

Test Report

Product	Gateway
Name and address of the applicant	Develco Products Olof Palmes Alle 40, DK-82000 Århus N, Denmark
Name and address of the manufacturer	Develco Products Olof Palmes Alle 40, DK-82000 Århus N, Denmark
Model	MGW101
Rating	5Vdc
Trademark	Squid.link Gateway
Serial number	Radiated sample: 0200000100001516 Conducted sample: 02000001000012EE
Additional information	This product SquidLink contains four radio units: - Zigbee covered by this test report - Wi-Fi covered by Nemko test report 2-300209 - GSM module from U-Blox (FCC ID: XPYSARAU280; IC:8595A-SARAU280) - Z-Wave module, 902 – 928 MHz (FCC ID: D87-ZM5304-U; IC: 11263A-ZM5304)
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters / Digital Transmission Systems Industry Canada RSS-247, Issue 1 Low Power Licence-Exempt Radiocommunications Devices
Order number	300209
Tested in period	2016.02.24 - 2016.03.10 and 2016.08.03
Issue date	2016.08.03
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 :	Squid.link Gateway
FCC ID :	2AHNM-GC981709
Industry Canada ID :	21398-GC981709
Model/version :	MGW101
Serial number :	Radiated sample: 0200000100001516 Conducted sample: 02000001000012EE
Hardware identity and/or version:	4.0.x
Software identity and/or version :	1.2.x
Frequency Range :	2405 - 2480MHz
Tunable Bands :	None
Number of Channels :	16
Channel BW:	5 MHz
Type of Modulation :	ZigBee uses Offset quadrature phase-shift keying (OQPSK)
User Frequency Adjustment :	N/A
Rated Output Power :	0.00294 W
Type of Power Supply :	5Vdc
Antenna Connector :	None (PCB antenna)
No of antennas:	1
Antenna Diversity Supported :	None
Desktop Charger :	None

Description of Test Item

The Squid. Link Gateway from Develco Products are flexible platforms for connecting elements in your Smart Home system with a control unit. They support a wide range of communication protocols, with state-of-the art data encryption to keep your data streams safe and private. The gateways are based on a programmable Linux-platform and support Java and OSGI.

The gateway is modular and can handle many different wireless protocols at the same time. Supported protocols are i.a. ZigBee, Z-Wave, Wireless M-Bus, GPRS, ethernet, and WiFi.

Theory of Operation

The Smart Home application running on the Squid.link gateway handles the communication with the different devices installed in the home. The gateway can receive and transmit data messages to/from the devices in the network. All the radios are pr. default RX-On idle.

1.2 Normal test conditions

Temperature: 20 - 24 °C

Relative humidity: 20 - 50 %

Normal test voltage: 5Vdc

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.

1.5 Description of modification for Modification Filing

Not applicable.

1.6 Family List Rational

Not Applicable.

1.7 Additional Comments

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

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 ANSI C63.10-2013.

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.

☒ 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, RSS-GEN Issue 4 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	Complies
Number of Operating Frequencies	15.31(m)	5.1 (6) (RSS-247)	N/A
Antenna Requirement	15.203	8.3 (RSS-GEN)	Complies ¹
Power Line Conducted Emission	15.107(a) 15.207(a)	8.8 (RSS-GEN)	Complies
Channel Separation	15.247(a)(1)	5.1 (4) (RSS-247)	N/A
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	N/A
Time of Occupancy	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	N/A
Occupied Bandwidth	15.247(a)(1)	5.1 (7) (RSS-247)	Complies
Occupied Bandwidth	N/A	6.6 (RSS-GEN)	
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	Complies
Peak Power Output	15.247(b)	5.4 (RSS-247)	Complies
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	Complies ¹
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

¹ The tested equipment has integrated antennas only.

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: G.Suhandhakumar

Date of Test: 2016.03.16

Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN.

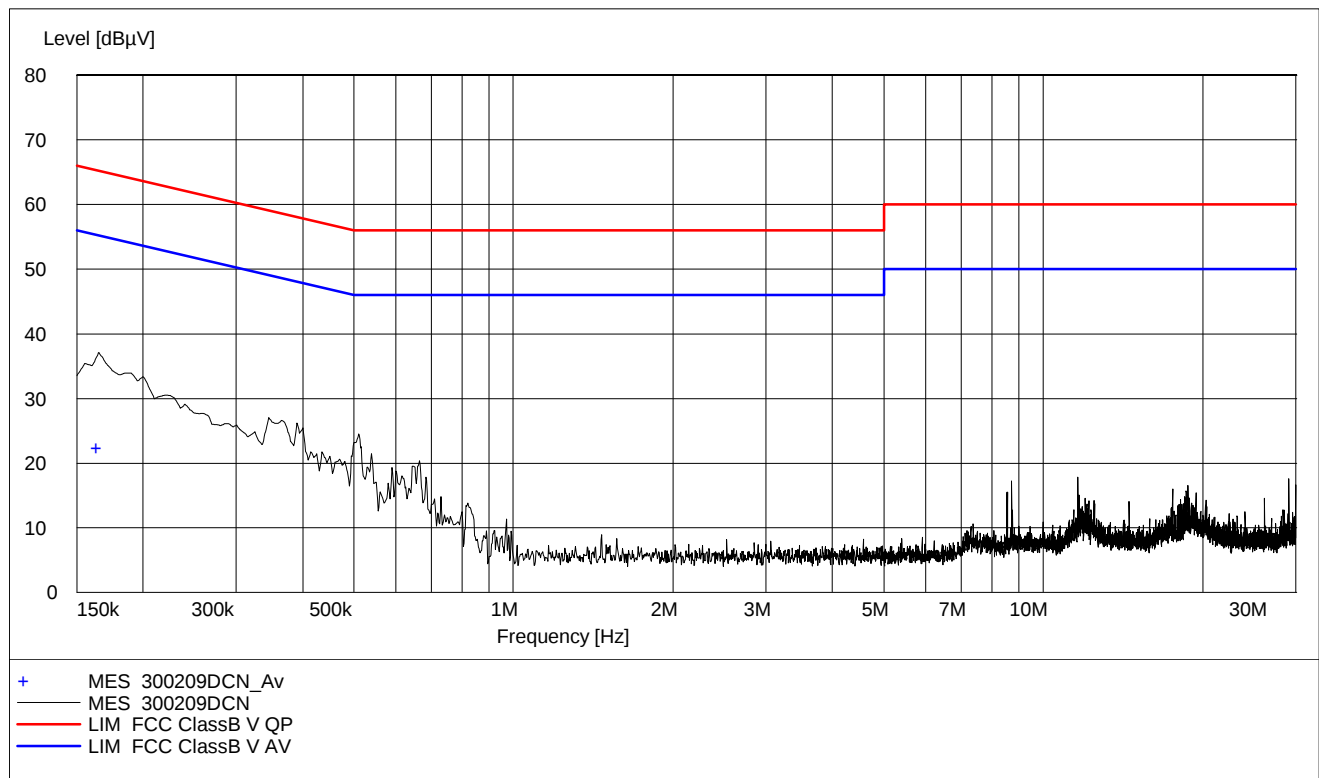
Test Results: Complies.

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

Measured for 5Vdc using Farnell D001 (S/N :001701) power supply and
AC/DC adapter typeSMP007B050100

Input voltage to Farnell DC power supply & AC/Dc adapter: 120Vac/60Hz

Highest measured value (L1 and N):



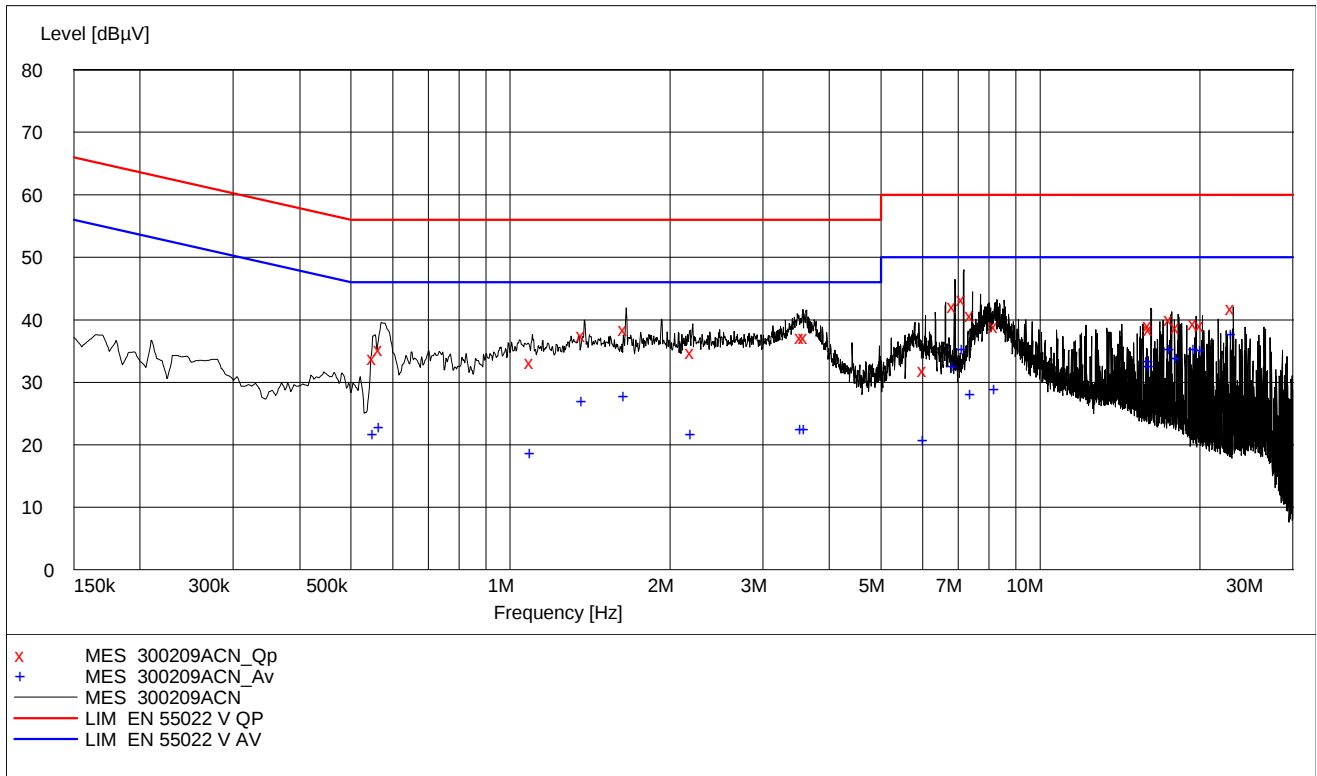
DC power 5Vdc- Farnell D001

QP detector:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
-	-	-	-	-	QP	-	-

AV detector:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.165000	22.30	10.70	55.20	32.90	AV	L1	Pass



AC/DC adaptor type: SMP007B050100

QP detector:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.555000	33.80	10.20	56.00	22.20	QP	L1	Pass
0.570000	35.20	10.20	56.00	20.80	QP	N	Pass
1.100000	33.20	10.40	56.00	22.80	QP	L1	Pass
1.380000	37.50	10.40	56.00	18.50	QP	L1	Pass
1.655000	38.50	10.40	56.00	17.50	QP	L1	Pass
2.210000	34.90	10.40	56.00	21.10	QP	L1	Pass
3.570000	37.20	10.40	56.00	18.80	QP	N	Pass
3.615000	37.30	10.40	56.00	18.70	QP	N	Pass
6.070000	32.00	10.50	60.00	28.00	QP	L1	Pass
6.900000	42.20	10.60	60.00	17.80	QP	N	Pass
7.175000	43.40	10.60	60.00	16.60	QP	N	Pass
7.450000	40.70	10.60	60.00	19.30	QP	N	Pass
8.280000	38.90	10.60	60.00	21.10	QP	N	Pass
16.165000	39.20	10.80	60.00	20.80	QP	L1	Pass
16.225000	38.40	10.80	60.00	21.60	QP	N	Pass
17.695000	40.10	10.80	60.00	19.90	QP	L1	Pass
18.240000	38.80	10.80	60.00	21.20	QP	N	Pass
19.710000	39.50	10.80	60.00	20.50	QP	L1	Pass
20.260000	39.20	10.80	60.00	20.80	QP	L1	Pass
23.130000	41.80	11.00	60.00	18.20	QP	L1	Pass

AV detector:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.555000	21.70	10.20	46.00	24.30	AV	L1	Pass
0.570000	22.80	10.20	46.00	23.20	AV	N	Pass
1.100000	18.70	10.40	46.00	27.30	AV	L1	Pass
1.380000	27.00	10.40	46.00	19.00	AV	L1	Pass
1.655000	27.80	10.40	46.00	18.20	AV	L1	Pass
2.210000	21.70	10.40	46.00	24.30	AV	L1	Pass
3.570000	22.50	10.40	46.00	23.50	AV	N	Pass
3.615000	22.50	10.40	46.00	23.50	AV	N	Pass
6.070000	20.80	10.50	50.00	29.20	AV	L1	Pass
6.900000	32.60	10.60	50.00	17.40	AV	N	Pass
7.175000	35.20	10.60	50.00	14.80	AV	N	Pass
7.450000	28.10	10.60	50.00	21.90	AV	N	Pass
8.280000	28.90	10.60	50.00	21.10	AV	N	Pass
16.165000	33.40	10.80	50.00	16.60	AV	L1	Pass
16.225000	32.50	10.80	50.00	17.50	AV	N	Pass
17.695000	35.30	10.80	50.00	14.70	AV	L1	Pass
18.240000	33.80	10.80	50.00	16.20	AV	N	Pass
19.710000	35.20	10.80	50.00	14.80	AV	L1	Pass
20.260000	35.10	10.80	50.00	14.90	AV	L1	Pass
23.130000	37.60	11.00	50.00	12.40	AV	L1	Pass

3.2 Minimum 6 dB Bandwidth

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

Test Performed By: G.Suwanthakumar

Date of Test: 2016.02.24 to 2016.03.09

Test Results: Complies

Measurement Data:

Measured 6 dB Bandwidth (MHz)		
2405MHz	2440 MHz	2480MHz
1.79	1.61	1.89

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

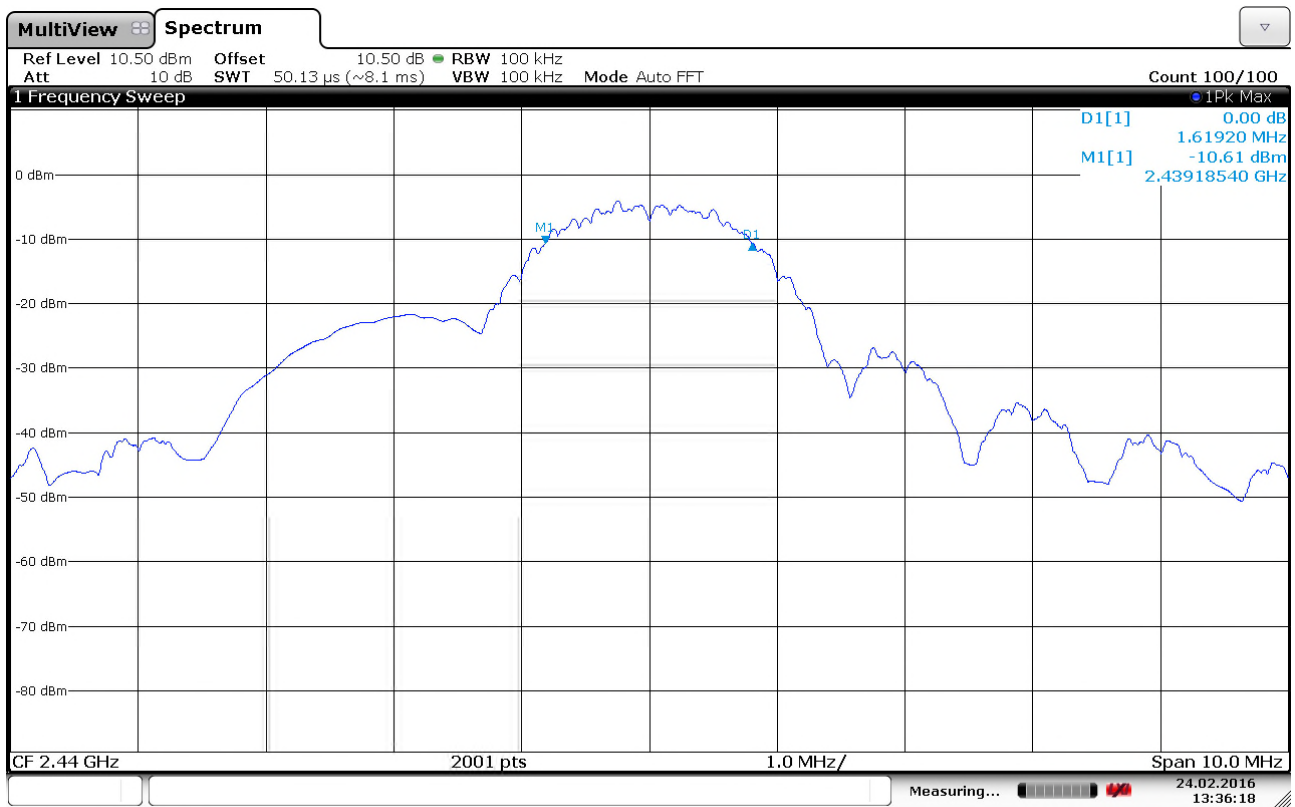
Requirements:

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

No requirements for Frequency Hopping Systems.

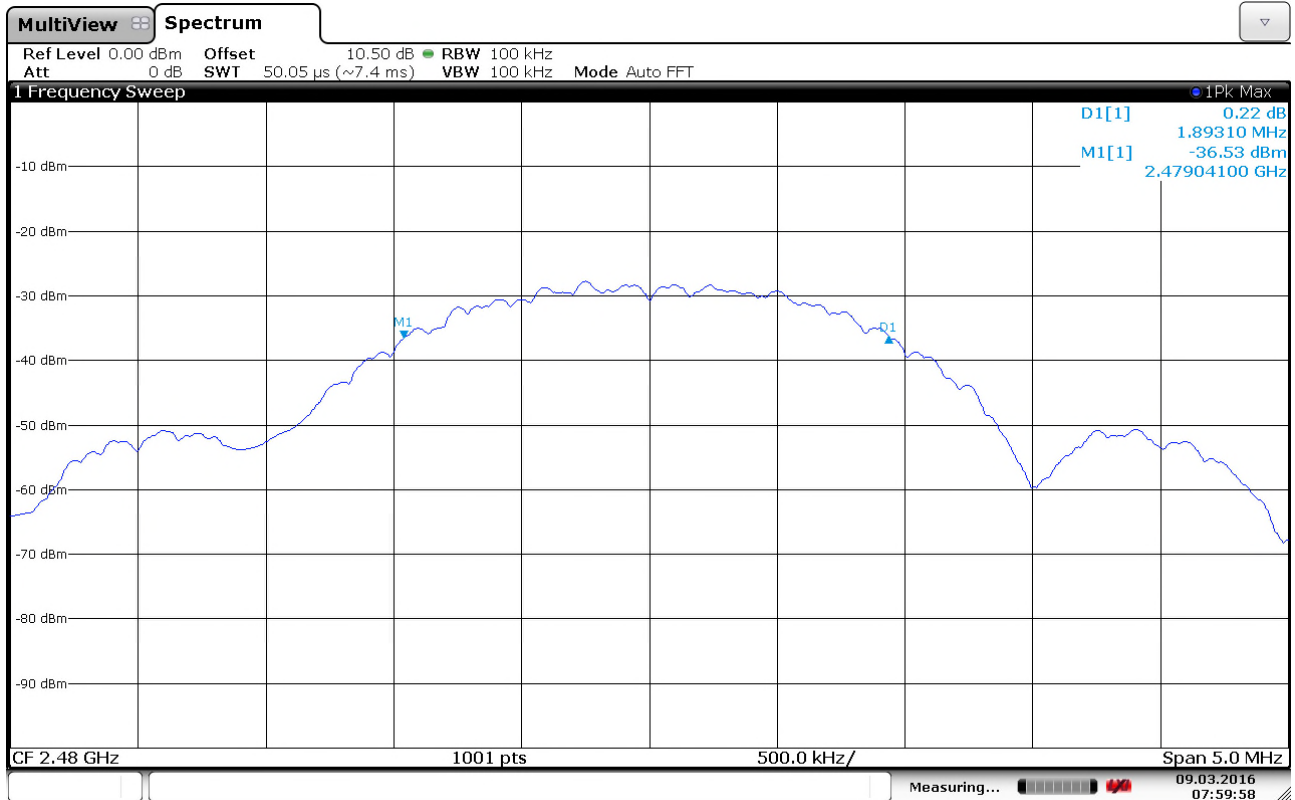


6 dB Bandwidth at 2405 MHz



Date: 24.FEB.2016 13:36:18

6 dB Bandwidth at 2440 MHz



6 dB Bandwidth at 2480 MHz

3.3 99% Bandwidth

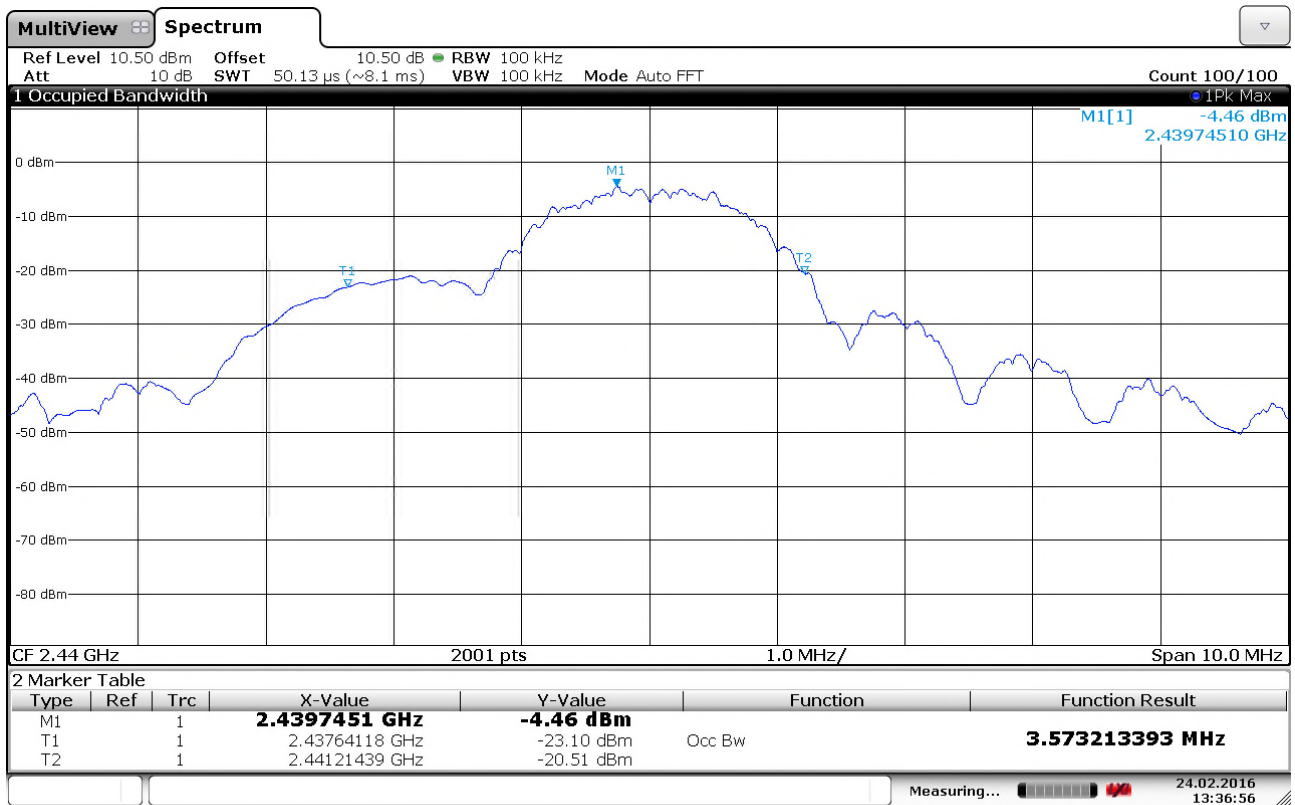
Test Performed By: G.Suwanthakumar	Date of Test: 2016.02.24
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Measurement Data:

Measured 99% Bandwidth (MHz)
2440 MHz
3.57

Requirements:

No requirements. Reported for information only.



Date: 24.FEB.2016 13:36:56

99% Bandwidth at 2440 MHz

3.4 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: G.Suwanthakumar	Date of Test: 2016.02.24 – 2016.03.09
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Test Results: Complies

Measurement Data:

RF channel	2405 MHz	2440 MHz	2480 MHz
Measured Maxium Field strength (dBμV/m) –VP	104.21	105.02	80.94
Calc. Radiated Power (dBm)	8.95	9.76	-14.31
Calc. Radiated Power (mW)	7.85	9.46	0.037
Measured Conducted Power (dBm)	4.22	4.69	-19.70
Measured Conducted Power (mW)	2.64	2.94	0.011
Calculated Antenna Gain (dBi)	4.73	5.08	5.27

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.

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

SW Power settings:

Ch11(2405MHz)	Ch18(2440MHz)	CH26(2480MHz)
26	28	14

See attached graph.

Detachable antenna?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

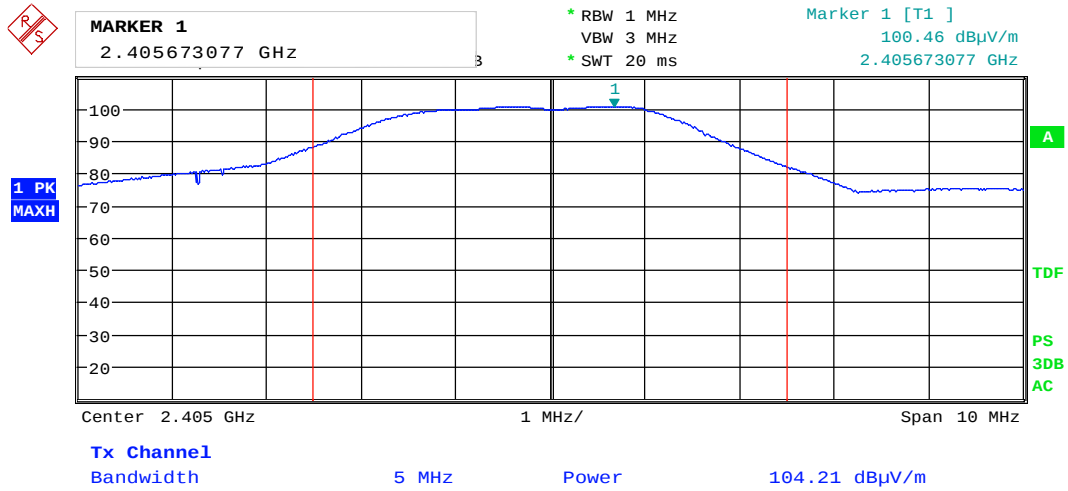
Type of antenna connector: N/A

Requirements:

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

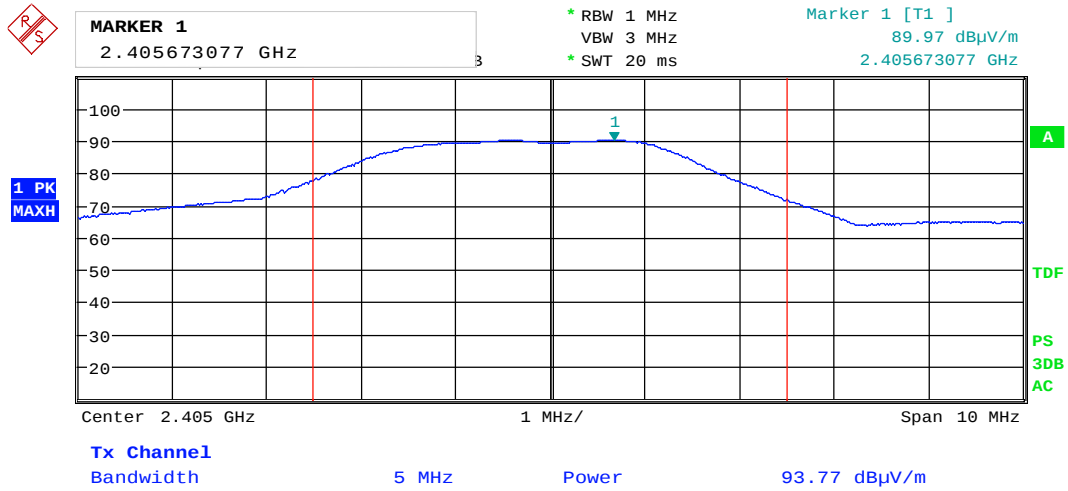
For Digital Transmission Systems in the 2400 - 2483.5 MHz band: 1 Watt

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.



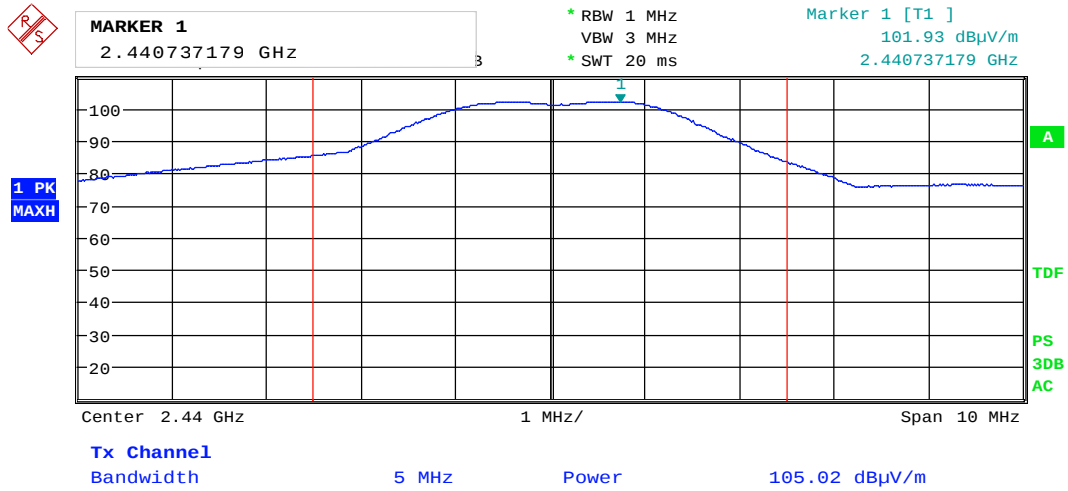
Date: 8.MAR.2016 11:04:17

Radiated Field strength, VP , 2405 MHz



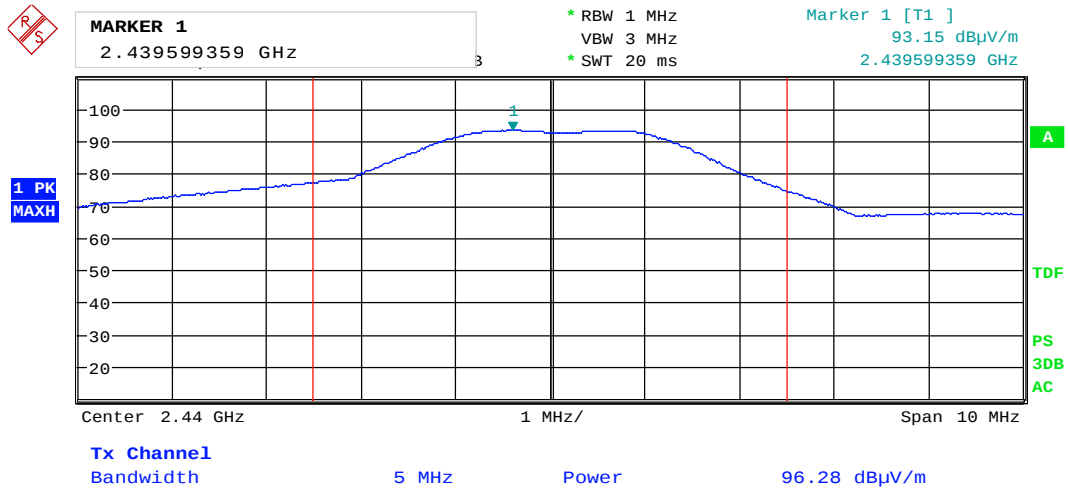
Date: 8.MAR.2016 11:07:25

Radiated field strength, HP, 2405 MHz



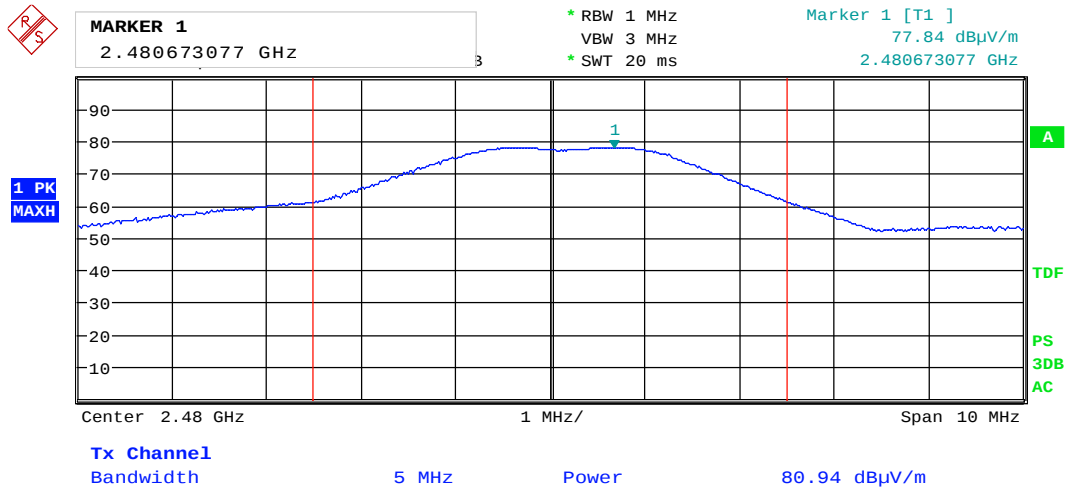
Date: 8.MAR.2016 11:14:34

Radiated field strength, VP, 2440 MHz



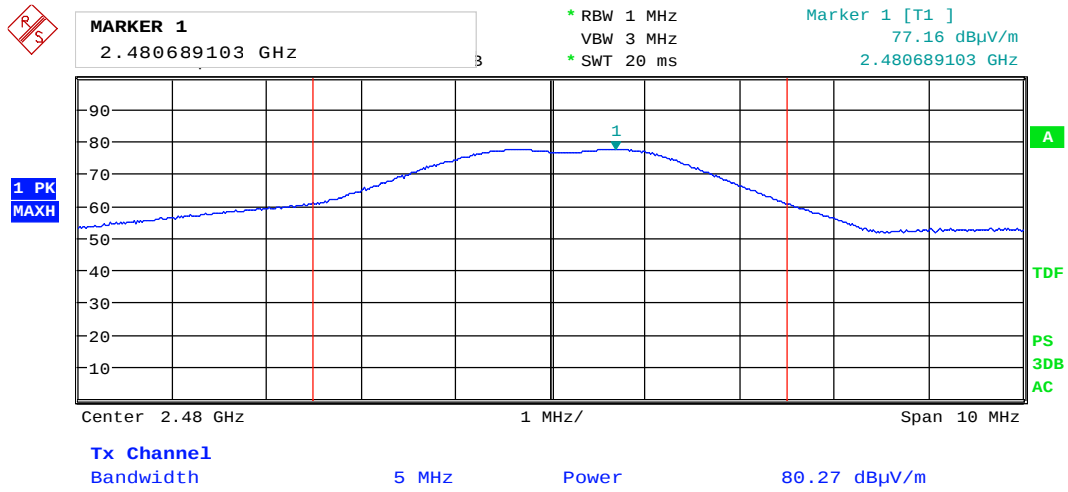
Date: 8.MAR.2016 11:09:10

Radiated field strength, HP, 2440 MHz



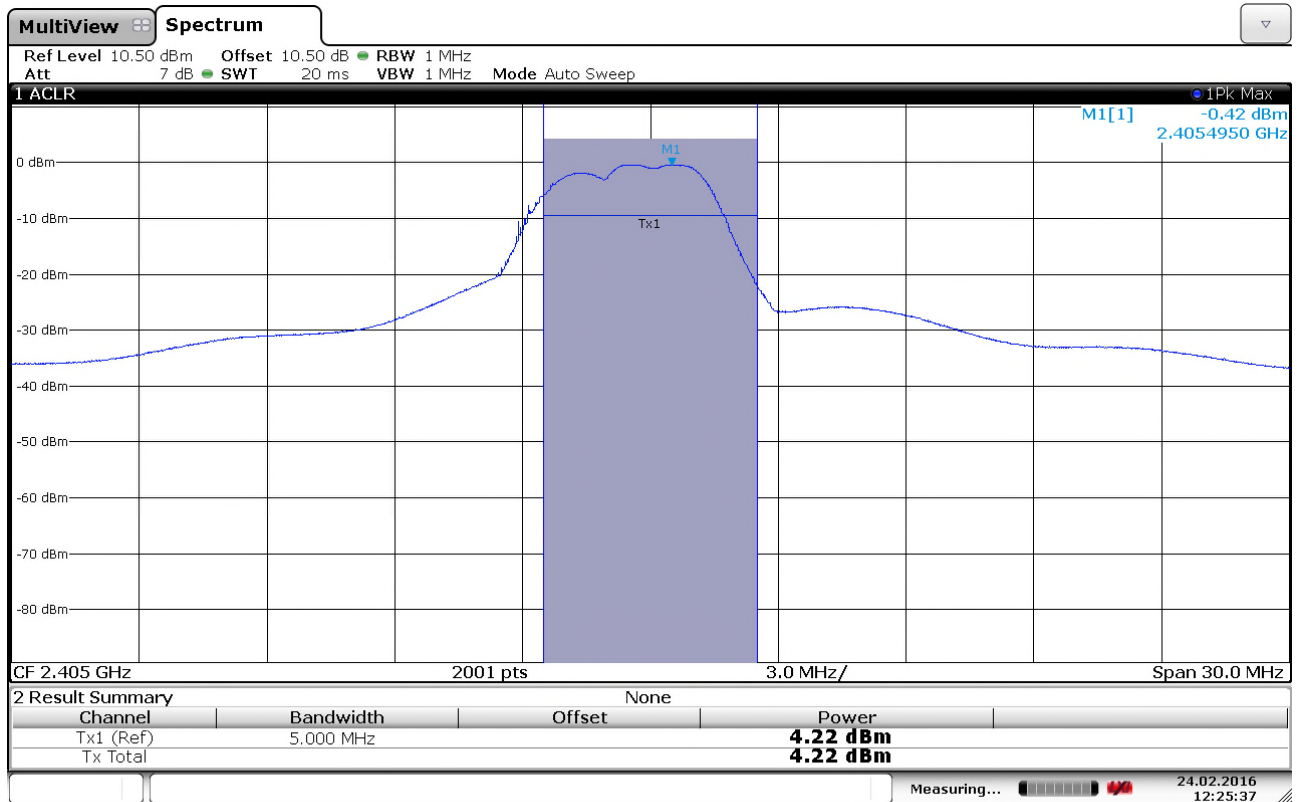
Date: 8.MAR.2016 11:16:38

Radiated field strength, VP, 2480 MHz



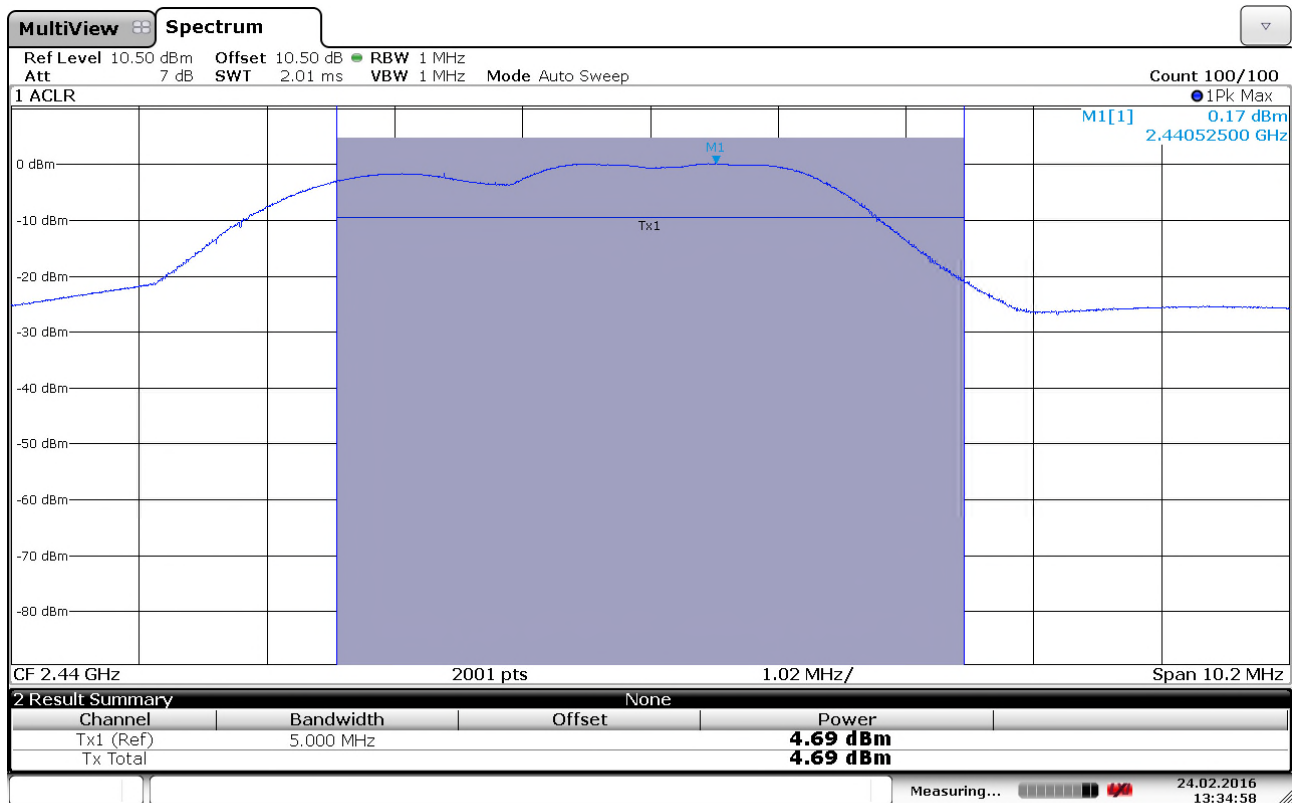
Date: 8.MAR.2016 11:21:08

Radiated field strength, HP, 2480 MHz



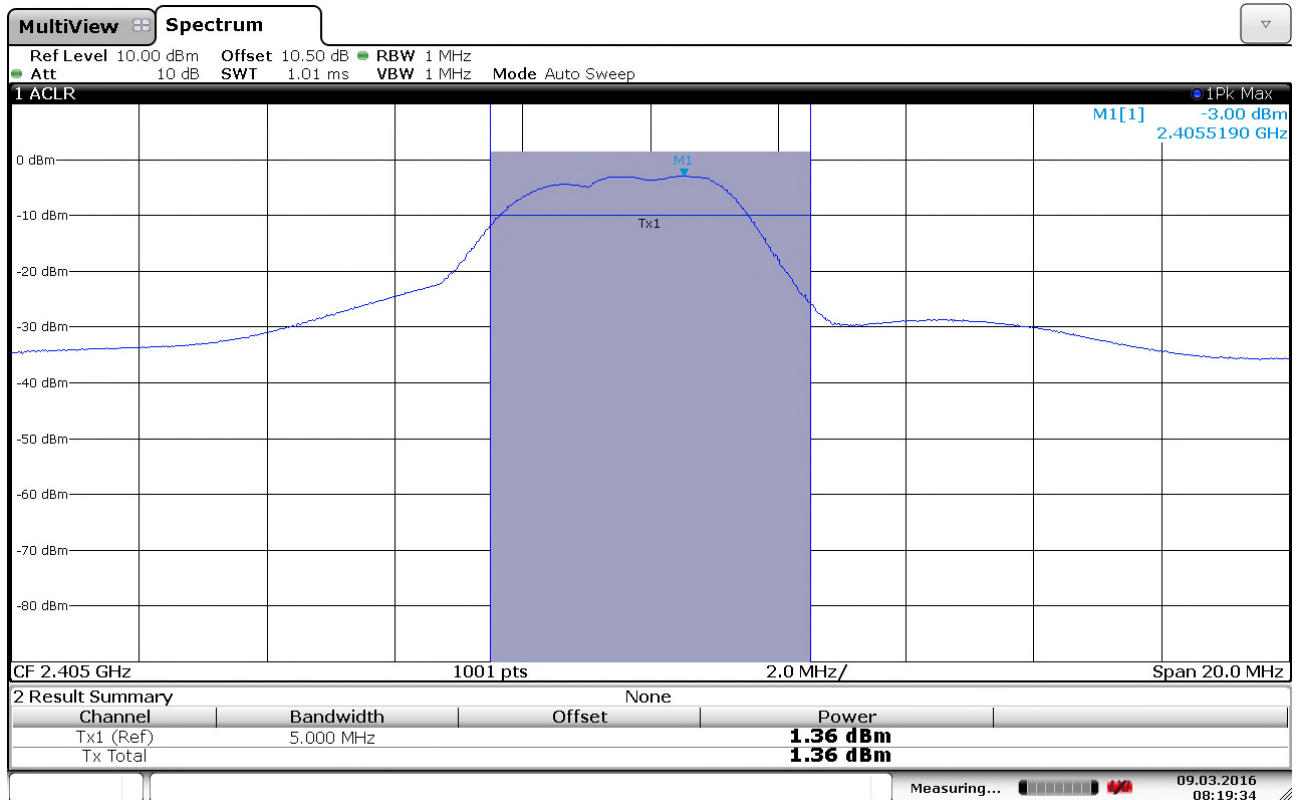
Date: 24.FEB.2016 12:25:36

Conducted power – 2405MHz



Date: 24.FEB.2016 13:34:58

Conducted power – 2440MHz



Conducted power – 2480MHz

3.5 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: G.Suwanthakumar

Date of Test: 2016.02.24 – 2016.03.09

Test Results: Complies

Measurement Data:

Band-edge, @3m

Frequency	Measured Field Strength @3m, dBμV/m	Detector	Limit dBμV/m	Margin dB
2.39 GHz	65.27	PK	74	8.73
	51.69	AV	54	2.31
2.4835 GHz	52.75	PK	74	21.26
	51.69	AV	54	2.31

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

See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle (x) = 17%

Duty Cycle Correction factor = $10 \times \log(\text{Duty Cycle}) = 7.5 \text{ dB}$

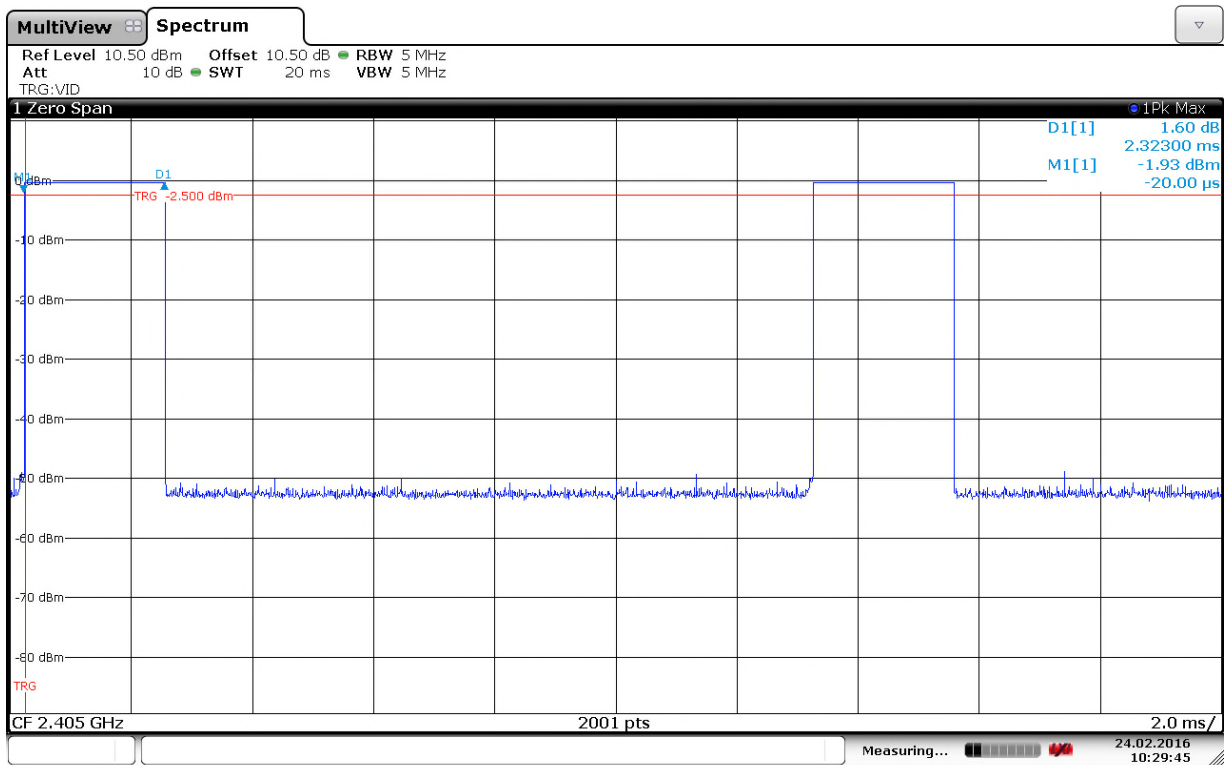
RF conducted power to 25 GHz see attached graph.

Maximum RF level outside operating band:

RF ch 11: 30.62 dB/C, margin >20 dB

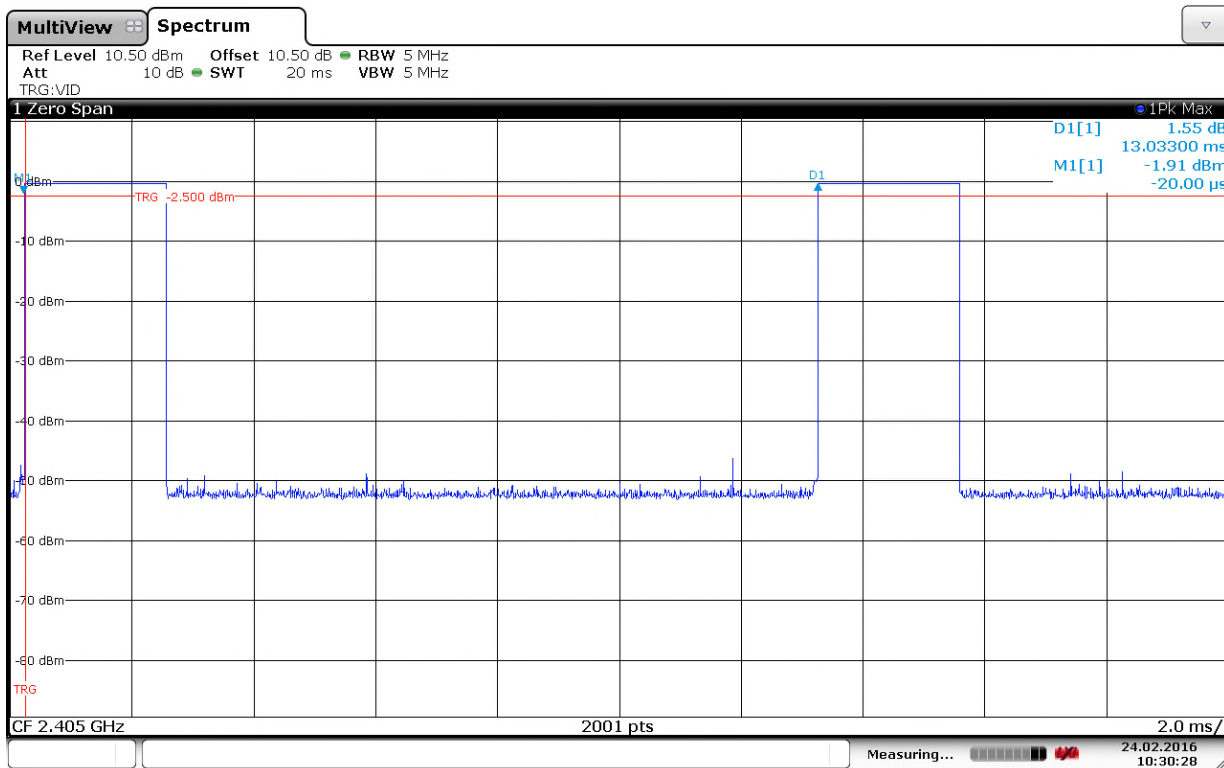
RF ch 18: 34.83 dB/C, margin >30 dB

RF ch 26: 30.53 dB/C, margin >30 dB



Date: 24.FEB.2016 10:29:45

ON time



Date: 24.FEB.2016 10:30:28

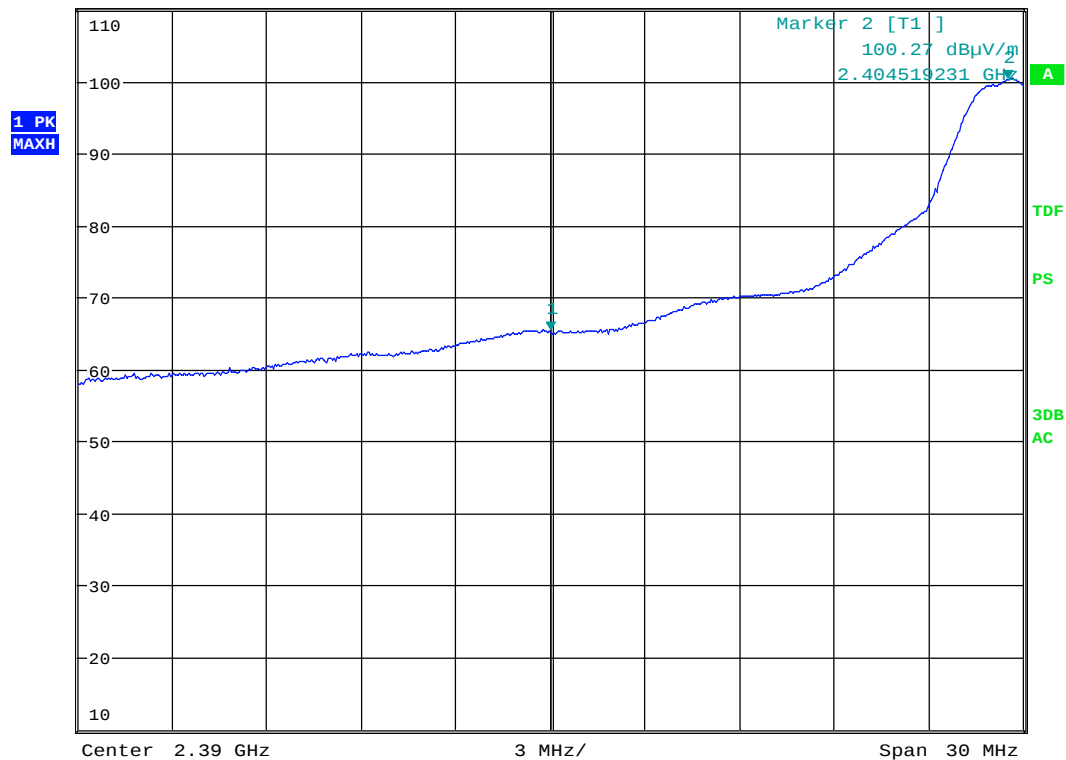
ON plus OFF time



MARKER 1
2.39 GHz
Ref 110 dBμV/m * Att 10 dB

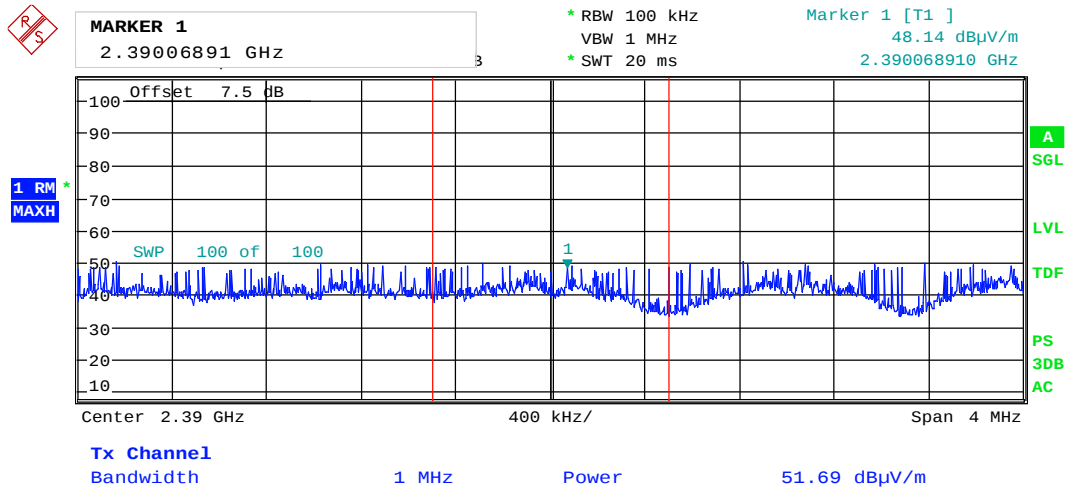
* RBW 1 MHz
VBW 3 MHz
* SWT 20 ms

Marker 1 [T1]
65.27 dBμV/m
2.390000000 GHz



Date: 8.MAR.2016 11:01:16

Band Edge, 2390 MHz, Peak Detector



Date: 8.MAR.2016 10:36:18

Band Edge, 2390 MHz, Average Detector



MARKER 2

2.480567308 GHz

Ref 110 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

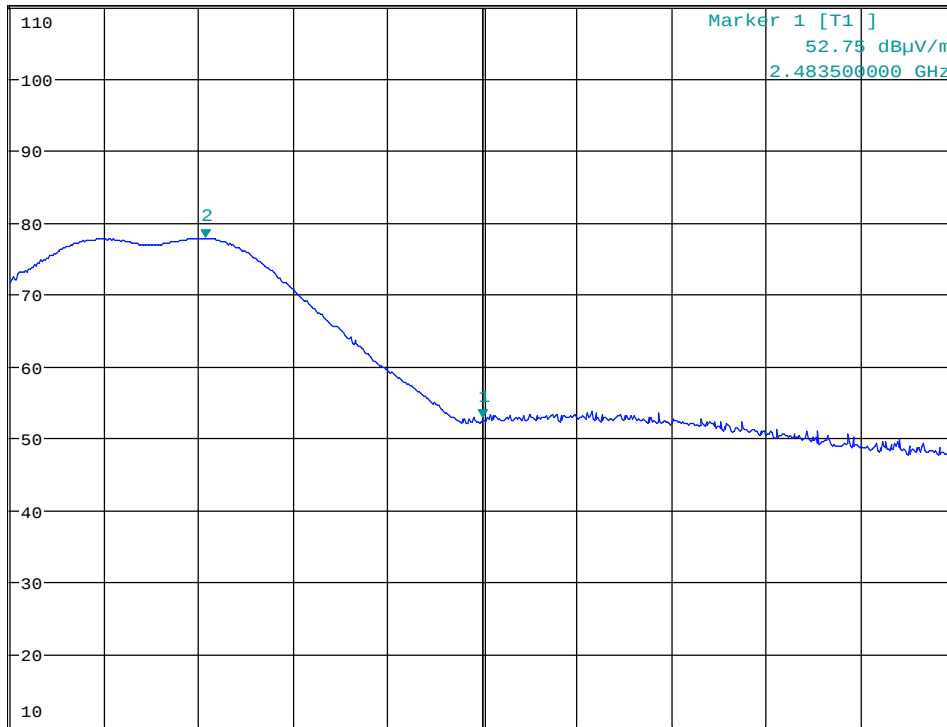
* SWT 20 ms

Marker 2 [T1]

77.76 dBμV/m

2.480567308 GHz

1 PK
MAXH



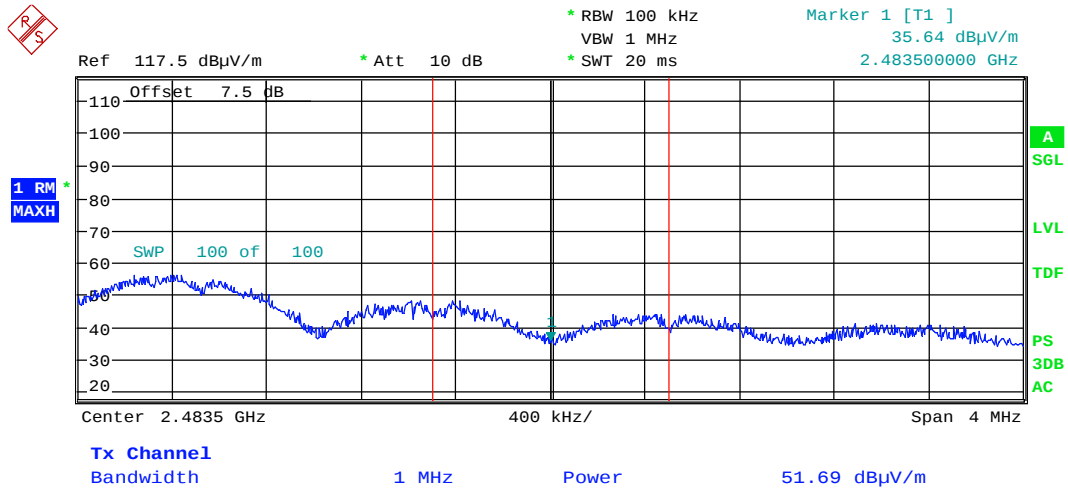
Center 2.4835 GHz

1 MHz/

Span 10 MHz

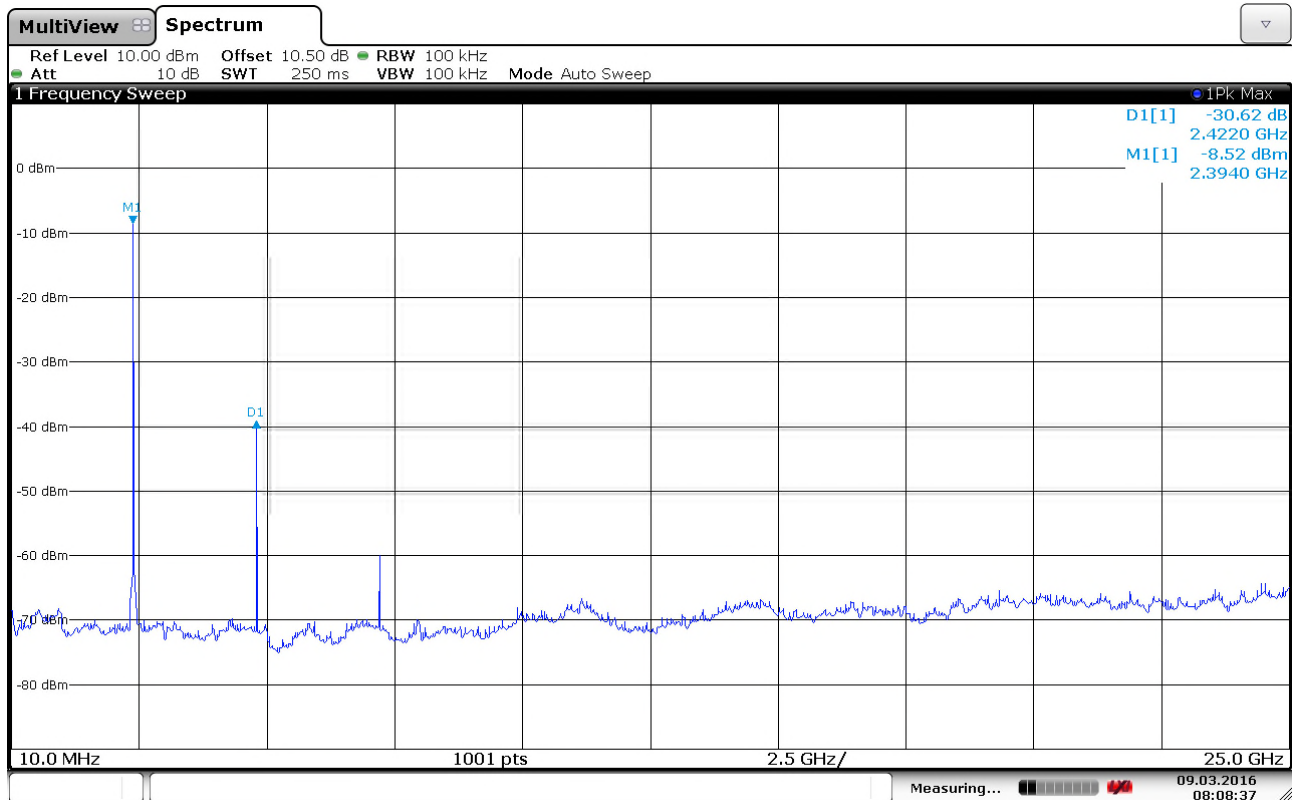
Date: 8.MAR.2016 10:05:35

Band Edge, 2483.5 MHz, Peak Detector

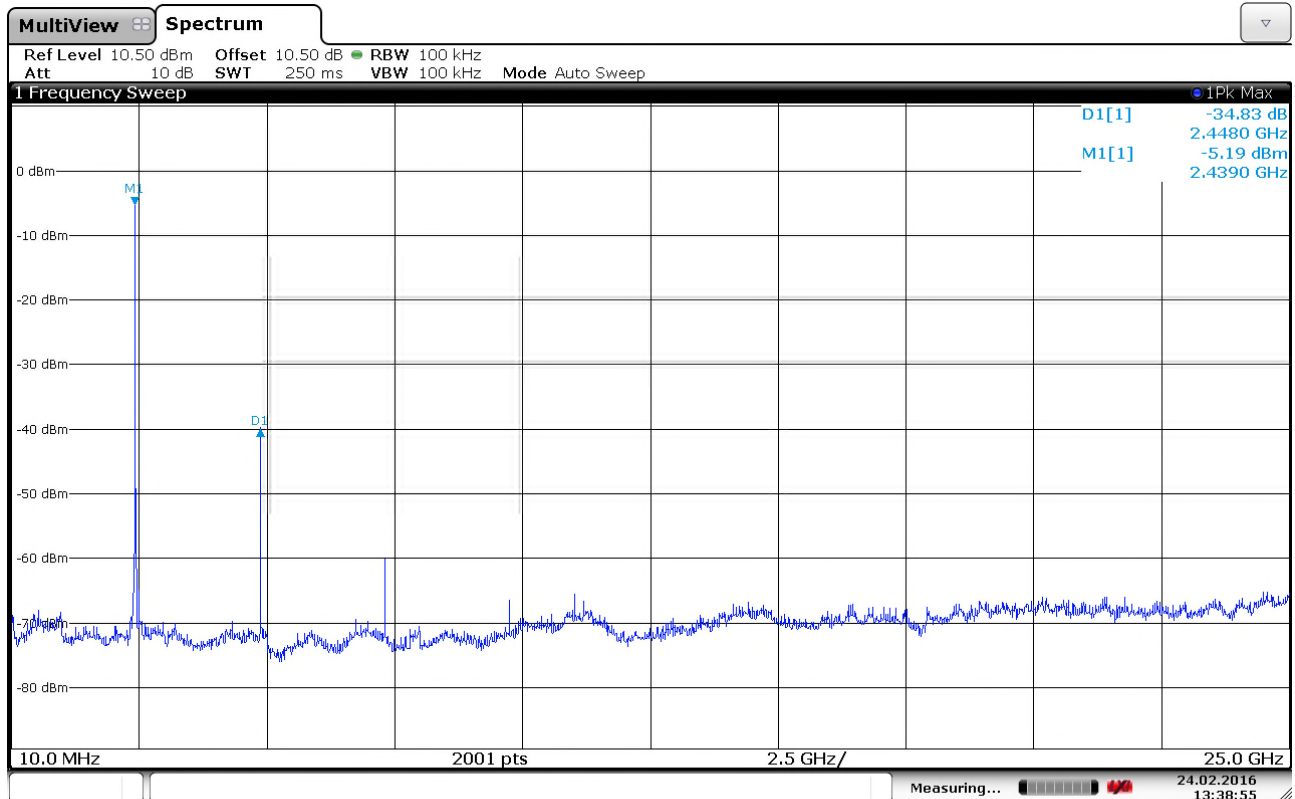


Date: 8.MAR.2016 10:02:55

Band Edge, 2483.5 MHz, Average Detector

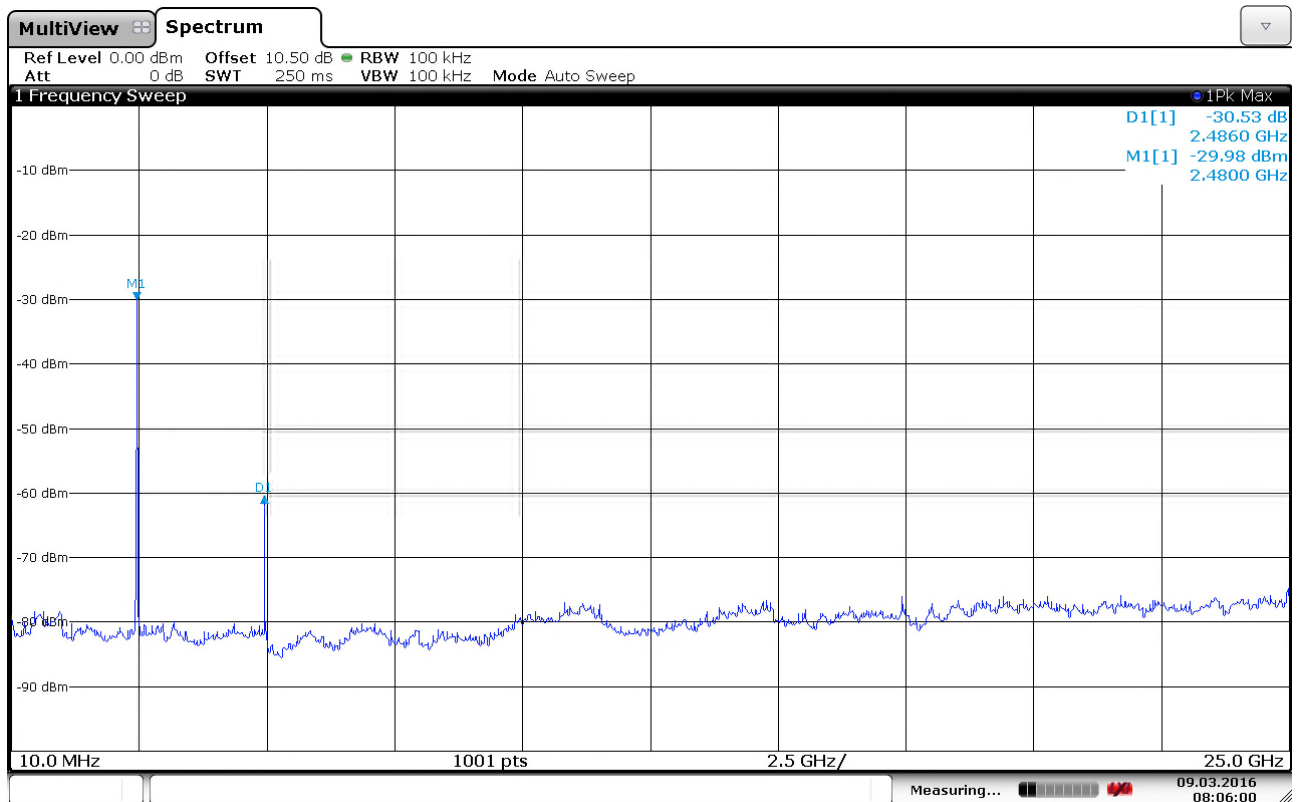


Conductd spurious emission 10MHz – 25GHz - ch2405MHz



Date: 24.FEB 2016 13:38:55

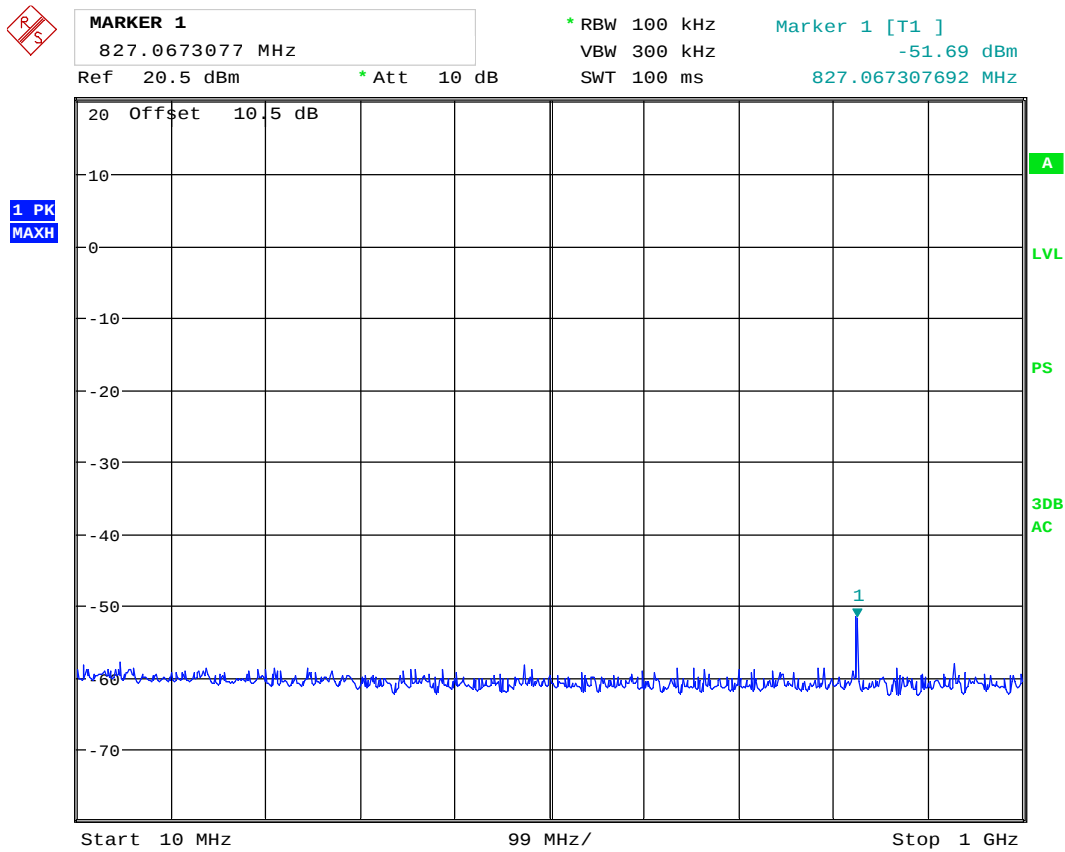
Conductd spurious emission 10MHz – 25GHz - ch2440MHz



Conducted spurious emission 10MHz – 25GHz - ch2480MHz

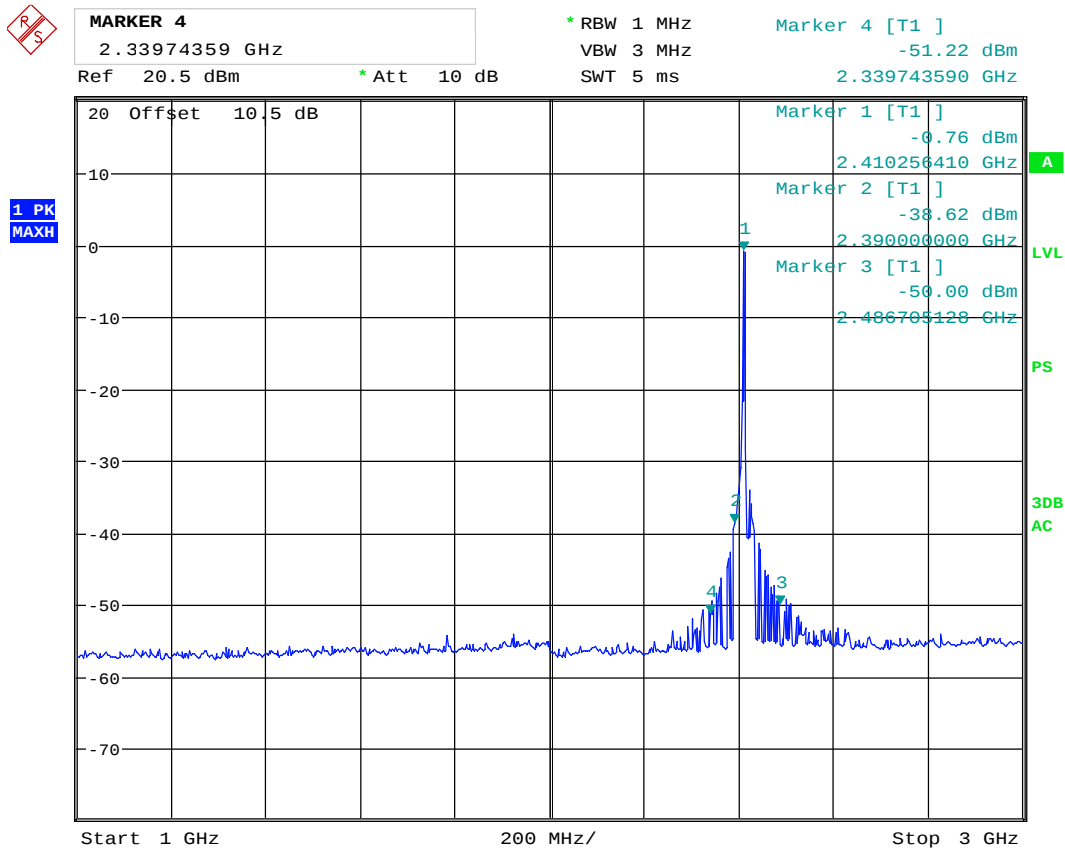
CONDUCTED EMISSIONS WITH ALL RADIO'S ON AND ACTIVE

All spurious in the restricted band is below 50 dB from the carrier.



Date: 3.AUG.2016 18:58:18

Conducted Emissions 10 MHz – 1 GHz, on Zigbee RF port



Date: 3.AUG.2016 19:01:28

Conducted Emissions 1 - 3 GHz, on Zigbee RF port



MARKER 1

24.40064103 GHz

Ref 20.5 dBm

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

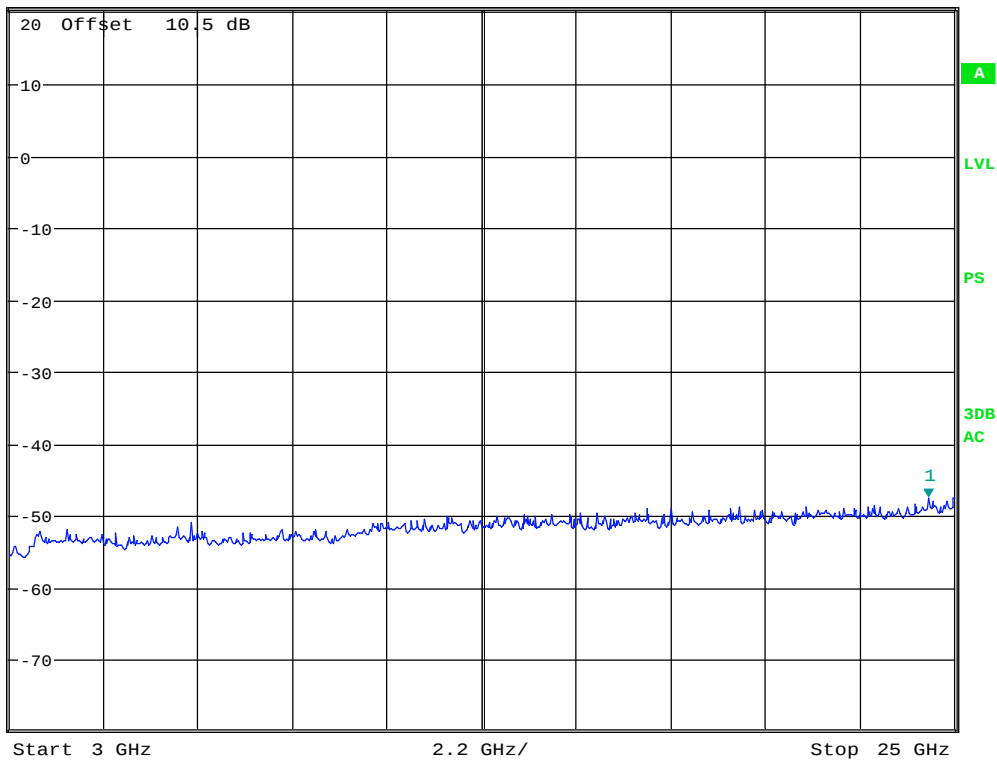
SWT 130 ms

Marker 1 [T1]

-47.46 dBm

24.400641026 GHz

1 PK
MAXH



Date: 3.AUG.2016 18:59:32

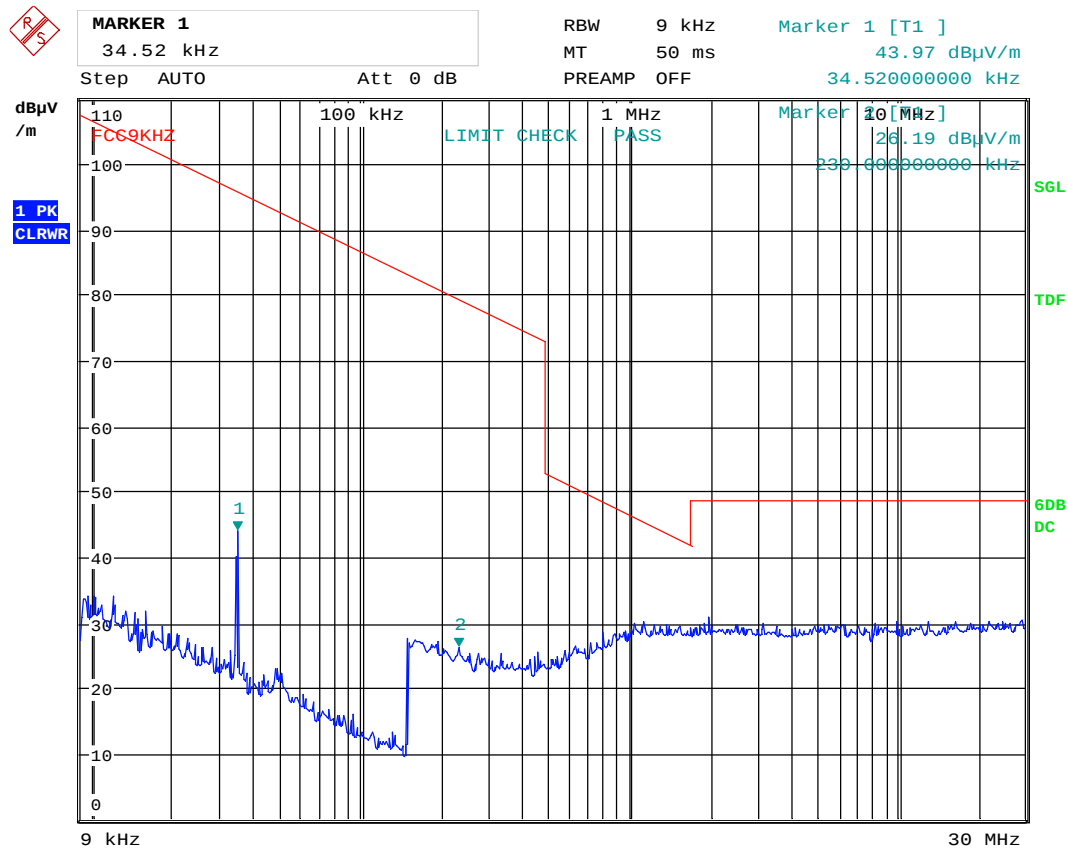
Conducted Emissions 3 - 25GHz, on Zigbee RF port

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: 10.MAR.2016 08:27:47

Radiated Emissions, 9 kHz – 30 MHz @10m

Radiated emission 30 – 1000 MHz.

Detector: Quasi-Peak

Measuring distance 3 m.

Frequency	Operational condition	Detector	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz			dB μ V/m	metres	dB μ V/m	dB
66.23	TX on	QP	39.83	3	40.0	0.17
98.38	TX on	QP	42.36	3	43.5	1.17
104.67	TX on	QP	38.38	3	43.5	5.12

The maximum is obtained at Vertical polarization

See attached graphs.



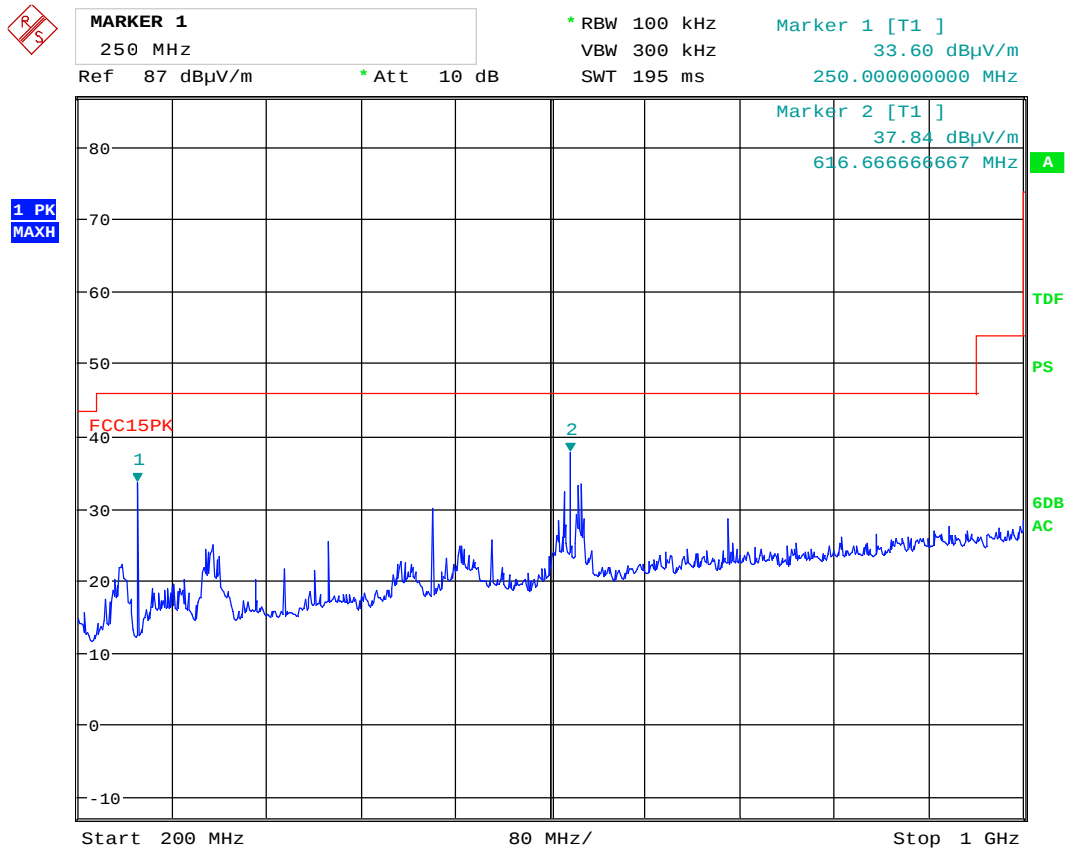
Date: 10.MAR.2016 07:15:23

Radiated Emissions, 30 – 200 MHz, VP, @3m, PK scan



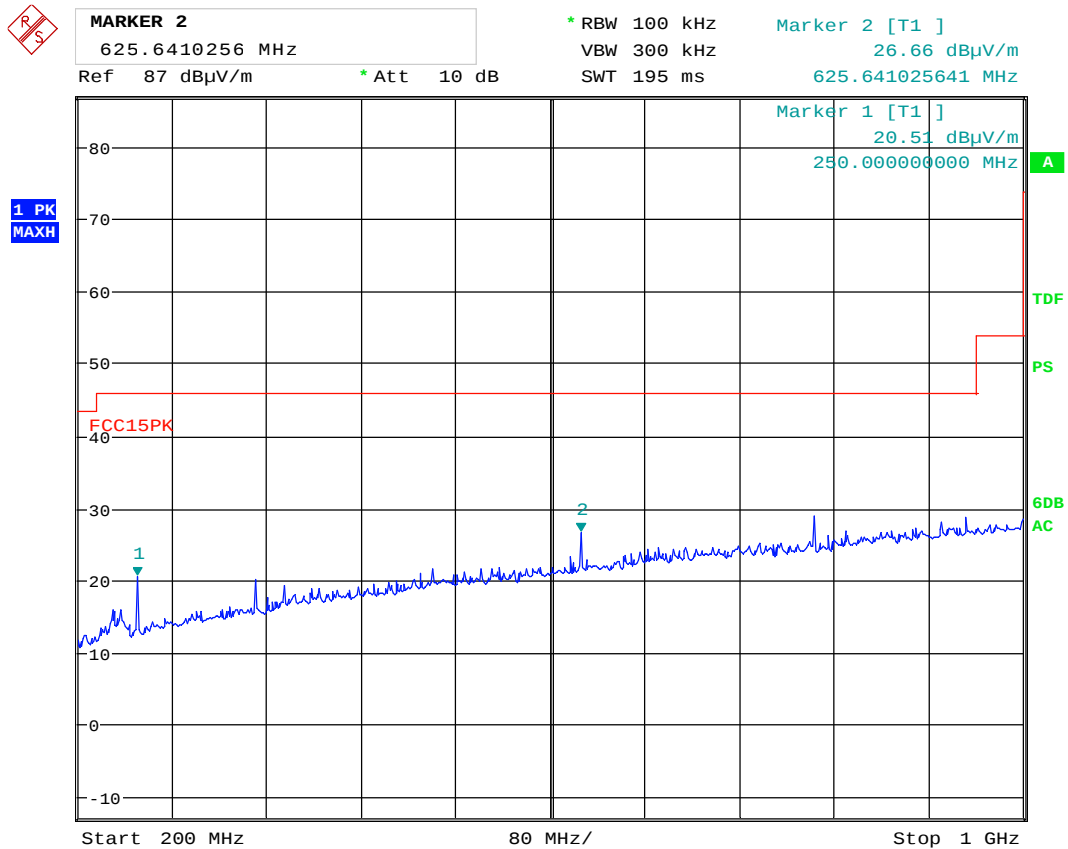
Date: 10.MAR.2016 07:17:38

Radiated Emissions, 30 – 200 MHz, HP, @3m, PK scan



Date: 10.MAR.2016 07:28:29

Radiated Emissions, 200 - 1000 MHz, VP , @3m, PK scan



Date: 10.MAR.2016 07:39:09

Radiated Emissions, 200 - 1000MHz, HP , @3m, PK scan

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.

Peak Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4.81	L	0	54.82	0	74	19.18
4.88	M	0	56.98	0	74	17.02
4.96	H	0	None detected	0	74	>20
Other freqs	L,M,H	0	None detected	0	74	>20

Average Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Average Detector, 3m	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4.81	L	0	49.02	*	54	4.98
4.88	M	0	52.37	*	54	1.63
4.96	H	/	None detected	/	54	>20
Other freqs	L,M,H	/	None detected	/	54	>20

*Duty cycle correction is included in the measurements. (10log(1/x), x=17%)

Tested according to KDB 558074 D01 DTS Meas Guidance v03r04, Section 12.2.5.2

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

See plots.



MARKER 1

4.810929487 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

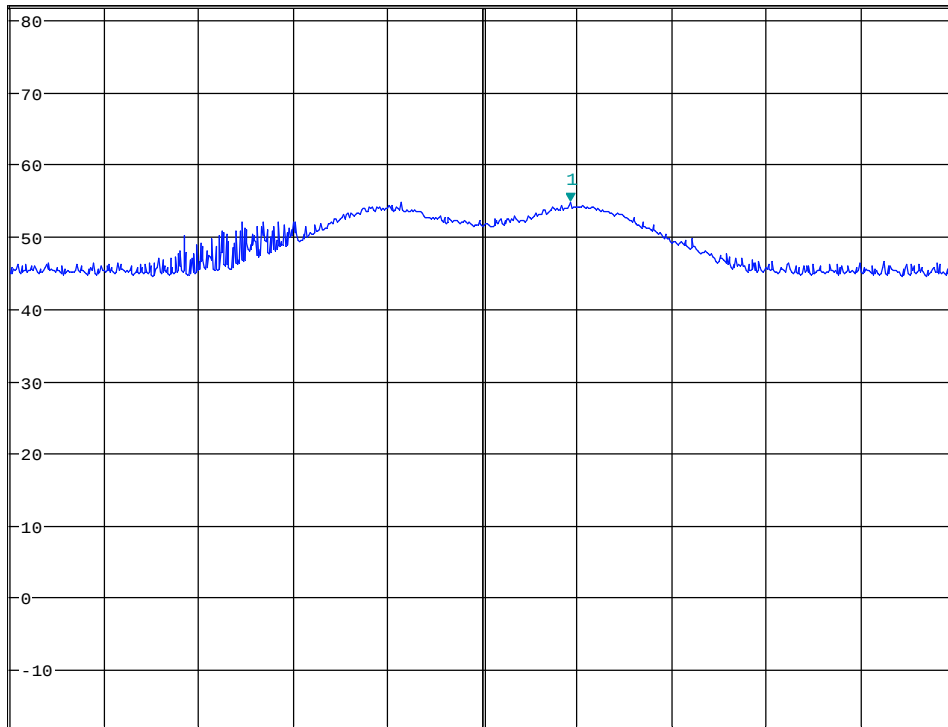
SWT 20 ms

Marker 1 [T1]

54.82 dBμV/m

4.810929487 GHz

1 PK
MAXH



A

TDF

LNA

PS

3DB

AC

Date: 10.MAR.2016 10:04:26

2nd Harm, 2405MHz , HP @3m , PK detector



MARKER 1

4.808974359 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 10 MHz

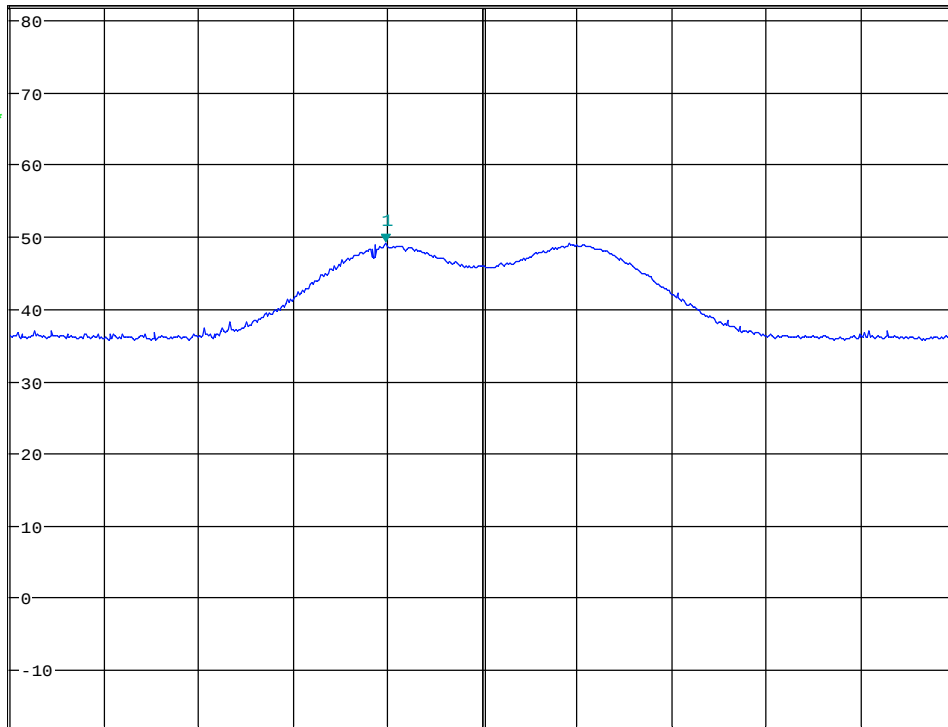
SWT 20 ms

Marker 1 [T1]

49.02 dBμV/m

4.808974359 GHz

1 RM
MAXH



Center 4.81 GHz

1 MHz/

Span 10 MHz

A

TDF

LNA

PS

3DB

AC

Date: 10.MAR.2016 10:04:55

2nd Harm, 2405MHz , HP @3m , rms detector



MARKER 1

4.881137821 GHz

Ref 92 dBμV/m

* Att 20 dB

* RBW 1 MHz

VBW 3 MHz

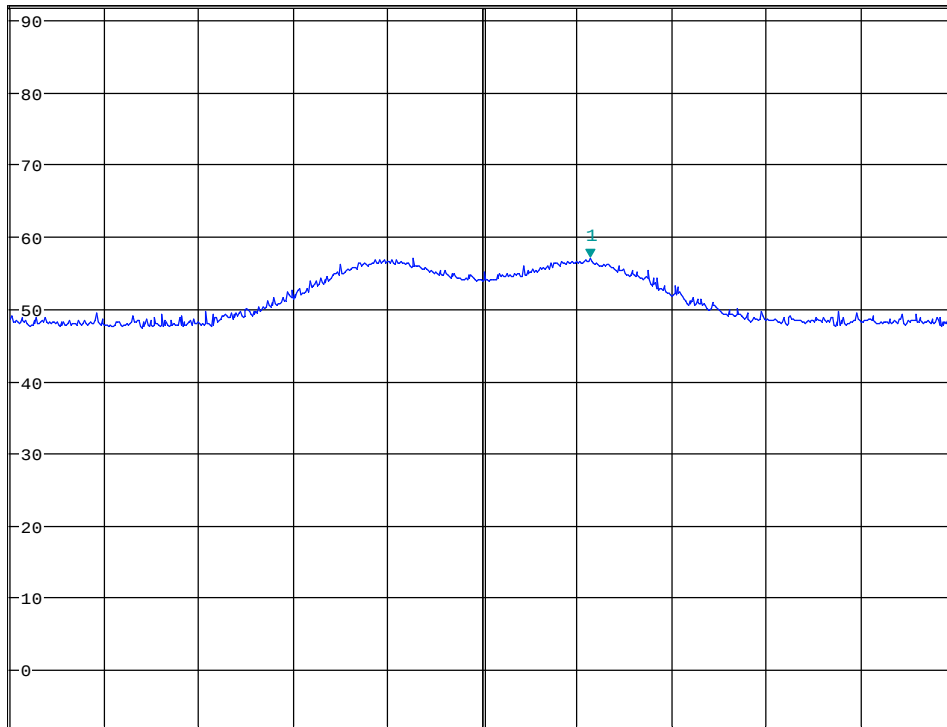
SWT 20 ms

Marker 1 [T1]

56.98 dBμV/m

4.881137821 GHz

1 PK
MAXH



Date: 10.MAR.2016 09:46:20

2nd Harm, 2440MHz , HP @3m , PK detector



MARKER 1

4.8788875 GHz

Ref 92 dBμV/m

* Att 20 dB

* RBW 1 MHz

VBW 10 MHz

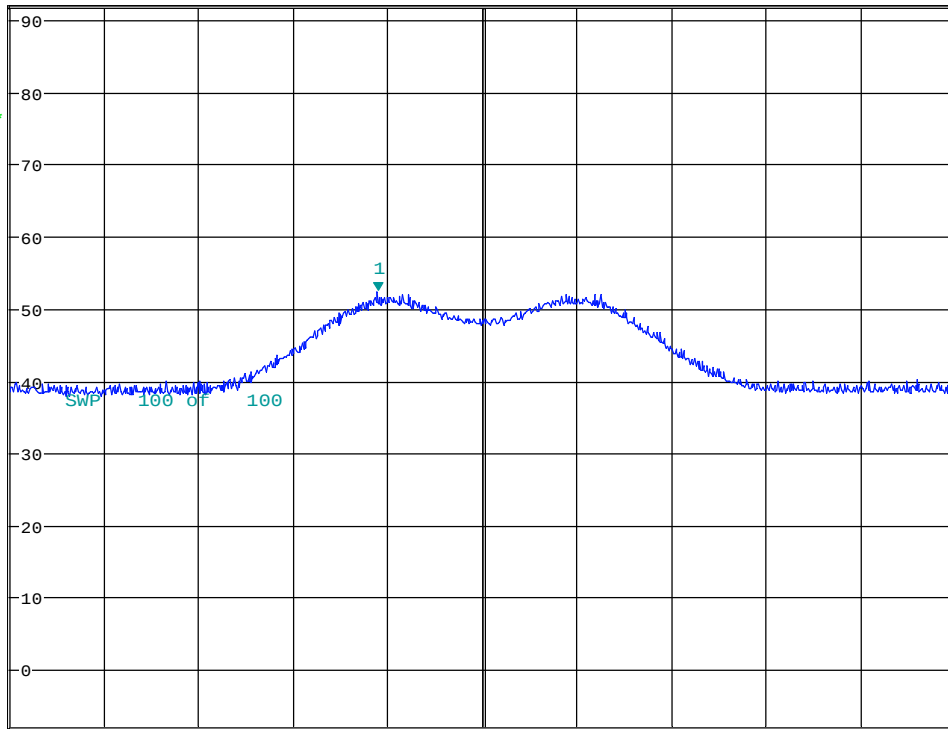
SWT 20 ms

Marker 1 [T1]

52.37 dBμV/m

4.878887500 GHz

1 RM
MAXH



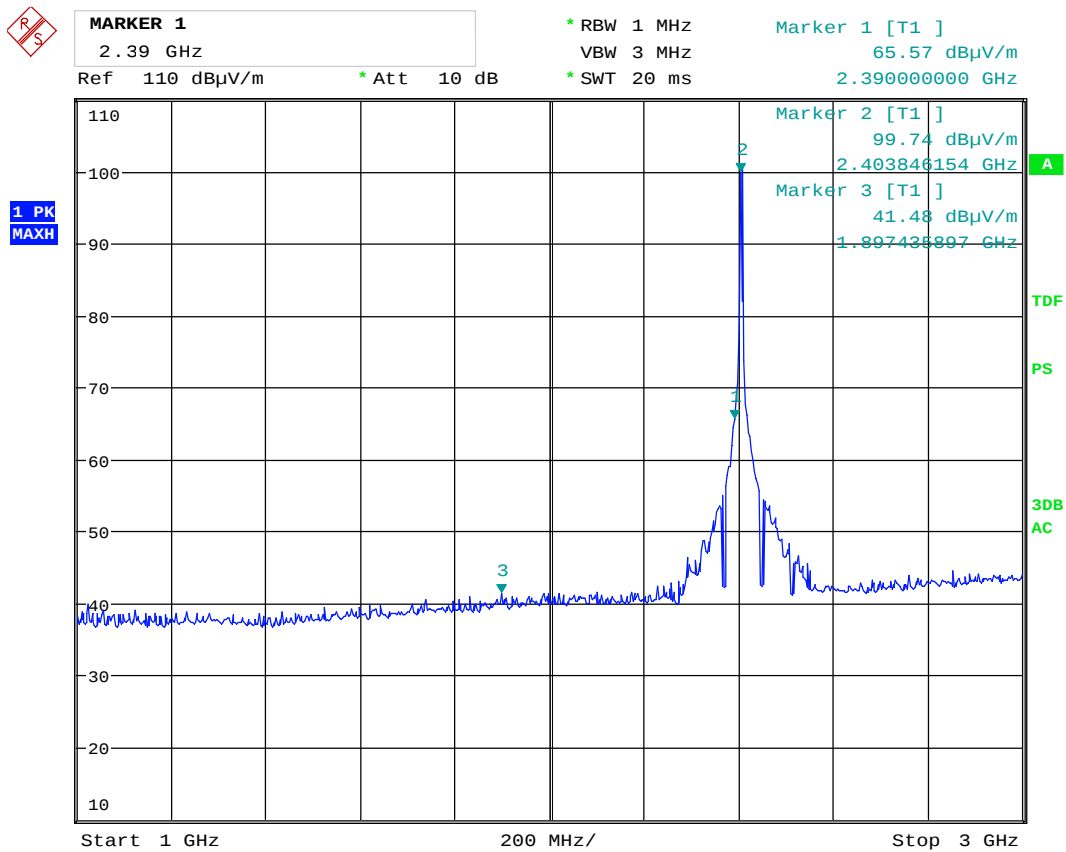
Center 4.88 GHz

1 MHz/

Span 10 MHz

Date: 10.MAR.2016 09:58:29

2nd Harm, 2440MHz , HP @3m , RMS detector



Date: 8.MAR.2016 11:02:08

Radiated Emissions, 2405MHz, 1 – 3 GHz, VP, @3m – Pre-scan with Peak detector

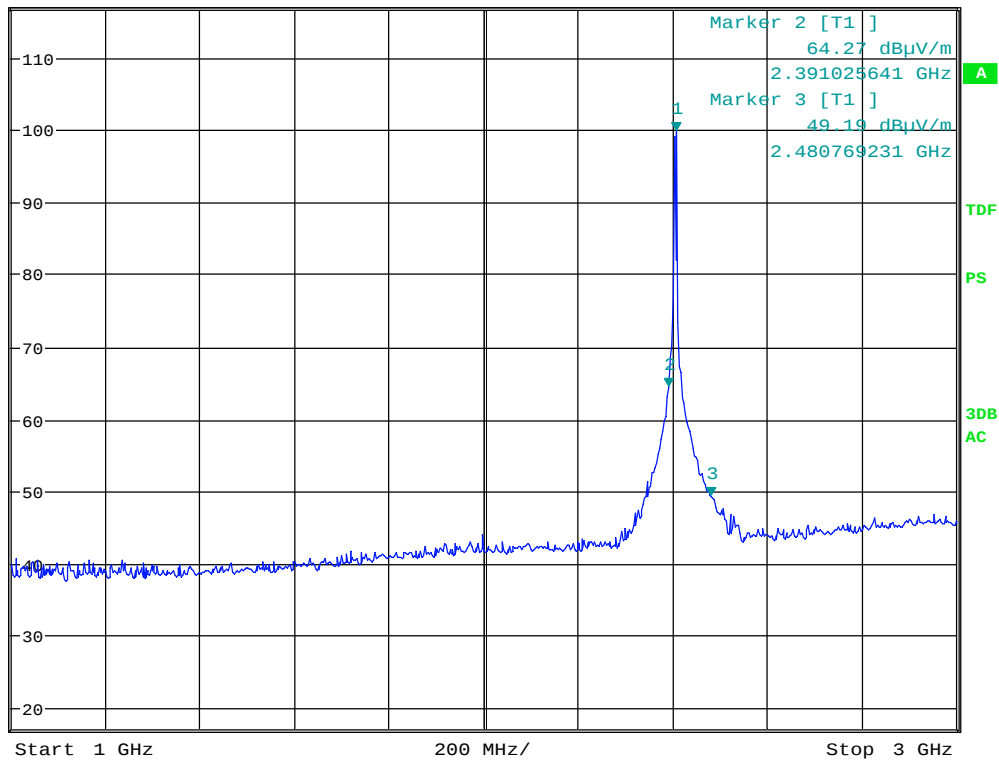


MARKER 1
2.405737179 GHz
Ref 117 dBμV/m * Att 10 dB

* RBW 1 MHz
VBW 3 MHz
SWT 5 ms

Marker 1 [T1]
99.97 dBμV/m
2.405737179 GHz

1 PK
MAXH



Date: 10.MAR.2016 09:17:58

Radiated Emissions, 2405 MHz, 1 – 3 GHz, HP, @3m – Pre-scan with Peak detector

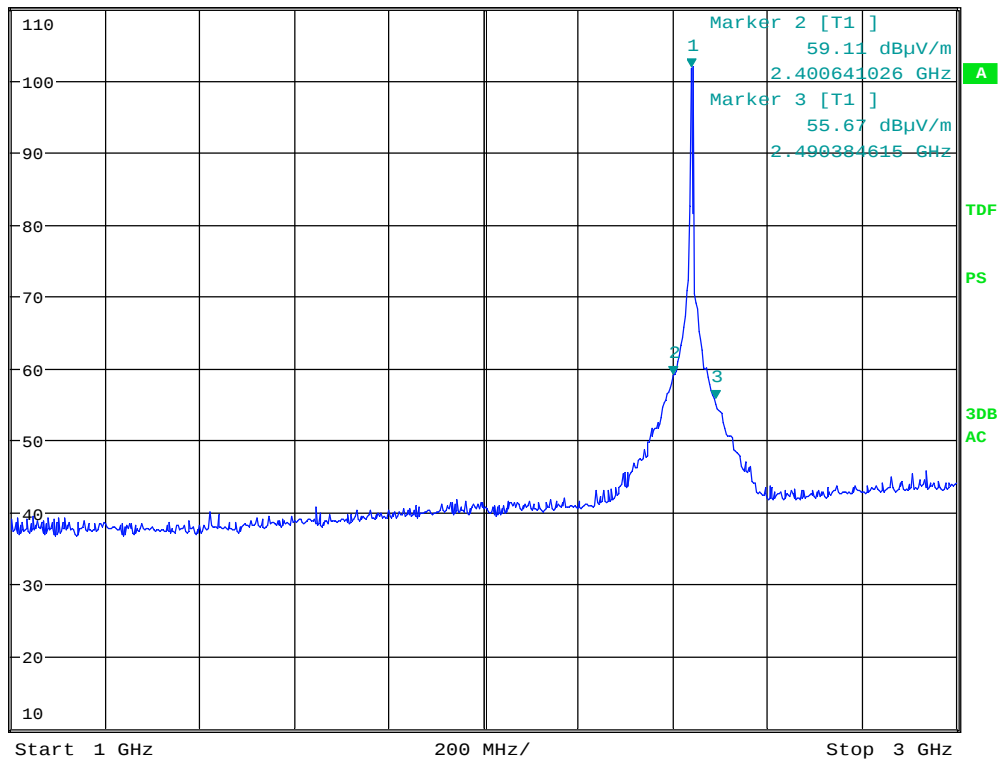


MARKER 1
2.439599359 GHz
Ref 110 dBμV/m * Att 10 dB

* RBW 1 MHz
VBW 3 MHz
* SWT 20 ms

Marker 1 [T1]
101.77 dBμV/m
2.439599359 GHz

1 PK
MAXH



Date: 8.MAR.2016 11:12:33

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

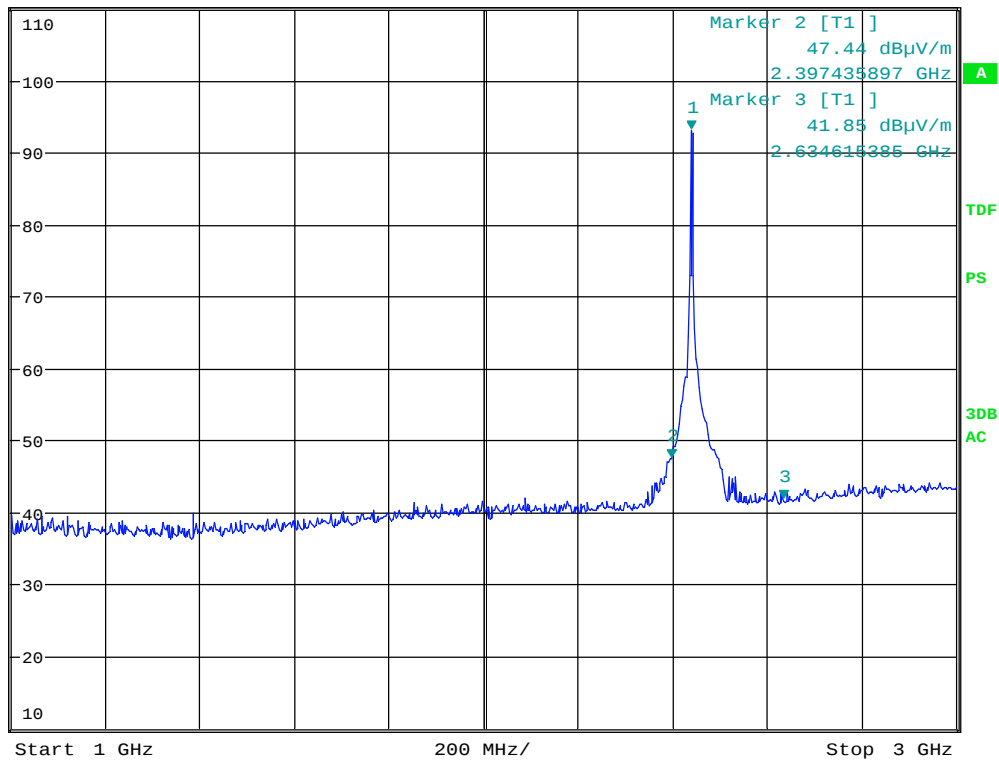


MARKER 1
2.439599359 GHz
Ref 110 dBμV/m * Att 10 dB

* RBW 1 MHz
VBW 3 MHz
* SWT 20 ms

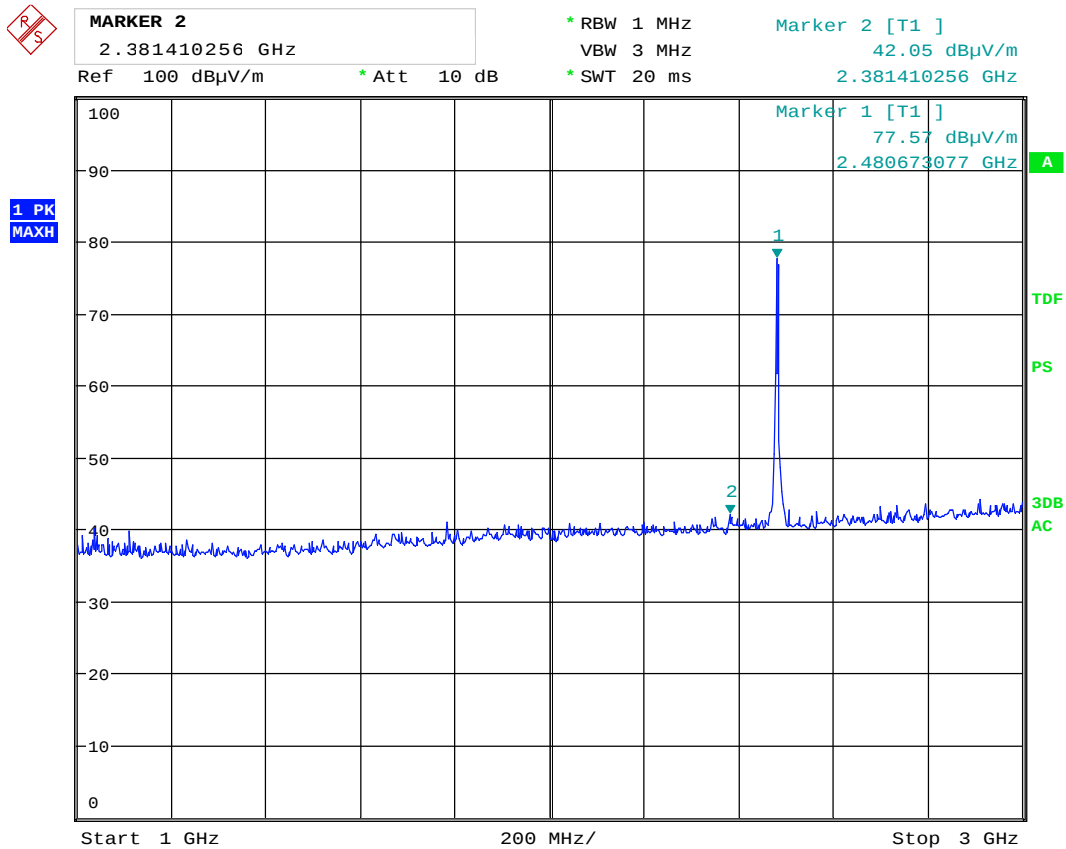
Marker 1 [T1]
93.13 dBμV/m
2.439599359 GHz

1 PK
MAXH



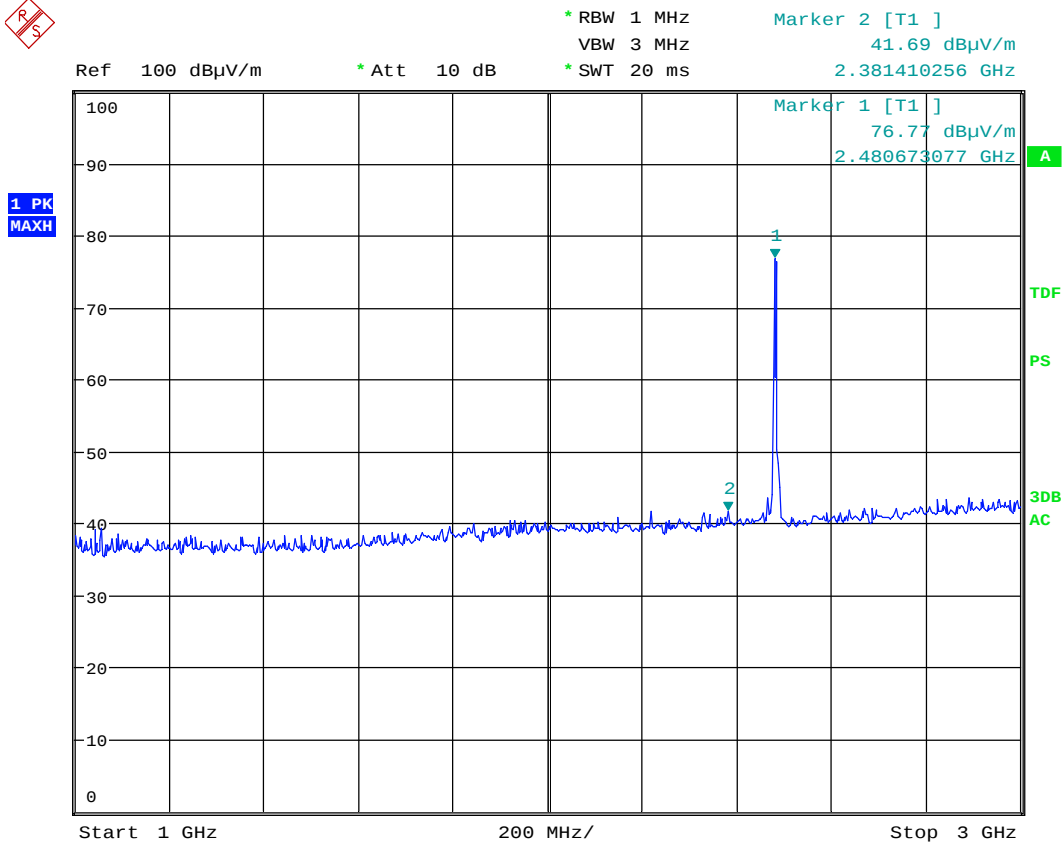
Date: 8.MAR.2016 11:10:01

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



Date: 8.MAR.2016 11:17:05

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



Date: 8.MAR.2016 11:18:27

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



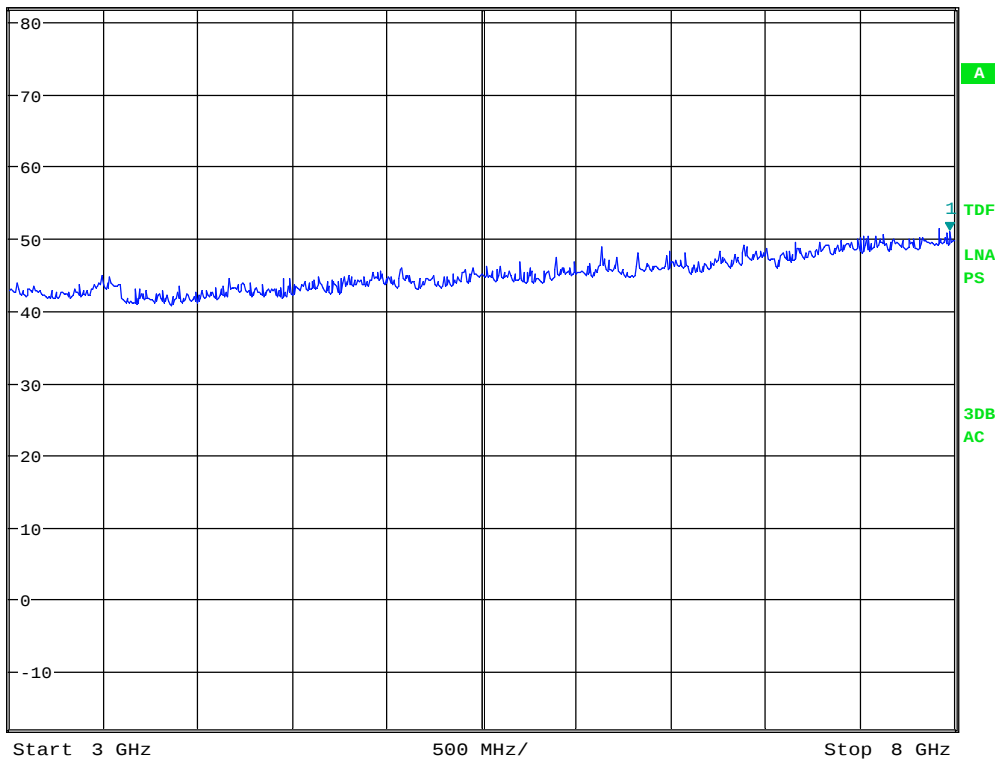
MARKER 1
7.975961538 GHz

* RBW 1 MHz
VBW 3 MHz
SWT 30 ms

Marker 1 [T1]
51.03 dBμV/m
7.975961538 GHz

Ref 82 dBμV/m * Att 10 dB

1 PK
MAXH



Date: 10.MAR.2016 10:05:38

Radiated Emissions ch. 2405 MHz, 3 – 8 GHz, VP, @3m – Pre-scan with Peak detector

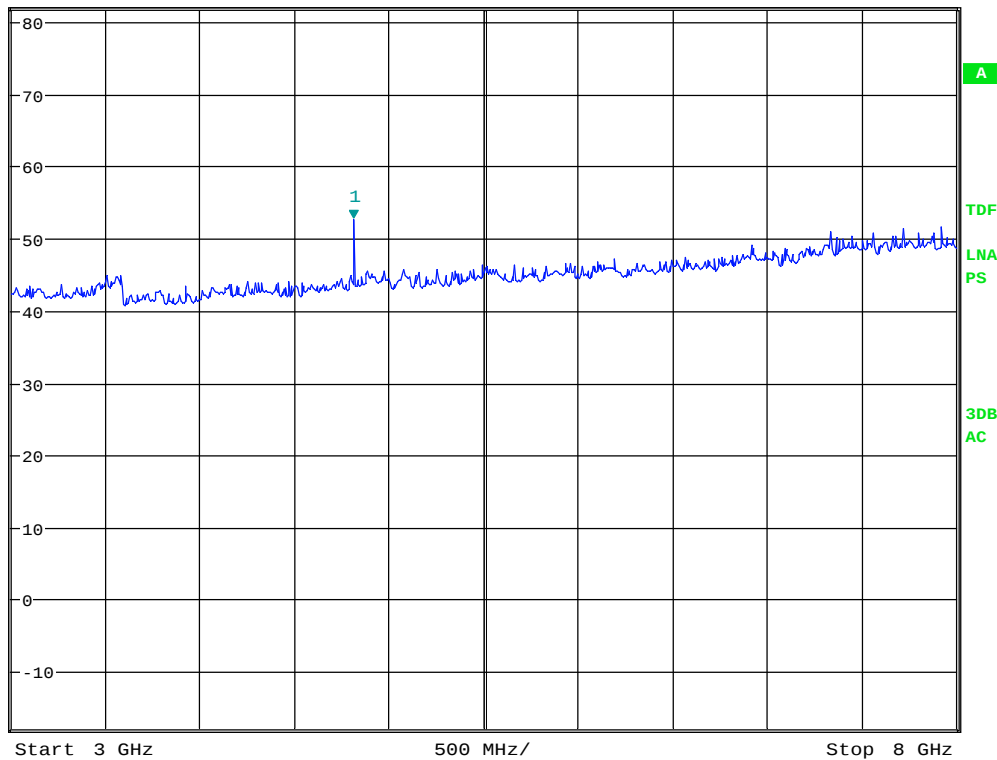


MARKER 1
4.810897436 GHz
Ref 82 dBμV/m * Att 10 dB

* RBW 1 MHz
VBW 3 MHz
SWT 30 ms

Marker 1 [T1]
52.75 dBμV/m
4.810897436 GHz

1 PK
MAXH



Date: 10.MAR.2016 10:03:16

Radiated Emissions ch. 2440 MHz, 3 – 8 GHz, HP, @3m – Pre-scan with Peak detector



MARKER 1

7.52724359 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

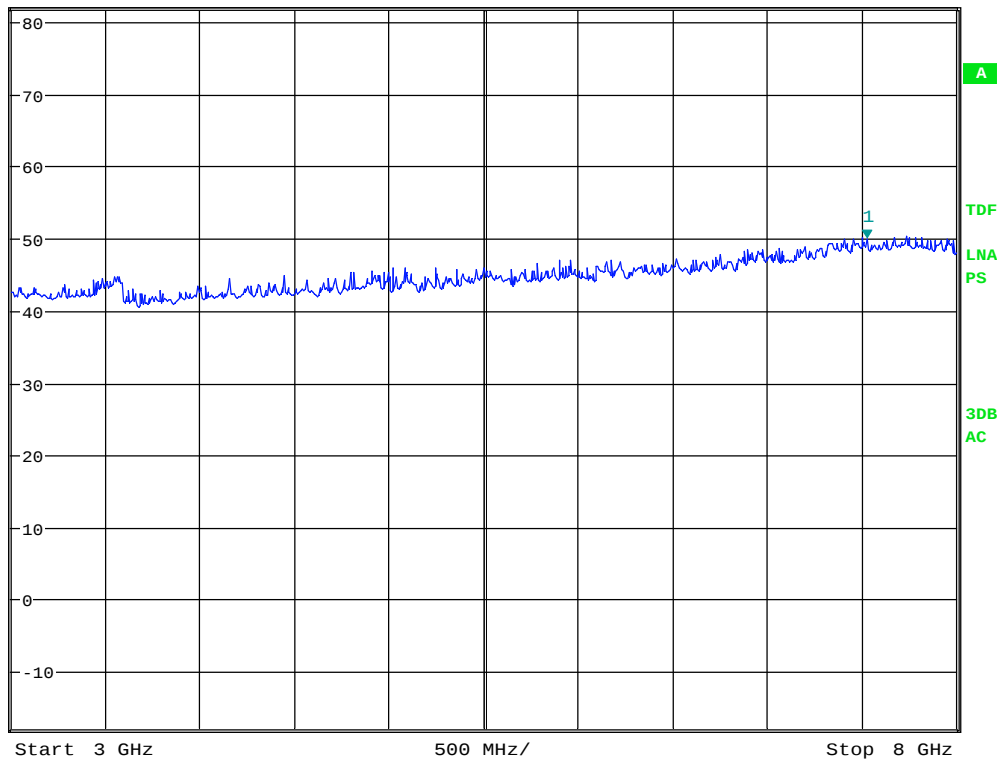
SWT 30 ms

Marker 1 [T1]

49.88 dBμV/m

7.527243590 GHz

1 PK
MAXH



Date: 10.MAR.2016 10:01:15

Radiated Emissions ch. 2480 MHz, 3 – 8 GHz, VP, @3m – Pre-scan with Peak detector



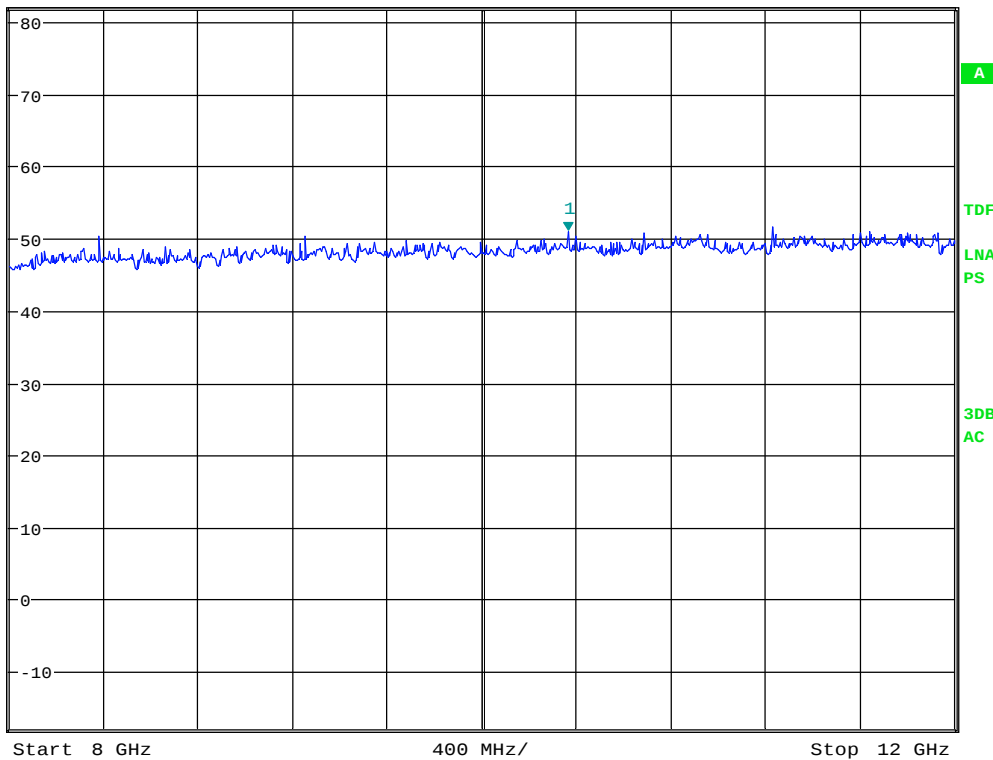
MARKER 1
10.36538462 GHz

* RBW 1 MHz
VBW 3 MHz
SWT 25 ms

Marker 1 [T1]
51.00 dBμV/m
10.365384615 GHz

Ref 82 dBμV/m * Att 10 dB

1 PK
MAXH



Date: 10.MAR.2016 10:23:45

Radiated Emissions ch. 2480 MHz, 3 – 8 GHz, HP, @3m – Pre-scan with Peak detector

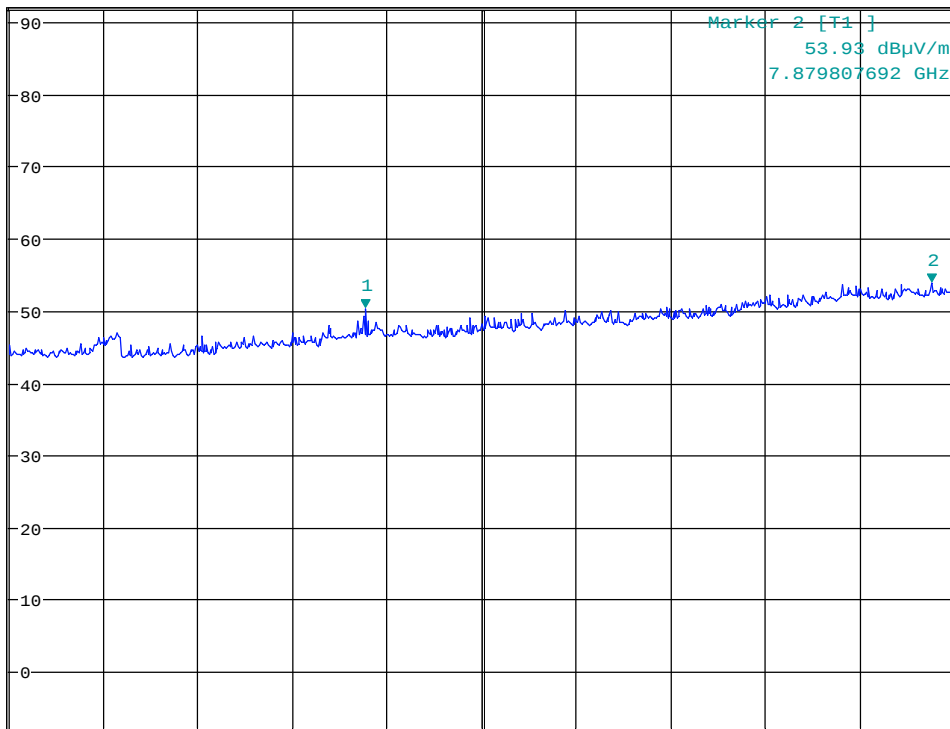


MARKER 1
4.883012821 GHz
Ref 92 dBμV/m * Att 20 dB

* RBW 1 MHz
VBW 3 MHz
SWT 30 ms

Marker 1 [T1]
50.30 dBμV/m
4.883012821 GHz

1 PK
MAXH



A

TDF

LNA

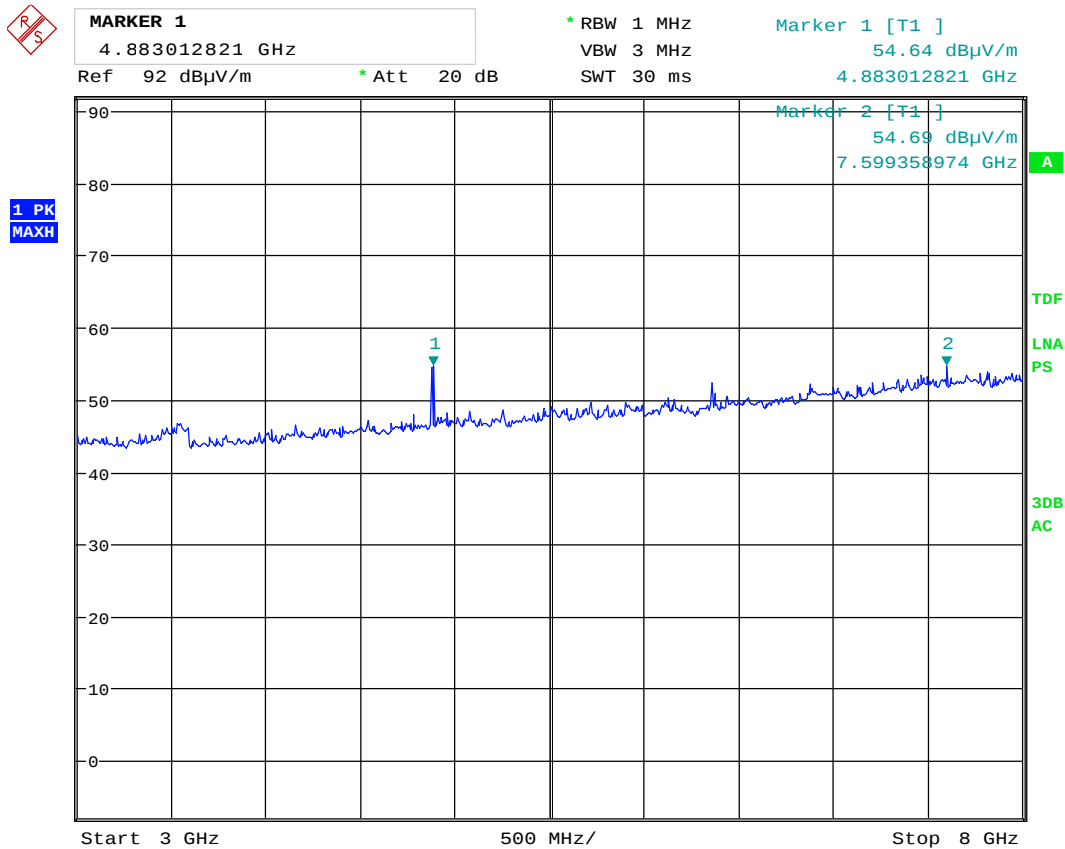
PS

3DB

AC

Date: 10.MAR.2016 09:41:12

Radiated Emissions ch. 2440 MHz, 3 – 8 GHz, VP, @3m – Pre-scan with Peak detector



Date: 10.MAR.2016 09:42:34

Radiated Emissions ch. 2440 MHz, 3 – 8 GHz, HP, @3m – Pre-scan with Peak detector



MARKER 1

11.91666667 GHz

Ref 82 dB μ V/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

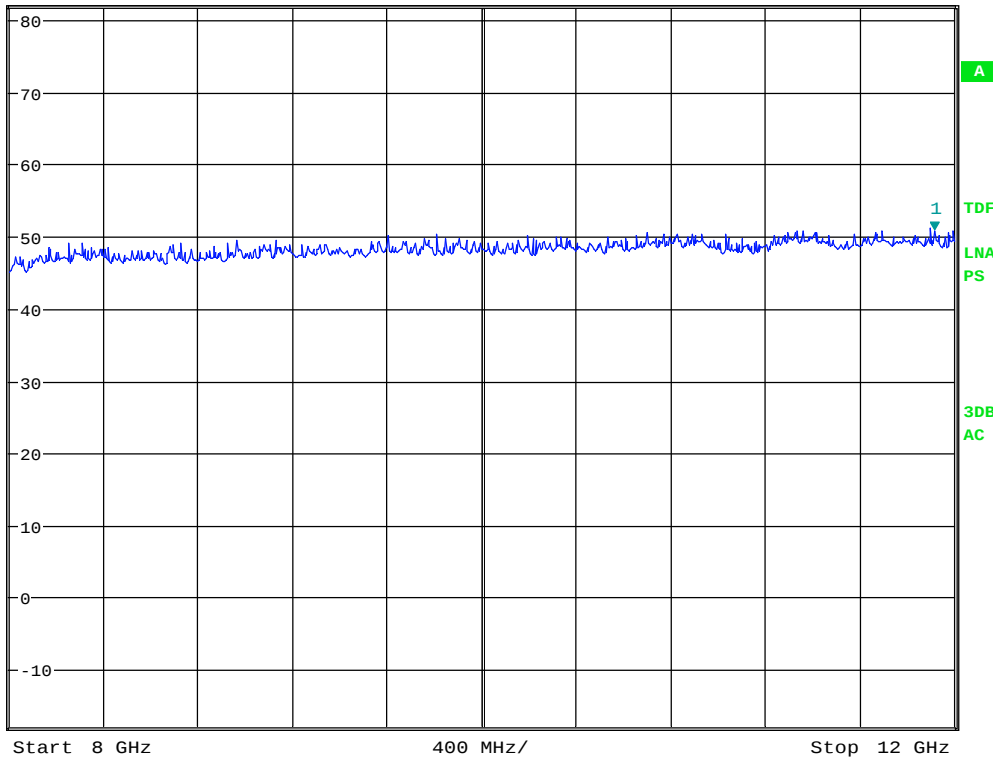
SWT 25 ms

Marker 1 [T1]

50.71 dB μ V/m

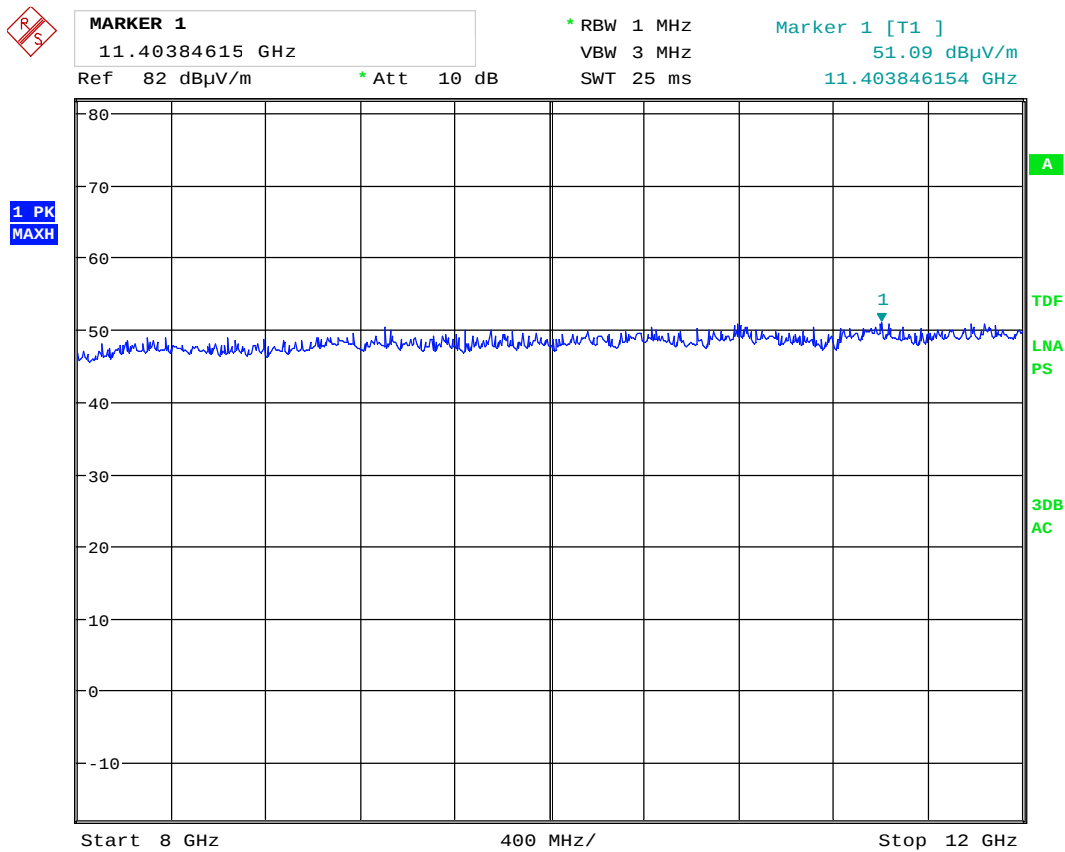
11.91666667 GHz

1 PK
MAXH



Date: 10.MAR.2016 10:24:58

**Radiated Emissions ch. 2440 MHz, 8 – 12 GHz, VP, @1m – Pre-scan with Peak detector ,
Distance Correction factor of -9.5 dB is not included in the plot**



Date: 10.MAR.2016 10:25:22

**Radiated Emissions ch. 2440 MHz, 8 – 12 GHz, HP, @1m – Pre-scan with Peak detector,
Distance Correction factor of -9.5 dB is not included in the plot**



MARKER 1

11.91666667 GHz

Ref 82 dBμV/m

* Att 10 dB

* RBW 1 MHz

VBW 3 MHz

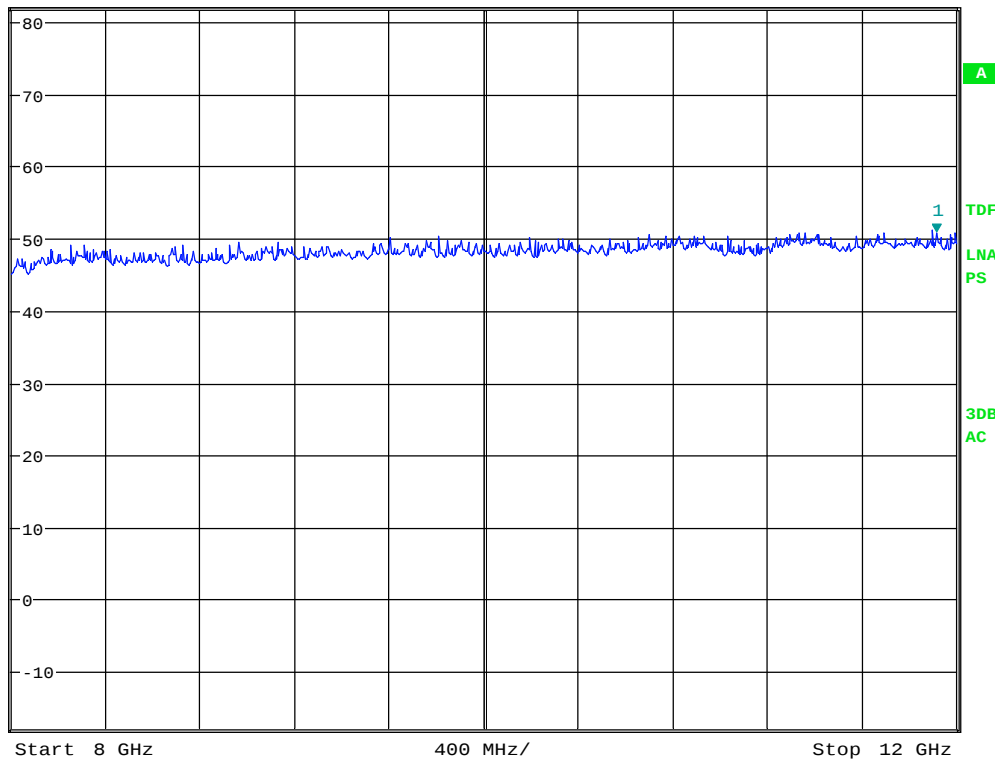
SWT 25 ms

Marker 1 [T1]

50.71 dBμV/m

11.91666667 GHz

1 PK
MAXH



Date: 10.MAR.2016 10:24:58

**Radiated Emissions ch. 2440 MHz, 12 – 18 GHz, VP, @1m – Pre-scan with Peak detector,
Distance Correction factor of -9.5 dB is not included in the plot**



MARKER 1

17.67307692 GHz

Ref 77 dB μ V/m

* Att 5 dB

* RBW 1 MHz

VBW 3 MHz

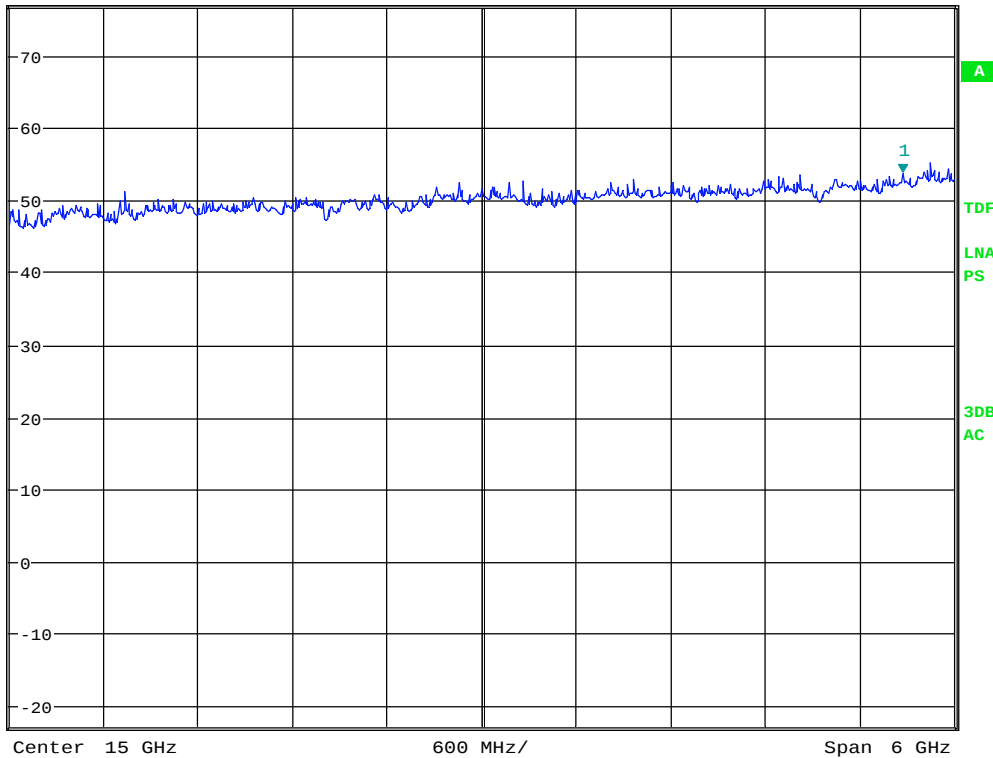
SWT 35 ms

Marker 1 [T1]

53.74 dB μ V/m

17.673076923 GHz

1 PK
MAXH



Date: 10.MAR.2016 10:28:07

**Radiated Emissions ch. 2440 MHz, 12 – 18 GHz, HP, @1m – Pre-scan with Peak detector,
Distance Correction factor of -9.5dB is not included in the plot**



MARKER 1

21.82532051 GHz

Ref 70 dBμV/m

* Att 0 dB

* RBW 1 MHz

VBW 3 MHz

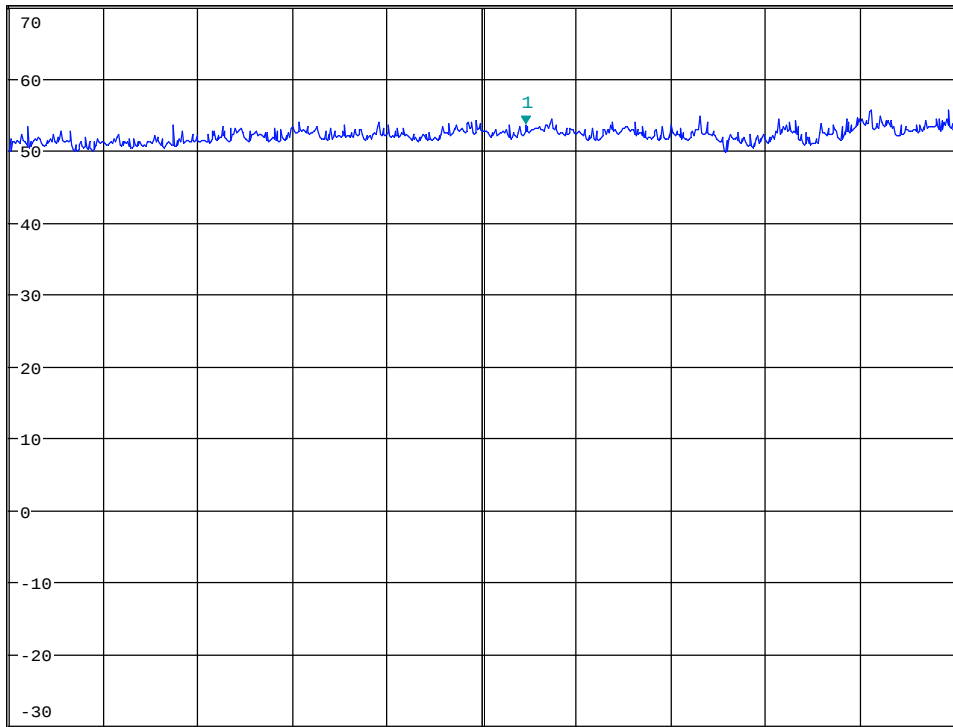
SWT 45 ms

Marker 1 [T1]

53.60 dBμV/m

21.825320513 GHz

1 PK
MAXH



Start 18 GHz

700 MHz/

Stop 25 GHz

A

TDF

LNA

PS

3DB

AC

Date: 10.MAR.2016 12:09:27

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

3.6 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Test Performed By: G.Suhanthakumar

Date of Test: 2016.02.24 – 2016.03.09

Test Results: Passed

Measured and Calculated Data:

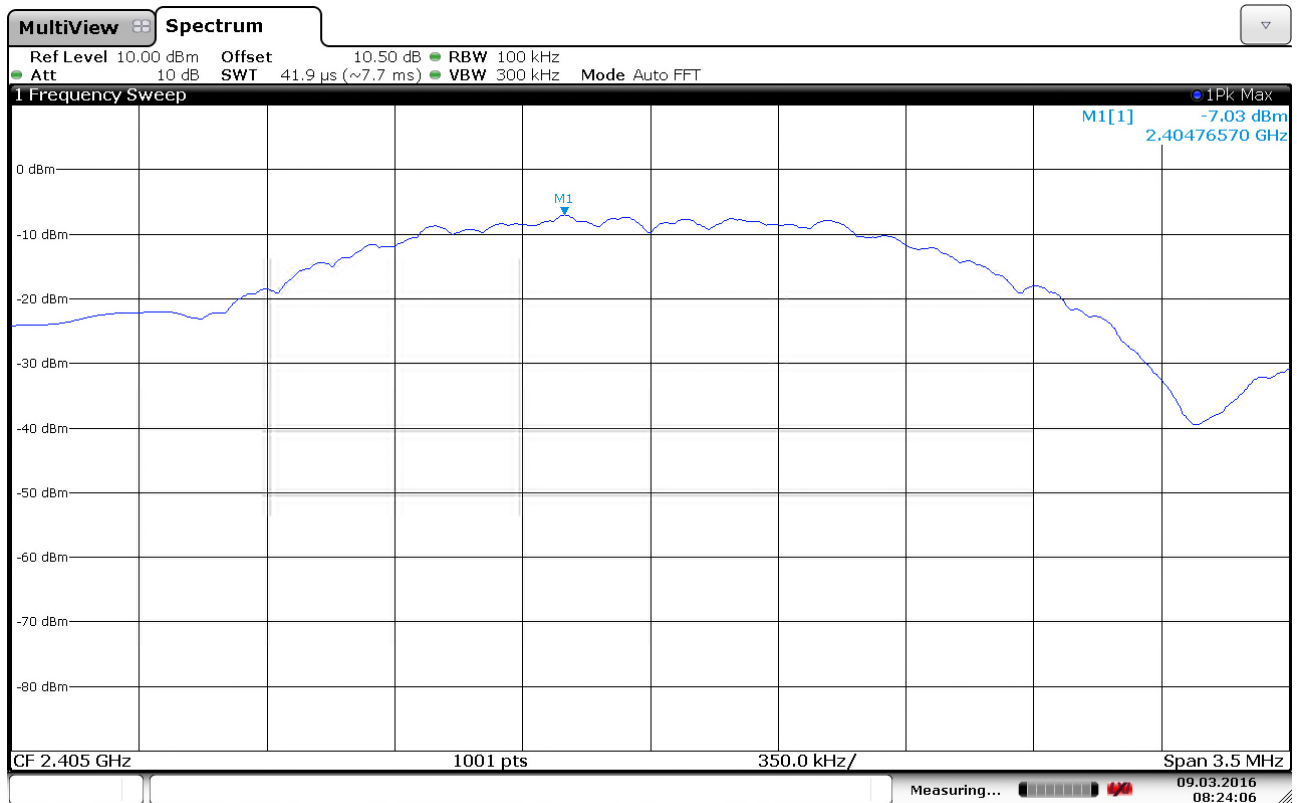
	calculated peak PSD dBm
Power Spectral Density @2405 MHz	-22.23
Power Spectral Density @2440 MHz	-18.91
Power Spectral Density @2480 MHz	-43.00

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

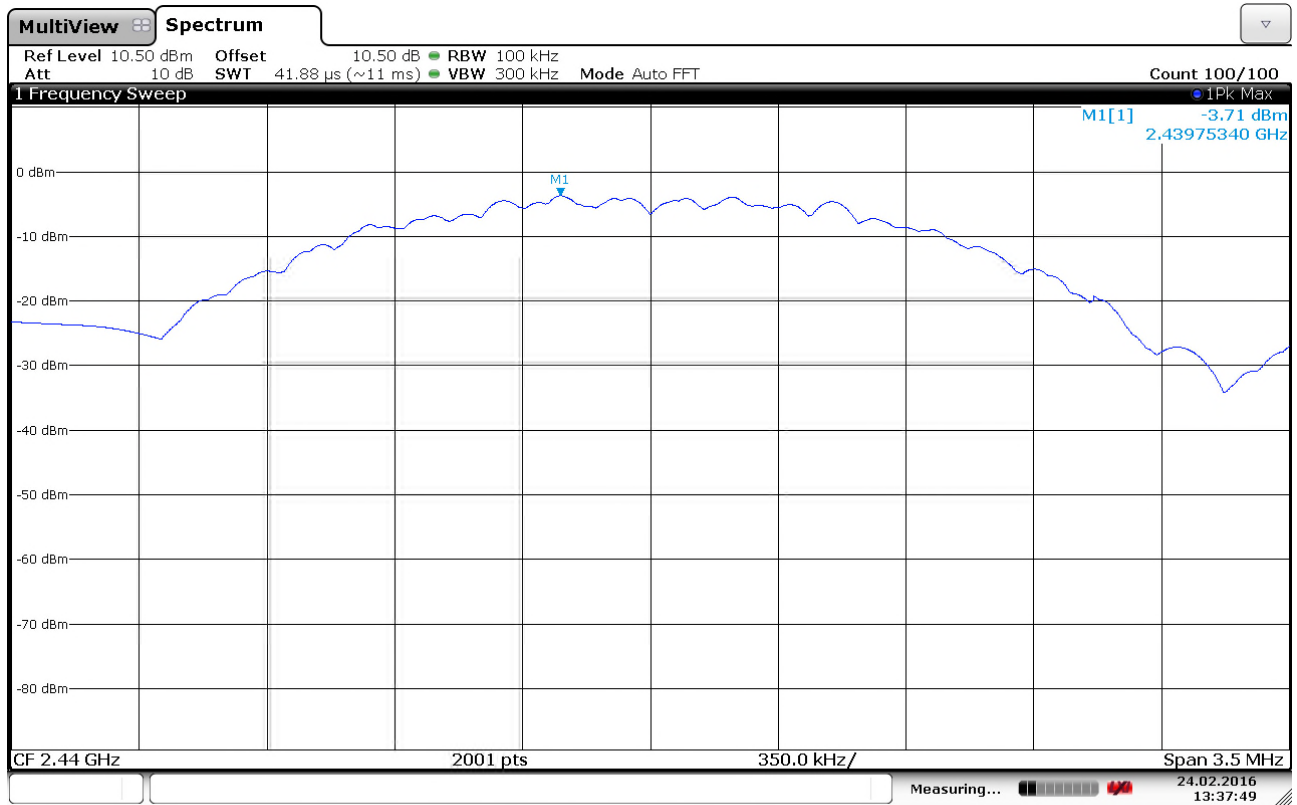
Requirements:

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

No requirements for Frequency Hopping Systems.

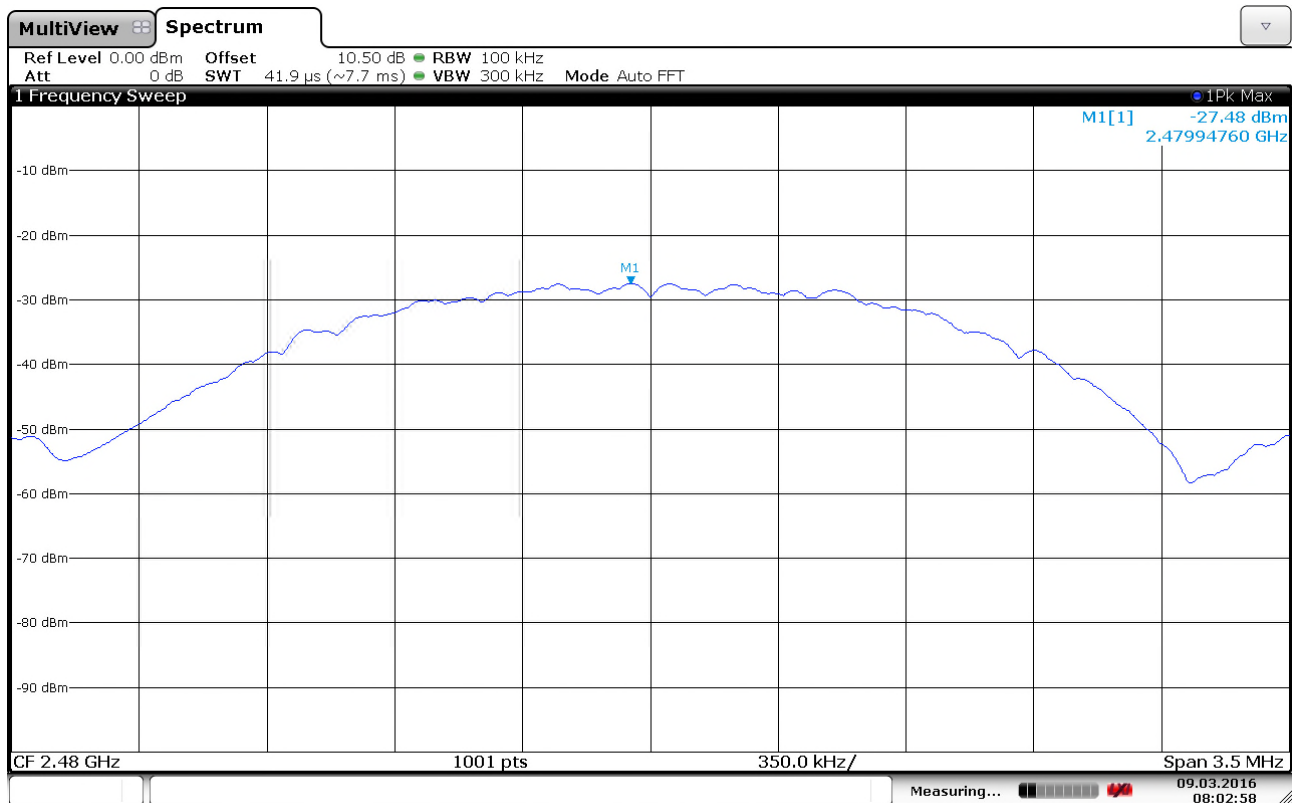


PSD Measurement - 2405MHz



Date: 24.FEB.2016 13:37:49

PSD Measurement – 2440MHz



PSD Measurement - 2480MHz

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

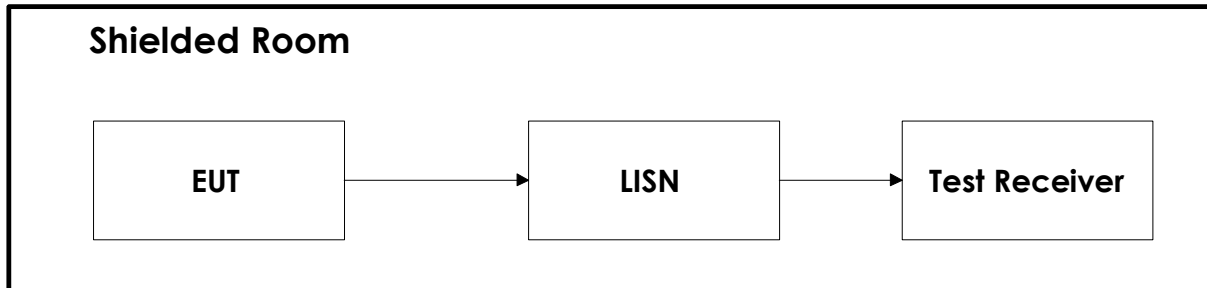
5 LIST OF TEST EQUIPMENT

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.

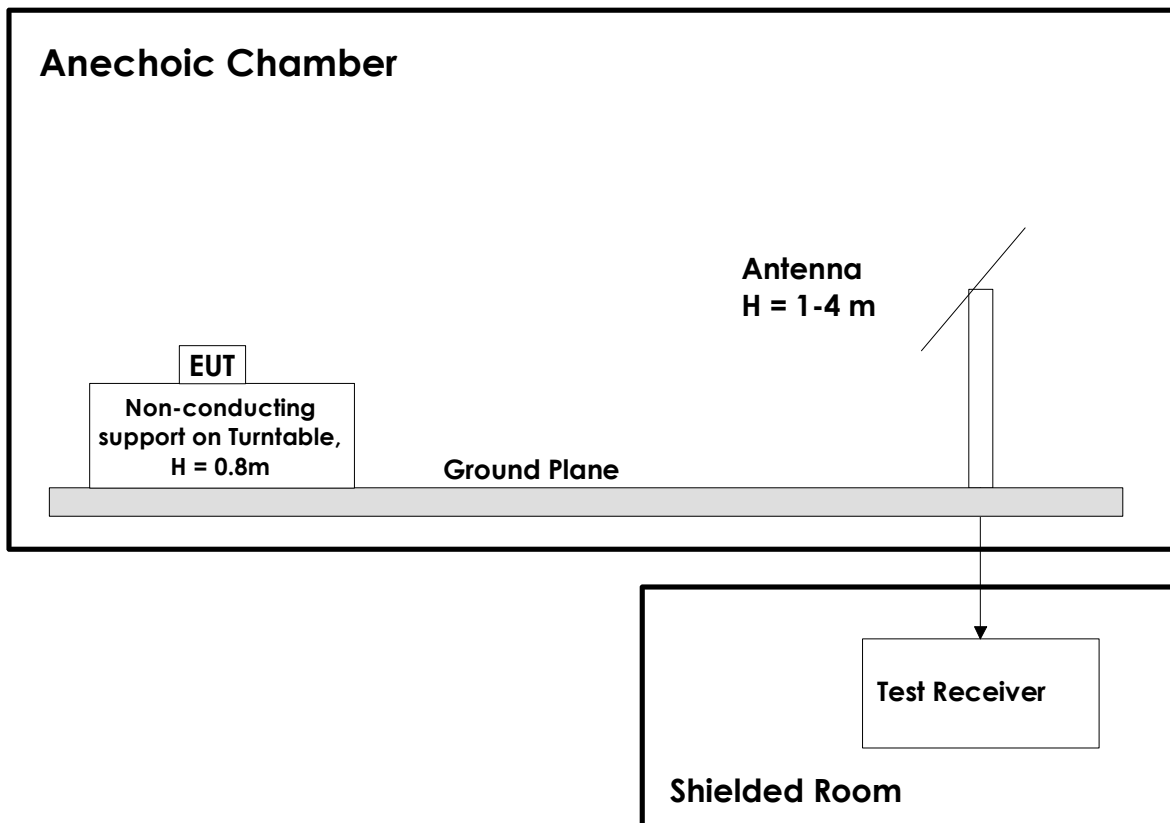
No.	Instrument/ ancillary	Type of instrument/ ancillary	Manufacturer	Ref. no.	Cal. Date	Cal. Due
1.	ESU40	EMI Receiver	Rohde & Schwarz	LR1639	2015.11	2016.11
2.	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2015.11	2016.11
3.	HFH2-Z2	Active Loop antenna	Rohde & Schwarz	LR1660	2014.10	2017.10
4.	3115	Antenna horn	EMCO	LR 1330	2010.08	2017.08
5.	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2016.12
6.	HL223	Log Periodic antenna	Rohde & Schwarz	LR 1261	2013.12	2016.12
7.	643	Antenna Horn	Narda	LR 093	10.2009	10.2019
8.	PM7320X	Antenna Horn	Sivers Lab	LR 102	10.2009	10.2019
9.	DBF-520-20	Antenna Horn	Systron Donner	LR 100	10.2009	10.2019
10	638	Antenna Horn	Narda	LR 1480	10.2009	10.2019
11	4768-10	Attenuator	Narda	LR 1356	Cal b4 use	
12	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
13	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2015.09	2016.09
14	HP 10855A	Pre-amplifier	Hewlett Packard	LR 1445	2015.10	2016.10
15	Model 87 V	Multimeter	Fluke	LR 1597	2015.10	2016.10
16	6812B	Power source	Agilent	LR 1515	2015.12.02	2017.12.02
17	D001	DC power supply	Farnell	LT 5150	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	2016.06.30	First test report	gns
2	2016.06.30	Spurious and intermodulations product update	gns