

FCC EVALUATION REPORT FOR CERTIFICATION

Applicant: 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: June 14, 2011

Order Number: GETEC-C1-11-056

Test Report Number: GETEC-E3-11-022

Test Site: Gumi College EMC Center

FCC Registration Number: (100749, 443957)

FCC ID. : XX5BHS-100

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 Stereo Headset

Type of Authority : Certification

Model Name : BHS-100

Trade Name : BnCOM

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 best 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,

Reviewed by,



Seung-Chul Lee, Associate Engineer
GUMI College EMC center



Jae-Hoon Jeong, Senior Engineer
GUMI College EMC center



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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 Ojeon-Dong, Uiwang-si,
Gyeonggi-Do, Korea**

Manufacturer: BNCOM Co., Ltd.

**Manufacturer address: Room 1007, Daehyun Techno World, 174 Ojeon-Dong, Uiwang-si,
Gyeonggi-Do, Korea**

Contact person: Mr. Seong-Gon Kim / CEO

Telephone number: +82-31-427-8904 Fax number: +82-31-427-8907

- **FCC ID.** XX5BHS-100
- **Equipment Class** Spread Spectrum Transmitter (DSS)
- **EUT Type** Bluetooth Stereo Headset
- **Model Name** BHS-100
- **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** March 20 ~ April 26, 2011
- **Place of Test** **Gumi College EMC Center** (FCC Registration No.: 100749, 443957)
407, Bugok-Dong, Gumi-si, Gyeongsangbuk-Do, Korea
- **Test Report Number** GETEC-E3-11-022
- **Dates of Issue** June 14, 2011

EUT Type: Bluetooth Stereo Headset

FCC ID.: XX5BHS-100



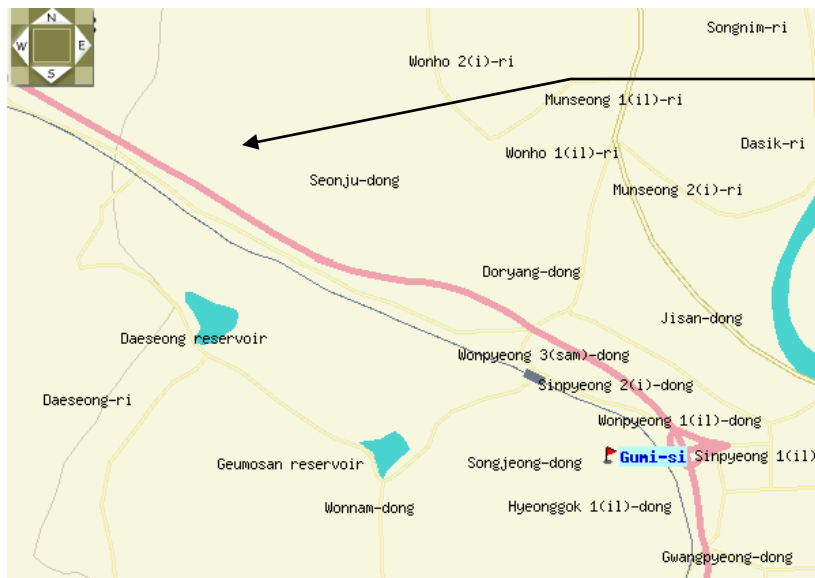
2. Introduction

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 Stereo Headset (Model name: BHS-100)**

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 Daejeon 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



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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 Stereo Headset (Model Name: BHS-100)**
FCC ID.: XX5BHS-100

- . Bluetooth Specification** : Version 2.1
- . Frequency Range** : 2 402 MHz – 2 480 MHz
- . Output Power** : 0.25 mW ~ 2.5 mW
- . Operating Range** : Up to 33 feet (10 m)
- . Dimensions** : 55.6 mm(L) × 17.8 mm(W) × 11 mm(H)
- . Weight** : 9.8 g
- . Battery Type** : DC 3.7 V lithium polymer
- . Frequency List**

Frequency Band (MHz)	Channel	Freq. [MHz]	Channel	Freq. [MHz]	Channel	Freq. [MHz]	Channel	Freq. [MHz]
2 402 ~ 2 480	0	2 402	20	2 422	40	2 442	60	2 462
	1	2 403	21	2 423	41	2 443	61	2 463
	2	2 404	22	2 424	42	2 444	62	2 464
	3	2 405	23	2 425	43	2 445	63	2 465
	4	2 406	24	2 426	44	2 446	64	2 466
	5	2 407	25	2 427	45	2 447	65	2 467
	6	2 408	26	2 428	46	2 448	66	2 468
	7	2 409	27	2 429	47	2 449	67	2 469
	8	2 410	28	2 430	48	2 450	68	2 470
	9	2 411	29	2 431	49	2 451	69	2 471
	10	2 412	30	2 432	50	2 452	70	2 472
	11	2 413	31	2 433	51	2 453	71	2 473
	12	2 414	32	2 434	52	2 454	72	2 474
	13	2 415	33	2 435	53	2 455	73	2 475
	14	2 416	34	2 436	54	2 456	74	2 476
	15	2 417	35	2 437	55	2 457	75	2 477
	16	2 418	36	2 438	56	2 458	76	2 478
	17	2 419	37	2 439	57	2 459	77	2 479
	18	2 420	38	2 440	58	2 460	78	2 480
	19	2 421	39	2 441	59	2 461		



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
Notebook PC	SAMSUNG	NT-Q45	S/N: CNBA4300168AI00682D5800 FCC ID.: N/A

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

3.2.2 System configuration

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

3.2.3 Used Cable(s)

Cable Name	Condition	Description
USB(power) gender cable	Connected to the EUT and notebook PC	1.00 m unshielded

3.3 Modification Item(s)

-. None



4. Description of tests

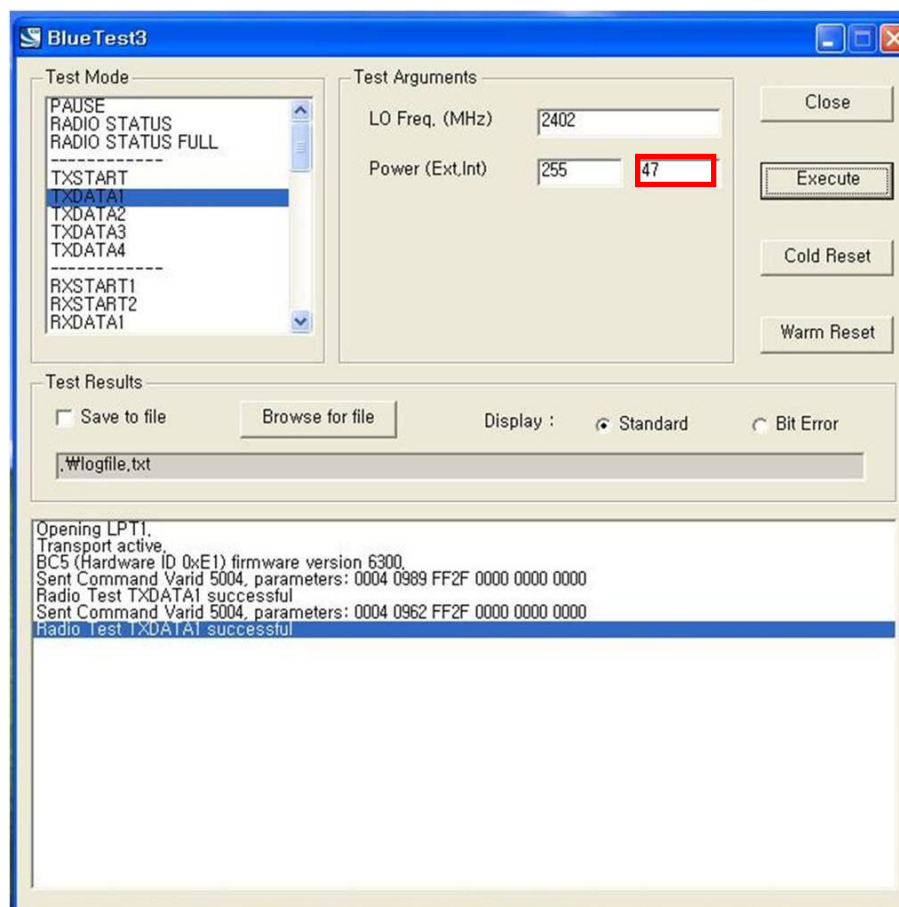
4.1 Test Condition

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:
 - AC 120 V / 60 Hz (Charging mode)
 - DC 3.7 V supplied from the lithium polymer battery
- 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 setting value	47	47	47





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 Stereo Headset** comply with the requirement of §15.203 with a chip 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. (FCC Registration No.: 100749)

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

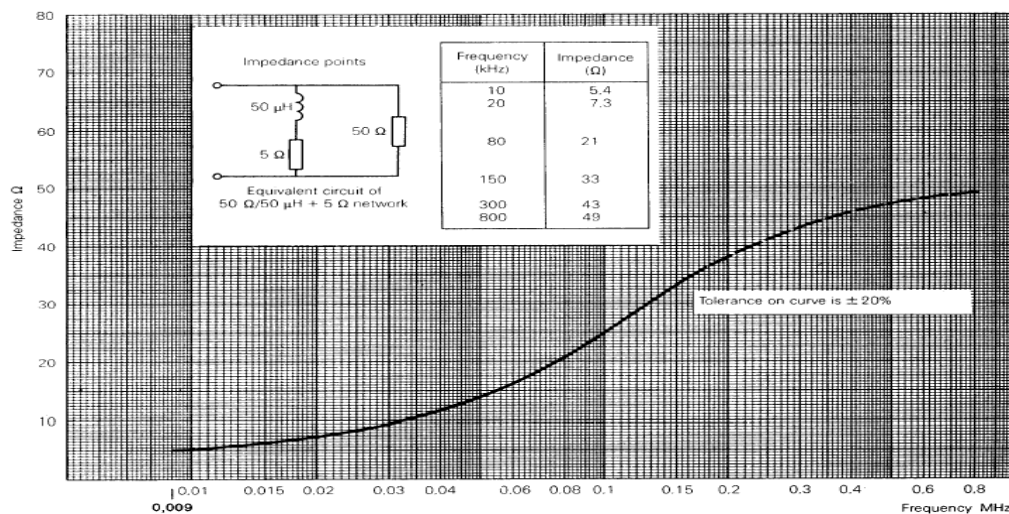


Fig 2. Impedance of LISN



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.

Final measurements were made 3 m chamber (FCC registration No.: 443957) and/or 10 m OATS (FCC registration No.: 100749).

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 1 MHz 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 \times 1.5 m table.

The turntable containing the test sample was rotated; the antenna height was varied 1 to 4 meter and stopped at the azimuth or height producing the maximum emission.

Each EME reported was calibrated using the R/S signal generator

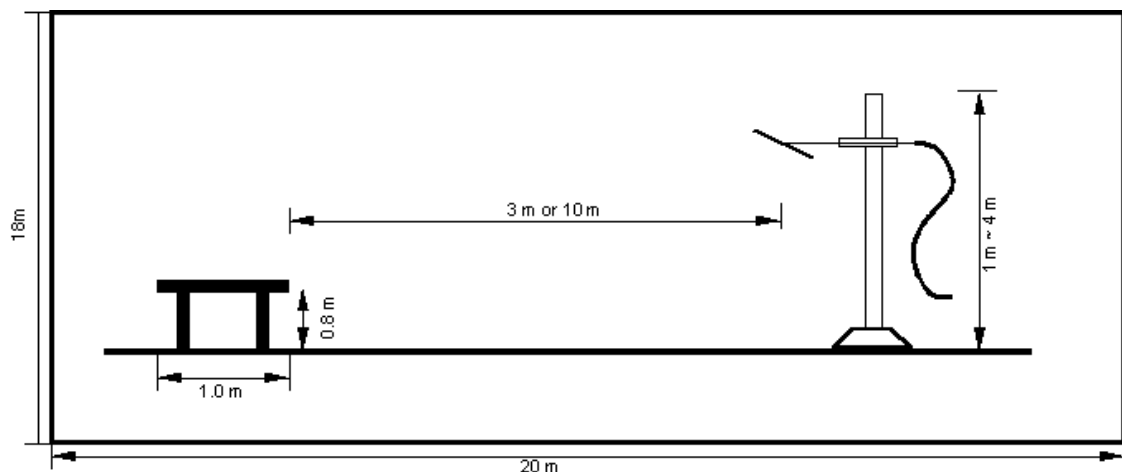


Fig 3. Dimensions of test site.



6. CONDUCTED EMISSION

6.1 Operating Environment

Temperature : 20.0 °C
Relative Humidity : 51.0 % R.H.

6.2 Test Set-up

The conducted emission measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, were filtered.

6.3 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
Conducted emission (9 kHz ~ 150 kHz)	± 2.71 dB	Confidence levels of 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	± 3.34 dB	Confidence levels of 95 % ($k = 2$)



6.4 Limit

RFI Conducted	FCC Limit(dB μ V/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

6.5 Test Equipment used

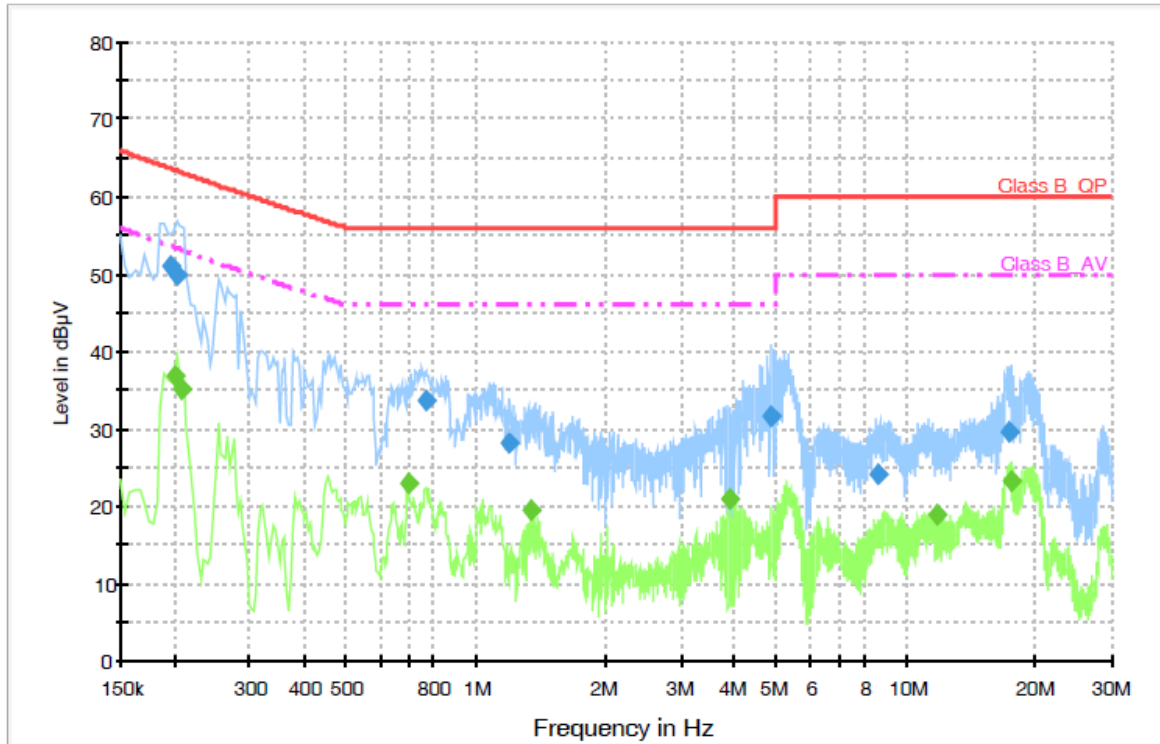
Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESCS30	Rohde & Schwarz	EMI Test Receiver	839809/003	12. 10. 2011
□ - ESH3-Z5	Rohde & Schwarz	LISN	838979/020	12. 10. 2011
■ - ESH2-Z5	Rohde & Schwarz	LISN	829991/009	12. 10. 2011
□ - ENY81-CA6	Rohde & Schwarz	ISN	101573	10. 27. 2011

6.6 Test data for Conducted Emission

-. Test Date : April 26, 2011
-. Resolution Bandwidth : 9 kHz
-. Frequency Range : 0.15 MHz ~ 30 MHz



Voltage with 4-Line-LISN_L1



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.196000	51.1	1000.000	9.000	GND	L1	10.1	12.5	63.6	
0.204000	49.9	1000.000	9.000	GND	L1	10.1	13.4	63.3	
0.768000	33.7	1000.000	9.000	GND	L1	10.1	22.3	56.0	
1.200000	28.1	1000.000	9.000	GND	L1	10.1	27.9	56.0	
4.836000	31.7	1000.000	9.000	GND	L1	10.3	24.3	56.0	
8.568000	24.2	1000.000	9.000	GND	L1	10.5	35.8	60.0	
17.428000	29.6	1000.000	9.000	GND	L1	11.0	30.4	60.0	

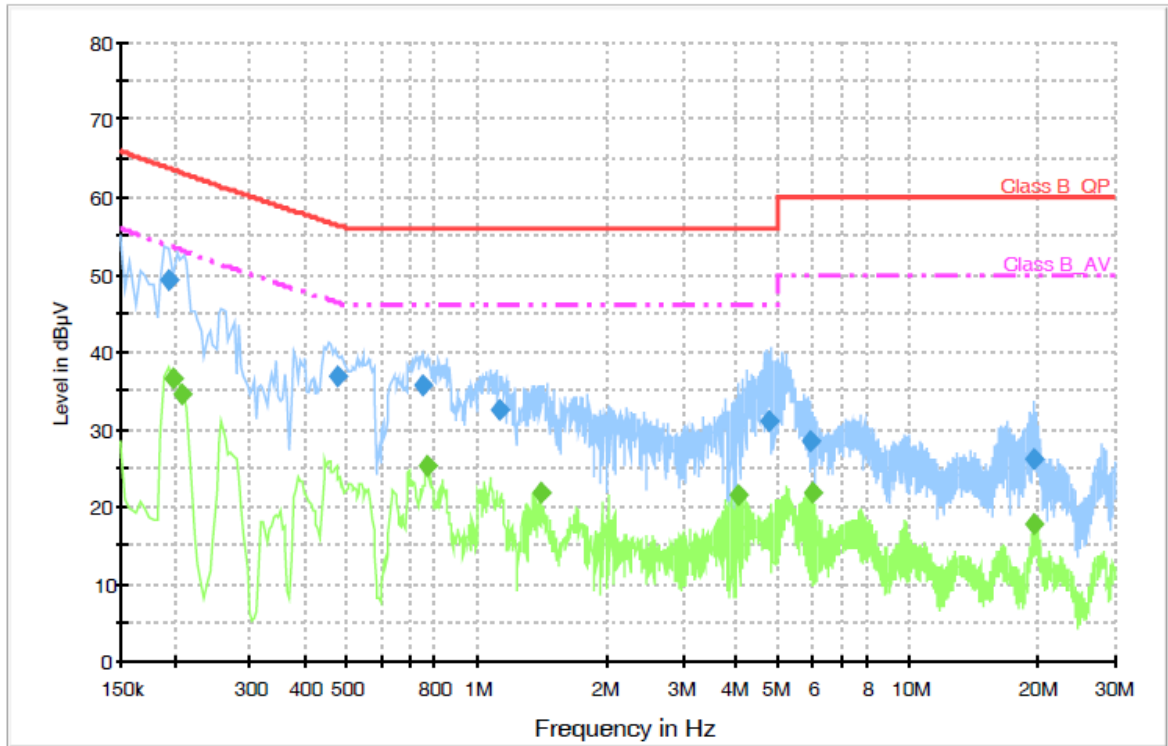
Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.200000	36.9	1000.000	9.000	GND	L1	10.1	16.5	53.4	
0.208000	35.1	1000.000	9.000	GND	L1	10.1	18.0	53.1	
0.696000	22.9	1000.000	9.000	GND	L1	10.1	23.1	46.0	
1.344000	19.6	1000.000	9.000	GND	L1	10.1	26.4	46.0	
3.908000	20.8	1000.000	9.000	GND	L1	10.3	25.2	46.0	
11.860000	18.8	1000.000	9.000	GND	L1	10.6	31.2	50.0	
17.436000	23.1	1000.000	9.000	GND	L1	11.0	26.9	50.0	

< Fig 4. Conducted emission result (Live line) >



Voltage with 4-Line-LISN_N



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.194000	49.2	1000.000	9.000	GND	N	10.1	14.5	63.7	
0.476000	36.8	1000.000	9.000	GND	N	10.1	19.6	56.4	
0.748000	35.7	1000.000	9.000	GND	N	10.1	20.3	56.0	
1.136000	32.4	1000.000	9.000	GND	N	10.1	23.6	56.0	
4.736000	31.1	1000.000	9.000	GND	N	10.3	24.9	56.0	
5.916000	28.5	1000.000	9.000	GND	N	10.4	31.5	60.0	
19.392000	26.2	1000.000	9.000	GND	N	10.9	33.8	60.0	

Final Measurement Detector 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.198000	36.5	1000.000	9.000	GND	N	10.1	17.0	53.5	
0.208000	34.6	1000.000	9.000	GND	N	10.1	18.5	53.1	
0.768000	25.2	1000.000	9.000	GND	N	10.1	20.8	46.0	
1.412000	21.7	1000.000	9.000	GND	N	10.1	24.3	46.0	
4.040000	21.5	1000.000	9.000	GND	N	10.3	24.5	46.0	
5.988000	21.7	1000.000	9.000	GND	N	10.4	28.3	50.0	
19.532000	17.7	1000.000	9.000	GND	N	10.9	32.3	50.0	

< Fig 5. Conducted emission result (Neutral line) >

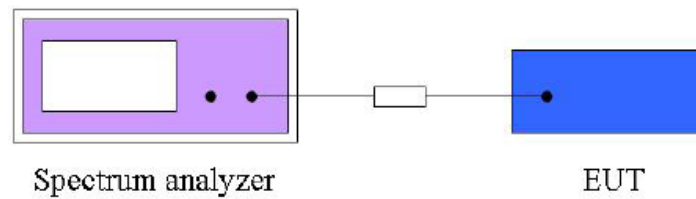


7. NUMBER OF HOPPING FREQUENCY USED

7.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 41.0 % R.H.

7.2 Test Set-up (Layout)



7.3 Limit

At least 15 channels frequencies, and should be equally spaced

7.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 10. 2011

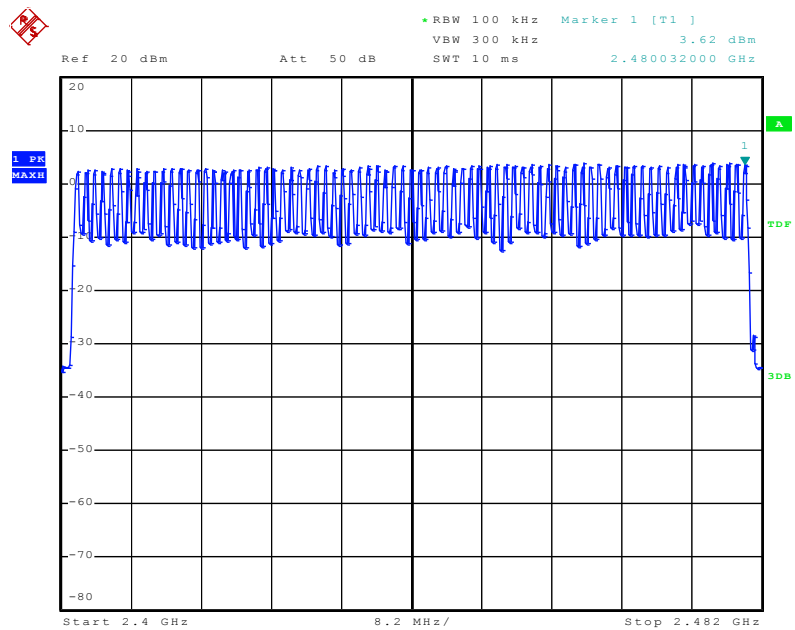
7.5 Test Result

- Test Date : March 20, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 3.7 V supplied from the lithium polymer battery

Modulation	Total channel No.	Hopping channel No.	Limit	Result
GFSK	79	79	> 15	Complies



Number of Hopping frequency used Plot on Configuration GFSK



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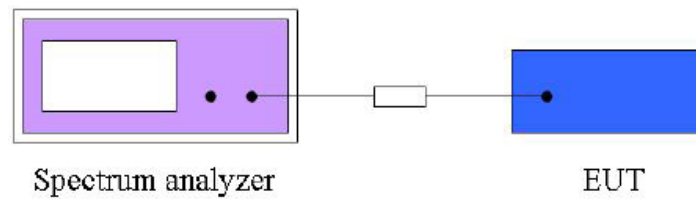


8. DWELL TIME ON EACH CHANNEL

8.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 41.0 % R.H.

8.2 Test Set-up (Layout)



8.3 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.

8.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 10. 2011

8.5 Test Result

- Test Date : March 20, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 3.7 V supplied from the lithium polymer battery

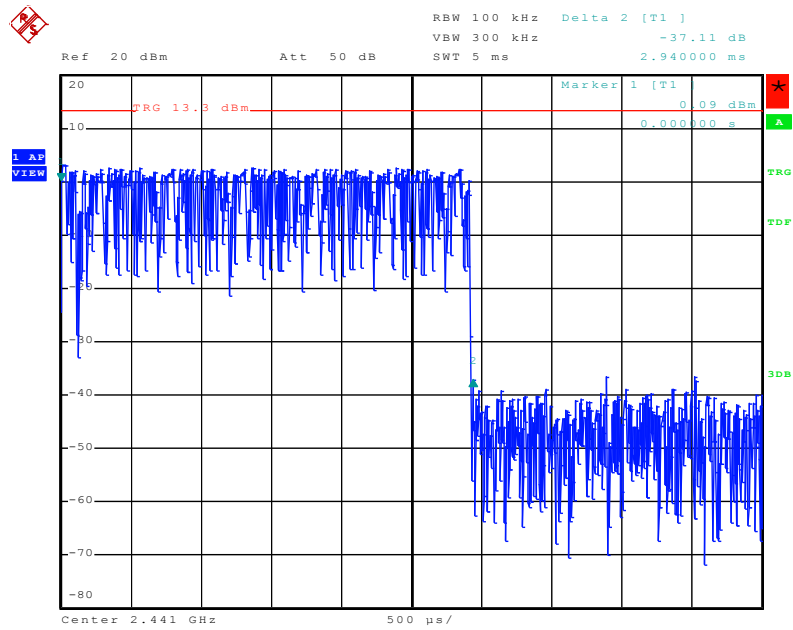
Spectrum Parameter

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

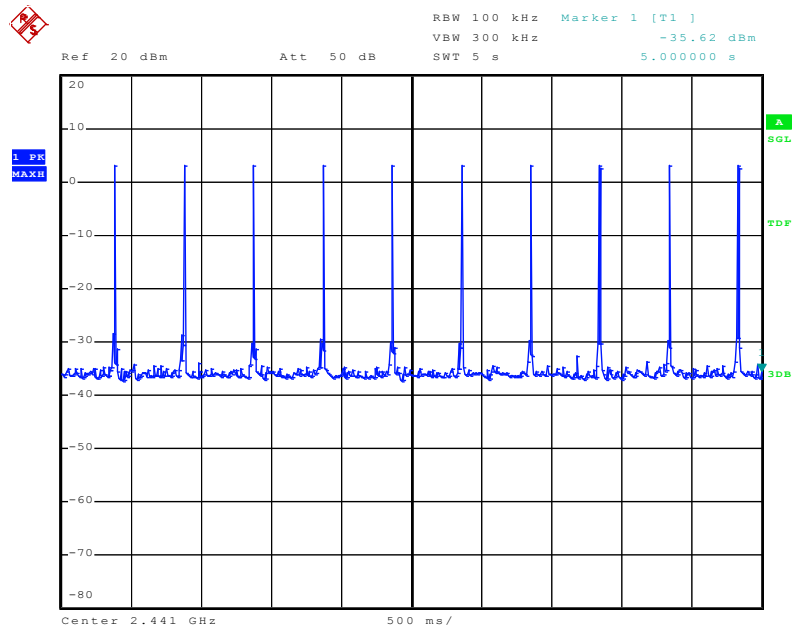
Mode	Number of transmission in a 31.6 (79 Hopping * 0.4)	Length of transmission time (ms)	Measured (ms)	Limit (ms)	Result
GFSK	10 (times / 5 s) * 6.32 = 63.20	2.94	185.808	400	Complies



Dwell time on each time used Plot on Configuration GFSK



Date: 20.MAR.2011 15:53:53



Date: 20.MAR.2011 15:50:06

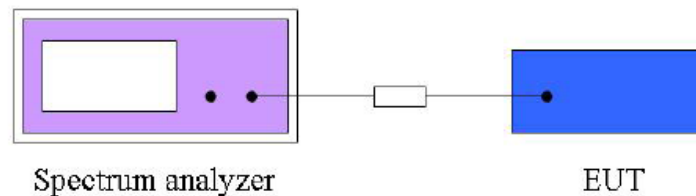


9. CHANNEL BANDWIDTH

9.1 Operating environment

Temperature : 23.0 °C
Relative Humidity : 41.0 % 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
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 10. 2011

9.5 Test result

- Test Date : March 20, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 3.7 V supplied from the lithium polymer battery

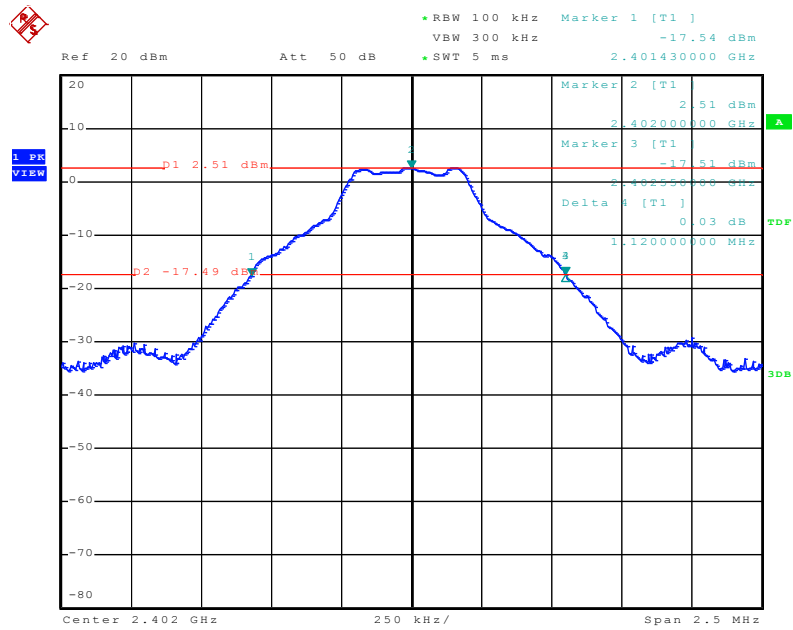
Spectrum Parameter

- Attenuation : Auto
- Span frequency : zero
- Resolution band width : 100 kHz
- Video band with : 300 kHz
- Sweep time : 5 ms

Group / Channel	Channel frequency (MHz)	20 dB bandwidth (MHz)	Result
0 CH	2 402	1.120	Complies
39 CH	2 441	1.130	Complies
78 CH	2 480	1.130	Complies

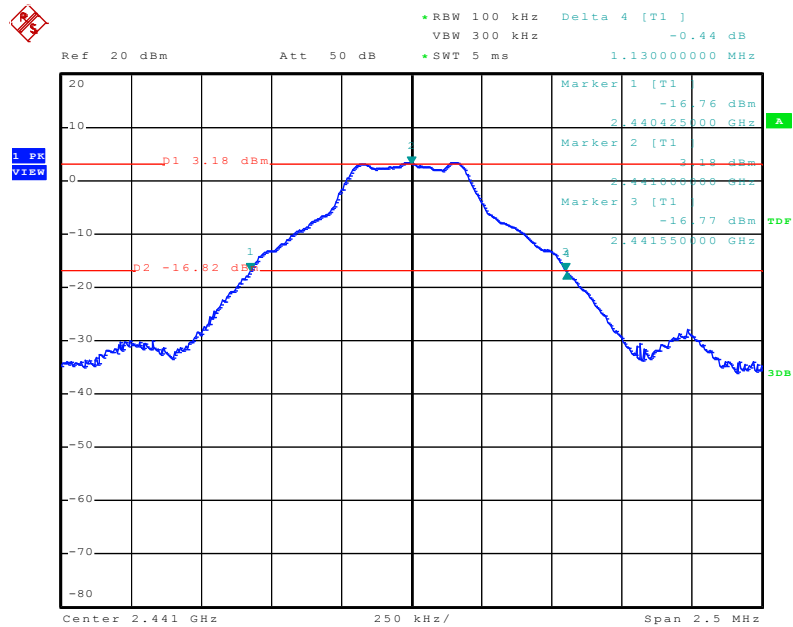


Channel bandwidth used Plot on Configuration GFSK/0 CH (2 402 MHz)



Date: 20.MAR.2011 16:17:13

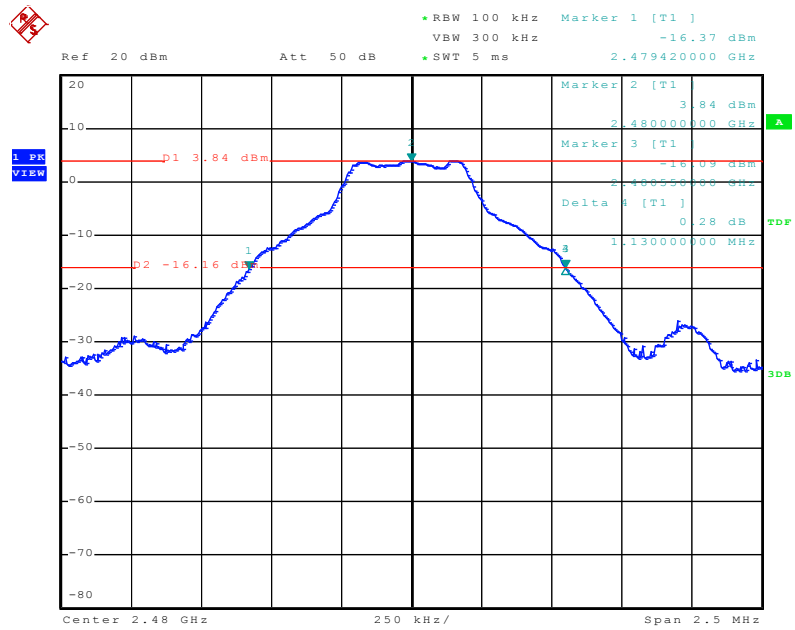
Channel bandwidth used Plot on Configuration GFSK/39 CH (2 441 MHz)



Date: 20.MAR.2011 16:20:42



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



Date: 20.MAR.2011 16:23:14

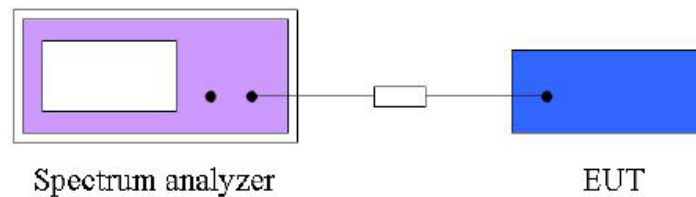


10. LIMIT OF HOPPING CHANNEL SEPARATION

10.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 41.0 % R.H.

10.2 Test Set-up (Layout)



10.3 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.

10.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 10. 2011

10.5 Test Result

- Test Date : March 20, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 3.7 V supplied from the lithium polymer battery

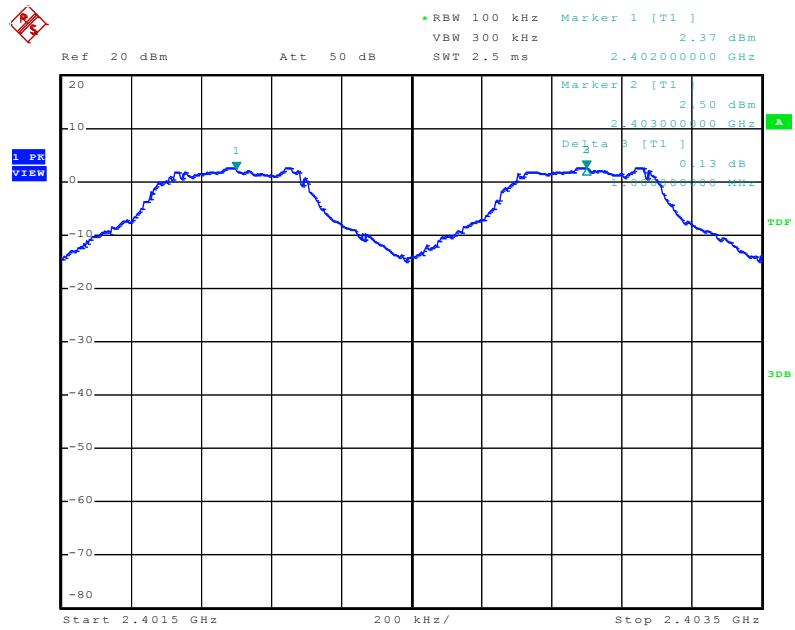
Spectrum Parameter

- Attenuation : Auto
- Span frequency : 10 MHz
- Resolution band width : 100 kHz
- Video band with : 300 kHz
- Sweep time : 5 ms

Channel	Channel frequency (MHz)	Adjacent channel Separation (MHz)	Limit (MHz) [2/3 of 20 dB bandwidth]	Result
0 CH	2 402	1	> 0.746	Complies
39 CH	2 441	1	> 0.753	Complies
78 CH	2 480	1	> 0.753	Complies

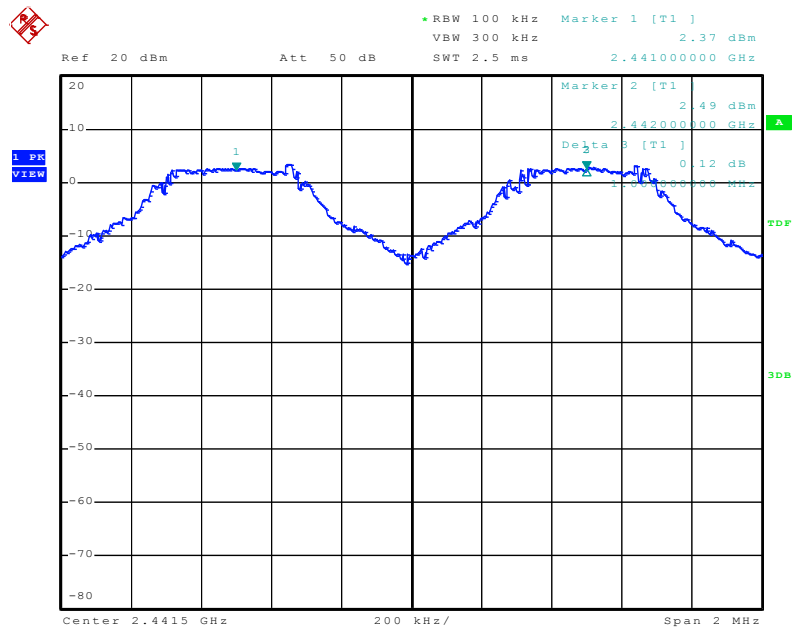


Channel separation used Plot on Configuration GFSK/0 CH (2 402 MHz)



Date: 20.MAR.2011 16:52:49

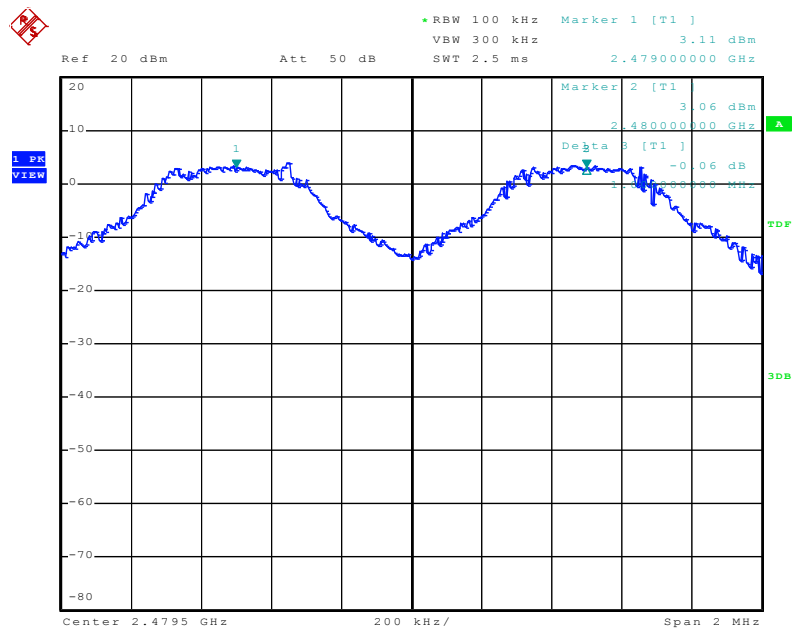
Channel separation used Plot on Configuration GFSK/39 CH (2 441 MHz)



Date: 20.MAR.2011 16:56:12



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



Date: 20.MAR.2011 16:59:03

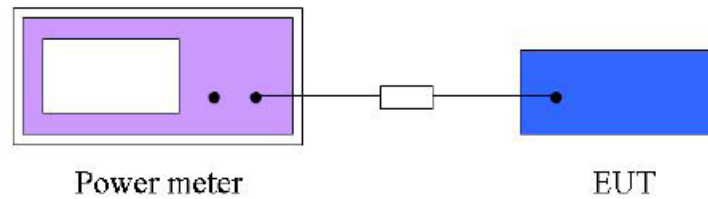


11. MAXIMUM PEAK OUTPUT POWER

11.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 41.0 % R.H.

11.2 Test Set-up (Layout)



11.3 Limit

The maximum peak output power measurement is 125 mW

11.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - NRVD	Rohde & Schwarz	Power meter	837794/048	12.10.2011
■ - NRV-Z32	Rohde & Schwarz	Power sensor	100062	10.20.2011

11.5 Test Result

- Test Date : March 20, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 3.7 V supplied from the lithium polymer battery

Channel	Channel Frequency (MHz)	Peak output power (dBm)	Peak output power (mW)	Limit (mW)	Result
0 CH	2 402	2.51	1.782	125	Complies
39 CH	2 441	3.18	2.080	125	Complies
78 CH	2 480	3.84	2.421	125	Complies

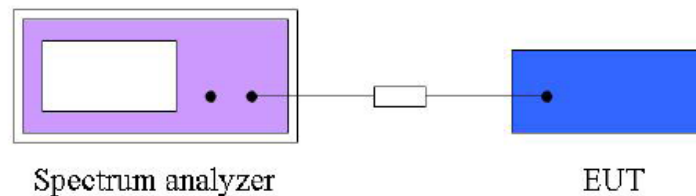


12. BAND EDGES MEASUREMENT

12.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 41.0 % R.H.

12.2 Test Set-up (Layout)



12.3 Limit

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

12.4 Test Equipment used

Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 10. 2011

12.5 Test Result

- Test Date : March 20, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)
- Modulation : GFSK
- Operating Condition : RF transmitting mode
- Power Source : DC 3.7 V supplied from the lithium polymer battery

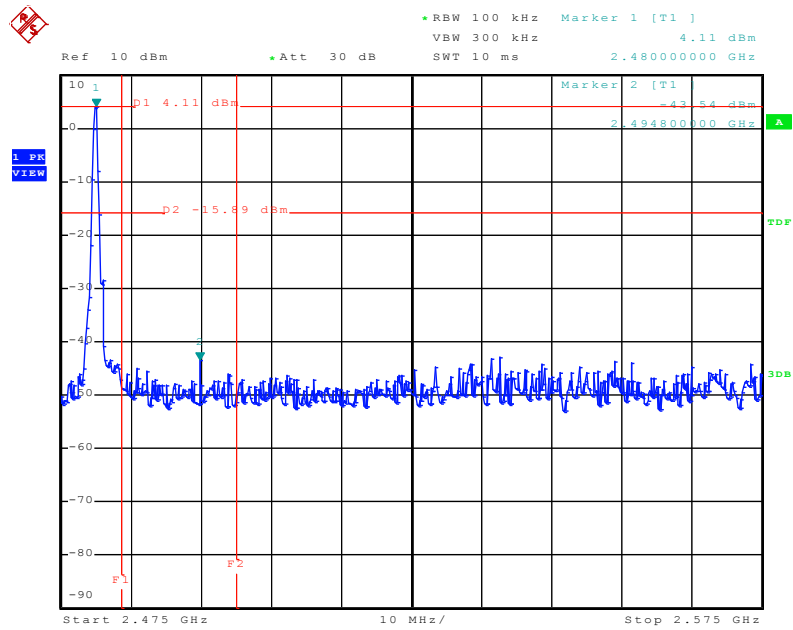
The spectrum plots are attached on the following 8 images, D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement in part 15.247(d)

Spectrum Parameter

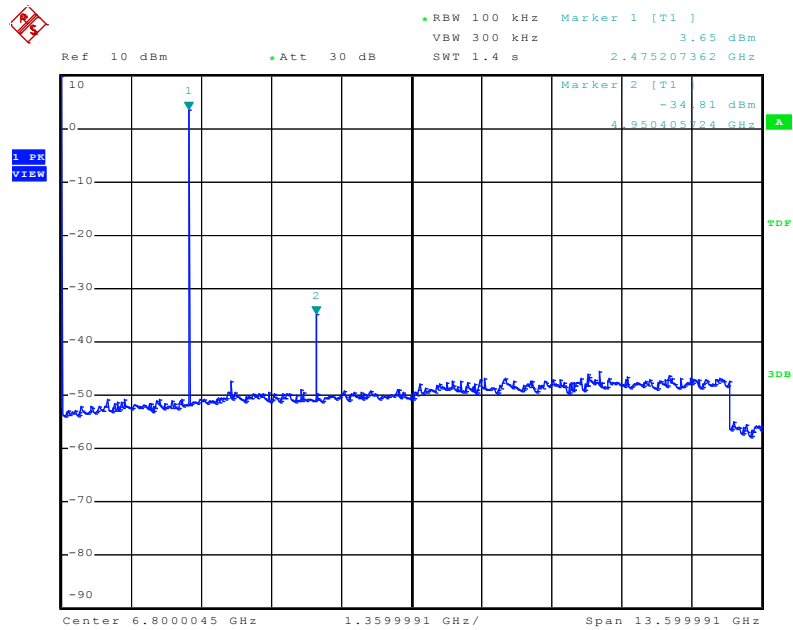
- Attenuation : Auto
- Resolution bandwidth : 100 kHz
- Video bandwidth : 300 kHz



Band edge used Plot on Configuration GFSK/0 CH (2 402 MHz)



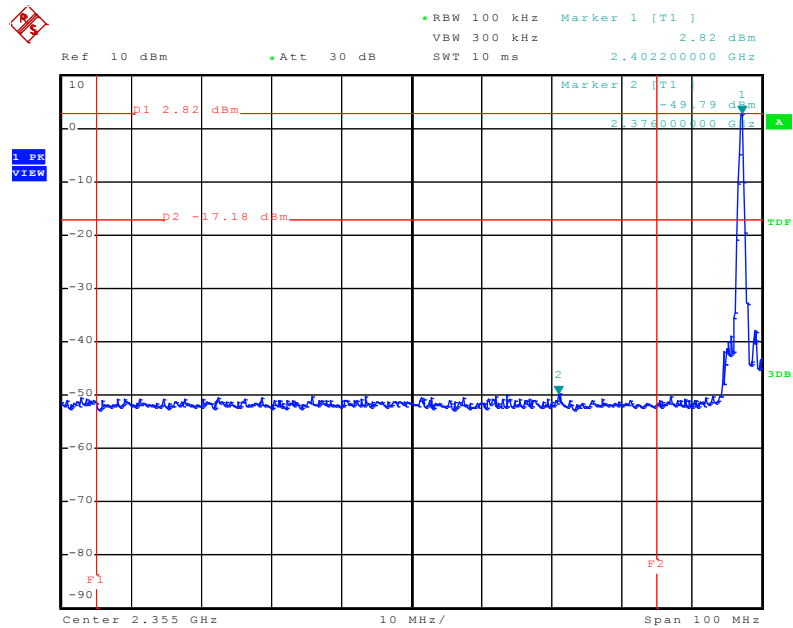
Date: 20.MAR.2011 17:19:05



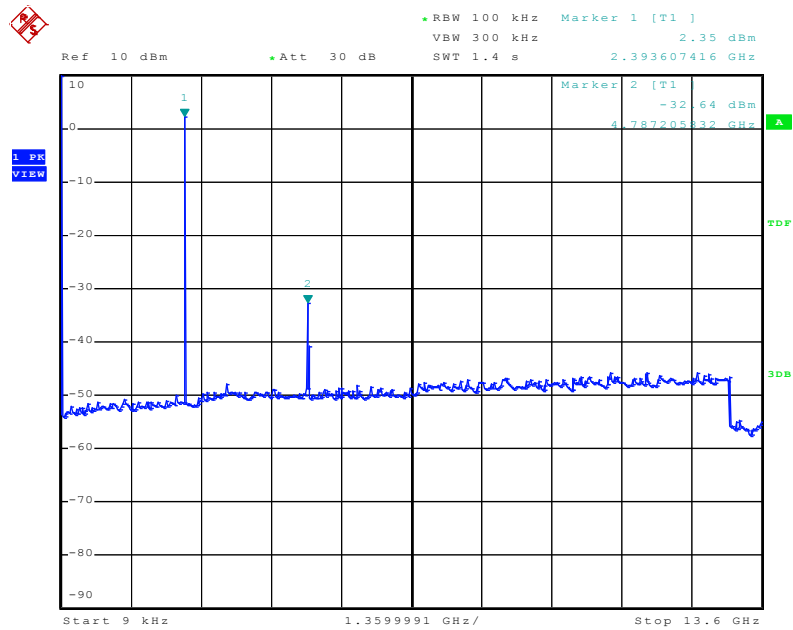
Date: 20.MAR.2011 17:44:19



Band edge used Plot on Configuration GFSK/78 CH (2 480 MHz)



Date: 20.MAR.2011 17:47:46



Date: 20.MAR.2011 17:50:00



13. RADIATED EMISSION

13.1 Operating Environment

Temperature : 23.0 °C
Relative Humidity : 43.0 % R.H.

13.2 Test Set-up

The formal radiated emission was measured at 3 m distance anechoic chamber.

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.

13.3 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, 3 m, Vertical)	± 4.38 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	± 3.50 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	± 3.75 dB	Confidence levels of 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	± 3.59 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	2 400/F (kHz)	300
0.490 ~ 1.705	2 400/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



13.5 Test Equipment used

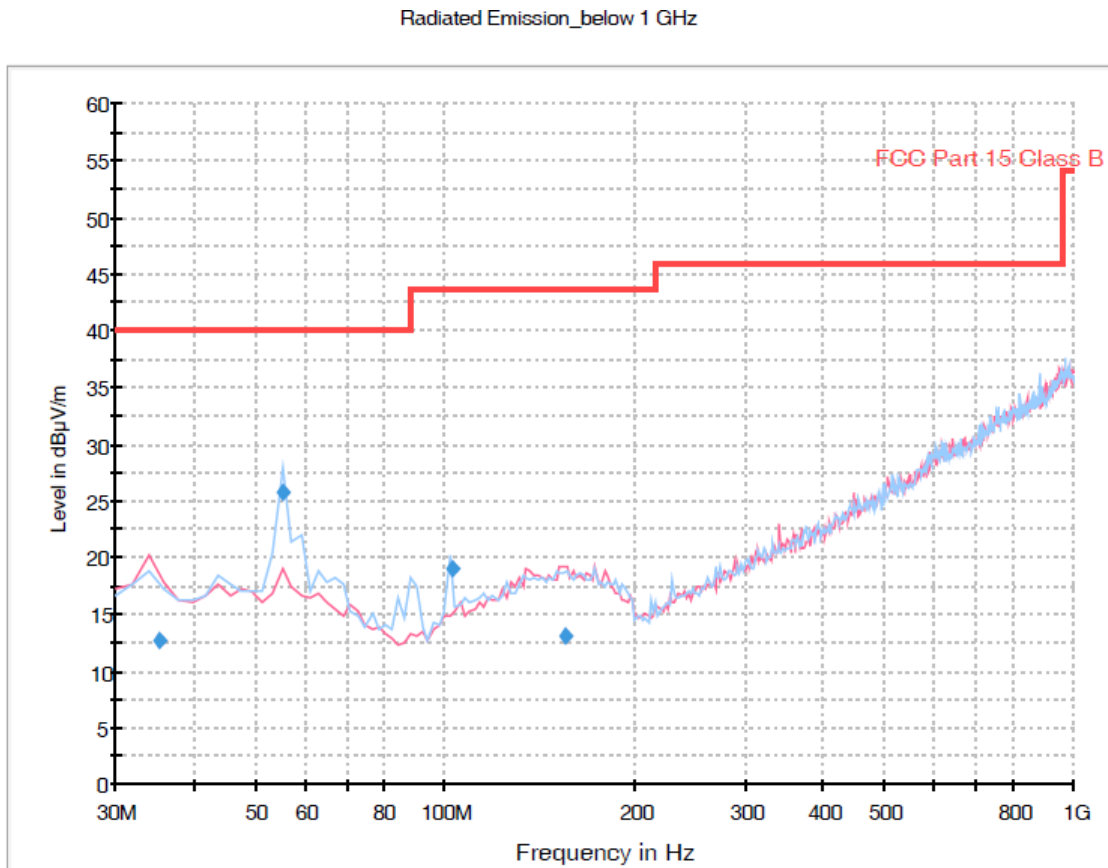
Model Name	Manufacturer	Description	Serial Number	Due to Calibration
■ - ESIB26	Rohde & Schwarz	EMI Test Receiver	830482/010	12. 10. 2011
■ - VULB9160	Schwarzbeck	Broadband test antenna	3193	03. 15. 2012
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - AM4.0	maturo GmbH	Antenna Mast	1390308	N/A
■ - BBHA9120D	Schwarzbeck	Horn antenna	207	12. 22. 2011
■ - 3160-09	ETS LINDGREN	Horn antenna	LM3423	04. 06. 2012
■ - AFS44-00101800-25-10P-44	MITEQ	Preamplifier	1258942	11. 12. 2011

13.6 Radiated emission test data

- Test Date : April 26, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(d)
- Modulation / Channel : GFSK
- Operating Condition : RF transmitting mode
- Measuring Distance : 3 m
- Spectrum Resolution Bandwidth(6 dB) : 120 kHz / 1 MHz / 10 Hz / 100 kHz
- 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. The EUT was tested with new battery.
2. Through three orthogonal axes were investigated and the worst case is report



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

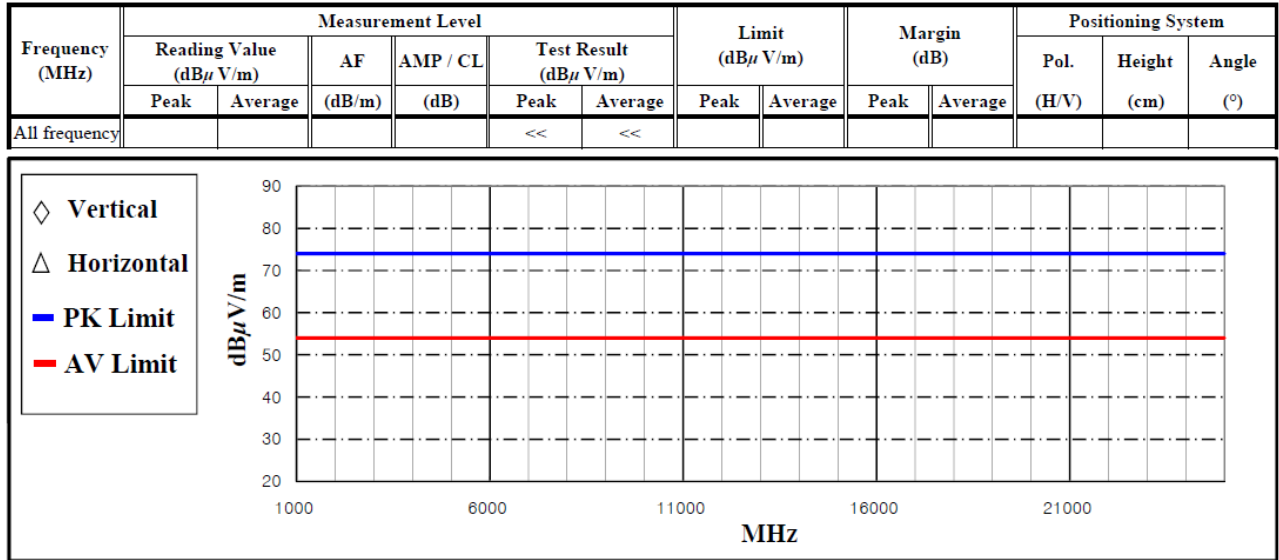


Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
35.347776	12.7	1000.0	120.000	100.0	V	129.0	13.0	27.3	40.0
55.290541	25.8	1000.0	120.000	100.0	H	15.0	13.6	14.2	40.0
103.103848	18.9	1000.0	120.000	100.0	H	299.0	11.6	24.6	43.5
155.692705	13.0	1000.0	120.000	149.0	V	229.0	15.1	30.5	43.5



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



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

Result of radiated emission (Band Edge)

0 CH (2 402 MHz)

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	(H/V)	(cm)	(°)				
2390.00	66.57	47.97	26.96	-36.93	56.60	38.00	74.00	54.00	17.40	16.00	-	-	-
2402.21	101.72	95.52	26.99	-36.91	91.80	85.60	-	-	-	-	-	-	-

78 CH (2 480 MHz)

Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V)		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)	(°)
2479.97	100.09	92.29	27.20	-36.79	90.50	82.70	-	-	-	-	-	-	-
2483.50	66.77	53.37	27.21	-36.78	57.20	43.80	74.00	54.00	16.80	10.20	-	-	-

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).

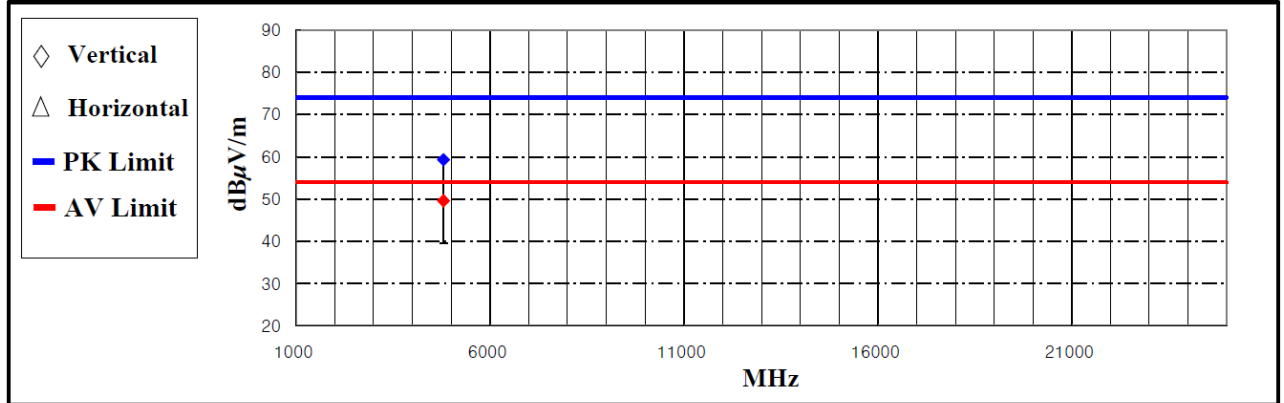
Corrected reading: Antenna factor + Cable loss + Preamplifier gain + Read value = Test result



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

(GFSK, 0 CH / 2 402 MHz)

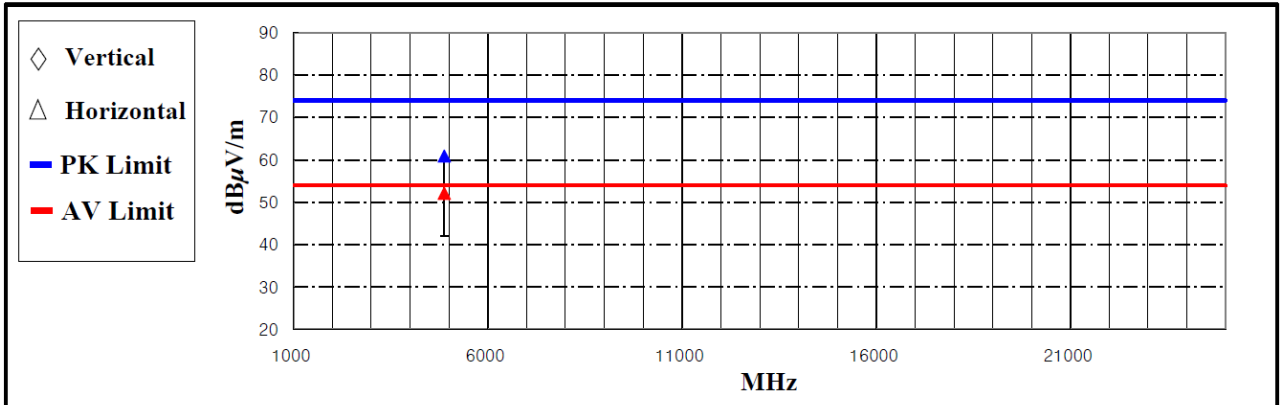
Frequency (MHz)	Measurement Level						Limit (dBμ V/m)		Margin (dB)		Positioning System		
	Reading Value (dBμ V/m)		AF	AMP / CL	Test Result (dBμ V/m)						Pol.	Height	Angle
	Peak	Average	(dB/m)	(dB)	Peak	Average	Peak	Average	Peak	Average	(H/V)	(cm)	(°)
4804.22	60.93	51.23	31.20	-32.83	59.30	49.60	74.00	54.00	14.70	4.40	V	113	96



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

(GFSK, 39 CH / 2 441 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	(H/V)	(cm)	(°)		
4882.38	62.33	53.53	31.34	-32.77	60.90	52.10	74.00	54.00	13.10	1.90	H	172	90

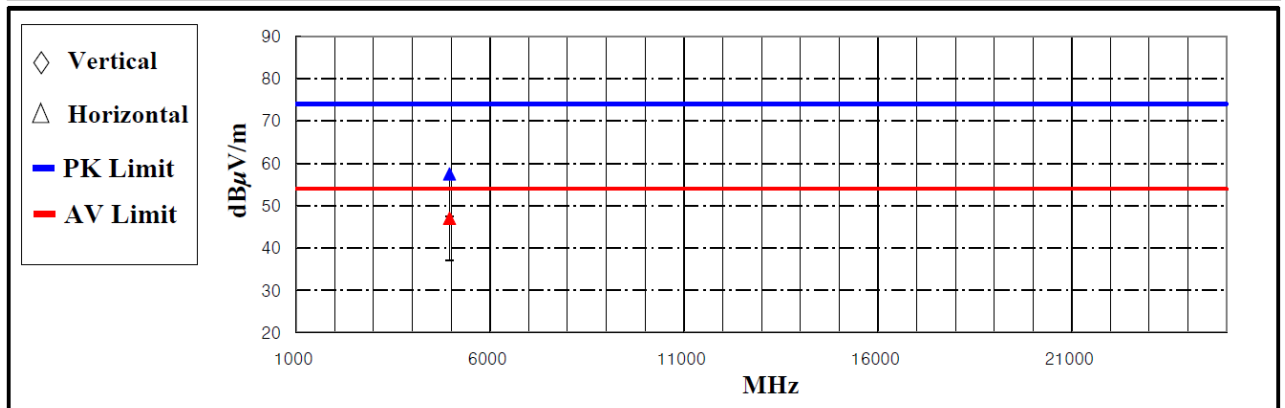


*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)



(GFSK, 78 CH / 2 480 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)	(°)
4960.14	58.74	48.24	31.47	-32.71	57.50	47.00	74.00	54.00	16.50	7.00	H	130	248



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

Note:

Emission level (dBμ V/m) = 20 log Emission level (μ V/m).

Corrected Reading: Reading value + AF (Antenna Factor) +AMP/CL (Cable Loss + Preamp factor) = Test result