



Dates of Tests: May 09 ~ 18, 2016  
Test Report S/N: LR500111605D  
Test Site : LTA CO., LTD.

## CERTIFICATION OF COMPLIANCE

FCC ID

**2AIHIGPR-BT-001**

APPLICANT

**GUNPOWER Inc.**

Equipment Class	:	Part 15 Spread Spectrum Transmitter (DSS)
Manufacturing Description	:	Bluetooth Module
Manufacturer	:	GUNPOWER Inc.
Model name	:	GPR-BT-001
Test Device Serial No.:	:	Identical prototype
Rule Part(s)	:	FCC Part 15.247 Subpart C; ANSI C-63.4-2014
Frequency Range	:	2402 ~ 2480 MHz
RF power	:	Max -8.4 dBm – Conducted
Data of issue	:	May 20, 2016

This test report is issued under the authority of:



Yong-Cheol, Wang, Manager

The test was supervised by:



Young-jin Lee, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.



NVLAP LAB Code.: 200723-0

---

## **TABLE OF CONTENTS**

1. GENERAL INFORMATION .....	3
2. INFORMATION ABOUT TEST ITEM .....	4
3. TEST REPORT .....	5
3.1 SUMMARY OF TESTS .....	5
3.2 FREQUENCY HOPPING SYSTEM REQUIREMENTS.....	6
3.3 TECHNICAL CHARACTERISTICS TEST .....	8
3.3.1 CARRIER FREQUENCY SEPARATION .....	8
3.3.2 NUMBER OF HOPPING FREQUENCIES .....	10
3.3.3 20 dB BANDWIDTH .....	12
3.3.4 TIME OF OCCUPANCY (Dwell Time) .....	15
3.3.5 TRANSMITTER OUTPUT POWER .....	19
3.3.6 BAND EDGE .....	22
3.3.7 CONDUCTED SPURIOUS EMISSIONS .....	26
3.3.8 RADIATED SPURIOUS EMISSIONS .....	29
3.3.9 AC CONDUCTED EMISSIONS .....	38
 <b>APPENDIX</b>	
APPENDIX TEST EQUIPMENT USED FOR TESTS .....	45

## 1. General information

### 1-1 Test Performed

Company name : LTA Co., Ltd.  
 Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 449-822  
 Web site : <http://www.ltalab.com>  
 E-mail : [chahn@ltalab.com](mailto:chahn@ltalab.com)  
 Telephone : +82-31-323-6008  
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

### 1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:


Agency	Country	Accreditation No.	Validity	Reference
NVLAP	U.S.A	200723-0	2016-09-30	ECT accredited Lab.
RRA	KOREA	KR0049	-	EMC accredited Lab.
FCC	U.S.A	610755	2017-04-21	FCC filing
FCC	U.S.A	649054	2017-04-13	FCC CAB
VCCI	JAPAN	R2133(10 m), C2307	2017-06-21	VCCI registration
VCCI	JAPAN	T-2009	2016-12-23	VCCI registration
VCCI	JAPAN	G-563	2018-12-13	VCCI registration
IC	CANADA	5799A-1	UPDATING	IC filing
KOLAS	KOREA	NO.551	2017-01-08	KOLAS accredited Lab.

## 2. Information about test item

### 2-1 Client & Manufacturer

Company name : GUNPOWER Inc.  
 Address : 2 floor No.201 33 Ajung-ro, Wansan-gu, Jeonju-city,  
 Jeollabuk-do, Republic of Korea  
 Telephone / Facsimile : +82-63-278-9373 / +82-63-278-9374

### 2-2 Equipment Under Test (EUT)

Trade name :   
 Model name : GPR-BT-001  
 Serial number : Identical prototype  
 Date of receipt : May 09, 2016  
 EUT condition : Pre-production, not damaged  
 Antenna type : Chip Antenna with Max Gain: 1.59 dBi  
 Frequency Range : 2402 ~ 2480 MHz  
 RF output power : Max. -8.4 dBm – Conducted  
 Number of Channels : 79  
 Channel Spacing : 1 MHz  
 Channel Access Protocol : Frequency Hopping Spread Spectrum (FHSS)  
 Type of Modulation : GFSK  
 Power Source : DC 3.3 V  
 Firmware Version : V 1.0.0

### 2-3 Tested frequency

Bluetooth	LOW	MID	HIGH
Frequency (MHz)	2402	2441	2480

### 2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
NOTEBOOK	PP37L	29705283757	DELL

### 3. Test Report

#### 3.1 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	Carrier Frequency Separation	$\geq 2/3$ of 20 dB BW	Conducted	C
15.247(a)	Number of Hopping Frequencies	$\geq 15$ channels		C
15.247(a)	20 dB Bandwidth 99% Bandwidth	—		C
15.247(a)	Dwell Time	$\leq 0.4$ seconds		C
15.247(b)	Transmitter Output Power	$\leq 1$ W for 1Mbps $\leq 125$ mW for 2,3 Mbps		C
15.247(d)	Conducted Spurious emission	$> 20$ dBc		C
15.247(d)	Band Edge	$> 20$ dBc		C
15.249 / 15.209	Field Strength of Harmonics	$< 54$ dBuV (at 3m)	Radiated	C
15.109	Field Strength	—		C
15.207 / 15.107	AC Conducted Emissions	EN 55022	Line Conducted	C
15.203	Antenna requirement	—	—	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

#### Note 1: Antenna Requirement

→ The **GUNPOWER Inc.** FCC ID: **2AIHIGPR-BT-001** unit complies with the requirement of §15.203.

The antenna type is Chip antenna.

**Note 2:** The sample was tested according to the following specification:

FCC Parts 15.247; ANSI C-63.4-2014

#### Note3: TEST METHODOLOGY

The measurement procedure described in the American National Standard for Testing Unlicensed Wireless Devices(ANSI C63.10-2013) and FCC Public Notice DA 00-705 dated March 30, 2000 entitled “Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems” were used in the measurement of the **GUNPOWER Inc.** FCC ID : **2AIHIGPR-BT-001**

## 3.2 Frequency Hopping System Requirements

### 3.2.1 Standard Applicable

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

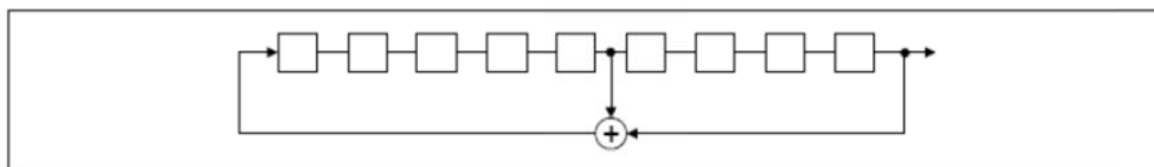
(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

### 3.2.2 EUT Pseudorandom Frequency Hopping Sequence

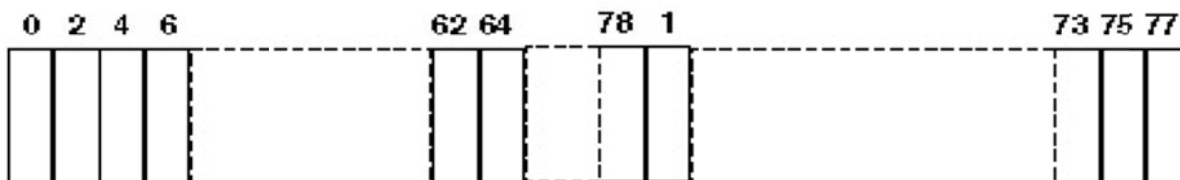
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones. Number of shift register stages: 9

Length of pseudo-random sequence:  $2^9 - 1 = 511$  bits

Longest sequence of zeros: 8 (non-inverted signal)



*Linear Feedback Shift Register for Generation of the PRBS sequence*



Each frequency used equally on the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

### 3.2.3 Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5 MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

\*Example for a Bluetooth device using channel numbers would be : Chan 44, 35, 78, 03, 15, 21, 76, 40, 56, 13, 02, 19, 67, 39, 78, 20, 21, 64, 75 etc.

### 3.3 TECHNICAL CHARACTERISTIC TEST

#### 3.3.1 Carrier Frequency Separation

##### Procedure:

The test follows DA00-705. The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 3 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 10 kHz (1% of the span or more)      Sweep = auto

VBW = 10 kHz      Detector function = peak

Trace = max hold

##### Measurement Data:

Test Results	
Carrier Frequency Separation (MHz)	Result
1.0029	Complies

- See next pages for actual measured spectrum plots.

##### Minimum Standard:

The EUT shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of 20 dB bandwidth of the hopping channel, whichever is greater.

##### Measurement Setup

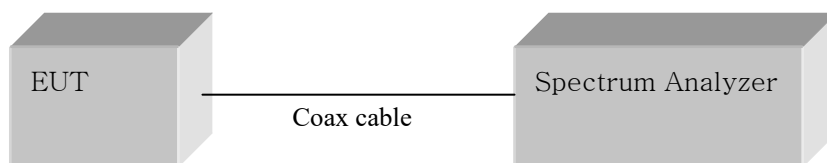
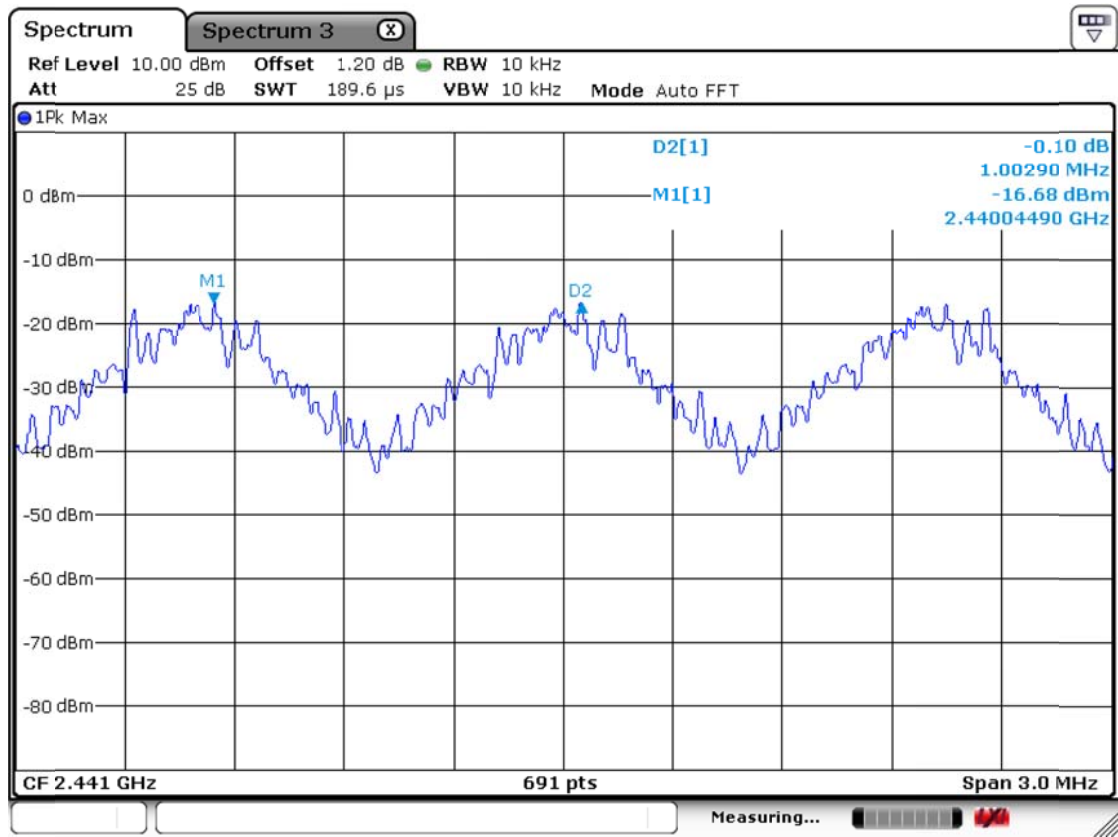


Figure 1: Measurement setup for the carrier frequency separation

## Carrier Frequency Separation

### Basic Mode



### 3.3.2 Number of Hopping Frequencies

#### Procedure:

The test follows DA00-705. The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, four frequency ranges within the 2400 ~ 2483.5 MHz FH band were examined.

The spectrum analyzer is set to (Bluetooth):

Frequency range      Start = 2400.0 MHz,    Stop = 2483.5 MHz

RBW = 100 kHz (1% of the span or more)      Sweep = auto

VBW = 100 kHz (VBW  $\geq$  RBW)      Detector function = peak

Trace = max hold      Span > 40 MHz

#### Measurement Data : **Complies**

<b>Total number of Hopping Channels</b>	79
---	----

- See next pages for actual measured spectrum plots.

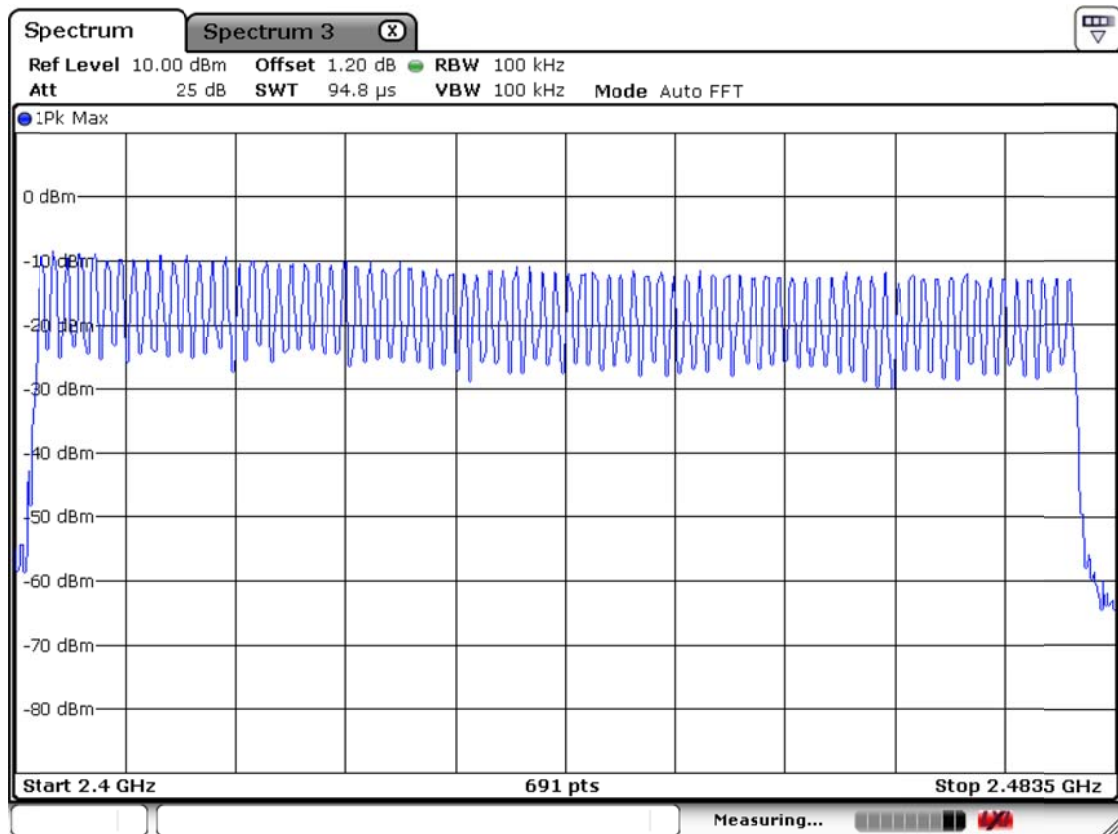
#### Minimum Standard:

At least 15 channels

#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

## Number of Hopping Frequencies



### 3.3.3 20 dB Bandwidth

#### Procedure:

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is ( as close as possible to ) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

#### The spectrum analyzer is set to (Bluetooth):

Center frequency = the highest, middle and the lowest channels

Span = 3 MHz (approximately 2 or 3 times of the 20 dB bandwidth)

RBW = 30 kHz

Sweep = auto

VBW = 30 kHz (VBW  $\geq$  RBW)

Detector function = peak

Trace = max hold

#### Measurement Data: Basic Mode

Frequency (MHz)	Channel No.	Test Results(MHz)
		20 dB Bandwidth
2402	0	0.820
2441	39	0.820
2480	78	0.820

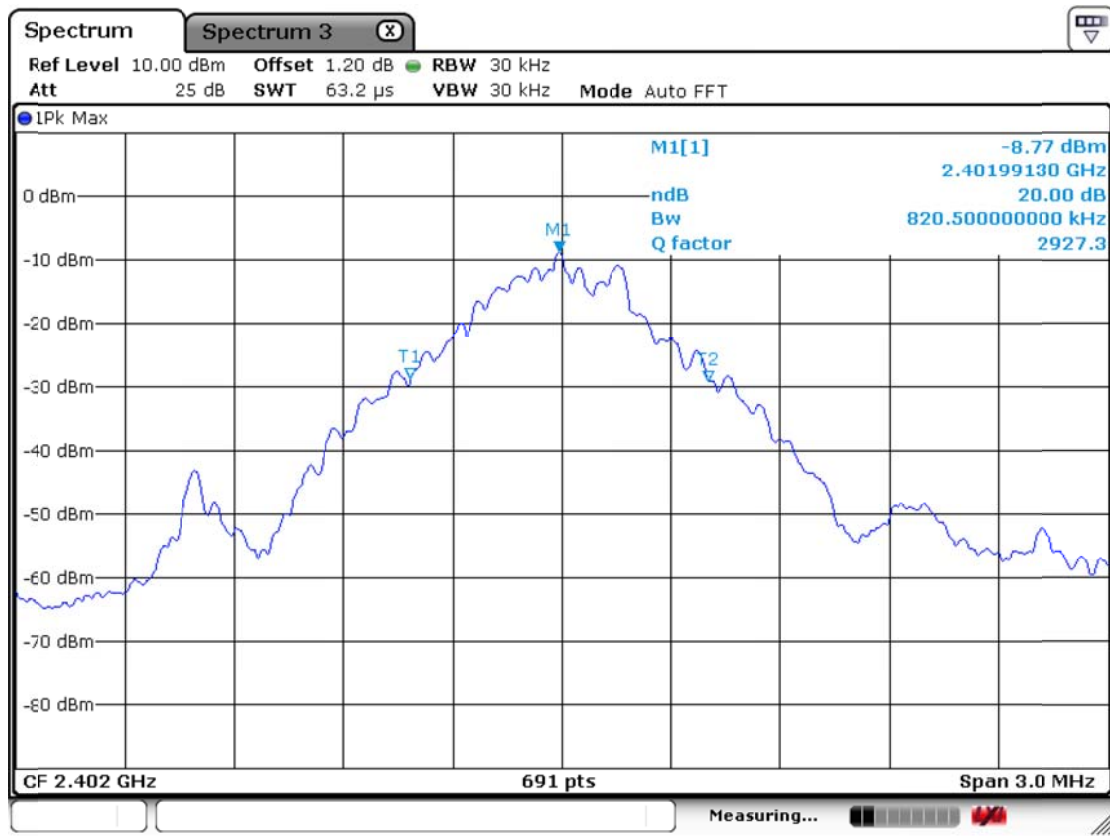
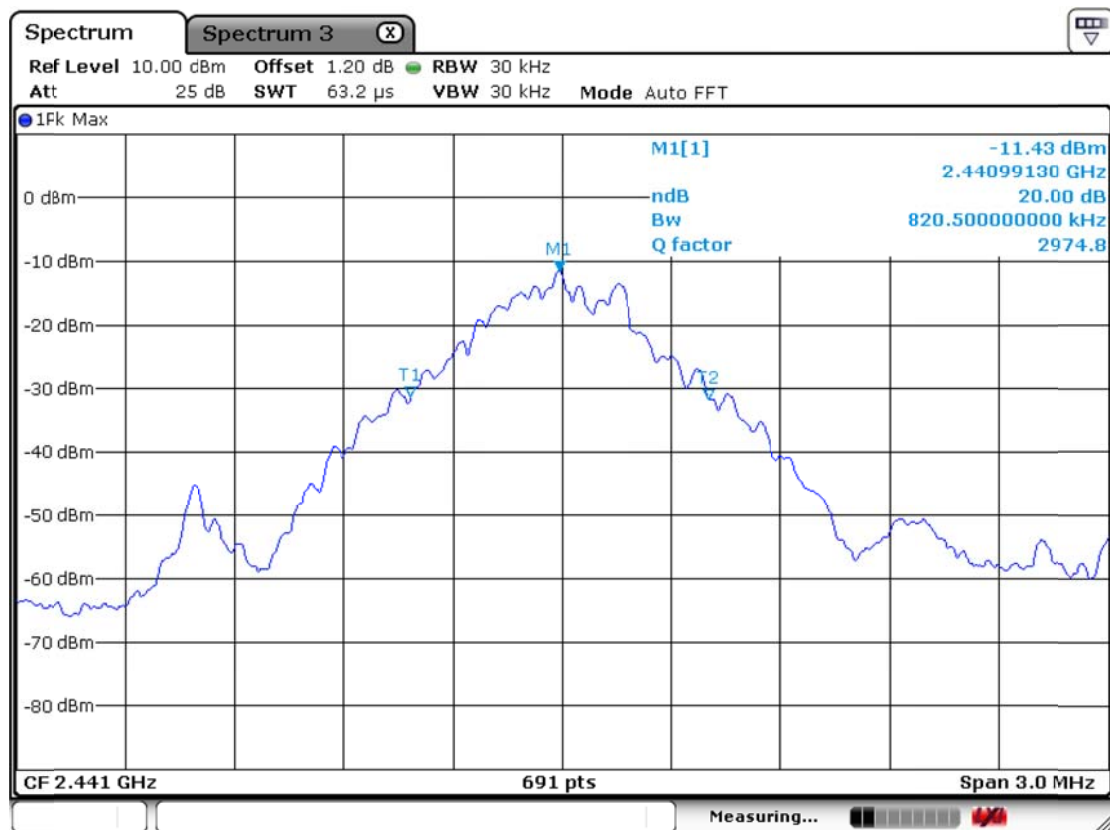
- See next pages for actual measured spectrum plots.

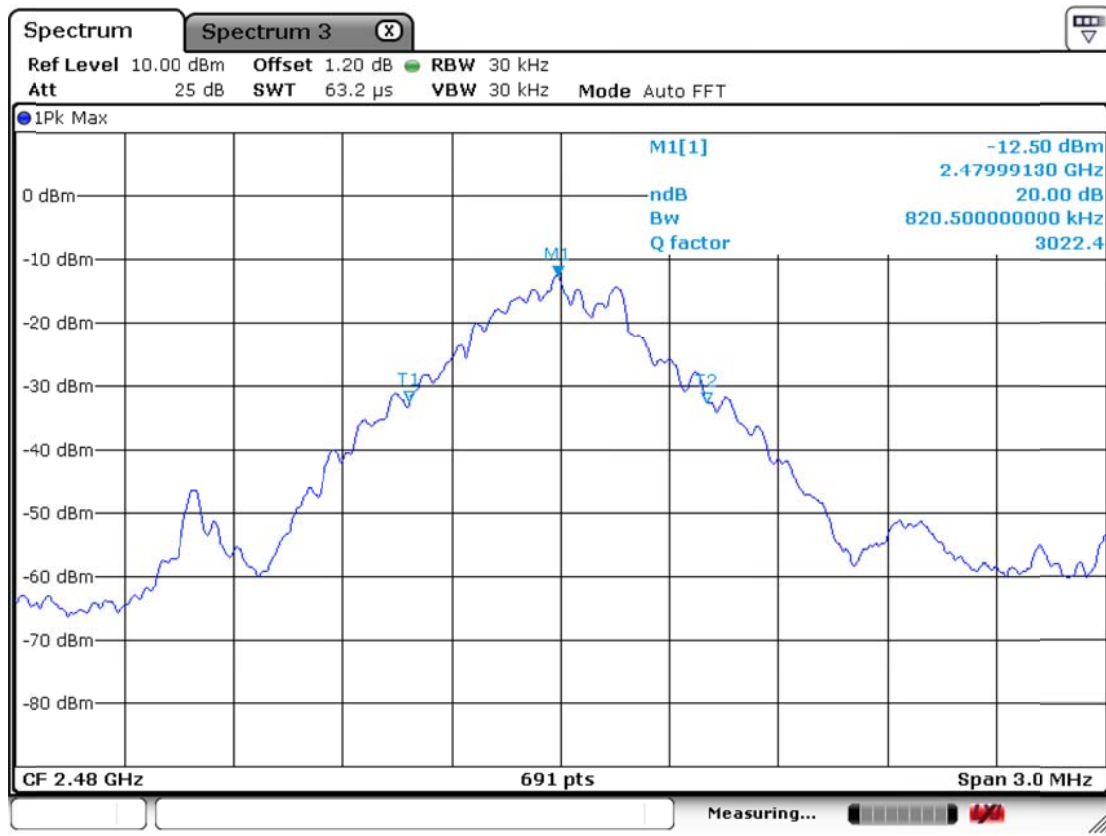
#### Minimum Standard:

N/A

#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

**Channel 1 of Basic mode****20 dB Bandwidth****Channel 2 of Basic mode****20 dB Bandwidth**

**Channel 3 of Basic mode****20 dB Bandwidth**

### 3.3.4 Time of Occupancy (Dwell Time)

#### Procedure:

The test follows DA00-705. The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to :

Center frequency = 2441 MHz

Span = zero

RBW = 1 MHz

VBW = 1 MHz (VBW  $\geq$  RBW)

Trace = max hold

Detector function = peak

#### Measurement Data (Bluetooth):

Mode	Number of transmission in a 31.6s ( 79Hopping*0.4)	Length of Transmission Time (msec)	Result (msec)	Limit (msec)
DH1	30(Times / 3sec) *10.533 = 315.99	0.464	146.62	400
DH3	15(Times / 3sec) *10.533 = 158.00	1.725	272.55	400
DH5	10(Times / 3sec) *10.533 = 105.33	3.174	334.32	400

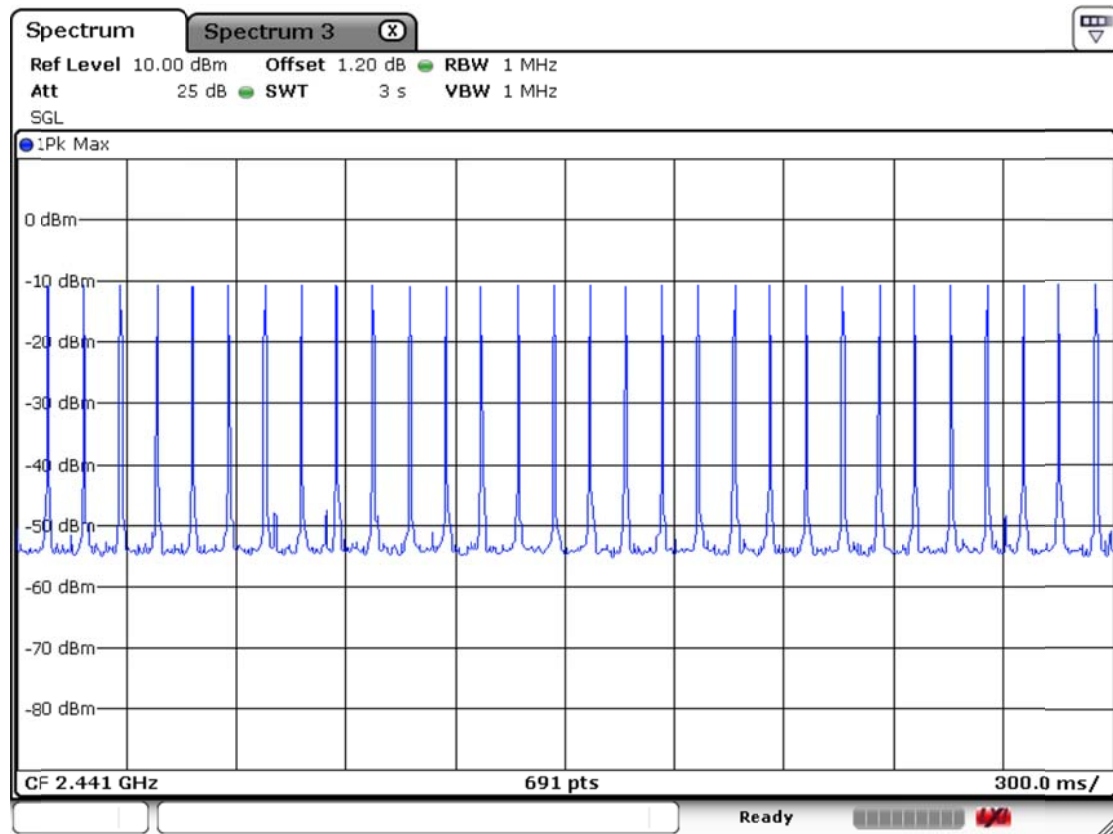
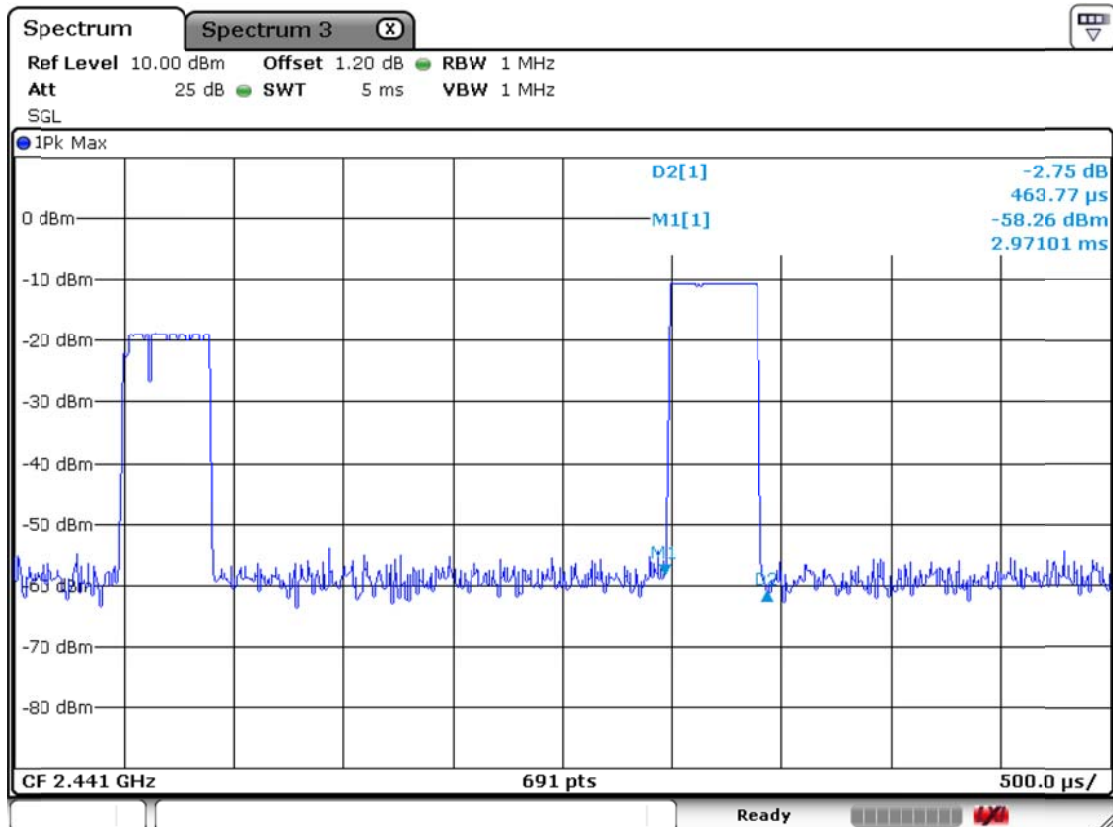
- See next pages for actual measured spectrum plots.
- dwell time = {(number of hopping per second / number of slot ) x duration time per channel} x 0.4 ms

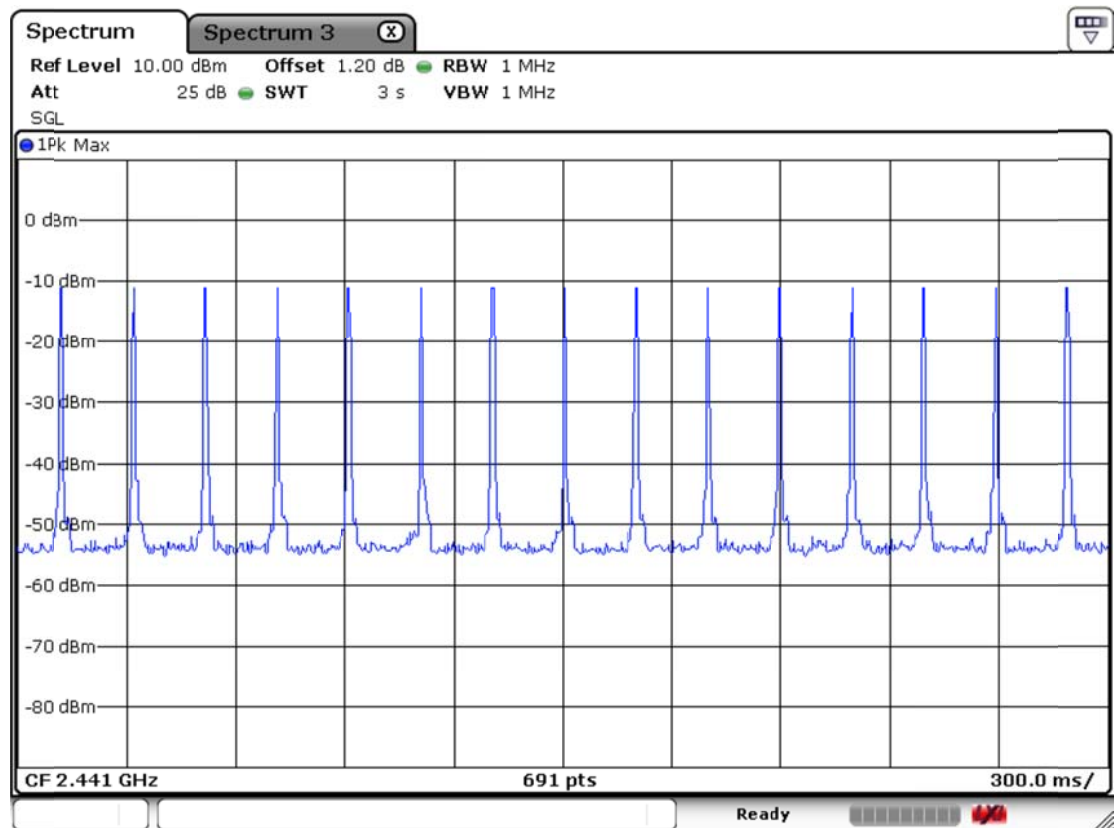
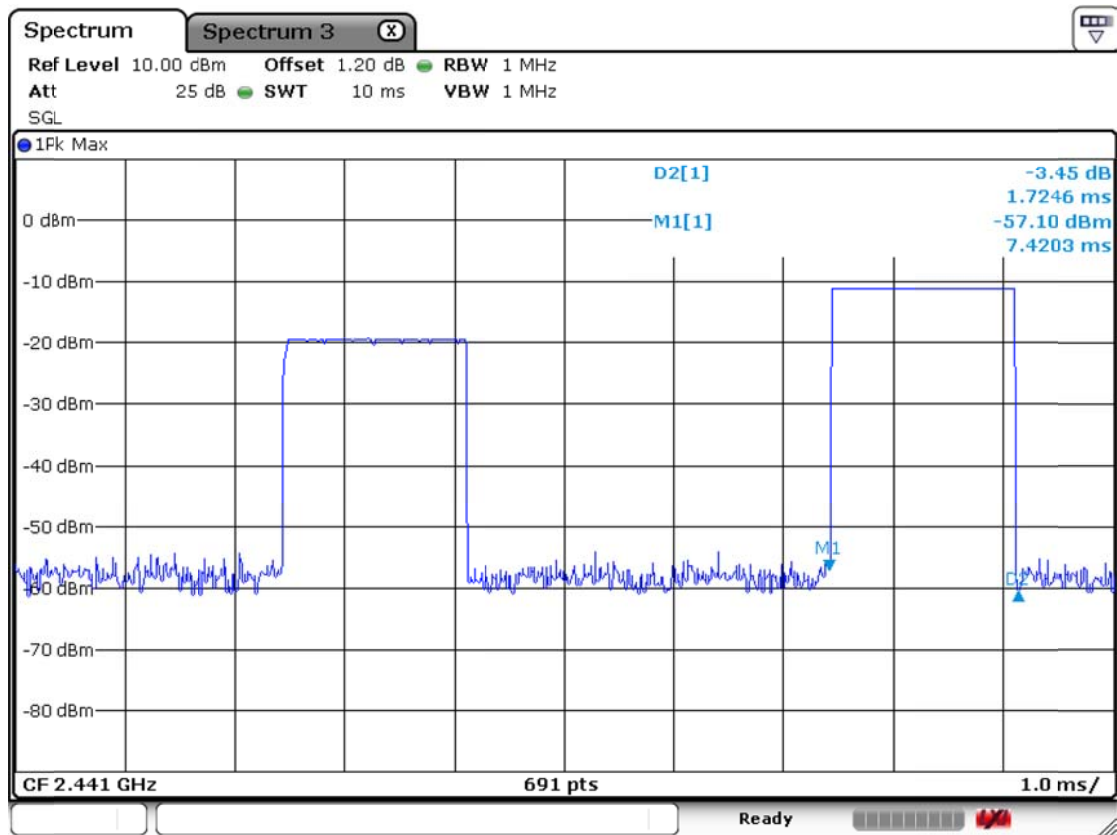
#### Minimum Standard:

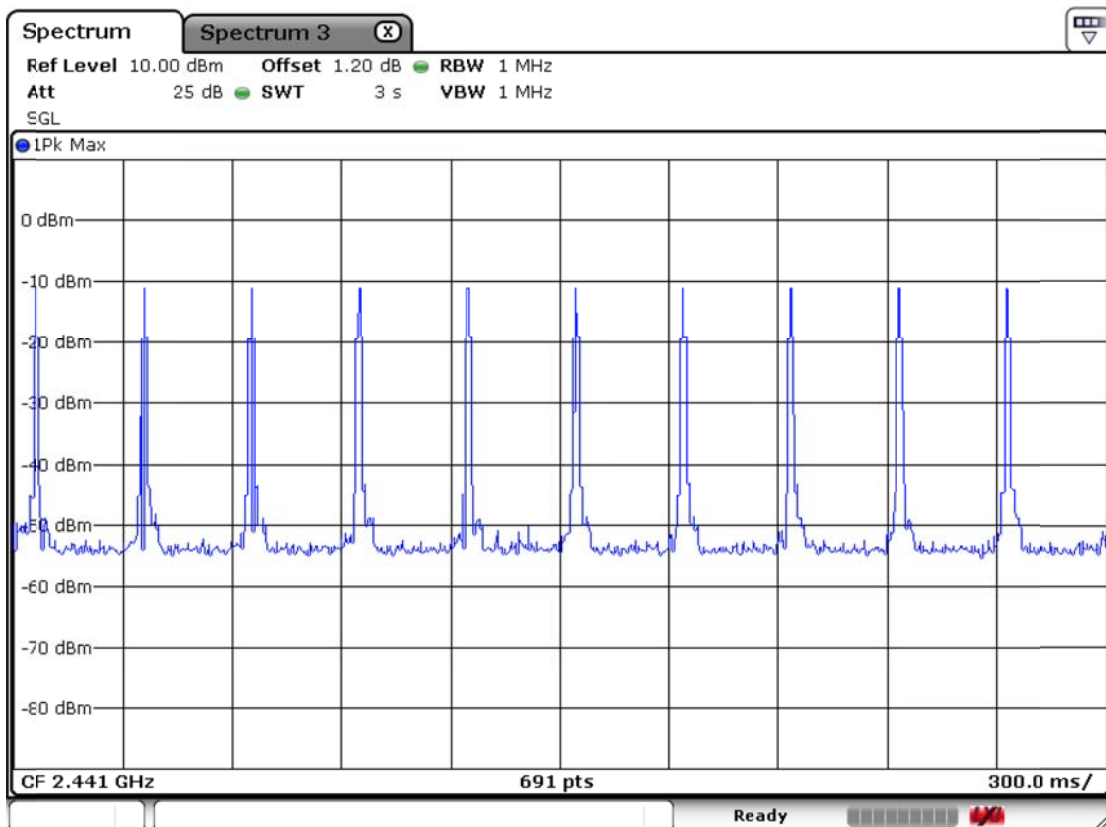
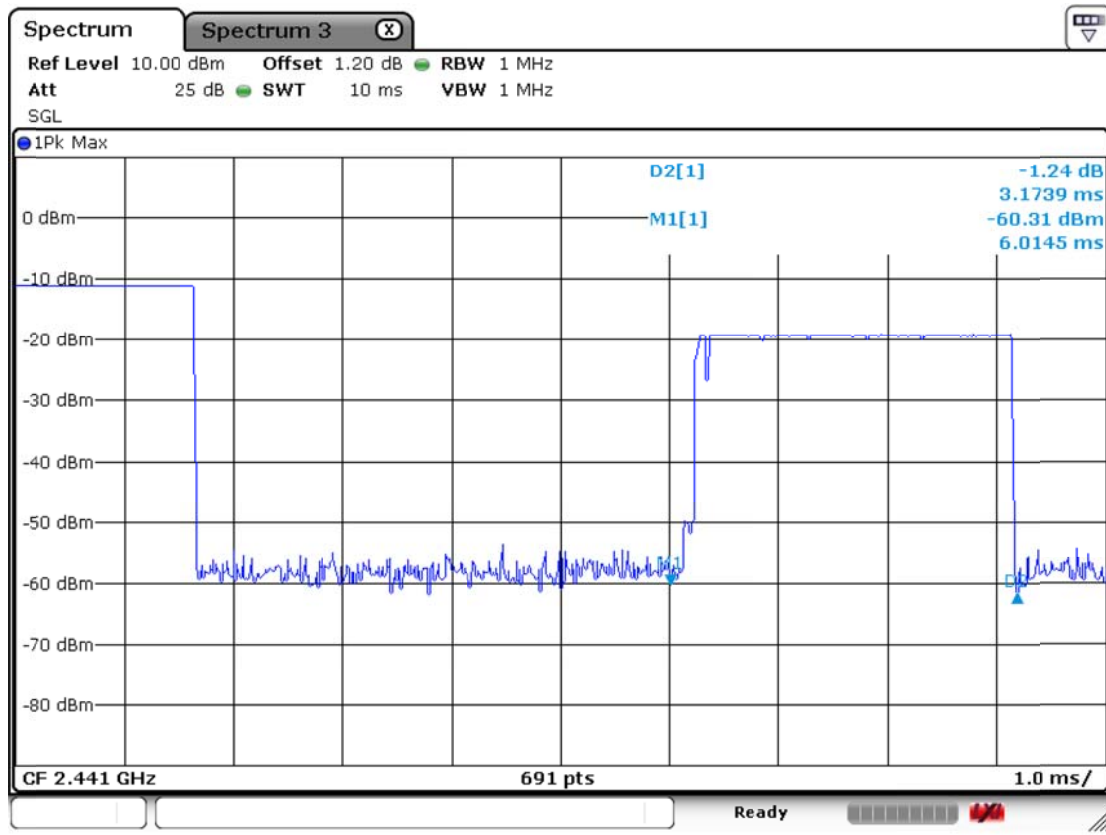
0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed

#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

**DH1 at Basic mode**

**DH3 at Basic mode**

**DH5 at Basic mode**

### 3.3.5 Transmitter Output Power

#### Procedure:

The test follows DA00-705. The peak output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

#### The spectrum analyzer is set to :

Center frequency = the highest, middle and the lowest channels

Span = 10 MHz (approximately 5 times of the 20 dB bandwidth)

RBW = 3 MHz (greater than the 20 dB bandwidth of the emission being measured)

VBW = 3 MHz (VBW  $\geq$  RBW)

Detector function = peak

Trace = max hold

Sweep = auto

#### Measurement Data : Basic Mode

Frequency (MHz)	Ch.	Test Results		
		dBm	mW	Result
2402	0	<b>-8.40</b>	<b>0.14</b>	Complies
2441	39	<b>-11.00</b>	<b>0.08</b>	Complies
2480	78	<b>-11.89</b>	<b>0.06</b>	Complies

- See next pages for actual measured spectrum plots.

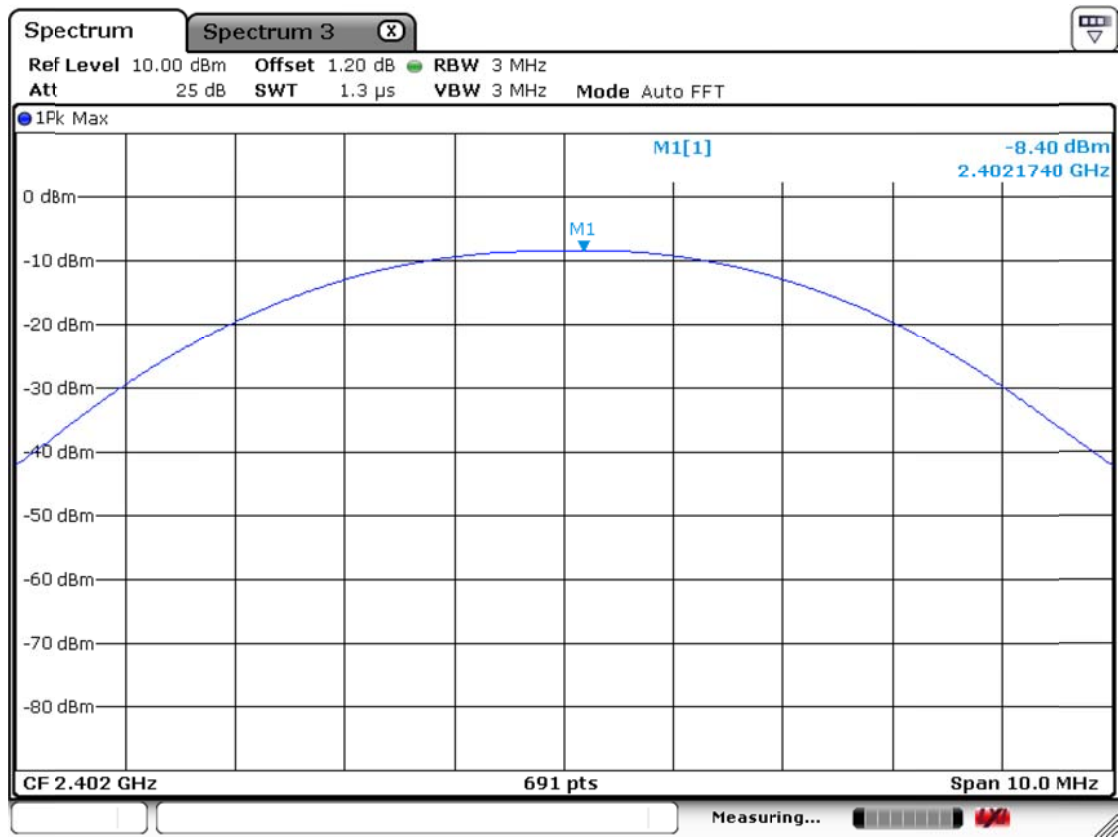
<b>Minimum Standard:</b>	For frequency hopping systems with at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems: 0.125W.
--------------------------	---

#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

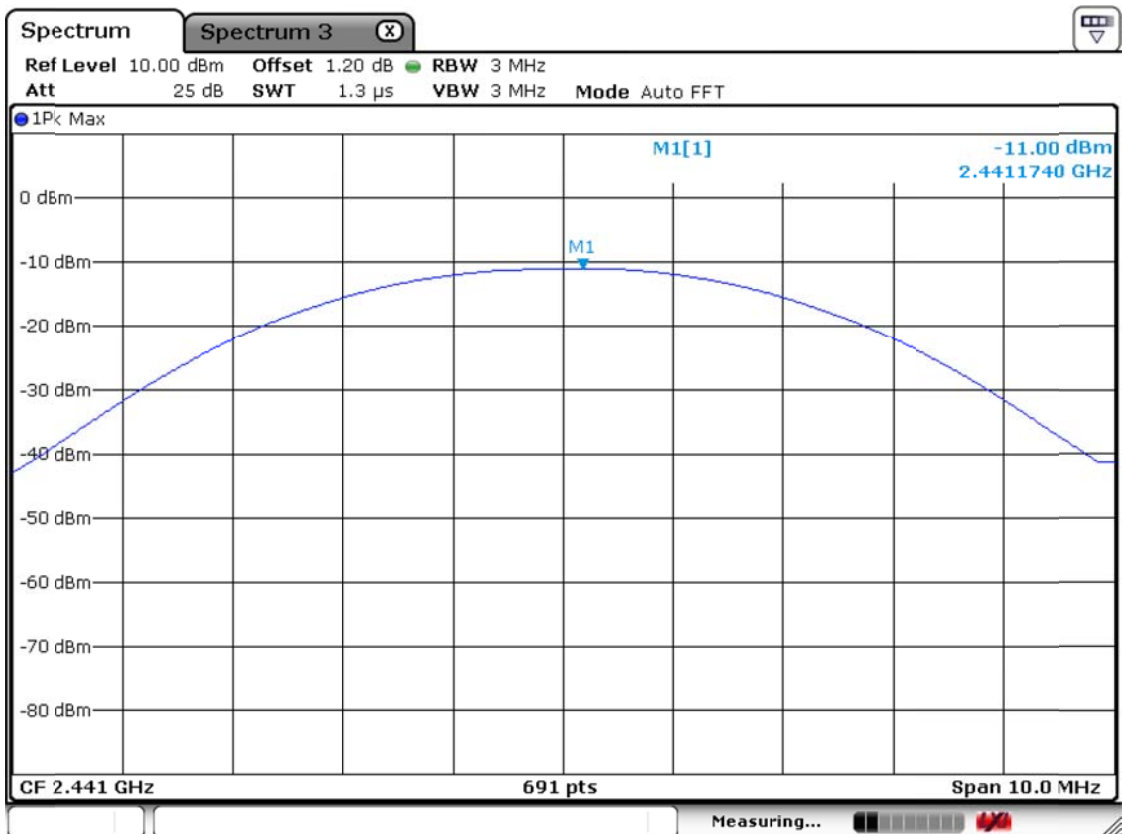
### Channel 1

### Basic mode



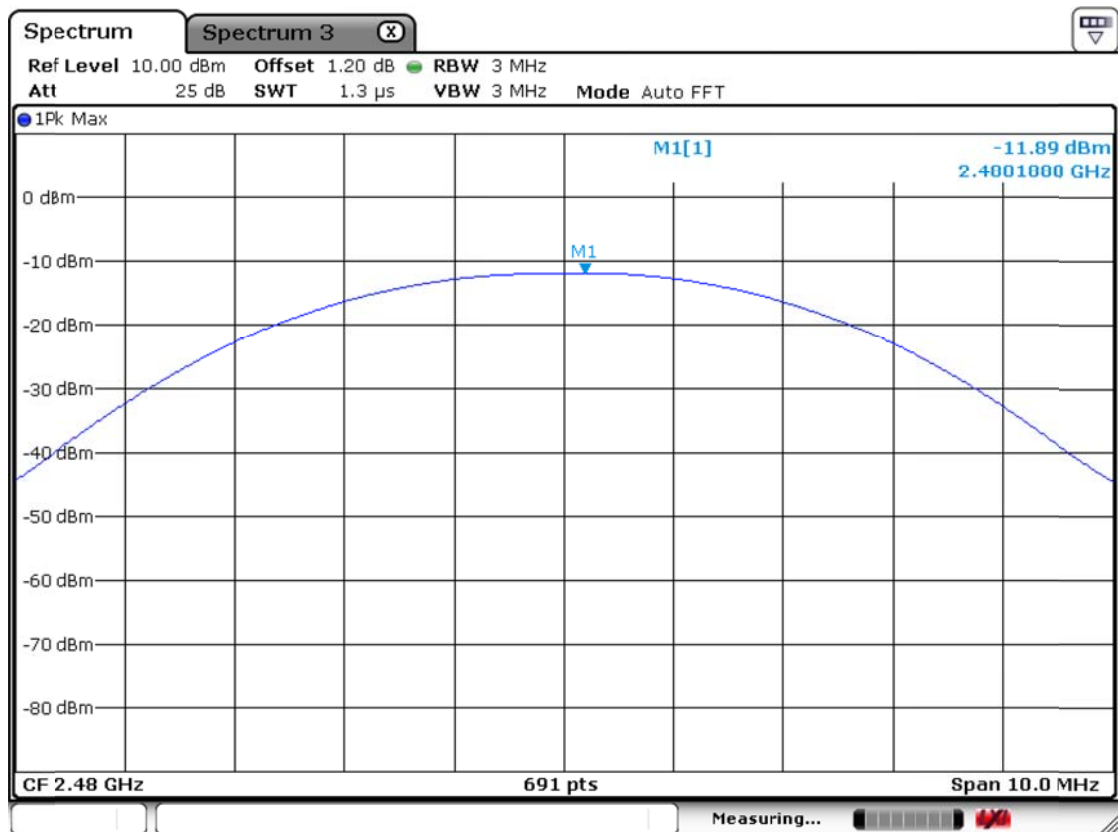
### Channel 2

### Basic mode



### Channel 3

### Basic mode



### 3.3.6 Band Edge

#### Procedure:

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

#### The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 100 kHz

Span = 10~30 MHz

Detector function = peak

Trace = max hold

Sweep = auto

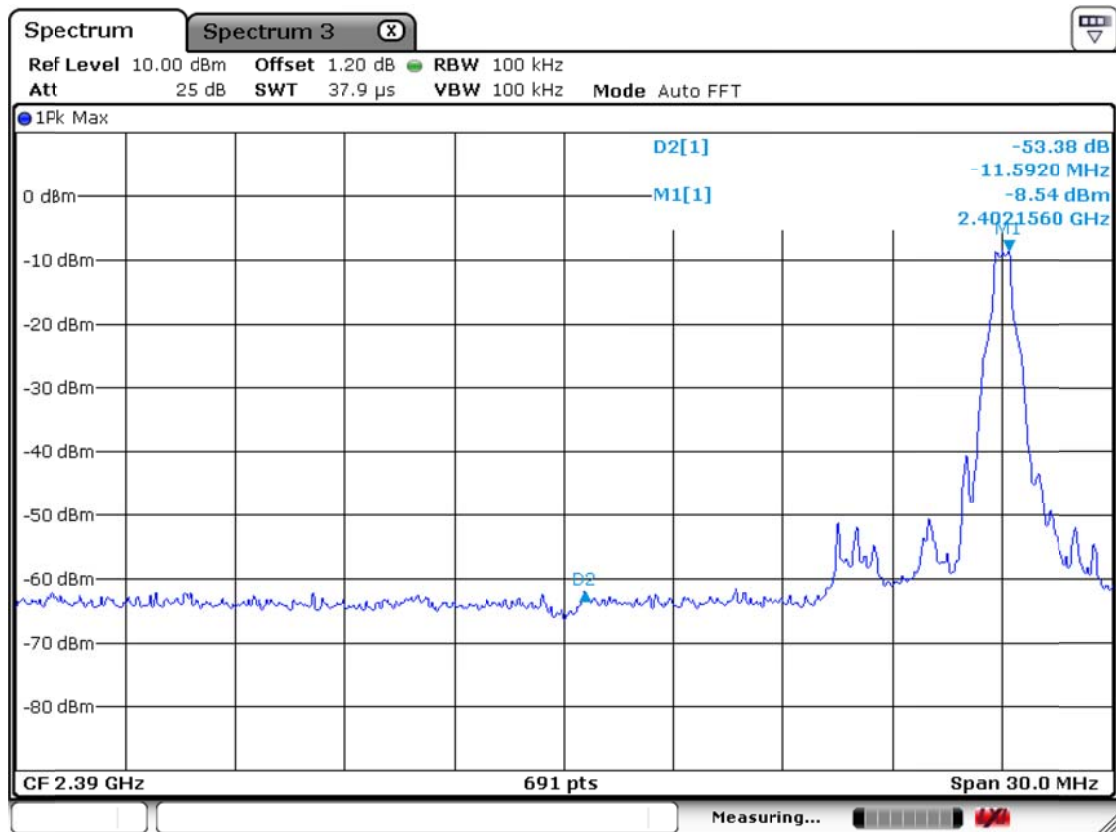
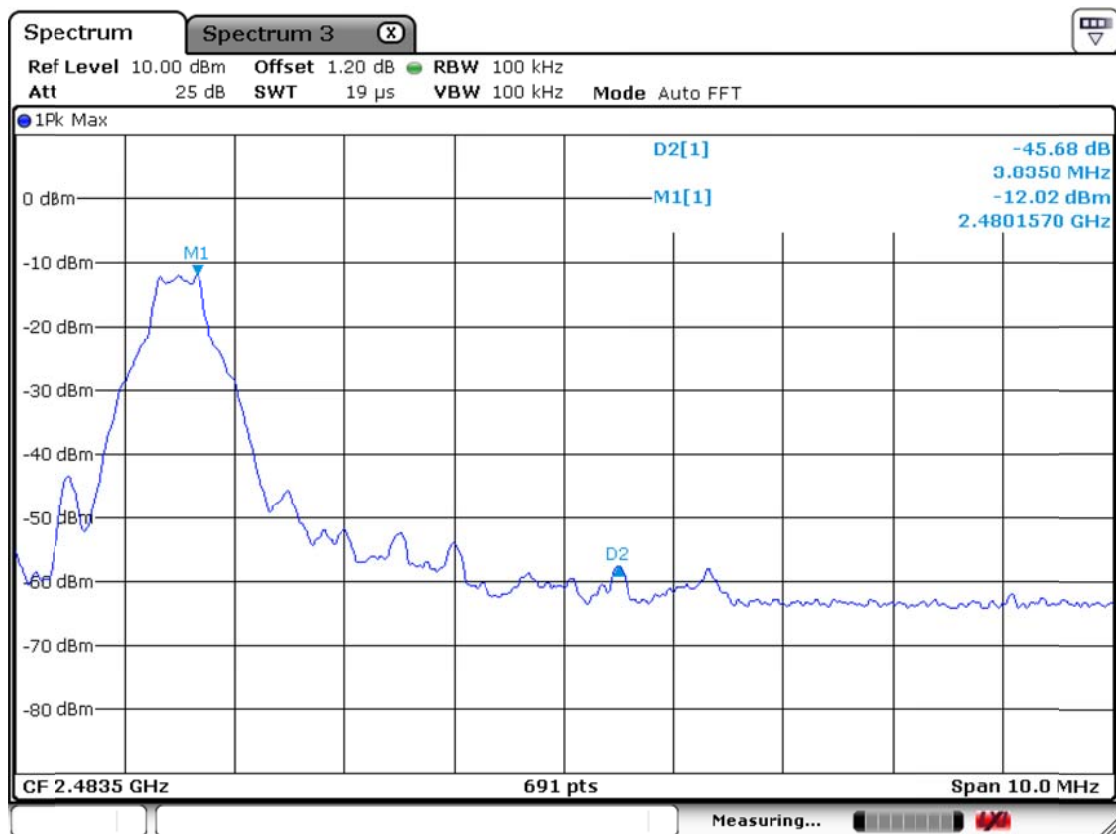
#### Measurement Data: **Complies**

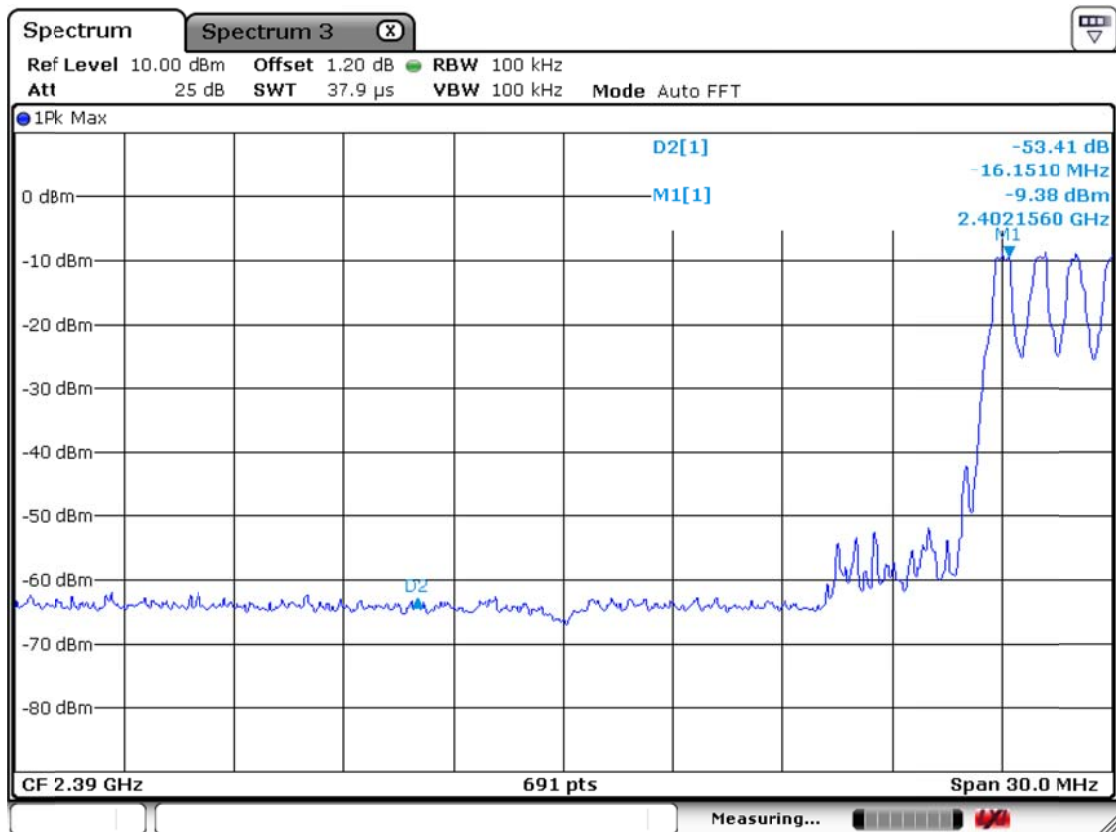
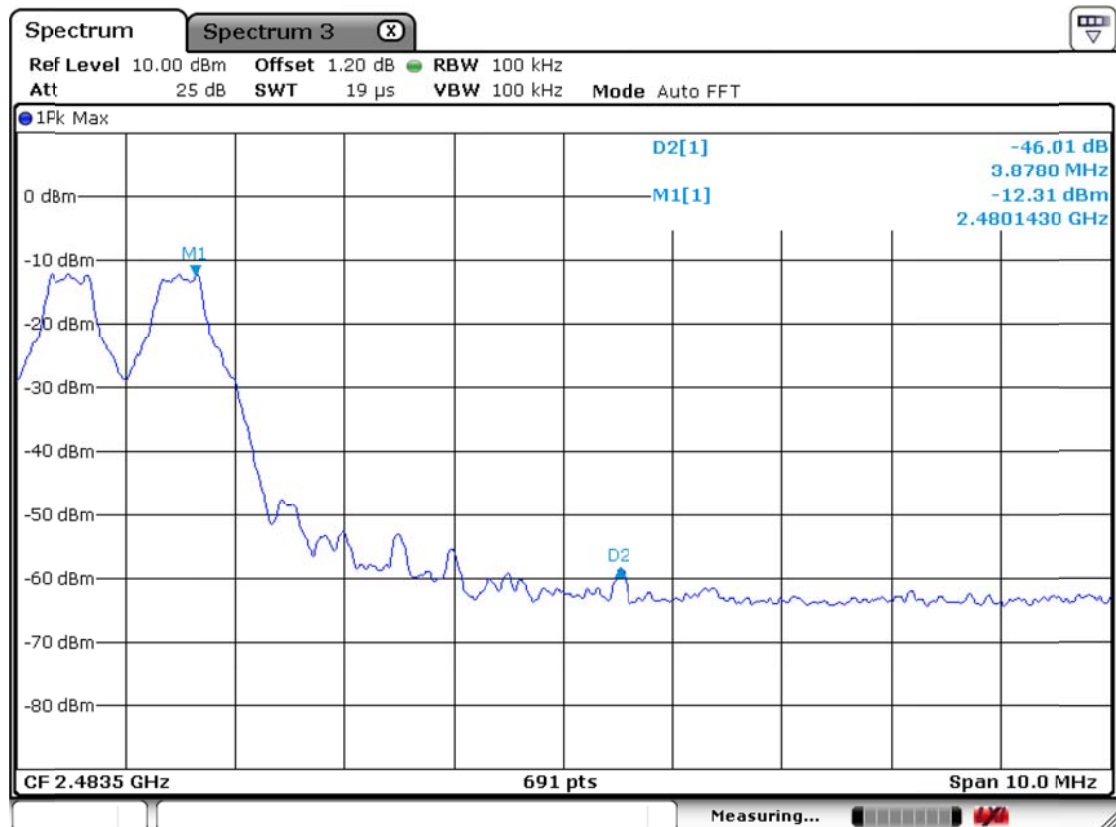
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

<b>Minimum Standard:</b>	> 20 dBc
--------------------------	----------

#### Measurement Setup

Same as the Chapter 3.3.1 (Figure 1)

**Band Edge****Lower edge****Upper edge**

**Band Edge- Hopping****Lower edge****Upper edge**

**Radiated Band edges in the restricted band 2310-2390 MHz measurement**

Frequency  [MHz]	Reading [dBuV/m]		Pol.	Correction  Factor		Limits [dBuV/m]		Result [dBuV/m]		Margin [dB]		
	AV / Peak					AV / Peak		AV / Peak		AV / Peak		
	Antenna	Amp. Gain+CableLoss				AV / Peak		AV / Peak		AV / Peak		
2382.5	33.5	47.6	V	32.3	25.3		54.0	74.0	40.5	54.6	13.5	19.4

**Radiated Band edges in the restricted band 2483.5-2500 MHz measurement**

Frequency  [MHz]	Reading  [dBuV/m]		Pol.	Correction  Factor		Limits  [dBuV/m]		Result  [dBuV/m]		Margin  [dB]	
	AV / Peak			Antenna	Amp. Gain+CableLoss	AV / Peak		AV / Peak		[MHz]	
2485.1	31.2	46.4	V	32.3	25.3	54.0	74.0	38.2	53.4	15.8	20.6

**Note : This EUT was tested in 3 orthogonal positions and the worst-case data was presented.**

### 3.3.7 Conducted Spurious Emissions

**Procedure:**

The test follows DA00-705. The conducted spurious emissions were measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels..

After the trace being stable, set the marker on the peak of any spurious emission recorded.

The spectrum analyzer is set to:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions

RBW = 100 kHz

Sweep = auto

VBW = 100 kHz

Detector function = peak

Trace = max hold

**Measurement Data: Complies**

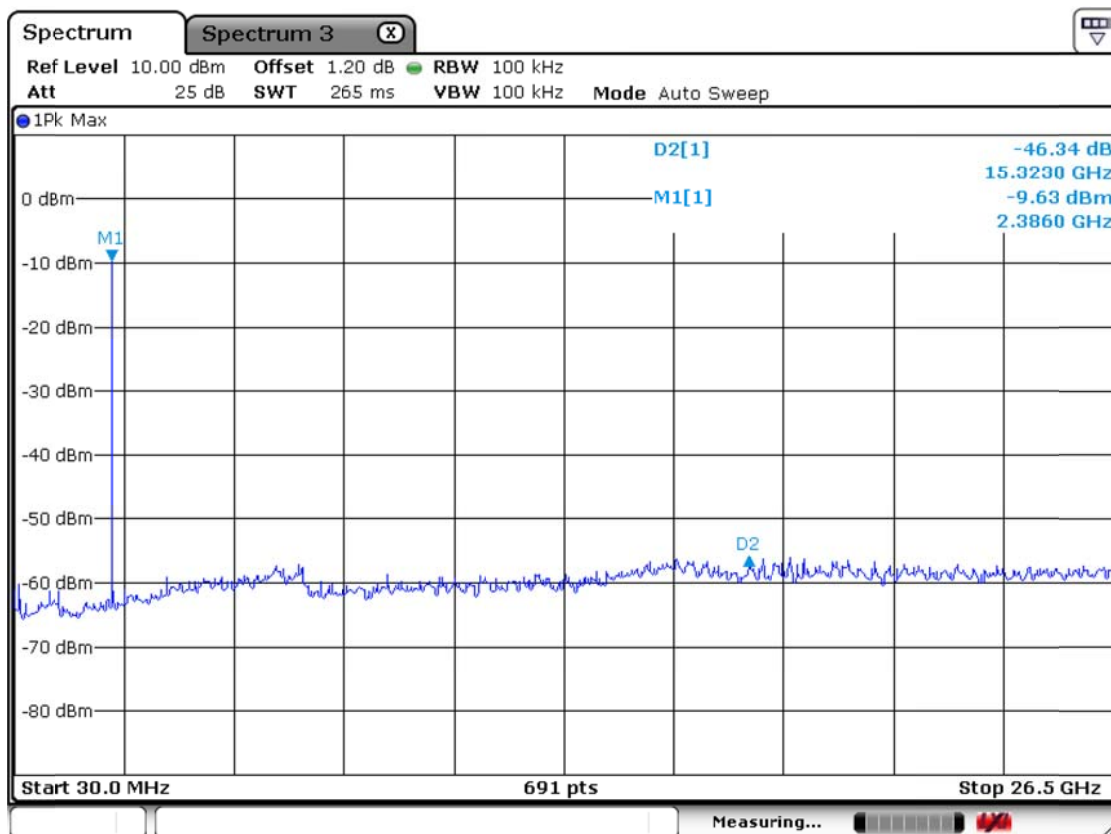
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

<b>Minimum Standard:</b>	> 20 dBc
--------------------------	----------

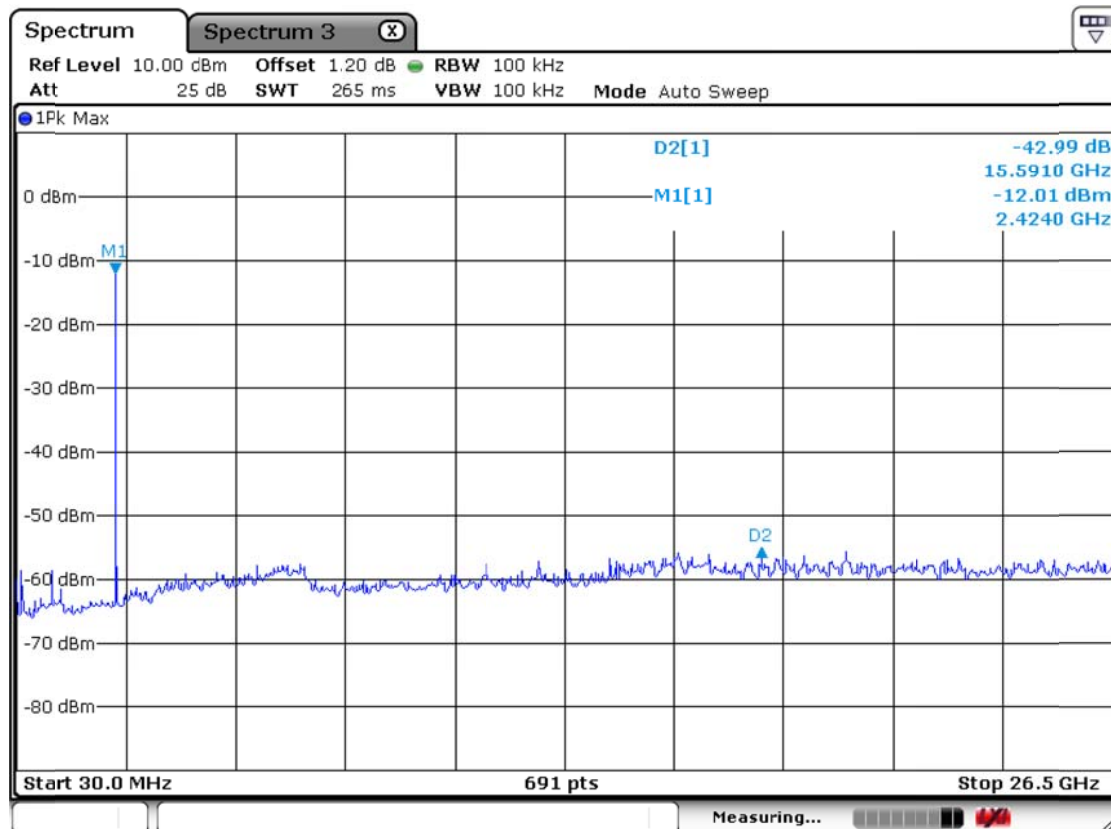
**Measurement Setup**

Same as the Chapter 3.3.1 (Figure 1)

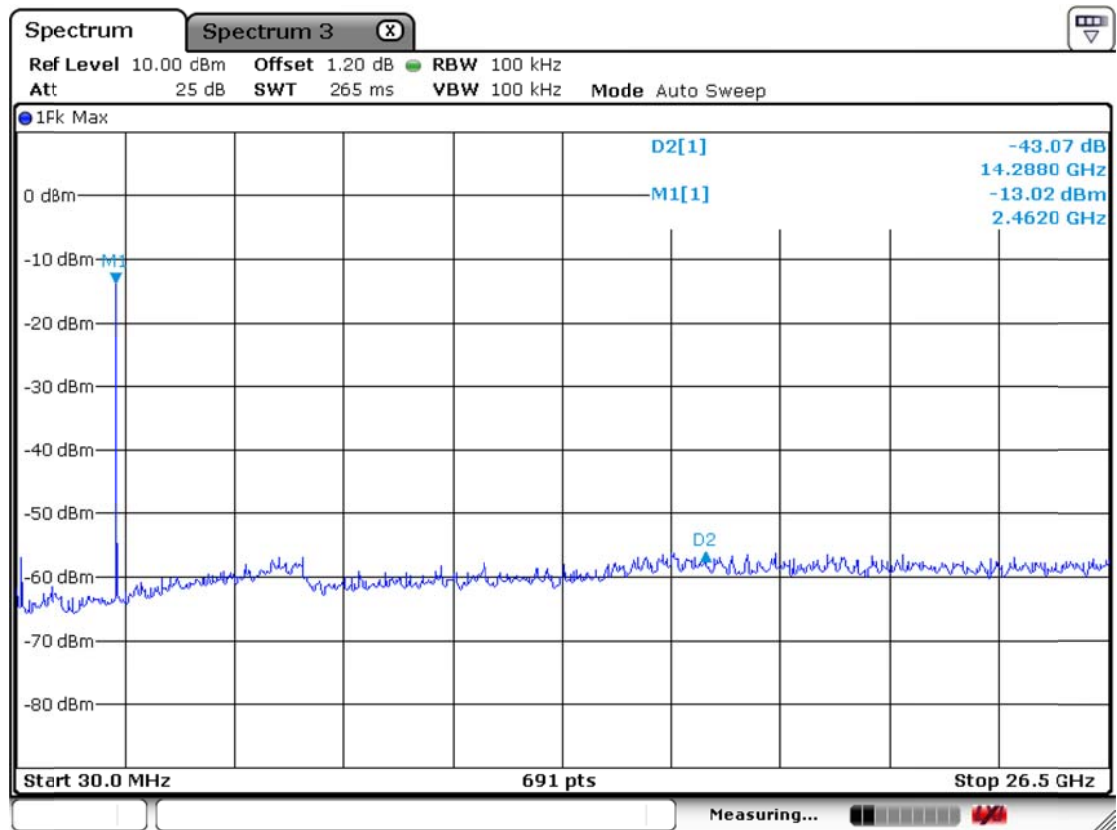
**Unwanted Emission – Low channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



**Unwanted Emission – Middle channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



**Unwanted Emission – High channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



### 3.3.8 Radiated Spurious Emissions

#### Procedure:

Radiated emissions from the EUT were measured according to the dictates of DA00-705. The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

- (a) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 3m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- (b) In the frequency range above 30 MHz, Bi-Log Test Antenna (30 MHz to 1 GHz) and Horn Test Antenna (above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

#### The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10<sup>th</sup> harmonic.

RBW = 120 kHz ( 30 MHz ~ 1 GHz)

= 1 MHz (1 GHz ~ 10<sup>th</sup> harmonic )

Span = 100 MHz

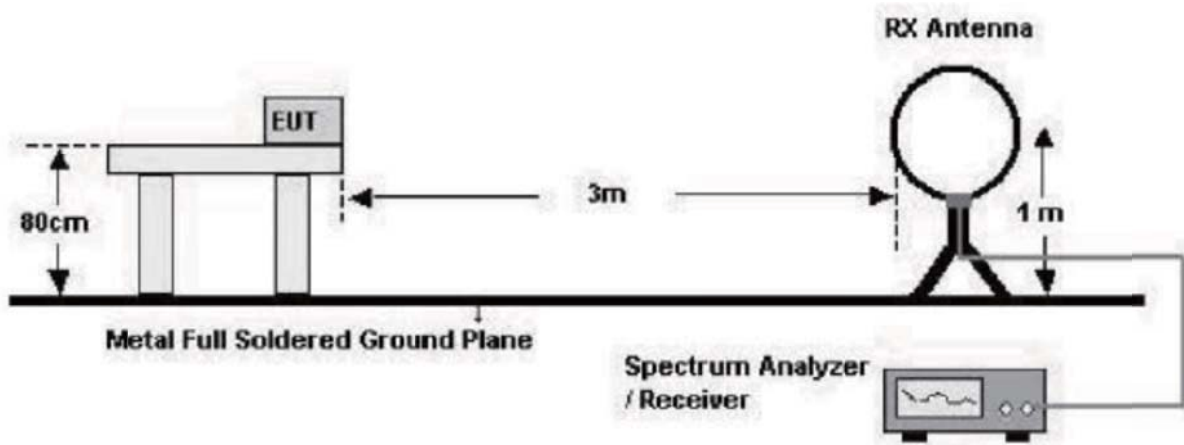
Trace = max hold

VBW  $\geq$  RBW

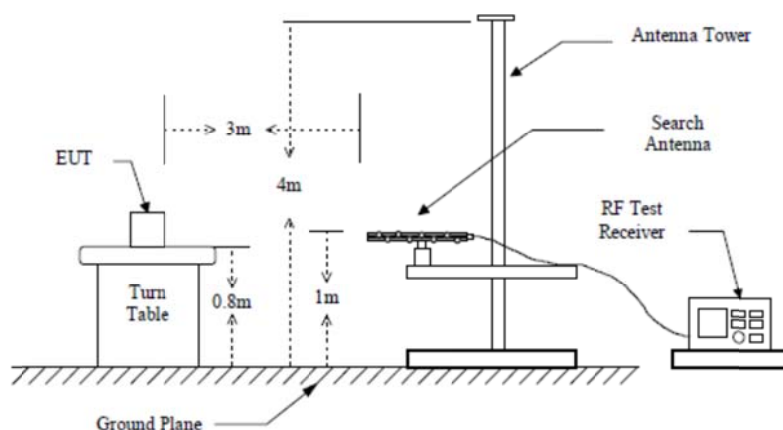
Detector function = peak

Sweep = auto

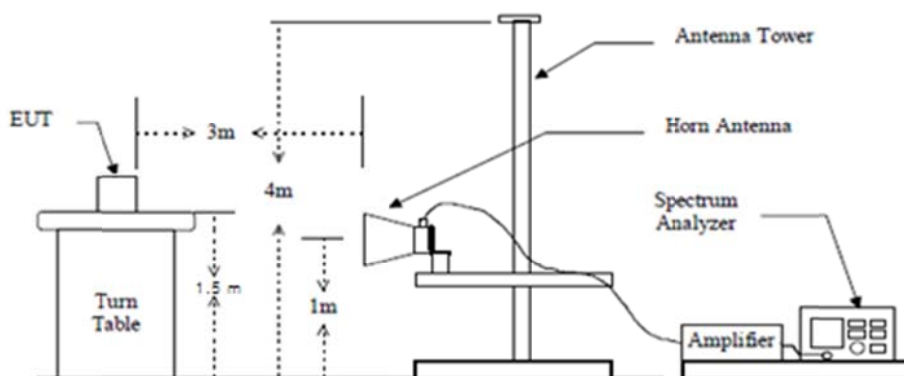
**below 30 MHz**



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



**Measurement Data:** **Complies**

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30 MHz.

**Minimum Standard: FCC Part 15.209(a)**

Frequency (MHz)	Limit (uV/m) @ 3 m
0.009 ~ 0.490	2400/F(kHz) (@ 300 m)
0.490 ~ 1.705	24000/F(kHz) (@ 30 m)
1.705 ~ 30	30(@ 30 m)
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

\*\* Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

**Measurement Data :**

Frequency  [MHz]	Reading [dBuV/m]		Pol.	Correction Factor		D.C.F	Limits [dBuV/m]		Result [dBuV/m]		Margin [dB]	
	AV / Peak			Antenna	Amp.Gain+Cable		AV/Peak		AV/Peak		AV / Peak	
4878.1	36.2	53.1	V	32.3	25.3	-29.9	54.0	74.0	13.3	30.2	40.7	43.8
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
Frequency  [MHz]	Reading [dBuV/m]		Pol.	Correction Factor		D.C.F	Limits [dBuV/m]		Result [dBuV/m]		Margin [dB]	
	AV / Peak			Antenna	Amp.Gain+Cable		AV/Peak		AV/Peak		AV / Peak	
4878.1	35.9	55.2	V	32.3	25.3	-29.9	54.0	74.0	13.0	32.3	41.0	41.7
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
Frequency  [MHz]	Reading [dBuV/m]		Pol.	Correction Factor		D.C.F	Limits [dBuV/m]		Result [dBuV/m]		Margin [dB]	
	AV / Peak			Antenna	Amp.Gain+Cable		AV/Peak		AV/Peak		AV / Peak	
4878.1	35.2	54.3	V	32.3	25.3	-29.9	54.0	74.0	12.3	31.4	41.7	42.6
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

- No other emissions were detected at a level greater than 20 dB below limit.

- D.C.F ( Duty Cycle Correction Factor) =  $20\log(\text{The worst Case DWELL Time}/100 \text{ ms})$   
 $= 20\log(3.174 \text{ ms}/100 \text{ ms}) = -29.9$

**Radiated Emissions(below 1 GHz) – Bluetooth mode (LOW)**

4, Songjuro236Beon-gil, Yangji-myeon,  
Cheoin-gu, Youngin-si, Gyeonggi-do,  
449-822 Korea  
Tel :+82-31-3236008,9  
Fax:+82-31-3236010

EUT/Model No. : CPR-BT-001

TEST MODE: Bluetooth mode(LOW)

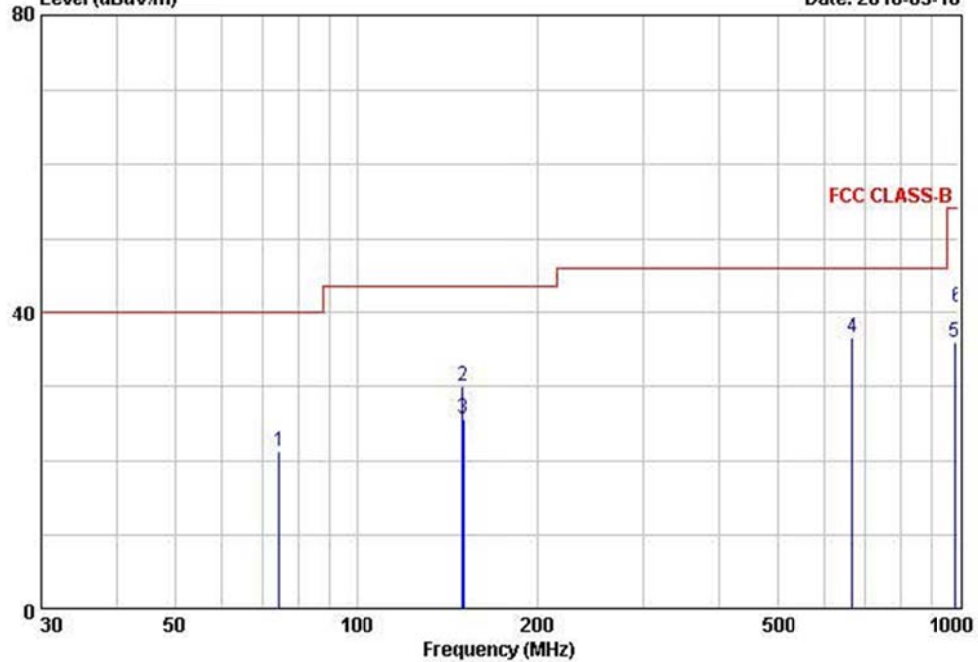
Temp Humi : 25 / 48

Tested by: JUNG J H

Data: 160

Level (dBuV/m)

Date: 2016-05-16



	Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	QP	dB	cm	deg	
1	74.60	40.20	-18.74	21.46	40.00	18.54	100	58	VERTICAL
2	150.20	44.10	-14.12	29.98	43.50	13.52	100	259	VERTICAL
3	150.60	39.80	-14.11	25.69	43.50	17.81	100	39	VERTICAL
4	665.80	39.80	-3.14	36.66	46.00	9.34	129	242	HORIZONTAL
5	986.40	32.10	3.80	35.90	54.00	18.10	152	64	HORIZONTAL
6	997.50	36.80	3.95	40.75	54.00	13.25	152	94	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

**Bluetooth mode (MID)**

4, Songjuro236Beon-gil, Yangji-myeon,  
Cheoin-gu, Youngin-si, Gyeonggi-do,  
449-822 Korea  
Tel :+82-31-3236008,9  
Fax:+82-31-3236010

EUT/Model No.: CPR-BT-001

TEST MODE: Bluetooth mode (MID)

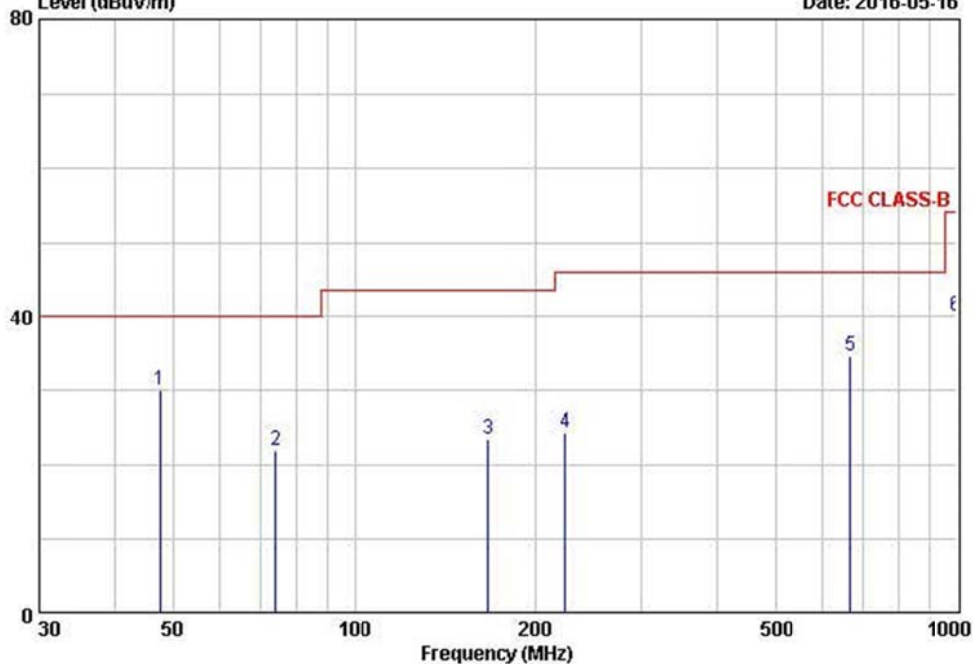
Temp Humi : 25 / 48

Tested by: JUNG J H

Data: 159

Level (dBuV/m)

Date: 2016-05-16



	Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	QP	dB	cm	deg	
1	47.60	45.80	-15.72	30.08	40.00	9.92	100	49	VERTICAL
2	74.10	40.60	-18.62	21.98	40.00	18.02	100	192	VERTICAL
3	166.80	37.80	-14.33	23.47	43.50	20.03	100	292	VERTICAL
4	223.90	39.90	-15.51	24.39	46.00	21.61	155	236	HORIZONTAL
5	665.20	37.90	-3.15	34.75	46.00	11.25	152	66	HORIZONTAL
6	997.20	36.10	3.95	40.05	54.00	13.95	182	152	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

**Bluetooth mode (HIGH)**

4, Songjuro236Beon-gil, Yangji-myeon,  
Cheoin-gu, Youngin-si, Gyeonggi-do,  
449-822 Korea  
Tel :+82-31-3236008,9  
Fax:+82-31-3236010

EUT/Model No.: CPR-BT-001

TEST MODE: Bluetooth mode(HIGH)

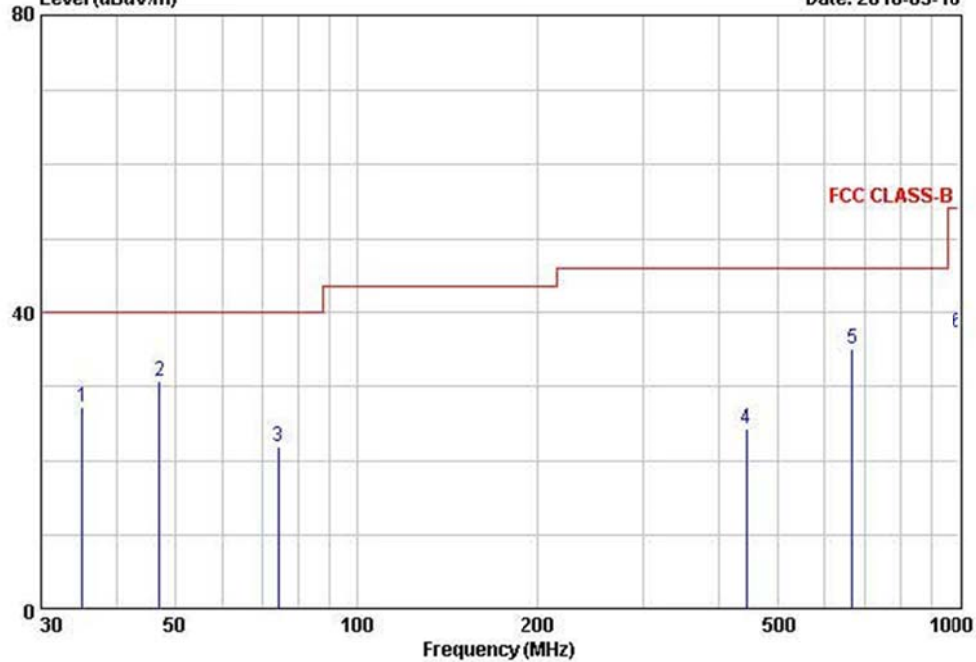
Temp Humi : 25 / 48

Tested by: JUNG J H

Data: 158

Level (dBuV/m)

Date: 2016-05-16



	Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	QP	dB	cm	deg	
1	35.10	43.90	-16.56	27.34	40.00	12.66	100	249	VERTICAL
2	47.20	46.50	-15.74	30.76	40.00	9.24	100	125	VERTICAL
3	74.30	40.60	-18.67	21.93	40.00	18.07	100	3	VERTICAL
4	443.80	32.90	-8.51	24.39	46.00	21.61	185	356	HORIZONTAL
5	665.20	38.20	-3.15	35.05	46.00	10.95	216	241	HORIZONTAL
6	997.20	33.40	3.95	37.35	54.00	16.65	124	321	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

**Radiated Emission(Above 1 GHz) – Bluetooth mode (LOW)**

EMI Chamber of LTA CO.,LTD.  
4, Songjuro236Beon-gil, Yangji-myeon,  
Yongin-si, Gyeonggi-do, Korea Autho.by NVLAP  
Tel :+82-31-3236008,9 www.ltalab.com  
Fax:+82-31-3236010

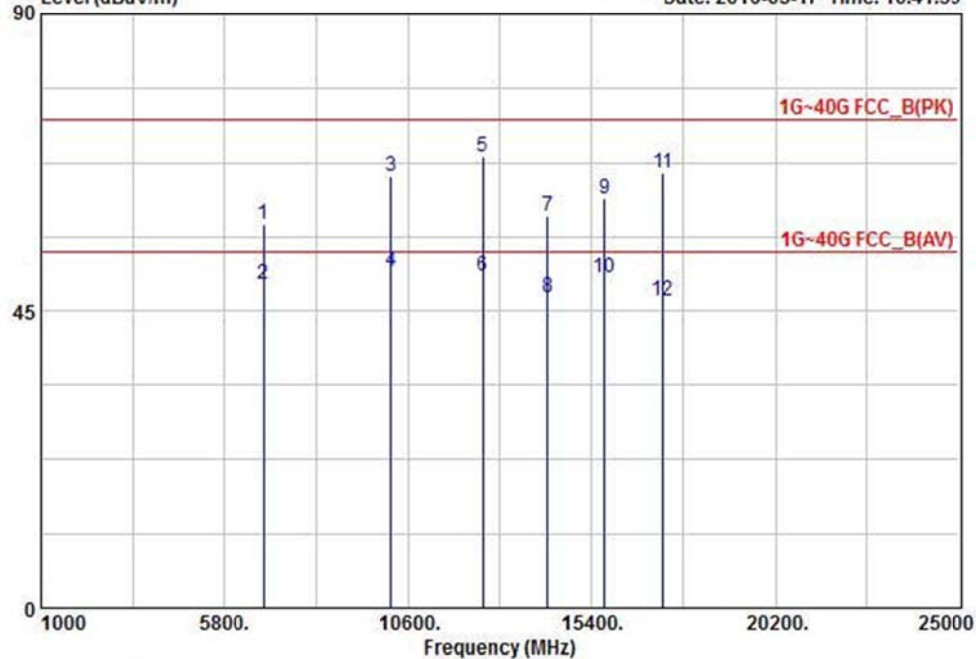
EUT/Model No. : GPR-BT-001

Test Mode: Bluetooth mode (LOW)

Tested by : JUNG J H

Temp/Humi: 21 / 44

Data: 31 File: D:\LTA\_e3\3\_backup\1GHz 이상\2016\CH1\_ABOVE 1GHz\_1605-1.EMI (31)  
Level (dBuV/m) Date: 2016-05-17 Time: 10:41:59



Freq	Reading	C.F	Result	Limit	Margin	Polarity
MHz	dBuV	dB	PK dBuV/m	dBuV/m	dB	
1 6821.94	32.80	25.36	58.16	74.00	15.84	HORIZONTAL
2 6821.94	23.60	25.36	48.96	54.00	5.04	HORIZONTAL
310151.64	35.20	30.39	65.59	74.00	8.41	HORIZONTAL
410151.64	20.60	30.39	50.99	54.00	3.01	HORIZONTAL
512541.58	25.90	42.60	68.50	74.00	5.50	HORIZONTAL
612541.58	7.60	42.60	50.20	54.00	3.80	HORIZONTAL
714251.62	16.20	43.24	59.44	74.00	14.56	HORIZONTAL
814251.62	3.80	43.24	47.04	54.00	6.96	HORIZONTAL
915742.94	22.40	39.73	62.13	74.00	11.87	VERTICAL
1015742.94	10.20	39.73	49.93	54.00	4.07	VERTICAL
1117254.95	22.40	43.46	65.86	74.00	8.14	HORIZONTAL
1217254.95	3.20	43.46	46.66	54.00	7.34	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain  
Blue : Vertical Black : Horizontal

**Bluetooth mode (MID)**

EM I Chamber of LTA CO.,LTD.  
4, Songjuro236Beon-gil, Yangji-myeon,  
Yongin-si, Gyeonggi-do, Korea Autho.by NVLAP  
Tel :+82-31-3236008,9 www.ltalab.com  
Fax:+82-31-3236010

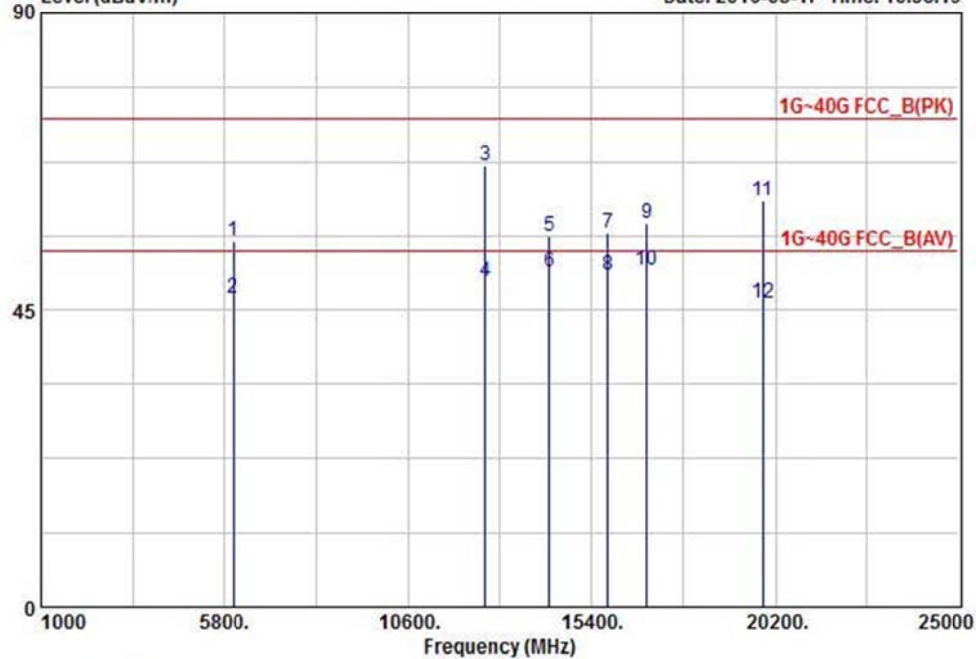
EUT/Model No.: GPR-BT-001

Test Mode: Bluetooth mode(MID)

Tested by : JUNG J H

Temp/Humi: 21 / 44

Data: 30 File: D:\LTA\_e3ie3\_backup\1GHz 이상\2016\CH1\_ABOVE 1GHz\_1605-1.EMI (30)  
Level (dBuV/m) Date: 2016-05-17 Time: 10:38:15



Freq	Reading	C.F	Result	Limit	Margin	Polarity
MHz	dBuV	dB	PK dBuV/m	dBuV/m	dB	
1 6027.69	32.30	23.13	55.43	74.00	18.57	HORIZONTAL
2 6027.69	23.80	23.13	46.93	54.00	7.07	HORIZONTAL
312614.69	22.40	44.45	66.85	74.00	7.15	HORIZONTAL
412614.69	4.90	44.45	49.35	54.00	4.65	HORIZONTAL
514291.93	13.20	43.05	56.25	74.00	17.75	VERTICAL
614291.93	7.60	43.05	50.65	54.00	3.35	VERTICAL
715823.49	16.70	39.96	56.66	74.00	17.34	HORIZONTAL
815823.49	10.30	39.96	50.26	54.00	3.74	HORIZONTAL
916842.74	15.90	42.10	58.00	74.00	16.00	HORIZONTAL
1016842.74	8.80	42.10	50.90	54.00	3.10	HORIZONTAL
1119874.62	25.60	35.98	61.58	74.00	12.42	HORIZONTAL
1219874.62	10.20	35.98	46.18	54.00	7.82	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain  
Blue : Vertical Black : Horizontal

**Bluetooth mode (HIGH)**

EMI I Chamber of LTA CO.,LTD.  
4, Songjuro236Beon-gil, Yangji-myeon,  
Yongin-si, Gyeonggi-do, Korea Autho.by NVLAP  
Tel :+82-31-3236008,9 www.ltalab.com  
Fax:+82-31-3236010

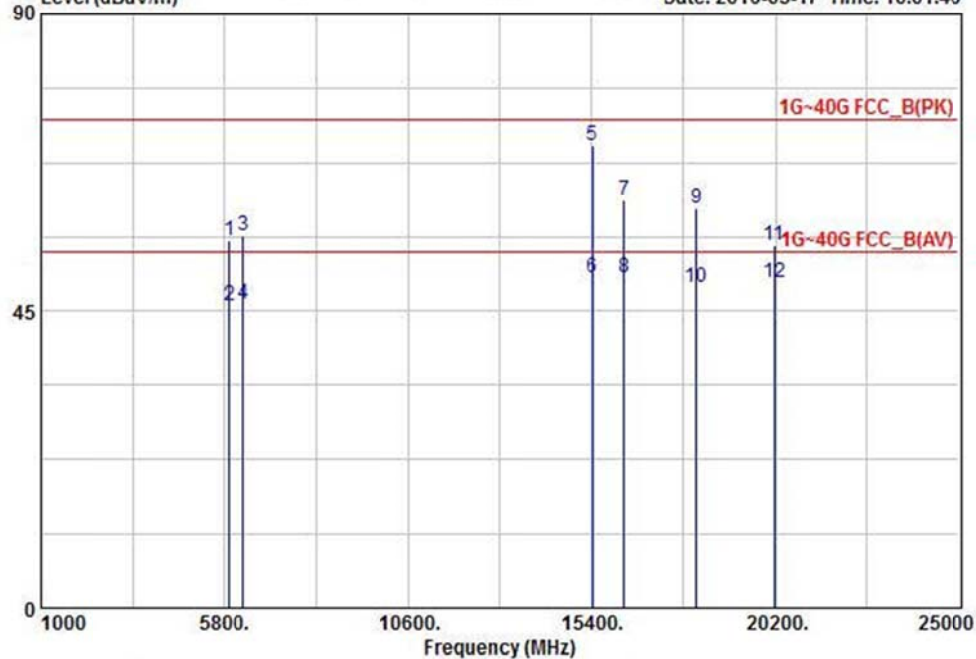
EUT/Model No. : GPR-BT-001

Test Mode: Bluetooth mode(HIGH)

Tested by : JUNG J H

Temp/Humi: 21 / 44

Data: 29 File: D:\LTA\_e3\3\_backup\1GHz 이상\2016\CH1\_ABOVE 1GHz\_1605-1.EMI (29)  
Level (dBuV/m) Date: 2016-05-17 Time: 10:01:46



Freq	Reading	C.F	Result	Limit	Margin	Polarity
MHz	dBuV	dB	PK dBuV/m	dBuV/m	dB	
1 5921.46	32.90	22.68	55.58	74.00	18.42	HORIZONTAL
2 5921.46	23.10	22.68	45.78	54.00	8.22	HORIZONTAL
3 6294.30	32.80	23.59	56.39	74.00	17.61	HORIZONTAL
4 6294.30	22.40	23.59	45.99	54.00	8.01	HORIZONTAL
515426.22	30.60	39.44	70.04	74.00	3.96	HORIZONTAL
615426.22	10.60	39.44	50.04	54.00	3.96	HORIZONTAL
716242.49	21.40	40.51	61.91	74.00	12.09	VERTICAL
816242.49	9.60	40.51	50.11	54.00	3.89	VERTICAL
918152.92	15.40	45.26	60.66	74.00	13.34	VERTICAL
1018152.92	3.20	45.26	48.46	54.00	5.54	VERTICAL
1120162.91	5.80	49.23	55.03	74.00	18.97	HORIZONTAL
1220162.91	0.10	49.23	49.33	54.00	4.67	HORIZONTAL

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain  
Blue : Vertical Black : Horizontal

### 3.3.9 AC Conducted Emissions

#### Procedure:

AC power line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4:2014.

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

#### Measurement Data: **Complies**

- Refer to the next page.
- No other emissions were detected at a level greater than 20 dB below limit
- It gave the worse case emissions

#### Minimum Standard: FCC Part 15.207(a)/EN 55022

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

\* Note: The limits will decrease with the frequency logarithmically within 0.15 MHz to 0.5 MHz

**Conducted Emissions Bluetooth mode (LOW) -LINE**

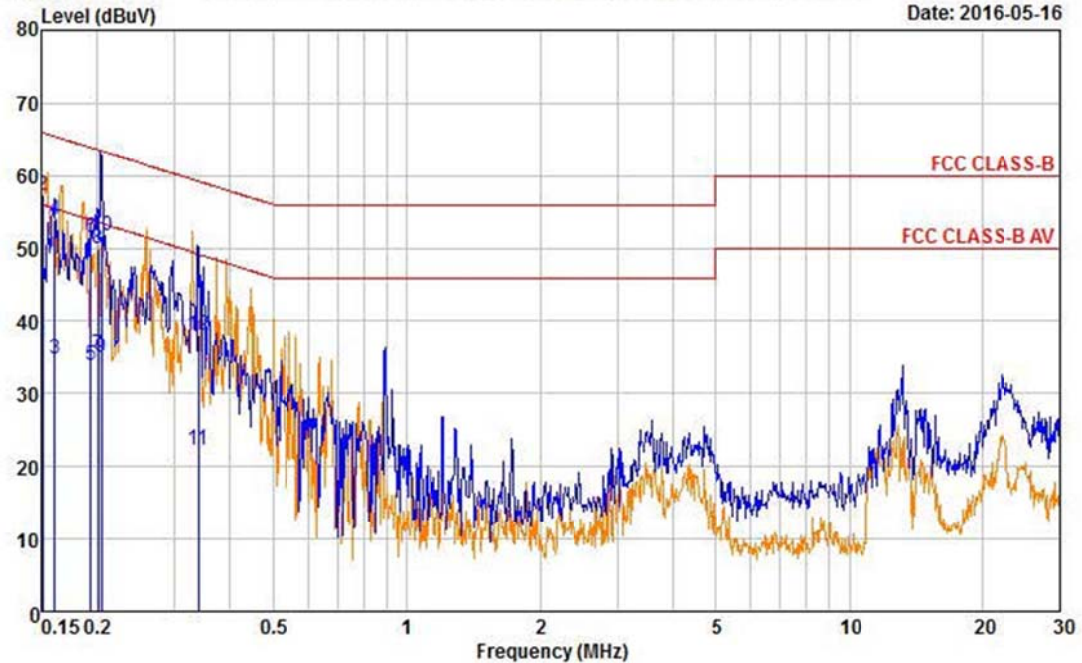
4, Songjuro 236 Beon-gil, Yangji-myeon  
Cheoin-gu, Youngin-si, Gyeonggi-do  
449-822 Korea  
Tel: +82-31-3236008, 9  
Fax: +82-31-3236010

EUT / Model No. : GPR-BT-001	Phase : LINE
Test Mode : Bluetooth mode(LOW)	Test Power : 120 / 60
Temp. / Humi. : 21 / 54	Test Engineer : JUNG J H

Data: 378

File: D:\Conducted Data\2015\2016\LTA\_Conduction\_2016\_05.EM6 (378)

Date: 2016-05-16



Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin
MHz	QP	AV		QP	AV	QP	AV	QP	AV
	dBuV	dBuV	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.151	37.63	17.17	19.60	57.23	36.77	65.95	55.95	8.72	19.18
0.161	34.45	15.23	19.59	54.04	34.82	65.44	55.44	11.40	20.62
0.194	31.87	14.36	19.52	51.39	33.88	63.88	53.88	12.49	20.00
0.201	30.31	15.90	19.51	49.82	35.41	63.56	53.56	13.74	18.15
0.205	32.28	15.42	19.51	51.79	34.93	63.42	53.42	11.63	18.49
0.339	18.64	2.73	19.46	38.10	22.19	59.22	49.22	21.12	27.03

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

**Conducted Emissions Bluetooth mode (LOW) – NEUTRAL**

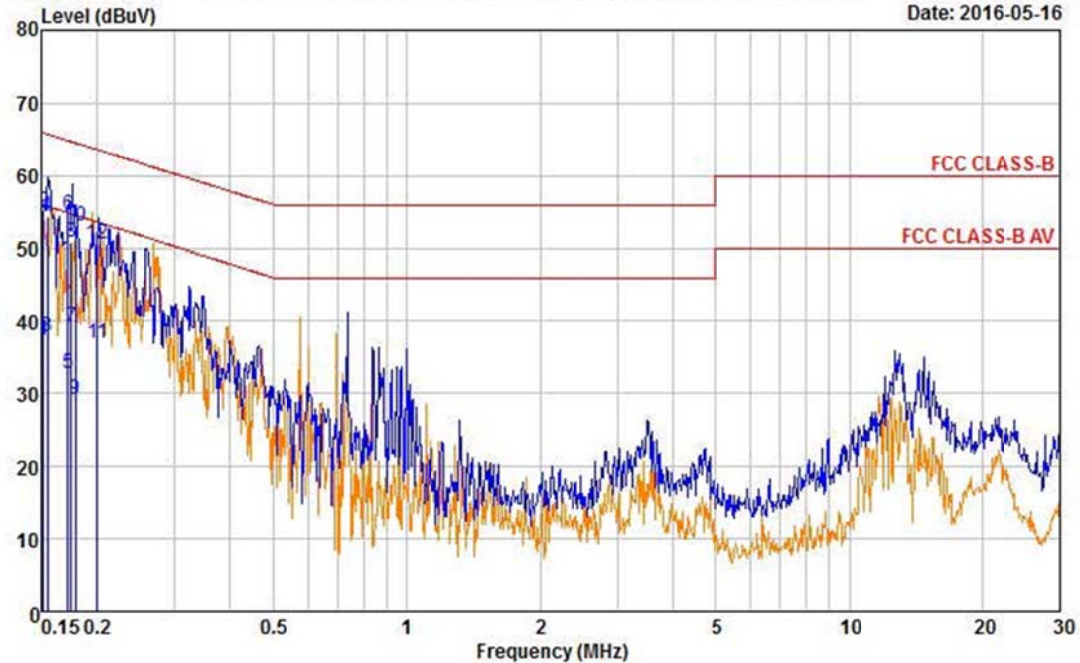
4, Songjuro 236 Beon-gil, Yangji-myeon  
Cheoin-gu, Youngin-si, Gyeonggi-do  
449-822 Korea  
Tel:+82-31-3236008,9  
Fax:+82-31-3236010

EUT / Model No. : GPR-BT-001	Phase : NEUTRAL
Test Mode : Bluetooth mode(LOW)	Test Power : 120 / 60
Temp. / Humi. : 21 / 54	Test Engineer : JUNG J H

Data: 382

File: D:\Conducted Data\2015\2016\LTA\_Conduction\_2016\_05.EM6 (382)

Date: 2016-05-16



Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin
MHz	QP	AV		QP	AV	QP	AV	QP	AV
	dBuV	dBuV	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.151	35.43	17.80	19.61	55.04	37.41	65.92	55.92	10.88	18.51
0.155	34.71	18.21	19.60	54.31	37.81	65.75	55.75	11.44	17.94
0.172	35.13	13.29	19.57	54.70	32.86	64.86	54.86	10.16	22.00
0.175	31.35	19.66	19.57	50.92	39.23	64.72	54.72	13.80	15.49
0.179	33.56	9.62	19.56	53.12	29.18	64.54	54.54	11.42	25.36
0.200	31.02	17.54	19.52	50.54	37.06	63.60	53.60	13.06	16.54

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

**Conducted Emissions Bluetooth mode (MID) -LINE**

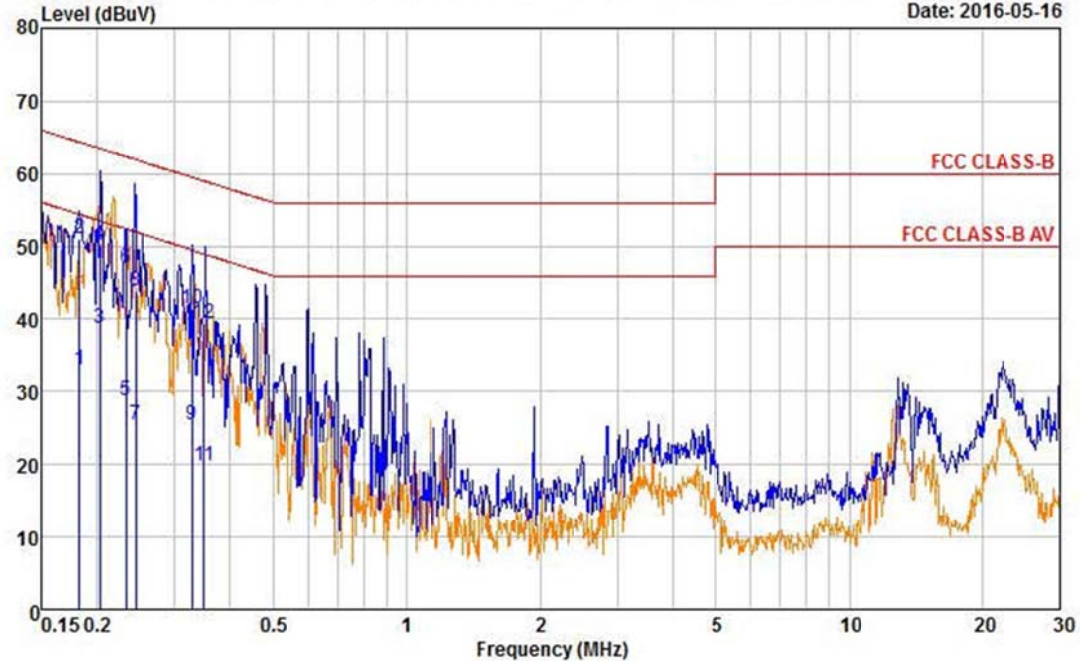
4, Songjuro 236 Beon-gil, Yangji-myeon  
Cheoin-gu, Youngin-si, Gyeonggi-do  
449-822 Korea  
Tel: +82-31-3236008, 9  
Fax: +82-31-3236010

EUT / Model No. : GPR-BT-001	Phase : LINE
Test Mode : Bluetooth mode(MID)	Test Power : 120 / 60
Temp. / Humi. : 21 / 54	Test Engineer : JUNG J H

Data: 374

File: D:\Conducted Data\2015\2016\LTA\_Conduction\_2016\_05.EM6 (374)

Date: 2016-05-16



Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin
MHz	QP	AV		QP	AV	QP	AV	QP	AV
	dBuV	dBuV	dB	dBuA	dBuA	dBuA	dBuA	dB	dB
0.182	31.38	13.41	19.54	50.92	32.95	64.38	54.38	13.46	21.43
0.202	30.66	19.15	19.51	50.17	38.66	63.51	53.51	13.34	14.85
0.232	27.44	9.18	19.49	46.93	28.67	62.39	52.39	15.46	23.72
0.244	24.44	5.85	19.49	43.93	25.34	61.96	51.96	18.03	26.62
0.328	21.88	5.87	19.47	41.35	25.34	59.50	49.50	18.15	24.16
0.349	19.92	0.34	19.46	39.38	19.80	58.99	48.99	19.61	29.19

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

**Conducted Emissions Bluetooth mode (MID) – NEUTRAL**

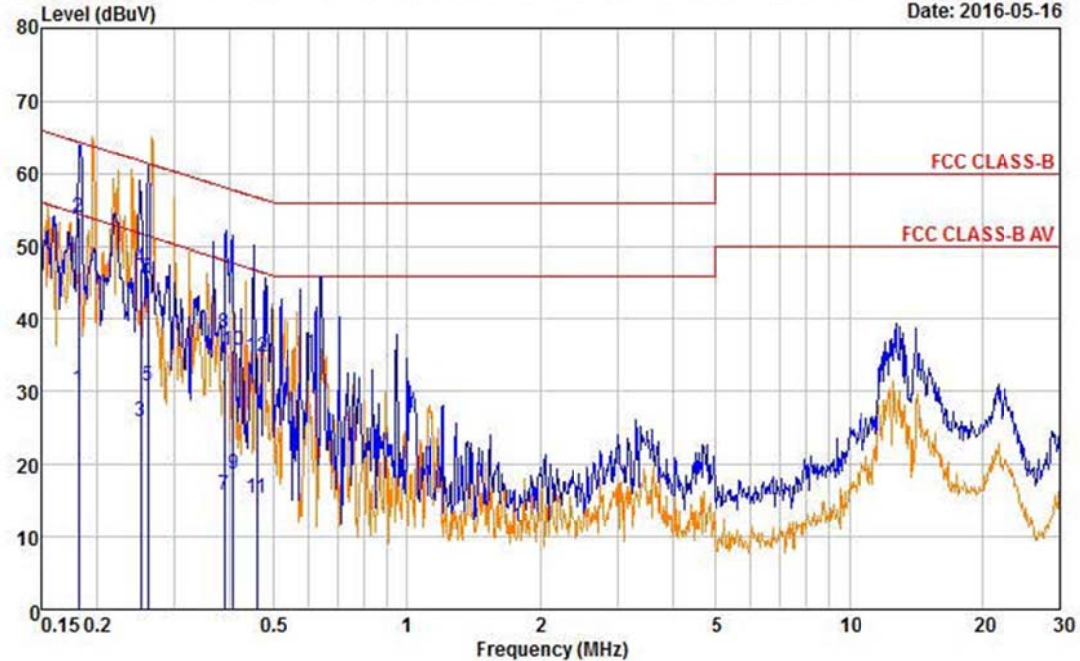
4, Songjuro 236 Beon-gil, Yangji-myeon  
Cheoin-gu, Youngin-si, Gyeonggi-do  
449-822 Korea  
Tel:+82-31-3236008,9  
Fax:+82-31-3236010

EUT / Model No. : GPR-BT-001	Phase : NEUTRAL
Test Mode : Bluetooth mode(MID)	Test Power : 120 / 60
Temp. / Humi. : 21 / 54	Test Engineer : JUNG J H

Data: 370

File: D:\Conducted Data\2015\2016\LTA\_Conduction\_2016\_05.EM6 (370)

Date: 2016-05-16



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuA	Result AV dBuA	Limit QP dBuA	Limit AV dBuA	Margin QP dB	Margin AV dB
0.182	34.32	10.69	19.55	53.87	30.24	64.40	54.40	10.53	24.16
0.251	27.62	6.40	19.50	47.12	25.90	61.74	51.74	14.62	25.84
0.261	26.25	11.34	19.49	45.74	30.83	61.39	51.39	15.65	20.56
0.388	18.67	-3.68	19.46	38.13	15.78	58.10	48.10	19.97	32.32
0.406	16.27	-0.71	19.45	35.72	18.74	57.72	47.72	22.00	28.98
0.458	15.38	-4.07	19.45	34.83	15.38	56.72	46.72	21.89	31.34

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

**Conducted Emissions Bluetooth mode (HIGH) -LINE**

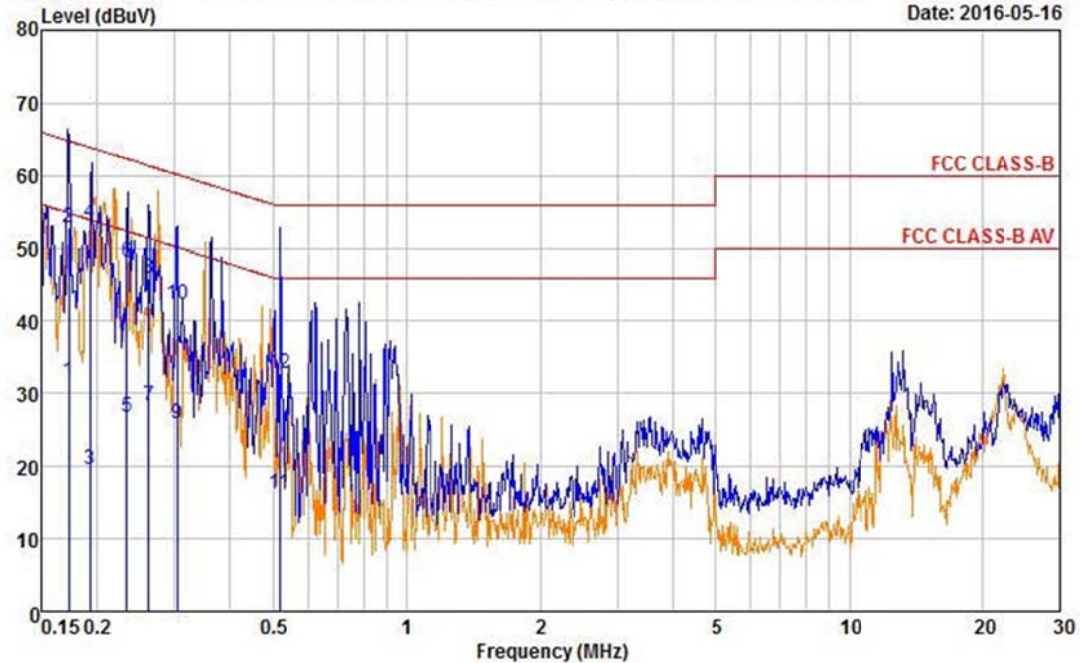
4, Songjuro 236 Beon-gil, Yangji-myeon  
Cheoin-gu, Youngin-si, Gyeonggi-do  
449-822 Korea  
Tel:+82-31-3236008,9  
Fax:+82-31-3236010

EUT / Model No. : GPR-BT-001	Phase : LINE
Test Mode : Bluetooth mode(HIGH)	Test Power : 120 / 60
Temp. / Humi. : 21 / 54	Test Engineer : JUNG J H

Data: 362

File: D:\Conducted Data\2015\2016\LTA\_Conduction\_2016\_05.EM6 (362)

Date: 2016-05-16



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuA	Result AV dBuA	Limit QP dBuA	Limit AV dBuA	Margin QP dB	Margin AV dB
0.173	33.34	12.09	19.56	52.90	31.65	64.82	54.82	11.92	23.17
0.193	34.06	0.11	19.52	53.58	19.63	63.92	53.92	10.34	34.29
0.233	28.74	7.35	19.49	48.23	26.84	62.35	52.35	14.12	25.51
0.263	26.38	8.88	19.48	45.86	28.36	61.35	51.35	15.49	22.99
0.304	22.78	6.35	19.47	42.25	25.82	60.14	50.14	17.89	24.32
0.516	13.36	-3.12	19.45	32.81	16.33	56.00	46.00	23.19	29.67

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

**Conducted Emissions Bluetooth mode (LOW) – NEUTRAL**

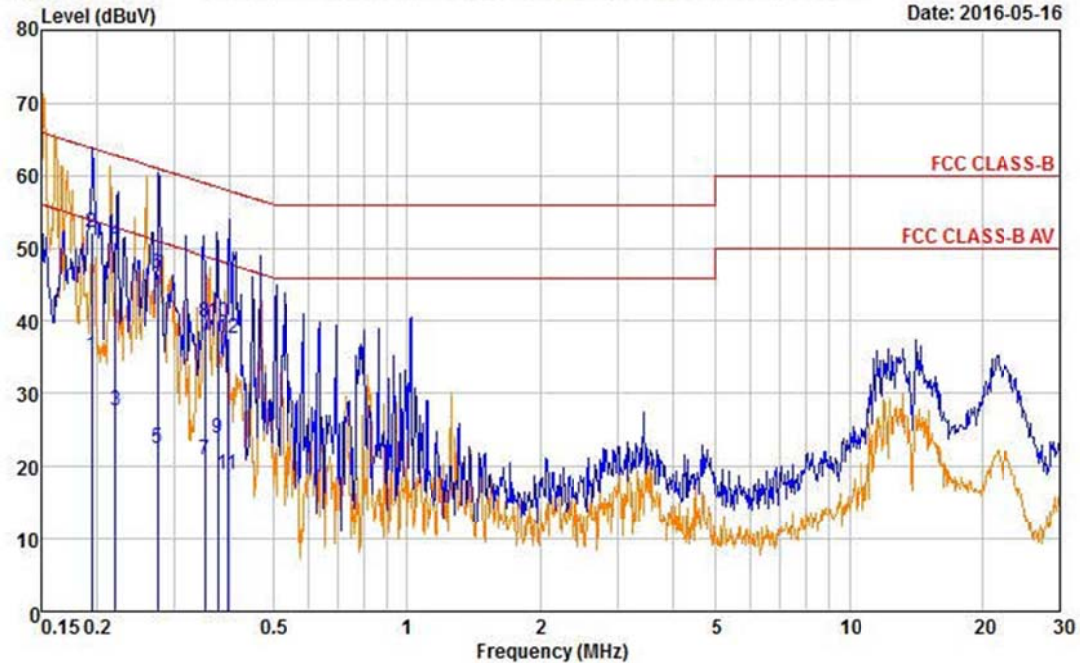
4, Songjuro 236 Beon-gil, Yangji-myeon  
Cheoin-gu, Youngin-si, Gyeonggi-do  
449-822 Korea  
Tel: +82-31-3236008, 9  
Fax: +82-31-3236010

EUT / Model No. : GPR-BT-001	Phase : NEUTRAL
Test Mode : Bluetooth mode(HIGH)	Test Power : 120 / 60
Temp. / Humi. : 21 / 54	Test Engineer : JUNG J H

Data: 366

File: D:\Conducted Data\2015\2016\LTA\_Conduction\_2016\_05.EM6 (366)

Date: 2016-05-16



Freq MHz	RD QP dBuV	RD AV dBuV	C.F dB	Result QP dBuA	Result AV dBuA	Limit QP dBuA	Limit AV dBuA	Margin QP dB	Margin AV dB
0.194	32.70	15.72	19.53	52.23	35.25	63.85	53.85	11.62	18.60
0.220	31.35	8.12	19.51	50.86	27.63	62.82	52.82	11.96	25.19
0.274	27.02	3.04	19.50	46.52	22.54	60.99	50.99	14.47	28.45
0.351	20.40	1.53	19.47	39.87	21.00	58.95	48.95	19.08	27.95
0.375	20.46	4.39	19.46	39.92	23.85	58.39	48.39	18.47	24.54
0.394	18.14	-0.57	19.46	37.60	18.89	57.97	47.97	20.37	29.08

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss + Pulse Limiter

APPENDIX

**TEST EQUIPMENT USED FOR TESTS**

	Description	Model No.	Serial No.	Manufacturer	Interval	Last Cal. Date
1	Signal Analyzer (9 kHz ~ 30 GHz)	FSV30	100757	R&S	1 year	2016-03-22
2	Signal Generator (~ 3.2 GHz)	8648C	3623A02597	HP	1 year	2016-03-21
3	SYNTHESIZED CW GENERATOR	83711B	US34490456	HP	1 year	2016-03-21
4	Attenuator (3 dB)	8491A	37822	HP	1 year	2015-09-14
5	Attenuator (10 dB)	8491A	63196	HP	1 year	2015-09-14
6	Test Receiver (~ 30 MHz)	ESHS10	828404/009	R&S	1 year	2016-03-21
7	EMI Test Receiver (~ 7 GHz)	ESCI7	100722	R&S	1 year	2015-09-15
8	RF Amplifier (~ 1.3 GHz)	8447D OPT 010	2944A07684	HP	1 year	2015-09-14
9	RF Amplifier (1 ~ 26.5 GHz)	8449B	3008A02126	HP	1 year	2016-03-22
10	Horn Antenna (1 ~ 18 GHz)	3115	00114105	ETS	1 year	2016-04-21
11	DRG Horn (Small)	3116B	81109	ETS-Lindgren	1 year	2016-02-26
12	DRG Horn (Small)	3116B	133350	ETS-Lindgren	1 year	2016-02-26
13	TRILOG Antenna	VULB 9160	9160-3237	SCHWARZBECK	2 year	2015-04-21
14	Temp.Humidity Data Logger	SK-L200TH II A	00801	SATO	1 year	2016-03-22
15	Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
16	Power Divider	11636A	06243	HP	1 year	2015-09-14
17	DC Power Supply	6674A	3637A01657	Agilent	-	-
18	Frequency Counter	5342A	2826A12411	HP	1 year	2016-03-21
19	Power Meter	EPM-441A	GB32481702	HP	1 year	2016-03-22
20	Power Sensor	8481A	3318A94972	HP	1 year	2016-01-05
21	Audio Analyzer	8903B	3729A18901	HP	1 year	2015-09-14
22	Modulation Analyzer	8901B	3749A05878	HP	1 year	2015-09-15
23	TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2015-09-14
24	Stop Watch	HS-3	812Q08R	CASIO	2 year	2016-03-22
25	LISN	KNW-407	8-1430-1	Kyoritsu	1 year	2015-09-14
26	Two-Lime V-Network	ESH3-Z5	893045/017	R&S	1 year	2016-03-21
27	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	1 year	2016-03-21
28	Highpass Filter	WHKX1.5/15G-10SS	74	Wainwright Instruments	1 year	2016-03-21
29	Highpass Filter	WHKX3.0/18G-10SS	118	Wainwright Instruments	1 year	2016-03-21
30	Active Loop Antenna	FMZB1519	1519-031	SCHWARZBECK	2 year	2016-01-12
31	OSP120 BASE UNIT	OSP120	101230	R&S	1 year	2016-03-22
32	Signal Generator(100 kHz ~ 40 GHz)	SMB100A	177621	R&S	1 year	2016-03-22
33	Signal Analyzer (10 Hz ~ 40 GHz)	FSV40	101367	R&S	1 year	2016-03-22