

TEST REPORT

Report No: KST-FCR-090006

Applicant	Name	UNEEDS Commerce Co.,Ltd.
	Address	Digital EmpireII, 486, Shin Dong, Yongtong Gu, Suwon, Gyeonggi Do, Korea
Manufacturer	Name	UNEEDS Commerce Co.,Ltd.
	Address	Digital EmpireII, 486, Shin Dong, Yongtong Gu, Suwon, Gyeonggi Do, Korea
Equipment	Name	Bluetooth Stereo Headset
	Model No	UNB-2000S
	Brand	None
	FCC ID	WM5UNB-2000S
Test Standard	FCC CFR 47, Part 15. Subpart C-15.247	
Test Date(s)	2009. 08. 17 ~ 2009. 08. 19	
Issue Date	2008. 08. 21	
Test Result	Compliance	

Supplementary Information

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI C 63.4-2003.

We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Tested by Mi Young, Lee

Approved by Gyeong Hyeon, Park

Signature



Signature



Table of Contents

1. GENERAL INFORMATION	3
1.1 Test Facility	3
1.2 Location	3
2. EQUIPMENT DESCRIPTION	4
3. SYSTEM CONFIGURATION FOR TEST	5
3.1 Characteristics of equipment	5
3.2 Used peripherals list	5
3.3 Product Modification	5
3.4 Operating Mode	5
3.5 Test Setup of EUT	5
3.6 Table for Test condition	6
3.7 Table for Parameters of Test Software Setting	6
3.8 Used Test Equipment List	7
4. SUMMARY TEST RESULTS	8
5. MEASUREMENT RESULTS	9
5.1 Carrier Frequency Separation	9
5.2 Number of hopping frequencies	13
5.3 Time of occupancy (Dwell Time)	15
5.4 Max. Conducted peak output power	17
5.5 Conducted peak power spectral density	20
5.6 Band-edge Compliance	22
5.7 Spurious RF conducted emissions	25
5.8 Spurious RF Radiated emissions	30
5.9 Antenna requirement	37
5.10 AC Power Conducted emissions	38

1. GENERAL INFORMATION

1.1 Test Facility

Test laboratory and address

KOSTEC Co., Ltd.

180-254, Annyeong-dong, Hwaseong-si, Gyeonggi-do, South Korea

The open area field test site and conducted measurement facility are used for these testing. This site at was fully described in a reports submitted to the Federal Communications Commission (FCC).

The details of these reports have been found to be in complies with the requirements of Section 2.948 of the FCC Rules on November 14, 2002. The facility also complies with the radiated and conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission (FCC) has the reports on file and KOSTEC Co., Ltd. is listed under FCC Registration No.525762. The test site has been approved by the FCC for public use and is List in the FCC Public Access Link CORES (Commission Registration System)

Registration information

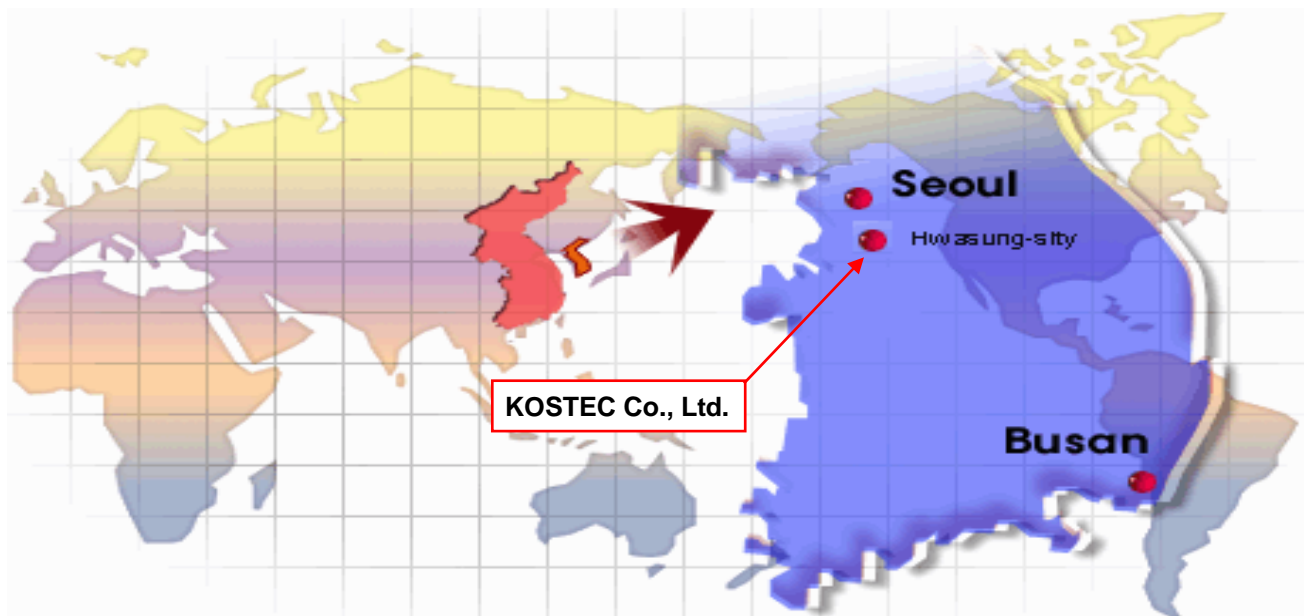
KCC (Korea Communications Commission) Number : KR0041

KOLAS(Korea Laboratory Accreditation Scheme) Number : 232

FCC Registration Number(FRN) : 525762

VCCI Registration Number : R-1657 / C -1763

1.2 Location



2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

1) Equipment Name	Bluetooth Stereo Headset
2) Model No	UNB-2000S
3) Brand	None
4) Serial Number	Prototype
5) ITU emission Code	1M00F1D
6) Oscillation Type	PLL (Phase Local Loop)
7) Modulation Type	FHSS (Frequency Hopping Spread Spectrum), GFSK
8) Operated Frequency	TX : 2 402 MHz ~ 2 480 MHz RX : 2 402 MHz ~ 2 480 MHz
9) Power	2.00 mW (Conducted power declared by applicant)
9) Channel spacing / Number	1 MHz / 79 Ch
10) Communication Type	Half duplex
11) Final Amplifier	U1
12) Weight / Dimension	61g / 50(L) mm x 50(W) mm x 20(D) mm
13) Operation temperature	- 30℃ ~ + 80℃
14) Power Source	DC 3.7 Vd.c. (Lithium polymer recharge battery)
	DC 5.0 Vd.c. (from USB Cable Connected to PC)
15) Antenna Description	Type: Chip type, Connect type: Internal, Length: 10 mm, Gain: 2.84 dBi
16) FCC ID	WM5UNB-2000S

3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

This equipment is named Bluetooth Stereo Headset and it's used for voice transceiver, image chatting and listing MP3 music to be wireless connecting through cellular phone and note book PC with installation bluetooth chip. Communication type is frequency hopping spread system(FHSS), and it does not support the EDR(Enhanced data rate), used frequency band is 2 402 MHz ~ 2 480 MHz

Power source is supplied 3.7 Vd.c. from Lithium polymer type battery inner product it's battery is charged through USB Cable and charger voltage is 5.00 Vd.c.

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
PC	LS40	1402KIAW215672	LG-IBM	
TEST JIG	None	None	UNEEDS Commerce Co., Ltd.	

3.3 Product Modification

N/A

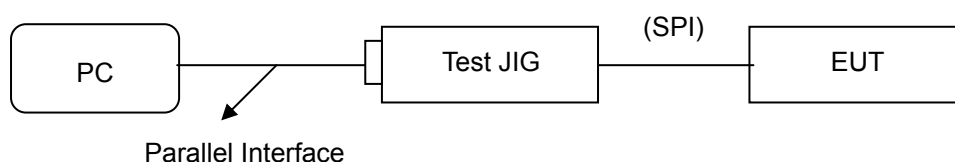
3.4 Operating Mode

All measurements were intended to emit maximum RF signal from EUT continuously.

3.5 Test Setup of EUT

The measurements were taken in continuous transmit / receive mode using the TEST MODE.

For controlling the EUT as TEST MODE, the test program and the test Jig were provided by the applicant.



3.6 Table for Test condition

Test Items	Channel No	Frequency (MHz)	Operated Condition
Carrier frequency separation	1, 2	2 402, 2 403	Hopping on and continuous modulation setting mode
	40, 41	2 441, 2 442	
	78, 79	2 479, 2 480	
Number of hopping frequencies	1 ~ 79	2 402 ~ 2 480	Hopping on mode
Time of occupancy (Dwell Time)	40	2 441	Hopping on mode
Conducted peak output power	1	2 402	Hopping off and continuous modulation setting mode
	40	2 441	
	79	2 480	
Band-edge Compliance	1	2 402	Hopping off and continuous modulation setting mode
	79	2 480	
Spurious RF conducted emissions	-	-	Frequency band setting by required standard (FCC Rules)
Spurious radiated emissions	-	-	

3.7 Table for Parameters of Test Software Setting

During testing, channel change & modulation and carrier controlling software program is provided by the Applicant.

Output power expected by the customer and is going to be fixed on the firmware of the final end product.

S/W commend value Table for Channel selecting

Frequency (MHz)	2 402	2 441	2 480
Channel Number	Ch 1	Ch 40	Ch 79
	Lowest channel	Middle channel	Highest channel
Test Software	Bluesuite Ver 1.0		

3.8 Used Test Equipment List

No.	Instrument	Model	Serial No.	Manufacturer	Due to Cal. Date	Used
1	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2010.05.20	<input checked="" type="checkbox"/>
2	Test Receiver	ESCS30	100111	Rohde & Schwarz	2010.03.07	<input checked="" type="checkbox"/>
3	Test Receiver	ESPI3	100109	Rohde & Schwarz	2010.03.03	<input type="checkbox"/>
4	LISN	ESH2-Z5	100044	Rohde & Schwarz	2010.03.16	<input checked="" type="checkbox"/>
5	LISN	ESH3-Z5	100147	Rohde & Schwarz	2010.06.25	<input checked="" type="checkbox"/>
6	Ultra broadband Antenna	HL562	100075	Rohde & Schwarz	2010.03.20	<input checked="" type="checkbox"/>
7	Ultra broadband Antenna	HL562	100076	Rohde & Schwarz	2010.04.14	<input type="checkbox"/>
8	Dipole Antenna	HZ-12	100005	Rohde & Schwarz	2010.04.03	<input type="checkbox"/>
9	Dipole Antenna	HZ-13	100007	Rohde & Schwarz	2010.04.03	<input type="checkbox"/>
10	Horn Antenna	3115	2996	EMCO	2010.06.13	<input checked="" type="checkbox"/>
11	Loop Antenna	6502	9203-0493	EMCO	2011.06.11	<input type="checkbox"/>
12	Digital Signal Generator	E4436B	US39260458	HP	2010.05.20	<input checked="" type="checkbox"/>
13	Tracking CW Signal Source	85645A	070521-A1	HP	2010.05.20	<input type="checkbox"/>
14	RF Power Amplifier	8347A	3307A01571	HP	2010.05.20	<input checked="" type="checkbox"/>
15	Microwave Amplifier	8349B	2627A01037	HP	2010.05.20	<input checked="" type="checkbox"/>
16	Attenuator	8498A	3318A09485	HP	2010.05.20	<input checked="" type="checkbox"/>
17	Temperature & Humidity Chamber	EY-101	90E14260	TABAI ESPEC	2010.03.16	<input type="checkbox"/>
18	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2010.05.20	<input type="checkbox"/>
19	RF Power Sensor	ECP-E18A	US37181768	Agilent Technology	2010.05.20	<input type="checkbox"/>
20	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2010.05.20	<input type="checkbox"/>
20	Band rejection filter	WTR-BRF2442-84NM	09020001	WAVE TECH Co.,Ltd.	2010.03.03	<input checked="" type="checkbox"/>
21	SLIDAC	None	0207-4	Myoung-Sung Electronic Co., Ltd.	2010.05.20	<input type="checkbox"/>
22	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2010.06.04	<input type="checkbox"/>
23	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2010.05.20	<input type="checkbox"/>
24	DC Power supply	E3610A	KR24104505	Agilent Technology	2010.05.20	<input checked="" type="checkbox"/>
25	Antenna Master	-	-	Daeil EMC	-	<input checked="" type="checkbox"/>
26	Turn Table	-	-	Daeil EMC	-	<input checked="" type="checkbox"/>

4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Reference Clause	Used	Test Result
Carrier frequency separation (20 dB bandwidth)	15.247(a)(1)	Clause 5.1	<input checked="" type="checkbox"/>	Compliance
	15.247(a)(1)	Clause 5.1	<input checked="" type="checkbox"/>	Compliance
Number of hopping frequencies	15.247(a)(1)(iii)	Clause 5.2	<input checked="" type="checkbox"/>	Compliance
Time of occupancy (Dwell Time)	15.247(a)(1)(iii)	Clause 5.3	<input checked="" type="checkbox"/>	Compliance
Max. Conducted peak output power	15.247(b)(1)	Clause 5.4	<input checked="" type="checkbox"/>	Compliance
Conducted peak output power spectrum density	15.247(e)	Clause 5.5	<input checked="" type="checkbox"/>	Compliance
Band edge compliance of RF emissions	15.247(d)	Clause 5.6	<input checked="" type="checkbox"/>	Compliance
Spurious RF conducted emissions	15.247(d)	Clause 5.7	<input checked="" type="checkbox"/>	Compliance
Spurious RF radiated emissions	15.247(d), 15.209	Clause 5.8	<input checked="" type="checkbox"/>	Compliance
Antenna requirement	15.203, 15.247	Clause 5.9	<input checked="" type="checkbox"/>	Compliance
AC Power line Conducted emission	15.207	Clause 5.10	<input checked="" type="checkbox"/>	Compliance
<p>Compliance : The EUT complies with the essential requirements in the standard.</p> <p>Not Compliance : The EUT does not comply with the essential requirements in the standard.</p> <p>N/A : The test was not applicable in the standard.</p>				

5. MEASUREMENT RESULTS

5.1 Carrier Frequency Separation

5.1.1 Standard Applicable [FCC §15.247(a),(1)]

Frequency hopping systems operating in the 2 400 ~ 2 483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

5.1.2 Measurement Procedure

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 peak of the adjacent channels using the marker-Delta function was recorded as the measurement results.

The spectrum analyzer is set to the as follows :

- Span : wide enough to capture the peak of two adjacent channels
 - RBW : $\geq 1\%$ of the span
 - VBW : \geq RBW
 - Sweep : auto
 - Detector function : peak
 - Trace : max hold
- ※ Measurement Setup is same as the Clause 3.5 (Test Setup of EUT)

5.1.3 Measurement Result

- Environmental Conditions :
 - Temperature : 25 °C, Relative Humidity : (54 ~ 56) % R.H.

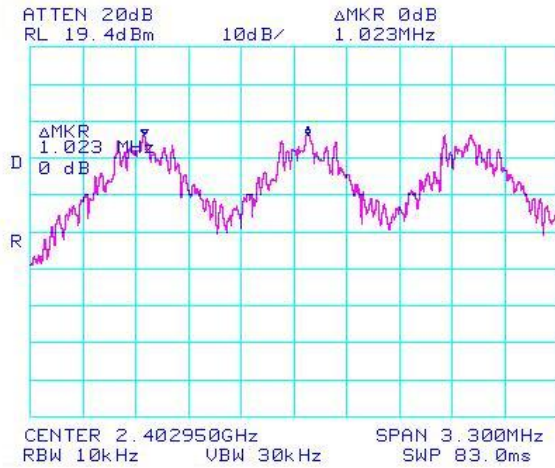
Ch.	Measured Frequency (MHz)	Test Results		
		Measured frequency Separation of Ch # 1 and # 2 [MHz]	Limit	Result
1, 2	2 402 MHz, 2 403 MHz	1, 023	≥ 25 kHz or 2/3 20dB bandwidth	Complies
40, 41	2 441 MHz, 2 442 MHz	1, 014		Complies
78, 79	2 479 MHz, 2 480 MHz	1, 029		Complies

* Above measured value is a result of measurement a channel separation and 20 dB bandwidth value is displayed in this plot 5.1.6

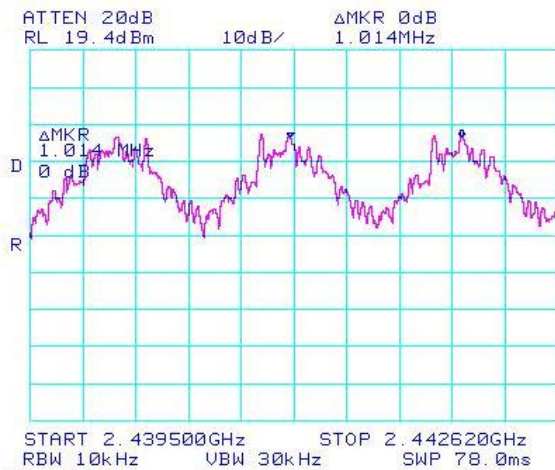
5.1.4 Test Equipment Used: 1, 16, 24

5.1.5 Test Plot

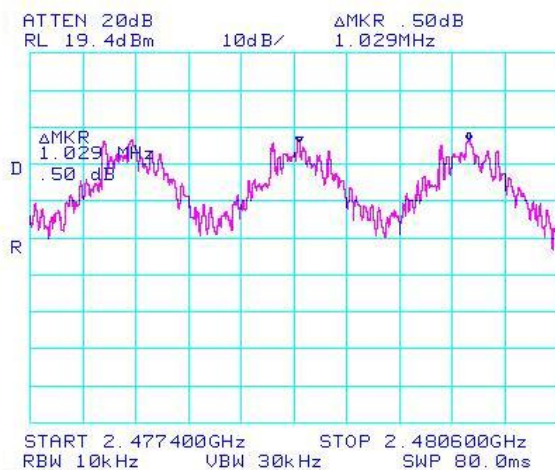
Channel 1, 2 (2 402 MHz, 2 403 MHz)



Channel 40, 41 (2 441 MHz, 2 442 MHz)



Channel 78, 79 (2 479 MHz, 2 480 MHz)

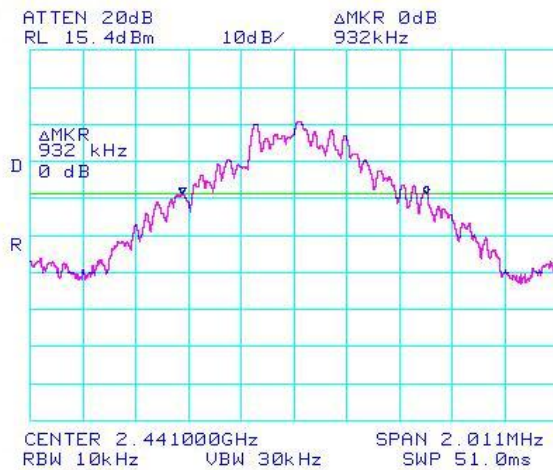


5.1.6 Test Plot (20 dB Occupied bandwidth)

Channel 1 (2 402 MHz)



Channel 40 (2 441 MHz)



Channel 79 (2 480 MHz)



* Note : above the 20 dB Bandwidth measurement method is described FCC Public Notice(DA 00-705),
and setting method on spectrum analyzer is as follows ;

- Span : approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW : $\geq 1\%$ of the 20 dB bandwidth
- VBW : \geq RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.2 Number of hopping frequencies

5.2.1 Standard Applicable [FCC §15.247(a),(1)(iii)]

Frequency hopping systems in the 2 400 MHz ~ 2 483.5 MHz band shall use at least 15 channels

5.2.2 Measurement Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna Terminal to get higher resolution, two frequency ranges within the 2 400 MHz ~ 2 483.5 MHz FH band were examined.

The spectrum analyzer is set to the as follows :

- Span : the frequency band of operation
- RBW : $\geq 1\%$ of the span
- VBW : \geq RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.2.3 Measurement Result

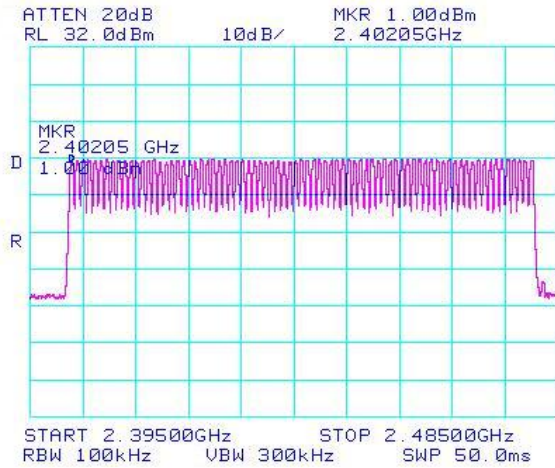
- Environmental Conditions:
 - Temperature : 25 °C, Relative Humidity : (54 ~ 56) % R.H.

Channel Number	Hopping frequency band (MHz)	Test Results		
		Measured total number of Hopping Channels	Limit	Result
1 ~ 79	2 402 MHz ~ 2 480 MHz	79	≥ 15	Complies

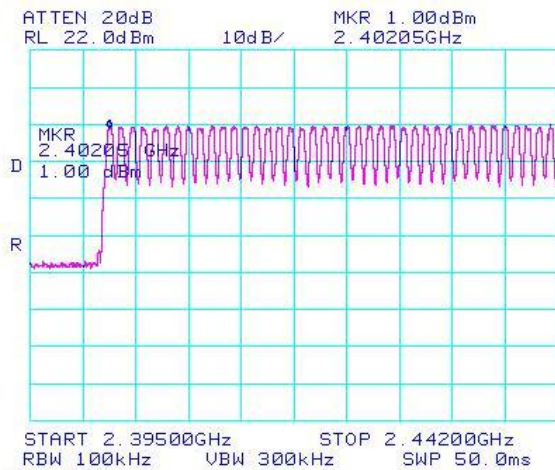
5.2.4 Test Equipment Used : 1, 16, 24

5.2.5 Test Plot

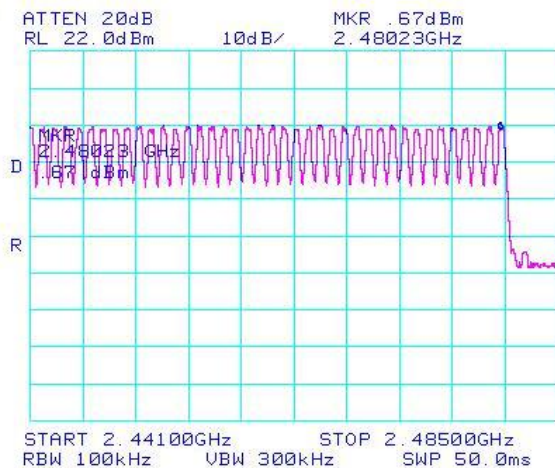
1. Hopping channel / Ch 1 ~ Ch 79



2. Hopping channel / Ch 1 ~ Ch 40



3. Hopping channel / Ch 41 ~ Ch 79



5.3 Time of occupancy (Dwell Time)

5.3.1 Standard Applicable [FCC §15.247(a),(1)(iii)]

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.

5.3.2 Measurement Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled. After used the marker-delta function to determine the dwell time.

The spectrum analyzer is set to the as follows :

- Span : Zero , Centered on a hopping channel
- RBW : 1 MHz
- VBW : \geq RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.3.3 Measurement Result

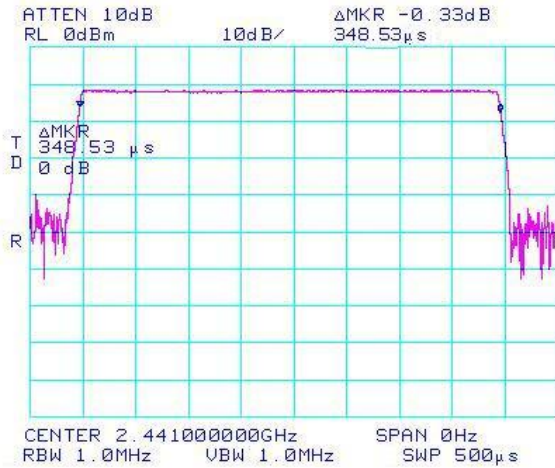
- Environmental Conditions :
 - Temperature : 25 °C, Relative Humidity : (54 ~ 56) % R.H.

Bust width per one hop (μ s)	Test Results		
	Measured dwell time (ms)	Limit	Result
348.53	111.567	≤ 0.4	Complies

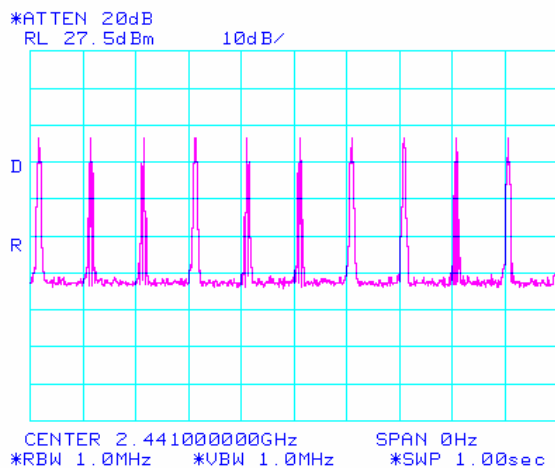
5.3.4 Test Equipment Used : 1, 16, 24

5.3.5 Test Plot

1. Burst width in one hop (μs)



2. Number of hop channel per 1 sec



The system makes worst case 1 600 hops per second or 1 time slot has a length of 625 μs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/2 = 800 hops per second with 79 channels. So you have each channel 800/79 = 10.13 times per A total time of occupancy is get by multiplying the measured number of transmissions occurred during second and so for a period of 0.4 x 79 = 31.6 seconds you have 10.13 x 31.6 = 320.11 times of appearance. So we have 320.11 x 348.53 μs = 111.567 ms per 31.6 second.

Dwell time = time slot x hop rate / number of hopping channels x 31.6 s
DH 1 time slot = time slot x (1600/2) / 79 x 31.6 s

5.4 Max. Conducted peak output power

5.4.1 Standard Applicable [FCC §15.247(b)(1)]

For frequency hopping systems operating in the 2 400 MHz ~ 2 483.5 MHz band employing at least 75 non-overlapping hopping channels, the maximum peak conducted output power shall not exceed 1 W.

5.4.2 Test Conditions

- Attenuator : 30 dB • dc Block : 1.0 dB • Cable loss : 0.5 dB
- Environmental Conditions : Ambient temperature : 25 °C, Relative Humidity : (54 ~ 56) % R.H.

5.4.3 Measurement Procedure

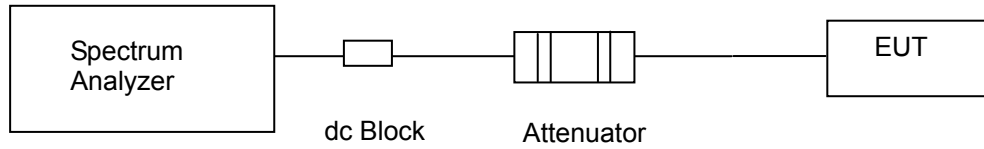
- ① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)
- ② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :
on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]
 - dc Block(1.0 dB)+Cable loss(0.5 dB)+Attenuator (30 dB)
- ③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.
- ④ Place the EUT on the table and set it hopping function disable at the highest, middle and the lowest available channels.
- ⑤ After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission
- ⑥ The indicated level is the peak output power.
- ⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705)

*The spectrum analyzer is set to the as follows ;

- Span : approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- RBW : > 20 dB bandwidth of the emission being measured
- VBW : ≥ RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

* above measurement frequency is selected to the lowest, Middle and Highest channel

5.4.4 Test Setup Configuration



5.4.5 Measurement Result

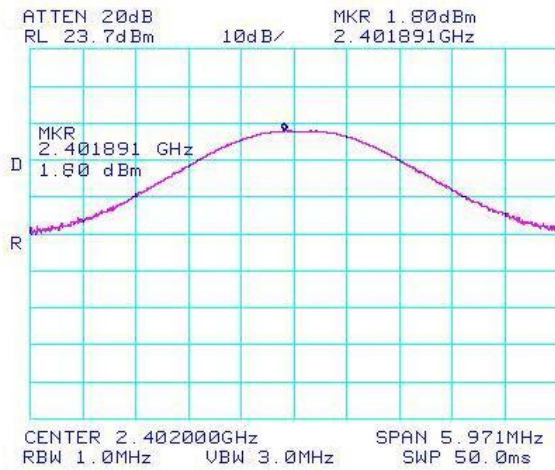
Channel No.	Frequency [MHz]	Test Results		
		Measured power [dBm]	Limit [dBm]	Result
1	2 402	1.80	≤ 30	Complies
40	2 441	2.03		Complies
79	2 480	1.87		Complies

* above measured power value is not contained antennal gain(dBi)

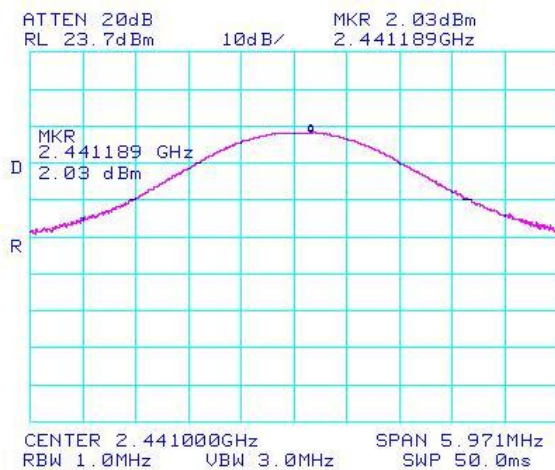
5.4.6 Test Equipment Used : 1, 12, 16, 24

5.4.7 Test Plot

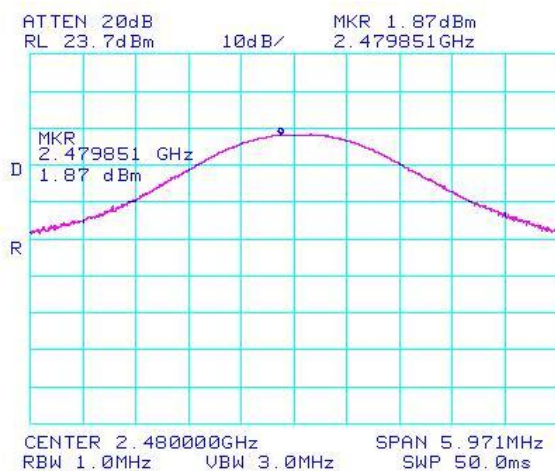
⇒ Lowest Channel _ch 1



⇒ Middle Channel _ch40



⇒ Highest Channel _ch79



5.5 Conducted peak power spectral density

5.5.1 Standard Applicable [FCC §15.247(e)]

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmit

5.5.2 Measurement Procedure

The power spectral density conducted from the intentional radiator was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disable 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 power spectral density.

The spectrum analyzer is set to the as follows :

- Span : 900 kHz
- RBW : 3 kHz
- VBW : 10 kHz (\geq RBW)
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.5.3 Measurement Result

- Environmental Conditions :
 - Temperature : 25 °C, Relative Humidity : (54 ~ 56) % R.H.

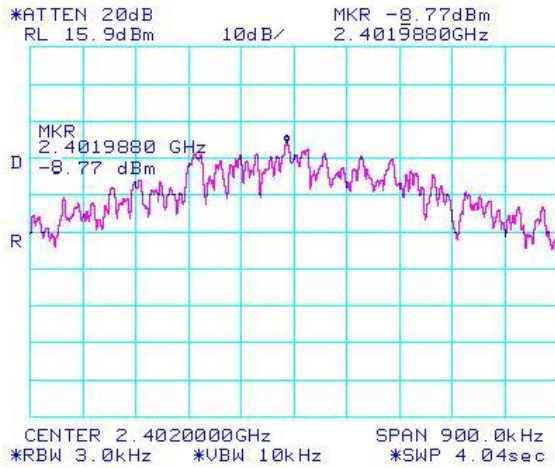
Ch.	Frequency [MHz]	Test Results		
		Measured PSD [dBm]	Limit	Result
1	2 402	- 8.77	8 dBm	Complies
40	2 441	- 8.60		Complies
79	2 480	- 8.60		Complies

* Above Measured power is contained cable loss(0.5 dB) on spectrum analyzer

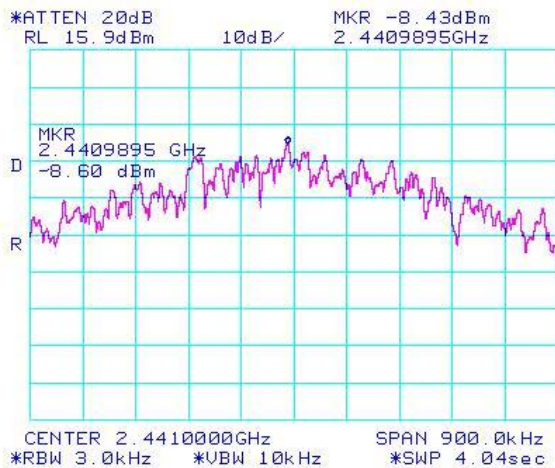
5.5.4 Test Equipment Used : 1, 12, 16, 24

5.5.5 Test Plot

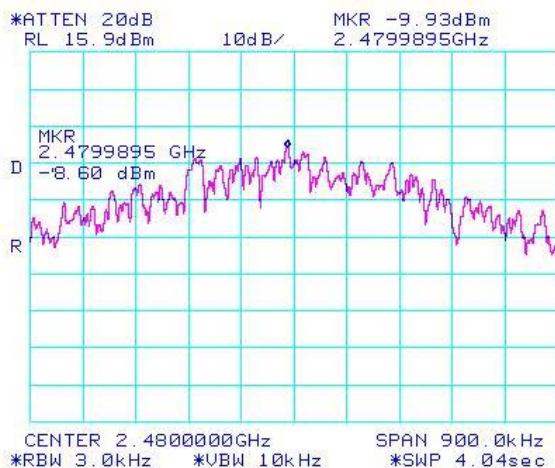
⇒ Lowest Channel _ch 1



⇒ Middle Channel _ch 40



⇒ Highest Channel _ch 79



5.6 Band-edge Compliance

5.6.1 Standard Applicable [FCC §15.247(d)]

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

5.6.2 Test Conditions

- Attenuator : 30 dB • dc Block : 1.0 dB • Cable loss : 0.5 dB
- Environmental Conditions : Ambient temperature : 25 °C, Relative Humidity : (54 ~ 56) % R.H.

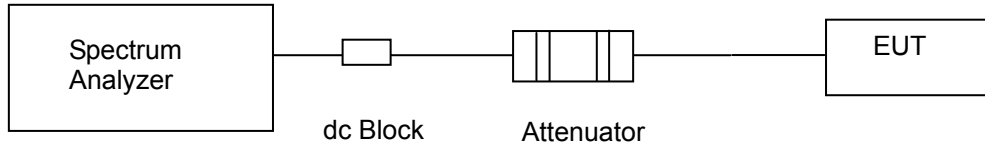
5.6.3 Measurement Procedure

- ① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)
- ② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :
on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]
 - dc Block(1.0 dB)+Cable loss(0.5 dB)+Attenuator (30 dB)
- ③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.
- ④ Place the EUT on the table and set on the emission at the band-edge,
- ⑤ After the trace being stable, Use the marker-to-peak function to move the marker to the peak of the in-band emission.
- ⑥ The marker-delta value now displayed must comply with the limit specified in above standard.
- ⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705)

The spectrum analyzer is set to the as follows :

- Span : Wide enough to capture the peak level of the emission operating on the channel closet to the Band-edge, as well as any modulation products which fall outside of the authorized band of operation
- RBW : ≥ 1 % of the span
- VBW : \geq RBW
- Sweep : auto
- Detector function : peak
- Trace : Max hold

5.6.4 Test Setup Configuration



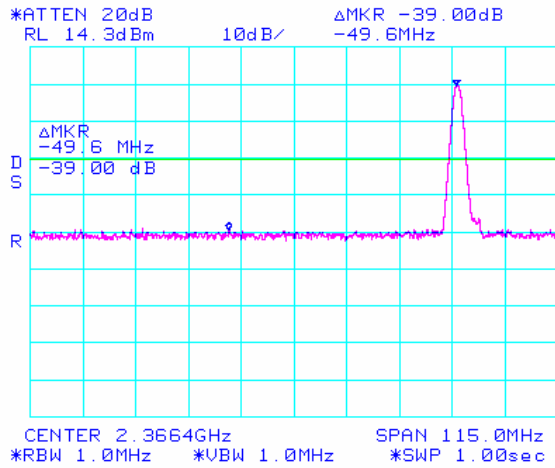
5.6.5 Measurement Result

Channel Range	Frequency band [MHz]	Test Results		
		Measured value [dBc]	Limit [dBc]	Result
Lowest channel 1 (2 402 MHz)	2.3089 GHz ~ 2.4239GHz	- 39.0 0	≤ - 20	Compliance
Highest channel 79 (2 480 MHz)	2.4651 GHz ~ 2.5801 GHz	- 38.34		Compliance

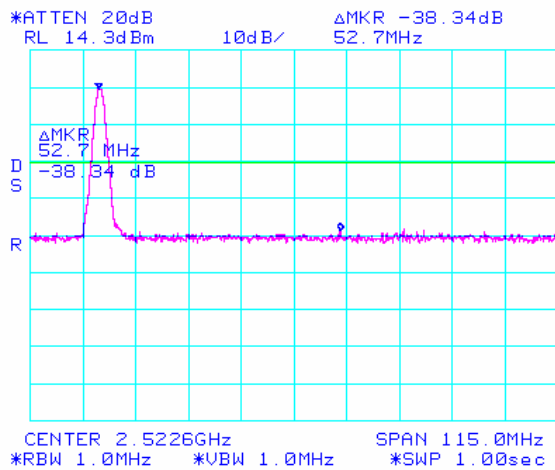
5.6.6 Test Equipment Used : 1, 16, 24

5.6.7 Test Plot

Lowest Channel_01



Highest Channel_79



※ Above signal is detected respectively one point from outside band edge at lowest and highest frequency

5.7 Spurious RF conducted emissions

5.7.1 Standard Applicable [FCC §15.247(d)] [RSS-210 A8.5]

In addition in this clause 5.5.1 In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

5.7.2 Test Conditions

- Attenuator : 30 dB • dc Block : 1.0 dB • Cable loss : 0.5 dB
- Environmental Conditions : Ambient temperature : 22 °C, Relative Humidity : (53 ~ 54) % R.H.

5.7.3 Measurement Procedure

- ① Pre-calibration for the spectrum analyzer has to be done first through a reference CW signal from CAL OUT(-10 dBm)
- ② Reference frequency signal generated from the signal generator is supply to RF input port in spectrum Analyzer via dc Block, RF cable and attenuator. and then, it's apply to offset value in spectrum analyzer as follows :
on Spectrum analyzer [Amplitude→1 More of 3→REF LVL OFFSET (31.5 dB)]
 - dc Block(1.0 dB)+Cable loss(0.5 dB)+Attenuator (30 dB)
- ③ Remove the antenna from the EUT and then, connected to spectrum analyzer via a dc Block, suitable low loss RF cable and attenuator.
- ④ Place the EUT on the table and set on the emission at the out band
- ⑤ After the trace being stable, Use the marker-to-peak function to move the marker to the peak of the in-band emission.
- ⑥ The marker-delta value now displayed spurious emission must comply with the limit specified in above standard.
- ⑦ please refer to the detailed procedure method FCC Public Notice(DA 00-705)

The spectrum analyzer is set to the as follows :

- Span : wide enough to capture the peak level of the in-band emission and all spurious emissions from the Lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
- RBW : 100 kHz
- VBW : ≥ RBW
- Sweep : Auto
- Detector function : Peak
- Trace : Max hold

* Test setup of configuration is same as in this clause 5.6.4

5.7.4 Measurement Result

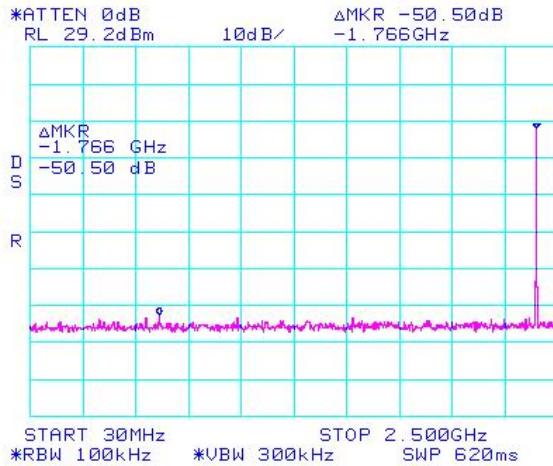
Hopping mode	Channel Range	Frequency band [MHz]	Test Results		
			Measured value [dBc]	Limit [dBc]	Result
Hopping off	Lowest channel_ 1 (2 402 MHz)	30 MHz – 2.5 GHz	- 50.50	≤ - 20	Compliance
		2 GHz – 26.5 GHz	-49.83		Compliance
	Middle channel_ 40 (2 441 MHz)	30 MHz – 2.5 GHz	-56.84		Compliance
		2 GHz – 26.5 GHz	-48.33		Compliance
	Highest channel_ 79 (2 480 MHz)	30 MHz – 3.0 GHz	-55.16		Compliance
		2 GHz – 26.5 GHz	-47.66		Compliance
Hopping on	Hopping ch (1~79)	30 MHz – 3.0 GHz	-60.66		Compliance
		2 GHz – 26.5 GHz	-45.00		Compliance

*Note: Spurious level at Hopping mode is 20dB below within the band that contains the highest level of the desired power. see to as below Test Plot of 5.7.6 and 5.7.7

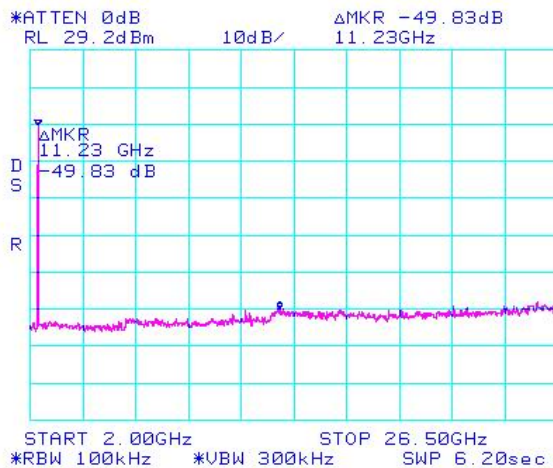
5.7.5 Test Equipment Used : 1, 16, 24

5.7.6 Test Plot (Hopping off)

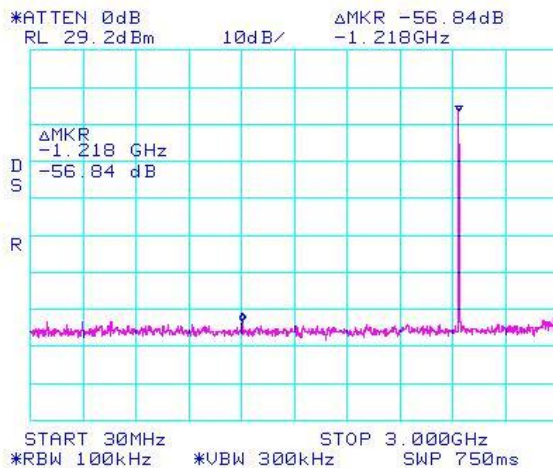
⇒Lowest Channel 30 MHz ~ 2.5 GHz



⇒Lowest Channel 2 GHz ~ 26.5 GHz

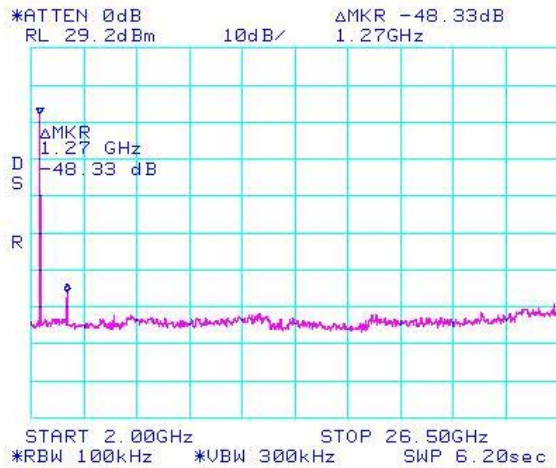


⇒Middle Channel 30 MHz ~ 3.0 GHz

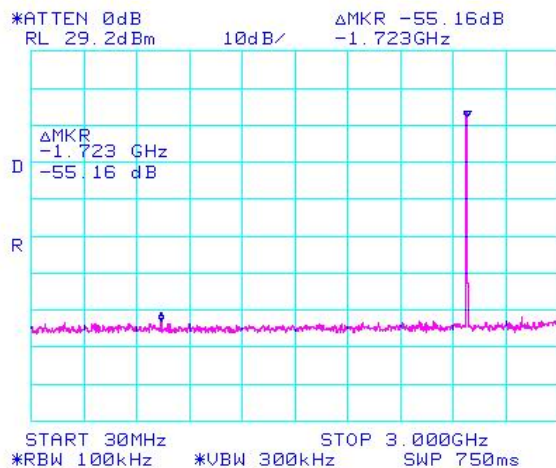


Continuous

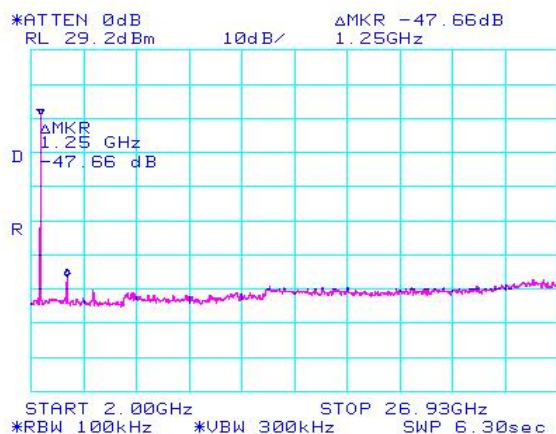
⇒ Middle Channel 2 GHz ~ 26.5 GHz



⇒ Highest Channel 30 MHz ~ 3.0 GHz

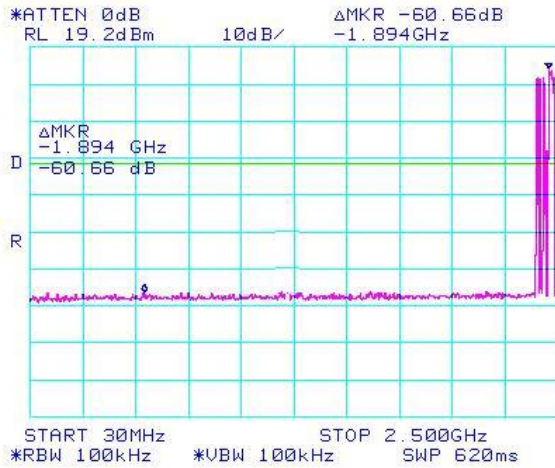


⇒ Highest Channel 2 GHz ~ 26.5 GHz

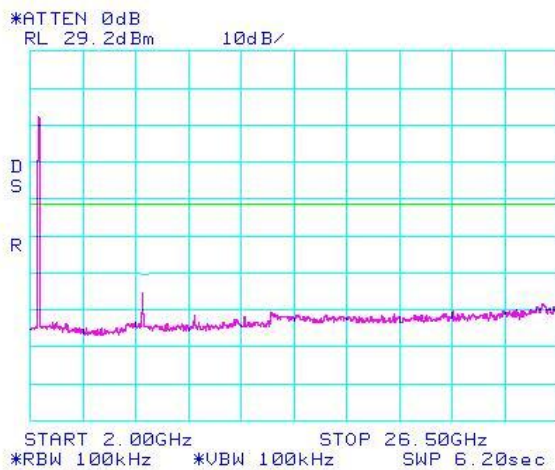


5.7.7 Test Plot (Hopping on)

⇒ frequency band (30 MHz ~ 2.5 GHz)



⇒ frequency band (2 GHz ~ 26.5 GHz)



5.8 Spurious RF Radiated emissions

5.8.1 Standard Applicable [FCC §15.247(d)]

All other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10 GHz, the frequency Range of measurements : to the tenth harmonic of the highest fundamental frequency or to 40 GHz, Whichever is lower.

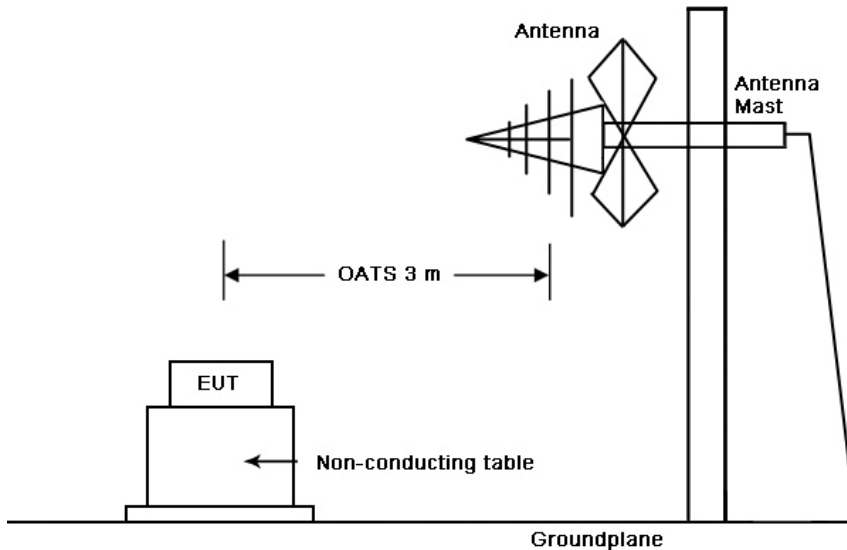
In addition, radiated emissions which fall in the restricted bands, as defined in Sec.15.205(a), must also comply with the radiated emission limits specified in Sec. 15.209(a)

5.8.2 Measurement Procedure

- ① As below test setup figure, for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is test mode function. Also was placed on a non-metallic table height of 0.8 m above the reference ground plane. If EUT is connected to cables, that were fixed to cause maximum emission. antenna was used to Horn antenna for above 1 GHz and Broadband antenna below 1GHz. it made with the antenna positioned in both the horizontal and vertical planes of polarization.
- ② For emission frequencies measured below and above 1 GHz, a pre-scan is performed in a Shield chamber to determine the accurate frequencies before final test, after maximum emissions level will be checked on a open test site and measuring distance is 3 meter from EUT to receiver antenna.
- ③ For emission frequencies measured below 1 GHz, set the Test Receiver on a 120KHz 120 KHz resolution bandwidth using measurement instrumentation employing a CISPR quasi-peak detector. and for above 1 GHz, set the spectrum analyzer on a 1 MHz resolution bandwidth with peak detector respectively for each frequency measured in step② and then EUT is located Position X,Y,Z on turn table
- ④ The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.
- ⑤ Repeat step④ until all frequencies to be measured were complete.
- ⑥ Repeat step⑤ with search antenna in vertical polarized orientations.
- ⑦ Check the frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worst case and record the result.

.The measurement results are obtained as described below:

$$\text{Result}(\text{dB}\mu\text{V}/\text{m}) = \text{Reading}(\text{dB}\mu\text{V}/\text{m}) + \text{Antenna factor}(\text{dB}/\text{m}) + \text{CL}(\text{dB}) + \text{other application factor}(\text{dB})$$



5.8.3 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are test receiver, Cable loss, Antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, Antenna frequency interpolation, measurement distance variation, Site imperfection, mismatch, and system repeatability based on NIS 80,81, The measurement uncertainty level with a 95 % confidence level were apply to Uncertainty of a radiation emissions measurement at OATS(Open Area Test Site) of KOSTEC is $\pm 4.0 \text{ dB}$

§15.209 : limits for radiated emissions measurements (distance at 3m)

Frequency Band	Limit [$\mu\text{V/m}$]	Limit [$\text{dB}\mu\text{V/m}$]	Detector
30 - 88	100 (3 nW)	40.0	Quasi peak
88 - 216	150 (6.8 nW)	43.5	Quasi peak
216 - 960	200 (12 nW)	46.0	Quasi peak
Above 960	500 (75 nW)	54.0	Average

§15.249 : The field strengths measured at 3 meters shall not exceed the following:

Fundamental Frequencies (MHz)	Field Strength (millivolts/m)	
	Fundamental	Harmonics
902 ~ 928	50 ^(Note 1)	0.5
2 400 ~ 2 483.5	50 ^(Note 1)	0.5
5 725 ~ 5 875	50 ^(Note 1)	0.5

§15.205 : Restrict Band of Operation : Only spurious emissions are permitted in any of the frequency bands listed below ;

[MHz]	[MHz]	[MHz]	[GHz]
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6

5.8.4 Measurement Result

• Environmental Conditions :

- Temperature : 24 °C, Relative Humidity : (56 ~ 57) % R.H. Pressure : 100.2 kPa

■ Lowest Channel_01 (2 402 MHz)

Below 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)					
302.00	23.25	90	1.5	H	10.91	5.90	40.06	46.02	5.96	Pass
604.25	15.50	215	1.8	V	16.97	8.51	40.98	46.02	5.04	Pass

Above 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn. (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)					
1,105	12.05	115	1.5	H	22.18	11.50	45.73	74	28.27	Pass
2,389.47	17.50	95	1.7	V	26.49	14.25	58.24	74	15.76	Pass
2,389.47	7.33	95	1.7	V	26.49	14.25	48.07	54	5.93	Pass
Above 2,389.47	Nil emission									

※ it is measured that both of used detector average and peak in band Edge zone at 2,389 47 MHz

Freq.(MHz) : Measurement frequency, Reading(dB μ V/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table, Antenna(Pol, Fctr) : Polarization and Factor
CL(dB) : Cable loss, Meas Result (dB μ V/m) : Reading(dB μ V/m)+ Antenna factor.(dB/m) + CL(dB)
Limit(dB μ V/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB μ V/m) – Meas Result(dB μ V/m),

■ Middle Channel_40 (2 441 MHz)

Below 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)					
339.00	21.56	120	1.5	H	10.89	5.85	38.30	46.02	7.72	Pass
638.56	11.20	90	1.6	V	16.95	8.46	36.61	46.02	9.41	Pass

Above 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn. (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)					
1,112	12.10	115	1.5	H	23.05	12.02	47.17	74	26.83	Pass
Above 1,112	Nil emission									

■ Highest Channel_79 (2 480 MHz)

Below 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)					
378.10	20.04	115	1.5	H	10.85	5.74	36.63	46.02	9.39	Pass
646.50	11.22	90	1.6	V	15.95	8.48	35.65	46.02	10.37	Pass

Above 1 GHz

Freq. (MHz)	Reading (dB μ V/m)	Table (Deg)	Antenna			CL (dB)	Meas Result (dB μ V/m)	Limit (dB μ V/m)	Mgn. (dB)	Result
			Height (m)	Pol. (H/V)	Fctr. (dB/m)					
1, 123	11.98	115	1.5	H	23.20	12.05	47.23	74	26.77	Pass
2,485 84	18.50	104	1.8	V	26.50	14.26	59.26	74	14.74	Pass
2,484 71	7.50	104	1.8	V	26.50	14.26	48.26	54	5.74	Pass
Above 2,485 84	Nil emission									

※ it is measured that both of used detector average and peak in band Edge zone at 2,485 84 and 2,484 71 MHz

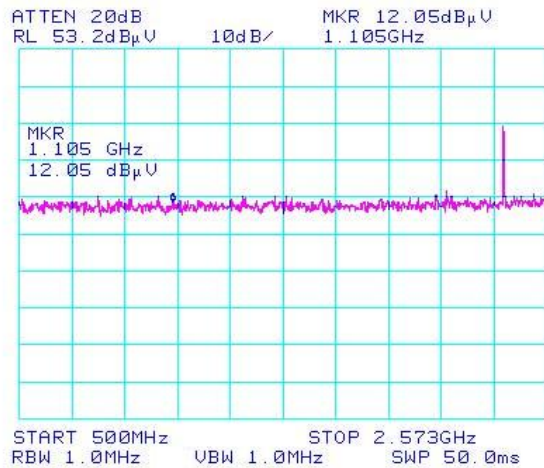
Freq.(MHz) : Measurement frequency, Reading(dB μ V/m) : Indicated value for test receiver,
Table (Deg) : Directional degree of Turn table, Antenna(Pol, Fctr) : Polarization and Factor
CL(dB) : Cable loss, Meas Result (dB μ V/m) : Reading(dB μ V/m)+ Antenna factor.(dB/m) + CL(dB)
Limit(dB μ V/m): Limit value specified with FCC Rule, Mgn(dB) : FCC Limit (dB μ V/m) – Meas Result(dB μ V/m),

■ Above Limit is set forth according to required standard FCC Rule 15.205 and 15.209

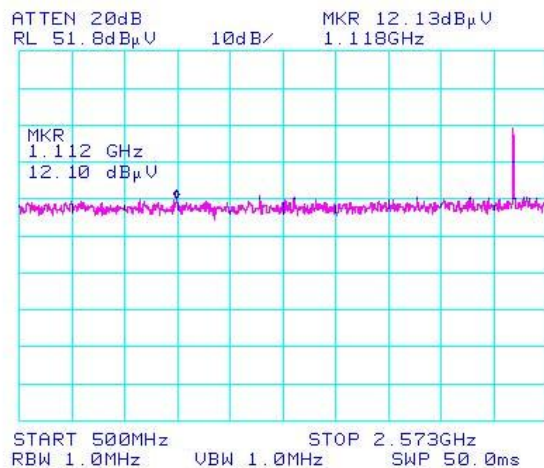
5.8.5 Test Equipment Used : 1, 2, 6,10,13, 14,15,20,25,26

5.8.6 Test Plot (Spurious emission zone)

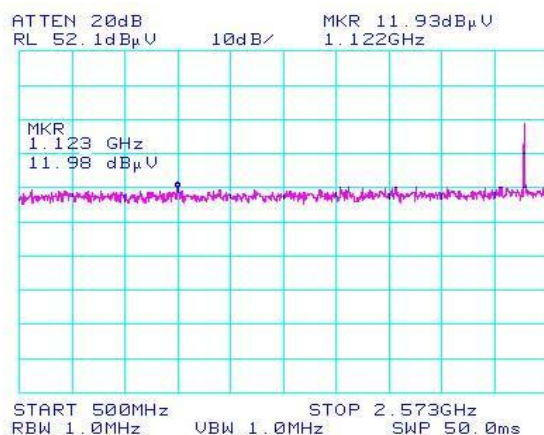
⇒ Lowest Channel_01 (Measured frequency: 1.105 GHz)



⇒ Middle Channel_40 (Measured frequency: 1.112 GHz)



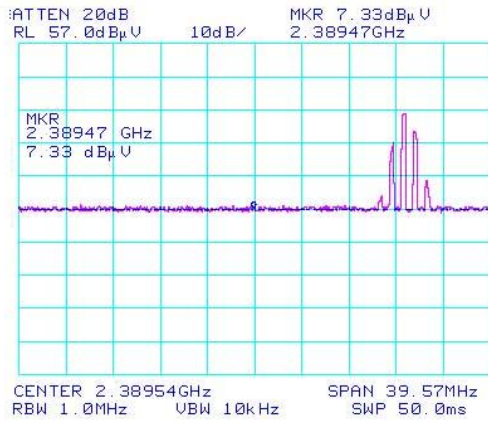
⇒ Highest Channel_79 (Measured frequency: 1.123 GHz)



*above 3 peak level is no more than required average level so, only peak level is measured

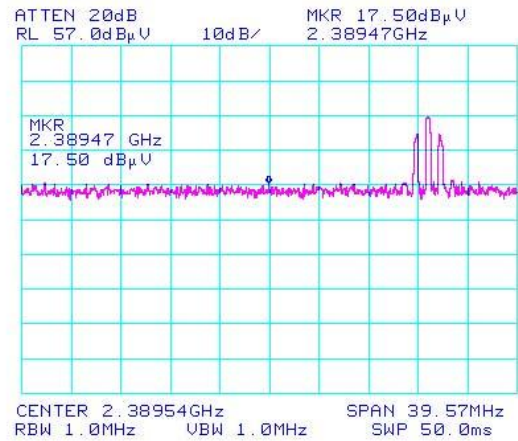
5.8.6 Test Plot (Band Edge emission zone)

⇒ Lowest Channel _01

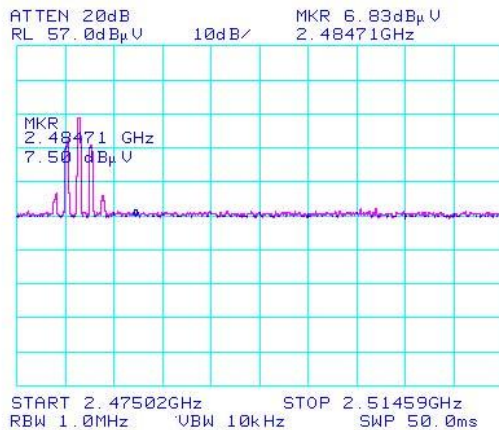


•Detector : Average

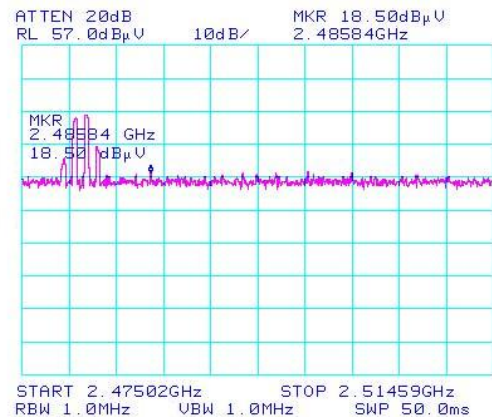
⇒ Highest Channel _79



•Detector : Peak



•Detector : Average



•Detector : Peak

5.9 Antenna requirement

5.9.1 Standard applicable [FCC §15.203, §15.247(4)(1)]

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit So that broken antenna can be replaced by the user, but the Use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(4)(1), the conducted output power limit specified in paragraph (b) of this section. is based on the use of antennas with directional gains that do not exceed 6dBi.

According to above requirement standard's This product's antenna type is an Chip and it's gain is 2.84dBi, So, antenna gain in this product is below requirement standard limit

5.9.2 Antenna gain

Frequency Band	Gain [dBi]	Limit [dBi]	Results
2 400 MHz – 2 500 MHz	2.84	≤ 6	Compliance

5.10 AC Power Conducted emissions

5.10.1 Standard Applicable [FCC §15.207(a)]

For intentional radiator that is designed to be connected to the public utility(AC)power line, the radio frequency Voltage that is conducted back onto the AC power line on any frequencies hopping mode within the band 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50uH/50 ohms line Impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on The measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

§15.207 limits for AC line conducted emissions;

Frequency of Emission(MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

5.10.2 EUT used cable

Cable Type	Shield	Length (m)	Ferrite	Connector	Connection Point 1	Connection Point 2
USB	Yes	1.0	No	No	E.U.T.	Note book PC

5.10.3 Operating conditions

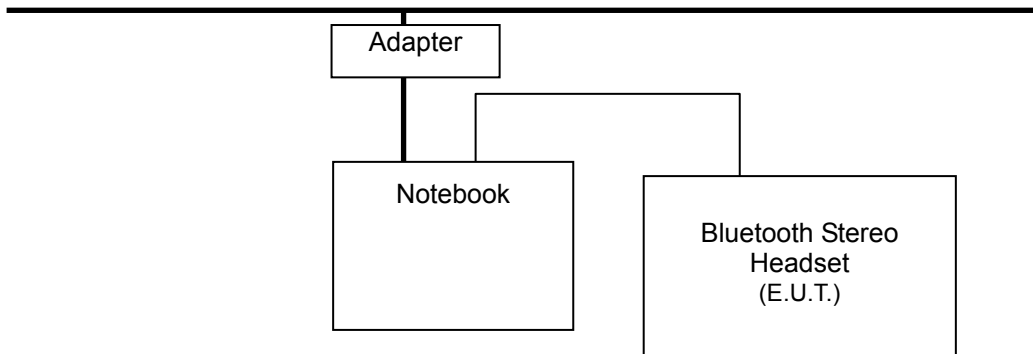
The operating mode/system was as follows in details:

Establish of BT communication link between Headset(EUT) and Mobile phone under the battery charging mode through USB connection. The mobile phone was set up with send to continuous calling (Inquiry mode) In order to search on BT device, So BT is Answer mode on frequencies band (2 402 MHz ~ 2 480 MHz)

5.10.4 Used Peripherals

Description	Manufacturer	Model / Part No	Serial Number
Note book PC	Dell Inc.	PP25L	CN-OXN850-48661-84P-25QH
Adaptor	Electronics (JIANG SU, LTD)	DA65NS4-00	CN-OU8042-70166-87 G-0AIL

5.10.5 E.U.T Test Configuration



5.10.6 Measurement Procedure

A pretest was performed at 3 m distances in a semi-anechoic chamber for searching correct Frequency.

The final test was done at a 10 m open area test site with a quasi-peak detector. EUT was placed on a non-metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization.

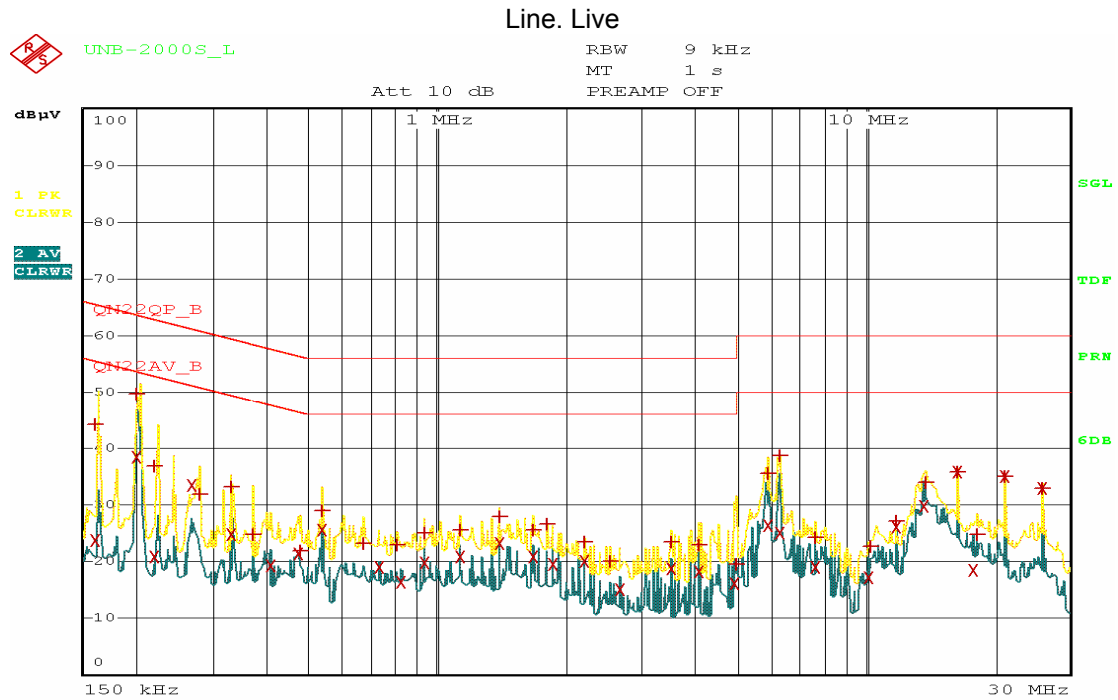
The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.10.7 Test Data

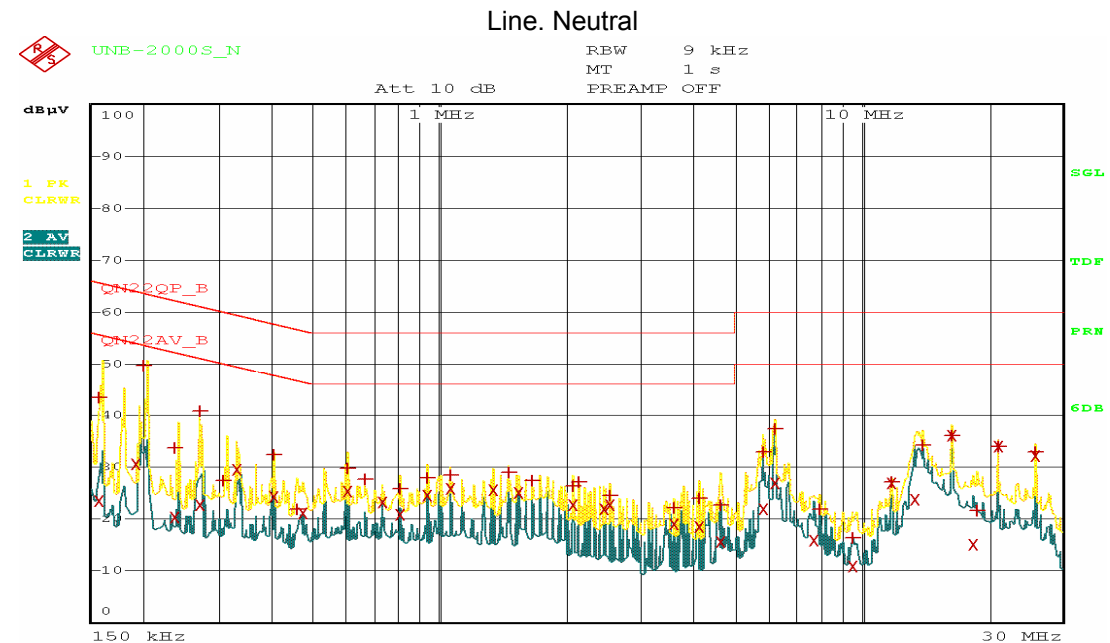
FREQ. (MHz)	LEVEL(dB μ V)		LINE Pol	Loss (dB)	LIMIT(dB μ V)		MARGIN(dB)	
	QP	AV			QP	AV	QP	AV
0.116	44.14	23.71	L	0.08	65.36	55.36	21.22	31.65
0.202	49.68	38.33	L	0.29	63.53	53.53	13.85	15.20
0.270	40.93	22.73	N	0.29	61.12	51.12	20.19	28.39
0.602	29.69	25.27	N	0.90	56.00	46.00	26.31	20.73
1.066	28.49	25.94	N	0.44	56.00	46.00	27.51	20.06
1.466	28.92	25.57	N	0.44	56.00	46.00	27.08	20.43
5.938	35.55	26.28	L	0.75	60.00	50.00	24.45	23.72
6.342	38.75	25.08	L	0.97	60.00	50.00	21.25	24.92
6.466	36.21	36.12	N	0.97	60.00	50.00	23.79	13.88

* Note: Measurement uncertainty ; ± 2.4 dB ($K=2$)

■ Conducted Emission test graph



Date: 23.JUL.2009 10:14:11



Date: 23.JUL.2009 10:11:27