

FCC EVALUATION REPORT FOR CERTIFICATION

Applicant: JSYSTEC Co., Ltd.

#722 Venture Complex II, Daegu Techno Park,

Hosan-Dong, Dalseo-Gu, Daegu, Korea

Attn: Mr. Sung-Ki Lee / Assistant Research Engineer

Date of Issue: October 4, 2011

Order Number: GETEC-C1-11-218

Test Report Number: GETEC-E3-11-110

Test Site: Gumi College EMC Center

FCC Registration Number: (100749, 443957)

FCC ID. : ZCUA250-GS

Applicant : JSYSTEC 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 : Car Multimedia System

Type of Authority : Certification

Model Name : A250-GS, N84SNTA, P-84SNTA, F84SNTA

Trade Name : INGENIX, JSYSTEC

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,



Seung-Chul Lee, Associate Engineer
GUMI College EMC center

Reviewed by,



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: JSYTEC Co., Ltd.

**Applicant address: #722 Venture Complex II, Daegu Techno Park, Hosan-Dong,
Dalseo-Gu, Daegu, Korea**

Manufacturer: JSYTEC Co., Ltd.

**Manufacturer address: #722 Venture Complex II, Daegu Techno Park, Hosan-Dong,
Dalseo-Gu, Daegu, Korea**

Contact person: Mr. Sung-Ki Lee / Assistant Research Engineer

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- **FCC ID.** ZCUA250-GS
- **Equipment Class** Spread Spectrum Transmitter (DSS)
- **EUT Type** Car Multimedia System
- **Model Name** A250-GS, N84SNTA, P-84SNTA, F84SNTA
"These model names are given in accordance with user interface change(Icon design and background) that are not effect on EMC performance. All the electrical and mechanical characteristics are the same as basic model except model name designation."
- **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** September 20 ~ 23, 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-E3-11-110
- **Dates of Issue** October 4, 2011

EUT Type: Car Multimedia System

FCC ID.: ZCUA250-GS



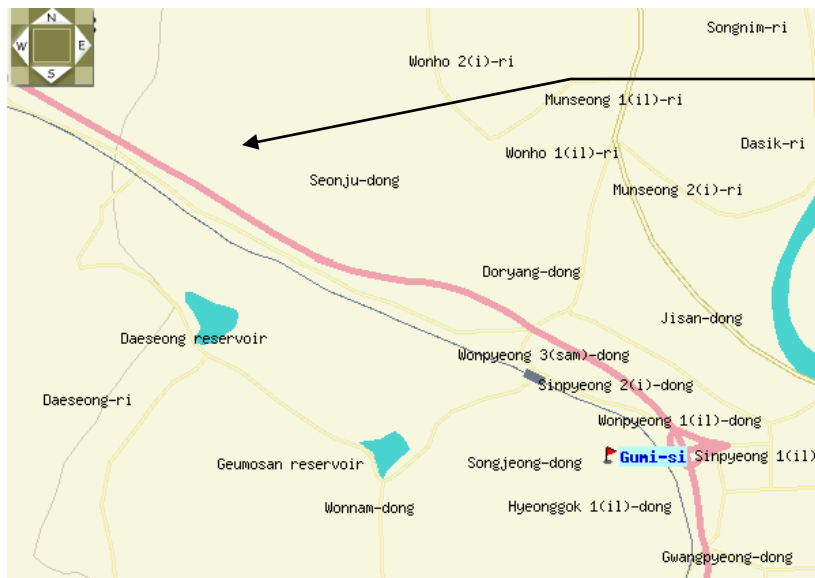
2. Introduction

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 **JSYSTEC Co., Ltd. Car Multimedia System (Model name: A250-GS, N84SNTA, P-84SNTA, F84SNTA)**

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 **JSYSTEC Co., Ltd. Car Multimedia System**
(Model Name: A250-GS, N84SNTA, P-84SNTA, F84SNTA) FCC ID.: ZCUA250-GS

Navigation portion of this equipment will be applied the “Verification (Class A digital device)” procedure.
(Report Number: GETEC-E3-11-111)

| | |
|---------------------------------------|---|
| -. General | Rated voltage: DC 12 V Maximum current consumption: 800 mA Processor speed: 700 MHz NAND flash memory: 128 MB |
| -. Monitor | Screen size: 8.3 inch diagonal Aspect ratio: 800 × 480 Pixels per square inch: 14 066 Backlight: LED |
| -. TV or FM Tuner RF module | ATSC-M/H module (BTL Systems.Inc.), G-MOUSE (Y&H, E&C), Bluetooth module (Collex communication Corp.) |
| -. Crystal and Clock Frequency | Crystal(12 MHz) for CPU operating, Crystal(32.768 kHz) for CPU operating, Crystal(48 MHz) for CPU to operate USB, Crystal(27 MHz) for Video encoder operating, Crystal(24.576 MHz) for AC97 codec operating, Crystal(27 MHz) for LCD Processor operating, crystal(14.318 MHz) for Video encoder operating, Crystal(14.745 6 MHz) for Quad UART operating, Crystal(16 MHz) in Bluetooth Module |
| -. RF Frequency | Bluetooth - Band(2.4 GHz ~ 2.483 5 GHz), Carrier Frequency(2 402 MHz ~ 2 480 MHz) |
| -. External Connector | MULTI BOX(USB, SD, AV-IN, AUX), IPOD, ATSC-M/H, GPS, MIC, SPEAKER, AV-OUT (CVBS, L, R), AUDIO-OUT (L, R), IR-Receiver, Rear camera, DVD-controller, DVD (CVBS, L, R) |
| -. GPS Receive Frequency | 1 575.42 MHz (L1) |



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

| Description | Manufacturer | Model Name | S/N & FCC ID. |
|------------------|----------------------------|-------------------------------|---|
| Speaker | UNISON Acoustics Co., Ltd. | U9040G | S/N: None. FCC ID.: N/A |
| GPS antenna | Y&H ENC | YGG-CD430B | S/N: None. FCC ID.: N/A |
| DVD player | LG Electronics Inc. | LC-954 | S/N: 3850R-Z674K FCC ID.: Verification |
| MIC | DAESHIN IC | OB-45L42 H.F-W3M-J3.5S-2pin M | S/N: None. FCC ID.: N/A |
| IR sensor | MI JI ELECTRONICS | MRV-3035 | S/N: None. FCC ID.: N/A |
| ATSC-M/H antenna | Maxwavei | ATSC-M/H external antenna | S/N: None. FCC ID.: N/A |
| iPod | Apple Computer Inc. | A1051 | S/N: 4J5087YXS45 FCC ID.: DoC |
| SD memory card | SANDISK | SDSDH-004G-U46 | S/N: BI1030816067G 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. |
|-----------------|-------------------|-------------|----------------------------|
| Control box | Jsystec Co., Ltd. | EM-7-SONATA | S/N: None. FCC ID.: N/A |
| ATSC-M/H module | BTL System | BMH-130 | S/N: None. FCC ID.: N/A |



3.2.3 Used Cable(s)

| Cable Name | Condition | Description |
|------------------------|---|-------------------|
| DC power cable | Connected to the EUT | 0.10 m unshielded |
| 20 pin cable | Connected to the EUT and control box | 0.60 m shielded |
| 20 pin to HDMI cable | Connected to the EUT and ATSC-M/H module | 0.30 m shielded |
| Speaker cable | Connected to the EUT and speaker | 1.80 m unshielded |
| GPS antenna cable | Connected to the EUT and GPS antenna | 3.20 m shielded |
| Rear camera cable | Connected to the EUT and DVD player | 1.60 m shielded |
| MIC cable | Connected to the EUT and MIC | 3.20 m shielded |
| IR sensor cable | Connected to the EUT and IR sensor | 3.20 m unshielded |
| AV out cable | Connected to the EUT and DVD player | 4.00 m shielded |
| ATSC-M/H antenna cable | Connected to the EUT and ATSC-M/H antenna | 4.00 m shielded |
| iPod cable | Connected to the EUT and iPod | 1.00 m shielded |

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.

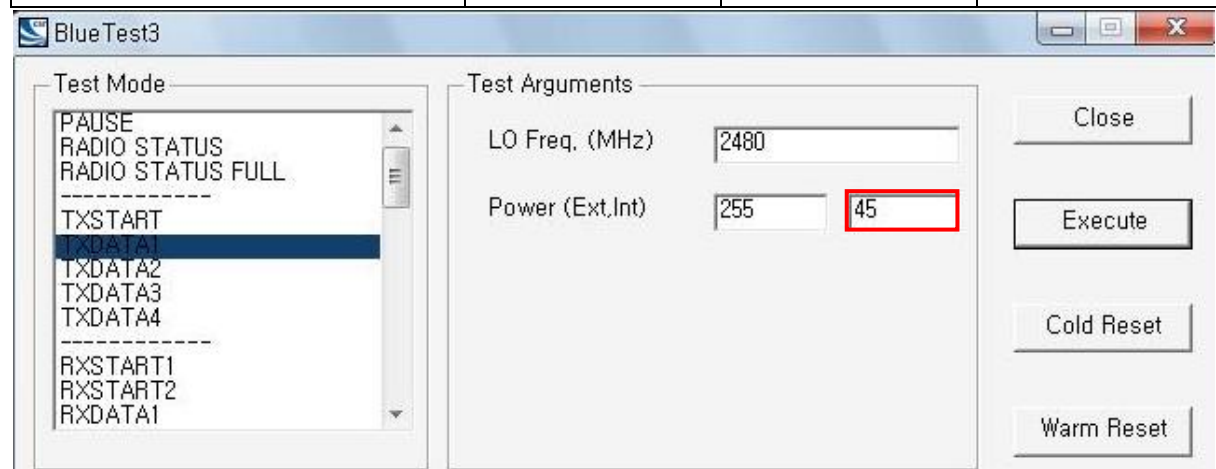
The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

- Test Voltage / Frequency:
DC 12 V (The EUT power is fed from car battery. So, the conducted emission test was skipped.)
- Test Mode(s): Bluetooth RF transmitting mode

-. Executed "Bluetest 3 (Copyright 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 [Ext/Int] | 255/45 | 255/45 | 255/45 |



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 **JSYTEC Co., Ltd. Car Multimedia System** comply with the requirement of §15.203 with a multilayer 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

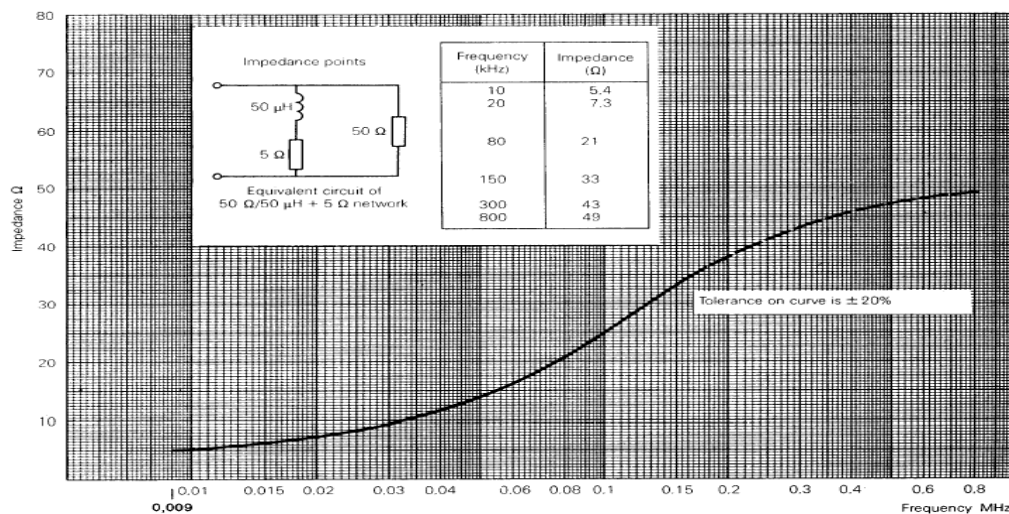


Fig 2. Impedance of LISN



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

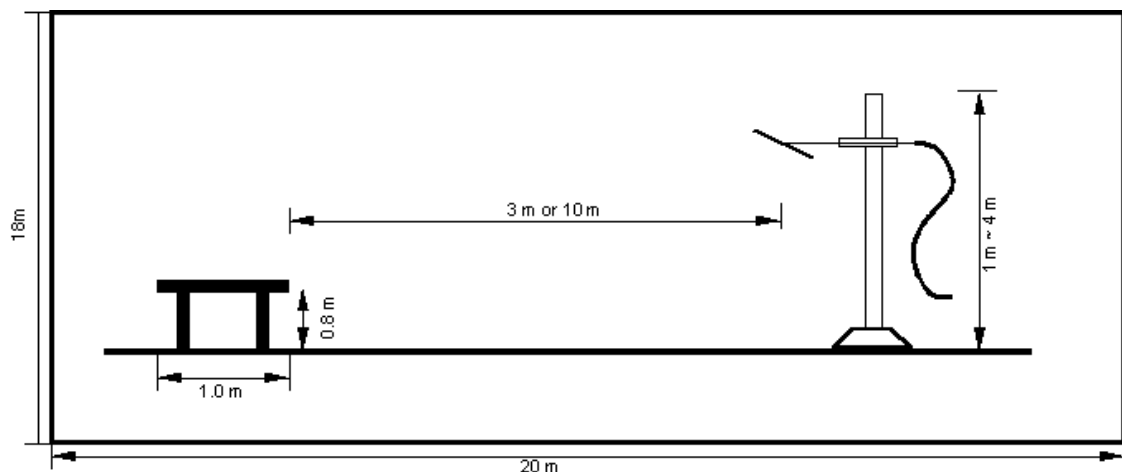


Fig 3. Dimensions of test site.

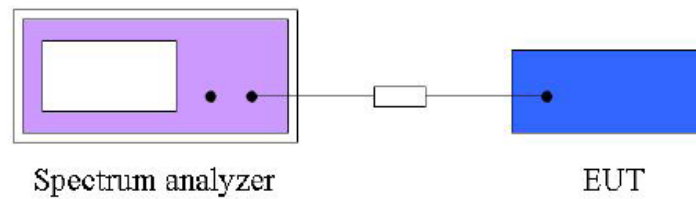


6. NUMBER OF HOPPING FREQUENCY USED

6.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 41.0 % 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 |
|------------|-----------------|-------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |

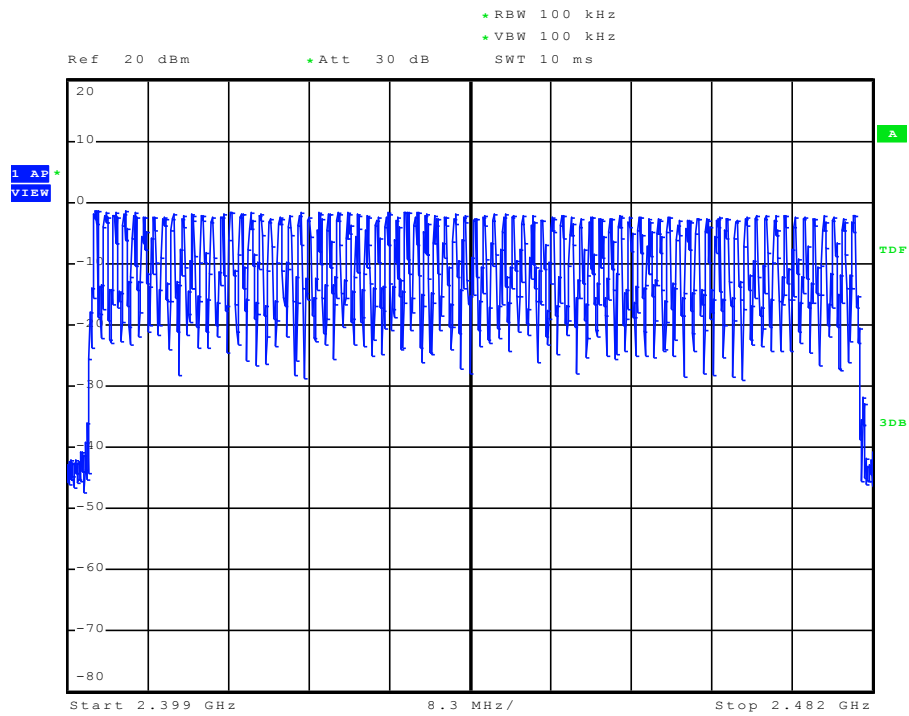
6.5 Test Result

- Test Date : September 22, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : Bluetooth RF transmitting mode
- Power Source : DC 12 V (Car battery)

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



Number of Hopping frequency used Plot on Configuration GFSK



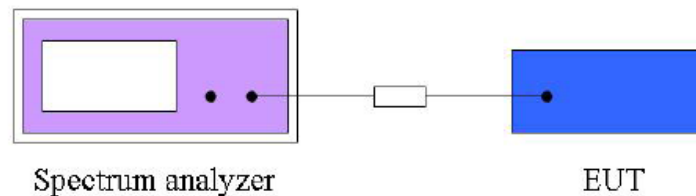


7. DWELL TIME ON EACH CHANNEL

7.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 41.0 % 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 |
|------------|-----------------|-------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |

7.5 Test Result

- Test Date : September 22, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : Bluetooth RF transmitting mode
- Power Source : DC 12 V (Car battery)

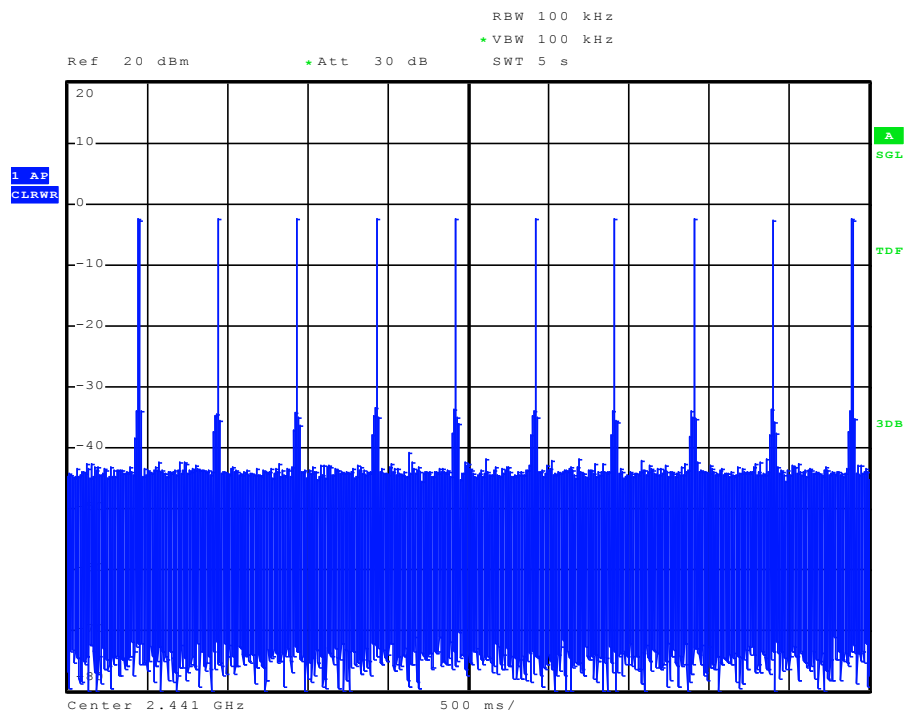
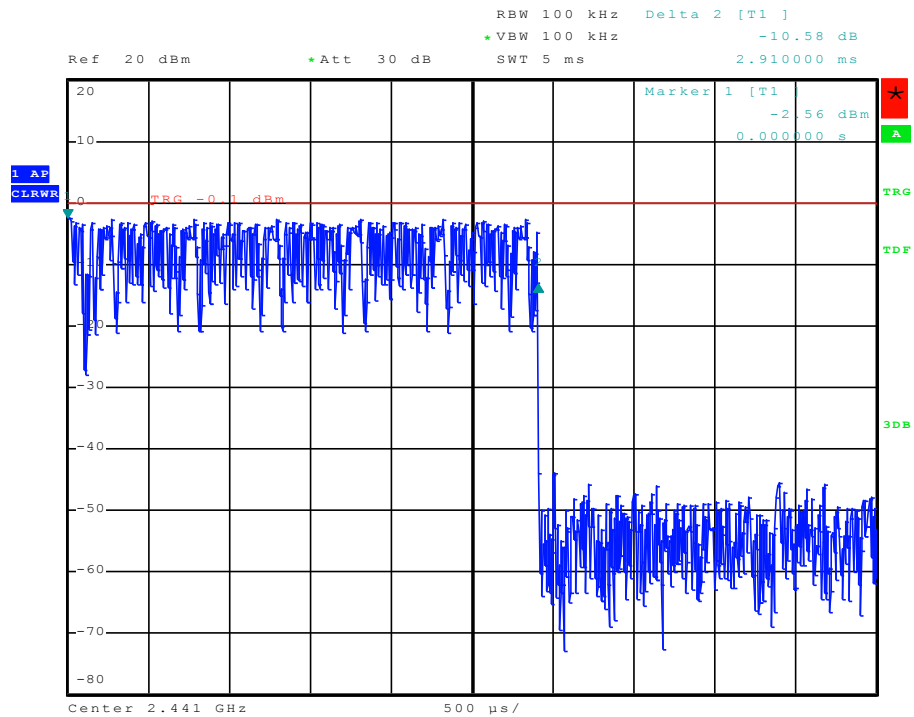
Spectrum Parameter

- Attenuation : Auto
- Span frequency : zero
- Resolution band width : 100 kHz
- Video band with : 100 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 = 63.2 | 2.91 | 183.912 | 400 | Complies |



Dwell time on each time used Plot on Configuration GFSK



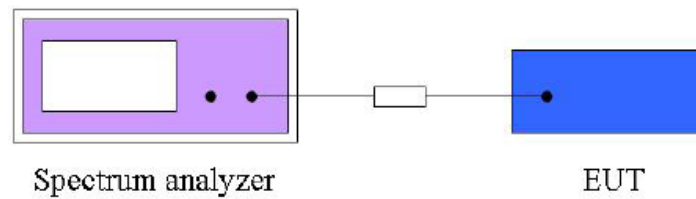


8. CHANNEL BANDWIDTH

8.1 Operating environment

Temperature : 24.0 °C
Relative Humidity : 41.0 % 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 |
|------------|-----------------|-------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |

8.5 Test result

- Test Date : September 22, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)(iii)
- Modulation : GFSK
- Operating Condition : Bluetooth RF transmitting mode
- Power Source : DC 12 V (Car battery)

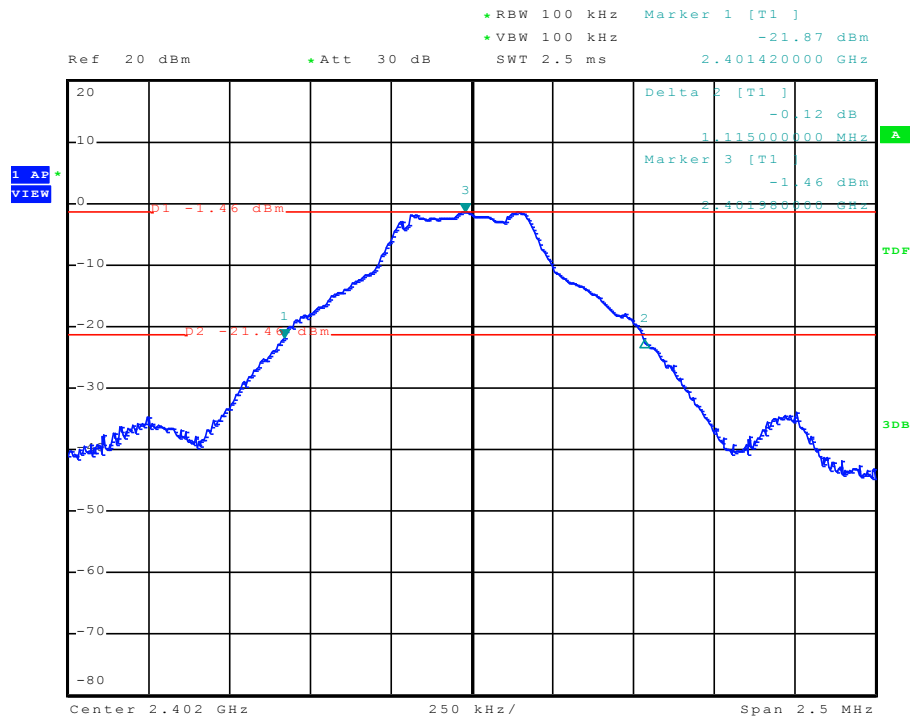
Spectrum Parameter

- Attenuation : Auto
- Span frequency : zero
- Resolution band width : 100 kHz
- Video band with : 100 kHz
- Sweep time : 2.5 ms

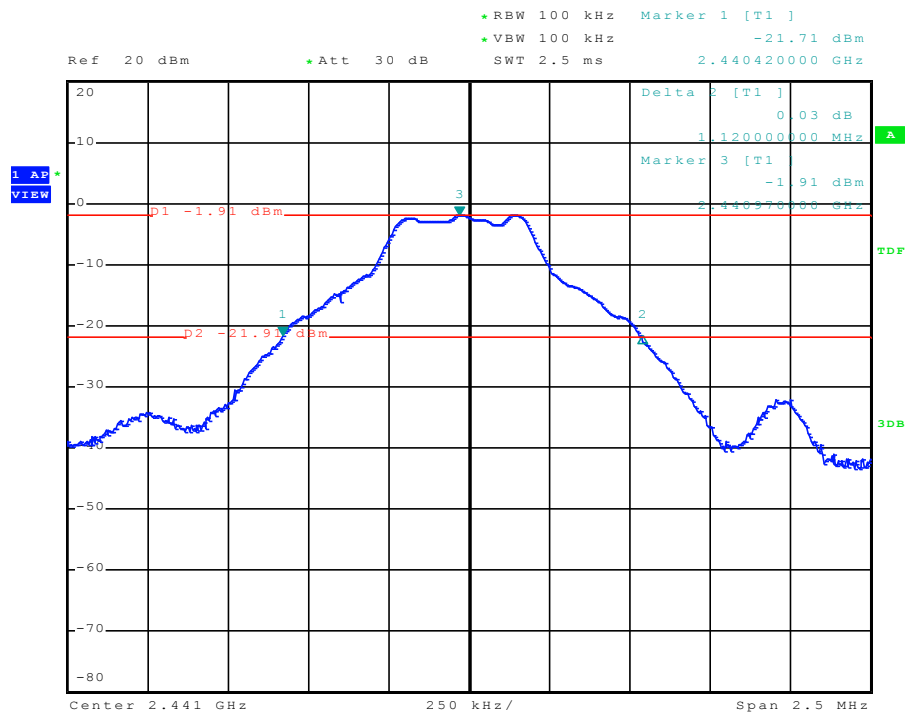
| Channel | Channel frequency (MHz) | 20 dB bandwidth (MHz) | Result |
|---------|-------------------------|-----------------------|----------|
| 0 | 2 402 | 1.115 | Complies |
| 39 | 2 441 | 1.120 | Complies |
| 78 | 2 480 | 1.120 | Complies |



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

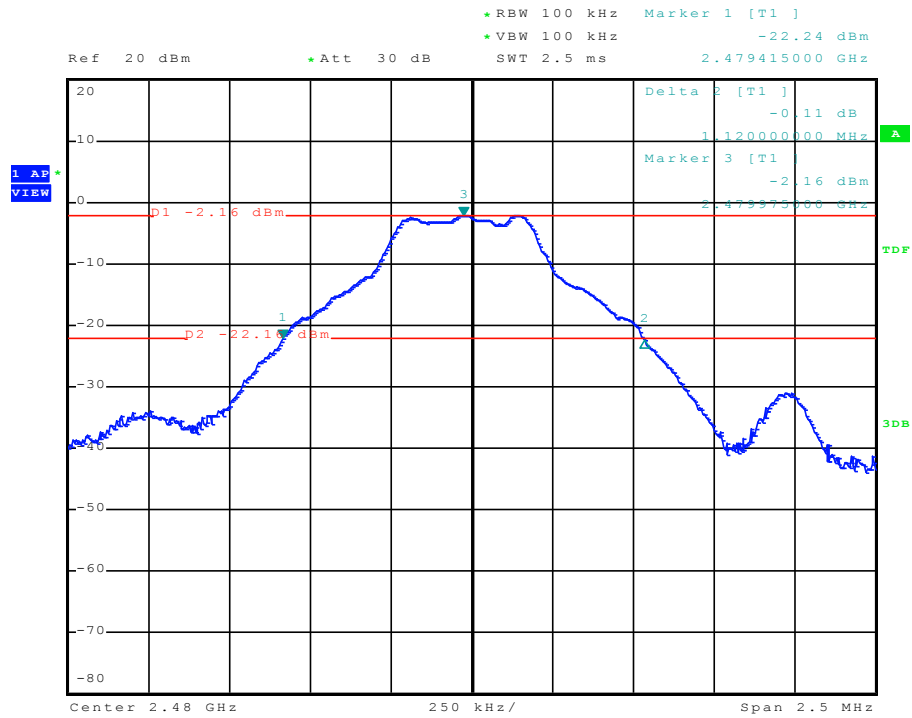


Channel bandwidth used Plot on Configuration GFSK/39 CH (2 441 MHz)





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



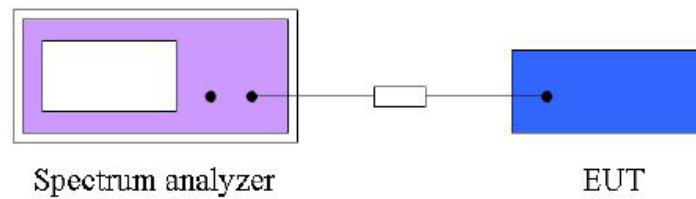


9. LIMIT OF HOPPING CHANNEL SEPARATION

9.1 Operating Environment

Temperature : 24.0 °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 : September 22, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(a)(1)
- Modulation : GFSK
- Operating Condition : Bluetooth RF transmitting mode
- Power Source : DC 12 V (Car battery)

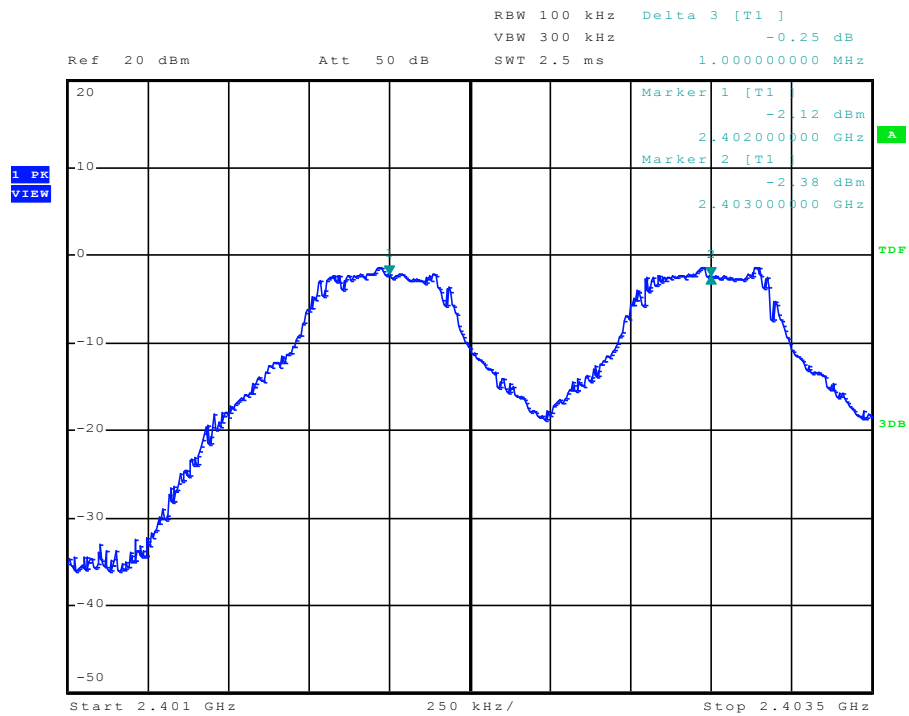
Spectrum Parameter

- Attenuation : Auto
- Span frequency : 8 MHz
- Resolution band width : 100 kHz
- Video band with : 300 kHz
- Sweep time : 2.5 ms

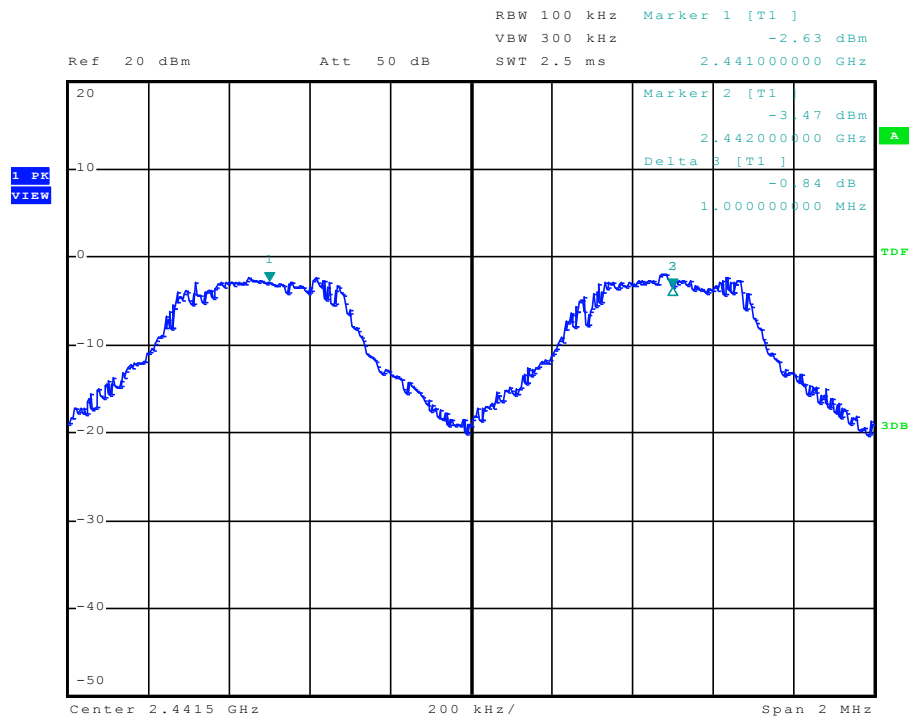
| Channel | Channel frequency (MHz) | Adjacent channel Separation (MHz) | Limit (MHz) [2/3 of 20 dB bandwidth] | Result |
|---------|-------------------------|-----------------------------------|---|----------|
| 0 | 2 402 | 1 | > 0.743 | Complies |
| 39 | 2 441 | 1 | > 0.747 | Complies |
| 78 | 2 480 | 1 | > 0.747 | Complies |



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

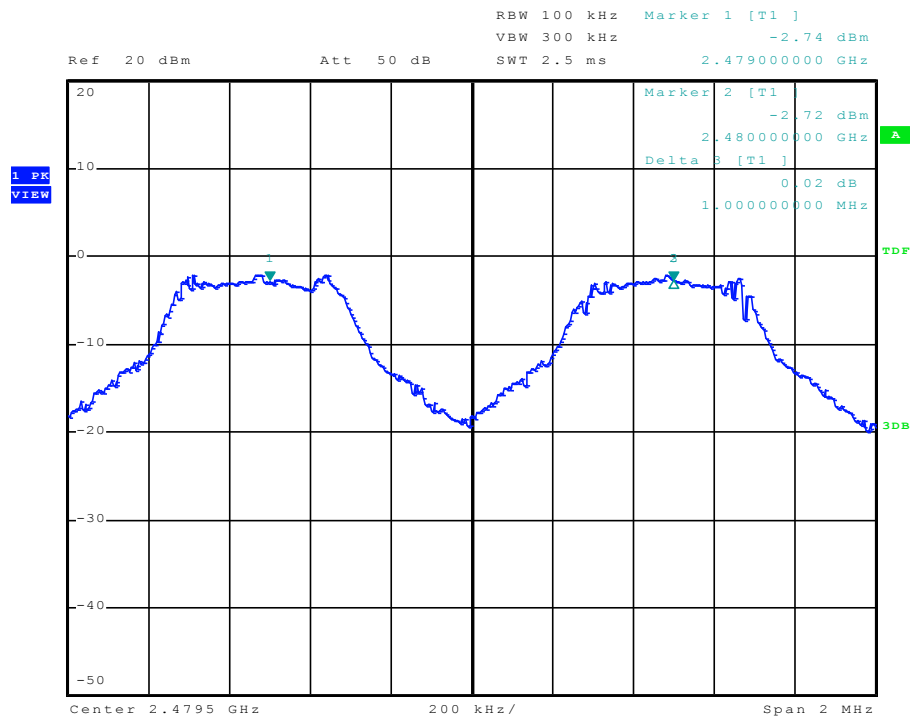


Channel separation used Plot on Configuration GFSK/39 CH (2 441 MHz)





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



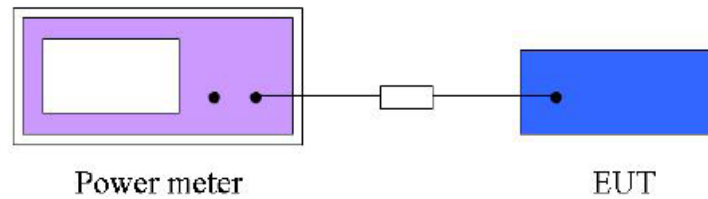


10. MAXIMUM PEAK OUTPUT POWER

10.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 41.0 % 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 |
|-------------|-----------------|--------------|---------------|--------------------|
| ■ - 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 : September 22, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)
- Modulation : GFSK
- Operating Condition : Bluetooth RF transmitting mode
- Power Source : DC 12 V (Car battery)

| Channel | Channel Frequency (MHz) | Peak output power (dBm) | Peak output power (mW) | Limit (mW) | Result |
|---------|-------------------------|-------------------------|------------------------|------------|----------|
| 0 | 2 402 | - 3.44 | 0.453 | 125 | Complies |
| 39 | 2 441 | - 3.64 | 0.433 | 125 | Complies |
| 78 | 2 480 | - 3.47 | 0.450 | 125 | Complies |

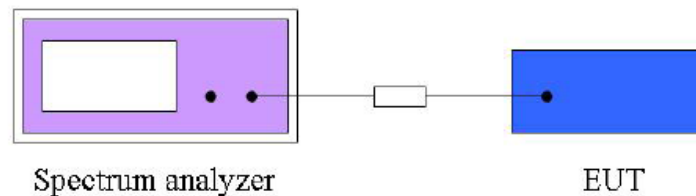


11. BAND EDGES MEASUREMENT

11.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 41.0 % 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 |
|------------|-----------------|-------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |

11.5 Test Result

- Test Date : September 22, 2011
- Reference Standard : Part 15 Subpart C, Sec. 15.247(b)
- Modulation : GFSK
- Operating Condition : Bluetooth RF transmitting mode
- Power Source : DC 12 V (Car battery)

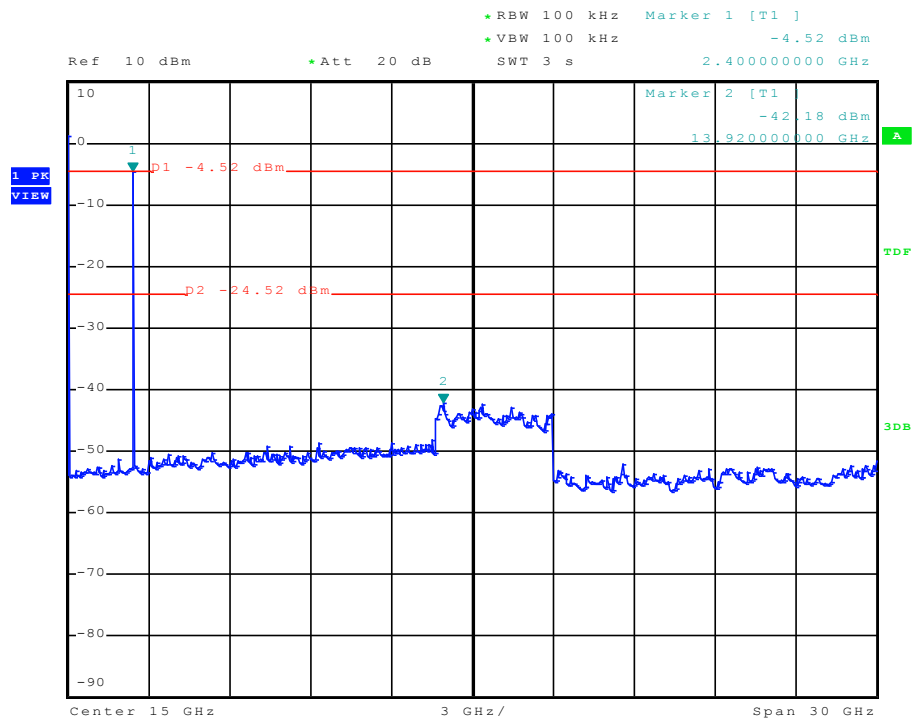
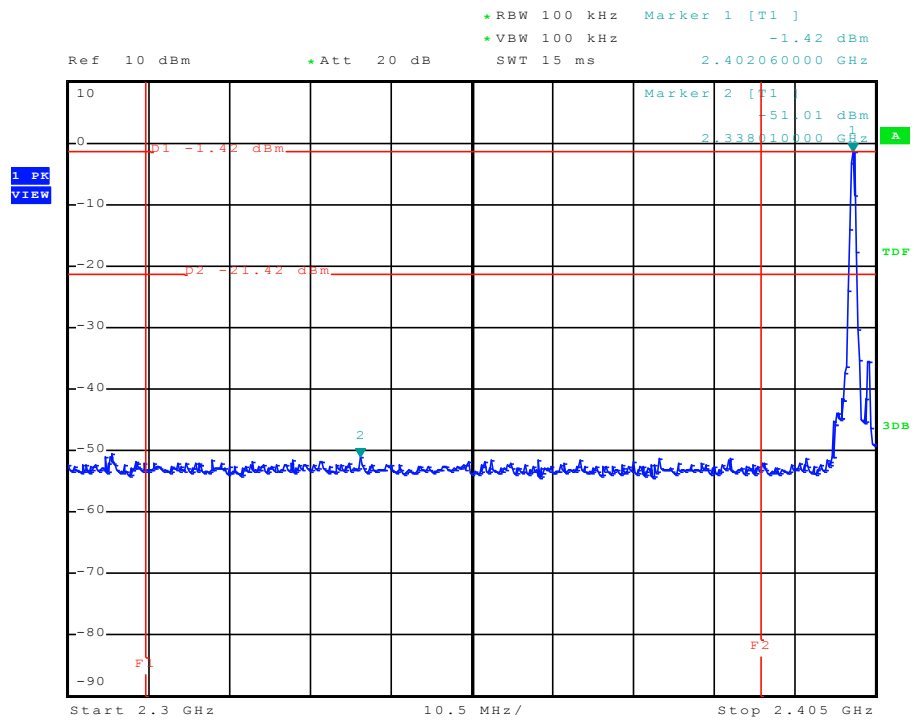
The spectrum plots are attached on the following 8 images, D1 line indicates the highest level, D2 line indicates the 20 dB offset below D1. It shows compliance with the requirement in part 15.247(d)

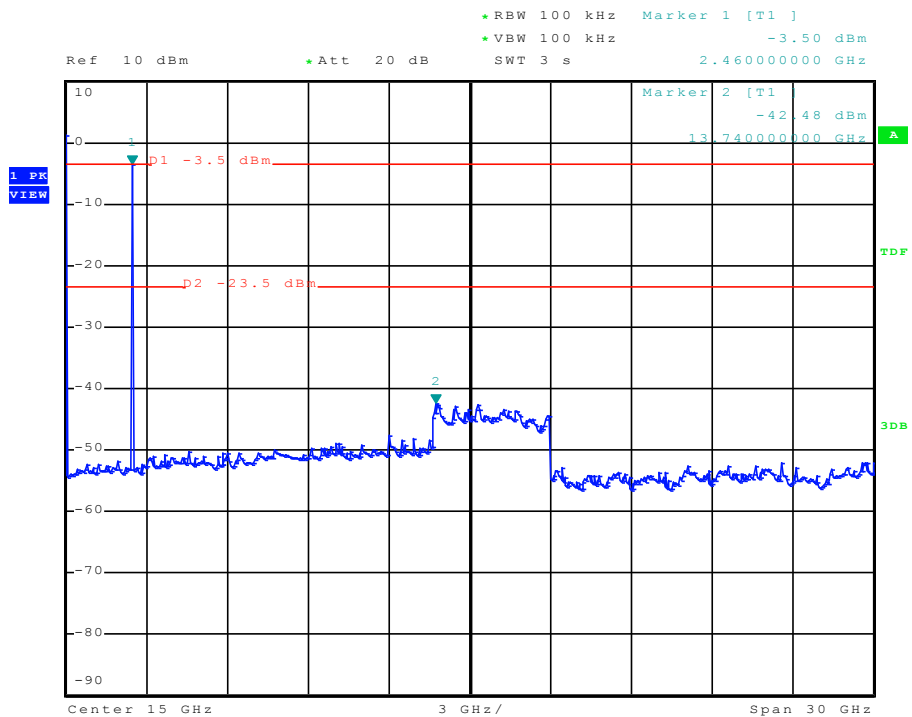
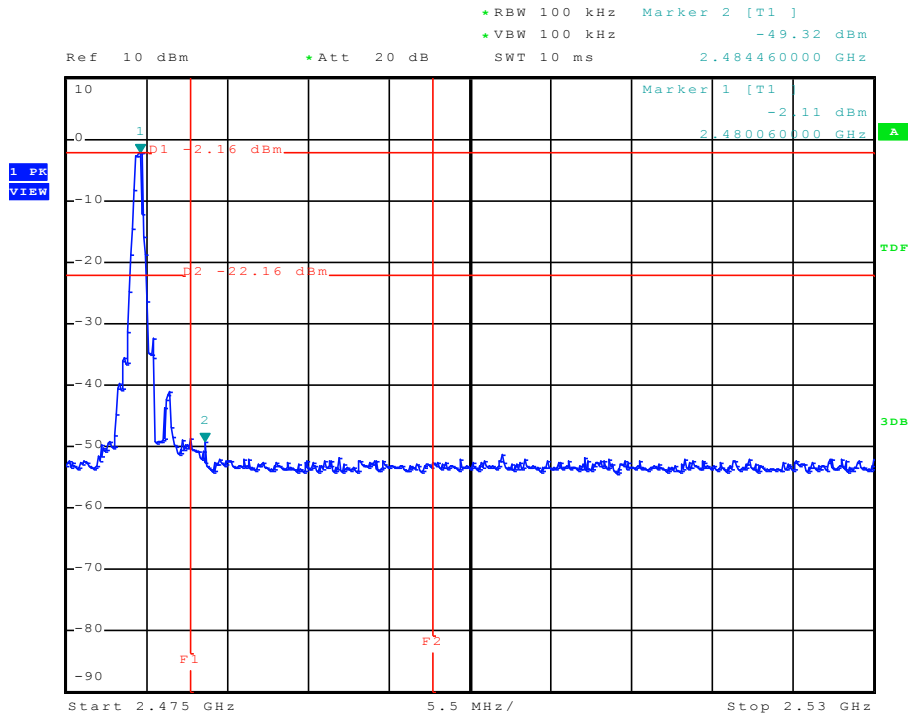
Spectrum Parameter

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



Band edge used Plot on Configuration GFSK







12. RADIATED EMISSION

12.1 Operating Environment

Temperature : 24.0 °C
Relative Humidity : 41.0 % R.H.

12.2 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.

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 (Anechoic chamber) | Uncertainty | Remark |
|--|-------------|---------------------------------------|
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical) | ± 4.09 dB | Confidence levels of 95 % ($k = 2$) |
| Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal) | ± 3.78 dB | Confidence levels of 95 % ($k = 2$) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical) | ± 3.85 dB | Confidence levels of 95 % ($k = 2$) |
| Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal) | ± 4.11 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 |



12.5 Test Equipment used

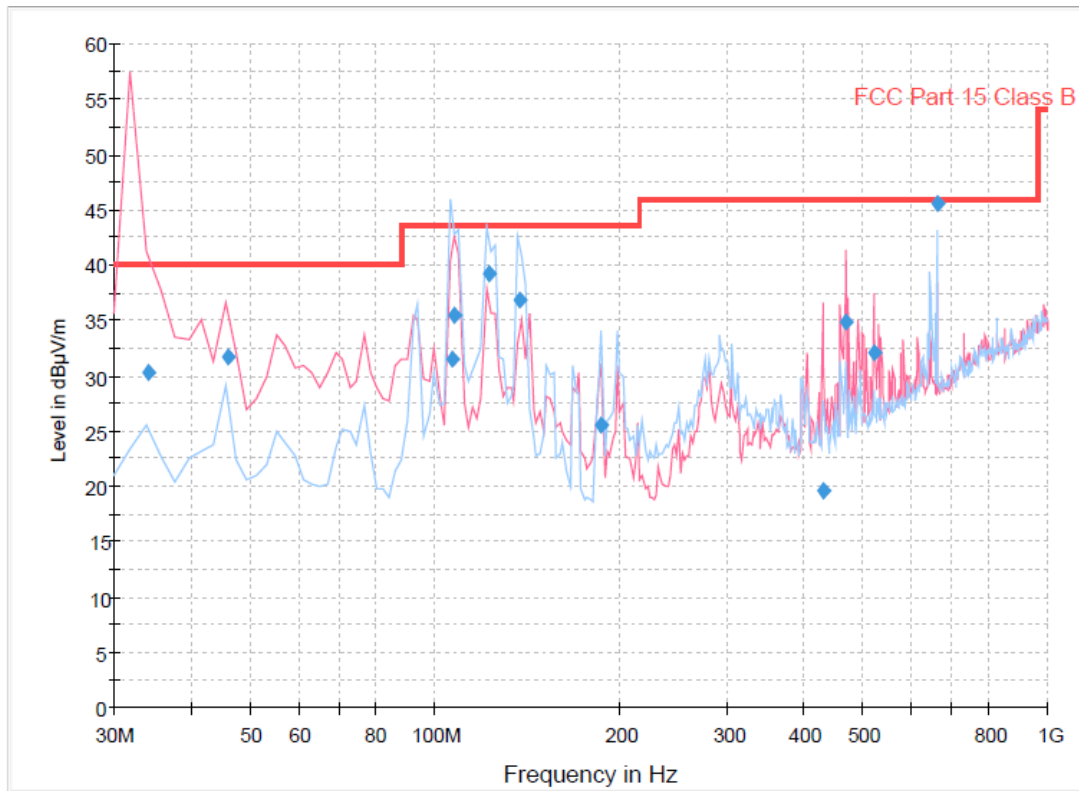
| Model Name | Manufacturer | Description | Serial Number | Due to Calibration |
|------------------------------|-----------------|------------------------|---------------|--------------------|
| ■ - ESIB26 | Rohde & Schwarz | EMI Test Receiver | 830482/010 | 12. 10. 2011 |
| ■ - VULB9160 | Schwarzbeck | 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 |
| ■ - AFS44-00101800-25-10P-44 | MITEQ | Preamplifier | 1258943 | 11. 12. 2011 |

12.6 Radiated emission test data

| | |
|---------------------------------------|---|
| - Test Date | : September 20 ~ 23, 2011 |
| - Reference Standard | : Part 15 Subpart C, Sec. 15.247(d) |
| - Modulation / Channel | : GFSK (0 CH / 39 CH / 78 CH) |
| - 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 12 V (Car battery) |
| - Note | : This equipment is used in a fixed location. |



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



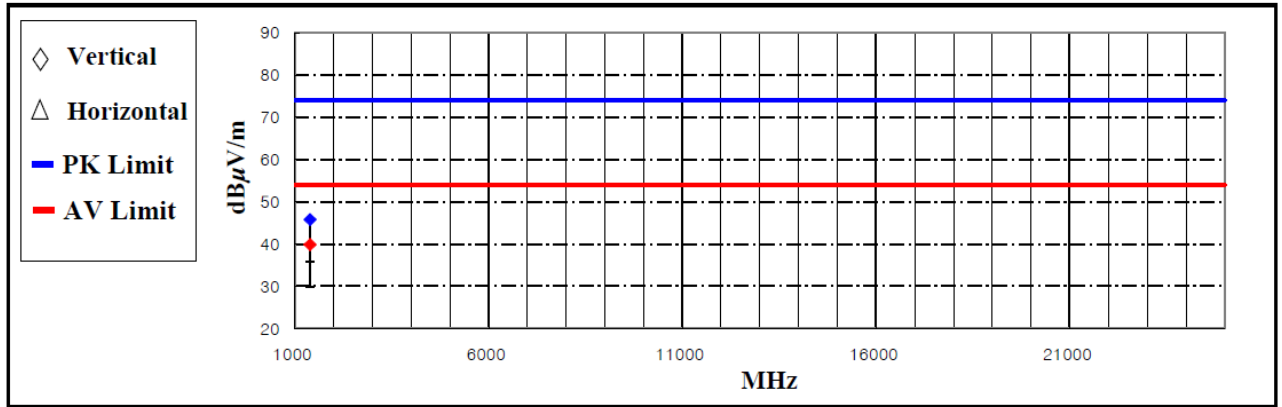
Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Corr. (dB) | Margin (dB) | Limit (dBμV/m) |
|-----------------|--------------------|-----------------|-----------------|-------------|--------------|---------------|------------|-------------|----------------|
| 34.300000 | 30.3 | 1000.0 | 120.000 | 250.0 | V | 244.0 | 11.5 | 9.7 | 40.0 |
| 45.951102 | 31.7 | 1000.0 | 120.000 | 150.0 | V | 346.0 | 12.5 | 8.3 | 40.0 |
| 107.115511 | 31.4 | 1000.0 | 120.000 | 150.0 | V | 312.0 | 11.8 | 12.1 | 43.5 |
| 107.411623 | 35.5 | 1000.0 | 120.000 | 285.0 | H | 107.0 | 11.8 | 8.0 | 43.5 |
| 122.402725 | 39.3 | 1000.0 | 120.000 | 246.0 | H | 280.0 | 13.3 | 4.2 | 43.5 |
| 137.713828 | 36.8 | 1000.0 | 120.000 | 236.0 | H | 261.0 | 13.9 | 6.7 | 43.5 |
| 187.294910 | 25.5 | 1000.0 | 120.000 | 150.0 | H | 151.0 | 12.1 | 18.0 | 43.5 |
| 430.040882 | 19.6 | 1000.0 | 120.000 | 100.0 | V | 217.0 | 19.7 | 26.4 | 46.0 |
| 468.238637 | 34.9 | 1000.0 | 120.000 | 100.0 | V | 167.0 | 20.3 | 11.1 | 46.0 |
| 520.019719 | 32.2 | 1000.0 | 120.000 | 100.0 | V | 198.0 | 21.3 | 13.8 | 46.0 |
| 658.979639 | 45.5 | 1000.0 | 120.000 | 115.0 | H | 177.0 | 24.1 | 0.5 | 46.0 |



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) | (°) |
| | 1392.19 | 59.13 | 53.23 | 25.37 | -38.70 | 45.80 | 39.90 | 74.00 | 54.00 | 28.20 | 14.10 | V | 100 |



*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

| 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 | (H/V) | (cm) | (°) | | |
| 2386.00 | 52.89 | 39.89 | 26.95 | -36.94 | 42.90 | 29.90 | 74.00 | 54.00 | 31.10 | 24.10 | V | 100 | 97 |
| 2402.21 | 105.22 | 97.12 | 26.99 | -36.91 | 95.30 | 87.20 | 74.00 | 54.00 | - | - | H | 126 | 132 |

79 CH

| 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 | (H/V) | (cm) | (°) | | |
| 2479.97 | 112.59 | 105.89 | 27.20 | -36.79 | 103.00 | 96.30 | 74.00 | 54.00 | - | - | H | 150 | 117 |
| 2483.50 | 64.27 | 51.17 | 27.21 | -36.78 | 54.70 | 41.60 | 74.00 | 54.00 | 19.30 | 12.40 | V | 150 | 92 |

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

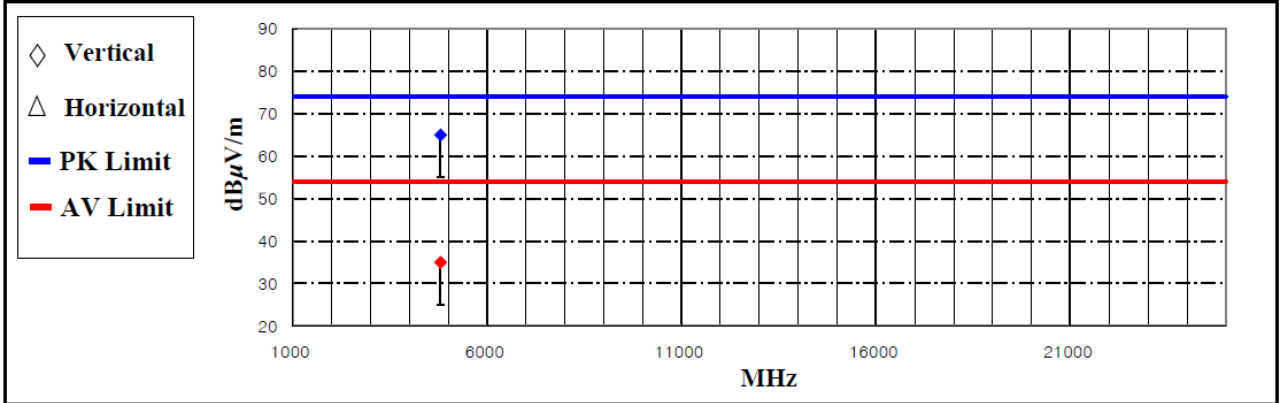
Corrected reading: Antenna factor + Cable loss + Preamplifier gain + Read value = Test result



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

(GFSK, 0 CH / 2 402 MHz)

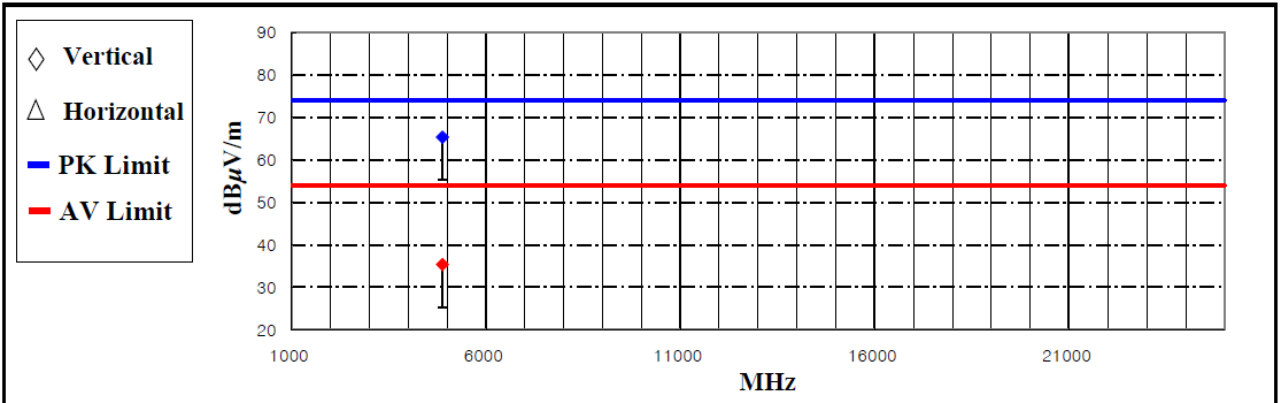
| Frequency (MHz) | Measurement Level | | | | | | Limit (dBμ V/m) | | Margin (dB) | | Positioning System | | |
|--------------------|----------------------------|---------|--------|----------|--------------------------|---------|--------------------|---------|----------------|------|--------------------|--------|-------|
| | 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 | (H/V) | (cm) | (°) | | |
| | 4804.21 | 66.63 | 36.63 | 31.20 | -32.83 | 65.00 | 35.00 | 74.00 | 54.00 | 9.00 | 19.00 | V | 100 |



*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) | (°) | | |
| 4882.37 | 66.83 | 36.83 | 31.34 | -32.77 | 65.40 | 35.40 | 74.00 | 54.00 | 8.60 | 18.60 | V | 131 | 88 |

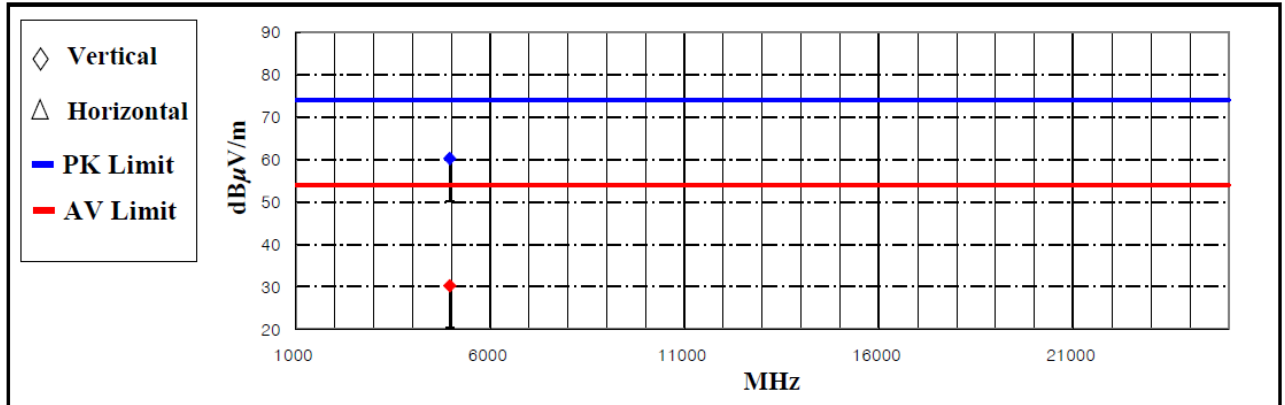


*Comment : AMP/CL_Cable loss value + AMP gain value
AF : Antenna factor value
Pol. : H(Horizontal), V(Vertical)



(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) | (°) |
| 4960.11 | 61.54 | 31.54 | 31.47 | -32.71 | 60.30 | 30.30 | 74.00 | 54.00 | 13.70 | 23.70 | V | 149 | 73 |



*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 296.25ms per channel, Therefore, the duty cycle correlation factor is equal to: $20 \log (3.125/100) = -30\text{dB}$.

Average value = peak reading - 20 log (duty cycle) = peak value - 30dB

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