



Test Report

Product Name : PC2PC-Bluetooth

Model No. : MS-6967

FCC ID. : I4L-MS6967

Applicant : MICRO-STAR INT'L Co., LTD.

Address : No. 69, Li-De St, Jung-He City, Taipei Hsieh,
Taiwan, R.O.C.

Date of Receipt : Apr. 22, 2002

Date of Test : May 03, 2002

Report No. : 024L065FI

The Test Results relate only to the samples tested.

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This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government

Test Report Certification

Test Date : May 03, 2002

Report No. : 024L065FI



Accredited by NIST (NVLAP)

NVLAP Lab Code: 200347-0

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Applicant : MICRO-STAR INT'L Co., LTD.

Address : No. 69, Li-De St, Jung-He City, Taipei Hsieh,
Taiwan, R.O.C.

Manufacturer : MICRO-STAR INT'L Co., LTD.

Model No. : MS-6967

FCC ID. : I4L-MS6967

Rated Voltage : DC 5V(Powered by PC)

Trade Name : MICRO-STAR

Measurement Standard : FCC Part 15 Subpart C Paragraph 15.247

Measurement Procedure : ANSI C63.4:1992

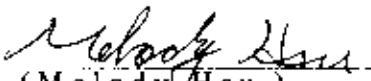
Test Result : Complied

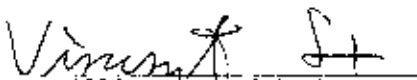


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Documented By : 
(Melody Hsu)

Tested By : 
(Vincent Lin)

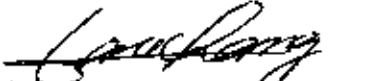
Approved By : 
(Gene Chang)

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Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	: PC2PC-Bluetooth
Trade Name	: MICRO-STAR
FCC ID.	: I4L-MS6967
Model No.	: MS-6967
Frequency Range	: 2402MHz to 2480MHz
Channel Number	: 79
Type of Modulation	: Frequency Hopping Spread Spectrum
Antenna Type	: Connector
Antenna Cable	: Shielded, 0.3m

Working 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		

➤ Section 15.247-(a1)

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

➤ Section 15.247-(g)

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

➤ Section 15.247-(h)

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

Note:

1. 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.
2. Regards to the frequency band operation; the lowest , middle and highest frequency of channel were selected to perform the test, then shown on this report.
3. This device is a composite device in accordance with Part 15 paragraph 15.5. The function for the receiver was, measured and made a test report that the report number is 024L065FI, certified under verification.
4. Quietek had verified among construction and function in typical operation, then shown in this test report.

1.2. Operational Description

The EUT is a 2.4GHz Bluetooth Module with 79 channels.

EUT is an USB interface 2.4GHz wireless USB Card with 79channels.

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 (printers, faxes,...), portable hard held devices, and connectivity to the internet.

1.3. Tested System Details

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

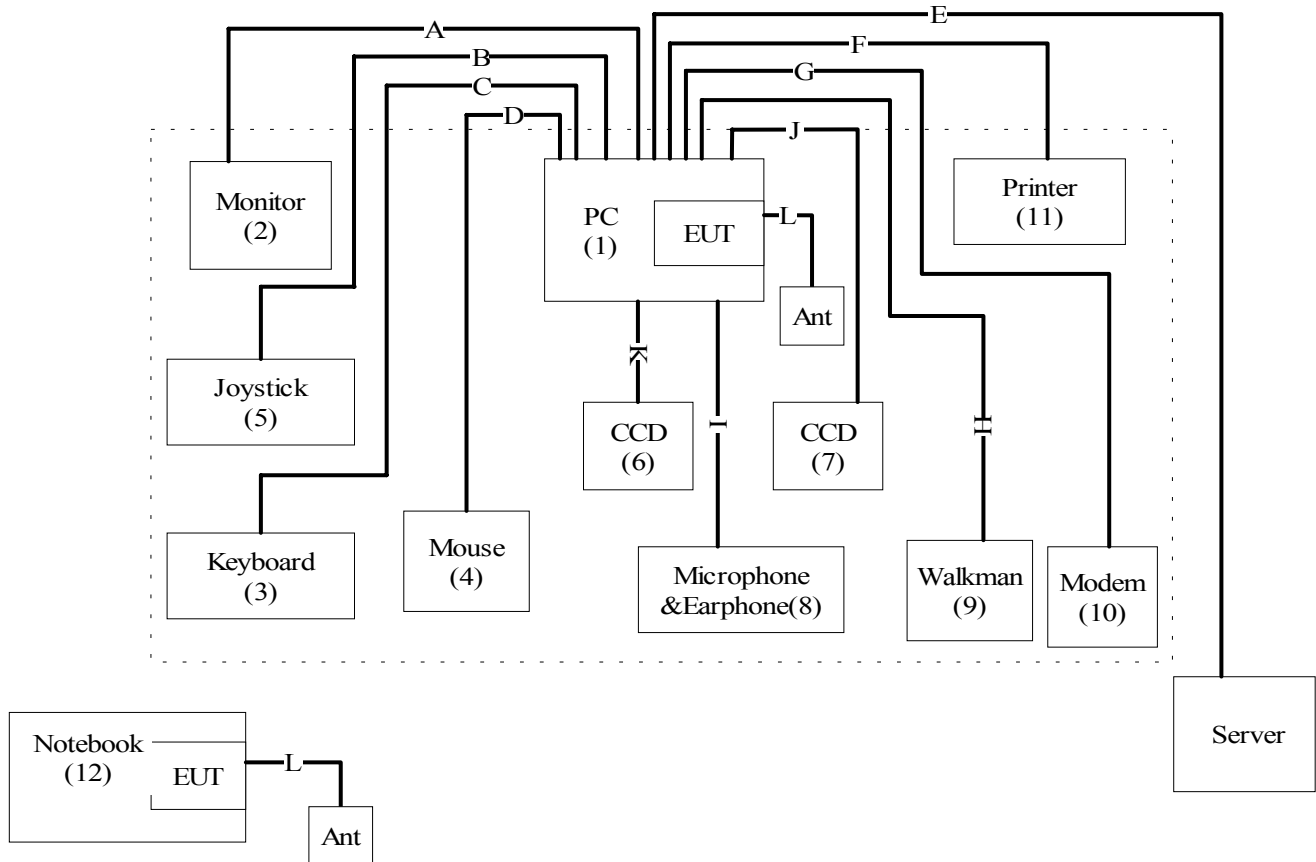
	Product	Manufacturer	Model No.	Serial No.	FCC ID
(1)	PC Mother Board CPU HDD FDD CD-ROM Bluetooth Card (EUT) Switch Power Supply	MICRO-STAR INTEL Quantum Panasonic TEAC MICRO-STAR ASTEC	MS-6580 Pentium 4,1.9GHz/100MHz Fireball JU-257A6069C CD-532E MS-6967 SA202-3545-2288A	N/A N/A N/A N/A N/A N/A 3154138594	FCC DoC
(2)	Monitor	ADI	CM703	038054T10203890A	FCC DoC
(3)	Keyboard	HP	SK-2506	C00083358	FCC DoC
(4)	Mouse	IBM	M-SAU-IBM6	23-022699	FCC DoC
(5)	Joystick	GENIUS	MAXFIRE FORCE G-09D	CJ0100200575	FSUGG09
(6)	USB Video Camera	Logitech	V-UB2	LZA04656864	FCC DoC
(7)	USB Video Camera	Logitech	V-UB2	LZA04656855	FCC DoC
(8)	Microphone & Earphone	TOKTO	SX-MI	N/A	FCC DoC
(9)	Walkman	AIWA	HS-TA164	N/A	FCC DoC
(10)	Modem	ACEEX	DM-1414	0102027532	IFAXDM1414

(11)	Printer	EPSON	Color 680	015999	FCC DoC
(12)	Notebook	DELL	PP01L	N/A	FCC DoC

Note: 1. The power cord of the device 1,2,10,11 and 12 are Non-shielded power cord.

Signal Cable Type		Signal cable Description
A.	VGA Cable	Shielded, 1.6m, a ferrite core bonded
B.	Joystick Cable	Shielded, 1.8m
C.	Keyboard Cable	Shielded, 1.8m
D.	Mouse Cable	Shielded, 1.2m
E.	LAN Cable	Non-shielded, 3.0m
F.	Printer Cable	Shielded, 1.6m
G.	Modem Cable	Shielded, 1.6m
H.	Walkman Cable	Non-shielded, 1.2m
I.	Microphone & Earphone Cable	Non-shielded, 1.6m
J.	CCD Cable	Shielded, 1.8m, a ferrite core bonded
K.	CCD Cable	Shielded, 1.8m, a ferrite core bonded
L.	Antenna Cable	Shielded, 0.3m, 2 pcs.

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1. Setup the EUT and simulators as shown on 1.4.
2. Turn on the power of all equipment.
3. PC reads data from disk.
4. Data will be transmitting and receiving through EUT.
5. The transmitted and receive status will be shown on the monitor.
6. Repeat the above procedure 4 to 5.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	30-60	50-65
Barometric pressure (mbar)	860-1060	950-1000

Site Description: June 22, 2001 File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Reference 31040/SIT1300F2



June 30, 2002 Accreditation on NVLAP
NVLAP Lab Code: 200533-0

Site Name: Quietek Corporation

Site Name: Quietek Corporation

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TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

2. Conducted Emission

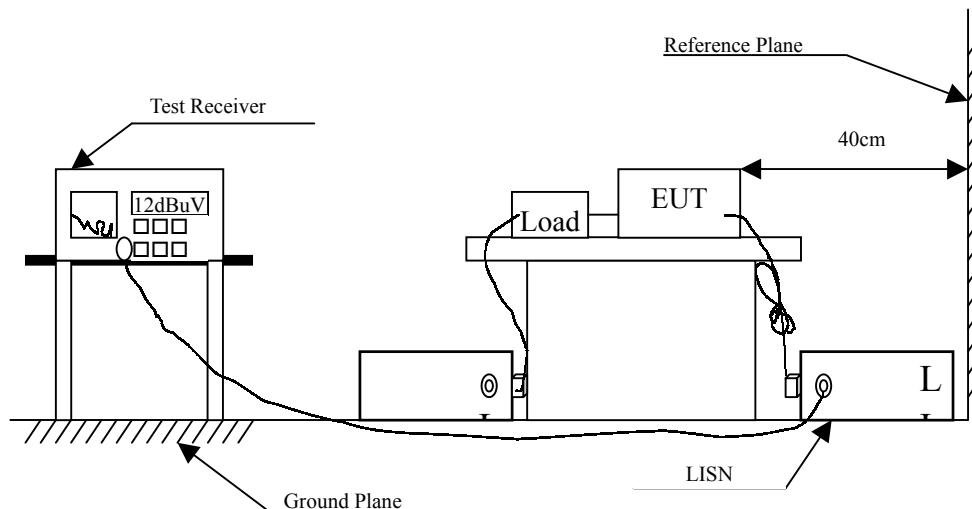
2.1. Test Equipment List

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

Item	Instrument	Manufacturer	Type No./Serial No	Last Cal.	Remark
1	Test Receiver	R & S	ESCS 30/838251/0001	May, 2002	
2	L.I.S.N.	R & S	ESH3-Z5/836679/0023	May, 2002	EUT
3	L.I.S.N.	R & S	ENV 4200/833209/0023	May, 2002	Peripherals
4	Pulse Limiter	R & S	ESH3-Z2	May, 2002	
5	No.4 Shielded Room			N/A	

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

2.2. Test Setup



2.3. Limits

FCC Part 15 Paragraph 15.207 (dBuV)		
Frequency MHz	Limits	
	uV	dBuV
0.45 - 30	250	48.0

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 C63.4:1992 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.45MHz to 30MHz using a receiver bandwidth of 9kHz.

2.5. Test Result of Conducted Emission

Product : PC2PC-Bluetooth
Test Item : Conducted Emission Test
Test Mode : Normal Operation

Frequency	Cable	LISN	Reading Level	Emission Level	Limits
MHz	Loss	Factor	dBuV	dBuV	dBuV
	dB	dB			

Line 1

Quasi-Peak:

*	0.528	0.21	0.10	32.79	33.10	48.00
	0.589	0.21	0.10	28.45	28.76	48.00
	0.877	0.16	0.10	22.37	22.63	48.00
	2.540	0.09	0.14	22.52	22.75	48.00
	14.591	0.30	0.34	27.19	27.83	48.00
	19.931	0.39	0.45	27.21	28.05	48.00

Line 2

Quasi-Peak:

*	0.528	0.21	0.10	32.34	32.65	48.00
	0.592	0.21	0.10	28.19	28.50	48.00
	0.930	0.16	0.10	28.54	28.80	48.00
	5.263	0.29	0.17	20.96	21.42	48.00
	8.669	0.33	0.19	19.63	20.15	48.00
	20.068	0.39	0.45	26.69	27.53	48.00

Remarks :

1. All Readings below 1GHz are Quasi-Peak value.
2. “ * ” means that this data is the worst emission level.
3. Emission Level = Reading Level + LISN Factor + Cable loss

3. Peak Power Output

3.1. Test Equipment

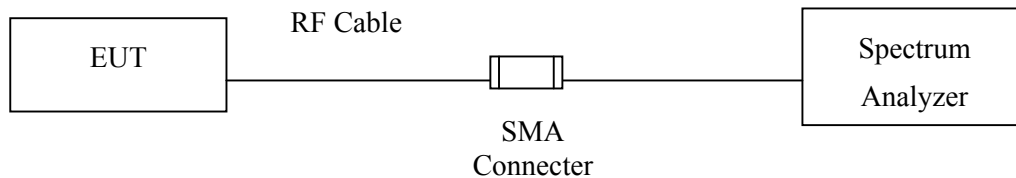
The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum	Advantest	R3162 / 00803480	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

3.2. Test Setup

Conduction Power Measurement



3.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

3.4. Limit

The maximum peak power shall be less 1 Watt.

3.5. Test Result of Peak Power Output

Product : PC2PC-Bluetooth
 Test Item : Peak Power Output Data
 Test Site : No.2 OATS
 Test Mode : Normal Operation

Channel No.	Frequency(MHz)	Measurement	Required Limit	Result
Channel 00	2401.99	16.51dBm	1 Watt= 30 dBm	Pass
Channel 39	2441.00	15.76dBm	1 Watt= 30 dBm	Pass
Channel 78	2479.95	14.70dBm	1 Watt= 30 dBm	Pass

Figure Channel 00

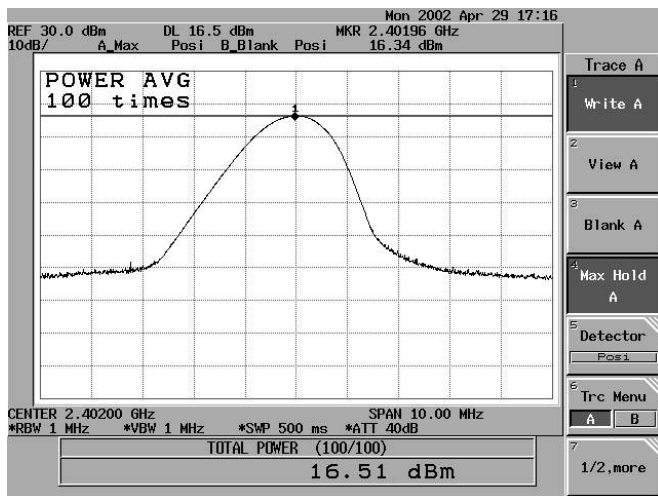


Figure Channel 39

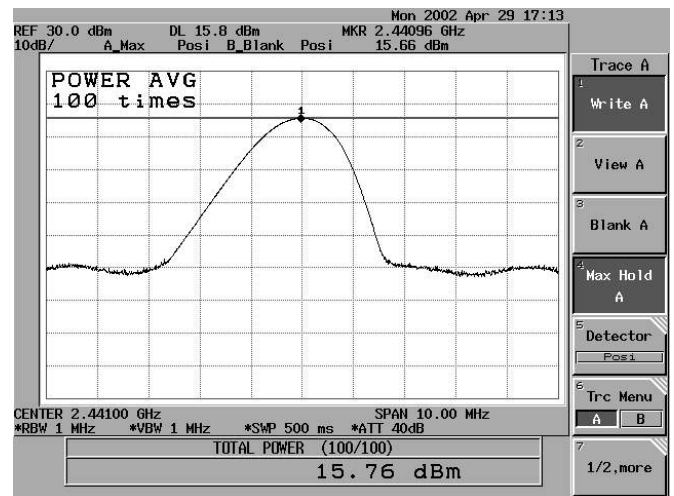
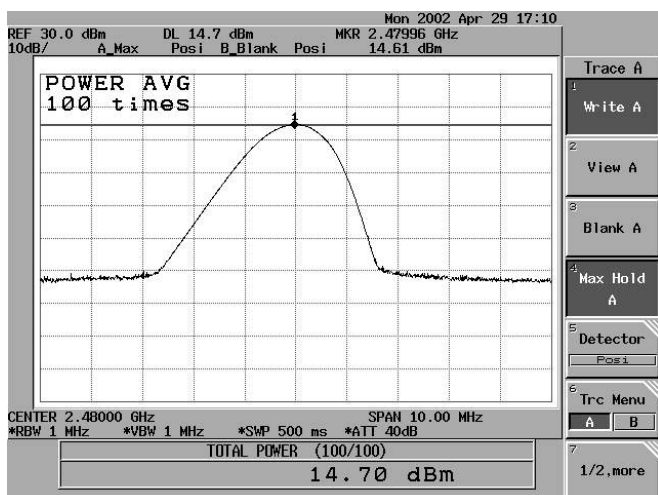


Figure Channel 78



4. RF Exposure Evaluation

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/ Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

F= Frequency in MHz

4.1. Friis Formula

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * r^2)$

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

R = distance between observation point and center of the radiator in cm

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.2. EUT Operation condition

A software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.3. Test Result of RF Exposure Evaluation

Product : PC2PC-Bluetooth
 Test Item : RF Exposure Evaluation Data
 Test Site : No.2 OATS
 Test Mode : Normal Operation

4.3.1 Antenna Gain

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 3dBi.

4.3.2 Output Power Into Antenna & RF Exposure Evaluation Distance

Channel	Channel Frequency (MHz)	Output Power to Antenna (dBm)	Minimum Allowable Distance ® From Skin(cm)
00	2402	16.51	2.666216
39	2439	15.76	2.445655
78	2480	14.7	2.164688

The distance r (4th column) calculated from the Friis transmission formula is far shorter than 20 cm separation requirement. So, RF exposure limit warning or SAR test are not required.

5. Radiated Emission

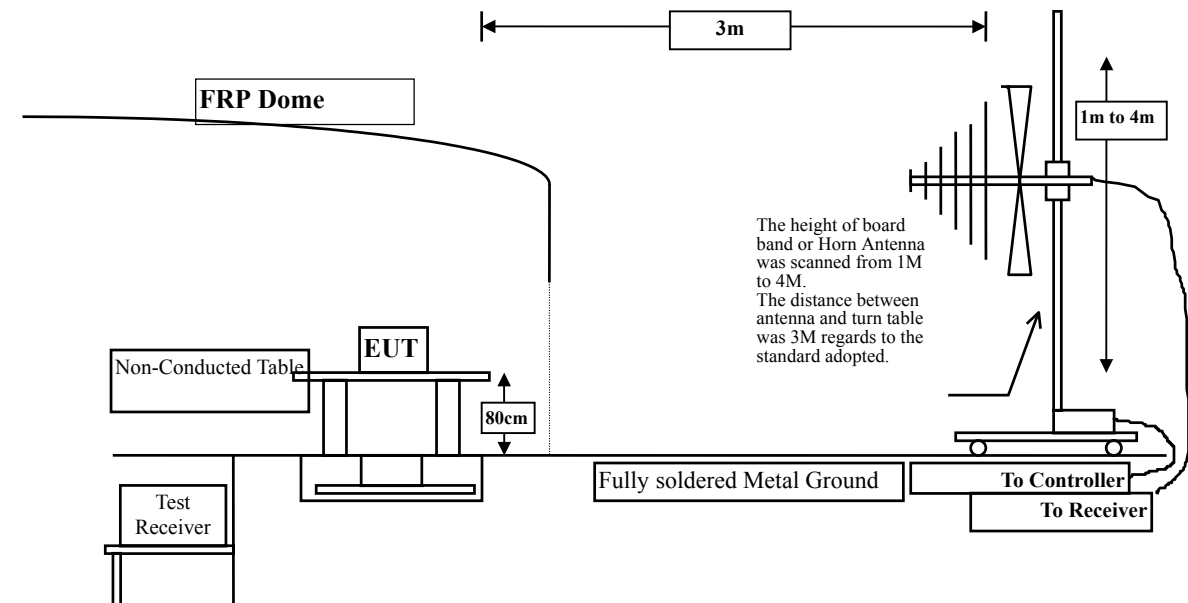
5.1. Test Equipment

The following test equipment 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	July, 2001
	Spectrum Analyzer	Advantest	R3162/ 00803480	May, 2002
	Pre-Amplifier	Advantest	BB525C/ 3307A01812	May, 2002
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	Nov., 2001
☒ Site # 2	Test Receiver	R & S	ESCS 30 / 836858 / 022	Nov., 2001
	Spectrum Analyzer	Advantest	3162 / 100803466	May, 2002
	Pre-Amplifier	Advantest	BB525C/3307A01814	May, 2002
	Bilog Antenna	SCHAFFNER	CBL6112B / 2705	Oct., 2001
	Horn Antenna	ETS	3115 / 0005-6160	July, 2001
	Pre-Amplifier	QTK	QTK-AMP-01/ 0001	July, 2001
☐ Site # 3	Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2002
	Spectrum Analyzer	Advantest	3162 / 100803480	May, 2002
	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2002
	Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2002
	Horn Antenna	ETS	3115 / 0005-6160	July, 2001
	Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2001

- Note:
1. All equipments that need to calibrate are with calibration period of 1 year.
 2. Mark "X" test instruments are used to measure the final test results.

5.2. Test Setup



5.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

5.4. 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(a) 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.

5.5. 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 C63.4:1992 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 (R&S Test Receiver ESCS 30)is 120 kHz, above 1GHz are 1 MHz.

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

5.6. Test Result of Radiated Emission

Product : PC2PC-Bluetooth
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 00

Freq.	Cable	Probe	PreAMP	Reading	Emission	Margin	Limit
MHz	Loss	Factor		Level	Level		
	dB	dB/m	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector

4803.960	6.15	33.55	20.34	33.44	52.80	21.20	74.00
7205.780	7.30	36.65	18.39	28.67	54.23	19.77	74.00
9607.890	8.70	38.22	15.86	27.97	59.03	14.97	74.00
12009.98	9.93	39.01	16.00	18.92	< 51.86	22.14	74.00
14413.42	10.65	40.64	17.02	17.89	< 52.16	21.84	74.00
16813.74	12.25	41.59	16.08	15.00	< 52.76	21.24	74.00
19215.85	12.70	48.78	17.97	9.50	< 53.01	20.99	74.00
21618.03	13.01	49.35	18.76	9.19	< 52.79	21.21	74.00
24019.52	13.61	49.77	19.05	9.14	< 53.48	20.52	74.00

Average Detector

7206.020	7.30	36.65	18.39	19.22	44.78	9.22	54.00
9608.060	8.70	38.22	15.86	18.14	49.20	4.80	54.00

Vertical

Peak Detector

4804.020	6.15	33.55	20.34	32.72	52.08	21.92	74.00
7205.980	7.30	36.65	18.39	29.08	54.64	19.36	74.00
9607.900	8.70	38.22	15.86	27.94	59.00	15.00	74.00
12009.15	9.93	39.01	16.00	18.63	< 51.57	22.43	74.00
14411.26	10.65	40.64	17.02	18.14	< 52.41	21.59	74.00
16814.05	12.25	41.59	16.08	15.11	< 52.86	21.14	74.00
19215.46	12.70	48.96	17.97	9.32	< 53.01	20.99	74.00
21617.84	13.01	49.29	18.76	9.32	< 52.86	21.14	74.00
24019.77	13.61	49.71	19.05	9.46	< 53.74	20.26	74.00

Average Detector

7205.880	7.30	36.65	18.39	18.94	44.50	9.50	54.00
9607.150	8.70	38.22	15.86	18.26	49.32	4.68	54.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Emission Level = Reading Level + Probe Factor + Cable loss-PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : PC2PC-Bluetooth
Test Item : Harmonic Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Channel 39

Freq.	Cable	Probe	PreAMP	Reading	Emission	Margin	Limit
MHz	Loss	Factor		Level	Level		
	dB	dB/m	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector

4882.300	6.21	33.82	19.50	30.53	51.07	22.93	74.00
7323.040	7.39	37.02	18.27	28.31	54.44	19.56	74.00
9764.160	8.87	38.35	15.81	27.00	58.42	15.58	74.00
12205.20	10.16	39.08	16.31	18.75	< 51.68	22.32	74.00
14646.35	10.67	40.02	17.87	19.25	< 52.06	21.94	74.00
17088.35	12.30	43.01	16.29	13.92	< 52.95	21.05	74.00
19529.34	12.76	48.75	18.19	9.72	< 53.04	20.96	74.00
21969.34	13.05	49.49	18.80	8.74	< 52.48	21.52	74.00
24410.15	13.73	49.82	19.10	9.04	< 53.49	20.51	74.00

Average Detector

7323.040	7.39	37.02	18.27	18.86	44.99	9.01	54.00
9764.160	8.87	38.35	15.81	18.31	49.73	4.27	54.00

Vertical

Peak Detector

4881.990	6.21	33.82	19.50	30.07	50.61	23.39	74.00
7322.900	7.39	37.02	18.27	28.53	54.66	19.34	74.00
9764.190	8.87	38.35	15.81	27.40	58.82	15.18	74.00
12205.30	10.16	39.08	16.31	18.75	< 51.68	22.32	74.00
14639.85	10.67	40.02	17.87	19.51	< 52.32	21.68	74.00
17087.56	12.30	43.01	16.29	13.92	< 52.95	21.05	74.00
19528.26	12.76	48.98	18.19	9.47	< 53.02	20.98	74.00
21969.21	13.05	49.35	18.80	9.08	< 52.68	21.32	74.00
24410.32	13.73	49.79	19.10	9.14	< 53.56	20.44	74.00

Average Detector

7323.010	7.39	37.02	18.27	19.02	45.15	8.85	54.00
9764.040	8.87	38.35	15.81	18.45	49.87	4.13	54.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Emission Level = Reading Level + Probe Factor + Cable loss-PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : PC2PC-Bluetooth
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.2 OATS
 Test Mode : Channel 78

Freq.	Cable	Probe	PreAMP	Reading	Emission	Margin	Limit
MHz	Loss	Factor		Level	Level		
	dB	dB/m	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal

Peak Detector

4959.860	6.27	33.99	19.49	31.10	51.87	22.13	74.00
7440.160	7.47	37.30	18.09	28.91	55.59	18.41	74.00
9920.100	9.03	38.51	15.62	28.30	60.22	13.78	74.00
12400.30	10.38	39.16	16.05	18.19	< 51.68	22.32	74.00
14880.50	10.69	39.20	17.10	19.15	< 51.95	22.05	74.00
17360.25	12.36	45.09	16.51	11.49	< 52.43	21.57	74.00
19840.30	12.82	48.72	18.44	9.86	< 52.96	21.04	74.00
22320.40	13.14	49.54	18.84	9.18	< 53.02	20.98	74.00
24800.61	13.84	49.87	19.14	8.95	< 53.52	20.48	74.00

Average Detector

7440.010	7.47	37.30	18.09	19.81	46.49	7.51	54.00
9920.210	9.03	38.51	15.62	17.94	49.86	4.14	54.00

Vertical

Peak Detector

4959.800	6.27	33.99	19.49	32.17	52.94	21.06	74.00
7440.020	7.47	37.30	18.09	28.87	55.55	18.45	74.00
9920.210	9.03	38.51	15.62	28.32	60.24	13.76	74.00
12400.20	10.38	39.16	16.05	17.87	< 51.36	22.64	74.00
14880.50	10.69	39.20	17.10	19.16	< 51.96	22.04	74.00
17360.25	12.36	45.09	16.51	11.36	< 52.30	21.70	74.00
19841.02	12.82	48.72	18.44	9.52	< 52.62	21.38	74.00
22320.10	13.14	49.54	18.84	9.17	< 53.01	20.99	74.00
24800.21	13.84	49.87	19.14	9.00	< 53.57	20.43	74.00

Average Detector

7439.950	7.47	37.30	18.09	20.09	46.77	7.23	54.00
9920.020	9.03	38.51	15.62	17.89	49.81	4.19	54.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Emission Level = Reading Level + Probe Factor + Cable loss-PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : PC2PC-Bluetooth
Test Item : General Radiated Emission Data
Test Site : No.2 OATS
Test Mode : Normal Operation

Freq.	Cable	Probe	PreAMP	Reading	Emission	Margin	Limit
	Loss	Factor		Level	Level		
MHz	dB	dB/m	dB	dBuV	dBuV/m	dB	dBuV/m

Horizontal:

195.870	0.60	10.88	20.70	46.94	37.71	5.79	43.50
400.540	0.80	14.95	20.70	42.78	37.83	8.17	46.00
* 458.740	1.00	21.20	20.70	39.64	41.14	4.86	46.00
589.690	1.20	22.62	20.70	34.70	37.82	8.18	46.00
835.100	1.60	26.61	20.70	32.52	40.02	5.98	46.00
861.290	1.60	25.53	20.70	31.63	38.06	7.94	46.00

Vertical:

195.870	0.60	14.12	20.70	45.20	39.22	4.28	43.50
339.430	1.00	13.66	20.70	42.04	36.00	10.00	46.00
400.540	0.80	13.23	20.70	40.27	33.60	12.40	46.00
* 456.800	1.00	16.90	20.70	44.77	41.97	4.03	46.00
521.790	1.20	19.45	20.70	36.28	36.23	9.77	46.00
629.460	1.40	19.20	20.70	34.85	34.76	11.24	46.00

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. “ * ”, means this data is the worst emission level.
3. Emission Level = Reading Level + Probe Factor + Cable loss- Pre Amp.

6. Band Edge

6.1. Test Equipment

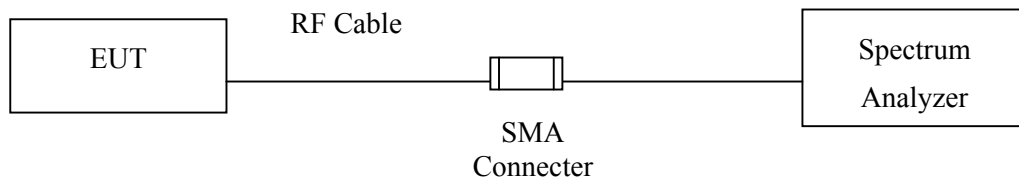
The following test equipments are used during the band edge tests:

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X Spectrum Analyzer	Advantest	R3272 / 72421194	May, 2002
X Test Receiver	R & S	ESCS 30 / 83685/022	Jan., 2002
X Spectrum Analyzer	Advantest	R3162 / 100803462	May, 2002
X Pre-Amplifier	HP	8447D/3307A01812	May, 2002
X Bilog Antenna	Chase	CBL6112B / 2705	Sep., 2001
X Horn Antenna	ETS	3115 / 0005-6160	May, 2002

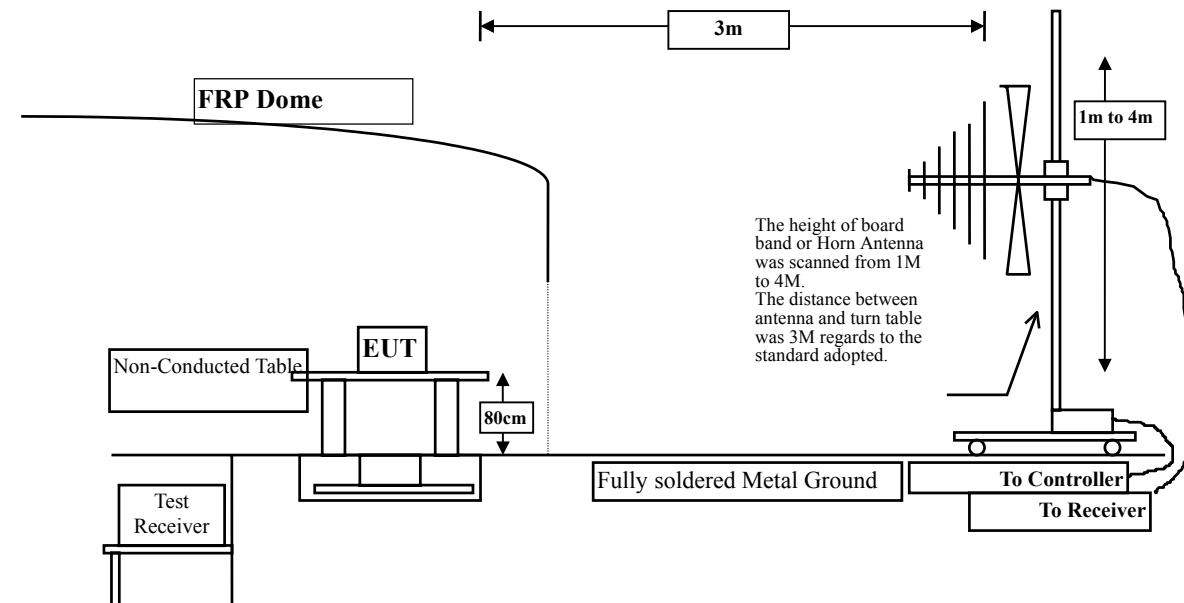
- Note: 1. All equipments that need to calibrate are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

6.2. Test Setup

RF Conducted Measurement:



RF Radiated Measurement:



6.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

6.4. 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)).

6.5. Test Result of Band Edge

Product : PC2PC-Bluetooth
 Test Item : Band Edge Data
 Test Site : No.2 OATS
 Test Mode : Channel 00

RF Radiated Measurement:

Polarization	Frequency (MHz)	Required Limit (dBc)	Result
Horizontal	<2400	>20	Pass
Vertical	<2400	>20	Pass

Figure Channel 00: (Horizontal)

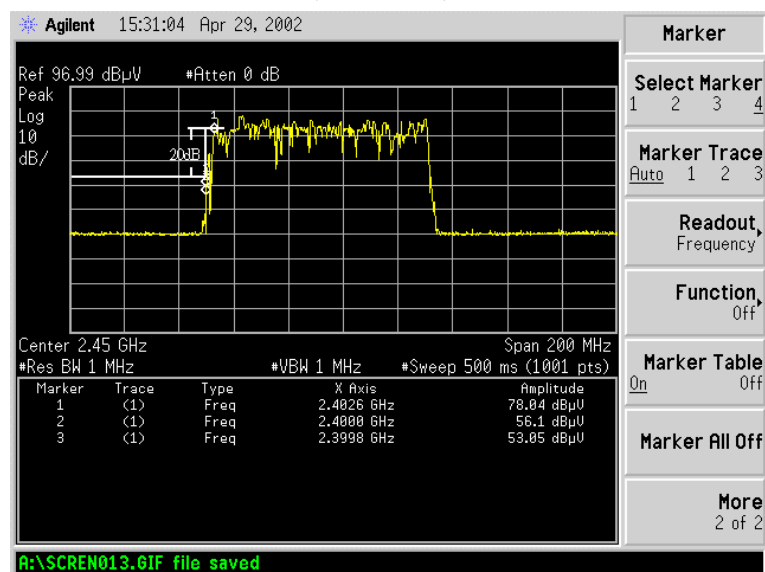
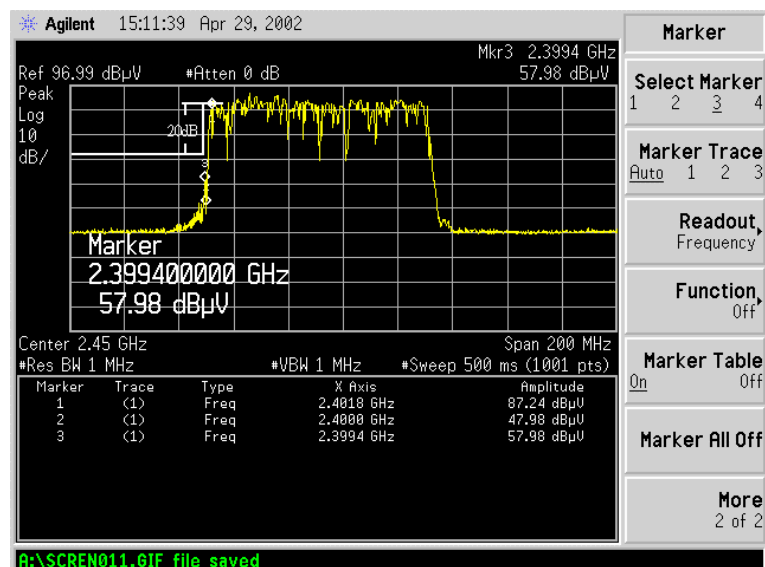


Figure Channel 00: (Vertical)



Product : PC2PC-Bluetooth
 Test Item : Band Edge Data
 Test Site : No.2 OATS
 Test Mode : Channel 78

RF Radiated Measurement:

Polarization	Frequency (MHz)	Reading Level (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Result
Horizontal	2497.2	39	51.91	54	Pass
Vertical	2484.7	40.08	52.89	54	Pass

Figure Channel 78:

(Horizontal)

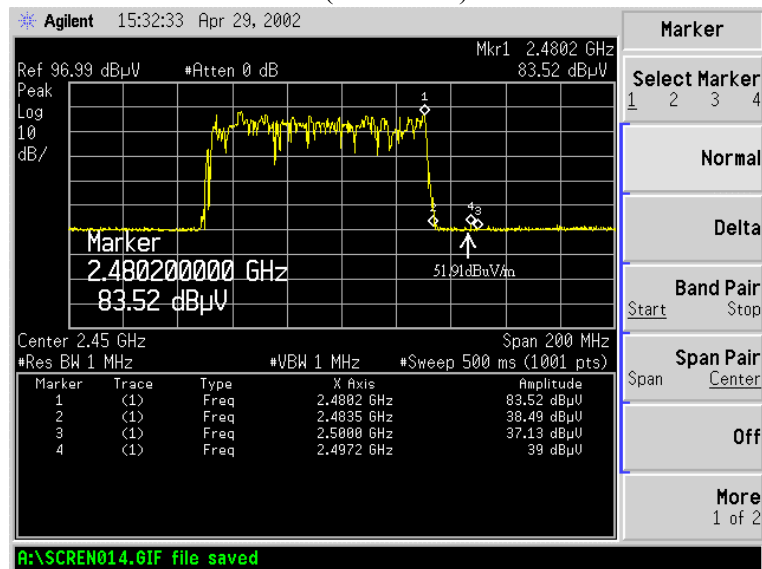
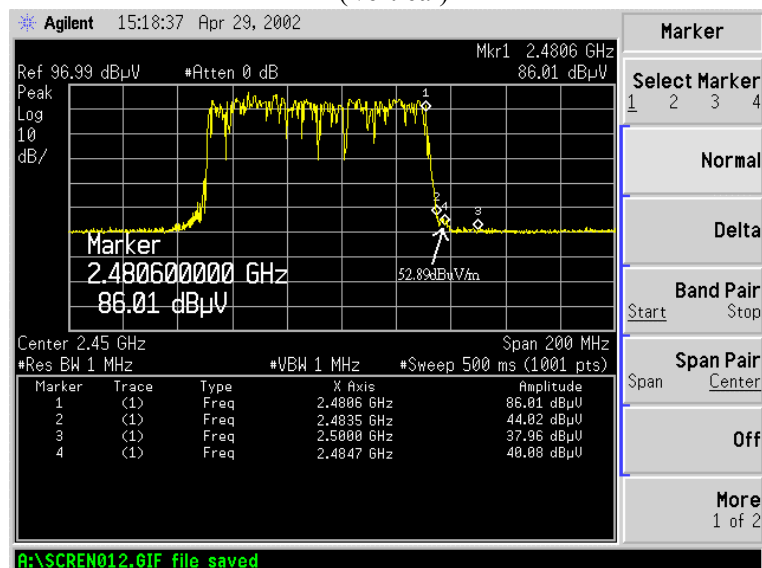


Figure Channel 78:

(Vertical)



7. Occupied Bandwidth

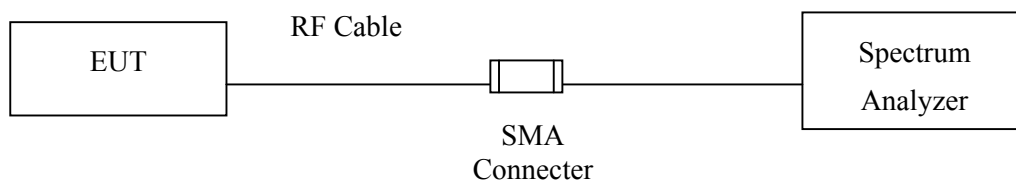
7.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum	Advantest	R3162 / 00803480	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

7.2. Test Setup



7.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

7.4. Limit

The maximum 20 dB bandwidth of the hopping channel is 1 MHz.

7.5. Test Result of Occupied Bandwidth

Product : PC2PC-Bluetooth
 Test Item : Occupied Bandwidth Data
 Test Site : No.2 OATS
 Test Mode : Normal Operation

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (MHz)	Result
00	2402	380	<1	Pass
39	2437	370	<1	Pass
78	2480	370	<1	Pass

Figure Channel 00

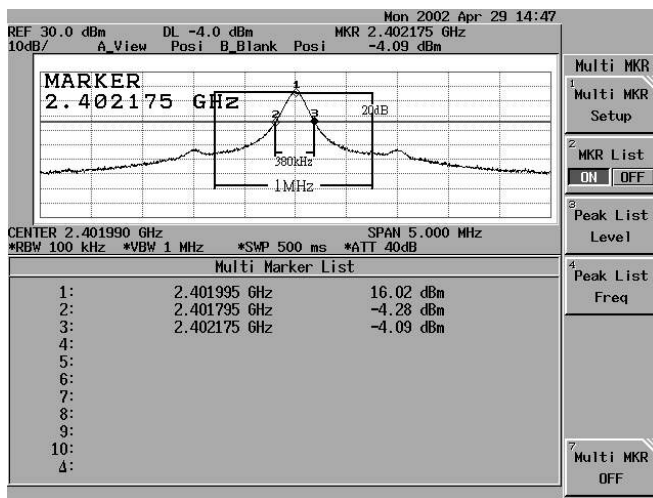


Figure Channel 39

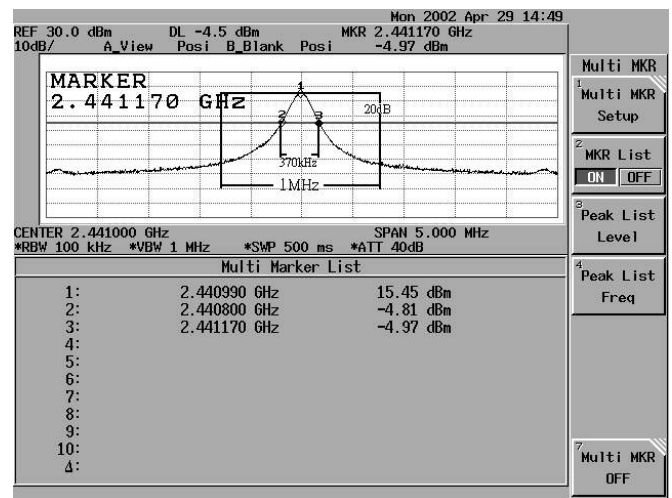
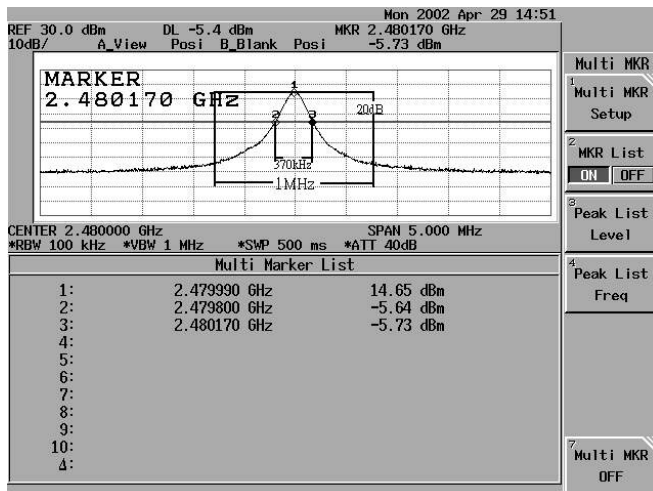


Figure Channel 78:



8. Channel of Number

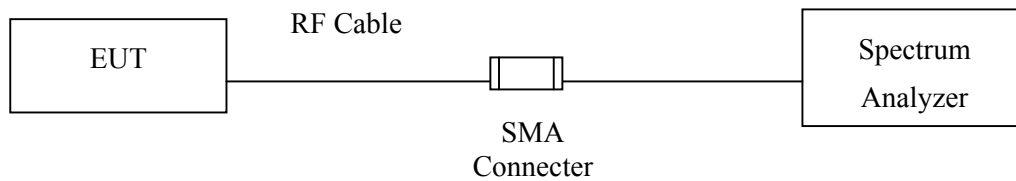
8.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum	Advantest	R3162 / 00803480	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

8.2. Test Setup



8.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

8.4. Limit

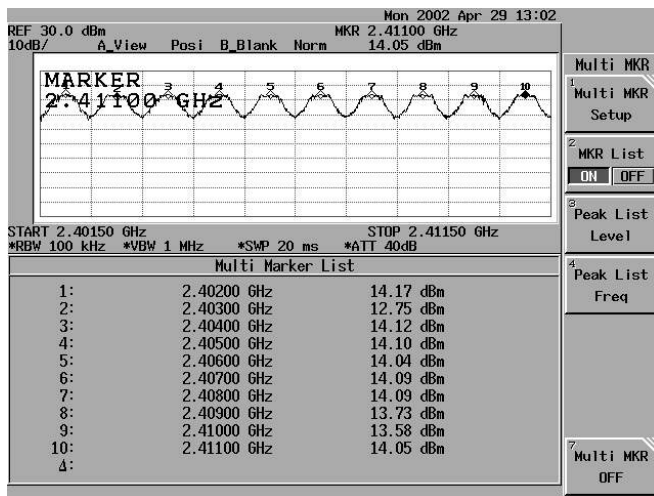
Frequency hopping systems operating in the 2400-2483.5 MHz bands shall use at least 75 hopping frequencies.

8.5. Test Result of Channel Number

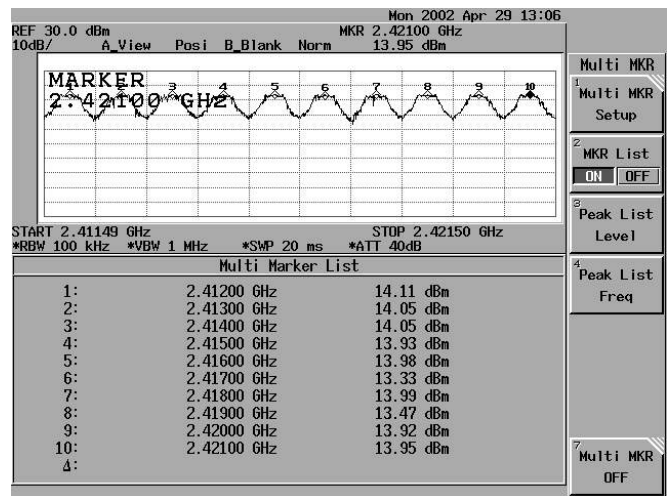
Product : PC2PC-Bluetooth
 Test Item : Sweep of Channel Number
 Test Site : No.3 OATS
 Test Mode : Normal Operation

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

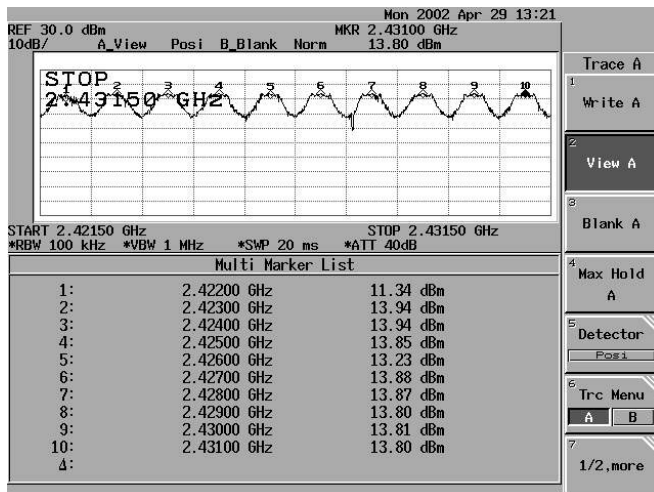
2402-2411MHz



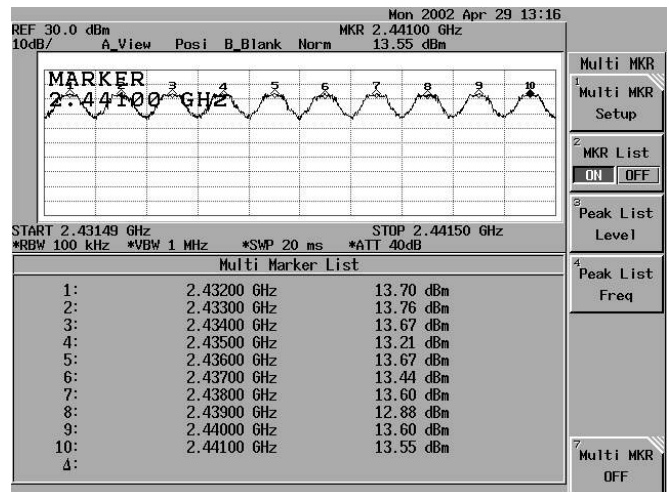
2412-2421MHz



2422-2431MHz

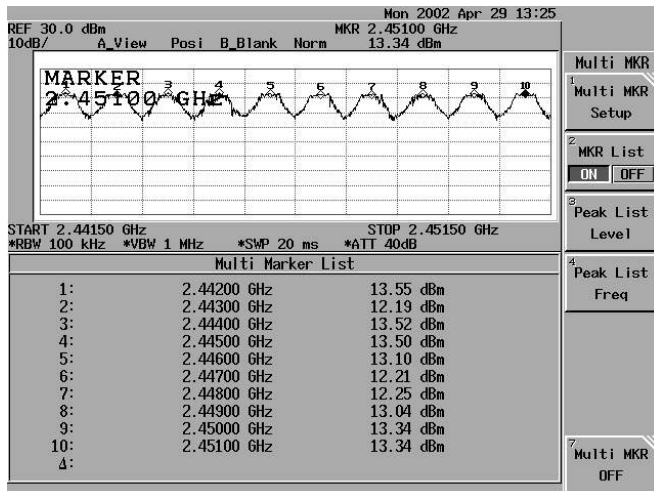


2432-2441MHz

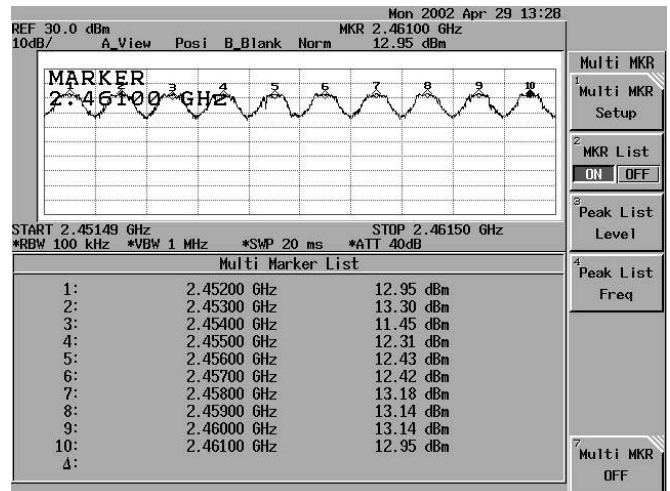


Product : PC2PC-Bluetooth
 Test Item : Sweep of Channel Number
 Test Site : No.3 OATS
 Test Mode : Normal Operation

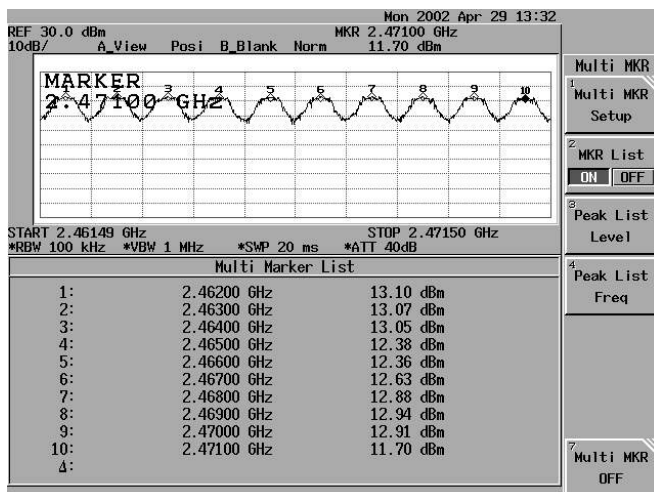
2442-2451MHz



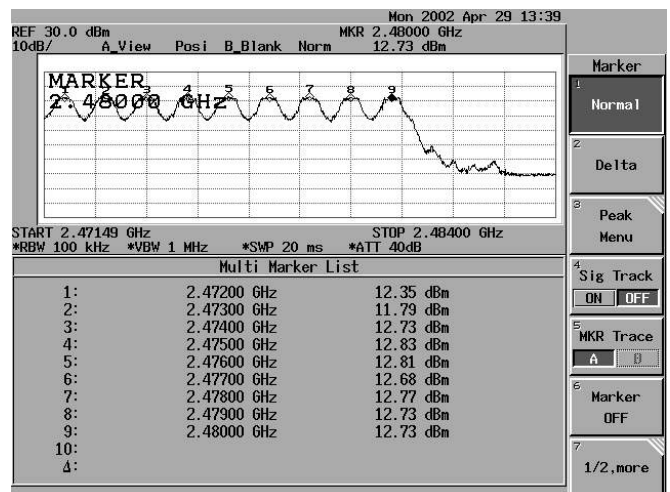
2452-2461MHz



2462-2471MHz



2472-2480MHz



9. Channel Separation

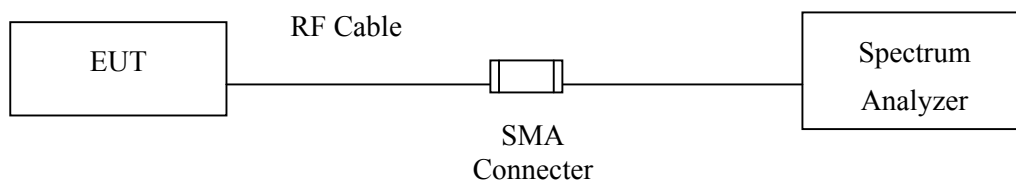
9.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum	Advantest	R3162 / 00803480	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

9.2. Test Setup



9.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

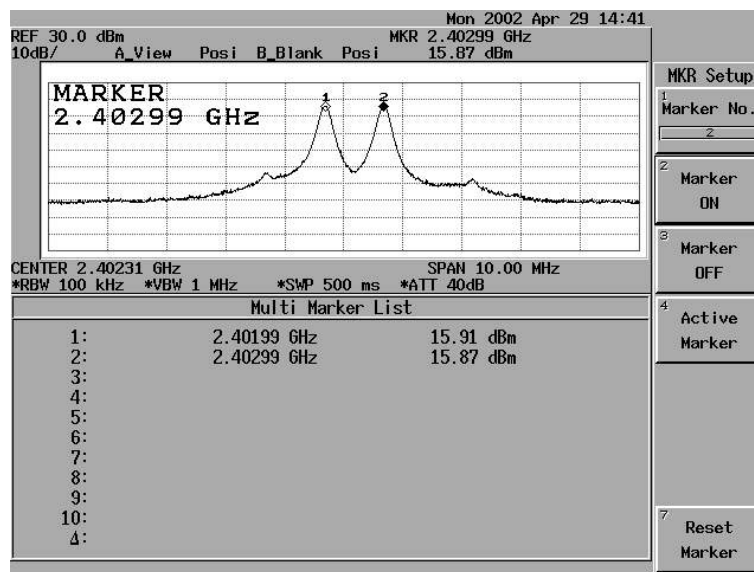
9.4. Limit

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.

9.5. Test Result of Channel Separation

Product : PC2PC-Bluetooth
 Test Item : Channel Separation Data
 Test Site : No.2 OATS
 Test Mode : Normal Operation

Measurement Level (MHz)	Required Limit (MHz)	Result
1	< 1	Pass



10. Dwell Time

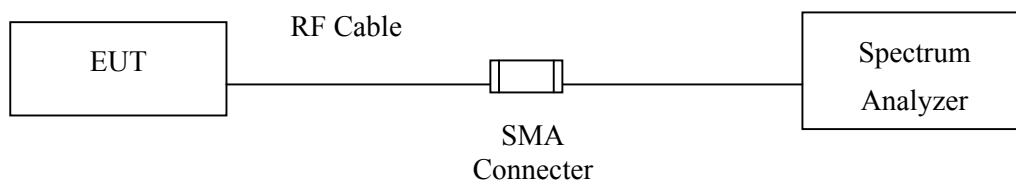
10.1. Test Equipment

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

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum	Advantest	R3162 / 00803480	May, 2002

Note: 1. All equipment upon which need to calibrated are with calibration period of 1 year.
2. Mark "X" test instruments are used to measure the final test results.

10.2. Test Setup



10.3. Test Condition

Standard Temperature and Humidity, Standard Test Voltage

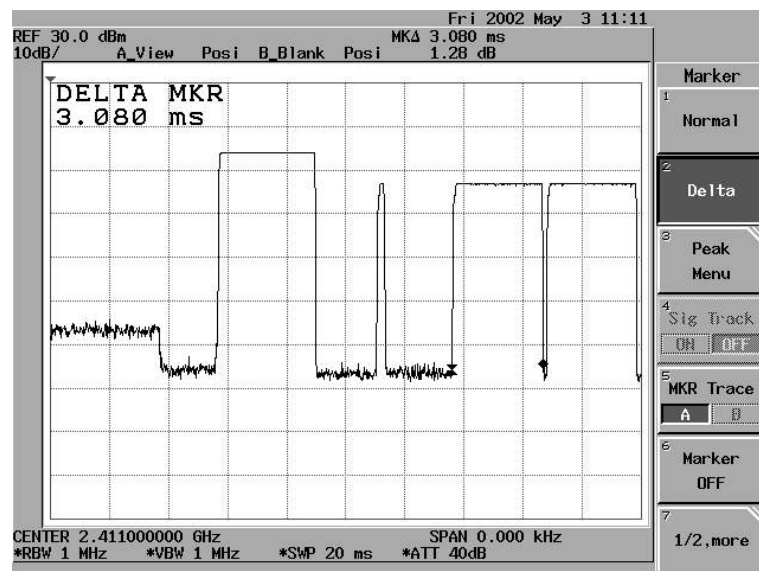
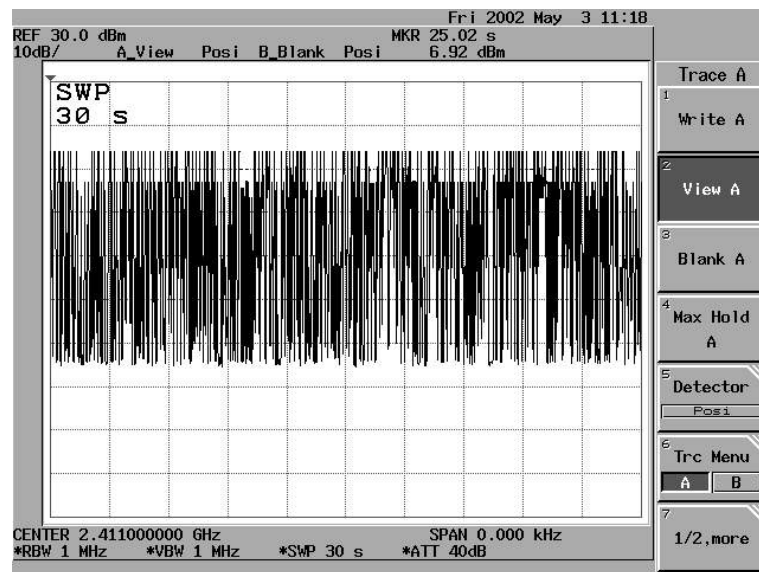
10.4. Limit

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.

10.5. Test Result of Dwell Time

Product : PC2PC-Bluetooth
 Test Item : Dwell Time Data
 Test Site : No.2 OATS
 Test Mode : Hopping Mode

Measurement Level (ms)	Required Limit (Sec)	Result
123*3.08=378.84(ms)	<0.4 (sec)	Pass



11. EMI Reduction Method During Compliance Testing

No modification was made during testing.

The following exhibit indicates the FCC Spread Spectrum requirements in Section 15.247 for devices meeting the Bluetooth Specifications in the 2.4GHz band. The purpose of this exhibit is to help expedite the approval process for Bluetooth devices. This exhibit only specifies requirements in Section 15.247, requirement in order rule Sections for intentional radiators such as in Section 15.203 or 15.207 must be also be addressed.

1. Frequency range and RF channels of a Bluetooth device

The operating frequency range of the device is 2402 – 2480MHz. The operating band of 78MHz is divided into 79 1MHz spaced channels, each signaling data at 1M symbols per second.

2. Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters

Bluetooth system provides a point-to-point connection or point-to-multipoint connection. The channel is shared among several Bluetooth units in the point-to-multipoint connection. Two or more bluetooth units sharing the same channel form a piconet. One bluetooth unit acts as the master of the piconet, while the other units act as slave. Up to 7 slaves can be active in a piconet. The bluetooth units in piconet perform 1600 frequency hopping per second over 79 RF channels. The frequency hopping sequence is determined by the bluetooth device address of the master, and the phase in the hopping sequence is determined by the system clock of the master. Since the bluetooth device address is unique for every bluetooth device, different piconets with different masters will always have different hopping sequence.

3. Equally average use of frequencies in data mode and short transmissions

The LAP (lower address part) are the 24 LSBs of the 48 bluetooth device address (BD_ADDR) while the UAP (upper address part) are 8 bits preceding LAP. The LAP and UAP form the significant part of the BD_ADDR. The BD_ADDRESS is an unambiguous number of every Bluetooth unit.

The generation of the hopping sequence in connection mode depends essentially on two input values

1.) LAP/UAP of the master of the connection

This part consists of 28 bits, i.e., the entire LAP and the 4 LSBs of the UAP.

2.) Internal master clock

Only the 27 MSBs of the master clock are used.

The hop sequence selection scheme chooses a segment of 32 hop frequencies spanning about 64 MHz and visits these hops in random order. Next, a different 32-hop segment is chosen, etc. The clock bit 6 to 2 determines the phase in the 32-hop segment, while the clock bit 1 selects whether master-to-slave or slave-to-master transmission. The master address bit 27 to 10 and 8,6,4,2,0 in conjunction with clock bit 25 to 7 determines the ordering within the segment. The address bit 1,3,5,7,9,11,13 and clock bit 27 to 7 determine the mapping onto the hop frequencies. Consequently, after every 32 time slots, a new length 32

segment is selected in the 79-hops system. The sequence order within a specific segment will not be repeated for a very long period. The frequency hopping sequence will not be repeated almost for a whole day. The kernel addresses a register containing the hop frequencies. The list should be created such that first all even hop frequencies are listed and then all odd hop frequencies. In this way, a 32-hop segments spans about 64 MHz. The overall hopping sequence consists of concatenated segments of 32-hops each. Since each 32-hop sequence spans more than 80% of the 78 MHz band, the desired frequency spreading over a short time interval is also obtained.

4. Receiver Input bandwidth, synchronization and retransmitting single or multiple packets

The input bandwidth of the receiver is 1MHz (per channel). In every connection, the master of piconet determines the hopping sequence. The slaves follow this sequence. All devices in the piconet shift between RX and TX time slot according to the clock of the master. The master shall start its transmission in even numbered time slots only, while the slave shall start its transmission in odd numbered time slots only. Additionally, the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The packet start shall be aligned with the slot start. Packets transmitted by the master or the slave may extend over up to five time slots. The hop frequency shall remain fixed for the duration of the packet. For a single packet, the hop frequency to be used is derived from the current master clock value. For a multi-slot packet, the hop frequency is derived from the master clock value in the first slot of packet. The hop frequency of the first slot after multi-slot packet shall be determined by the current master clock value. Retransmission of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That is, retransmission packet will not be sent on the same frequency, it is sent on the other hopping frequency of the frequency hopping sequence.