



Test report no. : 182223-5

Item tested : CC1111Dongle-868

**Type of equipment : Low power Transceiver
903.5 – 926.5 MHz**

FCC ID : ZAT1111USB900

Client : Texas Instruments Norway AS

FCC Part 15.249

Low Power Transceiver
902-928 MHz Band

RSS-210, Issue 8 and RSS-GEN, Issue 3

Low-Power Licence-exempt Radiocommunications devices
902 – 928 MHz Band

6 December 2012

Authorized by :



Frode Sveinsen
Technical Verificator



CONTENTS

1	GENERAL INFORMATION	3
1.1	Testhouse Info	3
1.2	Client Information.....	3
1.3	Manufacturer.....	3
2	Test Information.....	4
2.1	Test Item.....	4
2.2	Test Environment.....	5
2.2.1	Normal test condition	5
2.3	Test Period.....	5
3	TEST REPORT SUMMARY	6
3.1	General	6
3.2	Test Summary.....	7
3.3	Description of modification for Modification Filing.....	7
3.4	Comments	7
3.5	Family List Rationale	7
4	TEST RESULTS	8
4.1	Power-line Conducted Emissions	8
4.2	Transmitter Frequency Stability	11
4.3	20 dB Bandwidth.....	12
4.4	Peak Power Output.....	16
4.5	Band Edge Emissions.....	26
4.6	Spurious Emissions (Radiated)	29
4.7	Receiver Spurious Emissions (Radiated)	42
5	LIST OF TEST EQUIPMENT.....	46
6	BLOCK DIAGRAM	47
6.1	System set up for radiated measurements	47
6.2	Power line Conducted Emission	47
6.3	Test Site Radiated Emission.....	48

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
Email: comlab@nemko.no
FCC test firm : 994405
IC OATS : 2040D-1
Total Number of Pages: 48

1.2 Client Information

Name : Texas Instruments Norway AS
Address : Gaustadallen 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 Manufacturer

Same as client.

2 Test Information

2.1 Test Item

Name :	USB Dongle
Model/version :	CC1111Dongle-868
FCC ID :	ZAT1111USB900
IC :	451H-1111USB900
Serial number :	0000 093D
Hardware identity and/or version:	-
Software identity and/or version :	-
Frequency Range :	903.5 – 926.5 MHz
Operating Frequency:	903.5MHz,915MHz,926.5MHz
Number of Channels :	1
Operating Modes :	TX & RX
Type of Modulation :	2-GFSK
Data rate:	1.2kbit/s
User Frequency Adjustment :	None, Software controlled
Output Power :	0.36 mW (Peak, Conducted)
Type of Power Supply :	USB power (tested with 4.5 V DC, 3x 1.5Vdc)*
Antenna Connector :	No, integral antenna
Antenna type:	PCB antenna, gain: 1.0dBi
Antenna Diversity Supported :	None

*Tested using USB2.0 connector but power is supplied by 4.5V DC battery pack.

Description of Test Item

The CC1111 dongle is a RF-transceiver module with USB port.

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	20 – 22 °C
Relative humidity:	35 – 45 %
Normal test voltage:	4.5 V DC (Battery pack with 3x AAA Primary Batteries)

The values are the limit registered during the test period.

2.3 Test Period

Item received date:	2011-09-20
Test period :	from 2011-11-04 -2011-11-09

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Texas Instruments Norway AS
Model No.: CC1111Dongle-868
Serial No.: 0000 093D

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15.249.

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 3 and 10 meters.

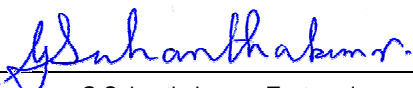
- | | |
|---|---|
| <input checked="" type="checkbox"/> New Submission | <input checked="" type="checkbox"/> Production Unit |
| <input type="checkbox"/> Class II Permissive Change | <input type="checkbox"/> Pre-production Unit |
| DXT Equipment Code | <input type="checkbox"/> Family Listing |

THIS TEST REPORT RELATES ONLY TO THE ITEM (S) TESTED.

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



TEST REPORT #: 182223-5

TESTED BY:  DATE: 2011-11-10
G.Suhanthakumar, Test engineer

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This test report applies only to the items and configurations tested.

3.2 Test Summary

Name of test	FCC Part 15 reference	RSS210 Issue 8 & RSS Gen Issue 3	Result
Supply Voltage Variations	15.31(e)	4.5	Complies ¹
Transmitter frequency stability	15.31(m)	7.2.4	Complies
Antenna Requirement	15.203	7.1.4	NA ²
Power-line Conducted Emission	15.207(c)	7.2.2	Complies
20 dB bandwidth	15.215(c)	-	Complies
Peak Power Output	15.249(a)(c)	A2.9	Complies
Band edge Emissions	15.249(d)	A.2.9	Complies
Spurious Emissions (Radiated)	15.249 (e)	A2.9 & 4.3	Complies
Spurious Emissions (Antenna Conducted)	15.249	7.2.3.1	Complies
Receiver Spurious Emissions (Radiated)	15.109	6 (RSS-GEN)	Complies
Receiver Spurious Emissions (Conducted)	N/A	6 (RSS-GEN)	-

¹ The power is taken from USB.

² integral antenna

RSS Gen issue 3 covers section 7 & 6

RSS 210 issue 8 covers section A2.9

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

The channels are selected with a computer connected to the EUT. The computer is only used for selection of channels. The measurements are performed at channels near top , near middle and near bottom . And the output level is set to maximum in the software. The EUT complies at these channels.

The radiated measurements are tested on three axis.

Fully charged battery is used.

3.5 Family List Rationale

Not Applicable.

4 TEST RESULTS

4.1 Power-line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: G.Suhanthakumar	Date of Test: 09.11.2011
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Measurement procedure: ANSI C63.4-2009 using 50 μ H/50 ohms LISN.

Test Results: Complies.

Measurement Data: Peak detector was used.

EUT is connected at the USB port.

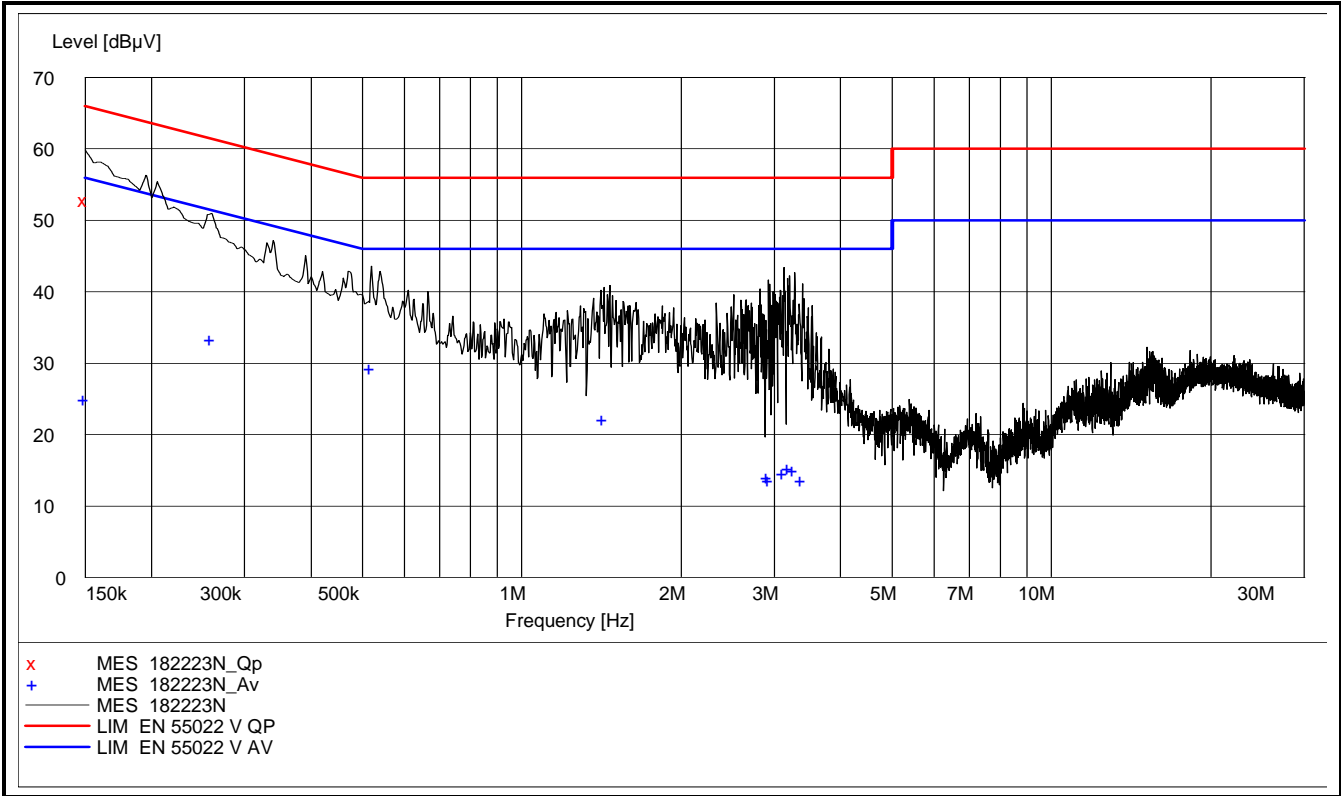
The graph shows peak scan and highest values. The QP and AV values are given in the table below.

Measured at AC mains 120V AC, 60Hz.

Model:Dell Latitude D610 and AC/DC adapter model:PA-12

Highest measured value (L and N):

See the attached plot for peak scan.



Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.150000	52.90	10.10	66.00	-13.10	QP	N	Pass
0.150000	25.00	10.10	56.00	-31.00	AV	N	Pass
0.260000	33.30	10.10	51.40	-18.10	AV	N	Pass
0.520000	29.40	10.20	46.00	-16.60	AV	N	Pass
1.430000	22.20	10.20	46.00	-23.80	AV	N	Pass
2.925000	14.00	10.30	46.00	-32.00	AV	L1	Pass
2.940000	13.60	10.30	46.00	-32.40	AV	N	Pass
3.125000	14.60	10.30	46.00	-31.40	AV	L1	Pass
3.205000	15.40	10.30	46.00	-30.60	AV	N	Pass
3.275000	15.10	10.30	46.00	-30.90	AV	L1	Pass
3.385000	13.60	10.30	46.00	-32.40	AV	L1	Pass

4.2 Transmitter Frequency Stability

Para. No.: 15.31(m)/7.2.4

Test Performed By: G.Suhandhakumar	Date of Test: 04-Nov-2011
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Measurement Data:

Temperature	Channel nr.	Given Frequency (MHz)	Measured value (MHz)	Deviation (Hz)
20 ° C	-	903.500	903.52269	-0.02269
	-	915.000	915.02317	-0.02317
	-	926.500	926.52335	-0.02335

Comment: Reported for information only. There are no requirements to frequency tolerance for low power devices in the 902-928 MHz band certified to 15.249 or RSS 210

4.3 20 dB Bandwidth

Para. No.: RSS-Gen

Test Performed By: G.Suwanthakumar	Date of Test: 04-Nov-2011
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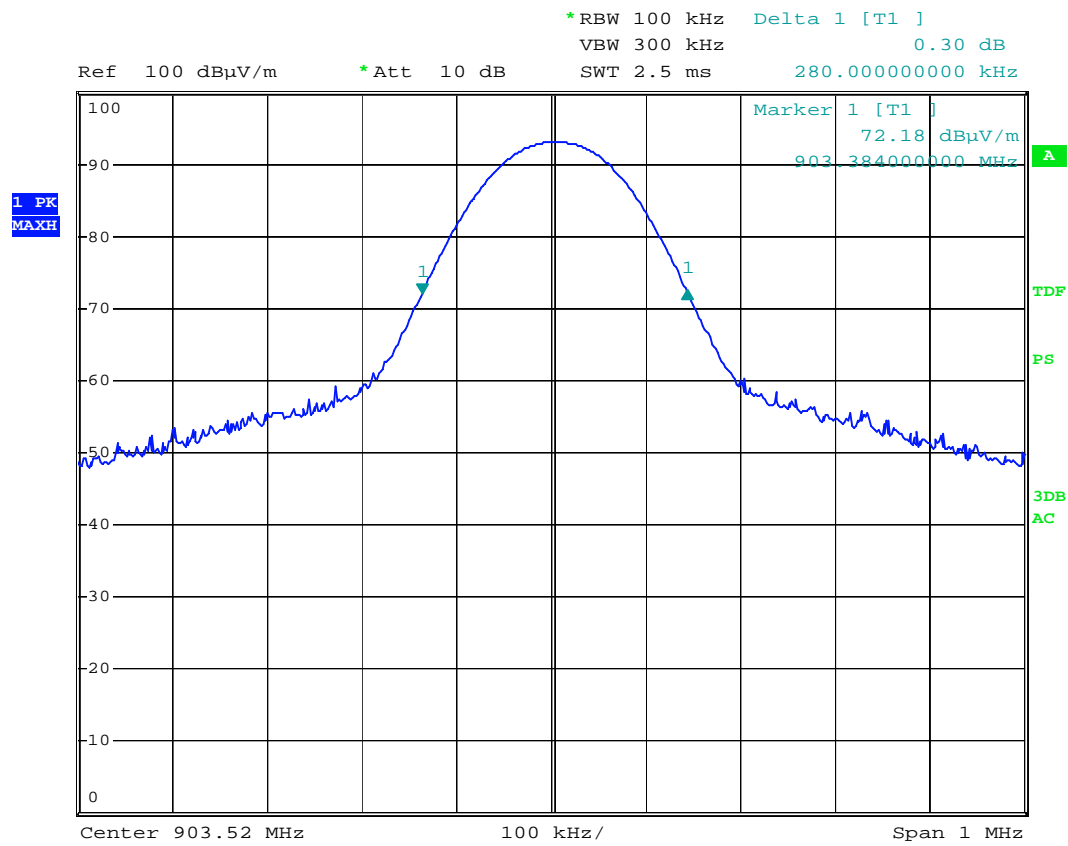
Test Results: Complies

Measurement Data:

Data Rate	20 dB Bandwidth (kHz)		
	903.500MHz	915.000MHz	926.500MHz
1.2 kbps	280	278	278

Requirements:

For information only



Date: 4.NOV.2011 08:47:06

903.5MHz – 20 dB bandwidth – 280kHz

4.4 Peak Power Output

Para. No.: 15.249 (a)/A.2,9

Test Performed By: G.Suhandhakumar	Date of Test: 04-Nov-2011
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Test Results: Complies

Measurement Data:

Maximum Conducted Peak Output Power

RF channel	903.5MHz	915MHz	926.5MHz
@ 1.2kbps, Measured value (dBm)	-4.41	-4.73	-5.04

Maximum Field strength

RF channel	903.5MHz	915MHz	926.5MHz
VP: Measured value (dB μ V/m)	81.15	80.02	80.23
HP: Measured value (dB μ V/m)	93.05	92.77	90.74

Radiated measurements are done at 3 m distance. Please see page 66 for test-setup

- Detachable antenna? Yes No
- If detachable, is the antenna connector non-standard? Yes No
- Reversed SMA connector

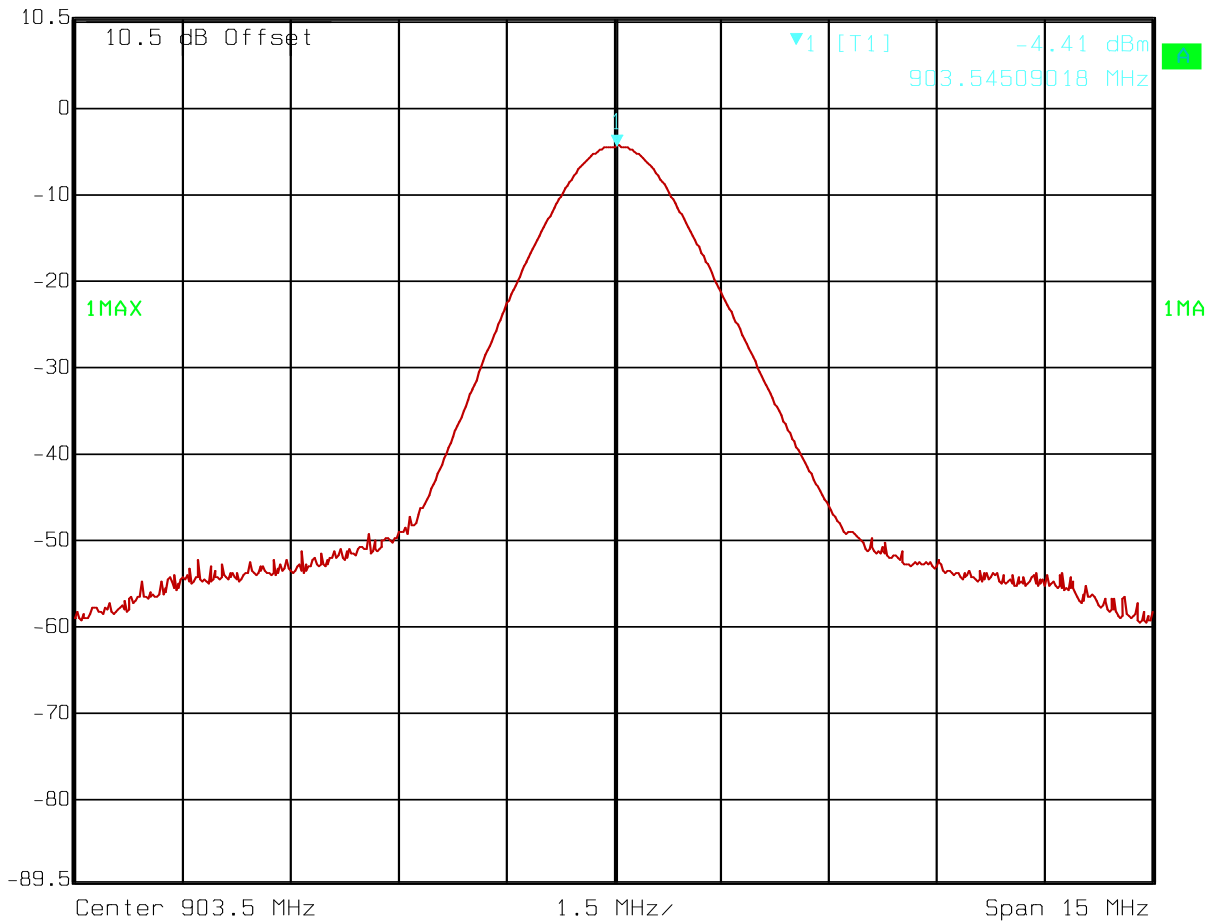
New batteries were used.

Requirements:

The maximum peak output power shall be ≤ 94 dB μ V/m



Ref Lvl 10.5 dBm Marker 1 [T1] 903.54509018 MHz RBW 1 MHz RF Att 10 dB
 -4.41 dBm VBW 1 MHz
 Unit dBm SWT 5 ms

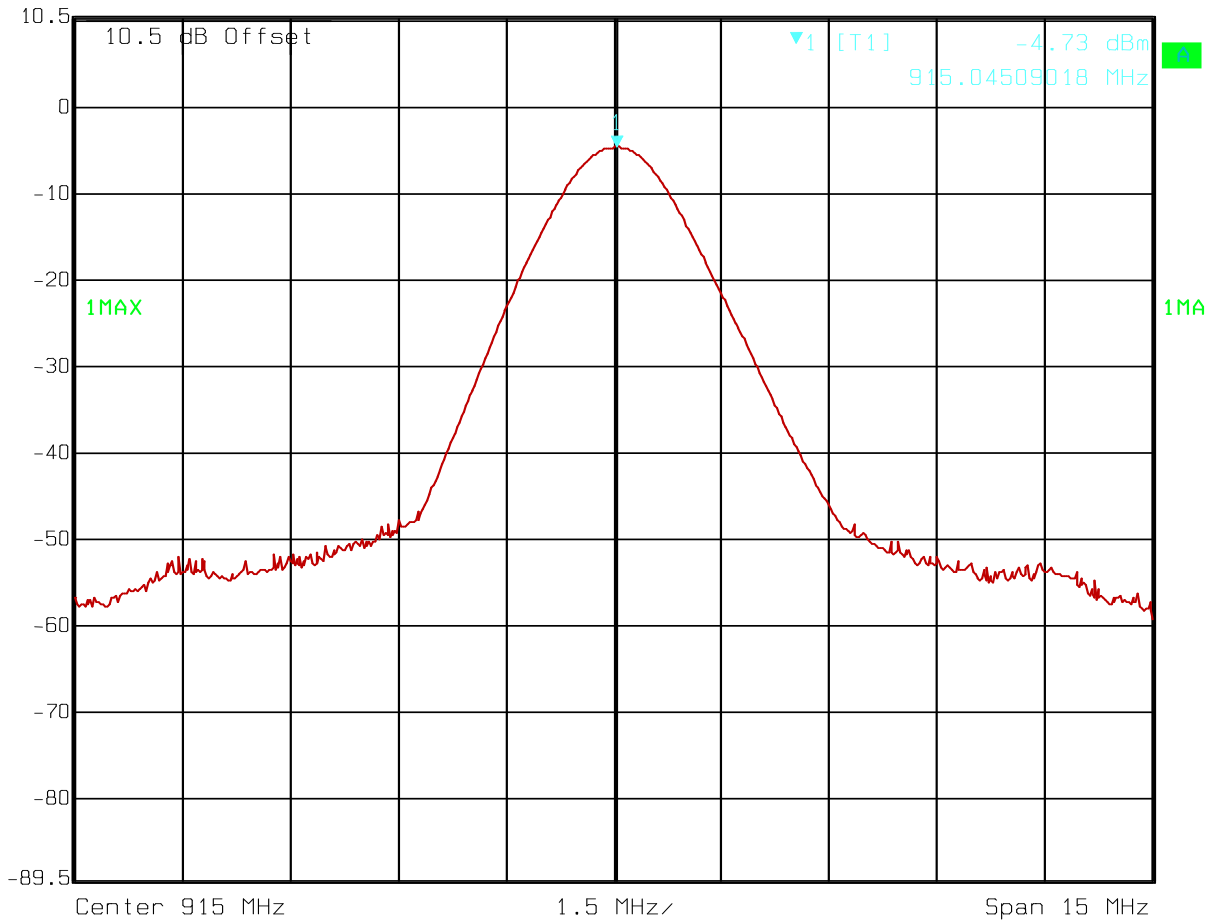


Date: 04.NOV.2011 16:11:36

Conducted power – 903.5MHz



Ref Lvl 10.5 dBm
 Marker 1 [T1] -4.73 dBm
 915.04509018 MHz
 RBW 1 MHz RF Att 10 dB
 VBW 1 MHz
 SWT 5 ms Unit dBm

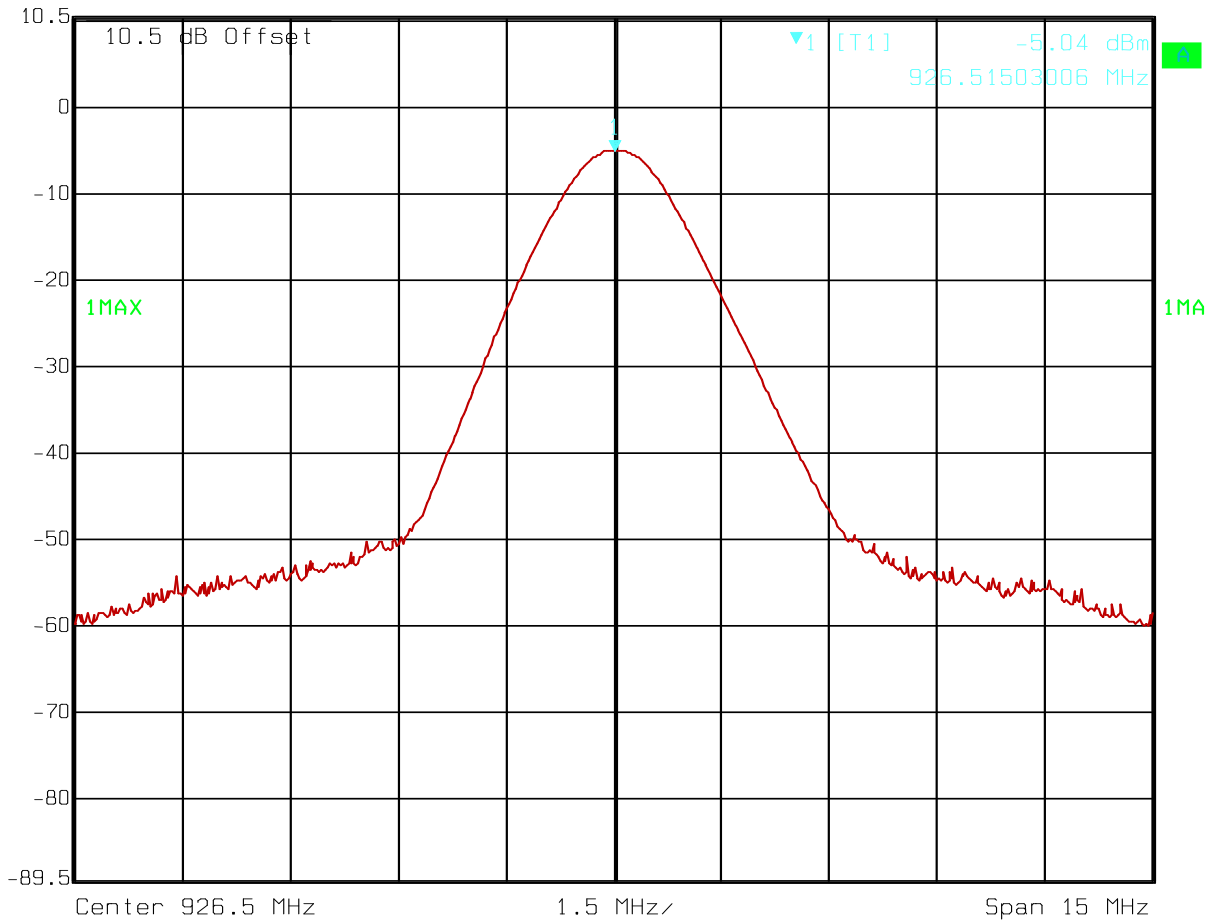


Date: 04.NOV.2011 16:09:56

Conducted power – 915MHz

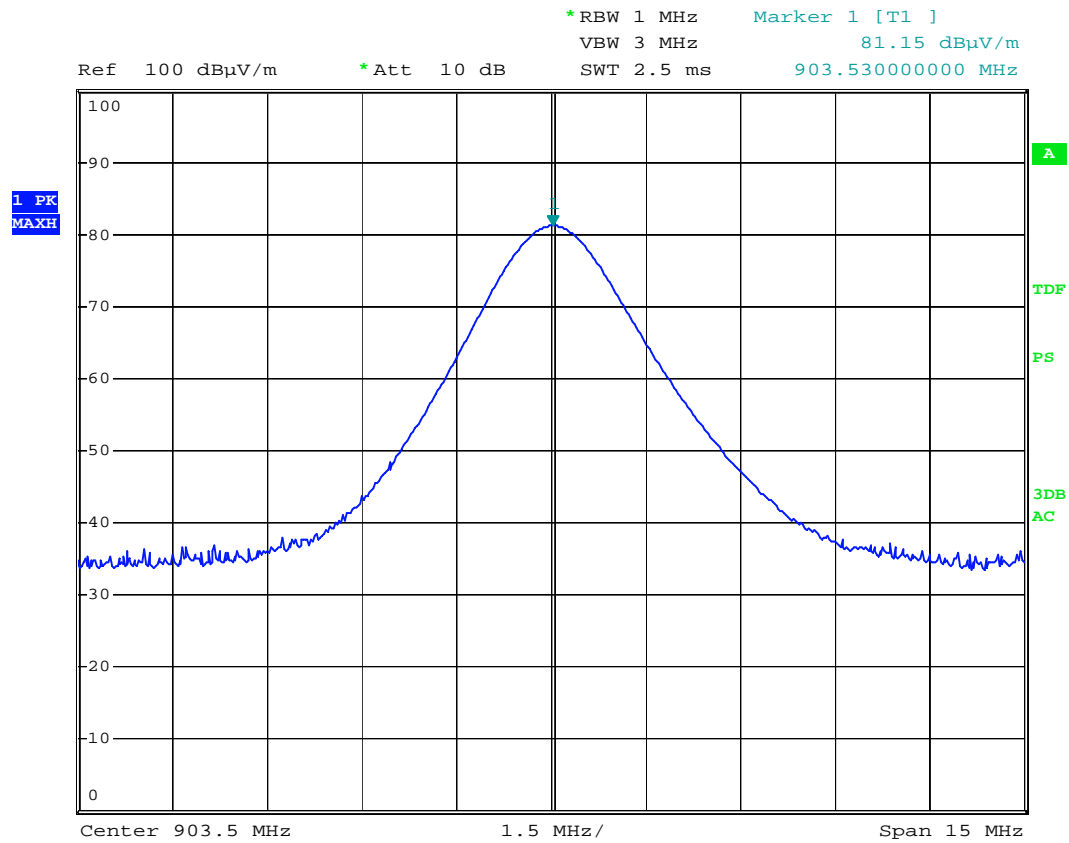


Ref Lvl 10.5 dBm
 Marker 1 [T1] 926.51503006 MHz
 RBW 1 MHz
 VBW 1 MHz
 RF Att 10 dB
 SWT 5 ms
 Unit dBm



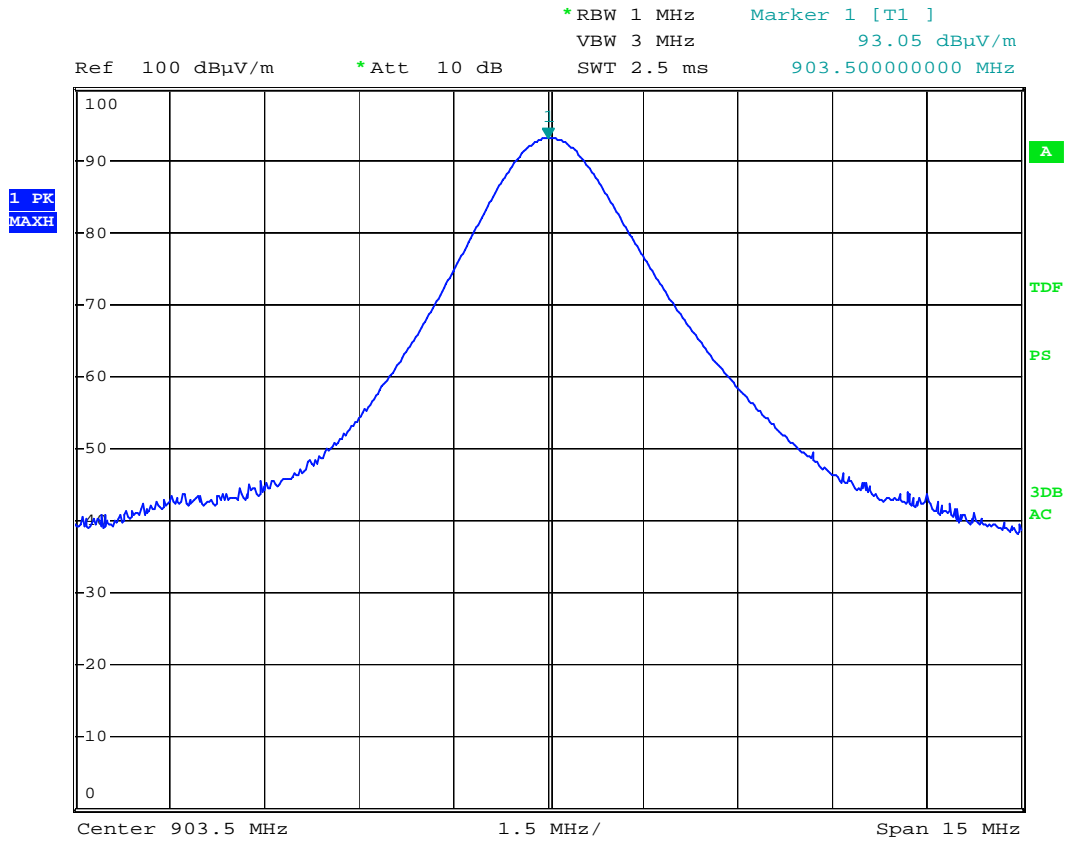
Date: 04.NOV.2011 16:09:03

Conducted power – 926.5MHz



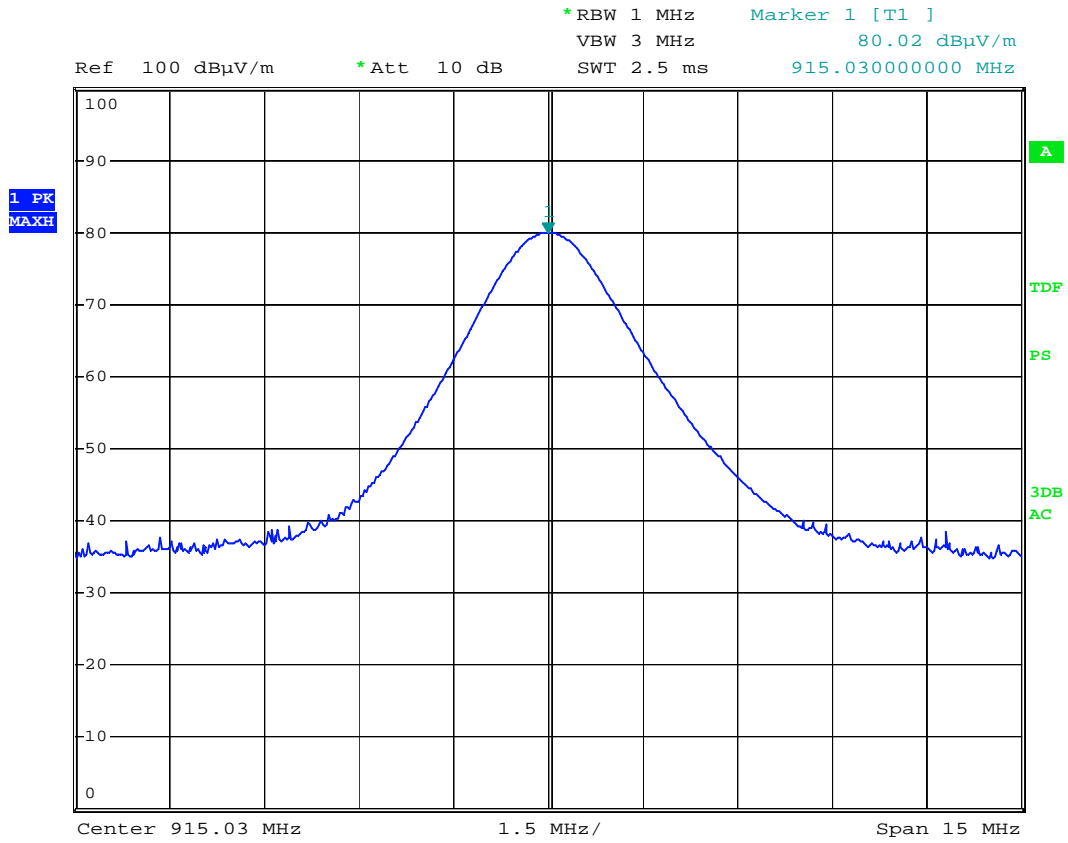
Date: 4.NOV.2011 08:38:51

VP: 903.5MHz – Field strength



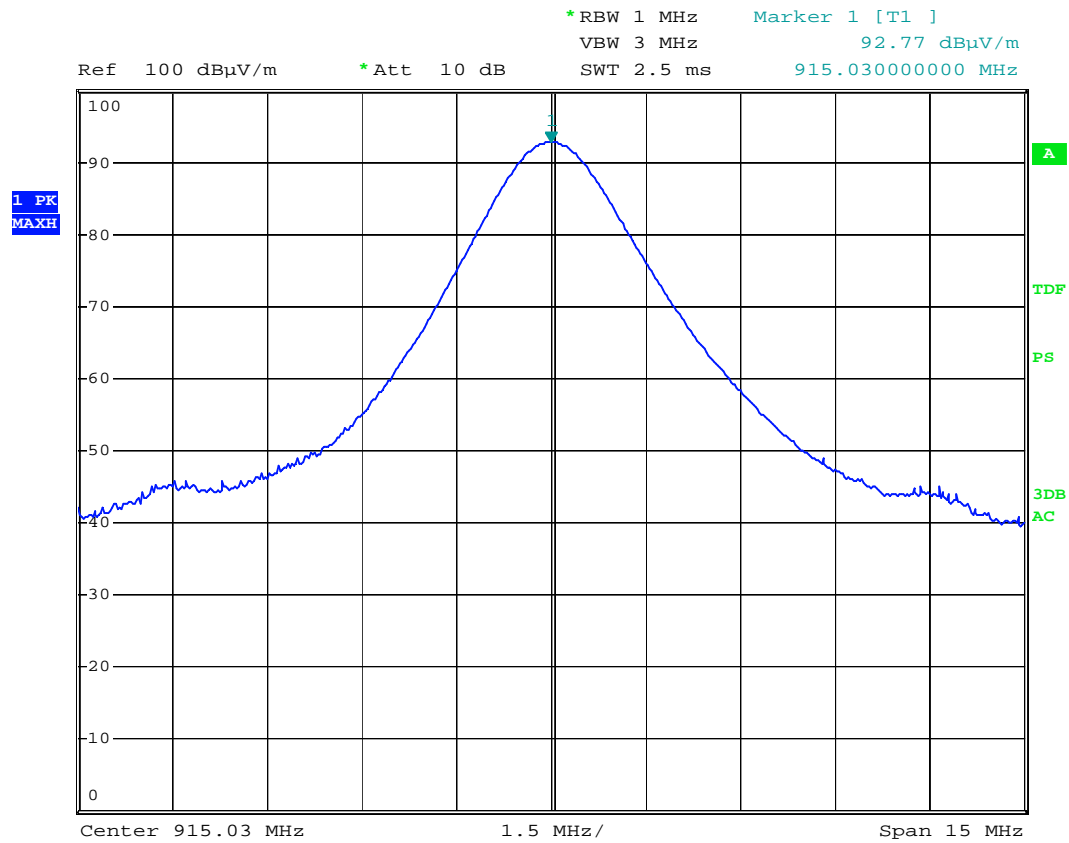
Date: 4.NOV.2011 08:39:54

HP: 903.5MHz – Field strength



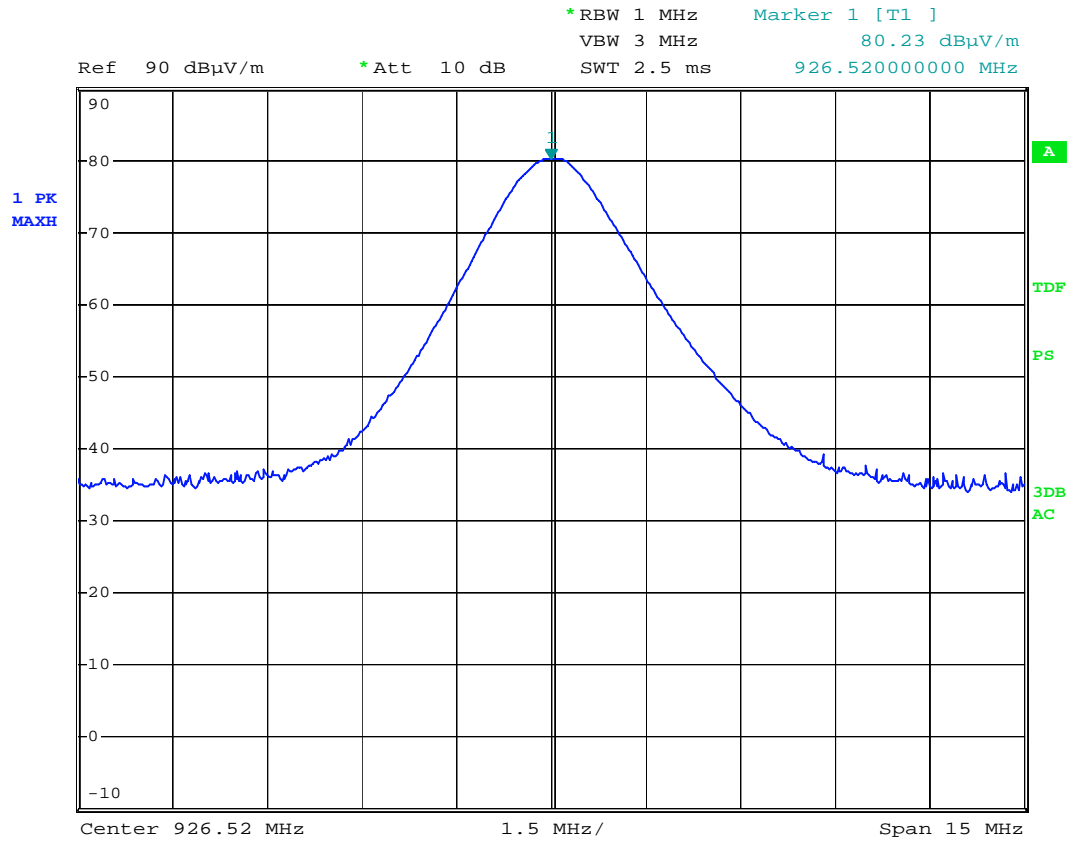
Date: 4.NOV.2011 08:36:06

VP: 915MHz – Field strength



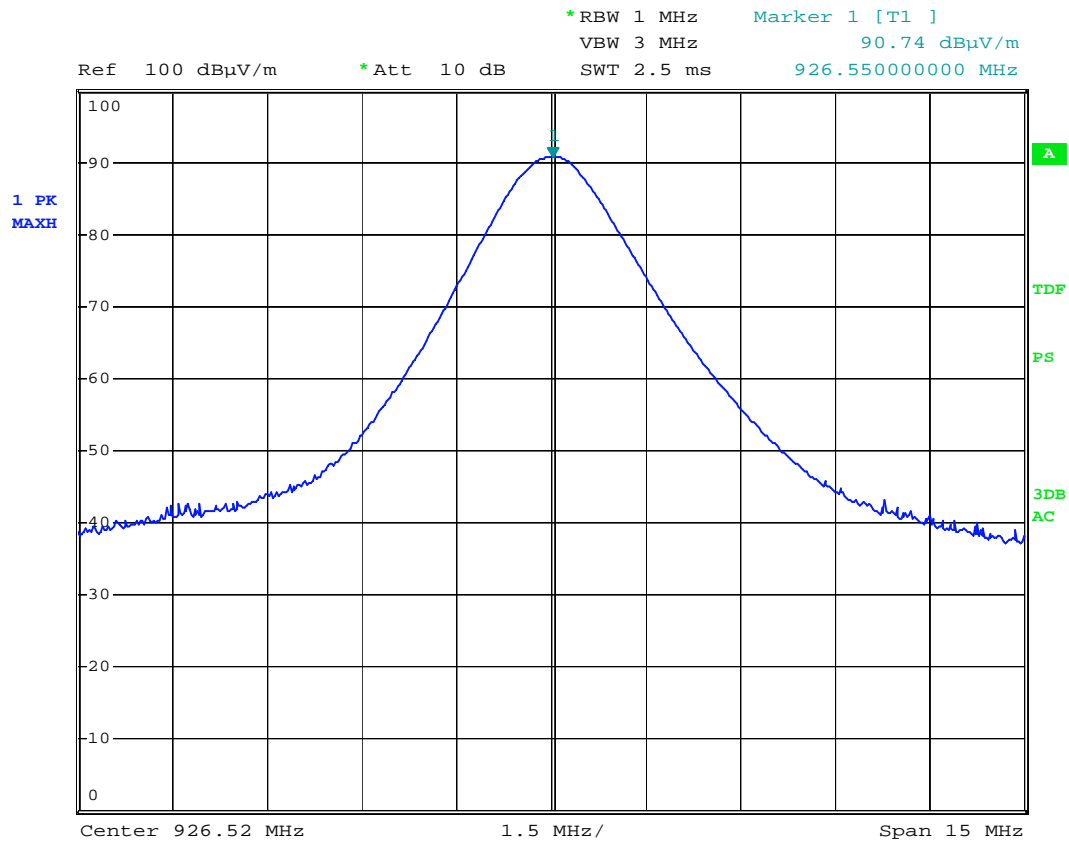
Date: 4.NOV.2011 08:32:39

HP: 915MHz – Field strength



Date: 4.NOV.2011 08:17:48

VP: 926.5MHz – Field strength



Date: 4.NOV.2011 08:22:42

HP: 926.5MHz – Field strength

4.5 Band Edge Emissions

Para. No.: 15.249 (d)

Test Performed By: G.Suhandhakumar	Date of Test: 04-Nov-2011
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Test Results: Complies

Measurement Data:

Lower Band edge :

RF channel	903.500MHz
Measured maximum dBc	53.05

Upper Band edge :

RF channel	926.500MHz
Measured maximum dBc	52.50

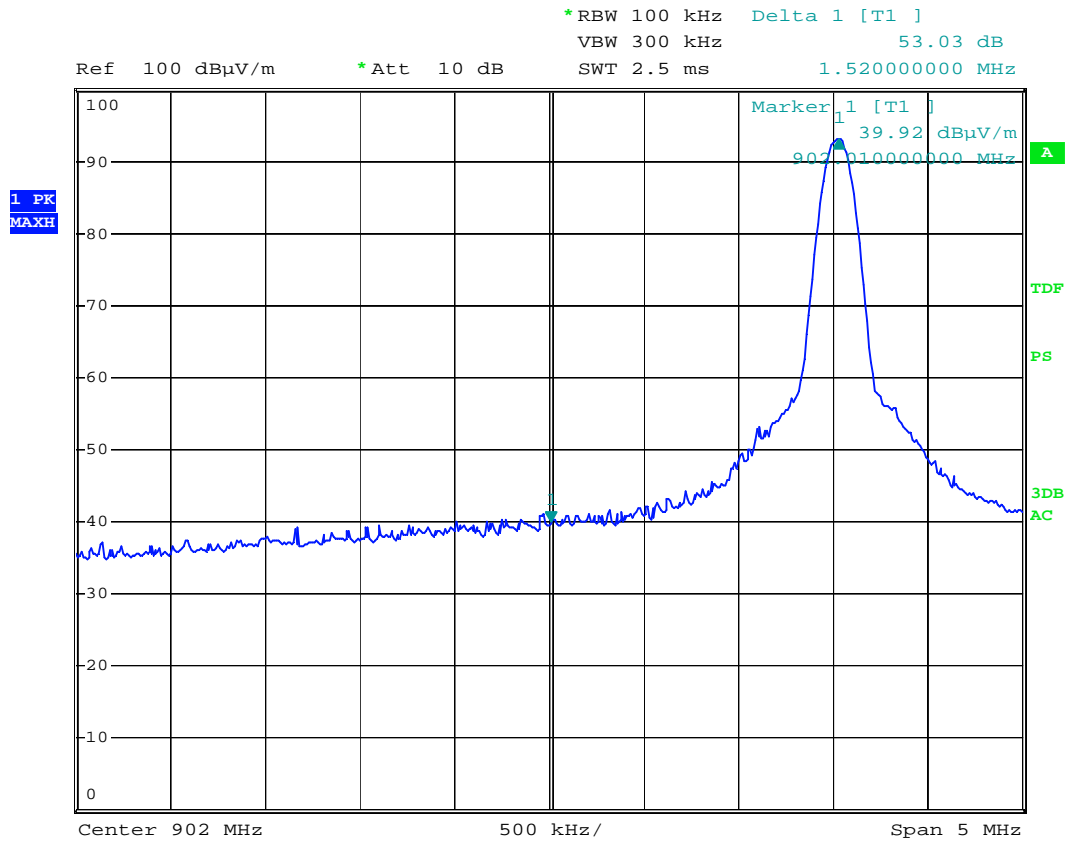
Band-edge, @3m

Frequency	Measured Field Strength @3m, dBµV/m	Detector	Limit dBµV/m	Margin dB
902.000MHz	-	AV	54	-
	39.92	PK	74	38.19
928.000MHz	-	AV	54	-
	37.97	PK	74	33.17

See the attached graphs

Requirements:

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emissions limits in section 15.209, whichever is the lesser attenuation..



Date: 4.NOV.2011 08:42:14

903.5MHz- Lower band edge -PK detector

4.6 Spurious Emissions (Radiated)

Para. No.: 15.249 (e)

Test Performed By: G.Suhanthakumar

Date of Test: 04-Nov-2011

Test Results: Complies

Measurement Data:

Tested item's transmission is with 100% duty cycle

RF conducted emissions 9kHz to 10 GHz

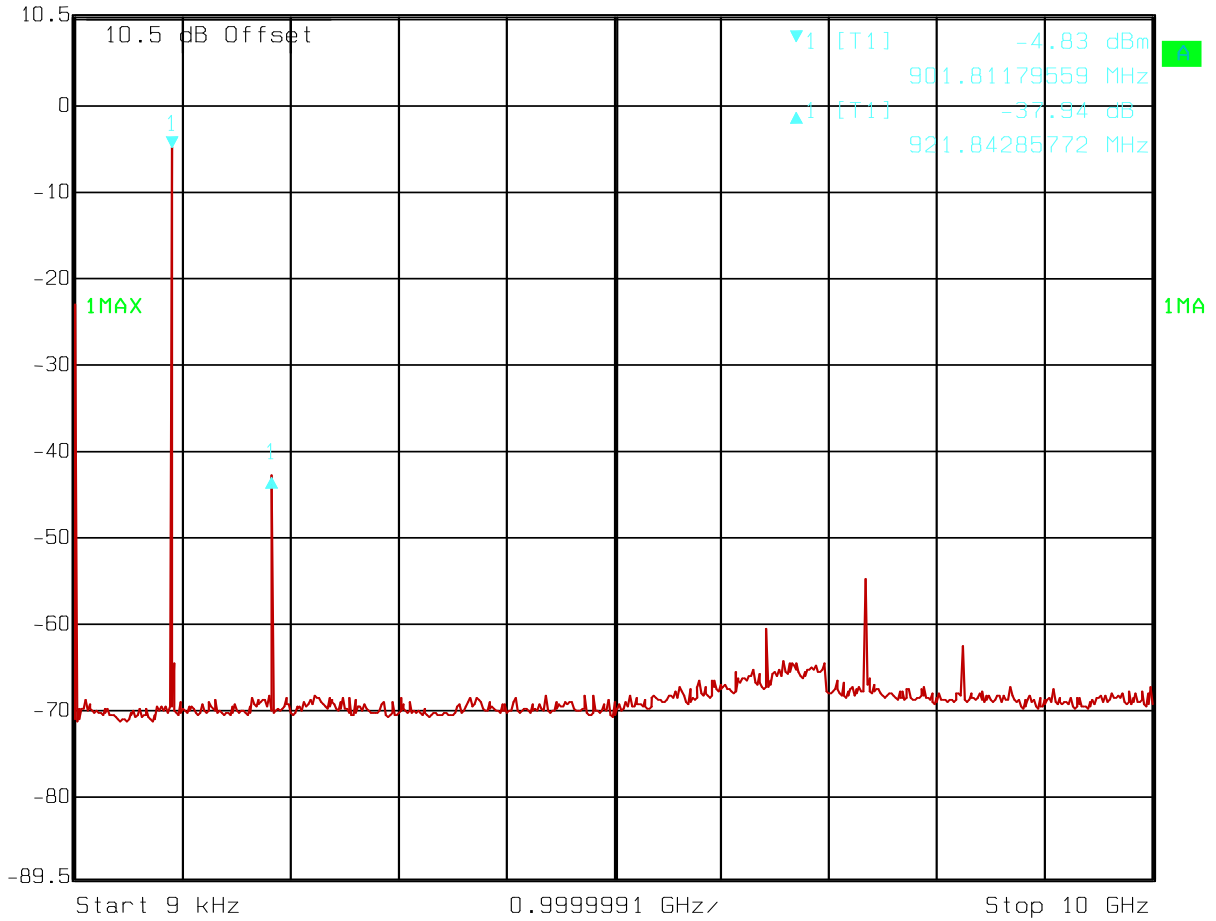
Maximum RF level outside operating band:

RF 915MHz: 37.94 dBC, margin > 20 dB

Requirements:

As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

Delta 1 [T1] RBW 100 kHz RF Att 10 dB
 Ref Lvl -37.94 dB VBW 100 kHz
 10.5 dBm 921.84285772 MHz SWT 2.5 s Unit dBm



Date: 04.NOV.2011 16:10:44

915MHz – Conducted Spurious – 9kHz – 10GHz

Radiated Emissions with antenna, 1-10 GHz, peak

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

Measured with Peak Detector

Frequency	Dist. corr. factor	Field strength, Peak	Duty cycle corr. factor	Limit	Margin
GHz	dB	dB μ V/m	dB	dB μ V/m	dB
1.807	0	42.78	-	74	31.22
1.830	0	42.25	-	74	31.75
1.853	0	41.76	-	74	32.24
>1.86 - 10	0	None detected	-	74	-

Radiated emissions with antenna, 1- 10 GHz, Average Detector


Frequency	Dist. corr. factor	Field strength, AV	Duty cycle corr. factor	Limit	Margin
GHz	dB	dB μ V/m	dB	dB μ V/m	dB
1.807	0	39.09	-	54	14.91
1.830	0	37.77	-	54	16.23
1.853	0	37.14	-	54	16.86
>1.86 - 10	0	None detected	-	54	-

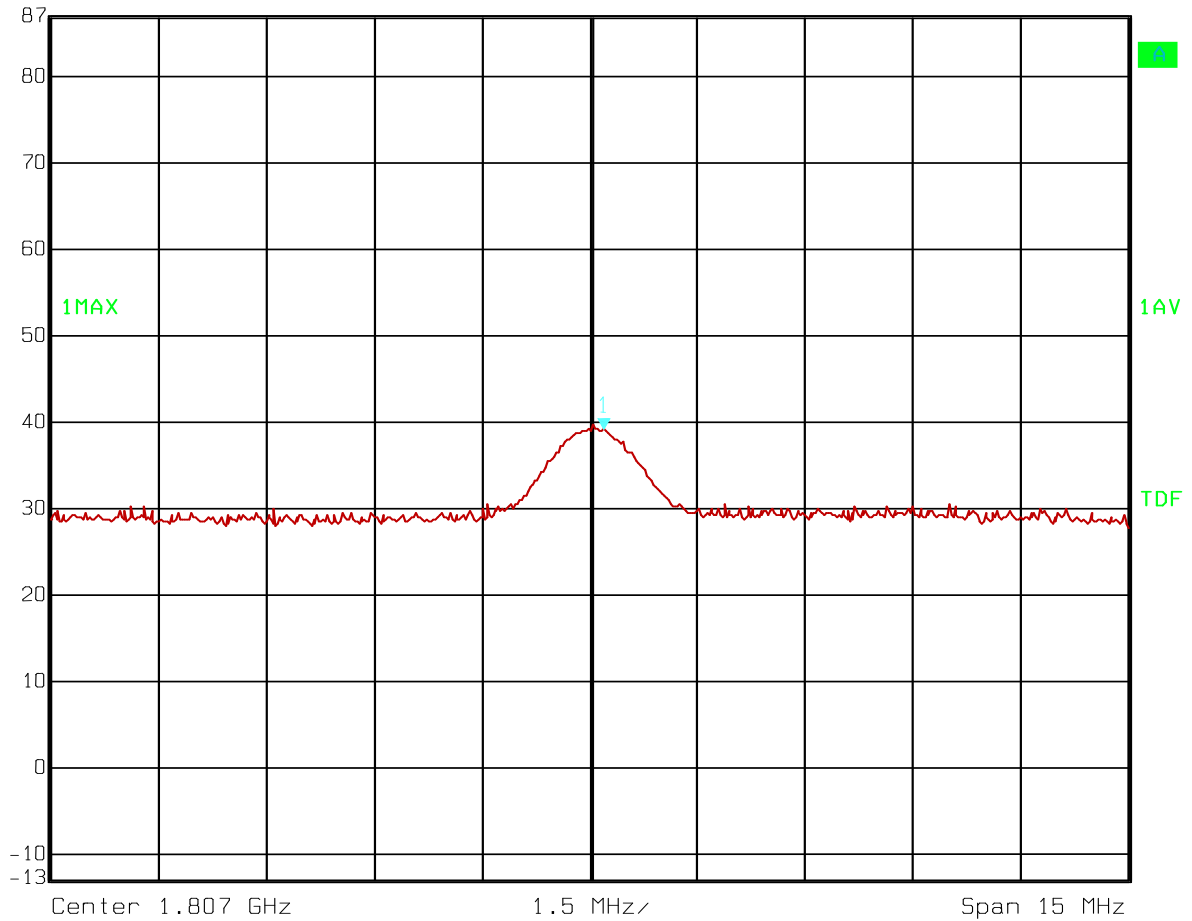
The maximum is observed in Horizontal polarization

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

Requirement:

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

	Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
	87 dB*	39.09 dB μ V/m	VBW	10 MHz	Unit	dB μ V/m
		1.80719539 GHz	SWT	5 ms		

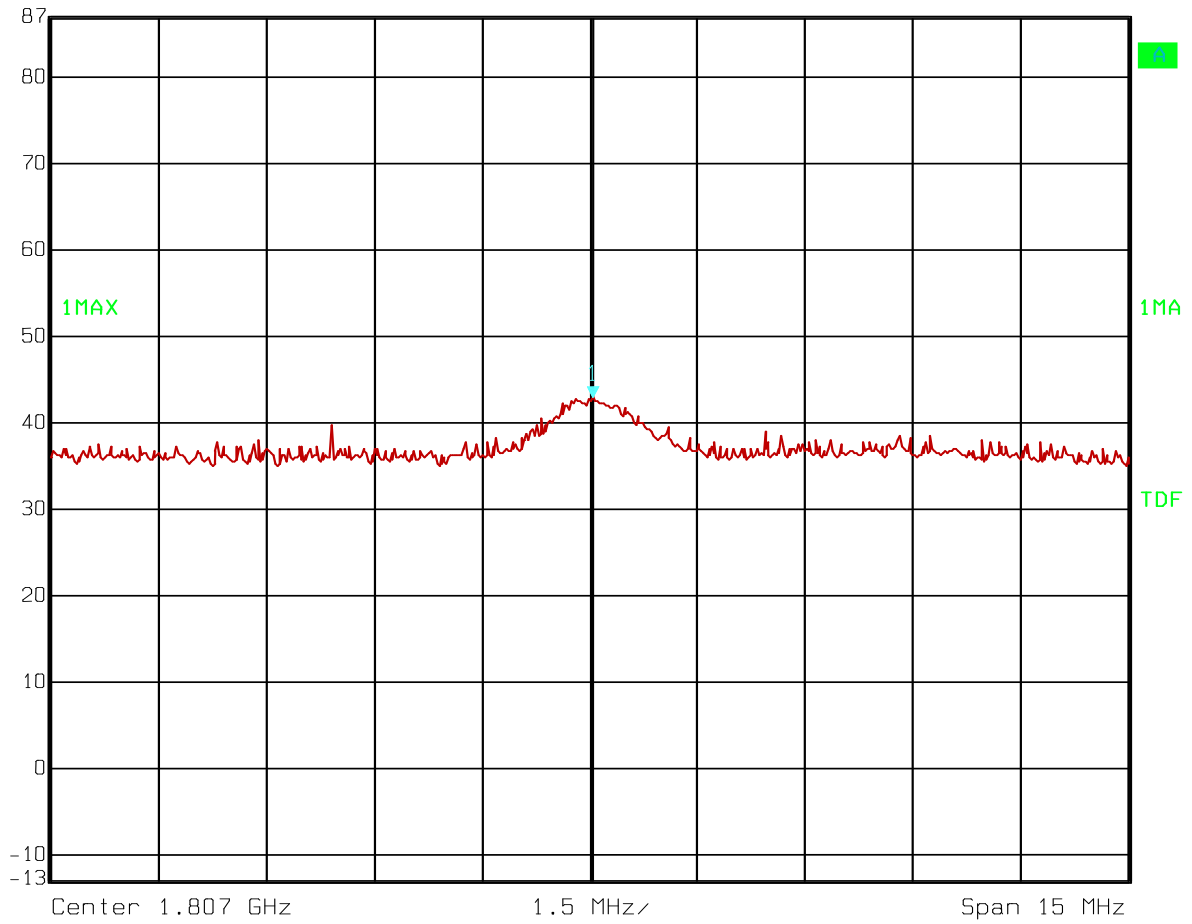


Date: 07.NOV.2011 17:50:33

903.5MHz – 2nd Harmonic- AV



Ref Lvl 87 dB* Marker 1 [T1] RBW 1 MHz RF Att 0 dB
 42.78 dB μ V/m VBW 1 MHz
 1.80704509 GHz SWT 5 ms Unit dB μ V/m

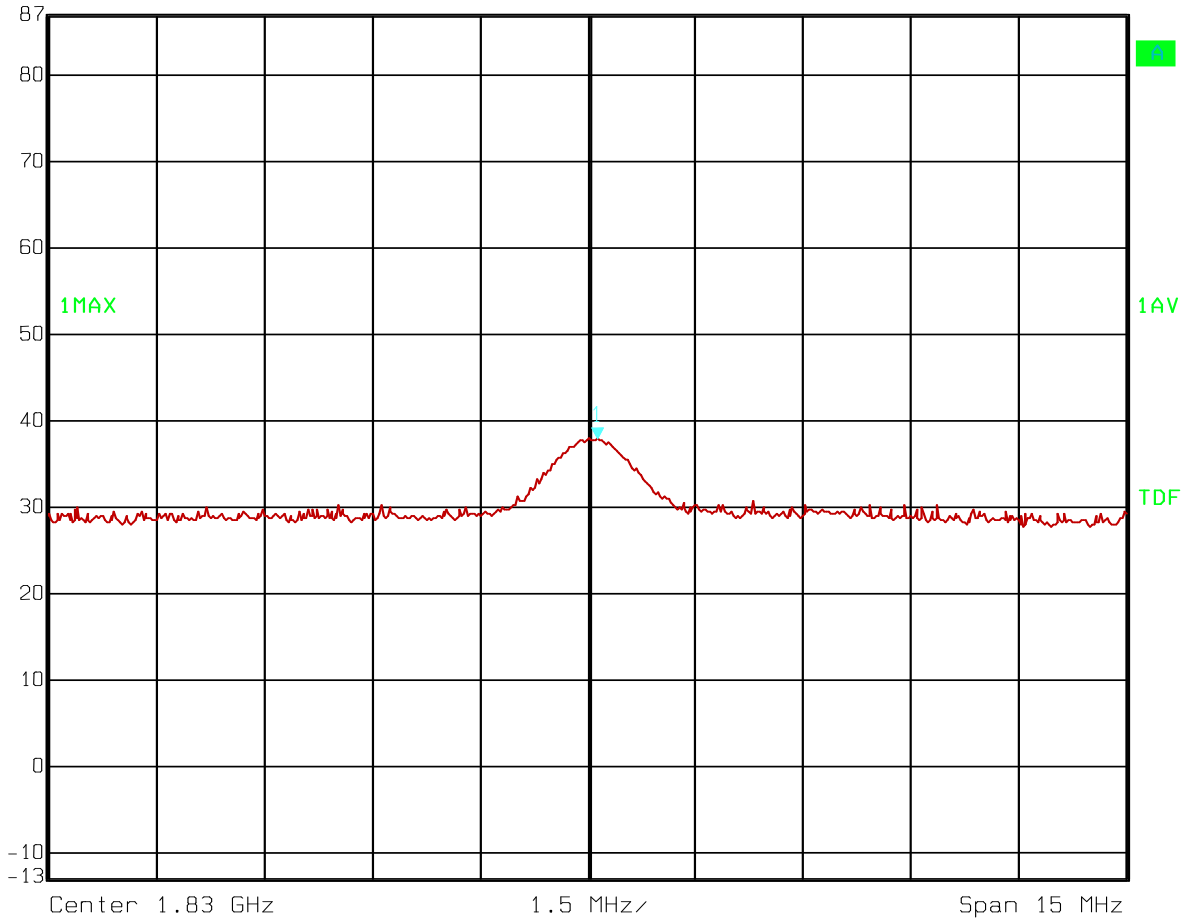


Date: 07.NOV.2011 17:51:01

903.5MHz – 2nd Harmonic- PK



Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
87 dB*	37.77 dB μ V/m	VBW	10 MHz		
	1.83013527 GHz	SWT	5 ms	Unit	dB μ V/m

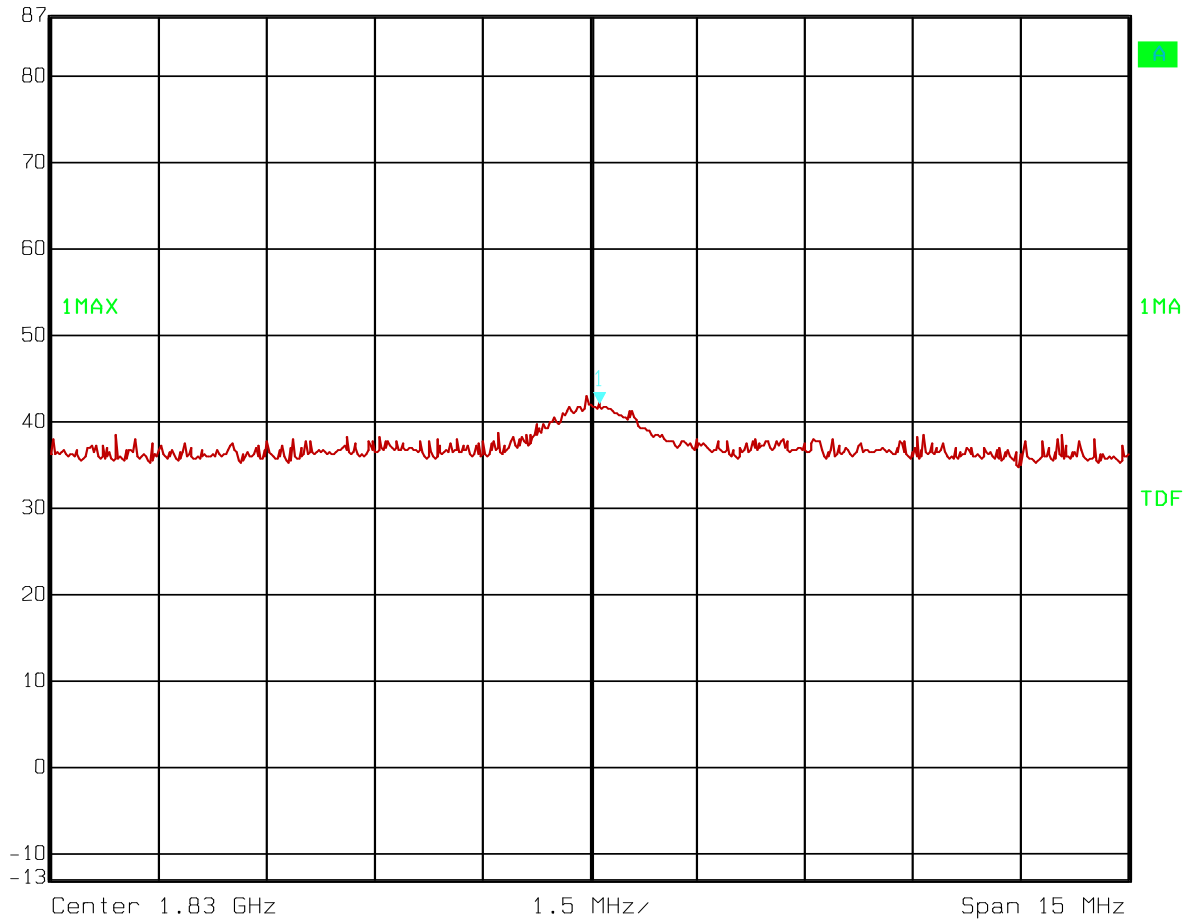


Date: 07.NOV.2011 17:48:46

915MHz – 2nd harmonic- AV



Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
87 dB*	42.25 dB μ V/m	VBW	1 MHz	Unit	dB μ V/m
	1.83013527 GHz	SWT	5 ms		

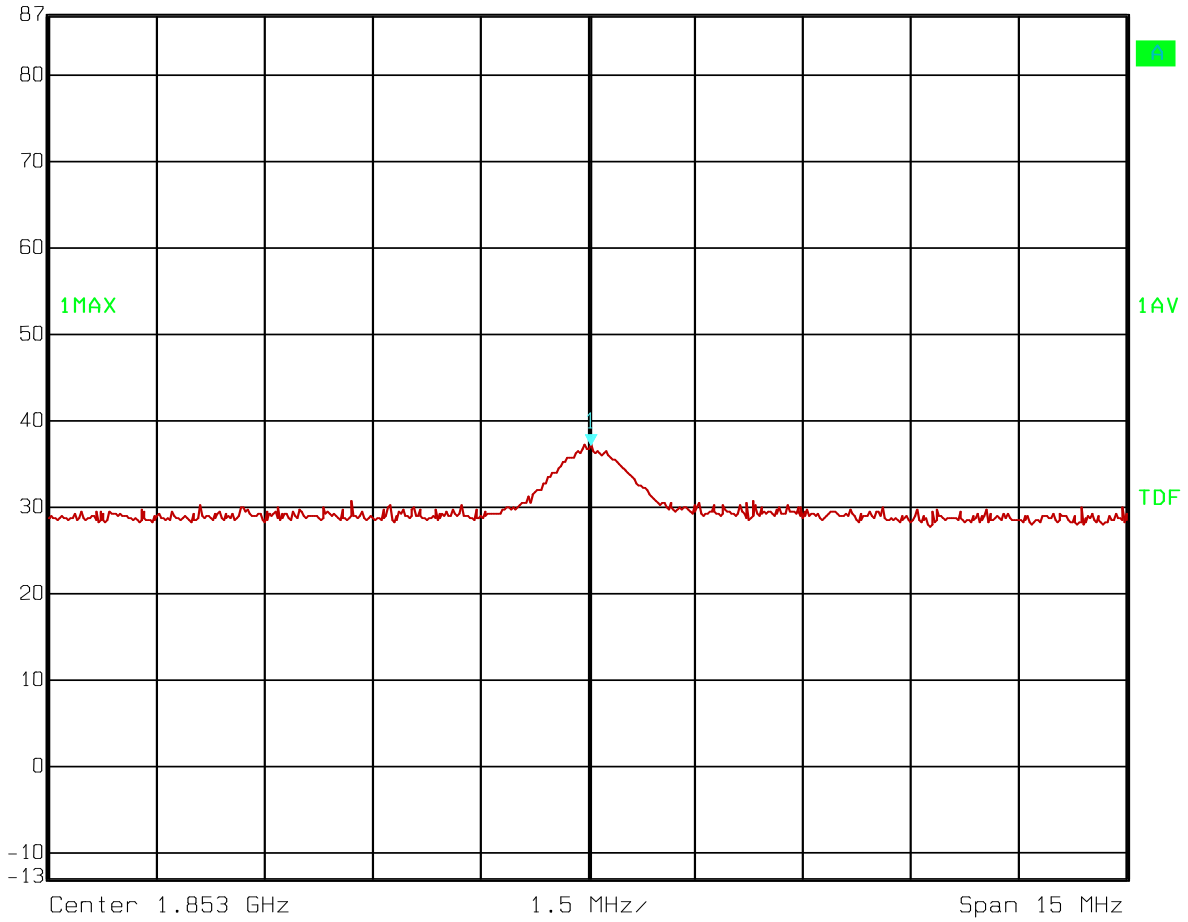


Date: 07.NOV.2011 17:48:07

915MHz – 2nd Harmonic – PK



Ref Lvl 87 dB*
 Marker 1 [T1] 37.14 dB μ V/m
 1.85304509 GHz
 RBW 1 MHz RF Att 0 dB
 VBW 10 MHz
 SWT 5 ms Unit dB μ V/m

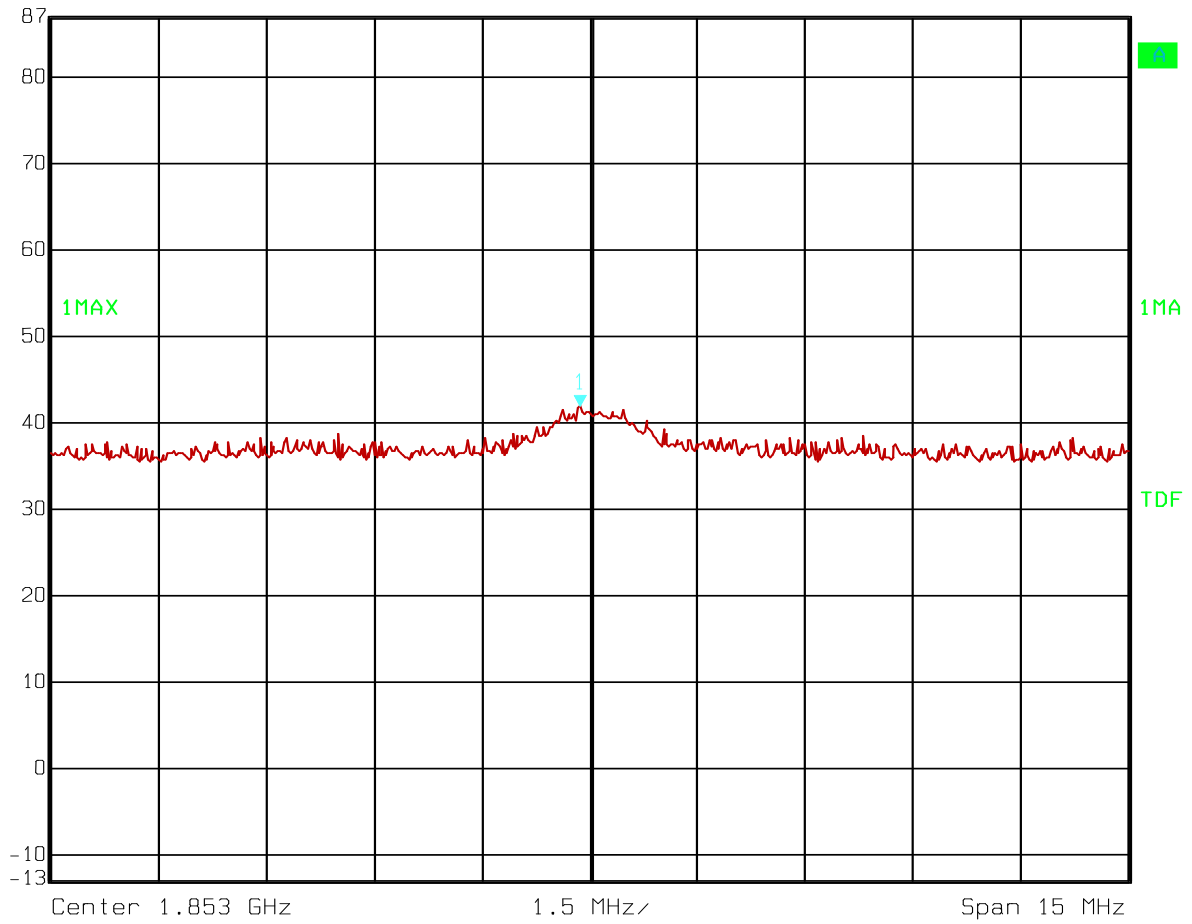


Date: 07.NOV.2011 17:52:52

926.5MHz – 2nd harmonic- AV



Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
87 dB*	41.76 dB μ V/m	VBW	1 MHz		
	1.85286473 GHz	SWT	5 ms	Unit	dB μ V/m

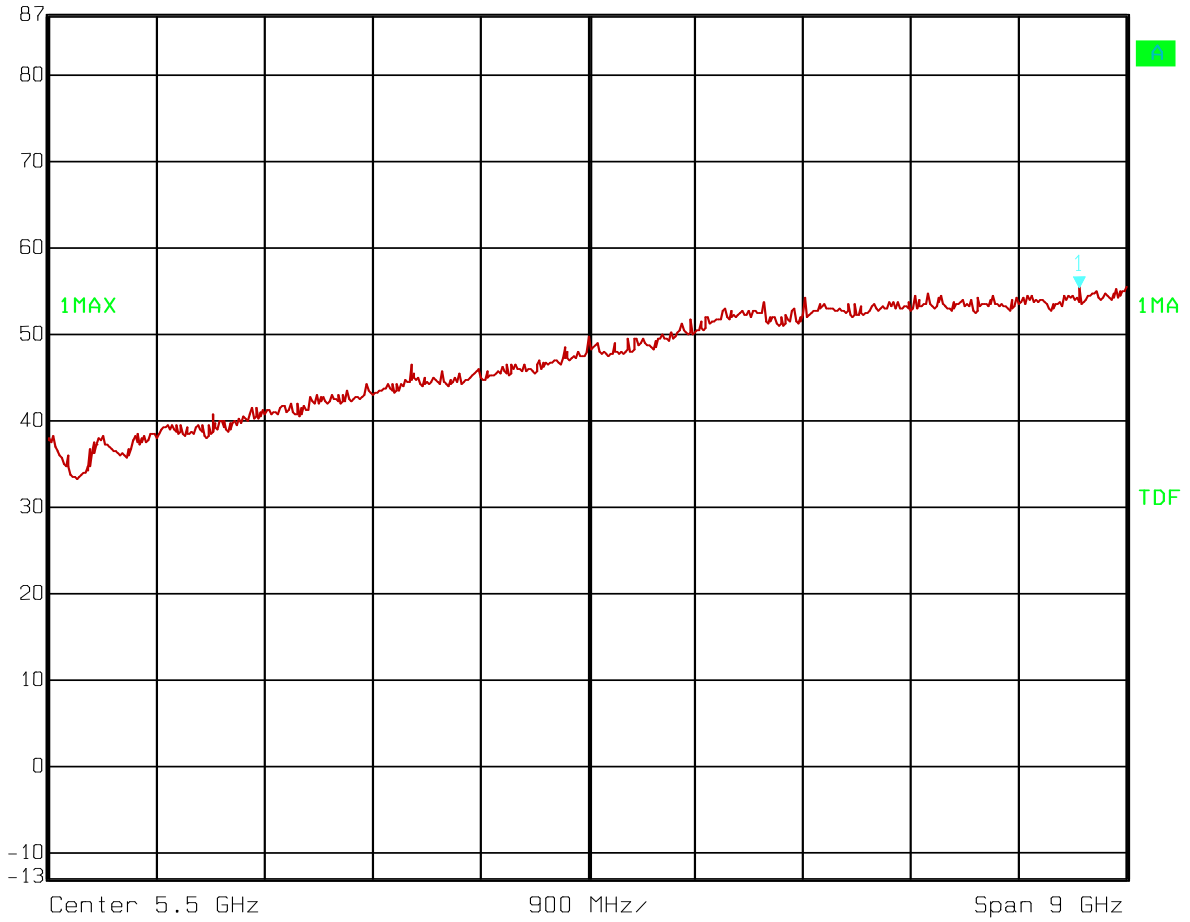


Date: 07.NOV.2011 17:52:25

926.5MHz – 2nd harmonic- PK



Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
87 dB*	55.49 dB μ V/m	VBW	1 MHz		
	9.60320641 GHz	SWT	90 ms	Unit	dB μ V/m

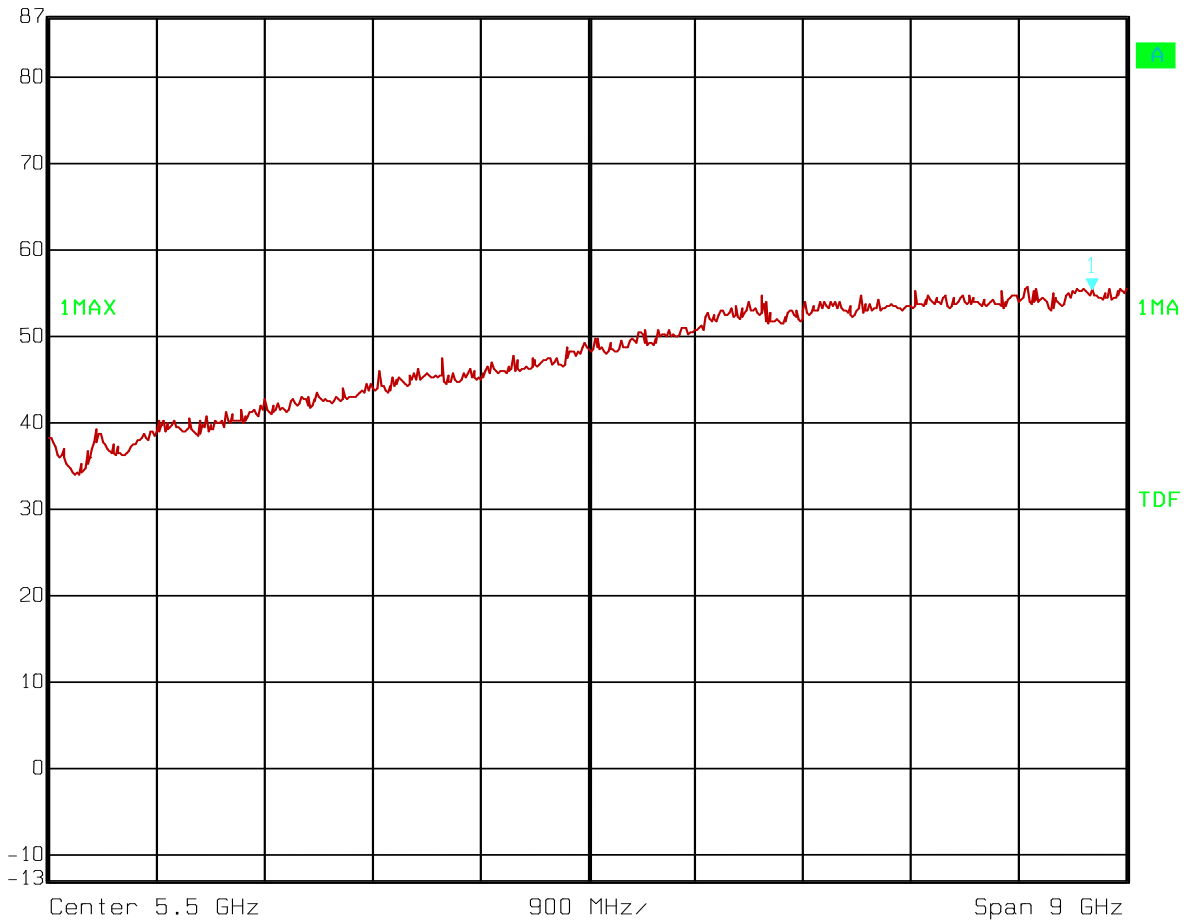


Date: 07.NOV.2011 17:40:31

VP: pre- scan 1 - 10 GHz



Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
87 dB*	55.46 dB μ V/m	VBW	1 MHz		
	9.71142285 GHz	SWT	90 ms	Unit	dB μ V/m



Date: 07.NOV.2011 17:39:38

HP: pre-scan 1 – 10 GHz

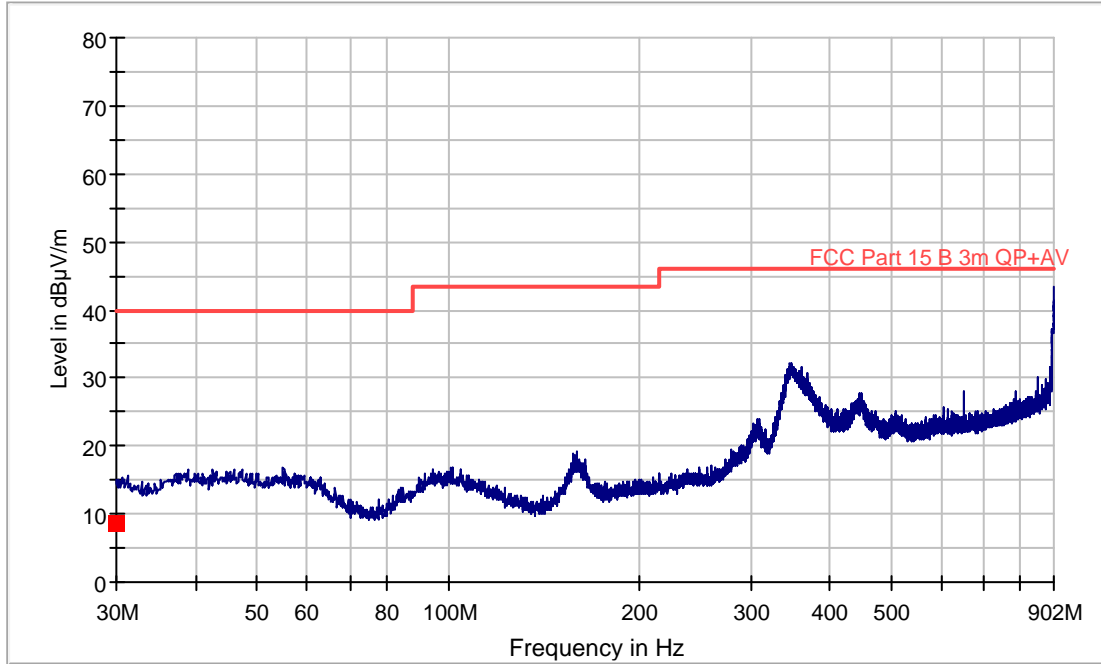
Radiated emissions 30 – 1000 MHz.

Detector: Peak

Measuring distance 3 m.

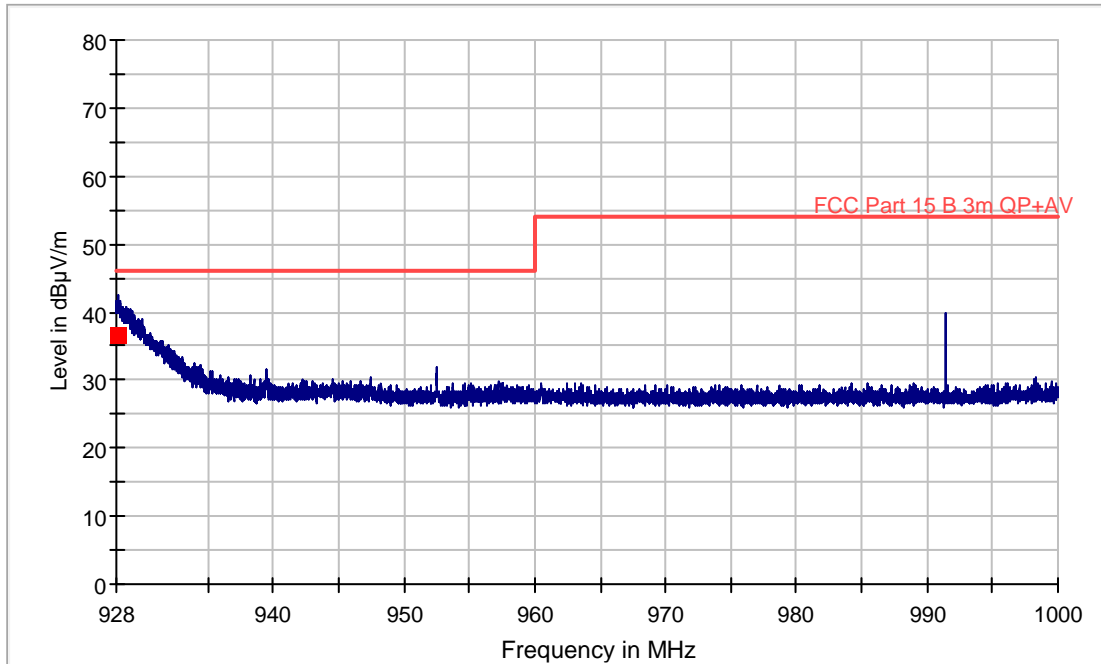
The graph shows peak scan and highest values. The QP values are given in the table below.

FCC Pt 15 Class B 30-902M 3m



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
902.000	40.2	1000.0	120.000	181.0	V	243.0	-10.6	5.8	46.0	

FCC Pt15 Class B 928-1000M 3m



Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
928.161955	36.7	1000.0	120.000	100.0	H	5.0	2.9	9.3	46.0	

4.7 Receiver Spurious Emissions (Radiated)

Para. No.: RSS-Gen (6)

Test Performed By: G.Suhandhakumar

Date of Test: 04-Nov-2011

Test Results: Complies

Measurement Data:

Radiated Emissions: 30MHz – 10GHz measured at 3m

Measured with Peak Detector

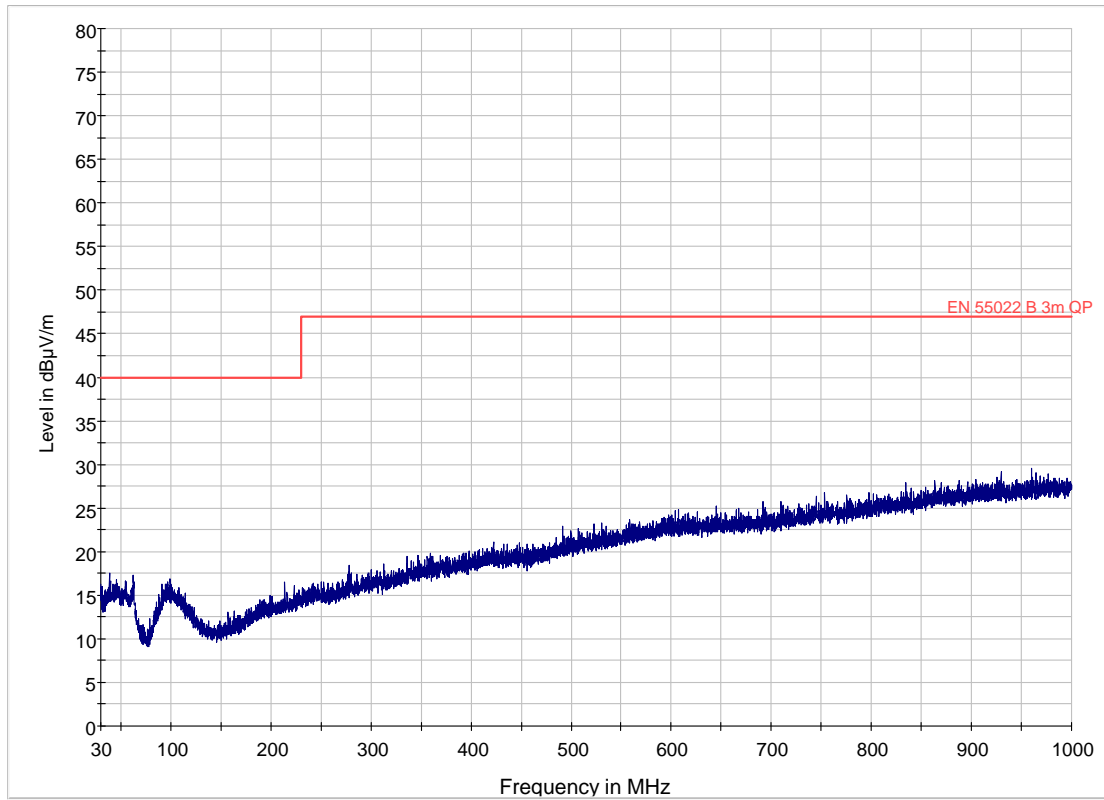
See attached plots below.

Requirement (Radiated):

Spurious emissions from receivers shall not exceed the radiated limits as given in RSS-Gen table 2 or FCC part 15B.109 (a) or CISPR 22

Requirement (Conducted):

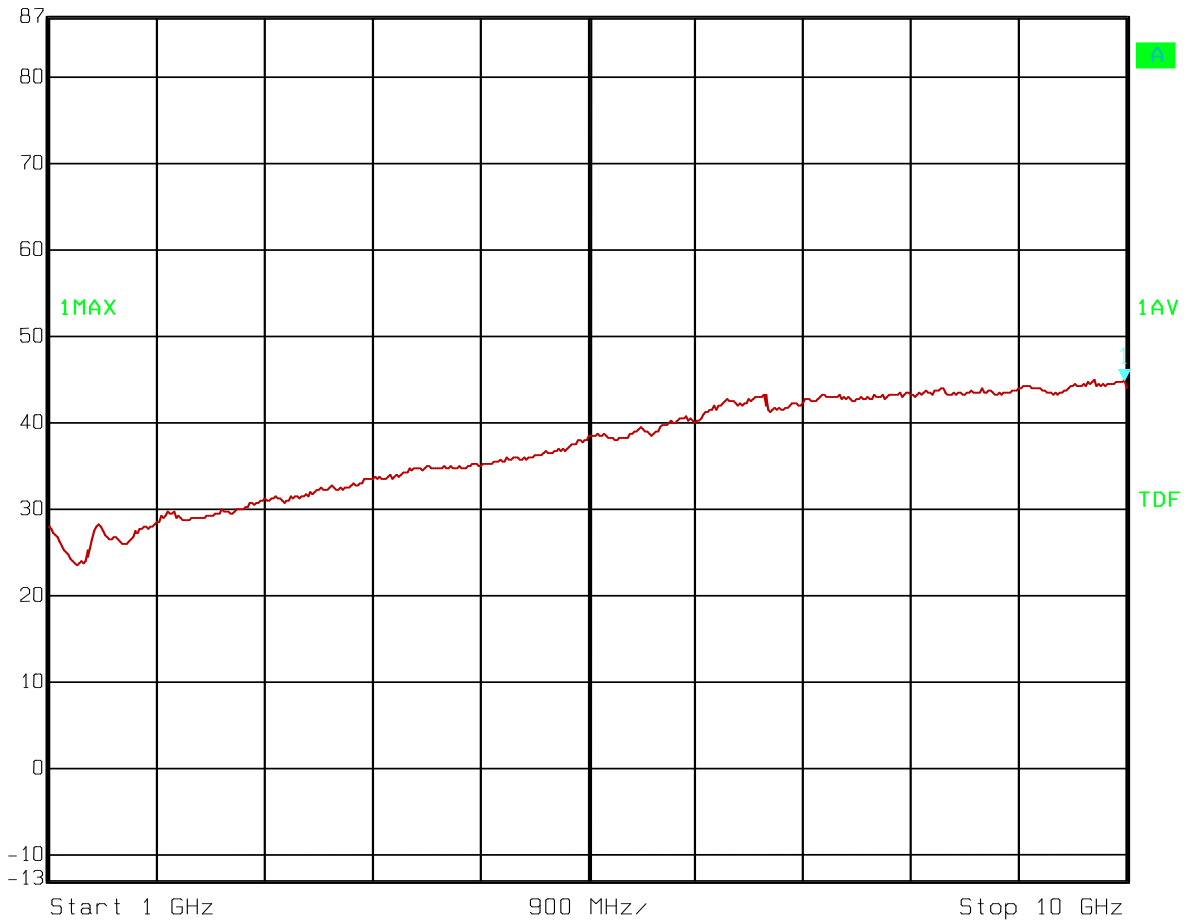
Receiver spurious emissions at any discrete frequency shall not exceed 2 nano watts in the band 30-1000 MHz, and 5 nano watts above 1000 MHz



Class B 30MHz-1GHz 3m, peak



Ref Lvl 87 dB* Marker 1 [T1] RBW 1 MHz RF Att 10 dB
 44.89 dB μ V/m VBW 10 MHz
 9.98196393 GHz SWT 90 ms Unit dB μ V/m

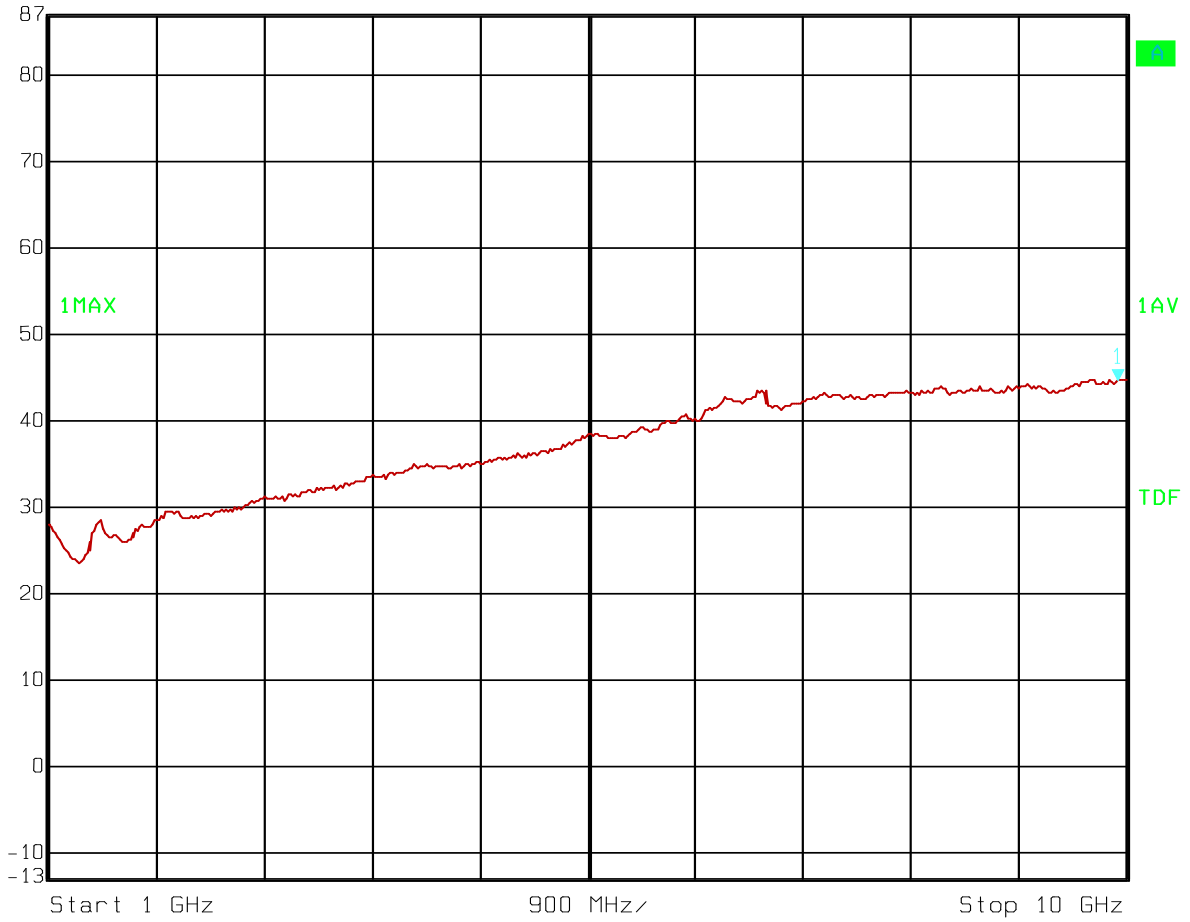


Date: 07.NOV.2011 17:43:20

RX, VP – 1 – 10GHz



Marker 1 [T1] RBW 1 MHz RF Att 10 dB
 Ref Lvl 44.66 dB μ V/m VBW 10 MHz
 87 dB* 9.92785571 GHz SWT 90 ms Unit dB μ V/m



Date: 07.NOV.2011 17:43:44

RX, HP 1 – 10GHz

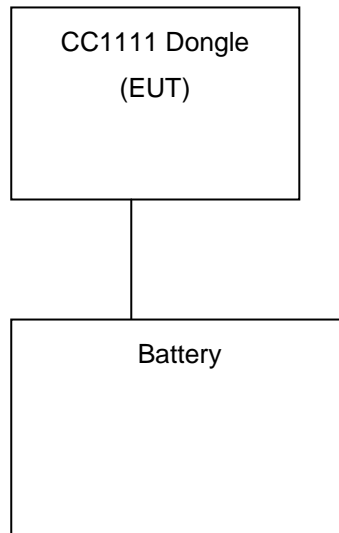
5 LIST OF TEST EQUIPMENT

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.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1.	ESCI	EMI Receiver	Rohde & Schwarz	N 4259	09.09.2010	09.09.2012
2.	FSEK 1088,3494,30	Spectrum Analyzer	R&S	1337	15.12.2010	15.12.2011
3.	3115	Antenna horn	EMCO	LR 1330	05.08.2010	05.08.2013
4.	643	Antenna horn	Narda	LR 093	26.01.2009	26.01.2012
5.	642	Antenna horn	Narda	LR 220	26.01.2009	26.01.2012
6.	PM7320X	Antenna horn	Sivers lab	LR 103	26.01.2009	26.01.2012
7.	DBF-520-20	Antenna horn	Systron Donner	LR 101	26.01.2009	26.01.2012
8.	638	Antenna horn	Narda	LR 098	26.01.2009	26.01.2012
9.	Sucoflex 102E	Cable microwave	Suhner	LR 1370	-	-
10.	6032A	Power supply	HP	LR 1062	-	-
11.	87V	Multimeter, Digital	Fluke	LR1601	15.12.2010	15.12.2012
12.	8449B	Amplifier	Hewlett Packard	LR 1322	26.09.2011	26.09.2012
13.	HFH2-Z2	Antenna loop	Rohde and Schwarz	LR 285	08.10.2010	08.10.2013
14.	10855A	Amplifier	Hewlett Packard	LR 1445	12.10.2011	12.10.2012
15.	HL223	Antenna log.per	Rohde & Schwarz	LR 1261	19.05.2010	09.05.2013
16.	HK116	Antenna biconic	Rohde & Schwarz	LR 1260	19.05.2010	09.05.2013
17.	ESN	Test Receiver	Rohde & Schwarz	LR 1237	21.10.2010	21.21.2012
18.	ESH3-Z3	LISN	Rohde & Schwarz	LR 1076	22.10.2009	22.10.2011
19.	B504D	Power supply	Oltronix	LR 534	-	-
20.	ESHS 10	EMI Receiver	Rohde & Schwarz	N3520	21.06.2011	14.04.2012
21.	ESH3-Z2	Pulse Limiter	Rohde & Schwarz	LR 1074	03.03.2010	03.03.2012
22.	VULB 9163	Antenna TriLog	Schwarzbeck	LR1616	2010-08	2012-08

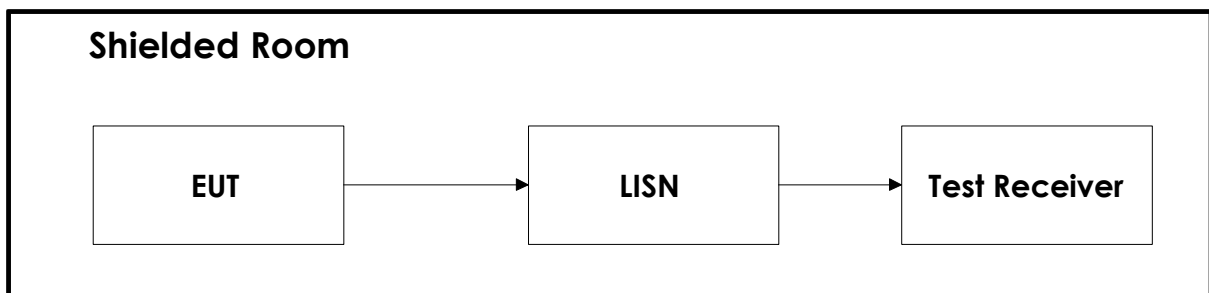
6 BLOCK DIAGRAM

6.1 System set up for radiated measurements



Test equipment: 2, 3, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18

6.2 Power line Conducted Emission



Test equipment: 17,18,19,20,21

6.3 Test Site Radiated Emission

