




Test Report

Product	Bluetooth Low Energy Transceiver		
Name and address of the applicant	Teptron AB Box 1009, SE-43213 Varberg Sweden		
Name and address of the manufacturer	Same as above		
Model	M1508		
Rating	4.8V DC (4x AAA NiMH cells)		
Trademark	Move		
Serial number	/		
Additional information	Bluetooth Low Energy		
Tested according to	FCC Part 15.247 Digital Transmission Systems Industry Canada RSS-247, Issue 1 Low Power Licence-Exempt Radiocommunications Devices		
Order number	308158		
Tested in period	2016.04.28 to 2016.04.29		
Issue date	2016.07.05		
Name and address of the testing laboratory	<div style="display: flex; align-items: center;">  <div> FCC No: 994405 IC OATS: 2040D-1 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50 </div> </div> <div style="margin-top: 10px;"> Instituttveien 6 Kjeller, Norway </div>		
<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Prepared by [Frode Sveinsen] </div> <div style="text-align: center;">  Approved by [G. Suhanthakumar] </div> </div>			
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1 INFORMATION

1.1 Test Item

Name :	Move
FCC ID :	2AICLM1508
Industry Canada ID :	21335-M1508
Model/version :	M1508
Serial number :	/
Hardware identity and/or version:	P4
Software identity and/or version :	1.3
Frequency Range :	2402 – 2480 MHz
Number of Channels :	40
Operating Modes :	Frequency Hopping
Type of Modulation :	GFSK
User Frequency Adjustment :	None
Rated Output Power :	0.0087
Type of Power Supply :	Secondary Batteries (4xAAA NiMH cells)
Antenna Connector :	None
Antenna Diversity Supported :	No
Desktop Charger :	None

Description of Test Item

The EUT is a Bluetooth Low Energy Transceiver for controlling an electrical motor.

1.2 Test Environment

Temperature: 20 - 24 °C

Relative humidity: 20 - 50 %

Normal test voltage: 5.0 V DC

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen / Jan G. Eriksen

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

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)	N/A ¹
Number of Operating Frequencies	15.31(m)	5.1 (6) (RSS-247)	N/A ²
Antenna Requirement	15.203	8.3 (RSS-GEN)	Complies
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 ²
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3) (RSS-247)	N/A ²
Time of Occupancy	15.247(a)(1)(iii)	5.1 (5) (RSS-247)	N/A ²
Occupied Bandwidth	N/A	6.6 (RSS-GEN)	Complies
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
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 EUT is normally battery operated

² Applies only for Frequency Hopping equipment

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: Jan G. Eriksen

Date of Test: 29-April-2016

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

Test Results: Complies.

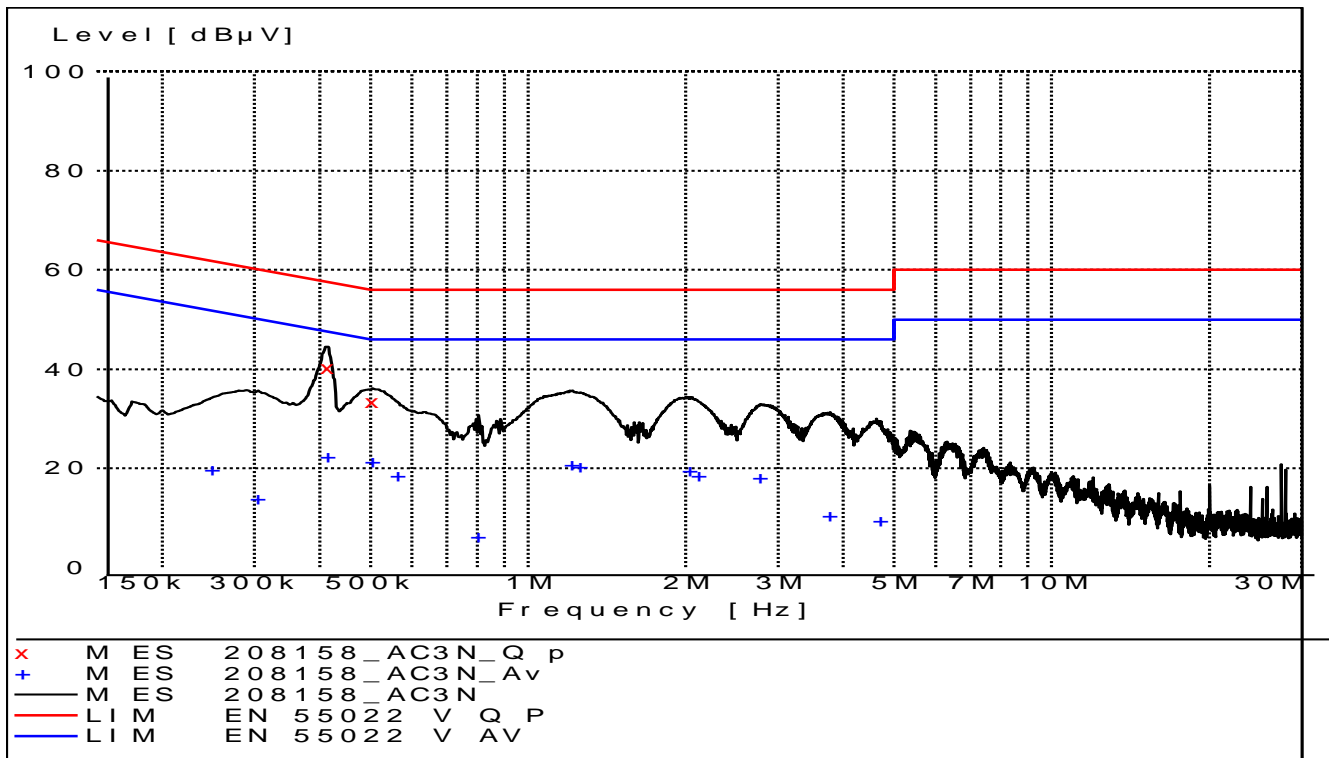
Measurement Data: See attached graph, (Peak detector).

Highest measured value (L1 and N):

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.415000	40.30	10.30	57.50	17.20	QP	N	Pass
0.505000	33.50	10.20	56.00	22.50	QP	L1	Pass
0.250000	19.70	10.60	51.80	32.10	AV	L1	Pass
0.305000	13.90	10.50	50.10	36.20	AV	N	Pass
0.415000	22.30	10.30	47.50	25.20	AV	N	Pass
0.505000	21.30	10.20	46.00	24.70	AV	L1	Pass
0.565000	18.50	10.20	46.00	27.50	AV	L1	Pass
0.805000	6.30	10.20	46.00	39.70	AV	L1	Pass
1.215000	20.70	10.40	46.00	25.30	AV	L1	Pass
1.260000	20.30	10.40	46.00	25.70	AV	L1	Pass
2.040000	19.50	10.40	46.00	26.50	AV	L1	Pass
2.125000	18.60	10.40	46.00	27.40	AV	L1	Pass
2.785000	18.20	10.40	46.00	27.80	AV	L1	Pass
3.770000	10.60	10.40	46.00	35.40	AV	N	Pass
4.715000	9.40	10.50	46.00	36.60	AV	N	Pass

120 V 60 Hz

Tested with External USB Adaptor Trust Model 19160.



120 V 60 Hz

Tested with External USB Adaptor Trust Model 19160.

3.2 Occupied Bandwidth

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

Test Results: Complies

Measurement Data:

99% BW Measured on Centre Channel (2440 MHz):	1.20 MHz
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See attached plots.

Requirements:

No requirement for 99% BW, reported for information only.

3.3 Minimum 6 dB Bandwidth

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

Test Results: **Complies**

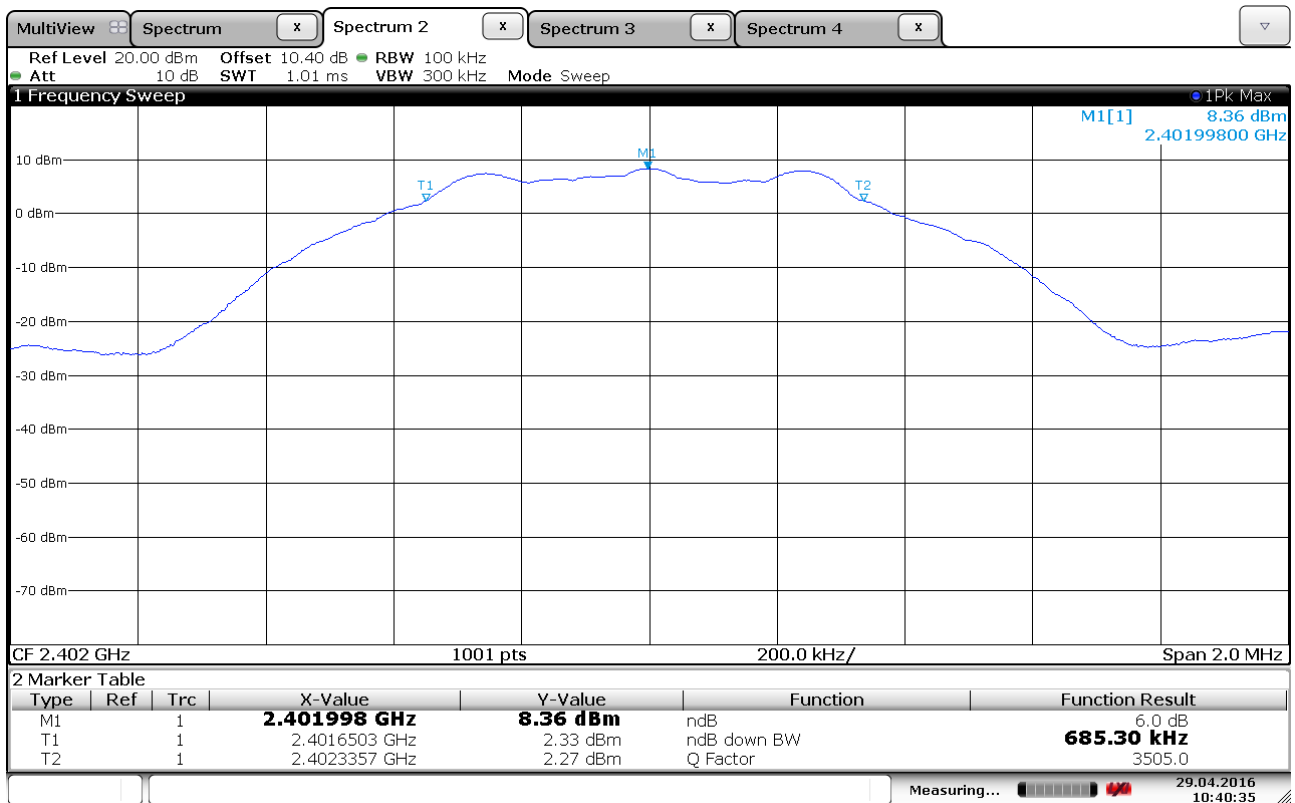
Measurement Data:

Measured 6 dB Bandwidth (kHz)		
2402 MHz, Ch 00	2440 MHz, Ch 19	2480 MHz, Ch 39
685	681	691

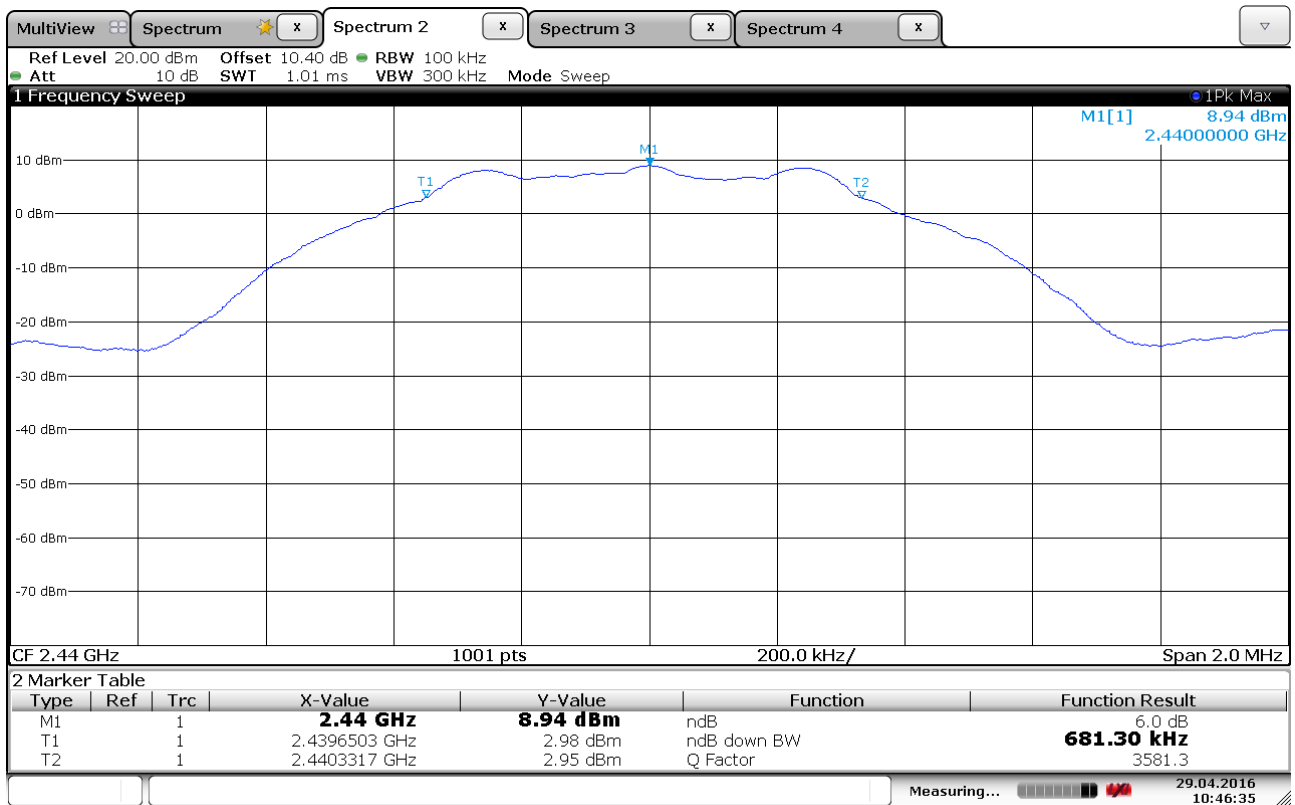
Requirements:

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

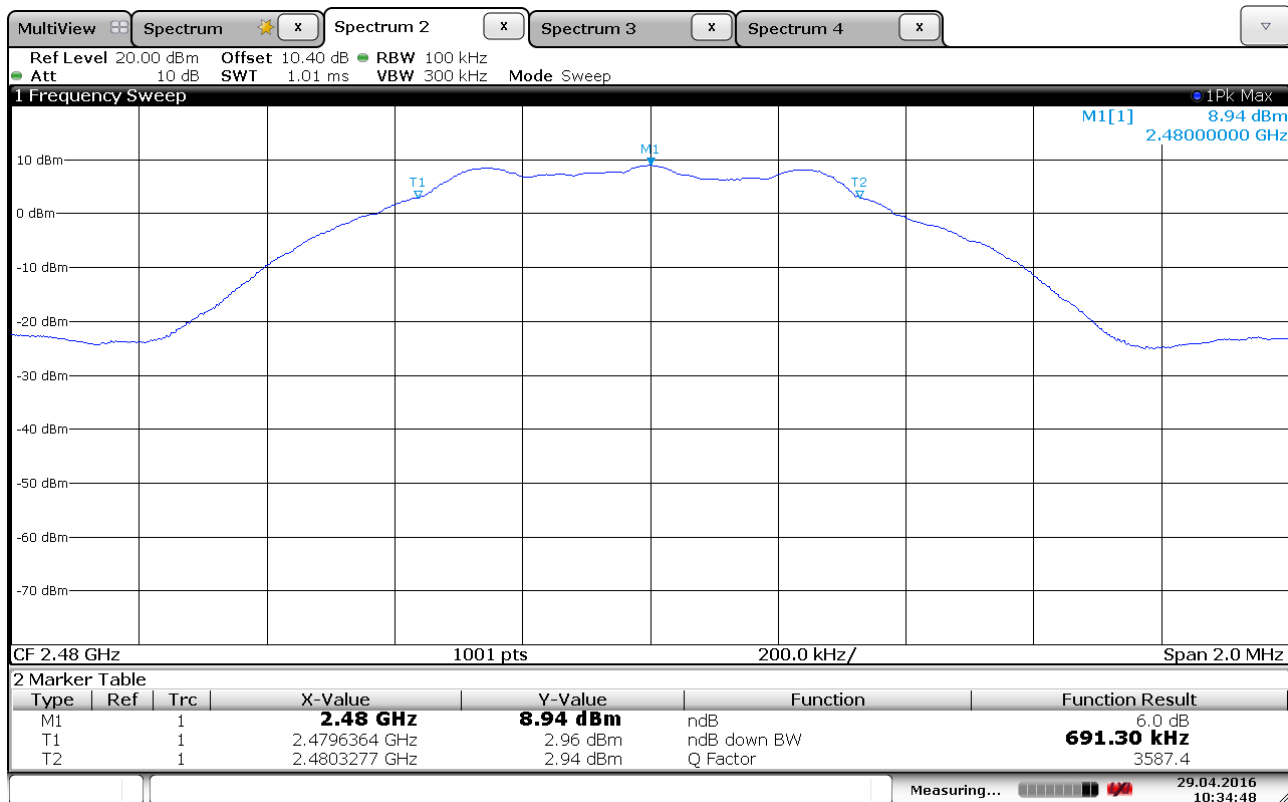
No requirements for Frequency Hopping Systems.



6 dB Bandwidth, 2402 MHz



6 dB Bandwidth, 2440 MHz



6 dB Bandwidth, 2480 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)	8.9	9.3	9.4
Conducted Power (mW)	7.71	8.43	8.65
Field Strength (dBµV/m)	103.2	102.2	101.1
EIRP, Calculated (mW)	6.24	5.00	3.87
Antenna gain (dBi)	-0.9	-2.3	-3.5

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

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

See attached graph.

Detachable antenna?

☐ Yes

☒ No

If detachable, is the antenna connector non-standard?

☐ Yes

☐ No

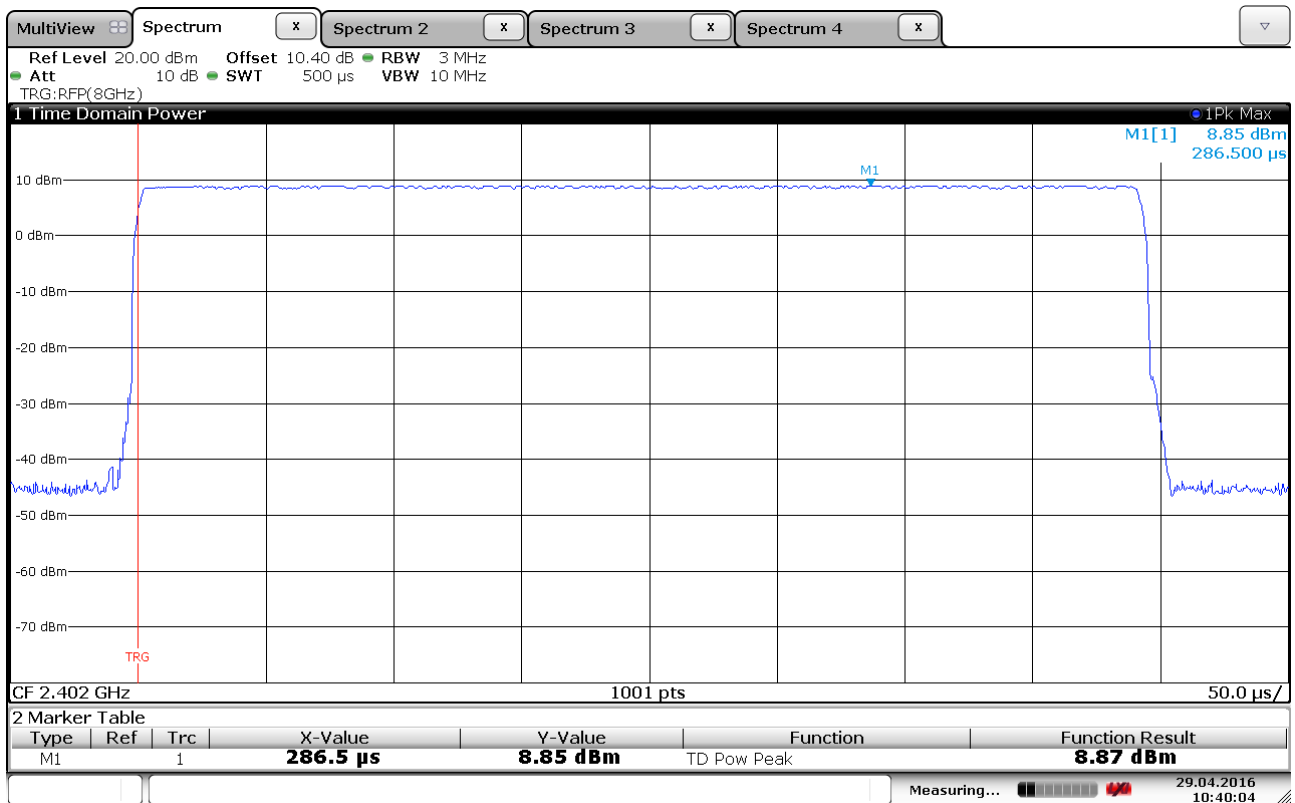
Type of antenna connector: N/A

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.



Conducted Output Power, 2402 MHz



MARKER 1

2.401967949 GHz

*RBW 3 MHz

VBW 10 MHz

SWT 2.5 ms

Marker 1 [T1]

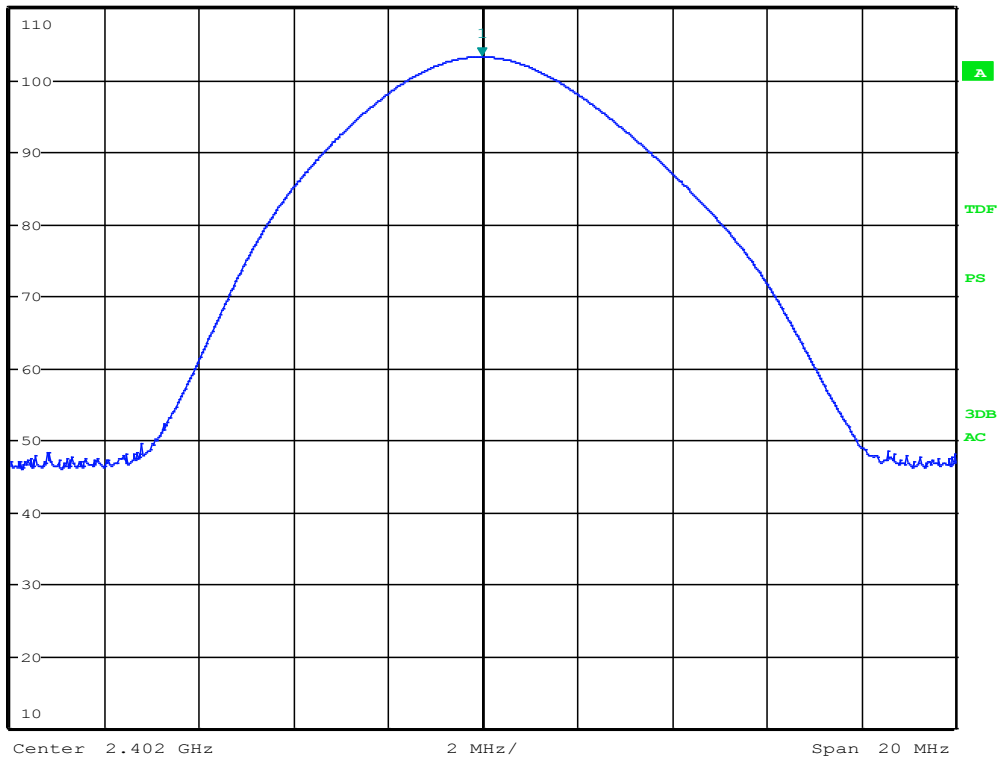
103.18 dBμV/m

2.401967949 GHz

Ref 110 dBμV/m

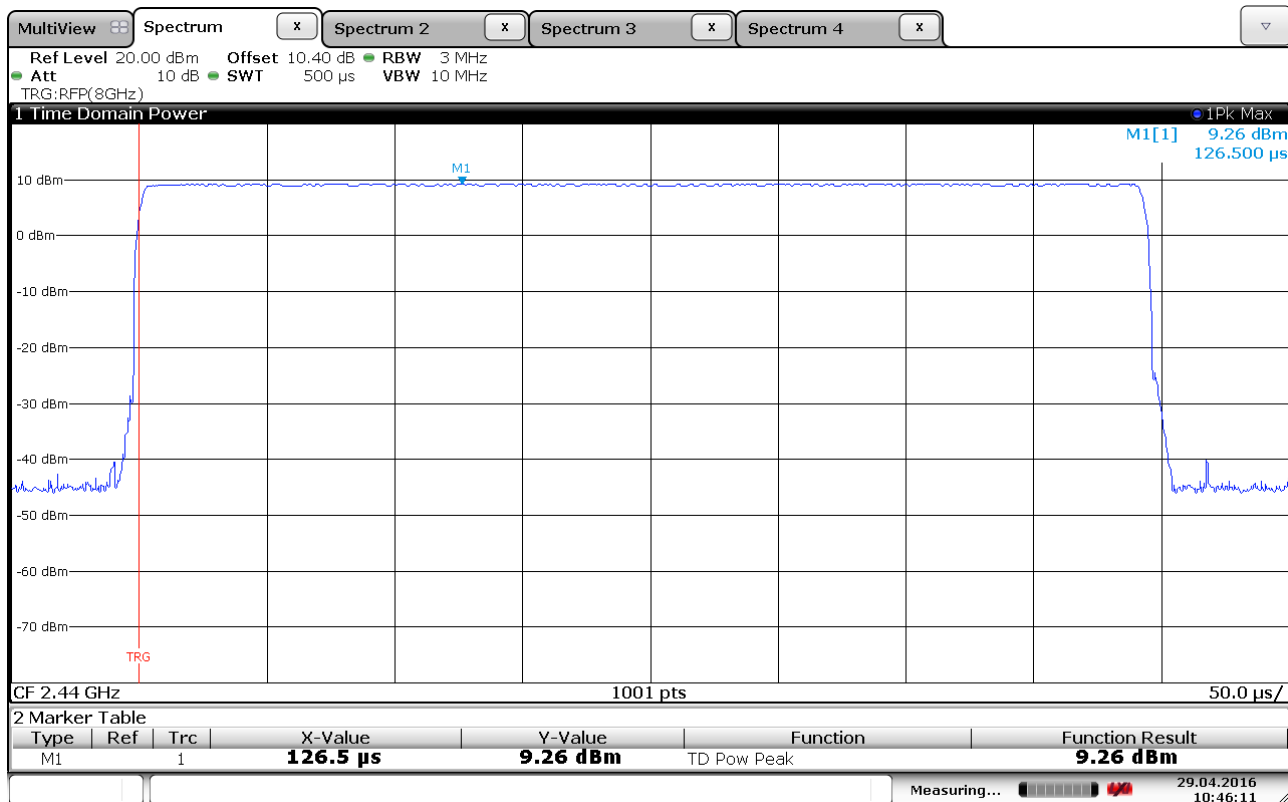
*Att 10 dB

1 PR
MAXH

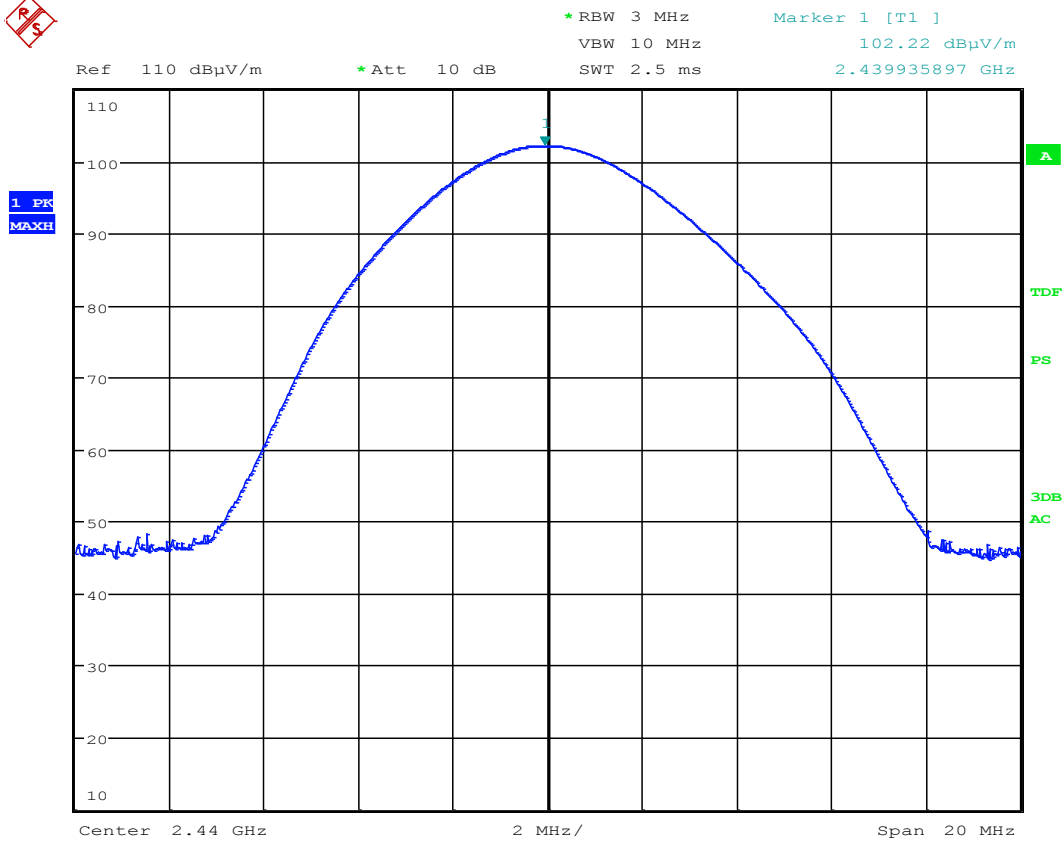


Date: 28.APR.2016 10:01:15

Radiated Field Strength, 2402 MHz (EUT H1, HP)

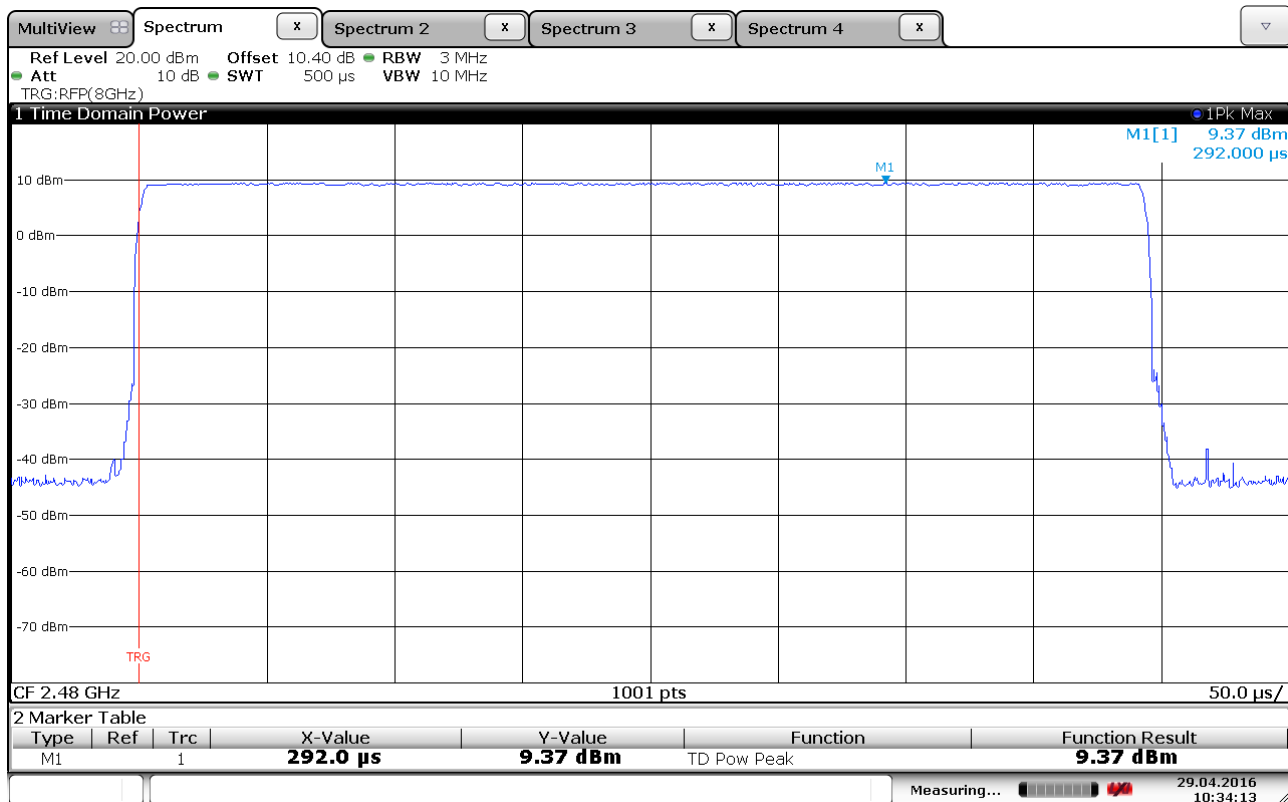


Conducted Output Power, 2440 MHz



Date: 28.APR.2016 09:56:03

Radiated Field Strength, 2440 MHz (EUT H1, HP)



Conducted Output Power, 2480 MHz



MARKER 1

2.479903846 GHz

*RBW 3 MHz

VBW 10 MHz

SWT 2.5 ms

Marker 1 [T1]

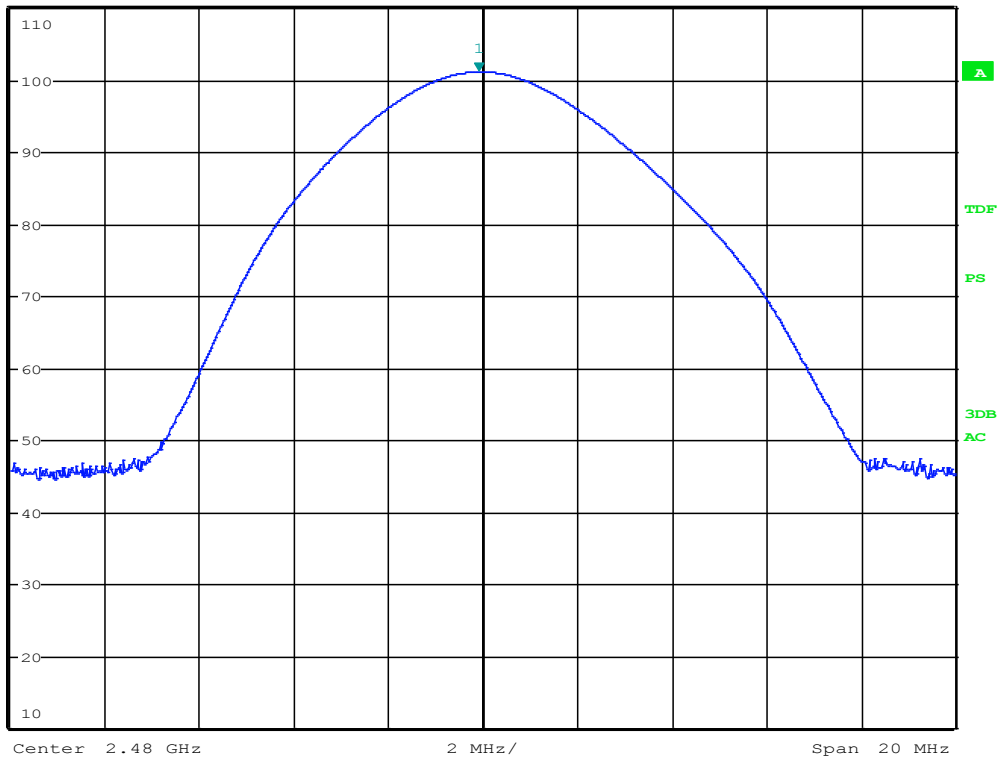
101.11 dBμV/m

2.479903846 GHz

Ref 110 dBμV/m

*Att 10 dB

1 PR
MAXH



Date: 28.APR.2016 10:07:24

Radiated Field Strength, 2480 MHz (EUT H1, HP)

3.5 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Results: Complies

Measurement Data:

Band-edge conducted power

	Measured field strength (dB μ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB μ V/m	dB	
Peak Detector	46.9	61.2	74	27.1	12.8
Average Detector	26.9	41.2	54	27.1	12.8

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

See attached plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = slot length / frame length

Duty Cycle Correction factor = $-20 \times \log(\text{Duty Cycle}) = 27.5 \text{ dB}$

Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

RF conducted power to 25 GHz see attached plots.

Maximum RF level outside operating band:

RF ch 0: >40 dB/C, margin >20 dB

RF ch 19: >40 dB/C, margin >20 dB

RF ch 39: >40 dB/C, margin >20 dB



MARKER 2

2.386121795 GHz

*RBW 1 MHz

VBW 3 MHz

SWT 2.5 ms

Marker 2 [T1]

46.90 dBuV/m

2.386121795 GHz

Ref 110 dBuV/m

*Att 10 dB

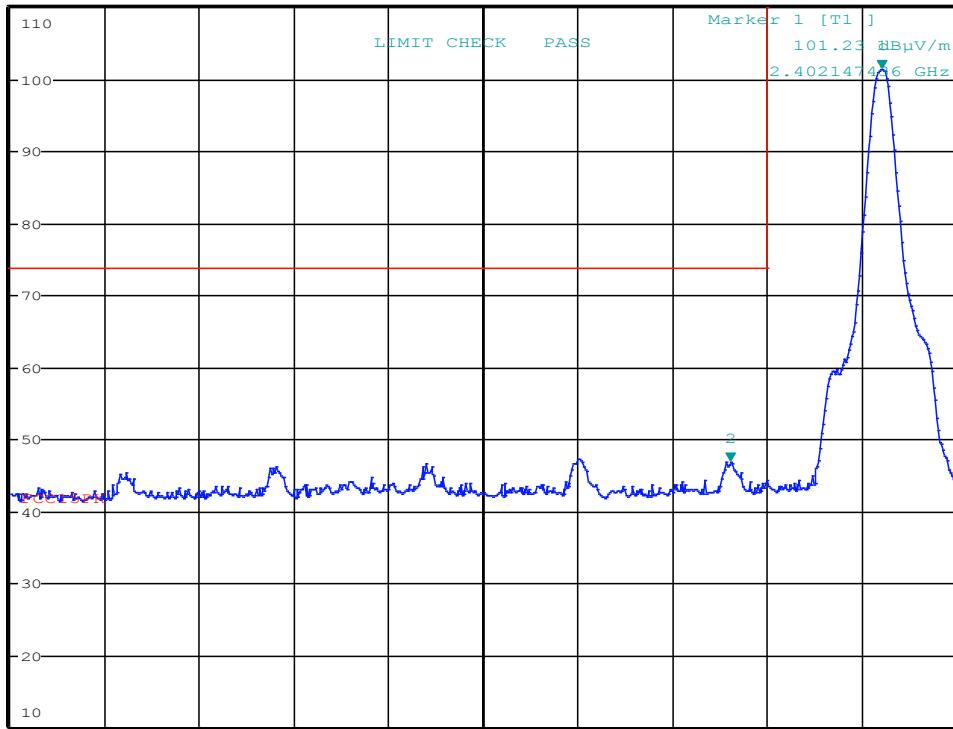
LIMIT CHECK PASS

Marker 1 [T1]

101.23 dBuV/m

2.402147426 GHz

1 PK
MAXH



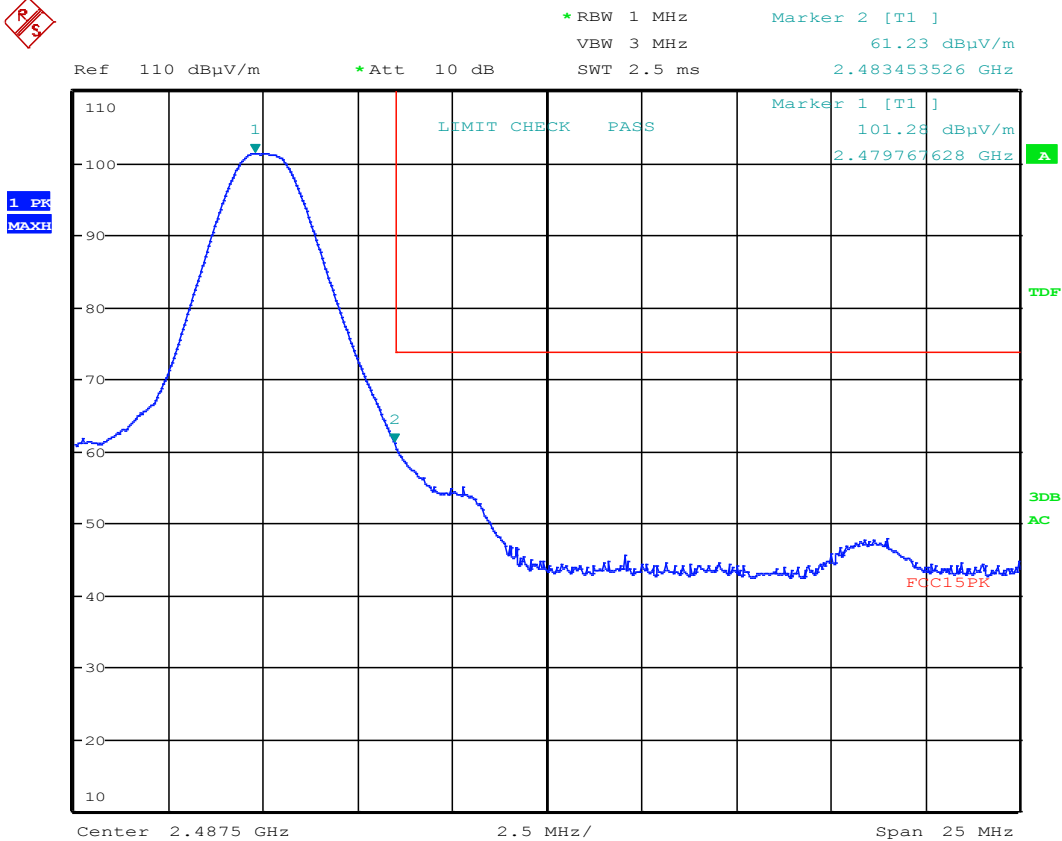
Center 2.36 GHz

10 MHz/

Span 100 MHz

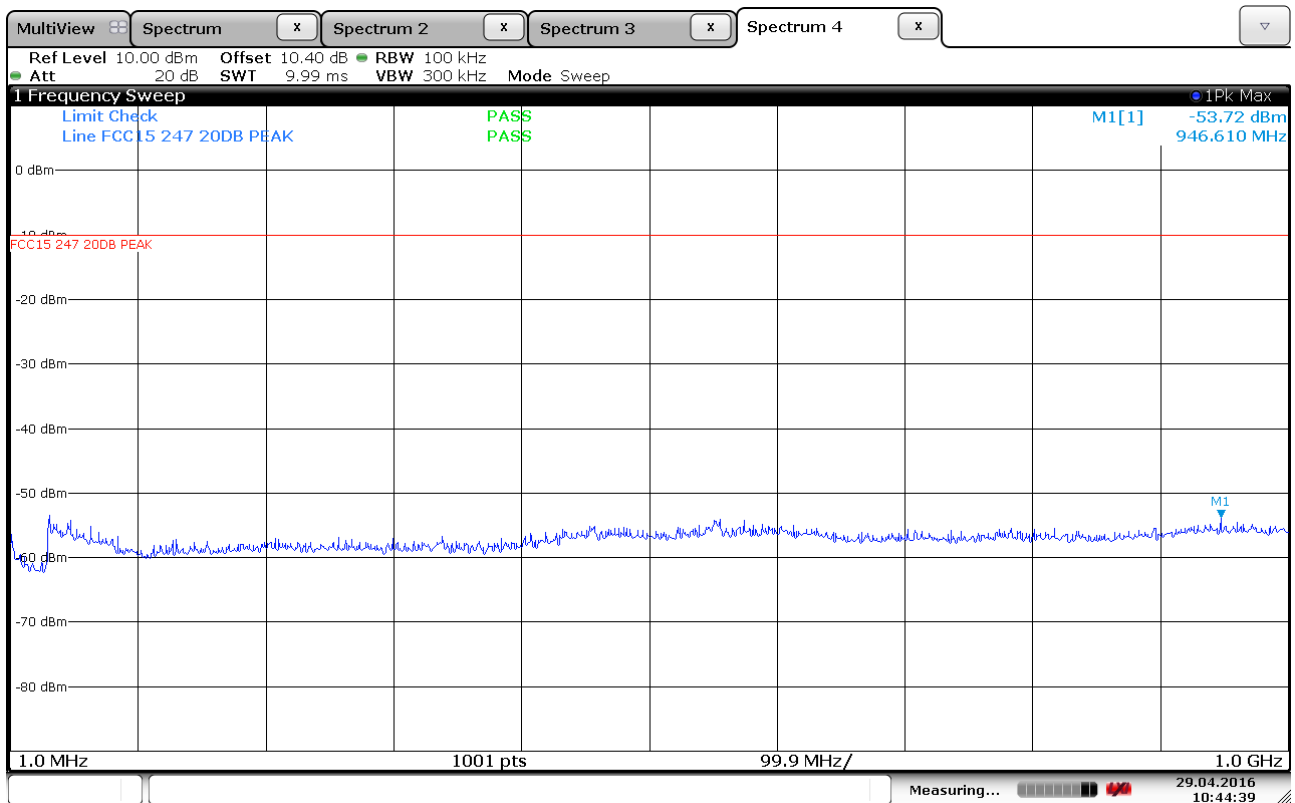
Date: 28.APR.2016 12:35:24

Band Edge, Peak, 2402 MHz

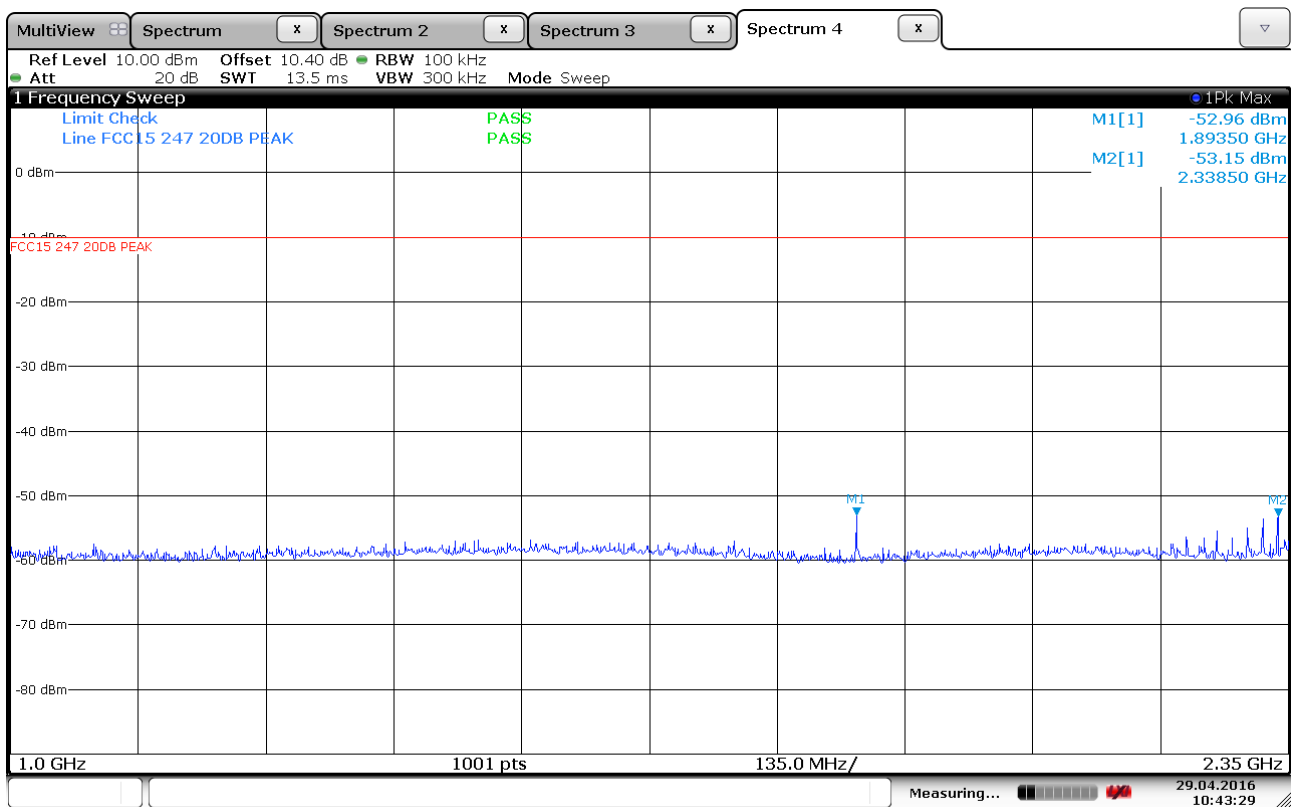


Date: 28.APR.2016 12:32:27

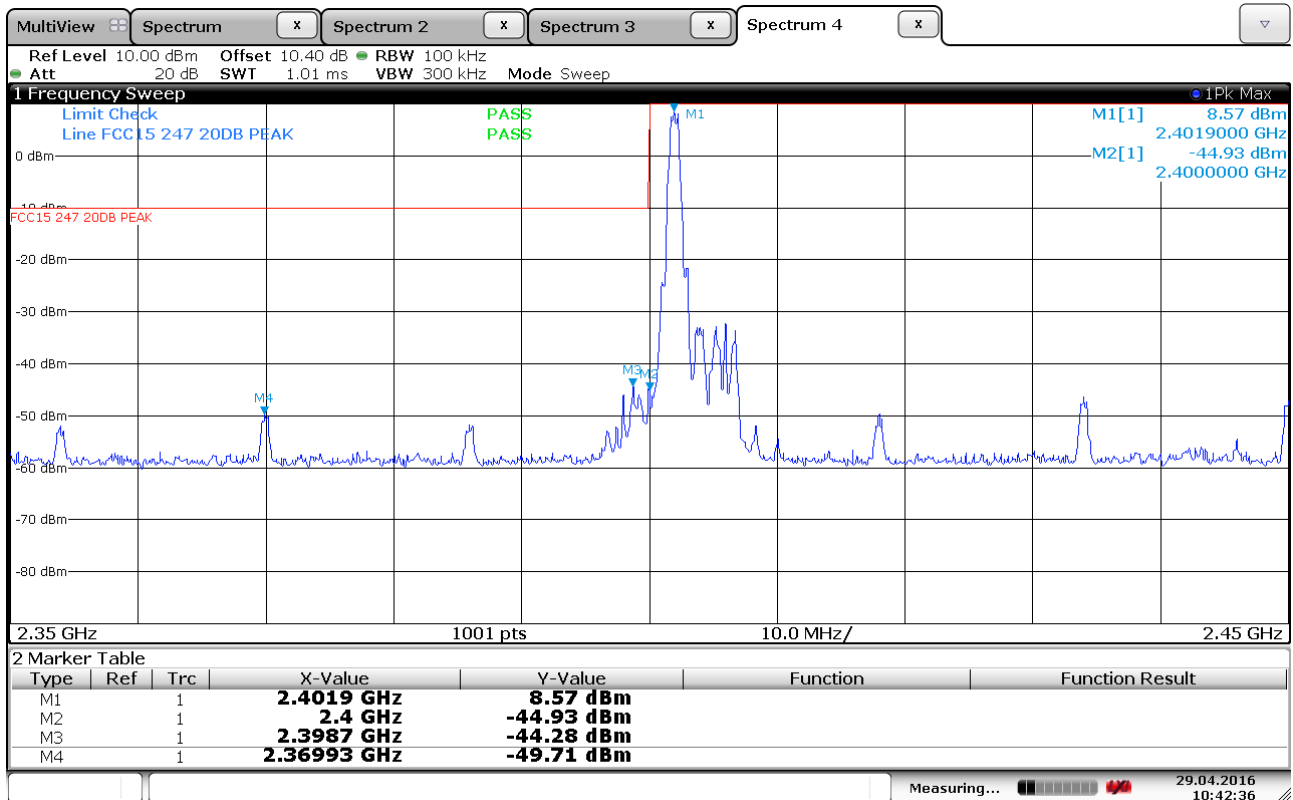
Band Edge, Peak, 2480 MHz



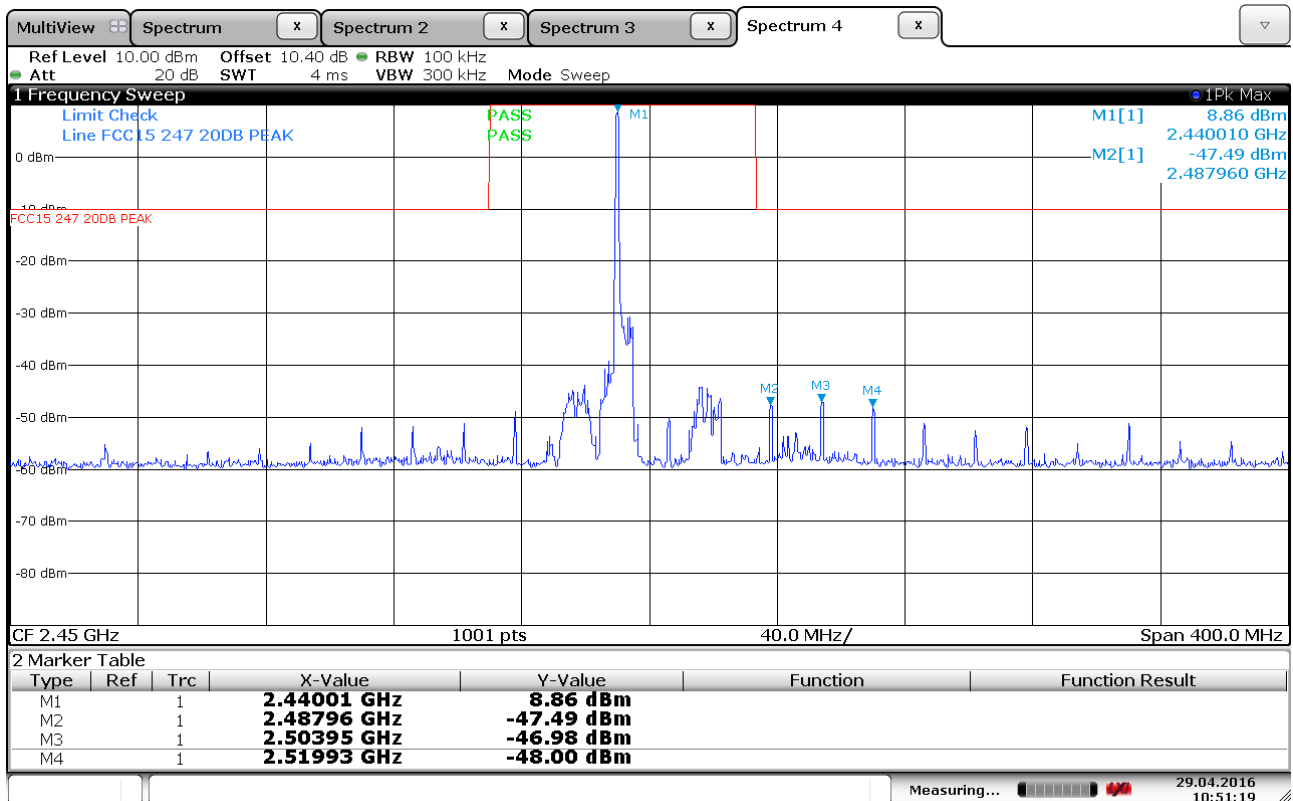
Conducted Emissions, 1 -1000 MHz, 2402 MHz



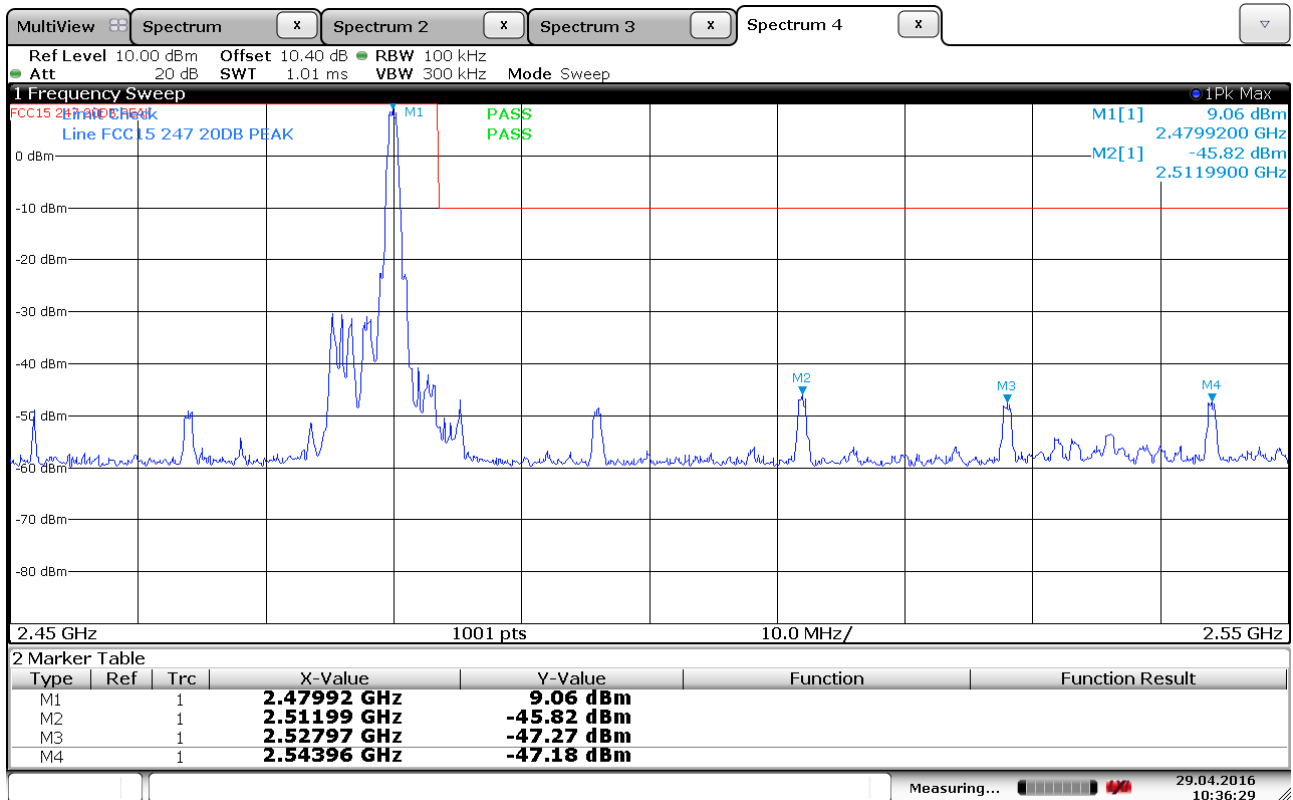
Conducted Emissions, 1000 -2350 MHz, 2402 MHz



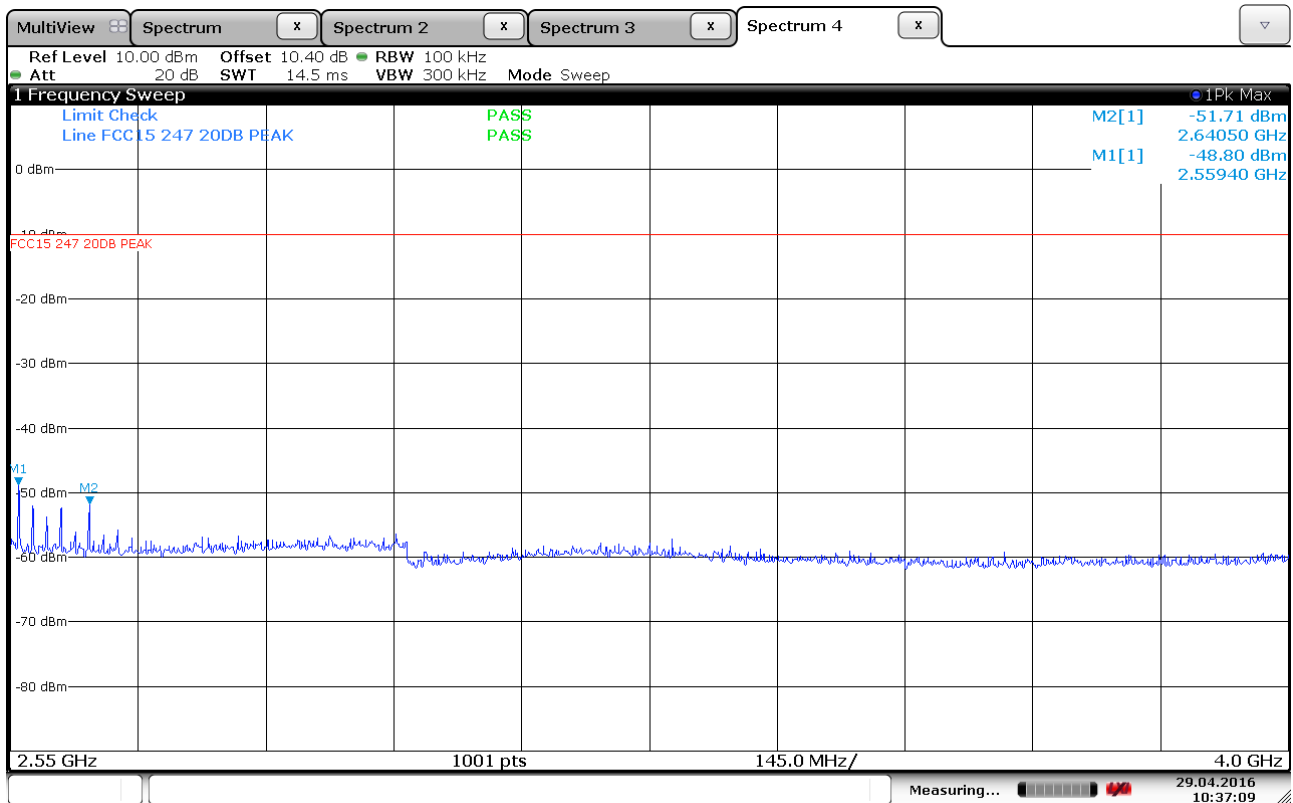
Conducted Emissions, 2350 -2450 MHz, 2402 MHz



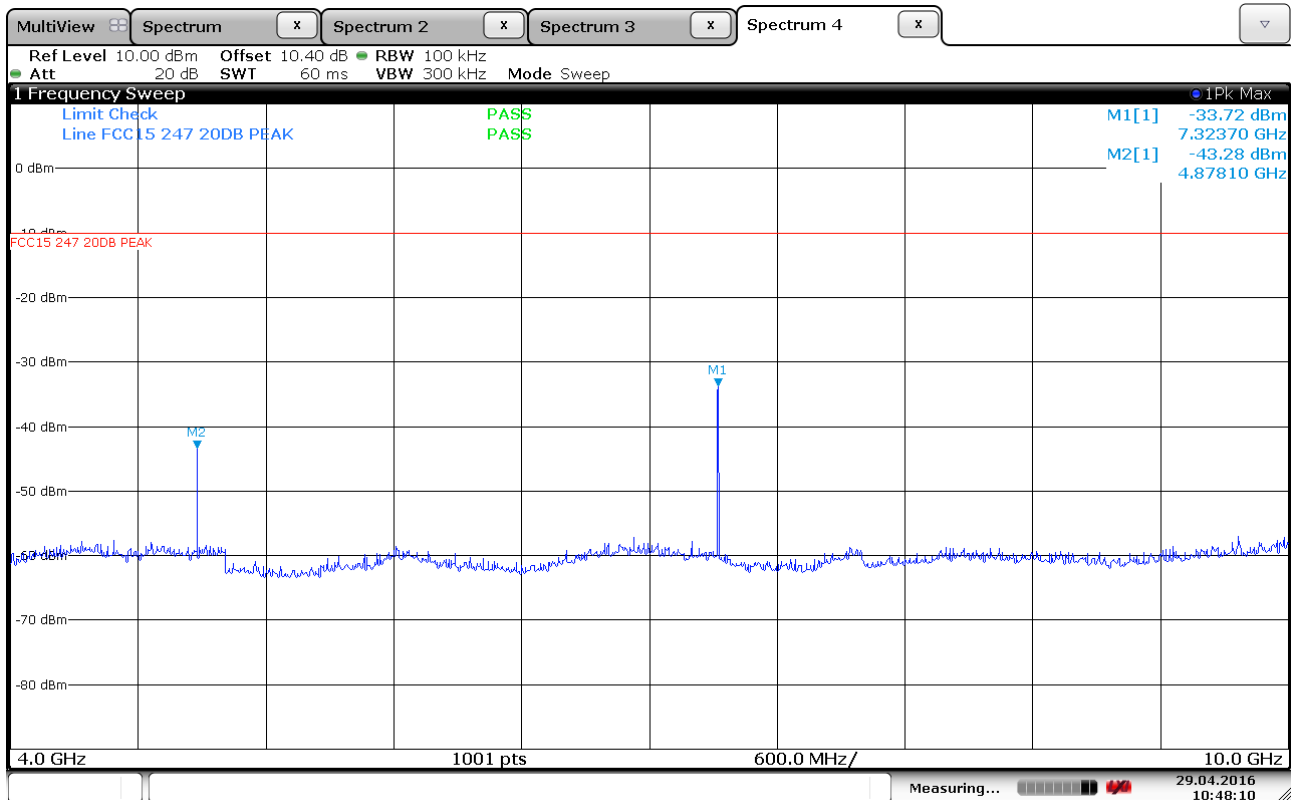
Conducted Emissions, 2300 -2600 MHz, 2440 MHz



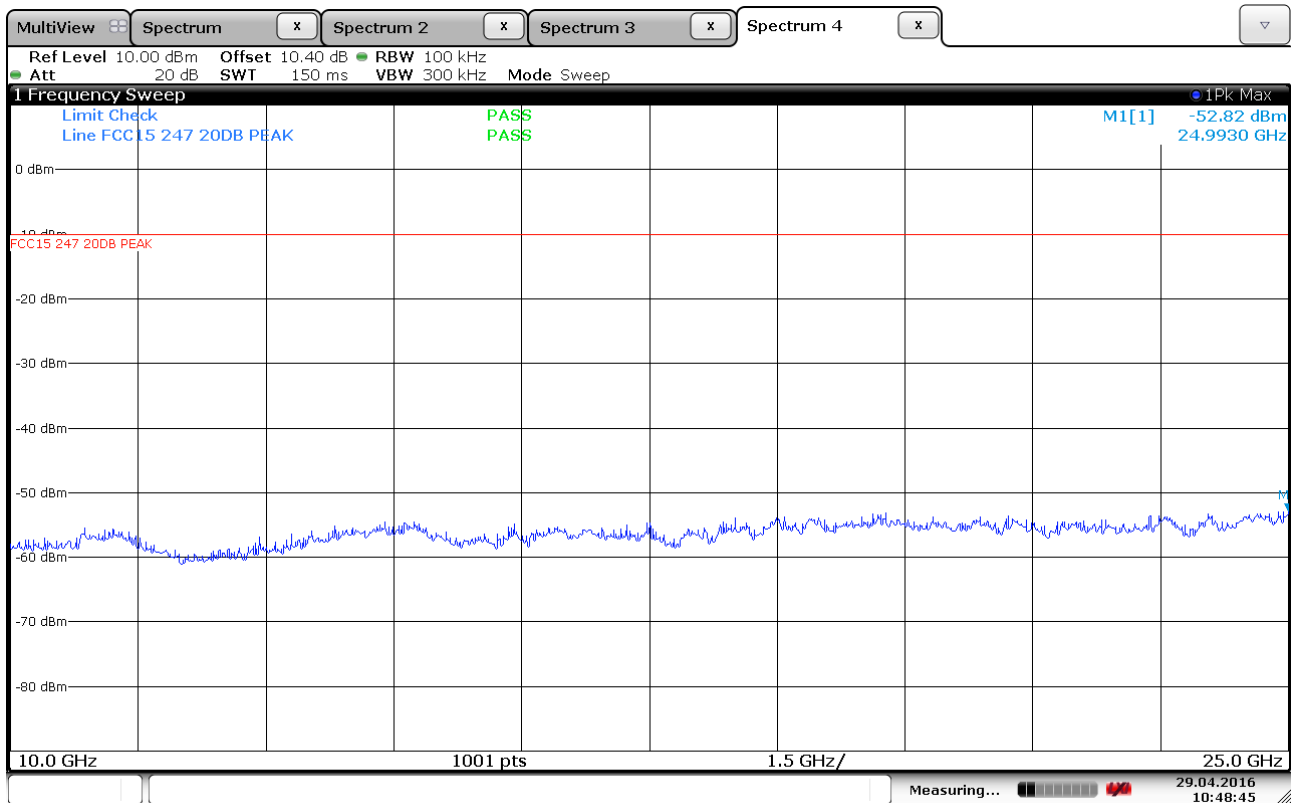
Conducted Emissions, 2450 -2550 MHz, 2480 MHz



Conducted Emissions, 2550 -4000 MHz, 2480 MHz



Conducted Emissions, 4000 -10000 MHz, 2440 MHz



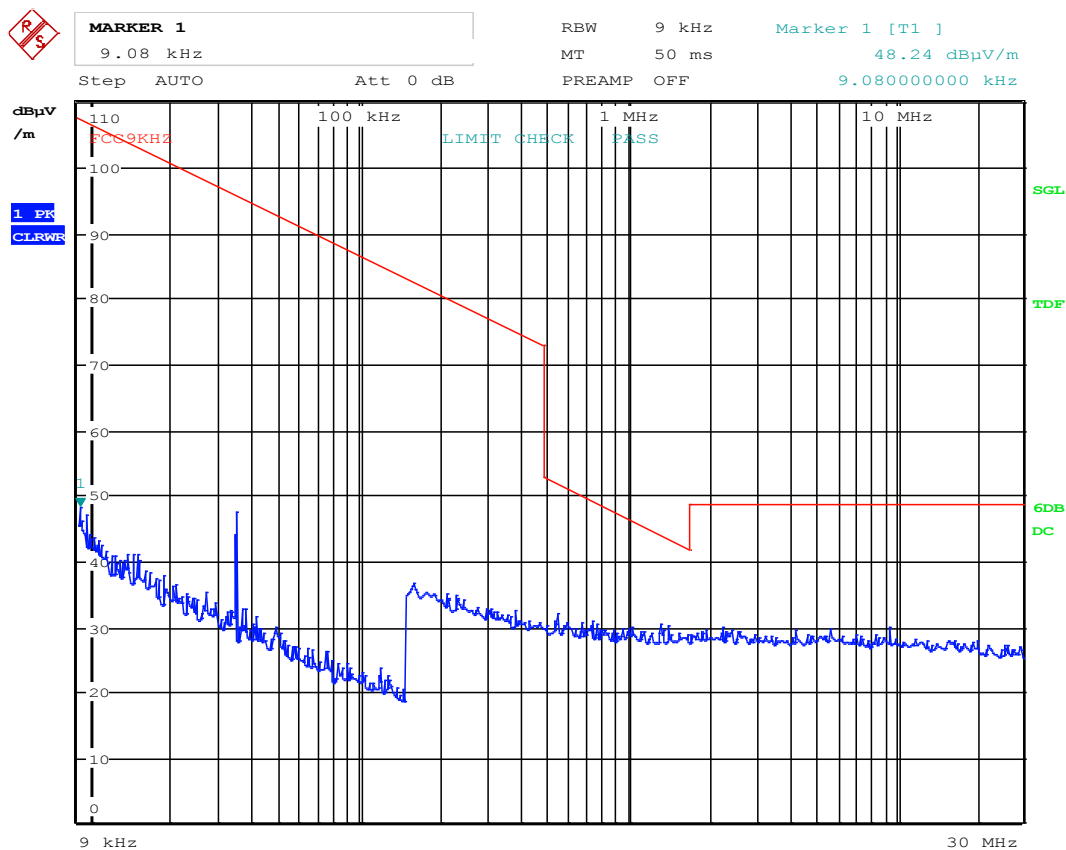
Conducted Emissions, 10000 -25000 MHz, 2440 MHz

Radiated emissions 9 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).



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Radiated emission 30 – 1000 MHz.

Detector: Peak

Measuring distance 3 m.

Tested in test mode mode with EUT Transmitting on ch19.

No Spurious Emissions were found.

See attached graphs.



MARKER 1

196.7307692 MHz

*RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

37.05 dBμV/m

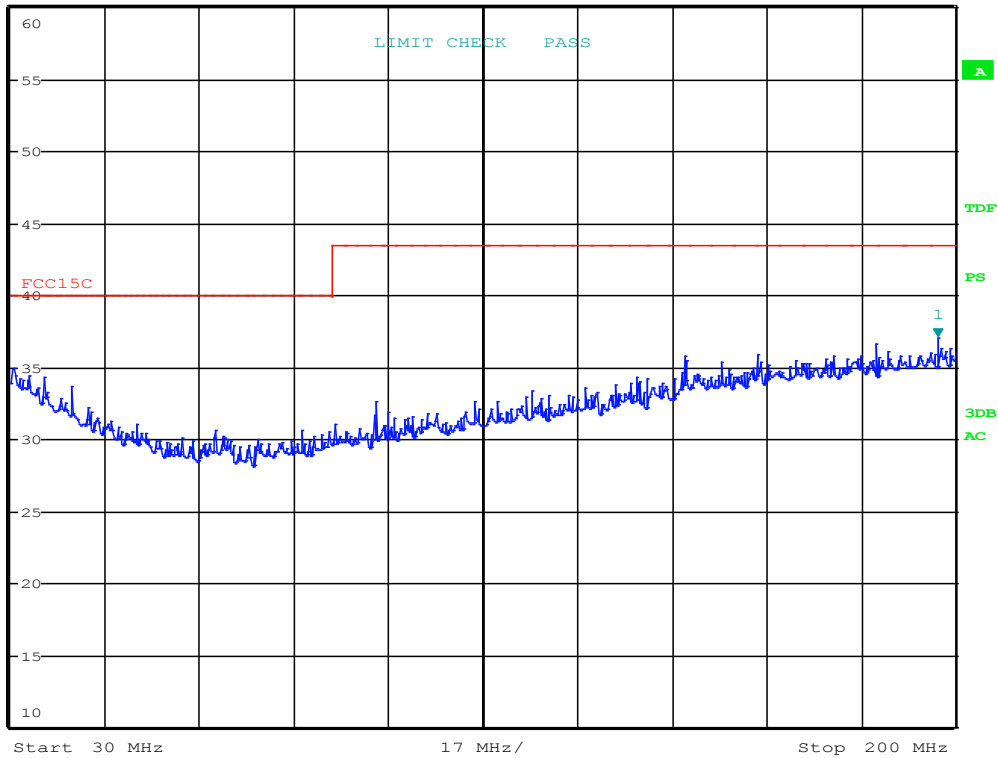
Ref 60 dBμV/m

*Att 10 dB

SWT 20 ms

196.730769231 MHz

1 PK
MAXH



Date: 28.APR.2016 15:03:49

Radiated 30 -200MHz, VP



Radiated 30 -200MHz, HP



MARKER 1

994.8717949 MHz

*RBW 100 kHz

Marker 1 [T1]

VBW 300 kHz

29.32 dBμV/m

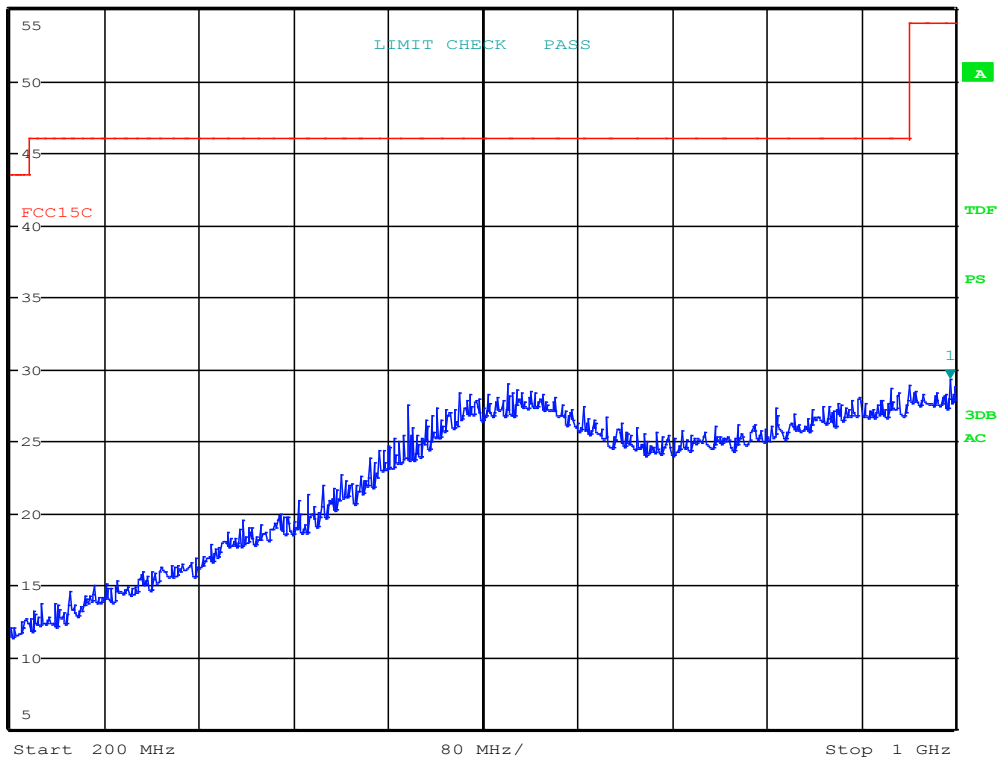
Ref 55 dBμV/m

*Att 10 dB

SWT 80 ms

994.871794872 MHz

1 PK
MAXH



Date: 28.APR.2016 15:41:59

Radiated 200 -1000MHz, VP

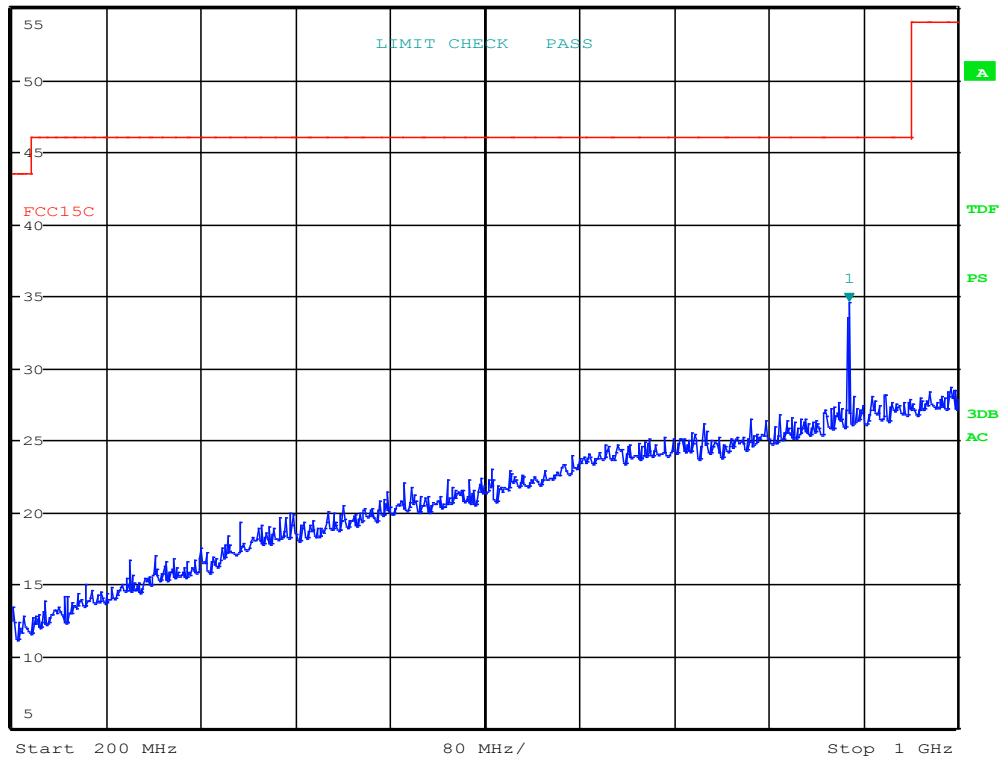


MARKER 1
907.6923077 MHz

*RBW 100 kHz Marker 1 [T1]
VBW 300 kHz 34.58 dBμV/m
SWT 80 ms 907.692307692 MHz

Ref 55 dBμV/m *Att 10 dB

1 PR
MAXH



Date: 28.APR.2016 15:39:01

Radiated 200 -1000MHz, HP

(The spike at 907.7 MHz in the above plot is from outside influence)

Radiated Emissions, 1-25 GHz

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

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

Peak Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Limit	Margin
MHz	L,M,H	dB	dB μ V/m	dB μ V/m	dB
7206	L	0	67.4	74	6.6
7320	M	0	67.6	74	6.4
7440	H	0	65.2	74	8.8
9760	M	-9.5	49.6	74	24.4
Other freqs	L,M,H	0	None detected	74	>20

Average 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
7206	L	0	47.4	20	54	6.6
7320	M	0	47.6	20	54	6.4
7440	H	0	45.2	20	54	8.8
9760	M	-9.5	29.6	20	54	24.4
Other freqs	L,M,H	/	None detected	20	54	>20

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

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

Distance correction Factor is included on the plot for measurements above 8.5 GHz.

See plots.



*RBW 1 MHz Marker 1 [T1]
*VBW 3 MHz 46.93 dBμV/m
SWT 5 ms 2.387772436 GHz

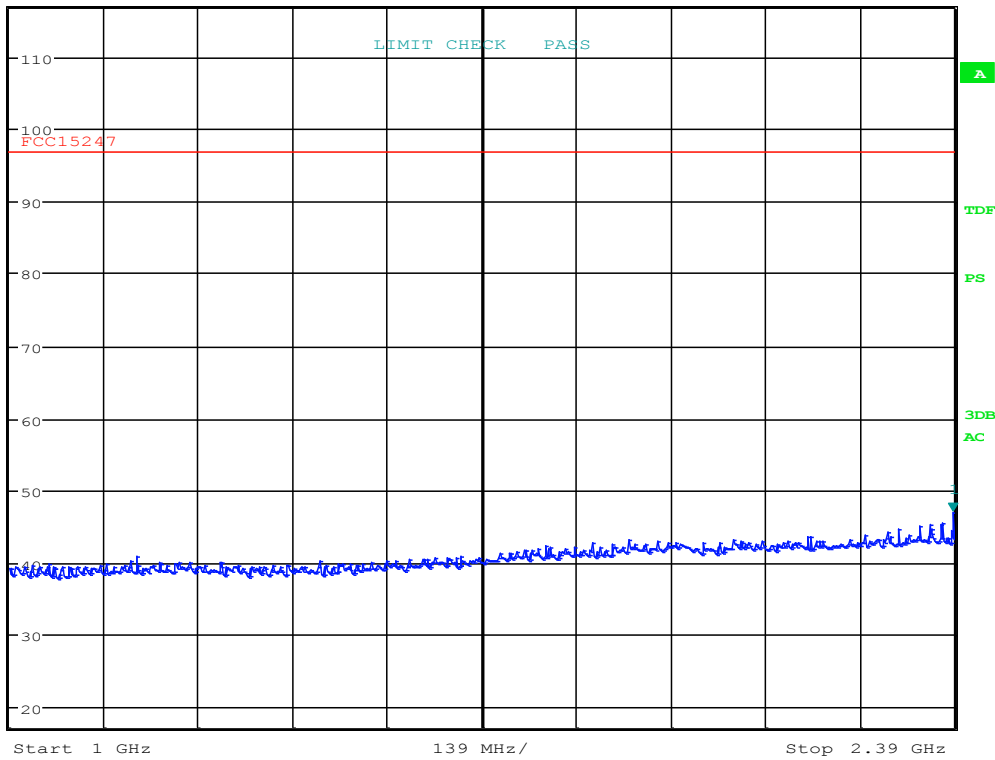
Ref 117 dBμV/m

*Att 10 dB

SWT 5 ms

2.387772436 GHz

1 PK
MAXH



Date: 28.APR.2016 10:18:07

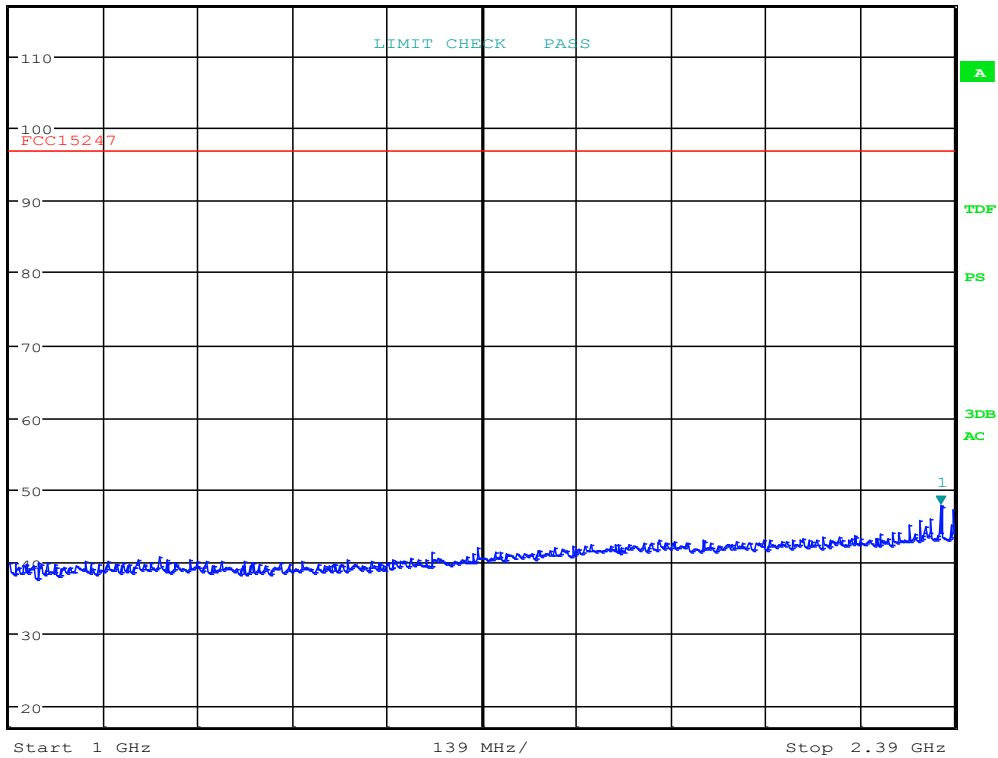
Radiated emissions, 1000 -2390 MHz, 2402 MHz, VP



*RBW 1 MHz Marker 1 [T1]
*VBW 3 MHz 47.84 dBμV/m
SWT 5 ms 2.369951923 GHz

Ref 117 dBμV/m *Att 10 dB

1 PK
MAXH

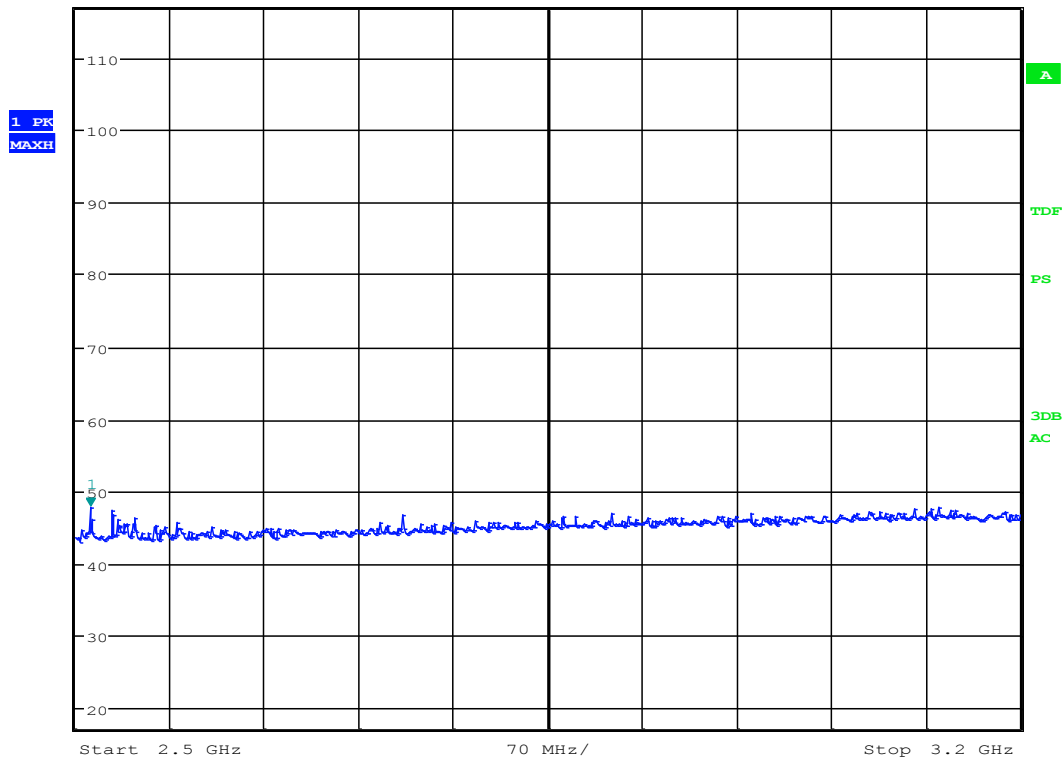


Date: 28.APR.2016 10:19:59

Radiated emissions, 1000 -2390 MHz, 2402 MHz, HP



*RBW 1 MHz Marker 1 [T1]
*VBW 3 MHz 47.83 dBμV/m
Ref 117 dBμV/m *Att 10 dB SWT 2.5 ms 2.511217949 GHz



Date: 28.APR.2016 10:10:40

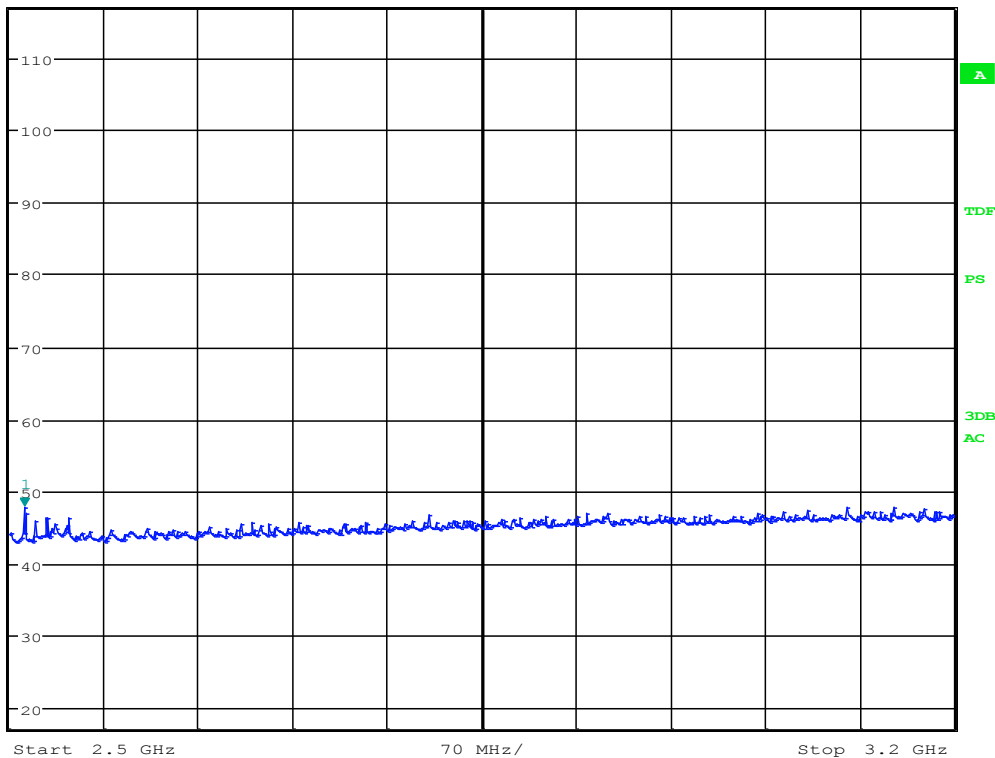
Radiated emissions, 2500 -3200 MHz, 2480 MHz, VP



*RBW 1 MHz Marker 1 [T1]
*VBW 3 MHz 47.86 dBμV/m
SWT 2.5 ms 2.511217949 GHz

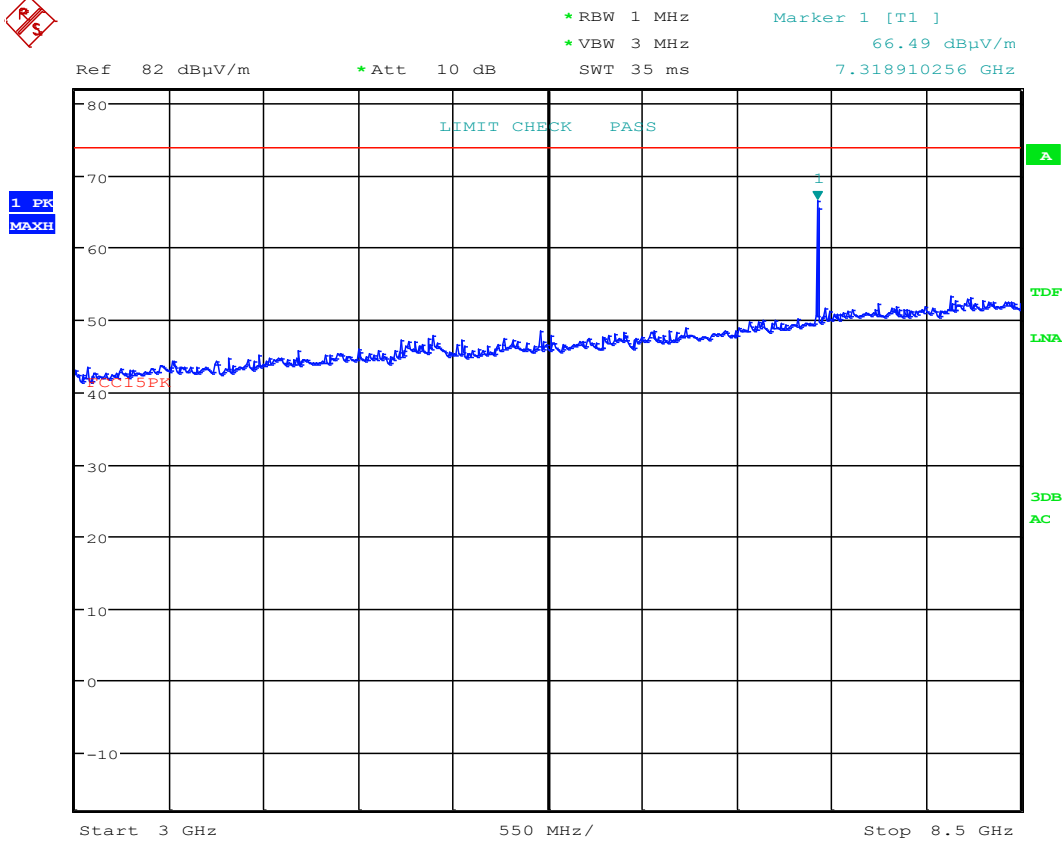
Ref 117 dBμV/m *Att 10 dB

1 PK
MAXH



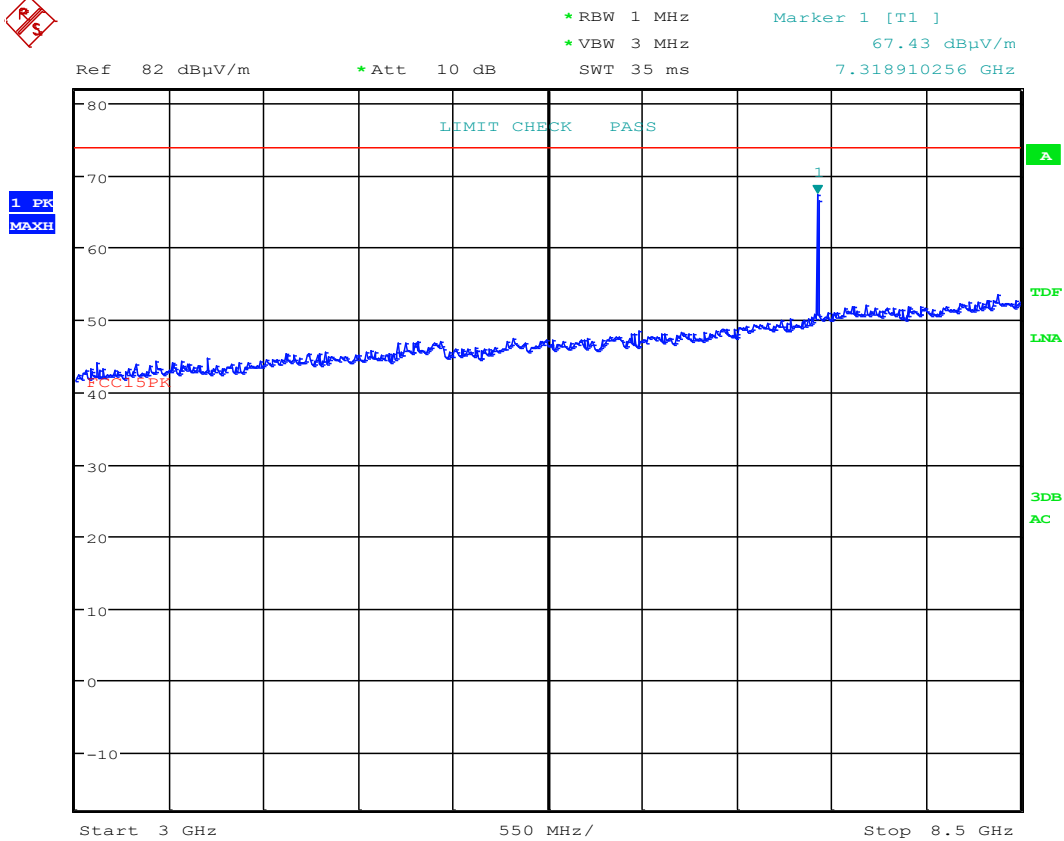
Date: 28.APR.2016 10:12:31

Radiated emissions, 2500 -3200 MHz, 2480 MHz, HP



Date: 28.APR.2016 10:31:00

Radiated emissions, 3000 -8500 MHz, 2440 MHz, VP

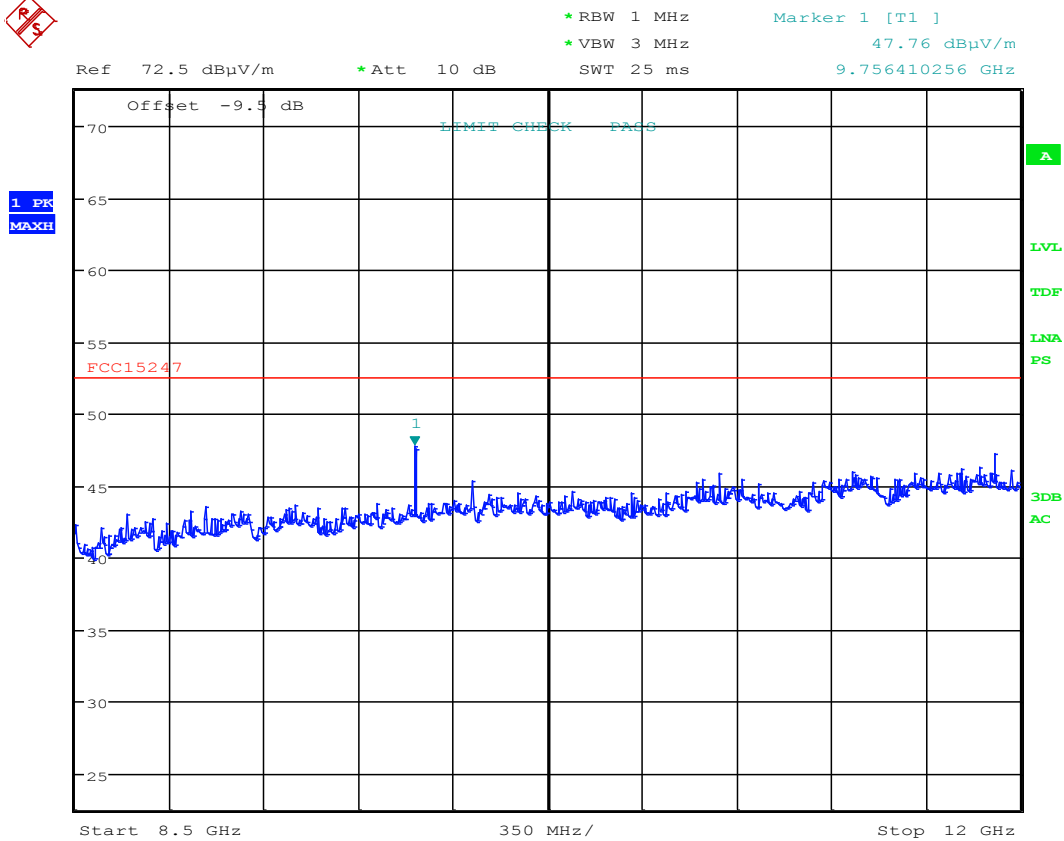


Date: 28.APR.2016 10:32:53

Radiated emissions, 3000 -8500 MHz, 2440 MHz, HP

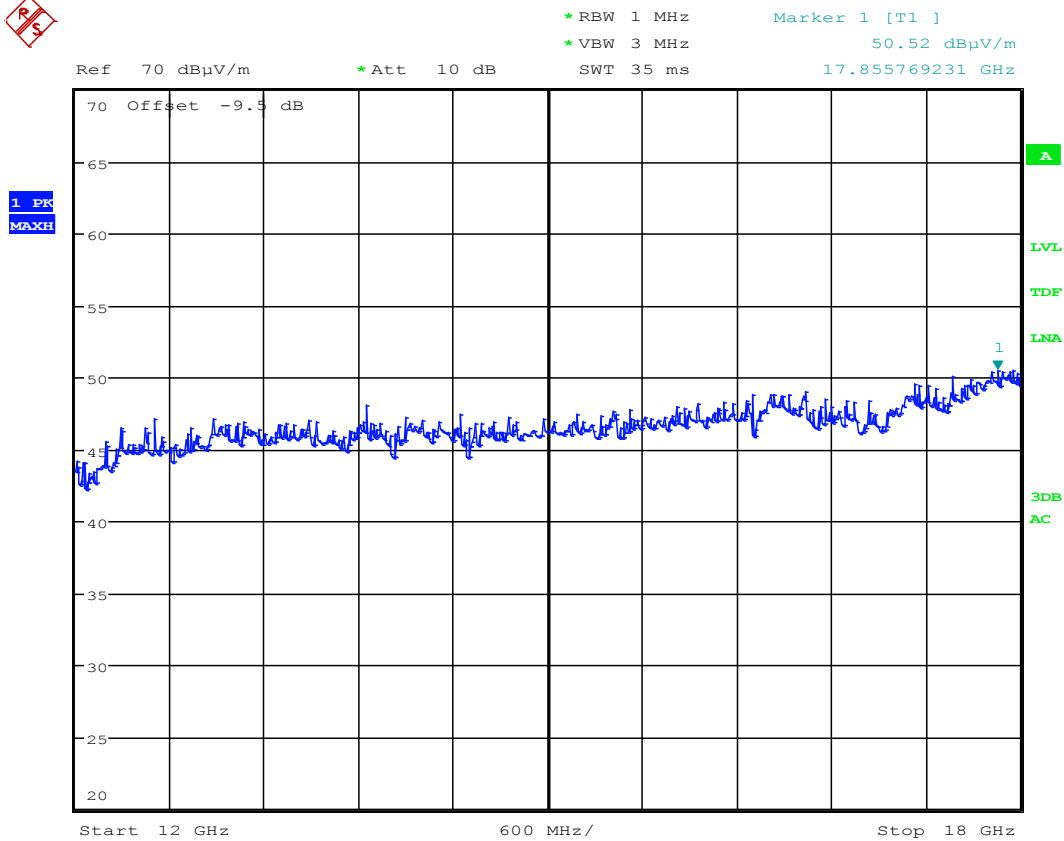


Radiated emissions, 8500 -12000 MHz, 2440 MHz, VP, @1m



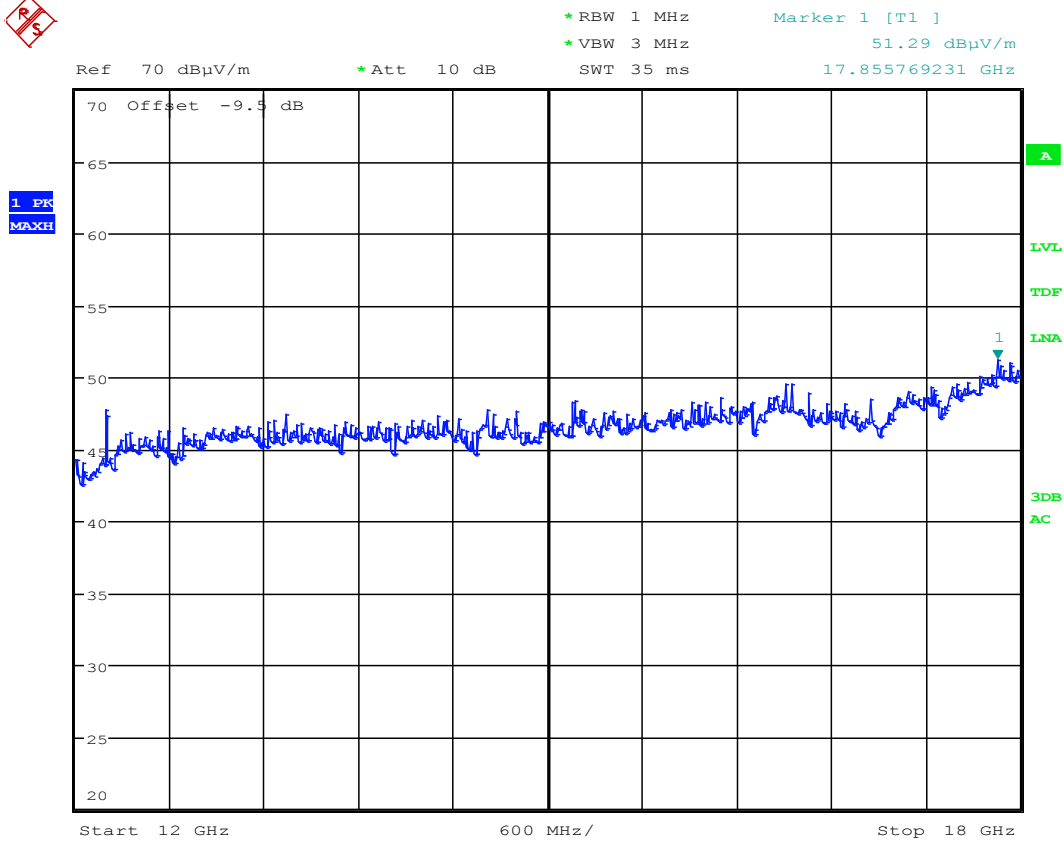
Date: 28.APR.2016 13:05:09

Radiated emissions, 8500 -12000 MHz, 2440 MHz, HP, @1m



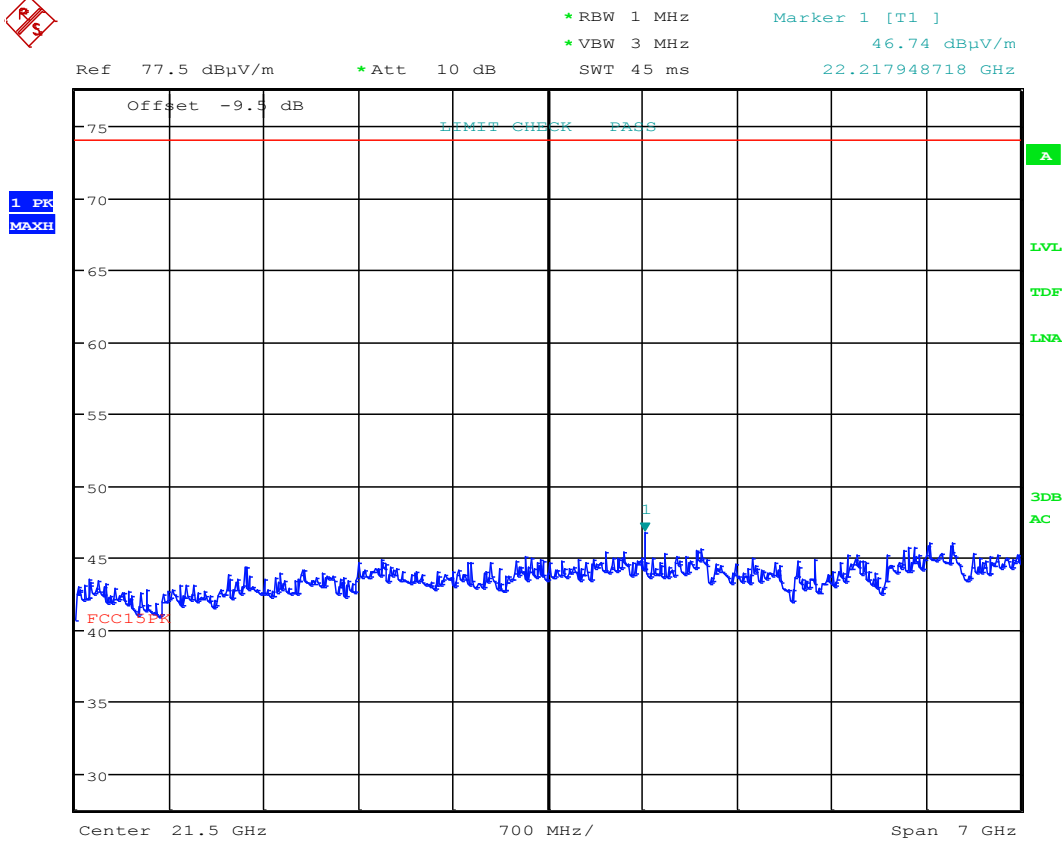
Date: 28.APR.2016 13:25:59

Radiated emissions, 12000 -18000 MHz, 2440 MHz, VP, @1m



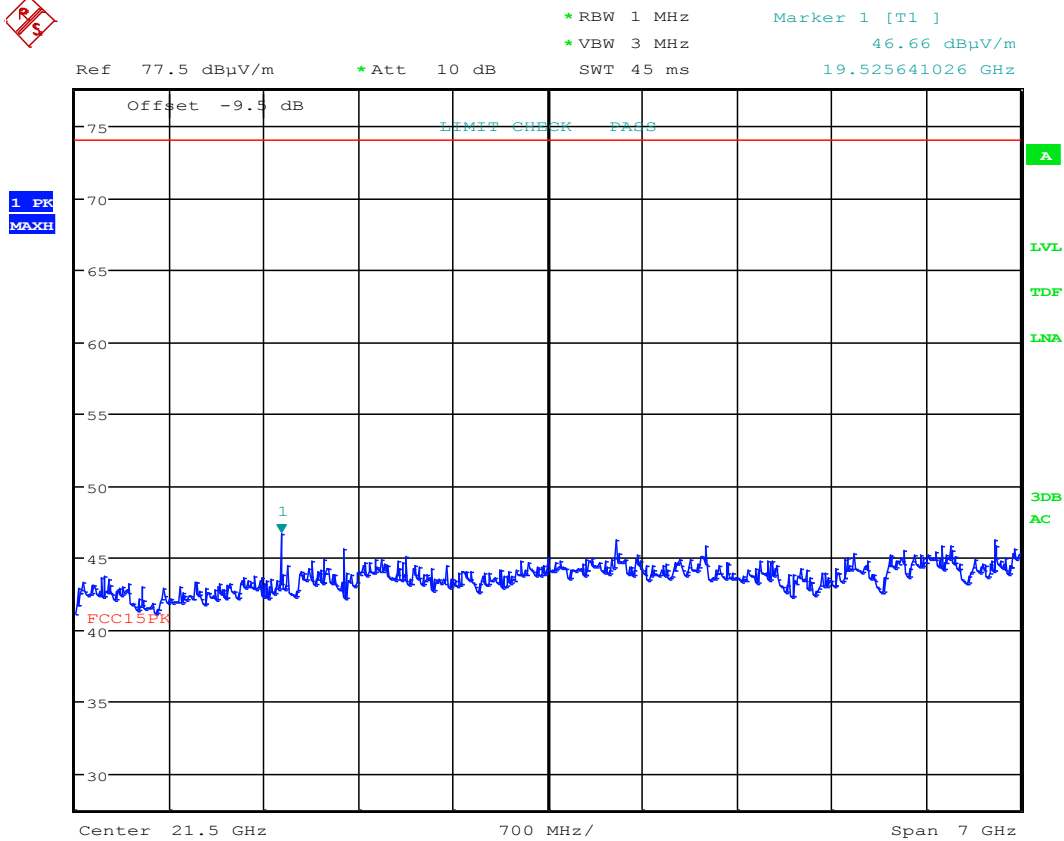
Date: 28.APR.2016 13:27:52

Radiated emissions, 12000 -18000 MHz, 2440 MHz, HP, @1m



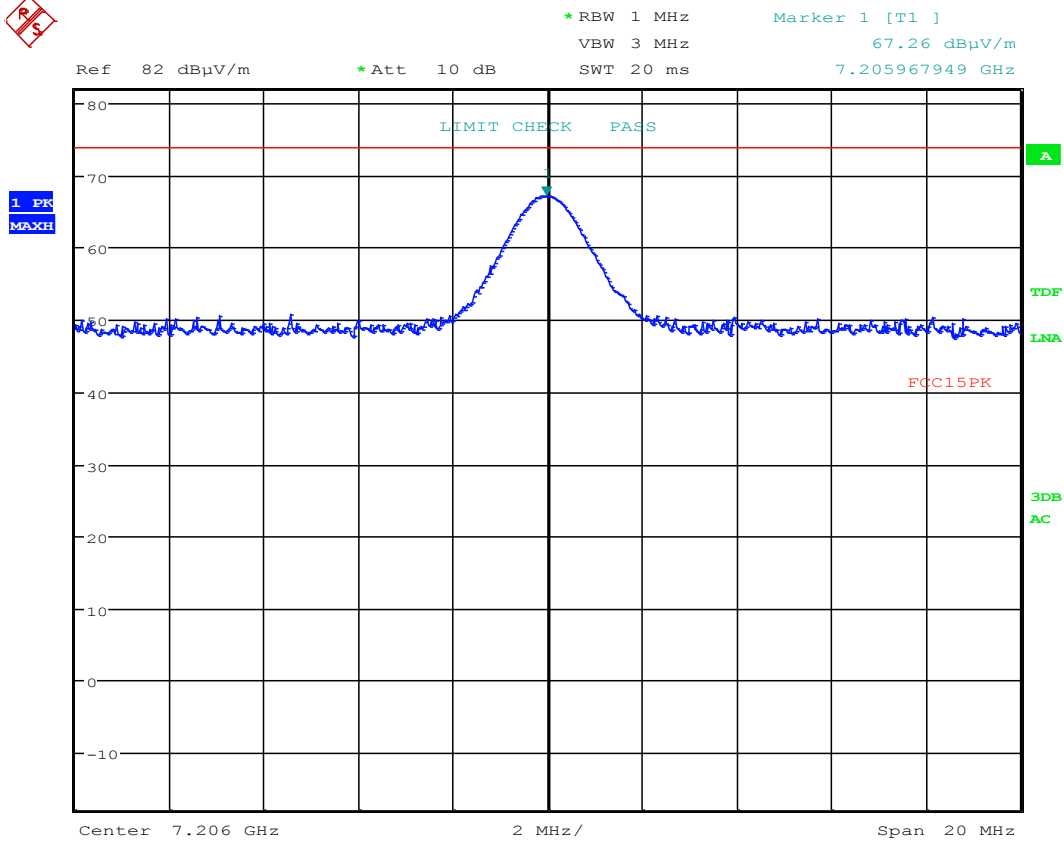
Date: 28.APR.2016 14:19:26

Radiated emissions, 18000 -25000 MHz, 2440 MHz, VP, @1m



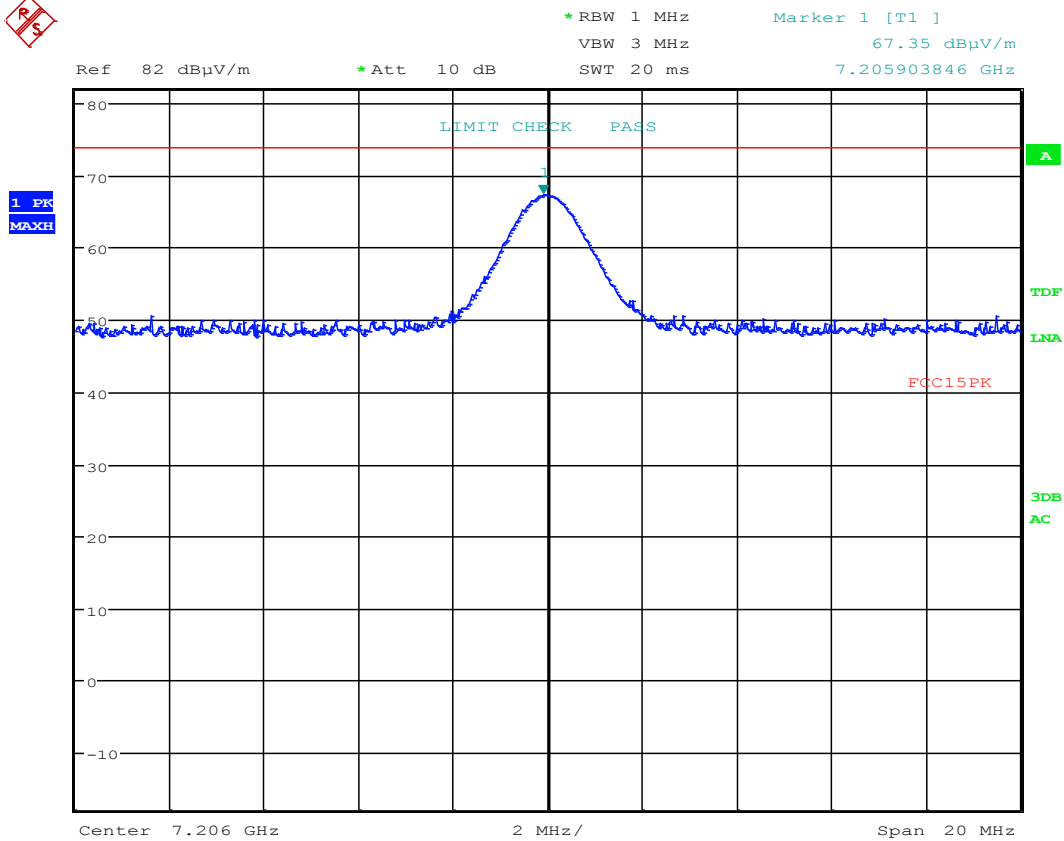
Date: 28.APR.2016 14:22:49

Radiated emissions, 18000 -25000 MHz, 2440 MHz, HP, @1m



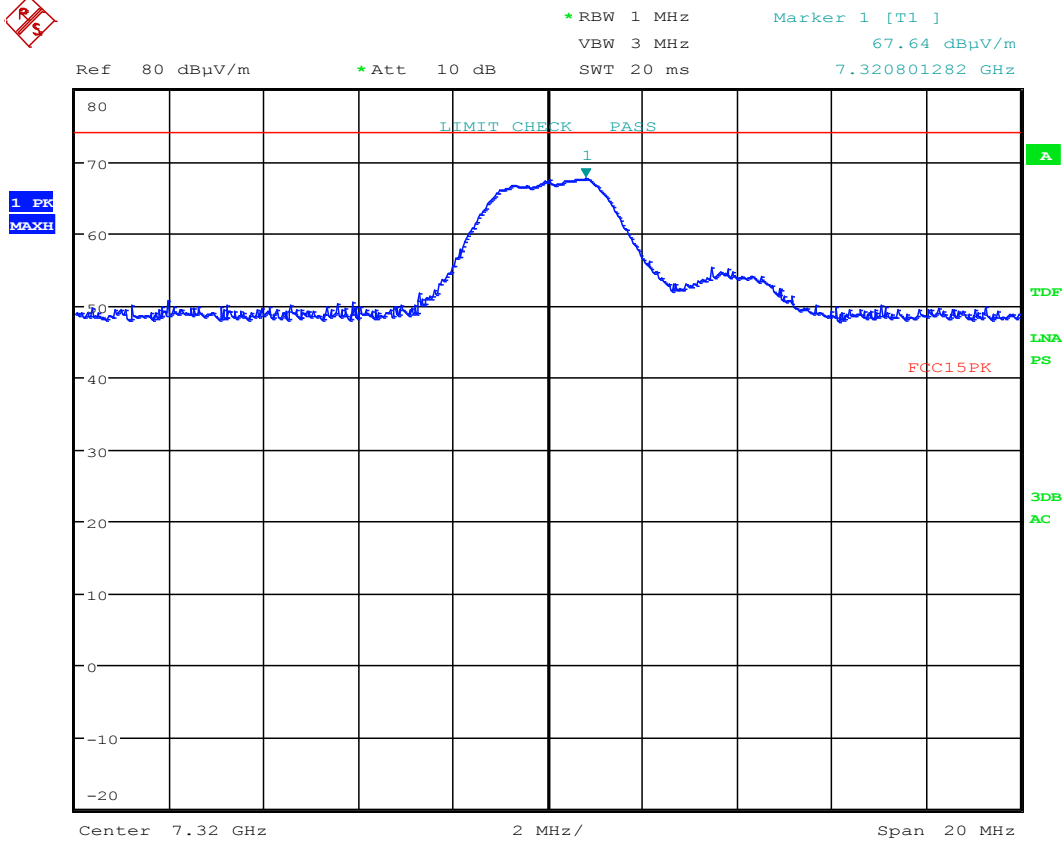
Date: 28.APR.2016 10:47:33

Radiated emissions, 7206 MHz, 2402 MHz, VP, EUT H1



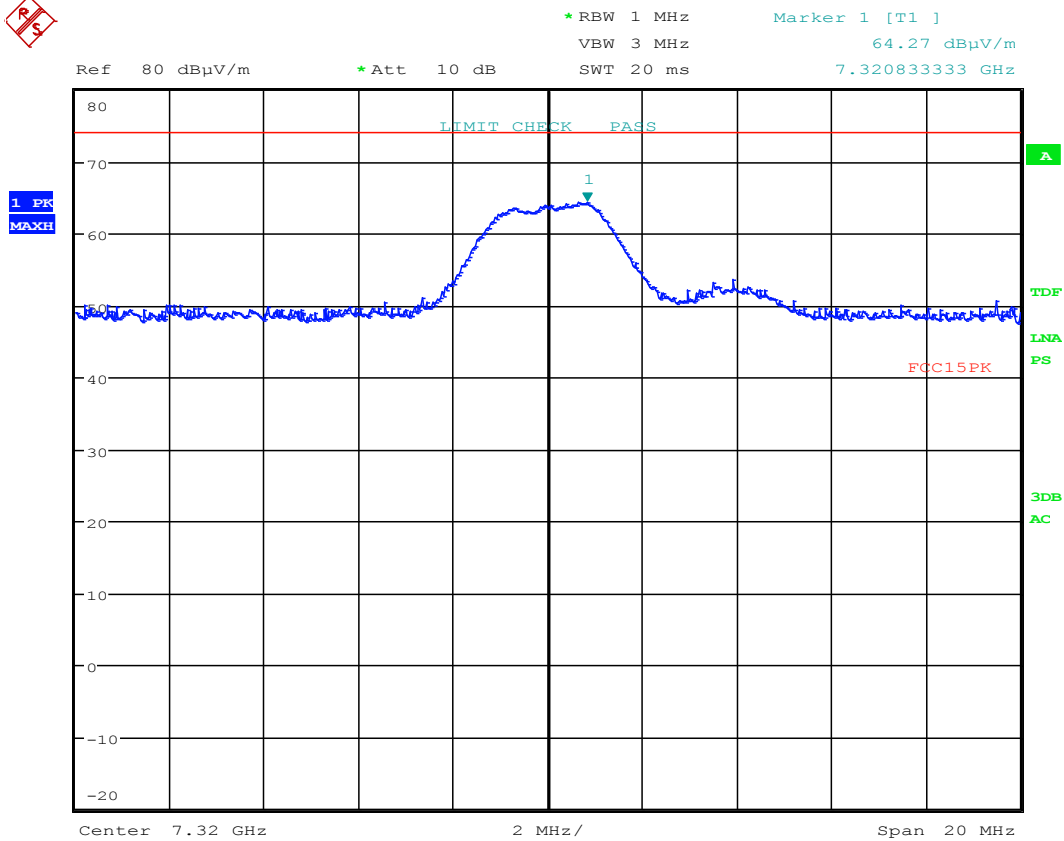
Date: 28.APR.2016 10:49:07

Radiated emissions, 7206 MHz, 2402 MHz, HP, EUT H1



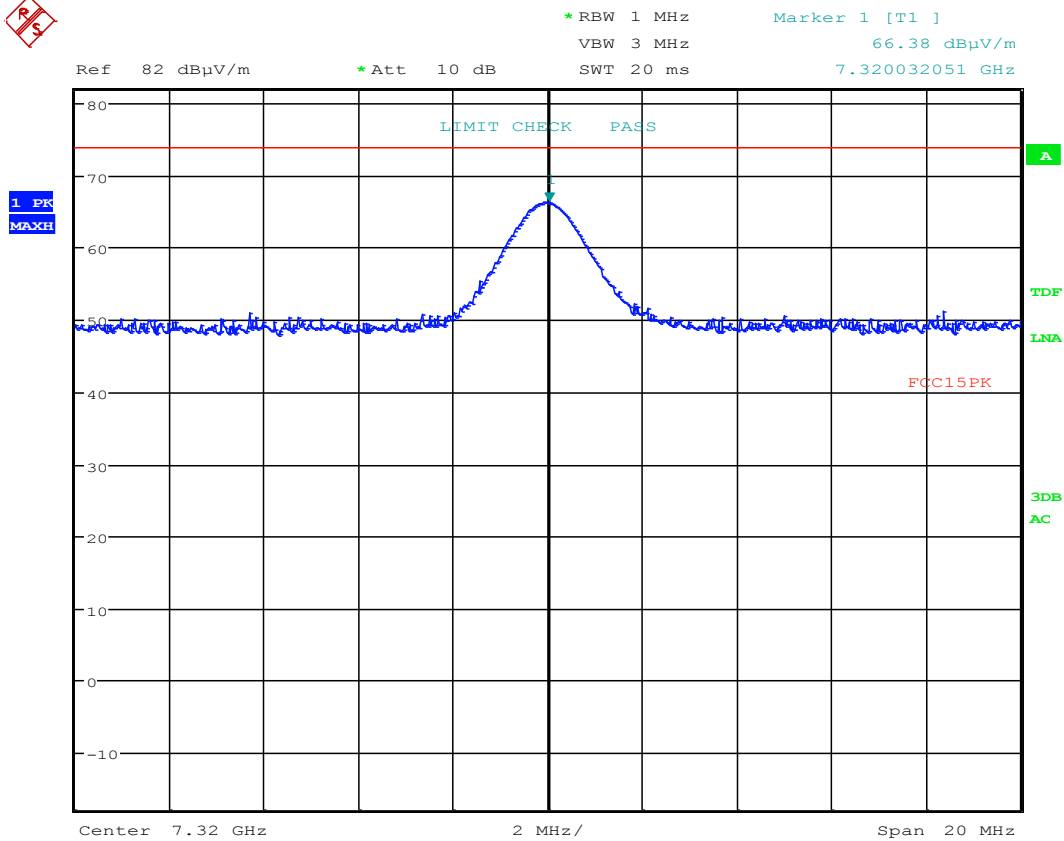
Date: 28.APR.2016 11:21:01

Radiated emissions, 7320 MHz, 2440 MHz, VP, EUT V



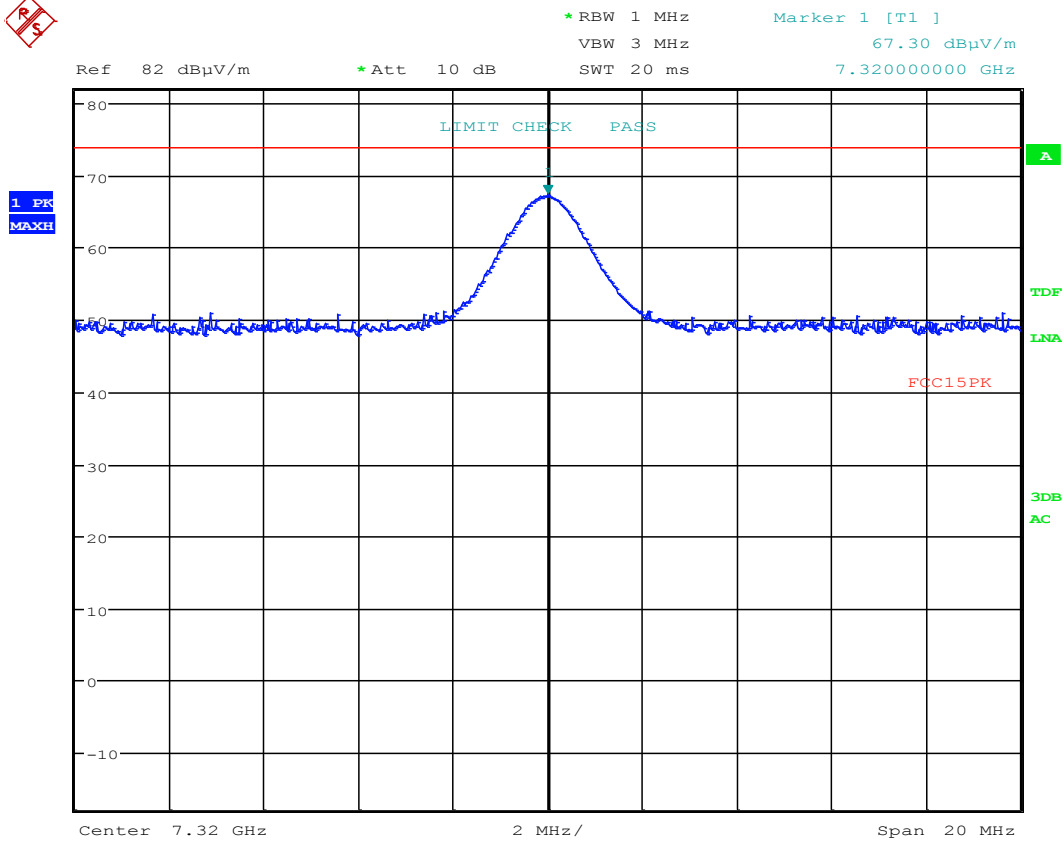
Date: 28.APR.2016 11:22:16

Radiated emissions, 7320 MHz, 2440 MHz, HP, EUT V



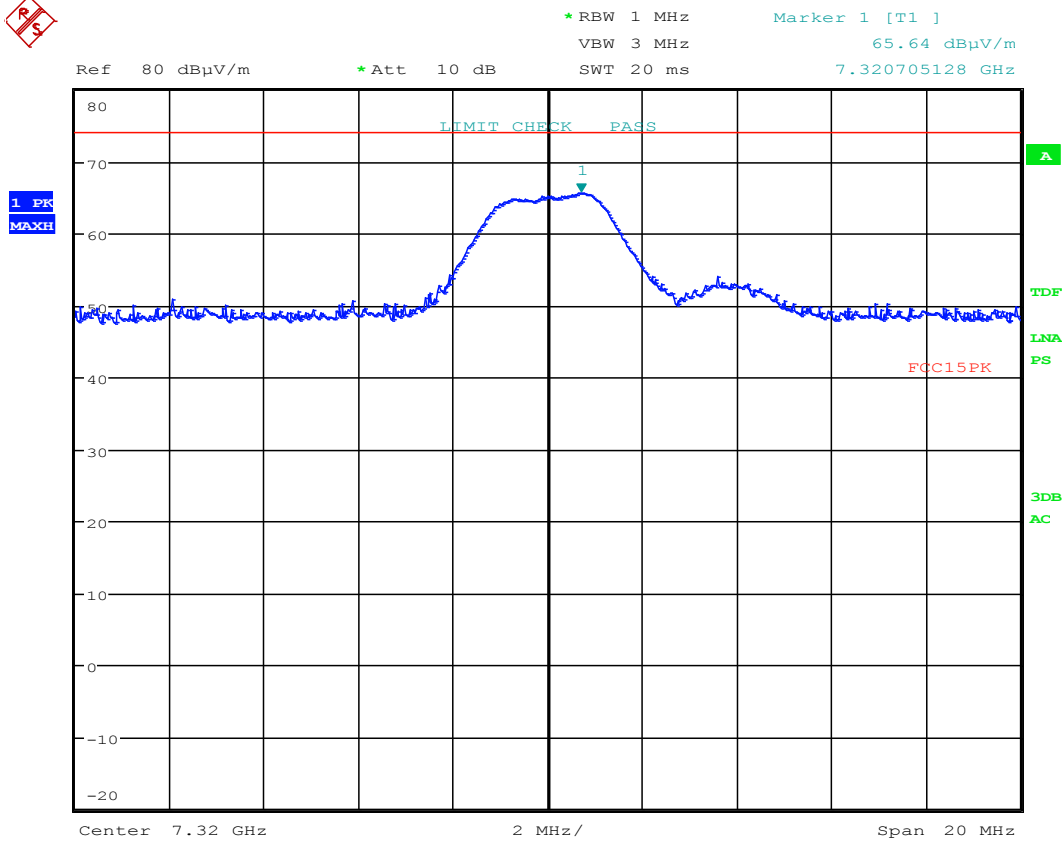
Date: 28.APR.2016 10:39:37

Radiated emissions, 7320 MHz, 2440 MHz, VP, EUT H1



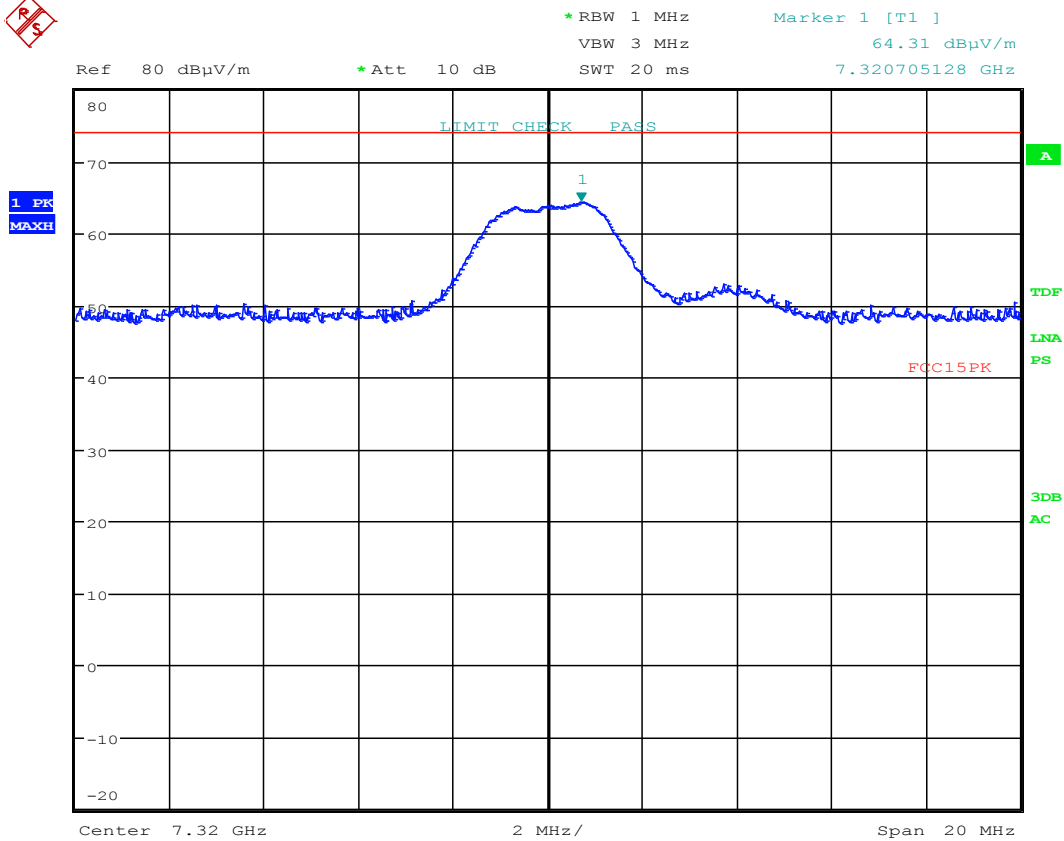
Date: 28.APR.2016 10:38:04

Radiated emissions, 7320 MHz, 2440 MHz, HP, EUT H1



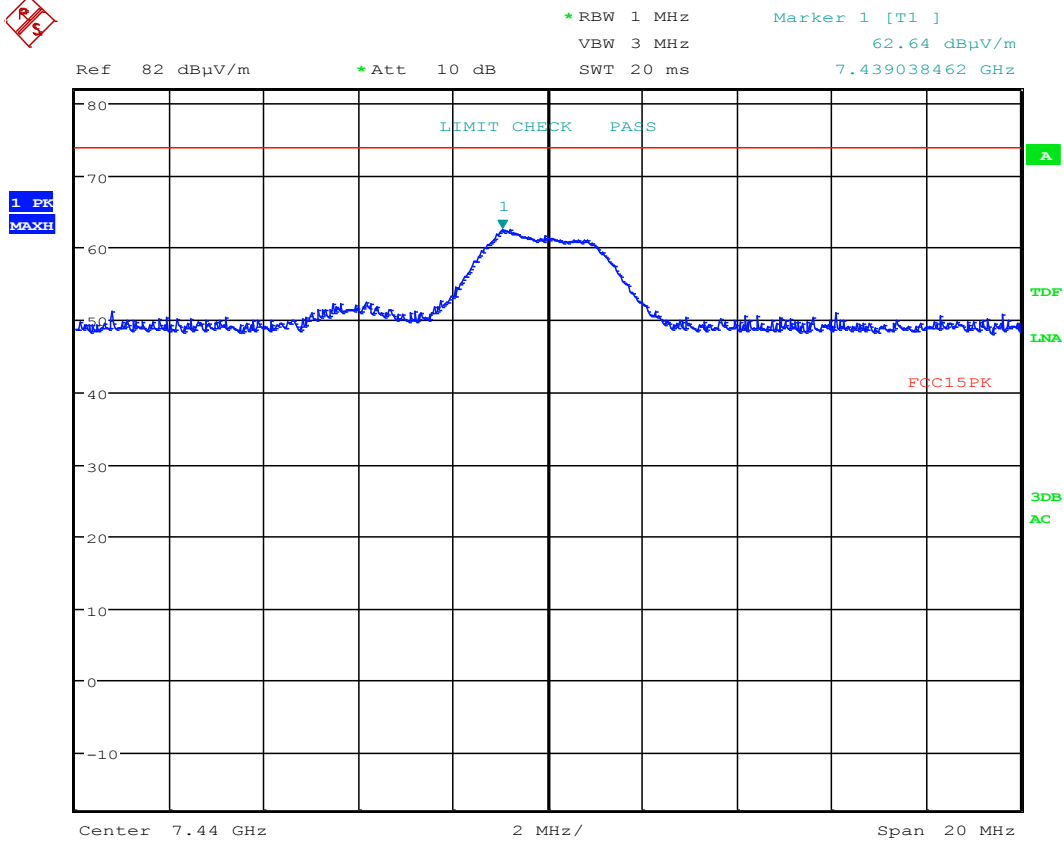
Date: 28.APR.2016 11:29:25

Radiated emissions, 7320 MHz, 2440 MHz, VP, EUT H2



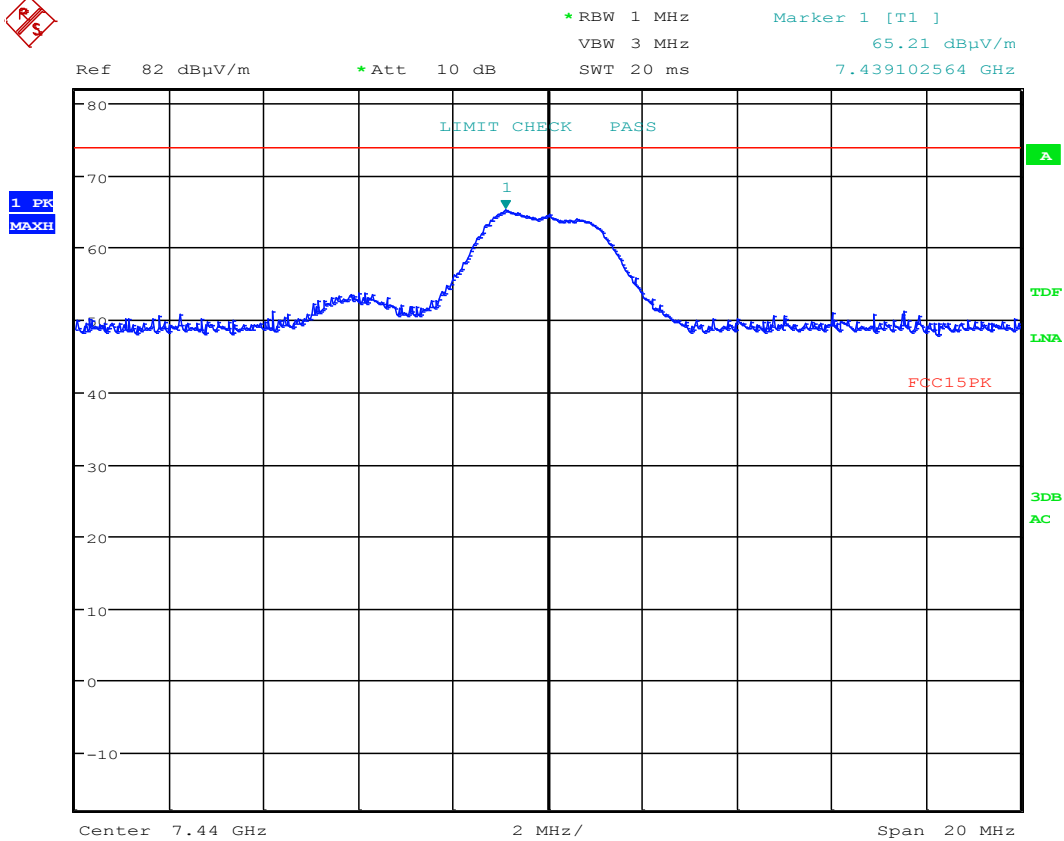
Date: 28.APR.2016 11:27:49

Radiated emissions, 7320 MHz, 2440 MHz, HP, EUT H2



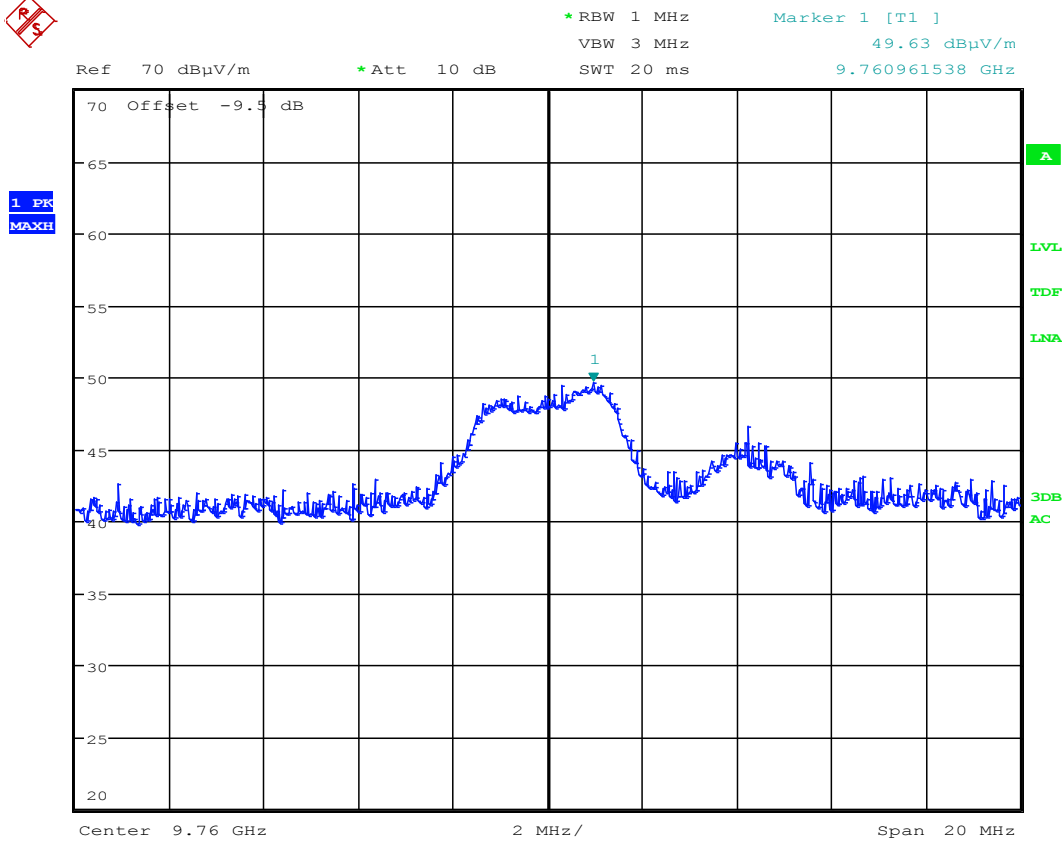
Date: 28.APR.2016 10:59:43

Radiated emissions, 7440 MHz, 2480 MHz, VP, EUT H1



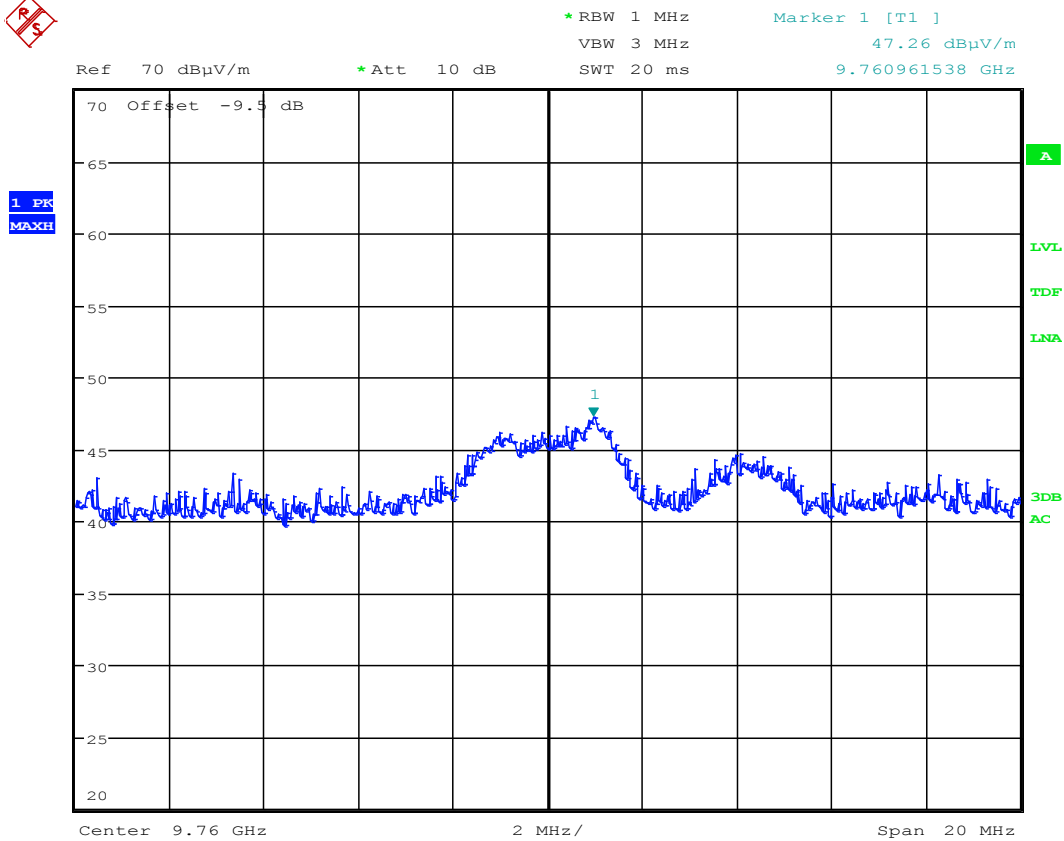
Date: 28.APR.2016 10:58:13

Radiated emissions, 7440 MHz, 2480 MHz, HP, EUT H1



Date: 28.APR.2016 13:21:18

Radiated emissions, 9760 MHz, 2440 MHz, VP



Date: 28.APR.2016 13:21:53

Radiated emissions, 9760 MHz, 2440 MHz, HP

3.6 Power Spectral Density (PSD)

Para. No.: 15.247 (d)

Test Results: Passed

Measured and Calculated Data:

The measurement procedure for PKPSD described in ANSI C63.10-2013 was used.

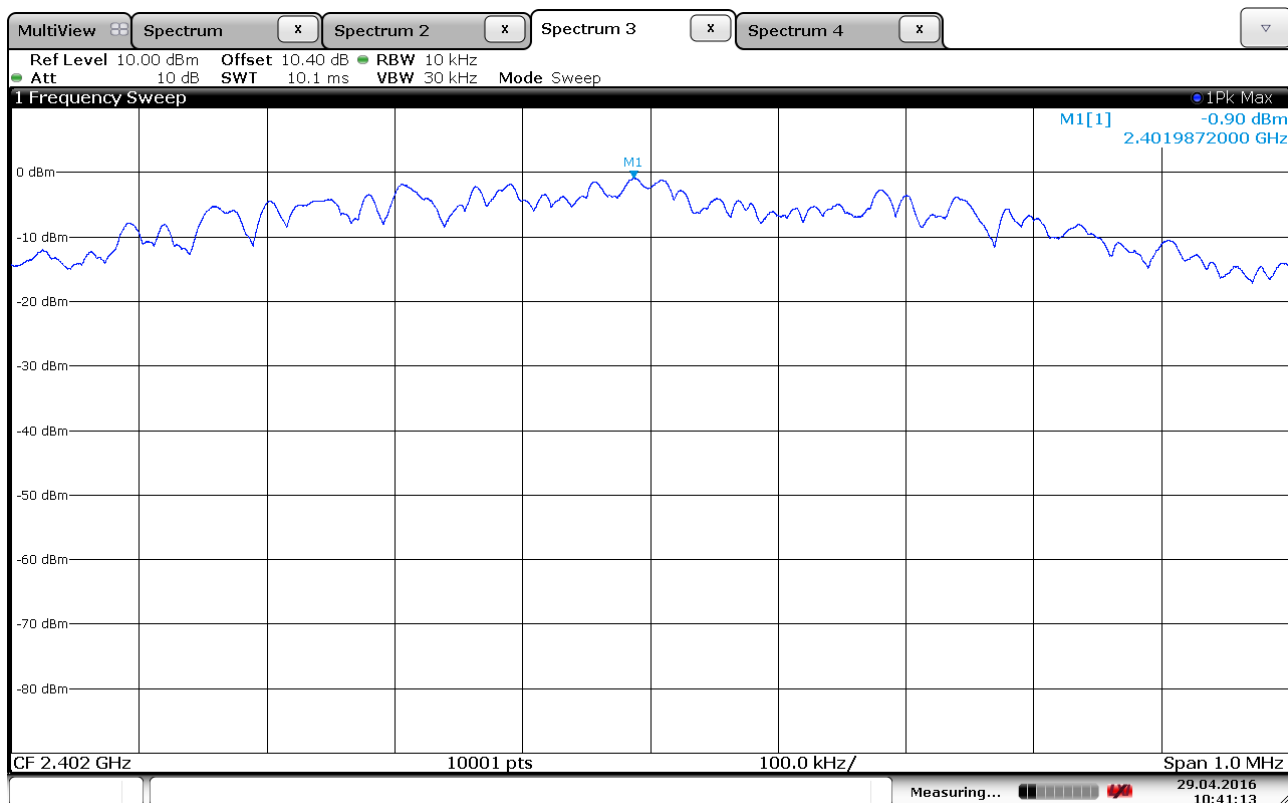
	2402 MHz	2440 MHz	2480 Mhz
Measured value (dBm)	-0.9	-0.4	-0.2

Measured with 10kHz RBW

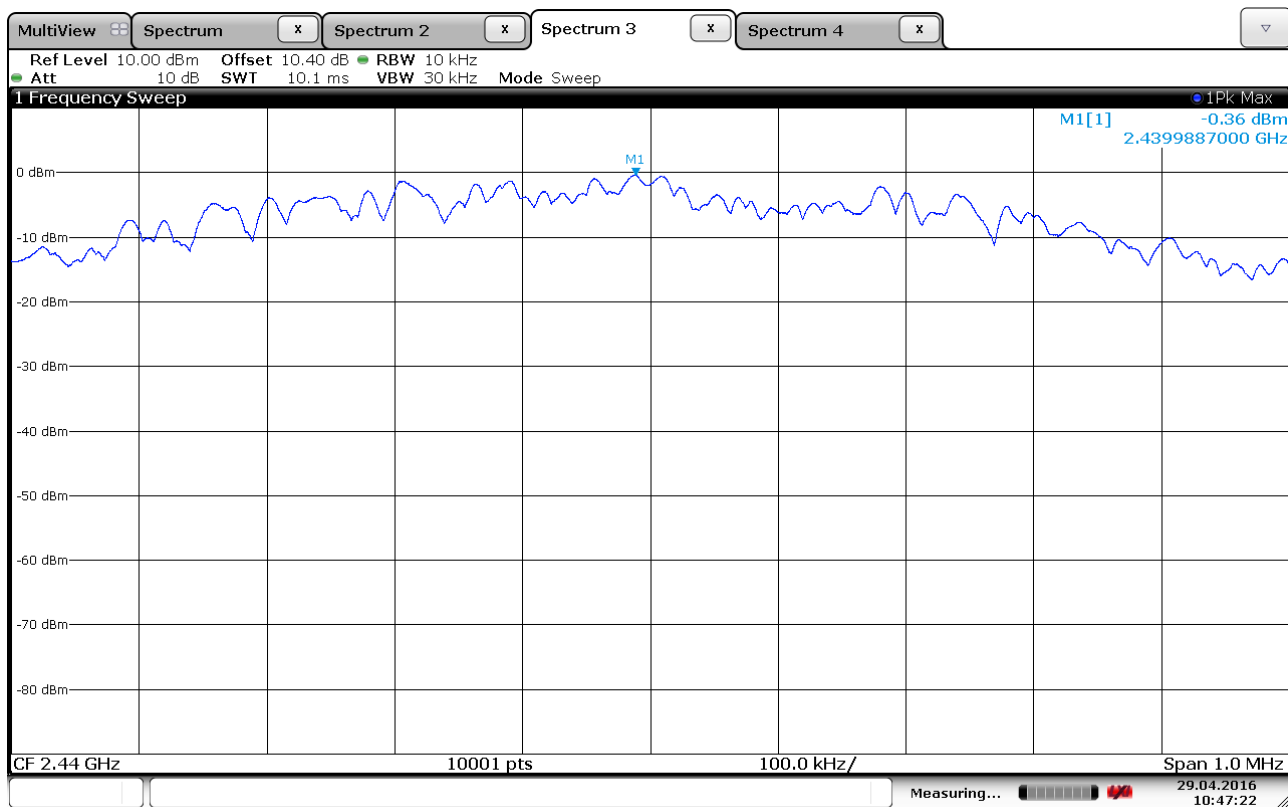
Requirements:

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

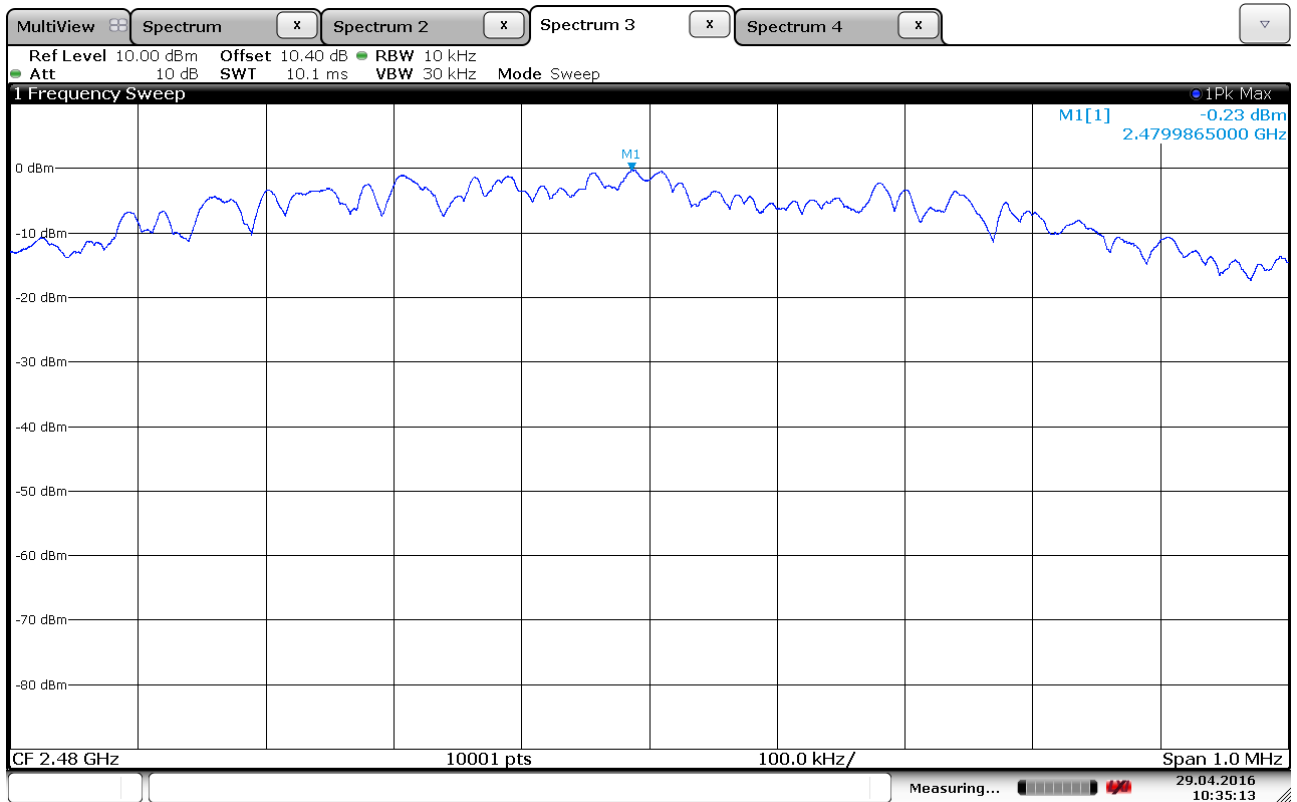
No requirements for Frequency Hopping Systems.



Power Spectral Density, 2402 MHz



Power Spectral Density, 2440 MHz



Power Spectral Density, 2480 MHz

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.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2015.10	2016.10
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2015.11	2016.11
3	6810.17B	Attenuator	Suhner	LR 1669	Cal b4 use	
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
5	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2017.12
6	HL223	LogPeriod Antenna	Rohde & Schwarz	LR 1261	2013.12	2017.12
7	3115	Horn Antenna	EMCO	LR 1226	2013.12	2018.12
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2015.10	2016.10
9	HP 10855A	Pre-amplifier	Hewlett Packard	LR 1445	2015.10	2016.10
10	PM7320X	Antenna horn	Siverts lab	LR 103	2009.01.26	2017.01.26
11	DBF-520-20	Antenna horn	Systron Donner	LR 101	2009.01.26	2017.01.26
12	638	Antenna Horn	Narda	LR 1480	2010.06	2020.06
14	642	Antenna Horn	Narda	LR 220	2009.01	2017.01
15	HFH2-Z2	Active Loop Antenna	Rohde & Schwarz	LR 1660	2014.10	2017.10
16	Model 87V	Multimeter	Fluke	N-4669	2015.10	2016.10
17	ESHS10	EMI	Rohde & Schwarz	N-3528	2015.08	2016.08
18	ESH3-Z5	Two-line V-Network	Rohde & Schwarz	LR 1076	2014.04.23	2016.04.23
19	ESH3-Z2	Pulse limiter	Rohde & Schwarz	LR 1074	2015.03.05	2017.03.05
20	6812B	AC power Source	Agilent	LR 1515	2015.12	2016.12

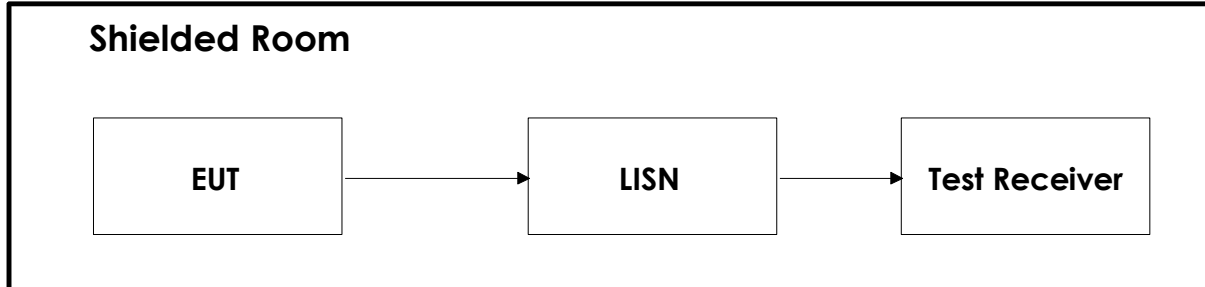
USB Power Adaptor Used during testing:

Power Line Conducted tests: Trust 19160, Mfd. 2015-08-07

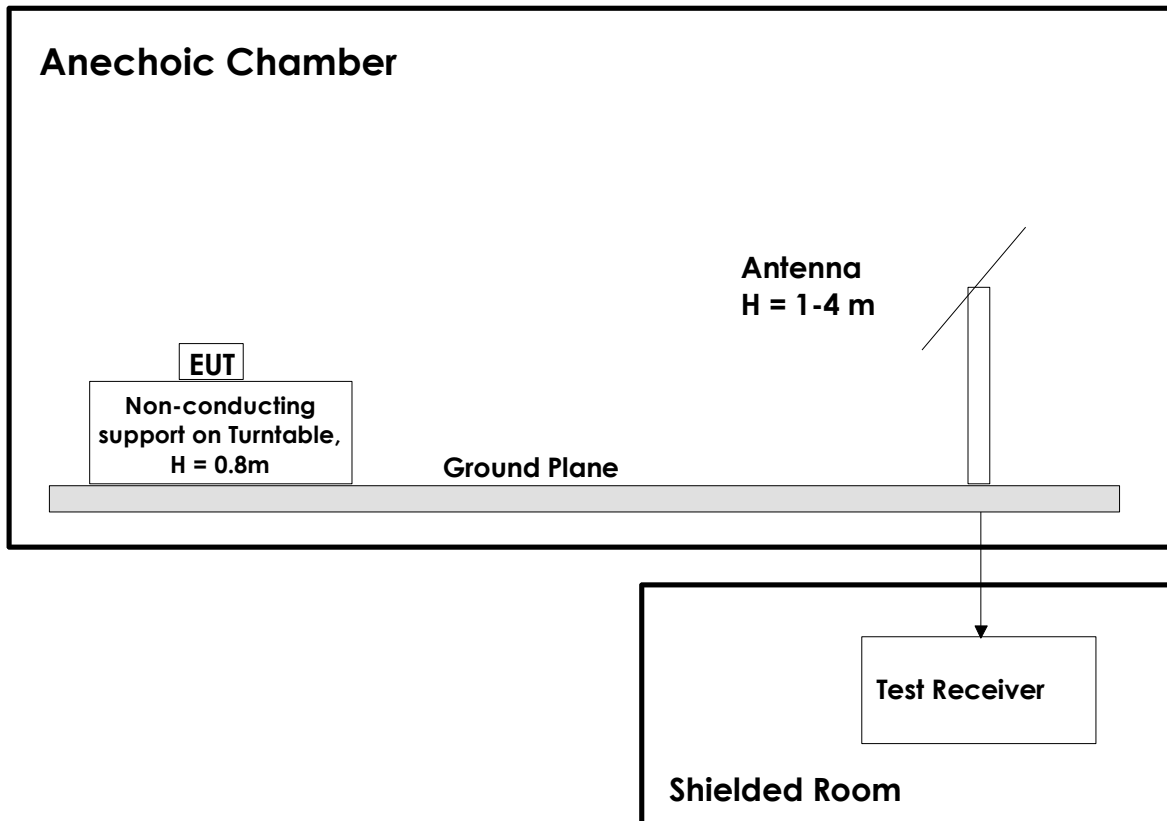
The adaptor is property of Nemko and has EU plug, but all tests were performed with 120V 60Hz AC.

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



Revision history

Version	Date	Comment	Sign
1.0	2016.07.01	First edition	FS