



Test report no. : 141532-2

Item tested : KX-TG6581

**Type of equipment : UPCS Base Station
with Bluetooth Transceiver**

Client : Panasonic System Networks Co., Ltd.

FCC Part 15.247

Frequency Hopping Transmitters /
Digital Transmission System

RSS-210, Issue 7

Low Power Licence-Exempt
Radiocommunication Devices

19 February 2010

Authorized by :



Egil Hauger
Technical Verificator

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1 GENERAL INFORMATION

1.1 Testhouse Info

Name : Nemko AS
Address : Nemko Kjeller
Instituttveien 6, Box 96
NO-2007 Kjeller, NORWAY
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
E-mail: comlab@nemko.com
FCC test firm
registration # : 994405
IC OATS
registration # : 2040D-1
Total Number of Pages: 39

1.2 Client Information

Name : Panasonic System Networks Co., Ltd.
Address : 1-62, 4-Chome, Minoshima, Hakata-ku, Fukuoka 812-8531 Japan
Telephone : +81-92-477-1405
Fax : +81-92-477-1487

Contact:

Name : Mr. Junji Sumi
Telephone : +81 92 477 1405
E-mail : sumi.junji@jp.panasonic.com

1.3 Responsible Manufacturer (if other than client)

Name : /
Address : /

2 Test Information

2.1 Tested Item

Name :	Panasonic
FCC ID :	ACJ96NKX-TG6581
Model/version :	KX-TG6581
Serial number :	/
Hardware identity and/or version:	/
Software identity and/or version :	/
Frequency Range :	2402 – 2480 MHz
Number of Channels :	From 79 to 20 (adaptive)
Operating Modes :	Frequency Hopping Spread Spectrum
Type of Modulation :	Digital (GFSK)
Rated Output Power :	1 mW Peak
Type of Power Supply :	Power Adaptor, Models: PQLV219(FW) and PQLV219(UC)
Antenna Connector :	None
Number of Antennas :	1
Antenna Diversity Supported :	No
Desktop Charger :	None

Description of Tested Device(s)

The tested equipment is a Bluetooth Transceiver that is integrated into a UPCS base station.

This test report covers only the Bluetooth Transceiver of the EUT, the UPCS part is covered by Nemko test report no. 137945-3. The UPCS part is identical to the previously certified model KX-TG6531 (FCC ID: ACJ96NKX-TG6531) except for the Bluetooth Module.

The tested equipment has integral antennas only.

Theory of Operation

The tested EUT is a Frequency Hopping Transmitter that uses the Bluetooth protocols.

This version of Bluetooth normally uses all 79 BT channels, but will exclude channels or shift to 20 channels if interference is detected. When 20 channels are used they can be either in the lower, middle or upper part of the 2.4 GHz frequency band, depending on the interference.

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 20cm from any persons. For the purposes of exposure evaluation this EUT is a mobile or fixed device. MPE Calculation at 20cm satisfying FCC requirements is submitted as a separate document.

The EUT is exempted from RF Exposure Evaluation to Industry Canada SAR requirements since the output power is below the limit in RSS-102 Issue 2, clause 2.5.2 for General Public Use.

2.2 Test Environment

2.2.1 Normal test condition

Temperature: 20 - 24 °C

Relative humidity: 20 - 50 %

Normal test voltage: 120 V AC

The values are the limit registered during the test period.

2.3 Test Period

Item received date: 2010-01-11

Test period : from 2010-01-18 to 2010-02-19

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Panasonic
Model No.: KX-TG6581
Serial No.: /

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 7.

Radiated tests were conducted in accordance with ANSI C63.4-2003. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

☒ 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".



TEST REPORT #: 141532-2

TESTED BY: Frode Sveinsen
Frode Sveinsen, Test engineer

DATE: 19 February 2010

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3.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 7 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 20 dB Bandwidth	15.247(a)(2)	A8.2	Complies
Peak Power Output	15.247(b)	A8.4	Complies
Power Spectral Density	15.247(d)	A8.2	NA ¹
Spurious Emissions (Antenna Conducted)	15.247(c)	A8.5	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	A8.5	Complies

¹ Not applicable for Frequency Hopping devices.

3.3 Description of modification for Modification Filing

Not applicable.

3.4 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.

This test report covers only the Bluetooth module of the tested device.

3.5 Family List Rational

Not Applicable.

4 TEST RESULTS

4.1 Power Line Conducted Emissions

Para. No.: 15.207 (a)

Test Performed By: Tore Løvlien

Date of Test: 28 January 2010

Measurement procedure: ANSI C63.4-2003 using 50 μ H/50 ohms LISN.

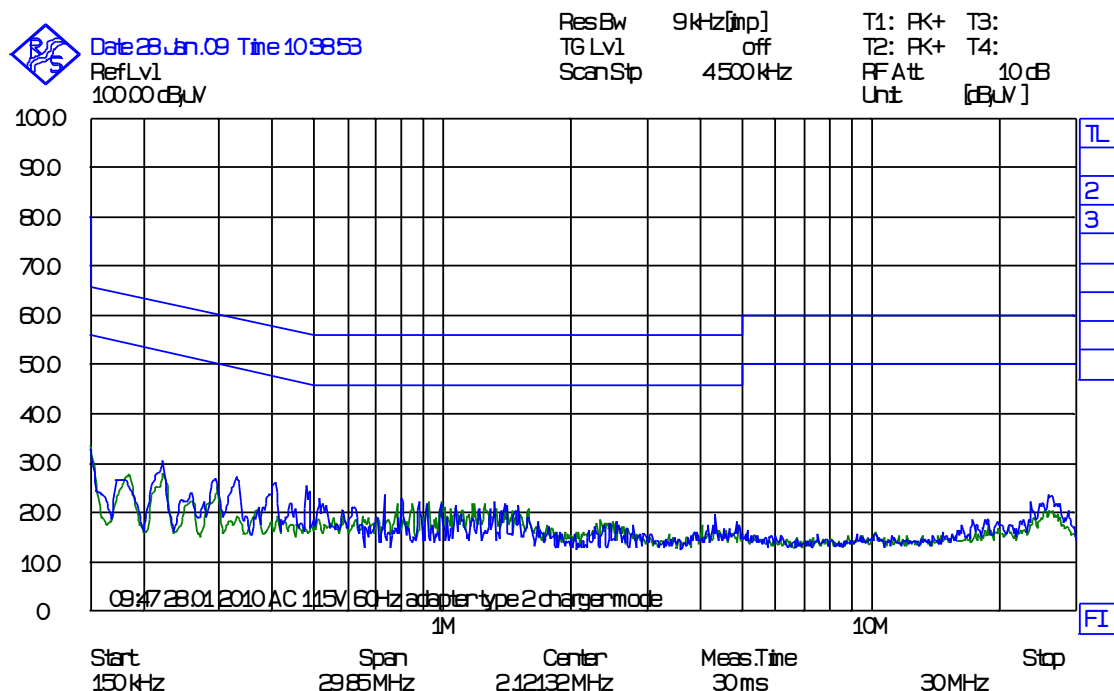
Test Results: Complies.

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

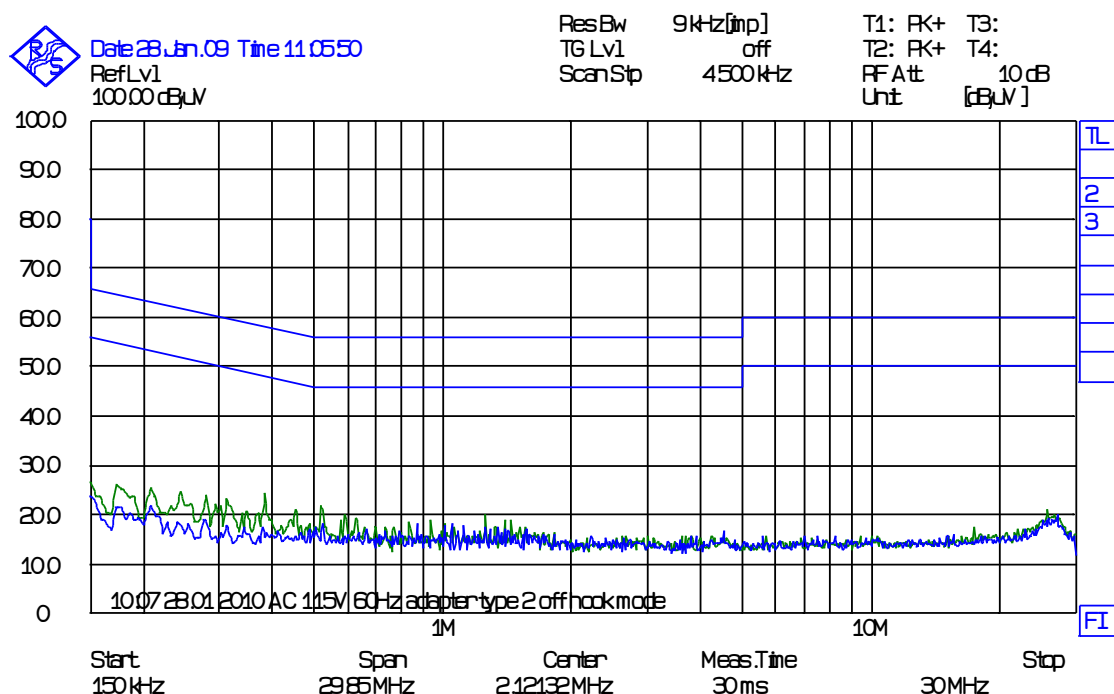
All emissions are below the Average limit, even when measured with Peak detector.

Highest measured value (L1 and N):

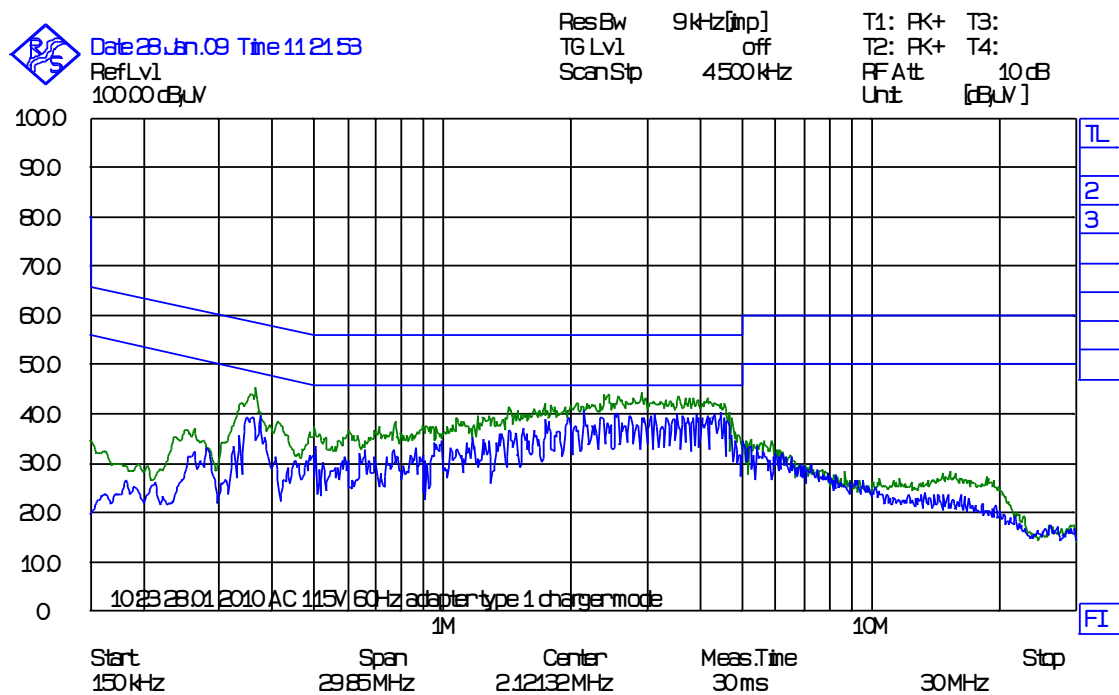
Frequency	Detector	Measured value	Limit	Margin
KHz	Peak/QP/AV	dB μ V	dB μ V	dB
/	QP	/	/	/
/	AV	/	/	/
/	QP	/	/	/
/	AV	/	/	/



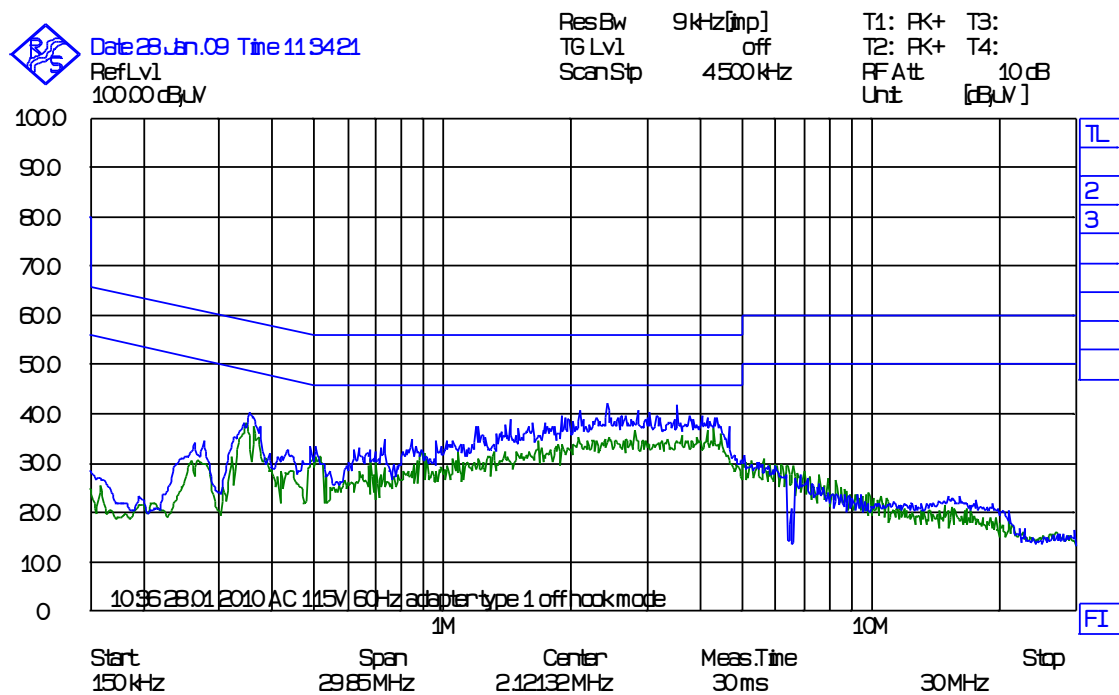
Handset in Charger, Phase N and L1, Adaptor type PQLV219(UC)



Off Hook, Phase N and L1, Adaptor type PQLV219(UC)



Handset in Charger, Phase N and L1, Adaptor type PQLV219(FW)



Off Hook, Phase N and L1, Adaptor type PQLV219(FW)

4.2 Channel Separation

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

Test Performed By: Frode Sveinsen

Date of Test: 18 January 2010

Test Results: **Complies**

Measurement Data: Channel Separation: 1.000 MHz
20 dB Bandwidth of hopping channel: 0.942 MHz

RF channel has no influence on 20 dB bandwidth.

See attached graph

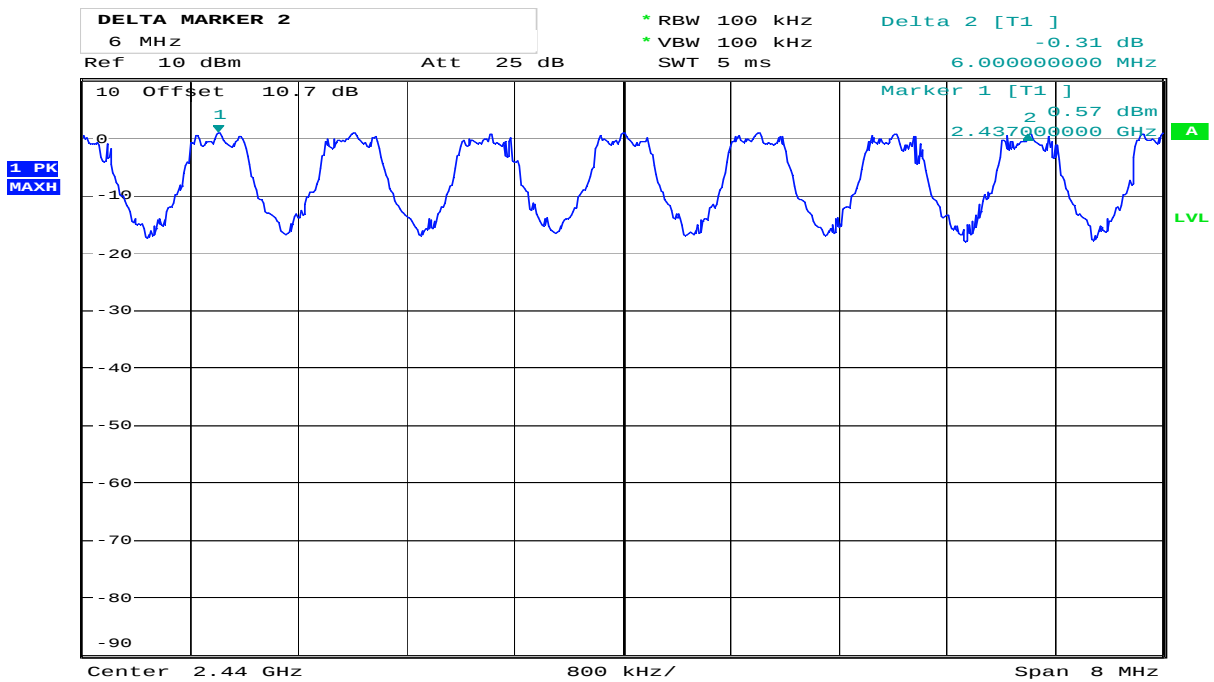
Channel Separation nominal value: 1.000 MHz.

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.

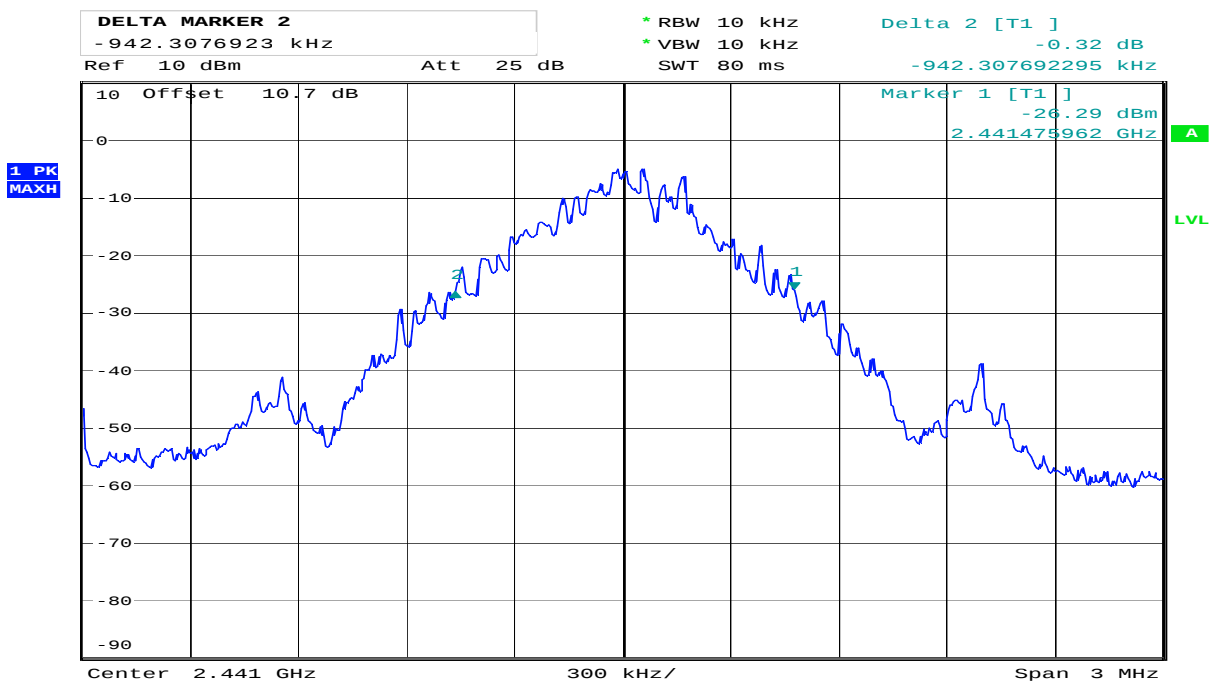
or:

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.



Date: 18. JAN. 2010 13:48:31

Carrier Frequency Separation



Date: 18. JAN. 2010 14:31:31

20 dB Bandwidth

4.3 Pseudorandom Hopping Algorithm

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

Test Performed By: Frode Sveinsen	Date of Test: 28 January 2010
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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.

Base Table Hopping Sequence

The hopping sequence is described in EXHIBIT I.

4.4 Occupancy Time

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

Test Performed By: Frode Sveinsen

Date of Test: 18 January 2010

Test Results: Complies

Measurement Data:

Number of RF channels: 20

RF burst pr channel (worst case, DH5): 2.923 ms

Time between each RF burst on same RF channel: $3.725 \times 20 = 74.5$ ms

Time of occupancy: $2.923\text{ms} \times 400 \times 20 / 74.5 = 0.3139$ seconds

Number of RF channels: 79

RF burst pr channel (worst case, DH5): 2.923 ms

Time between each RF burst on same RF channel: $3.725 \times 79 = 294.275$ ms

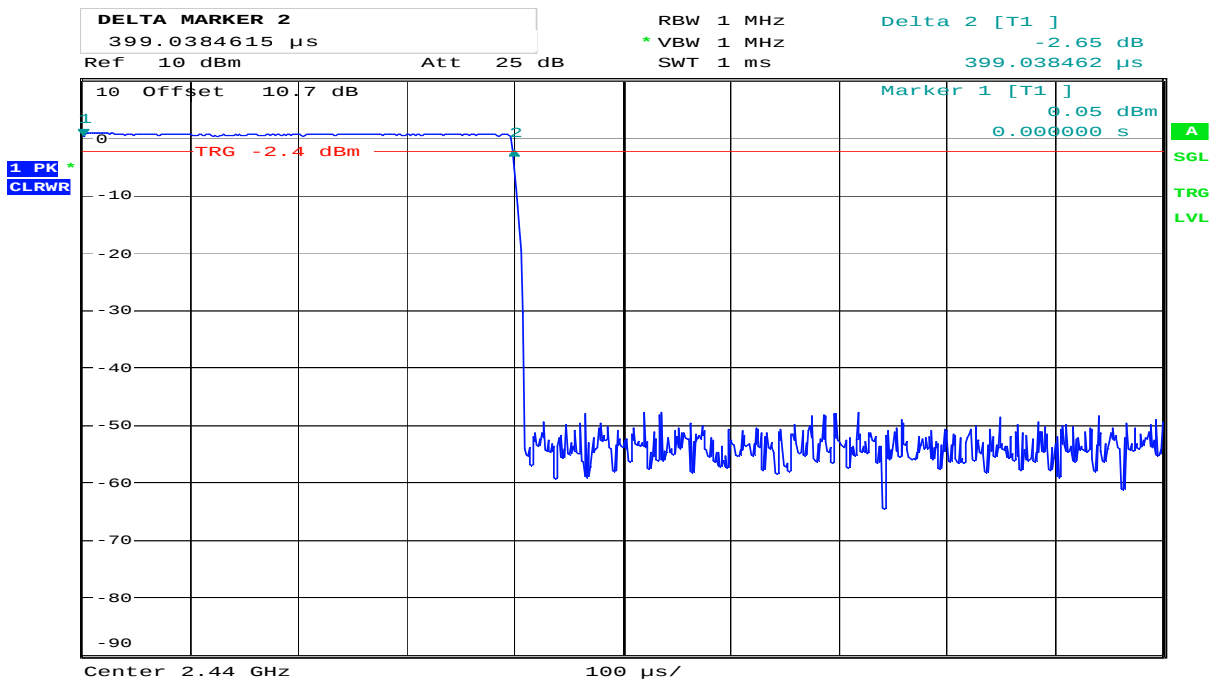
Time of occupancy: $2.923\text{ms} \times 400 \times 79 / 294.275 = 0.3139$ seconds

See attached graphs.

Requirements:

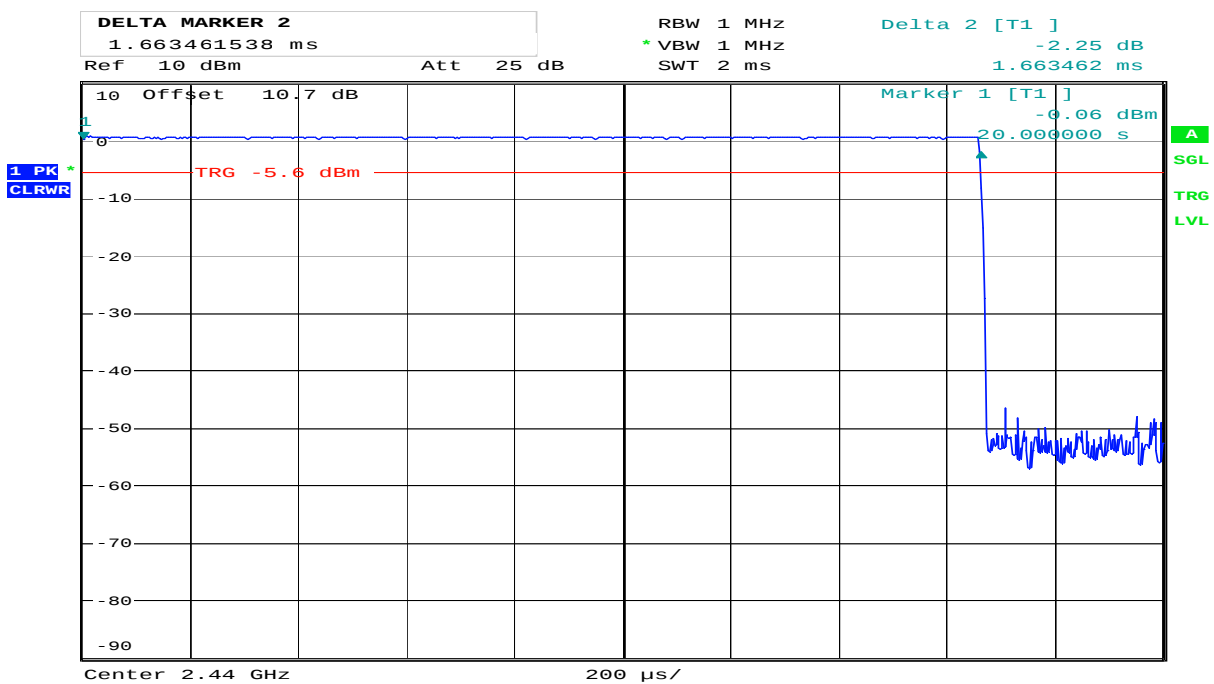
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

No requirements for Digital Transmission Systems.



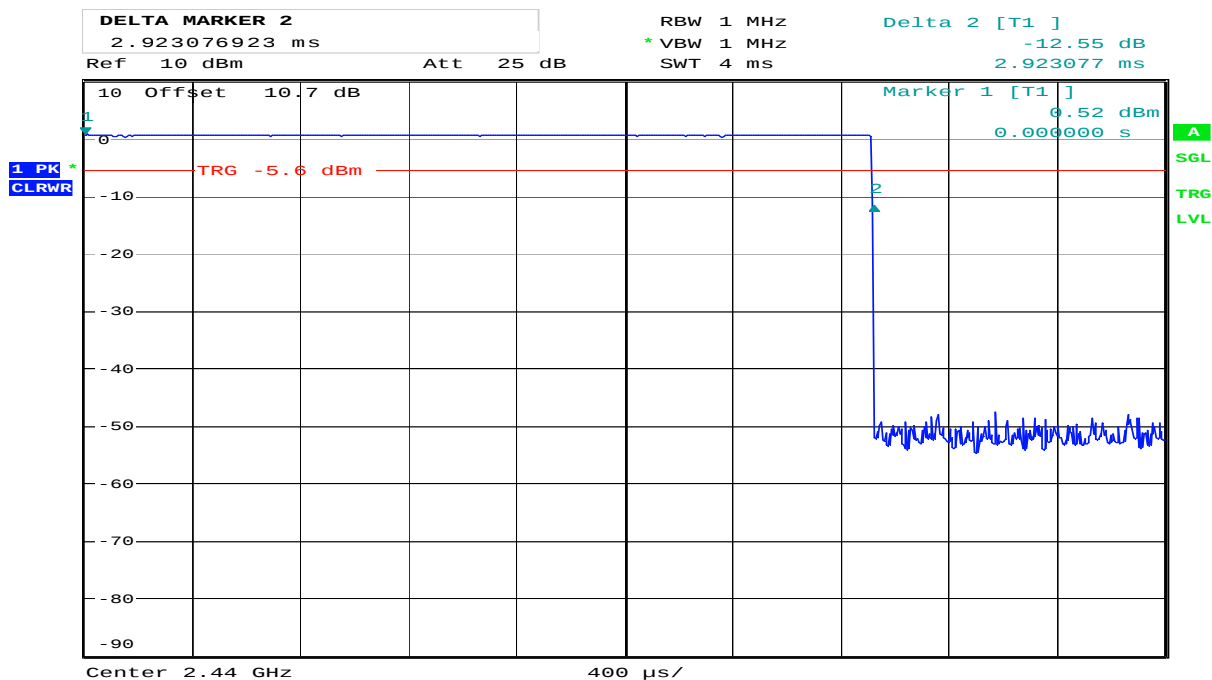
Date: 18.JAN.2010 13:57:02

Slot Type DH1



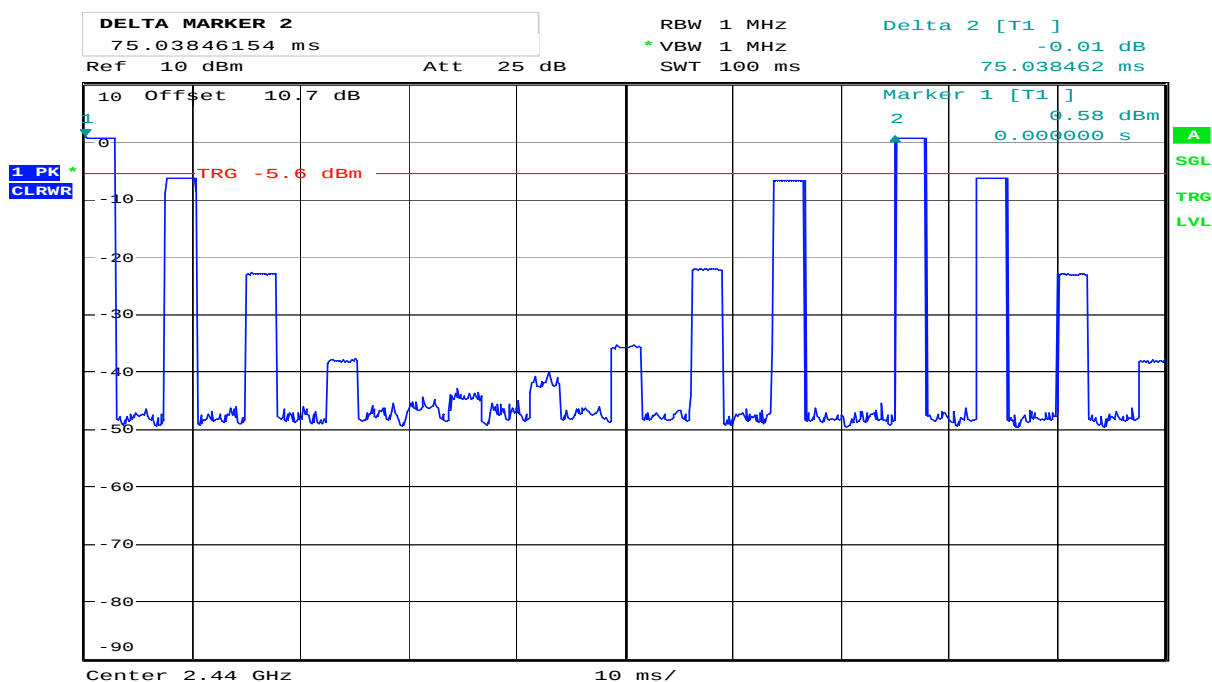
Date: 18.JAN.2010 13:58:50

Slot Type DH3



Date: 18.JAN.2010 14:05:37

Slot Type DH5



Date: 18.JAN.2010 14:06:39

Occupancy Time, Ch 28-47, DH5

4.5 Occupied Bandwidth

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

Test Performed By: Frode Sveinsen	Date of Test: 18 January 2010
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Test Results: Complies

Measurement Data: 79 or 20 RF channels in use

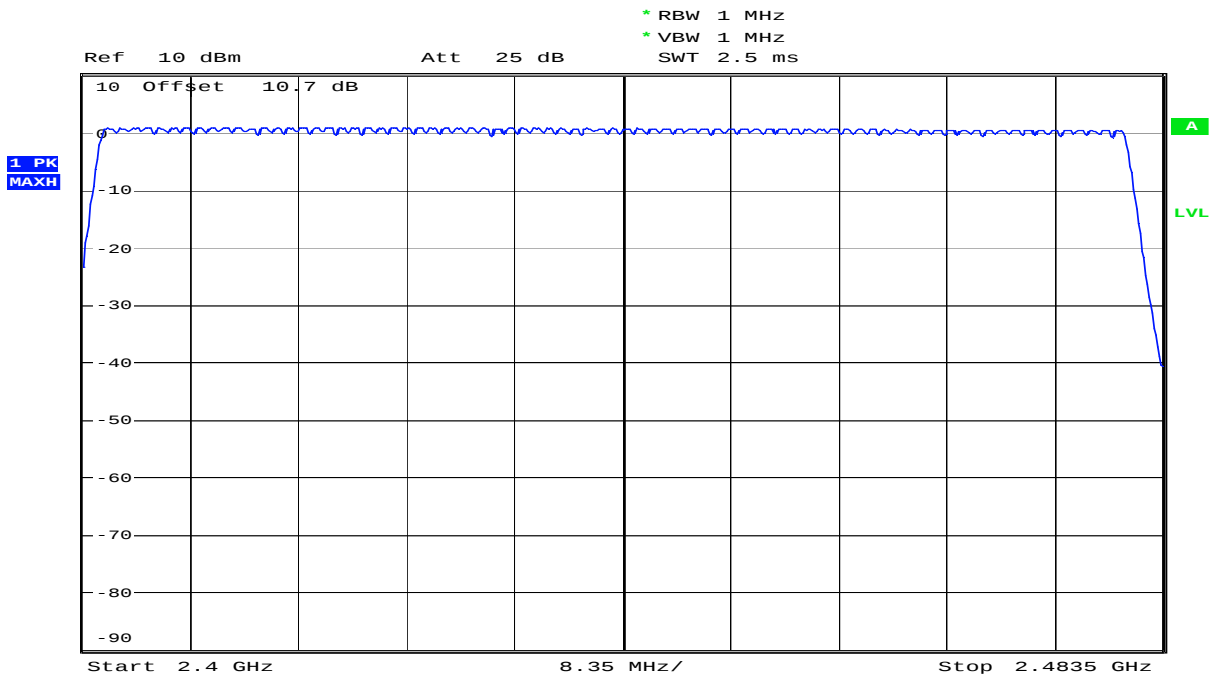
See attached graphs.

Channel Centre Frequencies

The 79 channels are centred at each full MHz from 2402 to 2480 MHz.

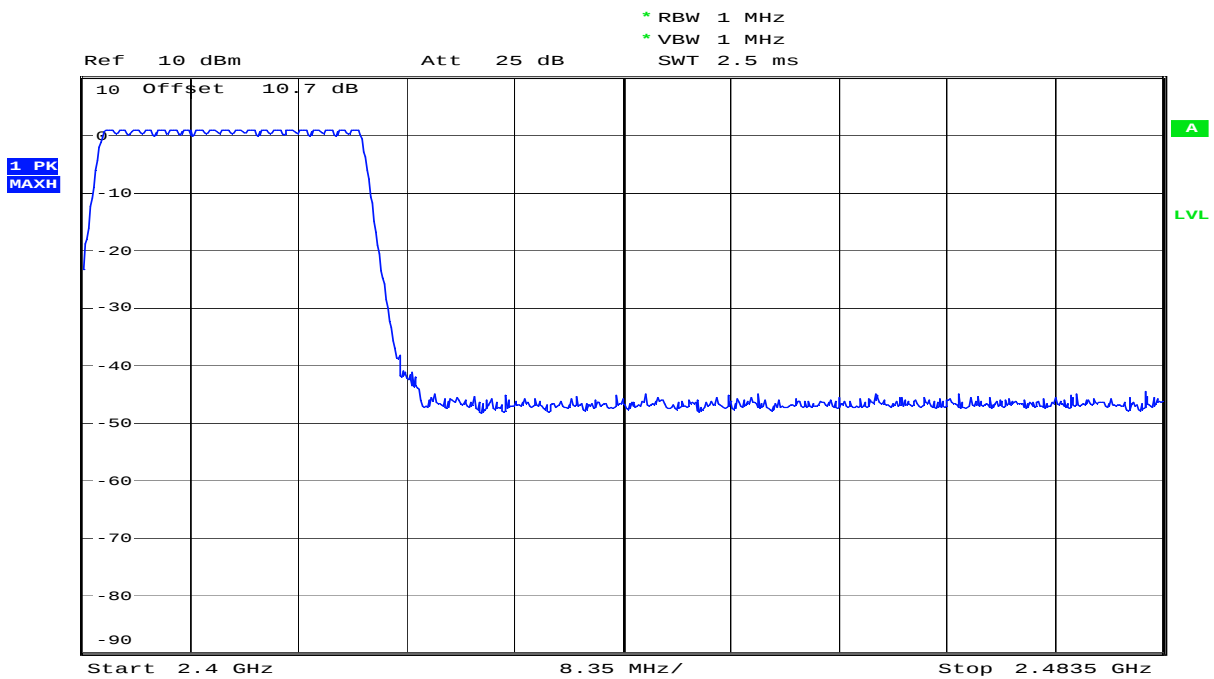
Requirements:

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.



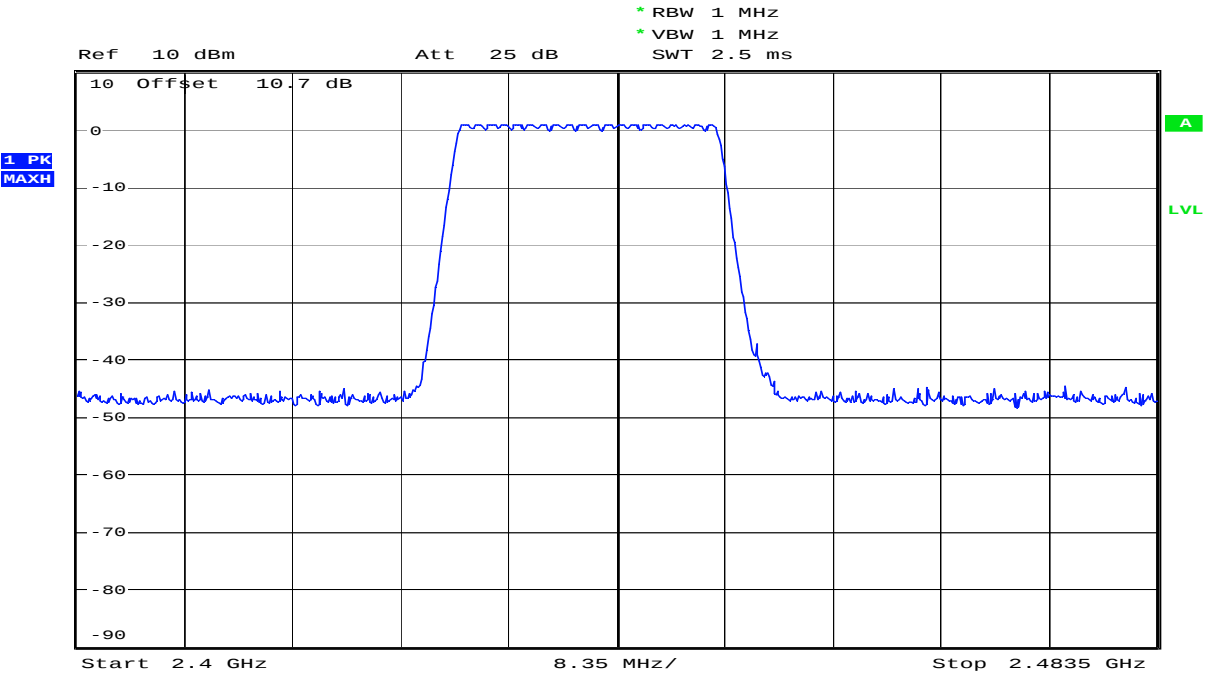
Date: 18. JAN. 2010 13:36:57

RF Channels in use – Full band used



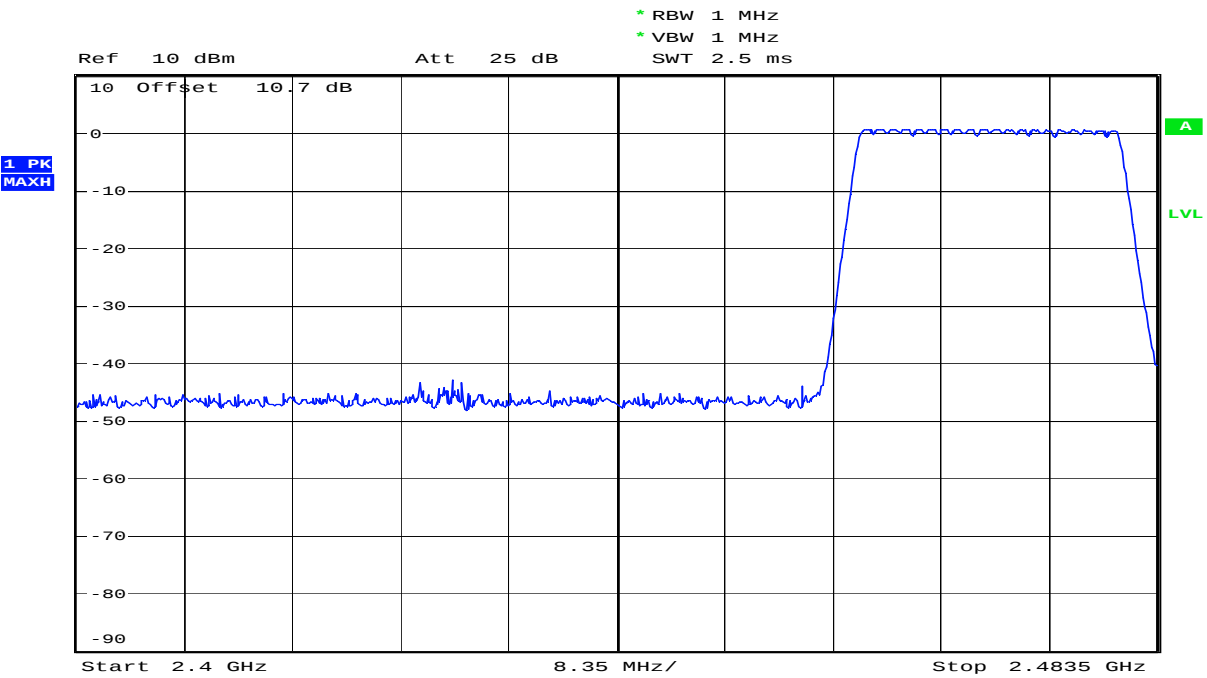
Date: 18. JAN. 2010 13:38:16

RF Channels in use – Lower band used



Date: 18. JAN. 2010 13:38:59

RF Channels in use – Middle band used



Date: 18. JAN. 2010 13:39:51

RF Channels in use – Upper band used

4.6 Peak Power Output

Para. No.: 15.247 (b)

Test Performed By: Frode Sveinsen	Date of Test: 18-20 January 2010
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Test Results: Complies

Measurement Data:

Maximum Conducted Peak Output Power, Watts

RF channel	00	39	79
Measured value	0.0012	0.0012	0.0011

Maximum EIRP, Watts

RF channel	00	39	79
Measured EIRP	0.0015	0.0018	0.0020
Antenna gain dBi	1.0	1.8	2.7

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

The EIRP is calculated from measured field strength by the formula in DA00-705.

See attached graph.

Detachable antenna?

☐ Yes ☒ No

If detachable, is the antenna connector non-standard?

☐ Yes ☐ No

Type of antenna connector: N/A

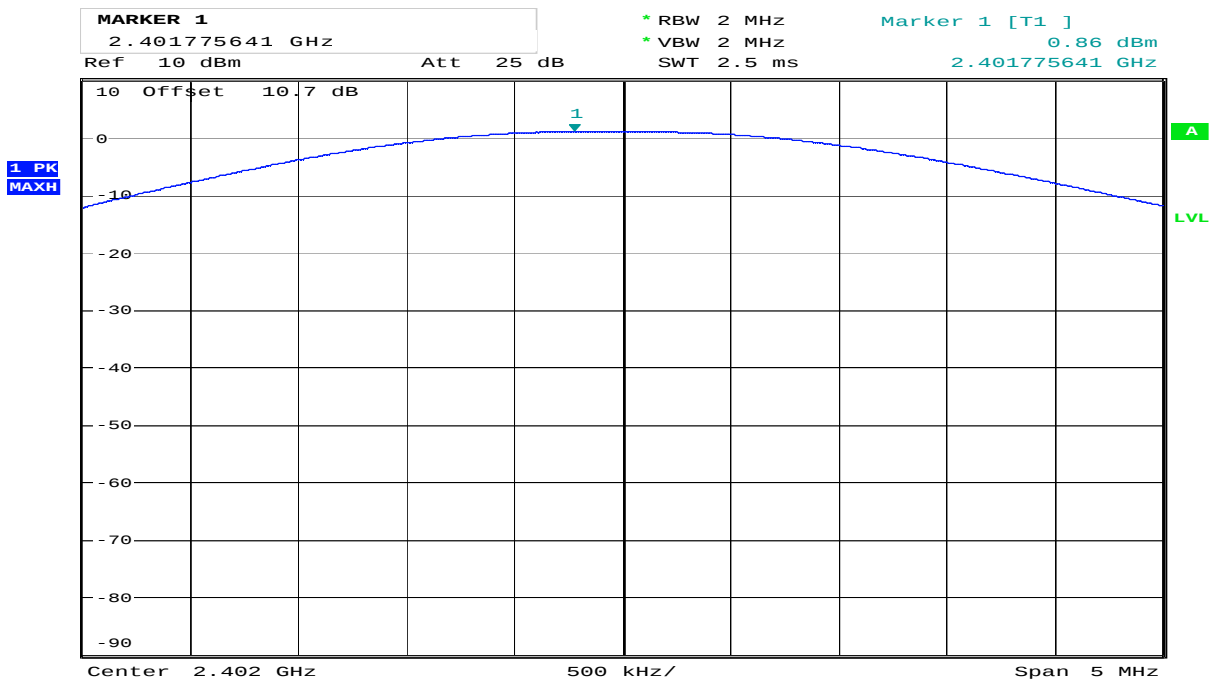
Requirements:

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

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

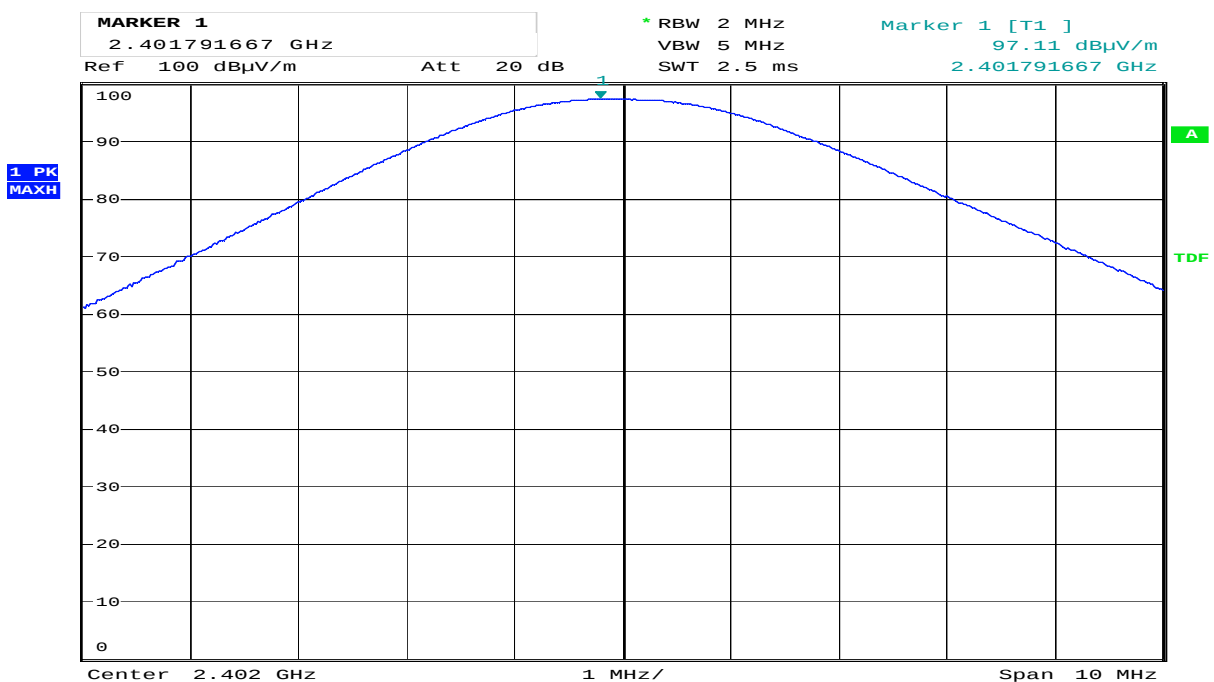
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

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



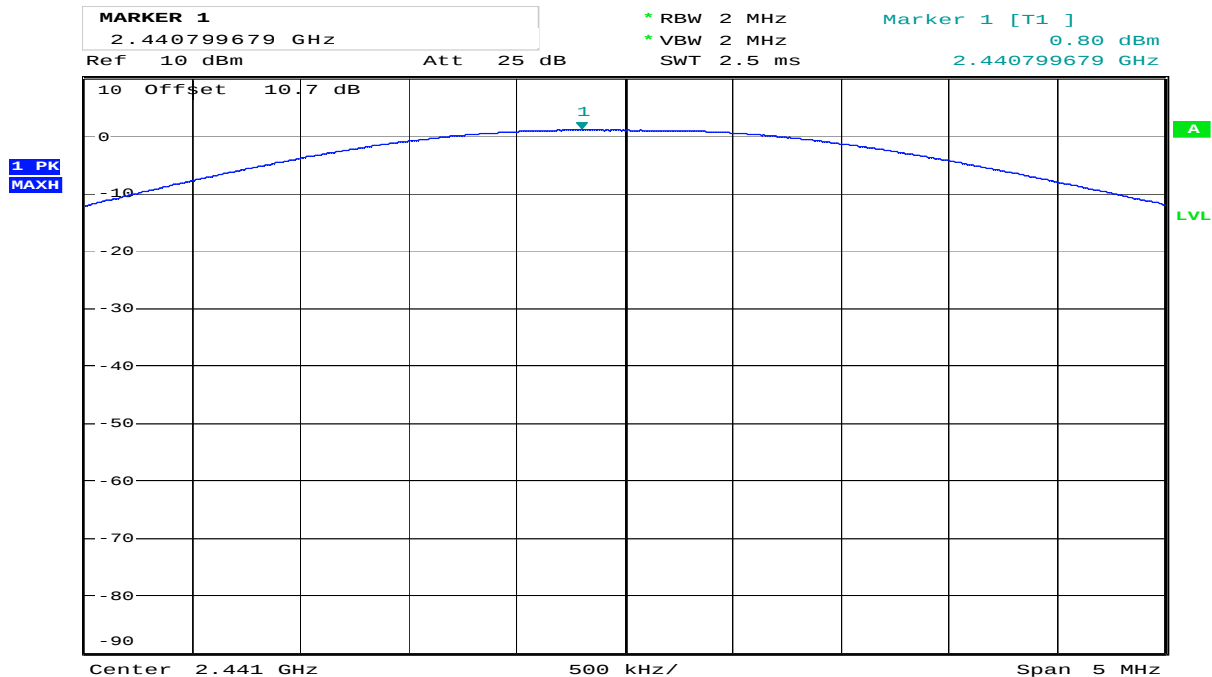
Date: 18. JAN. 2010 15:01:31

Conducted Output Power, 2402 MHz



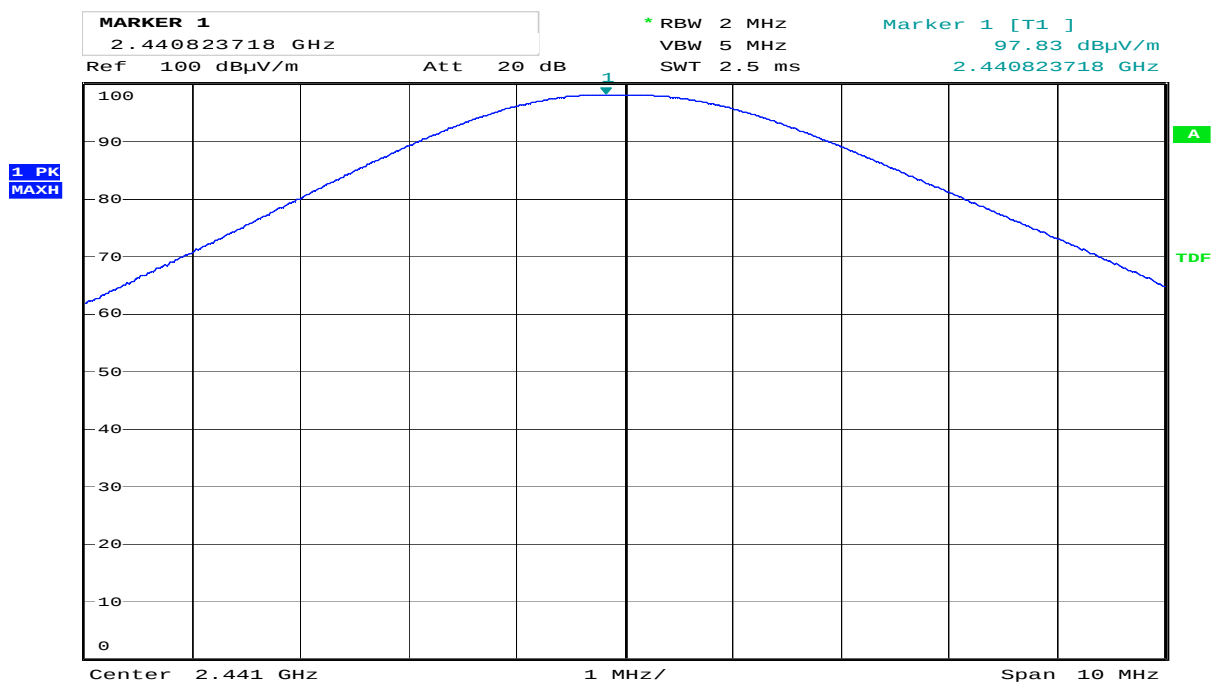
Date: 20. JAN. 2010 14:05:50

Radiated Output Power, 2402 MHz



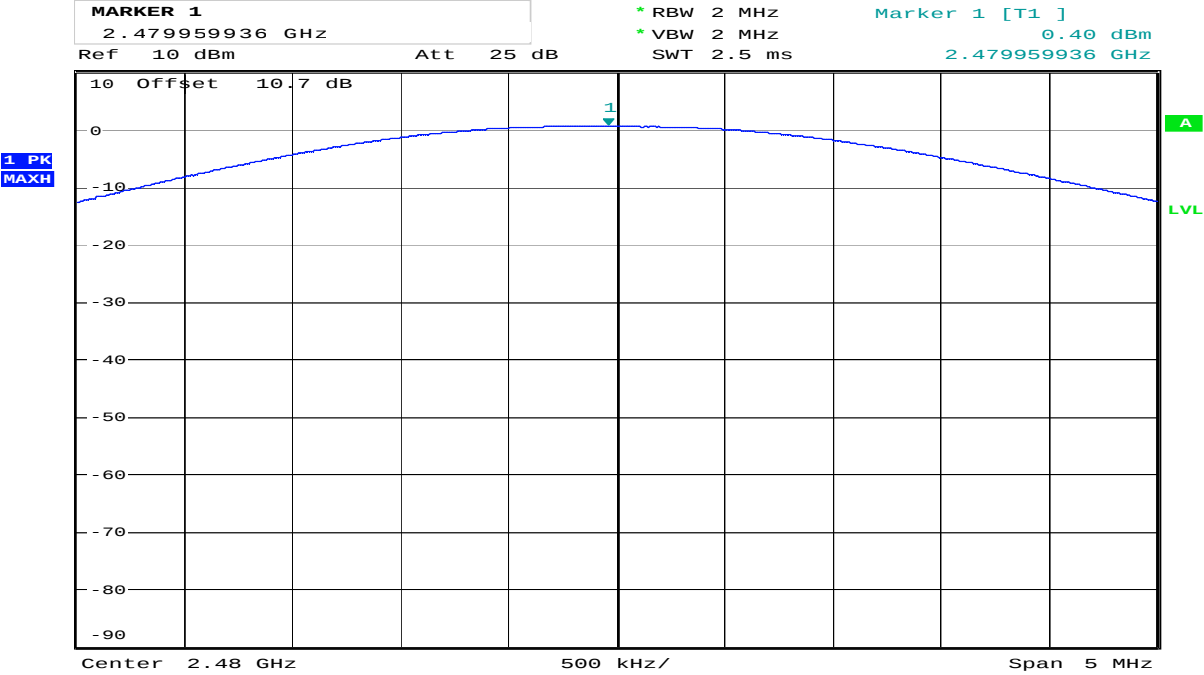
Date: 18. JAN. 2010 15:00:31

Conducted Output Power, 2441 MHz



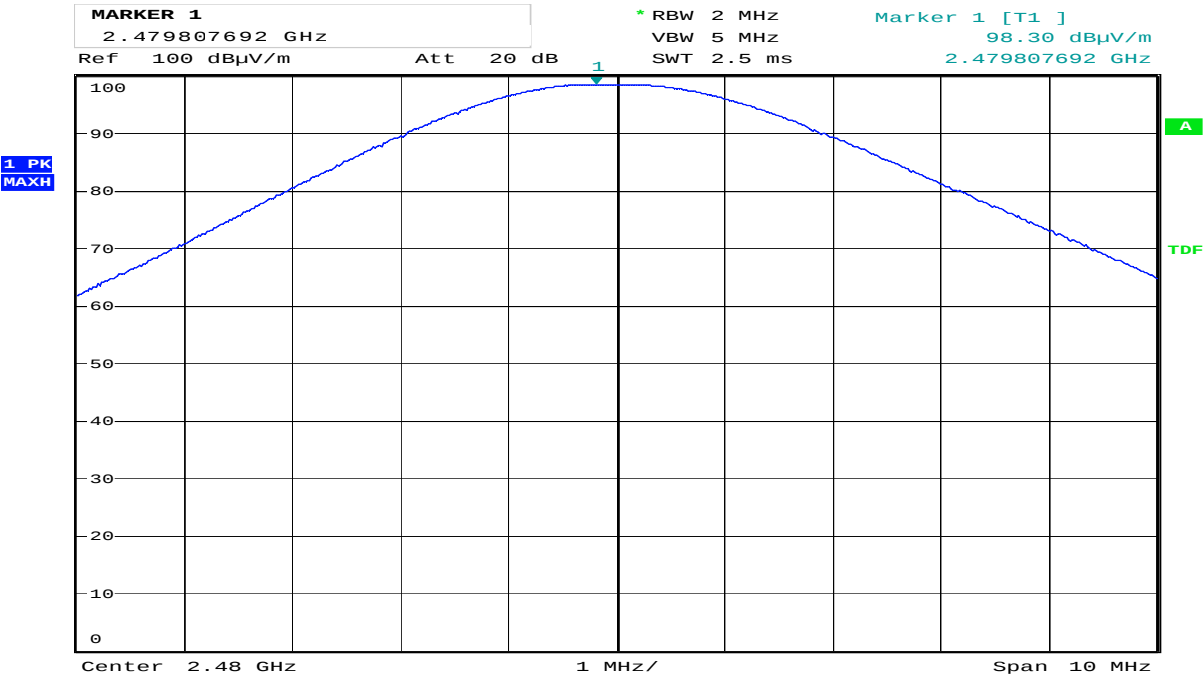
Date: 20. JAN. 2010 14:02:29

Radiated Output Power, 2441 MHz



Date: 18. JAN. 2010 14:59:35

Conducted Output Power, 2480 MHz



Date: 20. JAN. 2010 14:20:11

Radiated Output Power, 2480 MHz

4.7 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Frode Sveinsen	Date of Test: 21-28 January 2010
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Test Results: Complies

Measurement Data:

Radiated Emissions, 1-25 GHz, Peak

Measuring distance 3m.

A pre-scan was performed and no spurious emissions except the second harmonic were found.

Measured with Peak Detector

Frequency	RF channel	Dist. corr. factor	Field strength, Peak Detector, 3m	Duty cycle corr. factor	Limit	Margin
GHz	L,M,H	dB	dB μ V/m	dB	dB μ V/m	dB
4.804	L	0	58.9	20	74	15.1
4.882	M	0	58.6	20	74	15.4
4.960	H	0	58.3	20	74	15.7
Other freqs	L,M,H	0	None detected	20	74	>20

See attached graphs

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

Conducted Band-edge Power.

Frequency	Power below nearest channel, dBc		Limit	Margin
GHz	RF ch 0/78	Frequency hopping	dB	dB
2.39	-53.5	-53.0	-20	23.0
2.4835	-40.8	-41.8	-20	20.8

See attached graph

Calculated Radiated Band-edge Field Strength, Peak Detector

Frequency	RF Power	Calculated Field Strength, dB μ V/m		Limit	Margin
GHz	dB μ V/m	RF ch 0/78 and Frequency hopping		dB μ V/m	dB
2.39	97.1	43.6	44.1	74	29.9
2.4835	98.3	57.5	55.3	74	16.5

Duty Cycle Correction Factor Calculation:

See also Para 4.4 Occupancy Time.

RF duty cycle: Calculation according to RF burst Para 15.35 (c)

DH5 slots: 5 slots TX and 1 slot RX -> $5 \times 0.625\text{ms}$ per frame -> frame length is $6 \times 0.625\text{ms} = 3.75\text{ms}$

Minimum number of hopping carriers: 20 -> The frame is repeated on the same channel every 74.5ms.

DC Correction factor = $-20 \times \log((5 \times 0.625\text{ms}) / 74.5\text{ms}) = 27.5\text{ dB}$

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

This value is used to calculating the Peak Limit for radiated emissions above 1 GHz. The Peak Limit is the Average Limit (54 dB μ V/m) plus the Duty Cycle Correction Factor, i.e. the Peak Limit is 74 dB μ V/m when the DC Correction Factor is 20 dB.

Radiated emission 30 – 1000 MHz.

Measuring distance 3 m, measured with Peak Detector.

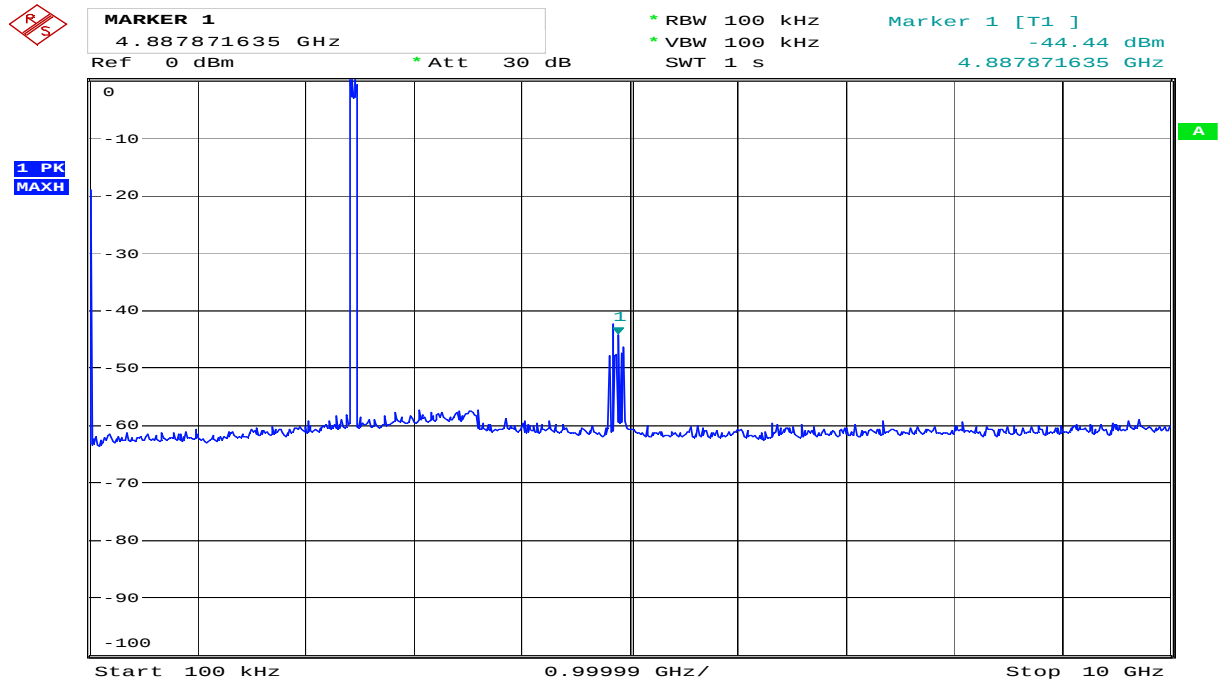
No component detected, see attached graphs.

Radiated emission 10 kHz-30 MHz.

Measuring distance 10m, measured with Peak detector.

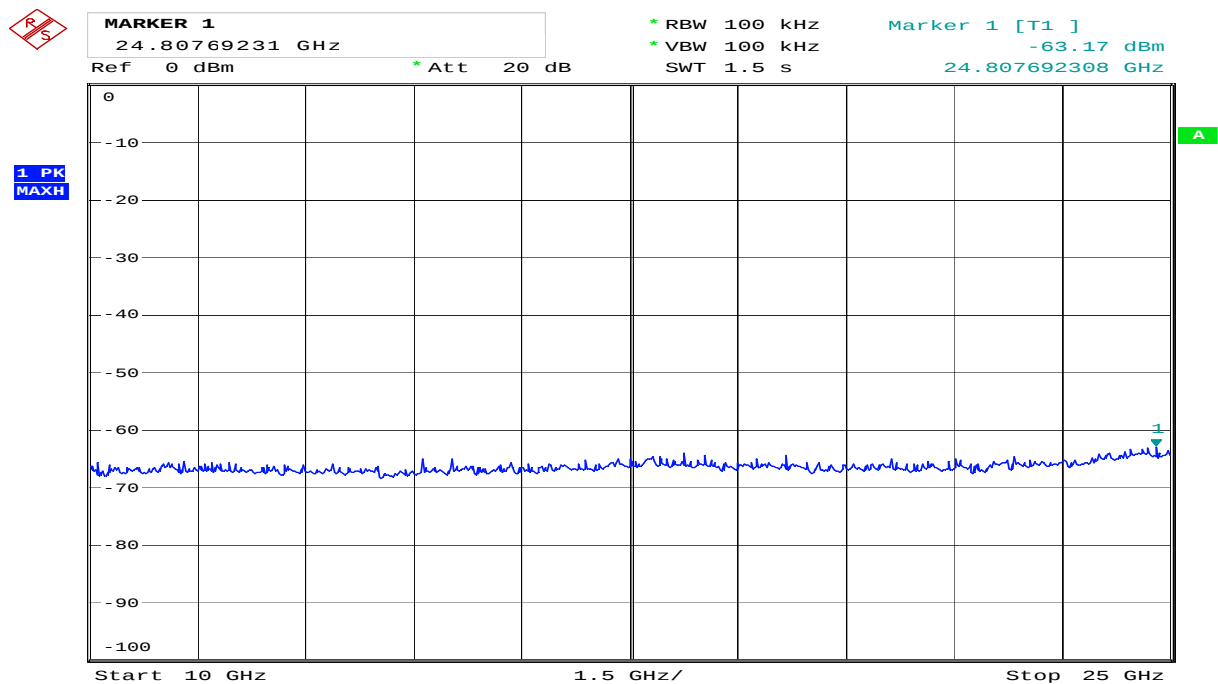
No component detected, see attached graphs.

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



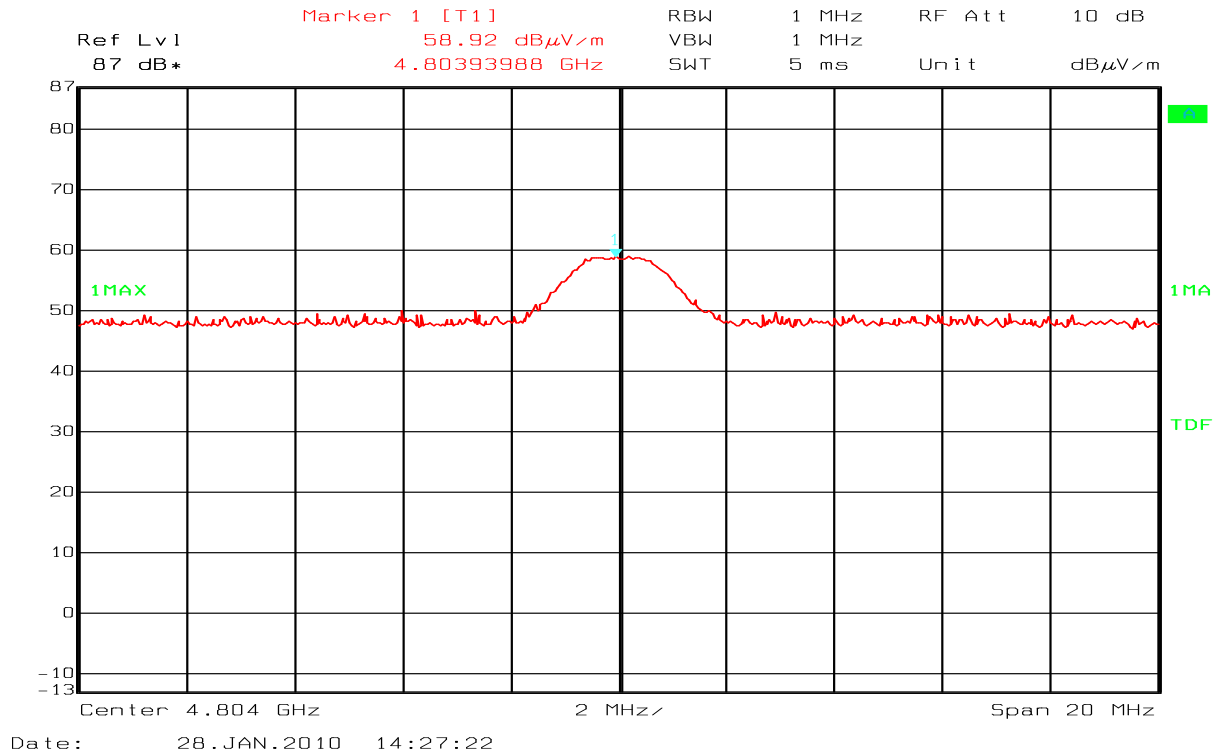
Date: 19.FEB.2010 15:51:10

Conducted Emissions, 100 kHz – 10 GHz

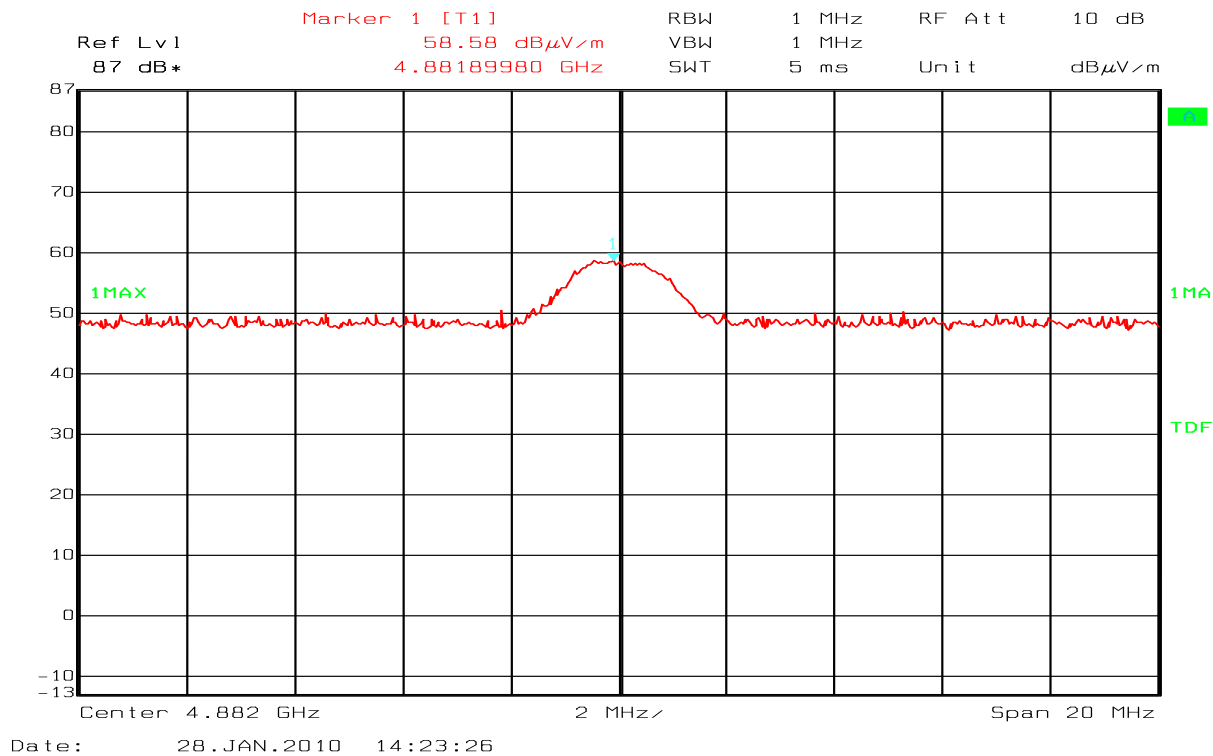


Date: 19.FEB.2010 15:53:35

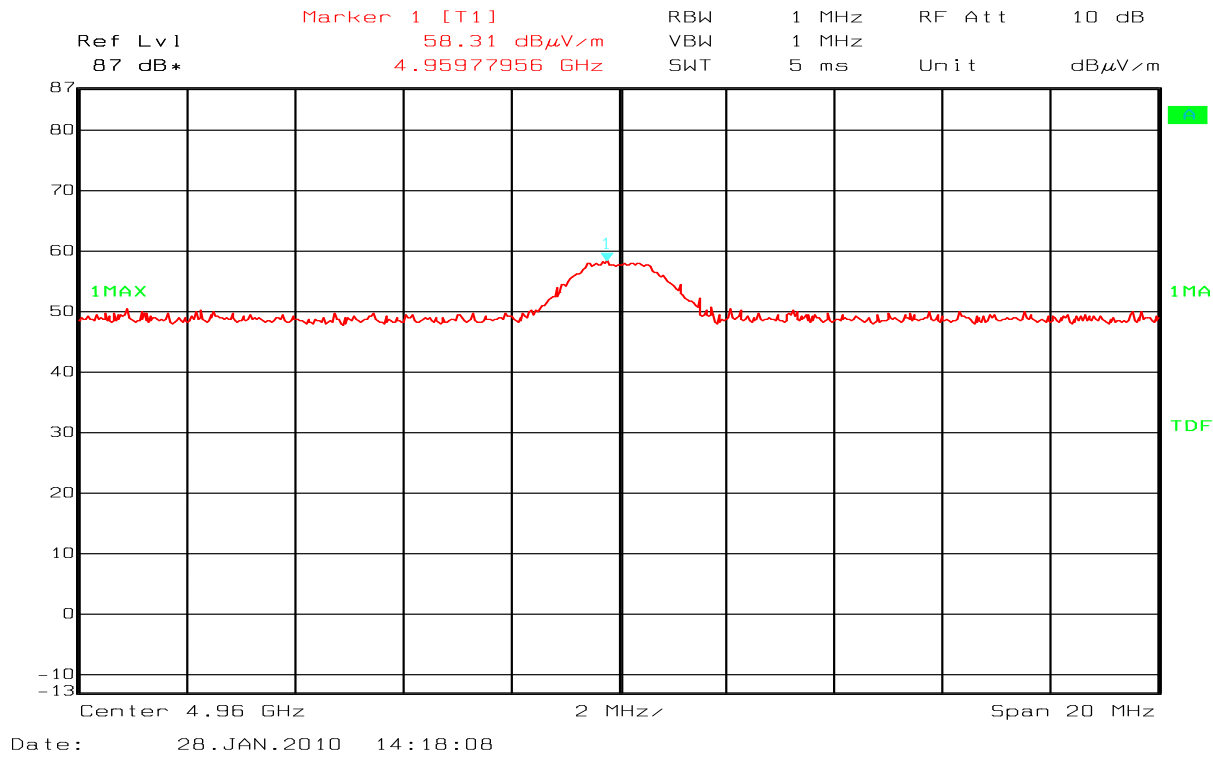
Conducted Emissions, 10 - 25 GHz



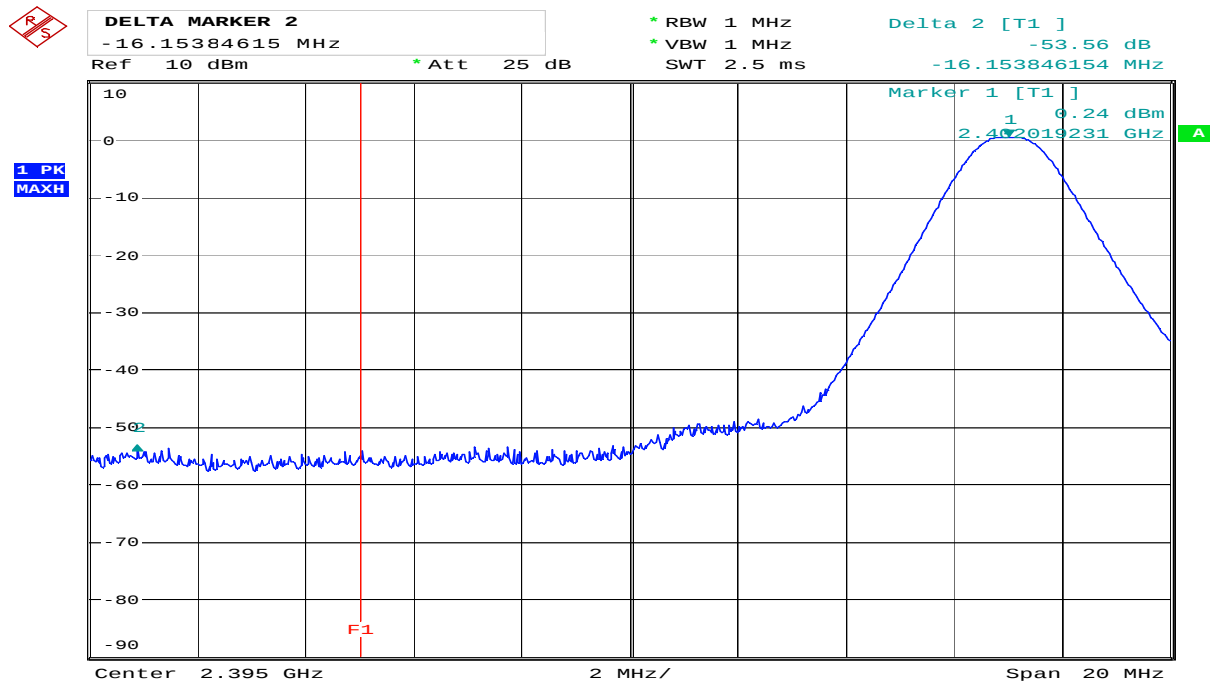
Radiated emissions, 2nd harmonic, ch00



Radiated emissions, 2nd harmonic, ch39

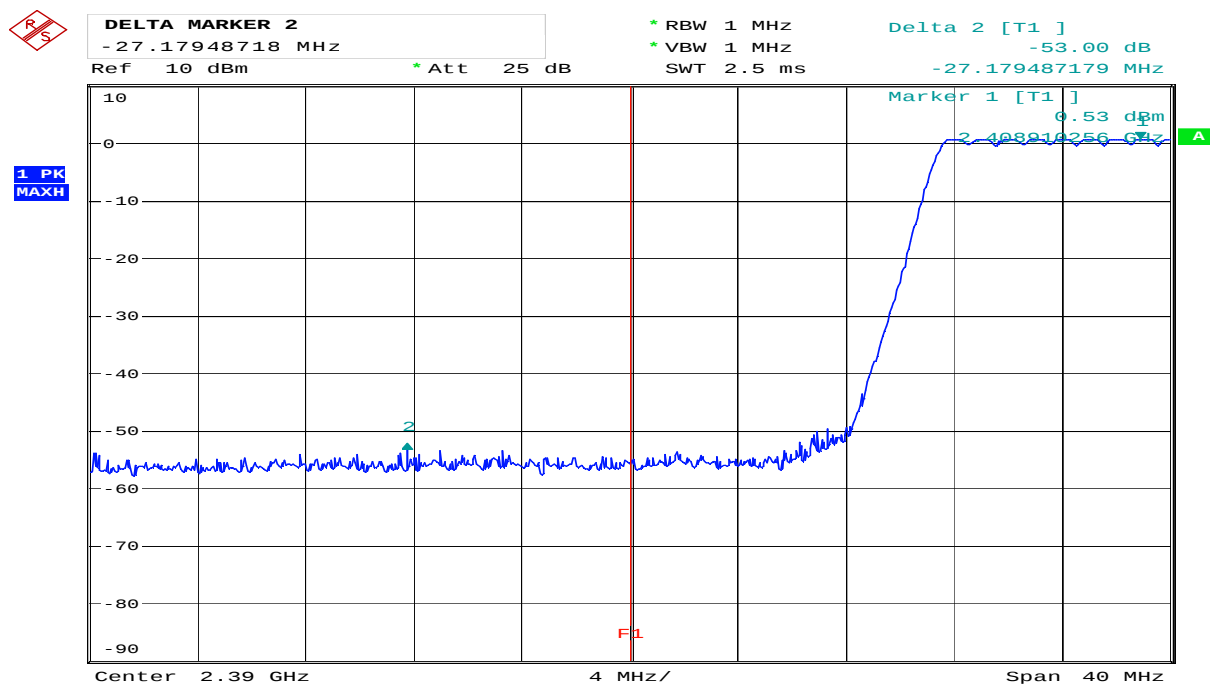


Radiated emissions, 2nd harmonic, ch78



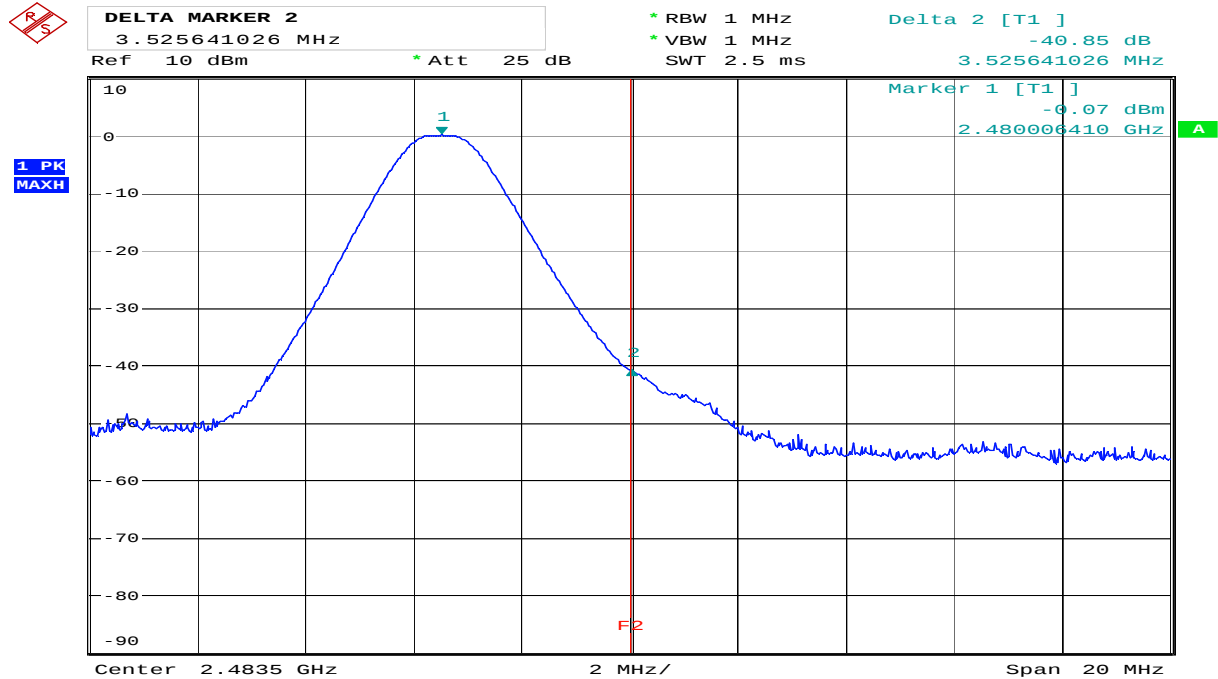
Date: 17.FEB.2010 15:00:18

Band Edge, Lower, Conducted, Hopping OFF



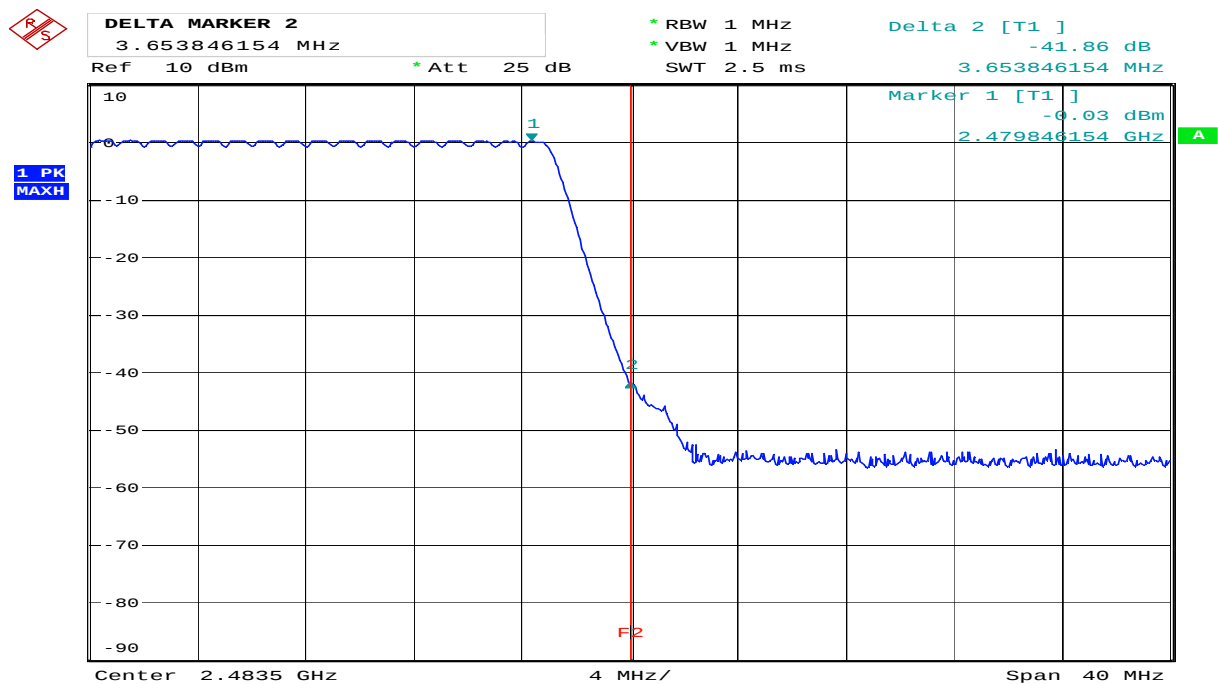
Date: 17.FEB.2010 15:03:36

Band Edge, Lower, Conducted, Hopping ON



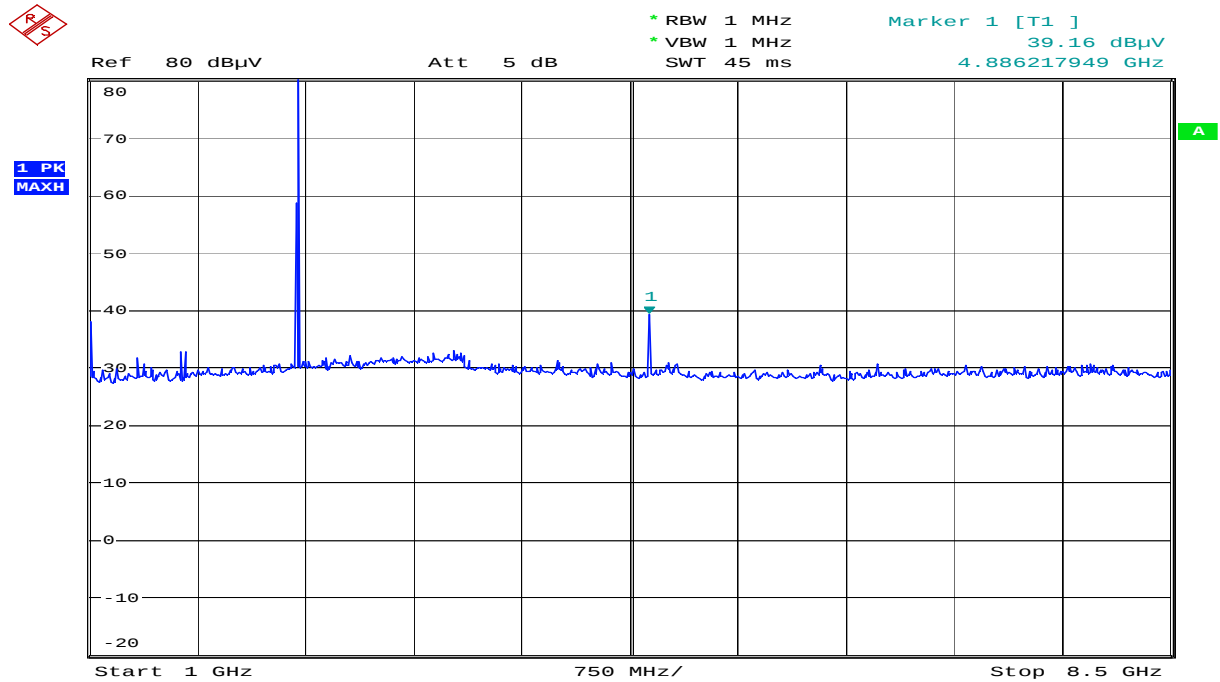
Date: 17.FEB.2010 15:08:20

Band Edge, Upper, Conducted, Hopping OFF



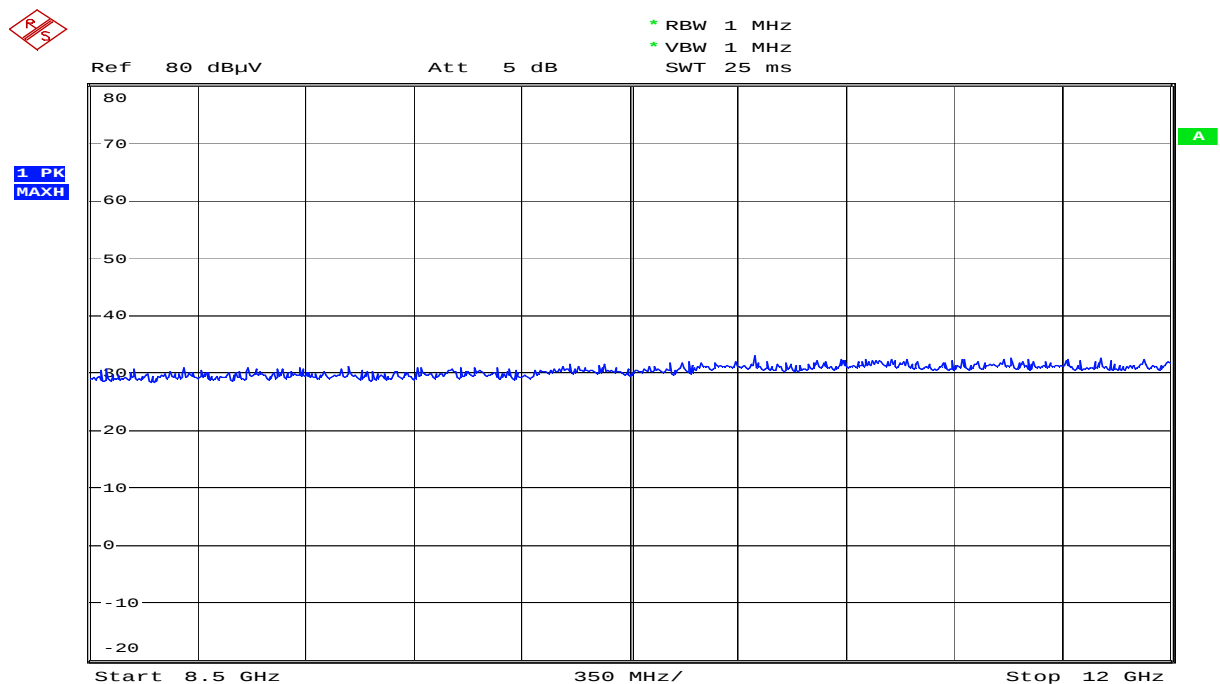
Date: 17.FEB.2010 15:06:39

Band Edge, Upper, Conducted, Hopping ON



Date: 21. JAN. 2010 14:07:55

Spurious emissions, pre-scan 1 – 8.5 GHz

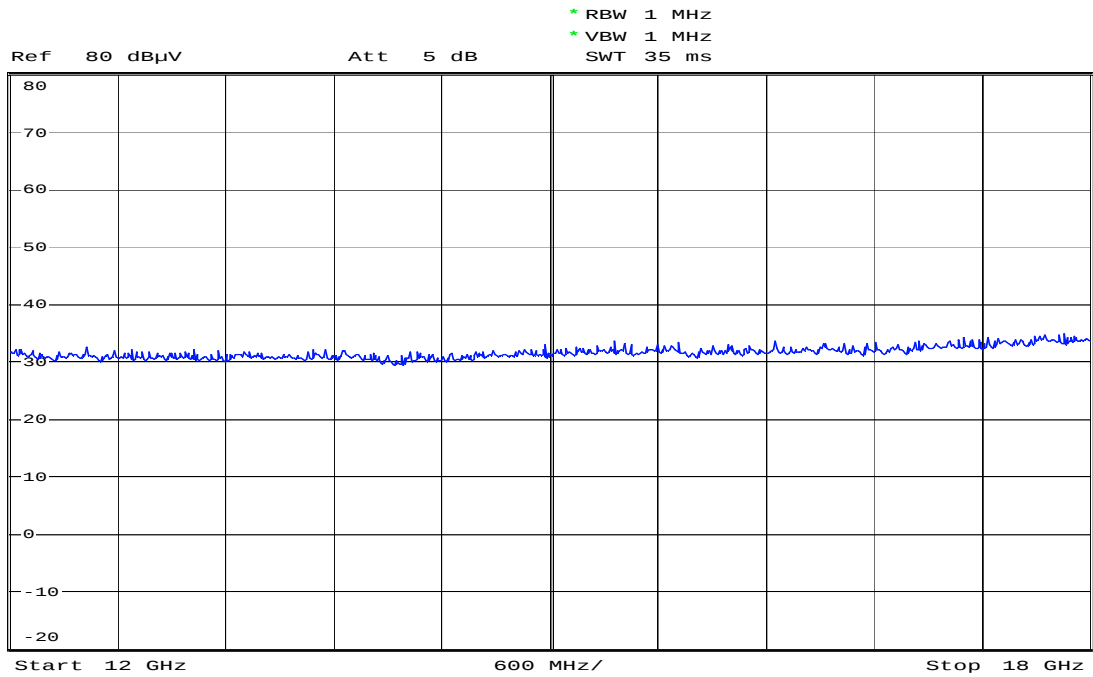


Date: 21. JAN. 2010 14:00:54

Spurious emissions, pre-scan 8.5 – 12 GHz



**1 PK
MAXH**

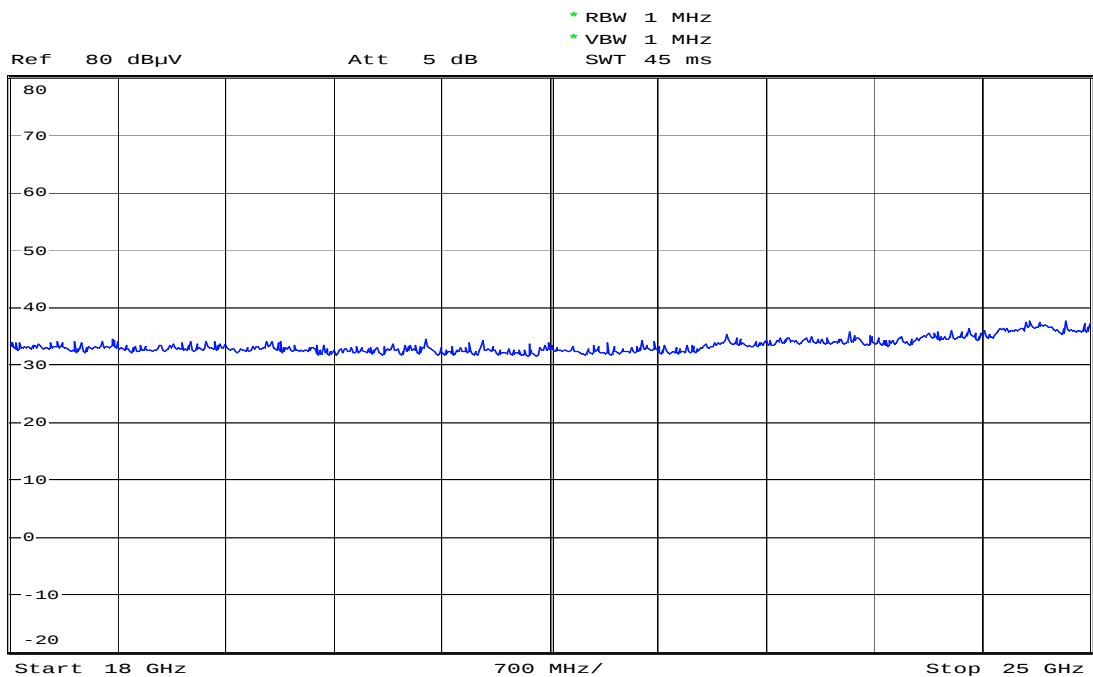


Date: 21. JAN. 2010 14:02:45

Spurious emissions, pre-scan 12 – 18 GHz



**1 PK
MAXH**



Date: 21. JAN. 2010 14:04:26

Spurious emissions, pre-scan 18 – 25 GHz

Nemko AS
Peak

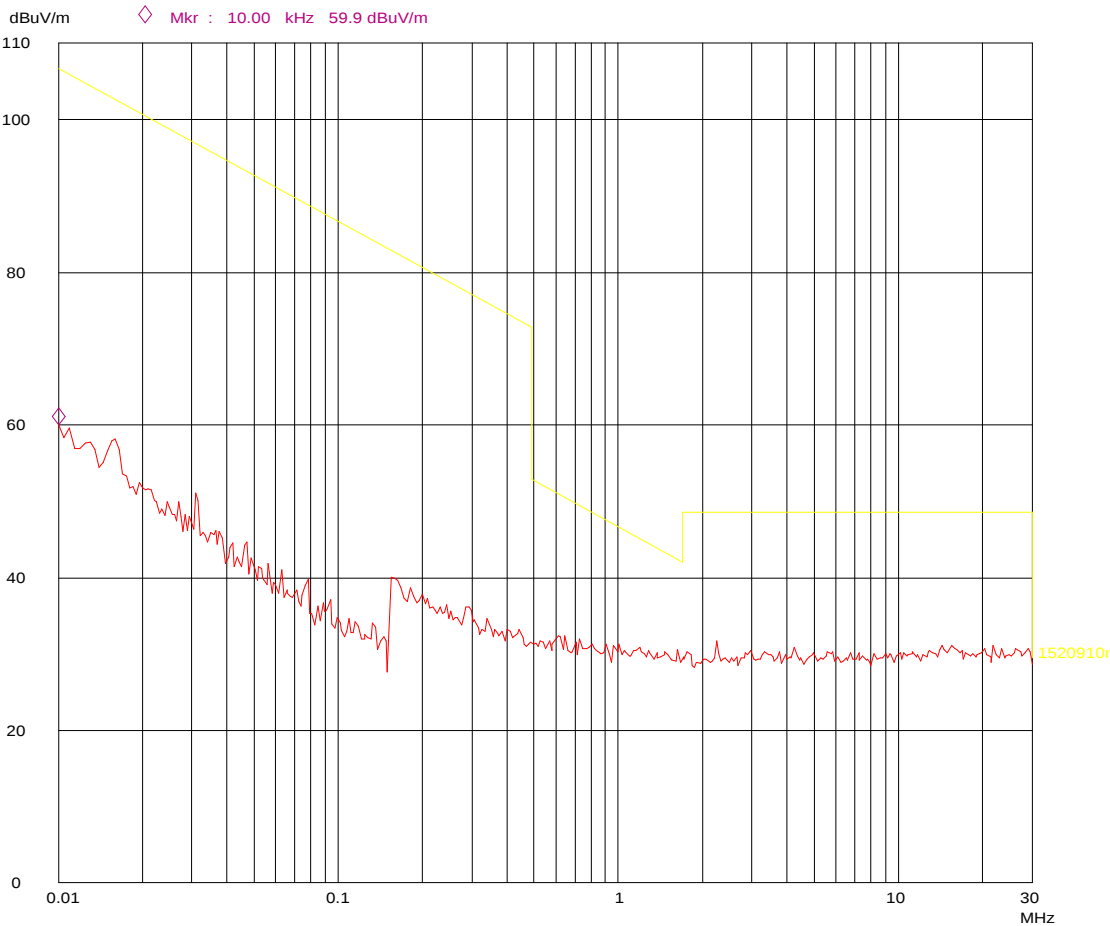
27. Jan 10 14:27

Operator: FS
Comment: Panasonic KX-TG6881BT
Peak Scan
d=10m

Scan Settings (2 Ranges)

Frequencies				Receiver Settings			
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp OpRge
10k	150k	500Hz	1k	PK	50ms	AUTO LN ON	60dB
150k	30M	4.5k	9k	PK	50ms	AUTO LN OFF	60dB

Transducer No.	Start	Stop	Name
3	9k	30M	HFH2Z2uV



100 kHz - 30 MHz

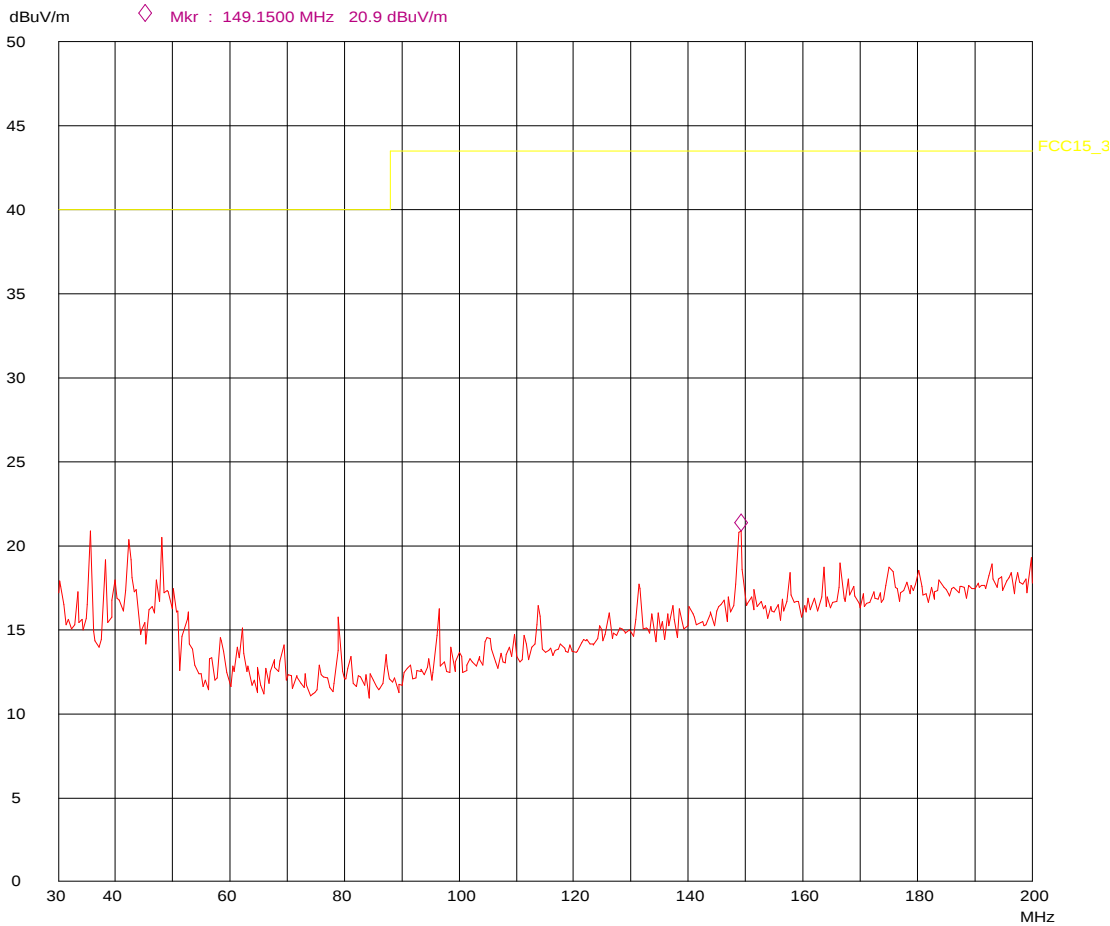
Nemko AS
Peak

27. Jan 10 12:55

Operator: FS
Comment: Panasonic KX-TG6881BT
VP
d=3m, h=1m
peak scan

Scan Settings (1 Range)
----- Frequencies -----|----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 200M 50k 120k PK 50ms AUTO LN ON 60dB

Transducer No. Start Stop Name
11 30M 200M HK116



VP, 30 - 200MHz

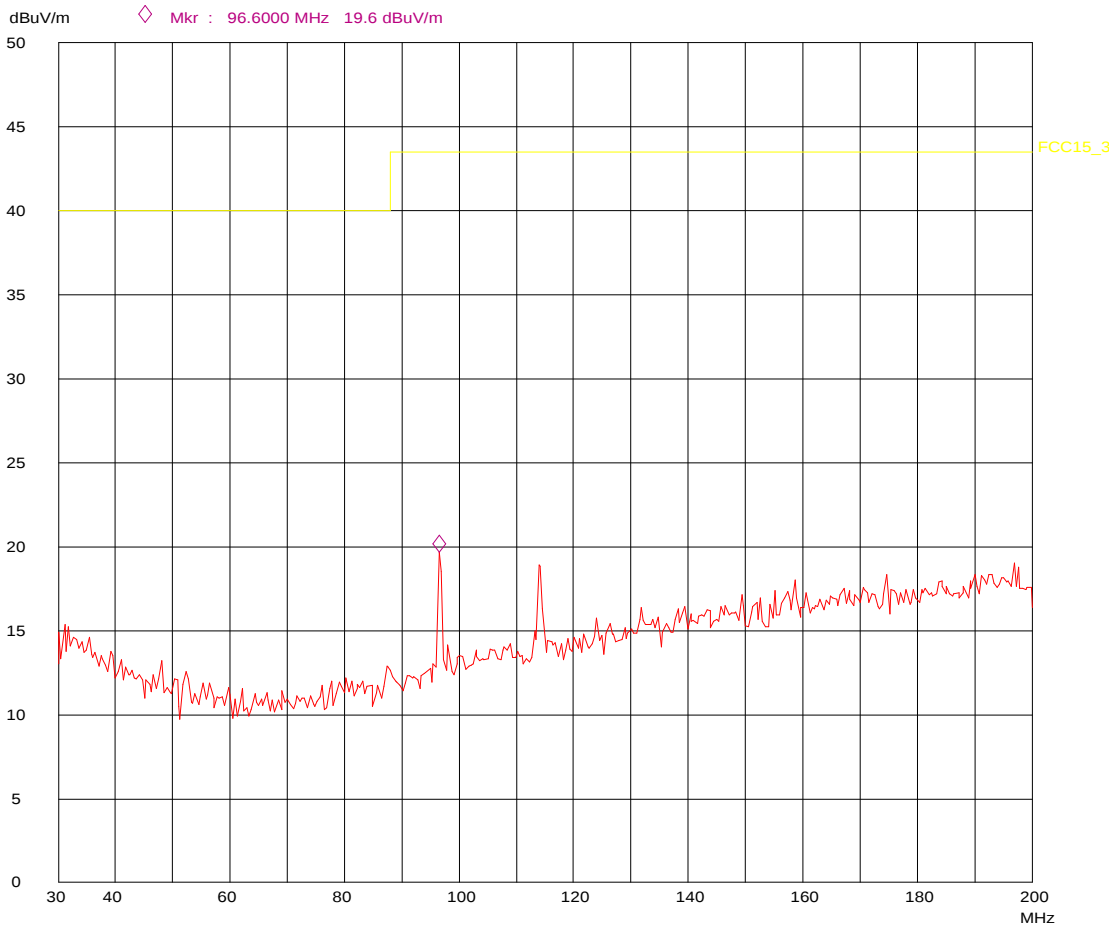
Nemko AS
Peak

27. Jan 10 13:09

Operator: FS
Comment: Panasonic KX-TG6881BT
HP
d=3m, h=2m
peak scan

Scan Settings (1 Range)					Receiver Settings				
Frequencies									
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
30M	200M	50k	120k	PK	50ms	AUTO	LN ON	60dB	

Transducer No.	Start	Stop	Name
11	30M	200M	HK116



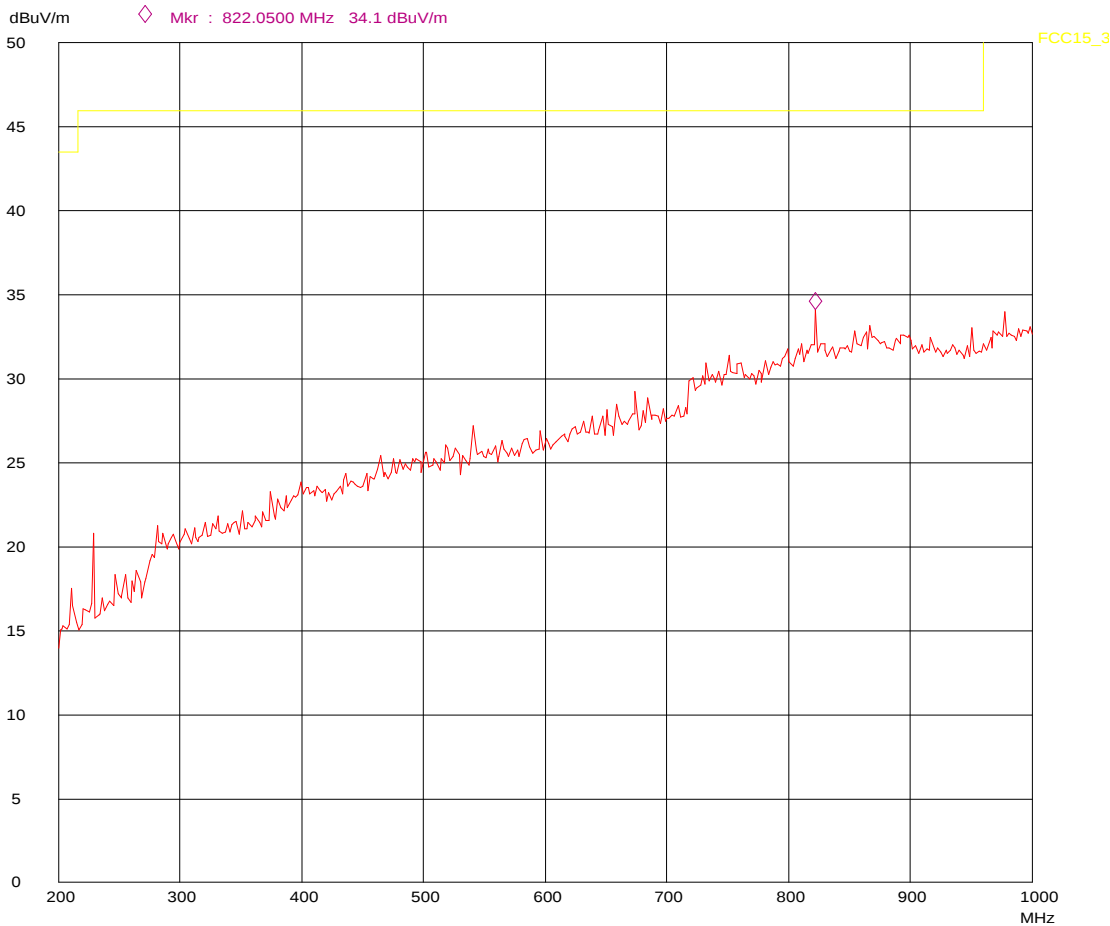
HP, 30 - 200MHz

Nemko AS
Peak

27. Jan 10 13:31

Operator: FS
Comment: Panasonic KX-TG6881BT
VP
d=3m, h=1m
peak scan

Scan Settings (1 Range)									
Frequencies					Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB	
Transducer No. Start Stop Name									
20	200M	1000M	HL223						



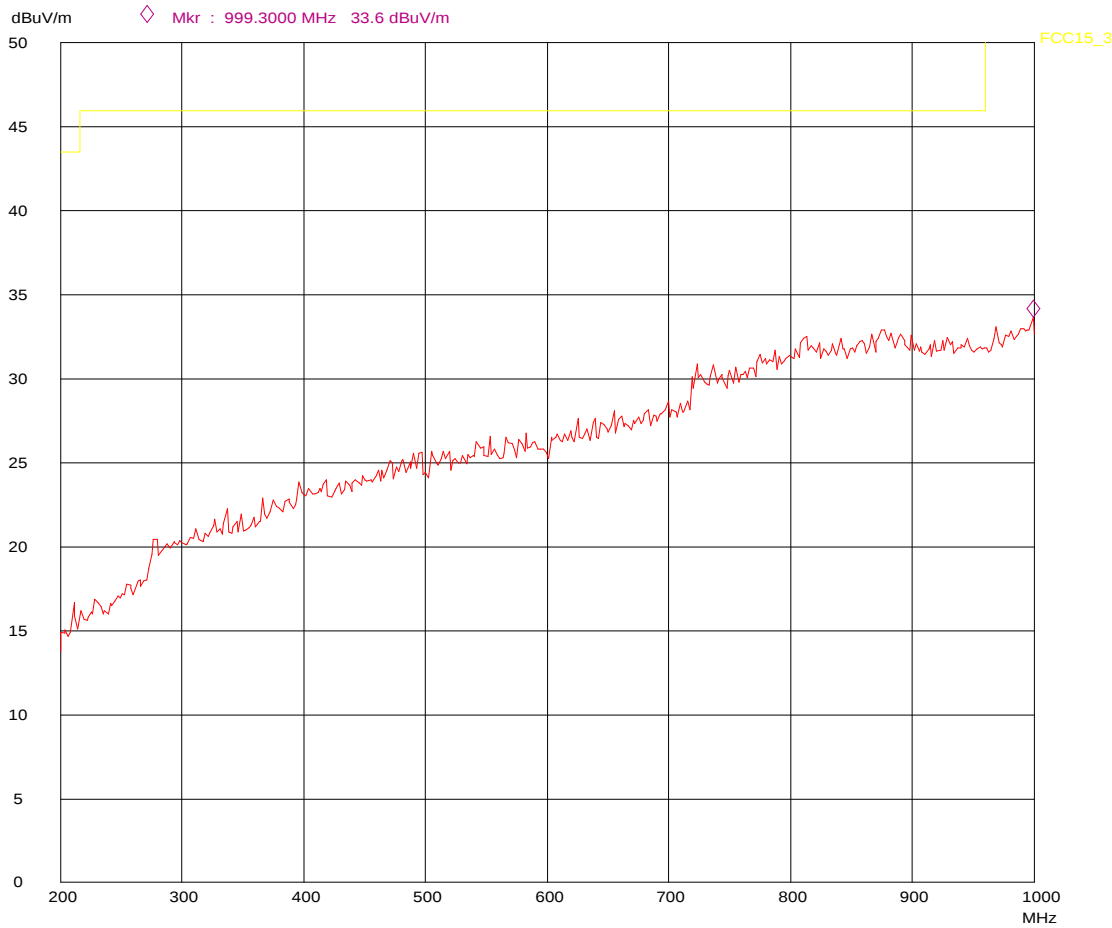
VP, 200 - 1000MHz

Nemko AS
Peak

27. Jan 10 13:50

Operator: FS
Comment: Panasonic KX-TG6881BT
HP
d=3m, h=2m
peak scan

Scan Settings (1 Range)									
Frequencies					Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB	
Transducer No. Start Stop Name									
20	200M	1000M							HL223



HP, 200 - 1000MHz

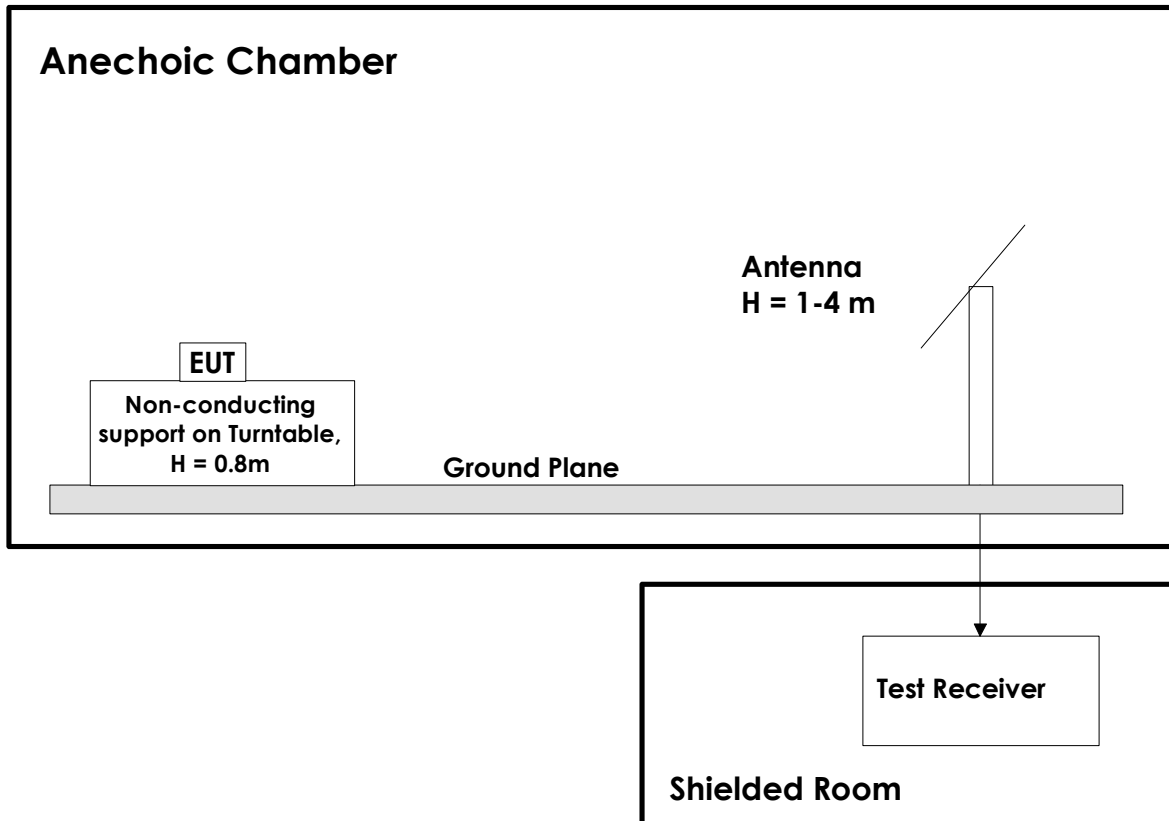
5 LIST OF TEST EQUIPMENT

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	Description	Manufactur	Type
1410	Shielded room	ETS	Semi-anechoic
1504	Spektrum Analyzer	R&S	FSU26
1337	Spectrum Analyzer	R&S	FSEK30
1330	Antenna Horn	EMCO	3115
1332	Antenna Dipole	R&S	HZ-12 633,0886,00
1260	Antenna, biconical	R&S	HK 116
1261	Antenna Log-periodic	R&S	HL 223
1020	Multimeter, Digital	Fluke	87
1143	Attenuator	Suhner	6810.17.A
1237	EMI-Receiver	R&S	ESN
1322	Amplifier RF	HP	8449B
285	Antenna, loop	R&S	HFH2-Z2
1515	AC power source/Analyzer	Agilent	6812B
93	Antenna Horn	Narda	643
100	Antenna Horn	Systron	DBF-520-20
103	Antenna Horn	Sivers	PM 7320X

6 Block Diagrams

6.1 Test Site Radiated Emission



6.2 Power Line Conducted Emission

