

Test Report

Product	BT Transceiver in UPCS Base Station	
Name and address of the applicant	Panasonic Corporation of North America	
Name and address of the manufacturer	Panasonic System Networks Co., Ltd. 1-62, 4-chome, Minoshima, Hakata-ku Fukuoka 812-8531, Japan	
Model	KX-TGH260	
Rating	120 V AC (Mains)	
Trademark	Panasonic	
Serial number	/	
Additional information	Bluetooth	
Tested according to	FCC Part 15.247 Frequency Hopping Transmitters Industry Canada RSS-210, Issue 8 Low Power Licence-Exempt Radiocommunications Devices	
Order number	248567	
Tested in period	2013.11.19 to 2013.11.21 and 2014.01.08	
Issue date	2014.01.08	
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1 INFORMATION

1.1 Test Item

Name :	Panasonic
FCC ID :	ACJ96NKX-TGH260
Industry Canada ID :	216A-KXTGH260
Model/version :	KX-TGH260
Serial number :	/
Hardware identity and/or version:	PNLB2281xx (Main PCB)
Software identity and/or version :	SW401
Frequency Range :	2402 - 2480 MHz
Number of Channels :	79
Type of Modulation :	Digital (GFSK)
User Frequency Adjustment :	None
Conducted Output Power :	0.0076 Watts (Peak)
Type of Power Supply :	AC Adaptor PNLV226
Antenna Connector :	None
Number of Antennas :	1
Antenna Diversity Supported :	No

Description of Test Item

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

The BT Module is identical to the BT part in KX-TGE270 (FCC ID: ACJ96NKX-TGE270), but the antenna and main PCB is different.

All conducted test were performed on a KX-TGE270, however all radiated tests including Power Line Conducted Emissions have been retested on a KX-TGH260.

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 4.

1.2 Test Environment

1.2.1 *Normal test condition*

Temperature:	20.8 – 23.3 °C
Relative humidity:	27 – 43 %
Normal test voltage:	120 V AC

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

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-210 Issue 8.

Tests were performed in accordance with ANSI C63.4-2003 and DA 00-705 Filing and Guidelines for Frequency Hopping Spread Spectrum Systems.

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-210 Issue 8 reference	Result
Supply Voltage Variations	15.31(e)	8 (RSS-GEN)	Complies
Number of Operating Frequencies	15.31(m)	A8.1	Complies
Antenna Requirement	15.203	7.1.4 (RSS-GEN)	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2.2 (RSS-GEN)	Complies
Channel Separation	15.247(a)(1)	A8.1	Complies
Pseudorandom Hopping Algorithm	15.247(a)(1)	A8.1	Complies
Time of Occupancy	15.247(a)(1)(iii)	A8.1	Complies
Occupied Bandwidth	15.247(a)(1)	A8.1	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	A8.2	N/A ²
Peak Power Output	15.247(b)	A8.4	Complies
Power Spectral Density	15.247(d)	A8.2	N/A ²
Spurious Emissions (Antenna Conducted)	15.247(c)	A8.5	N/A ¹
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	A8.5	Complies

¹ The tested equipment has integrated antennas only

² Not Applicable for FHSS equipments

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 Dangle	Date of Test: 13 Dec 2013
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Measurement procedure: ANSI C63.4-2009 using 50 μ H/50 ohms LISN.

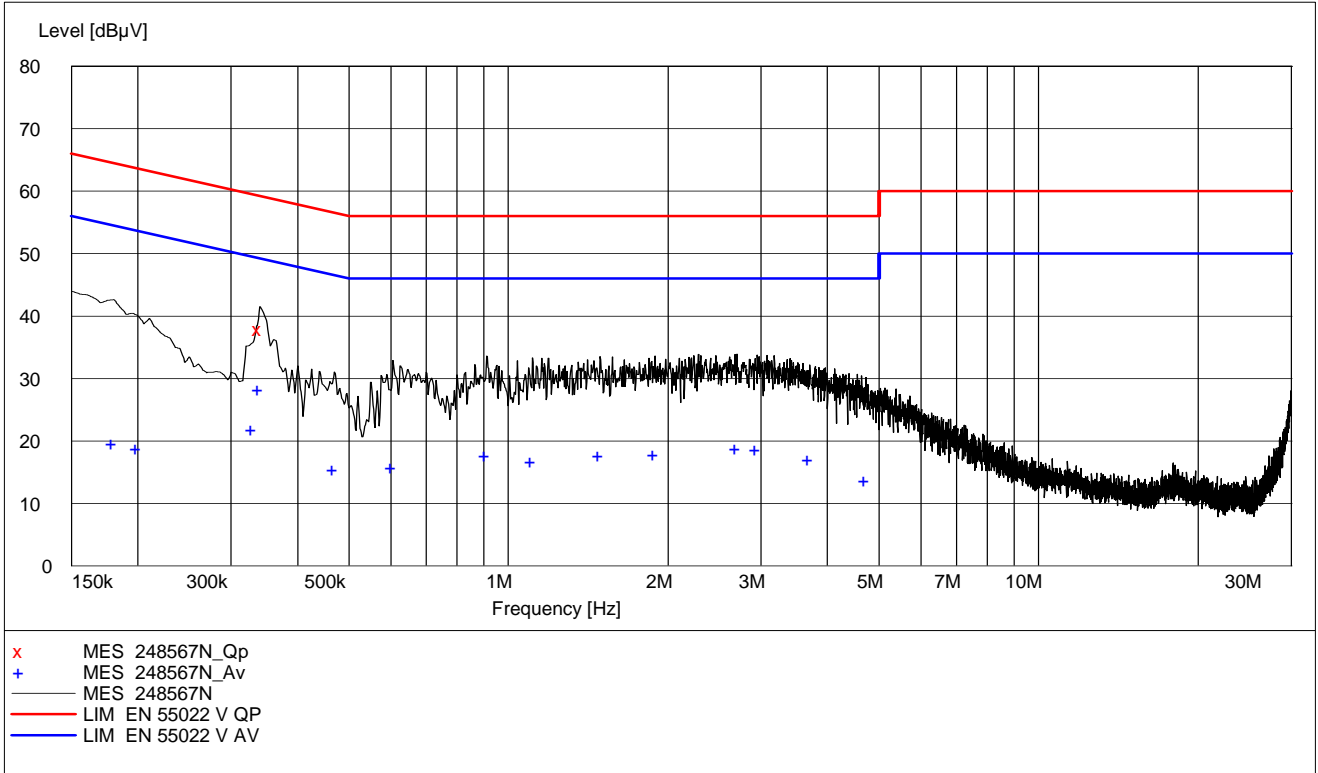
Test Results: Complies

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

Highest measured value (L1 and N):

AC Adaptor PNLV226 (UC):

Frequency [MHz]	Level [dBuV]	Af [dB]	Limit [dBuV]	Margin [dB]	Det	Position	Verdict [Pass/Fail]
0.340000	37.90	10.20	59.20	21.30	QP	L1	Pass
0.180000	19.70	10.10	54.50	34.80	AV	N	Pass
0.200000	18.80	10.10	53.60	34.80	AV	N	Pass
0.330000	21.90	10.20	49.50	27.60	AV	L1	Pass
0.340000	28.30	10.20	49.20	20.90	AV	L1	Pass
0.470000	15.50	10.20	46.50	31.00	AV	L1	Pass
0.605000	15.90	10.20	46.00	30.10	AV	L1	Pass
0.910000	17.70	10.20	46.00	28.30	AV	L1	Pass
1.110000	16.80	10.20	46.00	29.20	AV	L1	Pass
1.490000	17.80	10.20	46.00	28.20	AV	L1	Pass
1.890000	18.00	10.20	46.00	28.00	AV	L1	Pass
2.695000	18.80	10.30	46.00	27.20	AV	L1	Pass
2.950000	18.70	10.30	46.00	27.30	AV	L1	Pass
3.705000	17.00	10.30	46.00	29.00	AV	L1	Pass
4.725000	13.80	10.40	46.00	32.20	AV	L1	Pass



AC Adaptor PNLV226 (UC)

Plot shows maximum of Phase L1 and N

3.2 Channel Separation and 20dB Bandwidth

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

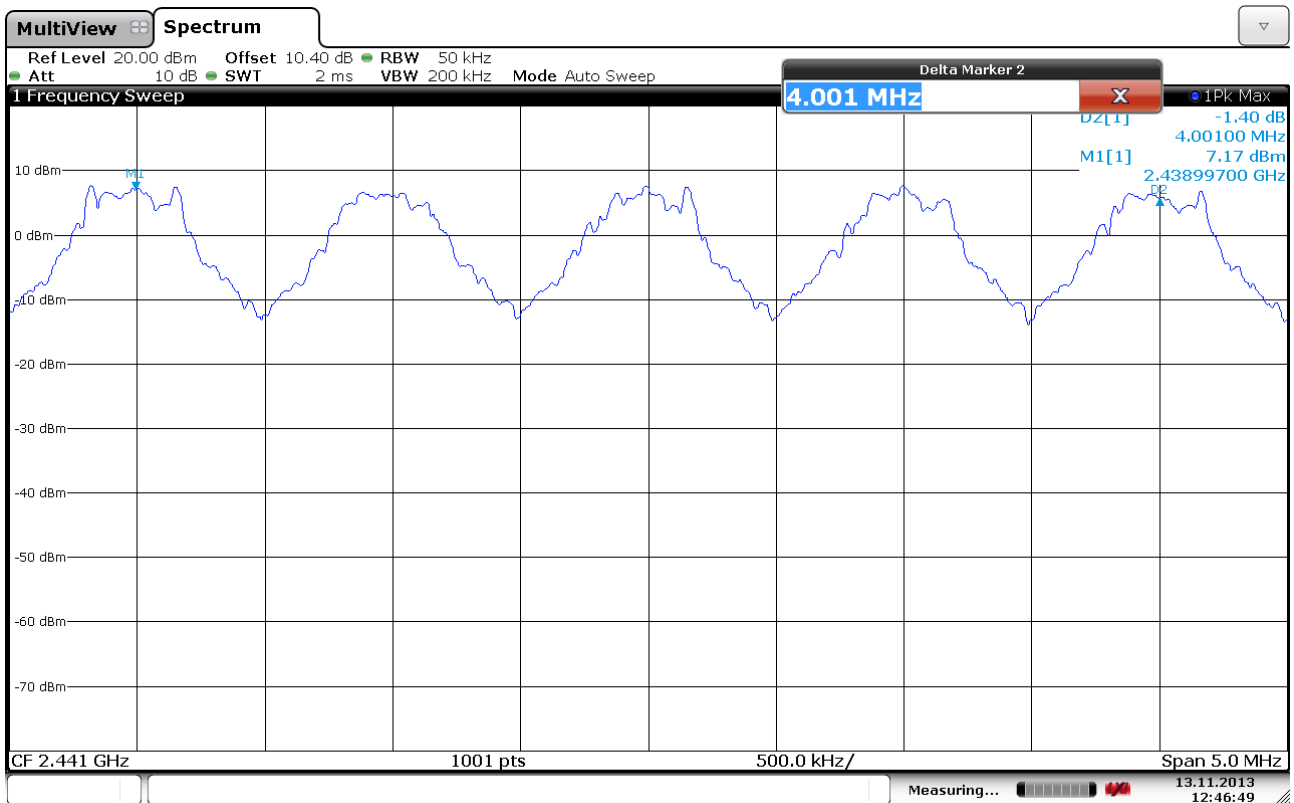
Requirement:

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.

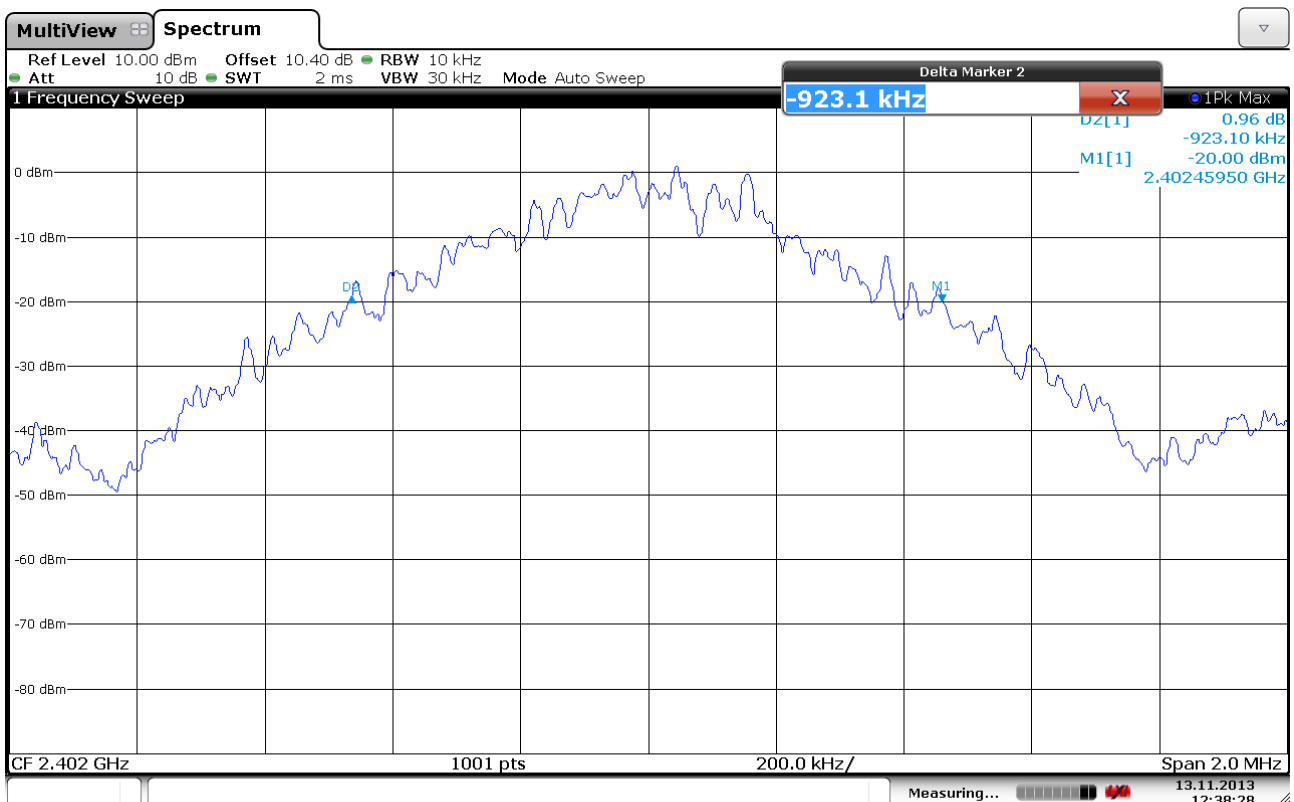
or:

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.

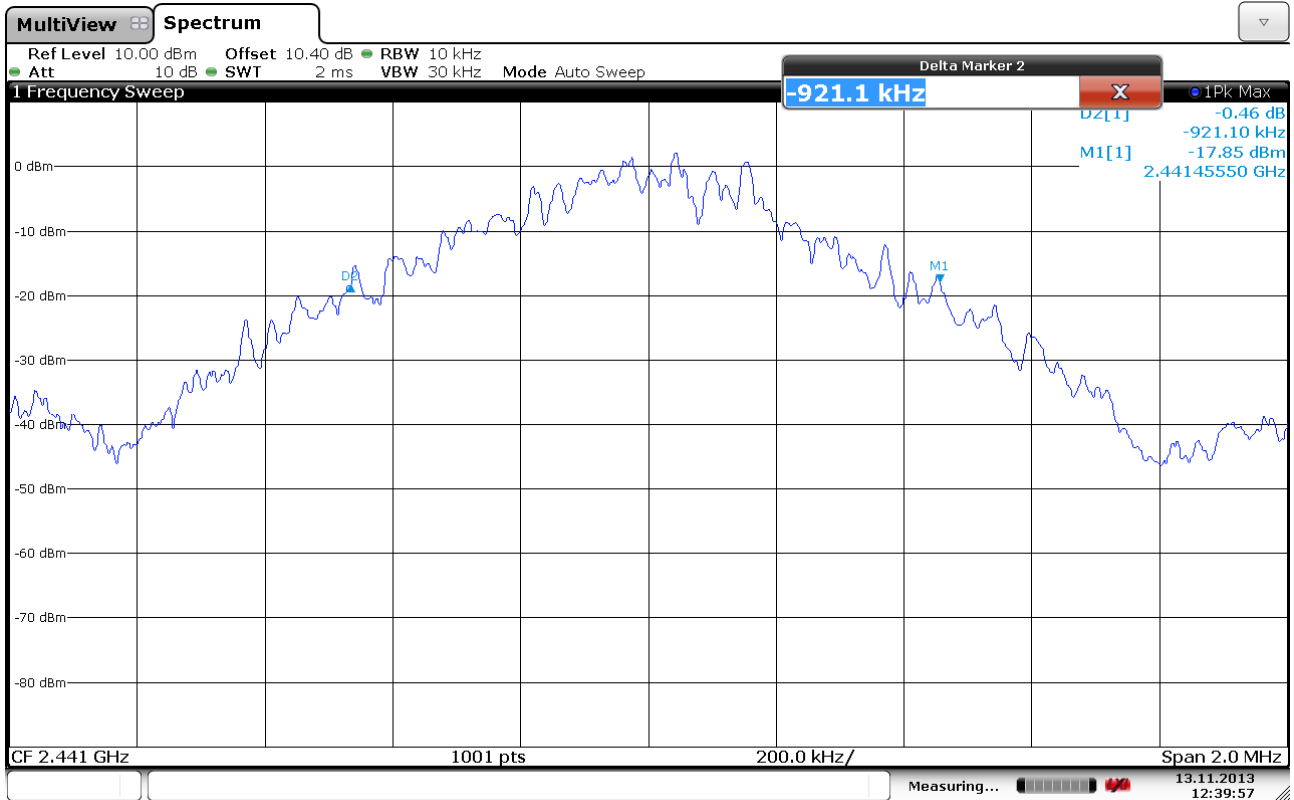
No requirements for Digital Transmission Systems.



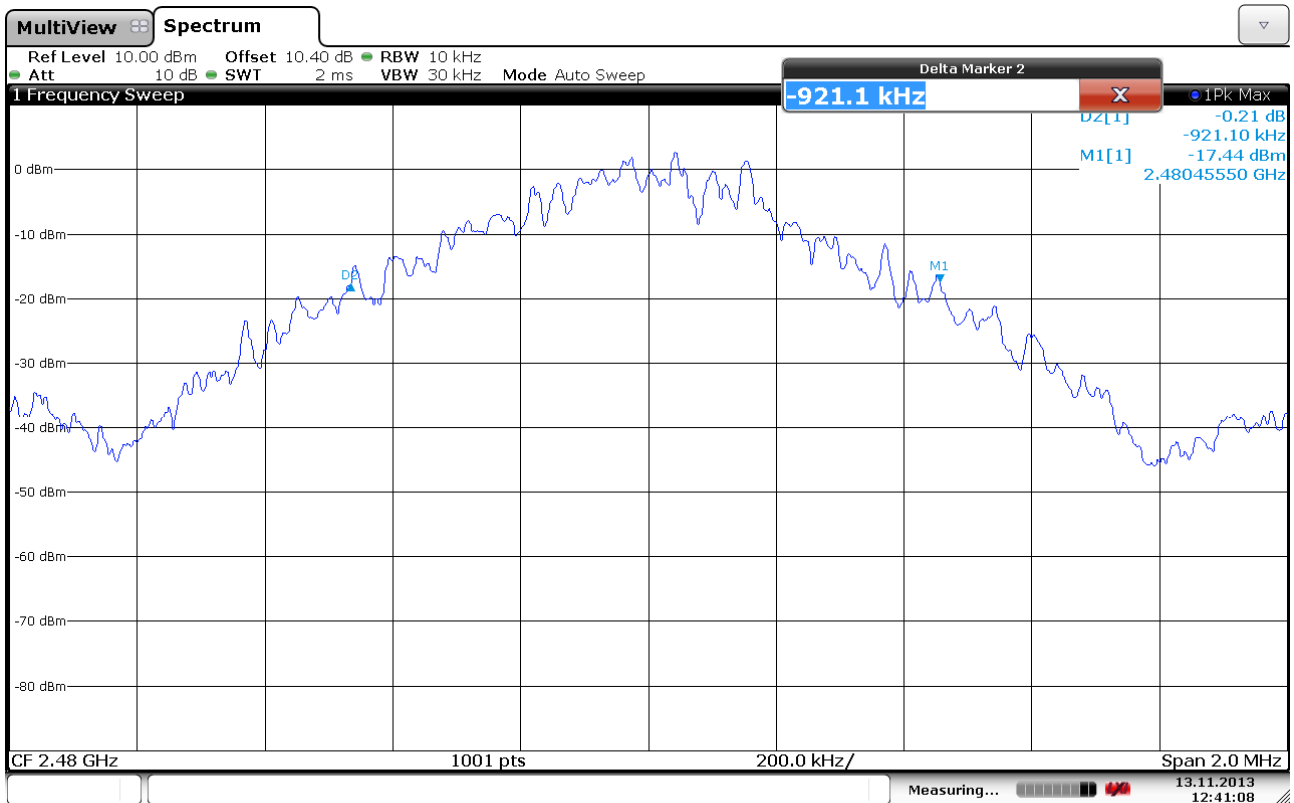
Channel Separation



20dB Bandwidth, 2402MHz



20dB Bandwidth, 2441MHz



20dB Bandwidth, 2480MHz

3.3 Pseudorandom Hopping Algorithm

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

Test Results: Complies

Measurement Data: /

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.

3.4 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: $3.75 \times 79 \text{ ms} = 296.25 \text{ ms}$

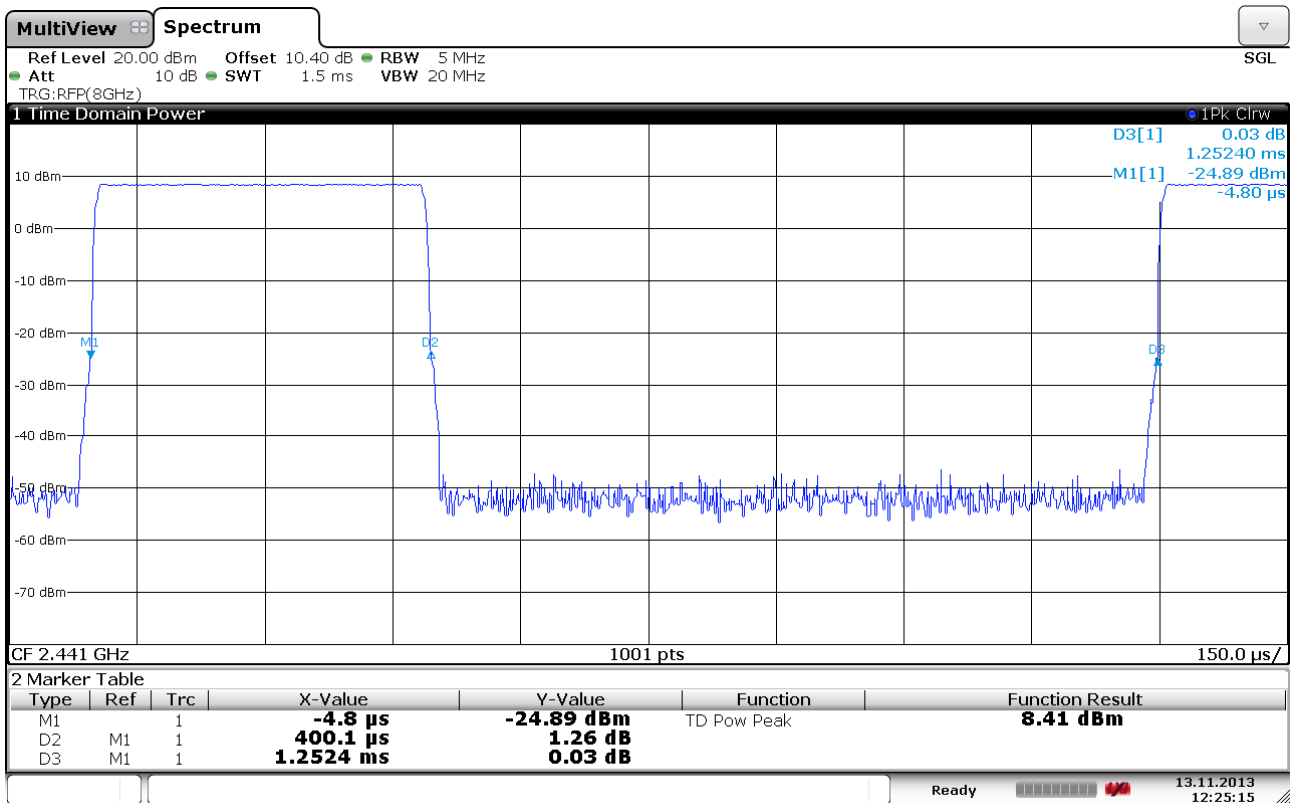
Time of occupancy: $(2.90 \times 400 \times 79) / 296.25 = 309.3 \text{ ms}$

See attached graph.

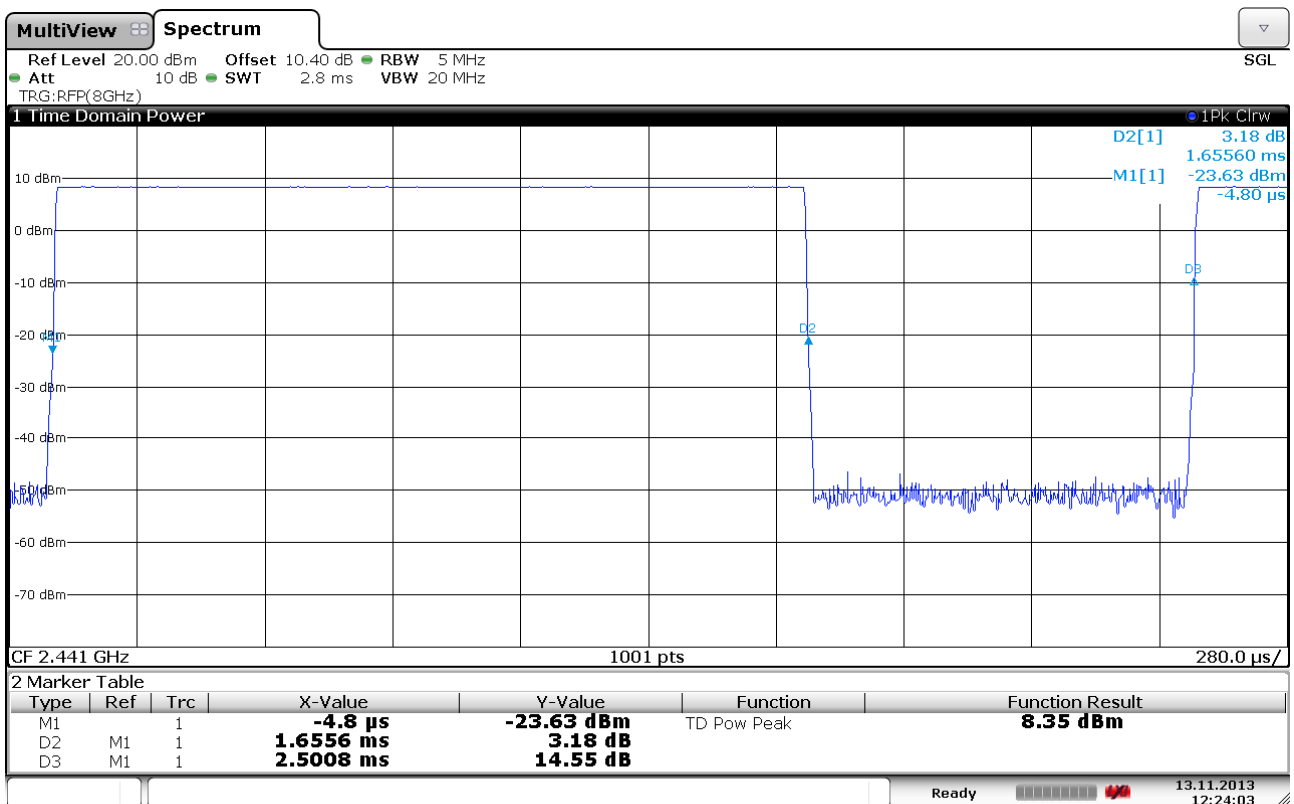
Requirements:

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.

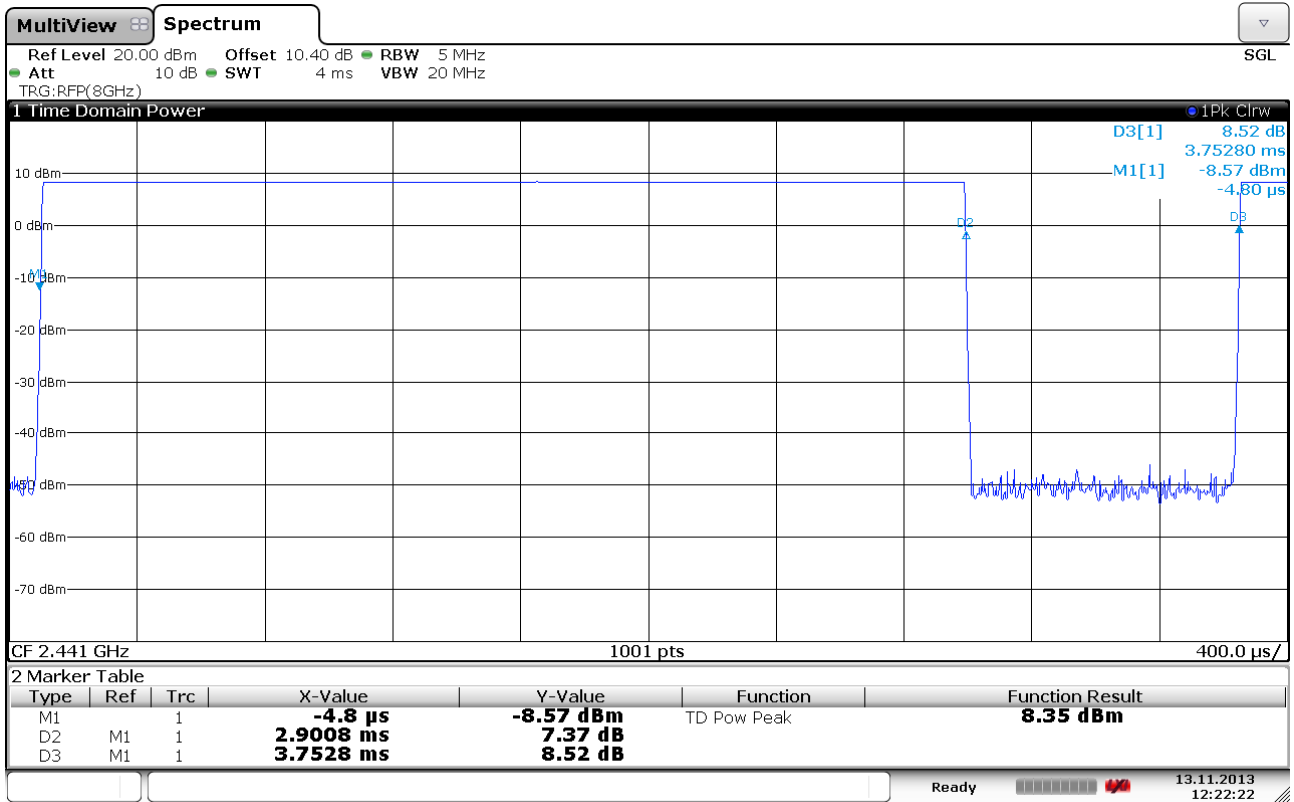
No requirements for Digital Transmission Systems.



Burst Length, DH1



Burst Length, DH3



Burst Length, DH5

3.5 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.

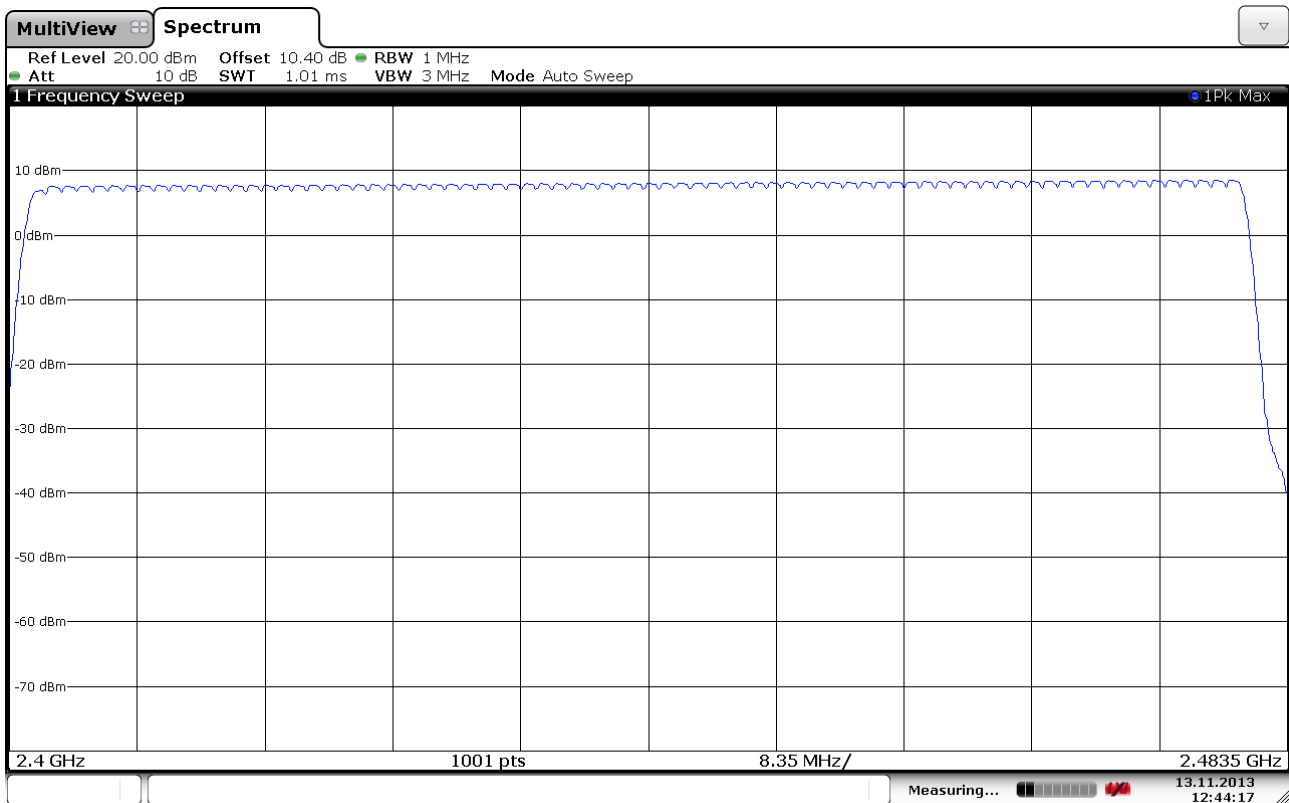
Requirements:

Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels.

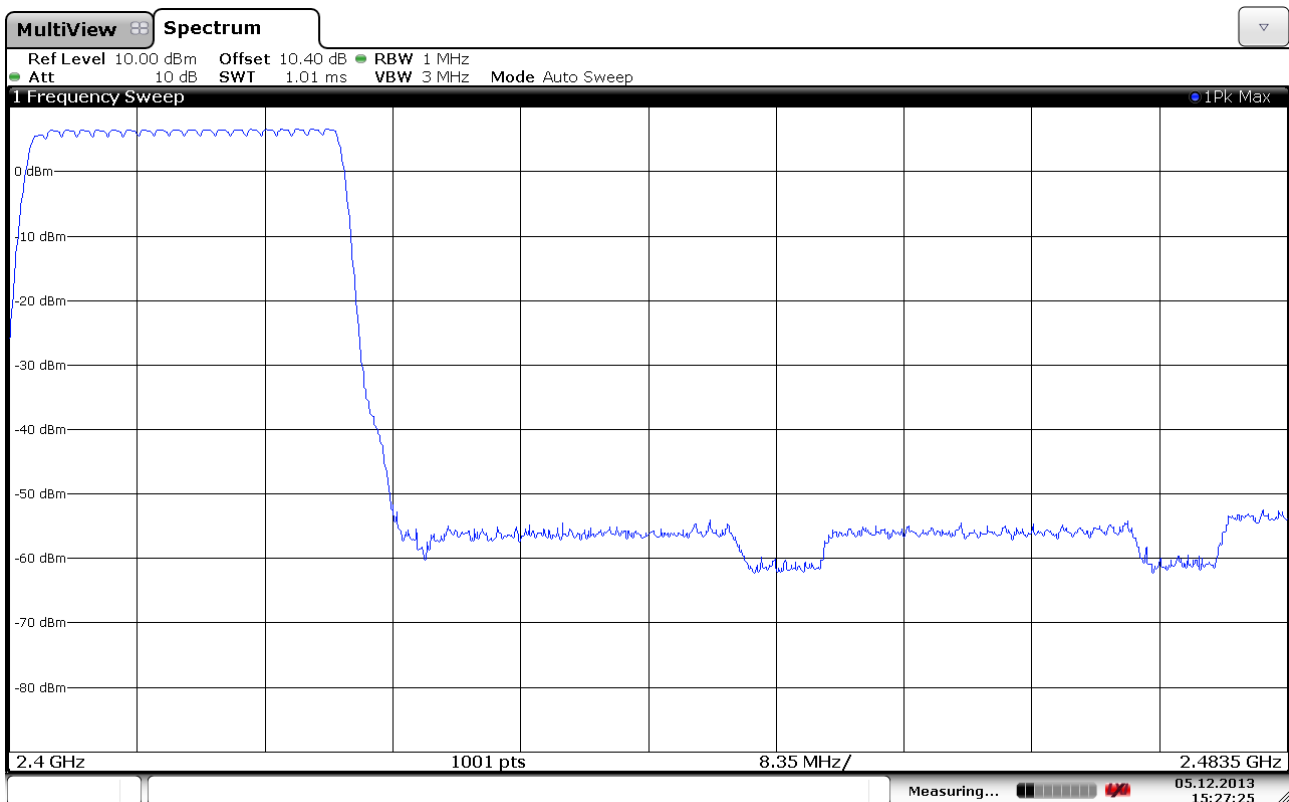
No requirements for bandwidth for this frequency band.

No requirements for Digital Transmission Systems.

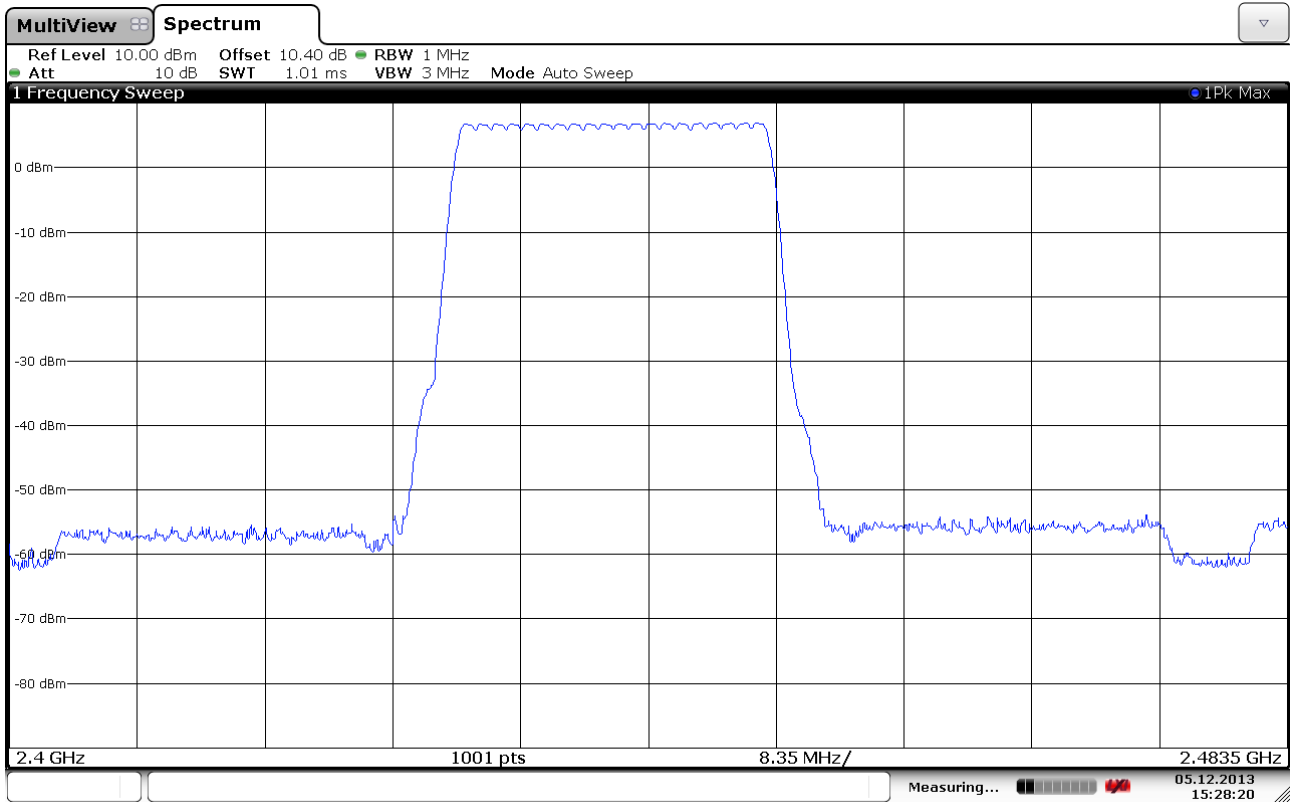
No requirement for 99% BW, reported for information only.



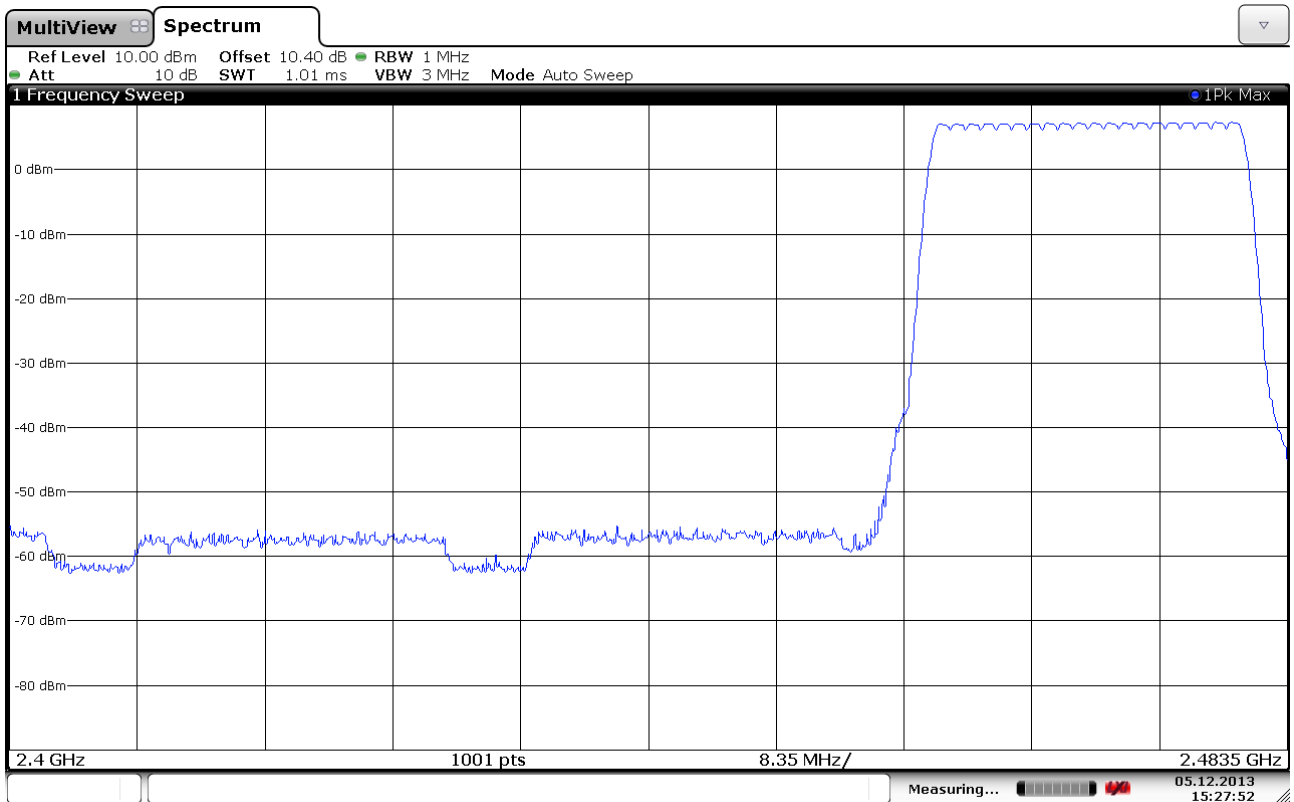
RF Channels in Use, Full Band



RF Channels in Use, 20 Channels, Lower



RF Channels in Use, 20 Channels, Middle



RF Channels in Use, 20 Channels, Upper

3.6 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)	101.0	101.3	100.4
EIRP, Calculated (Watts)	0.0038	0.0040	0.0033
Antenna gain (dBi)	-1.5	-2.3	-3.7

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: /

Requirements:

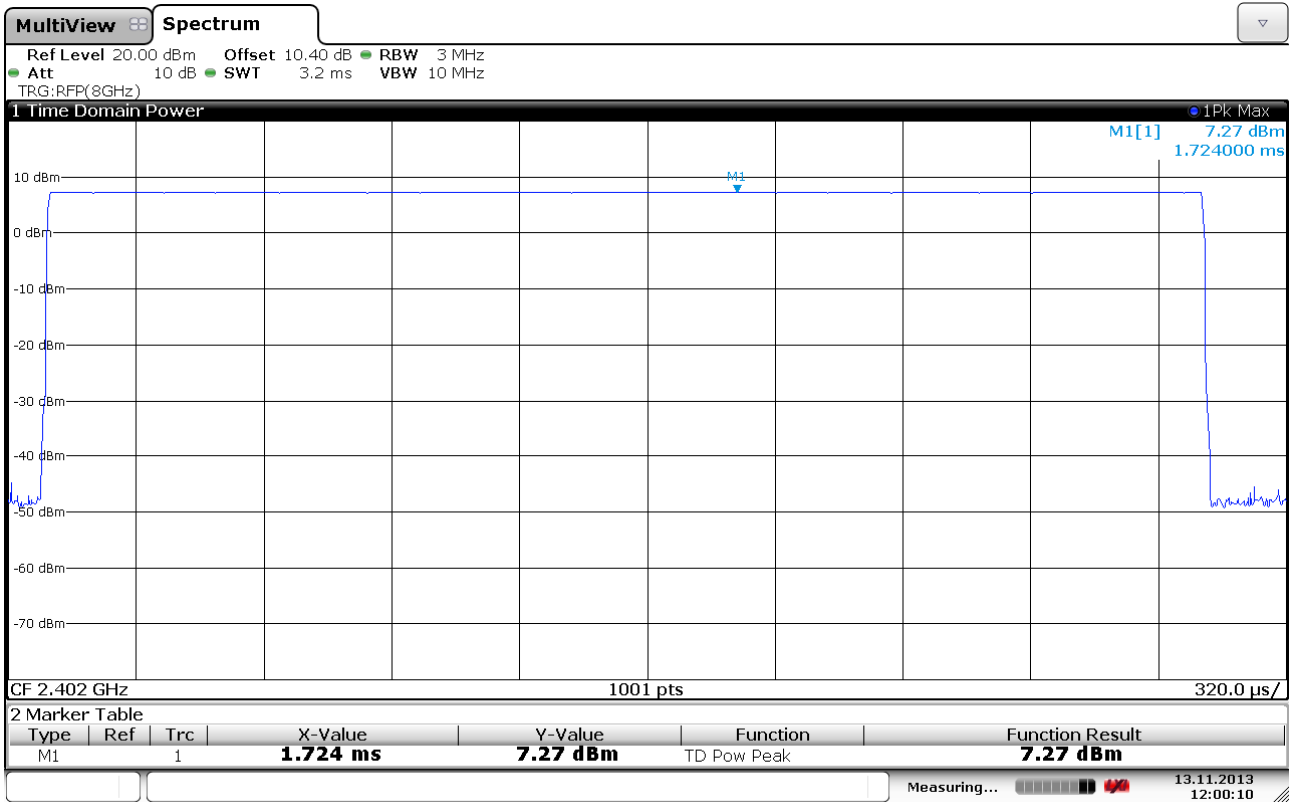
The maximum peak output power shall not exceed the following limits:

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

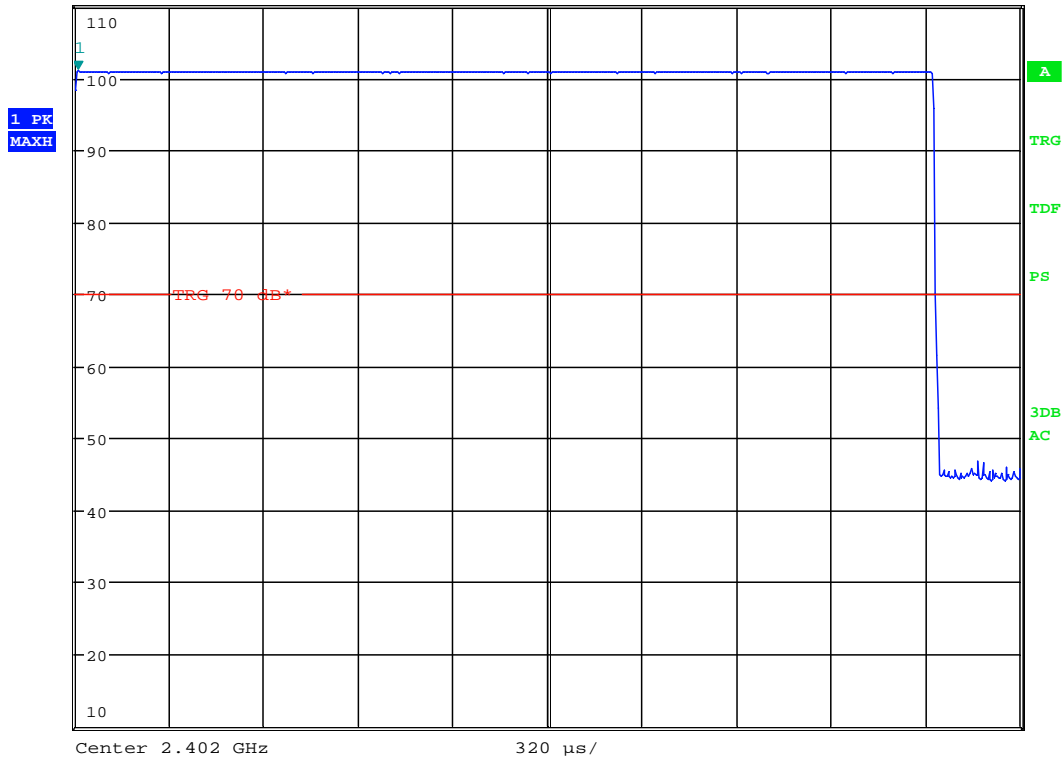
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



Conducted Output Power, 2402MHz

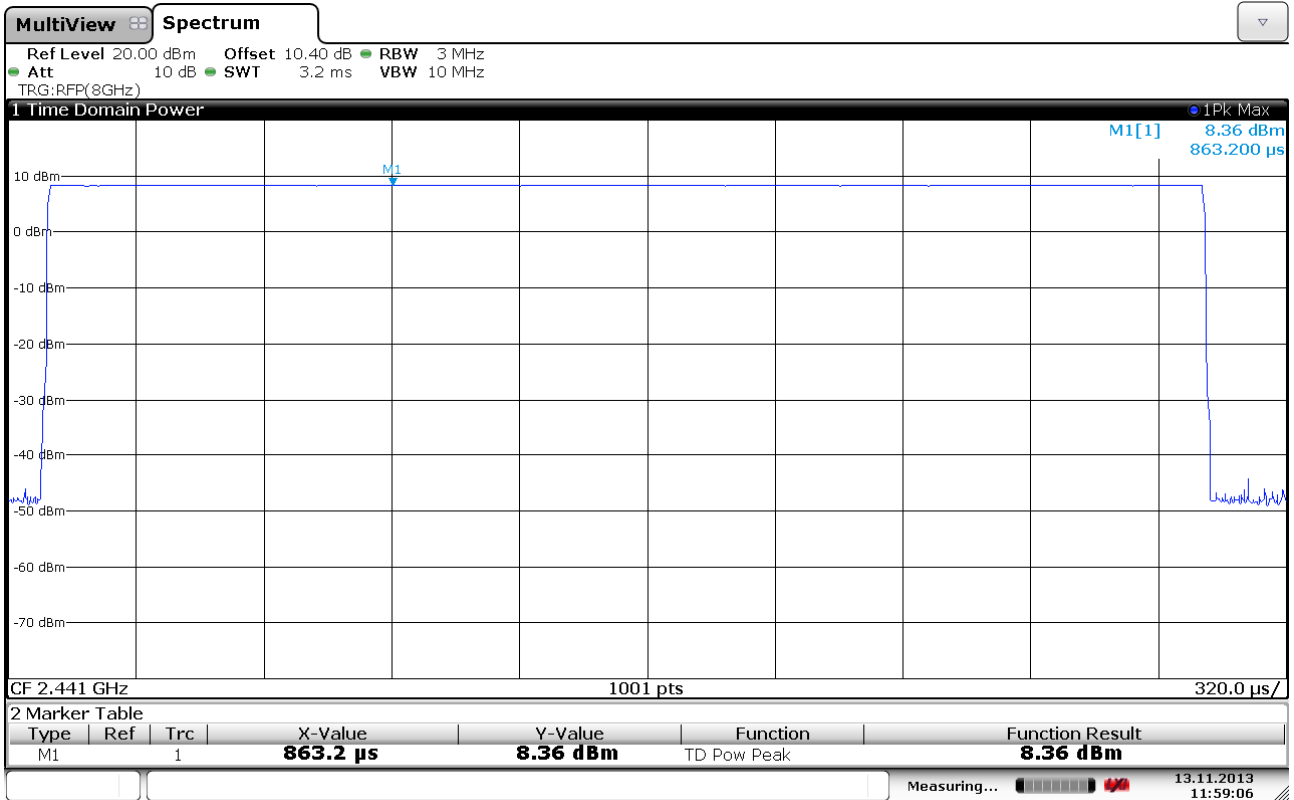


MARKER 1	RBW 3 MHz	Marker 1 [T1]
10.25641026 μ s	VBW 10 MHz	101.03 dB μ V/m
Ref 110 dB μ V/m	*Att 10 dB	SWT 3.2 ms
		10.256410 μ s



Date: 19.NOV.2013 11:21:28

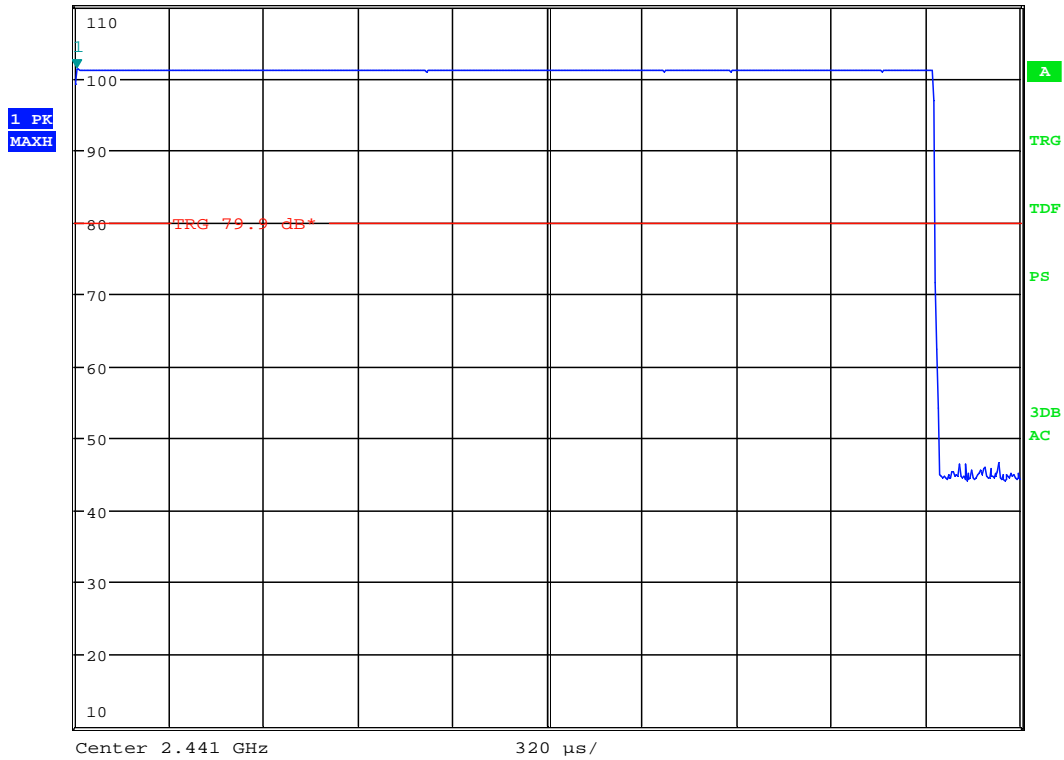
Maximum Field Strength, 2402MHz (Max: HP)



Conducted Output Power, 2441MHz



MARKER 1	RBW 3 MHz	Marker 1 [T1]
5.128205128 μ s	VBW 10 MHz	101.25 dB μ V/m
Ref 110 dB μ V/m	*Att 10 dB	SWT 3.2 ms
		5.128205 μ s



Date: 19.NOV.2013 12:21:55

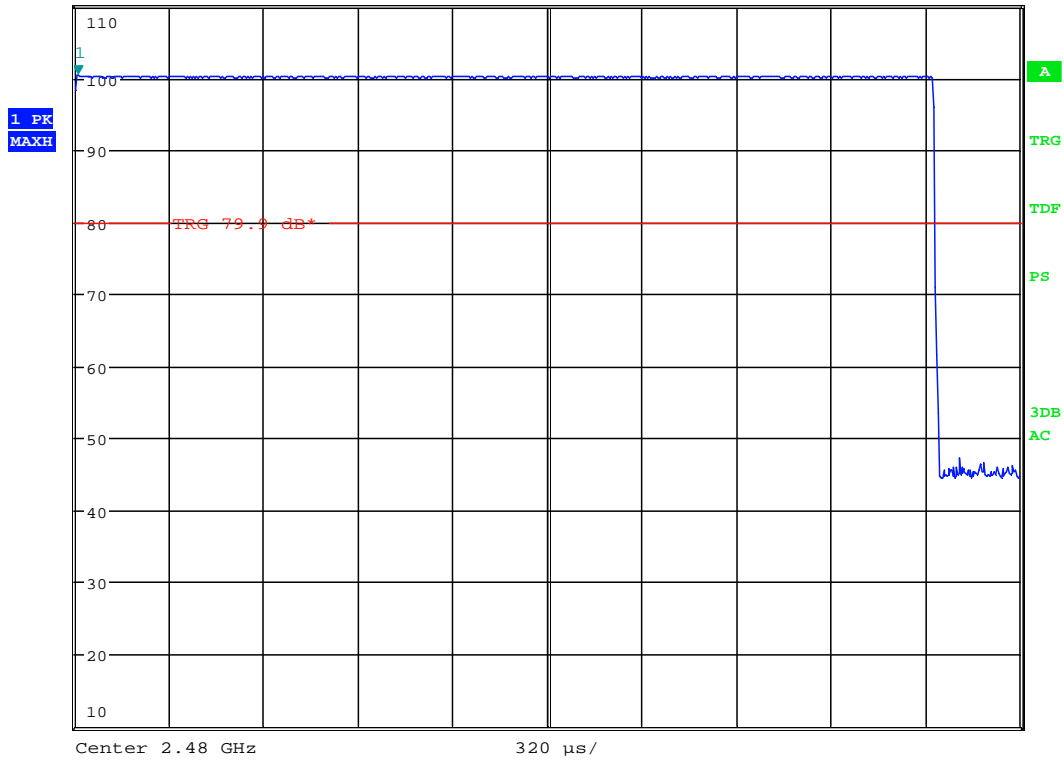
Maximum Field Strength, 2441MHz (Max: HP)



Conducted Output Power, 2480MHz



MARKER 1	RBW 3 MHz	Marker 1 [T1]
10.25641026 μ s	VBW 10 MHz	100.35 dB μ V/m
Ref 110 dB μ V/m	*Att 10 dB	10.256410 μ s
	SWT 3.2 ms	



Date: 19.NOV.2013 12:24:32

Maximum Field Strength, 2480MHz (Max: HP)

3.7 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Results: Complies

Measurement Data:

Band-edge conducted power, Hopping OFF:

	Measured field strength @3m (dBµV/m)		Limit dBµV/m	Margin	
	2390 MHz	2483.5 MHz		dB	
Peak Detector	43.1	59.4	74	30.9	14.6
Average Detector	23.1	39.4	54	30.9	14.6

Band-edge conducted power, Hopping ON:

	Measured field strength @3m (dBµV/m)		Limit dBµV/m	Margin	
	2390 MHz	2483.5 MHz		dB	
Peak Detector	43.7	58.9	74	30.3	15.1
Average Detector	23.7	38.9	54	30.3	15.1

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

All field strength values above are at 3m.

See attached plots.

Duty Cycle Correction Factor Calculation:

20 hopping frequencies:

$$\text{Duty Cycle} = -20 \log_{10}(3.5 / 78) = 26.96 \text{ dB}$$

79 hopping frequencies:

$$\text{Duty Cycle} = -20 \log_{10}(3.5 / 308) = 38.89 \text{ dB}$$

Calculations are for DH5, i.e. the slot length with highest duty cycle.

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

RF conducted power to 25 GHz see attached graph.

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

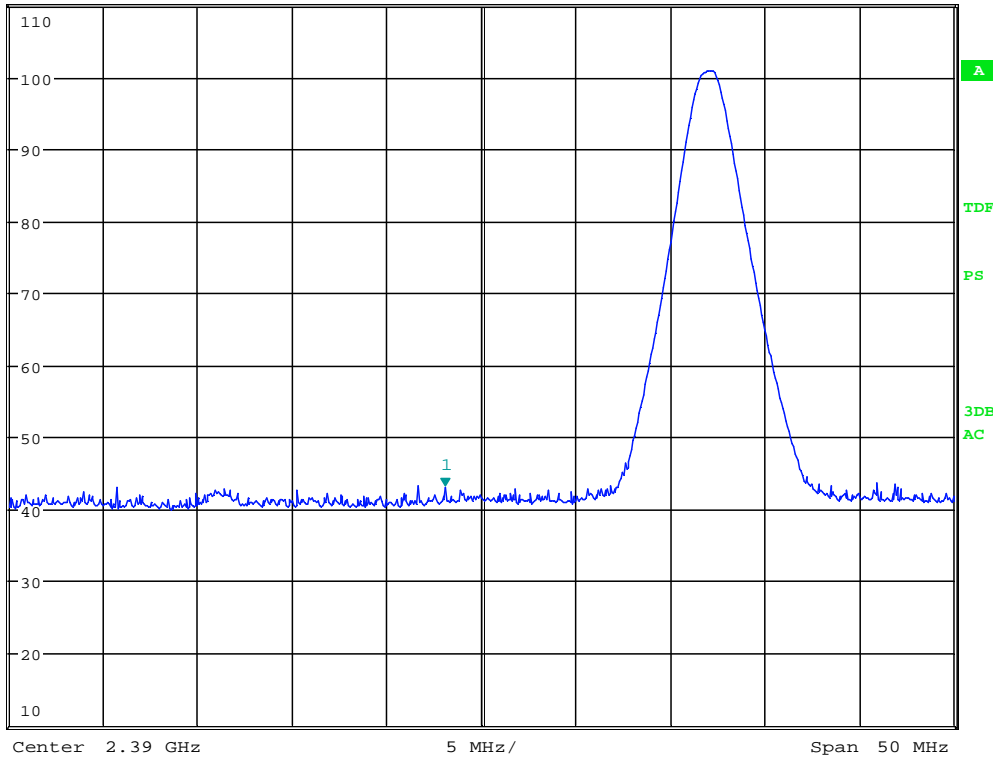


MARKER 1
 2.388076923 GHz
 Ref 110 dBμV/m *Att 10 dB

*RBW 1 MHz
 VBW 3 MHz
 SWT 2.5 ms

Marker 1 [T1]
 43.12 dBμV/m
 2.388076923 GHz

1 PK
 MAXH



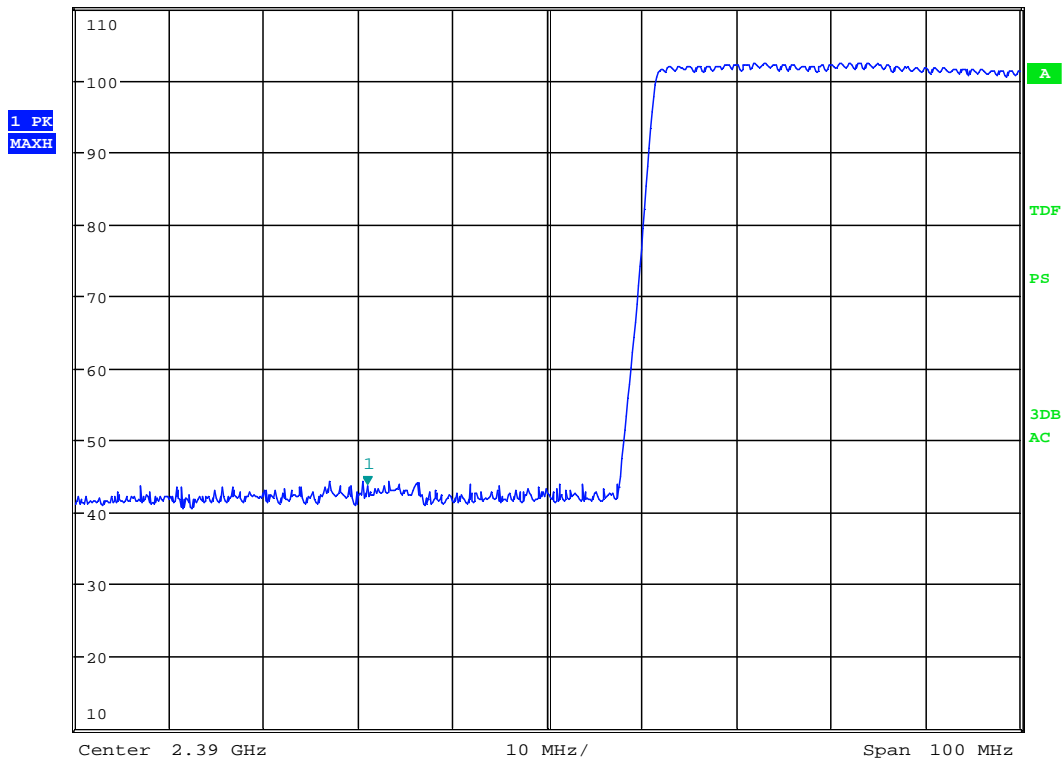
Date: 19.NOV.2013 11:22:20

Band Edge Lower Channel, Radiated, Peak, Hopping OFF



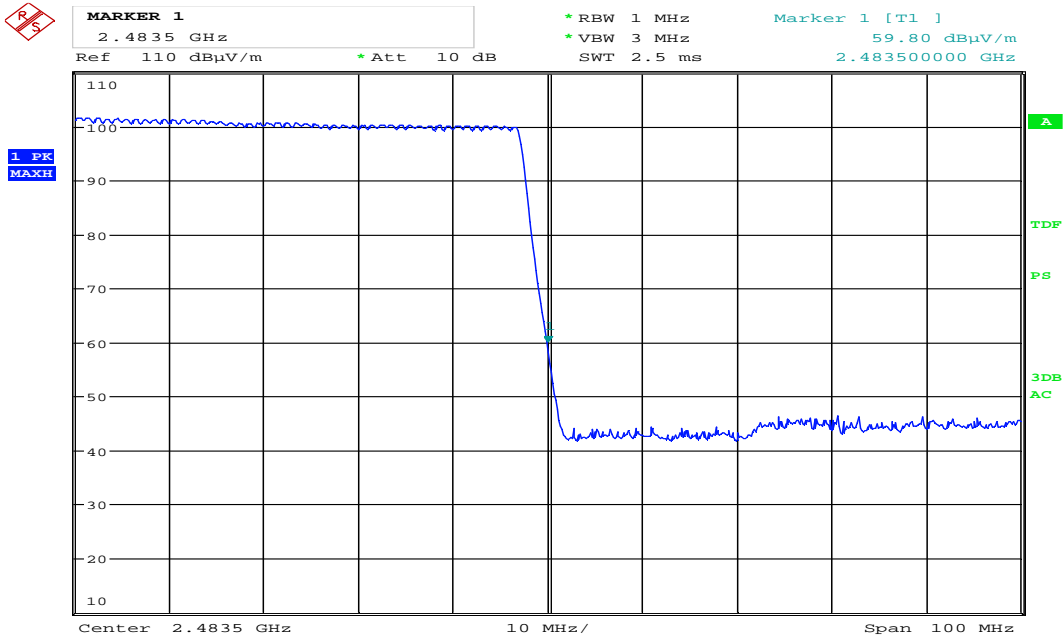
MARKER 1
 2.370929487 GHz
 Ref 110 dBuV/m * Att 10 dB

* RBW 1 MHz Marker 1 [T1]
 * VBW 3 MHz 43.69 dBuV/m
 SWT 2.5 ms 2.370929487 GHz

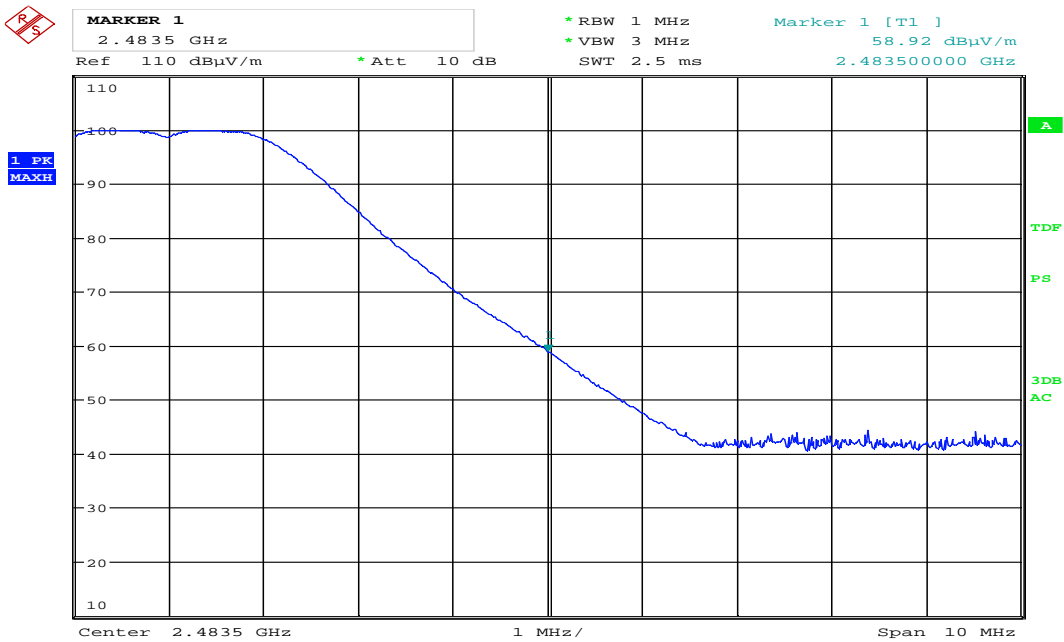


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Band Edge Lower Channel, Radiated, Peak, Hopping ON

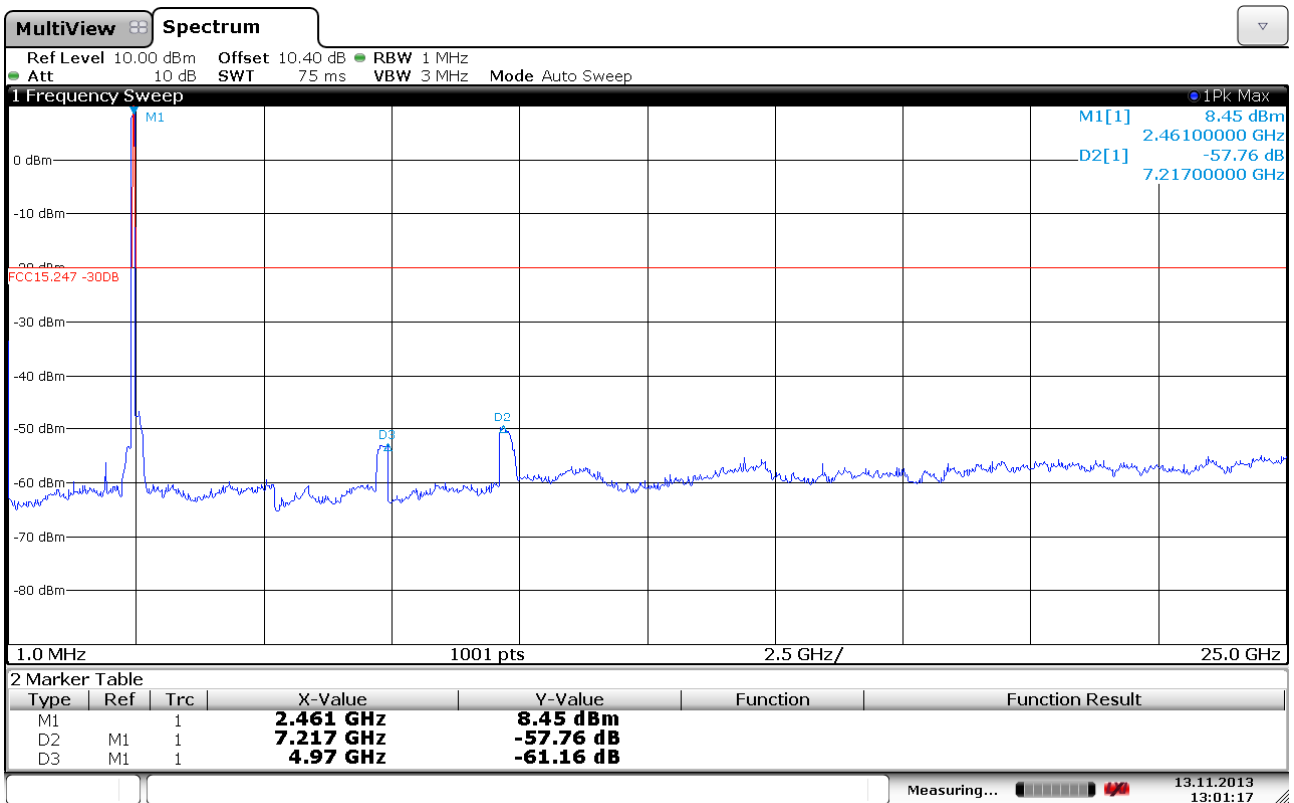


Date: 19.NOV.2013 14:09:05

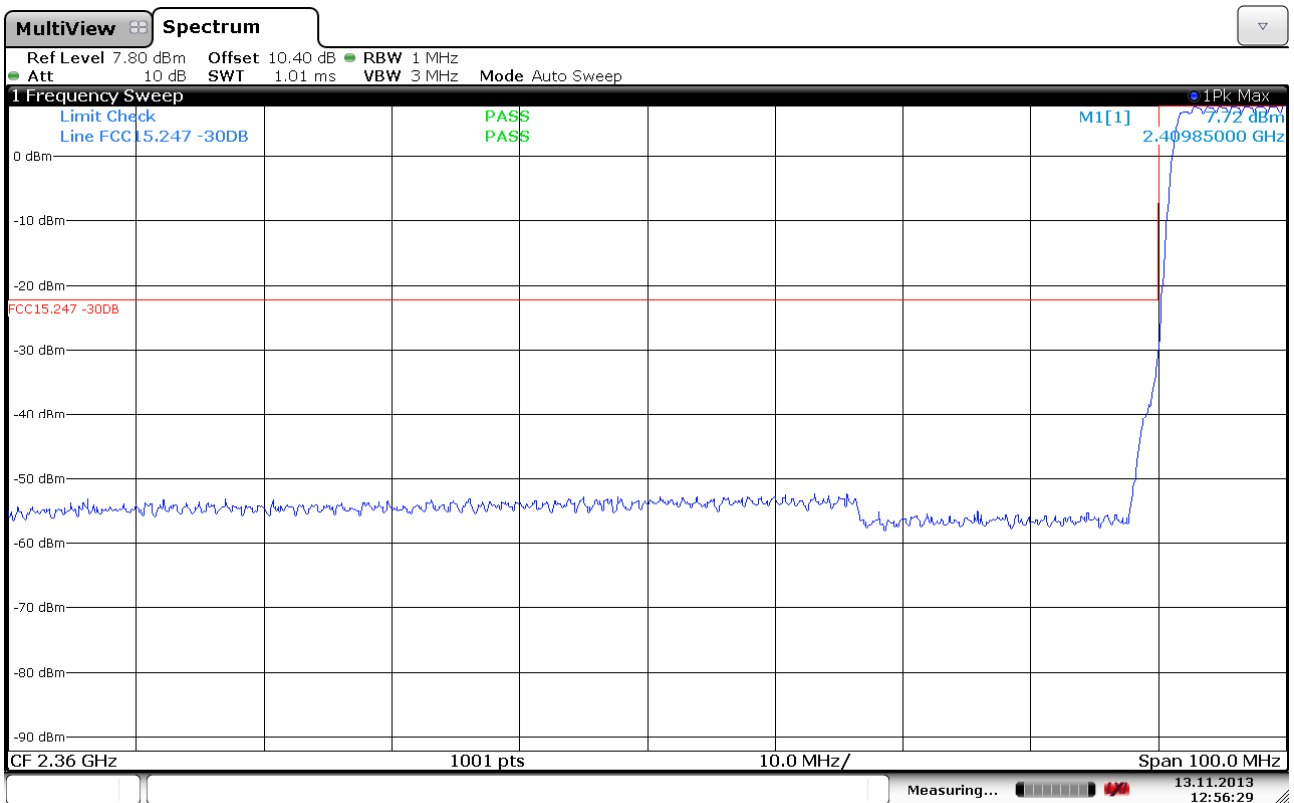


Date: 19.NOV.2013 14:09:52

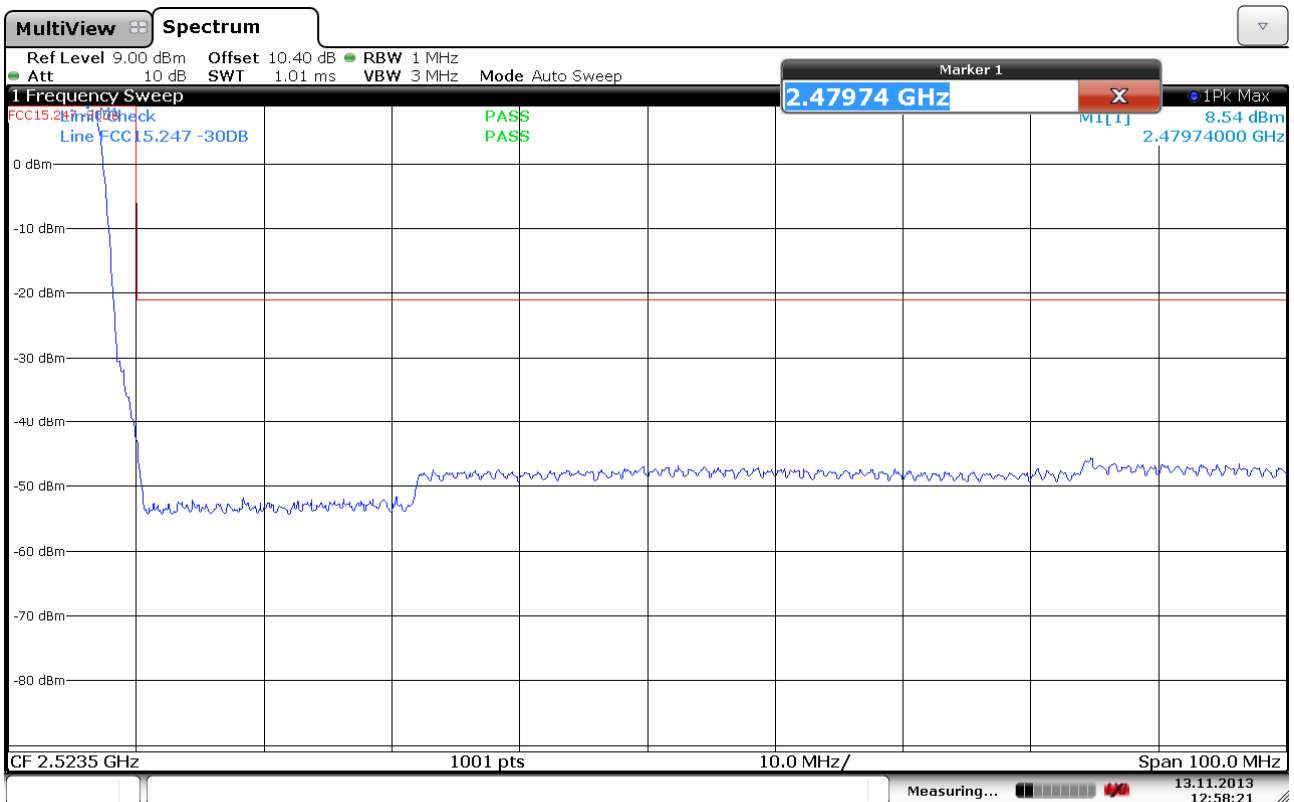
Band Edge Upper Channel, Radiated, Peak, Hopping ON



Conducted Emissions, 1MHz -25GHz, Hopping On



Conducted Emissions, 2310 -2410 MHz, Hopping ON



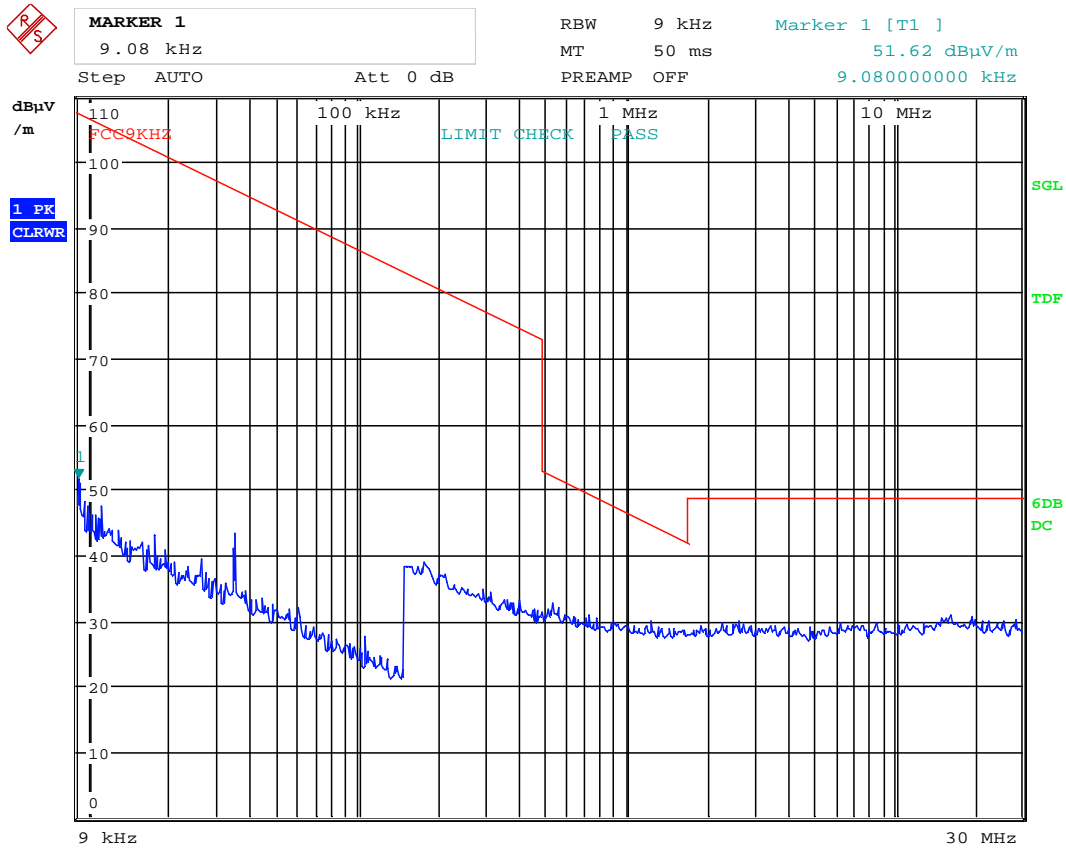
Conducted Emissions, 2473.5 -2573.5 MHz, Hopping ON

Radiated emissions 9 kHz-30 MHz.

Measuring distance 10 m, measured with Peak detector.

No component detected, see attached 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: Quasi-Peak

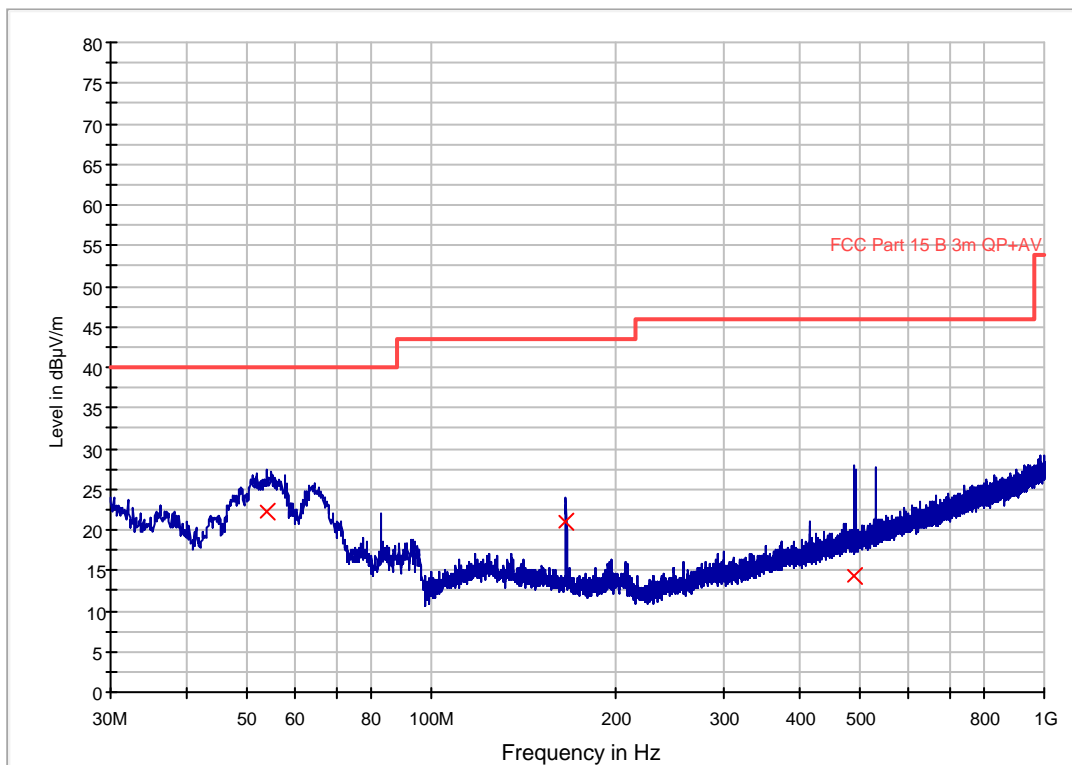
Measuring distance 3 m according to ANSI C63.4-2003.

Tested in speech mode with active connection.

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Polarization	Margin (dB)	Limit (dB μ V/m)	Comment
54.031718	22.1	120.000	V	17.9	40.0	
166.058825	21.0	120.000	V	22.5	43.5	
487.571248	14.2	120.000	H	31.8	46.0	

See plot.

NTC FCC Pt15 Class B 30-1000M 3m



Radiated Emissions, 1-25 GHz

Measuring distance: 3m (1 – 8.5 GHz)
 1m (5.5 – 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
4804	L	0	47.7	74	26.3
4960	H	0	49.3	74	24.7

Average Detector:

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
MHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4804	L	0	27.7	20	54	26.3
4960	H	0	29.3	20	54	24.7

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

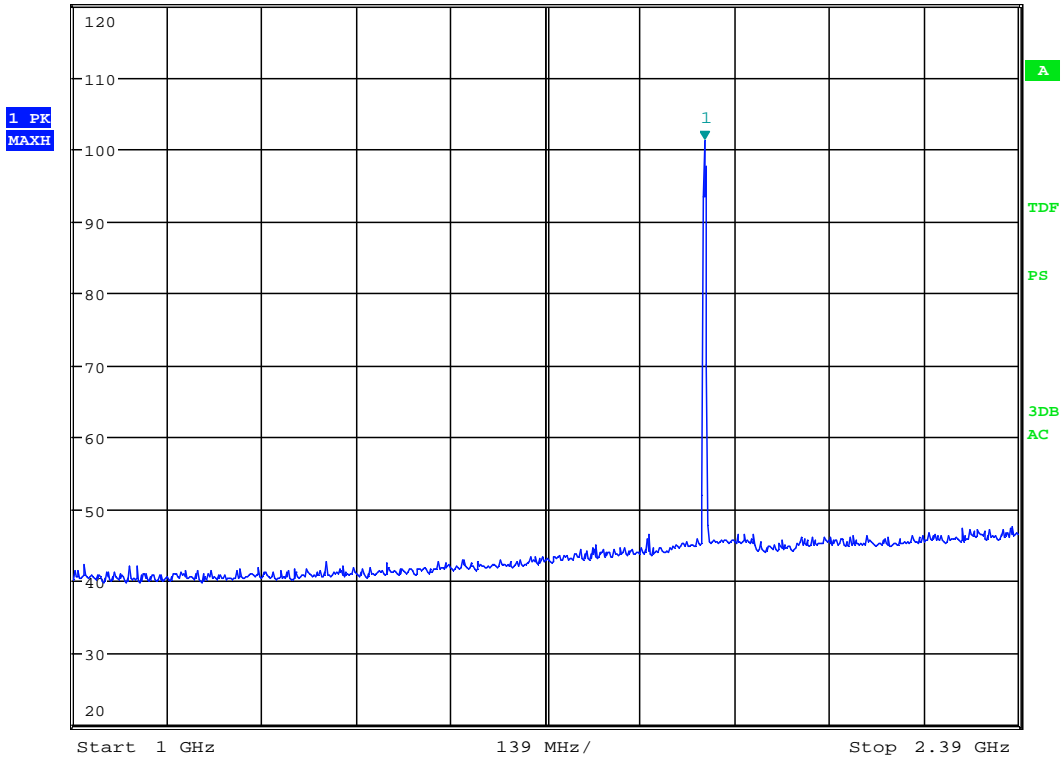
Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

Distance correction factor is included on the plots for measurements @1m.

See plots.



*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 101.23 dBµV/m
 Ref 120 dBµV/m *Att 20 dB SWT 5 ms 1.928894231 GHz



Date: 19.NOV.2013 14:14:36

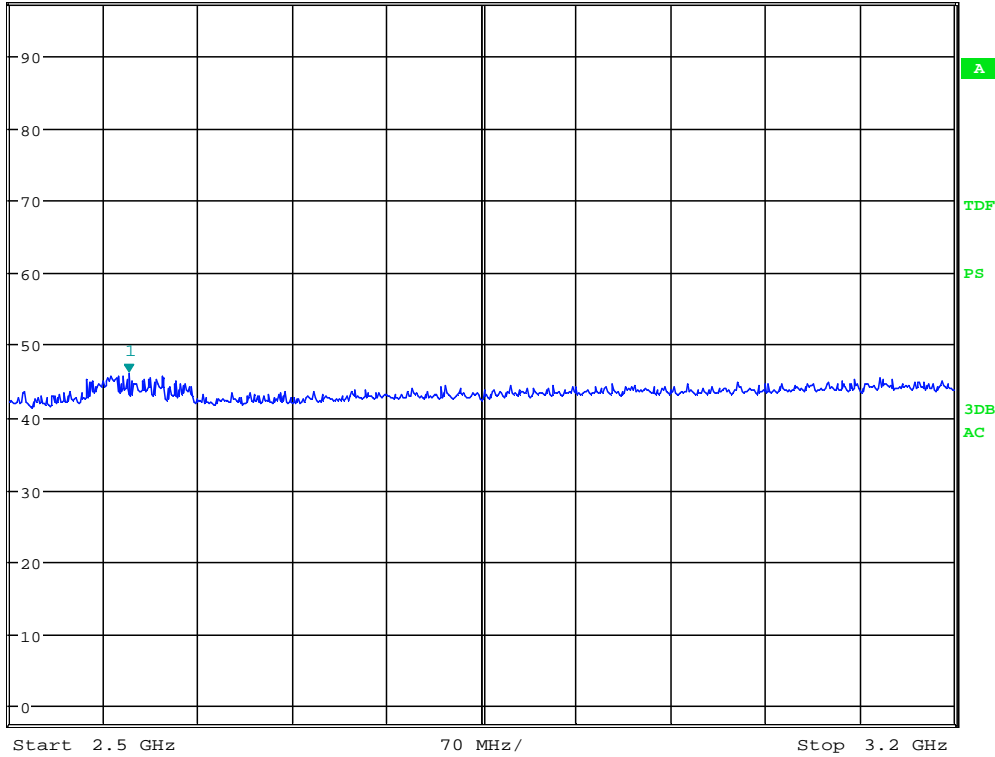
Radiated Emissions, 1000 -2390MHz, VP, Hopping ON, UPCS Active
(Strong signal @1926MHz is UPCS Transmitter)



*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 46.04 dBµV/m
 SWT 2.5 ms 2.588621795 GHz

Ref 97.5 dBµV/m *Att 10 dB

1 PK
 MAXH



Date: 19.NOV.2013 14:18:32

Radiated Emissions, 2500 -3200MHz, VP, Hopping ON, UPCS Active

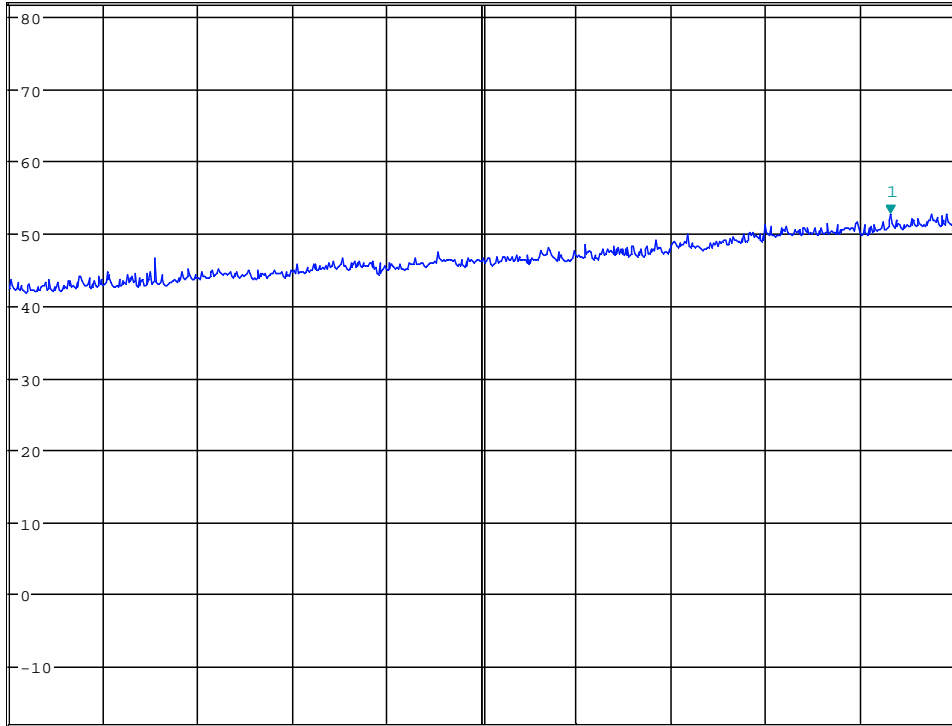


*RBW 1 MHz Marker 1 [T1]
*VBW 3 MHz 52.71 dBμV/m
SWT 35 ms 8.129807692 GHz

Ref 82 dBμV/m

*Att 10 dB

1 PK
MAXH



Date: 19.NOV.2013 13:18:10

Radiated Emissions, 3000 -8500MHz, VP

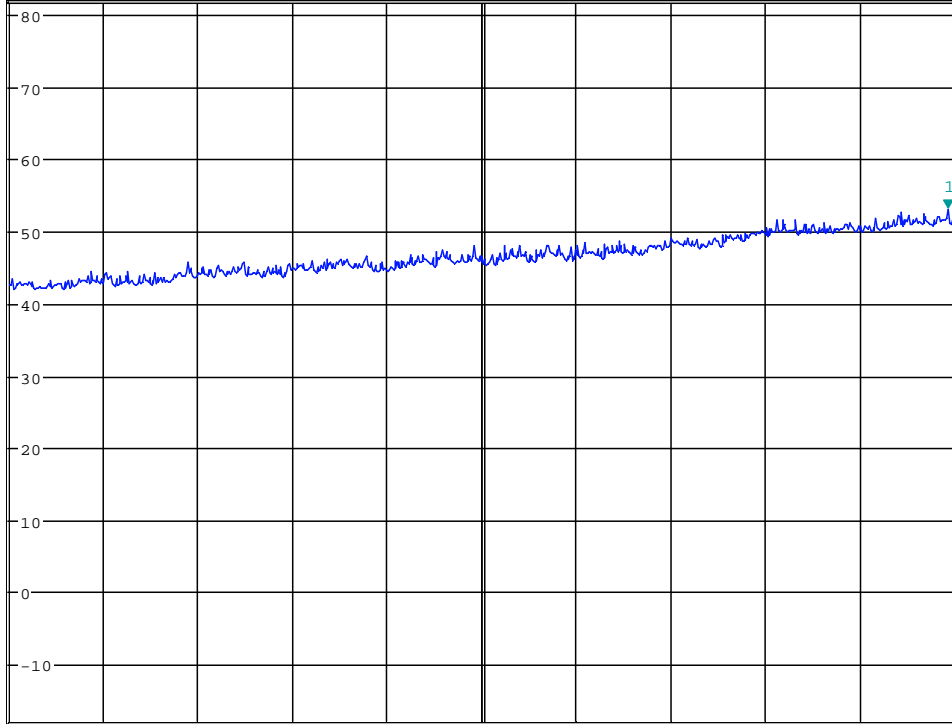


*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 53.12 dBμV/m
 SWT 35 ms 8.464743590 GHz

Ref 82 dBμV/m

*Att 10 dB

1 PK
 MAXH



Start 3 GHz

550 MHz/

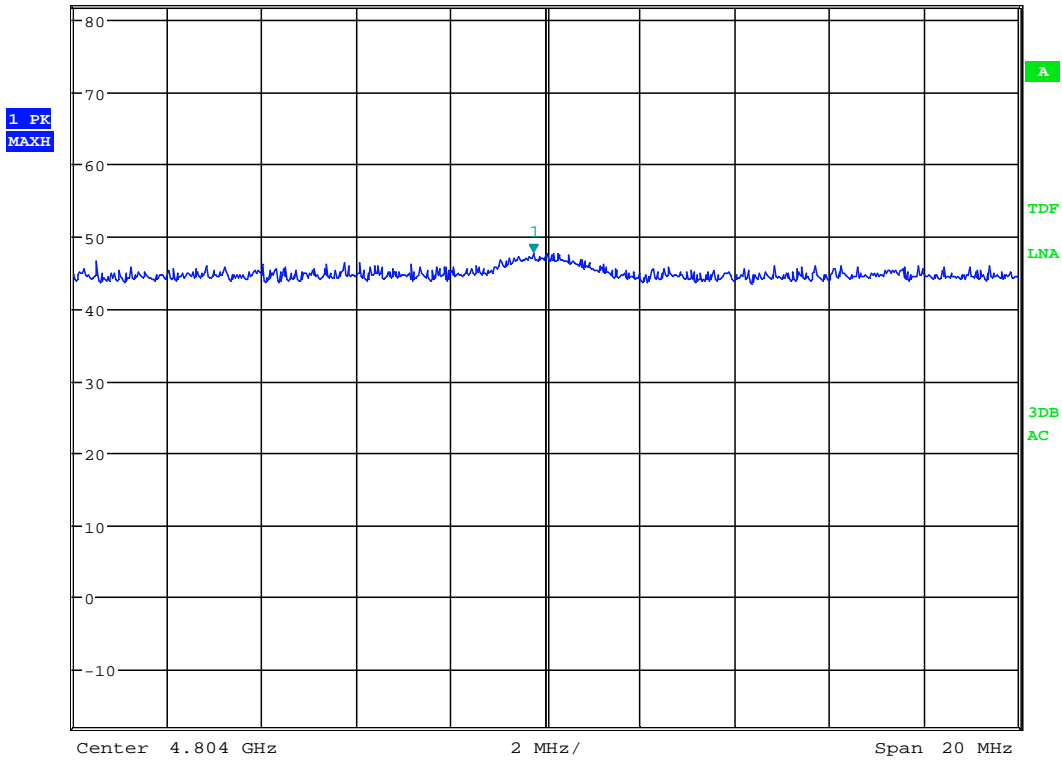
Stop 8.5 GHz

Date: 19.NOV.2013 13:19:52

Radiated Emissions, 3000 -8500MHz, HP



*RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 47.70 dBµV/m
 SWT 20 ms 4.803743590 GHz
 Ref 82 dBµV/m *Att 10 dB



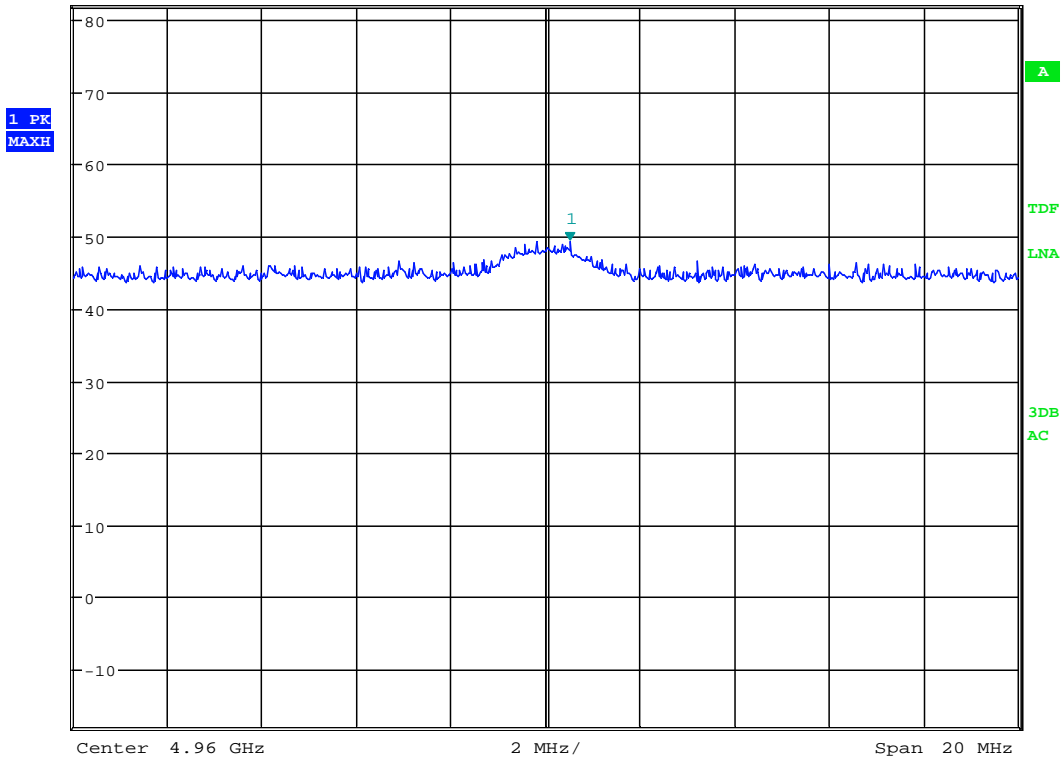
Date: 19.NOV.2013 13:13:57

Radiated Emissions, 4804MHz, HP, Ch00



*RBW 1 MHz Marker 1 [T1]
VBW 3 MHz 49.30 dBμV/m
SWT 20 ms 4.960512821 GHz

Ref 82 dBμV/m *Att 10 dB



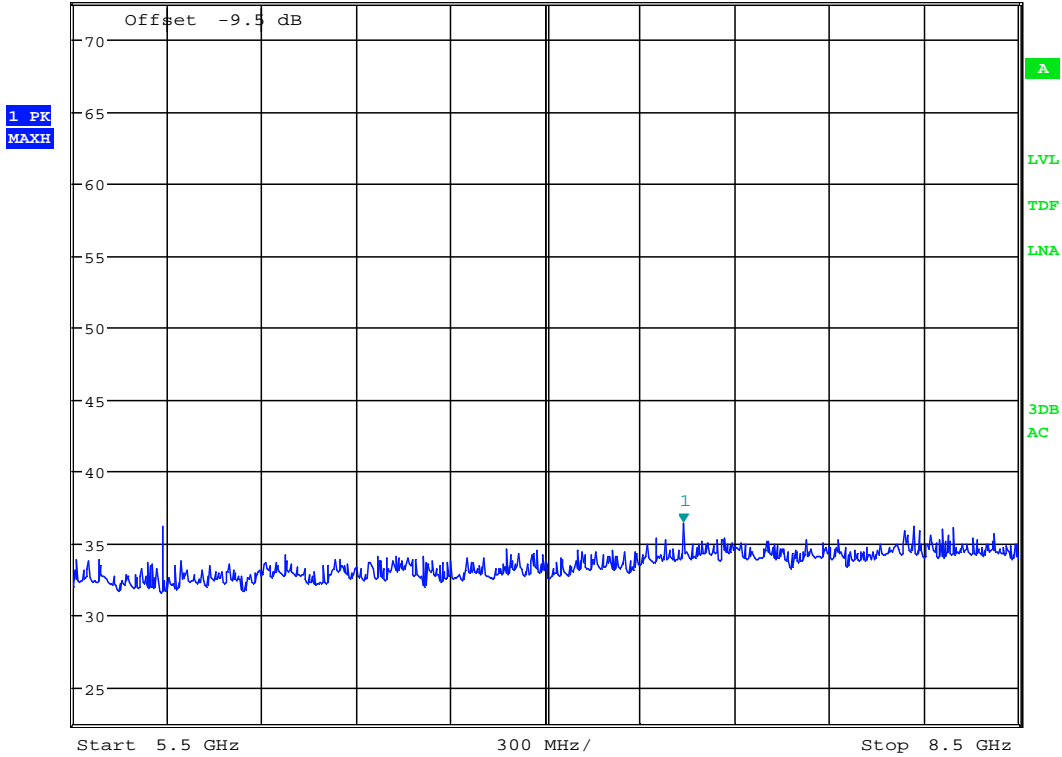
Date: 19.NOV.2013 12:59:35

Radiated Emissions, 4960MHz, VP, Ch78



*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 36.38 dBμV/m
 SWT 20 ms 7.437500000 GHz

Ref 72.5 dBμV/m *Att 10 dB



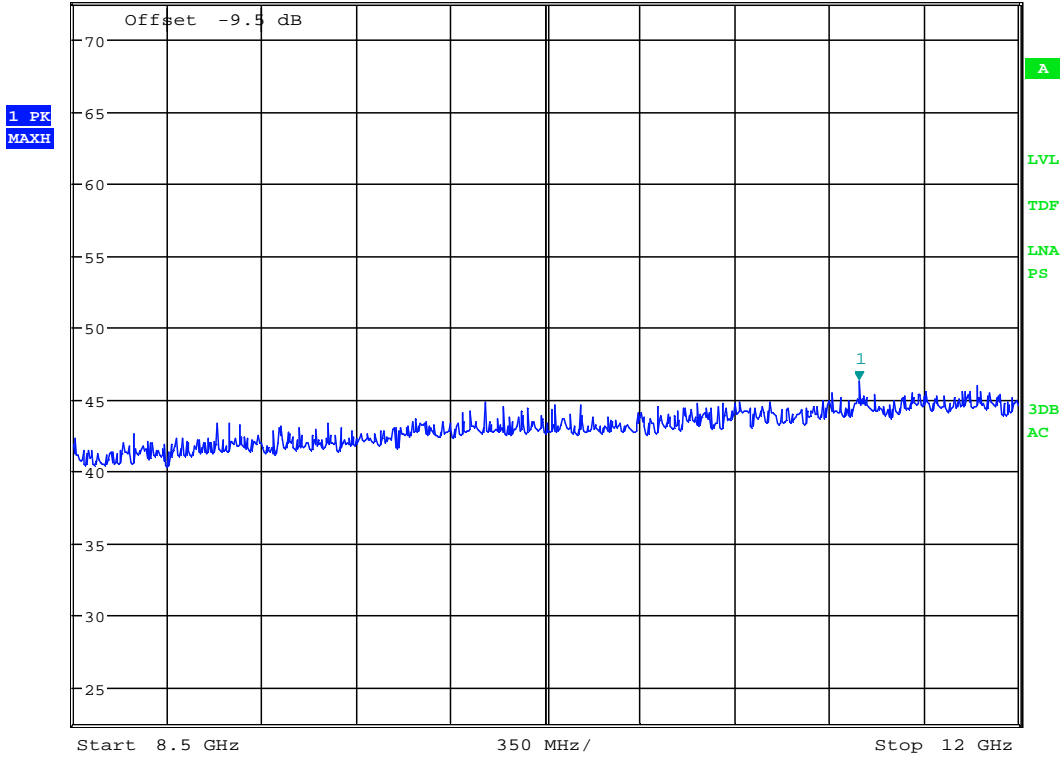
Date: 19.NOV.2013 13:33:19

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



*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 46.31 dBμV/m
 SWT 25 ms 11.411057692 GHz

Ref 72.5 dBμV/m *Att 10 dB



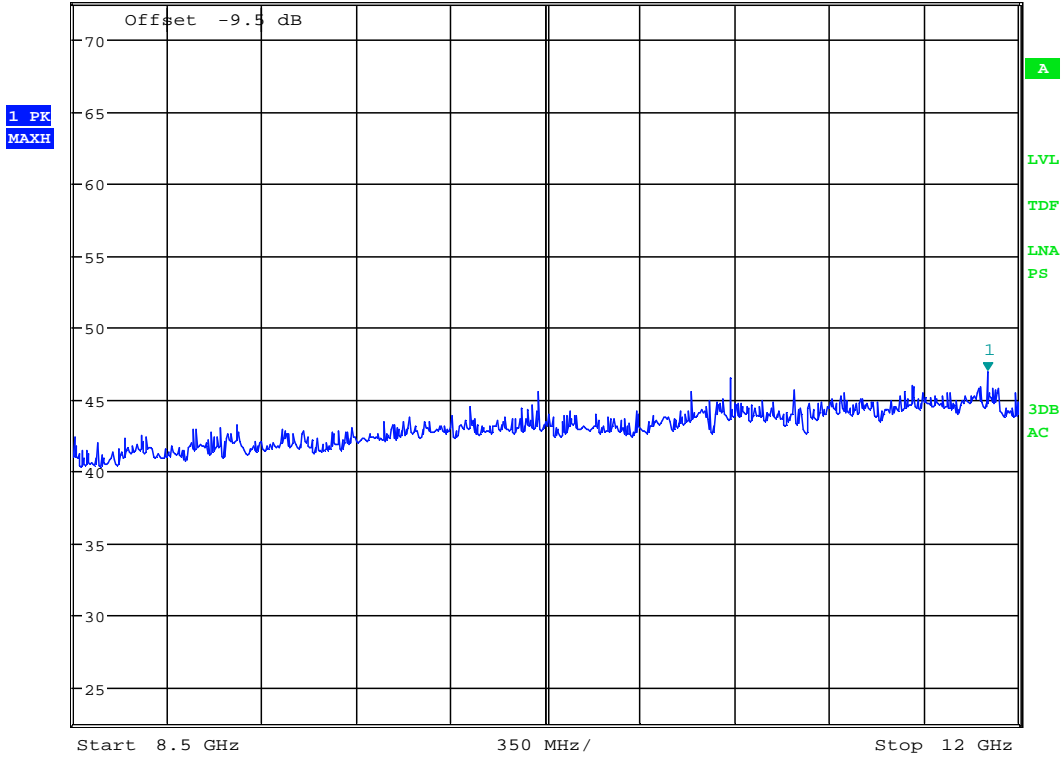
Date: 19.NOV.2013 13:41:34

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



*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 46.91 dBµV/m
 SWT 25 ms 11.887820513 GHz

Ref 72.5 dBµV/m *Att 10 dB



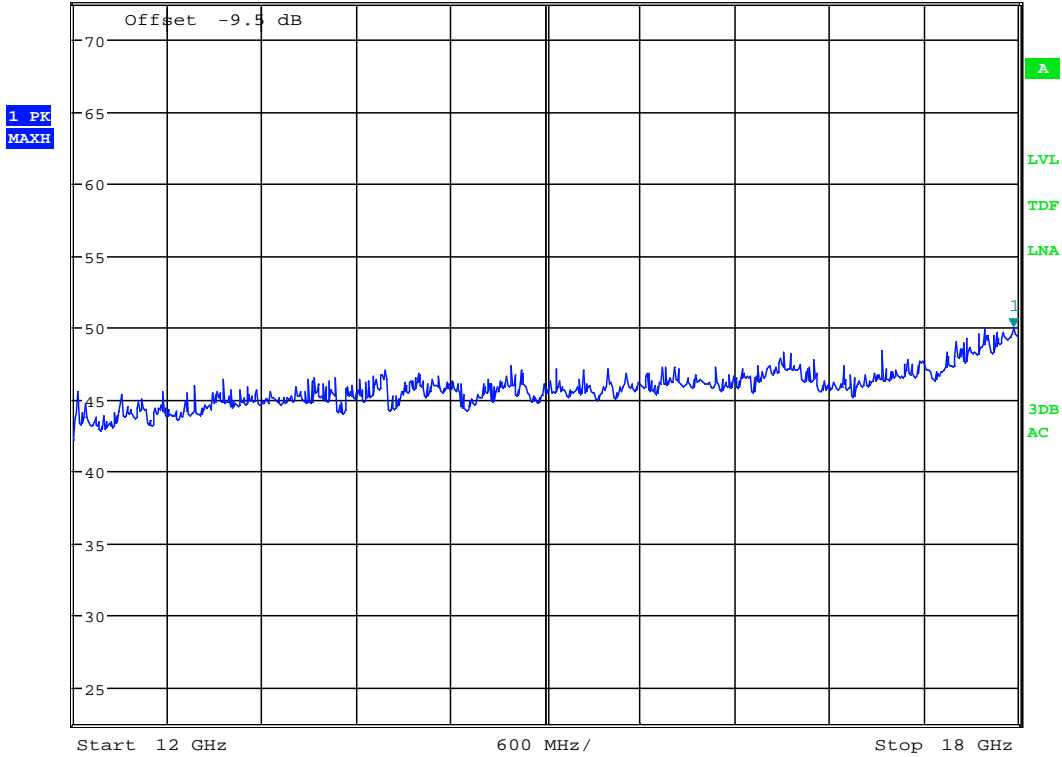
Date: 19.NOV.2013 13:43:16

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



*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 50.02 dBµV/m
 SWT 35 ms 17.971153846 GHz

Ref 72.5 dBµV/m *Att 10 dB



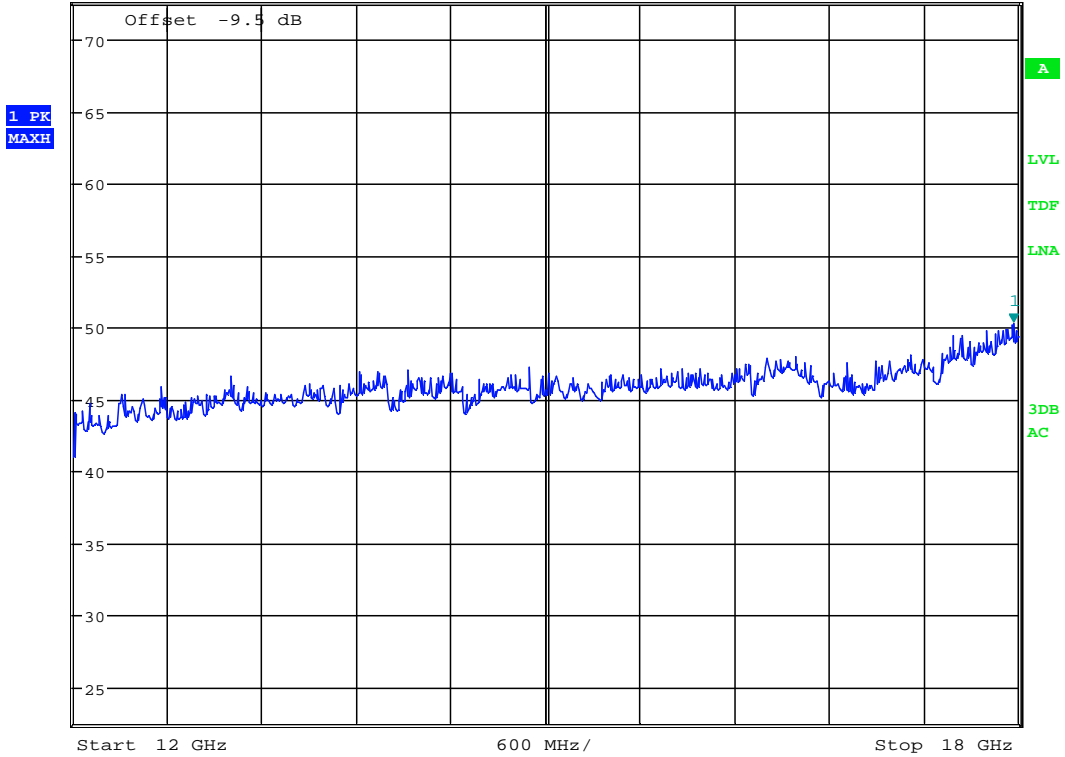
Date: 19.NOV.2013 13:51:16

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



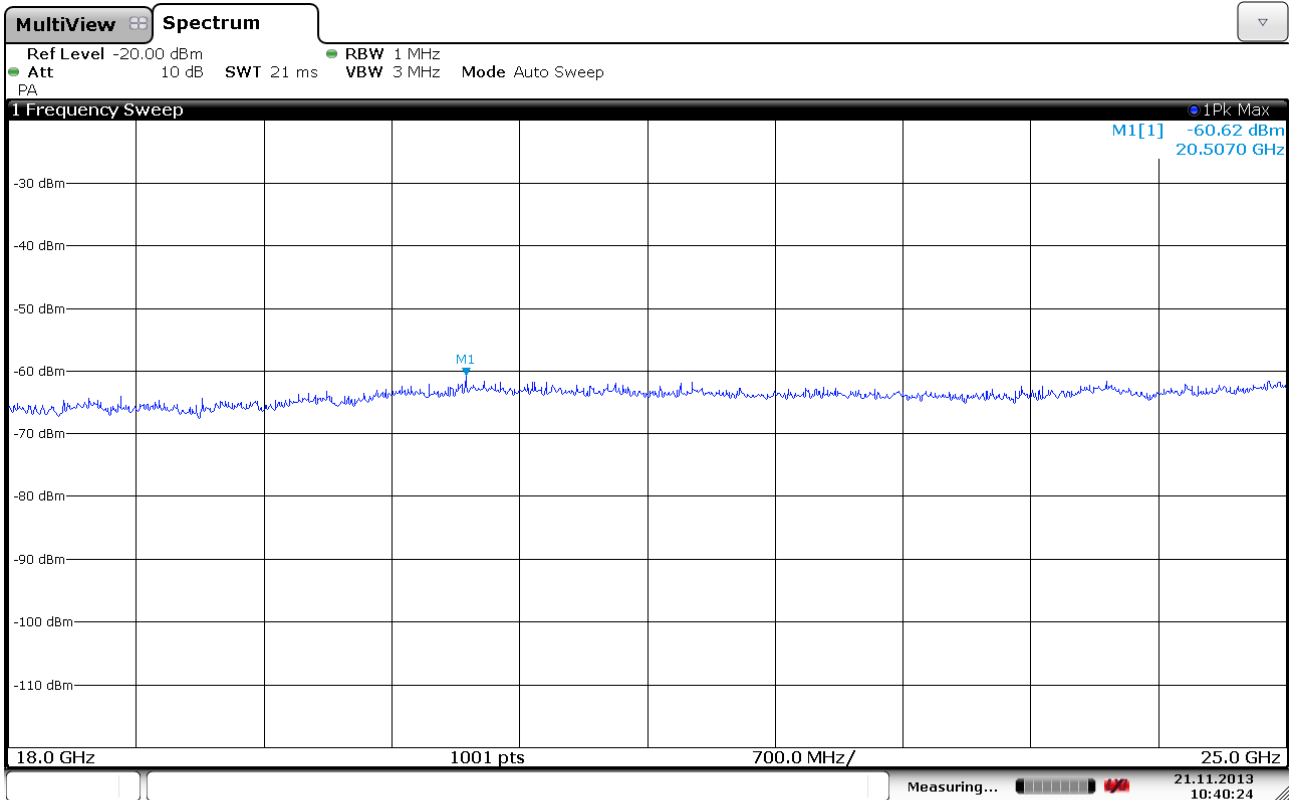
*RBW 1 MHz Marker 1 [T1]
 *VBW 3 MHz 50.30 dBμV/m
 SWT 35 ms 17.971153846 GHz

Ref 72.5 dBμV/m *Att 10 dB



Date: 19.NOV.2013 13:52:58

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



2487.000MHz

Pre-scan, 18000 -25000MHz, @ approx. 10cm

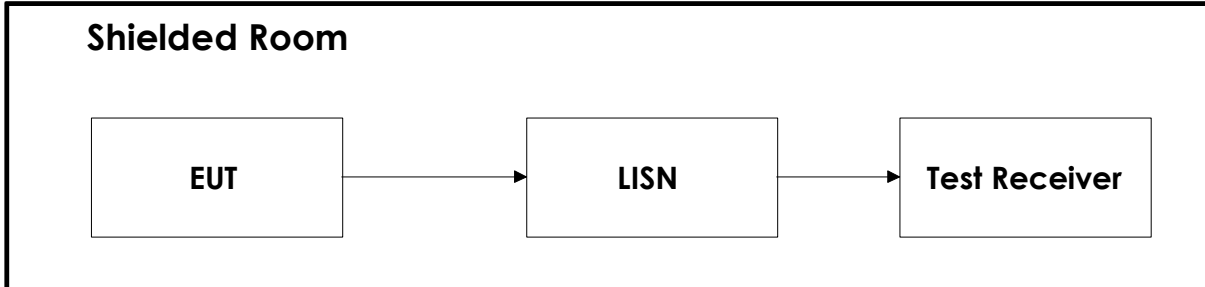
4 LIST OF TEST EQUIPMENT

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	2013.08.30	2014.08.30
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2013.09.24	2014.09.24
3	4768-10	Attenuator	Narda	LR 1356	Cal b4 use	
4	6HC3000/18000	Highpass Filter	Trilithic	LR 1614	Cal b4 use	
5	JB3	BiLog Antenna	Sunol Sciences	N-4525	2012.10.11	2015.10.11
6	LNA6900	Preamplifier	Teseq	LR 1593	2011.11.24	2013.11.24
7	3115	Horn Antenna	EMCO	LR 1330	2010.08.05	2015.08.05
8	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2013-09	2014-09
9	643	Antenna Horn	Narda	LR 093	2009.01.26	2014.01.26
10	PM7320X	Antenna Horn	Sivers Lab	LR 102	2009.01.26	2014.01.26
11	DBF-520-20	Antenna Horn	Systron Donner	LR 100	2009.01.26	2014.01.26
12	638	Antenna Horn	Narda	LR 1480	2010.06.17	2015.06.17
14	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 285	2010.10	2015.10
15	Model 87V	Multimeter	Fluke	N-4669	2013.09	2014.09
16	6812B	AC Power Source	Agilent	LR 1515	2013.10.28	2014.10.28
17	ESHS10	Measuring Receiver	Rohde & Schwarz	N- 3528	2012.06.28	2014.06.28
18	ESH3-Z5	Two Line V-Network	Rohde & Schwarz	LR 1076	Cal b4 use	
19	ESH3-Z2	Pulse Limiter	Rohde & Schwarz	LR 1074	2012.04.24	2014.04.24

5 BLOCK DIAGRAM

5.1 Power Line Conducted Emission



5.2 Test Site Radiated Emission

