



TEST REPORT

Report Number: 3175962MIN-001
Project Number: 3175962

Testing performed on the
775 Smart Wireless THUM Adapter
FCC ID: LW2 77501
Industry Canada ID: 2431A 77501

to
47 CFR Part 15. 247:2008
RSS- 210 , Issue 7, 2007

For
Emerson Process Management

Test Performed by:
Intertek Testing Services NA, Inc.
7250 Hudson Blvd., Suite 100
Oakdale, MN 55128

Test Authorized by:
Emerson Process Management
8200 Market Blvd.
Chanhassen, MN 55317

Prepared by: U. Spector
Uri Spector

Date: March 20, 2009

Reviewed by: N. Shpilsher
Norman Shpilsher

Date: March 20, 2009

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1.0 GENERAL DESCRIPTION

Model:	775
Type of EUT:	Industrial Wireless communication adapter
Serial Number:	N/A
FCC ID:	LW2 77501
Industry Canada ID:	2431A 77501
Related Submittal(s) Grants:	None
Company:	Emerson Process Management
Customer:	Mr. Merritt Pulkrabek
Address:	8200 Market Blvd., Mail Stop SB4L Chanhassen, MN 55317
Phone:	(952) 949-5193
Fax:	(952) 949-7626
Test Standards:	<input checked="" type="checkbox"/> 47 CFR, Part 15:2008, §15.247 <input checked="" type="checkbox"/> RSS-210, Issue 7, 2007 <input checked="" type="checkbox"/> RSS-Gen, Issue 2, 2007 <input checked="" type="checkbox"/> 47 CFR, Part 15:2008, §15.107 and §15.109, Class B <input type="checkbox"/> Other
Type of radio:	<input checked="" type="checkbox"/> Stand -alone <input type="checkbox"/> Module <input type="checkbox"/> Hybrid
Date Sample Submitted:	March 13, 2009
Test Work Started:	March 13, 2009
Test Work Completed:	March 20, 2009
Test Sample Conditions:	<input type="checkbox"/> Damaged <input type="checkbox"/> Poor (Usable) <input checked="" type="checkbox"/> Good



1.1 Product Description; Test Facility 2.4 – 2.4835GHz Transceiver

Product Description:	2.4 – 2.4835GHz Transceiver
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 1. From 2400 to 24835 MHz Range 2. From [redacted] to [redacted] MHz
Number of Channels:	16
Modulation:	QPSK
Emission Designator:	1M49G7D
Antenna(s) Info:	Antenna 1. Type: Omni directional Gain: 2 dBi Connector Type: Solder direct to circuit board via coax Antenna 2. Type: [redacted] Gain: [redacted] dBi Connector Type: [redacted]
Power settings:	1. [redacted] dBm 2. [redacted] dBm 3. [redacted] dBm
Antenna Installation:	<input type="checkbox"/> User <input type="checkbox"/> Professional <input checked="" type="checkbox"/> Factory
Transmitter power configuration:	<input type="checkbox"/> Internal battery <input checked="" type="checkbox"/> External power source <input type="checkbox"/> 120VAC <input type="checkbox"/> 230VAC <input type="checkbox"/> 400VAC <input checked="" type="checkbox"/> 13.1 VDC <input type="checkbox"/> Other: [redacted] [redacted] 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 C63.4-2003 and FCC Public Notice DA 00-705



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)

Operating modes of the EUT:

No.	Description
1	Test was performed at low channel, middle channel, and upper channel
2	

Cables:

No.	Type	Length	Designation	Note
1	RF cable, 0.25dB loss at 2.4GHz	12"	Measurements at the antenna terminal	
2	2-wire DC power cable	>10ft	DC power	
3	2-wire communication cable	>10ft		

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 emissions from 30 to 1000 MHz has been determined to be: ± 4 dB at 10m and ± 5.4 dB at 3m

The expanded uncertainty ($k = 2$) for conducted emissions from 150 kHz to 30 MHz 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: None



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-210A8.2	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	Pass
15.109/ICES-003	Receiver/digital device radiated emissions	Pass
15.107/ ICES-003	Digital device conducted emissions	Pass



3.0 TEST CONDITIONS AND RESULTS

3.1 Maximum peak output power

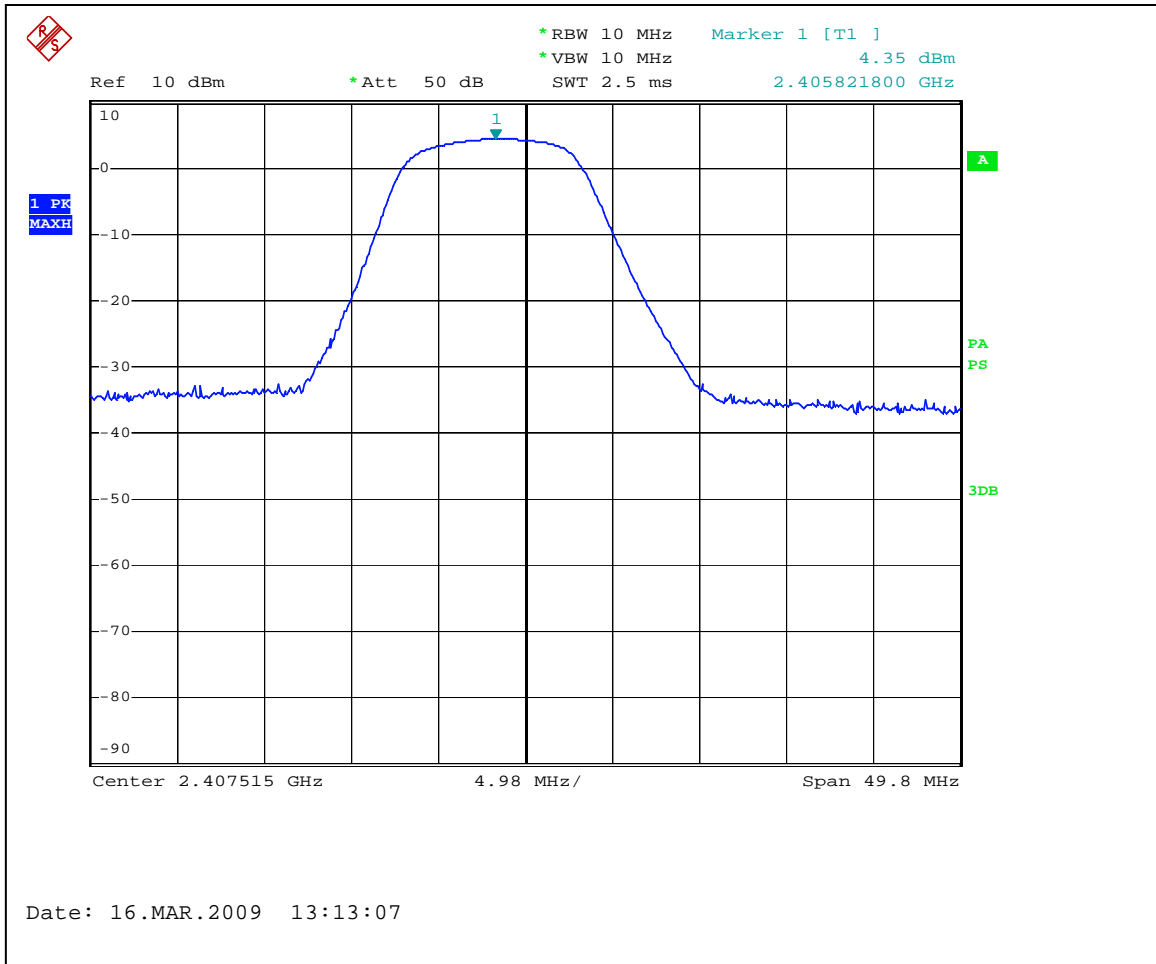
Test location: OATS Anechoic Chamber Other

Test result: **Pass**

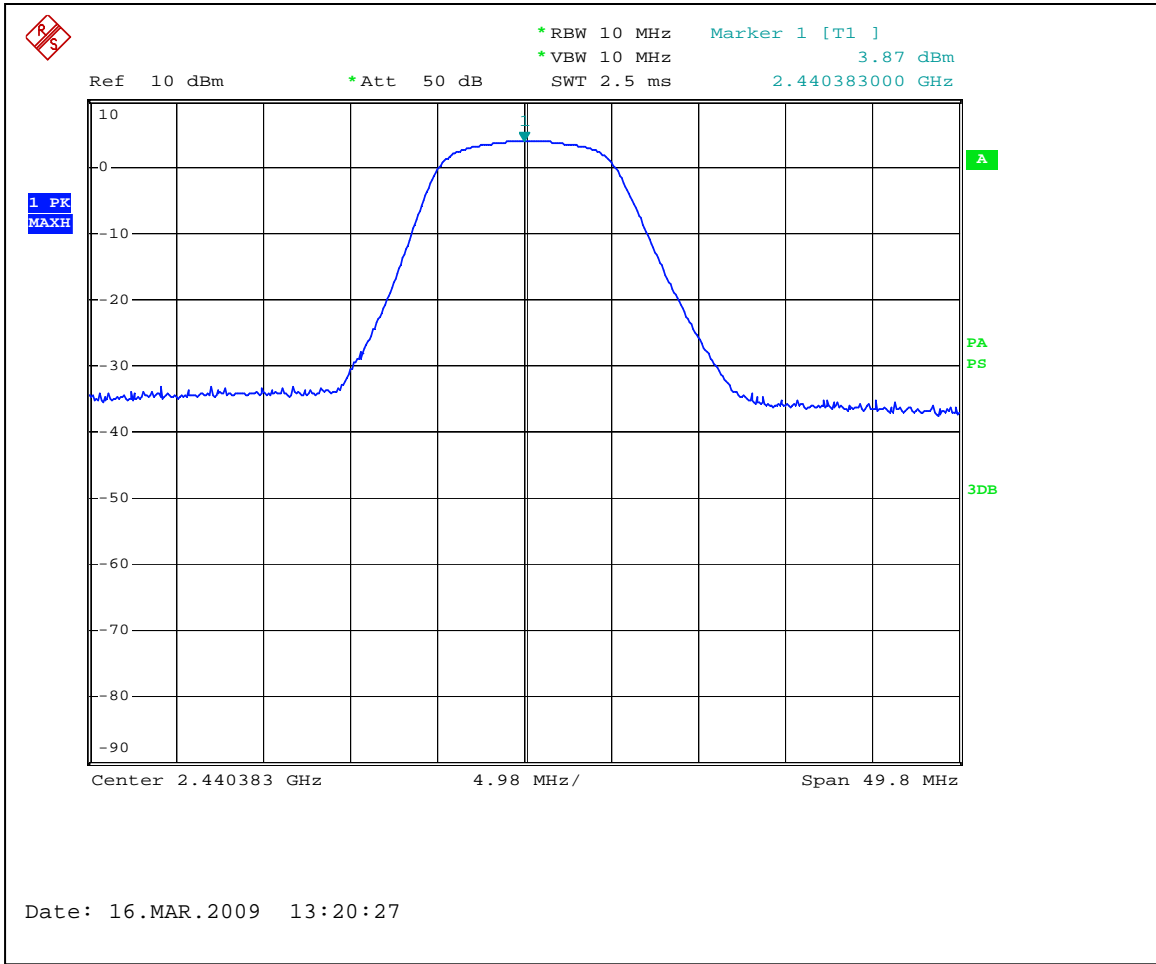
Max. Margin: 25.4 dB below the limits

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
2407	4.35	0.25	4.60	30	0	-25.40
Middle Frequency MHz						
2440	3.87	0.25	4.12	30	0	-25.88
Upper Frequency MHz						
2480	3.41	0.25	3.66	30	0	-26.34
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					

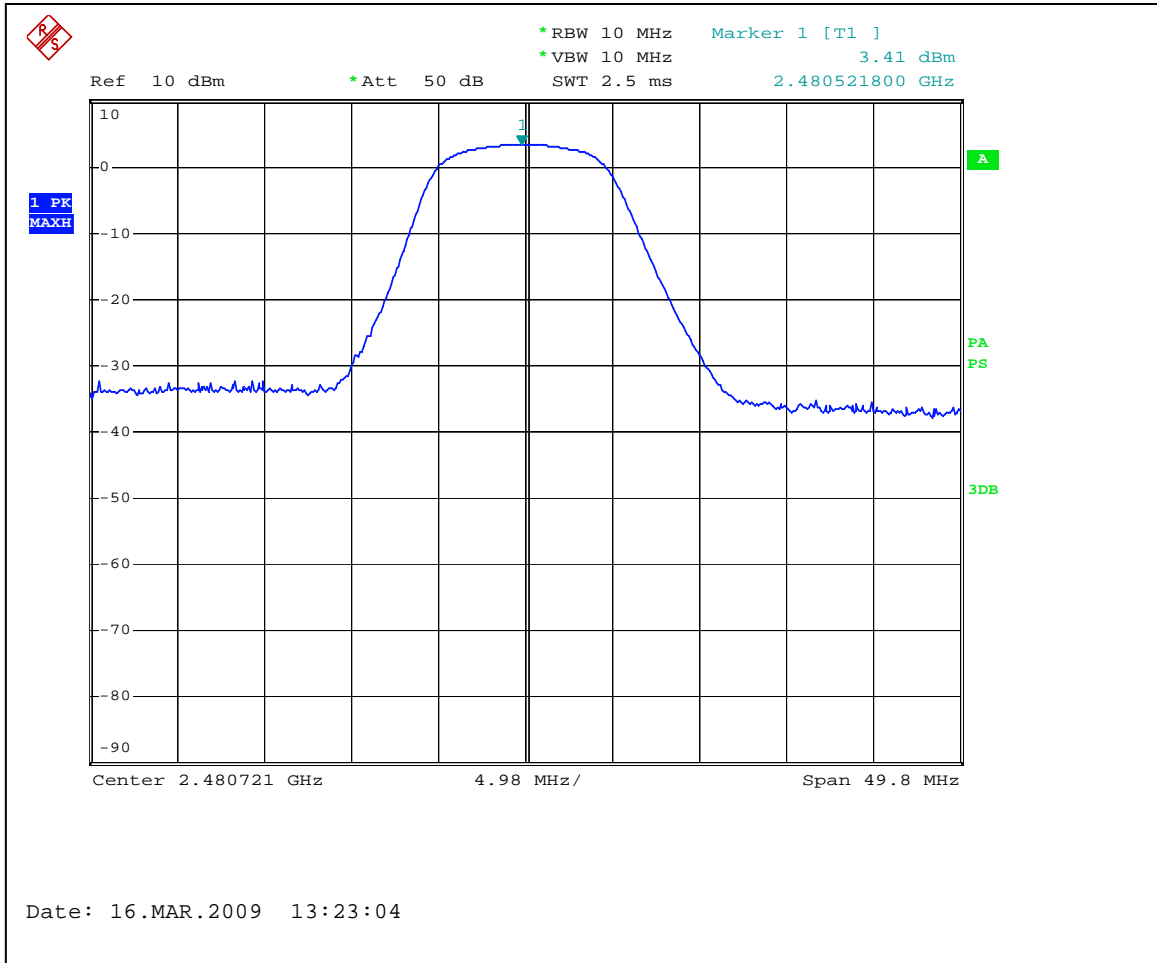
Notes: The maximum peak conducted output power limit is 1 W, or 30dBm
 Graphs 3.1.1 to 3.1.3 show the conducted output power



Graph 3.1.1



Graph 3.1.2

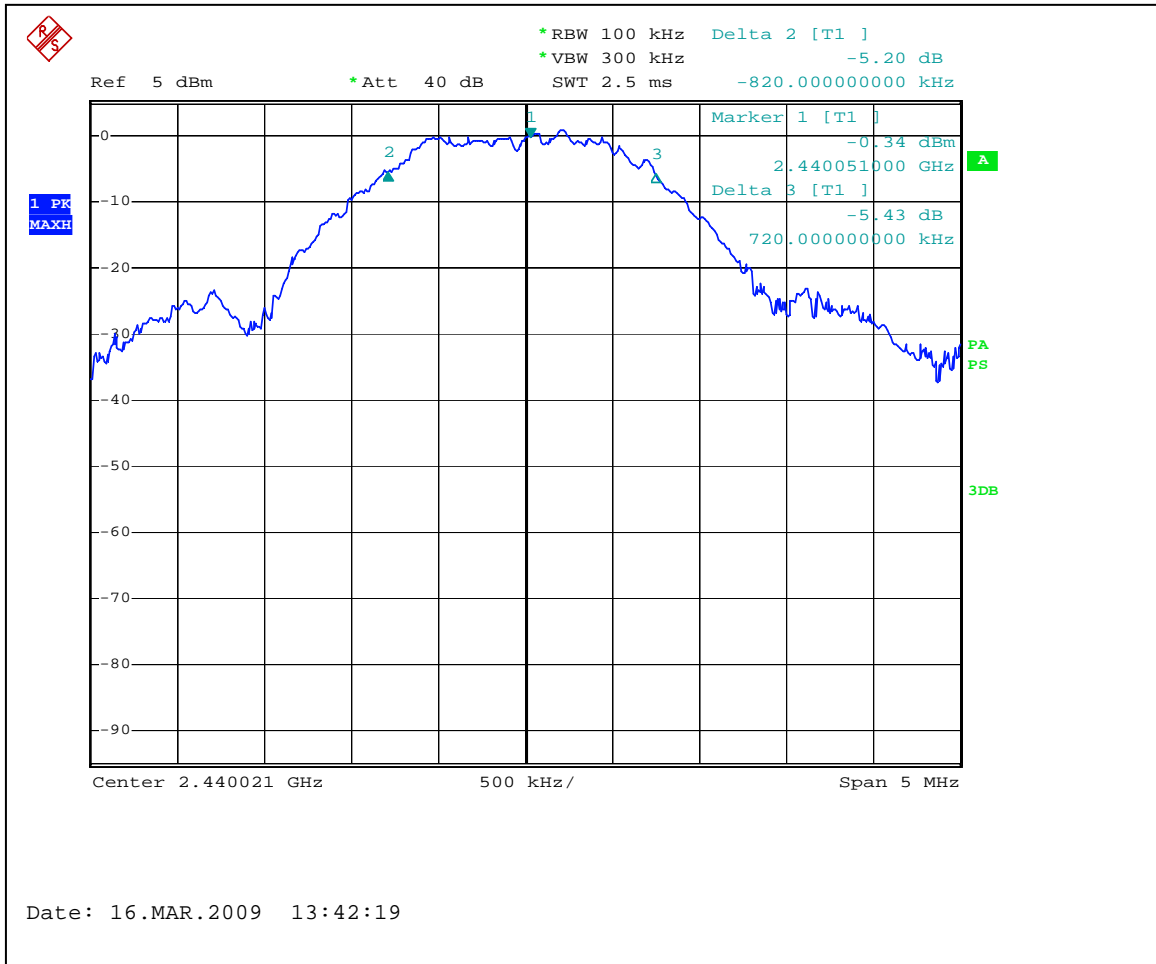


Graph 3.1.3

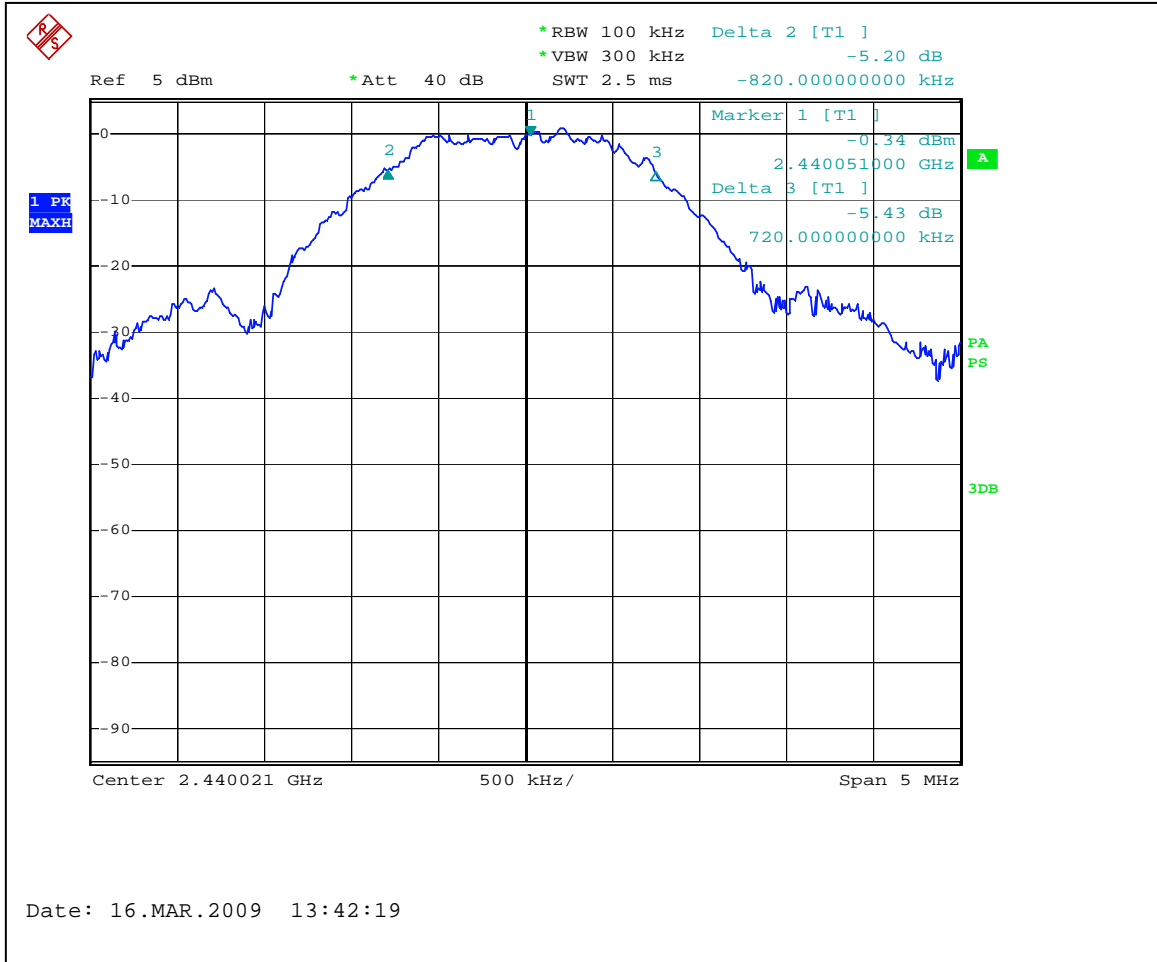
3.2 6dB bandwidth of the digital modulation

Low Frequency Channel kHz	Middle Frequency Channel kHz	Upper Frequency Channel kHz	Minimum Allowed Bandwidth kHz	Result
1530	1540	1490	500	Pass

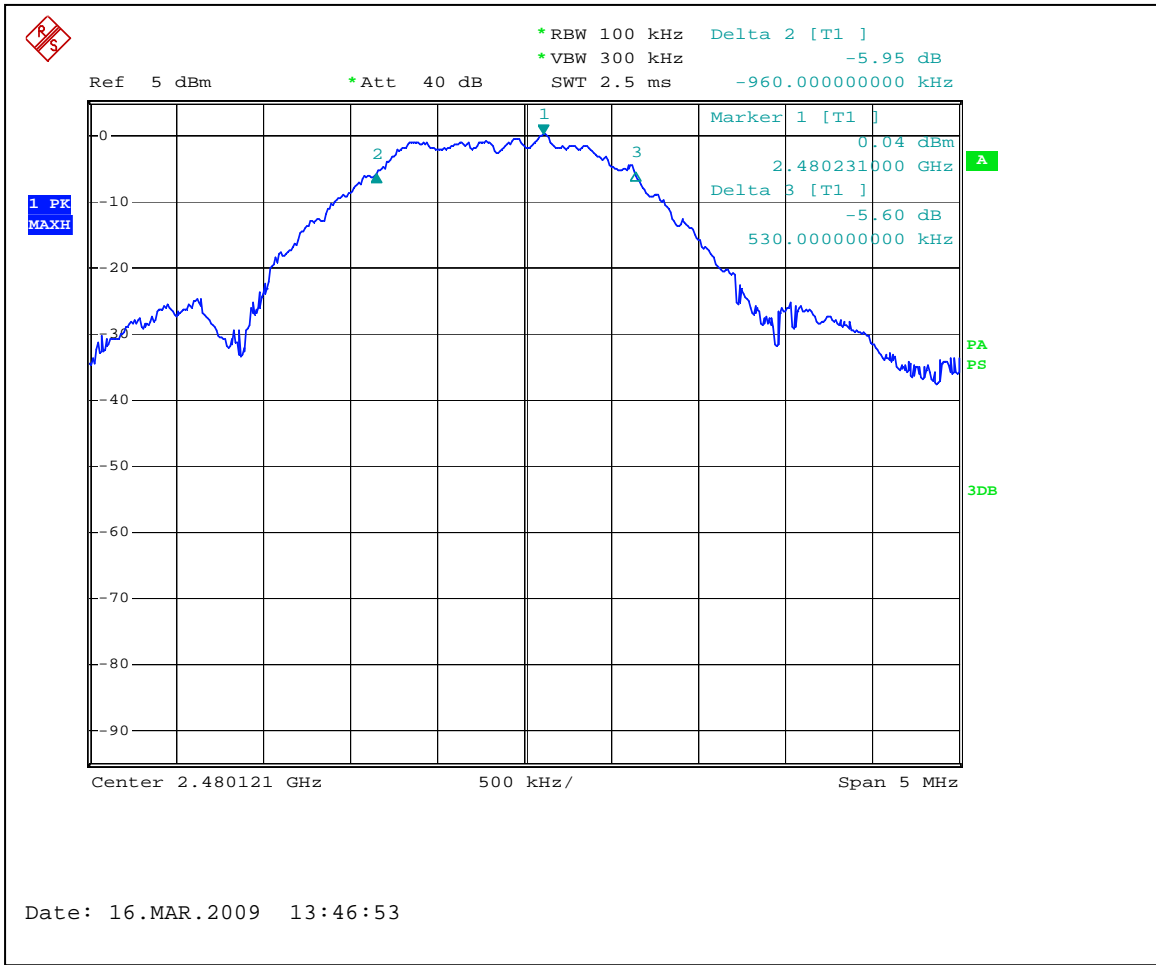
Notes: Graphs 3.2.1 to 3.2.3 show the 6dB bandwidth



Graph 3.2.1



Graph 3.2.2



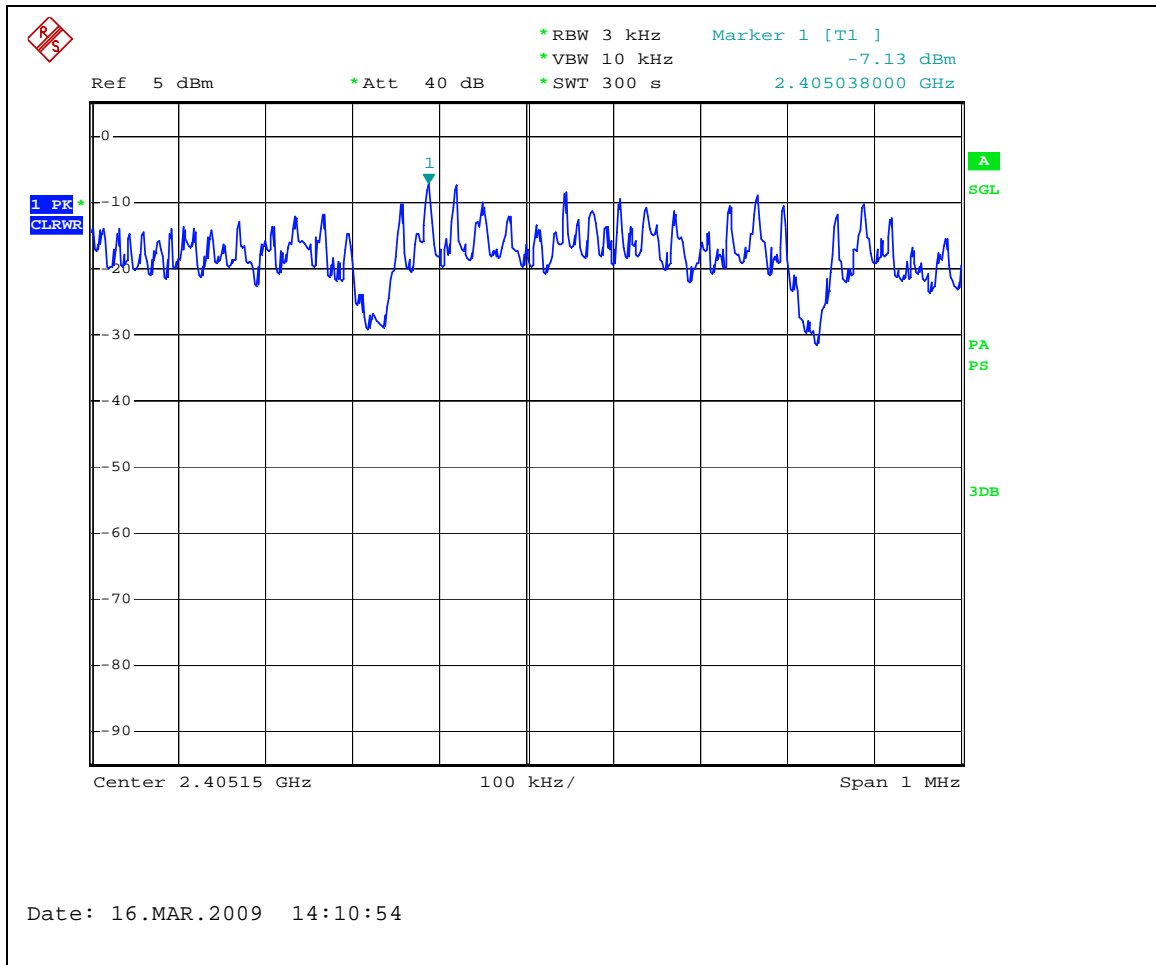
Graph 3.2.3



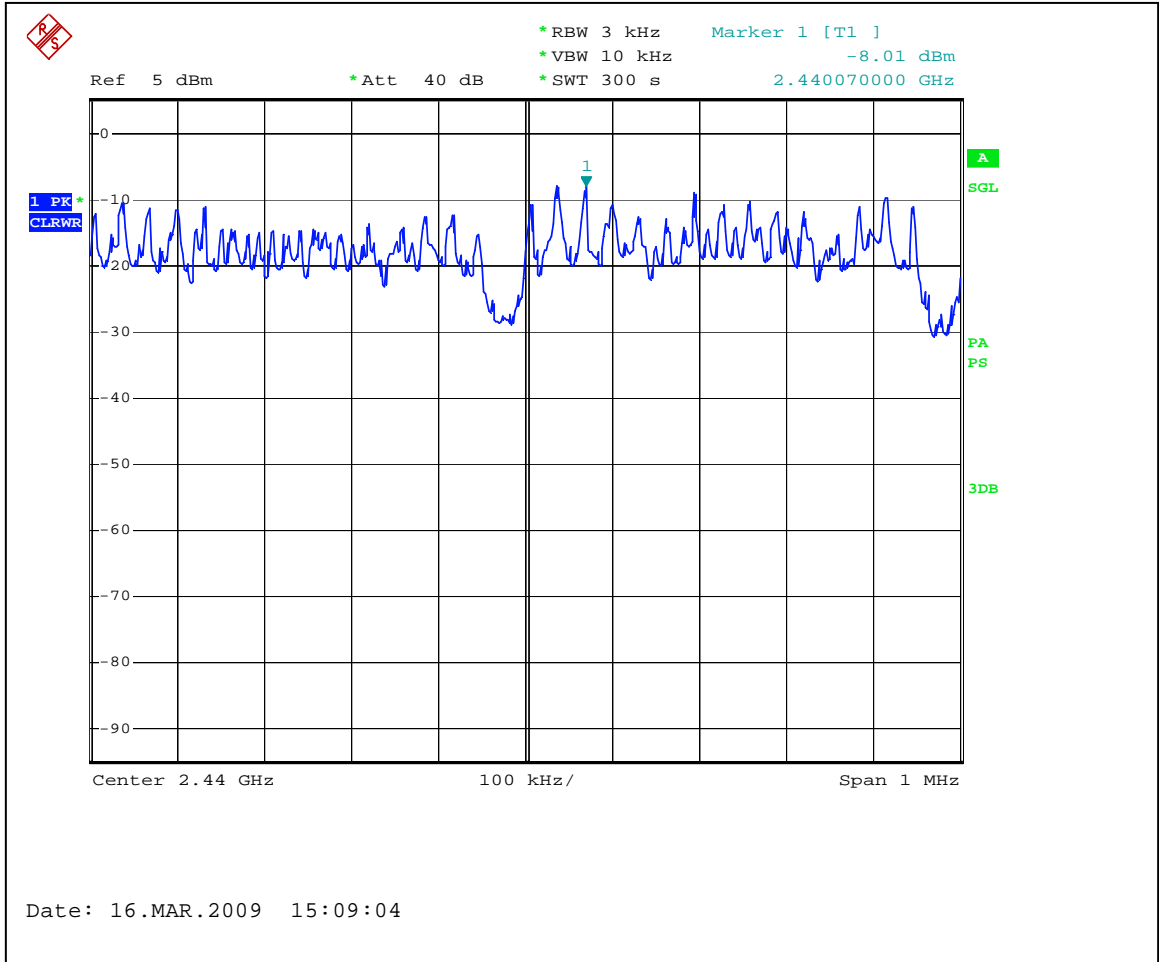
3.3 Power spectral density

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	-7.13	-6.88	8	-14.88
Middle Frequency Channel	-8.01	-7.76	8	-15.76
Upper Frequency Channel	-8.46	-8.21	8	-16.21
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 = 2 dBi <input type="checkbox"/> >6dBi and = █ dBi, limit reduction = █ dB			

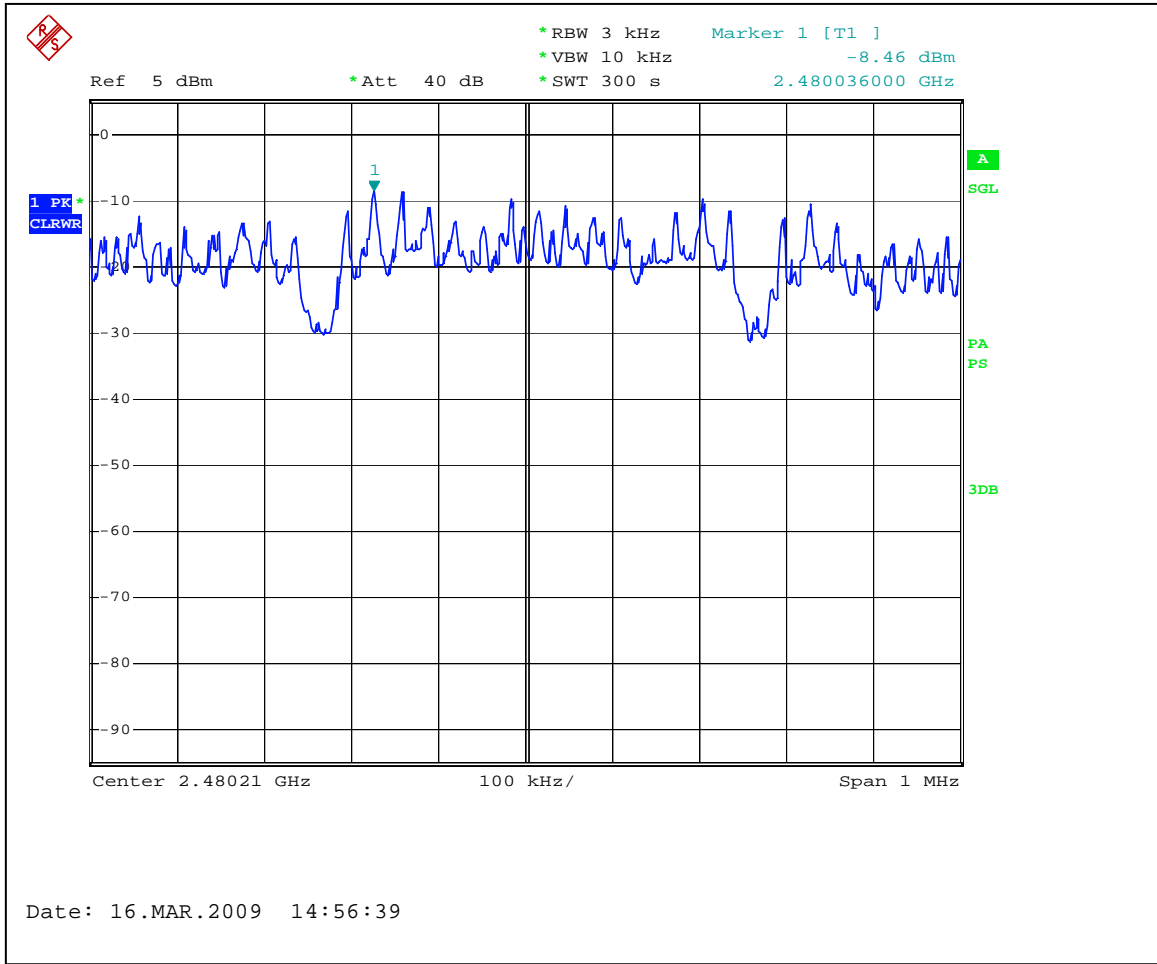
Notes: The Power Spectral Density was calculated adding the cable/attenuator loss of 0.25 dB from the measured density value.
 Graphs 3.3.1 to 3.3.3 show the Power Spectral Density



Graph 3.3.1



Graph 3.3.2



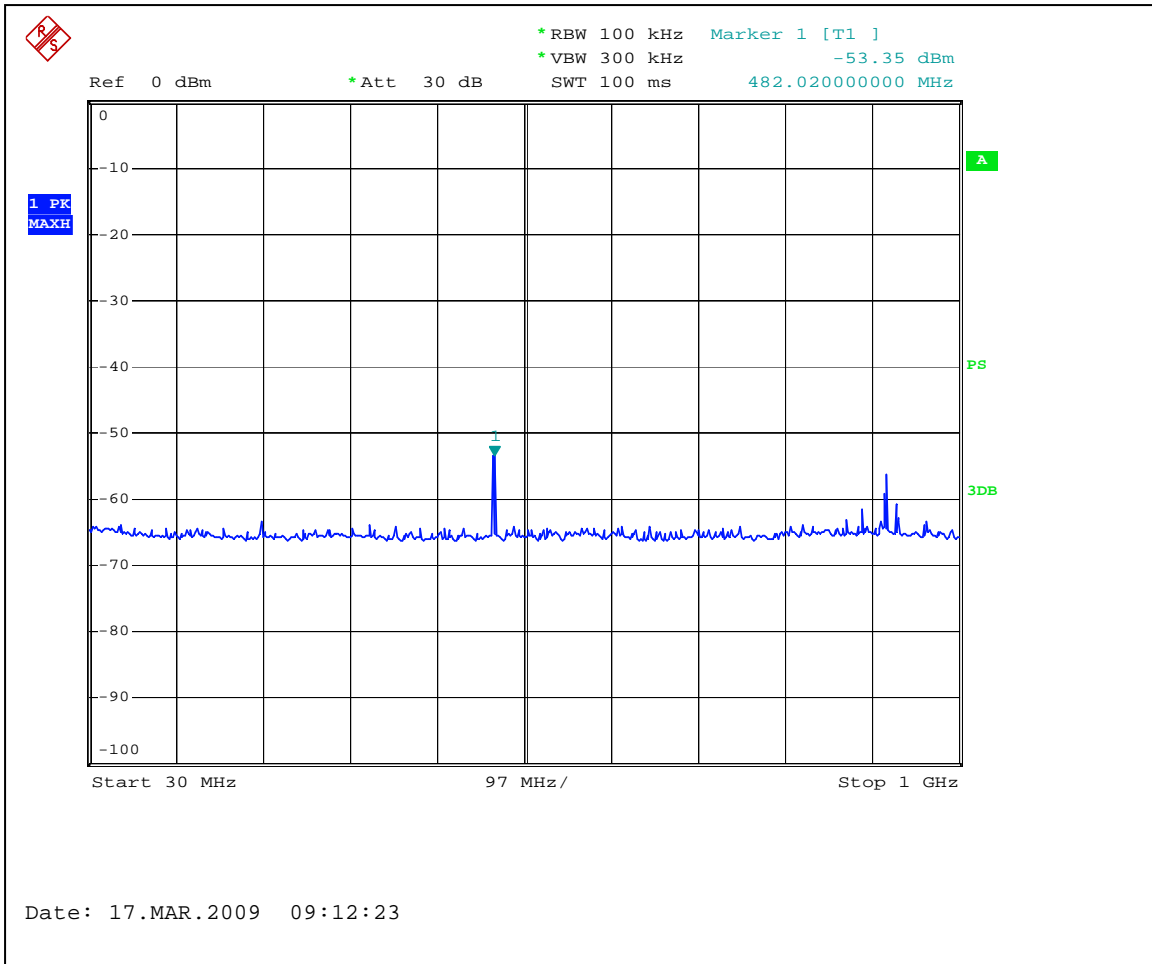
Graph 3.3.3



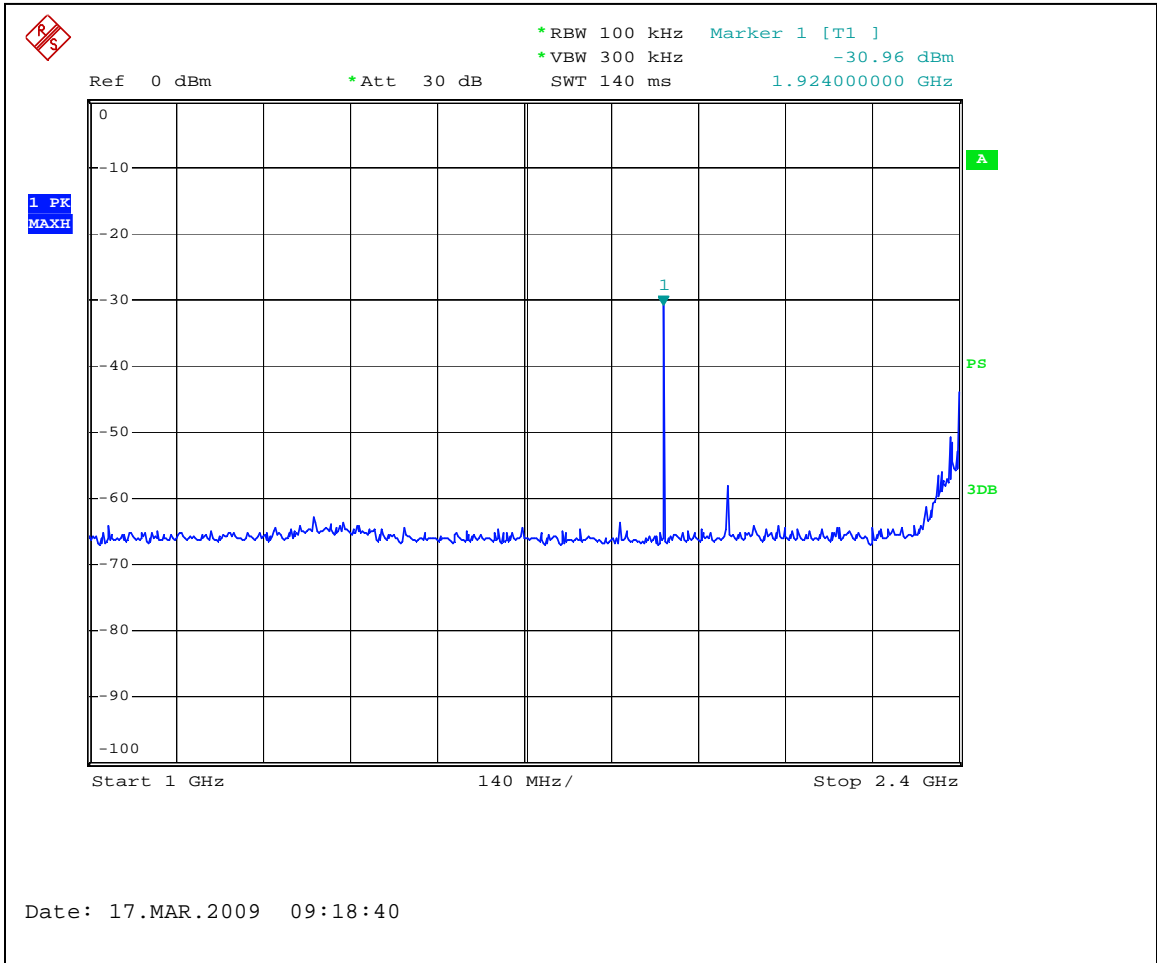
3.4 Antenna conducted spurious emissions

	Minimum Measured Attenuation dB	Minimum Allowed Attenuation dB	Margin dB
Low Frequency Channel	35.3	20	-15.3
Middle Frequency Channel	34.1	20	-14.1
Upper Frequency Channel	32.7	20	-12.7
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)		

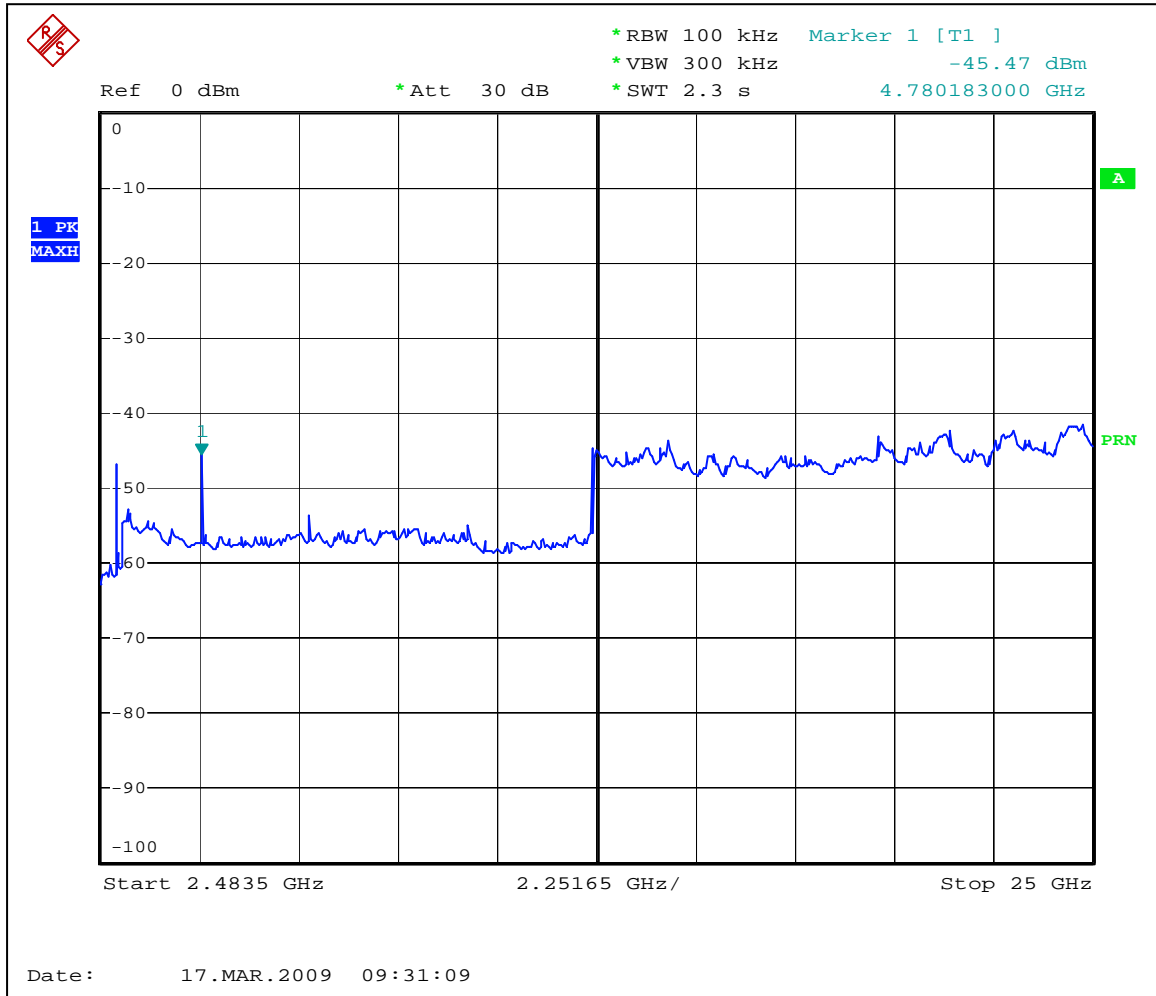
Notes: Test was performed in frequency range from 30MHz to 25GHz
Graphs 3.4.1 to 3.4.3 show the Antenna Conducted Spurious Emissions for channel 0
Graphs 3.4.4 to 3.4.6 show the Antenna Conducted Spurious Emissions for channel 7
Graphs 3.4.7 to 3.4.9 show the Antenna Conducted Spurious Emissions for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



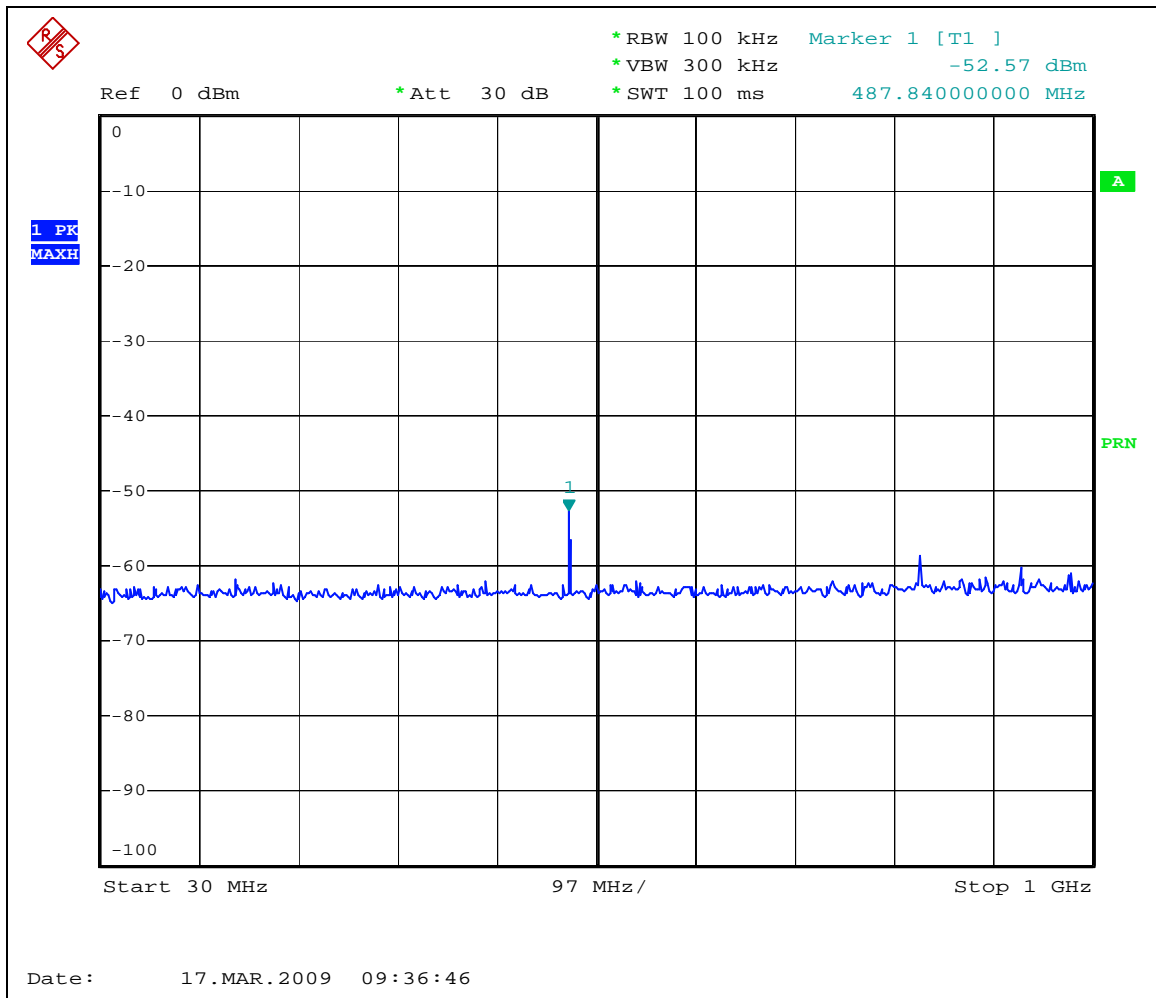
Graph 3.4.1



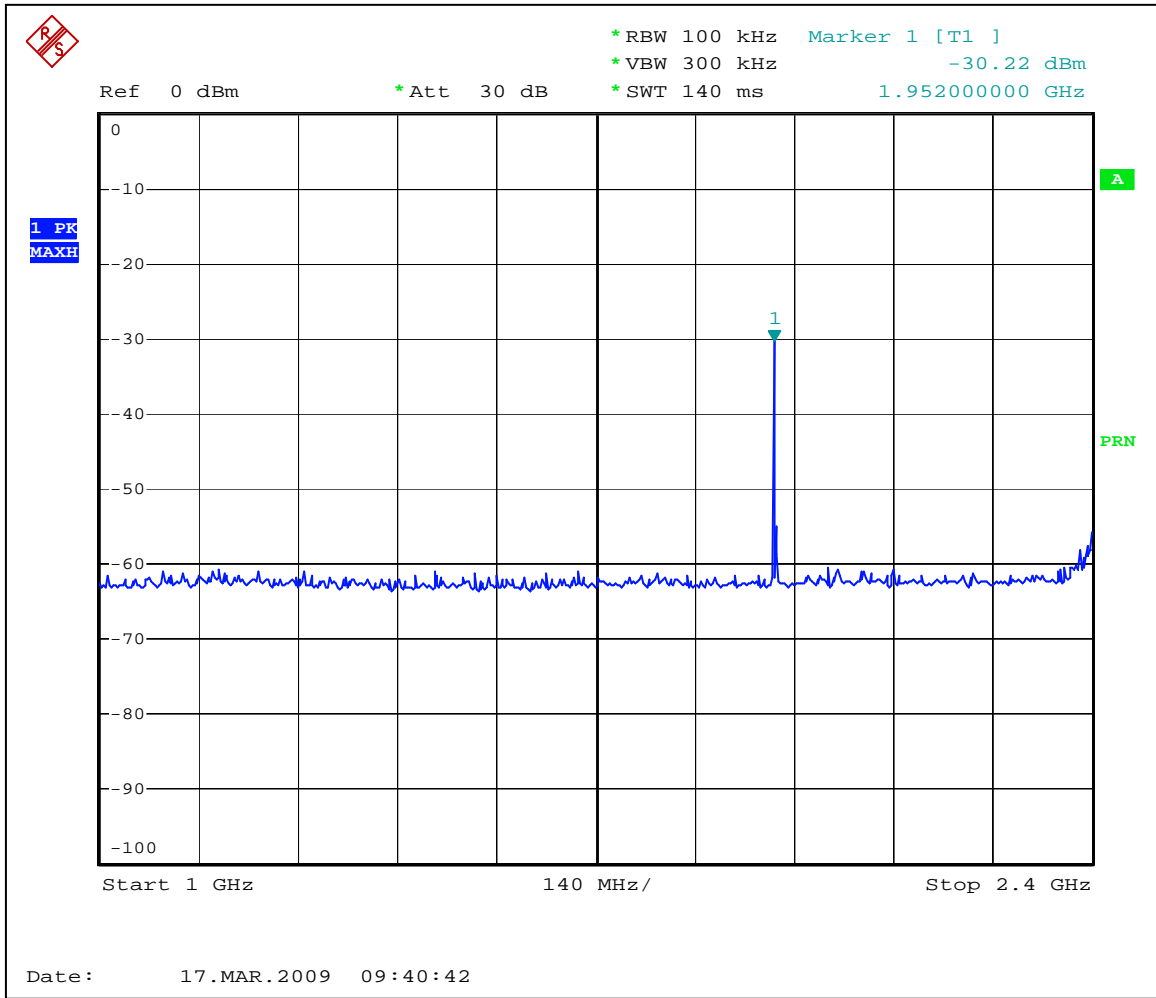
Graph 3.4.2



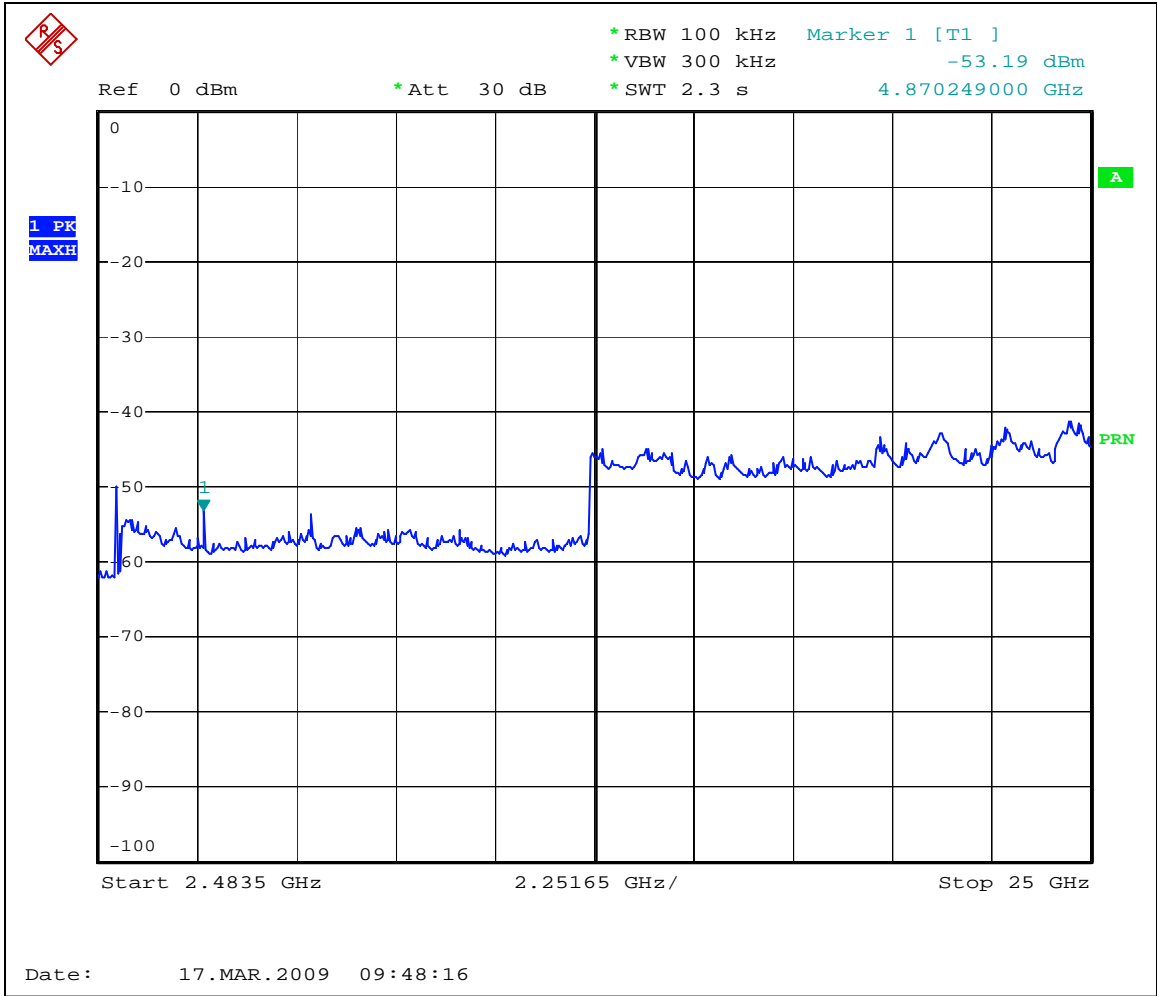
Graph 3.4.3



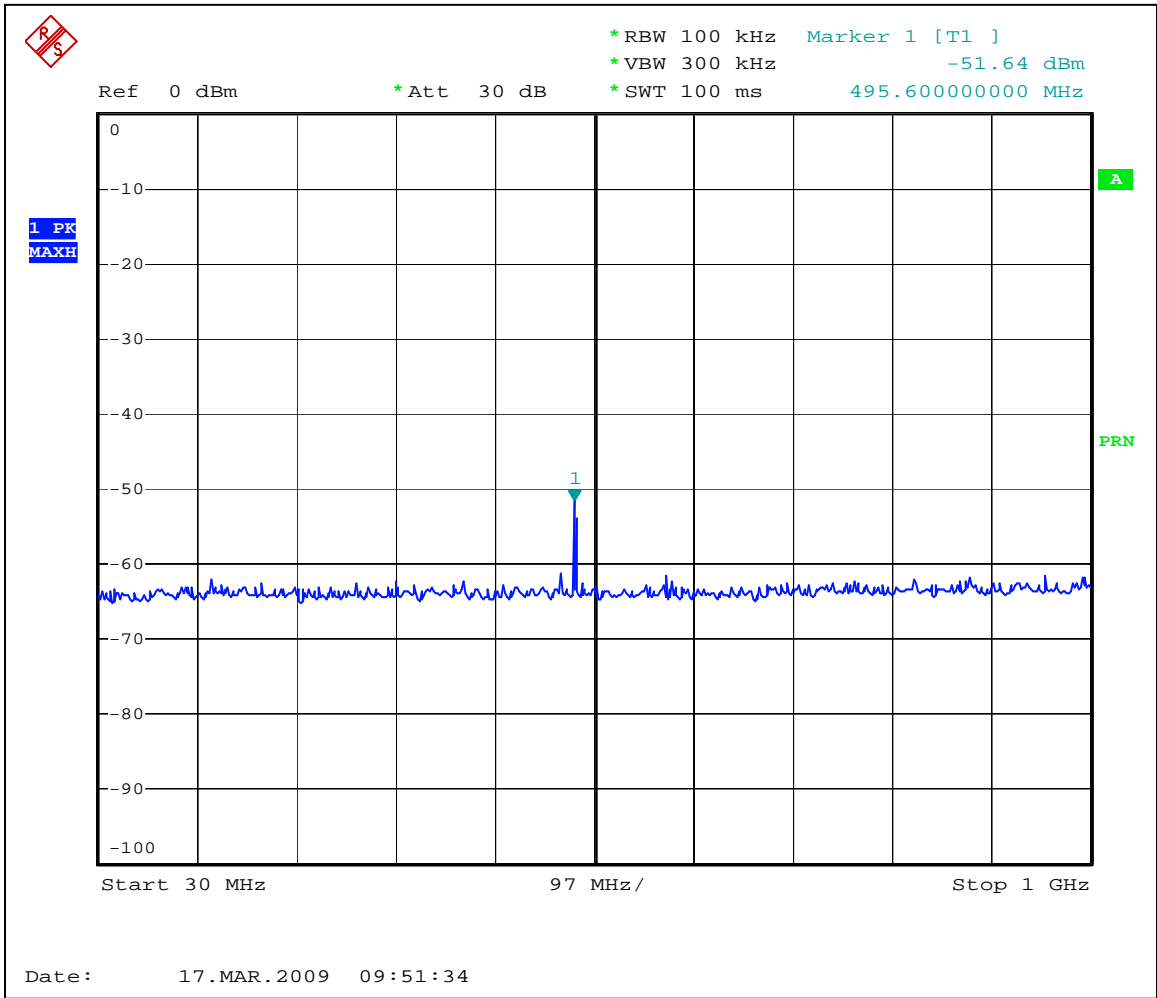
Graph 3.4.4



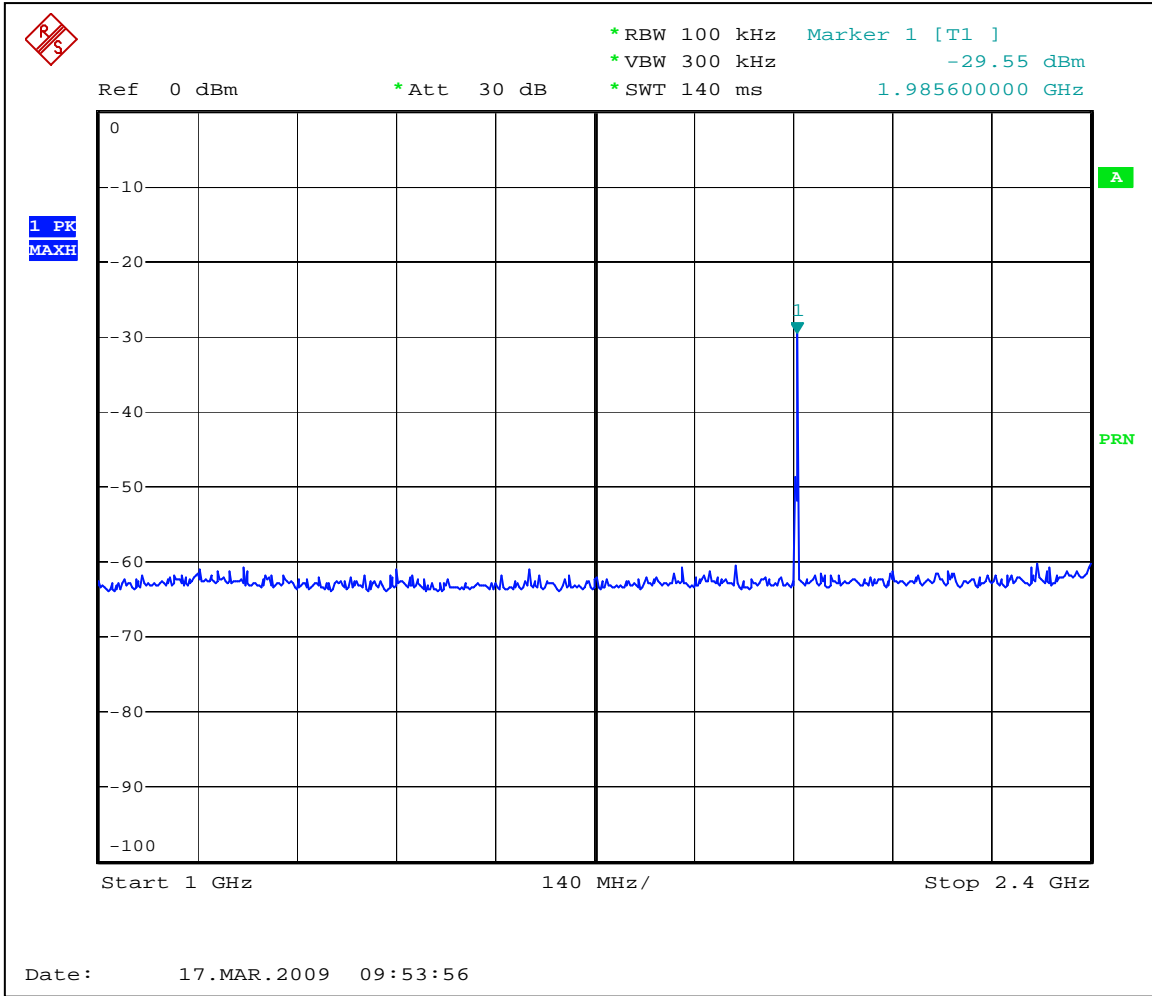
Graph 3.4.5



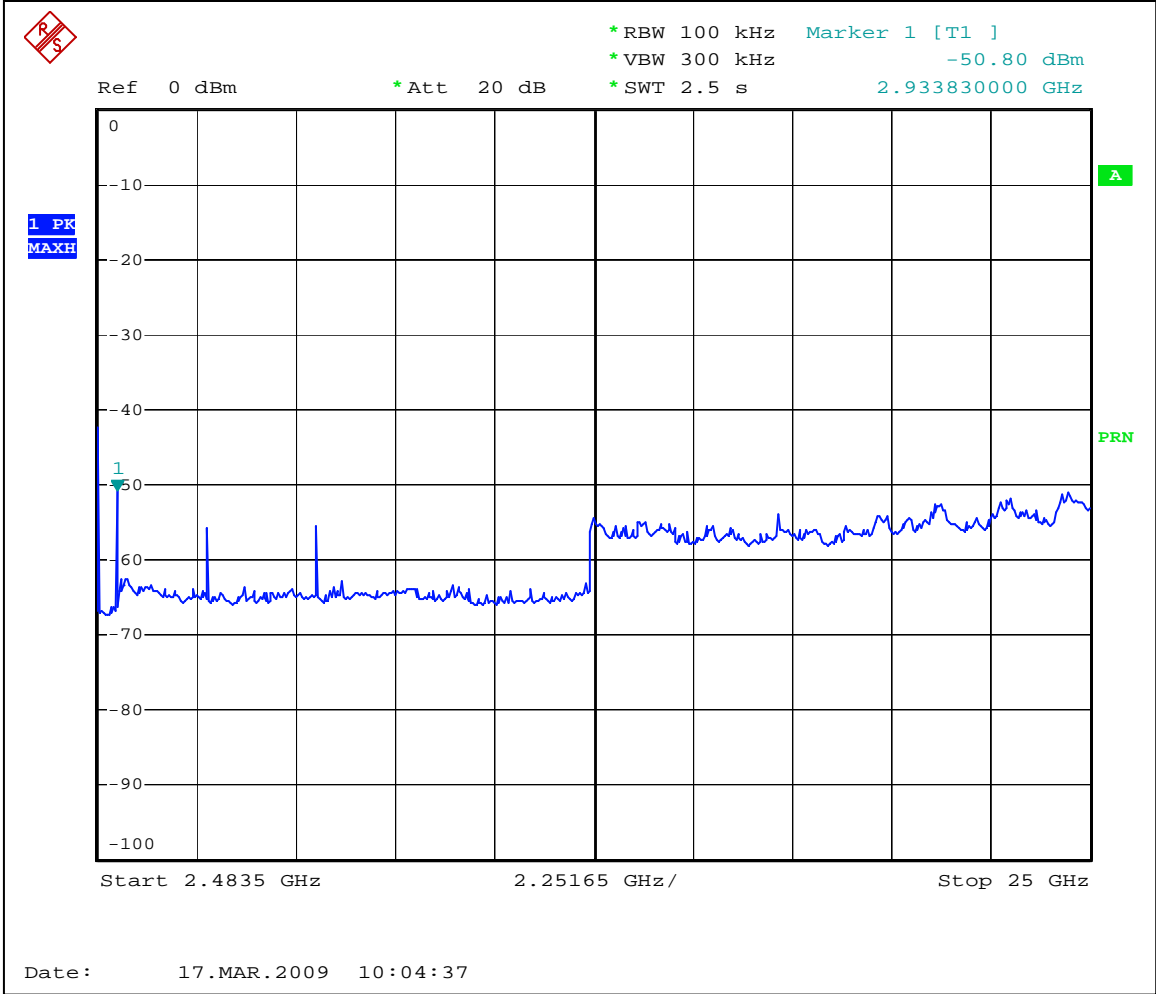
Graph 3.4.6



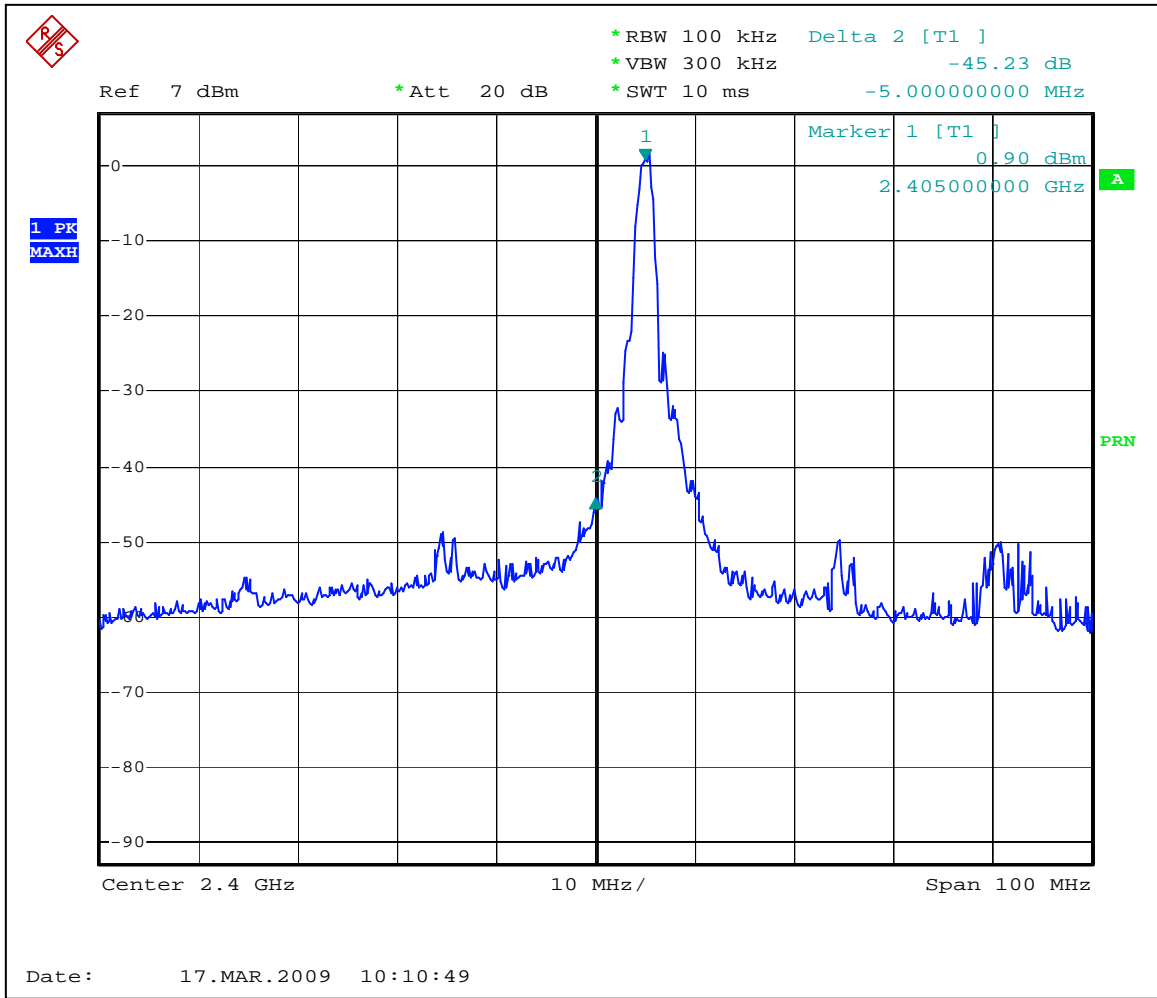
Graph 3.4.7



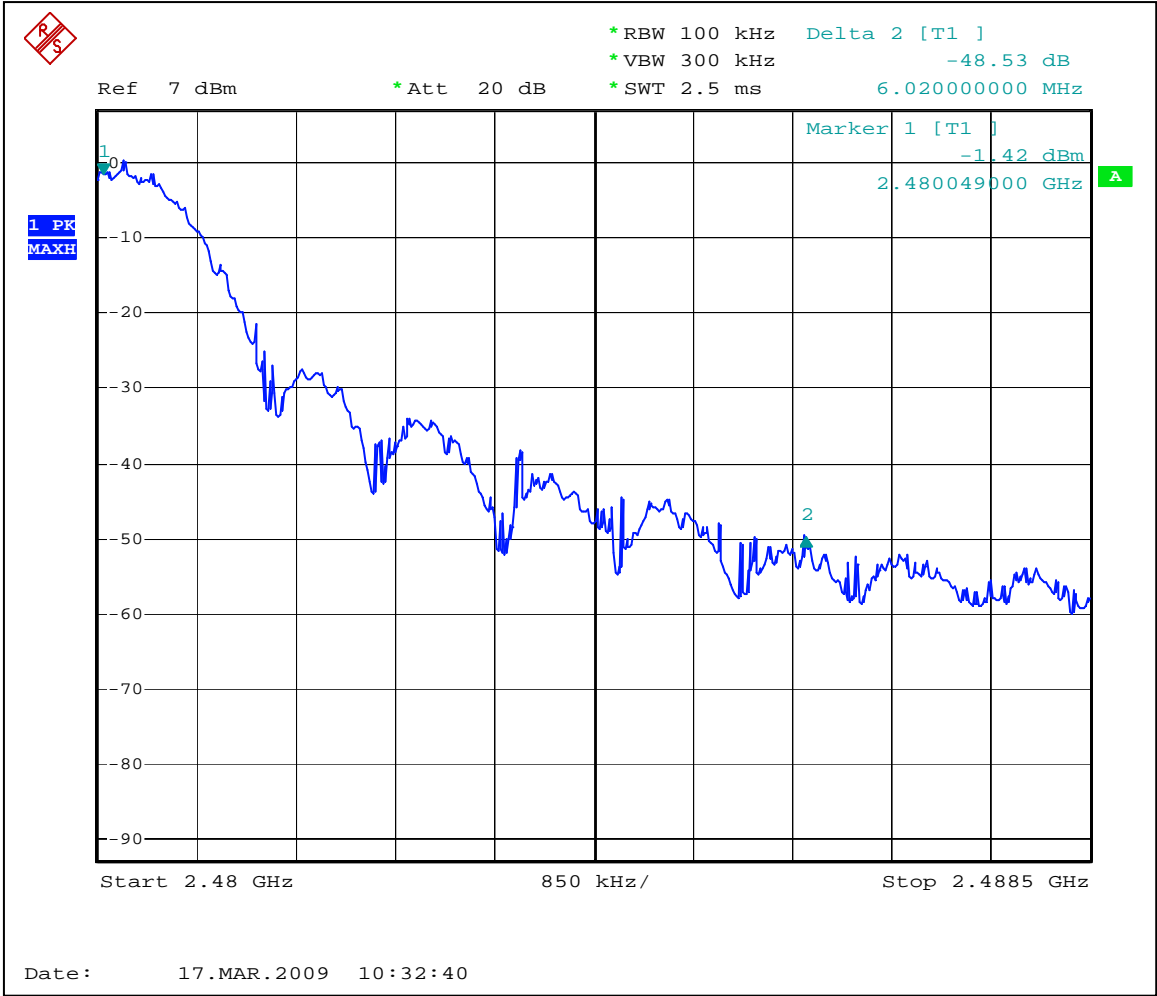
Graph 3.4.8



Graph 3.4.9



Graph 3.4.10



Graph 3.4.11



3.5 Radiated spurious emissions

Test location: OATS Anechoric Chamber

Test distance: 10 meters 3 meters

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

Test result: **Pass**

Max. Margin: 5.3 dB below the limits

Notes: The table 3.5.1 shows the 2nd and 3rd harmonics in restricted band of operation per FCC 15.205
No emissions were detected above ambient at 5th and above harmonics

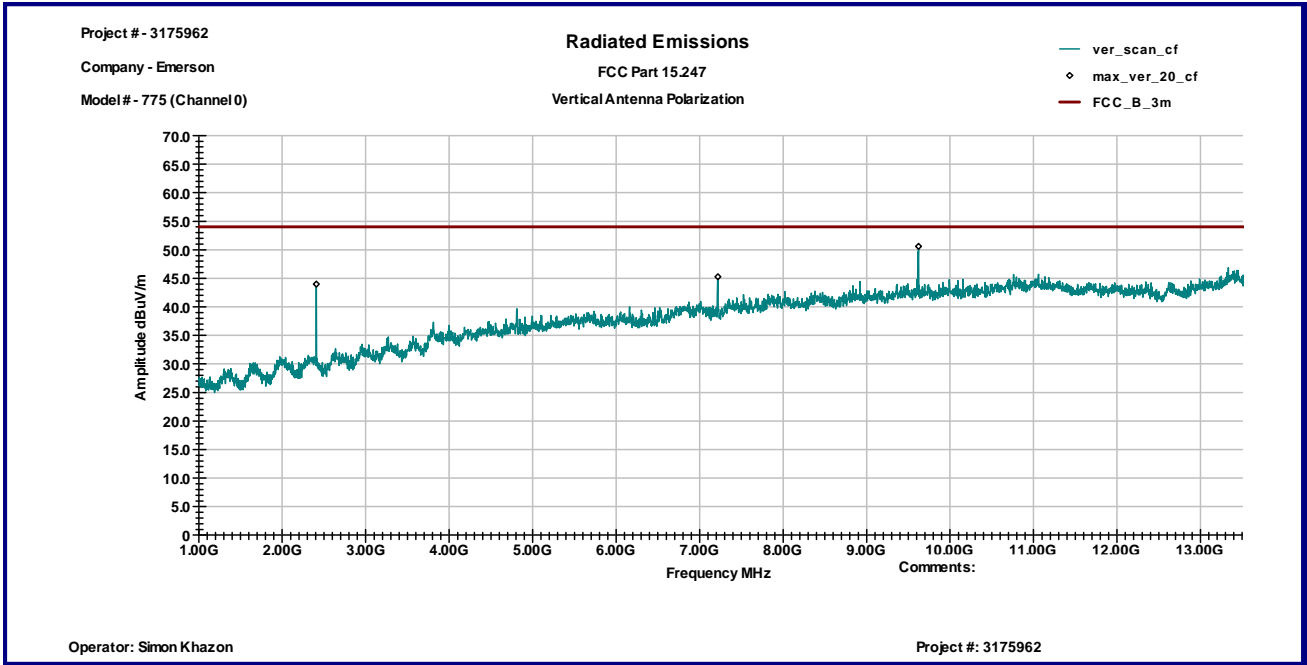


Date:	March 13, 2009	Result: Pass
Standard:	FCC part 15.247(d)	
Tested by:	Simon Khazon	
Test Point:	Enclosure with Antenna	
Operation mode:	See Page 5	
Note:		

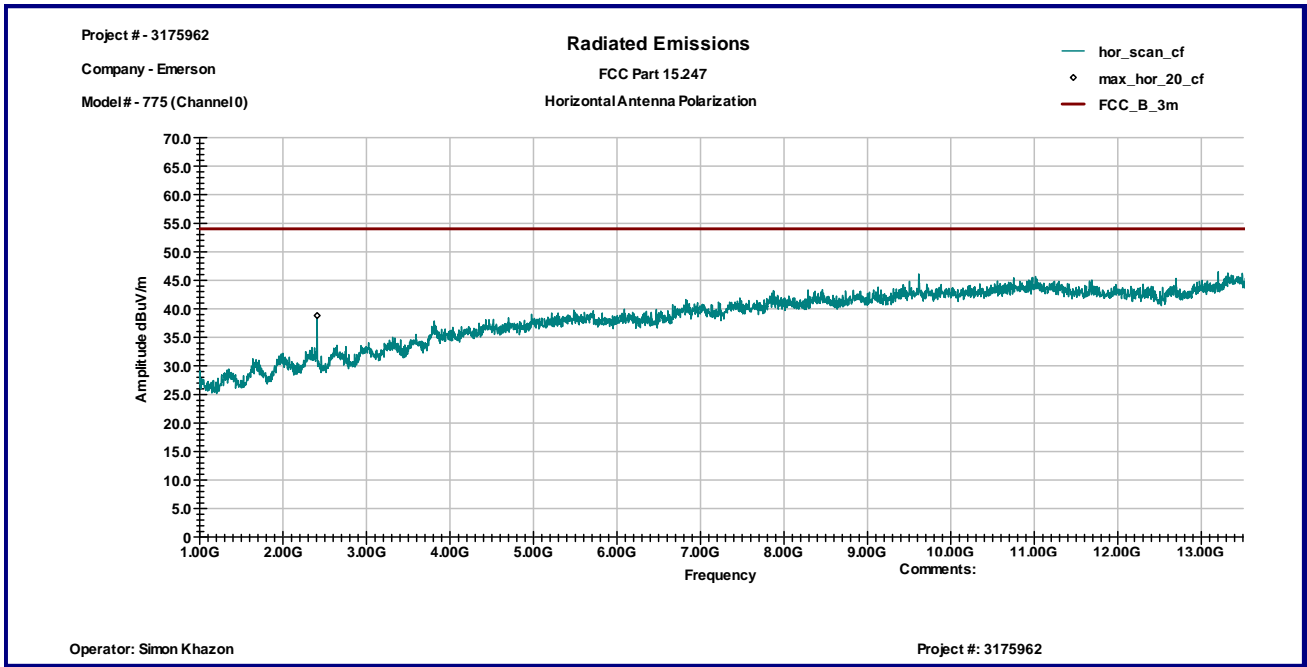
Table 3.5.1

Frequency MHz	Antenna Polarity	Peak Reading dB μ V	Total C.F. dB1/m	Pre-Amp. Gain (dB)	Total at 3m dB μ V/m	QP Limit dB μ V/m	Margin dB
Channel 0							
7.2186 GHz	V	41.8	43.5	40.0	45.3	54.0	-8.7
Channel 7							
4.8794 GHz	V	43.7	39.5	39.8	43.4	54.0	-10.6
7.3206 GHz	V	40.8	43.8	40.0	44.6	54.0	-9.3
Channel 15							
4.961 GHz		48.7	39.7	39.7	48.6	54.0	-5.3

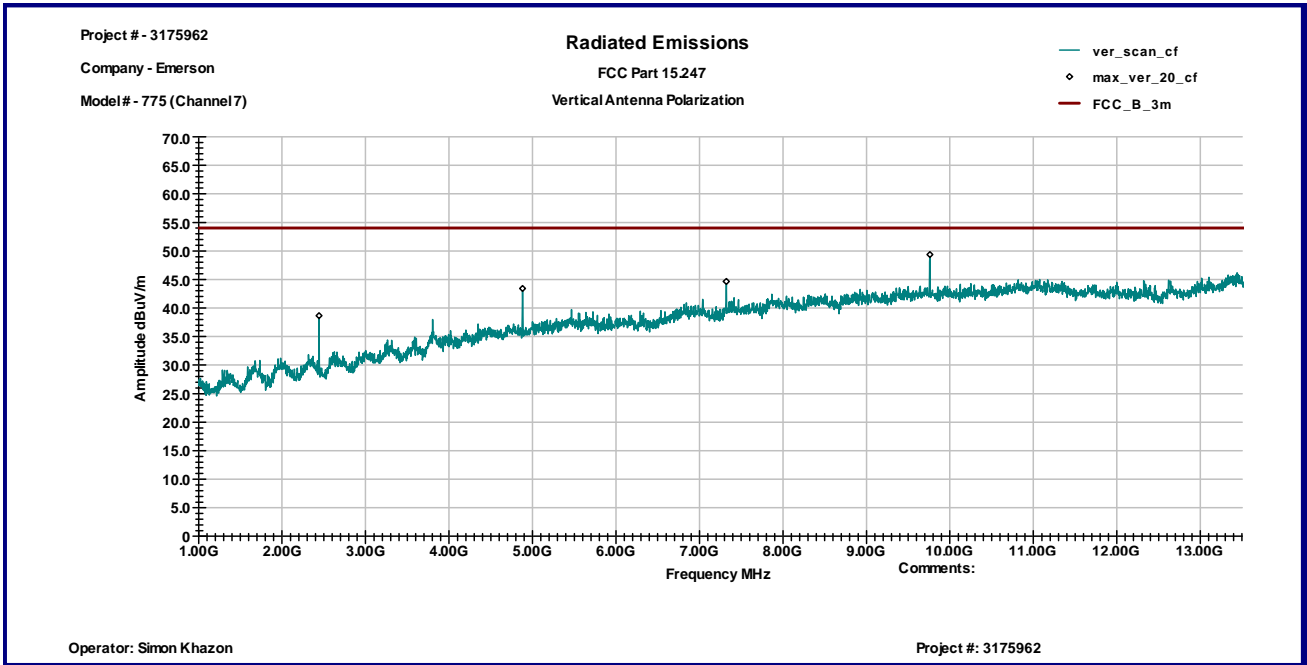
Note: The table shows the 2nd and 3rd harmonics in restricted band of operation per FCC 15.205
No emissions were detected above ambient at 5th and above harmonics



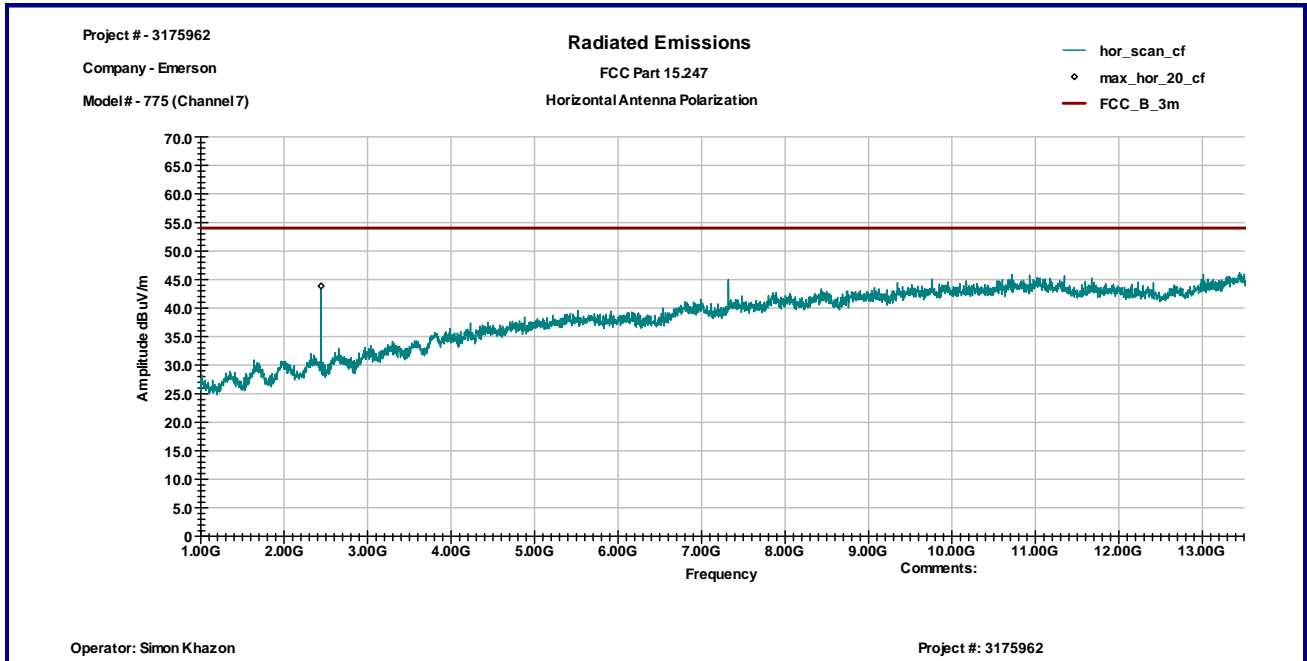
Graph 3.5.1



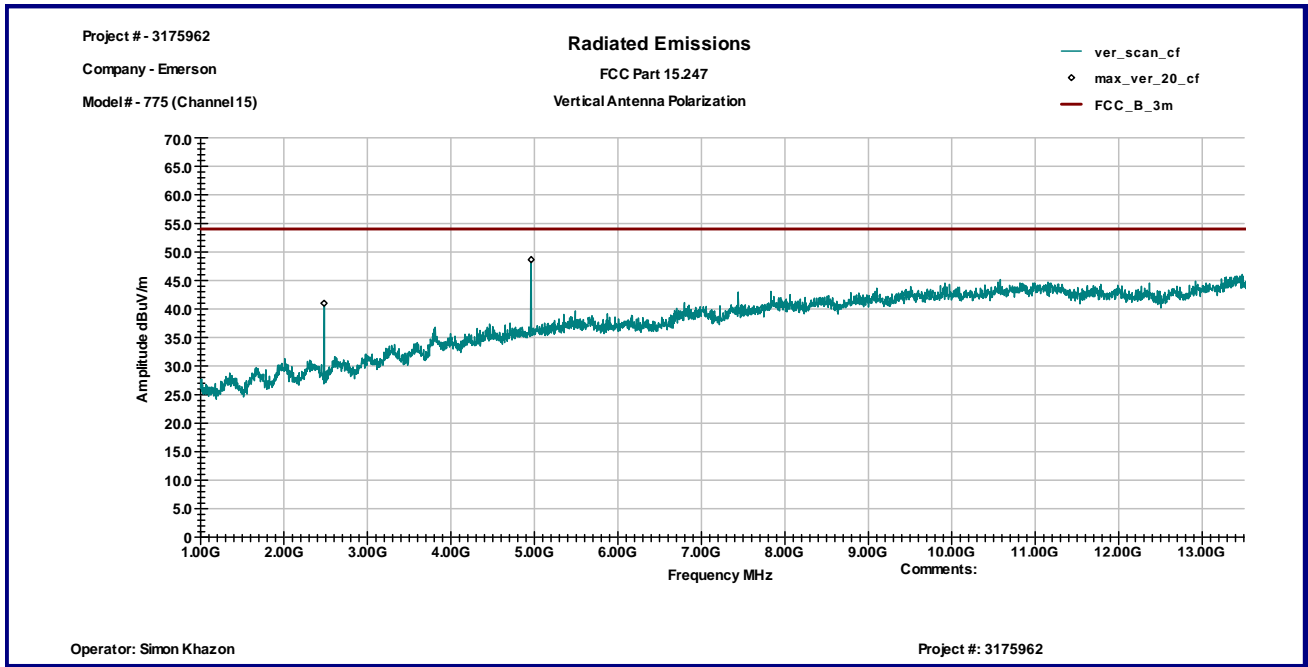
Graph 3.5.2



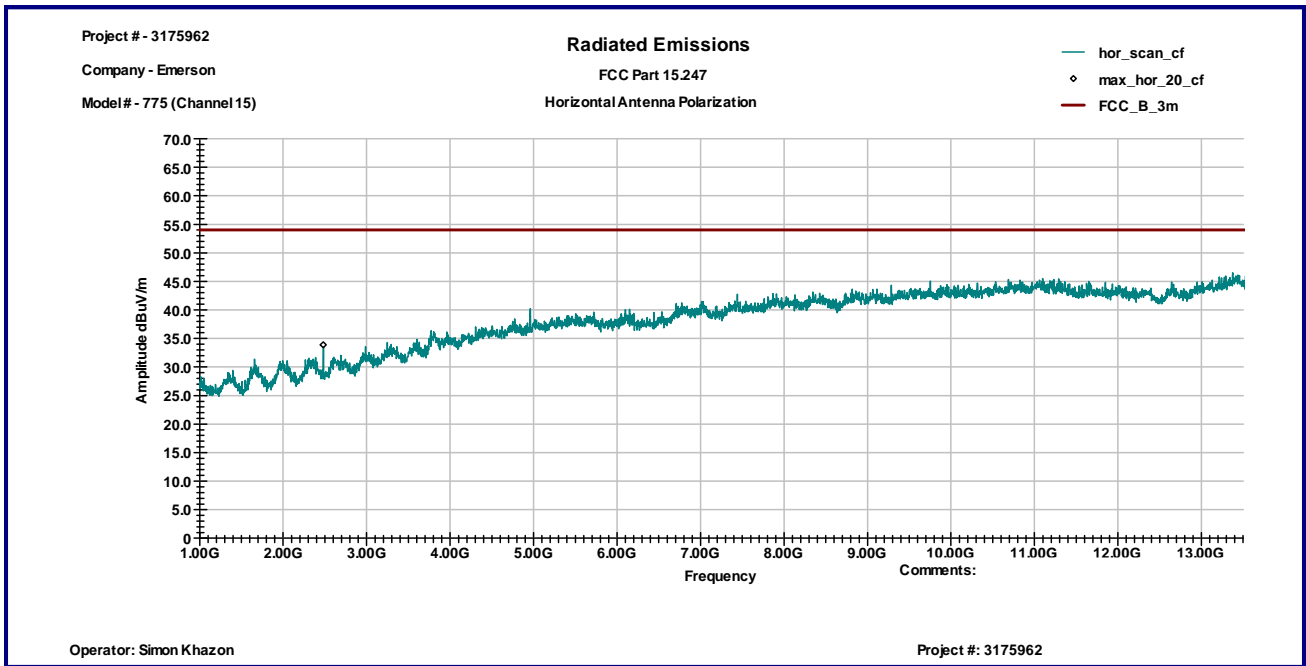
Graph 3.5.3



Graph 3.5.4



Graph 3.5.5



Graph 3.5.6



3.6 RF Exposure Compliance

The maximum measured antenna conducted power, P is 4.6dBm

The antenna gain, G is 2dBi

The maximum EIRP power = P + G
ERP = 4.6+ 2= 6.6dBm, or 0.00457W

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 $10 = 0.00457 / 4\pi D^2$,

The minimum safe separation distance, D = 0.6cm, which is below 20cm



3.7 Transmitter power line conducted emissions

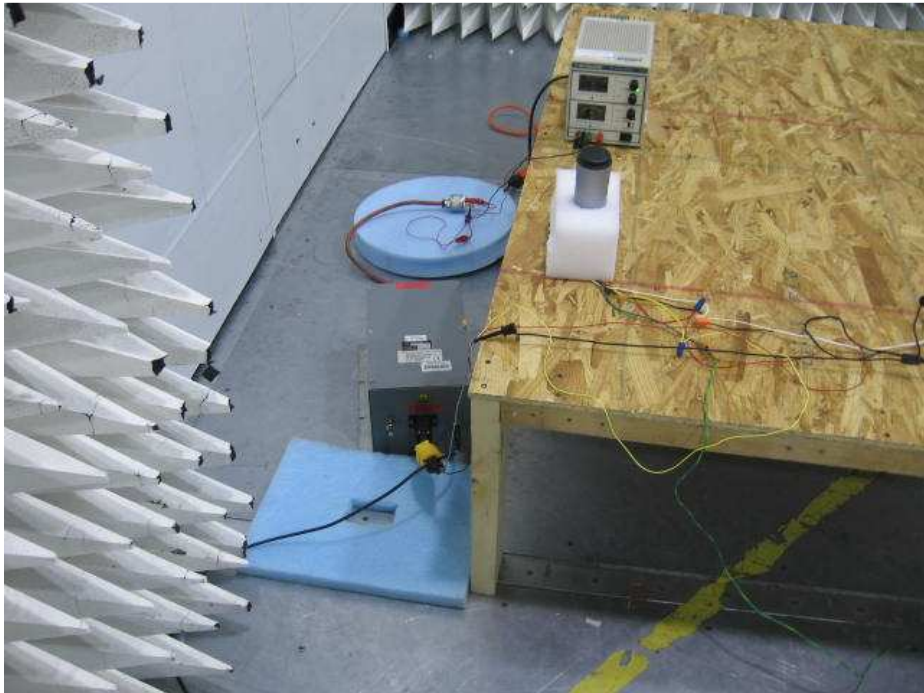
Test location: OATS Anechoic Chamber Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 17.4dB below the limits

Notes: Test was performed on the DC power lines.



Test Setup Photos



Date:	March 18, 2009	Result: Pass
Standard:	FCC Part 15.107, Class B	
Tested by:	Uri Spector	
Test Point:	Line 1 and Line 2	
Operation mode:	Transmitting mode	
Note:		

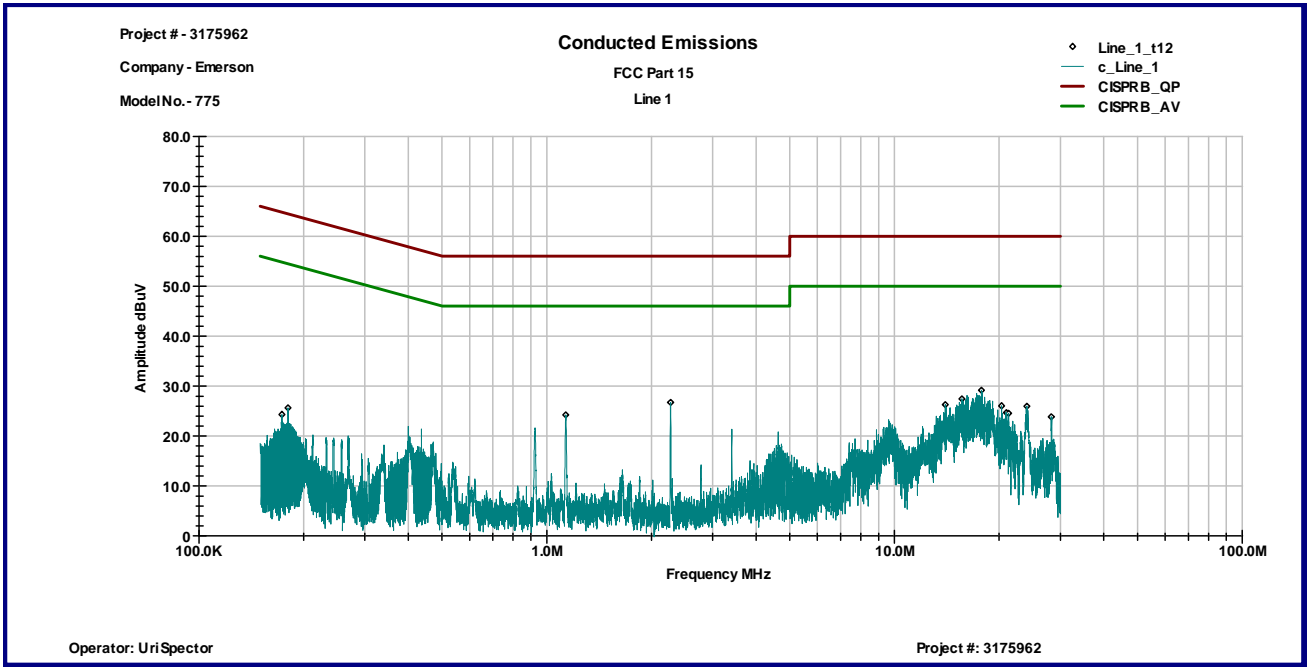
Table 3.7.1

Line 1

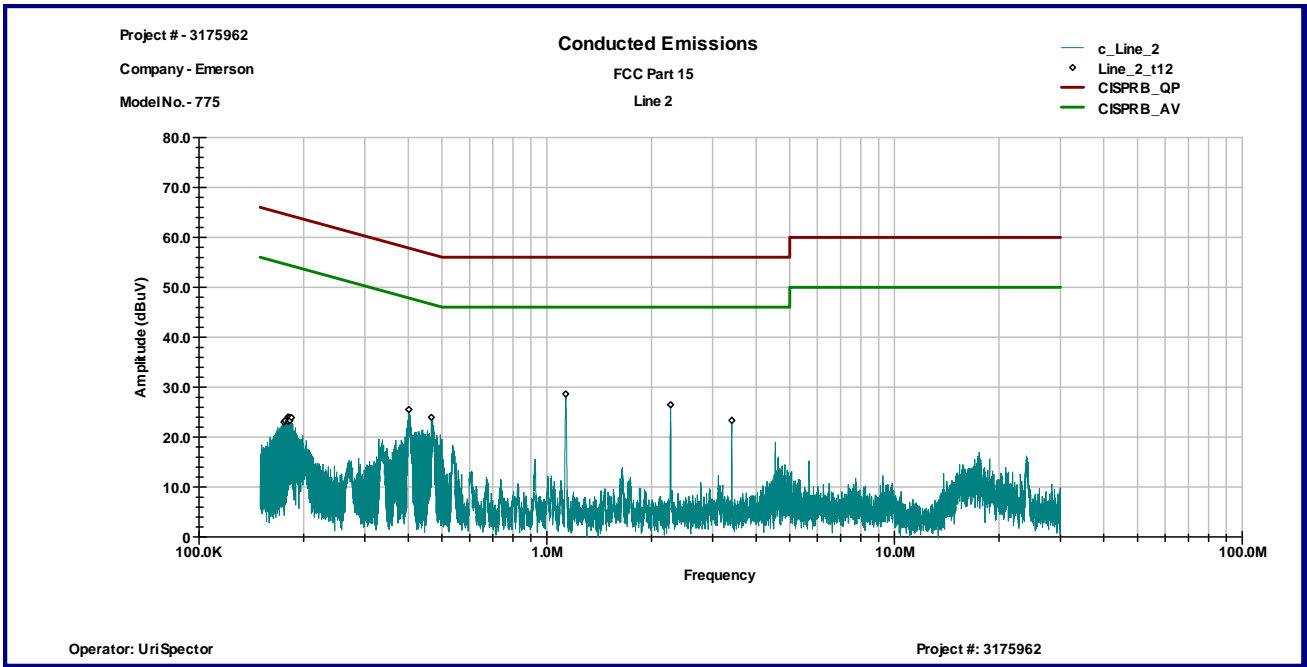
Frequency	Peak dB μ V	QP Limit dB μ V	AVG Limit dB μ V	QP Margin dB	AVG Margin dB
173.3 KHz	24.3	64.8	54.8	-40.5	-30.5
180.45 KHz	25.7	64.5	54.5	-38.8	-28.8
1.1346 MHz	24.2	56.0	46.0	-31.8	-21.8
2.2688 MHz	26.8	56.0	46.0	-29.3	-19.3
13.988 MHz	26.3	60.0	50.0	-33.7	-23.7
15.621 MHz	27.4	60.0	50.0	-32.6	-22.6
17.773 MHz	29.2	60.0	50.0	-30.8	-20.8
20.302 MHz	26.1	60.0	50.0	-34.0	-24.0
21.27 MHz	24.6	60.0	50.0	-35.5	-25.5
24.007 MHz	26.0	60.0	50.0	-34.0	-24.0
28.218 MHz	23.9	60.0	50.0	-36.1	-26.1

Line 2

Frequency	Peak dB μ V	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
175.56 KHz	23.1	64.7	54.7	-41.7	-31.7
180.14 KHz	24.0	64.5	54.5	-40.5	-30.5
182.08 KHz	24.0	64.4	54.4	-40.4	-30.4
184.64 KHz	23.9	64.3	54.3	-40.4	-30.4
401.17 KHz	25.5	57.8	47.8	-32.3	-22.3
465.95 KHz	24.0	56.6	46.6	-32.6	-22.6
1.1346 MHz	28.6	56.0	46.0	-27.4	-17.4
2.2698 MHz	26.5	56.0	46.0	-29.5	-19.5
3.4036 MHz	23.4	56.0	46.0	-32.6	-22.6



Graph 3.7.1



Graph 3.7.2



3.8 Receiver/digital device radiated emissions

Test location: OATS Anechoric Chamber

Test distance: 10 meters 3 meters

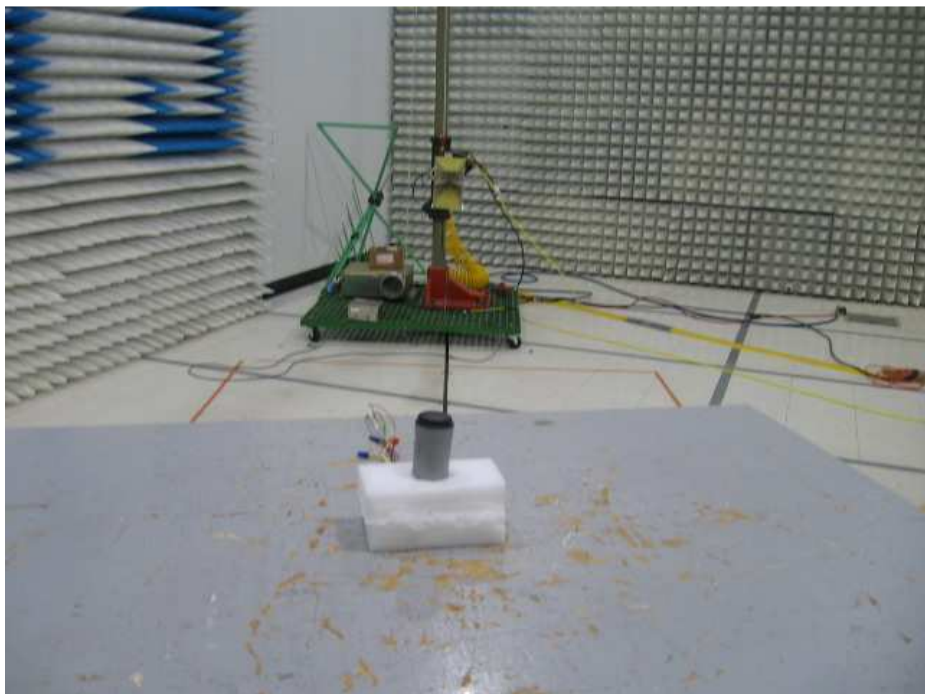
Frequency Range: 30MHz to 12.5GHz (5th Harmonic)

Test result: **Pass**

Frequency range: 30MHz-12.5GHz

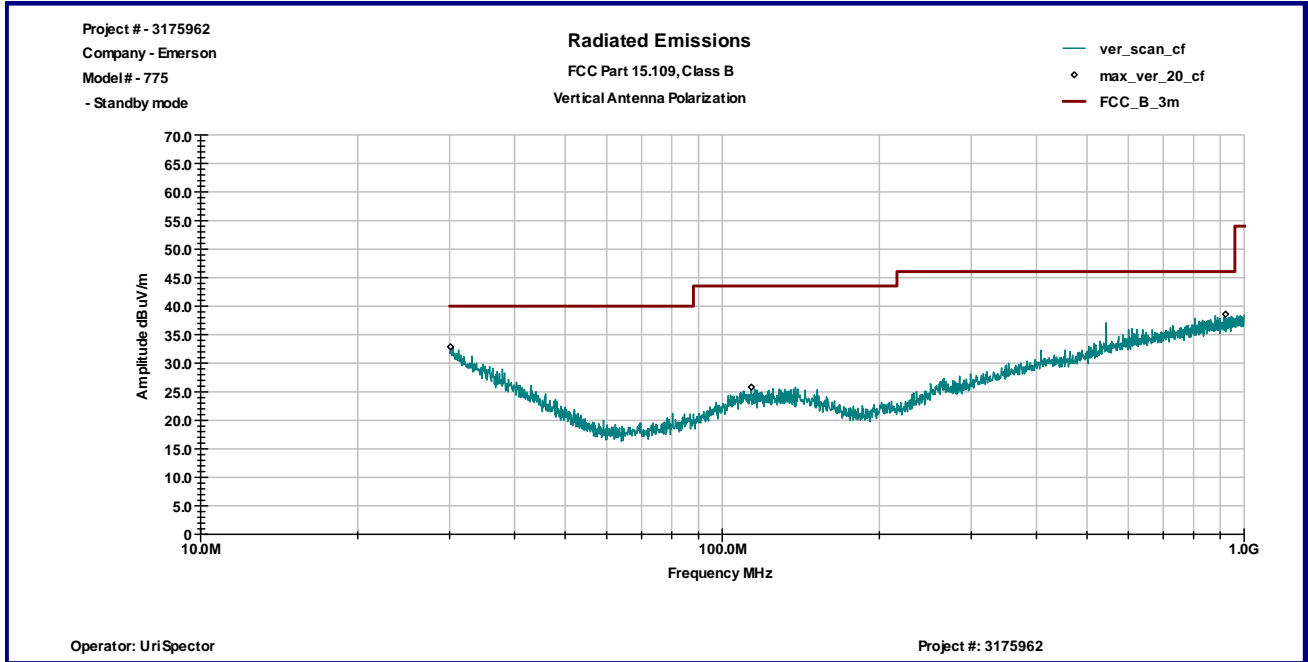
Max. Emissions margin: dB below the limits

Notes: No Radiated Emissions were detected in the frequency range 30MHz-12.5GHz (see Graphs 3.8.1-3.8.4)

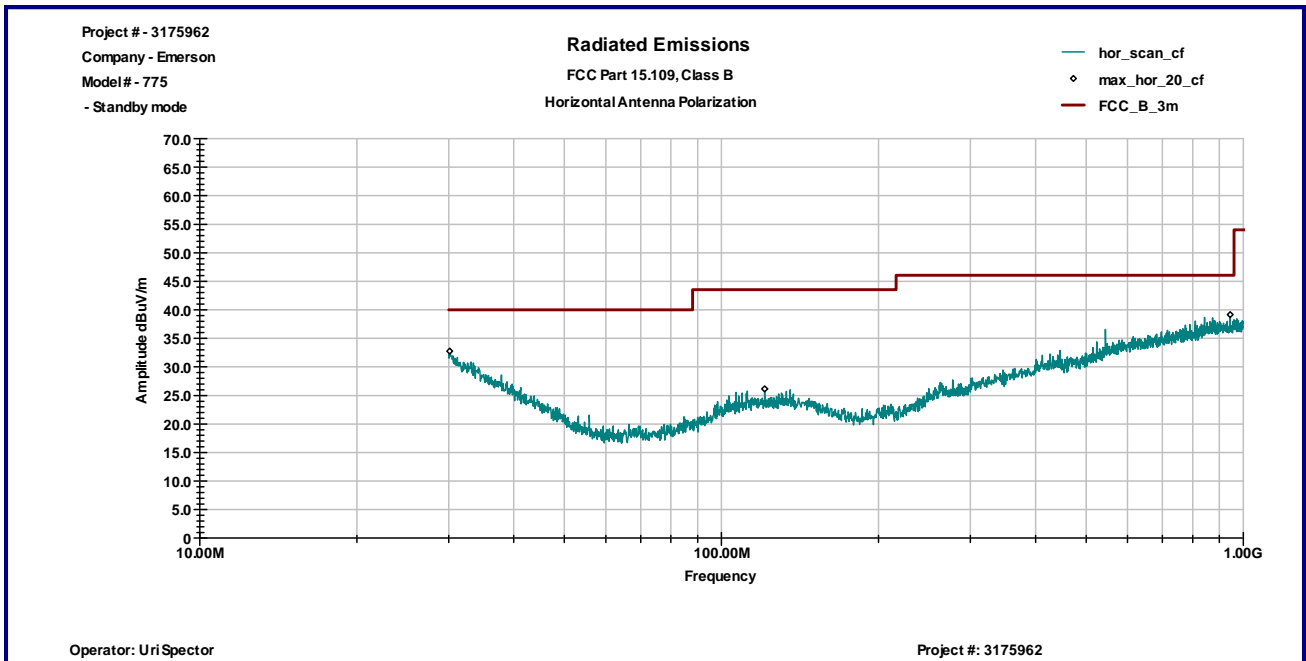


Test Setup Photos

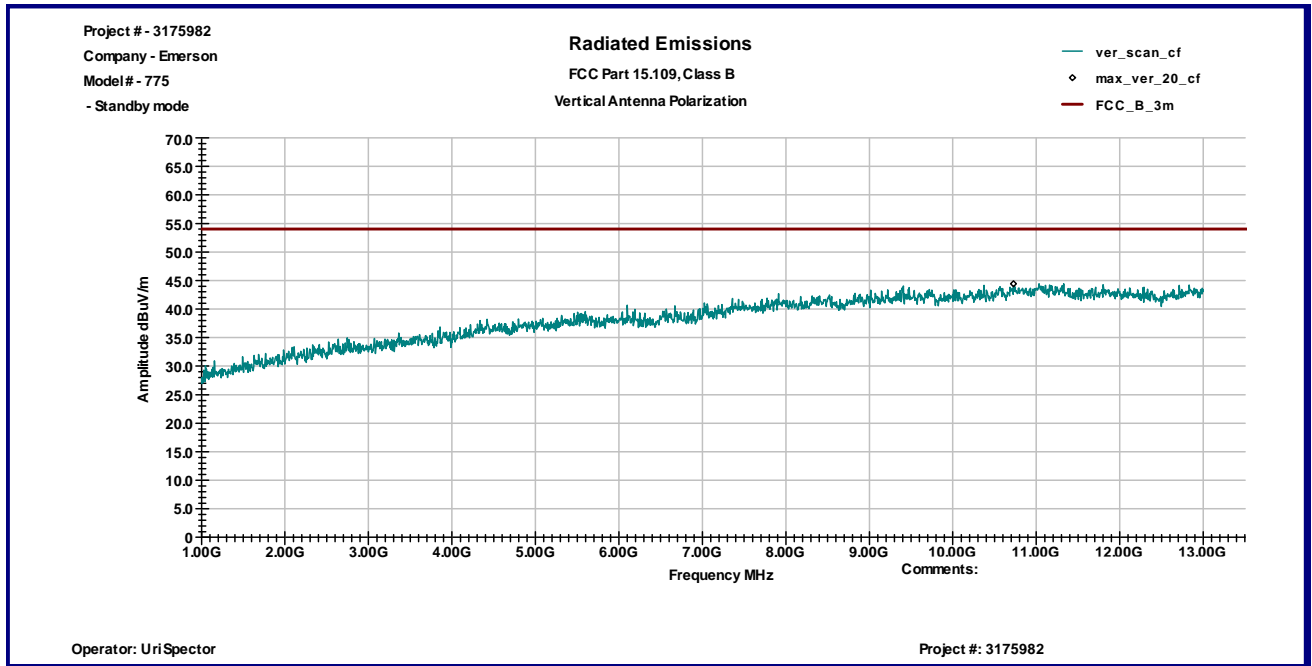
Date:	March 18, 2009	Result: Pass
Standard:	FCC Part 15.109, Class B	
Tested by:	Uri Spector	
Test Point:	Enclosure	
Operation mode:	Stand by	
Note:		



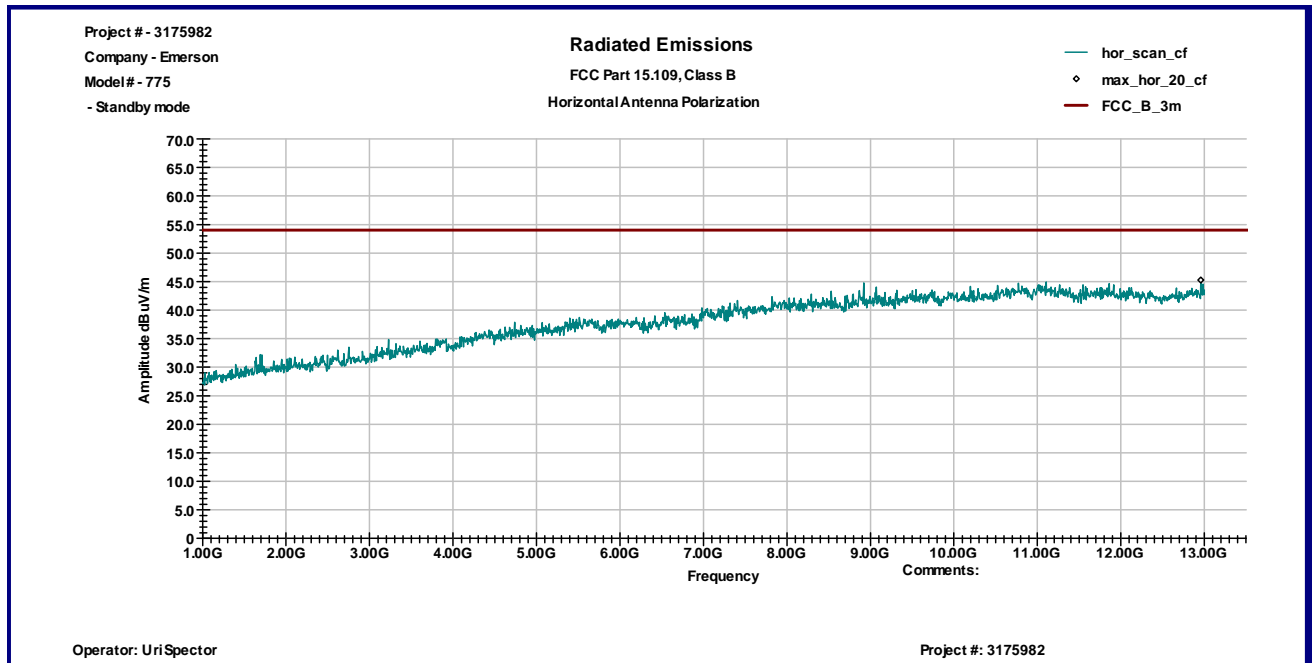
Graph 3.8.1



Graph 3.8.2



Graph 3.8.3



Graph 3.8.4



3.9 Digital device conducted emissions

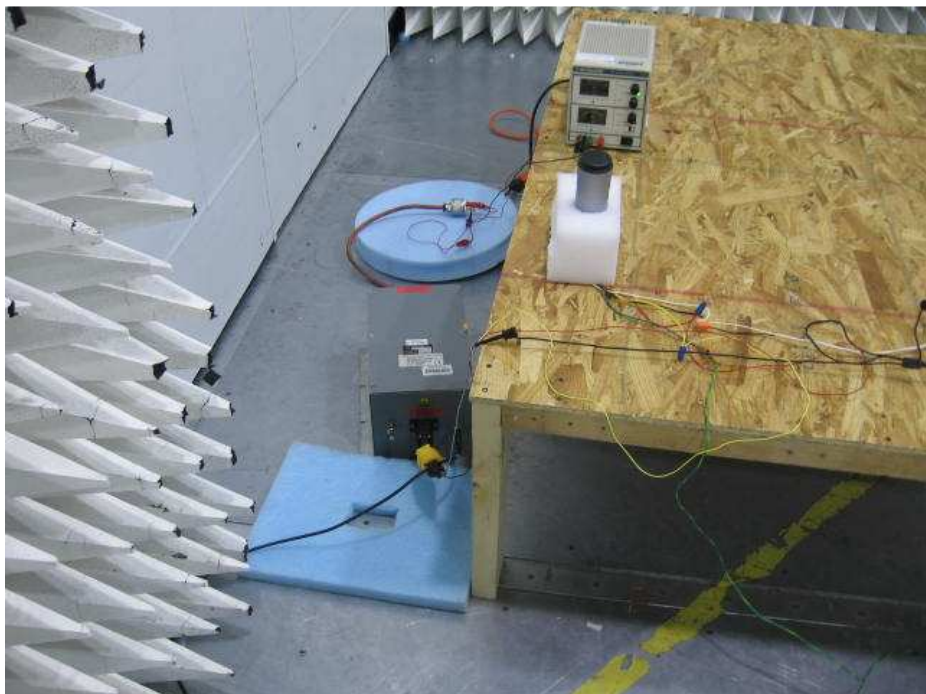
Test location: OATS Anechoic Chamber Other

Test result: **Pass**

Frequency range: 0.15MHz-30MHz

Max. Emissions margin: 17.6dB below the limits

Notes: Test was performed on the DC power lines



Test Setup Photos



Date:	March 18, 2009	Result: Pass
Standard:	FCC Part 15.107, Class B	
Tested by:	Uri Spector	
Test Point:	Line 1 and Line 2	
Operation mode:	Standby mode	
Note:		

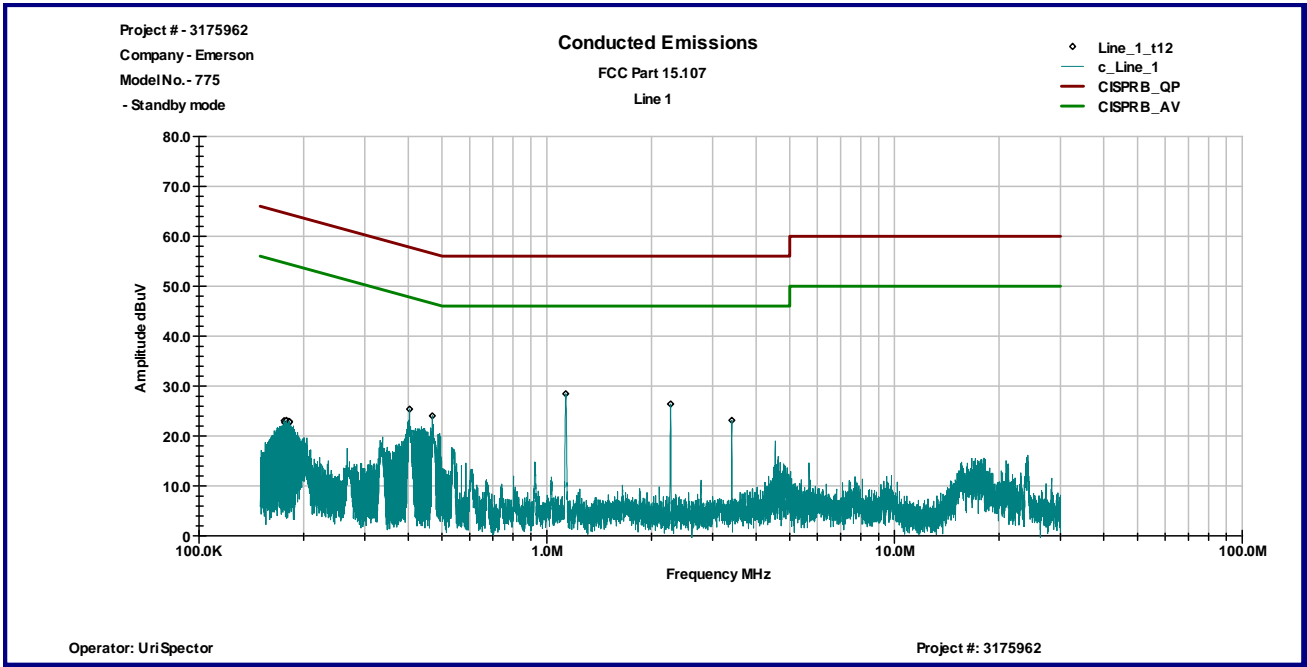
Table 3.9.1

Line 1

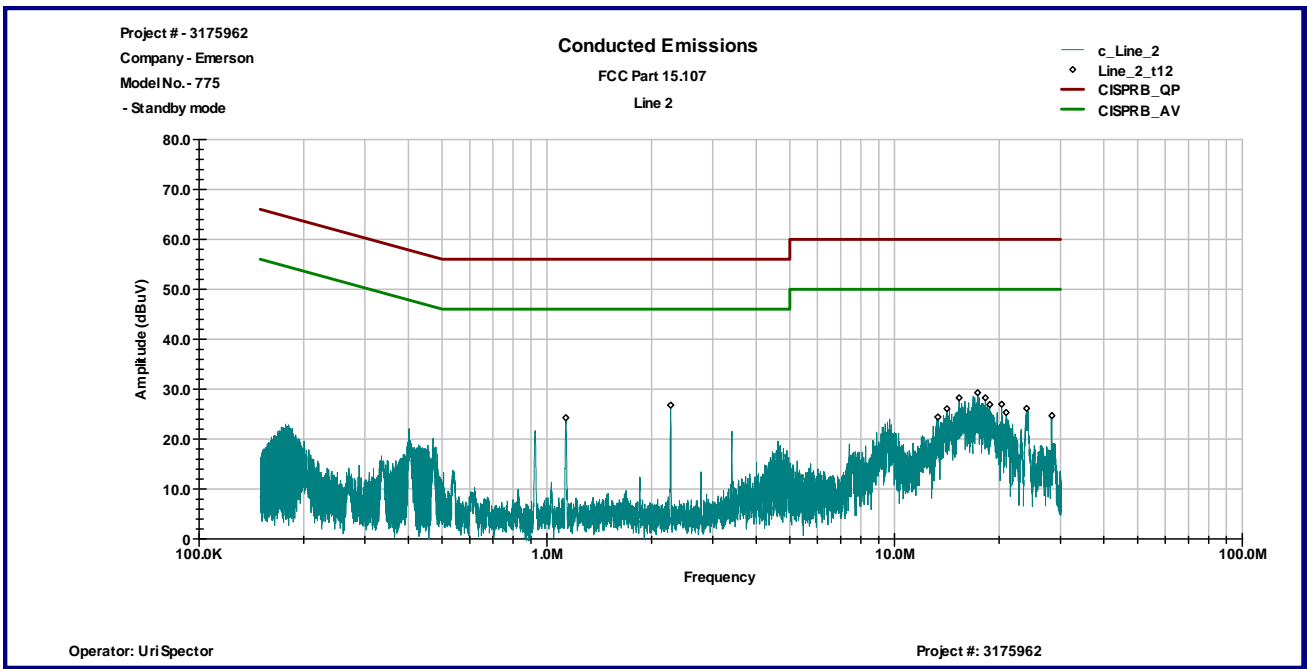
Frequency	Peak dB μ V	QP Limit dB μ V	AVG Limit dB μ V	QP Margin dB	AVG Margin dB
175.71 KHz	23.1	64.7	54.7	-41.6	-31.6
178.35 KHz	23.2	64.6	54.6	-41.4	-31.4
181.61 KHz	23.0	64.4	54.4	-41.5	-31.5
403.32 KHz	25.4	57.8	47.8	-32.4	-22.4
468.68 KHz	24.1	56.5	46.5	-32.5	-22.5
1.1346 MHz	28.4	56.0	46.0	-27.6	-17.6
2.2698 MHz	26.4	56.0	46.0	-29.6	-19.6

Line 2

Frequency	Peak dB μ V	QP Limit dBmV	AVG Limit dBmV	QP Margin dB	AVG Margin dB
1.1346 MHz	24.3	56.0	46.0	-31.7	-21.7
2.2698 MHz	26.8	56.0	46.0	-29.2	-19.2
15.318 MHz	28.3	60.0	50.0	-31.7	-21.7
17.338 MHz	29.3	60.0	50.0	-30.7	-20.7
18.231 MHz	28.3	60.0	50.0	-31.7	-21.7
20.302 MHz	27.0	60.0	50.0	-33.0	-23.0
28.292 MHz	24.7	60.0	50.0	-35.3	-25.3



Graph 3.9.1



Graph 3.9.2



4.0 TEST EQUIPMENT

Emissions Equipment

DESCRIPTION	MANUFACTURER	MODEL	SERIAL NO.	INTERTEK ID	CAL DUE	USED
Spectrum Analyzer	R & S	FSP 40	100024	12559	08/22/2009	<input checked="" type="checkbox"/>
Spectrum Analyzer	R & S	ESCI	100358	12909	05/07/2009	<input checked="" type="checkbox"/>
Bicono-Log Antenna	Schaffner-Chase	CBL 6112 B	2468	14459	08/27/2009	<input checked="" type="checkbox"/>
Horn Antenna	EMCO	3115	9507-4513	9936	03/04/2010	<input checked="" type="checkbox"/>
Waveguide Horn Antenna	EMCO	3116	9904-2423	9705	08/12/2009	<input checked="" type="checkbox"/>
LISN	Fischer Custom Communications	FCC-LISN-2 MOD.SD	316	9945	10/28/2009	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-5D-00501800-28-13P	1122951	13475	06/05/2009	<input checked="" type="checkbox"/>
Pre-Amplifier	MITEQ	AMF-6F-16002600-25-10P	1222383	MIN-0065	01/17/2010	<input checked="" type="checkbox"/>
High Pass Filter	Reactel	7HS-4G-S12	0223	015274	VBU	<input checked="" type="checkbox"/>
System	TILE! Instrument Control		Ver. 3.4.K.29	15259	VBU	<input checked="" type="checkbox"/>

