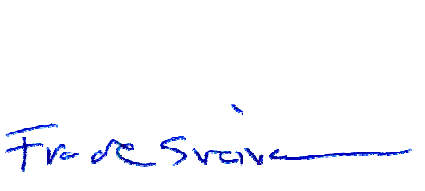


Test Report

Product	Maritime VHF Coast Station with DSC	
Name and address of the applicant	Jotron AS Østbyeien 1, 3280 Tjodalyng, Norway	
Name and address of the manufacturer	Same as above	
Model	TA-7650C	
Rating	50 Watts	
Trademark	JOTRON	
Serial number	0342	
Additional information	VHF, Coast Station, Transmitter, DSC	
Tested according to	FCC Part 80 Stations in the Maritime Services Industry Canada RSS-182 Issue 5, January 2012 Maritime Radio Transceivers in the Band 156 – 162.5 MHz	
Order number	244647	
Tested in period	2013.09.26 to 2013.10.17, 2014.04.02 to 2014.04.03 and 2014.06.02	
Issue date	2014.06.10	
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway FCC No: 994405 IC OATS: 2040D-1 TEL: (+47) 22 96 03 30 FAX: (+47) 22 96 05 50	
 Prepared by [Frode Sveinsen]  Approved by [Jan G Eriksen]		
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1 Test Information

1.1 Test Item

Name :	Jotron
FCC ID :	RA9TA-7650C
Industry Canada ID :	2131A-TA7650C
Model/version :	TA-7650C
Serial number :	0342
Hardware identity and/or version:	/
Software identity and/or version :	/
Frequency Range :	156.000 – 162.500 MHz
Number of Channels :	/
Type of Modulation :	Phase Modulation
Emissions Designator :	10K1G3E (25 kHz channels) 10K0G3E (12.5 kHz channels)
User Frequency Adjustment :	None (frequencies are pre-programmed)
Rated Output Power :	50 Watts (Maximum Conducted)
Antenna Connector :	50 Ohm N connector
Power Supply :	PSU-7002 or 28V DC.

Description of Tested Devices

The EUT is a Maritime VHF Coast Station Transmitter with DSC.

1.2 Test Environment

1.2.1 Normal test condition

Temperature:	20.6 – 23.3 °C
Relative humidity:	29.6 - 47 %
Normal test voltage:	28V DC (TA-7650C) 120V AC (PSU-7002)

The values are the limit registered during the test period.

The TA-7650C was powered from a PSU-7002 power supply during all tests. The PSU-7002 was powered with 120 V AC (60Hz) from a regulated AC power source for all tests.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Parts 80 and Industry Canada RSS-182 Issue 5.

Radiated tests were conducted in accordance with ANSI C63.4-2003 and ANSI/TIA/EIA-603-B-2002. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3 and 10metres.

☒ New Submission

☒ Production Unit

☐ Class II Permissive Change

☐ Pre-production Unit

TNB Equipment Code

☐ Family Listing



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test Summary

Name of test	FCC Parts 2 and 80 reference	RSS-182 Issue 5 reference	Result
RF Power Output	2.1046, 80.215	7.5	Pass
Modulation Characteristics, - Audio Frequency Response - Audio Low Pass Filter - Modulation Limiting	2.1047	7.3 7.8	Pass ¹
Occupied Bandwidth	2.1049, 80.205	N/A	Pass
Spurious Emissions at antenna terminals	2.1051, 2.1057, 80.211	7.9	Pass
Transmitter Spurious Radiations	2.1053, 2.1057, 80.211	7.9	Pass
Frequency Stability	2.1055, 80.209	7.4	Pass
Suppression of Interference Aboard Ships	80.217	N/A	N/A ²
Receiver Spurious Emissions	N/A	N/A	N/A

¹ The tested equipment transmits analog voice

² This is a Coast Station

2.3 Description of modification for Modification Filing

Not applicable.

2.4 Comments

The user can select the preprogrammed frequencies and can select full output power or lower the output power in steps down to 1 Watt output power. The pre-programmed frequencies and maximum power levels cannot be changed by the user.

2.5 Family List Rationale

Not Applicable.

3 TEST RESULTS

3.1 RF Output Power, Conducted

FCC Parts 2.1046, 80.215

RSS-182 Issue 5, Section 7.5

Test Results: Complies

Measurement Data:

25kHz channel bandwidth

Frequency (MHz)	Measured RF Output Power (W)	Rated Power Level (W)
156.300	48.9	50
156.775	48.5	50
156.800	1.02	1
156.825	11.9	12.5
162.000	47.5	50
Largest deviation from Rated Output Power	-0.24 dB	

12.5kHz channel bandwidth

Frequency (MHz)	Measured RF Output Power (W)	Rated Power Level (W)
156.3875	46.3	50
156.8125	46.3	50
162.0125	46.3	50
Largest deviation from Rated Output Power	-0.7 dB	

This measurement was performed with Power Measuring function the Spectrum analyzer and without modulation.

The test was performed conducted on the permanent 50 Ohm antenna connector.

Requirements:

FCC 80.215(e)(3):

The maximum conducted RF output power must not exceed 50 Watts.

RSS 182 section 7.5:

The output power shall be within ± 1.0 dB of the manufacturer's rated power and not exceed the limits listed in Table 3, unless indicated otherwise.

Transmitter Power Coast Stations: 50 Watts.

3.2 Modulation Characteristics

3.2.1 Audio Frequency Response

FCC Part 2.1047

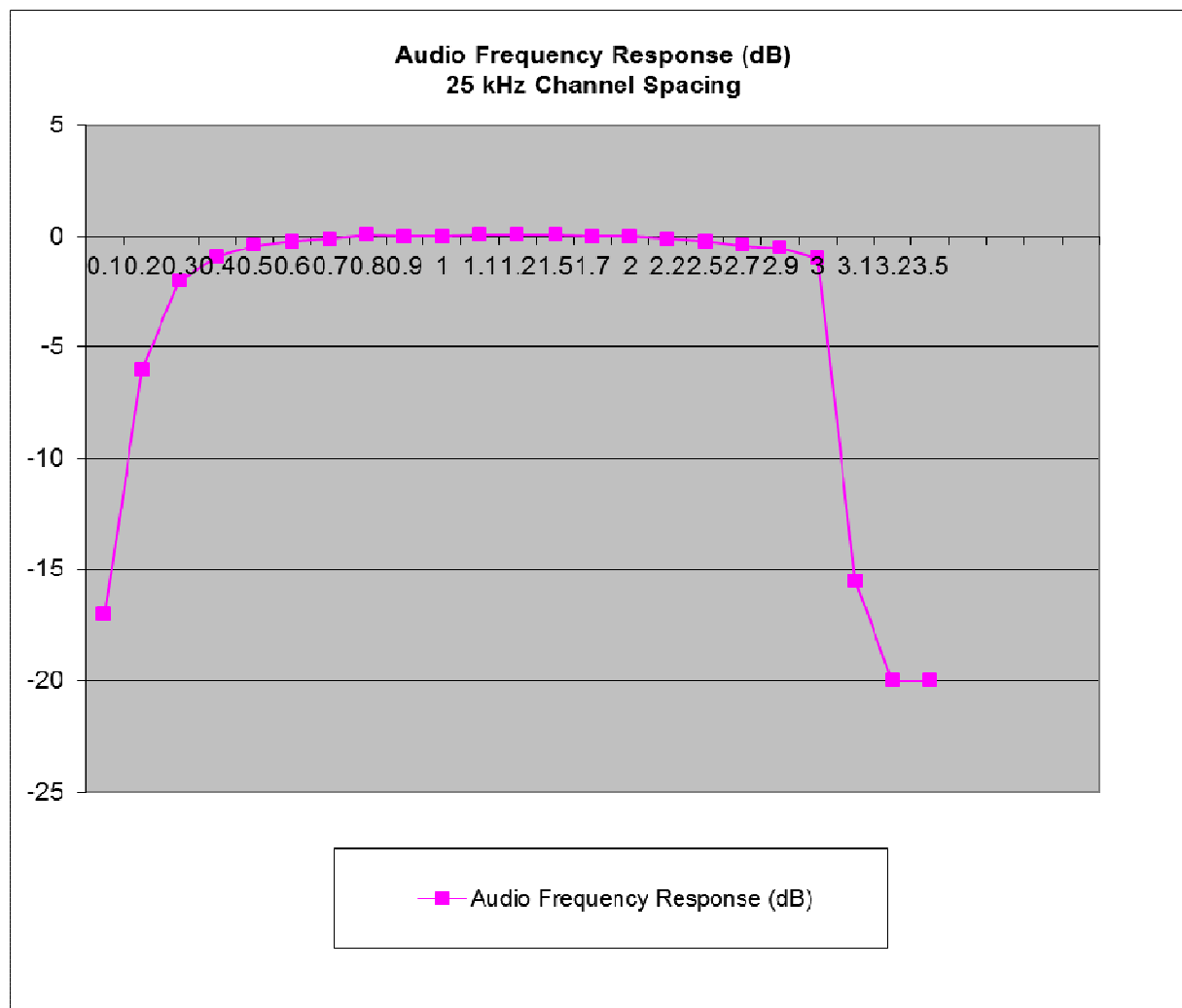
Test Results: Complies

Measurement Data:

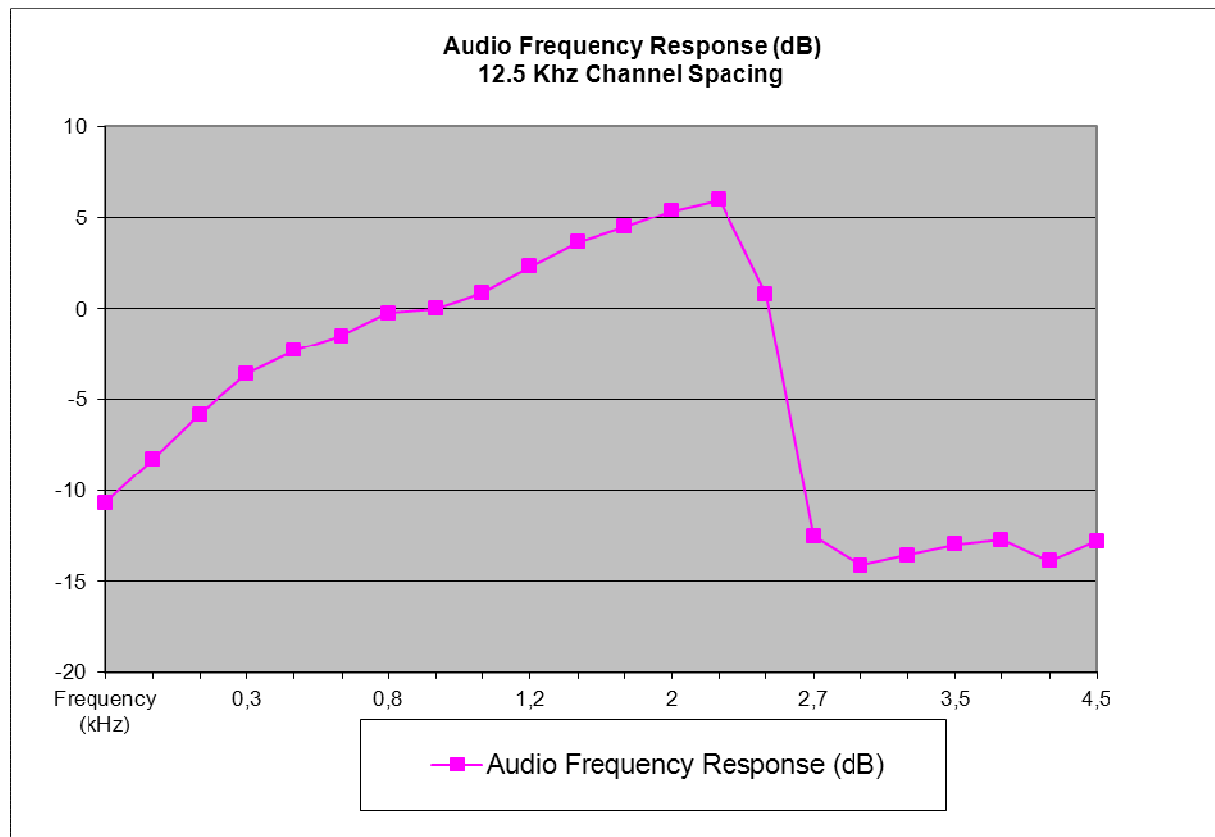
See attached plots.

Requirements:

None.



Audio frequency response for 25kHz Channel separation



Audio frequency response for 12.5kHz Channel separation

3.2.2 Audio Low Pass Filter

FCC Part 2.1047

RSS-182 Issue 5, Section 7.8

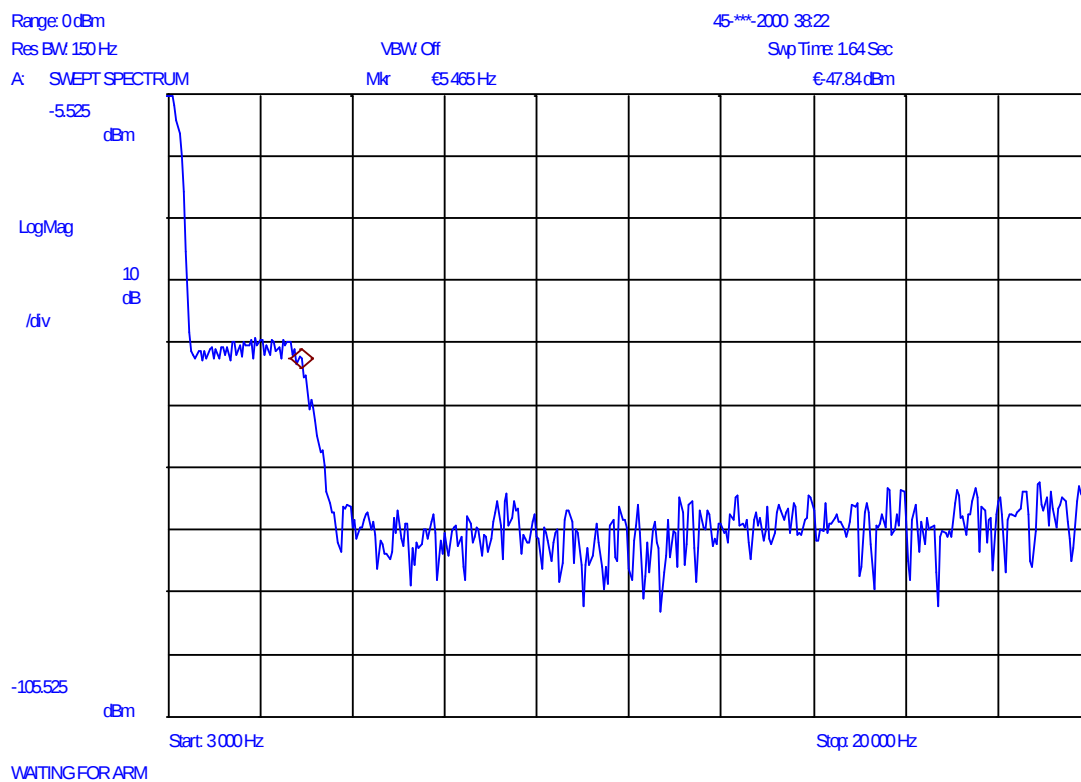
Test Results: Complies

Measurement Data:

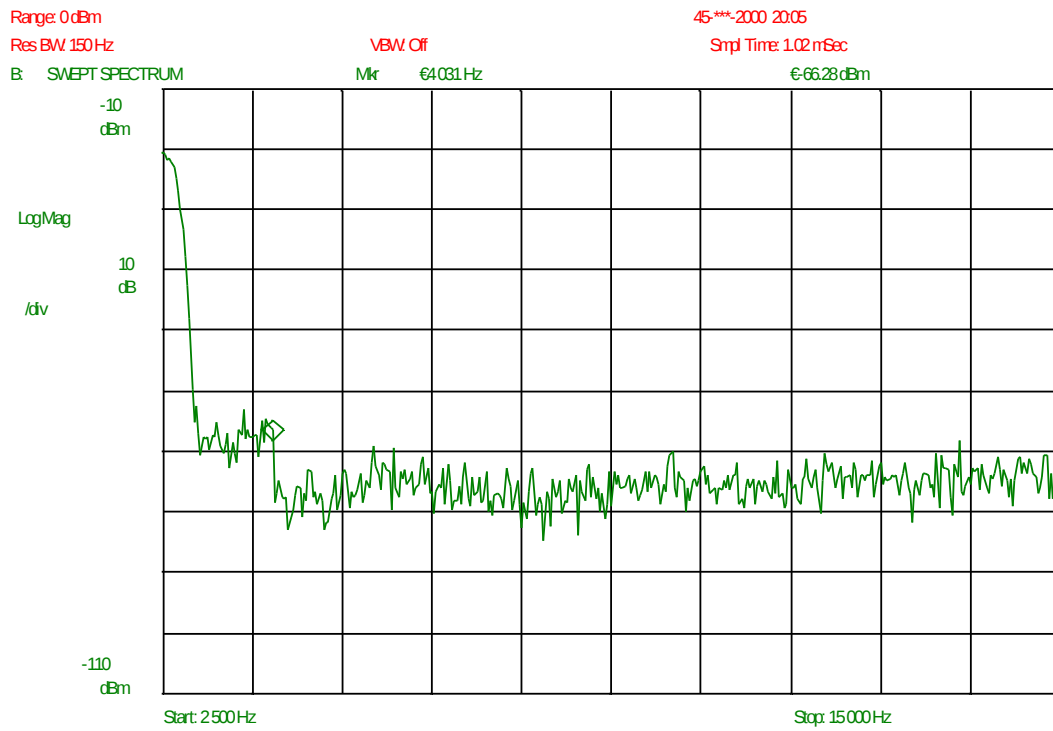
See attached plots.

Requirements:

None.



Audio Low pass filter, 25kHz



Audio Low pass filter, 12.5kHz

3.2.3 *Modulation Limiting*

FCC Part 2.1047

RSS-182 Issue 5, Section 7.8

Test Results: Complies

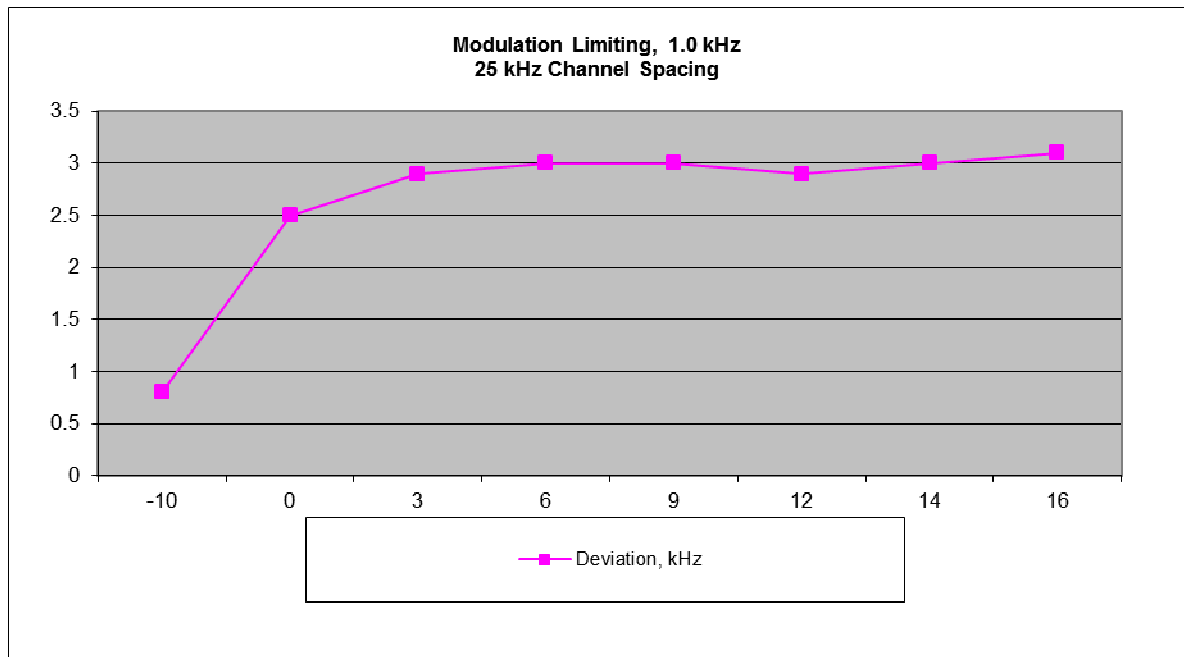
Measurement Data:

See attached plots.

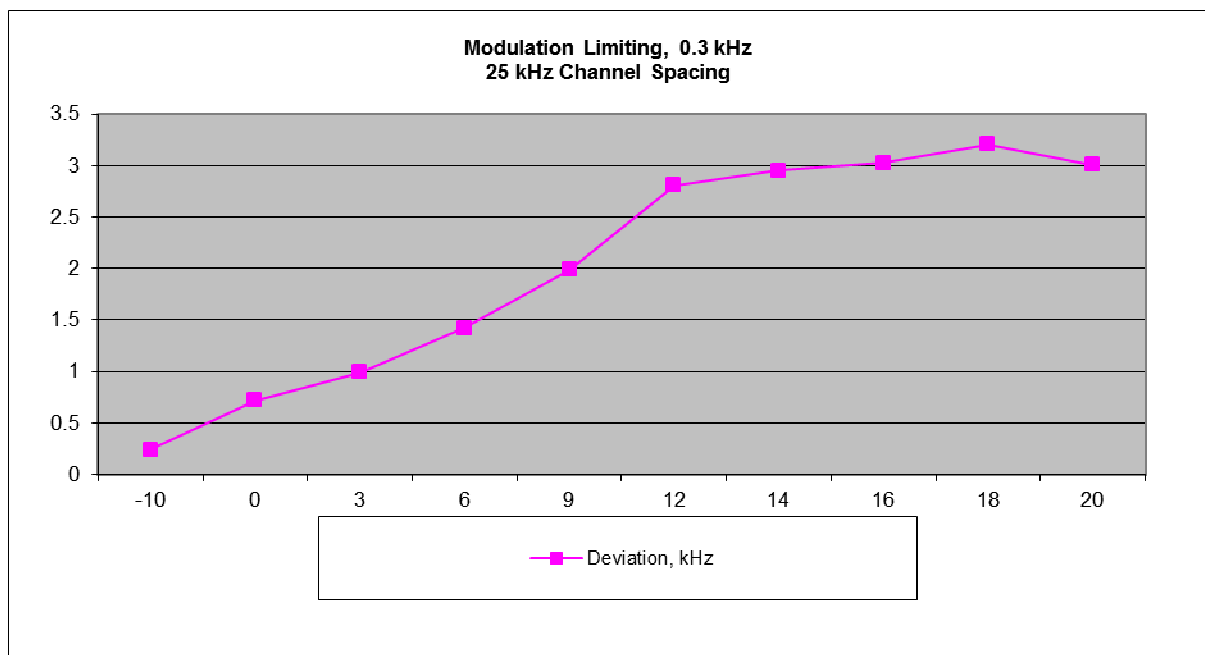
Requirements:

FCC 80.205(a) footnote 8:

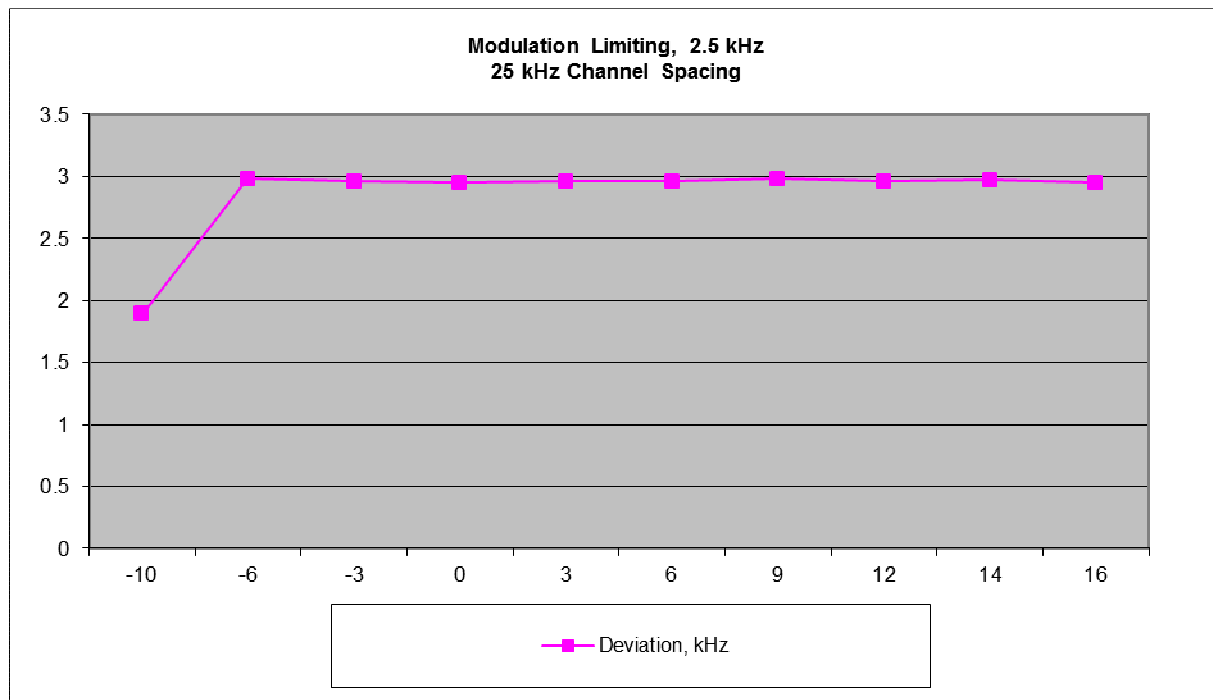
5 kHz Maximum Frequency Deviation



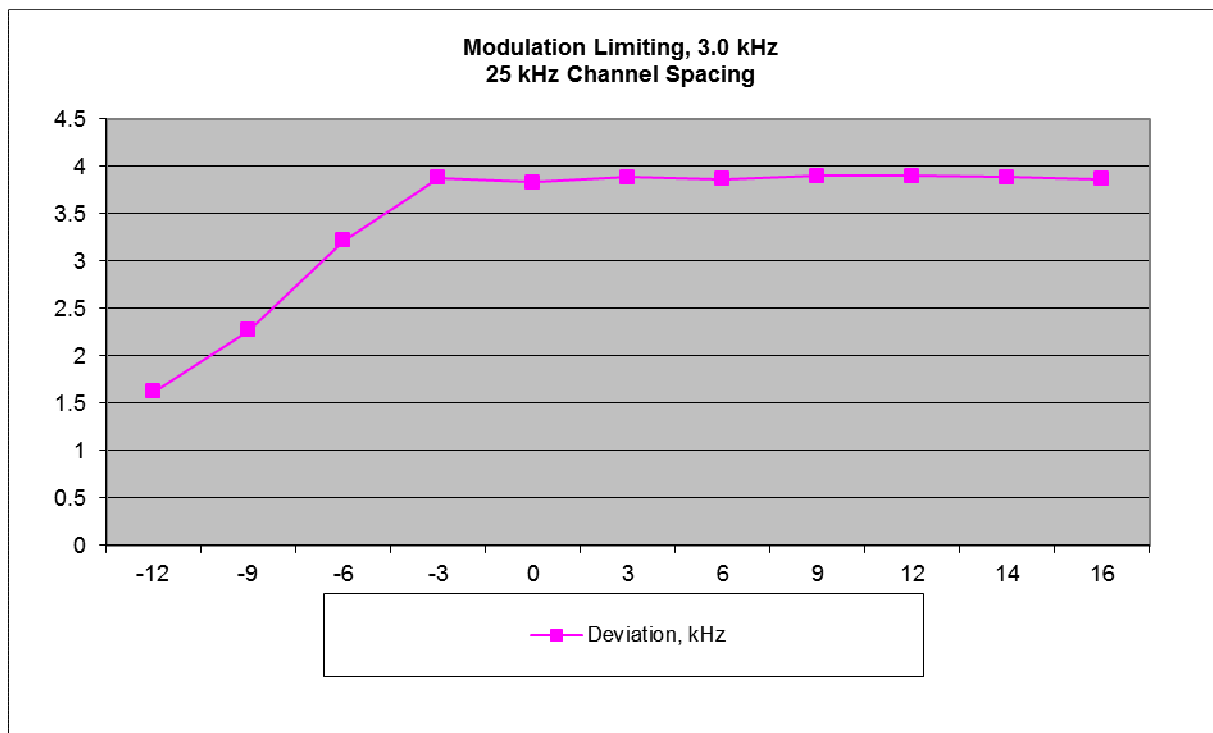
Modulation limiting, 1 kHz, Ref 2.5 kHz with 1 kHz test tone



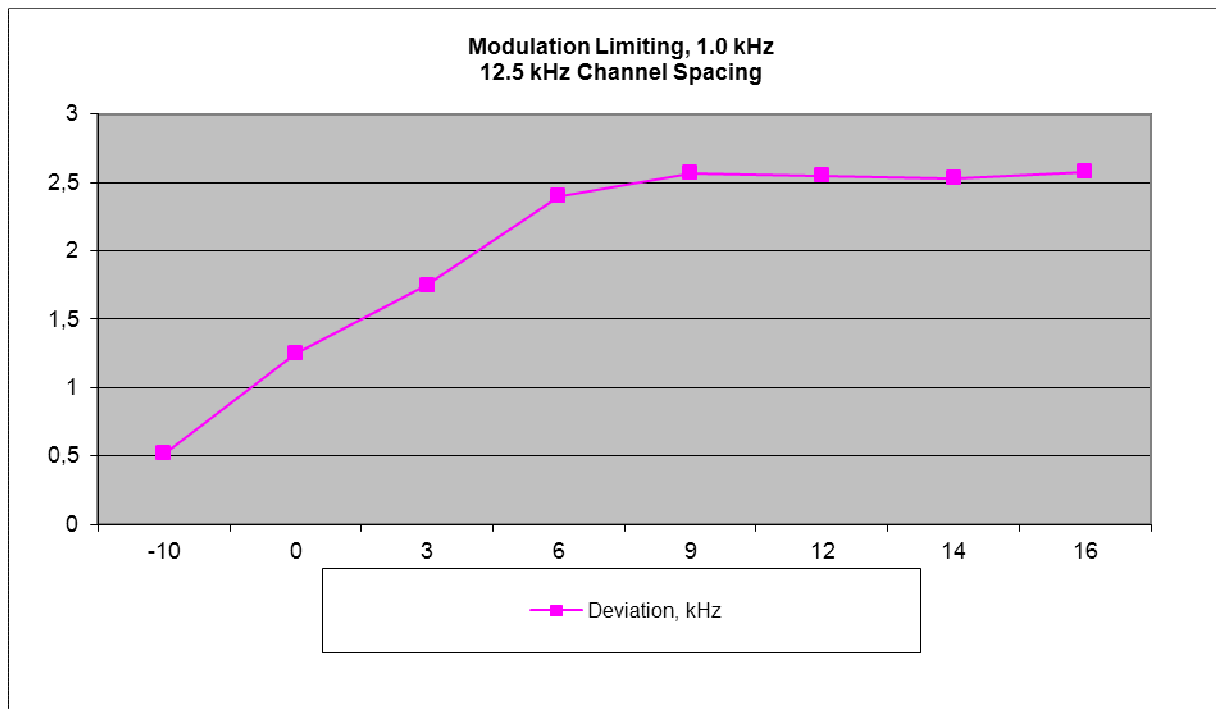
Modulation limiting, 0.3 kHz, Ref 2.5 kHz with 1 kHz test tone



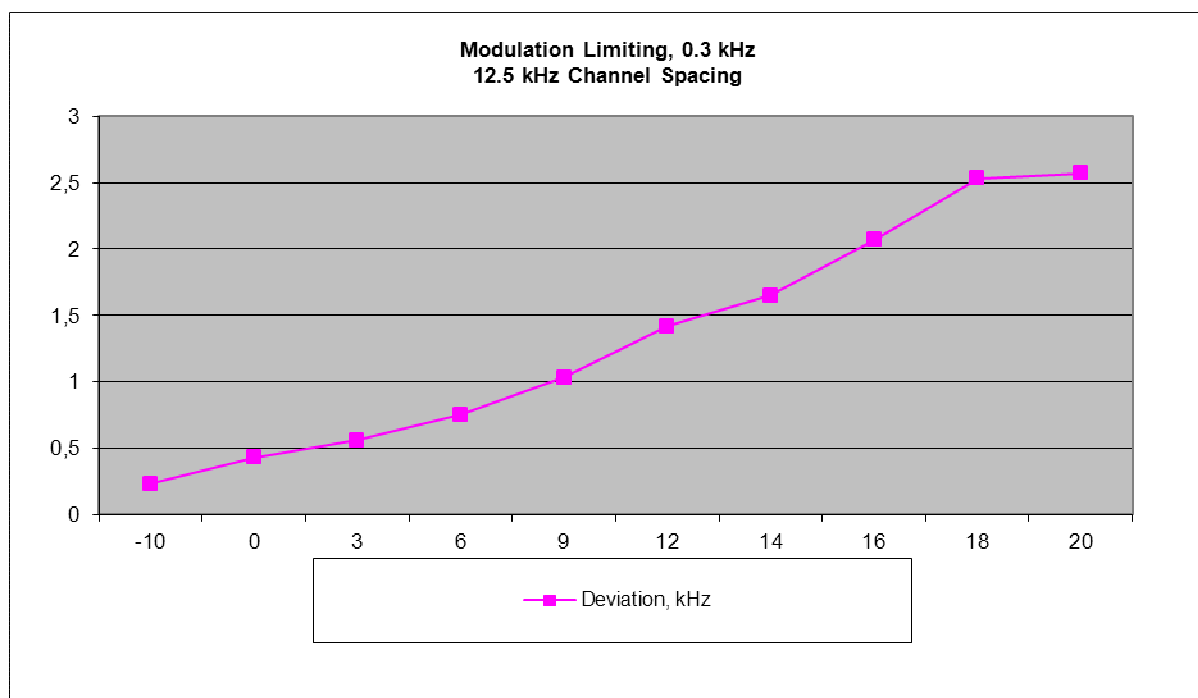
Modulation limiting, 2.5 kHz, Ref 2.5 kHz with 1 kHz test tone



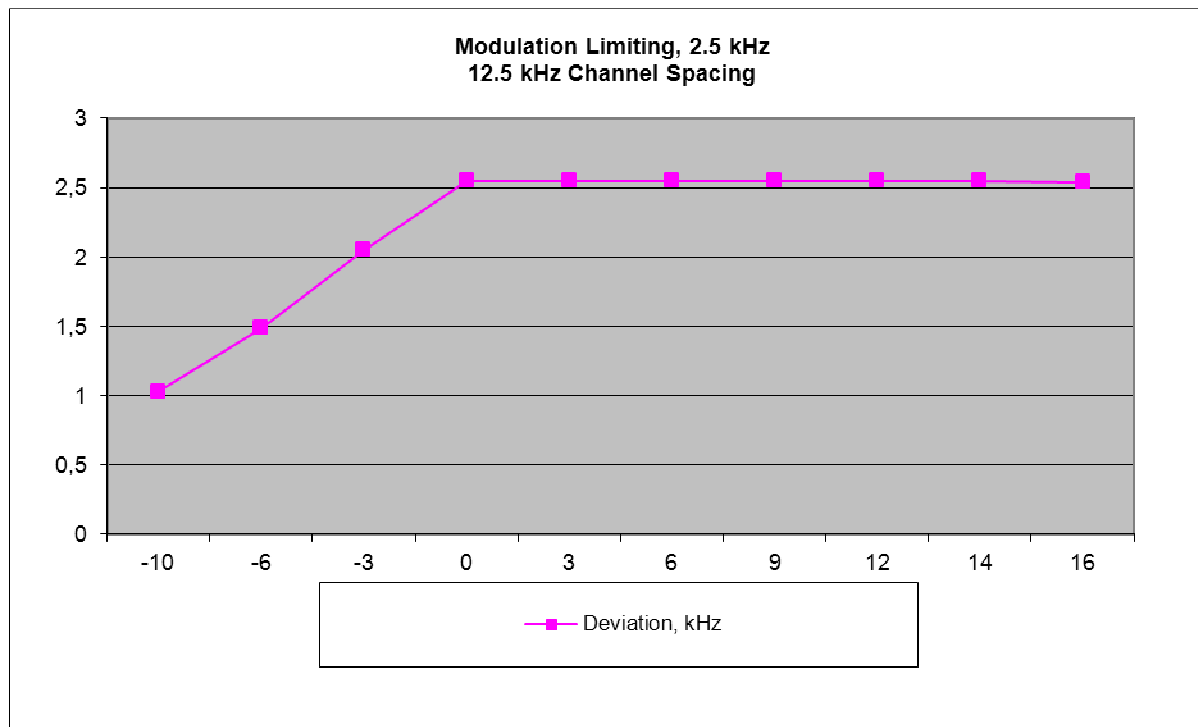
Modulation limiting, 3.0 kHz, Ref 2.5 kHz with 1 kHz test tone



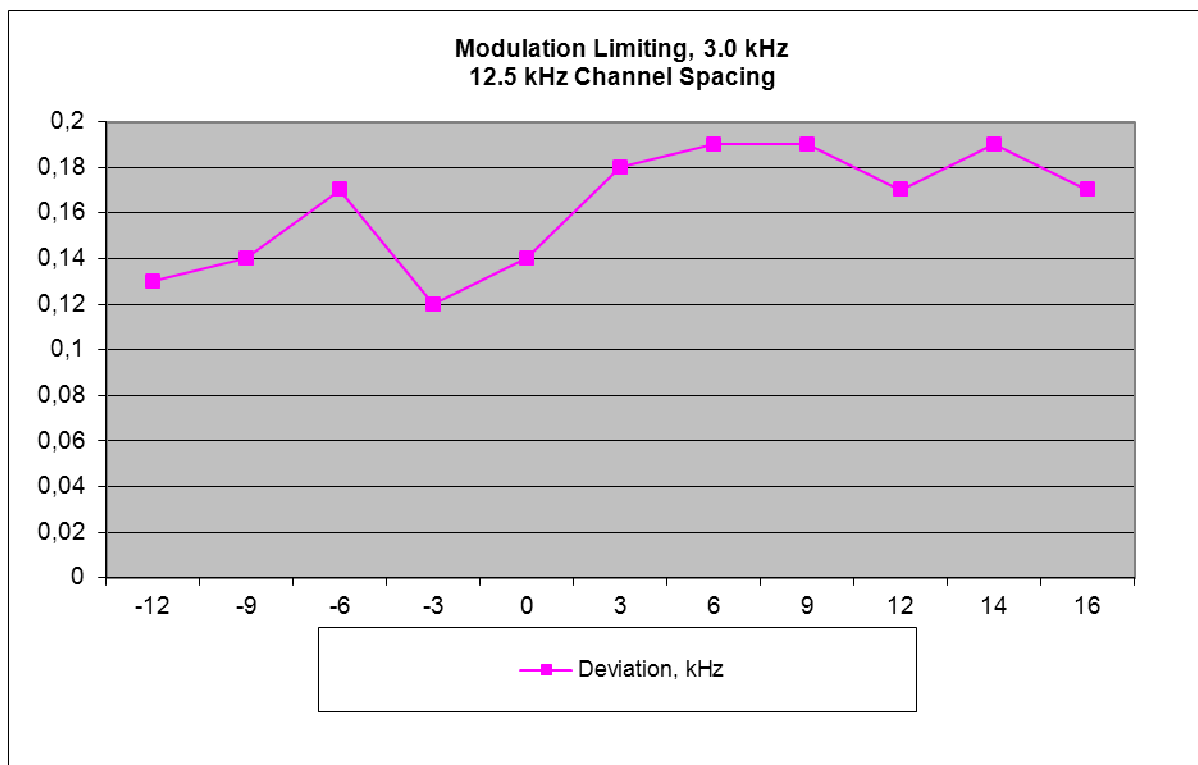
Modulation limiting, 1 kHz, Ref 2.5 kHz with 1 kHz test tone



Modulation limiting, 0.3 kHz, Ref 2.5 kHz with 1 kHz test tone



Modulation limiting, 2.5 kHz, Ref 2.5 kHz with 1 kHz test tone



Modulation limiting, 3 kHz, Ref 2.5 kHz with 1 kHz test tone

3.3 Occupied Bandwidth

FCC Parts 2.1049, 80.205

RSS-GEN Issue 3, Section 4.6.1

Test Results: Complies

Measurement Data:

25 kHz channel spacing:

Carrier Frequency	99% Occupied Bandwidth
156.300 MHz	10.1
156.800 MHz	10.1
162.000 MHz	10.1

12.5 kHz channel spacing:

Carrier Frequency	99% Occupied Bandwidth
156.3875 MHz	10.0
156.8125 MHz	10.0
162.0125 MHz	10.0

See attached plots.

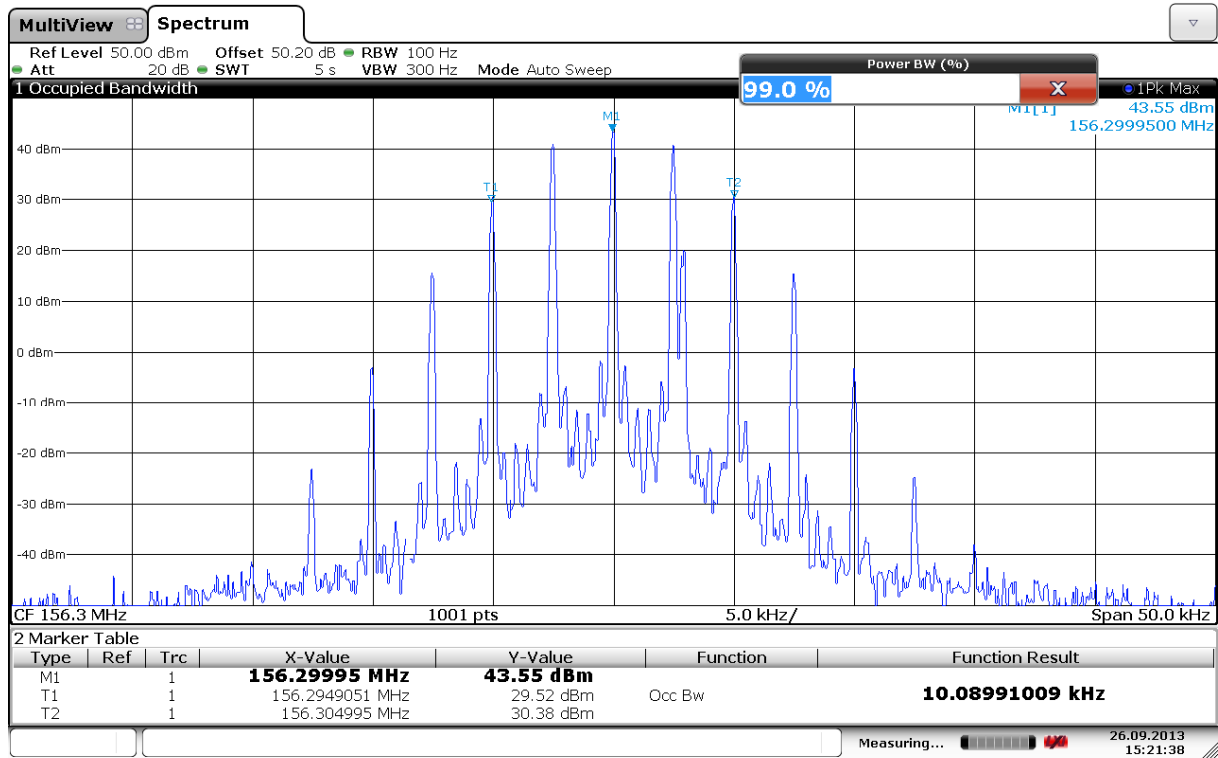
For this test the EUT was made to transmit continuously with modulation activated.

Modulated at 2.5KHz with 16dB overdrive

Requirements:

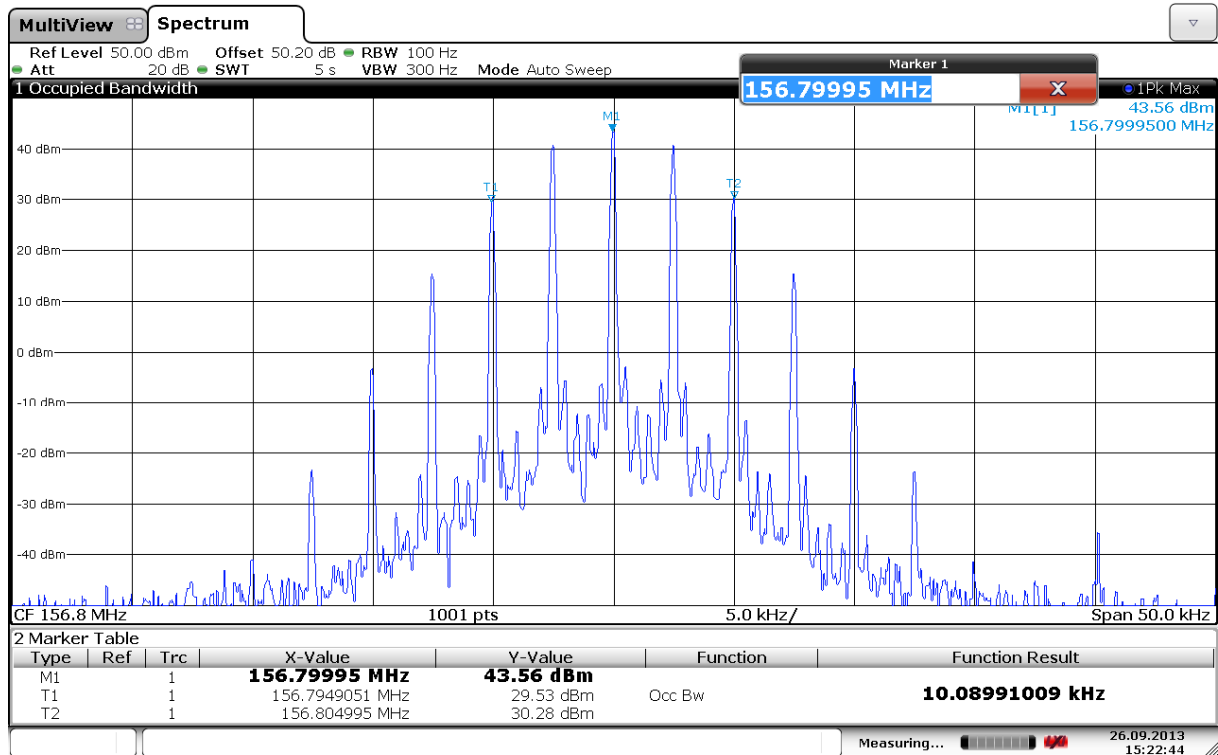
80.205(a):

Authorized Bandwidth for G3E emission, maximum authorized bandwidth = 20 kHz



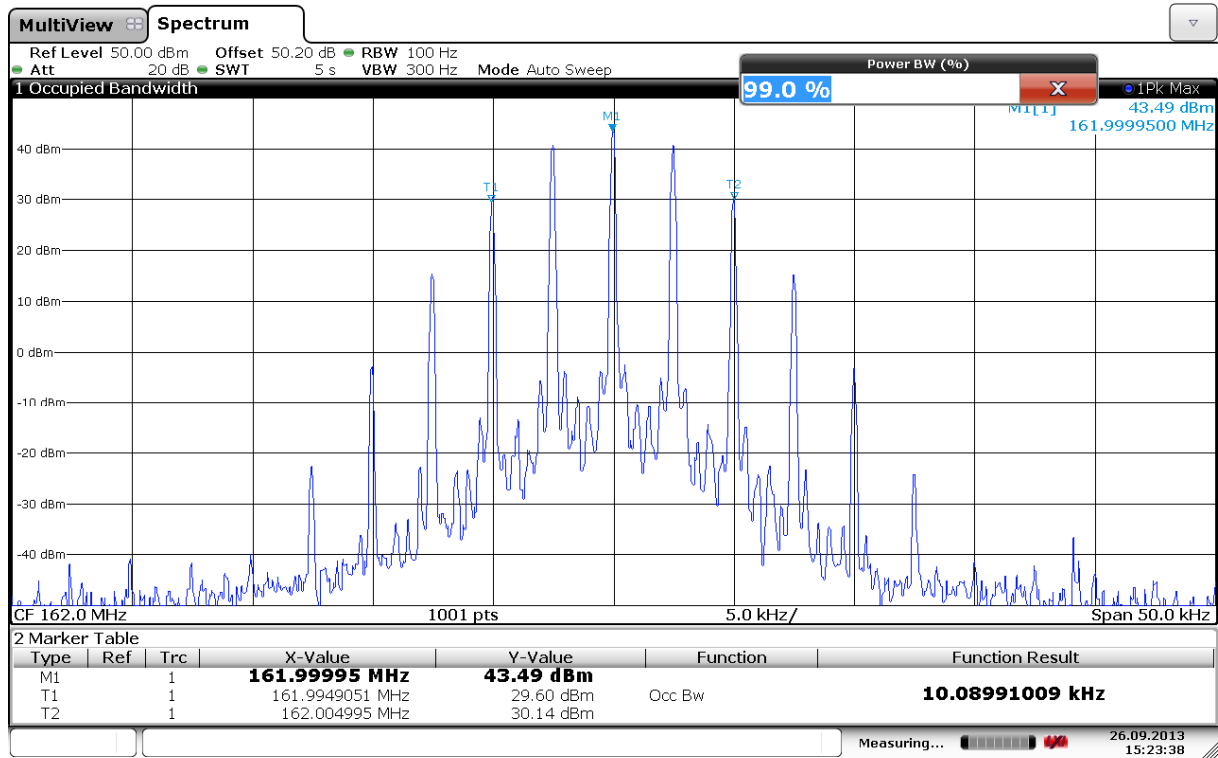
Date: 26.SEP.2013 15:21:38

99% Occupied Bandwidth, Low Channel, 25 Channel spacing



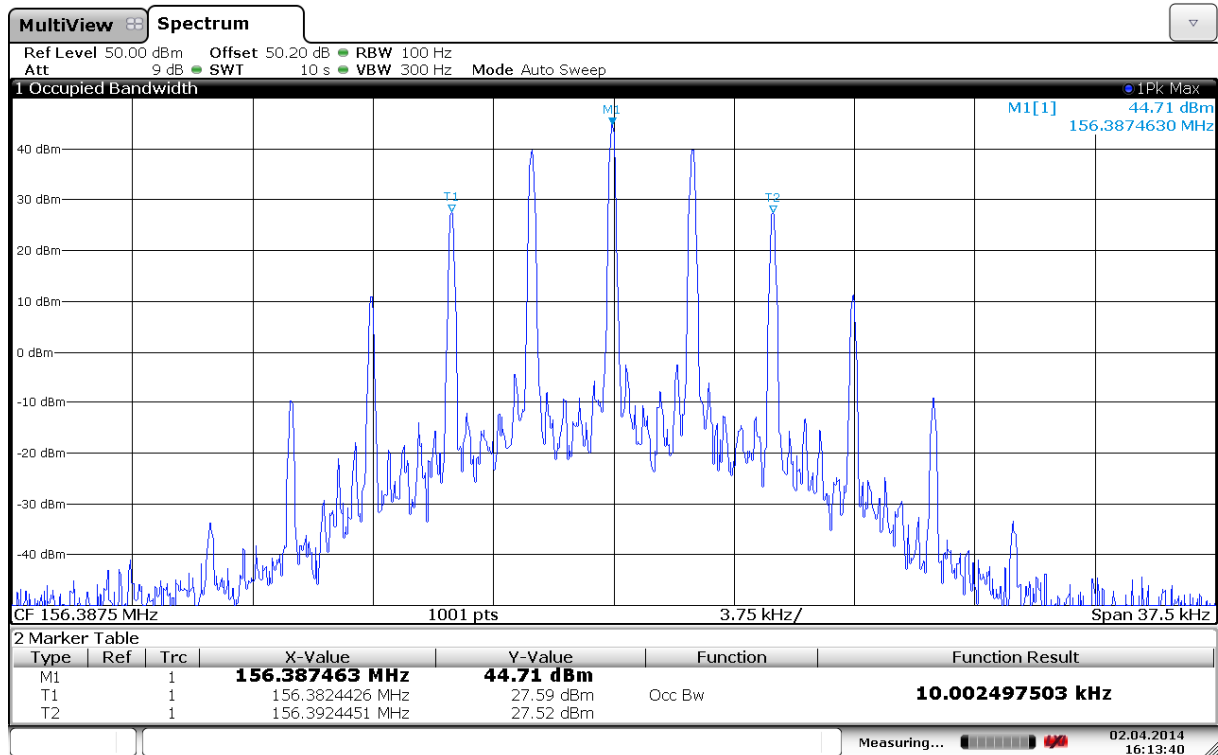
Date: 26.SEP.2013 15:22:44

99% Occupied Bandwidth, Mid Channel, 25 Channel spacing

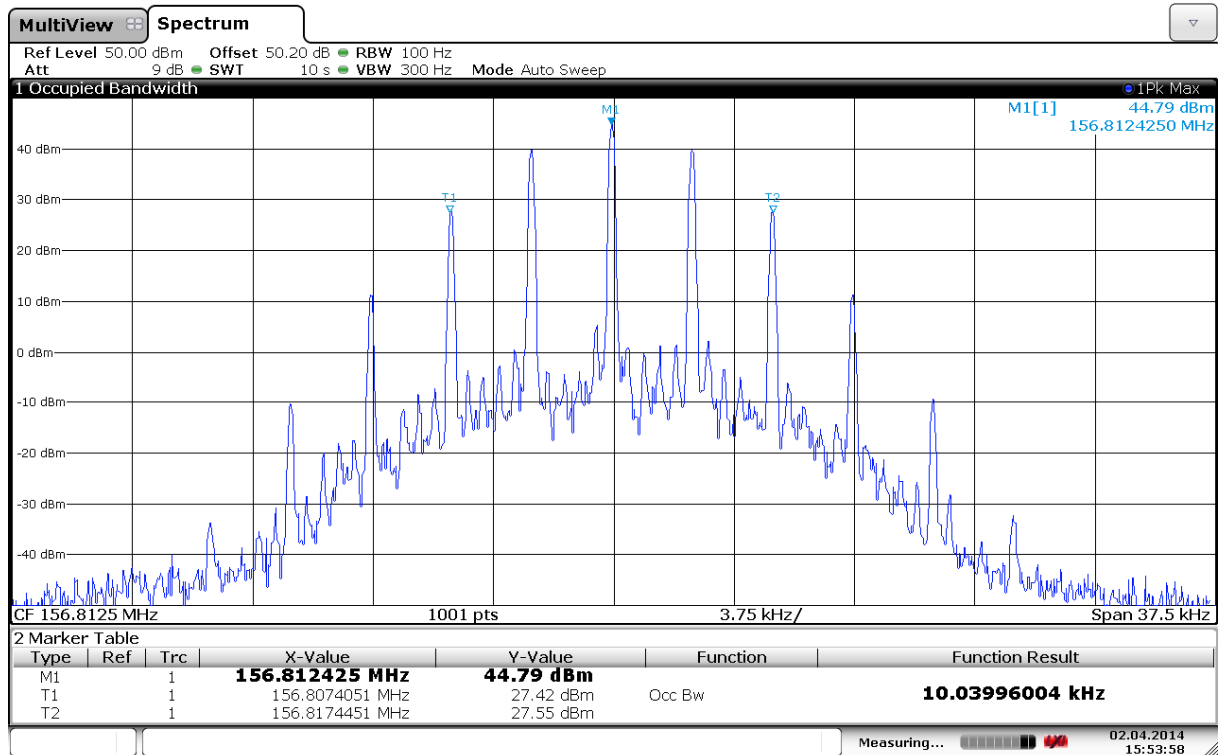


Date: 26.SEP.2013 15:23:38

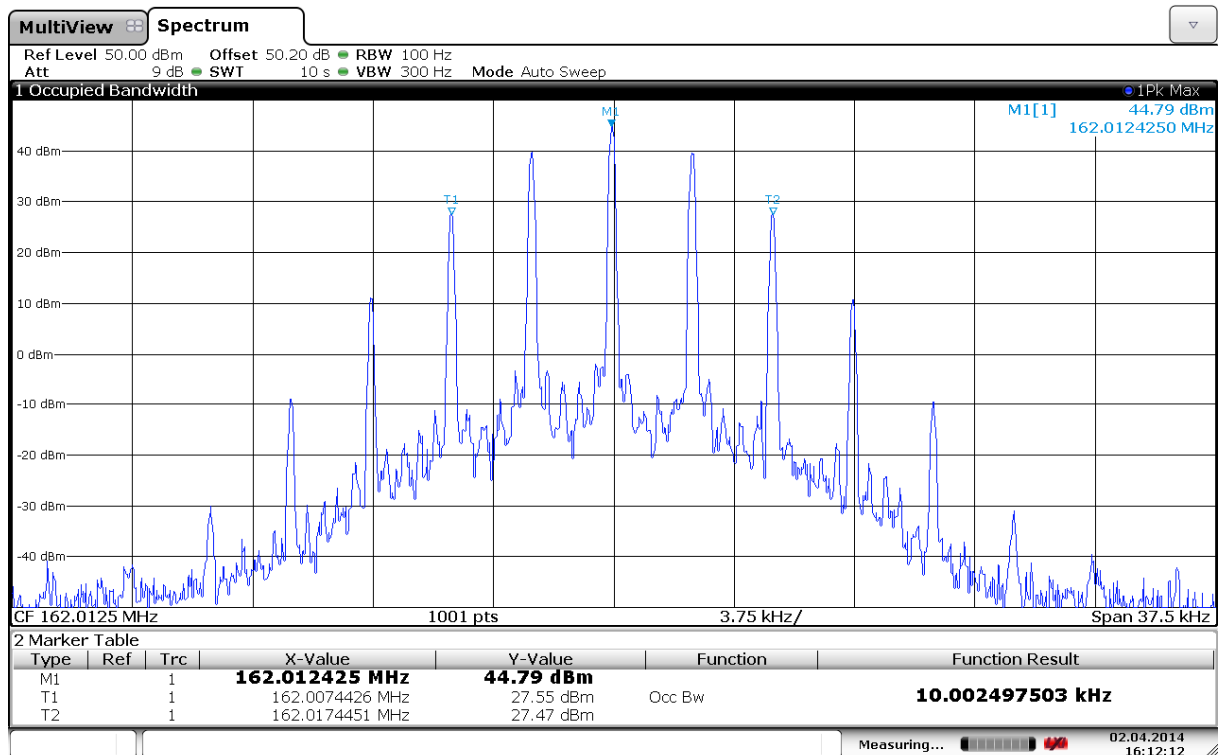
99% Occupied Bandwidth, High Channel, 25 Channel spacing



99% Occupied Bandwidth, Low Channel, 12.5 Channel spacing



99% Occupied Bandwidth, Mid Channel, 12.5 Channel spacing



99% Occupied Bandwidth, High Channel, 12.5 Channel spacing

3.4 Spurious Emissions at the Antenna Terminal, Swept Frequency

FCC Parts 2.1053, 2.1057, 80.211

RSS-182 Issue 5, Section 7.9.1

Test Results: Complies

Measurement Data:

The measurements are performed on ch06 (156.300MHz), ch16 (156.800MHz) and ch28 (162.000MHz) with maximum output power.

Modulated 2.5KHz with 16dB overdrive

Frequency of Emission (MHz)	Channel	Measured Emission Level (dBm)	Limit (dBm) 80.211(f)(3)	Margin (dB)
all	06	<-40	-13	>20
all	16	<-40	-13	>20
all	28	<-40	-13	>20

The measurements are performed on ch267 (156.3875MHz), ch216 (156.8125MHz) and ch228 (162.0125MHz) with maximum output power.

Modulated 2.5KHz with 16dB overdrive

Frequency of Emission (MHz)	Channel	Measured Emission Level (dBm)	Limit (dBm) 80.211(f)(3)	Margin (dB)
all	267	<-30	-13	>15
all	216	<-30	-13	>15
all	228	<-30	-13	>15

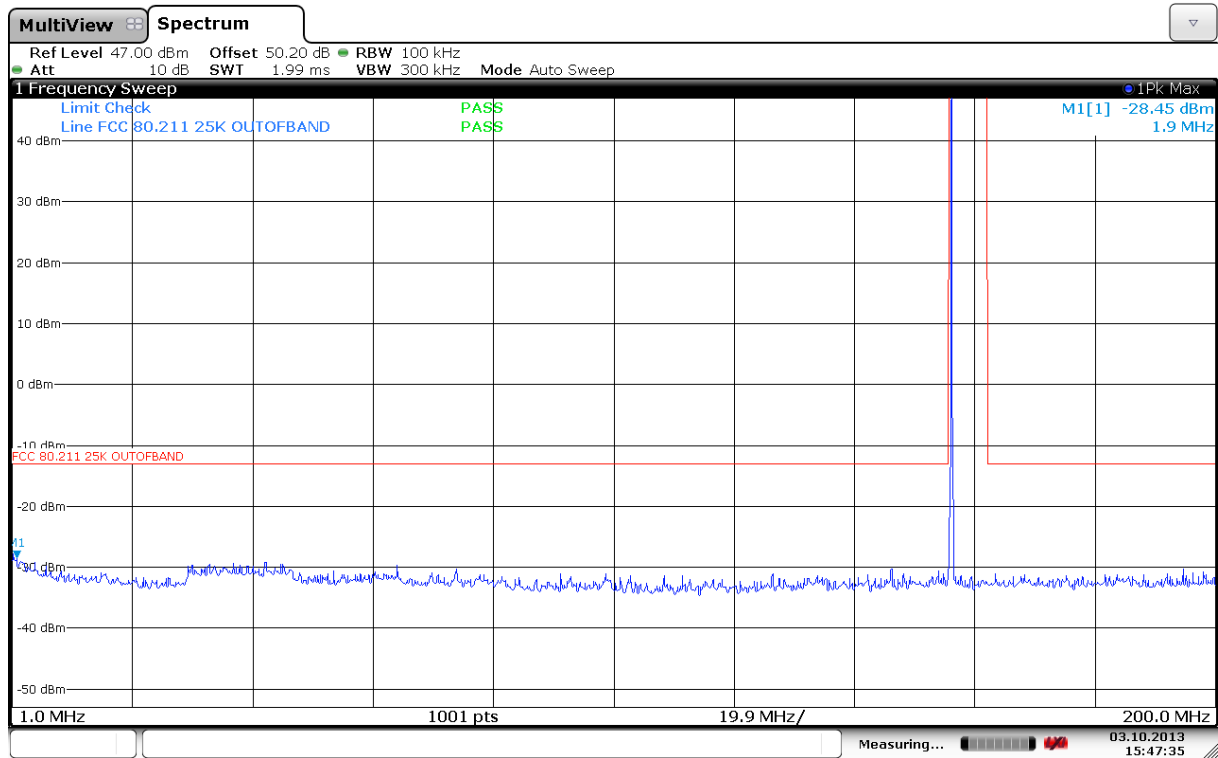
The results are valid for all frequencies removed from the carrier by at least 50 kHz.

See attached plots.

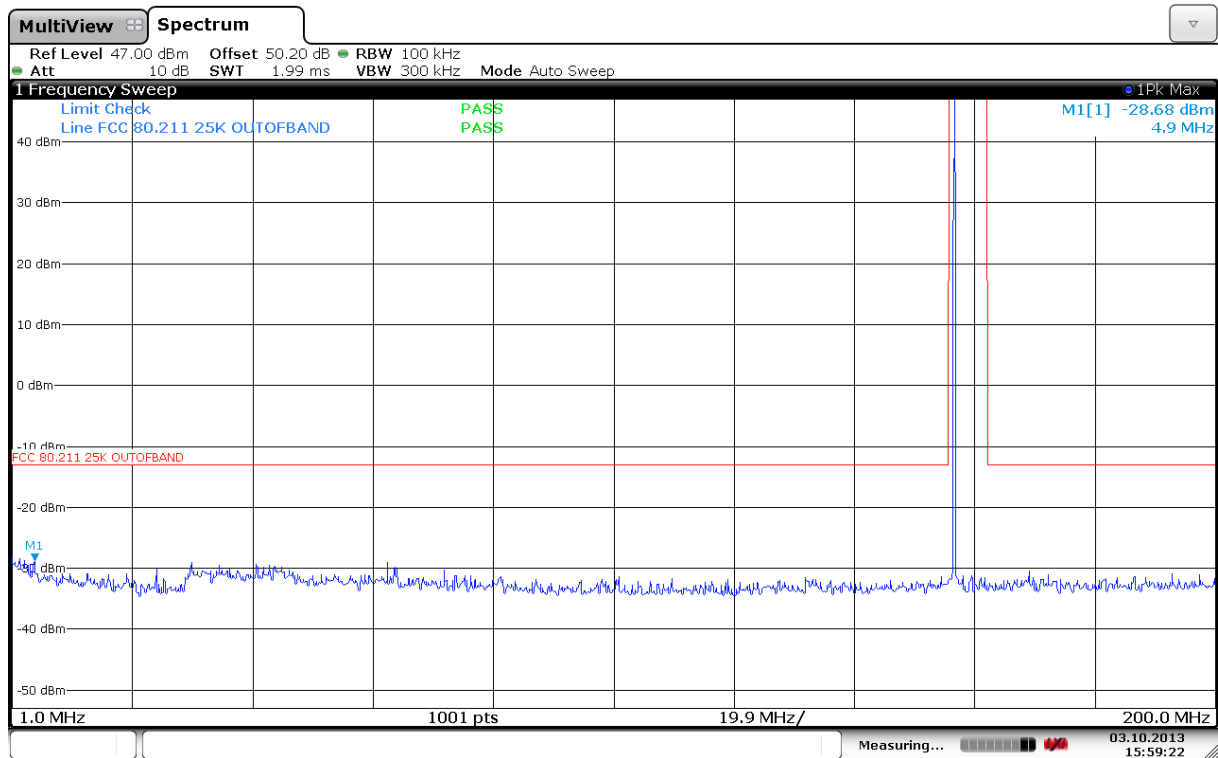
Requirements:

FCC Part 80.211(f)(3), RSS-182 Issue 5, Section 7.9.1

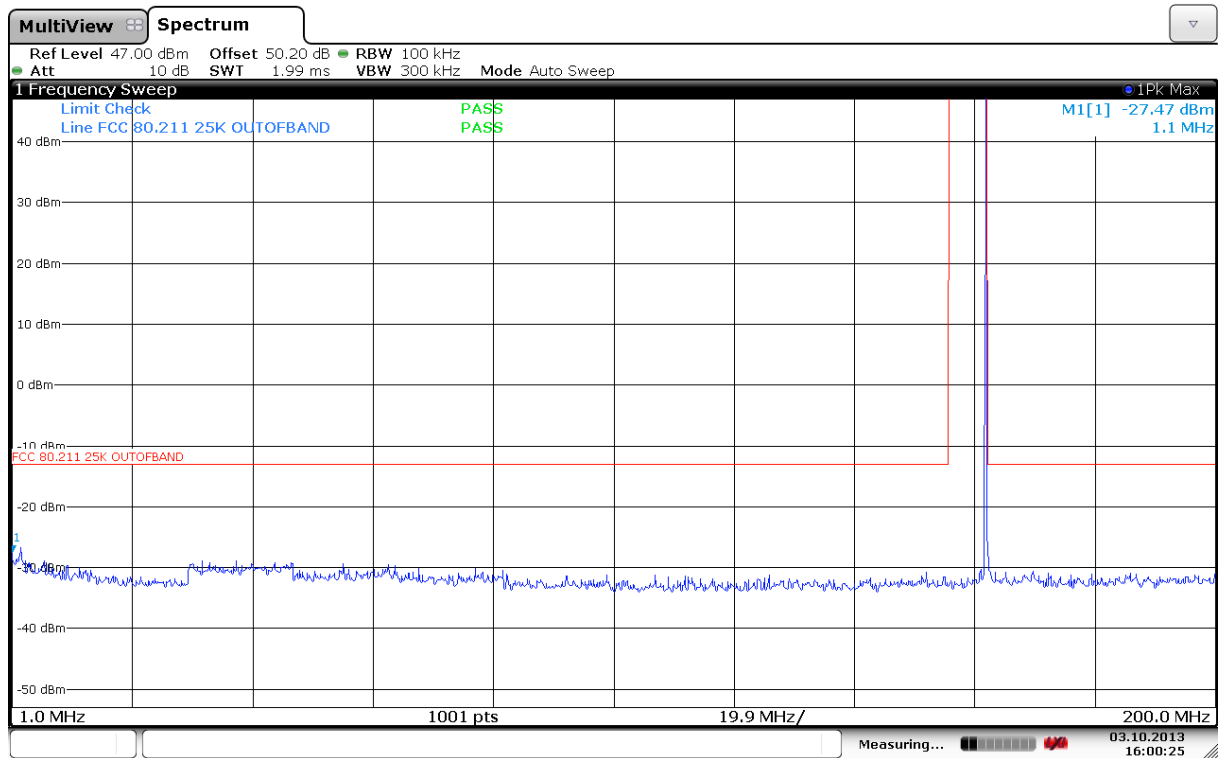
On any frequency removed from the carrier frequency by more than 250% of the authorized bandwidth: at least $43 + 10 \log_{10} p(\text{watts})$ dB (Below -13 dBm)



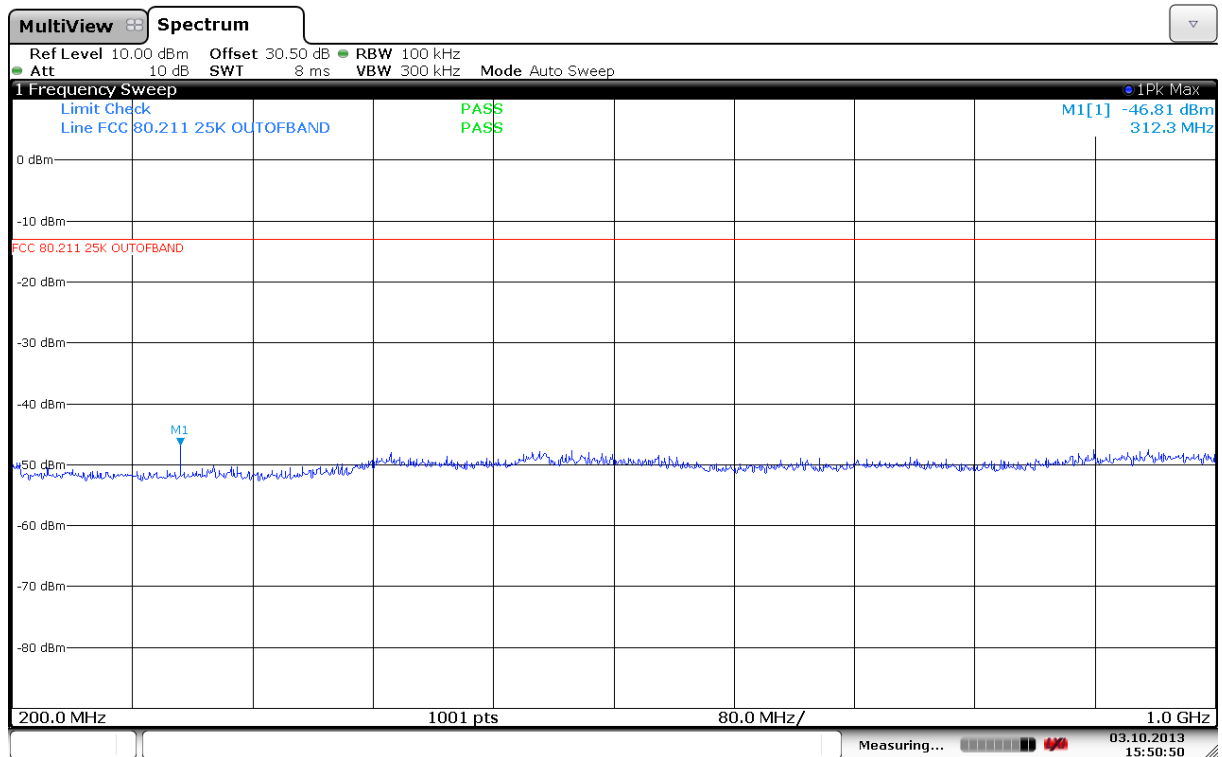
Emissions at antenna connector, 1 -200MHz, ch06, channel spacing 25 kHz



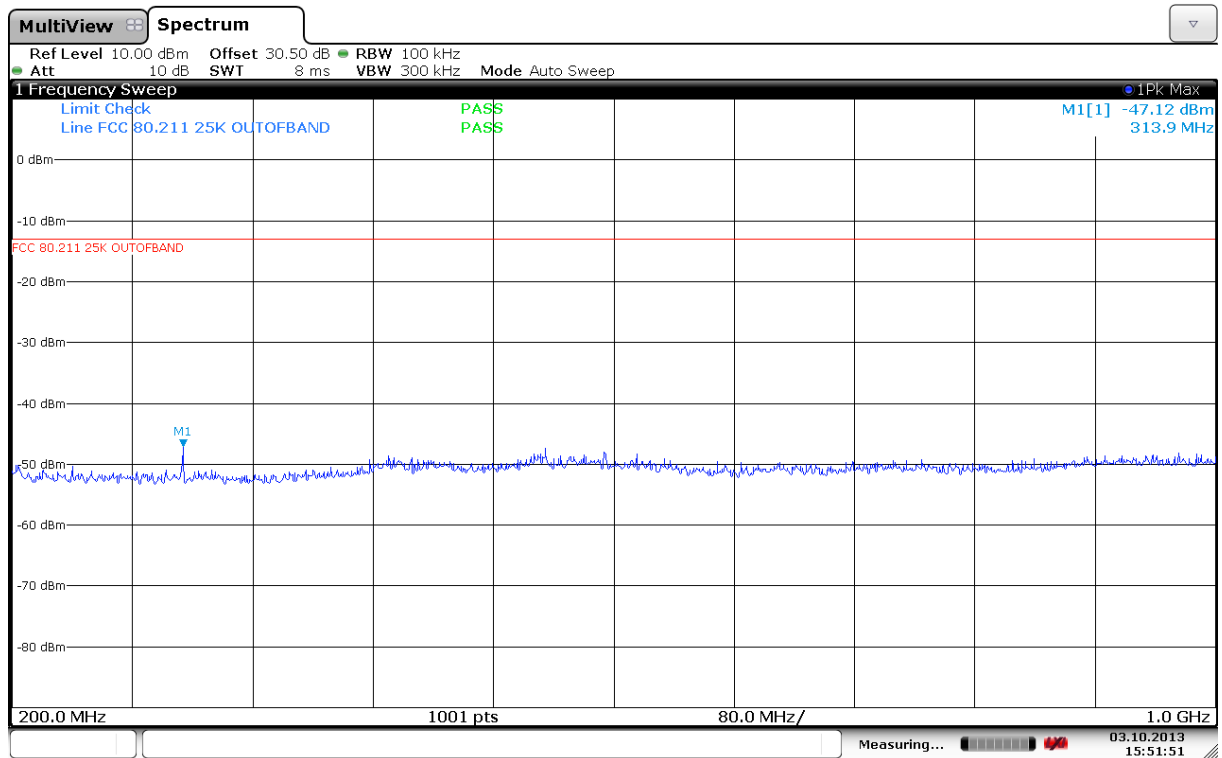
Emissions at antenna connector, 1 -200MHz, ch16, channel spacing 25 kHz



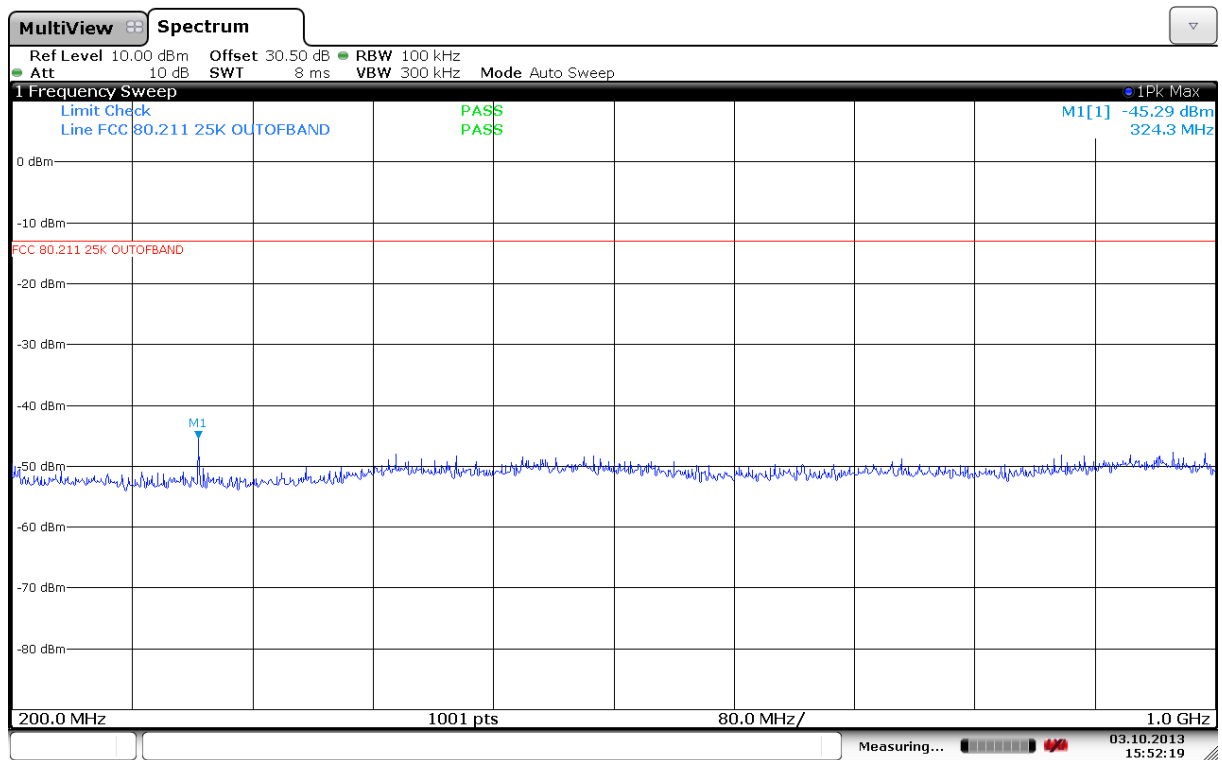
Emissions at antenna connector, 1 -200MHz, ch28, channel spacing 25 kHz



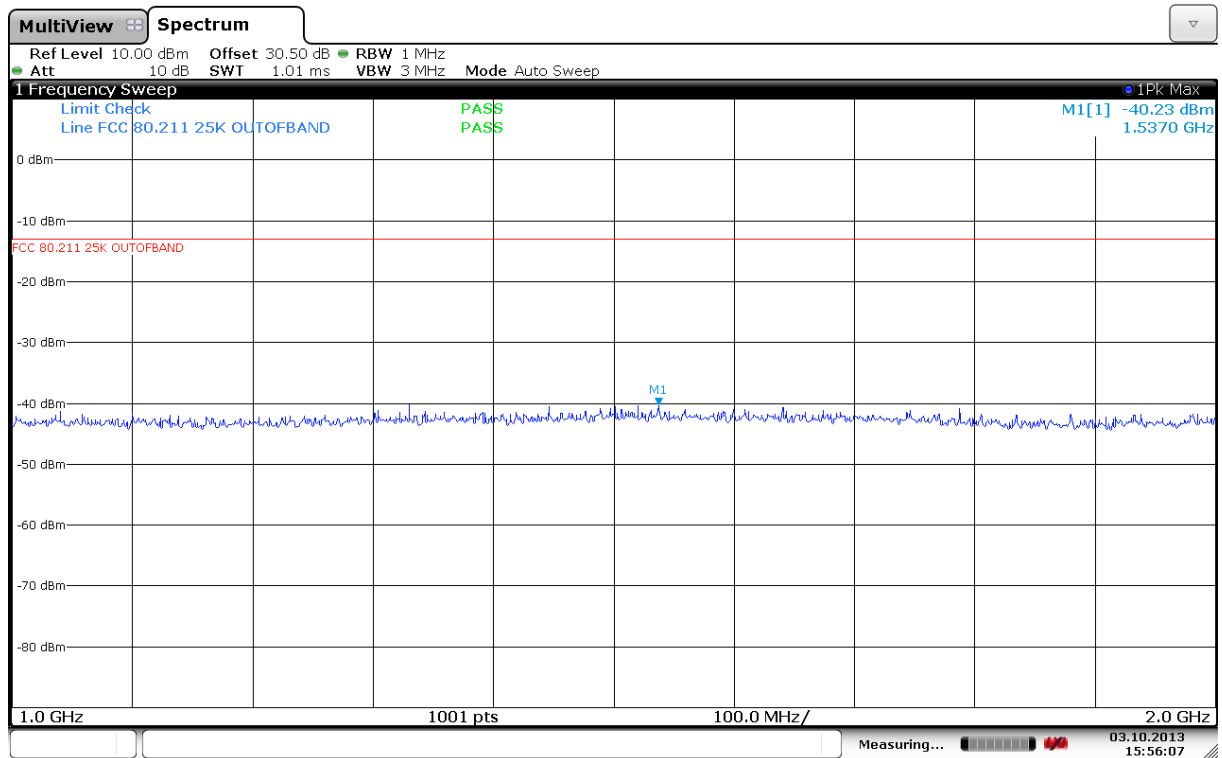
Emissions at antenna connector, 200 -1000MHz, ch06, channel spacing 25 kHz



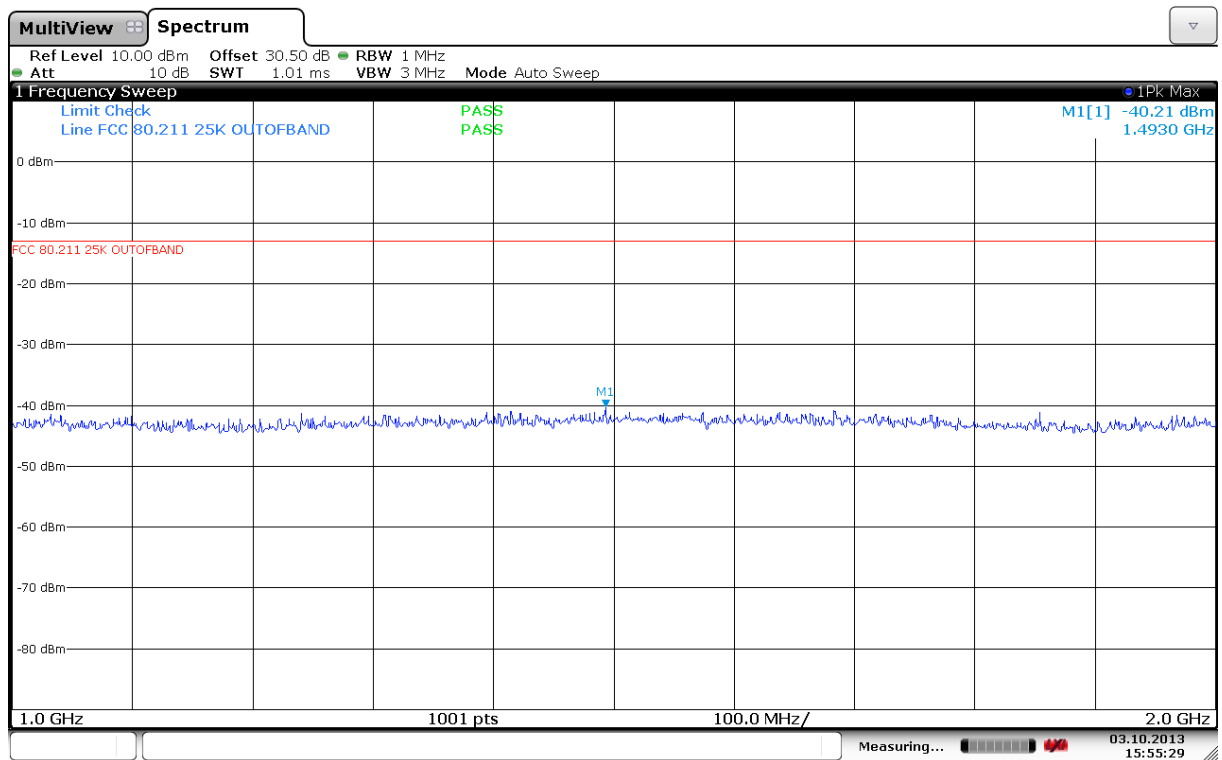
Emissions at antenna connector, 200 -1000MHz, ch16, channel spacing 25 kHz



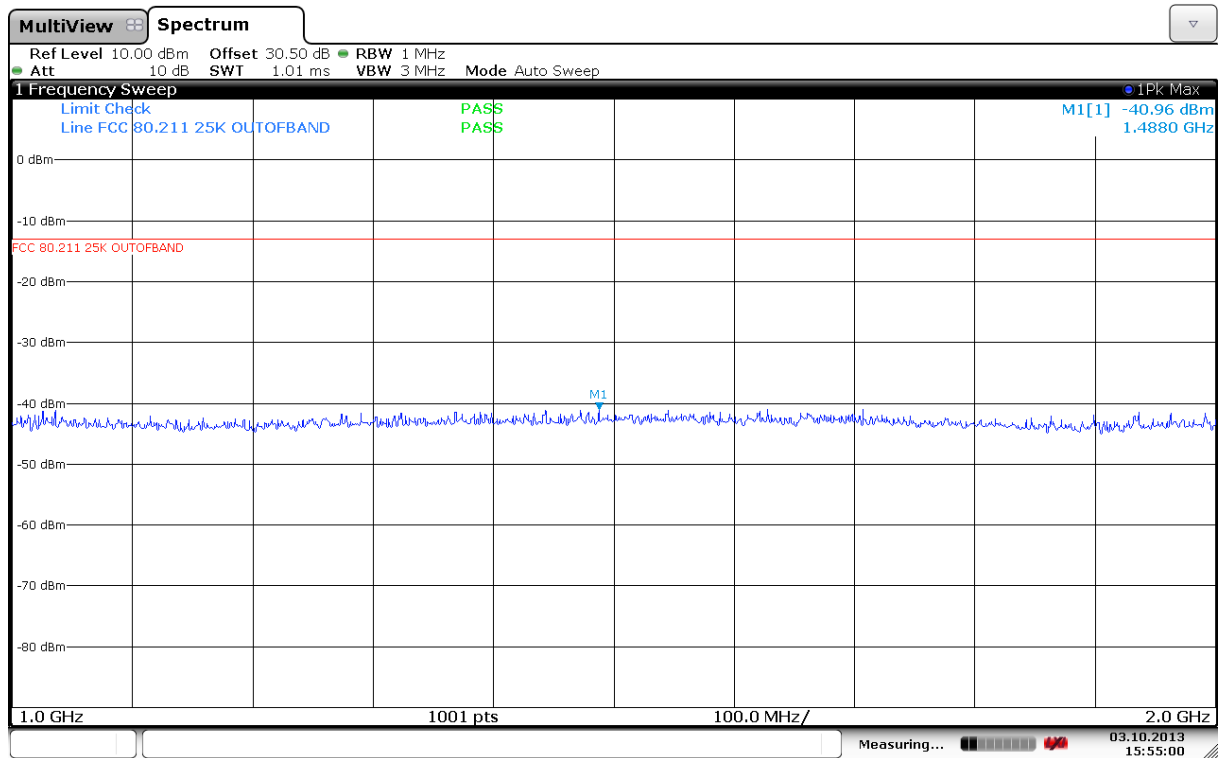
Emissions at antenna connector, 200 -1000MHz, ch28, channel spacing 25 kHz



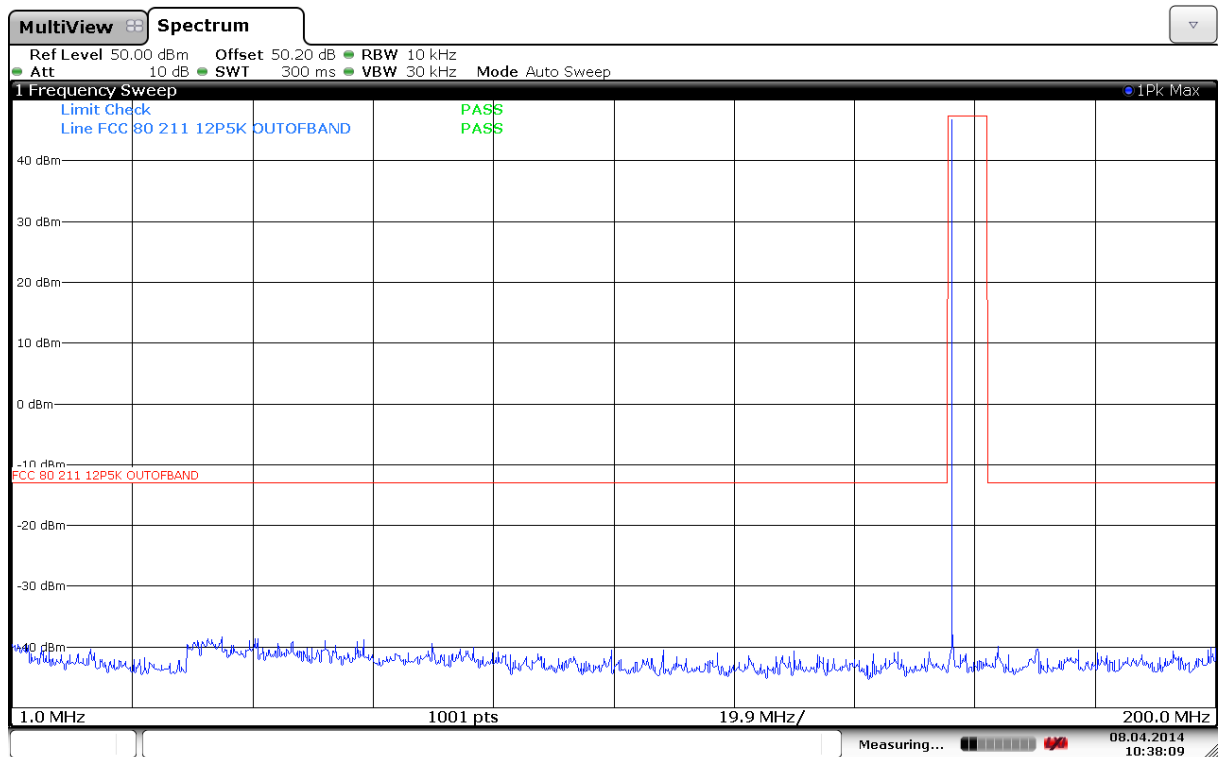
Emissions at antenna connector, 1000 -2000MHz, ch06, channel spacing 25 kHz



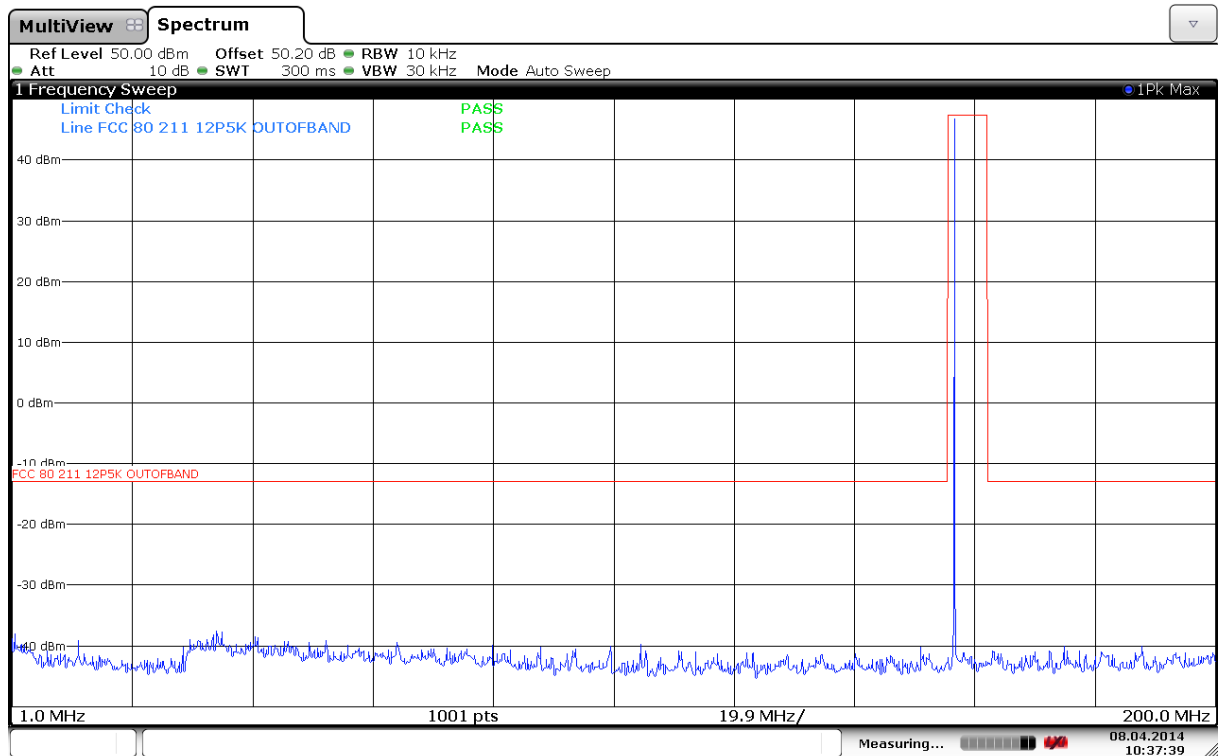
Emissions at antenna connector, 1000 -2000MHz, ch16, channel spacing 25 kHz



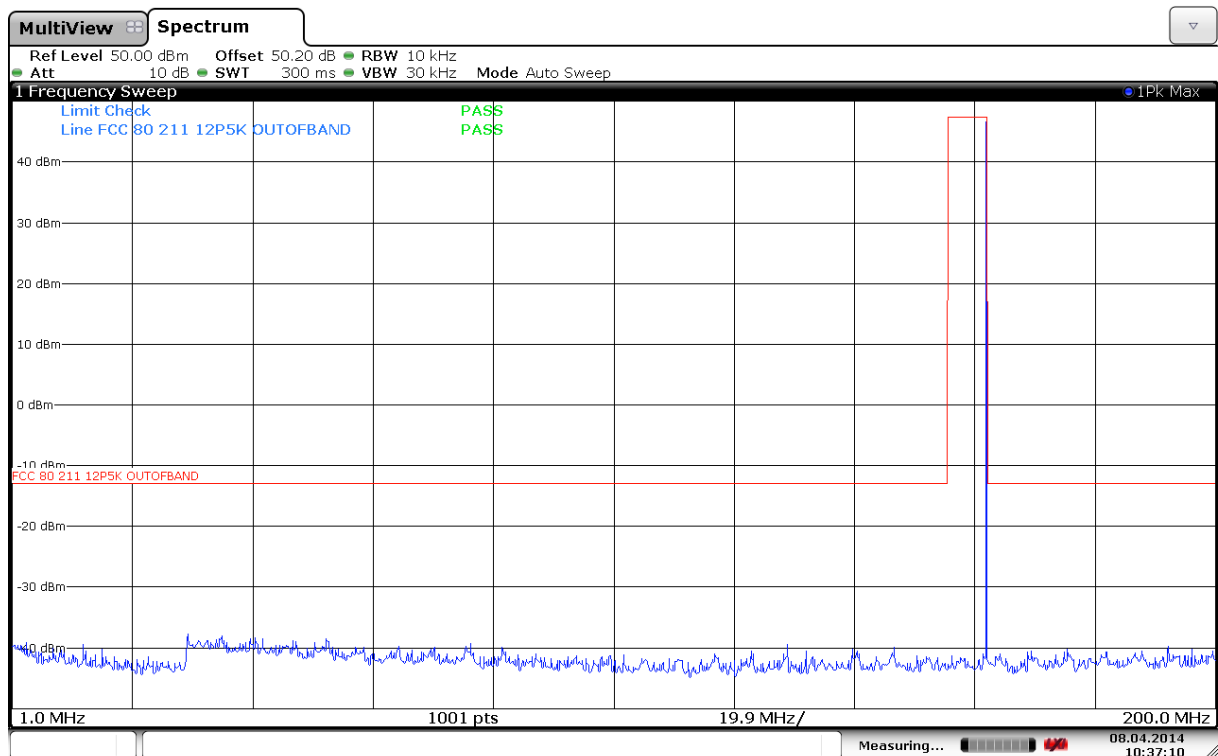
Emissions at antenna connector, 1000 -2000MHz, ch28, channel spacing 25 kHz



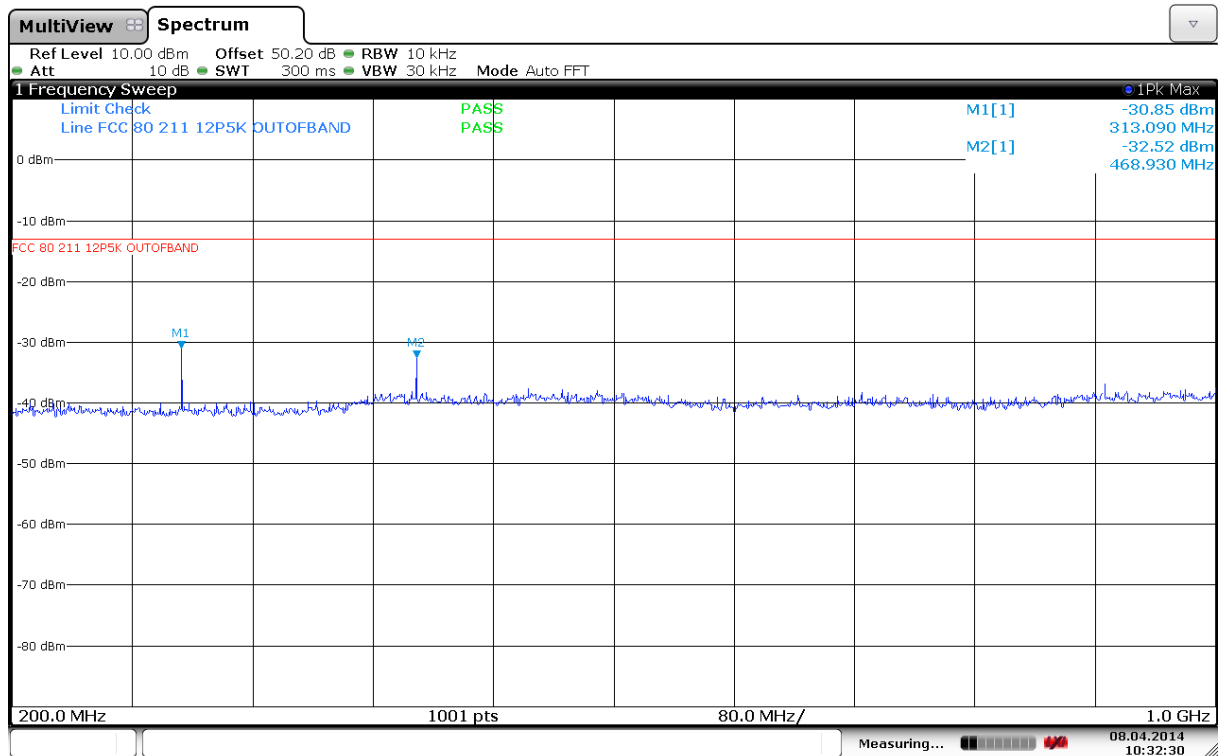
Emissions at antenna connector, 1 -200MHz, ch267, channel spacing 12.5 kHz



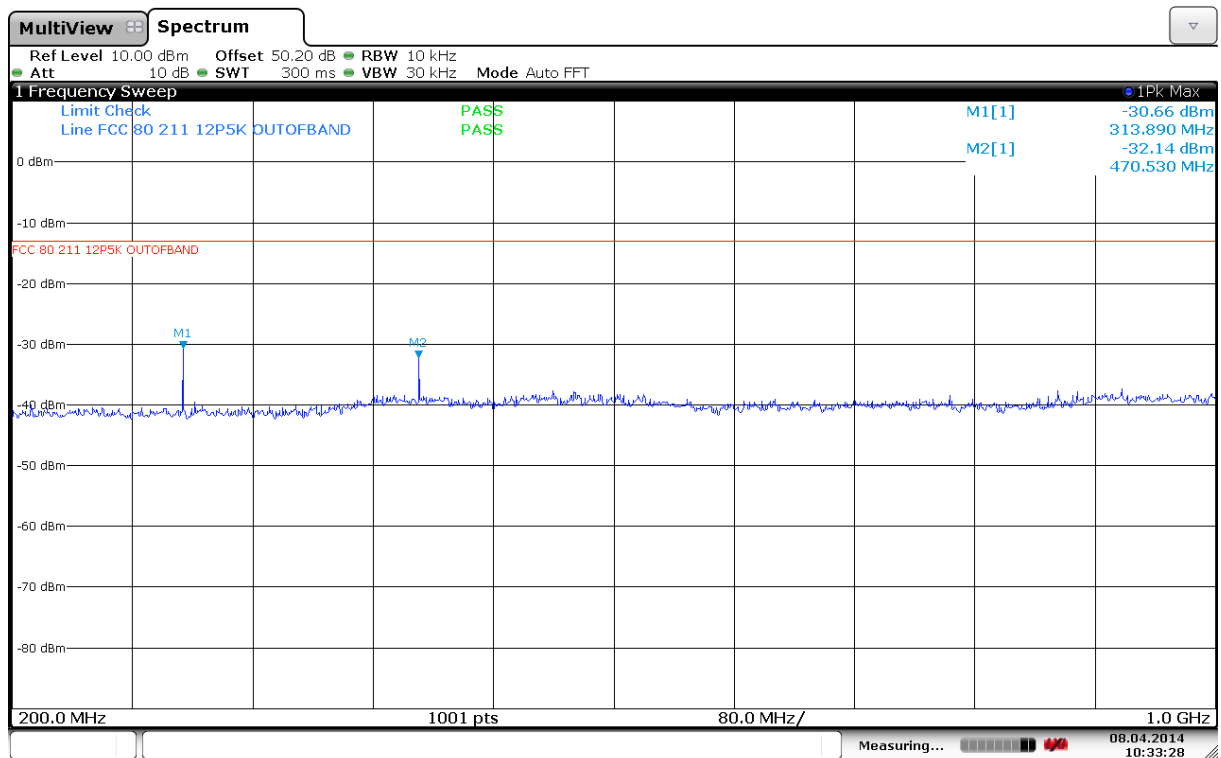
Emissions at antenna connector, 1 -200MHz, ch216, channel spacing 12.5 kHz



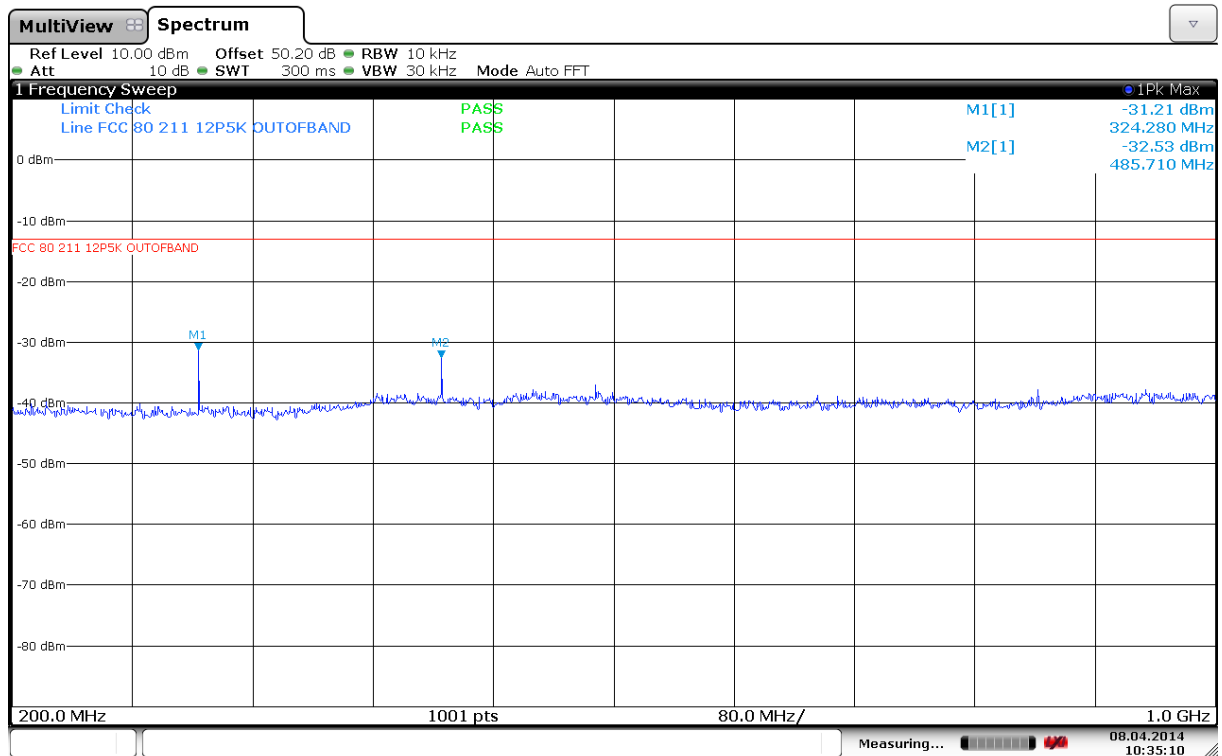
Emissions at antenna connector, 1 -200MHz, ch228, channel spacing 12.5 kHz



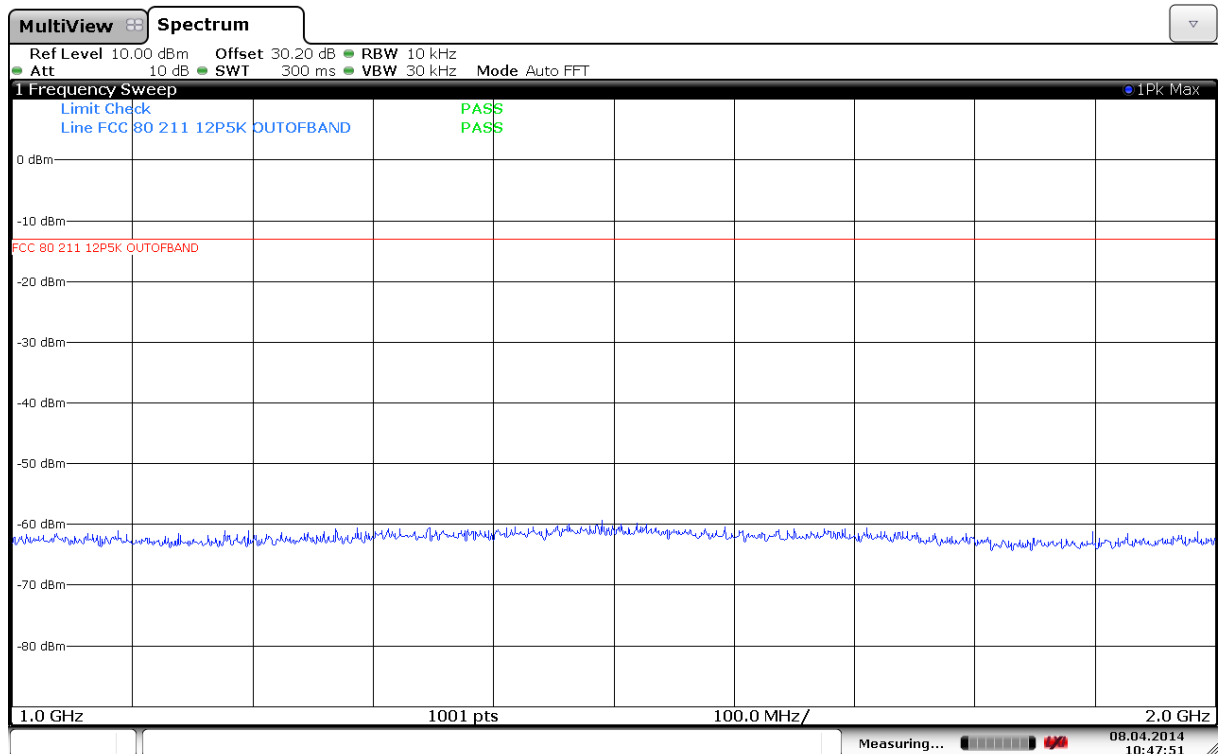
Emissions at antenna connector, 200 -1000MHz, ch267, channel spacing 12.5 kHz



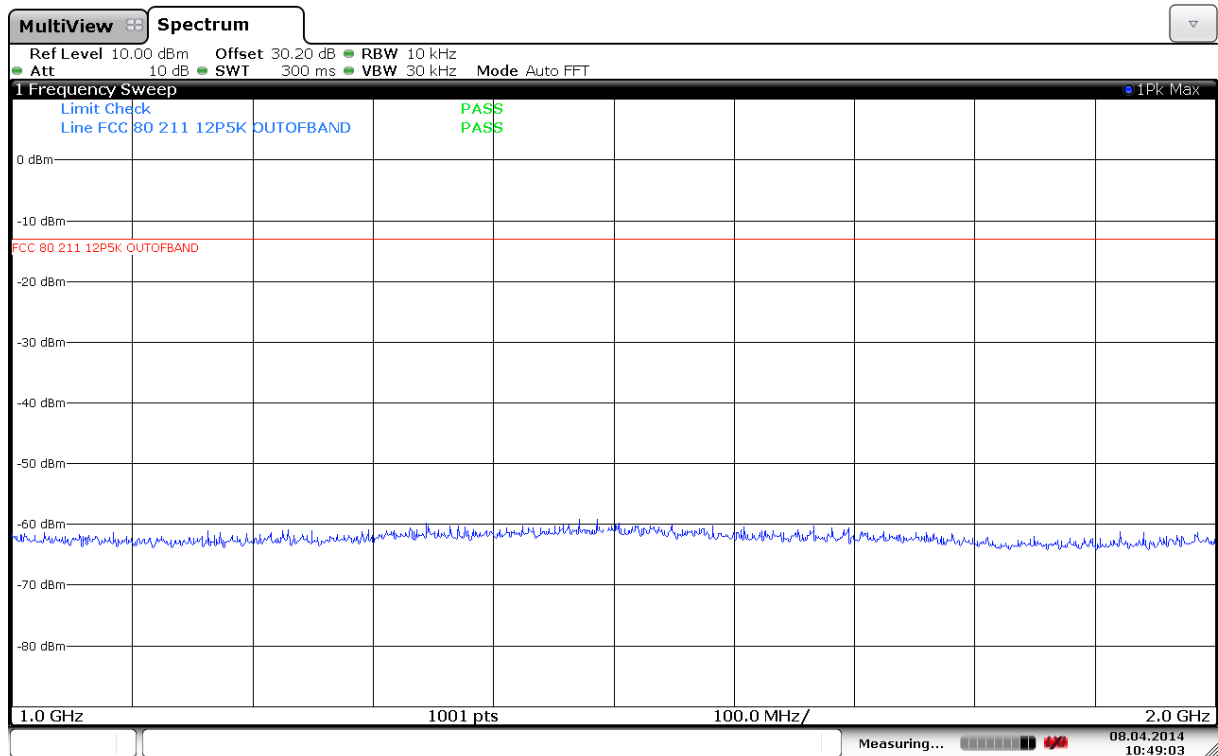
Emissions at antenna connector, 200 -1000MHz, ch216, channel spacing 12.5 kHz



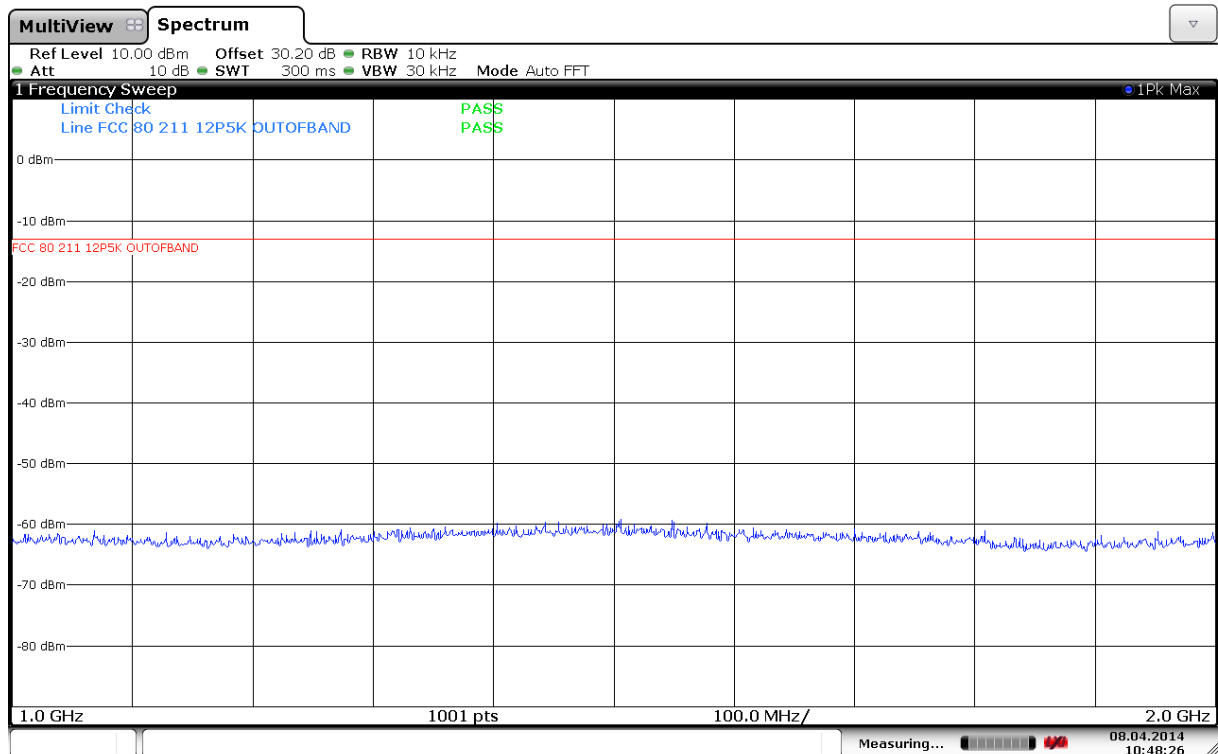
Emissions at antenna connector, 200 -1000MHz, ch228, channel spacing 12.5 kHz



Emissions at antenna connector, 1000 -2000MHz, ch267, channel spacing 12.5 kHz



Emissions at antenna connector, 1000 -2000MHz, ch216, channel spacing 12.5 kHz



Emissions at antenna connector, 1000 -2000MHz, ch228, channel spacing 12.5 kHz

3.5 Spurious Emissions at the Antenna Terminal, Emission Masks

FCC Parts 2.1053, 2.1057, 80.211

RSS-182 Issue 5, Section 7.9.1

Test Results: Complies

Measurement Data:

See attached plots.

Modulated 2.5KHz tone with 16dB overdrive

Requirements:

FCC 90.210, RSS-182 Issue 5:

Emission Mask for Equipment with 25 kHz channel spacing:

This mask is for FM or PM modulation equipment with 25 kHz channel spacing, an authorized bandwidth of 16 kHz for voice or 20 kHz for data.

On any frequency removed from the carrier frequency by more than 50%, but not more than 100% of the authorized bandwidth: at least 25 dB, measured with a bandwidth of 300 Hz

On any frequency removed from the carrier frequency by more than 100%, but not more than 250% of the authorized bandwidth: at least 35 dB, measured with a bandwidth of 300 Hz

On any frequency removed from the carrier frequency by more than 250% of the authorized bandwidth: at least $43 + 10 \log_{10} p(\text{watts})$ dB, measured with a bandwidth of 30 kHz

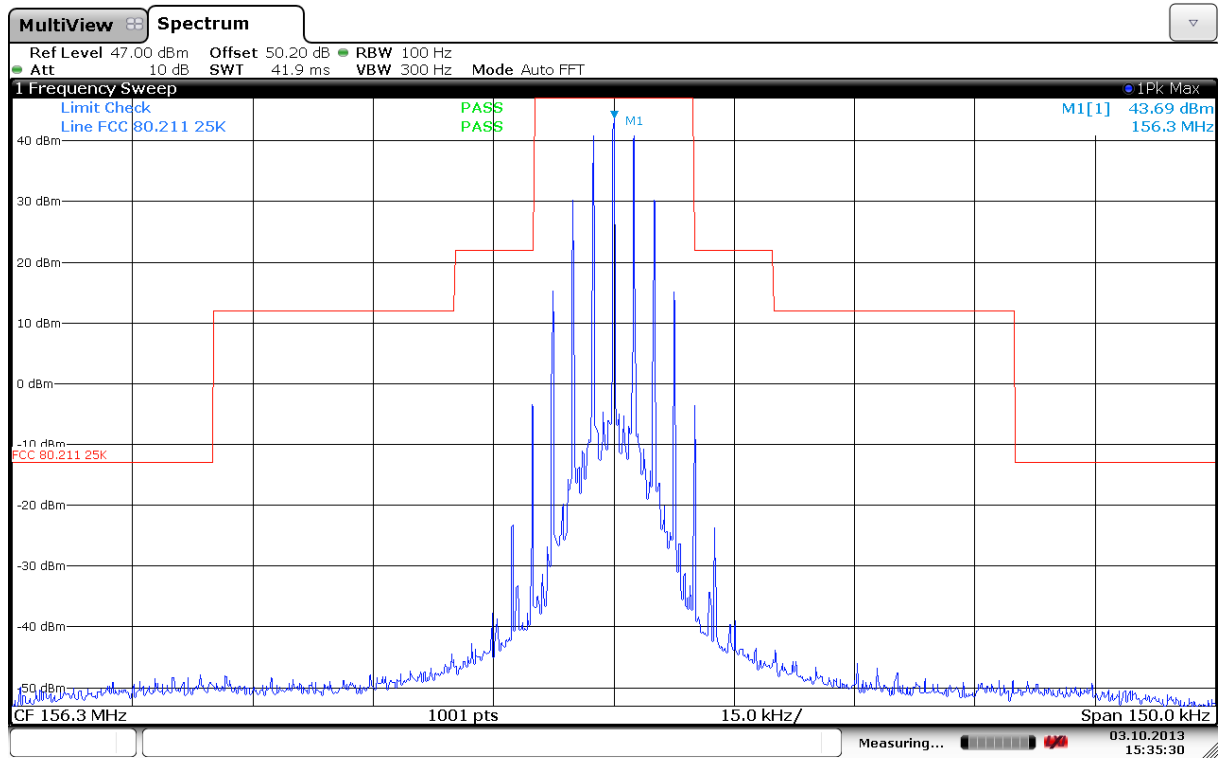
Emission Mask for Equipment with 12.5 kHz channel spacing:

This mask is for equipment with channel spacing of 12.5 kHz, an authorized bandwidth of 11.25 kHz

On any frequency removed from the carrier frequency f_c up to a displacement frequency of 5.625 kHz: 0 dB, measured with a bandwidth of 100 Hz

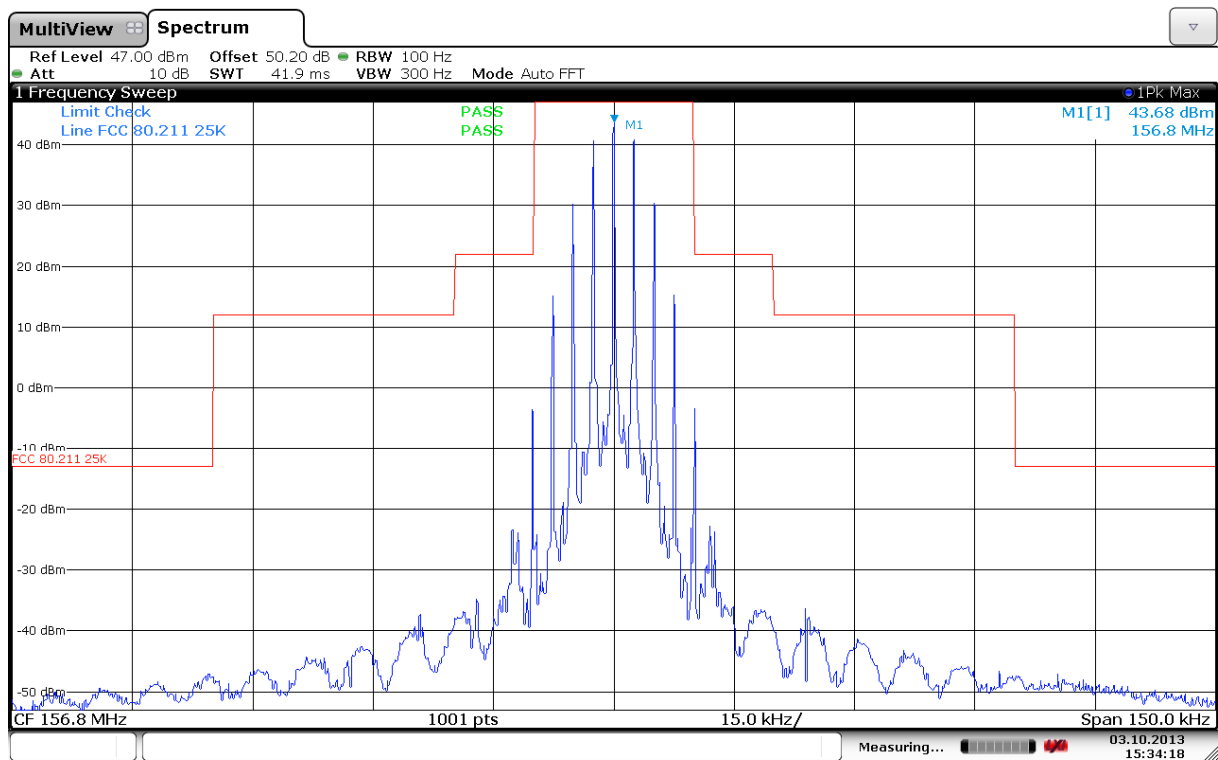
On any frequency removed from the carrier frequency by a displacement frequency (f_d in kHz) of more than 5.625 kHz, but no more than 12.5 kHz: at least $7.27 (f_d - 2.88 \text{ kHz})$ dB, measured with a bandwidth of 100 Hz

On any frequency removed from the carrier frequency by a displacement frequency (f_d in kHz) of more than 12.5 kHz: at least $50 + 10 \log_{10} p(\text{watts})$ dB or 70 dB, whichever is the lesser attenuation, measured with a bandwidth of 100 Hz for a displacement frequency of more than 12.5 kHz, but no more than 50 kHz, and measured with a bandwidth of 10 kHz for a displacement frequency of more than 50 kHz



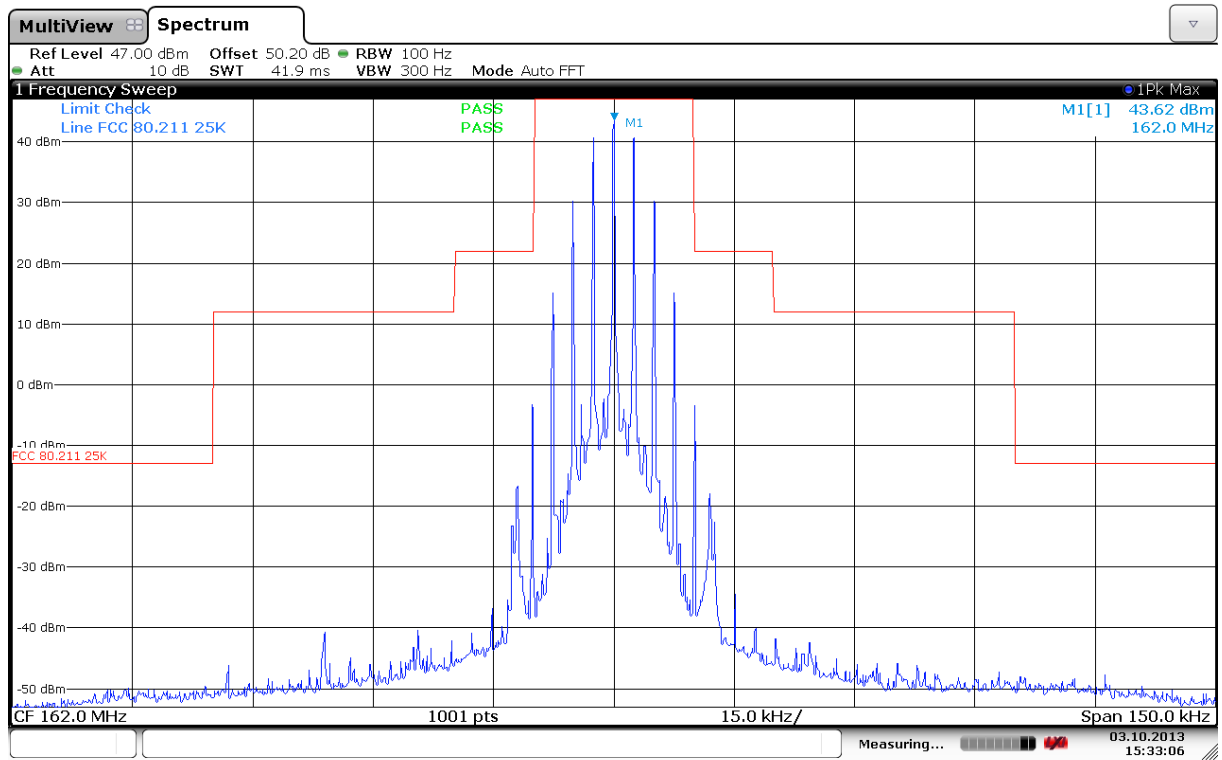
Date: 3.OCT.2013 15:35:30

Emission Mask, FCC 80.211(f), Lower Channel, High power, 25 kHz channel spacing



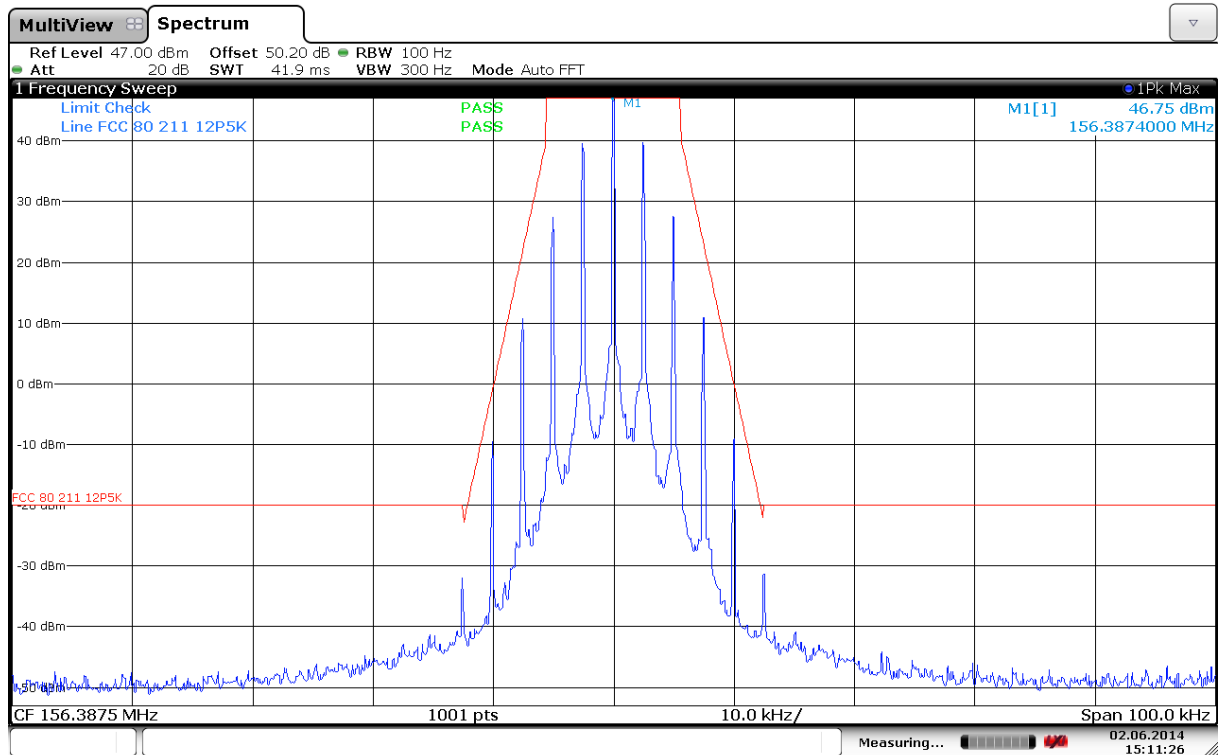
Date: 3.OCT.2013 15:34:18

Emission Mask, FCC 80.211(f), Middle Channel, High power, 25 kHz channel spacing

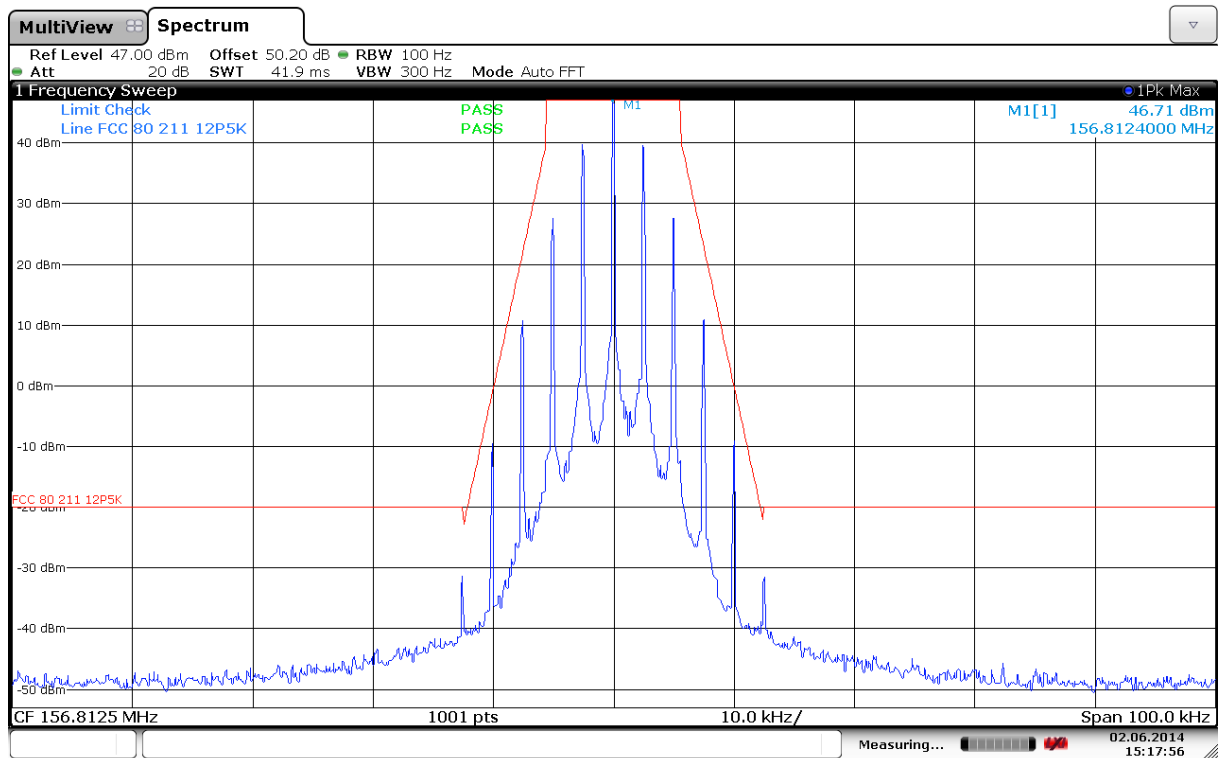


Date: 3.OCT.2013 15:33:06

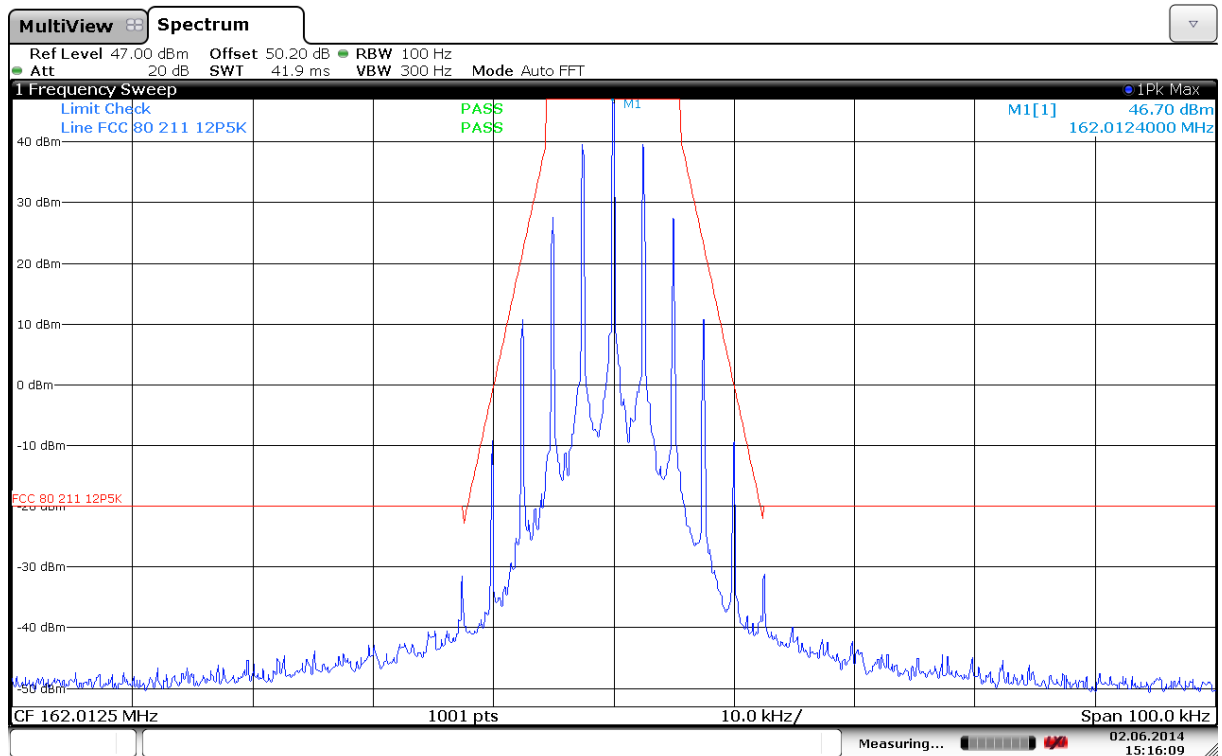
Emission Mask, FCC 80.211(f), Upper Channel, High Power, 25 kHz channel spacing



Emission Mask, FCC 90.210(d), Lower Channel, High Power, 12.5 kHz channel spacing



Emission Mask, FCC 90.210(d), Middle Channel, High Power, 12.5 kHz channel spacing



Emission Mask, FCC 90.210(d), Upper Channel, High Power, 12.5 kHz channel spacing

3.6 Transmitter Spurious Radiations

Para. No.: 2.1053, 2.1057, 80.211

Test Results: Complies

Measurement Data:

Middle channel with high power– 50ohm load , Modulated 2.5KHz with 16dB overdrive

Spurious Frequency MHz	Polarity	Measured Value dBm	Limit dBm	Margin dB
30 – 1000	V/H	< -60	-13	>40
1000 - 5000	V/H	< -50	-13	>30

The frequency band below 1 GHz is measured with 100 kHz and Peak Detector; the frequencies from 1 to 2 GHz were measured with 1 MHz RBW and Peak Detector.

The measurement was performed at 10m below 1 GHz and at 3m above 1 GHz, both measurements with transducer factor programmed in the spectrum analyzer.

The emissions on highest and lowest channel did not differ significantly from the values at the middle frequency.

EUT was transmitting continuously without modulation. The EUT was rotated in 3 planes for this test.

The plots show ERP below 1 GHz and EIRP above 1 GHz.

Requirements:

FCC 80.211(f)(3): Less than -13 dBm



MARKER 1

156.8108974 MHz

Ref -20 dBm

* Att 10 dB

* RBW 100 kHz

VBW 300 kHz

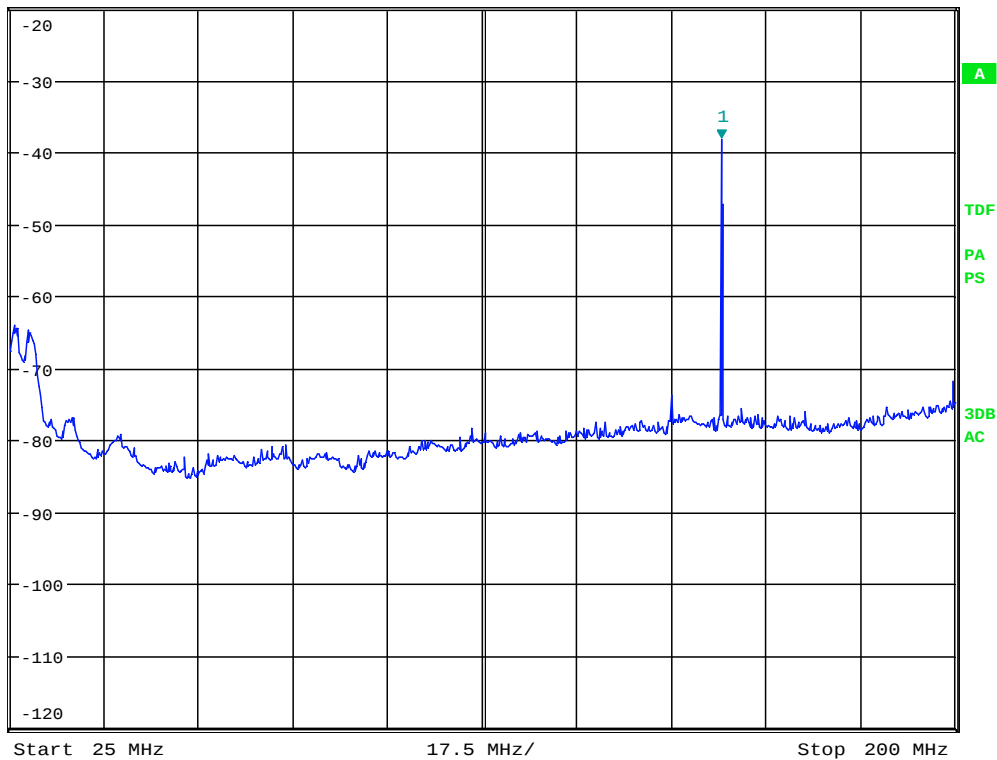
SWT 20 ms

Marker 1 [T1]

-38.22 dBm

156.810897436 MHz

1 PK
MAXH



Date: 17.OCT.2013 12:40:43

30 - 200MHz VP, TX on , 50ohm load



MARKER 1

26.12179487 MHz

Ref -25 dBm

* Att 10 dB

* RBW 100 kHz

VBW 300 kHz

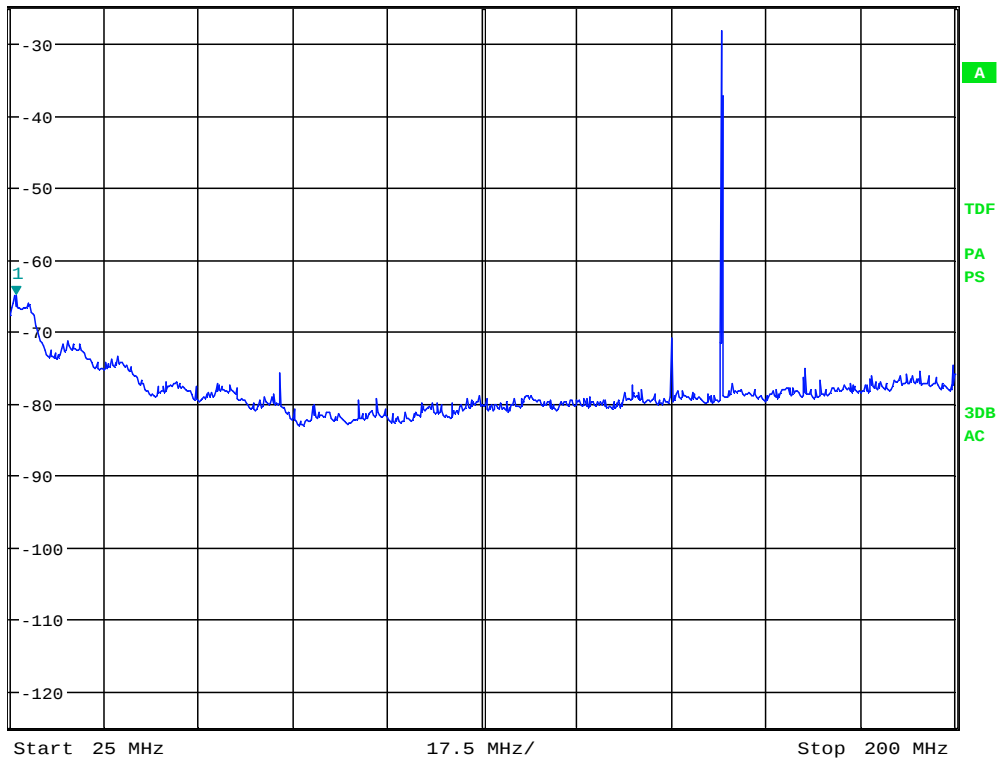
SWT 20 ms

Marker 1 [T1]

-64.92 dBm

26.121794872 MHz

1 PK
MAXH



Date: 17.OCT.2013 12:49:12

30 - 200MHz HP, TX on, 50ohm load

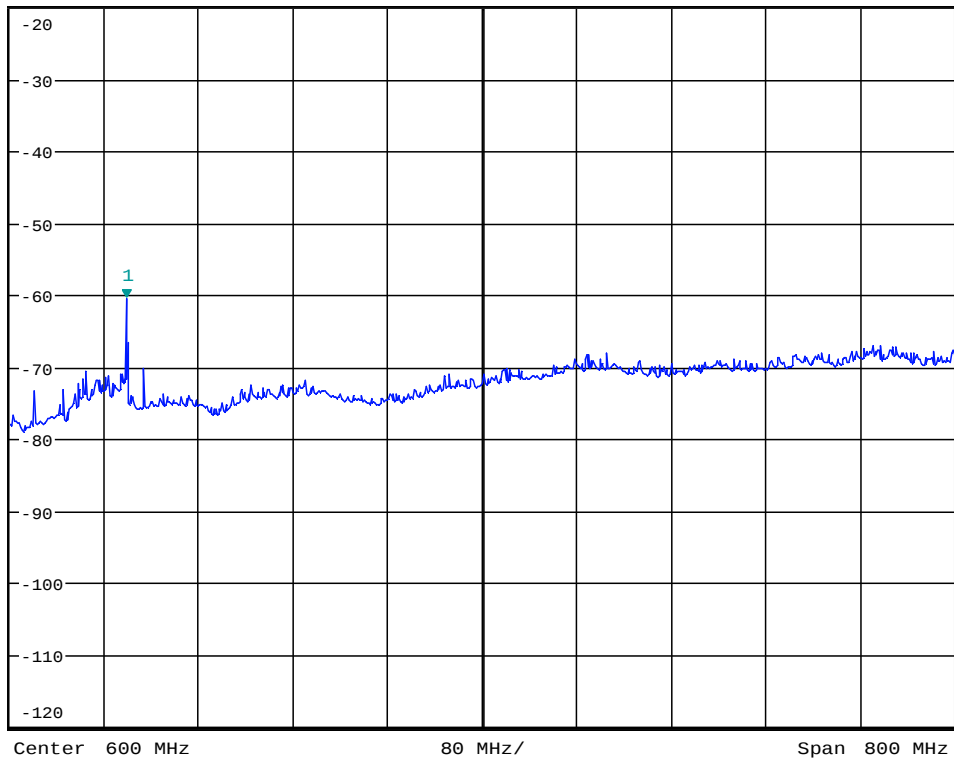


MARKER 1
298.7179487 MHz

* RBW 100 kHz
VBW 300 kHz
SWT 80 ms
Marker 1 [T1]
-60.36 dBm
298.717948718 MHz

Ref -20 dBm * Att 10 dB

1 PK
MAXH



Date: 17.OCT.2013 12:25:47

200 - 1000MHz VP, TX on, 50ohm load

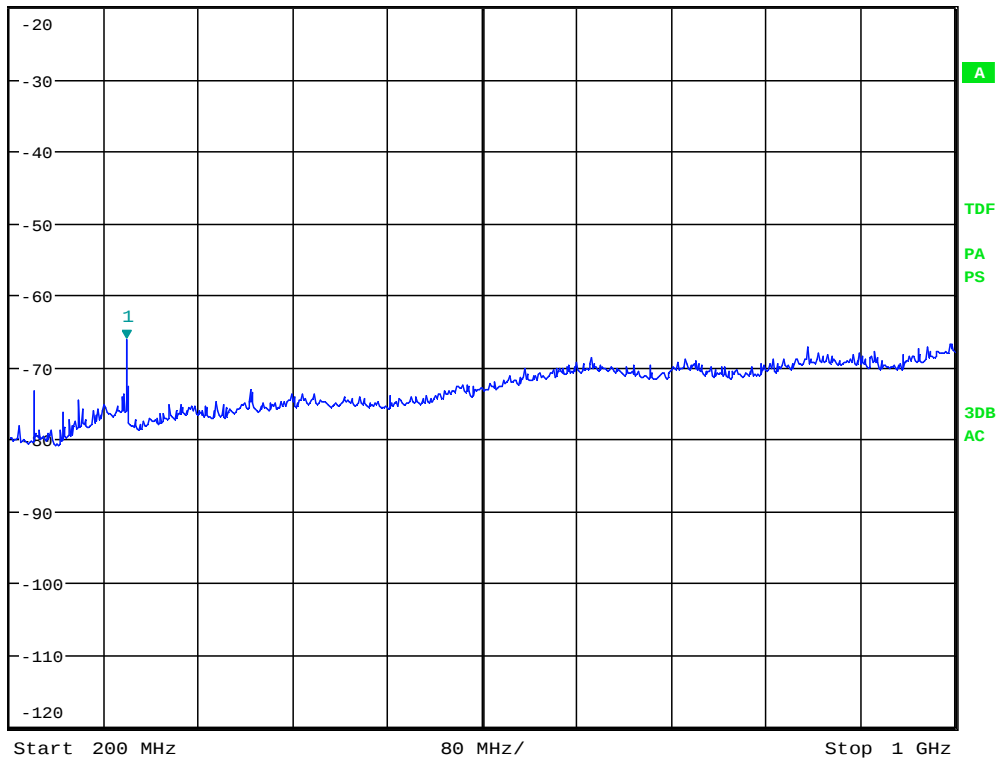


MARKER 1
298.7179487 MHz

* RBW 100 kHz
VBW 300 kHz
SWT 80 ms
Marker 1 [T1]
-66.19 dBm
298.717948718 MHz

Ref -20 dBm * Att 10 dB

1 PK
MAXH



Date: 17.OCT.2013 12:33:52

200 - 1000MHz HP, TX on, 50ohm load



MARKER 1

4.564102564 GHz

Ref -25 dBm

* Att 10 dB

* RBW 100 kHz

VBW 300 kHz

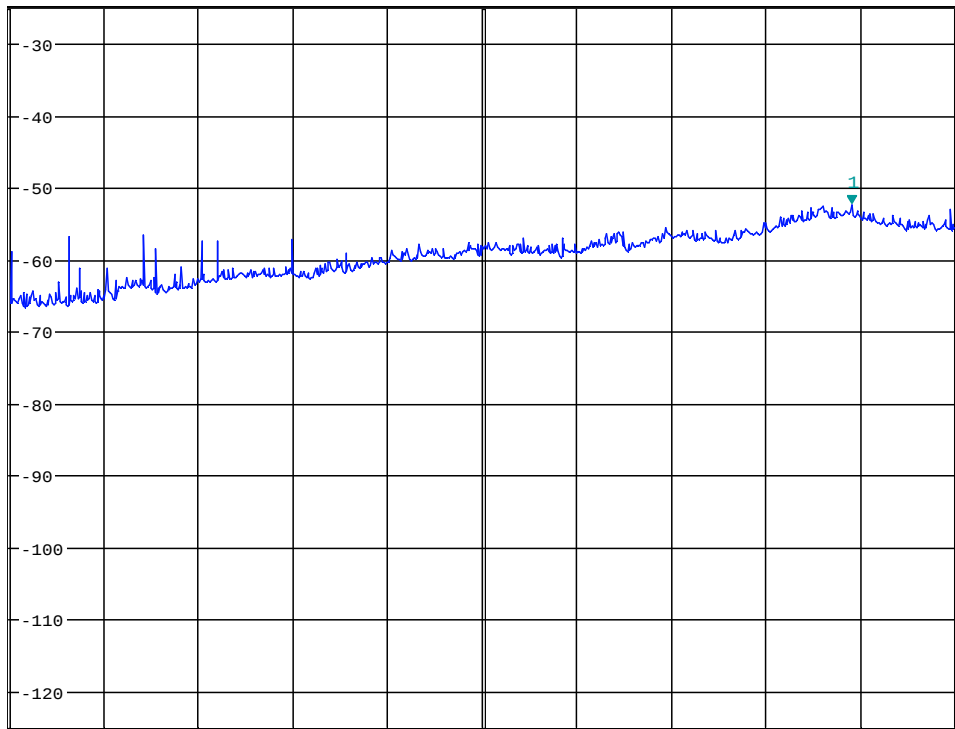
SWT 400 ms

Marker 1 [T1]

-52.36 dBm

4.564102564 GHz

1 PK
MAXH



Center 3 GHz

400 MHz/

Span 4 GHz

Date: 17.OCT.2013 13:09:40

1 - 5GHz VP, TX on, 50ohm load

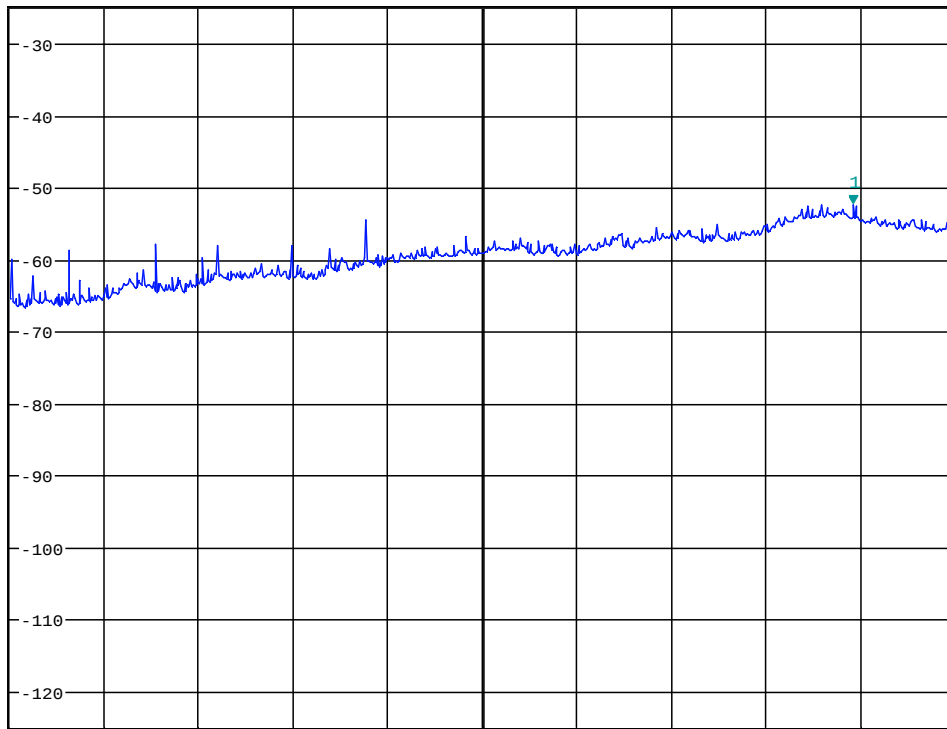


MARKER 1
4.570512821 GHz

* RBW 100 kHz
VBW 300 kHz
SWT 400 ms
Marker 1 [T1]
-52.51 dBm
4.570512821 GHz

Ref -25 dBm * Att 10 dB

1 PK
MAXH



Center 3 GHz

400 MHz/

Span 4 GHz

Date: 17.OCT.2013 13:14:05

1 – 5GHz HP, TX on, 50ohm load

3.7 Frequency Stability

Para. No.: 2.1055, 80.209

RSS-182 Issue 5, section 7.4

Test Results: Complies

Measurement Data:

Assigned frequency 156.800 MHz (Ch16)

Temperature	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
+55 degrees C	156.799948	-0.052	-0.332
+50 degrees C	156.799987	-0.013	-0.083
+40 degrees C	156.799975	-0.025	-0.159
+30 degrees C	156.799967	-0.033	-0.210
+20 degrees C	156.799970	-0.030	-0.191
+10 degrees C	156.799976	-0.024	-0.153
0 degrees C	156.799962	-0.038	-0.242
-10 degrees C	156.799966	-0.034	-0.217
-20 degrees C	156.799983	-0.017	-0.108
-30 degrees C	156.799990	-0.010	-0.064

Voltage	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
138 Volts (Maximum)	156.799970	-0.030	-0.191
120 Volts (Nominal)	156.799970	-0.030	-0.191
98 Volts (Minimum)	156.799970	-0.030	-0.191

Comment: /

Requirements:

FCC 80.209(a)(5)(i), RSS 182 Issue 5, section 7.4:

Band 156 -162MHz, Coast Stations with power between 3 and 100 Watts: 5.0 ppm

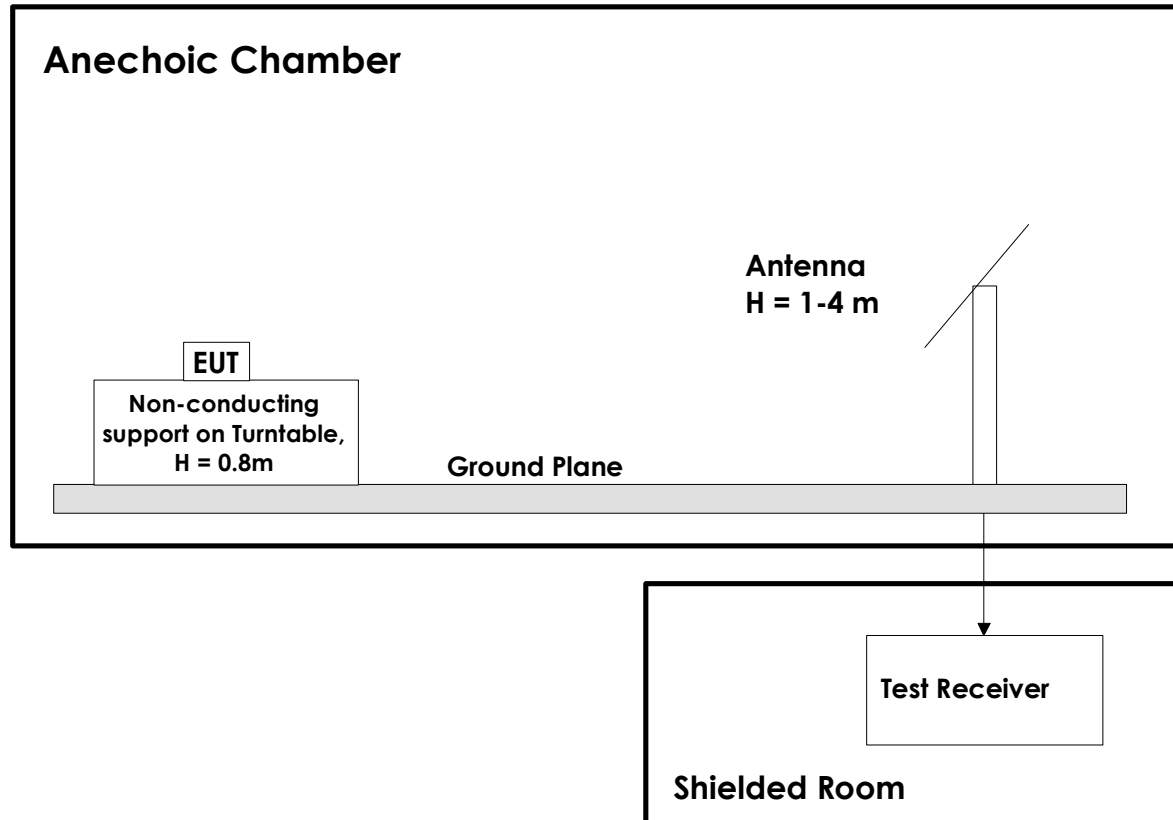
4 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2013.09.24	2014.09.24
2	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2013.08.30	2014.08.30
3	8901B	Modulation Analyzer	Hewlett Packard	LR 1255	Cal b4 use	
4	53310A	Modulation Domain Analyzer	Hewlett Packard	LR 1483	2013.08.14	2015.08.14
5	765-10	Attenuator	Narda	LR 1007	2013.09.10	2015.09.10
6	Model 8321	Attenuator	Bird Electronics	LR 061	Cal b4 use	
7	NRP-Z81	Power Meter	Rohde & Schwarz	LR 1644	2013.05.04	2014.05.04
8	6812B	AC Power Source	Agilent	LR 1515	2013.10.28	2014.10.28
9	JB3	BiLog Antenna	Sunol Sciences	N-4525	2011.09.07	2014.09.07
10	LNA6900	Preamplifier	Teseq	LR 1593	Cal b4 use	
11	3115	Horn Antenna	EMCO	LR 1330	2010.08.05	2015.08.05
12	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2013.09	2014.09
13	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 285	2010.11	2015.11
14	HZ-12	Substitution Dipoles	Rohde & Schwarz	LR 1332	2113.11.15	2015.11.15
15	HZ-13	Substitution Dipoles	Rohde & Schwarz	LR 1334	2013.11.15	2015.11.15
16	Model 87 V	Multimeter	Fluke	LR 1599	2012.10.29	2014.10.29
17	TG200DM	RC Oscillator	Levell	LR 204	N/A	

5 TEST SETUP

5.1 Test Site Radiated Emissions



5.2 Frequency Measurements

