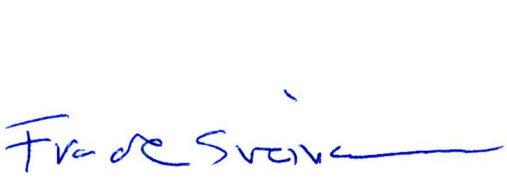


Test Report

Product	Bluetooth Low Energy Transceiver
Name and address of the applicant	LEGO System A/S Åstvej 1, 7190 Billund, Denmark
Name and address of the manufacturer	LEGO System A/S Åstvej 1, 7190 Billund, Denmark
Model	LPF2 Smart Hub
Rating	3.0V DC
Trademark	LEGO
Serial number	/
Additional information	Bluetooth 4.0 LE
Tested according to	FCC Part 15.247 Digital Transmission Systems Industry Canada RSS-247, Issue 1 Low Power Licence-Exempt Radiocommunications Devices
Order number	280471
Tested in period	2015.07.20 – 2015.07.29
Issue date	2015.12.08
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway FCC No: 994405 IC OATS: 2040D-1 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50
 Prepared by [G.Suhanthakumar]  Approved by [Frode Sveinsen]	
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1 INFORMATION

1.1 Test Item

Name :	LEGO
FCC ID :	NPI19071
Industry Canada ID :	3072A-19071
Model/version :	LPF2 Smart Hub
Serial number :	N/A
Hardware identity and/or version:	18884_20J
Software identity and/or version :	1.0.06.0000
Frequency Range :	2402 – 2480 MHz
Tunable Bands :	None
Number of Channels :	40
Operating Modes :	TX/RX
Type of Modulation :	GFSK
User Frequency Adjustment :	None
Rated Output Power :	0.00095 W
Type of Power Supply :	Primary batteries (AA 2x1.5V) or rechargeable Lithium ION polymer 3.7V
Antenna Connector :	N/A (only integra antenna)
Antenna Diversity Supported :	None
Desktop Charger :	N/A (Any DC power supply voltage of 10.4V can used for charging)

Description of Test Item

The items tested are a system concentrated around a central unit which contains the radio functionality. To this central unit various accessories can be attached, featuring 2 different sensors, a motor and optionally a rechargeable battery.

When used for building models there are no single setup of the system, but it can vary depending on the demands.

Theory of Operation

The system is built up around a device (iPad or other tablet) with a dedicated program which is connected to the central unit using BLE. This smart device is able to execute a programmed sequence to control the system.

Exposure Evaluation

The user manual contains text that it shall be mounted with a separation distance of at least 20 cm from any humans. For the purposes of exposure evaluation this EUT is a portable device. MPE Calculation at 20 cm satisfying FCC requirements is submitted as a separate document.

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 5.

1.2 Test Environment

1.2.1 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	3.0 V DC

The values are the limit registered during the test period.

1.3 Test Engineer(s)

G.Suwanthakumar

1.4 Test Equipment

See list of test equipment in clause 5.

2 TEST REPORT SUMMARY

2.1 General

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-247 Issue 1.

Tests were performed in accordance with ANSI C63.4-2014 and KDB 55074 D01 DTS Measurement Guidance v03r02.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 1m, 3m and 10m.

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

☒ 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".

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 1 reference	Result
Supply Voltage Variations	15.31(e)	8 (RSS-GEN)	N/A ¹
Antenna Requirement	15.203	7.1.4 (RSS-GEN)	N/A ²
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2.2 (RSS-GEN)	Complies ³
Occupied Bandwidth	15.247(a)(1)	8.1	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2(1)	Complies
Peak Power Output	15.247(b)	5.4(4)	Complies
Power Spectral Density	15.247(d)	5.2(2)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5	N/A ²
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5	Complies

¹ The tested equipment only operates with battery.

² The tested equipment has integrated antennas only.

³ During charging of rechargeable battery with any external DC power supply.

2.3 Description of modification for Modification Filing

Not applicable.

2.4 Comments

The measurements were done with fully charged batteries.

All ports were populated during spurious emission measurements.

The following LEGO parts were connected during the measurements

- 1x 10019071 LPF2 Smart Hub 2 IO
- 1x 10019104 LPF2 Smart Hub 2AA BatteryBox
- 1x 10019106 LPF2 Rechargeable Battery
- 1x 10020841 LPF2 Tilt Sensor
- 1x 10020844 LPF2 Detect Sensor
- 1x 10021980 LPF2 Medium Motor
- 1x 2 Wire DC power supply cable for the rechargeable battery (10.4V)

2.5 Family List Rational

Not Applicable.

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: G.Suwanthakumar	Date of Test: 2015.07.20
------------------------------------	--------------------------

Measurement procedure: ANSI C63.4-2009 using 50 μ H/50 ohms LISN.

Test Results: Complies.

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

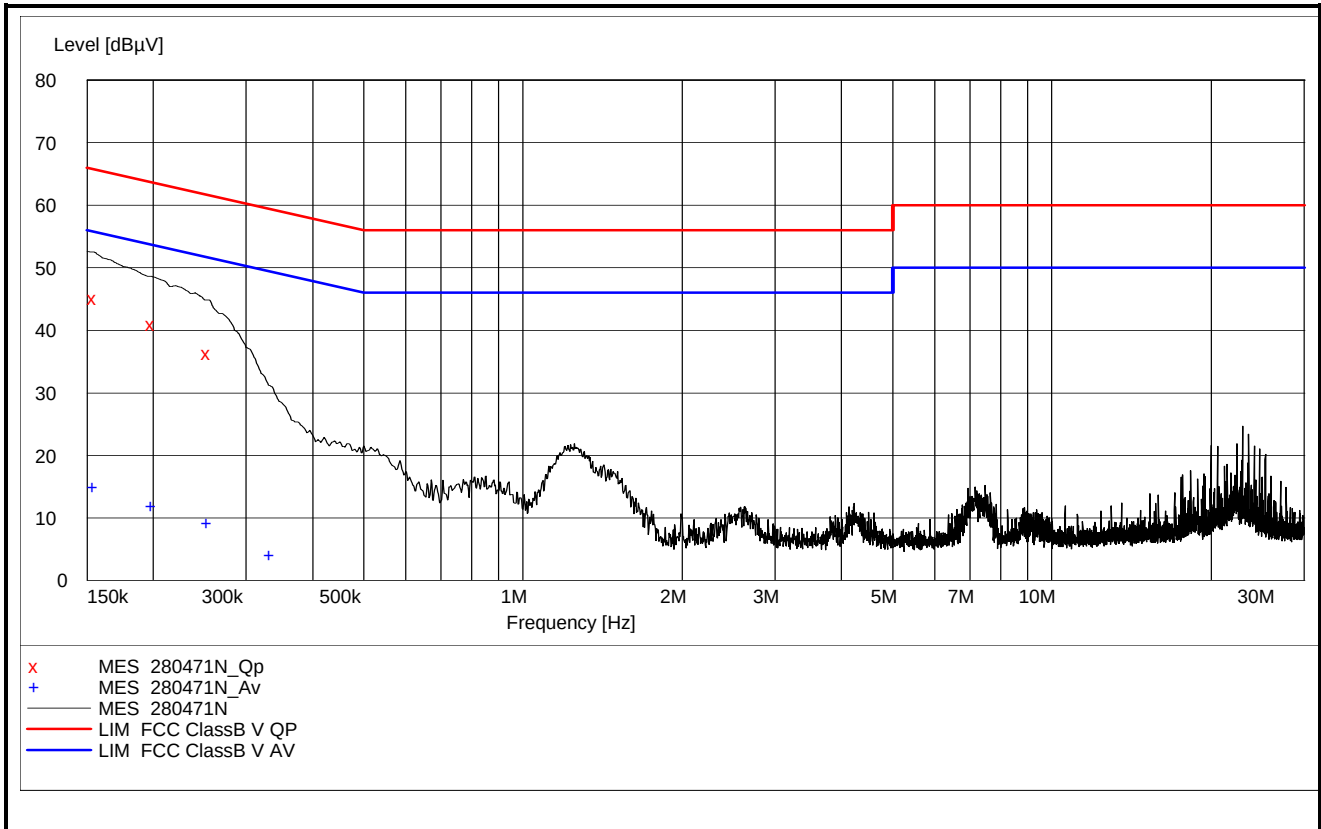
Øltronix DC power supply type B603D is used for charging the battery.
120Vac/60Hz

QP Detector:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.155000	45.10	10.70	65.70	20.60	QP	N	Pass
0.200000	41.00	10.70	63.60	22.60	QP	N	Pass
0.255000	36.30	10.60	61.60	25.30	QP	N	Pass

AV detector:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.155000	15.00	10.70	55.70	40.70	AV	N	Pass
0.200000	12.00	10.70	53.60	41.60	AV	N	Pass
0.255000	9.10	10.60	51.60	42.50	AV	N	Pass
0.335000	4.00	10.50	49.30	45.30	AV	N	Pass



3.2 Minimum 6 dB Bandwidth

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

Test Performed By: G.Suhanthakumar	Date of Test: 2015.07.20
------------------------------------	--------------------------

Test Results: Complies

Measurement Data:

Measured 6 dB Bandwidth (kHz)		
2402 MHz	2440 MHz	2480 MHz
711.5	737.2	753.2

Duty cycle: 100%

Tested according to KDB 558074 D01 DTS Meas Guidance v03r02, Section 8.1.

Requirements:

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

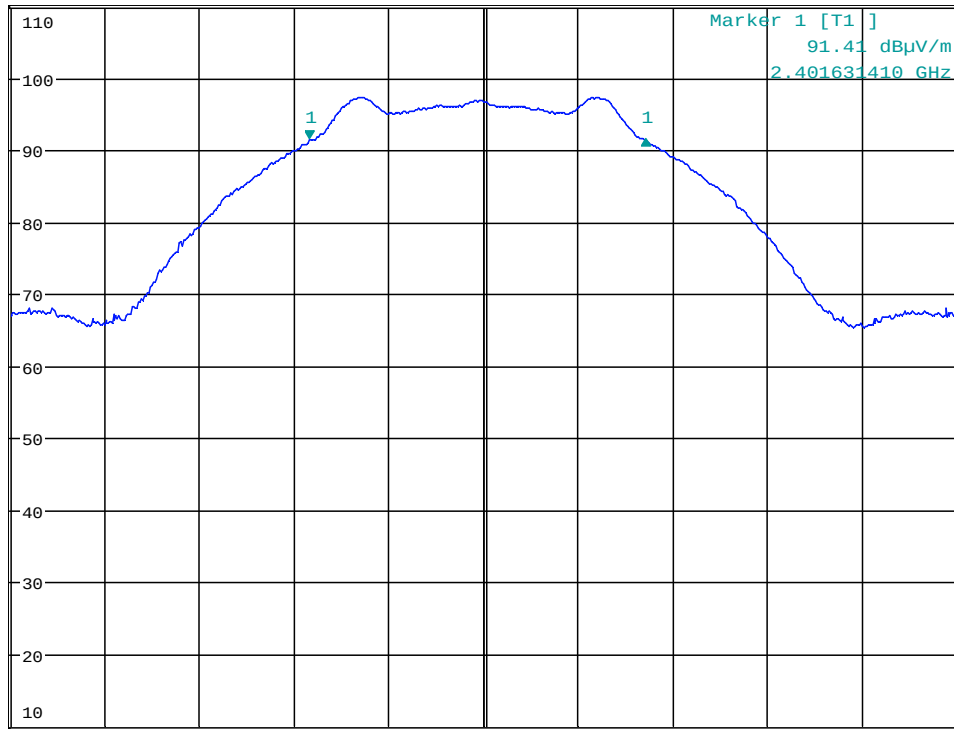


* RBW 100 kHz Delta 1 [T1]
VBW 300 kHz -0.02 dB
SWT 2.5 ms 711.538461553 kHz

Ref 110 dBμV/m

* Att 15 dB

1 PK
MAXH



Center 2.402 GHz

200 kHz/

Span 2 MHz

Date: 20.JUL.2015 12:55:10

6 dB Bandwidth at 2402 MHz

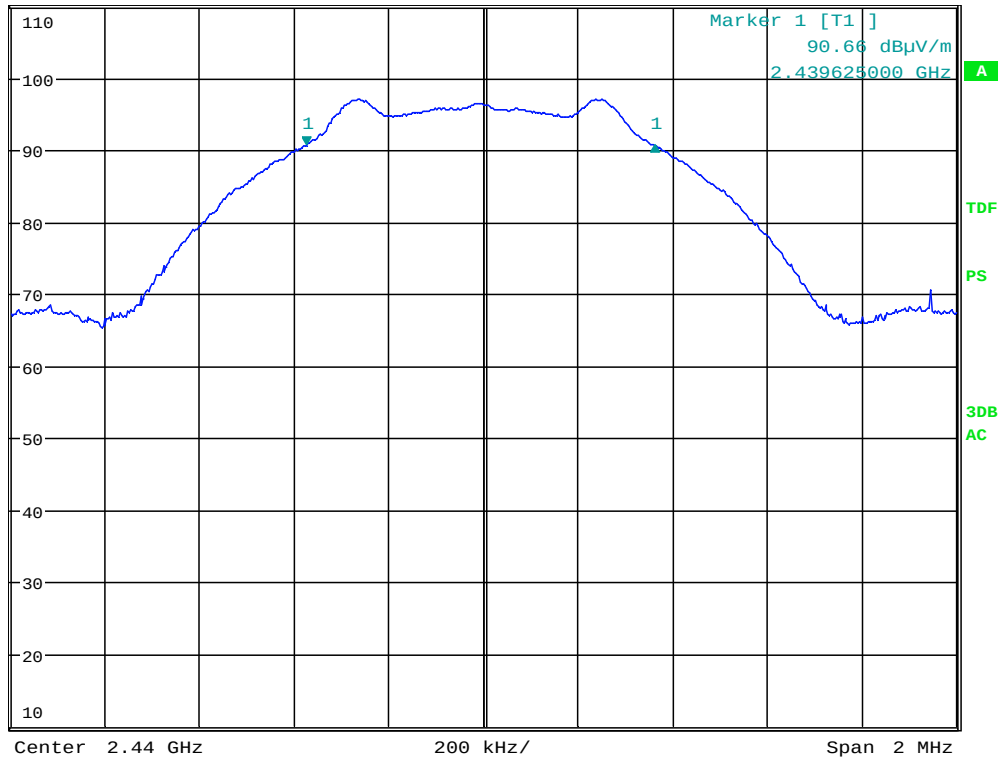


* RBW 100 kHz Delta 1 [T1]
VBW 300 kHz -0.10 dB
SWT 2.5 ms 737.179487205 kHz

Ref 110 dBμV/m

* Att 15 dB

1 PK
MAXH



Date: 20.JUL.2015 13:57:00

6 dB Bandwidth at 2440 MHz

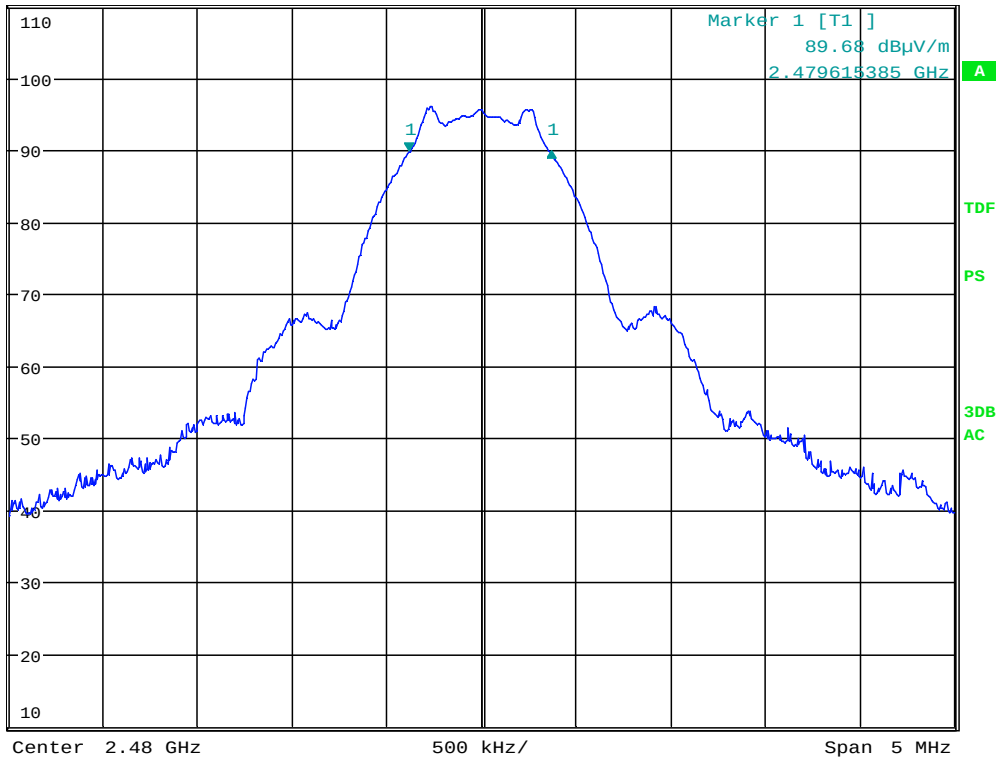


* RBW 100 kHz Delta 1 [T1]
VBW 300 kHz -0.01 dB
SWT 2.5 ms 753.205128201 kHz

Ref 110 dBμV/m

* Att 15 dB

1 PK
MAXH



Date: 20.JUL.2015 13:36:14

6 dB Bandwidth at 2480 MHz

3.3 20 dB Bandwidth

Test Performed By: G.Suwanthakumar

Date of Test: 20.07.2015

Measurement Data:

Measured 20 dB Bandwidth (MHz)
2402 MHz
1.23

Requirements:

No requirements. Reported only for information.

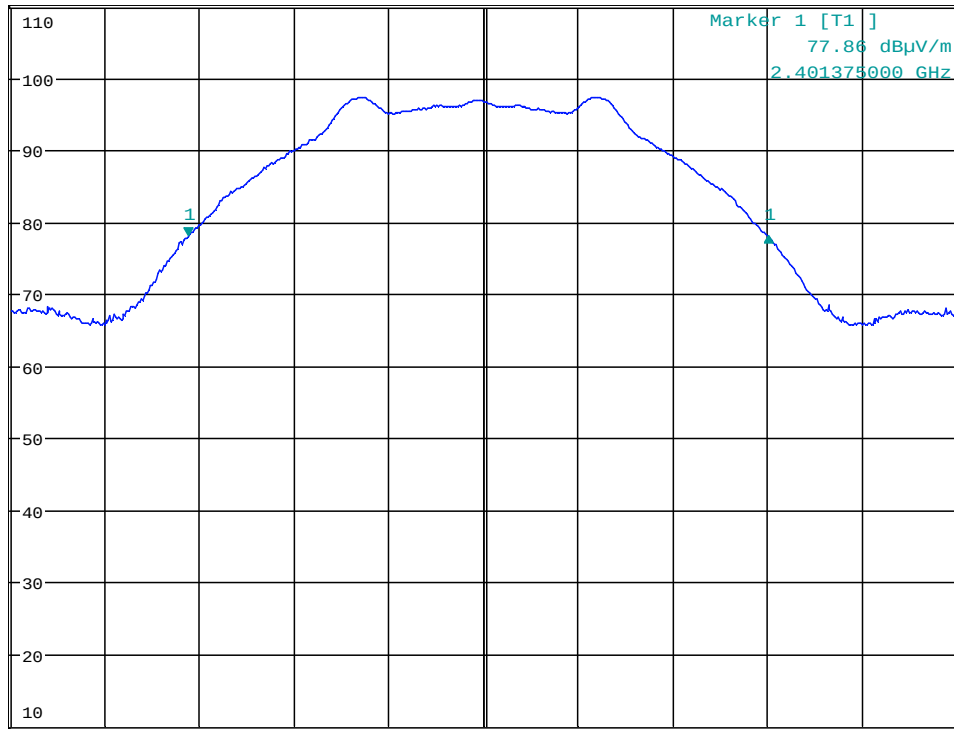


* RBW 100 kHz Delta 1 [T1]
VBW 300 kHz 0.02 dB
SWT 2.5 ms 1.227564103 MHz

Ref 110 dBμV/m

* Att 15 dB

1 PK
MAXH



A

TDF

PS

3DB
AC

Center 2.402 GHz

200 kHz/

Span 2 MHz

Date: 20.JUL.2015 12:56:05

20 dB Bandwidth at 2402 MHz

3.4 Peak Power Output

Para. No.: 15.247 (b)

Test Results: Complies

Measurement Data:

	2402 MHz	2440 MHz	2480 MHz
Conducted Power (dBm)	-0.23	-0.76	-1.20
Conducted Power (Watts)	0.00095	0.00084	0.00076
Field Strength (dBµV/m)	98.7	97.8	96.4
EIRP, Calculated (Watts)	0.0022	0.0018	0.0013
Antenna gain (dBi)	3.6	3.3	2.3

Duty cycle: 100%

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

Tested according to KDB 558074 D01 DTS Meas Guidance v03r02, Section 9.1.1.

EIRP is calculated according to KDB 558074 D01 DTS Meas Guidance v03r02, Section 12.2.2. (e)

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

See attached graph.

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.

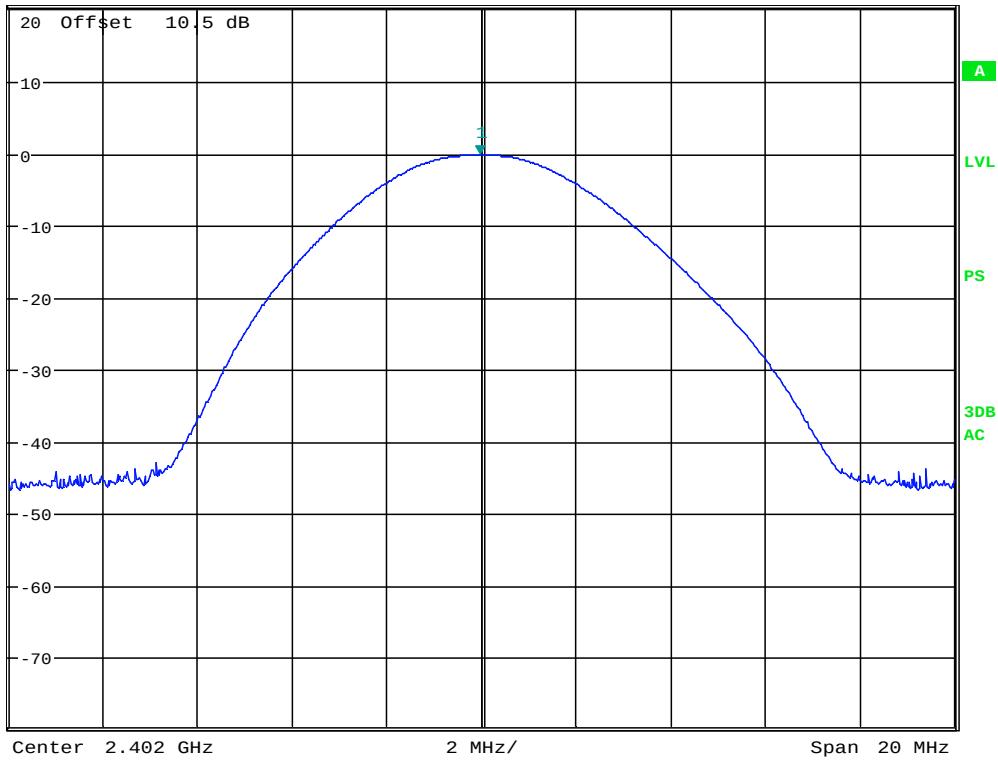


* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
-0.23 dBm
2.401967949 GHz

Ref 20.5 dBm

* Att 20 dB

1 PK
MAXH



Date: 20.JUL.2015 15:11:14

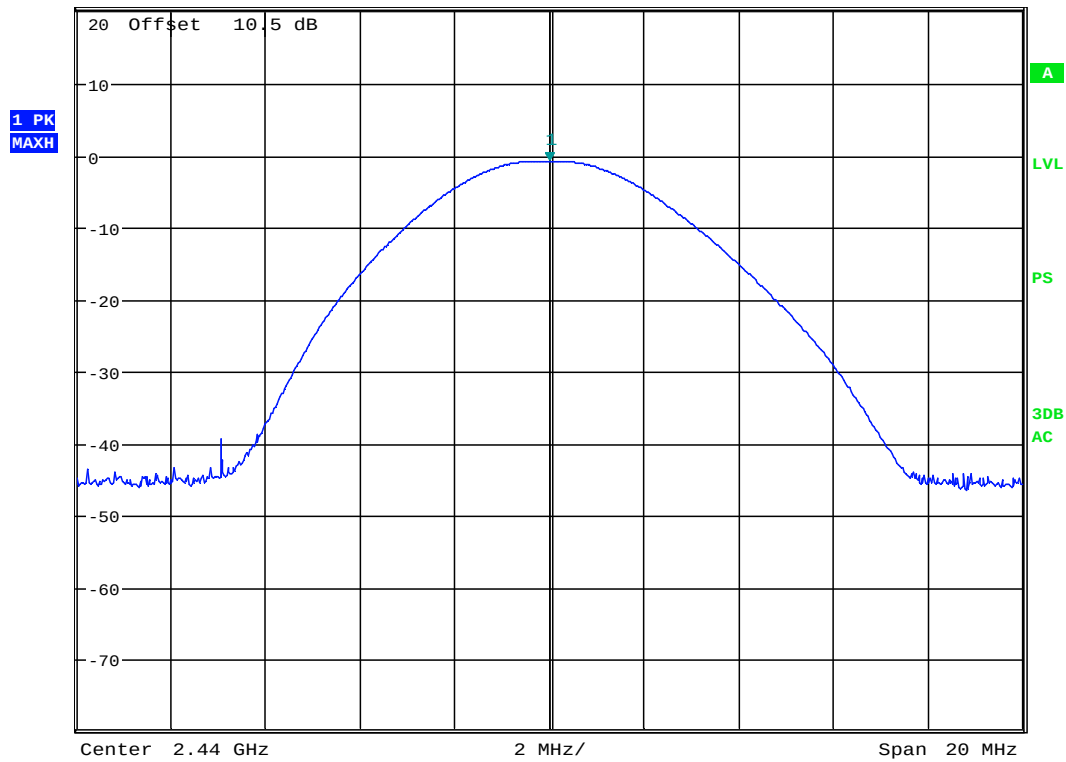
Conducted power – 2402MHz



MARKER 1
2.44 GHz
Ref 20.5 dBm * Att 20 dB

* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms

Marker 1 [T1]
-0.76 dBm
2.440000000 GHz



Date: 20.JUL.2015 15:31:10

Conducted power – 2440MHz



MARKER 1

2.479807692 GHz

Ref 20.5 dBm

* Att 20 dB

* RBW 3 MHz

VBW 10 MHz

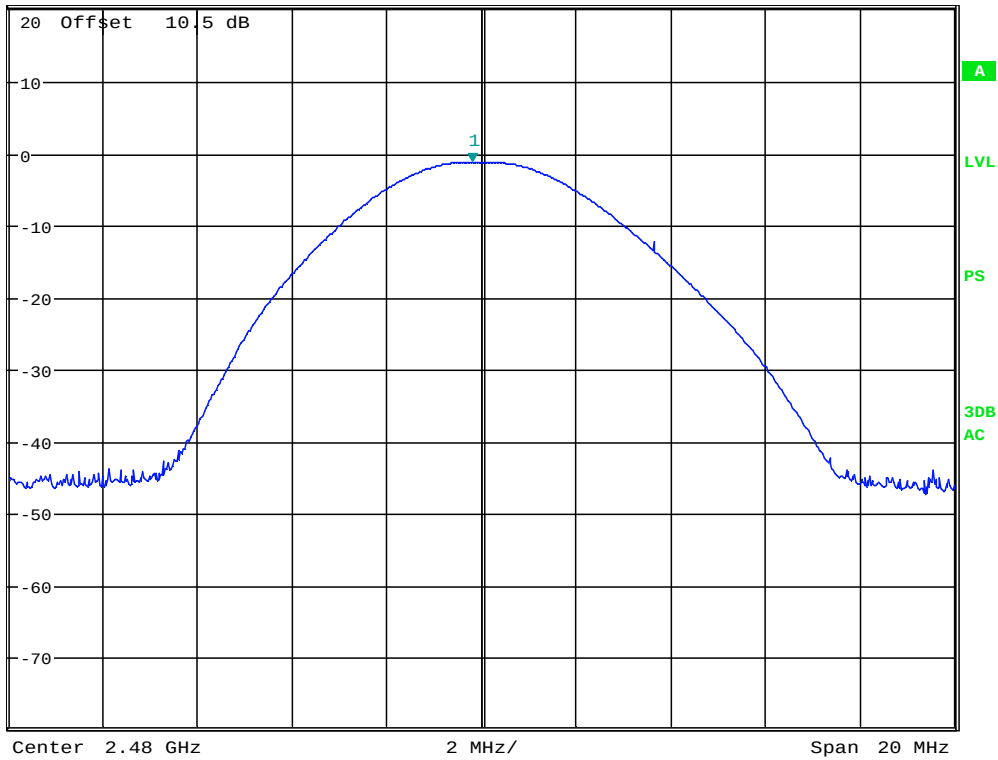
SWT 2.5 ms

Marker 1 [T1]

-1.20 dBm

2.479807692 GHz

1 PK
MAXH



Date: 20.JUL.2015 15:31:42

Conducted power – 2480MHz



* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
98.65 dBμV/m
2.402000000 GHz

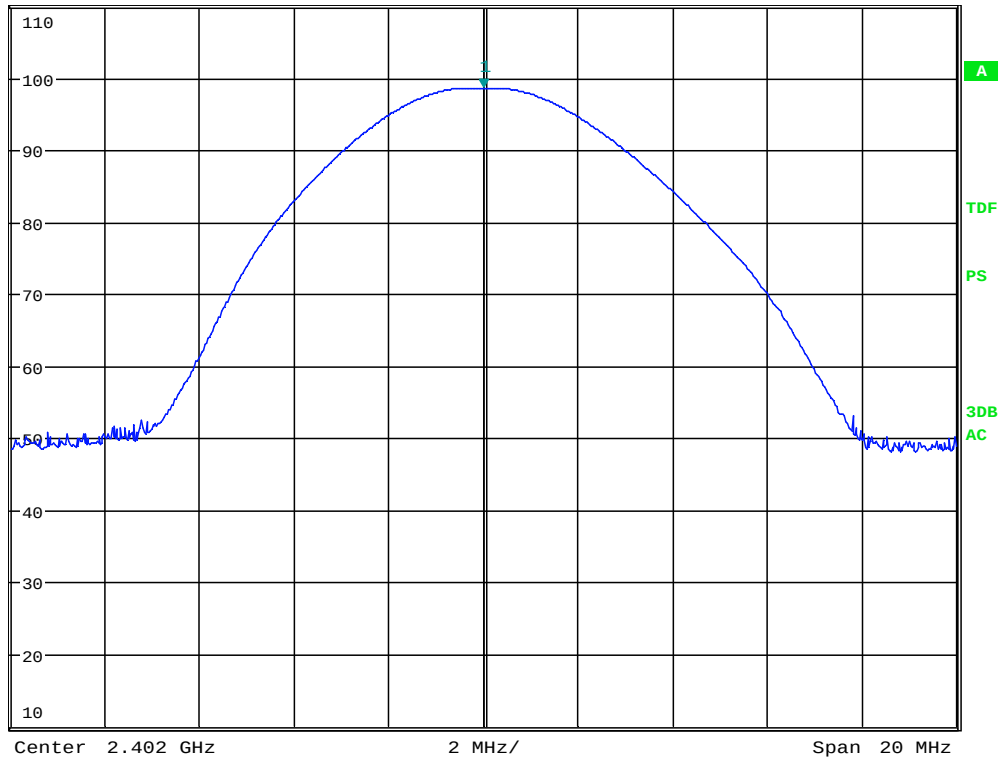
Ref 110 dBμV/m

* Att 15 dB

SWT 2.5 ms

2.402000000 GHz

1 PK
MAXH



Date: 20.JUL.2015 11:22:45

Radiated field strength, VP, 2402 MHz

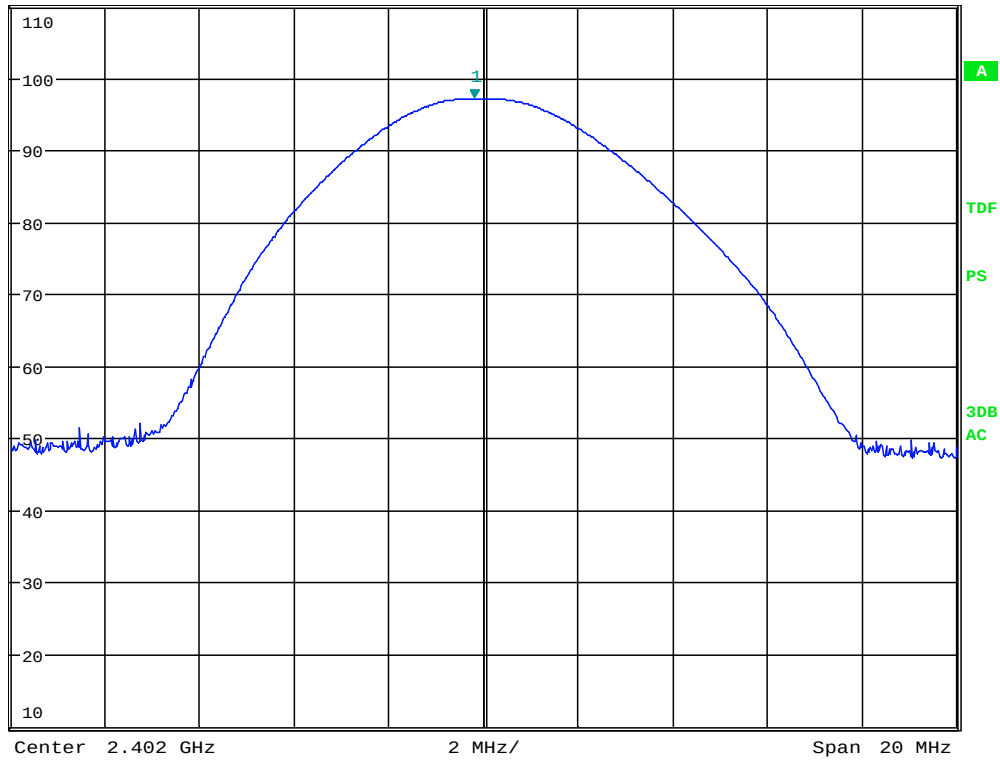


* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
97.11 dB μ V/m
2.401807692 GHz

Ref 110 dB μ V/m

* Att 15 dB

1 PK
MAXH



Date: 20.JUL.2015 11:21:54

Radiated field strength, HP, 2402 MHz



MARKER 1

2.43974359 GHz

Ref 110 dB μ V/m

* Att 15 dB

* RBW 3 MHz

VBW 10 MHz

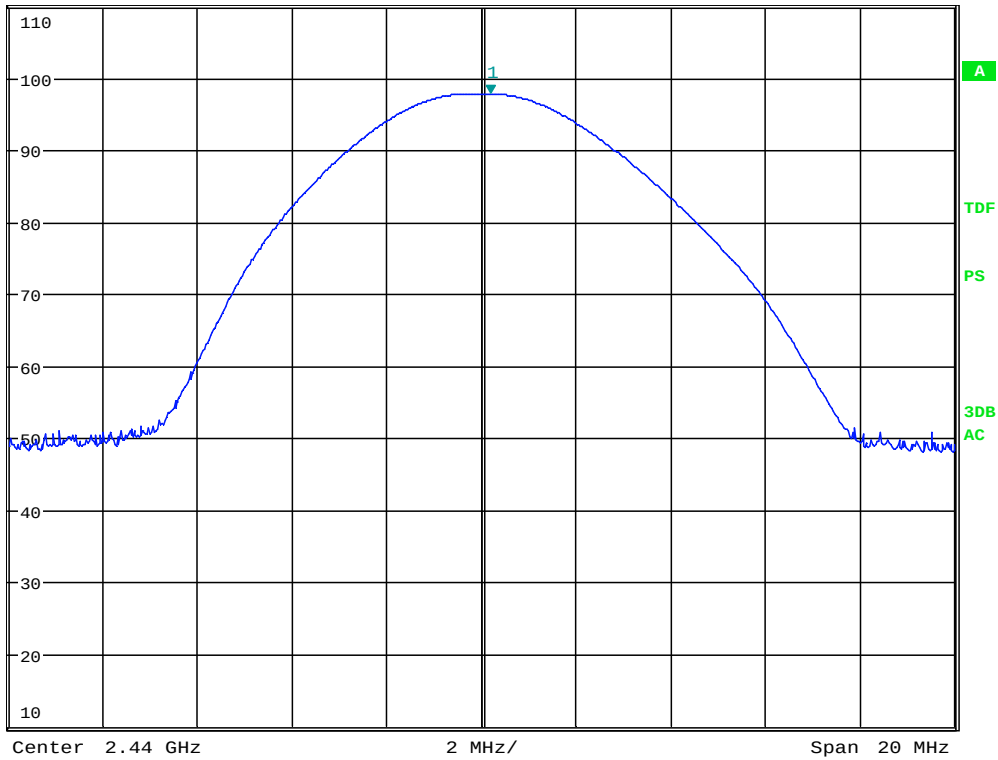
SWT 2.5 ms

Marker 1 [T1]

97.79 dB μ V/m

2.440192308 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:49:49

Radiated field strength, VP, 2440 MHz



MARKER 1

2.43974359 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 3 MHz

VBW 10 MHz

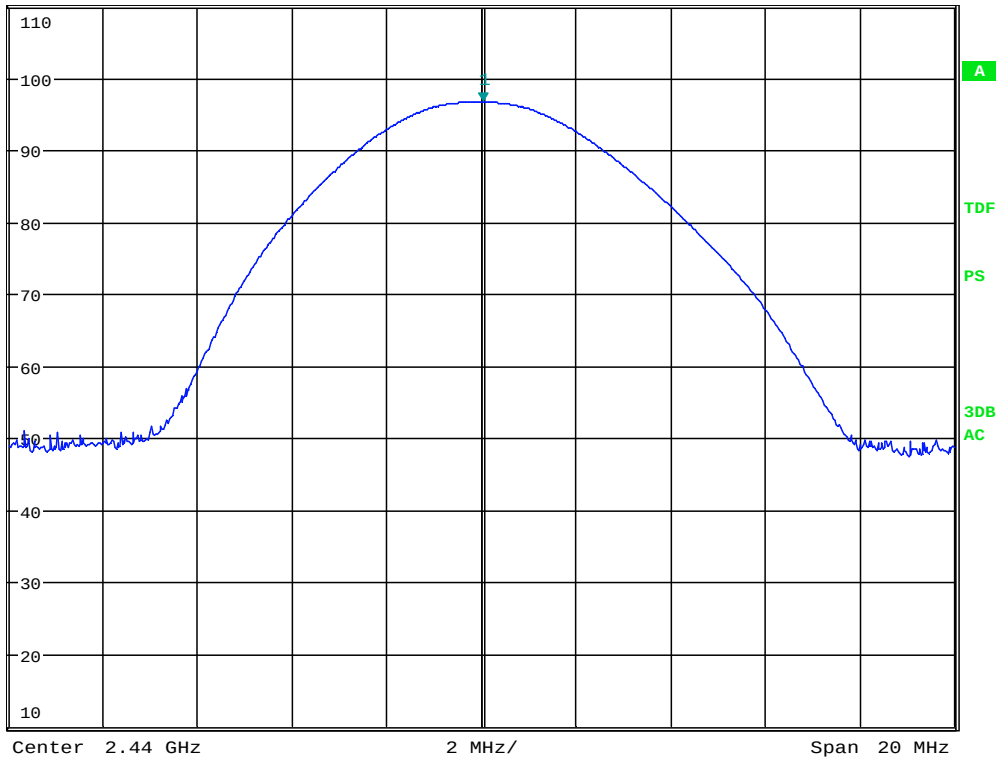
SWT 2.5 ms

Marker 1 [T1]

96.62 dBμV/m

2.440032051 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:48:57

Radiated field strength, HP, 2440 MHz

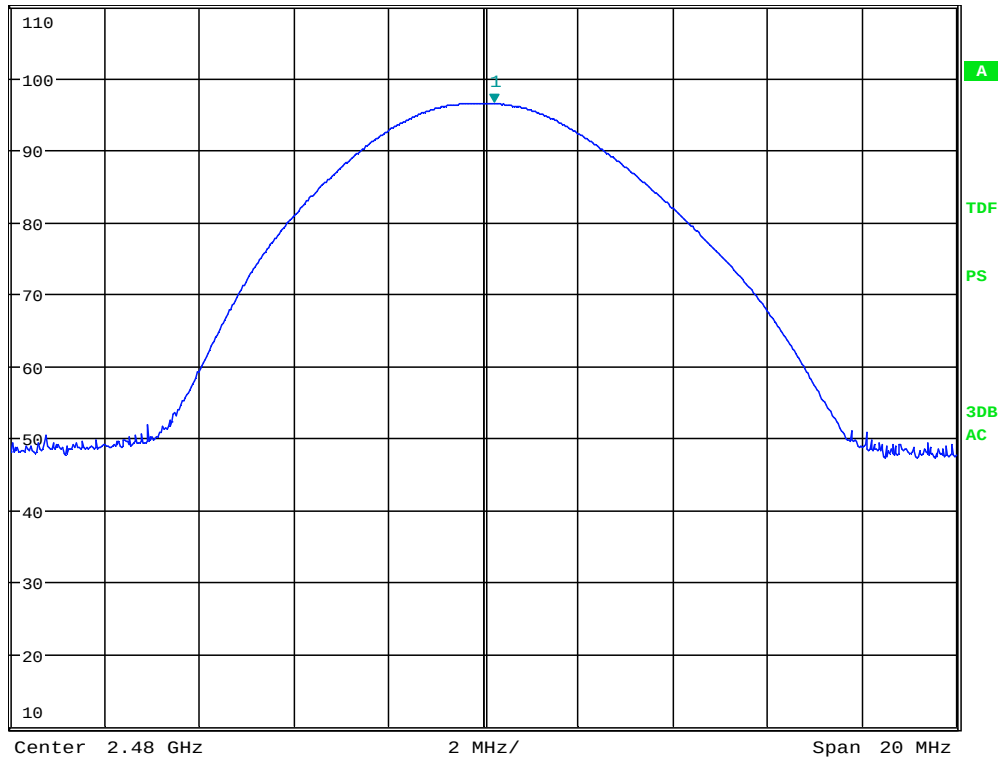


* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
96.42 dB μ V/m
2.480224359 GHz

Ref 110 dB μ V/m

* Att 15 dB

1 PK
MAXH



Date: 20.JUL.2015 13:31:48

Radiated field strength, VP, 2480 MHz



* RBW 3 MHz
VBW 10 MHz
SWT 2.5 ms
Marker 1 [T1]
93.40 dBμV/m
2.479871795 GHz

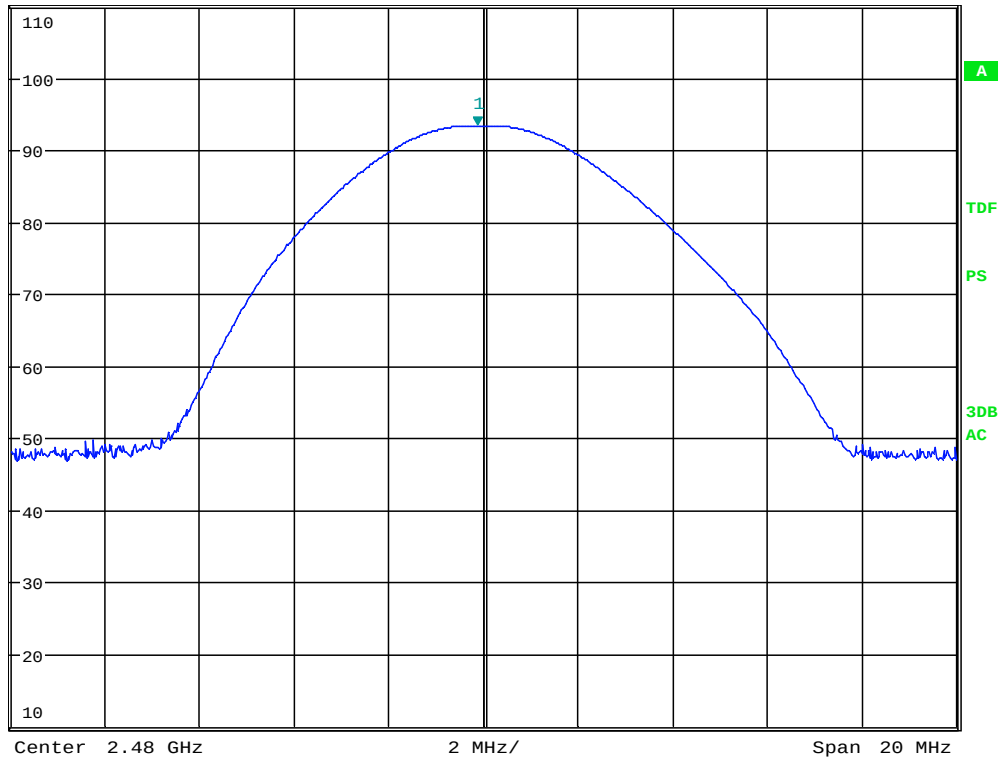
Ref 110 dBμV/m

* Att 15 dB

SWT 2.5 ms

2.479871795 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:30:53

Radiated field strength, HP, 2480 MHz

3.5 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Results: Complies

Measurement Data:

Peak detector:

Radiated Band-edge:

Frequency	Measured Field Strength dB μ V/m	Detector	Limit dB μ V/m	Margin dB
2.39GHz	42.97	PK	74	31.0
2.4835 GHz	55.76	PK	74	18.2

Average detector:

Radiated Band-edge:

Frequency	Measured Field Strength dB μ V/m	Detector	Limit dB μ V/m	Margin dB
2.39 GHz	33.24	AV	54	20.8
2.4835 GHz	35.29	AV	54	18.7

Duty cycle : 100%

According to KDB 558074 D01 DTS Meas Guidance v03r02, Section 13.3.1 the band edge is applicable to unwanted emissions within 2 MHz of the authorized band.

RF conducted power to 25 GHz see attached graph.

Maximum RF level outside operating band:

RF ch 2402MHz: 20 dB/C, margin >30 dB

RF ch 2440MHz: 20 dB/C, margin >30 dB

RF ch 2480MHz: 20 dB/C, margin >30 dB

See attached plots.



MARKER 2

2.401778846 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 1 MHz

VBW 3 MHz

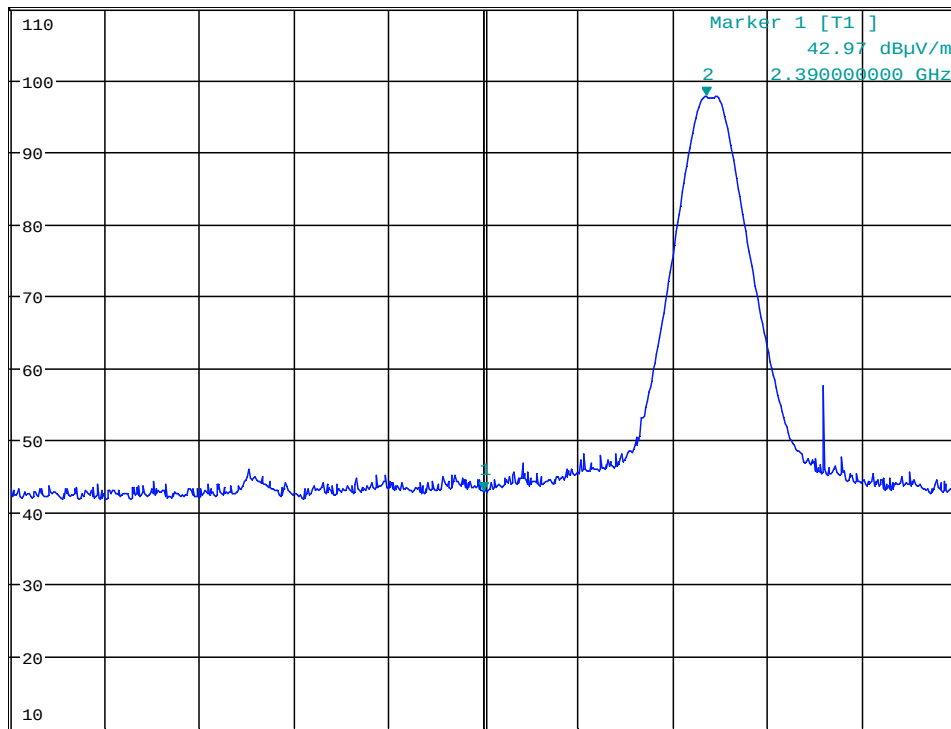
SWT 2.5 ms

Marker 2 [T1]

97.63 dBμV/m

2.401778846 GHz

1 PK
MAXH



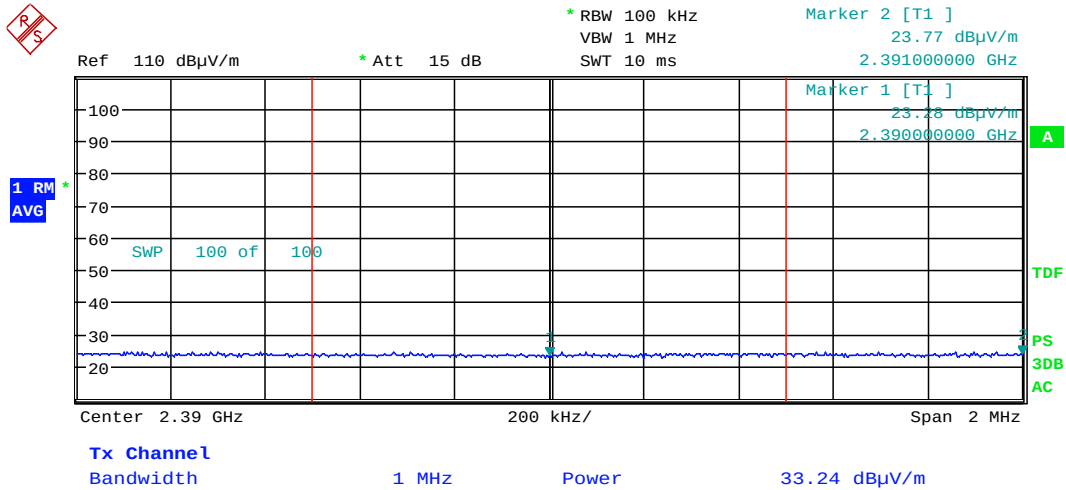
Center 2.39 GHz

5 MHz/

Span 50 MHz

Date: 20.JUL.2015 12:47:50

Lower Band Edge, 2390 MHz, Peak Detector



Date: 20.JUL.2015 12:52:48

Lower Band Edge, 2390 MHz, Average Detector



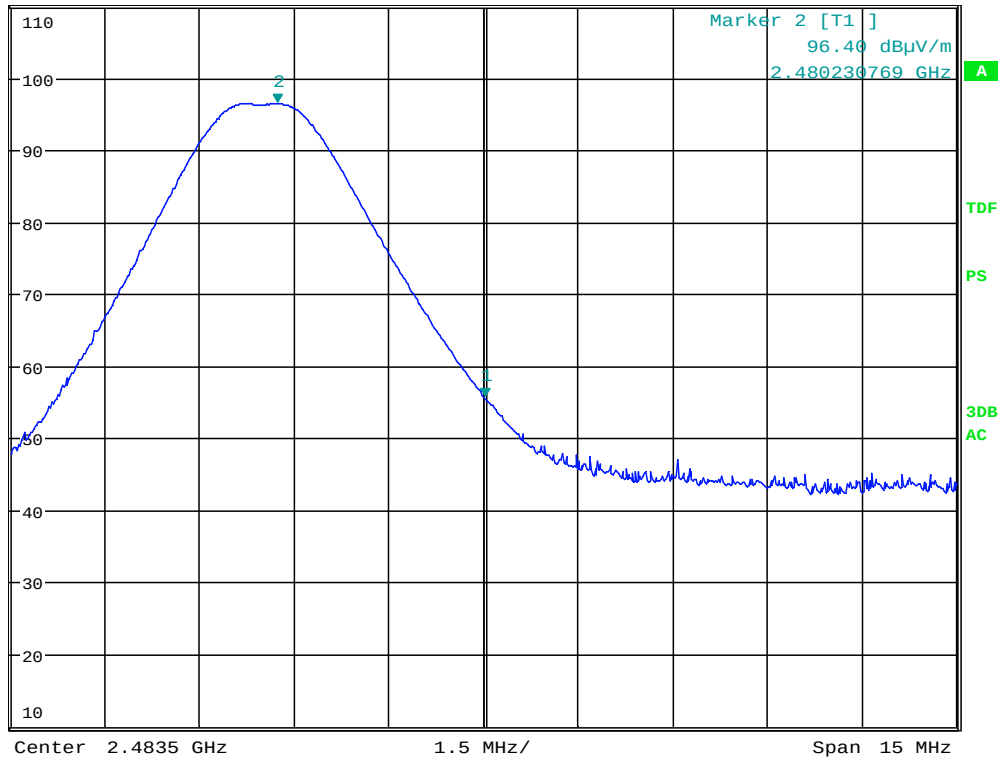
* RBW 1 MHz
VBW 3 MHz
SWT 2.5 ms

Marker 1 [T1]
55.76 dBμV/m
2.483524038 GHz

Ref 110 dBμV/m

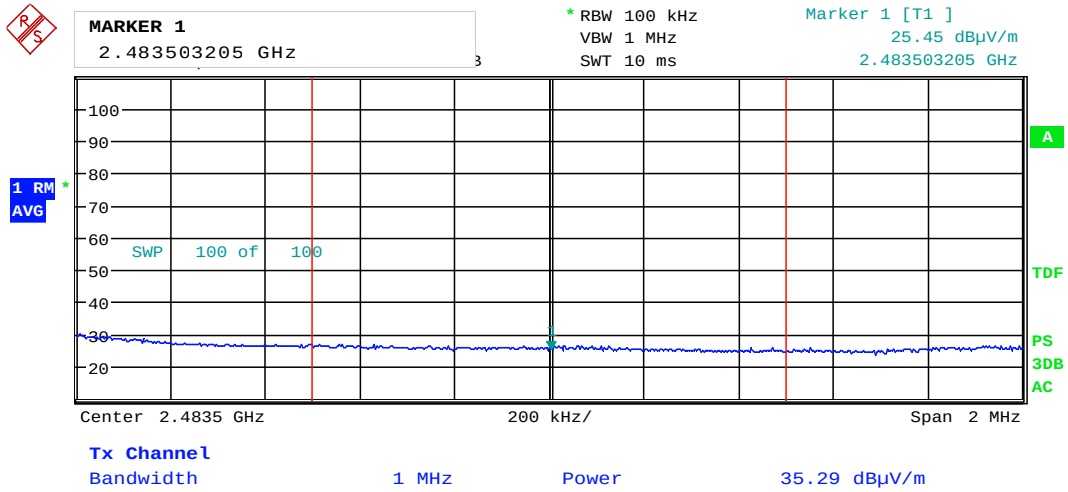
* Att 15 dB

1 PK
MAXH



Date: 20.JUL.2015 13:39:57

Upper Band Edge, 2483.5 MHz, Peak Detector



Date: 20.JUL.2015 13:40:59

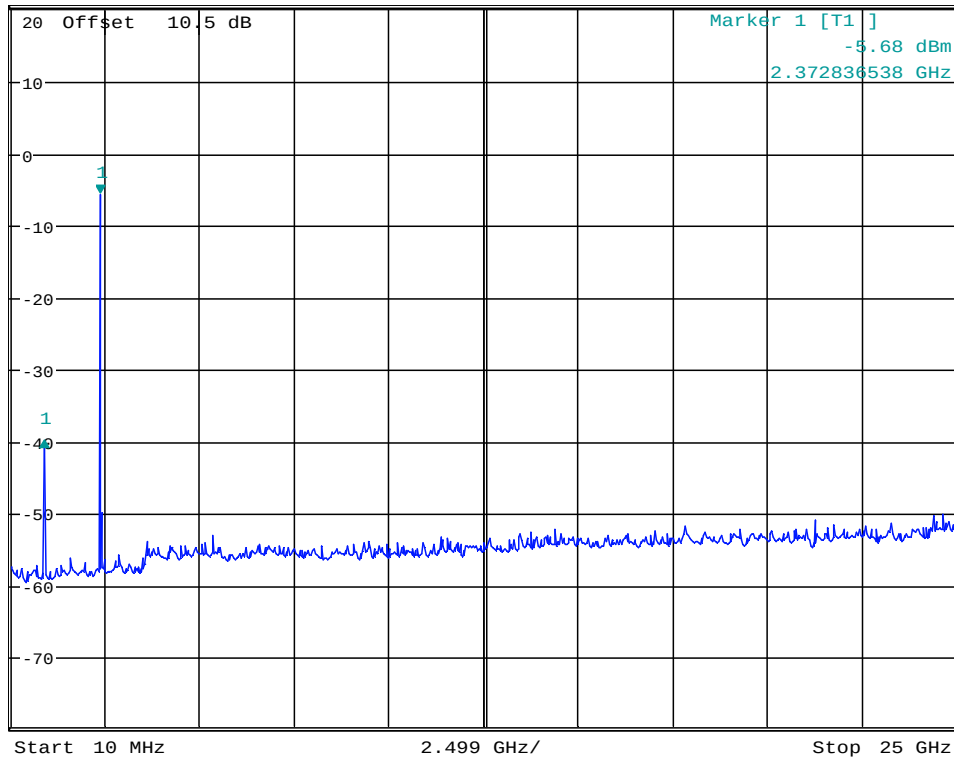
Upper Band Edge, 2483.5 MHz, Average Detector



* RBW 100 kHz Delta 1 [T1]
VBW 300 kHz -34.16 dB
SWT 2.5 s -1.481778846 GHz

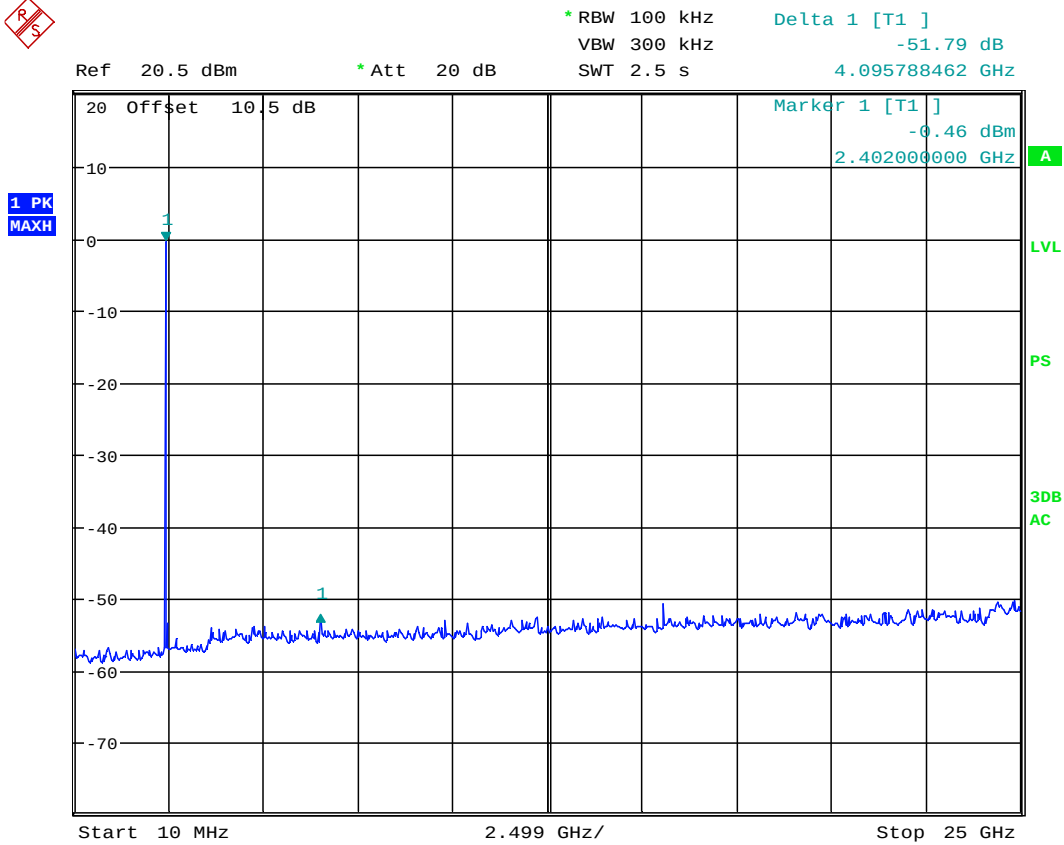
Ref 20.5 dBm

* Att 20 dB



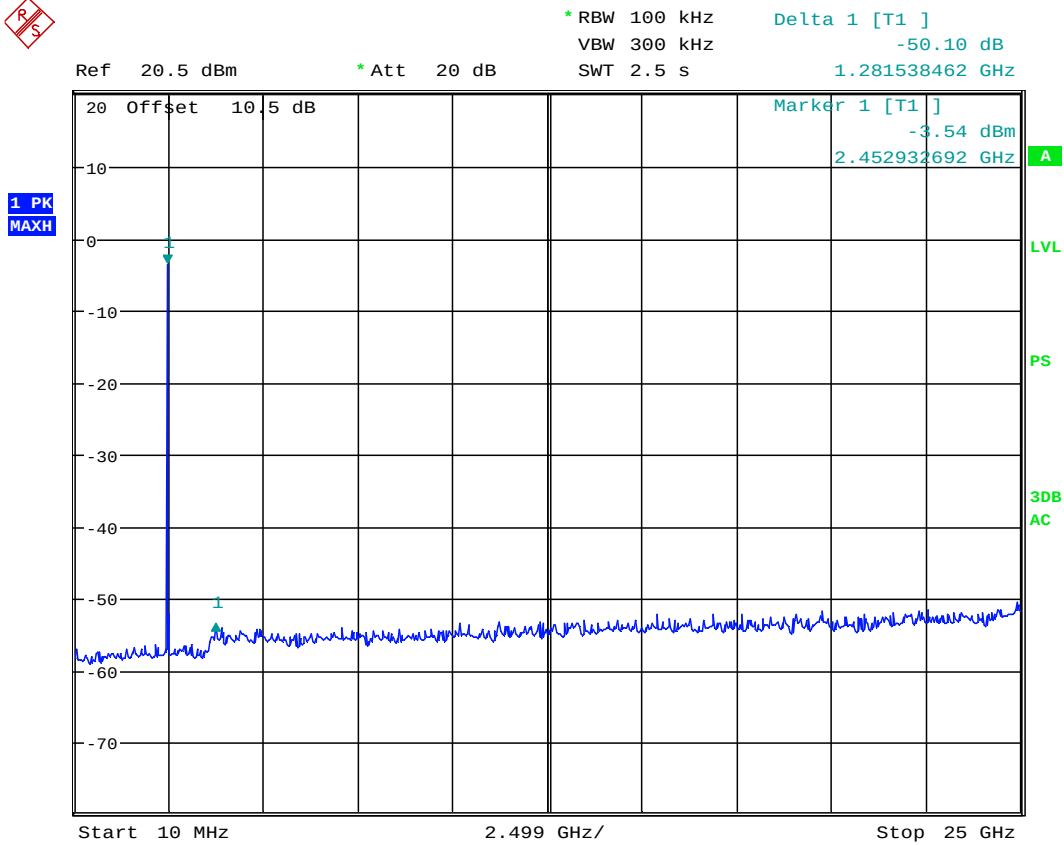
Date: 20.JUL.2015 15:32:54

Conductd spurious emission 10MHz – 25GHz - ch2402MHz



Date: 20.JUL.2015 15:37:53

Conductd spurious emission 10MHz – 25GHz - ch2440MHz



Date: 20.JUL.2015 15:38:49

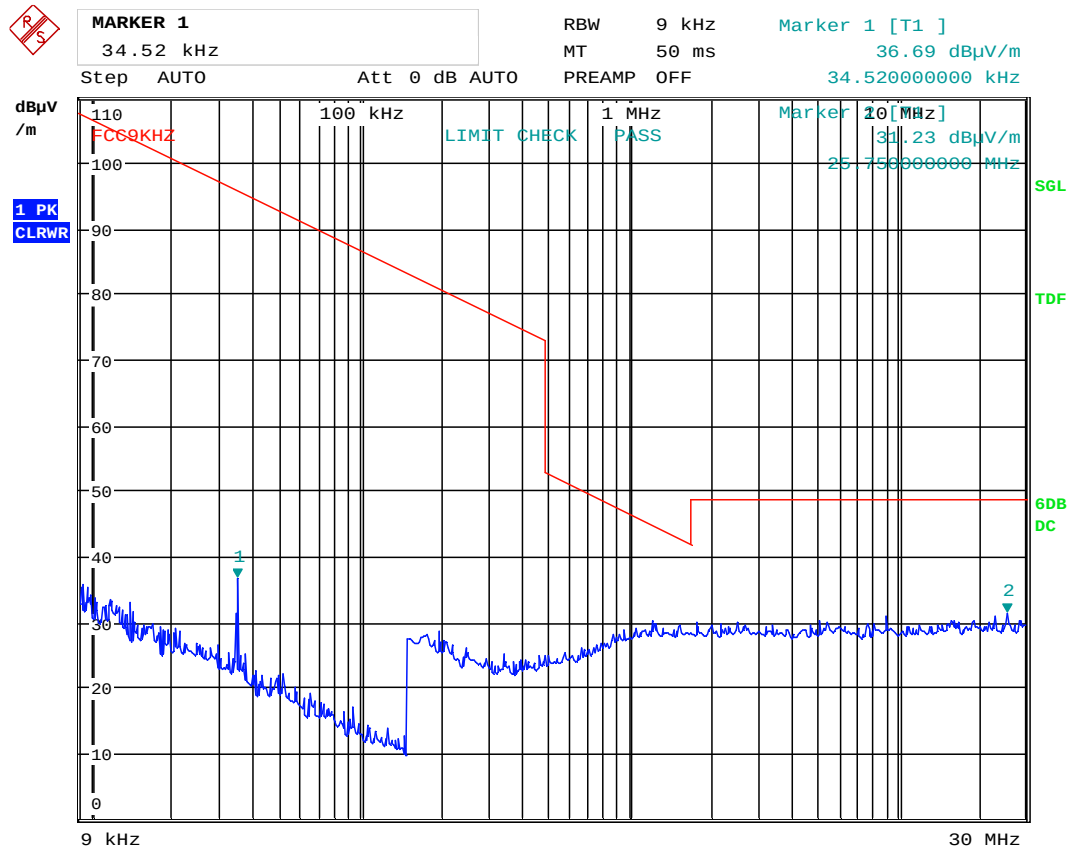
Conductd spurious emission 10MHz – 25GHz - ch2480MHz

Radiated emissions 10 kHz-30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached graph.

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

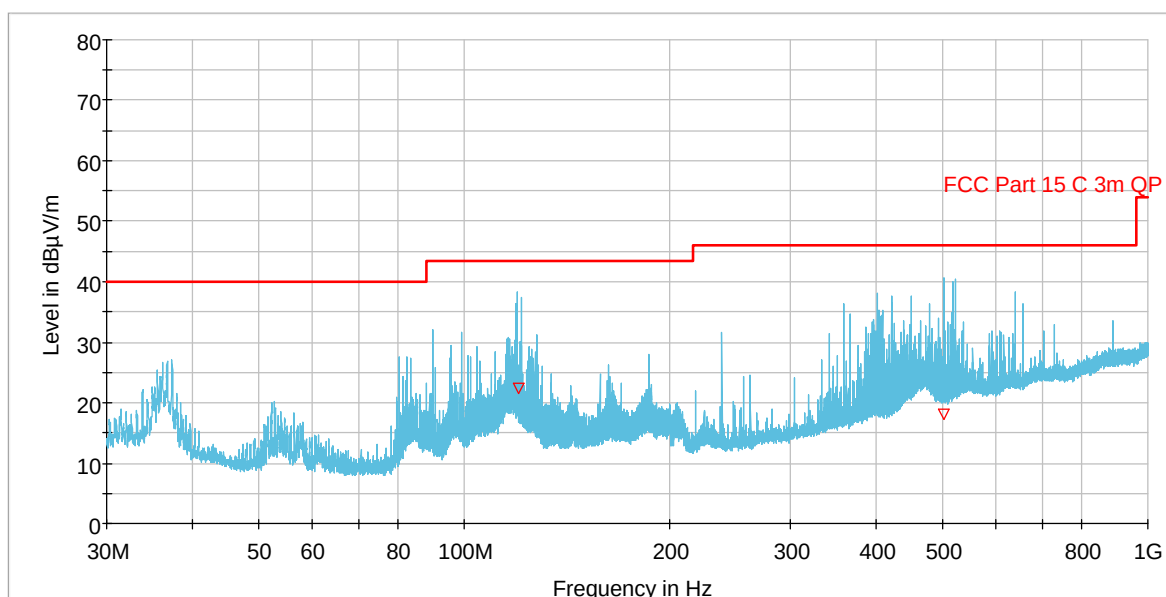


Date: 20.JUL.2015 14:51:44

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 3 m .



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
119.919350	22.34	43.50	21.16	1000.0	120.000	110.0	V	339.0	-12.6
503.607800	17.99	46.00	28.01	1000.0	120.000	111.0	V	326.0	-3.9

Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 8 GHz)
1m (8 – 18 GHz)

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

Measurement Data:

Radiated : peak detector

Frequency GHz	Channel MHz	Measured Field Strength (dBµV/m)	Duty cycle correction (dB)	Corrected Field Strength dBµV/m	Detector	Limit dBµV/m	Margin dB
1 - 25	2402	< 54	-	-	PK	74	-
1 - 25	2440	< 54	-	-	PK	74	-
1 - 25	2480	< 54	-	-	PK	74	-

Radiated: Average detector

Frequency GHz	Channel MHz	Measured Field Strength (dBµV/m)	Duty cycle correction (dB)	Corrected Field Strength dBµV/m	Detector	Limit dBµV/m	Margin dB
2.311	2402	#	-	-	AV	54	-
2.367	2440	#	-	-	AV	54	-
2.492	2480	#	-	-	AV	54	-

Measured emission level with peak detector is below the average limit.

Duty cycle : 100%

Tested according to KDB 558074 D01 DTS Meas Guidance v03r02, Section 12.1 ,12.2.3, 12.2.4 & 12.2.5.1

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

See plots.



MARKER 1

1.657051282 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 1 MHz

VBW 3 MHz

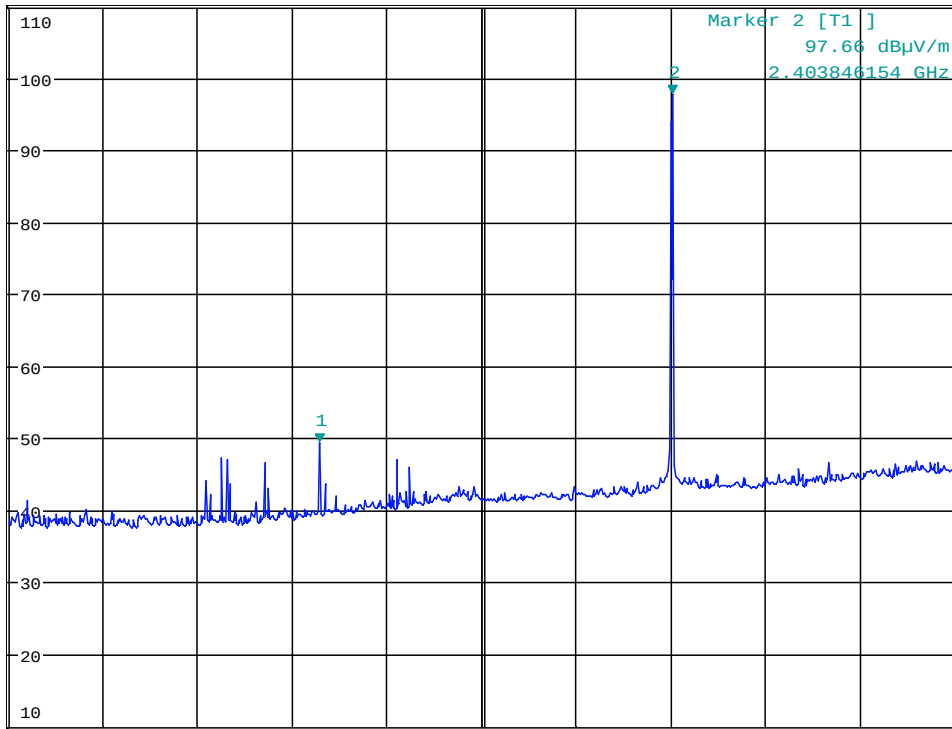
SWT 5 ms

Marker 1 [T1]

49.48 dBμV/m

1.657051282 GHz

1 PK
MAXH



Start 1 GHz

200 MHz/

Stop 3 GHz

A

TDF

PS

3DB

AC

Date: 20.JUL.2015 12:58:11

Radiated Emissions ch. 2402 MHz, 1 – 3 GHz, VP, @3m – with Peak detector



MARKER 1

1.580128205 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 1 MHz

VBW 3 MHz

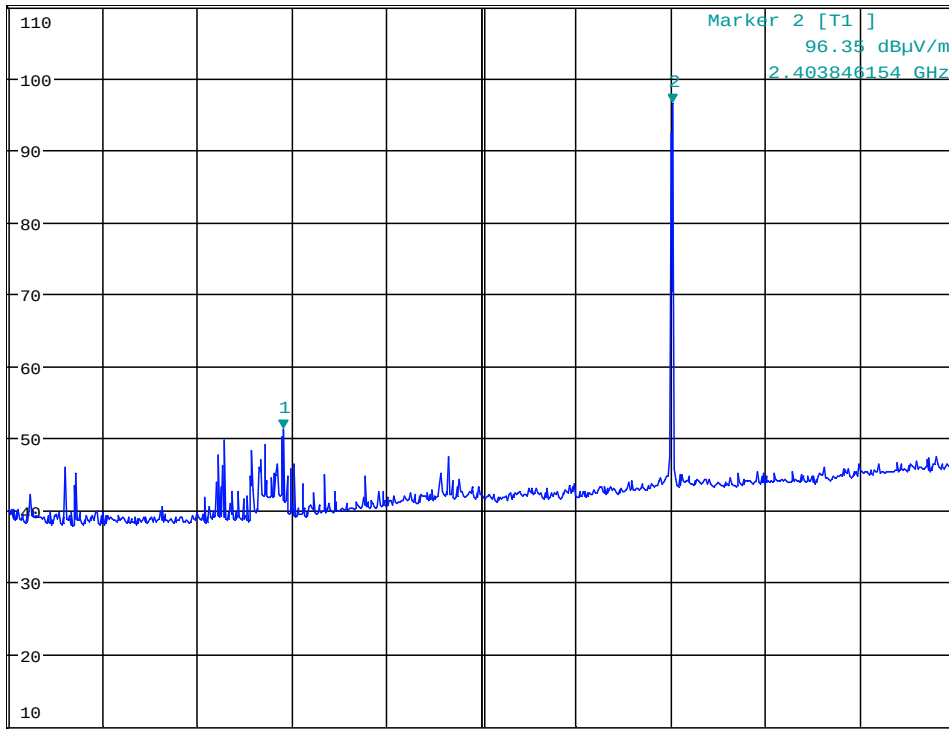
SWT 5 ms

Marker 1 [T1]

51.36 dBμV/m

1.580128205 GHz

1 PK
MAXH



Start 1 GHz

200 MHz/

Stop 3 GHz

A

TDF

PS

3DB

AC

Date: 20.JUL.2015 12:59:51

Radiated Emissions ch. 2402 MHz, 1 – 3 GHz, HP, @3m – with Peak detector



MARKER 1

1.533141026 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 1 MHz

VBW 3 MHz

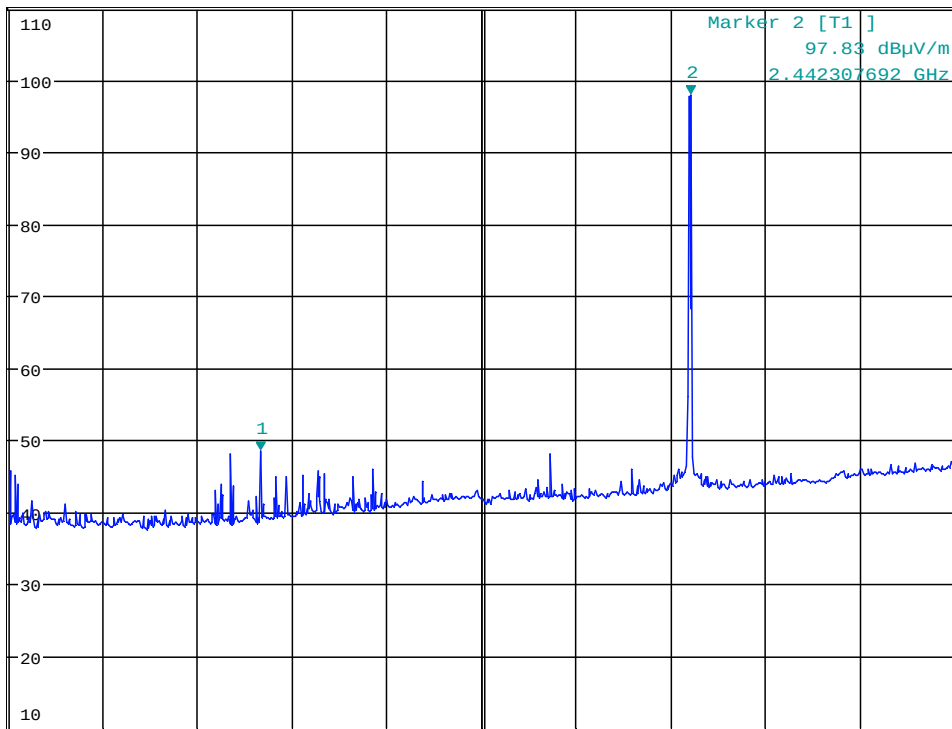
SWT 5 ms

Marker 1 [T1]

48.59 dBμV/m

1.533141026 GHz

1 PK
MAXH



Start 1 GHz

200 MHz/

Stop 3 GHz

A

TDF

PS

3DB

AC

Date: 20.JUL.2015 13:53:16

Radiated Emissions ch. 2440 MHz, 1 – 3 GHz, VP, @3m – with Peak detector



MARKER 1

1.549166667 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 1 MHz

VBW 3 MHz

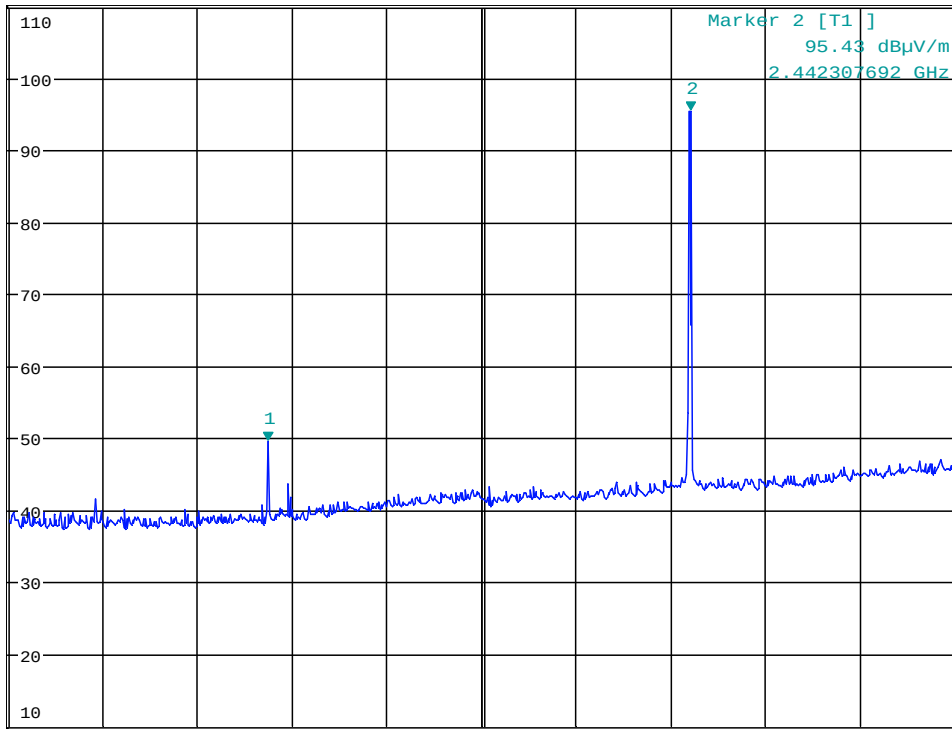
SWT 5 ms

Marker 1 [T1]

49.66 dBμV/m

1.549166667 GHz

1 PK
MAXH



Start 1 GHz

200 MHz/

Stop 3 GHz

A

TDF

PS

3DB

AC

Date: 20.JUL.2015 13:54:00

Radiated Emissions ch. 2440 MHz, 1 – 3 GHz, HP, @3m – with Peak detector



MARKER 1

1.457788462 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 1 MHz

VBW 3 MHz

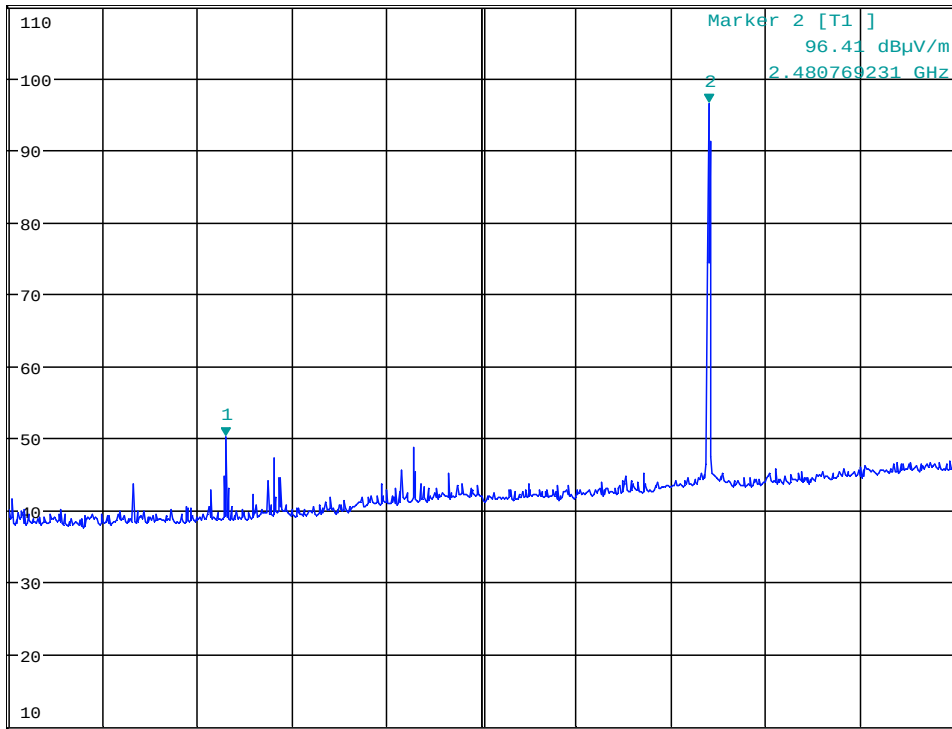
SWT 5 ms

Marker 1 [T1]

50.32 dBμV/m

1.457788462 GHz

1 PK
MAXH



A

TDF

PS

3DB

AC

Date: 20.JUL.2015 13:35:14

Radiated Emissions ch. 2480 MHz, 1 – 3 GHz, VP, @3m – with Peak detector



MARKER 1

1.560897436 GHz

Ref 110 dBμV/m

* Att 15 dB

* RBW 1 MHz

VBW 3 MHz

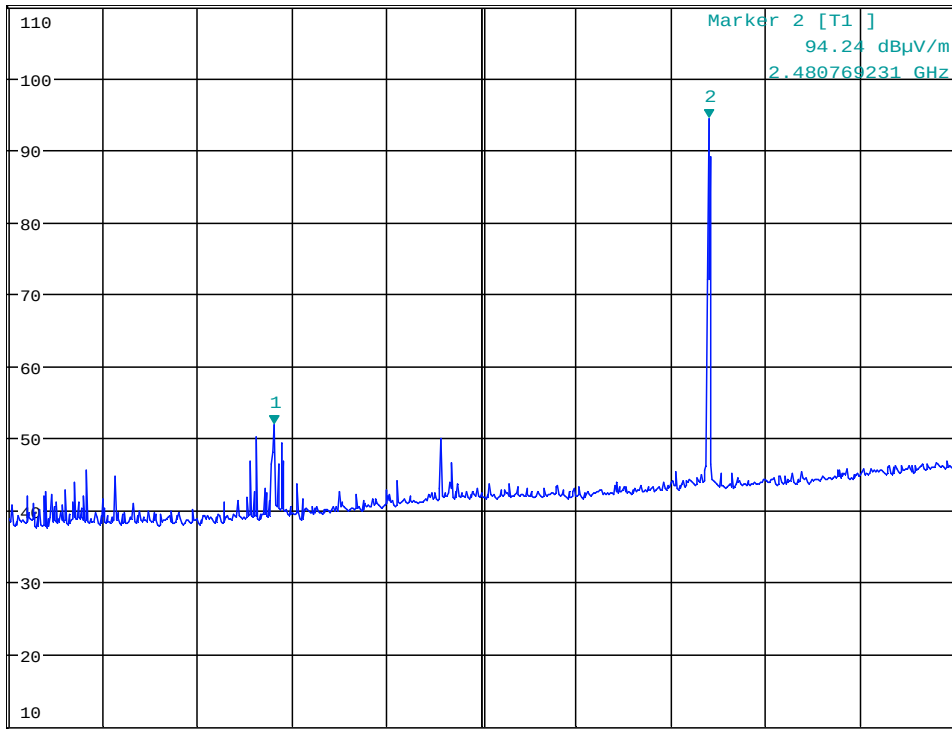
SWT 5 ms

Marker 1 [T1]

51.85 dBμV/m

1.560897436 GHz

1 PK
MAXH



Start 1 GHz

200 MHz/

Stop 3 GHz

Date: 20.JUL.2015 14:00:23

Radiated Emissions ch. 2480 MHz, 1 – 3 GHz, HP, @3m – with Peak detector



MARKER 1

7.84775641 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

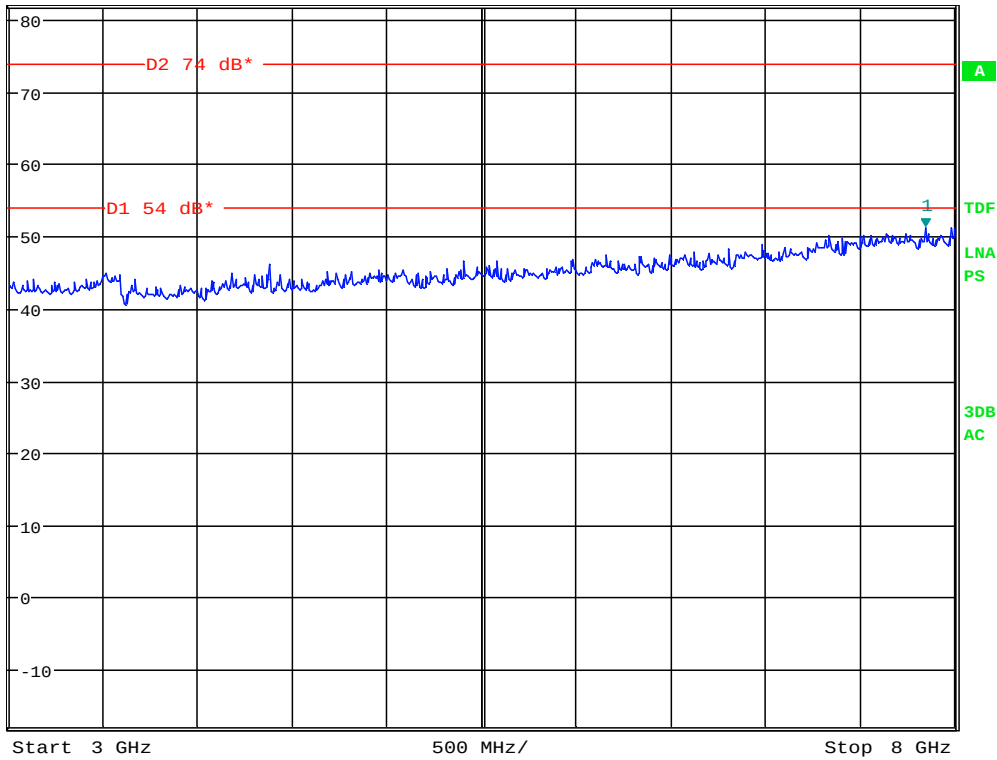
SWT 30 ms

Marker 1 [T1]

51.23 dBμV/m

7.847756410 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:18:57

Radiated emissions ch 2402 MHz , 3 - 8GHz, HP @3m with Peak detector (measured with HP filter)



MARKER 1

7.391025641 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

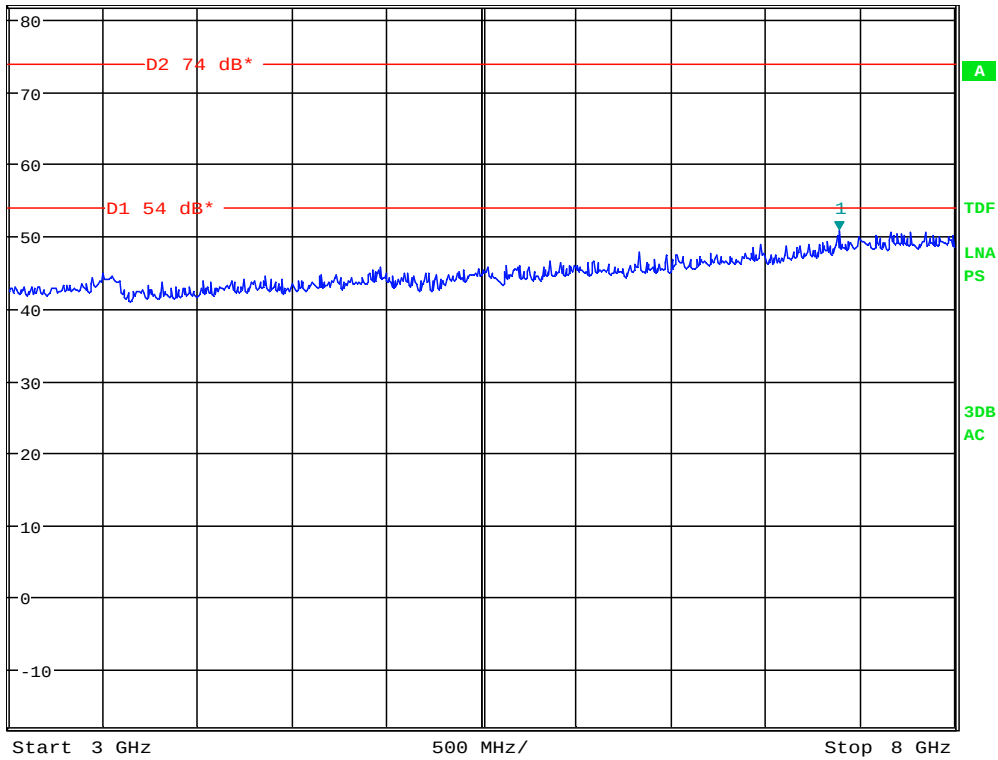
SWT 30 ms

Marker 1 [T1]

50.90 dBμV/m

7.391025641 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:19:41

Radiated emissions ch 2402 MHz , 3 - 8GHz, VP @3m with Peak detector(measured with HP filter)



MARKER 1

7.399038462 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

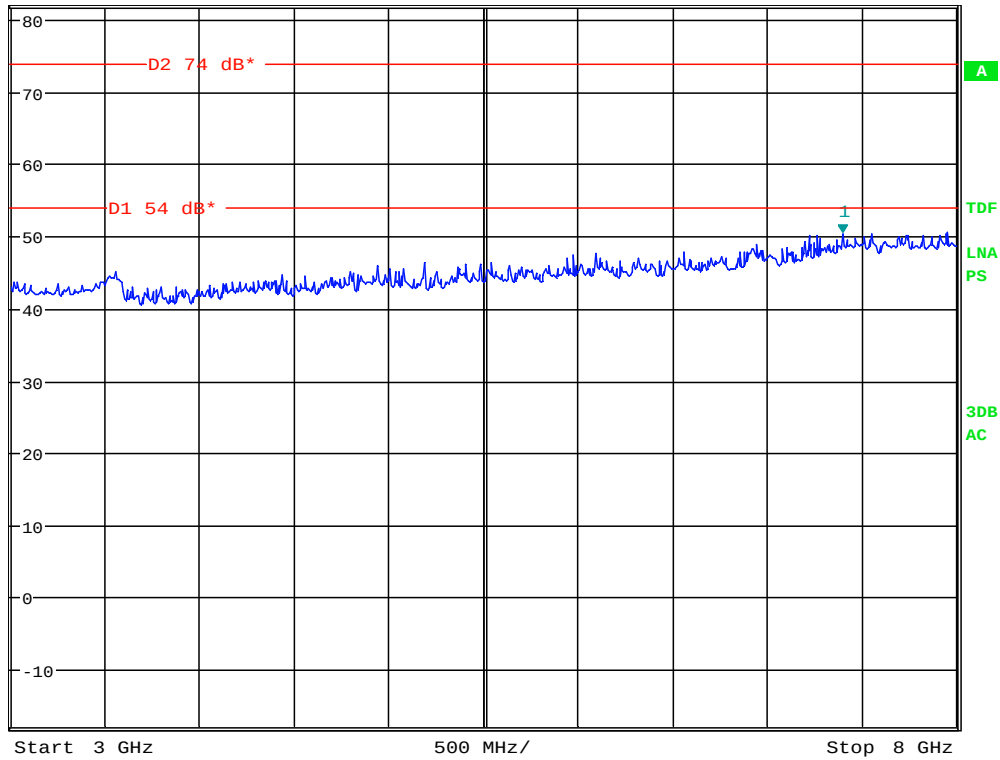
SWT 30 ms

Marker 1 [T1]

50.29 dBμV/m

7.399038462 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:21:34

Radiated emissions ch 2440 MHz , 3 - 8GHz, HP @3m with Peak detector(measured with HP filter)



MARKER 1

7.927884615 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

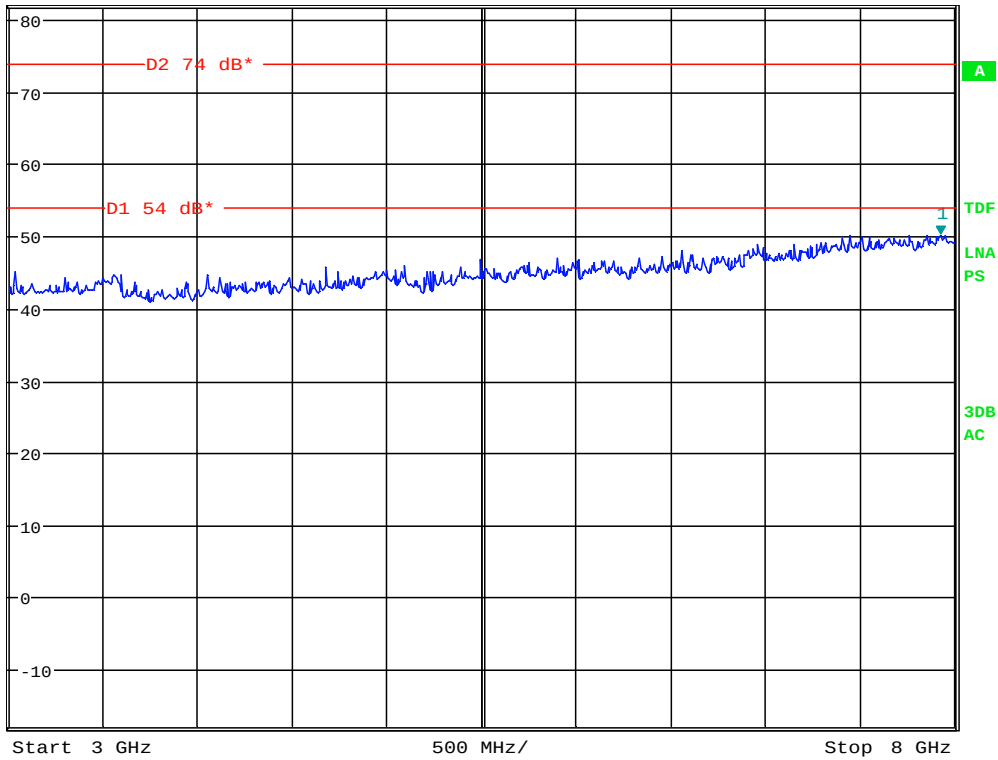
SWT 30 ms

Marker 1 [T1]

50.13 dBμV/m

7.927884615 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:20:55

Radiated emissions ch 2440 MHz , 3 - 8GHz, VP @3m with Peak detector(measured with HP filter)



MARKER 1

7.735576923 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

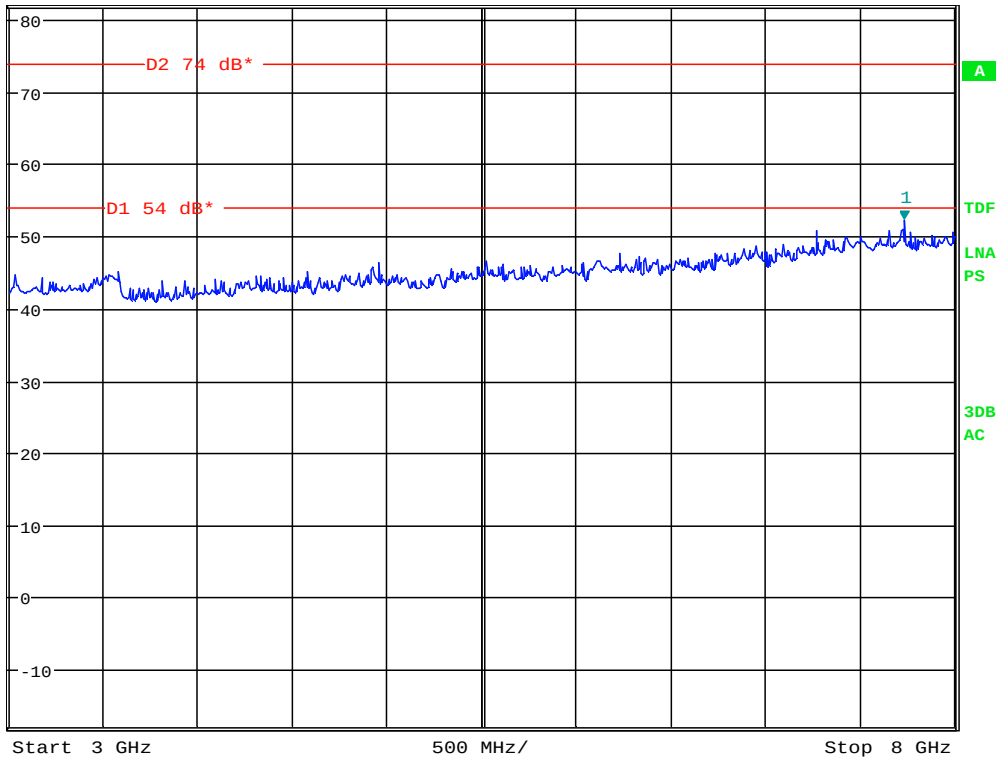
SWT 30 ms

Marker 1 [T1]

52.28 dBμV/m

7.735576923 GHz

1 PK
MAXH



Date: 20.JUL.2015 13:22:27

Radiated emissions ch 2480 MHz , 3 - 8GHz, HP @3m with Peak detector(measured with HP filter)



MARKER 1

7.479166667 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

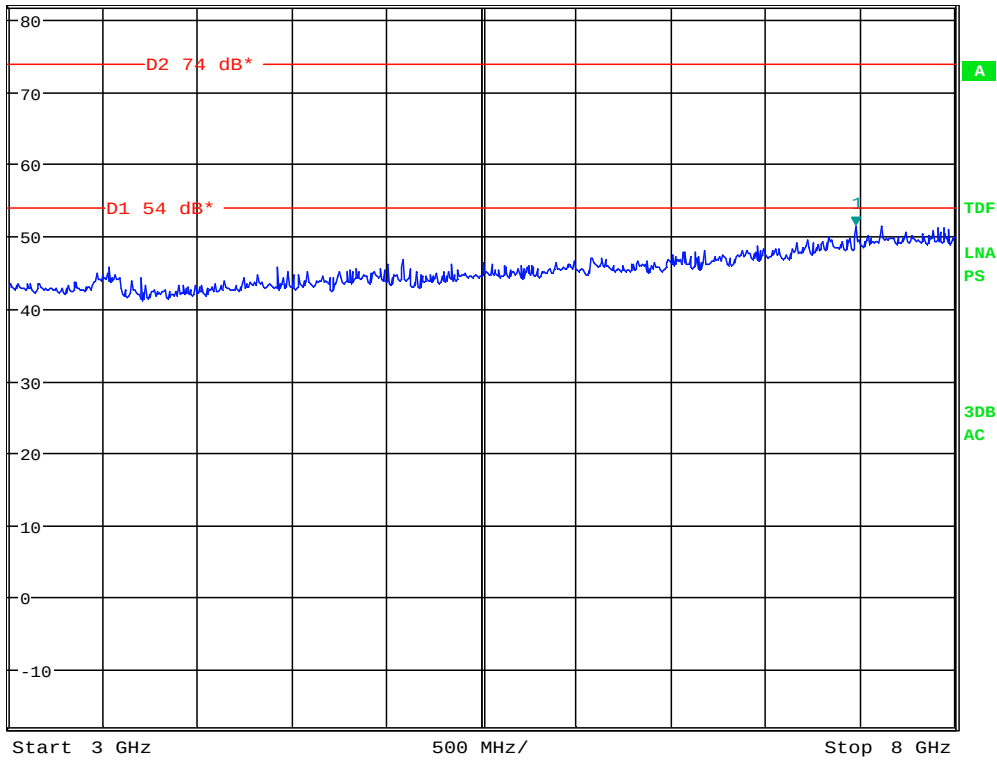
SWT 30 ms

Marker 1 [T1]

51.39 dBμV/m

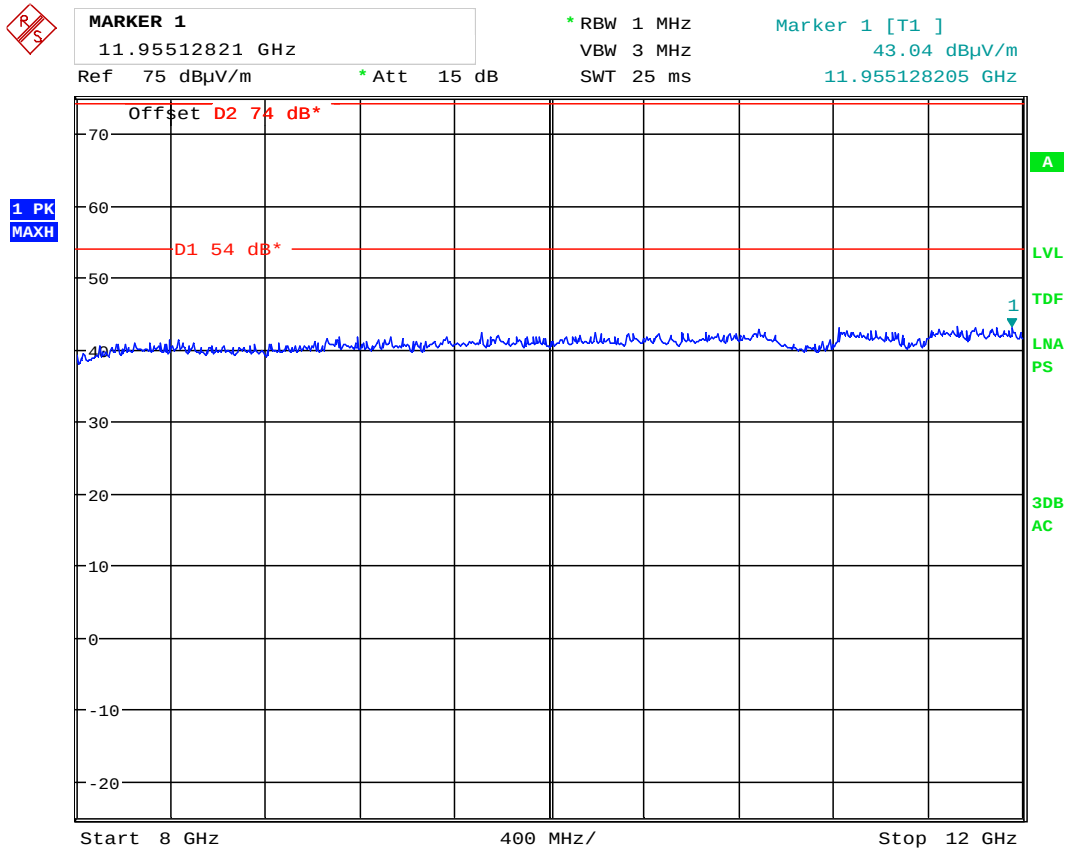
7.479166667 GHz

1 PK
MAXH



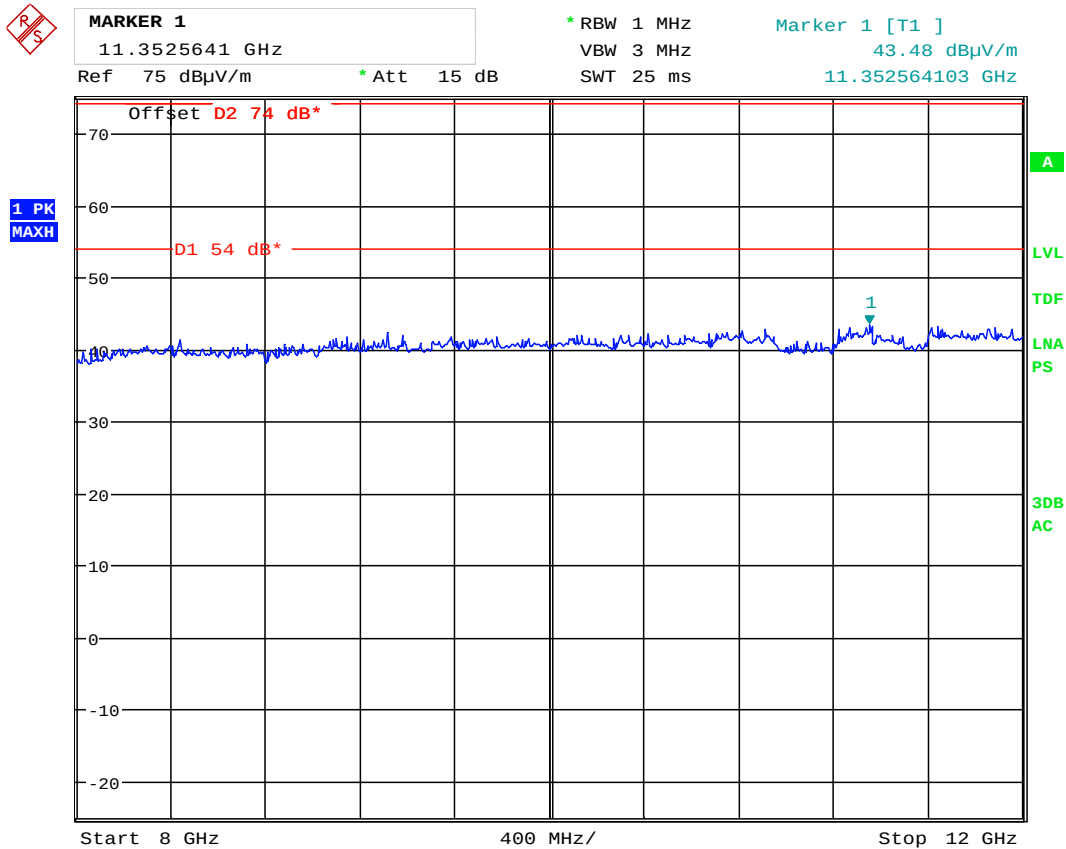
Date: 20.JUL.2015 13:22:55

Radiated emissions ch 2480 MHz , 3 - 8GHz, VP @3m with Peak detector(measured with HP filter)



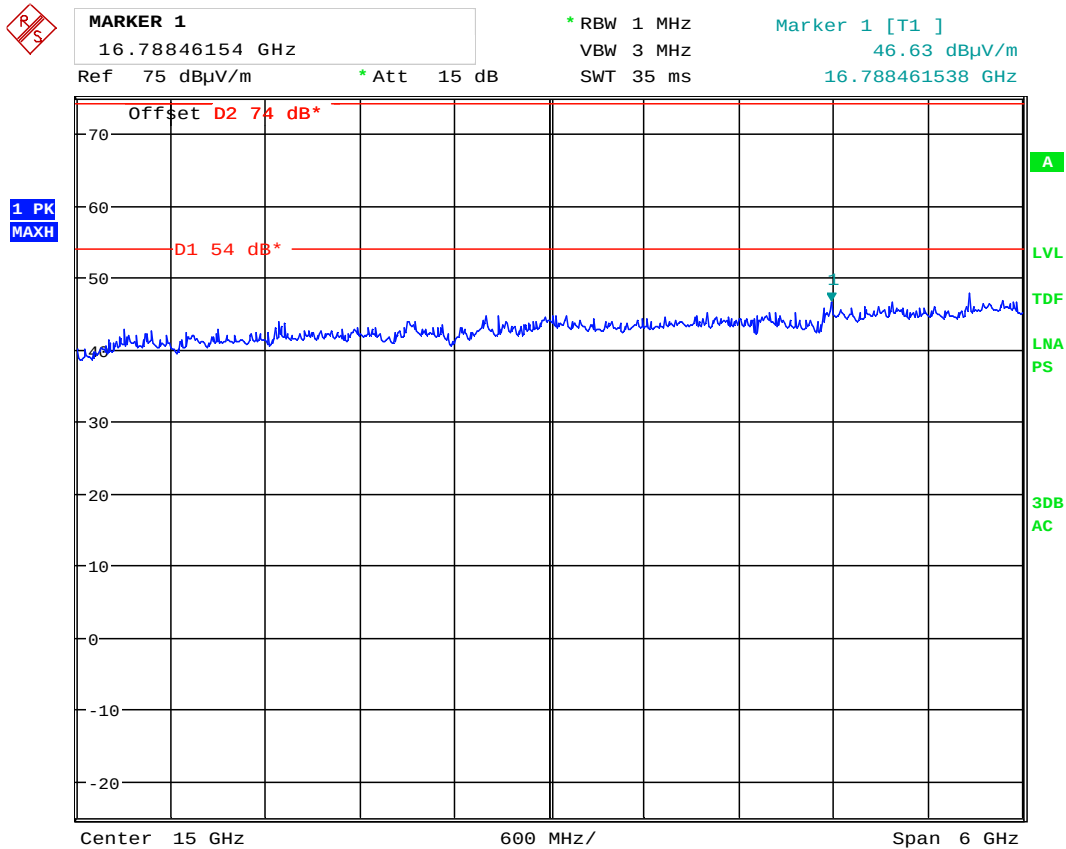
Date: 20.JUL.2015 10:55:02

Radiated Emissions ch. 2440 MHz, 8 – 12 GHz, VP, @1m – with Peak detector (distance correction factor of -9.5 dB is included in the graph)



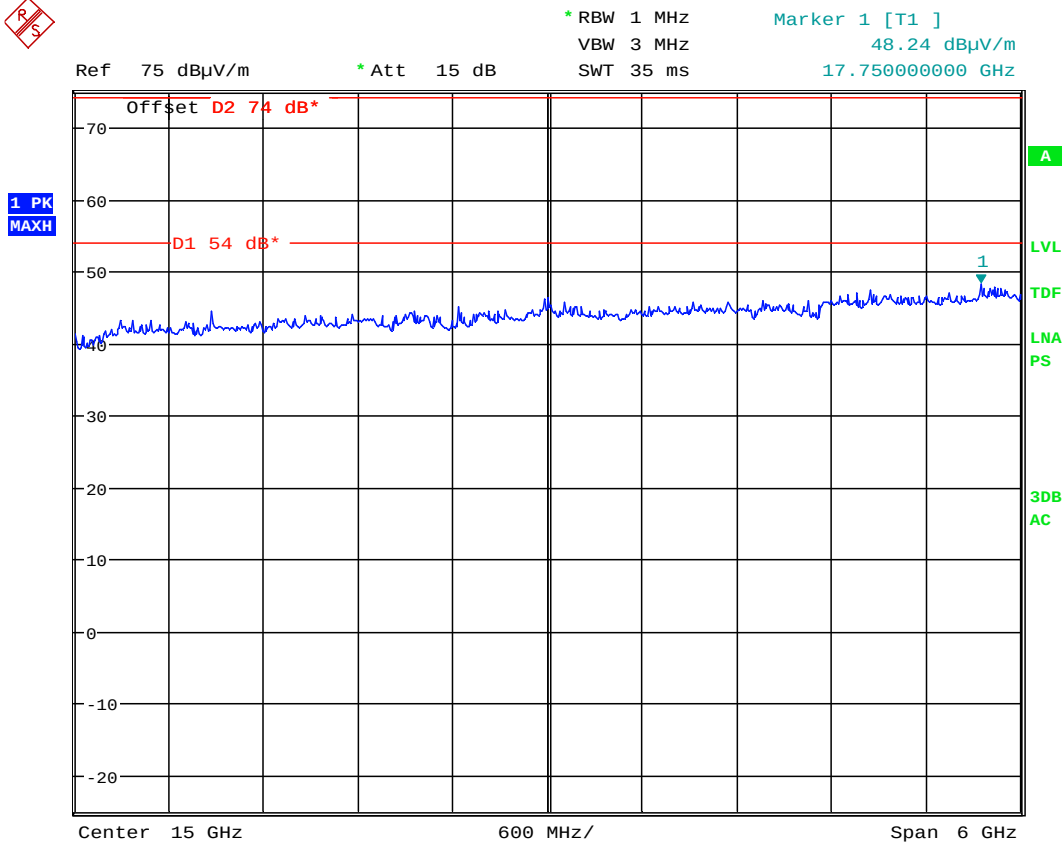
Date: 20.JUL.2015 10:56:11

Radiated Emissions ch. 2440 MHz, 8 – 12 GHz, HP, @1m – with Peak detector(distance correction factor of -9.5 dB is included in the graph)



Date: 20.JUL.2015 10:52:10

Radiated Emissions ch. 2440 MHz, 12 – 18 GHz, VP, @1m – with Peak detector(distance correction factor of -9.5 dB is included in the graph)



Date: 20.JUL.2015 10:51:28

Radiated Emissions ch. 2440 MHz, 12 – 18 GHz, HP, @1m – with Peak detector (distance correction factor of -9.5 dB is included in the graph)



MARKER 1

24.86538462 GHz

Ref 72.5 dBμV/m * Att 10 dB

* RBW 1 MHz

VBW 3 MHz

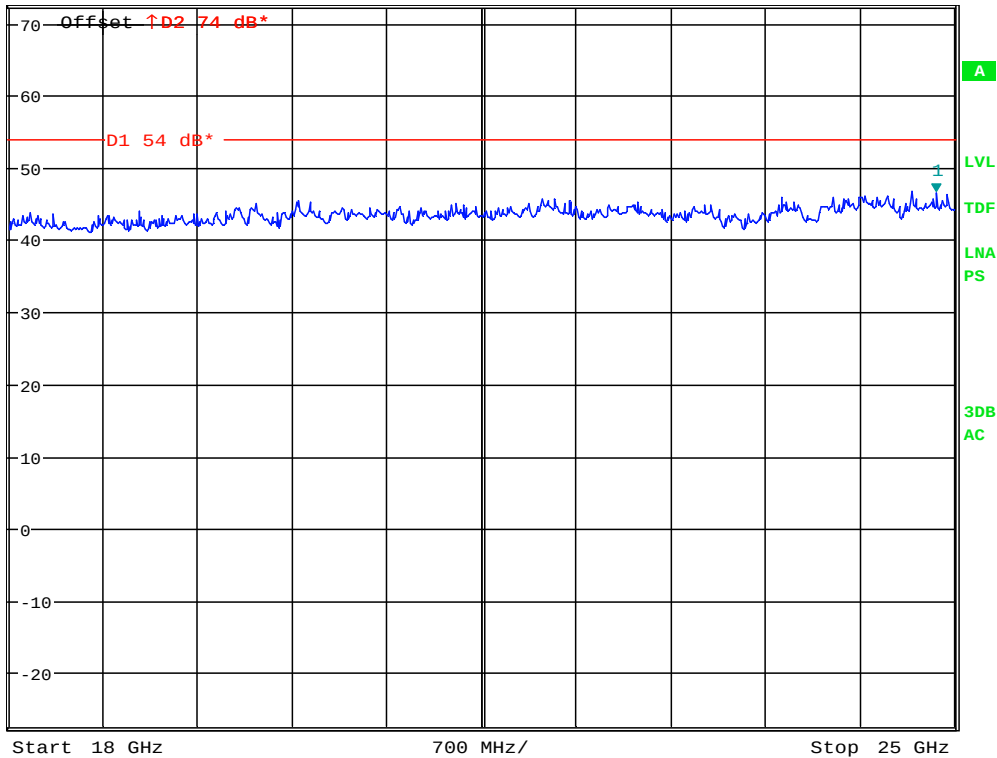
SWT 45 ms

Marker 1 [T1]

46.59 dBμV/m

24.865384615 GHz

1 PK
MAXH



Date: 20.JUL.2015 15:55:16

Radiated Emissions ch. 2440 MHz, 18 – 25 GHz, VP/HP, @1m – Pre-scan with Peak detector

3.6 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Test Performed By: G.Suwanthakumar

Date of Test: 2015.07.20

Test Results: Passed

Measured and Calculated Data:

According to KDB 558074 D01 DTS Meas Guidance v03r02, Section 10.2.

	2402 MHz	2440 MHz	2480 MHz
Measured value (dBm)	-10.4	-11.9	-11.9

Requirements:

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



MARKER 1

2.401748718 GHz

Ref 20.5 dBm

* Att 20 dB

* RBW 3 kHz

VBW 10 kHz

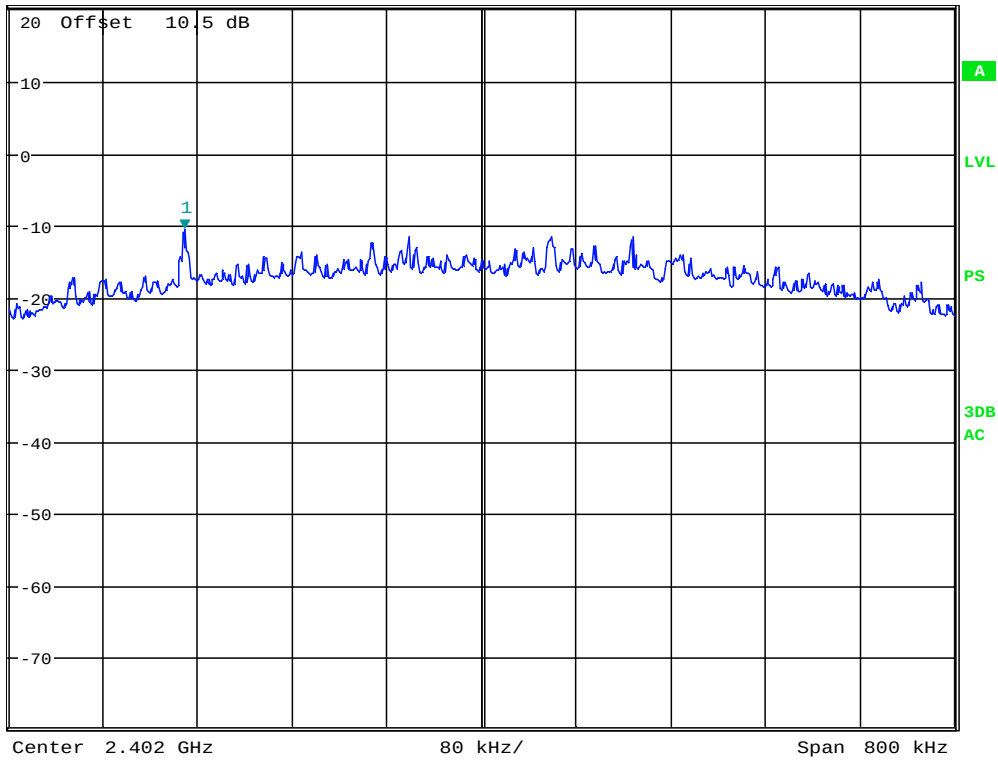
SWT 90 ms

Marker 1 [T1]

-10.41 dBm

2.401748718 GHz

1 PK
MAXH



Date: 20.JUL.2015 15:29:00

Power spectral density, ch2402MHz



MARKER 1

2.440126923 GHz

Ref 20.5 dBm

* Att 20 dB

* RBW 3 kHz

VBW 10 kHz

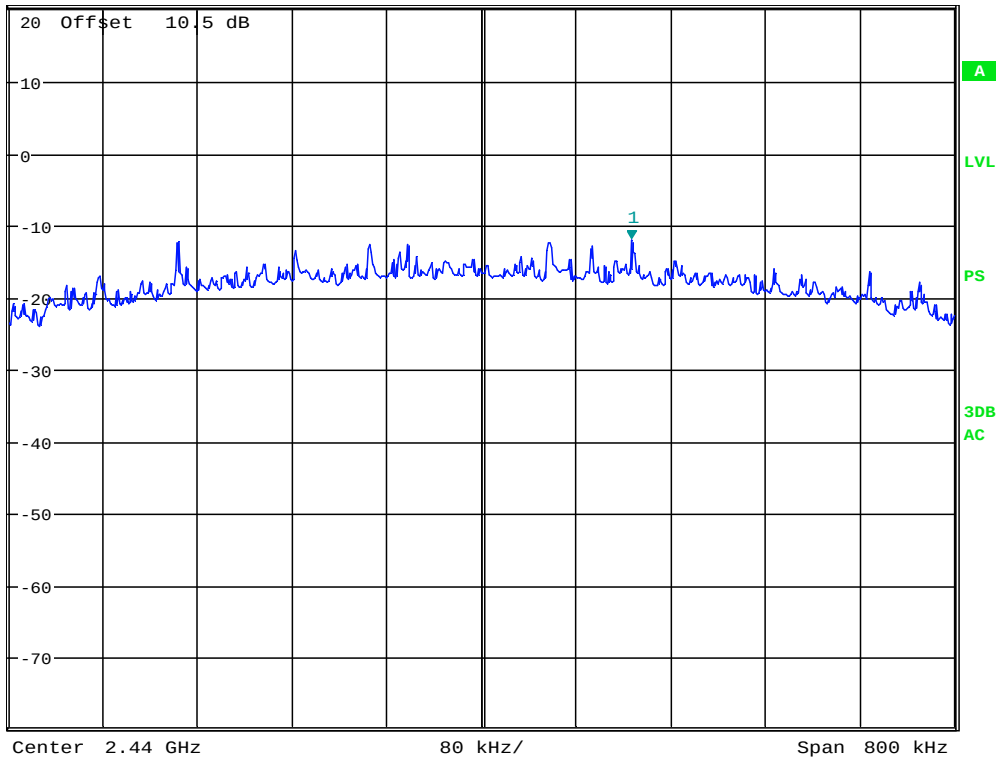
SWT 90 ms

Marker 1 [T1]

-11.92 dBm

2.440126923 GHz

1 PK
MAXH



Date: 20.JUL.2015 15:39:43

Power spectral density, ch2440MHz



MARKER 1

2.479742308 GHz

Ref 20.5 dBm

* Att 20 dB

* RBW 3 kHz

VBW 10 kHz

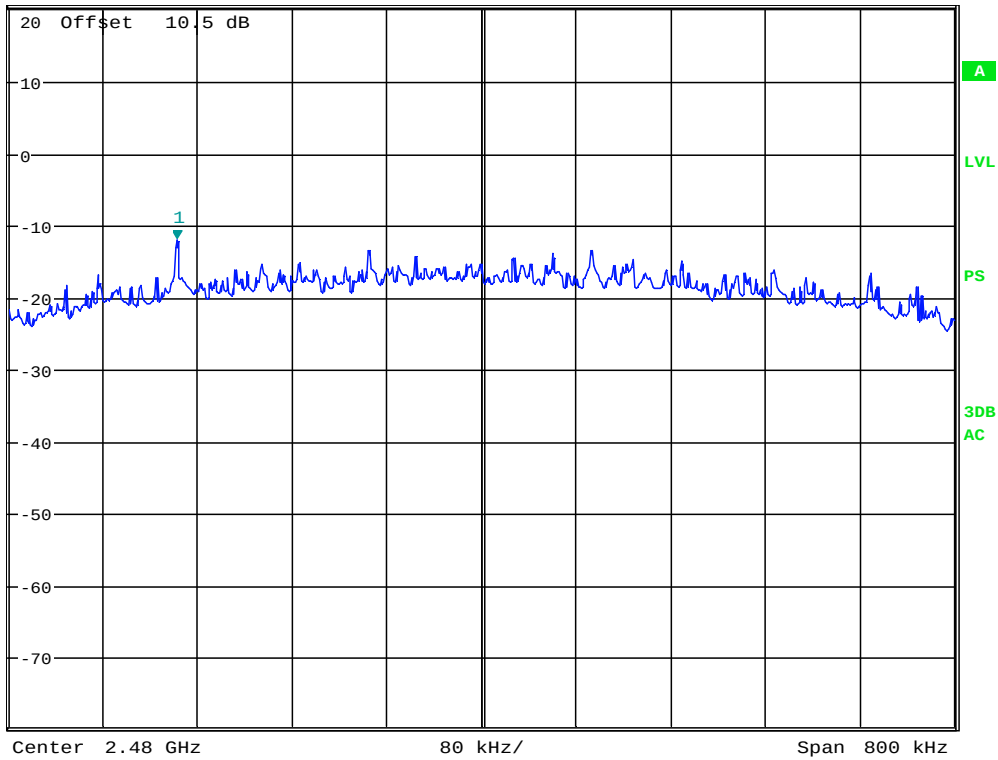
SWT 90 ms

Marker 1 [T1]

-11.86 dBm

2.479742308 GHz

1 PK
MAXH



Date: 20.JUL.2015 15:40:09

Power spectral density, ch2480MHz

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

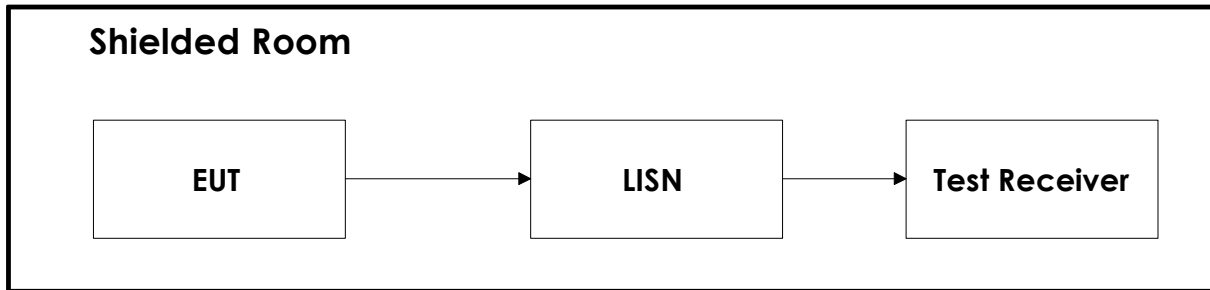
5 LIST OF TEST EQUIPMENT

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.

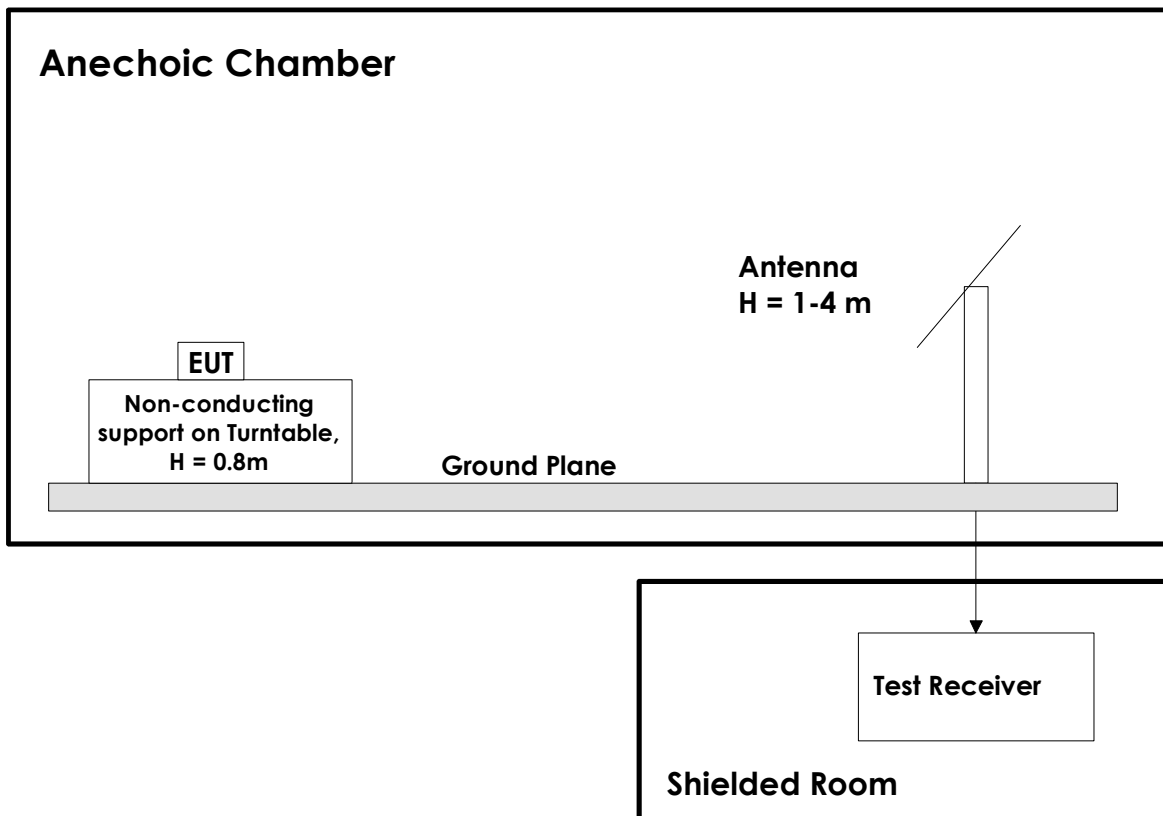
No.	Instrument/ ancillary	Type of instrument/ ancillary	Manufacturer	Ref. no.	Cal. Date	Cal. Due
1	ESU40	EMI Receiver	Rohde & Schwarz	LR 1639	2014.11	2015.11
2	3115	Antenna horn	EMCO	LR 1330	2010.08	2017.08
3	HFH2-Z2	Loop antenna	Rohde & Schwarz	LR1660	2010.08	2017.08
4	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2015.12
5	HL223	Log Periodic antenna	Rohde & Schwarz	LR 1261	2013.12	2015.12
6	PM7320X	Antenna horn	Siverts lab	LR 103	2009.01.26	2016.01.26
7	DBF-520-20	Antenna horn	Systron Donner	LR 101	2009.01.26	2016.01.26
8	638	Antenna horn	Narda	LR 098	2010.06.17	2016.06.17
9	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2014.11	2015.11
10	LNA6900	Pre-amplifier	Teseq	LR 1593	2014.07	2015.07
11	B603D	DC power supply	Øltronix	LT 666	Cal b4 use	
12	6032A	DC power supply	Hewlett Packard	LT 1062	Cal b4 use	
13	Model 87 V	Multimeter	Fluke	LR 1600	2013.10	2015.10
14	ESH3-Z5	AMN	Rohde & Schwarz	LR 1076	2014.10	2016.10
15	ESHS 10	EMI receiver	Rohde & Schwarz	N -3528	2014.06	2016.06
16	ESH3-Z2	Puls Limiter	Rohde & Schwarz	LR 1074	2014.07	2017.07
17	6812B	AC power source	Agilent	LR 1515	2013.10	2015.10
18	74-10-12	10 attenuator	Aeroflex	LR 1579	Cal b4 use	
19	FA210A1010003030	Microwave cable	Rosenberger	LR1566	Cal b4 use	
20	6HC 3000-18000	HP Filter	Trithlic	LR1614	Cal b4 use	

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



Revision history

Version	Date	Comment	Sign
1.0	2015.12.08	Version for TCB review	FS