Test report no. : 215176-1

Item tested : CC1101-CC1190EM-915

Type of equipment : 902 - 928MHz Transceiver

FCC ID : ZAT110190EM915

Client : Texas Instruments Norway AS

FCC Part 15.247
Digital Transmission System

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

15 November 2013

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

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:	42

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)

Same as the client.

2 TEST INFORMATION

2.1 Test Item

Name :	Texas Instruments
FCC ID :	ZAT110190EM915
IC :	451H-110190EM915
Model/version :	CC1101-CC1190EM-915
Serial number :	-
Hardware identity and/or version:	-
Software identity and/or version :	-
Frequency Range :	903.5 – 926.5 MHz
Number of Channels :	-
Type of Modulation :	Digital (4-FSK)
Conducted Output Power:	20 mW (Peak)
User Frequency Adjustment :	None
Type of Power Supply :	$3.0V_{DC}$ (Two AA 1.5 V_{DC} batteries)
Antenna Connector :	SMA, Antenna type Pulse W5017
Antenna Diversity Supported :	No
Desktop Charger :	None

Description of Test Item

The CC1101-CC1190EM-915 is a RF-transceiver module with receiver and a range extender.

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	21.6 – 22.2 °C
Relative humidity:	41.7 – 42.7 %
Normal test voltage:	Nominal 3.0 V DC (2 x AA battery)

New batteries were used for all tests.

The values are the limit registered during the test period.

2.3 Test Period

Item received date:	2013-05-28
Test period :	from 2013-06-03

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 C63.4-2003. 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 #: 215176-1

TESTED BY: _____ DATE: 2013-08-28

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)(d) 15.109(a) 15.209(a)	A8.5	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: 03 June 2013**

Test Results: Complies

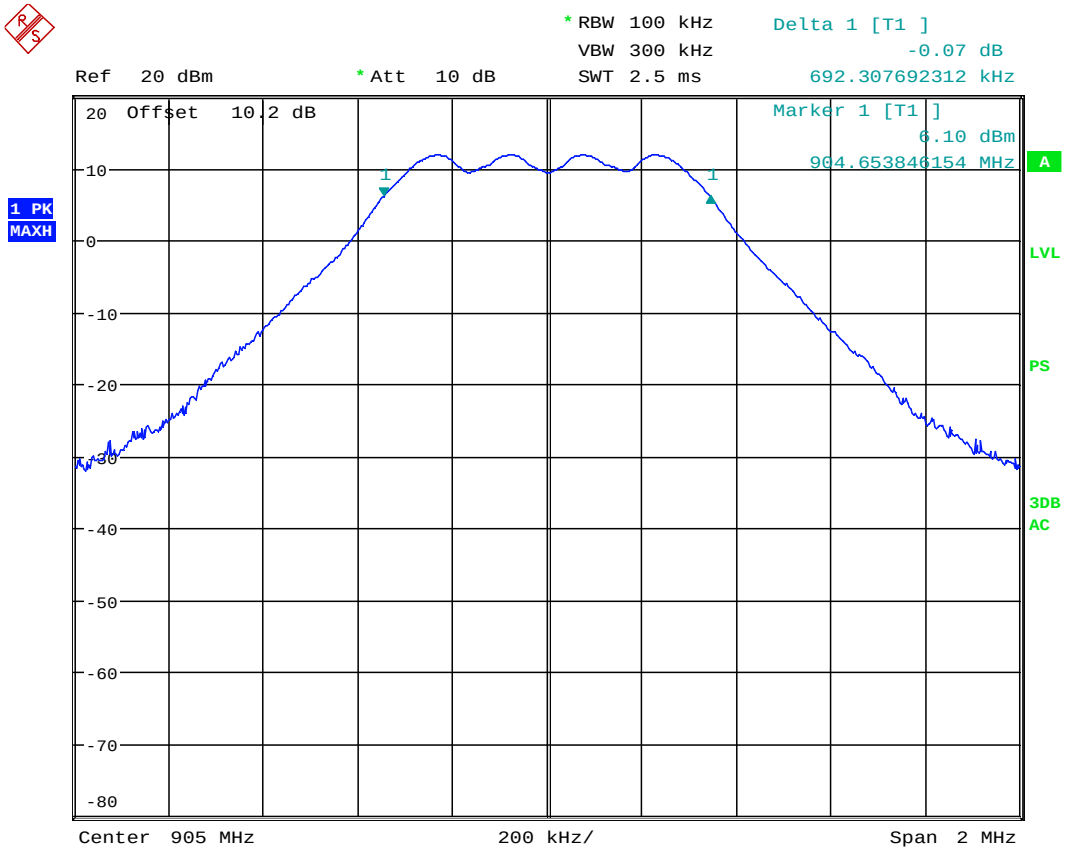
Measurement Data:

Measured 6 dB Bandwidth (kHz)		
905MHz	**915 MHz**	**925 MHz**
692.3	692.3	689.1

Tested to KDB 558074 D01 DTS Meas Guidance v03r01, Section 8.1.

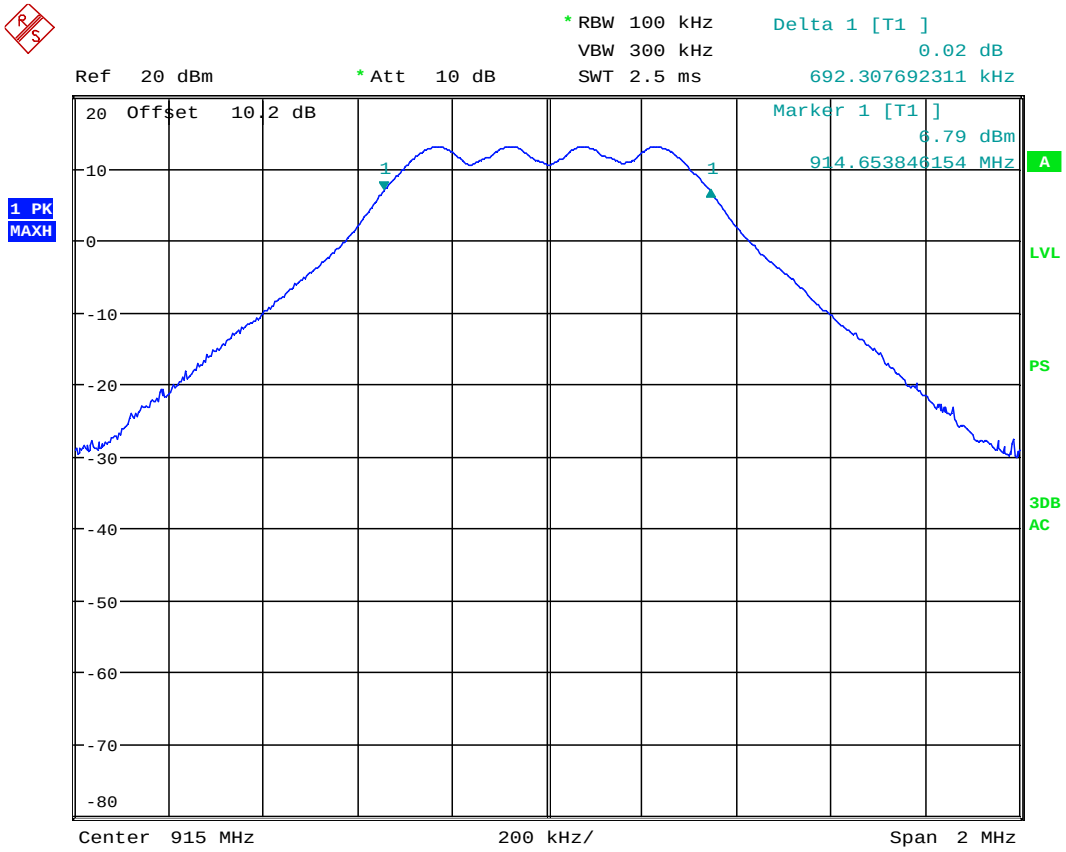
Requirements:

For Digital Transmission Systems in the 902 - 928 MHz band the minimum 6 dB bandwidth shall be at least 500 KHz.



Date: 3.JUN.2013 13:34:29

6 dB Bandwidth at 905 MHz



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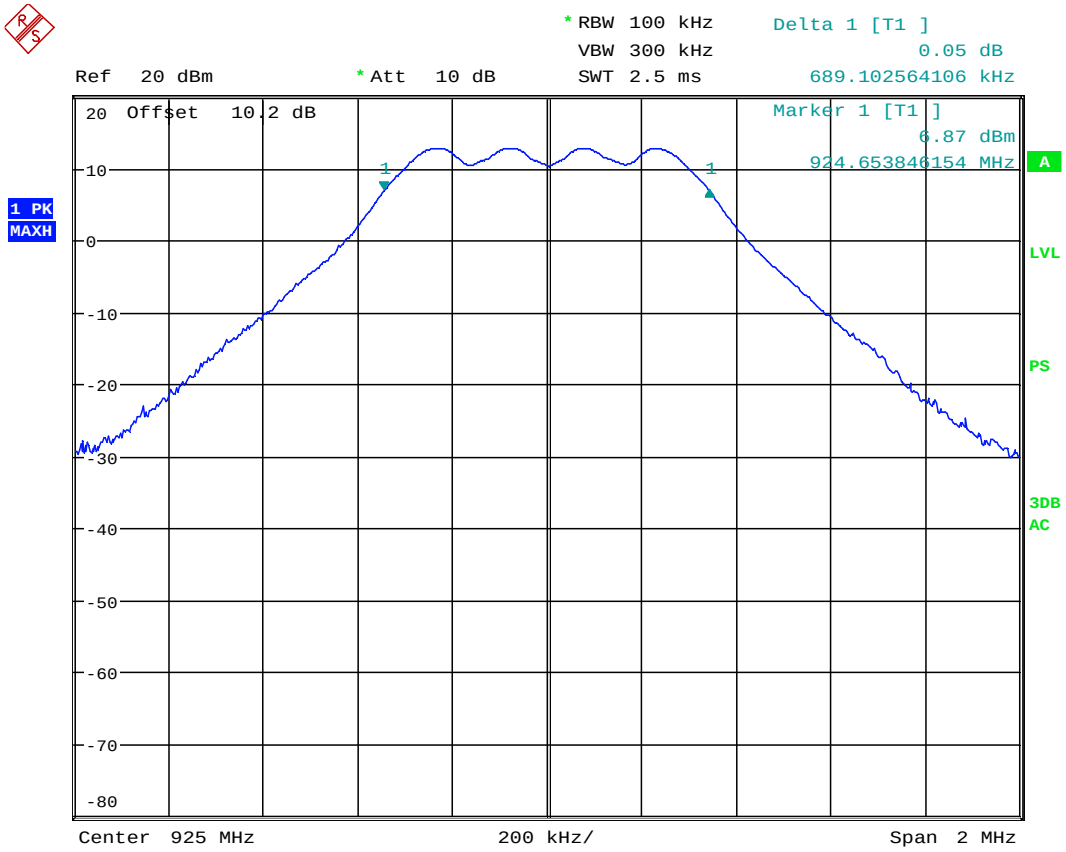
6 dB Bandwidth at 915 MHz



Date: 3.JUN.2013 13:32:41

6 dB Bandwidth at 925 MHz

4.2 20 dB Bandwidth

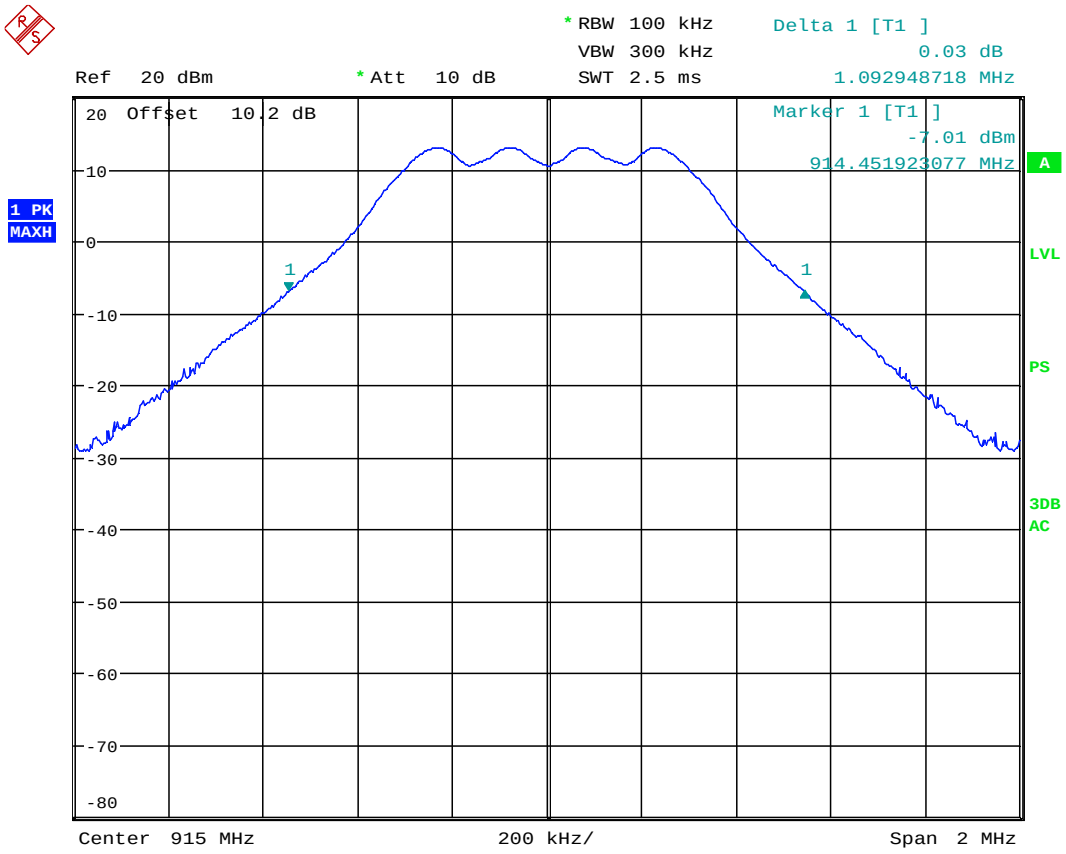
Test Performed By: G.Suhanthakumar	Date of Test: 03 June 2013

Measurement Data:

Measured 20 dB Bandwidth (MHz)
915 MHz
1.09

Requirements:

No requirements. Reported for information only.



Date: 3.JUN.2013 13:48:24

20 dB Bandwidth at 915 MHz

4.3 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: G.Suhanthakumar	**Date of Test: 03 June 2013**

Test Results: Complies

Measurement Data:

RF channel	**905 MHz**	**915 MHz**	**925 MHz**
Measured Maxium Field strength (dBµV/m) –VP	113.6	114.8	114.4
Radiated Power (ERP) (dBm)	16.2	17.4	17.0
Conducted Power (dBm)	11.9	13.0	12.9
Calculated Antenna Gain (dBi)	4.3	4.4	4.1

Tested to KDB 558074 D01 DTS Meas Guidance v03r01, Section 9.1.1.

EIRP is calculated according to KDB 412172 D01 Determining ERP and EIRP v01.

The maximum field strength is obtained in XY plane and Vertical polarization.

See attached graph.

Detachable antenna? ☒ Yes ☐ No

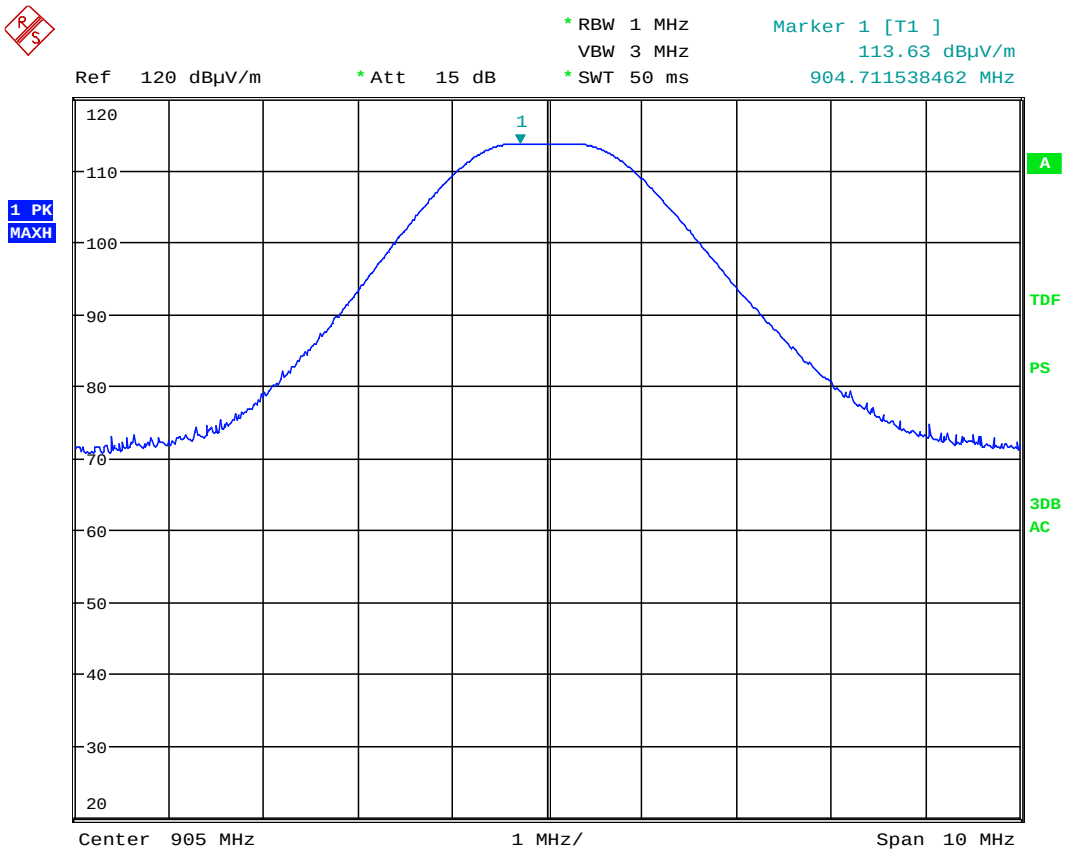
If detachable, is the antenna connector non-standard? ☐ Yes ☐ No

Requirements:

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

For Digital Transmission Systems in the 902 - 928 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.



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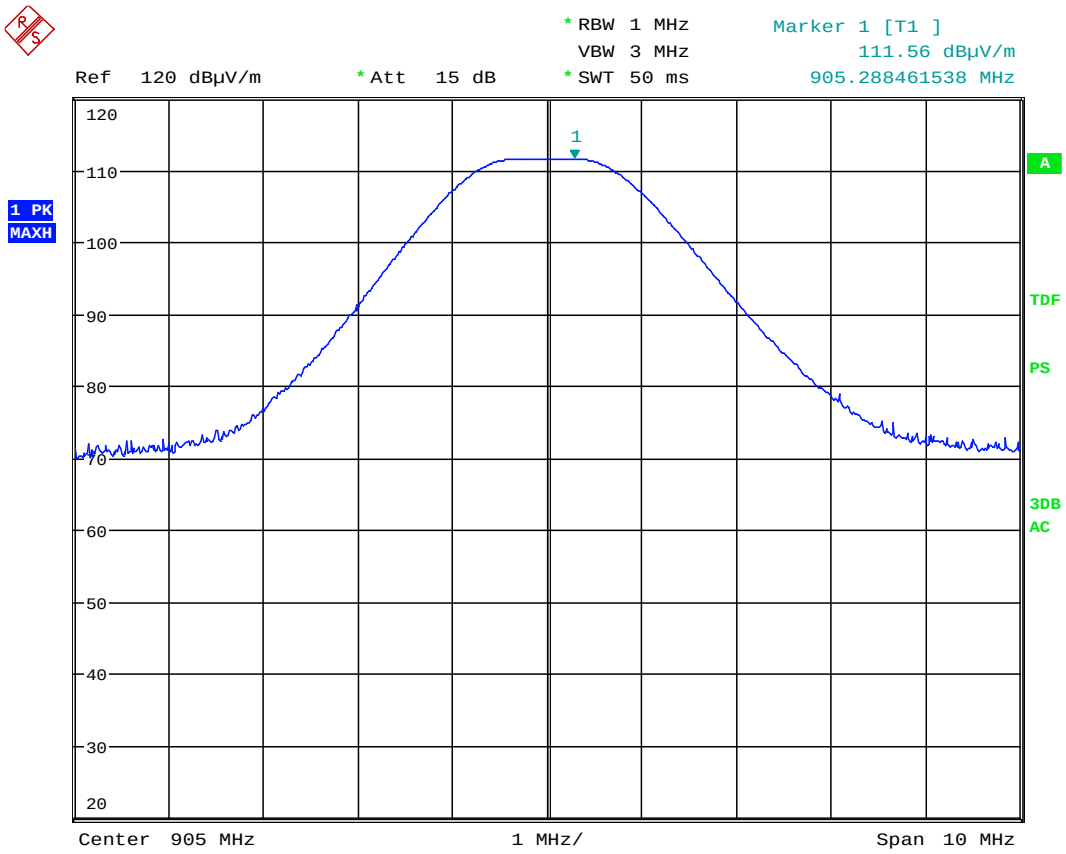
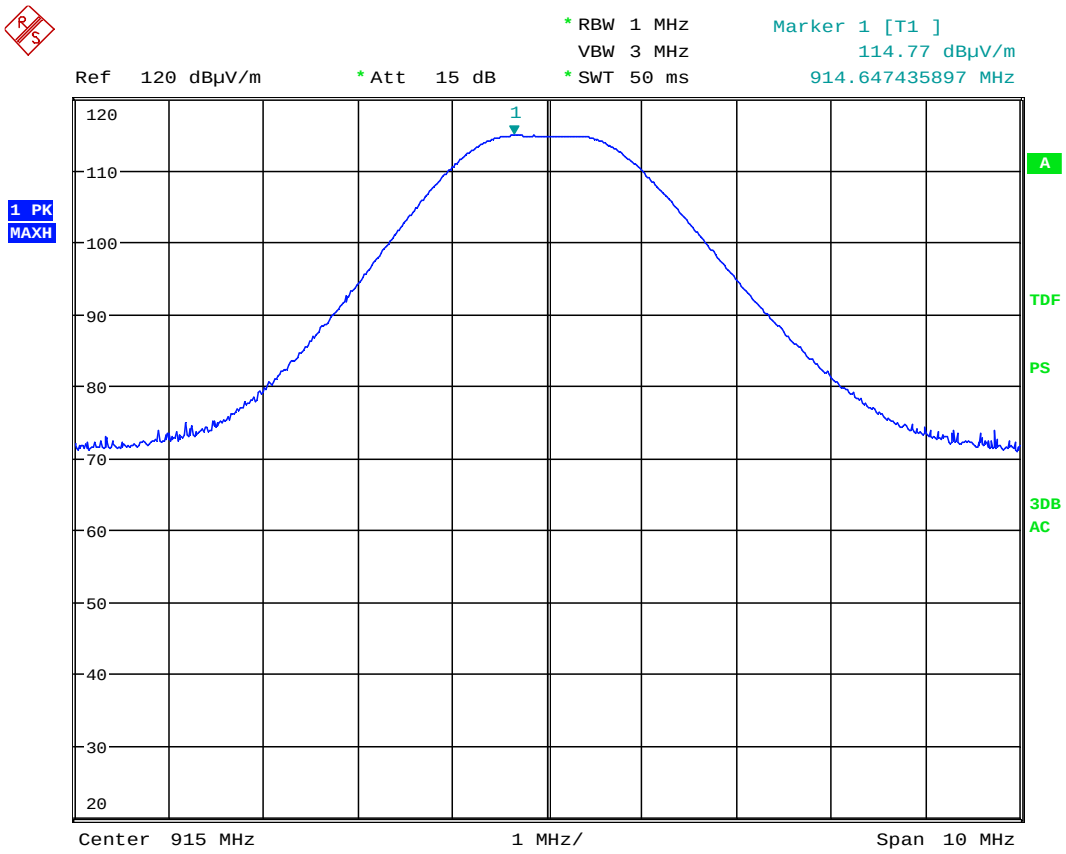
Radiated Field strength, VP , 905 MHz



Radiated field strength, HP, 905 MHz



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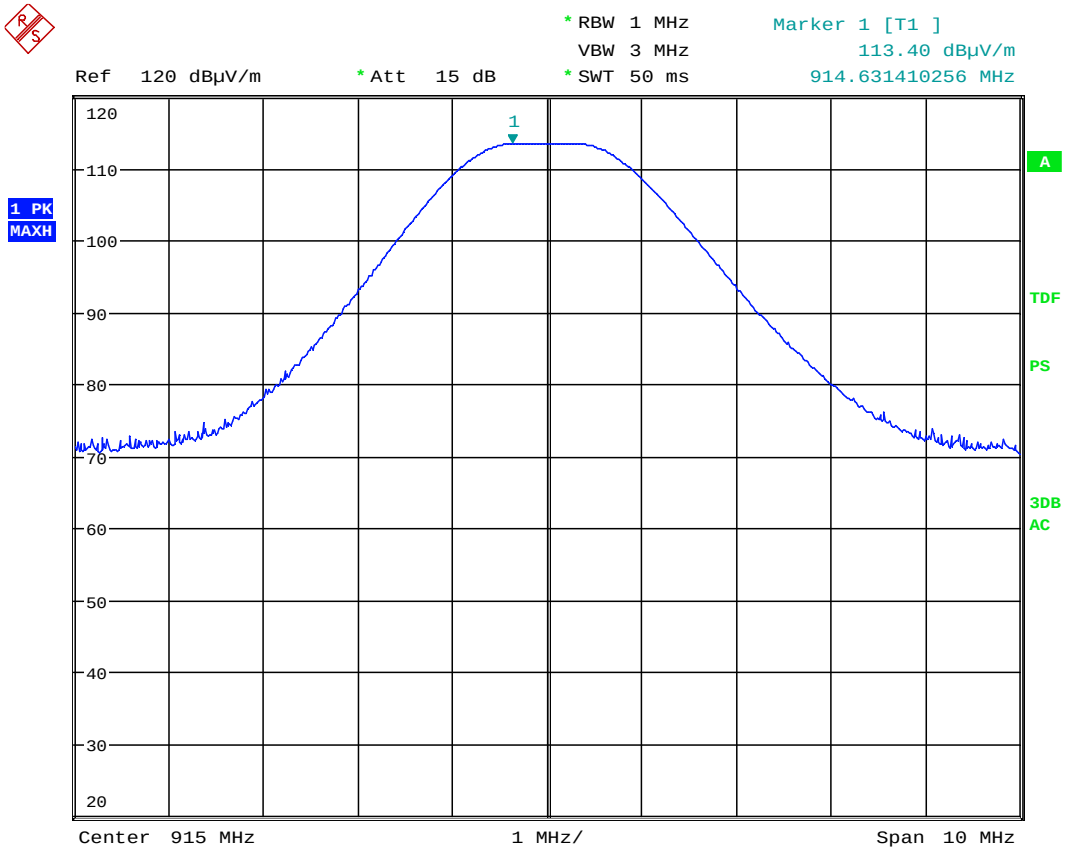
Radiated field strength, VP, 915 MHz



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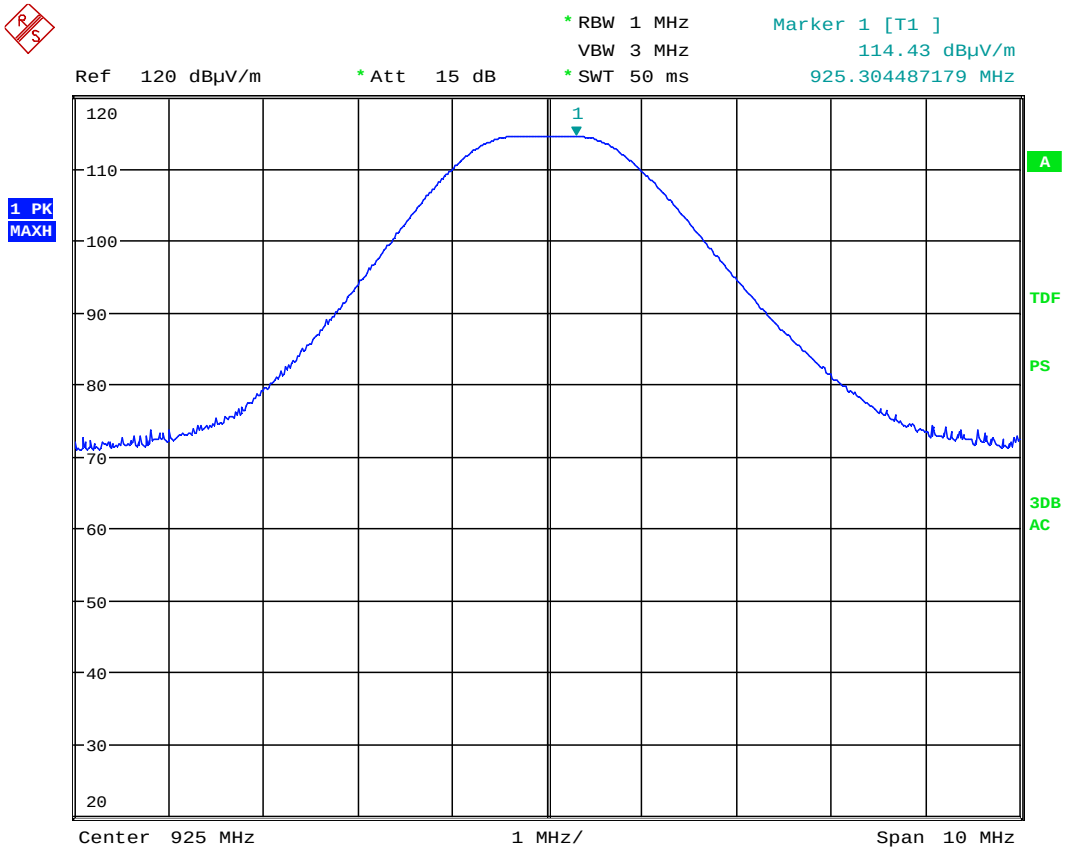
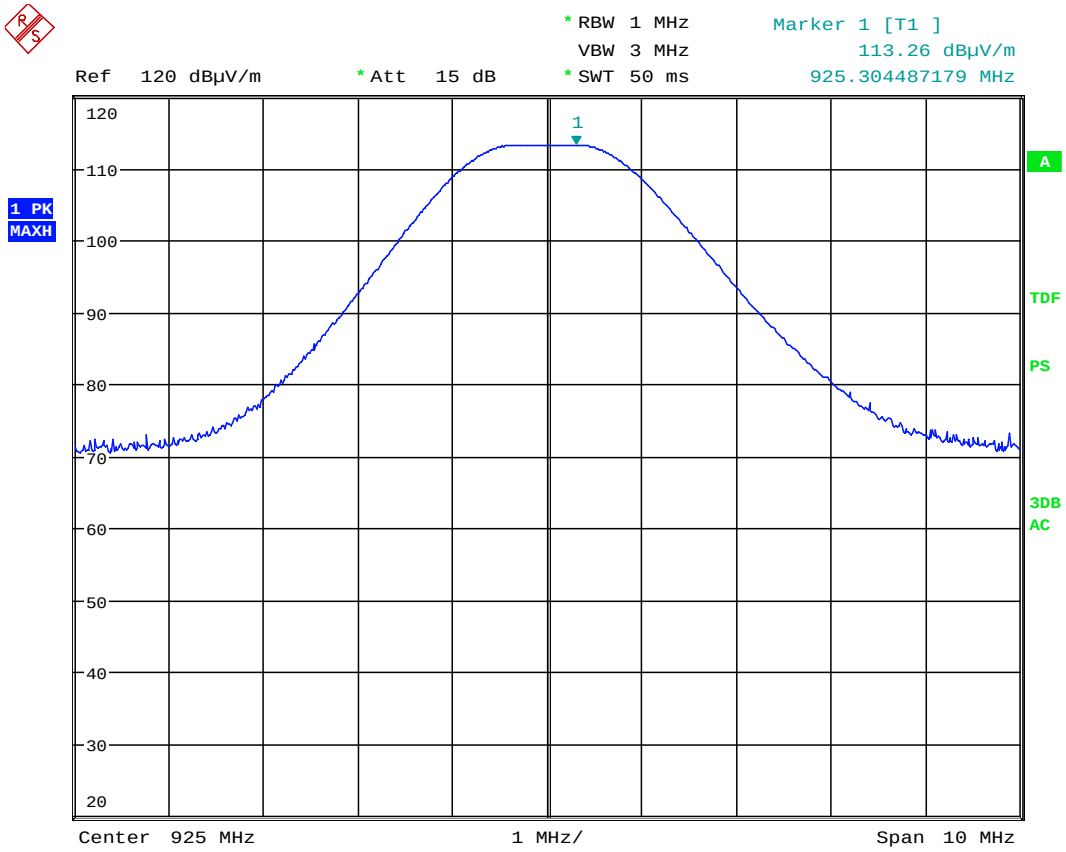
Radiated field strength, HP, 915 MHz



Date: 3.JUN.2013 12:18:48

Radiated field strength, VP, 925 MHz



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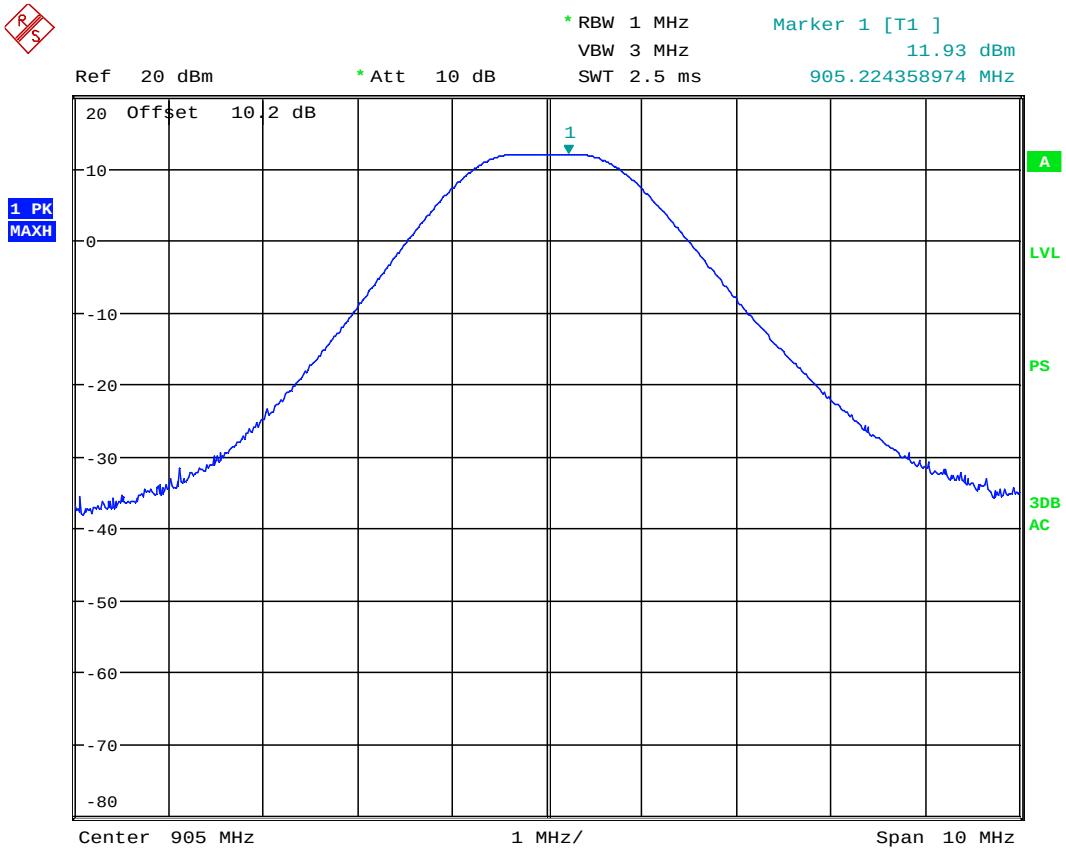
Radiated field strength, HP, 925 MHz



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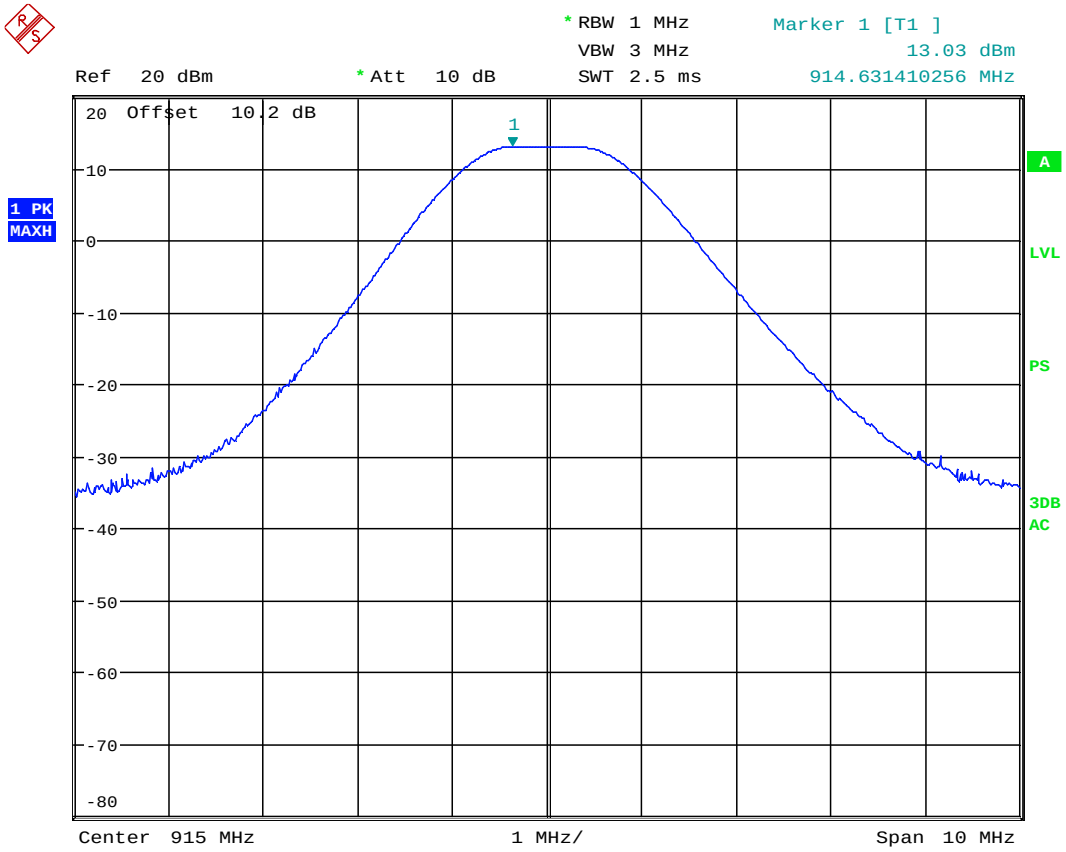
Conducted power – 905 MHz



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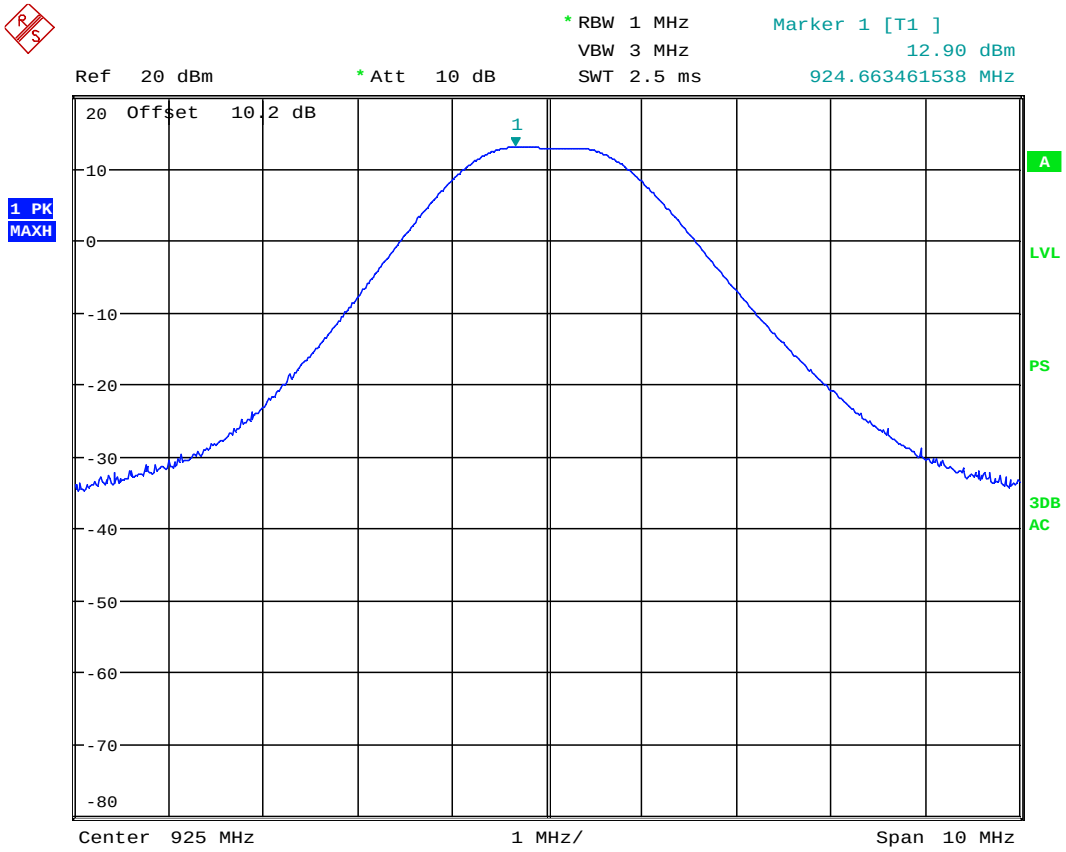
Conducted power – 915 MHz



Date: 3.JUN.2013 13:43:00

Conducted power – 925 MHz

4.4 Spurious Emissions

Para. No.: 15.247 (c)

Test Performed By: G.Suhanthakumar	**Date of Test: 03 June 2013**

Radiated emissions 9 kHz – 30 MHz

Detector: Quasi-Peak

Measuring distance: 10m

No emissions were detected.

Radiated emission 30 – 1000 MHz

Detector: Peak

Measuring distance: 3m

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

Radiated Emissions 1 – 10 GHz

Detector: Peak

Measuring Distance: 3m

No emissions were detected in any of the restricted bands.

RF conducted power

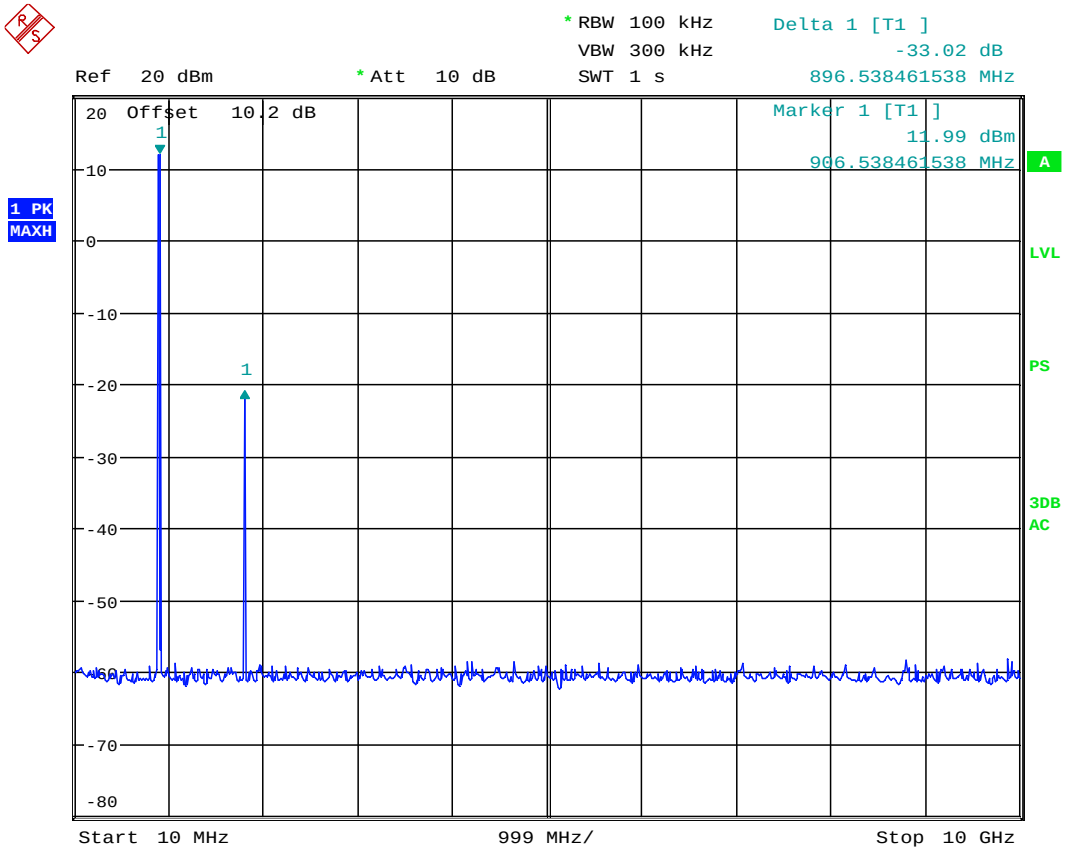
Scan performed radiated with 100 kHz Bandwidth from 0.01 to 25 GHz.

All emissions are more than 20dB below carrier.

Test Results: Complies

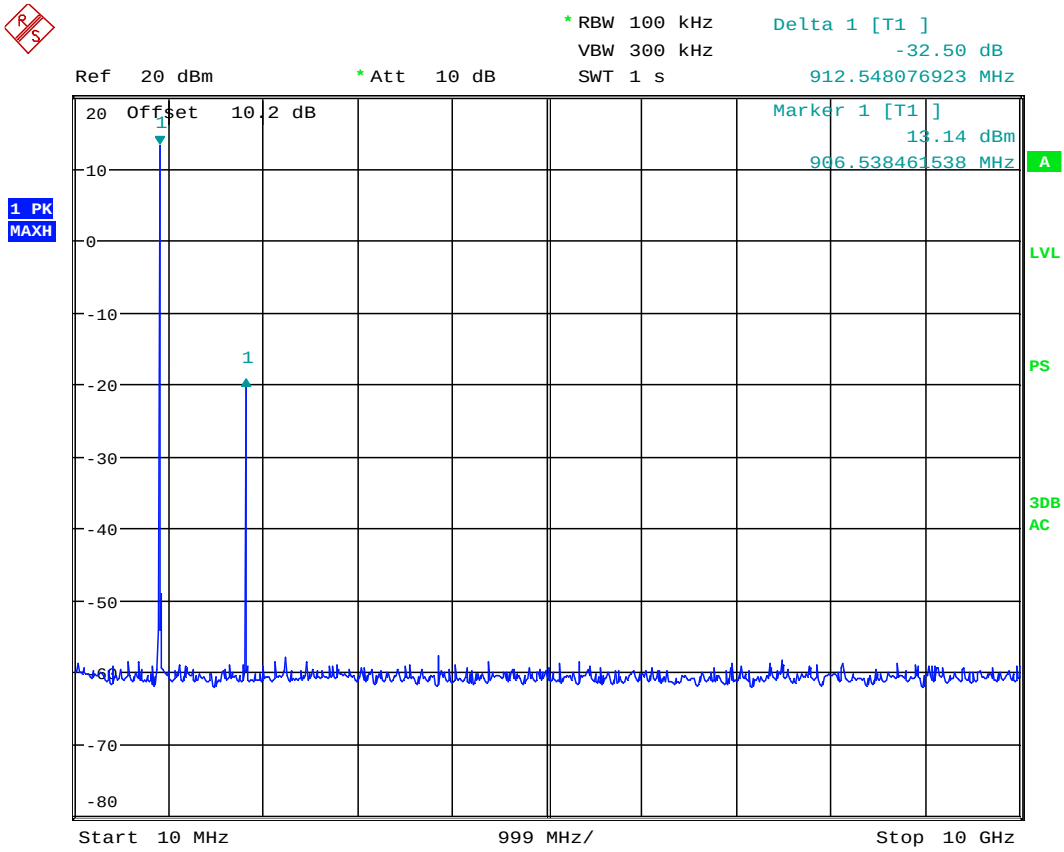
Measurement Data:

See attached plots.



Date: 3.JUN.2013 13:46:54

Conducted emissions 10 MHz – 10 GHz, 905 MHz



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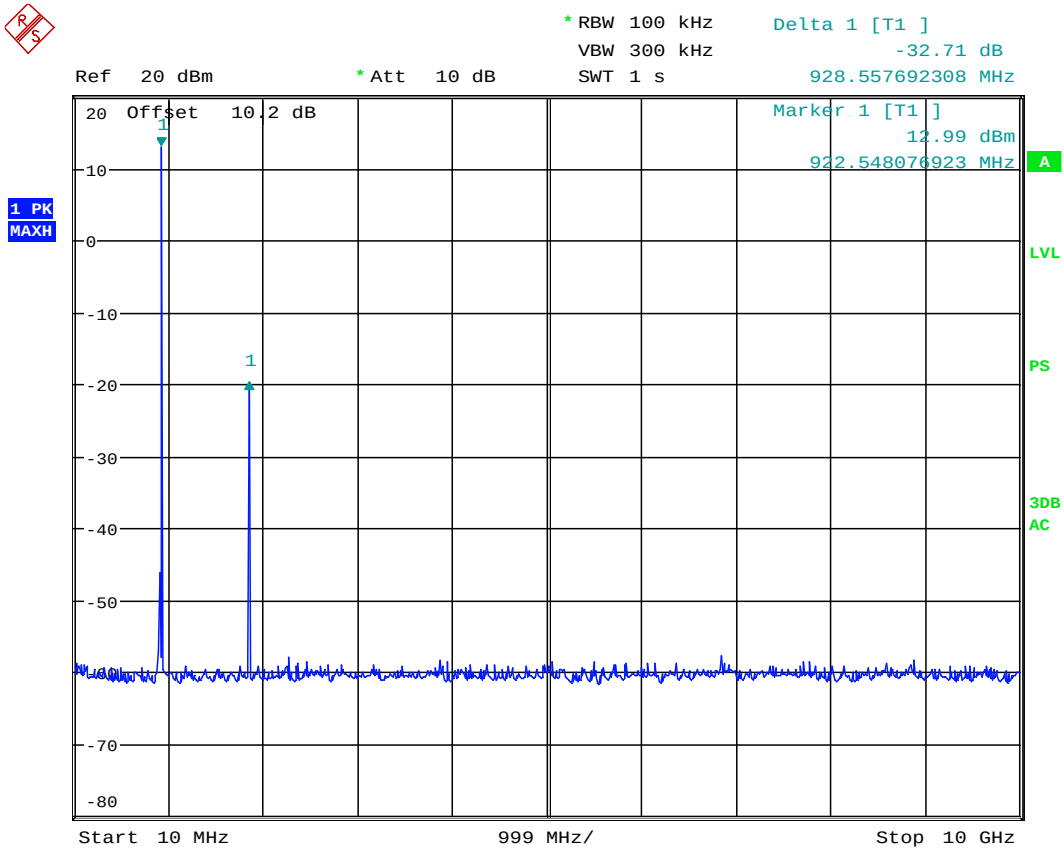
Conducted emission 10 MHz – 10 GHz, 915 MHz



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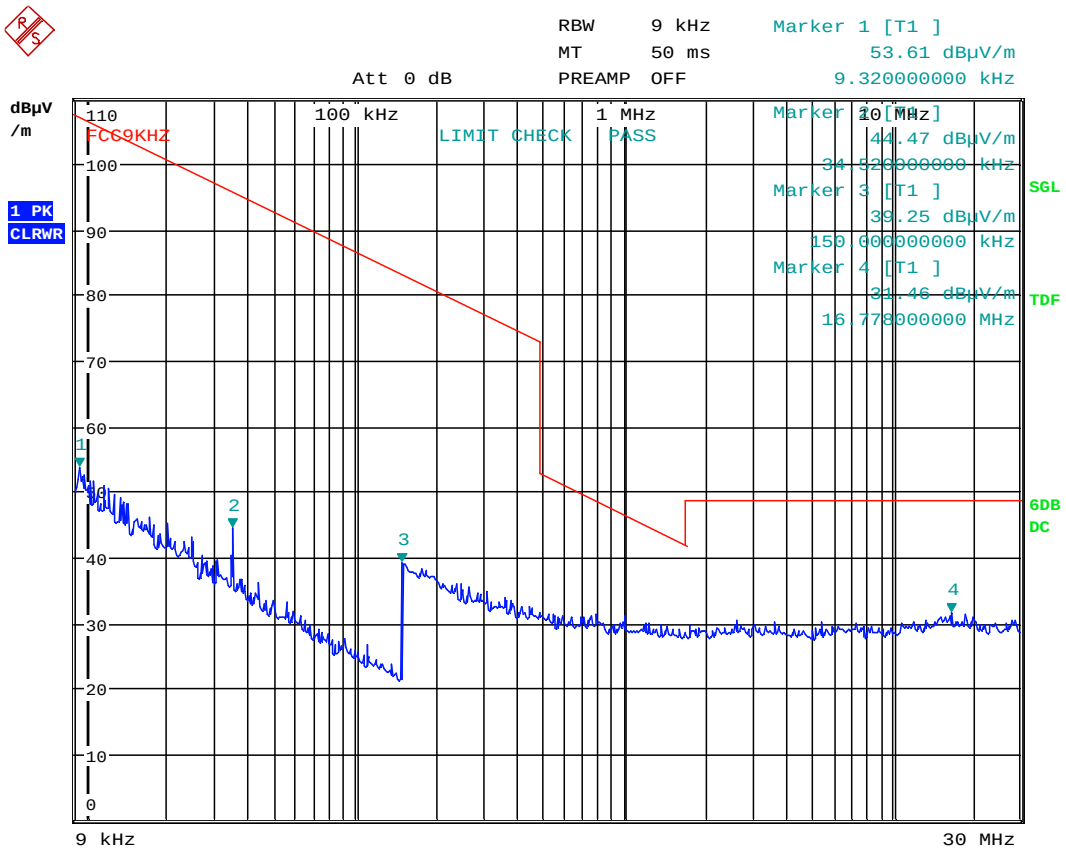
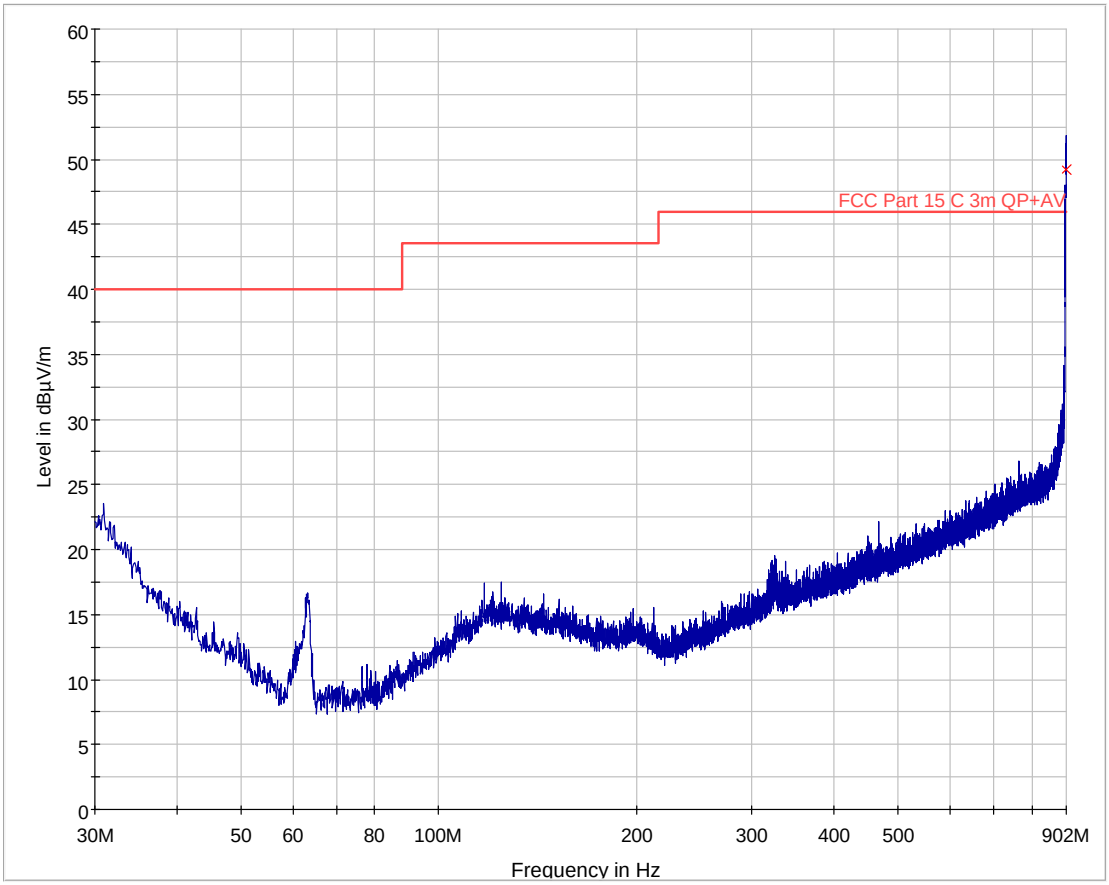
Conducted emission 10 MHz – 10 GHz, 925 MHz



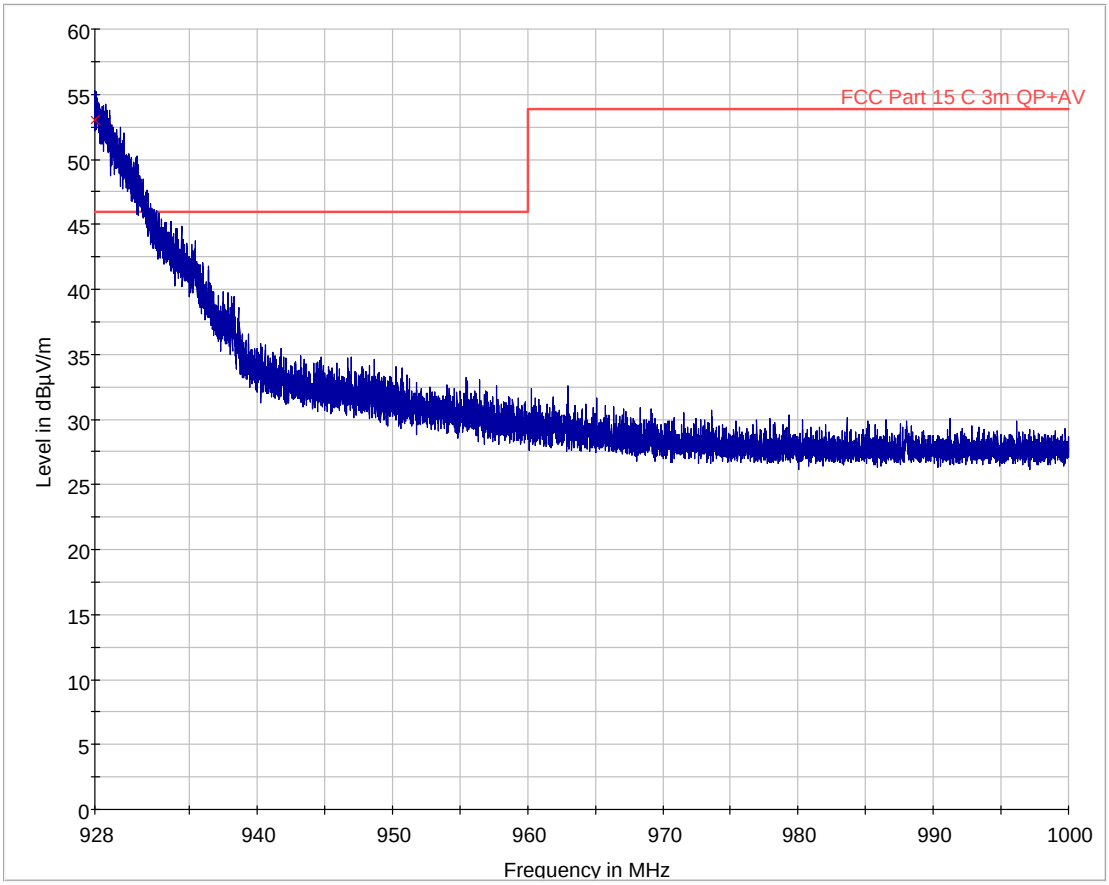
Date: 30.MAY.2013 09:44:12

Radiated Emissions, 9 kHz – 30 MHz @10m



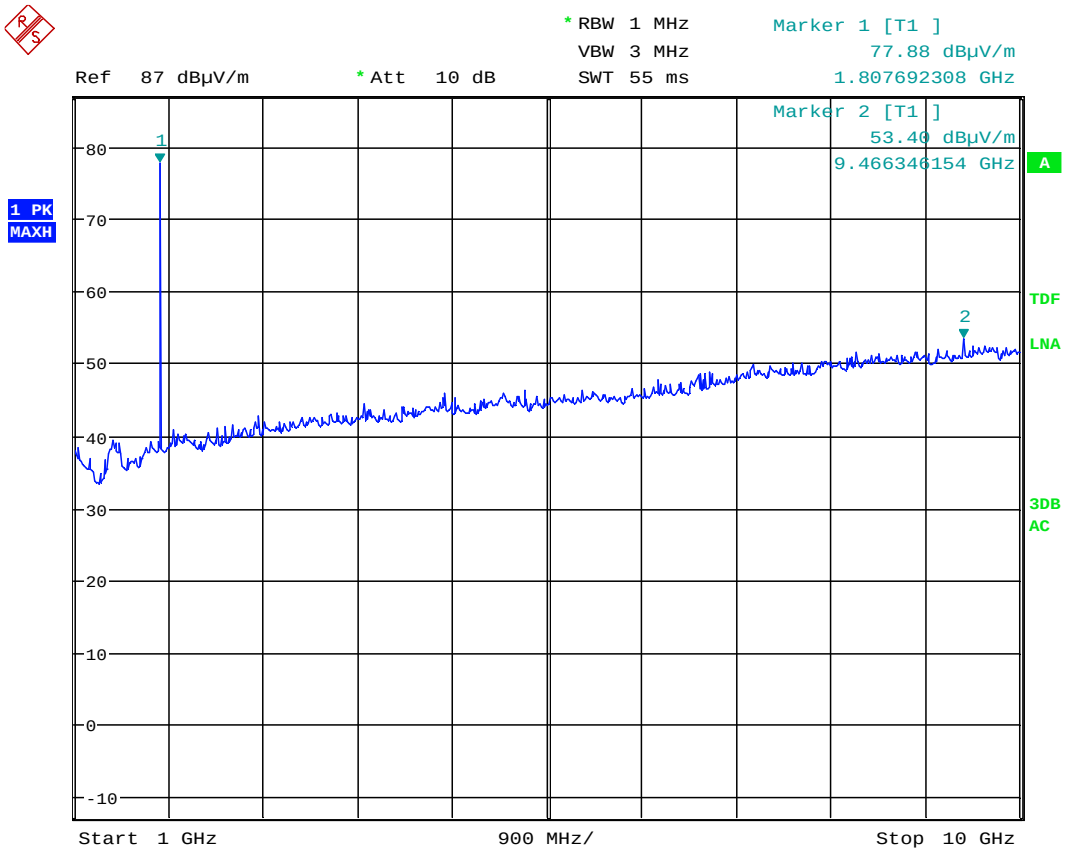
Radiated Emissions, 30 – 902 MHz, VP and HP, @3m

Frequency (MHz)	Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB) (below carrier)
902.00	49.2	1000.0	100.000	100.0	H	234.0	1.4	> 30



Radiated Emissions, 928 – 1000 MHz, VP and HP, @3m

Frequency (MHz)	Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB) (below carrier)
928.000000	53.0	1000.0	100.000	121.0	V	0.0	1.8	>30



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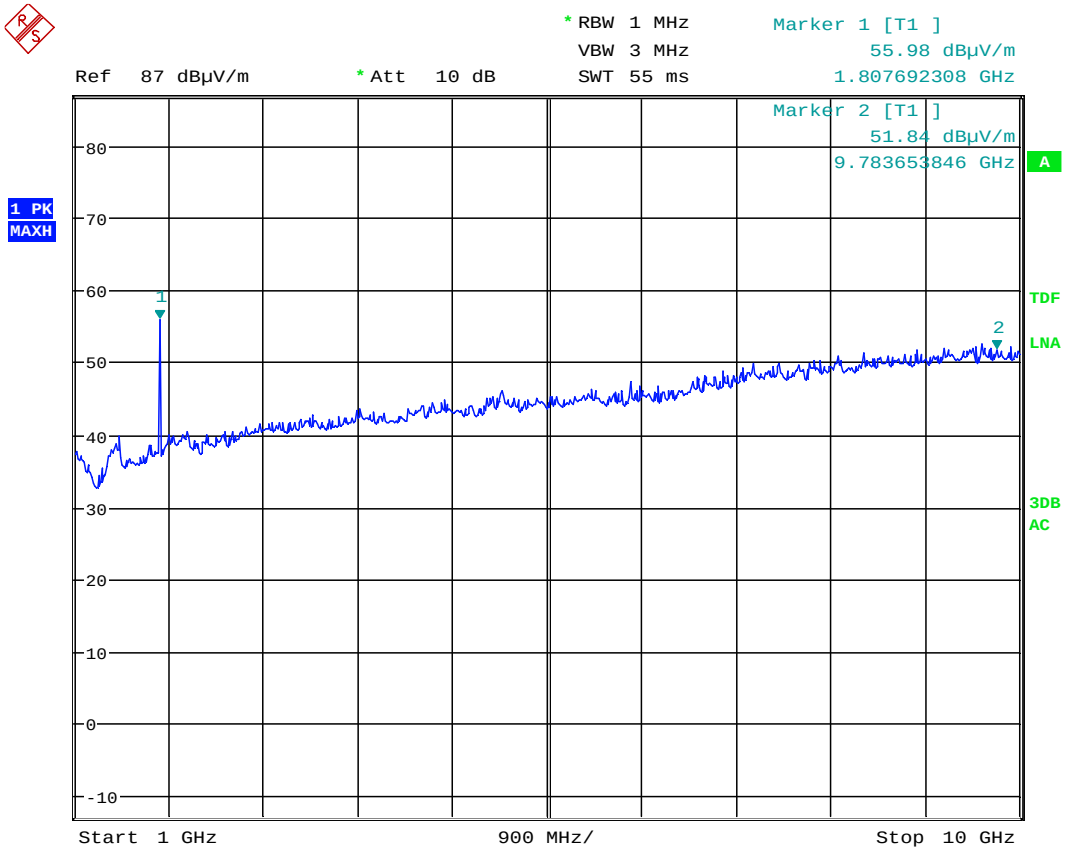
Radiated Emissions, 905 MHz, 1 – 10 GHz, VP,
@3m – Pre-scan with Peak detector, with HP filter



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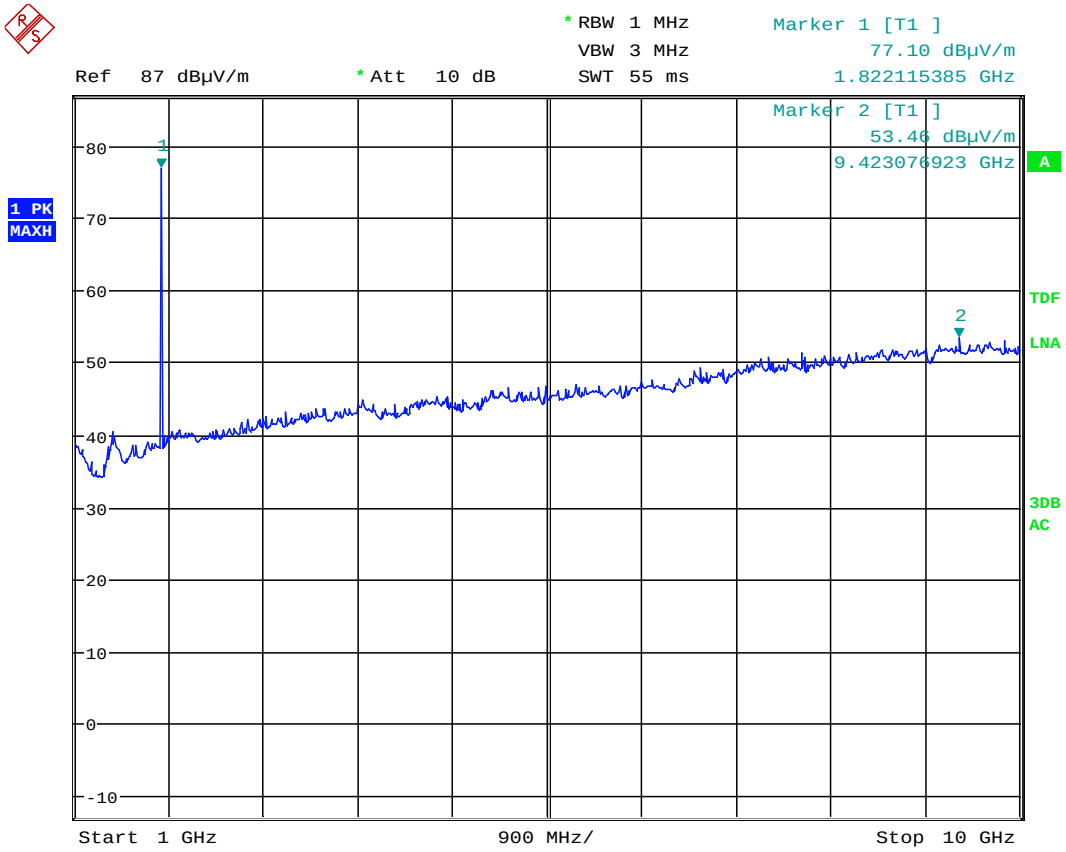
Radiated Emissions, 905 MHz, 1 – 10 GHz, HP,
@3m – Pre-scan with Peak detector, with HP filter



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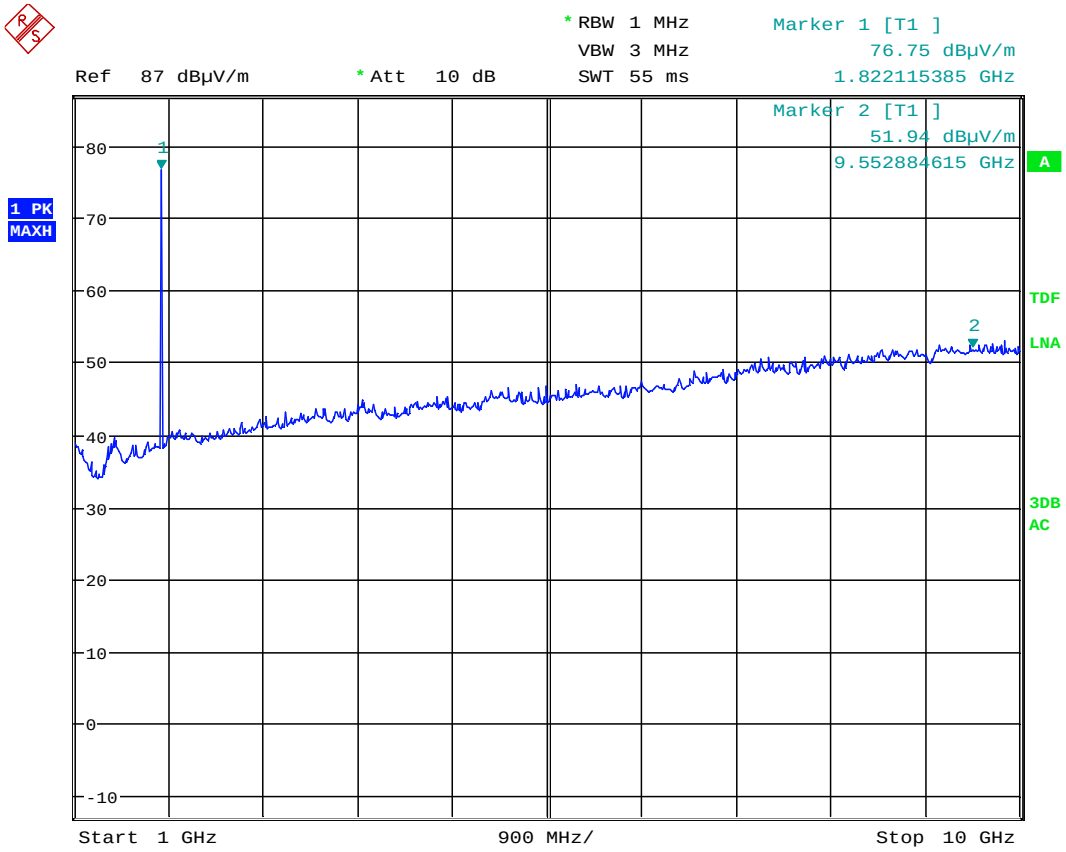
Radiated Emissions, 915 MHz, 1 – 10 GHz, VP,
@3m – Pre-scan with Peak detector, with HP filter



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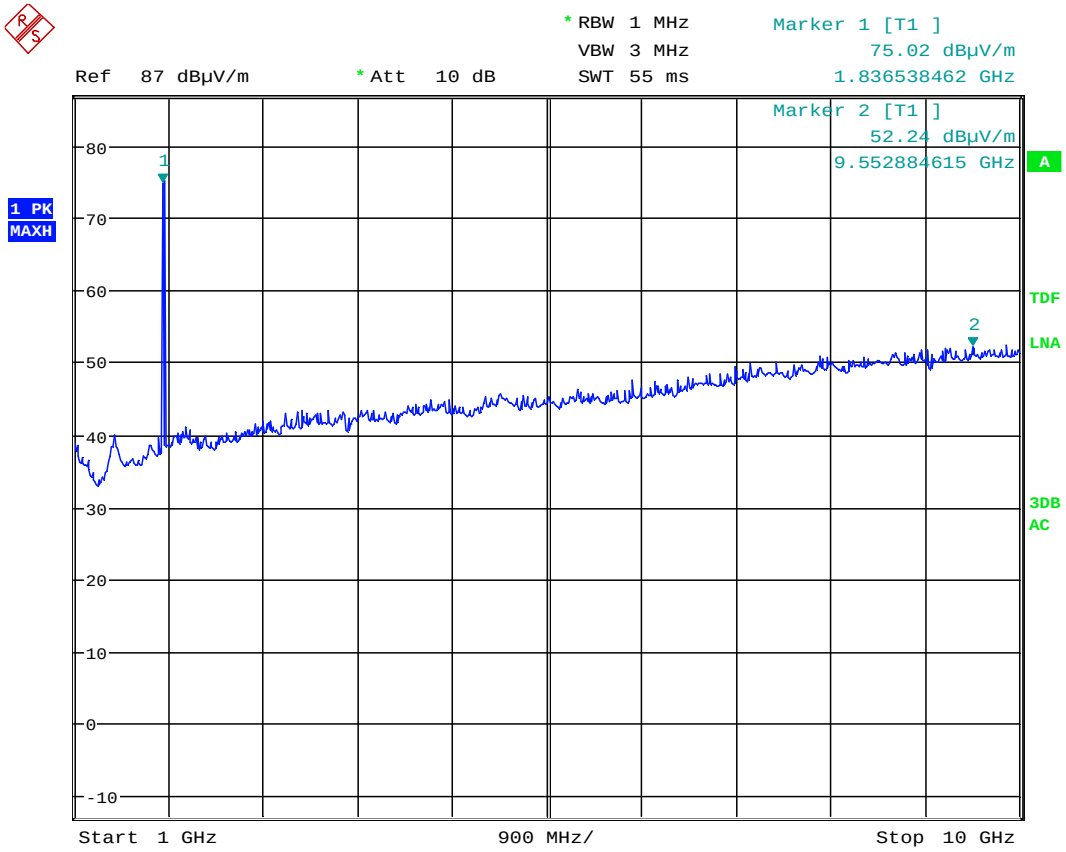
Radiated Emissions, 915 MHz, 1 – 10 GHz, HP,
@3m – Pre-scan with Peak detector, with HP filter



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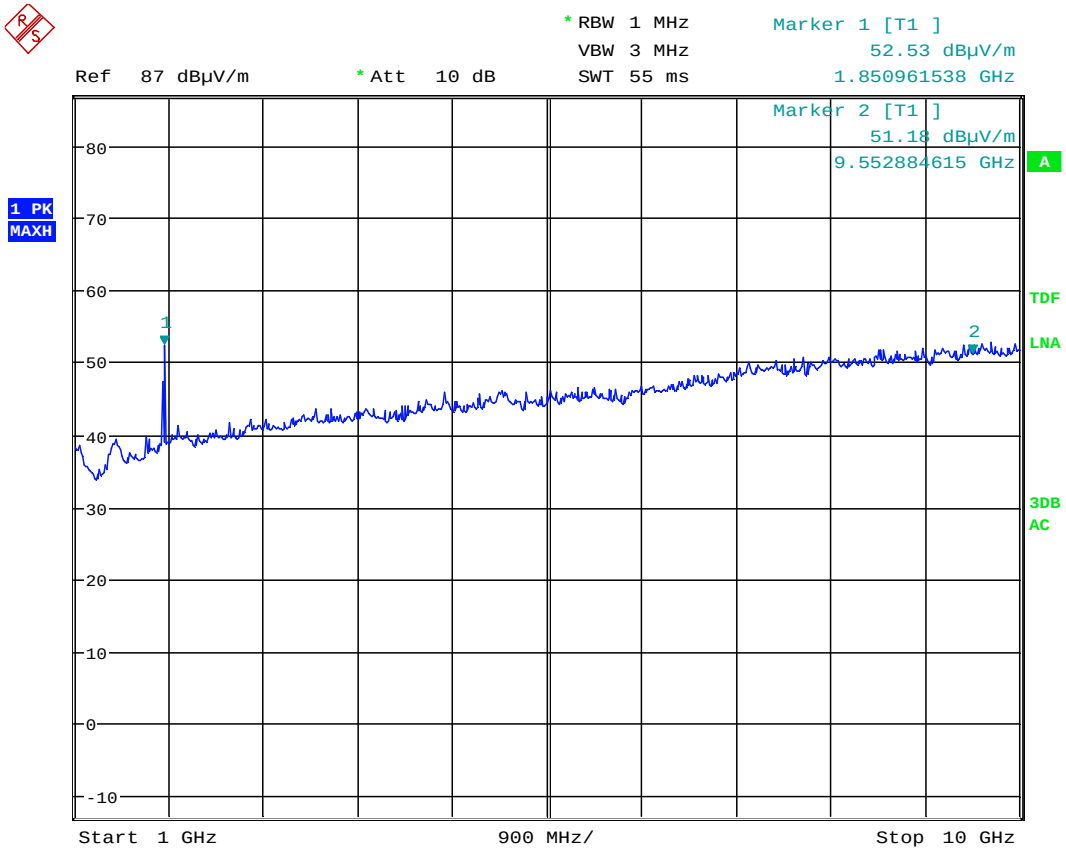
Radiated Emissions, 925 MHz, 1 – 10 GHz, VP,
@3m – Pre-scan with Peak detector, with HP filter



Date: 3.JUN.2013 13:18:15

Radiated Emissions, 925 MHz, 1 – 10 GHz, HP,
@3m – Pre-scan with Peak detector, with HP filter

4.5 Power Spectral Density (PSD)

Para. No.: 15.247 (e)

Test Performed By: G.Suhanthakumar	**Date of Test: 03 June 2013**

Test Results: Complies

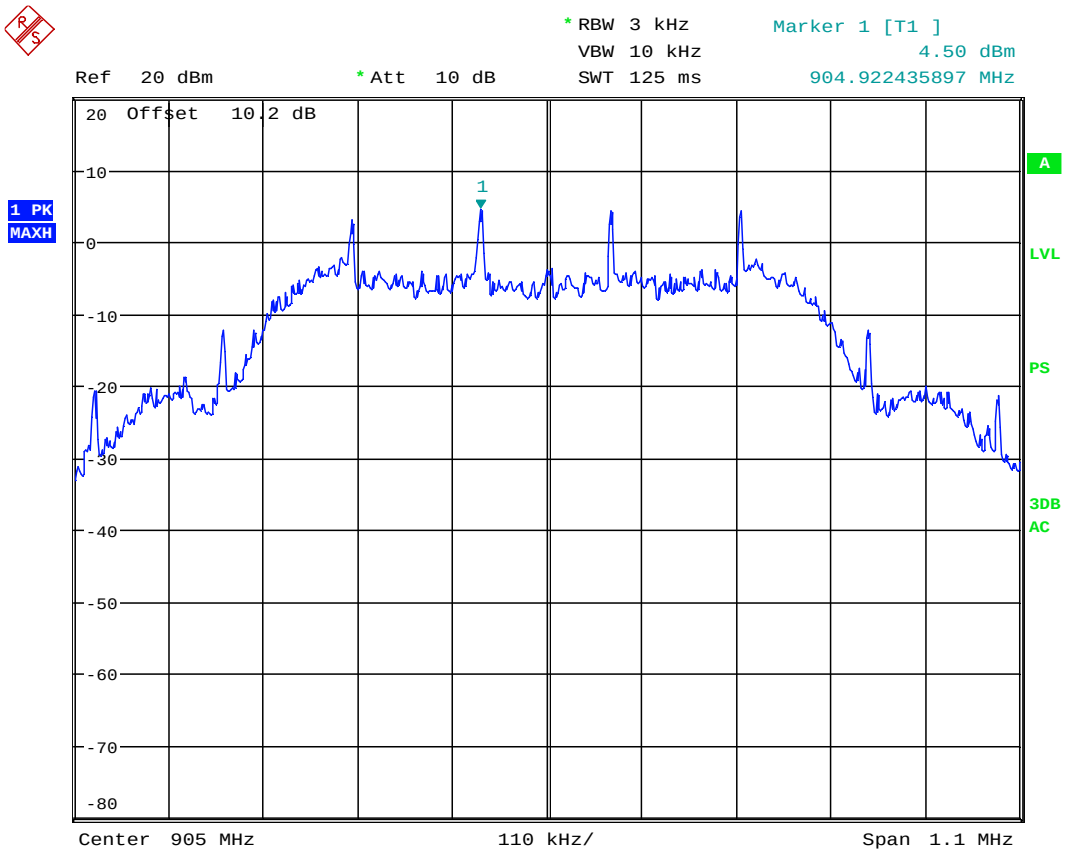
Measured and Calculated Data:

	calculated peak PSD dBm
Power Spectral Density @905 MHz	4.5
Power Spectral Density @915 MHz	5.4
Power Spectral Density @925 MHz	5.4

Tested to KDB 558074 D01 DTS Meas Guidance v03r01, Section 10.2.

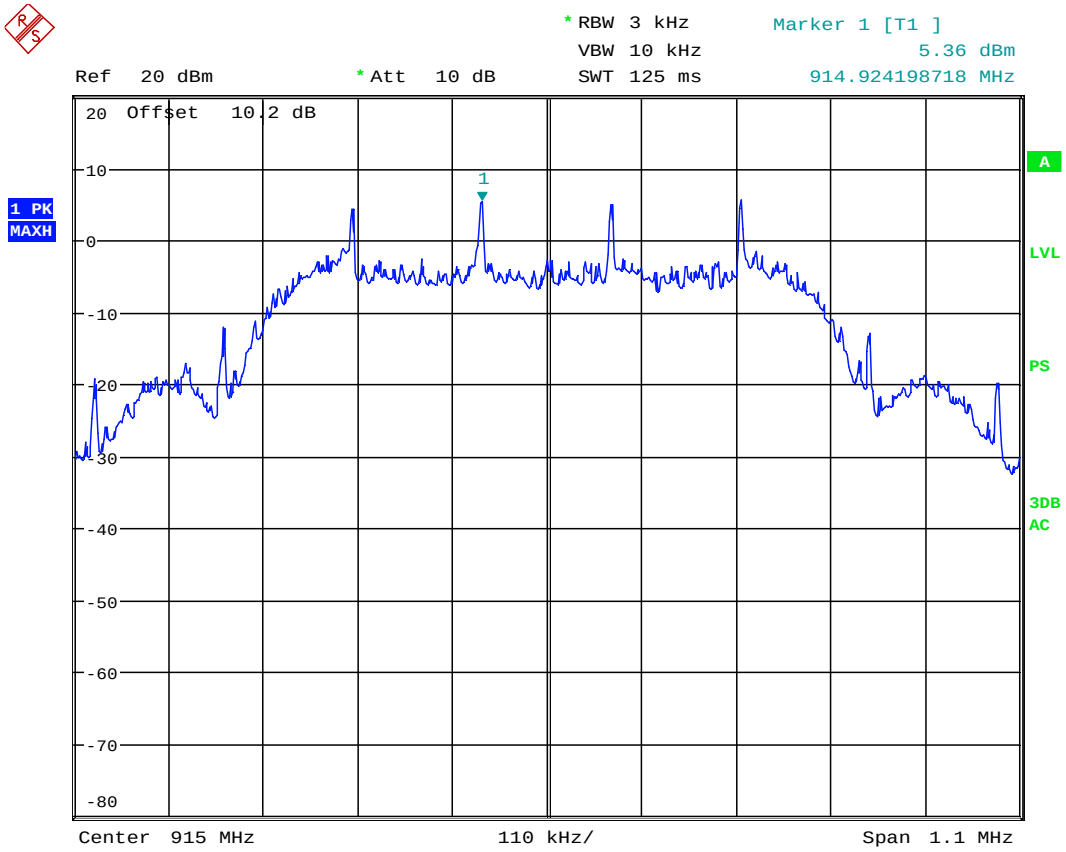
Requirements:

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



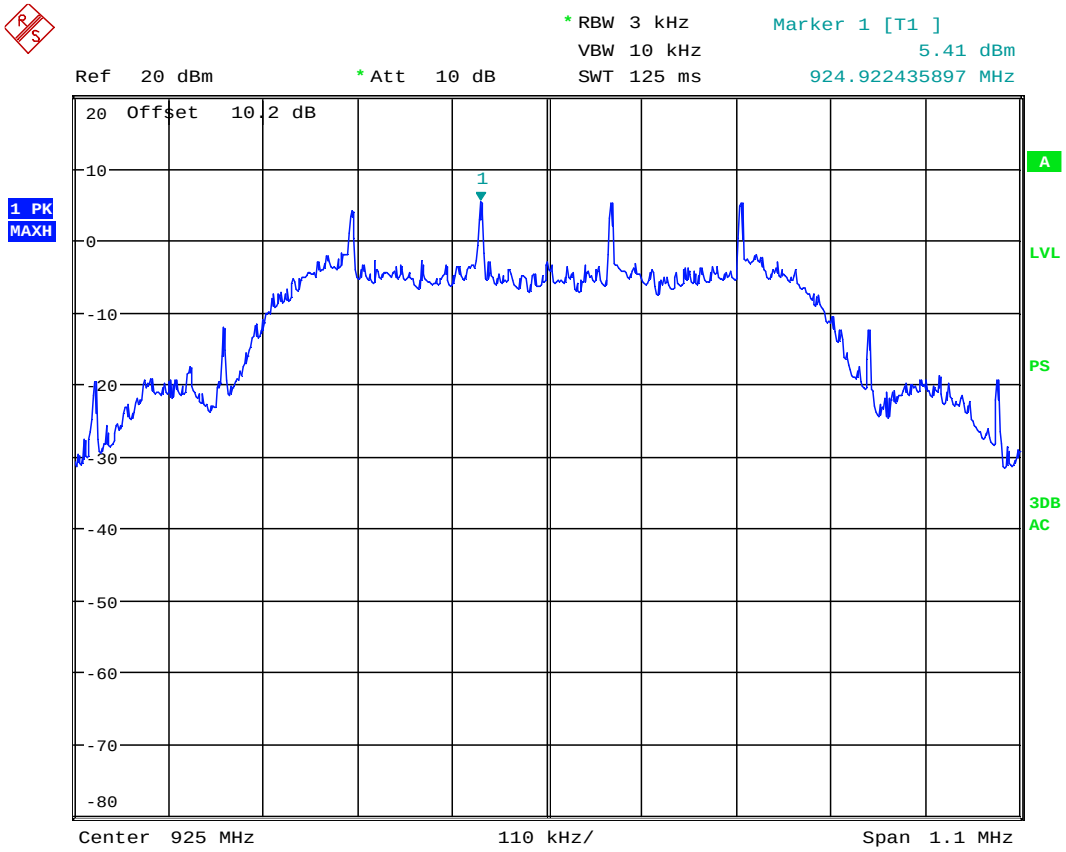
Date: 3.JUN.2013 13:38:01

PSD Measurement - 905MHz



Date: 3.JUN.2013 13:45:09

PSD Measurement – 915MHz



Date: 3.JUN.2013 13:44:22

PSD Measurement - 925MHz

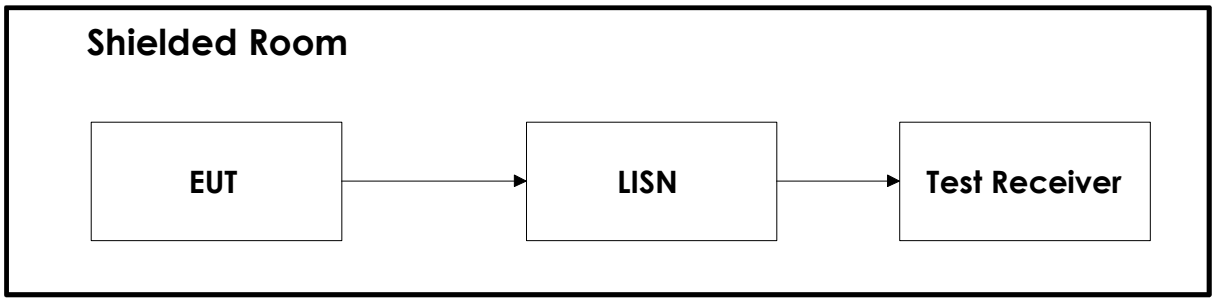
5 LIST OF TEST EQUIPMENT

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	FSP30	Spectrum Analyzer	Rohde & Schwarz	LR 1551	2012.04.05	2013.04.05
2	ESU40	EMI Receiver	Rohde & Schwarz	LR1639	2010.06	2013.06
3	3115	Antenna horn	EMCO	LR 1330	2010.08.05	2013.08.05
4	643	Antenna horn	Narda	LR 093	2009.01.26	2014.01.26
5	642	Antenna horn	Narda	LR 220	2009.01.26	2014.01.26
6	PM7320X	Antenna horn	Siverts lab	LR 103	2009.01.26	2014.01.26
7	DBF-520-20	Antenna horn	Systron Donner	LR 101	2009.01.26	2014.01.26
8	638	Antenna horn	Narda	LR 098	2010.06.17	2015.06.17
9	VULB 9163	Antenna TriLog	Schwarzbeck	LR1616	2012-08	2013-08
10	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2012-09-27	2013-09-27
11	LNA6900	Pre-amplifier	Teseq	LR 1593	2012-11	2013-11
14	80S	Signal Generator	Powertron	LT 502	Cal b4 use	
15	Model 87 V	Multimeter	Fluke	LR 1598	2012-12-14	2014-12-14
17	6810.17A	10 attenuator	Suhner	LR 1143	2012.09.15	2014.09.15
18	FA210A1010003030	Microwave cable	Rosenberger	LR1566	Cal b4 use	
19	6HC 3000-18000	HP Filter	Trithlic	LR1614	Cal b4 use	
20	6HC 2500-18000	HP Filter	Trithlic	LR1615	Cal b4 use	
21	FSW	Spectrum Analyzer	Rohde & Schwarz	LR1640	2012.06	2014.06

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission