

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product name: Bluetooth Headset

Brand Name: WELLDONE

Model Name: BTW-301

FCC ID: RRQ-BTW-301

REPORT NO: ER/2003/C0016

ISSUE DATE: Dec. 31, 2003

FCC Rule Part: §15.247

Prepared for WELLDONE COMPANY

No. 1, Lane 279, Nanyang Street, Shijr
City, Taipei County, Taiwan.

Prepared by SGS Taiwan Ltd.

No. 134, Wu Kung Rd., Wuku Industrial
Zone, Taipei County, Taiwan.

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VERIFICATION OF COMPLIANCE

Applicant: WELLDONE COMPANY

No. 1, Lane 279, Nanyang Street, Shijr City,
Taipei County, Taiwan.

Equipment Under Test: Bluetooth Headset

Brand Name: WELLDONE

FCC ID Number: RRQ-BTW-301

MODEL No.: BTW-301

Model Difference: N/A

File Number: ER/2003/C0016

Date of test: Dec. 09, 2003 ~ Dec. 17, 2003

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (1992) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247

The test results of this report relate only to the tested sample identified in this report.

Test By:

Willis Chen

Date

Dec. 31, 2003

Willis Chen

Approved By

Vincent Su

Date

Dec. 31, 2003

Vincent Su

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Table of Contents

1. GENERAL INFORMATION	5
1.1 Product Description	5
1.2 Related Submittal(s) / Grant (s)	5
1.3 Test Methodology	5
1.4 Test Facility.....	5
1.5 Special Accessories.....	5
1.6 Equipment Modifications.....	5
2. SYSTEM TEST CONFIGURATION	6
2.1 EUT Configuration	6
2.2 EUT Exercise	6
2.3 Test Procedure.....	6
2.4 Configuration of Tested System.....	7
3. SUMMARY OF TEST RESULTS	8
4. DESCRIPTION OF TEST MODES	8
5. CONDUCTED EMISSION TEST.....	9
5.1 Standard Applicable	9
5.2 EUT Setup.....	9
5.3 Measurement Procedure.....	9
5.4 Measurement Equipment Used:.....	10
5.5 Measurement Result.....	10
6. PEAK OUTPUT POWER MEASUREMENT.....	15
6.1 Standard Applicable	15
6.2 Measurement Procedure.....	15
6.3 Measurement Result.....	15
6.4 Measurement Equipment Used:.....	15
7. 20dB BAND WIDTH	18
7.1 Standard Applicable	18
7.2 Measurement Procedure.....	18
7.3 Measurement Result.....	18
7.4 Measurement Equipment Used:.....	18
8. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT.....	21
8.1 Standard Applicable	21
8.2 Measurement Procedure.....	21
8.3 Measurement Result.....	21
8.4 Measurement Equipment Used:.....	21

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9. SPURIOUS RADIATED EMISSION TEST.....	25
9.1 Standard Applicable	25
9.2 EUT Setup.....	25
9.3 Measurement Procedure.....	25
9.4 Test SET-UP (Block Diagram of Configuration).....	26
9.5 Measurement Equipment Used:	27
9.6 Field Strength Calculation	27
9.7 Measurement Result.....	27
10. FREQUENCY SEPARATION.....	40
10.1 Standard Applicable	40
10.2 Measurement Procedure.....	40
10.3 Measurement Result.....	40
10.4 Measurement Equipment Used:	40
11. NUMBER OF HOPPING FREQUENCY	42
11.1 Standard Applicable	42
11.2 Measurement Procedure.....	42
11.3 Measurement Result.....	42
11.4 Measurement Equipment Used:	42
12. TIME OF OCCUPANCY (DWELL TIME)	44
12.1 Standard Applicable	44
12.2 Measurement Procedure.....	44
12.3 Measurement Result.....	44
12.4 Measurement Equipment Used:	45
13. Peak Power Spectral Density	48
13.1 Standard Applicable	48
13.2 Measurement Procedure.....	48
13.3 Measurement Result.....	48
13.4 Measurement Equipment Used:	48
14. ANTENNA REQUIREMENT	51
14.1 Standard Applicable	51
14.2 Antenna Connected Construction	51
15. RF EXPOSURE	52
15.1 Standard Applicable	52
15.2 Measurement Result:	52

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1. GENERAL INFORMATION

1.1 Product Description

The WELL DONE COMPANY, Model: BTW-301 (referred to as the EUT in this report) is Bluetooth Headset

The EUT is compliance with Bluetooth Standard.

A major technical descriptions of EUT is described as following:

- A). Operation Frequency: 2402 – 2480MHz, 79 channels
- B). Rated output power: 0 dBm
- C). Modulation type: Frequency Hopping Sequence Spread Spectrum (FHSS)
- D). Antenna Designation: SMD Antenna, 4 dBi, Non-User Replaceable (Fixed)
- E). Power Supply: Output: 3.7V DC by AC/DC Power Adapter

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **RRQ-BTW-301** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (receiver) is compliance with Subpart B is authorized under a Doc procedure.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the address of SGS Taiwan Ltd. No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan. The Open Area Test Sites and the Line Conducted labs are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 1992 and CISPR 22/EN 55022 requirements. Site No. 1(3 &10 meters) Registration Number: 94644, Anechoic chamber (3 meters) Registration Number: 573967

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

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2. SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-1992. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-1992.

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2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

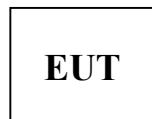


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	FCC ID	Series No.	Data Cable	Power Cord
1.	N/A						

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	Conducted Emission	Compliant
§15.247(b)	Peak Output Power	Compliant
§15.247(a)(1)(ii)	20dB Bandwidth	Compliant
§15.247(c)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.209(a) (f)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(ii)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)	Time of Occupancy	Compliant
§15.247	Peak Power Density	Compliant
§15.203	Antenna Requirement	Compliant
§1.1310	RF Exposure	Compliant

4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low (2402MHz) 、 mid (2441MHz) and high (2480MHz) with 741k highest data rate are chosen.

The device will not work when Battery Charge.

Two AC/DC power adapters were tested for AC power line Conducted Emission.

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5. CONDUCTED EMISSION TEST

5.1 Standard Applicable

According to §15.207. frequency within 150KHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

5.2 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-1992.
2. The AC/DC power adapter of EUT was plug-in LISN of the back edge on the test table.
3. The system was connected with 110Vac/60Hz power source.

5.3 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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5.4 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMC Analyzer	HP	8594EM	3624A00203	12/31/2003	12/30/2004
EMI Test Receiver	R&S	ESCS30	828985/004	1/15/2003	1/14/2004
LISN	Rolf-Heine	NNB-2/16Z	99012	12/30/2003	12/29/2004
LISN	Rolf-Heine	NNB-2/16Z	99013	11/06/2003	11/05/2004

5.5 Measurement Result

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Battery Charge			Test Date:	Dec. 18, 2003
Temperature:	24 °C		Humidity:	68 %	Test By:
Adapter model:	MU03-D050020-A1				Willis Chen

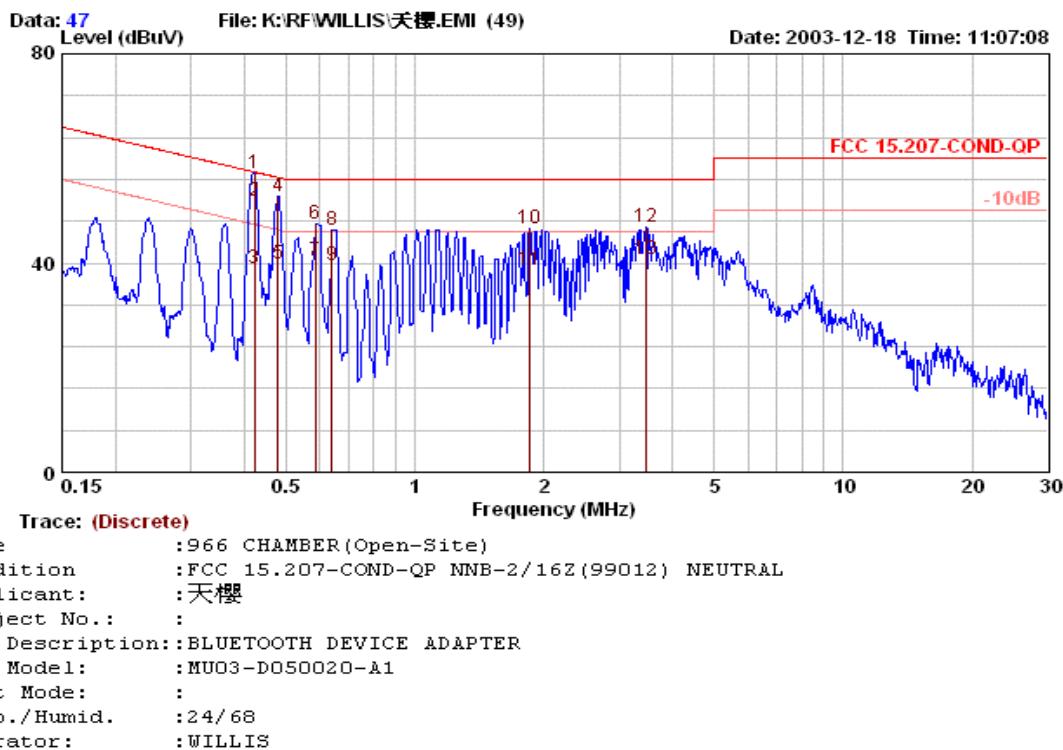
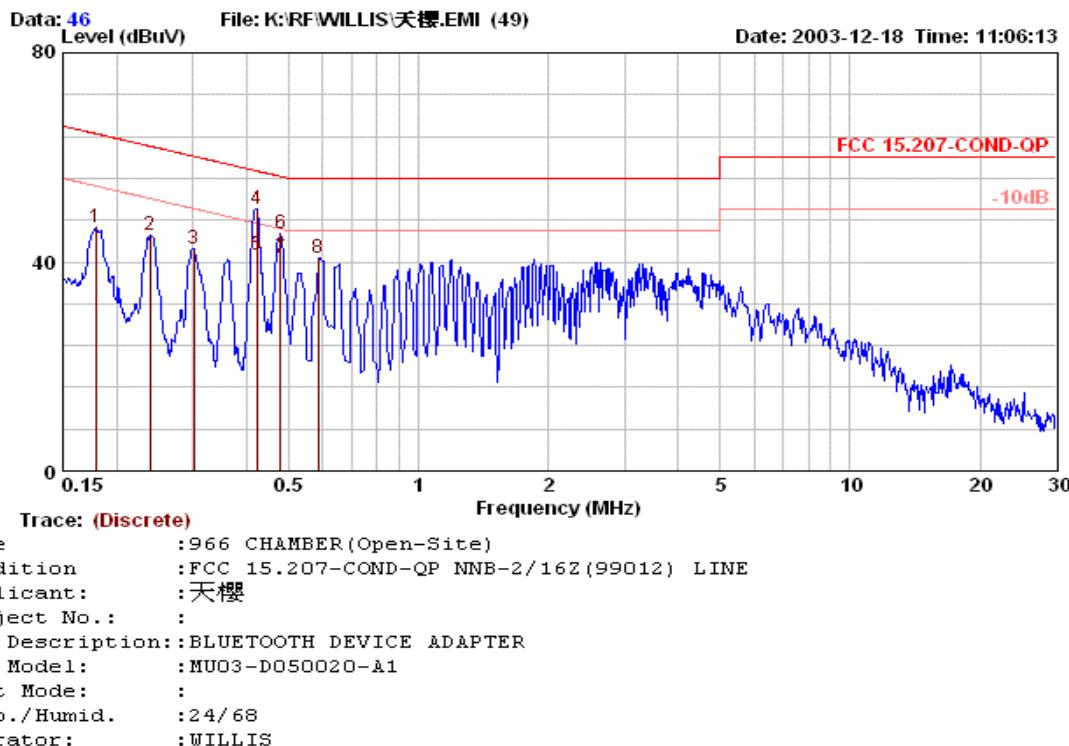
FREQ MHz	Q.P. Raw dBuV	AVG Raw dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
0.179	46.56	---	64.55	54.55	-17.99	---	L1
0.239	45.22	---	62.13	52.13	-16.91	---	L1
0.302	42.56	---	60.19	50.19	-17.63	---	L1
0.421	50.07	---	57.43	47.43	-7.36	---	L1
0.479	45.47	41.39	56.36	46.36	-10.89	-4.97	L1
0.585	40.87	40.84	56.00	46.00	-15.13	-5.16	L1
0.421	51.96	38.93	57.43	47.43	-5.47	-8.50	L2
0.479	52.74	39.92	56.36	46.36	-3.62	-6.44	L2
0.585	47.54	40.33	56.00	46.00	-8.46	-5.67	L2
0.641	46.21	39.53	56.00	46.00	-9.79	-6.47	L2
1.858	46.55	38.65	56.00	46.00	-9.45	-7.35	L2
3.472	46.78	40.76	56.00	46.00	-9.22	-5.24	L2

Remark :

- (1) Measuring frequencies from 0.15 MHz to 30MHz .
- (2) The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Qusia-Peak detector and Average detector.
- (3) “---” denotes the emission level was or more than 2dB below the Average limit, so no re-check anymore.
- (4) The IF bandwidth of SPA between 0.15MHz to 30MHz was 10KHz;
The IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9KHz;
- (5) L1 = Line One (Hot side) / L2 = Line Two (Neutral side)

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Conducted Emission Test Plot



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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Battery Charge			Test Date:	Dec. 18, 2003
Temperature:	24 °C		Humidity:	68 %	Test By:
Adapter model:	MU03-D050020-C5				Willis Chen

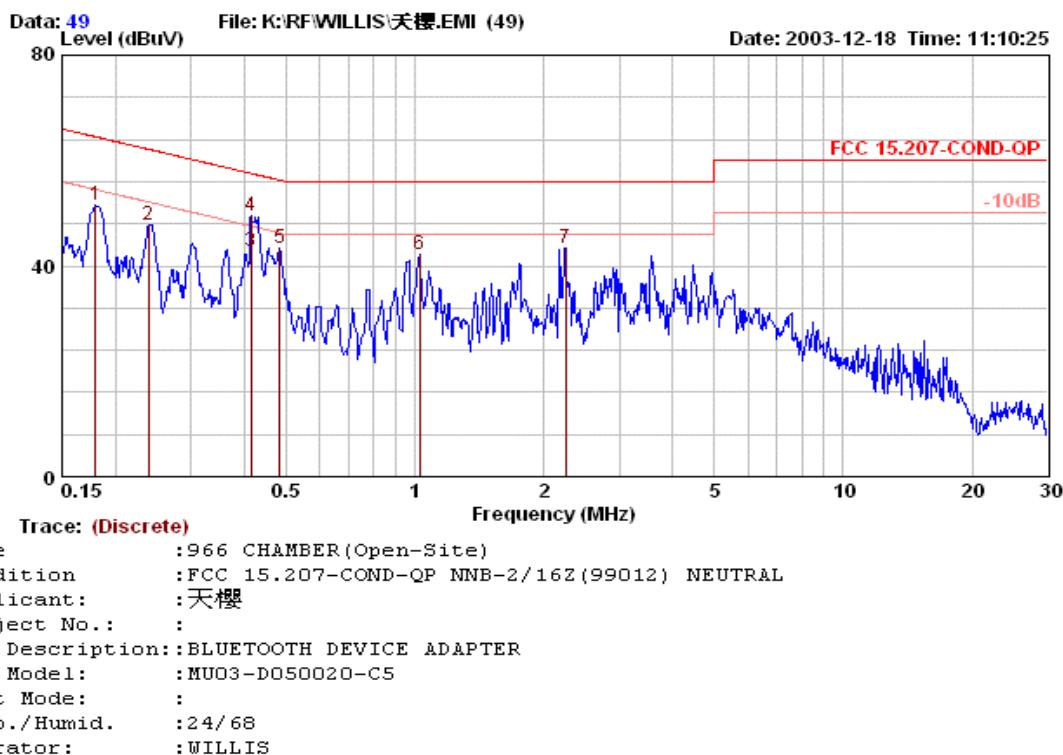
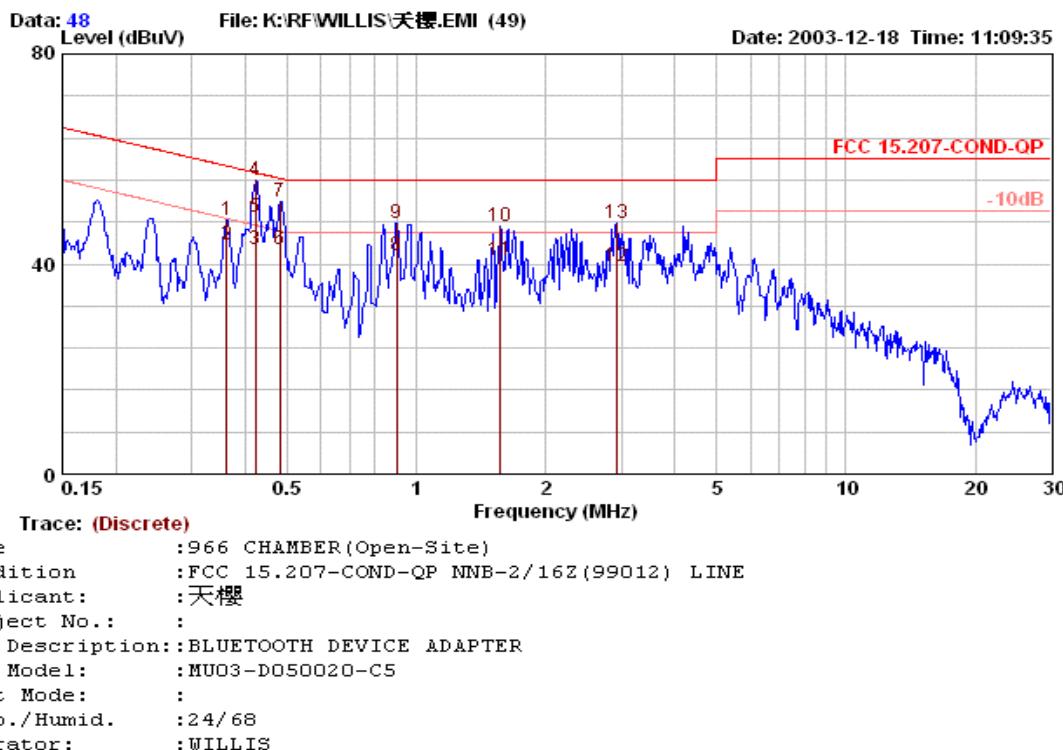
FREQ MHz	Q.P. Raw dBuV	AVG Raw dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
0.361	43.71	---	58.71	48.71	-15.00	---	L1
0.421	48.87	42.89	57.43	47.43	-8.56	-4.54	L1
0.481	51.84	42.81	56.32	46.32	-4.48	-3.51	L1
0.899	47.84	41.49	56.00	46.00	-8.16	-4.51	L1
1.568	47.11	40.76	56.00	46.00	-8.89	-5.24	L1
2.915	47.64	39.67	56.00	46.00	-8.36	-6.33	L1
<hr/>							
0.180	51.44	---	64.49	54.49	-13.05	---	L2
0.239	47.91	---	62.13	52.13	-14.22	---	L2
0.415	49.58	42.84	57.55	47.55	-7.97	-4.71	L2
0.484	43.44	---	56.27	46.27	-12.83	---	L2
1.027	42.20	---	56.00	46.00	-13.80	---	L2
2.249	43.29	---	56.00	46.00	-12.71	---	L2

Remark :

- (1) Measuring frequencies from 0.15 MHz to 30MHz .
- (2) The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Qusia-Peak detector and Average detector.
- (3) “---” denotes the emission level was or more than 2dB below the Average limit, so no re-check anymore.
- (4) The IF bandwidth of SPA between 0.15MHz to 30MHz was 10KHz;
The IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9KHz;
- (5) L1 = Line One (Hot side) / L2 = Line Two (Neutral side)

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Conducted Emission Test Plot



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6. PEAK OUTPUT POWER MEASUREMENT

6.1 Standard Applicable

According to §15.247(b)(1), for frequency hopping systems in the 240-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watt.

6.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Channel power function, RBW, VBW = 1MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

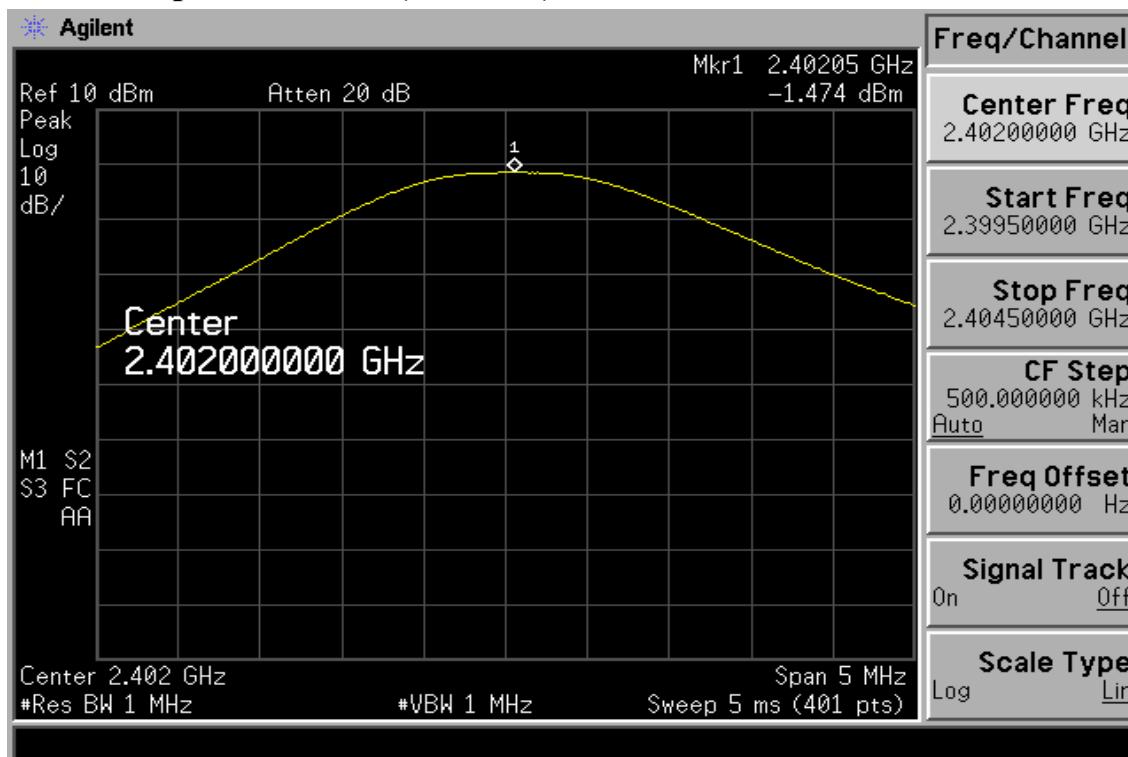
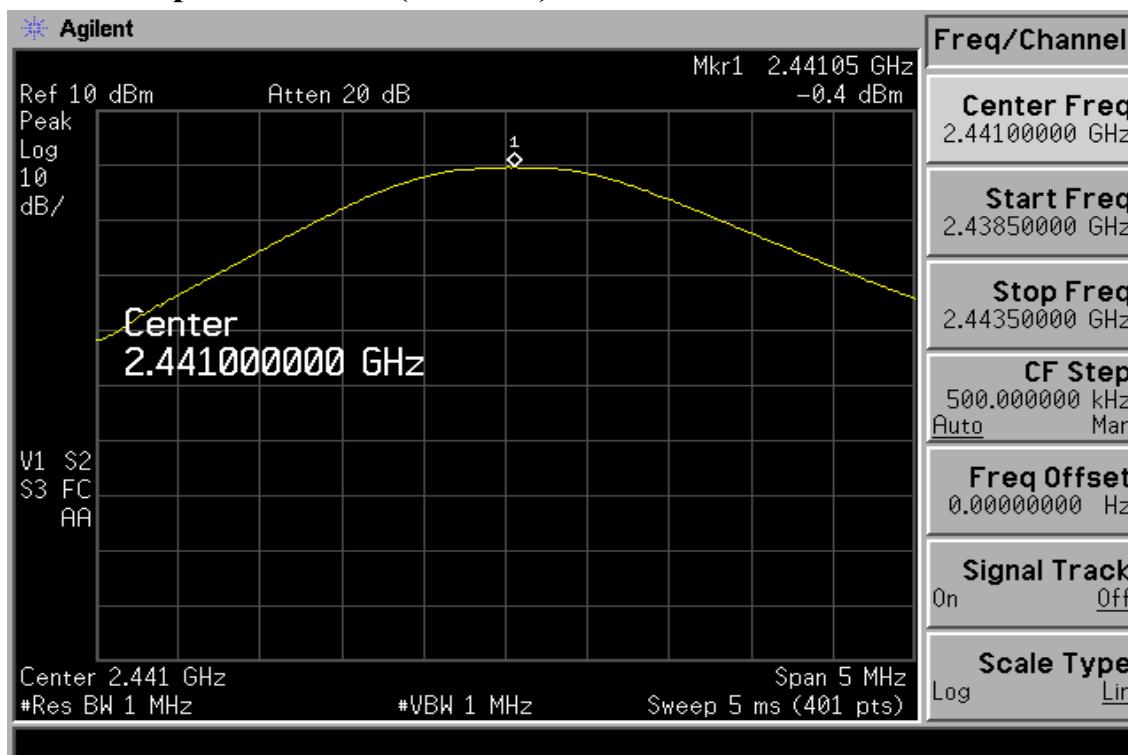
6.3 Measurement Result

CH	Frequency (MHz)	Reading Power dBm	Cable Loss	Output Power dBm	Output Power W	Limit (W)
LOW	2402.00	-1.47	0.80	-0.67	0.00086	1
MID	2441.00	-0.40	0.80	0.40	0.00110	1
HIGH	2480.00	-0.48	0.80	0.32	0.00108	1

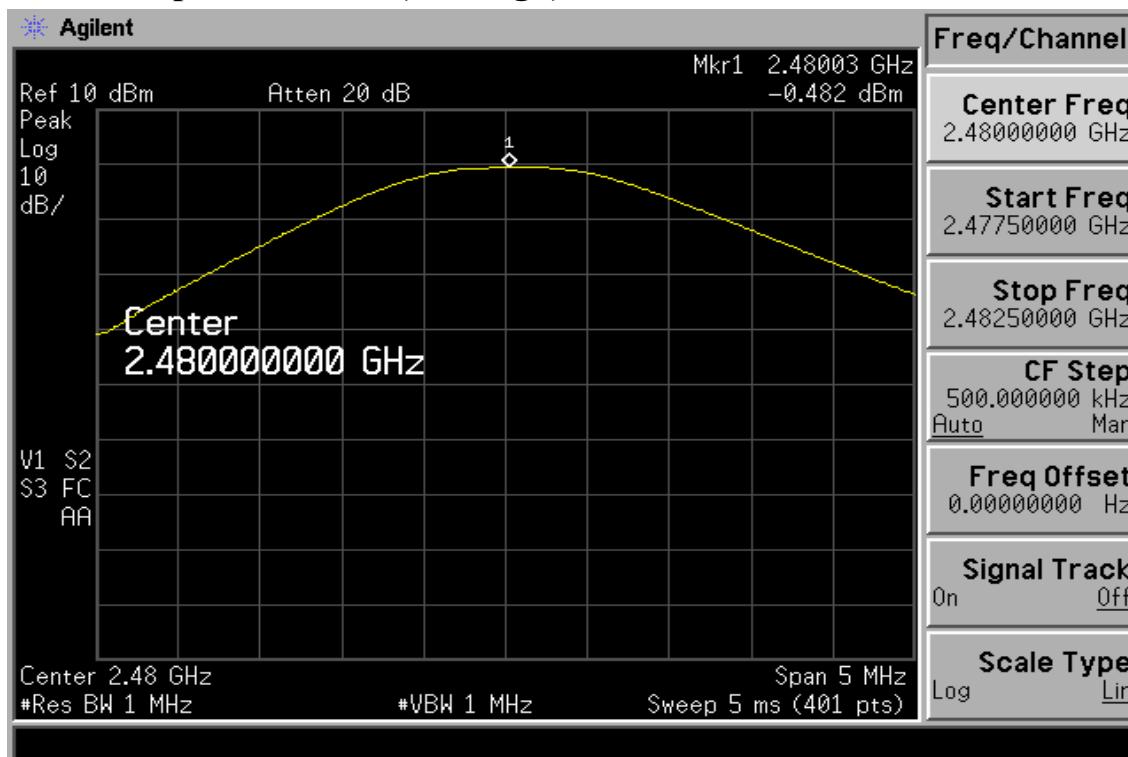
6.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2003	10/06/2004

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Peak Power Output Data Plot (CH Low)**Peak Power Output Data Plot (CH Mid)**

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Peak Power Output Data Plot (CH High)

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7. 20dB BAND WIDTH

7.1 Standard Applicable

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz and 5725MHz – 5850MHz bands. The Maximum 20dB bandwidth of the hopping channel is 1MHz.

7.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 2MHz, Sweep=auto
4. Mark the peak frequency and –20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

7.3 Measurement Result

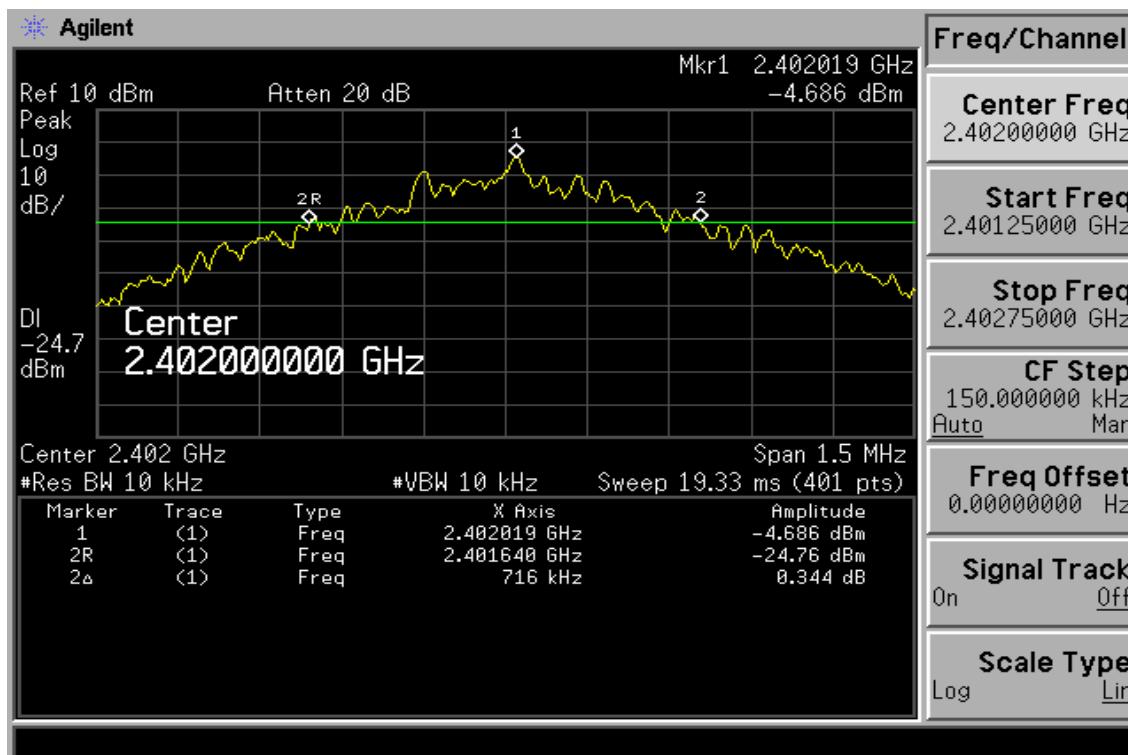
CH	Bandwidth (MHz)	Bandwidth Limit (MHz)	Result
Lower	0.716	1	PASS
Mid	0.799	1	PASS
Higher	0.818	1	PASS

7.4 Measurement Equipment Used:

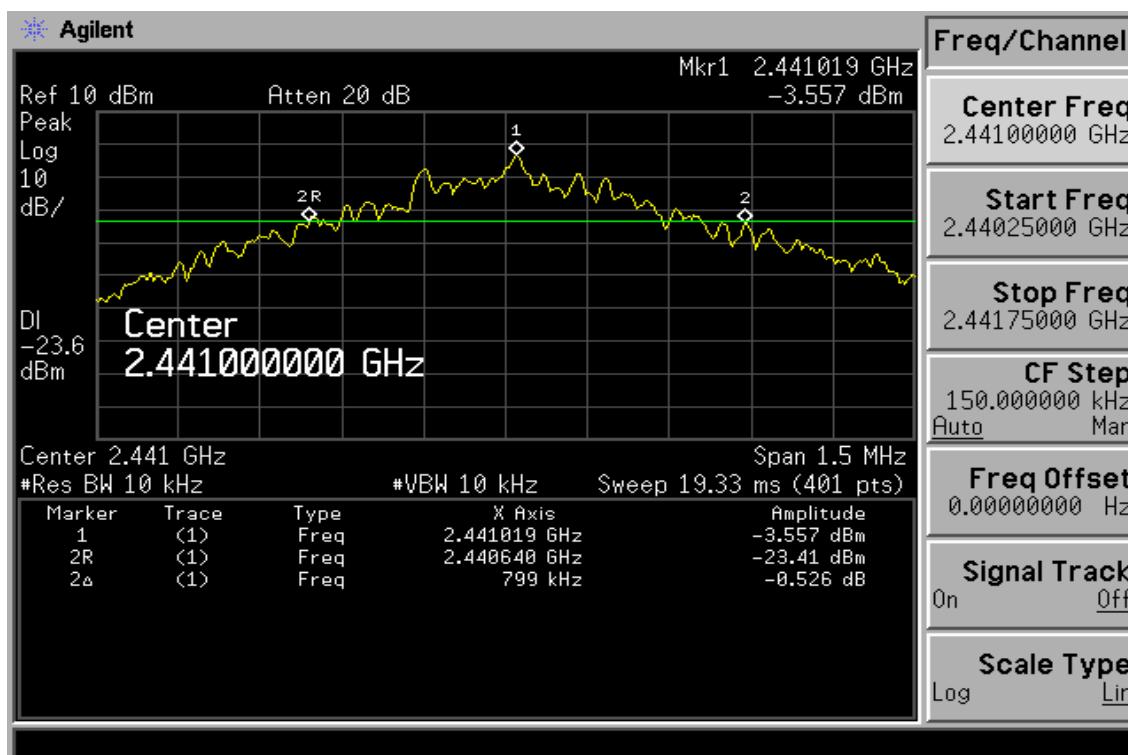
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2003	08/26/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circuit	BW-S6W5	N/A	10/07/2003	10/06/2004

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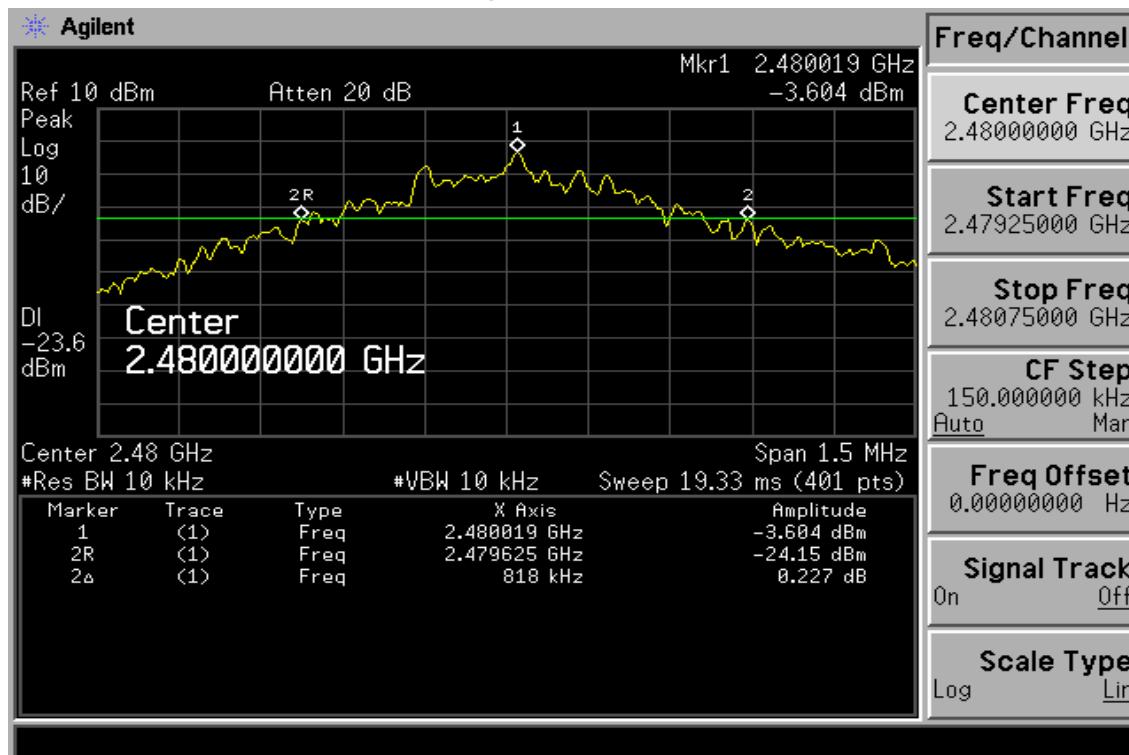
20dB Band Width Test Data CH-Low



20dB Band Width Test Data CH-Mid



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20dB Band Width Test Data CH-High

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8. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

8.1 Standard Applicable

According to §15.247(c), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.488GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.
7. Radiated Emission refer to section 9.

8.3 Measurement Result

Refer to attach spectrum analyzer data chart.

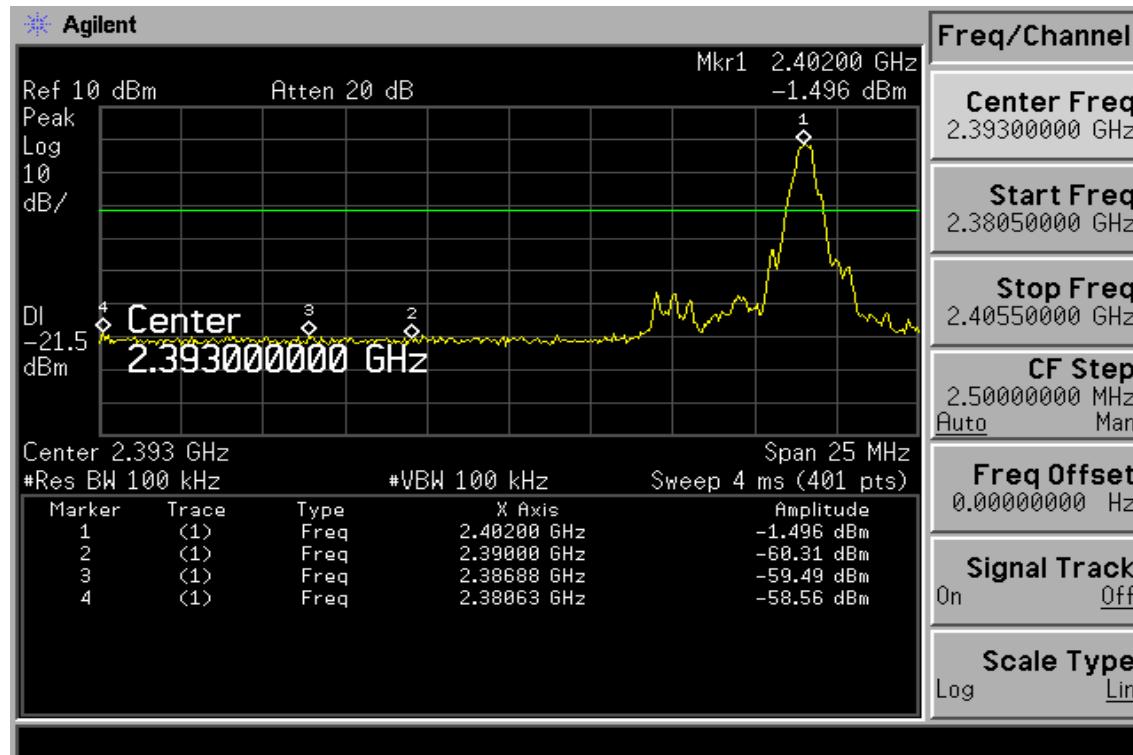
8.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2003	08/26/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2003	10/06/2004

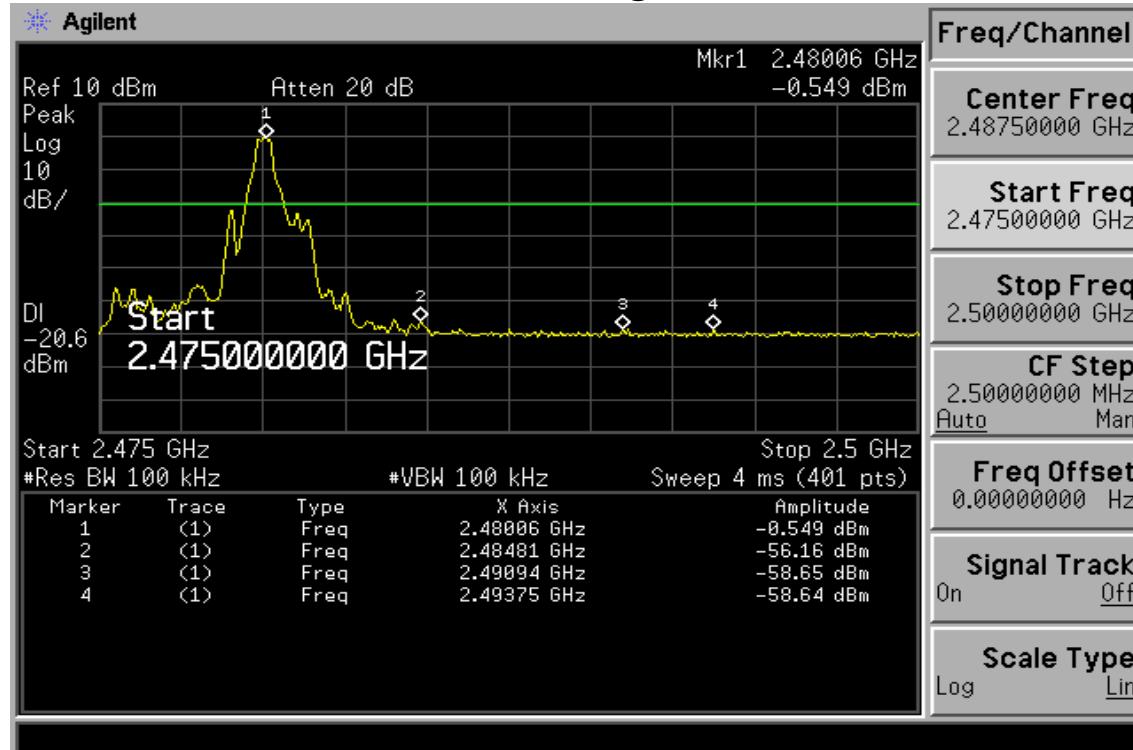
Note: Measurement Equipment for radiated emission refer to section 9.

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Conducted Emission: Test Data CH-Low



Conducted Emission: Test Data CH-High



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Radiated Emission:

Operation Mode TX CH Low
Fundamental Frequency 2402 MHz
Temperature 24 °C
Humidity 68 %

Test Date Dec. 17, 2003
Test By Willis Chen
Pol Ver.

Freq. (MHz)	Peak (dBuV)	AV (dBuV)	Reading CF(dB)	Actual FS		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
				Peak (dBuV/m)	AV (dBuV/m)						
2390.0	20.05		-0.51	19.54		74.00	54.00	-34.46	-34.46		Peak

Operation Mode TX CH Low
Fundamental Frequency 2402 MHz
Temperature 24 °C
Humidity 68 %

Test Date Dec. 17, 2003
Test By Willis Chen
Pol Hor.

Freq. (MHz)	Peak (dBuV)	AV (dBuV)	Reading CF(dB)	Actual FS		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
				Peak (dBuV/m)	AV (dBuV/m)						
2390.0	19.31		-0.51	18.80		74.00	54.00	-35.20	-35.20		Peak

Remark :

- (1) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Emission:

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 24 °C
Humidity 68 %

Test Date Dec. 17, 2003
Test By Willis Chen
Pol Ver.

Freq. (MHz)	Peak (dBuV)	AV (dBuV)	Reading CF(dB)	Actual FS		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
				Peak (dBuV/m)	AV (dBuV/m)						
2484.8	21.30		-0.10	21.20		74.00	54.00	-32.80	-32.80	Peak	

Operation Mode TX CH High
Fundamental Frequency 2480 MHz
Temperature 24 °C
Humidity 68 %

Test Date Dec. 17, 2003
Test By Willis Chen
Pol Hor.

Freq. (MHz)	Peak (dBuV)	AV (dBuV)	Reading CF(dB)	Actual FS		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
				Peak (dBuV/m)	AV (dBuV/m)						
2484.8	19.68		-0.10	19.58		74.00	54.00	-34.42	-34.42	Peak	

Remark :

- (1) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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9. SPURIOUS RADIATED EMISSION TEST

9.1 Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

9.2 EUT Setup

1. The radiated emission tests were performed in the 3 meter open-test site, using the setup in accordance with the ANSI C63.4-1992.
2. The EUT was put in the front of the test table.
3. The PC system was connected with 110Vac/60Hz power source.

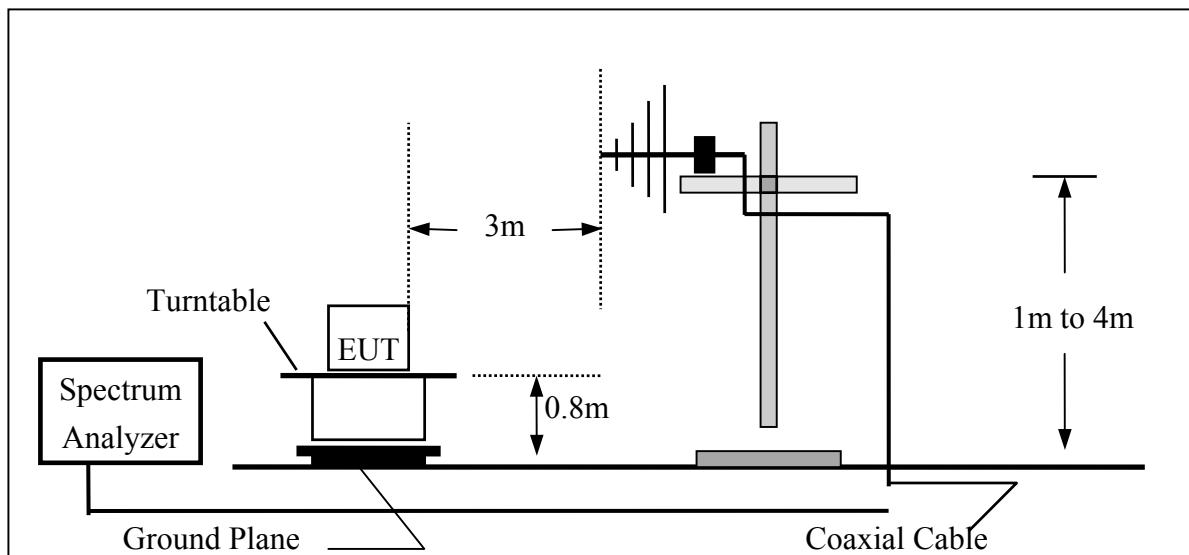
9.3 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until all frequency measured were complete.

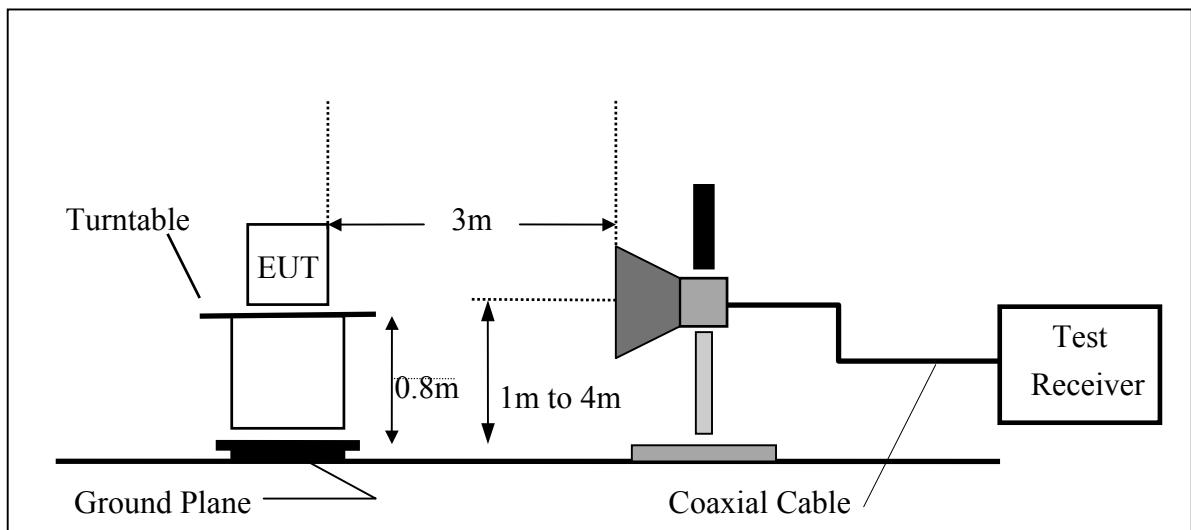
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

9.4 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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9.5 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2003	08/26/2004
Bilog Antenna	SCHWAZBECK	VULB9163	152	06/03/2003	06/02/2004
Horn antenna	Schwarzbeck	BBHA 9120D	309/320	08/16/2003	08/15/2004
Horn antenna	Schwarzbeck	BBHA 9170	184/185	07/04/2003	07/03/2004
Pre-Amplifier	HP	8447D	2944A09469	07/19/2003	07/18/2004
Pre-Amplifier	HP	8494B	3008A00578	02/26/2003	02/25/2004
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	10/09/2003	10/08/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	10/09/2003	10/08/2004
Site NSA	SGS	966 chamber	N/A	11/17/2003	11/16/2004

9.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude		AG = Amplifier Gain
AF = Antenna Factor		

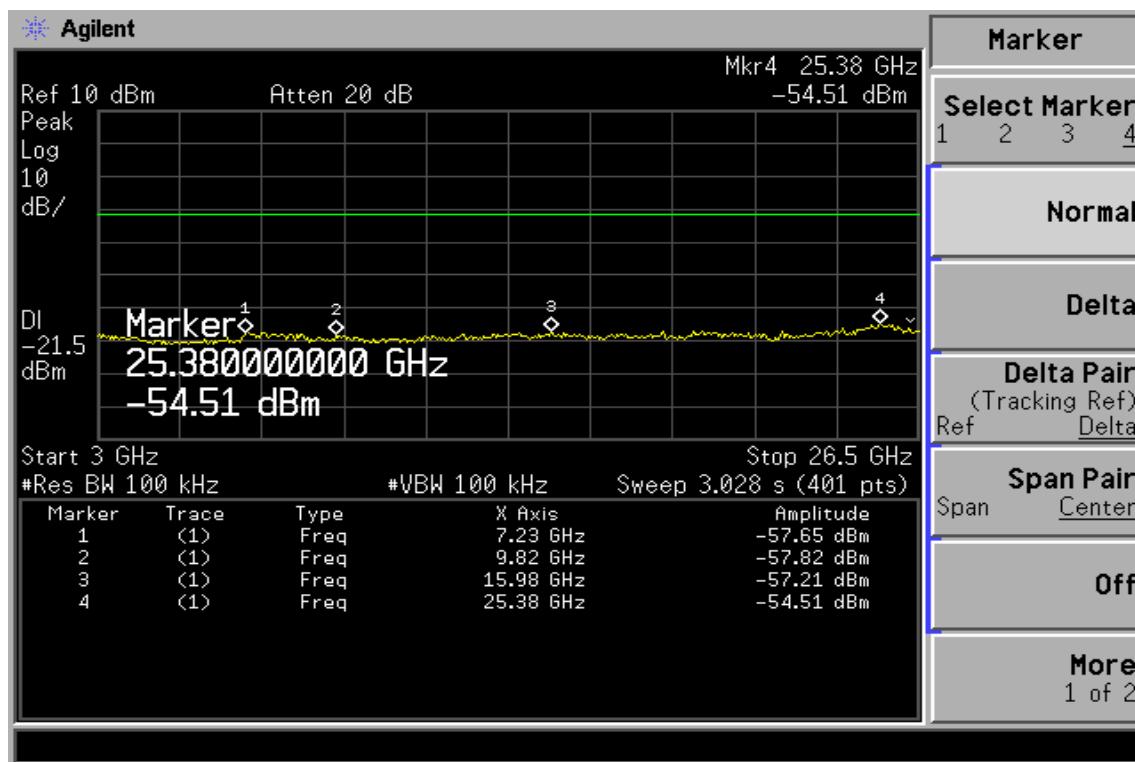
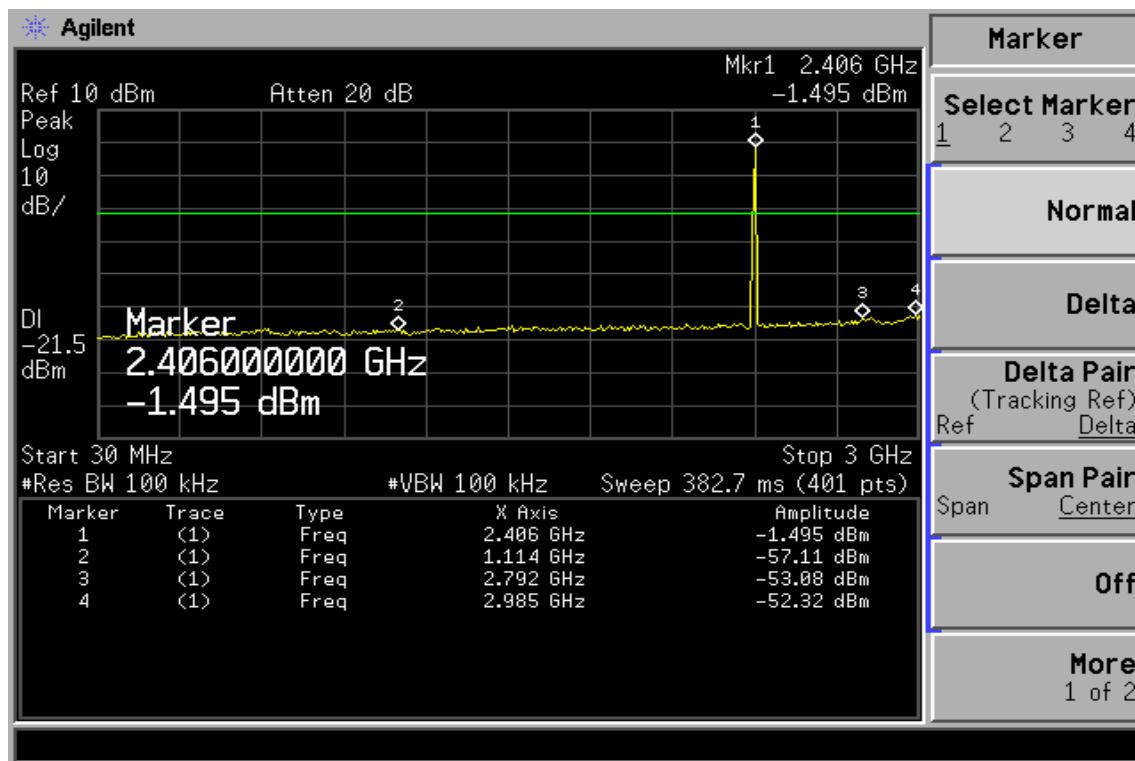
9.7 Measurement Result

Refer to attach tabular data sheets.

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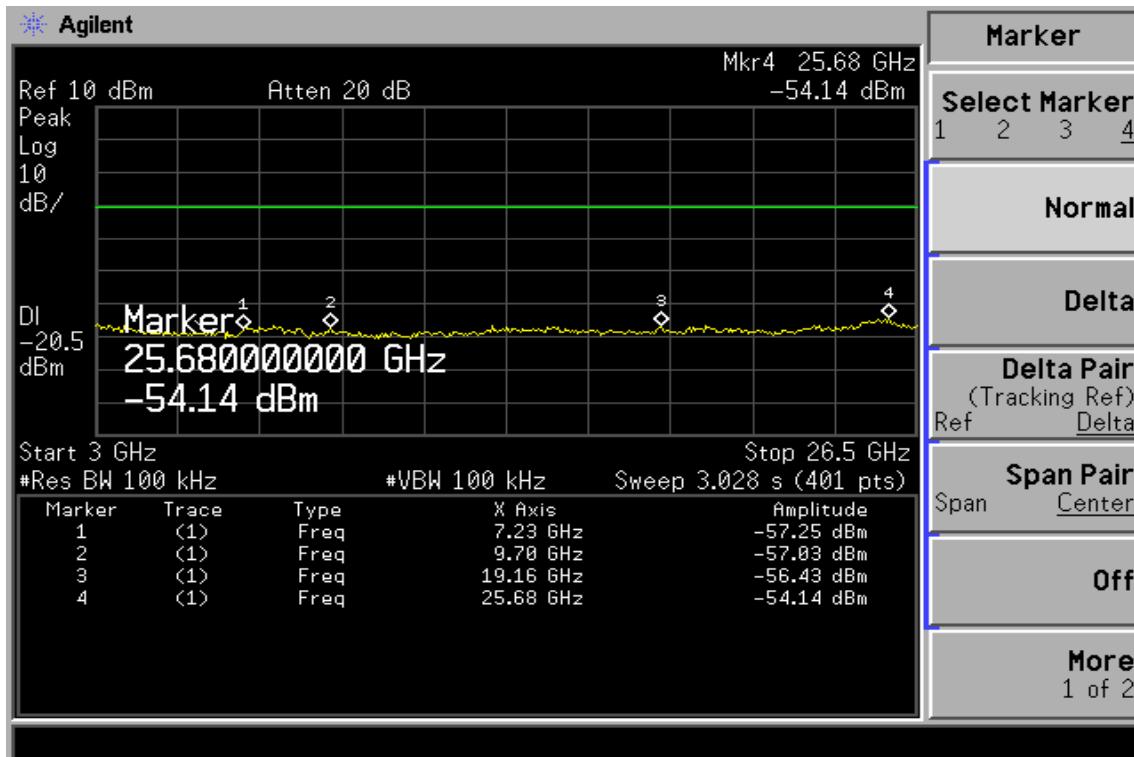
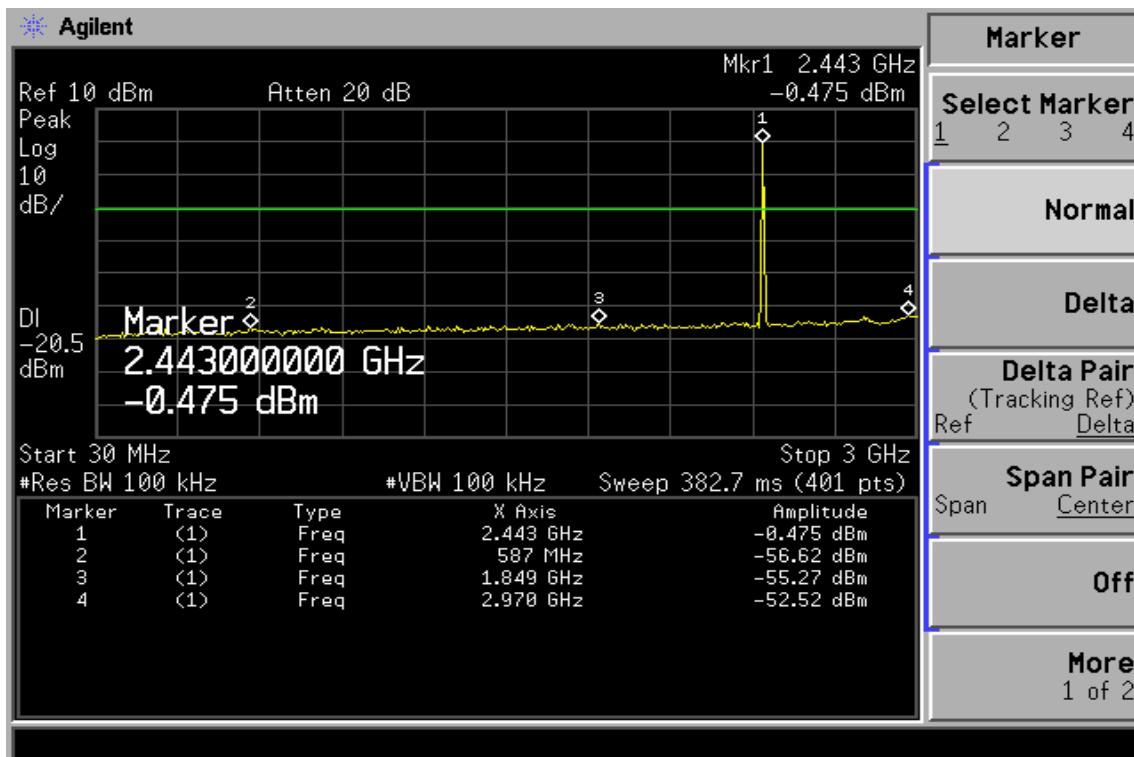
Conducted Spurious Emission Measurement Result

Ch Low 30MHz – 26.5GHz



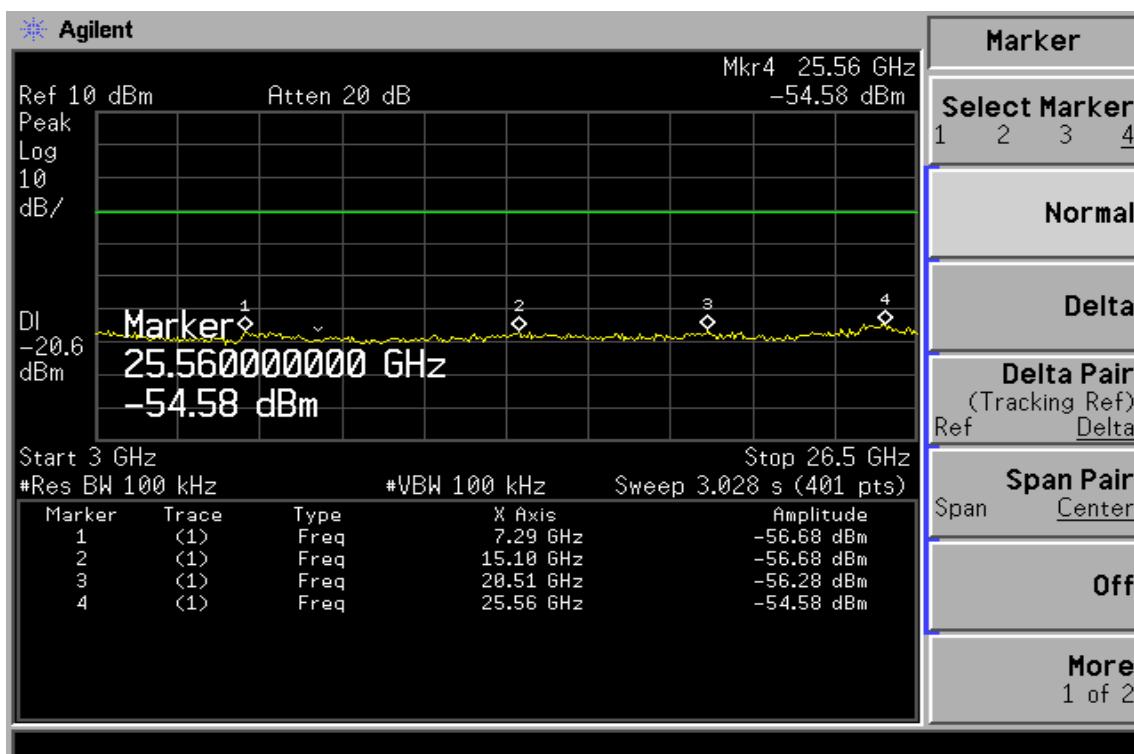
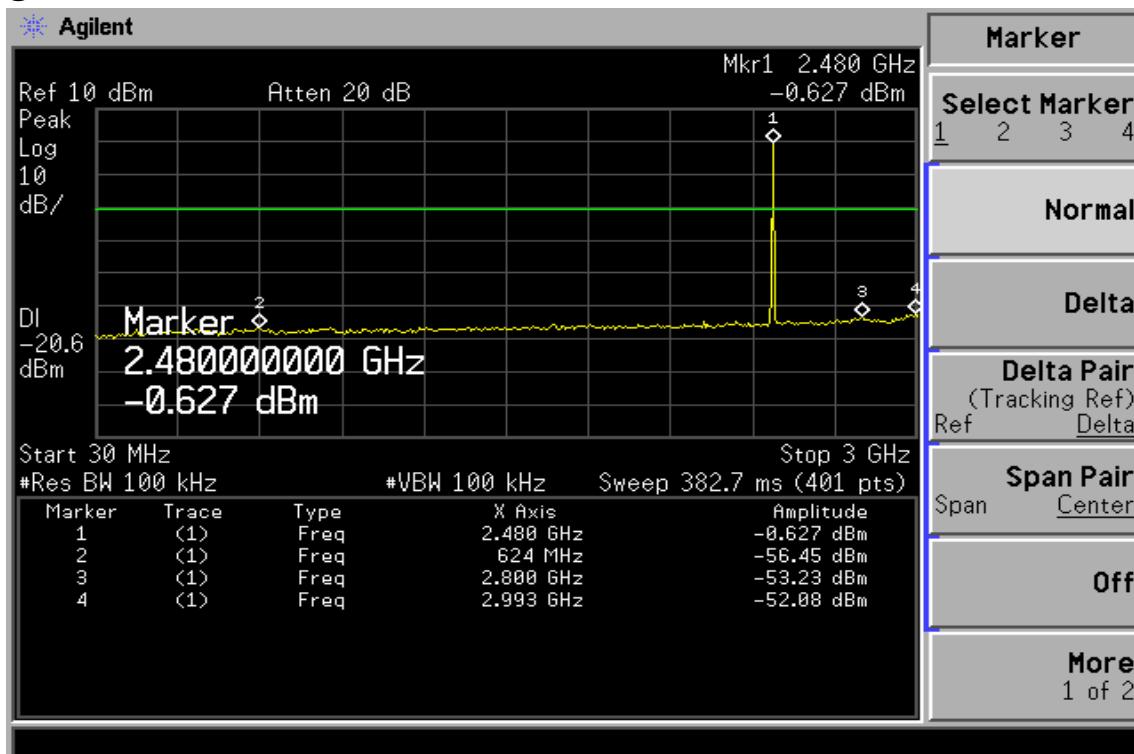
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Ch Mid 30MHz – 26.5GHz



The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report cannot be reproduced, except in full, without prior written permission of the Company.

Ch High 30MHz – 26.5 GHz



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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH Low	Test Date	Dec. 17, 2003
Fundamental Frequency	2402MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Ver./Hor
Humidity	68 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
399.40	V	Peak	41.28	-10.15	31.13	46.00	-14.87
674.50	V	Peak	33.00	-5.18	27.82	46.00	-18.18
729.80	V	Peak	36.41	-4.37	32.04	46.00	-13.96
836.90	V	Peak	32.92	-2.68	30.24	46.00	-15.76
892.20	V	Peak	33.47	-2.02	31.45	46.00	-14.55
945.40	V	Peak	33.54	-1.61	31.93	46.00	-14.07
233.85	H	Peak	40.42	-13.73	26.69	46.00	-19.31
662.60	H	Peak	38.06	-5.27	32.79	46.00	-13.21
732.60	H	Peak	37.55	-4.31	33.24	46.00	-12.76
867.70	H	Peak	33.55	-2.35	31.20	46.00	-14.80
959.40	H	Peak	36.71	-1.55	35.16	46.00	-10.84

Remark :

- (1) Measuring frequencies from 30 MHz to the 1GHz .
- (2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- (3) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH Mid	Test Date	Dec. 17, 2003
Fundamental Frequency	2441MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Ver./Hor
Humidity	68 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
399.40	V	Peak	40.26	-10.15	30.11	46.00	-15.89
567.40	V	Peak	35.95	-6.86	29.09	46.00	-16.91
729.80	V	Peak	36.29	-4.37	31.92	46.00	-14.08
892.20	V	Peak	33.48	-2.02	31.46	46.00	-14.54
945.40	V	Peak	33.13	-1.61	31.52	46.00	-14.48
233.85	H	Peak	40.03	-13.73	26.3	46.00	-19.70
662.60	H	Peak	38.35	-5.27	33.08	46.00	-12.92
732.60	H	Peak	36.76	-4.31	32.45	46.00	-13.55
867.70	H	Peak	33.11	-2.35	30.76	46.00	-15.24

Remark :

- (1) Measuring frequencies from 30 MHz to the 1GHz .
- (2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- (3) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH High	Test Date	Dec. 17, 2003
Fundamental Frequency	2480MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Ver./Hor
Humidity	68 %		

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
399.40	V	Peak	40.27	-10.15	30.12	46.00	-15.88
567.40	V	Peak	35.98	-6.84	29.14	46.00	-16.86
729.80	V	Peak	36.99	-4.37	32.62	46.00	-13.38
892.20	V	Peak	33.15	-2.02	31.13	46.00	-14.87
945.40	V	Peak	34.03	-1.61	32.42	46.00	-13.58
233.85	H	Peak	40.54	-13.73	26.81	46.00	-19.19
662.60	H	Peak	39.05	-5.27	33.78	46.00	-12.22
732.60	H	Peak	37.14	-4.31	32.83	46.00	-13.17
864.90	H	Peak	33.13	-2.39	30.74	46.00	-15.26
959.40	H	Peak	32.15	-1.55	30.6	46.00	-15.40

Remark :

- (1) Measuring frequencies from 30 MHz to the 1GHz .
- (2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- (3) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Low	Test Date	Dec. 17, 2003
Fundamental Frequency	2402 MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Ver.
Humidity	68 %		

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	
1000.0	26.81	--	-6.49	20.32	--	74.00	54.00	-33.68 Peak
1376.0	25.62	--	-5.02	20.60	--	74.00	54.00	-33.40 Peak
1728.0	22.75	--	-3.49	19.26	--	74.00	54.00	-34.74 Peak
2592.0	20.10	--	0.22	20.32	--	74.00	54.00	-33.68 Peak
4804.0	----							
7206.0	----							
9608.0	----							
12010.0	----							
14412.0	----							
16814.0	----							
19216.0	----							
21618.0	----							
24020.0	----							

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Low	Test Date	Dec. 17, 2003
Fundamental Frequency	2402 MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Hor
Humidity	68 %		

Freq. (MHz)	Peak	AV		Actual FS		Peak	AV		Margin (dB)
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
1184.0	28.30	--	-5.79	22.51	--	74.00	54.00	-31.49	Peak
1528.0	22.49	--	-4.41	18.08	--	74.00	54.00	-35.92	Peak
2592.0	25.57	--	0.22	25.79	--	74.00	54.00	-28.21	Peak
4804.0	----								
7206.0	----								
9608.0	----								
12010.0	----								
14412.0	----								
16814.0	----								
19216.0	----								
21618.0	----								
24020.0	----								

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Mid	Test Date	Dec. 17, 2003
Fundamental Frequency	2441 MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Ver
Humidity	68 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1184.0	22.97	--	-5.79	17.18	--	74.00	54.00	-36.82 Peak
1592.0	21.17	--	-4.14	17.03	--	74.00	54.00	-36.97 Peak
2592.0	19.12	--	0.22	19.34	--	74.00	54.00	-34.66 Peak
4882.0	----							
7323.0	----							
9764.0	----							
12205.0	----							
14646.0	----							
17087.0	----							
19528.0	----							
21969.0	----							
24410.0	----							

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Mid	Test Date	Dec. 17, 2003
Fundamental Frequency	2441 MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Hor
Humidity	68 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)		
1208.0	28.53	--	-5.70	22.83	--	74.00	54.00 -31.17 Peak
1592.0	23.31	--	-4.14	19.17	--	74.00	54.00 -34.83 Peak
2592.0	26.36	--	-26.36	0.00	--	74.00	54.00 -54.00 Peak
4882.0	----						
7323.0	----						
9764.0	----						
12205.0	----						
14646.0	----						
17087.0	----						
19528.0	----						
21969.0	----						
24410.0	----						

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode TX CH High Test Date Dec. 17, 2003
Fundamental Frequency 2480 MHz Test By Willis Chen
Temperature 24 °C Pol Ver
Humidity 68 %

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1000.0	25.76	--	-6.49	19.27	--	74.00	54.00	-34.73 Peak
2592.0	21.21	--	0.22	21.43	--	74.00	54.00	-32.57 Peak
4960.0	----							
7440.0	----							
9920.0	----							
12400.0	----							
14880.0	----							
17360.0	----							
19840.0	----							
22320.0	----							
24800.0	----							

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH High	Test Date	Dec. 17, 2003
Fundamental Frequency	2480 MHz	Test By	Willis Chen
Temperature	24 °C	Pol	Hor
Humidity	68 %		

Freq. (MHz)	Peak	AV	Actual FS		Peak	AV	Margin (dB)	
	Reading (dBuV)	Reading (dBuV)	Ant./CL CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)		
1528.0	22.47	--	-4.41	18.06	--	74.00	54.00	-35.94 Peak
2592.0	24.12	--	0.22	24.34	--	74.00	54.00	-29.66 Peak
4960.0	----							
7440.0	----							
9920.0	----							
12400.0	----							
14880.0	----							
17360.0	----							
19840.0	----							
22320.0	----							
24800.0	----							

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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10. FREQUENCY SEPARATION

10.1 Standard Applicable

According to §15.247(a), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 20dB bandwidth of the hopping channel, whichever is greater.

10.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100KHz, Adjust Span to 5 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

10.3 Measurement Result

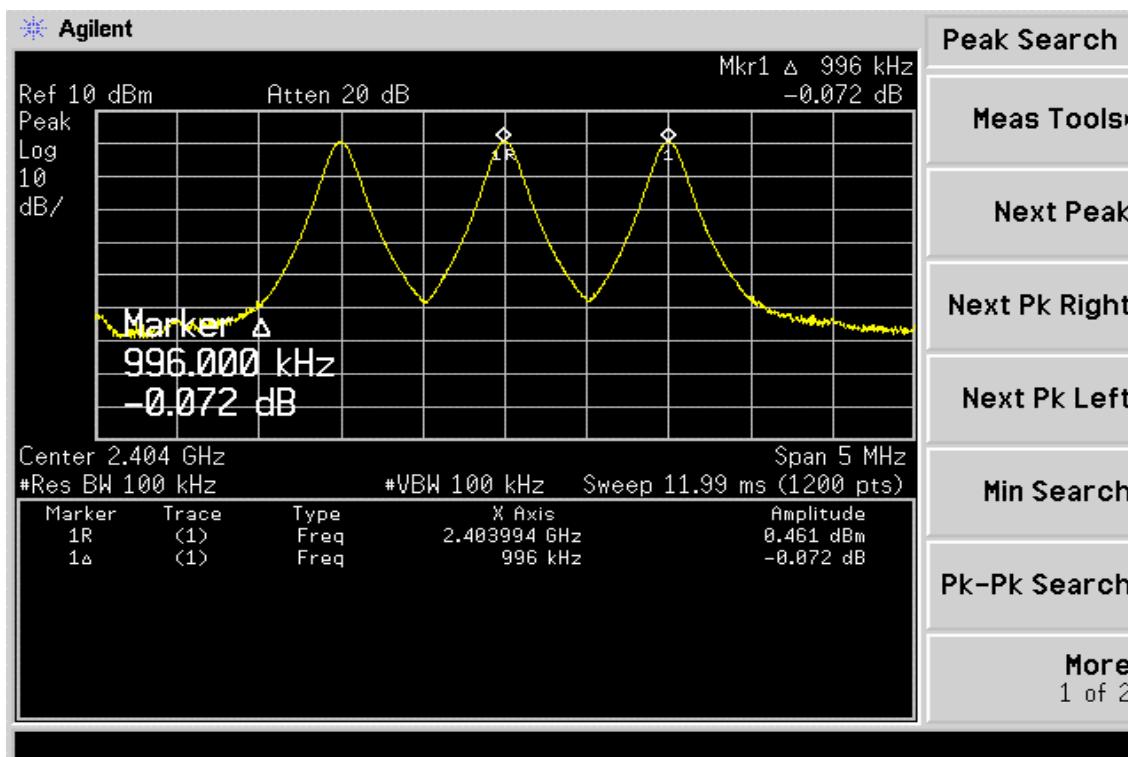
Channel separation	Limit	Result
MHz	kHz	
0.996	>=25KHz/ 20 dB bandwidth	PASS

10.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2003	08/26/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2003	10/06/2004

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Frequency Separation Test Data



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11. NUMBER OF HOPPING FREQUENCY

11.1 Standard Applicable

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz and 5725MHz – 5850MHz bands shall use at least 15 hopping frequencies.

11.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=100KHz,
5. Max hold, view and count how many channel in the band.

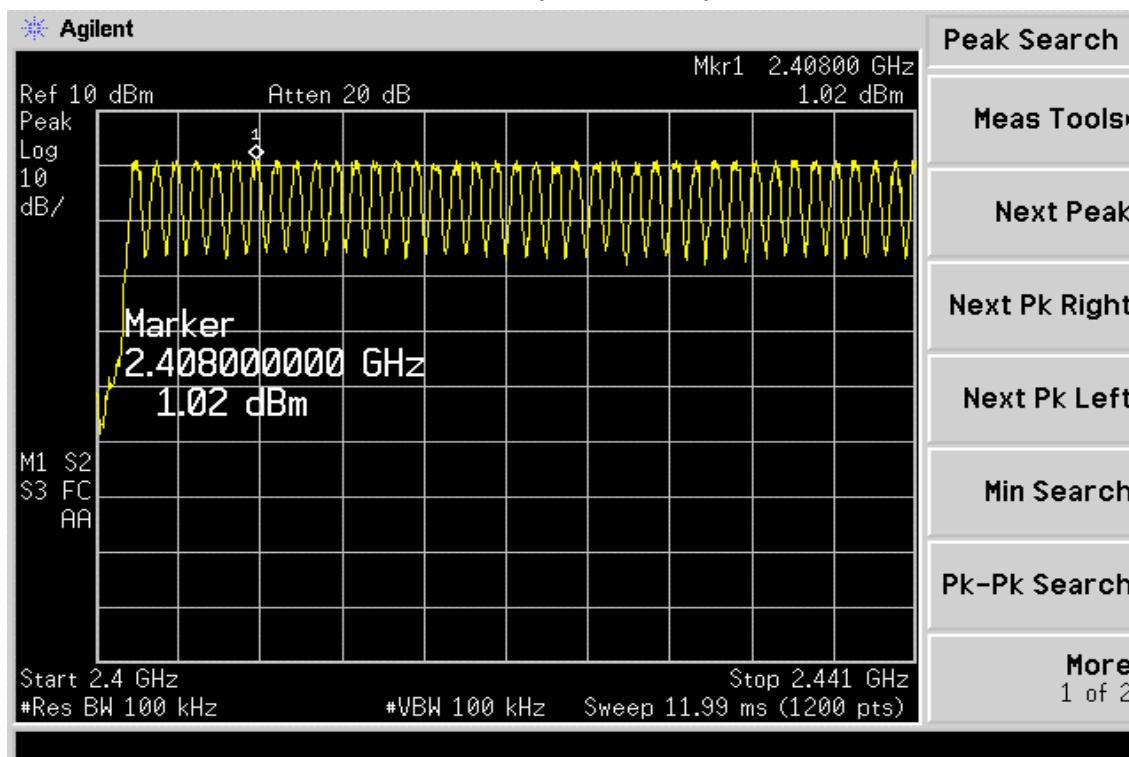
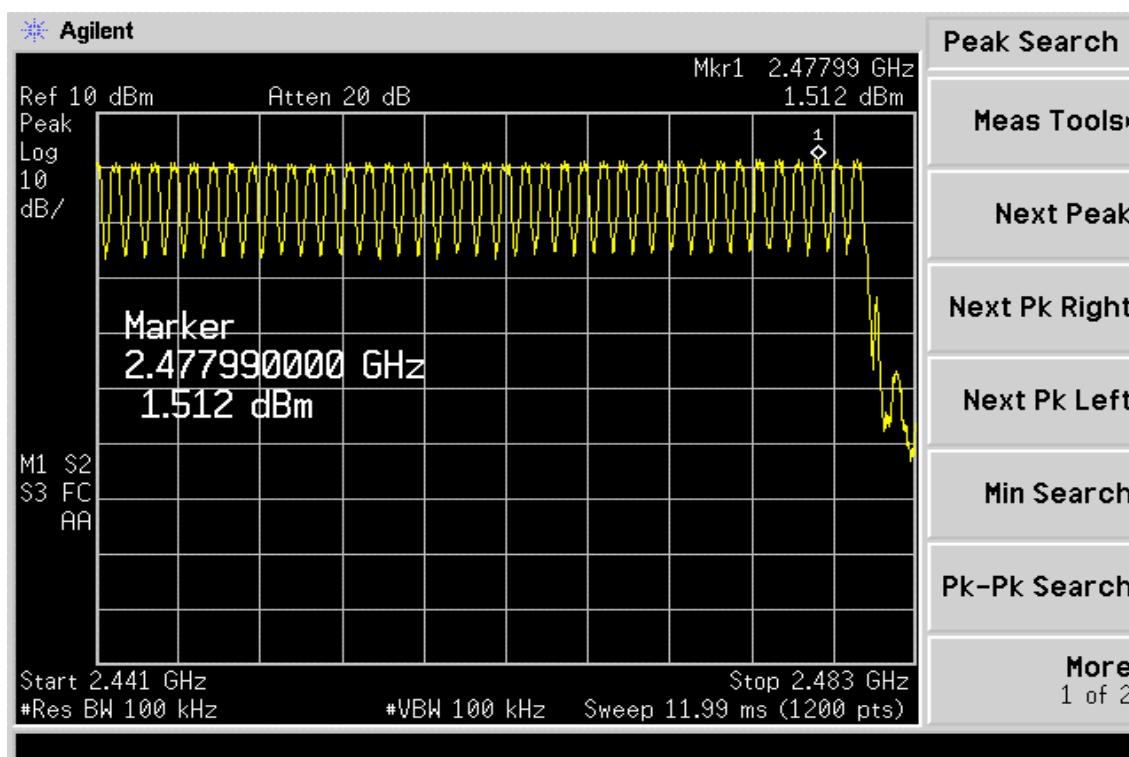
11.3 Measurement Result

Total No of hopping channel	Limit (CH)	Measurement result (CH)	Result
	15	79	Pass

11.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2003	08/26/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circuit	BW-S6W5	N/A	10/07/2003	10/06/2004

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Channel Number**2.4 GHz – 2.441GHz****2.441 GHz – 2.4835GHz**

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12. TIME OF OCCUPANCY (DWELL TIME)

12.1 Standard Applicable

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz and 5725MHz – 5850MHz bands. The average time of occupancy on any frequency shall not greater than 0.4 s within a 30s period.

12.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span = 0Hz, Adjust Sweep = 30s.
5. Repeat above procedures until all frequency measured were complete.

12.3 Measurement Result

A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low: 0.42 (ms) * 1600/79 * 31.6= 268.80 (ms)

CH Mid: 0.42 (ms) * 1600/79 * 31.6= 268.80 (ms)

CH High: 0.43 (ms) * 1600/79 * 31.6= 275.20 (ms)

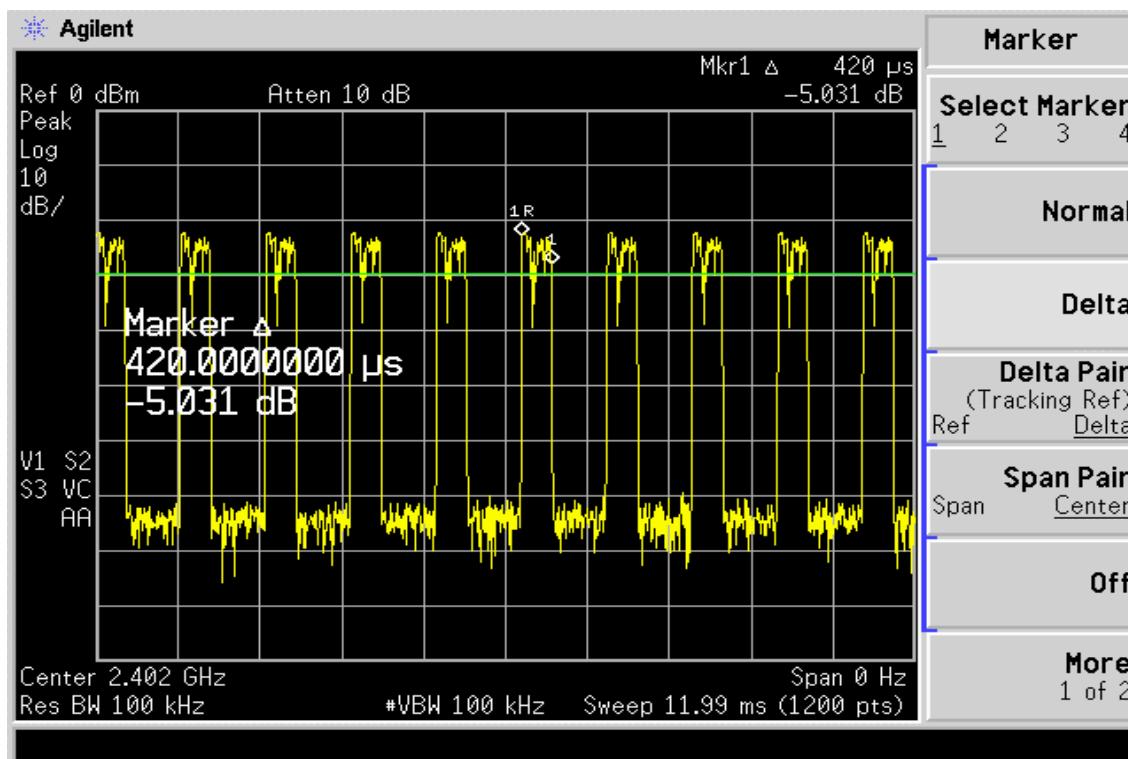
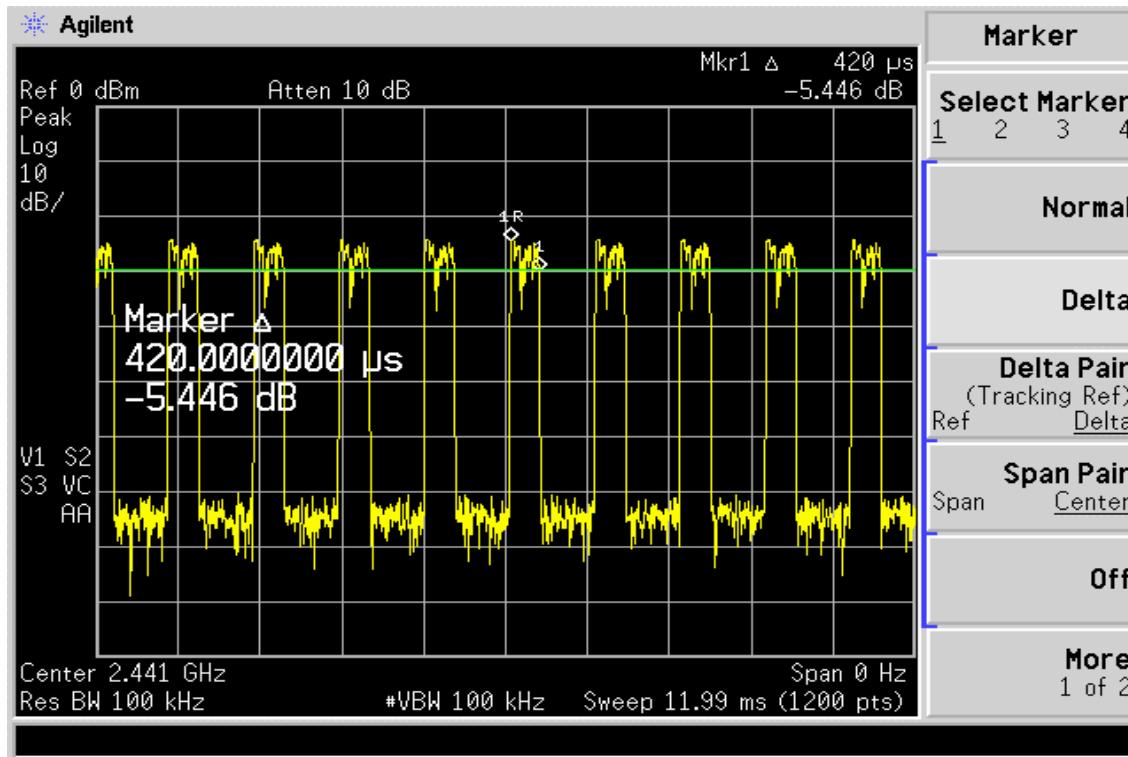
CH	Pulse Time ms	Total of Dwell Time (ms)	Period time (ms)	Limit (ms)
Low	0.42	268.80	31.60	400.00
Mid	0.42	268.80	31.60	400.00
High	0.43	275.20	31.60	400.00

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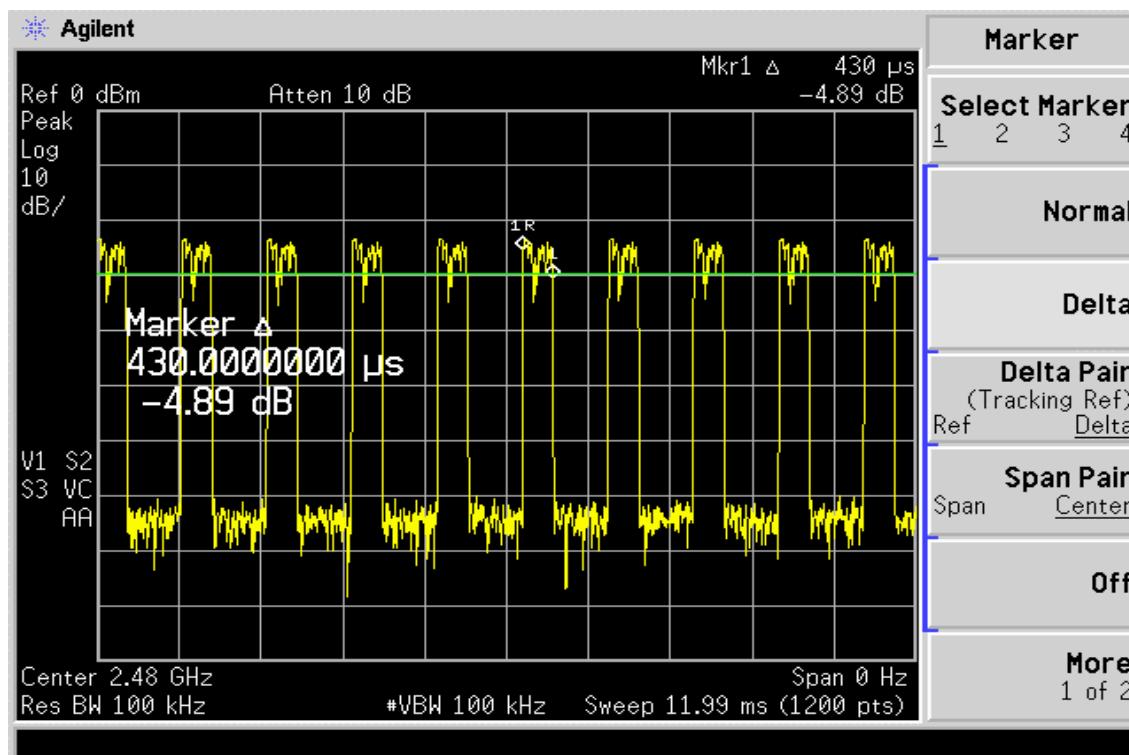
12.4 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2003	08/26/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2003	10/06/2004

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Dwell Time Test Data**CH LOW****CH MID**

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CH HIGH

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13. Peak Power Spectral Density

13.1 Standard Applicable

According to §15.247(d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3kHz band during any time interval of continuous transmission.

13.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3KHz, VBW = 3KHz, Span = 300KHz, Sweep=100s
4. Record the max. reading.
5. Repeat above procedures until all frequency measured were complete.

13.3 Measurement Result

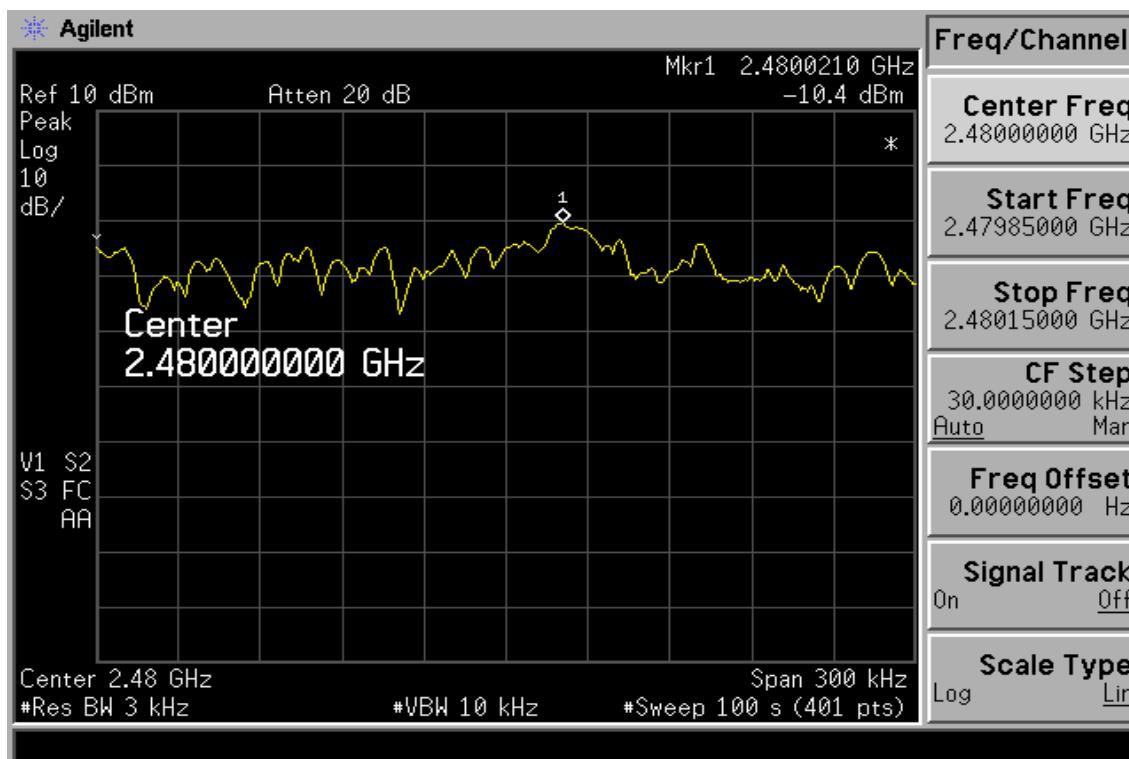
CH	RF Power Density Reading (dBm)	Cable loss (dB)	RF Power Density Level (dBm)	Maximum Limit (dBm)
Low	-9.42	2.00	-7.42	8
Mid	-9.71	2.00	-7.71	8
High	-8.91	2.00	-6.91	8

13.4 Measurement Equipment Used:

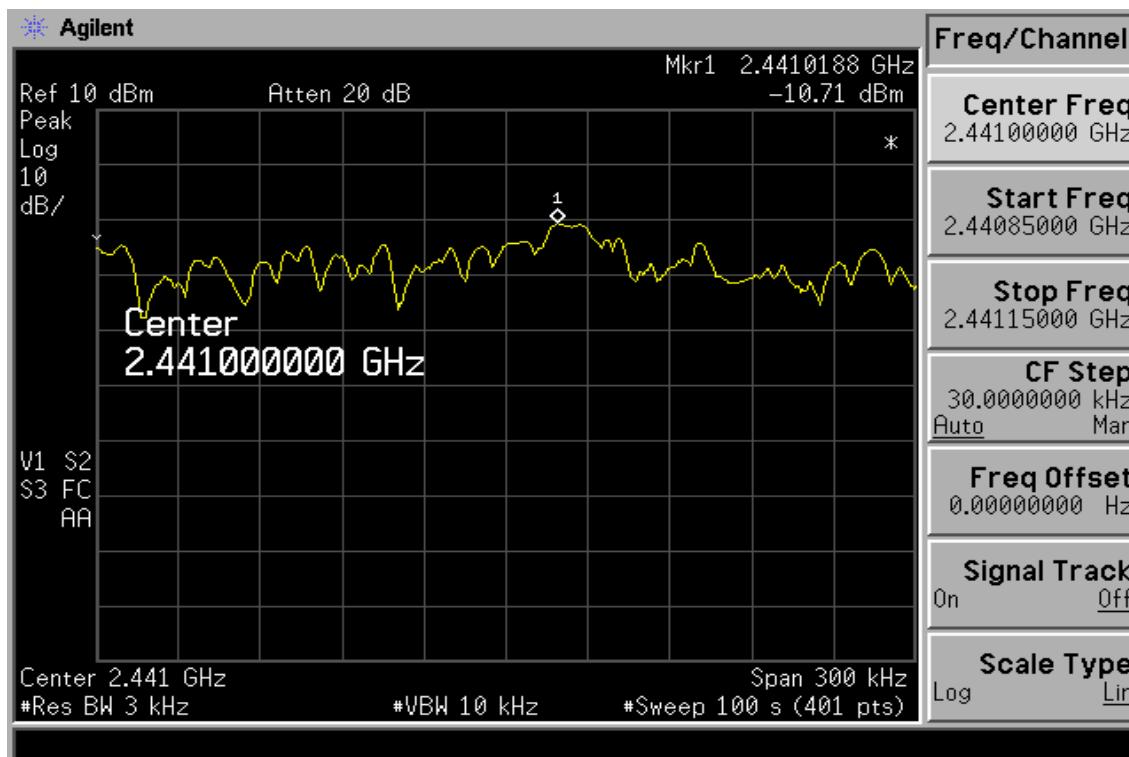
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2003	05/26/2004
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2003	08/26/2004
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2003	10/06/2004

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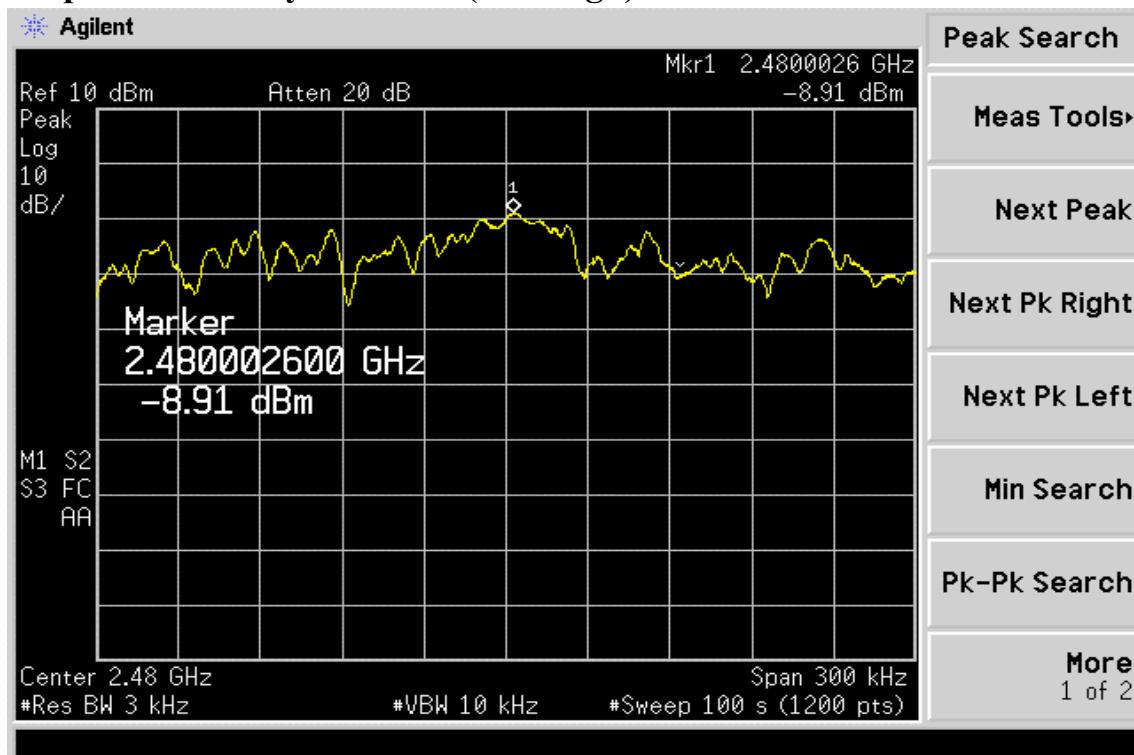
Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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Power Spectral Density Test Plot (CH-High)

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14. ANTENNA REQUIREMENT

14.1 Standard Applicable

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

And according to §15.246(1), if transmitting antennas of directional gain greater than 6dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

14.2 Antenna Connected Construction

The directional gain of antenna used for transmitting is 4 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

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15. RF EXPOSURE

15.1 Standard Applicable

According to §15.247(b)(4) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

15.2 Measurement Result:

This is a portable device and the Max peak output power is 0.40dBm (0.0011mW) lower than low threshold 60/fGHz mW (65.57mW), d<2.5cm in general population category :

The SAR measurement is not necessary.

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