



Test report no. : 140534-7

Item tested : DH5BL Bluetooth Module

Type of equipment : Bluetooth Module in DECT Handset

FCC ID : BXZDH5BL

Client : Ascom Sweden AB

Parts of FCC Part 15.247

Frequency Hopping Transmitters /
Digital Transmission System

3 June 2010

Authorized by :

A handwritten signature in blue ink that reads 'Egil Hauger'.

Egil Hauger
Technical Verificator

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1 GENERAL INFORMATION

1.1 Testhouse Info

Name : Nemko AS
Address : Nemko Kjeller
Instituttveien 6
NO-2007 Kjeller, NORWAY
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
E-mail: comlab@nemko.com
FCC test firm reg.no. : 994405
Total no. of Pages: 25

1.2 Client Information

Name : Ascom Sweden AB
Address : P.O.Box 8783,
SE-040276 Gøteborg, Sweden

Contact:

Name : Lena Kindmark
E-mail : Lena.Kindmark@ascom.se

1.3 Responsible Manufacturer (if other than client)

Name : /
Address : /

2 Test Information

2.1 Tested Item

Name :	Ascom
Model/version :	DH5BL
FCC ID :	BXZDH5BL
Serial number :	10084514
Hardware identity and/or version:	2.0.5
Software identity and/or version :	B2
Frequency Range :	2402 - 2480 MHz
Number of Channels :	79
Type of Modulation :	FHSS
Channel Spacing :	1MHz
User Frequency Adjustment :	None
Peak Output Power :	2 mW
Power Adaptor :	Battery operated 3.7 V DC
Antenna Connector :	Integral
Antenna Diversity Supported :	None
Desktop Charger :	Yes, Ascom DC-3

Description of Tested Device(s)

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

The tested equipment has integral antennas only.

Theory of Operation

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

Exposure Evaluation

The EUT is a portable device and is designed to be held to ear or worn in a belt clip when used. A test reports with the measured SAR values for both configurations are submitted with the application. The SAR values are also included in the user manual.

The SAR test only include the exposure from the UPCS transmitter, the contribution from the BT transmitter is considered to be zero because of the low output power.

2.2 Test Environment

2.2.1 Normal test condition

Temperature: 20 - 24 °C

Relative humidity: 20 - 50 %

Normal test voltage: 3.7 V DC

The values are the limit registered during the test period.

2.3 Test Period

Item received date: 2010-01-13

Test period : from 2010-01-13 to 2010-01-27

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Ascom

Model No.: DH5BT

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.

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 #: 140534-7

TESTED BY: Frøde Sveinsen
Frøde Sveinsen, Chief Engineer

DATE: 17 March 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 ¹
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2.2 (RSS-GEN)	N/A
Channel Separation	15.247(a)(1)	A8.1	NT
Pseudorandom Hopping Algorithm	15.247(a)(1)	A8.1	NT
Time of Occupancy	15.247(a)(1)(iii)	A8.1	NT
Occupied Bandwidth	15.247(a)(1)	A8.1	NT
Minimum 20 dB Bandwidth	15.247(a)(2)	A8.2	NT
Peak Power Output	15.247(b)	A8.4	Complies
Power Spectral Density	15.247(d)	A8.2	N/A
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.

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

This test report covers only the Bluetooth Transceiver of the EUT, the UPCS part is covered by Nemko test report no. 140534-8.

The measurements were done with the fully charged batteries.

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 Radiated Power Output

Para. No.: 15.247 (b)

Test Performed By: Frode Sveinsen

Date of Test: 15 January 2010

Test Results: Complies

Measurement Data:

Maximum field strength

RF channel	2402MHz	2442MHz	2480MHz
Measured value (dBμV/m)	97.8	98.9	98.2
Calculated Output Power (Watts)	0.0018	0.0023	0.0020

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

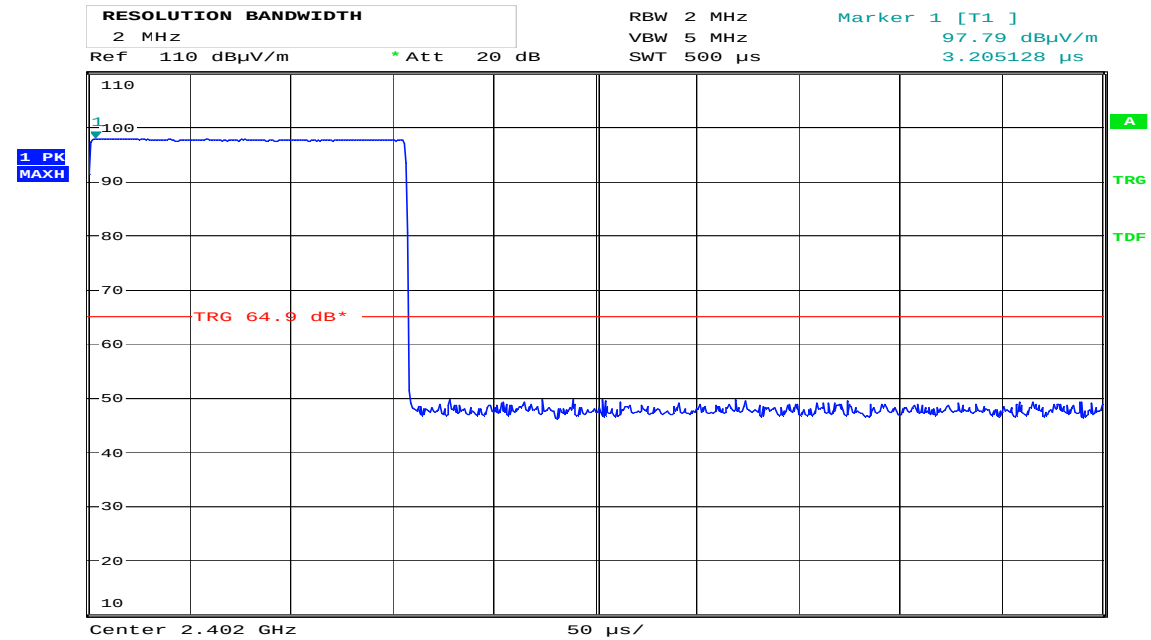
Requirements:

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

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

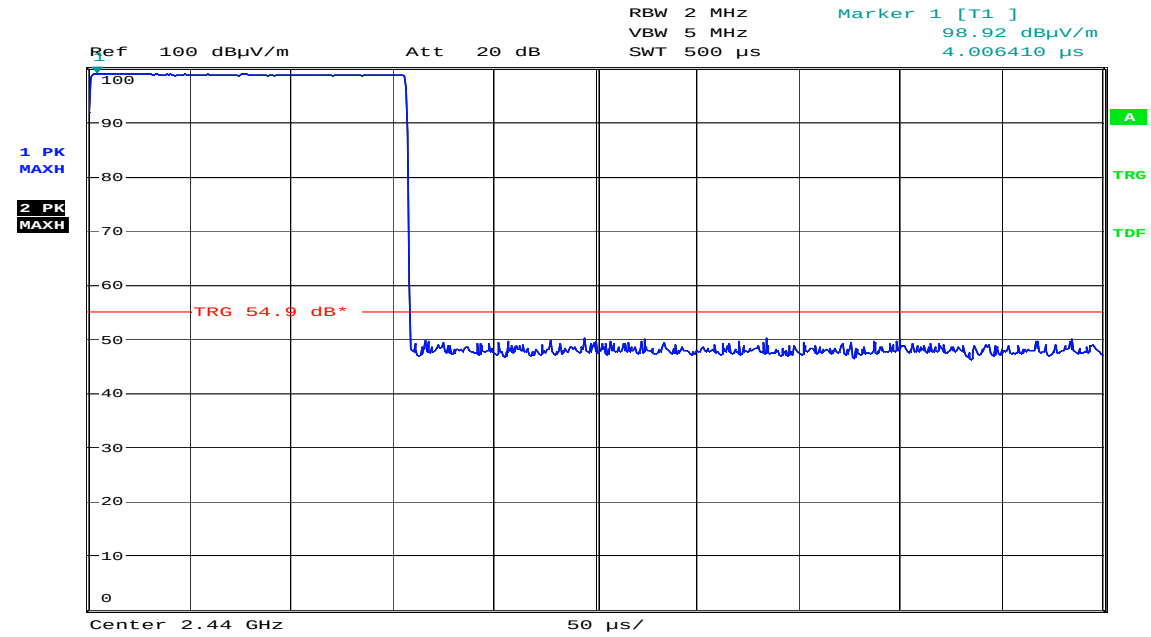
For all other frequency hopping systems in the 2400 - 2483.5 MHz band: 0.125 Watts

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.



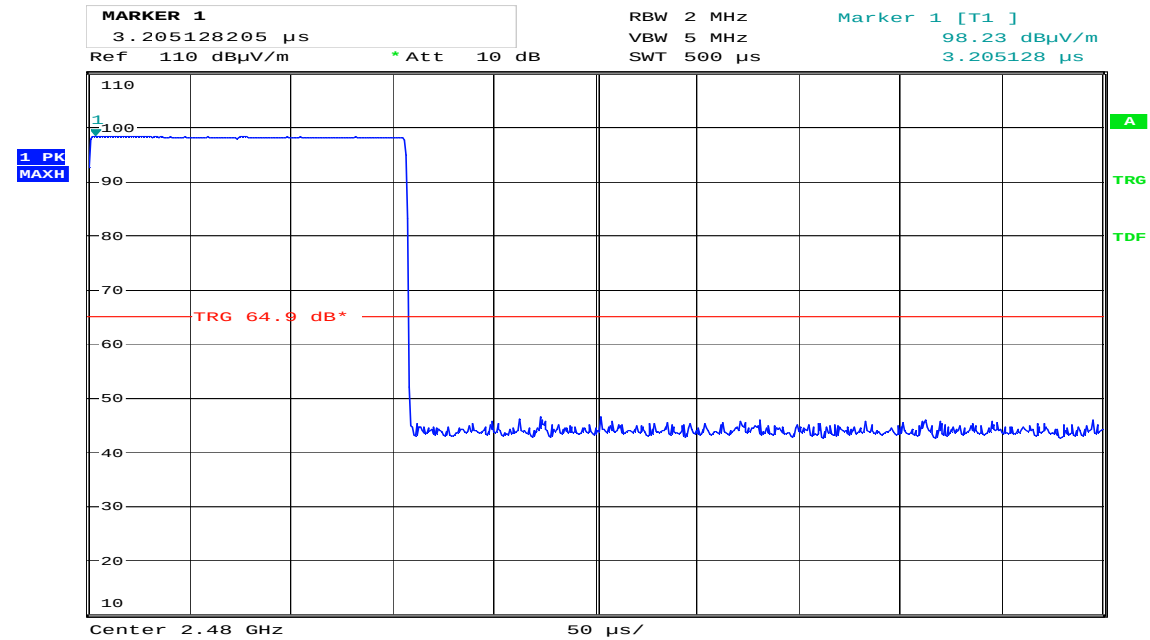
Date: 15. JAN. 2010 15:45:11

Field strength – Lower Frequency, 2.402GHz



Date: 15. JAN. 2010 13:44:49

Field strength – Middle Frequency, 2.442GHz



Date: 15. JAN. 2010 16:01:25

Field strength – Upper Frequency, 2.48GHz

4.2 Spurious Emissions (Radiated)

Para. No.: 15.247 (c)

Test Performed By: Frode Sveinsen

Date of Test: 15/21 January 2010

Test Results: Complies

Measurement Data:

Radiated Emissions, 1-25 GHz, peak

1-18 GHz measured at a distance of 3m, 18-25 GHz measured at 1m.

The worst case spurious emission is observed in HP and in XZ plane.

Measured with Peak Detector

Frequency	RF channel	Dist. corr. factor	Transducer Factor	Field strength, Peak Detector, 3m	Peak Limit	Margin
GHz	L,M,H	dB	dB	dBμV/m	dBμV/m	dB
4.809	L	0	10.6	60.7	74	13.3
4.889	M	0	10.9	58.5	74	15.5
4.958	H	0	11.2	67.4	74	6.6
Other freq	L,M,H	0	/	None detected	74	>20

Calculated Average value from Peak Detector measurements

Frequency	RF channel	Dist. corr. factor	Transducer Factor	Field strength, Average Detector, 3m	Average Limit	Margin
GHz	L,M,H	dB	dB	dBμV/m	dBμV/m	dB
4.809	L	0	10.6	40.7	54	13.3
4.889	M	0	10.9	38.5	54	15.5
4.958	H	0	11.2	47.4	54	6.6
Other freq	L,M,H	0	/	None detected	54	>20

See attached graphs

Measurement was performed with Peak Detector, Average Detector values were calculated from the Peak values using the Duty Cycle Correction Factor. The Average Limit was calculated in the same way.

Antenna factor, preamplifier gain and cable loss are included in Spectrum Analyzer "Transducer factor".

Duty Cycle Correction Factor Calculation:

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

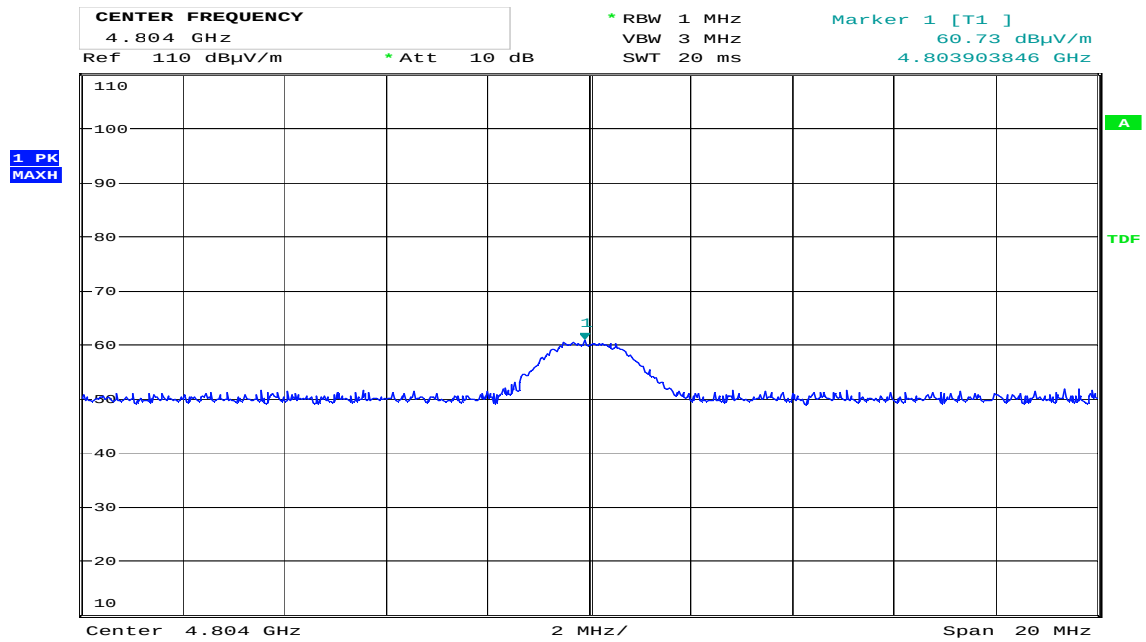
DH5 slots: 5 slots TX and 1 slot RX -> $5 \times 0.625\text{ms}$ per frame -> frame length is $6 \times 0.625\text{ms} = 3.75\text{ms}$

Minimum number of hopping carriers: 79 -> The frame is repeated on the same channel every > ms.

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

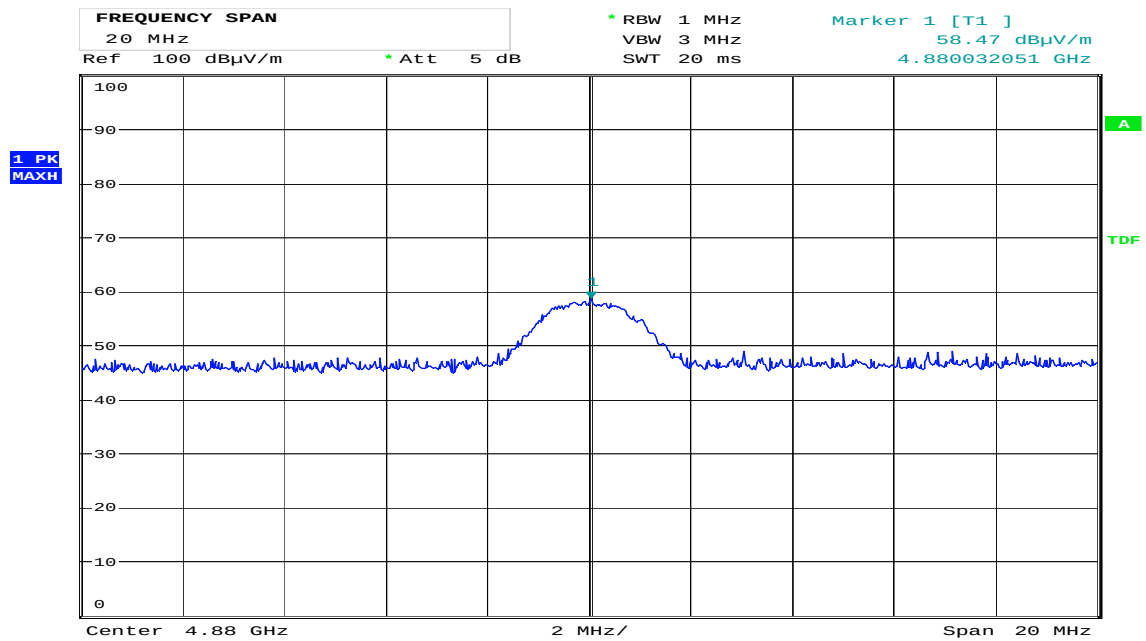
Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

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.



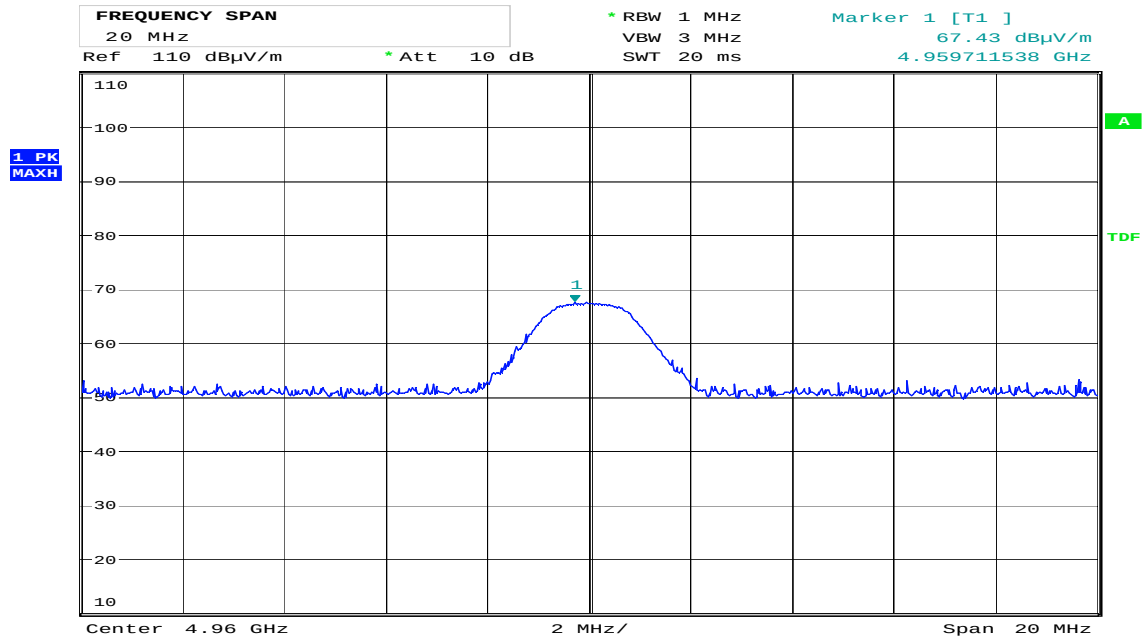
Date: 15. JAN. 2010 17:04:02

2nd harmonic, Lower Channel



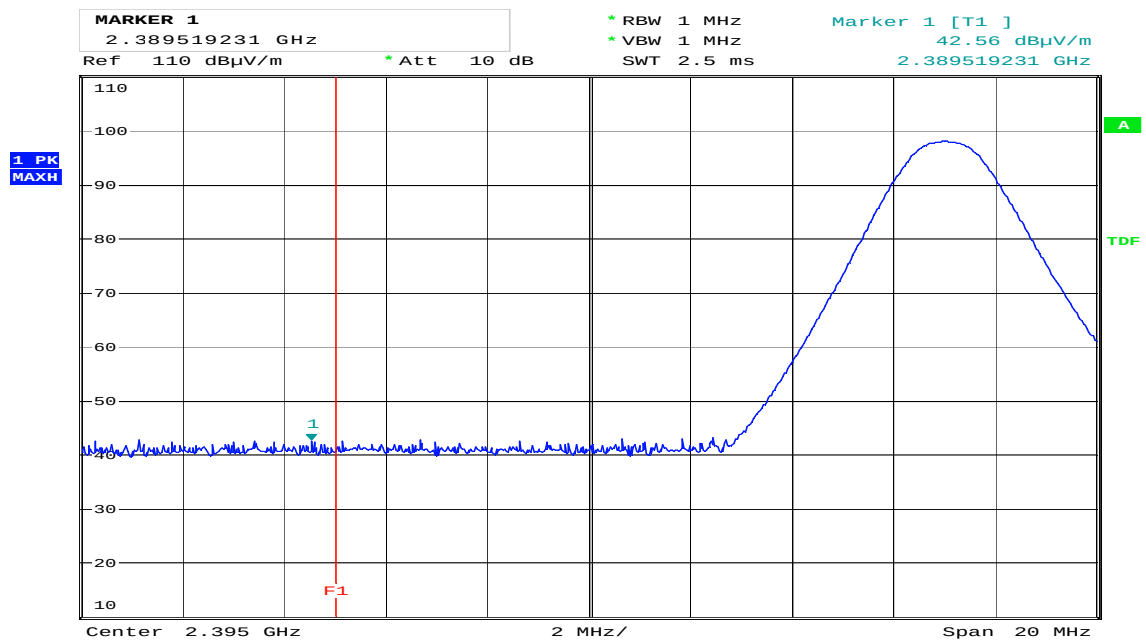
Date: 15. JAN. 2010 14:58:31

2nd harmonic, Middle Channel



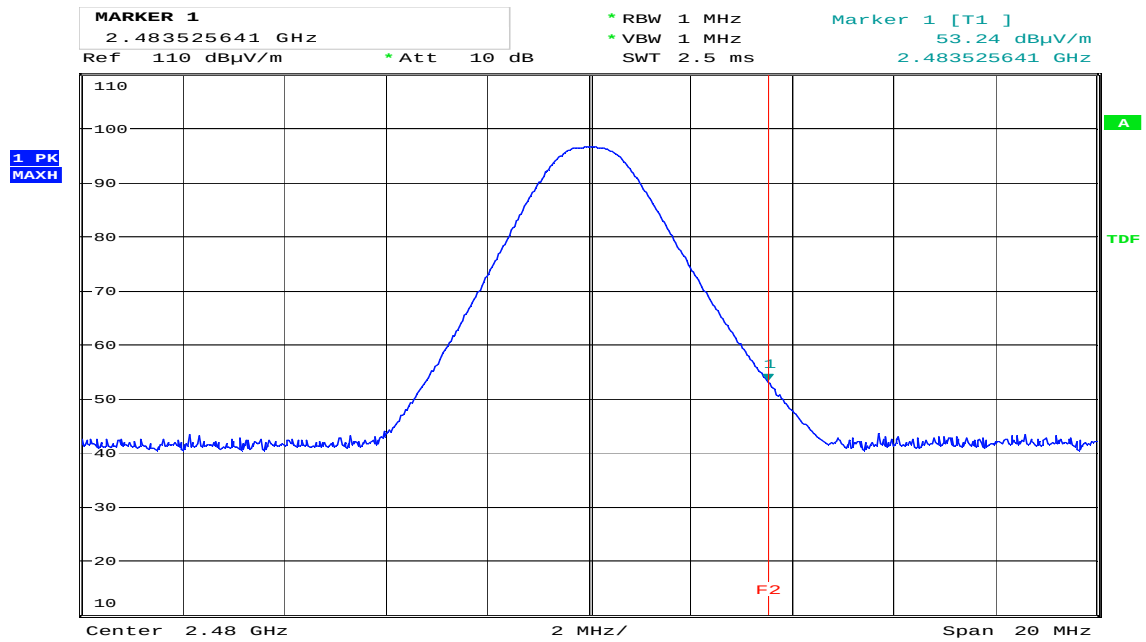
Date: 15. JAN. 2010 16:32:00

2nd harmonic, Upper channel



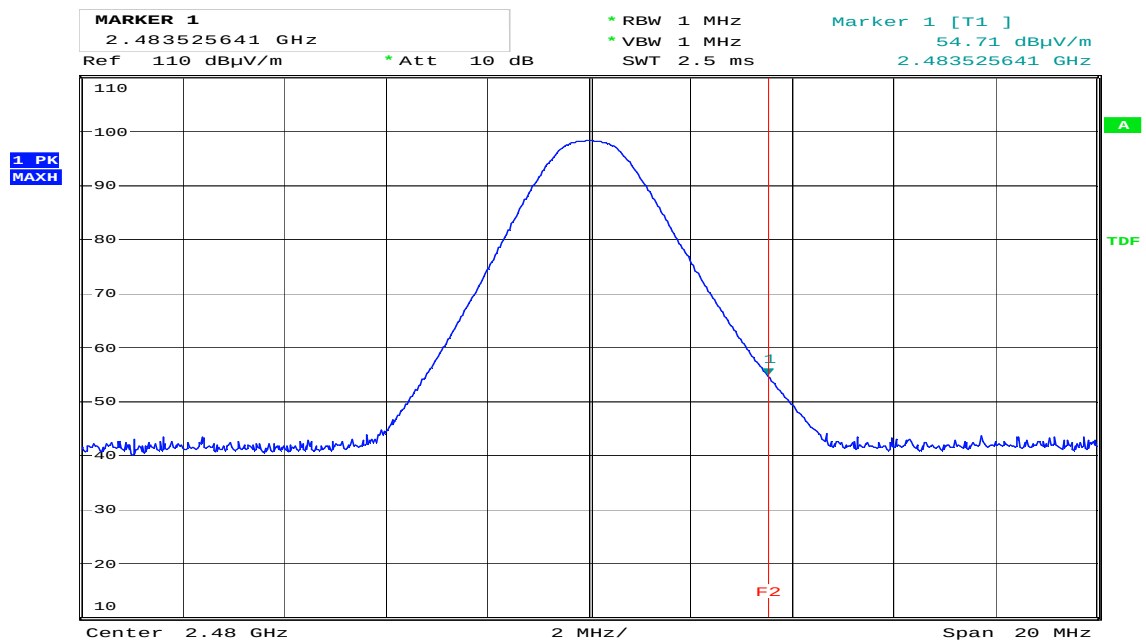
Date: 15. JAN. 2010 15:48:52

Band Edge, Lower, VP



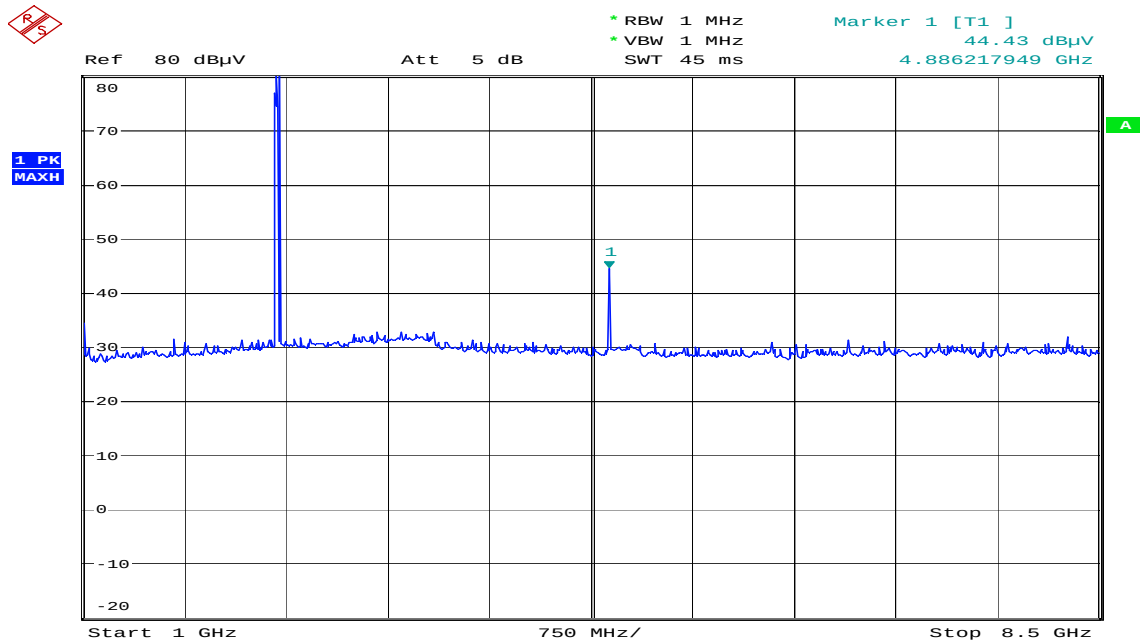
Date: 15. JAN. 2010 15:53:59

Band Edge, Upper, VP



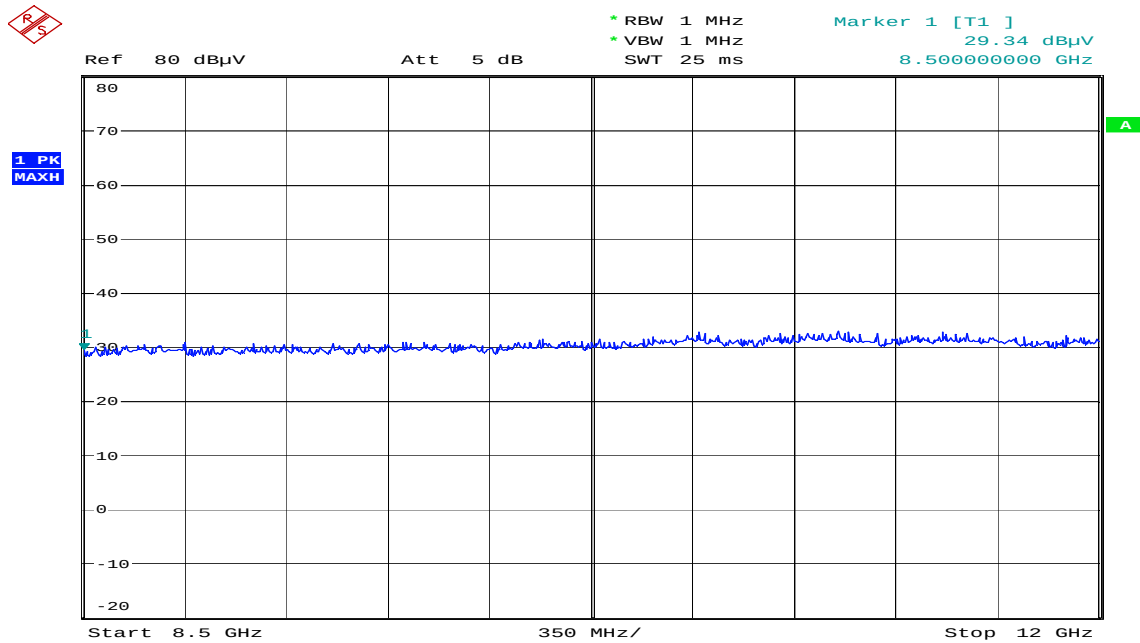
Date: 15. JAN. 2010 16:17:25

Band Edge, Upper, HP



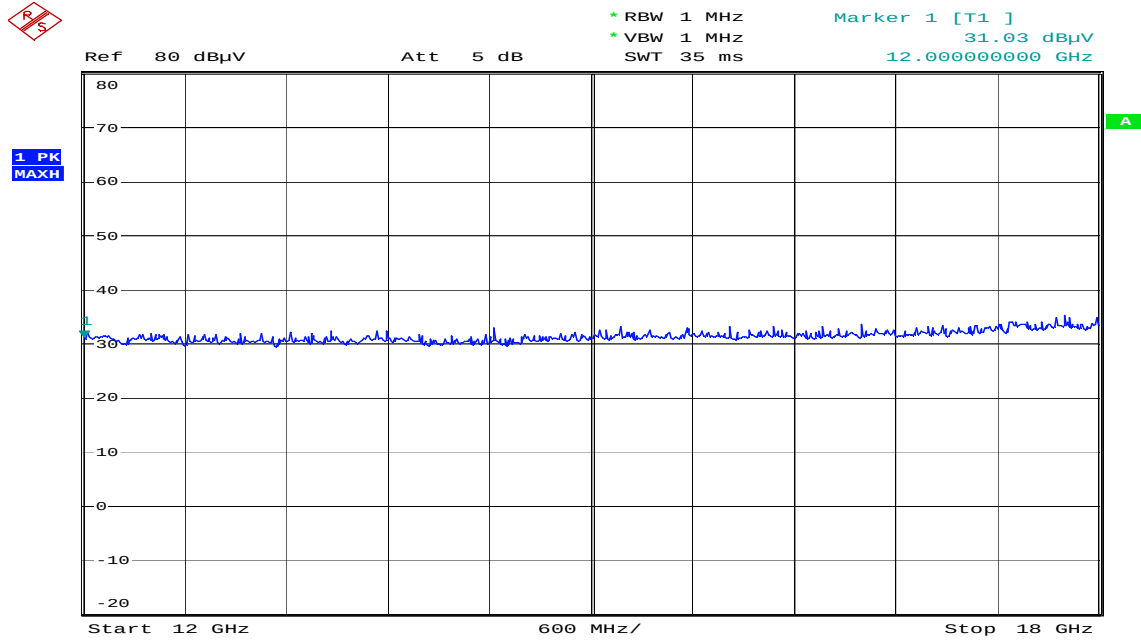
Date: 21. JAN. 2010 14:17:57

Spurious emissions, pre-scan 1 – 8.5 GHz



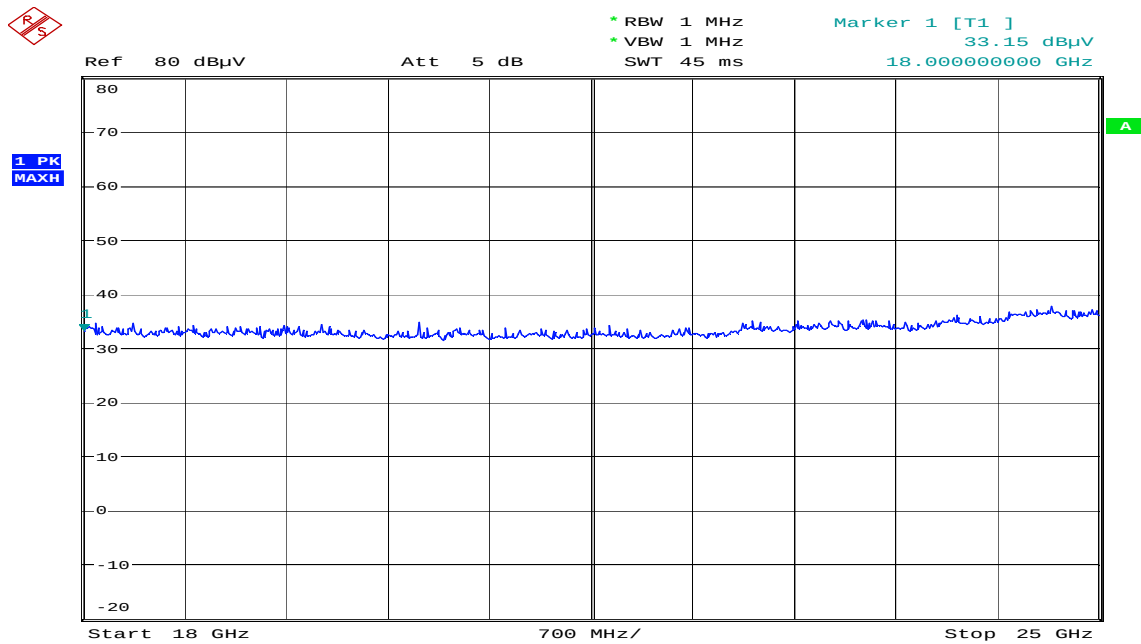
Date: 21. JAN. 2010 14:20:15

Spurious emissions, pre-scan 8.5 – 12 GHz



Date: 21. JAN. 2010 14:21:32

Spurious emissions, pre-scan 12 – 18 GHz



Date: 21. JAN. 2010 14:23:02

Spurious emissions, pre-scan 18 – 25 GHz

Radiated emission 10 kHz-30 MHz.

Measuring distance 10m, measured with Peak detector.

No component detected, see attached graph.

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

Radiated emission 30 – 1000 MHz.

Measuring distance 3 m, measured with Peak Detector.

No component detected, see attached graphs.

Nemko AS
Peak

27. Jan 10 15:03

Operator:

FS

Comment:

Ascom DH5 Bluetooth Module

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.

3

Start

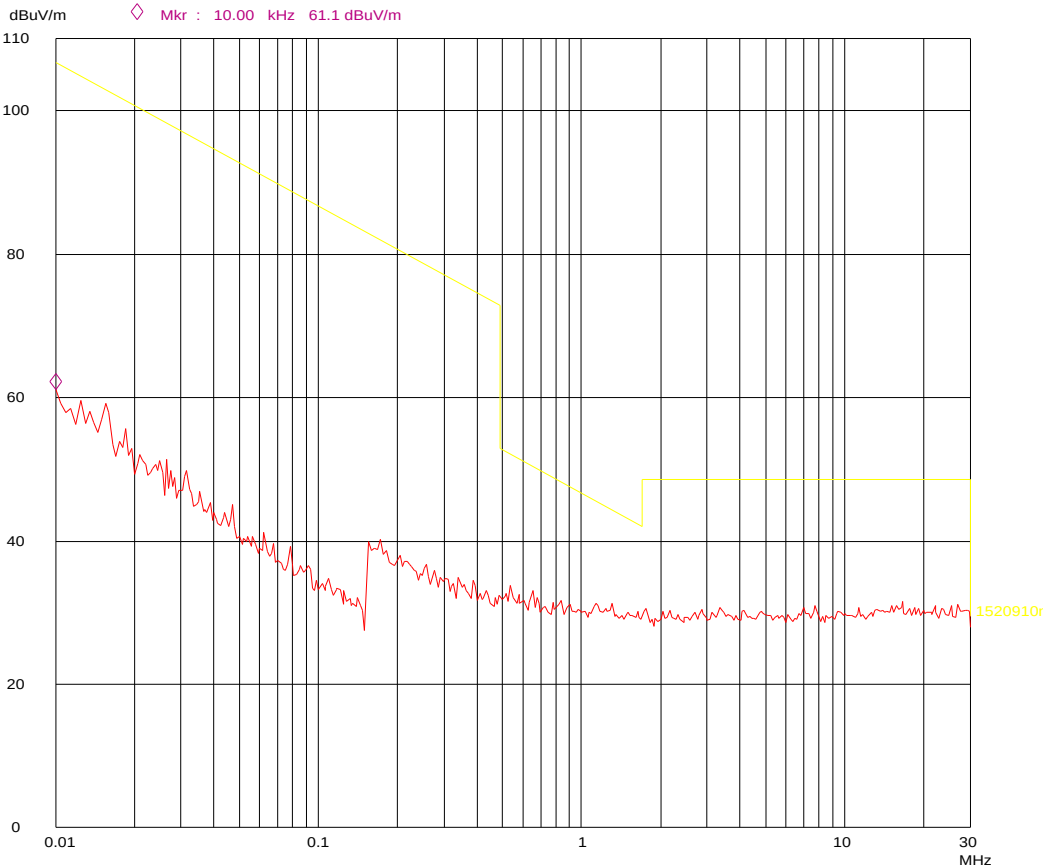
9k

Stop

30M

Name

HFH2Z2uV



Radiated Emissions, 9 kHz - 30 MHz

Nemko AS

Peak

15. Jan 10 12:04

Operator:

FS

Comment:

Ascom DH5

BT Tx 2440MHz

FCC 15.209

VP d3m, h1m

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.

11

Start

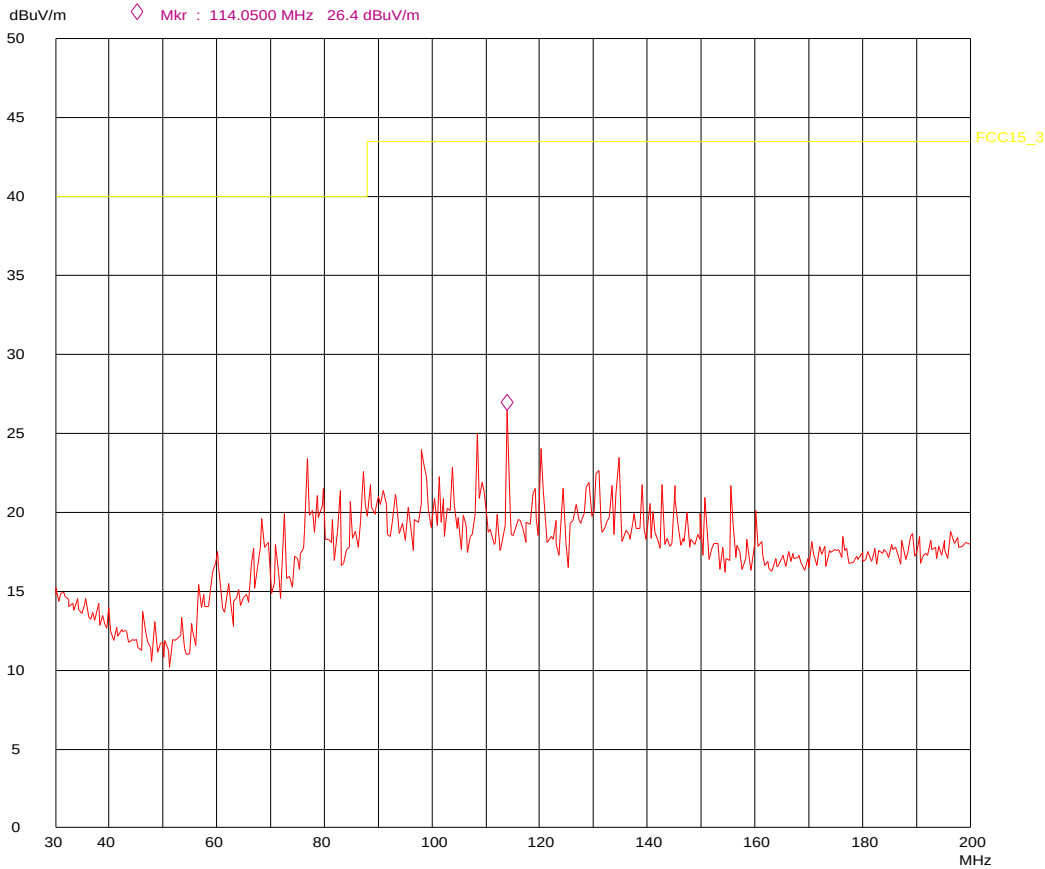
30M

Stop

200M

Name

HK116



VP, 30 - 200MHz

Nemko AS
Peak

15. Jan 10 12:18

Operator: FS
Comment: Ascom DH5
BT Tx 2440MHz
FCC 15.209
HP d3m, h2m

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

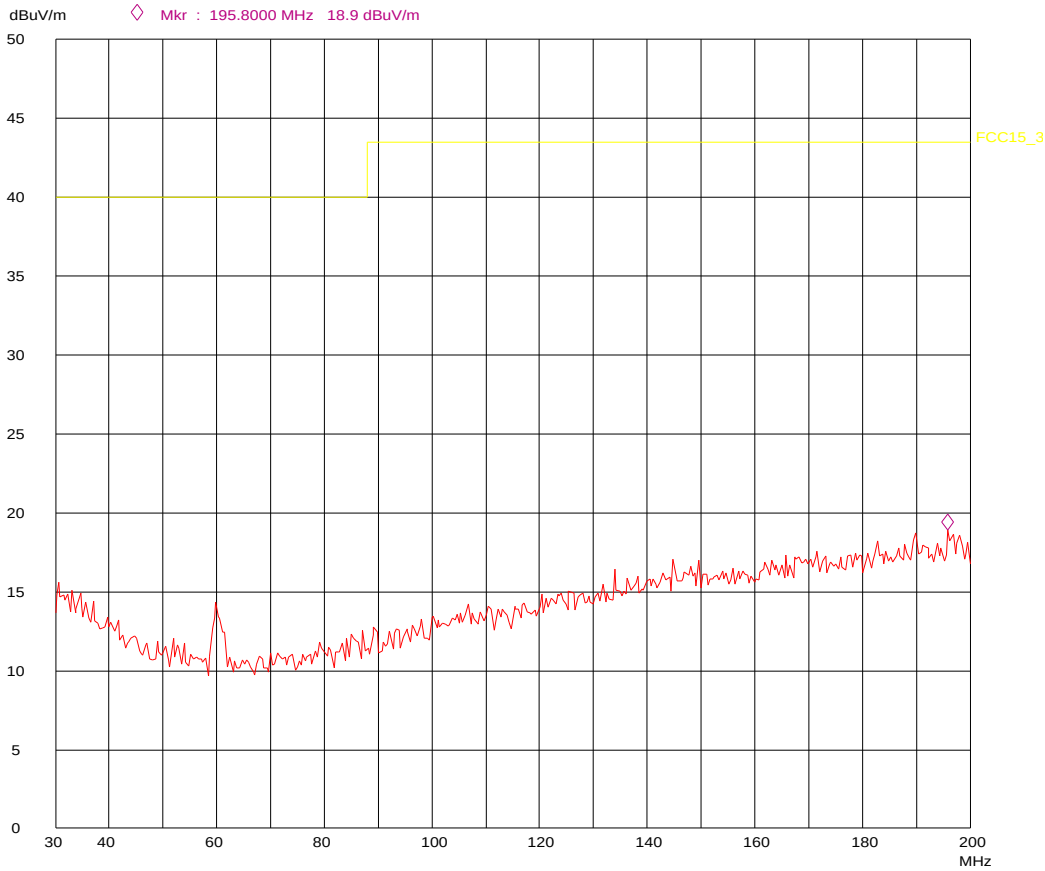
Name

11

30M

200M

HK116



HP, 30 - 200MHz

Nemko AS
Peak

15. Jan 10 10:01

Operator: FS
Comment: Ascom DH5
BT Tx 2440MHz
FCC 15.209
VP d3m, h1m

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.

20

Start

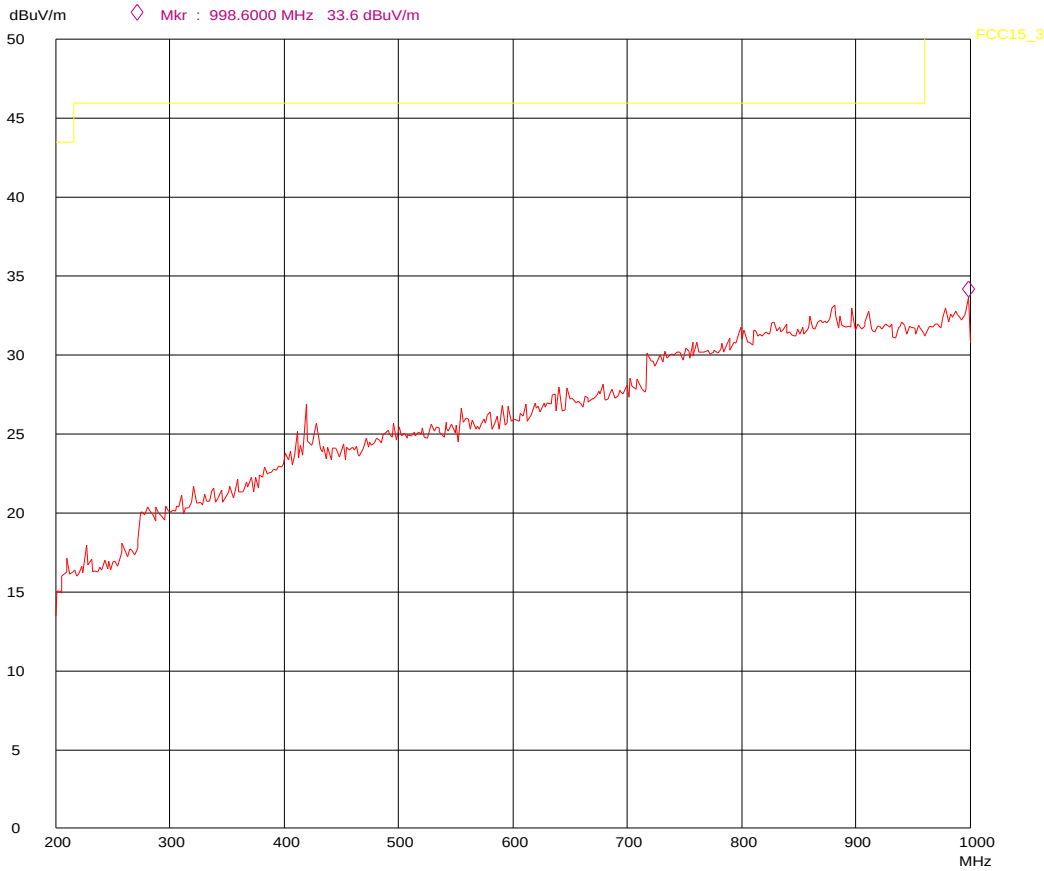
200M

Stop

1000M

Name

HL223



VP, 200 - 1000MHz

Nemko AS
Peak

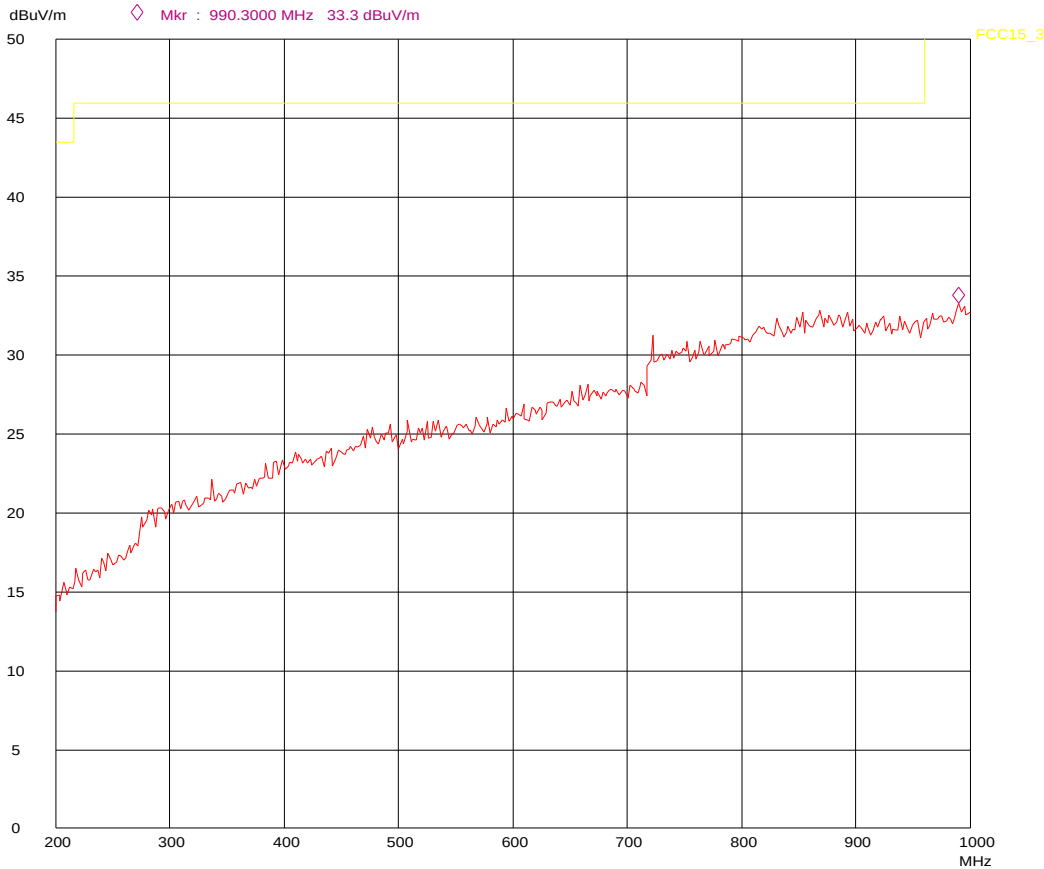
15. Jan 10 11:10

Operator: FS
Comment: Ascom DH5
BT Tx 2440MHz
FCC 15.209
HP d3m, h2m

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



5 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.

Ref. no	Description	Manufacturer	Model number	Cal. date	Cal. due
1504	Spectrum Analyzer	R&S	FSU26	2009-05	2011-05
1337	Spectrum Analyzer	R&S	FSEK30	2009.12.23	2011.12.23
1226	Antenna Horn	EMCO	3115	2008.11.206	2010.11.06
1260	Antenna, biconical	R&S	HK 116	2010.04.25	2012.04.25
1261	Antenna Log-periodic	R&S	HL 223	2008.07.24	2010.07.24
1020	Multimeter, Digital	Fluke	87	2009.10.15	2011.10.15
1143	Attenuator	Suhner	6810.17.A	2008.09.25	2010.09.25
1237	EMI-Receiver	R&S	ESN	2009.10.22	2011.10.22
1322	Amplifier RF	HP	8449B	2009.08.04	2011.08.04
285	Antenna, loop	R&S	HFH2-Z2	2008.07.31	2010.07.31
1515	AC power source	Agilent	6812B	2009.04.21	2010.04.21
1480	Antenna Horn	Narda	638	2010.04.26	2012.04.26
100	Antenna Horn	Systron	DBF-520-20	2009.01.26	2011.01.26
103	Antenna Horn	Sivers	PM 7320X	2009.01.26	2011.01.26

6 BLOCK DIAGRAM

6.1 Test Site Radiated Emission

