

FC

Test Report

Product Name	2.4GHz WIRELESS TRANSMITTER
Model No.	JW-02-T
FCC ID.	VH7-JW02T

Applicant	JETVOX ACOUSTIC CORP.
Address	No.22, Dalin Rd., Taoyuan City, Taoyuan County 330. Taiwan (R.O.C.)

Date of Receipt	Aug. 08, 2007
Issued Date	Sep. 13, 2007
Report No.	078147R-RFUSP06V01

The Test Results relate only to the samples tested.
The test report shall not be reproduced except in full without the written approval of QuieTek Corporation.
This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government

Test Report Certification

Issued Date: Sep. 13, 2007

Report No.: 078147R-RFUSP06V01



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Applicant	JETVOX ACOUSTIC CORP.
Address	No.22, Dalin Rd., Taoyuan City, Taoyuan County 330. Taiwan (R.O.C.)
Manufacturer	JETVOX ACOUSTIC CORP.
Model No.	JW-02-T
FCC ID.	VH7-JW02T
Rated Voltage	AC 120V/60Hz
Working Voltage	AC 120V/60Hz
Trade Name	JVOX
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2006 ANSI C63.4: 2003
Test Result	Complied



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Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	2.4GHz WIRELESS TRANSMITTER
Trade Name	JVOX
FCC ID.	VH7-JW02T
Model No.	JW-02-T
Frequency Range	2404 – 2478MHz
Type of Modulation	FHSS
Channel Number	38
Channel Control	Auto
Antenna Type	Dipole Antenna
Antenna Gain	Refer to the table “Antenna List”
Power Adapter	MFR: AK, M/N: AK01G-0500100U Input: 100-240V, 50-60Hz 0.2A Output: 5V –1A Cable Out: Shielded, 0.1m

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	GLD	G01SL-IA-IXC1-A008	Dipole	2.55dBi for 2.4 GHz

Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 01:	2404 MHz	Channel 02:	2406 MHz	Channel 03:	2408 MHz	Channel 04:	2410 MHz
Channel 05:	2412 MHz	Channel 06:	2414 MHz	Channel 07:	2416 MHz	Channel 08:	2418 MHz
Channel 09:	2420 MHz	Channel 10:	2422 MHz	Channel 11:	2424 MHz	Channel 12:	2426 MHz
Channel 13:	2428 MHz	Channel 14:	2430 MHz	Channel 15:	2432 MHz	Channel 16:	2434 MHz
Channel 17:	2436 MHz	Channel 18:	2438 MHz	*Channel 19:	2440 MHz	Channel 20:	2442 MHz
Channel 21:	2444 MHz	Channel 22:	2446 MHz	Channel 23:	2448 MHz	Channel 24:	2450 MHz
Channel 25:	2452 MHz	Channel 26:	2454 MHz	Channel 27:	2456 MHz	Channel 28:	2458 MHz
Channel 29:	2460 MHz	Channel 30:	2462 MHz	Channel 31:	2464 MHz	Channel 32:	2466 MHz
Channel 33:	2468 MHz	Channel 34:	2470 MHz	Channel 35:	2472 MHz	Channel 36:	2474 MHz
Channel 37:	2476 MHz	Channel 38:	2478 MHz				

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals. Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. The transmitter is presented with a continuous data stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its 38 channels and over the minimum number of hopping channels (15 channels).

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted.

The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

*What is available is 2441MHz from the RF Engineer sample from the customer, and that does not comply with Channel 19 in this report, which is 2440MHz.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals. The transmitter is presented with a continuous data stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its 38 channels and over the minimum number of hopping channels (15 channels).

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted.

The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

The Frequency Hopping Sequences have the following characteristics:

- Pseudorandomly ordered frequency list
- Predesigned pseudorandom list of 38 frequencies
- Minimum hop distance of 4 channels
- Additional hopping sequences derived by modulo 38 frequency offset
- 38 hopping patterns organized in 2 sets of 19 patterns each.
- Sequences from same set collide 3 times on average, 5 times worst case, over a hopping pattern cycle, including hits and adjacent channel hits.
- Denote frequency as $2404 + b[i]$, $b[i]$ is the base sequence in range 0.. 37.
- k-th sequence is formed from the base sequence as $2404 + (b[i] + k) \bmod 38$
- Example:
 - Base sequence: 2404, 2452, 2470, 2446, ...
 - 10-th sequence: 2420, 2470, 2412, 2464, .

Note:

1. The EUT is a 2.4GHz WIRELESS TRANSMITTER with a built-in 2.4GHz transceiver
2. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency band, the lowest, middle, and highest frequency are selected to perform the test.
4. Quietek verified constructions and functions, which are shown in the test report, in typical operation.
5. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

1.2. Operational Description

The EUT is a 2.4GHz WIRELESS TRANSMITTER with a built-in 2.4GHz transceiver. It supports 38 channels in 2404-2478MHz. The signals are modulated by FHSS.

The EUT use antenna type is a Dipole antenna. Support stereo audio RCA and optical inputs.

The EUT provides wireless technology that revolutionizes personal connectivity.

Test Mode	Mode 1: Transmitter
	Mode 2: Charge Mode

1.3. Test System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Mode 1

	Product	Manufacturer	Model No.	Serial No.	FCC ID	Power Cord
(1)	DVD PLAYER	BenQ	JH300	N/A	DoC	Non-Shielded, 1.8m
(2)	Notebook PC	DELL	PP04X	2D2ZM1S	DoC	Non-Shielded, 0.8m

Mode 2

	Product	Manufacturer	Model No.	Serial No.	FCC ID	Power Cord
(3)	DVD PLAYER	BenQ	JH300	N/A	DoC	Non-Shielded, 1.8m
(4)	Notebook PC	DELL	PP04X	2D2ZM1S	DoC	Non-Shielded, 0.8m
(5)	Headphone	N/A	N/A	N/A	N/A	N/A

Mode 1

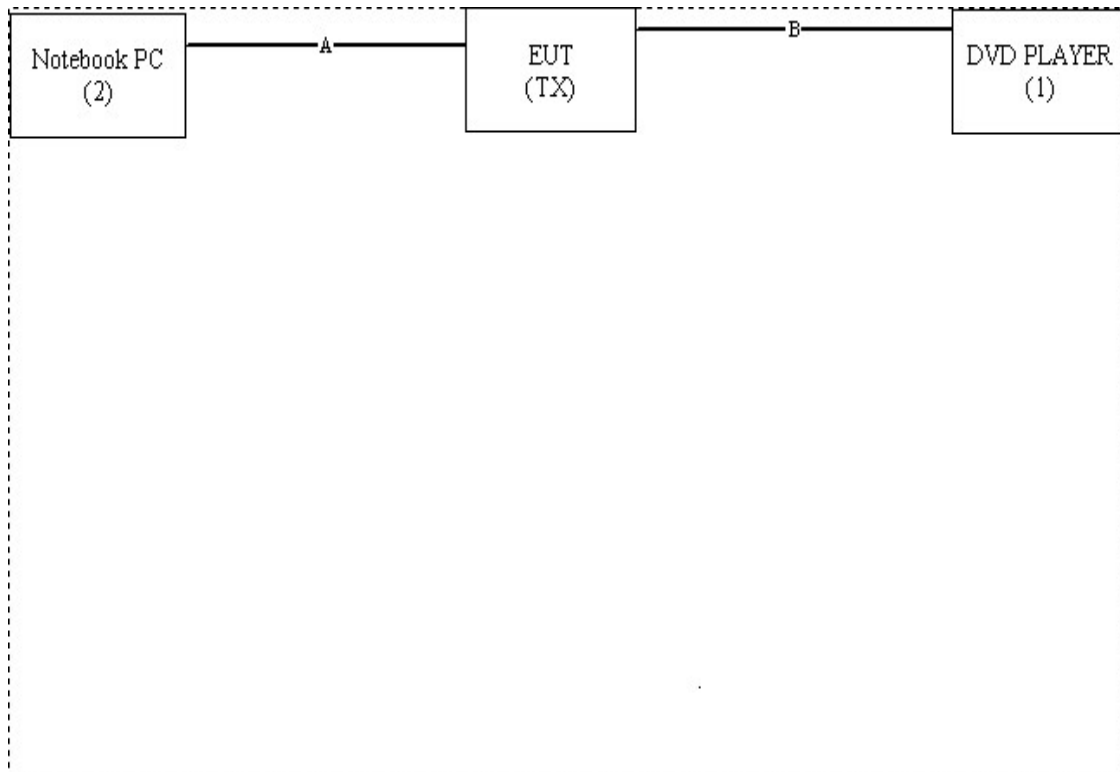
	Signal Cable Type	Signal cable Description
A.	Headphone Cable	Shielded, 1.0m
B.	Earphone Cable	Non-Shielded, 1.2m

Mode 2

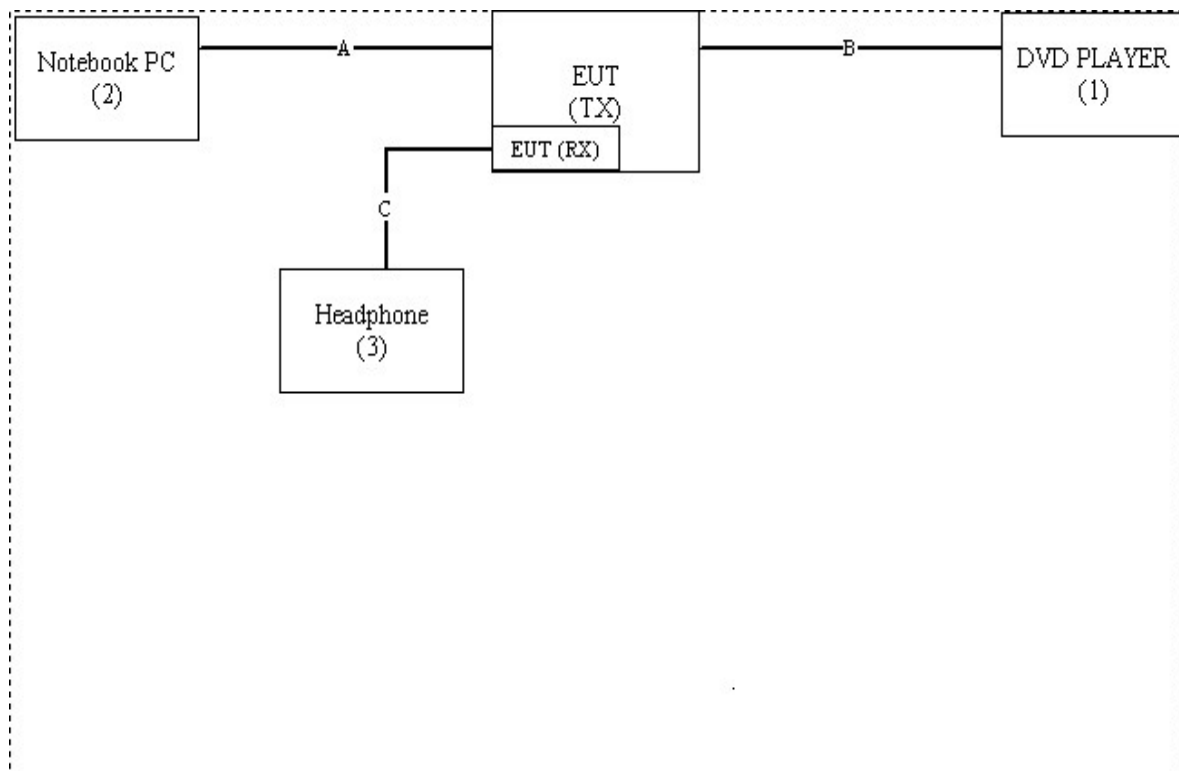
	Signal Cable Type	Signal cable Description
A.	Headphone Cable	Shielded, 1.0m
B	Earphone Cable	Non-Shielded, 1.2m
C	Fiber Cable	Non-Shielded, 1.4m

1.4. Configuration of Test System

Mode 1



Mode 2



1.5. EUT Exercise Software

(1)	EUT into a RF test mode.
(2)	Selection test mode via DIP SW
(3)	Configure the test channel and the packet type.
(4)	Press to start the continuous transmission/receiving.
(5)	Setup the EUT as shown in section 1.3.
(6)	Verify that the EUT works correctly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	30-65
Barometric pressure (mbar)	860-1060	950-1000

Site Description: Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Reference 31040/SIT1300F2



Accreditation on NVLAP
NVLAP Lab Code: 200533-0



Site Name: Quietek Corporation
Site Address: No. 5-22, Ruei-Shu Valley, Ruei-Ping Tsuen,
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TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com



FCC Accreditation Number: TW1014

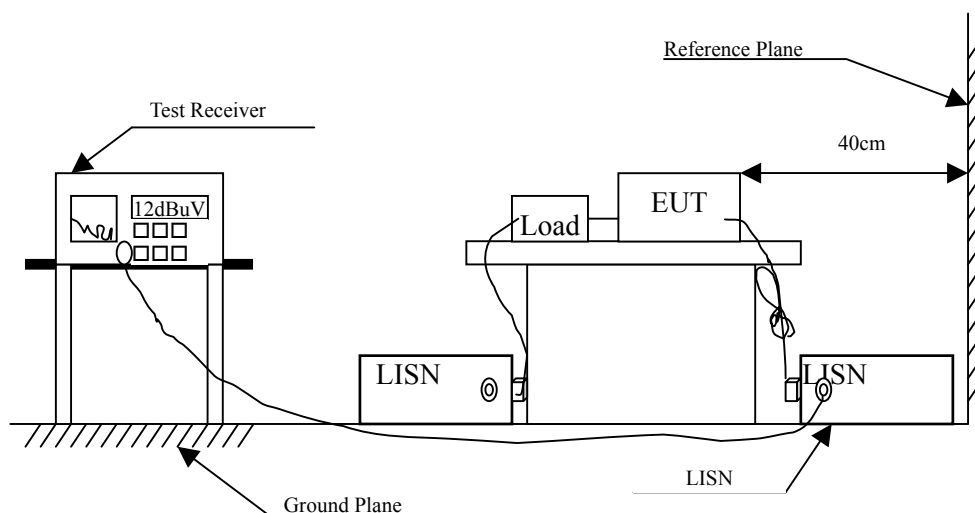
2. Conducted Emission

2.1. Test Equipment

Item	Instrument	Manufacturer	Type No./Serial No	Last Cal.	Remark
1	EMI Test Receiver	R&S	ESCS 30/100367	Aug., 2007	
2	LISN	R&S	ESH3-Z5/836679/023	July, 2007	EUT
3	LISN	R&S	ESH3-Z5/836679/017	Feb., 2007	Peripherals
4	Pulse Limiter	R&S	ESH3-Z2/357.8810.52	Sep., 2007	
5	No.7 Shielded Room			N/A	

Note: All equipments are calibrated every one year.

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.5. Uncertainty

± 2.26 dB

2.6.

2.7. Test Result of Conducted Emission

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 1: Transmitter (Channel 19)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 1					
Quasi-Peak					
0.310	0.300	40.190	40.490	-20.939	61.429
0.634	0.302	32.040	32.342	-23.658	56.000
0.684	0.310	30.340	30.650	-25.350	56.000
0.724	0.310	30.130	30.440	-25.560	56.000
1.104	0.320	28.340	28.660	-27.340	56.000
1.454	0.330	27.780	28.110	-27.890	56.000
Average					
0.310	0.300	29.400	29.700	-21.729	51.429
0.634	0.302	20.390	20.692	-25.308	46.000
0.684	0.310	19.640	19.950	-26.050	46.000
0.724	0.310	19.560	19.870	-26.130	46.000
1.104	0.320	17.010	17.330	-28.670	46.000
1.454	0.330	17.220	17.550	-28.450	46.000

Note:

1. All reading levels are quasi-peak and average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Product : 2.4GHz WIRELESS TRANSMITTER
Test Item : Conducted Emission Test
Power Line : Line 2
Test Mode : Mode 1: Transmitter (Channel 19)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.298	0.300	39.550	39.850	-21.921	61.771
0.627	0.310	32.120	32.430	-23.570	56.000
0.737	0.317	30.210	30.527	-25.473	56.000
0.837	0.320	28.560	28.880	-27.120	56.000
0.917	0.320	27.450	27.770	-28.230	56.000
1.227	0.330	29.840	30.170	-25.830	56.000
Average					
0.298	0.300	27.020	27.320	-24.451	51.771
0.627	0.310	21.060	21.370	-24.630	46.000
0.737	0.317	19.380	19.697	-26.303	46.000
0.837	0.320	17.410	17.730	-28.270	46.000
0.917	0.320	16.070	16.390	-29.610	46.000
1.227	0.330	18.290	18.620	-27.380	46.000

Note:

1. All reading levels are quasi-peak and average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 2: Charge Mode (Channel 19)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 1					
Quasi-Peak					
0.302	0.300	42.020	42.320	-19.337	61.657
0.615	0.300	32.180	32.480	-23.520	56.000
0.675	0.310	31.150	31.460	-24.540	56.000
0.715	0.310	31.440	31.750	-24.250	56.000
0.825	0.310	30.940	31.250	-24.750	56.000
0.935	0.310	30.750	31.060	-24.940	56.000
Average					
0.302	0.300	30.010	30.310	-21.347	51.657
0.615	0.300	19.570	19.870	-26.130	46.000
0.675	0.310	18.410	18.720	-27.280	46.000
0.715	0.310	20.380	20.690	-25.310	46.000
0.825	0.310	18.510	18.820	-27.180	46.000
0.935	0.310	16.770	17.080	-28.920	46.000

Note:

1. All reading levels are quasi-peak and average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Product : 2.4GHz WIRELESS TRANSMITTER
Test Item : Conducted Emission Test
Power Line : Line 2
Test Mode : Mode 2: Charge Mode (Channel 19)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.306	0.300	40.480	40.780	-20.763	61.543
0.388	0.310	32.020	32.330	-26.870	59.200
0.603	0.310	30.910	31.220	-24.780	56.000
0.857	0.320	30.840	31.160	-24.840	56.000
0.917	0.320	29.340	29.660	-26.340	56.000
2.060	0.350	28.710	29.060	-26.940	56.000
Average					
0.306	0.300	26.820	27.120	-24.423	51.543
0.388	0.310	21.110	21.420	-27.780	49.200
0.603	0.310	15.640	15.950	-30.050	46.000
0.857	0.320	18.840	19.160	-26.840	46.000
0.917	0.320	16.330	16.650	-29.350	46.000
2.060	0.350	16.440	16.790	-29.210	46.000

Note:

1. All reading levels are quasi-peak and average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

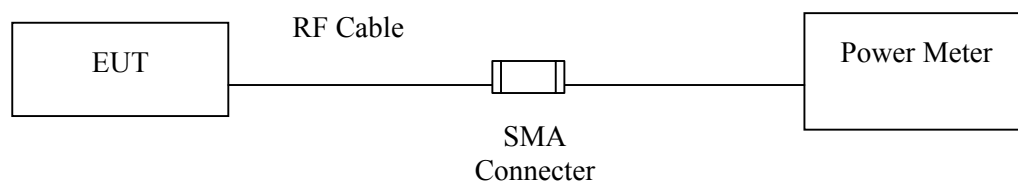
3. Peak Power Output

3.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Power Meter	Anritsu	ML2495A/6K00003357	May, 2007
X	Power Sensor	Anritsu	MA2491A/034457	May, 2007

Note: 1. All equipments are calibrated every one year.
 2. Test instruments marked by “X” are used to measure the final test results.

3.2. Test Setup



3.3. Limit

All other Frequency hopping system in the 2400-2483.5MHz band: 0.125W

3.4. Uncertainty

± 1.27 dB

3.5. Test Result of Peak Power Output

Product : 2.4GHz WIRELESS TRANSMITTER
Test Item : Peak Power Output
Test Site : CTR1
Test Mode : Mode 1: Transmitter

Channel No.	Frequency (MHz)	Measurement	Required Limit	Result
Channel 01	2404.00	12.55dBm	0.125Watt= 20.97dBm	Pass
Channel 19	2440.00	13.01dBm	0.125Watt= 20.97dBm	Pass
Channel 38	2478.00	13.55dBm	0.125Watt= 20.97dBm	Pass

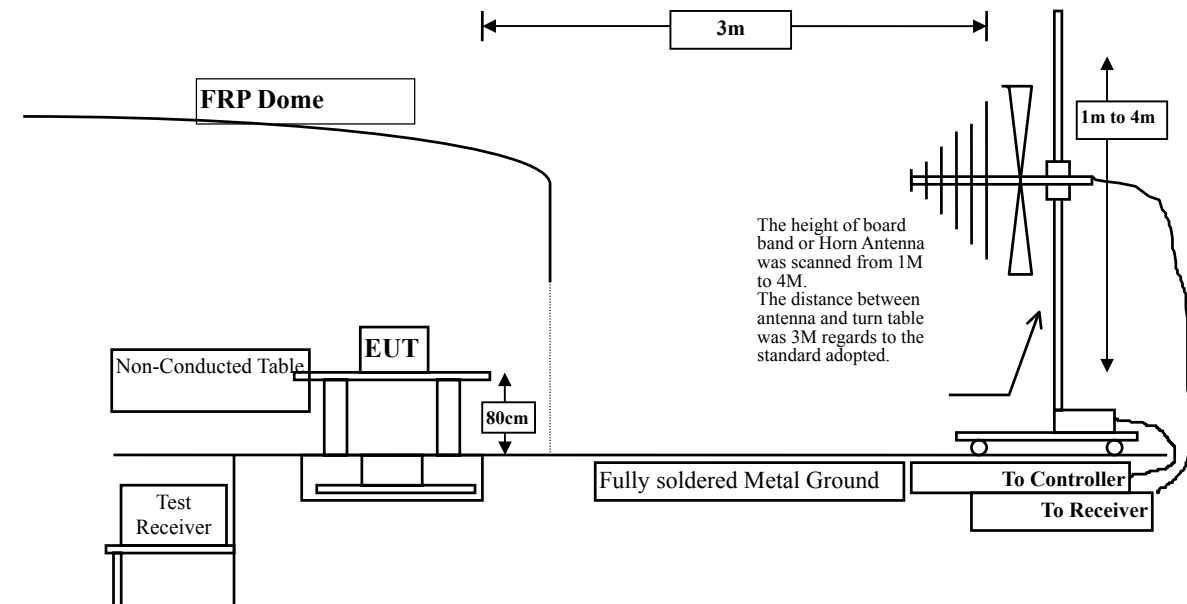
4. Radiated Emission

4.1. Test Equipment

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☐ Site # 1		Test Receiver	R & S	ESVS 10 / 834468/003	May, 2007
		Spectrum Analyzer	Advantest	R3162/ 00803480	May, 2007
		Pre-Amplifier	Advantest	BB525C/ 3307A01812	May, 2007
		Bilog Antenna	SCHAFFNER	CBL6112B / 2697	Sep., 2007
☐ Site # 2		Test Receiver	R & S	ESCS 30 / 836858 / 022	May, 2007
		Spectrum Analyzer	Advantest	R3162 / 100803466	May, 2007
		Pre-Amplifier	Advantest	BB525C/3307A01814	May, 2007
		Bilog Antenna	SCHAFFNER	CBL6112B / 2705	May, 2007
		Horn Antenna	ETS	3115 / 0005-6160	Sep., 2007
		Pre-Amplifier	QTK	QTK-AMP-01/ 0001	May, 2007
☒ Site # 3	X	Test Receiver	R & S	ESI 26 / 838786/004	May, 2007
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2007
	X	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2007
	X	Horn Antenna	Schwarzbeck	BBHA9120D / 305, 306	July, 2007
	X	Horn Antenna	Schwarzbeck	BBHA9170 / 208, 209	July, 2007
	X	Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2007
	X	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2007
	X	Pre-Amplifier	HP	8449B / 3008A01123	July, 2007

- Note:
1. All equipments are calibrated every one year.
 2. Test equipments marked by "X" are used to measure the final test results.

4.2. Test Setup



4.3. Limits

➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	uV/m @3m	dBuV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

- Remarks:
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4: 2003 on radiated measurement.

The additional latch filter below 1GHz was used to measure the level of harmonics radiated emission during field strength of harmonics measurement.

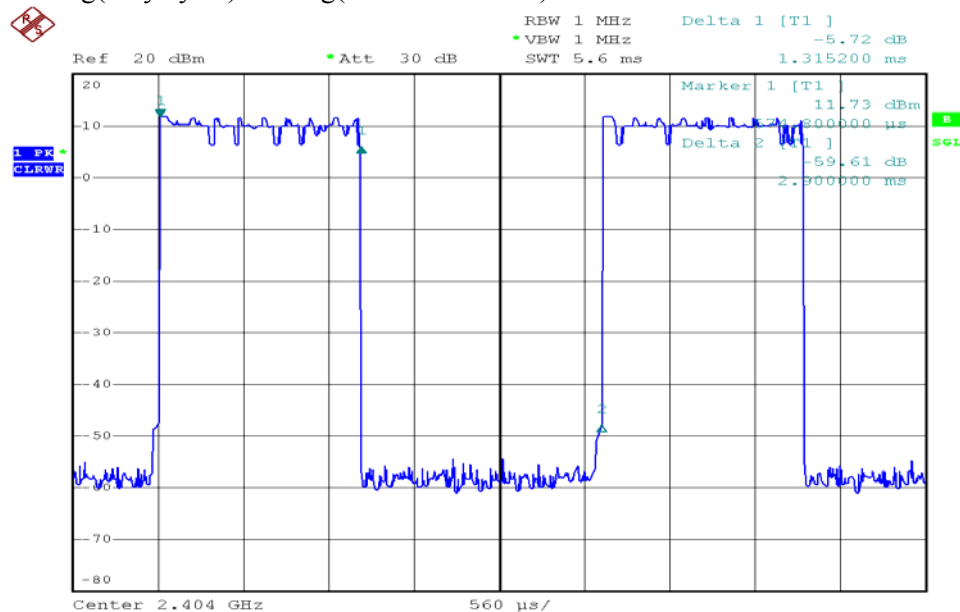
The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz.

The frequency range from 30MHz to 10th harmonics is checked.

The average value of the radiated emission is calculated according to the following table from FCC15.35(c).

Average Value= PK+20*log(duty cycle)

20*log(duty cycle)=20*log(1.3152ms/2.9ms)= -6.8682dB



PN1

Date: 20.AUG.2007 13:53:19

This value is used when measuring average field strength above 1 GHz with Peak Detector function employed on spectrum analyzer.

4.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

4.6. Test Result of Radiated Emission

Product : 2.4GHz WIRELESS TRANSMITTER
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmitter (Channel 01)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
4807.875	3.675	54.783	58.457	-15.543	74.000
7211.875	9.373	41.371	50.743	-23.257	74.000
9615.875	11.836	37.154	48.990	-25.010	74.000
Average Value:					
4807.875			51.588	-2.4112	54.000
Vertical					
Peak Detector:					
4807.875	3.675	53.800	57.474	-16.526	74.000
7211.875	9.373	42.356	51.728	-22.272	74.000
9615.875	11.836	37.367	49.203	-24.797	74.000
Average Value:					
4807.875			50.605	-3.3942	54.000

Note:

1. The reading levels below 1GHz and above 1GHz are quasi-peak values and peak/average values, respectively.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz °
3. Receiver setting (Average Value) : PK+20*log(duty cycle)=PK-6.8682dB °
4. Emission Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 19)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4881.750	3.921	54.342	58.262	-15.738	74.000
7323.000	9.657	40.300	49.957	-24.043	74.000
9764.000	11.798	39.211	51.009	-22.991	74.000
Average Value:					
4881.750			51.3938	-2.6062	54.000
Vertical					
Peak Detector:					
4882.000	3.921	53.367	57.288	-16.712	74.000
7323.000	9.657	40.759	50.416	-23.584	74.000
9764.000	11.798	38.169	49.967	-24.033	74.000
Average Value:					
4882.000			50.4198	-3.5802	54.000

Note:

1. The reading levels below 1GHz and above 1GHz are quasi-peak values and peak/average values, respectively.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Receiver setting (Average Value) : PK+20*log(duty cycle)=PK-6.8682dB ◦
4. Emission Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 38)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m
	dB	dBuV	dBuV/m		

**Horizontal
Peak Detector:**

4956.000	4.182	49.341	53.523	-20.477	74.000
7434.000	9.939	40.268	50.207	-23.793	74.000
9912.000	11.853	40.325	52.178	-21.822	74.000

Average Value:

**Vertical
Peak Detector:**

4956.000	4.182	54.452	58.634	-15.366	74.000
7434.000	9.939	39.084	49.023	-24.977	74.000
9912.000	11.853	38.221	50.074	-23.926	74.000

Average Value:

4956.000			51.765	-2.2342	54.000
----------	--	--	--------	---------	--------

Note:

1. Reading levels below 1GHz and above 1GHz are quasi-peak values and peak/average values, respectively.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz °
3. Receiver setting (Average Value) : PK+20*log(duty cycle)=PK-6.8682dB °
4. Emission Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 19)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
46.975	10.785	16.816	27.601	-12.399	40.000
461.650	18.642	12.690	31.332	-14.668	46.000
515.000	18.950	9.581	28.531	-17.469	46.000
544.100	19.945	10.493	30.438	-15.562	46.000
854.500	22.477	10.215	32.692	-13.308	46.000
883.600	22.418	8.857	31.275	-14.725	46.000
Vertical					
46.975	8.840	19.423	28.263	-11.737	40.000
107.600	11.442	16.601	28.043	-15.457	43.500
544.100	20.532	5.955	26.487	-19.513	46.000
687.175	20.372	7.009	27.381	-18.619	46.000
757.500	22.922	5.026	27.948	-18.052	46.000
966.050	22.938	9.235	32.173	-21.827	54.000

Note:

1. The reading levels below 1GHz are quasi-peak values.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor
4. The radiated emissions below 1GHz of the lowest, middle, highest frequency are pretested. Only the worst case is shown on the report.

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 2: Charge Mode (Channel 19)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
302.564	13.997	9.463	23.461	-22.539	46.000
438.265	17.740	11.808	29.547	-16.453	46.000
518.324	18.723	9.437	28.159	-17.841	46.000
574.362	19.530	7.666	27.196	-18.804	46.000
712.340	20.710	6.705	27.415	-18.585	46.000
800.500	21.766	9.459	31.225	-14.775	46.000
Vertical					
125.489	11.413	16.553	27.966	-15.534	43.500
284.751	13.791	9.362	23.153	-22.847	46.000
374.655	16.683	10.065	26.748	-19.252	46.000
523.471	18.833	9.066	27.899	-18.101	46.000
623.514	21.210	9.564	30.774	-15.226	46.000
689.327	20.440	9.198	29.638	-16.362	46.000

Note:

1. The reading levels below 1GHz are quasi-peak values.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor
4. The radiated emissions below 1GHz of the lowest, middle, highest frequency are pretested. Only the worst case is shown on the report.

5. Band Edge

5.1. Test Equipment

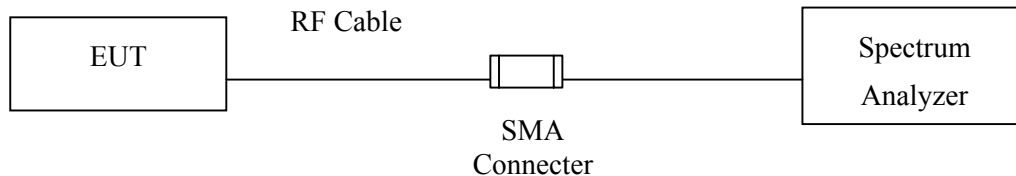
OATS No.3

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X Test Receiver	R & S	ESI 26 / 838786/004	May, 2007
X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2007
X Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2007
X Horn Antenna	Schwarzbeck	BBHA9120D / 305, 306	July, 2007
X Horn Antenna	Schwarzbeck	BBHA9170 / 208, 209	July, 2007
X Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2007
X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2007
X Pre-Amplifier	HP	8449B / 3008A01123	July, 2007

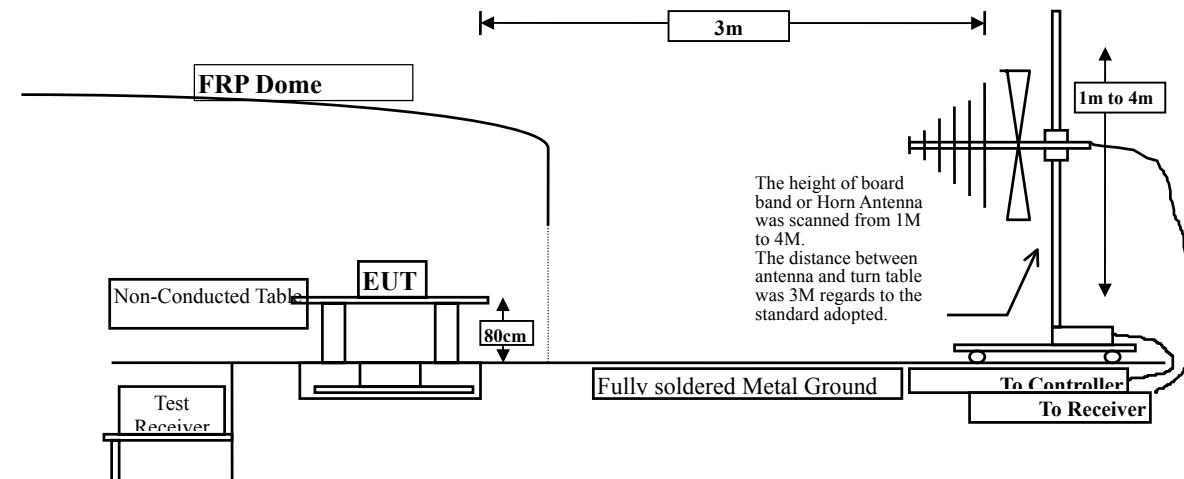
Note: 1. All equipments are calibrated every one year.
2. The test equipments marked by "X" are used to measure the final test results.

5.2. Test Setup

RF conducted Measurement:



RF Radiated Measurement:



5.5. Uncertainty

± 3.9 dB above 1GHz

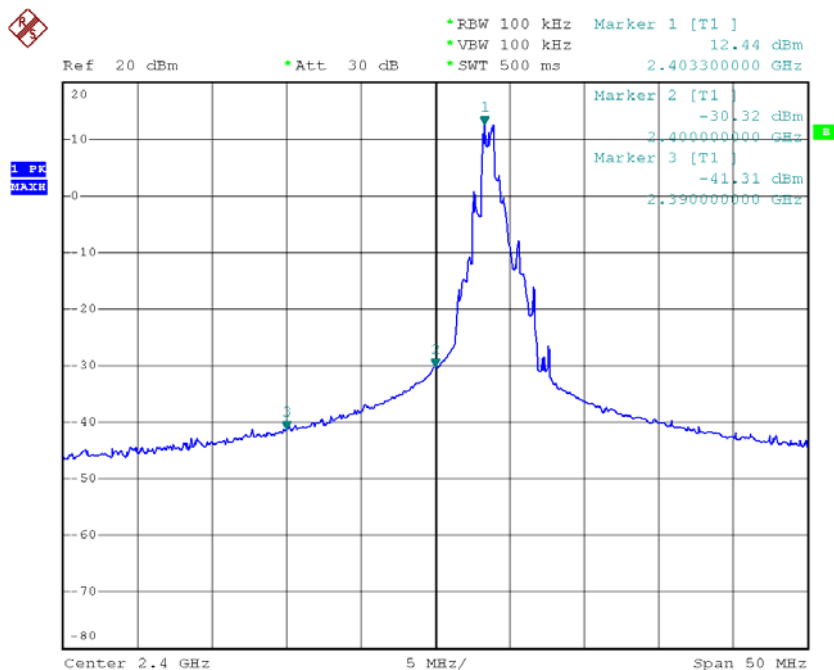
± 3.8 dB below 1GHz

5.6. Test Result of Band Edge

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 01) -hopping

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
01	<2400	>20	Pass

Peak



PN1

Date: 21.AUG.2007 21:17:35

Fundamental Field Strength:

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)
Horizontal				
01 (Peak)	2403.875	-2.308	99.799	97.490
Vertical				
01 (Peak)	2403.875	-2.308	110.205	107.896

Maximum field strength

Channel No.	Emission Level (dBuV/m)	Correct (dBc)	Maximum field strength (dBuV/m)	Limit (dBuV/m)
Horizontal				
01 (Peak)	97.49	53.75	43.740	74
01 (Avg)			36.871	54
Vertical				
01 (Peak)	107.896	53.75	54.146	74
01 (Avg)			47.277	54

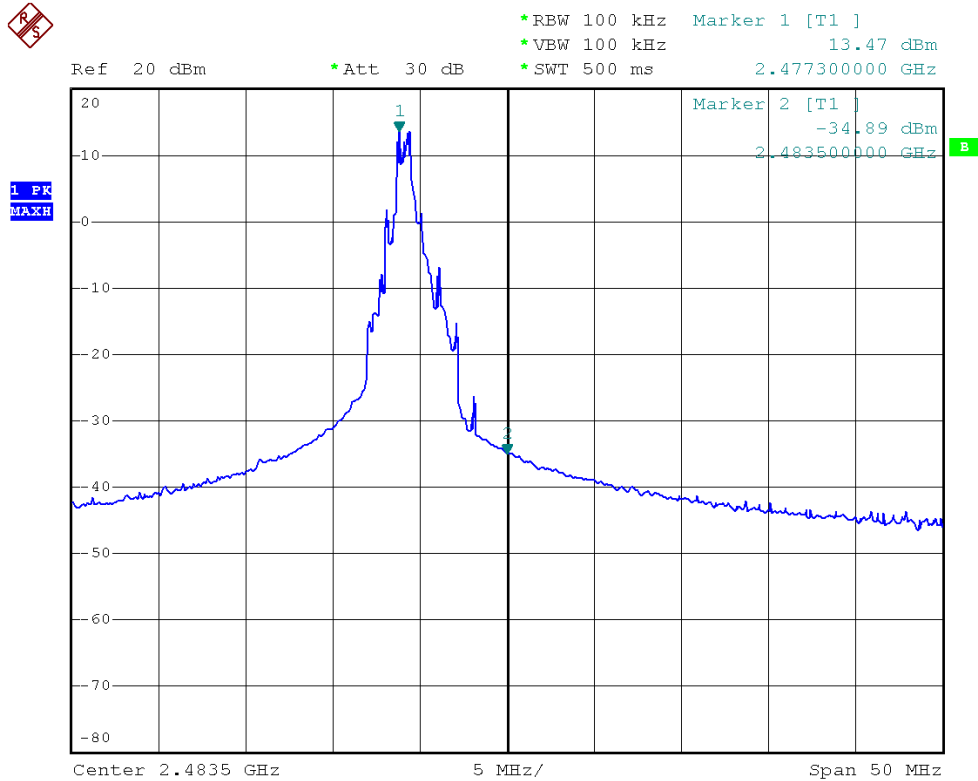
Note:

1. The peak conducted emission plot shows 53.75dBc between the carrier and the maximum emission in the restricted band. The maximum fundamental field strength in the peak measurement is 107.896dBuV/m. So the maximum field strength in the restricted band is $107.896 - 53.75 = 54.146$ dBuV/m which is under Limit 74dBuV/m.
2. The average value: (PK Value) +20*log(duty cycle)=PK-6.8682dB must be under Limit 54dBuV/m.

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 38) -hopping

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
38	>2483.5	>20	Pass

Peak



PN1

Date: 21.AUG.2007 21:18:30

Fundamental Field Strength:

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)
Horizontal				
38 (Peak)	2478.000	-1.960	107.242	105.282
Vertical				
38 (Peak)	2478.000	-1.960	110.323	108.363

Maximum field strength

Channel No.	Emission Level (dBuV/m)	Correct (dBc)	Maximum field strength (dBuV/m)	Limit (dBuV/m)
Horizontal				
38 (Peak)	105.282	48.36	56.922	74
38 (Avg)			50.053	54
Vertical				
38 (Peak)	108.363	48.36	60.003	74
38 (Avg)			53.134	54

Note:

1. The peak conducted emission plot shows 48.36dBc between the carrier and the maximum emission in the restricted band. The maximum fundamental field strength in the peak measurement is 108.363dBuV/m. So the maximum field strength in the restricted band is $108.363 - 48.36 = 60.003\text{dBuV/m}$ which is under Limit 74dBuV/m.
2. The average value: $(\text{PK Value}) + 20 \cdot \log(\text{duty cycle}) = \text{PK} - 6.8682\text{dB}$ must be under Limit 54dBuV/m.

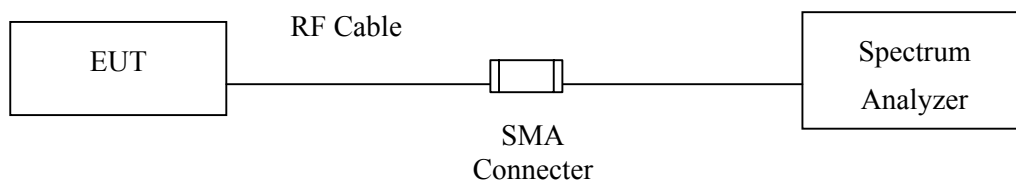
6. Channel Number

6.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	R & S	FSP40 / 100170	Nov., 2006

Note: 1. All equipments are calibrated every one year.
2. The test equipments marked by "X" are used to measure the final test results.

6.2. Test Setup



6.3. Limit

Frequency hopping systems in the 2400 - 2483.5 MHz band shall use at least 15 non-overlapping channels.

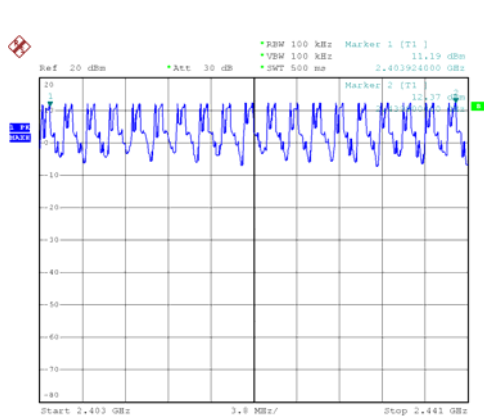
6.4. Uncertainty

N/A

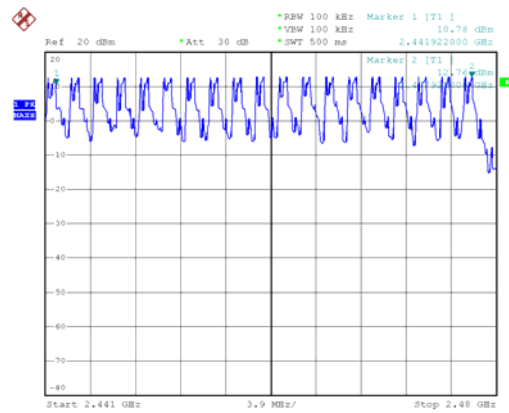
6.5. Test Result of Channel Number

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Channel Number
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter

Frequency Range (MHz)	Measurement (Hopping Channel)	Required Limit (Hopping Channel)	Result
2404 - 2478	38	>15	Pass



PN1
 Date: 20.AUG.2007 17:00:25



PN1
 Date: 20.AUG.2007 17:02:52

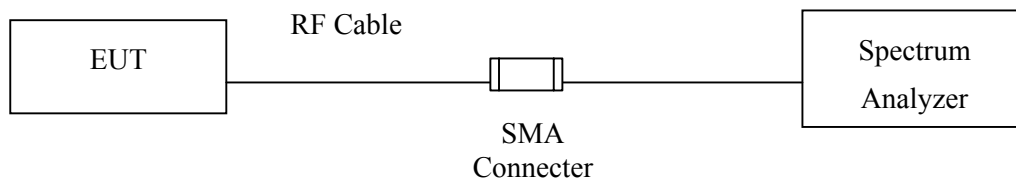
7. Channel Separation

7.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	R & S	FSP40 / 100170	Nov., 2006

Note: 1. All equipments are calibrated every one year.
 2. The test instruments marked by “X” are used to measure the final test results.

7.2. Test Setup



7.3. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 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.

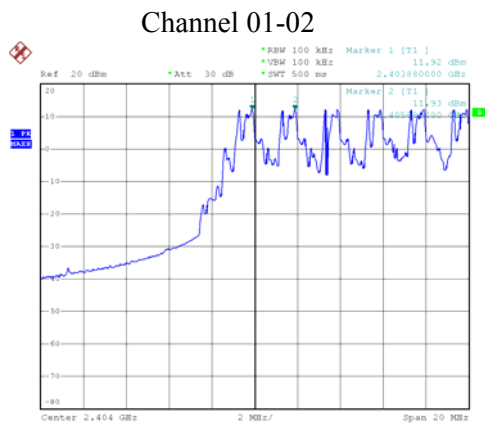
7.4. Uncertainty

± 150Hz

7.5. Test Result of Channel Separation

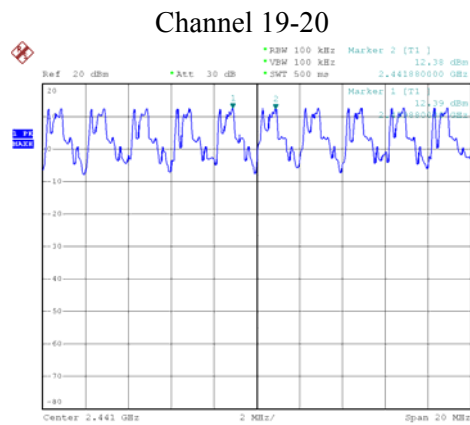
Product	:	2.4GHz WIRELESS TRANSMITTER
Test Item	:	Channel Separation
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmitter

Frequency (MHz)	Measurement Level (MHz)	Required Limit	Result
2404	2.00	>25 kHz or 2/3 * 20 dB BW	Pass
2440	2.00	>25 kHz or 2/3 * 20 dB BW	Pass
2478	2.00	>25 kHz or 2/3 * 20 dB BW	Pass



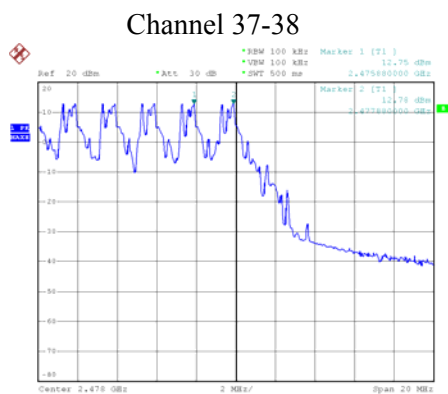
PN1

Date: 20.AUG.2007 16:56:10



PN1

Date: 20.AUG.2007 16:57:50



PN1
Date: 20.AUG.2007 16:58:30

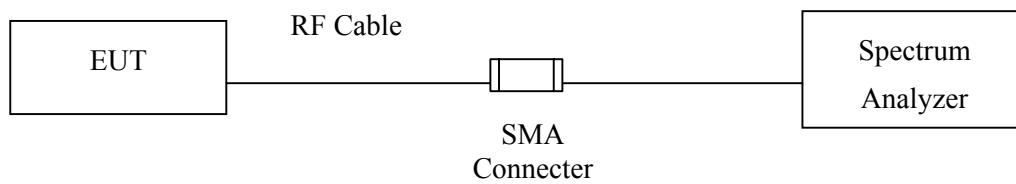
8. Dwell Time

8.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	R & S	FSP40 / 100170	Nov., 2006

Note: 1. All equipments are calibrated every one year.
2. The test equipments marked “X” are used to measure the final test results.

8.2. Test Setup



8.3. Limit

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

8.4. Uncertainty

± 25msec

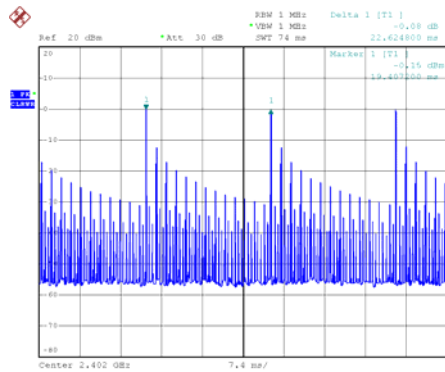
8.5. Test Result of Dwell Time

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Dwell Time
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 01,19,38)

Channel No.	Frequency (MHz)	Time Interval between hops (ms)	Transmission Time (us)	Dwell Time (ms)	Limit (ms)	Result
01	2404	22.6248	95.2	62.275	400	Pass
19	2440	22.6248	95.2	62.275	400	Pass
38	2478	22.6248	91.8	60.050	400	Pass

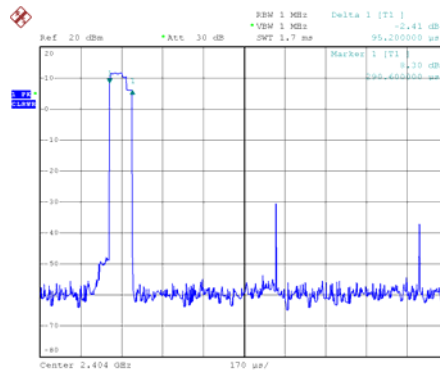
Note: Dwell Time = $37 * 400\text{ms} / \text{Time Interval Between Hops} * \text{Transmission Time} / 1000$

CH 2404MHz Time Interval between hops



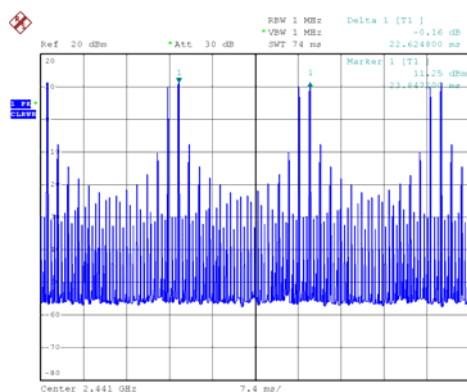
FN1
 Date: 20.AUG.2007 17:07:41

Transmission Time



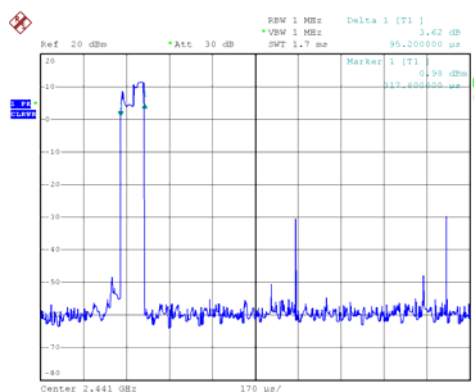
FN1
 Date: 20.AUG.2007 17:10:41

CH 2440MHz Time Interval between hops



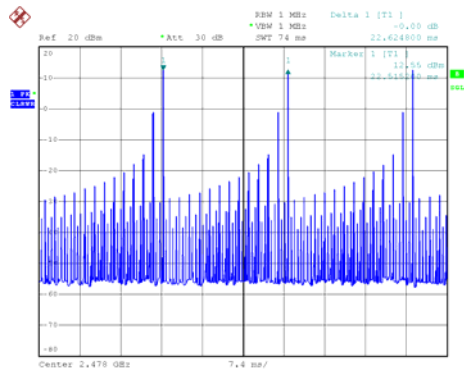
FN1
 Date: 20.AUG.2007 17:08:19

Transmission Time



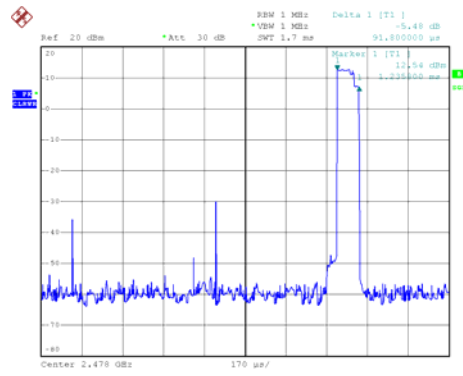
FN1
 Date: 20.AUG.2007 17:11:19

CH 2478MHz Time Interval between hops



PN1
Date: 20.AUG.2007 17:08:47

Transmission Time



PN1
Date: 20.AUG.2007 17:11:55

9. Occupied Bandwidth

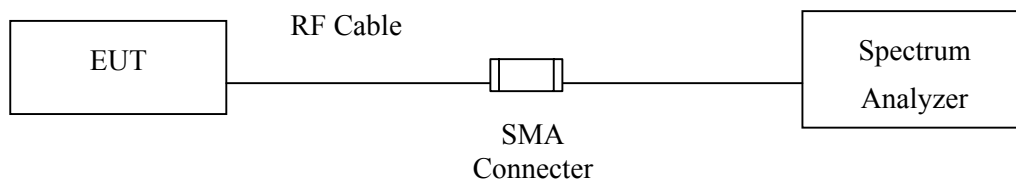
9.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2007

Note:

1. All equipments are calibrated every one year.
2. The test instruments Marked “X” are used to measure the final test results.

9.2. Test Setup



9.3. Limits

N/A

9.4. Uncertainty

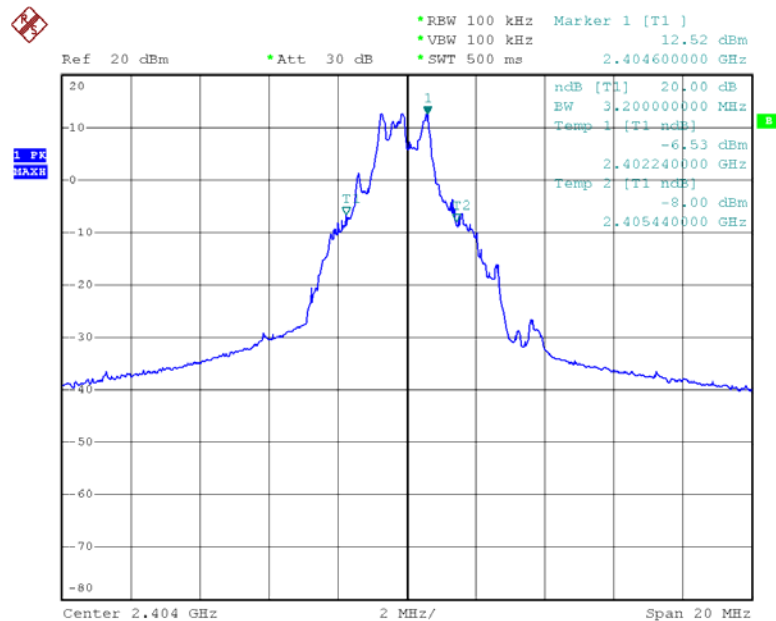
$\pm 150\text{Hz}$

9.5. Test Result of Occupied Bandwidth

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2404MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2404	3200	--	N/A

Figure Channel 01:



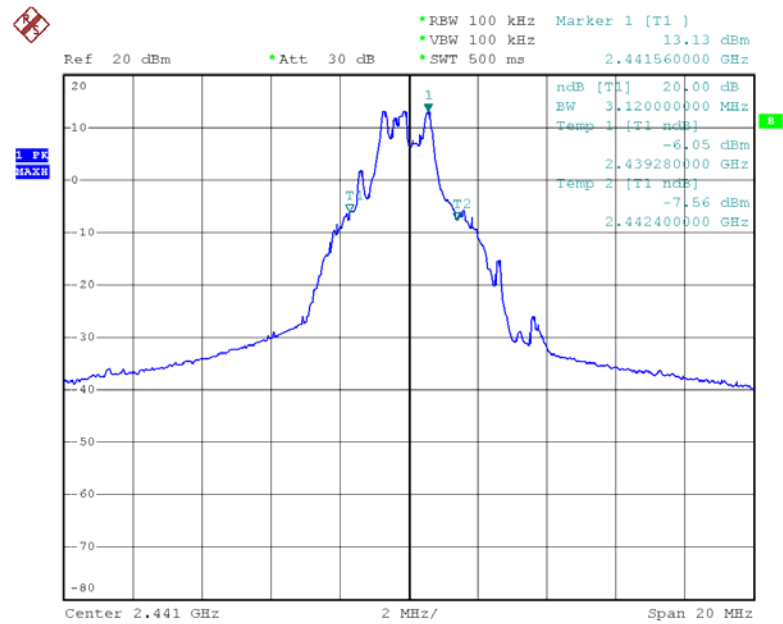
PN1

Date: 24.AUG.2007 11:26:14

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	3120	--	N/A

Figure Channel 19:



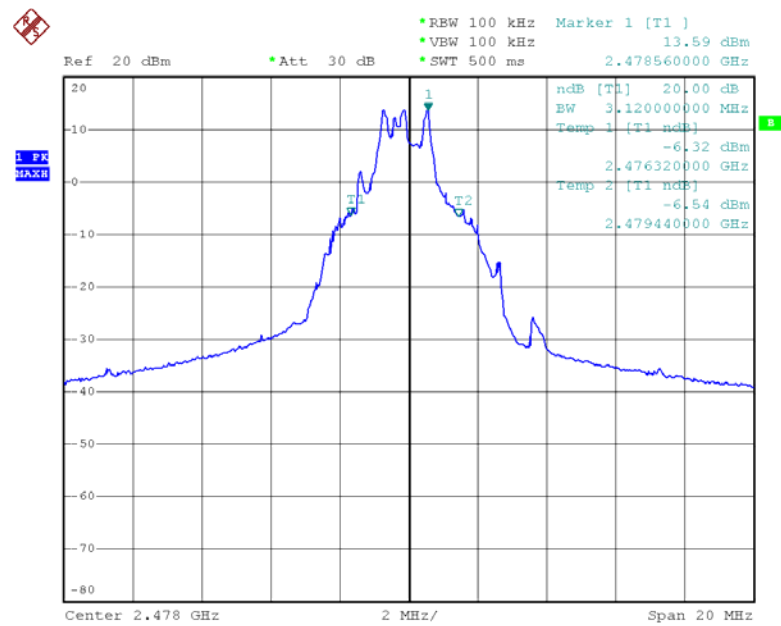
PN1

Date: 24.AUG.2007 11:25:00

Product : 2.4GHz WIRELESS TRANSMITTER
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2478MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
38	2478	3120	--	N/A

Figure Channel 38:



PN1

Date: 24.AUG.2007 11:31:02

10. Pseudo Random Hopping Algorithm

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies.

Each frequency must be used equally by the transmitter.

Base Table Hopping Sequence

The hopping sequence is described below.

Pseudo random properties of the embedded FHSS engine

The embedded FHSS engine uses 38 hopping locations, out of which 18 are non-overlapping channels.

The hopping sequence is contained in a table with the 38 frequency location entries staggered in a pseudorandom order. A single data frame is transmitted on each frequency location before skipping to the next hopping frequency in the list. Upon completion of the list, the hopping sequence is repeated on a cyclic basis.

Upon reception of faulty/no data, the frequency(ies) resulting in loss of data is temporarily removed from the hopping list. The hopping sequence cycle is thus correspondingly shortened. The frequency locations resulting in loss of data are added to a list of banned frequencies containing the frequency locations unsuitable for use.

This list is limited to a maximum number (NBCH), set to 0x12 in this application.

The duration of the ban is given by the equation $(BCHD+1) * NBCH * t_p$

The BCHD parameter is set to 0x0A and t_p is 2.91ms for the 44.1KHz sampling setting.

In normal operation, the initial pseudorandom list of frequency hopping locations is volatile in terms of the number of hopping frequencies in use and the sequence of which they occur.

These elements combined result in an unpredictable hopping sequence with pseudorandom properties.

Base sequence hopping frequency locations

Hopping frequency location	Frequency / UDC* [GHz]	Hopping frequency location	Frequency / UDC* [GHz]	Hopping frequency location	Frequency / UDC* [GHz]
1:	2.406	14:	2.412	27:	2.422
2:	2.428	15:	2.436	28:	2.446
3:	2.452	16:	2.460	29:	2.470
4:	2.476	17:	2.408	30:	2.418
5:	2.424	18:	2.432	31:	2.442
6:	2.448	19:	2.456	32:	2.466
7:	2.472	20:	2.404	33:	2.414
8:	2.420	21:	2.430	34:	2.438
9:	2.444	22:	2.454	35:	2.462
10:	2.468	23:	2.478	36:	2.410
11:	2.416	24:	2.426	37:	2.434
12:	2.440	25:	2.450	38:	2.458
13:	2.464	26:	2.474		

* UDC = User Defined Channel centre frequency defined for the nRF24Z1 Headphone Reference

Design 1. See table on below table.

UDC 01:	2404 MHz	UDC 02:	2406 MHz	UDC 03:	2408 MHz	UDC 04:	2410 MHz
UDC 05:	2412 MHz	UDC 06:	2414 MHz	UDC 07:	2416 MHz	UDC 08:	2418 MHz
UDC 09:	2420 MHz	UDC 10:	2422 MHz	UDC 11:	2424 MHz	UDC 12:	2426 MHz
UDC 13:	2428 MHz	UDC 14:	2430 MHz	UDC 15:	2432 MHz	UDC 16:	2434 MHz
UDC 17:	2436 MHz	UDC 18:	2438 MHz	UDC 19:	2440 MHz	UDC 20:	2442 MHz
UDC 21:	2444 MHz	UDC 22:	2446 MHz	UDC 23:	2448 MHz	UDC 24:	2450 MHz
UDC 25:	2452 MHz	UDC 26:	2454 MHz	UDC 27:	2456 MHz	UDC 28:	2458 MHz
UDC 29:	2460 MHz	UDC 30:	2462 MHz	UDC 31:	2464 MHz	UDC 32:	2466 MHz
UDC 33:	2468 MHz	UDC 34:	2470 MHz	UDC 35:	2472 MHz	UDC 36:	2474 MHz
UDC 37:	2476 MHz	UDC 38:	2478 MHz				

11. EMI Reduction Method During Compliance Testing

No modification was made during testing.