Report No. 292268-3

Test Report

Product	Bluetooth Transceiver in Desktop IP Phone
Name and address of the applicant	Panasonic System Networks Co., Ltd. 1-62,4-Chome, Minoshima, Hakata-ku, Fukuoka 812-8531, Japan
Name and address of the manufacturer	Panasonic System Networks Co., Ltd. 1-62,4-Chome, Minoshima, Hakata-ku, Fukuoka 812-8531, Japan
Model	KX-HDV330
Rating	12V DC (AC Adaptor, 1.5A; 100-240 V AC, 50/60 Hz, 1.2-0.6 A) 48V DC (Power over Ethernet, 135mA)
Trademark	Panasonic
Serial number	S11CA000081 / S11CA000081
Additional information	Bluetooth 2.1, VoIP, SIP, Power over Ethernet
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	292268
Tested in period	2015.08.25 to 2015.08.28
Issue date	2015.10.02
Name and address of the testing laboratory	Nemko 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 [Frode Sveinsen]	Approved by [G.Suhanthakumar]

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1 INFORMATION

1.1 Test Item

Name :	Panasonic
FCC ID :	ACJ96NKX-HDV330
Industry Canada ID :	216A-KXHDV330
Model/version :	KX-HDV330
Serial number :	Radiated sample: S11CA000081 Conducted sample: S11CA000069
Hardware identity and/or version:	BlueTooth unit PNLB2118 (KX-HDV330 PNLB2455S1)
Software identity and/or version :	BlueTooth unit Ver.1198 (KX-HDV330 Ver.00.017)
Frequency Range :	2402 – 2480 MHz
Number of Channels :	Minimum 20 and Maximum 79 (Adaptive Frequency Hopping)
Operating Modes :	Bluetooth Headset Mode
Type of Modulation :	Digital (GFSK)
User Frequency Adjustment :	None
Rated Output Power :	6.2 mW
Type of Power Supply :	AC Adaptor
Antenna Connector :	None
Antenna Diversity Supported :	No
Desktop Charger :	N/A

Description of Test Item

The EUT is a desktop IP telephone with Bluetooth Transceiver for connection of a BT headset.

Exposure Evaluation

The EUT is designed to be fixed to a wall etc. and 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 mobile or fixed 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:	20.8 – 22.1 °C
Relative humidity:	40 - 54 %
Normal test voltage:	120 V AC, 60 Hz

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen / Thanh Tran

1.4 Test Equipment

See list of test equipment in clause 5.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-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
DSS 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)	Complies
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)	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3)	Complies
Time of Occupancy	15.247(a)(1)(iii)	5.1 (5)	Complies
Occupied Bandwidth	15.247(a)(1)	5.1 (7)	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1)	N/A[1]
Peak Power Output	15.247(b)	5.4 (5)	Complies
Power Spectral Density	15.247(d)	5.2 (2)	N/A[1]
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

[1] Not applicable for Frequency Hopping equipment.

2.3 Description of modification for Modification Filing

Not applicable.

2.4 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.

2.5 Family List Rational

Not Applicable.

3 TEST RESULTS

3.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: Thanh Tran	**Date of Test: 27-Aug-2015 and 4-sept-2015**

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

Test Results: Complies.

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

Highest measured value (L1 and N):

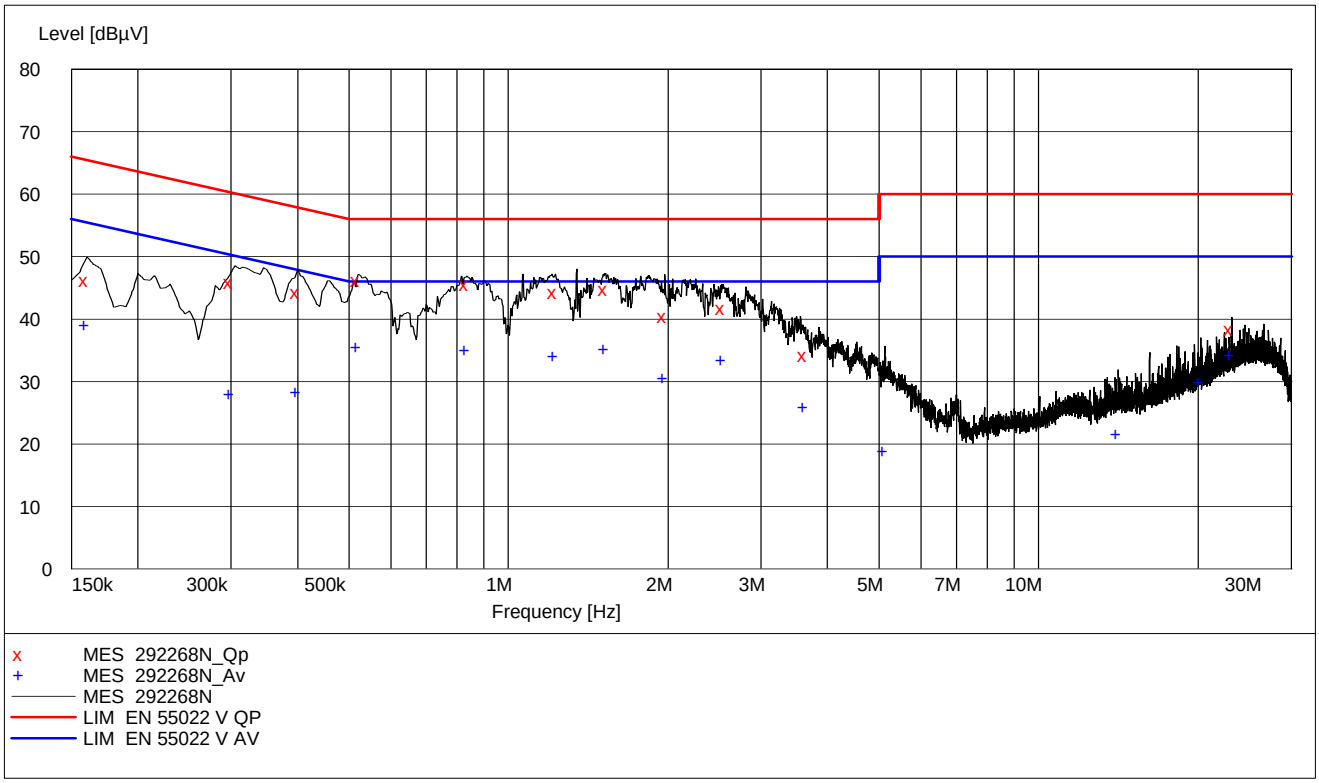
AC Adaptor:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.160000	46.30	10.70	65.50	19.20	QP	L1	Pass
0.300000	45.90	10.50	60.20	14.30	QP	L1	Pass
0.400000	44.30	10.40	57.90	13.60	QP	N	Pass
0.520000	46.30	10.20	56.00	9.70	QP	N	Pass
0.835000	45.60	10.20	56.00	10.40	QP	N	Pass
1.225000	44.40	10.40	56.00	11.60	QP	N	Pass
1.525000	44.80	10.40	56.00	11.20	QP	N	Pass
1.975000	40.50	10.40	56.00	15.50	QP	L1	Pass
2.545000	41.80	10.40	56.00	14.20	QP	L1	Pass
3.630000	34.20	10.40	56.00	21.80	QP	N	Pass
23.130000	38.40	11.00	60.00	21.60	QP	L1	Pass
0.160000	39.10	10.70	55.50	16.40	AV	L1	Pass
0.300000	28.00	10.50	50.20	22.20	AV	L1	Pass
0.400000	28.30	10.40	47.90	19.60	AV	N	Pass
0.520000	35.50	10.20	46.00	10.50	AV	N	Pass
0.835000	35.00	10.20	46.00	11.00	AV	N	Pass
1.225000	34.00	10.40	46.00	12.00	AV	N	Pass
1.525000	35.30	10.40	46.00	10.70	AV	N	Pass
1.975000	30.50	10.40	46.00	15.50	AV	L1	Pass
2.545000	33.40	10.40	46.00	12.60	AV	L1	Pass
3.630000	25.90	10.40	46.00	20.10	AV	N	Pass
5.130000	18.80	10.50	50.00	31.20	AV	N	Pass
14.155000	21.60	10.80	50.00	28.40	AV	L1	Pass
20.260000	30.00	10.80	50.00	20.00	AV	L1	Pass
23.130000	34.20	11.00	50.00	15.80	AV	L1	Pass

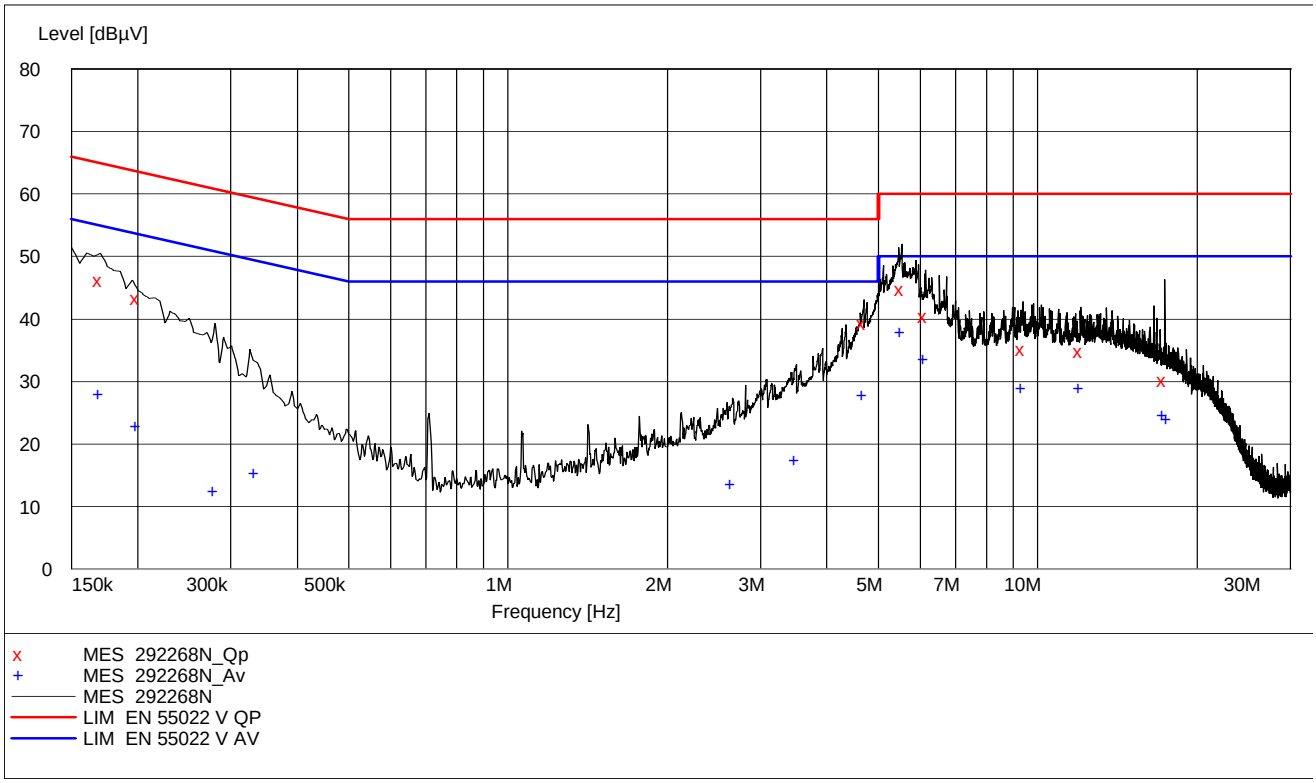
Power over Ethernet:

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.170000	46.20	10.70	65.00	18.80	QP	N	Pass
0.200000	43.40	10.70	63.60	20.20	QP	L1	Pass
4.695000	39.30	10.50	56.00	16.70	QP	L1	Pass
5.540000	44.70	10.50	60.00	15.30	QP	N	Pass
6.140000	40.40	10.60	60.00	19.60	QP	L1	Pass
9.395000	35.20	10.60	60.00	24.80	QP	N	Pass
12.055000	34.90	10.70	60.00	25.10	QP	N	Pass
17.350000	30.30	10.80	60.00	29.70	QP	L1	Pass
0.170000	28.00	10.70	55.00	27.00	AV	N	Pass
0.200000	22.90	10.70	53.60	30.70	AV	L1	Pass
0.280000	12.50	10.50	50.80	38.30	AV	N	Pass
0.335000	15.30	10.50	49.30	34.00	AV	N	Pass
2.655000	13.60	10.40	46.00	32.40	AV	L1	Pass
3.505000	17.50	10.40	46.00	28.50	AV	L1	Pass
4.695000	27.80	10.50	46.00	18.20	AV	L1	Pass
5.540000	37.90	10.50	50.00	12.10	AV	N	Pass
6.140000	33.60	10.60	50.00	16.40	AV	L1	Pass
9.395000	28.90	10.60	50.00	21.10	AV	N	Pass
12.055000	29.00	10.70	50.00	21.00	AV	N	Pass
17.350000	24.60	10.80	50.00	25.40	AV	L1	Pass
17.670000	24.10	10.80	50.00	25.90	AV	L1	Pass

Tested with NetGear GS108 Ethernet Switch.



AC Adaptor



Power over Ethernet

3.2 Channel Separation

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

Test Results: **Complies**

Measurement Data:

Channel Separation:	0.998 MHz
20 dB Bandwidth of hopping channel:	0.86 MHz
Nominal value for Channel Separation	1.0 MHz

RF channel has no influence on 20 dB bandwidth.

See attached plots

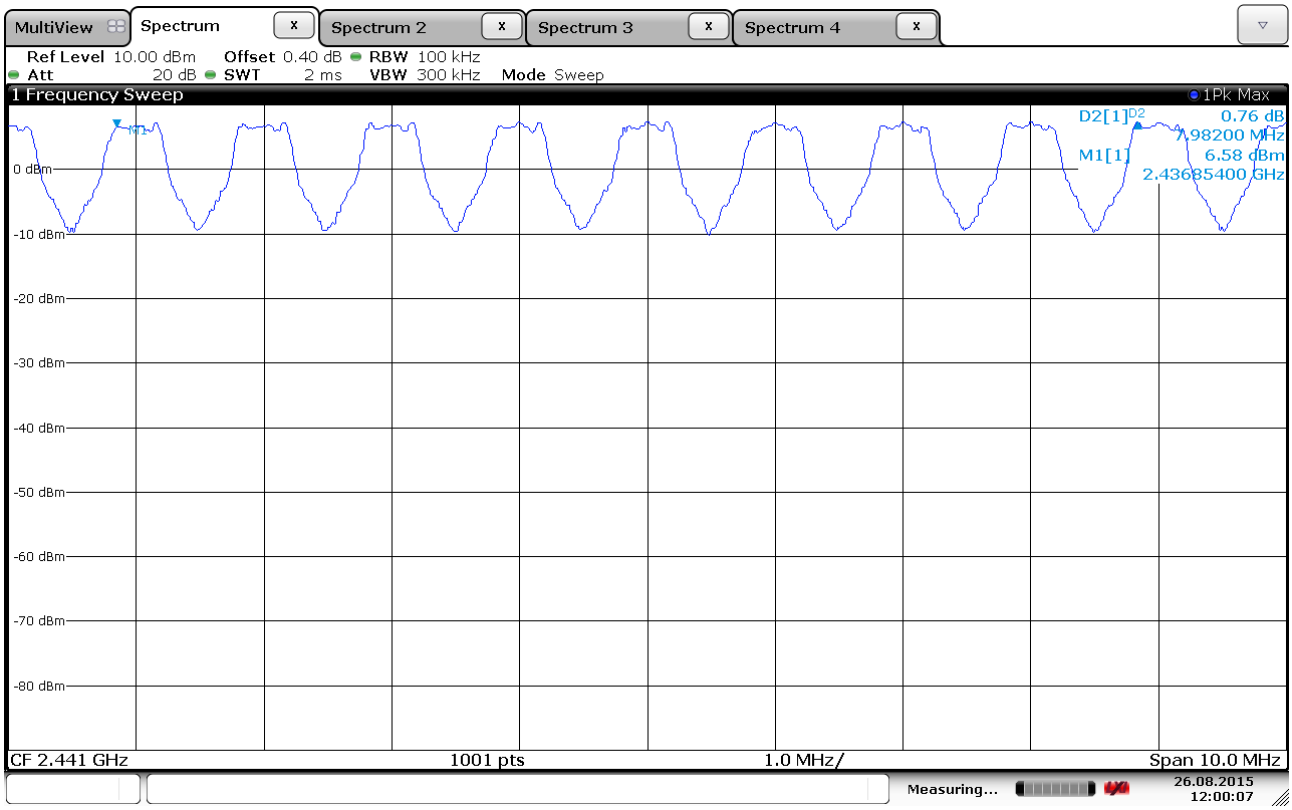
Requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

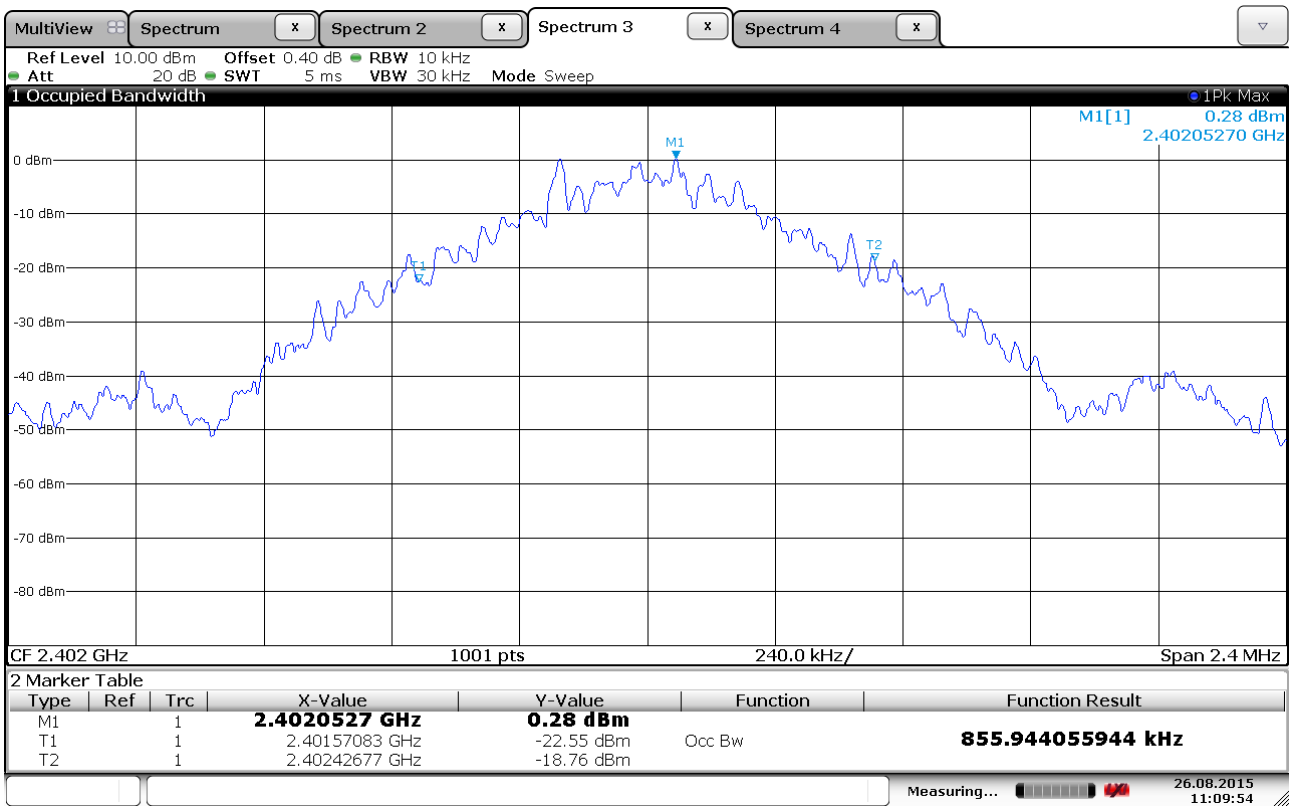
or:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125 mW.

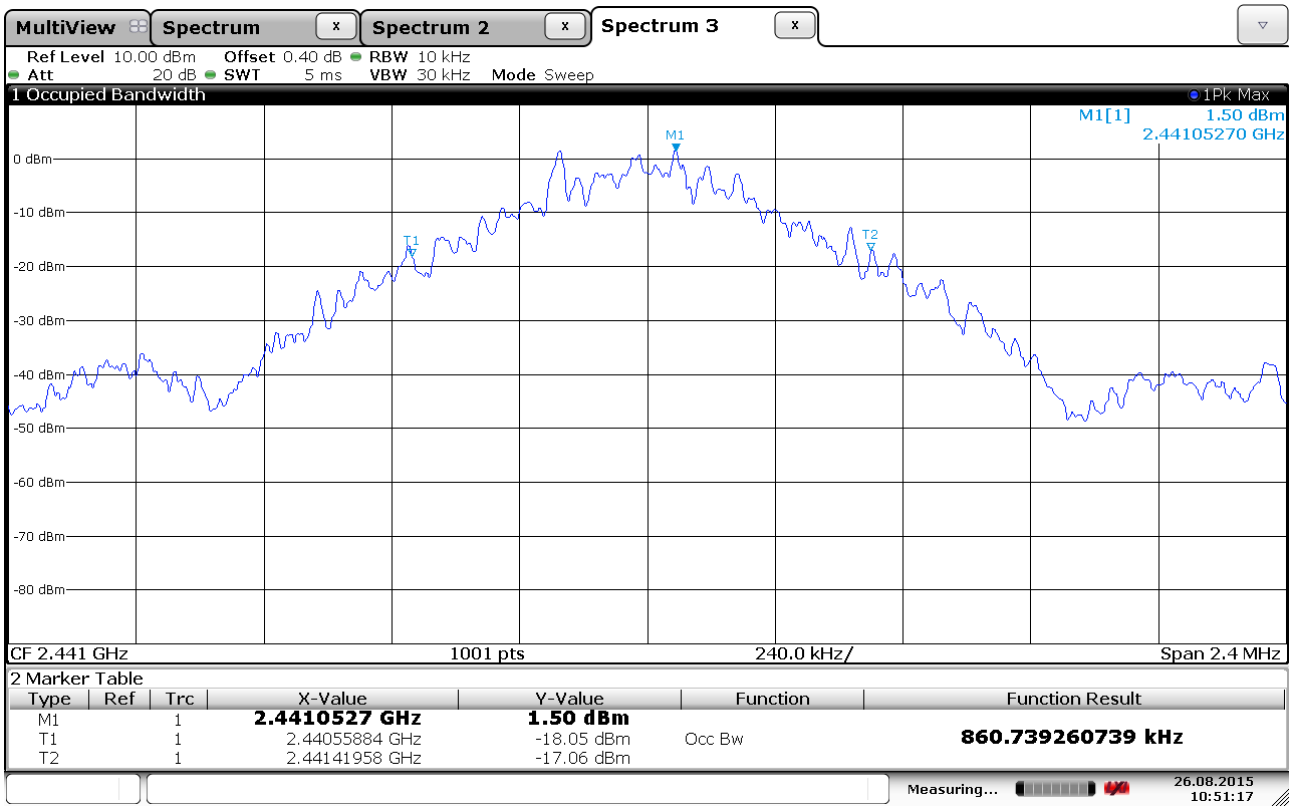
No requirements for Digital Transmission Systems.



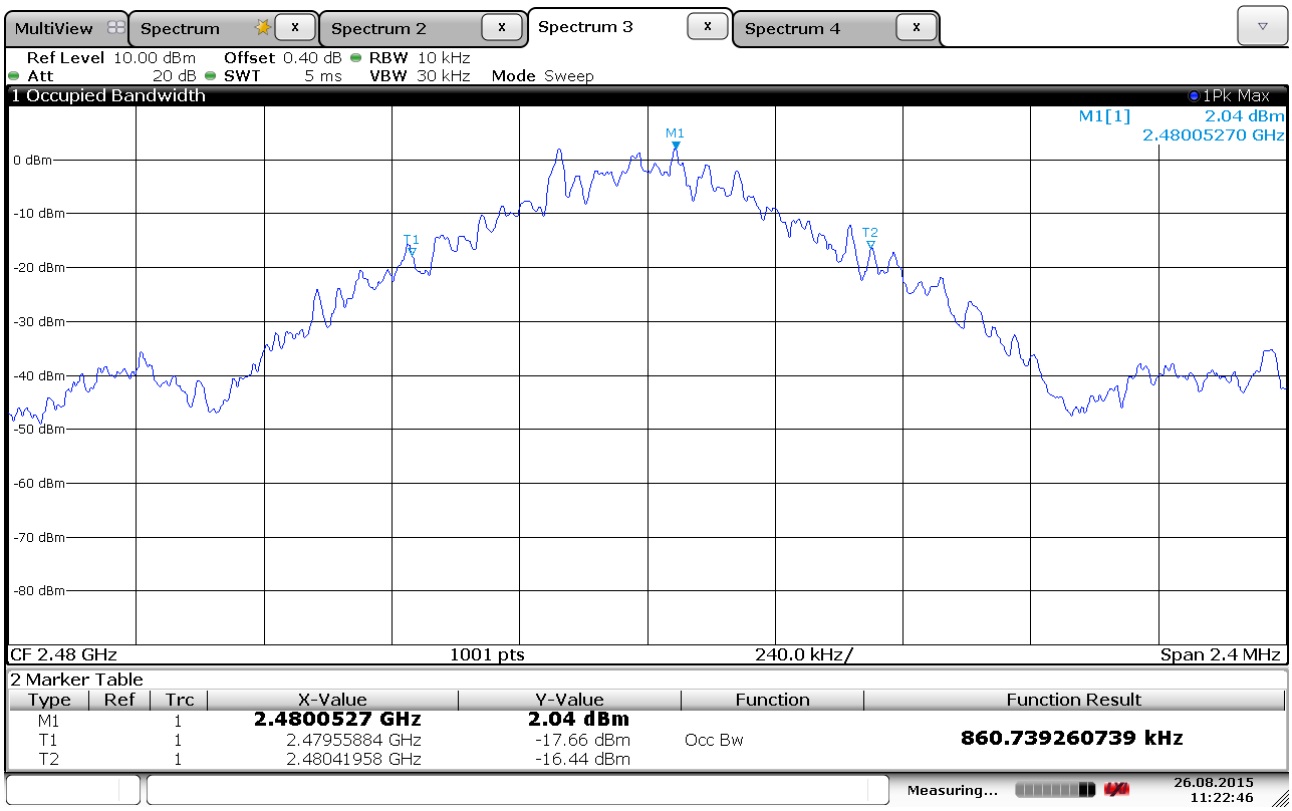
Channel Separation



20dB Bandwidth, 2402 MHz



20dB Bandwidth, 2441 MHz



20dB Bandwidth, 2480 MHz

3.3 Pseudorandom Hopping Algorithm

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

Test Results: Complies

Measurement Data: The EUT follows the Bluetooth standard.

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

No requirements for Digital Transmission Systems.

Occupancy Time

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

Test Results: Complies

Measurement Data:

	DH1	DH3	DH5
Number of RF Channels:	20 or 79		
Maximum Length of RF Burst pr. channel (ms)	0.413	1.671	2.923
Slot length (ms)	1.251	2.501	3.751
Time between RF Burst on same RF Channel (ms)	25.02	50.02	75.02
Time of Occupancy	132 ms	267 ms	312 ms

DH1:

Time between RF burst on same channel: 1.251 x 20 ms = 25.02 ms

Time of occupancy: (0.413 x 400 x 20) / 25.02 = 132 ms

DH3:

Time between RF burst on same channel: 2.501 x 20 ms = 50.02 ms

Time of occupancy: (1.671 x 400 x 20) / 50.02 = 267 ms

DH5:

Time between RF burst on same channel: 3.751 x 20 ms = 75.02 ms

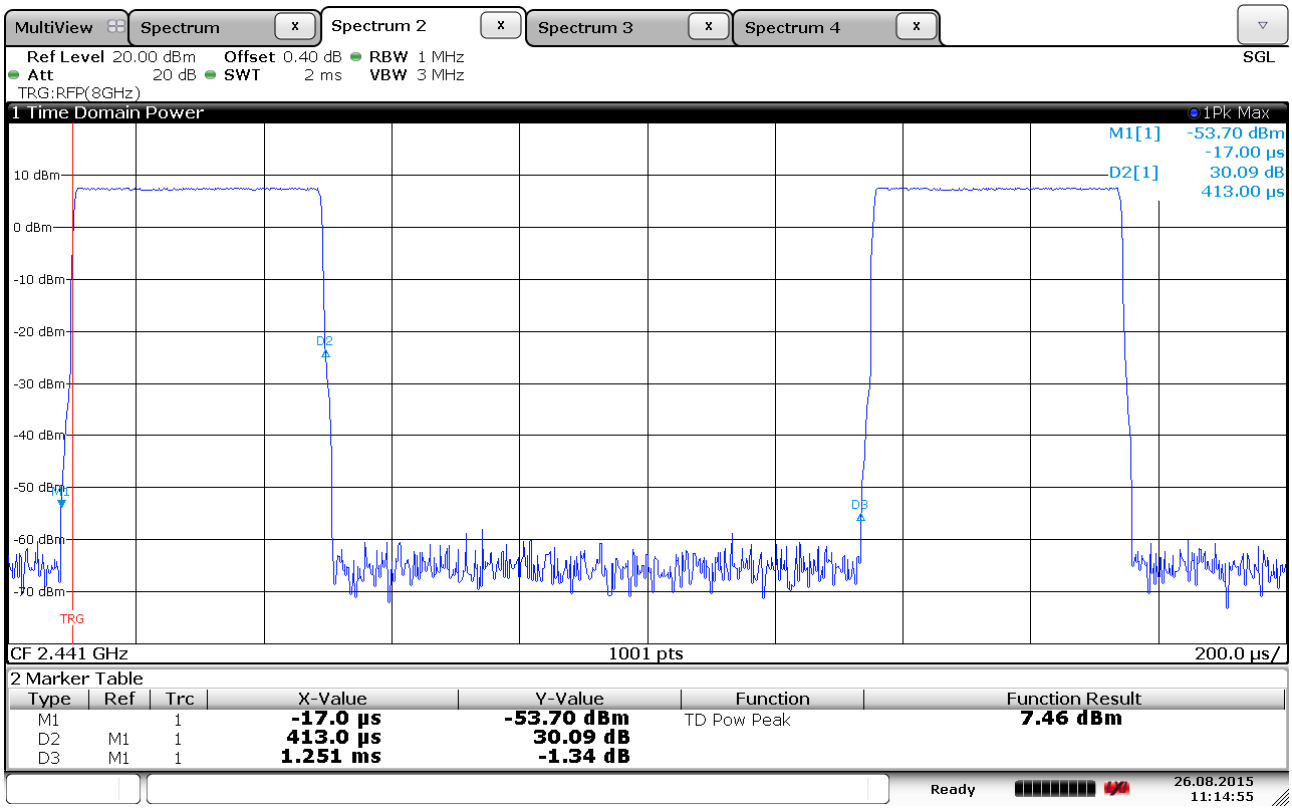
Time of occupancy: (2.923 x 400 x 20) / 75.02 = 312 ms

See attached graph.

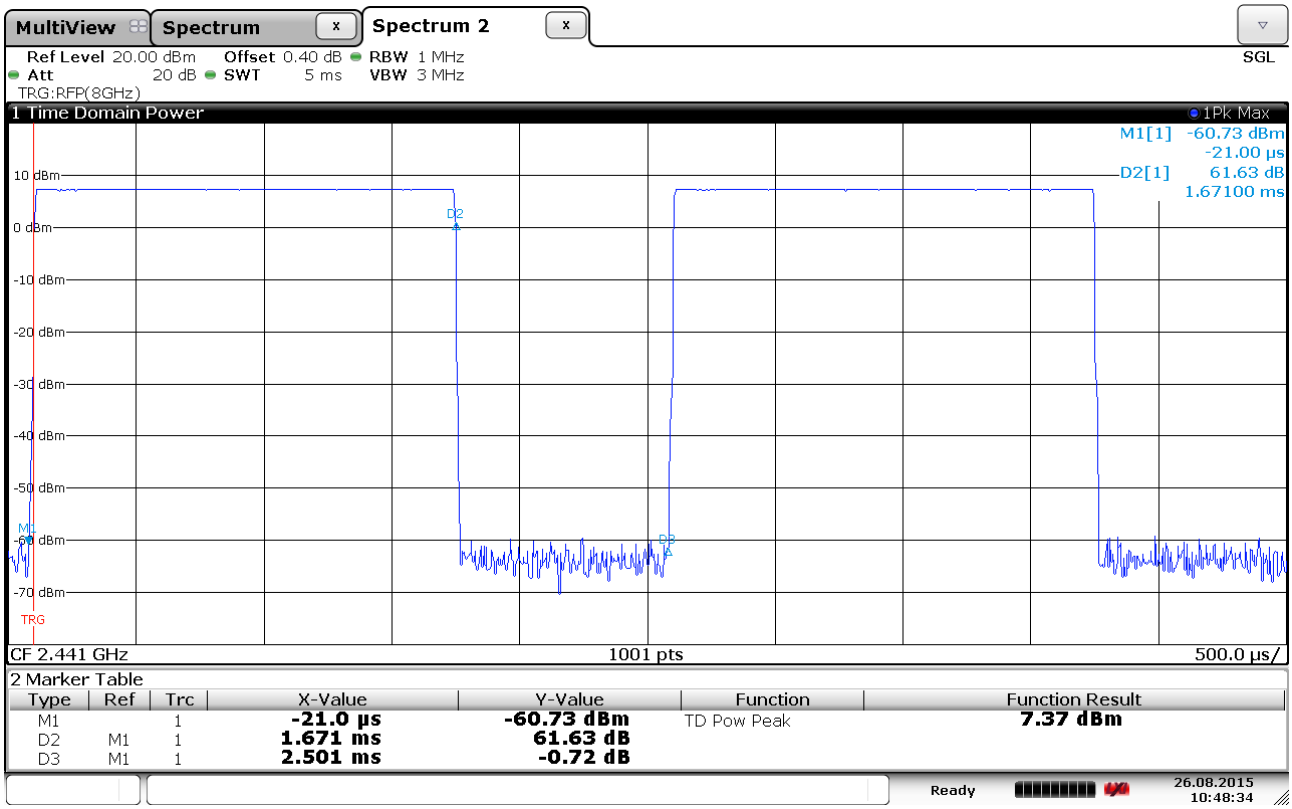
Requirements:

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

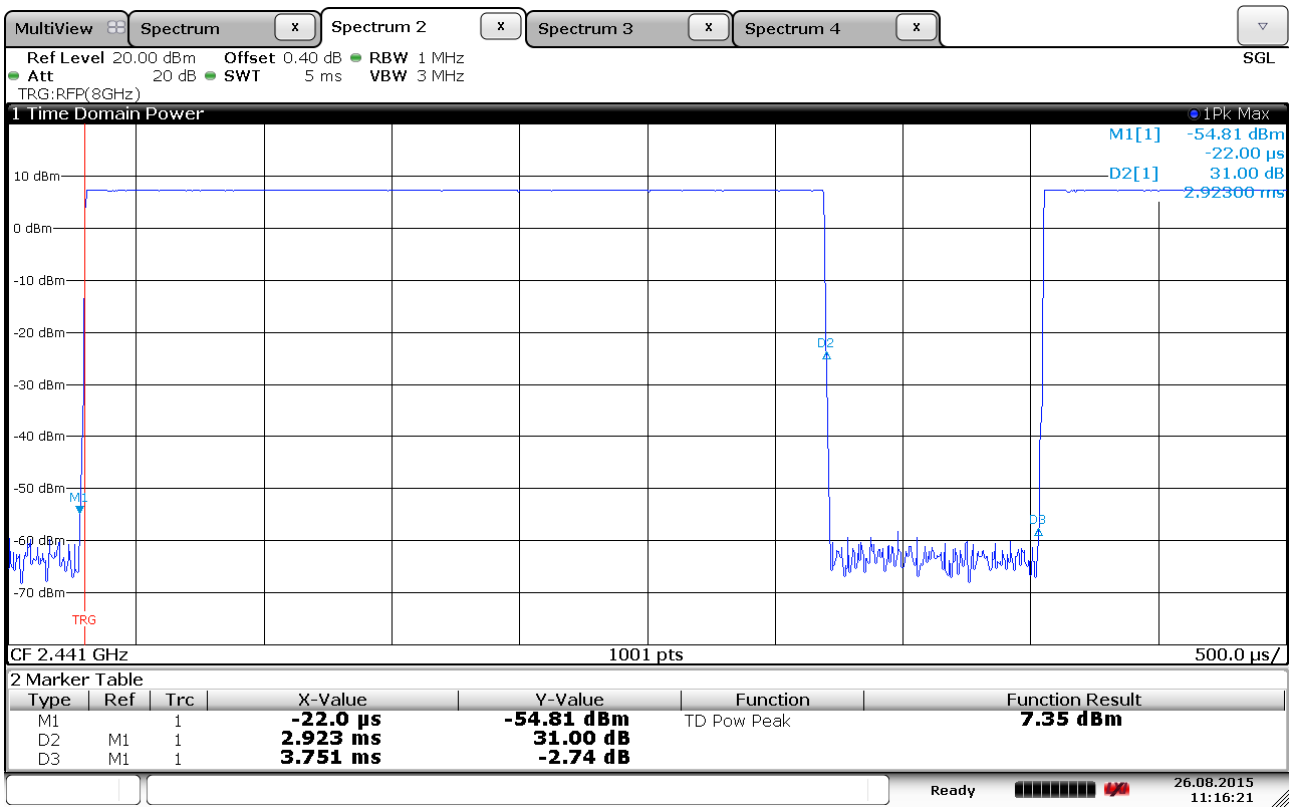
No requirements for Digital Transmission Systems.



Burst Length DH1



Burst Length DH3



Burst Length DH5

3.4 Occupied Bandwidth

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

Test Results: Complies

Measurement Data:

Number of RF Channels in use:	20 or 79
Channel Centre Frequencies:	2402 to 2480 MHz
99% BW Measured on Centre Channel (2402 MHz)	856 kHz
99% BW Measured on Centre Channel (2441 MHz)	861 kHz
99% BW Measured on Centre Channel (2480 MHz)	861 kHz

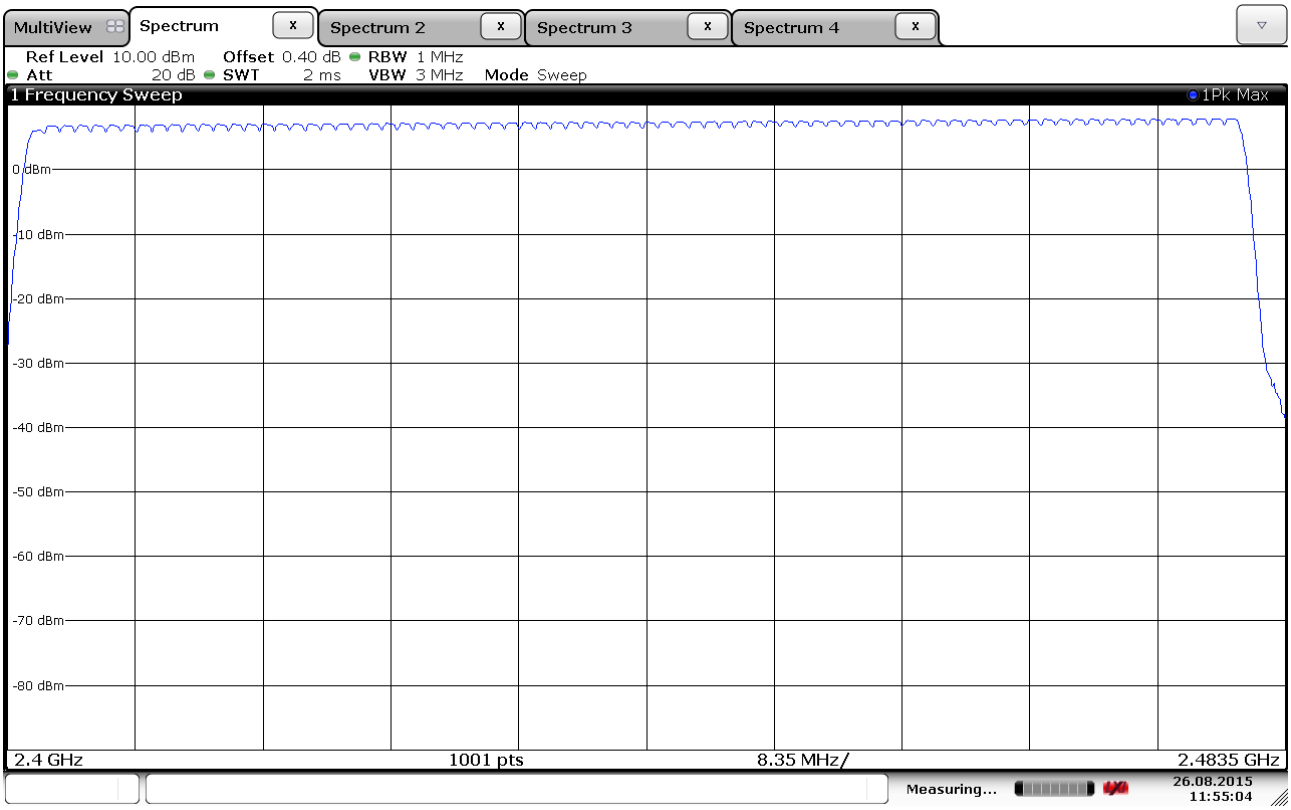
See attached plots.

Requirements:

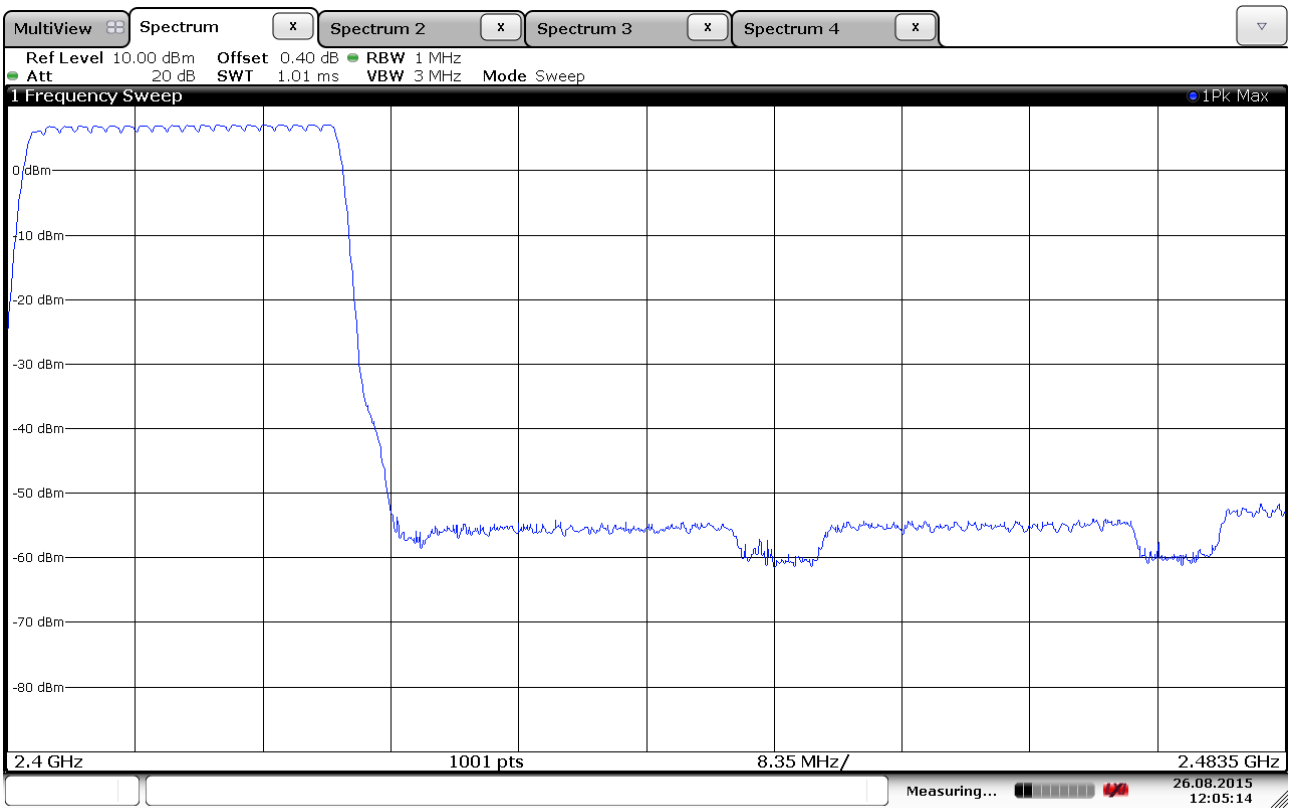
Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels. No requirements for bandwidth for this frequency band.

No requirements for Digital Transmission Systems.

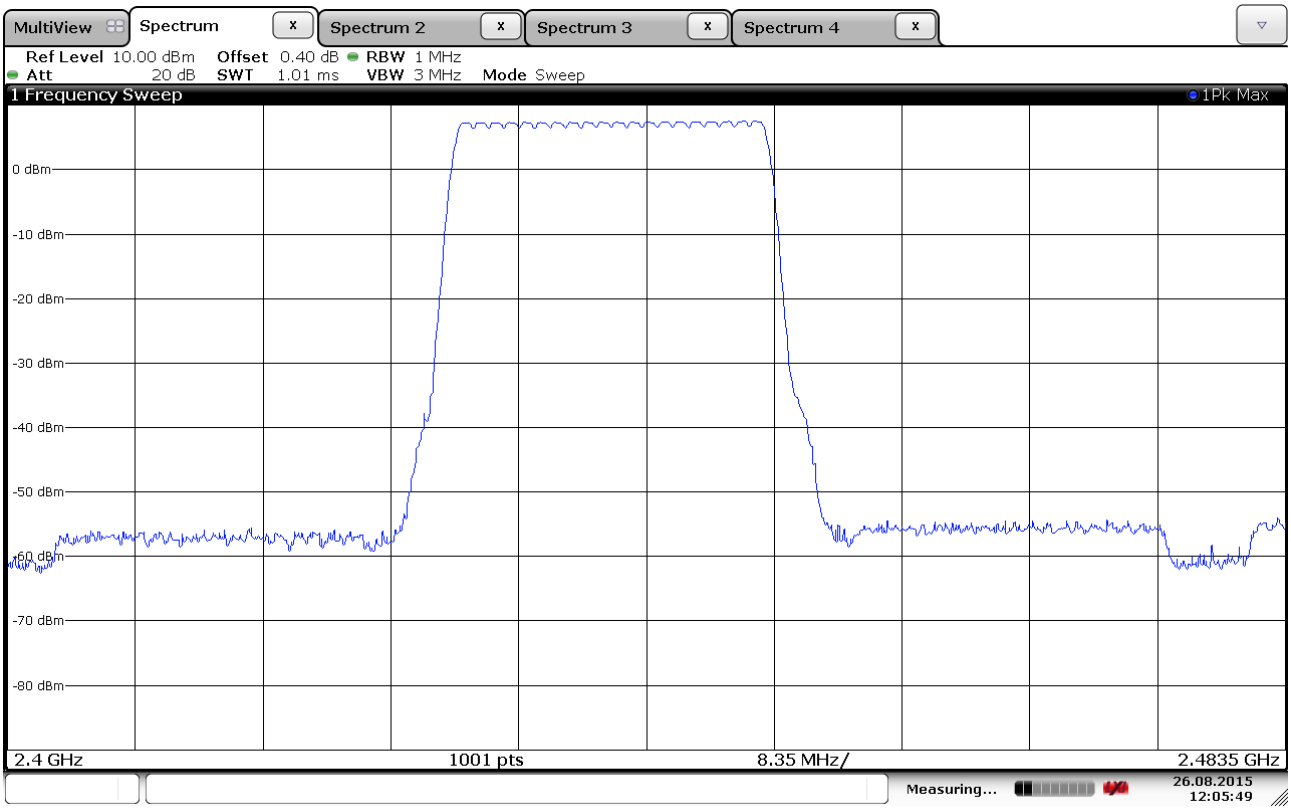
No requirement for 99% BW, reported for information only.



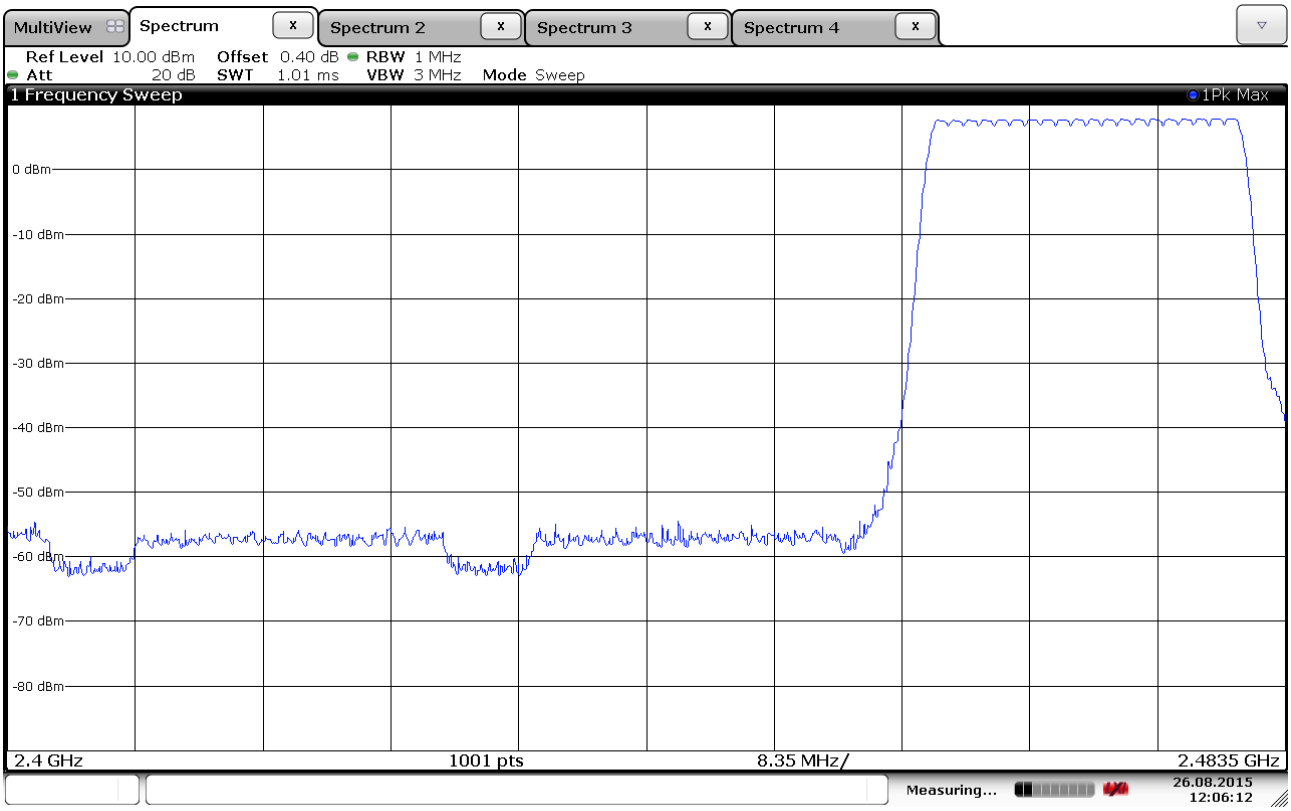
RF Channels in Use, 79 Ch



RF Channels in Use, 20 Ch, Low



RF Channels in Use, 20 Ch, Mid



RF Channels in Use, 20 Ch, High

3.5 Peak Power Output

Para. No.: 15.247 (b)

Test Results: Complies

Measurement Data:

	2402 MHz	2441 MHz	2480 MHz
Conducted Power (dBm)	6.14	7.43	7.92
Conducted Power (Watts)	0.0041	0.0055	0.0062
Field Strength (dBµV/m)	104.2	106.2	106.3
EIRP, Calculated (Watts)	0.0079	0.0125	0.0128
Antenna gain (dBi)	2.8	3.5	3.2

Antenna gain = 10*log(EIRP/Conducted power) dBi

EIRP is calculated from measured field strength by the formulas in KDB 412172 D01 Determining ERP and EIRP v02.

See attached plots

Detachable antenna? ☐ Yes ☒ No

If detachable, is the antenna connector non-standard? ☐ Yes ☐ No

Type of antenna connector: N/A

Requirements:

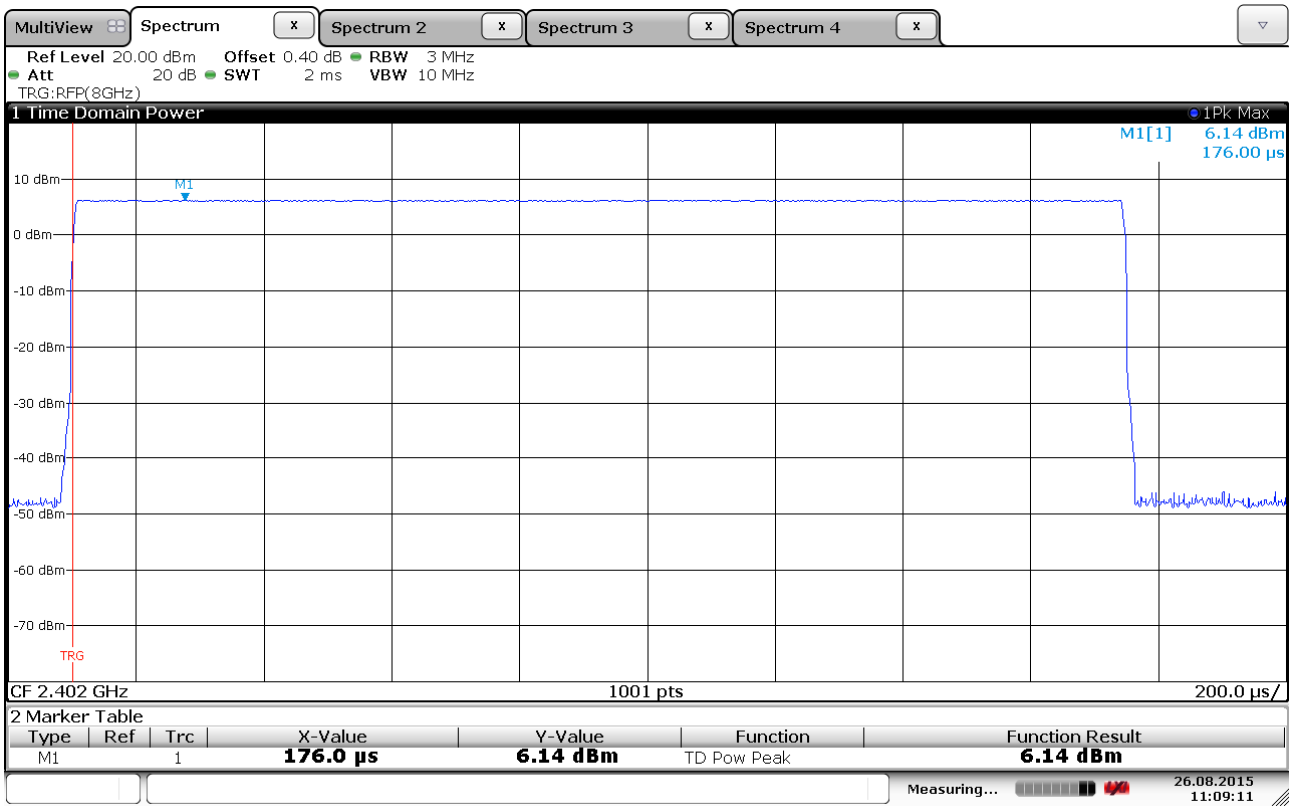
The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

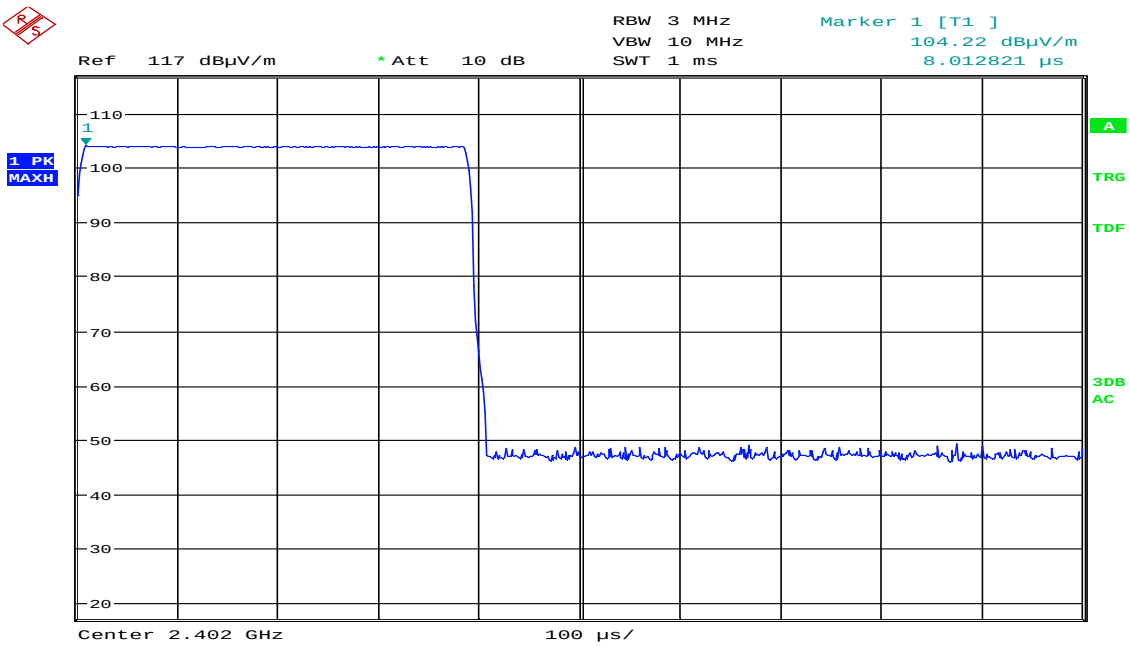
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

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 Power, 2402 MHz



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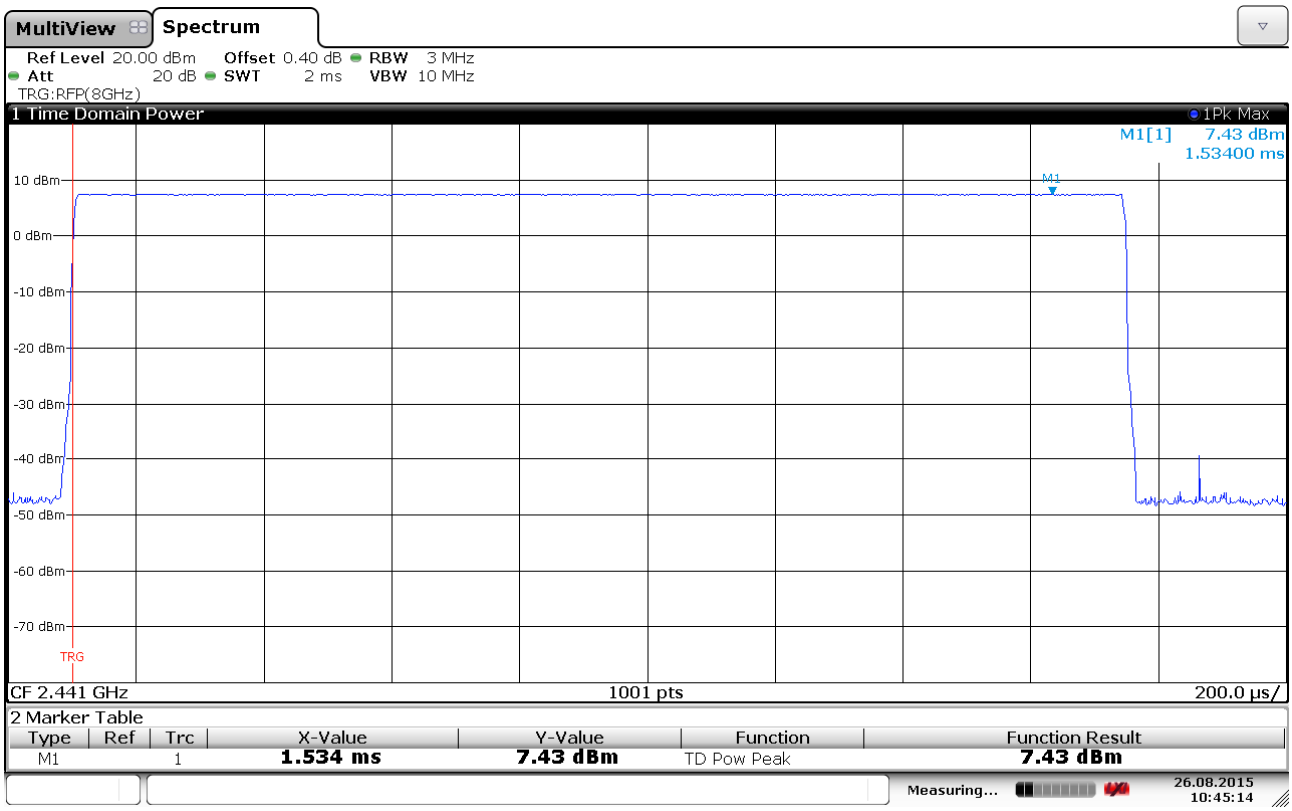
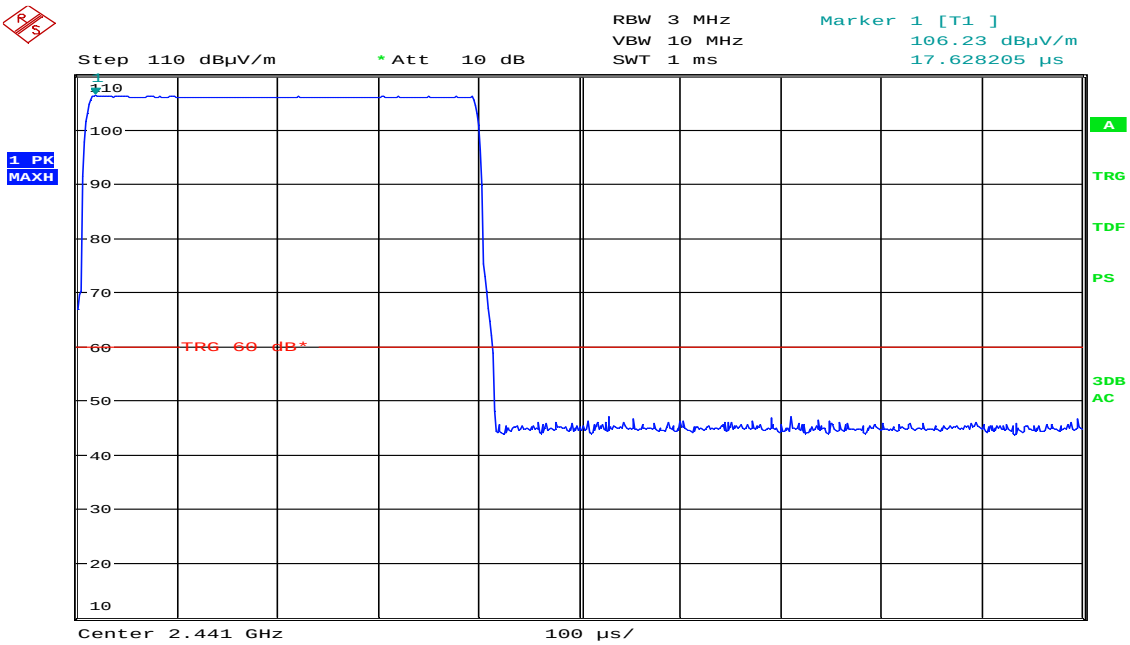
Radiated Power, 2402 MHz (EUT V, HP)



Conducted Power, 2441 MHz



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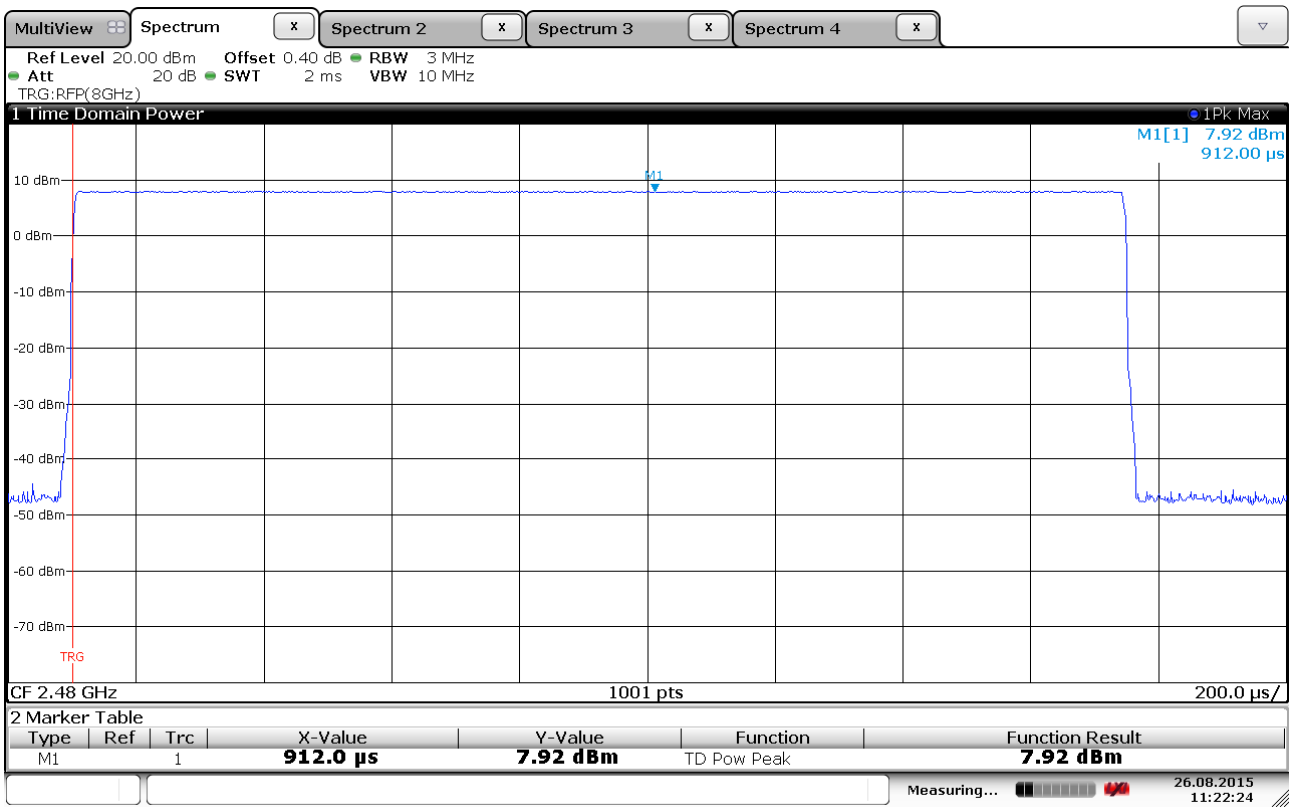
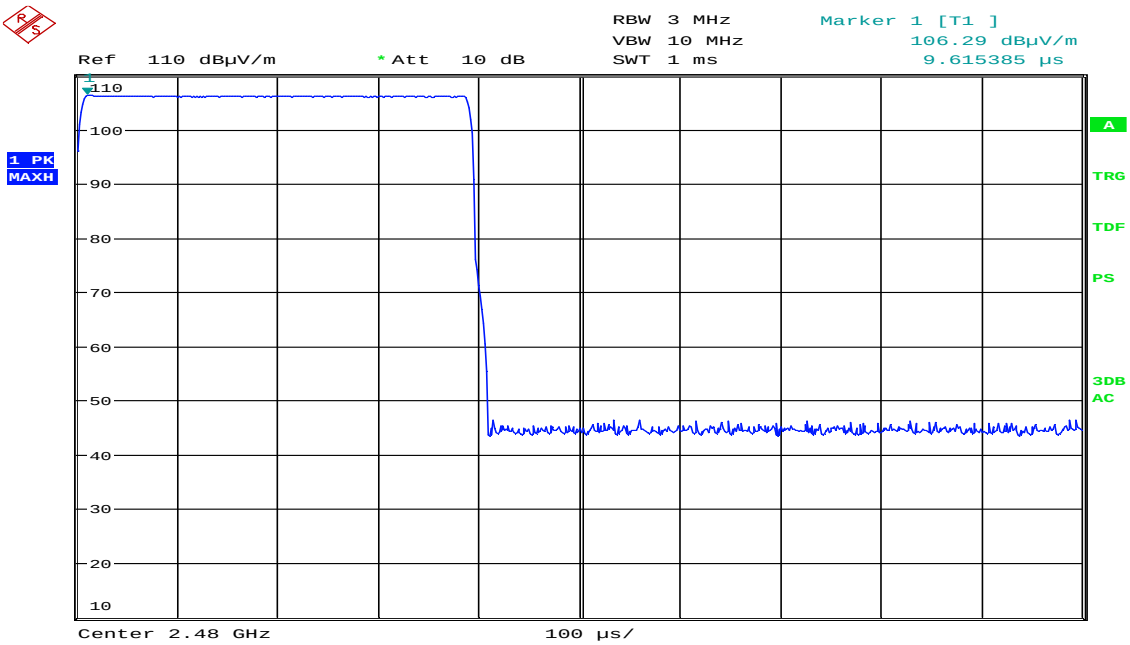
Radiated Power, 2441 MHz (EUT V, HP)



Conducted Power, 2480 MHz



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Radiated Power, 2480 MHz (EUT V, HP)

3.6 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Results: Complies

Measurement Data:

Band-Edge Spurious Emissions

	Measured field strength (dBµV/m)		Limit	Margin	
	2390 MHz	**2483.5 MHz**	**dBµV/m**	**dB**	
Peak Detector	42.8*	64.9	74	>30	9.1
Average Detector	N/A	44.9	54	>20	9.1

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

See attatched plots.

Duty Cycle Correction Factor Calculation:

Duty Cycle = slot length / (frame length * number of hopping channels)

Duty Cycle Correction factor = -20 x log(Duty Cycle) > 20 dB

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

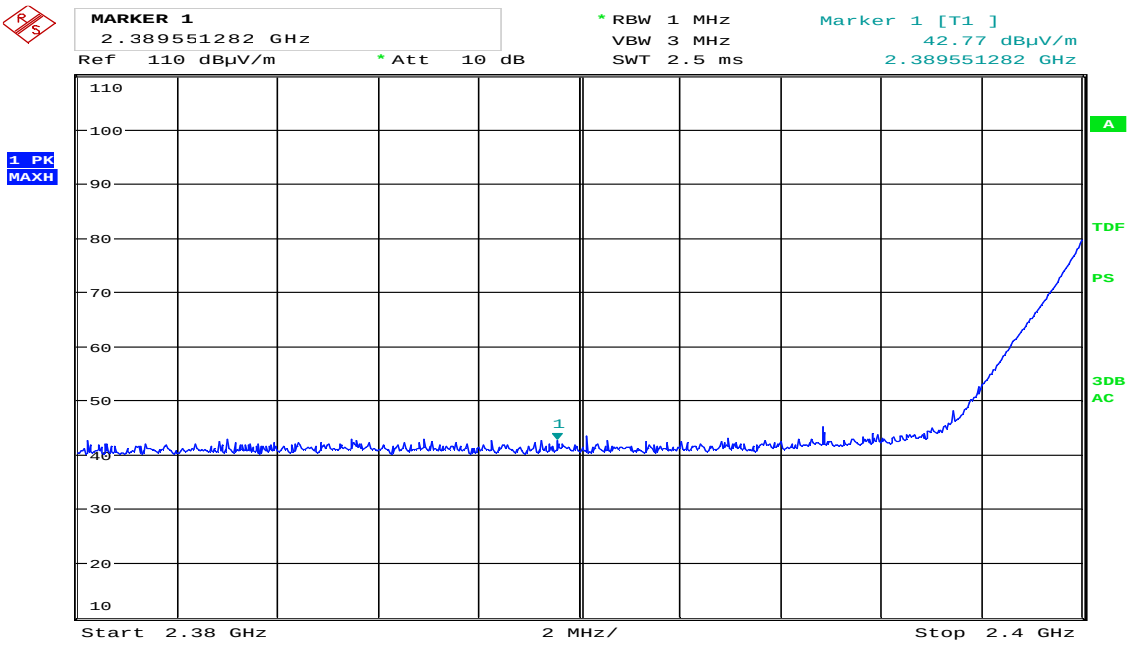
RF conducted power to 25 GHz see attached plots.

Maximum RF level outside operating band:

RF ch 00: >50 dB/C, margin >30 dB

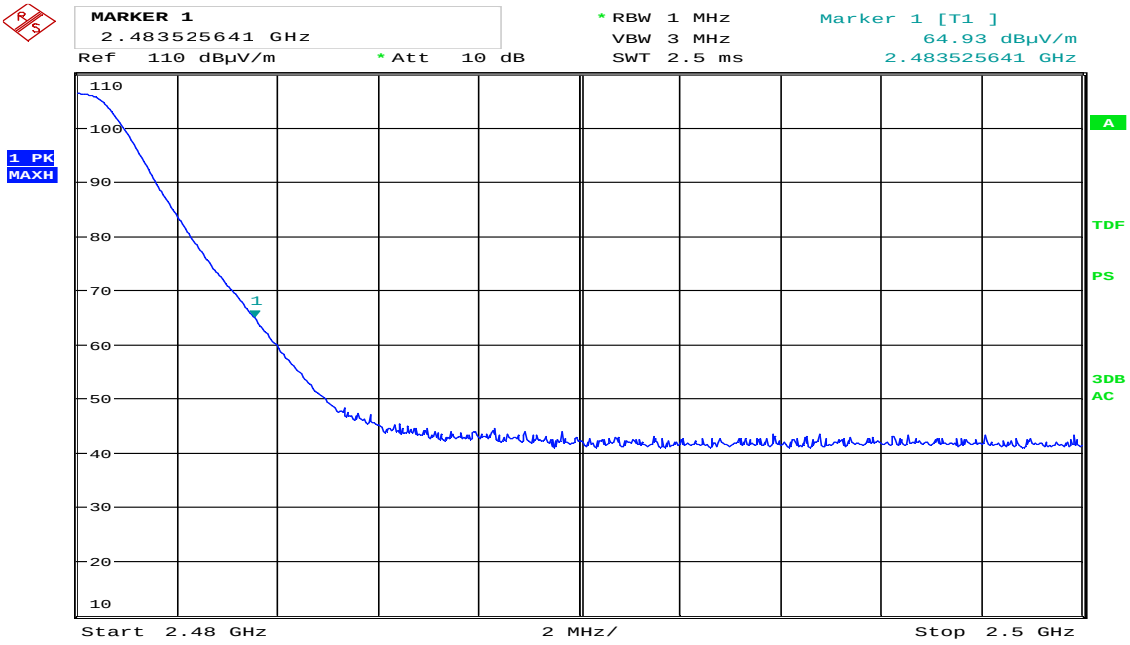
RF ch 39: >50 dB/C, margin >30 dB

RF ch 78: >50 dB/C, margin >30 dB



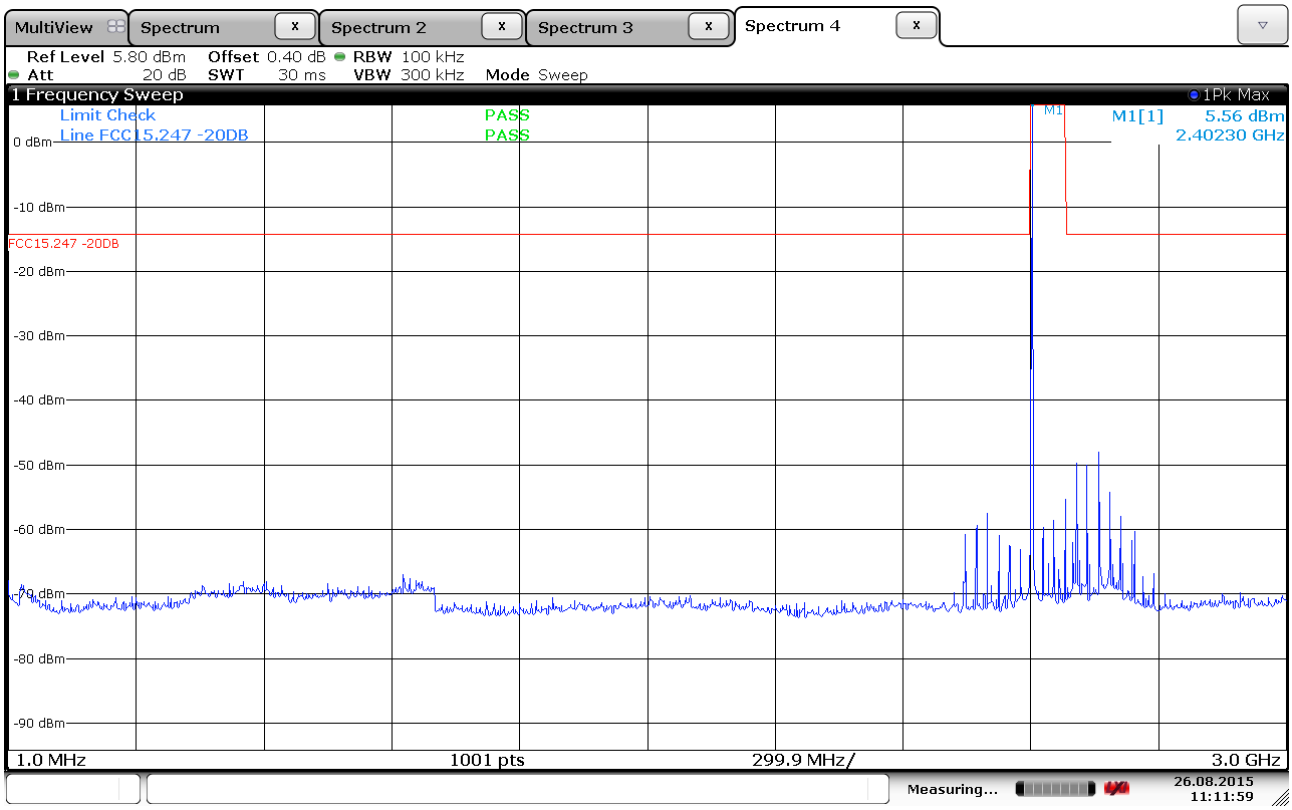
Date: 25.AUG.2015 16:24:14

Lower Band Edge, Radiated, 2402 MHz

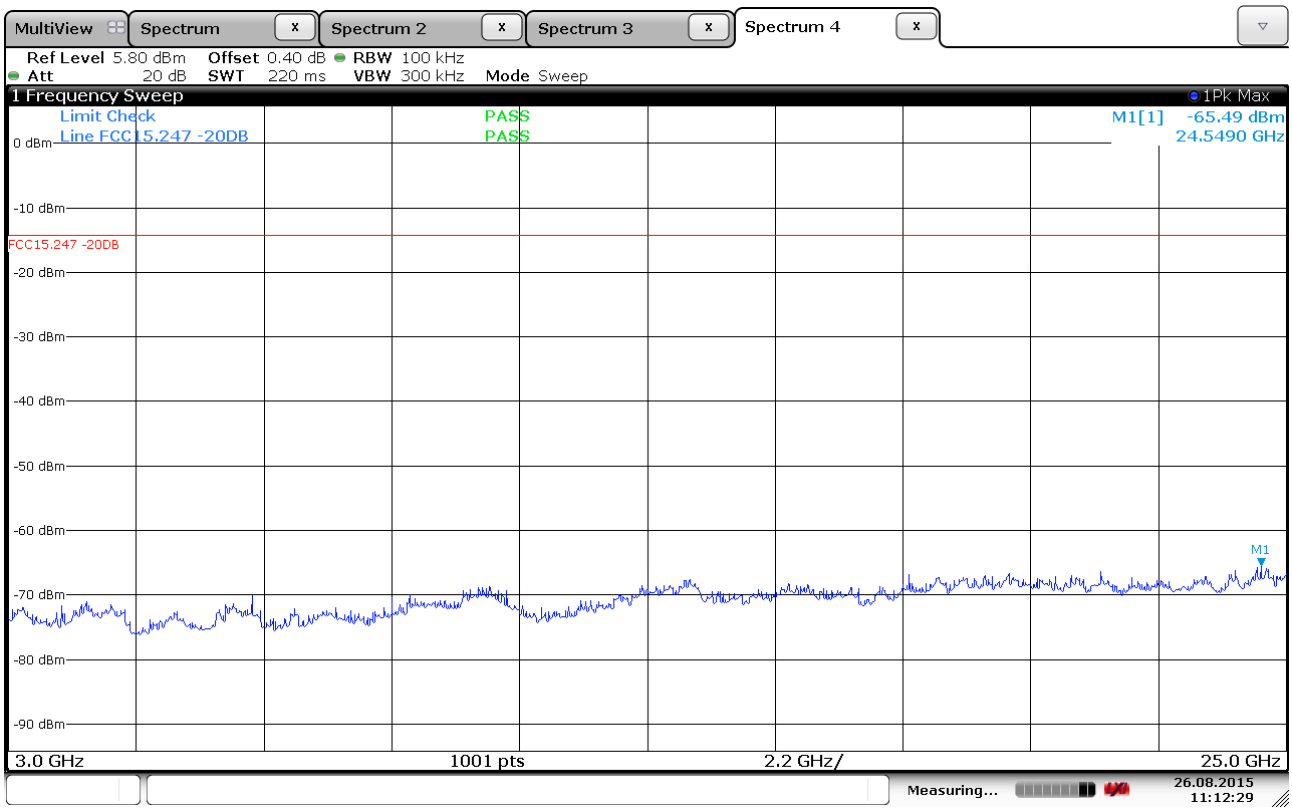


Date: 25.AUG.2015 16:50:07

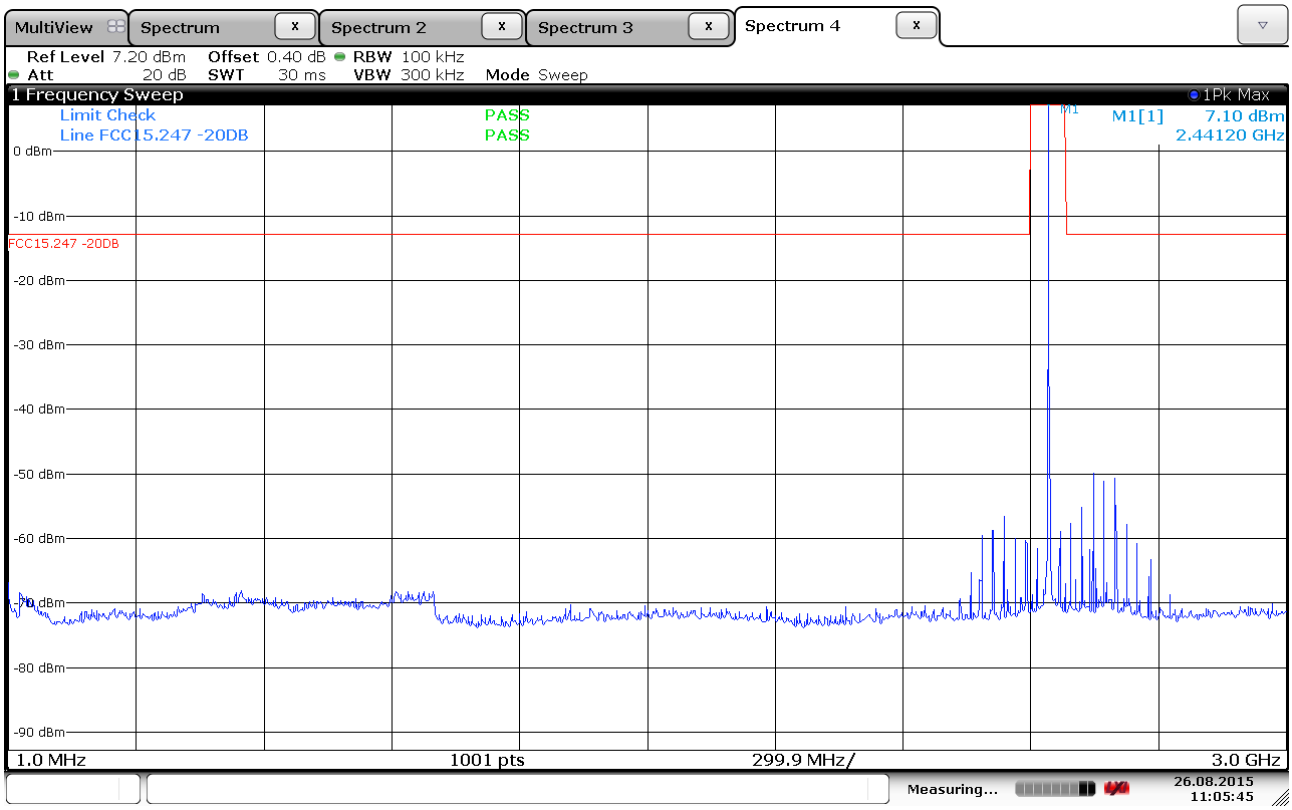
Upper Band Edge, Radiated, 2402 MHz



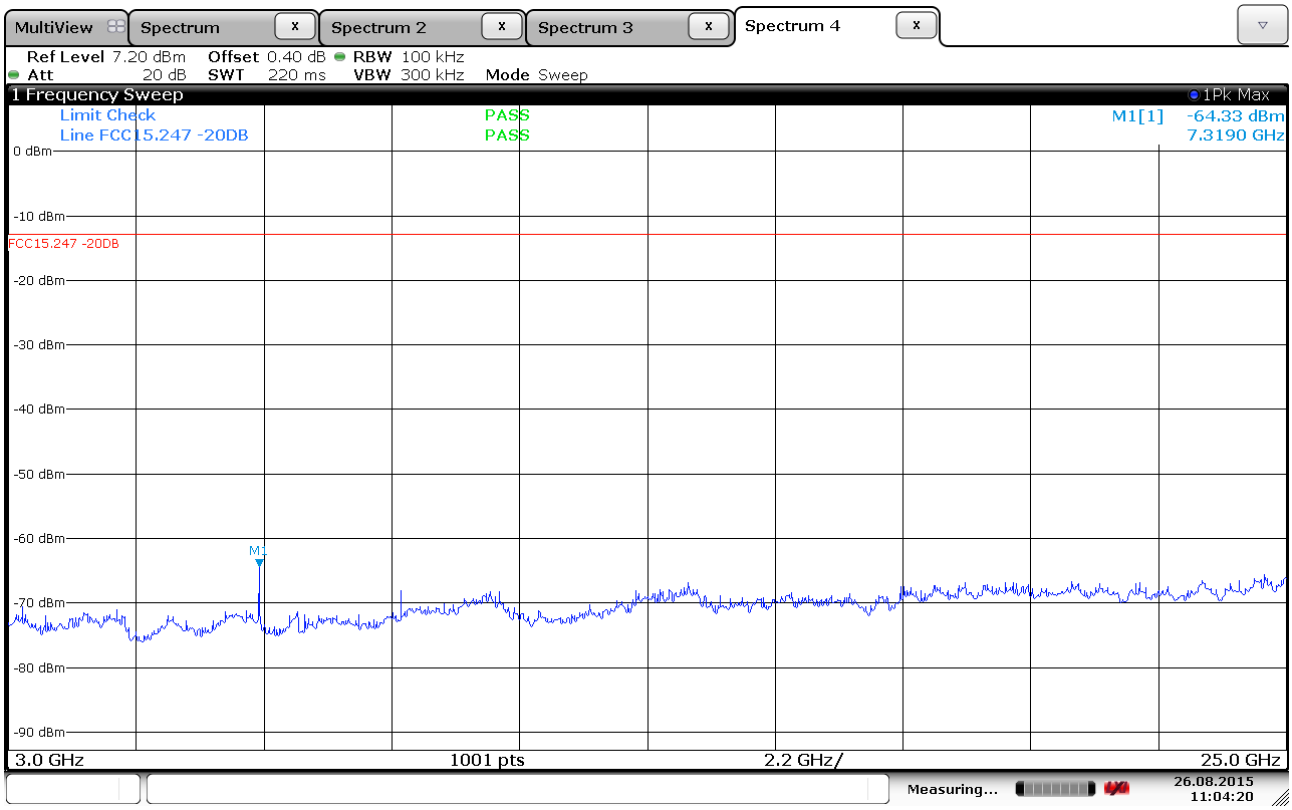
Conducted Emissions, 1 -3000 MHz, 2402 MHz



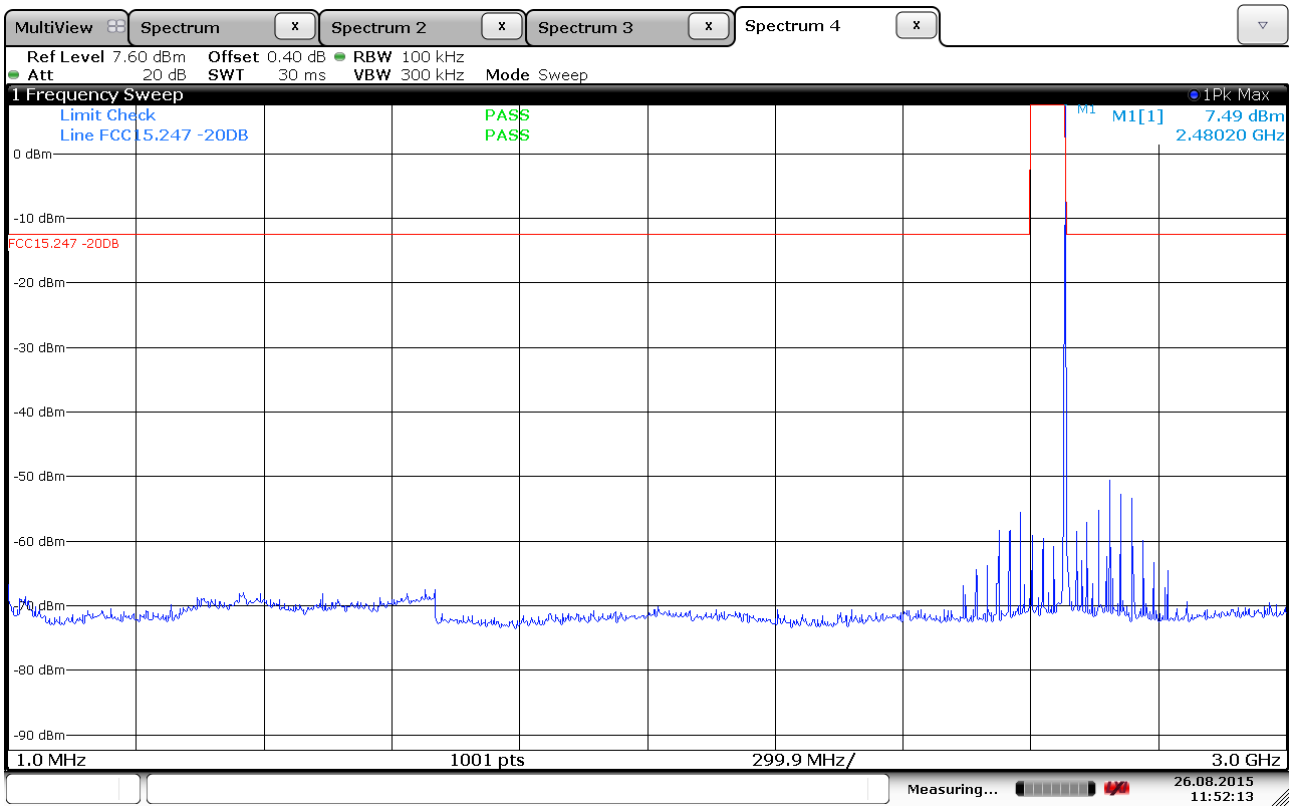
Conducted Emissions, 3000 -25000 MHz, 2402 MHz



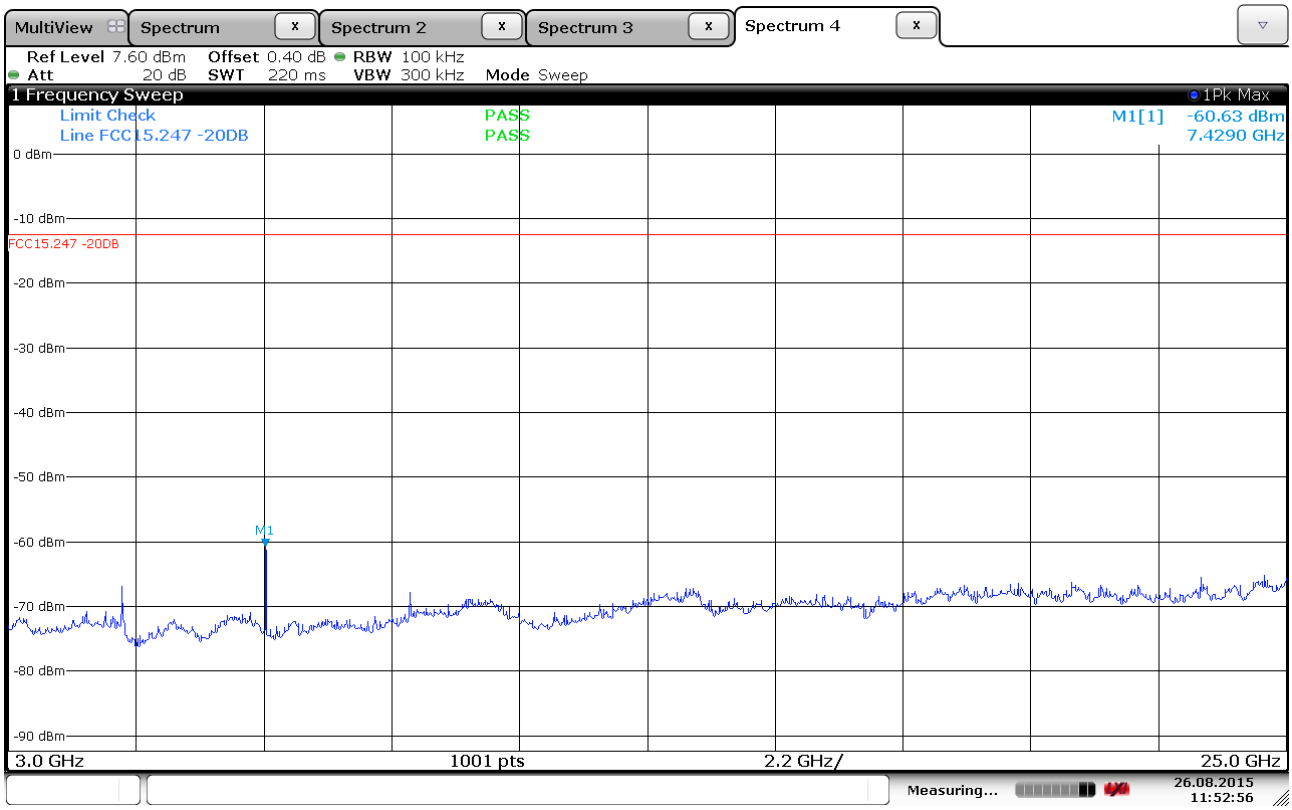
Conducted Emissions, 1 -3000 MHz, 2441 MHz



Conducted Emissions, 3000 -25000 MHz, 2441 MHz



Conducted Emissions, 1 -3000 MHz, 2480 MHz



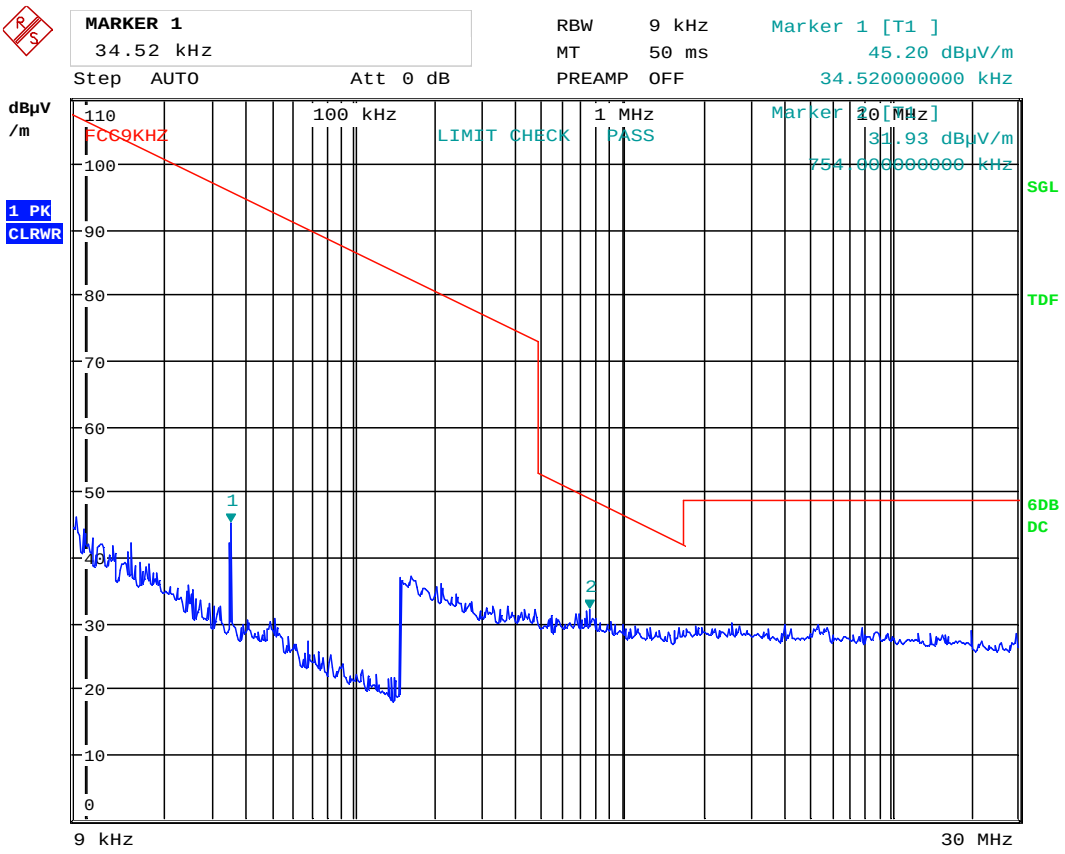
Conducted Emissions, 3000 -25000 MHz, 2480 MHz

Radiated emissions 10 kHz-30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached plot.

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



Date: 25.AUG.2015 14:47:30

Radiated emission 30 – 1000 MHz.

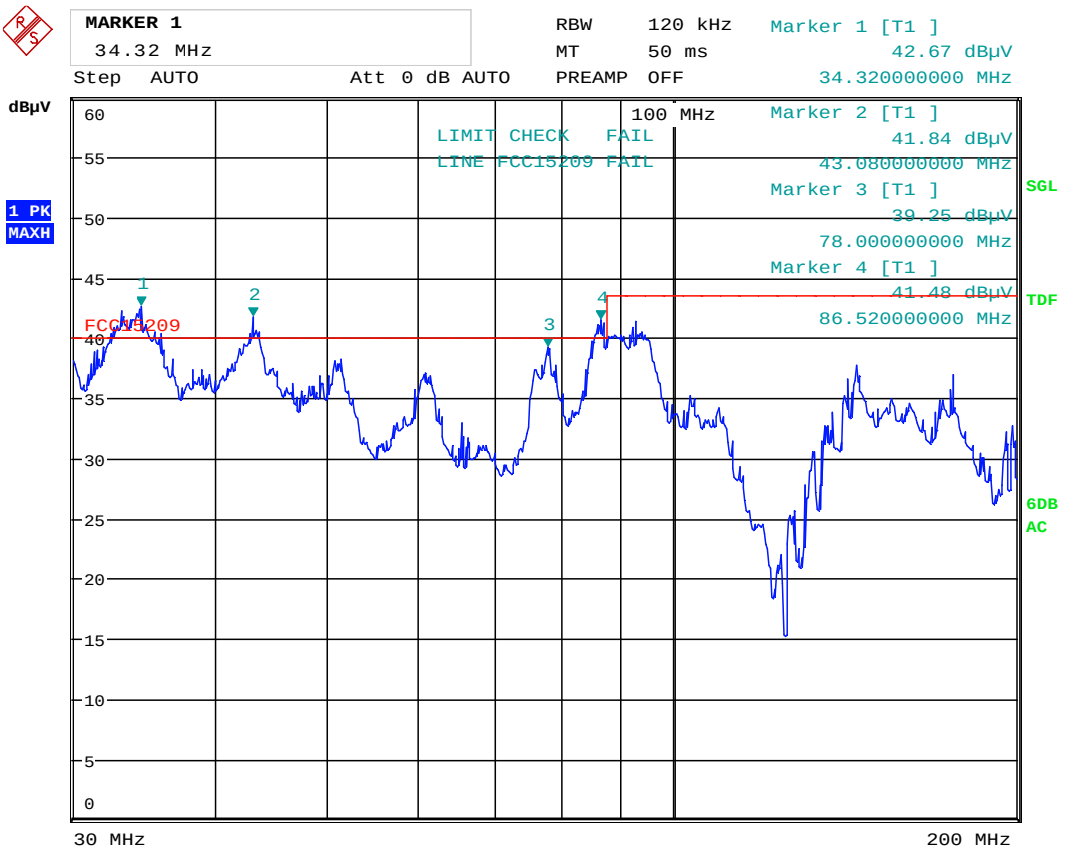
Detector: Quasi-Peak

Measuring distance 3m according to FCC 15.209.

Tested in speech mode with active connection.

Frequency	Operational condition	Polarization	Field strength	Measuring distance	Limit FCC15.209	Margin
MHz			dBµV/m	metres	dBµV/m	dB
34.0	TX on	VP	37.5	3	40	2.5
43.08	TX on	VP	35.9	3	40	4.1
50.96	TX on	VP	33.7	3	40	6.3
78.0	TX on	VP	34.3	3	40	5.7
86.52	TX on	VP	37.0	3	40	3.0
204.2	TX on	HP	33.0	3	43.5	10.5
207.74	TX on	HP	32.1	3	43.5	11.4
624.95	TX on	VP	26.8	3	46	19.2
925.76	TX on	HP	28.8	3	46	17.2

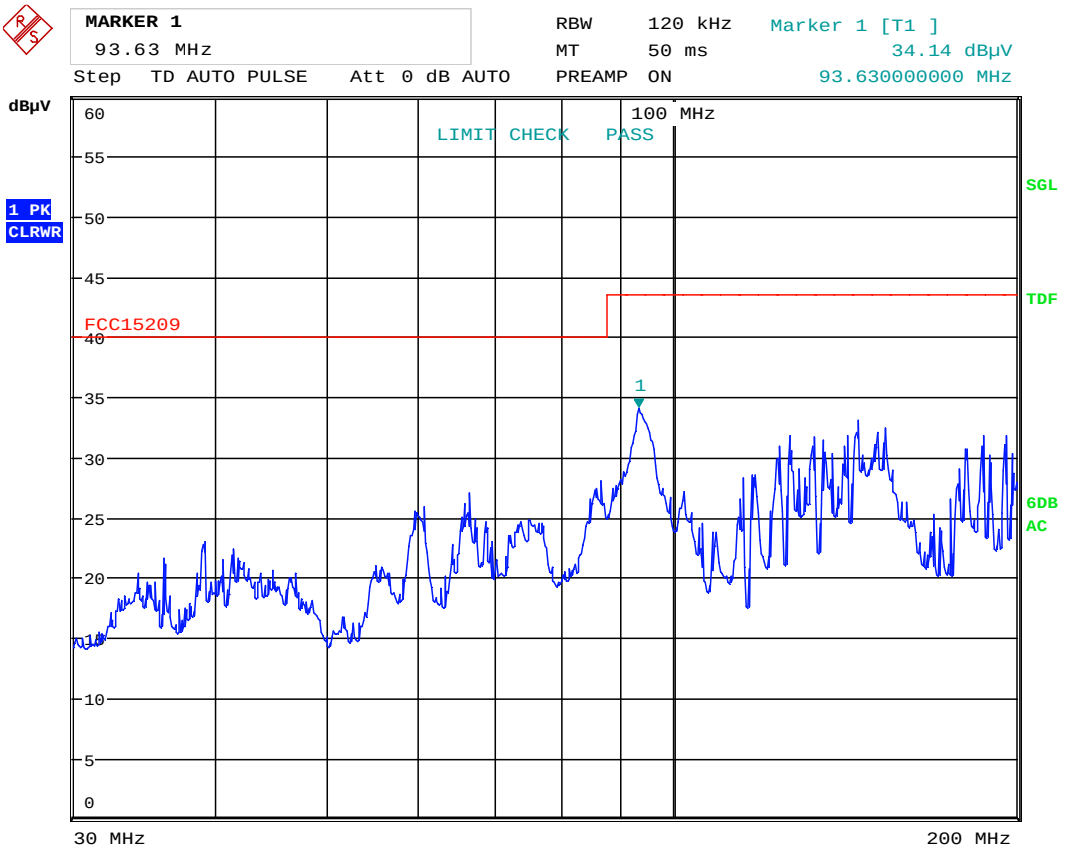
See attached plots.



Date: 25.AUG.2015 13:59:58

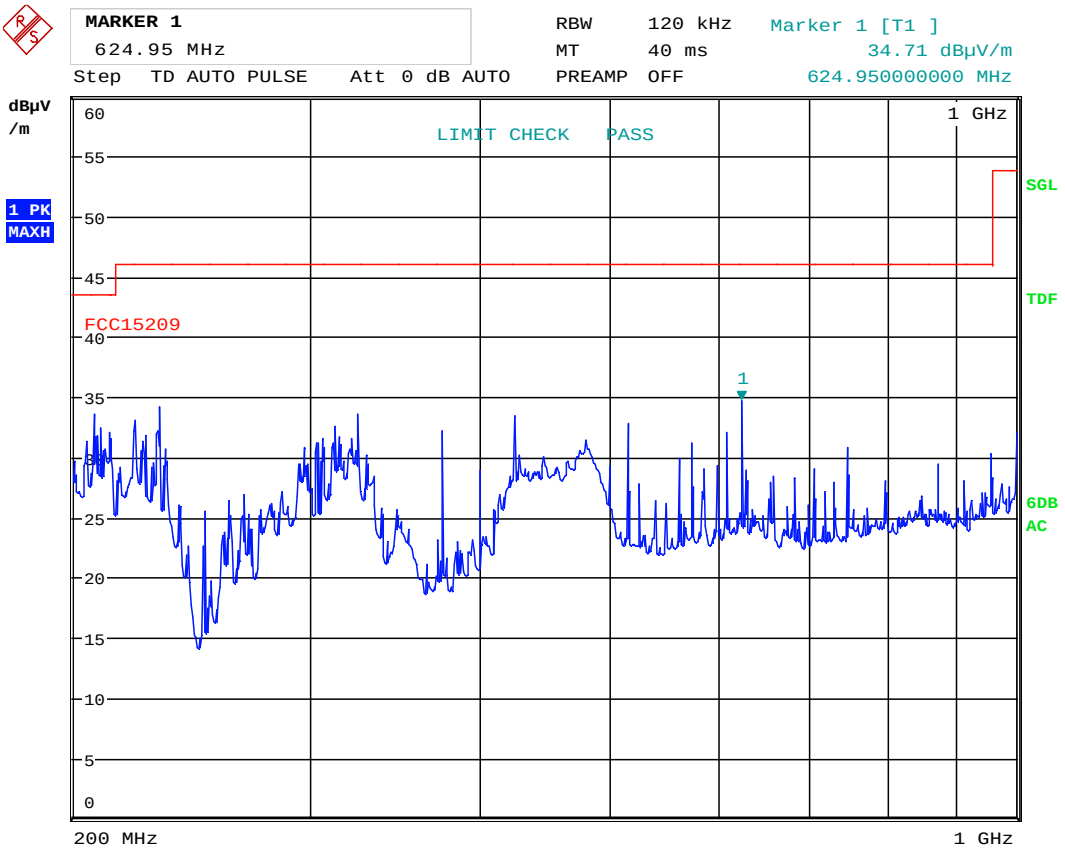
Radiated Emissions, 30 -200MHz, VP

All Radiated Emissions were below the limit when measured with a QuasiPeak detector



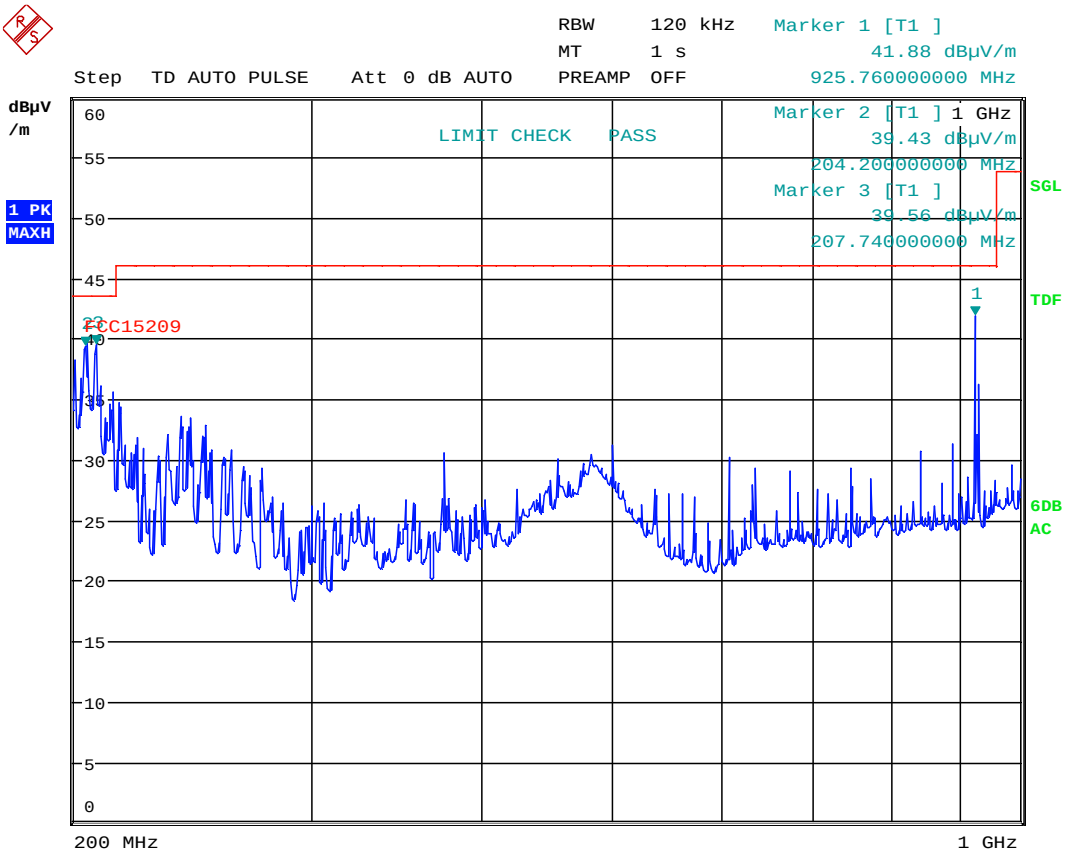
Date: 25.AUG.2015 13:42:07

Radiated Emissions, 30 -200MHz, HP



Date: 25.AUG.2015 14:14:12

Radiated Emissions. 200 -1000MHz, VP



Date: 25.AUG.2015 14:21:21

Radiated Emissions. 200 -1000MHz, HP

Radiated Emissions, 1 -25 GHz

Measuring distance: 3m (1 – 8.5 GHz)
1m (5.5 – 25 GHz)

Peak Detector:

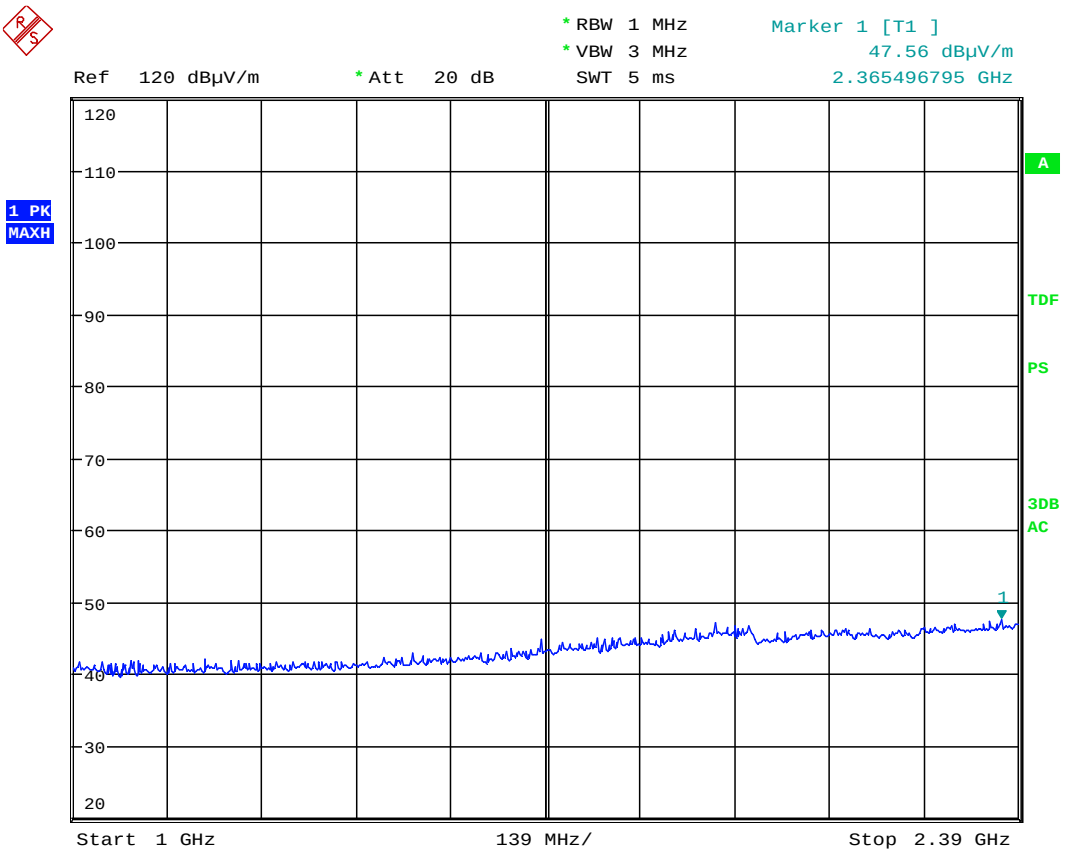
Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dBµV/m	dB	dBµV/m	dB
4882	M	0	51.1	20	74	22.9
Other freqs	L,M,H	0	None detected	20	74	>20

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”.

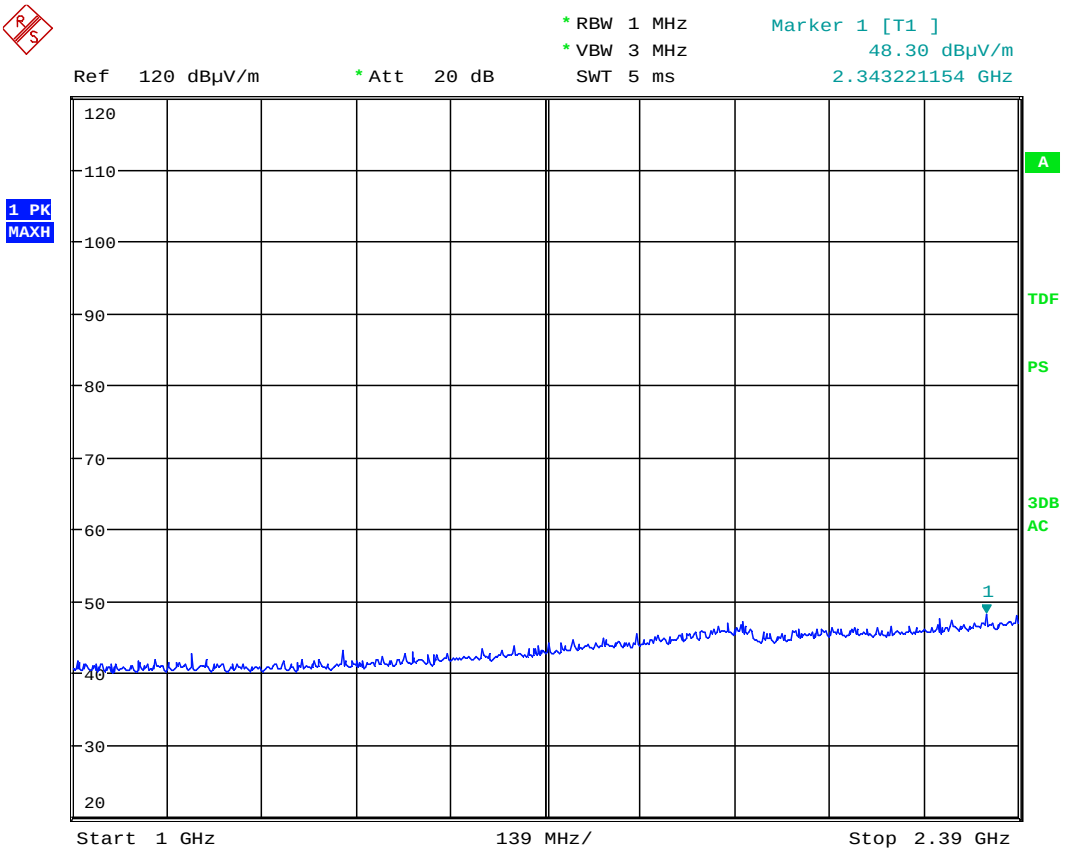
Distance correction factor is included on the plots when the measurement is performed @1m.

See plots.



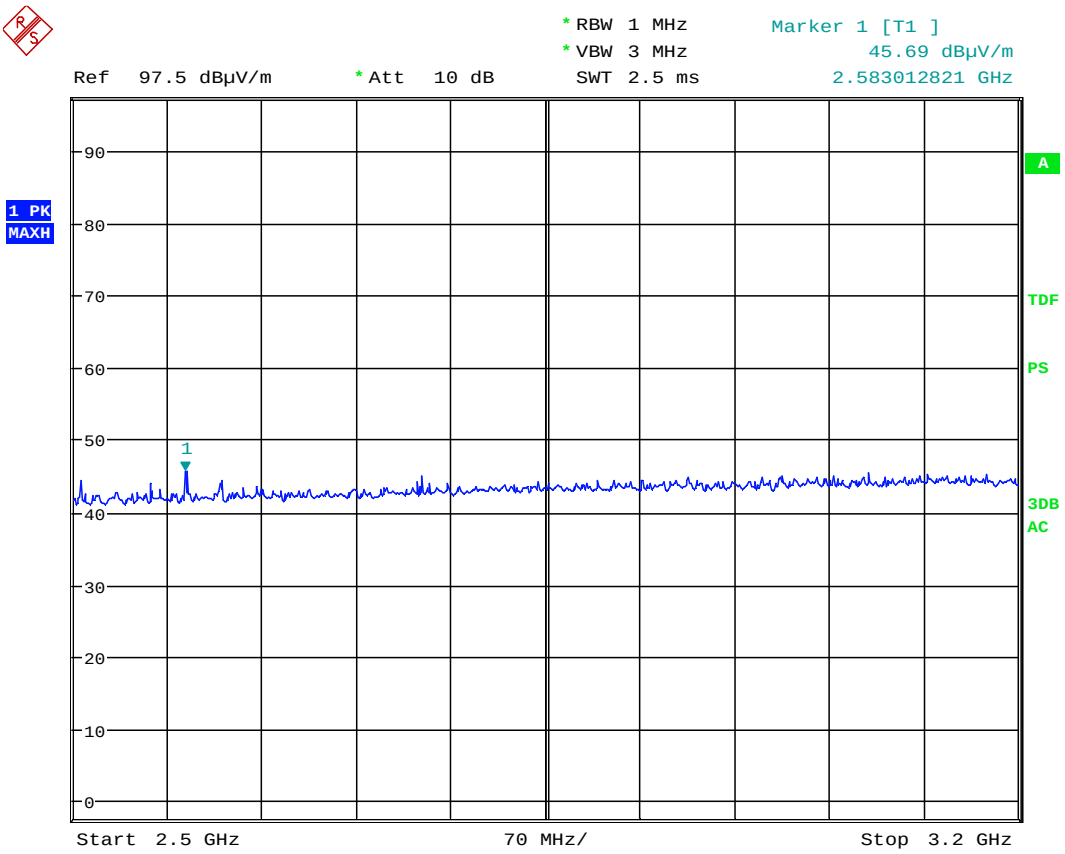
Date: 25.AUG.2015 16:27:41

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



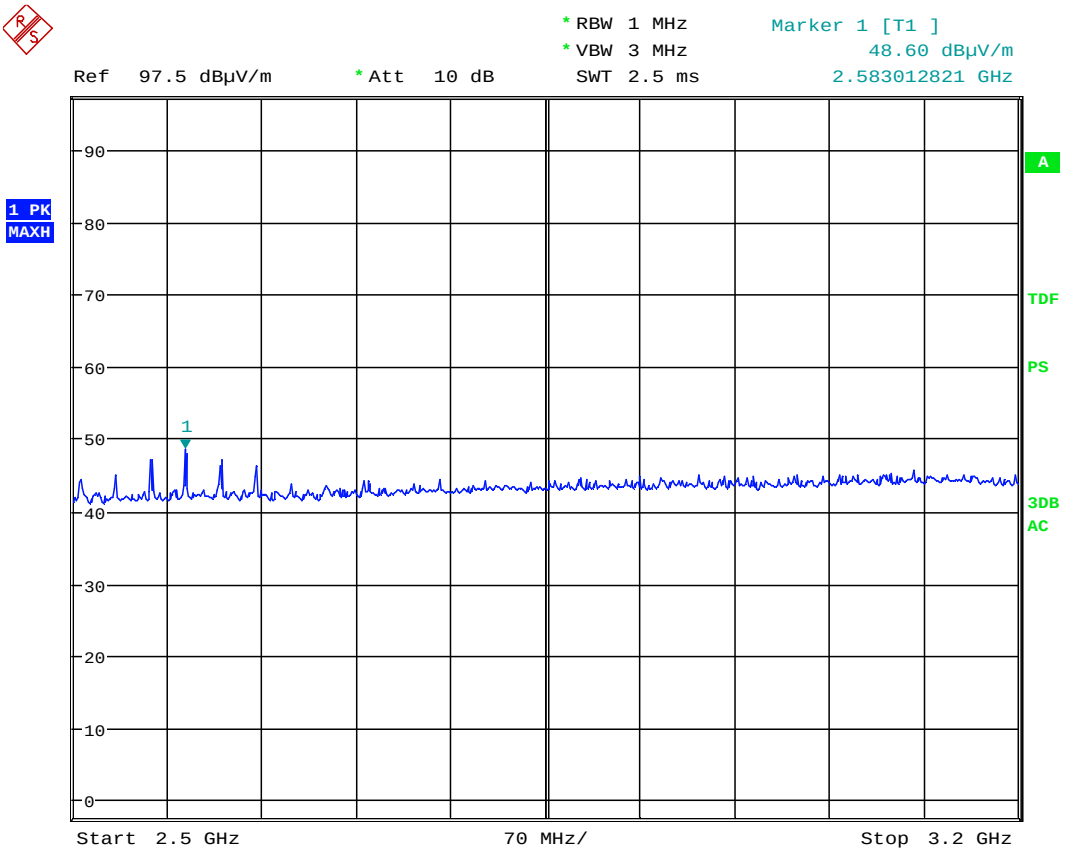
Date: 25.AUG.2015 16:29:32

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



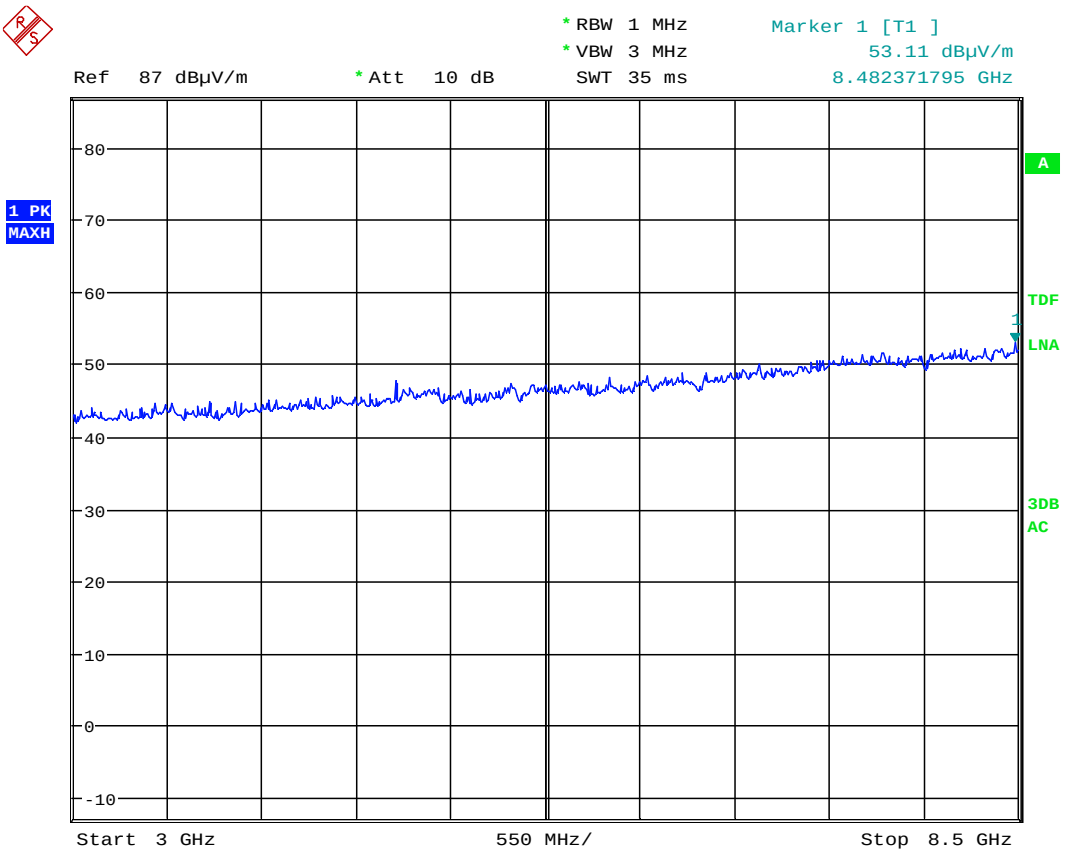
Date: 25.AUG.2015 16:53:15

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



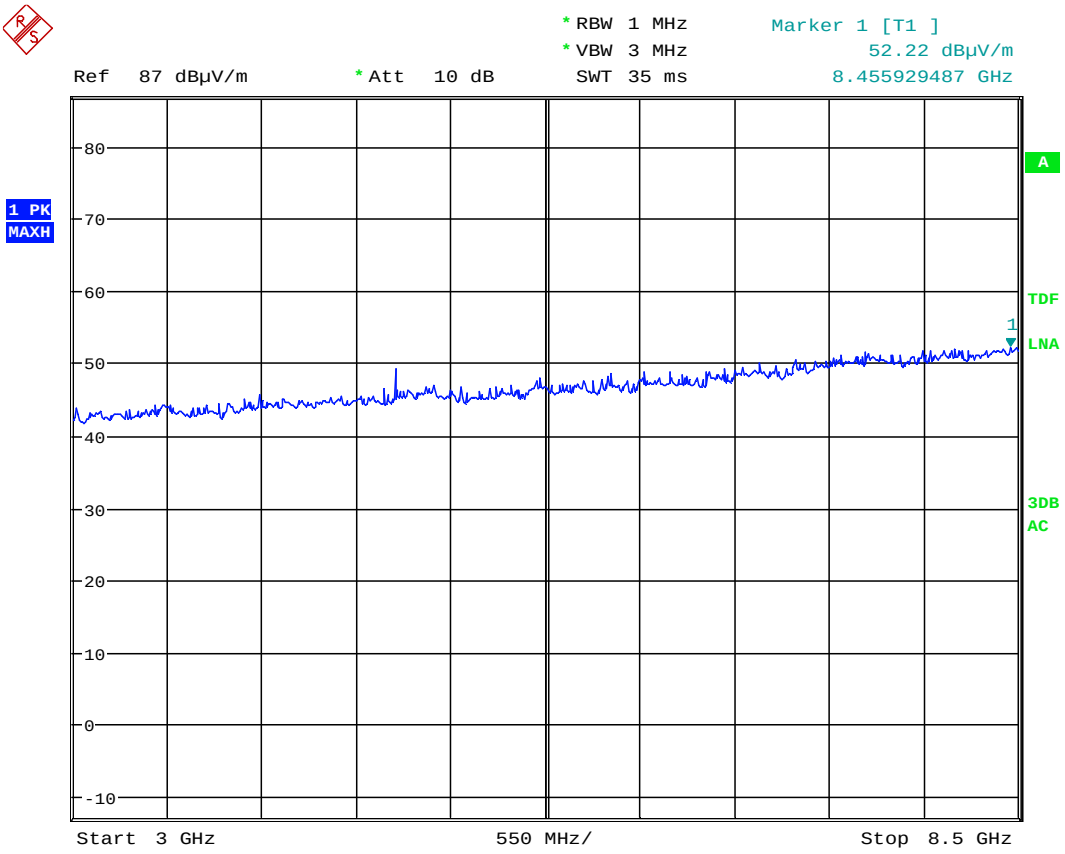
Date: 25.AUG.2015 16:55:09

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



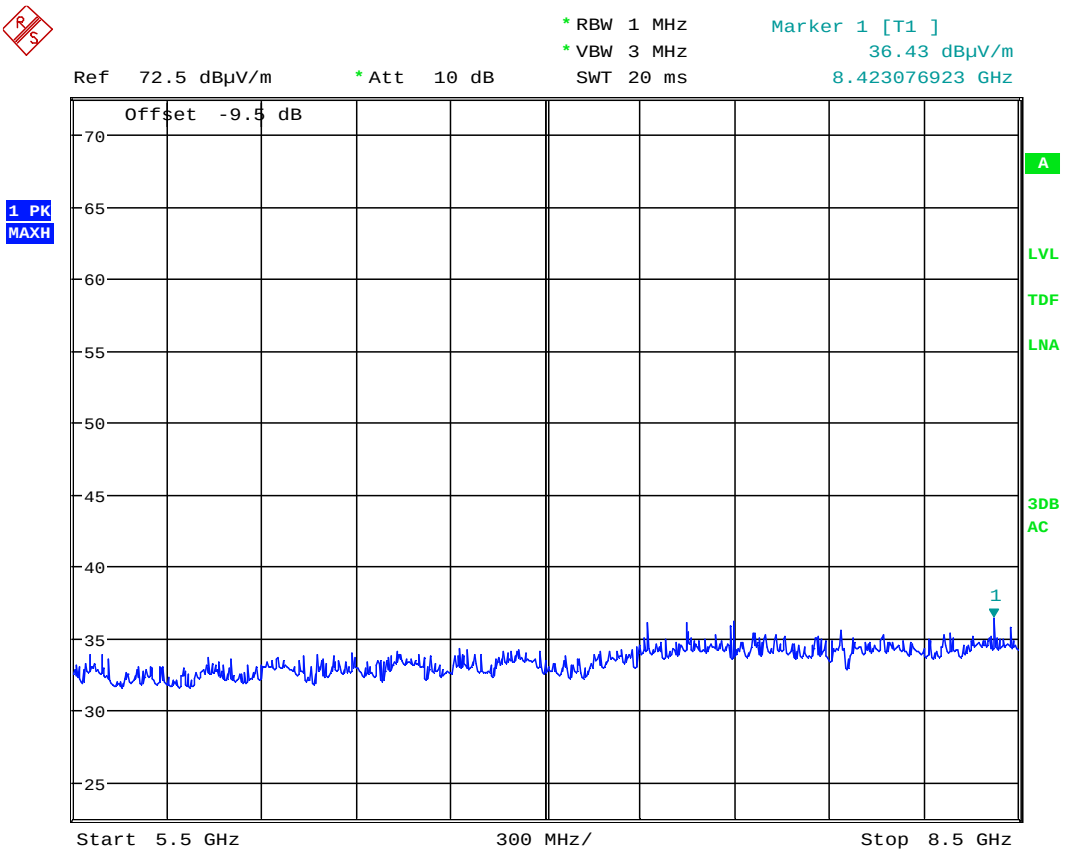
Date: 25.AUG.2015 16:00:25

Radiated Emissions, 3000 -8500MHz, 2441MHz, VP



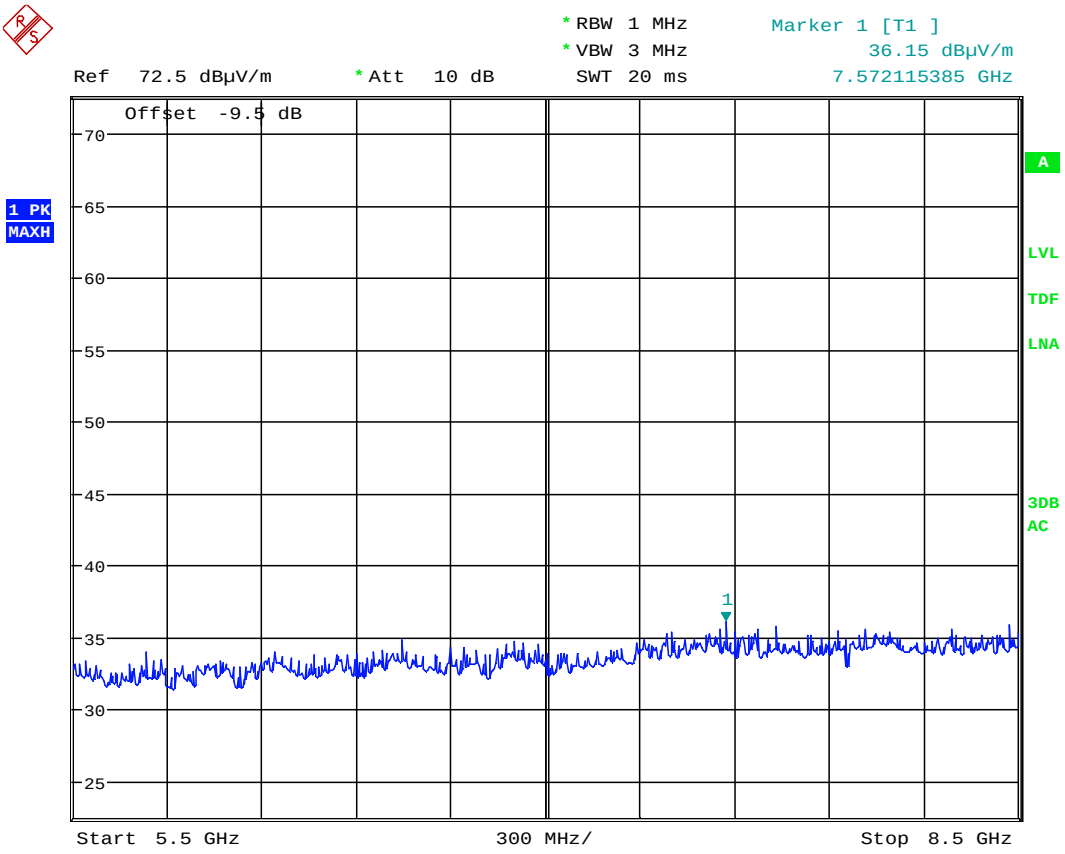
Date: 25.AUG.2015 16:02:18

Radiated Emissions, 3000 -8500MHz, 2441MHz, HP



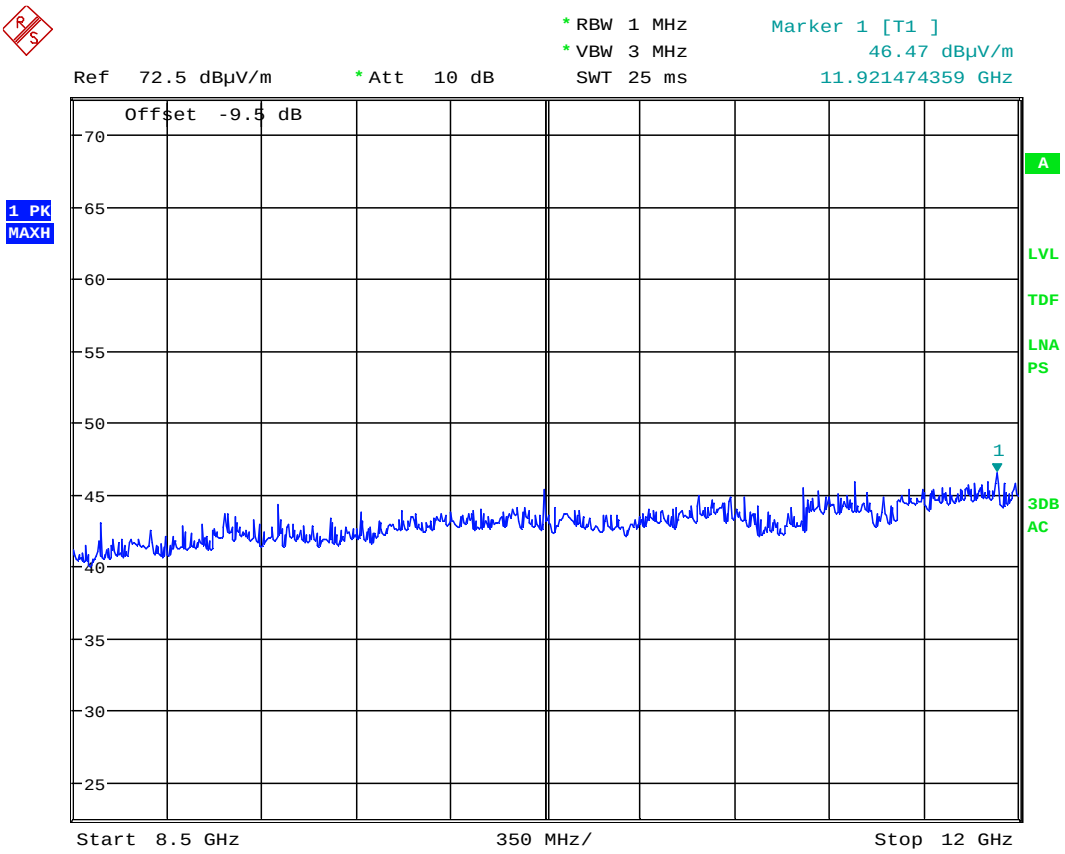
Date: 25.AUG.2015 17:26:28

Radiated Emissions, 5500 -8500MHz, 2441MHz, VP, 1m



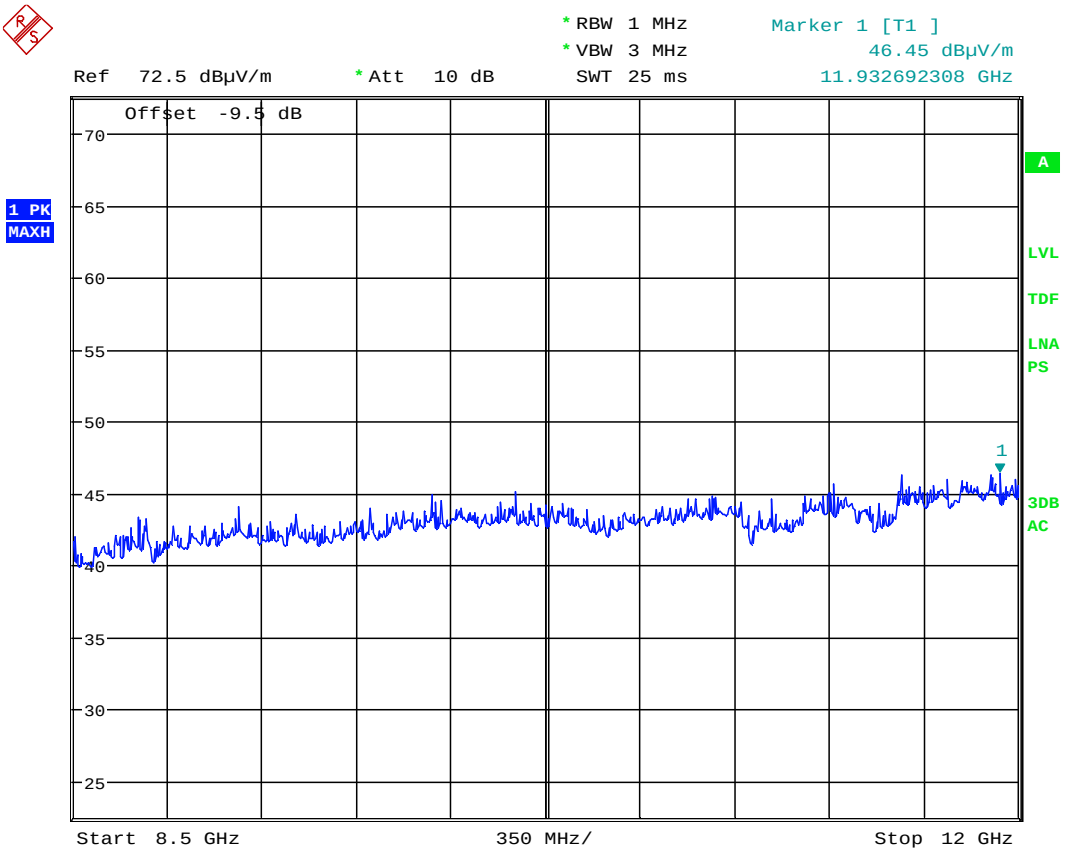
Date: 25.AUG.2015 17:28:21

Radiated Emissions, 5500 -8500MHz, 2441MHz, HP, 1m



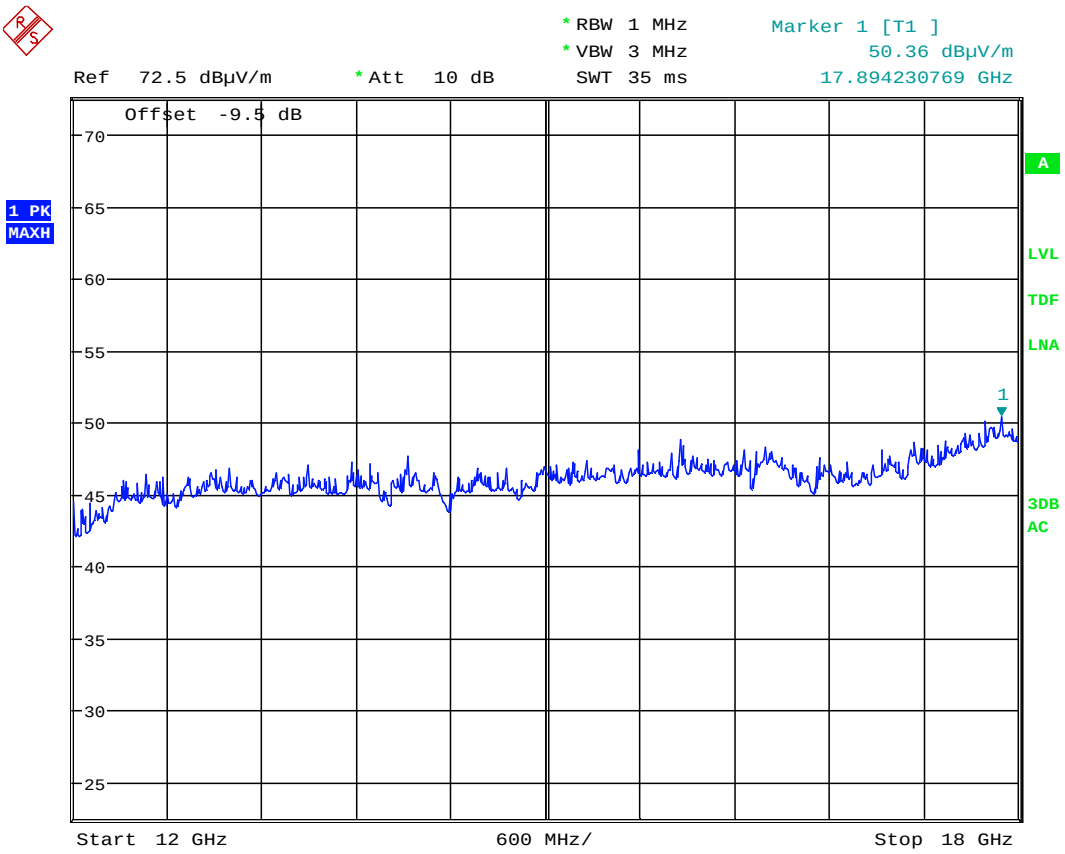
Date: 25.AUG.2015 17:12:44

Radiated Emissions, 8500 -12000MHz, 2441MHz, VP, 1m



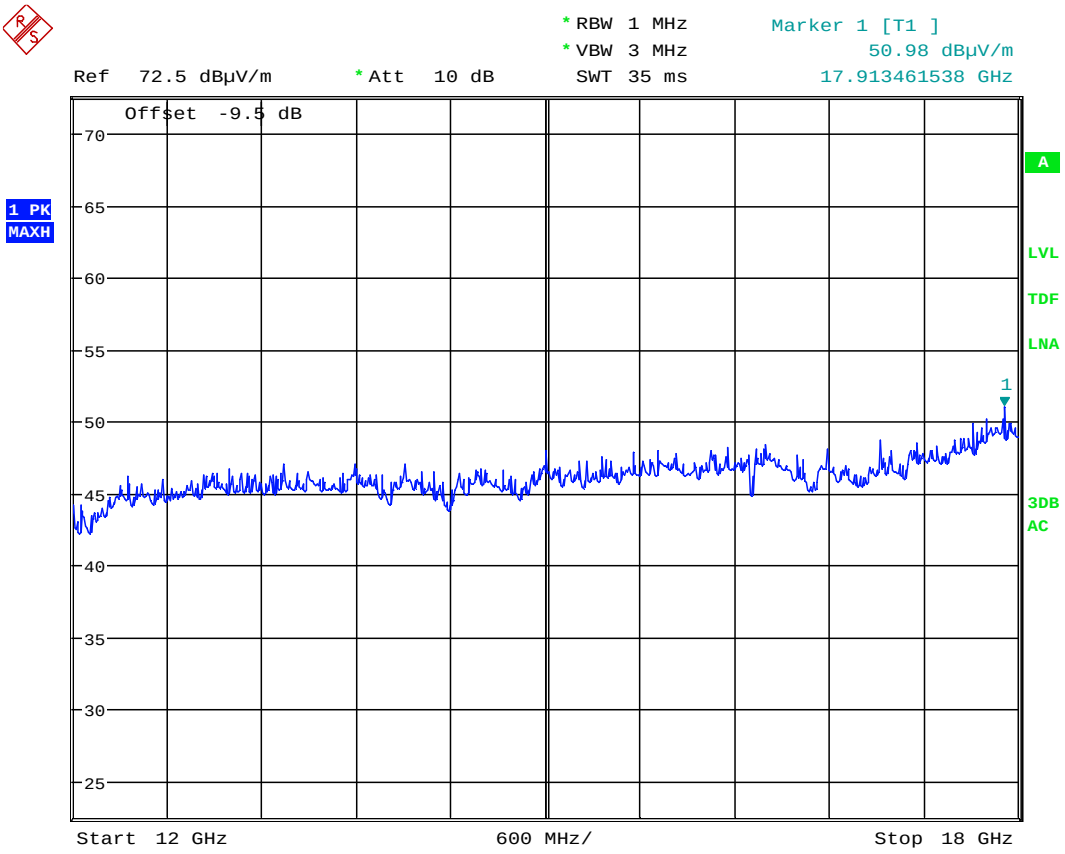
Date: 25.AUG.2015 17:14:37

Radiated Emissions, 8500 -12000MHz, 2441MHz, HP, 1m



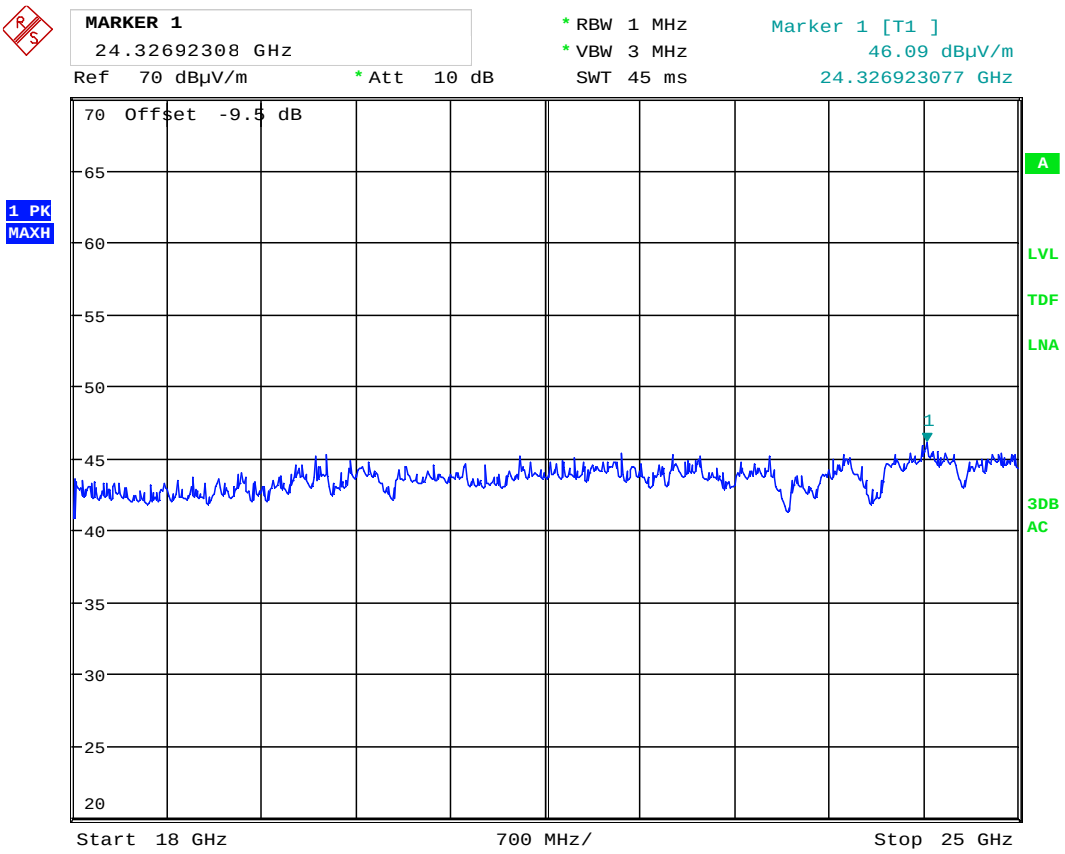
Date: 25.AUG.2015 17:21:23

Radiated Emissions, 12000 -18000MHz, 2441MHz, VP, 1m



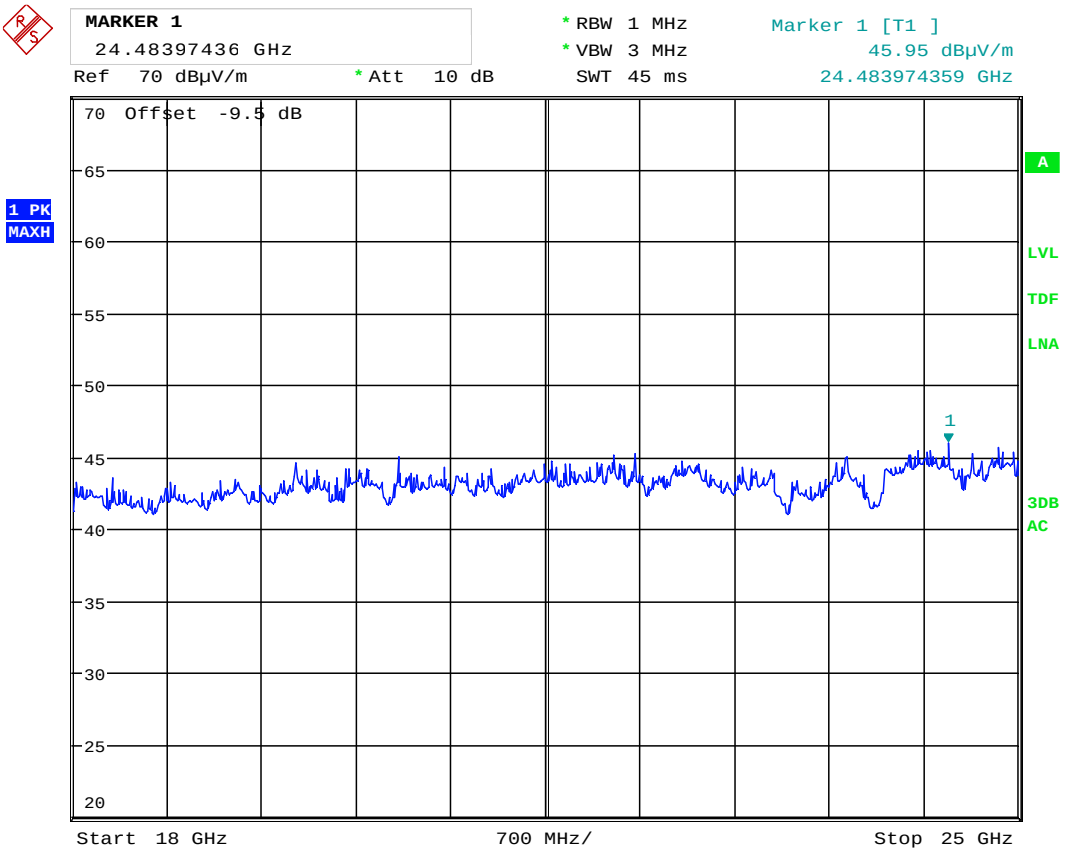
Date: 25.AUG.2015 17:23:16

Radiated Emissions, 12000 -18000MHz, 2441MHz, HP, 1m



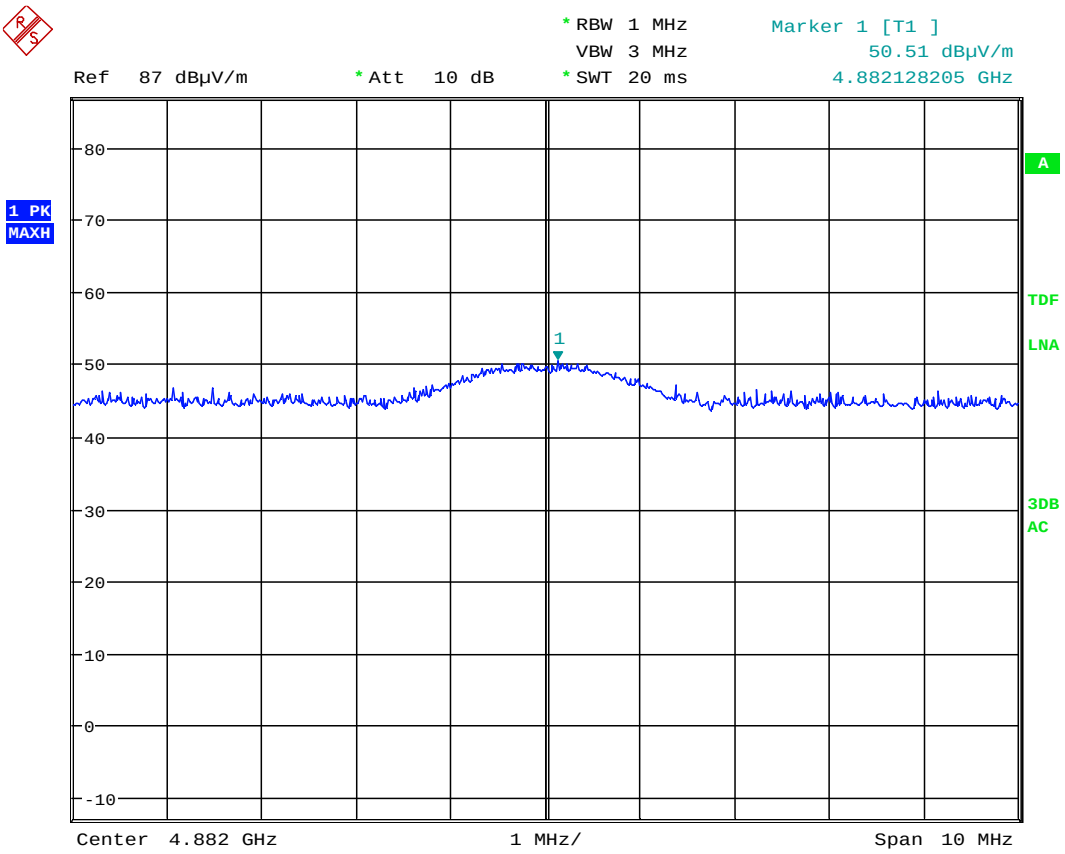
Date: 25.AUG.2015 18:04:49

Radiated Emissions, 18000 -25000MHz, 2441MHz, VP, 1m



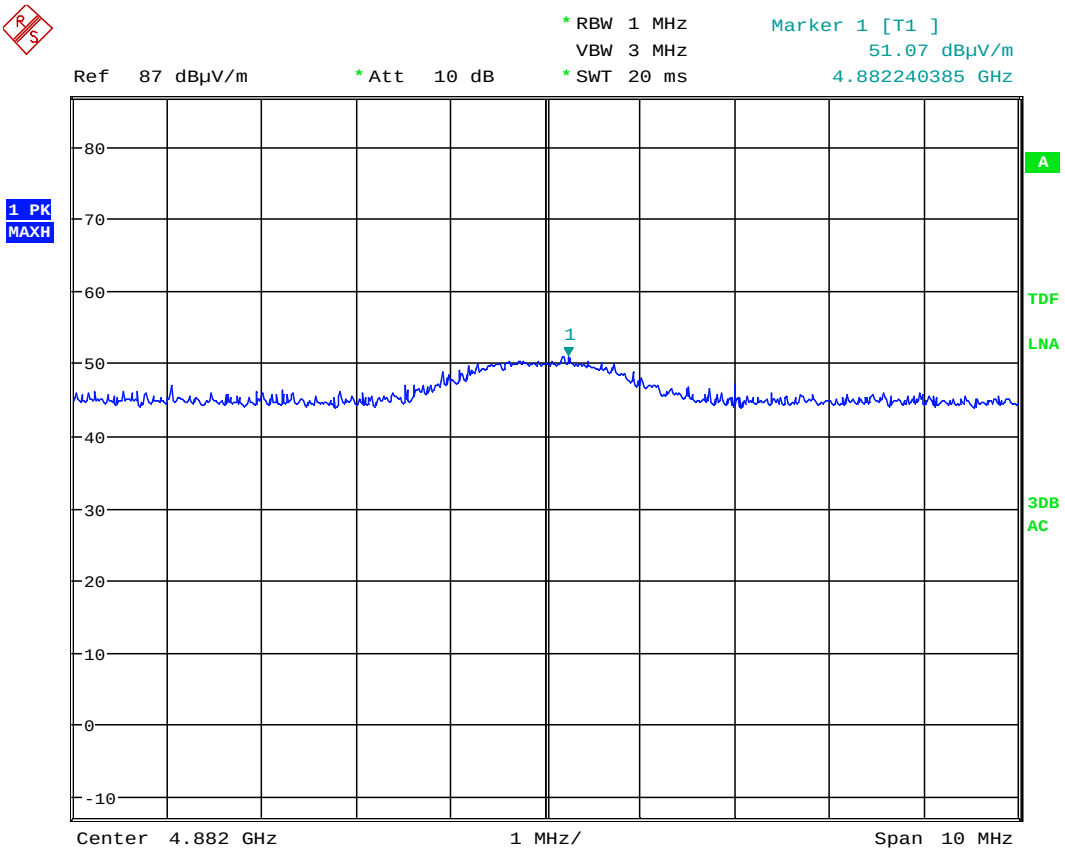
Date: 25.AUG.2015 18:08:28

Radiated Emissions, 18000 -25000MHz, 2441MHz, HP, 1m



Date: 25.AUG.2015 15:54:19

Radiated Emissions, 4882MHz, 2441MHz, VP



Date: 25.AUG.2015 15:53:10

Radiated Emissions, 4882MHz, 2441MHz, HP

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

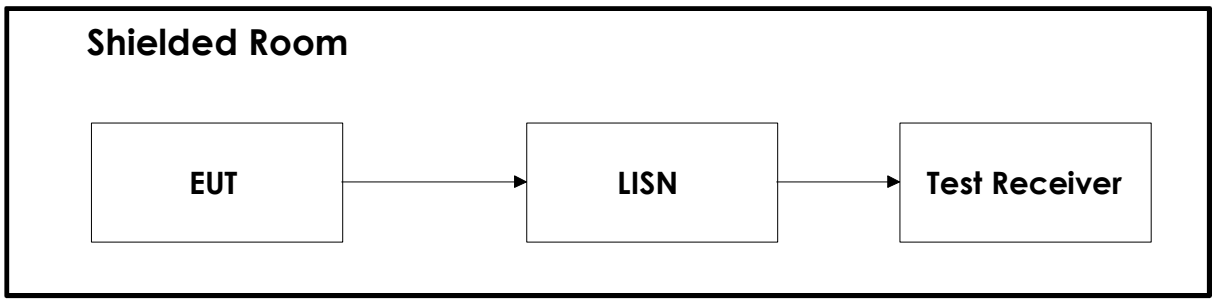
5 LIST OF TEST EQUIPMENT

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.

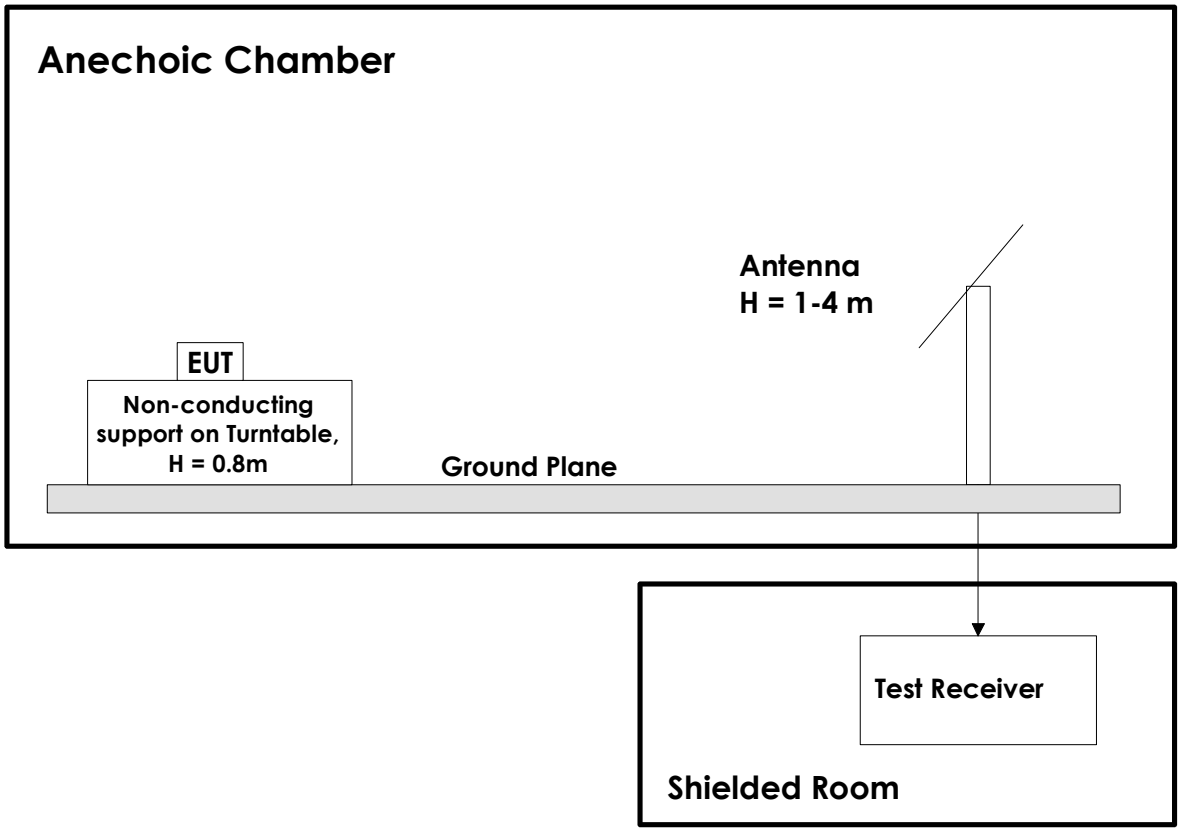
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2014.09	2015.09
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2014.11.20	2015.11.20
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
5	HK116	Biconical Antenna	Rohde & Schwarz	LR 1260	2013.12	2017.12
6	HL223	LPDA 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	2014.11	2015.11
9	642	Antenna Horn	Narda	LR 220	2009.01.26	2017.01.26
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	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 1660	2014.10	2016.10
15	Model 87V	Multimeter	Fluke	LR 1599	2014.10	2015.10
16	ESHS10	EMI	Rohde & Schwarz	N 3528	2014.09.12	2015.09.12
17	ESH3-Z5	Two-line V-Network	Rohde & Schwarz	LR 1076	2014.04.23	2016.04.23
18	ESH3-Z2	Pulse limiter	Rohde & Schwarz	LR 1074	2015.03.05	2017.03.05
19	6812B	AC power Source	Agilent	LR 1515	2013.10.28	2015.10.28

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



Revision history

Version	Date	Comment	Sign
1.0	2015.09.15	First Edition	Frode Sveinsen
1.1	2015.09.15	Minor corrections	Frode Sveinsen
1.2	2015.10.02	Minor corrections	Frode Sveinsen