	N/A	N/A	21672
Li-Polymer Battery	Harris Corporation	7.4 V, 26Wh, 3600 MAh	BT-023436-001	N/A	N/A	21671

Figure 2-1: Configuration of Tested System



3 FCC Part 2.1033(C)(8) Voltages and Currents through the Final Amplifying Stage

7.5 VDC and 1.52 Amps

Results: The EUT is compliant.

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty = 0.05 A

4 FCC Part 2.1046(a), 22.659, 80.215, 90.205; IC RSS-119 5.4: Transmitter Power

4.1 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:

(3) On board stations 456–468 MHz—4W

NOTE: Certification based on a carrier power of 4 watts with transmitter connected to a dummy load of matching impedance. The effective radiated power must not exceed 2 watts.

(f) *Fixed stations.* The maximum power must not exceed the values listed below.

(1) Maritime support (receiver test): F3E emission—50W

Maximum Power Authorized to Use: 83.5 W for UHF less than 456 MHz, or EIRP 2W from 456-468 MHz.

Manufacturer's Rated Power: 5.0 W

4.2 Test Data

Table 4-1: RF Conducted Output Power – Measured

Frequency (MHz)	High Power (dBm)	High Power (W)	Low Power (dBm)	Low Power (W)
440.0125	37.4	5.5	28.1	0.7
450.0125	37.3	5.4	28.1	0.7
453.9875	37.3	5.4	28.0	0.6
455.9875	37.3	5.4	27.9	0.6
456.0125	37.3	5.4	27.9	0.6
469.9875	37.3	5.4	27.6	0.6
511.9875	37.3	5.4	27.5	0.6

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

Results: The EUT is compliant.

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty = 0.5 dB.

Table 4-2: Test Equipment Used for Testing RF Power Output - Conducted

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/6/15

Test Personnel:

Daniel Baltzell		September 9, 2015
EMC Test Engineer	Signature	Date of Test

5 FCC Part 2.1051, 22.359, 80.217, 90.210; RSS-119 5.8: Conducted Spurious Emissions

5.1 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.

Part 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	3.0
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) used 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)

5.2 Test Data

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

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

The following channels (in MHz) were investigated:

UHF Test Frequencies
440.0125
450.0125
453.9875
455.9875
456.0125
469.9875
511.9875

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

No emissions were found within 20 dB of the narrowband limit, therefore no data is presented.

Results: The EUT is compliant.

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty= -2 dB / +2 dB.

Table 5-1: Test Equipment Used for Testing Spurious Emissions

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/6/15
901133	Par Electronics	400-512 (25W)	UHF Notch Filter	N/A	7/1/16

Test Personnel:

Daniel Baltzell		September 9, 2015
EMC Test Engineer	Signature	Date of Test

6 FCC Part 2.1053(a), 80.211, 90.210; IC RSS-119 5.8.9.2: Radiated Emissions

6.1 Test Procedure

ANSI/TIA-603-2004, section 2.2.12

The device uses digital modulation modulated to its maximum extent using a pseudo-random data sequence. 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 dBc, and compared to the limit.

6.2 Test Data

Table 6-1: Field Strength of Spurious Radiation – 440.0125 MHz – Antenna KRE1011223/12

Conducted Power 37.4 dBm; 5.5 W; Limit=50+10LogP=57.4 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
880.0250	35.6	-35.9	0.5	-1.3	75.2	-17.8
1320.0375	45.1	-26.4	0.6	5.3	59.1	-1.7
1760.0500	3.2	-68.3	0.6	6.6	99.8	-42.4
2200.0625	22.7	-48.8	0.6	6.8	80.0	-22.6
2640.0750	3.5	-68.0	0.5	7.5	98.4	-41.0
3080.0875	4.8	-66.7	0.5	7.1	97.5	-40.1
3520.1000	6.7	-64.8	0.9	7.6	95.6	-38.2
3960.1125	-1.5	-72.7	0.9	7.3	103.8	-46.4
4400.1250	-0.7	-71.9	1.1	8.8	101.7	-44.3

Table 6-2: Field Strength of Spurious Radiation – 453.9875 MHz – Antenna KRE1011223/12

Conducted Power 37.3 dBm; 5.4 W; Limit=50+10LogP=57.3 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
907.9750	44.2	-27.3	0.5	-1.2	66.4	-9.0
1361.9625	39.6	-31.6	0.6	5.7	63.9	-6.6
1815.9500	15.4	-55.8	0.7	6.6	87.2	-29.9
2269.9375	13.3	-58.2	0.6	7.2	88.9	-31.6
2723.9250	4.0	-67.5	0.4	7.8	97.5	-40.2
3177.9125	8.0	-63.5	0.6	7.1	94.4	-37.0
3631.9000	-1.6	-73.1	0.9	7.5	103.9	-46.5
4085.8875	-0.1	-71.6	1.0	8.0	101.9	-44.6
4539.8750	-1.5	-73.0	1.1	8.8	102.6	-45.3

Table 6-3: Field Strength of Spurious Radiation – 469.9875 MHz – Antenna KRE1011223/12

Conducted Power 37.3 dBm; 5.4 W; Limit=50+10LogP=57.3 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
939.9750	34.3	-37.2	0.5	-1.0	76.1	-18.8
1409.9625	26.1	-45.4	0.6	6.0	77.3	-20.0
1879.9500	3.4	-68.1	0.7	6.3	99.8	-42.4
2349.9375	6.5	-65.0	0.5	7.3	95.6	-38.2
2819.9250	6.7	-64.8	0.4	7.9	94.7	-37.4
3289.9125	5.9	-65.6	0.7	7.1	96.5	-39.2
3759.9000	-0.7	-72.2	0.9	7.0	103.4	-46.1
4229.8875	0.6	-70.6	1.0	8.6	100.4	-43.1
4699.8750	-1.6	-72.8	1.2	9.0	102.4	-45.0

Table 6-4: Field Strength of Spurious Radiation – 440.0125 MHz – Antenna KRE1011219/14

Conducted Power 37.4 dBm; 5.5 W; Limit=50+10LogP=57.4 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
880.0250	40.5	-31.0	0.5	-1.3	70.3	-12.9
1320.0375	31.2	-40.3	0.6	5.3	73.0	-15.6
1760.0500	9.3	-62.2	0.6	6.6	93.7	-36.3
2200.0625	9.2	-62.3	0.6	6.8	93.5	-36.1
2640.0750	3.9	-67.6	0.5	7.5	98.0	-40.6
3080.0875	5.0	-66.5	0.5	7.1	97.3	-39.9
3520.1000	6.1	-65.4	0.9	7.6	96.2	-38.8
3960.1125	-1.7	-72.9	0.9	7.3	104.0	-46.6
4400.1250	-0.9	-72.4	1.1	8.8	102.2	-44.8

Table 6-5: Field Strength of Spurious Radiation – 453.9875 MHz – Antenna KRE1011219/14

Conducted Power 37.3 dBm; 5.4 W; Limit=50+10LogP=57.3 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
907.9750	44.6	-26.9	0.5	-1.2	66.0	-8.6
1361.9625	39.3	-32.2	0.6	5.7	64.5	-7.2
1815.9500	12.1	-59.1	0.7	6.6	90.5	-33.2
2269.9375	18.7	-52.8	0.6	7.2	83.5	-26.2
2723.9250	4.2	-67.3	0.4	7.8	97.3	-40.0
3177.9125	4.4	-67.1	0.6	7.1	98.0	-40.6
3631.9000	-2.4	-73.9	0.9	7.5	104.7	-47.3
4085.8875	-1.6	-73.1	1.0	8.0	103.4	-46.1
4539.8750	-1.9	-73.1	1.1	8.8	102.7	-45.4

Table 6-6: Field Strength of Spurious Radiation – 469.9875 MHz – Antenna KRE1011219/14

Conducted Power 37.3 dBm; 5.4 W; Limit=50+10LogP=57.3 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
939.9750	37.4	-34.1	0.5	-1.0	73.0	-15.7
1409.9625	26.5	-45.0	0.6	6.0	76.9	-19.6
1879.9500	2.5	-69.0	0.7	6.3	100.7	-43.3
2349.9375	6.1	-65.4	0.5	7.3	96.0	-38.6
2819.9250	6.5	-65.0	0.4	7.9	94.9	-37.6
3289.9125	5.0	-66.2	0.7	7.1	97.1	-39.8
3759.9000	1.5	-70.0	0.9	7.0	101.2	-43.9
4229.8875	-0.6	-72.1	1.0	8.6	101.9	-44.6
4699.8750	-1.3	-72.5	1.2	9.0	102.1	-44.7

Table 6-7: Field Strength of Spurious Radiation – 440.0125 MHz – Antenna KRE1011219/12

Conducted Power 37.4 dBm; 5.5 W; Limit=50+10LogP=57.4 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
880.0250	41.6	-29.9	0.5	-1.3	69.2	-11.8
1320.0375	35.4	-36.1	0.6	5.3	68.8	-11.4
1760.0500	7.0	-64.5	0.6	6.6	96.0	-38.6
2200.0625	17.5	-54.0	0.6	6.8	85.2	-27.8
2640.0750	5.9	-65.6	0.5	7.5	96.0	-38.6
3080.0875	4.9	-66.6	0.5	7.1	97.4	-40.0
3520.1000	5.4	-66.1	0.9	7.6	96.9	-39.5
3960.1125	-1.7	-73.2	0.9	7.3	104.3	-46.9
4400.1250	-0.6	-71.8	1.1	8.8	101.6	-44.2

Table 6-8: Field Strength of Spurious Radiation – 453.9875 MHz – Antenna KRE1011219/12

Conducted Power 37.3 dBm; 5.4 W; Limit=50+10LogP=57.3 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
907.9750	45.1	-26.4	0.5	-1.2	65.5	-8.1
1361.9625	34.3	-37.2	0.6	5.7	69.5	-12.2
1815.9500	16.5	-54.7	0.7	6.6	86.1	-28.8
2269.9375	19.5	-51.7	0.6	7.2	82.4	-25.1
2723.9250	4.9	-66.6	0.4	7.8	96.6	-39.3
3177.9125	7.6	-63.6	0.6	7.1	94.5	-37.1
3631.9000	-0.9	-72.4	0.9	7.5	103.2	-45.8
4085.8875	-0.2	-71.7	1.0	8.0	102.0	-44.7
4539.8750	-2.0	-73.2	1.1	8.8	102.8	-45.5

Table 6-9: Field Strength of Spurious Radiation – 469.9875 MHz – Antenna KRE1011219/12

Conducted Power 37.3 dBm; 5.4 W; Limit=50+10LogP=57.3 dBc

Frequency (MHz)	Spectrum Analyzer Level (dBuV)	Signal Generator Level (dBm)	Cable Loss to Transmit Antenna (dB)	Substitution Antenna Gain (dBi)	Corrected Signal Generator Level (dBc)	Margin (dB)
939.9750	39.2	-32.0	0.5	-1.0	70.9	-13.6
1409.9625	30.5	-41.0	0.6	6.0	72.9	-15.6
1879.9500	2.6	-68.9	0.7	6.3	100.6	-43.2
2349.9375	5.7	-65.8	0.5	7.3	96.4	-39.0
2819.9250	7.8	-63.7	0.4	7.9	93.6	-36.3
3289.9125	7.4	-64.1	0.7	7.1	95.0	-37.7
3759.9000	-0.5	-72.0	0.9	7.0	103.2	-45.9
4229.8875	1.8	-69.7	1.0	8.6	99.5	-42.2
4699.8750	-0.6	-71.8	1.2	9.0	101.4	-44.0

Results: The EUT is compliant.

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. +4.0 dB / -2.65 dB

Table 6-10: Test Equipment Used for Testing Field Strength of Spurious Radiation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900878	Rhein Tech Laboratories	AM3-1197-0005	3 meter Antenna Mast, polarizing	OATS1	N/A
901592	Insulated Wire Inc.	KPS-1503-3600-KPR	SMK RF Cables 20’	NA	9/4/16
901593	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	9/4/16
901594	Insulated Wire Inc.	KPS-1503-360-KPR	SMK RF Cables 36”	NA	9/4/16
901242	Rhein Tech Laboratories	WRT-000-0003	Wood rotating table	N/A	N/A
900791	Chase	CBL6111B	Bilog Antenna (30 MHz – 2000 MHz)	N/A	6/11/17
900321	EMCO	3161-03	Horn Antennas (4 – 8 GHz)	9508-1020	4/9/18
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	4/9/18
901582	Rohde & Schwarz	1167.0000.02	Signal Generator	101903	11/14/15
901262	ETS	3160-9	Double ridged Guide Antenna (1 - 18 GHz)	6748	7/29/17
901158	Compliance Design, Inc.	Roberts Dipole Antenna	Adjustable Elements Dipole Antennas (25 - 1000 MHz)	00401	6/27/16

Test Personnel:

Daniel Baltzell		September 13, 2015
Test Engineer	Signature	Date of Tests

7 FCC Part 2.1049(c)(1), 22.359(b), 74.462(c), 80.205, 80.211(f), 90.210; IC RSS-119 5.5: Bandwidths/Masks

Occupied Bandwidth - Compliance with the Emission Masks

FCC 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.

(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.

FCC 80.211(f)
(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 10log (mean power in watts) dB.

7.1 Test Procedure

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

TIA-102.CCAA August 2011, section 2.2.5

Notes: FCC 90.210, RSS-119 and TIA-102.CCAB October 2011 section 3.2.5.1 all specify mask D

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.

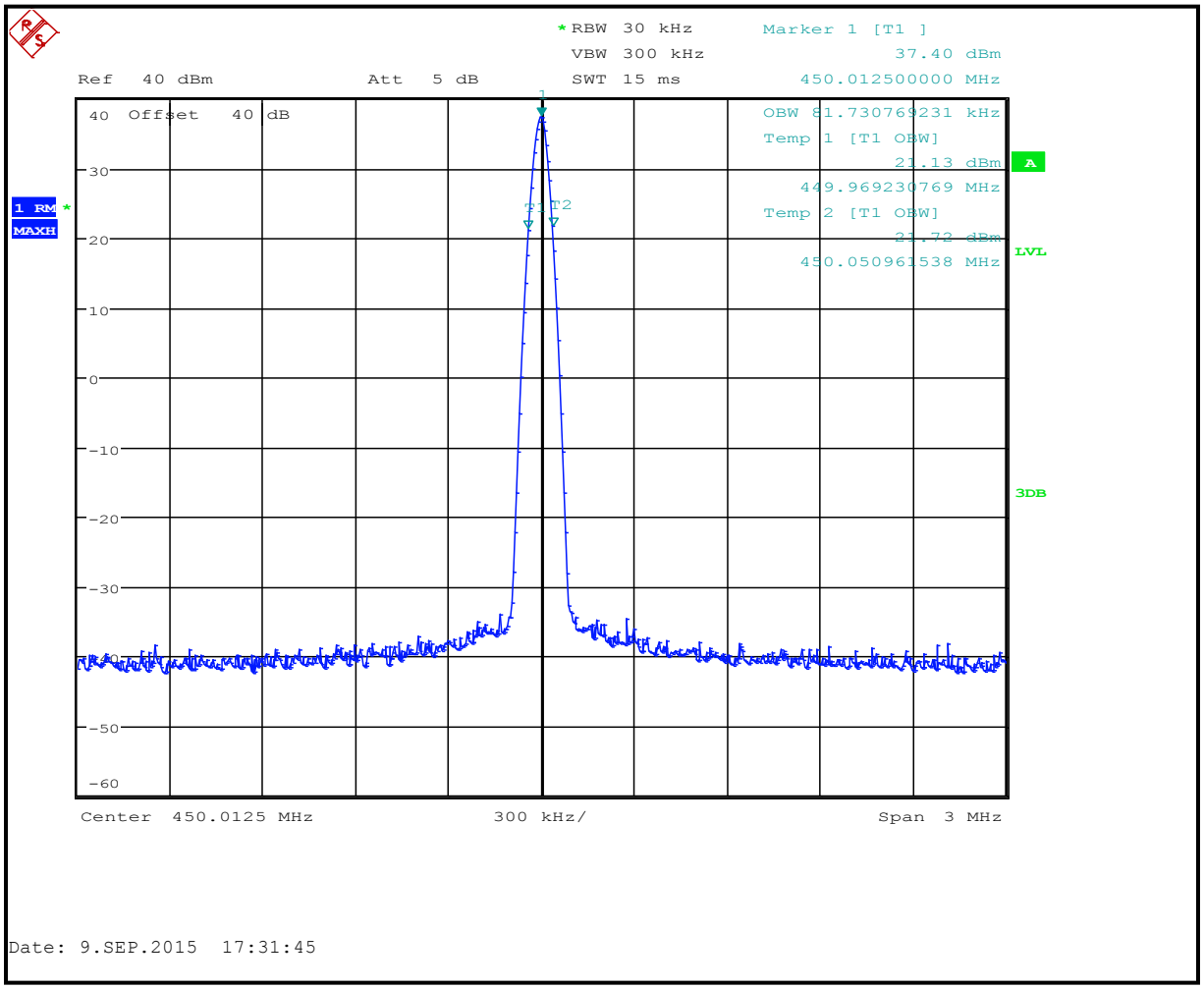
[2] Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel 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.

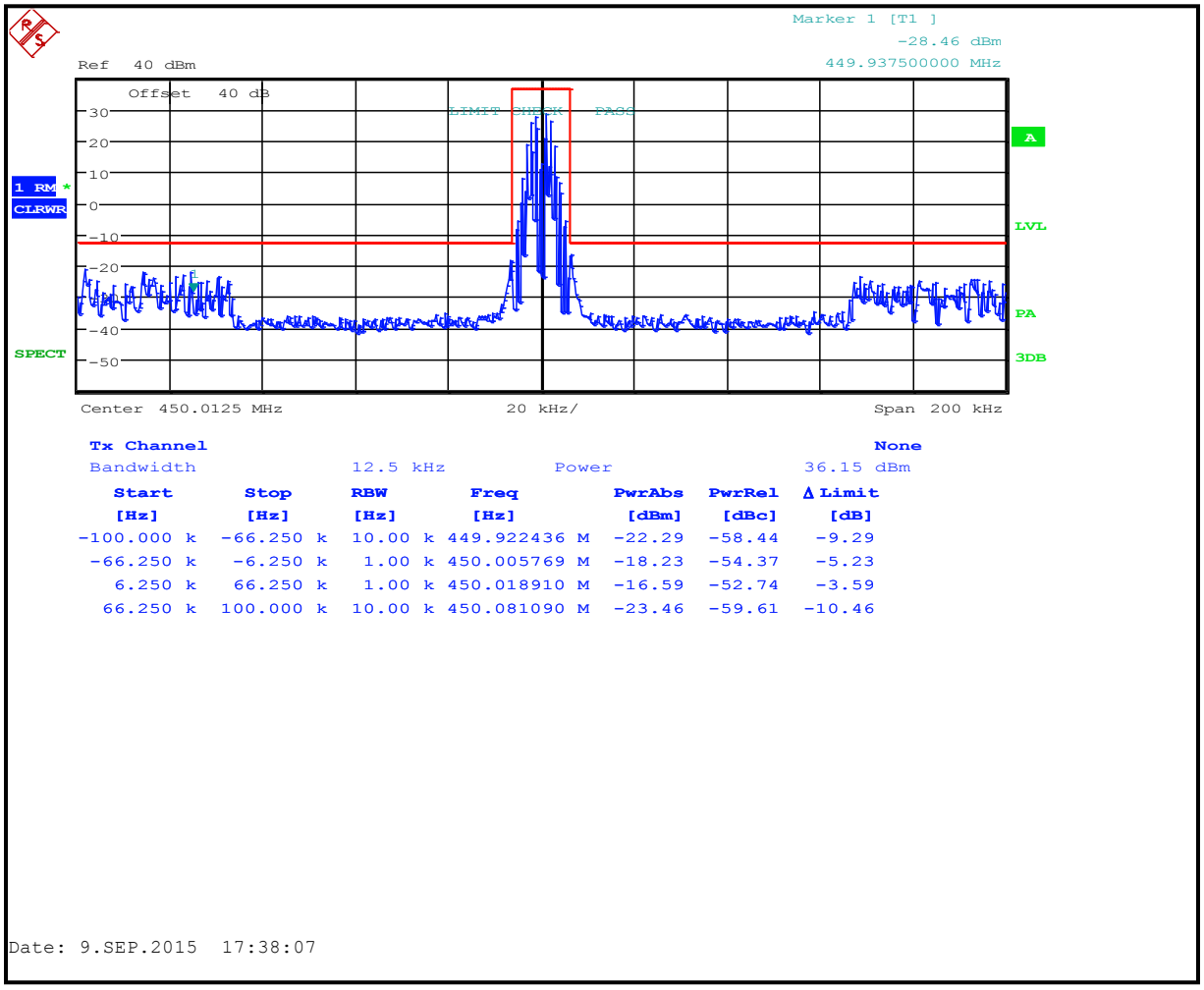
[4] DSRCS Roadside Unit equipment in the 5850–5925 MHz band is governed under subpart M of this part.

7.2 Test Data

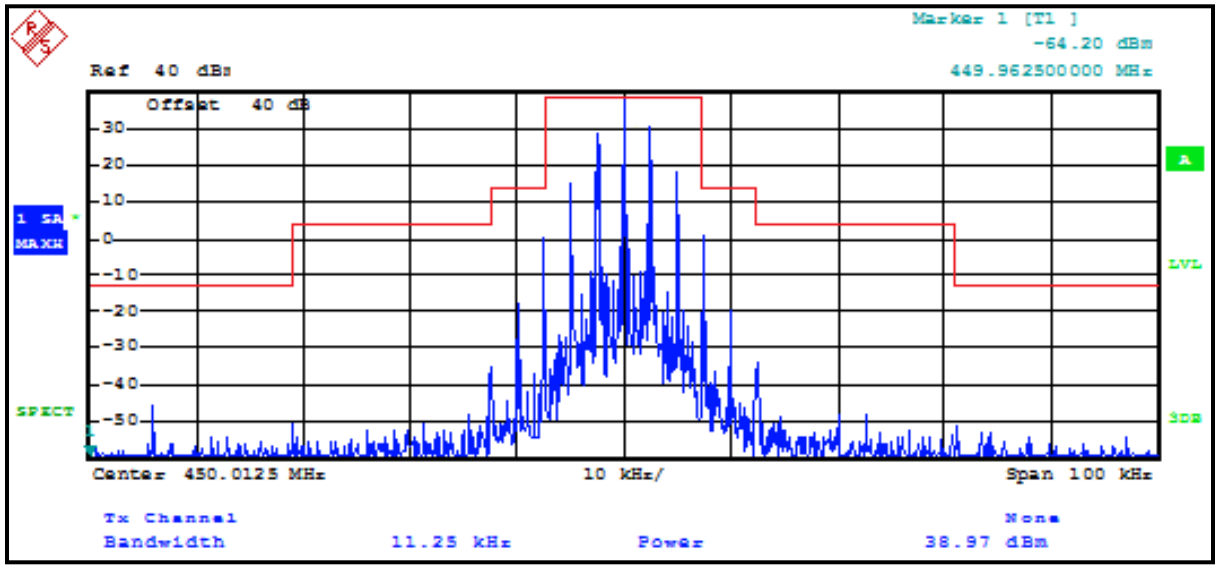
Plot 7-1: Occupied Bandwidth – 450.0125 MHz; Analog (FCC Part 22)



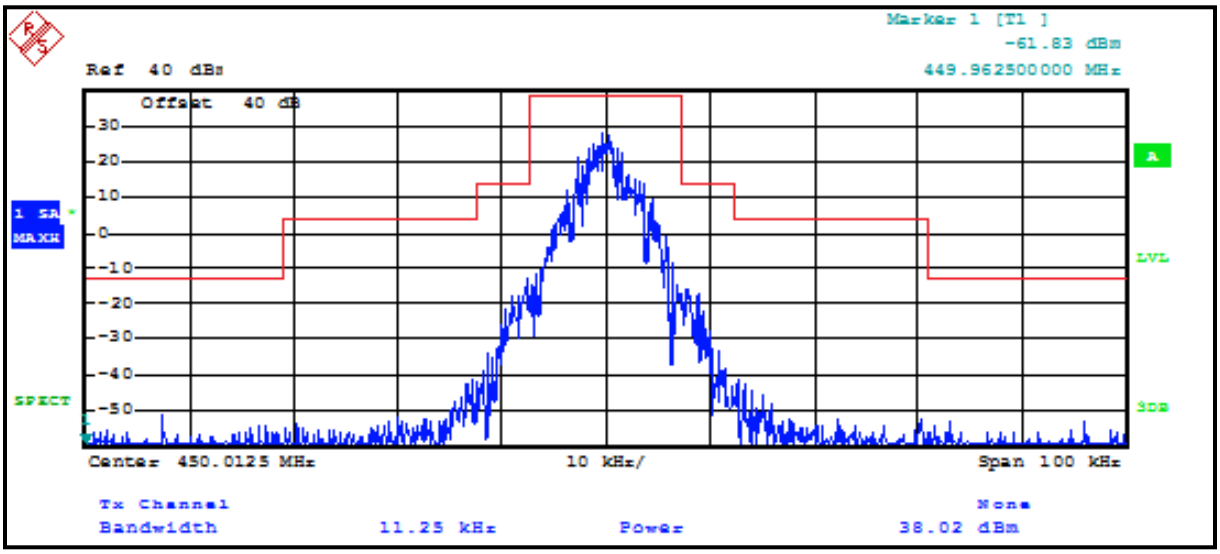
Plot 7-2: Occupied Bandwidth – 450.0125 MHz; NB Mask; (FCC Part 22)



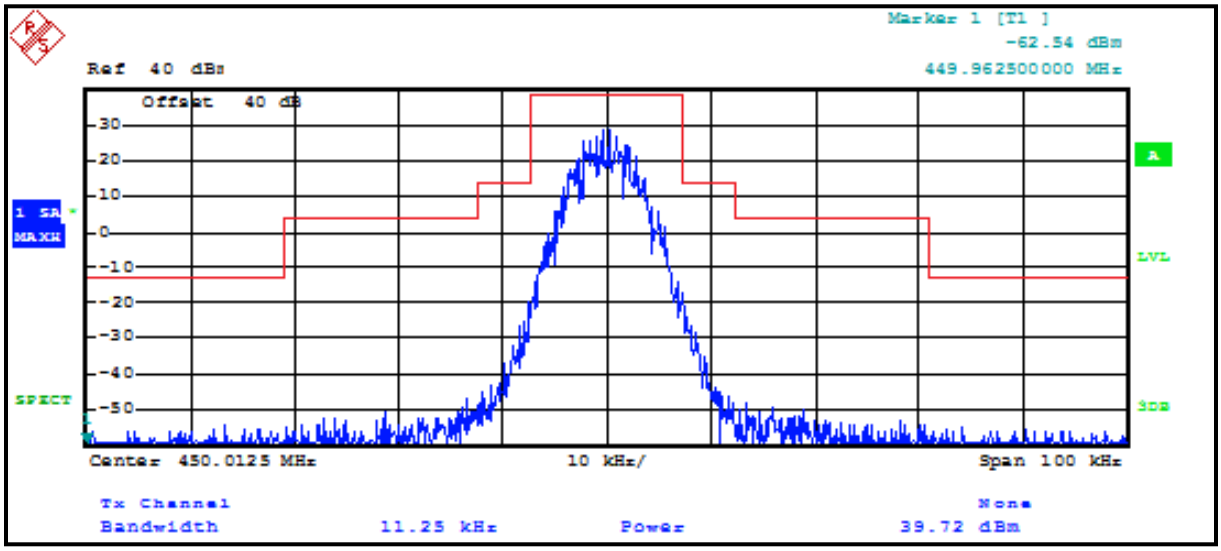
Plot 7-3: Occupied Bandwidth – 450.0125 MHz; (FCC Part 80.211(f) Analog Mask)



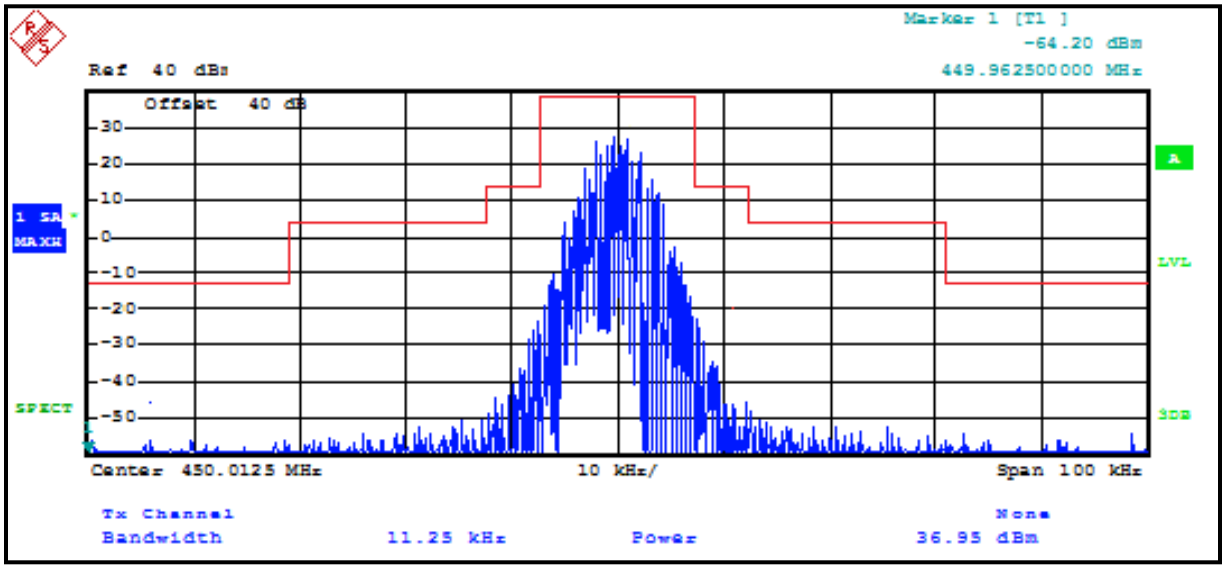
Plot 7-4: Occupied Bandwidth – 450.0125 MHz; (FCC Part 80.211(f) 2-Level 9600 FSK Mask)



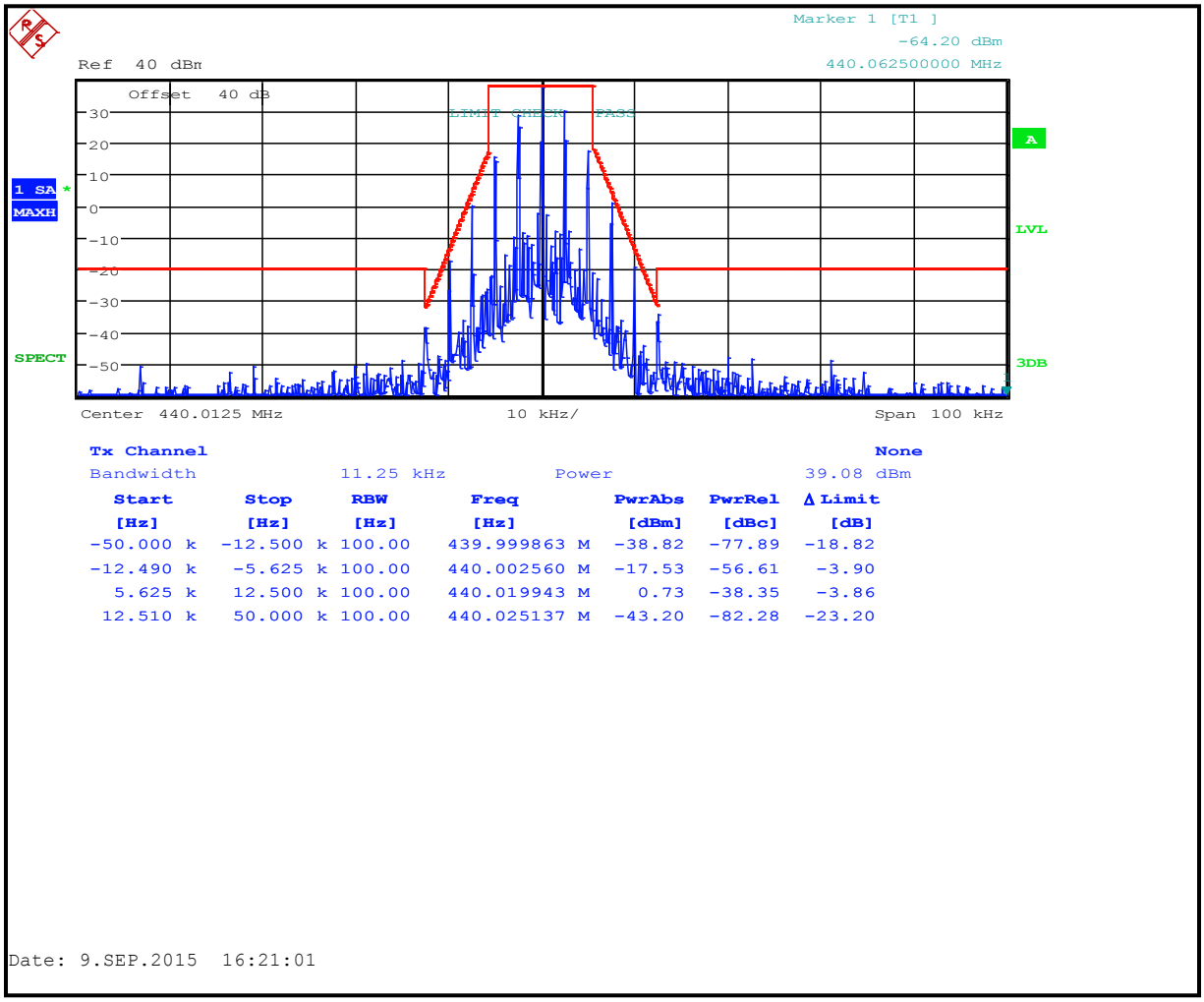
Plot 7-5: Occupied Bandwidth – 450.0125 MHz; (FCC Part 80.211(f) P25 Mask)



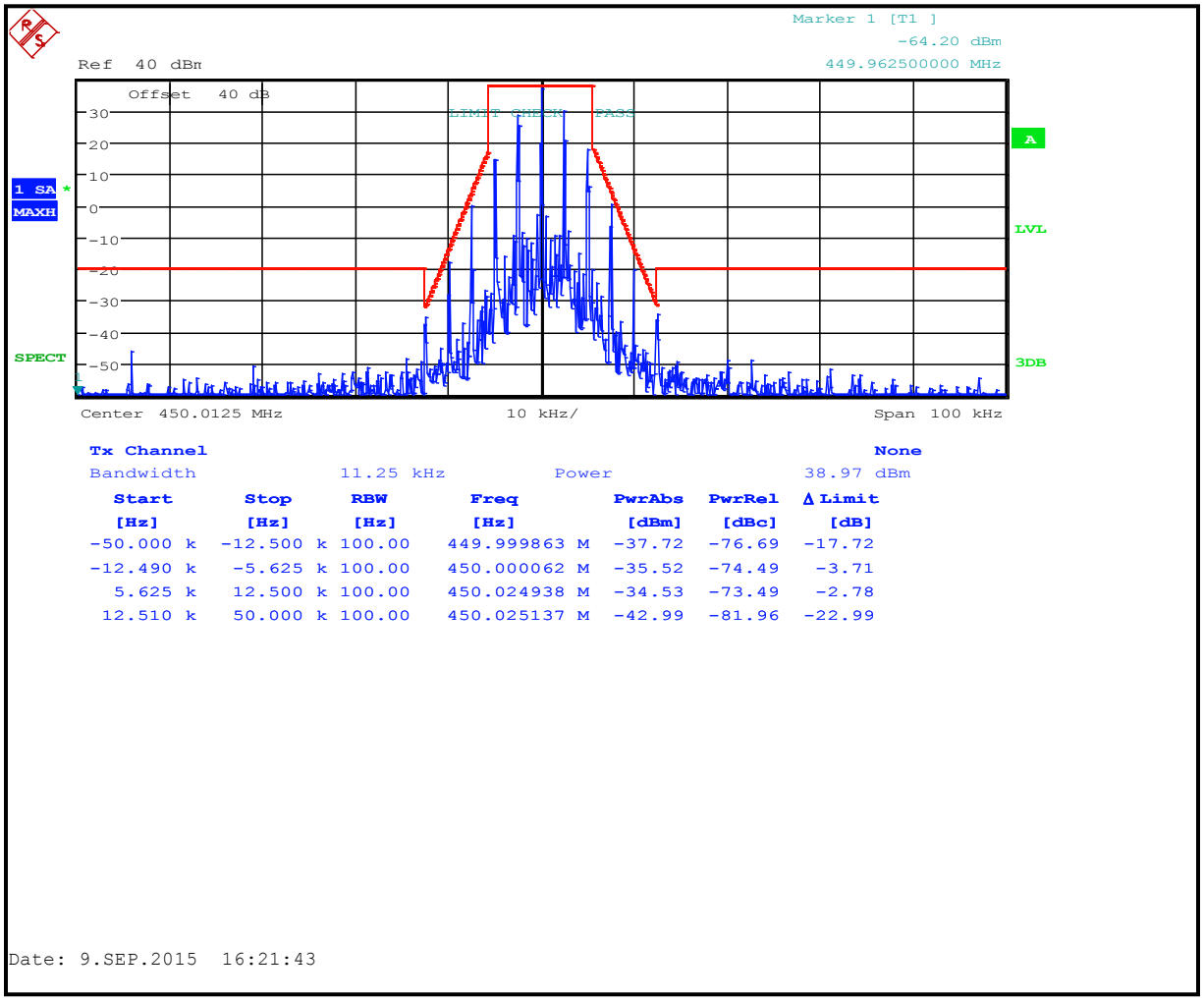
Plot 7-6: Occupied Bandwidth – 450.0125 MHz; (FCC Part 80.211(f) H-CPM TDMA Mask)



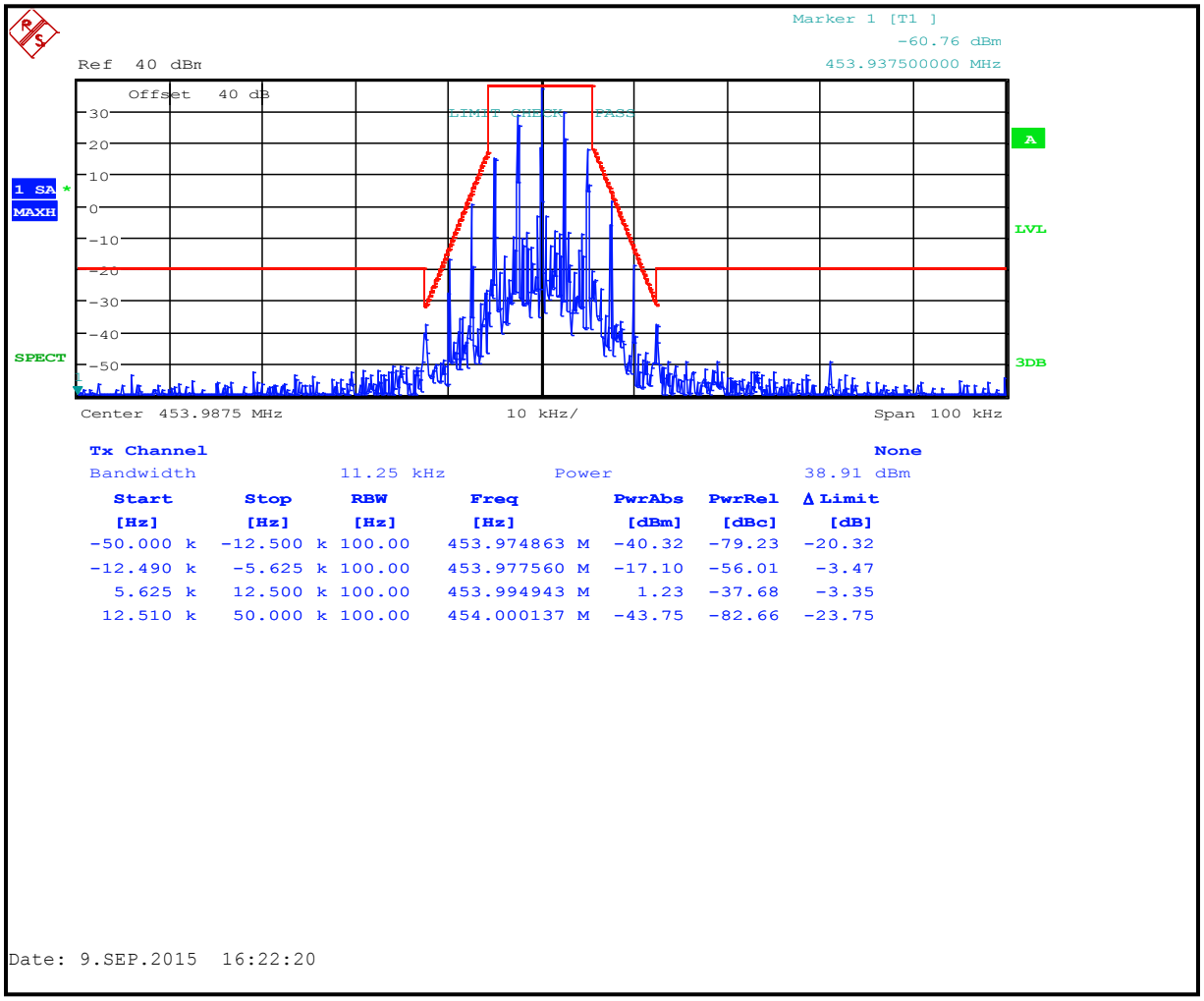
Plot 7-7: Occupied Bandwidth – 440.0125 MHz; Narrowband Analog; Mask D



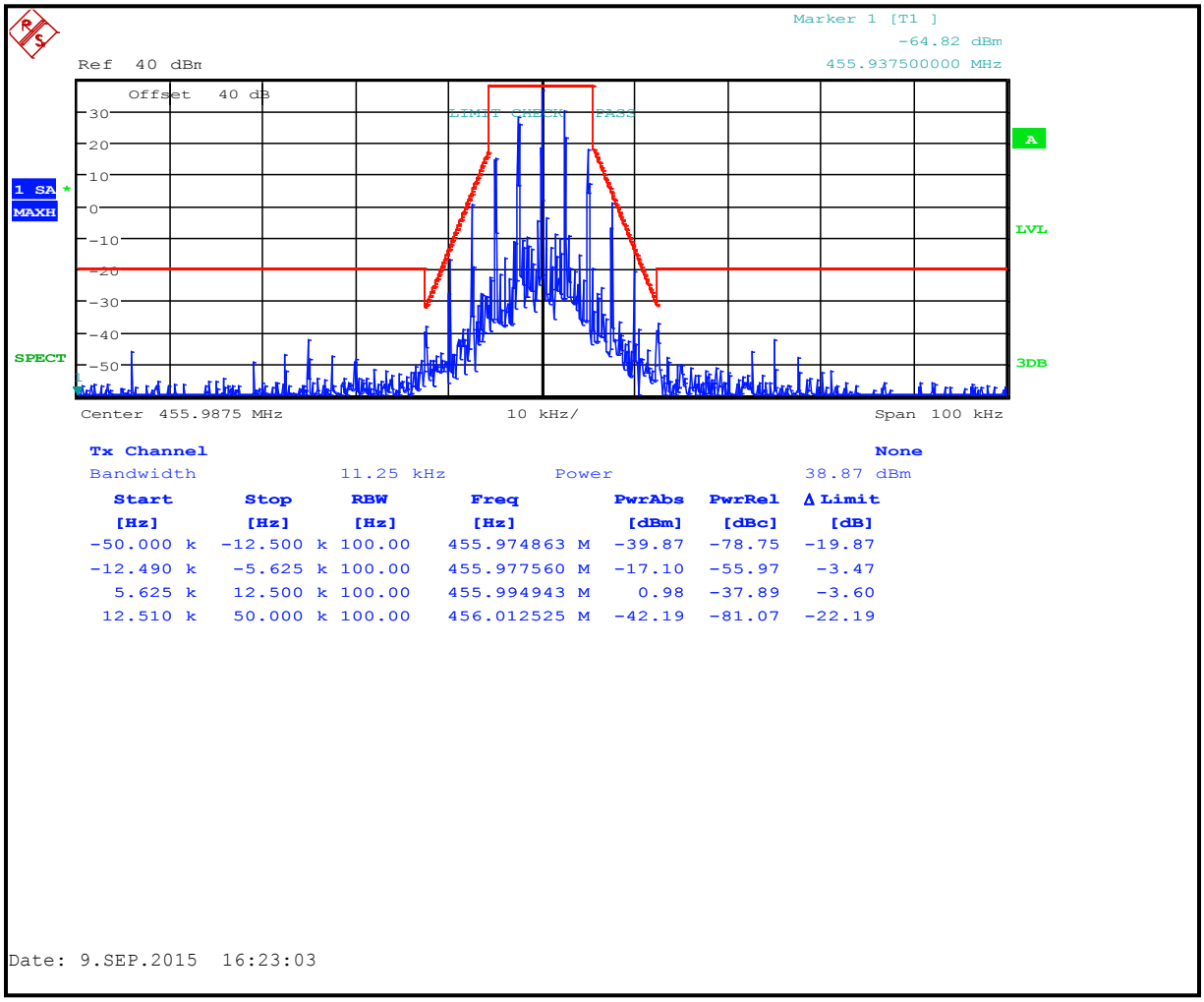
Plot 7-8: Occupied Bandwidth – 450.0125 MHz; Narrowband Analog; Mask D



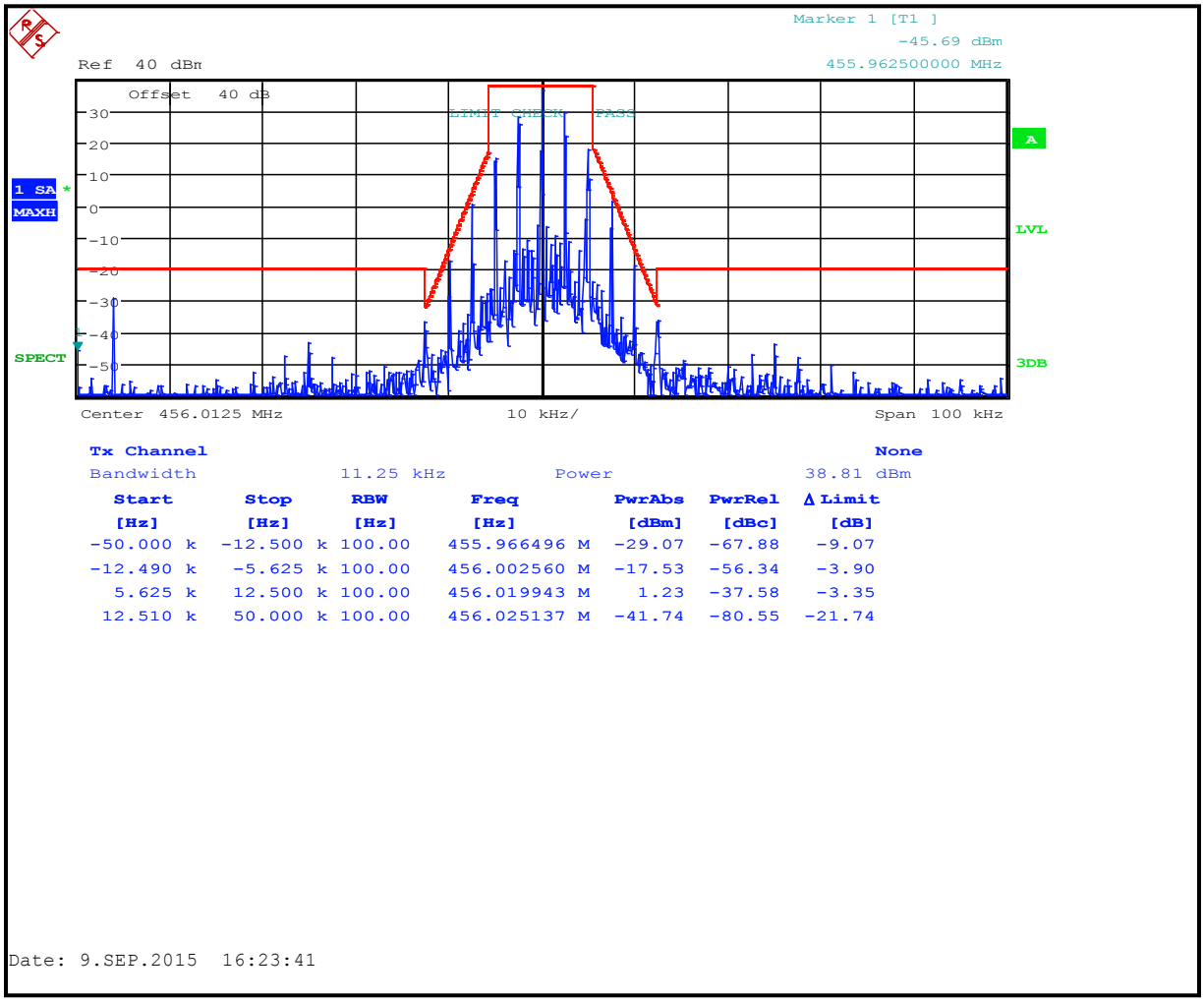
Plot 7-9: Occupied Bandwidth – 453.9875 MHz; Narrowband Analog; Mask D



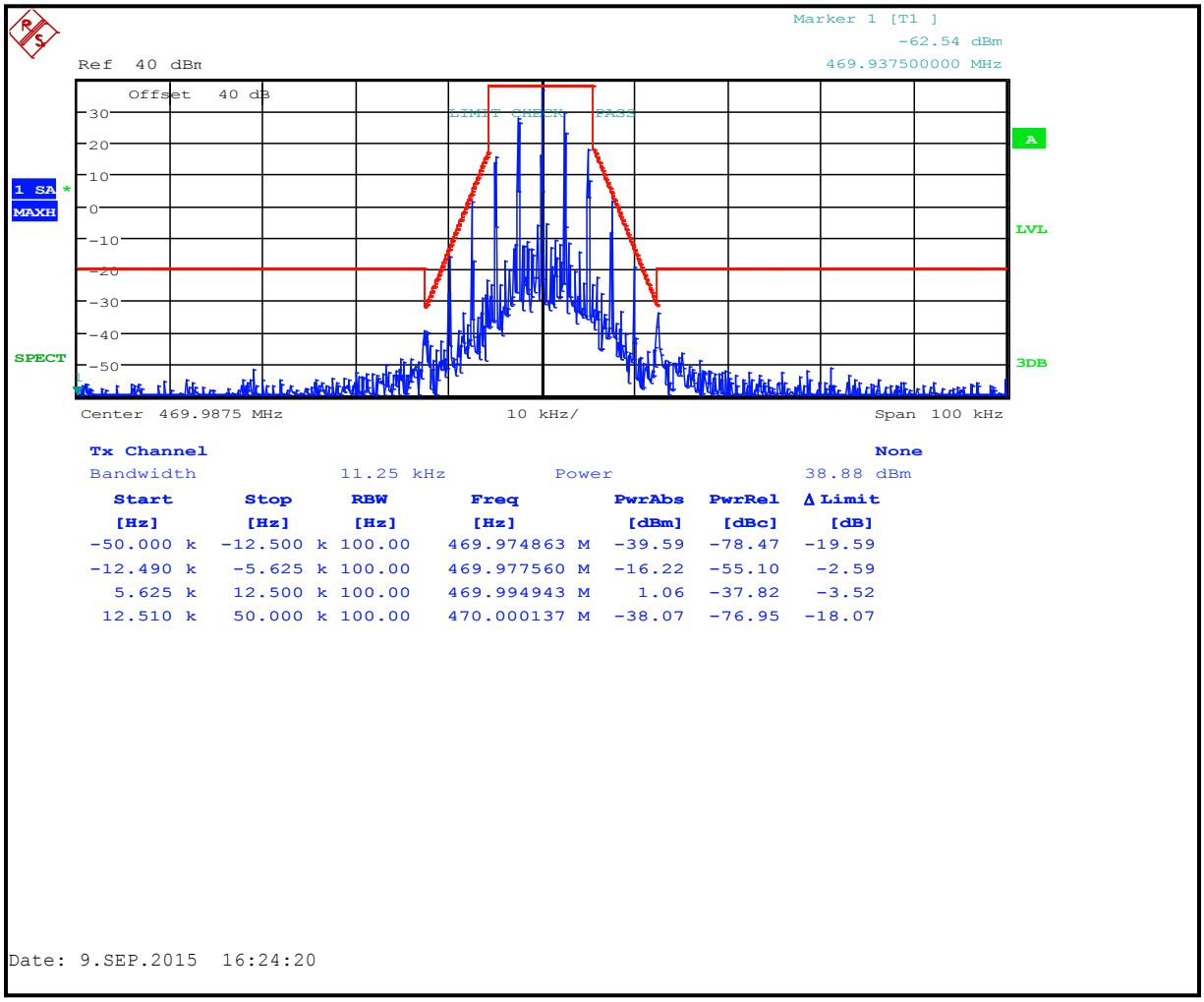
Plot 7-10: Occupied Bandwidth – 455.9875 MHz; Narrowband Analog; Mask D



Plot 7-11: Occupied Bandwidth – 456.0125 MHz; Narrowband Analog; Mask D



Plot 7-12: Occupied Bandwidth – 469.9875 MHz; Narrowband Analog; Mask D

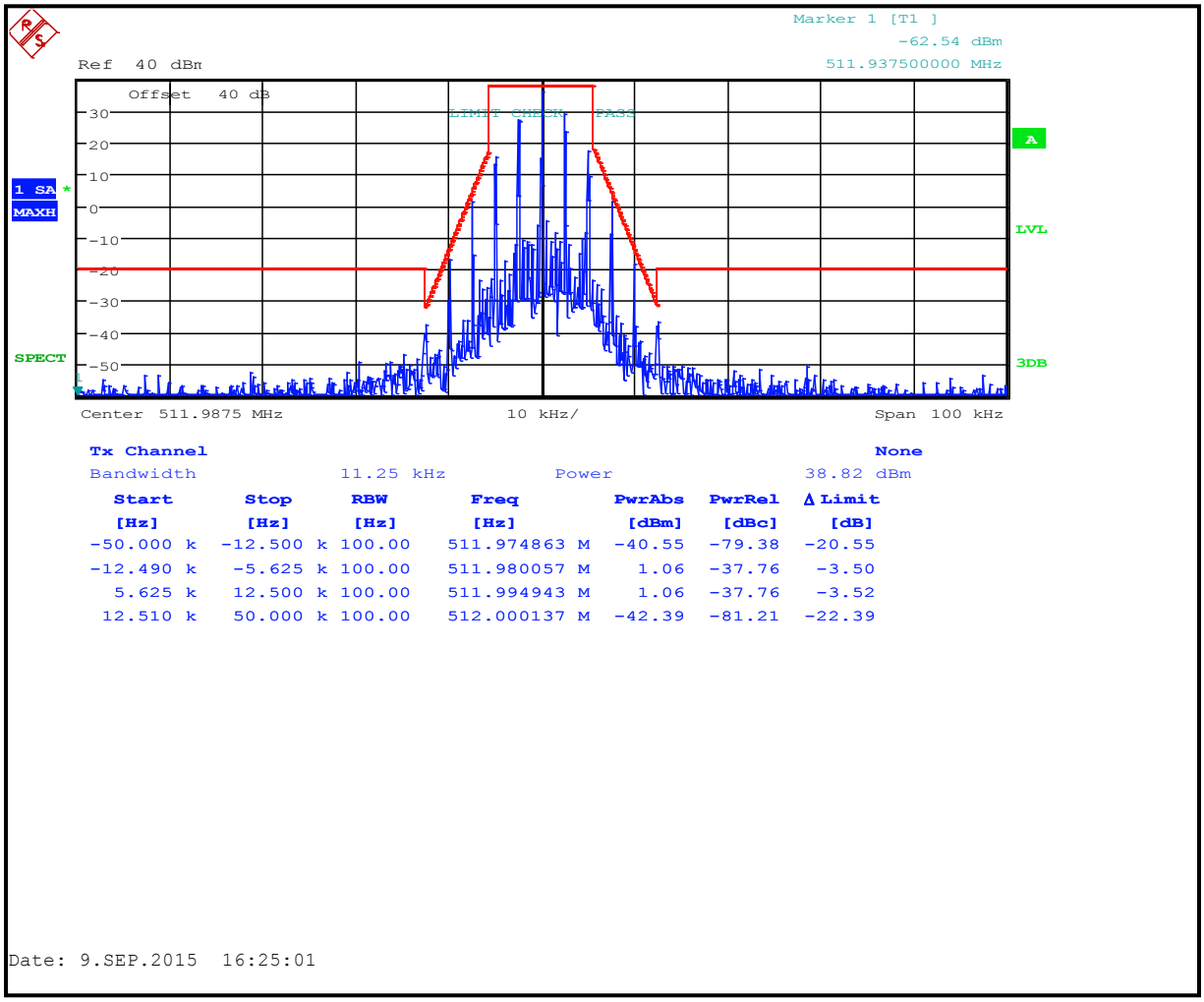


Tx Channel **None**
Bandwidth 11.25 kHz Power 38.88 dBm

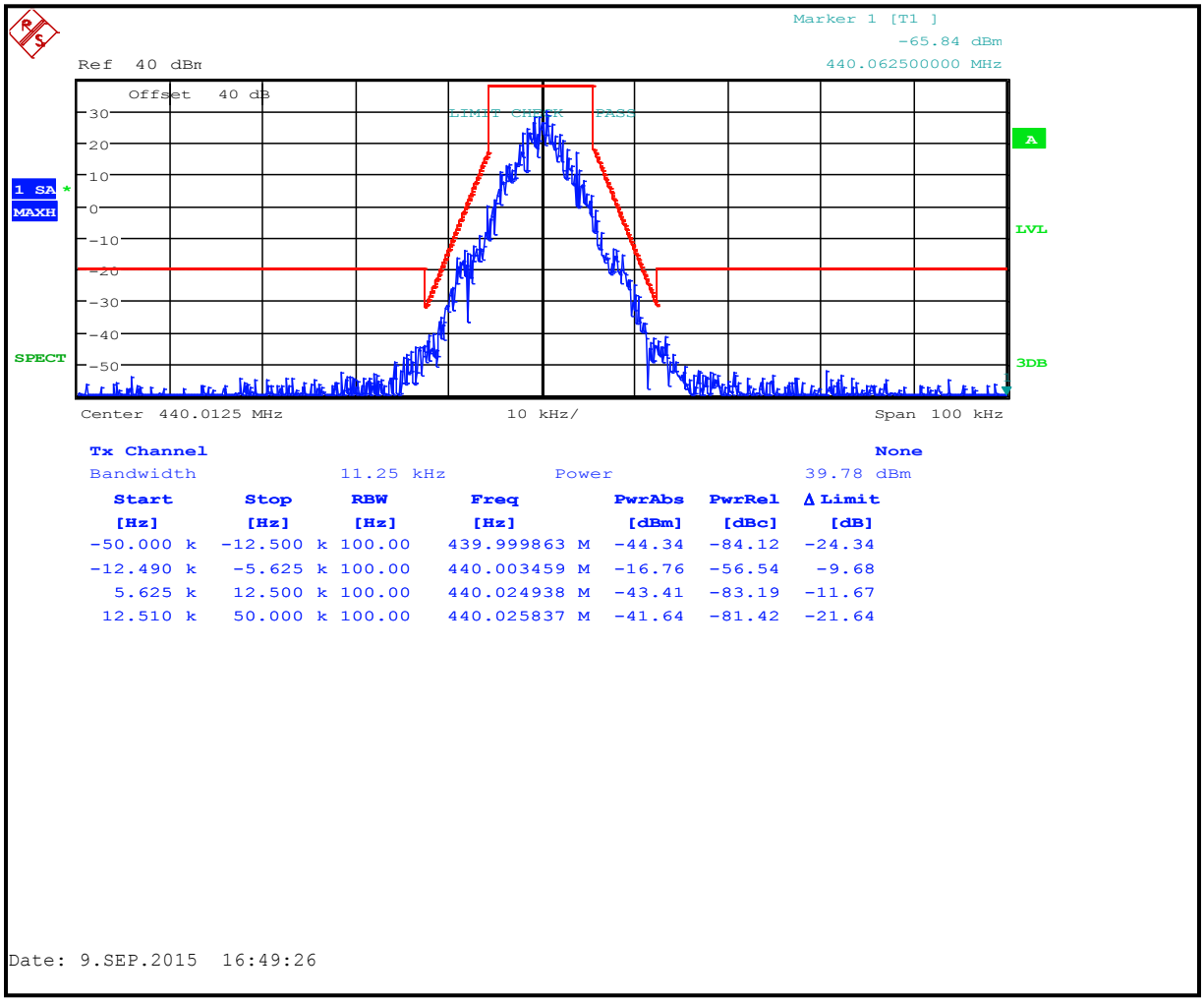
Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	PwrRel [dBc]	Δ Limit [dB]
-50.000 k	-12.500 k	100.00	469.974863 M	-39.59	-78.47	-19.59
-12.490 k	-5.625 k	100.00	469.977560 M	-16.22	-55.10	-2.59
5.625 k	12.500 k	100.00	469.994943 M	1.06	-37.82	-3.52
12.510 k	50.000 k	100.00	470.000137 M	-38.07	-76.95	-18.07

Date: 9.SEP.2015 16:24:20

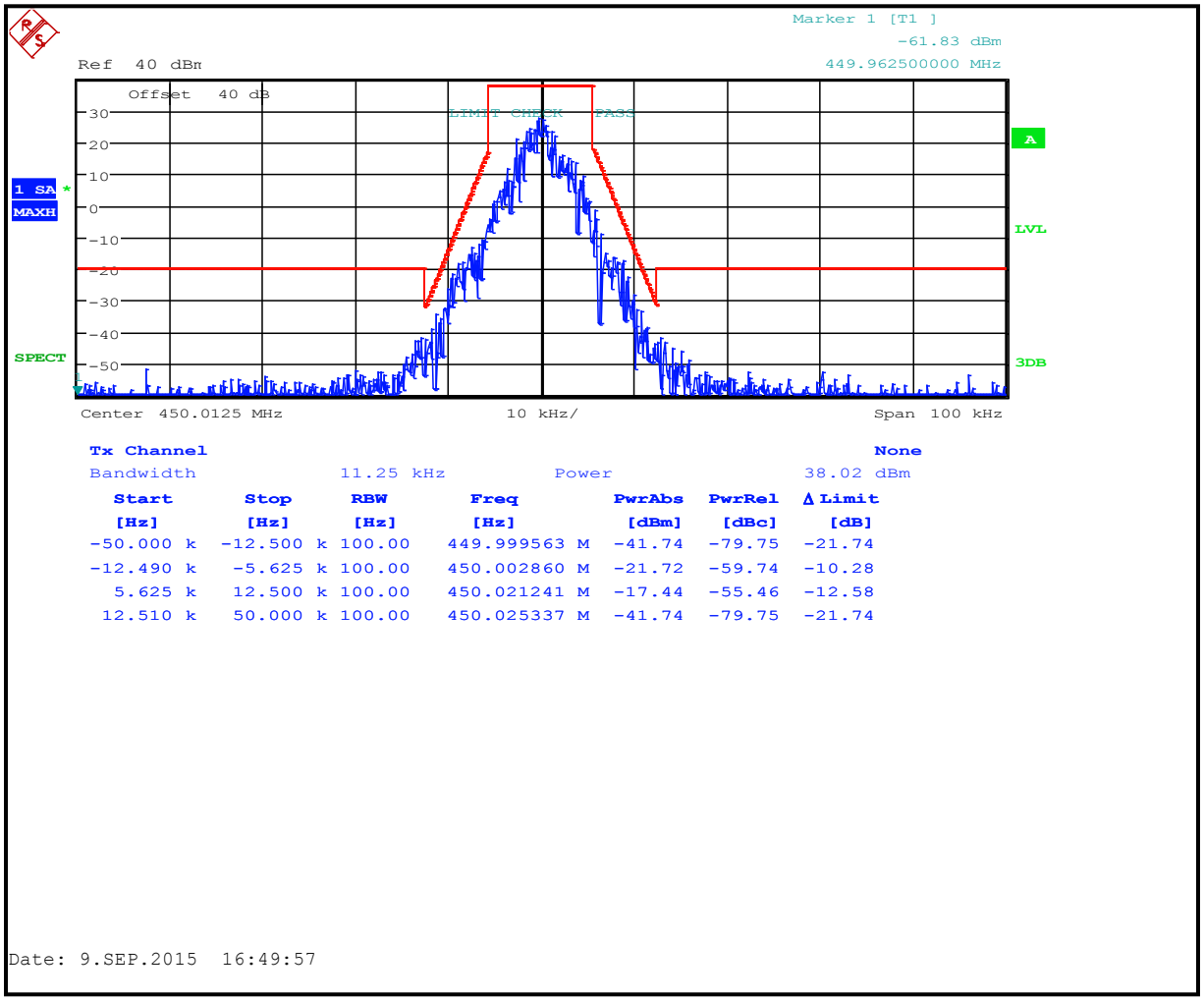
Plot 7-13: Occupied Bandwidth – 511.9875 MHz; Narrowband Analog; Mask D



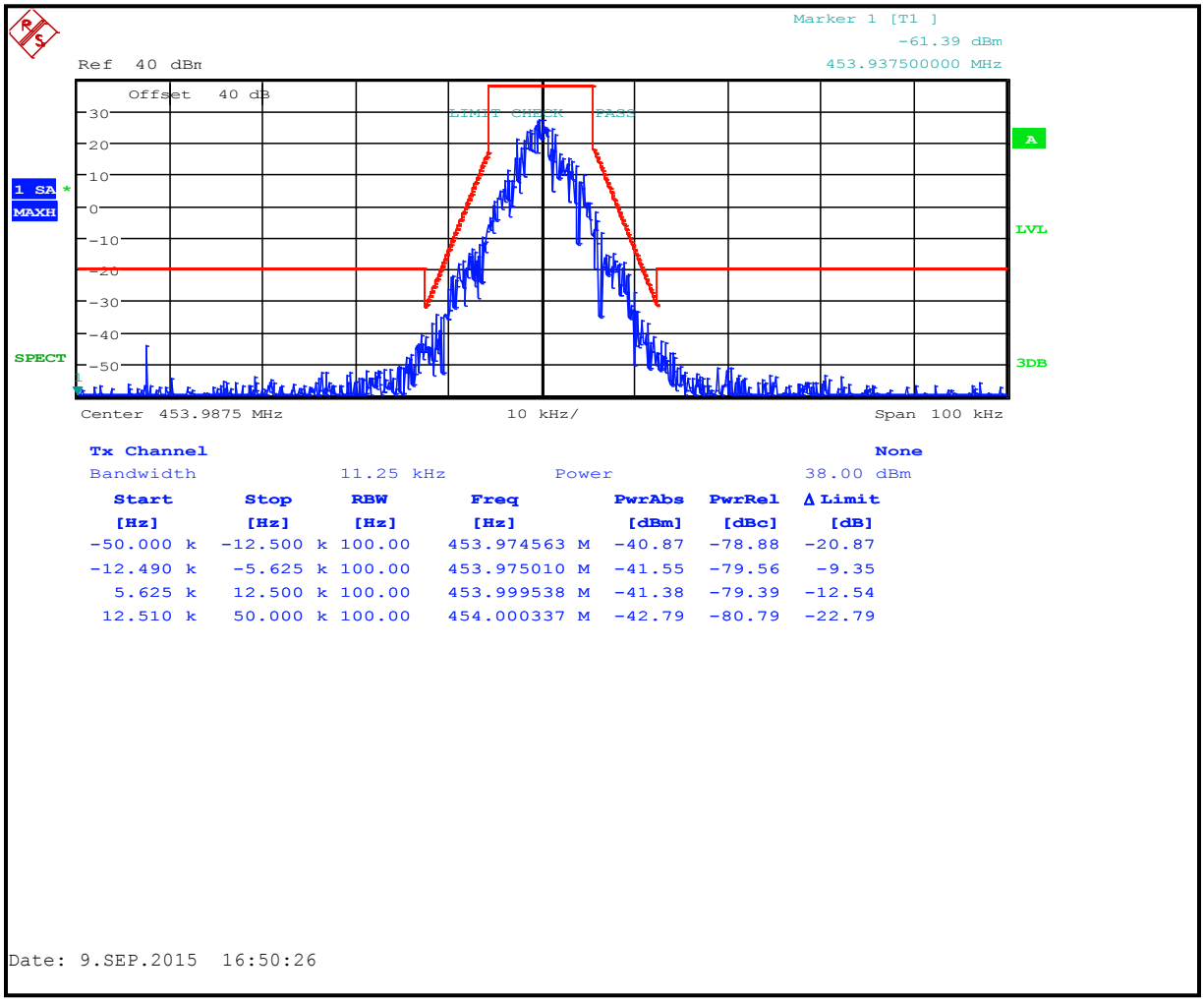
Plot 7-14: Occupied Bandwidth – 440.0125 MHz; Narrowband 2-level 9600 FSK; Mask D



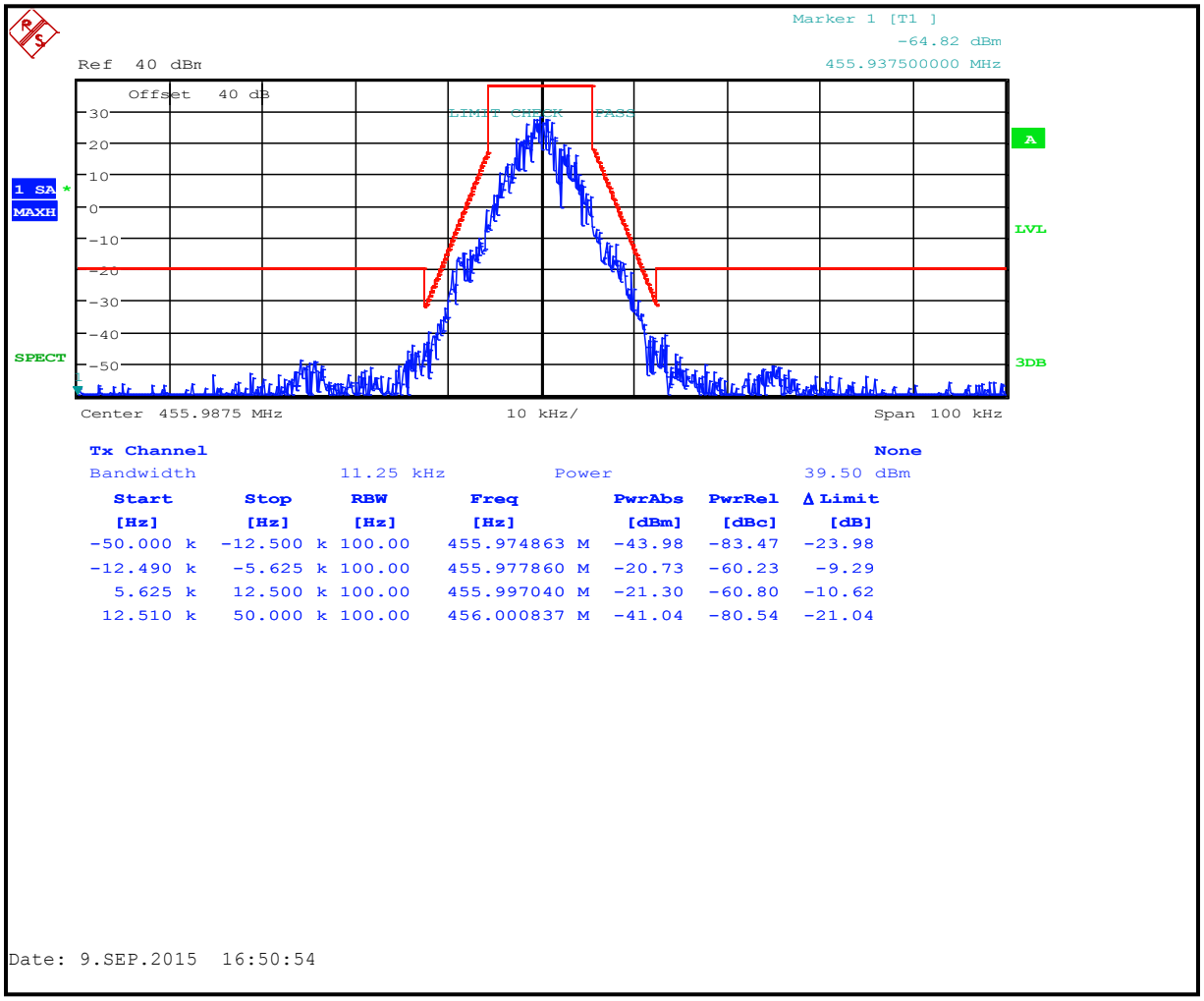
Plot 7-15: Occupied Bandwidth – 450.0125 MHz; Narrowband 2-level 9600 FSK; Mask D



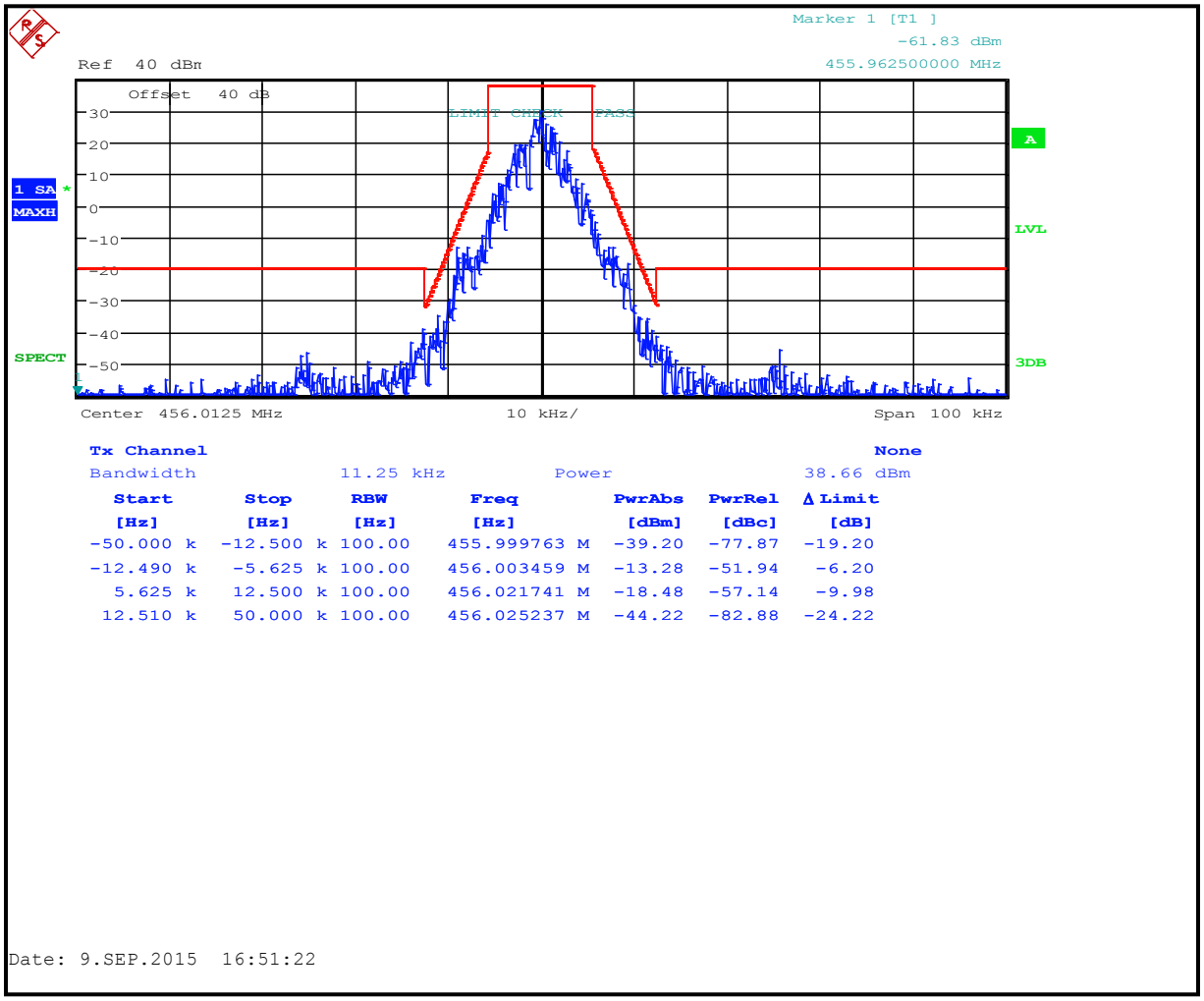
Plot 7-16: Occupied Bandwidth – 453.9875 MHz; Narrowband 2-level 9600 FSK; Mask D



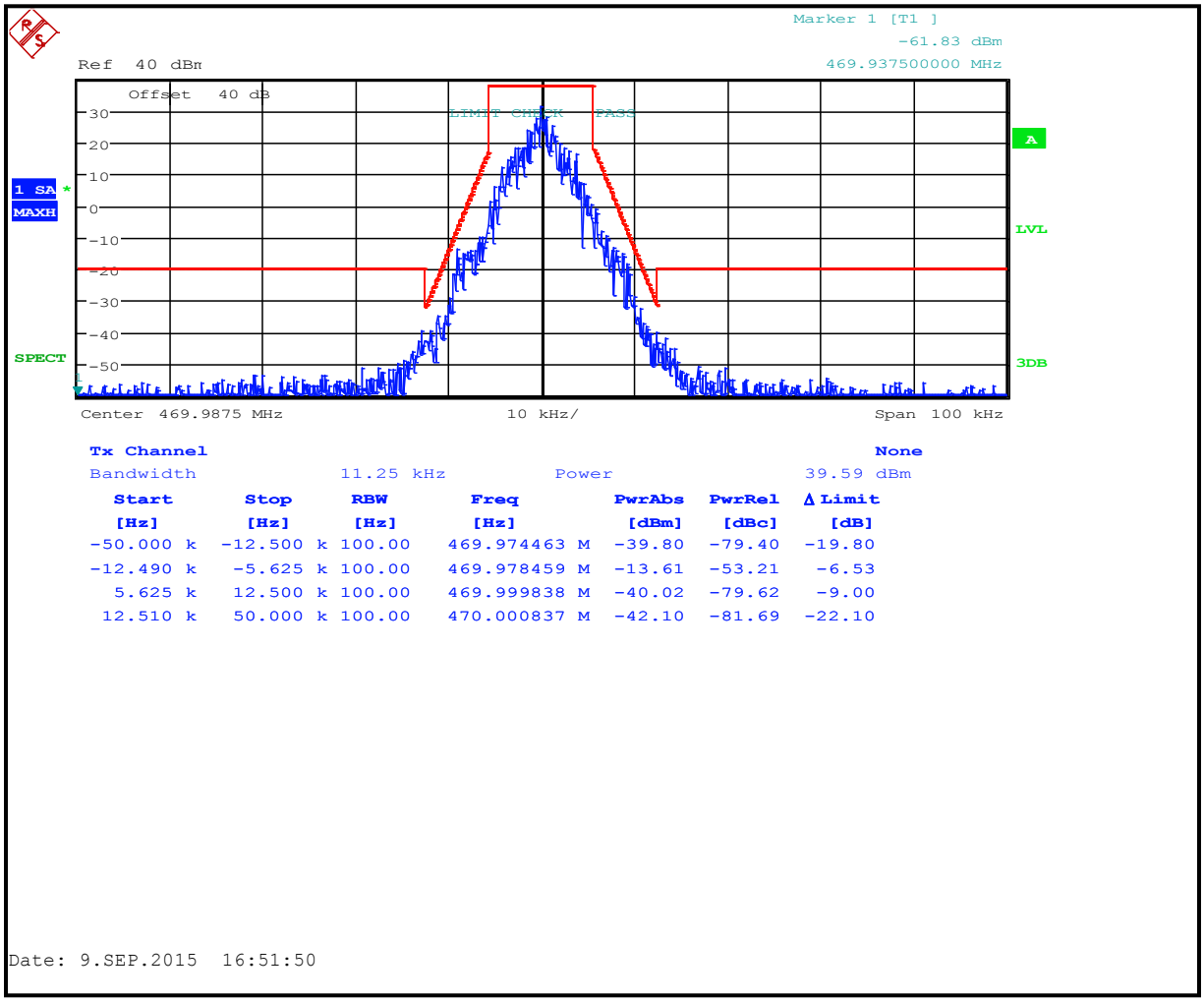
Plot 7-17: Occupied Bandwidth – 455.9875 MHz; Narrowband 2-level 9600 FSK; Mask D



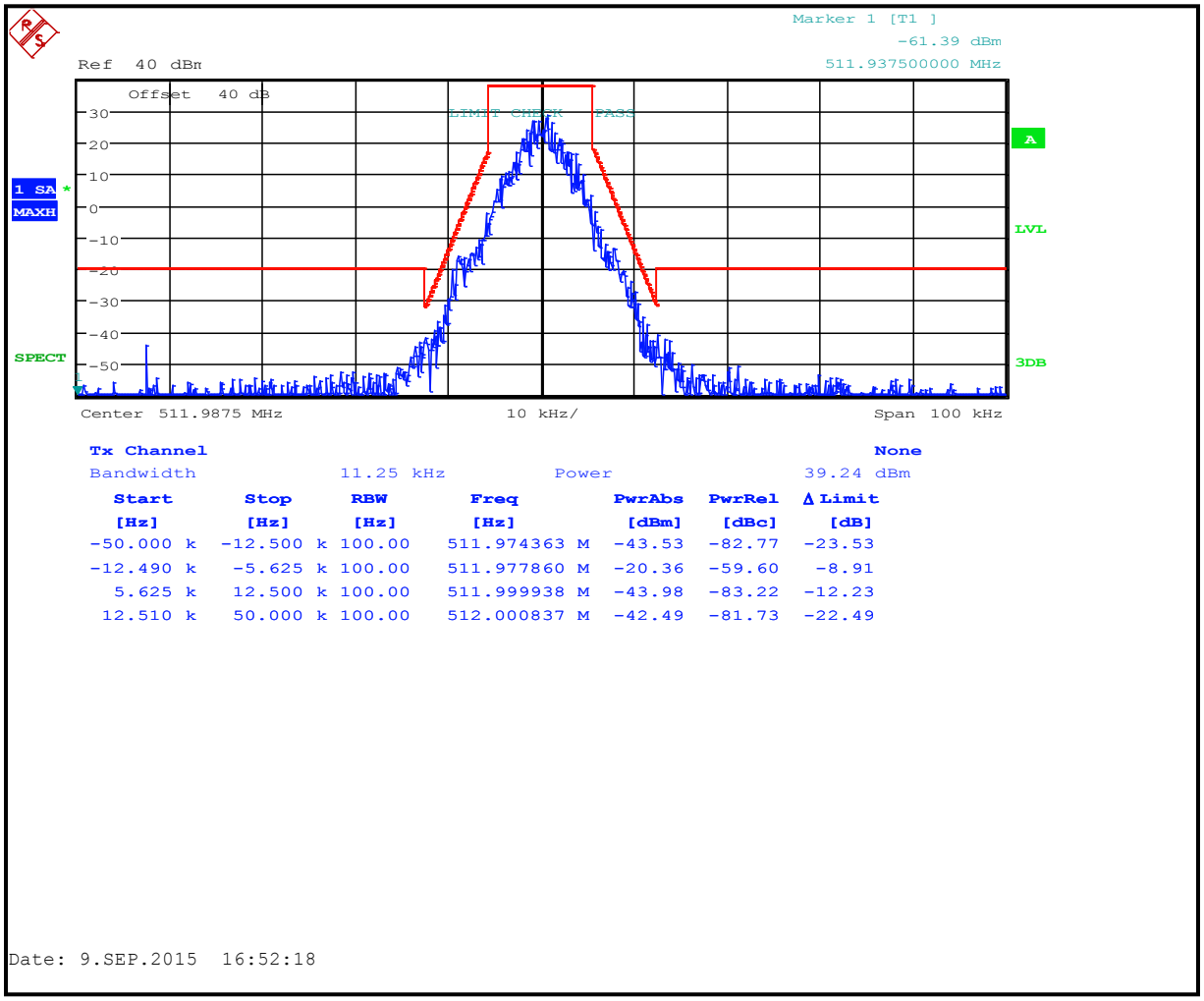
Plot 7-18: Occupied Bandwidth – 456.0125 MHz; Narrowband 2-level 9600 FSK; Mask D



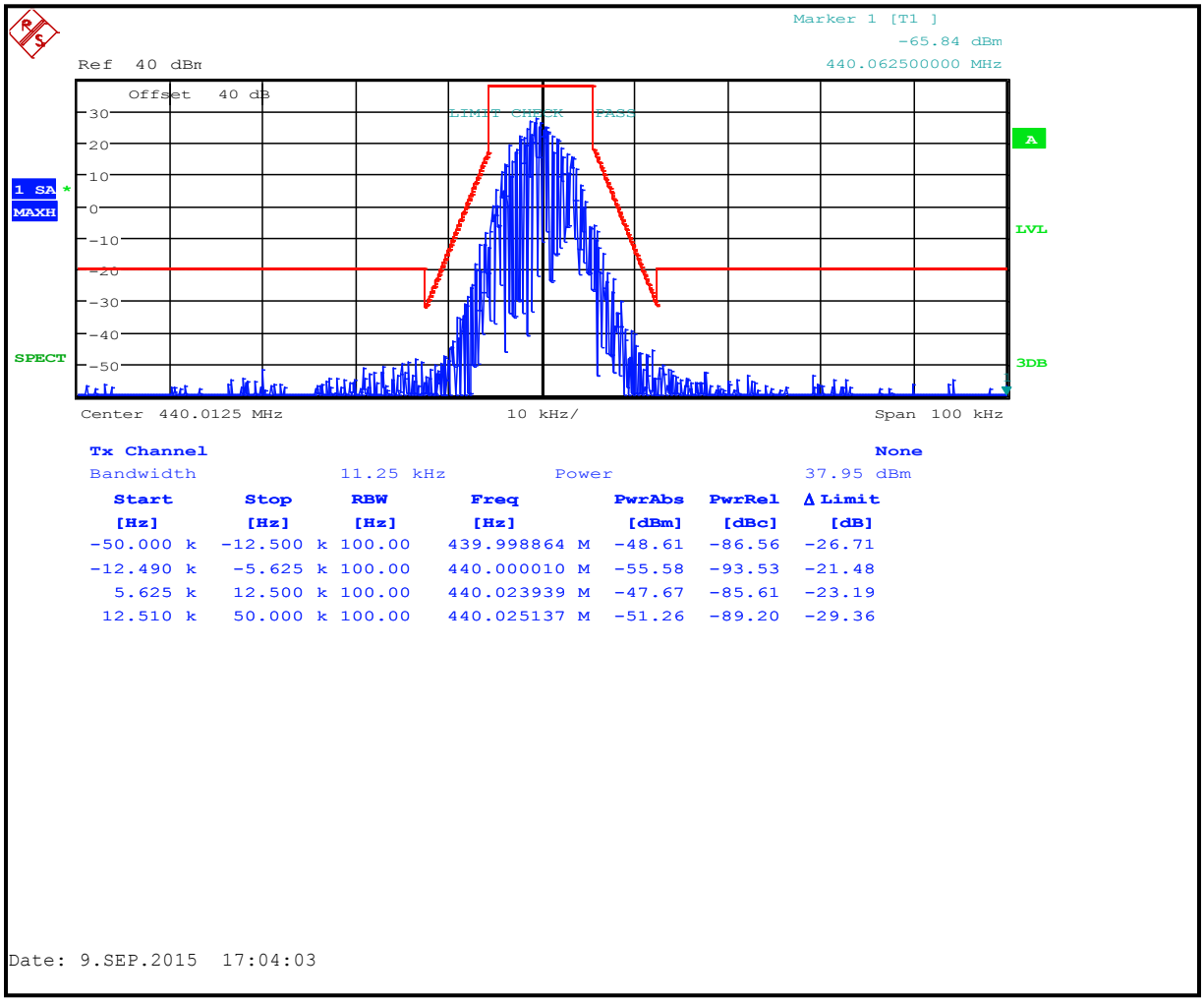
Plot 7-19: Occupied Bandwidth – 469.9875 MHz; Narrowband 2-level 9600 FSK; Mask D



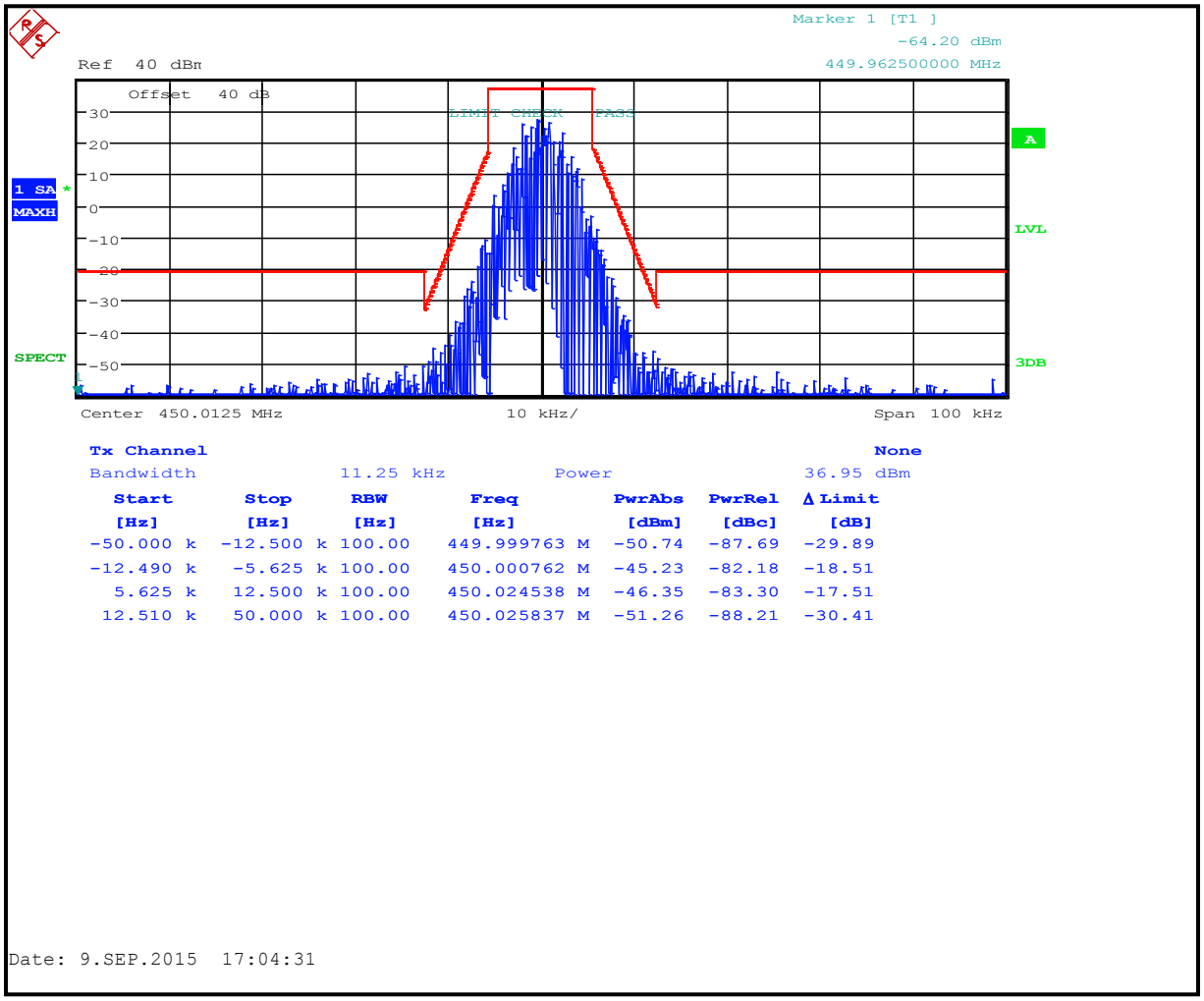
Plot 7-20: Occupied Bandwidth – 511.9875 MHz; Narrowband 2-level 9600 FSK; Mask D



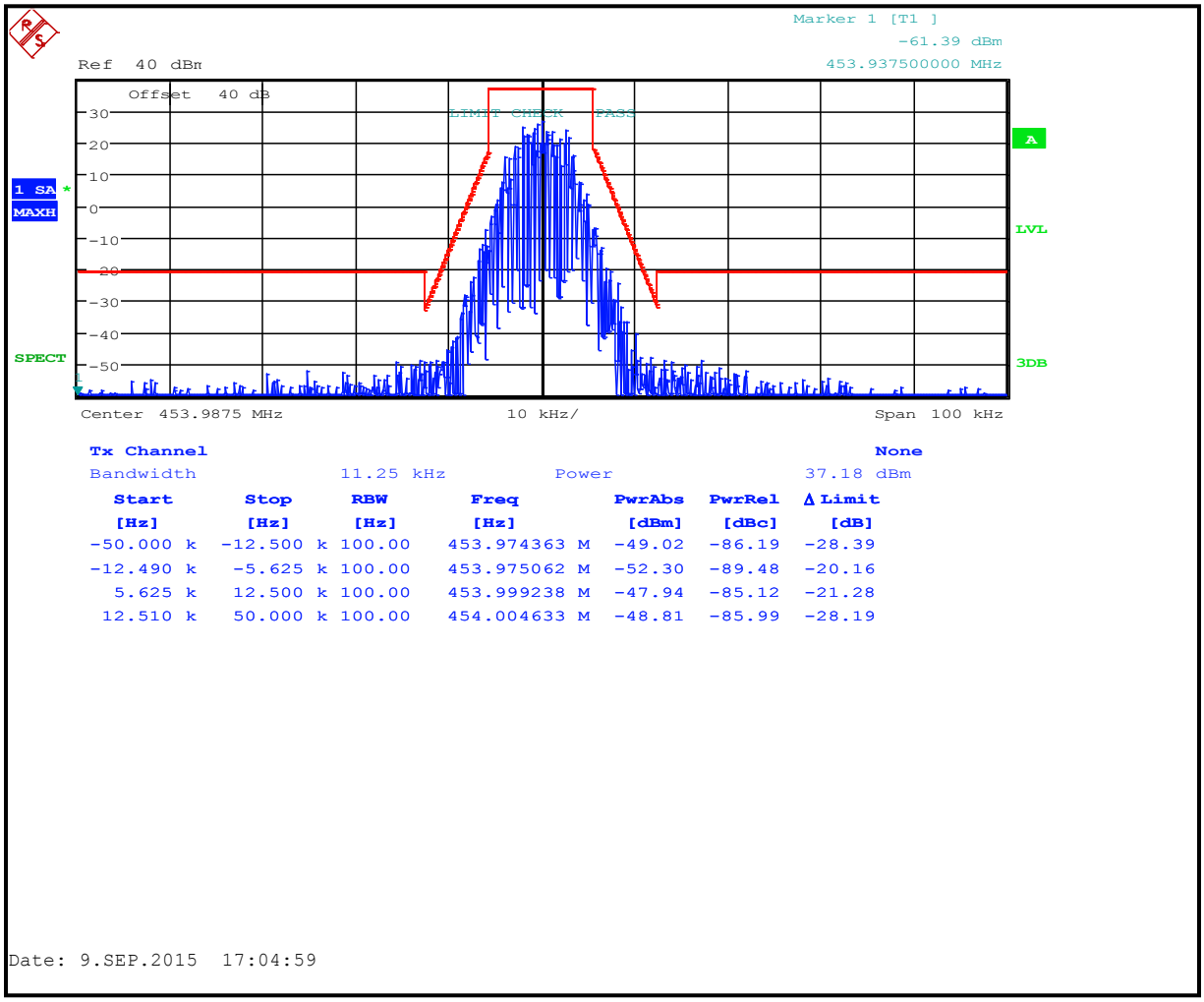
Plot 7-21: Occupied Bandwidth – 440.0125 MHz; Narrowband H-CPM TDMA; Mask D



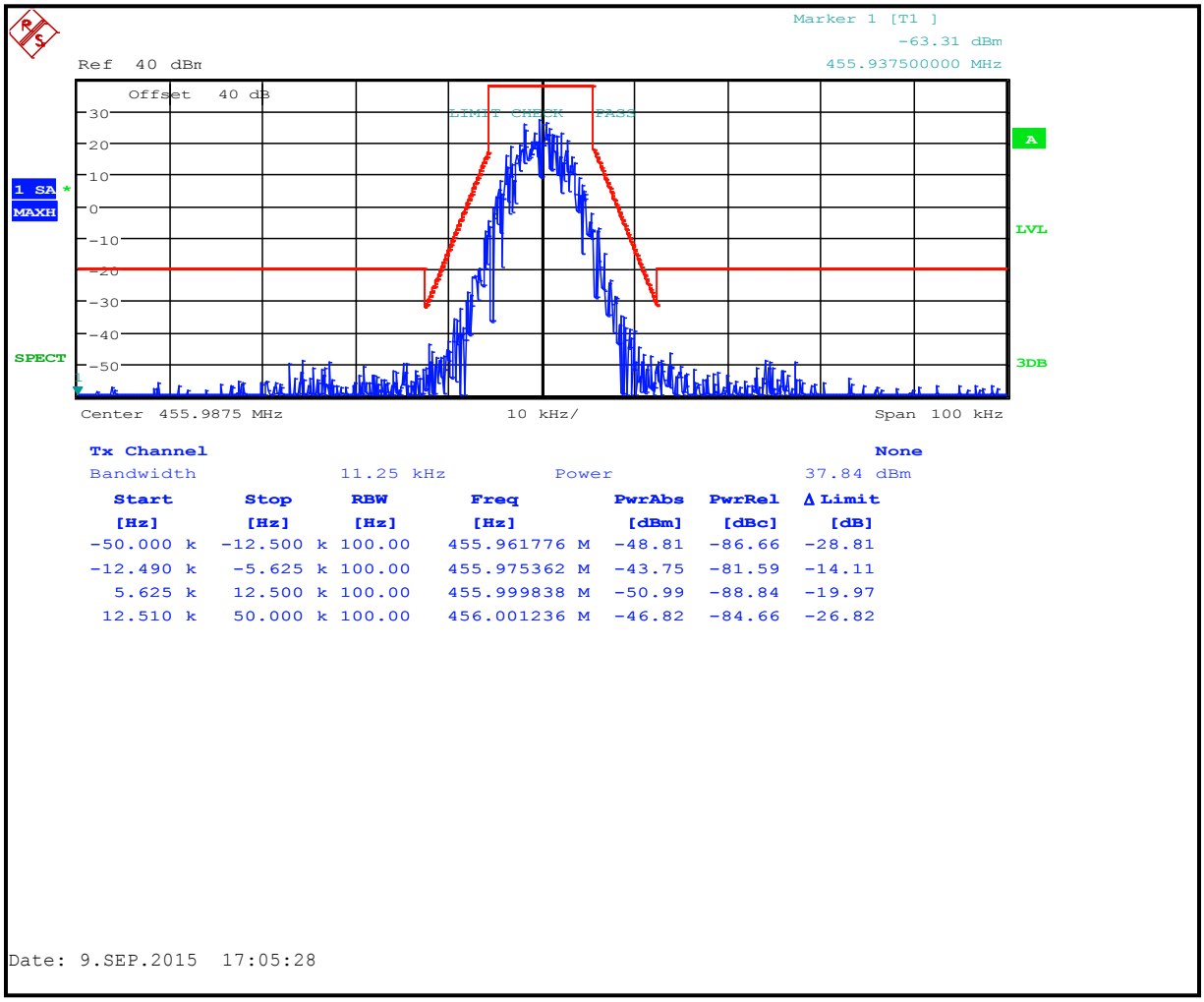
Plot 7-22: Occupied Bandwidth – 450.0125 MHz; Narrowband H-CPM TDMA; Mask D



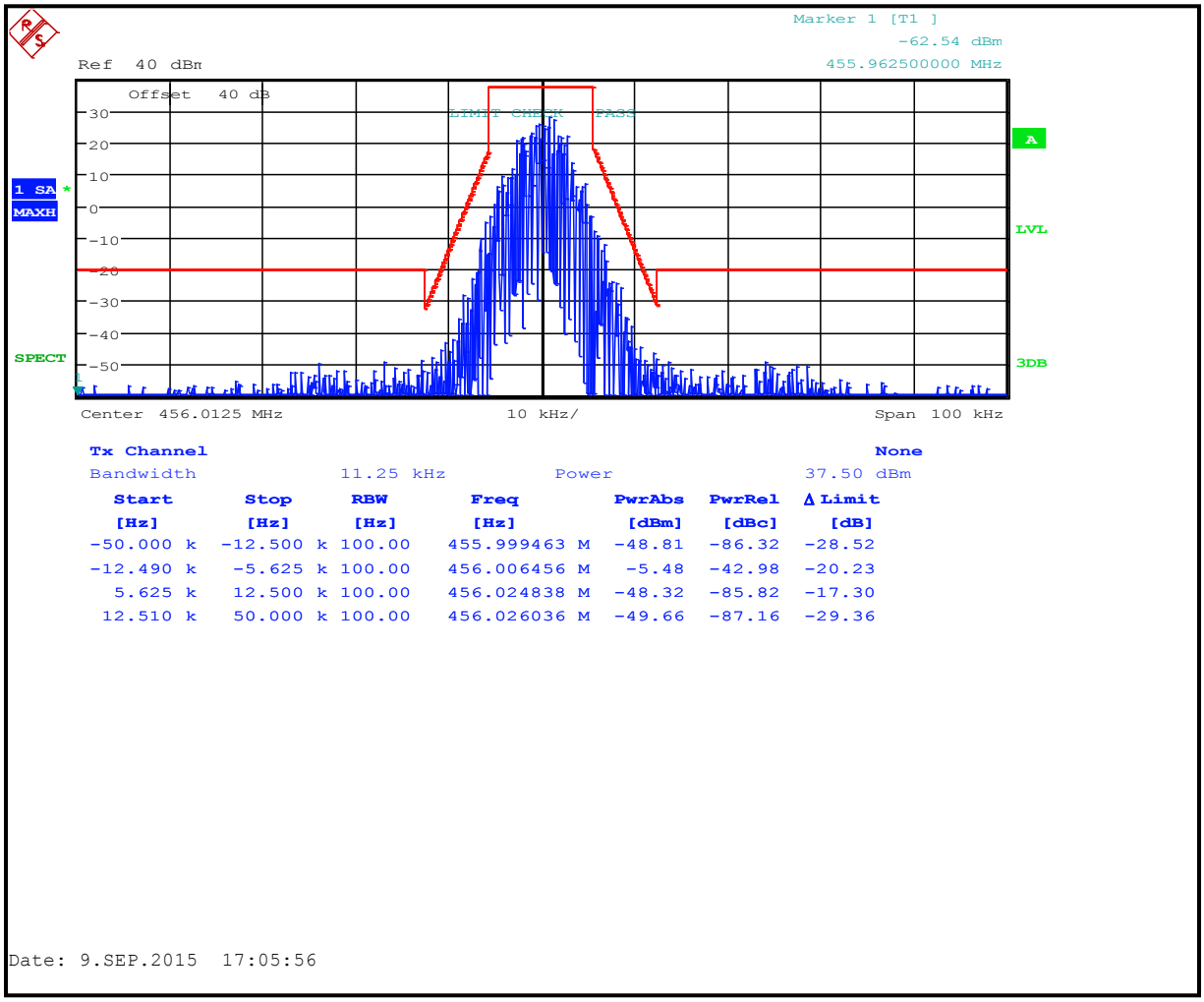
Plot 7-23: Occupied Bandwidth – 453.9875 MHz; Narrowband H-CPM TDMA; Mask D



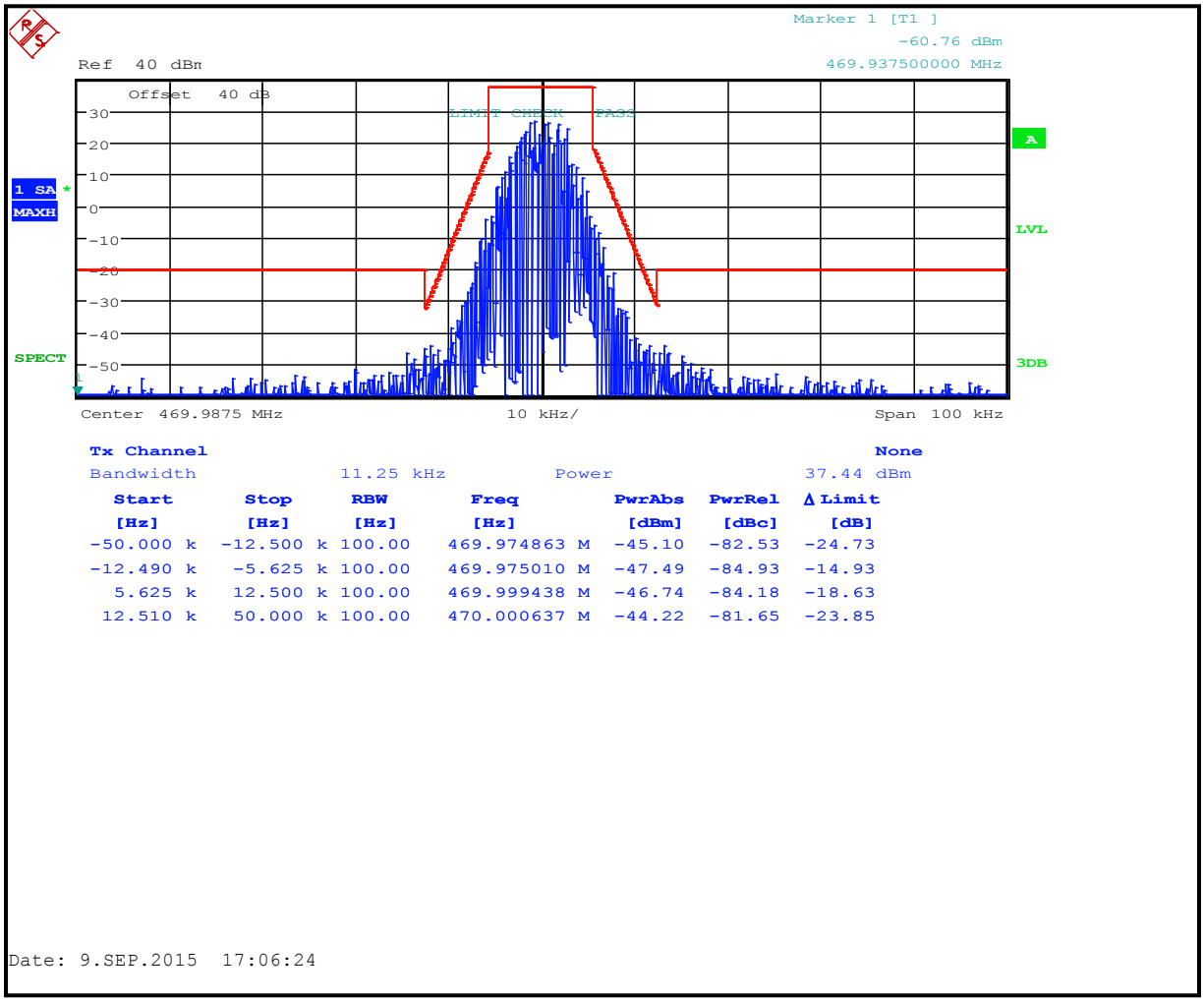
Plot 7-24: Occupied Bandwidth – 455.9875 MHz; Narrowband H-CPM TDMA; Mask D



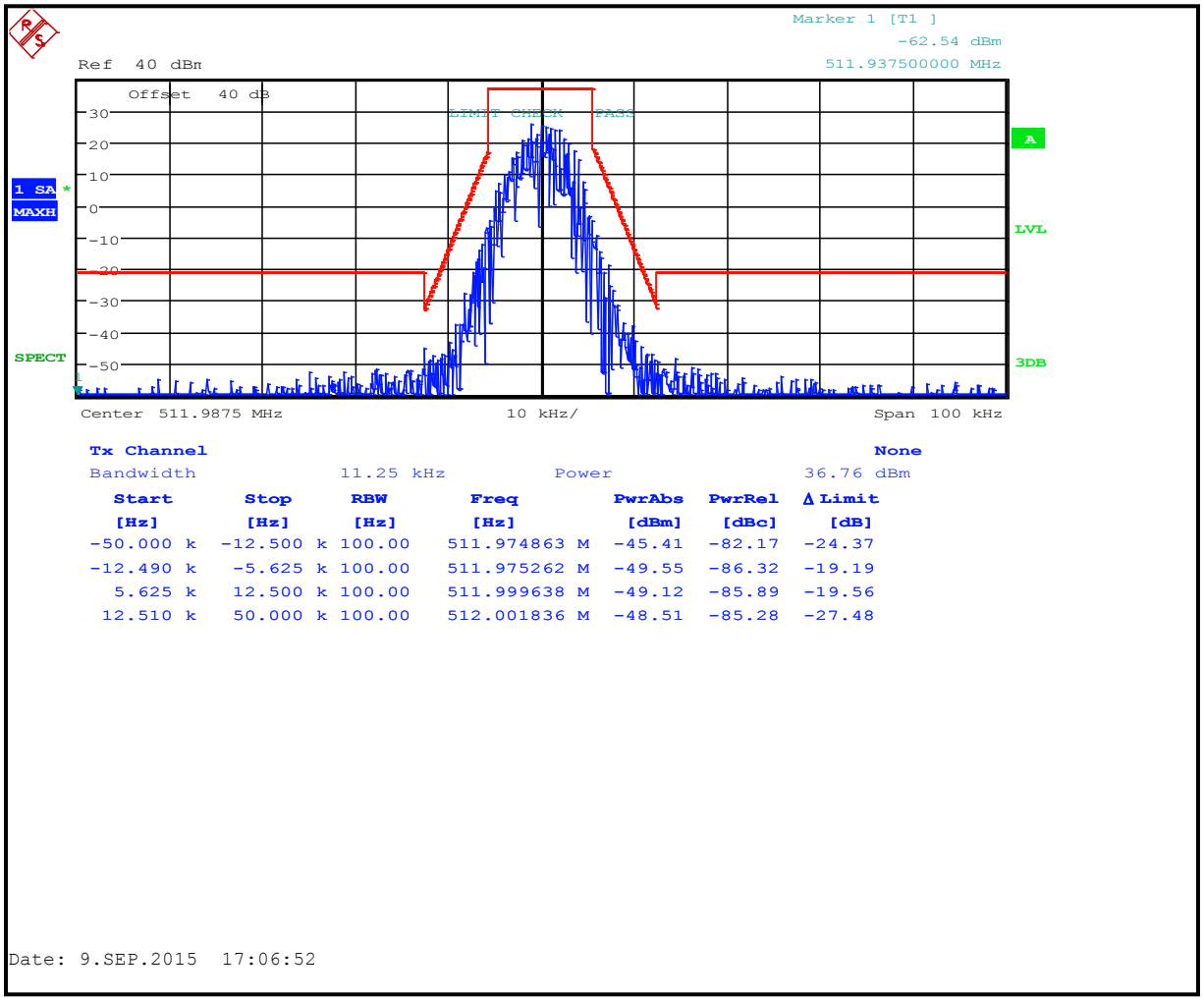
Plot 7-25: Occupied Bandwidth – 456.0125 MHz; Narrowband H-CPM TDMA; Mask D



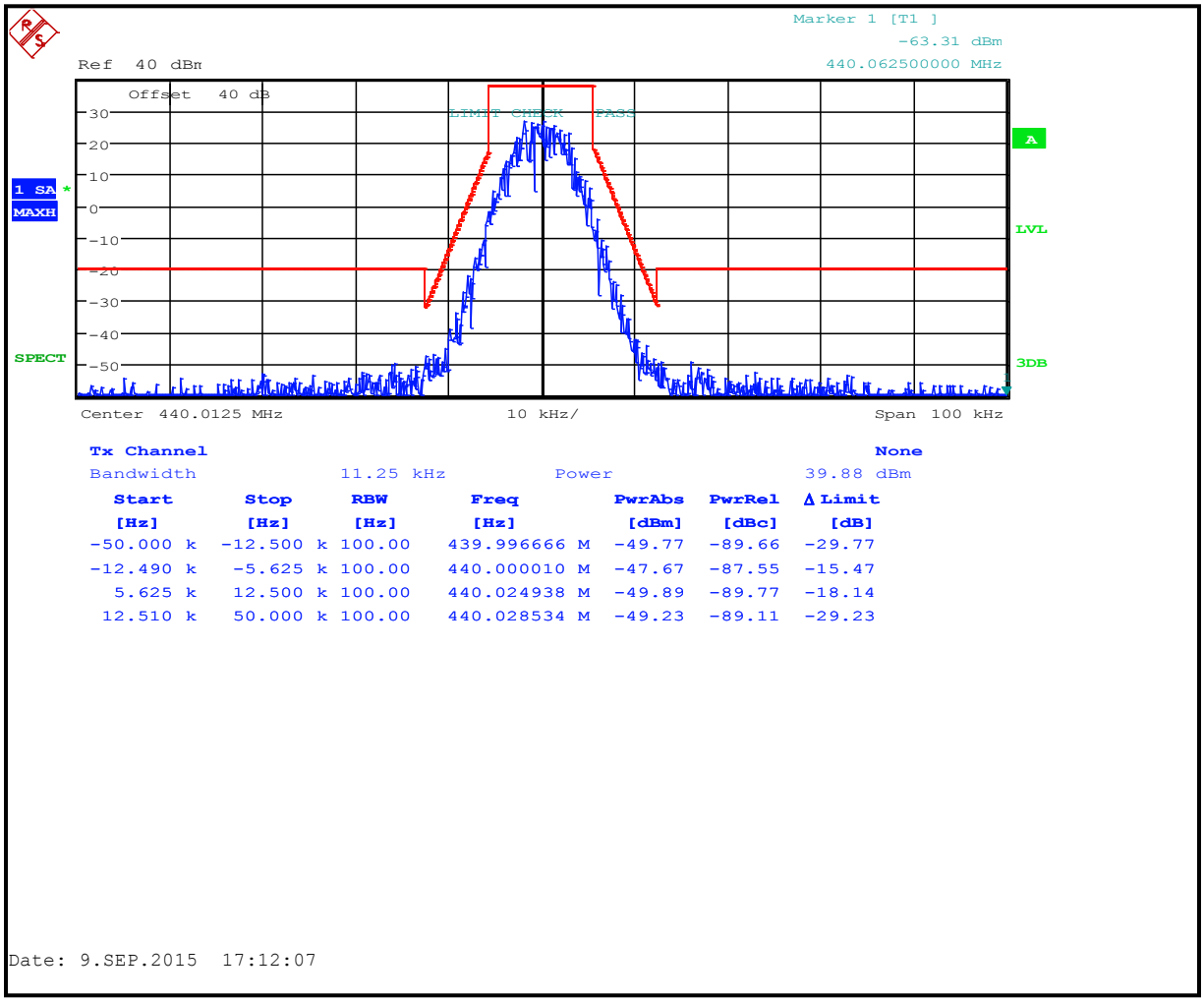
Plot 7-26: Occupied Bandwidth – 469.9875 MHz; Narrowband H-CPM TDMA; Mask D



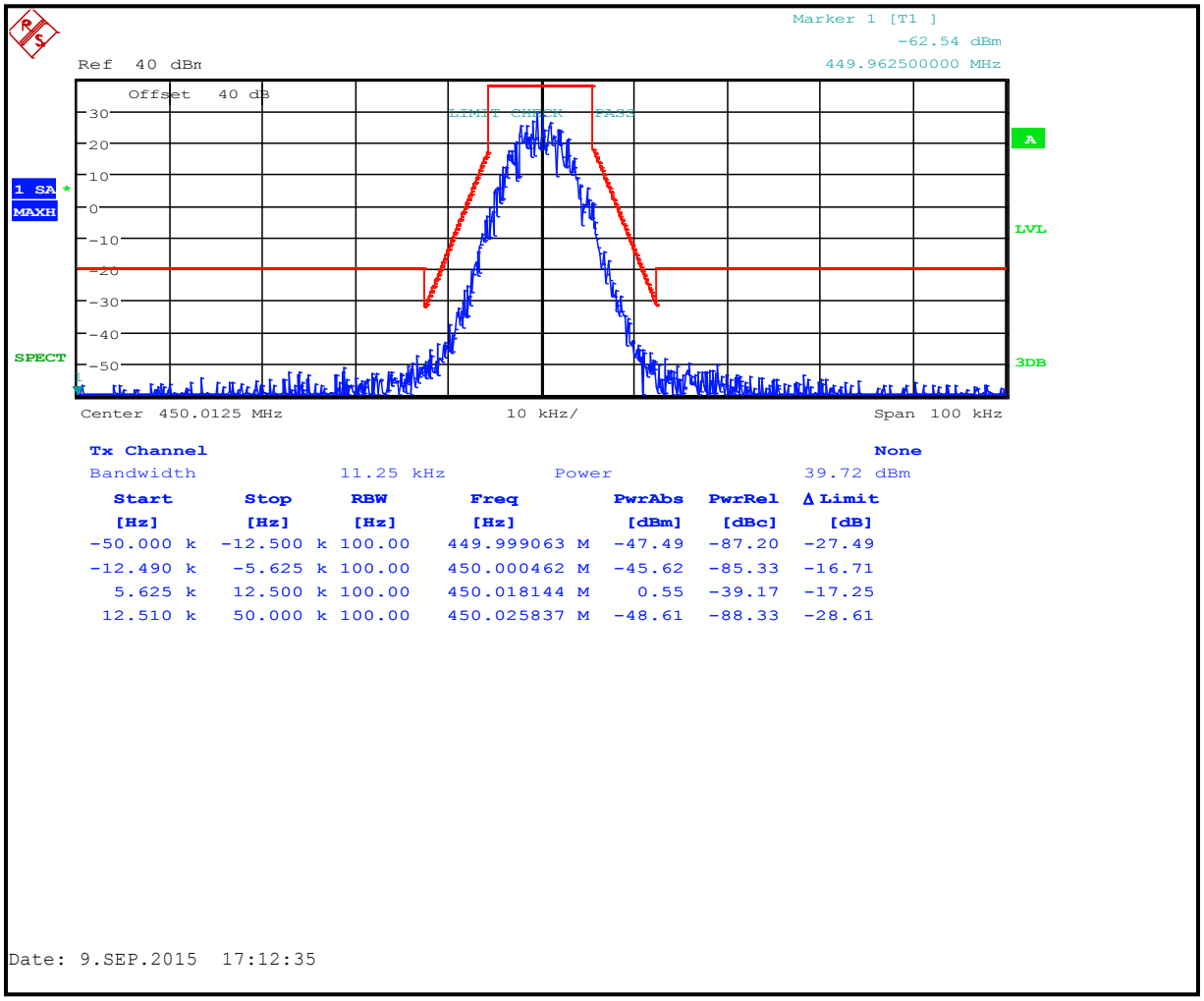
Plot 7-27: Occupied Bandwidth – 511.9875 MHz; Narrowband H-CPM TDMA; Mask D



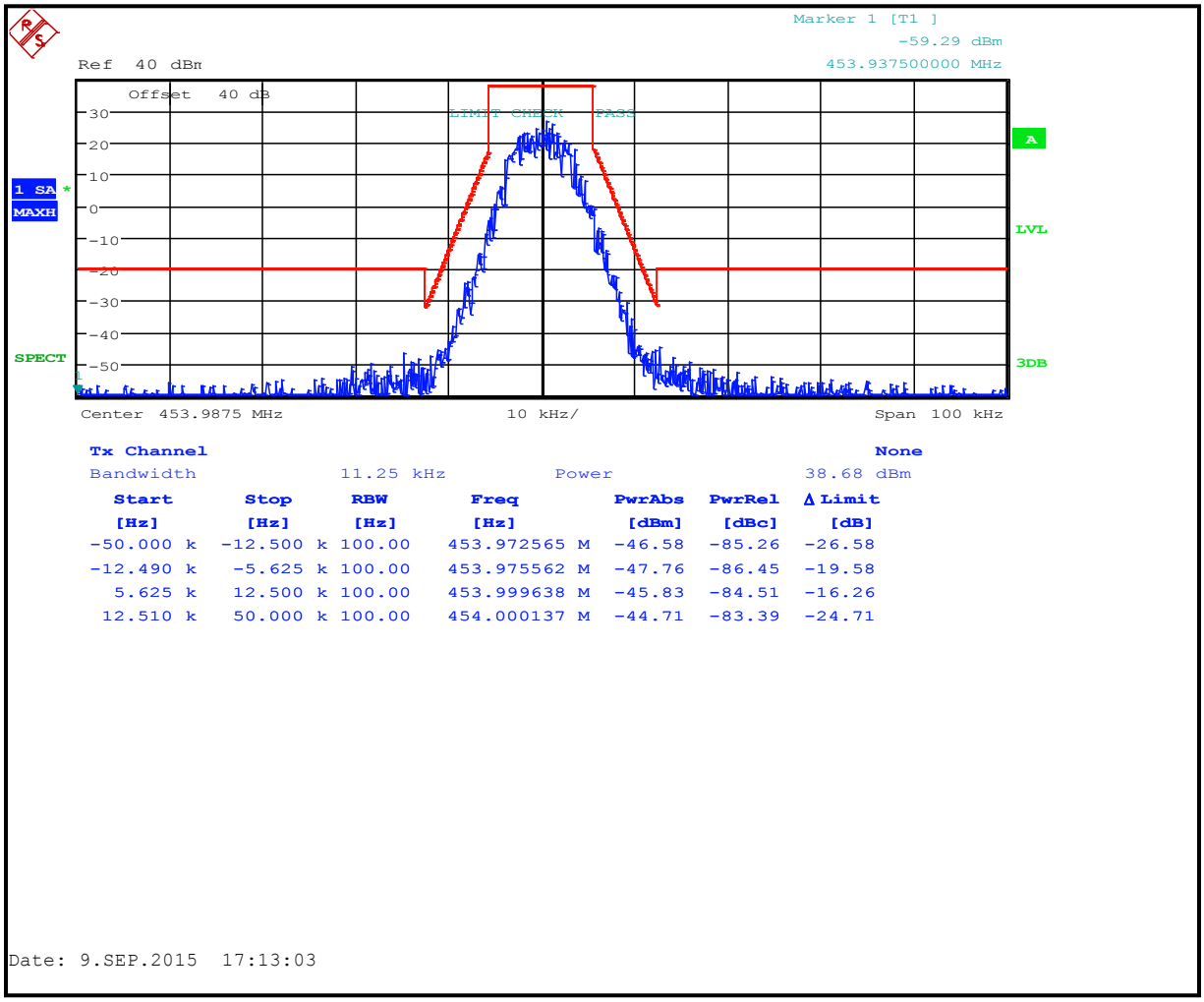
Plot 7-28: Occupied Bandwidth – 440.0125 MHz; Narrowband P25; Mask D



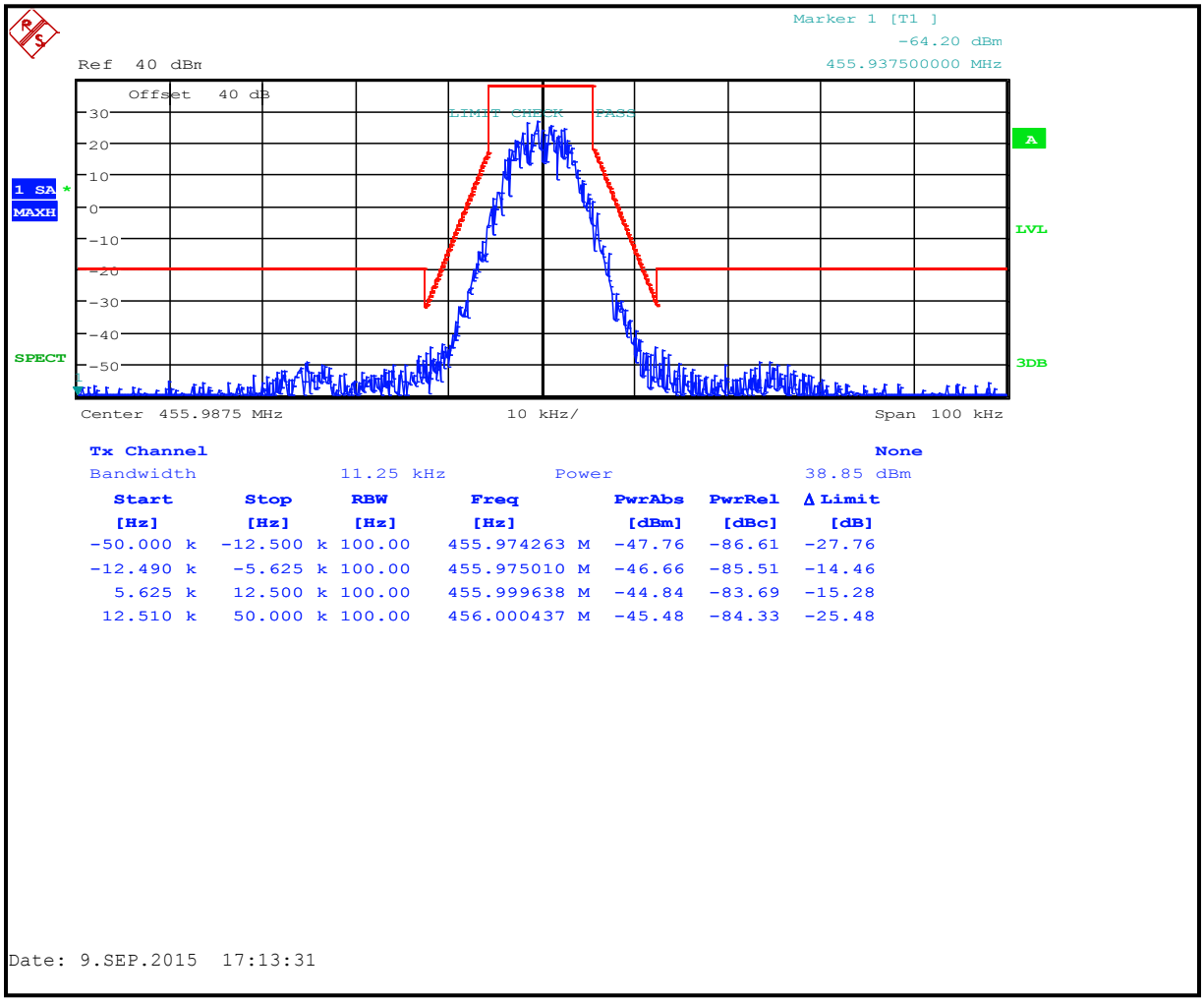
Plot 7-29: Occupied Bandwidth – 450.0125 MHz; Narrowband P25; Mask D



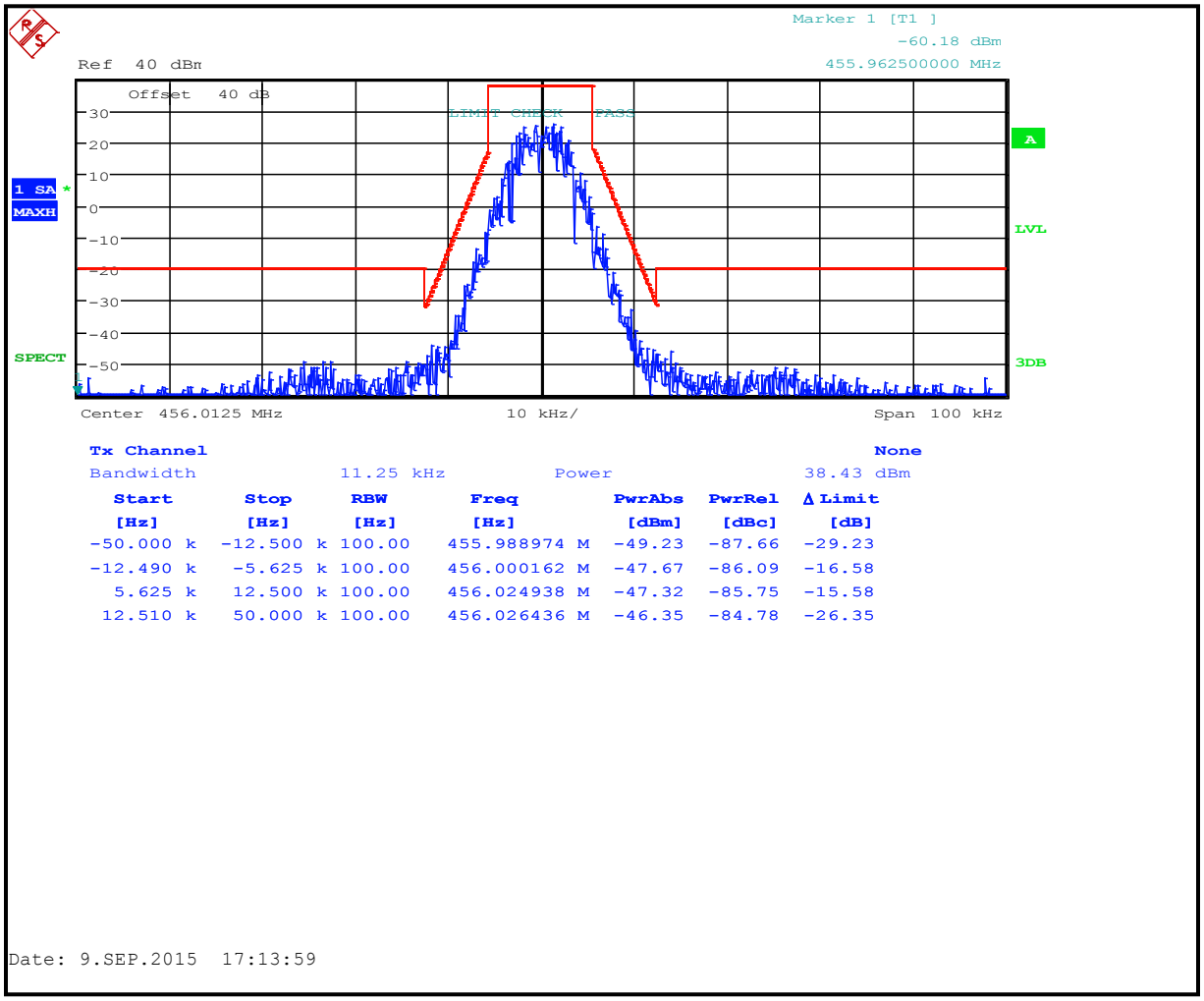
Plot 7-30: Occupied Bandwidth – 453.9875 MHz; Narrowband P25; Mask D



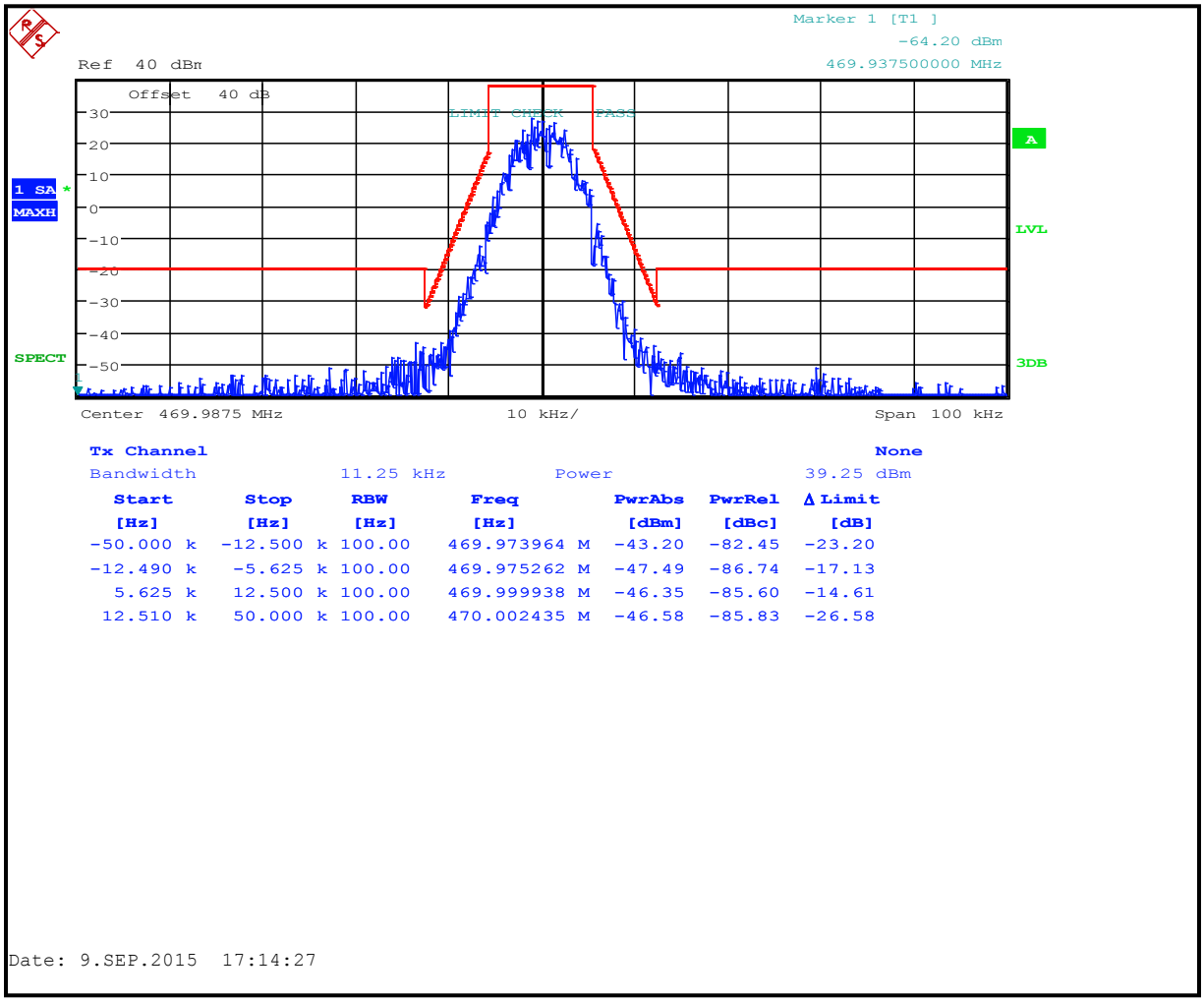
Plot 7-31: Occupied Bandwidth – 455.9875 MHz; Narrowband P25; Mask D



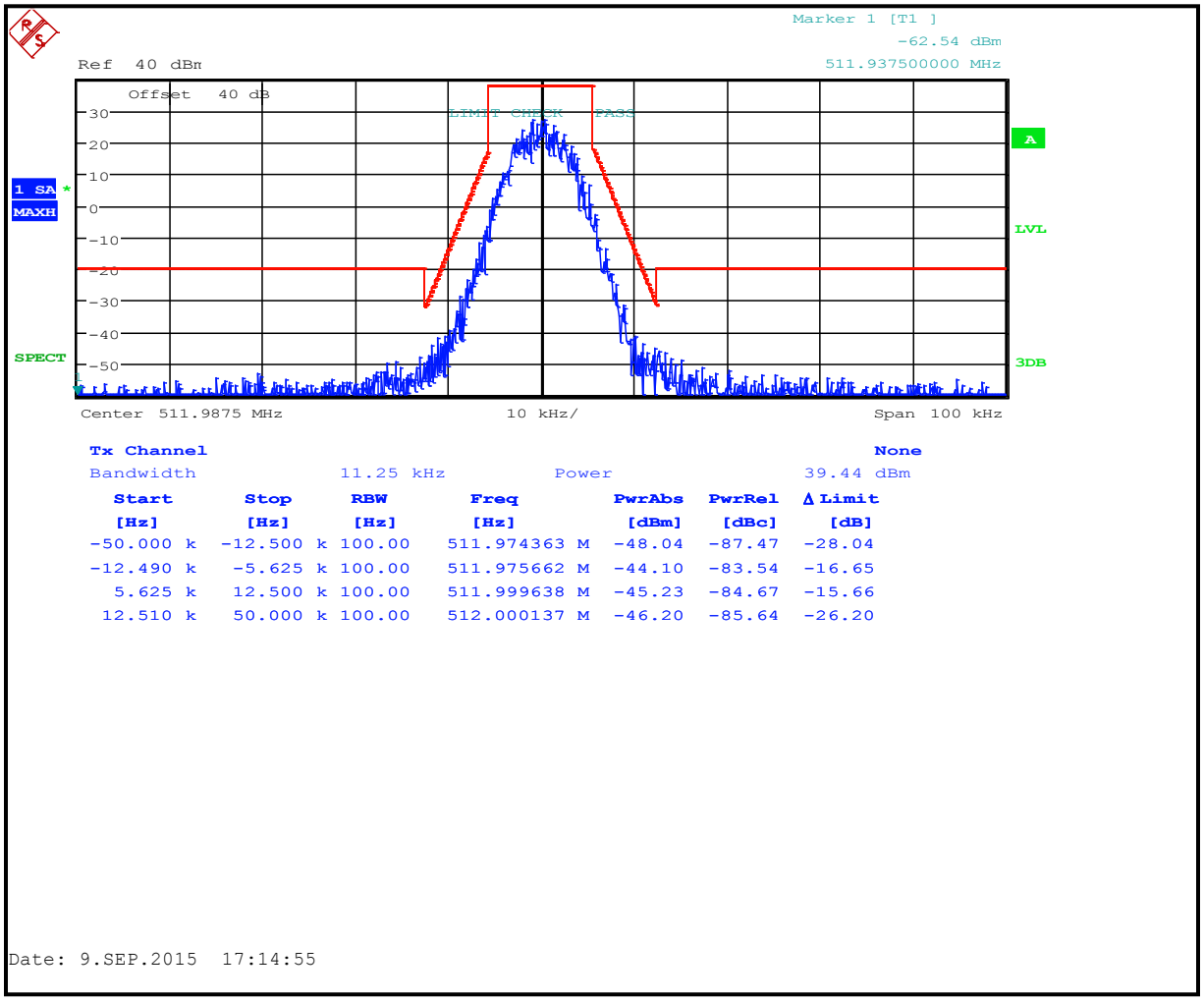
Plot 7-32: Occupied Bandwidth – 456.0125 MHz; Narrowband P25; Mask D



Plot 7-33: Occupied Bandwidth – 469.9875 MHz; Narrowband P25; Mask D



Plot 7-34: Occupied Bandwidth – 511.9875 MHz; Narrowband P25; Mask D



Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty = 12 Hz.

Results: The EUT is compliant.

Table 7-1: Test Equipment Used for Testing Occupied Bandwidth

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901581	Rohde & Schwarz	FSU	Spectrum Analyzer	1166.1660.50	11/13/15
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/6/15
901057	Hewlett Packard	3336B	Synthesizer/ Level Generator	2514A02585	4/13/17

Test Personnel:

Daniel Baltzell		September 9, 2015
Test Engineer	Signature	Date of Test

8 FCC Part 2.1055, 22.355, 74.464, 80.209, 90.213; IC RSS-119 5.3: Frequency Stability

8.1 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 +55°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.

Part 22.355 and 90.213: Mobile stations over 2 W operating power - 5 ppm.

Part 74 Mobile is 0.0005%

80.209(a)(7) Band 400–466 MHz: 5ppm.

8.2 Test Data

8.2.1 Temperature Frequency Stability

Table 8-1: Temperature Frequency Stability – 450.0125 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	450.012514	-0.03
-20	450.012456	0.10
-10	450.012544	-0.10
0	450.012525	-0.06
10	450.012548	-0.11
20 (reference)	450.012500	0.00
30	450.012448	0.12
40	450.012395	0.23
50	450.012365	0.30
55	450.012369	0.29

Table 8-2: Temperature Frequency Stability – 456.0125 MHz

Temperature (°C)	Measured Frequency (Hz)	ppm
-30	469.987536	-0.08
-20	469.987478	0.05
-10	469.987561	-0.13
0	469.987544	-0.09
10	469.987560	-0.13
20 (reference)	469.987500	0.00
30	469.987451	0.10
40	469.987410	0.19
50	469.987374	0.27
55	469.987385	0.24

Results: The EUT is compliant.

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty = 12 Hz.

Table 8-3: 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	3/28/16
901300	Agilent Technologies	53131A (225 MHz)	Universal Frequency Counter	MY40001345	3/5/16
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/6/15
901350	Meterman	33XR	Multimeter	040402802	4/14/17

Test Personnel:

Daniel Baltzell		September 10, 2015
Test Engineer	Signature	Date of Tests

8.2.2 Frequency Stability/Voltage Variation

Table 8-4: Frequency Stability/Voltage Variation – 450.0125 MHz

Voltage (VDC)	Measured Frequency (MHz)	ppm
5.07 (battery end-point)	450.012465	0.08
6.375	450.012472	0.06
7.5 (reference)	450.012474	0.06
8.625	450.012481	0.04

Table 8-5: Frequency Stability/Voltage Variation – 456.0125 MHz

Voltage (VDC)	Measured Frequency (MHz)	ppm
5.13 (battery end-point)	469.987475	0.05
6.375	469.987484	0.03
7.5 (reference)	469.987492	0.02
8.625	469.987494	0.01

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 1.96. Measurement uncertainty = 12 Hz.

Results: The EUT is compliant.

Table 8-6: Test Equipment Used for Testing Frequency Stability/Voltage Variation

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity	11380	3/28/16
901300	Agilent Technologies	53131A (225 MHz)	Universal Frequency Counter	MY40001345	3/5/16
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/6/15
901350	Meterman	33XR	Multimeter	040402802	4/14/17

Test Personnel:

Daniel Baltzell		September 10, 2015
Test Engineer	Signature	Date of Tests

9 FCC Rules and Regulations Part 74.462(c), 90.214; IC RSS-119 5.9: Transient Frequency Response

9.1 Test Procedure

ANSI/TIA-603-C-2004 Section 2.2.3

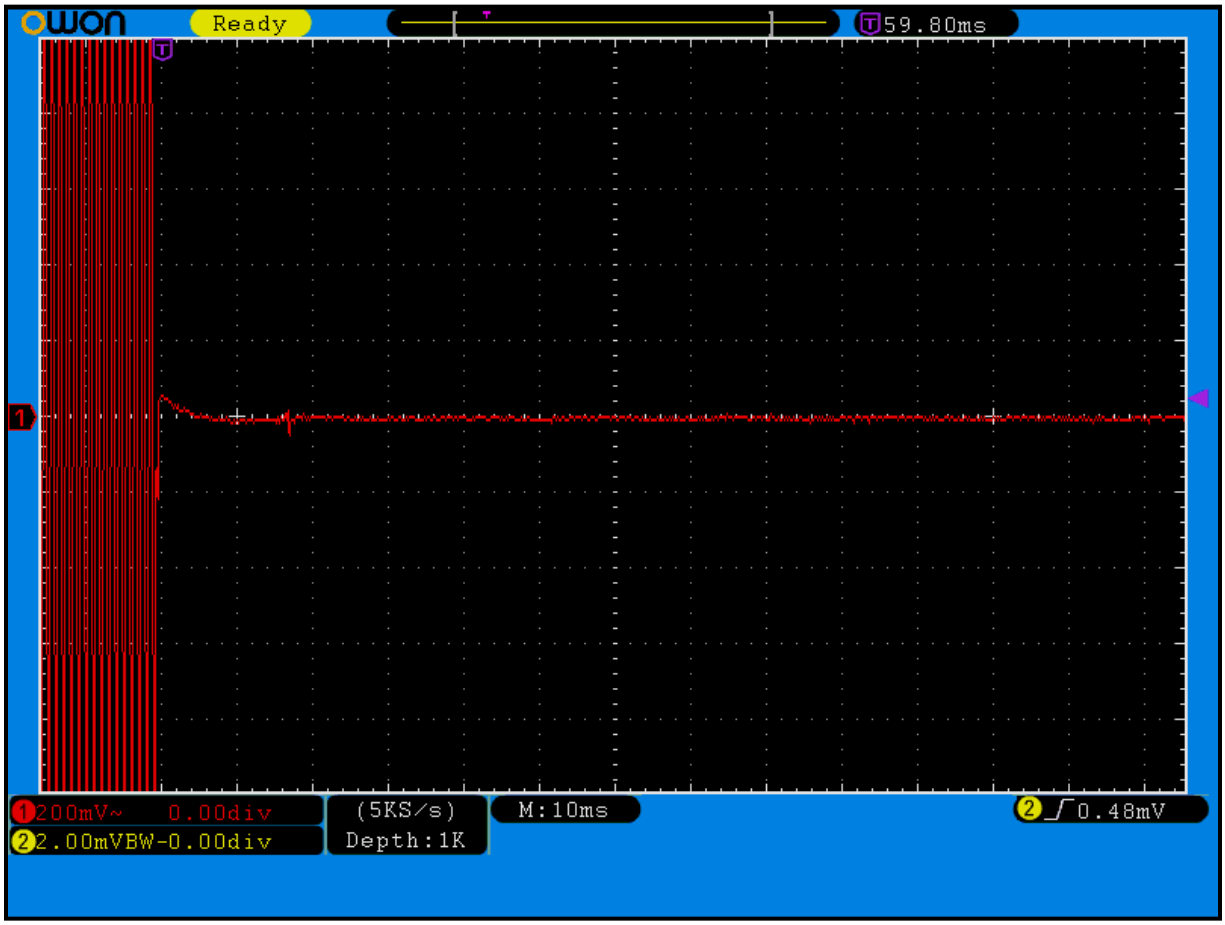
90.214 Transient frequency behavior. Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

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]	±625 kHz	5.0 ms	10.0 ms

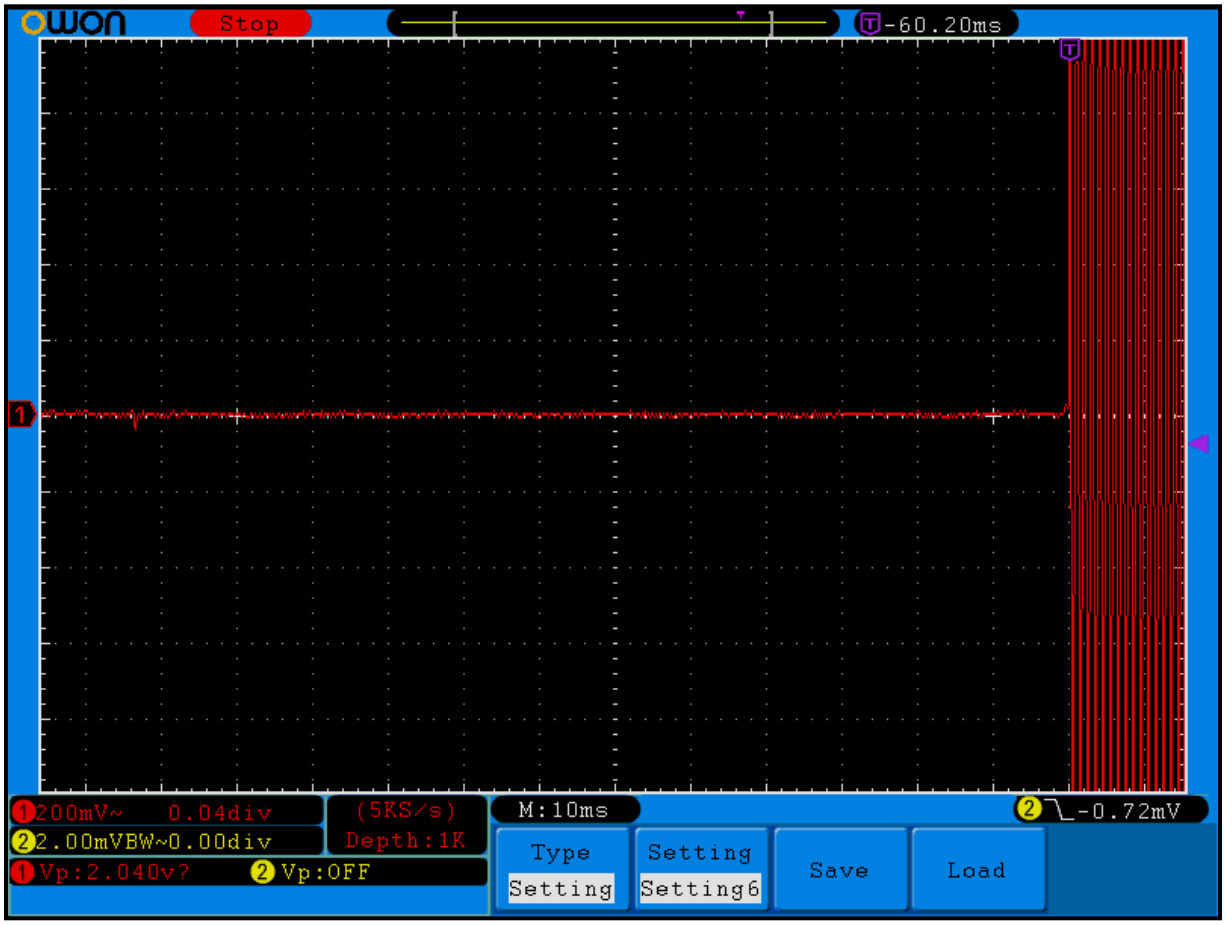
[1] t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
t_1 is the time period immediately following $t_{on.}$
t_2 is the time period immediately following $t_{1.}$
t_3 is the time period from the instant the transmitter is turned off until $t_{off.}$
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 W or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

9.2 Test Data

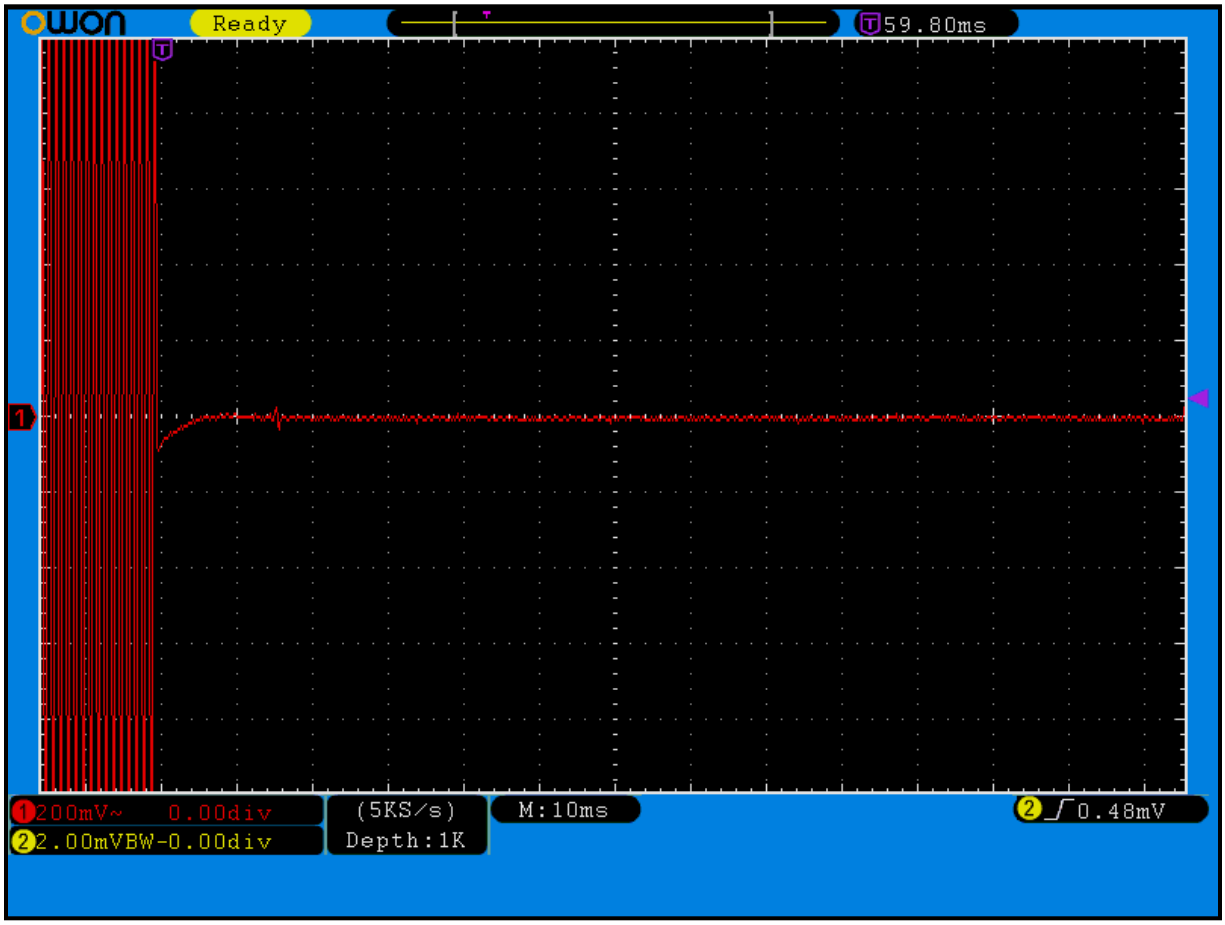
Plot 9-1: Transient Frequency Behavior – NB; Carrier On Time; 450.0125 MHz



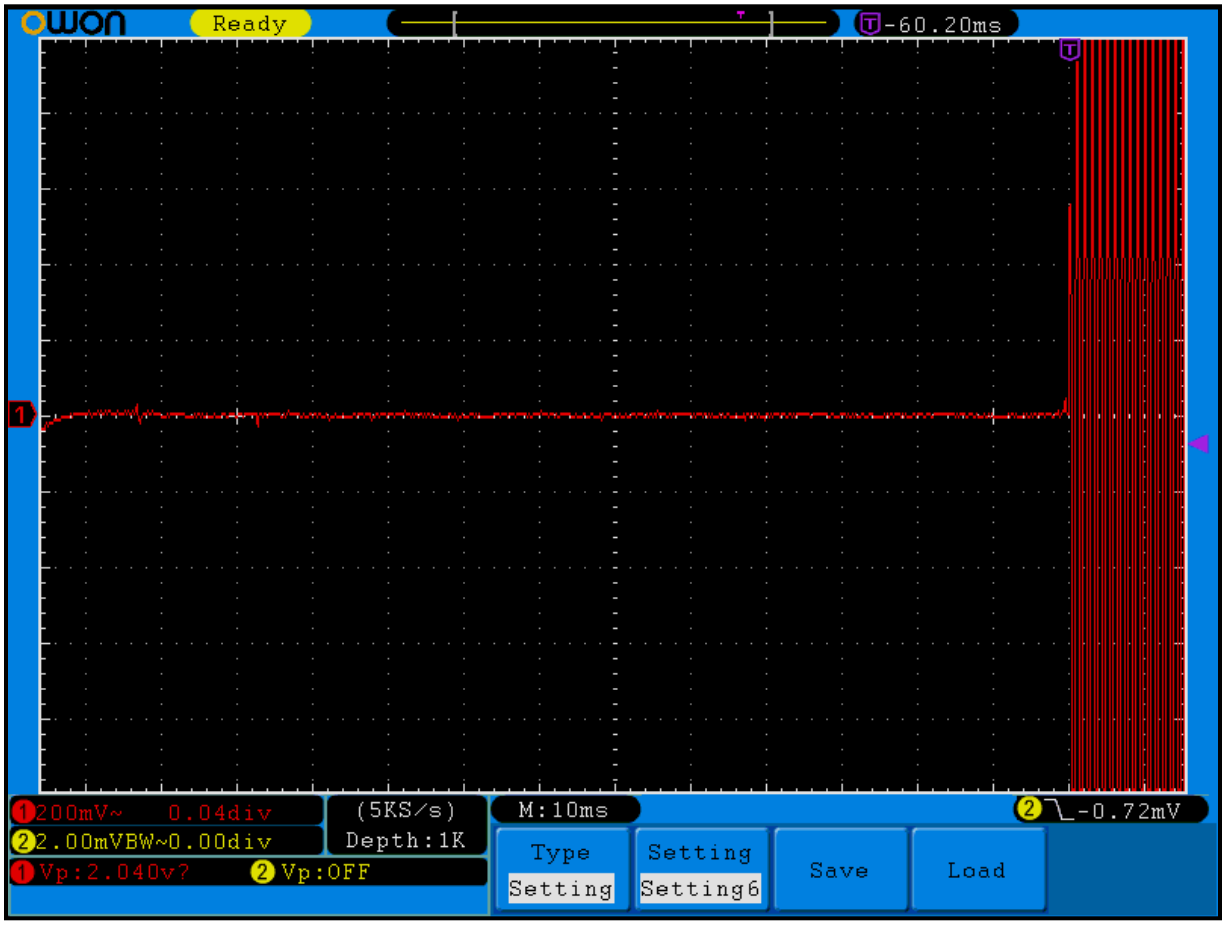
Plot 9-2: Transient Frequency Behavior – NB; Carrier Off Time; 450.0125 MHz



Plot 9-3: Transient Frequency Behavior – NB; Carrier On Time; 456.0125 MHz



Plot 9-4: Transient Frequency Behavior – NB; Carrier Off Time; 456.0125 MHz



Measurement uncertainty: ±0.015 kHz. This measurement uncertainty is an expanded uncertainty for 95.45% confidence level received with a coverage factor k=2.

Results: The EUT is compliant.

Table 9-1: Test Equipment Used for Testing Transient Frequency Behavior

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901610	WON	SDS7102V	Oscilloscope	SDS71021312068	N/A
900917	Hewlett Packard	8648C	Synthesized. Signal Generator (9 kHz - 3200 MHz)	3537A01741	2/17/16
901337	Narda Microline	766-10	Attenuator (DC-4GHz, 10 dB, 20W)	6242	9/10/16
901511	Pasternack	PE 2003	Power Divider (10 MHz - 1 GHz)	NA	N/A
901463	Werlatone	Directional Coupler	Coupler	4067	9/10/16
901263	Agilent Technologies	.01-12 GHz	SMA Detector	2936A05505	N/A
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	4/14/17
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/6/15

Test Personnel:

Daniel Baltzell		September 10, 2015
Test Engineer	Signature	Date of Tests

10 FCC Part 2.1047(a)(b), 74.463, 80.213, IC RSS-119 5.8: Modulation Characteristics

§80.213 Modulation requirements.

(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.

10.1 Test Procedures

10.1.1 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)

10.1.2 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.

10.1.3 Modulation Limiting

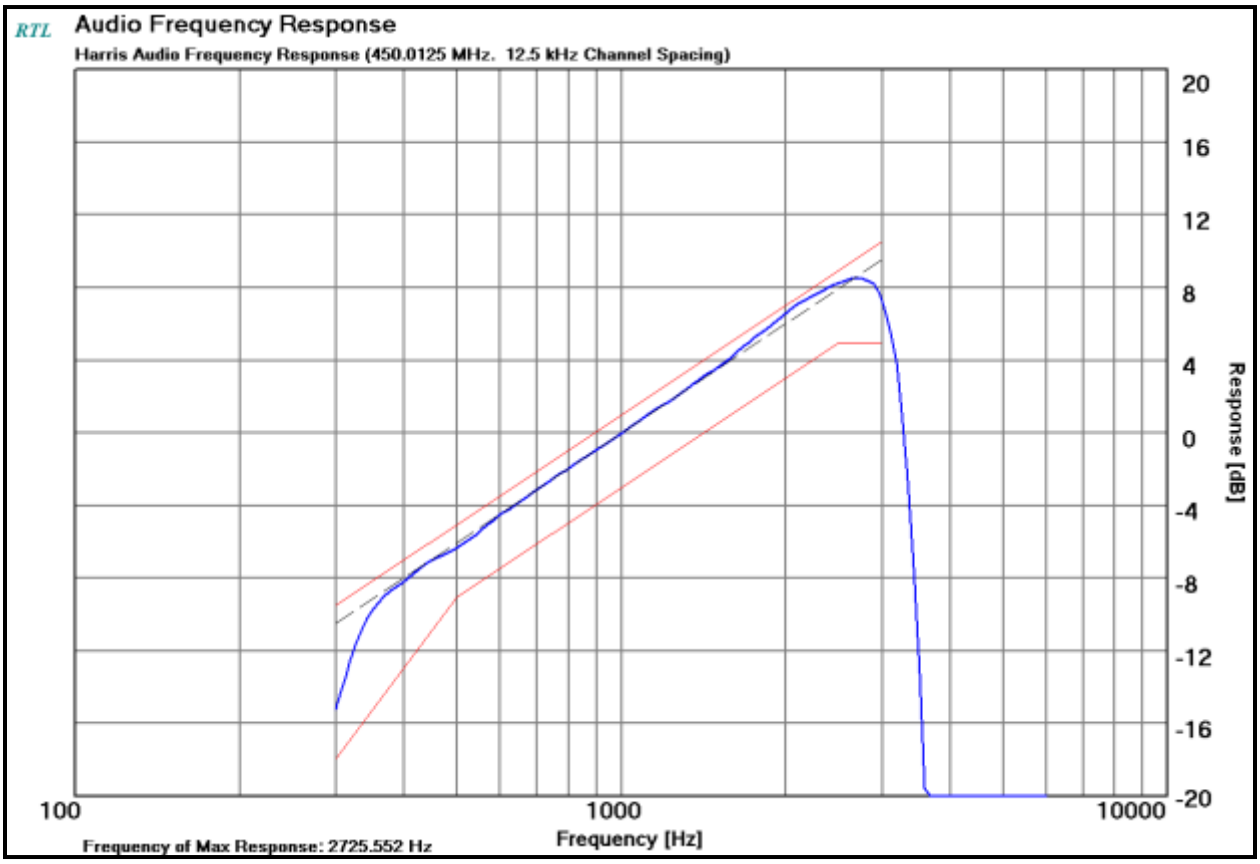
ANSI/TIA/EIA-603-2004, section 2.2.3

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.

10.2 Test Data

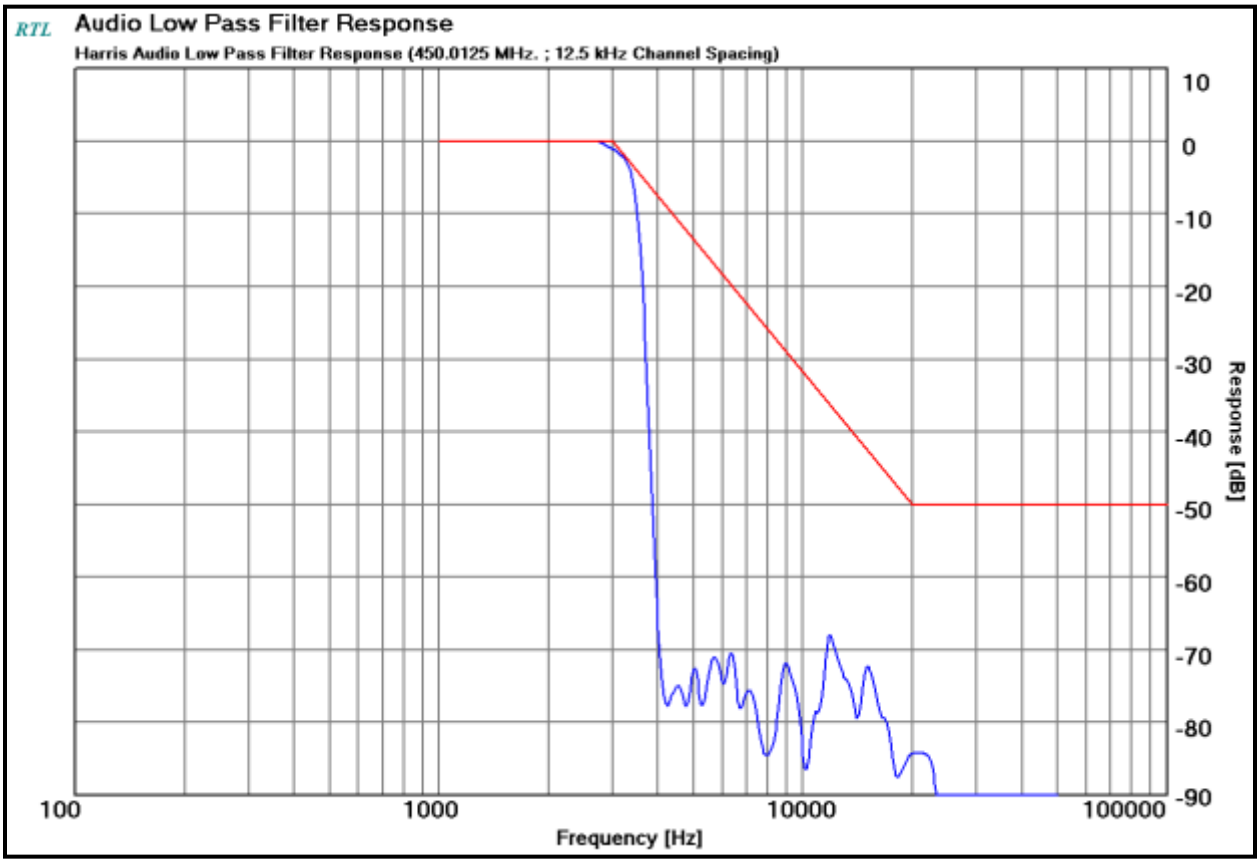
10.2.1 Audio Frequency Response

Plot 10-1: Modulation Characteristics - Audio Frequency Response – 450.0125 MHz



10.2.2 Audio Low Pass Filter Response

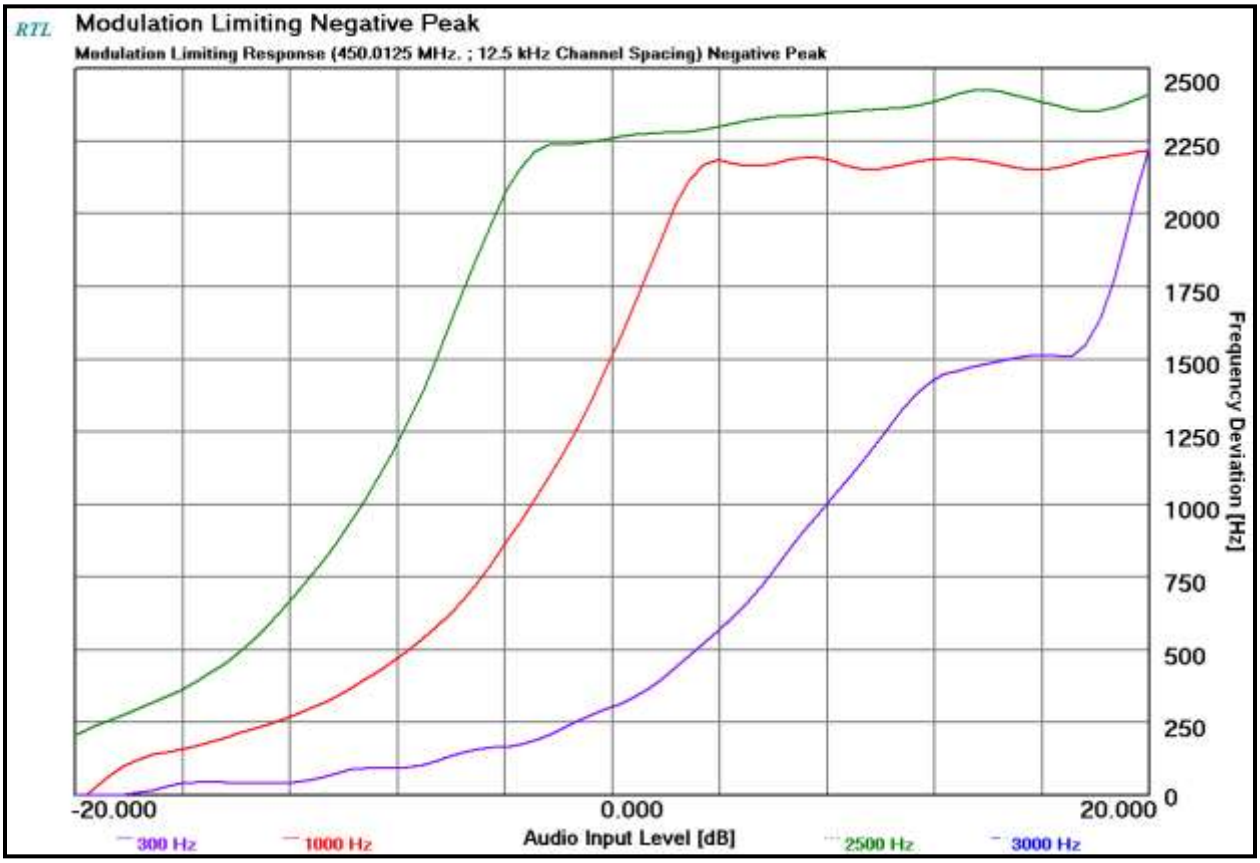
Plot 10-2: Modulation Characteristics – Audio Low Pass Filter – 450.0125 MHz



10.2.3 Modulation Limiting

Plot 10-3: Modulation Characteristics – Modulation Limiting – 450.0125 MHz; NB, Positive Peak

Plot 10-4: Modulation Characteristics – Modulation Limiting – 450.0125 MHz; NB, Negative Peak



Measurement uncertainty: ±0.015 dB. This measurement uncertainty is an expanded uncertainty for 95.45% confidence level received with a coverage factor k=2.

Results: The EUT is compliant.

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	4/13/17
901118	Hewlett Packard	8901A Opt. 002-003	Modulation Analyzer	2406A00178	4/14/17
901536	Aeroflex	48-40-34	40 dB Attenuator	CB6627	10/6/15
901054	Hewlett Packard	HP 3586B	Selective Level Meter	1928A01892	4/21/17
901088	Hewlett Packard	HP8954A	Transceiver Interface	2146A00139	Not Required

Test Personnel:

Daniel Baltzell		September 10, 2015
Test Engineer	Signature	Date of Test

11 FCC Part 2.202: Necessary Bandwidth and Emission Bandwidth

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

9600 digital voice/data 2-level FSK
Calculation:
Data rate in bps (R) =9600
Deviation Peak deviation of carrier (D) = 2370
Constant factor (K): 1 (default)
Bn = 3.86D+0.27RK = 3.86(2370) + 0.27(9600)(1) =11.7 kHz
Emission designator: 11K7F1D, 11K7F1E

P25 – 9600 sps - 4-level FSK
Calculation:
Data rate in bps (R) = 9600
Peak deviation of carrier (D) = 1800
Constant factor (K): 1 (default)
Bn = $[9600/\log_2(4) + 2 (1800) (1) = 8.4$ kHz
Emission designator: 8K40F1D, 8K40F1E

P25 Phase 2 data/voice (H-CPM TDMA) 4-level FSK
Calculation:
Data rate in bps (R) =9600
Peak deviation of carrier (D) = 1650
Constant factor (K): 1 (default)
Bn = $[9600/\log_2(4) + 2 (1650) (1) = 8.1$ kHz
Emission designator: 8K10DXW

12 Conclusion

The data in this measurement report shows that the Harris Corporation Model XG-15 UHF-H portable radio, FCC ID: OWDTR-0136-E, IC: 3636B-0136, complies with the applicable requirements of Parts 90, 80, 74, 22 and 2 of the FCC Rules and Industry Canada RSS-119.