

TEST REPORT

Report No: KST-FCR-080006

Applicant	Name	UNEEDS Commerce Co.,Ltd.
	Address	851-1, Dongchun-dong, Suji-gu, Yongin-si, Gyeonggi-do, South Korea
Manufacturer	Name	UNEEDS Commerce Co.,Ltd.
	Address	851-1, Dongchun-dong, Suji-gu, Yongin-si, Gyeonggi-do, South Korea
Equipment	Name	Bluetooth Mono Headset
	Model No	UM-1000B
	Usage	Wireless Hands-free for cellular phone
	FCC ID	WM5UM-1000B
Test Standard	FCC CFR 47, Part 15. Subpart B-15.109, Subpart C-15.247	
Test Date(s)	2008. 08. 11 ~ 2008. 08. 14	
Issue Date	2008. 08. 18	
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



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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 Mono Headset
2) Model No	UM-1000B
3) Usage	Wireless Hands-free for Cellular phone
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) Channel spacing / Number	1 MHz / 79 Ch
10) Communication Type	Half duplex
11) Final Amplifier	U1
12) Weight / Dimension	150g / 68(L) mm x 15(W) mm x 23(D) mm
13) Operation temperature	- 20 °C ~ + 80 °C
14) Power Source	DC 3.7V (Lithium battery)
15) Antenna Description	Type: Film type, Connect type: Fixed, Length: 40 mm, Gain: -1.5 dBi
16) FCC ID	WM5UM-1000B

3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

This equipment is named Bluetooth Mono Headset and used to wireless hands-free for Cellular phone. Communication type is frequency hopping spread system(FHSS), and also it does not support the EDR (Enhanced Data Rate)

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
PC	LS40	1402KIAW215672	LG-IBM	
TEST JIG	None	None	UNEEEDS 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.

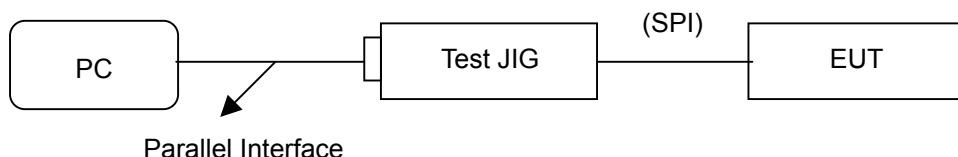
- Low Mid, High channel without Hopping mode
- Hopping mode for FHSS characteristics
- Inquiry mode

Note : For Blue tooth RF test, the BIST software with Bluecore 01 was used.

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 Used Test Equipment List

No.	Instrument	Model	Serial No.	Manufacturer	Due to Cal. Date	Used
1	Spectrum Analyzer	8563E	3846A10662	Agilent Technology	2009.05.20	<input checked="" type="checkbox"/>
2	Spectrum Analyzer	E4445A	US42220283	Agilent Technology	2009.06.30	<input checked="" type="checkbox"/>
3	Test Receiver	ESCS30	100111	Rohde & Schwarz	2009.03.07	<input checked="" type="checkbox"/>
4	Test Receiver	ESP13	100109	Rohde & Schwarz	2009.03.03	<input checked="" type="checkbox"/>
5	Test Receiver	ESPI3	100109	Rohde & Schwarz	2009.03.03	<input type="checkbox"/>
6	LISN	ESH2-Z5	100044	Rohde & Schwarz	2009.04.30	<input checked="" type="checkbox"/>
7	LISN	ESH3-Z5	100147	Rohde & Schwarz	2009.06.25	<input checked="" type="checkbox"/>
8	Ultra broadband Antenna	HL562	100075	Rohde & Schwarz	2010.03.20	<input checked="" type="checkbox"/>
9	Ultra broadband Antenna	HL562	100076	Rohde & Schwarz	2010.04.14	<input type="checkbox"/>
10	Horn Antenna	3115	2996	EMCO	2009.06.13	<input checked="" type="checkbox"/>
11	Loop Antenna	6502	9203-0493	EMCO	2009.06.15	<input type="checkbox"/>
12	RF Power Amplifier	8347A	3307A01571	HP	2009.05.20	<input checked="" type="checkbox"/>
13	Microwave Amplifier	8349B	2627A01037	HP	2009.05.20	<input checked="" type="checkbox"/>
14	Attenuator	8498A	3318A09485	HP	2009.05.20	<input checked="" type="checkbox"/>
15	Temperature & Humidity Chamber	EY-101	90E14260	TABAI ESPEC	2009.03.26	<input type="checkbox"/>
16	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2009.05.20	<input type="checkbox"/>
17	RF Power Sensor	ECP-E18A	US37181768	Agilent Technology	2009.05.20	<input type="checkbox"/>
18	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2009.05.20	<input type="checkbox"/>
19	SLIDAC	None	0207-4	Myoung-Sung Electronic Co., Ltd.	2009.05.20	<input type="checkbox"/>
20	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2009.06.04	<input type="checkbox"/>
21	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2009.05.20	<input type="checkbox"/>
22	DC Power supply	E3610A	KR24104505	Agilent Technology	2009.05.20	<input checked="" type="checkbox"/>
23	Antenna Master	-	-	Daeil EMC	-	<input checked="" type="checkbox"/>
24	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	15.247(a)(1)	Clause 5.1	<input checked="" type="checkbox"/>	Compliance
20 dB bandwidth	15.247(a)(1)	Clause 5.2	<input checked="" type="checkbox"/>	Compliance
Number of hopping frequencies	15.247(a)(1)(iii)	Clause 5.3	<input checked="" type="checkbox"/>	Compliance
Time of occupancy (Dwell Time)	15.247(a)(1)(iii)	Clause 54	<input checked="" type="checkbox"/>	Compliance
Conducted peak output power	15.247(b)(1)	Clause 5.5	<input checked="" type="checkbox"/>	Compliance
Conducted peak output power spectrum density	15.247(e)	Clause 5.6	<input checked="" type="checkbox"/>	Compliance
Band edge compliance of RF emissions	15.247(d)	Clause 5.7	<input checked="" type="checkbox"/>	Compliance
Spurious RF conducted emissions	15.247(d)	Clause 5.8	<input checked="" type="checkbox"/>	Compliance
Spurious RF radiated emissions	15.247(d), 15.209	Clause 5.9	<input checked="" type="checkbox"/>	Compliance
Antenna requirement	15.203, 15.247	Clause 5.10	<input checked="" type="checkbox"/>	Compliance
AC Power line Conducted emission	15.207	Clause 5.11	<input checked="" type="checkbox"/>	Compliance
Unintentional radiated emissions	15.109	Clause 5.12	<input checked="" type="checkbox"/>	Compliance
Compliance : The EUT complies with the essential requirements in the standard.				
Not Compliance : The EUT does not comply with the essential requirements in the standard.				
N/A : The test was not applicable in the standard.				

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

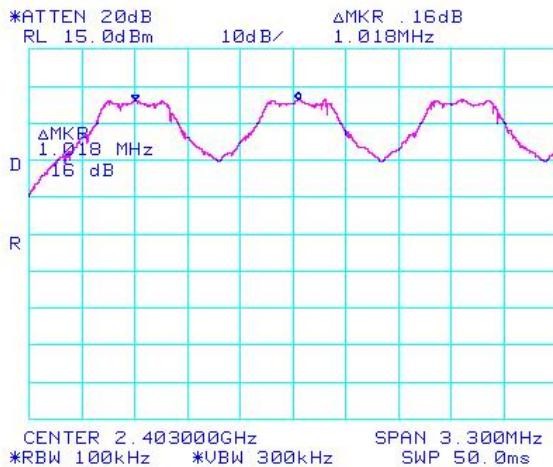
- Environmental Conditions :
 - Temperature : (26 ~ 29) °C, Relative Humidity : (54 ~ 56) % R.H.

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, 018	≥ 25 kHz or 2/3 20dB bandwidth	Complies
40, 41	2 441 MHz, 2 442 MHz	1, 051		Complies
78, 79	2 479 MHz, 2 480 MHz	1, 023		
Inquiry	2 406 MHz, 2 408 MHz	2		Complies

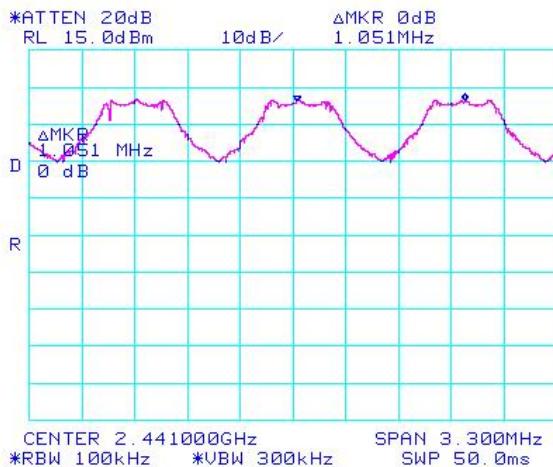
5.1.4 Test Equipment Used: 1, 13, 21

5.1.5 Test Plot

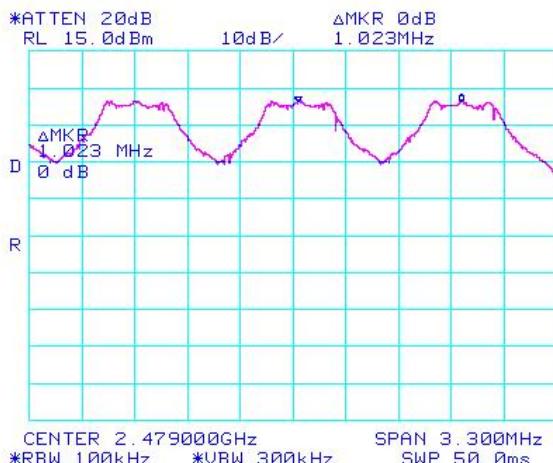
Channel 1, 2 (2 402 MHz, 2 403 MHz)



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



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



Inquiry mode



5.2 20 dB Bandwidth

5.2.1 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.

5.2.2 Measurement Procedure

The Bandwidth at 20 dB down from the highest in band spectral density is measured with spectrum analyzer Connected to the antenna terminal, while EUT had transmitting at its maximum data rate. allow the trace to stabilize after use the marker to peak function to set the marker to the peak of the emission.

Reset the marker delta function, and move the marker to the other side of the emission, until it is 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 the 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

※ Measurement Setup is same as the Clause 3.5 (Test Setup of EUT)

5.2.3 Measurement Result

- Environmental Conditions:

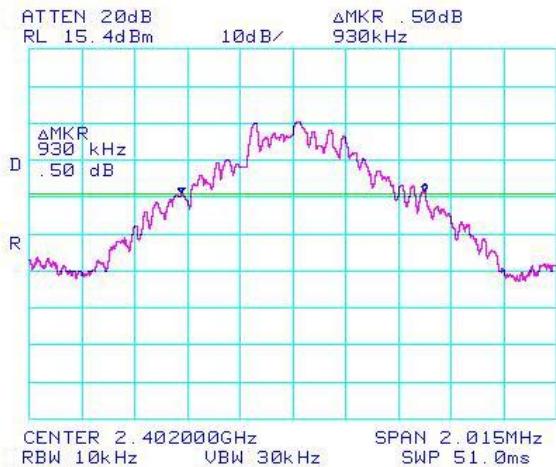
- Temperature : (26 ~ 29) °C, Relative Humidity : (54 ~ 56) % R.H.

Frequency [MHz]	Ch.	Test Results		
		Measured BW [MHz]	Limit	Result
2 402	1	0.930	-	-
2 441	40	0.932		-
2 480	79	0.928		-
2 404	Inquiry	0.603		-

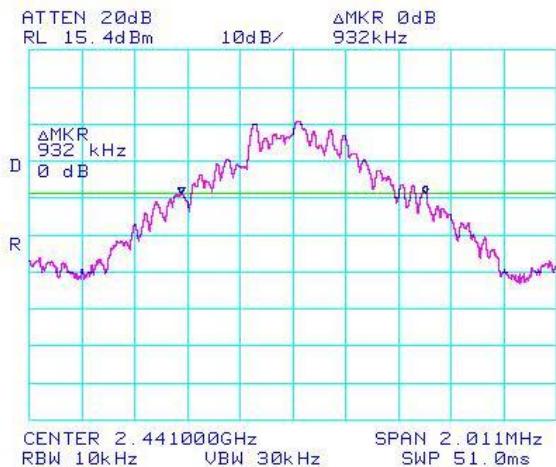
5.2.4 Test Equipment Used : 1, 13, 21

5.2.5 Test Plot

Channel 1 (2 402 MHz)



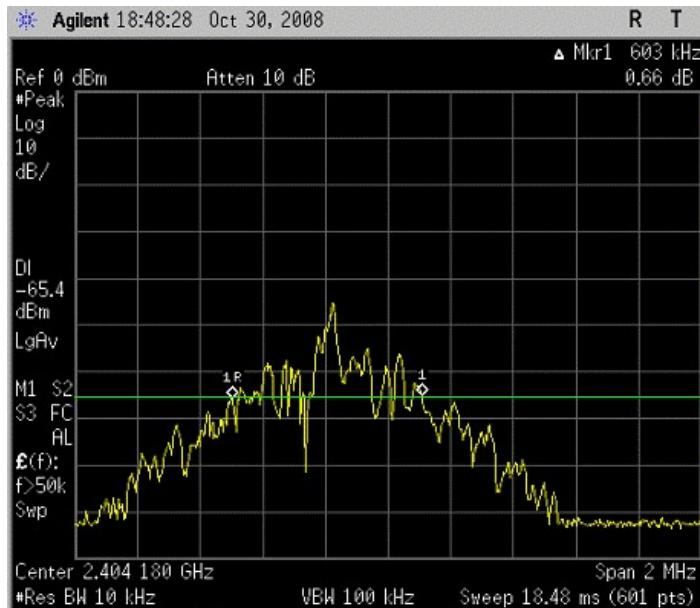
Channel 40 (2 441 MHz)



Channel 79 (2 480 MHz)



Inquiry mode



5.3 Number of hopping frequencies

5.3.1 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

5.3.2 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

5.3.3 Measurement Result

- Environmental Conditions:

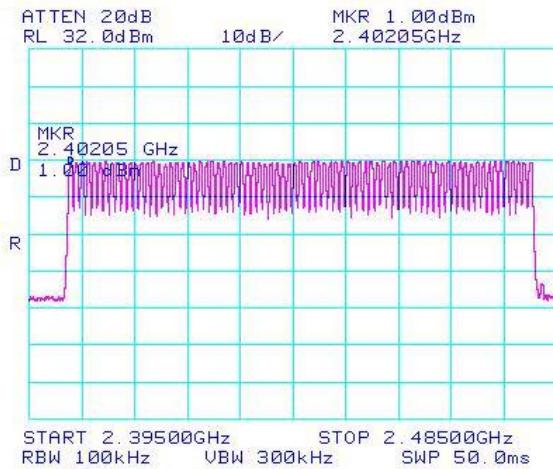
- Temperature : (26 ~ 29) °C, Relative Humidity : (54 ~ 56) % R.H.

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
Inquiry	2 402 MHz ~ 2 480 MHz	32	≥ 15	Complies

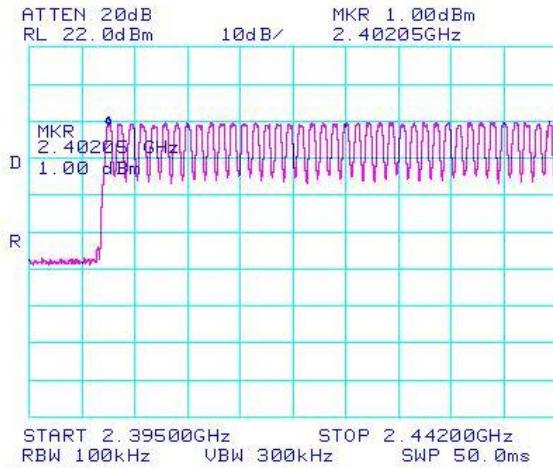
5.3.4 Test Equipment Used : 1, 13, 21

5.3.5 Test Plot (RBW: 100 kHz, VBW: 300kHz)

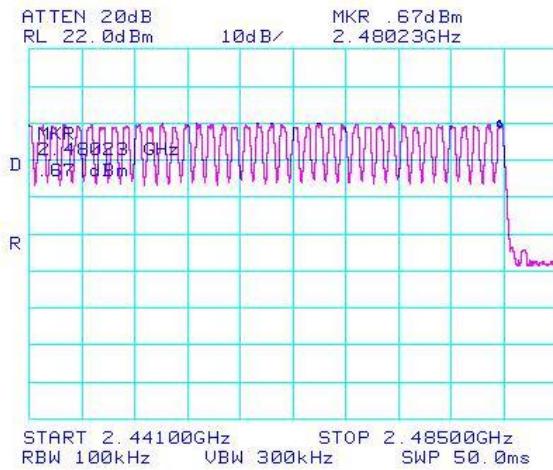
1. Hopping channel / Full band (2 402 MHz ~ 2 480 MHz)



2. Hopping channel / Half band (2 402 MHz ~ 2 442 MHz)

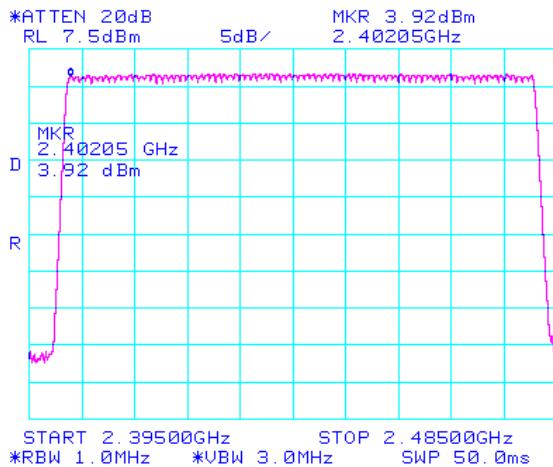


3. Hopping channel / Half band (2 443 MHz ~ 2 480 MHz)

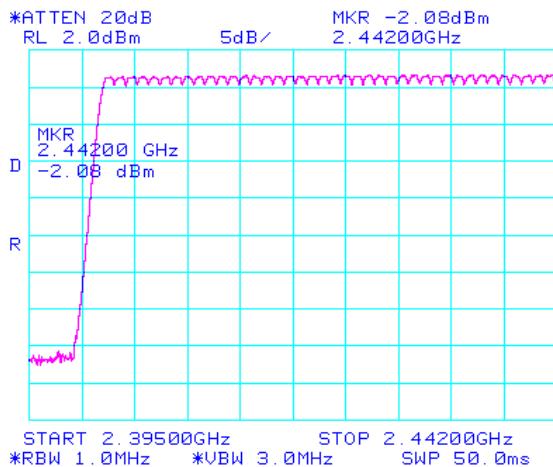


5.3.5 Test Plot (RBW: 1 MHz, VBW: 3 MHz)

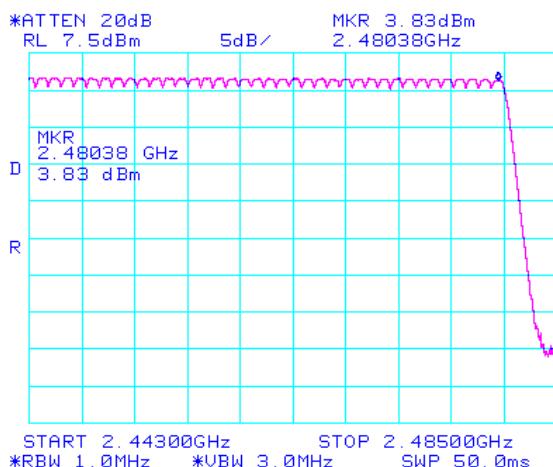
1. Hopping channel / Full band (2 402 MHz ~ 2 480 MHz)



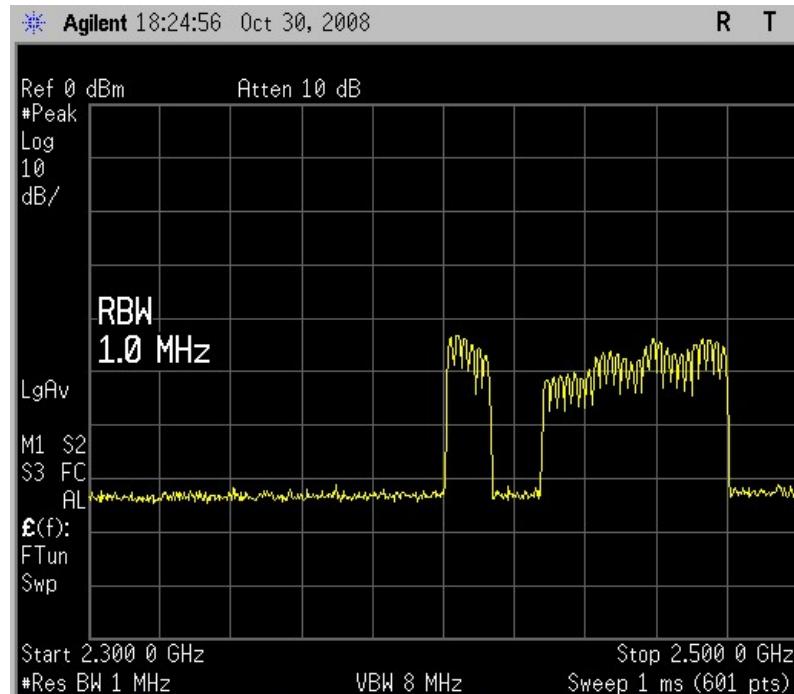
2. Hopping channel / Half band (2 402 MHz ~ 2 442 MHz)



3. Hopping channel / Half band (2 443 MHz ~ 2 480 MHz)



Inquiry mode



5.4 Time of occupancy (Dwell Time)

5.4.1 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.

5.4.2 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

5.4.3 Measurement Result

- Environmental Conditions :
- Temperature : (26 ~ 29) °C, Relative Humidity : (54 ~ 56) % R.H.

Hopping frequency (MHz)	Bust duration in one hop (μ s)	Test Results		
		Measured dwell time (ms)	Limit	Result
2.441 MHz	398.33	127.509	\leq 0.4	Complies
Inquiry	83.07	3.323	\leq 0.4	Complies

Note : This device is operated only DH1 Packet type (packet length)

The system makes worst case 1 600 hops per second or 1 time slot has a length of 625μ s 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 second. A total time of occupancy is get by multiplying the measured number of transmissions occurred during second and so for a period of $0.4 \times 79 = 31.6$ seconds you have $10.13 \times 31.6 = 320.11$ times of appearance. So we have $320.11 \times 398.33 \mu$ s = 127.509 ms per 31.6 second.

Dwell time = time slot \times hop rate / number of hopping channels \times 31.6 s

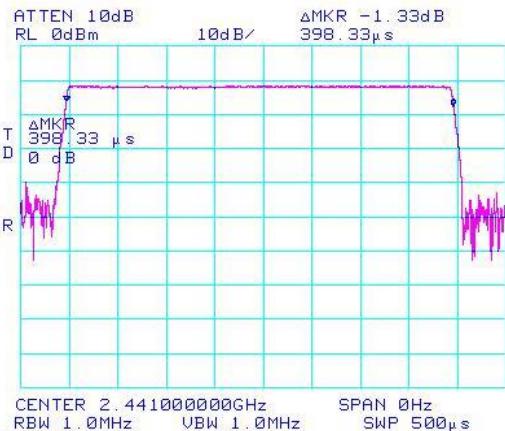
DH 1 time slot = time slot \times (1600/2) / 79 \times 31.6 s

Inquiry mode Dwell time = $100/32 \times (0.4 \times 32) \times 83.07 = 3.323$ ms

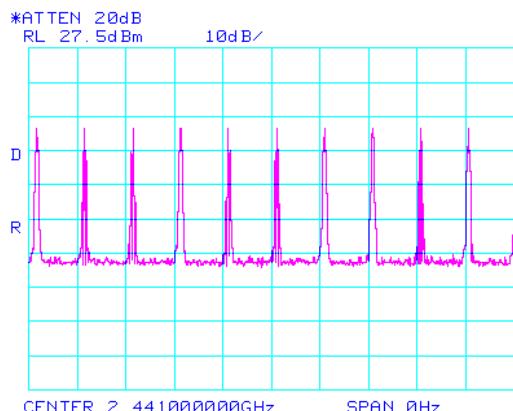
5.4.4 Test Equipment Used : 1, 13, 21

5.4.5 Test Plot

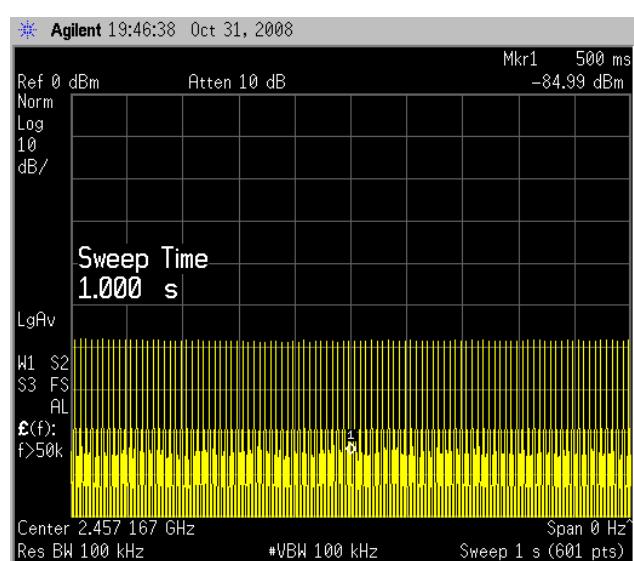
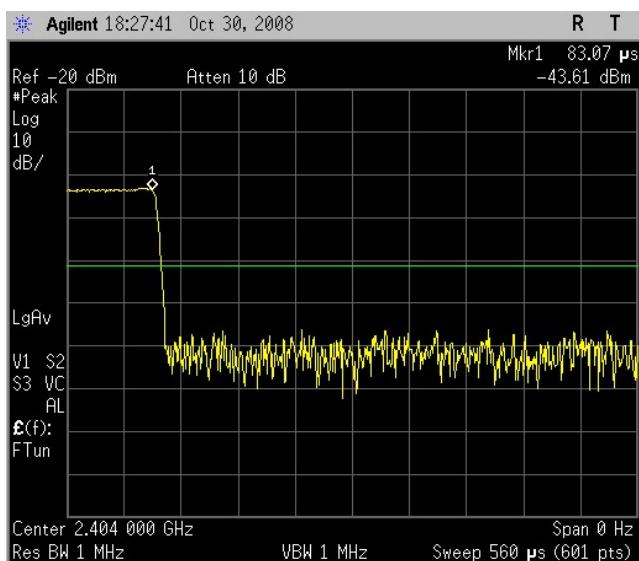
Mid ch 2 441 MHz, Burst width in one hop (μ s)



Channel 2 (2 441 MHz), Number of hop channel per 1 sec



Inquiry mode



5.5 Conducted peak output power

5.5.1 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, and all frequency hopping systems in the 5 725 MHz ~ 5850 MHz band : 1 watt. For all other frequency hopping systems in the 2 400 MHz ~ 2 483.5 MHz band : 0.125 Watts.

5.5.2 Measurement Procedure

The peak output power 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 output power.

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 : \geq RBW
- Sweep : auto
- Detector function : peak
- Trace : max hold

5.5.3 Measurement Result

- Environmental Conditions :

- Temperature : (27 ~ 28) °C, Relative Humidity : (55 ~ 57) % R.H.

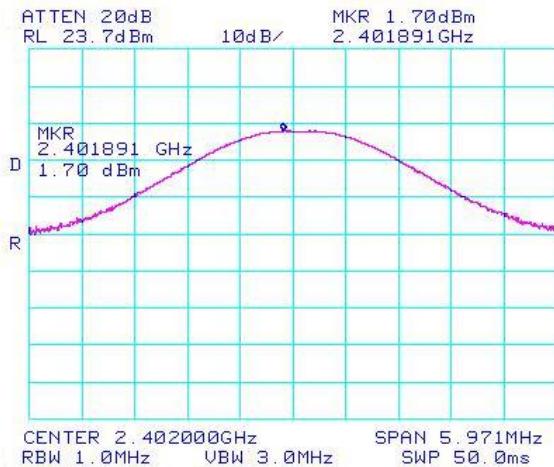
Ch.	Frequency [MHz]	Test Results		
		Measured power [dBm]	Limit [dBm]	Result
1	2 402	1.70	≤ 30	Complies
40	2 441	2.03		Complies
79	2 480	1.87		Complies
Inquiry	2 404	-41.04		Complies

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

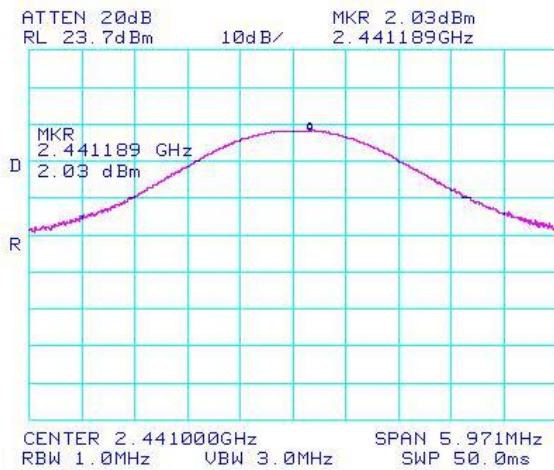
5.5.4 Test Equipment Used : 1, 13, 21

5.5.5 Test Plot

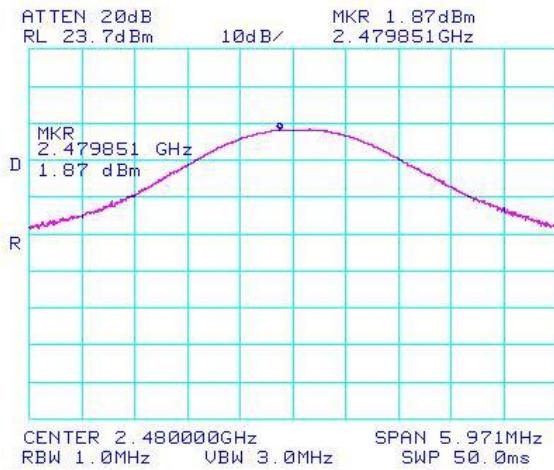
Channel 1 (2.402 MHz)



Channel 40 (2441 MHz)



Channel 79 (2.480 MHz)



Inquiry mode : 2 404 MHz



5.6 Conducted peak power spectral density

5.6.1 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

5.6.2 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

5.6.3 Measurement Result

- Environmental Conditions :
 - Temperature : (27 ~ 28) °C, Relative Humidity : (55 ~ 57) % R.H.

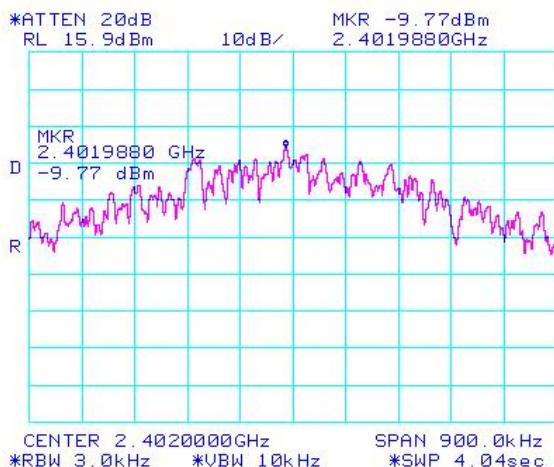
Ch.	Frequency [MHz]	Test Results		
		Measured PSD [dBm]	Limit	Result
1	2 402	- 9.77	8 dBm	Complies
40	2 441	- 9.43		Complies
79	2 480	- 9.93		Complies

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

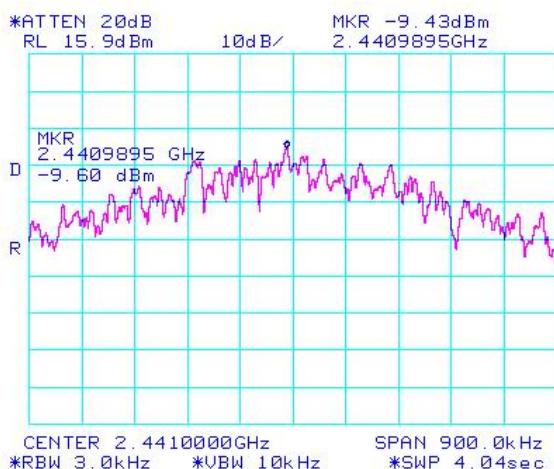
5.6.4 Test Equipment Used : 1, 13, 21

5.6.5 Test Plot

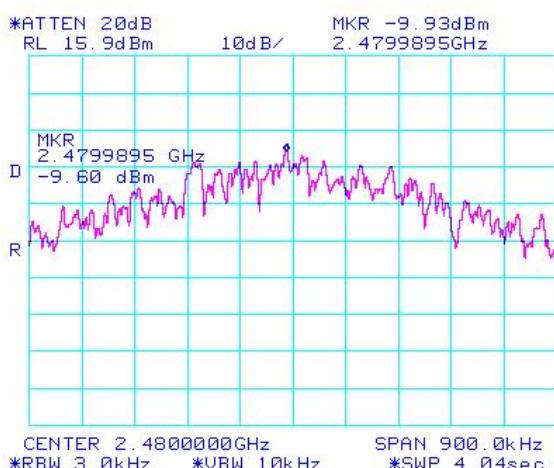
Channel 1 (2402 MHz)



Channel 40 (2441 MHz)



Channel 79 (2480 MHz)



5.7 Band-edge Compliance of RF Conducted emissions

5.7.1 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.

5.7.2 Measurement Procedure

The Bandwidth at 20 dB down from the highest in band spectral density is measured with spectrum analyzer Connected to the antenna terminal, while EUT had transmitting at its maximum data rate. allow the trace to stabilize. Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band. Then use the marker-to peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in above Section.

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 : $\geq 1\%$ of the span
- VBW : \geq RBW
- Sweep : auto
- Detector function : peak
- Trace : Max hold

5.7.3 Measurement Result

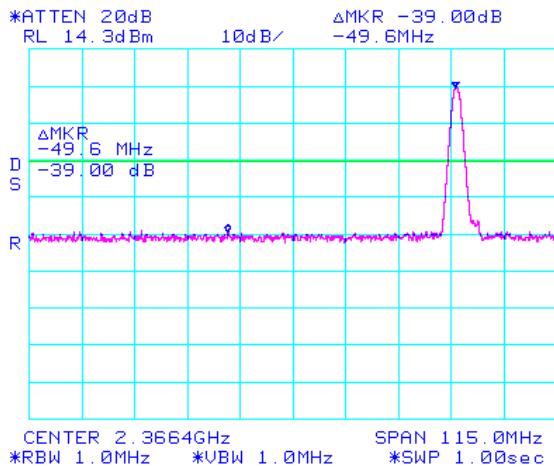
- Environmental Conditions :
 - Temperature : (27 ~ 28) °C, Relative Humidity : (55 ~ 57) % R.H.

Channel Range	Frequency band [MHz]	Test Results		
		Measured value [dBc]	Limit [dBc]	Result
Lowest channel 1 (2 402 MHz)	2.3089 GHz ~ 2.4239GHz	- 39.00	$\leq - 20$	Compliance
Highest channel 79 (2 480 MHz)	2.4651 GHz ~ 2.5801 GHz	- 38.34		Compliance

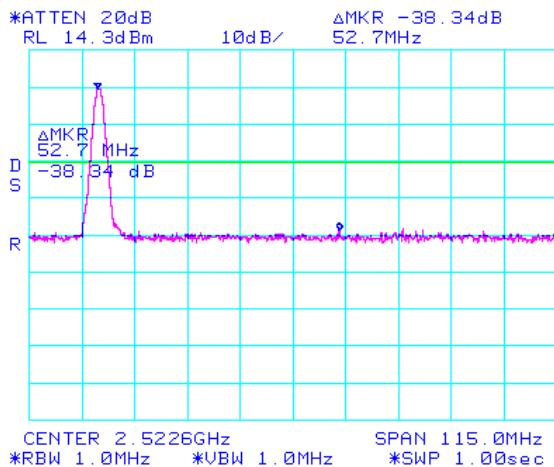
5.7.4 Test Equipment Used : 1, 13, 21

5.7.4 Test Plot

Lowest Channel 1 (2 402 MHz)



Highest Channel 79 (2 480 MHz)



5.8 Spurious RF Conducted emissions

5.8.1 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.

5.8.2 Measurement Procedure

The Spurious RF Conducted Emissions from the highest in band spectral density is measured with spectrum Analyzer. Connected to the antenna terminal, while EUT had transmitting at its maximum data rate. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must Comply with the limit specified in section §15.247(d)

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 : \geq RBW
- Sweep : Auto
- Detector function : Peak
- Trace : Max hold

5.8.3 Measurement Result

- Environmental Conditions ;
- Temperature : (27 ~ 30) °C, Relative Humidity : (54 ~ 58) % R.H.

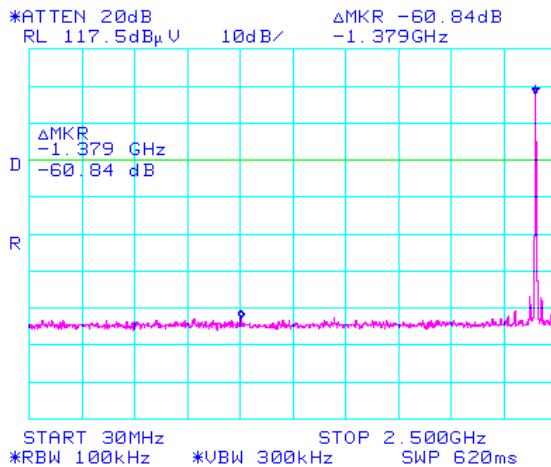
Hopping mode	Channel Range	Frequency band [MHz]	Test Results		
			Measured value [dBc]	Limit [dBc]	Result
Hopping off	Lowest channel 1 (2 402 MHz)	30 MHz – 2.5 GHz	- 60.84	≤ - 20	Compliance
		2 GHz – 26.5 GHz	-44.50		Compliance
	Middle channel 40 (2 441 MHz)	30 MHz – 2.5 GHz	-62.84		Compliance
		2 GHz – 26.5 GHz	-47.17		Compliance
	Highest channel 79 (2 480 MHz)	30 MHz – 3.0 GHz	- 62.84		Compliance
		2 GHz – 26.5 GHz	-42.00		Compliance
Hopping on	Hopping ch (1~79)	30 MHz – 3.0 GHz	-42.50		Compliance
		2 GHz – 26.5 GHz	-45.33		Compliance

*Note: Hopping mode and Harmonic level is 20dB below within the band that contains the highest level of the desired power. see to as below Test Plot of 5.8.5

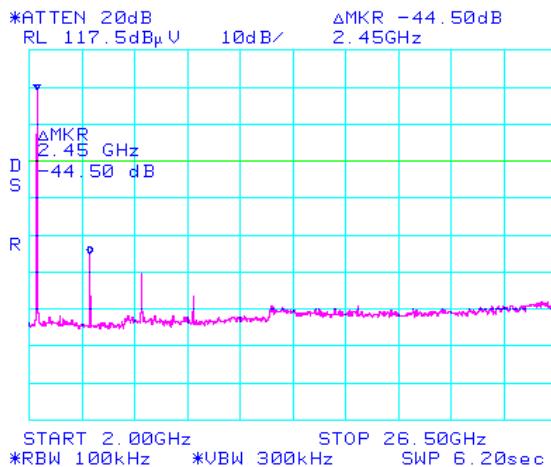
5.8.4 Test Equipment Used : 1, 13, 21

5.8.5 Test Plot (Hopping off)

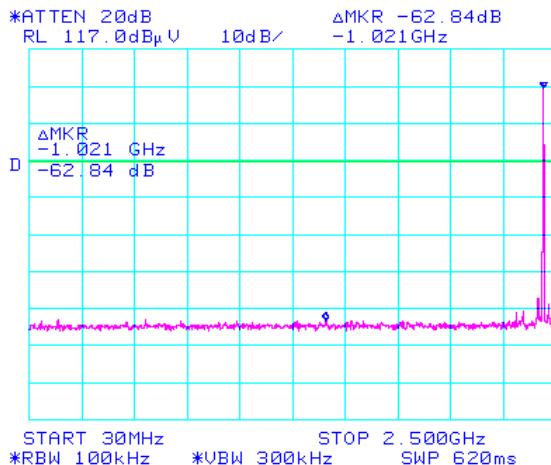
Lowest Channel 1 (2 402 MHz) 30 MHz ~ 2.5 GHz



Lowest Channel 1 (2 402 MHz) 2 GHz ~ 26.5 GHz

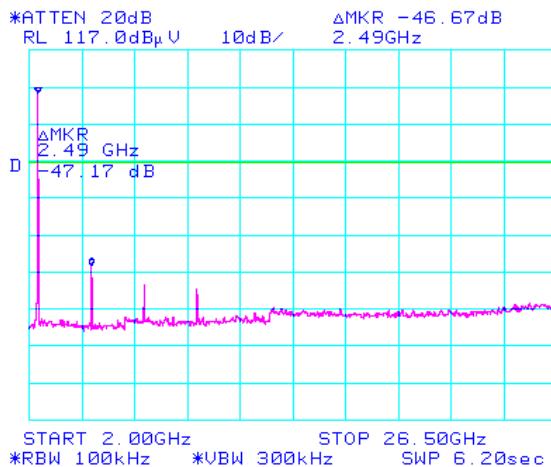


Middle Channel 40 (2 441 MHz) 30 MHz ~ 3.0 GHz

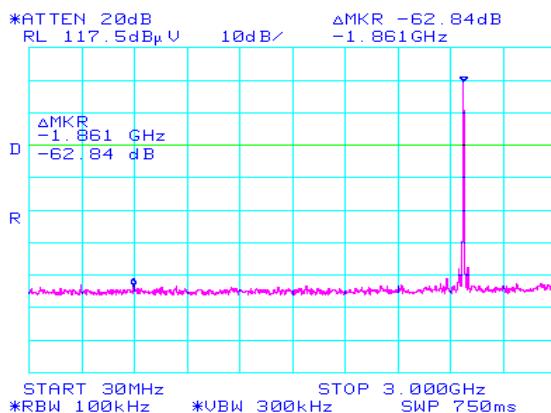


⇒ Continus

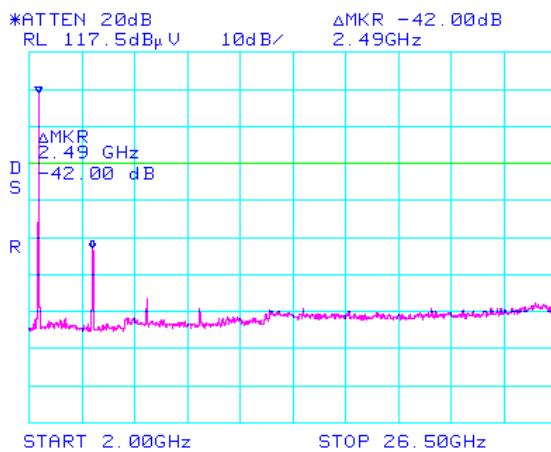
Middle Channel 40 (2 441 MHz) 2 GHz ~ 26.5 GHz



Highest Channel 79 (2 480 MHz) 30 MHz ~ 3.0 GHz

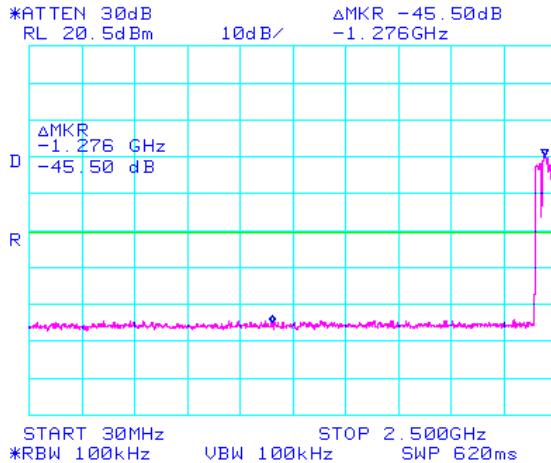


Highest Channel 79 (2 480 MHz) 2 GHz ~ 26.5 GHz

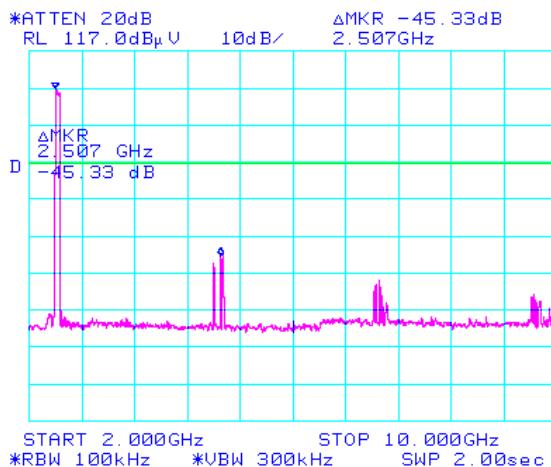


5.8.5 Test Plot (Hopping on, hopping band = Ch 1 ~ Ch 79, 2 402 MHz ~ 2 480 MHz)

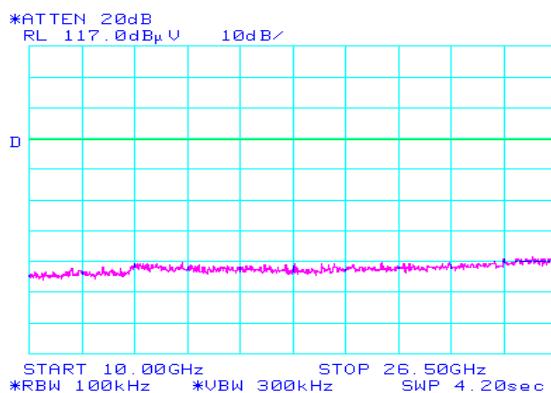
Measured frequency band (30 MHz ~ 2.5 GHz)



Measured frequency band (2 GHz ~ 10 GHz)



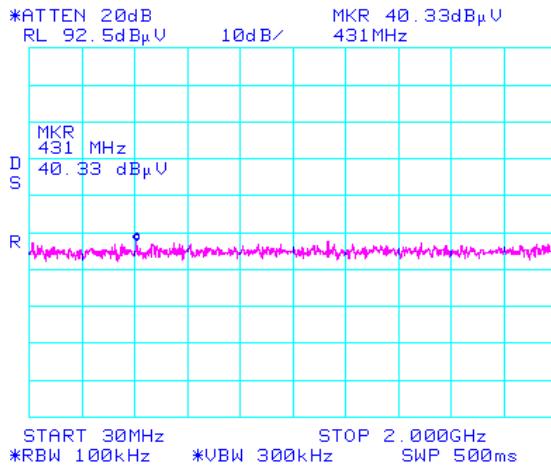
Measured frequency band (10 GHz ~ 26.5 GHz)



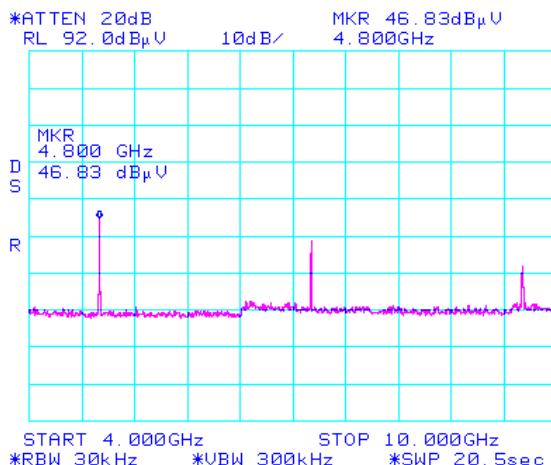
* Signal is not detected above 10 GHz

5.8.5 Test Plot (Harmonic frequency)

Harmonic frequency (30 MHz ~ 2.0 GHz)



Harmonic frequency (4 GHz ~ 10 GHz)



* Not detected signal above 10 GHz

Harmonic Frequency Level :

2nd harmonic: 4.804 MHz 46.83 dB μ V

3rd harmonic: 7.206 MHz 42.15 dB μ V

4th harmonic: 9.608 MHz 38.75 dB μ V

• Above Measured level is contained cable loss(0.5 dB) on spectrum analyzer

5.9 Spurious RF Radiated emissions

5.9.1 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)

5.9.2 Measurement Procedure

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed in the OATS(Open-Area Test –Site), if the Preliminary Measurement results are closer than 20 dB to the permissible value.

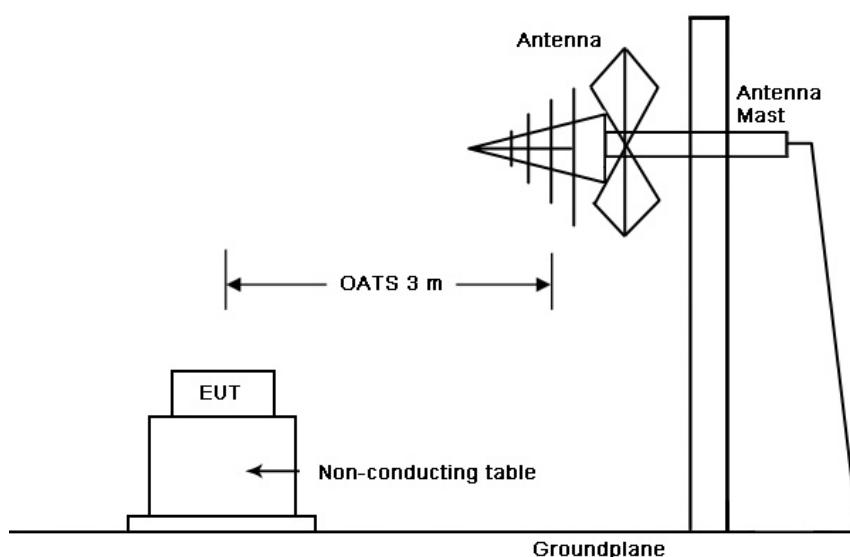
The EUT is placed at nonconductive plate at the turntable center.

For each suspected frequency, the turntable is rotated 360 degrees and antenna is scanned from 1 to 4 m. This is repeated for both horizontal and vertical receive antenna polarizations.

The emissions less than 20 dB below the permissible value are reported.

The measurement results are obtained as described below:

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



§15.209 limits for radiated emissions measurements (Measurement distance at 3m)			
Frequency Band	Limit [μ V/m]	Limit [dB μ V/m]	Detector
30 - 88	100	40.0	Quasi peak
88 - 216	150	43.5	Quasi peak
216 - 960	200	46.0	Quasi peak
960 - 1000	500	54.0	Quasi peak
Above 1000	500	54.0	Average

§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

5.9.3 Measurement Result

- Environmental Conditions :

- Temperature : 24 °C, Relative Humidity : 57 % R.H. Pressure : 100.4 kPa

Lowest Channel 1 (2 402 MHz)

Below 1 GHz

Freq.	Reading	Tbl	Antenna			CL	Result	Lmt	Mgn.
(MHz)	(dB μ V/m)	(Deg)	Height (m)	Pol. (H/V)	Fctr. (dB/m)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
302.00	25.15	90	1.5	H	10.91	5.90	41.97	46.02	4.05
607.25	16.70	215	1.8	V	16.97	8.51	42.18	46.02	3.84
852.30	9.87	135	1.3	V	20.13	10.32	40.32	46.02	5.70

Detector : Quasi-peak

Above 1 GHz

Freq.	Reading	Tbl	Antenna			CL	Duty factor	Result	Lmt	Mgn.
(MHz)	(dB μ V/m)	(Deg)	Height (m)	Pol. (H/V)	Fctr. (dB/m)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
1.027	14.52	115	1.5	H	24.48	12.05	- 9.94	41.11	54	12.89
2.530	8.37	80	1.5	V	29.00	19.50	- 9.94	46.93	54	7.07
Above 2 530	Nil emission							- 20 dB below Limit		

Detector : Average

Note : Average value based on the duty factor (Average = Peak + Duty factor)

Duty factor : -9.94 dB (※ See Next pages for actual measured spectrum plots.)

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

□ Middle Channel 40 (2 441 MHz)

Below 1 GHz

Freq.	Reading	Tbl	Antenna			CL	Result	Lmt	Mgn.
(MHz)	(dB μ V/m)	(Deg)	Height (m)	Pol. (H/V)	Fctr. (dB/m)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
341.00	22.08	90	1.5	H	10.91	5.90	38.89	46.02	7.13
645.24	11.25	215	1.8	V	16.97	8.51	36.73	46.02	9.29
890.28	10.02	135	1.3	V	20.13	10.32	40.47	46.02	5.55

Detector : Quasi-peak

Above 1 GHz

Freq.	Reading	Tbl	Antenna			CL	Duty factor	Result	Lmt	Mgn.
(MHz)	(dB μ V/m)	(Deg)	Height (m)	Pol. (H/V)	Fctr. (dB/m)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
1.065	12.12	115	1.5	H	24.48	12.05	- 9.94	38.71	54	15.29
2.568	9.25	80	1.5	V	29.00	19.50	- 9.94	47.81	54	6.19
Above 2 568	Nil emission							- 20 dB below Limit		

Detector : Average

Note : Average value based on the duty factor (Average = Peak + Duty factor)

Duty factor : -9.94 dB (※ See Next pages for actual measured spectrum plots.)

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

□ High Channel 79 (2 480 MHz)

Below 1 GHz

Freq.	Reading	Tbl	Antenna			CL	Result	Lmt	Mgn.
(MHz)	(dB μ V/m)	(Deg)	Height (m)	Pol. (H/V)	Fctr. (dB/m)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
380.05	21.05	90	1.5	H	10.93	5.92	37.90	46.02	8.12
683.20	10.29	215	1.8	V	16.98	8.54	35.81	46.02	10.21
929.32	11.10	135	1.3	V	20.13	10.34	41.57	46.02	4.45

Detector : Quasi-peak

Above 1 GHz

Freq.	Reading	Tbl	Antenna			CL	Duty factor	Result	Lmt	Mgn.
(MHz)	(dB μ V/m)	(Deg)	Height (m)	Pol. (H/V)	Fctr. (dB/m)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
1.104	14.26	115	1.5	H	24.48	12.09	- 9.94	40.89	54	13.11
2.607	10.01	80	1.5	V	29.00	19.52	- 9.94	48.59	54	5.41
Above 2 568	Nil emission							- 20 dB below Limit		

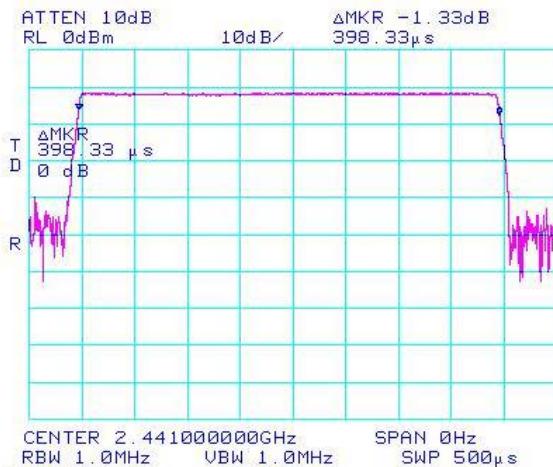
Detector : Average

Note : Average value based on the duty factor (Average = Peak + Duty factor)

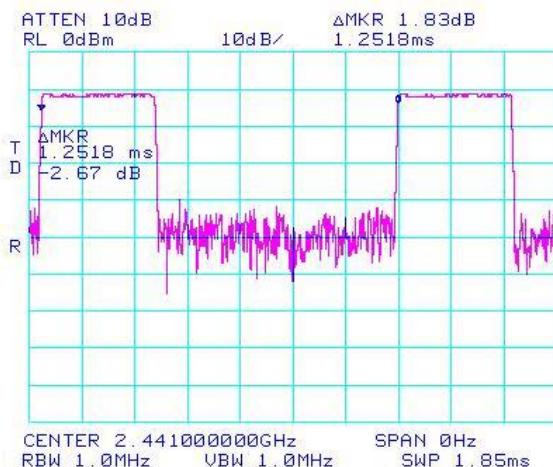
Duty factor : -9.94 dB (※ See Next pages for actual measured spectrum plots.)

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

Burst Width in one hop (μ s)



Burst duration in one hop (μ s)



Duty factor = $20 \log \frac{\text{Burst Width}}{\text{Burst duration [in one hop]}}$

$$= 20 \log \frac{398.33}{1251.8}$$

$$= -9.94 \text{ dB}$$

According to Formula of above Duty factor, Average power(AV) is calculated Peak power + Duty factor

5.9.4 Test Equipment Used : 1, 2, 7, 9, 11, 12, 21, 22, 23

5.10 Antenna requirement

5.10.1 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 Film type and it's gain is 1.5dBi, So radiated emission field strength from EUT is below requirement standard limit

5.10.2 Antenna gain

Frequency Band	Gain [dBi]	Limit [dBi]	Results
2 400 MHz – 2 500 MHz	-1.5	≤ 6	Compliance

5.11 AC Power Conducted emissions

5.11.1 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

5.11.2 EUT used cable

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

5.11.3 Operating conditions

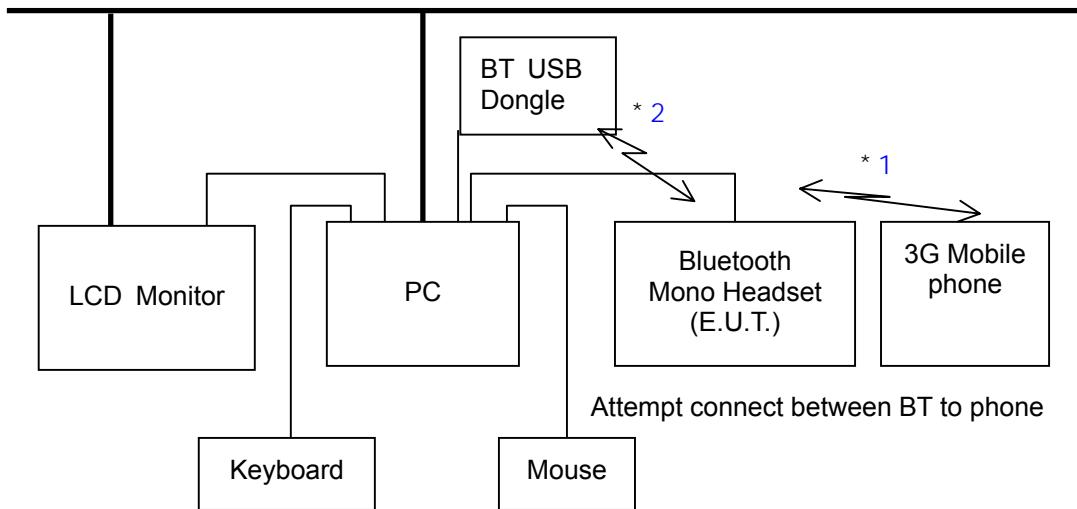
The operating mode/system was as follows in details:

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)

5.11.4 Used Peripherals

Description	Manufacturer	Model / Part No	Serial Number
PC	Dell Inc.	Vostro VOSTRO_200	J73GDBX
LCD Monitor	Dell Inc.	E153FPb	CN-0U4938-46633-0YNL
Keyboard	YET FOUNDATION LTD..	SK-8115	None
Mouse	Suzhou Logitech Electronics Co.,Ltd.	M-UVDEL1	HCM50435061
3G Mobile phone	Samsung Electronics Co., Ltd.	SCH-W270	None

5.11.5 E.U.T Test Configuration



5.11.6 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.

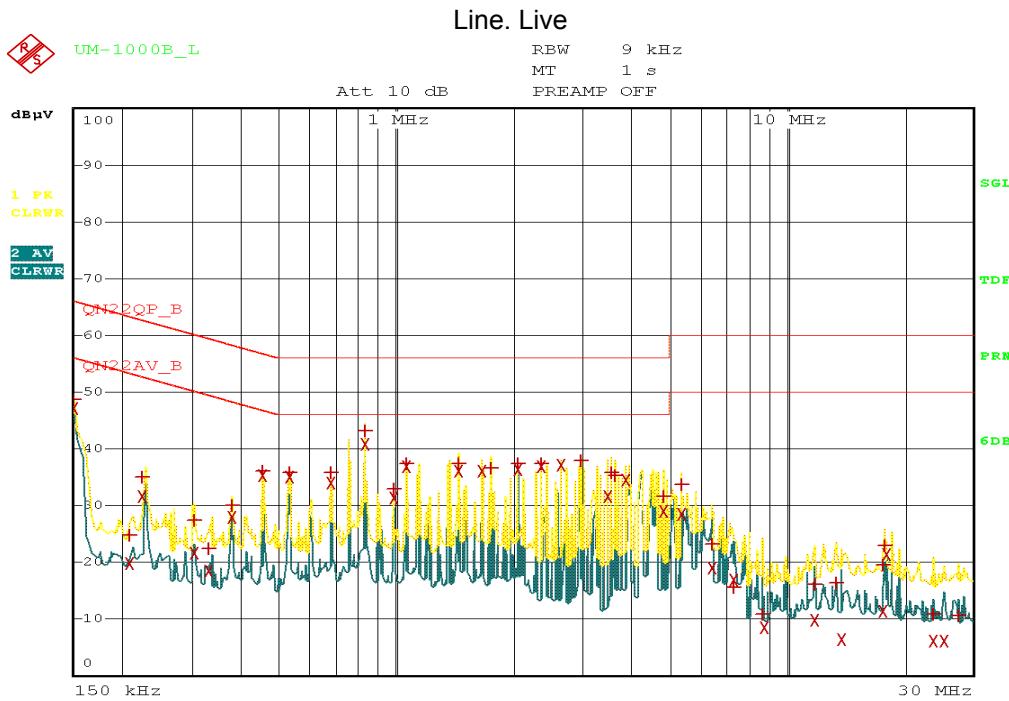
The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

5.11.7 Test Data

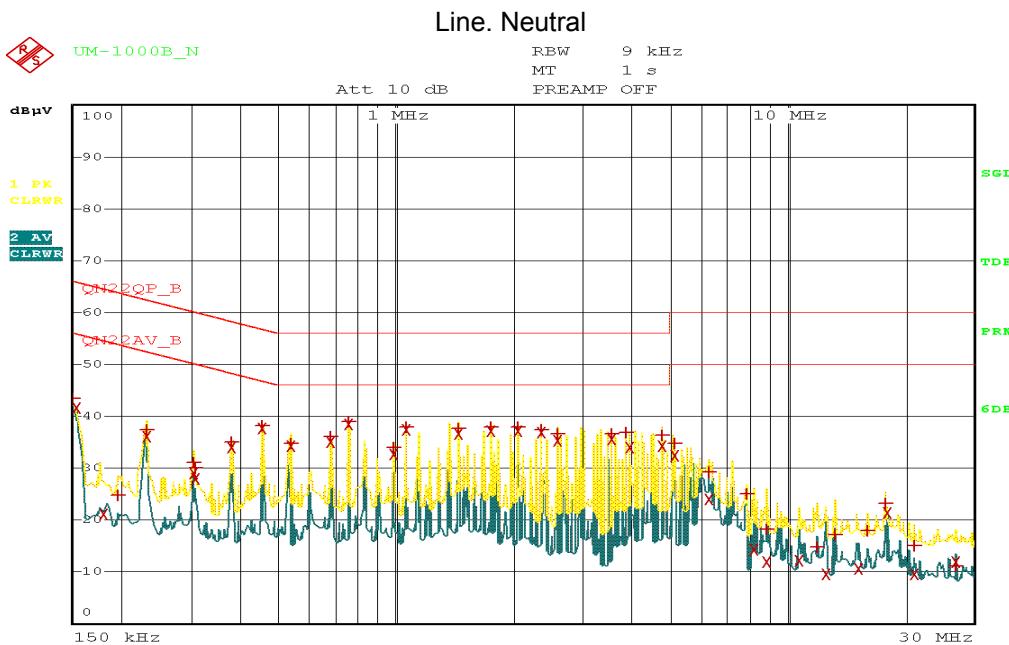
FREQ. (MHz)	LEVEL(dB μ V)		LINE Pol	Loss (dB)	LIMIT(dB μ V)		MARGIN(dB)	
	QP	AV			QP	AV	QP	AV
0.150	48.64	47.01	L	0.08	66.00	56.00	17.36	8.99
0.230	37.39	36.10	N	0.29	62.45	52.45	25.06	16.35
0.454	38.19	37.72	N	0.29	56.80	46.80	18.61	9.08
0.834	43.14	40.82	L	0.43	56.00	46.00	12.86	5.18
1.062	37.96	37.52	N	0.44	56.00	46.00	18.04	8.48
2.050	37.94	37.11	N	0.57	56.00	46.00	18.06	8.89
5.162	34.72	32.53	N	0.75	60.00	50.00	25.28	17.47
6.298	29.38	23.94	N	0.97	60.00	50.00	30.62	26.06
7.894	24.97	14.26	N	1.20	60.00	50.00	35.03	35.74

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

■ Conducted Emission test graph



Date: 1.SEP.2008 10:41:19



Date: 1.SEP.2008 10:46:28

5.12 Unintentional Radiated emissions

5.12.1 Standard Applicable [FCC §15.109(a)]

Except for Class A DIGITAL DEVICES. The field strength of radiated emissions from unintentional radiators At a distance of 3 meters shall not exceed the following values :

§15.109 Radiated emission limits;

Frequency of Emission(MHz)	Radiated Limit (μ V, dB μ V)	
	Microvolts / meter	dB Microvolts / meter
30 ~ 88	100	40
88 ~ 216	150	43.5
216 ~ 960	200	46
Above 960	500	54

5.12.2 Measurement Procedure

• See Clause 5.9.2

5.12.3 Operating conditions

• See Clause 5.11.3

5.12.4 Test Data

Freq (MHz)	Reading (dB μ V)	P (H/V)	H (m)	A (.)	Antenna (dB /m)	Cable Loss (dB)	Result (dB μ V /m)	Limit (dB μ V /m)	Margin (dB)
86.83	10.92	H	4.00	315	8.50	3.46	34.60	40.0	5.40
166.28	10.34	V	1.00	360	7.40	4.38	29.90	43.5	13.60
204.41	12.77	V	1.00	90	7.46	5.06	32.40	43.5	11.10
219.04	9.10	V	1.00	135	8.14	4.91	31.60	46.0	14.40
399.40	2.40	H	3.50	135	13.48	7.39	34.50	46.0	11.50
462.01	8.98	H	1.40	135	14.84	7.85	32.00	46.0	14.00
478.90	7.18	H	2.00	360	15.08	7.77	40.00	46.0	6.00
642.50	7.17	V	1.00	180	17.66	9.47	32.90	46.0	13.10

Reading = Test receiver reading / P= antenna Polarization / H=antenna High A=turn table Angle

Antenna = antenna factor / Cable loss = used cable loss Result = reading + antenna + loss

Margin = Limit - result

* Receiving Antenna Mode: Horizontal, Vertical * Test site: 10 m Open area site

*Note : Radiated Emission measurement : 30 ~ 300MHz + 3.96dB / -4.04dB
 300 ~ 1000MHz + 3.04dB / -3.00dB

5.12.5 Test Equipment Used : 1, 2, 7, 9,12, 22, 23