



Test report no. : 219868-3

Item tested : ATW-R1100

Type of equipment : 2.4 GHz Wireless Receiver

FCC ID : JFZR1100

Client : Audio-Technica U.S., Inc.

FCC Part 15.247

Digital Transmission System

RSS-210, Issue 8

Low Power Licence-Exempt
Radiocommunication Devices

17 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: 38

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 U.S., Inc.
FCC ID :	JFZR1100
Industry Canada ID :	1752B-R1100
Model/version :	ATW-R1100
Serial number :	Radiated Sample: 017
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
Rated Output Power :	0.023 Watt
Type of Power Supply :	AC Adaptor Model: 3A-068WU12
Antenna Connector :	None
Number of Antennas :	2
Antenna Diversity Supported :	Yes
Desktop Charger :	N/A

Description of Test Item

The EUT is the receiver for a wireless microphone.

Theory of Operation

The EUT is a digital wireless receiver for a wireless microphone; it also transmits a signal back to the microphone to confirm the connection. The system uses digital modulation and automatically selects the least disturbed of the available channels.

Exposure Evaluation

The EUT is a fixed or mobile device. The EUT must be positioned at least 20 cm away from any persons when in use.

The EUT is exempted from RF Exposure Evaluation to Industry Canada requirements since the output power complies with the power levels of section 2.5.2 of RSS-102 Issue 4.

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	20.5 - 21.8 °C
Relative humidity:	38 - 48 %
Normal test voltage:	120 V AC

The values are the limit registered during the test period.

2.3 Test Period

Item received date:	2012-09-13
Test period :	from 2012-09-13 to 2012-09-21

2.4 Test Engineer(s)

Frode Sveinsen

2.5 Test Equipment

See list of test equipment in clause 6.

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Audio Technica
Model No.: ATW-R1100

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 #: 219868-3

TESTED BY: Frode Sveinsen
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)	Complies
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)	Complies
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

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

It was checked that supply voltage variations have no influence on measured values, neither conducted nor radiated.

3.5 Family List Rational

Not Applicable.

4 TEST RESULTS

4.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: Frode Sveinsen	Date of Test: 21 Sept 2012
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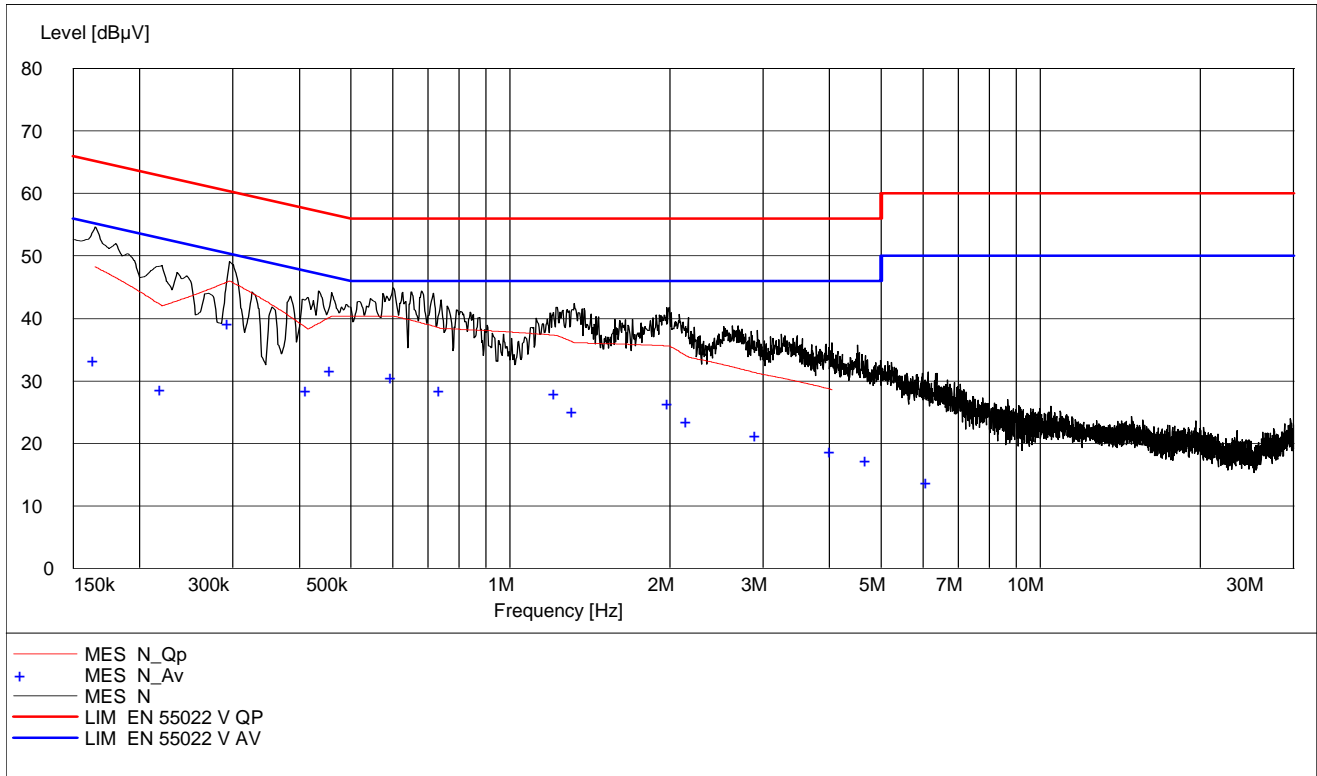
Measurement procedure: ANSI C63.4-2009 using 50 μ H/50 ohms LISN.

Test Results: Complies.

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

Highest measured value (L1 and N):

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.165000	48.20	10.10	65.20	17.00	QP	N	Pass
0.220000	42.00	10.10	62.80	20.80	QP	N	Pass
0.295000	46.00	10.10	60.40	14.40	QP	N	Pass
0.415000	38.30	10.20	57.50	19.20	QP	N	Pass
0.460000	40.40	10.20	56.70	16.30	QP	N	Pass
0.600000	40.40	10.20	56.00	15.60	QP	N	Pass
0.740000	38.40	10.20	56.00	17.60	QP	N	Pass
1.220000	37.30	10.20	56.00	18.70	QP	N	Pass
1.320000	36.10	10.20	56.00	19.90	QP	N	Pass
1.995000	35.60	10.20	56.00	20.40	QP	N	Pass
2.165000	33.80	10.30	56.00	22.20	QP	N	Pass
2.925000	31.20	10.30	56.00	24.80	QP	N	Pass
4.045000	28.60	10.40	56.00	27.40	QP	N	Pass
0.165000	33.30	10.10	55.20	21.90	AV	N	Pass
0.220000	28.70	10.10	52.80	24.10	AV	N	Pass
0.295000	39.30	10.10	50.40	11.10	AV	N	Pass
0.415000	28.60	10.20	47.50	18.90	AV	N	Pass
0.460000	31.70	10.20	46.70	15.00	AV	N	Pass
0.600000	30.60	10.20	46.00	15.40	AV	N	Pass
0.740000	28.60	10.20	46.00	17.40	AV	N	Pass
1.220000	28.00	10.20	46.00	18.00	AV	N	Pass
1.320000	25.20	10.20	46.00	20.80	AV	N	Pass
1.995000	26.40	10.20	46.00	19.60	AV	N	Pass
2.165000	23.60	10.30	46.00	22.40	AV	N	Pass
2.925000	21.30	10.30	46.00	24.70	AV	N	Pass
4.045000	18.70	10.40	46.00	27.30	AV	N	Pass
4.720000	17.30	10.40	46.00	28.70	AV	N	Pass
6.135000	13.90	10.50	50.00	36.10	AV	N	Pass



Connection Active, Maximum of phase L1 and N, 120V 60Hz

4.2 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)
Ch19, 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 14:18:18

Occupied Bandwidth, 2441 MHz

4.3 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

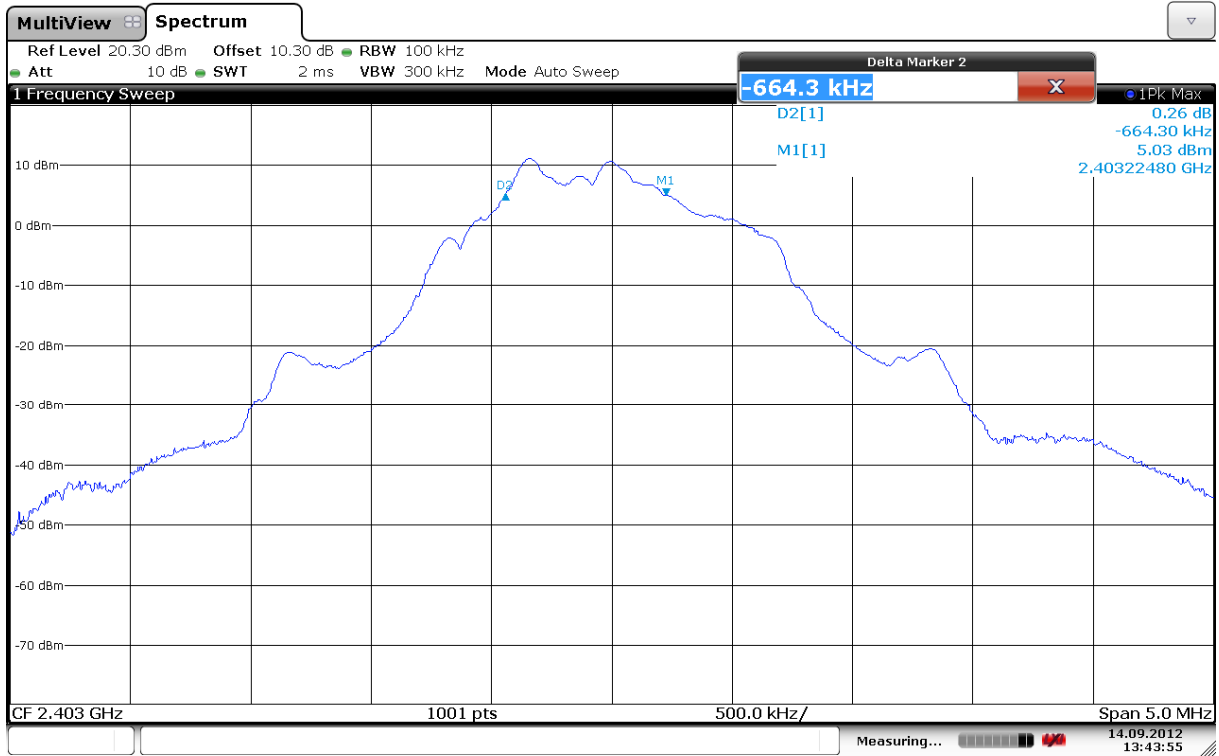
Measurement Data:

	Measured 6 dB Bandwidth (kHz)
Ch 01, 2403 MHz	664.3
Ch 19, 2441 MHz	854.1
Ch 40, 2481 MHz	824.2

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

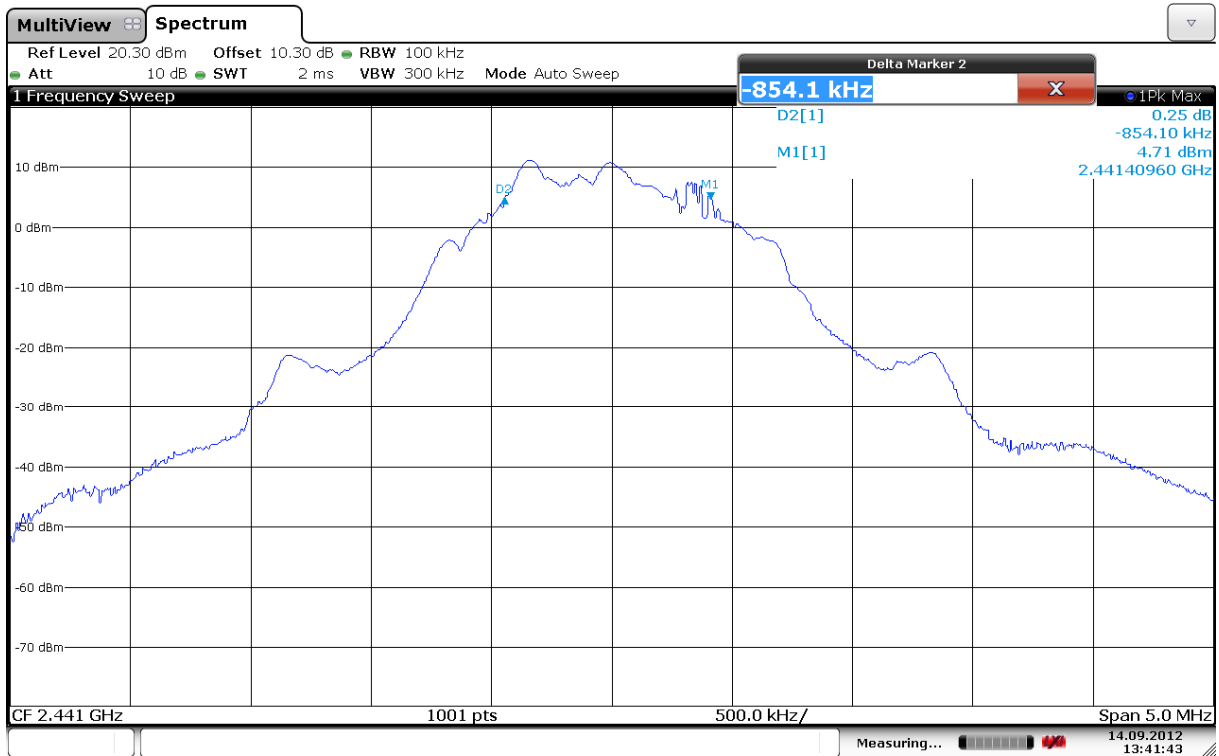
Requirements:

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



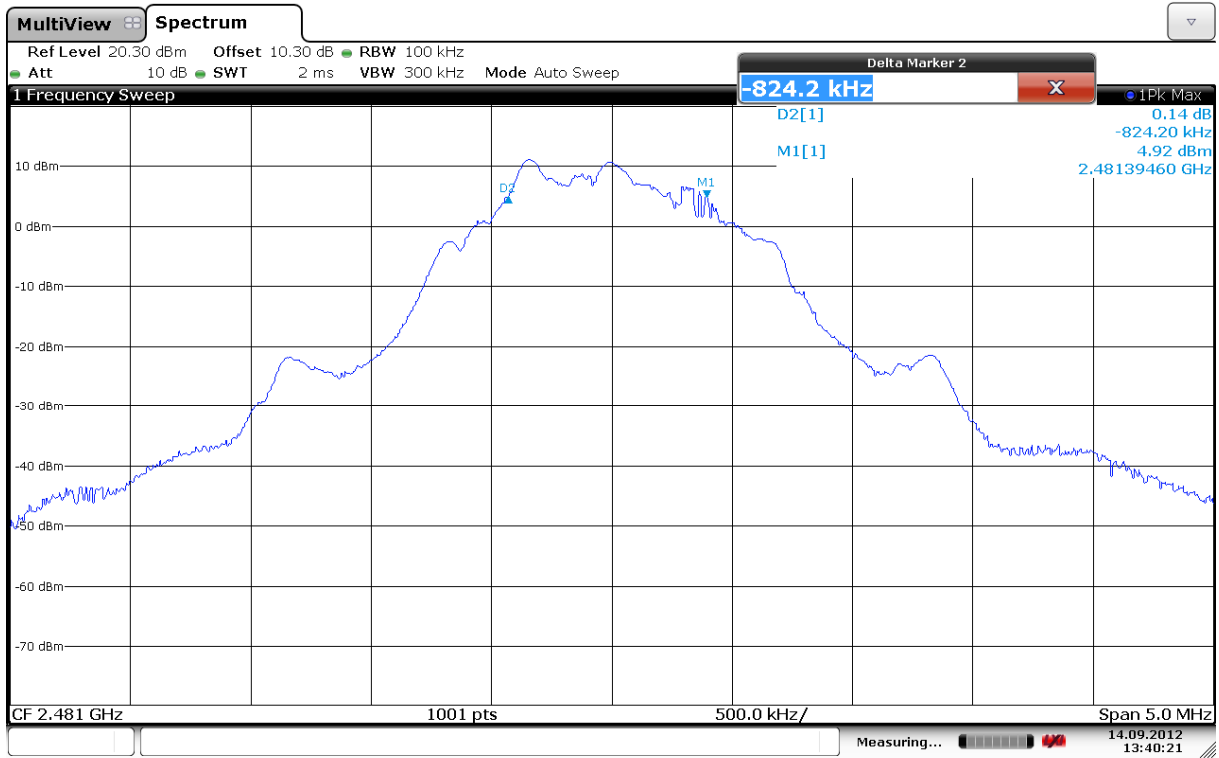
Date: 14.SEP.2012 13:43:56

6 dB Bandwidth, 2403 MHz



Date: 14.SEP.2012 13:41:43

6 dB Bandwidth, 2441 MHz



Date: 14.SEP.2012 13:40:22

6 dB Bandwidth, 2481 MHz

4.4 Peak Power Output

Para. No.: 15.247 (b)

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

Measurement Data:

Carrier Frequency	Maximum Conducted Output Power	Maximum EIRP	Maximum Antenna Gain
2403 MHz	0.023 W	0.076 W	5.2 dBi
2441 MHz	0.023 W	0.079 W	5.5 dBi
2481 MHz	0.021 W	0.048 W	3.6 dBi

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

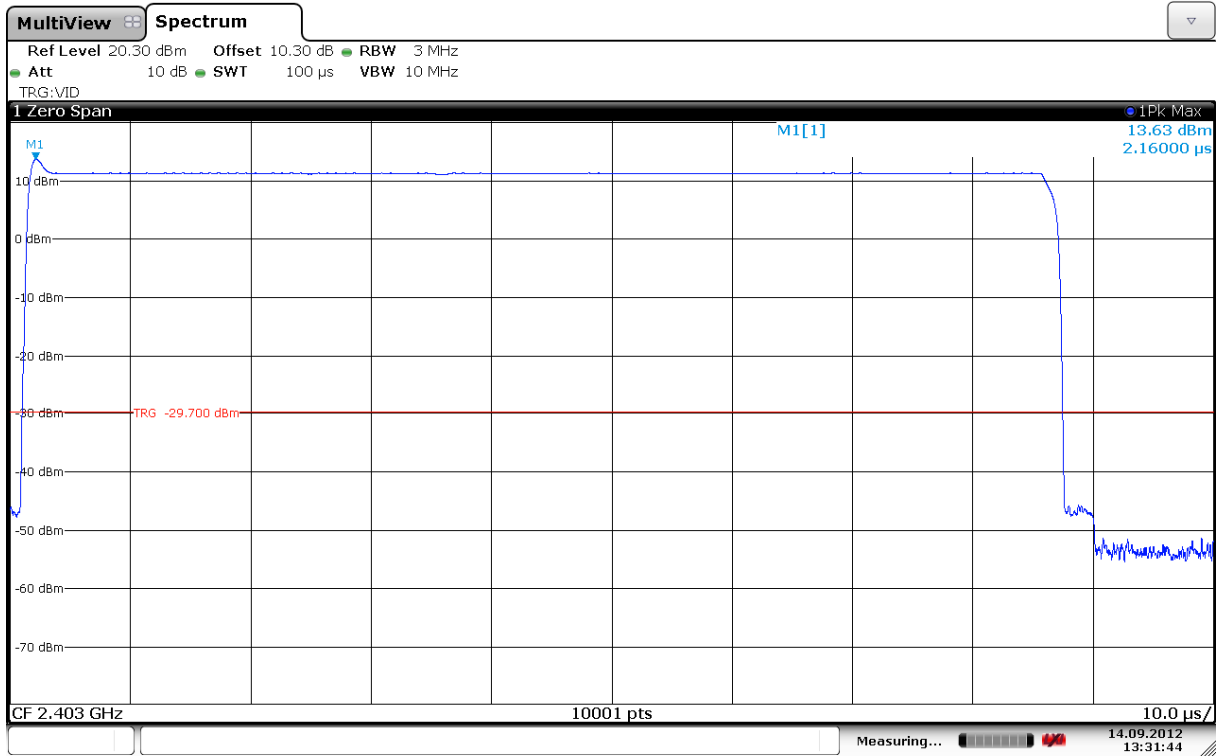
Type of antenna connector: N/A

Requirements:

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

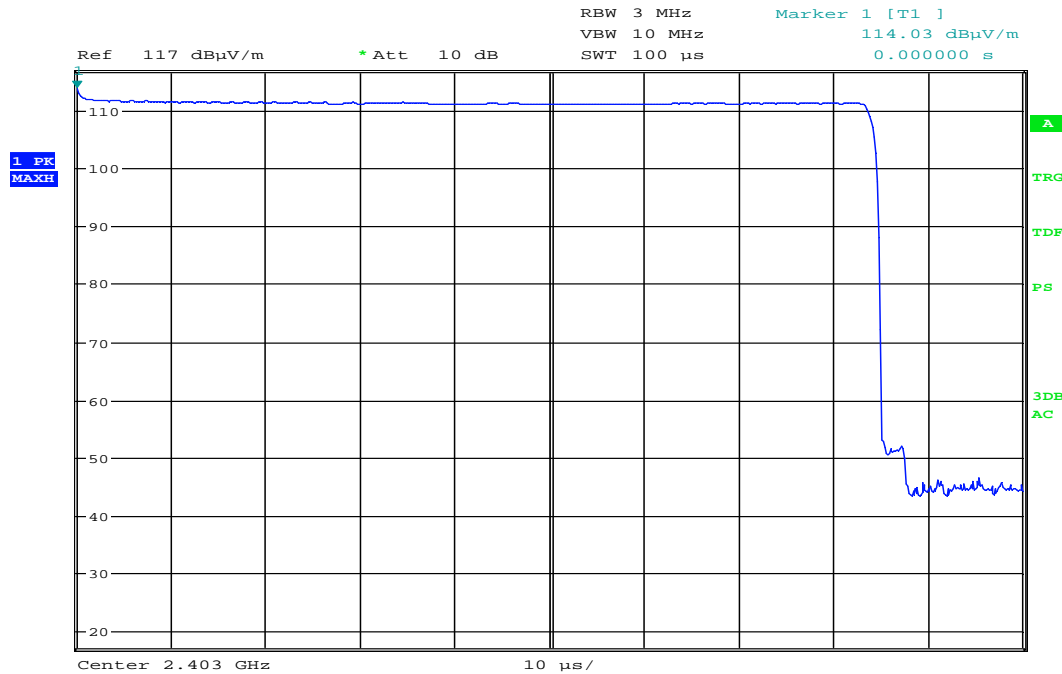
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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.



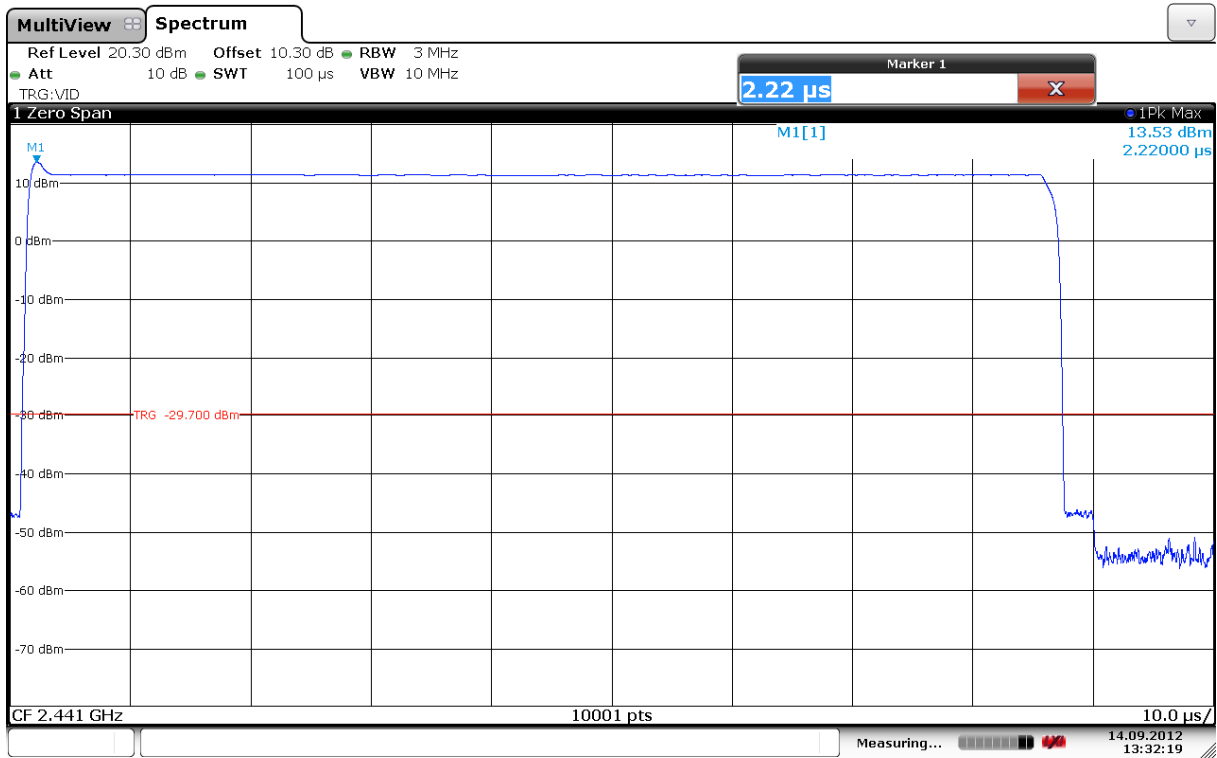
Date: 14.SEP.2012 13:31:44

Conducted Output Power, 2403 MHz



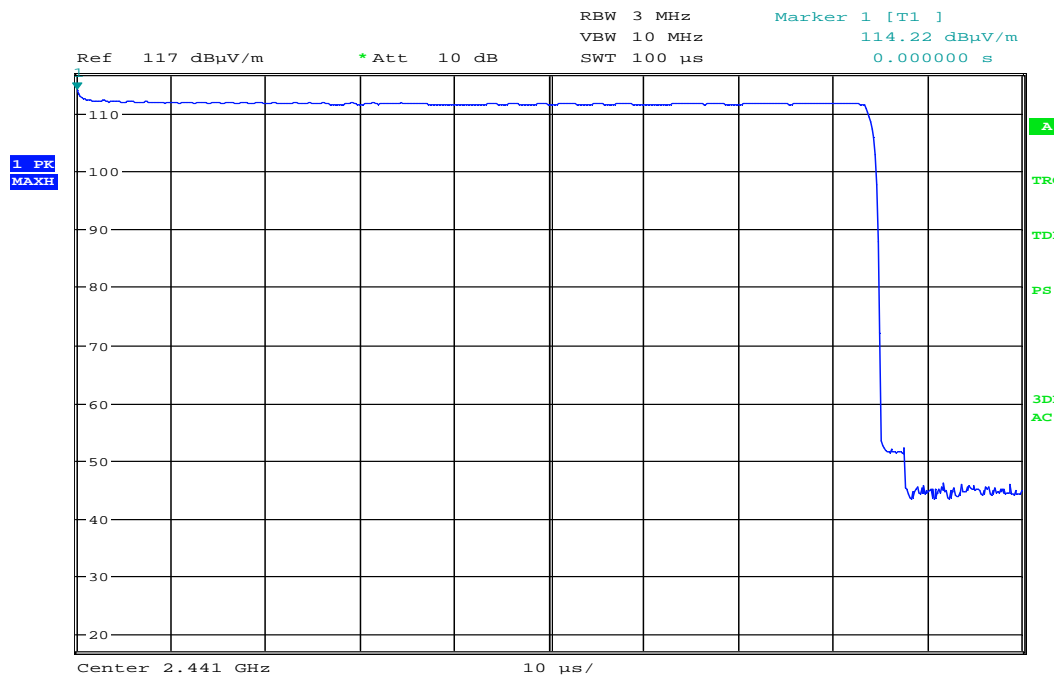
Date: 14.SEP.2012 10:11:11

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



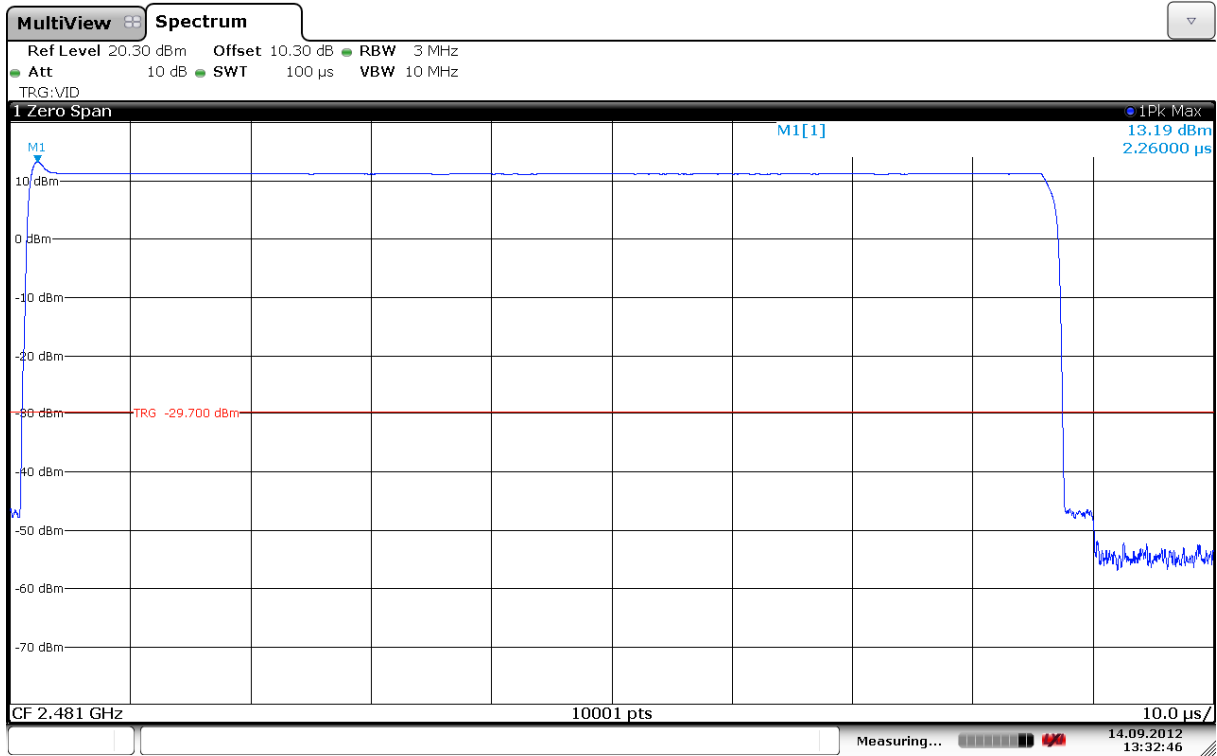
Date: 14.SEP.2012 13:32:19

Conducted Output Power, 2441 MHz



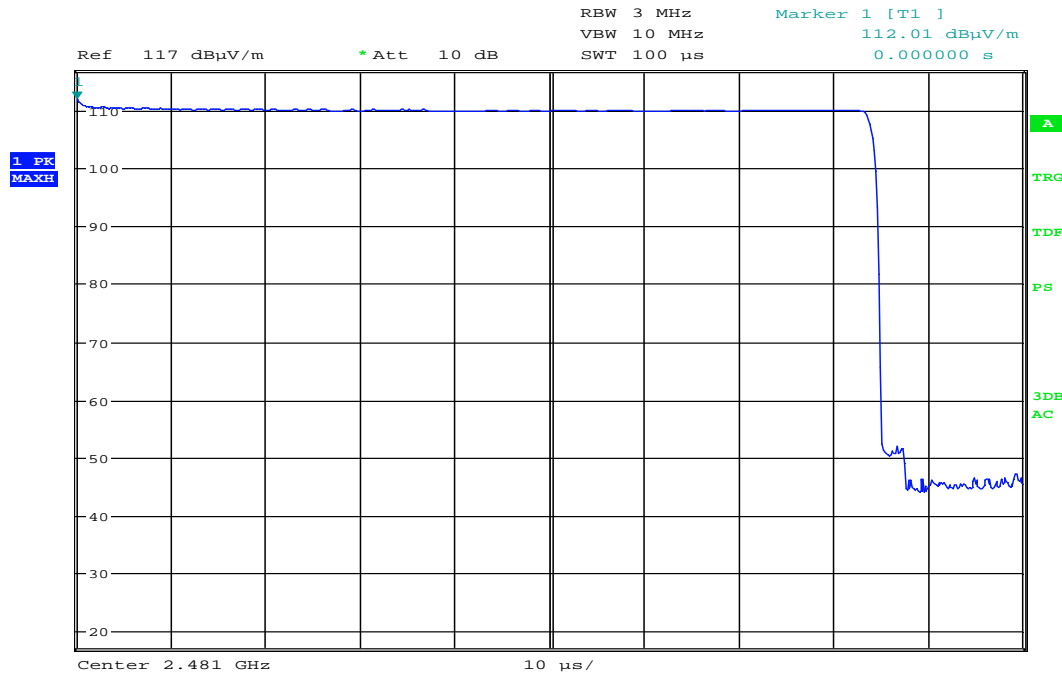
Date: 14.SEP.2012 10:04:24

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



Date: 14.SEP.2012 13:32:46

Conducted Output Power, 2481 MHz



Date: 14.SEP.2012 10:29:49

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

4.5 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Frode Sveinsen	Date of Test: 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	52.4	49.1	74	21.6	24.9
Average Detector	46.4	43.1	54	7.6	10.9

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: 111.5 dBμV/m

Delta marker 100 kHz BW: 62.4 dB

Field strength at 2.4835 GHz Peak: 49.1 dBμV/m

Field strength at 2.4835 GHz Average 43.1 dBμV/m

See attached plots.

Duty Cycle Correction Factor Calculation:

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

Maximum Duty Cycle: 50% (Value stated by manufacturer)

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

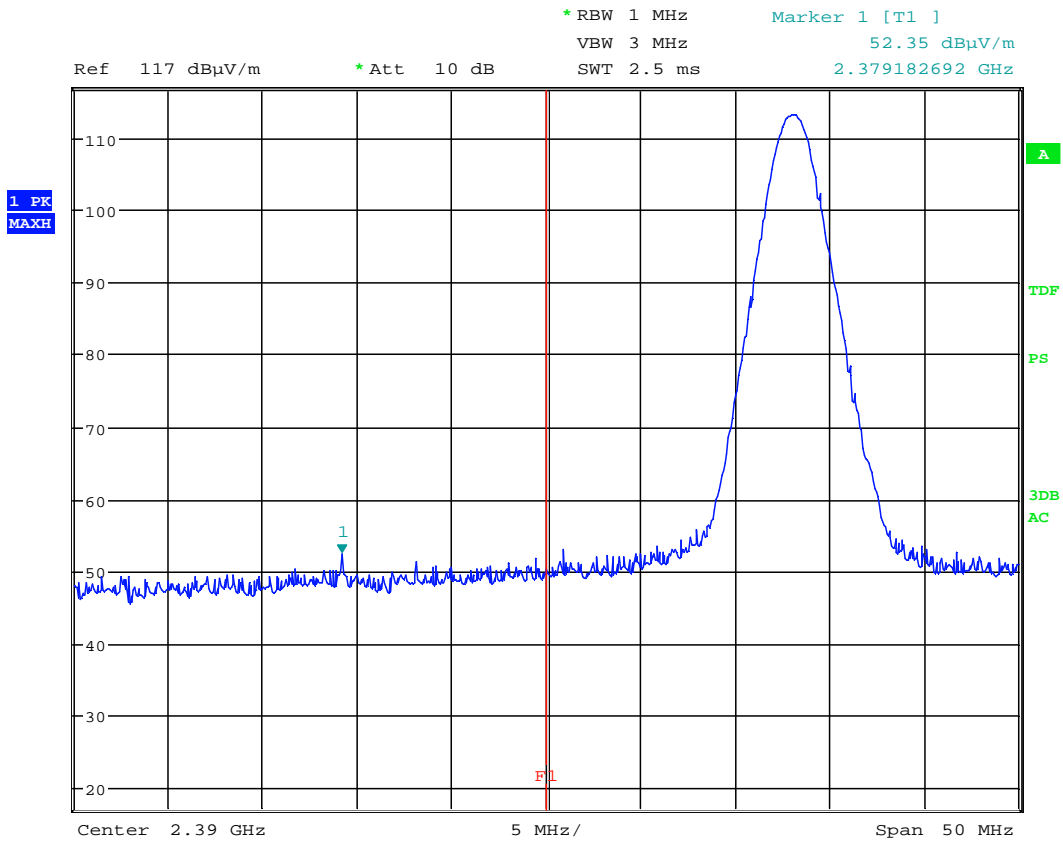
RF conducted power to 25 GHz see attached graph.

Maximum RF level outside operating band:

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

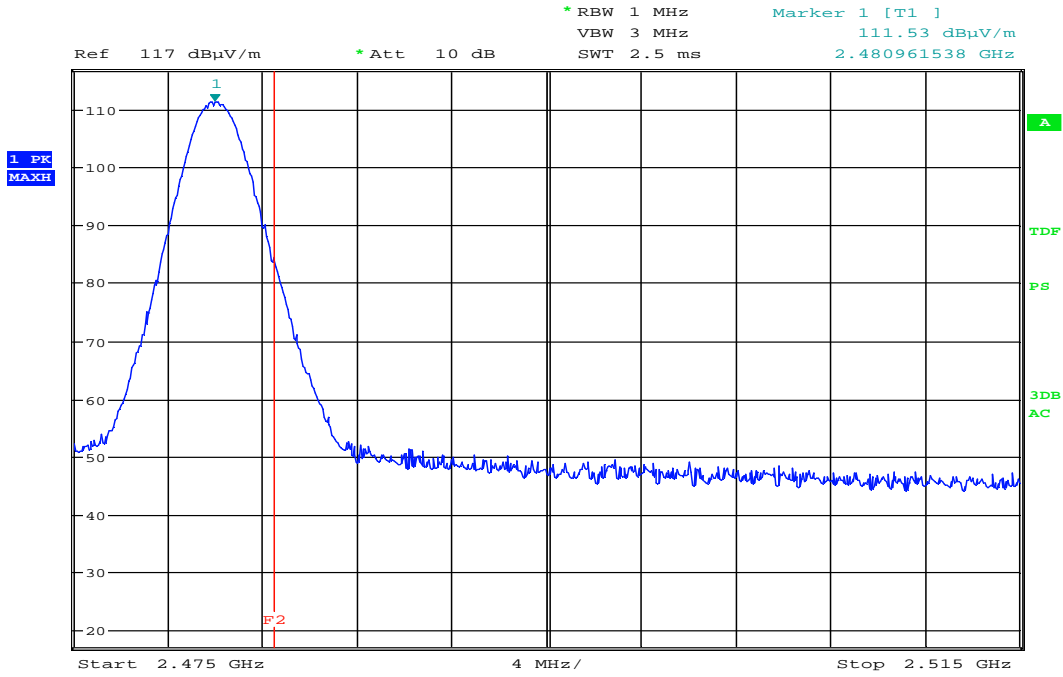
RF 2441MHz: >60 dB/C, margin >40 dB

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



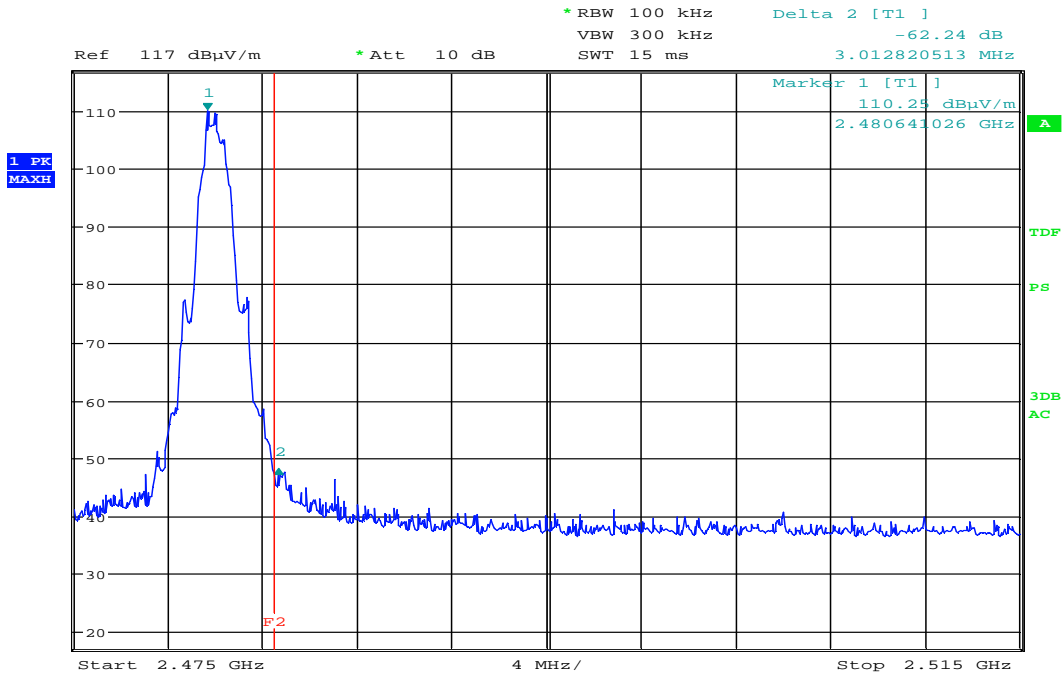
Date: 14.SEP.2012 10:14:56

Band Edge, Lower, Peak, 2403 MHz



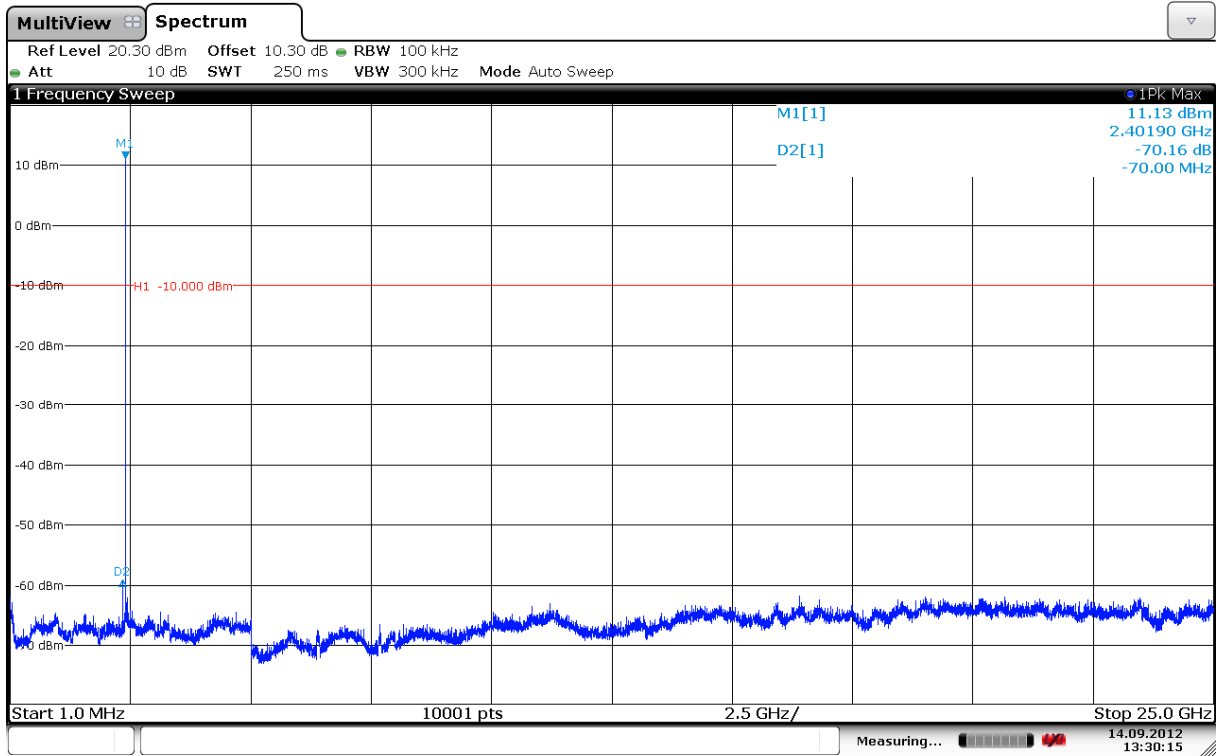
Date: 14.SEP.2012 10:32:06

Band Edge, Upper, Peak, 2481 MHz



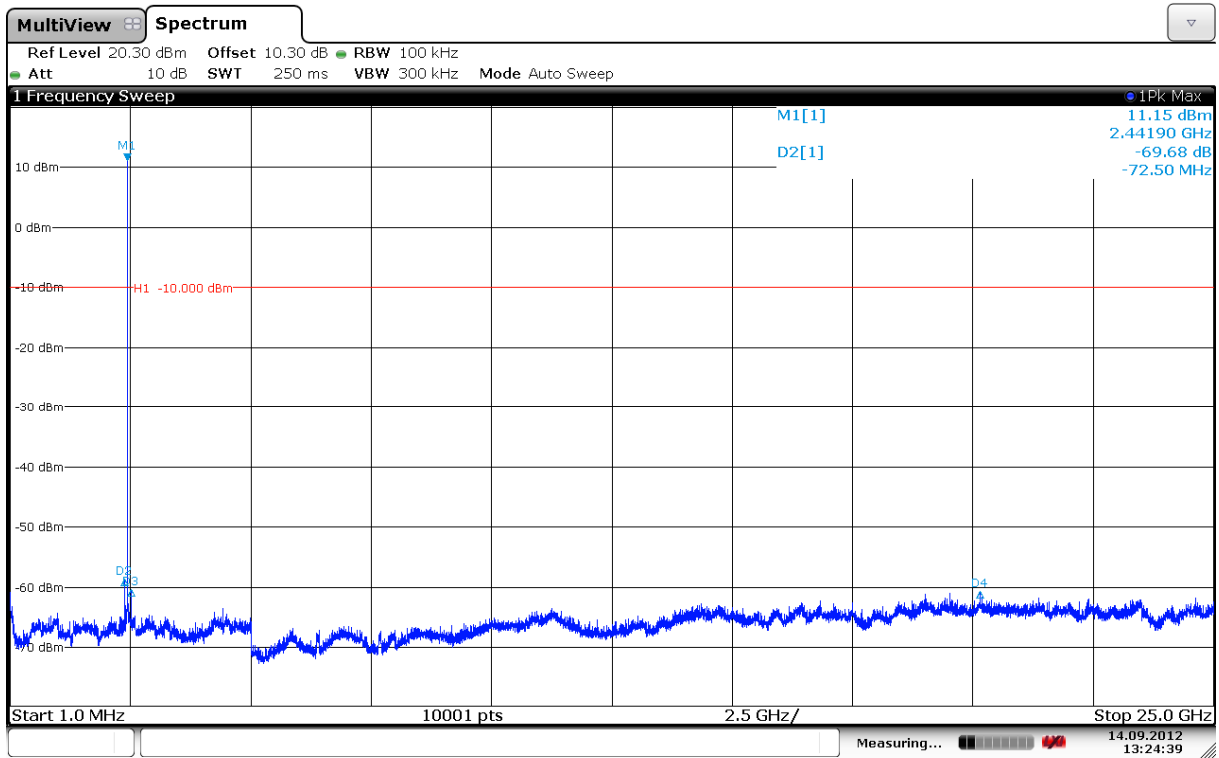
Date: 14.SEP.2012 10:34:32

Band Edge, Upper, Marker Delta, 2481 MHz



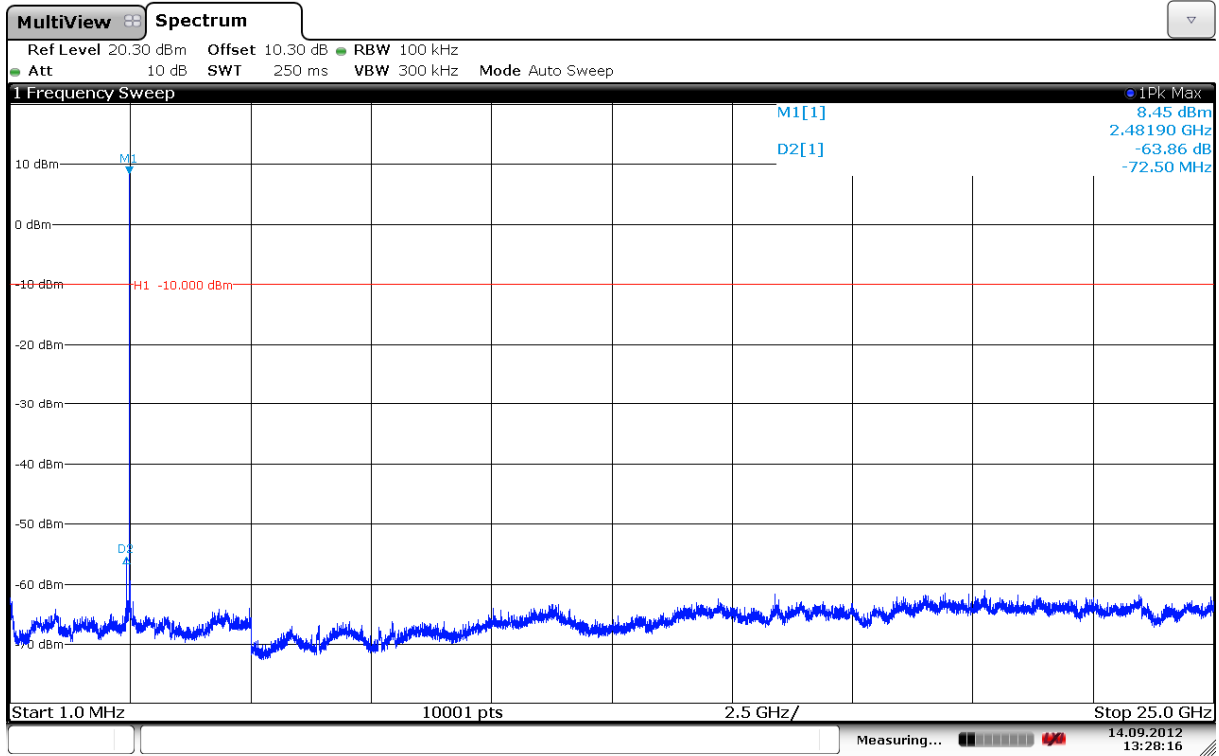
Date: 14.SEP.2012 13:30:15

Conducted Emissions 1 MHz – 25 GHz, 2403 MHz



Date: 14.SEP.2012 13:24:39

Conducted Emissions 1 MHz – 25 GHz, 2441 MHz



Date: 14.SEP.2012 13:28:17

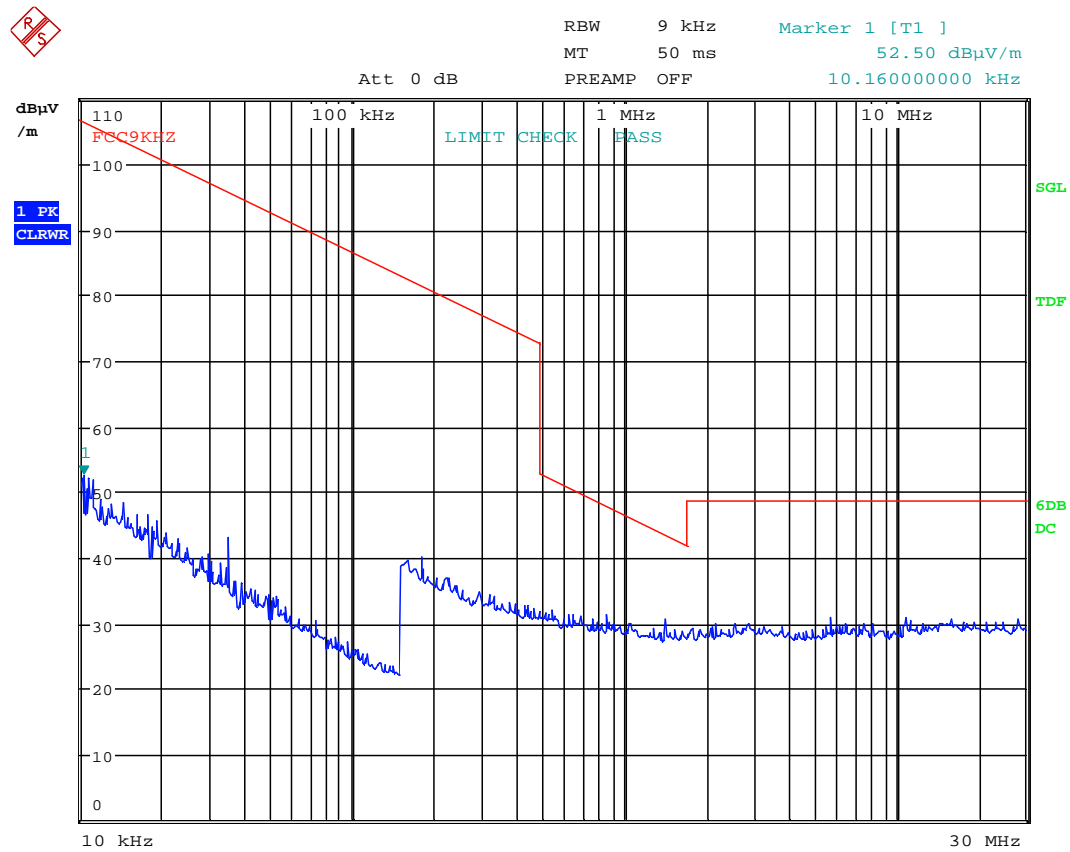
Conducted Emissions 1 MHz – 25 GHz, 2481 MHz

Radiated emissions 10 kHz -30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see plot.

Limit is converted to 10 m using 40 dB/decade according to 15.31 (f) (2).



Date: 20.SEP.2012 15:41:26

Radiated emission 30 – 1000 MHz.

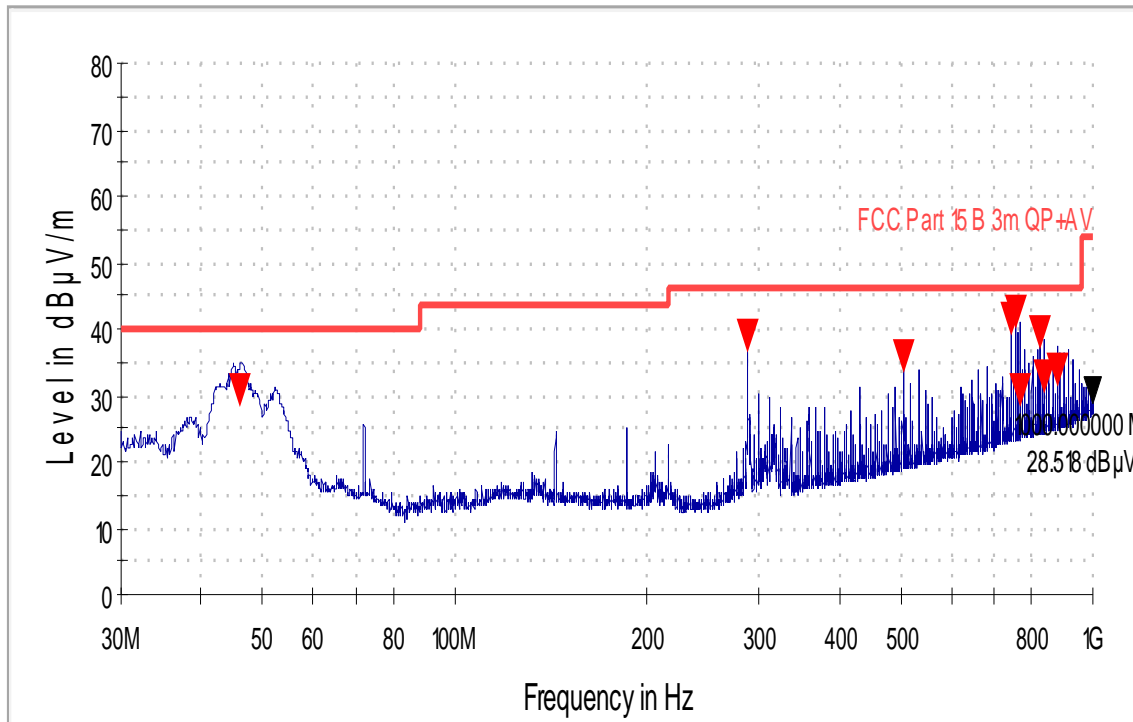
Detector: Quasi-Peak

Measuring distance 3 m.

Tested with active connection.

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Margin (dB)	Limit (dBµV/m)	Comment
46.170803	30.6	120.000	100.0	V	358.0	9.4	40.0	
288.000866	39.0	120.000	100.0	H	293.0	7.0	46.0	
503.806876	36.0	120.000	100.0	V	318.0	10.0	46.0	
743.421617	41.6	120.000	100.0	H	136.0	4.4	46.0	
755.709675	42.5	120.000	100.0	H	137.0	3.5	46.0	
768.069472	30.8	120.000	100.0	H	150.0	15.2	46.0	
829.437496	39.4	120.000	100.0	H	122.0	6.6	46.0	
841.773146	32.8	120.000	100.0	H	120.0	13.2	46.0	
878.638861	33.8	120.000	100.0	H	122.0	12.2	46.0	

See plot.



Radiated Emissions, 1-25 GHz

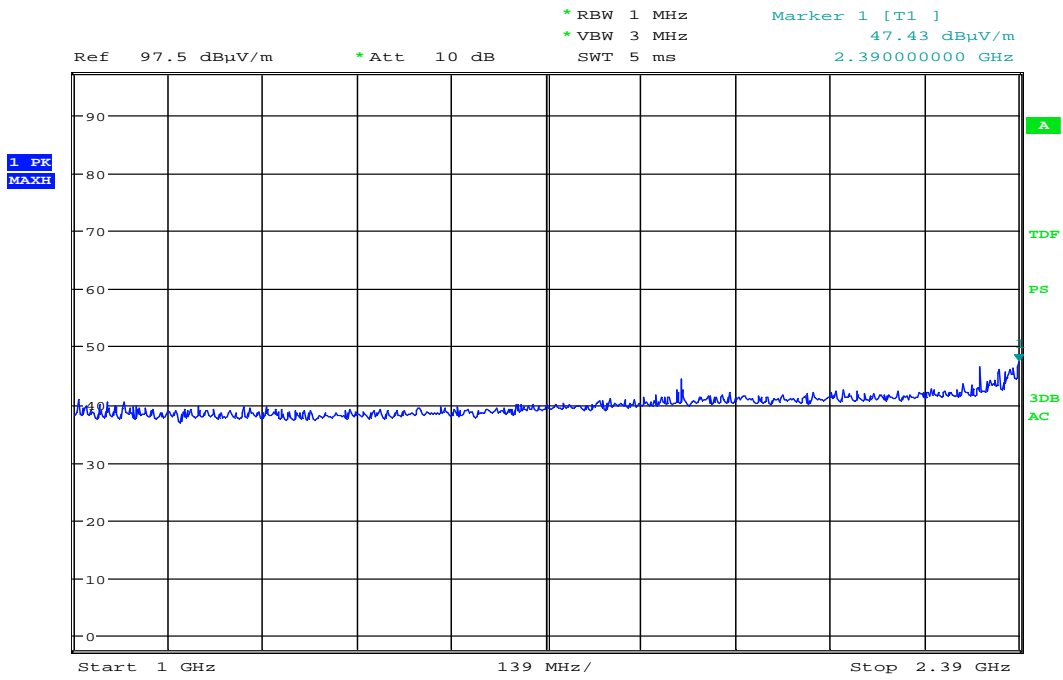
Measuring distance: 3m (1 – 8.5 GHz)
1m (8.5 – 18 GHz)

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

No spurious emissions were found.

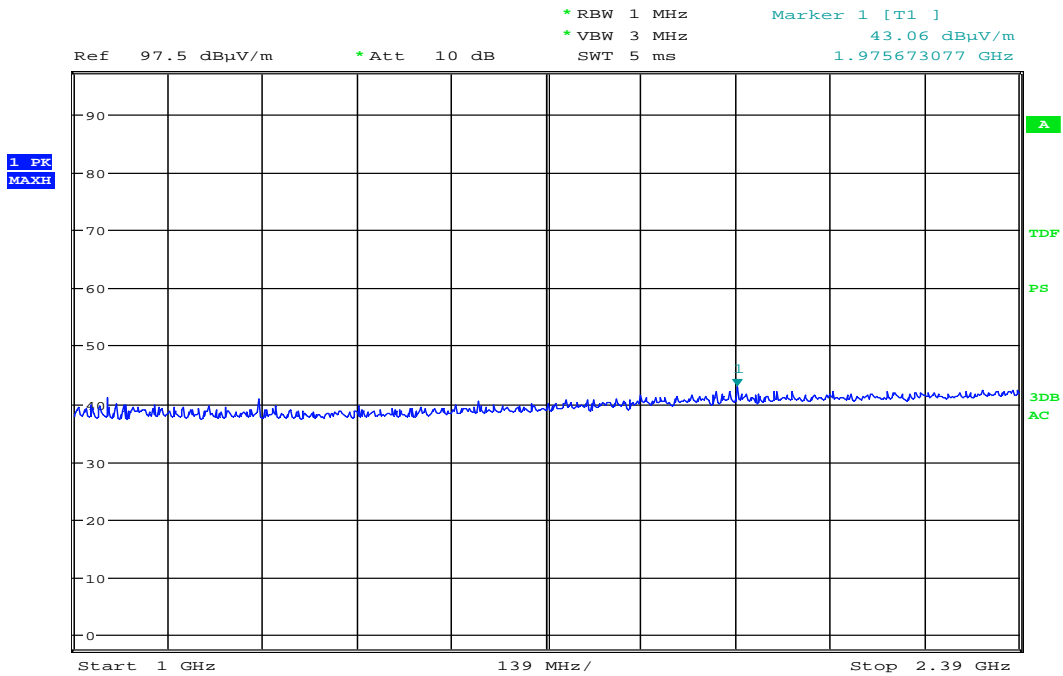
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

See plots.



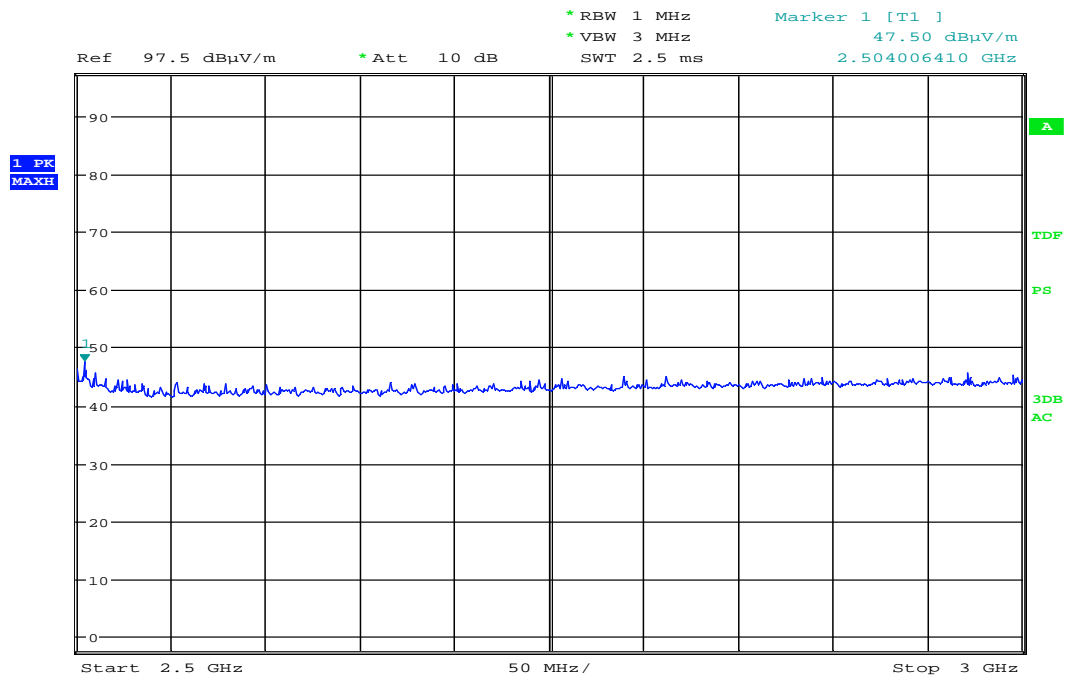
Date: 14.SEP.2012 10:17:50

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



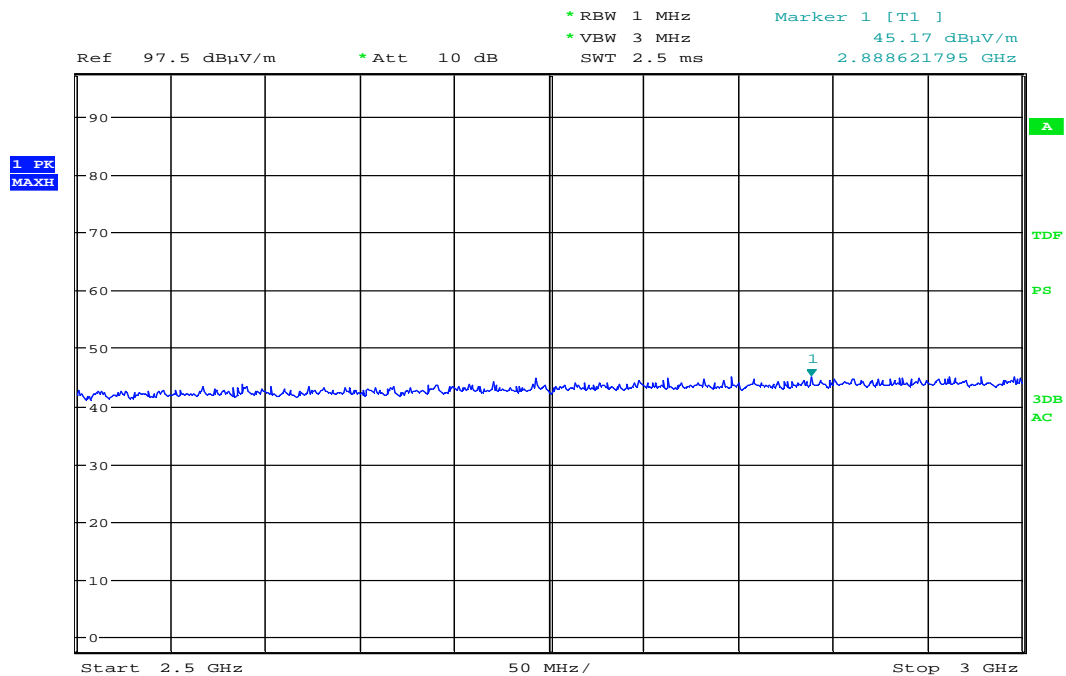
Date: 14.SEP.2012 10:19:41

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



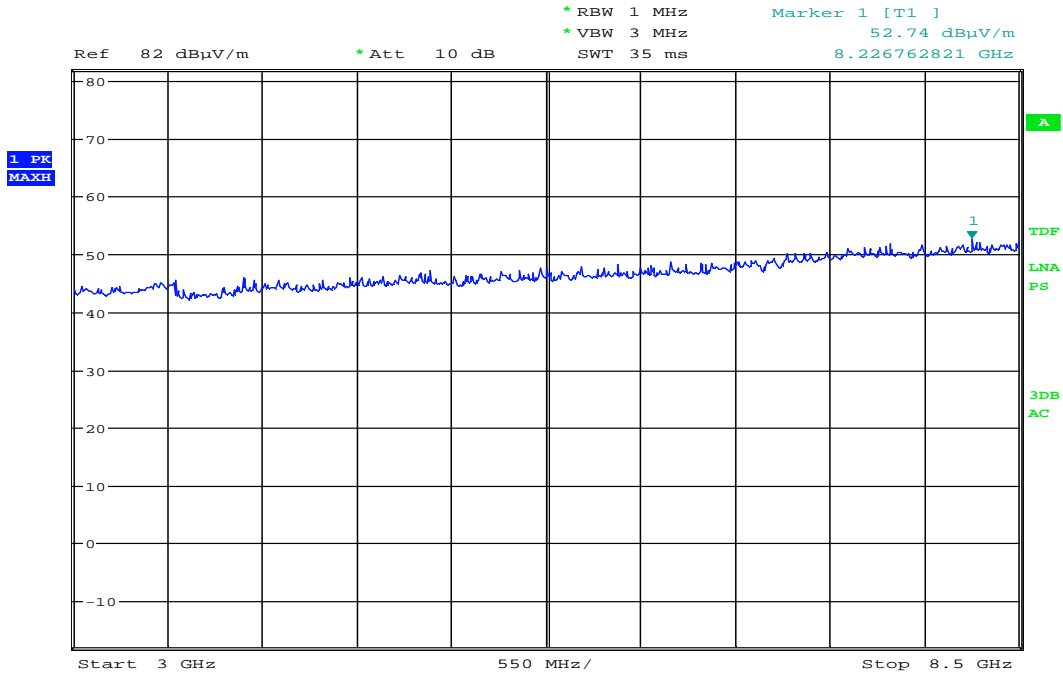
Date: 14.SEP.2012 10:23:38

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



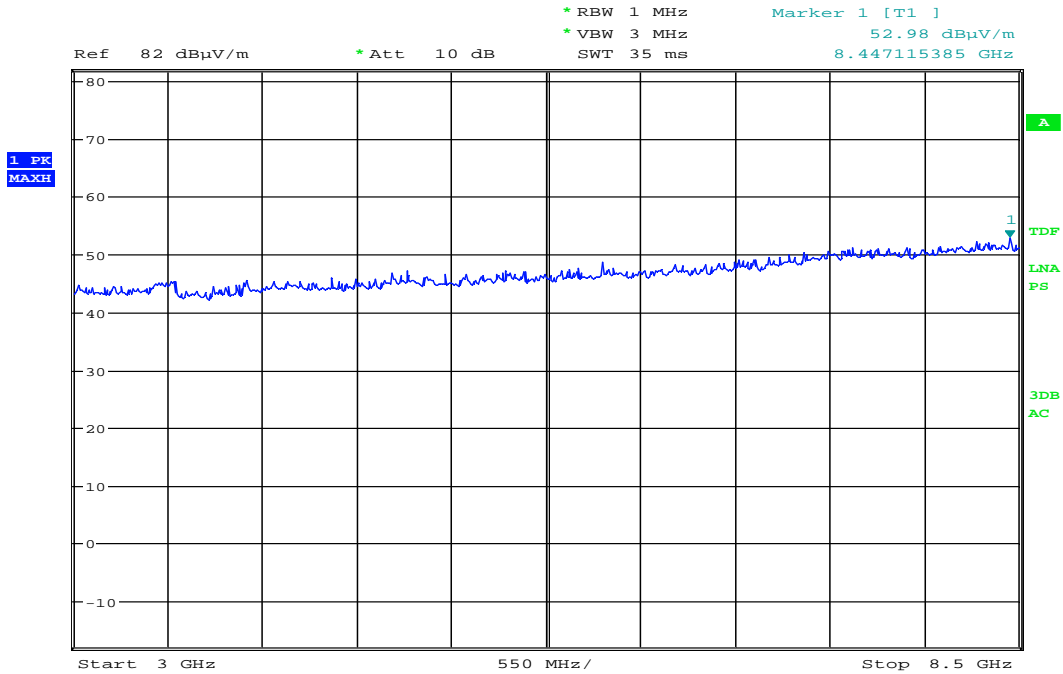
Date: 14.SEP.2012 10:25:30

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



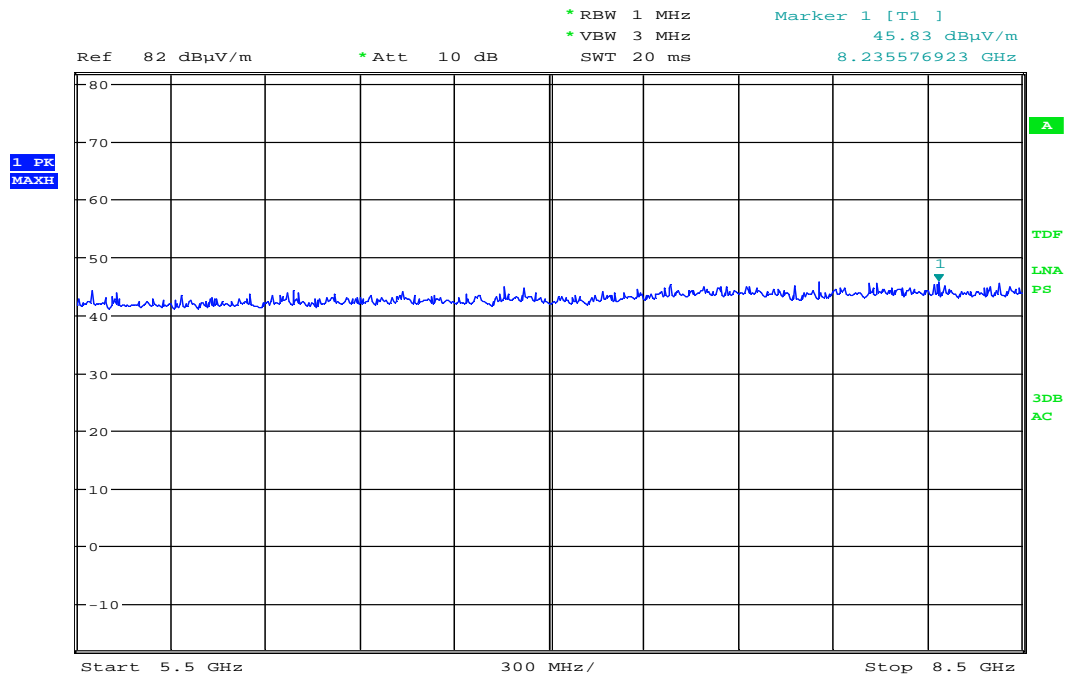
Date: 14.SEP.2012 10:38:56

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



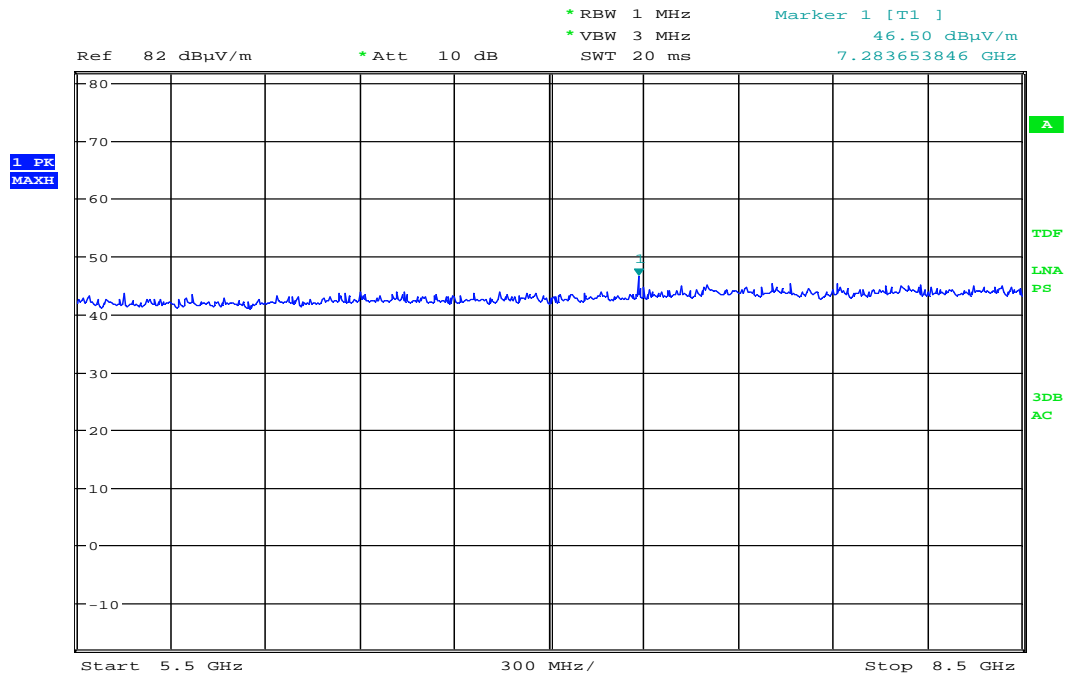
Date: 14.SEP.2012 10:40:39

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



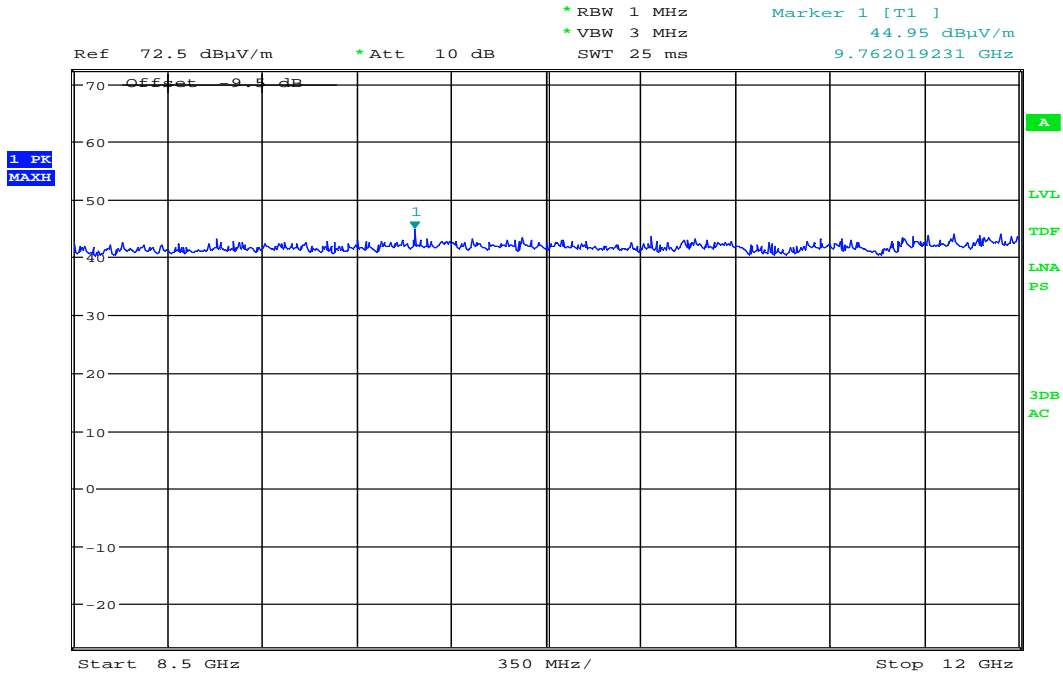
Date: 14.SEP.2012 10:59:55

Radiated Emissions, 5500 -8500 MHz, Ant 1, VP



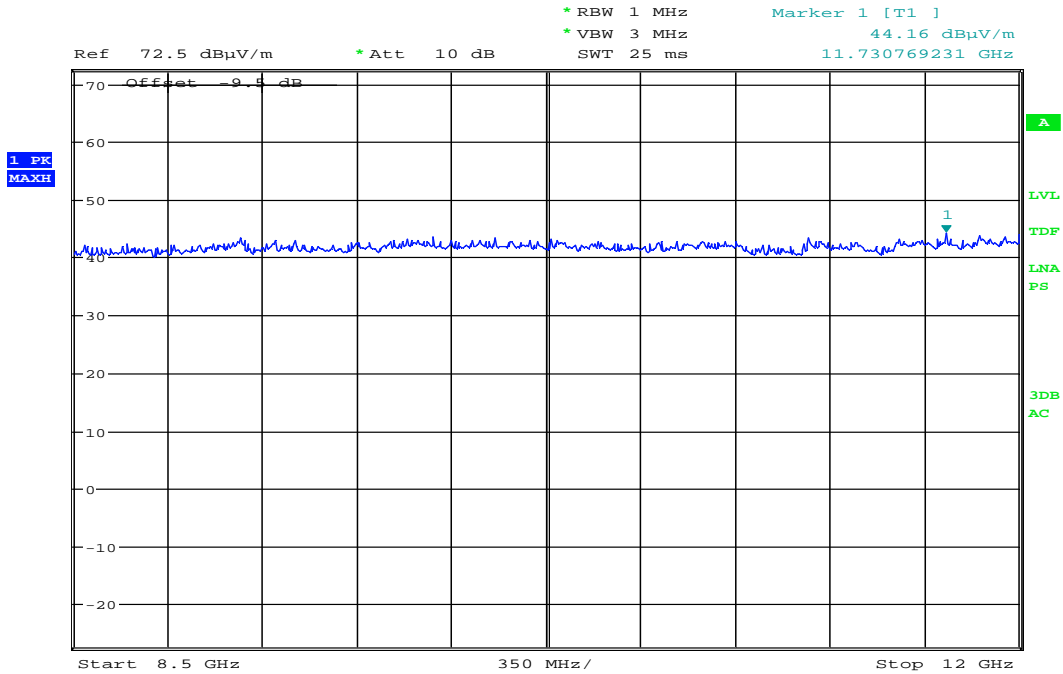
Date: 14.SEP.2012 11:01:38

Radiated Emissions, 5500 -8500 MHz, Ant 1, HP



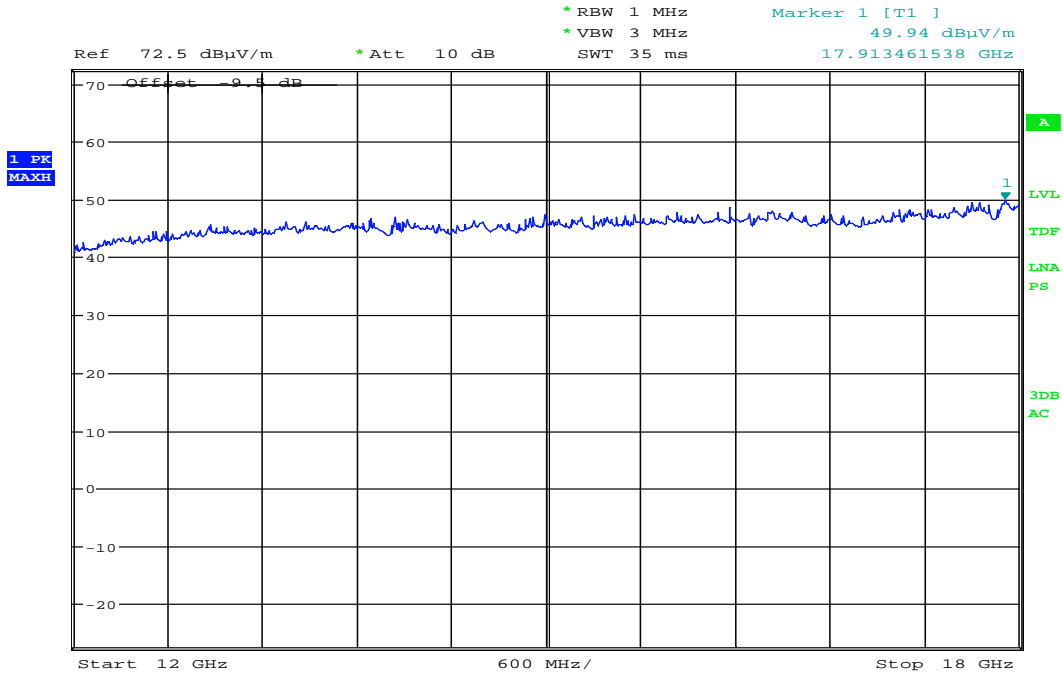
Date: 14.SEP.2012 11:14:35

Radiated Emissions, 8500 -12000 MHz, Ant 1, VP



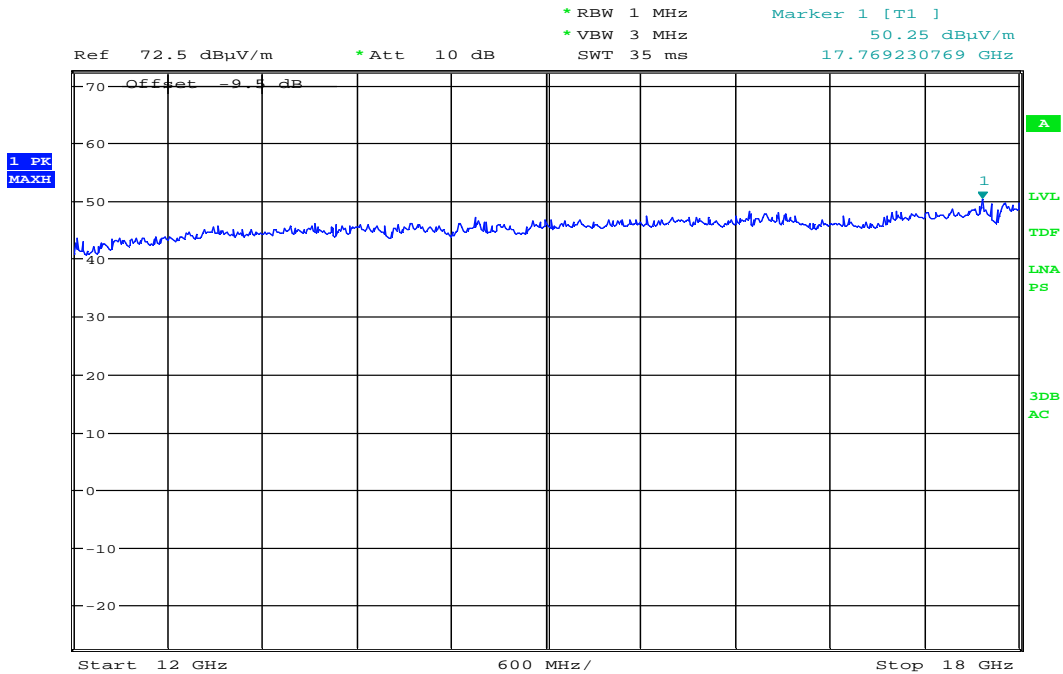
Date: 14.SEP.2012 11:16:18

Radiated Emissions, 8500 -12000 MHz, Ant 1, HP



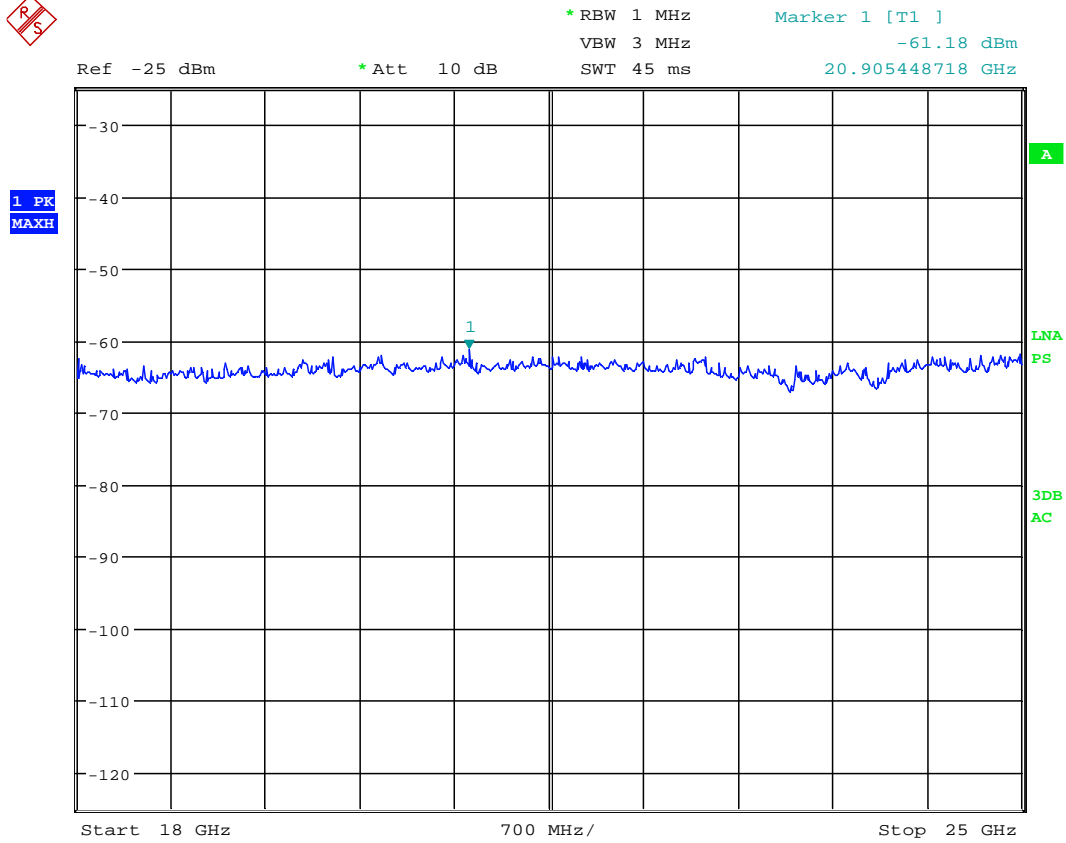
Date: 14.SEP.2012 11:49:21

Radiated Emissions, 12000 -18000 MHz, Ant 1, VP



Date: 14.SEP.2012 11:51:03

Radiated Emissions, 12000 -18000 MHz, Ant 1, HP



Date: 20.SEP.2012 15:47:09

Pre-scan, 18000 -25000 MHz

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:

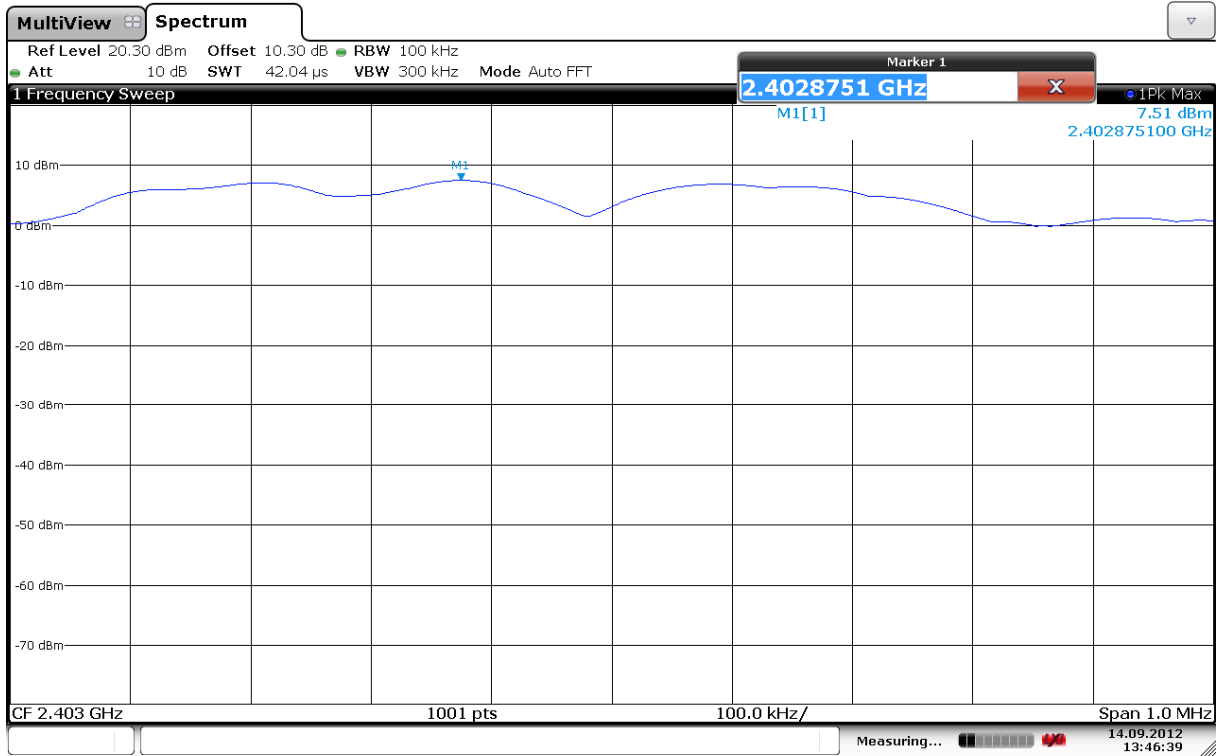
The measurement procedures PKPSD described in KDB 558074 D01 v01 was used.

Carrier Frequency (MHz)	Power Spectral Density (dBm)	
	Measured 100kHz	Corrected Value
2403	7.5	-7.7
2441	8.0	-7.2
2481	7.6	-7.6

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

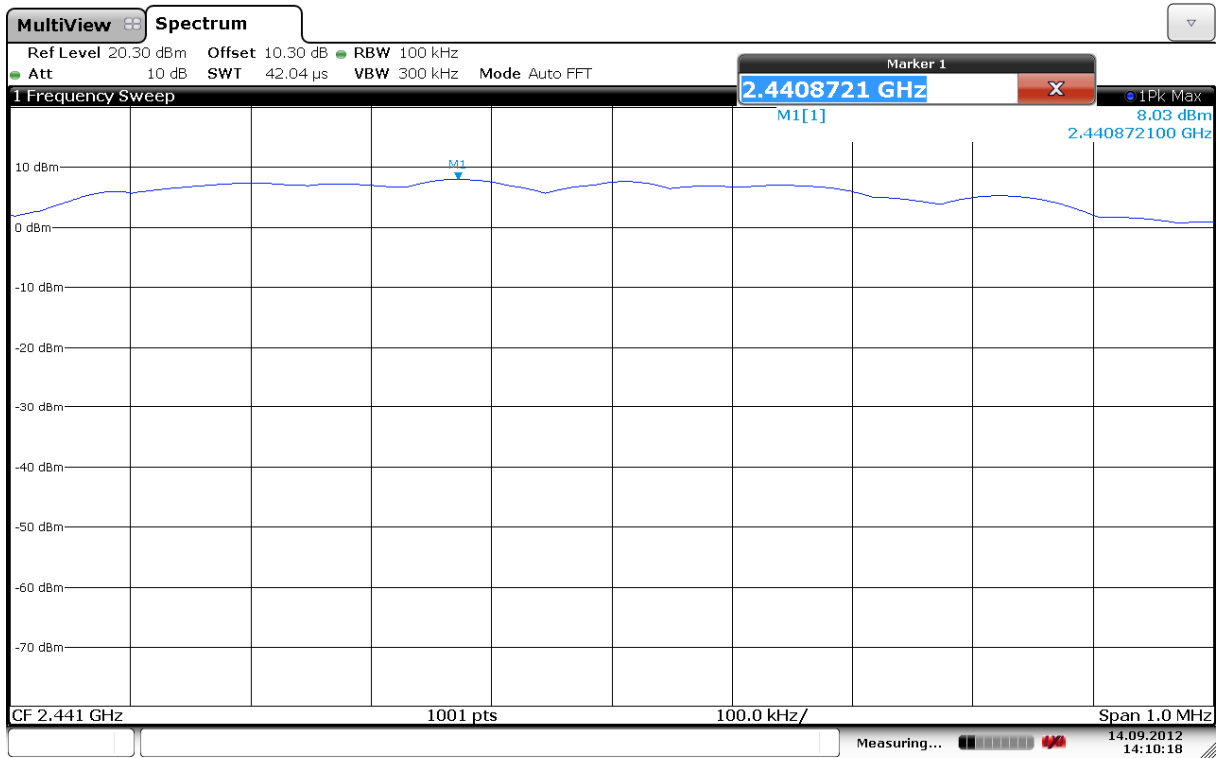
Requirements:

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



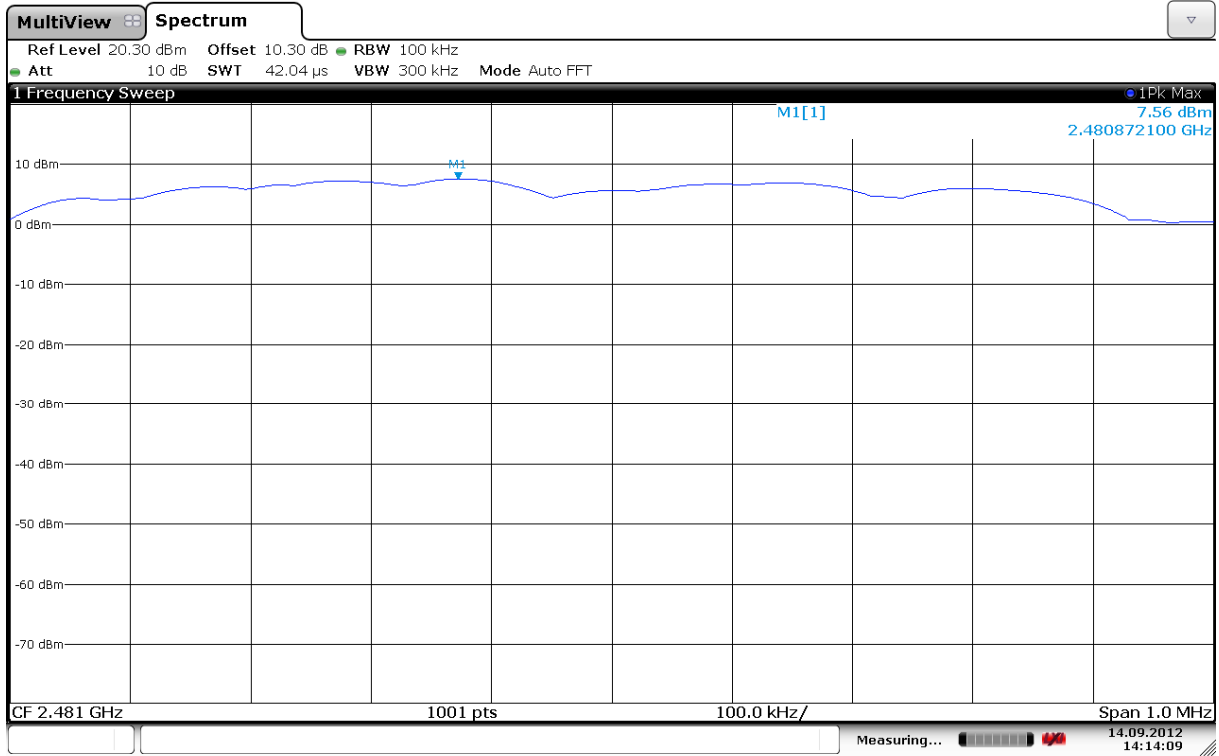
Date: 14.SEP.2012 13:46:40

PSD, 2403 MHz



Date: 14.SEP.2012 14:10:18

PSD, 2441 MHz



Date: 14.SEP.2012 14:14:09

PSD, 2481 MHz

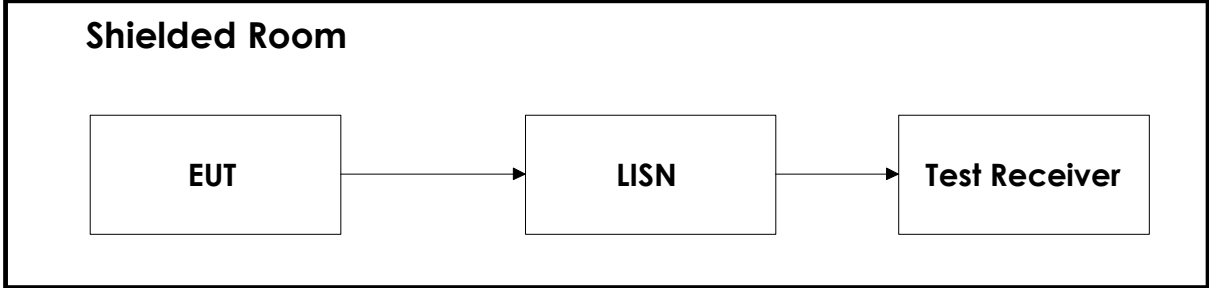
5 LIST OF TEST EQUIPMENT

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.

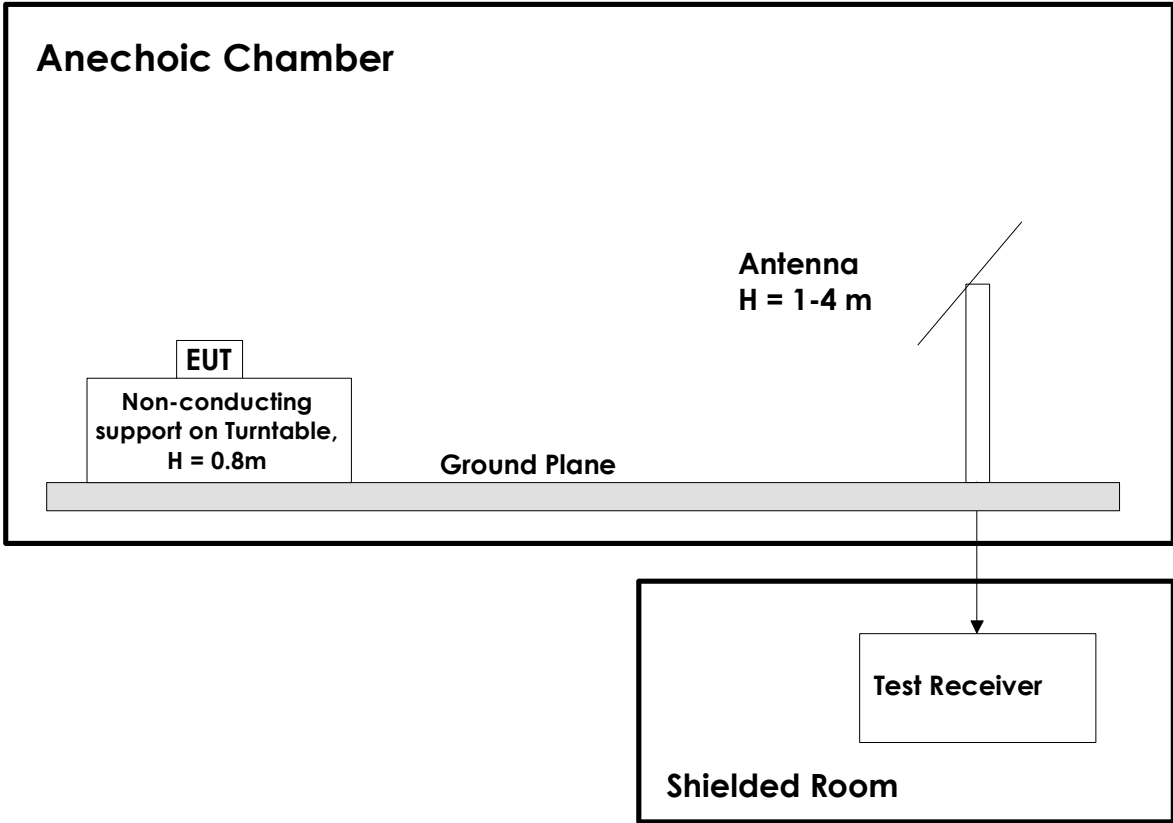
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2012-06	2013-06
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2012-06	2013-06
3	4768-10	Attenuator	Narda	LR 1356	Cal b4 use	
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal 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

