
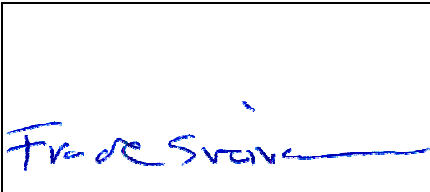
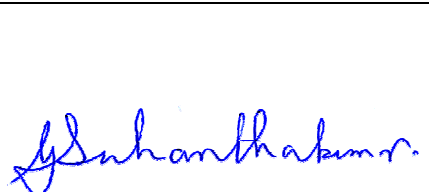


## Test Report

<b>Product</b>	Bluetooth Transceiver in UPCS Base Station	
<b>Name and address of the applicant</b>	Panasonic System Networks Co., Ltd. 1-62,4-Chome, Minoshima, Hakata-ku, Fukuoka 812-8531, Japan	
<b>Name and address of the manufacturer</b>	Panasonic System Networks Co., Ltd. 1-62,4-Chome, Minoshima, Hakata-ku, Fukuoka 812-8531, Japan	
<b>Model</b>	KX-TGL460 KX-TGL490C	
<b>Rating</b>	5.5V DC (AC Adaptor, 1.5A; 100-240 V AC, 50/60 Hz, 1.2-0.6 A)	
<b>Trademark</b>	Panasonic	
<b>Serial number</b>	/	
<b>Additional information</b>	Bluetooth 2.1, DECT 6.0	
<b>Tested according to</b>	<b>FCC Part 15.247</b> Frequency Hopping Transmitters / Digital Transmission Systems <b>Industry Canada RSS-247, Issue 1</b> Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices	
<b>Order number</b>	297372	
<b>Tested in period</b>	2015.10.26 to 2015.11.10	
<b>Issue date</b>	2015.11.19	
<b>Name and address of the testing laboratory</b>	 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

<b>Name :</b>	Panasonic
<b>FCC ID :</b>	ACJ96NKX-TGL460
<b>Industry Canada ID :</b>	216A-KXTGL490
<b>Model/version :</b>	KX-TGL460 KX-TGL490C
<b>Serial number :</b>	/
<b>Hardware identity and/or version:</b>	PNLB2573xx
<b>Software identity and/or version :</b>	SW302
<b>Frequency Range :</b>	2402 – 2480 MHz
<b>Number of Channels :</b>	Minimum 20 and Maximum 79 (Adaptive Frequency Hopping)
<b>Operating Modes :</b>	Bluetooth Headset Mode
<b>Type of Modulation :</b>	Digital (GFSK)
<b>User Frequency Adjustment :</b>	None
<b>Conducted Output Power :</b>	0.0076 Watts (Peak)
<b>Type of Power Supply :</b>	AC Adaptor Model PNLV226
<b>Antenna Connector :</b>	None
<b>Antenna Diversity Supported :</b>	No
<b>Desktop Charger :</b>	N/A

### Description of Test Item

The EUT is a Bluetooth Module in a DECT Base station.

The BT module in KX-TGL460 is identical to the BT Module in KX-TGE270 (FCC ID: ACJ96NKX-TGE270), all conducted test results are from Nemko Test Report No: 248567-3 for KX-TGE270.

The models KX-TGL460 and KX-TGL490C are identical.

### Exposure Evaluation

The EUT is designed tabletop or wall mounting and the user manual contains text that it shall be mounted with a separation distance of at least 20 cm from any persons. 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:	20.2 – 22.6 °C
Relative humidity:	22.1 – 35.0 %
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 / Thomas Dangle

## 1.4 Test Equipment

See list of test equipment in clause 5.

## 2 TEST REPORT SUMMARY

### 2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and Industry Canada RSS-247 Issue 1.

Tests were performed in accordance with ANSI C63.4-2014 and 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 <sup>3</sup>
Pseudorandom Hopping Algorithm	15.247(a)(1)	5.1 (3)	Complies <sup>3</sup>
Time of Occupancy	15.247(a)(1)(iii)	5.1 (5)	Complies <sup>3</sup>
Occupied Bandwidth	15.247(a)(1)	5.1 (7)	Complies <sup>3</sup>
Minimum 6 dB Bandwidth	15.247(a)(2)	5.2 (1)	N/A <sup>1</sup>
Peak Power Output	15.247(b)	5.4 (5)	Complies <sup>3</sup>
Power Spectral Density	15.247(d)	5.2 (2)	N/A <sup>1</sup>
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5	Complies <sup>2</sup>
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	6.13 (RSS-GEN) 8.9 (RSS-GEN)	Complies

<sup>1</sup> Not applicable for FHSS equipment

<sup>2</sup> The tested equipment has integrated antennas only

<sup>3</sup> All Conducted test results are from Nemko Test report No 248567-3 and were tested on KX-TGE270

## 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: Thomas Danglé	Date of Test: 11-Nov-2015
----------------------------------	---------------------------

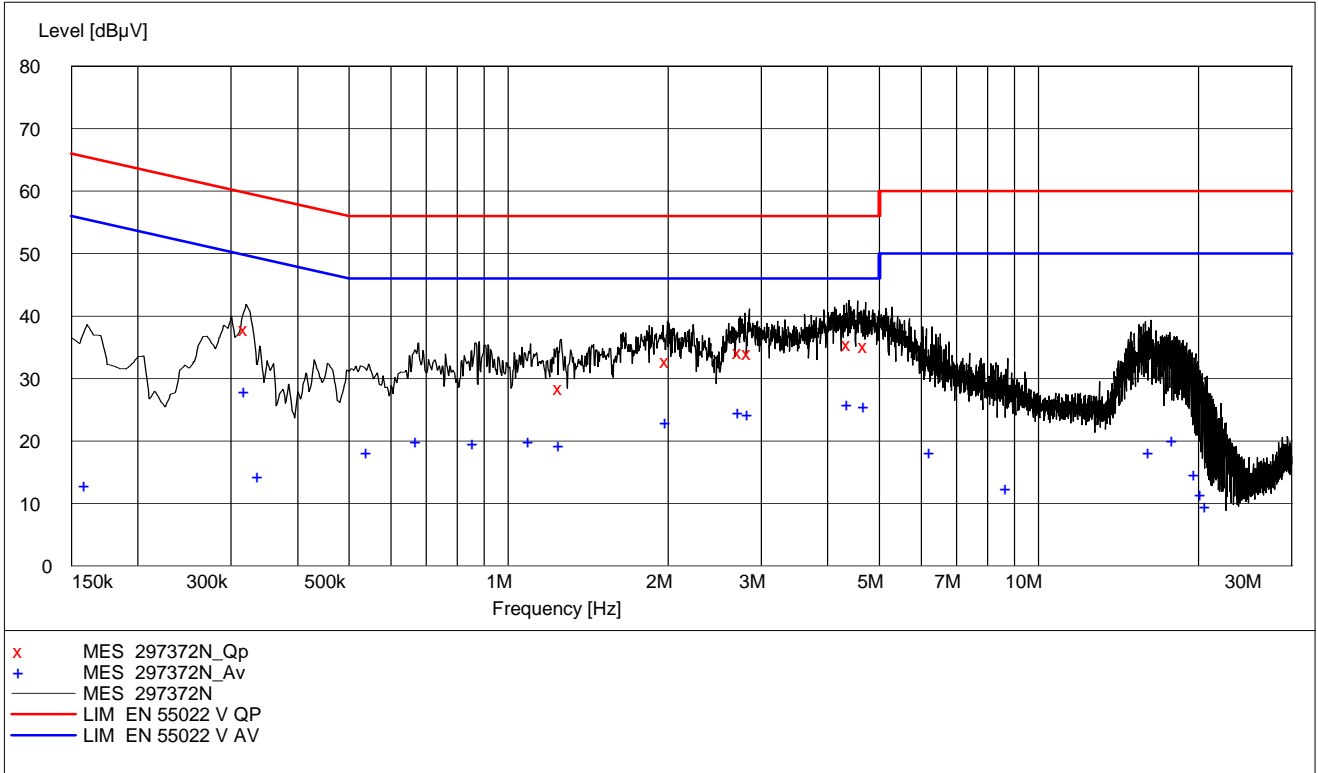
Measurement procedure: ANSI C63.4-2014 using 50 µH/50 ohms LISN.

Test Results: Complies.

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

Highest measured value (L1 and N):

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.320000	37.90	10.50	59.70	21.80	QP	L1	Pass
1.255000	28.50	10.40	56.00	27.50	QP	L1	Pass
1.995000	32.70	10.40	56.00	23.30	QP	L1	Pass
2.735000	34.30	10.40	56.00	21.70	QP	L1	Pass
2.845000	34.00	10.40	56.00	22.00	QP	L1	Pass
4.390000	35.50	10.50	56.00	20.50	QP	L1	Pass
4.710000	35.30	10.50	56.00	20.70	QP	L1	Pass
0.160000	13.00	10.70	55.50	42.50	AV	N	Pass
0.320000	28.00	10.50	49.70	21.70	AV	L1	Pass
0.340000	14.40	10.50	49.20	34.80	AV	N	Pass
0.545000	18.30	10.20	46.00	27.70	AV	L1	Pass
0.675000	19.90	10.20	46.00	26.10	AV	L1	Pass
0.865000	19.70	10.30	46.00	26.30	AV	L1	Pass
1.100000	19.90	10.40	46.00	26.10	AV	L1	Pass
1.255000	19.40	10.40	46.00	26.60	AV	L1	Pass
1.995000	23.00	10.40	46.00	23.00	AV	L1	Pass
2.735000	24.70	10.40	46.00	21.30	AV	L1	Pass
2.845000	24.30	10.40	46.00	21.70	AV	L1	Pass
4.390000	25.90	10.50	46.00	20.10	AV	L1	Pass
4.710000	25.60	10.50	46.00	20.40	AV	L1	Pass
6.290000	18.30	10.60	50.00	31.70	AV	L1	Pass
8.745000	12.50	10.60	50.00	37.50	AV	L1	Pass
16.275000	18.30	10.80	50.00	31.70	AV	L1	Pass
18.000000	20.20	10.80	50.00	29.80	AV	L1	Pass
19.770000	14.70	10.80	50.00	35.30	AV	L1	Pass
20.350000	11.60	10.90	50.00	38.40	AV	L1	Pass
20.775000	9.60	10.90	50.00	40.40	AV	L1	Pass



### 3.2 Channel Separation

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

Test Results: **Complies**

**Measurement Data:**

Channel Separation:	1.0 MHz
Nominal value for Channel Separation	1.0 MHz
20 dB BW of hopping channel, 2402MHz:	923.1 kHz
20 dB BW of hopping channel, 2441MHz:	921.1 kHz
20 dB BW of hopping channel, 2480MHz:	921.1 kHz

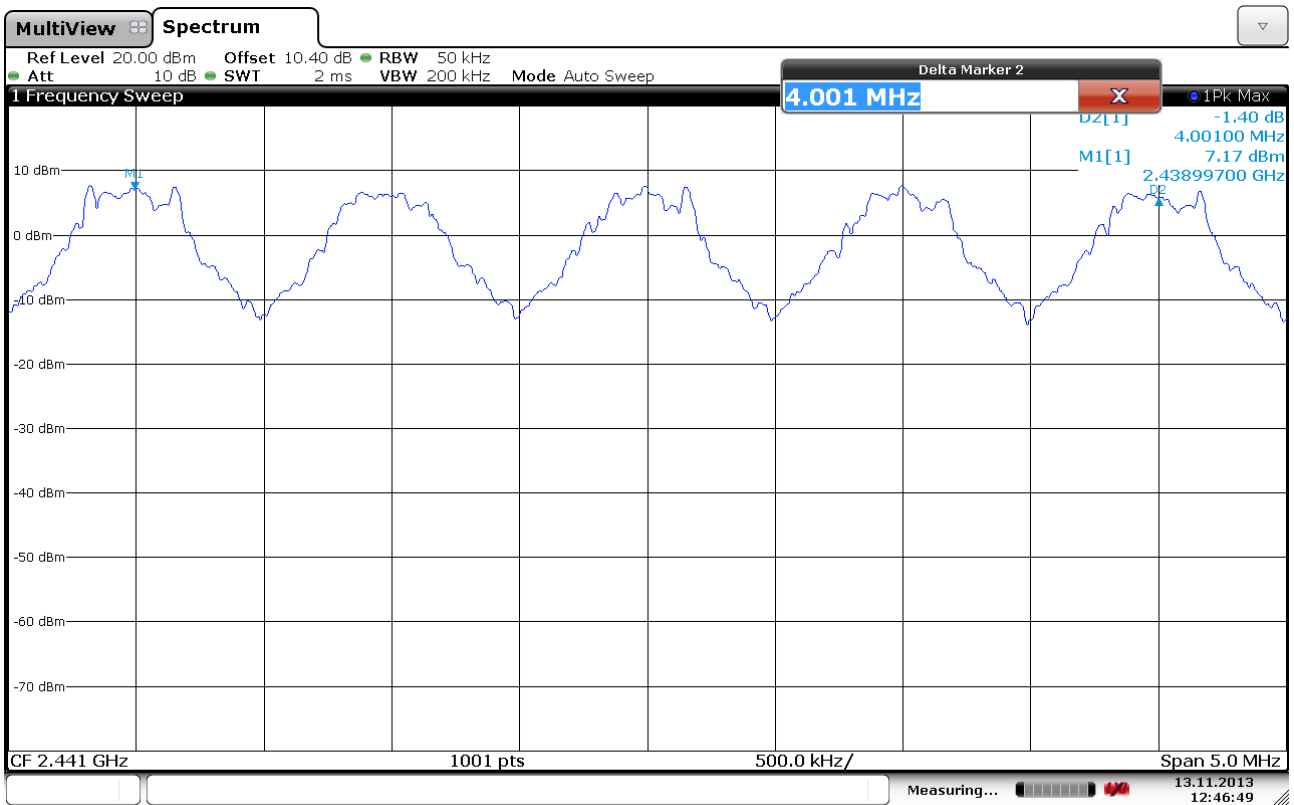
**See attached plots**

**Requirement:**

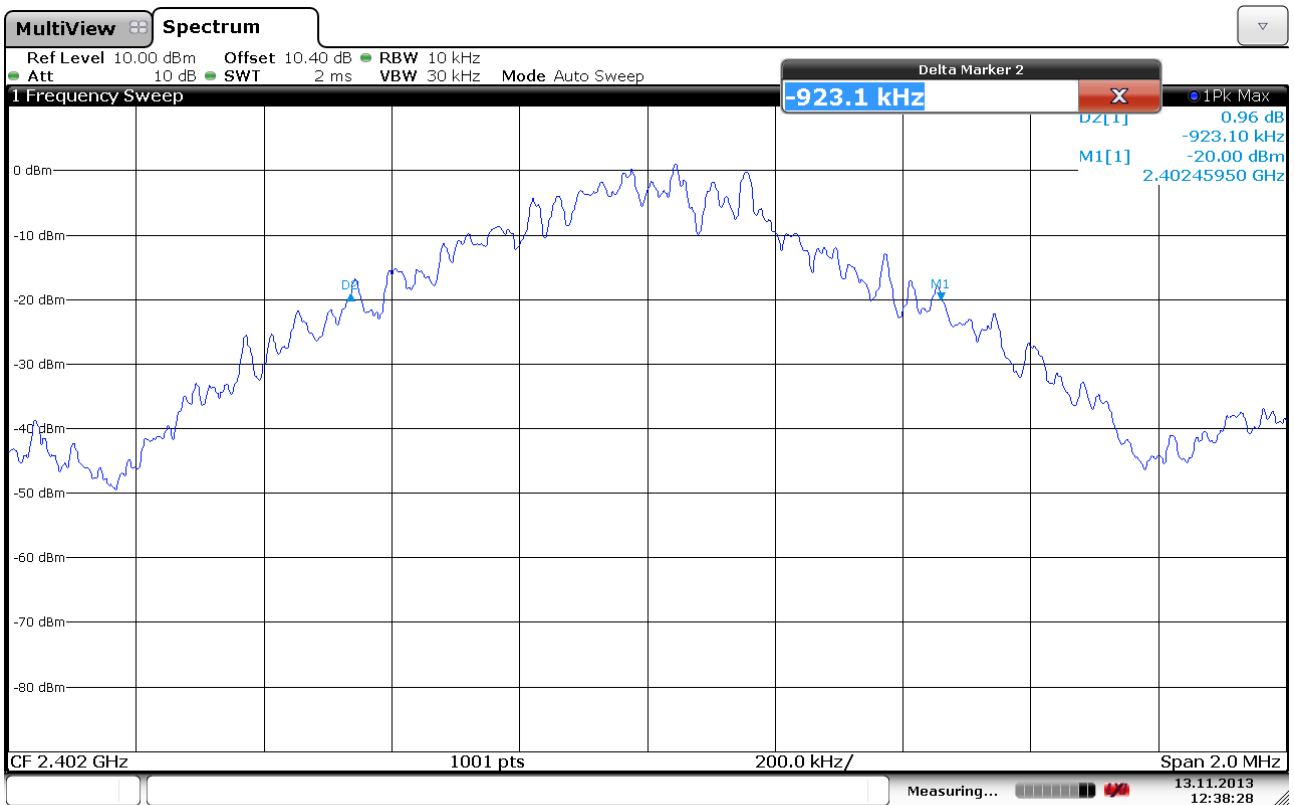
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

or:

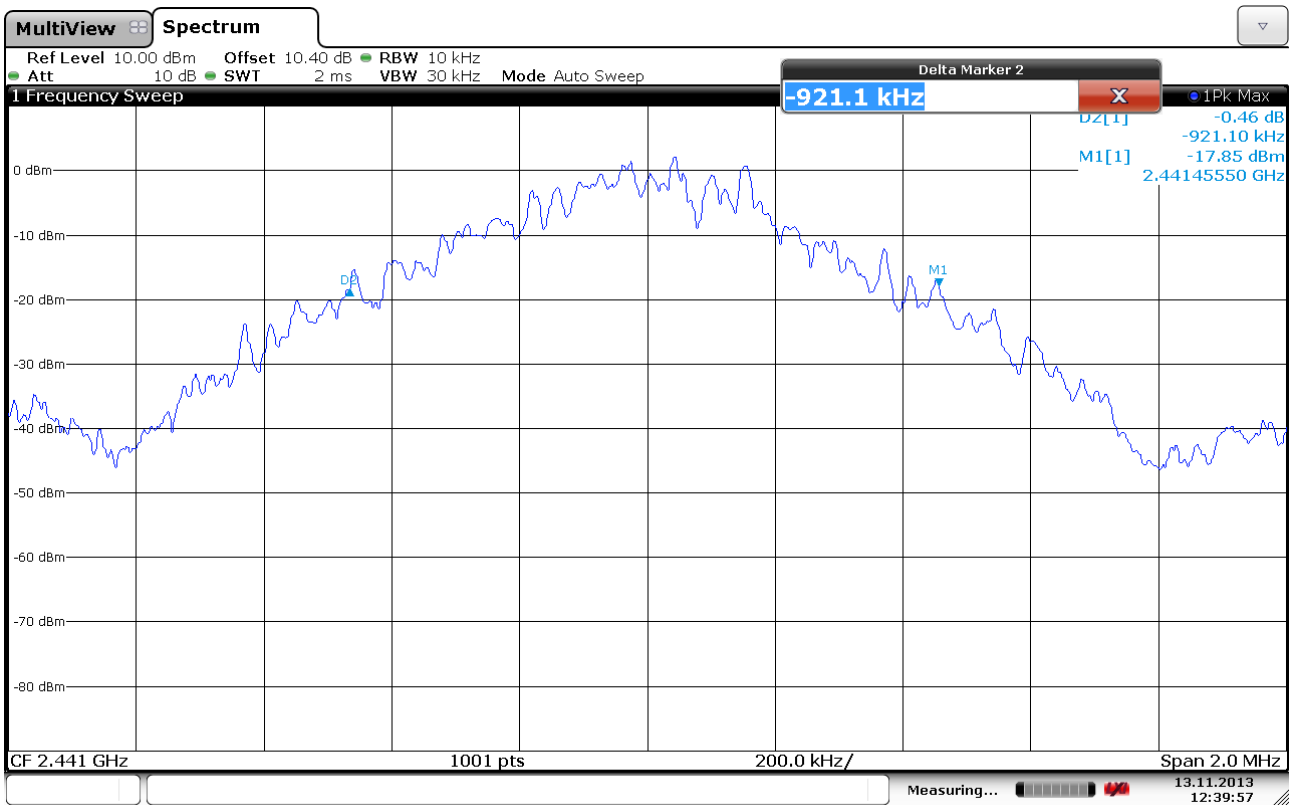
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the system operates with an output power no greater than 125 mW.



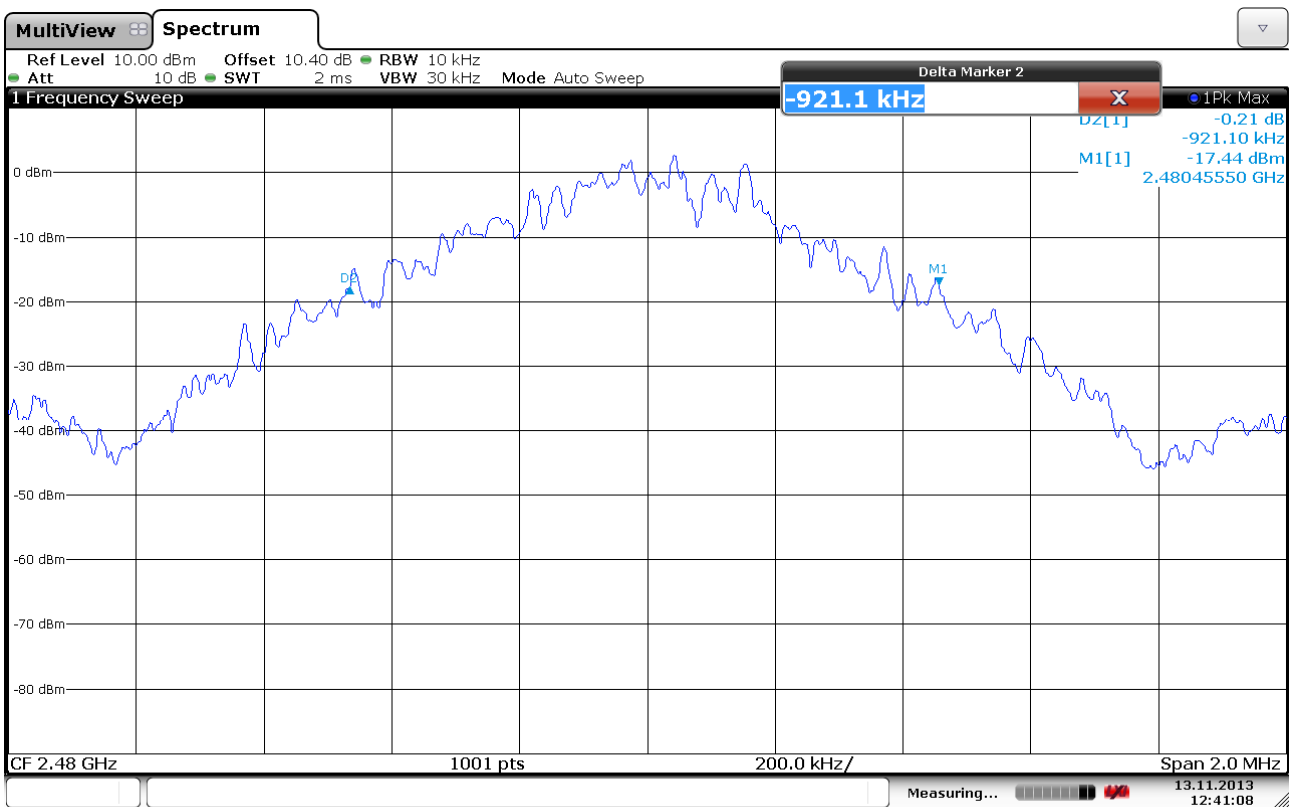
### Channel Separation



### 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:

Minimum Number of RF Channels:	20
Maximum Number of RF Channels:	79
Maximum Length of RF Burst pr. channel	2.90 ms
Time between RF Burst on same RF Channel	75.0 ms (20 ch)
	296.25 ms (79 ch)
Time of Occupancy (20 and 79 ch mode)	309.3 ms

20 Ch Mode:

Time between RF burst on same channel:  $3.75 \times 20 \text{ ms} = 75.0 \text{ ms}$

Time of occupancy:  $(2.90 \times 400 \times 20) / 75.0 = 309.3 \text{ ms}$

79 Ch Mode:

Time between RF burst on same channel:  $3.75 \times 79 \text{ ms} = 296.25 \text{ ms}$

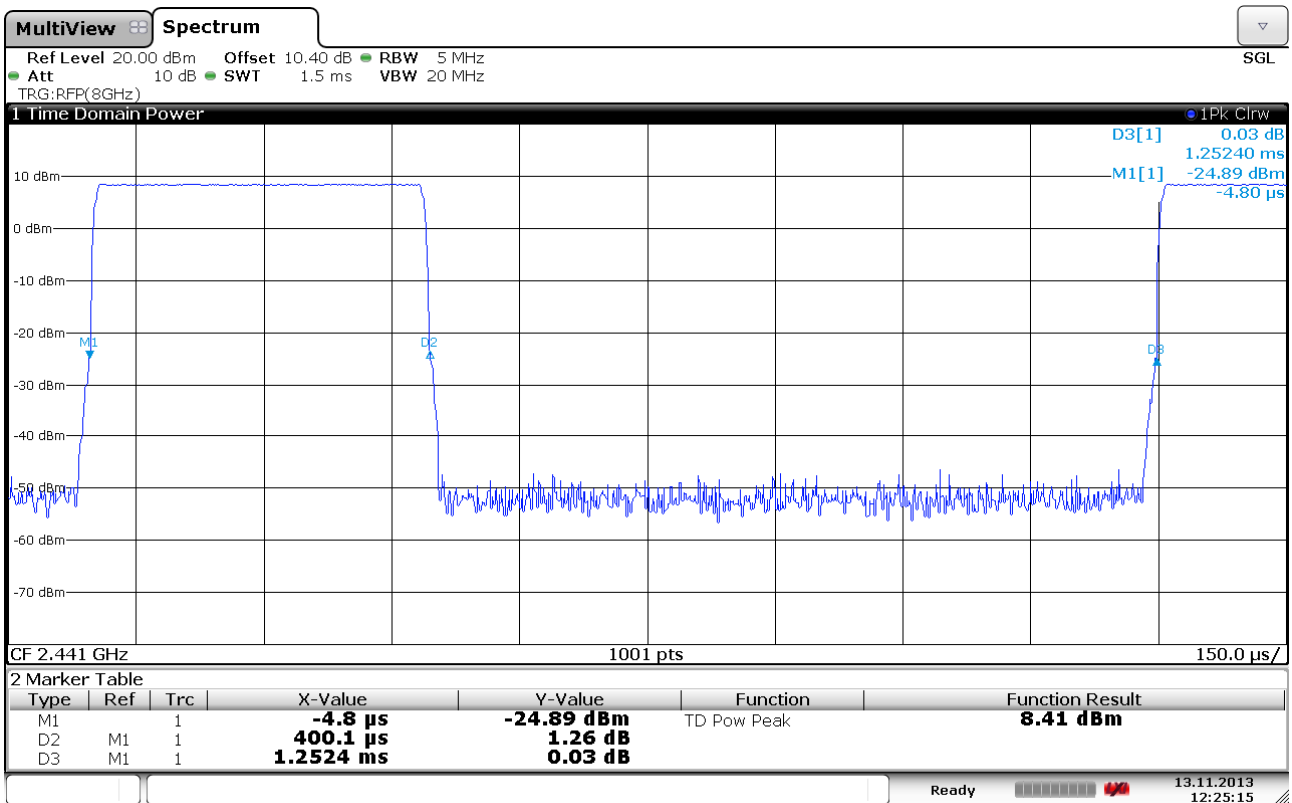
Time of occupancy:  $(2.90 \times 400 \times 79) / 296.25 = 309.3 \text{ ms}$

**See attached graph.**

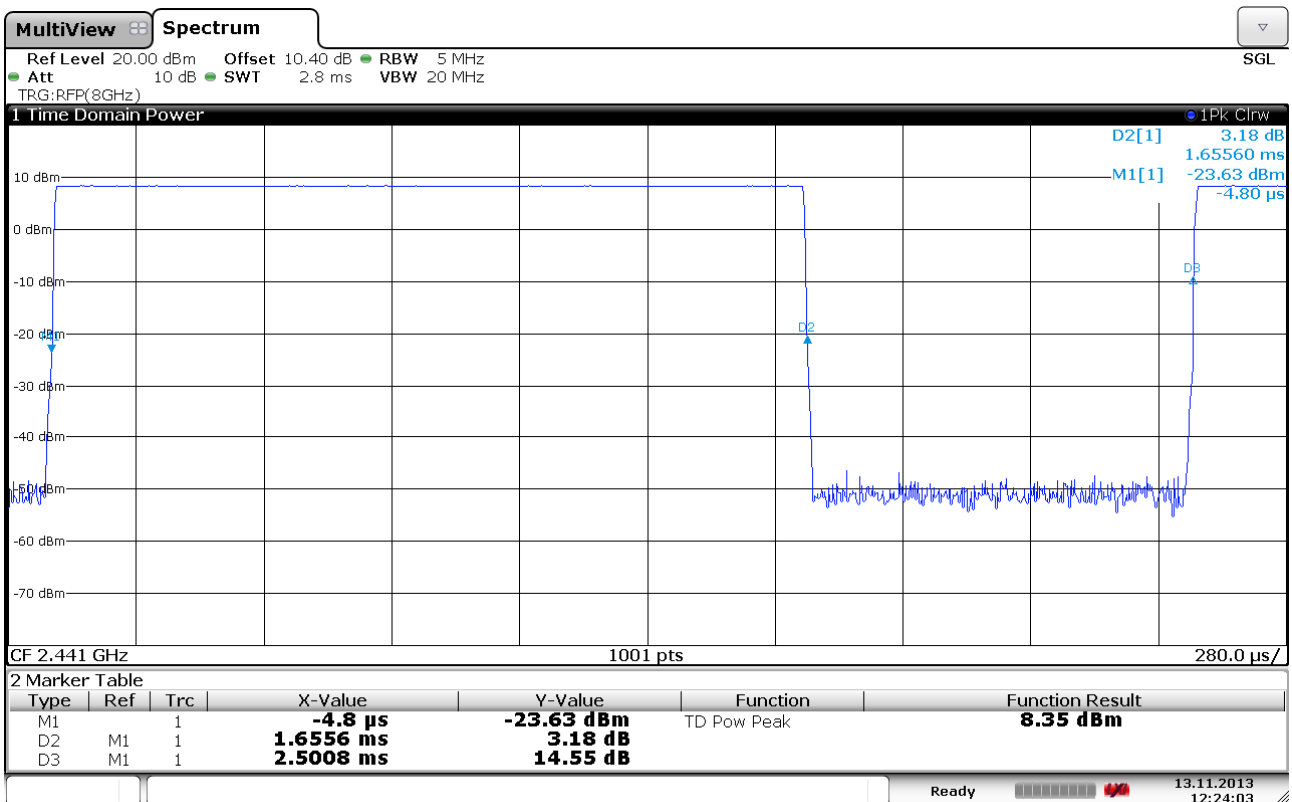
### Requirements:

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.

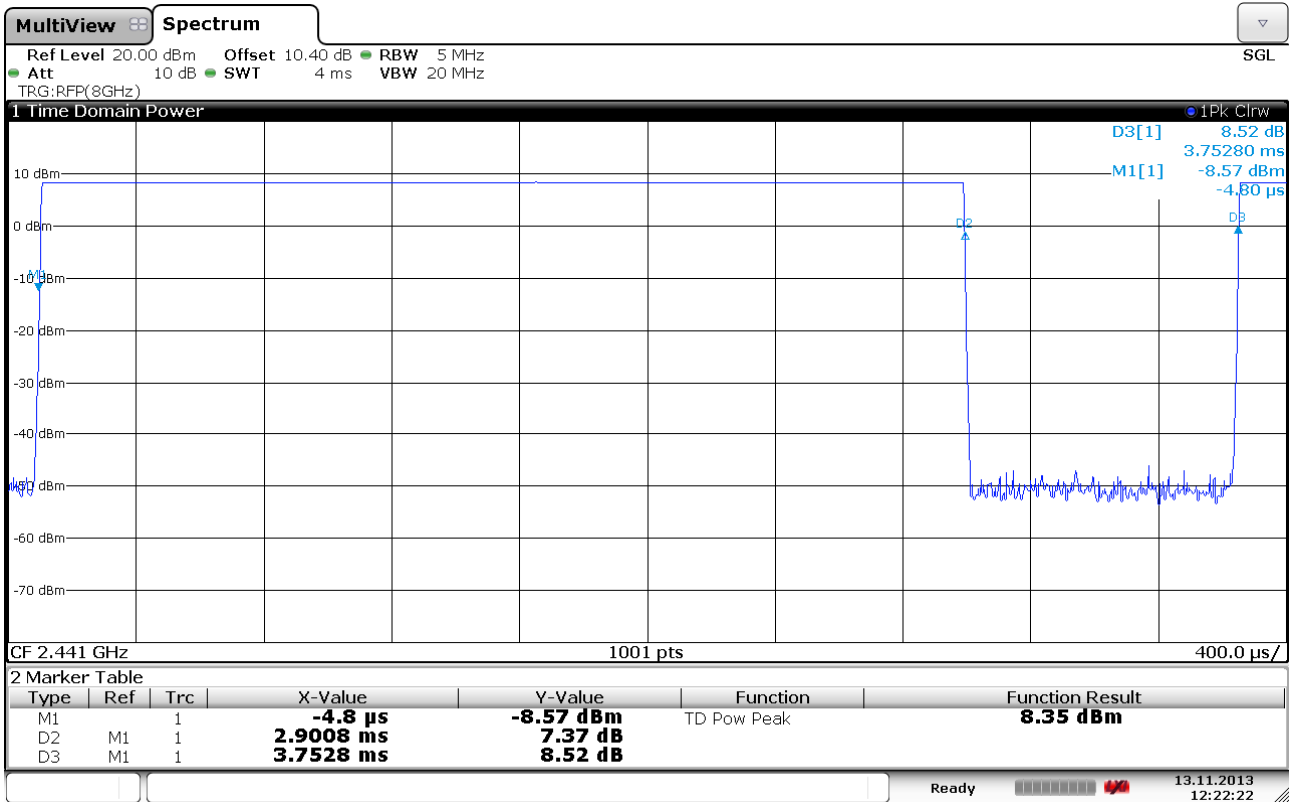
No requirements for Digital Transmission Systems.



### 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 RF channels in use
Channel Centre Frequencies:	The channels are centered at each full MHz from 2402 to 2480 MHz

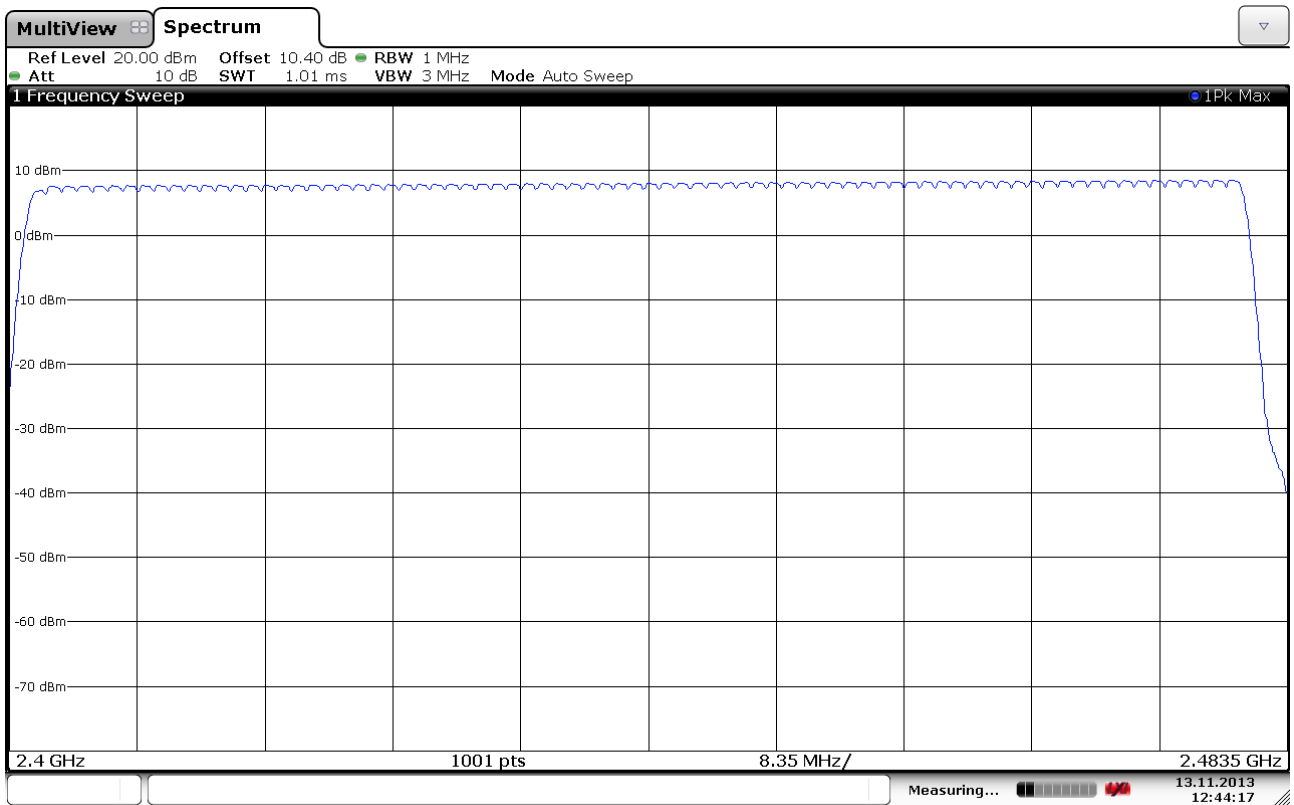
See attached plots.

#### Requirements:

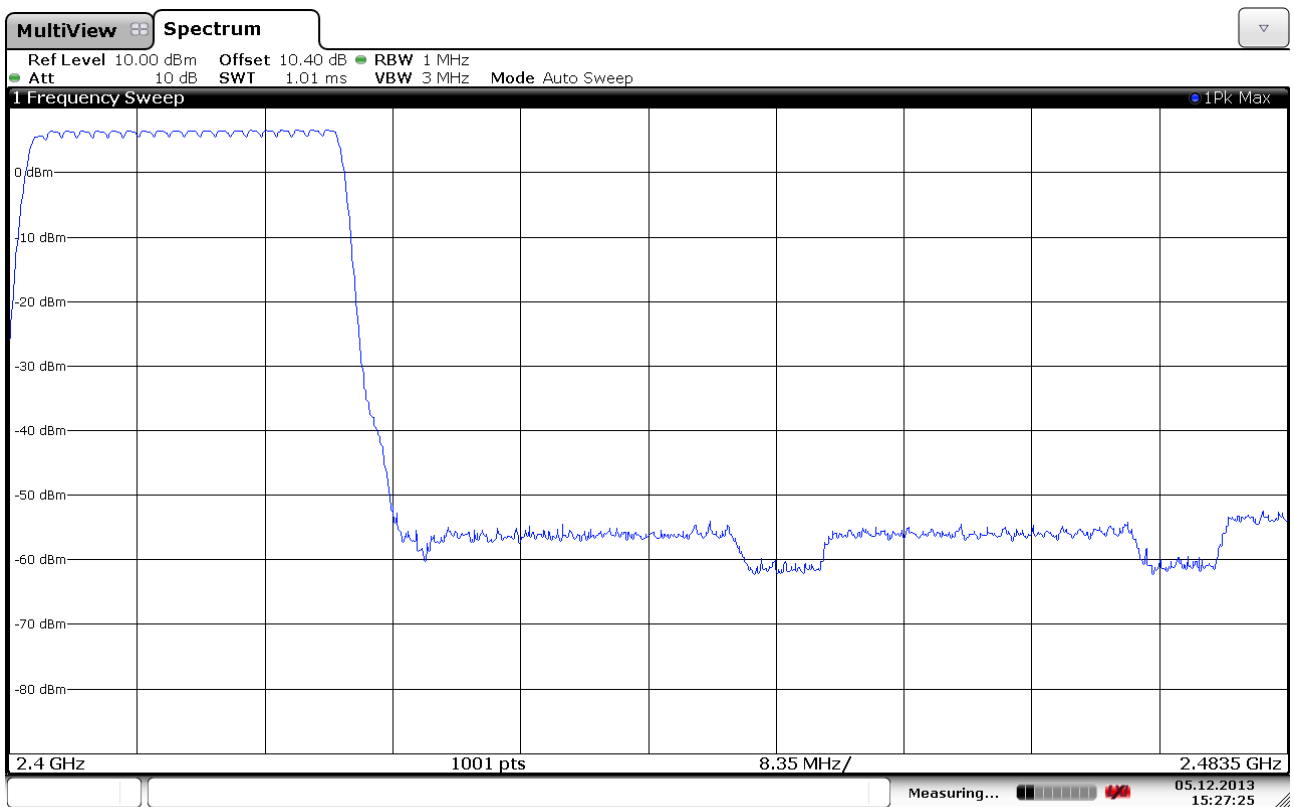
Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels.  
No requirements for bandwidth for this frequency band.

No requirements for Digital Transmission Systems.

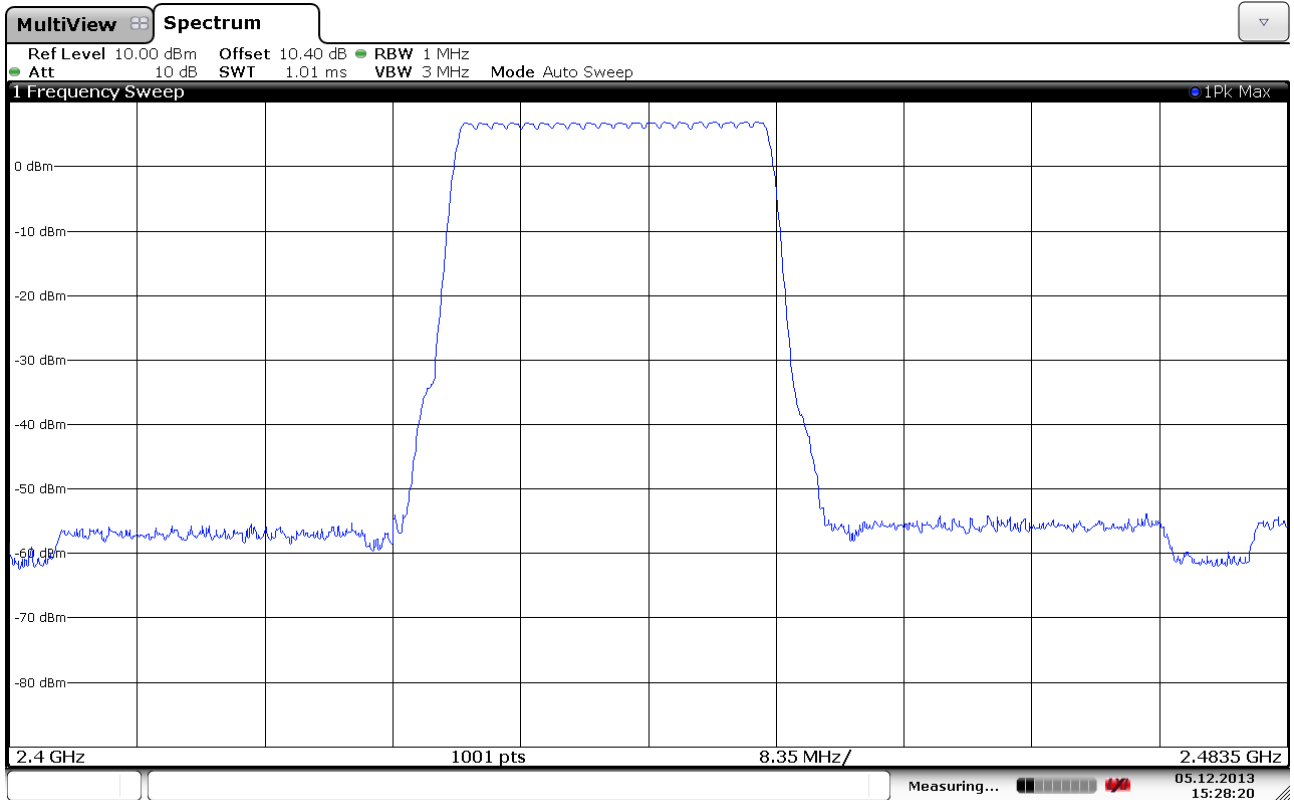
No requirement for 99% BW, reported for information only.



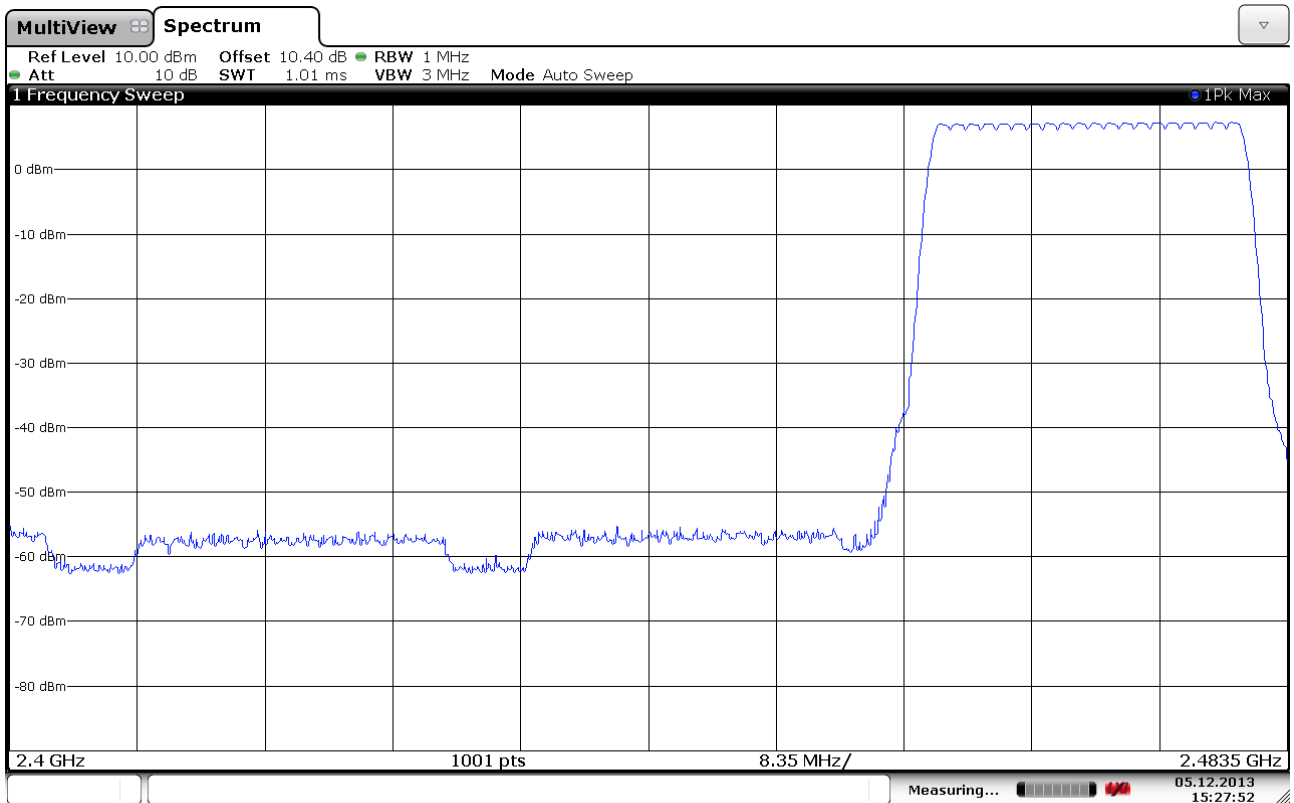
RF Channels in Use, 79 Ch



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
Peak Power (dBm)	7.3	8.4	8.8
Peak Power (Watts)	0.0053	0.0069	0.0076
Field Strength (dBµV/m)	101.1	102.5	101.1
EIRP, Calculated (Watts)	0.0038	0.0054	0.0039
Antenna gain (dBi)	-1.4	-1.0	-2.9

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 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:

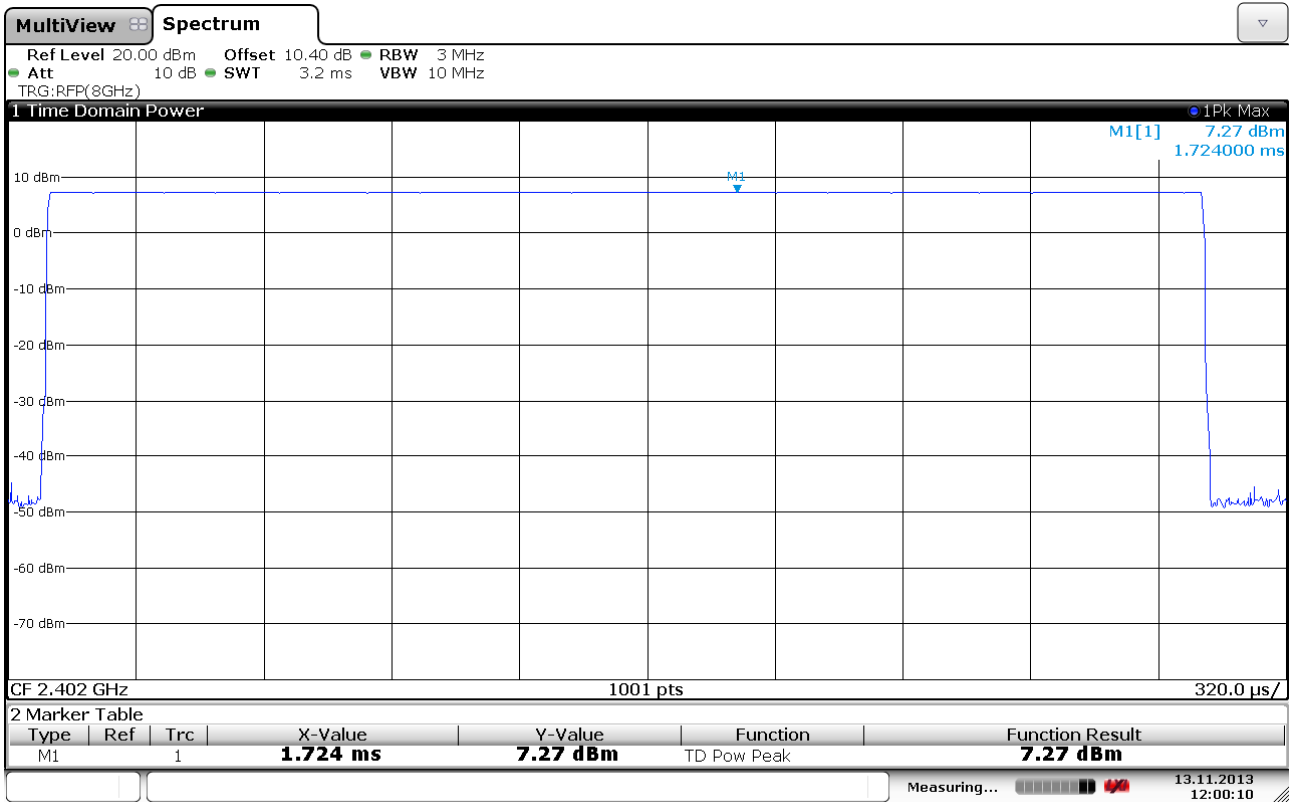
The maximum peak output power shall not exceed the following limits:

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

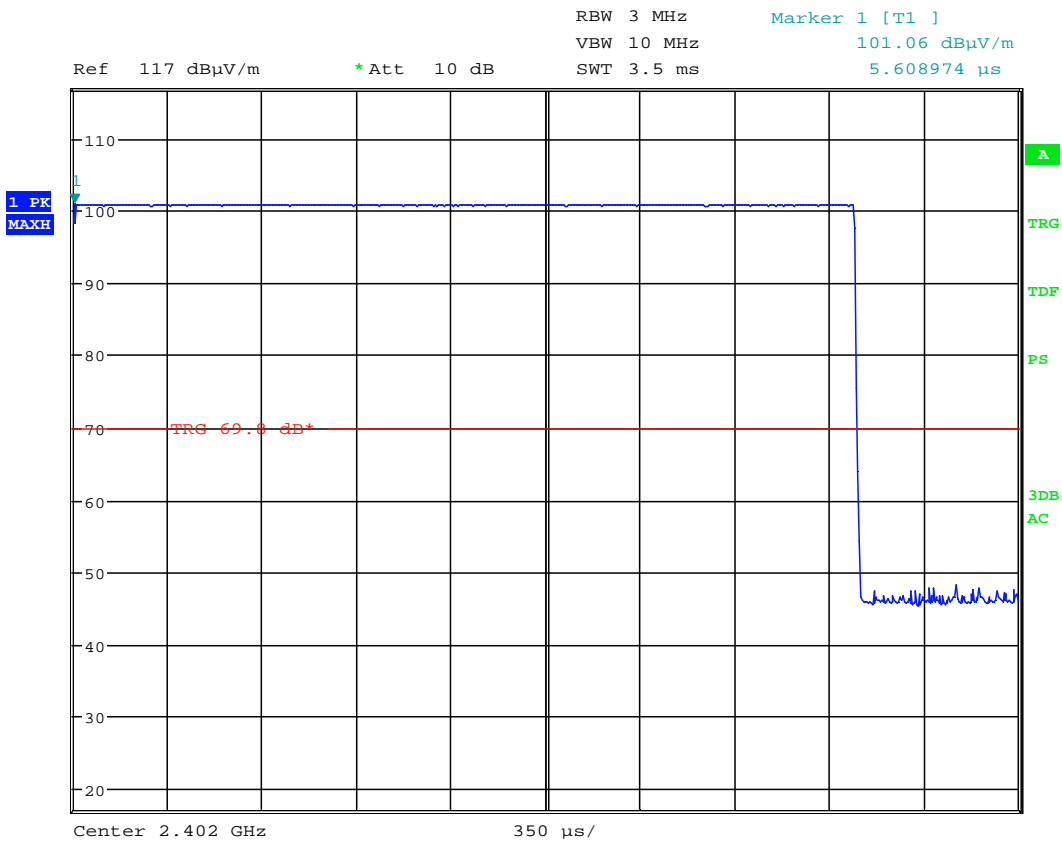
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

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.

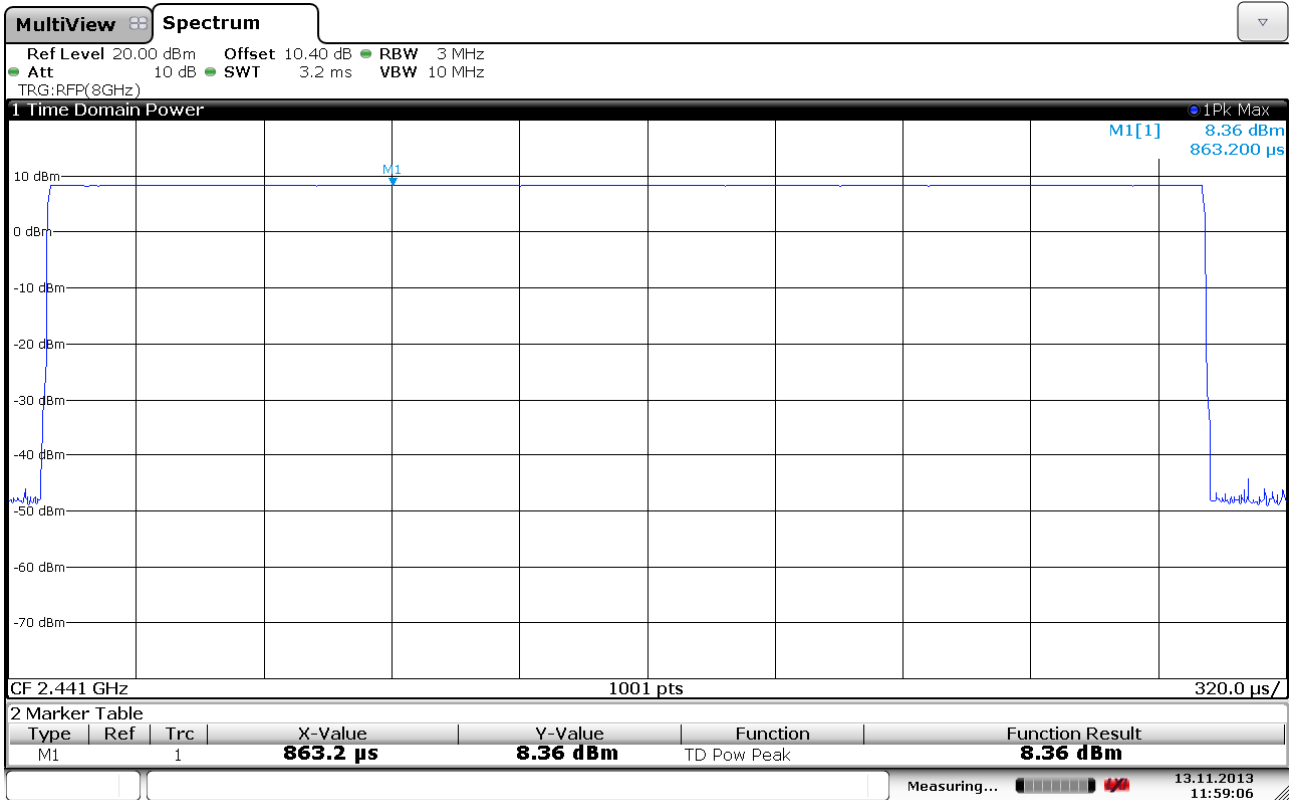


**Conducted Power, 2402 MHz**

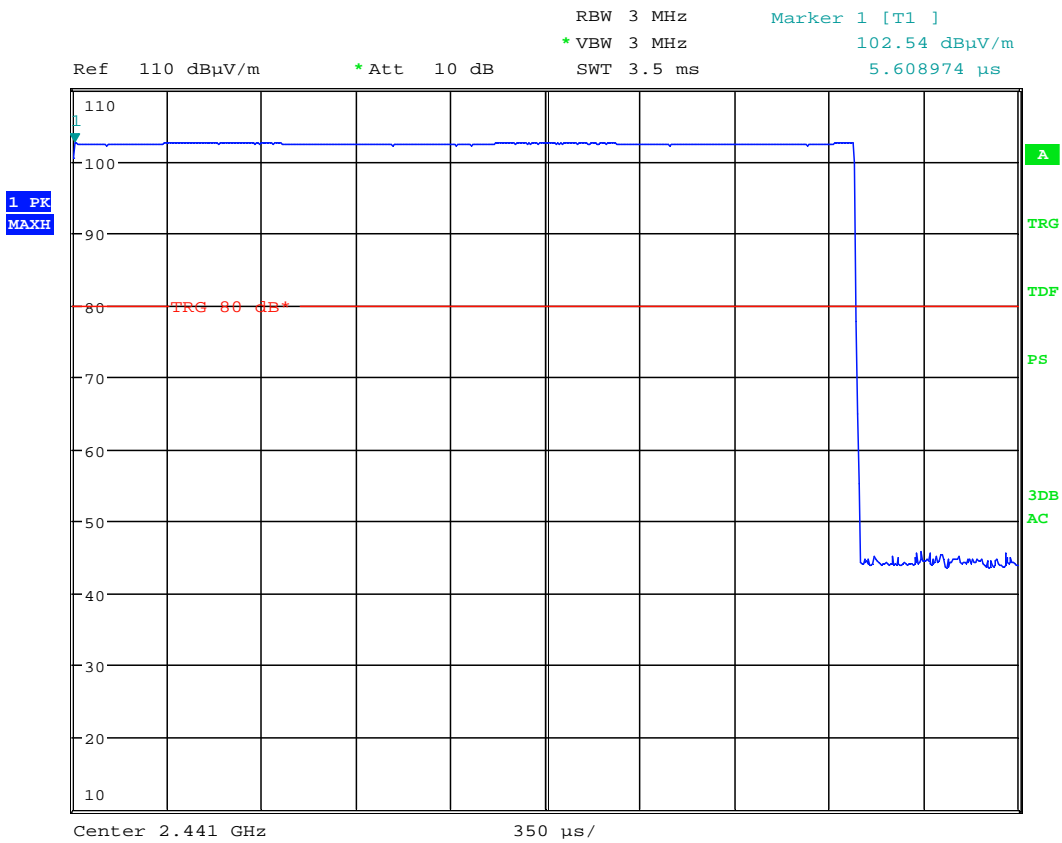


Date: 26.OCT.2015 13:03:49

**Radiated Power, 2402 MHz (VP)**

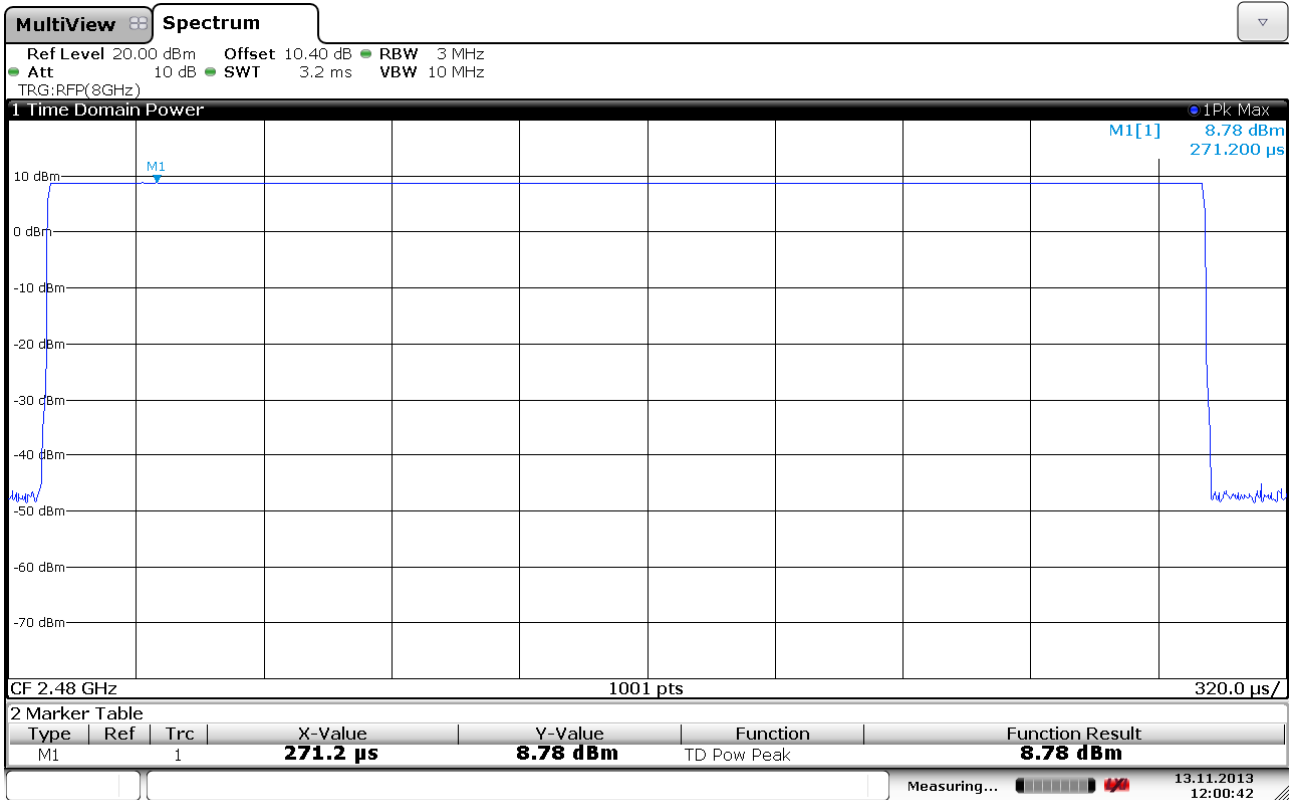


### Conducted Power, 2441 MHz

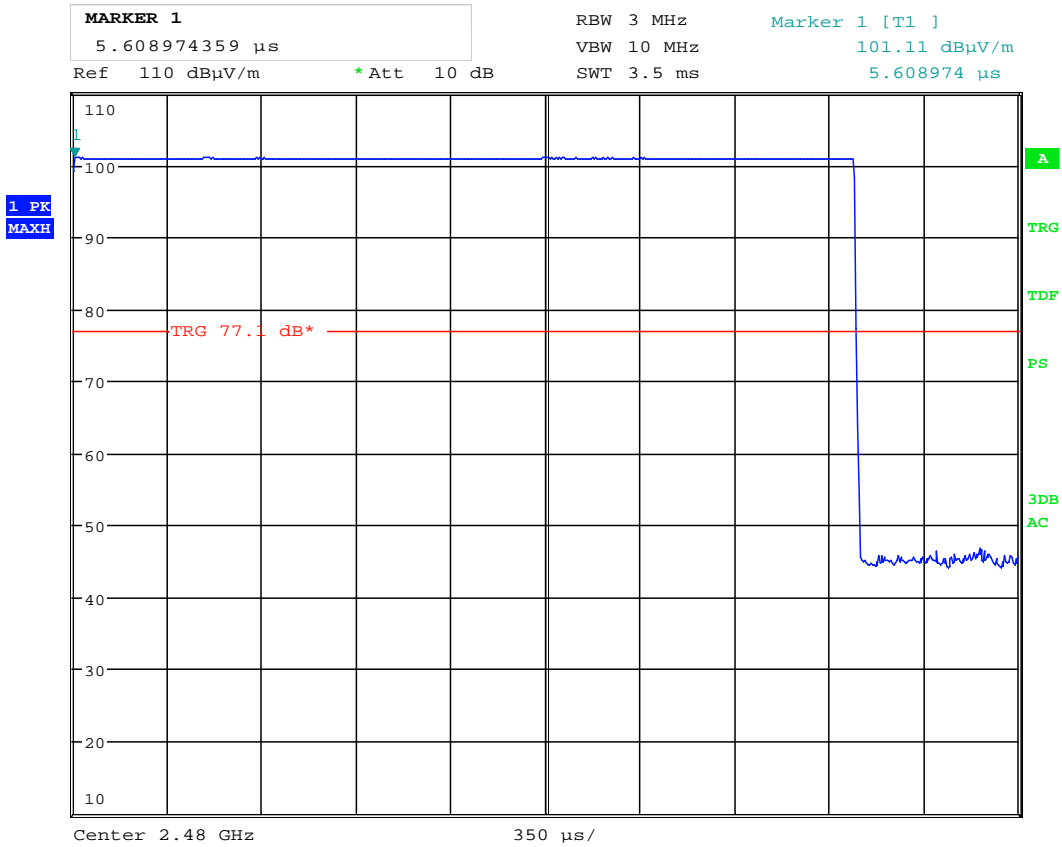


Date: 26.OCT.2015 13:27:47

**Radiated Power, 2441 MHz (VP)**



**Conducted Power, 2480 MHz**



Date: 26.OCT.2015 13:49:57

**Radiated Power, 2480 MHz (VP)**

### 3.6 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Results: Complies

Measurement Data:

#### Band-Edge Spurious Emissions

	Measured field strength (dB $\mu$ V/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB $\mu$ V/m	dB	
Peak Detector	44.3	58.6	74	29.7	15.4
Average Detector	24.3	38.6	54	29.7	15.4

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 \* number of hopping channels)

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

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

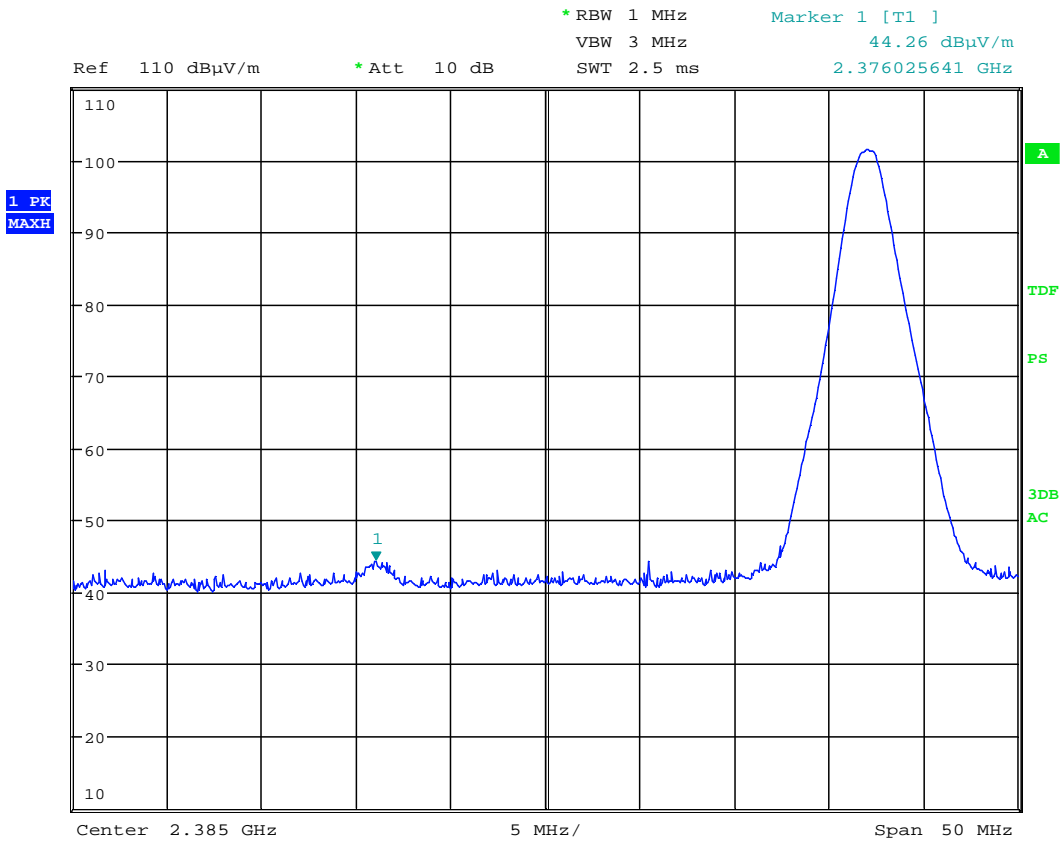
**RF conducted power** to 25 GHz see attached plots.

Maximum RF level outside operating band:

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

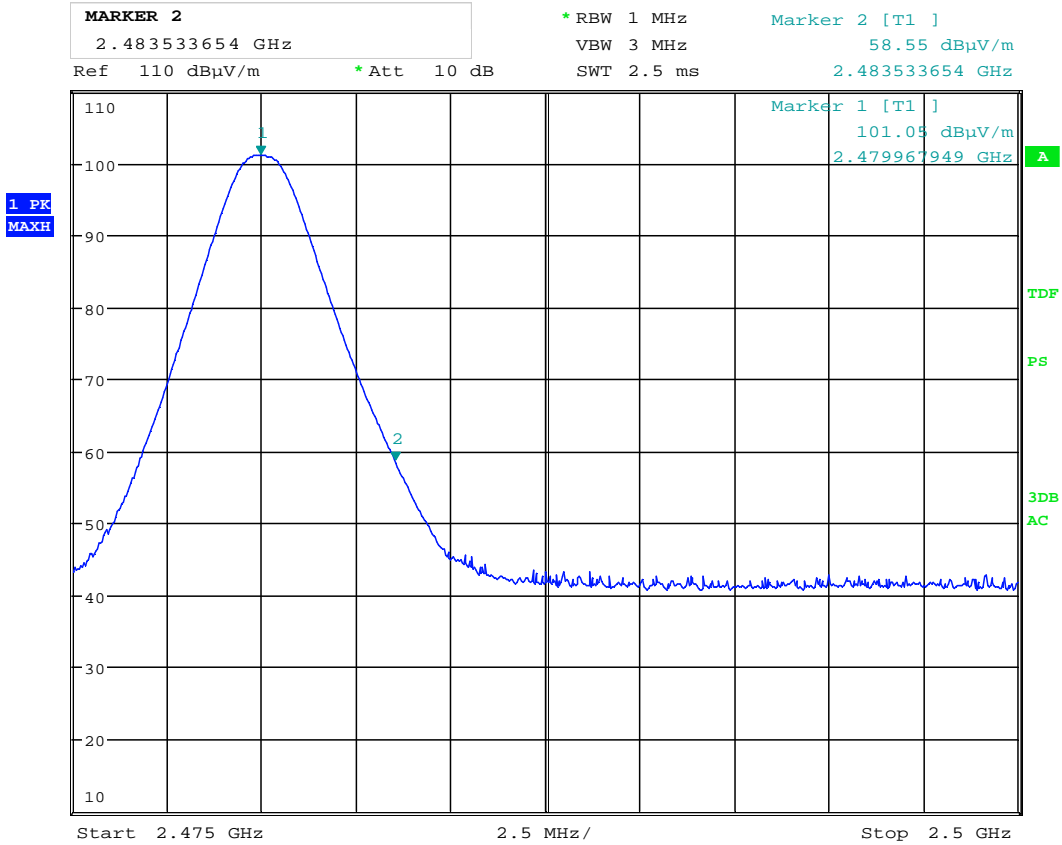
RF ch 39: >50 dB/C, margin >30 dB

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



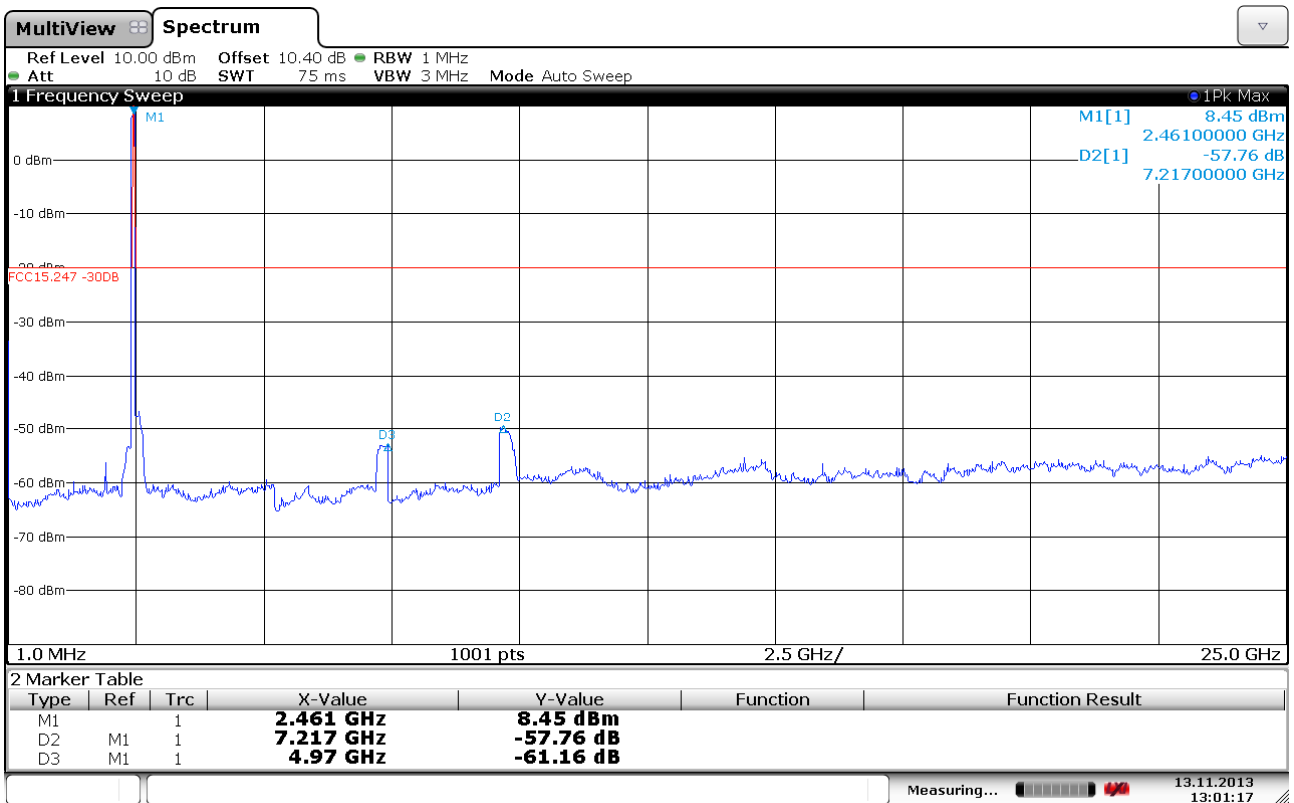
Date: 26.OCT.2015 13:11:12

**Lower Band Edge, Radiated, 2402 MHz, Peak**

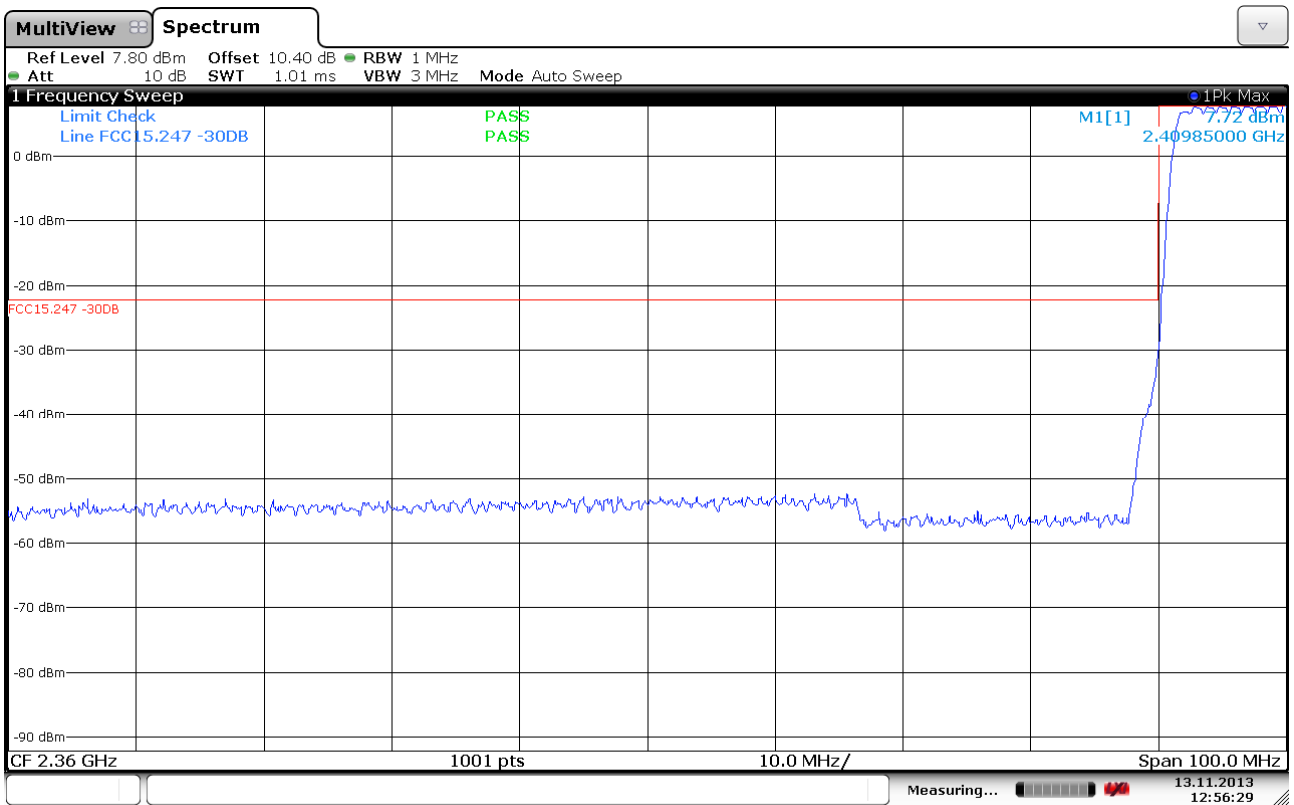


Date: 26.OCT.2015 13:51:31

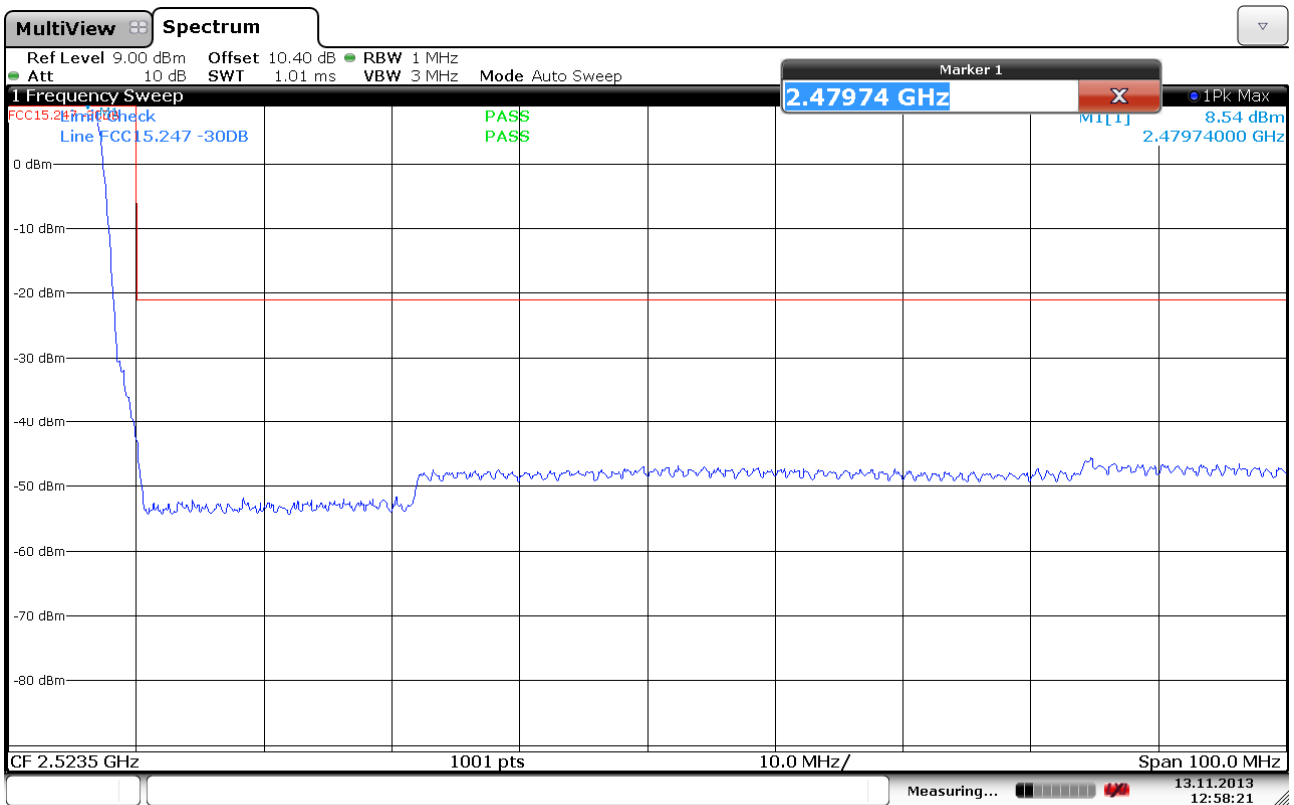
**Upper Band Edge, Radiated, 2480 MHz, Peak**



### Conducted Emissions, 1MHz -25GHz, Hopping On



**Conducted Emissions, 2310 -2410 MHz, Hopping ON**



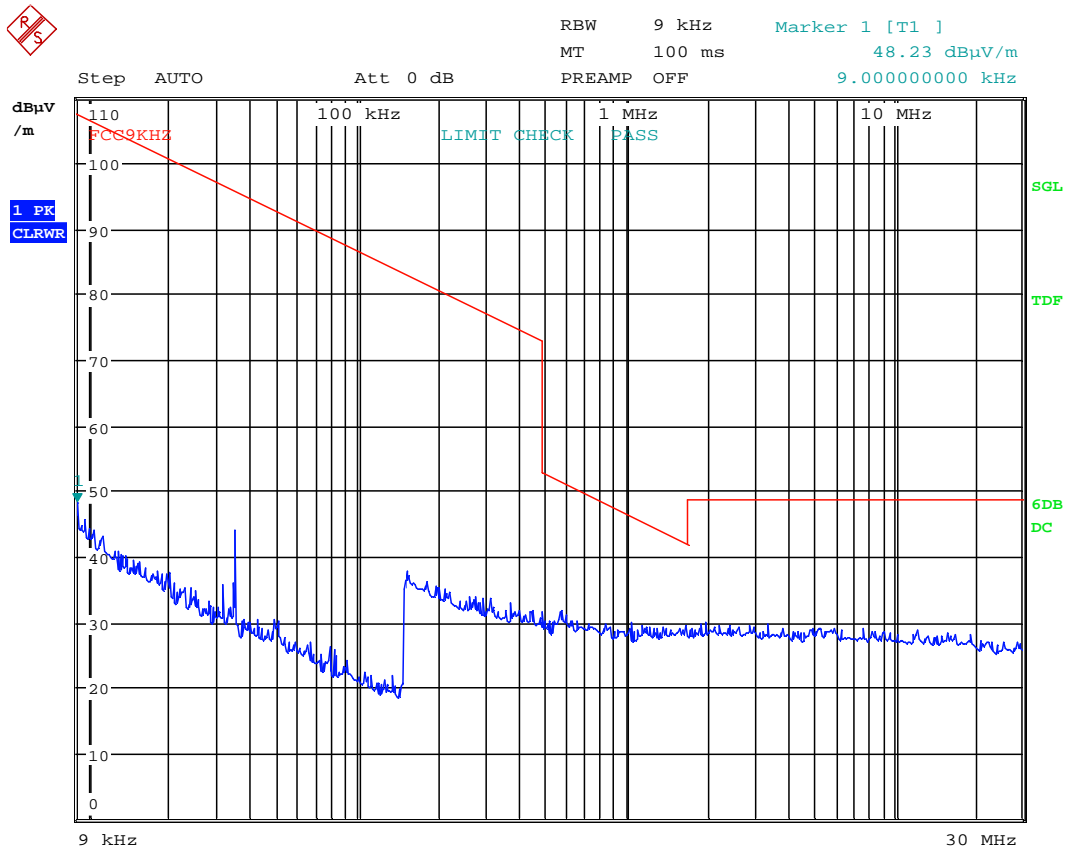
**Conducted Emissions, 2473.5 -2573.5 MHz, Hopping ON**

**Radiated emissions 9 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: 26.OCT.2015 16:41:38

**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			$\text{dB}\mu\text{V}/\text{m}$	metres	$\text{dB}\mu\text{V}/\text{m}$	dB
30 -200	TX on	VP/HP	<30	3	$\geq 40$	>10
200 - 1000	TX on	VP/HP	<31	3	$\geq 43.5$	>10

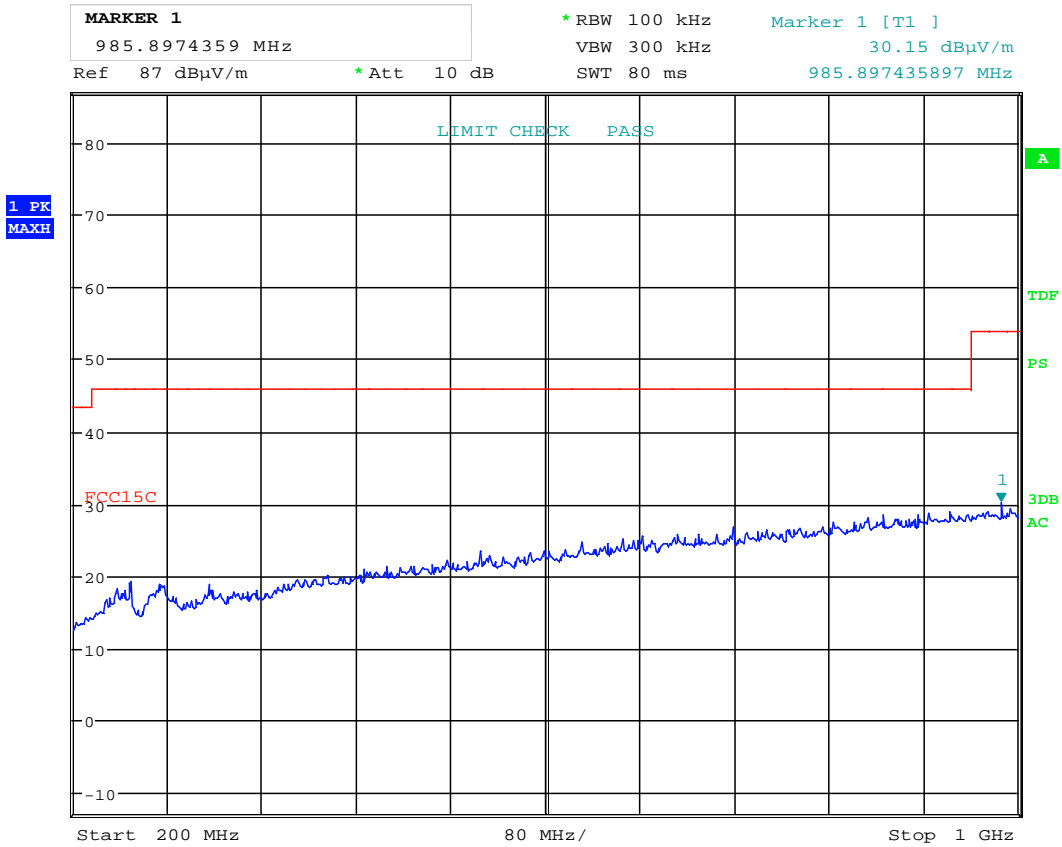
See attached plots.



Date: 26.OCT.2015 11:03:33

**Radiated Emissions, 30 -200MHz, VP**





Date: 26.OCT.2015 11:58:51

**Radiated Emissions. 200 -1000MHz, VP**



**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	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB
2.584	H	0	50.0	20	74	24.0
7.322	M	9.5	45.0	20	74	29.0
Other freqs	L,M,H	/	None detected	20	74	>20

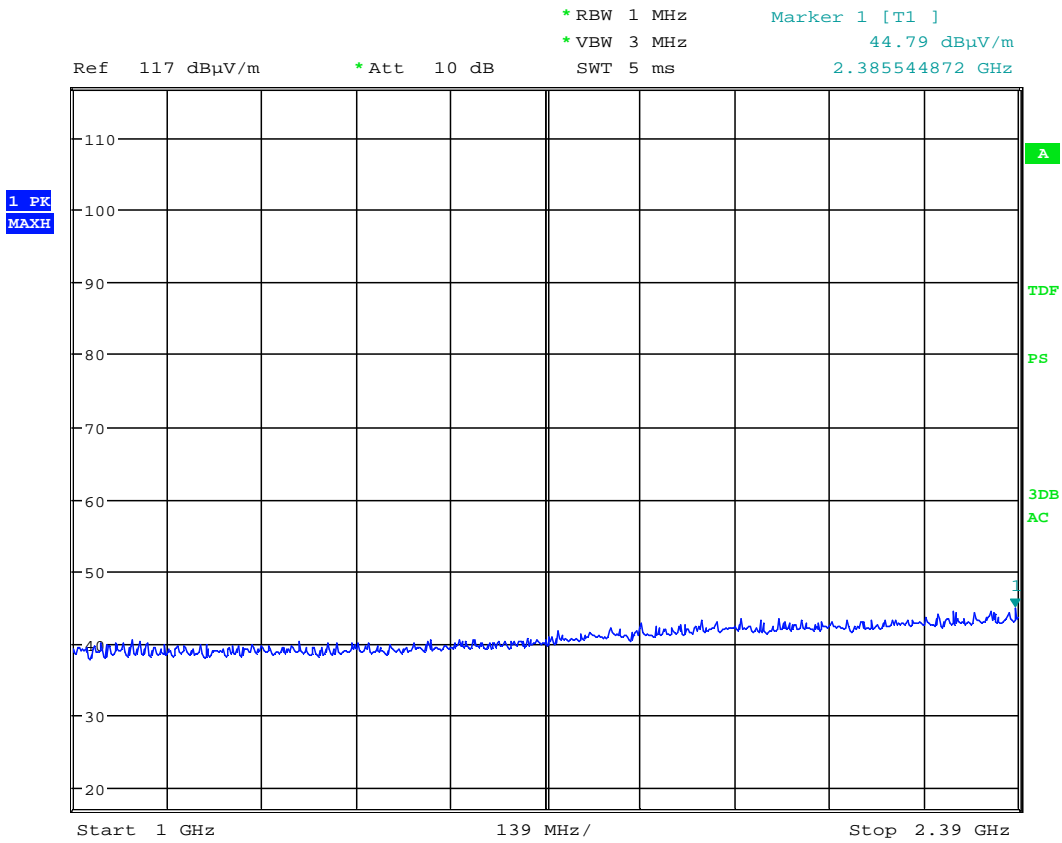
Average Detector values are calculated from Peak values by Duty Cycle Correction Factor.

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

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

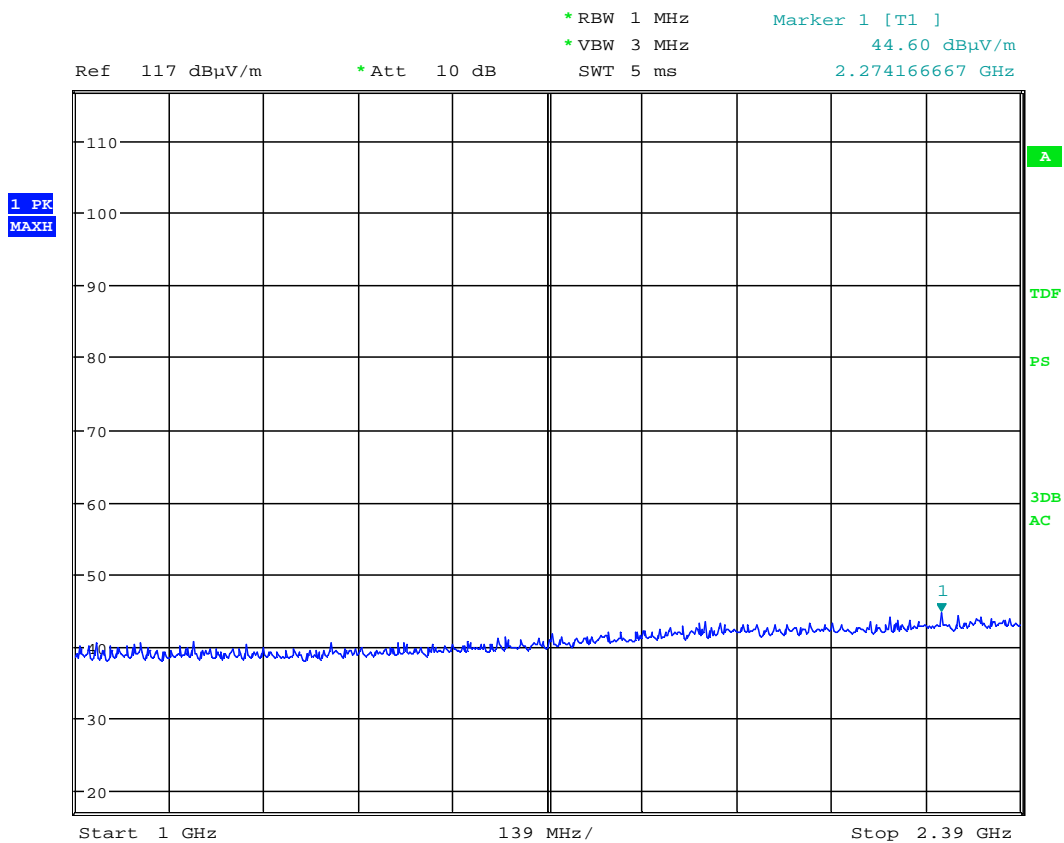
Distance correction factor is included on the plots when the measurement is performed @1m.

See plots.



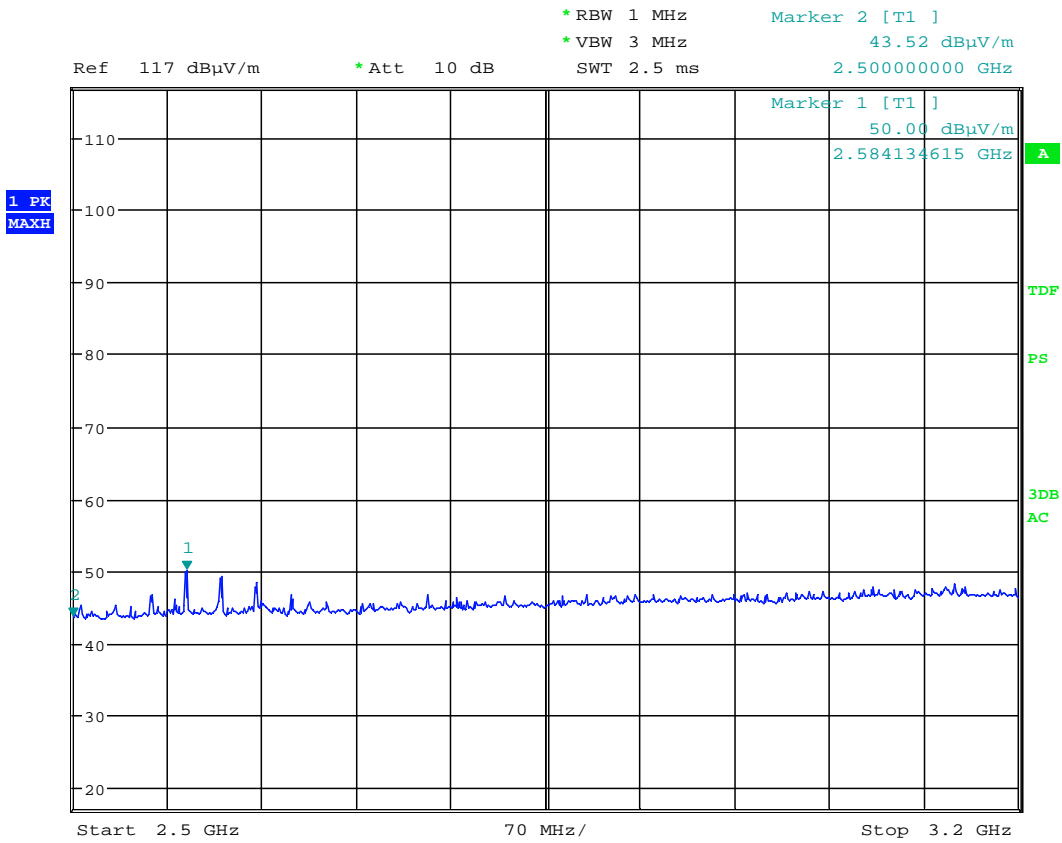
Date: 26.OCT.2015 13:14:25

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



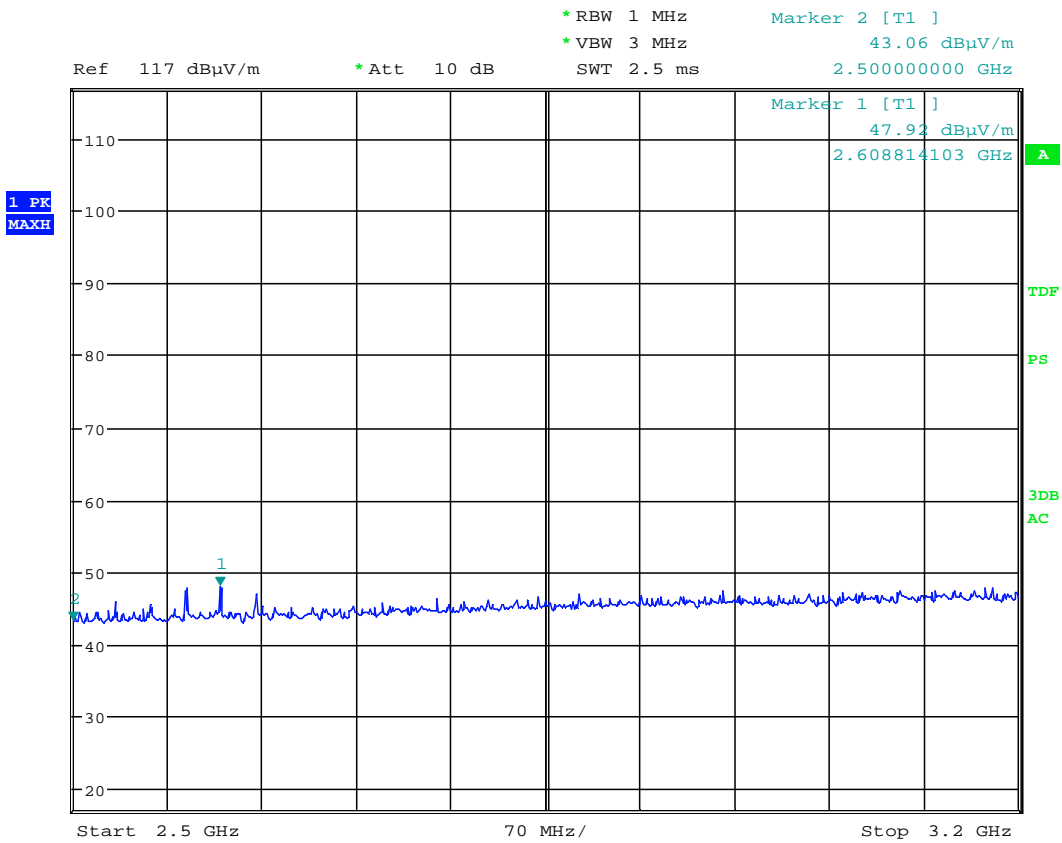
Date: 26.OCT.2015 13:16:16

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



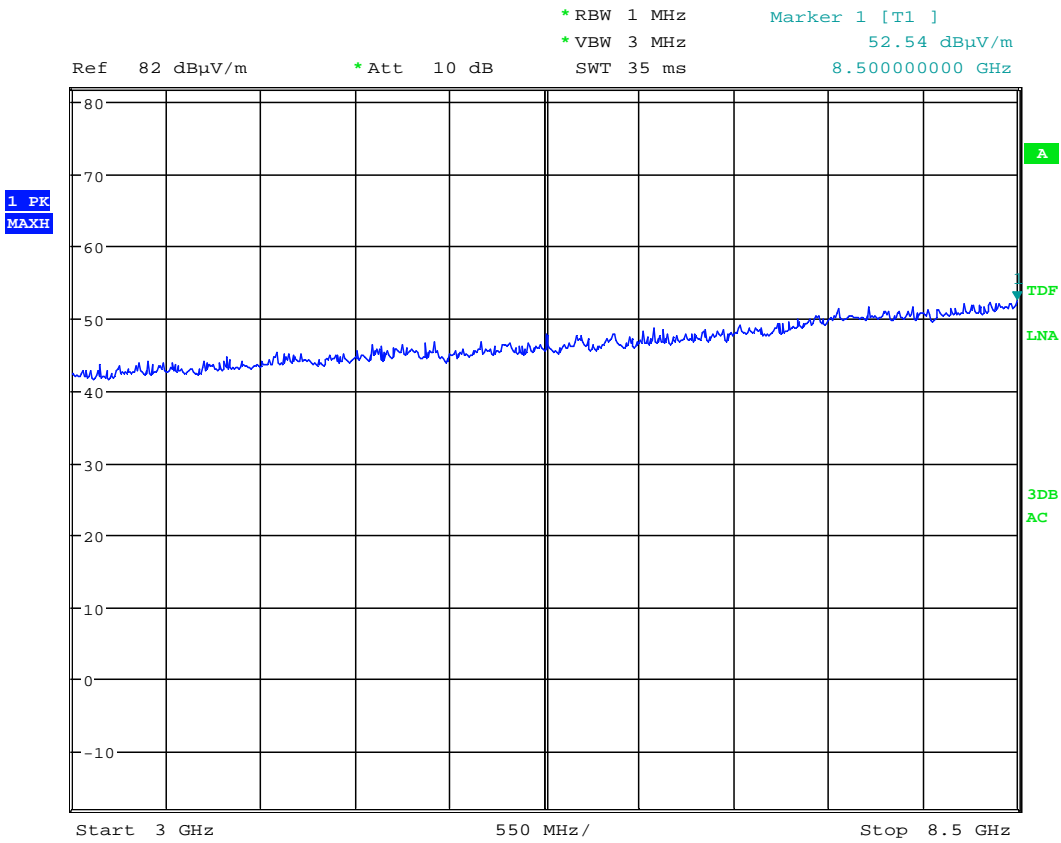
Date: 26.OCT.2015 13:56:20

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



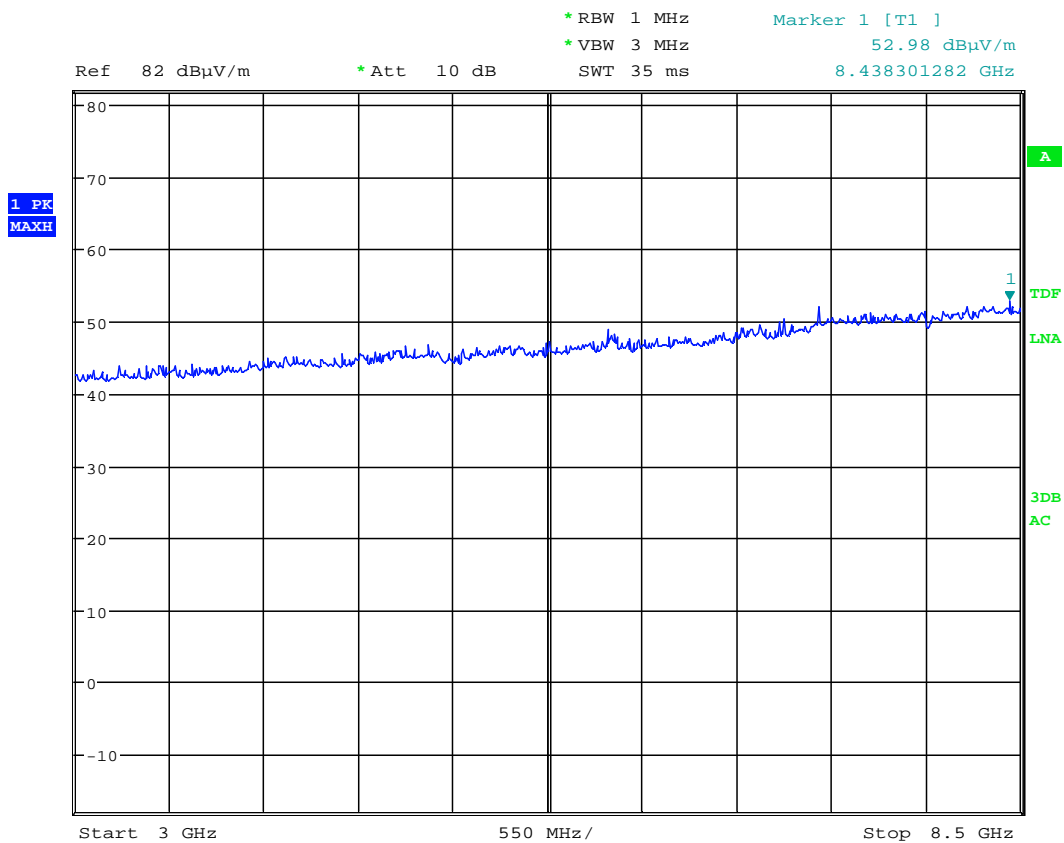
Date: 26.OCT.2015 13:58:57

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



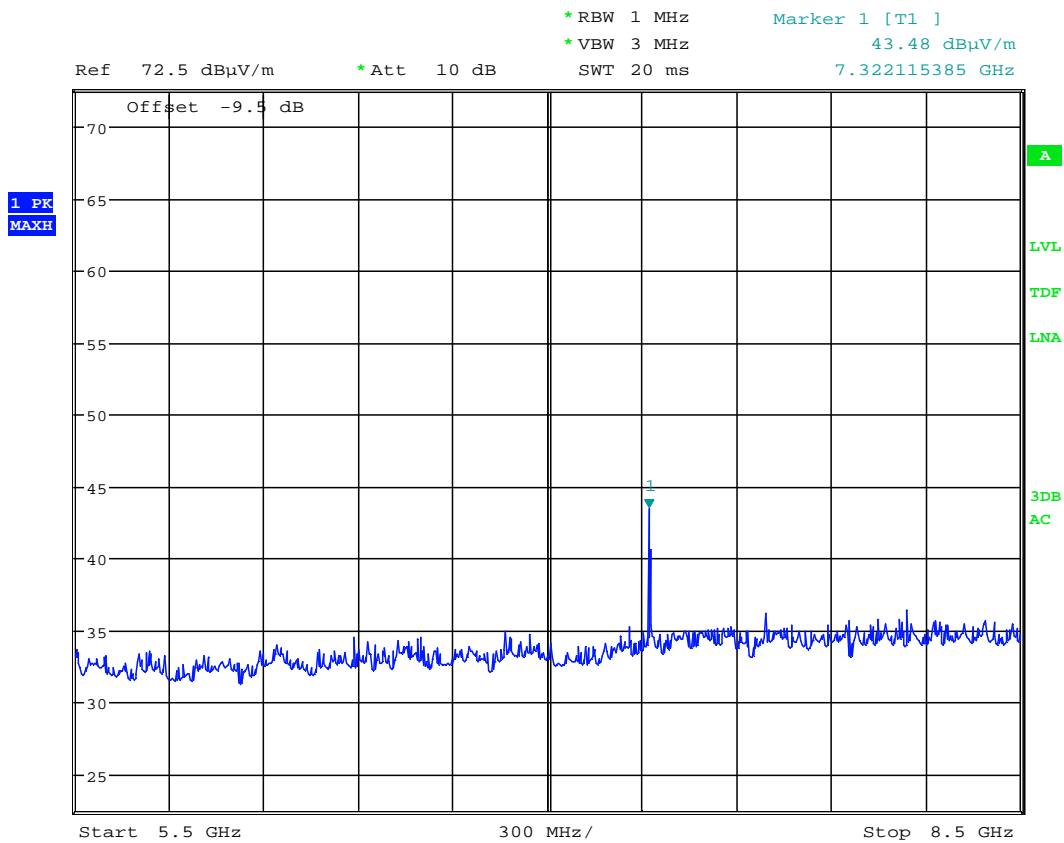
Date: 26.OCT.2015 14:34:13

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



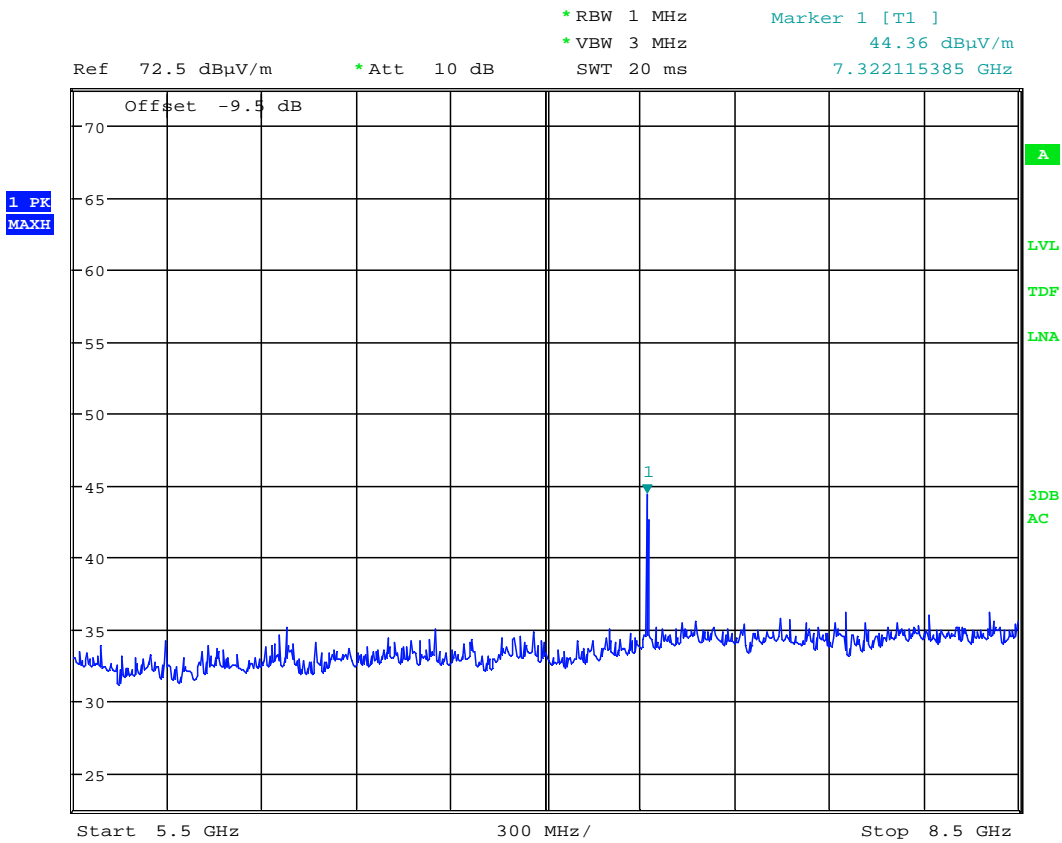
Date: 26.OCT.2015 14:36:06

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



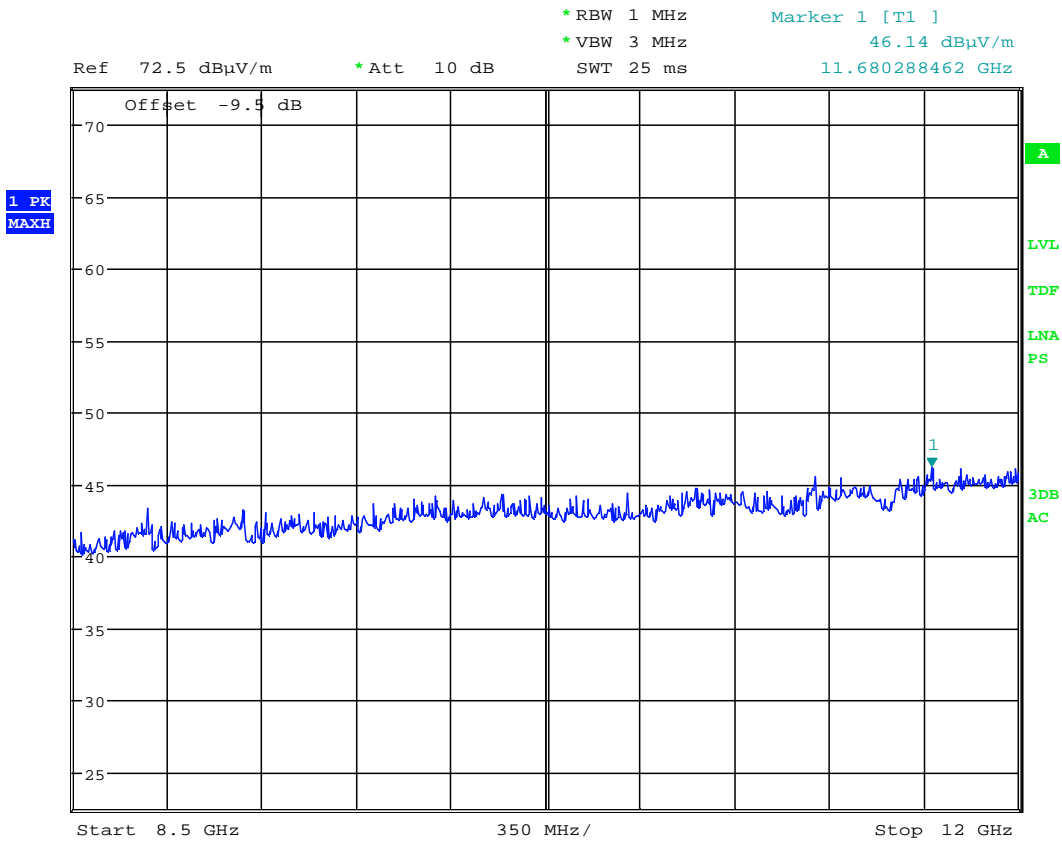
Date: 26.OCT.2015 15:01:17

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



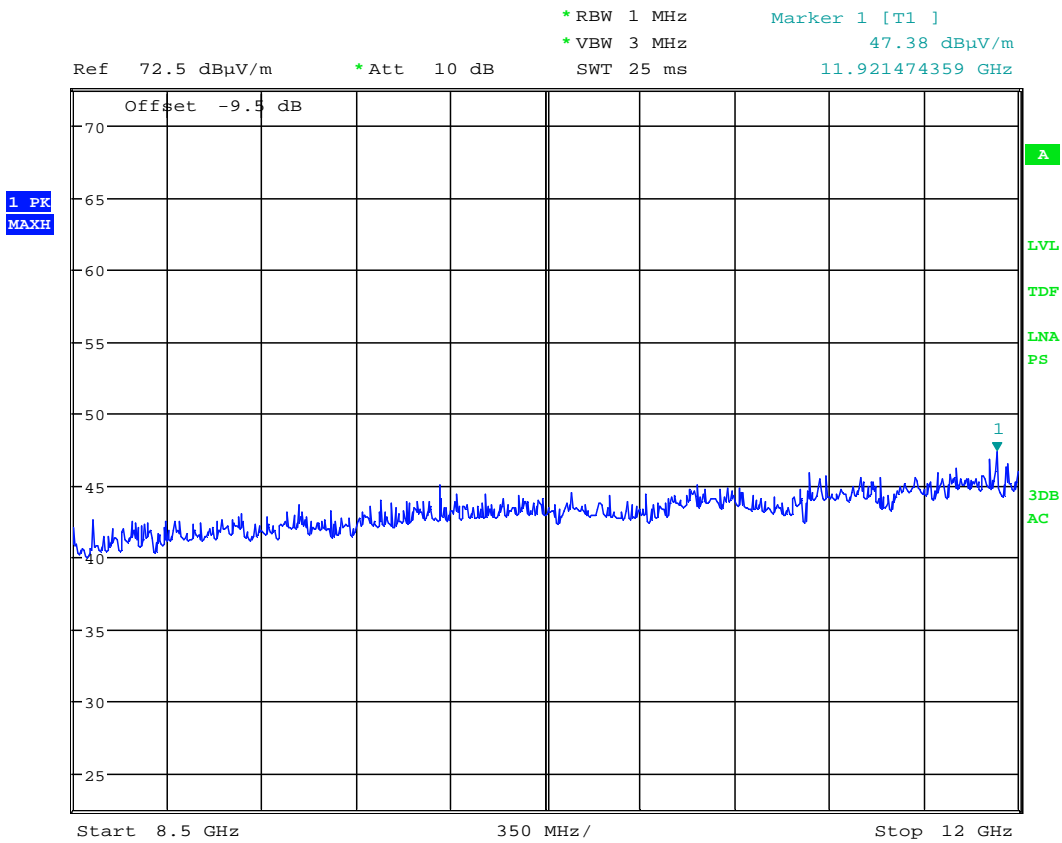
Date: 26.OCT.2015 15:03:08

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



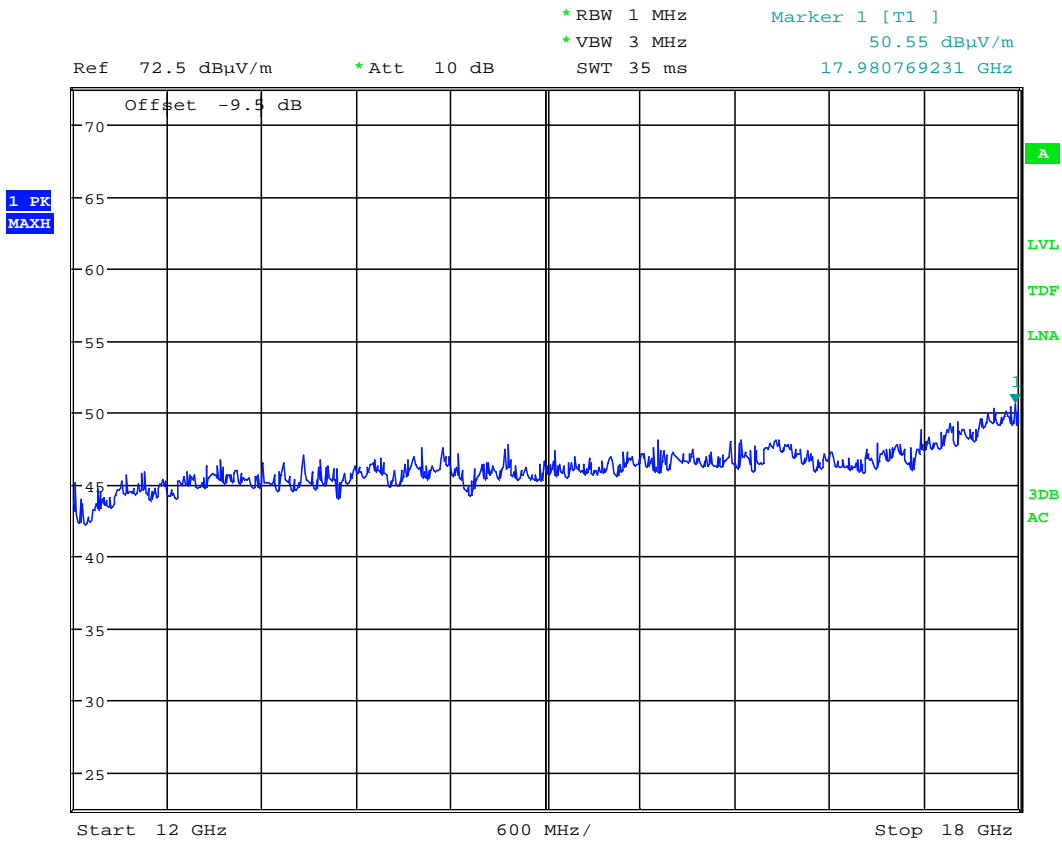
Date: 26.OCT.2015 15:18:24

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



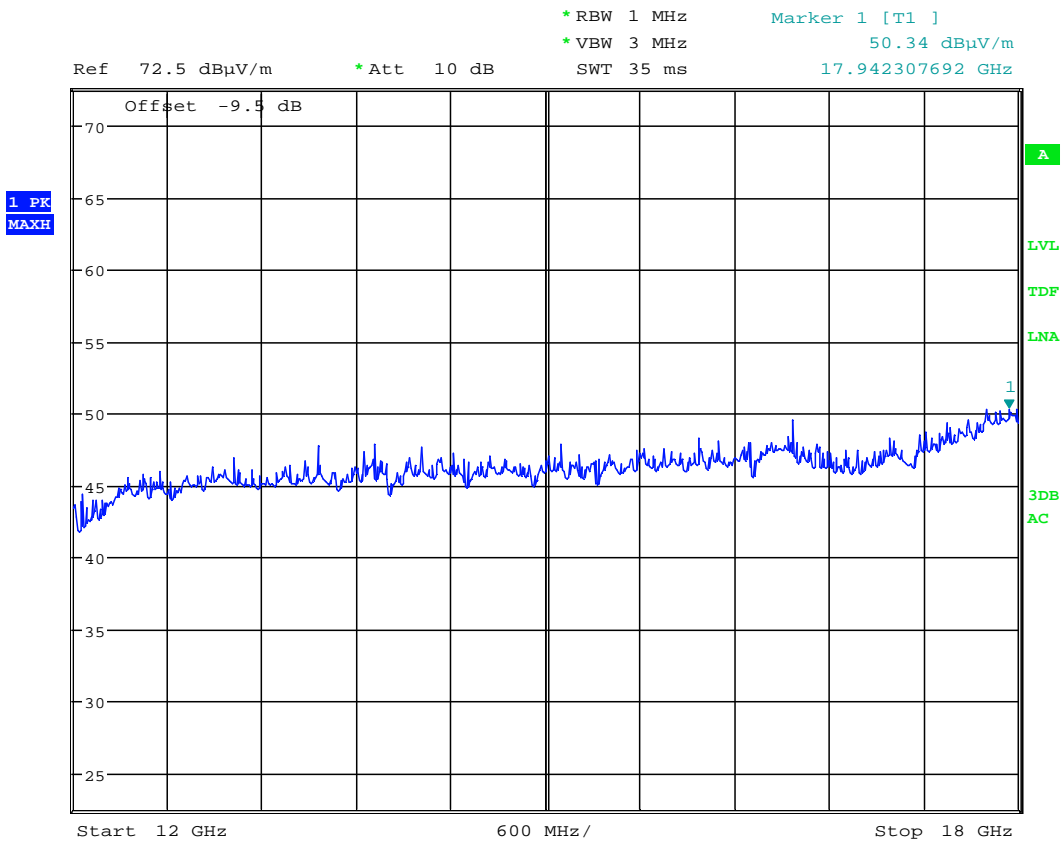
Date: 26.OCT.2015 15:20:16

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



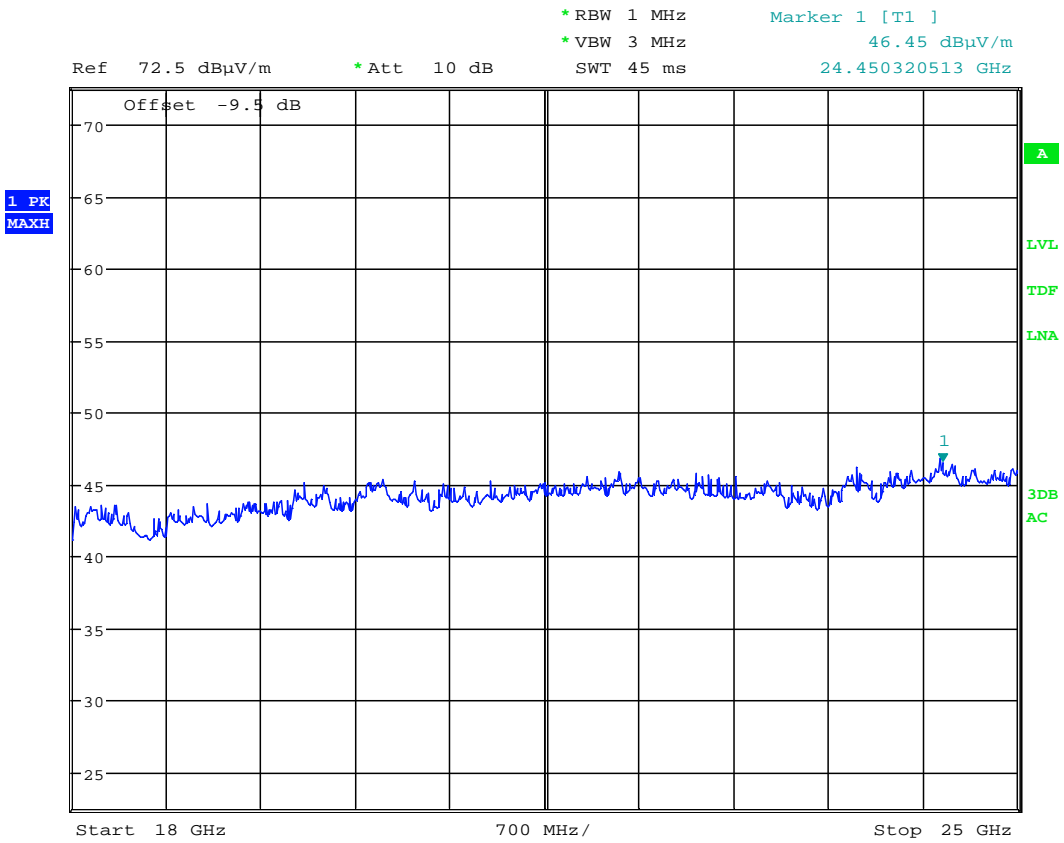
Date: 26.OCT.2015 15:28:10

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



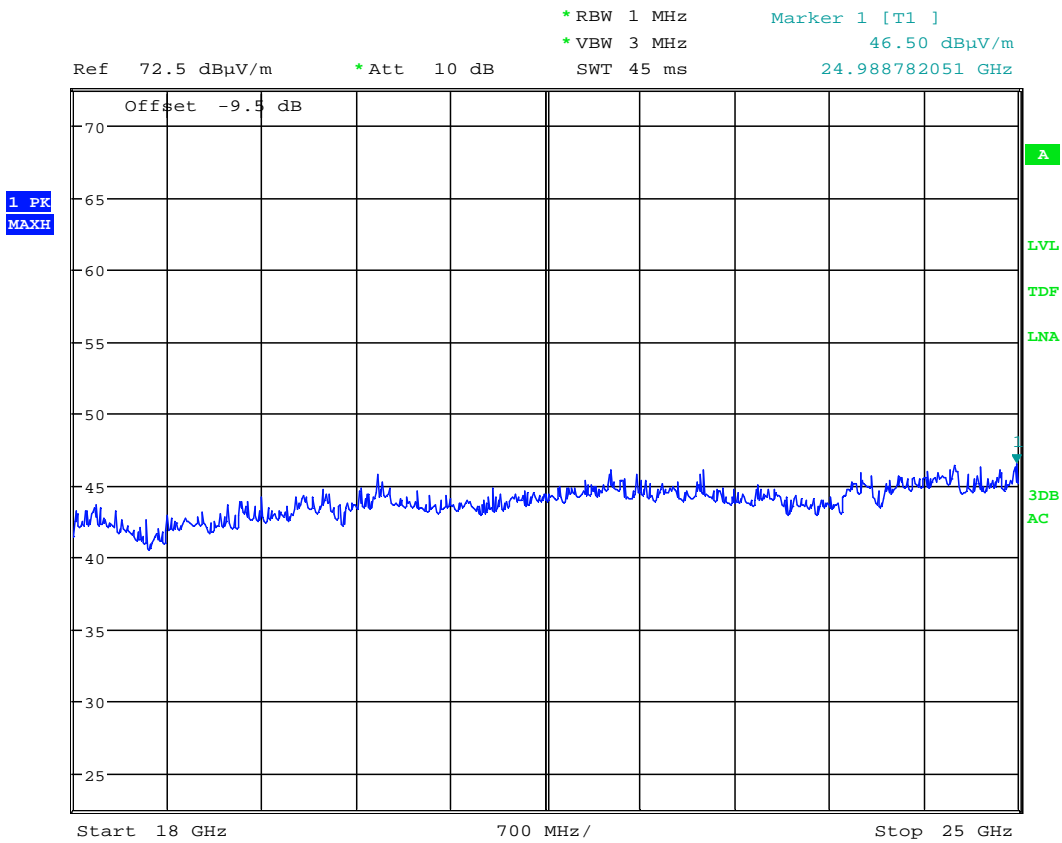
Date: 26.OCT.2015 15:30:02

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



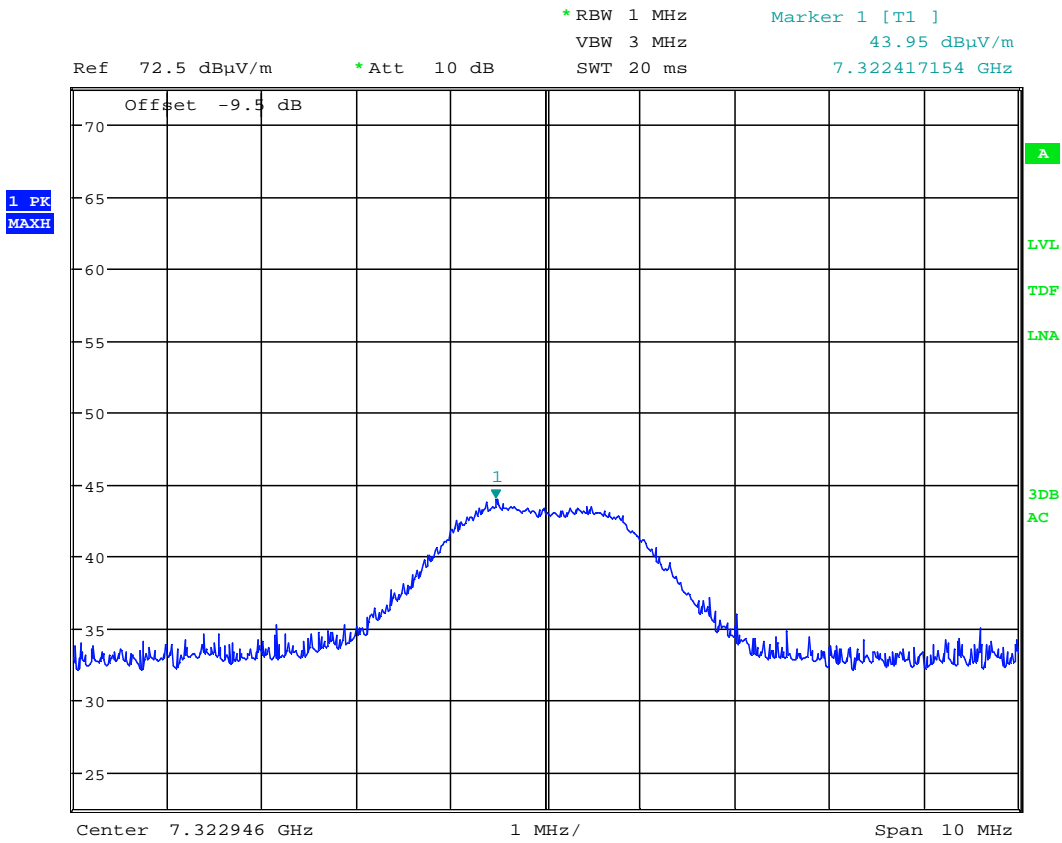
Date: 26.OCT.2015 16:01:42

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



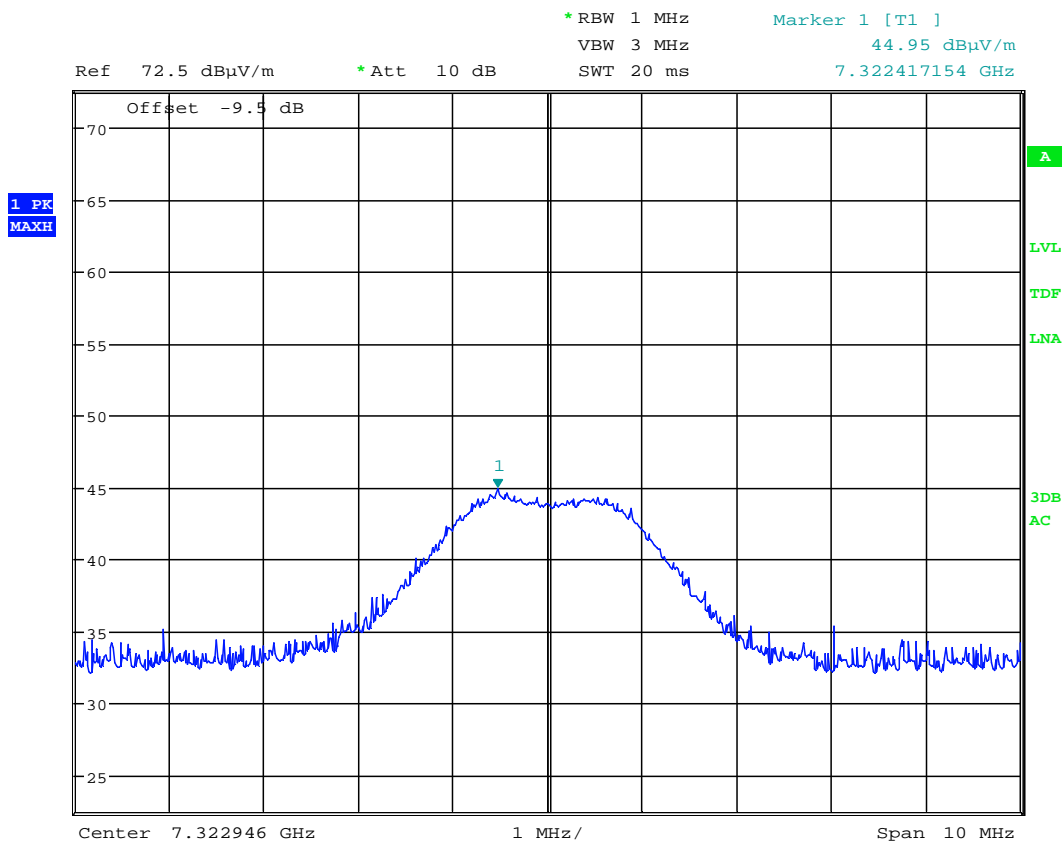
Date: 26.OCT.2015 16:07:18

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



Date: 26.OCT.2015 15:11:59

**Radiated Emissions, 7322MHz, 2441MHz, VP**



Date: 26.OCT.2015 15:11:13

**Radiated Emissions, 7322MHz, 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

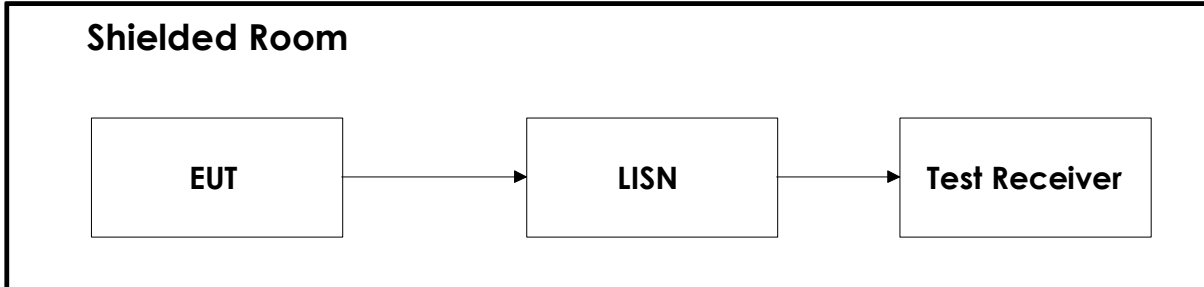
## 5 LIST OF TEST EQUIPMENT

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.

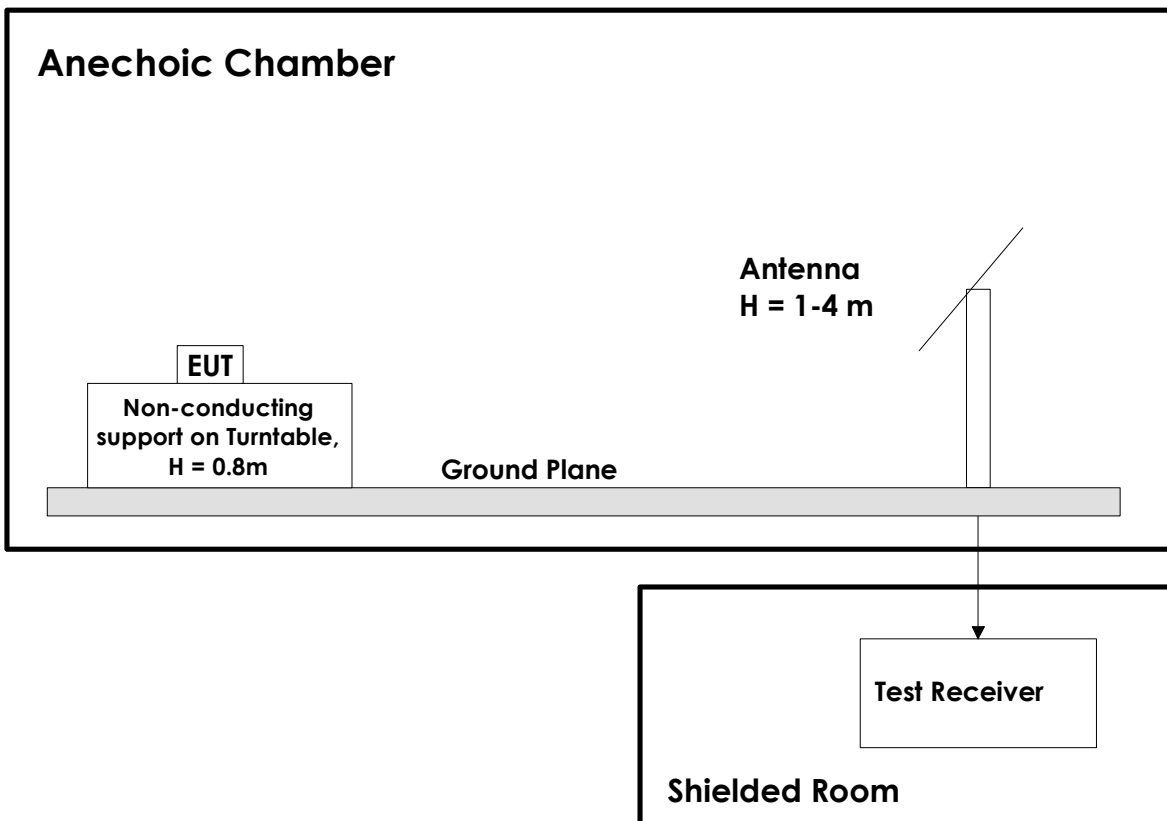
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW26	Spectrum Analyzer	Rohde & Schwarz	LR 1640	2014.09	2016.09
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2014.11.20	2015.11.20
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
5	HK116	Biconical Antenna	Rohde & 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	2015.10	2016.10
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	2015.08.13	2016.08.13
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	Cal b4 use	

## 6 BLOCK DIAGRAM

### 6.1 Power Line Conducted Emission



### 6.2 Test Site Radiated Emission



## Revision history

Version	Date	Comment	Sign
1.0	2015.11.13	First Edition	FS
1.1	2015.11.19	Editorial corrections	FS