FCC EVALUATION REPORT FOR CERTIFICATION

Manufacturer : BNCOM Co., Ltd

Room 1007, Daehyun Techno World, 174 Ojeon-Dong,

Uiwang-si, Gyeonggi-Do, Korea

Attn : Mr. Seong-Gon Kim / CEO

Date of Issue : December 3, 2009

Order Number : GETEC-C1-09-213

Test Report Number : GETEC-E3-09-127

Test Site : Gumi College EMC Center

FCC Registration Number: (443957)

FCC ID.: XX5-DCS-BT1

Applicant: BNCOM Co., Ltd.

Rule Part(s)	: FCC Part 15 Subpart C-Intentional Radiator § 15.247
Test method	: Public Notice DA 00-705 (Guidance on measurement for Frequency hopping spread spectrum system)
Equipment Class	: Part 15 Spread Spectrum Transmitter (DSS)
EUT Type	: Bluetooth handsfree
Type of Authority	: Certification
Model Name	: DCS-BT1
Trade Name	: ALPINE

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the vest of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by,

Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center

Reviewed by,

Tae-Sig Park, Technical Manger
GUMI College EMC center

CONTENTS

Scope: *Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.*

1. General Information

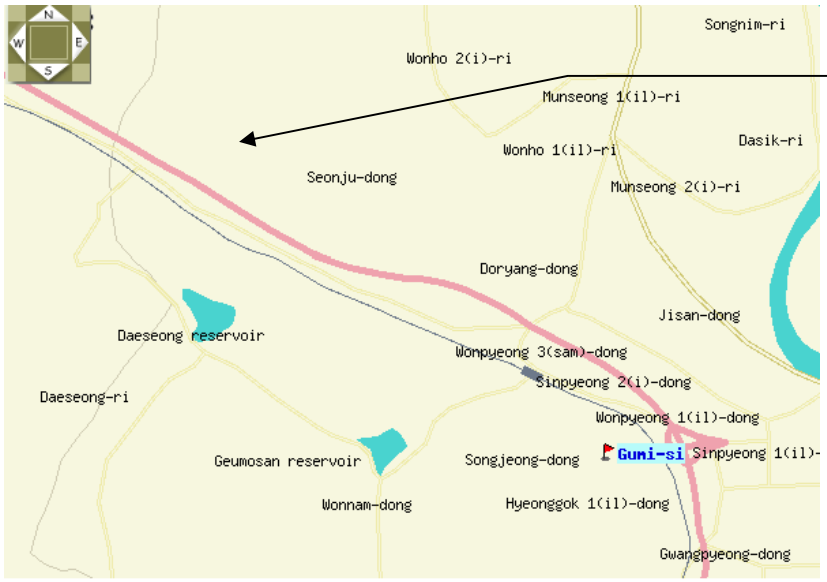
Applicant: BNCOM Co., Ltd.
Applicant address: Room 1007, Daehyun Techno World, 174 Ojeong-Dong, Uiwang-Si Gyeonggi-Do, 437-753, Republic of Korea
Manufacturer: BNCOM Co., Ltd.
Manufacturer address : Room 1007, Daehyun Techno World, 174 Ojeong-Dong, Uiwang-Si Gyeonggi-Do, 437-753, Republic of Korea
Contact person: Seong-Gon Kim / CEO
Telephone number: +82-32-427-8904 Fax number: +82-32-427-8907

- **FCC ID.** XX5-DCS-BT1
- **Equipment Class** Spread Spectrum Transmitter (DSS)
- **EUT Type** Bluetooth handsfree
- **Power Source** DC 3.7 V supplied from the lithium polymer battery
- **Model Name** DCS-BT1
- **Rule Part(s)** FCC Part 15, Subpart C-Intentional Radiator § 15.247
- **Test Method** Public Notice DA 00-705 (Guidance on measurement for frequency hopping spread spectrum systems)
- **Type of Authority** Certification
- **Test Procedure(s)** ANSI C63.4 (2003)
- **Dates of Test** October 16 ~ 28, 2009
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 443957) 407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
- **Test Report Number** GETEC-E3-09-127
- **Dates of Issue** December 3, 2009

2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ASNI C63.4-2003) was used in determining radiated and conducted emissions emanating from **BNCOM Co., Ltd. Bluetooth handsfree (Model name: DCS-BT1)**

These measurement tests were conducted at **Gumi College EMC Center**.
The site address is 407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
This test site is one of the highest point of Gumi 1 college at about 200 kilometers away from Seoul city and 40 kilometers away from Daege city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 on October 19, 1992



GUMI COLLEGE EMC CENTER
407,Bugok-Dong, Gumi-si,
Gyeongsangbuk-Do 730-711, Korea
Tel: +82-54-440-1195~8
Fax: +82-54-440-1199

Fig 1. The map above shows the Gumi College in vicinity area.

3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **BNCOM Co., Ltd. Bluetooth handsfree (Model Name: DCS-BT1)**
FCC ID.: XX5-DCS-BT1

External connector	Charging port

Frequency Band	Channel	Freq. [MHz]	Channel	Freq. [MHz]	Channel	Freq. [MHz]	Channel	Freq. [MHz]
2400-2483.5MHz	0	2402	20	2422	40	2442	60	2462
	1	2403	21	2423	41	2443	61	2463
	2	2404	22	2424	42	2444	62	2464
	3	2405	23	2425	43	2445	63	2465
	4	2406	24	2426	44	2446	64	2466
	5	2407	25	2427	45	2447	65	2467
	6	2408	26	2428	46	2448	66	2468
	7	2409	27	2429	47	2449	67	2469
	8	2410	28	2430	48	2450	68	2470
	9	2411	29	2431	49	2451	69	2471
	10	2412	30	2432	50	2452	70	2472
	11	2413	31	2433	51	2453	71	2473
	12	2414	32	2434	52	2454	72	2474
	13	2415	33	2435	53	2455	73	2475
	14	2416	34	2436	54	2456	74	2476
	15	2417	35	2437	55	2457	75	2477
	16	2418	36	2438	56	2458	76	2478
	17	2419	37	2439	57	2459	77	2479
	18	2420	38	2440	58	2460	78	2480
	19	2421	39	2441	59	2461		

3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID
None	-	-	

See "Appendix E – Test Setup Photographs" for actual system test set-up

3.2.2 Used Cable(s)

Cable Name	Condition	Description
None.	-	-

3.3 Modification Item(s)

-. None

4. Description of tests

4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.
The representative and worst test mode(s) were noted in the test report.

Test Voltage / Frequency:
-. DC 3.7 V supplied from the lithium polymer battery
(The EUT used battery. So, the conducted emission test was skip.)

- Test Mode(s)
  -. Executed “BlueTest3 (made by CSR)” to control the EUT continuously transmit RF signal

Test Software Version	BlueTest3		
Frequency	2 402 MHz	2 441 MHz	2 480 MHz
Power internal value	50	50	50

5. Antenna Requirement - §15.203

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

5.1 Description of Antenna

The **BNCOM Co., Ltd. Bluetooth Clipcomm Inc. Phone adapter** comply with the requirement of §15.203 with a built-in monopole antenna permanently attached to the transmitter.

5.2 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure.
The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.
The EUT is powered from the Rohde & Schwarz LISN (ESH2-Z5) and the support equipment is powered from the Rohde & Schwarz LISN (ESH3-Z5). Powers to the LISN are filtered by high-current high insertion loss power line filter.
Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCS30).
The EMI test receiver was scanned from 150 kHz to 30 MHz with 20 ms sweep time to determine the frequency producing the maximum EME from the EUT. The frequency producing the maximum level was re-examined using Quasi-Peak mode of the EMI test receiver.
The bandwidth of Quasi-peak mode was set to 9 kHz. Each emission was maximized consistent with typical applications by varying the configuration of the test sample. Interface cables were connected to the available interface ports of the test unit. The effect of varying the position of cables was investigated to find the configuration that produces maximum diagram emission. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.
Each EME reported was calibrated using the R/S signal generator

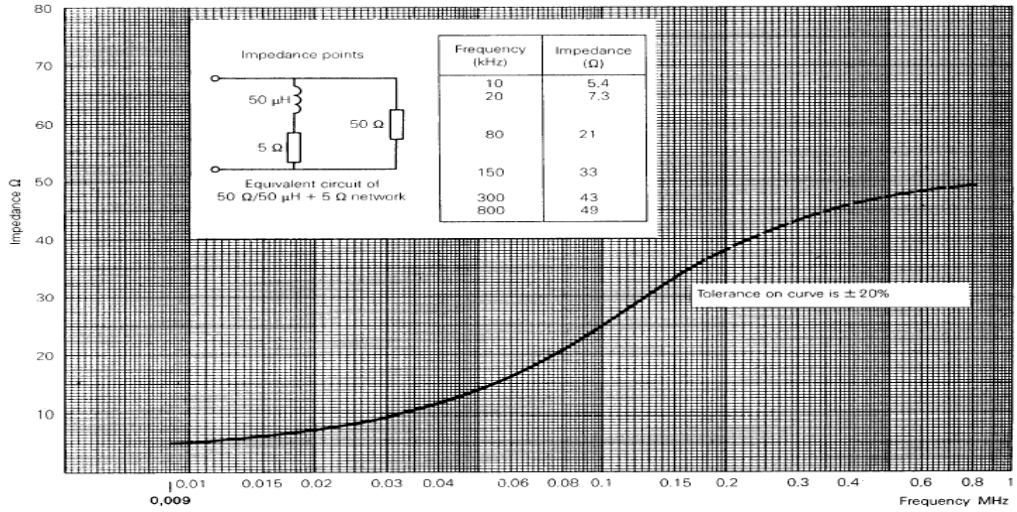


Fig 2. Impedance of LISN

5.3 Radiated Emission

Preliminary measurements were conducted 3 m semi anechoic chamber using broadband antennas to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The technology configuration, mode of operation and turntable azimuth with respect to antenna was note for each frequency found.
The spectrum was scanned from 30 MHz to 1 000 MHz, using bicornical log antenna (Schwarzbeck, VULB9160).
Above 1 GHz, horn antenna (Schwarzbeck, BBHA9120D / EMCO 3160) was used.
Final measurements were made outdoors at 3 m test range.
Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
Each frequency found during pre-scan measurements was re-examined and investigated using EMI test receiver. The detector function was set to CISPR quasi-peak mode average mode and the bandwidth of the receiver was set to 120 kHz or 1MHz depending on the frequency or type of signal.
The EUT, support equipment and interconnecting cables were reconfigured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8 m high non-metallic 1.0 m ×1.5 m table.
The turntable containing the test sample was rotated; the antenna height was varied 1 m to 4 m and stopped at the azimuth or height producing the maximum emission.
Each EME reported was calibrated using the R/S signal generator

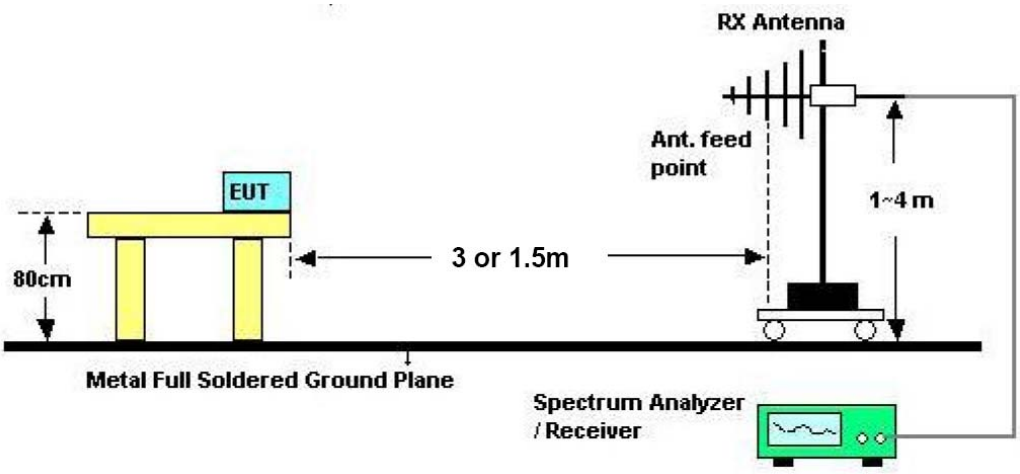


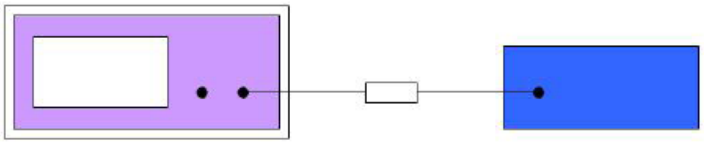
Fig 3. Dimensions of test site.

6. Number of Hopping Frequency Used

6.1 Operating Environment

Temperature : 21.0 °C
Relative Humidity : 45.0 % R.H.

6.2 Test Set-up (Layout)



6.3 Limit

At least 15 channels frequencies, and should be equally spaced

6.4 Test Equipment used

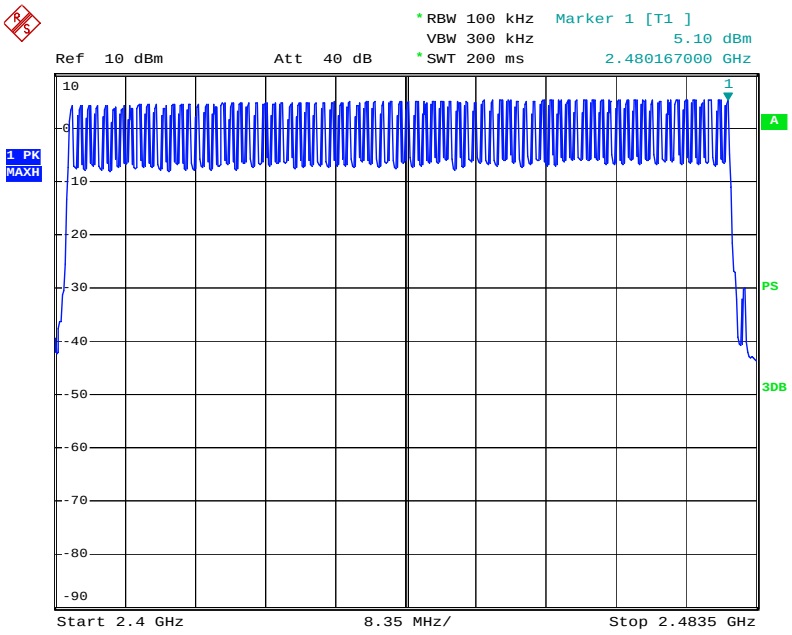
	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESCI	Rohde & Schwarz	EMI test receiver	100237	12. 13. 2009

6.5 Test Result

-. Test Date : October 16, 2009
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
-. Modulation : GFSK, QPSK, 8-DPSK
-. Operating Condition : Bluetooth RF transmitting mode
-. Power Source : DC 3.7 V supplied from the lithium polymer battery

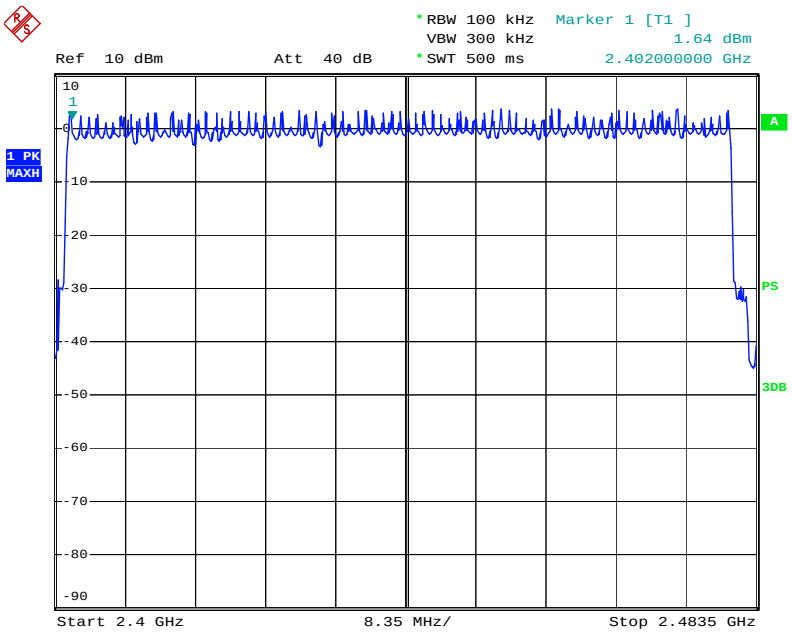
Modulation	Channel number	Limit	Result
GFSK DH5	79	> 15	Complies
QPSK DH5	79	> 15	Complies
8-DPSK DH5	79	> 15	Complies

Number of Hopping frequency used Plot on Configuration GFSK



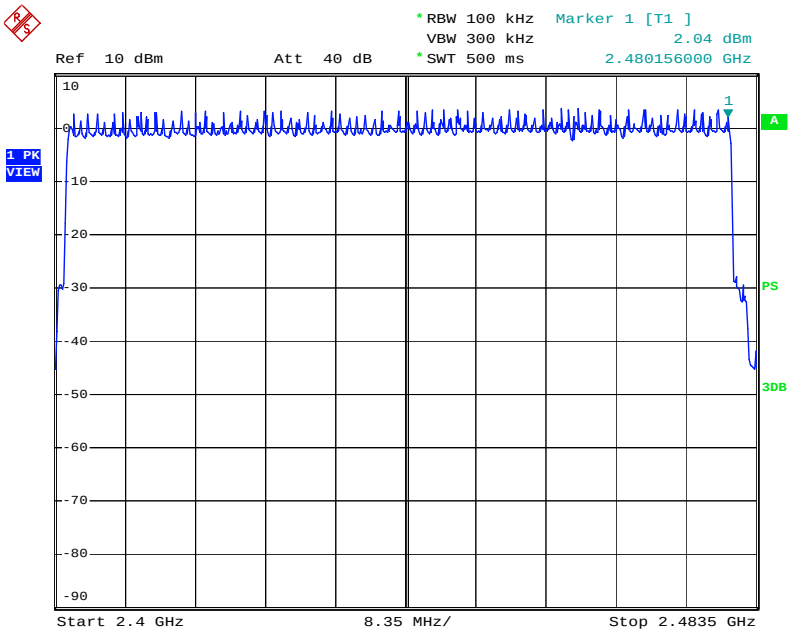
Date: 16.OCT.2009 18:50:27

Number of Hopping frequency used Plot on Configuration QPSK



Date: 16.OCT.2009 18:59:46

Number of Hopping frequency used Plot on Configuration 8-DPSK



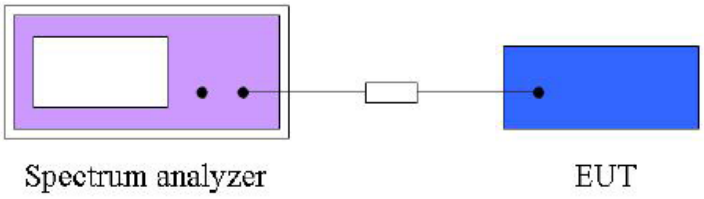
Date: 16.OCT.2009 19:02:41

7. Dwell Time On Each Channel

7.1 Operating Environment

Temperature : 21.0 °C
Relative Humidity : 45.0 % R.H.

7.2 Test Set-up (Layout)



7.3 Limit

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.

7.4 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009

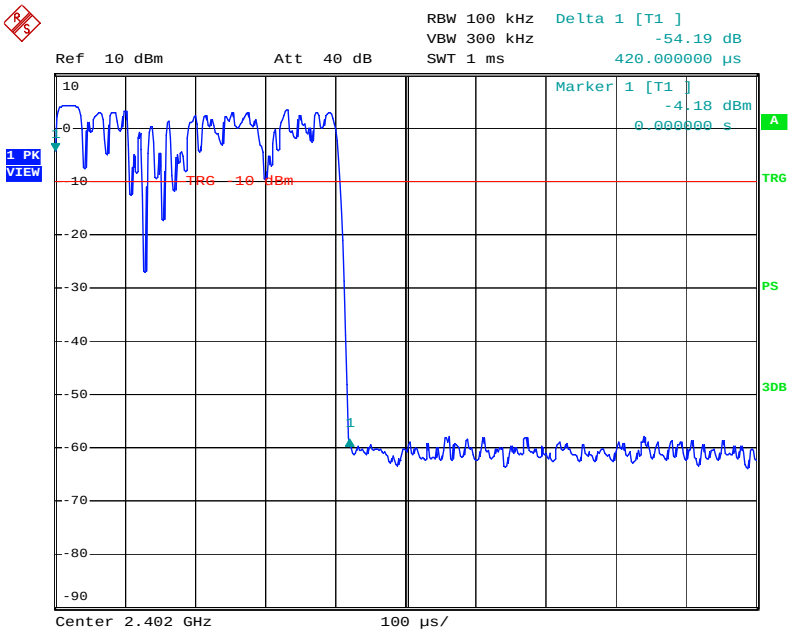
7.5 Test Result

-. Test Date : October 17, 2009
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
-. Modulation : GFSK, QPSK, 8-DPSK
-. Operating Condition : Bluetooth RF transmitting mode
-. Power Source : DC 3.7 V supplied from the lithium polymer battery

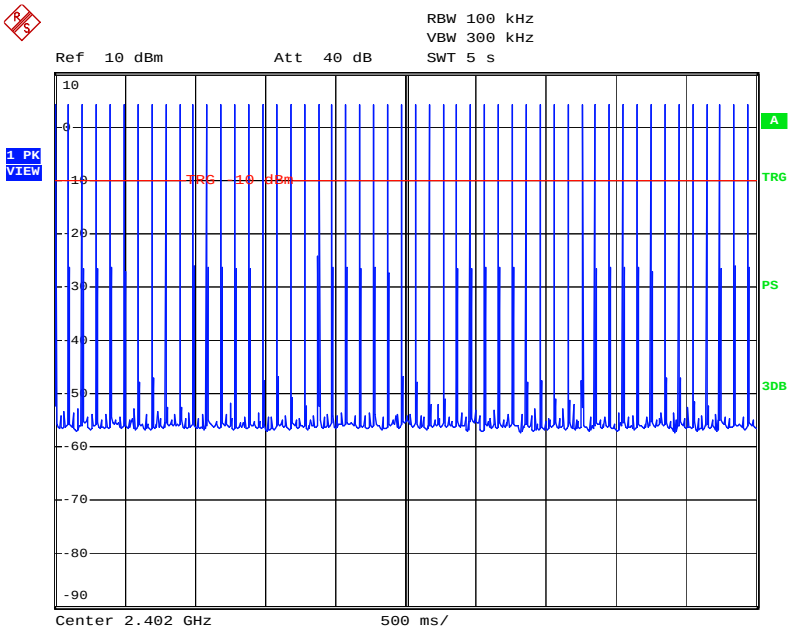
Spectrum Parameter
-. Attenuation : Auto
-. Span frequency : zero
-. Resolution band width : 100 kHz
-. Video band with : 300 kHz
-. Sweep time : 5 s

Mode	Number of transmission in a 31.6 (79 Hopping *0.4)	Length of transmission time (ms)	Measured (ms)	Limit (ms)	Result
GFSK DH1	51 (times / 5 s) * 6.32 = 107.44	0.42	135.374	400	Complies
QPSK DH5	17 (times / 5 s) * 6.32 = 107.44	2.95	316.948	400	Complies
8-DPSK DH5	17 (times / 5 s) * 6.32 = 107.44	2.95	316.948	400	Complies

Dwell time on each time used Plot on Configuration GFSK

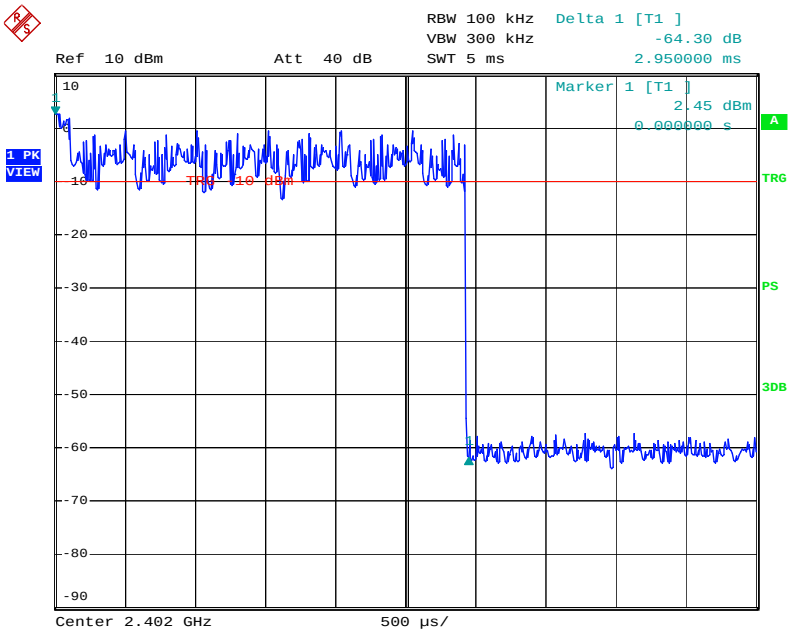


Date: 17.OCT.2009 09:21:30

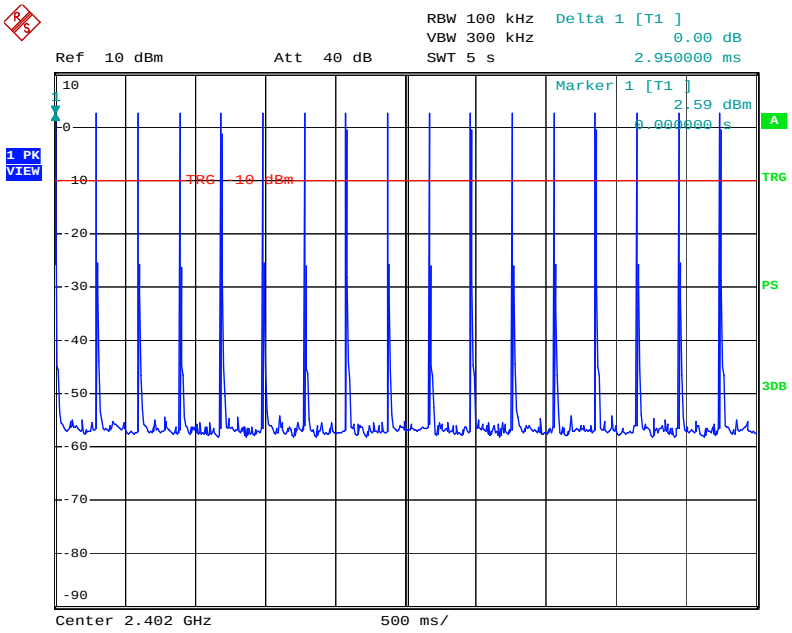


Date: 17.OCT.2009 09:23:28

Dwell time on each time used Plot on Configuration QPSK

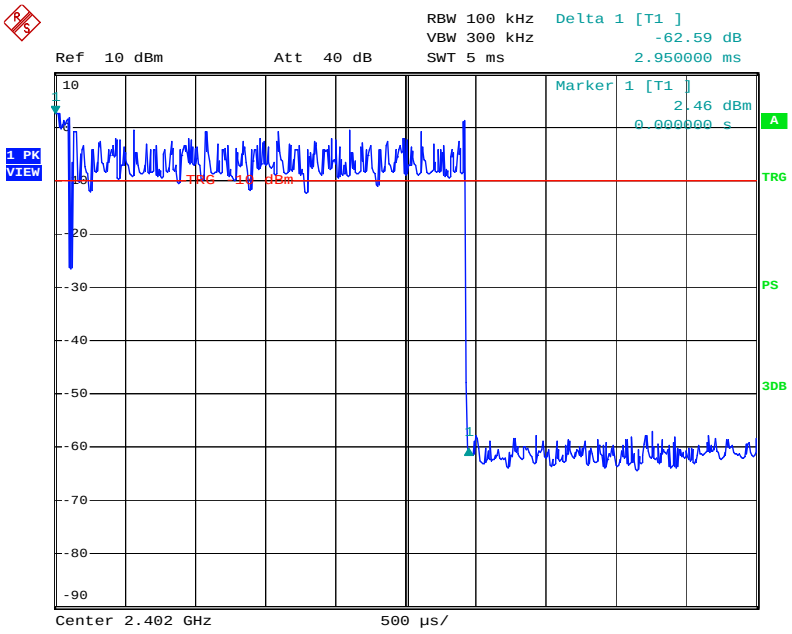


Date: 17.OCT.2009 09:27:45

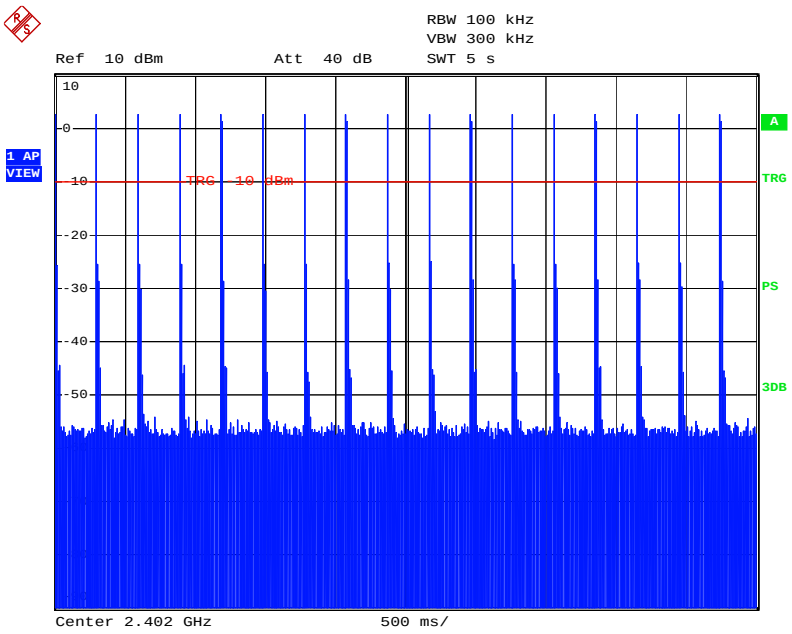


Date: 17.OCT.2009 09:28:22

Dwell time on each time used Plot on Configuration 8-DPSK



Date: 17.OCT.2009 09:26:46



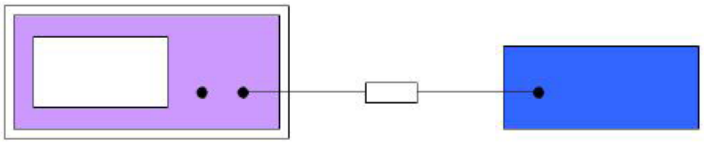
Date: 17.OCT.2009 09:25:01

8. CHANNEL BANDWIDTH

8.1 Operating environment

Temperature : 21.0 °C
Relative Humidity : 45.0 % R.H.

8.2 Test Set-up (Layout)



8.3 Limit

For frequency hopping system operating in the 2 400 MHz ~ 2 483.5 MHz, If the 20 dB bandwidth of hopping channel is greater than 25 kHz, two-thirds 20 dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

8.4 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009

8.5 Test result

-. Test Date : October 17, 2009
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
-. Modulation : GFSK, QPSK, 8-DPSK
-. Operating Condition : Bluetooth RF transmitting mode
-. Power Source : DC 3.7 V supplied from the lithium polymer battery

Spectrum Parameter
-. Attenuation : Auto
-. Span frequency : zero
-. Resolution band width : 100 kHz
-. Video band with : 100 kHz
-. Sweep time : 5 s

For GFSK (DH5)

Channel	Channel frequency (MHz)	20 dB bandwidth (MHz)	Result
0	2 402	1.120	Complies
39	2 441	1.120	Complies
78	2 480	1.120	Complies

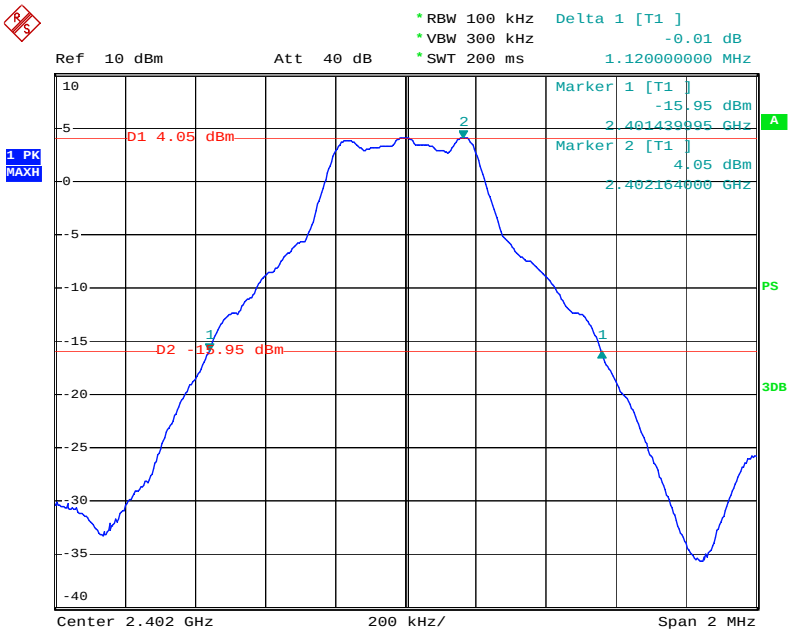
For QPSK (2-DH5)

Channel	Channel frequency (MHz)	20 dB bandwidth (MHz)	Result
0	2 402	1.404	Complies
39	2 441	1.396	Complies
78	2 480	1.392	Complies

For 8-DPSK (3-DH5)

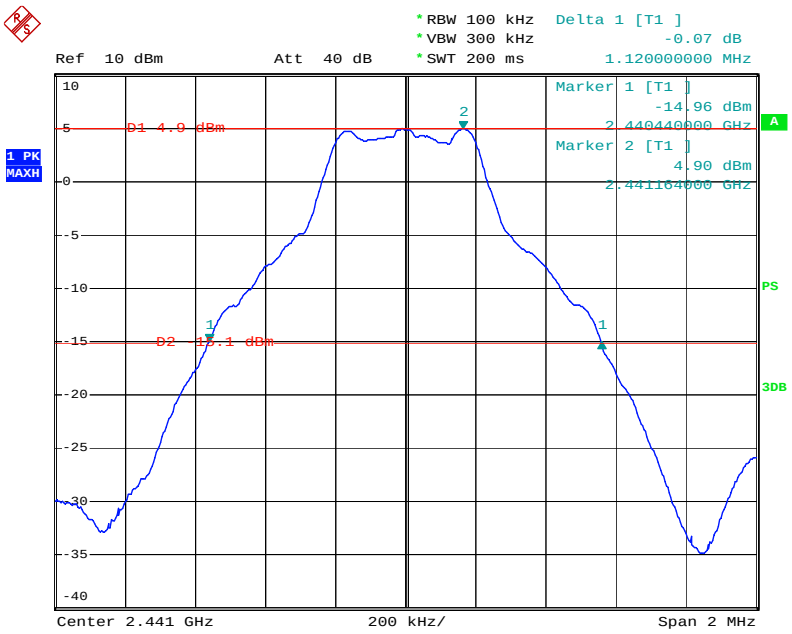
Channel	Channel frequency (MHz)	20 dB bandwidth (MHz)	Result
0	2 402	1.396	Complies
39	2 441	1.396	Complies
78	2 480	1.392	Complies

Channel bandwidth used Plot on Configuration GFSK/0 CH (2 402 MHz)



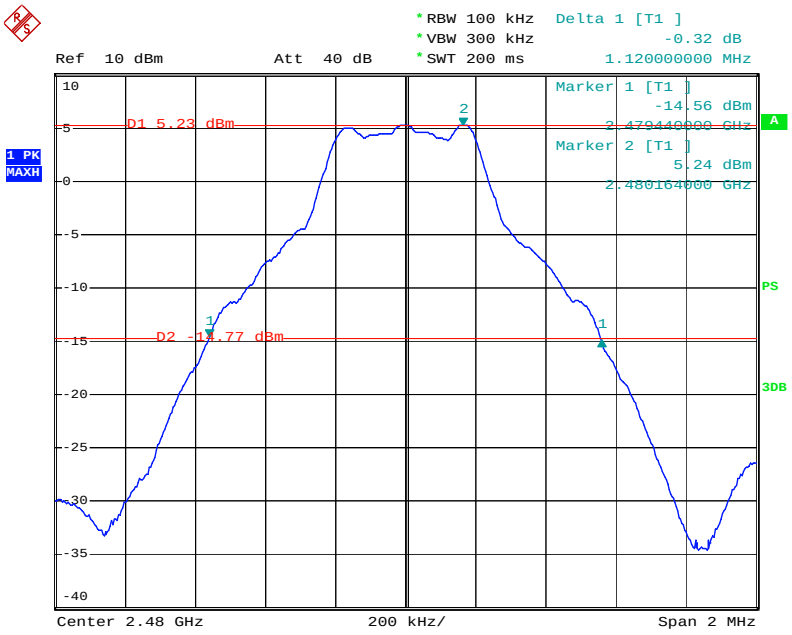
Date: 17.OCT.2009 09:42:48

Channel bandwidth used Plot on Configuration GFSK/39 CH (2 441 MHz)



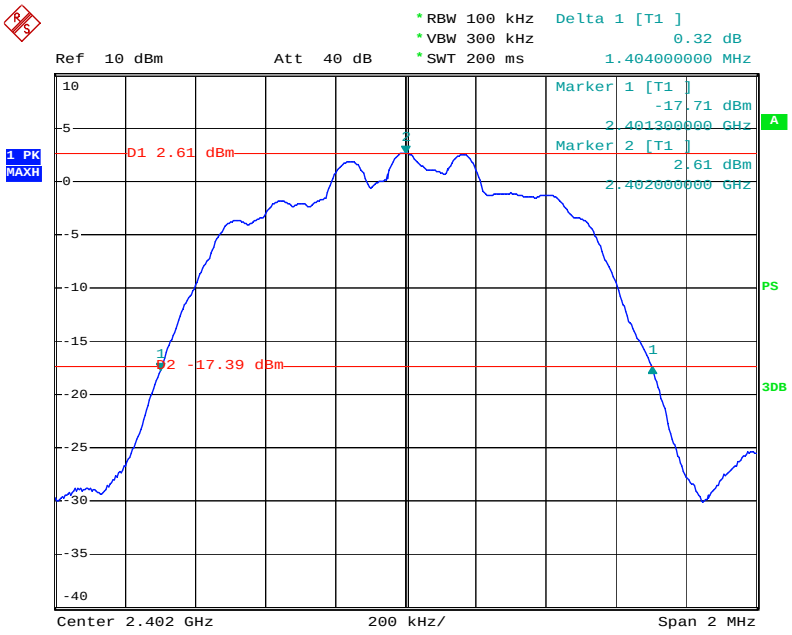
Date: 17.OCT.2009 09:45:00

Channel bandwidth used Plot on Configuration GFSK/78 CH (2 480 MHz)



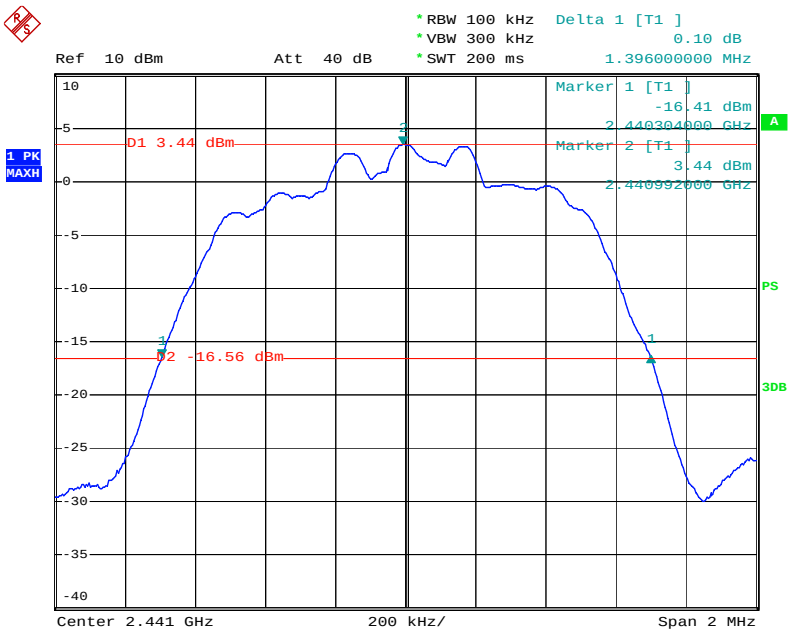
Date: 17.OCT.2009 09:46:12

Channel bandwidth used Plot on Configuration QPSK/0 CH (2 402 MHz)



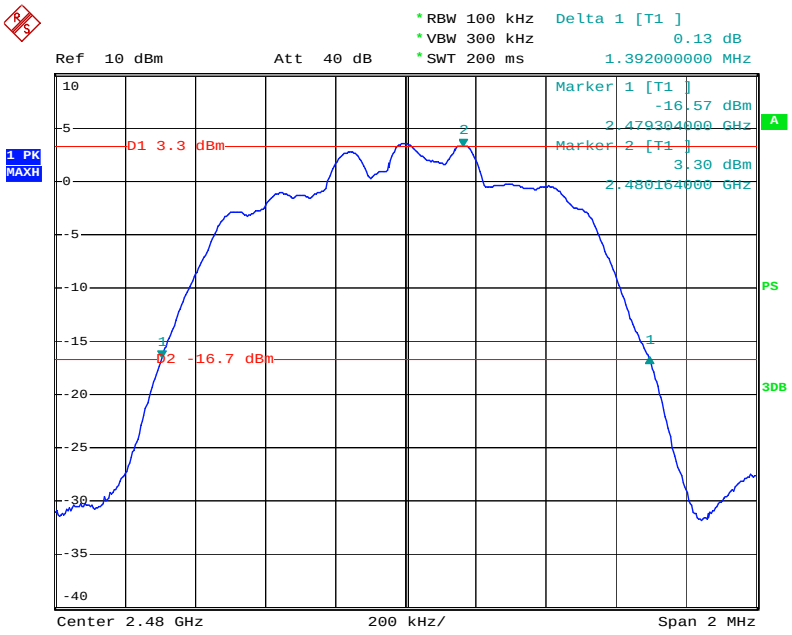
Date: 17.OCT.2009 09:52:51

Channel bandwidth used Plot on Configuration QPSK/39 CH (2 441 MHz)



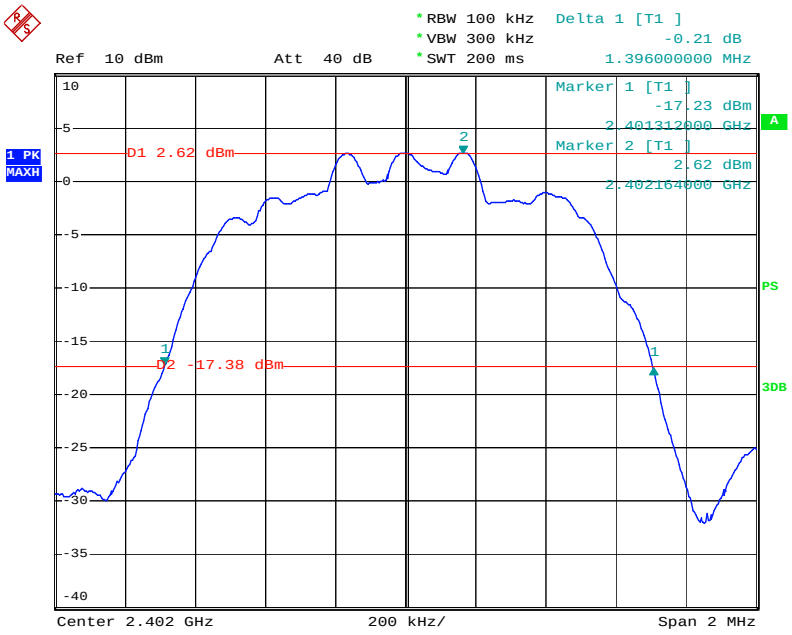
Date: 17.OCT.2009 09:50:56

Channel bandwidth used Plot on Configuration QPSK/78 CH (2 480 MHz)



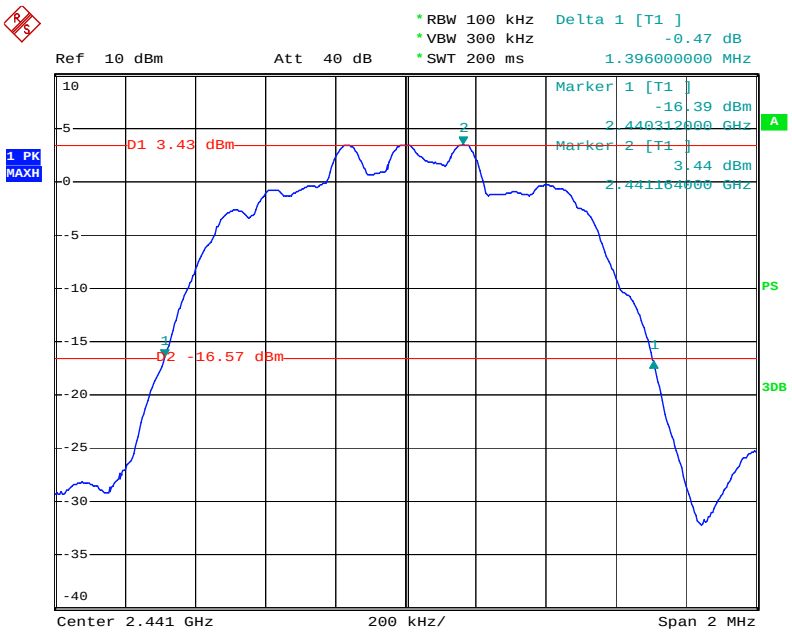
Date: 17.OCT.2009 09:48:56

Channel bandwidth used Plot on Configuration 8-DPSK/0 CH (2 402 MHz)



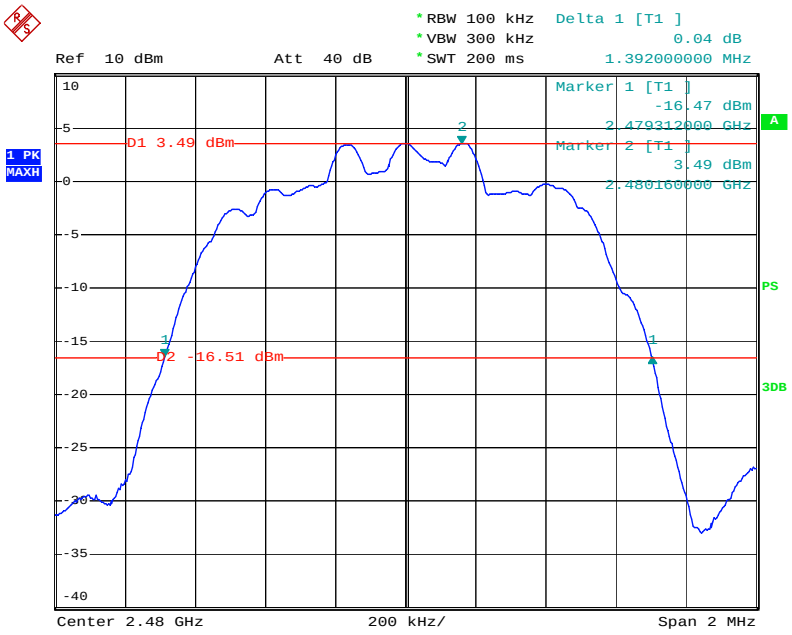
Date: 17.OCT.2009 09:54:59

Channel bandwidth used Plot on Configuration 8-DPSK/39 CH (2 441 MHz)



Date: 17.OCT.2009 09:56:23

Channel bandwidth used Plot on Configuration 8-DPSK/78 CH (2 480 MHz)



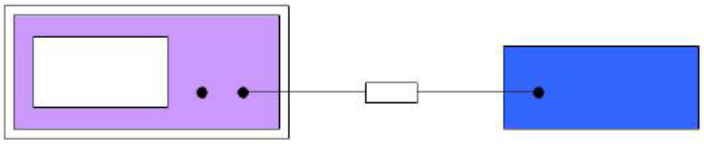
Date: 17.OCT.2009 09:57:51

9. LIMIT OF HIPPING CHANNEL SEPARATION

9.1 Operating Environment

Temperature : 21.0 °C
Relative Humidity : 45.0 % R.H.

9.2 Test Set-up (Layout)



9.3 Limit

For frequency hopping system operating in the 2 400 MHz ~ 2 483.5 MHz, If the 20 dB bandwidth of hopping channel is greater than 25 kHz, two-thirds 20 dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

9.4 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009

9.5 Test Result

-. Test Date : October 17, 2009
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)
-. Modulation : GFSK
-. Operating Condition : Bluetooth RF transmitting mode
-. Power Source : AC 120 V / 50 Hz (DC 5.1 V supplied from the AC/DC adapter)

Spectrum Parameter
-. Attenuation : Auto
-. Span frequency : 2.5 MHz
-. Resolution band width : 100 kHz
-. Video band with : 100 kHz
-. Sweep time : 10 ms

For GFSK (DH5)

Channel	Channel frequency (MHz)	Adjacent channel separation (MHz)	Limit (MHz)	Result
0	2 402	1.000	> 0.5	Complies
39	2 441	1.000	> 0.5	Complies
78	2 480	1.000	> 0.5	Complies

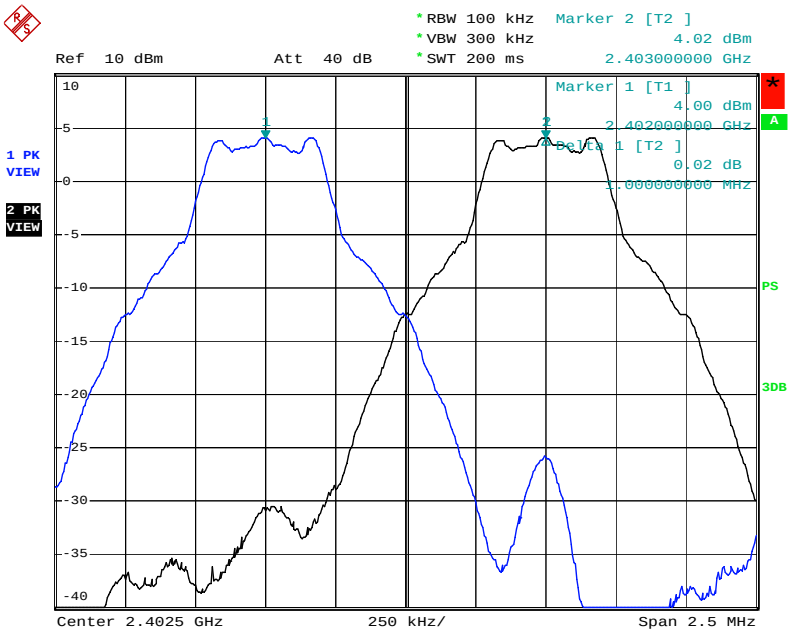
For QPSK (2-DH5)

Channel	Channel frequency (MHz)	Adjacent channel separation (MHz)	Limit (MHz)	Result
0	2 402	1.000	> 0.5	Complies
39	2 441	1.000	> 0.5	Complies
78	2 480	1.000	> 0.5	Complies

For 8-DPSK (3-DH5)

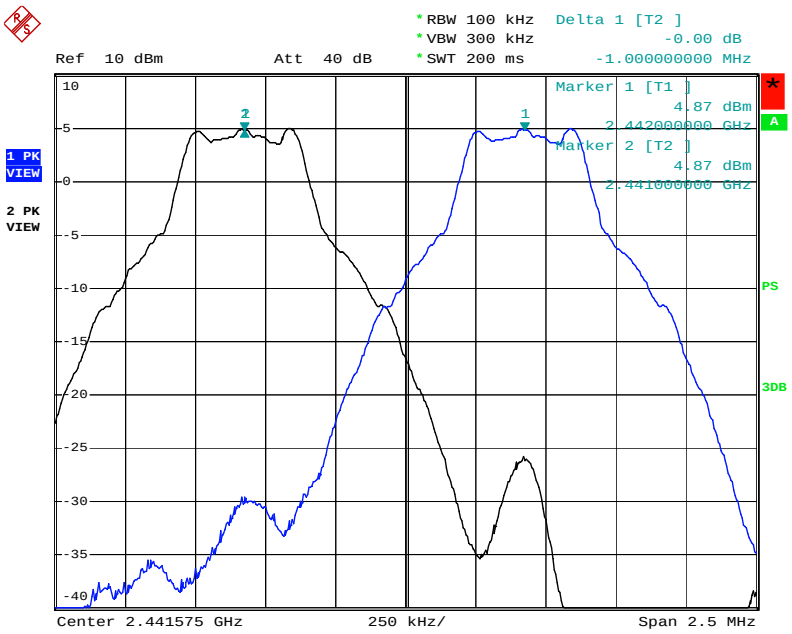
Channel	Channel frequency (MHz)	Adjacent channel separation (MHz)	Limit (MHz)	Result
0	2 402	1.000	> 0.5	Complies
39	2 441	1.000	> 0.5	Complies
78	2 480	1.000	> 0.5	Complies

Channel separation used Plot on Configuration GFSK/0 CH (2 402 MHz)



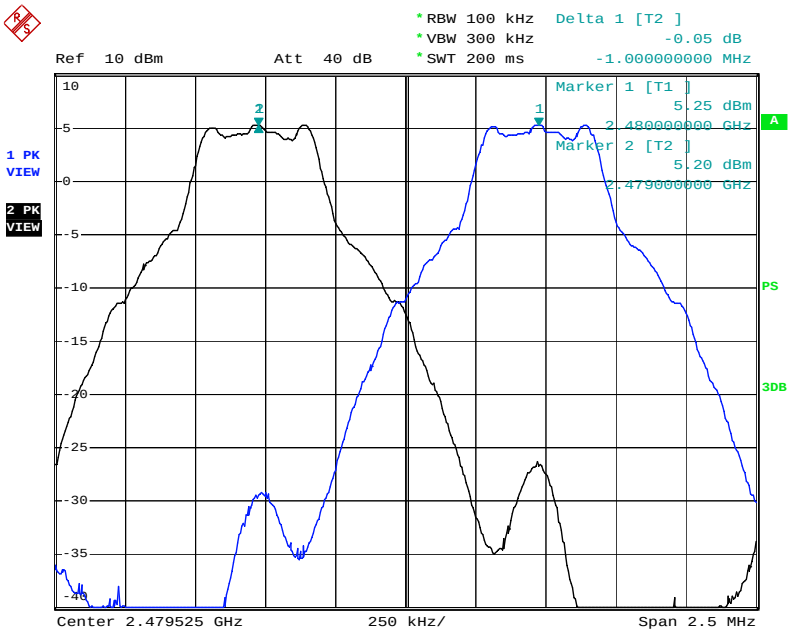
Date: 17.OCT.2009 10:30:33

Channel separation used Plot on Configuration GFSK/39 CH (2 441 MHz)



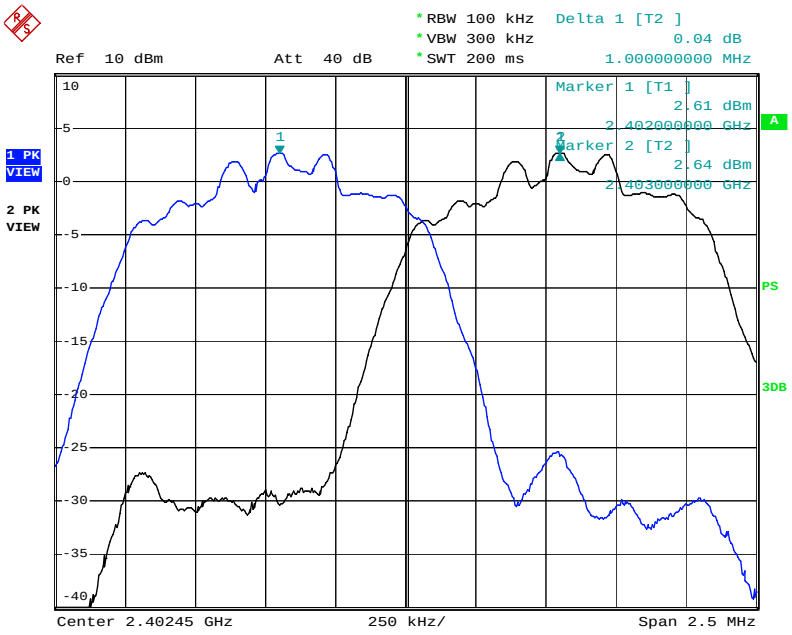
Date: 17.OCT.2009 10:28:57

Channel separation used Plot on Configuration GFSK/78 CH (2 480 MHz)



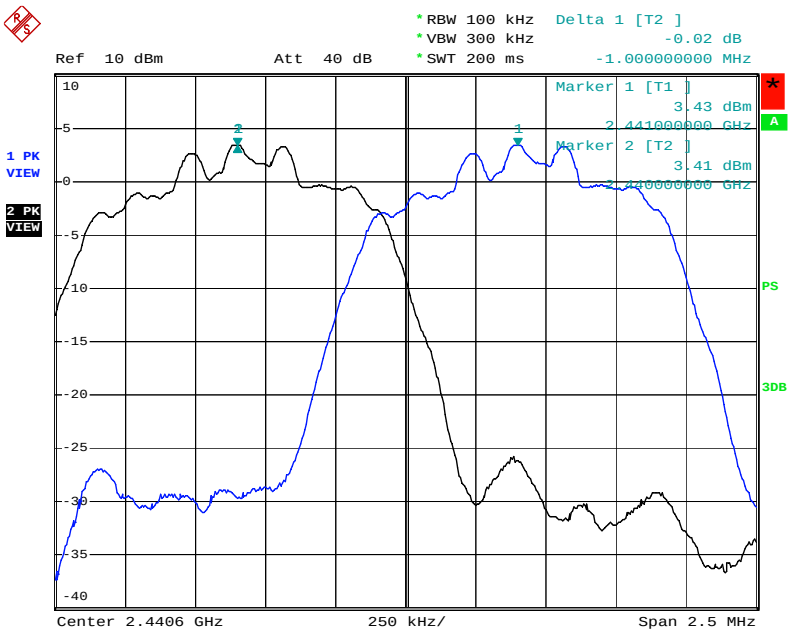
Date: 17.OCT.2009 10:24:52

Channel separation used Plot on Configuration QPSK/0 CH (2 402 MHz)



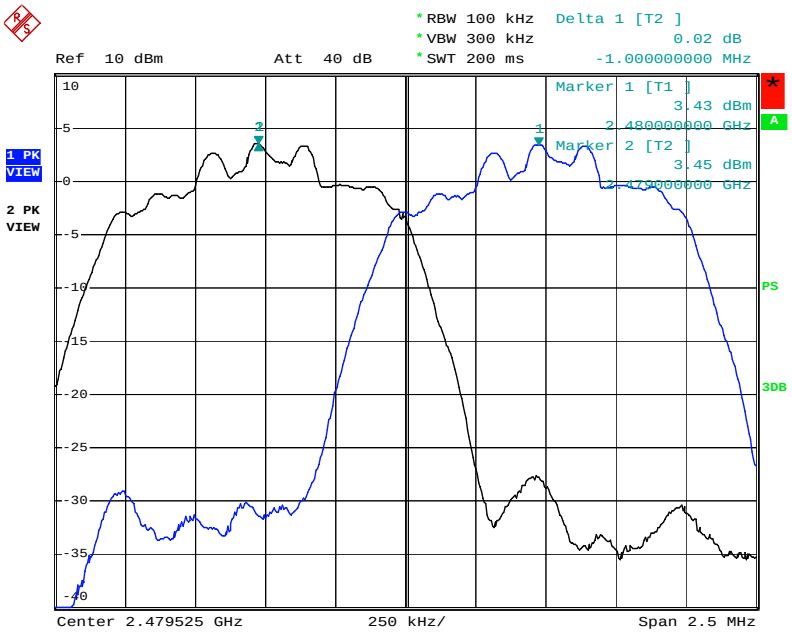
Date: 17.OCT.2009 10:07:42

Channel separation used Plot on Configuration QPSK/39 CH (2 441 MHz)



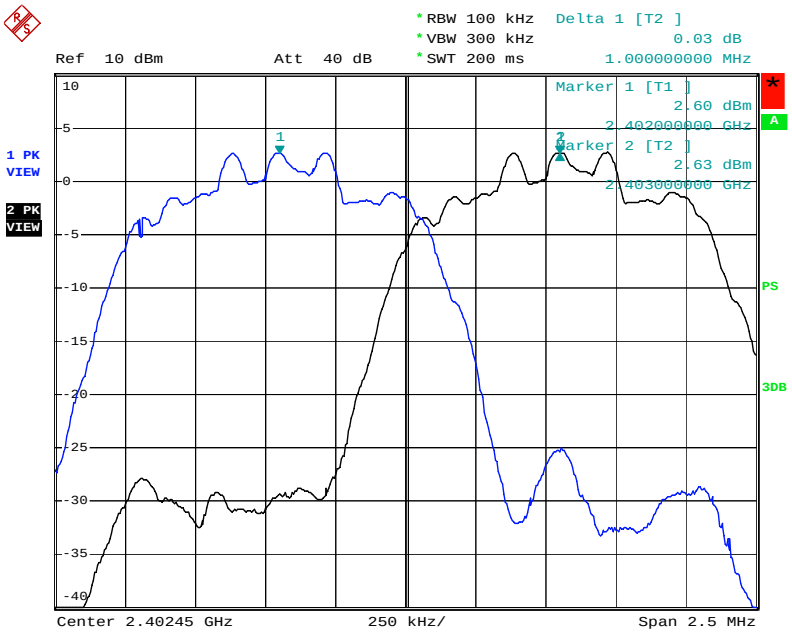
Date: 17.OCT.2009 10:09:36

Channel separation used Plot on Configuration QPSK/78 CH (2 480 MHz)



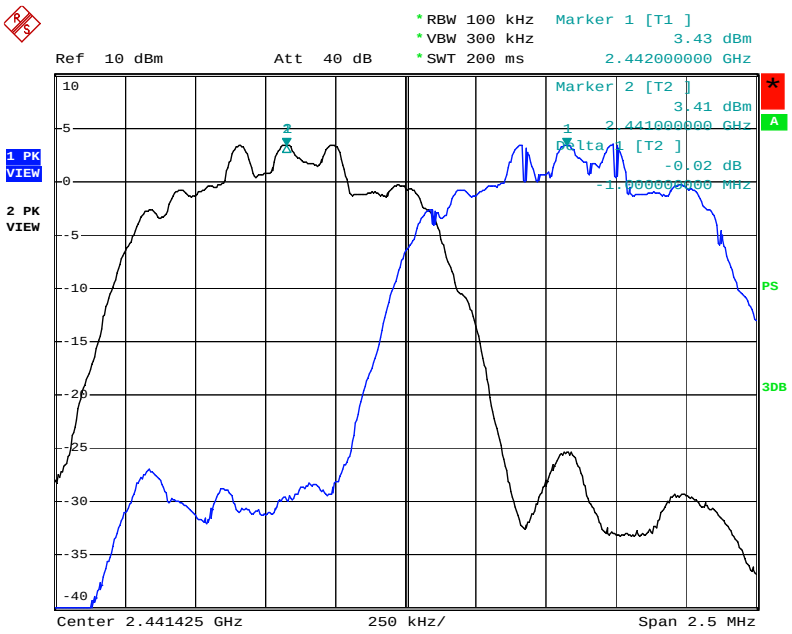
Date: 17.OCT.2009 10:11:30

Channel separation used Plot on Configuration 8-DPSK/0 CH (2 402 MHz)



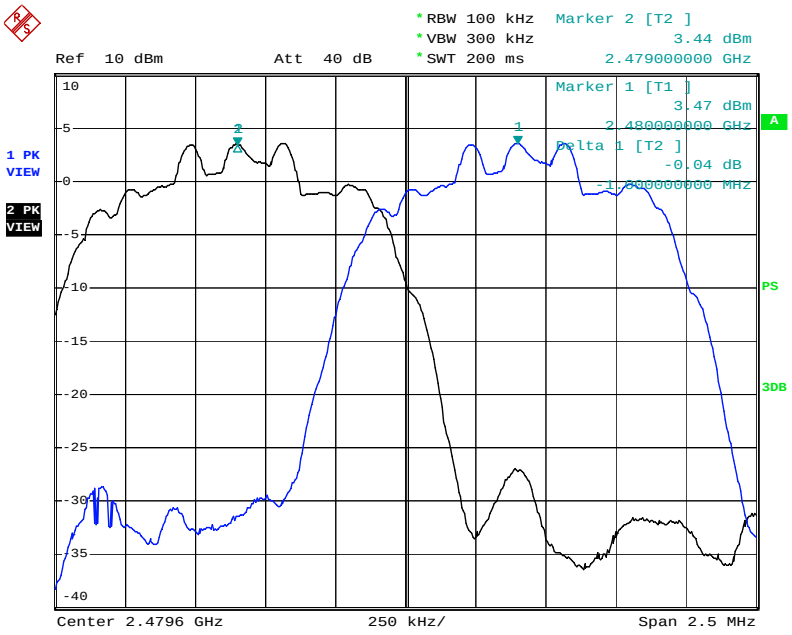
Date: 17.OCT.2009 10:06:11

Channel separation used Plot on Configuration 8-DPSK/39 CH (2 441 MHz)



Date: 17.OCT.2009 10:04:32

Channel separation used Plot on Configuration 8-DPSK/78 CH (2 480 MHz)



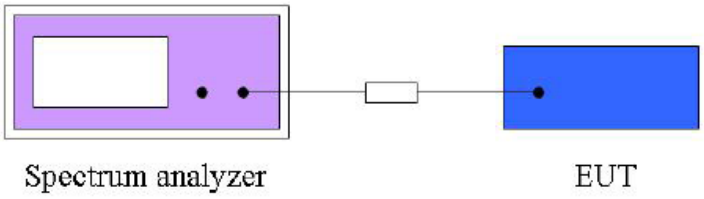
Date: 17.OCT.2009 10:02:37

10. MAXIMUM PEAK OUTPUT POWER

10.1 Operating Environment

Temperature : 21.0 °C
Relative Humidity : 45.0 % R.H.

10.2 Test Set-up (Layout)



10.3 Limit

The maximum peak output power measurement is 125 mW

10.4 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009

10.5 Test Result

-. Test Date : October 17, 2009
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(b)
-. Modulation : GFSK, QPSK, 8-DPSK
-. Operating Condition : Bluetooth RF transmitting mode
-. Power Source : DC 3.7 V supplied from the lithium polymer battery

Spectrum Parameter
-. Attenuation : Auto
-. Span frequency : 40 MHz
-. Resolution band width : 3 MHz
-. Video band with : 10 MHz
-. Sweep time : 300 ms

For GFSK (DH5)

Channel	Channel frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Limit (mW)	Result
0	2 402	4.08	2.55	125	Complies
39	2 441	4.91	3.09	125	Complies
78	2 480	5.18	3.29	125	Complies

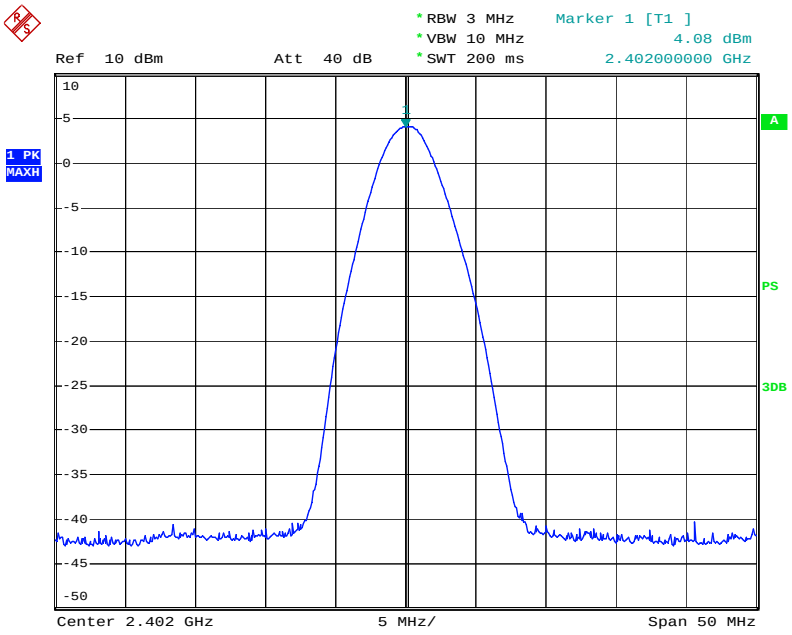
For QPSK (2-DH5)

Channel	Channel frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Limit (mW)	Result
0	2 402	3.23	2.10	125	Complies
39	2 441	4.05	2.54	125	Complies
78	2 480	4.18	2.61	125	Complies

For 8-DPSK (3-DH5)

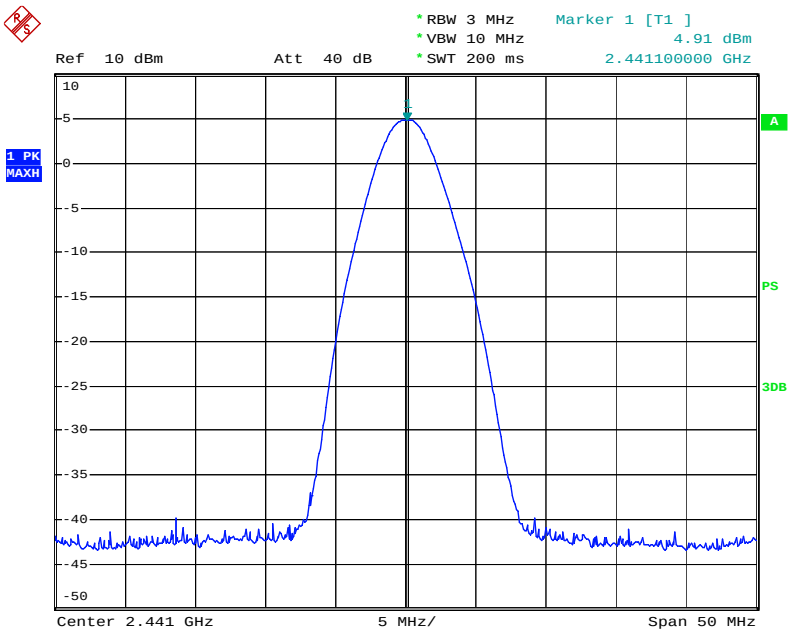
Channel	Channel frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Limit (mW)	Result
0	2 402	3.38	2.17	125	Complies
39	2 441	4.24	2.65	125	Complies
78	2 480	4.39	2.74	125	Complies

Maximum peak output power used Plot on Configuration GFSK/0 CH (2 402 MHz)



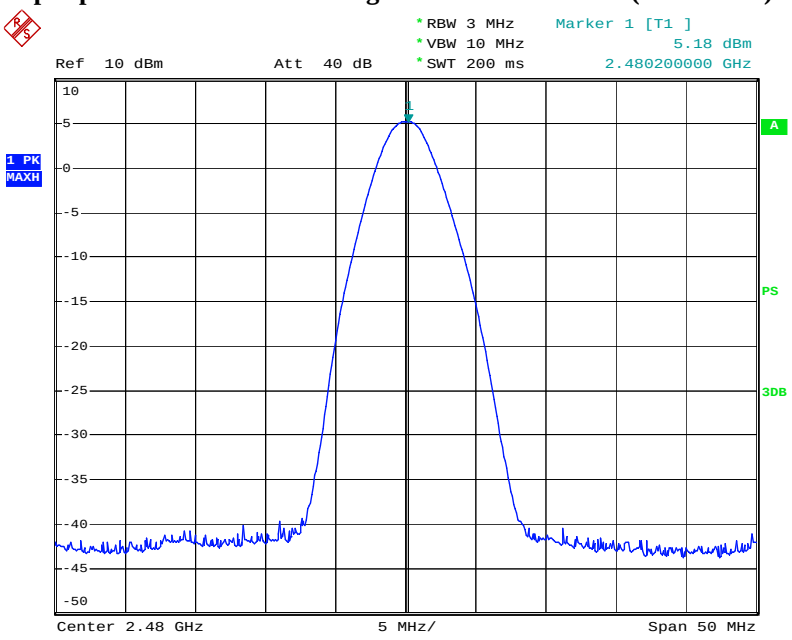
Date: 17.OCT.2009 10:33:08

Maximum peak output power used Plot on Configuration GFSK/39 CH (2 441 MHz)



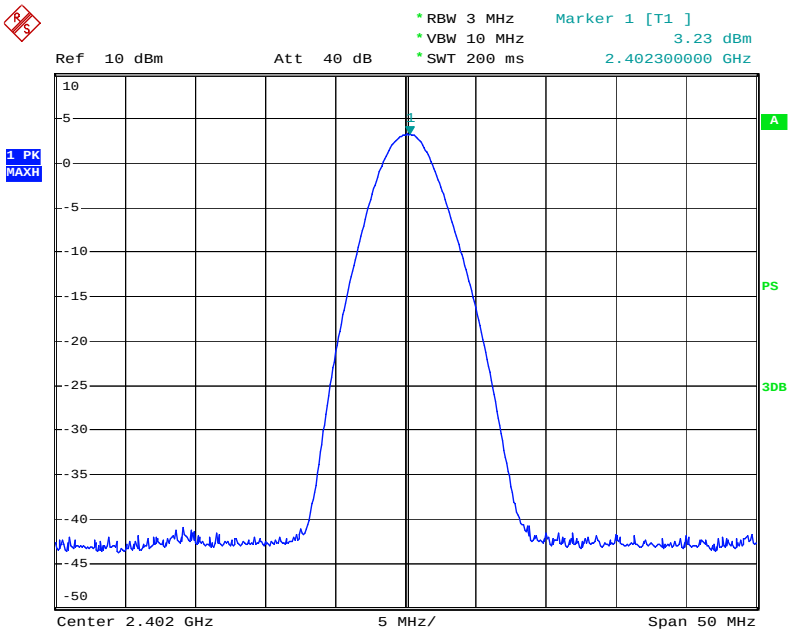
Date: 17.OCT.2009 10:33:47

Maximum peak output power used Plot on Configuration GFSK/78 CH (2 480 MHz)



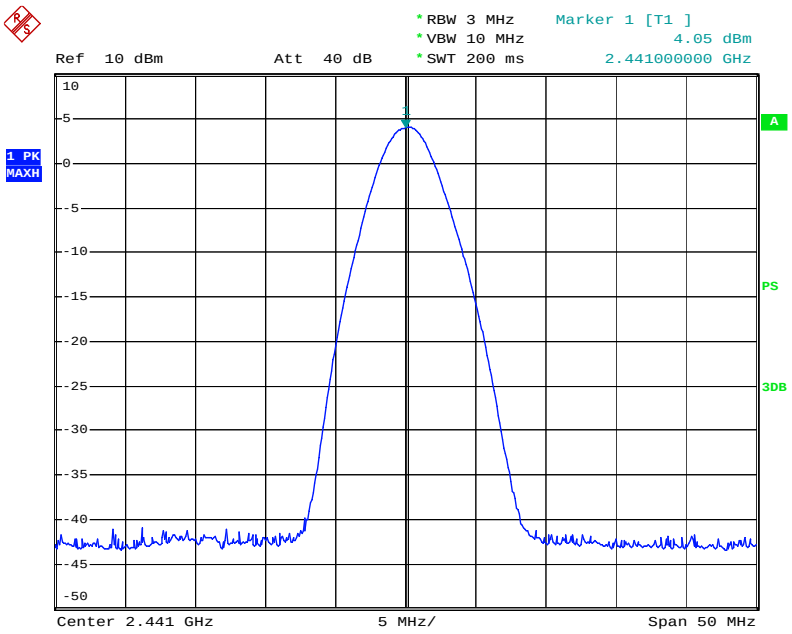
Date: 17.OCT.2009 10:34:14

Maximum peak output power used Plot on Configuration QPSK/0 CH (2 402 MHz)



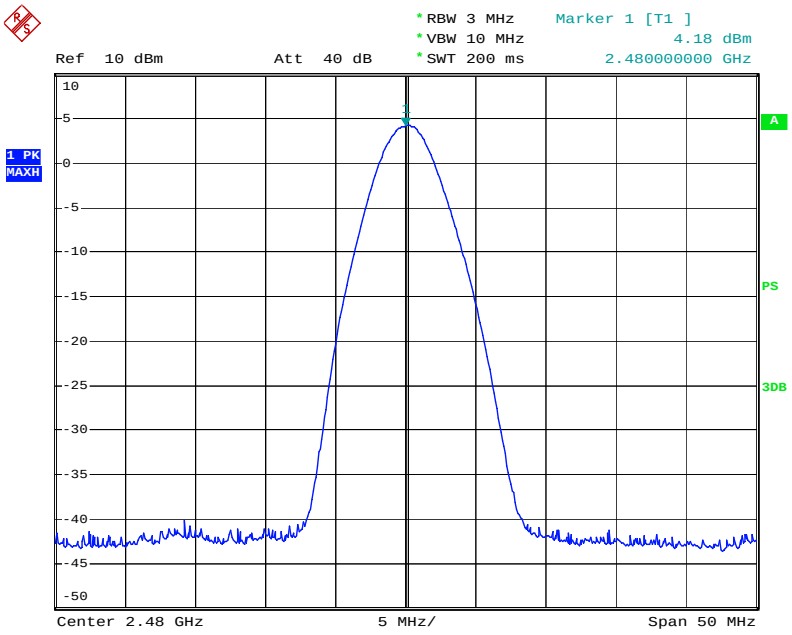
Date: 17.OCT.2009 10:36:20

Maximum peak output power used Plot on Configuration QPSK/39 CH (2 441 MHz)



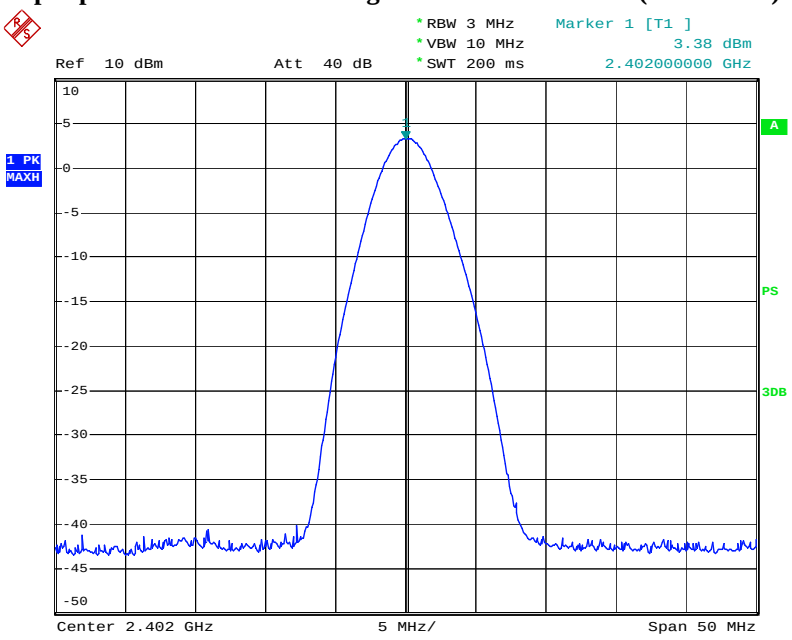
Date: 17.OCT.2009 10:35:49

Maximum peak output power used Plot on Configuration QPSK/78 CH (2 480 MHz)



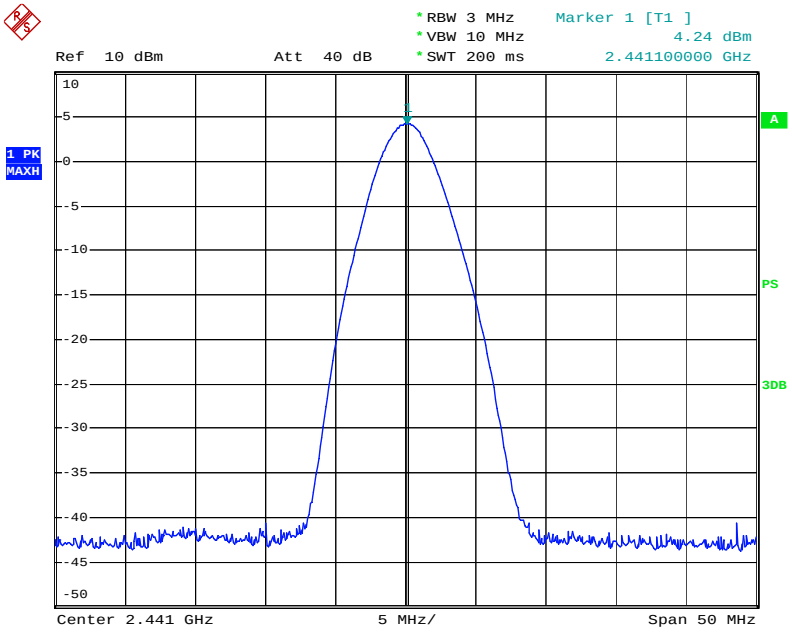
Date: 17.OCT.2009 10:35:13

Maximum peak output power used Plot on Configuration 8-DPSK/0 CH (2 402 MHz)



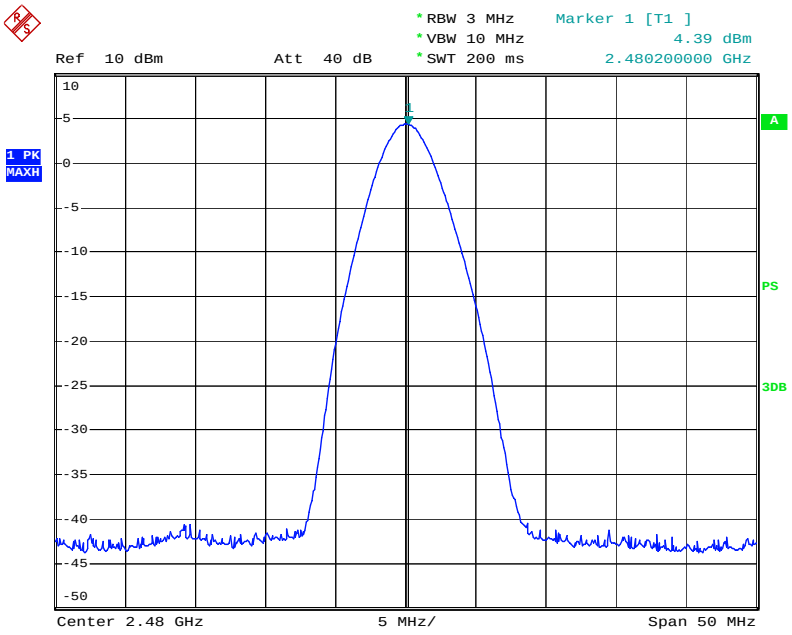
Date: 17.OCT.2009 10:38:20

Maximum peak output power used Plot on Configuration 8-DPSK/39 CH (2 441 MHz)



Date: 17.OCT.2009 10:39:04

Maximum peak output power used Plot on Configuration 8-DPSK/78 CH (2 480 MHz)



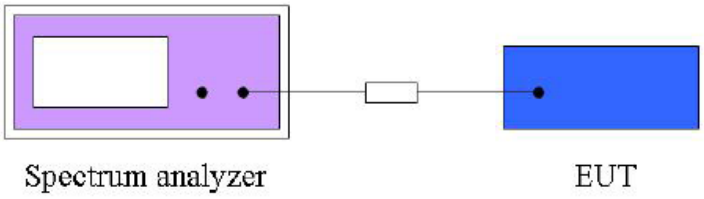
Date: 17.OCT.2009 10:39:30

11. BAND EDGES MEASUREMENT

11.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 42.0 % R.H.

11.2 Test Set-up (Layout)



11.3 Limit

Below -20 dB of the highest emission level of operating band (in 100 kHz resolution band width)

11.4 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009

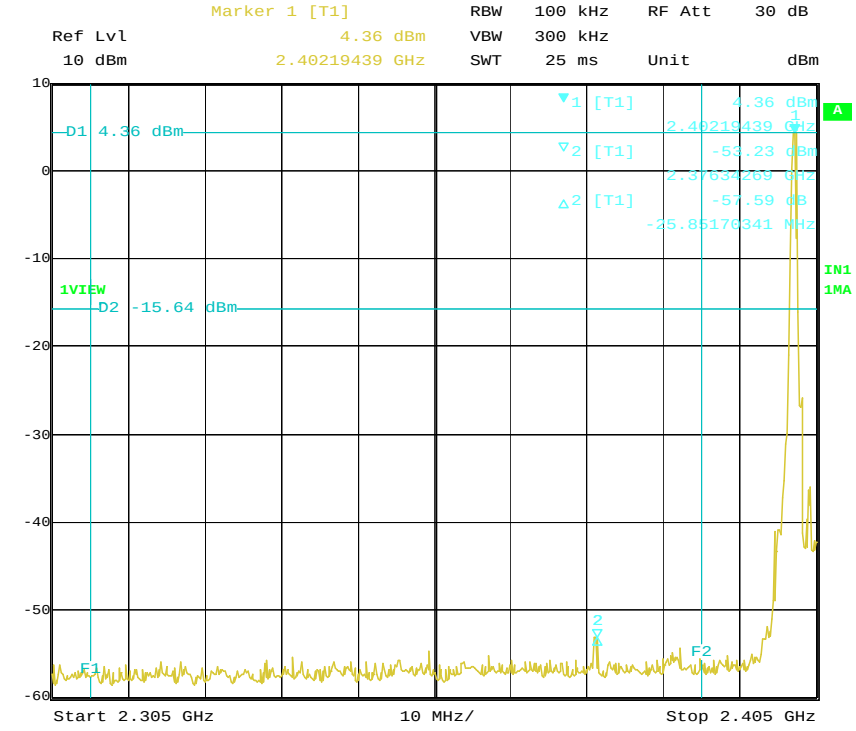
11.5 Test Result

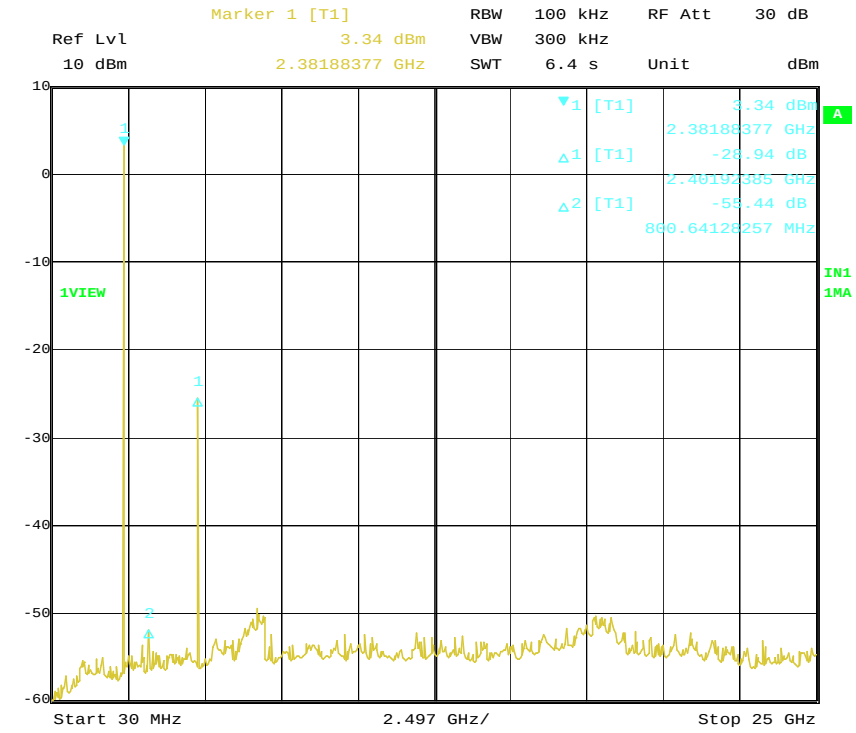
-. Test Date : October 27, 2009
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(d)
-. Modulation : GFSK, QPSK, 8-DPSK
-. Operating Condition : Bluetooth RF transmitting mode
-. Power Source : DC 3.7 V supplied from the lithium polymer battery

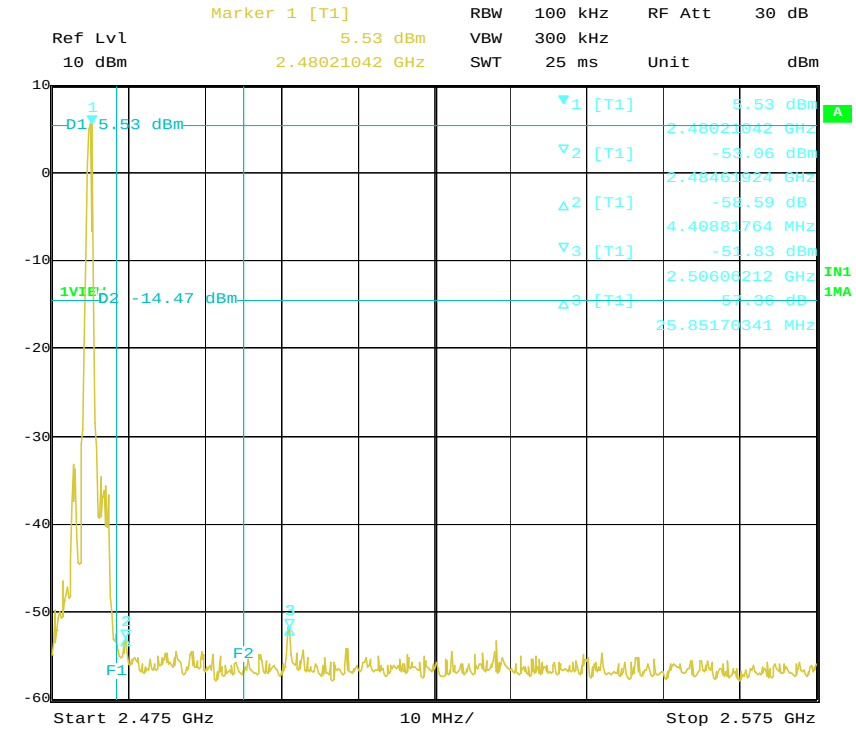
The spectrum plots are attached on the following 8 images. D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement in part 15.247(d)

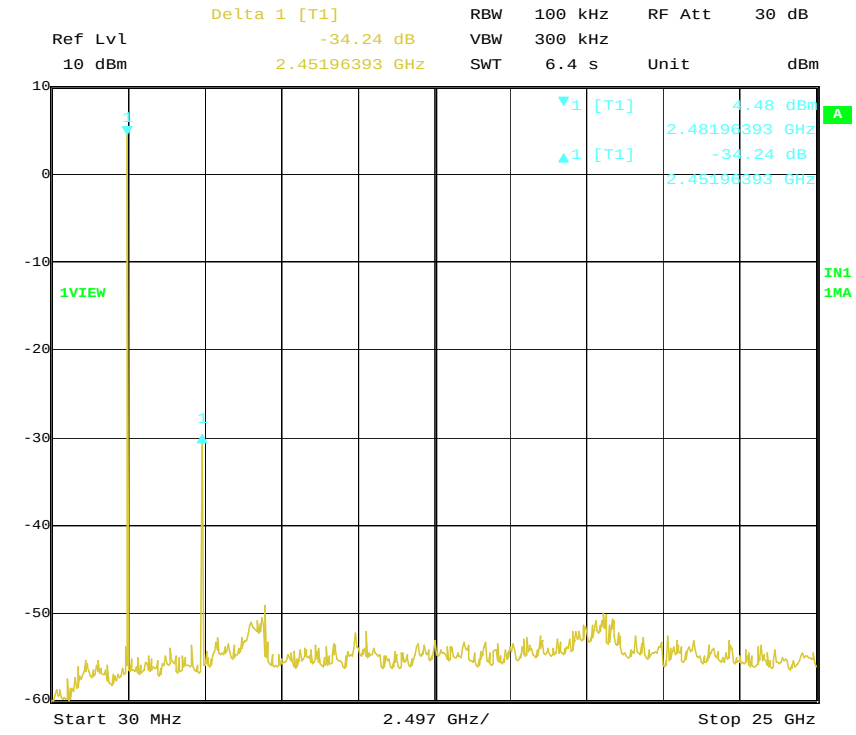
Spectrum Parameter
-. Attenuation : Auto
-. Resolution band width : 100 kHz
-. Video band with : 100 kHz

Band edge used Plot on Configuration GFSK

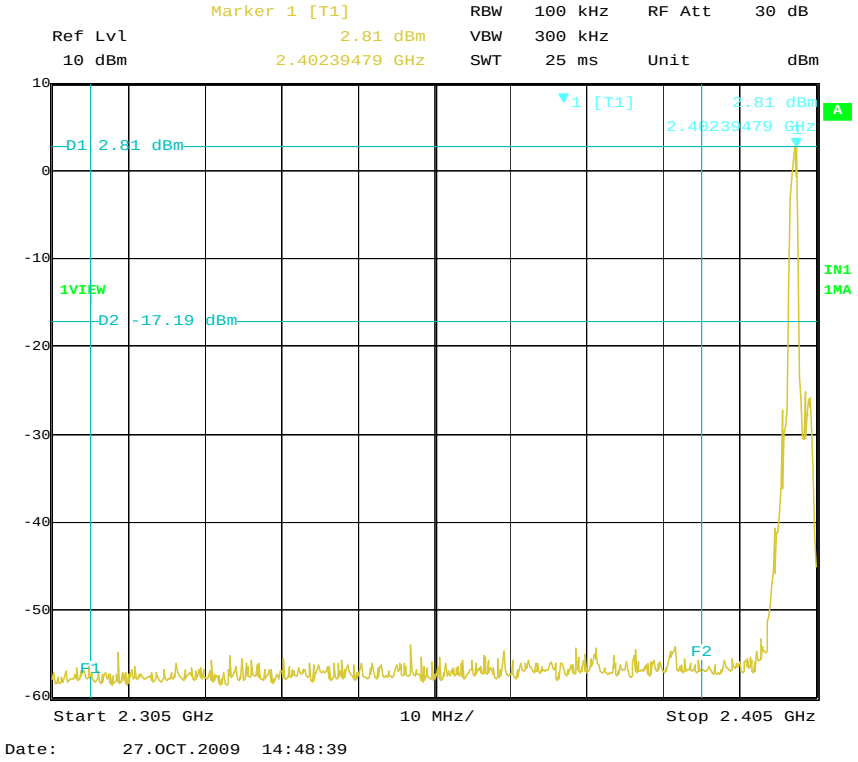


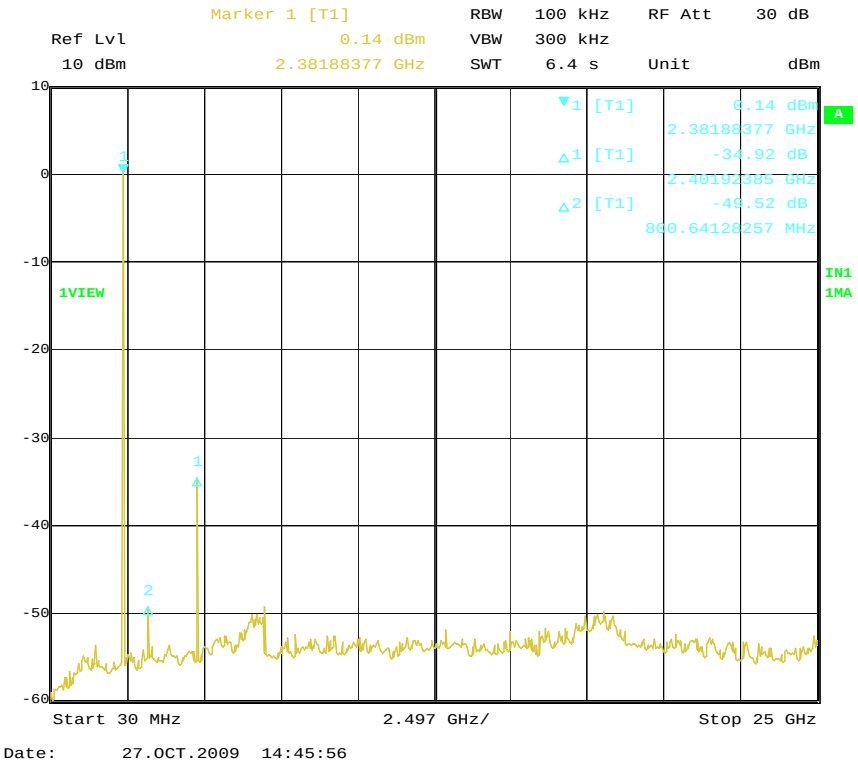


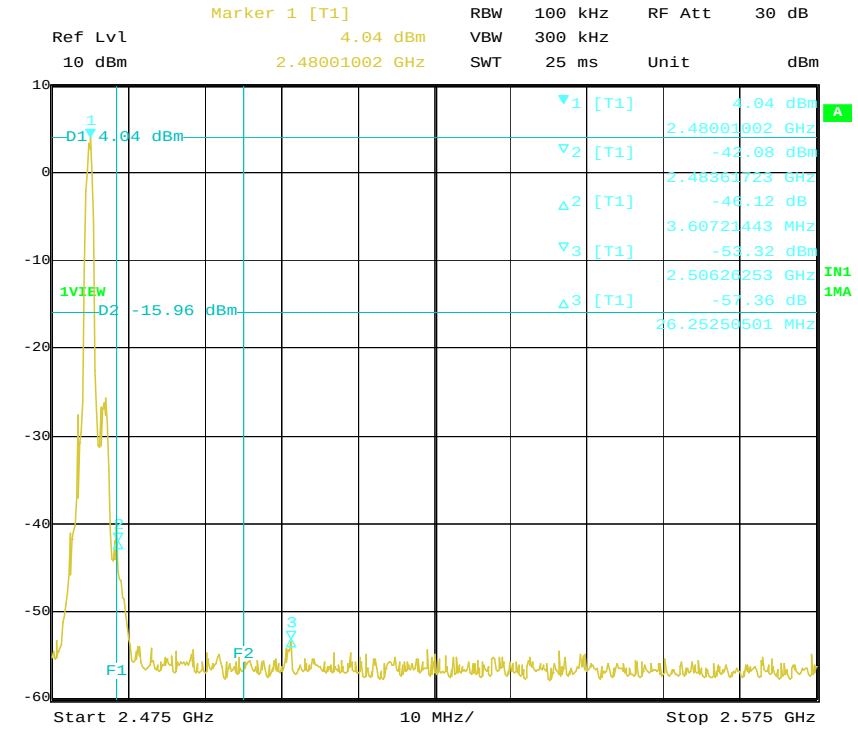

Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
5.53 dBm
VBW 300 kHz
10 dBm
2.48021042 GHz
SWT 25 ms
Unit dBm
D1 5.53 dBm
D2 -14.47 dBm
1VIEW
1 [T1] 5.53 dBm
2.48021042 GHz
2 [T1] -53.06 dBm
2.48461924 GHz
Δ2 [T1] -58.59 dB
4.40881764 MHz
3 [T1] -51.83 dBm
2.50606212 GHz
Δ3 [T1] -57.36 dB
25.85170341 MHz
A
IN1
1MA
F1
F2
Start 2.475 GHz
10 MHz/
Stop 2.575 GHz
Date: 27.OCT.2009 15:02:27

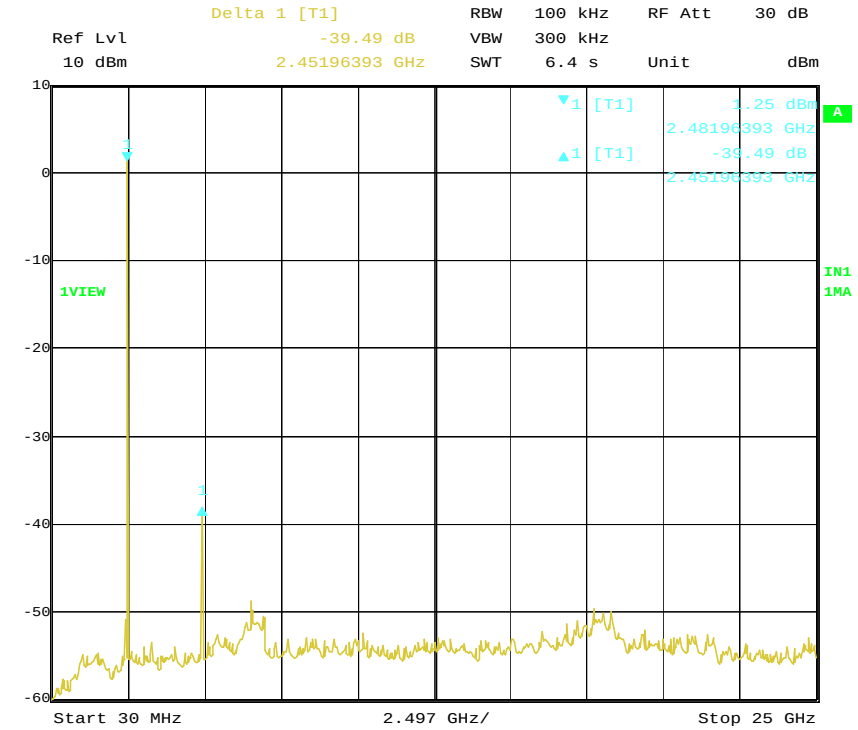

Delta 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-34.24 dB
VBW 300 kHz
10 dBm
2.45196393 GHz
SWT 6.4 s
Unit dBm
1VIEW
1 [T1] 4.48 dBm
2.48196393 GHz
Δ1 [T1] -34.24 dB
2.45196393 GHz
A
IN1
1MA
Start 30 MHz
2.497 GHz/
Stop 25 GHz
Date: 27.OCT.2009 14:58:26

Band edge used Plot on Configuration QPSK

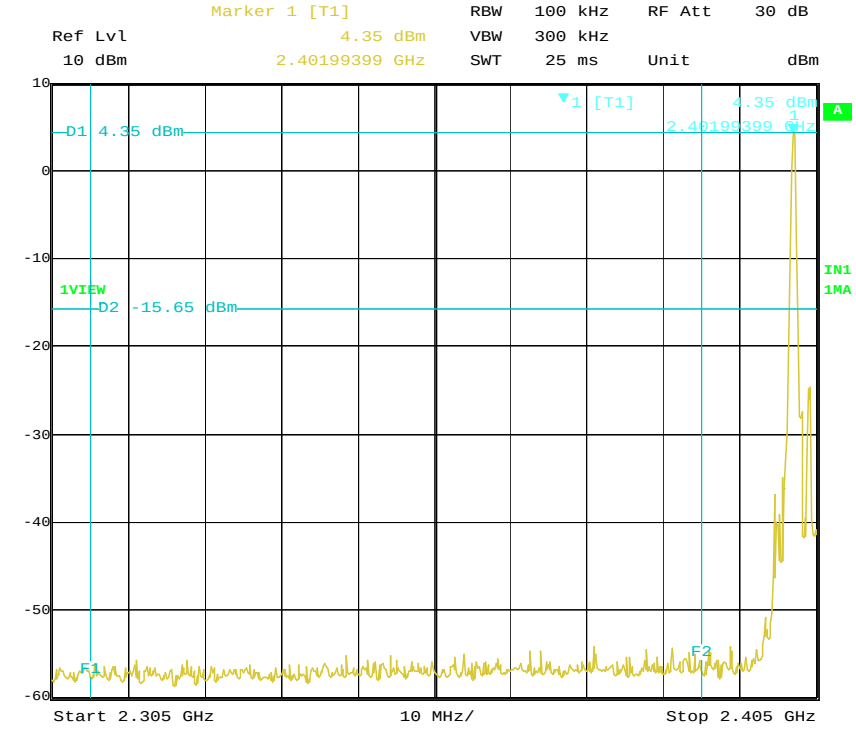


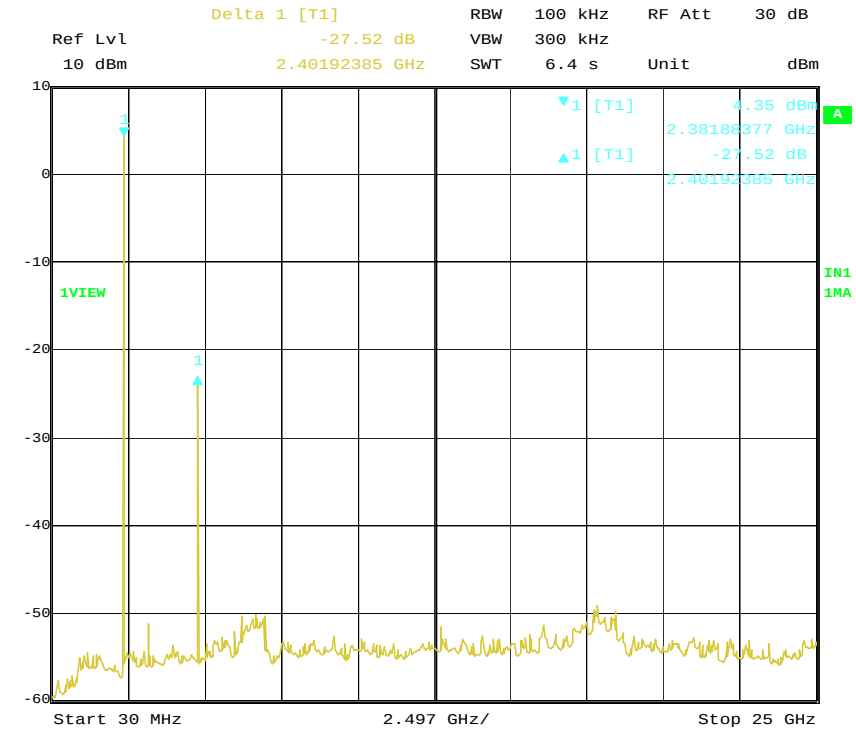


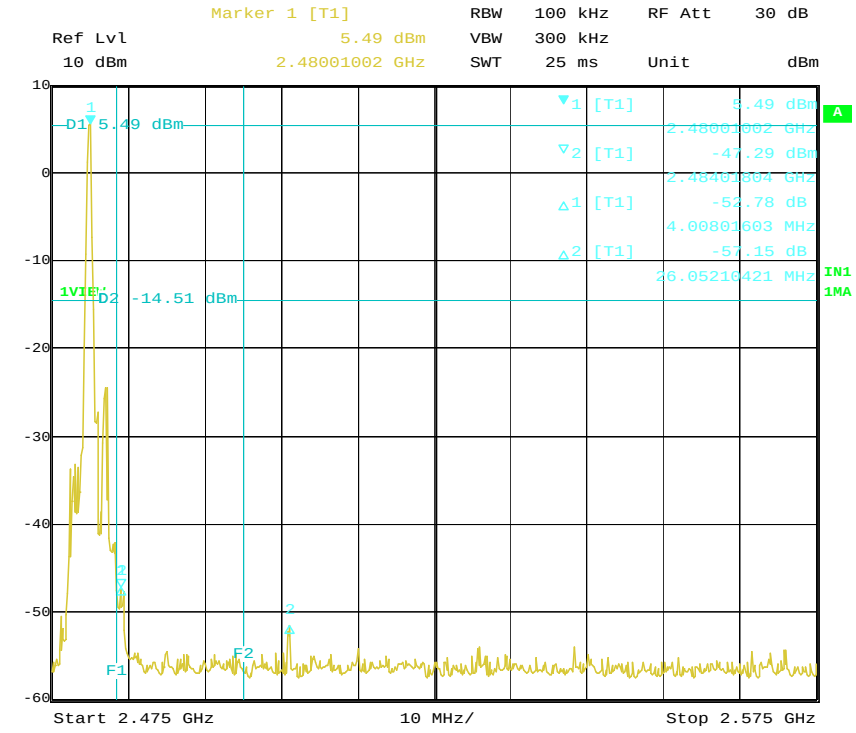

Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
4.04 dBm
VBW 300 kHz
10 dBm
2.48001002 GHz
SWT 25 ms
Unit dBm
1 [T1] 4.04 dBm
2.48001002 GHz
2 [T1] -42.08 dBm
2.48361723 GHz
2 [T1] -46.12 dB
3.60721443 MHz
3 [T1] -53.32 dBm
2.50620253 GHz
3 [T1] -57.36 dB
26.25250501 MHz
D1 4.04 dBm
D2 -15.96 dBm
1VIEW
A
IN1
1MA
10
0
-10
-20
-30
-40
-50
-60
F1
F2
Start 2.475 GHz
10 MHz/
Stop 2.575 GHz
Date: 27.OCT.2009 14:52:49

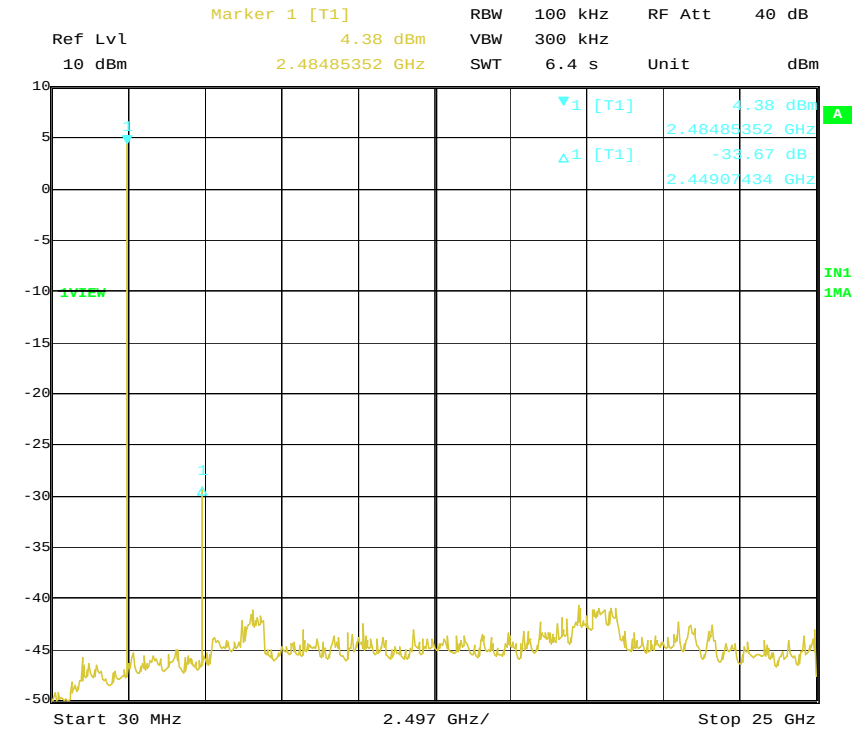

Delta 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
-39.49 dB
VBW 300 kHz
10 dBm
2.45196393 GHz
SWT 6.4 s
Unit dBm
1 [T1] 1.25 dBm
2.48196393 GHz
1 [T1] -39.49 dB
2.45196393 GHz
1VIEW
A
IN1
1MA
10
0
-10
-20
-30
-40
-50
-60
Start 30 MHz
2.497 GHz/
Stop 25 GHz
Date: 27.OCT.2009 14:55:04

Band edge used Plot on Configuration 8-DPSK






Marker 1 [T1]
RBW 100 kHz
RF Att 30 dB
Ref Lvl
5.49 dBm
VBW 300 kHz
10 dBm
2.48001002 GHz
SWT 25 ms
Unit dBm
D1 5.49 dBm
D2 -14.51 dBm
1VIEW
1 [T1] 5.49 dBm
2.48001002 GHz
2 [T1] -47.29 dBm
2.48401604 GHz
Δ1 [T1] -52.78 dB
4.00801603 MHz
Δ2 [T1] -57.15 dB
26.05210421 MHz
A
IN1
1MA
F1
F2
Start 2.475 GHz
10 MHz/
Stop 2.575 GHz
Date: 27.OCT.2009 14:31:30


Marker 1 [T1]
RBW 100 kHz
RF Att 40 dB
Ref Lvl
4.38 dBm
VBW 300 kHz
10 dBm
2.48485352 GHz
SWT 6.4 s
Unit dBm
1VIEW
1 [T1] 4.38 dBm
2.48485352 GHz
Δ1 [T1] -33.67 dB
2.44907434 GHz
A
IN1
1MA
Start 30 MHz
2.497 GHz/
Stop 25 GHz
Date: 27.OCT.2009 13:49:56

12. Radiated Emission

12.1 Operating Environment

Temperature : 6.0 °C
Relative Humidity : 38.0 % R.H.

12.2 Test Set-up

The formal radiated emission was measured at 3 m distance open area test site.
The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane.
The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.
This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

12.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.
The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3m, Vertical)	± 3.54 dB	Confidence levels of 95 % (k=2)
Radiated emission (30 MHz ~ 300 MHz, 3m, Horizontal)	± 3.49 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 3m, Vertical)	± 3.70 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 3m, Horizontal)	± 3.61 dB	Confidence levels of 95 % (k=2)
Radiated emission (30 MHz ~ 300 MHz, 10m, Vertical)	± 3.21 dB	Confidence levels of 95 % (k=2)
Radiated emission (30 MHz ~ 300 MHz, 10m, Horizontal)	± 3.32 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 10m, Vertical)	± 3.63 dB	Confidence levels of 95 % (k=2)
Radiated emission (300 MHz ~ 1 000 MHz, 10m, Horizontal)	± 3.69 dB	Confidence levels of 95 % (k=2)

12.4 Limit

20 dB in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F (kHz)	300
0.490~1.705	2400/F (kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

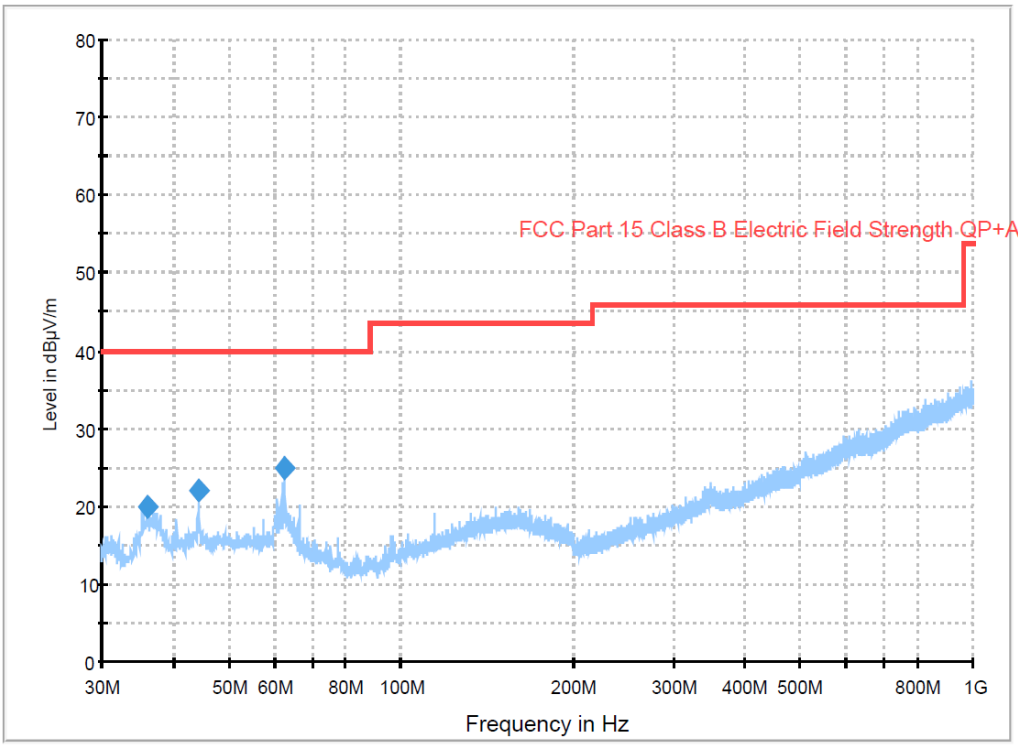
12.5 Test Equipment used

	Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ -	ESI	Rohde & Schwarz	EMI test receiver	830482/010	12. 14. 2009
■ -	HK116	Rohde & Schwarz	Biconical ANT	832639/007	12. 28. 2009
■ -	HL223	Rohde & Schwarz	Log-periodic antenna	835998/004	12. 28. 2009
■ -	HD100	HD GmbH	Position Controller	100/692/01	N/A
■ -	DS415S	HD GmbH	Turntable	415/657/01	N/A
■ -	MA240	HD GmbH	Antenna Mast	240/565/01	N/A
■ -	BBHA9120D	Schwarzbeck	Horn antenna	597	12.18. 2010
■ -	3160	EMCO	Horn antenna	6741	12.26. 2009
■ -	AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258943	N/A
■ -	8449B	Agient	Amplifier	3008A01828	N/A

12.6 Radiated emission test data

-. Test Date : October 28, 2009
-. Reference Standard : Part 15 Subpart C, Sec. 15.247(d)
-. Modulation / Channel : GFSK (0 CH / 39 CH / 78 CH), QPSK (0 CH / 39 CH / 78 CH), 8-DPSK (0 CH / 39 CH / 78 CH)
-. Operating Condition : Bluetooth RF transmitting mode
-. Measuring Distance : 3 m
-. Spectrum Resolution Bandwidth(6dB) : 120 kHz / 1 MHz
-. Detector mode : Peak detector mode / Quasi Peak detector mode / Average detector mode
-. Power Source : DC 3.7 V supplied from the lithium polymer battery
-. Note : 1. Through three orthogonal axes were investigated and the worst case is report
2. The EUT was tested with new battery.

Worst case result of radiated emission (30 MHz to 1 000 MHz): GFSK



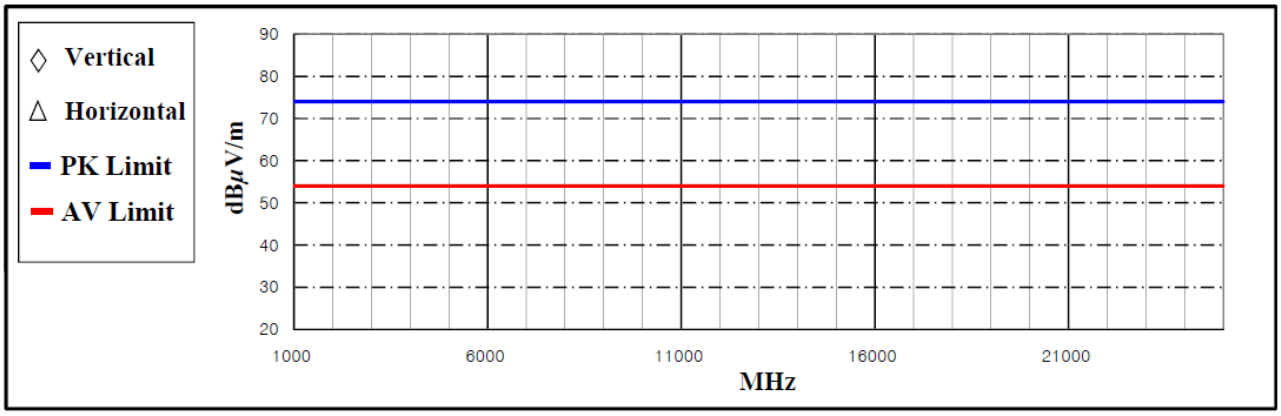
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
36.120000	19.9	1000.0	120.000	110.0	V	151.0	12.1	20.1	40.0
44.240000	22.1	1000.0	120.000	100.0	V	34.0	13.2	17.9	40.0
62.680000	25.0	1000.0	120.000	100.0	V	225.0	12.5	15.0	40.0

Note:
The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBμV/m) = 20 log Emission level (μV/m).
Corrected Reading: Antenna Factor + Cable Loss + Read value = Test result

Worst case result of radiated emission (1 GHz to 25 GHz): GFSK

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
All frequency					<<	<<							



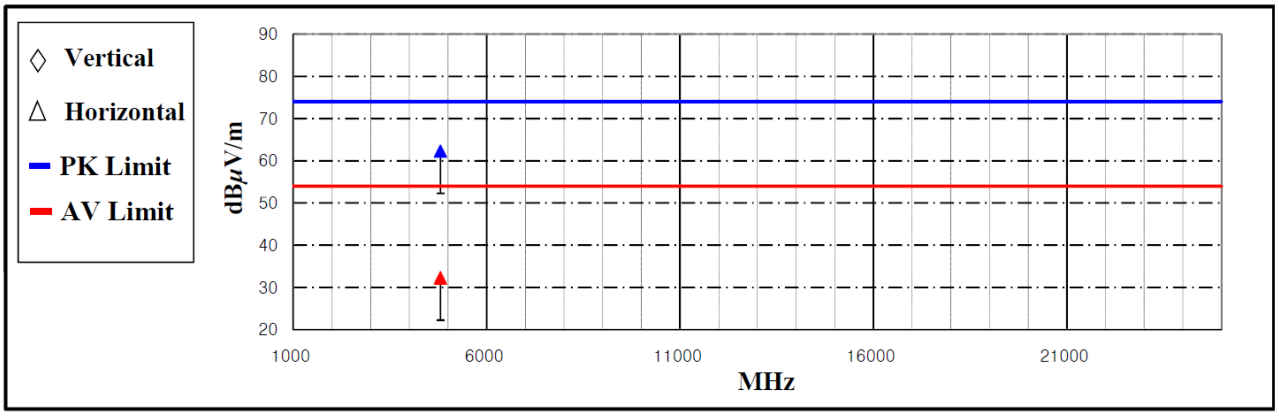
*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

Note:
The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.
Emission level (dBμV/m) = 20 log Emission level (μV/m).
Corrected reading: Antenna factor + Cable loss + Preamplifier gain + Read value = Test result

Result of radiated emission (1 GHz to 10th harmonics)

(GFSK, 0 CH / 2402 MHz)

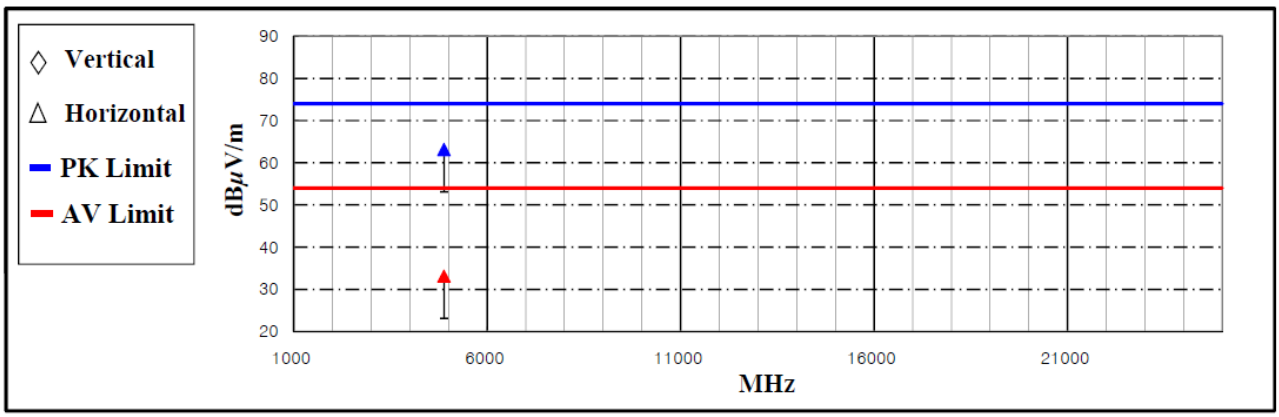
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4804.00	64.72	34.72	31.35	-33.77	**62.30**	**32.30**	**74.00**	**54.00**	**11.70**	**21.70**	**H**	**102**	**94**



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(GFSK, 39 CH / 2441 MHz)

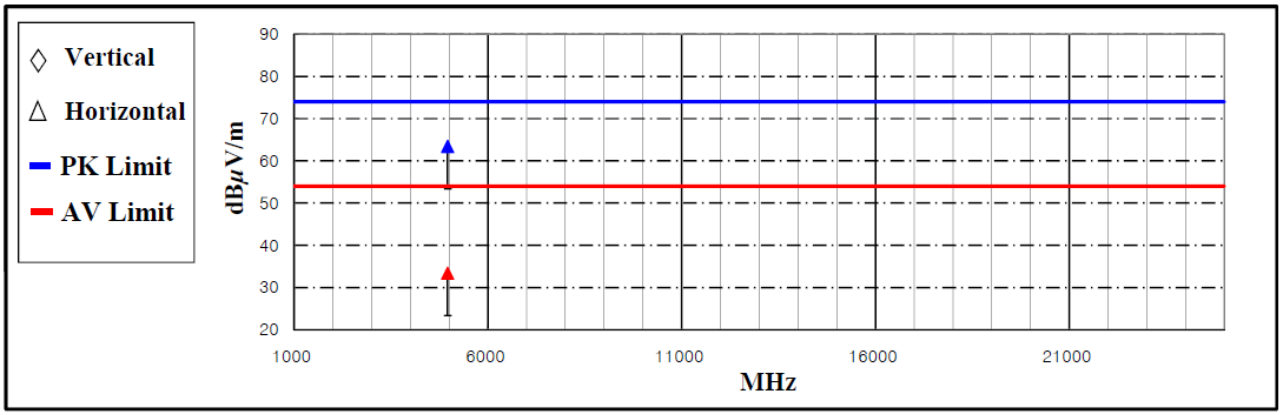
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4882.00	65.77	35.77	31.52	-34.16	**63.13**	**33.13**	**74.00**	**54.00**	**10.87**	**20.87**	**H**	**102**	**94**



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(GFSK, 78 CH / 2480 MHz)

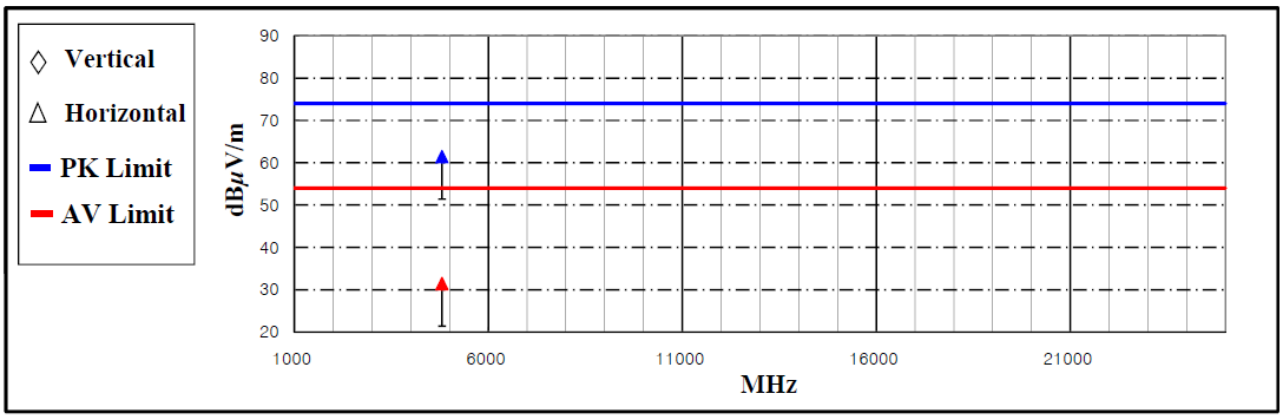
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4960.00	65.91	35.91	31.70	-34.21	63.40	33.40	74.00	54.00	10.60	20.60	H	102	94



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(QPSK, 0 CH / 2402 MHz)

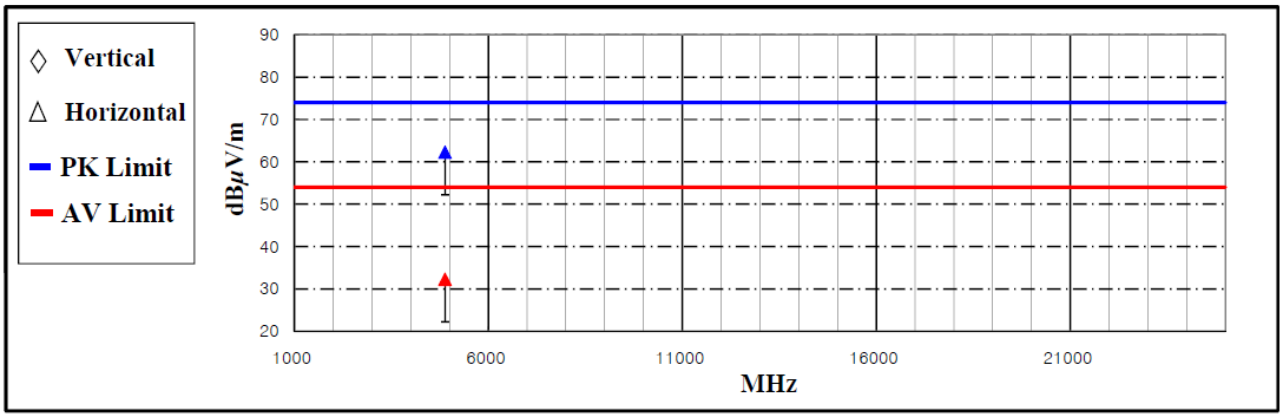
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4804.00	63.87	33.87	31.35	-33.77	61.45	31.45	74.00	54.00	12.55	22.55	H	105	92



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(QPSK, 39 CH / 2441 MHz)

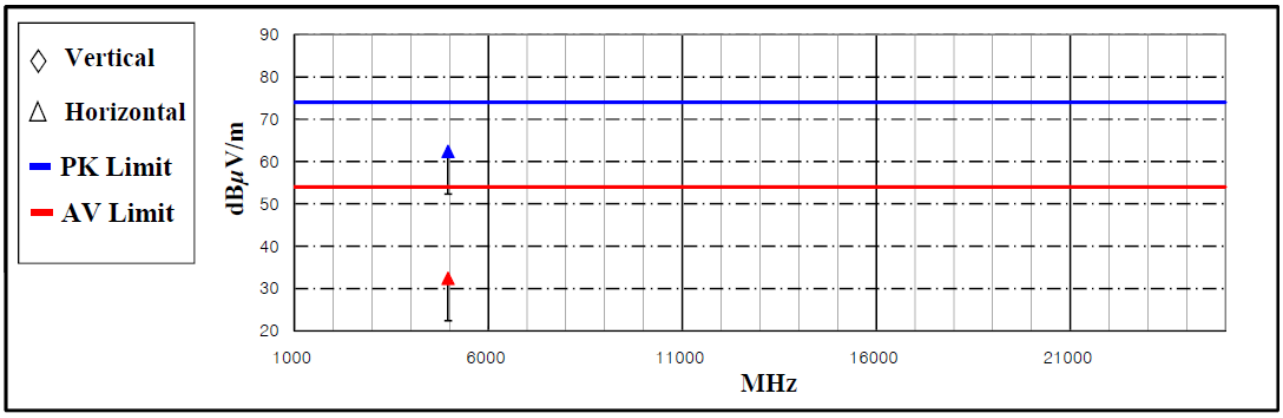
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4882.00	64.91	34.91	31.52	-34.16	62.27	32.27	74.00	54.00	11.73	21.73	H	105	92



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(QPSK, 78 CH / 2480 MHz)

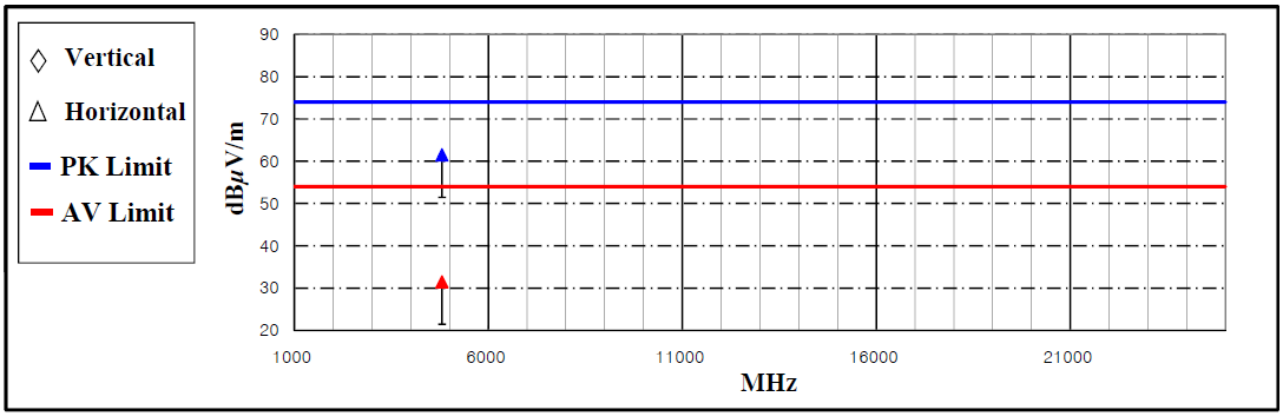
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4960.00	64.91	34.91	31.70	-34.21	62.40	32.40	74.00	54.00	11.60	21.60	H	105	92



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(8-DPSK, 0 CH / 2402 MHz)

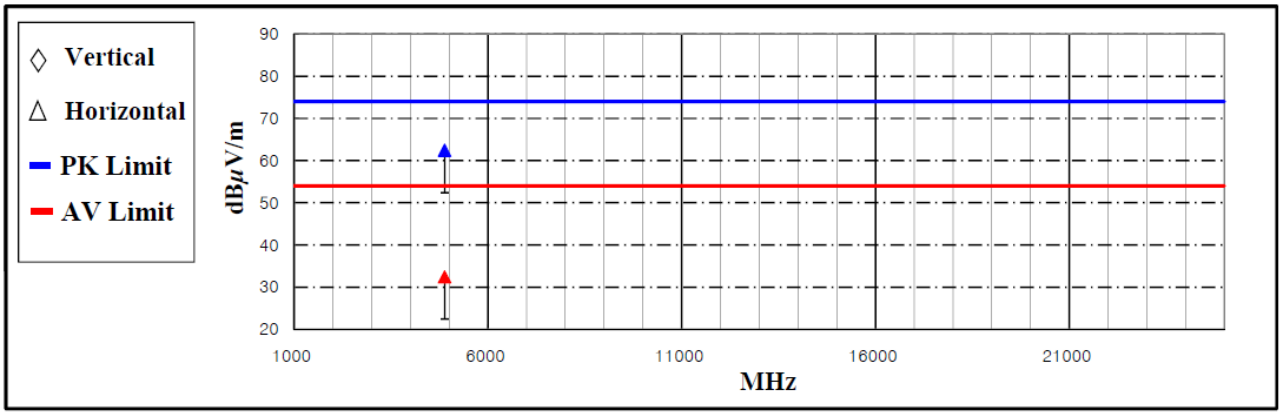
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4804.00	63.92	33.92	31.35	-33.77	61.50	31.50	74.00	54.00	12.50	22.50	H	104	96



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(8-DPSK, 39 CH / 2441 MHz)

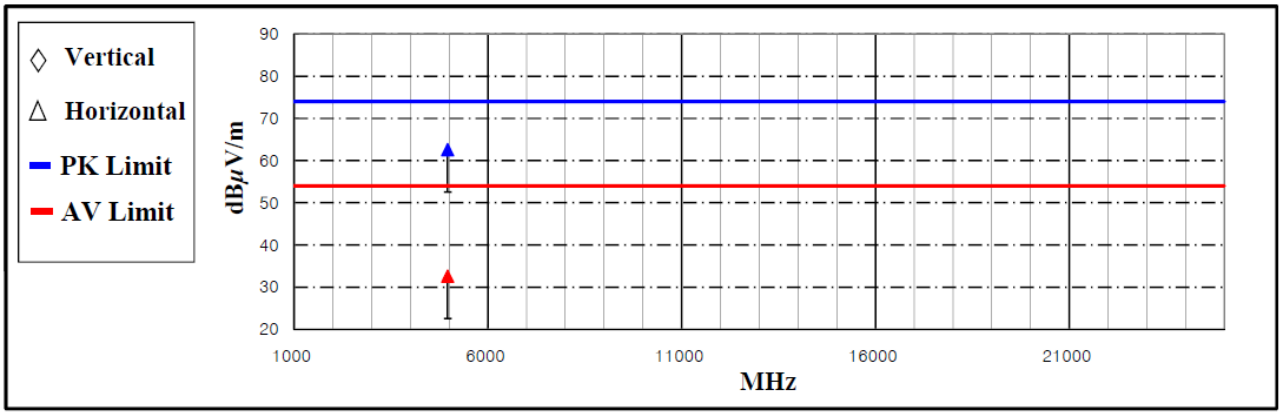
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4882.00	65.10	35.10	31.52	-34.16	62.46	32.46	74.00	54.00	11.54	21.54	H	104	96



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

(8-DPSK, 78 CH / 2480 MHz)

Frequency (MHz)	Measurement Level						Limit (dBμV/m)		Margin (dB)		Positioning System		
	Reading Value (dBμV/m)		AF	AMP / CL	Test Result (dBμV/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4960.00	65.12	35.12	31.70	-34.21	62.61	32.61	74.00	54.00	11.39	21.39	H	104	96



*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)

Note:
The DH5 packet was the worse case duty for a transmit dwell time on a each channel, based upon Bluetooth theory the transmitter is on 0.625 * 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor is equal to:
20log (3.125/100) = -30 dB.
Average value = peak reading – 20log (duty cycle) = peak value – 30 dB
Emission level (dBμV/m) = 20 log Emission level (μV/m).
Corrected Reading: Reading value + AF (Antenna Factor) +AMP/CL (Cable Loss + Preamp factor) = Test result