

FC

Test Report

Product Name	Industrial PDA
Model No.	DOLPHIN 7600
FCC ID.	HD5760002

Applicant	Hand Held Products, Inc.
Address	700 Visions Drive P.O. Box 208 Skaneateles Falls, NY, 13153-0208 USA

Date of Receipt	April 03, 2006
Issued Date	Sep. 08, 2006
Report No.	064L048-RF-US-P06V01

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. 08, 2006

Report No.: 064L048-RF-US-P06V01



Product Name	Industrial PDA
Applicant	Hand Held Products, Inc.
Address	700 Visions Drive P.O. Box 208 Skaneateles Falls, NY, 13153-0208 USA
Manufacturer	E-TEN Information Systems Co., Ltd.
Model No.	DOLPHIN 7600
FCC ID.	HD5760002
Rated Voltage	AC 120V/60Hz
Working Voltage	AC 120V/60Hz
Trade Name	HHP
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2005 ANSI C63.4: 2003
Test Result	Complied



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Documented By : Rita Huang

(Rita Huang)



0914

Tested By : Tim Sung

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(George Chen)



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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Industrial PDA
Trade Name	HHP
FCC ID.	HD5760002
Model No.	DOLPHIN 7600
Frequency Range	2402 - 2480MHz
Channel Number	79
Type of Modulation	FHSS
Antenna type	Connector
Channel Control	Auto
Antenna Gain	Refer to the table "Antenna List"
Power Adapter	MFR: PHIHONG M/N: PSA15R-050P Cable out: Non-Shielded, 1.8m with one ferrite core bonded.
Infineon	HYB25L256160A
Samsung	K4M561633G-R(B)N/G/L/F

Antenna List

No.	Manufacturer	Part No.	Peak Gain
1	E-TEN	A700_BT_Antenna 2.4GHz	3.649dBi in 2.4 GHz

Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 20:	2422 MHz	Channel 40:	2442 MHz	Channel 60:	2462 MHz
Channel 01:	2403 MHz	Channel 21:	2423 MHz	Channel 41:	2443 MHz	Channel 61:	2463 MHz
Channel 02:	2404 MHz	Channel 22:	2424 MHz	Channel 42:	2444 MHz	Channel 62:	2464 MHz
Channel 03:	2405 MHz	Channel 23:	2425 MHz	Channel 43:	2445 MHz	Channel 63:	2465 MHz
Channel 04:	2406 MHz	Channel 24:	2426 MHz	Channel 44:	2446 MHz	Channel 64:	2466 MHz
Channel 05:	2407 MHz	Channel 25:	2427 MHz	Channel 45:	2447 MHz	Channel 65:	2467 MHz
Channel 06:	2408 MHz	Channel 26:	2428 MHz	Channel 46:	2448 MHz	Channel 66:	2468 MHz
Channel 07:	2409 MHz	Channel 27:	2429 MHz	Channel 47:	2449 MHz	Channel 67:	2469 MHz
Channel 08:	2410 MHz	Channel 28:	2430 MHz	Channel 48:	2450 MHz	Channel 68:	2470 MHz
Channel 09:	2411 MHz	Channel 29:	2431 MHz	Channel 49:	2451 MHz	Channel 69:	2471 MHz
Channel 10:	2412 MHz	Channel 30:	2432 MHz	Channel 50:	2452 MHz	Channel 70:	2472 MHz
Channel 11:	2413 MHz	Channel 31:	2433 MHz	Channel 51:	2453 MHz	Channel 71:	2473 MHz
Channel 12:	2414 MHz	Channel 32:	2434 MHz	Channel 52:	2454 MHz	Channel 72:	2474 MHz
Channel 13:	2415 MHz	Channel 33:	2435 MHz	Channel 53:	2455 MHz	Channel 73:	2475 MHz
Channel 14:	2416 MHz	Channel 34:	2436 MHz	Channel 54:	2456 MHz	Channel 74:	2476 MHz
Channel 15:	2417 MHz	Channel 35:	2437 MHz	Channel 55:	2457 MHz	Channel 75:	2477 MHz
Channel 16:	2418 MHz	Channel 36:	2438 MHz	Channel 56:	2458 MHz	Channel 76:	2478 MHz
Channel 17:	2419 MHz	Channel 37:	2439 MHz	Channel 57:	2459 MHz	Channel 77:	2479 MHz
Channel 18:	2420 MHz	Channel 38:	2440 MHz	Channel 58:	2460 MHz	Channel 78:	2480 MHz
Channel 19:	2421 MHz	Channel 39:	2441 MHz	Channel 59:	2461 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 79 channels and over the minimum number of hopping channels (75 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.

Note:

1. This device is an Industrial PDA with a built-in 2.4GHz Bluetooth 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, the lowest, middle and highest frequency are selected to perform the test.
4. 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 an Industrial PDA with a built-in 2.4GHz Bluetooth transceiver. The number of the channels is 79. The device adapts the frequency hopping spread spectrum modulation. The antenna is connector-type and provides diversity function to improve the receiving function.

This device provides wireless technology that revolutionizes personal connectivity. It is the solution for the seamless integration of Bluetooth technology into personal computer enabling short-range wireless connections between desktop/laptop computers, Bluetooth-enabled peripherals, and portable handheld devices.

Test Mode	Mode 1: Transmitter
-----------	---------------------

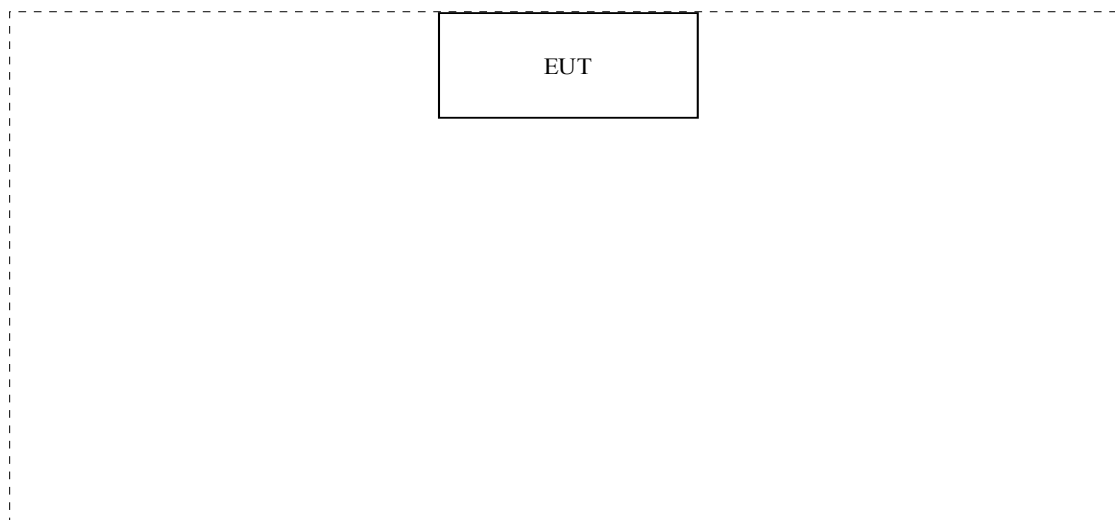
1.3. Tested System Details

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

	Product	Manufacturer	Model No.	Serial No.	Power Cord
(1)	N/A	N/A	N/A	N/A	N/A

Signal Cable Type	Signal cable Description
A.	N/A

1.4. Configuration of Tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in section 1.4
- (2) Power on the EUT.
- (3) Double-click the icon “My Device” on the desktop.
- (4) Double-click the file folder “IPSM”.
- (5) Execute EnterTestMode M600.
- (6) Click on the test channel to transmit continuously.
- (7) Verify that the EUT works properly.

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: File on
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

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E-Mail : service@quietek.com



2. Conducted Emission

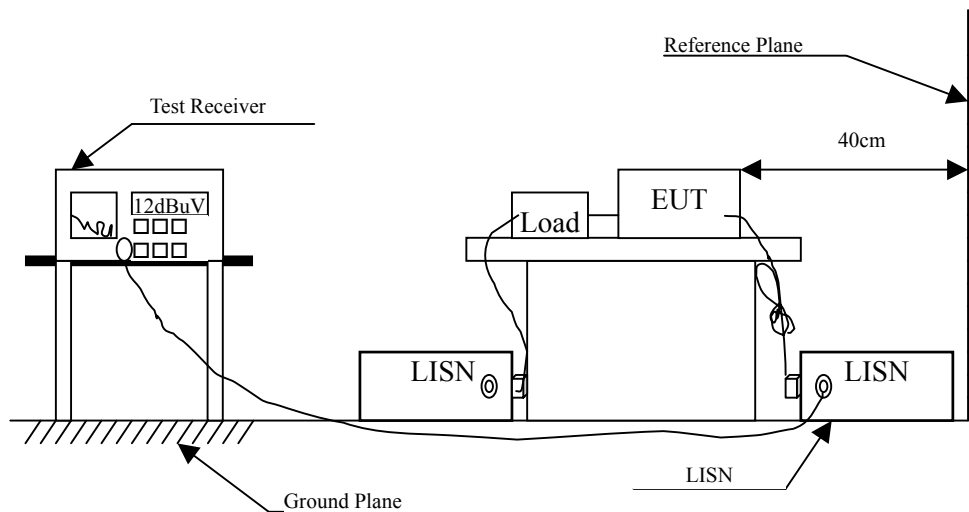
2.1. Test Equipment

The following test equipment are used during the conducted emission test:

Item	Instrument	Manufacturer	Type No./Serial No	Last Cal.	Remark
1	EMI Test Receiver	R&S	ESCS 30/100367	Aug., 2006	
2	LISN	R&S	ESH3-Z5/836679/023	July, 2006	EUT
3	LISN	R&S	ESH3-Z5/836679/017	Feb., 2006	Peripherals
4	Pulse Limiter	R&S	ESH3-Z2/357.8810.52	Sep, 2005	
5	No.7 Shielded Room			N/A	

Note: All instruments 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 refer 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 the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement.

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

2.5. Uncertainty

± 2.26 dB

2.6. Test Result of Conducted Emission

Product : Industrial PDA
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 1: Transmitter (2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 1					
Quasi-Peak					
0.193	0.697	52.810	53.507	-11.264	64.771
0.771	0.310	38.060	38.370	-17.630	56.000
1.287	0.320	33.340	33.660	-22.340	56.000
2.959	0.370	37.180	37.550	-18.450	56.000
8.365	0.542	32.320	32.862	-27.138	60.000
18.986	1.080	29.940	31.020	-28.980	60.000
Average					
0.193	0.697	46.160	46.857	-7.914	54.771
0.771	0.310	31.370	31.680	-14.320	46.000
1.287	0.320	26.530	26.850	-19.150	46.000
2.959	0.370	33.150	33.520	-12.480	46.000
8.365	0.542	28.260	28.802	-21.198	50.000
18.986	1.080	25.780	26.860	-23.140	50.000

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 : Industrial PDA
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test Mode : Mode 1: Transmitter (2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.193	0.300	52.410	52.710	-12.061	64.771
0.720	0.311	43.040	43.351	-12.649	56.000
1.673	0.340	35.710	36.050	-19.950	56.000
3.025	0.370	36.870	37.240	-18.760	56.000
7.591	0.460	35.360	35.820	-24.180	60.000
14.025	0.860	30.890	31.750	-28.250	60.000
Average					
0.193	0.300	45.480	45.780	-8.991	54.771
0.720	0.311	30.100	30.411	-15.589	46.000
1.673	0.340	32.500	32.840	-13.160	46.000
3.025	0.370	32.310	32.680	-13.320	46.000
7.591	0.460	33.560	34.020	-15.980	50.000
14.025	0.860	28.430	29.290	-20.710	50.000

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

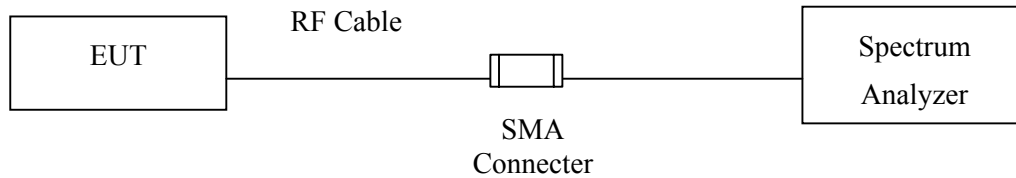
3.1. Test Equipment

The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	EMI Test Receiver	R&S	ESI 26 / 838786/004	May, 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.

3.2. Test Setup



3.3. Limit

The maximum peak power shall be less 1Watt.

3.4. Uncertainty

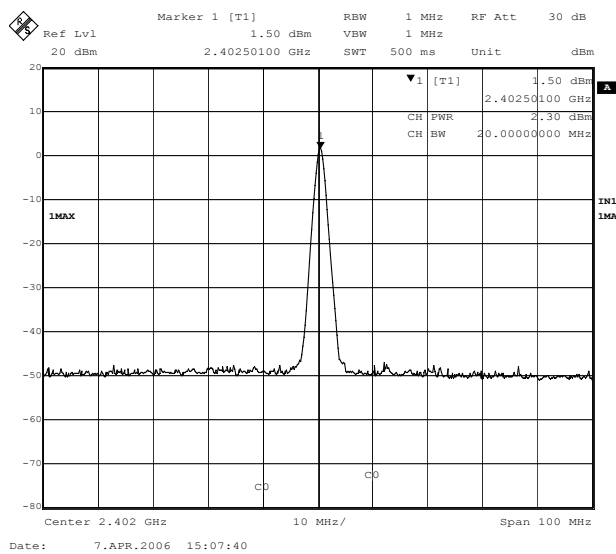
± 1.27 dB

3.5. Test Result of Peak Power Output

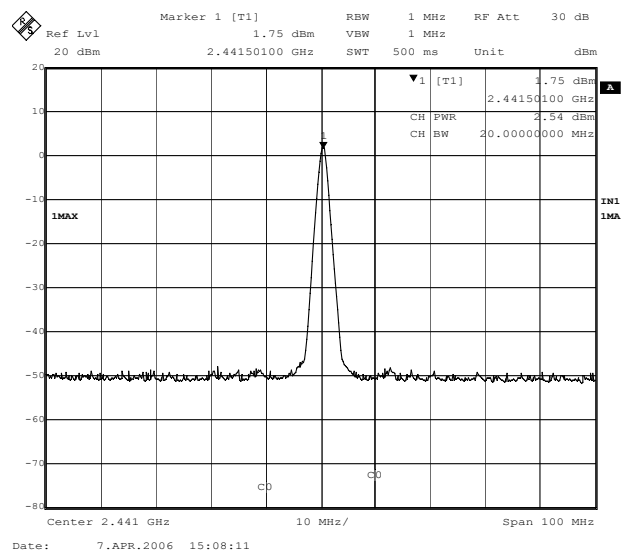
Product : Industrial PDA
 Test Item : Peak Power Output
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter

Channel No.	Frequency (MHz)	Measurement	Required Limit	Result
Channel 00	2402.00	2.30dBm	1 Watt= 30 dBm	Pass
Channel 39	2441.00	2.54dBm	1 Watt= 30 dBm	Pass
Channel 78	2480.00	2.62dBm	1 Watt= 30 dBm	Pass

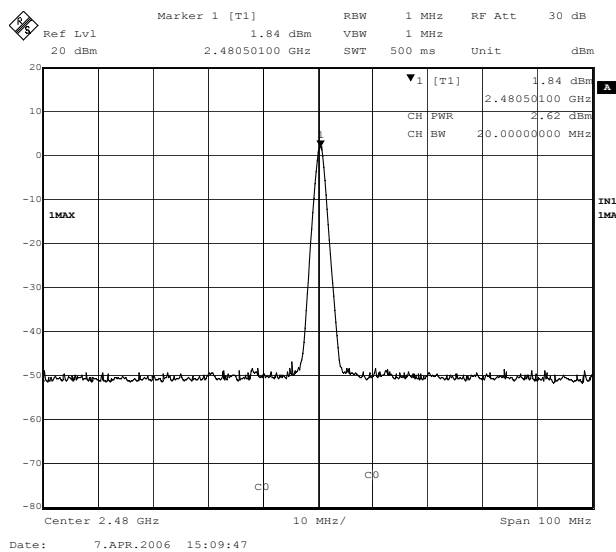
Channel 00



Channel 39



Channel 78



4. Radiated Emission

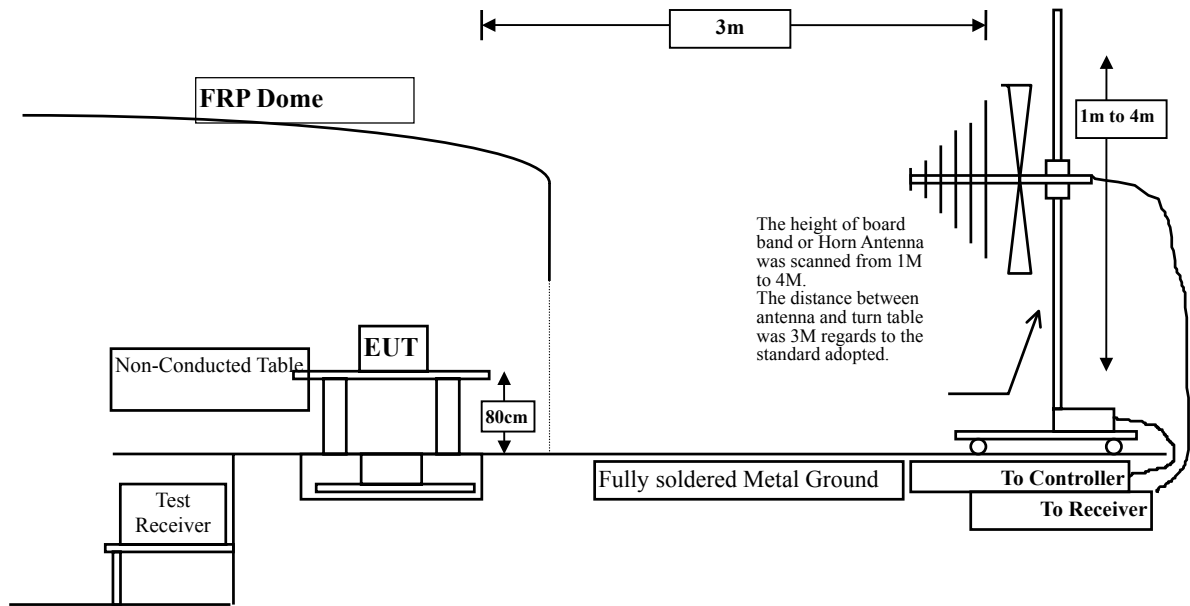
4.1. Test Equipment

The following test equipments are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☐ Site # 1	Test Receiver	R & S	ESVS 10 / 834468/003	May, 2006
	Spectrum Analyzer	Advantest	R3162/ 00803480	May, 2006
	Pre-Amplifier	Advantest	BB525C/ 3307A01812	May, 2006
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	Sep., 2005
☐ Site # 2	Test Receiver	R & S	ESCS 30 / 836858 / 022	May, 2006
	Spectrum Analyzer	Advantest	R3162 / 100803466	May, 2006
	Pre-Amplifier	Advantest	BB525C/3307A01814	May, 2006
	Bilog Antenna	SCHAFFNER	CBL6112B / 2705	May, 2006
	Horn Antenna	ETS	3115 / 0005-6160	Sep., 2005
	Pre-Amplifier	QTK	QTK-AMP-01/ 0001	May, 2006
☒ Site # 3	Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2006
	Spectrum Analyzer	HP	E4407B / US39440758	May, 2006
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2006
	Horn Antenna	Schwarzbeck	BBHA9120D / 305, 306	July, 2006
	Horn Antenna	Schwarzbeck	BBHA9170 / 208, 209	July, 2006
	Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2006
	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2006
	Pre-Amplifier	HP	8449B / 3008A01123	July, 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.

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.

4.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

4.6. Test Result of Radiated Emission

Product : Industrial PDA
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmitter (2402MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4804.000	3.663	45.657	49.320	-24.680	74.000
7206.000	9.357	37.954	47.310	-26.690	74.000
9608.000	11.842	37.538	49.380	-24.620	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4804.000	3.663	44.567	48.230	-25.770	74.000
7206.000	9.357	37.594	46.950	-27.050	74.000
9608.000	11.842	37.928	49.770	-24.230	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz ◦
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 : Industrial PDA
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4882.000	3.921	47.209	51.130	-22.870	74.000
7323.000	9.657	37.163	46.820	-27.180	74.000
9764.000	11.798	37.622	49.420	-24.580	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4882.000	3.921	46.399	50.320	-23.680	74.000
7323.000	9.657	37.253	46.910	-27.090	74.000
9764.000	11.798	36.452	48.250	-25.750	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz °
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz °
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 : Industrial PDA
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Transmitter (2480MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4960.000	4.197	49.414	53.610	-20.390	74.000
7440.000	9.951	36.379	46.330	-27.670	74.000
9920.000	11.856	38.564	50.420	-23.580	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4960.000	4.197	43.764	47.960	-26.040	74.000
7440.000	9.951	36.929	46.880	-27.120	74.000
9920.000	11.856	37.814	49.670	-24.330	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz ◦
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 : Industrial PDA
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2441MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
321.000	13.673	26.132	39.805	-6.195	46.000
466.500	18.593	22.139	40.732	-5.268	46.000
522.275	18.602	20.401	39.003	-6.997	46.000
604.728	20.211	18.342	38.553	-7.447	46.000
810.850	21.606	16.580	38.186	-7.814	46.000
944.225	22.818	16.805	39.622	-6.378	46.000
Vertical					
105.175	11.138	25.962	37.100	-6.400	43.500
134.275	11.774	24.345	36.119	-7.381	43.500
323.425	14.317	24.107	38.423	-7.577	46.000
350.100	15.082	26.418	41.500	-4.500	46.000
461.650	18.489	16.850	35.339	-10.661	46.000
522.275	18.746	17.781	36.527	-9.473	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are performed with peak and/or average measurements as necessary.
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

The following test equipments are used during the band edge tests:

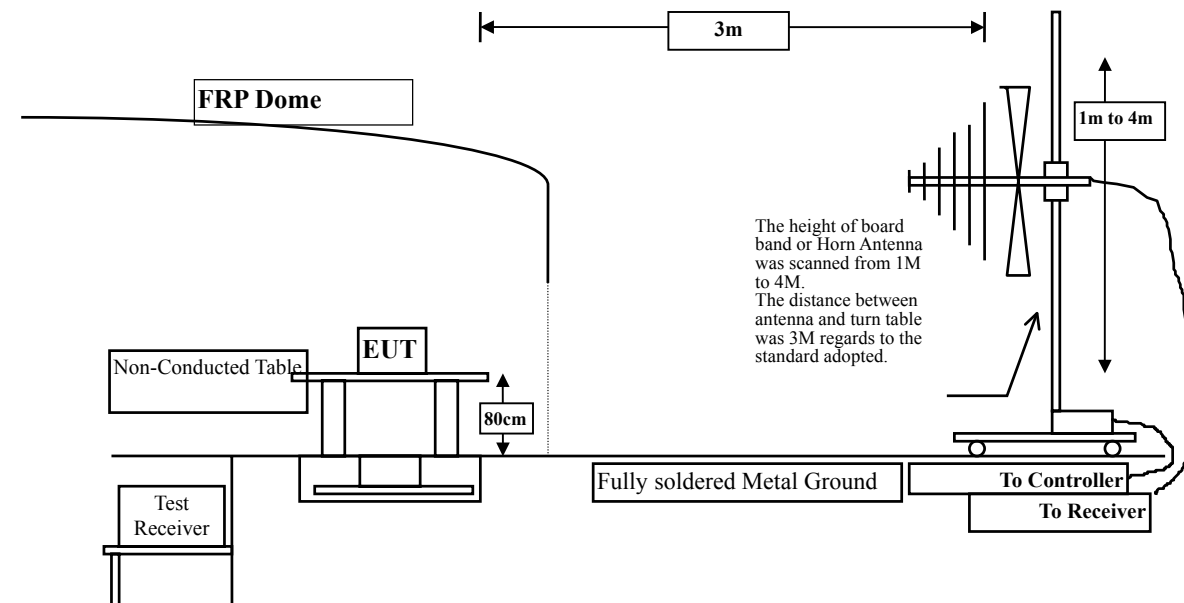
	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2006
X	Spectrum Analyzer	HP	E4407B / US39440758	May, 2006
X	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2006
X	Horn Antenna	Schwarzbeck	BBHA9120D / 305, 306	July, 2006
X	Horn Antenna	Schwarzbeck	BBHA9170 / 208, 209	July, 2006
X	Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2006
X	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2006
X	Pre-Amplifier	HP	8449B / 3008A01123	July, 2006

Test Site Site 3

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

5.2. Test Setup

RF Radiated Measurement:



5.3. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

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

5.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

5.6. Test Result of Band Edge

Product : Industrial PDA
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2402MHz)

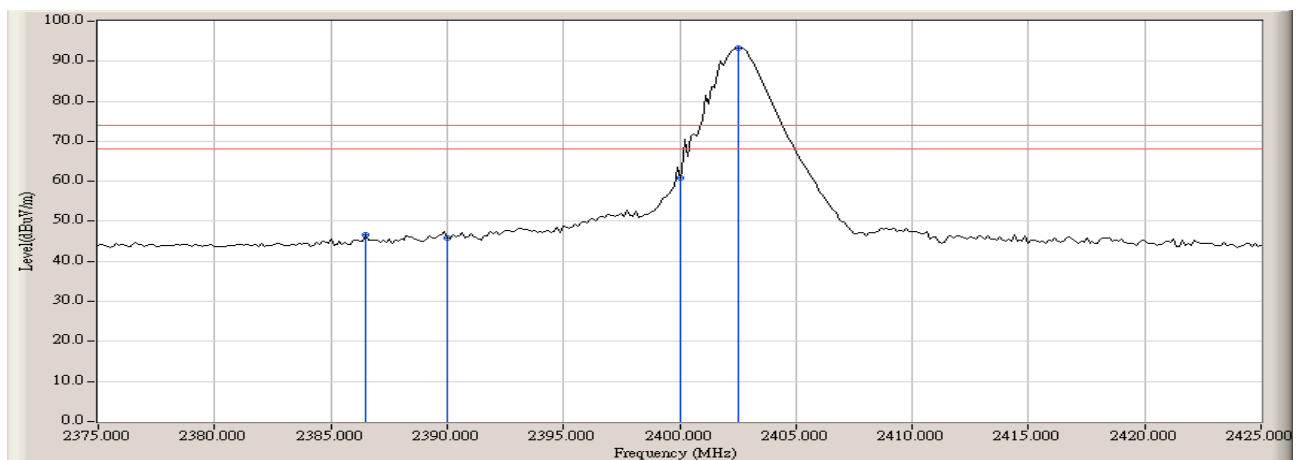
RF Radiated Measurement:

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
00	<2400	>20	Pass

RF Radiated Measurement (Horizontal):

Channel	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
00 (Peak)	2386.500	-2.900	49.433	46.533	74.00	54.00	Pass
00 (Average)	--	--	--	--	74.00	54.00	Pass

Figure Channel 00: (Horizontal)



Note:

RBW=1MHz, VBW=1MHz, Sweep Time=500ms.

Product : Industrial PDA
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2402MHz)

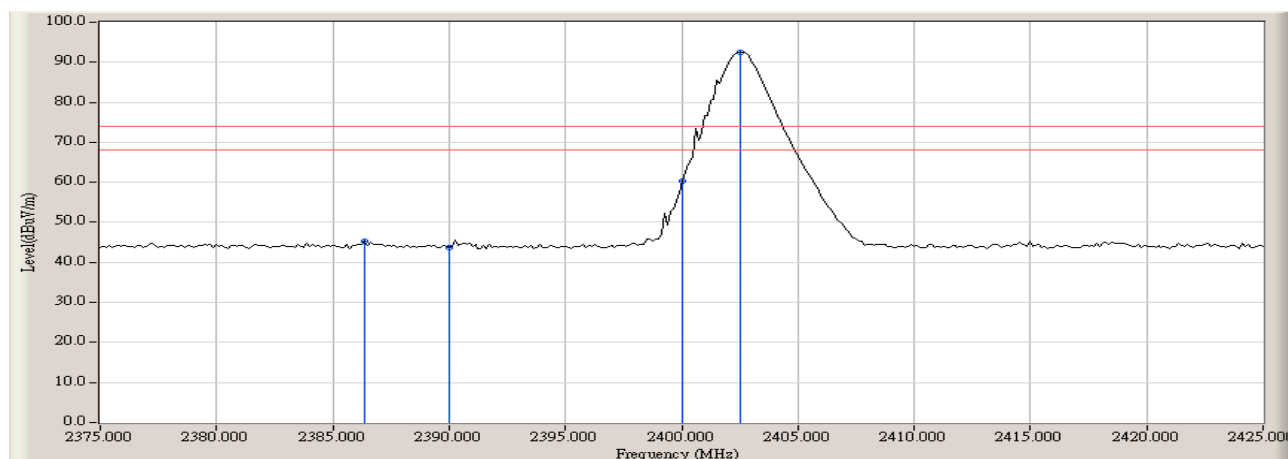
RF Radiated Measurement:

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
00	<2400	>20	Pass

RF Radiated Measurement (Vertical):

Channel	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
00 (Peak)	2386.375	-2.901	48.130	45.229	74.00	54.00	Pass
00(Average)	--	--	--	--	74.00	54.00	Pass

Figure Channel 00: (Vertical)



Note:

RBW=1MHz, VBW=1MHz, Sweep Time=500ms.

Product : Industrial PDA
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2480MHz)

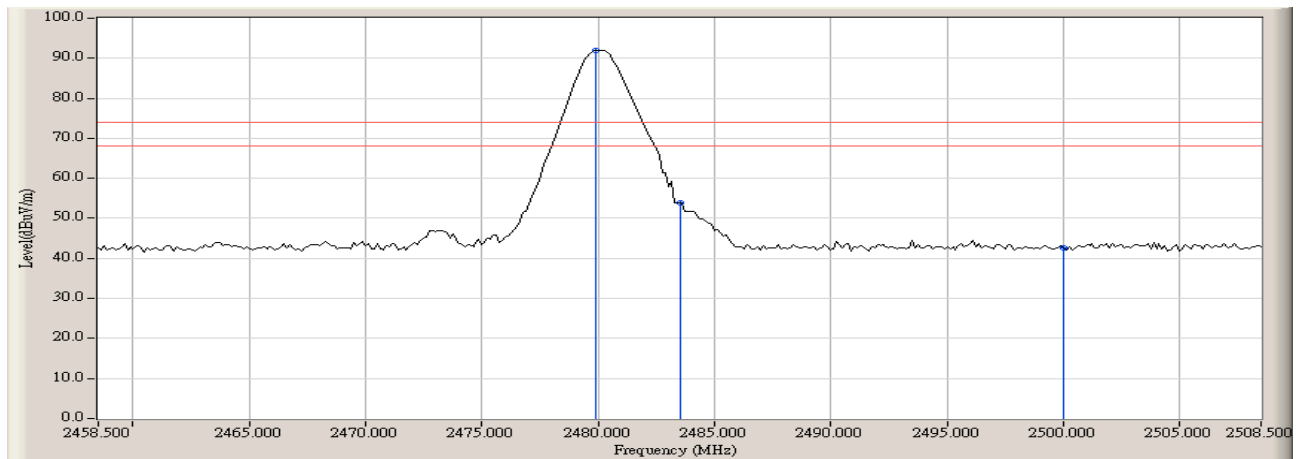
RF Radiated Measurement:

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
78	>2483.5	>20	Pass

RF Radiated Measurement (Horizontal):

Channel	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
78(Peak)	2483.500	-2.442	56.351	53.909	74.00	54.00	Pass
78(Average)	--	--	--	--	74.00	54.00	Pass

Figure Channel 78: (Horizontal)



Note:

RBW=1MHz, VBW=1MHz, Sweep Time=500ms.

Product : Industrial PDA
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2480MHz)

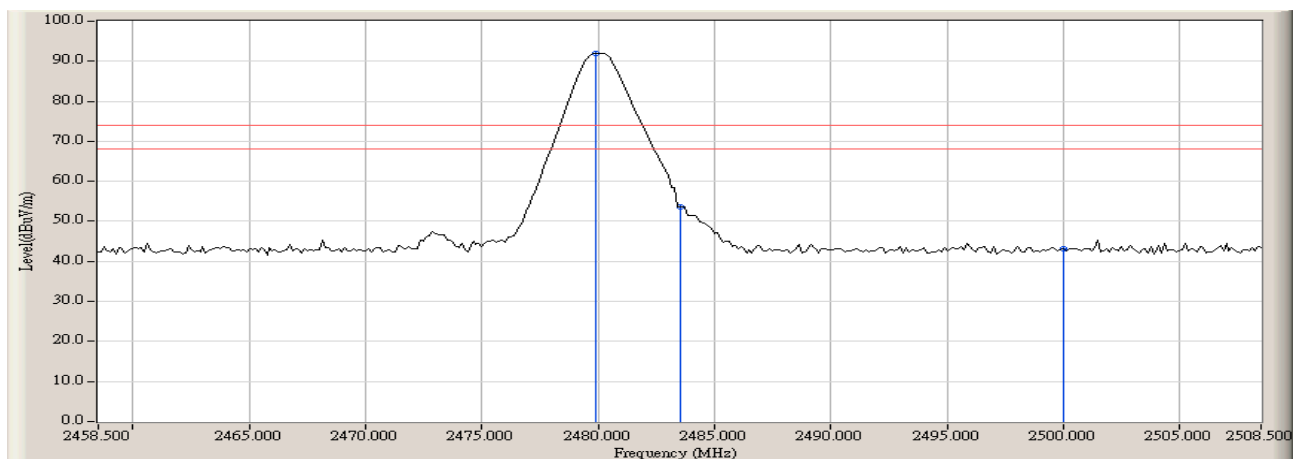
RF Radiated Measurement:

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
78	>2483.5	>20	Pass

RF Radiated Measurement (Vertical):

Channel	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
78(Peak)	2483.500	-2.442	55.940	53.498	74.00	54.00	Pass
78(Average)	--	--	--	--	74.00	54.00	Pass

Figure Channel 78: (Vertical)



Note:

RBW=1MHz, VBW=1MHz, Sweep Time=500ms.

Note: 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.

6. Channel Number

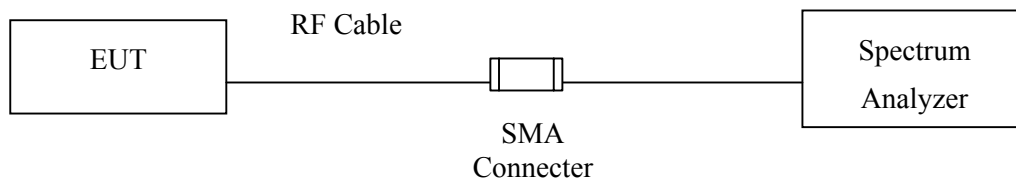
6.1. Test Equipment

The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	EMI Test Receiver	R&S	ESI 26 / 838786/004	May, 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.

6.2. Test Setup



6.3. Limit

Frequency hopping systems operating in the 2400-2483.5 MHz bands shall use at least 75 hopping frequencies.

6.4. Uncertainty

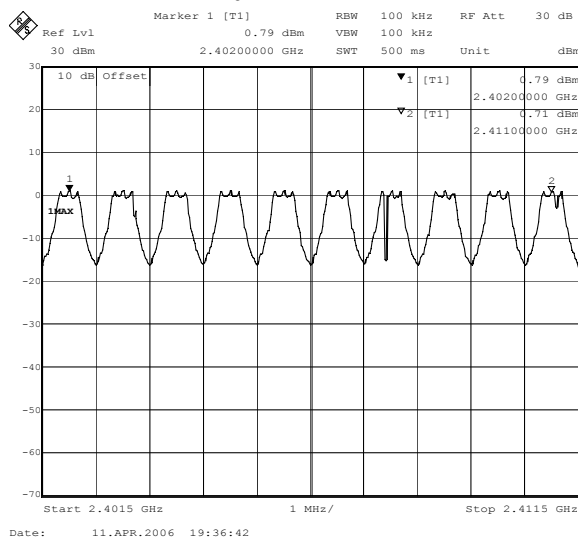
N/A

6.5. Test Result of Channel Number

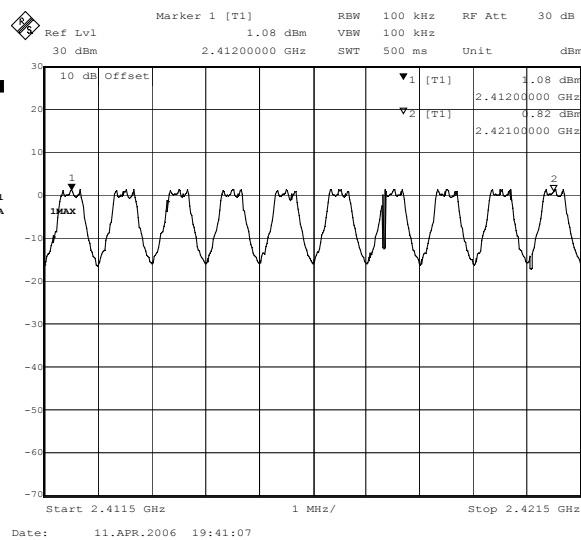
Product : Industrial PDA
 Test Item : Channel Number
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter

Frequency Range (MHz)	Measurement (Hopping Channel)	Required Limit (Hopping Channel)	Result
2402 ~ 2480	79	>75	Pass

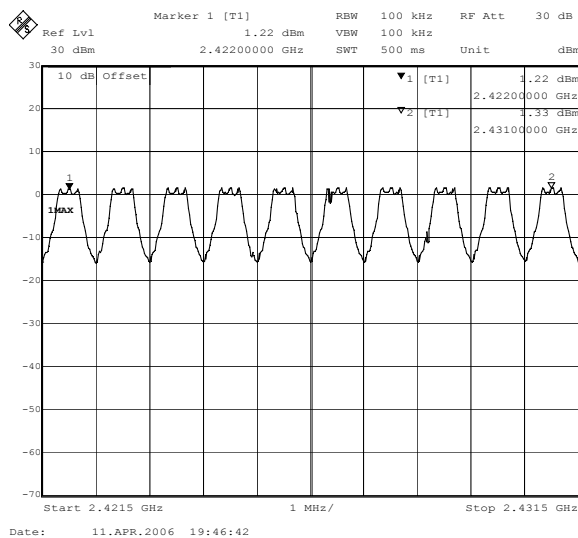
2402-2411MHz



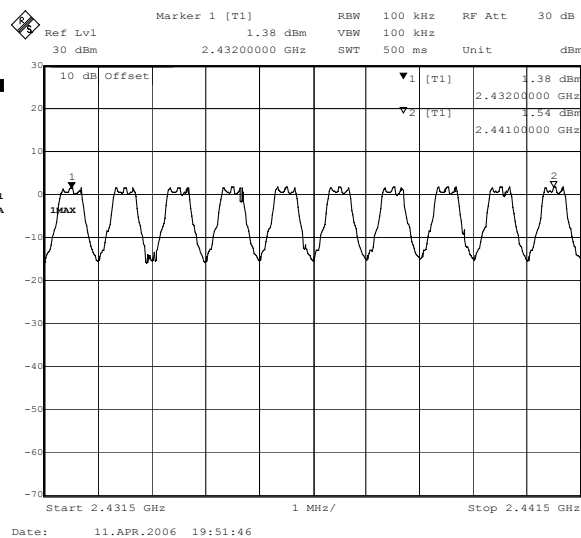
2412-2421MHz



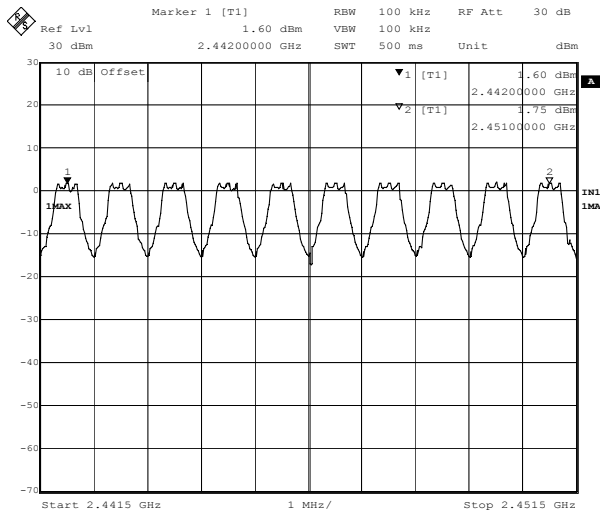
2422-2431MHz



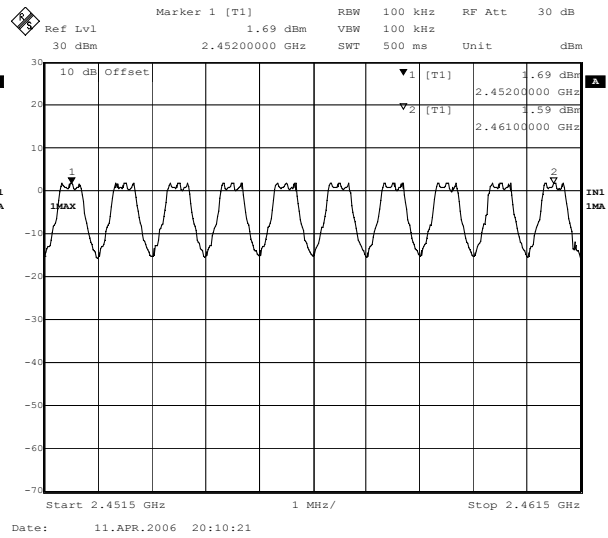
2432-2441MHz



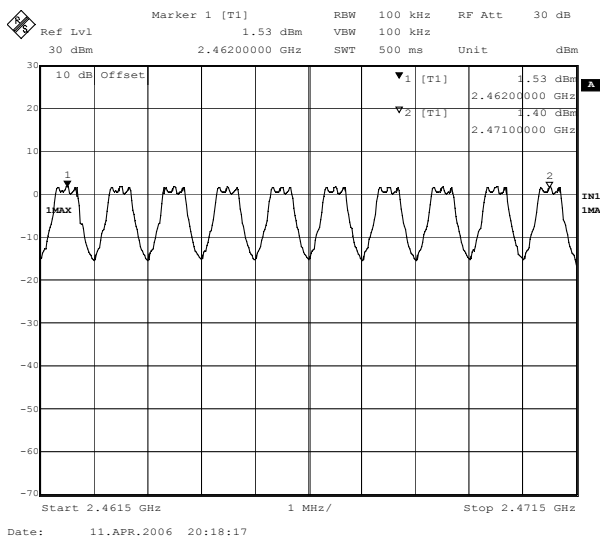
2442-2451MHz



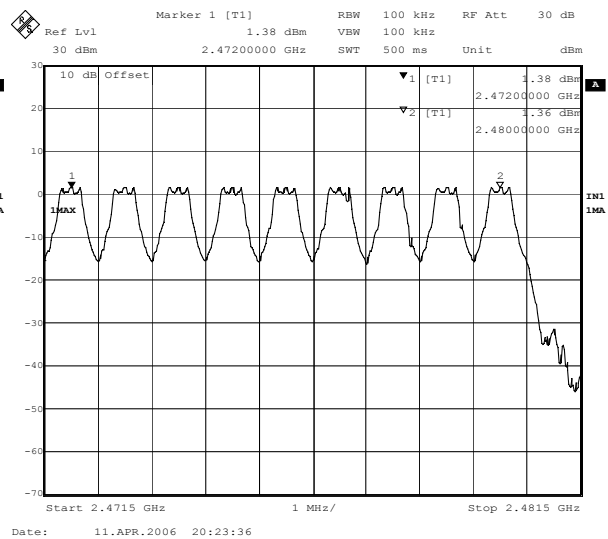
2452-2461MHz



2462-2471MHz



2472-2481MHz



7. Channel Separation

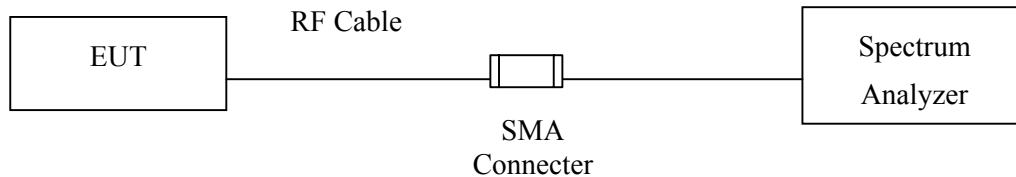
7.1. Test Equipment

The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	EMI Test Receiver	R&S	ESI 26 / 838786/004	May, 2006

Note: 1. All equipments are calibrated every one year.
2. The test instruments mark 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.

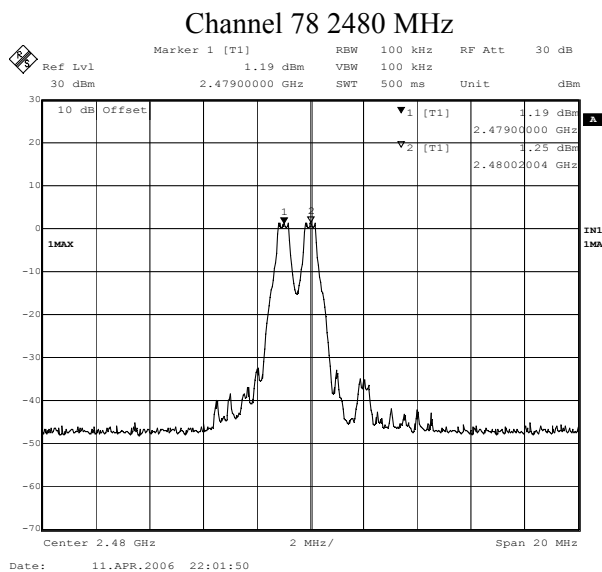
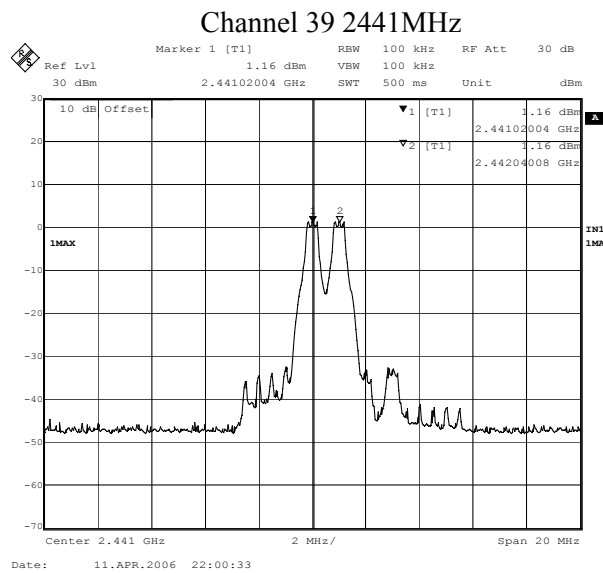
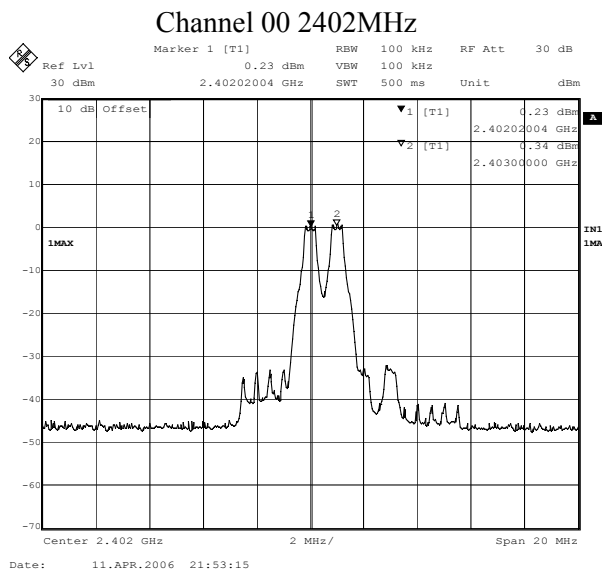
7.4. Uncertainty

$\pm 150\text{Hz}$

7.5. Test Result of Channel Separation

Product : Industrial PDA
 Test Item : Channel Separation
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter

Frequency (MHz)	Measurement Level (MHz)	Required Limit	Result
2402	1.00	>25 kHz or 2/3 * 20 dB BW	Pass
2441	1.00	>25 kHz or 2/3 * 20 dB BW	Pass
2480	1.00	>25 kHz or 2/3 * 20 dB BW	Pass



8. Dwell Time

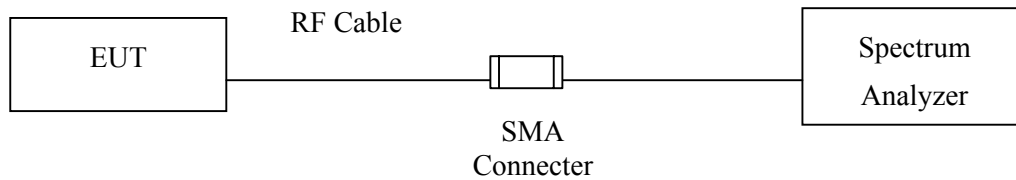
8.1. Test Equipment

The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	EMI Test Receiver	R&S	ESI 26 / 838786/004	May, 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.

8.2. Test Setup



8.3. Limit

The dwell time shall be the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

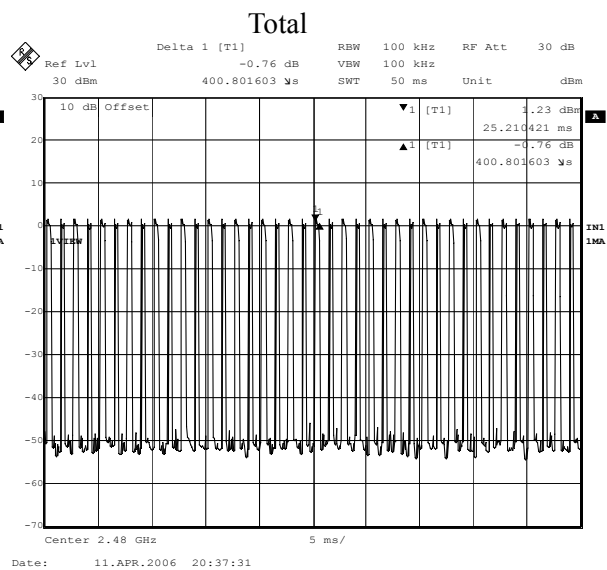
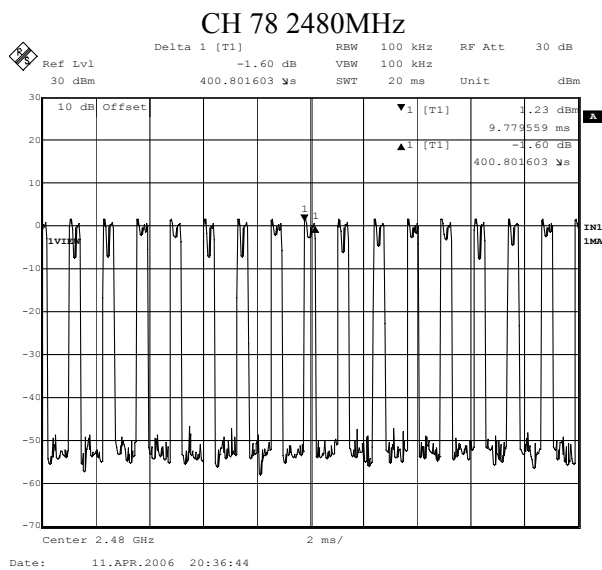
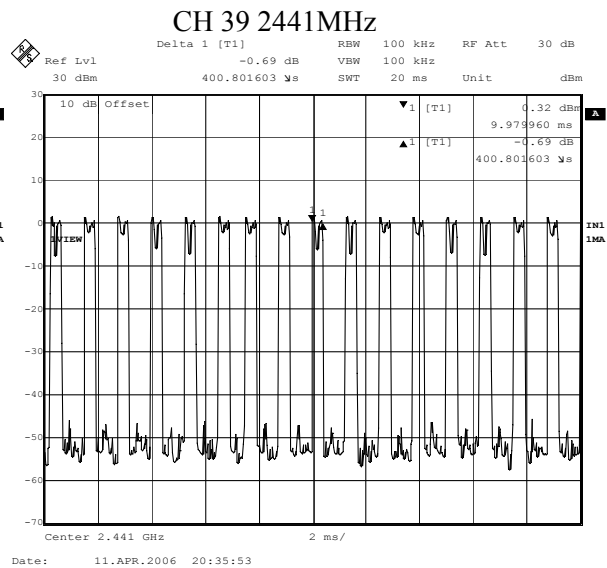
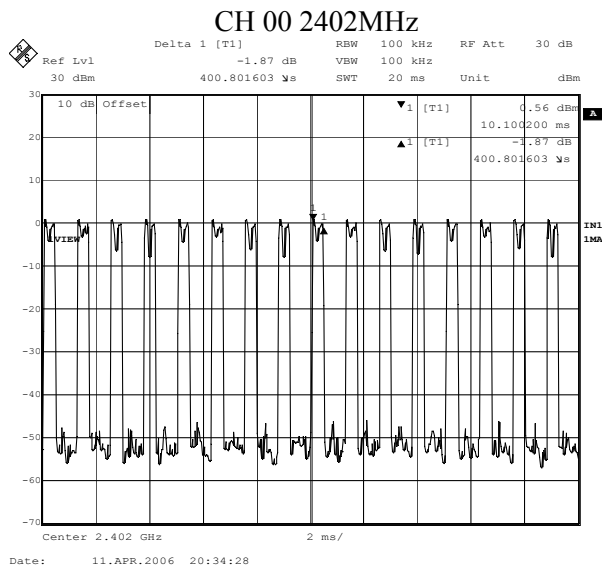
8.4. Uncertainty

± 25msec

8.5. Test Result of Dwell Time

Product : Industrial PDA
 Test Item : Dwell Time
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 00,39,78 –DH1)

Channel (MHz)	Measurement Level (ms)	Required Limit (sec.)	Result
CH 00 2402	128	< 0.4	Pass
CH 39 2441	128	< 0.4	Pass
CH 78 2480	128	< 0.4	Pass



Note: Dwell time=time slot length * hop rate / number of hopping channels * period

Occupancy Time of Frequency Hopping System

Test Time Period: $0.4 \times 79 = 31.6\text{sec}$, Hopping Times Within 1sec: $40/50\text{msec} = 0.8 \text{ hops/msec}$.

A) 2402MHz The Maximum Occupancy Time Within 31.6sec: $400 \mu\text{s} \times 800 / 79 \times 31.6 = 128\text{msec}$.

B) 2441MHz The Maximum Occupancy Time Within 31.6sec: $400 \mu\text{s} \times 800 / 79 \times 31.6 = 128\text{msec}$.

C) 2480MHz The Maximum Occupancy Time Within 31.6sec: $400 \mu\text{s} \times 800 / 79 \times 31.6 = 128\text{msec}$.

Test Result: The average occupancy times of the highest, middle and lowest channel are less than 0.4sec, and thus complies the standard.

PS: (1) From Bluetooth Specification, It Hops 1640 Times in 1sec. The Average Occupancy Time of Each 79 Channels is $1600/79$ Times, Therefore, We Calculate The Maximum Occupancy Time (worst case) As Below:

A) 2402Mhz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

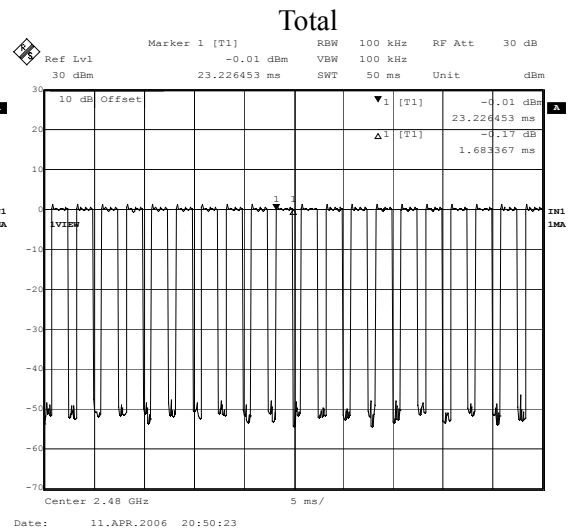
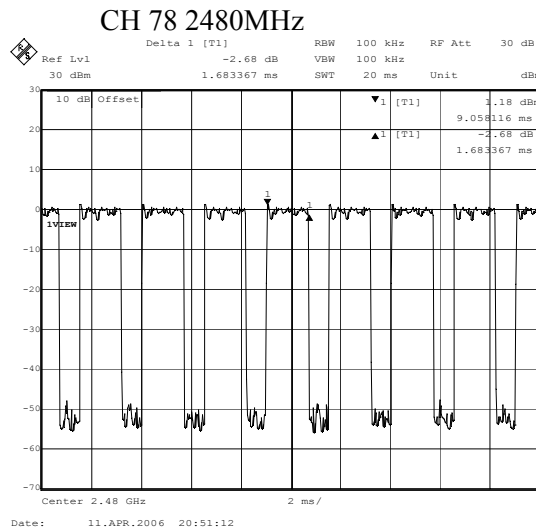
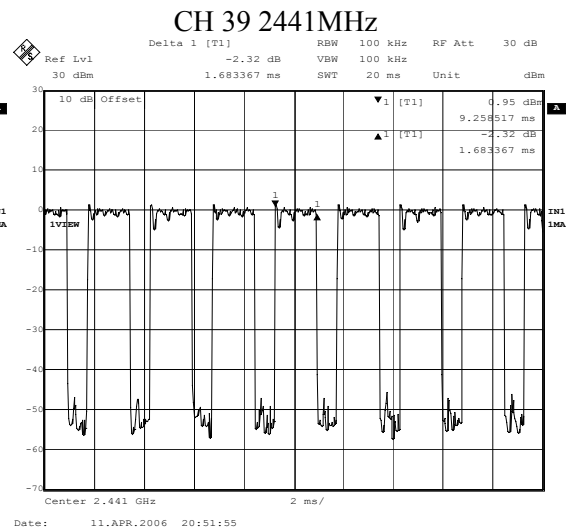
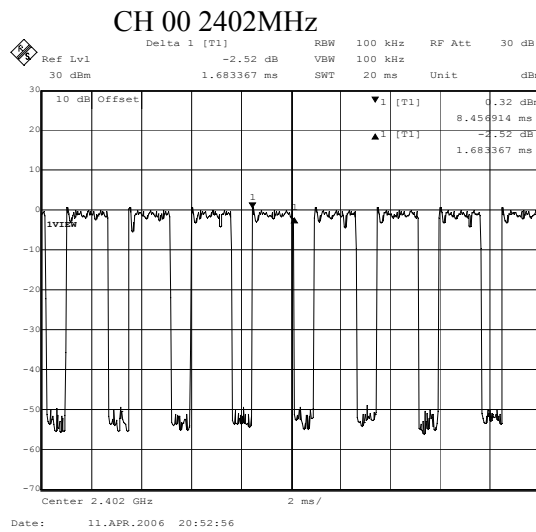
B) 2441MHz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

C) 2480MHz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

Test Result: The average occupancy times of the highest, middle and lowest channel are less than 0.4sec, and thus complies the standard.

Product : Industrial PDA
 Test Item : Dwell Time
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 00,39,78 –DH3)

Channel (MHz)	Measurement Level (ms)	Required Limit (sec.)	Result
CH 00 2402	269.28	< 0.4	Pass
CH 39 2441	269.28	< 0.4	Pass
CH 78 2480	269.28	< 0.4	Pass



Note: Dwell time = time slot length * hop rate / number of hopping channels * period

Occupancy Time of Frequency Hopping System

Test Time Period: $0.4 \times 79 = 31.6\text{sec}$, Hopping Times Within 1sec: $20/50\text{msec} = 0.4 \text{ hops/msec}$.

A) 2402MHz The Maximum Occupancy Time Within 31.6sec: $1683 \mu\text{s} \times 400 / 79 \times 31.6 = 269.28\text{msec}$ °

B) 2441MHz The Maximum Occupancy Time Within 31.6sec: $1683 \mu\text{s} \times 400 / 79 \times 31.6 = 269.28\text{msec}$ °

C) 2480MHz The Maximum Occupancy Time Within 31.6sec: $1683 \mu\text{s} \times 400 / 79 \times 31.6 = 269.28\text{msec}$ °

Test Result: The average occupancy times of the highest, middle and lowest channel are less than 0.4sec, and thus complies the standard.

PS: (1) From Bluetooth Specification, It Hops 1640 Times in 1sec. The Average Occupancy Time of Each 79 Channels is $1600/79$ Times, Therefore, We Calculate The Maximum Occupancy Time (worst care) As Below:

A) 2402Mhz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

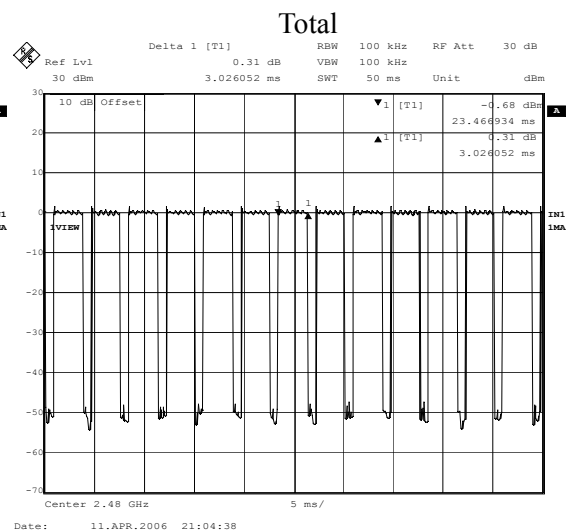
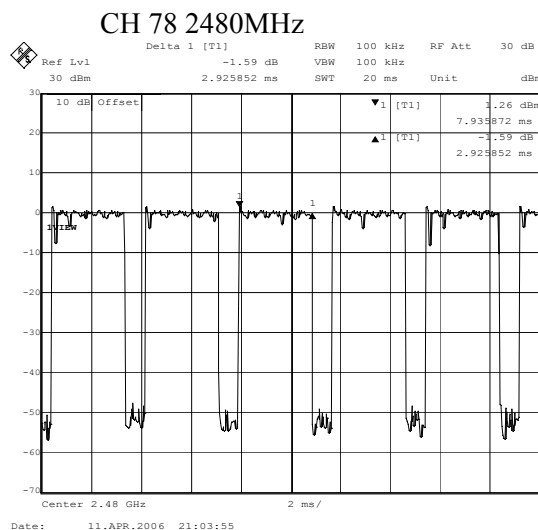
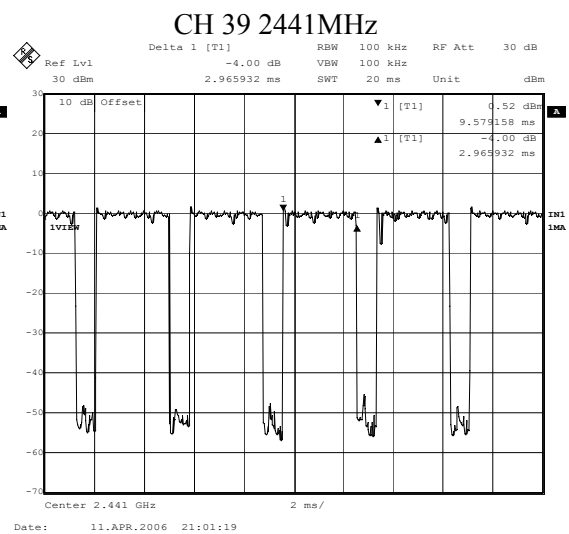
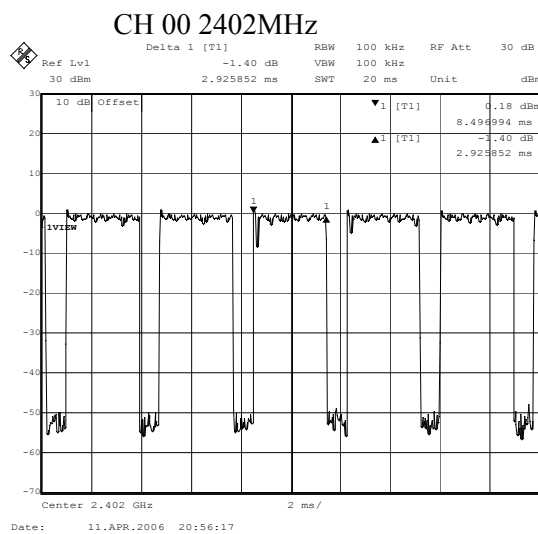
B) 2441MHz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

C) 2480MHz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

Test Result: The average occupancy times of the highest, middle and lowest channel are less than 0.4sec, and thus complies the standard.

Product : Industrial PDA
 Test Item : Dwell Time
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (Channel 00,39,78 –DH5)

Channel (MHz)	Measurement Level (ms)	Required Limit (sec.)	Result
CH 00 2402	304.2	< 0.4	Pass
CH 39 2441	308.36	< 0.4	Pass
CH 78 2480	304.2	< 0.4	Pass



Note: Dwell time=time slot length * hop rate / number of hopping channels * period

Occupancy Time of Frequency Hopping System

Test Time Period: $0.4 \times 79 = 31.6\text{sec}$, Hopping Times Within 1sec: $13/50\text{msec} = 0.26 \text{ hops/msec}$.

A) 2402MHz The Maximum Occupancy Time Within 31.6sec: $2925 \mu\text{s} \times 260 / 79 \times 31.6 = 304.2\text{msec}$ °

B) 2441MHz The Maximum Occupancy Time Within 31.6sec: $2965 \mu\text{s} \times 260 / 79 \times 31.6 = 308.36\text{msec}$ °

C) 2480MHz The Maximum Occupancy Time Within 31.6sec: $2925 \mu\text{s} \times 260 / 79 \times 31.6 = 304.2\text{msec}$ °

Test Result: The average occupancy times of the highest, middle and lowest channel are less than 0.4sec, and thus complies the standard.

PS: (1) From Bluetooth Specification, It Hops 1640 Times in 1sec. The Average Occupancy Time of Each 79 Channels is $1600/79$ Times, Therefore, We Calculate The Maximum Occupancy Time (worst care) As Below:

A) 2402Mhz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

B) 2441MHz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

C) 2480MHz The Occupancy Time of Each Pulse is 0.4msec, The Maximum Occupancy Time within 31.6sec is $0.4\text{msec} \times 1640/79 \times 31.6 = 289.056\text{msec}$

Test Result: The average occupancy times of the highest, middle and lowest channel are less than 0.4sec, and thus complies the standard.

9. Occupied Bandwidth

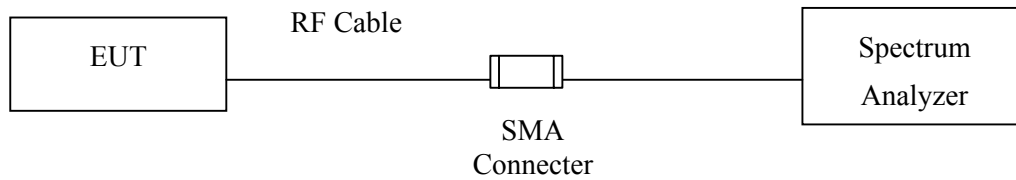
9.1. Test Equipment

The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	EMI Test Receiver	R&S	ESI 26 / 838786/004	May, 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.

9.2. Test Setup



9.3. Limits

N/A

9.4. Uncertainty

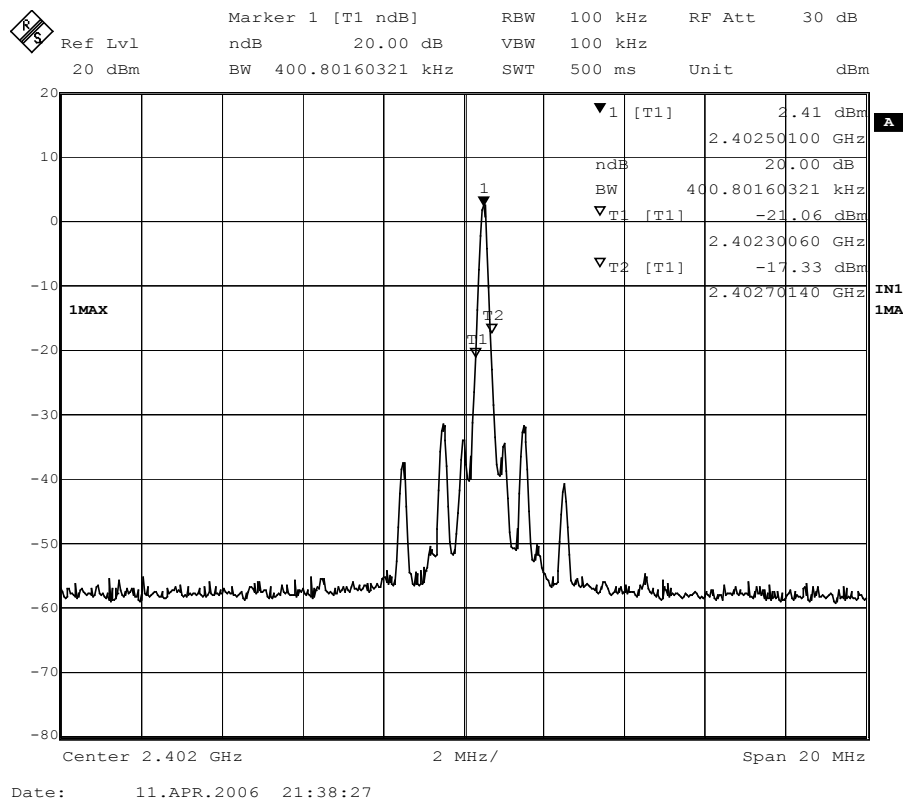
$\pm 150\text{Hz}$

9.5. Test Result of Occupied Bandwidth

Product : Industrial PDA
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2402MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	400	--	NA

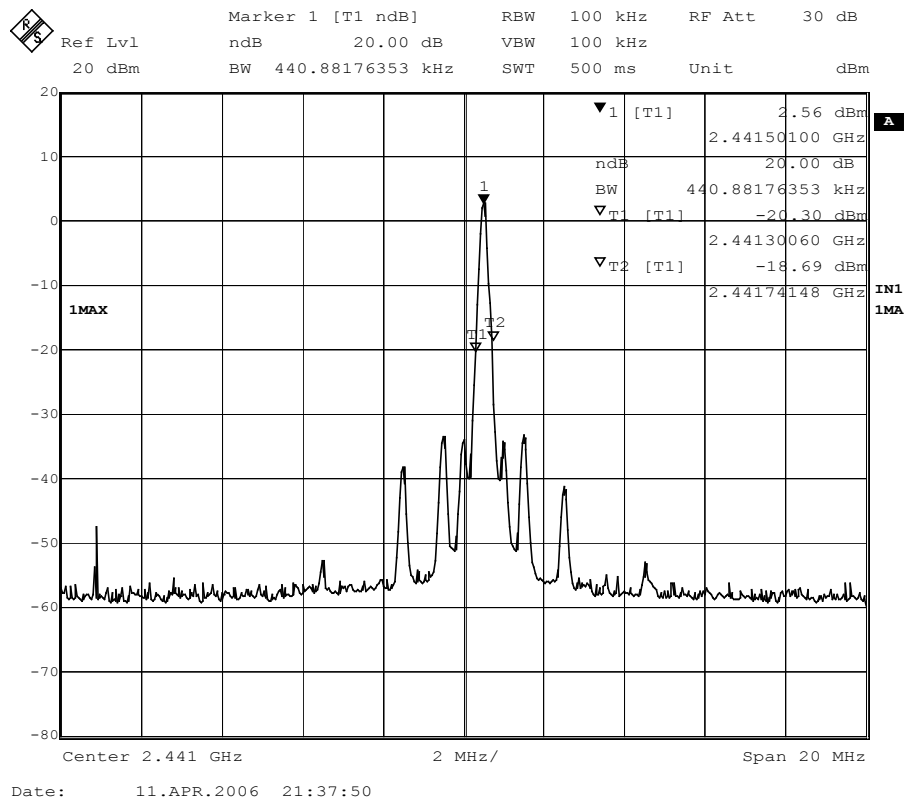
Figure Channel 00:



Product : Industrial PDA
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2441MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2441	440	--	NA

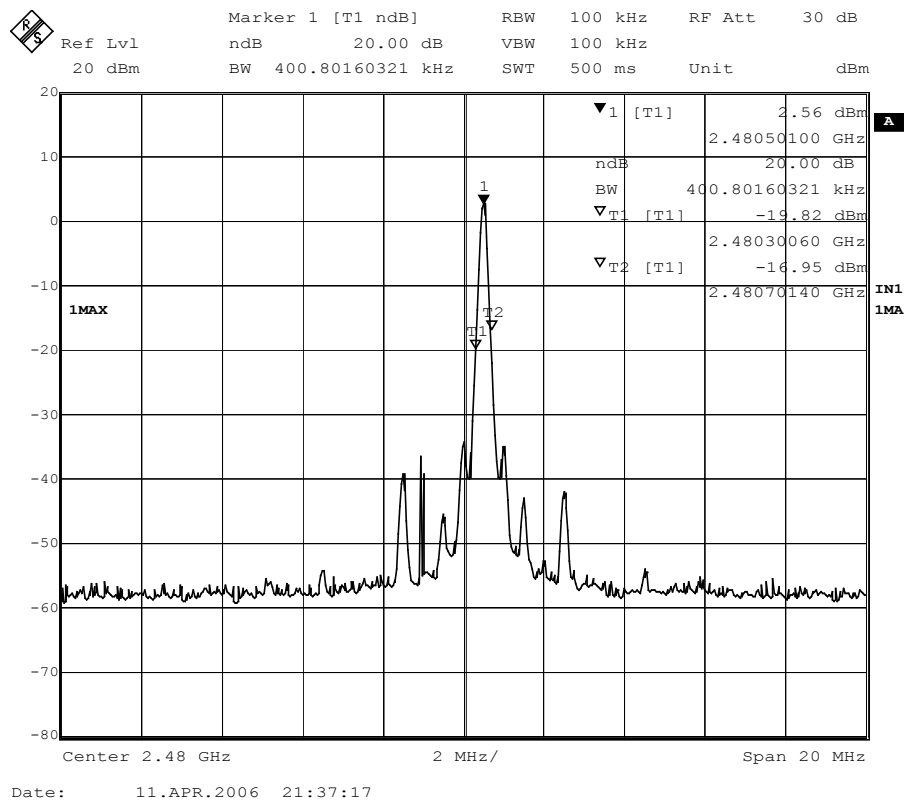
Figure Channel 39:



Product : Industrial PDA
 Test Item : Occupied Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
78	2480	400	--	NA

Figure Channel 78:



10. EMI Reduction Method During Compliance Testing

No modification was made during testing.