



Test report no. : 219868-1

Item tested : ATW-T1002

Type of equipment : 2.4GHz Wireless Microphone

FCC ID : JFZT1002

Client : Audio Technica U.S., Inc.

FCC Part 15.247

Digital Transmission System

RSS-210, Issue 8

Low Power Licence-Exempt
Radiocommunication Devices

03 October 2012

Authorized by : 

G.Suhanthakumar
Technical Verificator

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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: 41

1.2 Client Information

Name : Audio Technica U.S., Inc
Address : 1221 Commerce Drive, Stow, Ohio 44224, U.S.A.

Contact:

Name : Lynn Van Lowe
E-mail : lvanlowe@atus.com
Phone : 330-686-2600

1.3 Manufacturer

Name : Audio Technica Corporation
Address : 2206 Naruse, Machida, Tokyo 194-8666, Japan

2 Test Information

2.1 Test Item

Name :	Audio Technica
FCC ID :	JFZT1002
Industry Canada ID :	1752B-T1002
Model/version :	ATW-T1002
Serial number :	Radiated sample: 007
Hardware identity and/or version:	V3
Software identity and/or version :	/
Frequency Range :	2403 – 2481 MHz
Number of Channels :	40
Type of Modulation :	Digital (GFSK)
User Frequency Adjustment :	None
Conducted Output Power :	0.025 Watt
Type of Power Supply :	Primary or Secondary Batteries (2xAA cells)
Antenna Connector :	None
Number of Antennas :	2
Antenna Diversity Supported :	Yes
Desktop Charger :	N/A

Description of Test Item

The EUT is a digital wireless microphone.

Theory of Operation

The EUT is a digital wireless microphone. The system uses digital modulation and automatically selects the least disturbed of the available channels.

Exposure Evaluation

The EUT is a portable device and is designed to be handheld when used. The EUT is exempted from routine SAR evaluation according to §2.1093(c).

Measured Source Base Time Averaged Output Power:	8.32 mW (Conducted)
Measured Antenna Gain:	4.1 dBi
Calculated Source Based Time Averaged Output Power:	21.3 mW (Radiated)

See measurement results in clause 4.4.

Test Environment

2.1.1 Normal test condition

Temperature:	20.5 - 21.8 °C
Relative humidity:	38 - 48 %
Normal test voltage:	3.0 V DC (2xAA Batteries)

All radiated tests were performed with fresh batteries. Conducted tests were performed with a regulated power supply at 3.0V DC.

The values are the limit registered during the test period.

2.2 Test Period

Item received date: 2012-09-13

Test period : from 2012-09-13 to 2012-09-20

2.3 Test Engineer(s)

Frode Sveinsen

2.4 Test Equipment

See list of test equipment in clause 6.

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Audio Technica
Model No.: ATW-T1002

All measurements are traceable 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.

All tests were conducted in accordance with ANSI C63.4-2003 and KDB 558074 D01 DTS Measurement Guidance v01.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

A description of the test facility is on file with the FCC and Industry Canada.

- | | |
|---|---|
| <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 |
| DTS Equipment Code | <input type="checkbox"/> 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 #: 219868-1

TESTED BY: Frode Svein
Frode Sveinsen, Chief engineer

DATE: 27 September 2012

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3.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 8 reference	Result
Supply Voltage Variations	15.31(e)	8 (RSS-GEN)	N/A ¹
Antenna Requirement	15.203	7.1.4 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2.2 (RSS-GEN)	N/A ¹
Occupied Bandwidth	N/A	A8.1	No requirement
Minimum 6 dB Bandwidth	15.247(a)(2)	A8.2	Complies
Peak Power Output	15.247(b)	A8.4	Complies
Power Spectral Density	15.247(d)	A8.2	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	A8.5	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	A8.5	Complies

¹ The tested equipment is battery operated only.

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

The EUT was rotated in 3 planes for the radiated emissions and radiated output power tests.

3.5 Family List Rational

Not Applicable.

4 TEST RESULTS

4.1 Occupied Bandwidth

Para. No.: 15.247 (a)(1)(iii)

Test Performed By: Frode Sveinsen	Date of Test: 14 Sept 2012
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Test Results: **Complies**

Measurement Data: 40 RF channels in use

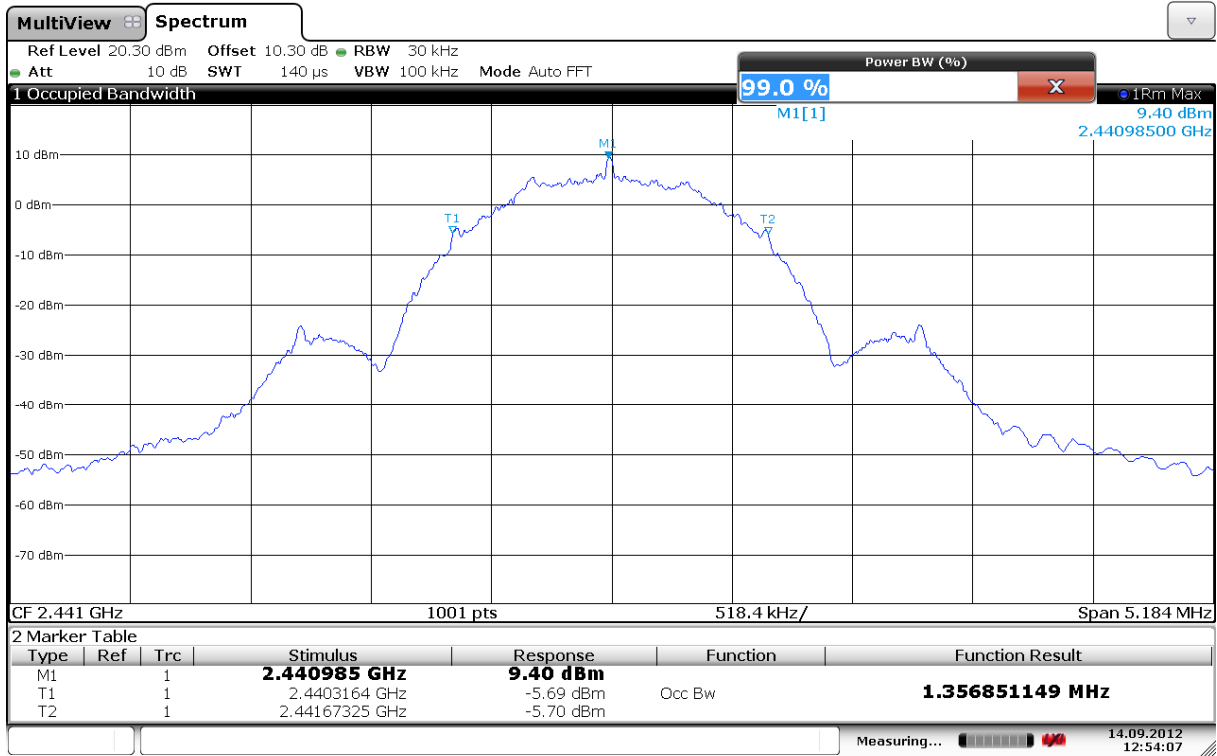
	Occupied Bandwidth (kHz)
2441 MHz	1356.8

Occupied Bandwidth is reported for information only.

See attached graph.

Requirements:

No requirements for Digital Transmission Systems.



Date: 14.SEP.2012 12:54:07

Occupied Bandwidth, 2441 MHz

4.2 Minimum 6 dB Bandwidth

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

Test Performed By: Frode Sveinsen	Date of Test: 14 Sept 2012
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Test Results: Complies

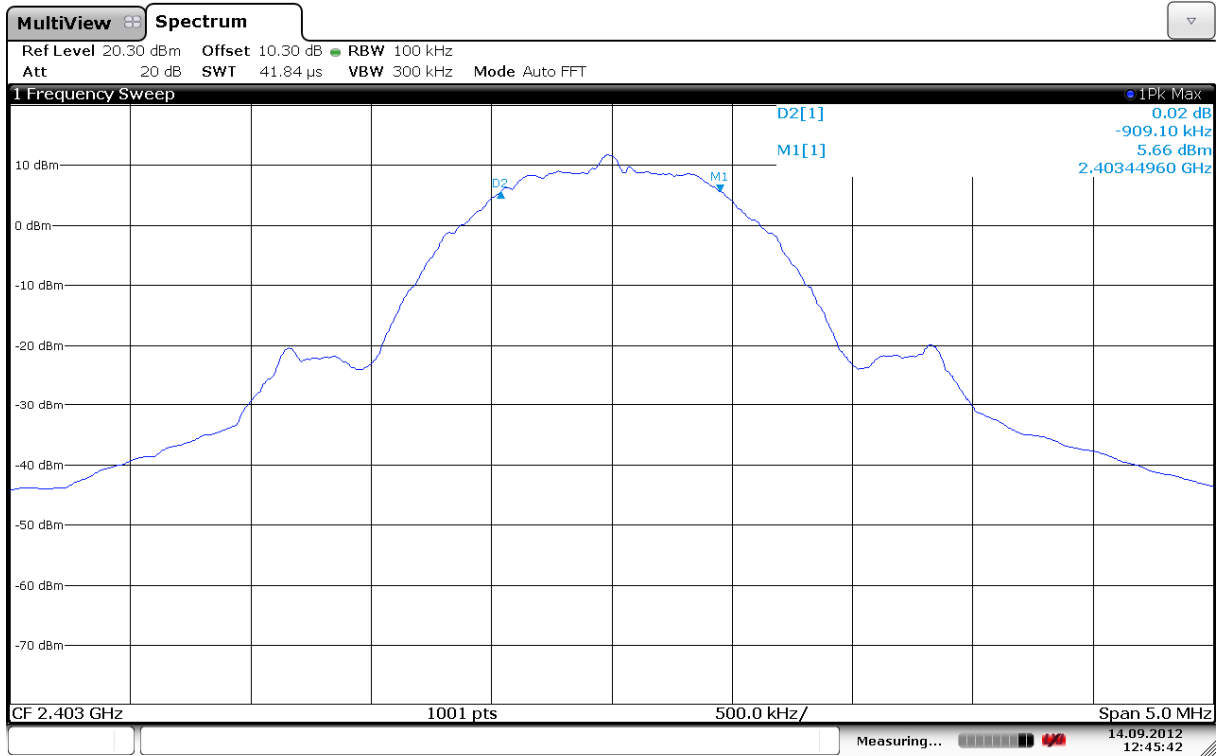
Measurement Data:

	Measured 6 dB Bandwidth (kHz)
Ch 01, 2403 MHz	909.1
Ch 19, 2441 MHz	824.2
Ch 40, 2481 MHz	904.1

Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

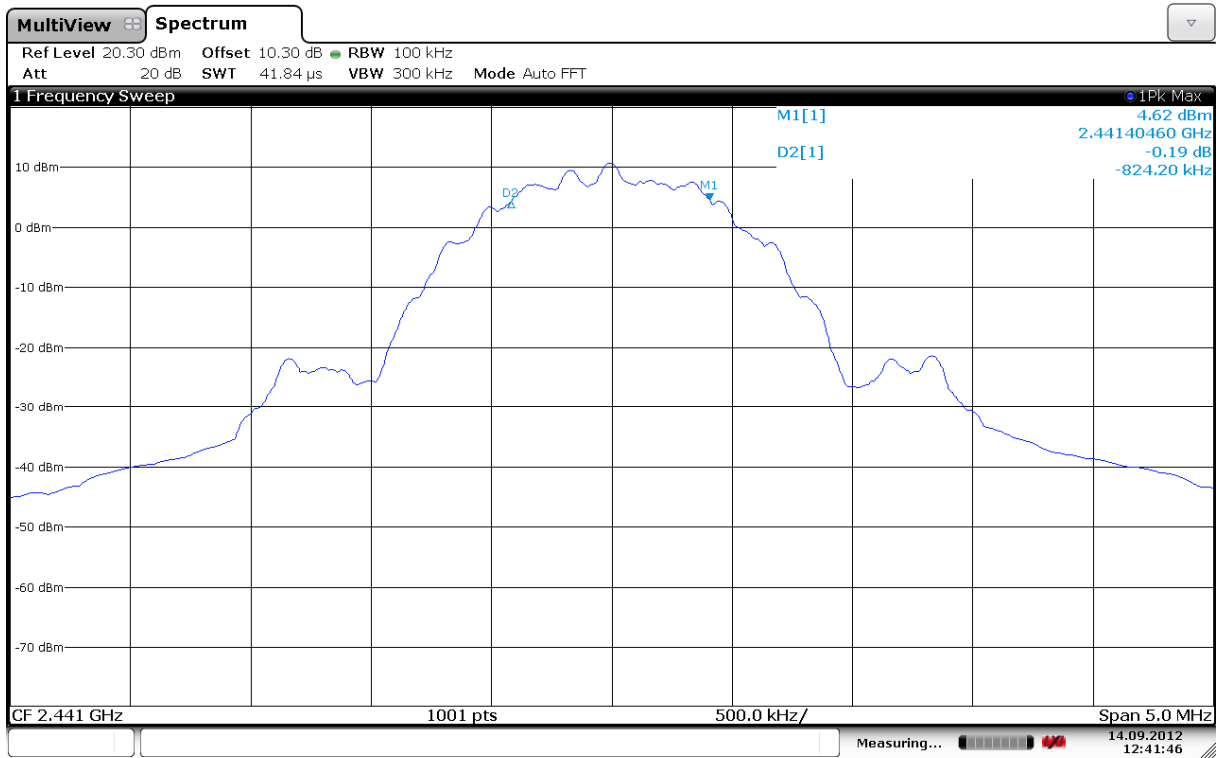
Requirements:

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



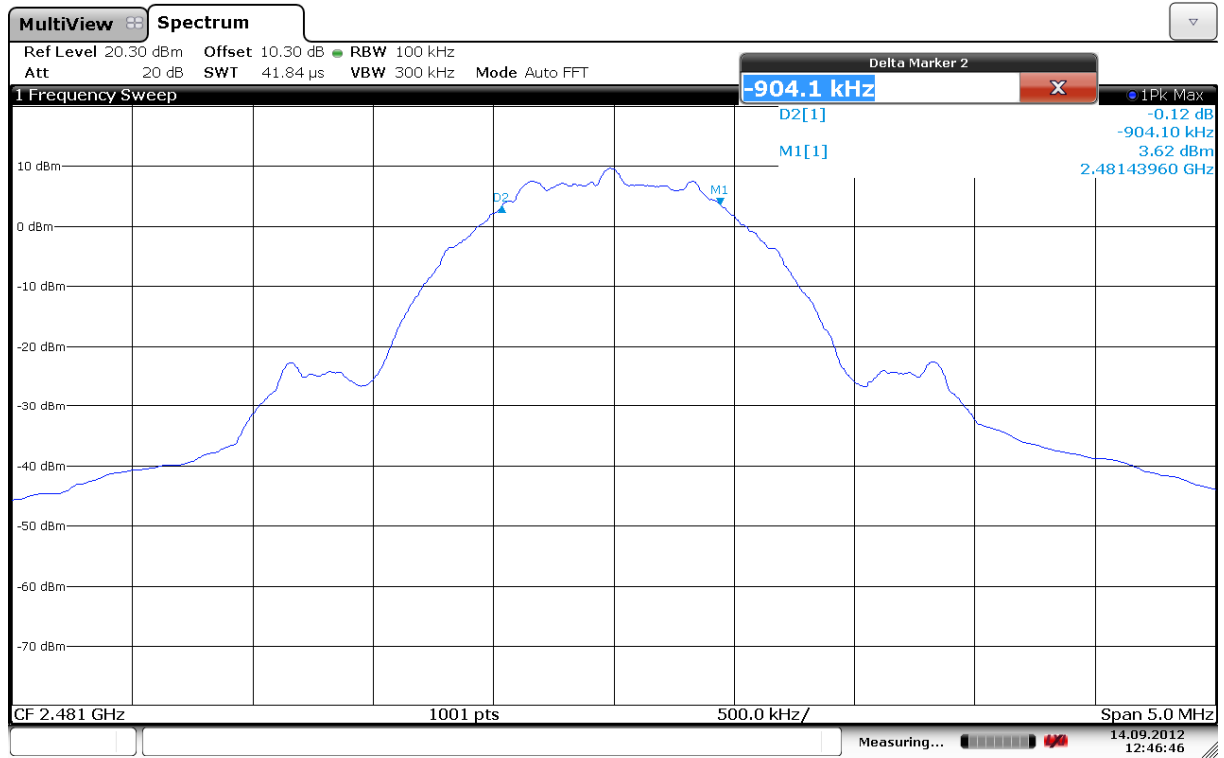
Date: 14.SEP.2012 12:45:42

6 dB Bandwidth, 2403 MHz



Date: 14.SEP.2012 12:41:45

6 dB Bandwidth, 2441 MHz



Date: 14.SEP.2012 12:46:46

6 dB Bandwidth, 2481 MHz

4.3 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: Frode Sveinsen	Date of Test: 13-14 Sept 2012
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Test Results: Complies

Measurement Data:

Carrier Frequency	Maximum Conducted Output Power, Watts	Maximum EIRP, Watts	Maximum Antenna Gain, dBi
2403 MHz	0.025	0.065	4.1
2441 MHz	0.022	0.060	4.5
2481 MHz	0.018	0.055	4.9

Antenna gain = $10 \cdot \log(\text{EIRP}/\text{Conducted power})$ dBi

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v01.

See attached plots.

Detachable antenna? Yes No

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

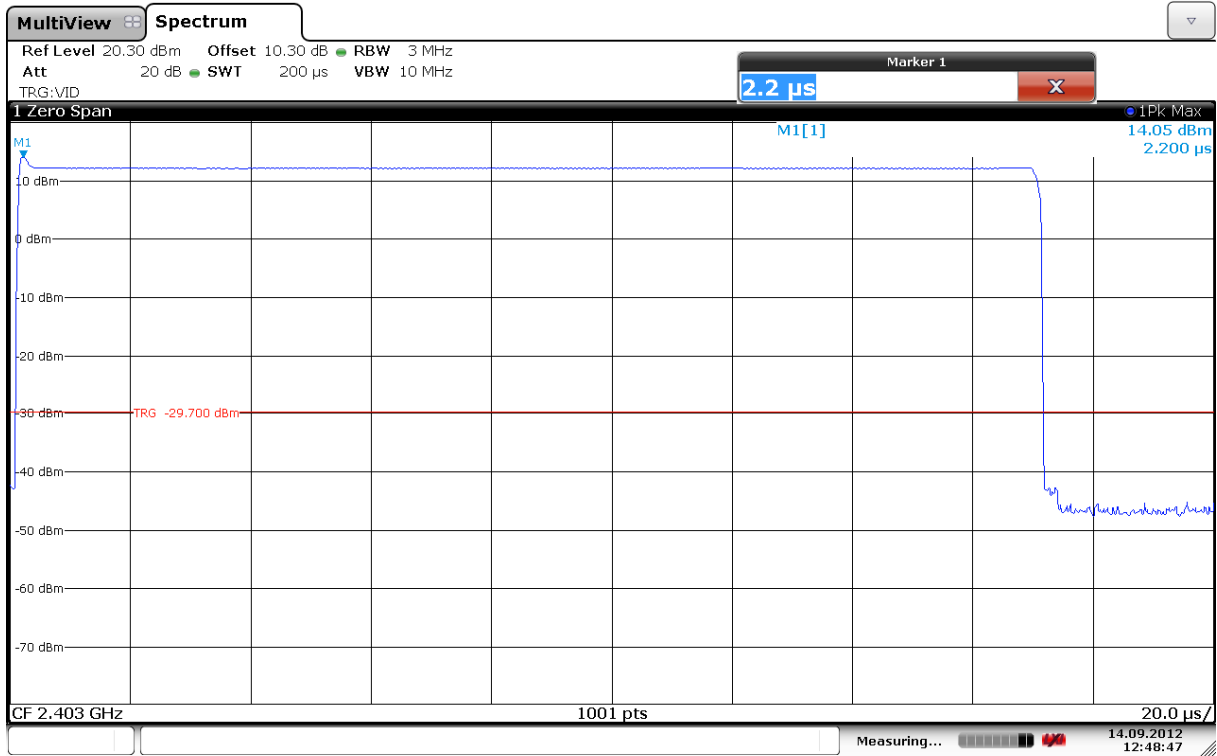
Type of antenna connector: N/A

Requirements:

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

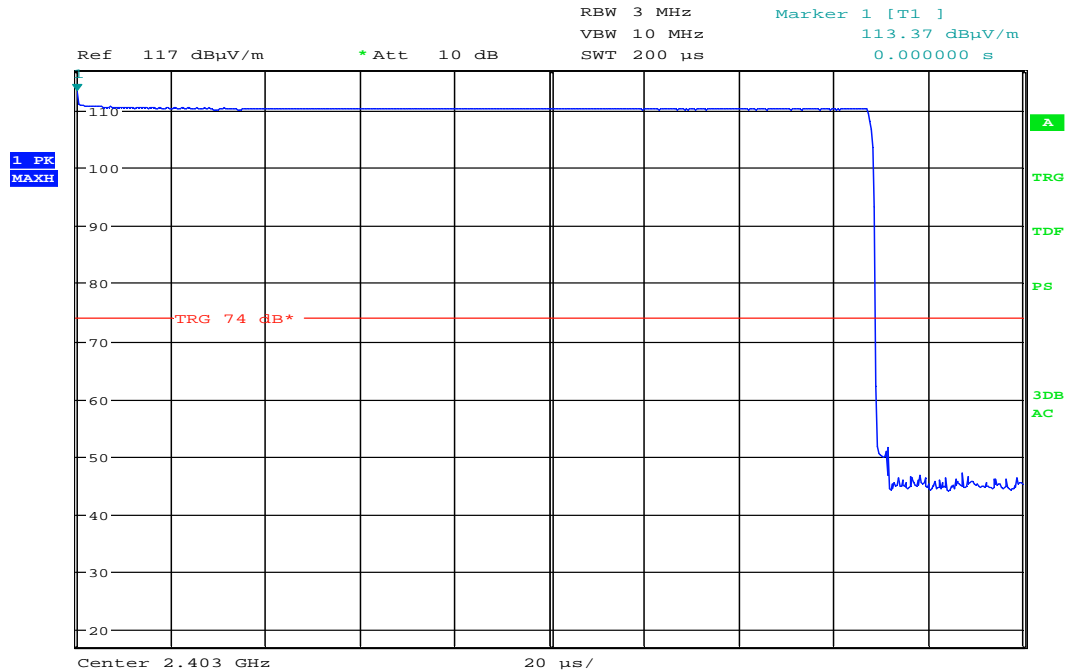
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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.



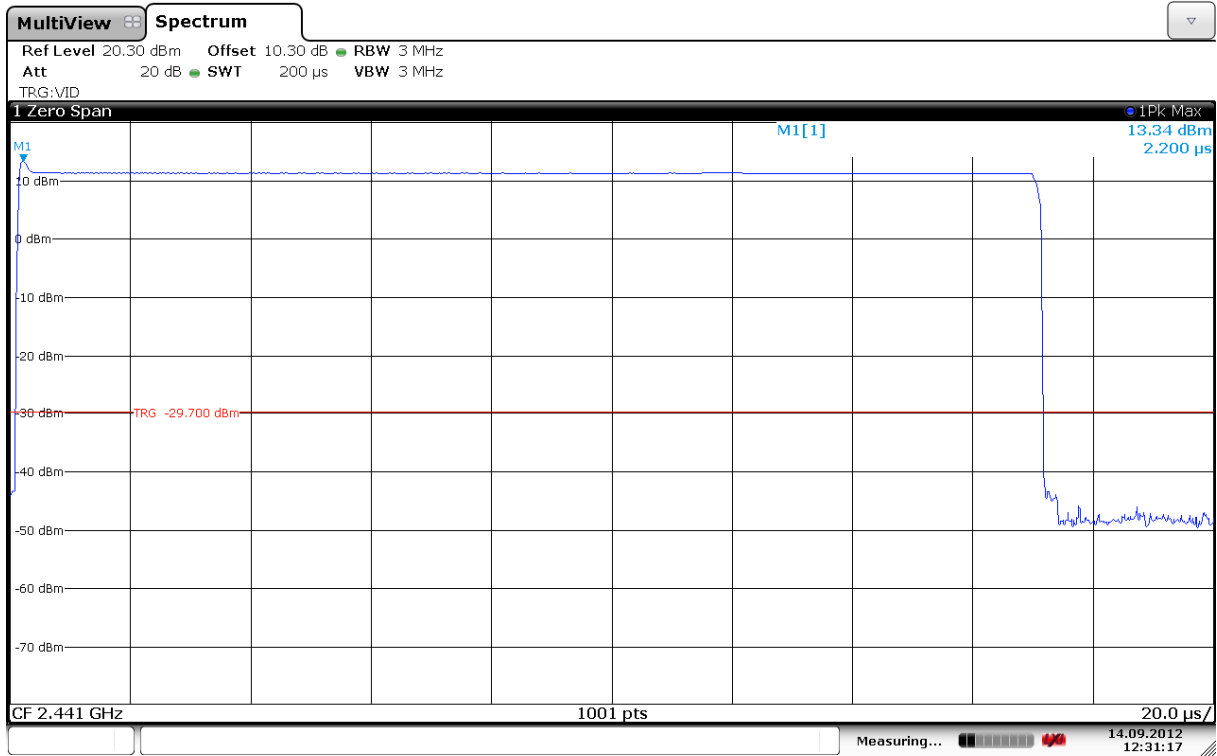
Date: 14.SEP.2012 12:48:47

Conducted Output Power, 2403 MHz



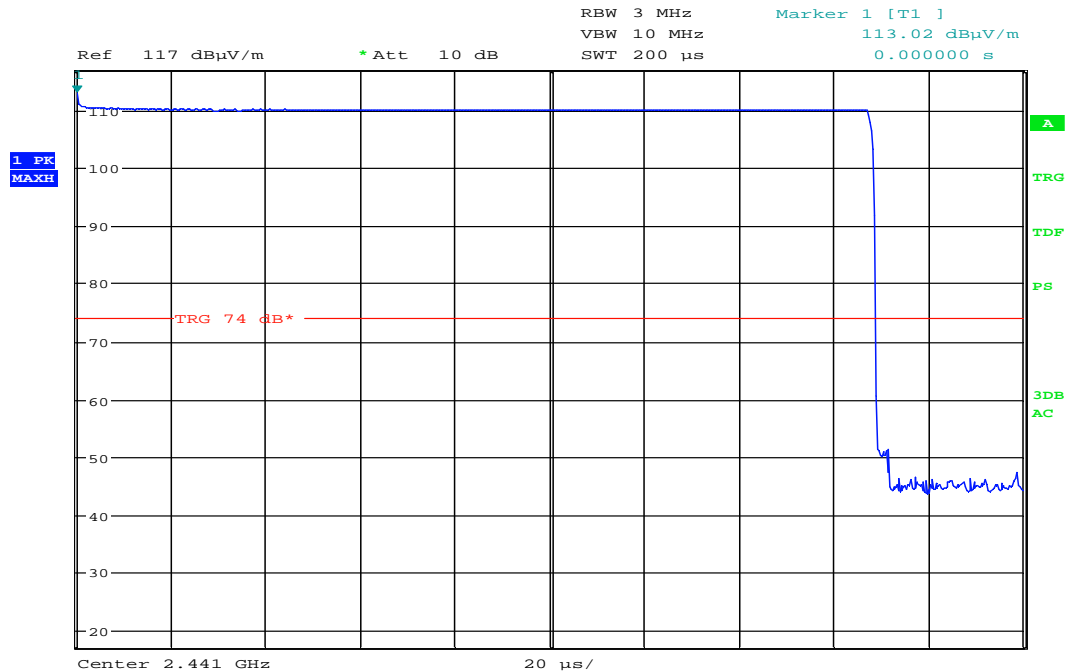
Date: 13.SEP.2012 17:10:42

Radiated Output Power, 2403 MHz (Max: EUT H2, Ant 2, VP)



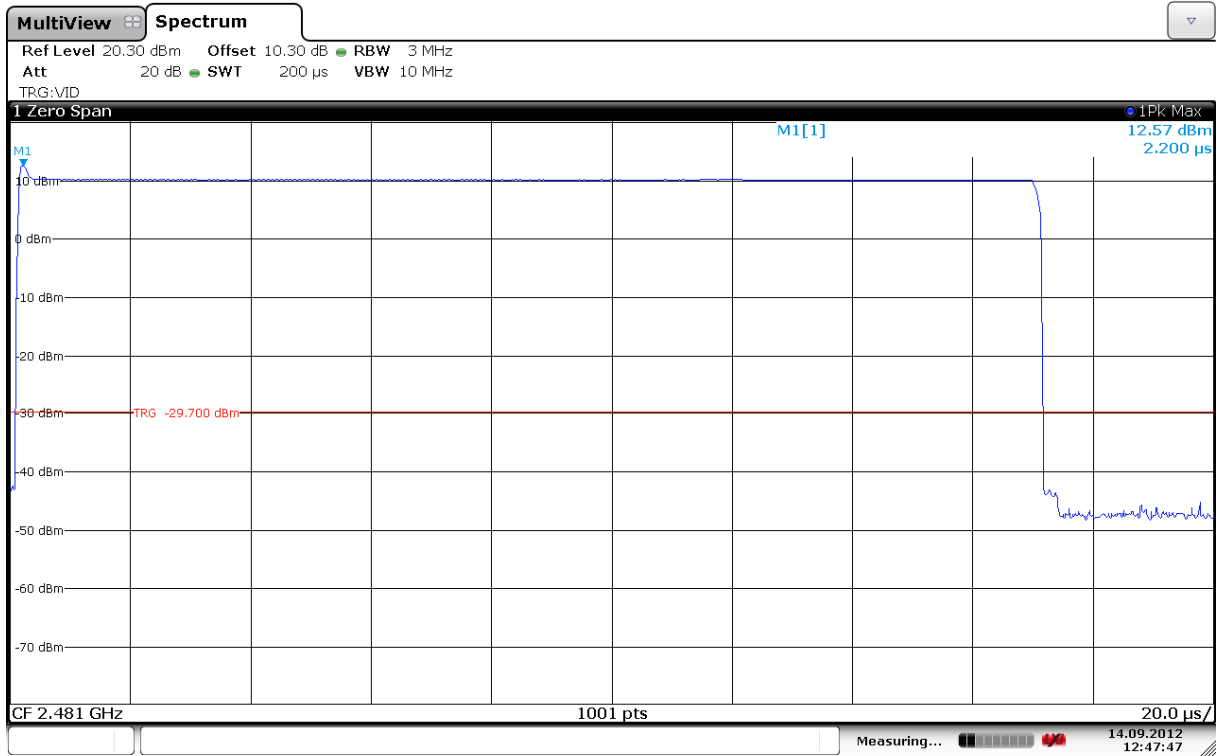
Date: 14.SEP.2012 12:31:17

Conducted Output Power, 2441 MHz



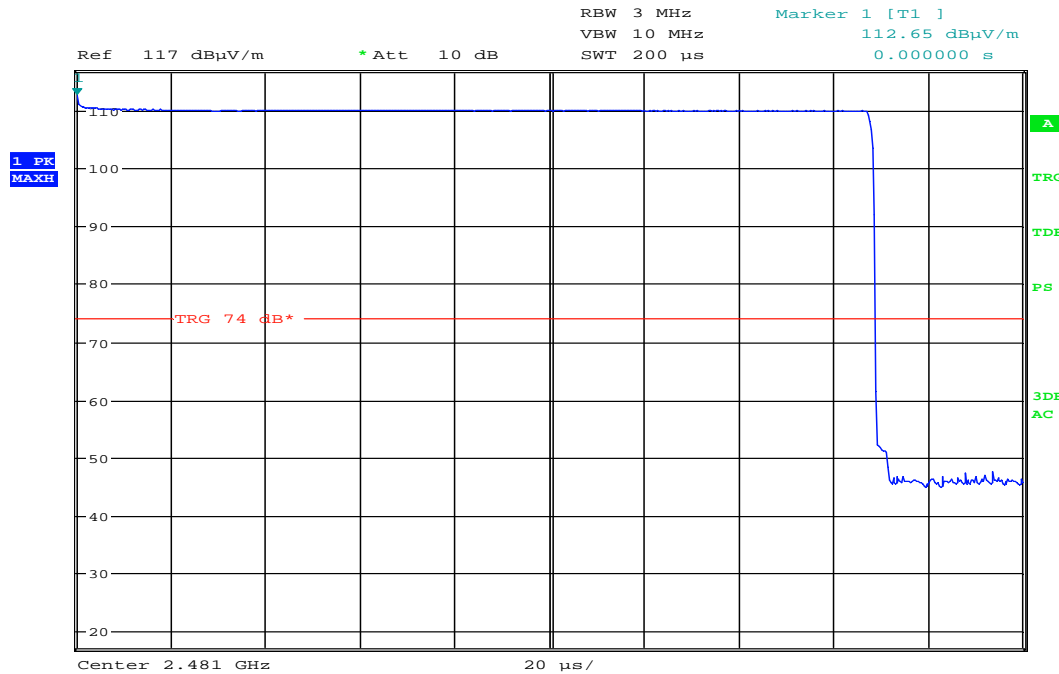
Date: 13.SEP.2012 17:09:47

Radiated Output Power, 2441 MHz (Max: EUT H2, Ant 2, VP)



Date: 14.SEP.2012 12:47:47

Conducted Output Power, 2481 MHz



Date: 13.SEP.2012 17:25:41

Radiated Output Power, 2481 MHz (Max: EUT H2, Ant 2, VP)

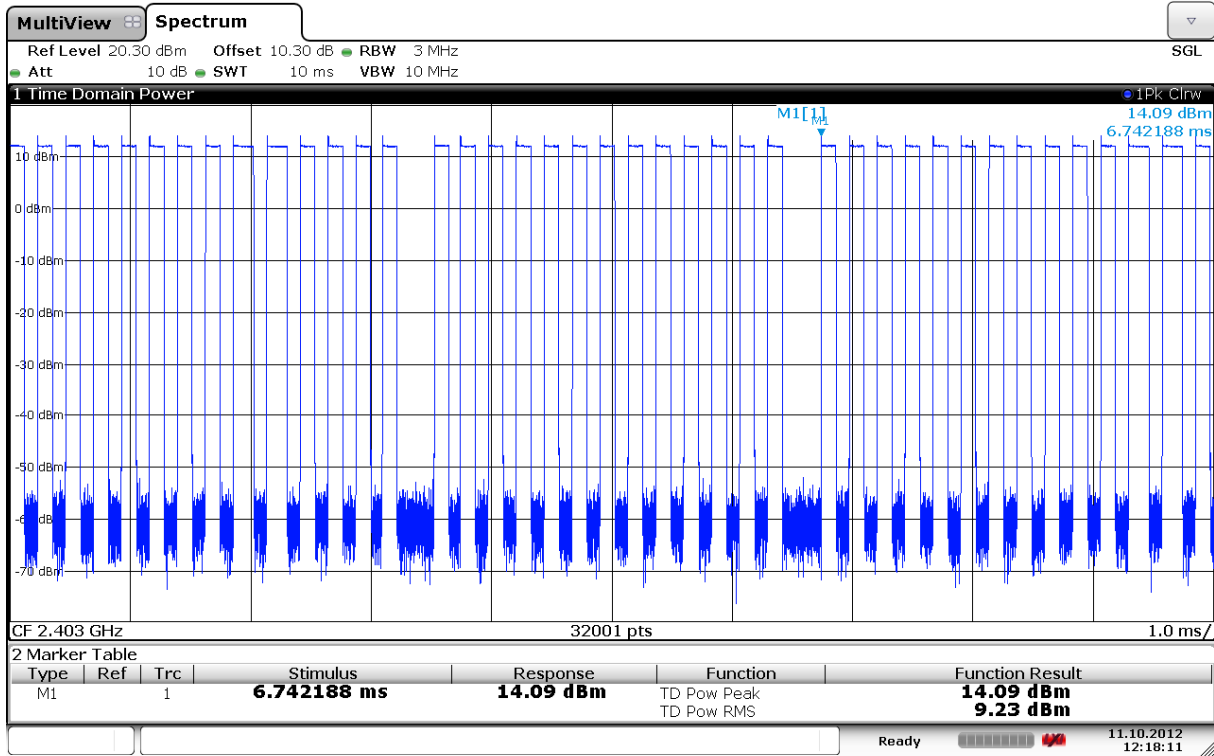
4.4 Time Averaged Output Power

Measurement Data:

Carrier Frequency	Measured Time Averaged Conducted Power RMS, dBm	Antenna Gain, dBi	Calculated Time Averaged Radited Power RMS, mW
2403 MHz	9.2	4.1	21.3
2441 MHz	8.3	4.5	19.1
2481 MHz	7.2	4.9	16.2

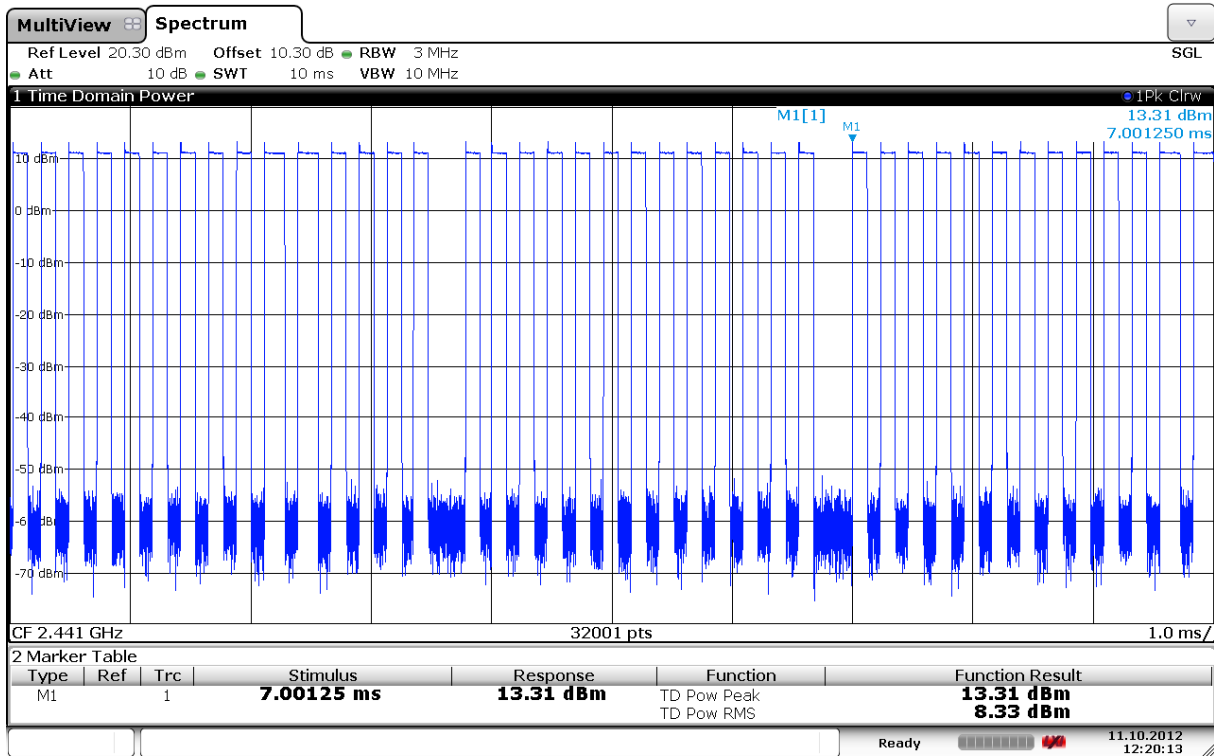
Average values above are measured over 10ms with the EUT connected to Receiver and transmitting in normal mode. Average value is measured with the Time Domain Power measurement function of an R&S FSW26 spectrum analyzer and includes duty cycle in the calculated RMS value.

Values above are reported for SAR evaluation only.



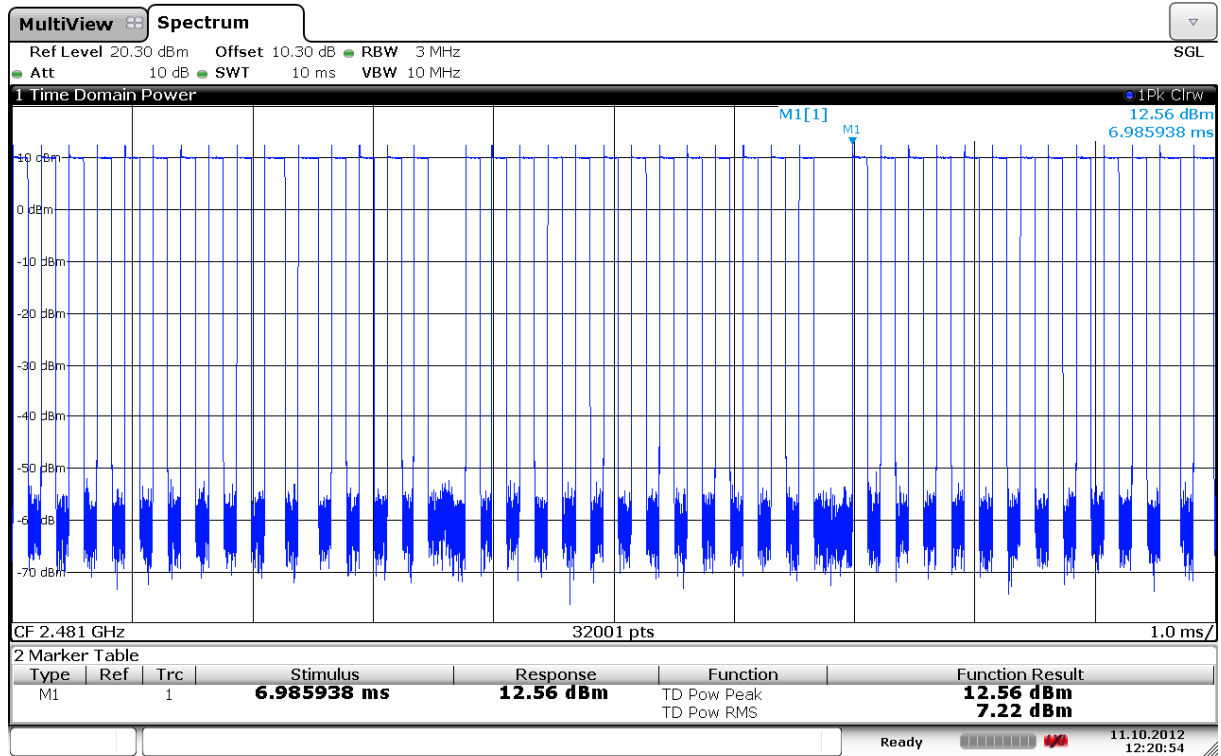
Date: 11.OCT.2012 12:18:10

Conducted Output Power, 2403 MHz



Date: 11.OCT.2012 12:20:13

Conducted Output Power, 2441 MHz



Date: 11.OCT.2012 12:20:54

Conducted Output Power, 2481 MHz

4.5 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Frode Sveinsen	Date of Test: 13-14 Sept 2012
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Test Results: Complies

Measurement Data:

	Measured field strength (dBµV/m)		Limit dB	Margin dB	
	2390 MHz	2483.5 MHz			
Peak Detector	51.6	56.6	74	22.4	17.4
Average Detector	45.6	50.6	54	8.4	3.4

Average values are measured with Peak Detector and corrected for Duty Cycle.

See attached plots.

Band-edge field strength 2.4835 GHz.

Max field strength upper channel, 1 MHz BW: 112.5 dBµV/m

Delta marker 100 kHz BW: 55.9 dB

Field strength at 2.4835 GHz Peak: 56.6 dBµV/m

Field strength at 2.4835 GHz Average 50.6 dBµV/m.

See attached plots.

Duty Cycle Correction Factor Calculation:

See also Para 4.4 Occupancy Time.

RF duty cycle: Calculation according to RF burst Para 15.35 (c)

Maximum Duty Cycle: 50%

Duty Cycle Correction factor = $-20 \times \log(0.50) = 6.0$ dB

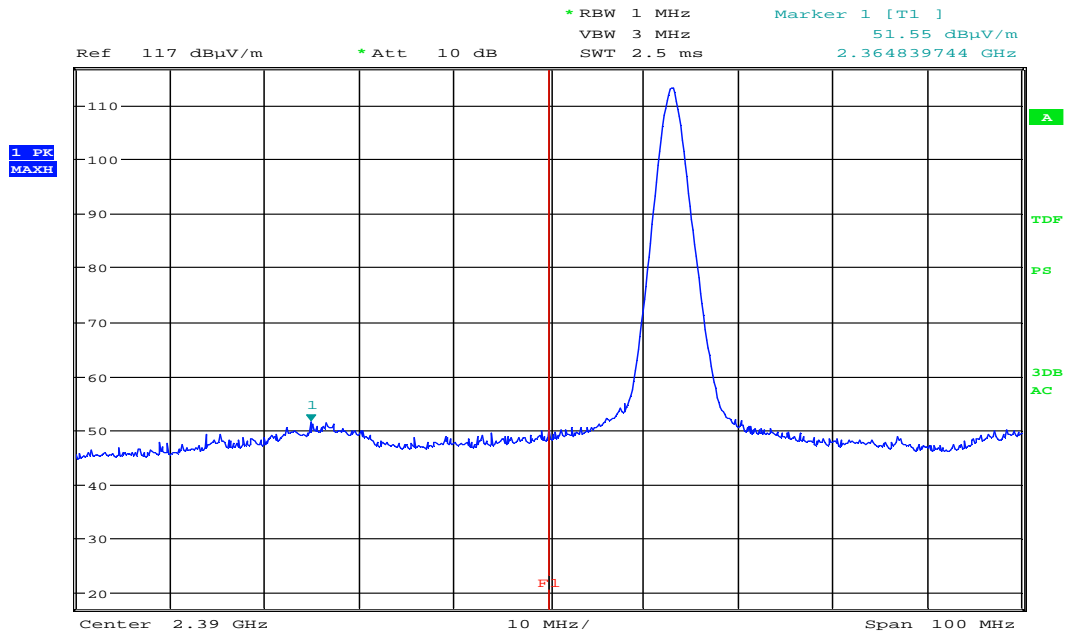
RF conducted power to 25 GHz see attached graph.

Maximum RF level outside operating band:

RF 2403MHz: >60 dB/C, margin >40 dB

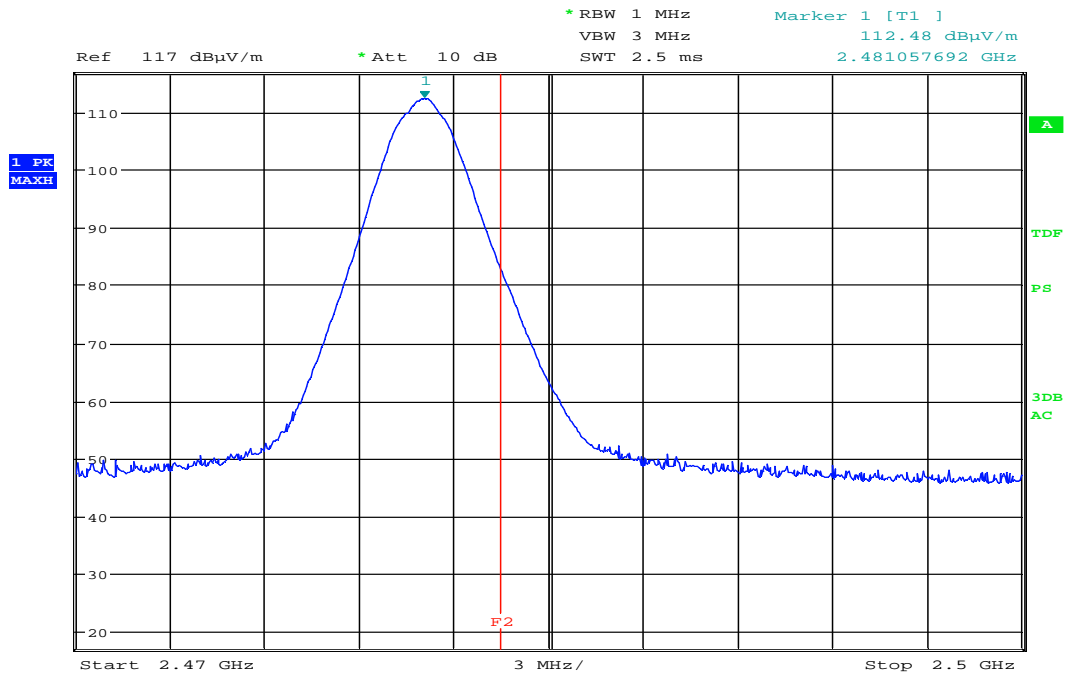
RF 2441MHz: >60 dB/C, margin >40 dB

RF 2481MHz: >60 dB/C, margin >40 dB



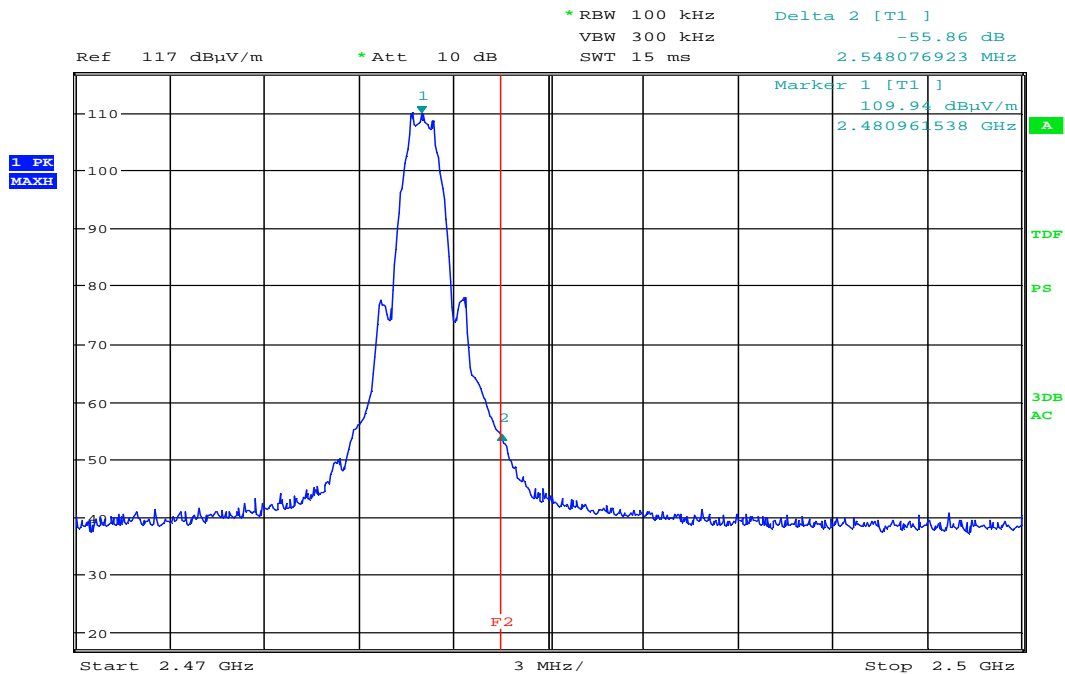
Date: 13.SEP.2012 17:17:54

Band Edge, Lower, Peak, 2403 MHz



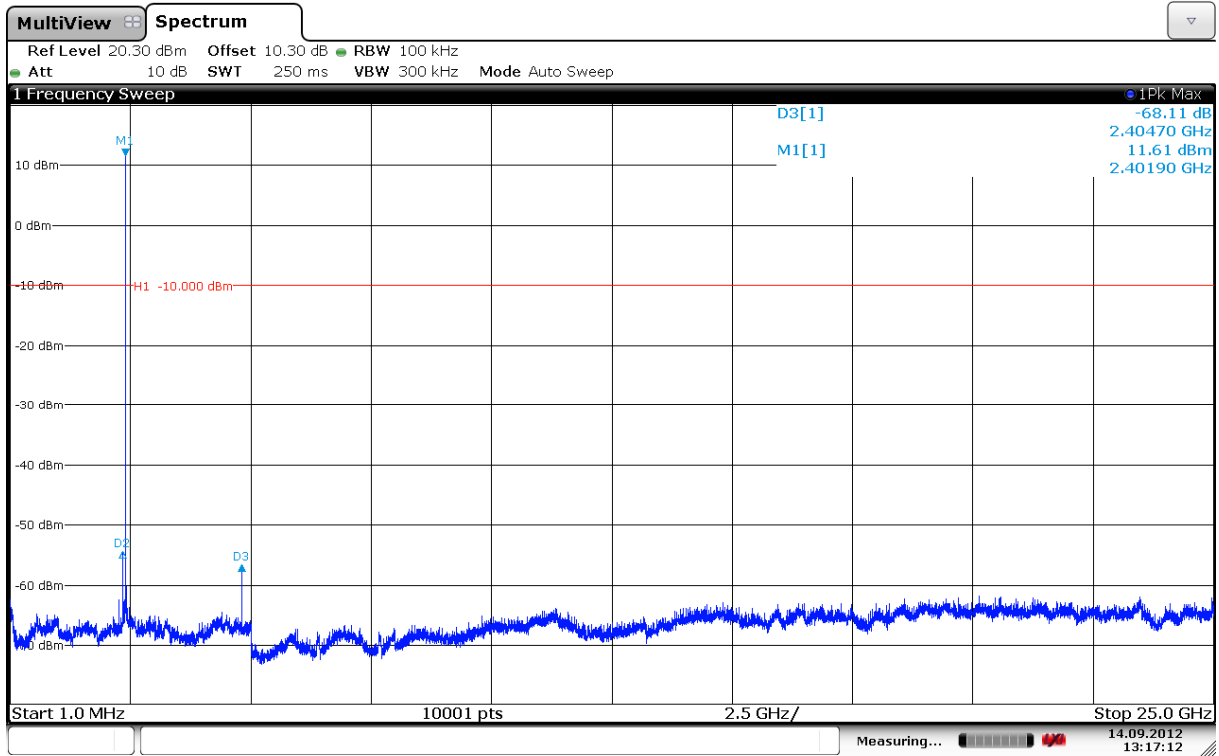
Date: 13.SEP.2012 17:23:16

Band Edge, Upper, Peak, 2481 MHz



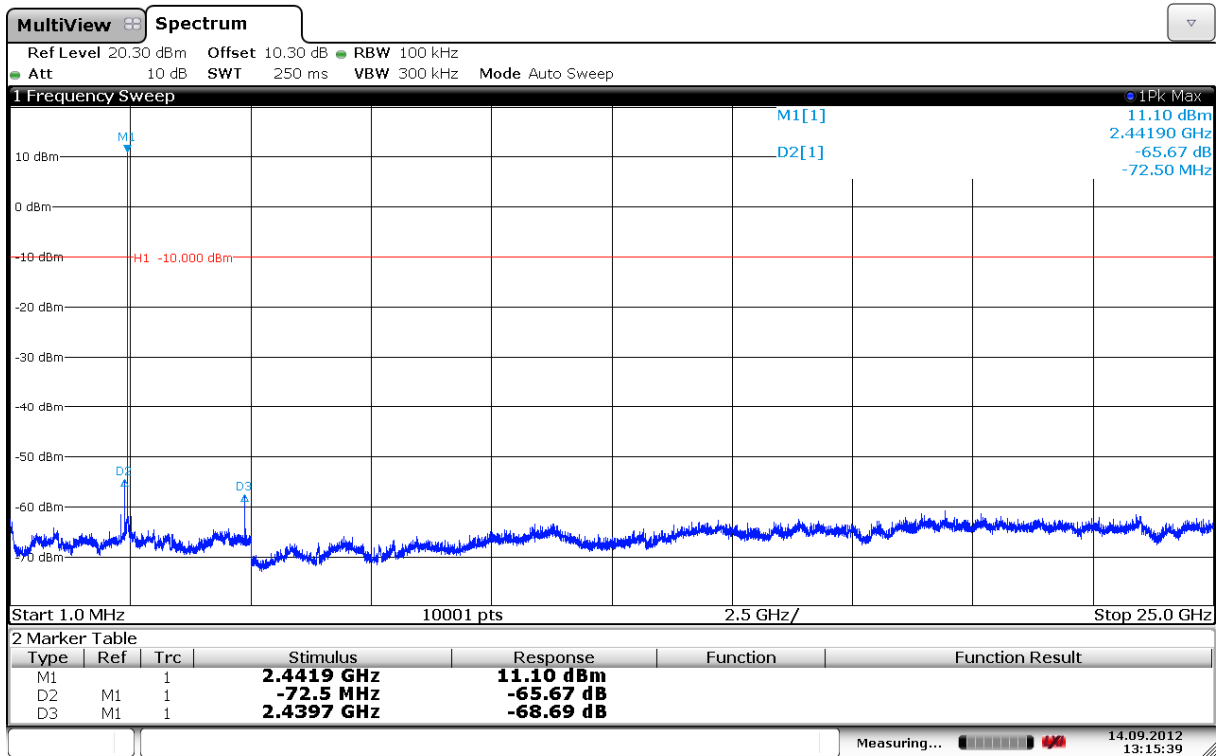
Date: 13.SEP.2012 17:24:39

Band Edge, Upper, Marker Delta, Peak, 2481 MHz



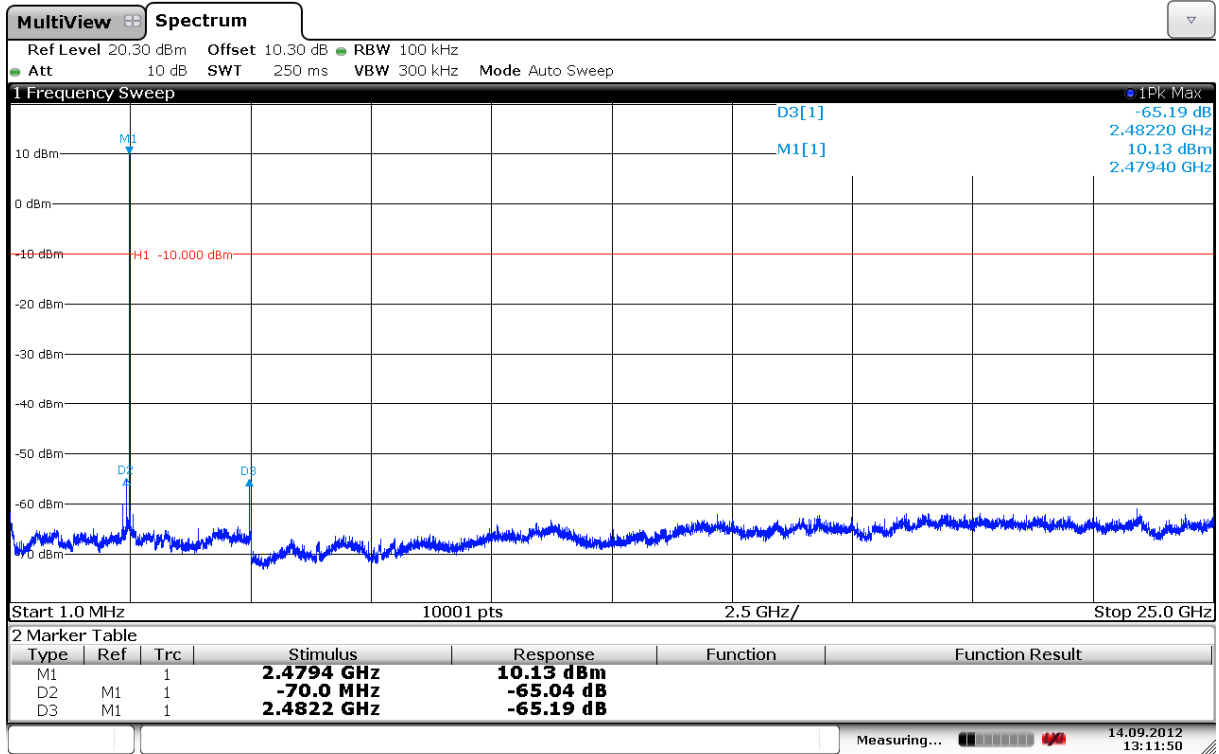
Date: 14.SEP.2012 13:17:12

Conducted Emissions 1 MHz – 25 GHz, 2403 MHz



Date: 14.SEP.2012 13:15:39

Conducted Emissions 1 MHz – 25 GHz, 2441 MHz



Date: 14.SEP.2012 13:11:50

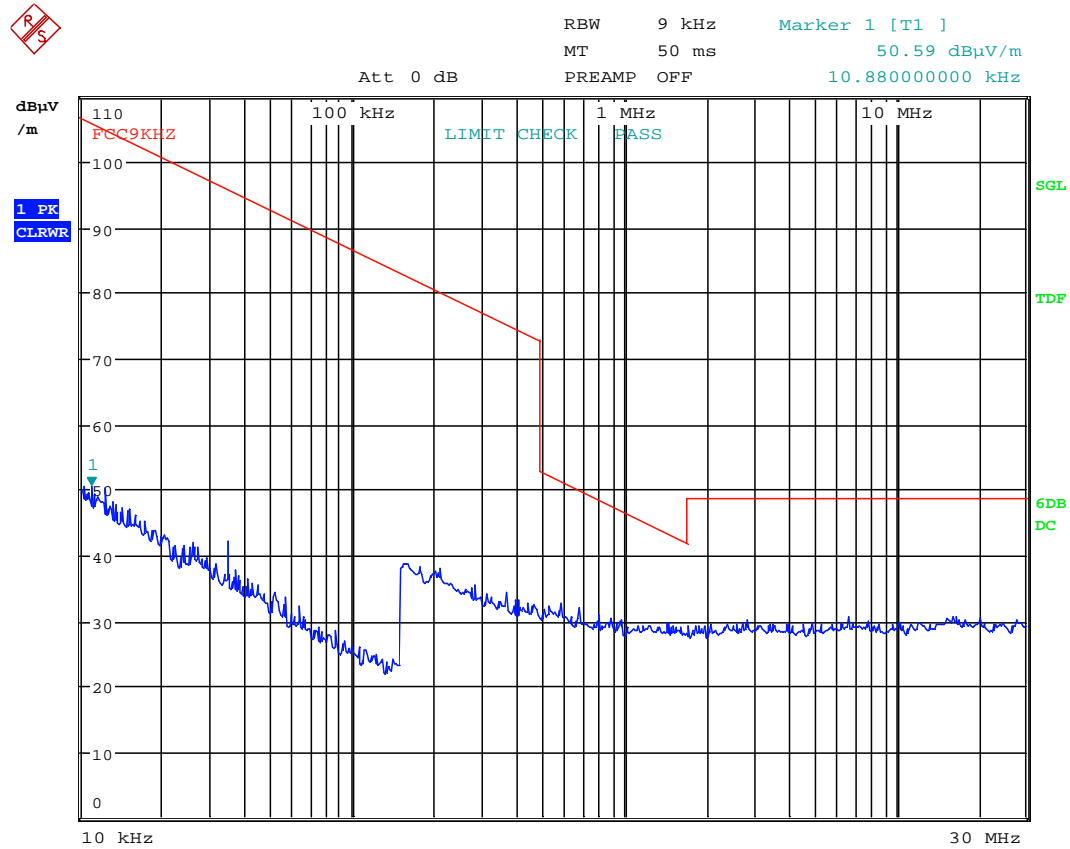
Conducted Emissions 1 MHz – 25 GHz, 2481 MHz

Radiated emissions 10 kHz-30 MHz.

Measuring distance 3 m, measured with Peak detector.

No component detected, see plot.

Limit is converted to 3 m using 40 dB/decade according to 15.31 (f) (2).



Date: 20.SEP.2012 15:14:05

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

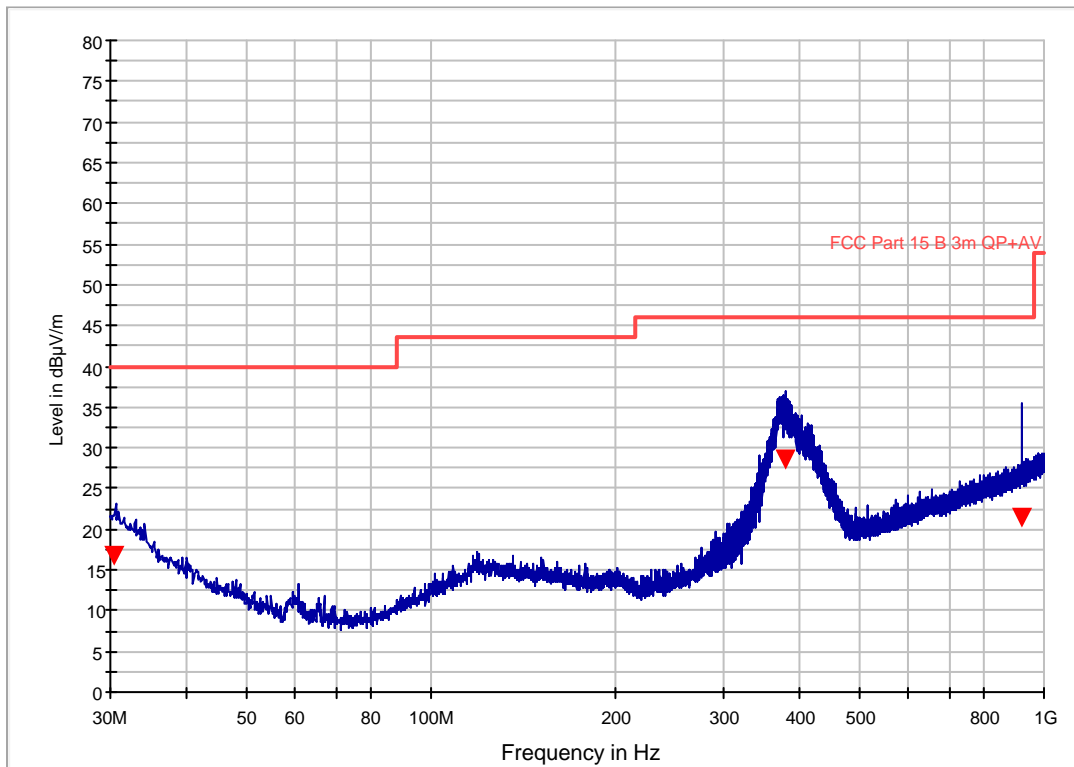
Measuring distance 10 m according to CISPR 22.

Tested with active connection.

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)	Comment
30.550932	16.7	120.000	400.0	H	128.0	23.3	40.0	
378.035685	28.5	120.000	216.0	H	272.0	17.5	46.0	
923.395929	21.5	120.000	129.0	V	165.0	24.5	46.0	

See plot.

FCC Pt15 Class B 30-1000M 3m



Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 8.5 GHz)
 1m (5.5 – 18 GHz)

A pre-scan was performed above 18 GHz and no spurious emissions were detected.

Peak Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
7209	L	-9.5	48.9	20	74	25.1
7323	M	-9.5	50.9	20	74	23.1
7443	H	-9.5	49.9	20	74	24.1
Other freqs	L,M,H	/	None detected	20	74	>20

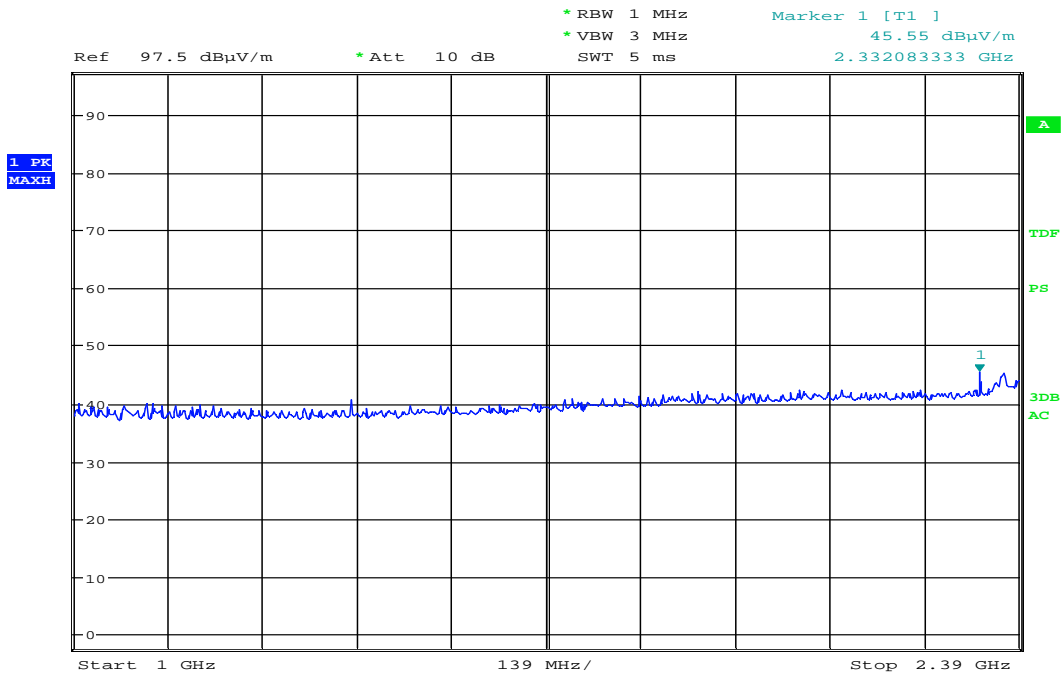
Average Detector:

Frequency	RF channel	Dist. corr. Factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
7209	L	-9.5	42.9	20	54	11.1
7323	M	-9.5	44.9	20	54	9.1
7443	H	-9.5	43.9	20	54	10.1
Other freqs	L,M,H	/	None detected	20	54	>20

Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

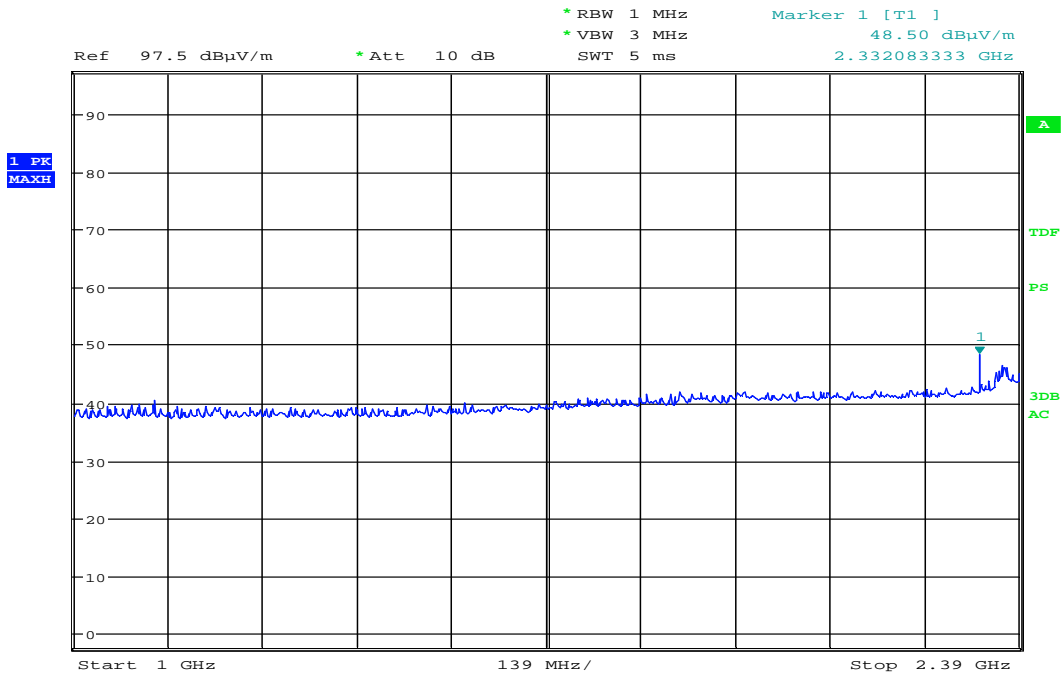
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

See plots.



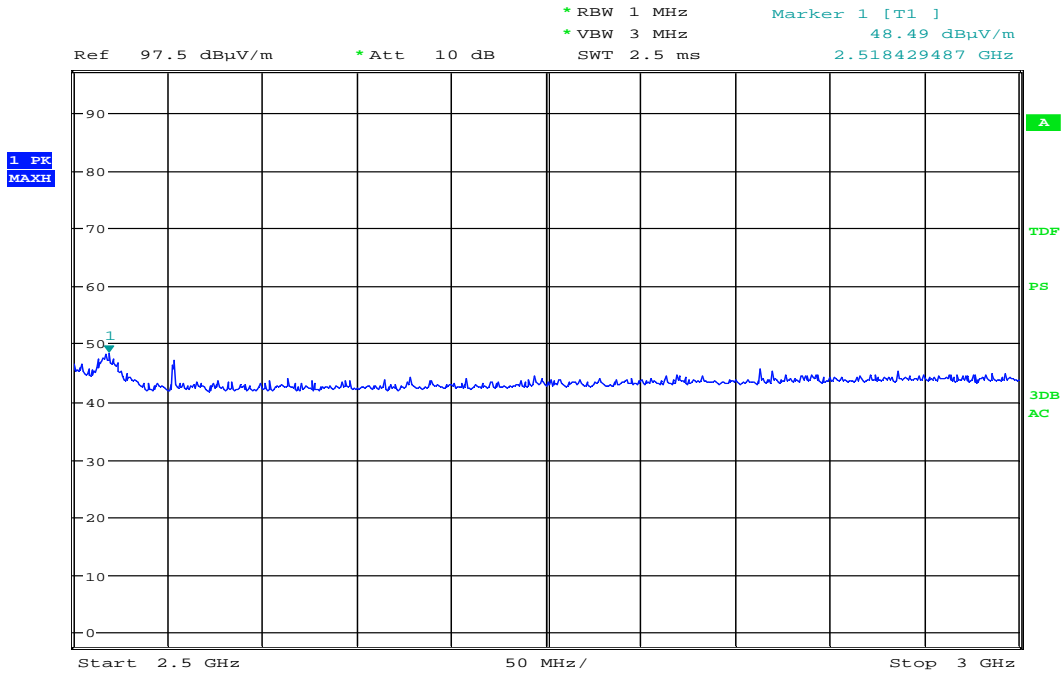
Date: 13.SEP.2012 17:40:40

Radiated Emissions, 1000 -2390 MHz, EUT H2, Ant 2, VP



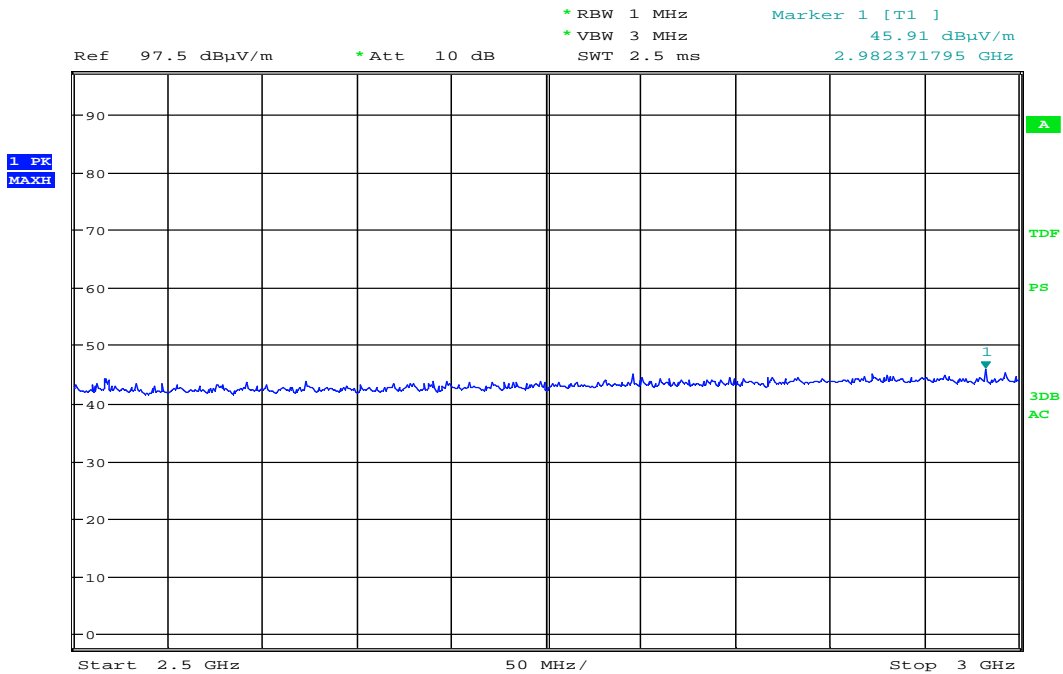
Date: 13.SEP.2012 17:42:32

Radiated Emissions, 1000 -2390 MHz, EUT H2, Ant 2, HP



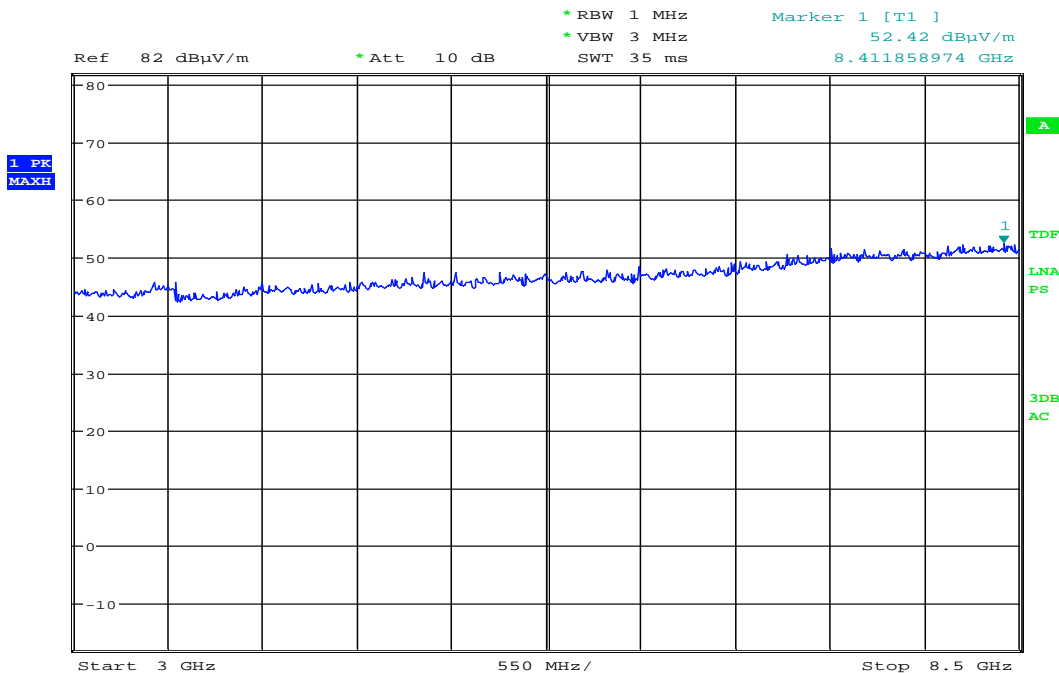
Date: 13.SEP.2012 17:49:44

Radiated Emissions, 2500 -3000 MHz, EUT H2, Ant 2, VP



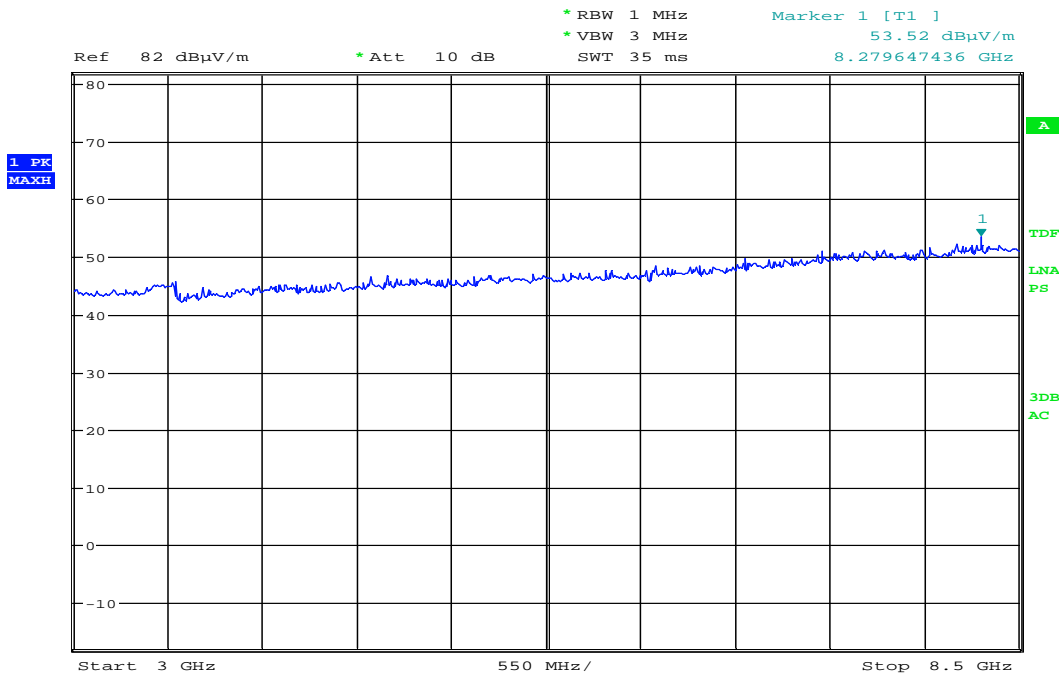
Date: 13.SEP.2012 17:51:36

Radiated Emissions, 2500 -3000 MHz, EUT H2, Ant 2, HP



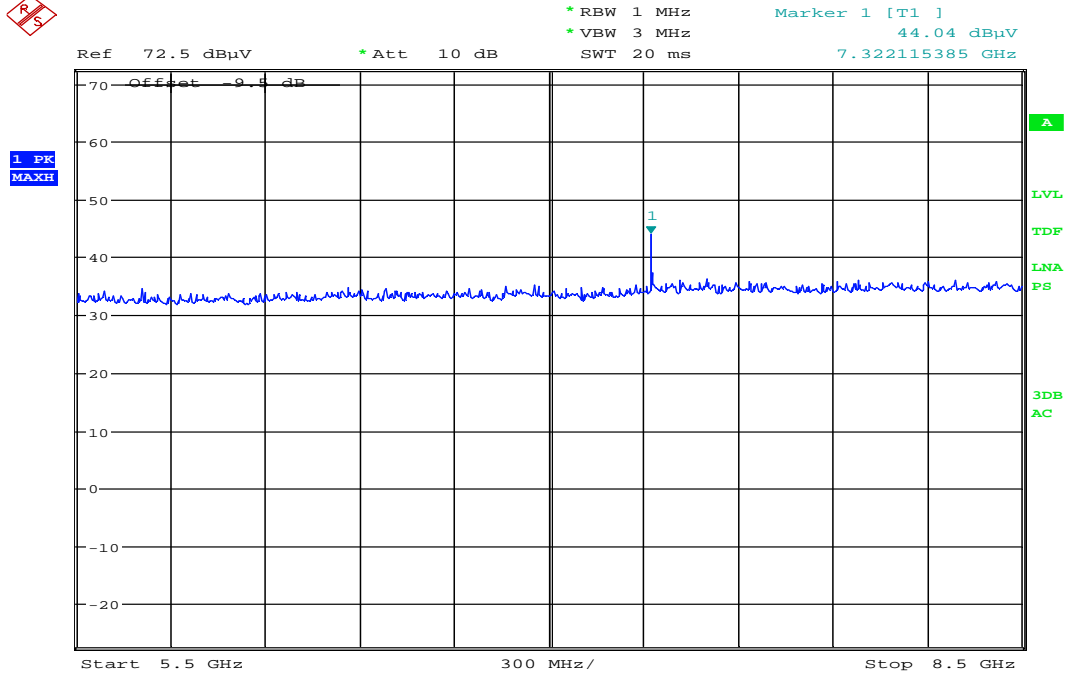
Date: 14.SEP.2012 09:39:00

Radiated Emissions, 3000 -8500 MHz, EUT H1, Ant 1, VP



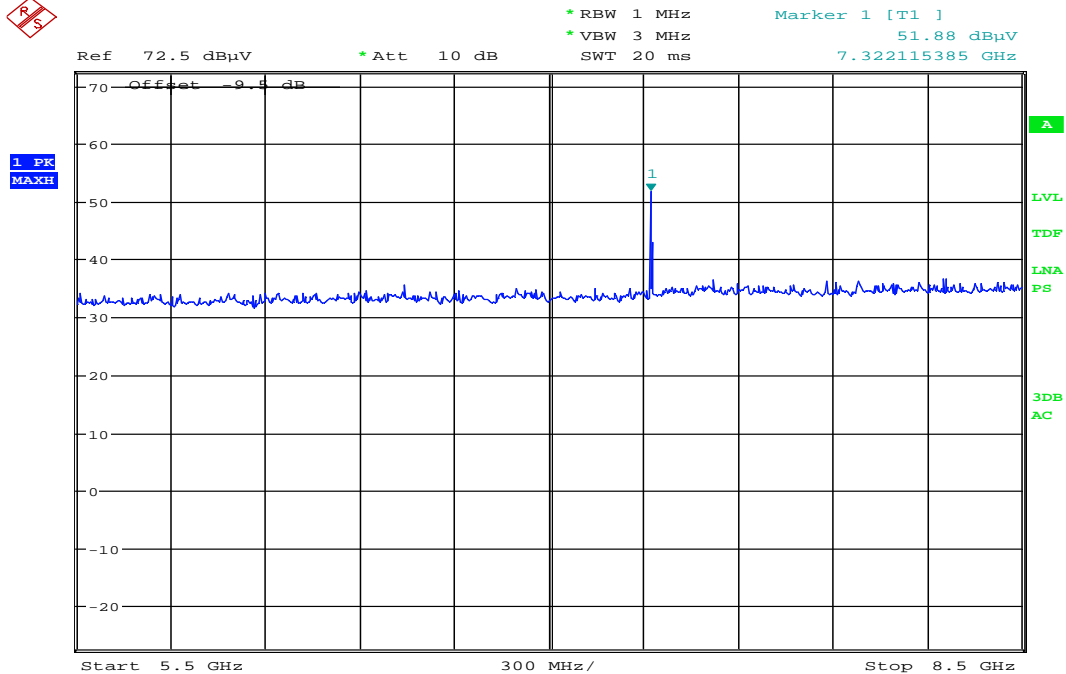
Date: 14.SEP.2012 09:40:56

Radiated Emissions, 3000 -8500 MHz, EUT H1, Ant 1, HP



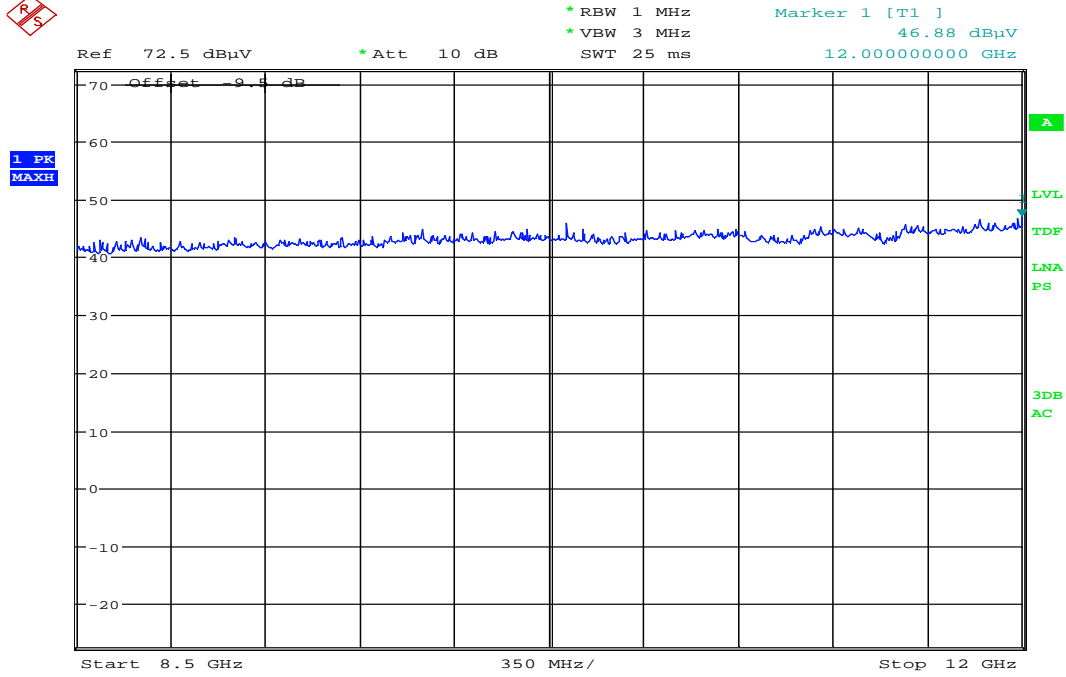
Date: 20.SEP.2012 14:28:48

Radiated Emissions, 5500 -8500 MHz, EUT V, Ant 1, VP, d=1m



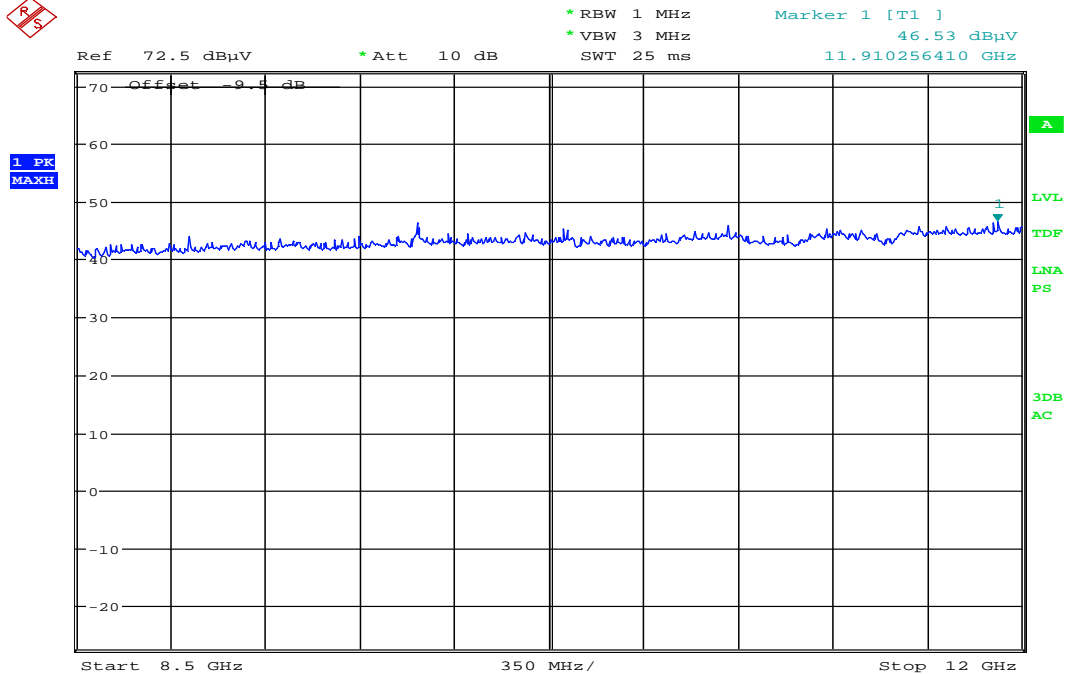
Date: 20.SEP.2012 14:30:31

Radiated Emissions, 5500 -8500 MHz, EUT V, Ant 1, HP, d=1m



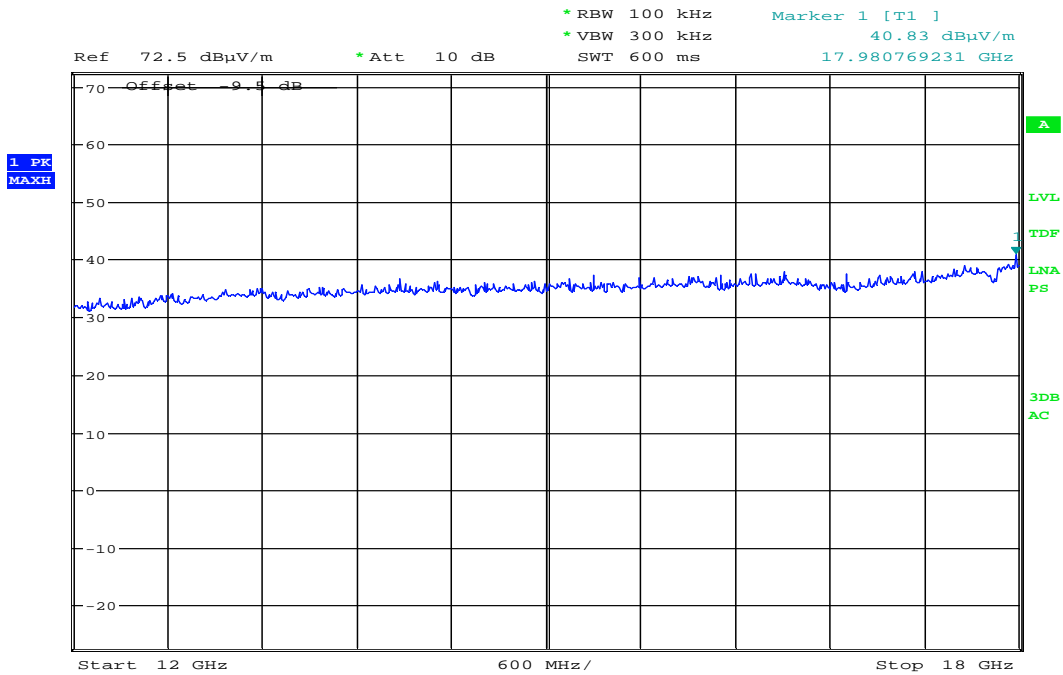
Date: 20.SEP.2012 14:43:03

Radiated Emissions, 8500 -12000 MHz, EUT V, Ant 1, VP, d=1m



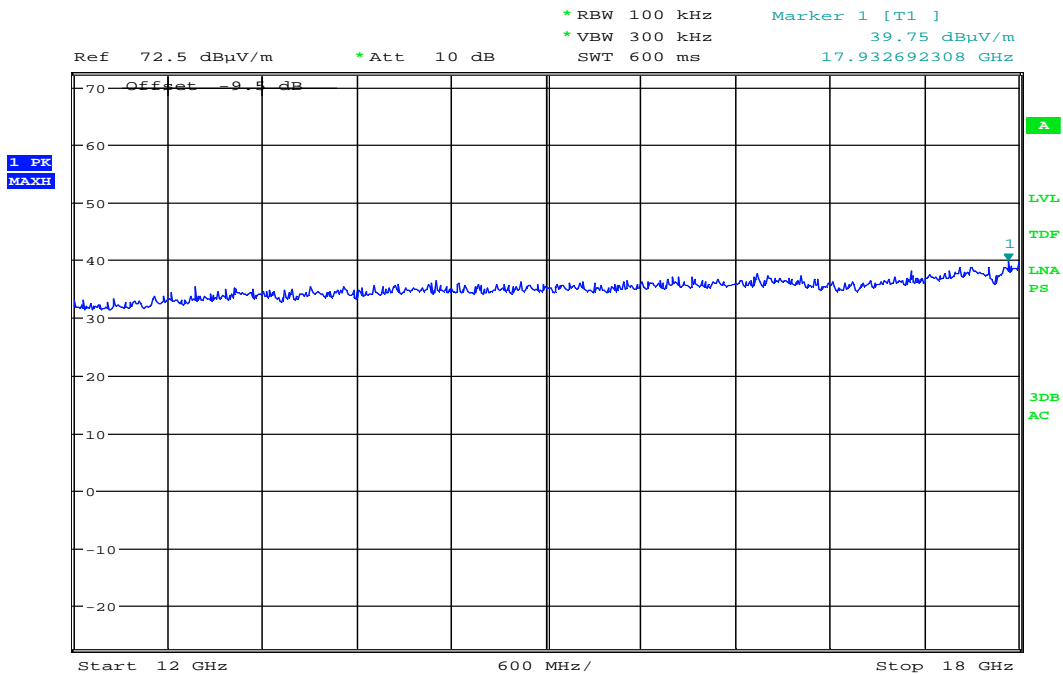
Date: 20.SEP.2012 14:44:46

Radiated Emissions, 8500 -12000 MHz, EUT V, Ant 1, HP, d=1m



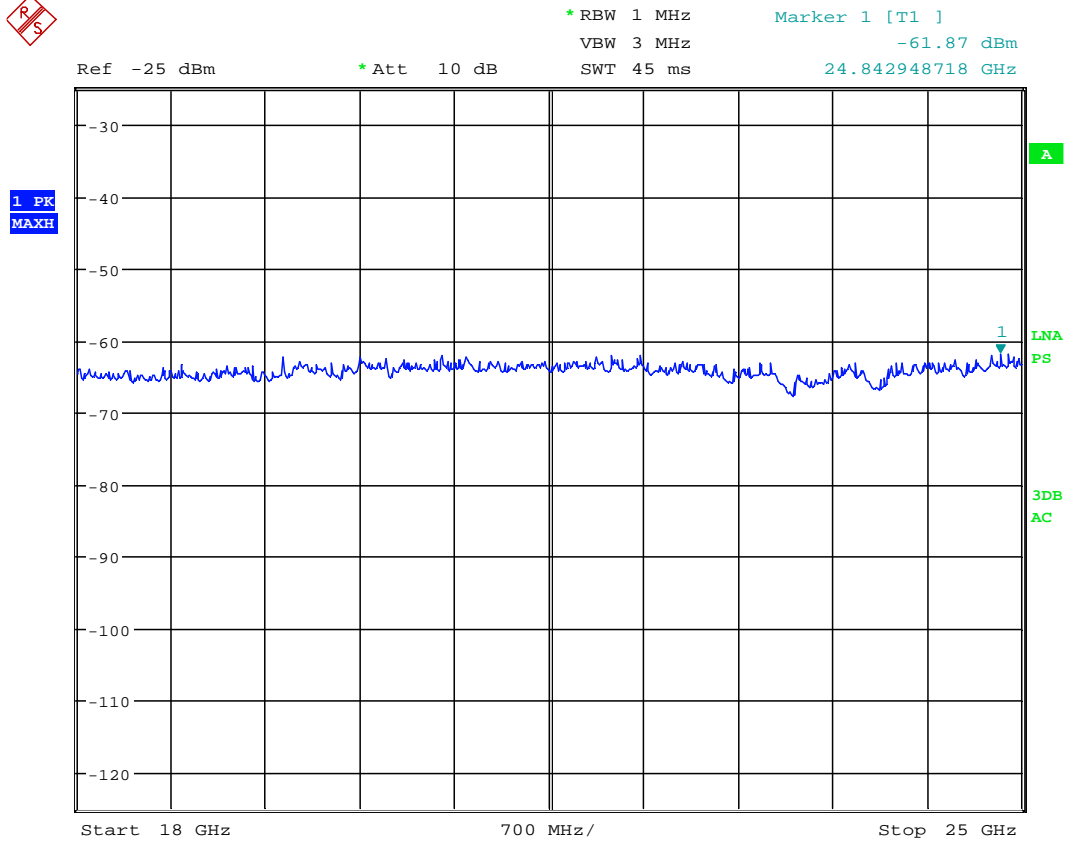
Date: 14.SEP.2012 08:50:38

Radiated Emissions, 12000 -18000 MHz, EUT V, Ant 1, VP, d=1m



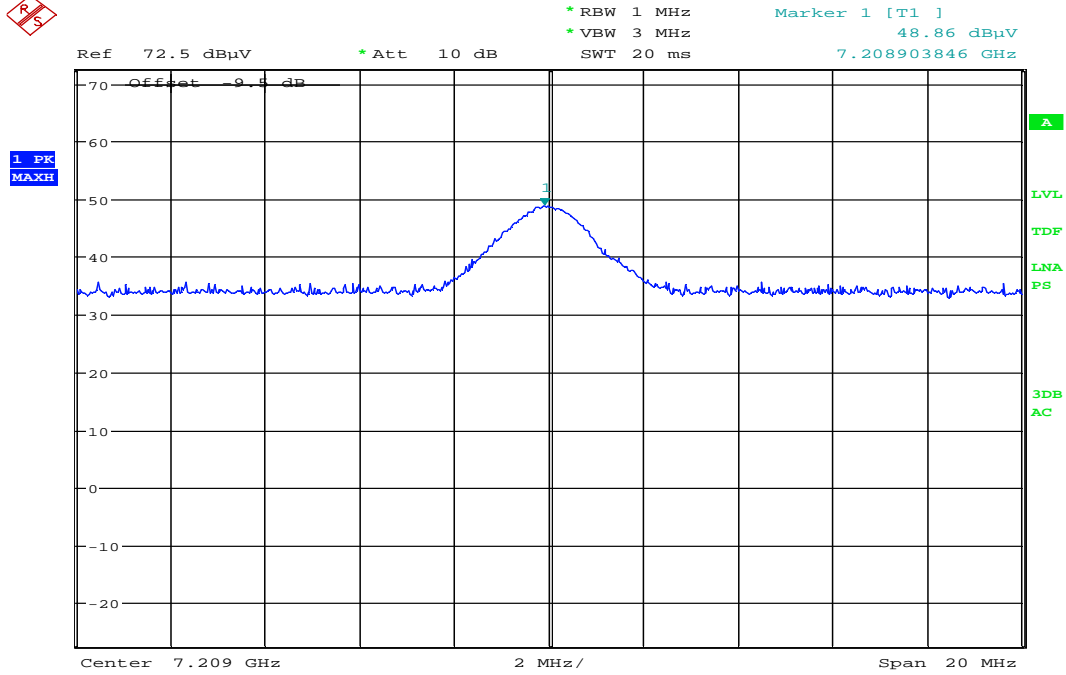
Date: 14.SEP.2012 08:52:21

Radiated Emissions, 12000 -18000 MHz, EUT V, Ant 1, HP, d=1m



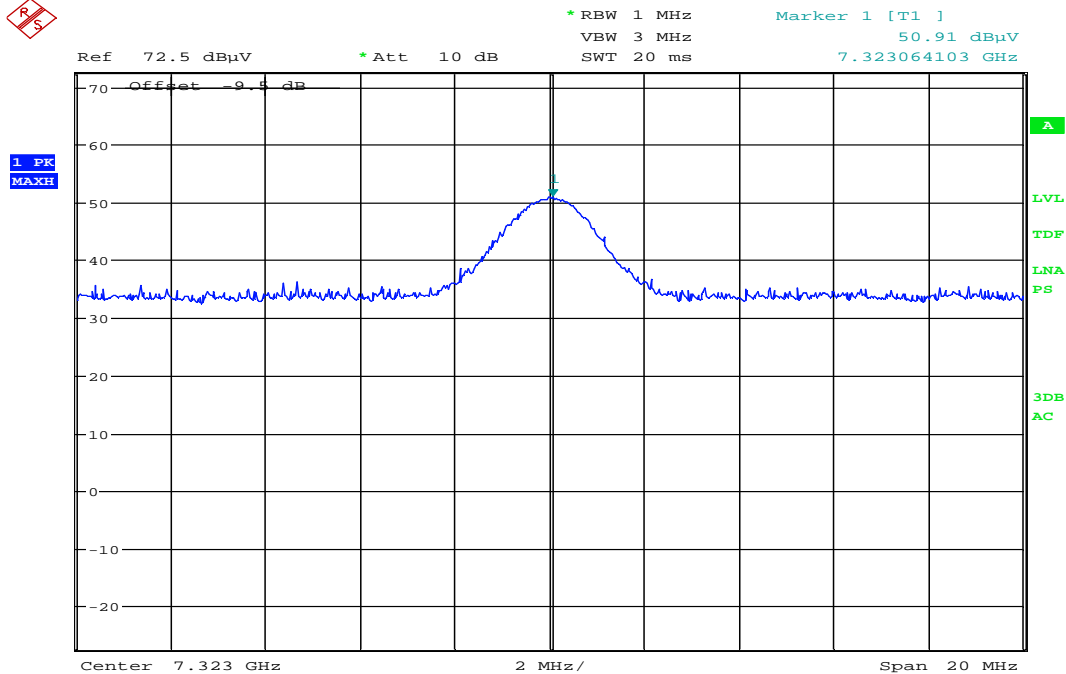
Date: 20.SEP.2012 15:49:41

Pre-scan, 18000 -25000 MHz



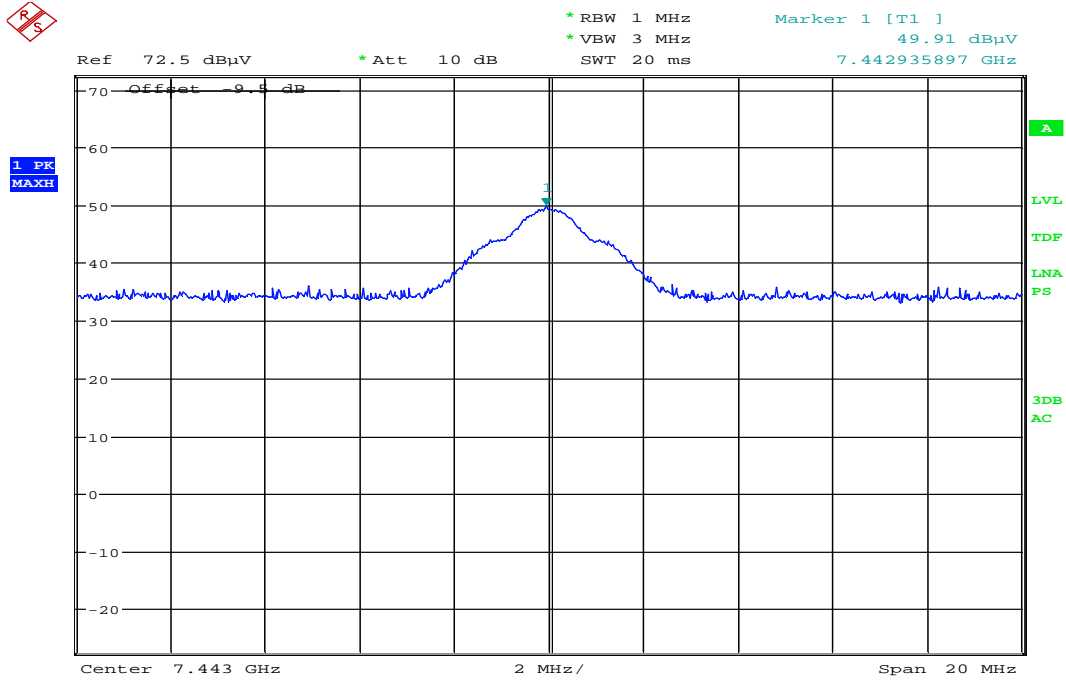
Date: 20.SEP.2012 14:37:52

Radiated Emissions, 7209 MHz, EUT V, Ant 1, HP, d=1m



Date: 20.SEP.2012 13:54:57

Radiated Emissions, 7323 MHz, EUT V, Ant 1, HP, d=1m



Date: 20.SEP.2012 14:39:18

Radiated Emissions, 7443 MHz, EUT V, Ant 1, HP, d=1m

4.6 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Test Performed By: Frode Sveinsen	Date of Test: 14 Sept 2012
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Test Results: Passed

Measured and Calculated Data:

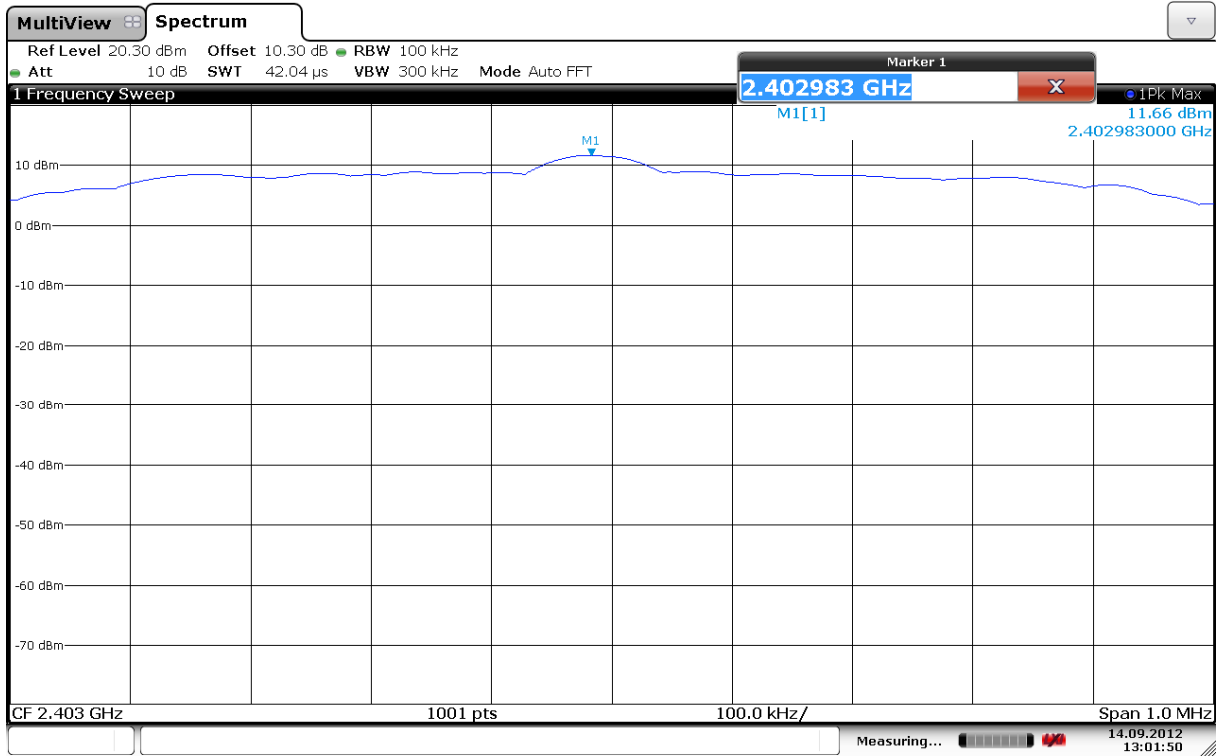
The measurement procedures PKPSD described in KDB 558074 D01 v01 was used.

Carrier Frequency (MHz)	Power Spectral Density (dBm)	
	Measured 100kHz	Corrected Value
2403	11.7	-3.5
2441	10.7	-4.5
2481	9.6	-5.6

The measured values with 100kHz RBW are corrected by a Bandwidth Correction Factor of -15.2 dB.

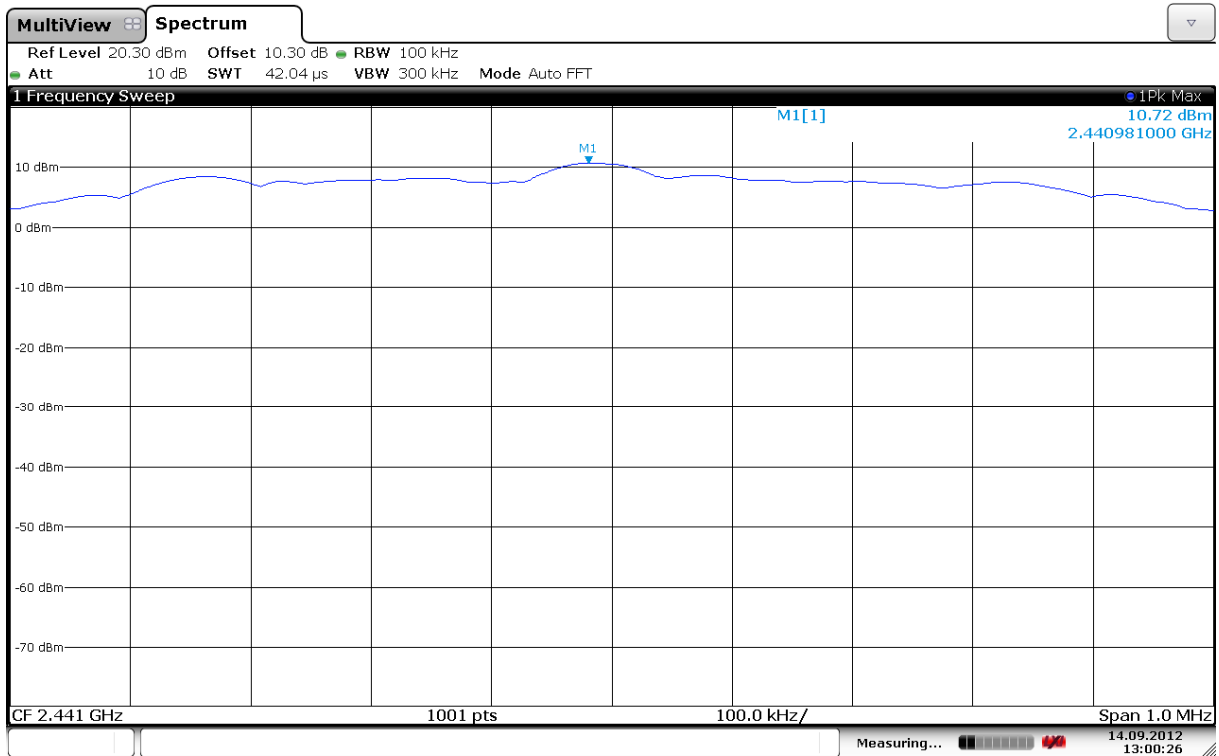
Requirements:

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



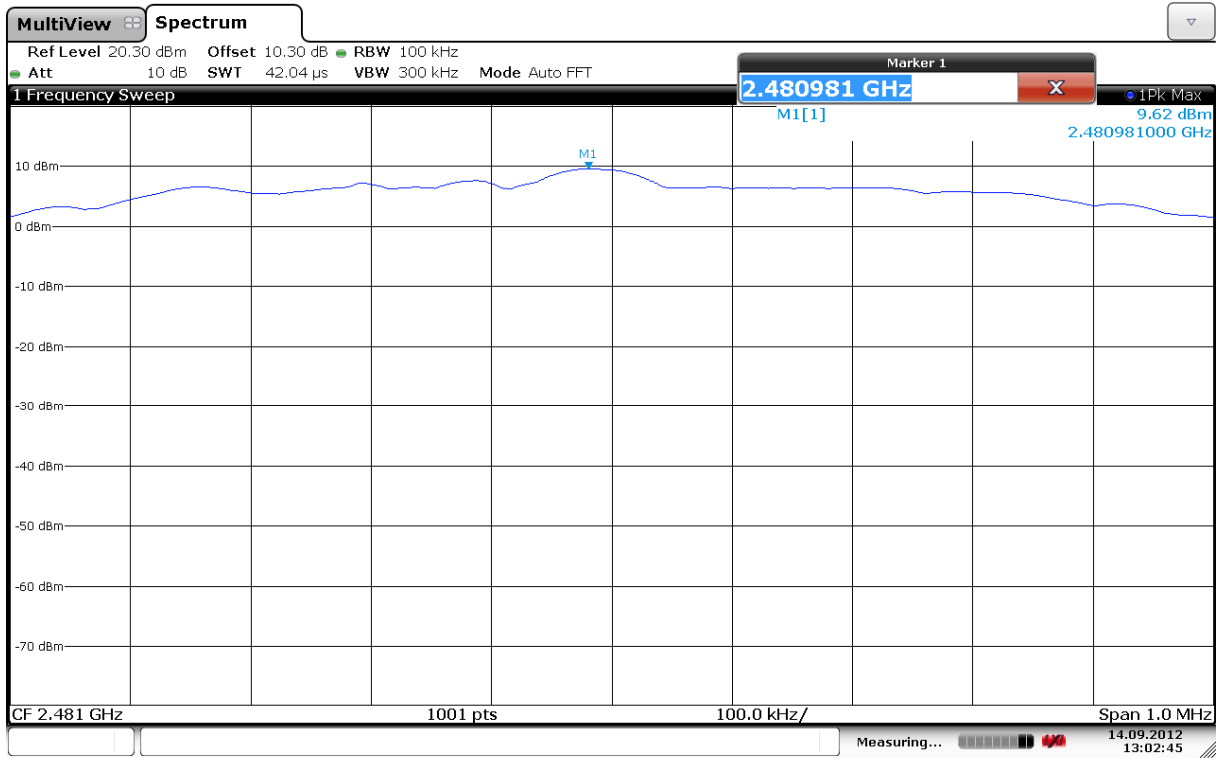
Date: 14.SEP.2012 13:01:51

PSD, 2403 MHz



Date: 14.SEP.2012 13:00:27

PSD, 2441 MHz



Date: 14.SEP.2012 13:02:45

PSD, 2481 MHz

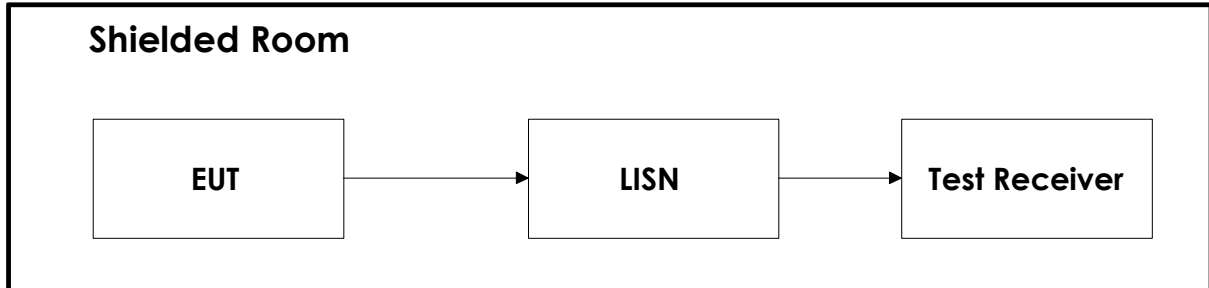
5 LIST OF TEST EQUIPMENT

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.

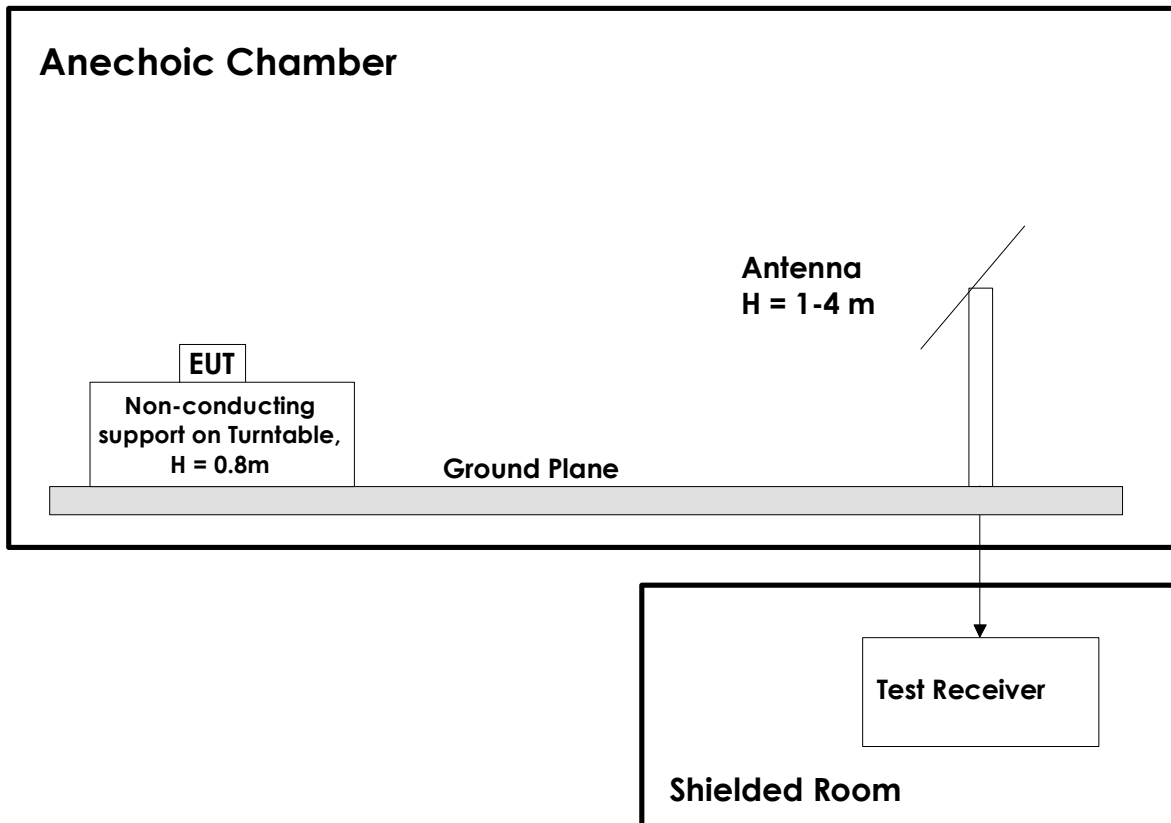
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2012-06	2013-06
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2012-06	2013-06
3	4768-10	Attenuator	Narda	LR 1356	Cal b4 use	
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
5	JB3	BiLog Antenna	Sunol Sciences	N-4525	2011.09.07	2014.09.07
6	LNA6900	Preamplifier	Teseq	LR 1593	2010.11.16	2012.11.16
7	3115	Horn Antenna	EMCO	LR 1330	2010.08.05	2013.08.05
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2011.09.27	2012.09.27
9	643	Antenna Horn	Narda	LR 093	2009.01.26	2014.01.26
10	PM7320X	Antenna Horn	Sivers Lab	LR 102	2009.01.26	2014.01.26
11	DBF-520-20	Antenna Horn	Systron Donner	LR 100	2009.01.26	2014.01.26
12	638	Antenna Horn	Narda	LR 1480	2010.06.17	2013.06.17
14	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 285	2010.10.08	2013.10.08

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



6.3 Conducted Tests

