Test report no. : 182222-5

Item tested : CC2510EM

Type of equipment : 2.4GHz Transceiver

FCC ID : ZAT2510EM

Client : Texas Instruments Norway AS

FCC Part 15.247
Digital Transmission System

RSS-210, Issue 8
Low Power Licence-Exempt
Radiocommunication Devices

4 October 2013

Authorized by : .....
Frode Sveinsen
Technical Verificator

Nemko AS, Gaustadalléen 30, P.O.Box 73 Blindern, NO-0314 Oslo Norway **T** +47 22 96 03 30 **F** +47 22 96 05 50 Enterprise number NO974404532
Visiting address: Nemko Kjeller, Instituttveien 6, P.O.Box 96, NO-2027 Kjeller Norway **T** +47 64 84 57 00 **F** +47 64 84 57 05

CONTENTS

1 GENERAL INFORMATION

1.1 Testhouse Info

Name :	Nemko AS
Address :	Nemko Kjeller Instituttveien 6, Box 96 NO-2027 Kjeller, NORWAY
Telephone :	+47 64 84 57 00
Fax :	+47 64 84 57 05
E-mail:	comlab@nemko.com
FCC test firm :	994405
IC OATS :	2040D-1
Total Number of Pages:	34

1.2 Client Information

Name :	Texas Instruments Norway AS
Address :	Gaustadalléen 21, NO-0349 Oslo, Norway
Telephone :	+47 22 95 85 44
Fax :	+47 22 95 85 46

Contact:

Name :	Dag Grini
Telephone :	+47 22 95 83 01
E-mail :	d.grini@ti.com

1.3 Responsible Manufacturer (If other than client)

Name :	/
Address :	/

2 Test Information

2.1 Test Item

Name :	Texas Instruments
FCC ID :	ZAT2510EM
IC :	451H-2510EM
Model/version :	CC2510EM
Serial number :	/
Hardware identity and/or version:	/
Software identity and/or version :	/
Frequency Range :	2402 – 2480 MHz
Number of Channels :	/
Type of Modulation :	Digital (2-FSK)
Conducted Output Power :	0.0020 W (Peak)
Data rate:	500Kbps
User Frequency Adjustment :	None
Type of Power Supply :	Primary Battery (1x9V)
Antenna Connector :	SMA (Antenna type: W1010)
Antenna Diversity Supported :	No
Desktop Charger :	None

Description of Test Item

The tested EUT is a 2.4GHz transceiver with SMA connector.

Exposure Evaluation

The EUT is exempted from RF Exposure Evaluation.

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	20 – 22 °C
Relative humidity:	27 – 36 %
Normal test voltage:	9.0 V DC

The radiated emissions tests were performed with the EUT powered from a test-jig with 9.0V primary battery.Fully charged battery is used.

The values are the limit registered during the test period.

2.3 Test Period

Item received date:	2011-11-30
Test period :	from 2011-12-02 to 2011-12-06

3 TEST REPORT SUMMARY

3.1 General

All measurements are tracable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-210 Issue 8.

Radiated tests were conducted in accordance with ANSI C63.4-2009 and ANSI C63.10-2009. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-production Unit

DTS 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".

TEST REPORT #: 182222-5

TESTED BY: _____ DATE: 2013-09-05

G.Suhanthakumar, Test engineer

3.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 8 reference	Result
Antenna Requirement	15.203	7.1.4 (RSS-GEN)	Pass
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2.2 (RSS-GEN)	N/A*
Minimum 6 dB Bandwidth	15.247(a)(2)	A8.2	Pass
Peak Power Output	15.247(b)	A8.4	Pass
Power Spectral Density	15.247(d)	A8.2	Pass
Spurious Emissions (Antenna Conducted)	15.247(c)	A8.5	Pass
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	A8.5	Pass
Receiver Emissions (Radiated)	N/A	2.3	Pass

*EUT is battery operated only.

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

All ports were populated during spurious emission measurements.

3.5 Family List Rational

Not Applicable.

4 TEST RESULTS

4.1 Minimum 6 dB Bandwidth

Para. No.: 15.247 (a)(2)

Test Performed By: G.Suhanthakumar	**Date of Test: 6 Dec 2011**

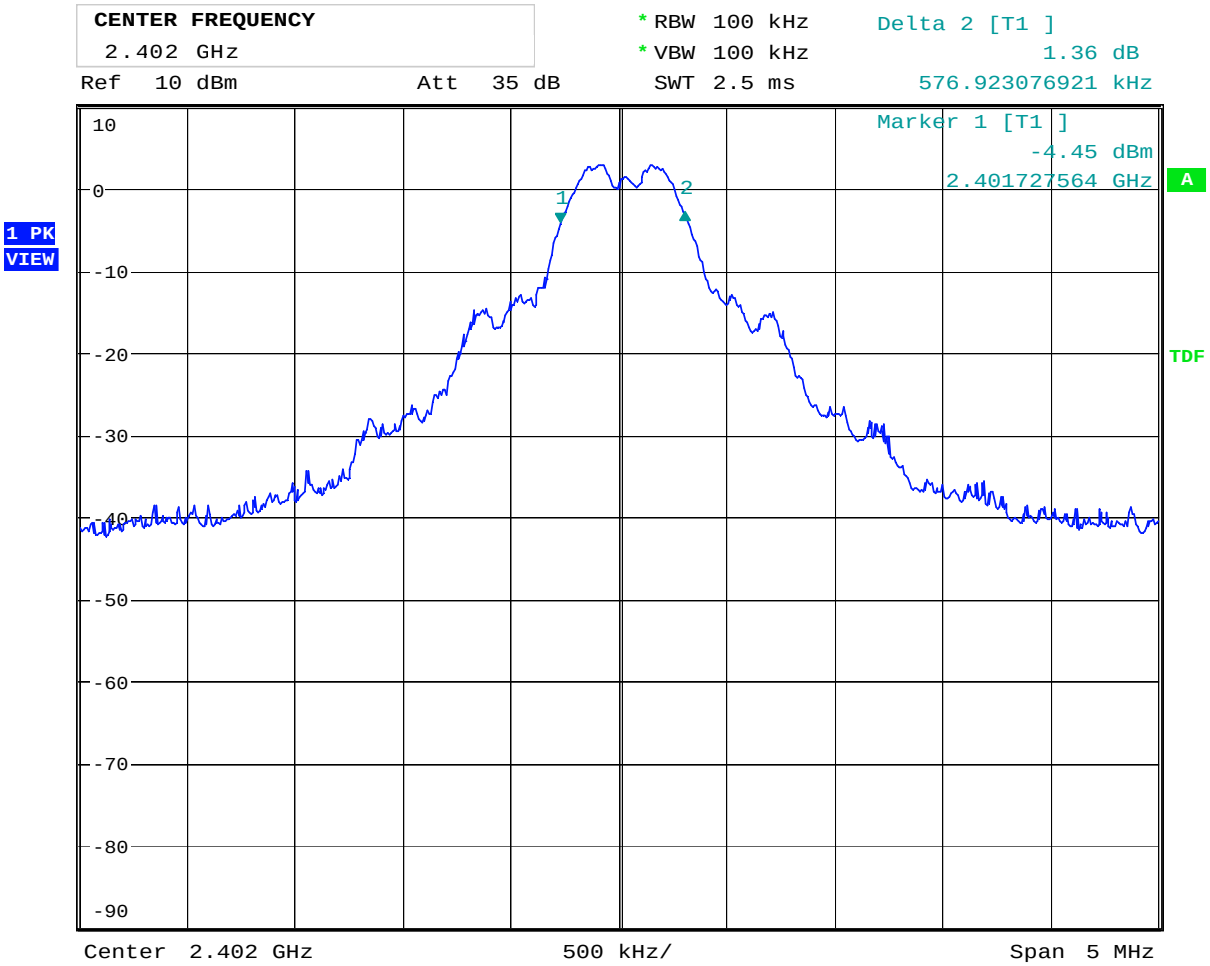
Test Results: Complies

Measurement Data:

Measured 6 dB Bandwidth (kHz)		
2402 MHz	**2440 MHz**	**2480 MHz**
576.9	552.9	584.9

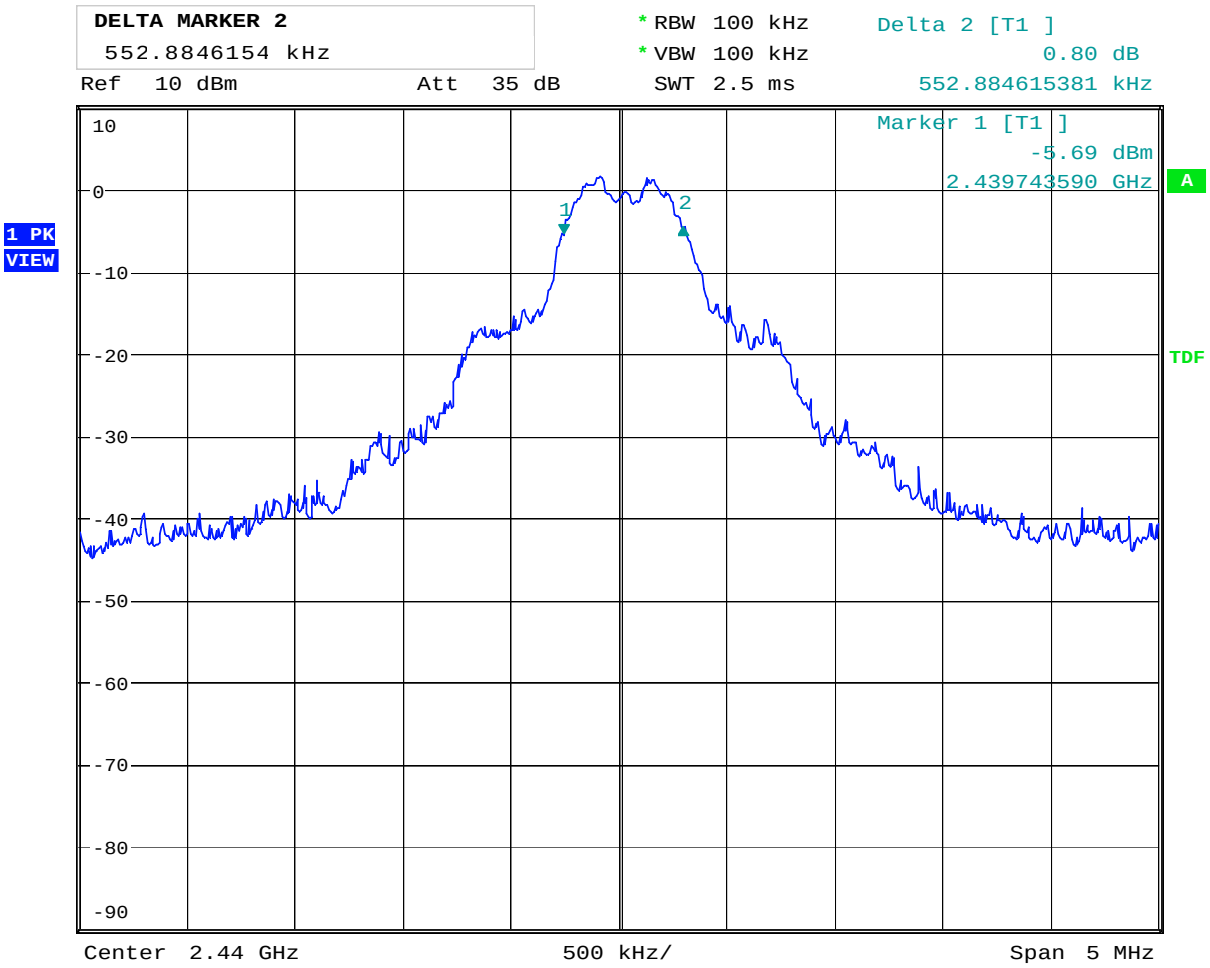
Requirements:

For Digital Transmission Systems in the 2400-2483.5 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.



Date: 6.DEC.2011 09:26:42

6 dB Bandwidth at 2402 MHz



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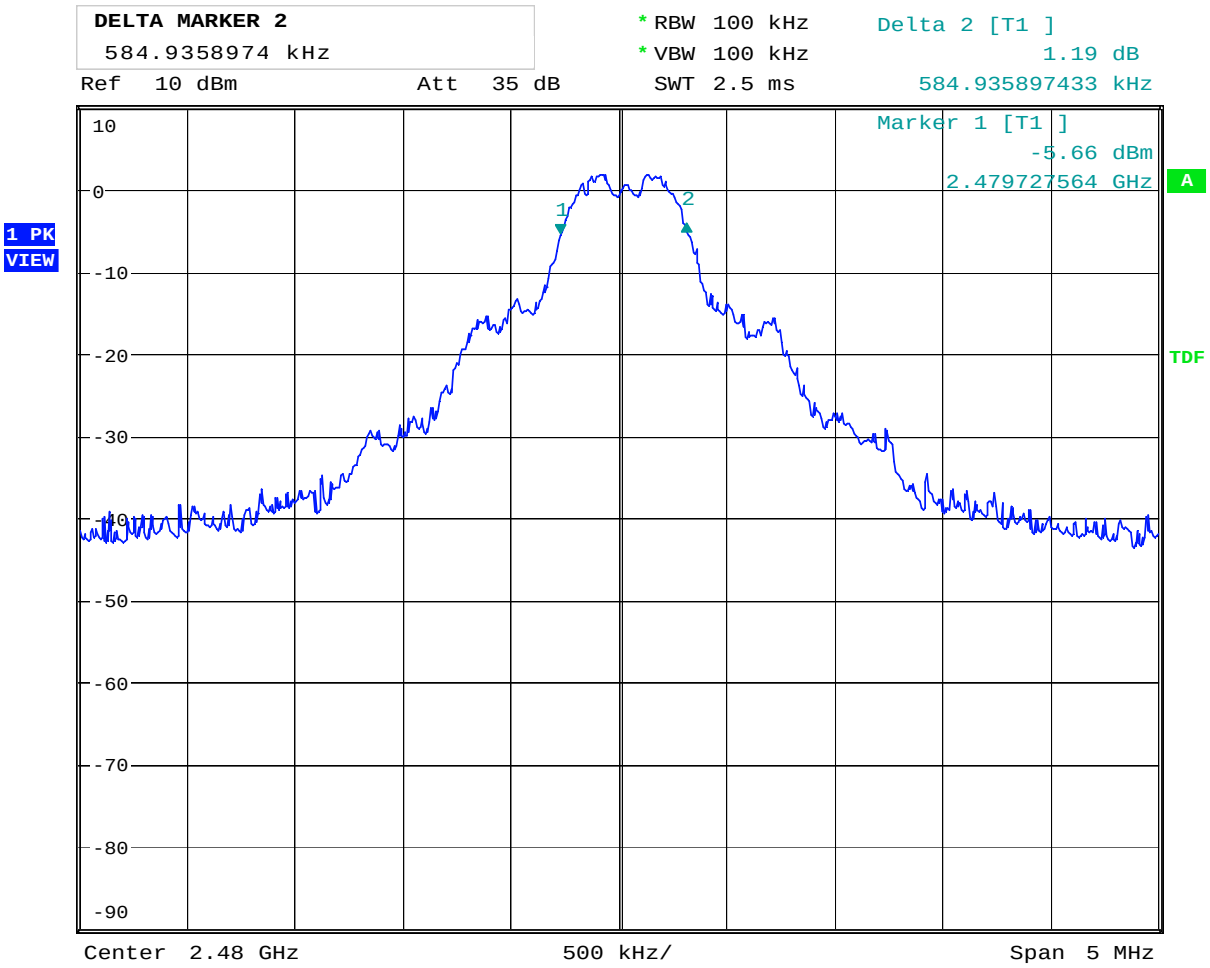
6 dB Bandwidth at 2440 MHz



Date: 6.DEC.2011 09:30:18

6 dB Bandwidth at 2480 MHz

4.2 20 dB Bandwidth

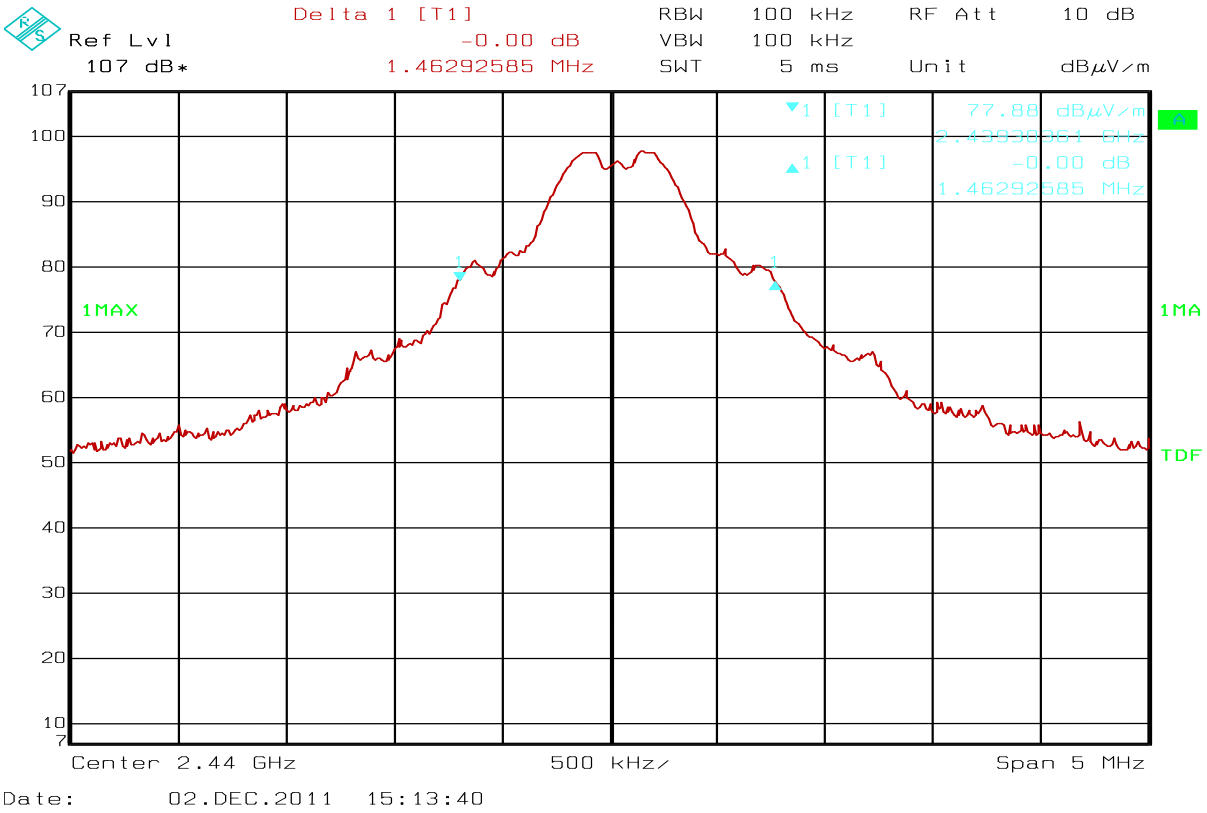
Test Performed By: G.Suhanthakumar	Date of Test: 02 Dec 2011

Measurement Data:

Measured 20 dB Bandwidth (MHz)
2440 MHz
1.46

Requirements:

No requirements. Reported for information only.



20 dB Bandwidth at 2440 MHz

4.3 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: G.Suhanthakumar	**Date of Test: 02 Dec 2011**

Test Results: Complies

Measurement Data:

RF channel	**2402 MHz**	**2440 MHz**	**2480 MHz**
Conducted Power (dBm)	3.0	2.5	2.5
Conducted Power (mW)	0.0020	0.0018	0.0018
Measured Maxium Field strength (dBµV/m) –VP	98.2	98.6	97.2
Radiated Power (dBm)	3.0	3.4	1.9
Antenna Gain (dB)	0.0	0.9	-0.6

Radiated Power is calculated from measured field strength by the formula in DA00-705.

See attached graph.

Detachable antenna? ☒ Yes ☐ No

If detachable, is the antenna connector non-standard? ☐ Yes ☒ No

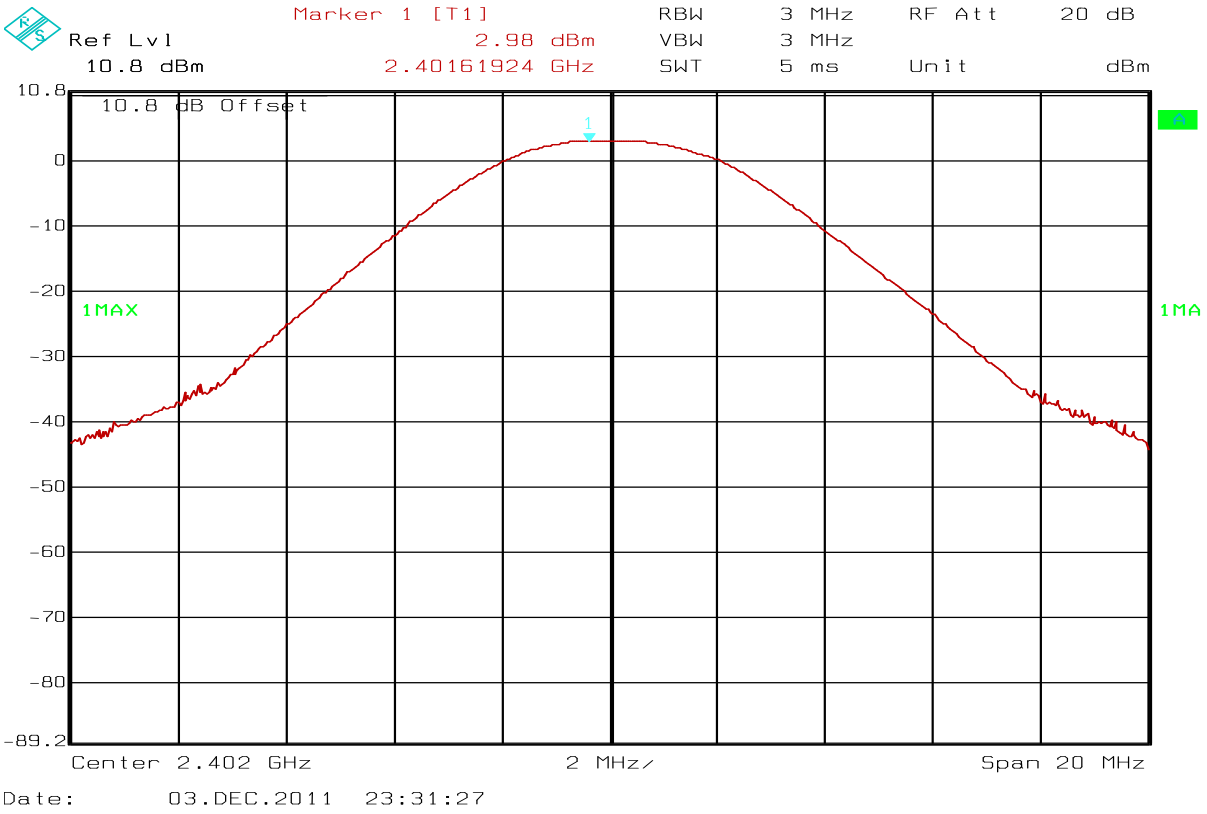
Type of antenna connector: SMA.

Requirements:

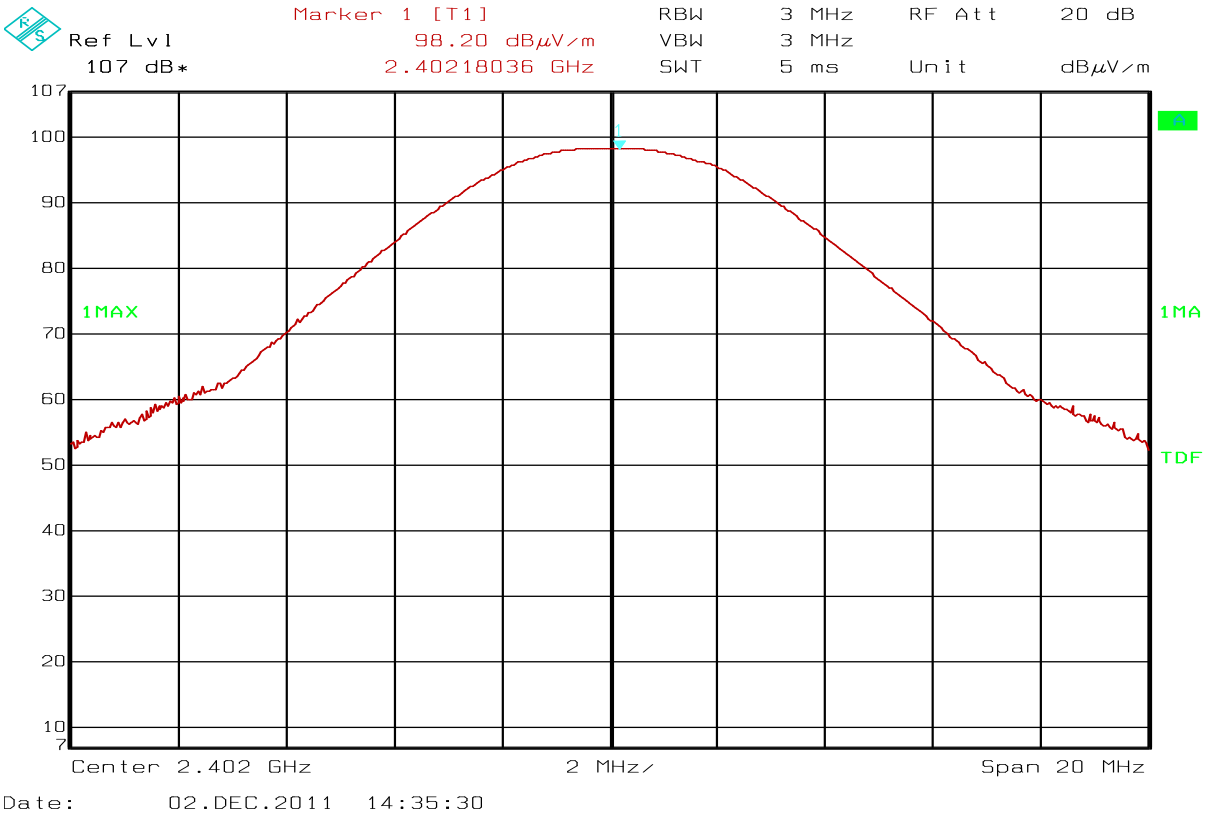
The maximum peak output power shall not exceed the following limits:

For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

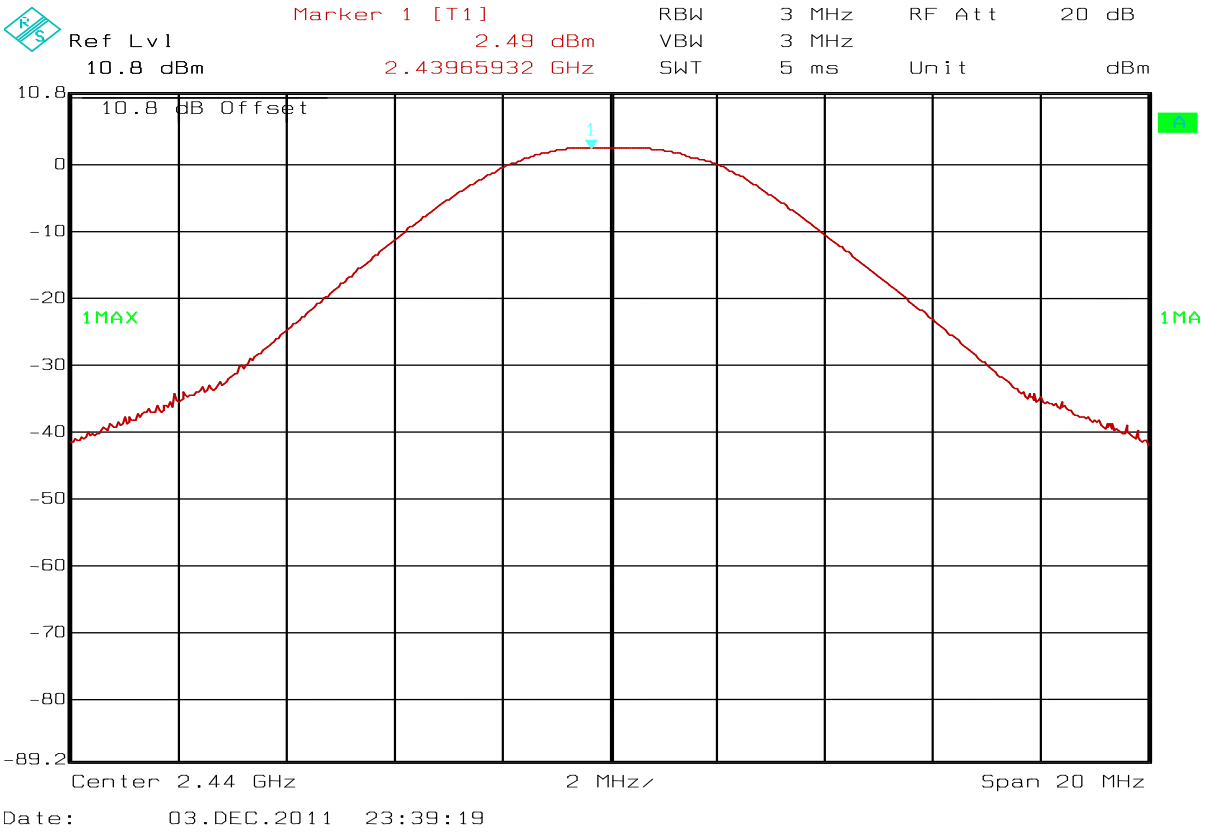
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



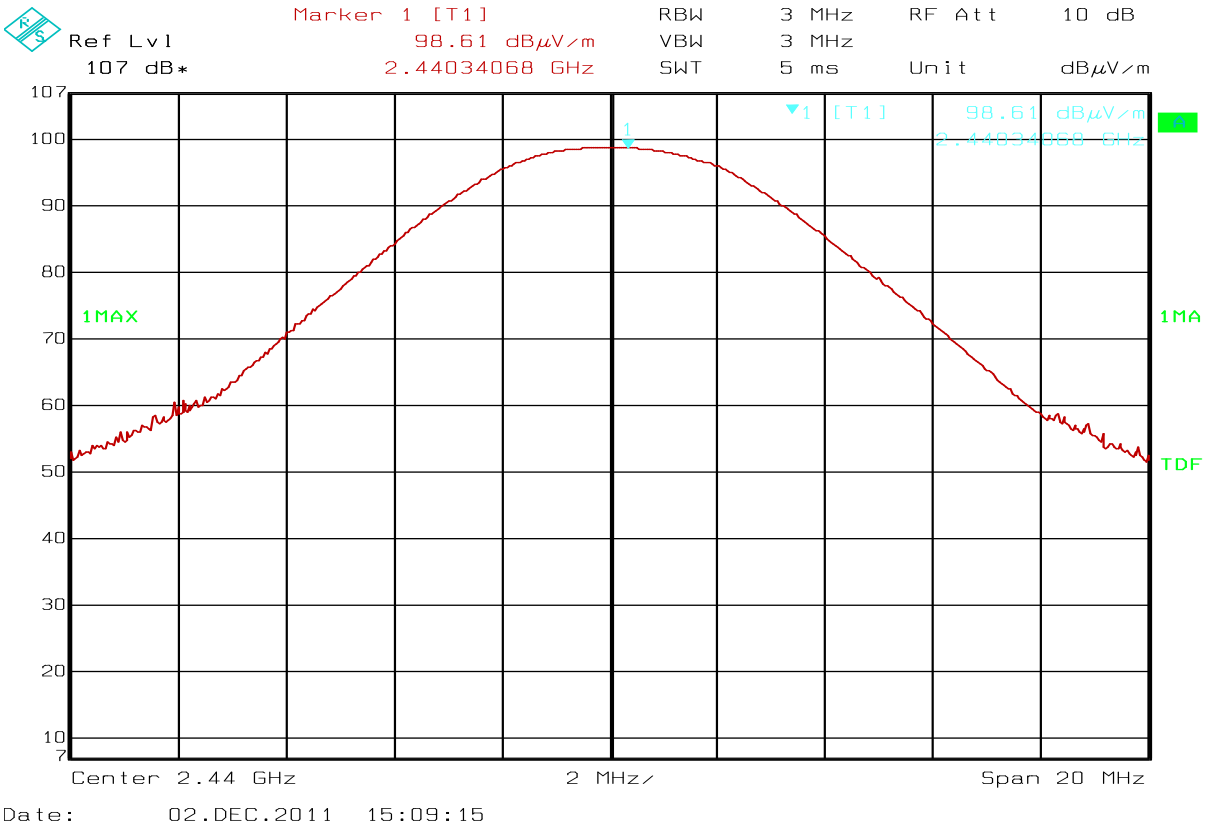
Conducted Power, 2402 MHz



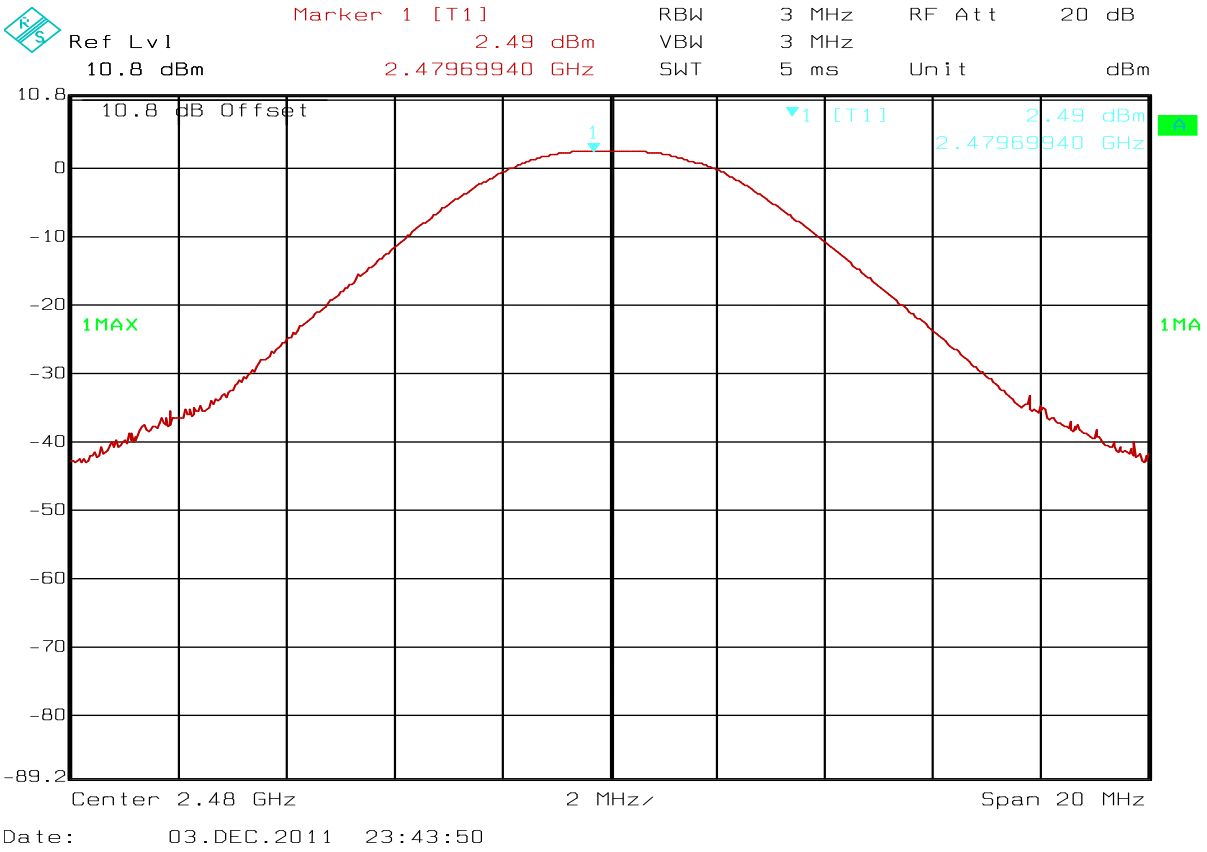
Radiated Field strength, VP, 2402 MHz



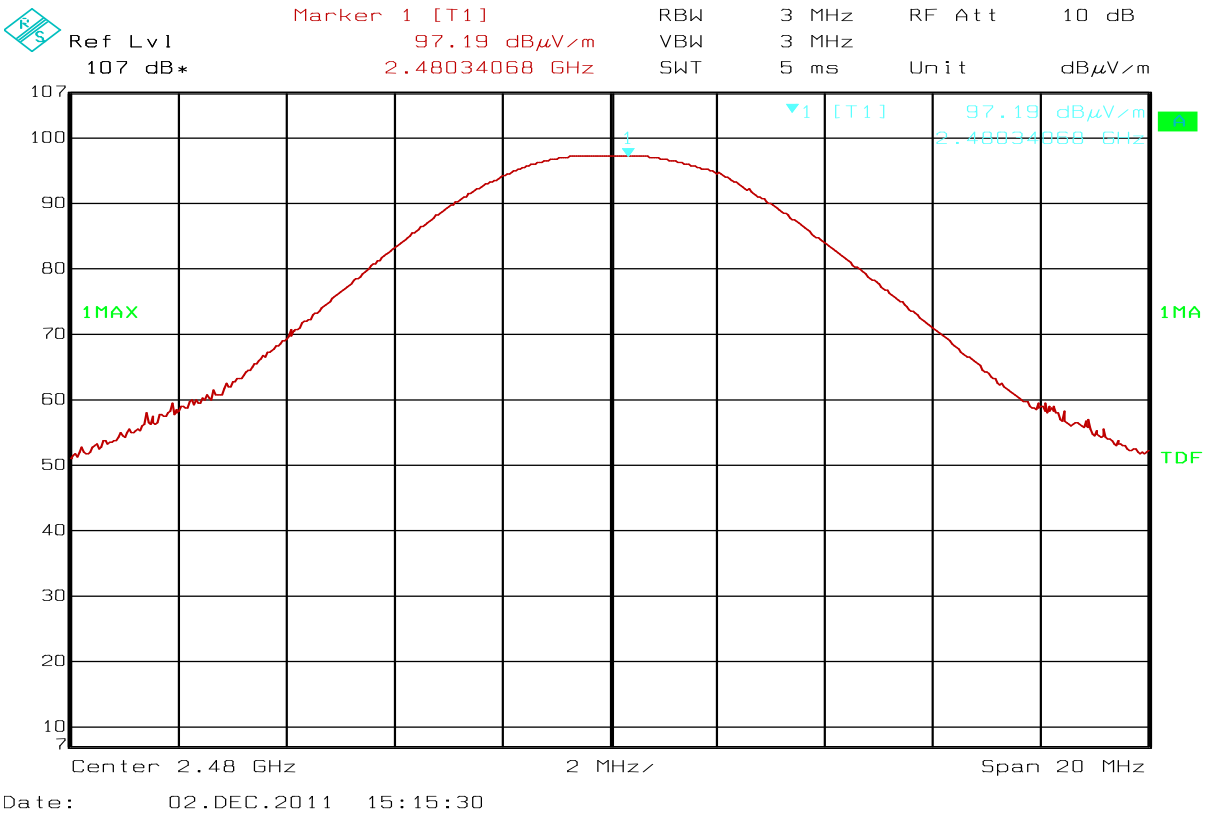
Conducted Power, 2440 MHz



Radiated field strength, VP, 2440 MHz



Conducted Power, 2480 MHz



Radiated field strength, VP, 2480 MHz

4.4 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: G.Suhanthakumar	**Date of Test: 02 Dec 2011**

Test Results: Complies

Measurement Data:

Band-edge, @3m

Frequency	Measured Field Strength @3m, dBµV/m	Detector	Limit dBµV/m	Margin dB
2.39 GHz	39.9	AV	54	14.1
	39.9	PK	74	34.1
2.4835 GHz	48.0	AV	54	6.0
	48.0	PK	74	26.0

See attached plots.

Marker Delta Calculation:

Max: 97.1 dBµV/m

Delta: 49.1 dB

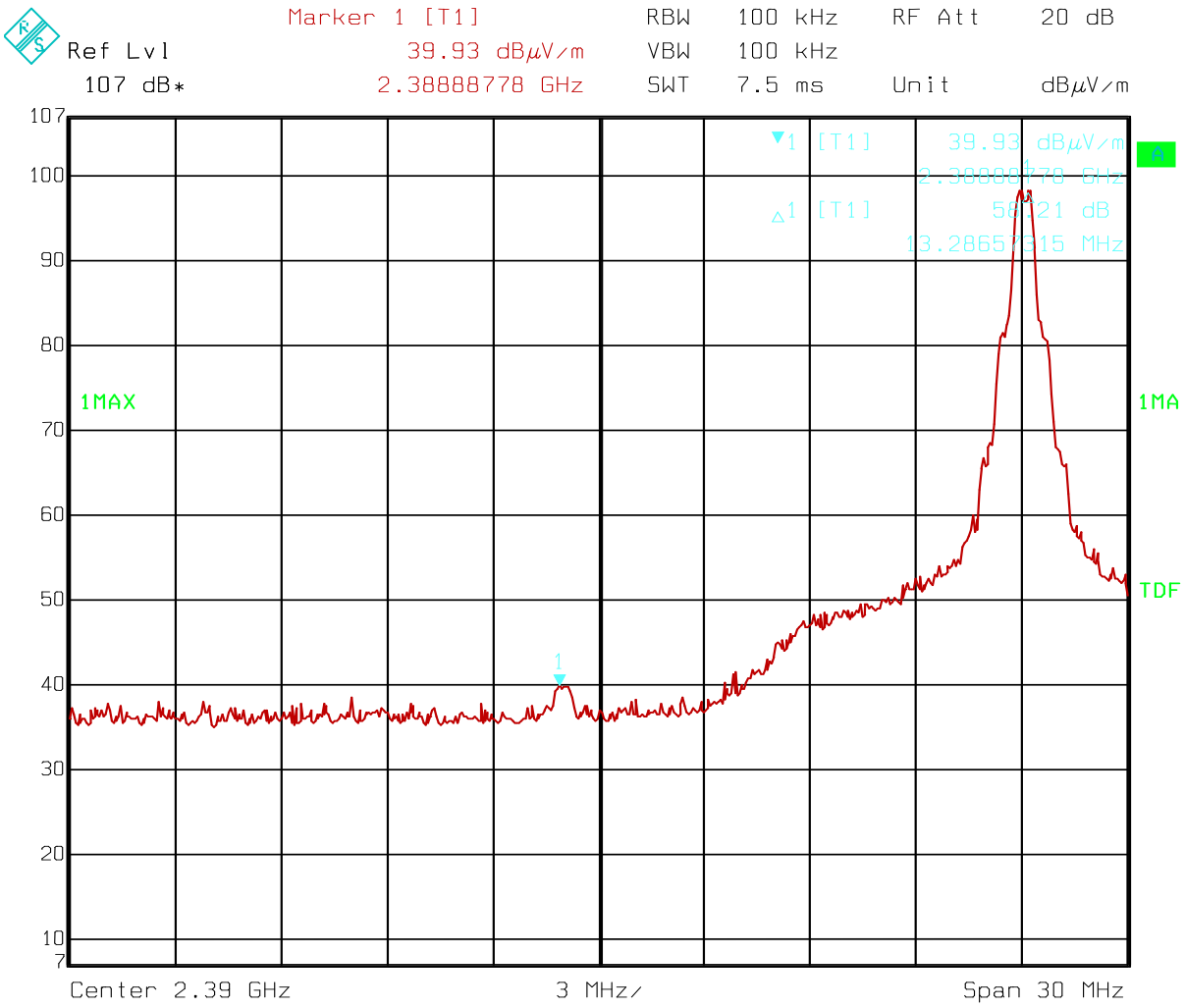
Band Edge Field Strength, Peak: 97.1 – 49.1 dBµV/m = 48.0 dBµV/m

RF conducted power

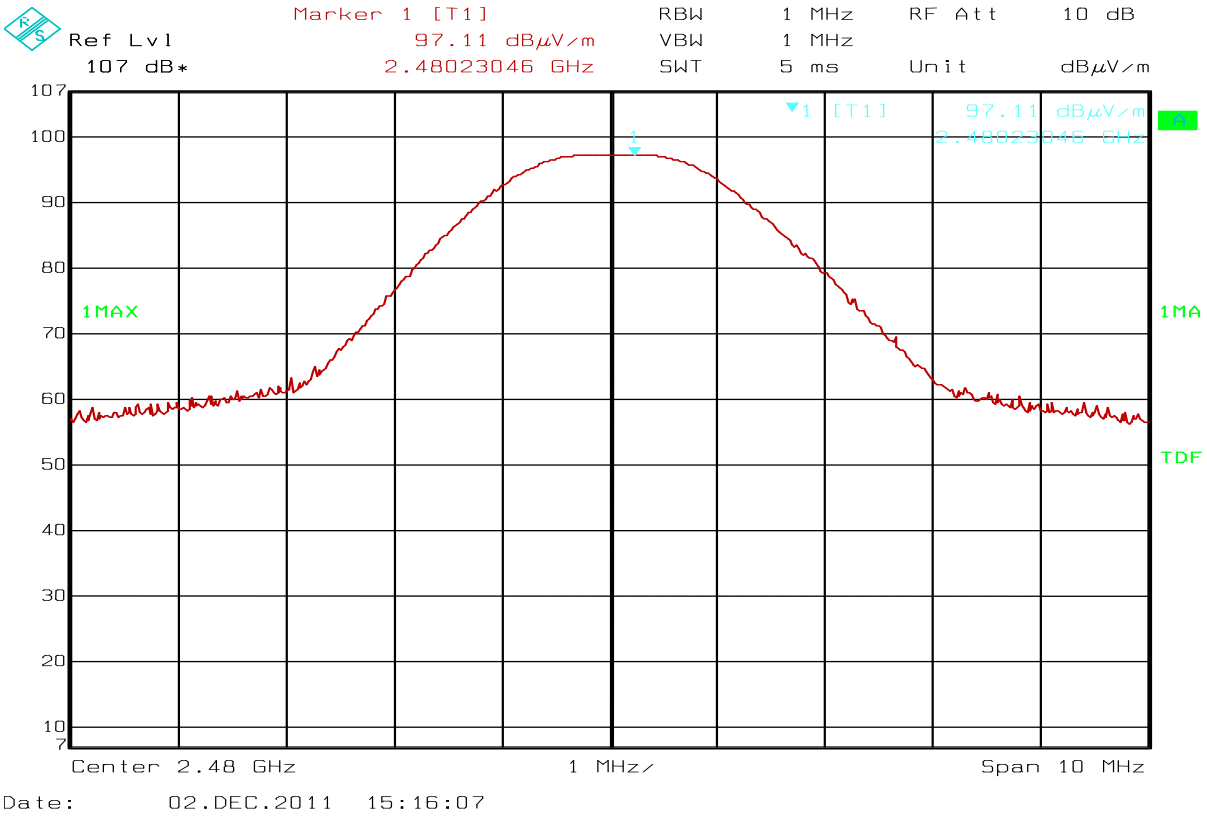
Scan performed radiated with 100 kHz Bandwidth from 0.001 to 25 GHz.

All emissions are more than 20dB below carrier.

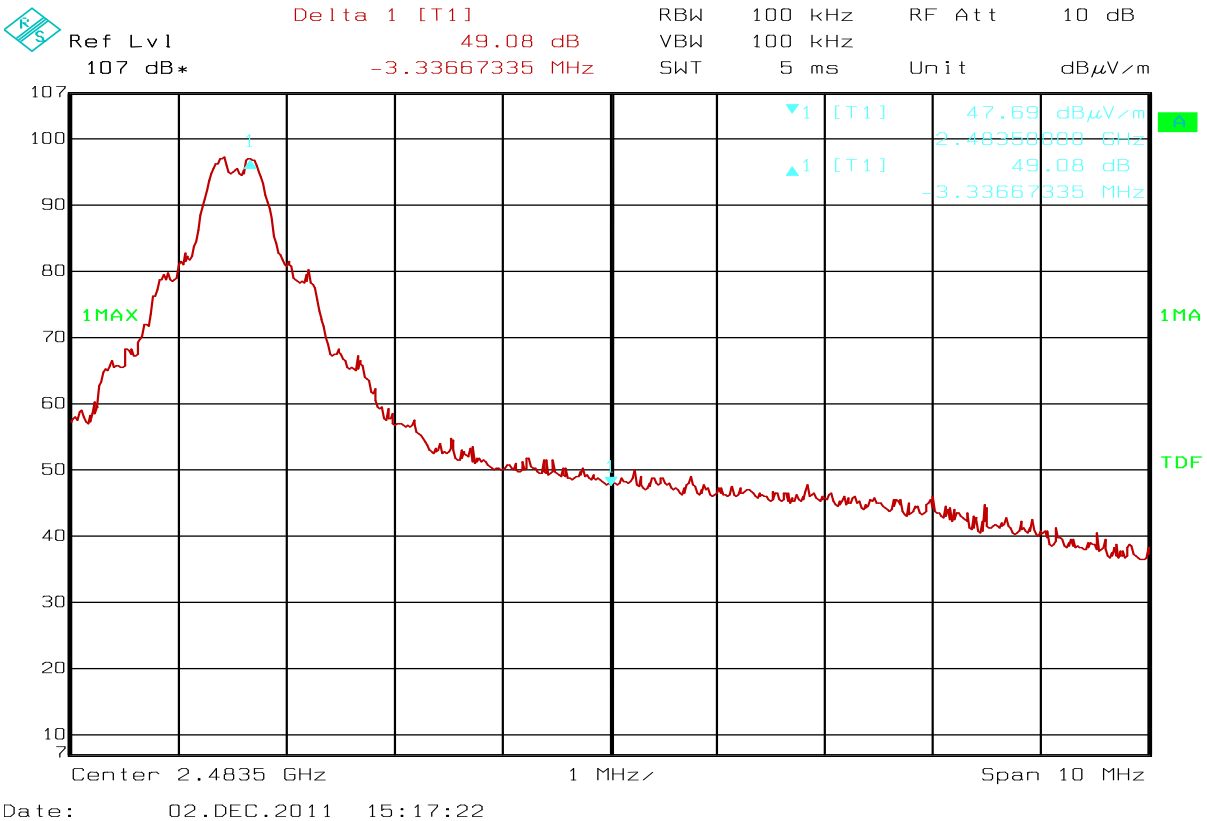
See plots.



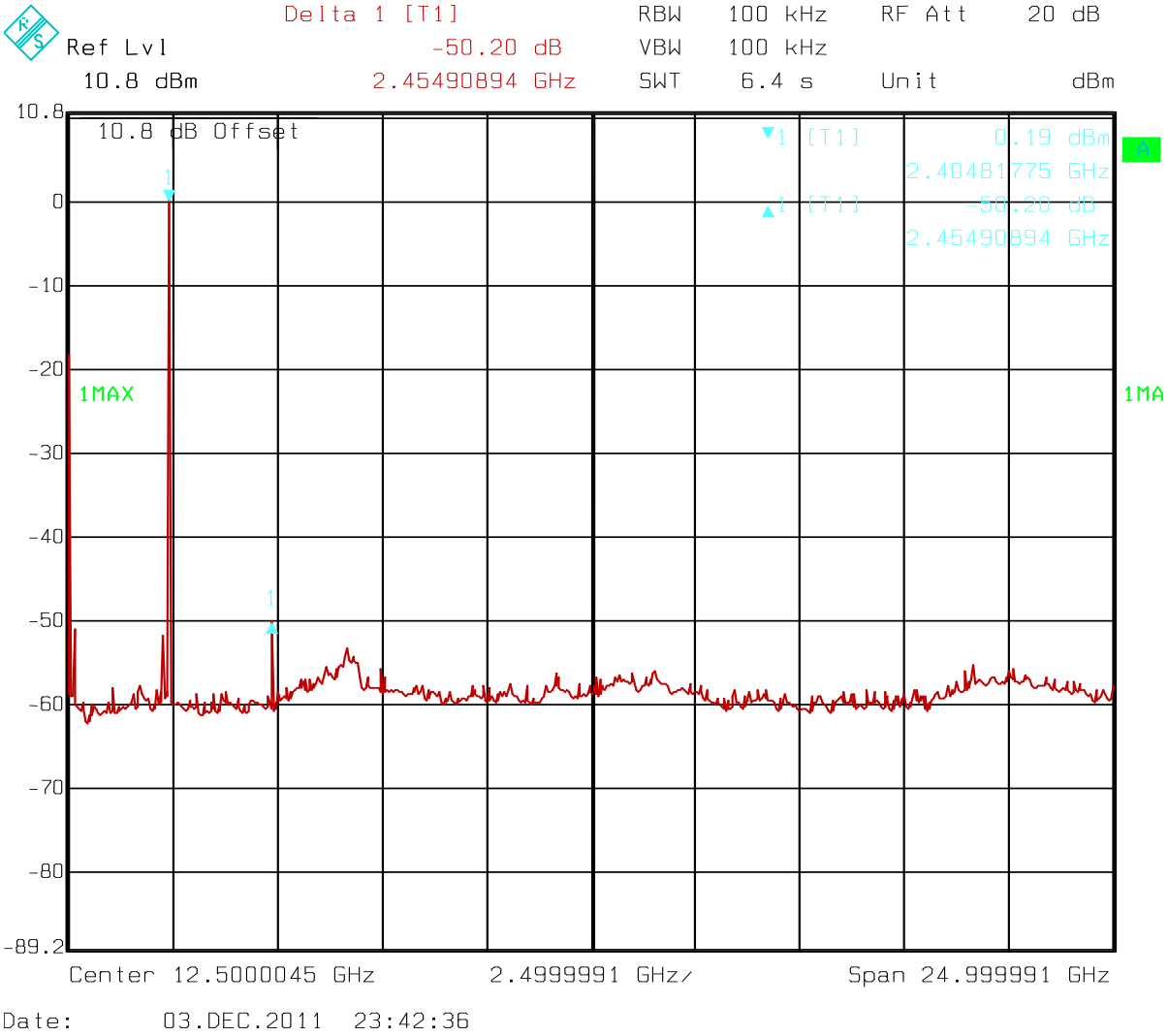
Band Edge, 2390 MHz, Peak Detector



Band Edge, 2483.5 MHz, Marker Delta, Max



Band Edge, 2483.5 MHz, Marker Delta, Delta



Conducted Emissions, 9 kHz – 25 GHz

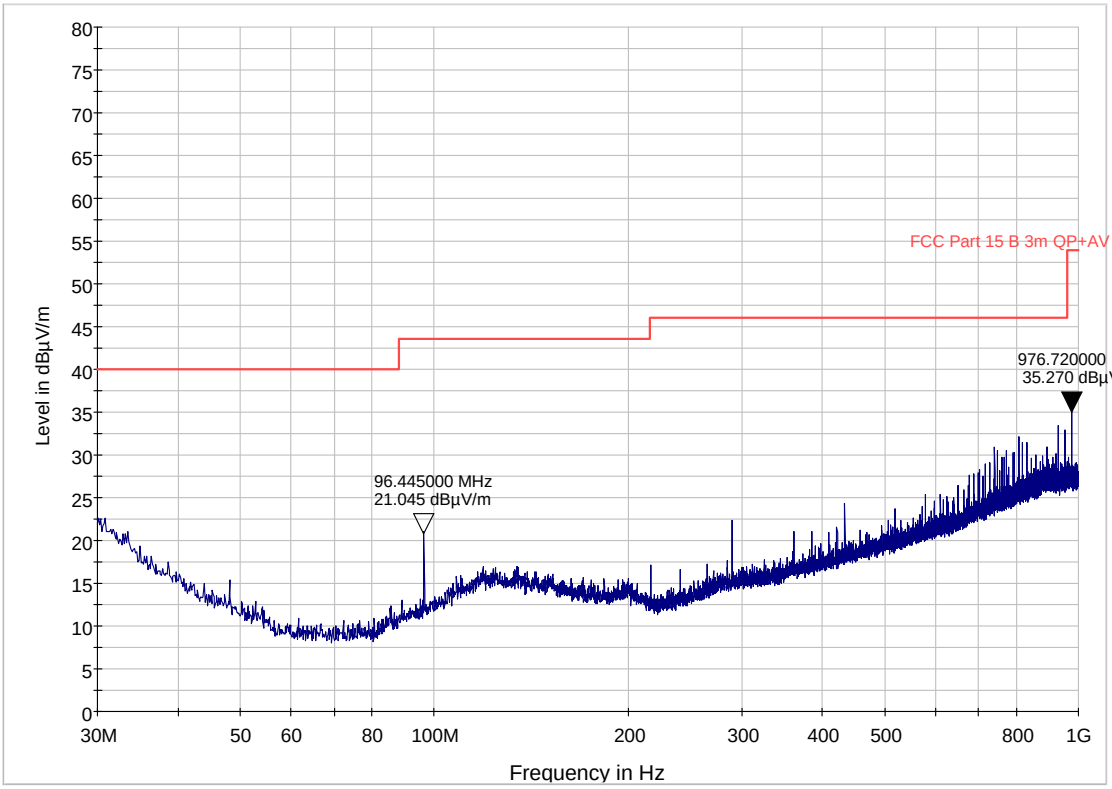
Radiated emission 30 – 1000 MHz.

Detector: Peak

Measuring distance 3m.

All values are below the limit even when measured with Peak Detector.

See attached plot.



Radiated Emissions, 30 – 1000 MHz, VP and HP, @3m

Radiated Emissions, 1-25 GHz

1-10 GHz measured at a distance of 1 or 3m

10 - 18 GHz prescan at 1m

Prescan performed from 18 to 25 GHz at 1m.

PK- detector

Frequency MHz	Field strength @3m dBµV/m	Detector	Limit dBµV/m	Margin dB
4804	56.6	Pk	74	17.4
4880	55.9	Pk	74	18.1
4960	54.2	Pk	74	19.8

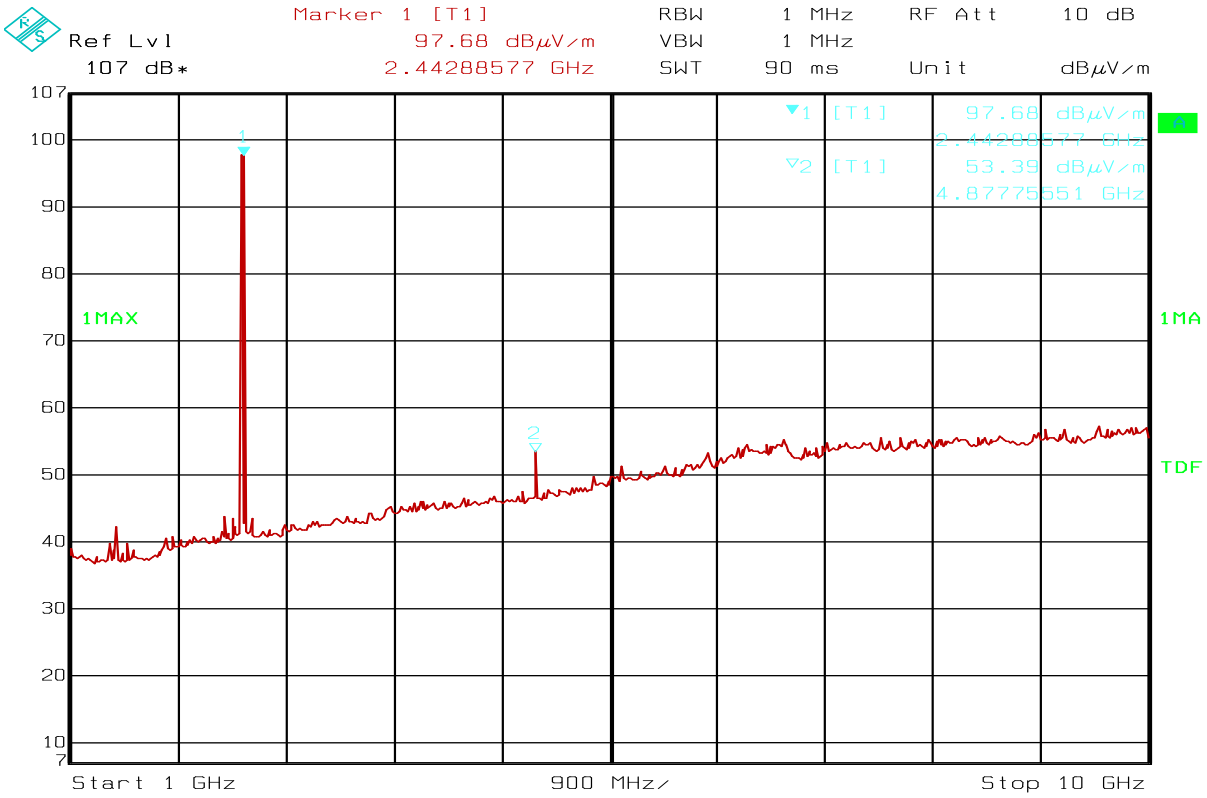
AV- detector

Frequency MHz	Field strength @3m dBµV/m	Detector	Limit dBµV/m	Margin dB
4804	53.2	AV	54	0.8
4880	53.3	AV	54	0.7
4960	50.8	AV	54	3.2

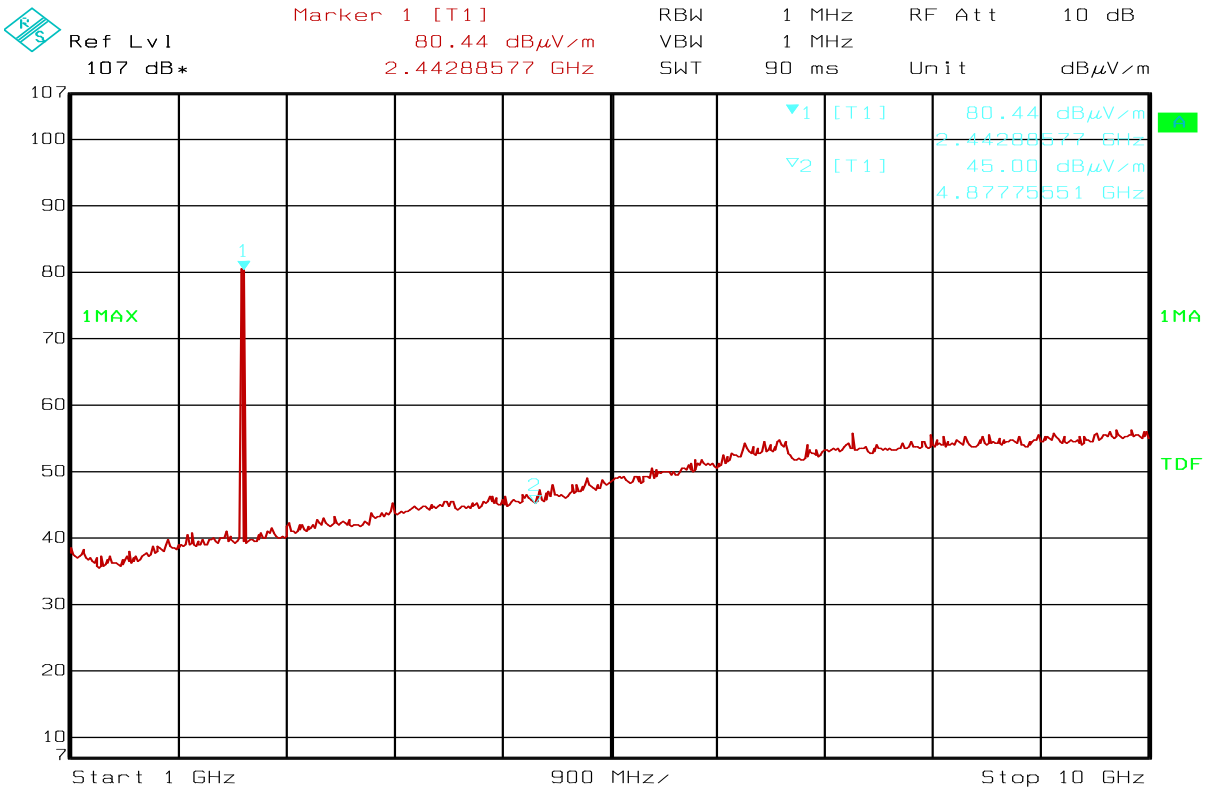
All emissions are below the Average Limit, even when measured with Peak Detector.

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

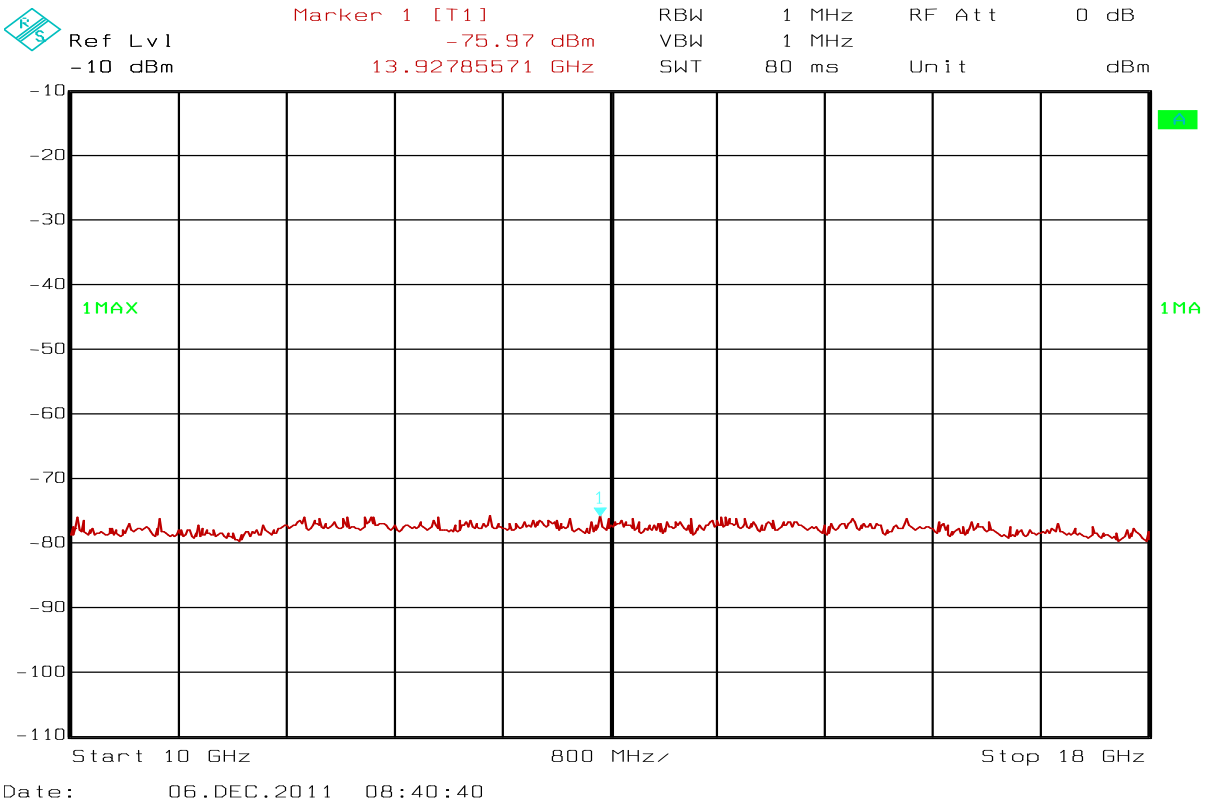
See attached graphs.



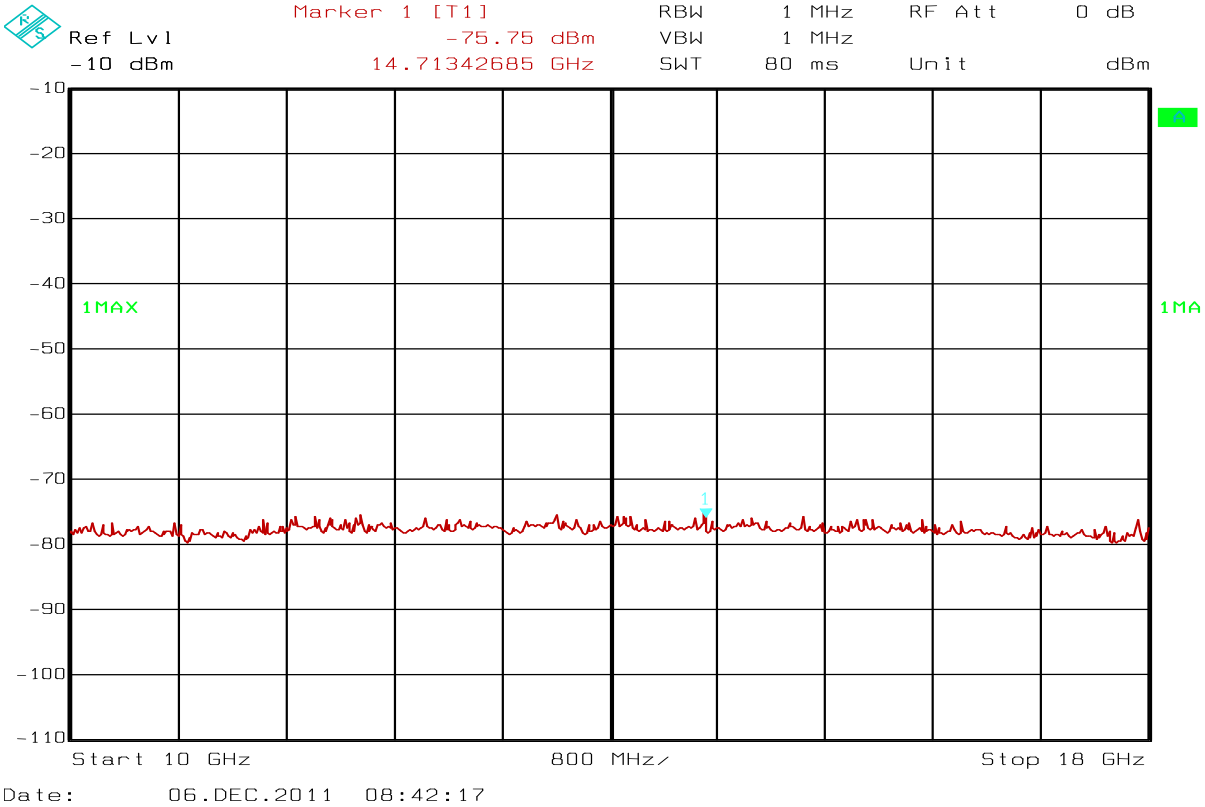
Radiated Emissions, 1 – 10 GHz, VP, @3m



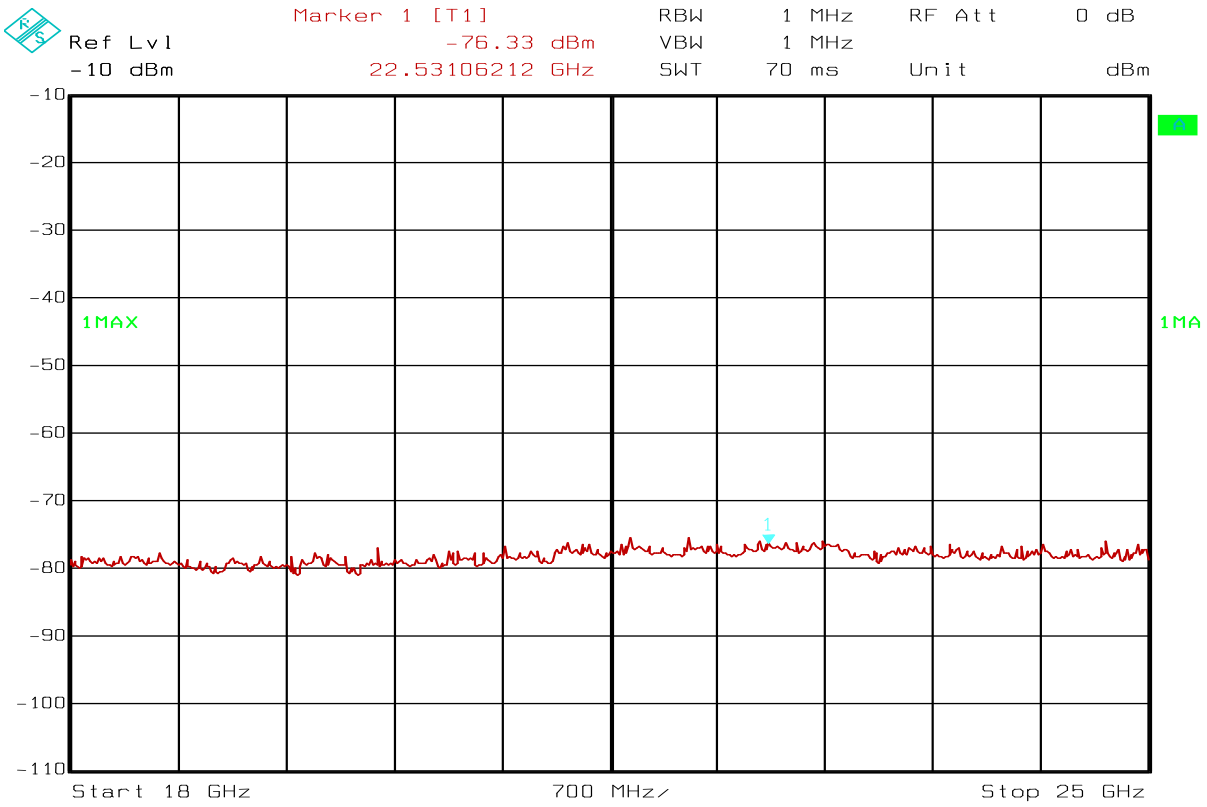
Radiated Emissions, 1 – 10 GHz, HP, @3m



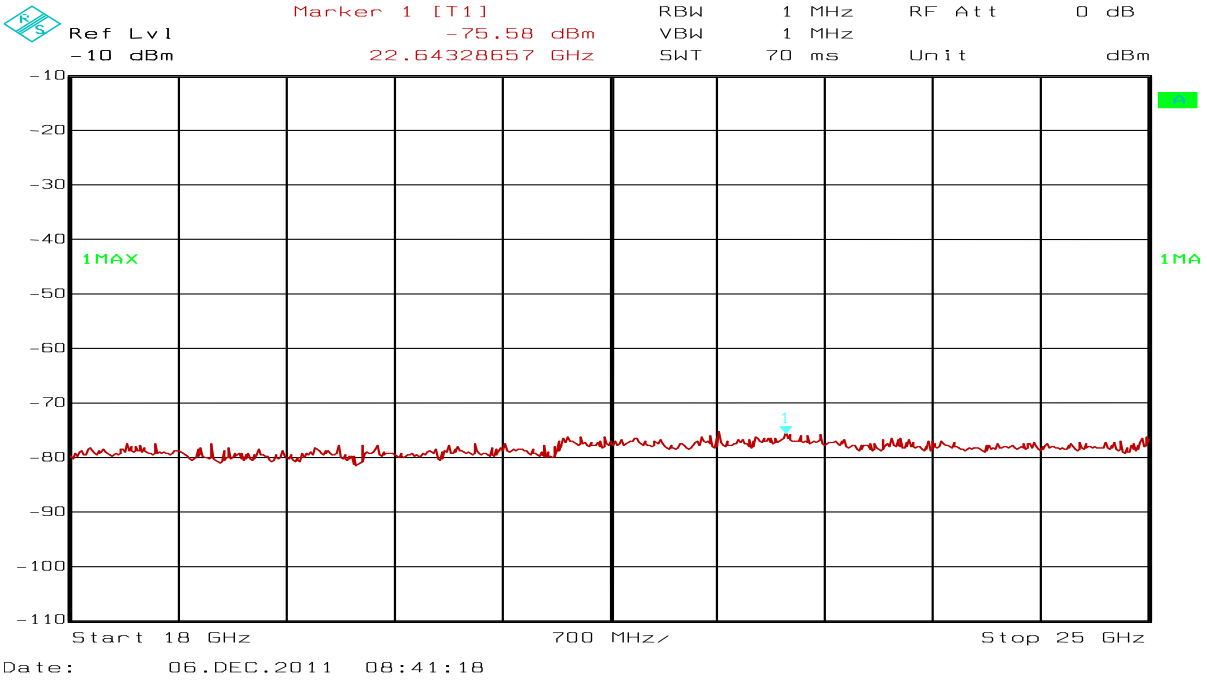
Radiated Emissions, 10 – 18 GHz, VP, @1m – pre-view scan



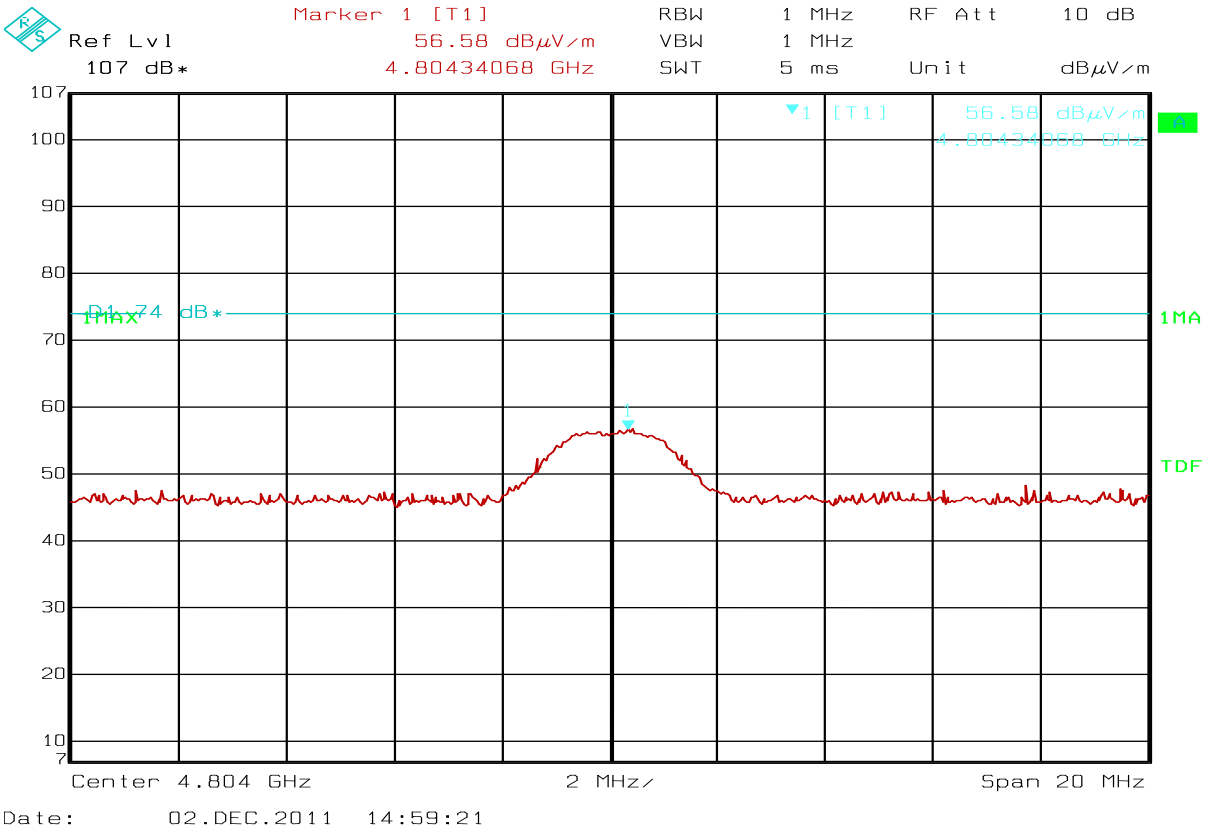
Radiated Emissions, 10 – 18 GHz, HP, @1m – pre-view scan



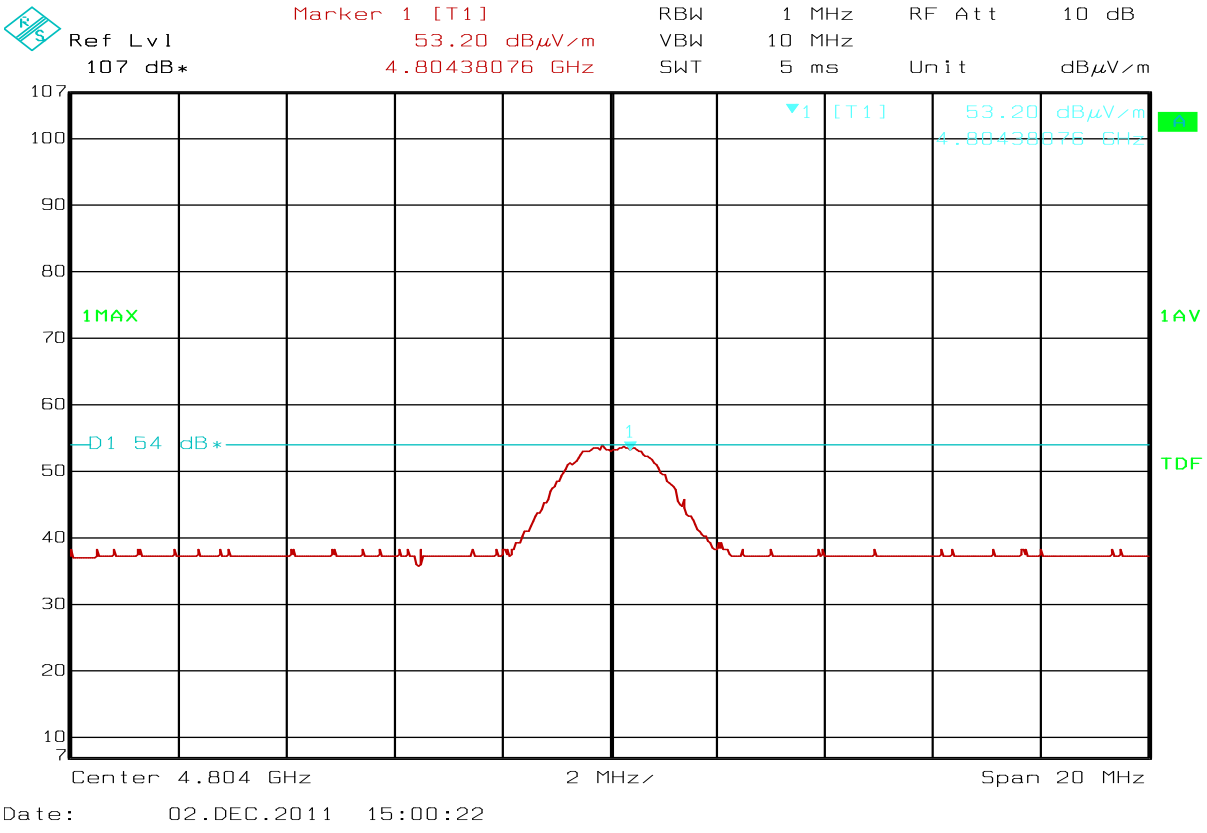
Radiated Emissions, 18 – 25 GHz, HP, @1m , pre-view scan



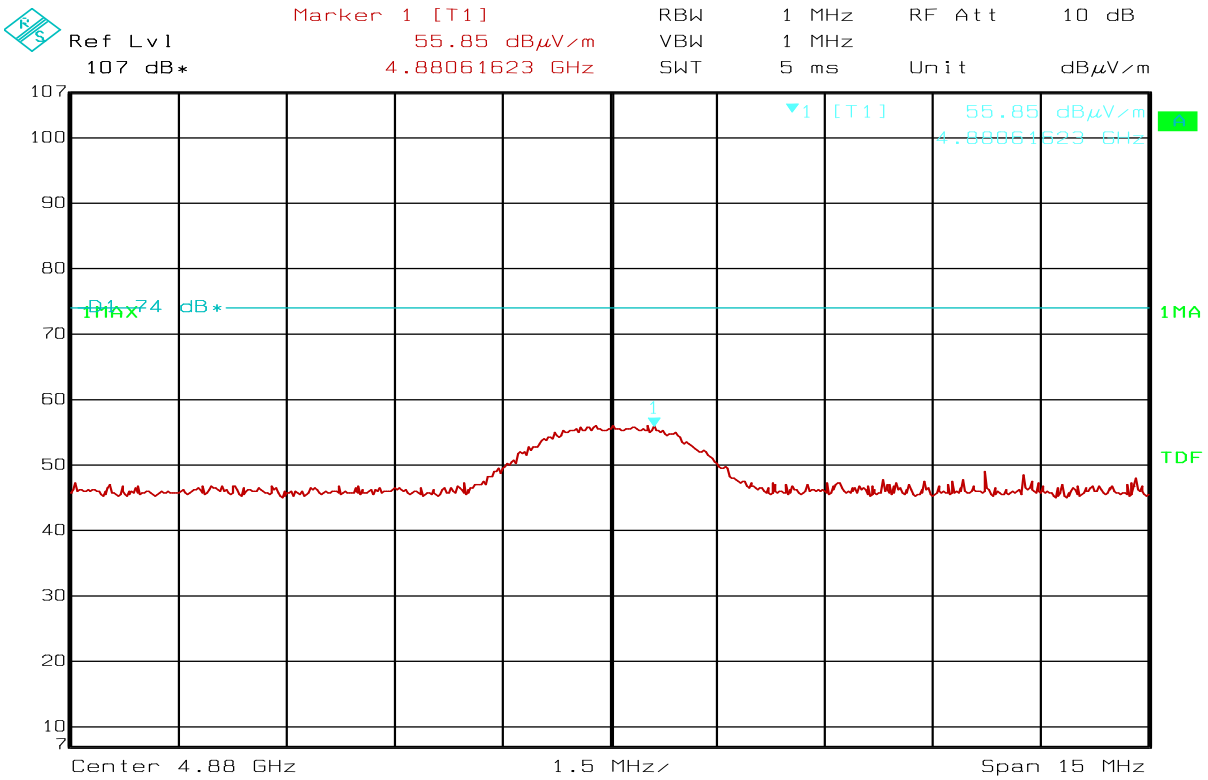
Radiated Emissions, 18 – 25 GHz, VP, @1m, Pre-view scan



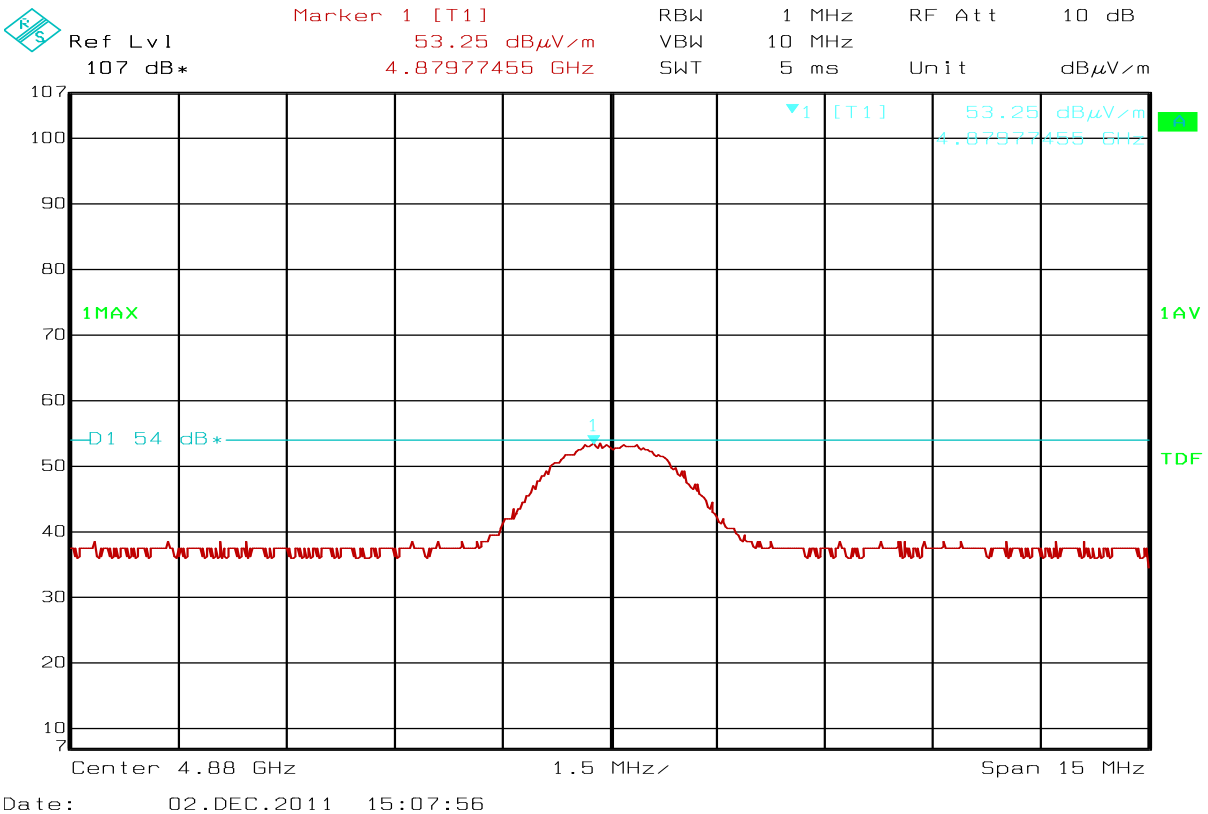
Radiated Emissions, 4804 MHz, Max, Pk Det.



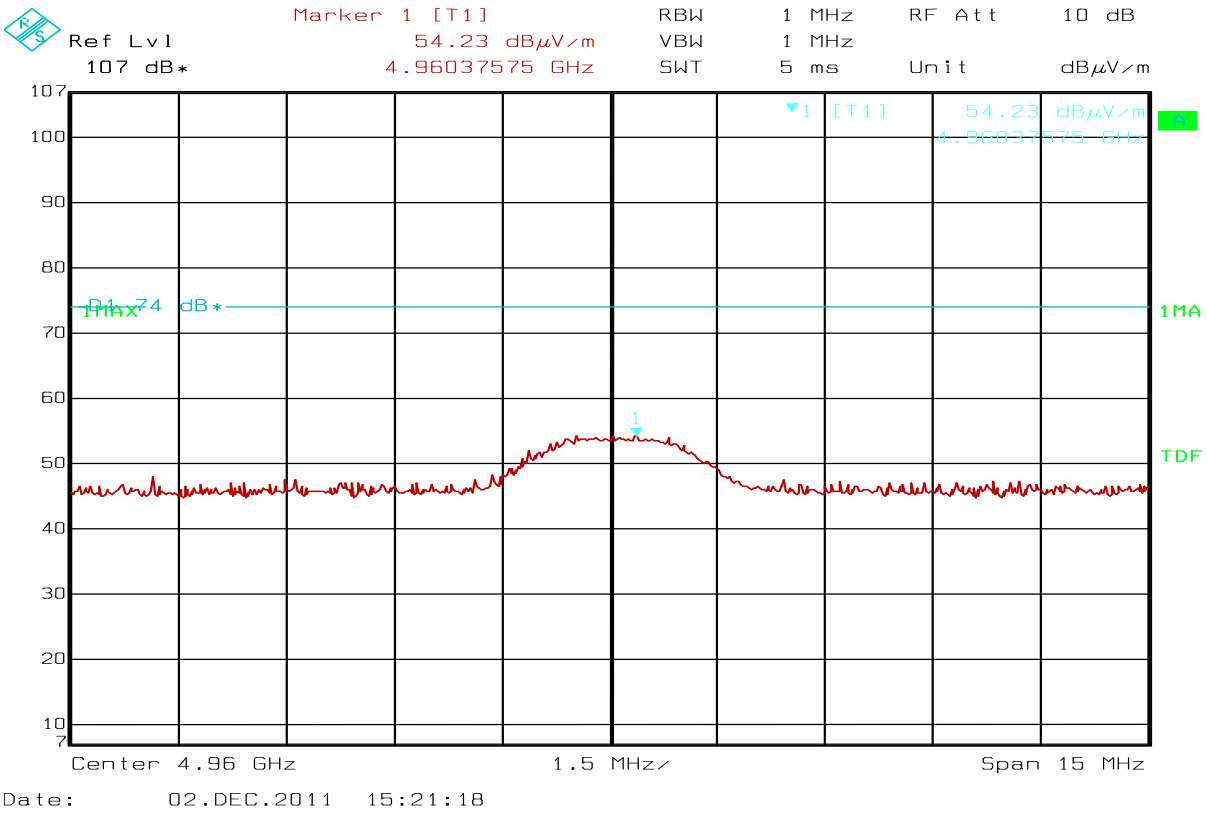
Radiated Emissions, 4804 MHz, Max, AV Det.



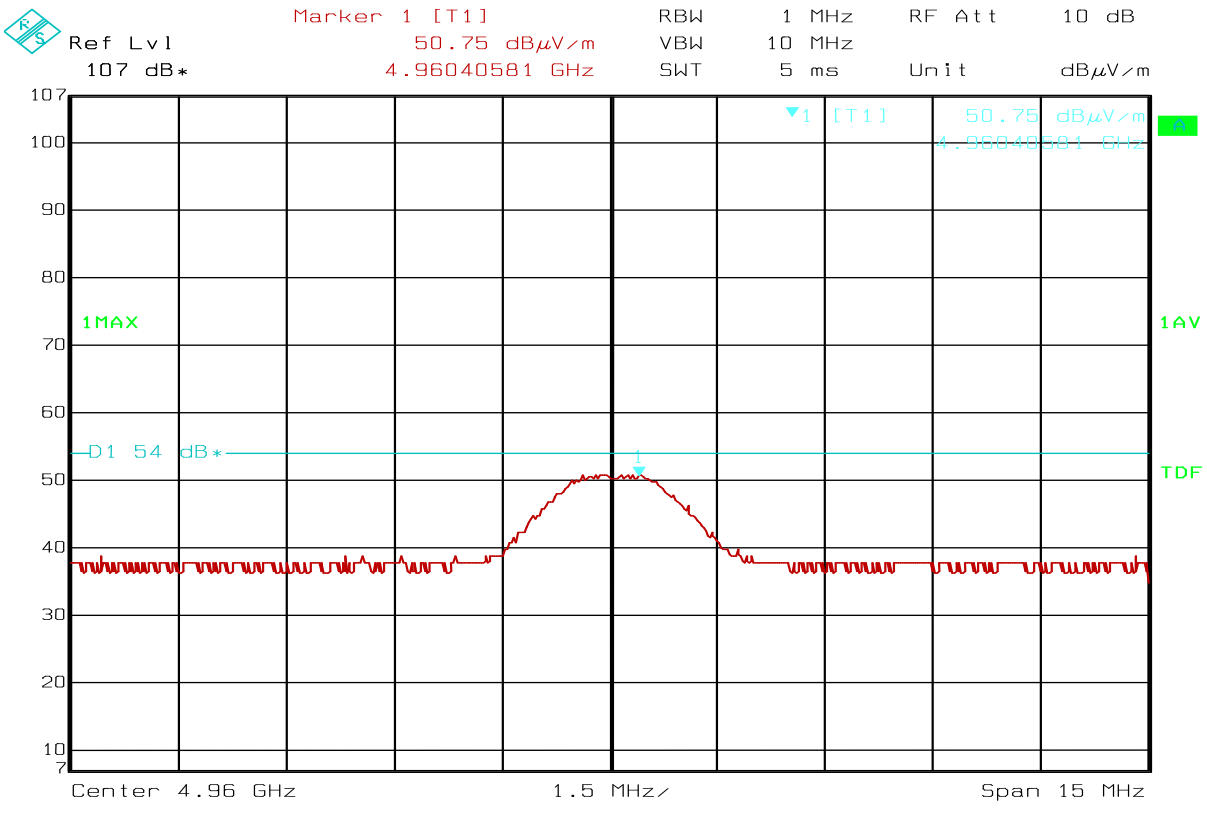
Radiated Emissions, 4880 MHz, Max, Pk Det.



Radiated Emissions, 4880 MHz, Max, AV Det.



Radiated Emissions, 4960 MHz, Max, Pk Det.



Radiated Emissions, 4960 MHz, Max, AV Det.

4.5 Receiver Spurious Emissions

Measurement Procedure:

Industry Canada RSS-210 paragraph 2.3 and RSS-GEN paragraphs 4.10 and 6.

Test results:

Frequency MHz	Carrier Freq. MHz	Measured Value Radiated dBuV/m @3m	Limit dBuV/m @3m	Margin dB
30 – 1000	all	None found	/	/
> 1000 (all others)	all	None found	54	/

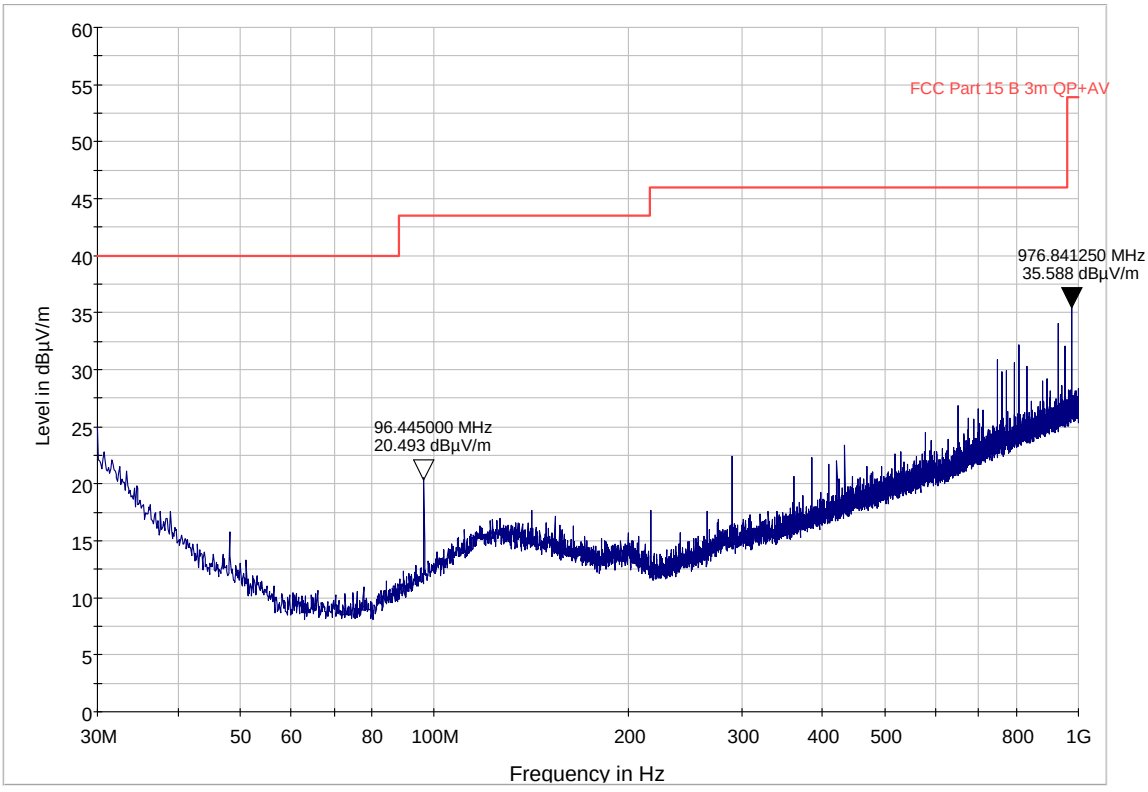
The measurement was performed radiated with the EUT in receive-only mode.

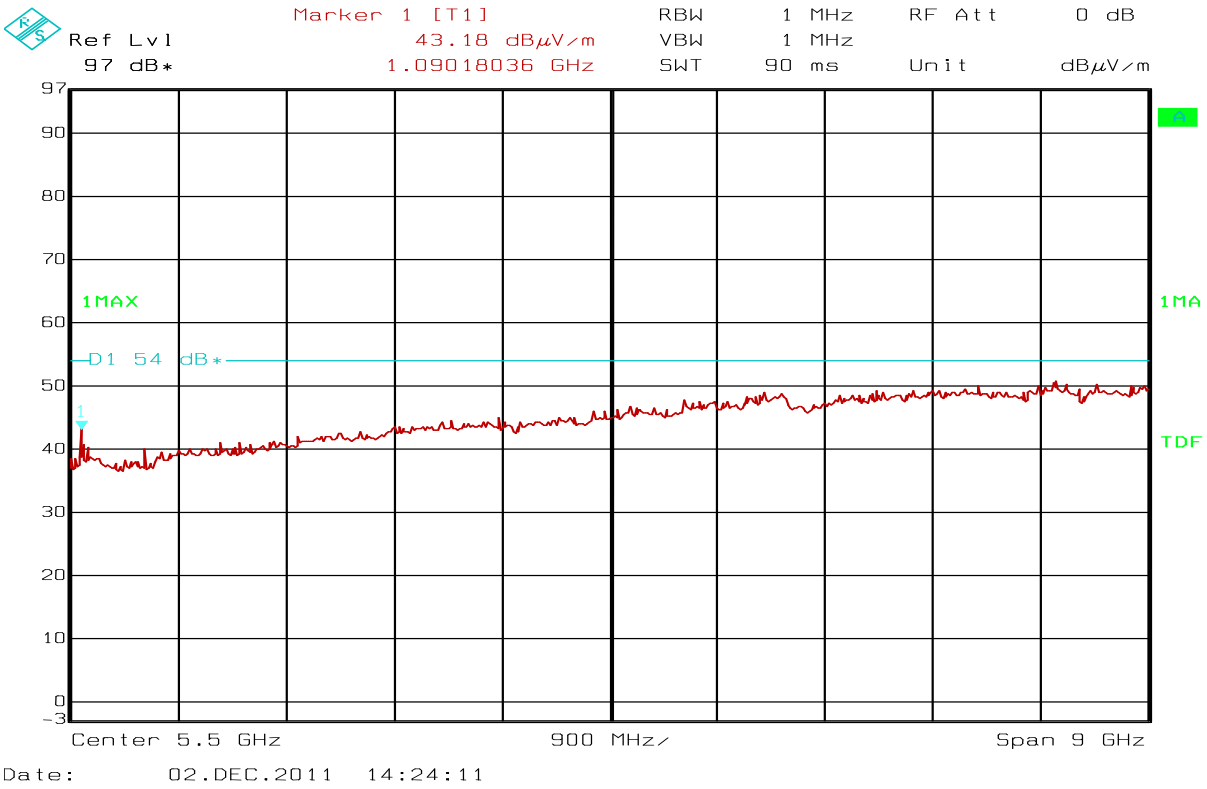
Requirements, RSS-GEN Issue 3, clause 6

The measurement can be performed either radiated or conducted.

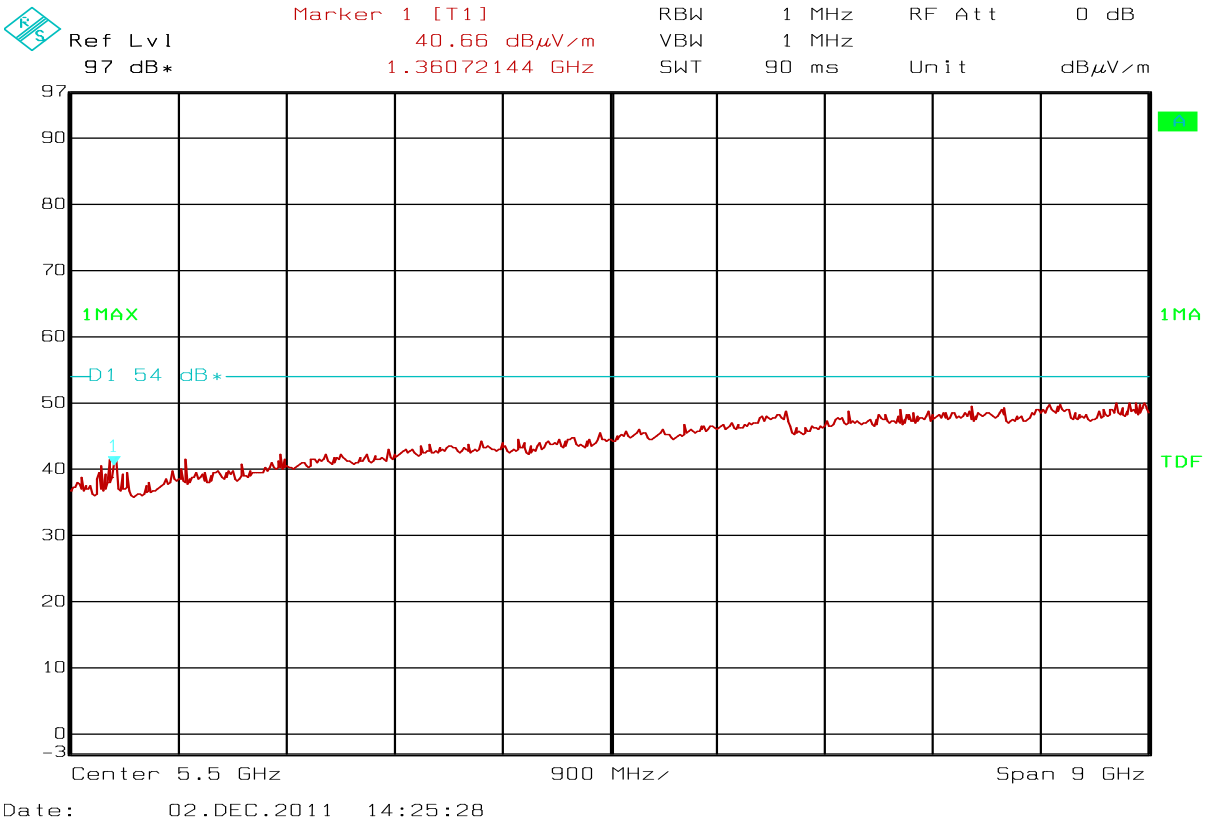
When measured Conducted*:* no spurious signals appearing at the antenna terminals shall exceed 2 nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nW above 1 GHz.

When measured Radiated: See Table 2 in RSS-GEN Issue 3, clause 6.





Receiver Radiated Emissions, 1 - 10GHz , VP



Receiver Radiated Emissions, 1 - 10GHz , HP

4.6 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Test Performed By: G.Suhanthakumar	**Date of Test: 02 Dec 2011**

Test Results: Passed

Measured and Calculated Data:

The alternative test procedures in point 2) A , B and formula 1 described in guidance on measurements for Digital Transmission Systems is used.

	Measured PSD
Power Spectral Density @2440 MHz	-8.93

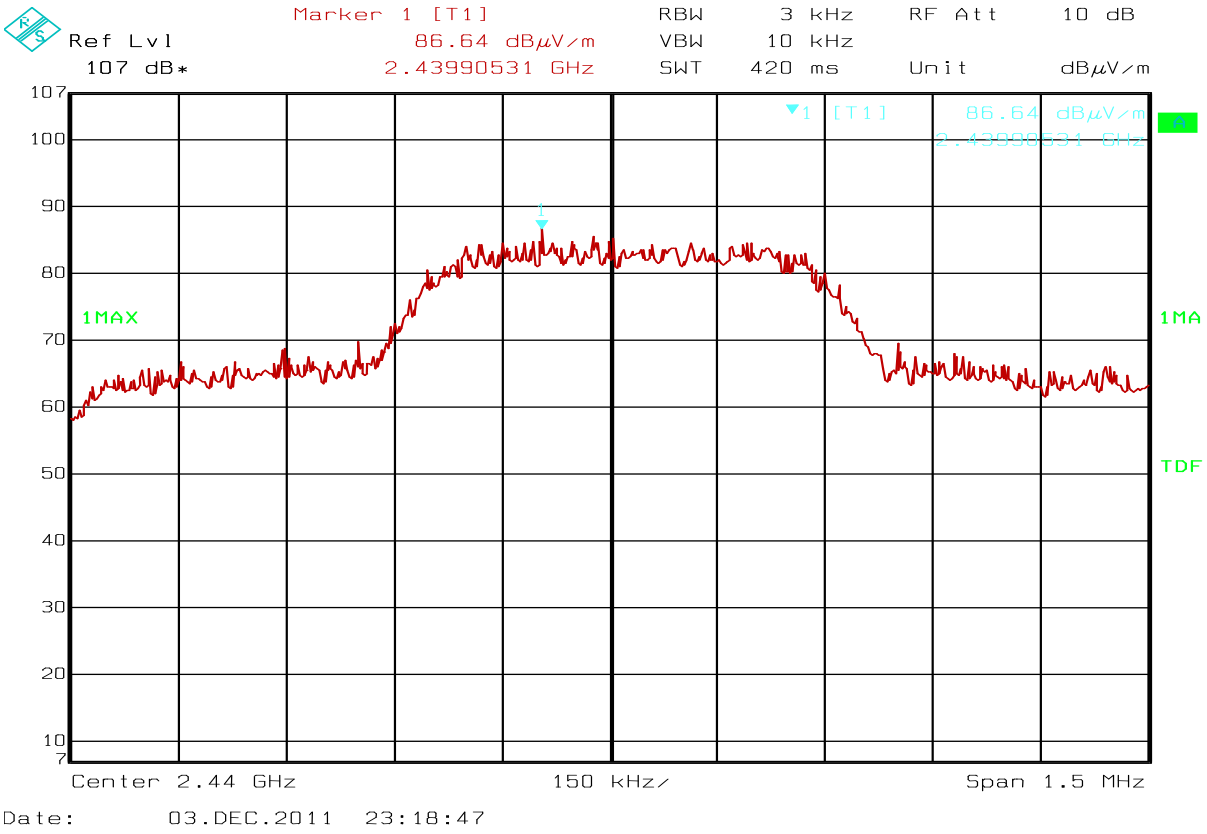
2440MHz - Middle Channel:

PSD = 35 – 43.93 dBm/Hz = -8.93 dBm

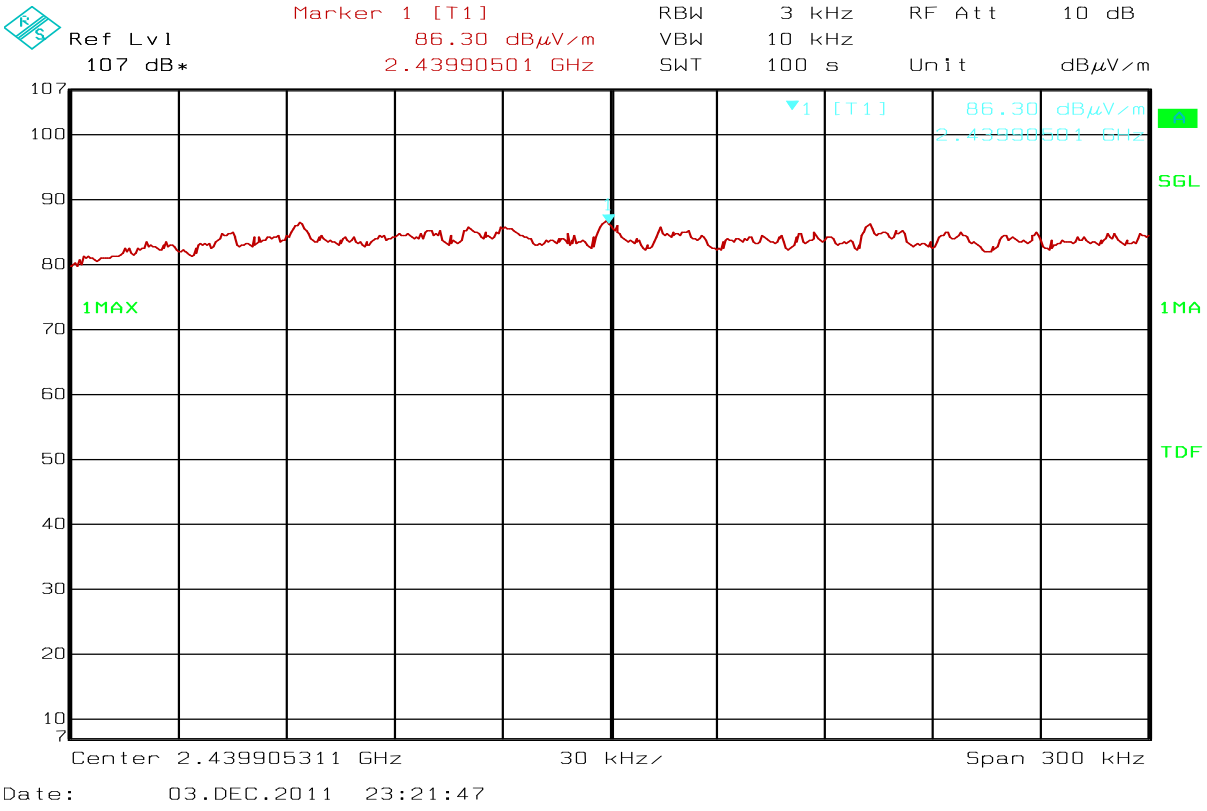
The spectrum line spacing is less than 3 kHz, therefore used noise power density and corrected 35 dB for 3 kHz

Requirements:

The Power Spectral Density of a Digital Transmission System shall be no greater than +8 dBm in any 3 kHz band.



PSD Overview



PSD Measurement

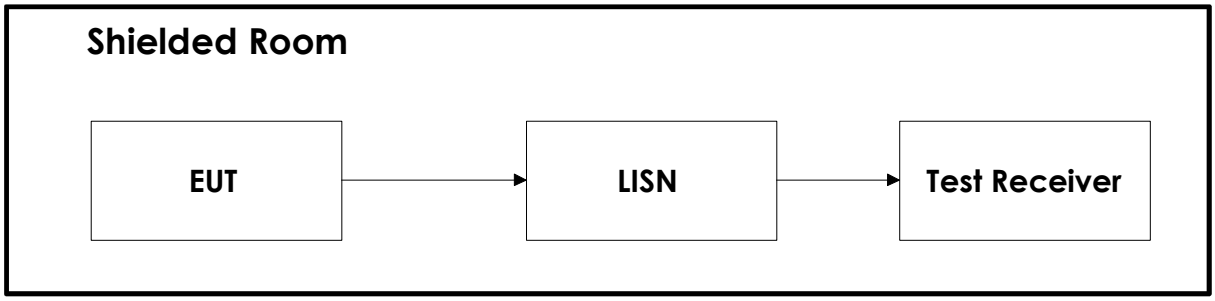
5 LIST OF TEST EQUIPMENT

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.	Instrument/ ancillary	Type of instrument/ ancillary	Manufacturer	Ref. no.	Cal. Date	Cal. Due
1	FSEK	Spectrum Analyzer	Rohde & Schwarz	LR 1337	2010.12.15	2012.12.15
2	ESHS10	Spectrum Analyzer	Rohde & Schwarz	N-3528	2011.06.21	2012.06.21
3	3115	Antenna horn	EMCO	LR 1330	2010.08.05	2013.08.05
4	643	Antenna horn	Narda	LR 093	2009.01.26	2012.01.26
5	642	Antenna horn	Narda	LR 220	2009.01.26	2012.01.26
6	PM7320X	Antenna horn	Siverts lab	LR 103	2009.01.26	2012.01.26
7	DBF-520-20	Antenna horn	Systron Donner	LR 101	2009.01.26	2012.01.26
8	638	Antenna horn	Narda	LR 098	2010.06.17	2015.06.17
9	JB3	Antenna Bilog	Sunol Sciences Inc.	N-4525	2011.09	2012.09
10	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2011-09-27	2012-09-27
11	LNA6900	Pre-amplifier	Teseq	LR 1593	2011.11.24	2013.11.24
12	ESCI	Test Receiver	Rohde & Schwarz	N-4529	2010.11.08	2012.11.08
13	ESH3-Z3	LISN	Rohde & Schwarz	LR 1076	2011-11-03	2013-11-03
14	SMP04	Signal Generator	Rohde & Schwarz	LR 1336	2010.11.09	2012.11.09
15	Model 87 V	Multimeter	Fluke	LR 1598	2010-12-14	2011-12-14
16	FSP30	Spectrum Analyzer	Rohde & Schwarz	LR 1551	2011-03	2012-02
17	FSU26	Spectrum Analyzer	Rohde & Schwarz	LR 1504	2010.09.28	2012.09.28
18	ESH3-Z2	Puls Limiter	Rohde & Schwarz	N-3932	2010.11.04	2012.11.04

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission