



**Test report no. : 182231-5**

**Item tested : SmartRFCC1110EM -868**

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

**FCC ID : ZAT1110SRF900**

**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

**15 January 2013**

**Authorized by :** .....

Frode Sveinsen  
Technical Verificator



## CONTENTS

<b>1</b>	<b>GENERAL INFORMATION .....</b>	<b>3</b>
1.1	Testhouse Info .....	3
1.2	Client Information.....	3
1.3	Manufacturer.....	3
<b>2</b>	<b>Test Information.....</b>	<b>4</b>
2.1	Test Item.....	4
2.2	Test Environment.....	5
2.2.1	Normal test condition .....	5
2.3	Test Period.....	5
<b>3</b>	<b>TEST REPORT SUMMARY .....</b>	<b>6</b>
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
<b>4</b>	<b>TEST RESULTS .....</b>	<b>8</b>
4.1	Transmitter Frequency Stability .....	8
4.2	20 dB Bandwidth.....	9
4.3	Peak Power Output.....	11
4.4	Band Edge Emissions.....	21
4.5	Spurious Emissions .....	24
<b>5</b>	<b>LIST OF TEST EQUIPMENT .....</b>	<b>37</b>
<b>6</b>	<b>BLOCK DIAGRAM .....</b>	<b>38</b>
6.1	System set up for radiated measurements .....	38
6.2	Power line Conducted Emission .....	38
6.3	Test Site Radiated Emission.....	39

## 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](mailto:comlab@nemko.no)  
FCC test firm : 994405  
IC OATS : 2040D-1  
Total Number of Pages: 39

### 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](mailto:d.grini@ti.com)

### 1.3 Manufacturer

Same as client

## 2 Test Information

### 2.1 Test Item

Name :	Texas Instruments
Model/version :	SmartRFCC1110EM-868
FCC ID :	ZAT1110SRF900
IC :	451H-1110SRF900
Serial number :	0000 09A8
Hardware identity and/or version:	-
Software identity and/or version :	-
Frequency Range :	903.5 – 926.5 MHz
Operating Modes :	TX & RX
Type of Modulation :	2-GFSK
Data rate:	1.2kbit/s
User Frequency Adjustment :	None
Output Power :	0.00014 W (Conducted)
Type of Power Supply :	3.0 V DC*
Antenna Connector :	No, integral antenna
Antenna type:	PCB antenna
Antenna Diversity Supported :	None

\*Tested with primary batteries (2xAA alkaline cells).

#### Theory of Operation

The SmartRFCC1110EM-868 is a RF-transceiver module.

## 2.2 Test Environment

### 2.2.1 Normal test condition

Temperature:	23 – 24 °C
Relative humidity:	35 – 50 %
Normal test voltage:	3.0 V DC

Fresh batteries were used for all tests (2xAA alkaline cells).

The values are the limit registered during the test period.

## 2.3 Test Period

Item received date:	2011-09-20
Test period :	from 2011-10-12 to 2011-11-09

### 3 TEST REPORT SUMMARY

#### 3.1 General

Manufacturer: Texas Instruments Norway AS  
Model No.: SmartRFCC1110EM-868  
Serial No.: 0000 09A8

All measurements are traceable to national standards.

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

All tests were conducted in accordance with ANSI C63.4-2003 and ANSI C63.10-2009. Radiated tests were made in a semi-anechoic chamber at measuring distances of 3 and 10 meters. The chamber is on file with FCC and Industry Canada under the registration numbers listed on page 3.

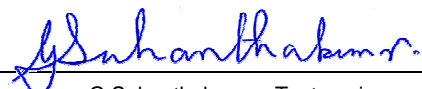
- |   |   |
|---|---|
| <input checked="" type="checkbox"/> New Submission  | <input checked="" type="checkbox"/> Production Unit |
| <input type="checkbox"/> Class II Permissive Change | <input type="checkbox"/> Pre-production Unit        |
| <b>DXT</b> Equipment Code                           | <input 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 #: 182231-5**

TESTED BY:   
G.Suhanthakumar, Test engineer

DATE: 2011-11-22

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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 <sup>1</sup>
Transmitter frequency stability	15.31(m)	7.2.4	Complies
Antenna Requirement	15.203	7.1.4	complies <sup>2</sup>
Power-line Conducted Emission	15.207(c)	7.2.2	NA <sup>1</sup>
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)	-

<sup>1</sup> EUT is powered from batteries.

<sup>2</sup> 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 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 Transmitter Frequency Stability

Para. No.: 15.31(m)/7.2.4

Test Performed By: G.Suwanthakumar	Date of Test: 04.11.2011
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#### Measurement Data:

Temperature	Channel nr.	Given Frequency (MHz)	Measured value (MHz)	Deviation (Hz)
20 ° C	-	903.500	903.48731	0.01269
	-	915.000	914.98714	0.01286
	-	926.500	926.48695	0.01305

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



## 4.2 20 dB Bandwidth

Para. No.: RSS-Gen

Test Performed By: G.Suwanthakumar	Date of Test: 04.11.2011
------------------------------------	--------------------------

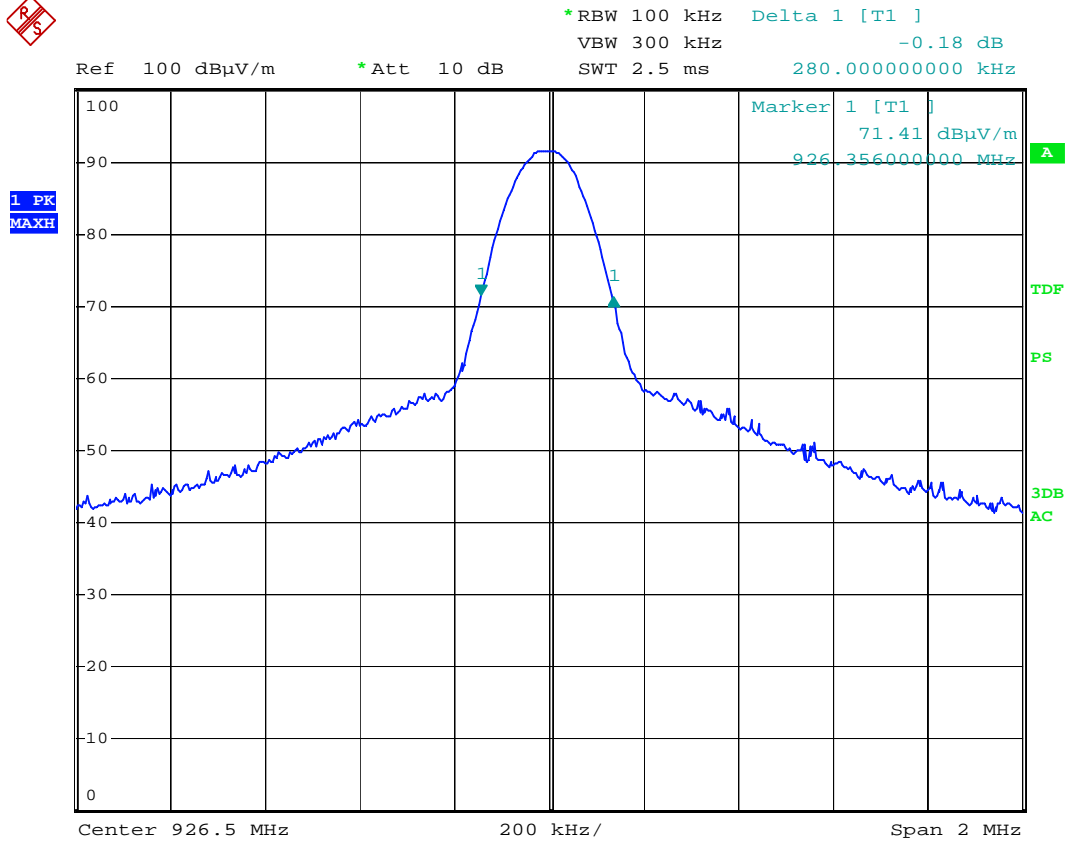
Test Results: Complies

Measurement Data:

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

Requirements:

For information only



Date: 1.NOV.2011 13:50:30

**915MHz – 20 dB bandwidth – 280kHz**

### 4.3 Peak Power Output

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

Test Performed By: G.Suhandhakumar	Date of Test: 04.11.2011
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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)	-8.4	-8.5	-8.6
1.2kbps, Measured value (W)	0.00014	0.00014	0.00014

#### Maximum Field strength

RF channel	903.5MHz	915MHz	926.5MHz
VP: Measured value (dB $\mu$ V/m)	79.2	78.5	78.9
HP: Measured value (dB $\mu$ V/m)	91.1	91.6	91.7

Radiated measurements were performed @3m distance.

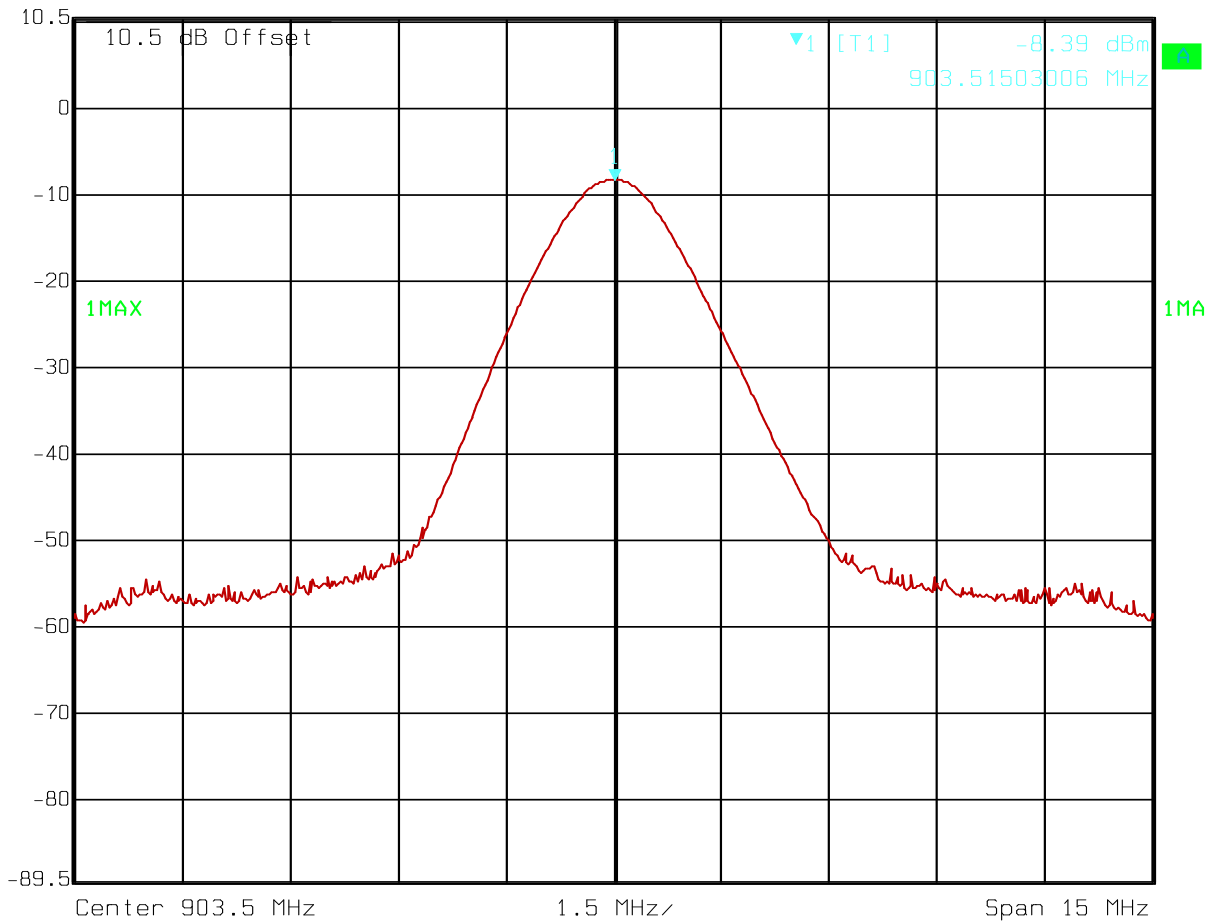
- Detachable antenna?  Yes  No
- If detachable, is the antenna connector non-standard?  
 SMA connector  Yes  No

#### Requirements:

The maximum peak output power shall be  $\leq 94$ dB $\mu$ V/m



**Marker 1 [T1]**      RBW    1 MHz    RF Att    10 dB  
 Ref Lvl                      -8.39 dBm    VBW    1 MHz  
 10.5 dBm                    903.51503006 MHz    SWT    5 ms    Unit        dBm

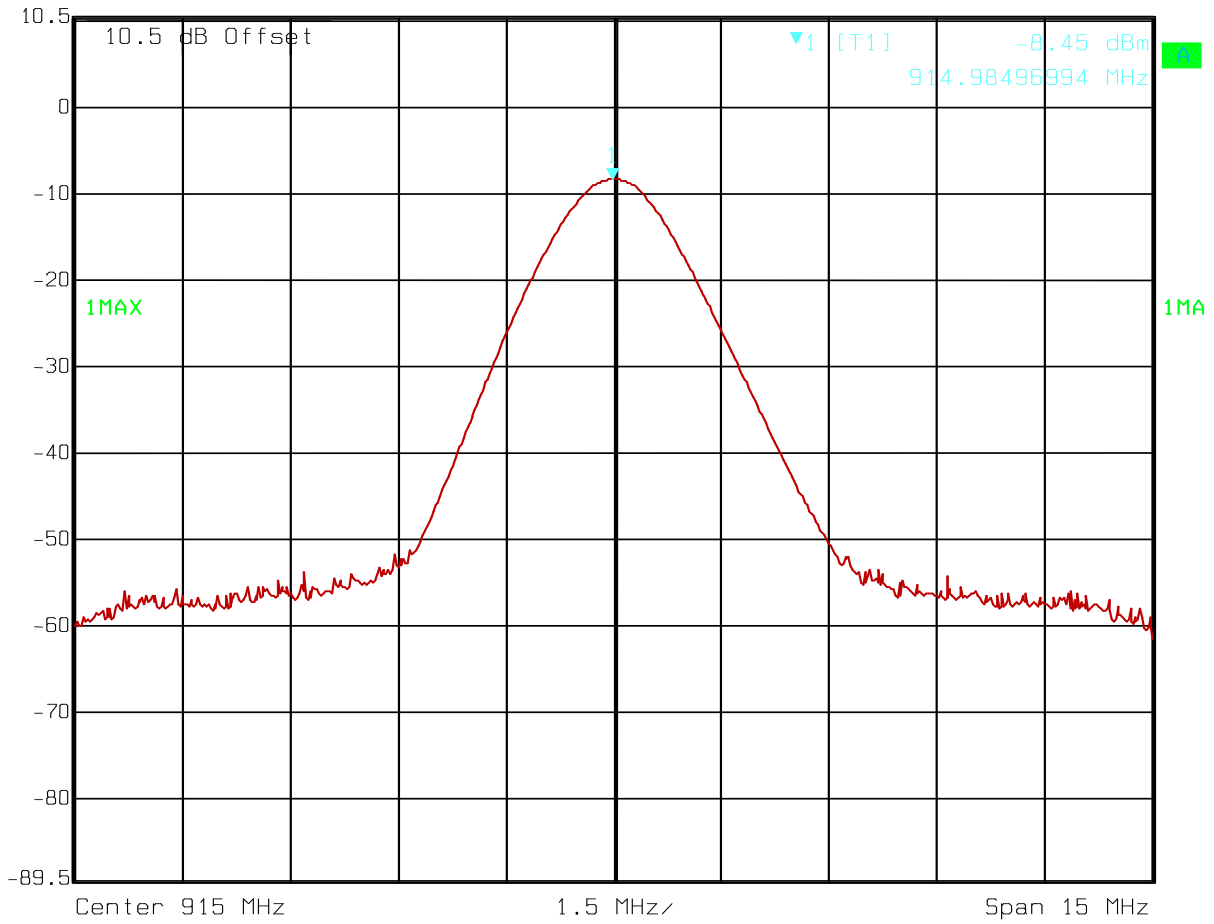


Date: 04.NOV.2011 16:06:05

Conducted power – 903.5MHz



Ref Lvl 10.5 dBm  
 Marker 1 [T1] -8.45 dBm  
 914.98496994 MHz  
 RBW 1 MHz RF Att 10 dB  
 VBW 1 MHz  
 SWT 5 ms Unit dBm

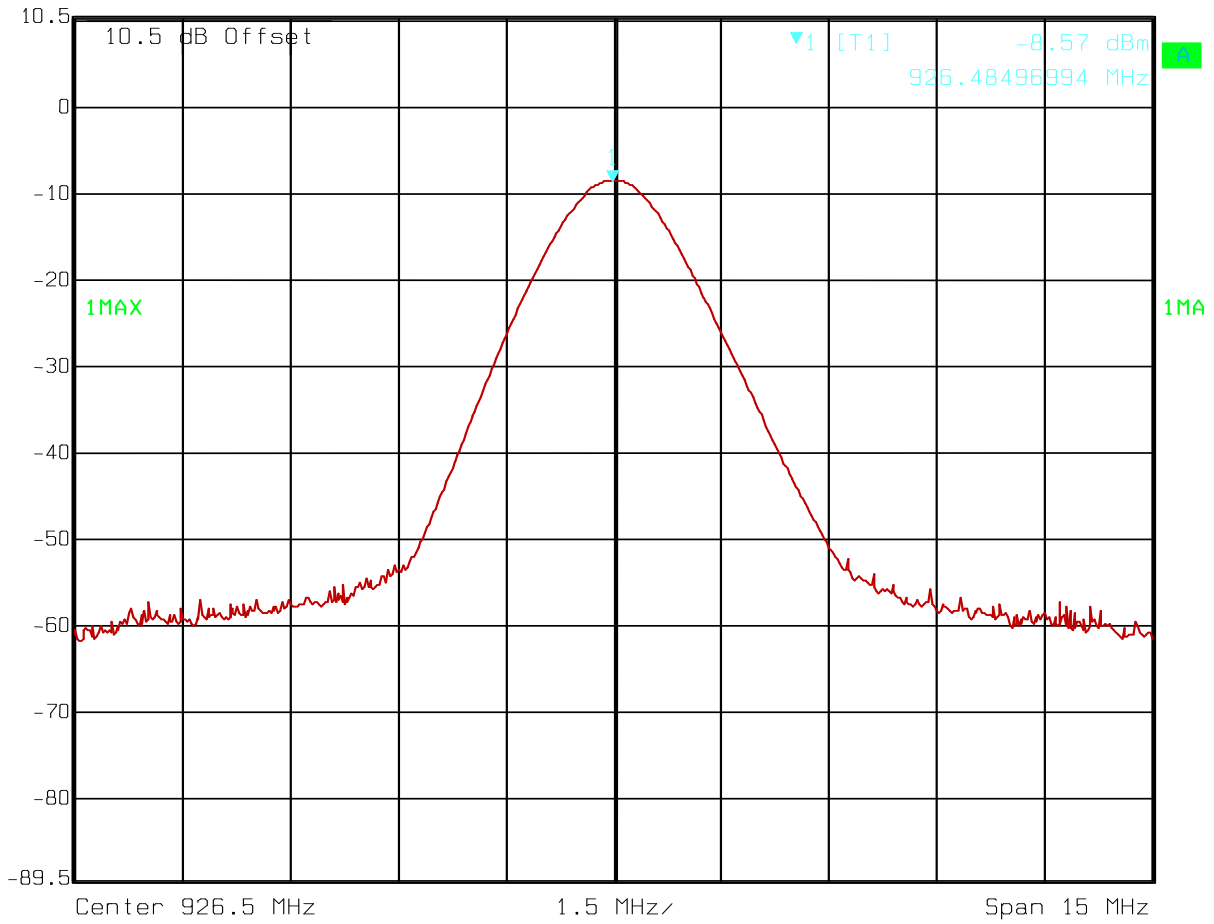


Date: 04.NOV.2011 16:04:08

Conducted power – 915MHz



Ref Lvl 10.5 dBm  
 Marker 1 [T1] 926.48496994 MHz  
 RBW 1 MHz  
 VBW 1 MHz  
 RF Att 10 dB  
 Unit dBm  
 -8.57 dBm  
 SWT 5 ms



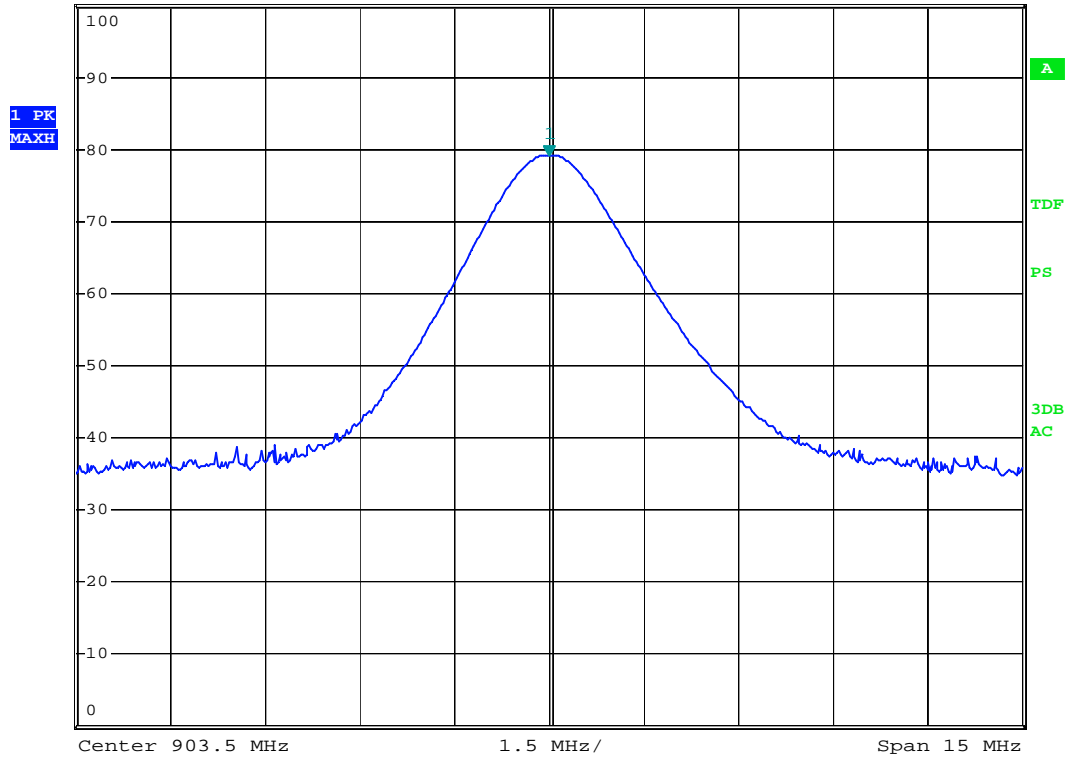
Date: 04.NOV.2011 16:03:14

Conducted power – 926.5MHz



\*RBW 1 MHz      Marker 1 [T1 ]  
VBW 3 MHz      79.22 dBμV/m  
SWT 2.5 ms      903.50000000 MHz

Ref 100 dBμV/m      \*Att 10 dB

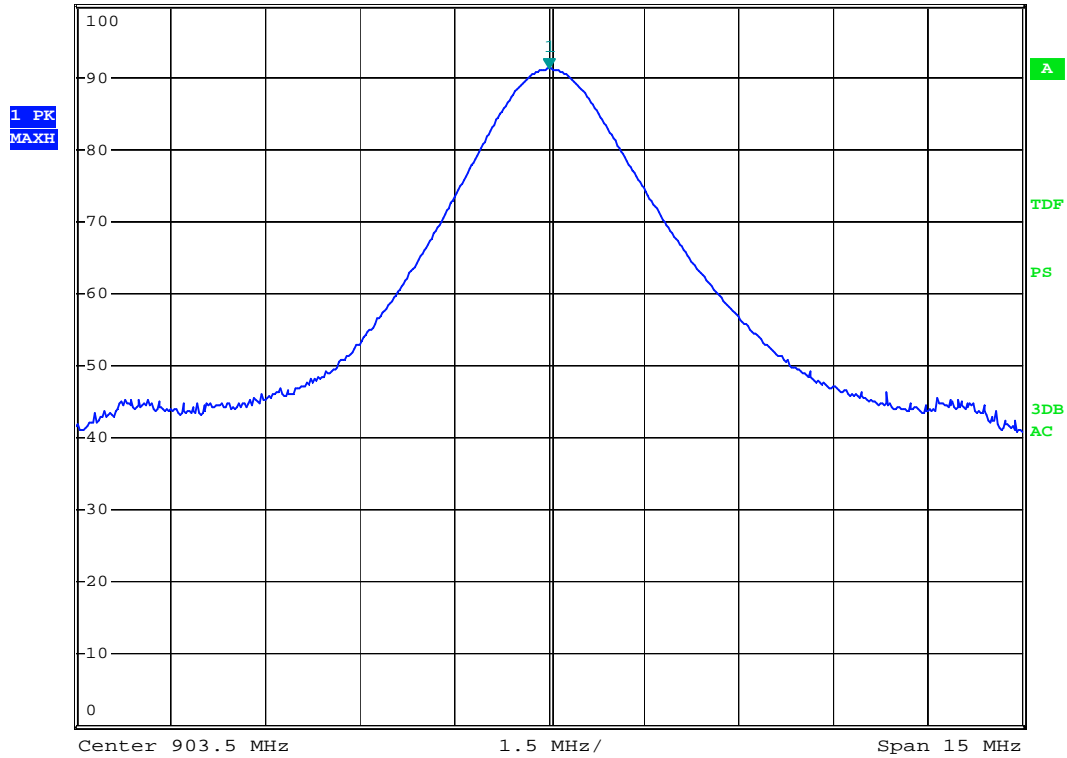


Date: 1.NOV.2011 14:47:31

**VP: 903.5MHz – Field strength**



\*RBW 1 MHz      Marker 1 [T1 ]  
VBW 3 MHz      91.09 dBμV/m  
Ref 100 dBμV/m    \*Att 10 dB      SWT 2.5 ms      903.50000000 MHz



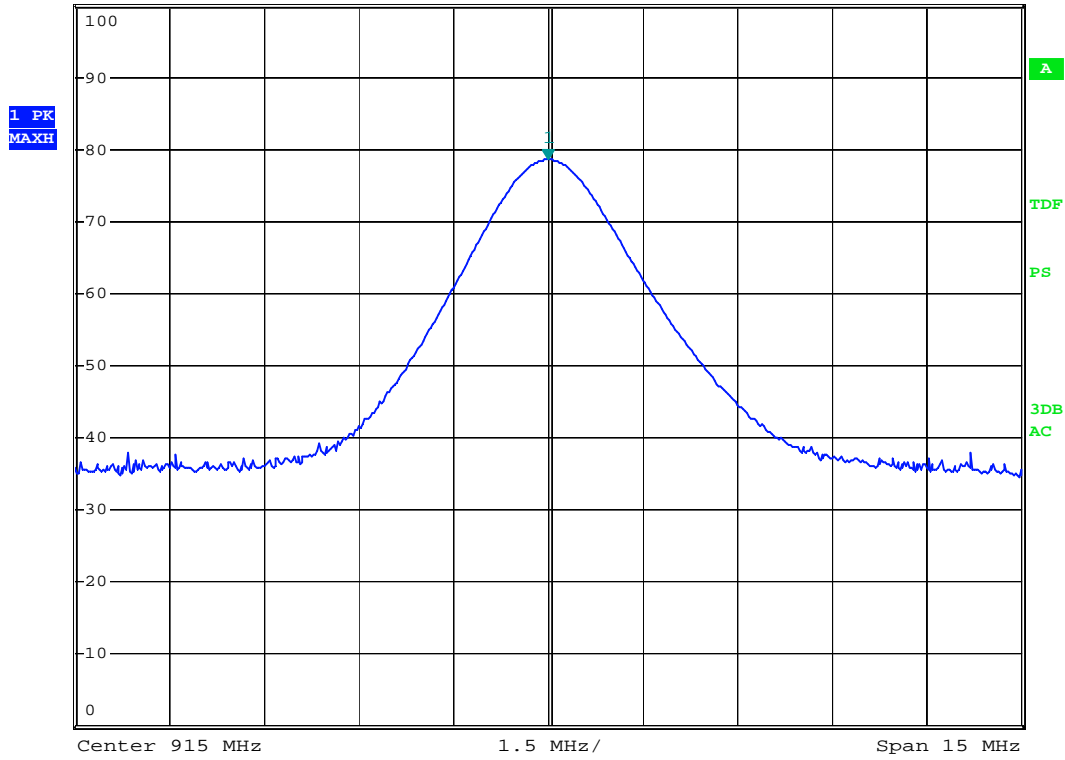
Date: 1.NOV.2011 14:46:00

**HP: 903.5MHz – Field strength**





Ref 100 dB $\mu$ V/m      \*Att 10 dB      \*RBW 1 MHz      Marker 1 [T1 ]  
 VBW 3 MHz      78.52 dB $\mu$ V/m  
 SWT 2.5 ms      915.00000000 MHz

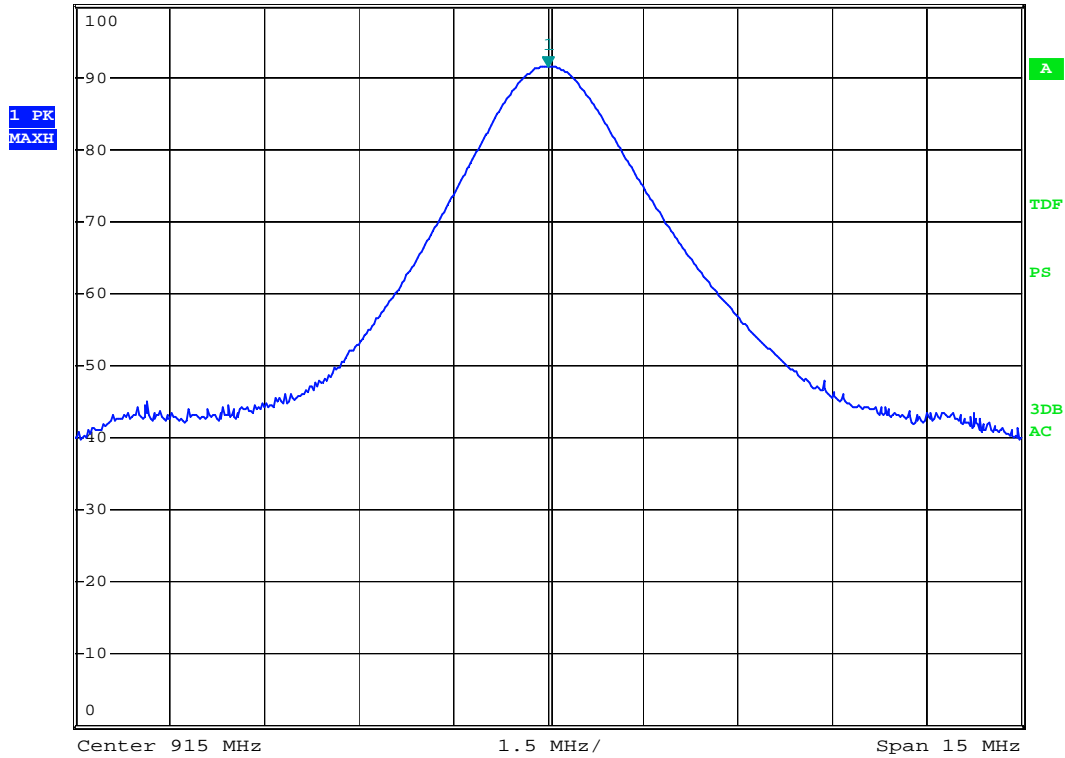


Date: 1.NOV.2011 14:50:11

**VP: 915MHz – Field strength**



\*RBW 1 MHz      Marker 1 [T1 ]  
VBW 3 MHz      91.55 dBμV/m  
Ref 100 dBμV/m    \*Att 10 dB      SWT 2.5 ms      915.000000000 MHz

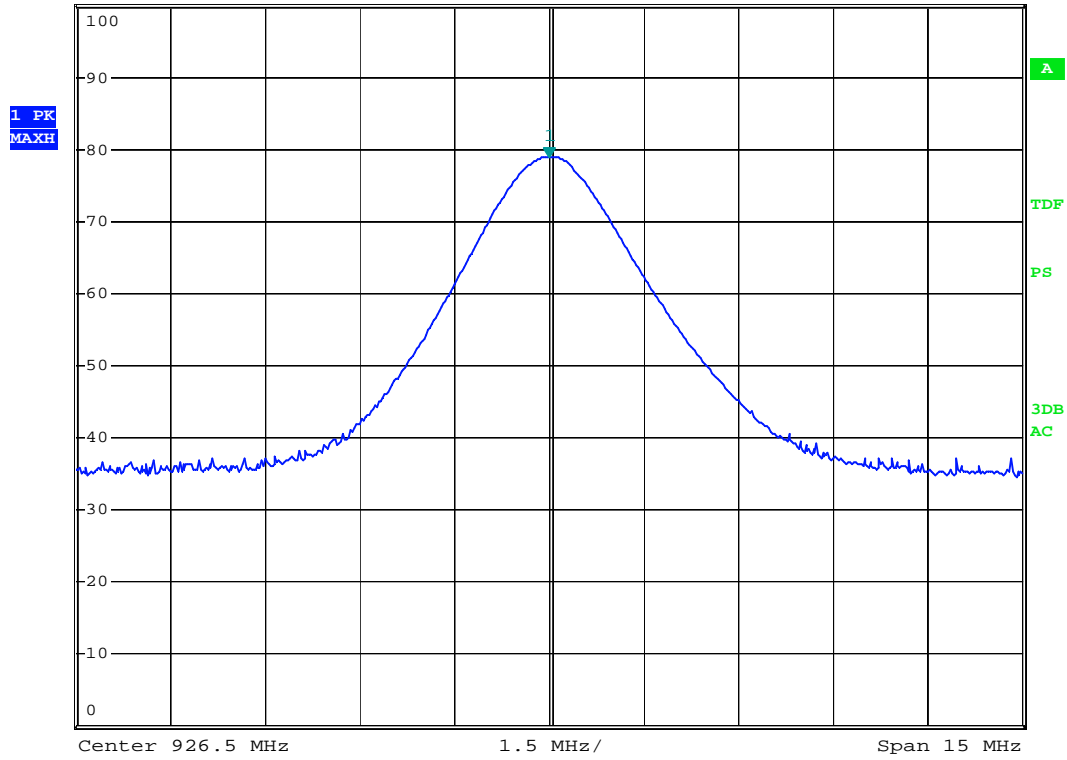


Date: 1.NOV.2011 14:50:47

**HP: 915MHz – Field strength**



Ref 100 dB $\mu$ V/m      \*Att 10 dB      \*RBW 1 MHz      Marker 1 [T1 ]  
 VBW 3 MHz      78.94 dB $\mu$ V/m  
 SWT 2.5 ms      926.50000000 MHz

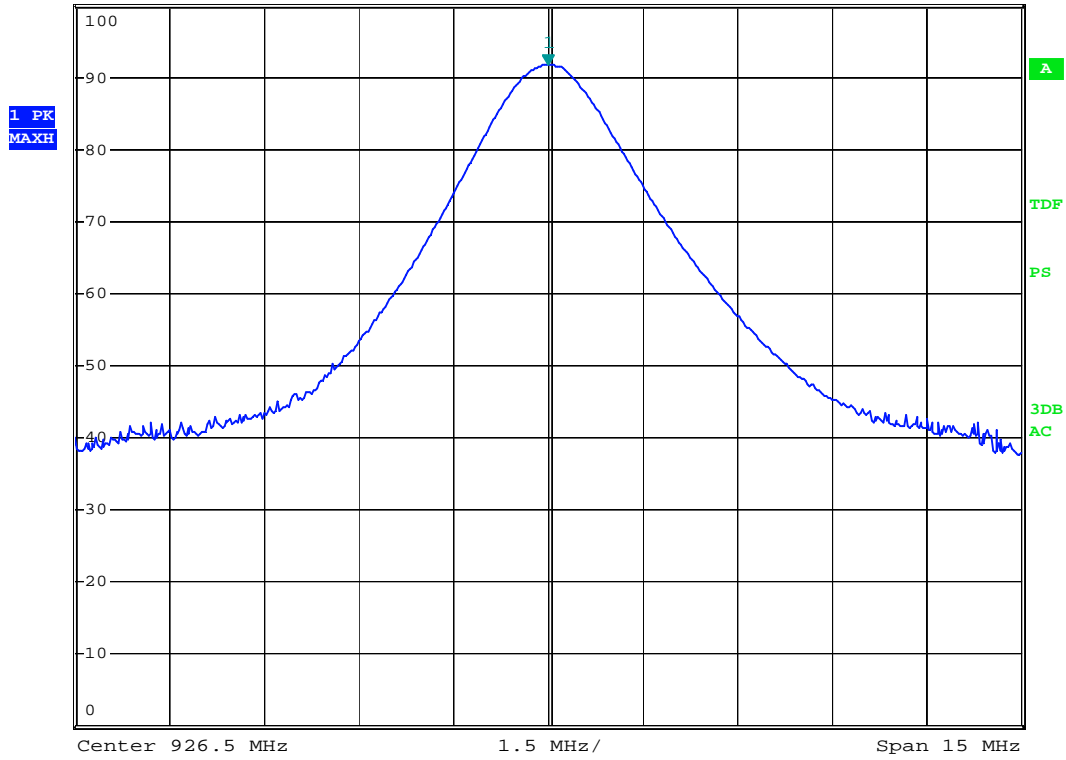


Date: 1.NOV.2011 13:56:58

**VP: 926.5MHz – Field strength**



Ref 100 dB $\mu$ V/m    \*Att 10 dB    \*RBW 1 MHz    Marker 1 [T1]    91.68 dB $\mu$ V/m  
VBW 3 MHz    926.50000000 MHz  
SWT 2.5 ms



Date: 1.NOV.2011 13:50:54

**HP: 926.5MHz – Field strength**

#### 4.4 Band Edge Emissions

Para. No.: 15.249 (d)

Test Performed By: G.Suwanthakumar	Date of Test: 04.11.2011
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Test Results: Complies

##### Measurement Data:

Lower Band edge :

RF channel	903.500MHz
Measured maximum dBc	53.0

Upper Band edge :

RF channel	926.500MHz
Measured maximum dBc	52.6

##### Band-edge, @3m

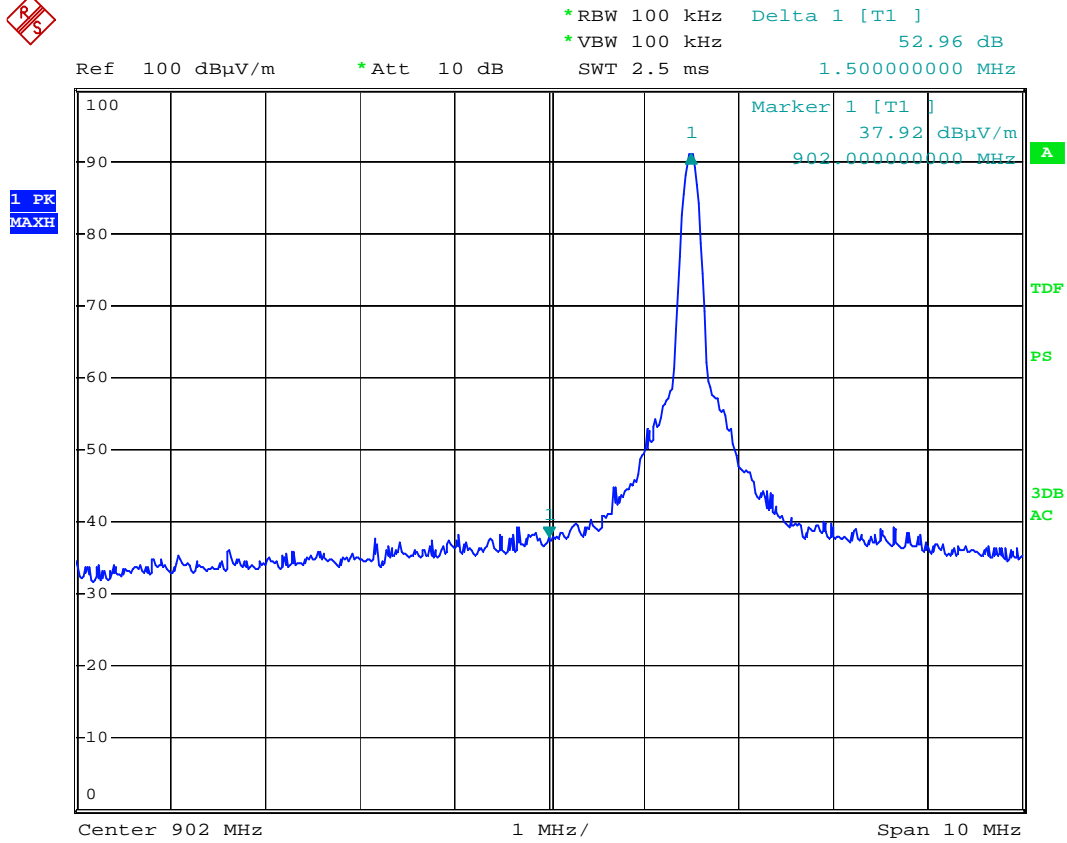
Frequency	Measured Field Strength @3m (dB $\mu$ V/m)	Detector	Limit (dB $\mu$ V/m)	Margin dB
902.000MHz	37.9	PK	46	8.1
928.000MHz	38.8	PK	46	7.2

Limit below 1 GHz is with QP detector.

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.

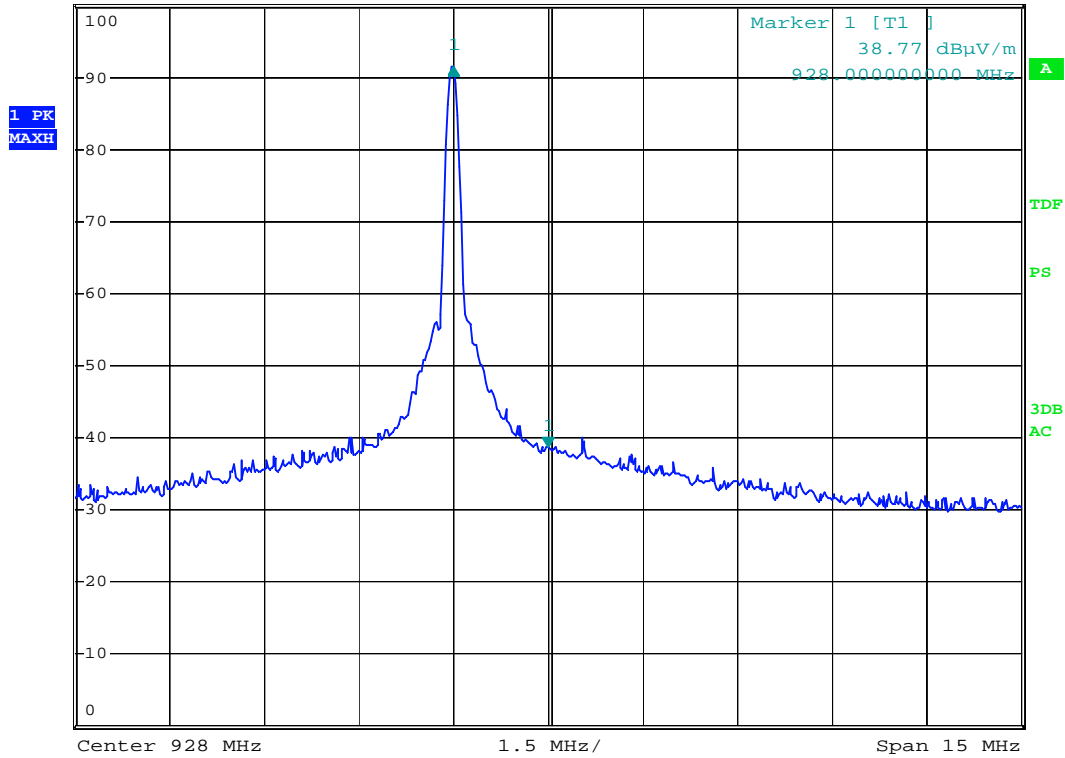


Date: 1.NOV.2011 14:45:15

903.5MHz- Lower Band Edge -PK detector



Ref 100 dB $\mu$ V/m      \*Att 10 dB      \*RBW 100 kHz      Delta 1 [T1 ]  
 \*VBW 100 kHz      52.63 dB  
 SWT 5 ms      -1.500000000 MHz



Date: 1.NOV.2011 13:59:49

926.5MHz- Upper Band Edge- PK detector

## 4.5 Spurious Emissions

Para. No.: 15.249 (e)

Test Performed By: G.Suhanthakumar

Date of Test: 04.11.2011

Test Results: Complies

Measurement Data:

### Conducted Emissions, 9 kHz to 10 GHz

Maximum RF level outside operating band:

RF 915MHz:  $\geq 42.0$  dBc, margin  $> 20$  dB

The EUT was transmitting with 100% duty cycle for all emission tests.

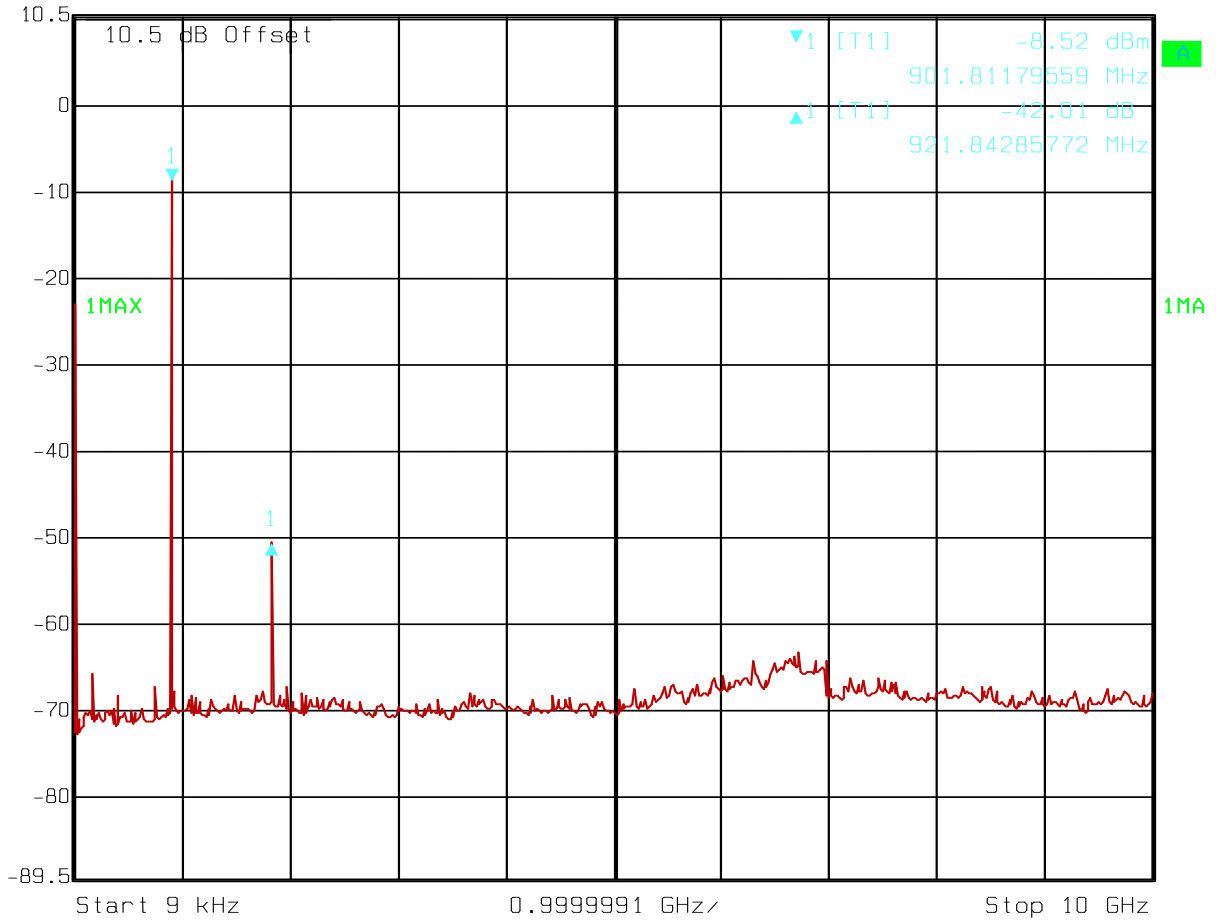
### Requirements:

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 -42.01 dB VBW 100 kHz  
 10.5 dBm 921.84285772 MHz SWT 2.5 s Unit dBm



Date: 04.NOV.2011 16:04:52

**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 $\mu$ V/m	dB	dB $\mu$ V/m	dB
1.807	0	49.40	-	74	24.60
1.830	0	49.68	-	74	24.32
1.853	0	50.24	-	74	23.76
>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 $\mu$ V/m	dB	dB $\mu$ V/m	dB
1.807	0	48.22	-	54	5.78
1.830	0	48.17	-	54	5.83
1.853	0	48.43	-	54	5.57
>1.86 - 10	0	None detected	-	54	-

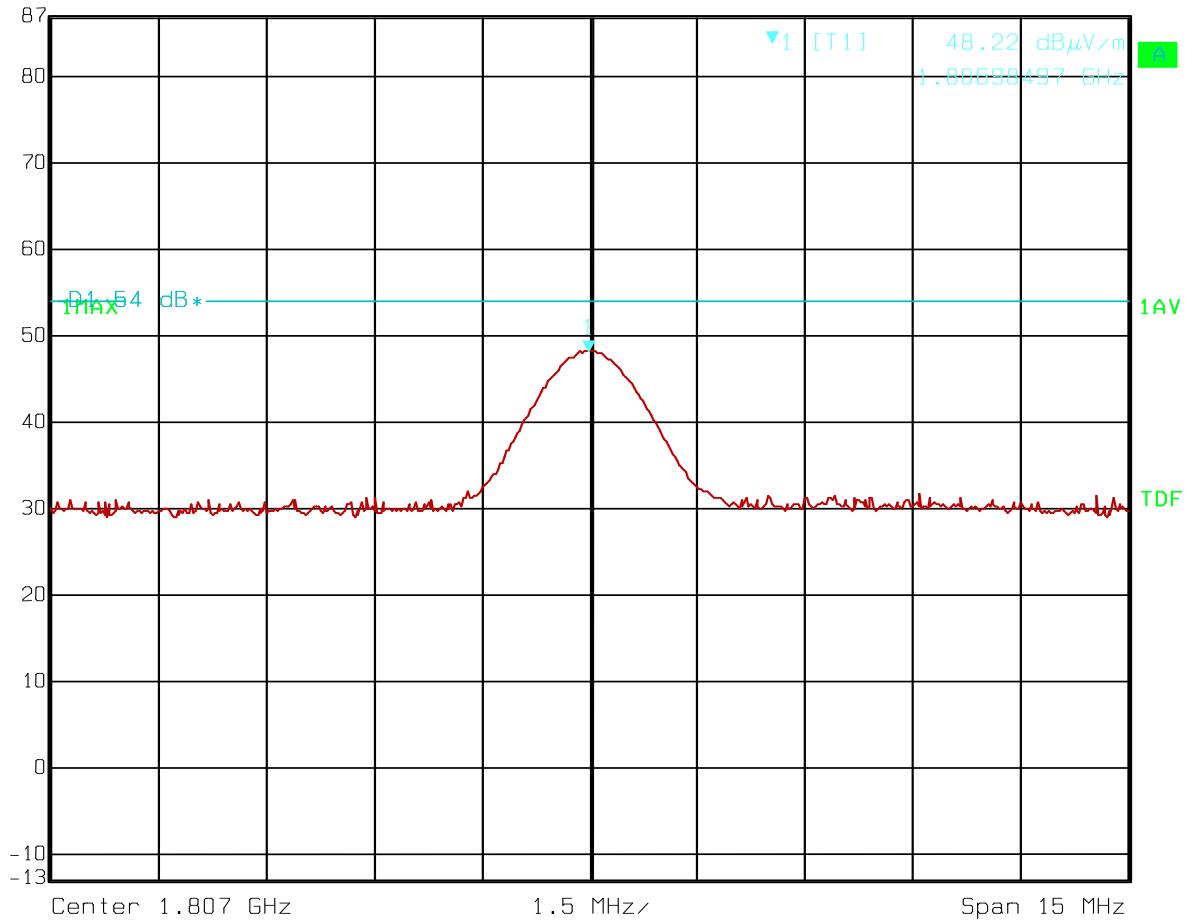
The maximum is observed in Vertical polarization

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*	48.22 dB $\mu$ V/m	VBW	10 MHz		
		1.80698497 GHz	SWT	5 ms	Unit	dB $\mu$ V/m

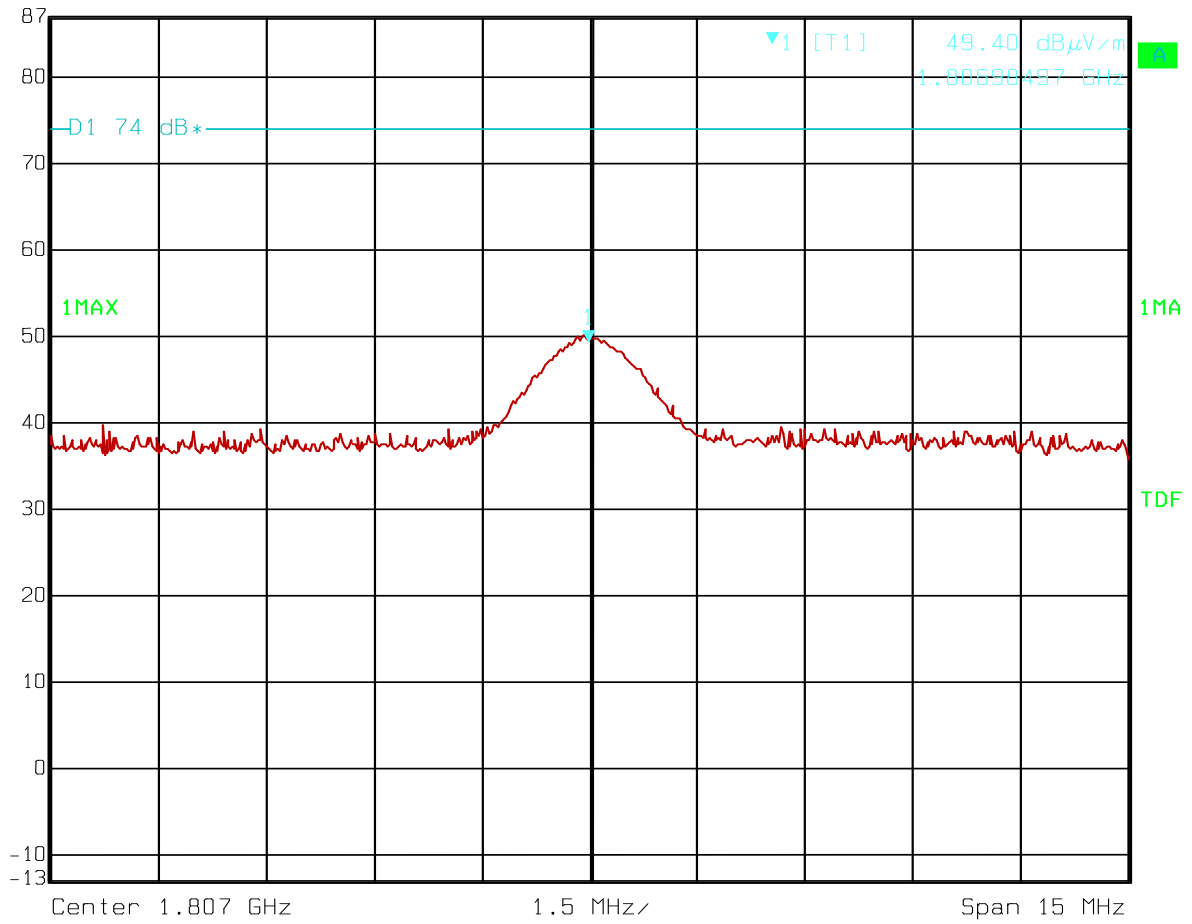


Date: 04.NOV.2011 14:36:48

**903.5MHz – 2<sup>nd</sup> Harmonic- AV**



Ref Lvl 87 dB\*  
 Marker 1 [T1] 49.40 dB $\mu$ V/m  
 1.80698497 GHz  
 RBW 1 MHz RF Att 0 dB  
 VBW 1 MHz  
 SWT 5 ms Unit dB $\mu$ V/m

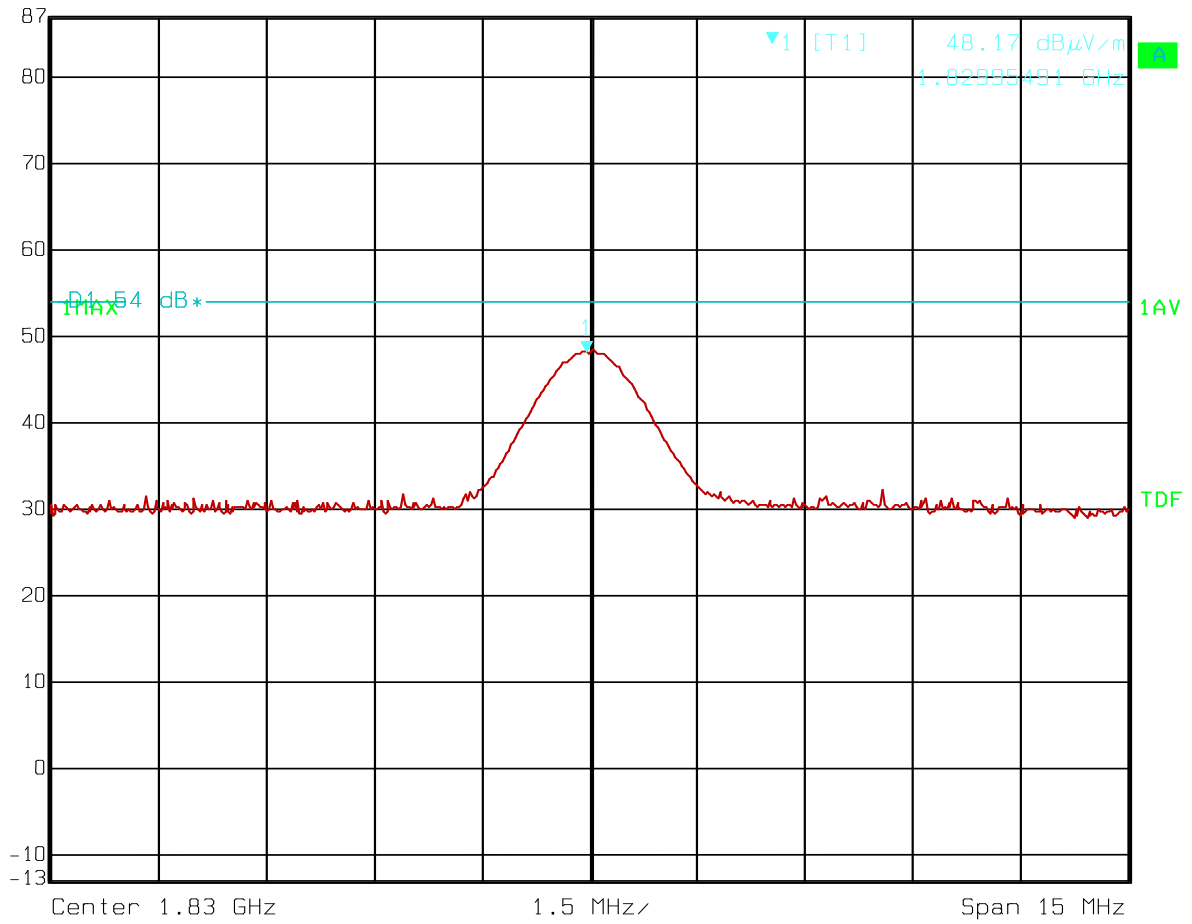


Date: 04.NOV.2011 14:37:17

**903.5MHz – 2<sup>nd</sup> Harmonic- PK**



Ref Lvl 87 dB\*  
 Marker 1 [T1] 48.17 dB $\mu$ V/m  
 1.82995491 GHz  
 RBW 1 MHz RF Att 0 dB  
 VBW 10 MHz  
 SWT 5 ms Unit dB $\mu$ V/m

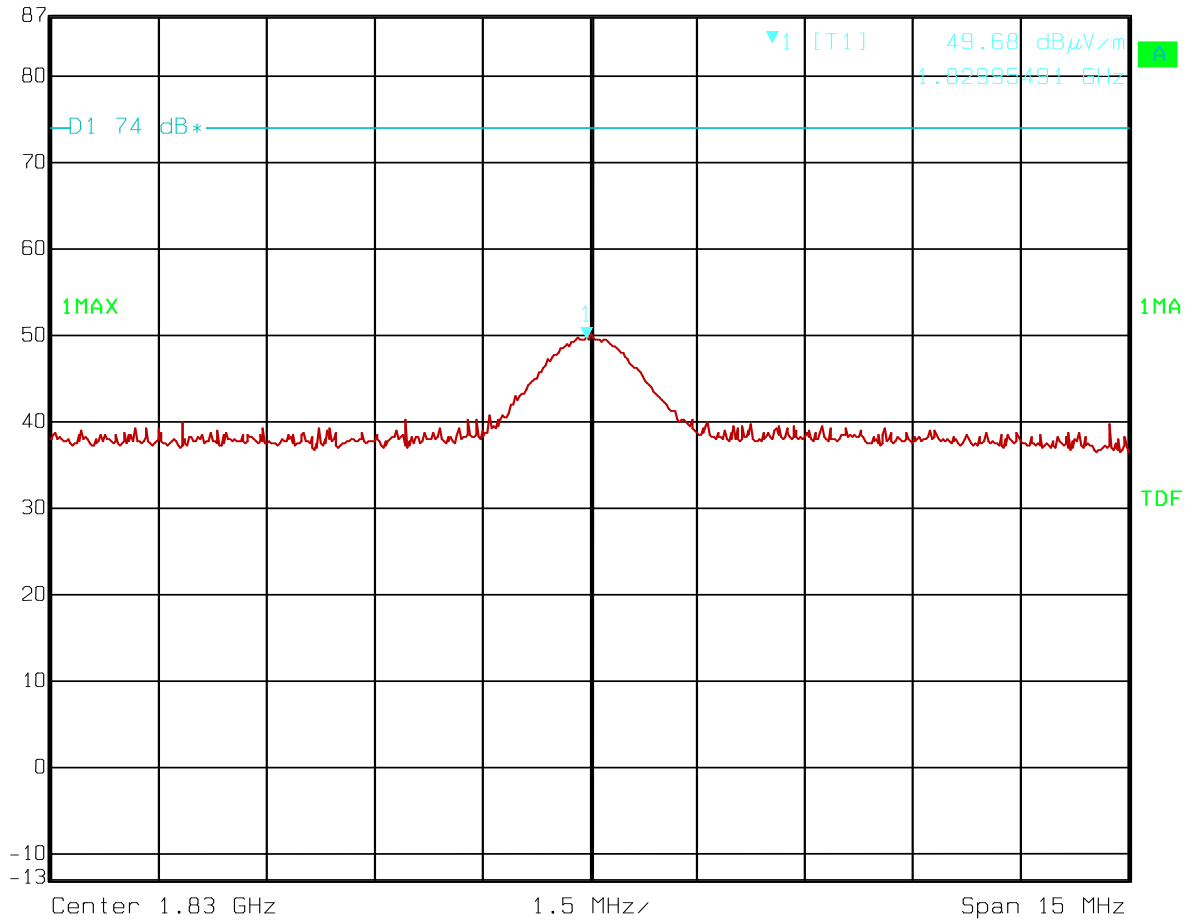


Date: 04.NOV.2011 14:35:02

**915MHz – 2<sup>nd</sup> harmonic- AV**



Ref Lvl 87 dB\*  
 Marker 1 [T1] 49.68 dB $\mu$ V/m  
 1.82995491 GHz  
 RBW 1 MHz  
 VBW 1 MHz  
 RF Att 0 dB  
 Unit dB $\mu$ V/m  
 SWT 5 ms

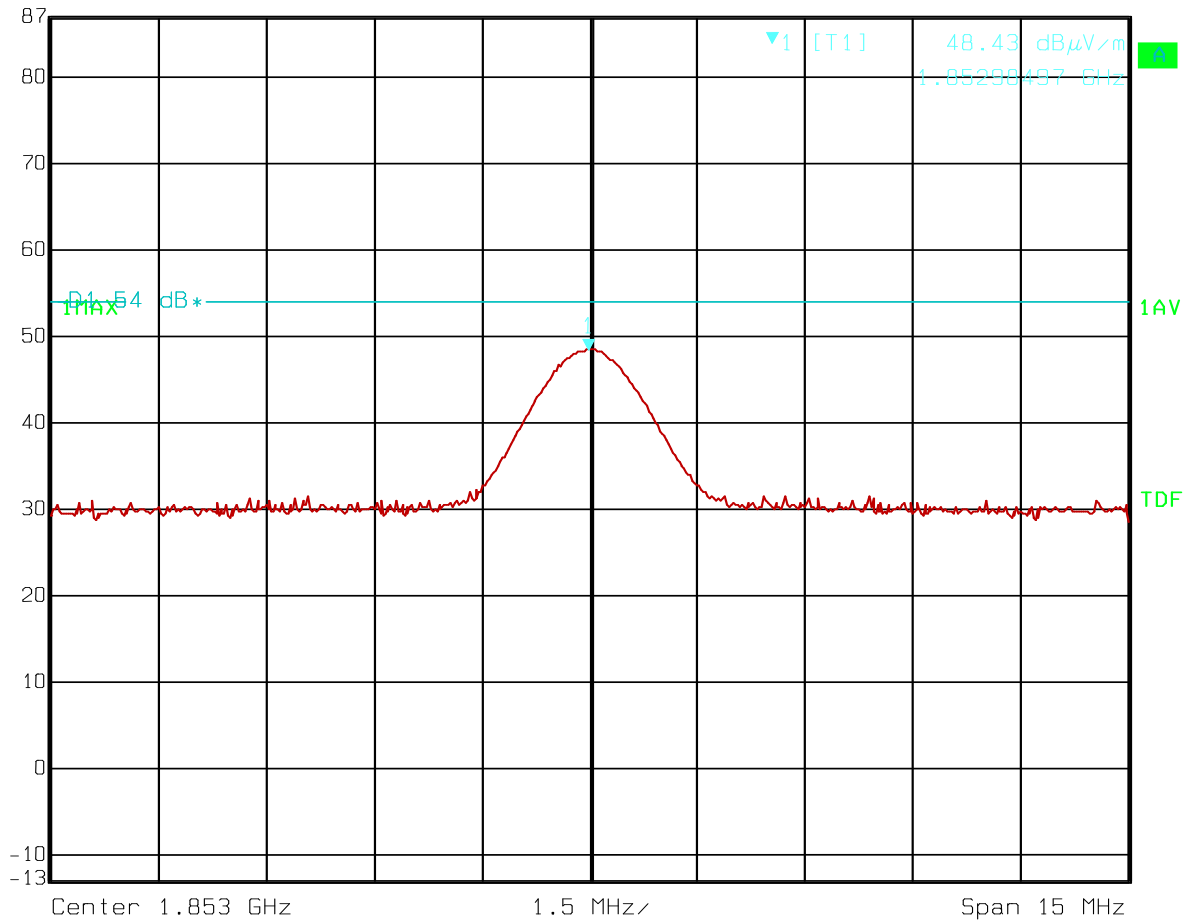


Date: 04.NOV.2011 14:34:13

**915MHz – 2<sup>nd</sup> Harmonic – PK**



Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	0 dB
87 dB*	48.43 dB $\mu$ V/m	VBW	10 MHz		
	1.85298497 GHz	SWT	5 ms	Unit	dB $\mu$ V/m

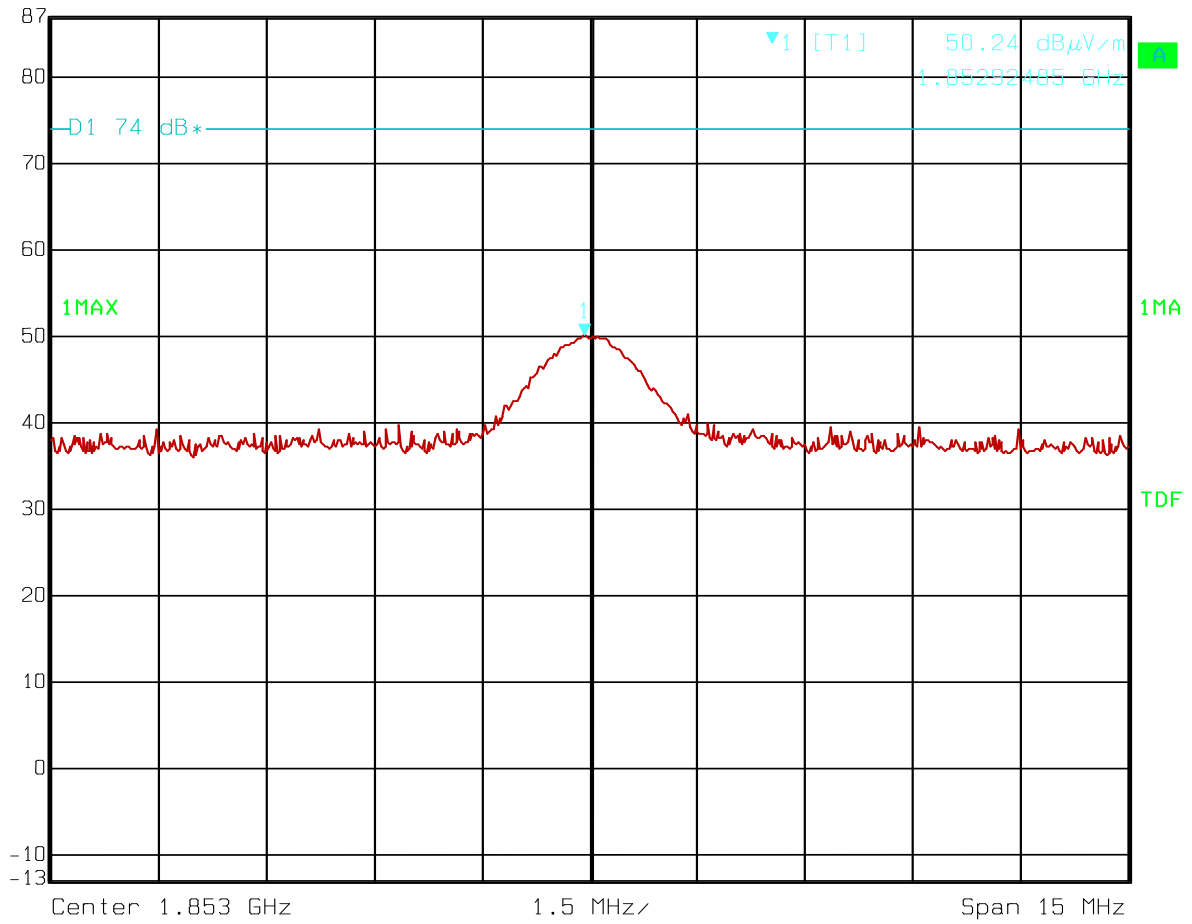


Date: 04.NOV.2011 14:30:21

**926.5MHz – 2<sup>nd</sup> harmonic- AV**



Ref Lvl 87 dB\*      Marker 1 [T1] 50.24 dB $\mu$ V/m      RBW 1 MHz      RF Att 0 dB  
 1.85292485 GHz      VBW 1 MHz  
 Unit dB $\mu$ V/m      SWT 5 ms



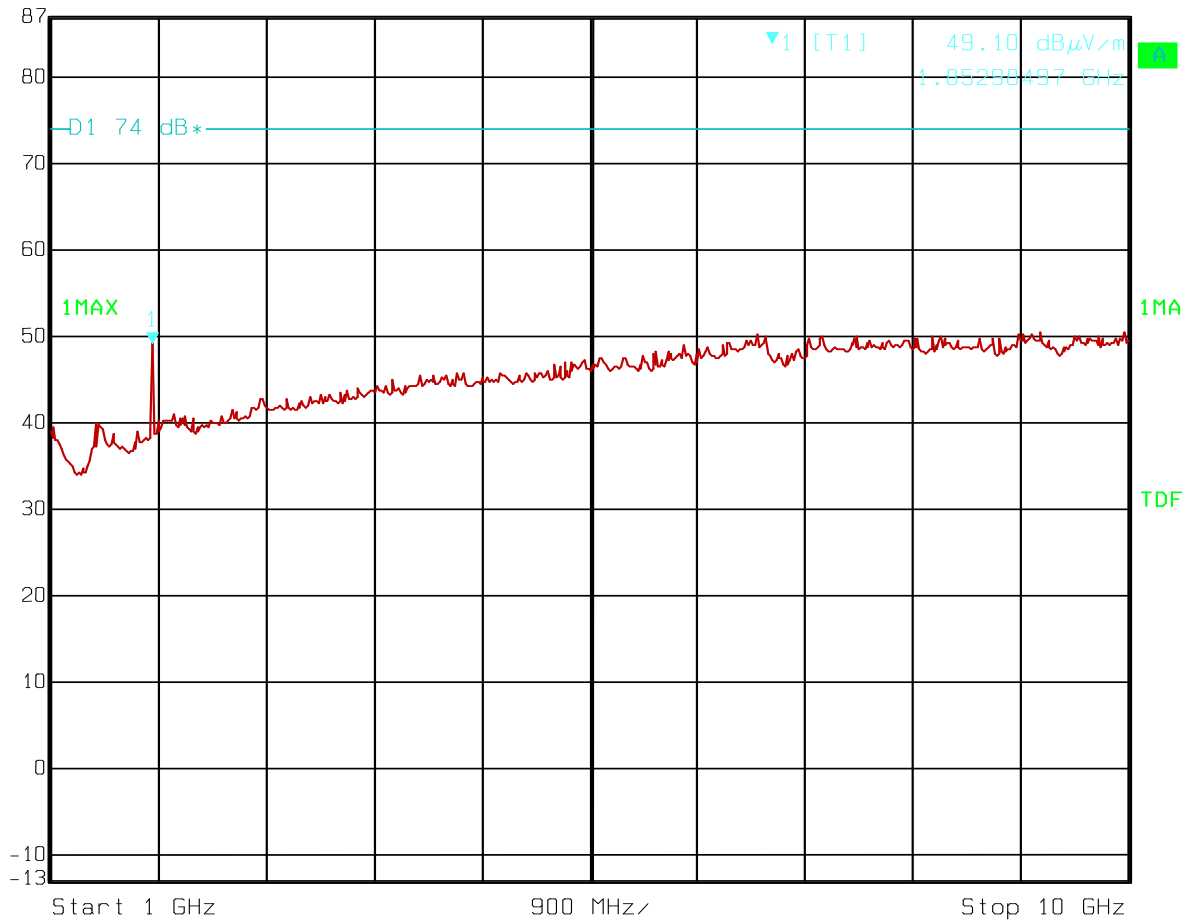
Date: 04.NOV.2011 14:29:22

**926.5MHz – 2<sup>nd</sup> harmonic- PK**





Ref Lvl 87 dB\*  
 Marker 1 [T1] 49.10 dB $\mu$ V/m  
 1.85298497 GHz  
 RBW 1 MHz RF Att 0 dB  
 VBW 1 MHz  
 SWT 90 ms Unit dB $\mu$ V/m

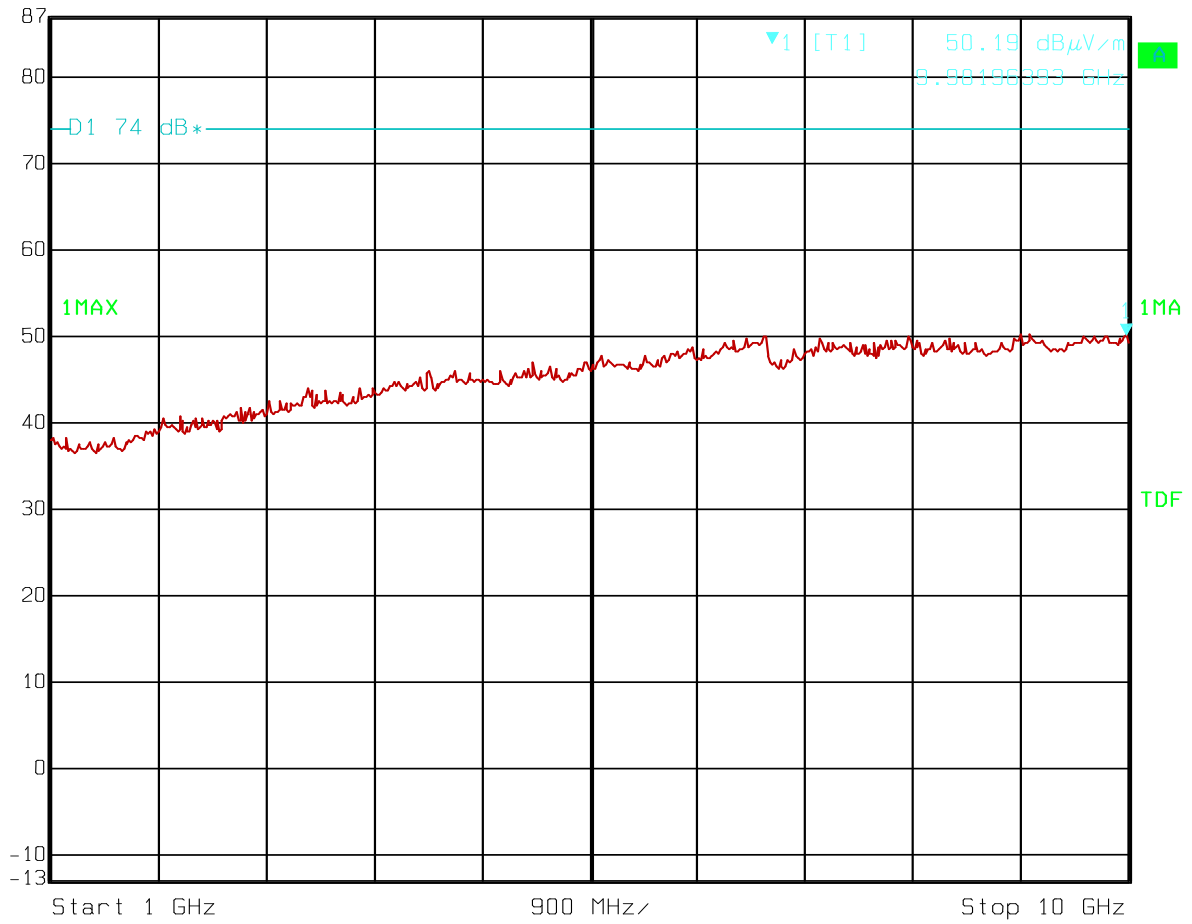


Date: 04.NOV.2011 14:31:31

**VP: pre-scan 1 - 10GHz-pk**



Ref Lvl 87 dB\*  
 Marker 1 [T1] 50.19 dB $\mu$ V/m  
 9.98196393 GHz  
 RBW 1 MHz RF Att 0 dB  
 VBW 1 MHz  
 SWT 90 ms Unit dB $\mu$ V/m



Date: 04.NOV.2011 14:43:05

**HP: pre-view scan 1 - 10GHz -pk**

**Radiated emissions 30 – 1000 MHz.**

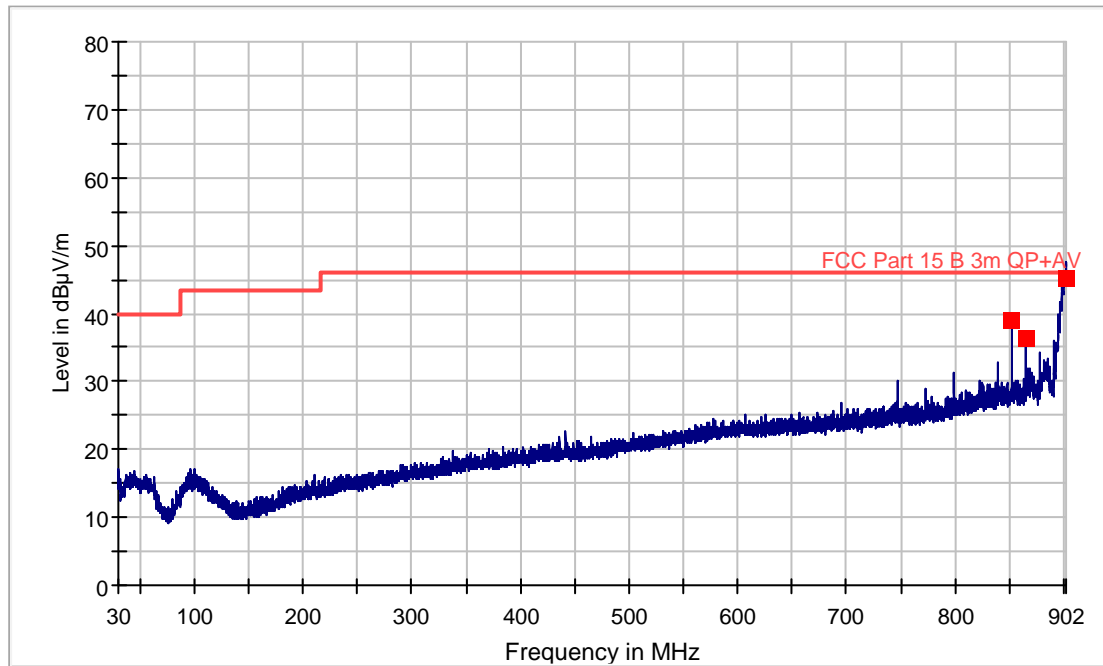
Detector: Peak

Measuring distance 3 m.

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

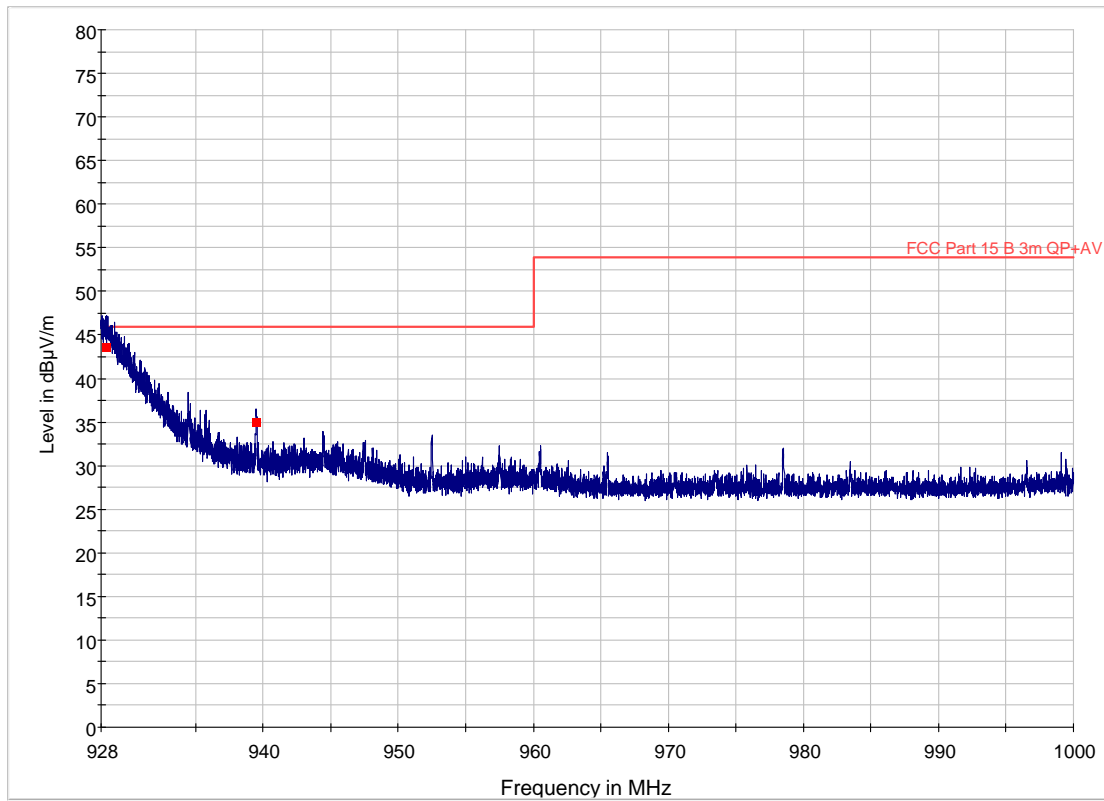
**FCC Pt15 Class B 30-902M 3m**

FCC Pt15 Class B 30-2000M 3m



Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Polarization	Margin (dB)	Limit (dBµV/m)	Comment
851.495830	39.0	120.000	H	7.0	46.0	
864.495236	36.3	120.000	H	9.7	46.0	
901.552041	45.3	120.000	H	0.7	46.0	

**FCC Pt15 Class B 928-1000M 3m**



Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Polarization	Margin (dB)	Limit (dBµV/m)	Comment
928.433924	43.6	120.000	H	2.4	46.0	
939.497039	35.0	120.000	H	11.0	46.0	

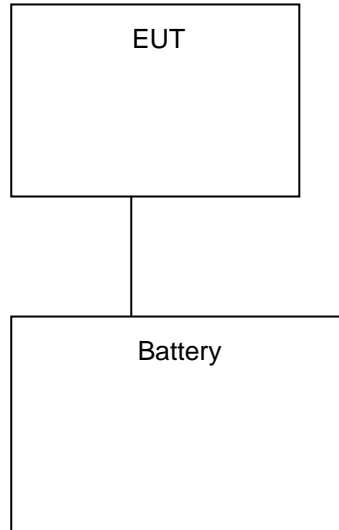
## 5 LIST OF TEST EQUIPMENT

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	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	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	21.10.2012
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

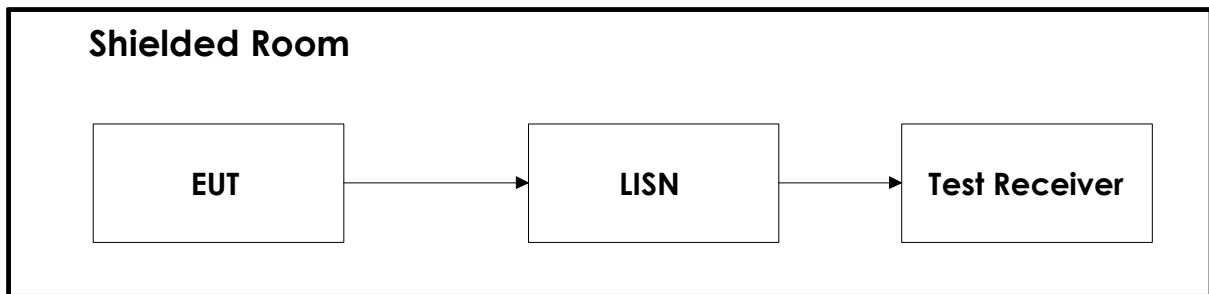
## 6 BLOCK DIAGRAM

### 6.1 System set up for radiated measurements



Test equipment: 2, 3, 6, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18,22

### 6.2 Power line Conducted Emission



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

### 6.3 Test Site Radiated Emission

