



Test report no. : 182225-5

Item tested : CC2511Dongle

Type of equipment : 2.4GHz USB Dongle

FCC ID : ZAT2511USB

Client : Texas Instruments Norway AS

FCC Part 15.247

Digital Transmission System

RSS-210, Issue 8

Low Power Licence-Exempt
Radiocommunication Devices

2013-11-14

Authorized by : 

G.Suhanthakumar
Technical Vericator

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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: 35

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 : Fredrik Kervel
Telephone : +47 22 95 8362
E-mail : f.kervel@ti.com

1.3 Responsible Manufacturer (If other than client)

Name : /
Address : /

2 Test Information

2.1 Test Item

Name :	Texas Instruments
FCC ID :	ZAT2511USB
IC ID:	451H-2511USB
Model/version :	CC2511Dongle
Serial number :	/
Hardware identity and/or version:	/
Software identity and/or version :	/
Frequency Range :	2405 – 2480 MHz
Number of Channels :	/
Type of Modulation :	Digital
User Frequency Adjustment :	None
Type of Power Supply :	Powered from USB
Antenna Connector :	None (PCB Antenna)
Antenna Diversity Supported :	No
Desktop Charger :	None

Description of Test Item

The CC2511 is an RF-transceiver USB dongle operating in the 2.4 GHz ISM band. It is based on the CC2511 system on-chip device.

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:	42 - 52 %
Normal test voltage:	4.5 V DC

The radiated emissions tests were performed with the EUT powered from a test-jig with 3xAA primary batteries.

The values are the limit registered during the test period.

2.3 Test Period

Item received date:	2011-08-15
Test period :	from 2011-08-12 to 2011-10-04

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 #: 182225-5

TESTED BY:



DATE: 2013-09-23

Frode Sveinsen, Test engineer

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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)	Pass
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

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 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: Thomas Dangle	Date of Test: 19 Aug 2011
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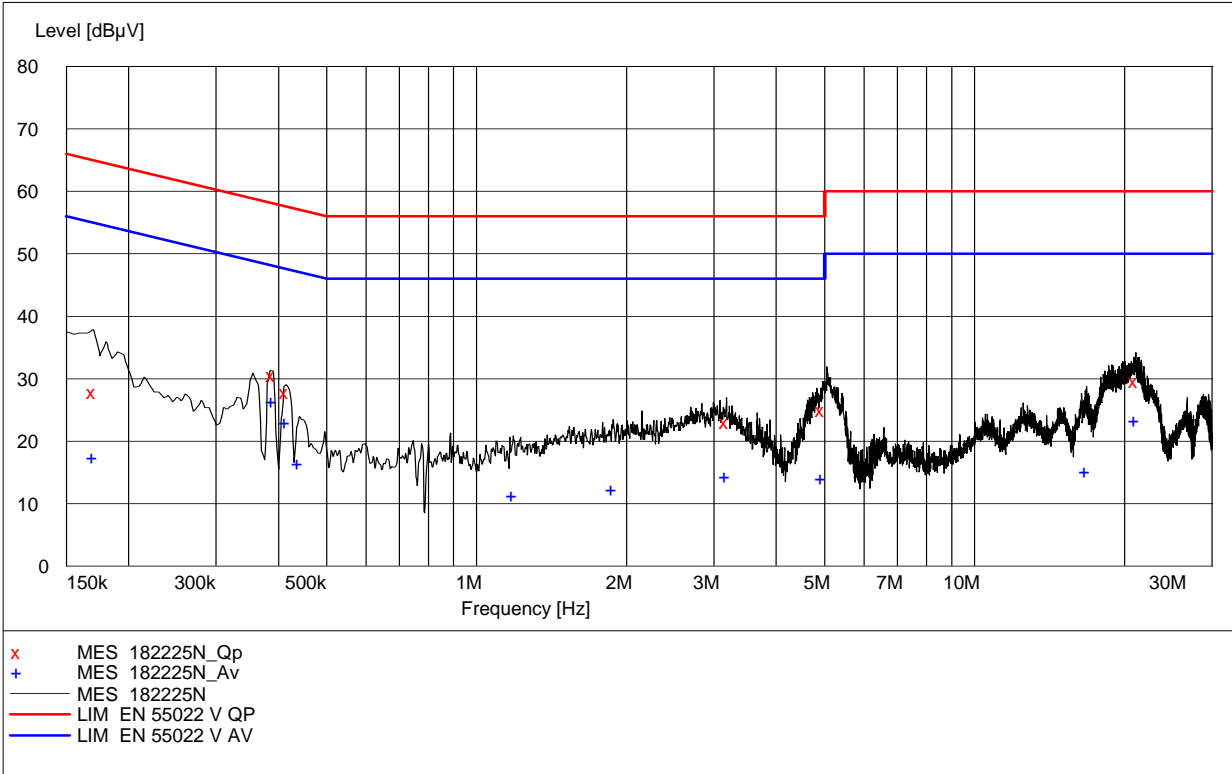
Measurement procedure: ANSI C63.4-2003 using 50 μ H/50 ohms LISN.

Test Results: Complies.

Measurement Data: See attached graph, (Peak detector).

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.170000	27.80	10.10	65.00	37.20	QP	N	Pass
0.390000	30.50	10.20	58.10	27.60	QP	L1	Pass
0.415000	27.80	10.20	57.50	29.70	QP	L1	Pass
3.175000	23.00	10.30	56.00	33.00	QP	L1	Pass
4.955000	25.00	10.40	56.00	31.00	QP	L1	Pass
21.085000	29.60	11.30	60.00	30.40	QP	L1	Pass

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.170000	17.50	10.10	55.00	37.50	AV	N	Pass
0.390000	26.40	10.20	48.10	21.70	AV	L1	Pass
0.415000	23.10	10.20	47.50	24.40	AV	L1	Pass
0.440000	16.40	10.20	47.10	30.70	AV	L1	Pass
1.185000	11.30	10.20	46.00	34.70	AV	N	Pass
1.880000	12.40	10.20	46.00	33.60	AV	N	Pass
3.175000	14.50	10.30	46.00	31.50	AV	L1	Pass
4.955000	14.00	10.40	46.00	32.00	AV	L1	Pass
16.770000	15.30	10.90	50.00	34.70	AV	L1	Pass
21.085000	23.40	11.30	50.00	26.60	AV	L1	Pass



4.2 Minimum 6 dB Bandwidth

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

Test Performed By: Frode Sveinsen	Date of Test: 18 Aug 2011
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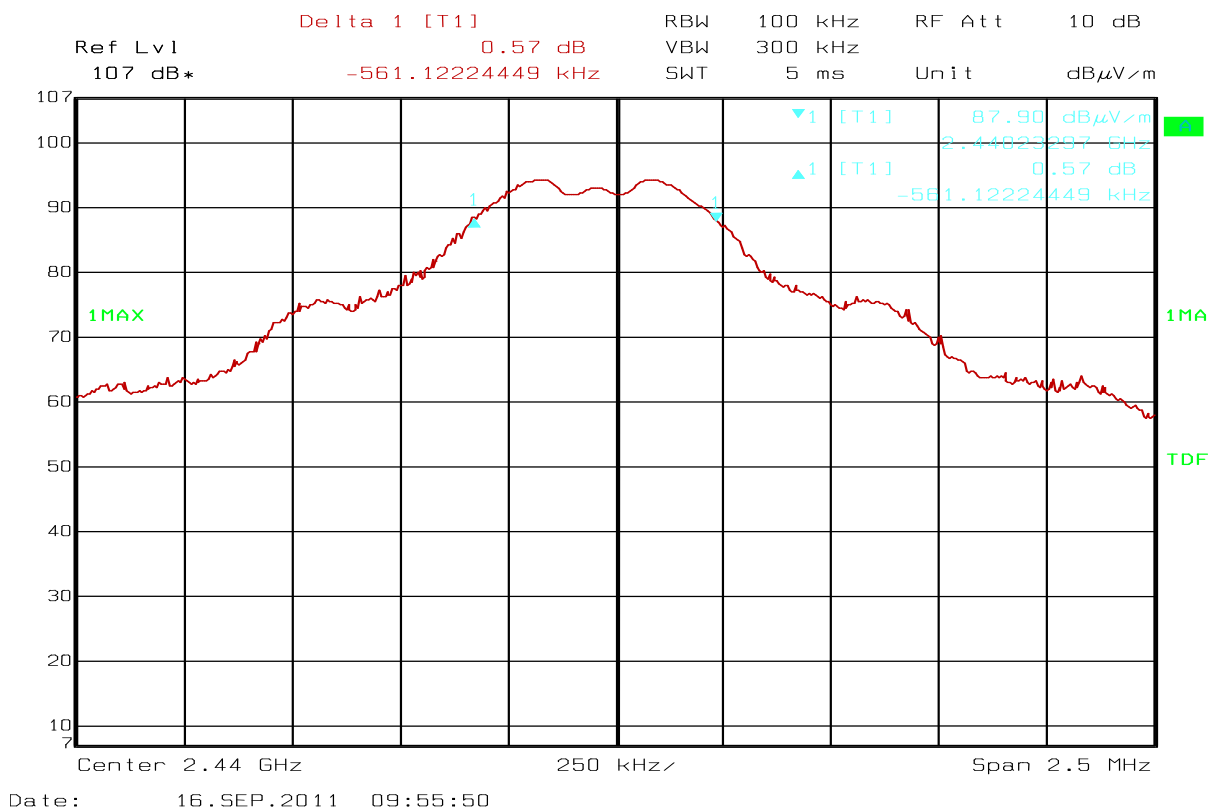
Test Results: Complies

Measurement Data:

Measured 6 dB Bandwidth (MHz)		
/	2440 MHz	/
/	0.561	/

Requirements:

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



6 dB Bandwidth at 2440 MHz

4.3 20 dB Bandwidth

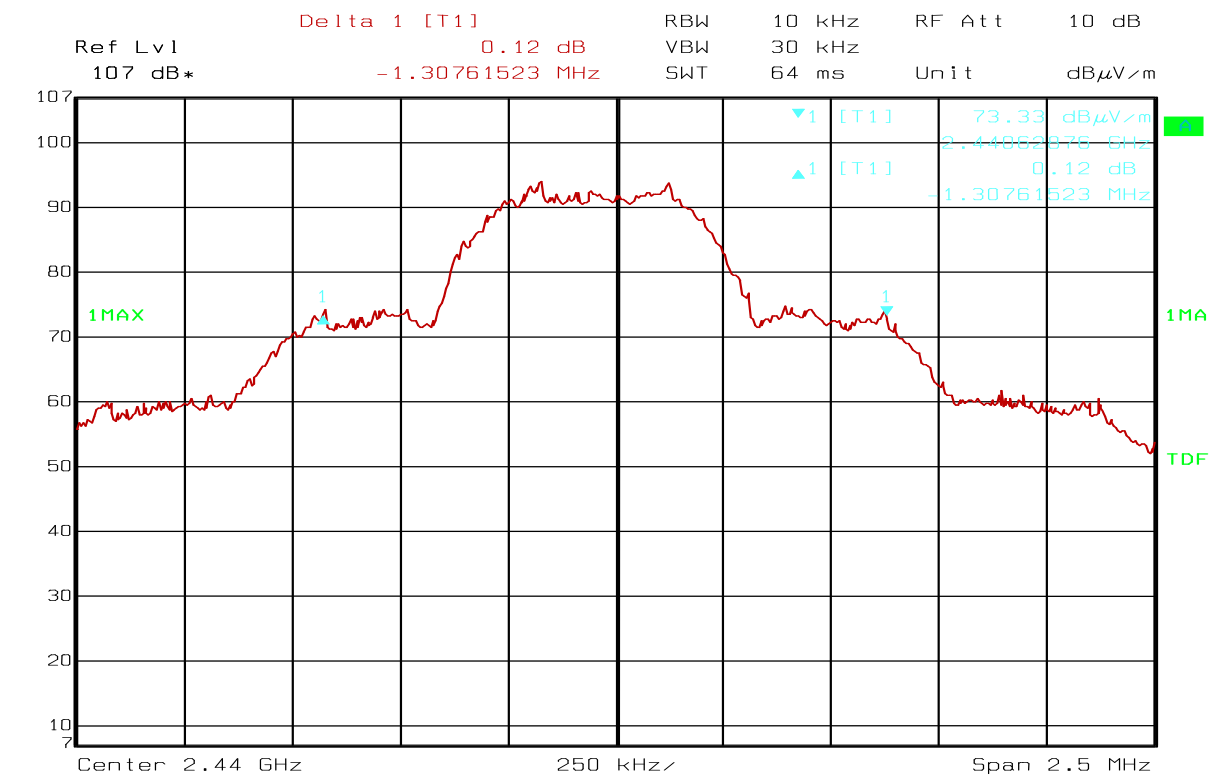
Test Performed By: Frode Sveinsen	Date of Test: 16 Aug 2011
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Measurement Data:

Measured 20 dB Bandwidth (MHz)
2440 MHz
1.31

Requirements:

No requirements. Reported for information only.



Date: 16.SEP.2011 10:13:56

20 dB Bandwidth at 2440 MHz

4.4 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: Frode Sveinsen	Date of Test: 4 Oct 2011
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Test Results: Complies

Measurement Data:

RF channel	2405 MHz	2440 MHz	2480 MHz
Measured Field Strength (dB μ V/m)	100.5	101.4	101.2
Measured EIRP (dBm)	5.3	6.2	6.0
Antenna Gain (dBi)*	4.3	4.1	3.7
Conducted Power (dBm)	1.0	2.1	2.3
Conducted Power (W)	0.0013	0.0016	0.0017

* Antenna Gain values are provided by the manufacturer. Conducted Power is calculated.

The Output 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

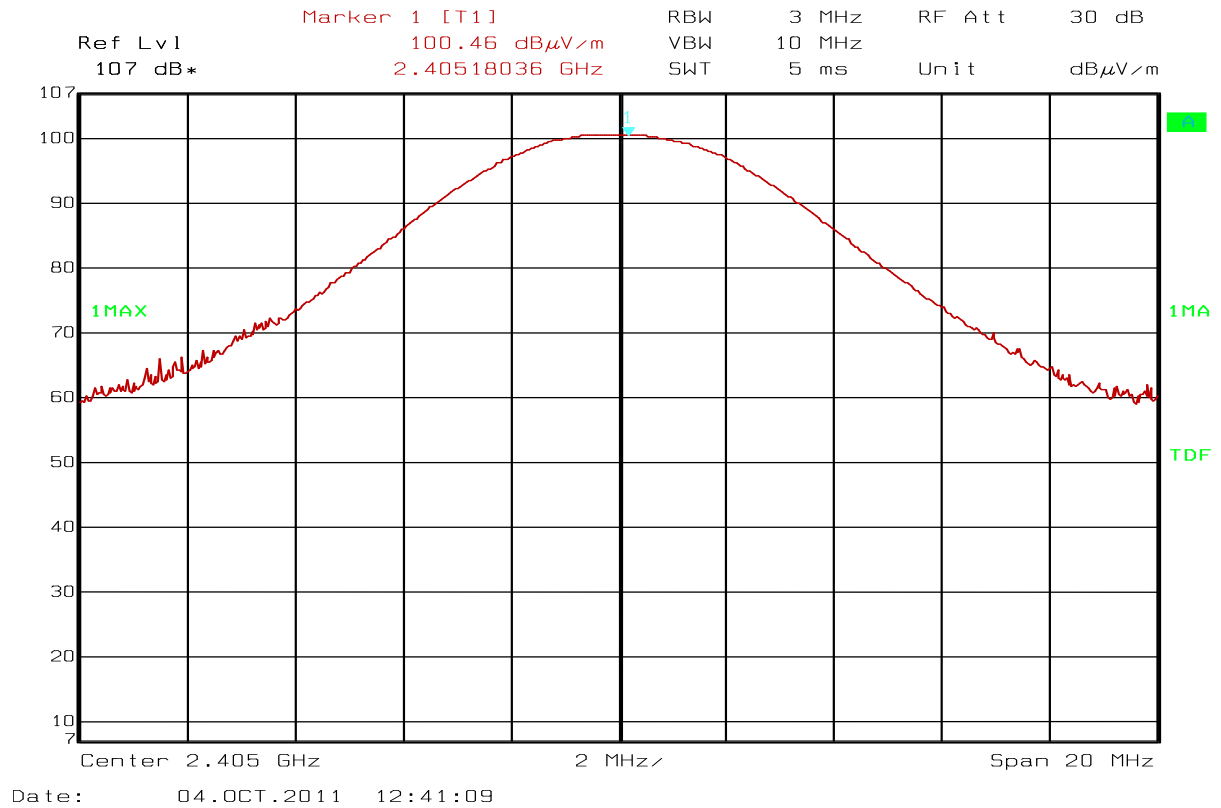
Type of antenna connector: None (PCB antenna).

Requirements:

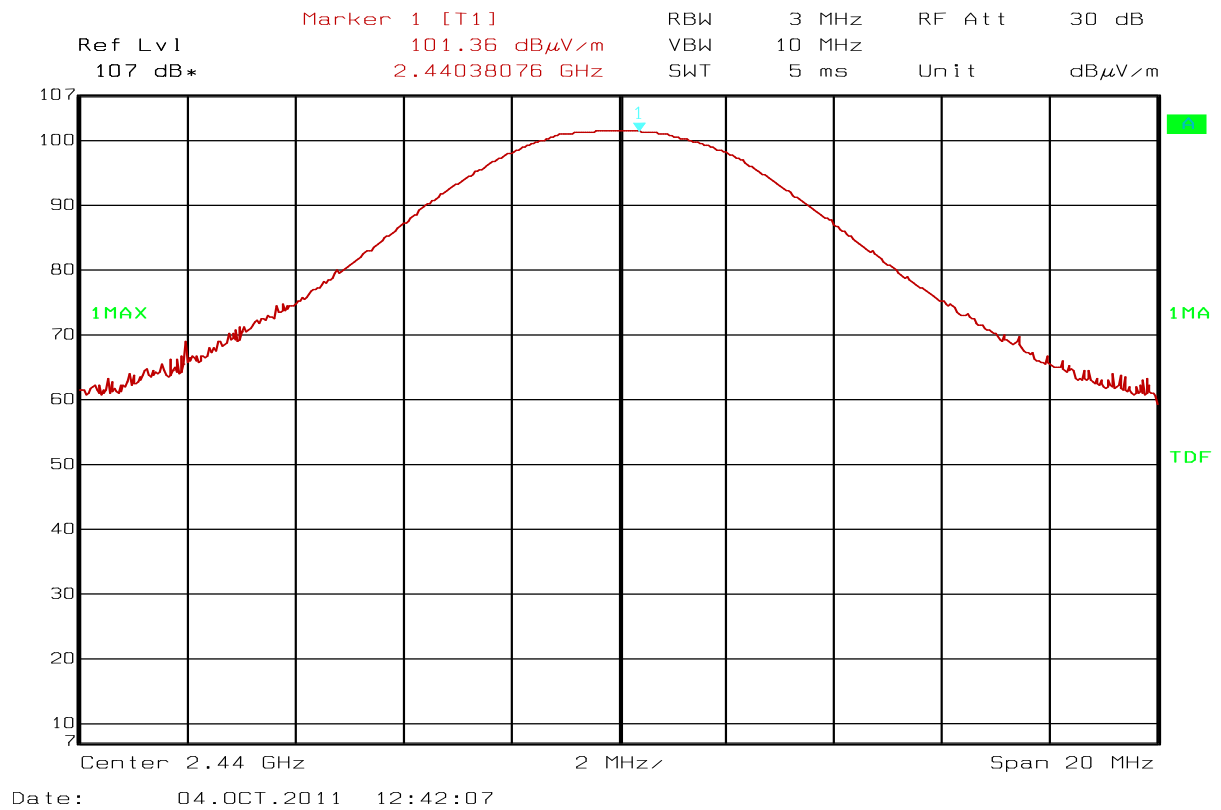
The maximum peak output power shall not exceed the following limits:

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

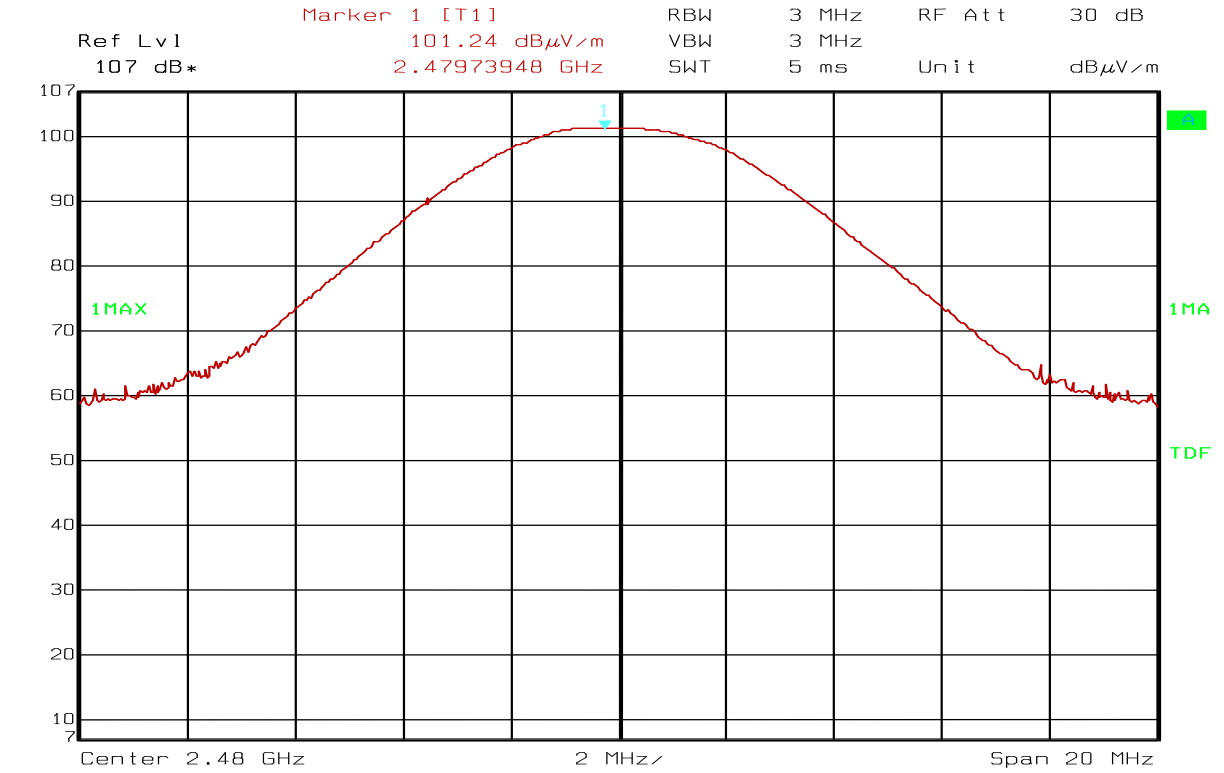
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



Output Power, 2405 MHz



Output Power, 2440 MHz



Date: 04.OCT.2011 12:31:11

Output Power, 2480 MHz

4.5 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Frode Sveinsen	Date of Test: 4 Oct 2011
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Test Results: Complies

Measurement Data:

Band-edge, @3m

Frequency	Measured Field Strength @3m, dBµV/m	Detector	Limit dBµV/m	Margin dB
2.389 GHz	45.4	AV	54	8.6
	45.4	PK	74	28.6
2.4835 GHz	53.7*	AV	54	0.3
	53.7*	PK	74	20.3

*Calculated with Marker-Delta method.

See attached plots.

Marker Delta Calculation:

Max: 101.2 dBµV/m

Delta: 47.5 dB

Band Edge Field Strength, Peak: $101.2 - 47.5 \text{ dB}\mu\text{V/m} = 53.7 \text{ dB}\mu\text{V/m}$

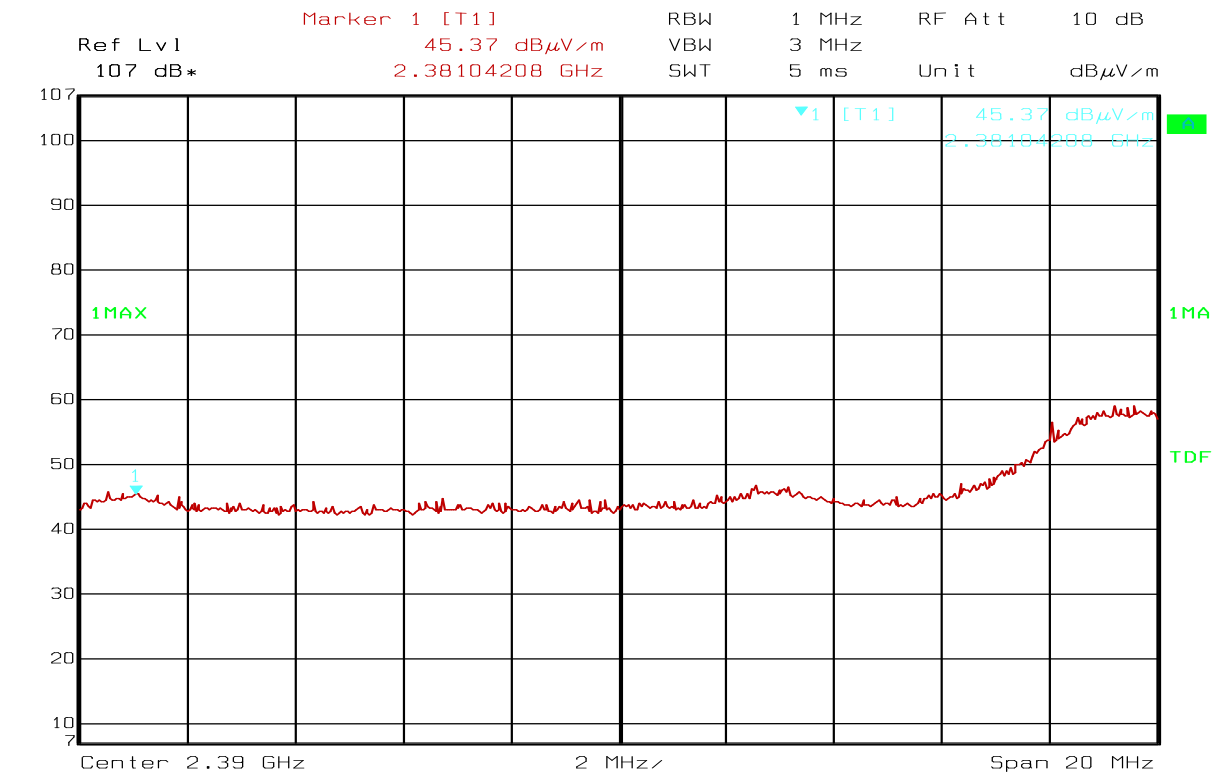
RF conducted power

Scan performed radiated with 100 kHz Bandwidth from 1 to 12 GHz.

Scans at other frequencies were performed radiated with 1 MHz BW.

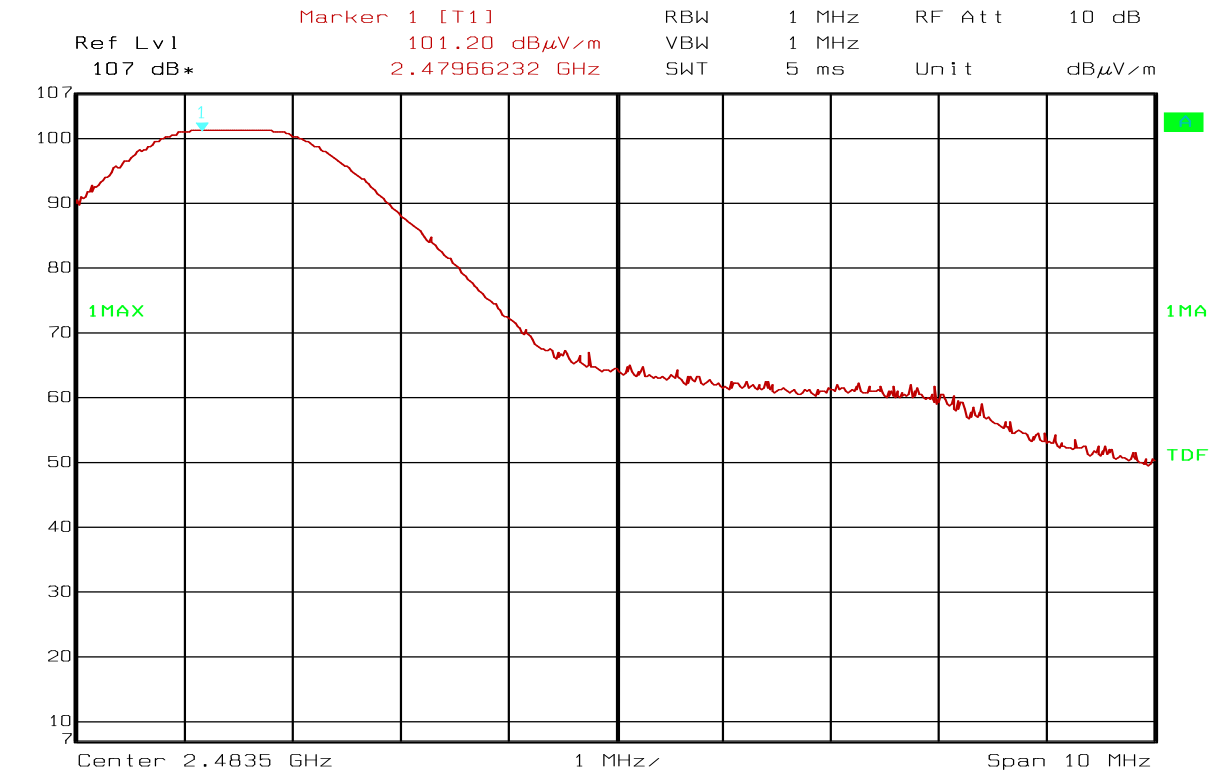
All emissions are more than 20dB below carrier.

See plots.



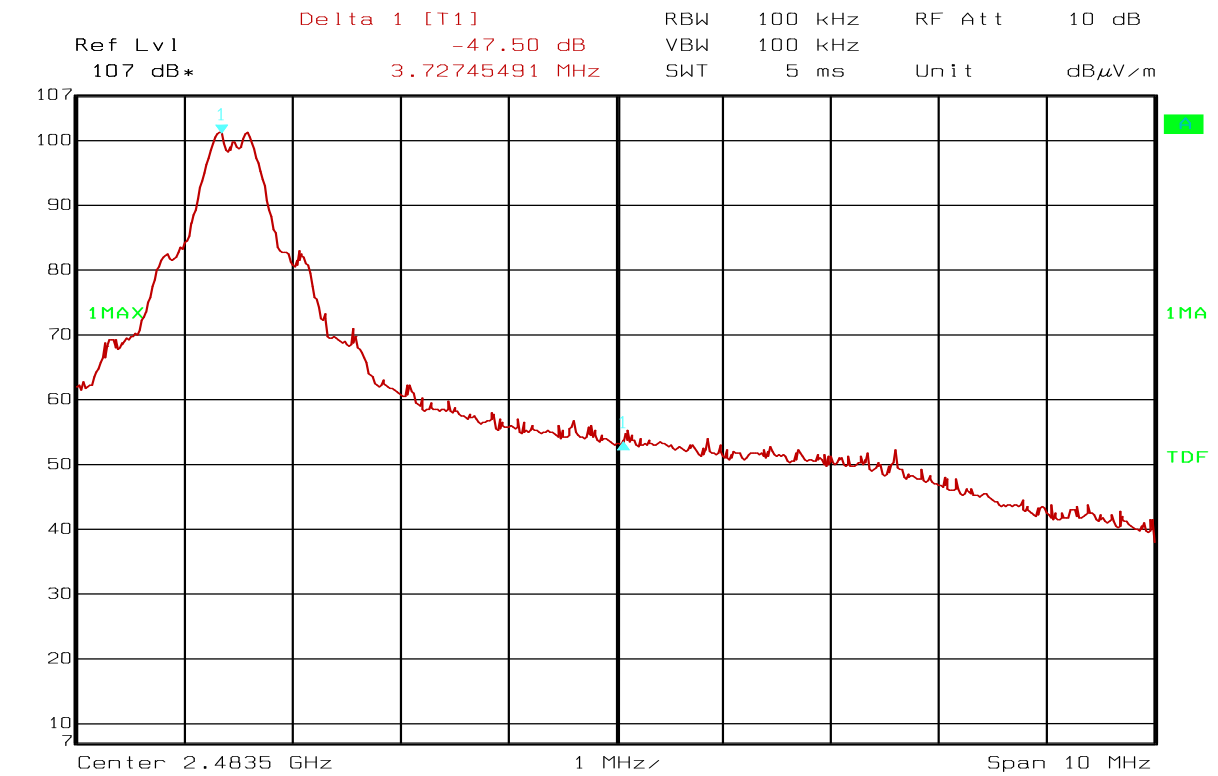
Date: 16.SEP.2011 10:29:38

Band Edge, 2390 MHz, Peak Detector (marker at 2389MHz)



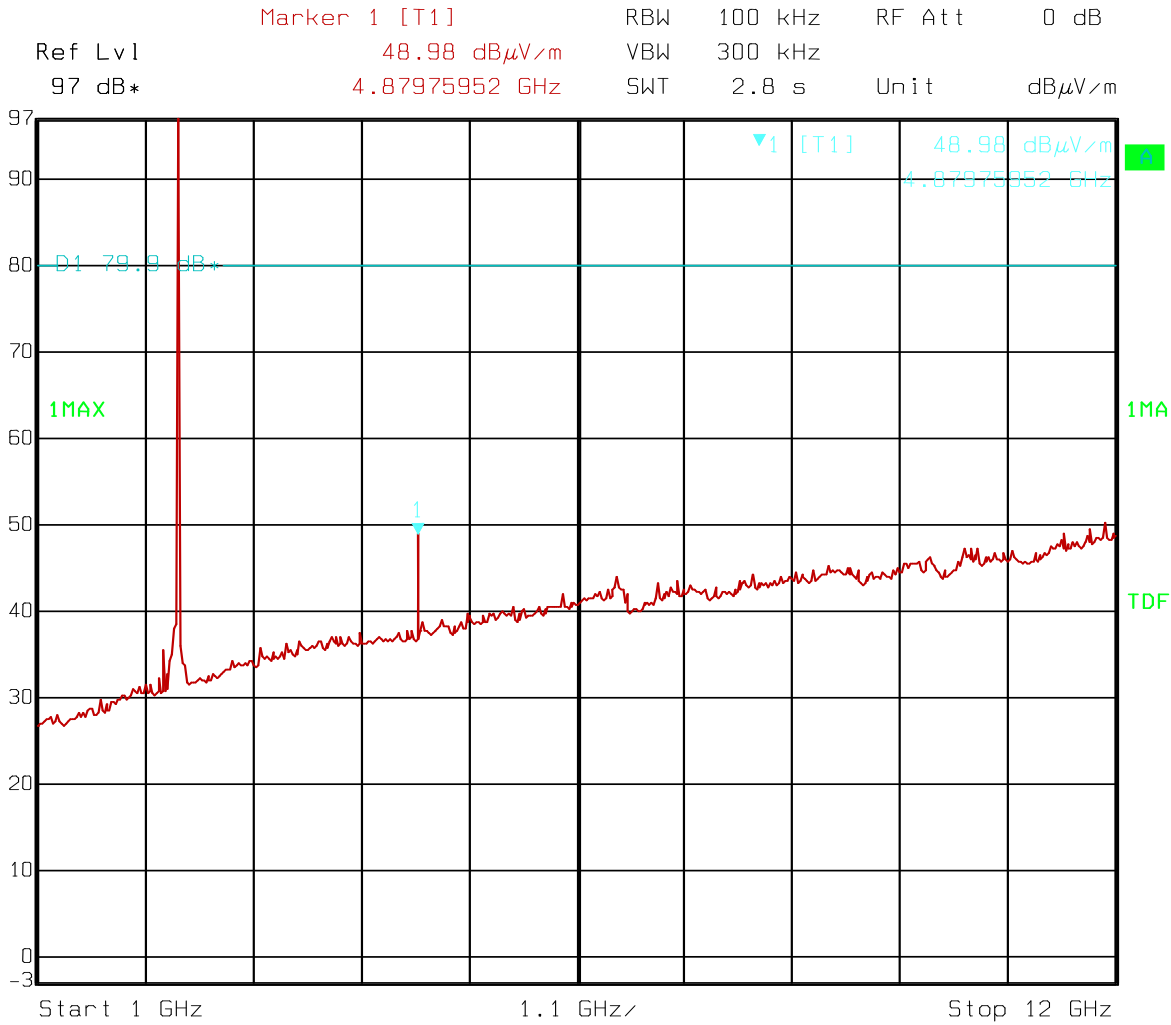
Date: 04.OCT.2011 12:32:58

Band Edge, 2483.5 MHz, Marker Delta, Max



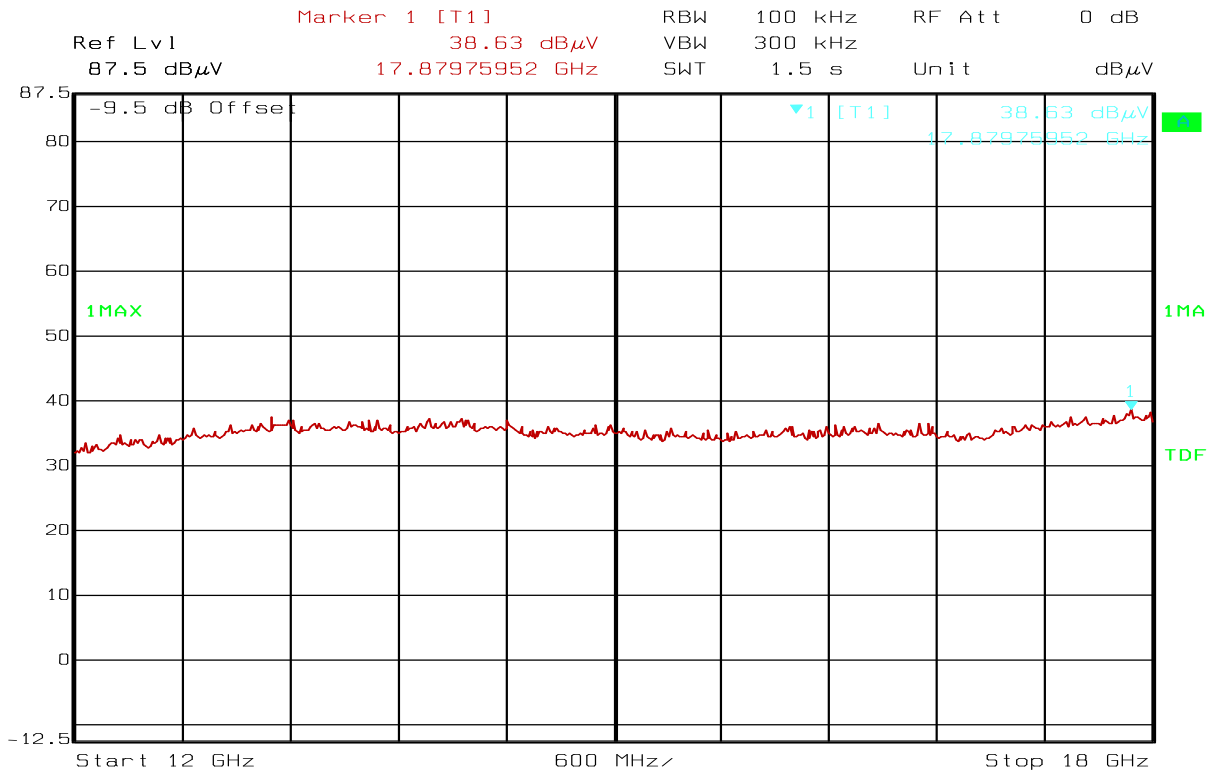
Date: 04.OCT.2011 12:34:17

Band Edge, 2483.5 MHz, Marker Delta, Delta



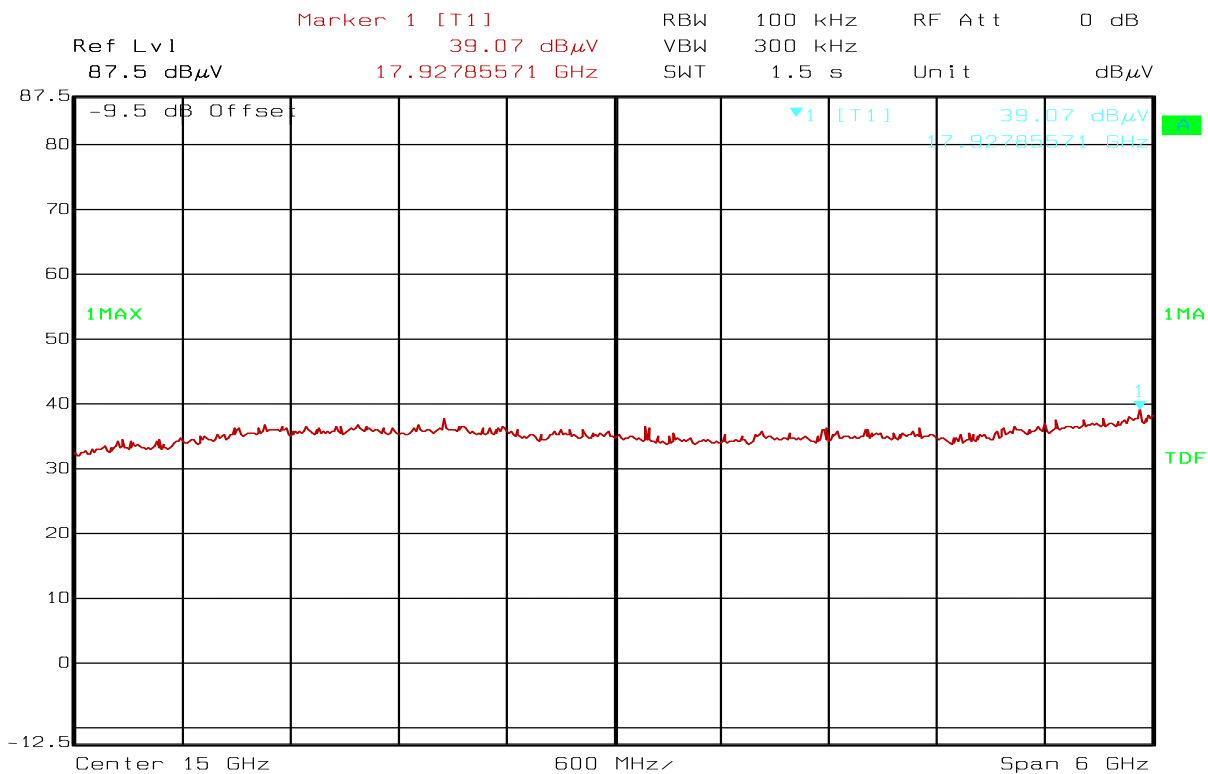
Date: 17.AUG.2011 17:14:15

Radiated Emissions 100kHz, VP, 1 – 12 GHz



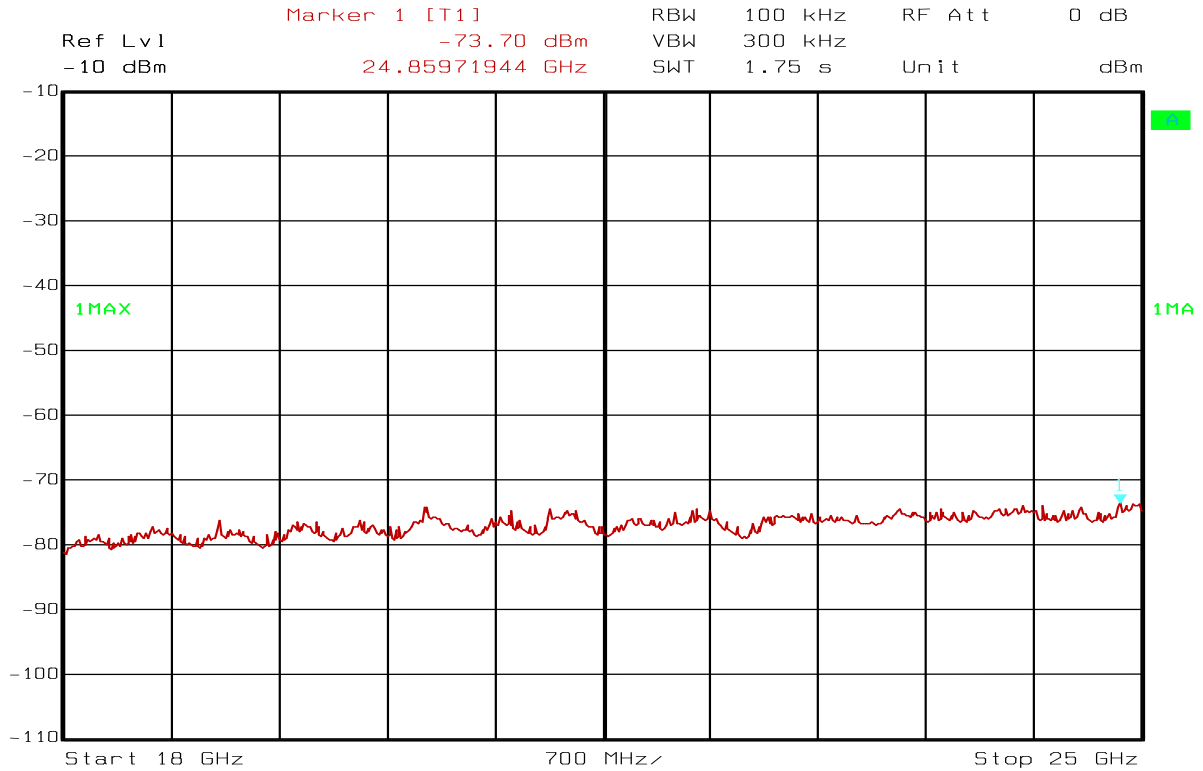
Date: 18.AUG.2011 15:11:08

Radiated Emissions 100kHz, VP, 12 – 18 GHz



Date: 18.AUG.2011 15:13:01

Radiated Emissions 100kHz, HP, 12 – 18 GHz



Date: 23.AUG.2011 09:25:24

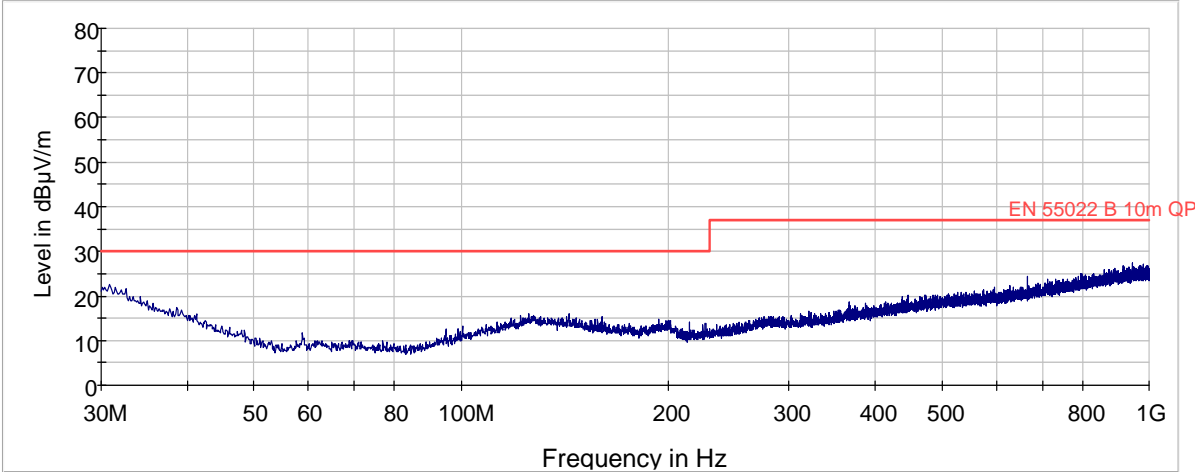
Pre-scan 100kHz, 18 – 25 GHz

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 10 m according to CISPR 22.

See attached plot.



Radiated Emissions, 30 – 1000 MHz, VP and HP, @10m

Radiated Emissions, 1-25 GHz

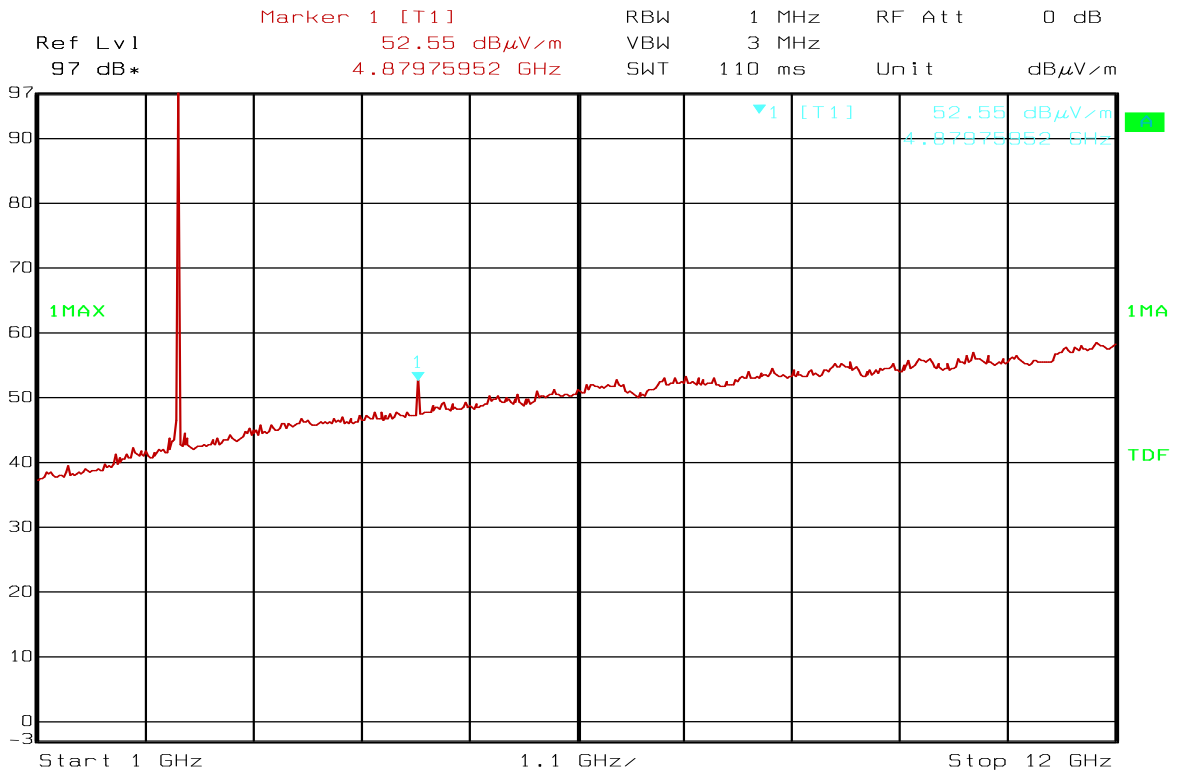
1-12 GHz measured at a distance of 1 or 3m, 12 - 25 GHz measured at 1m.

Frequency MHz	Field strength @3m dBµV/m	Detector	Limit dBµV/m	Margin dB
4810	49.6	Pk	74	24.4
4880	50.7	Pk	74	23.3
4960	50.0	Pk	74	24.0
4810	< 49.6	Av	54	> 4.4
4880	< 50.7	Av	54	> 3.3
4960	< 50.0	Av	54	> 4.0

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

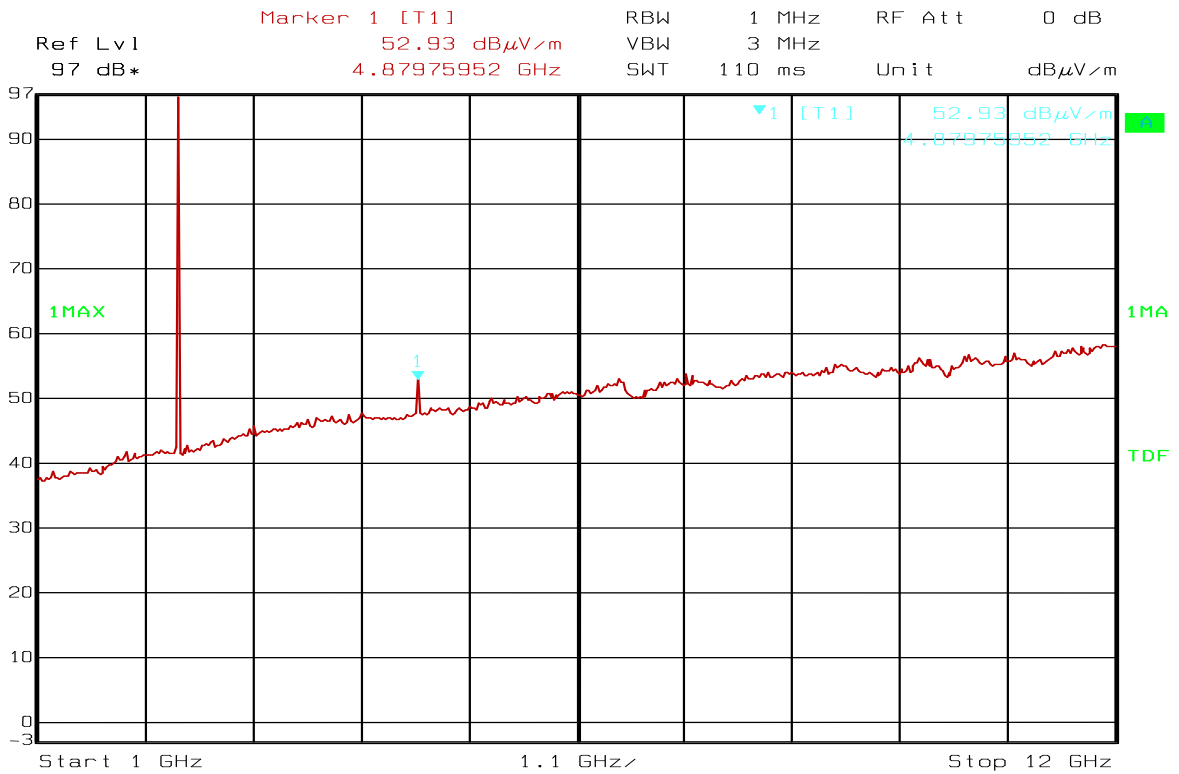
Distance Correction factor of 9.5 dB for measurements at 1m is included in above values

See attached graphs.



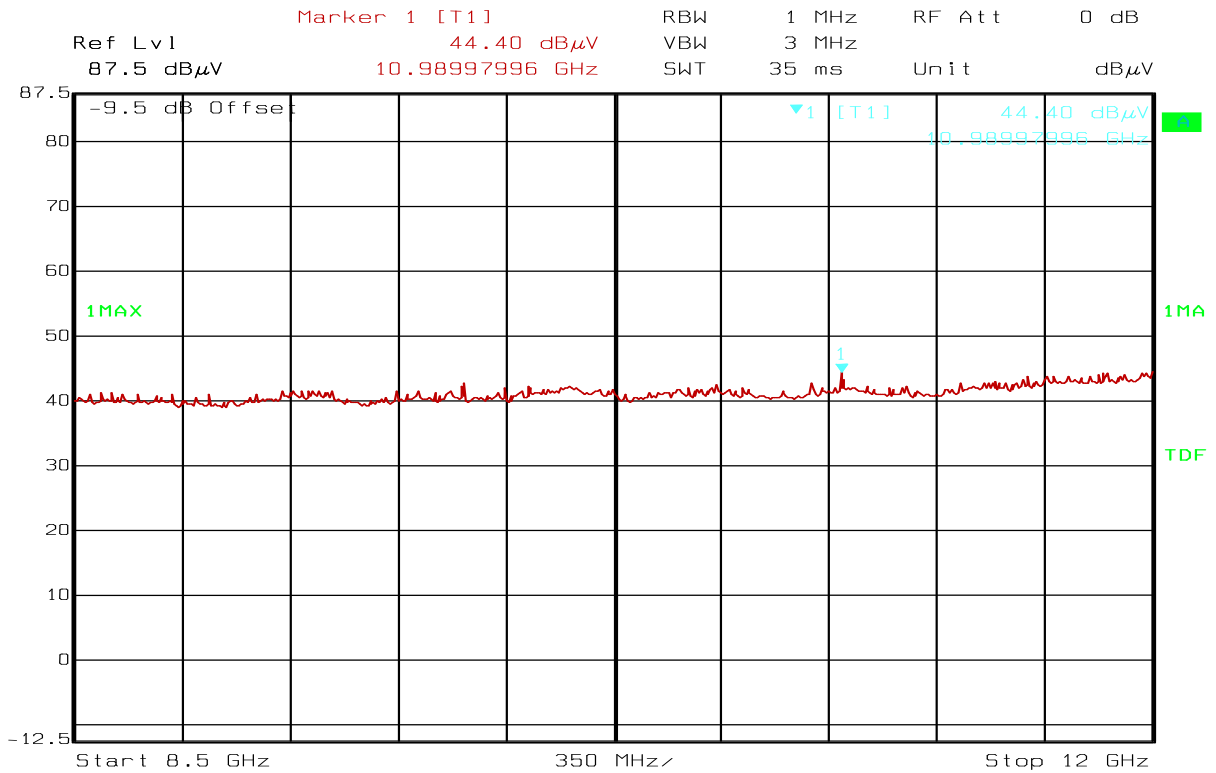
Date: 17.AUG.2011 17:10:39

Radiated Emissions, 1 - 12 GHz, VP



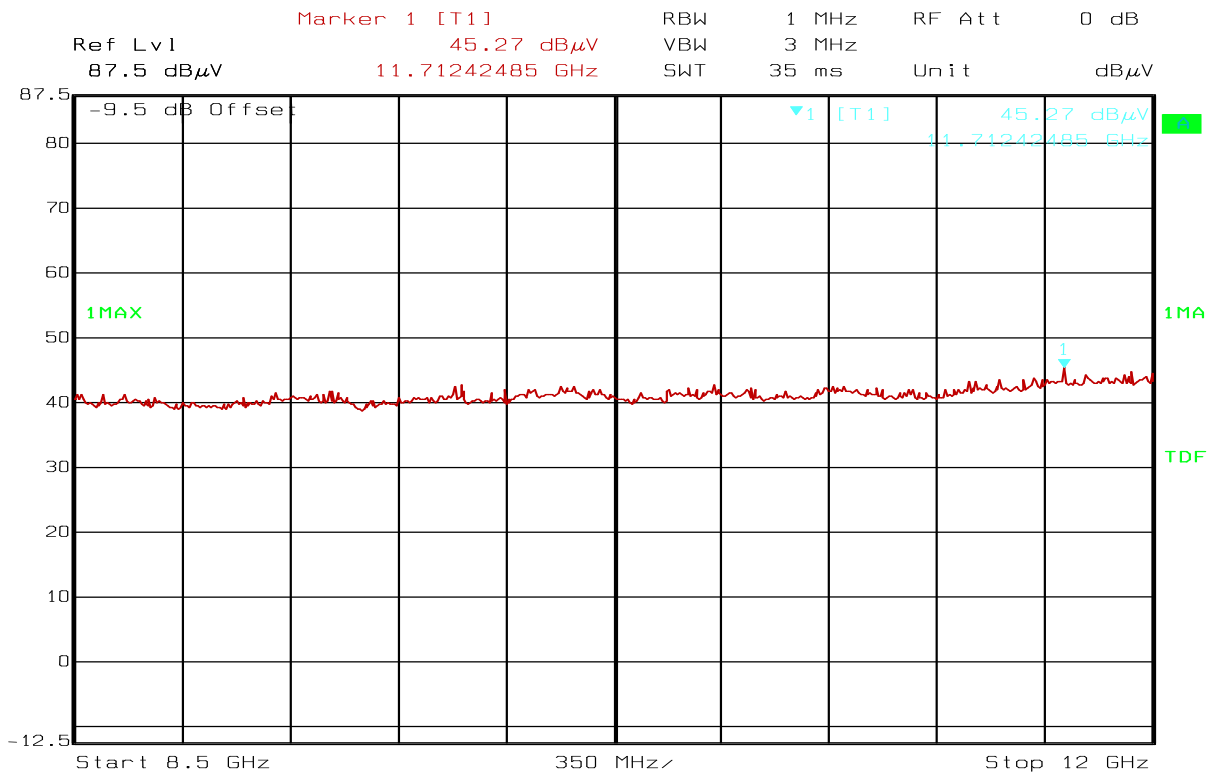
Date: 17.AUG.2011 17:04:03

Radiated Emissions, 1 - 12 GHz, HP



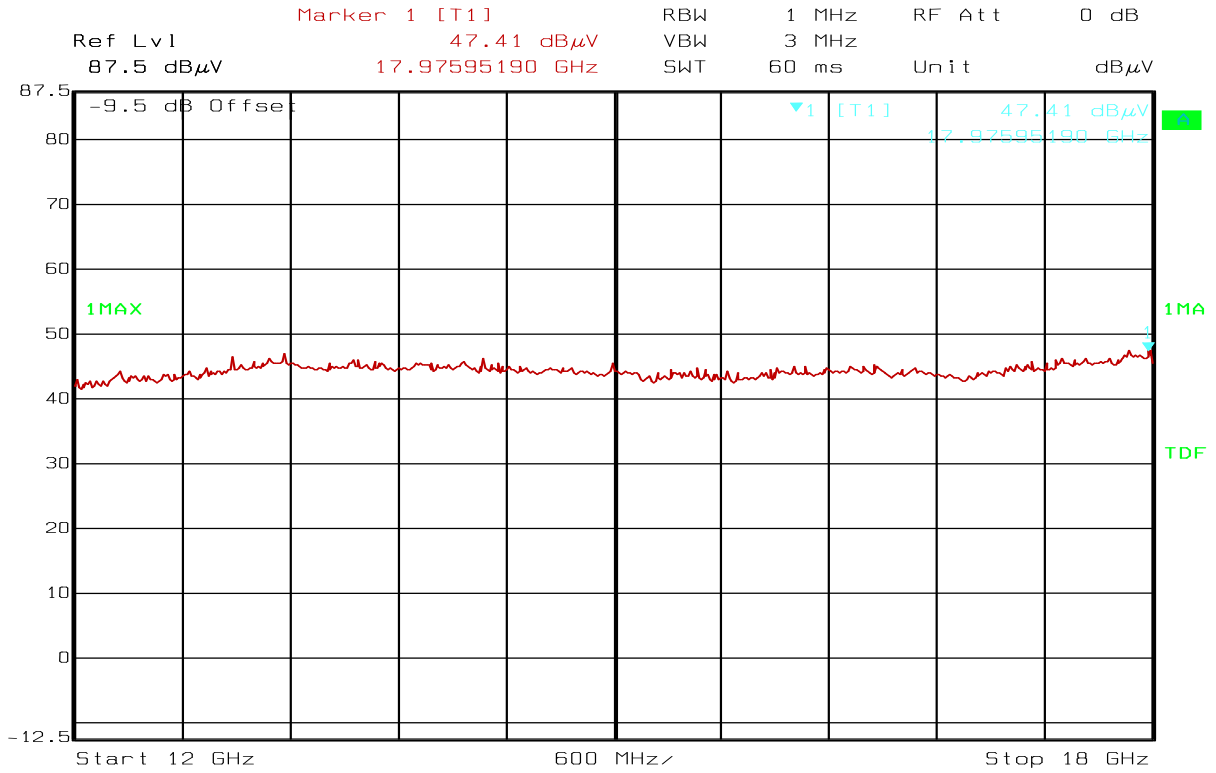
Date: 18.AUG.2011 12:46:41

Radiated Emissions, 8.5 – 12 GHz, VP, @1m



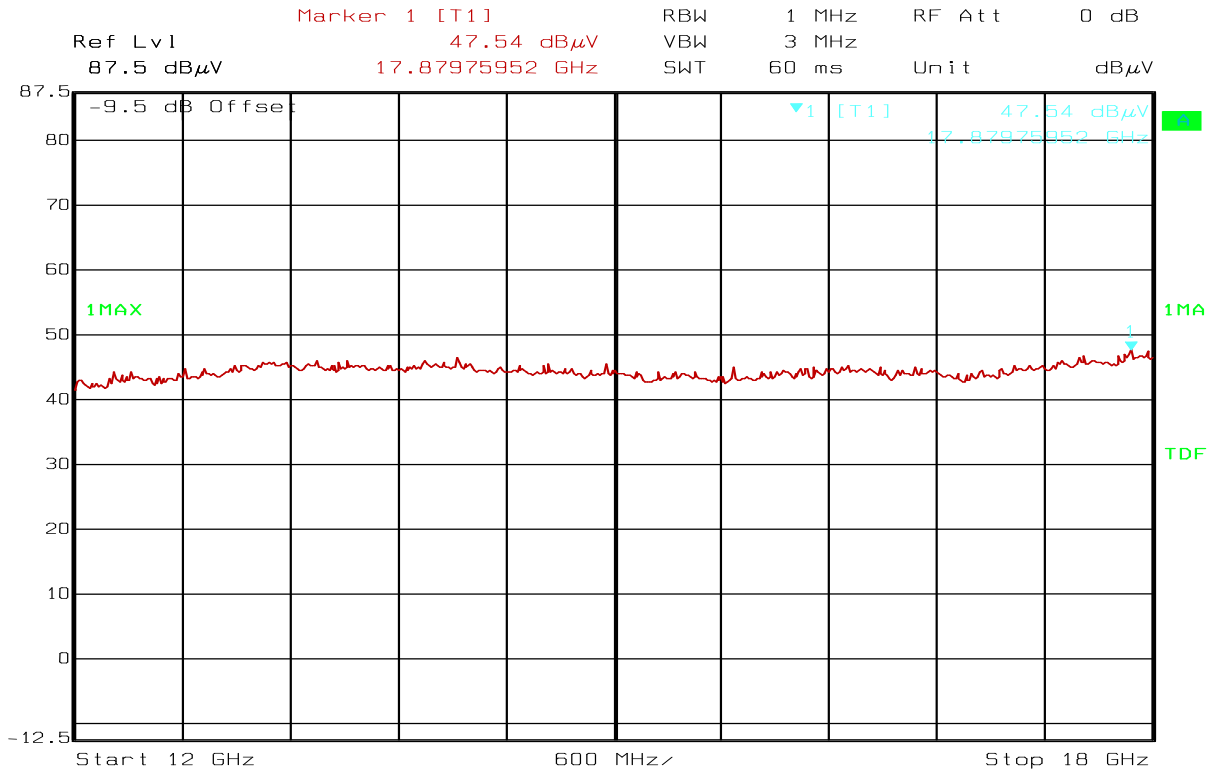
Date: 18.AUG.2011 12:48:34

Radiated Emissions, 8.5 – 12 GHz, HP, @1m



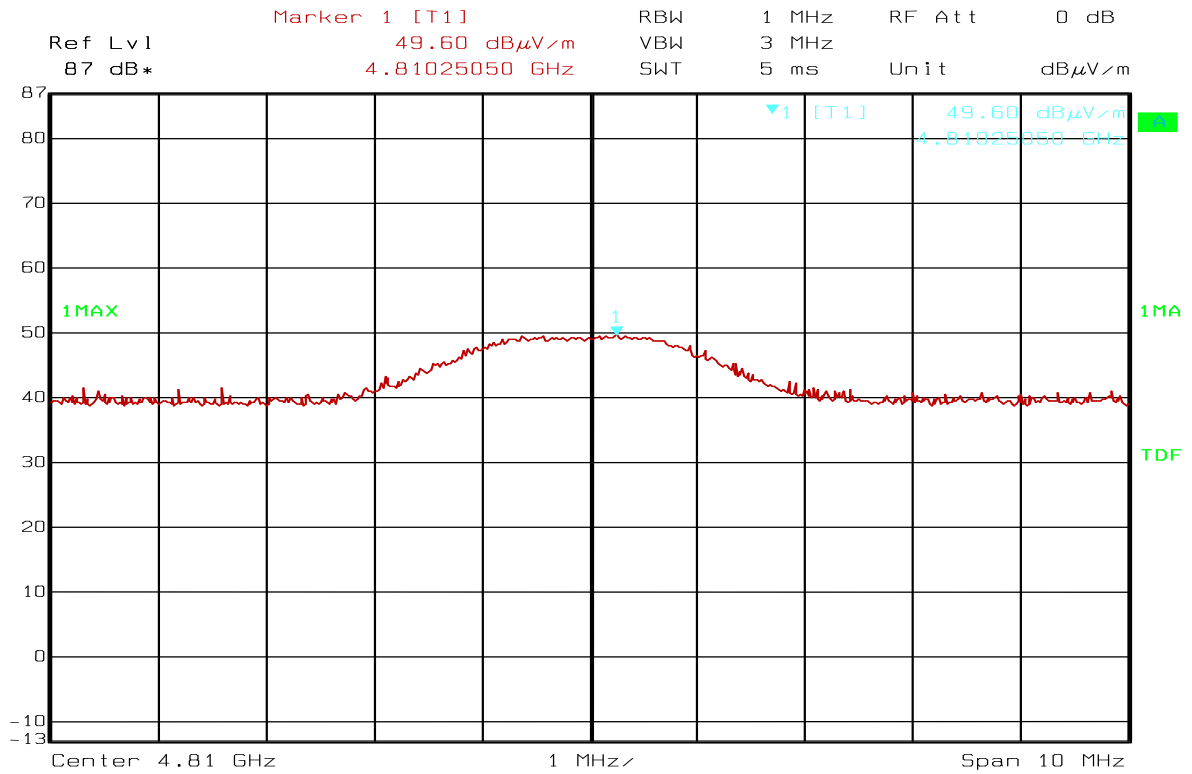
Date: 18.AUG.2011 12:37:42

Radiated Emissions, 12 – 18 GHz, VP, @1m



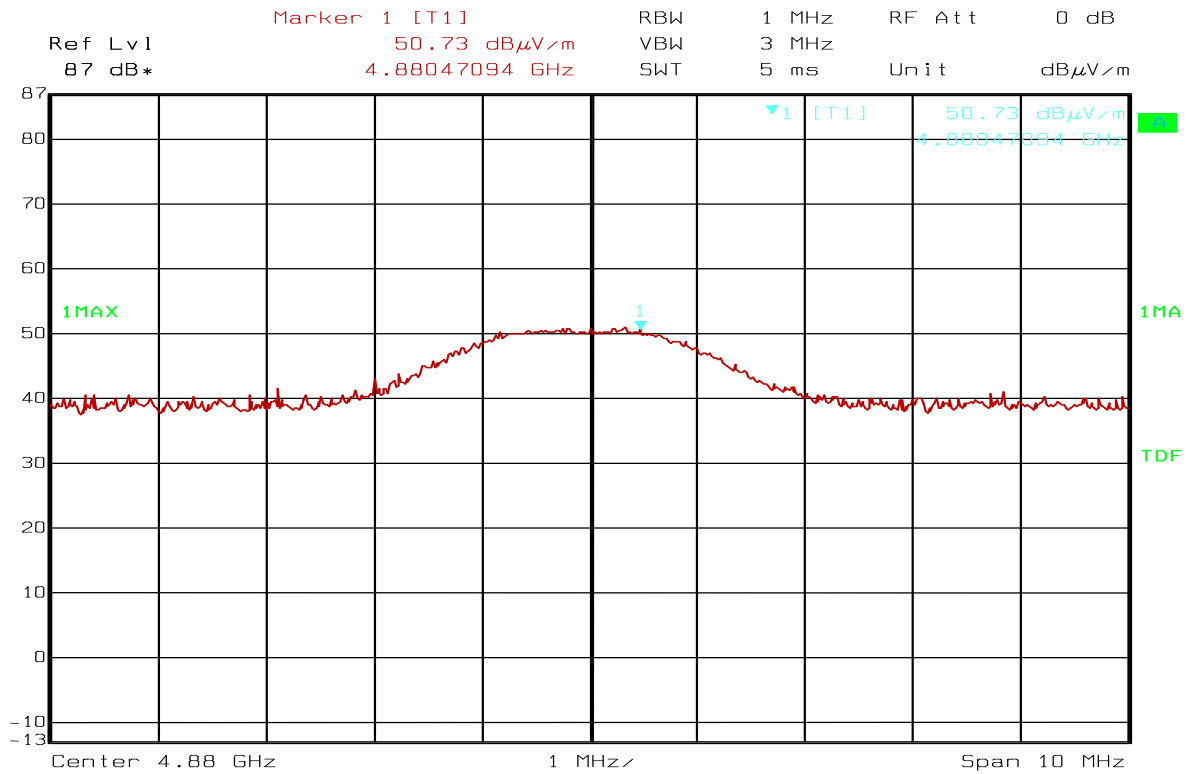
Date: 18.AUG.2011 12:39:35

Radiated Emissions, 12 – 18 GHz, HP, @1m



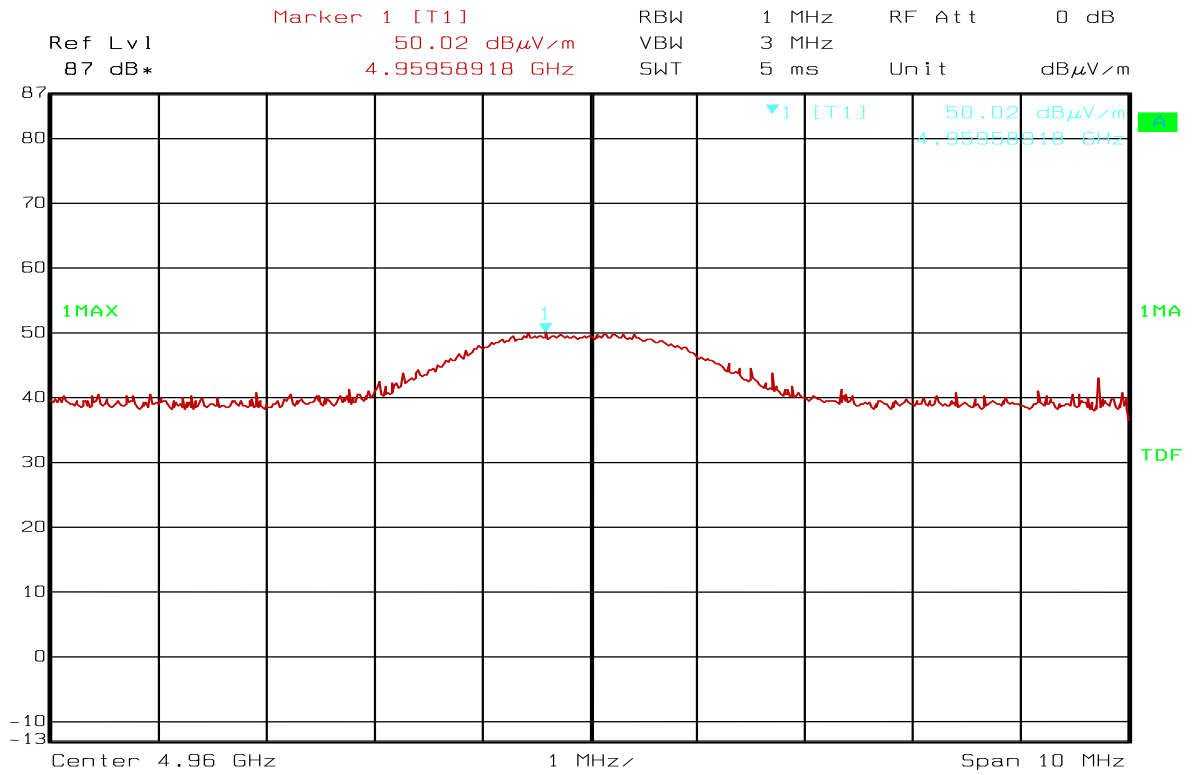
Date: 16.SEP.2011 11:07:35

Radiated Emissions, 4810 MHz, Max, Pk Det.



Date: 16.SEP.2011 11:02:55

Radiated Emissions, 4880 MHz, Max, Pk Det.



Date: 16.SEP.2011 11:05:41

Radiated Emissions, 4960 MHz, Max, Pk Det.

4.6 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	/	/
2405	4809.45	45.5	54	8.5
2440	4879.45	48.1	54	5.9
2480	4959.45	49.5	54	4.5
> 1000 (all others)	all	None found	54	/

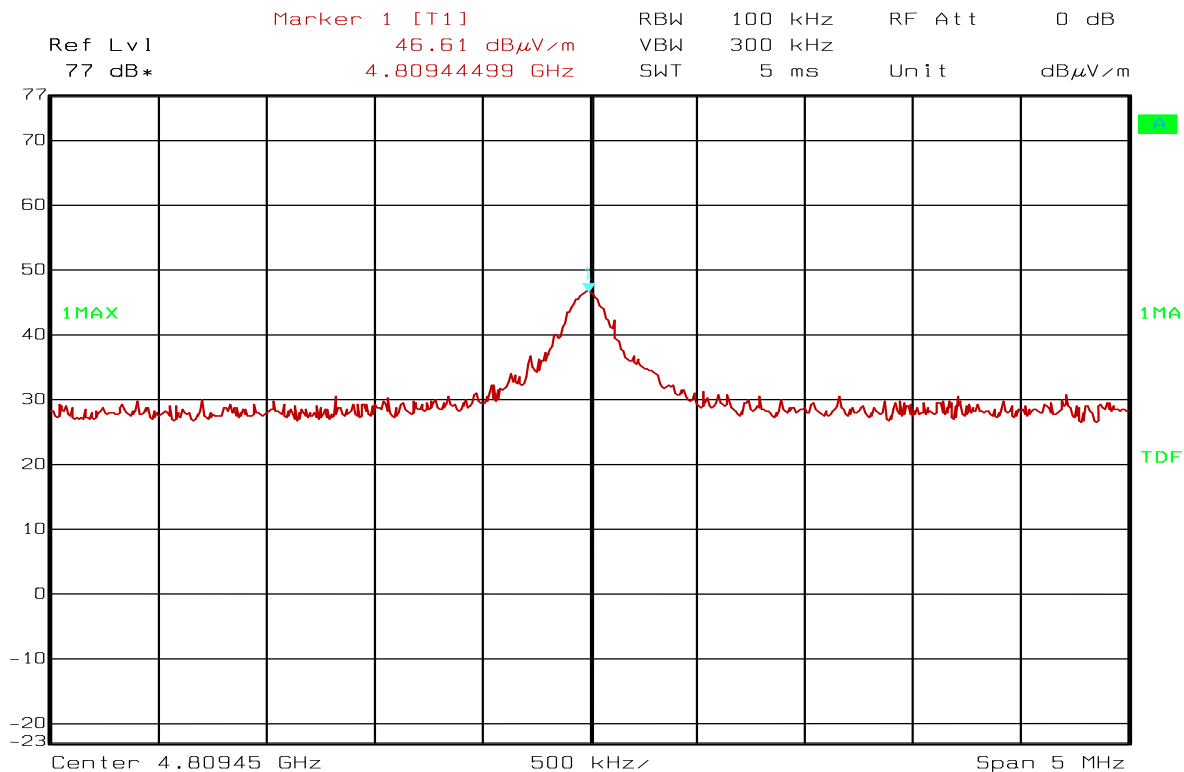
The measurement was performed radiated with the EUT in receive-only mode.

Requirements, RSS-GEN Issue 3, clause 6

The measurement can be performed either radiated or conducted.

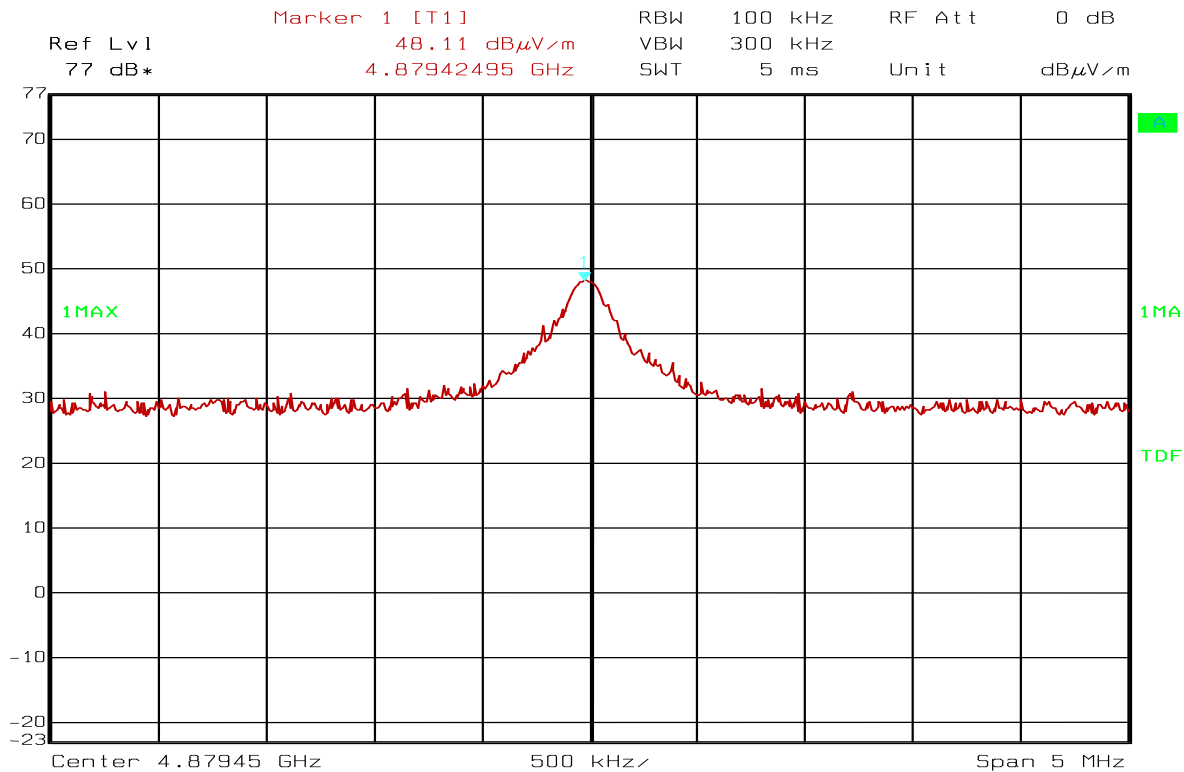
When measured Conducted: no spurious signals appearing at the antenna terminals shall exceed 2 nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nW above 1 GHz.

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



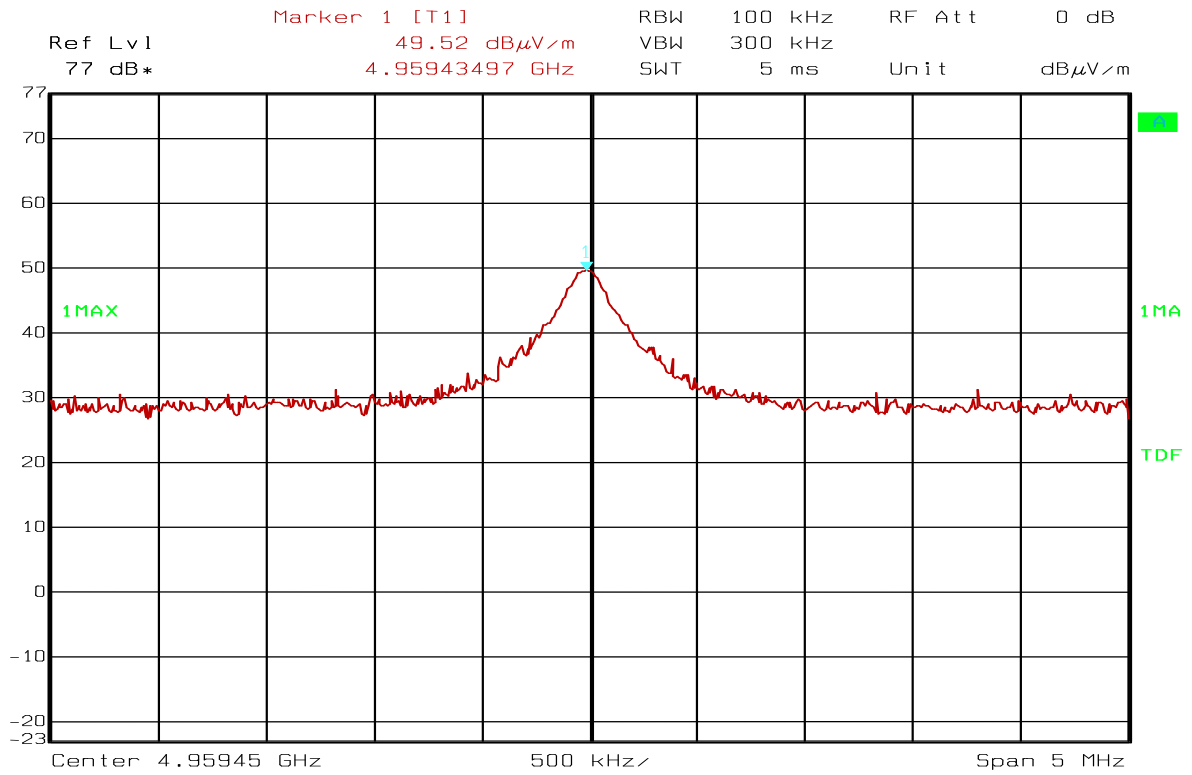
Date: 22.AUG.2011 12:45:47

Receiver Radiated Emissions, 4809.45 MHz



Date: 22.AUG.2011 12:48:06

Receiver Radiated Emissions, 4879.45 MHz



Date: 22.AUG.2011 12:49:37

Receiver Radiated Emissions, 4959.45 MHz

4.7 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Test Performed By: Frode Sveinsen	Date of Test: 18 Aug 2011
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Test Results: Passed

Measured and Calculated Data:

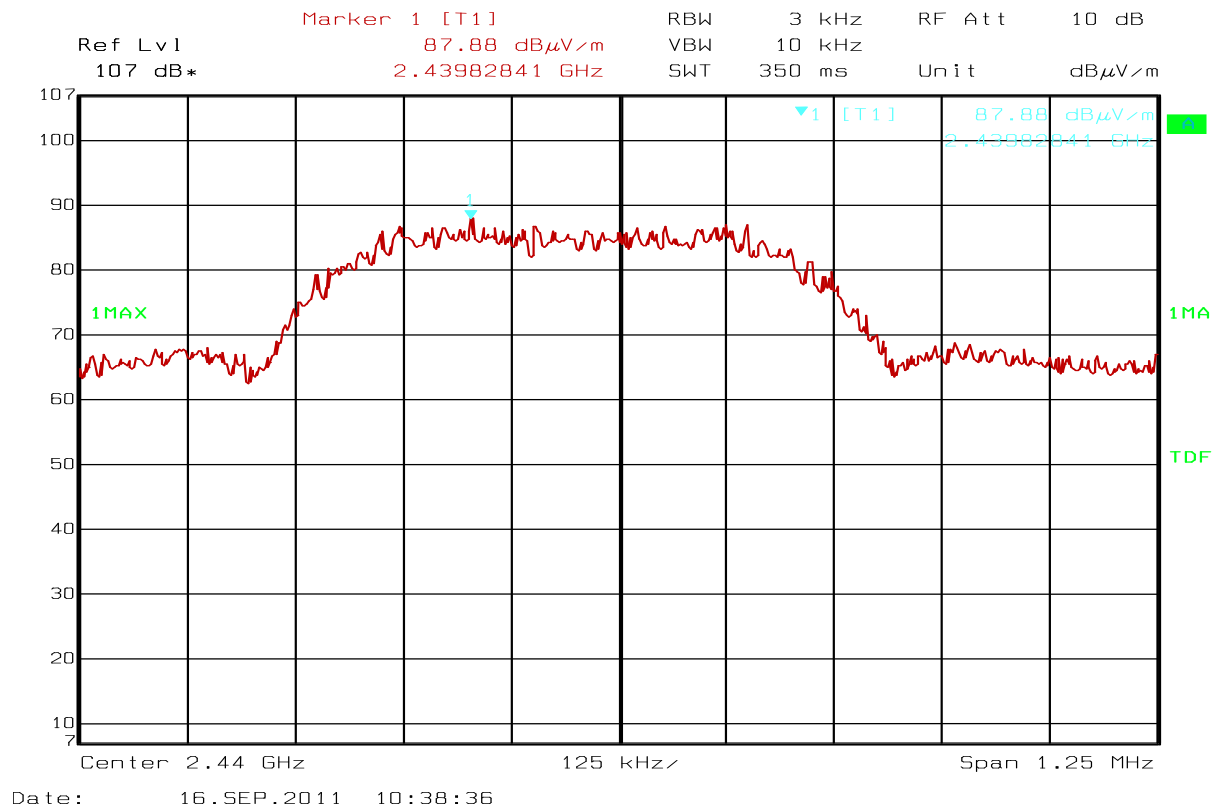
The alternative test procedures in point 2) A , B and formula 1 described in guidance on measurements for Digital Transmission Systems is used.

	Measured Field Strength @3m dB μ V/m	Calculated PSD dBm
Power Spectral Density @2440 MHz	88.6	-6.6

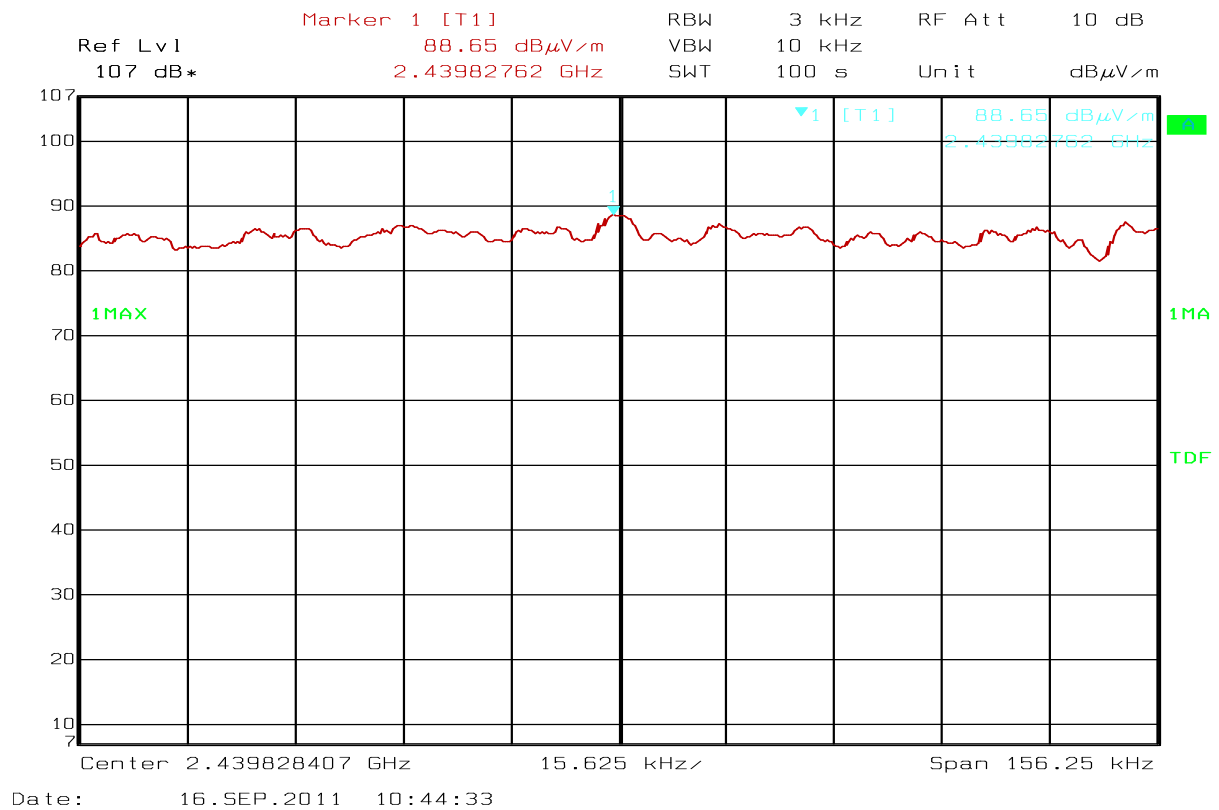
PSD in dBm is calculated from the field strength value using the Free Field Formula.

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

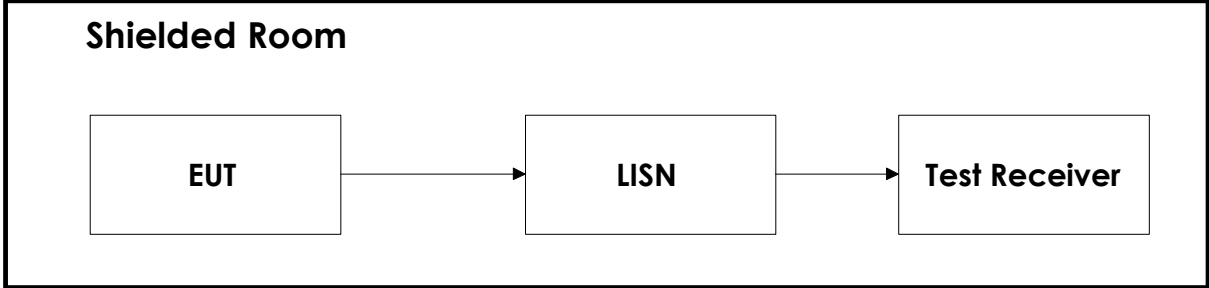
5 LIST OF TEST EQUIPMENT

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	LR 1090	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	N-4525	2010-09	2011-09
10	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2011-09-27	2012-09-27
11	LNA6900	Pre-amplifier	Teseq	LR 1593	2010-11	2011-11
12	ESCI	Test Receiver	Rohde & Schwarz	N-4529	2010.11.08	2011.11.02
13	ESH3-Z3	LISN	Rohde & Schwarz	LR 1076	2009-10-22	2011-10-22
14	80S	Signal Generator	Powertron	LT 502	Cal b4 use	
15	Model 87 V	Multimeter	Fluke	LR 1598	2010-12-14	2011-12-14

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission

