



TEST REPORT

Report Number: 100454947MIN-003

Project Number: G100454947

Testing performed on the
Rosemount 2051 Wireless and Rosemount 3051 Wireless

FCC ID: LW2-RMCT
Industry Canada ID: 2731A-RMCT

to
47 CFR Part 15. 247:2010
RSS- 210, Issue 8, 2010

For
Emerson Process Management

Test Performed by:
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Test Authorized by:
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Date: October 2, 2012

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Date: October 2, 2012

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1.0 GENERAL DESCRIPTION

Model:	Rosemount 2051 Wireless and Rosemount 3051 Wireless
Type of EUT:	Wireless Pressure Sensor
Serial Number:	Demo
FCC ID:	LW2-RMCT
Industry Canada ID:	2731A-RMCT
Related Submittal(s) Grants:	None
Company:	Emerson Process Management
Customer:	Mr. Merritt Pulkrabek
Address:	8200 Market Blvd. Mail Stop PM17 Chanhassen, MN 55317
Phone:	952-949-5193
Fax:	952-949-7626
e-mail:	Merritt.Pulkrabek@Emerson.com
Test Standards:	<input checked="" type="checkbox"/> 47 CFR, Part 15:2010, §15.247 <input checked="" type="checkbox"/> RSS-210, Issue 8, 2010 <input checked="" type="checkbox"/> RSS-Gen, Issue 3, 2010 <input checked="" type="checkbox"/> 47 CFR, Part 15:2010, §15.107 and §15.109, Class B <input type="checkbox"/> ICES-003, Issue 4:2004 <input type="checkbox"/> Other [REDACTED]
Type of radio:	<input checked="" type="checkbox"/> Stand -alone <input type="checkbox"/> Module <input type="checkbox"/> Hybrid
Date Sample Submitted:	July 12, 2011
Test Work Started:	July 12, 2011
Test Work Completed:	July 18, 2011
Test Sample Conditions:	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good



1.1 Product Description; Test Facility

Product Description:	2.4 – 2.4835GHz Wireless Pressure Sensor
Transmitter Type:	<input type="checkbox"/> FHSS <input checked="" type="checkbox"/> Digital Modulation <input type="checkbox"/> WiFi <input type="checkbox"/> Blue Tooth
Operating Frequency Range(s):	Range: From 2400 to 2483.5 MHz
Number of Channels:	16
Modulation:	QPSK
Emission Designator:	1M55G7D
Antenna(s) Info:	Antenna Type: Omni directional Gain: 2.0dBi Connector Type: Solder direct to circuit board via coax
Antenna Installation:	<input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory
Transmitter power configuration:	<input checked="" type="checkbox"/> Internal battery <input type="checkbox"/> External power source <input type="checkbox"/> 120VAC <input type="checkbox"/> 230VAC <input type="checkbox"/> 400VAC <input checked="" type="checkbox"/> 3.6VDC <input type="checkbox"/> Other: <input type="checkbox"/> <input type="checkbox"/> Amp. <input type="checkbox"/> 50Hz <input type="checkbox"/> 60Hz
Special Test Arrangement:	None
Test Facility Accreditation:	A2LA (Certificate No. 1427.01)
Test Methodology:	Measurements performed according to the procedures in ANSI C63.10-2009 and FCC DTS Measurement Guide

1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

- Standby
- Continuous transmissions (modulated signal)
- Continuous transmissions (un-modulated signal)
- Continuous receiving
- Test program (customer specific)
- [REDACTED]

Operating modes of the EUT:

No.	Description
1	Test was performed at low channel, middle channel, and upper channel

Cables:

No.	Type	Length	Designation	Note
1	2-wire communication cable	<10ft	USB HART cable	

Support equipment/Services:

No.	Item	Description
1	Laptop PC	Interface PCB
2	Viator HART interface	USB HART interface to control EUT

1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal

Temperature:	+15 to +35 °C
Humidity:	20-75 %
Atmospheric pressure:	86-106 kPa

Extreme

<input type="checkbox"/> Temperature:	-20 to +50 °C
<input type="checkbox"/> Supply voltage:	85% to +115%

1.4 Measurement uncertainty

The expanded uncertainty ($k = 2$) for radiated measurements has been determined to be:

± 4 dB at 10m and ± 5.4 dB at 3m

The expanded uncertainty ($k = 2$) for conducted measurements at antenna terminal has been determined to be:

± 1.0 dB

The expanded uncertainty ($k = 2$) for line conducted measurements has been determined to be:

± 2.6 dB

1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength in dB(μ V/m)

RA = Receiver Amplitude in dB(μ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB(m^{-1})

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(μ V) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(μ V/m).

$$RA = 48.1 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu\text{V}/\text{m})$$

General notes:



2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

TEST SPECIFICATION	TEST PARAMETERS	RESULT
15.247(b), (c) / RSS-210 A8.4	Maximum peak output power	Pass
15.247(a) / RSS-210 A8.2	6dB bandwidth of the digital modulation system	Pass
15.247(e) / RSS-210 A8.2	Power spectral density	Pass
15.247(d) / RSS-210 A8.5	Antenna conducted spurious emissions	Pass
15.247(d) / RSS-210 A8.5	Radiated spurious emissions	Pass
15.247(i) / RSS- Gen 5.5	RF Exposure Compliance	Pass
15.207 / RSS-Gen 7.2.2	Transmitter Power Line conducted emissions	N/A
15.109 / ICES-003	Receiver/digital device radiated emissions	Pass
15.107 / ICES-003	Digital device conducted emissions	N/A



3.0 TEST CONDITIONS AND RESULTS

3.1 Maximum peak output power

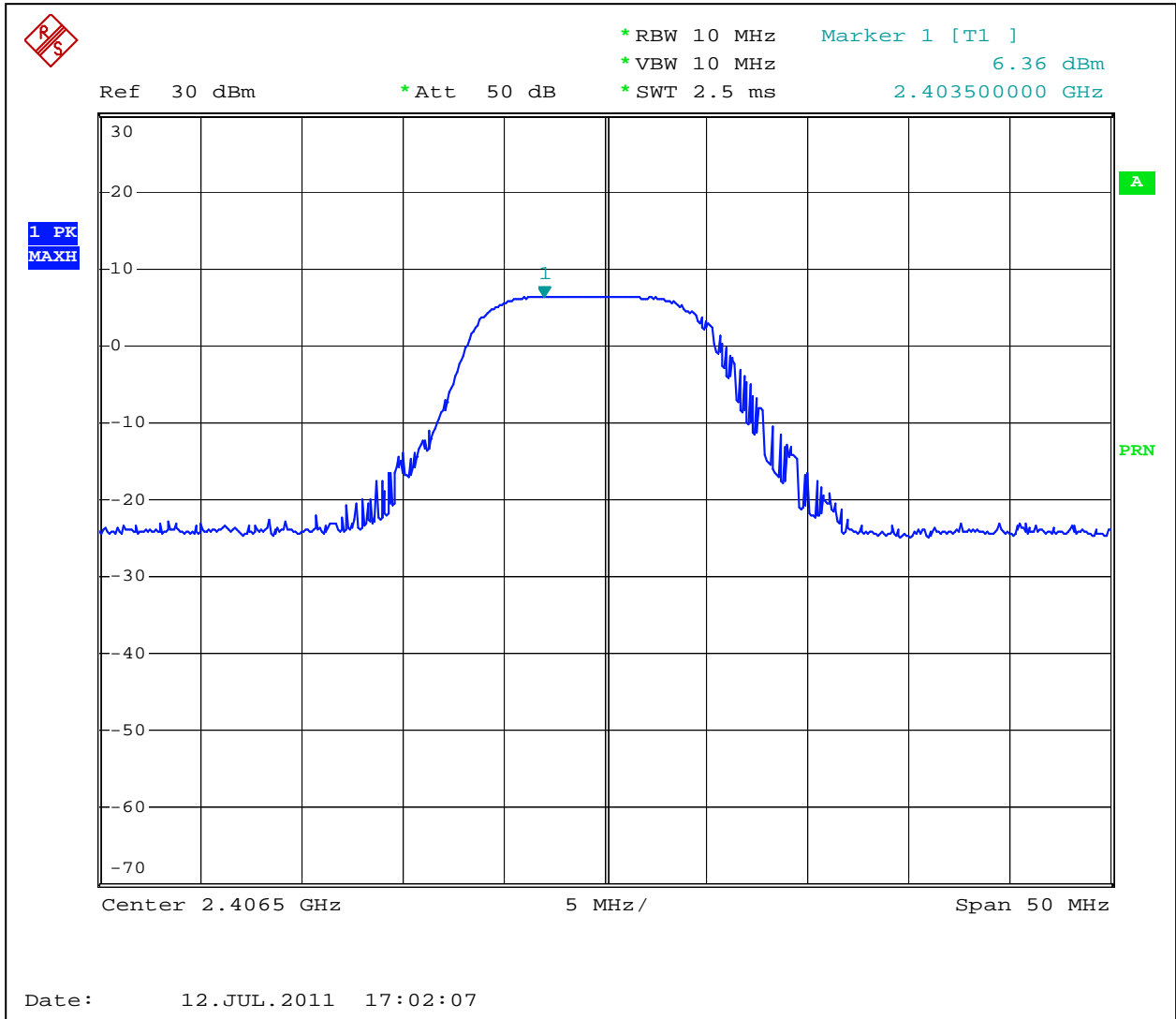
Test location: OATS Anechoic Chamber Other

Test result: **Pass**

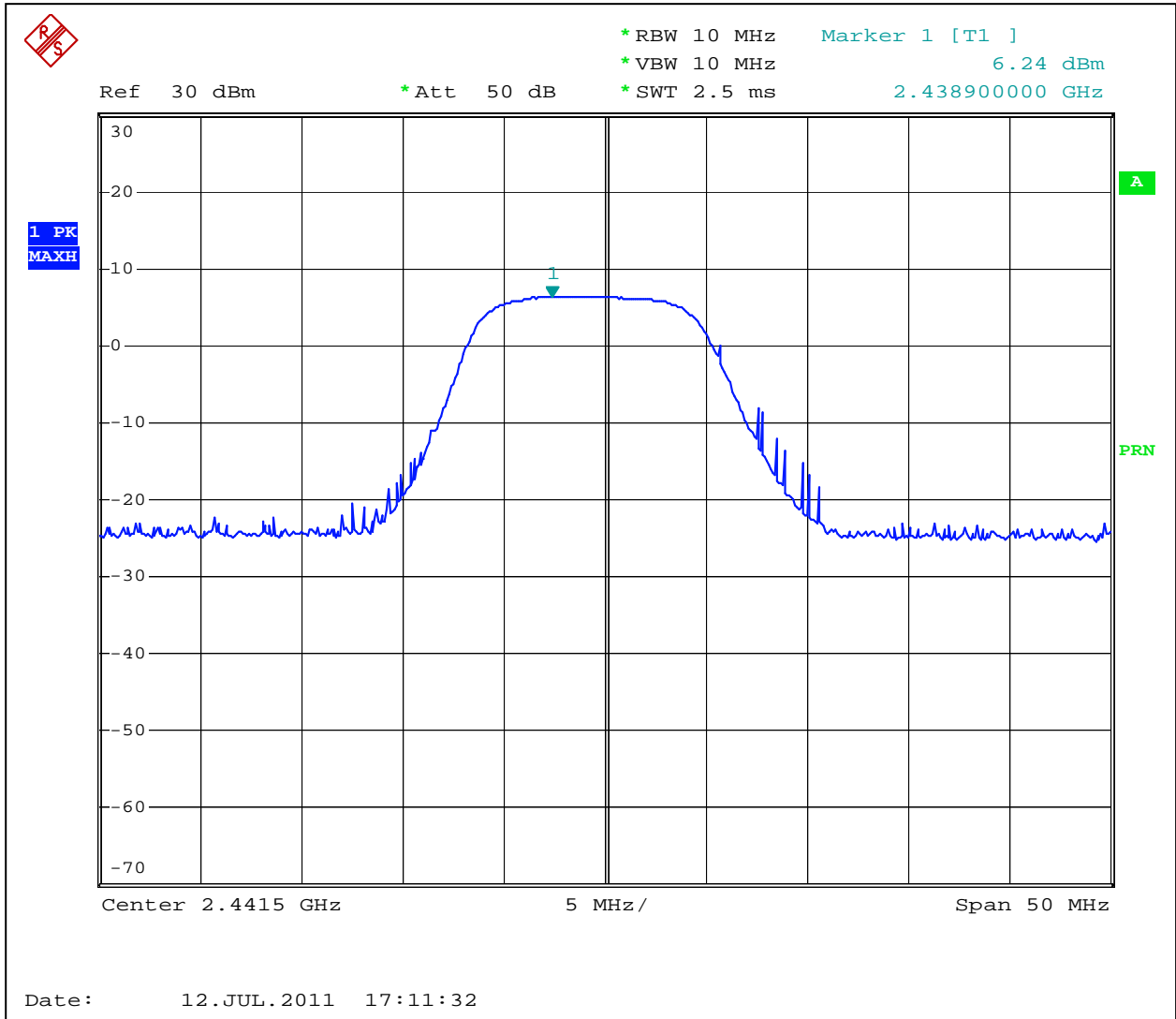
Max. Margin: 22.64dB below the limits

Power Output:	Conducted					
Frequency Range:	<input type="checkbox"/> 902-928MHz		<input checked="" type="checkbox"/> 2400-2483.5MHz		<input type="checkbox"/> 5725-5850MHz	
Low Frequency MHz	Measured power dBm	Attenuation dB	Power at Antenna dBm	Limit dBm	Limit Reduction dB	Margin dB
	6.36	1.0	7.36	30	0	-22.64
Middle Frequency MHz						
	6.24	1.0	7.24	30	0	-22.76
Upper Frequency MHz						
	5.57	1.0	6.57	30	0	-23.43
RBW:	<input type="checkbox"/> 1MHz <input type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 10MHz					
VBW:	<input type="checkbox"/> 1MHz <input type="checkbox"/> 3MHz <input checked="" type="checkbox"/> 10MHz					
Antenna Gain:	<input checked="" type="checkbox"/> < 6dBi <input type="checkbox"/> >6dBi and = <input type="text"/> dBi, Output power reduction = <input type="text"/> dB					

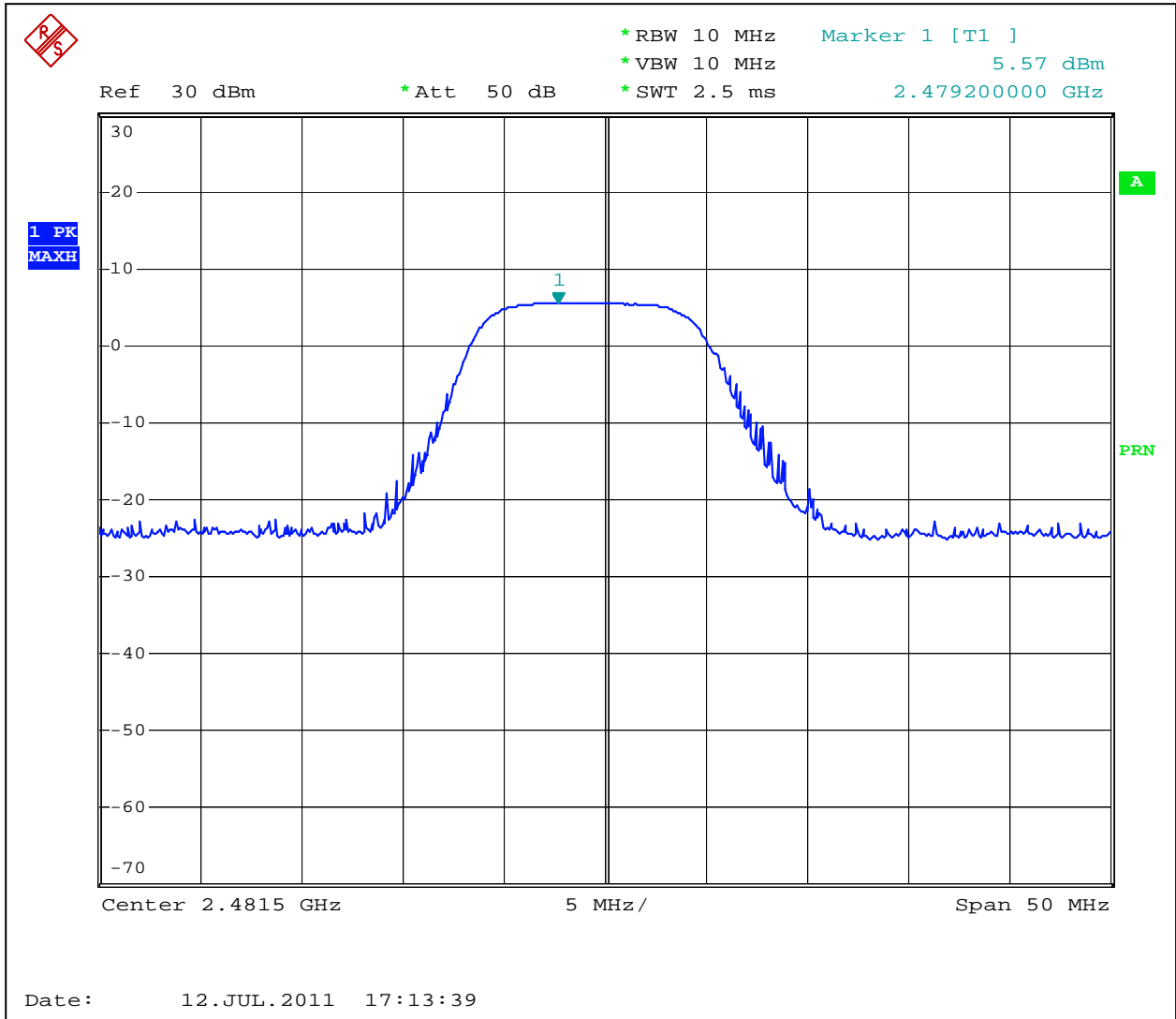
Notes: None



Graph 3.1.1



Graph 3.1.2



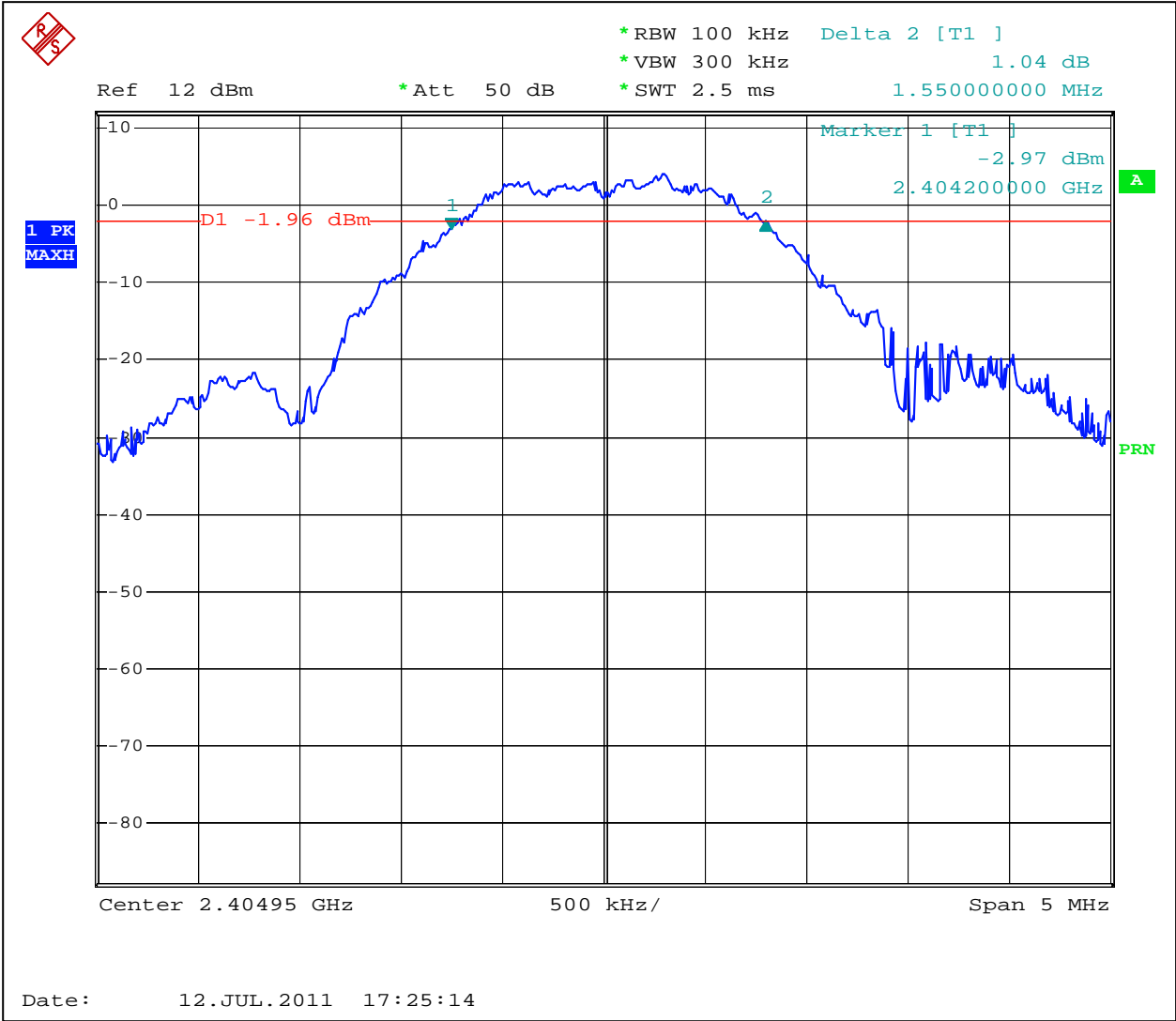
Graph 3.1.3



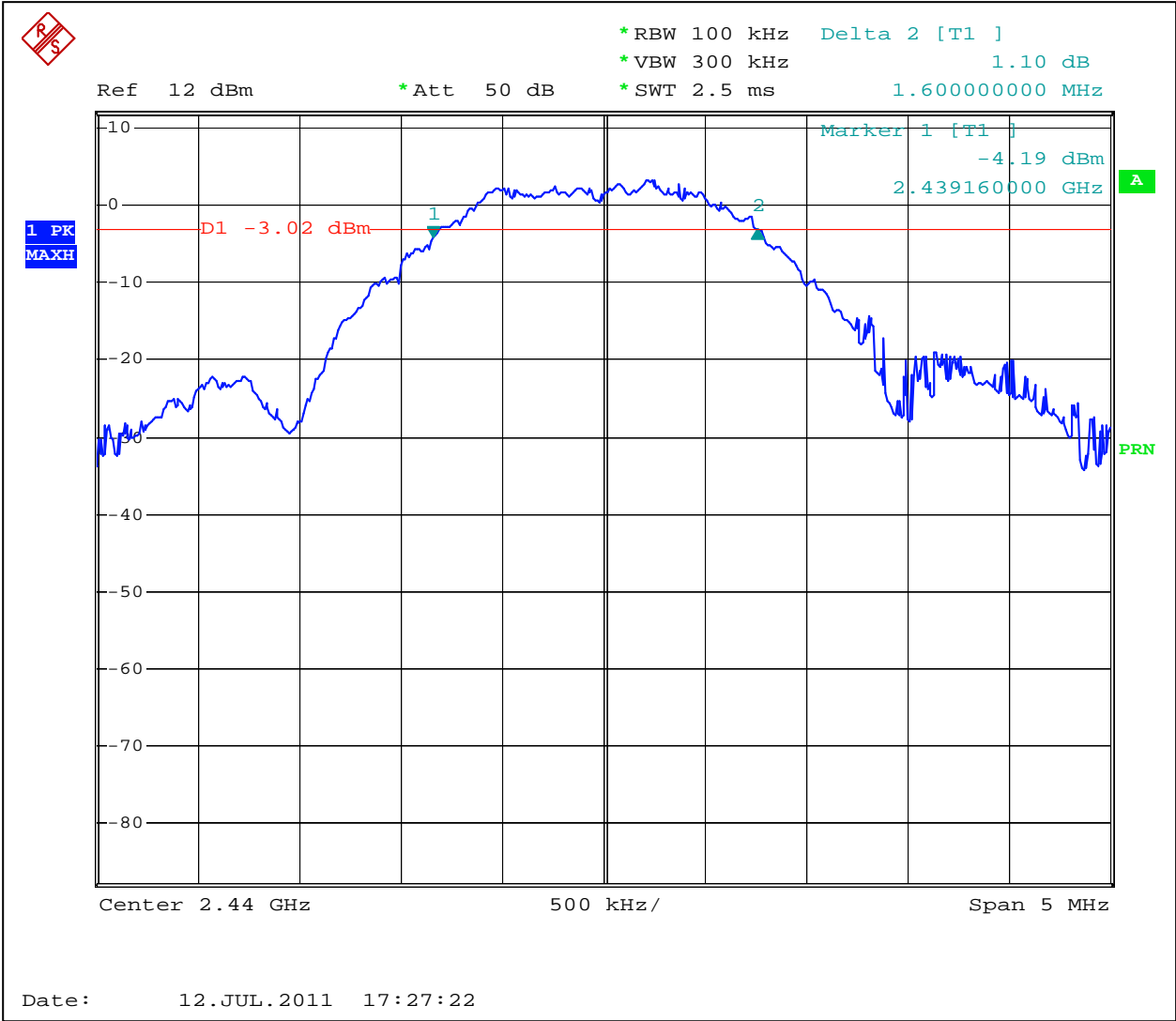
3.2 6dB bandwidth of the digital modulation

Low Frequency Channel kHz	Middle Frequency Channel kHz	Upper Frequency Channel kHz	Minimum Bandwidth kHz	Result
1550	1600	1550	500	Pass
RBW:	<input checked="" type="checkbox"/> 100kHz <input type="checkbox"/> other [redacted] kHz			
VBW:	<input type="checkbox"/> 100kHz <input checked="" type="checkbox"/> 300kHz <input type="checkbox"/> other [redacted] kHz			

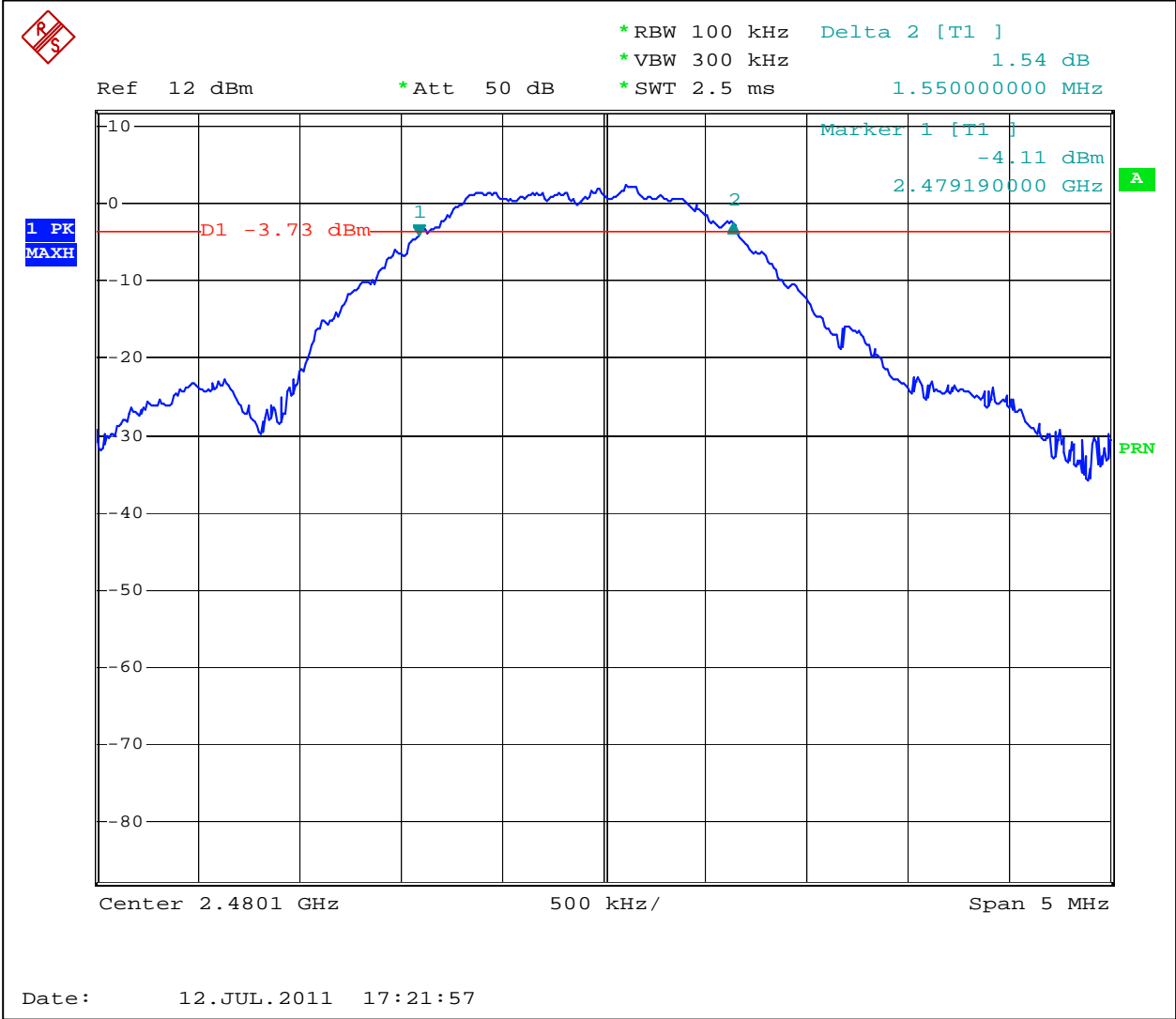
Notes:



Graph 3.2.1



Graph 3.2.2



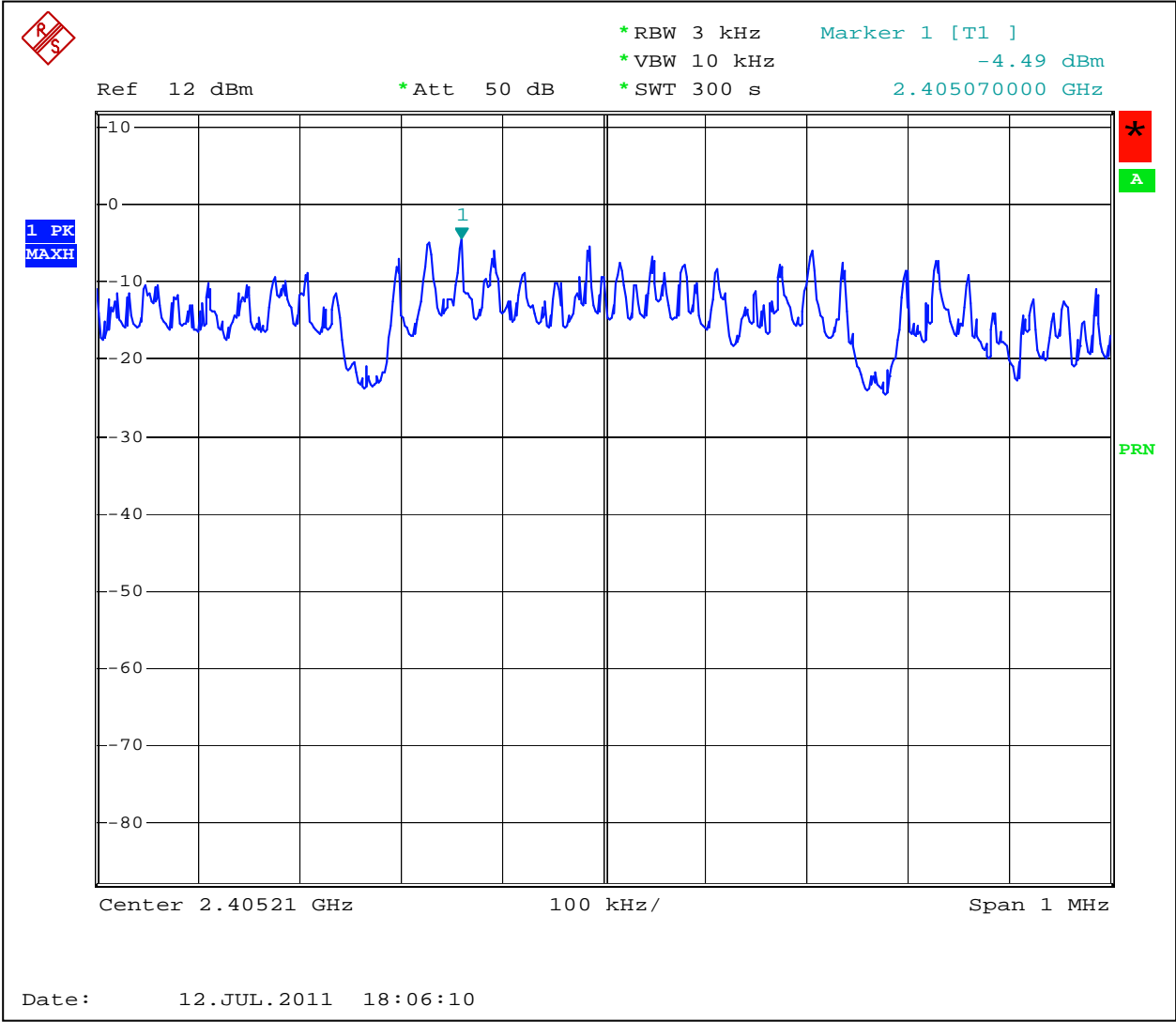
Graph 3.2.3



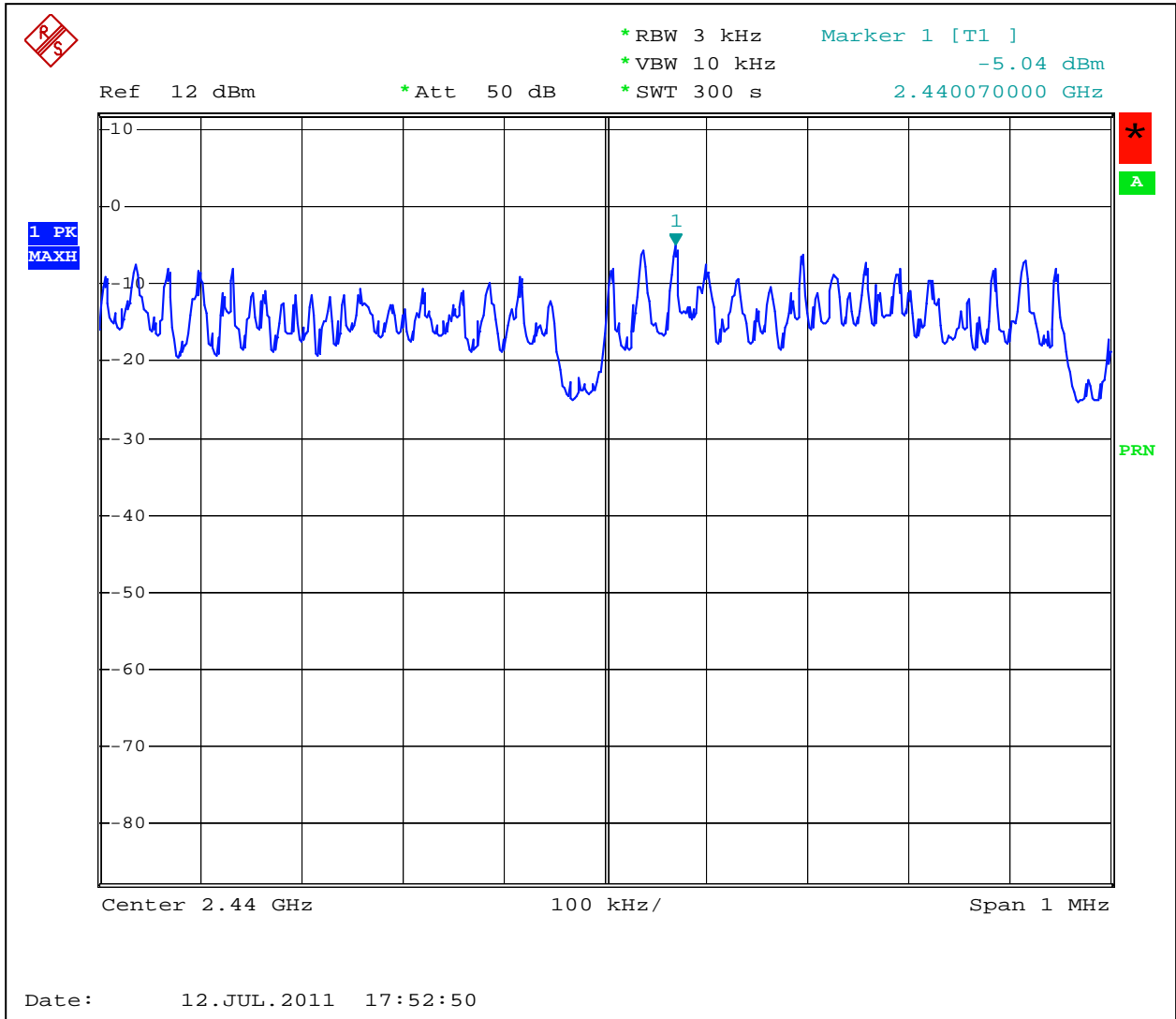
3.3 Power spectral density

Power Output:	<input checked="" type="checkbox"/> Conducted <input type="checkbox"/> Radiated			
	Measured Density dBm	Power Spectral Density dBm	Limit dBm	Margin dB
Low Frequency Channel	-4.49	-3.49	8	-11.49
Middle Frequency Channel	-5.04	-4.04	8	-12.04
Upper Frequency Channel	-6.03	-5.03	8	-13.03
Analyzer Settings:	<input checked="" type="checkbox"/> RBW=3KHz <input checked="" type="checkbox"/> VBW=10KHz <input checked="" type="checkbox"/> Span=1MHz <input checked="" type="checkbox"/> Sweep=300sec			
Antenna Gain:	<input checked="" type="checkbox"/> < 6dBi and = <input type="text"/> dBi <input type="checkbox"/> >6dBi and = <input type="text"/> dBi, limit reduction = <input type="text"/> dB			

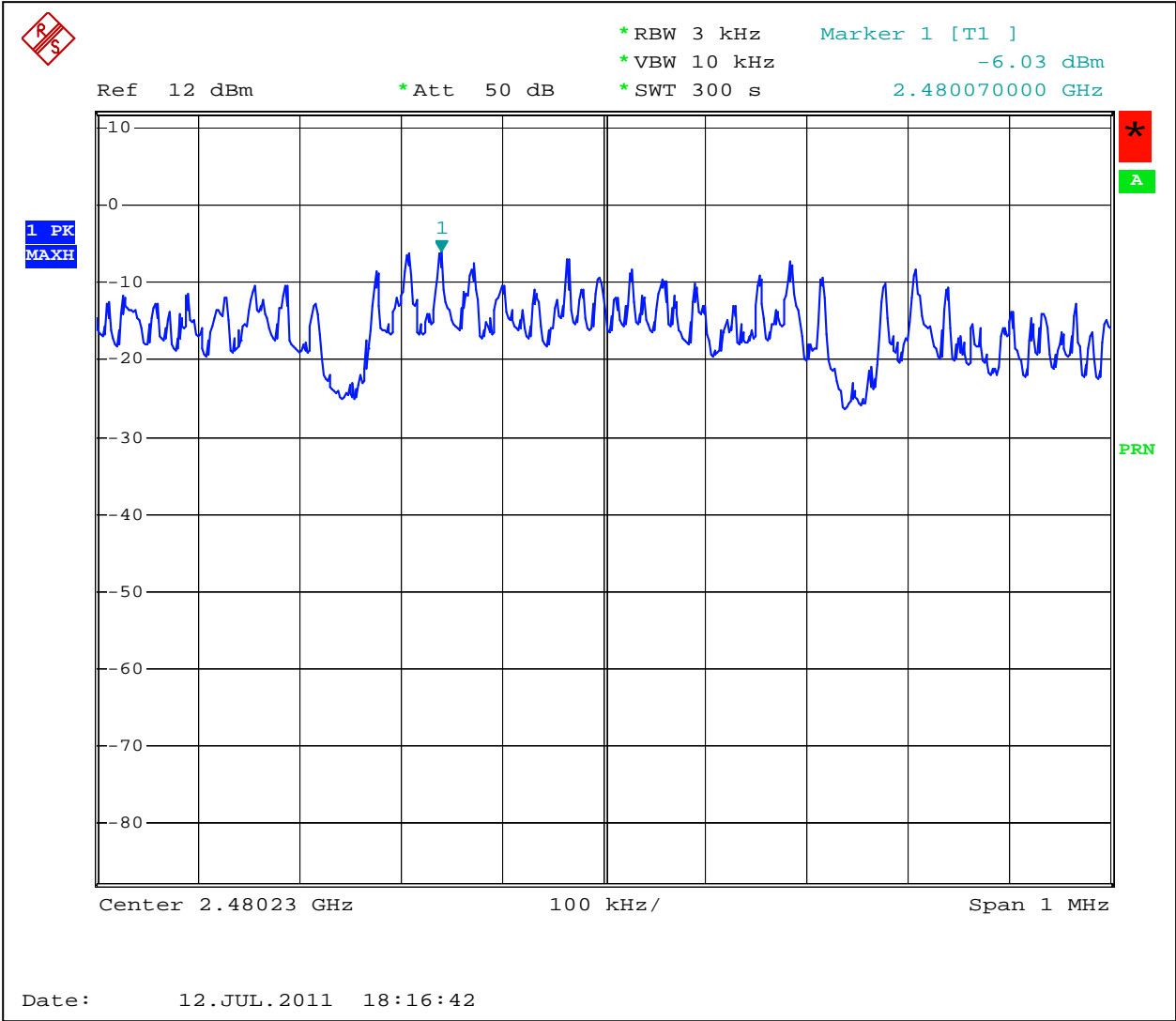
Notes: The Power Spectral Density was calculated adding the cable/attenuator loss of 1.0dB from the measured density value.



Graph 3.3.1



Graph 3.3.2



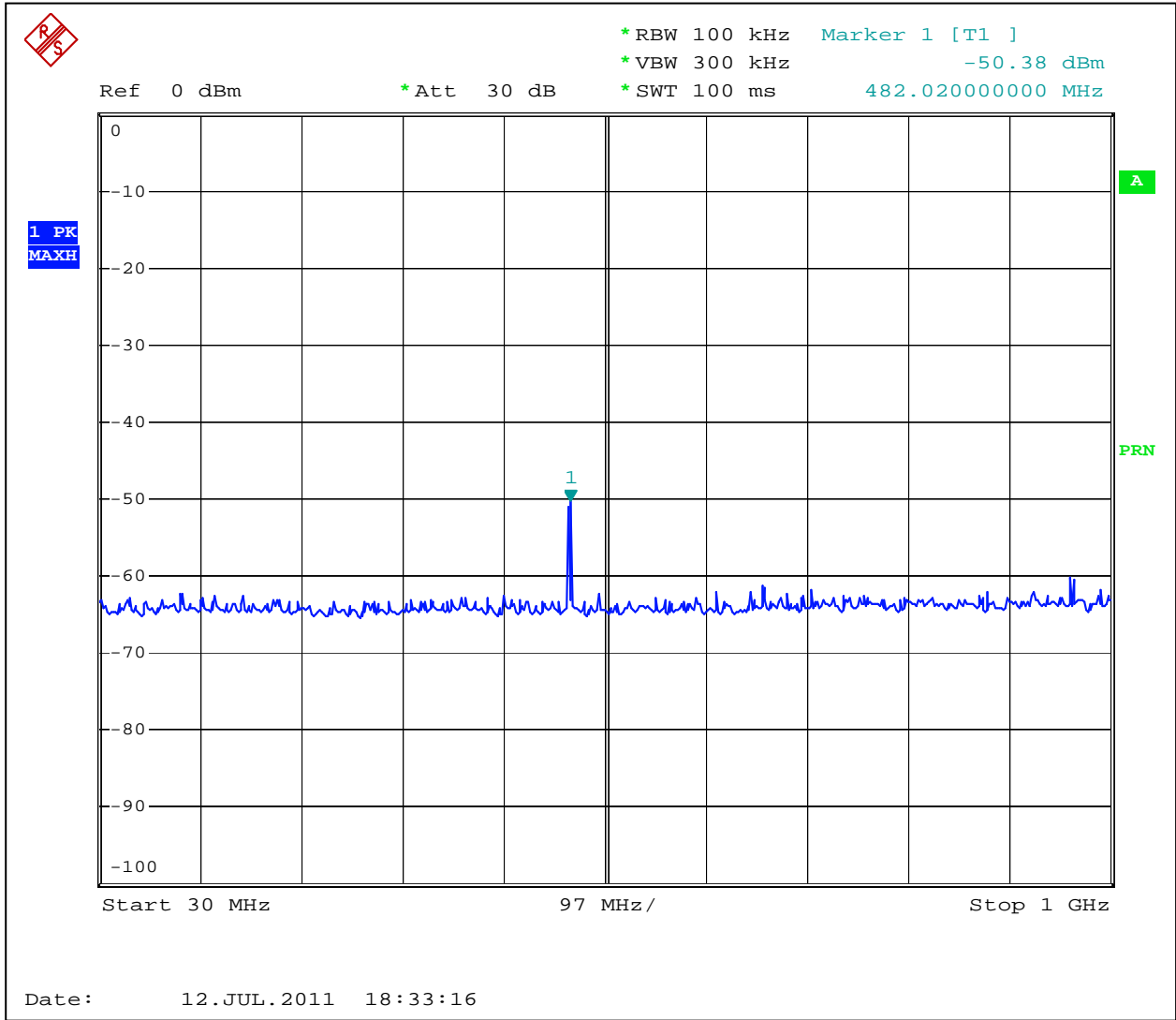
Graph 3.3.3



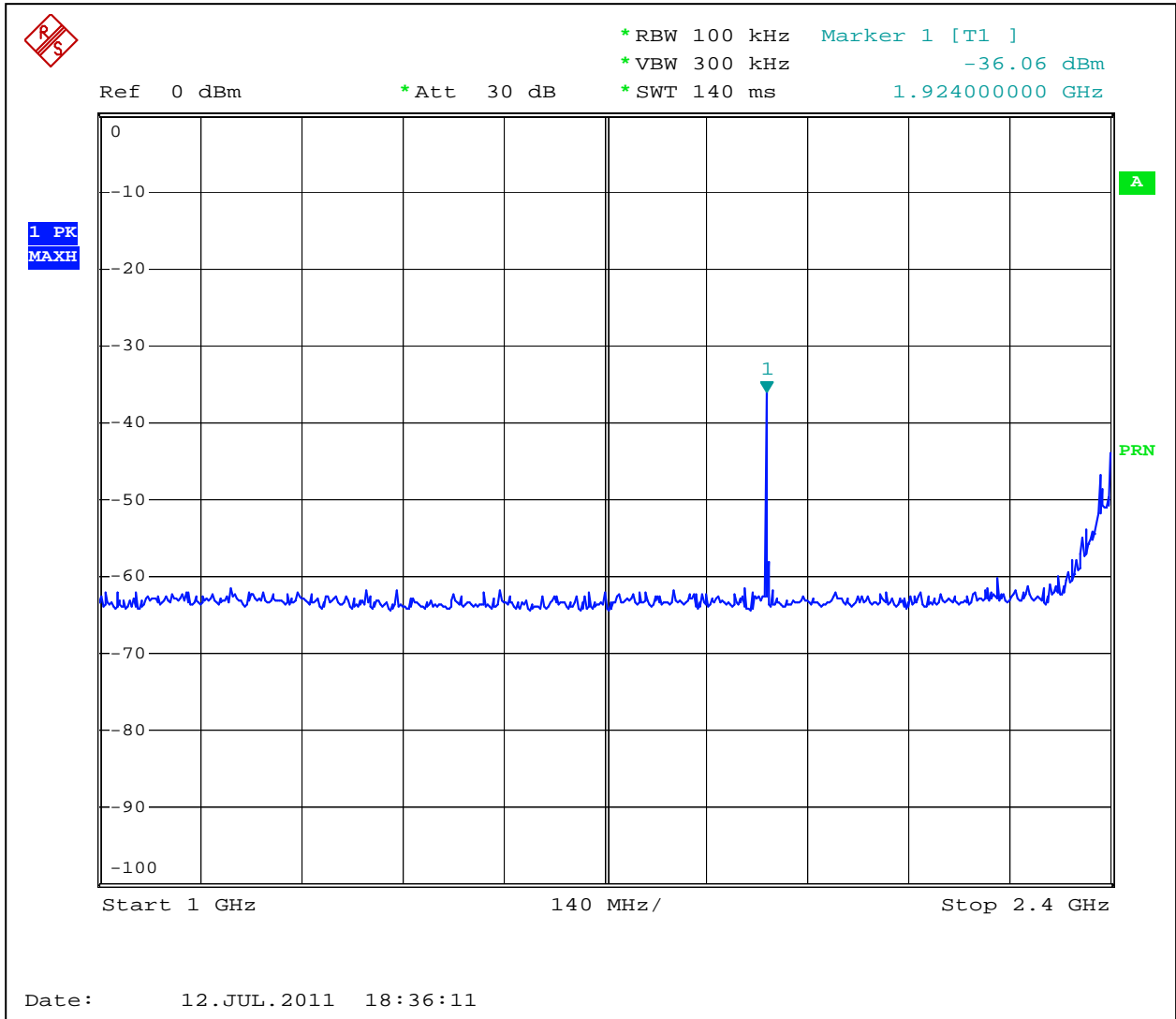
3.4 Antenna conducted spurious emissions

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel	42.42	20	-22.42
Middle Frequency Channel	42.17	20	-22.17
Upper Frequency Channel	36.01	20	-16.01
Analyzer Settings:	<input checked="" type="checkbox"/> RBW=100KHz		
Minimum Allowed Attenuation:	<input checked="" type="checkbox"/> 20dB <input type="checkbox"/> 30dB (for digital systems with conducted power measured using RMS averaging over a time interval)		

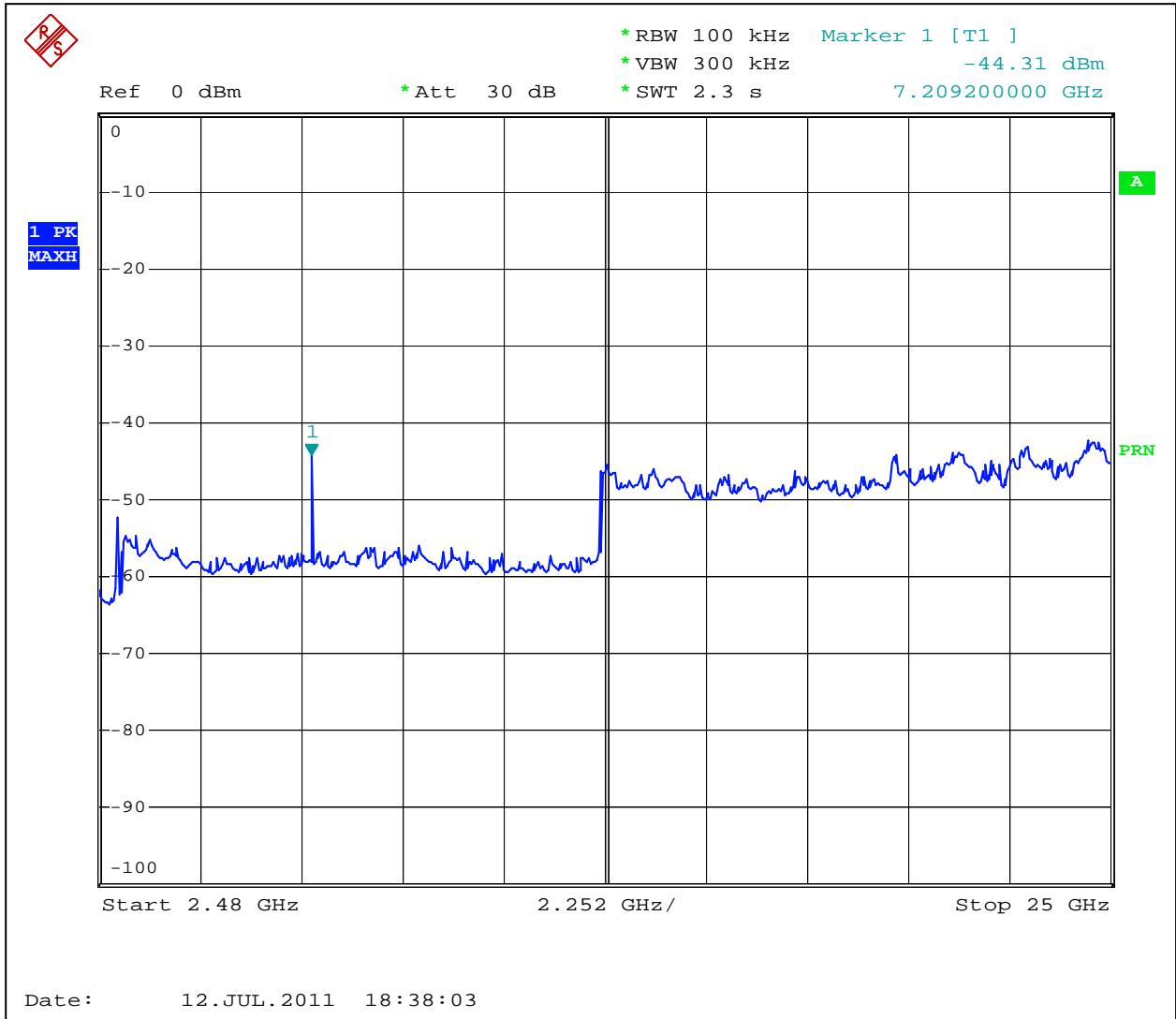
Notes: Test was performed in frequency range from 30MHz to 25GHz
Graphs 3.4.1 to 3.4.3 show the Antenna Conducted Spurious Emissions for channel 0
Graphs 3.4.4 to 3.4.6 show the Antenna Conducted Spurious Emissions for channel 7
Graphs 3.4.7 to 3.4.9 show the Antenna Conducted Spurious Emissions for channel 15
Graph 3.4.10 shows band edge compliance at 2400MHz
Graph 3.4.11 shows band edge compliance at 2483.5MHz



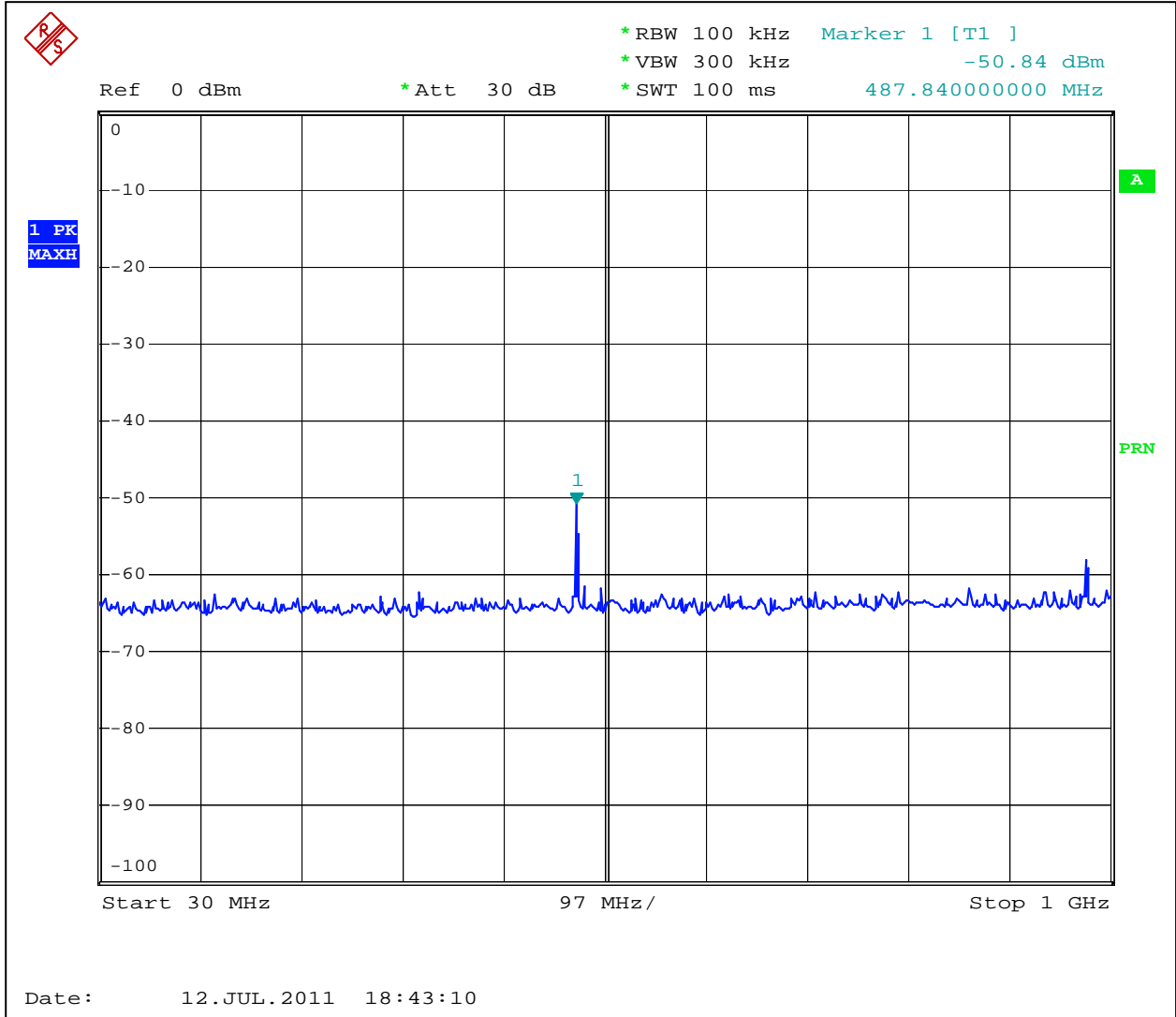
Graph 3.4.1



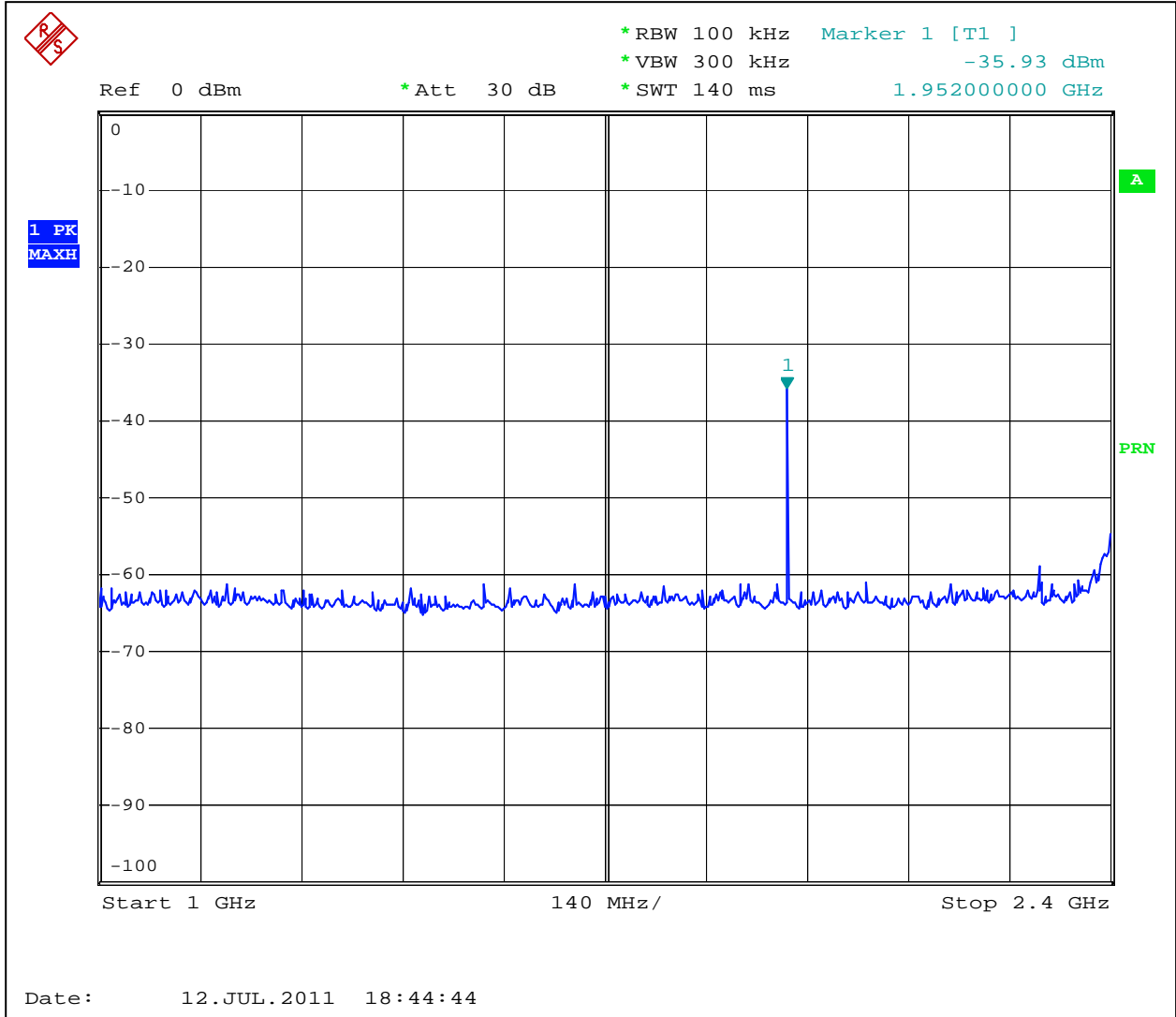
Graph 3.4.2



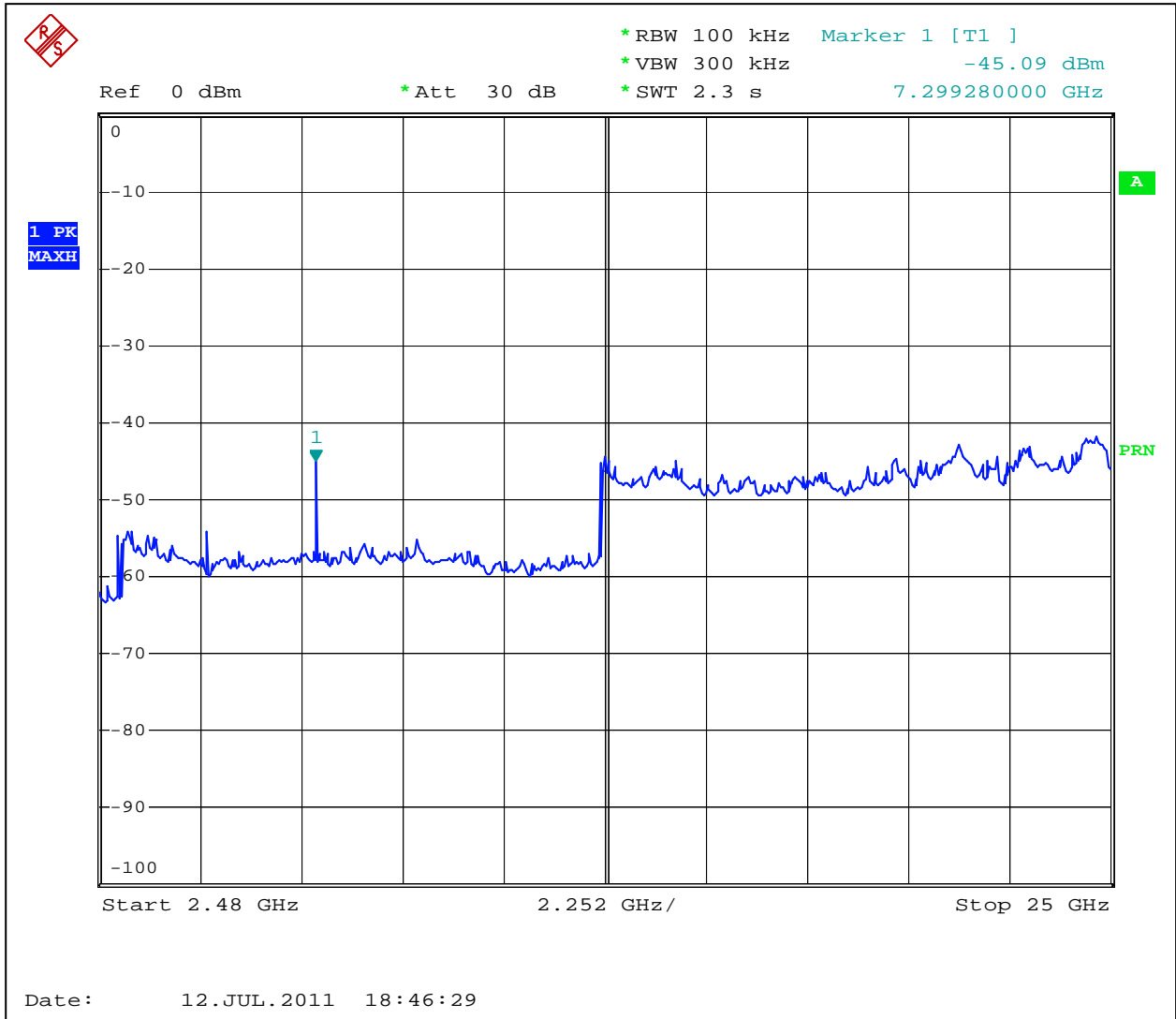
Graph 3.4.3



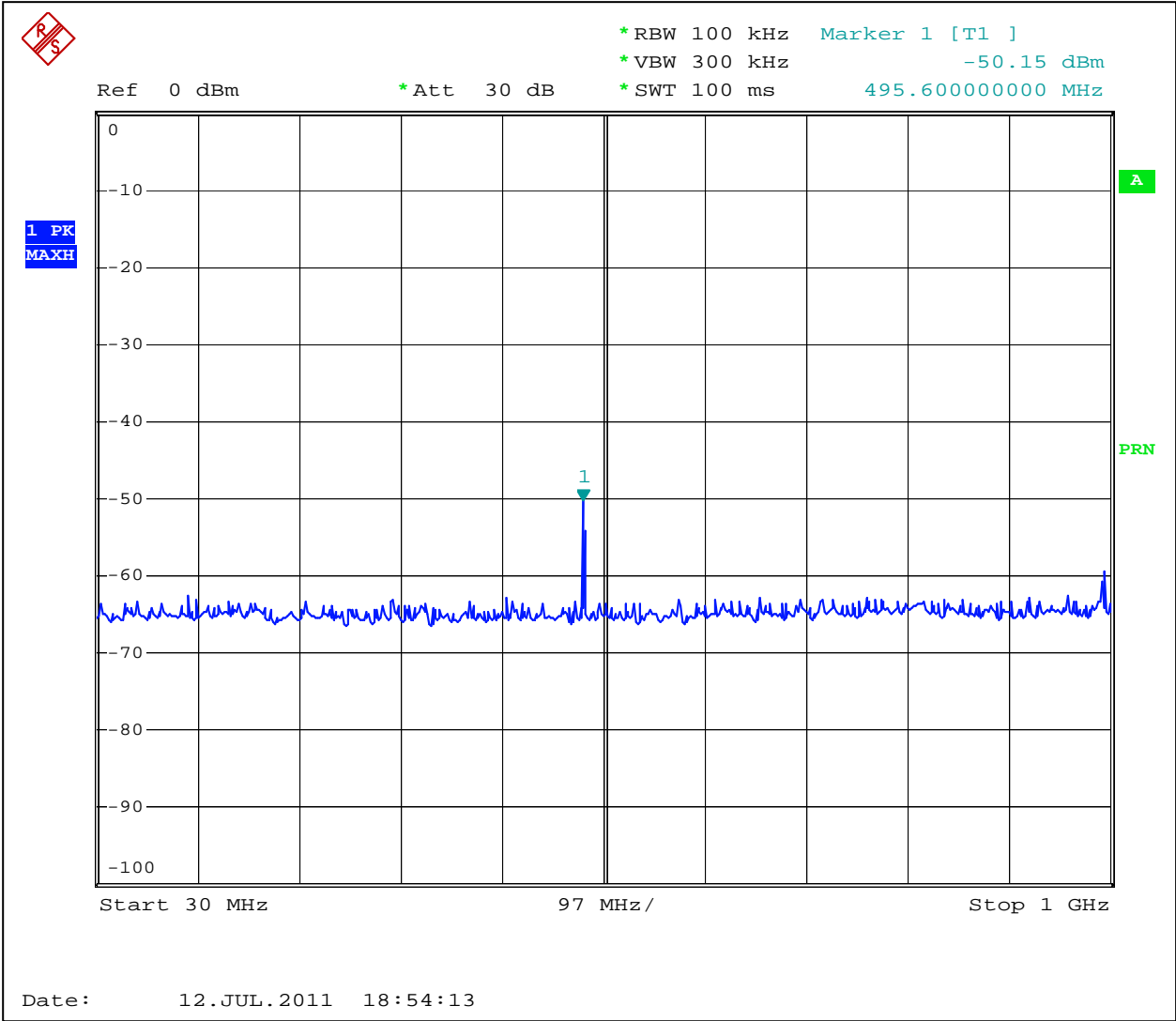
Graph 3.4.4



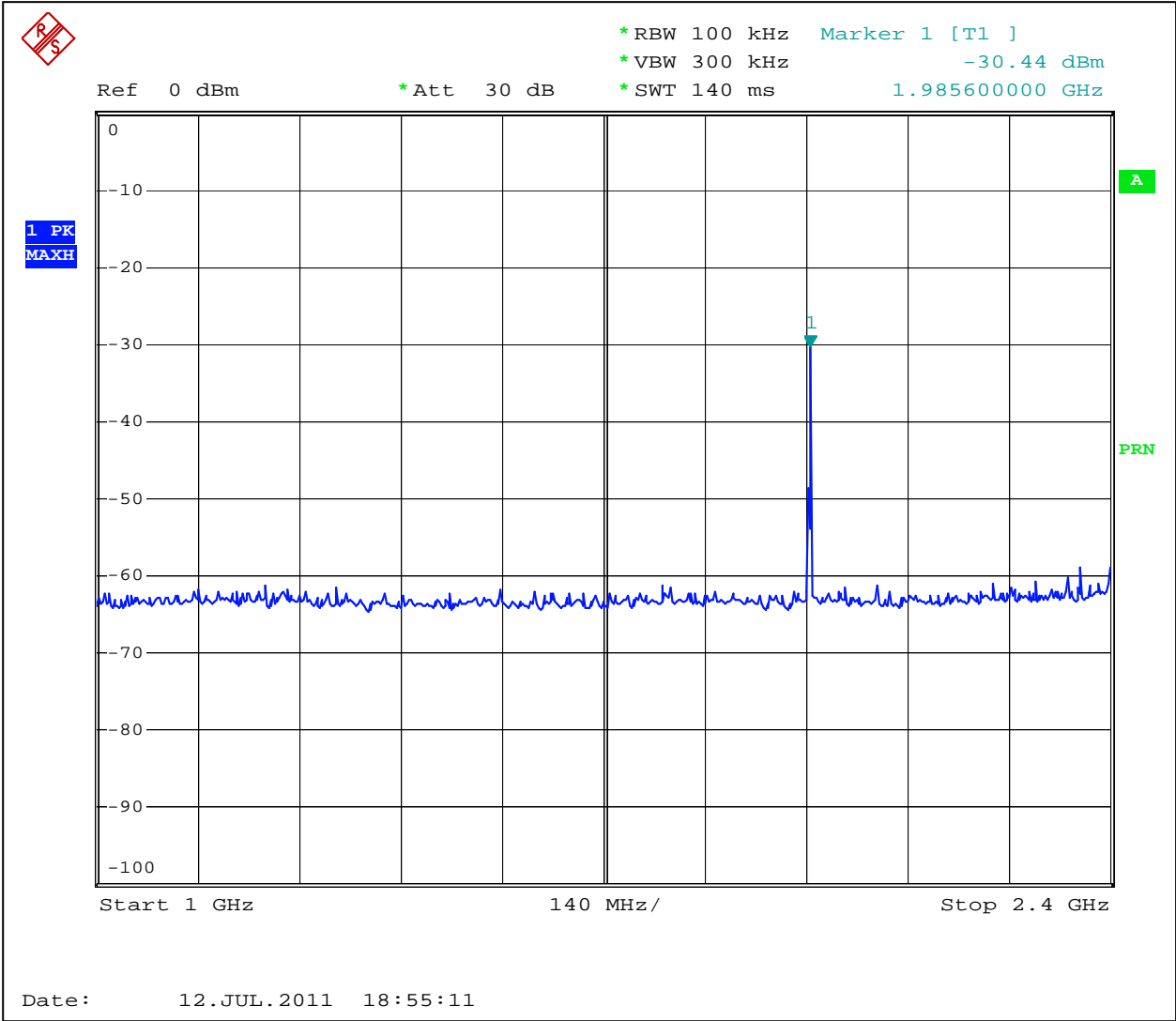
Graph 3.4.5



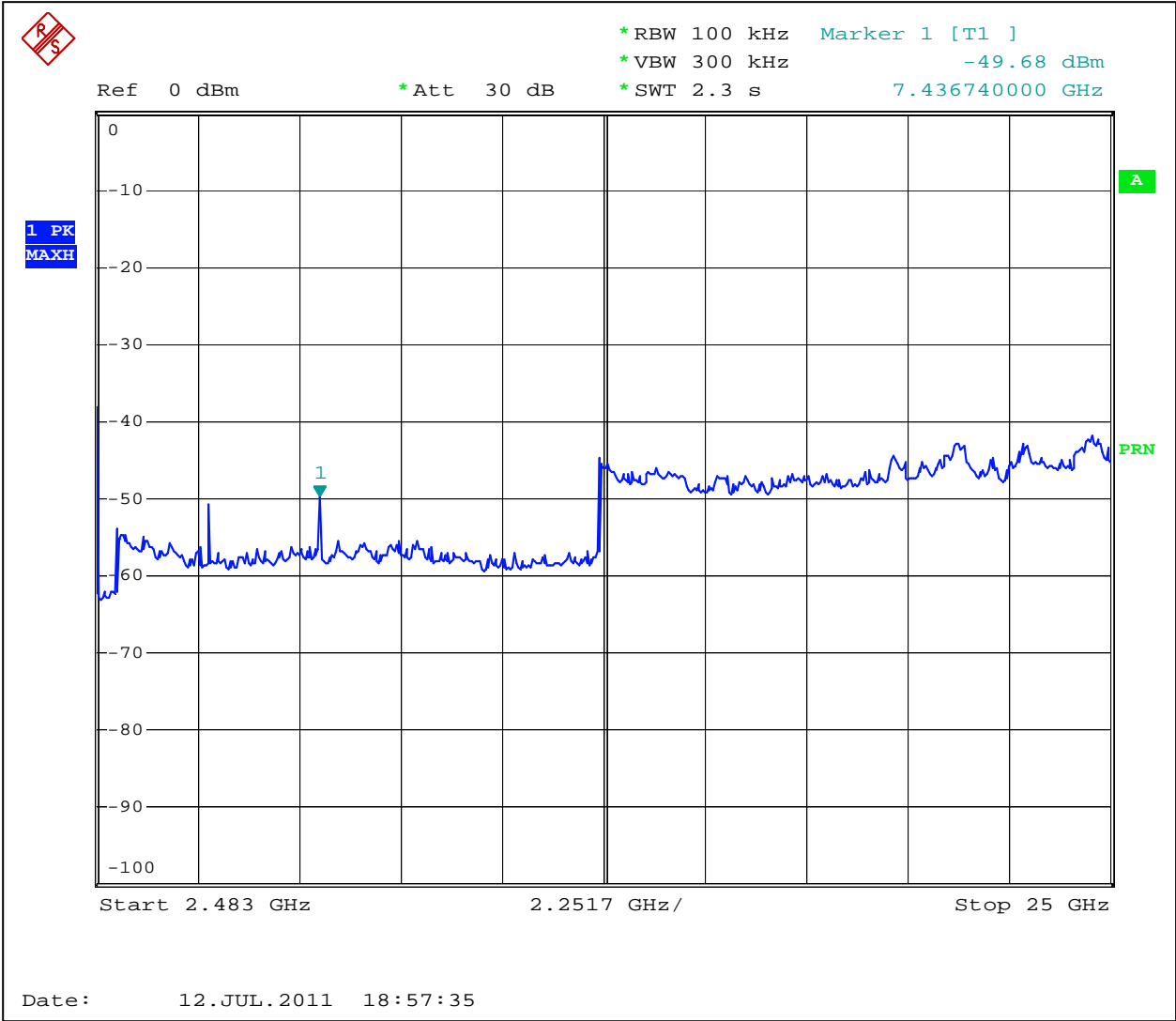
Graph 3.4.6



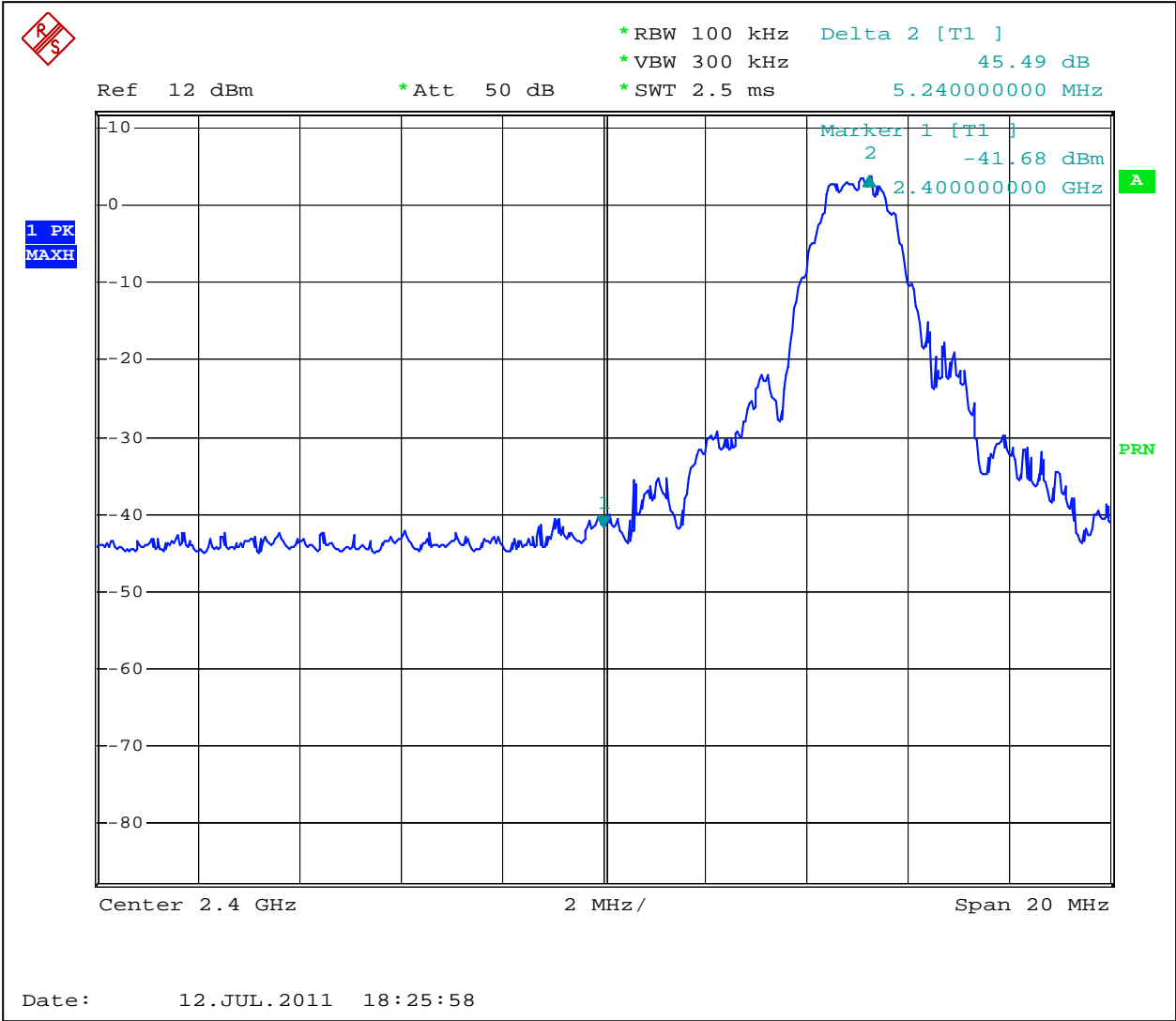
Graph 3.4.7



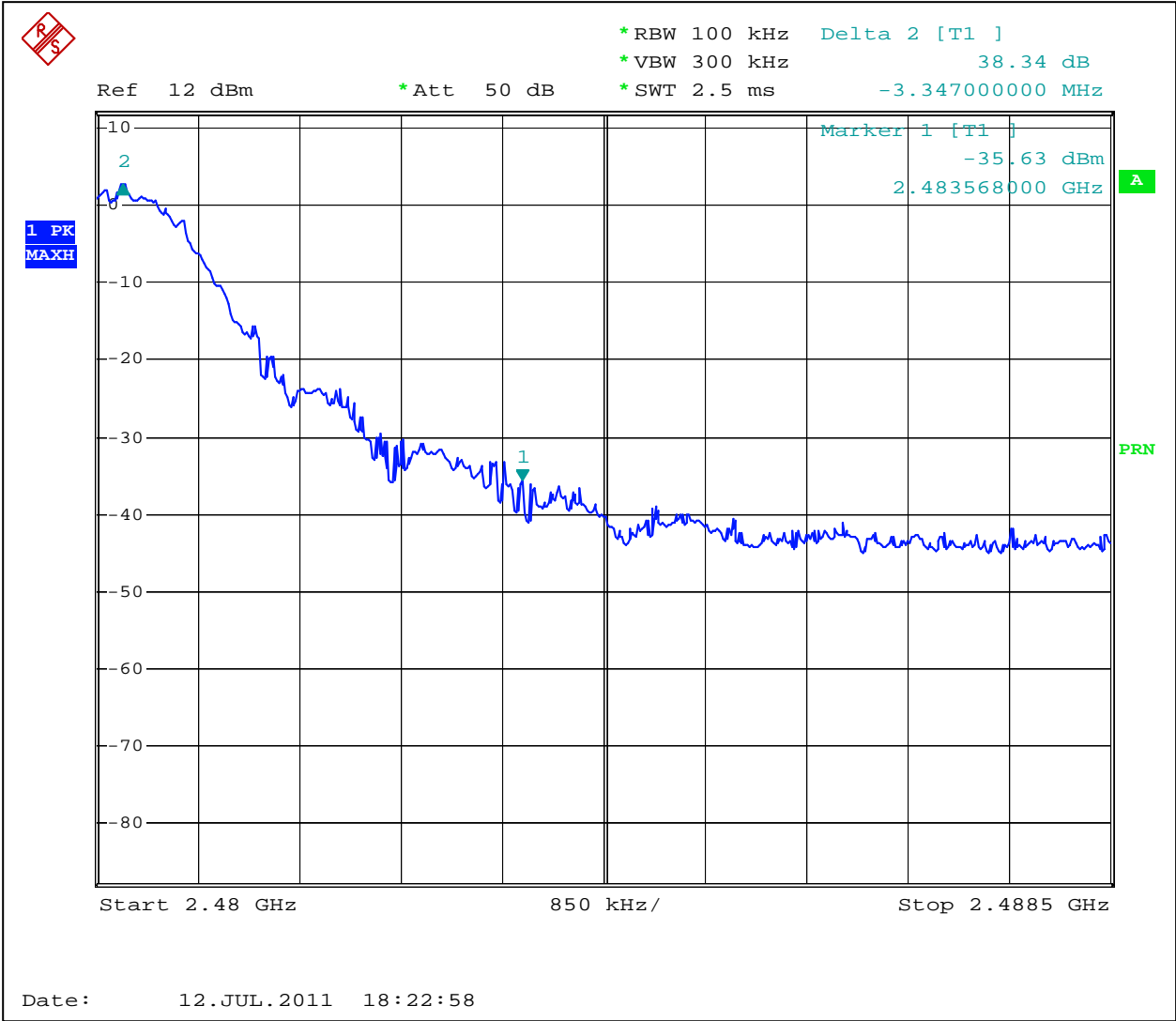
Graph 3.4.8



Graph 3.4.9



Graph 3.4.10



Graph 3.4.11



3.5 Radiated spurious emissions

Test location: OATS Anechoic Chamber Other

Frequency Range: 30MHz to 25GHz (10th Harmonic)

Test result: **Pass**

Max. Margin: 7.6dB below the limits

Notes: Tables 3.5.1, 3.5.2, 3.5.3 and Graphs 3.5.1-3.5.24 show radiated spurious and the 2nd and 3rd harmonic in restricted band of operation per FCC 15.205. Fundamental frequencies were excluded.
No emissions were detected above ambient at 5th and above harmonics.



Date:	July 18, 2011	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	See Page 5	
Note:	None	

Table 3.5.1

Frequency	Ant. Polarity	Peak Reading dB μ V	Ant.Factor dB1/m	Total at 3m dB μ V/m	QP Limit dB μ V/m	Margin dB
Channel 0						
75.378 MHz	V	17.7	8.2	25.9	40.0	-14.1
80.004 MHz	V	17.0	8.9	25.9	40.0	-14.1
138.5 MHz	V	13.6	13.4	27.1	43.5	-16.5
299.04 MHz	V	19.2	15.9	35.0	46.0	-11.0
311.78 MHz	V	19.3	16.3	35.6	46.0	-10.5
962.51 MHz	V	17.1	26.0	43.1	54.0	-10.9
127.16 MHz	H	12.8	14.0	26.8	43.5	-16.7
962.51 MHz	H	20.4	26.0	46.3	54.0	-7.6
Channel 7						
285.21 MHz	V	17.6	15.6	33.1	46.0	-12.9
293.25 MHz	V	19.6	15.7	35.4	46.0	-10.7
300.0 MHz	V	17.8	15.9	33.7	46.0	-12.3
976.66 MHz	V	15.3	26.2	41.5	54.0	-12.5
132.53 MHz	H	13.2	13.8	27.0	43.5	-16.5
976.66 MHz	H	16.2	26.2	42.4	54.0	-11.6
Channel 15						
69.856 MHz	V	17.6	7.3	24.9	40.0	-15.1
75.378 MHz	V	17.9	8.2	26.1	40.0	-13.9
80.004 MHz	V	17.8	8.9	26.8	40.0	-13.3
121.34 MHz	V	12.7	14.0	26.7	43.5	-16.8
294.21 MHz	V	21.2	15.7	37.0	46.0	-9.1
300.0 MHz	V	19.5	15.9	35.5	46.0	-10.6
992.22 MHz	V	14.2	26.3	40.5	54.0	-13.5
127.46 MHz	H	13.1	14.0	27.1	43.5	-16.4
992.22 MHz	H	14.9	26.3	41.1	54.0	-12.9



**Table 3.5.2
Peak Readings**

Frequency MHz	Antenna Polarity	Reading dB μ V	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dB μ V/m	Limit dB μ V/m	Margin dB
Channel 0							
4.816 GHz	V	51.0	38.2	36.7	52.5	74.0	-21.5
7.216 GHz	V	57.6	42.0	36.7	62.9	74.0	-11.1
4.816 GHz	H	52.8	38.1	36.7	54.2	74.0	-19.8
7.216 GHz	H	57.2	42.1	36.7	62.6	74.0	-11.4
Channel 7							
4.88 GHz	V	55.6	38.3	36.6	57.3	74.0	-16.7
7.32 GHz	V	58.1	42.3	36.6	63.9	74.0	-10.1
4.88 GHz	H	54.5	38.2	36.6	56.1	74.0	-17.9
7.32 GHz	H	57.7	42.4	36.6	63.5	74.0	-10.5
Channel 15							
4.96 GHz	V	59.8	38.5	36.6	61.6	74.0	-12.4
7.44 GHz	V	55.6	42.7	36.5	61.8	74.0	-12.3
4.96 GHz	H	60.9	38.4	36.6	62.7	74.0	-11.4
7.44 GHz	H	54.8	42.7	36.5	61.0	74.0	-13.0

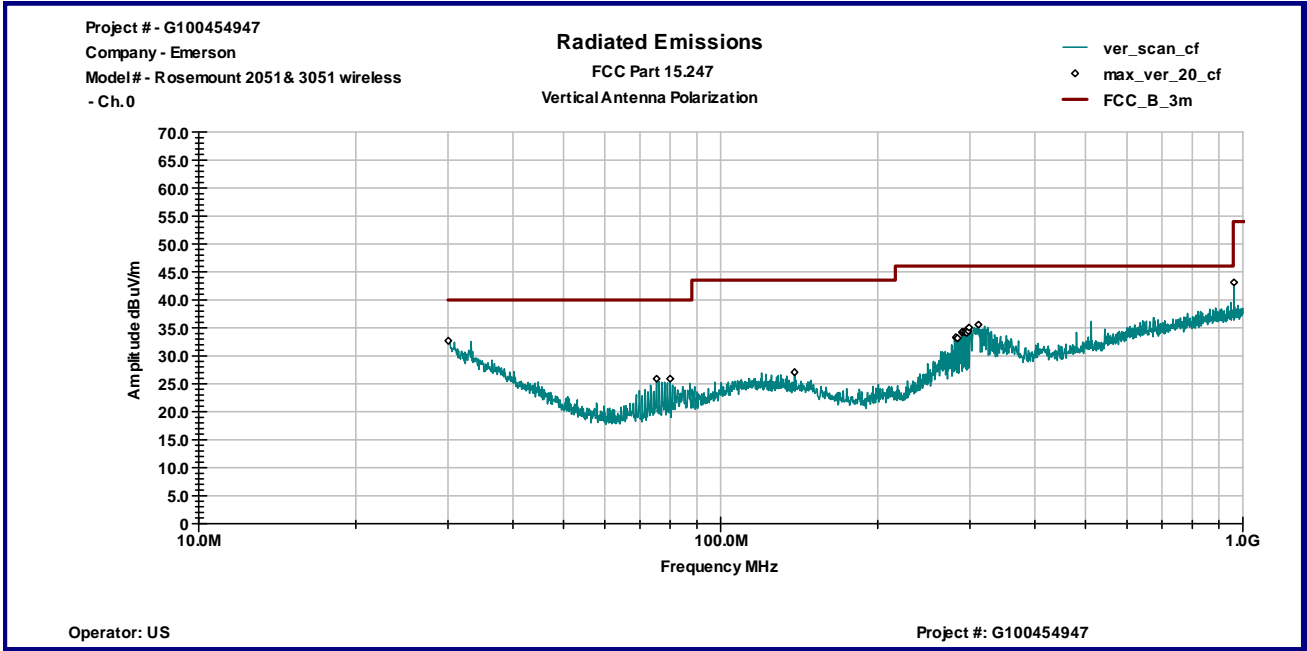


**Table 3.5.3
Average Value Readings**

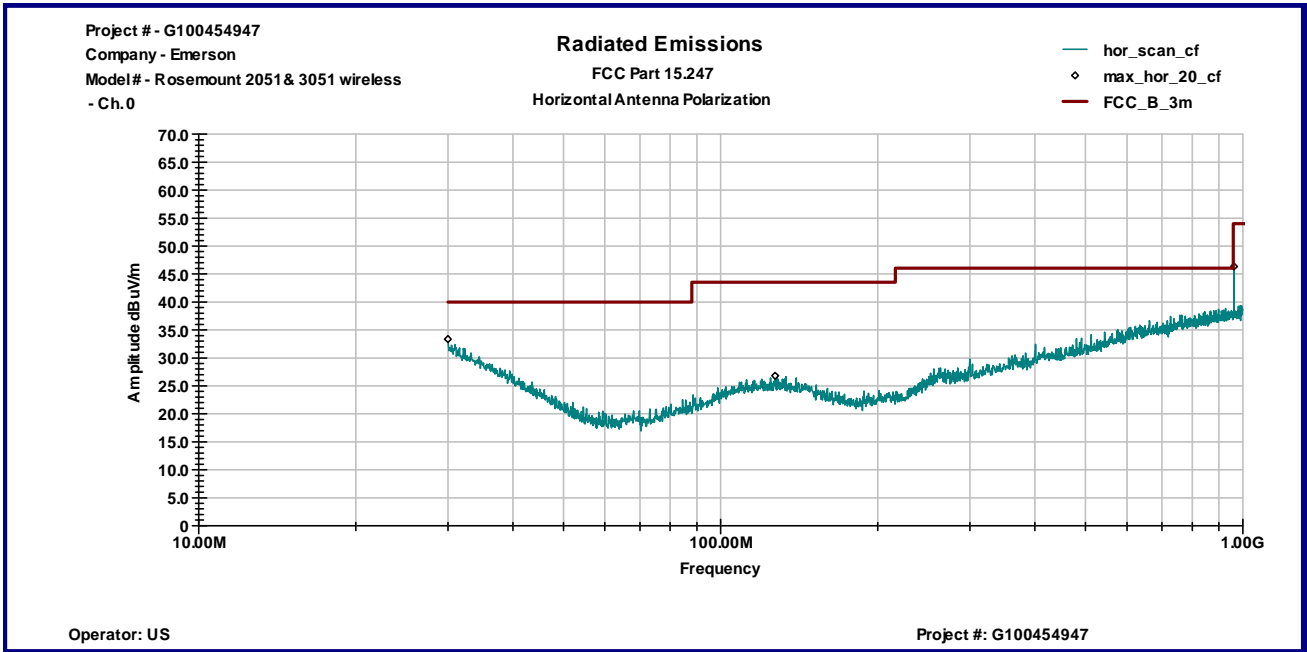
Frequency MHz	Antenna		Ant. CF dB1/m	Cable loss dB	Pre-amp Gain (dB)	Reading dB μ V	Total @ 3m dB μ V/m	Limit dB μ V/m	Margin dB	Comments
	Polarity	Hts(cm)								
Channel 0										
4810.00	V	100	33.2	4.9	36.7	31.1	32.6	54.0	-21.4	
4810.00	H	158	33.2	4.9	36.7	30.9	32.4	54.0	-21.6	
7216.44	V	100	35.9	6.2	36.7	31.3	36.7	54.0	-17.3	
7216.44	H	146	35.9	6.2	36.7	30.3	35.7	54.0	-18.3	
Channel 7										
4880.88	V	100	33.4	4.9	36.6	33.3	35.0	54.0	-19.0	
4880.88	H	116	33.4	4.9	36.6	33.1	34.8	54.0	-19.2	
7321.52	V	100	36.1	6.2	36.6	30.1	35.9	54.0	-18.1	
7321.52	H	120	36.1	6.2	36.6	29.6	35.4	54.0	-18.6	
Channel 15										
4961.04	V	100	33.5	5.0	36.6	33.3	35.2	54.0	-18.8	
4961.04	H	140	33.5	5.0	36.6	33.2	35.1	54.0	-18.9	
7441.40	V		36.4	6.3	36.5	27.7	33.9	54.0	-20.1	
7441.40	H	145	36.4	6.3	36.5	26.9	33.1	54.0	-20.9	

Comments:

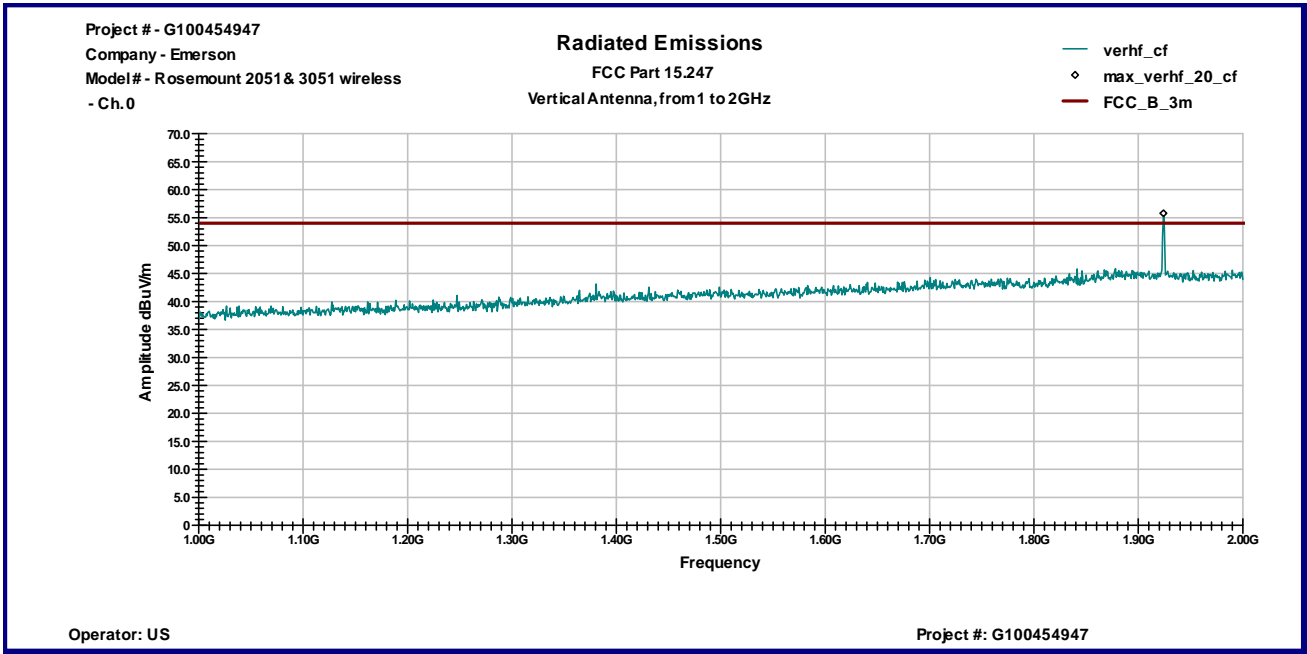
1. Measurements were taken using an Average Value (RBW 1MHz, VBW 10Hz)
2. The table shows the 2nd and 3rd harmonic in restricted band of operation per FCC 15.205
3. The Frequencies from 1.923GHz to 1.985GHz and the 4th harmonic are outside restricted band of operation per FCC 15.205.
4. No emissions were detected above ambient at 5th and above harmonics



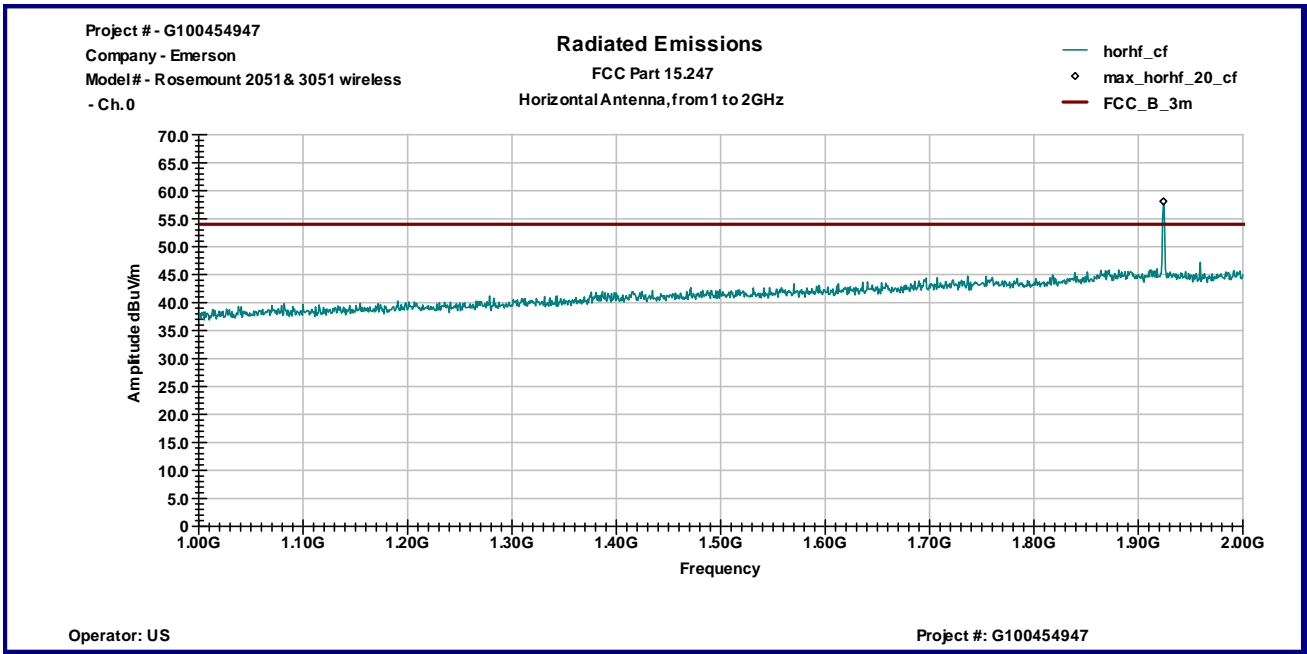
Graph 3.5.1



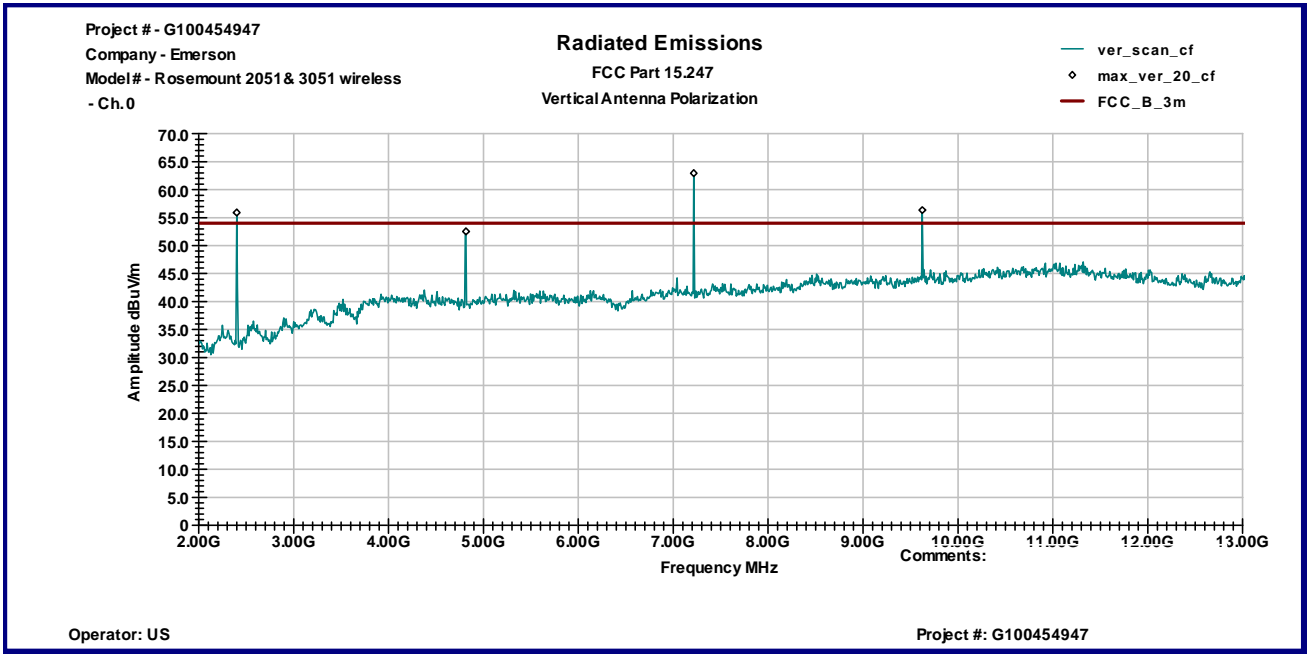
Graph 3.5.2



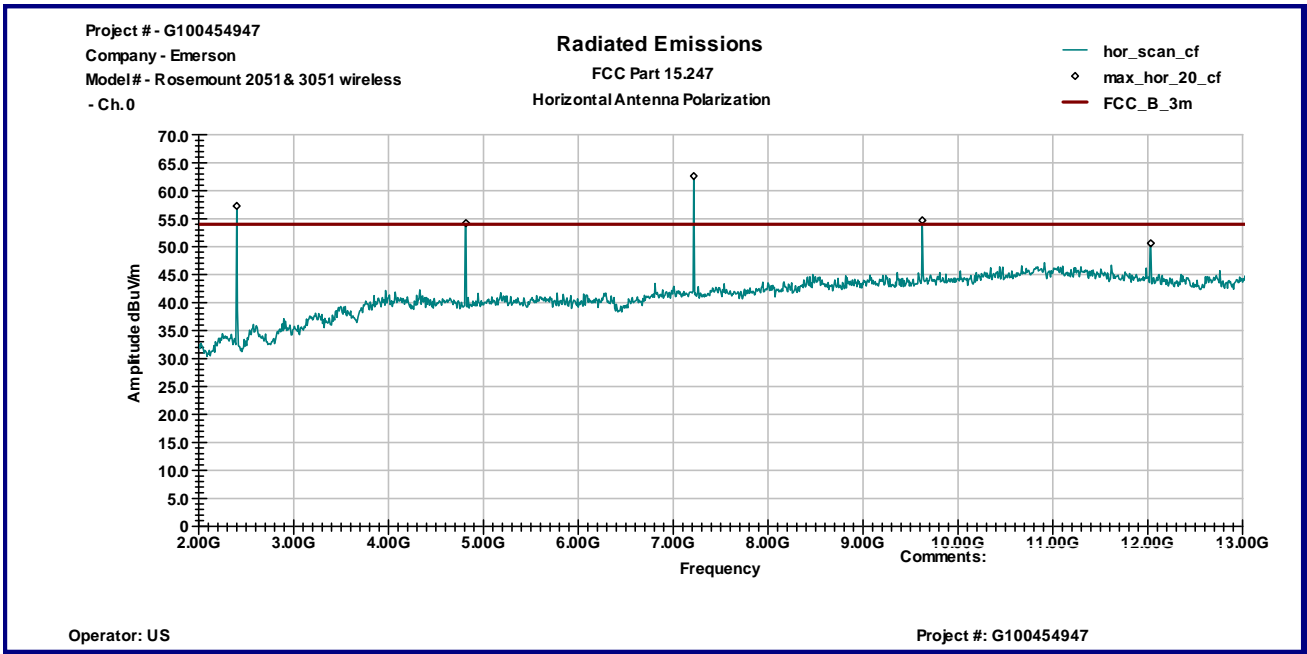
Graph 3.5.3



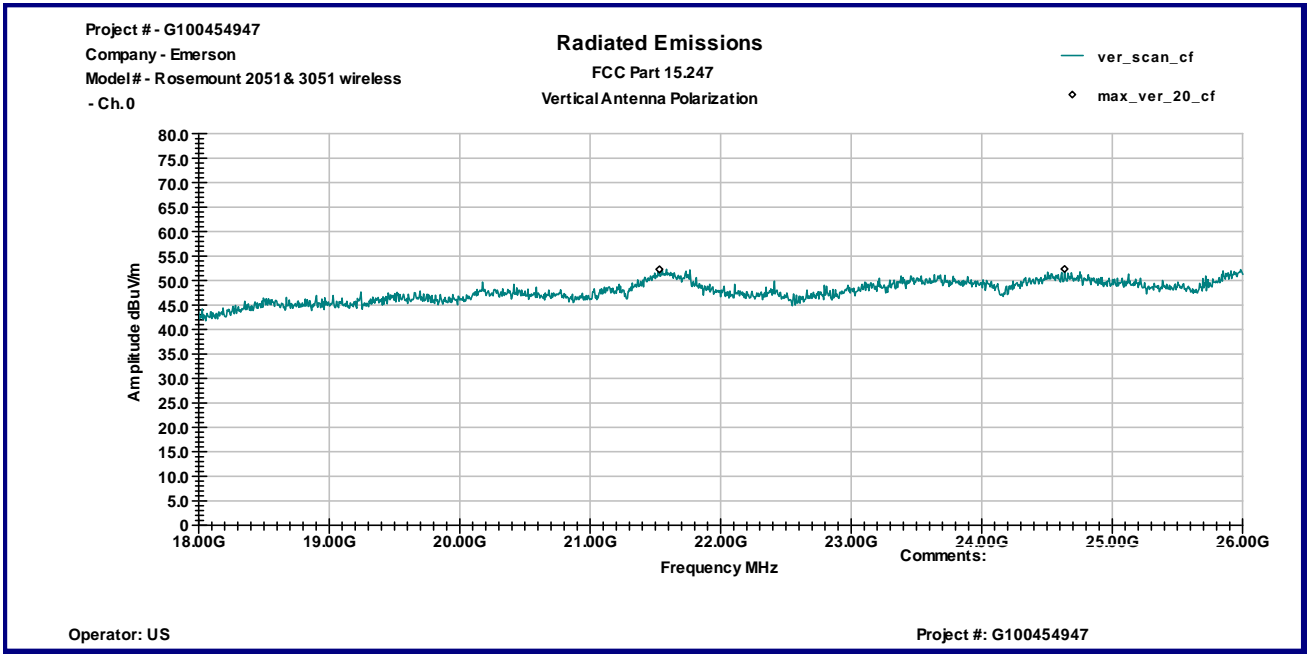
Graph 3.5.4



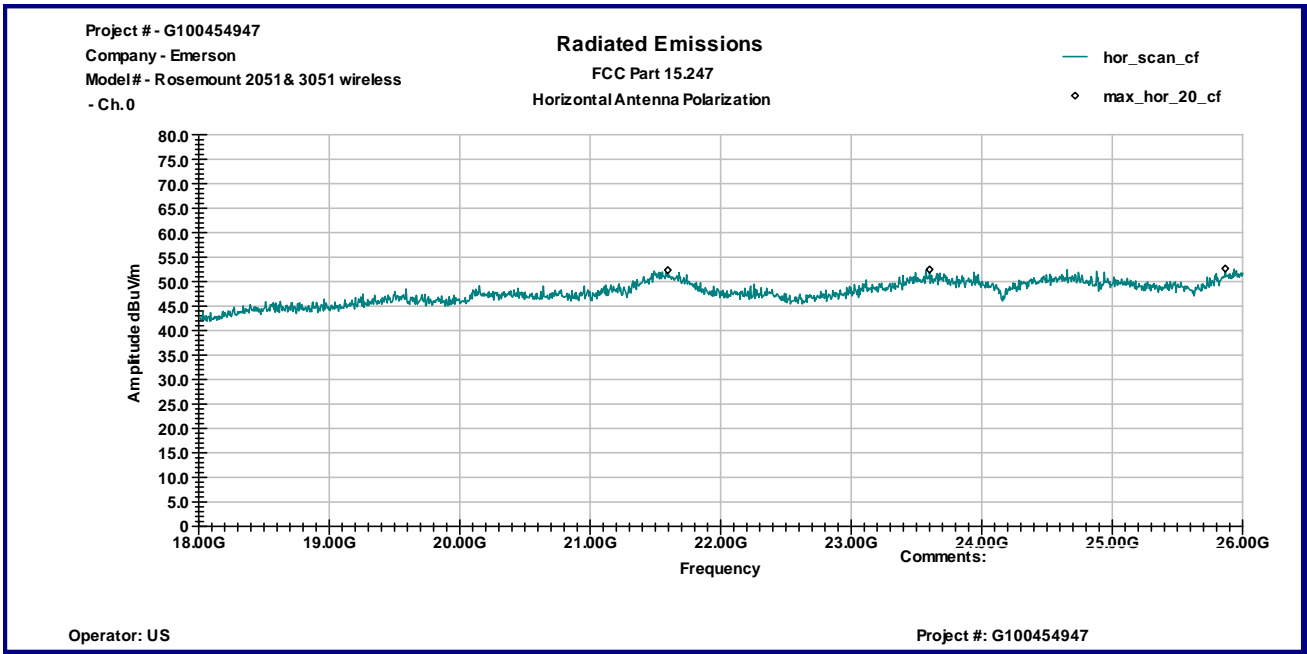
Graph 3.5.5



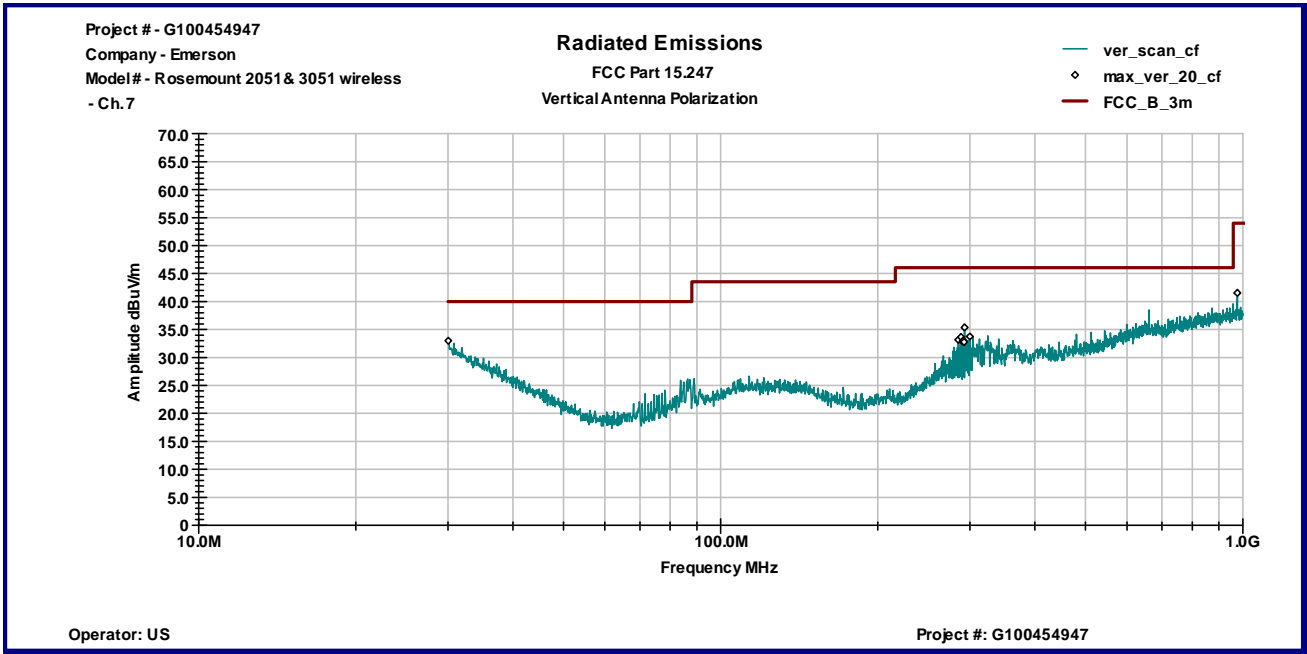
Graph 3.5.6



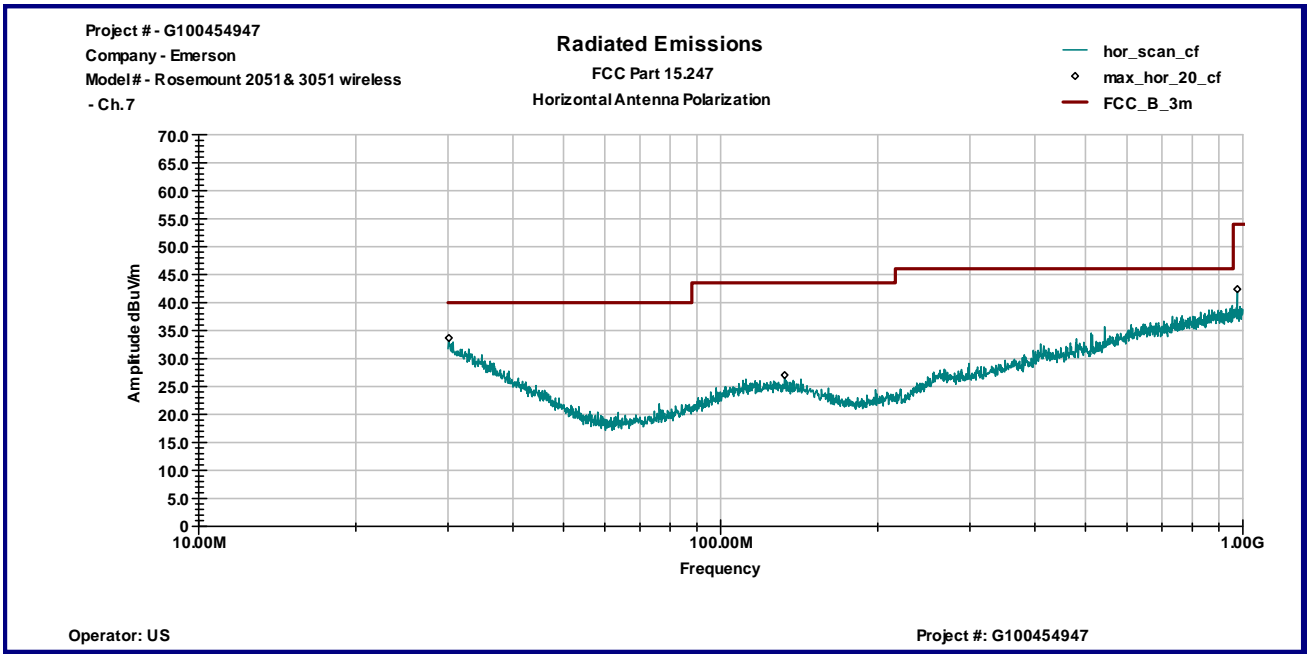
Graph 3.5.7



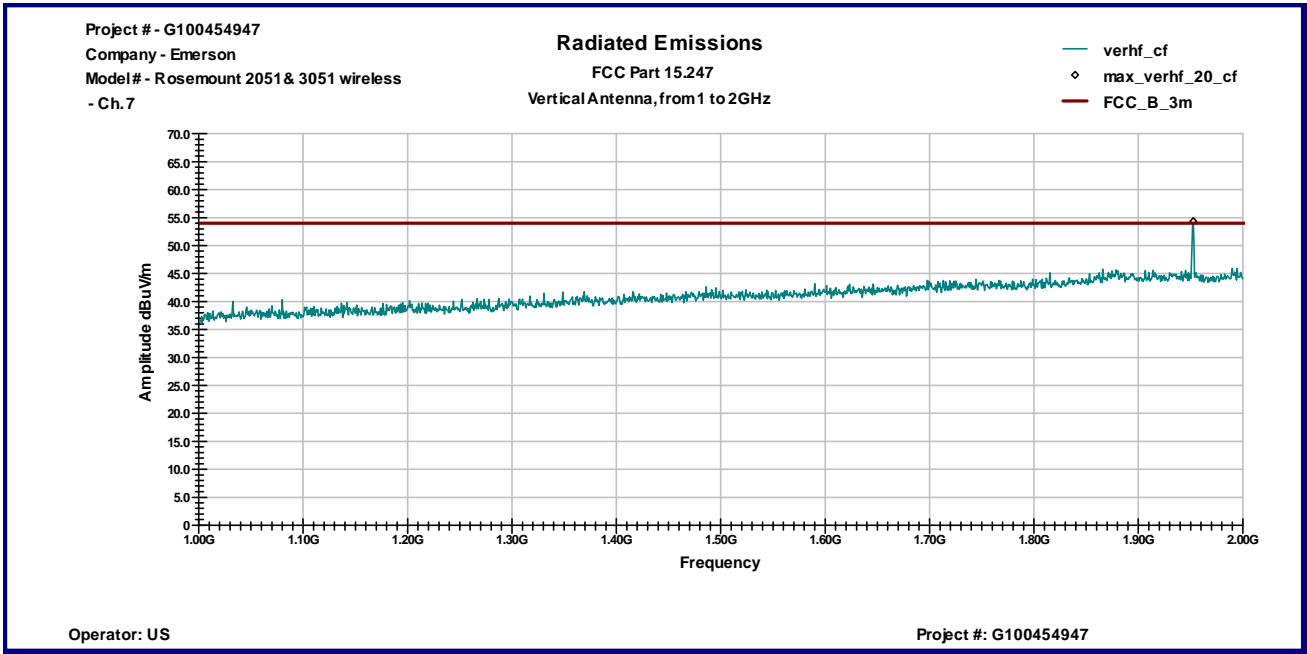
Graph 3.5.8



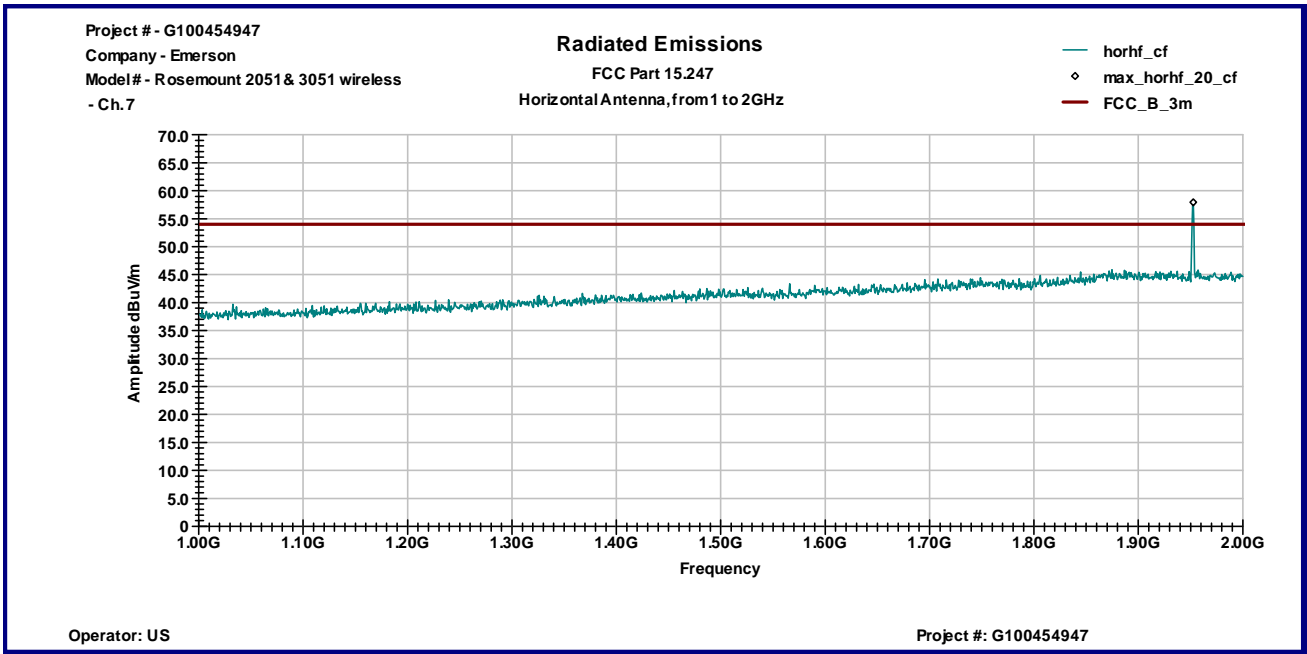
Graph 3.5.9



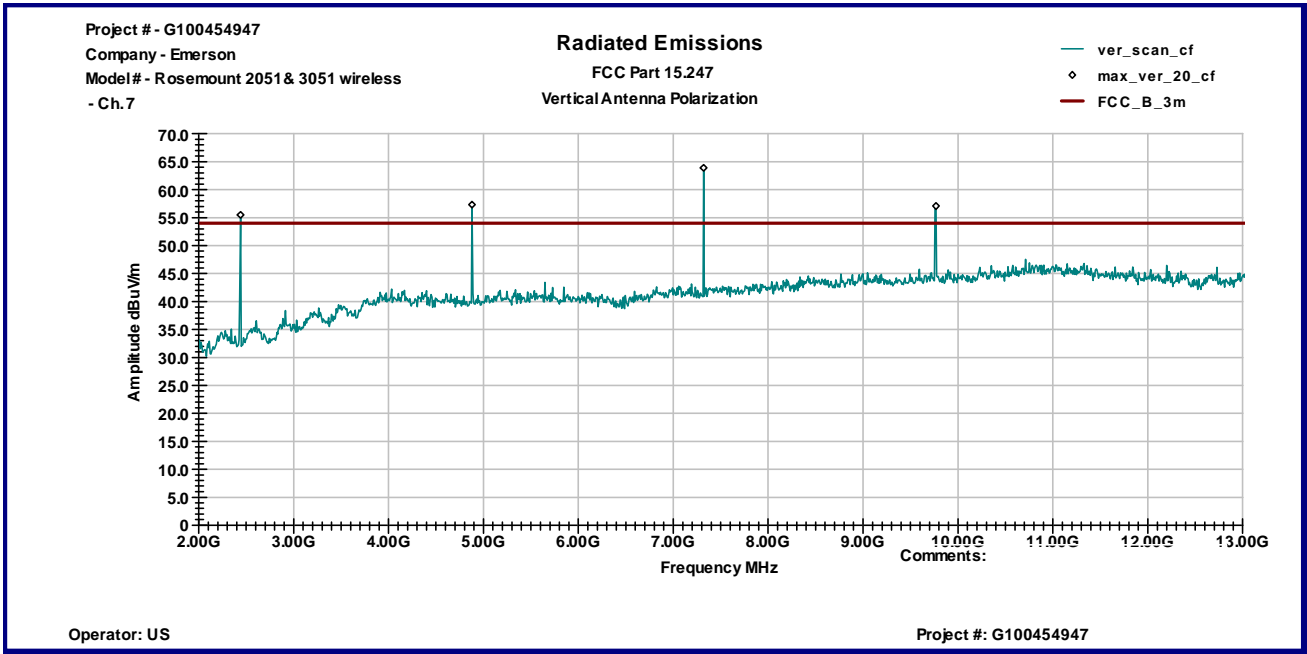
Graph 3.5.10



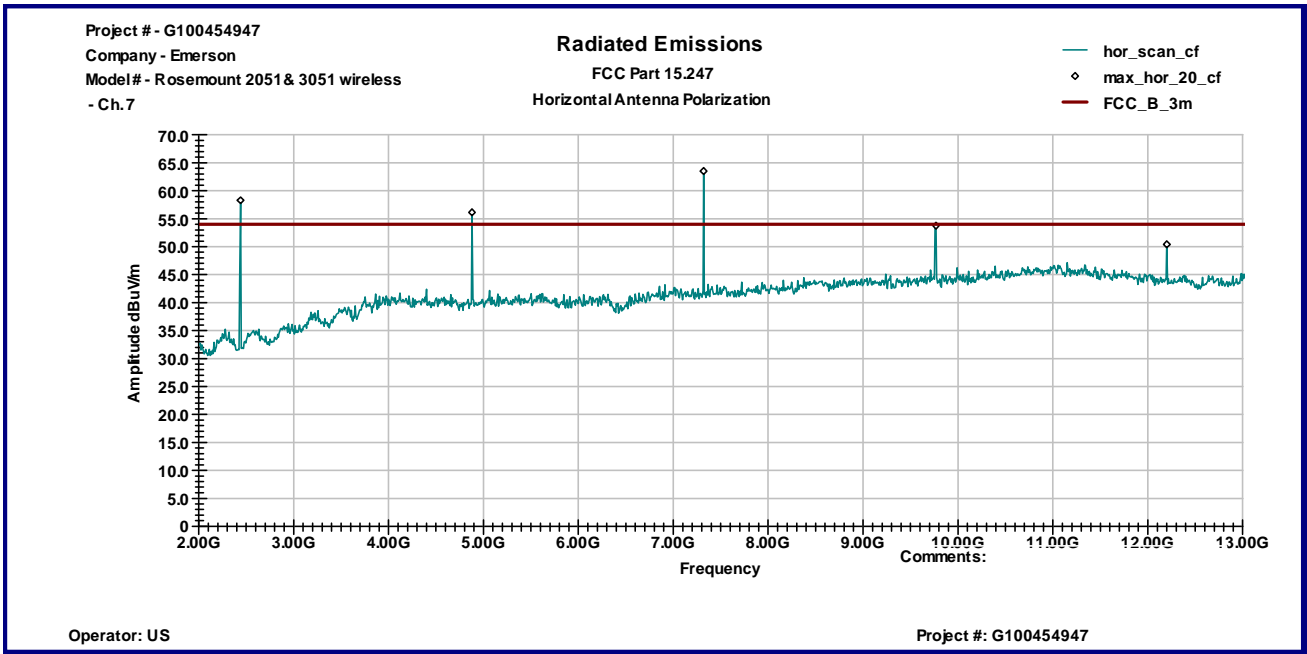
Graph 3.5.11



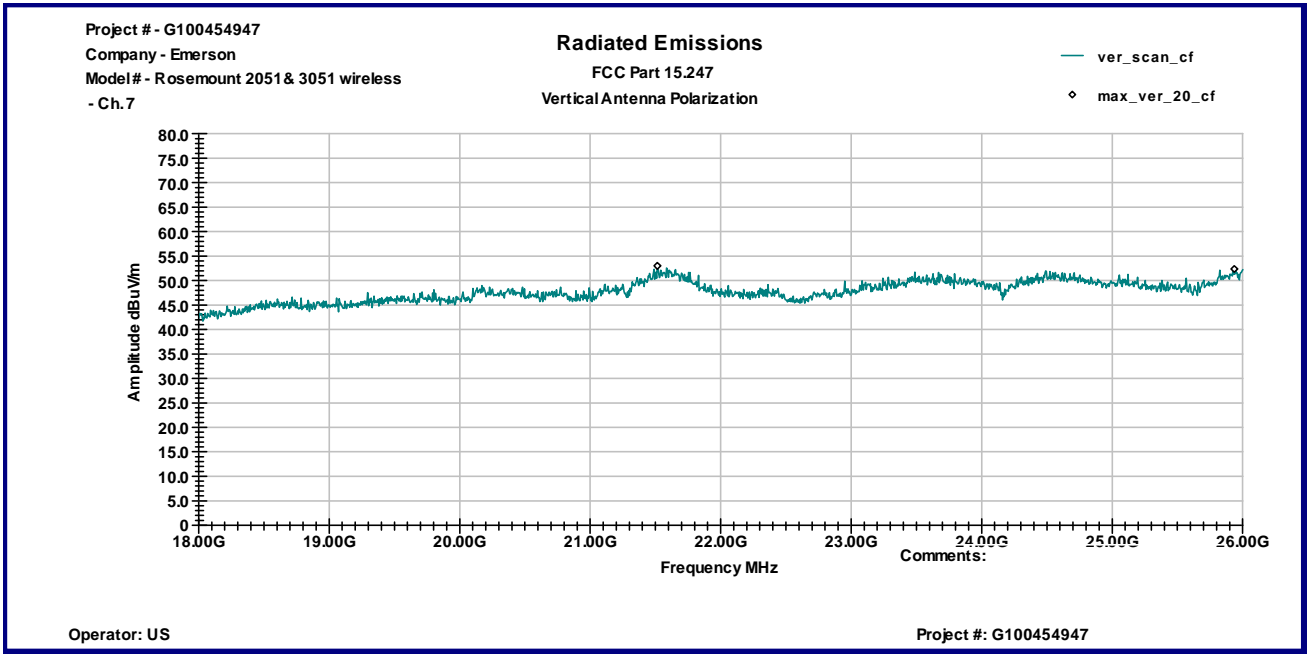
Graph 3.5.12



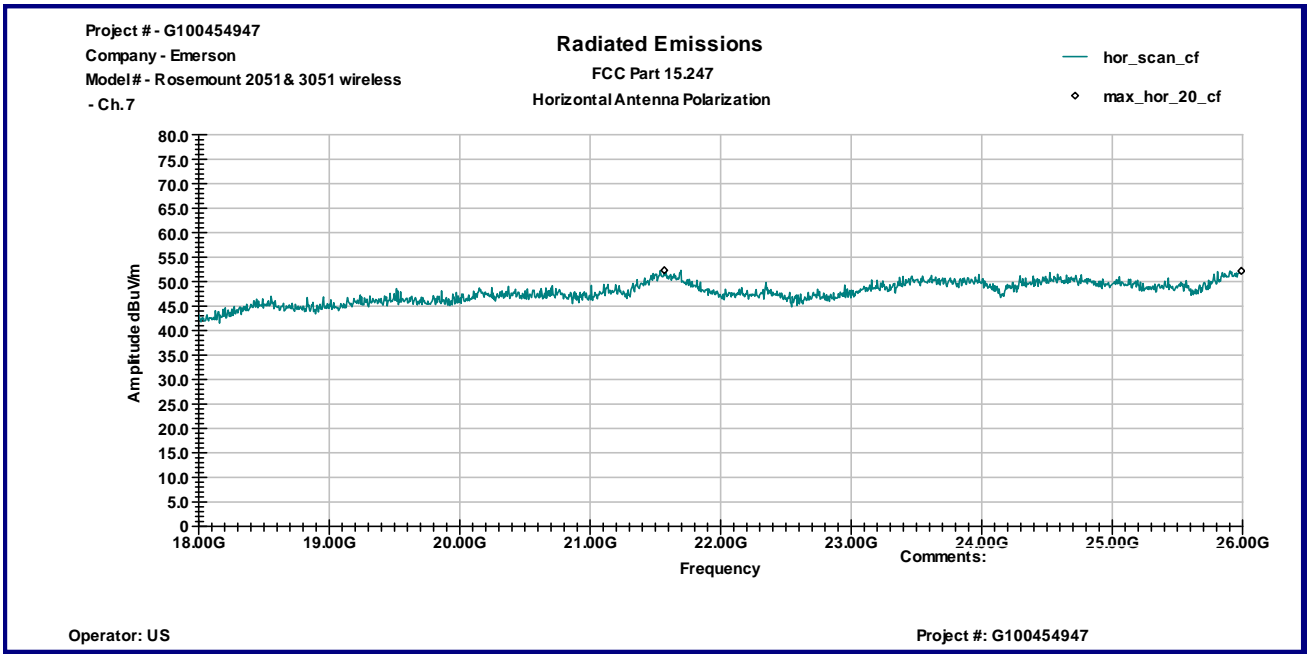
Graph 3.5.13



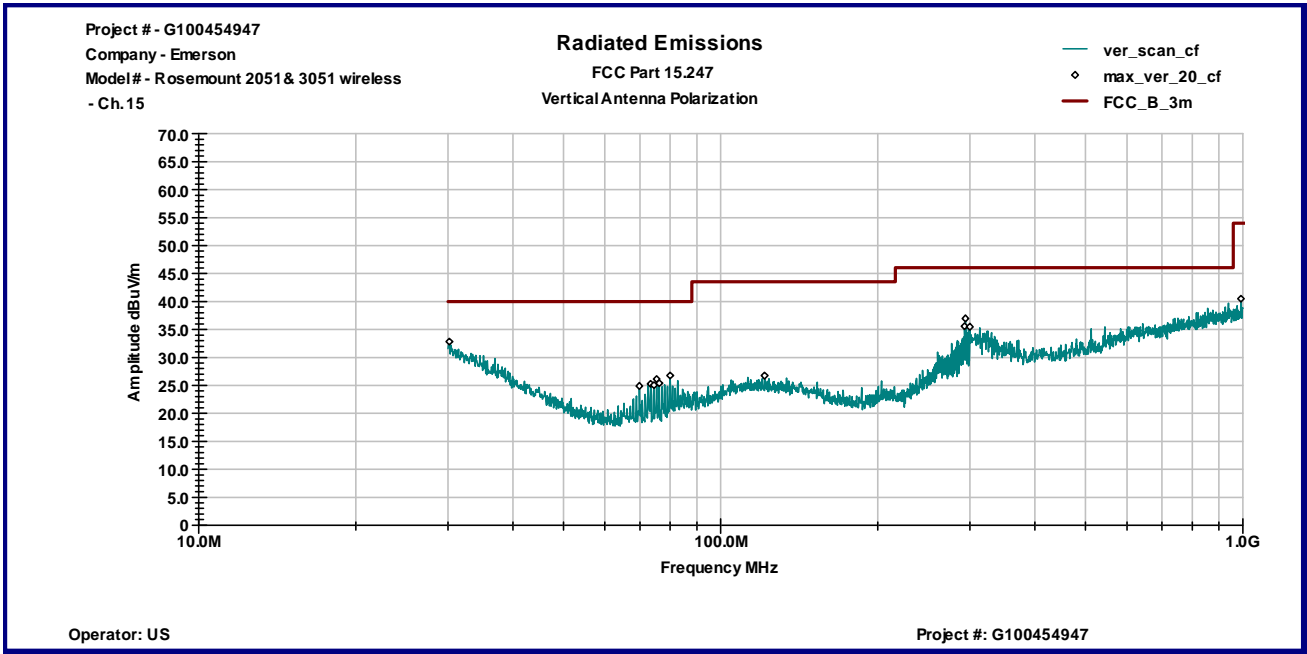
Graph 3.5.14



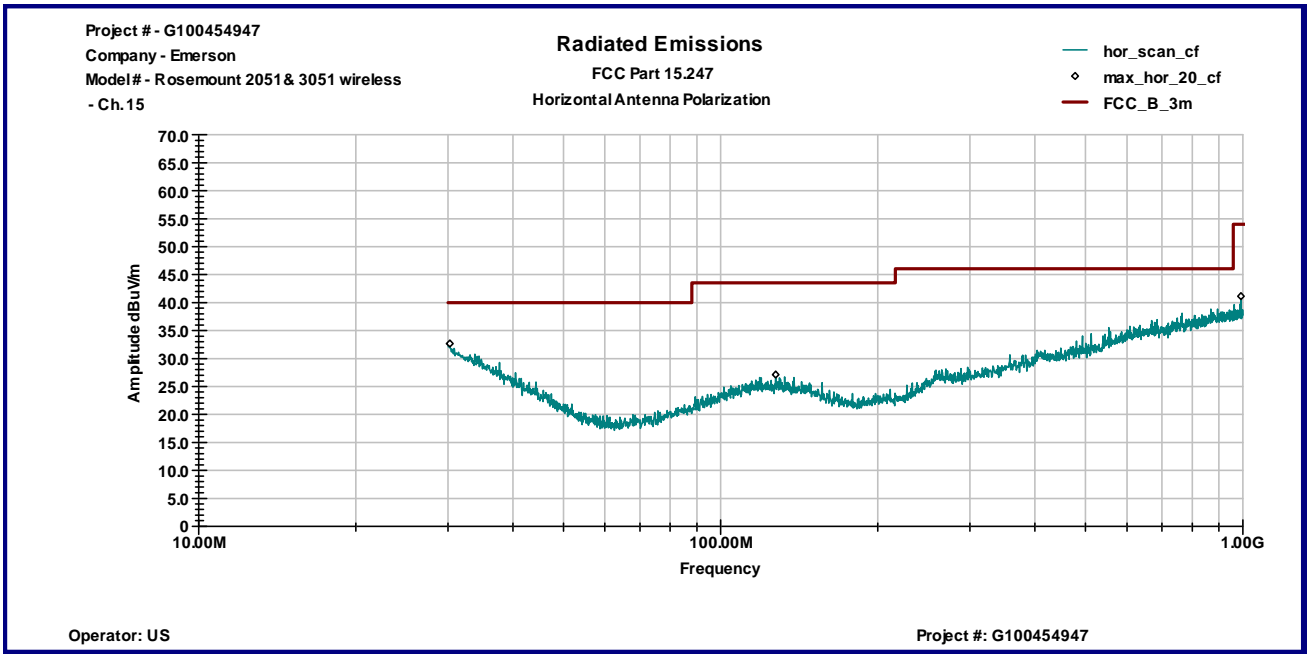
Graph 3.5.15



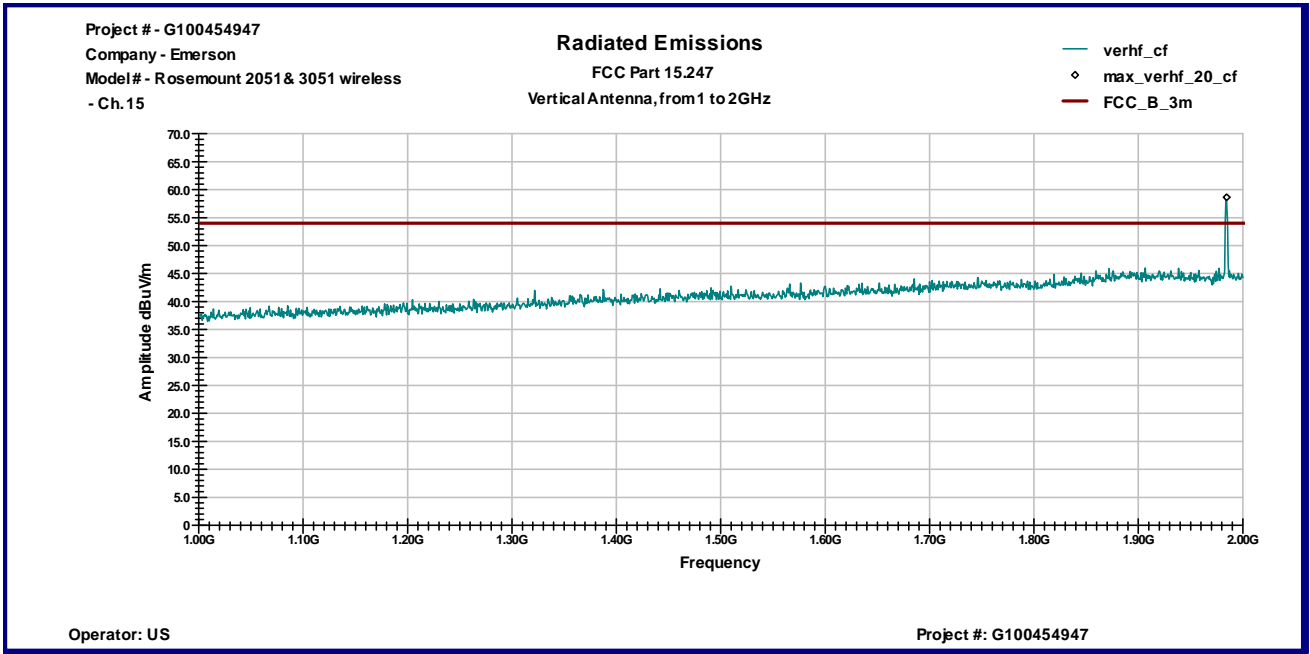
Graph 3.5.16



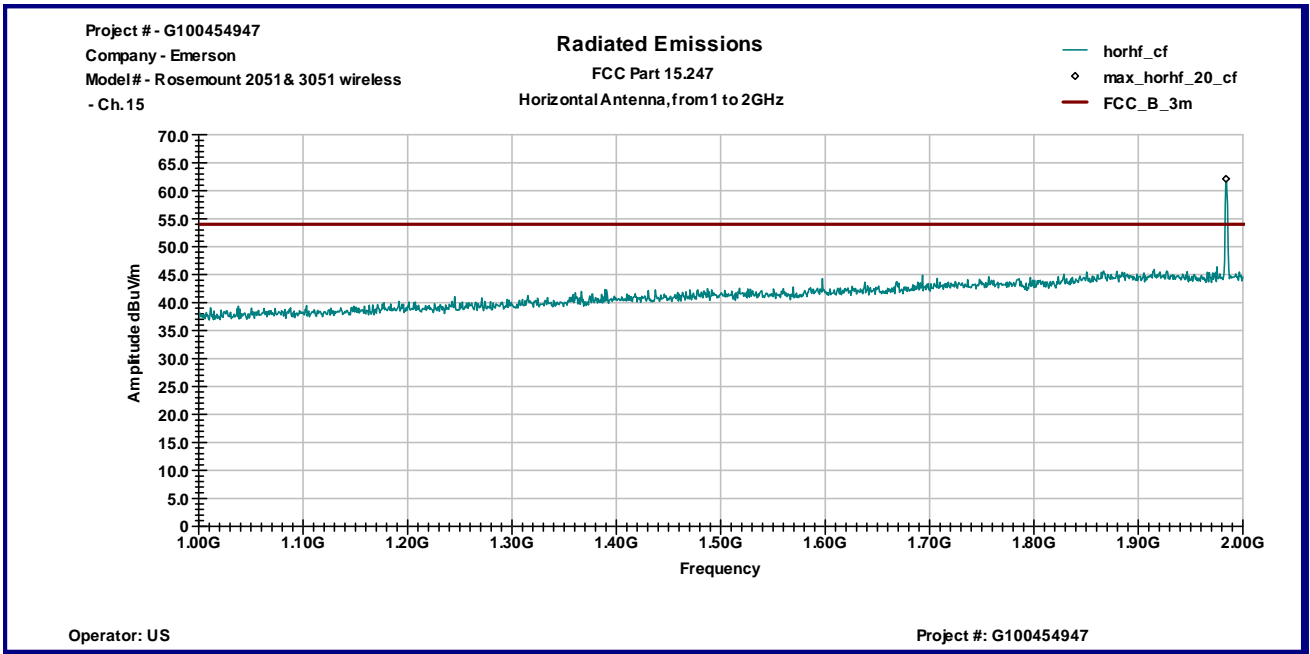
Graph 3.5.17



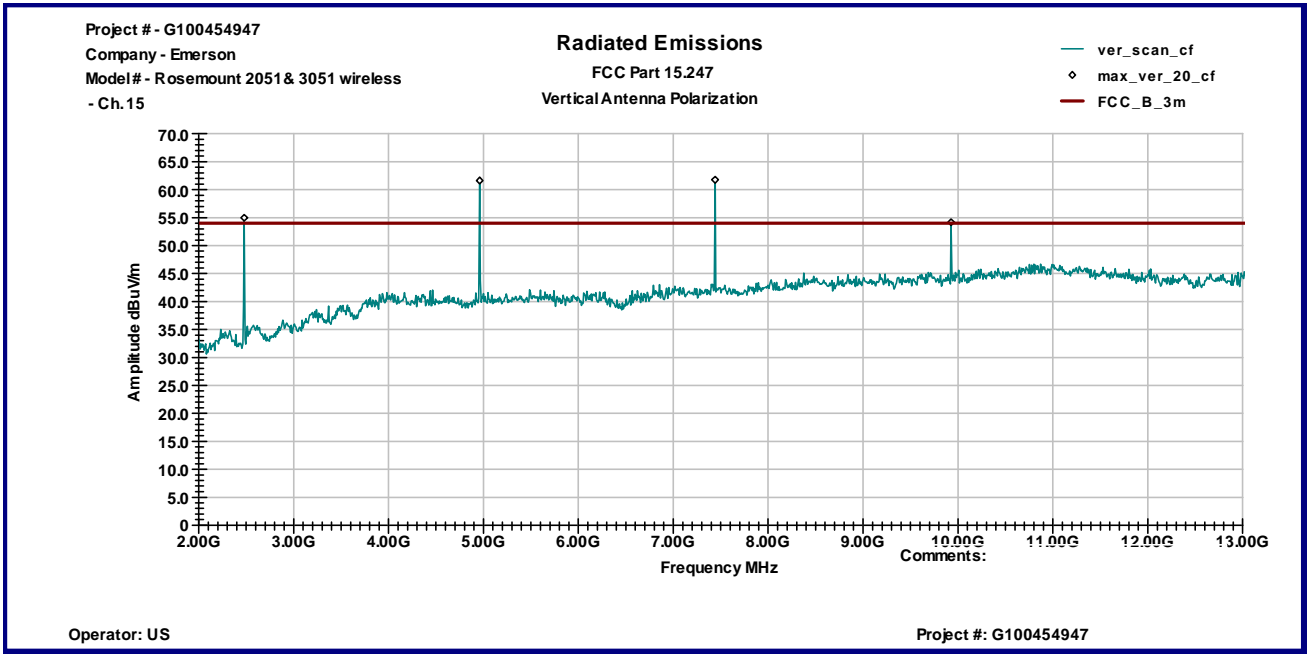
Graph 3.5.18



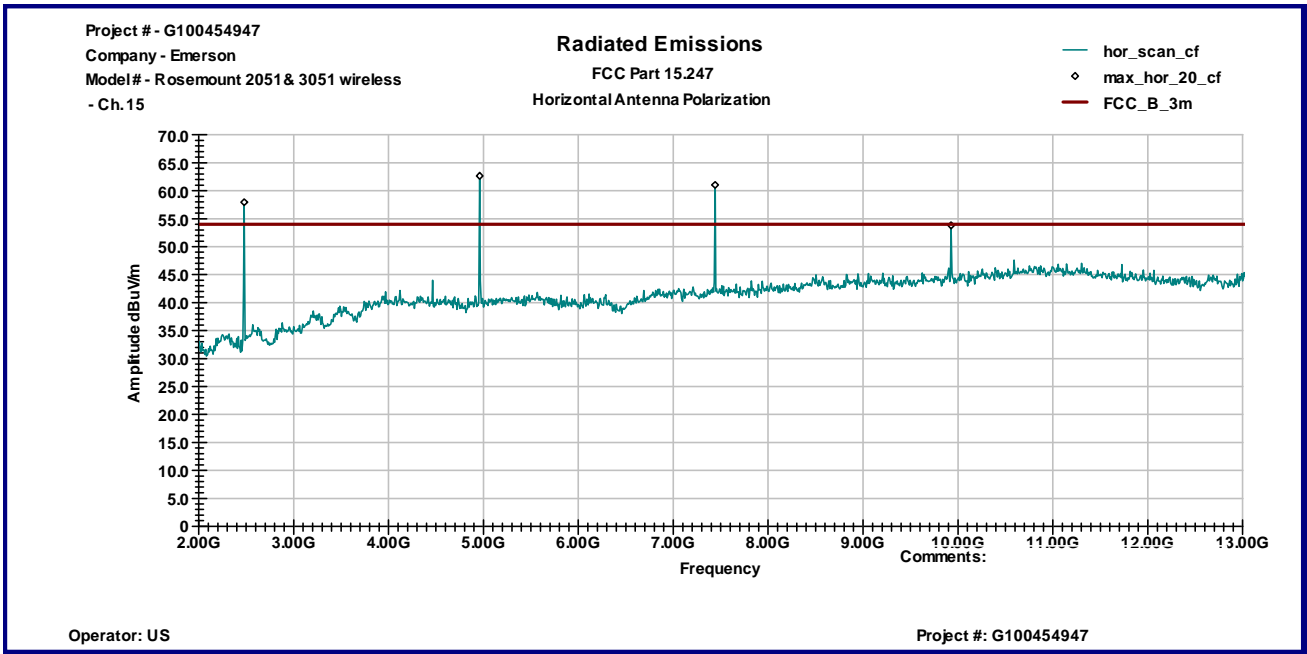
Graph 3.5.19



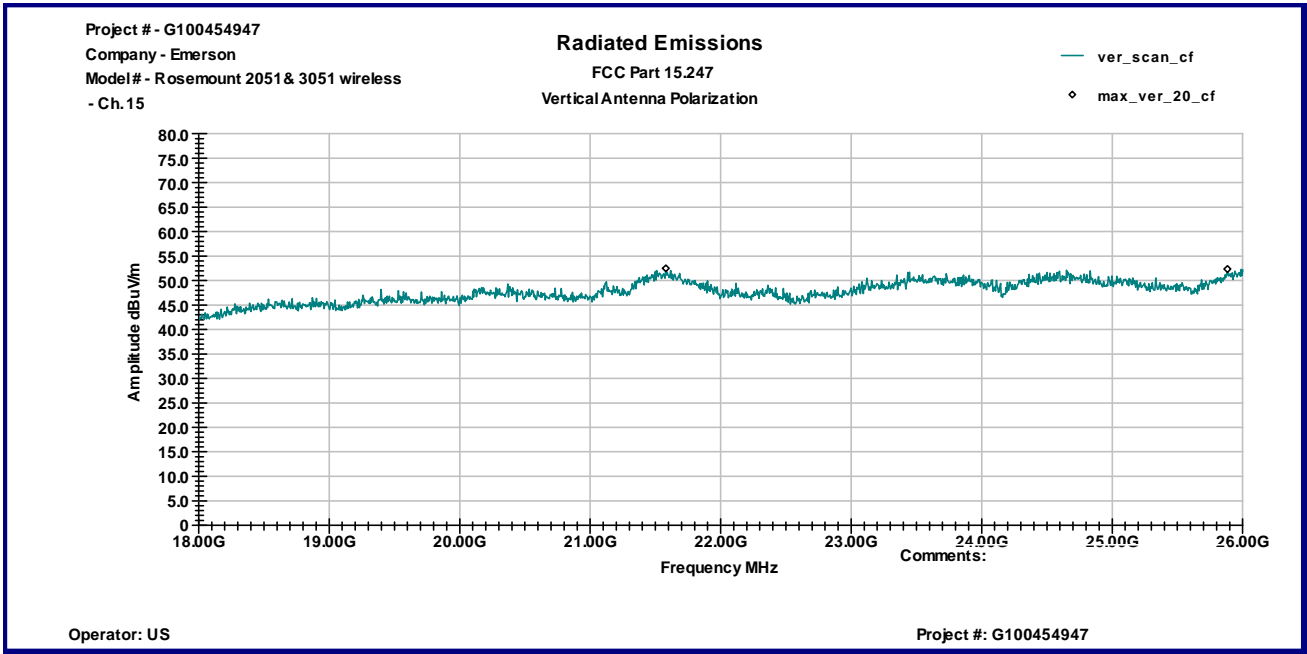
Graph 3.5.20



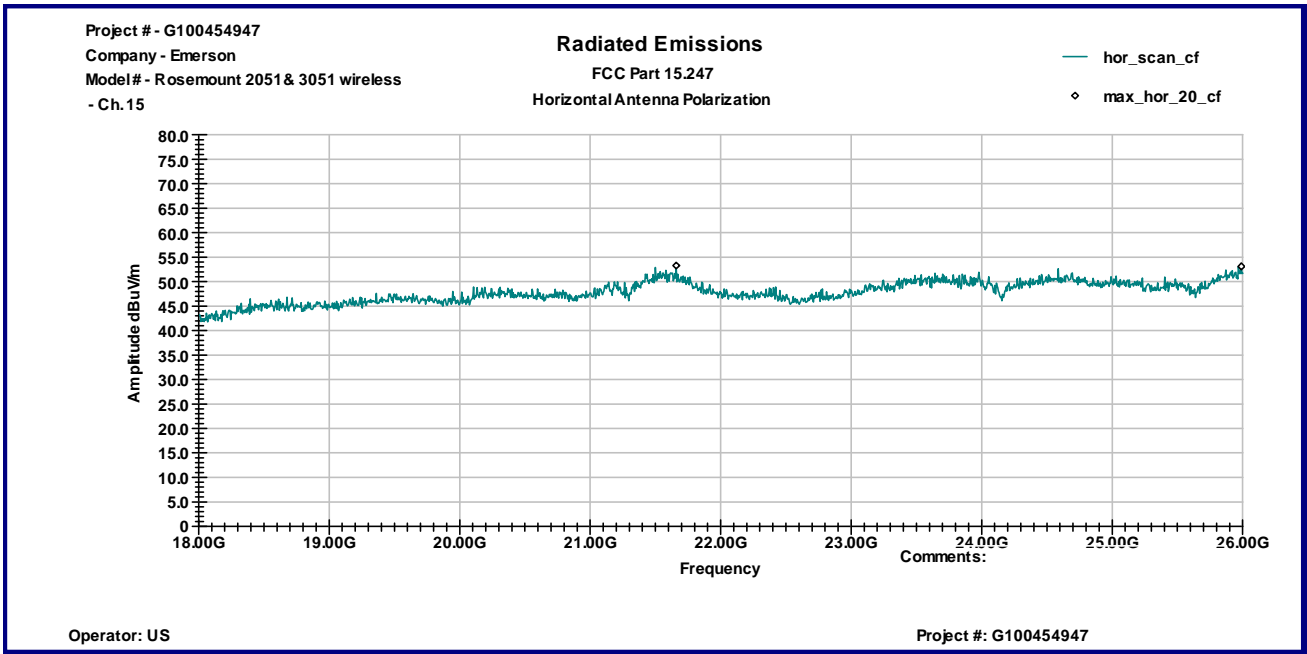
Graph 3.5.21



Graph 3.5.22



Graph 3.5.23



Graph 3.5.24



3.6 RF Exposure Compliance

The maximum measured antenna conducted power, P is 7.36dBm

The antenna gain, G is 2.0dBi

The maximum EIRP power = P + G
ERP = 7.36+ 2.0= 9.36dBm, or 0.00863W

The limits for Maximum Permissible Exposure (MPE) for transmitter operating at 2.4Hz, MPE is $1\text{mW}/\text{cm}^2$, or $10\text{W}/\text{m}^2$

The Power Density is related to EIRP with the equation:
 $S = \text{EIRP} / 4\pi D^2$, or $10 = 0.00863 / 4\pi D^2$,

The minimum safe separation distance, D = 0.83cm, which is below 20cm



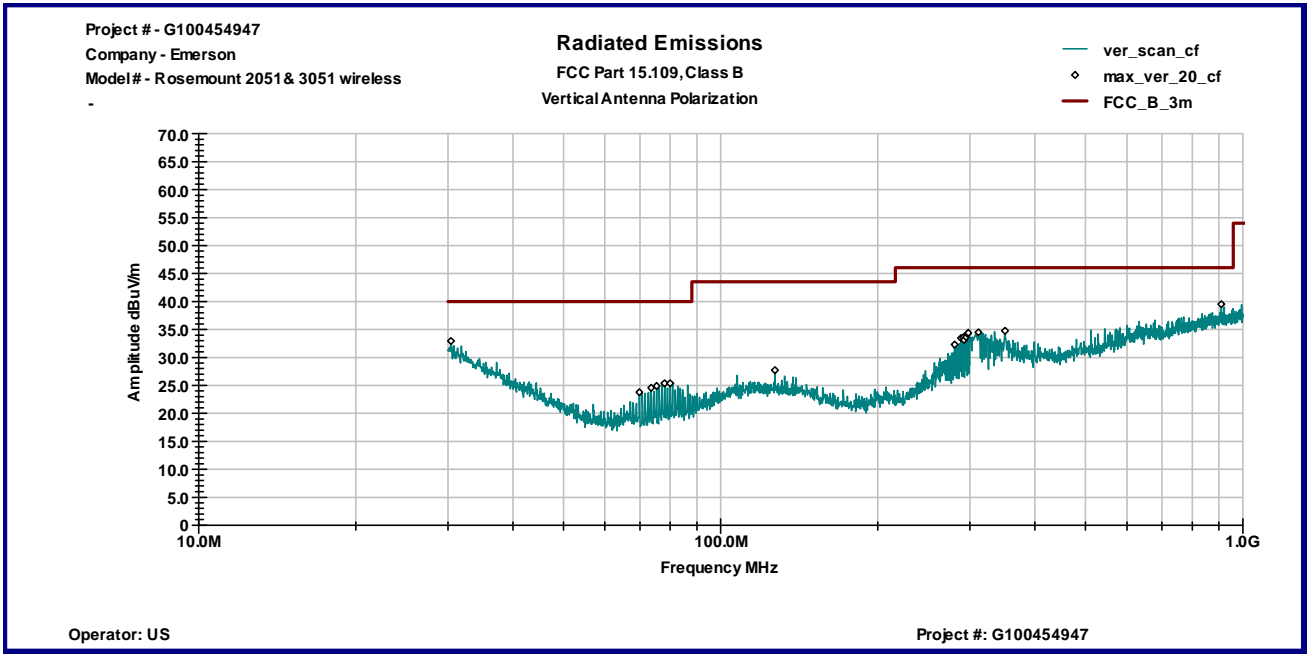
Date:	July 18-19, 2011	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	Receiving Mode	
Note:	None	

Table 3.8.1

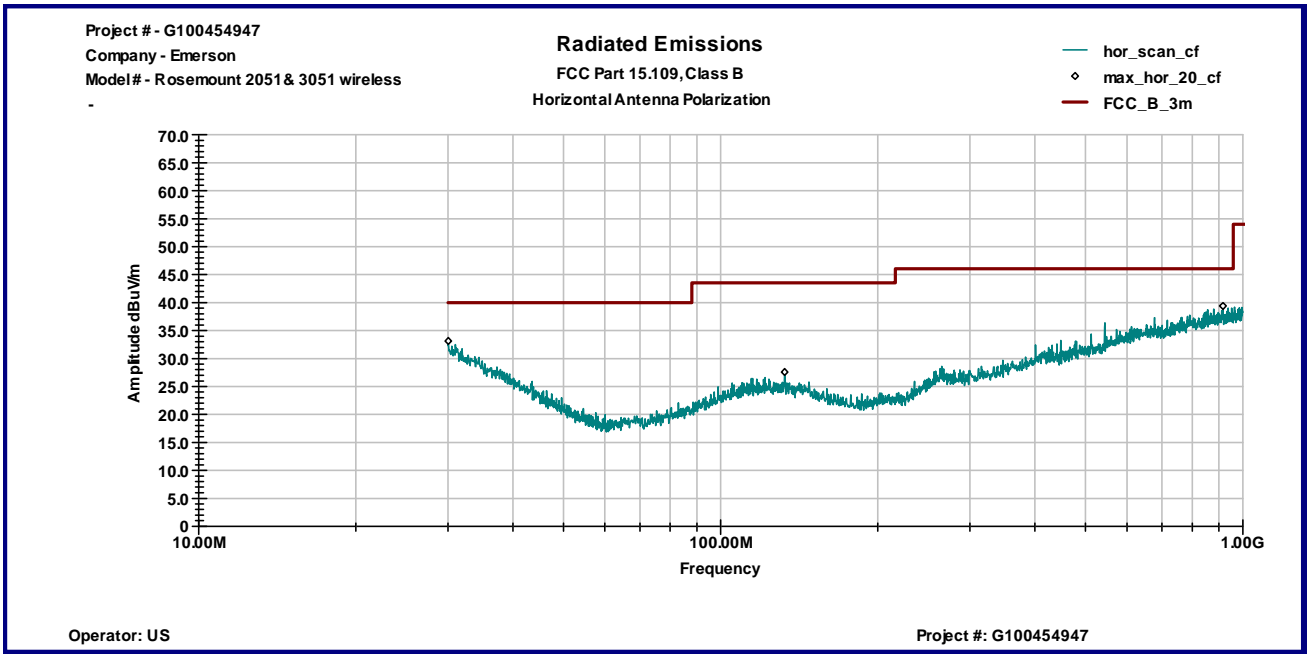
Frequency	Ant. Polarity	Peak Reading dB μ V	Ant.Factor dB1/m	Total at 3m dB μ V/m	QP Limit dB μ V/m	Margin dB
69.856 MHz	V	16.4	7.3	23.8	40.0	-16.3
78.064 MHz	V	16.7	8.6	25.4	40.0	-14.6
80.004 MHz	V	16.5	8.9	25.4	40.0	-14.6
127.01 MHz	V	13.7	14.0	27.7	43.5	-15.8
297.11 MHz	V	18.4	15.8	34.2	46.0	-11.8
298.07 MHz	V	18.5	15.9	34.4	46.0	-11.6
311.78 MHz	V	18.2	16.3	34.5	46.0	-11.6
350.56 MHz	V	17.2	17.5	34.7	46.0	-11.3
132.53 MHz	H	13.8	13.8	27.6	43.5	-15.9

Table 3.8.2

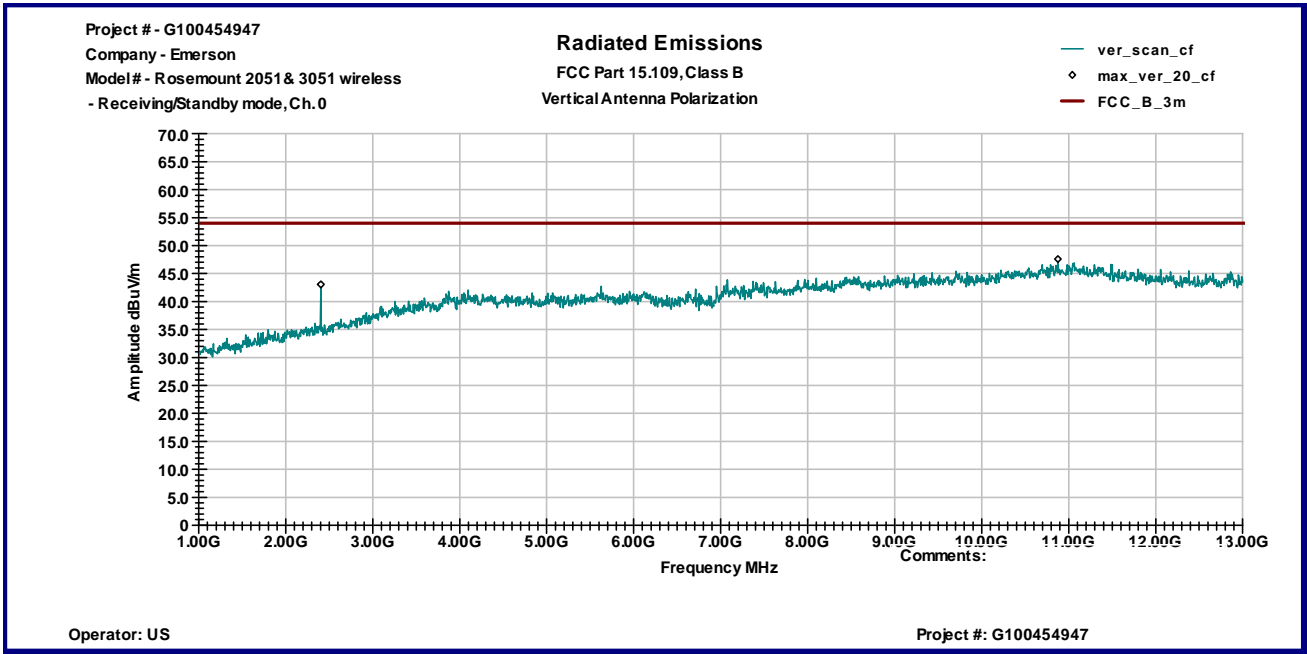
Frequency MHz	Antenna Polarity	Reading dB μ V	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dB μ V/m	Limit dB μ V/m	Margin dB
2.404 GHz	V	48.9	32.0	37.9	43.1	54.0	-10.9
2.404 GHz	H	51.0	31.9	37.9	45.1	54.0	-8.9



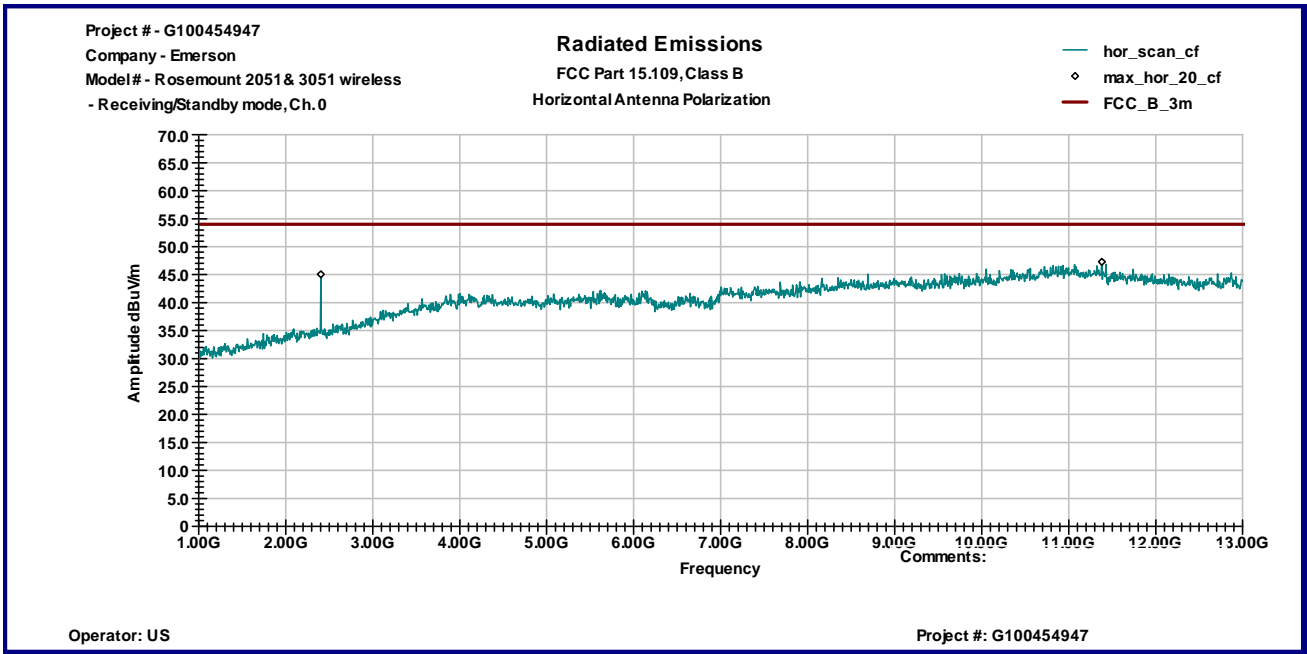
Graph 3.8.1



Graph 3.8.2



Graph 3.8.3



Graph 3.8.4



3.9 Digital device conducted emissions

Test location: OATS Anechoic Chamber Other

Test result: **N/A**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: dB below the limits

Notes: It was determined from consideration of the electrical characteristics and usage of particular apparatus that Conducted Emissions testing is inappropriate and therefore unnecessary (as battery operated equipment).



4.0 TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	12/07/2011	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESCI	100358	12909	05/12/2012	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	10/18/2011	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	10/06/2011	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	9507-4513	9936	04/29/2012	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	10/06/2011	<input checked="" type="checkbox"/>
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBV	<input checked="" type="checkbox"/>
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBV	<input checked="" type="checkbox"/>

