



Test report no. : 208688-4

Item tested : MI301M01

Type of equipment : 2.4GHz Transceiver

FCC ID : OG3MI301M01

Client : GRUNDFOS Holding A/S

FCC Part 15.247

Digital Transmission System

RSS-210, Issue 8

Low Power Licence-Exempt
Radiocommunication Devices

23 July 2013

Authorized by : 

Frode Sveinsen
Technical Verificator

CONTENTS

1 GENERAL INFORMATION 3

1.1 Testhouse Info 3

1.2 Client Information..... 3

1.3 Responsible Manufacturer (If other than client) 3

2 Test Information..... 4

2.1 Test Item 4

2.2 Test Environment..... 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 Rational 7

4 TEST RESULTS 8

4.1 Power-line Conducted Emissions 8

4.2 Minimum 6 dB Bandwidth 11

4.3 20 dB Bandwidth..... 15

4.4 Peak Power Output..... 16

4.5 Spurious Emissions (Radiated) 23

4.6 Power Spectral Density (PSD)..... 43

5 LIST OF TEST EQUIPMENT..... 46

6 BLOCK DIAGRAM 47

6.1 Power Line Conducted Emission 47

6.2 Test Site Radiated Emission..... 47

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: 47

1.2 Client Information

Name : GRUNDFOS Management A/S
Address : Poul Due Jensens Vej 7
DK-8850 Bjerringbro, Denmark
Telephone : +45 87501400

Contact:

Name : Bo Henriksen
Telephone : +45 87504936
E-mail : bohenriksen@grundfos.com

1.3 Responsible Manufacturer (If other than client)

Name : /
Address : /

2 Test Information

2.1 Test Item

| | |
|------------------------------------|---|
| Name : | R10000 Universal Dongle |
| Model/version : | MI301M01 |
| FCC ID : | OG3MI301M01 |
| IC : | 10447A-MI301M01 |
| Serial number : | 02-210-00140 (Radiated measurements) 03-218-00234 (Conducted measurements) |
| Hardware identity and/or version: | C sample |
| Software identity and/or version : | / |
| Frequency Range : | 2405 – 2480 MHz |
| Number of Channels : | 16 |
| Type of Modulation : | DSSS (O-QPSK) |
| Rated output power: | 0.00043 Watt |
| Data rate: | 250kbps |
| User Frequency Adjustment : | None |
| Type of Power Supply : | 3.7 VDC/ 560 mAh from a Lithium ion battery pack (rechargeable from USB port) |
| Antenna Connector : | Integrated chip antenna |
| Antenna Diversity Supported : | No |
| Desktop Charger : | / |

Description of Test Item

The MI301M01 is a dual RF transceiver with a separate 2.4 GHz radio module according to IEEE 802.15.4 with O-QPSK modulation (DSSS) and a Bluetooth module.

This test report does not cover the BT module (FCC ID: X3ZBTMOD5; IC: 8828A-MOD4).

The client supports the test pc model IBM ThinkPad (# L-no. 695) with Docklight test program for operate the EUT to enter the test mode and so on.

2.2 Exposure Evaluation

Test separation distance is assumed to be ≥ 5 mm. The EUT and BT module does not transmit simultaneously.

SAR exclusion criteria according to KDB 447498 D01 v05, clause 4.3.1):

$$(1 \text{ mW} / 5 \text{ mm}) \times (\sqrt{2.485 \text{ GHz}}) = 0.32 < 3.0$$

SAR exclusion criteria of BT Module (FCC ID: X3ZBTMOD5):

$$(3 \text{ mW} / 5 \text{ mm}) \times (\sqrt{2.485 \text{ GHz}}) = 0.95 < 3.0$$

The EUT fulfills the SAR Exclusion criteria according to KDB 447498 D01 v05 clause 4.3.1.

2.3 Test Environment

2.3.1 Normal test condition

| | |
|----------------------|---------------------------------|
| Temperature: | 21 – 23 °C |
| Relative humidity: | 31 – 50 % |
| Normal test voltage: | Secondary Battery (3.7V Li-Ion) |

The battery was fully charged during all tests.

The values are the limit registered during the test period.

2.4 Test Period

Item received date: 2012-05-29

Test period : from 2012-06-12 to 2012-07-05 and 2013-06-13

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.

- | | |
|---|---|
| <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 #: 208688-4

TESTED BY: Thomas Dangle
Thomas Dangle, Test engineer

DATE: 2013-06-14

Nemko Group authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any reproduction of parts of this report requires approval in writing from Nemko Group.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Group accepts no responsibility for damages suffered by any third party as a result of decisions made or actions based on this report.

3.2 Test Summary

| Name of test | FCC Part 15 reference | RSS-210 Issue 8 reference | Result |
|--|-------------------------------------|---------------------------|--------|
| Antenna Requirement | 15.203 | 7.1.2 (RSS-GEN) | Pass |
| Power Line Conducted Emission | 15.107(a) 15.207(a) | 7.2.4 (RSS-GEN) | Pass* |
| 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(e) | A8.2 | Pass |
| Spurious Emissions (Antenna Conducted) | 15.247(d) | A8.5 | Pass |
| Spurious Emissions (Radiated) | 15.247(d) 15.205(c) 15.209(a) | A8.5 | Pass |

* Tested with IBM ThinkPad and Lenovo AC adapter.

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 Power-line Conducted Emissions

Para. No.: 15.207 (a)

| |
|----------------------------------|
| Test Performed By: Thomas Danglé |
|----------------------------------|

| |
|----------------------------|
| Date of Test: 05 July 2012 |
|----------------------------|

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 micro port only for charging.

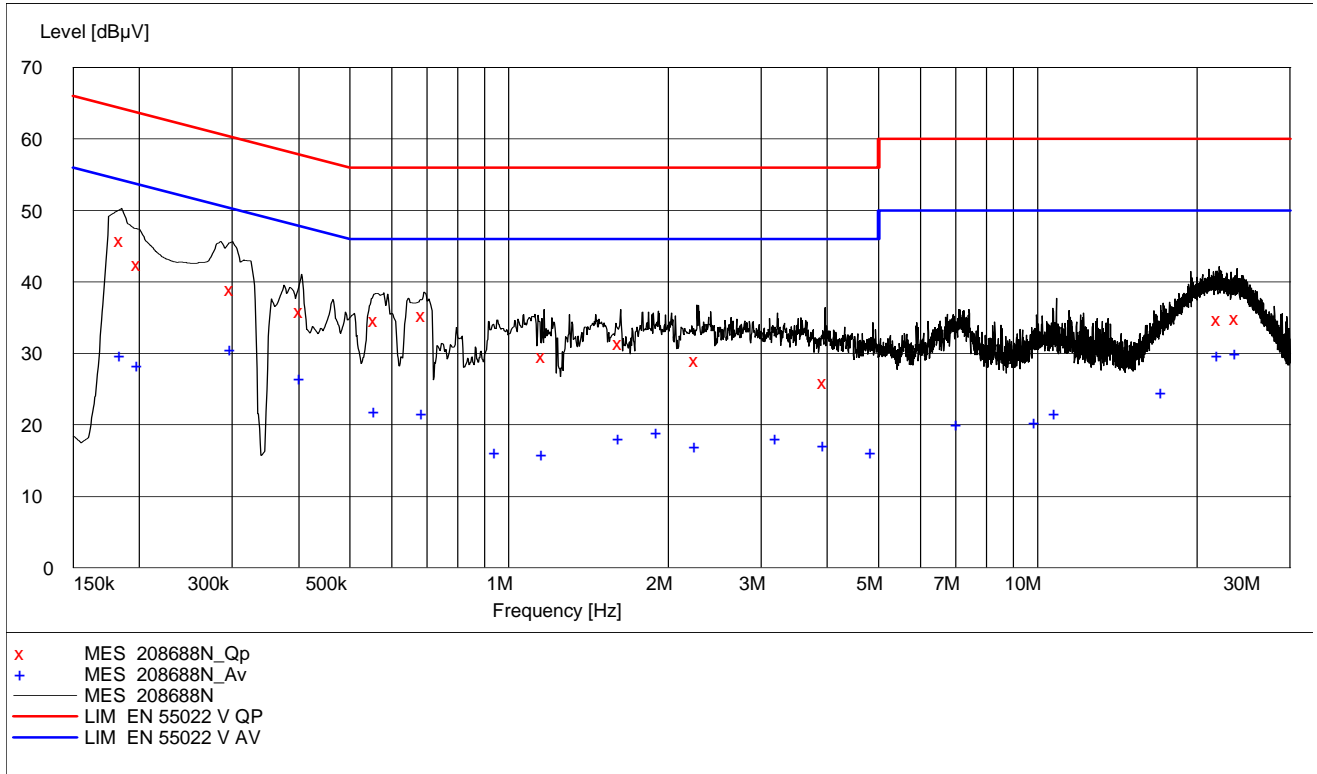
The graph shows peak scan and highest values. The QP and AV values are given in the table below.

Measured at AC mains 120V AC, 60Hz.

Model: IBM ThinkPad and AC adapter Lenovo 90W 20V

Highest measured value (L and N):

See the attached plot for peak scan and these QP detector data and Average detector data below.



Quasi Peak Detector Data:

| Frequency [MHz] | Level [dBµV] | Af [dB] | Limit [dBµV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|-----------------|--------------|---------|--------------|-------------|-----|----------|---------------------|
| 0.185000 | 45.90 | 10.10 | 64.30 | 18.40 | QP | N | Pass |
| 0.200000 | 42.50 | 10.10 | 63.60 | 21.10 | QP | N | Pass |
| 0.300000 | 39.00 | 10.10 | 60.20 | 21.20 | QP | L1 | Pass |
| 0.405000 | 35.90 | 10.20 | 57.80 | 21.90 | QP | N | Pass |
| 0.560000 | 34.70 | 10.20 | 56.00 | 21.30 | QP | L1 | Pass |
| 0.690000 | 35.40 | 10.20 | 56.00 | 20.60 | QP | L1 | Pass |
| 1.165000 | 29.70 | 10.20 | 56.00 | 26.30 | QP | L1 | Pass |
| 1.625000 | 31.40 | 10.30 | 56.00 | 24.60 | QP | L1 | Pass |
| 2.270000 | 29.10 | 10.30 | 56.00 | 26.90 | QP | L1 | Pass |
| 3.960000 | 26.00 | 10.40 | 56.00 | 30.00 | QP | N | Pass |
| 22.045000 | 34.80 | 11.30 | 60.00 | 25.20 | QP | N | Pass |
| 23.820000 | 35.00 | 11.30 | 60.00 | 25.00 | QP | L1 | Pass |

Average Detector Data:

| Frequency [MHz] | Level [dBuV] | Af [dB] | Limit [dBuV] | Margin [dB] | Det | Position | Verdict [Pass/Fail] |
|--------------------|-----------------|------------|-----------------|----------------|-----|----------|------------------------|
| 0.185000 | 29.80 | 10.10 | 54.30 | 24.50 | AV | N | Pass |
| 0.200000 | 28.40 | 10.10 | 53.60 | 25.20 | AV | N | Pass |
| 0.300000 | 30.70 | 10.10 | 50.20 | 19.50 | AV | L1 | Pass |
| 0.405000 | 26.60 | 10.20 | 47.80 | 21.20 | AV | N | Pass |
| 0.560000 | 22.00 | 10.20 | 46.00 | 24.00 | AV | L1 | Pass |
| 0.690000 | 21.70 | 10.20 | 46.00 | 24.30 | AV | L1 | Pass |
| 0.950000 | 16.20 | 10.20 | 46.00 | 29.80 | AV | L1 | Pass |
| 1.165000 | 15.90 | 10.20 | 46.00 | 30.10 | AV | L1 | Pass |
| 1.625000 | 18.20 | 10.30 | 46.00 | 27.80 | AV | L1 | Pass |
| 1.915000 | 19.00 | 10.20 | 46.00 | 27.00 | AV | L1 | Pass |
| 2.270000 | 17.10 | 10.30 | 46.00 | 28.90 | AV | L1 | Pass |
| 3.215000 | 18.10 | 10.30 | 46.00 | 27.90 | AV | N | Pass |
| 3.960000 | 17.20 | 10.40 | 46.00 | 28.80 | AV | N | Pass |
| 4.880000 | 16.20 | 10.40 | 46.00 | 29.80 | AV | N | Pass |
| 7.080000 | 20.10 | 10.50 | 50.00 | 29.90 | AV | N | Pass |
| 9.945000 | 20.40 | 10.60 | 50.00 | 29.60 | AV | N | Pass |
| 10.865000 | 21.70 | 10.60 | 50.00 | 28.30 | AV | L1 | Pass |
| 17.280000 | 24.50 | 10.90 | 50.00 | 25.50 | AV | L1 | Pass |
| 22.045000 | 29.80 | 11.30 | 50.00 | 20.20 | AV | N | Pass |
| 23.820000 | 30.10 | 11.30 | 50.00 | 19.90 | AV | L1 | Pass |

4.2 Minimum 6 dB Bandwidth

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

| | |
|----------------------------------|----------------------------|
| Test Performed By: Thomas Dangle | Date of Test: 12 June 2012 |
|----------------------------------|----------------------------|

Test Results: Complies

Measurement Data:

| Measured 6 dB Bandwidth (MHz) | | |
|-------------------------------|----------|---------|
| 2405MHz | 2440 MHz | 2480MHz |
| 1.62 | 1.64 | 1.66 |

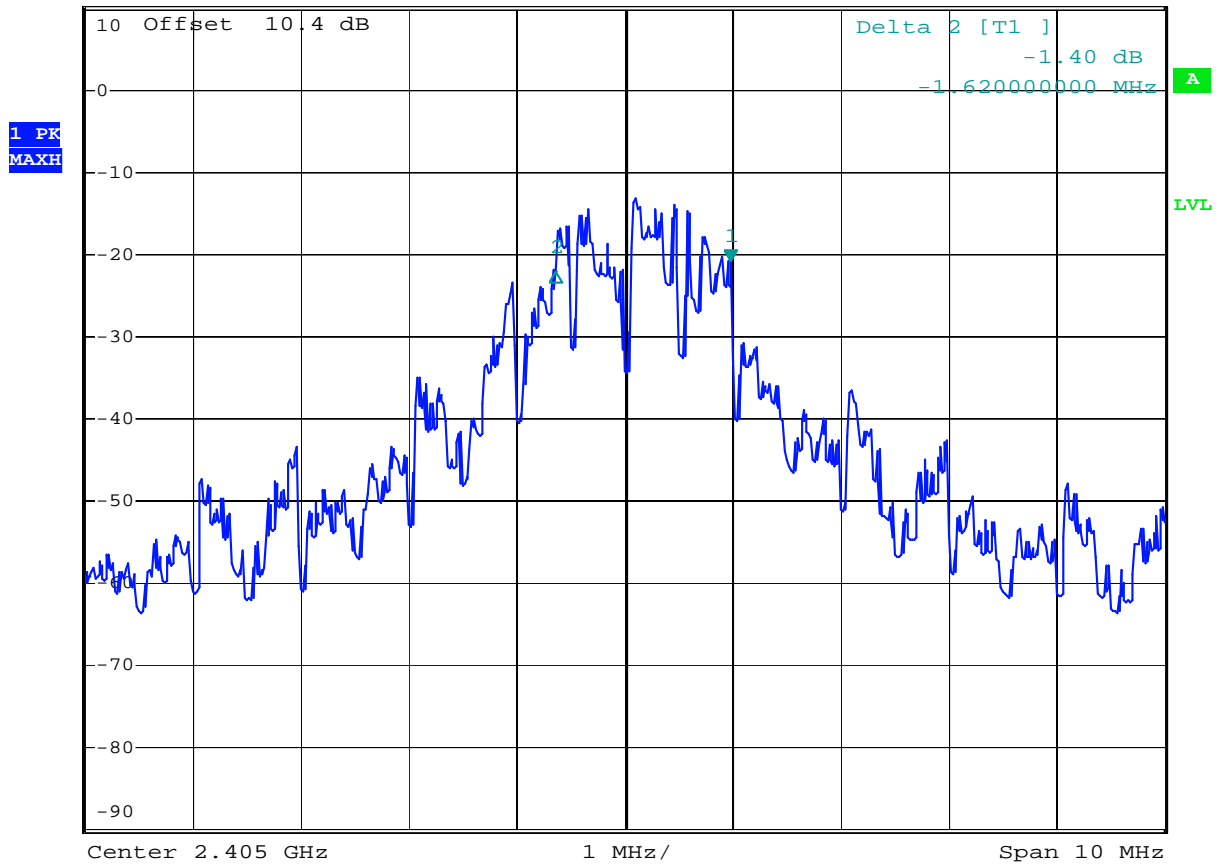
Conducted measurements

Tested according to KDB 558074 D01 DTS Meas Guidance v02, Section 7.1.

Requirements:

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

MARKER 1
 2.40598 GHz
 Ref 10 dBm *Att 10 dB *RBW 30 kHz VBW 100 kHz SWT 15 ms
 Marker 1 [T1] -20.88 dBm
 2.405980000 GHz

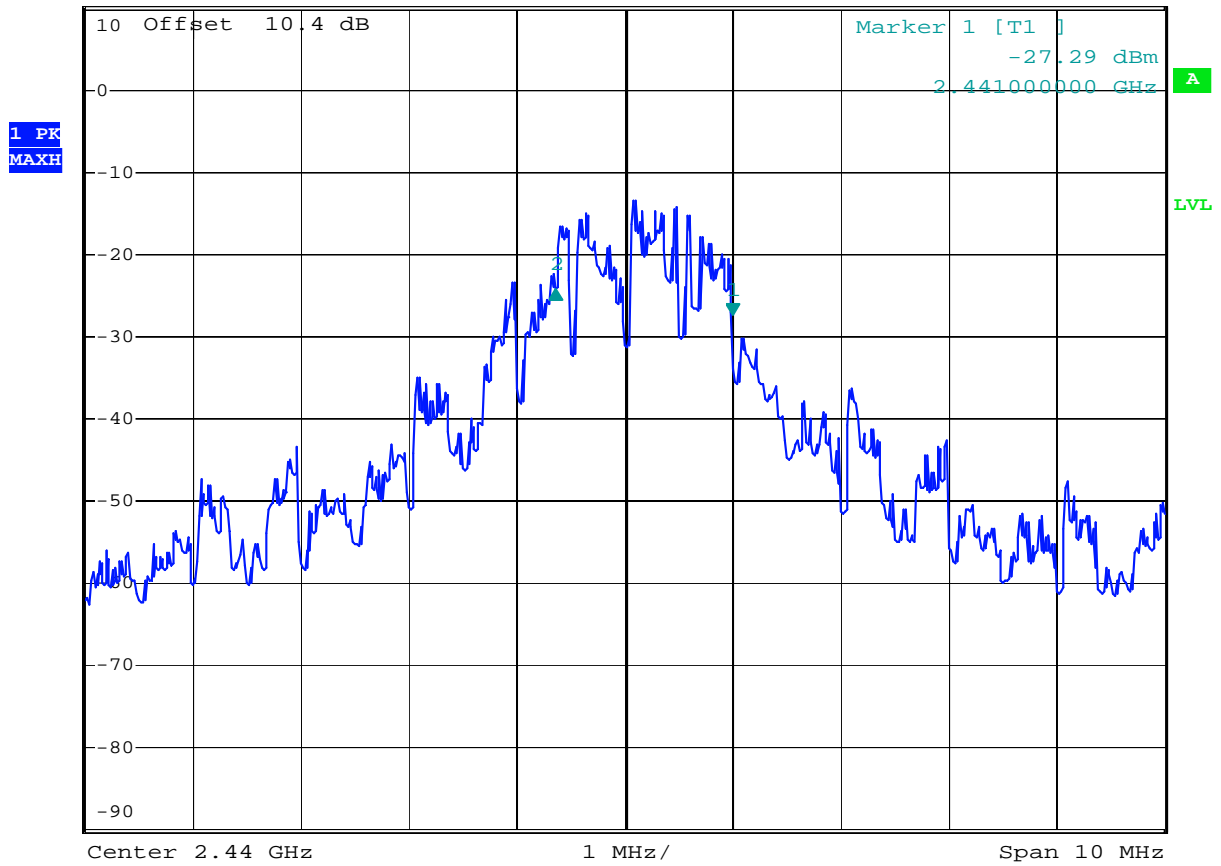


Date: 12.JUN.2012 12:58:32

6 dB Bandwidth at 2405 MHz

DELTA MARKER 2
 -1.64 MHz
 Ref 10 dBm *Att 10 dB

*RBW 30 kHz Delta 2 [T1]
 VBW 100 kHz 3.01 dB
 SWT 15 ms -1.640000000 MHz

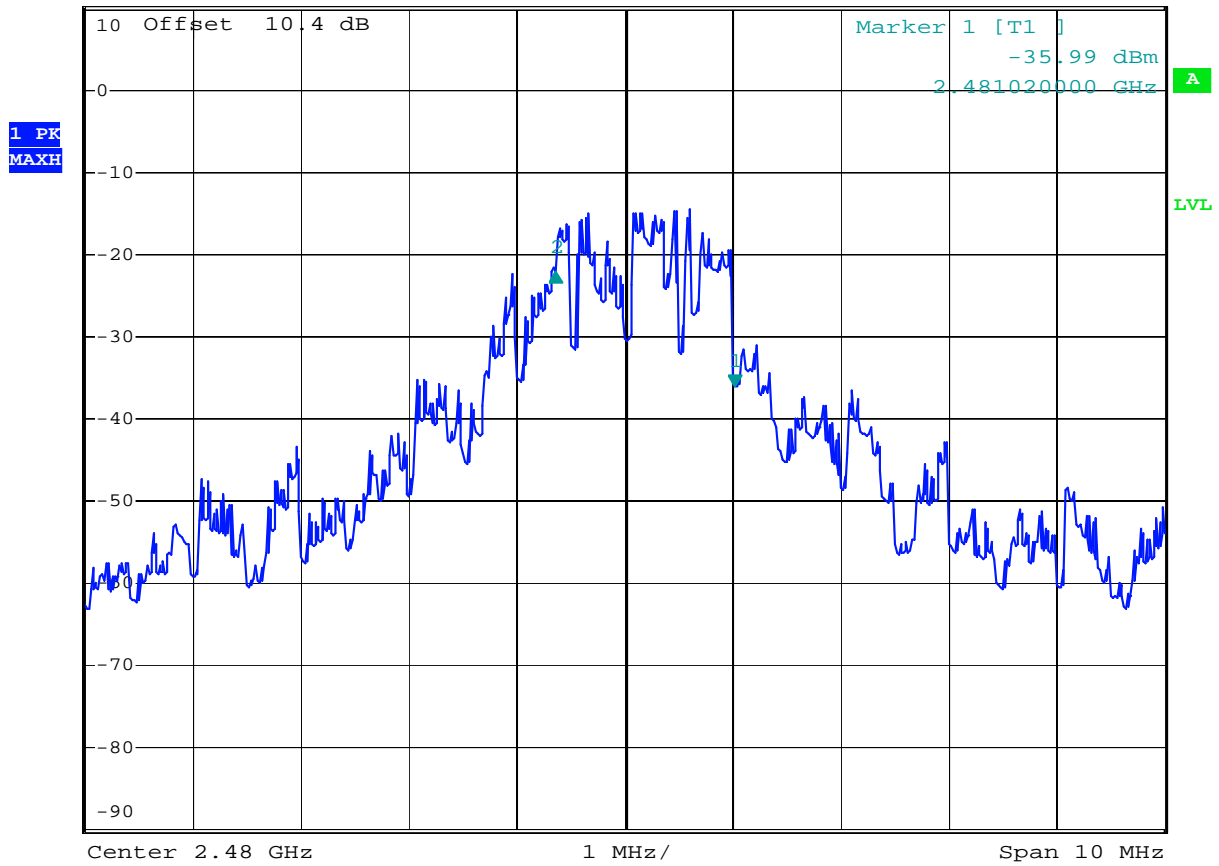


Date: 12.JUN.2012 12:55:40

6 dB Bandwidth at 2440 MHz

DELTA MARKER 2
 -1.66 MHz
 Ref 10 dBm *Att 10 dB

*RBW 30 kHz Delta 2 [T1]
 VBW 100 kHz 13.87 dB
 SWT 15 ms -1.660000000 MHz



Date: 12.JUN.2012 12:52:03

6 dB Bandwidth at 2480 MHz

4.3 20 dB Bandwidth

| | |
|----------------------------------|----------------------------|
| Test Performed By: Thomas Danglé | Date of Test: 12 June 2012 |
|----------------------------------|----------------------------|

Measurement Data:

| Measured 20 dB Bandwidth (MHz) | | |
|--------------------------------|----------|---------|
| 2405MHz | 2440 MHz | 2480MHz |
| / | 2.54 | / |

Conducted measurements

Requirements:

No requirements. Reported for information only.



Date: 12.JUN.2012 12:57:18

20 dB Bandwidth at 2440 MHz

4.4 Peak Power Output

Para. No.: 15.247 (b)

| | |
|----------------------------------|--------------------------------------|
| Test Performed By: Thomas Danglé | Date of Test: 12 June & 19 June 2012 |
|----------------------------------|--------------------------------------|

Test Results: Complies

Measurement Data:

| RF channel | 2405 MHz | 2440 MHz | 2480 MHz |
|---|----------|----------|----------|
| Conducted Power (dBm) | -3.67 | -3.95 | -4.07 |
| Conducted Power (mW) | 0.43 | 0.40 | 0.39 |
| Measured Maximum Field strength (dB μ V/m) – HP | 89.04 | 85.49 | 80.81 |
| Radiated Power (dBm) | -6.19 | -9.74 | -14.42 |
| Antenna Gain (dB) | -2.52 | -5.79 | -10.35 |

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

Tested according to KDB 558074 D01 DTS Meas Guidance v02, Section 8.1.1.

EIRP is calculated according to KDB 558074 D01 DTS Meas Guidance v02, Section 10.2.2.1

See attached graph.

Detachable antenna?

Yes No

If detachable, is the antenna connector non-standard?

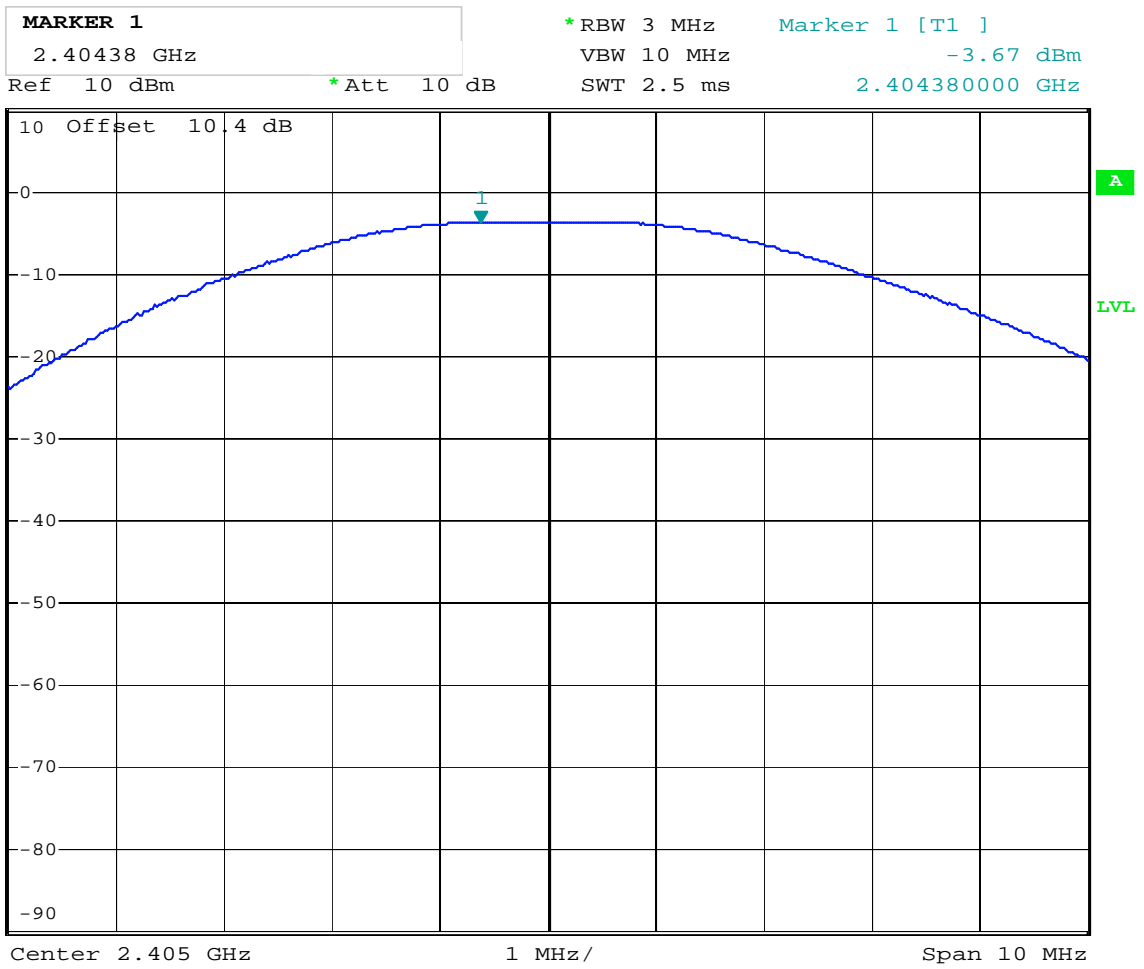
Yes No

Requirements:

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

For Digital Transmission Systems in the 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.

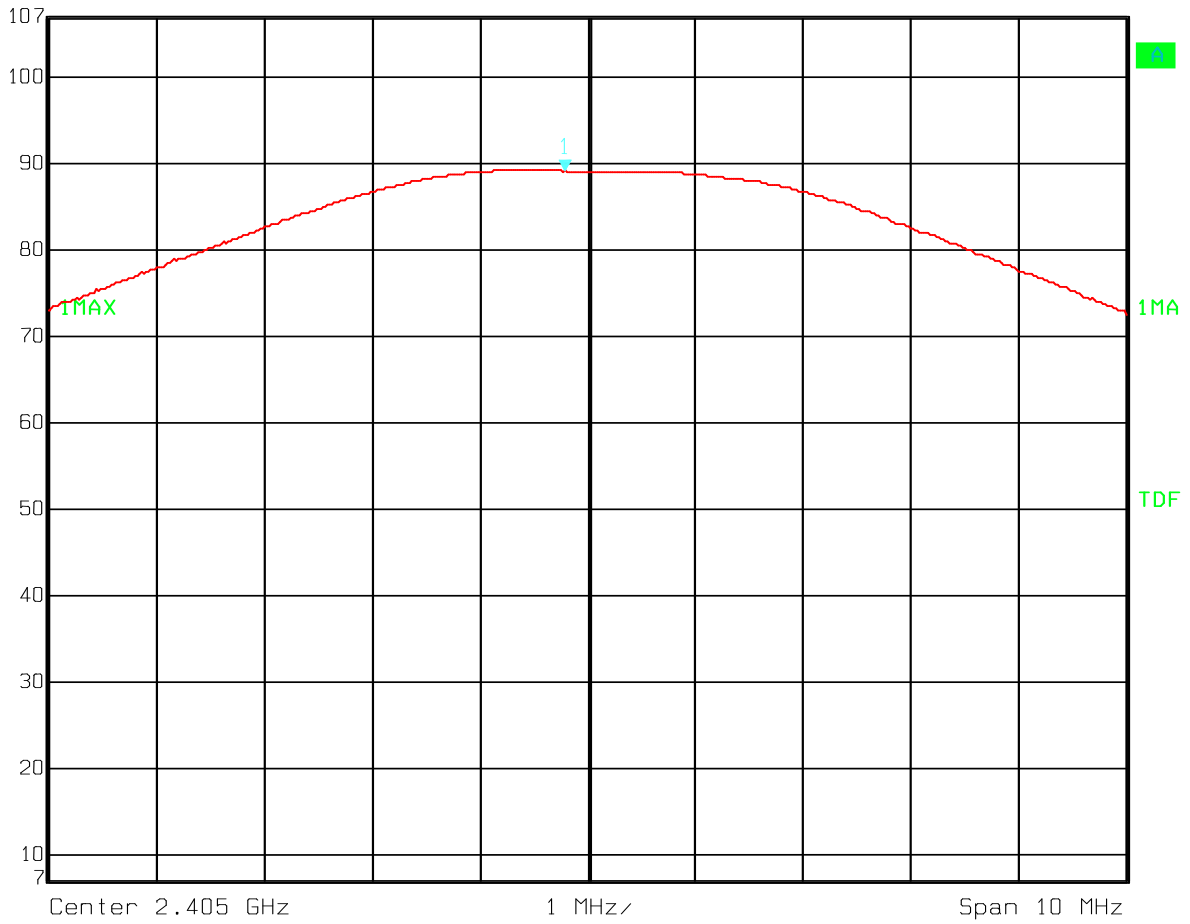


Date: 12.JUN.2012 12:59:09

Conducted Power, 2405 MHz- peak detector

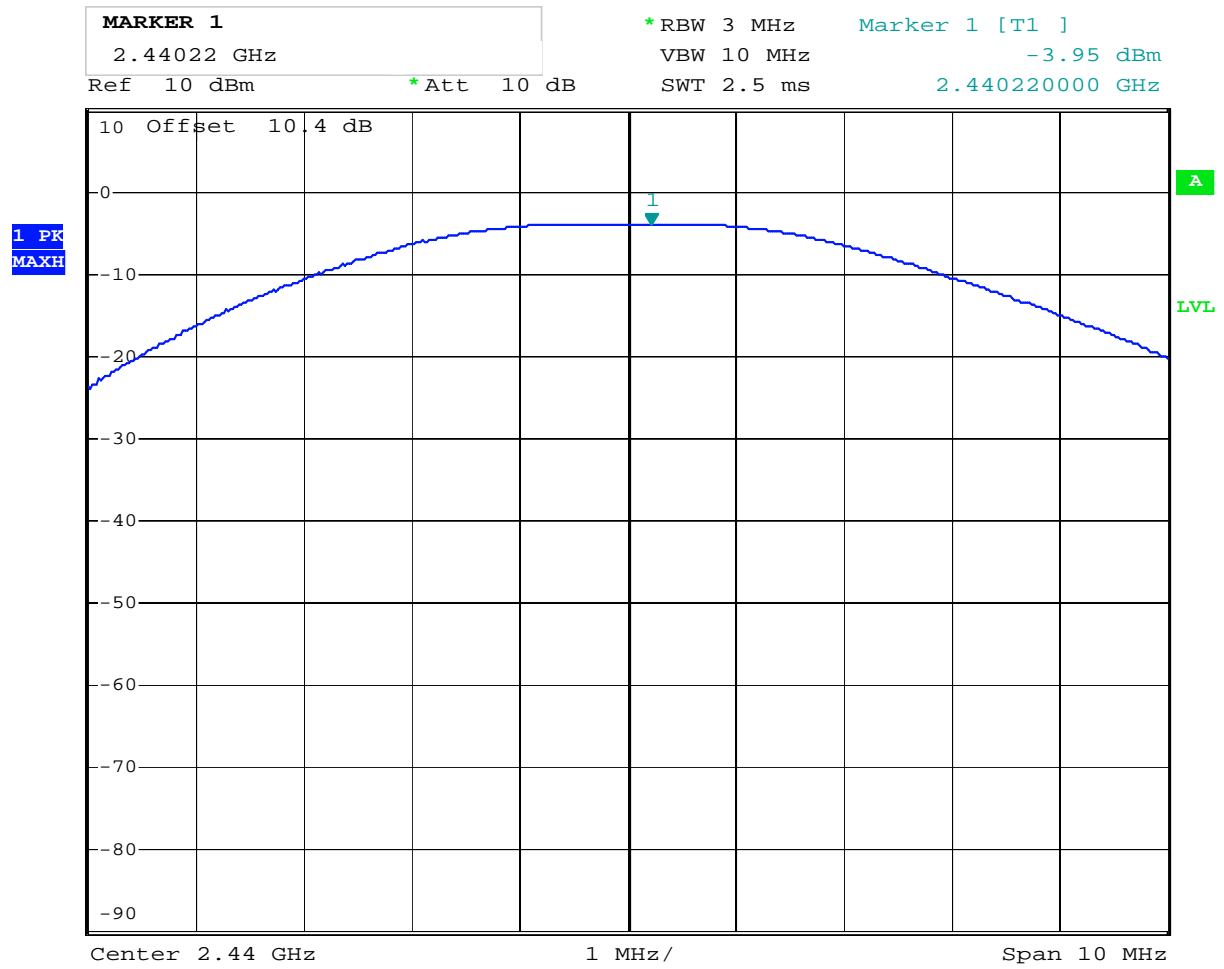


| | | | | | |
|---------|--------------------|-----|--------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 3 MHz | RF Att | 10 dB |
| 107 dB* | 89.04 dB μ V/m | VBW | 10 MHz | | |
| | 2.40478958 GHz | SWT | 5 ms | Unit | dB μ V/m |



Date: 19.JUN.2012 12:51:44

Radiated Field strength, HP, 2405 MHz, EUT V

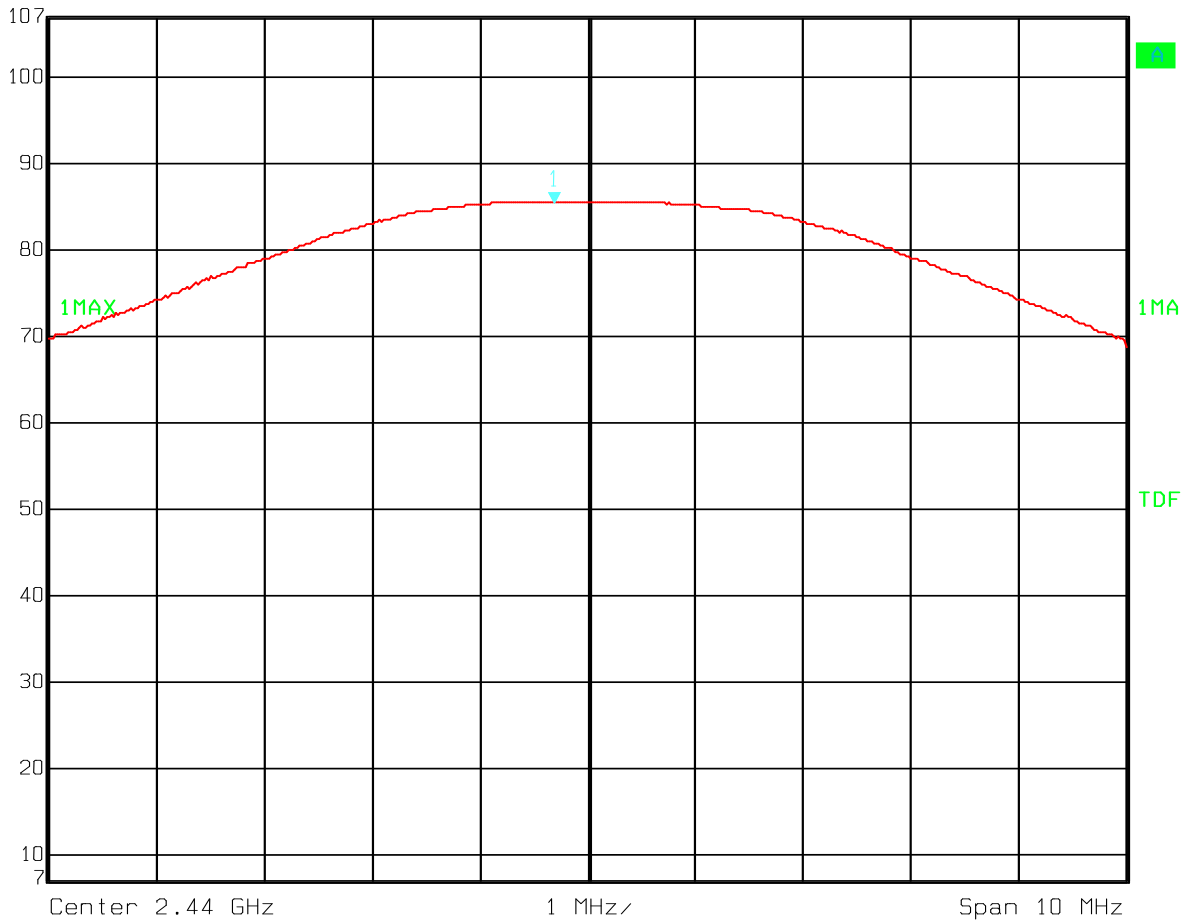


Date: 12.JUN.2012 12:54:22

Conducted Power, 2440 MHz, peak detector



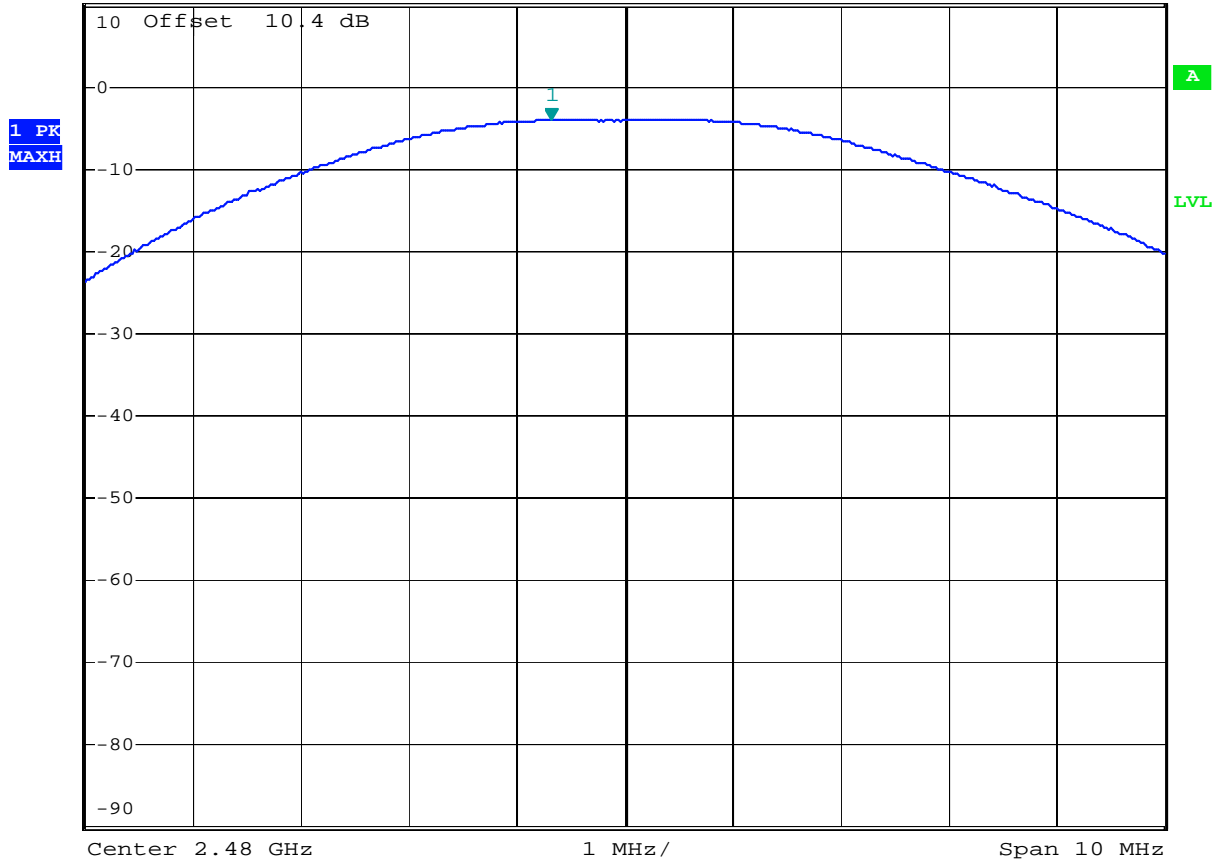
Ref Lvl 107 dB*
 Marker 1 [T1] 85.49 dB μ V/m
 2.43968938 GHz
 RBW 3 MHz RF Att 10 dB
 VBW 10 MHz
 SWT 5 ms Unit dB μ V/m



Date: 19.JUN.2012 12:56:10

Radiated Field strength, HP, 2440 MHz, EUT V

MARKER 1
 2.47932 GHz
 Ref 10 dBm *Att 10 dB *RBW 3 MHz Marker 1 [T1]
 VBW 10 MHz -4.07 dBm
 SWT 2.5 ms 2.479320000 GHz

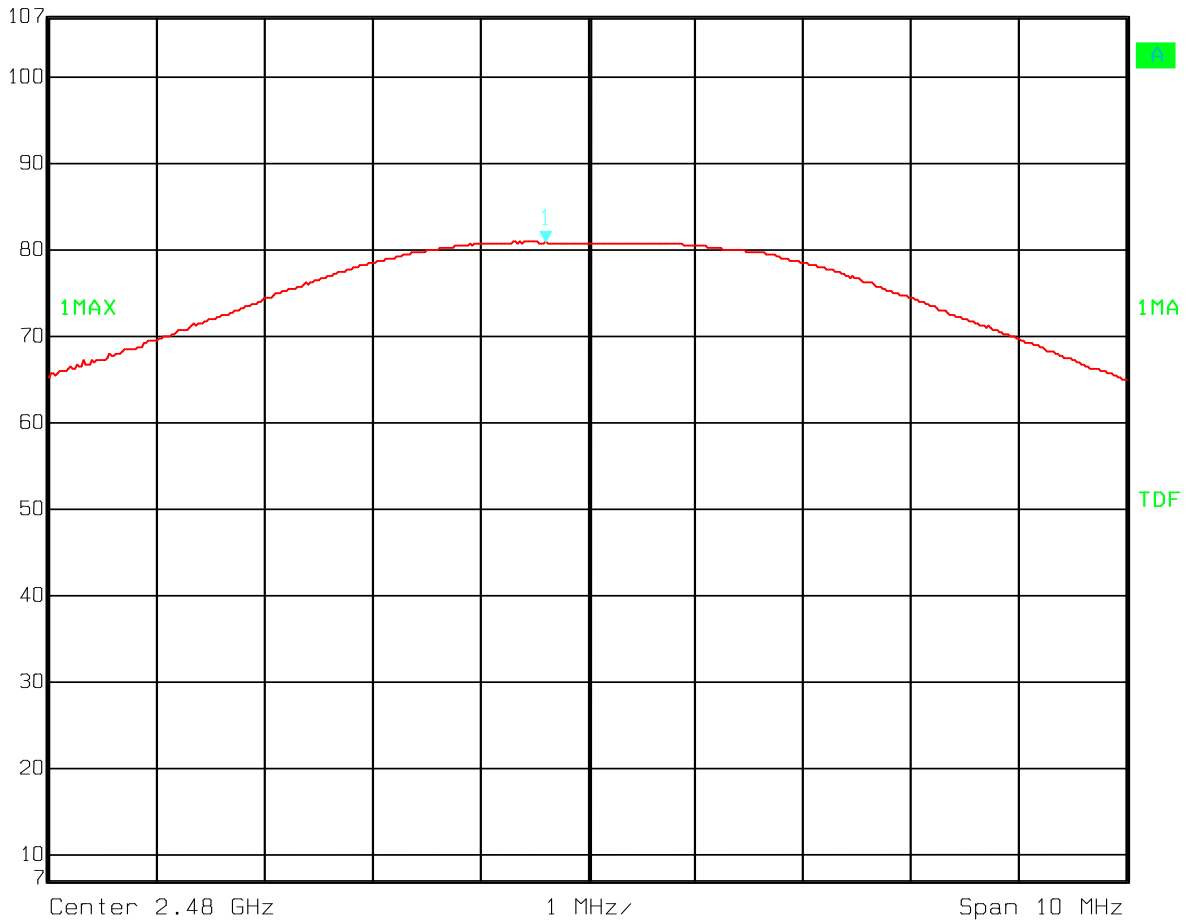


Date: 12.JUN.2012 12:53:10

Conducted Power, 2480 MHz, peak detector



| | | | | | |
|---------|--------------------|-----|--------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 3 MHz | RF Att | 10 dB |
| 107 dB* | 80.81 dB μ V/m | VBW | 10 MHz | Unit | dB μ V/m |
| | 2.47960922 GHz | SWT | 5 ms | | |



Date: 19.JUN.2012 12:58:58

Radiated Field strength, HP, 2480 MHz, EUT V

4.5 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Thomas Dangle

Date of Test: 19 - 28 June 2012

Test Results: Complies

Measurement Data:

Band-edge, @3m

| Frequency | Measured Field Strength @3m, dB μ V/m | Detector | Limit dB μ V/m | Margin dB |
|------------|---|----------|--------------------|-----------|
| 2.39 GHz | 34.64 | AV | 54 | 19.36 |
| | 44.09 | PK | 74 | 29.91 |
| 2.4835 GHz | 45.54 | AV | 54 | 8.46 |
| | 53.31 | PK | 74 | 20.69 |

See attached plots.


Tested according to KDB 913591.

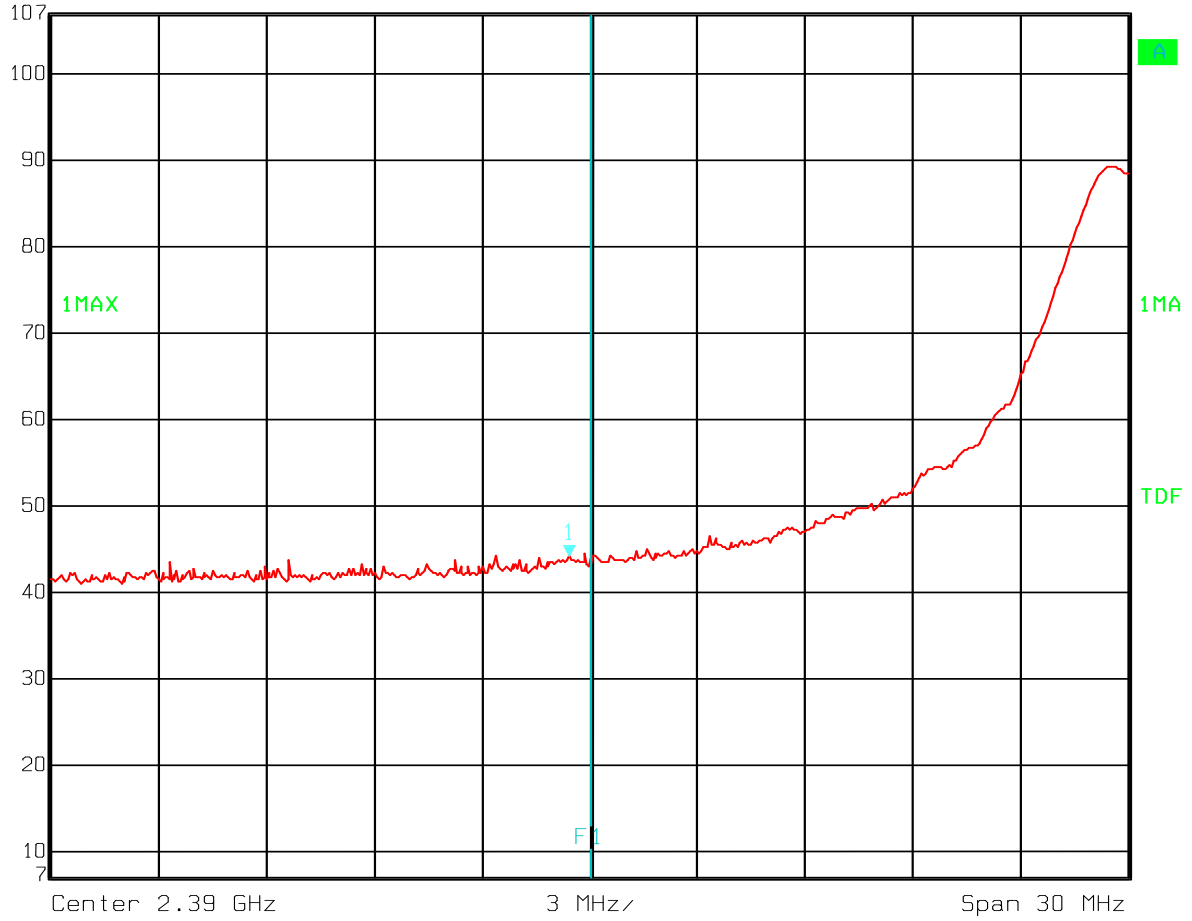
RF conducted power

Tested according to KDB 558074 D01 DTS Meas Guidance v02, Section 10.1.1 & 10.1.2 performed with 100 kHz Bandwidth from 1MHz to 25 GHz.

All emissions are more than 20dB below carrier.

See plots.

| | | | | | | |
|---|---------|--------------------|-----|-------|--------|--------------|
|  | Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 10 dB |
| | 107 dB* | 44.09 dB μ V/m | VBW | 3 MHz | | |
| | | 2.38942886 GHz | SWT | 5 ms | Unit | dB μ V/m |

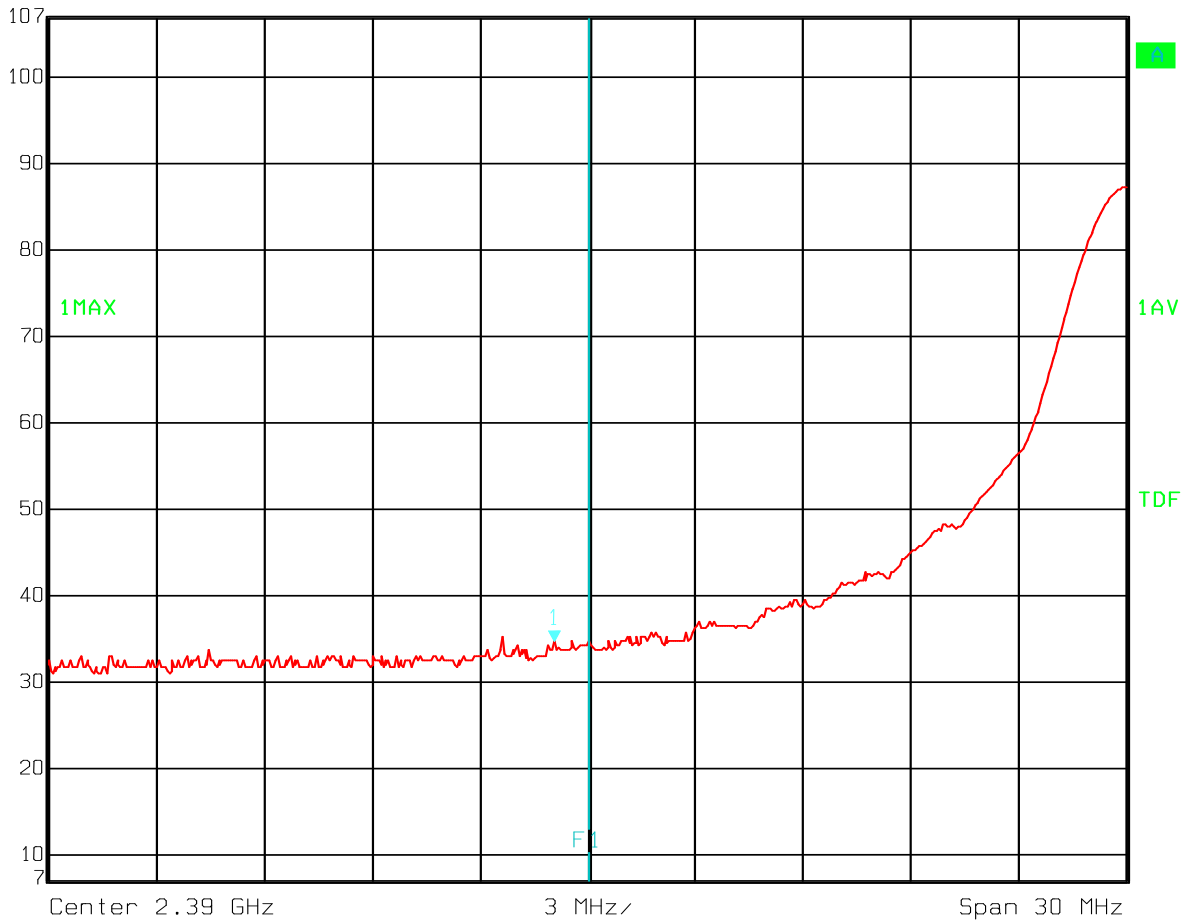


Date: 19.JUN.2012 13:12:52

Band Edge, 2390 MHz, Peak Detector



| | | | | | |
|---------|--------------------|-----|-------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 10 dB |
| 107 dB* | 34.64 dB μ V/m | VBW | 3 MHz | Unit | dB μ V/m |
| | 2.38906814 GHz | SWT | 5 ms | | |

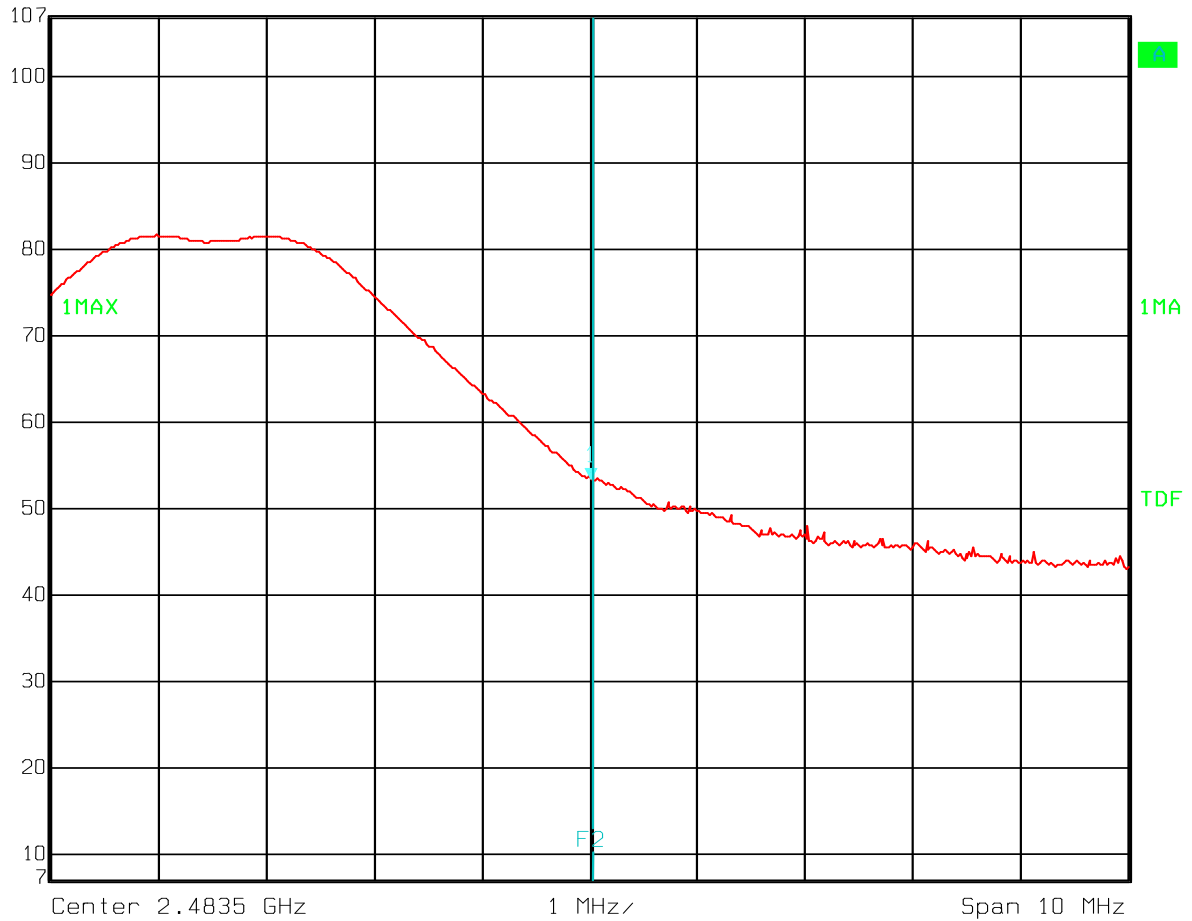


Date: 19.JUN.2012 13:16:20

Band Edge, 2390 MHz, AV Detector



| | | | | | | | |
|---------|---------|---------------|--------------------|-----|-------|--------|--------------|
| Ref Lvl | 107 dB* | Marker 1 [T1] | 53.31 dB μ V/m | RBW | 1 MHz | RF Att | 10 dB |
| | | | 2.48351002 GHz | VBW | 3 MHz | Unit | dB μ V/m |
| | | | | SWT | 5 ms | | |

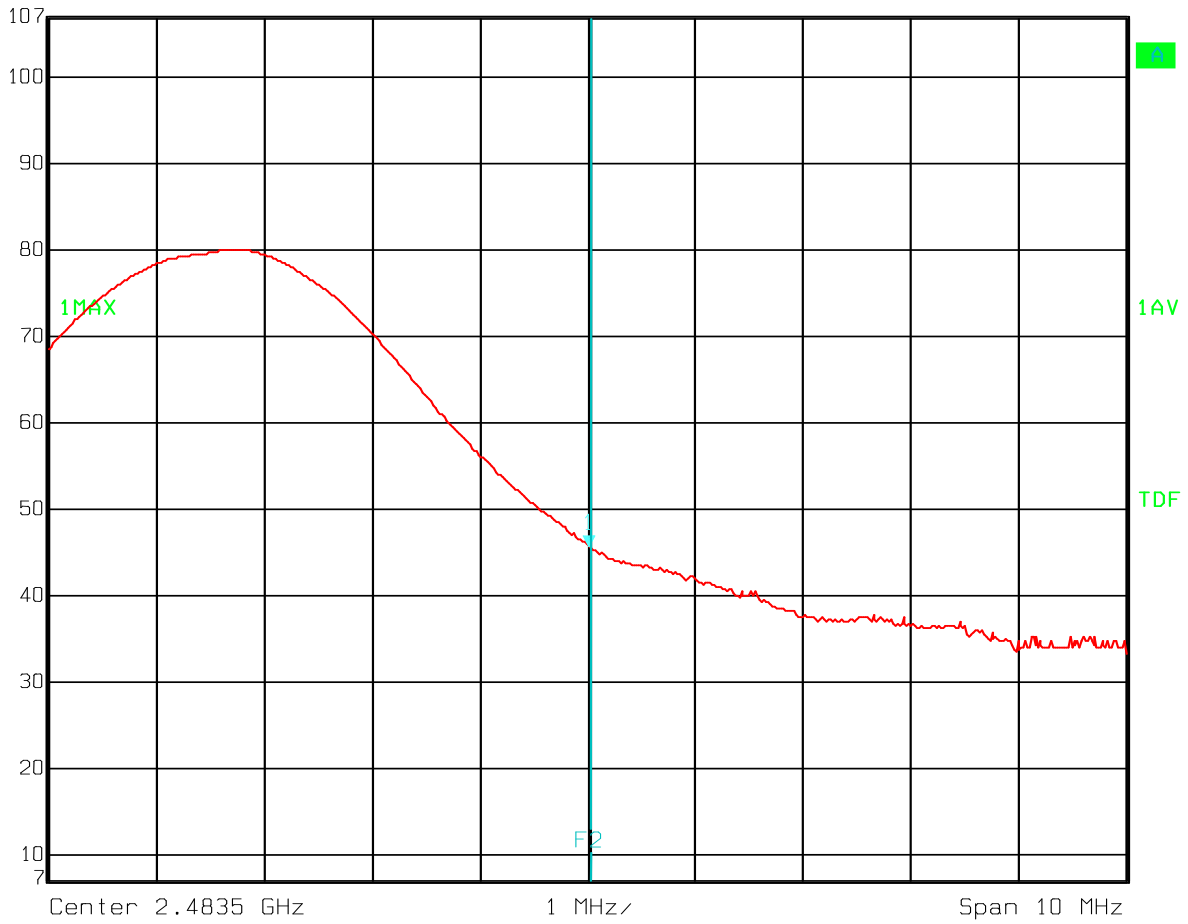


Date: 19.JUN.2012 13:21:25

Band Edge, 2483.5 MHz, PK detector

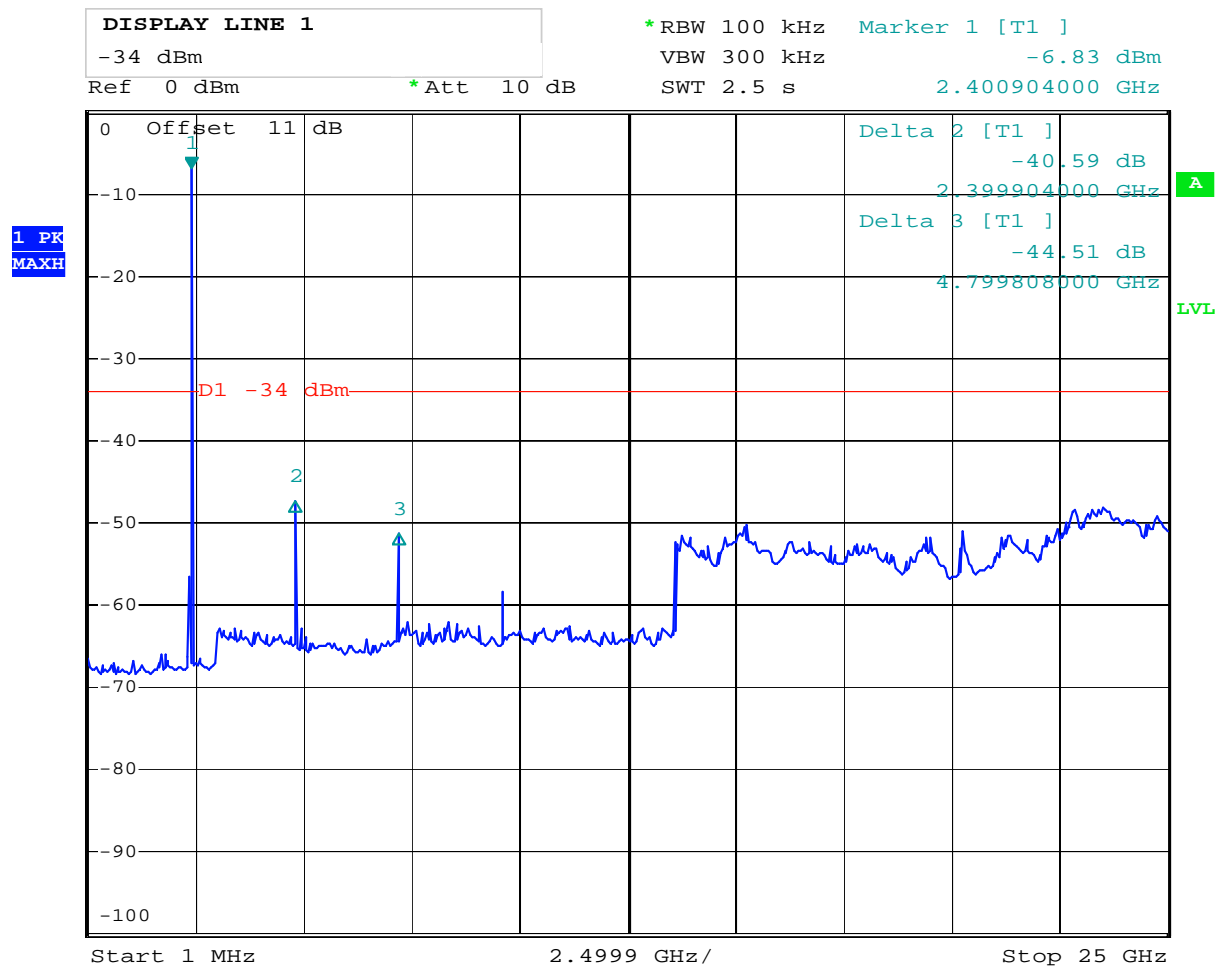


| | | | | | |
|---------|--------------------|-----|-------|--------|--------------|
| Ref Lvl | Marker 1 [T1] | RBW | 1 MHz | RF Att | 10 dB |
| 107 dB* | 45.54 dB μ V/m | VBW | 3 MHz | Unit | dB μ V/m |
| | 2.48351002 GHz | SWT | 5 ms | | |



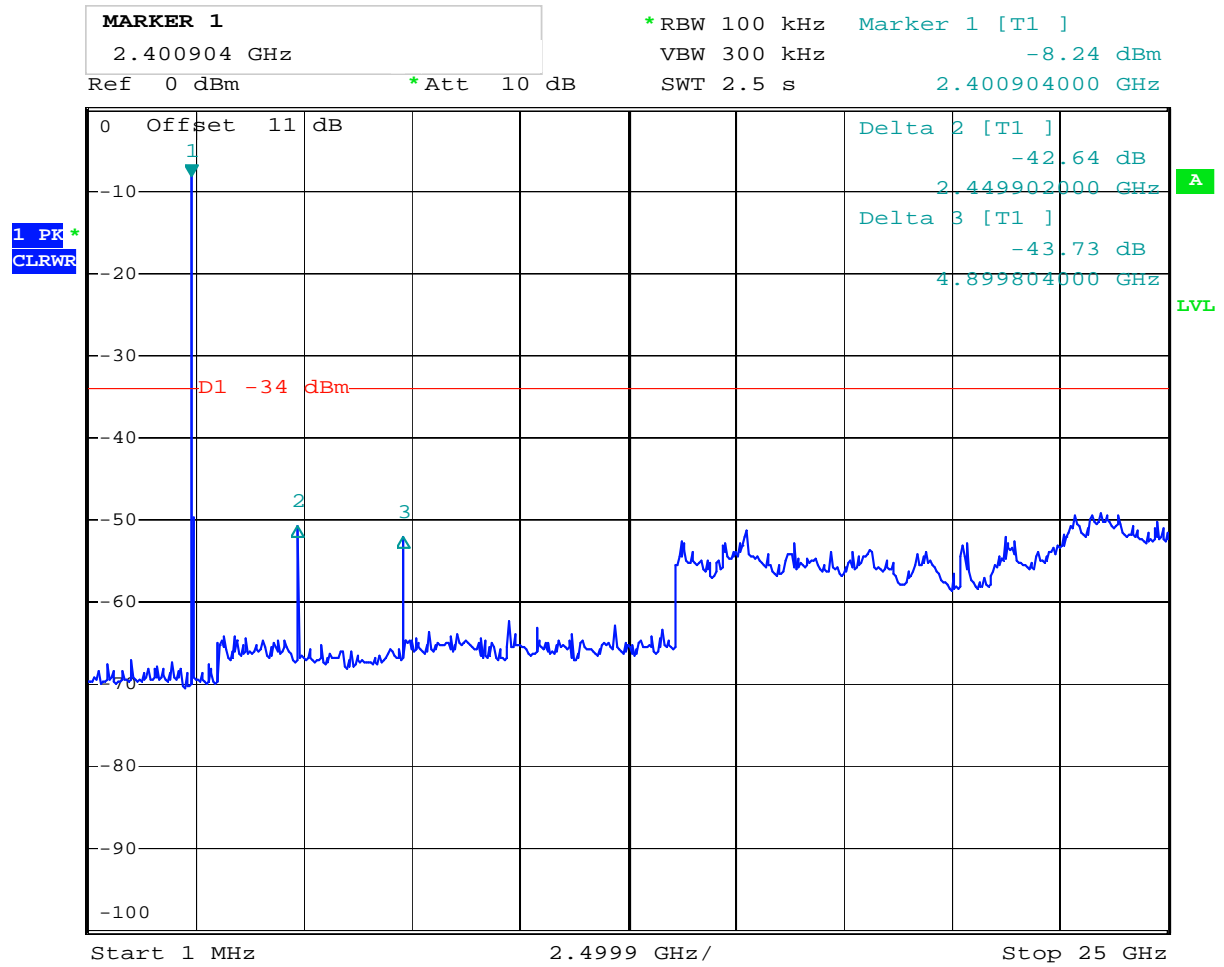
Date: 19.JUN.2012 13:22:28

Band Edge, 2483.5 MHz, AV detector



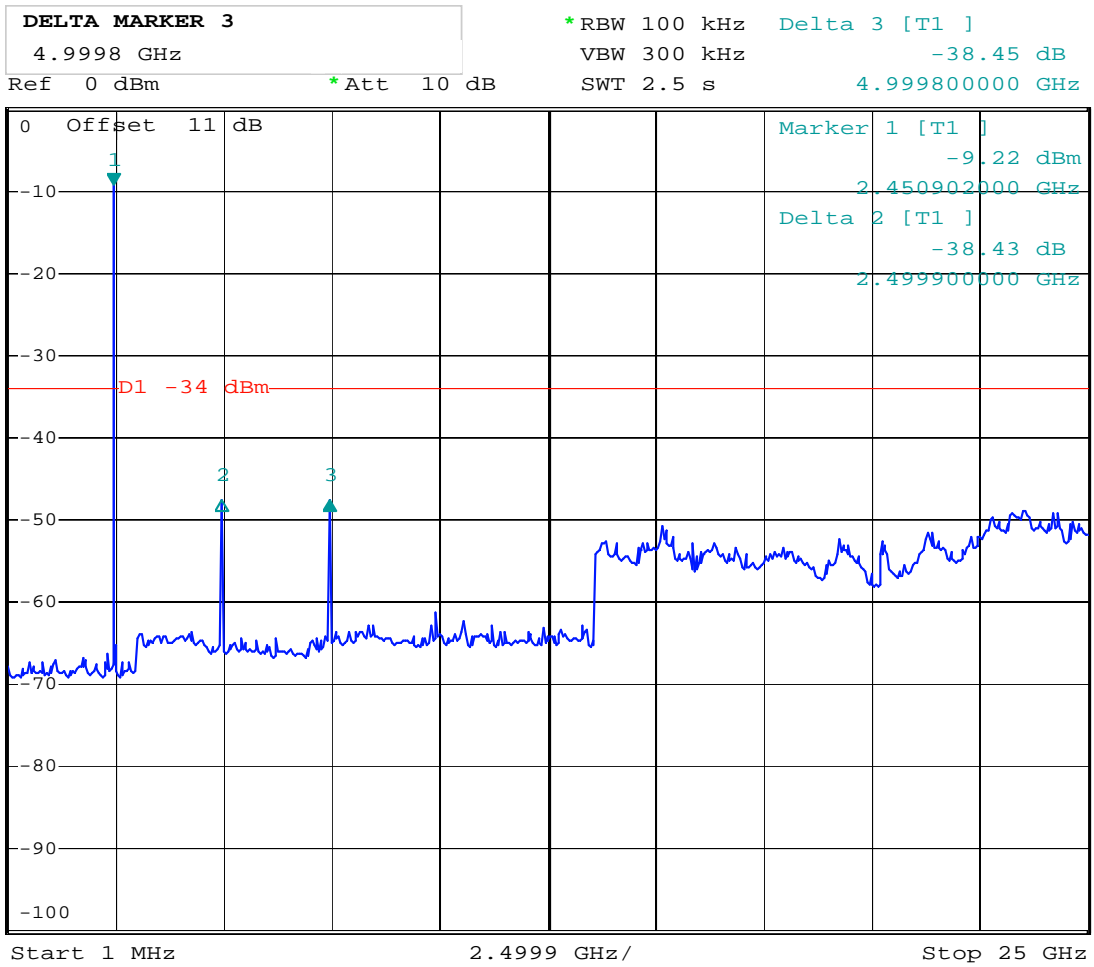
Date: 12.JUN.2012 13:20:33

2405MHz - Conducted Emissions, 1 MHz – 25 GHz



Date: 12.JUN.2012 13:21:44

2440MHz - Conducted Emissions, 1 MHz – 25GHz



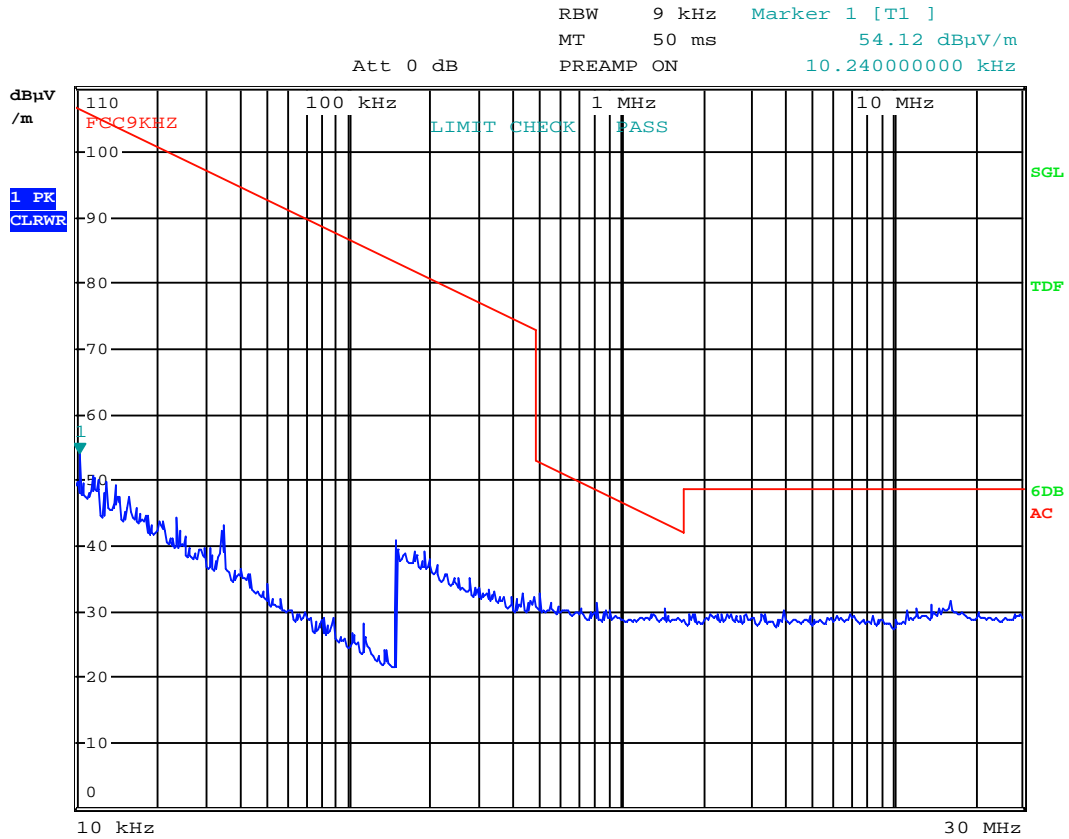
Date: 12.JUN.2012 13:22:31

2480MHz - Conducted Emissions, 1 MHz – 25GHz

Radiated emissions 9kHz - 30 MHz.

Detector: Quasi-Peak

Measuring distance 10 m.



Date: 28.JUN.2012 09:28:00

10kHz - 30MHz

Radiated emission 30 – 1000 MHz.

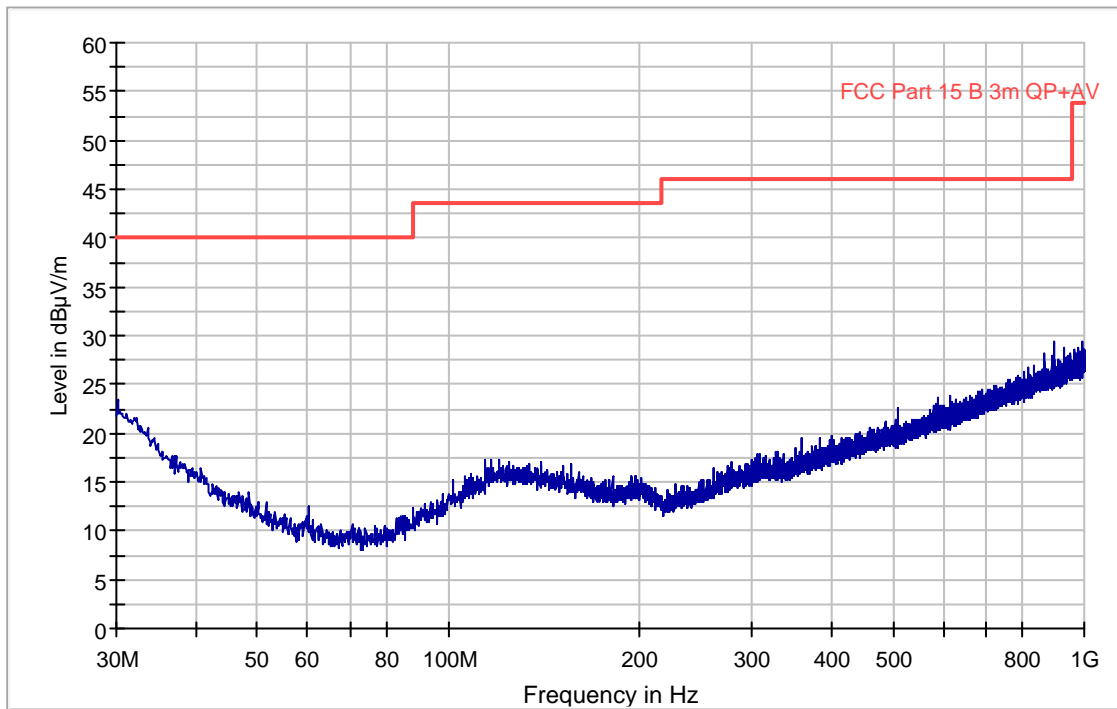
Detector: Peak

Measuring distance 3m.

RBW: 100kHz , VBW: 300kHz

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

FCC Pt15 Class B 30-1000M 3m



Radiated Emissions, 30 – 1000 MHz, VP and HP, @3m – TX on 2440 MHz.

Radiated Emissions, 1-25 GHz

1-3 GHz measured at a distance of 3 m

3 - 18 GHz measured at 1 m

Prescan performed from 18 to 25 GHz.

PK-detector

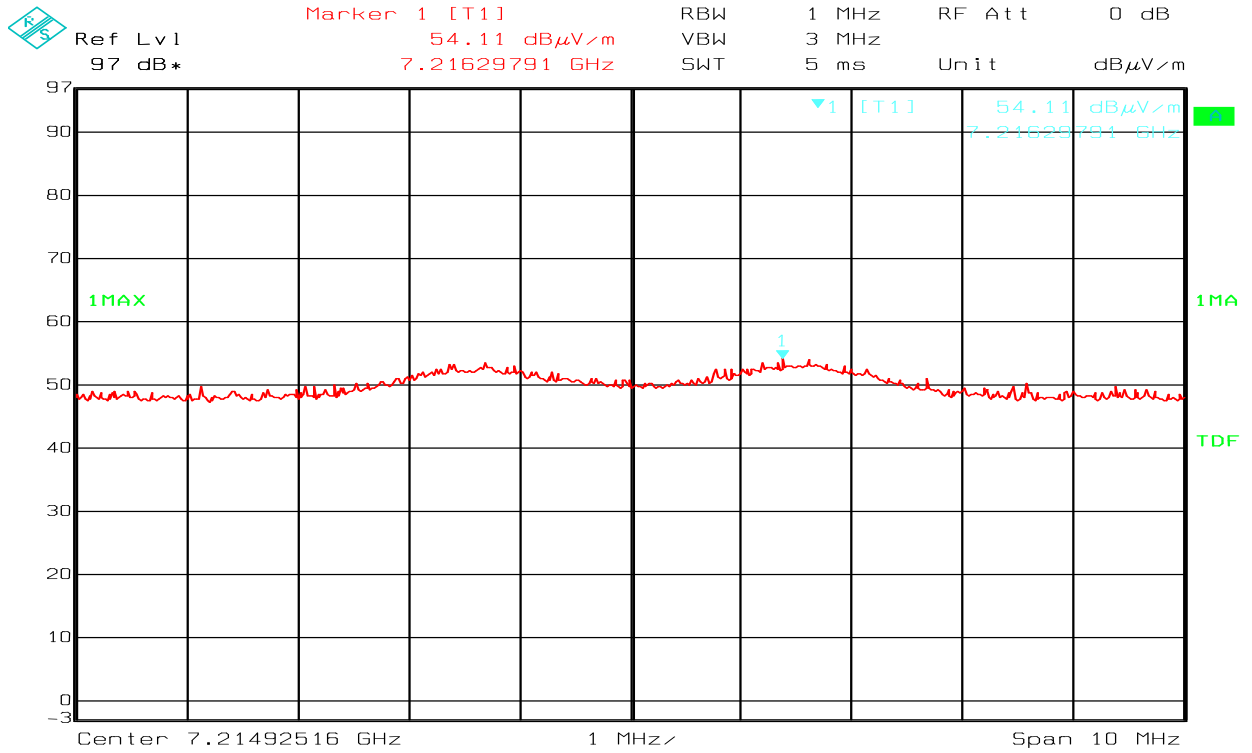
| Channel | Frequency MHz | Field strength @3m dB μ V/m | Detector | Limit dB μ V/m | Margin dB |
|---------|------------------|---------------------------------------|----------|-----------------------|--------------|
| Ch 2405 | 7215 | 54.11 | Pk | 74 | 19.89 |
| Ch 2440 | 7320 | 56.88 | Pk | 74 | 17.12 |
| Ch 2480 | 7440 | 58.78 | Pk | 74 | 15.22 |

AV-detector

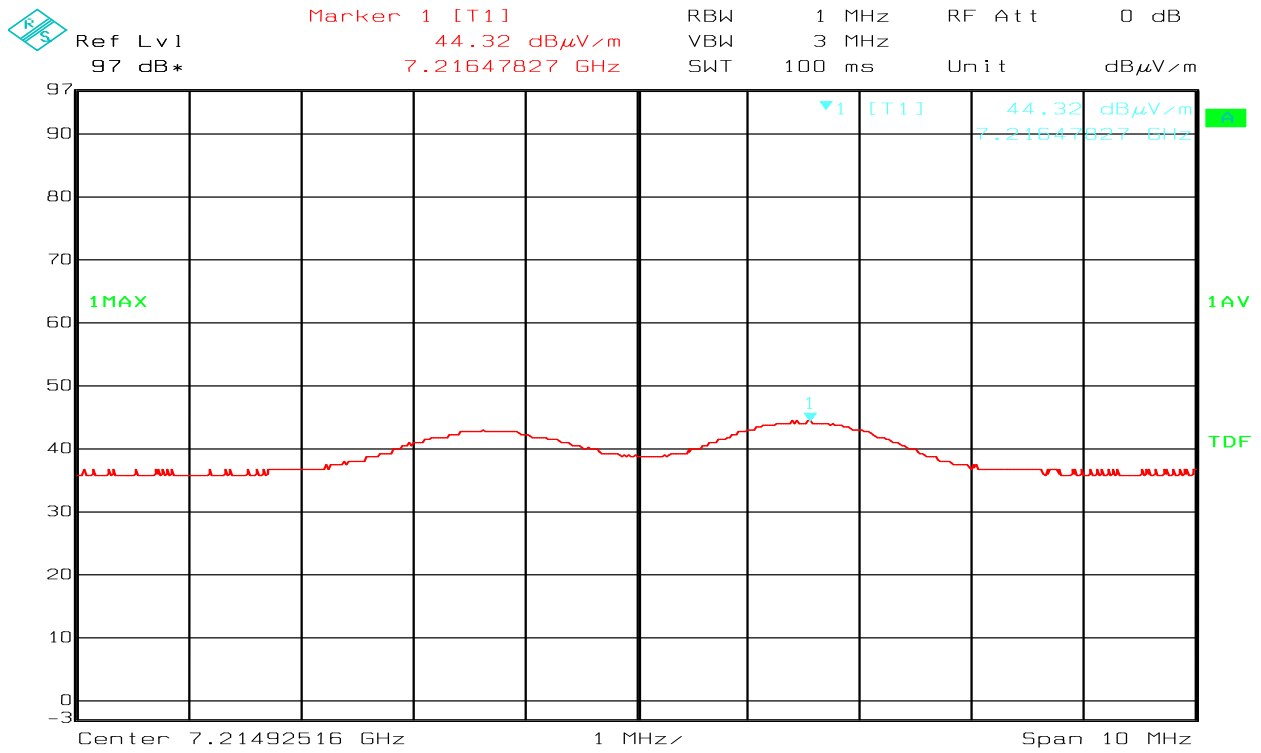
| Channel | Frequency MHz | Field strength @3m dB μ V/m | Detector | Limit dB μ V/m | Margin dB |
|---------|------------------|---------------------------------------|----------|-----------------------|--------------|
| Ch 2405 | 7215 | 44.32 | AV | 54 | 9.68 |
| Ch 2440 | 7320 | 48.36 | AV | 54 | 5.64 |
| Ch 2480 | 7440 | 50.77 | AV | 54 | 3.23 |

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

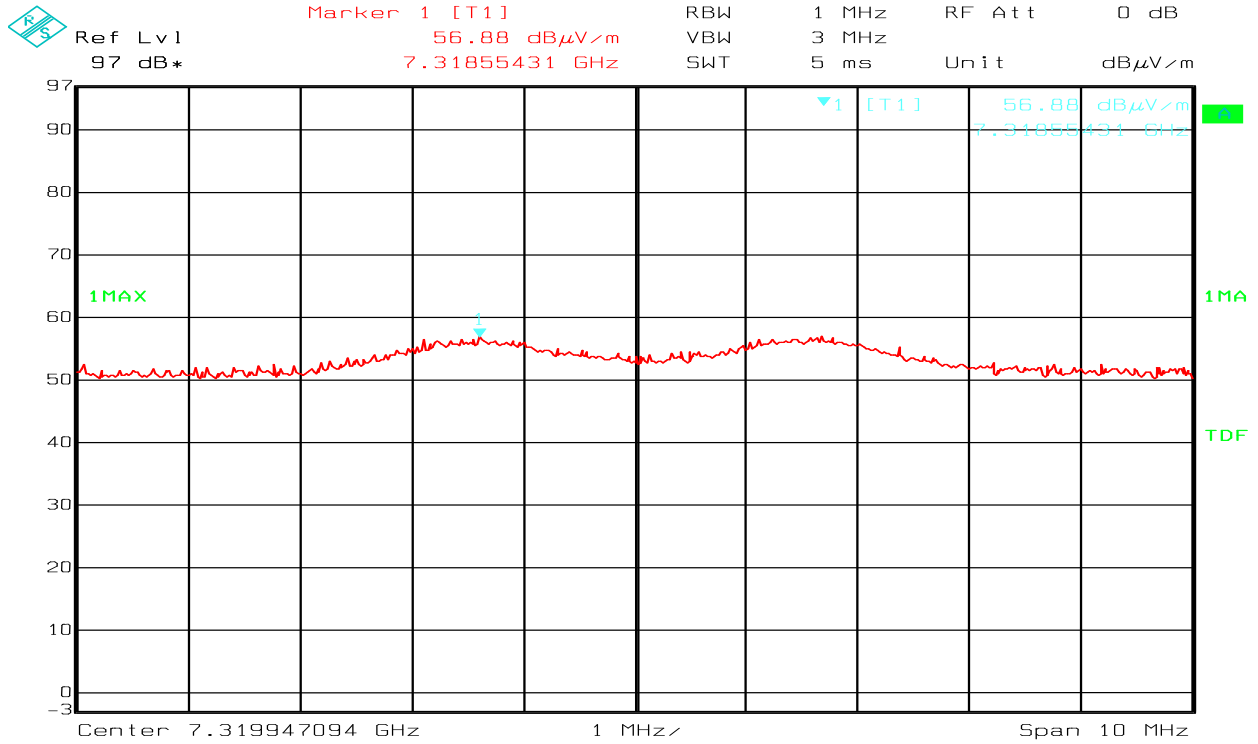
See attached graphs.



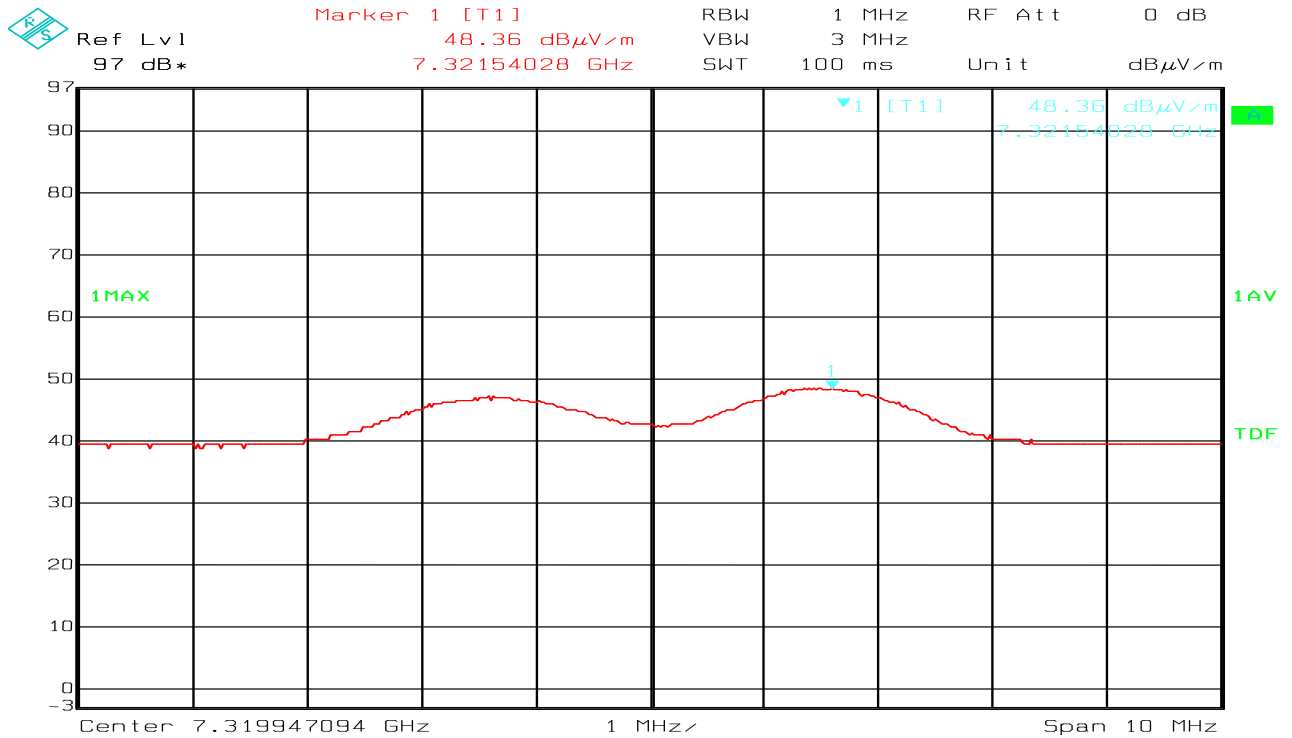
Radiated Emissions, HP, @3m, ch 2405MHz – 3rd harmonic - Max PK detector



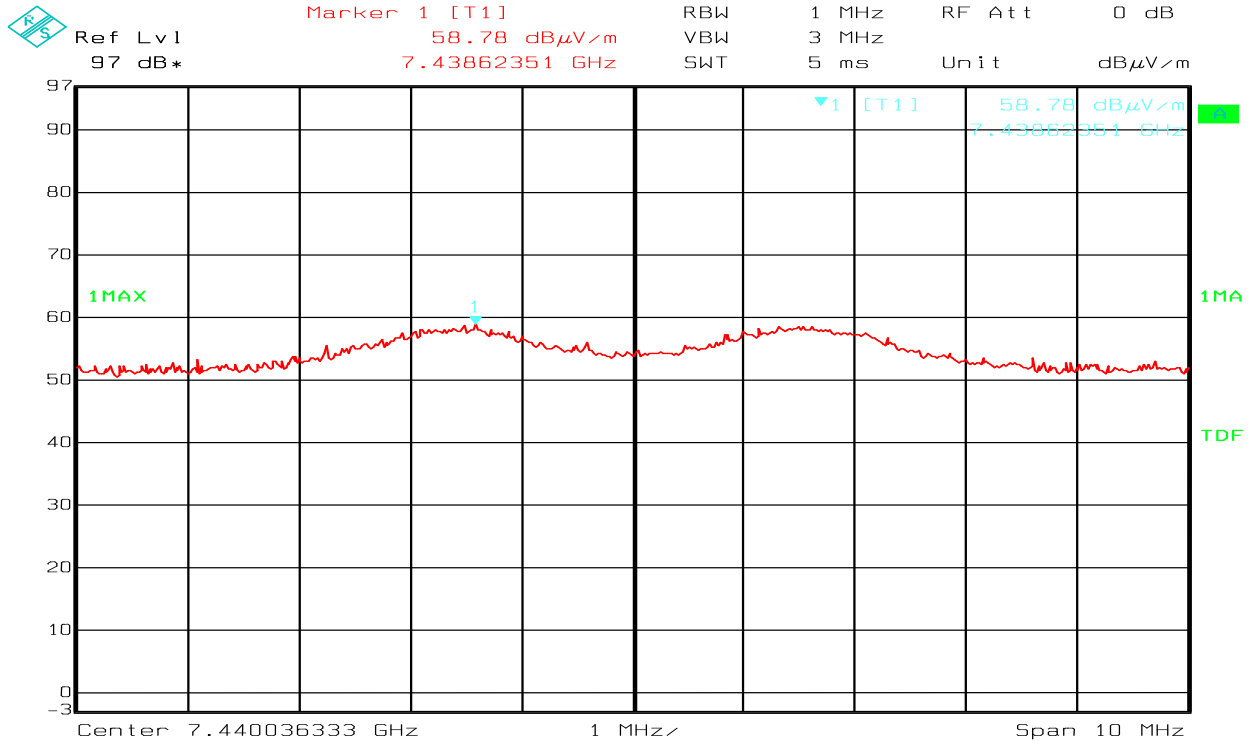
Radiated Emissions, HP, @3m, ch 2405MHz – 3rd harmonic - AV detector



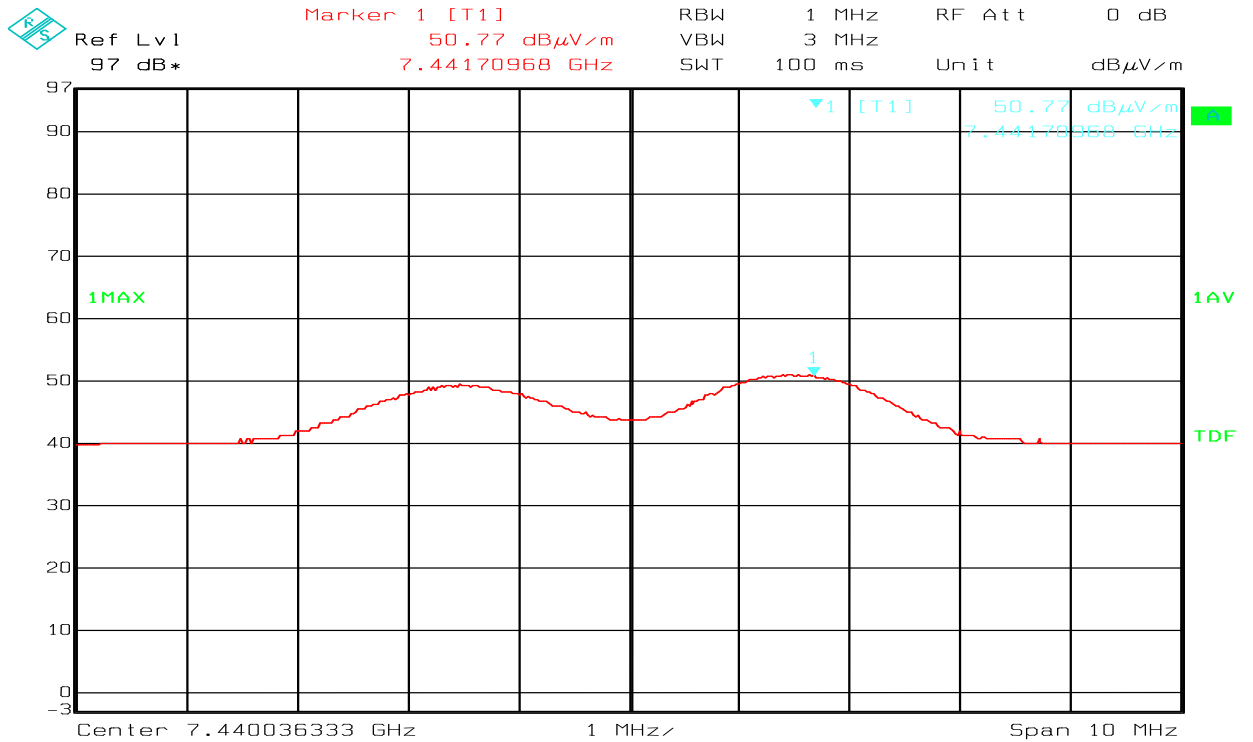
Radiated Emissions, HP, @3m, Ch 2440MHz – 3rd harmonic – PK detector



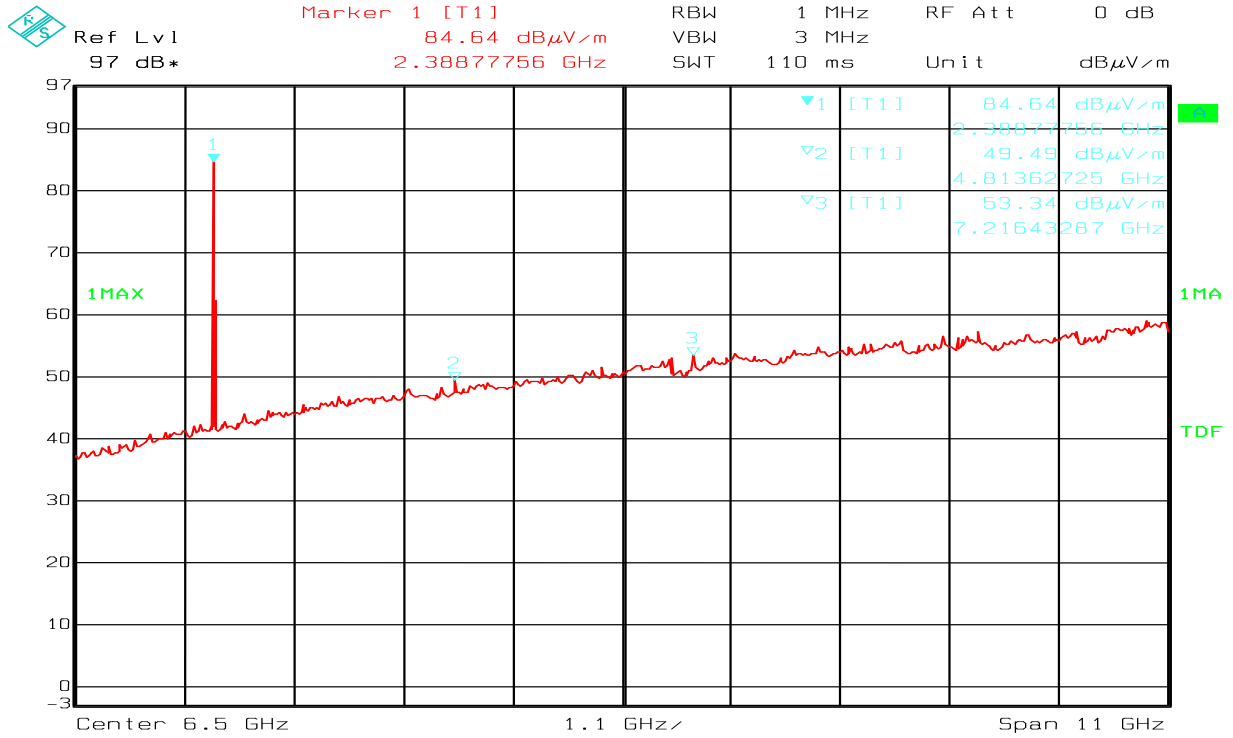
Radiated Emissions, HP, @3m, Ch 2440MHz – 3rd harmonic – AV detector



Radiated Emissions, HP, @3m, Ch 2480MHz – 3rd harmonic – PK detector

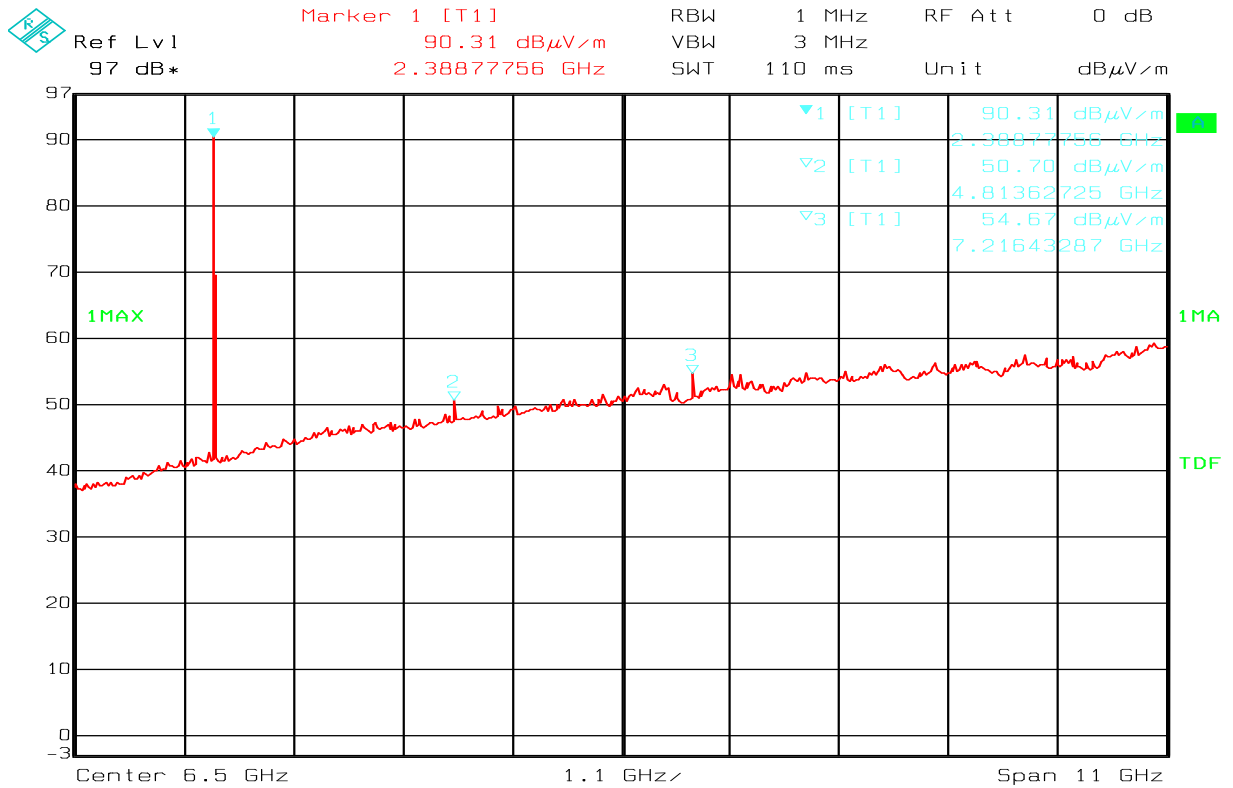


Radiated Emissions, HP, @3m, Ch 2480MHz – 3rd harmonic – AV detector



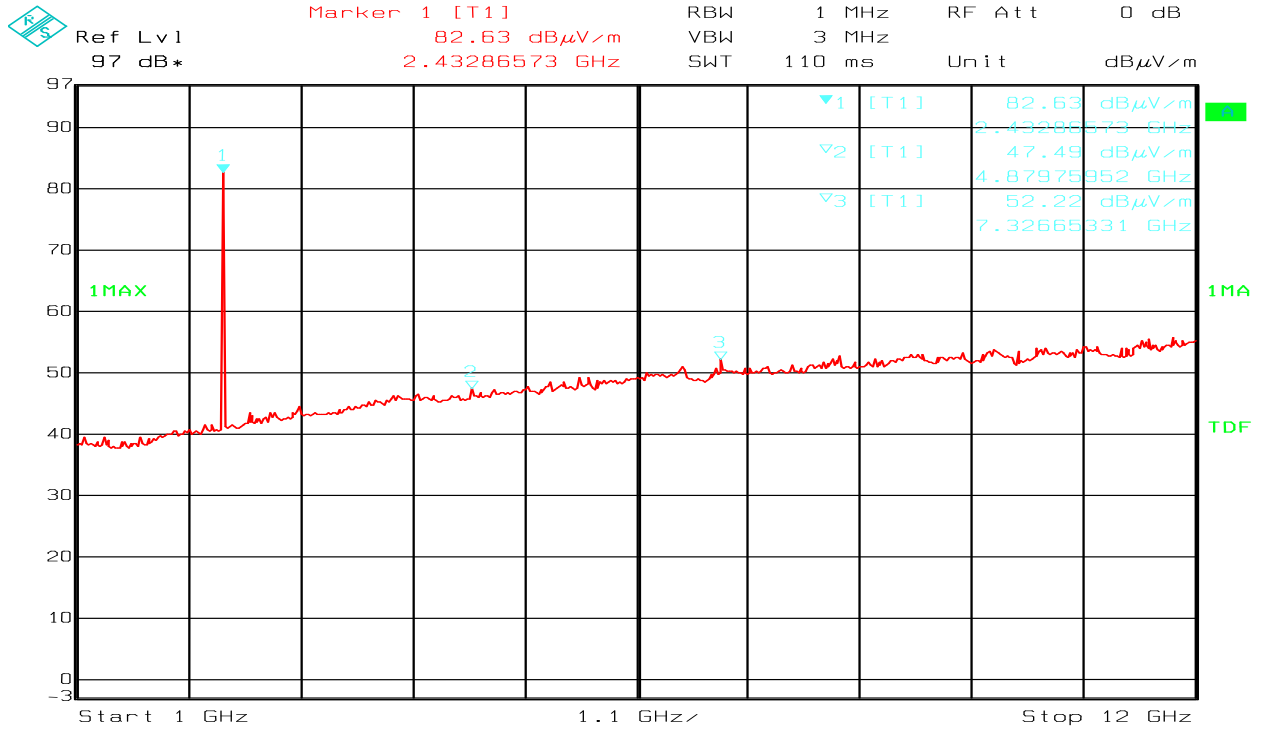
Date: 19.JUN.2012 14:08:24

Radiated Emissions 2405 MHz, 1 – 12 GHz, VP, @3m, VP



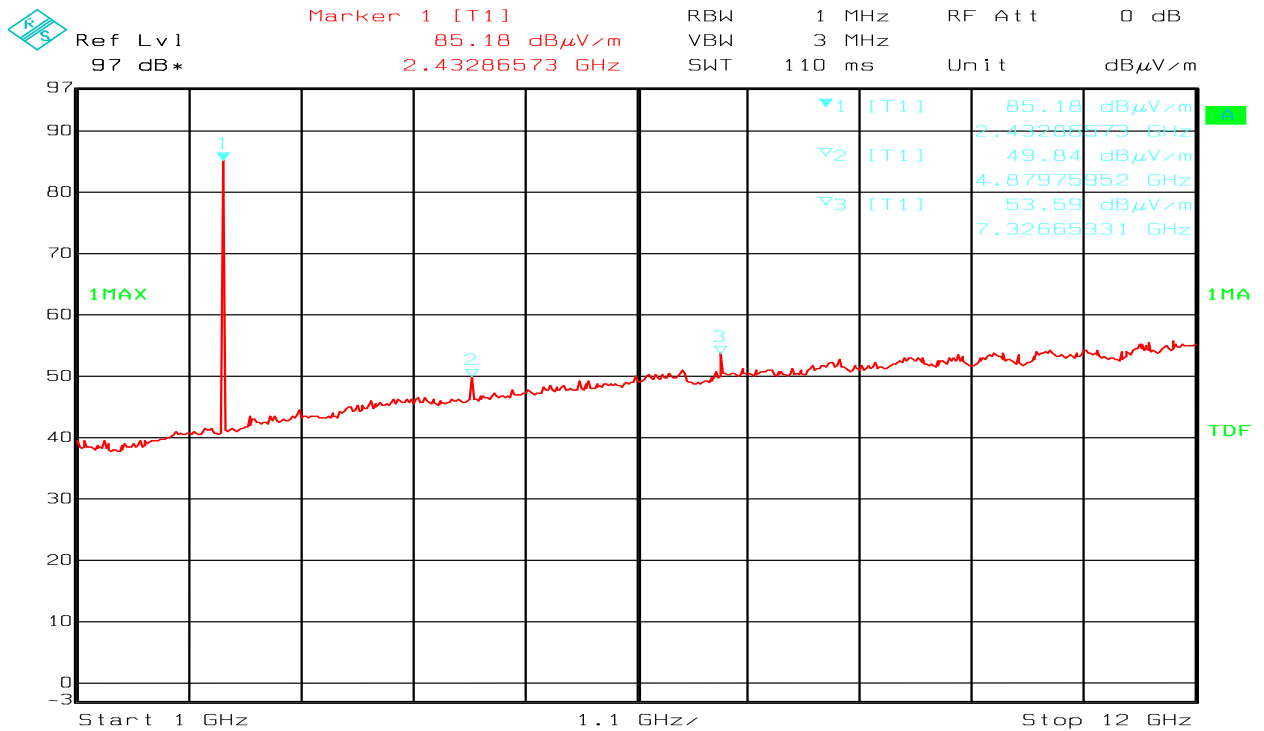
Date: 19.JUN.2012 14:05:50

Radiated Emissions 2405 MHz, 1 - 12GHz, HP, @3m,- HP



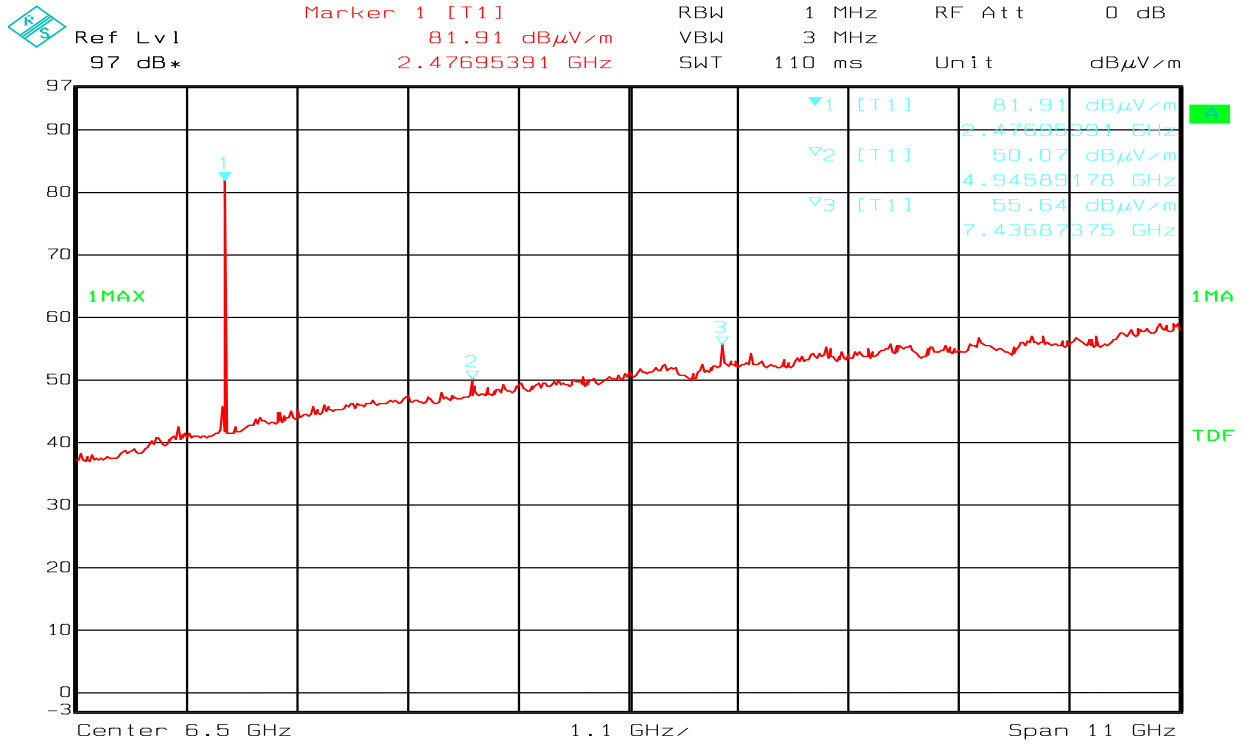
Date: 20. JUN. 2012 06:25:00

Radiated Emissions 2440 MHz, 1 – 12 GHz, VP, @3m, VP



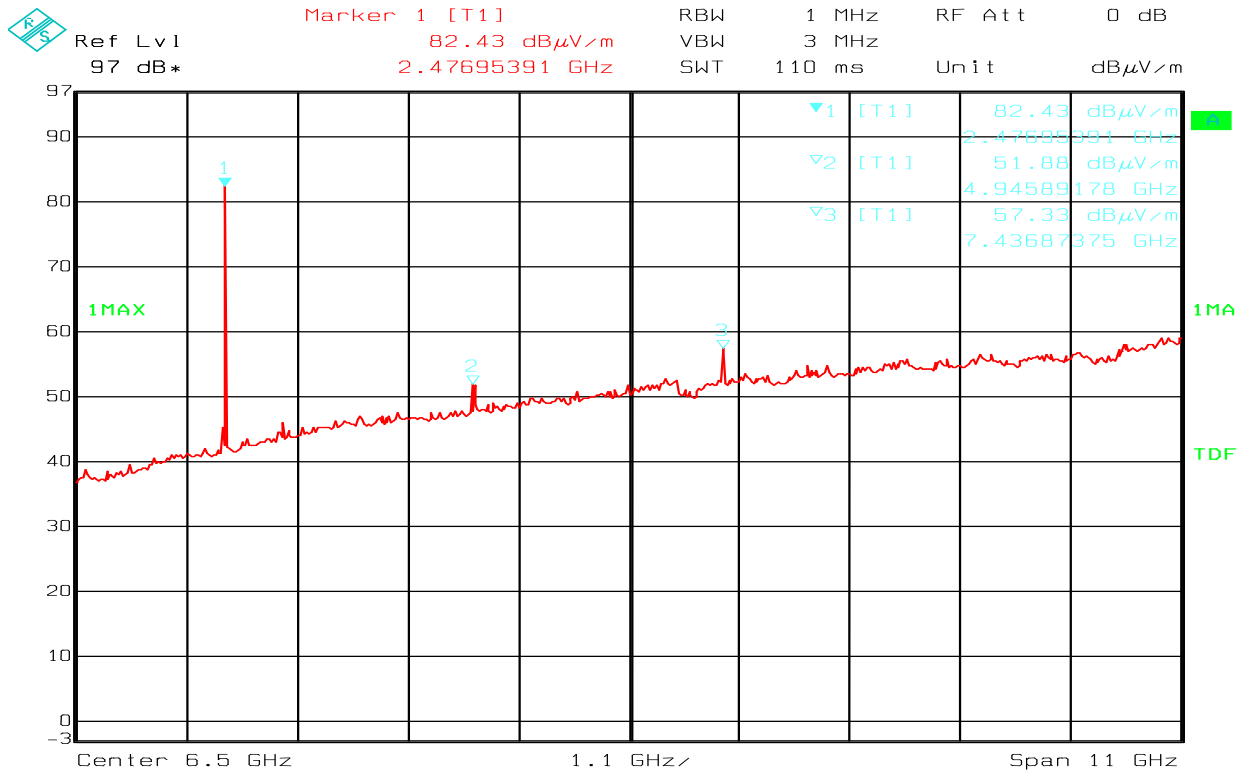
Date: 20. JUN. 2012 06:27:32

Radiated Emissions 2440 MHz, 1 - 12GHz, HP, @3m,- HP



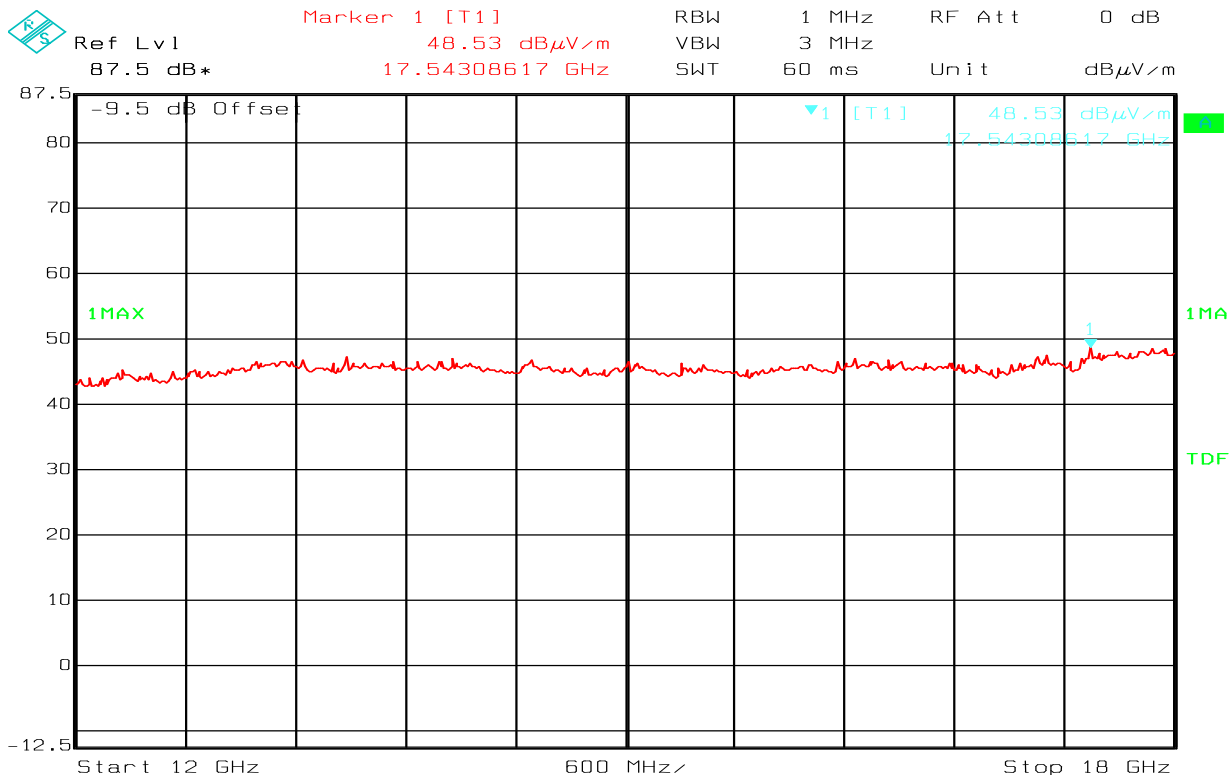
Date: 19.JUN.2012 14:12:56

Radiated Emissions 2480 MHz, 1 – 12 GHz, VP, @3m, VP



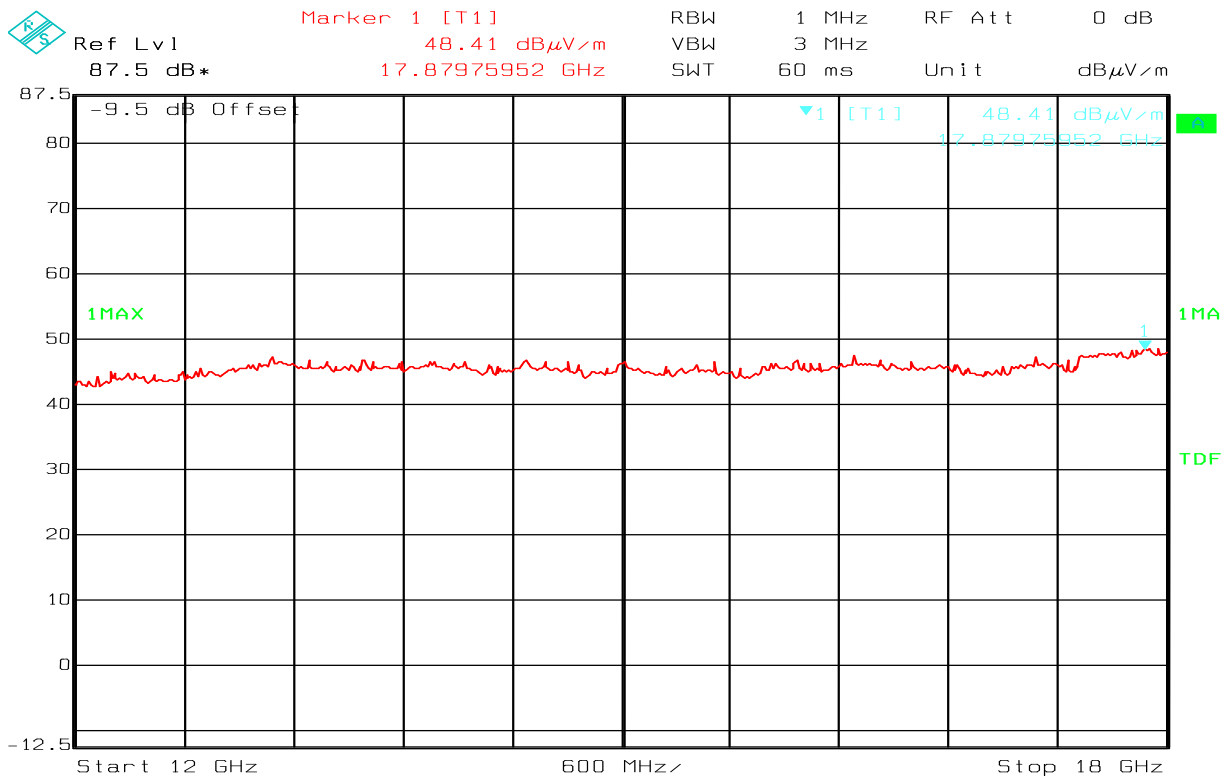
Date: 19.JUN.2012 14:15:10

Radiated Emissions 2480 MHz, 1 - 12GHz, HP, @3m,- HP



Date: 20.JUN.2012 07:23:06

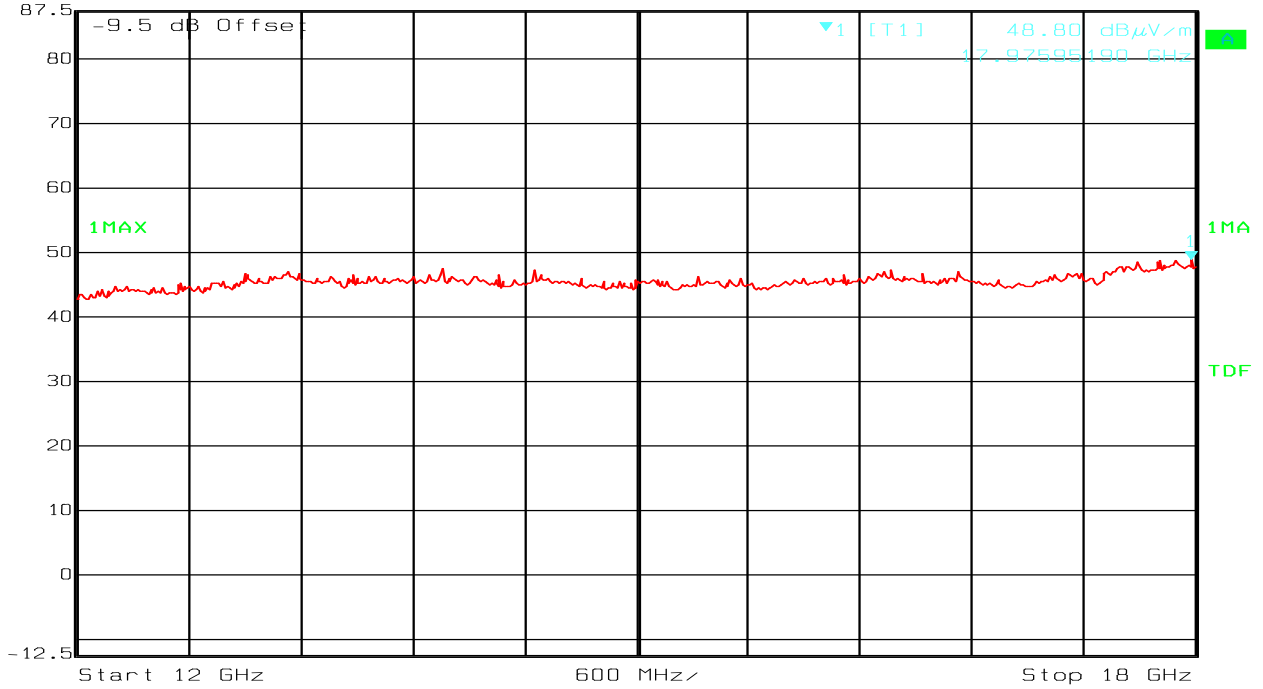
Radiated Emissions 2405 MHz, 12 – 18 GHz, @1m – VP



Date: 20.JUN.2012 07:20:55

Radiated Emissions 2405 MHz, 12 – 18 GHz, @1m – HP

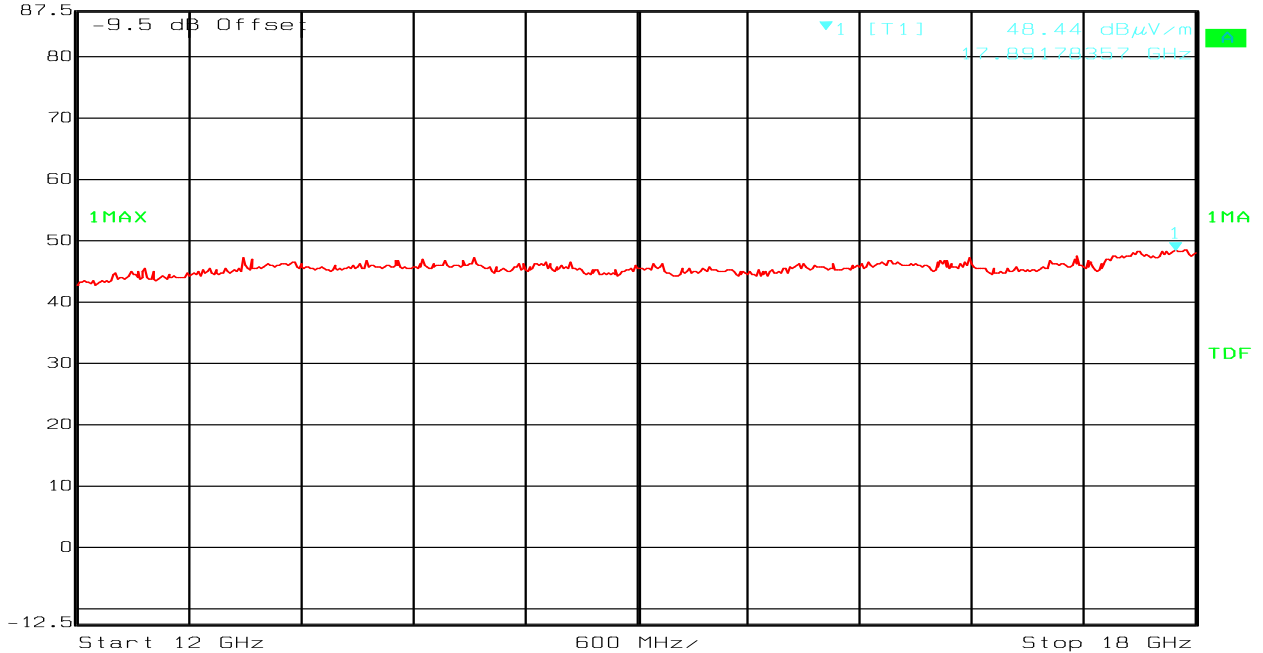
◆ ◆ ◆ ◆
 Ref Lvl 87.5 dB* Marker 1 [T1] 48.80 dB μ V/m RBW 1 MHz RF Att 0 dB
 -9.5 dB Offset 17.97595190 GHz VBW 3 MHz
 Unit dB μ V/m SWT 60 ms



Date: 20 JUN. 2012 07:12:55

Radiated Emissions 2440 MHz, 12 – 18 GHz, @1m – VP

◆ ◆ ◆ ◆
 Ref Lvl 87.5 dB* Marker 1 [T1] 48.44 dB μ V/m RBW 1 MHz RF Att 0 dB
 -9.5 dB Offset 17.89178357 GHz VBW 3 MHz
 Unit dB μ V/m SWT 60 ms



Date: 20 JUN. 2012 07:15:54

Radiated Emissions 2440 MHz, 12 – 18 GHz, @1m – HP

4.6 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

| | |
|----------------------------------|----------------------------|
| Test Performed By: Thomas Dangle | Date of Test: 13 June 2013 |
|----------------------------------|----------------------------|

Test Results: Complies

Measured Data:

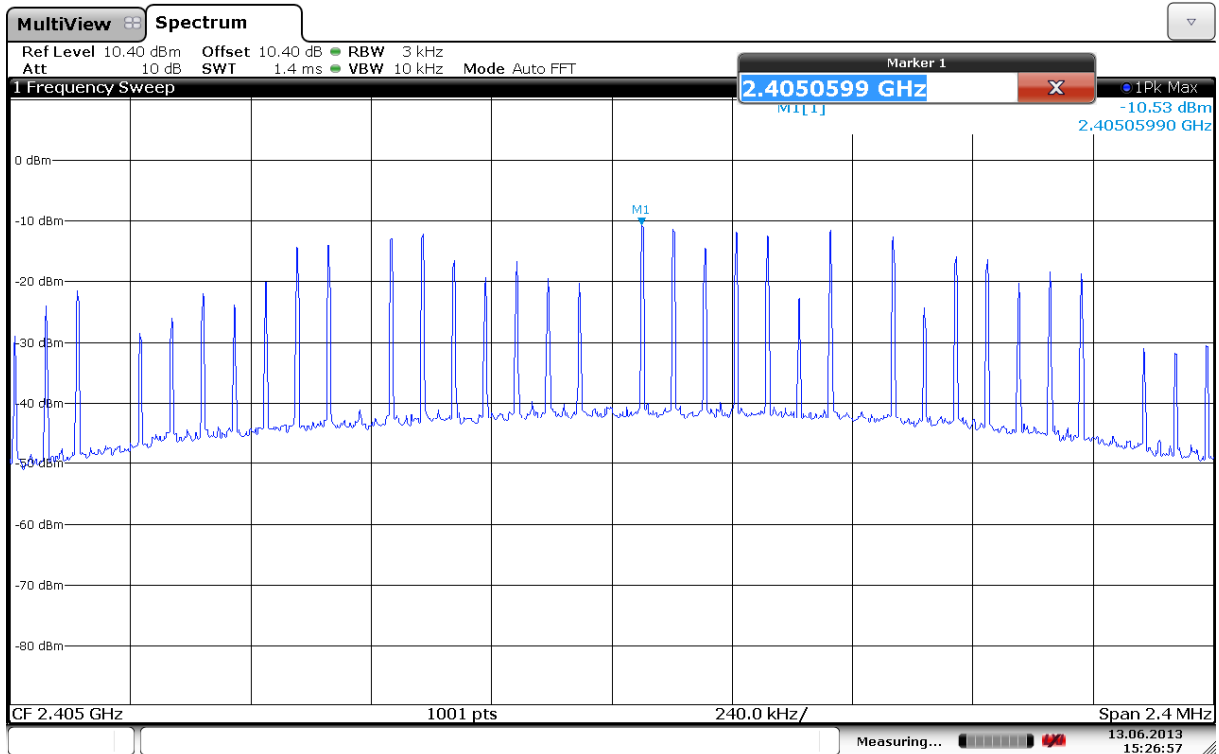
The alternative test procedures in point 2) A , B and formula 1 described in guidance on measurements for Digital Transmission Systems is used.

| | Measured PSD |
|----------------------------------|--------------|
| Power Spectral Density @2405 MHz | -10.53 |
| Power Spectral Density @2440 MHz | -11.65 |
| Power Spectral Density @2480 MHz | -12.95 |

Tested according to KDB 558074 D01 DTS Meas Guidance v02, Section 9.1.

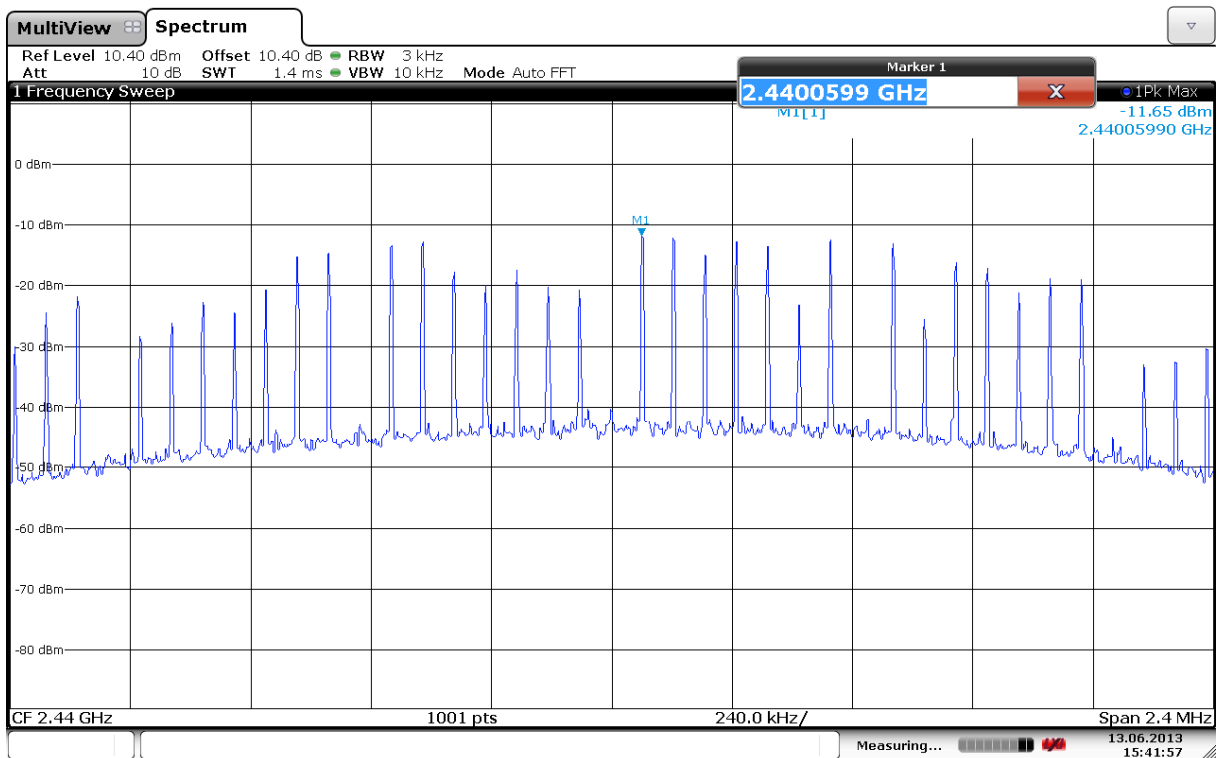
Requirements:

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



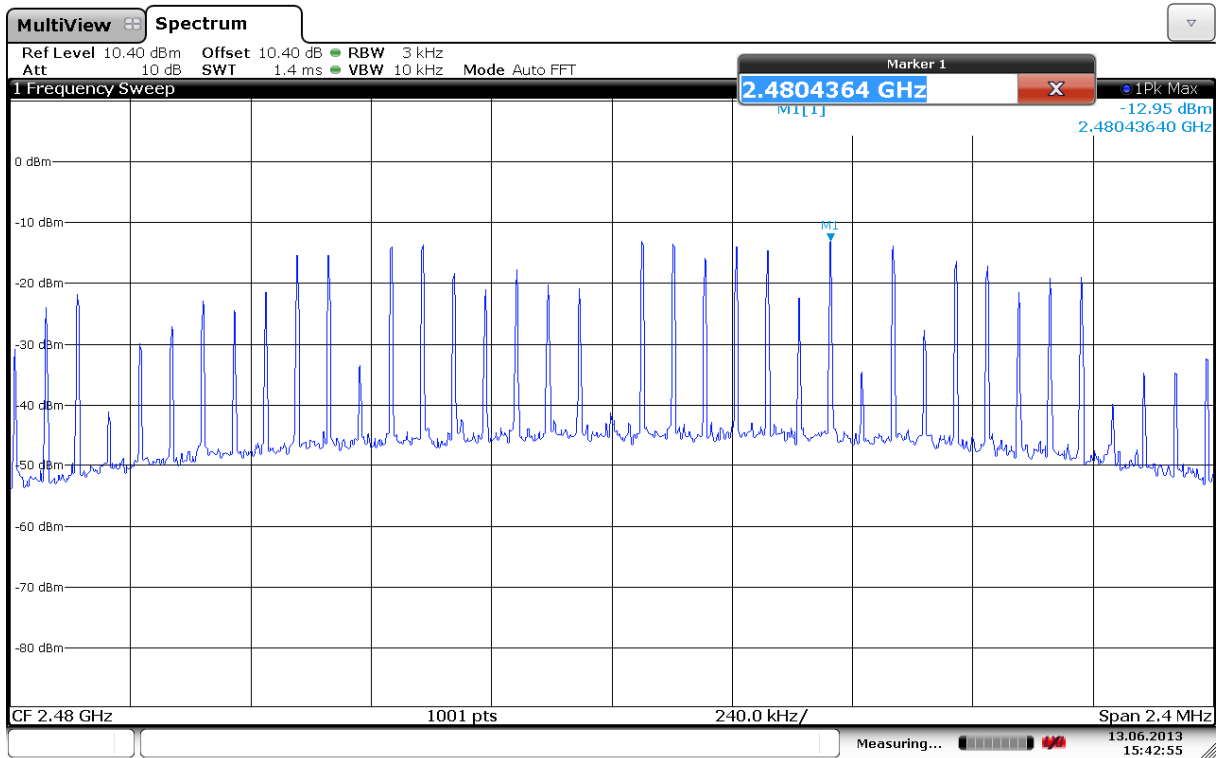
2397.500MHZ
 Date: 13.JUN.2013 15:26:57

PSD Measurement - 2405MHz



2397.500MHZ
 Date: 13.JUN.2013 15:41:57

PSD Measurement – 2440MHz



2397.500MHz
Date: 13 JUN 2013 15:42:55

PSD Measurement - 2480MHz

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.

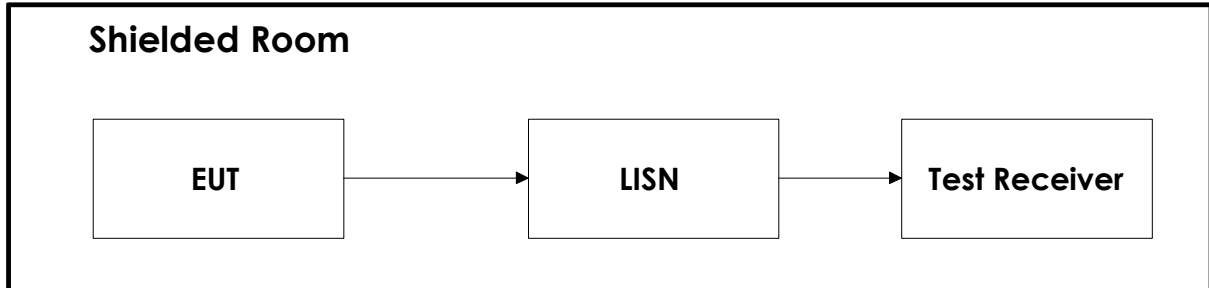
| No. | Instrument/ ancillary | Type of instrument/ ancillary | Manufacturer | Ref. no. | Cal. Date | Cal. Due |
|-----|--------------------------|----------------------------------|-----------------|----------|--------------|-------------|
| 1 | FSEK | Spectrum Analyzer | Rohde & Schwarz | LR 1337 | 2010.12.15 | 2012.12.15 |
| 2 | ESCS30 | Spectrum Analyzer | Rohde & Schwarz | N-3924 | 2011.12.15 | 2012.12.15 |
| 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 | 2010-08 | 2012-08 |
| 10 | 8449B | Pre-amplifier | Hewlett Packard | LR 1322 | 2011-09-27 | 2012-09-27 |
| 11 | LNA6900 | Pre-amplifier | Teseq | LR 1593 | 2011-11 | 2012-11 |
| 12 | ESCI | Test Receiver | Rohde & Schwarz | N-4529 | 2010.11.08 | 2012.11.08 |
| 13 | ESH3-Z3 | LISN | Rohde & Schwarz | LR 1076 | 2011-11-03 | 2013-11-03 |
| 14 | 80S | Signal Generator | Powertron | LT 502 | Cal b4 use | |
| 15 | Model 87 V | Multimeter | Fluke | LR 1598 | 2011-12-14 | 2012-12-14 |
| 17 | FSU26 | Spectrum Analyzer | Rohde & Schwarz | LR 1504 | 2010.09.28 | 2012.09.28 |
| 18 | ESH3-Z2 | Puls Limiter | Rohde & Schwarz | N-3932 | 2010.11.04 | 2012.11.04 |
| 19 | 6810.17A | 10 attenuator | Suhner | LR 1143 | 2010.09.15 | 2012.09.15 |
| 20 | FA210A1010003030 | Microwave cable | Rosenberger | LR1566 | Cal b4 use | |

Date:13 June 2013

| No. | Instrument/ ancillary | Type of instrument/ ancillary | Manufacturer | Ref. no. | Cal. Date | Cal. Due |
|-----|--------------------------|----------------------------------|-----------------|----------|--------------|-------------|
| 1 | 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

