

FCC PART 15.247
EMI MEASUREMENT AND TEST REPORT

For

Wi-Gear Inc.

795 Folsom St., 1st Floor
San Francisco, CA 94107, USA

FCC ID: TIQ-MA100

This Report Concerns: ☒ Original Report	Equipment Type: 2.4GHz Bluetooth Dongle
	
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Report No.: <u>R0508013</u>	
Report Date: <u>2005-08-26</u>	
	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Wi-Gear Inc.*'s, FCC ID: *TIQ-MA100*, or the "EUT" as referred to in this report is a 2.4GHz Bluetooth Dongle, which measures approximately 60mmL x 25mm W x 5mm H. The EUT is a frequency hopping device, which operates at the frequency range of 2402 – 2480MHz, with the maximum conducted output power of 2.8dBm (1.91mW) and emission designator 859KF1D.

** The test data gathered are from a production sample, S/N: 001, provided by the manufacturer.*

Objective

This type approval report is prepared on behalf of *Wi-Gear Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, C.

Related Submittal(s)/Grant(s)

No Related Submittals

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003& TIA/EIA-603.

Test Facility

The Open Area Test site used by BACL to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA with registration number:90464.

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was designed to exercise the system components.

Once loaded, set the Tx channel to low, mid and high for testing.

Special Accessories

As shown in following test block diagram, all interface cables used for compliance testing are shielded.

Schematics / Block Diagram

Please refer to Appendix A.

Equipment Modifications

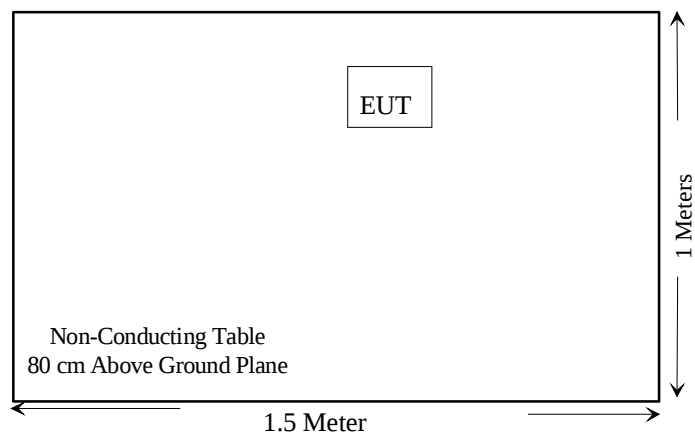
No modifications were made to the EUT.

Configuration of Test System



EUT

Test Setup Block Diagram



SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§ 15.205	Restricted Bands	Compliant
§15.209	Radiated Emission	Compliant*
§15.247 (a) (1)	Hopping Channel Separation	Compliant
§15.247 (a) (1)	Channel Bandwidth	Compliant
§15.247 (a) (1) (iii)	Number of Hopping Frequencies Used	Compliant
§15.247 (a) (1) (iii)	Dwell Time of Each Frequency within a 35.2 Second Period of time (0.4 x Number of Channel)	Compliant
§15.247 (b) (1)	Maximum Peak Output Power	Compliant
§ 15.247 (b)(4) § 2.1093	RF Safety Requirements	Compliant
§ 15.247 (d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
	Spurious Emission at Antenna Port	Compliant

*: Test data are within the measurement uncertainty.

ANTENNA REQUIREMENT

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

And according to § 15.247 (1), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The antenna for the EUT is an integral antenna. The gain of antenna used for transmitting is 4.4dBi. Please see EUT photo for details. Please refer to antenna specification, file name: R0508013Antenna.

§15.205 & §15.209 - RADIATED EMISSION

Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ± 4.0 dB.

Test Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 25GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

<i>Frequency Range</i>	<i>RBW</i>	<i>Video B/W</i>
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Amplifier, Pre (.1 ~1300MHz)	8447D	2944A10198	8/20/2004
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004
HP	Pre, Amplifier (1 ~ 26.5 GHz)	8449B	3147A00400	05/10/2005
Sunol Science	30Mhz ~ 2 GHz Antenna	JB1	A03105-3	02/11/2005
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	4/20/2005

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	27° C
Relative Humidity:	68%
ATM Pressure:	1026 mbar

**The testing was performed by Snell Leong on 2005-08-17.*

Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "Qp" in the data table.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

-1.8 dB at 4804.00 MHz in the **Vertical** polarization, Low Channel, 3 meters

-2.3 dB at 4884.00 MHz in the **Horizontal** polarization, Middle Channel, 3 meters

-1.4 dB at 4960.00 MHz in the **Horizontal** polarization, High Channel, 3 meters

-7.5 dB at 813.70 MHz in the **Vertical** polarization, Unintentional Emission, 3 meters

3 Meters Radiated Emission Test Data

Indicated			Antenna	Antenna		Correction Factor			FCC 15.247		
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dBμV/m	Degree	Meter	H/V	dB	dB	dB	dBμV/m	dBμV/m	dB	
Low Channel											
4804.0000	51.4	270	2.4	v	32.5	3.1	34.8	52.2	54	-1.8	Ave
4804.0000	45.0	180	2.3	h	32.5	3.1	34.8	45.8	54	-8.2	Ave
1601.3000	72.1	90	2.0	v	24.8	1.9	36.3	62.5	74	-11.6	Peak
1601.3000	69.0	180	2.0	h	24.8	1.9	36.3	59.3	74	-14.7	Peak
4804.0000	55.1	270	2.4	v	32.5	3.1	34.8	55.9	74	-18.1	Peak
7206.0000	29.6	90	2.0	h	36.7	4.3	34.7	35.9	54	-18.1	Ave
7206.0000	29.0	180	2.0	v	36.7	4.3	34.7	35.3	54	-18.7	Ave
4804.0000	51.1	180	2.3	h	32.5	3.1	34.8	51.9	74	-22.1	Peak
1601.3000	41.5	180	2.0	v	24.8	1.9	36.3	31.8	54	-22.2	Ave
1601.3000	40.3	90	2.0	h	24.8	1.9	36.3	30.6	54	-23.4	Ave
7206.0000	41.7	180	2.0	h	36.7	4.3	34.7	48.0	74	-26.0	Peak
7206.0000	39.9	90	2.0	v	36.7	4.3	34.7	46.2	74	-27.8	Peak
Middle Channel											
4884.0000	50.9	180	2.2	h	32.5	3.1	34.8	51.7	54	-2.3	Ave
4884.0000	50.3	270	2.4	v	32.5	3.1	34.8	51.1	54	-2.9	Ave
1627.4200	71.6	90	2.0	v	24.8	1.9	36.3	61.9	74	-12.1	Peak
1627.4200	70.9	180	2.0	h	24.8	1.9	36.3	61.2	74	-12.8	Peak
7326.0000	29.8	270	2.4	v	36.7	4.3	34.7	36.1	54	-17.9	Ave
7326.0000	29.5	180	2.1	h	36.7	4.3	34.7	35.8	54	-18.2	Ave
4884.0000	54.0	180	2.2	h	32.5	3.1	34.8	54.8	74	-19.2	Peak
4884.0000	53.0	270	2.4	v	32.5	3.1	34.8	53.8	74	-20.2	Peak
1627.4200	41.2	180	2.0	v	24.8	1.9	36.3	31.5	54	-22.5	Ave
1627.4200	40.8	90	2.0	h	24.8	1.9	36.3	31.1	54	-22.9	Ave
7326.0000	41.6	270	2.4	v	36.7	4.3	34.7	47.9	74	-26.1	Peak
7326.0000	40.5	180	2.3	h	36.7	4.3	34.7	46.8	74	-27.2	Peak
High Channel											
4960.0000	51.8	90	2.1	h	32.5	3.1	34.8	52.6	54	-1.4	Ave
4960.0000	51.4	270	2.4	v	32.5	3.1	34.8	52.2	54	-1.8	Ave
1653.3000	71.4	90	2.0	v	24.8	1.9	36.3	61.7	74	-12.3	Peak
1653.3000	68.4	180	2.0	h	24.8	1.9	36.3	58.7	74	-15.3	Peak
7440.0000	29.5	270	2.4	v	36.7	4.3	34.7	35.8	54	-18.2	Ave
7440.0000	29.1	90	2.1	h	36.7	4.3	34.7	35.4	54	-18.6	Ave
4960.0000	53.2	90	2.1	h	32.5	3.1	34.8	54.0	74	-20.0	Peak
4960.0000	52.8	270	2.4	v	32.5	3.1	34.8	53.6	74	-20.4	Peak
1653.3000	41.5	180	2.0	v	24.8	1.9	36.3	31.8	54	-22.2	Ave
1653.3000	40.1	90	2.0	h	24.8	1.9	36.3	30.4	54	-23.6	Ave
7440.0000	42.5	270	2.4	v	36.7	4.3	34.7	48.8	74	-25.2	Peak
7440.0000	41.8	90	2.1	h	36.7	4.3	34.7	48.1	74	-25.9	Peak

Note:

FUND: Fundamental
 AVG: Average

Unintentional Emission

Frequency MHz	Indicated		Antenna	Antenna		Correction Factor			FCC 15.247	
	Ampl. dB μ V/m	Direction Degree	Height Meter	Polar H/V	Antenna dB	Cable Loss dB	Amp. dB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
813.70	38.1	75	1.8	V	21.9	6.3	27.8	38.5	46	-7.5
813.70	35.6	270	2.0	H	21.9	6.3	27.8	36.0	46	-10.0
780.00	34.2	270	2.1	H	20.5	6.2	28.0	32.9	46	-13.1
780.00	33.1	330	1.2	V	20.5	6.2	28.0	31.8	46	-14.2
806.10	31.6	280	2.8	H	21.5	6.2	28.0	31.3	46	-14.7
806.10	30.4	250	1.0	V	21.5	6.2	28.0	30.1	46	-15.9

§15.247 (a) (1) - HOPPING CHANNEL SEPARATION

Standard Applicable

According to §15.247(a)(1), frequency hopping system 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the Max-Hold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function, and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	27° C
Relative Humidity:	68%
ATM Pressure:	1026 mbar

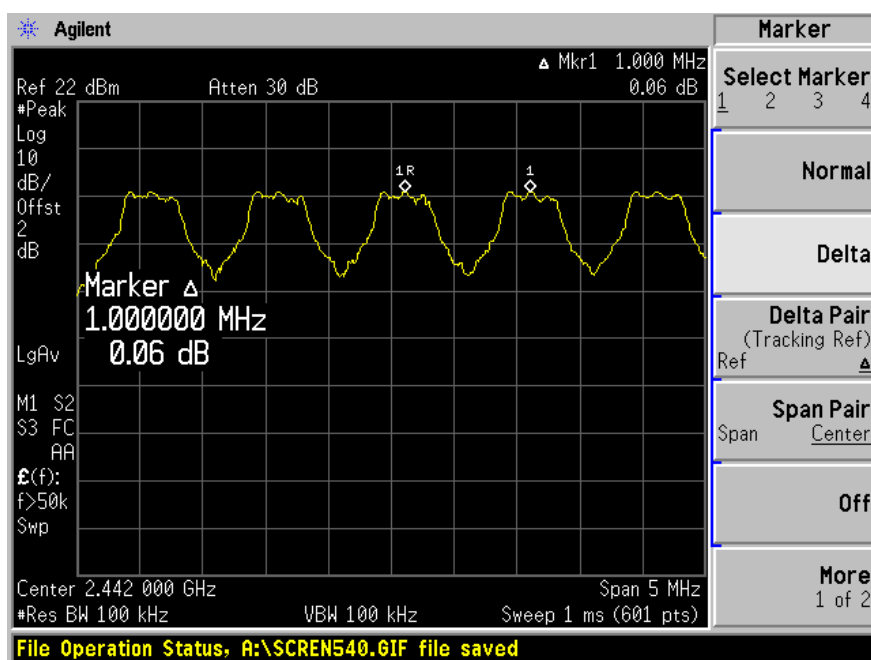
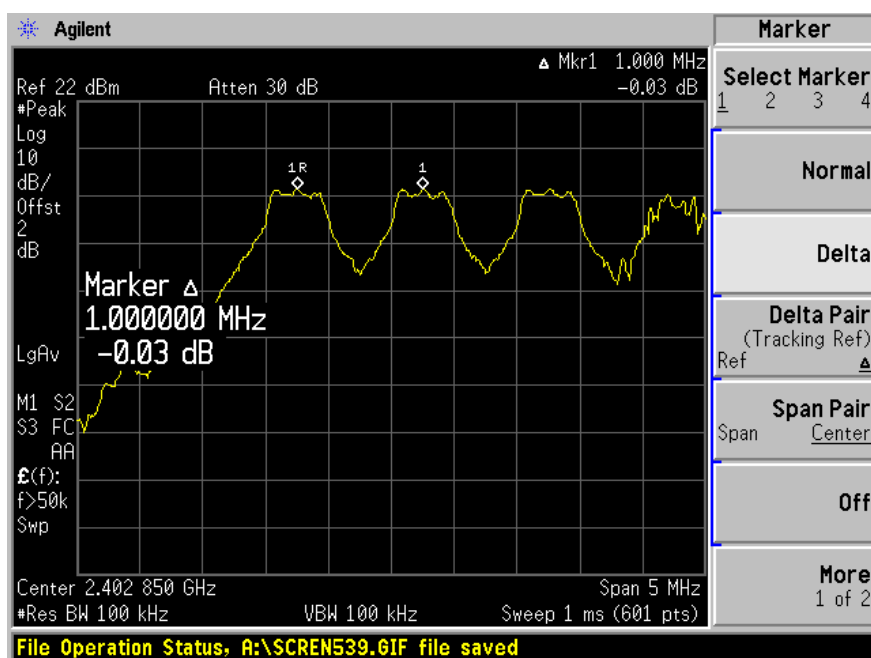
*The testing was performed by Snell Leong on 2005-08-17.

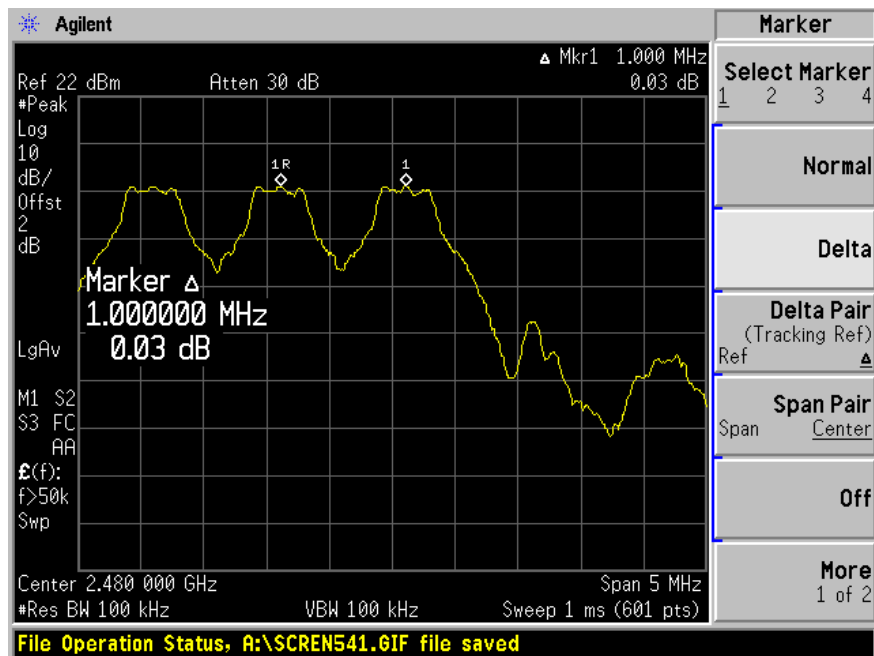
Measurement Results

Channel	Frequency MHz	Channel Separation (KHz)
Low	2402	1000
Mid	2442	1000
High	2480	1000

Plots of Hopping Channel Separation

Please refer to the following plots.





§15.247 (a) (1) - CHANNEL BANDWIDTH

Standard Applicable

According to §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

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Environmental Conditions

Temperature:	27° C
Relative Humidity:	68%
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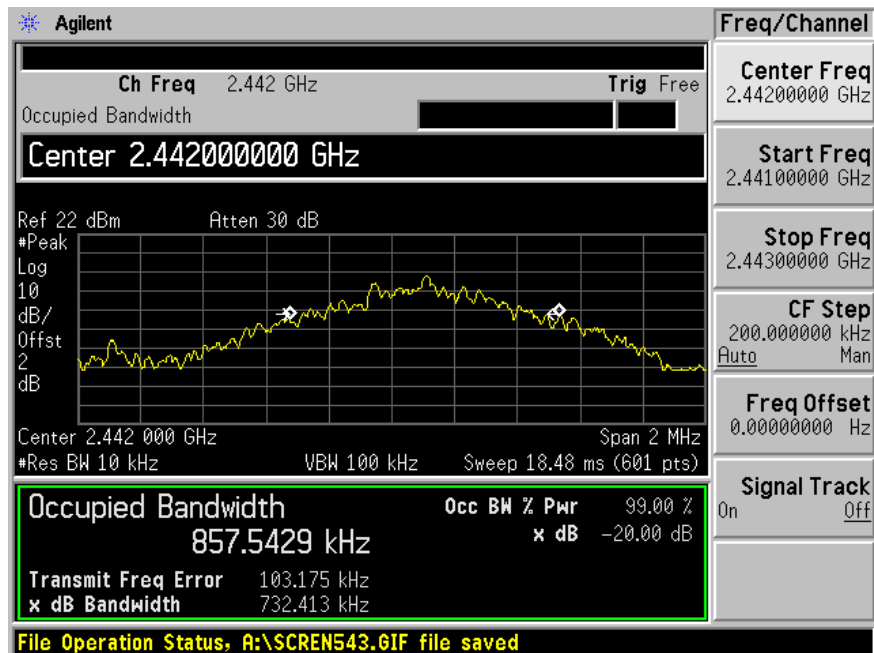
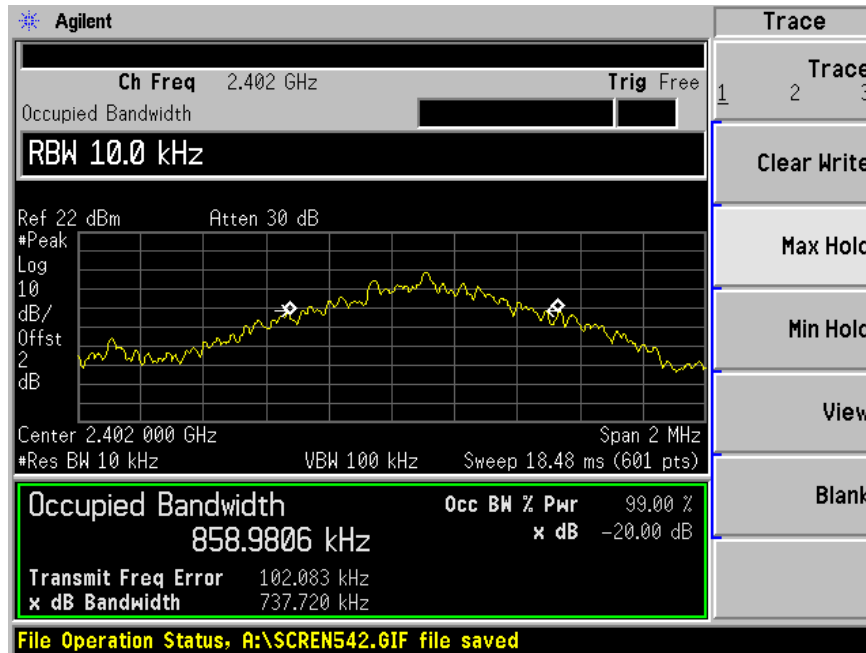
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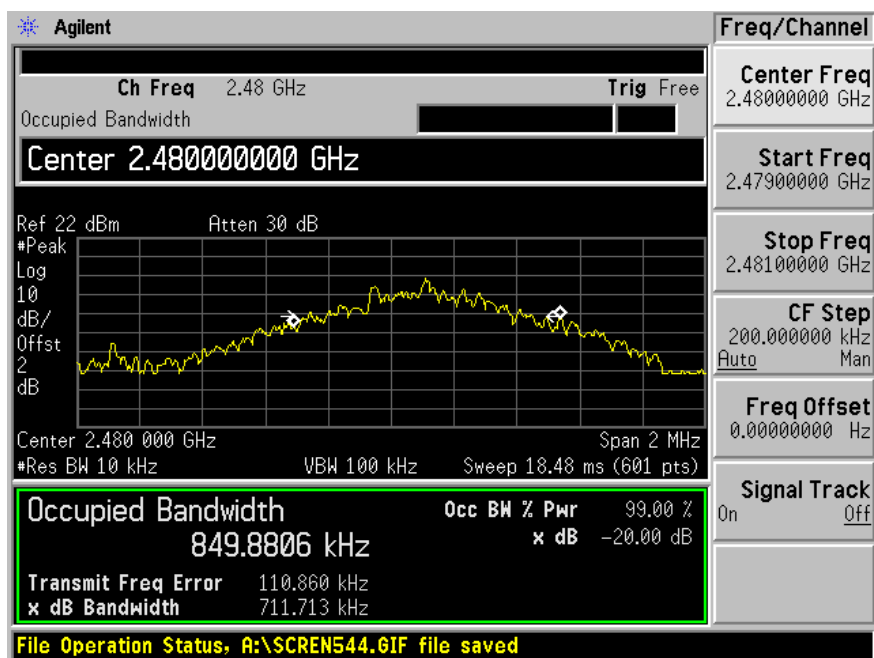
Measurement Result

Channel	Frequency MHz	Channel Bandwidth (KHz)	Limit KHz
Low	2402	737.72	<1000
Mid	2442	732.41	<1000
High	2480	711.71	<1000

Plot of Channel Bandwidth

Please see the following plots





§15.247 (a) (1) (iii) - NUMBER OF HOPPING FREQUENCY USED**Standard Applicable**

According to §15.247(a)(1)(iii), frequency hopping systems operating in the 2400-2483.5Mhz band shall use at least 15 hopping frequencies.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

*** Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	27° C
Relative Humidity:	68%
ATM Pressure:	1026 mbar

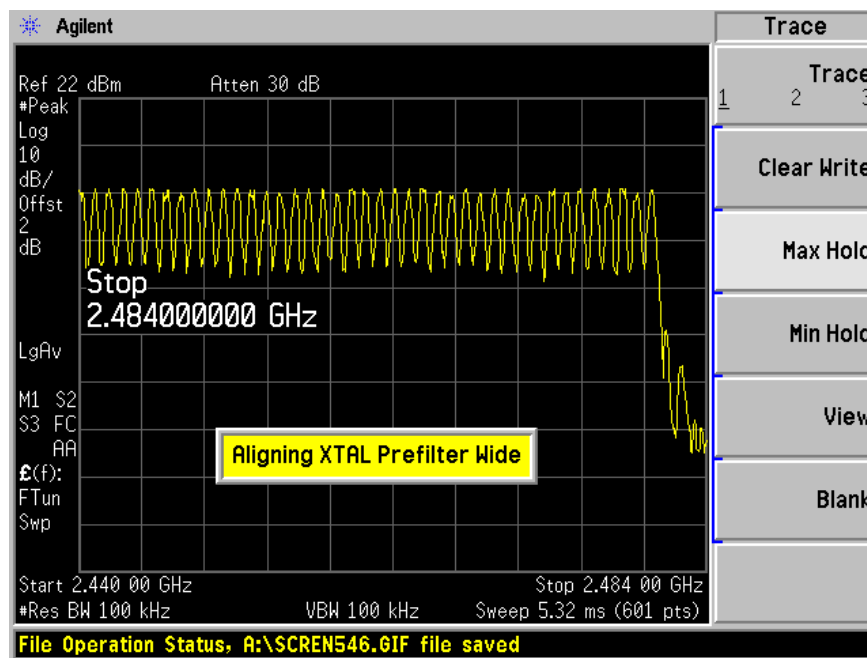
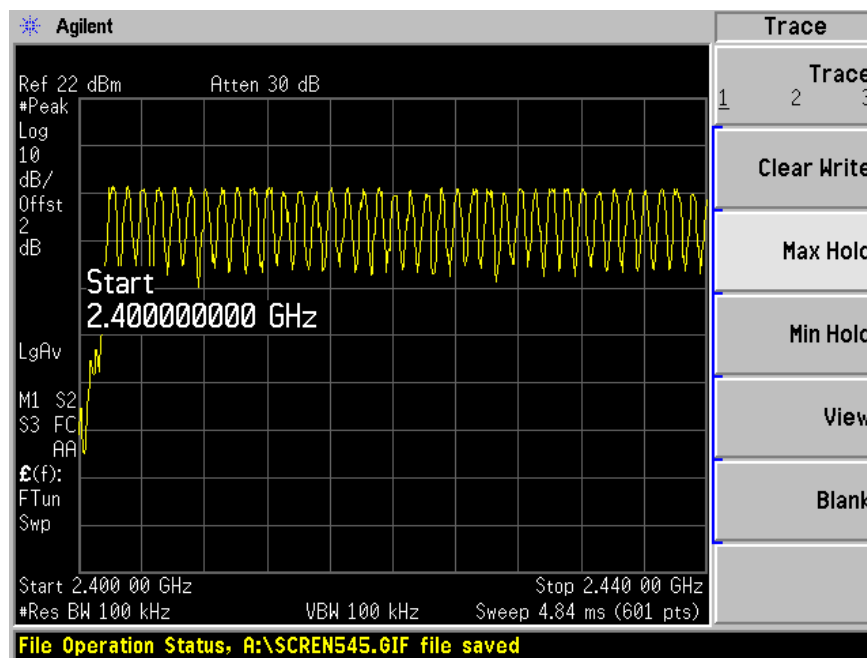
**The testing was performed by Snell Leong on 2005-08-17.*

Measurement Results

Measurement	Standard	Result
79	>15	Compliant

Plots of Number of Hopping Frequency

Please refer to the attached plots.



§15.247 9 (a) (1) (iii) - DWELL TIME

Standard Applicable

According to §15.247 (a)(1)(iii), the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

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Environmental Conditions

Temperature:	27° C
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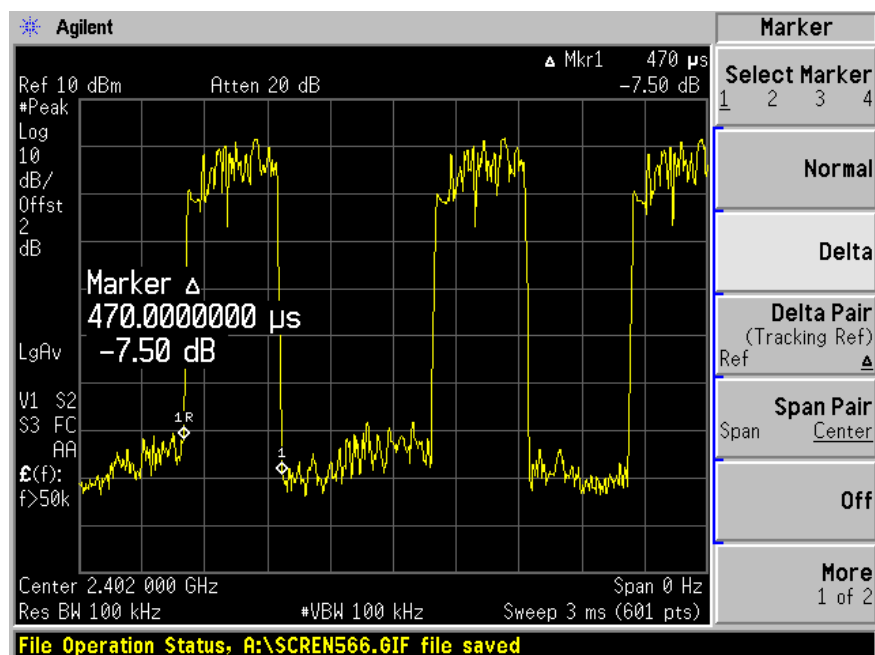
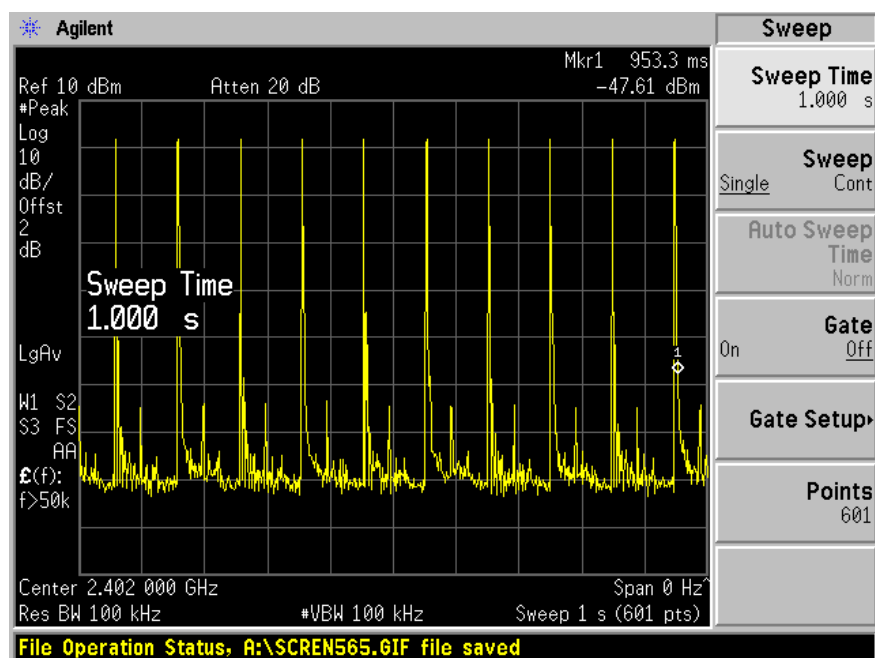
**The testing was performed by Snell Leong on 2005-08-17.*

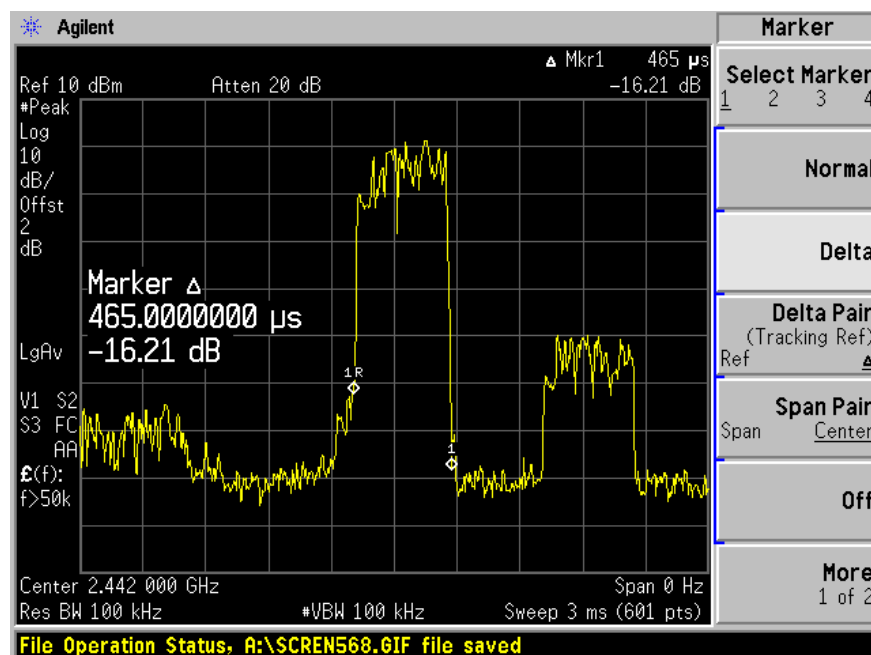
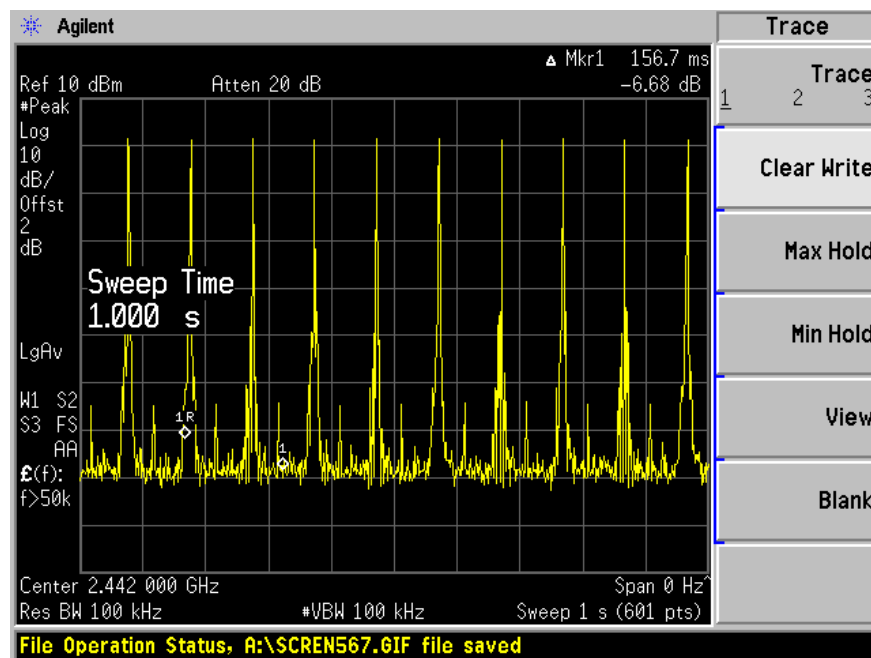
Measurement Results

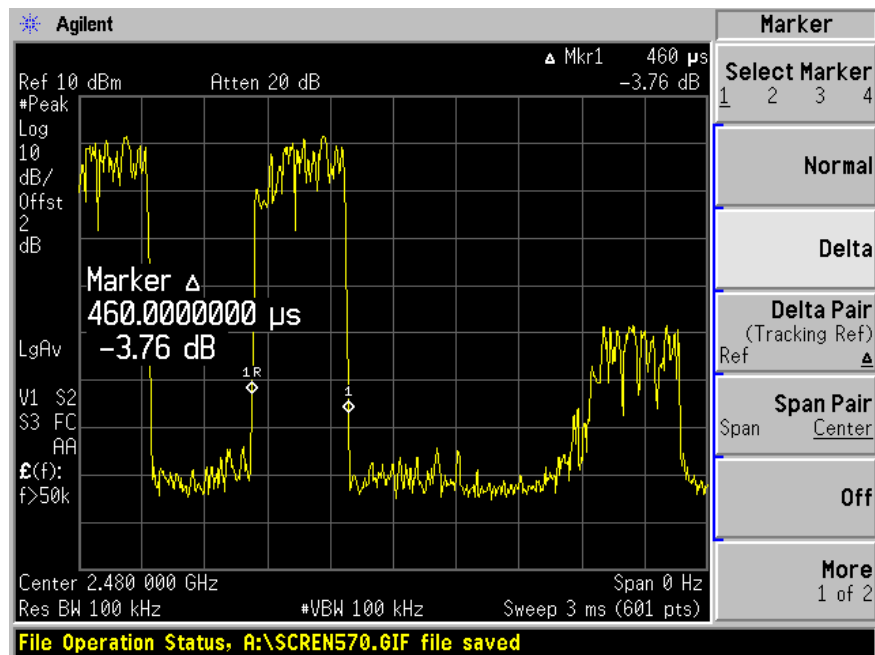
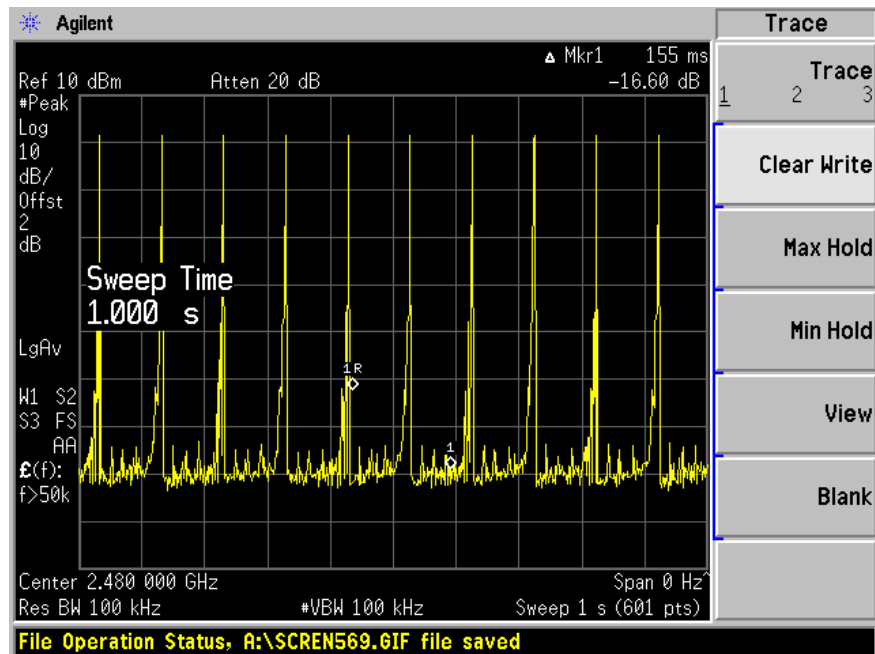
Channel	Frequency MHz	Pulse Wide uSec	Occupied time per Sec	Dwell Time Sec	Limit Sec
Low	2402	470	10	0.149	0.4
Mid	2442	465	10	0.147	0.4
High	2480	460	10	0.145	0.4

Plots of Dwell Time

Please refer the following plots.







§15.247 (b) (1) - MAXIMUM PEAK OUTPUT POWER

Standard Applicable

According to §15.247(b) (1), for frequency hopping systems in the 2400-2483.5MHz band employing at least 75 hopping channels, and all direct sequence systems, the maximum peak output power of the transmitter shall not exceed 1 Watt.

Measurement Procedure

1. Place the EUT on the turntable 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.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	27° C
Relative Humidity:	68%
ATM Pressure:	1026 mbar

**The testing was performed by Snell Leong on 2005-08-17.*

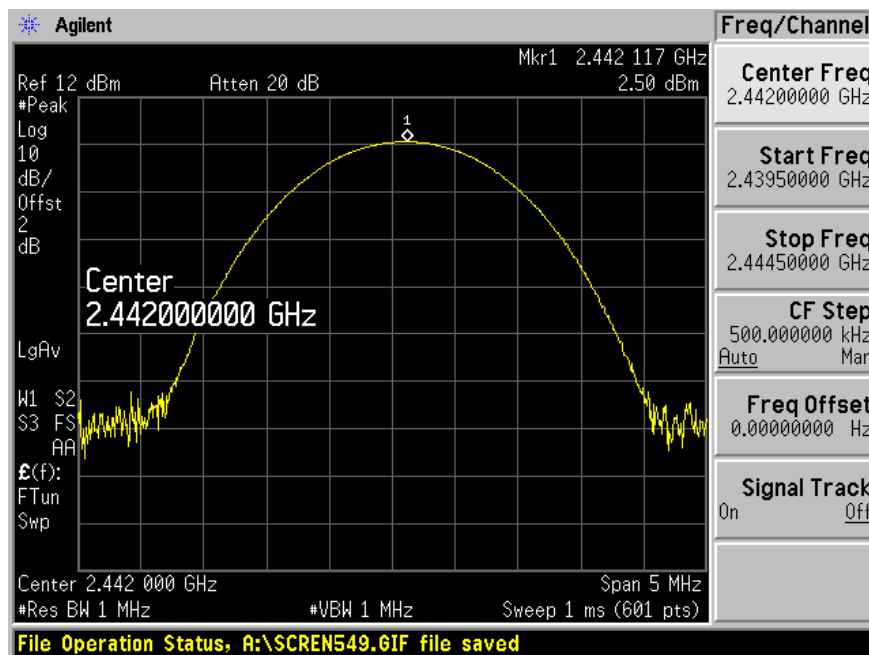
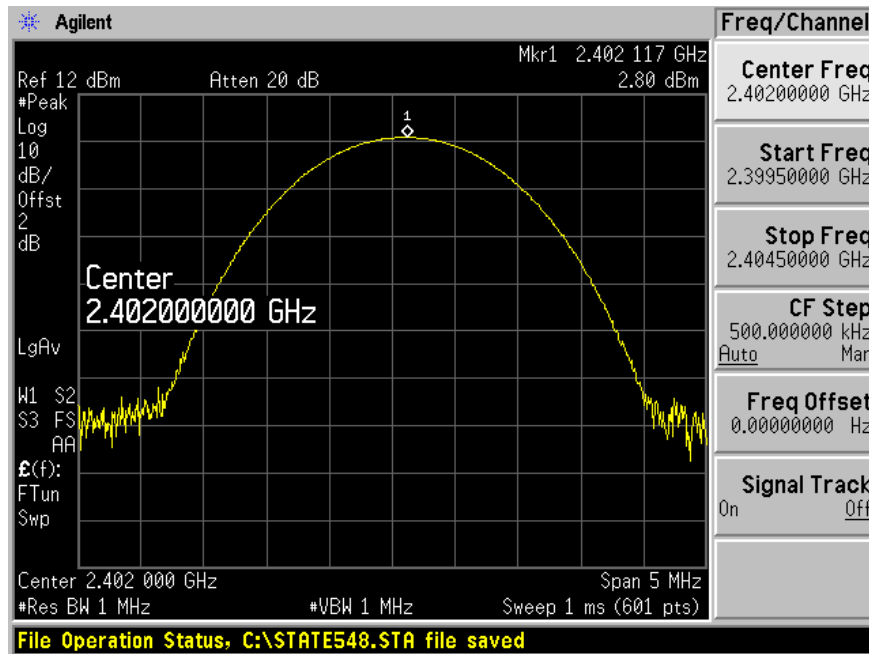
Measurement Result

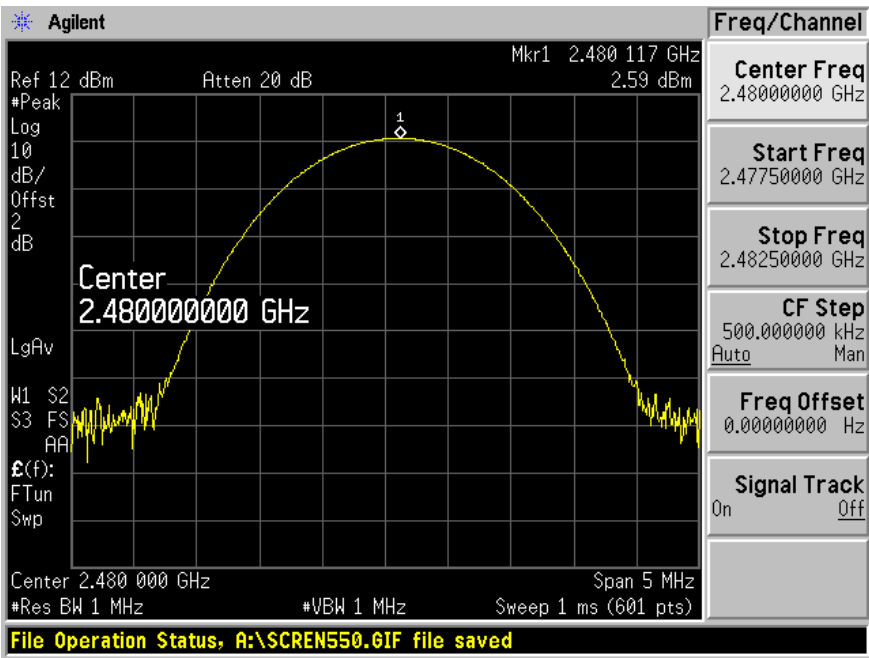
Channel	Frequency MHz	Max Peak Output Power		Limit (m Watt)	Result
		(dBm)	(m Watt)		
Low	2402	2.8	1.91	1000	pass
Mid	2442	2.5	1.78	1000	pass
High	2480	2.59	1.82	1000	pass

Offset = 2 db (cable loss + connector)

Plots of Maximum Peak Output Power

Please see the following plots





§15.247 (d) - 100 KHZ BANDWIDTH OF BAND EDGES

Standard Applicable

According to §15.247(d), 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 §15.209(a) is not required.

Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

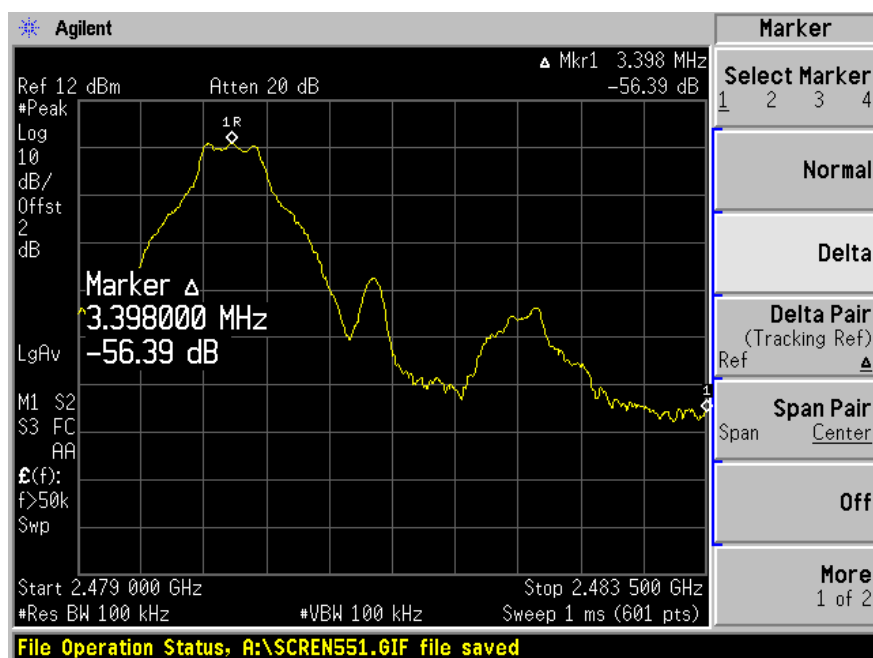
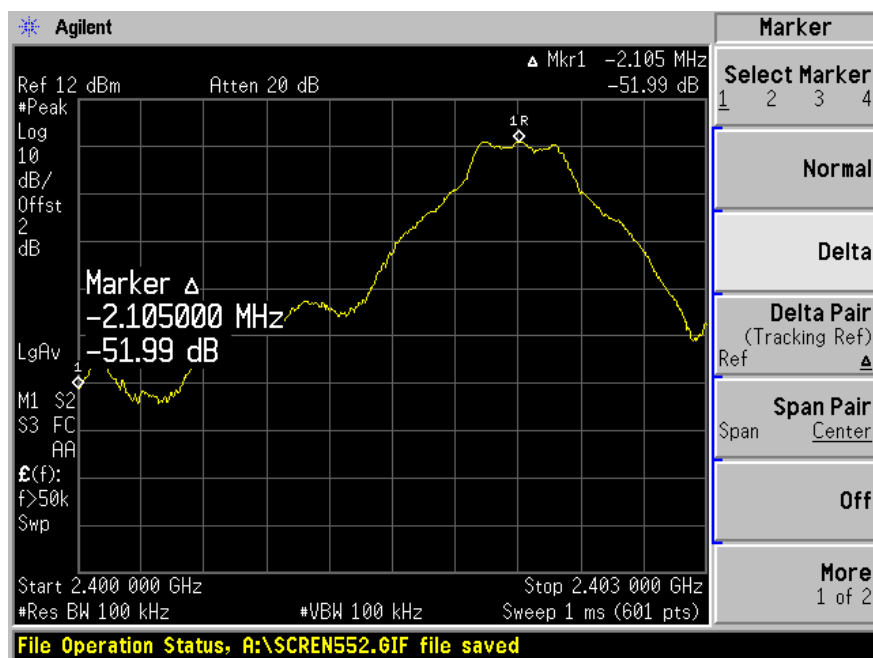
Environmental Conditions

Temperature:	27° C
Relative Humidity:	68%
ATM Pressure:	1026 mbar

**The testing was performed by Snell Leong on 2005-08-17.*

Plots of 100kHz Bandwidth of Band Edge

Please refer the following plots.



SPURIOUS EMISSION AT ANTENNA PORT

Standard Applicable

According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	11/10/2004

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

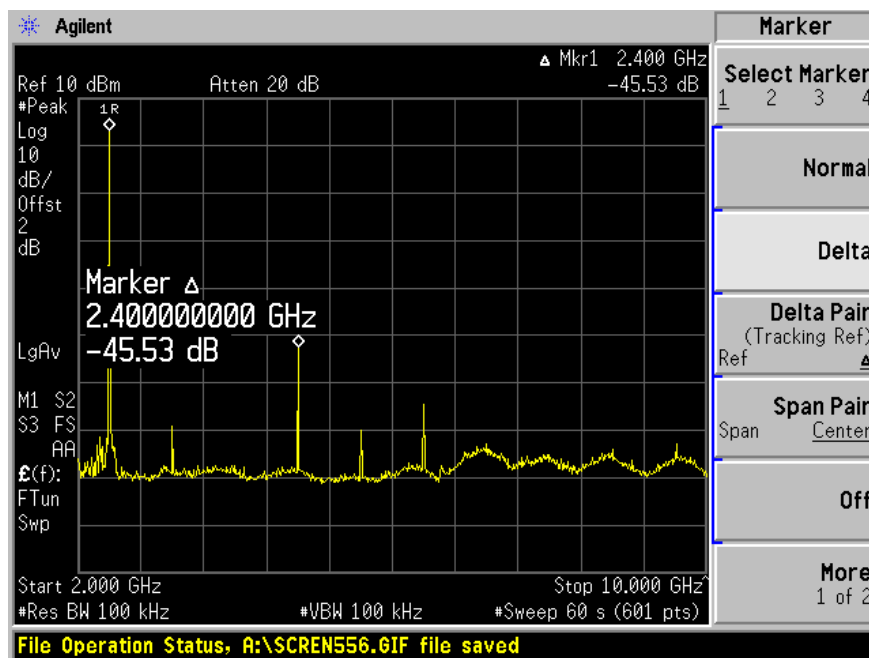
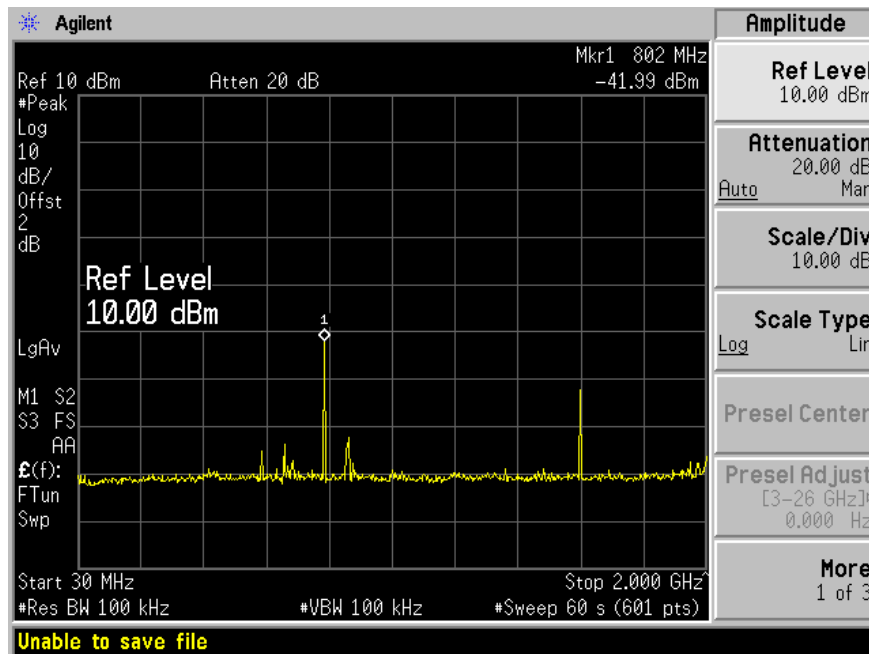
Temperature:	27° C
Relative Humidity:	68%
ATM Pressure:	1026 mbar

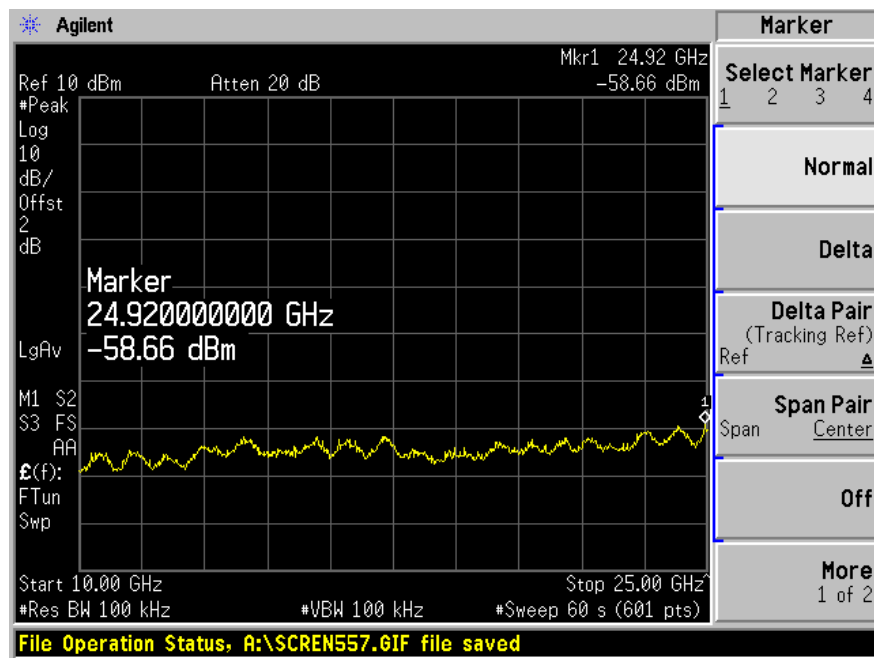
**The testing was performed by Snell Leong on 2005-08-17.*

Measurement Results

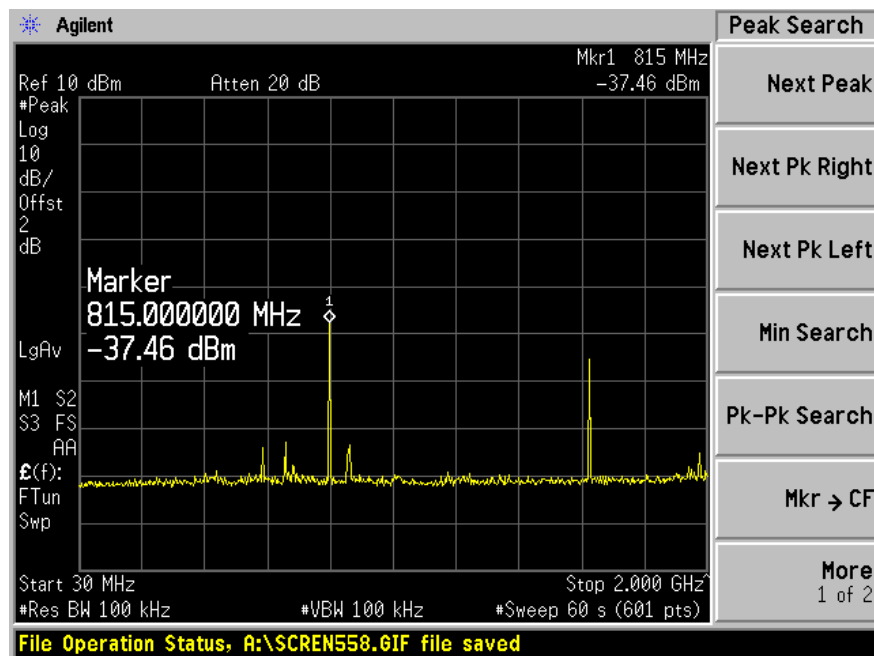
Please refer to the following plots.

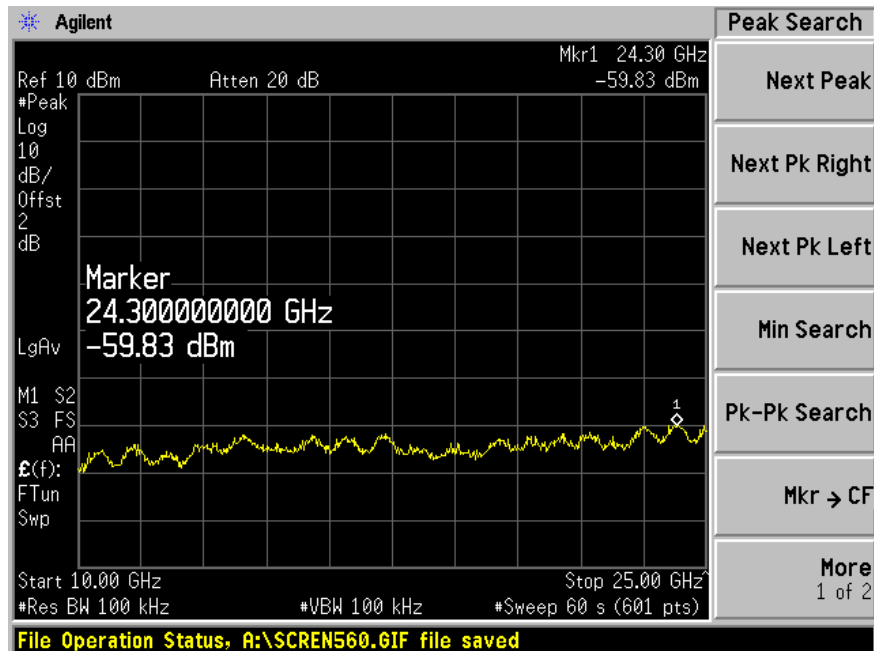
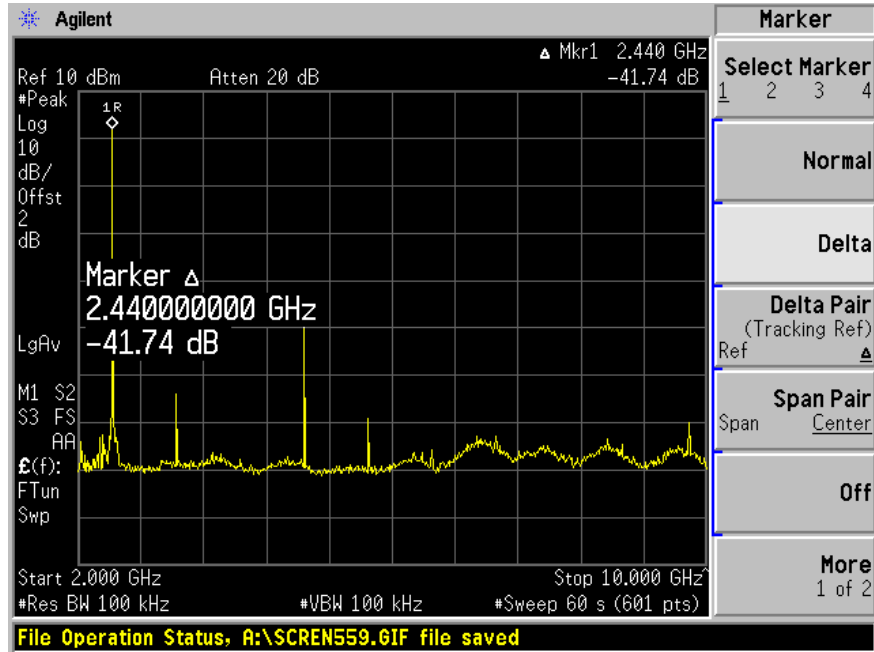
Low Channel





Mid Channel





High Channel

