

FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

I-TEL CORPORATION

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Kwangmyung-Si, Kyunggi-Do, South Korea

**FCC ID: QVF0410**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> 5.8GHz FHSS Cordless Phone
<b>Test Engineer:</b> Ming Jin	
<b>Report No.:</b> R0409213	
<b>Test Date:</b>	2004-11-01
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## GENERAL INFORMATION

### Product Description for Equipment Under Test (EUT)

The *I-Tel Corporation's*, FCC ID: *QVF0410*, model: *GH5862 EX*, or the “EUT” as referred to in this report is a 5.8GHz cordless Phone. The EUT was composed of two parts, one is the base which measures approximately 166 mm L x 145 mm W x 52 mm H, and the other is the handset which measures 180 mm L x 55mm W x 25 mm H.

*\* The test data gathered are from a production sample, S/N: GH5862-001, provided by the manufacturer.*

### Objective

This type approval report is prepared on behalf of *I-TEL CORPORATION* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, C rules.

The objective is to determine compliance with FCC 15.247 rules for the bluetooth:

- Maximum Peak Output Power
- Hopping Channel Separation
- Number of Hopping Frequency Used
- 20 dB Bandwidth
- Dwell Time on Each Channel
- 100 kHz Bandwidth of Band Edge
- Conducted Emission
- Spurious Emission
- Radiated Emission
- Antenna Requirement

### Related Submittal(s)/Grant(s)

No Related Submittals

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001& TIA/EIA-603.

### Test Facility

The Open Area Test site used by BACL Corp. 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.

Test site at BACL Corp. 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 test methods and procedures set forth in ANSI C63.4-2001& TIA/EIA-603.

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 scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22:2002, Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods.

## SYSTEM TEST CONFIGURATION

### Justification

The EUT was configured for testing according to ANSI C63.4-2001.

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

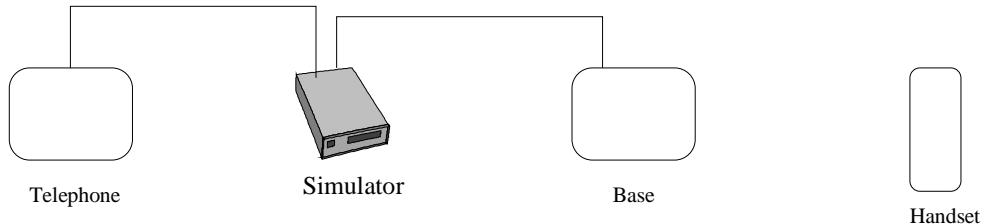
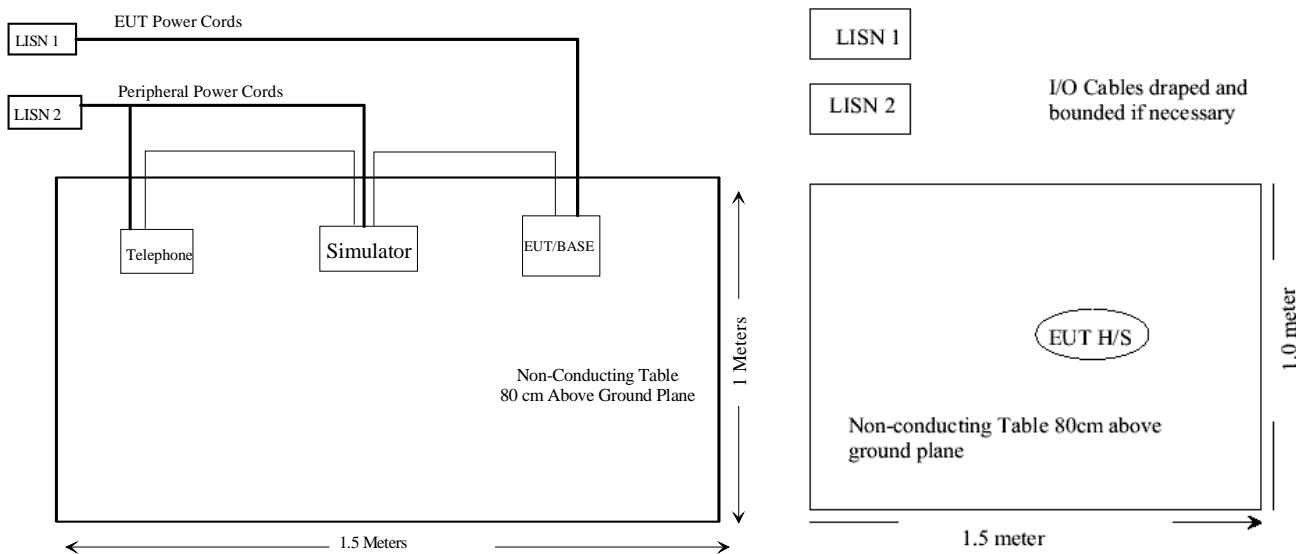
No modifications were made to the EUT.

### Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
TELTONE CORP.	SIMULATOR	TLS-3B-01	80071	DOC
Tak Fi	Telephone	T106B	None	None

### External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
None-Shielded Telephone Cable	2.0	RJ45 Port/EUT	Telephone Simulator RJ45 Port
None-Shielded Telephone Cable	2.0	RJ45 Port/Simulator	Telephone RJ45Port/telephone

**Configuration of Test System****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	N/A
§15.207 (a)	Conducted Emission	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 10 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 (c)	100 kHz Bandwidth of Frequency Band Edge	Compliant
	Spurious Emission at Antenna Port	Compliant

## **ANTENNA REQUIREMENT**

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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 gain of antenna used for transmitting is 0 dBi by default, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

## §15.207(a) - CONDUCTED 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, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is  $\pm 2.4$  dB.

### Test Setup

The measurement was performed at shield room, using the same setup per ANSI C63.4 – 2001 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with LISN-1.

### Spectrum Analyzer Setup

The spectrum analyzer was set to investigate the spectrum from 150 kHz to 30MHz.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	LISN	ESH2-Z5	871884/039	2004-03-28
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2004-05-06
Fluke	Calibrated Voltmeter	189	18485-38	2004-07-18

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Test Procedure

During the conducted emission test, the power cord of the host system was connected to the mains outlet of the LISN-1.

Maximizing procedure were performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with an “QP”. Average readings are distinguished with an “Ave”.

## Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

The testing was performed by Ming Jin on 2004-10-04

## Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Conducted limit for a Class B device, with the *worst* margin reading of:

**-37.1 dB at 0.81 MHz in the Neutral conductor**

## Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dB $\mu$ V	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dB $\mu$ V	Margin dB
0.81	8.9	AVE	Neutral	46	-37.1
0.81	3.0	AVE	Line	46	-43.0
29.13	16.2	QP	Neutral	60	-43.8
29.13	5.1	AVE	Line	50	-44.9
29.13	4.8	AVE	Neutral	50	-45.2
0.81	10.4	QP	Neutral	56	-45.6
29.13	13.2	QP	Line	60	-46.8
0.15	17.8	QP	Neutral	66	-48.2
0.15	16.9	QP	Line	66	-49.1
0.15	5.4	AVE	Neutral	56	-50.6
0.15	4.7	AVE	Line	56	-51.3
0.81	3.7	QP	Line	56	-52.3

## Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented in the following page as reference.

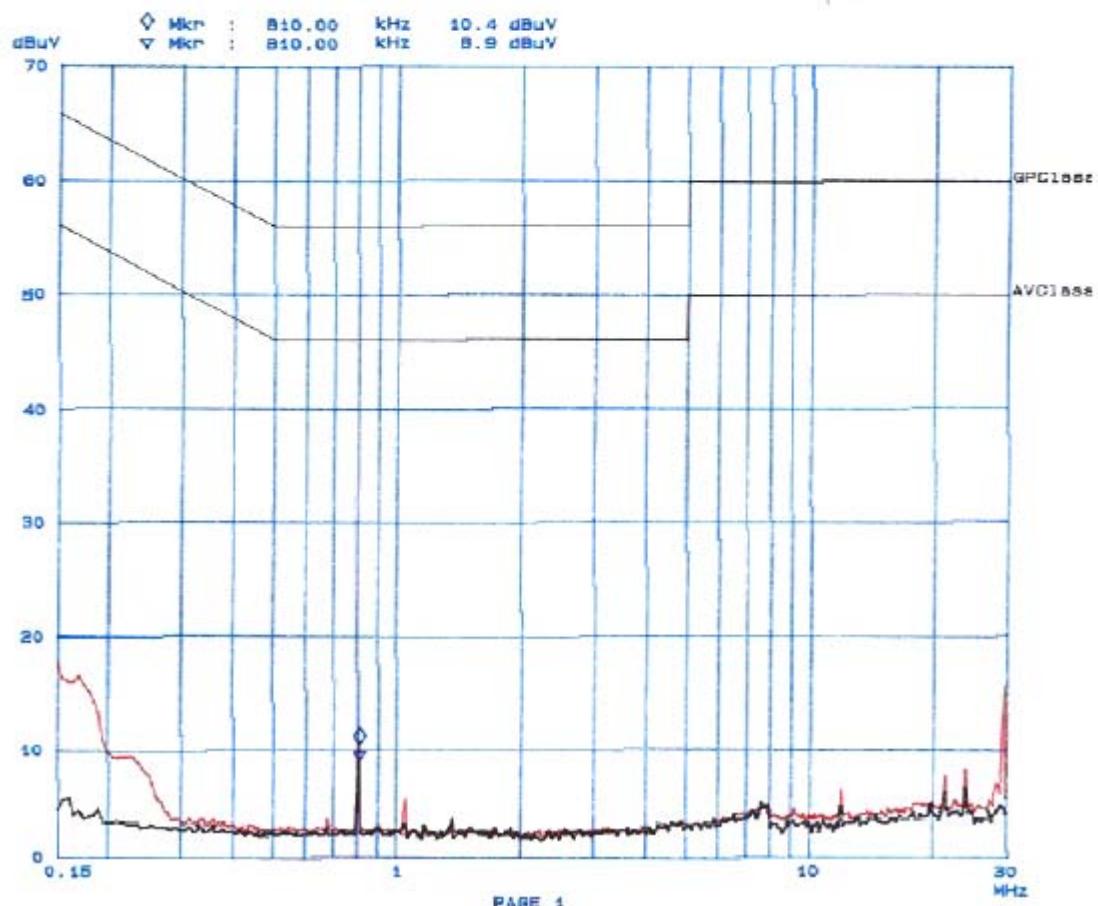
Bay Area Compliance Laboratory Corp  
Class B

28. Oct 04 17:36

EUT: SH5862  
Manuf: I-Tel  
Op Cond: Normal  
Operator: Ming  
Comment: N

Scan Settings (3 Ranges)

Frequency			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-time	Atten	Preamp	
150K	5M	5K	9K	QP+AV	20ms	15dBLN	OFF	
1M	5M	10K	9K	QP+AV	1ms	15dBLN	OFF	
5M	30M	100K	9K	QP+AV	1ms	15dBLN	OFF	



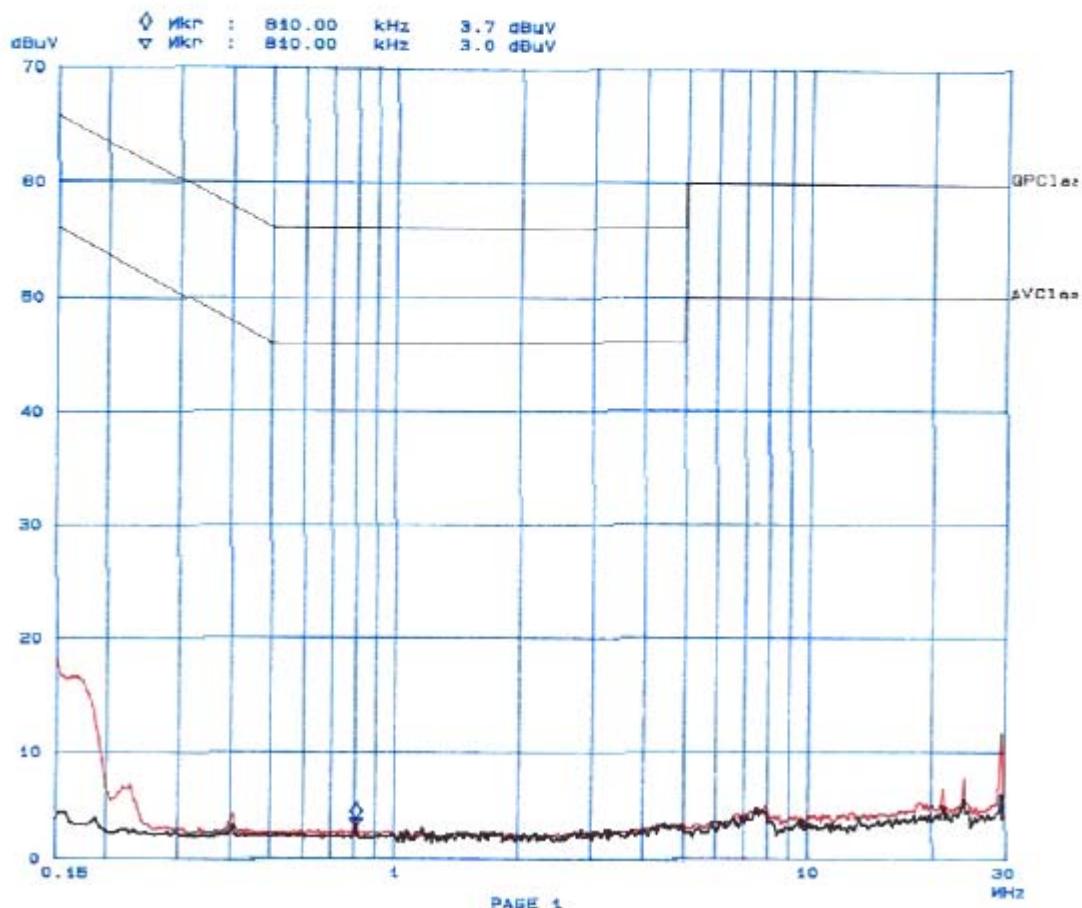
Bay Area Compliance Laboratory Corp  
Class B

28. Oct 04 15:08

EUT: GH5B62  
Manuf: I-Tel  
Op Cond: Normal  
Operator: ming  
Comment: L

### Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	MTIME	ATTEN	PREAMP
150k	1M	5k	9k	GP+AV	20ms	15dBBLN	OFF
1M	5M	10k	9k	GP+AV	1ms	15dBBLN	OFF
5M	30M	100k	9k	GP+AV	1ms	15dBBLN	OFF



## §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  $\pm 4.0$  dB.

### Test Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with ANSI C63.4-2001. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with 120Vac/60Hz power source.

### Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 40GHz.

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

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

### Test Equipment List and Details

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Cal. Due Date</b>
HP	Amplifier, Pre, microwave	8449B	3147A00400	2004-03-14
HP	Amplifier, Pre	8447E	1937A01057	2004-08-04
HP	Analyzer, Spectrum	8565EC	3946A00131	2004-06-30
ETS	Antenna, Biconical	3110B	9603-2315	2004-01-11
A.R.A.	Antenna, Horn, DRG	DRG-118/A	1132	2004-09-30
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	2455-261	2004-08-01
ETS	Antenna, logperiodic	3148	0004-1155	2003-10-11

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

*The testing was performed by Ming Jin on 2004-10-25*

## Test Procedure

For the radiated emissions test, both the laptop and all peripheral power cords were connected to the AC floor outlet since the power supply used in the laptop did not provide an accessory power outlet.

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 recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.247, and had the worst margin of:

Base:

- 5.6 dB at 11522.97 MHz** in the **Vertical** polarization, Low Channel.
- 5.3 dB at 11601.46 MHz** in the **Vertical** polarization, Middle Channel.
- 5.2 dB at 11678.16 MHz** in the **Vertical** polarization, High Channel.
- 10.7 dB at 37.79 MHz** in the **Horizontal** polarization, Unintentional Emission.

Handset:

- 6.0 dB at 11522.97 MHz** in the **Vertical** polarization, Low Channel.
- 5.9 dB at 11601.46 MHz** in the **Vertical** polarization, Middle Channel.
- 6.6 dB at 11678.16 MHz** in the **Vertical** polarization, High Channel.
- 13.4 dB at 39.70 MHz** in the **Horizontal** polarization, Unintentional Emission.

**Radiated Emission Test Data, Base**

Indicated			Antenna	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dB $\mu$ V/m	Degree	Meter	H/V	dB $\mu$ V/m	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB	
Low Channel											
5761.49	110.9	290	1.8	v	34.1	3.4	35.5	112.9			Fund/Peak
5761.49	104.2	330	1.5	h	34.1	3.4	35.5	106.2			Fund/Peak
5761.49	83.8	290	1.8	v	34.1	3.4	35.5	85.8			Fund/Ave.
5761.49	80.1	330	1.5	h	34.1	3.4	35.5	82.1			Fund/Ave.
11522.97	65.5	0	1.6	v	34.1	3.4	34.6	68.4	74	-5.6	Peak
11522.97	62.9	15	1.5	h	34.1	3.4	34.6	65.8	74	-8.2	Peak
17284.47	56.7	180	1.6	v	34.1	3.4	30.9	63.3	74	-10.7	Peak
11522.97	39.2	0	1.6	v	34.1	3.4	34.6	42.1	54	-11.9	Ave.
17284.47	54.8	90	1.5	h	34.1	3.4	30.9	61.4	74	-12.6	Peak
11522.97	37.3	15	1.5	h	34.1	3.4	34.6	40.2	54	-13.8	Ave.
17284.47	31.6	180	1.6	v	34.1	3.4	30.9	38.2	54	-15.8	Ave.
17284.47	29.5	90	1.5	h	34.1	3.4	30.9	36.1	54	-17.9	Ave.
Middle Channel											
5800.73	111.3	310	1.6	v	34.1	3.4	35.5	113.3			Fund/Peak
5800.73	104.5	0	1.5	h	34.1	3.4	35.5	106.5			Fund/Peak
5800.73	84.2	310	1.6	v	34.1	3.4	35.5	86.2			Fund/Ave.
5800.73	80.3	0	1.5	h	34.1	3.4	35.5	82.3			Fund/Ave.
11601.46	65.8	120	1.6	v	34.1	3.4	34.6	68.7	74	-5.3	Peak
11601.46	63.2	290	1.6	h	34.1	3.4	34.6	66.1	74	-7.9	Peak
17402.19	57.3	60	1.6	v	34.1	3.4	30.9	63.9	74	-10.1	Peak
11601.46	39.4	120	1.6	v	34.1	3.4	34.6	42.3	54	-11.7	Ave.
17402.19	55.1	0	1.6	h	34.1	3.4	30.9	61.7	74	-12.3	Peak
11601.46	37.6	290	1.6	h	34.1	3.4	34.6	40.5	54	-13.5	Ave.
17402.19	31.8	60	1.6	v	34.1	3.4	30.9	38.4	54	-15.6	Ave.
17402.19	29.6	0	1.6	h	34.1	3.4	30.9	36.2	54	-17.8	Ave.
High Channel											
5839.08	112.1	0	1.8	v	34.1	3.4	35.5	114.1			Fund/Peak
5839.08	105.4	15	1.5	h	34.1	3.4	35.5	107.4			Fund/Peak
5839.08	84.9	0	1.8	v	34.1	3.4	35.5	86.9			Fund/Ave.
5839.08	80.7	15	1.5	h	34.1	3.4	35.5	82.7			Fund/Ave.
11678.16	65.9	45	1.5	v	34.1	3.4	34.6	68.8	74	-5.2	Peak
11678.16	63.8	270	1.6	h	34.1	3.4	34.6	66.7	74	-7.3	Peak
17517.24	57.7	90	1.5	v	34.1	3.4	30.9	64.3	74	-9.7	Peak
11678.16	40.2	45	1.5	v	34.1	3.4	34.6	43.1	54	-10.9	Ave.
17517.24	55.6	210	1.6	h	34.1	3.4	30.9	62.2	74	-11.8	Peak
11678.16	38.3	270	1.6	h	34.1	3.4	34.6	41.2	54	-12.8	Ave.
17517.24	32.4	90	1.5	v	34.1	3.4	30.9	39.0	54	-15.0	Ave.
17517.24	30.2	210	1.6	h	34.1	3.4	30.9	36.8	54	-17.2	Ave.

Note:

FUND: Fundamental

AVG: Average

## Unintentional Emission

Frequency MHz	Indicated		Antenna Height Meter	Antenna		Cable Loss dB $\mu$ V/ m	Correction Factor		FCC 15 Subpart C	
	Ampl. dB $\mu$ V/m	Direction Degree		Polar H/V	Antenna dB $\mu$ V/m		Amp. dB	Corr. Ampl. dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
37.79	44.5	210	1.5	h	11.5	2.2	28.9	29.3	40	-10.7
670.20	46.3	330	1.8	h	11.8	2.2	28.4	31.9	46	-14.1
72.68	38.4	90	1.2	v	11.8	2.2	28.8	23.6	40	-16.4
871.96	41.9	60	1.2	v	11.8	2.2	28.8	27.1	46	-18.9

**Radiated Emission Test Data, Handset**

Indicated			Antenna	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin	Comments
MHz	dB $\mu$ V/m	Degree	Meter	H/V	dB $\mu$ V/m	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB	
Low Channel											
5761.49	110.5	180	1.6	v	34.1	3.4	35.5	112.5			Fund/Peak
5761.49	103.8	45	1.5	h	34.1	3.4	35.5	105.8			Fund/Peak
5761.49	83.2	180	1.6	v	34.1	3.4	35.5	85.2			Fund/Ave.
5761.49	79.7	45	1.5	h	34.1	3.4	35.5	81.7			Fund/Ave.
11522.97	65.1	0	1.6	v	34.1	3.4	34.6	68.0	74	-6.0	Peak
11522.97	62.3	30	1.5	h	34.1	3.4	34.6	65.2	74	-8.8	Peak
17284.47	56.2	120	1.5	v	34.1	3.4	30.9	62.8	74	-11.2	Peak
11522.97	38.7	0	1.6	v	34.1	3.4	34.6	41.6	54	-12.4	Ave.
17284.47	54.3	90	1.5	h	34.1	3.4	30.9	60.9	74	-13.1	Peak
11522.97	37.1	30	1.5	h	34.1	3.4	34.6	40.0	54	-14.0	Ave.
17284.47	31.4	120	1.5	v	34.1	3.4	30.9	38.0	54	-16.0	Ave.
17284.47	29.3	90	1.5	h	34.1	3.4	30.9	35.9	54	-18.1	Ave.
Middle Channel											
5800.73	110.8	290	1.6	v	34.1	3.4	35.5	112.8			Fund/Peak
5800.73	104.1	0	1.5	h	34.1	3.4	35.5	106.1			Fund/Peak
5800.73	83.5	290	1.6	v	34.1	3.4	35.5	85.5			Fund/Ave.
5800.73	79.9	0	1.5	h	34.1	3.4	35.5	81.9			Fund/Ave.
11601.46	65.2	120	1.5	v	34.1	3.4	34.6	68.1	74	-5.9	Peak
11601.46	62.5	270	1.2	h	34.1	3.4	34.6	65.4	74	-8.6	Peak
17402.19	56.4	60	1.5	v	34.1	3.4	30.9	63.0	74	-11.0	Peak
11601.46	38.9	120	1.5	v	34.1	3.4	34.6	41.8	54	-12.2	Ave.
17402.19	54.5	45	1.5	h	34.1	3.4	30.9	61.1	74	-12.9	Peak
11601.46	37.3	270	1.2	h	34.1	3.4	34.6	40.2	54	-13.8	Ave.
17402.19	31.6	60	1.5	v	34.1	3.4	30.9	38.2	54	-15.8	Ave.
17402.19	30.1	45	1.5	h	34.1	3.4	30.9	36.7	54	-17.3	Ave.
High Channel											
5839.08	109.9	90	1.8	v	34.1	3.4	35.5	111.9			Fund/Peak
5839.08	103.1	15	1.5	h	34.1	3.4	35.5	105.1			Fund/Peak
5839.08	82.7	90	1.8	v	34.1	3.4	35.5	84.7			Fund/Ave.
5839.08	79.2	15	1.5	h	34.1	3.4	35.5	81.2			Fund/Ave.
11678.16	64.5	45	1.5	v	34.1	3.4	34.6	67.4	74	-6.6	Peak
11678.16	61.7	0	1.6	h	34.1	3.4	34.6	64.6	74	-9.4	Peak
17517.24	55.6	210	1.5	v	34.1	3.4	30.9	62.2	74	-11.8	Peak
11678.16	38.3	45	1.5	v	34.1	3.4	34.6	41.2	54	-12.8	Ave.
17517.24	53.7	270	1.6	h	34.1	3.4	30.9	60.3	74	-13.7	Peak
11678.16	36.4	0	1.6	h	34.1	3.4	34.6	39.3	54	-14.7	Ave.
17517.24	30.9	210	1.5	v	34.1	3.4	30.9	37.5	54	-16.5	Ave.
17517.24	28.7	270	1.6	h	34.1	3.4	30.9	35.3	54	-18.7	Ave.

Note:

FUND: Fundamental

AVG: Average

## Unintentional Emission

Frequency MHz	Indicated		Antenna Height Meter	Antenna		Cable Loss dB $\mu$ V/ m	Correction Factor		FCC 15 Subpart C	
	Ampl. dB $\mu$ V/m	Direction Degree		Polar H/V	Antenna dB $\mu$ V/m		Amp. dB	Corr. Ampl. dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
39.70	41.8	180	1.5	h	11.5	2.2	28.9	26.6	40	-13.4
670.20	45.6	45	1.8	h	11.8	2.2	28.4	31.2	46	-14.8
90.14	37.2	110	1.2	v	11.8	2.2	28.8	22.4	40	-17.6

## §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	Model No.	Description	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

*The testing was performed by Ming Jin on 2004-10-25*

**Measurement Results**

Base:

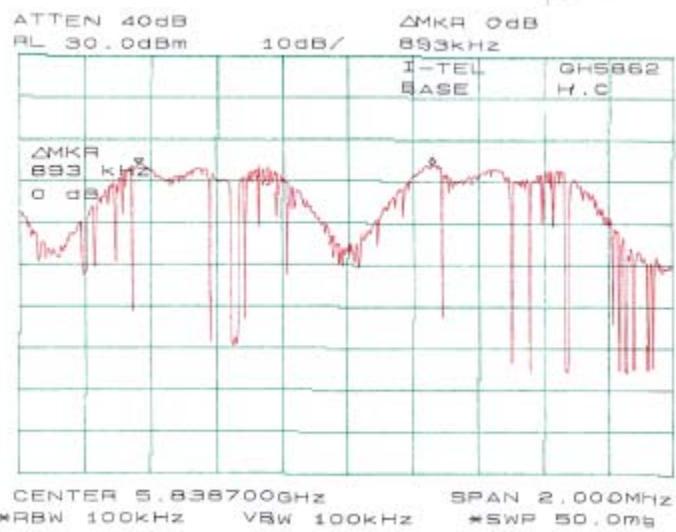
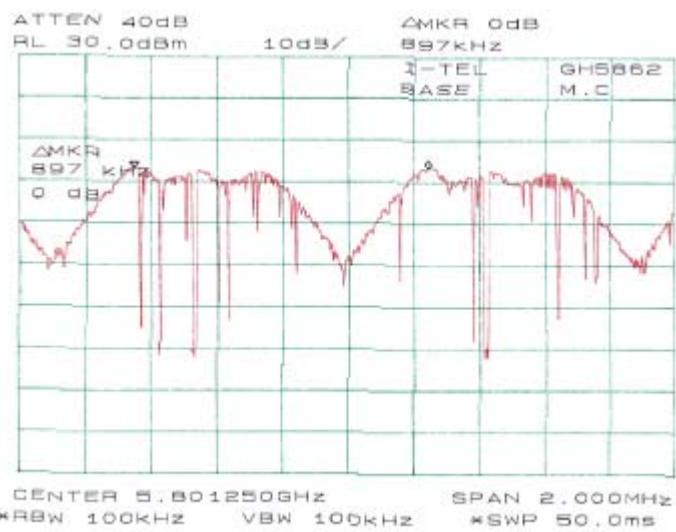
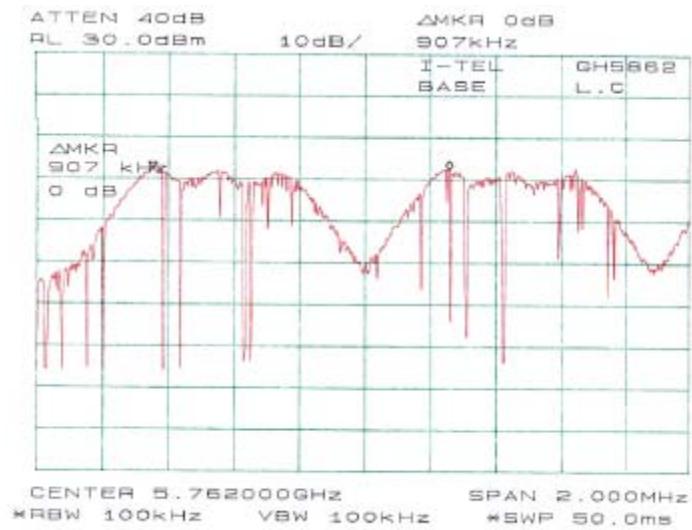
Channel	Measurement (KHz)	Result
Low	907	Compliant
Middle	897	Compliant
High	893	Compliant

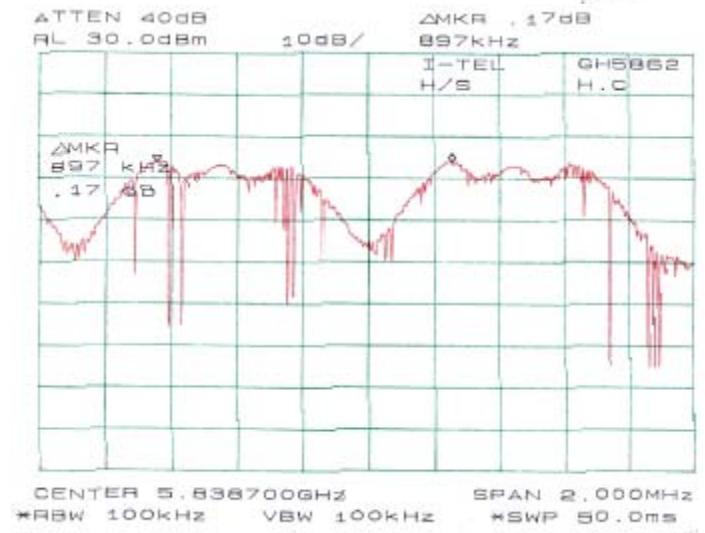
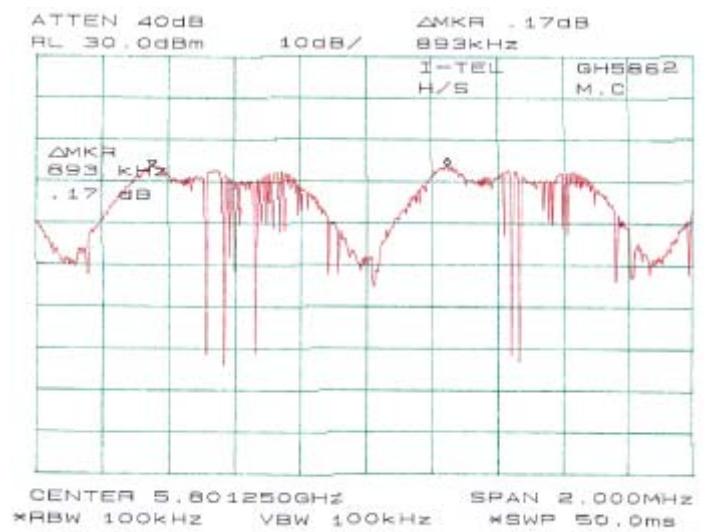
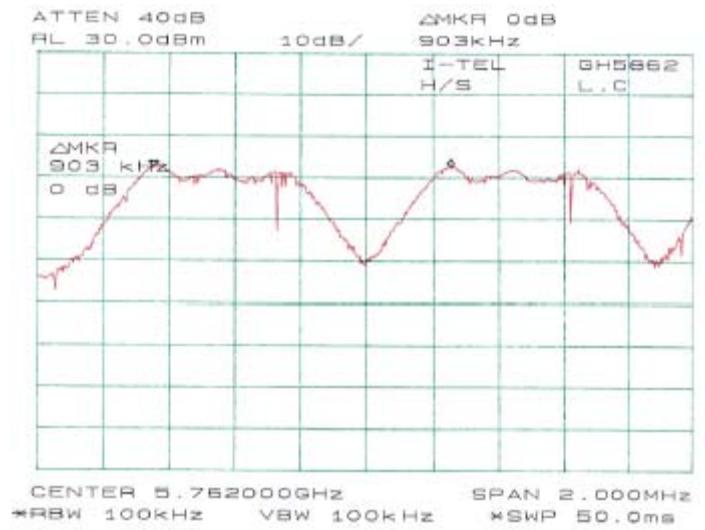
Handset:

Channel	Measurement (KHz)	Result
Low	903	Compliant
Middle	893	Compliant
High	897	Compliant

**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	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

*The testing was performed by Ming Jin on 2004-10-25*

**Measurement Result**

Base:

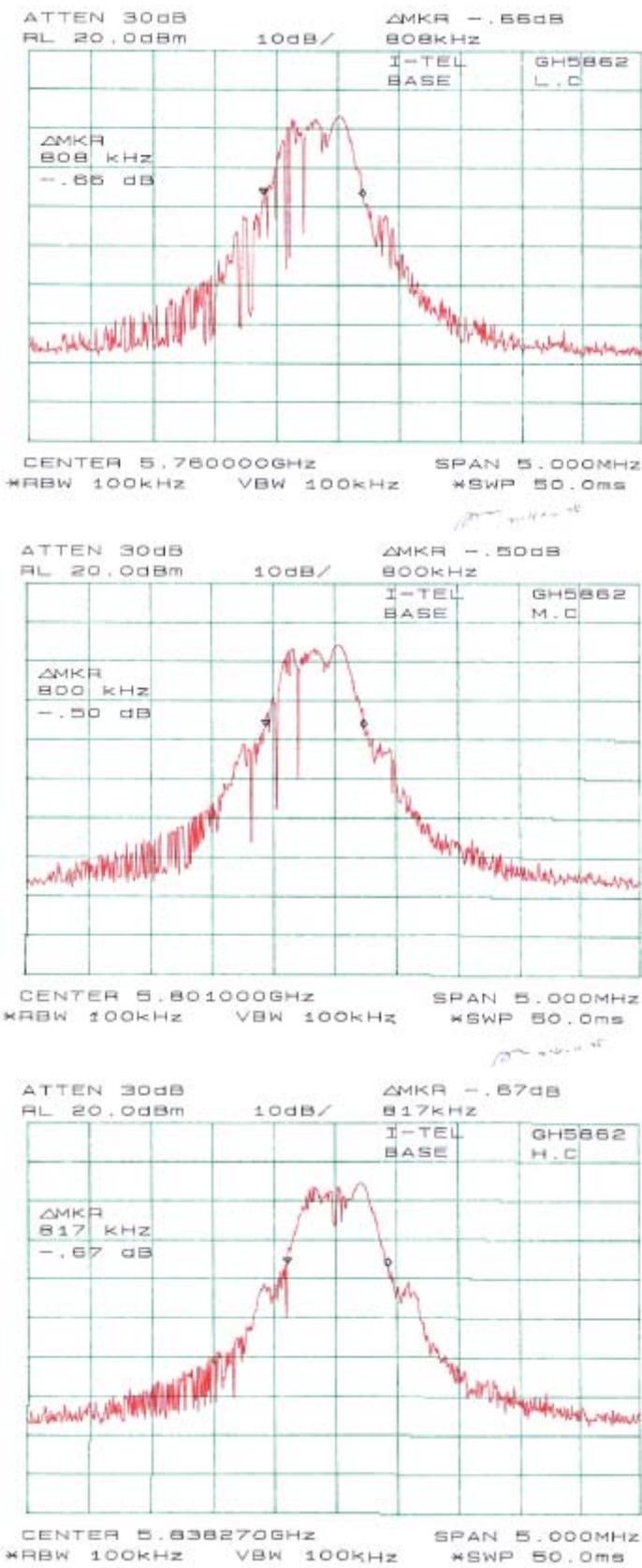
Frequency	Measurement (kHz)	Standard	Result
Low	808	$\leq 1\text{MHz}$	Compliant
Middle	800	$\leq 1\text{MHz}$	Compliant
High	817	$\leq 1\text{MHz}$	Compliant

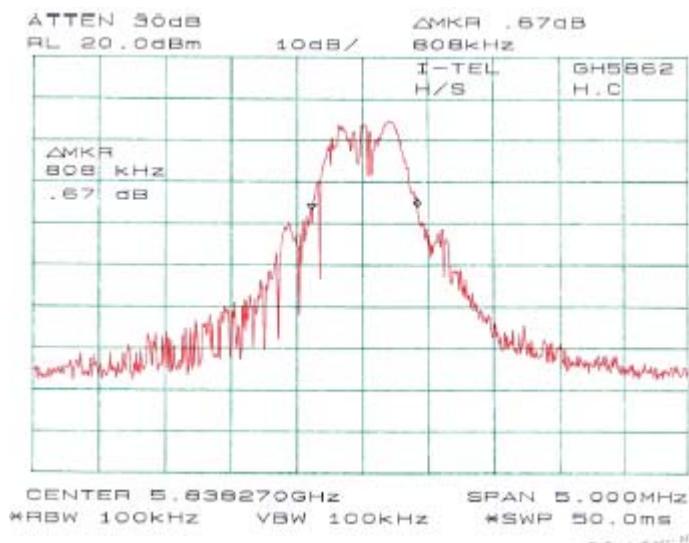
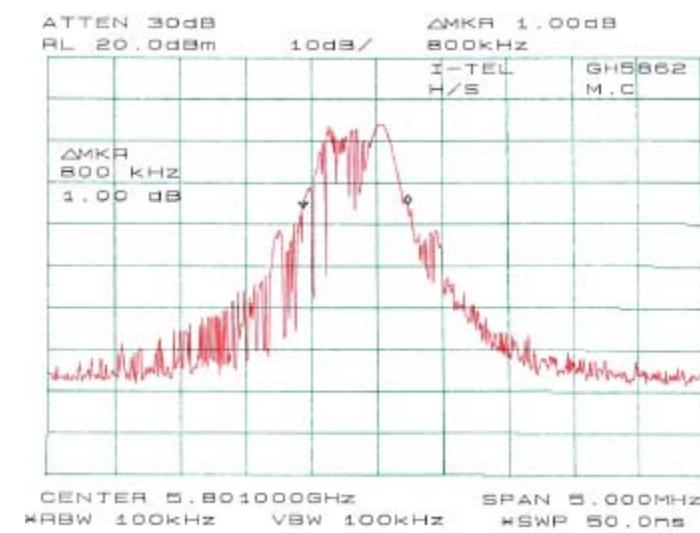
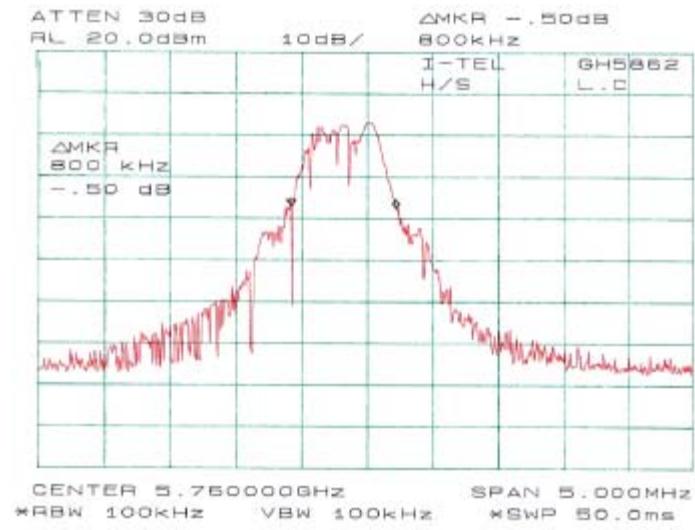
Handset:

Frequency	Measurement (kHz)	Standard	Result
Low	800	$\leq 1\text{MHz}$	Compliant
Middle	800	$\leq 1\text{MHz}$	Compliant
High	808	$\leq 1\text{MHz}$	Compliant

**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 75 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	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2003-08-01

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

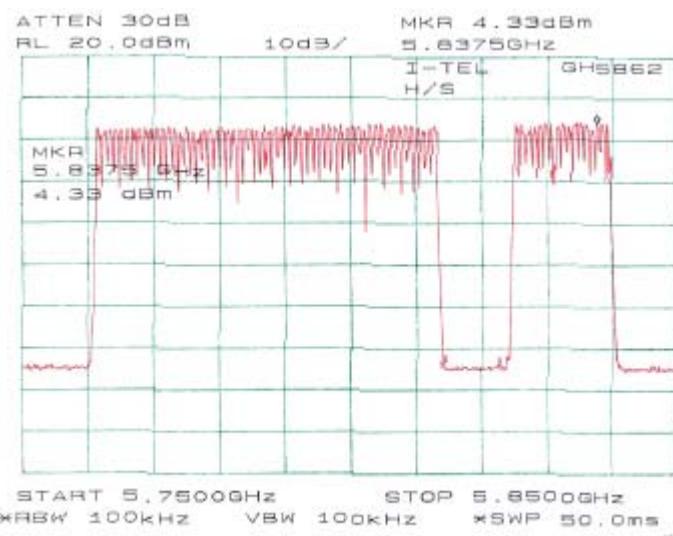
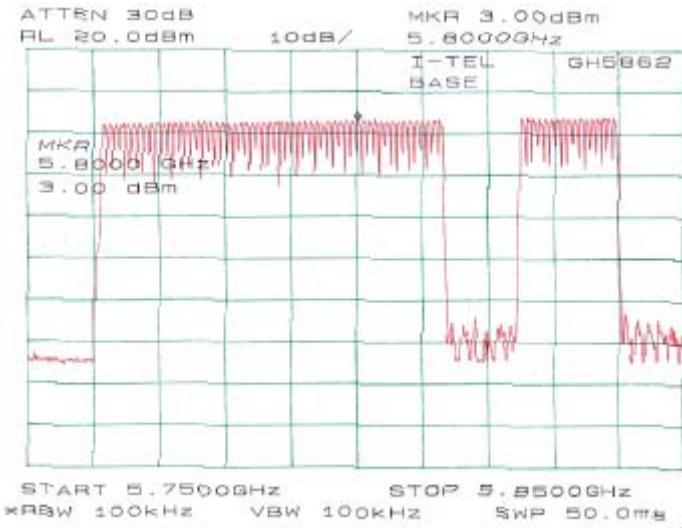
*The testing was performed by Ming Jin on 2004-10-25*

### Measurement Results

Measurement	Standard	Result
75	75	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	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

\* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

*The testing was performed by Ming Jin on 2004-10-25*

**Measurement Results**

Base:

Frequency	Measurement (Second)	Standard (Second)	Result
Low	0.0135	0.4	Compliant
Mid	0.0135	0.4	Compliant
High	0.0135	0.4	Compliant

Low:  $4 \times 0.3383 \times (75 \times 0.4 / 3000 \text{ms}) = 0.0135 \text{s}$

Mid:  $4 \times 0.3383 \times (75 \times 0.4 / 3000 \text{ms}) = 0.0135 \text{s}$

High:  $4 \times 0.3367 \times (75 \times 0.4 / 3000 \text{ms}) = 0.0135 \text{s}$

Handset:

Frequency	Measurement (Second)	Standard (Second)	Result
Low	0.0135	0.4	Compliant
Mid	0.0136	0.4	Compliant
High	0.0135	0.4	Compliant

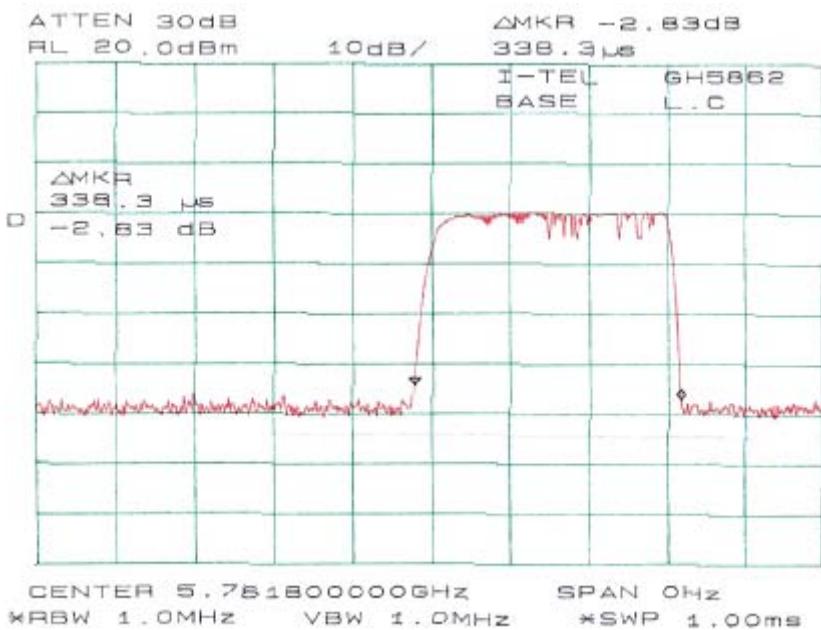
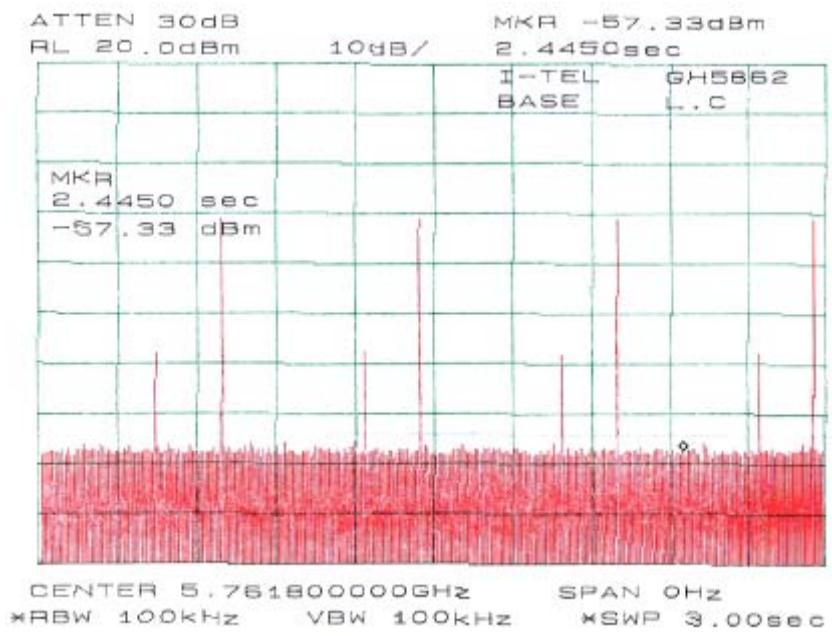
Low:  $4 \times 0.3367 \times (75 \times 0.4 / 3000 \text{ms}) = 0.0135 \text{s}$

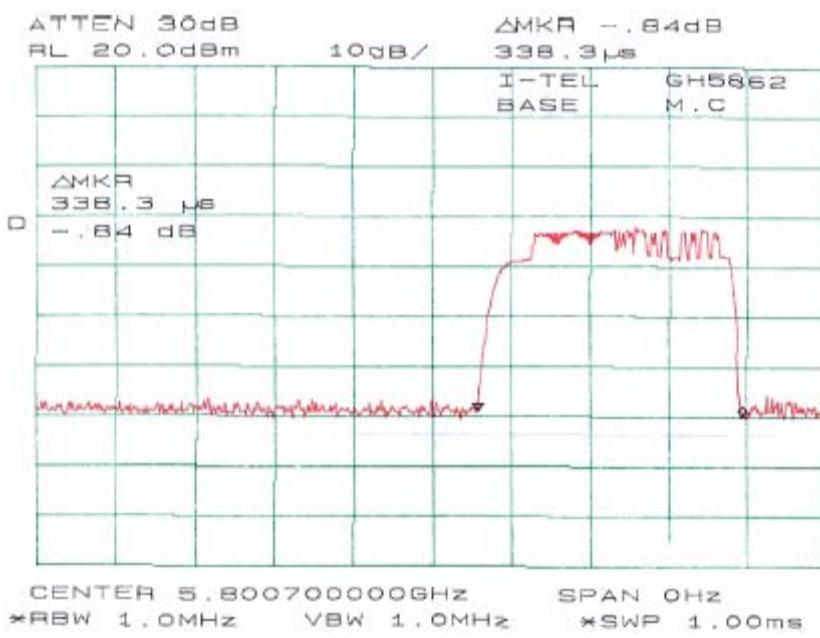
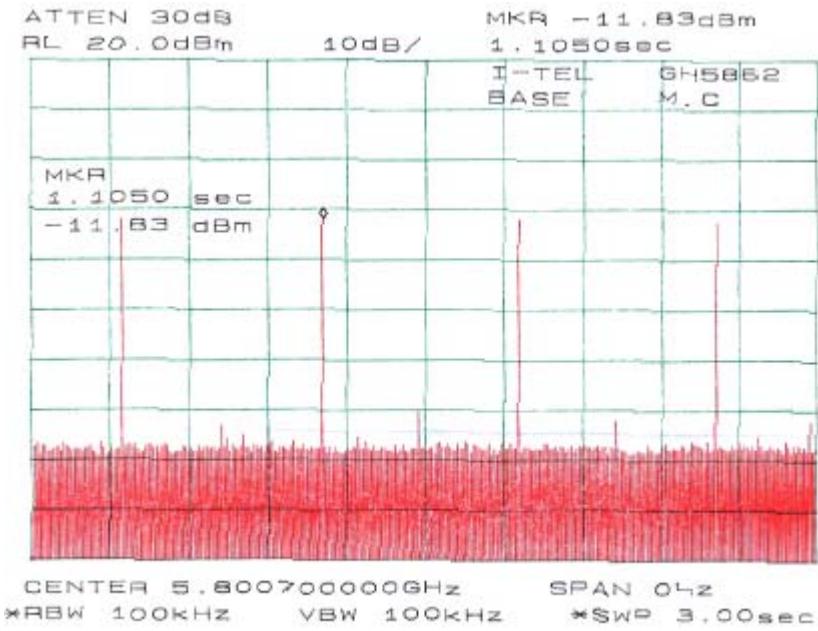
Mid:  $4 \times 0.3400 \times (75 \times 0.4 / 3000 \text{ms}) = 0.0136 \text{s}$

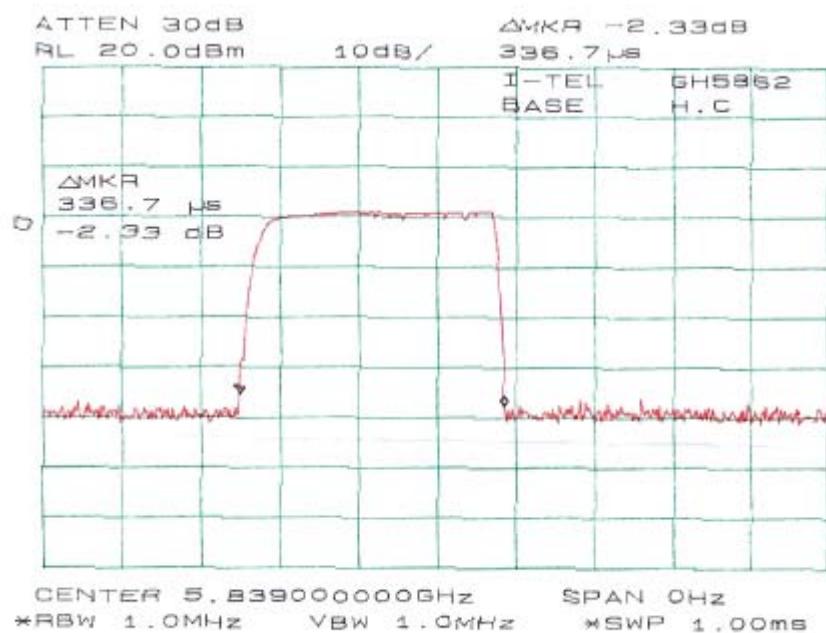
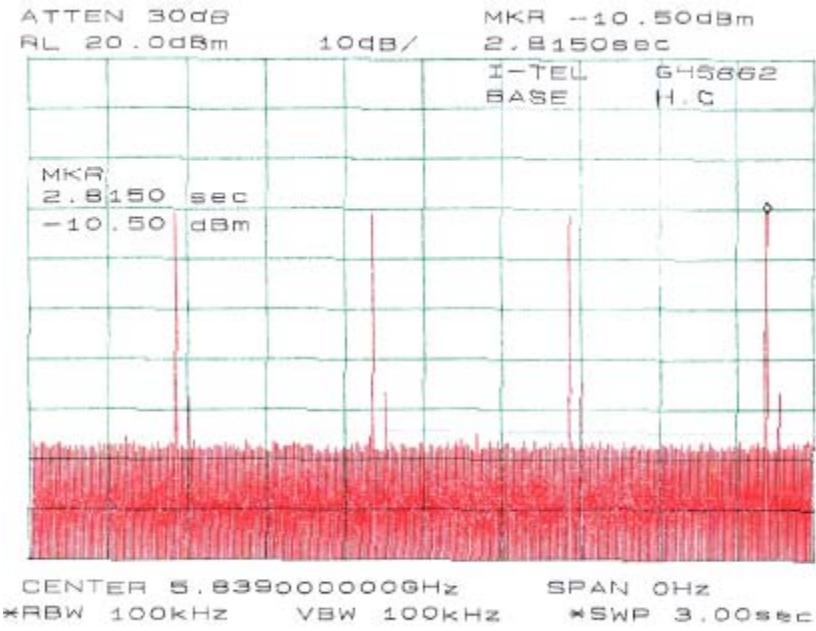
High:  $4 \times 0.3383 \times (75 \times 0.4 / 3000 \text{ms}) = 0.0135 \text{s}$

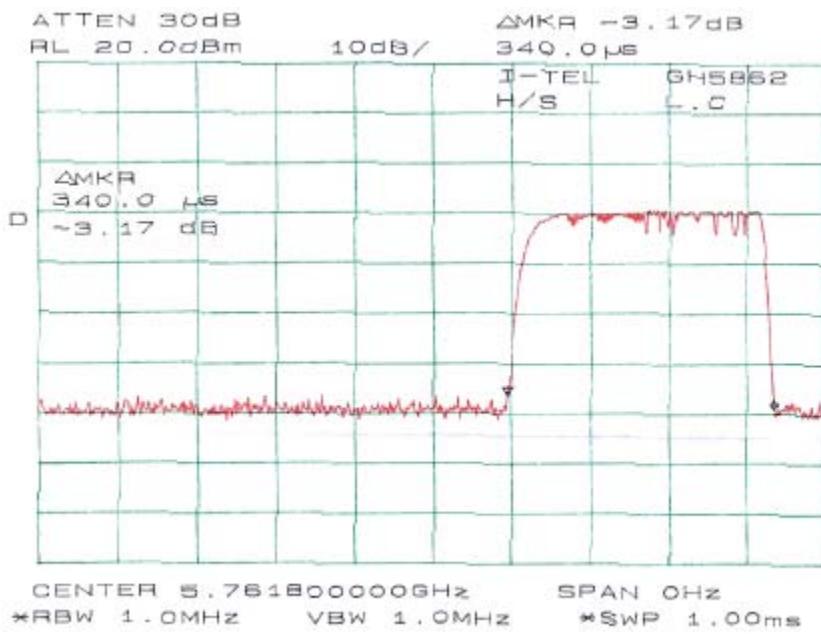
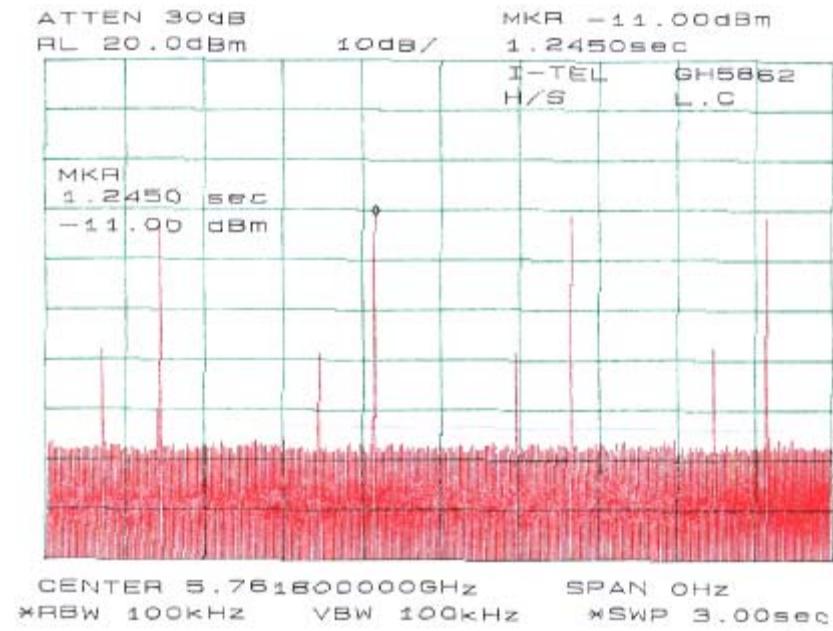
**Plots of Dwell Time**

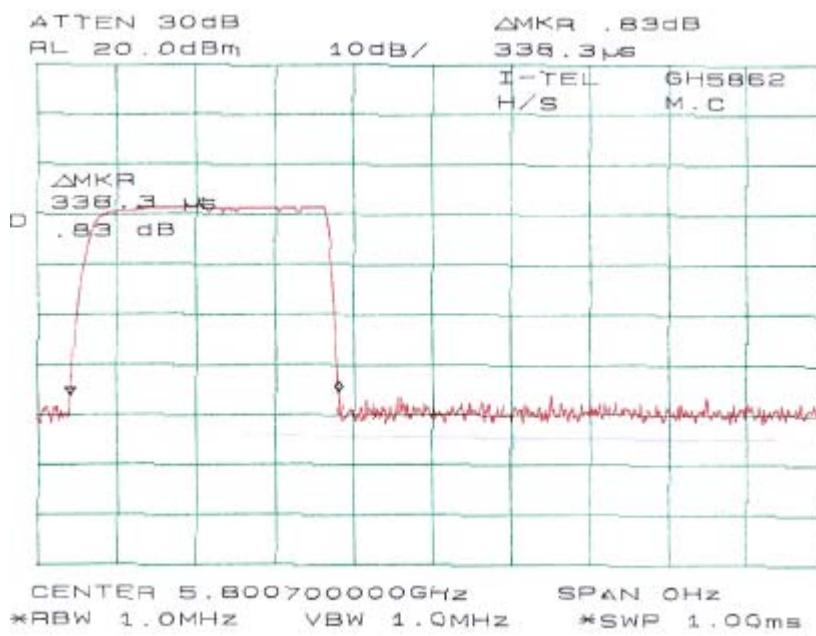
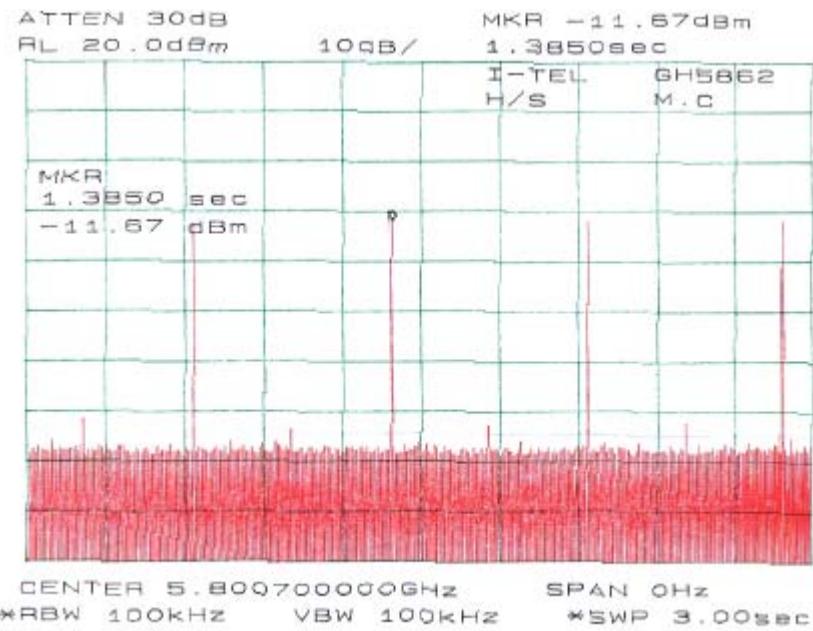
Please refer the following plots.

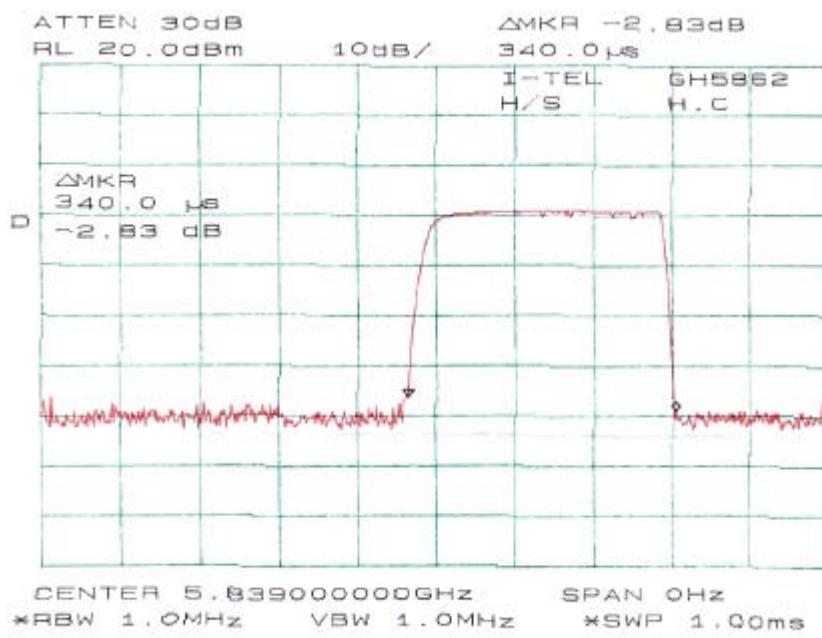
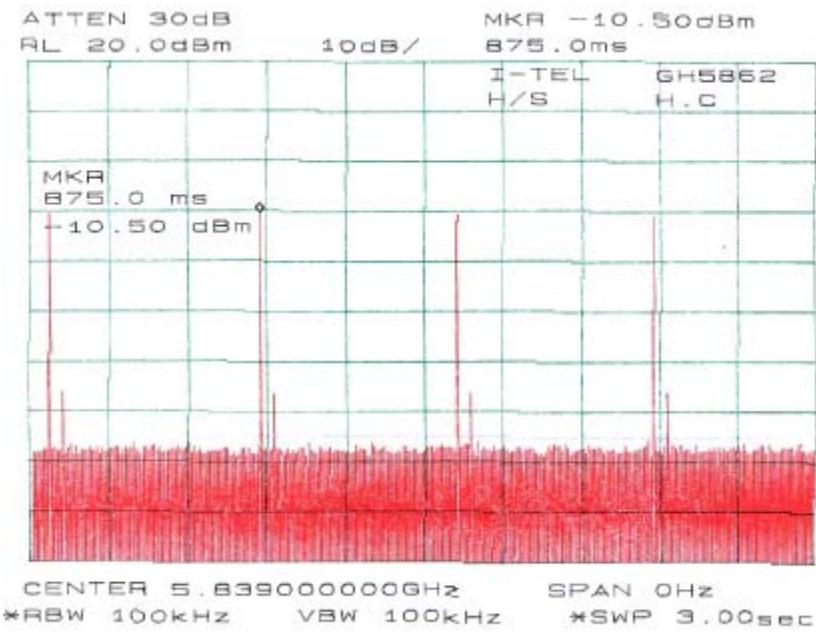












## §15.247 (b) (1) - MAXIMUM PEAK OUTPUT POWER

### Standard Applicable

According to §15.247(b) (1), for all frequency hopping systems in the 5725-5850 MHz band, 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	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

\* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

*The testing was performed by Ming Jin on 2004-10-25*

### Measurement Result

	Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Standard	Result
base	Low	5761.486	9.1	8.13	≤ 1W	Compliant
	Middle	5800.728	9.3	8.51	≤ 1W	Compliant
	High	5839.077	8.9	7.76	≤ 1W	Compliant
handset	Low	5761.486	8.7	7.41	≤ 1W	Compliant
	Middle	5800.728	9.1	8.13	≤ 1W	Compliant
	High	5839.077	8.9	7.76	≤ 1W	Compliant

## §15.247 (b)(4) - RF EXPOSURE

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 ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1093 RF exposure is calculated.

### Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-15000	/	/	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

### MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

*Base:*

Maximum peak output power at antenna input terminal: 9.3 (dBm)

Maximum peak output power at antenna input terminal: 8.51 (mW)

Predication distance: 20 (cm)

Predication frequency: 5800 (MHz)

Antenna Gain (typical): 0 (dBi)

Maximum antenna gain: 1 (numeric)

Power density at predication frequency at 20 cm: 0.0017(mW/cm<sup>2</sup>)

MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm<sup>2</sup>)

*Handset:*

Maximum peak output power at antenna input terminal: 9.1 (dBm)

Maximum peak output power at antenna input terminal: 8.13 (mW)

Predication distance: 2.5 (cm)

Predication frequency: 5800 (MHz)

Antenna Gain (typical): 0 (dBi)

Maximum antenna gain: 1 (numeric)

Power density at predication frequency at 2.5 cm: 0.10(mW/cm<sup>2</sup>)

MPE limit for uncontrolled exposure at prediction frequency: 1 (mW/cm<sup>2</sup>)

**Test Result**

The predicted power density level for base at 20 cm is 0.0017 mW/cm<sup>2</sup>. The predicted power density level for handset at 2.5 cm is 0.10 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 5800 MHz. The base unit of EUT is used at least 20cm away from user's body. The handset unit of EUT is used at least 2.5cm away from body.

## §15.247 (c) - 100 KHZ BANDWIDTH OF BAND EDGES

### Standard Applicable

According to §15.247(c), 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	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

\* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

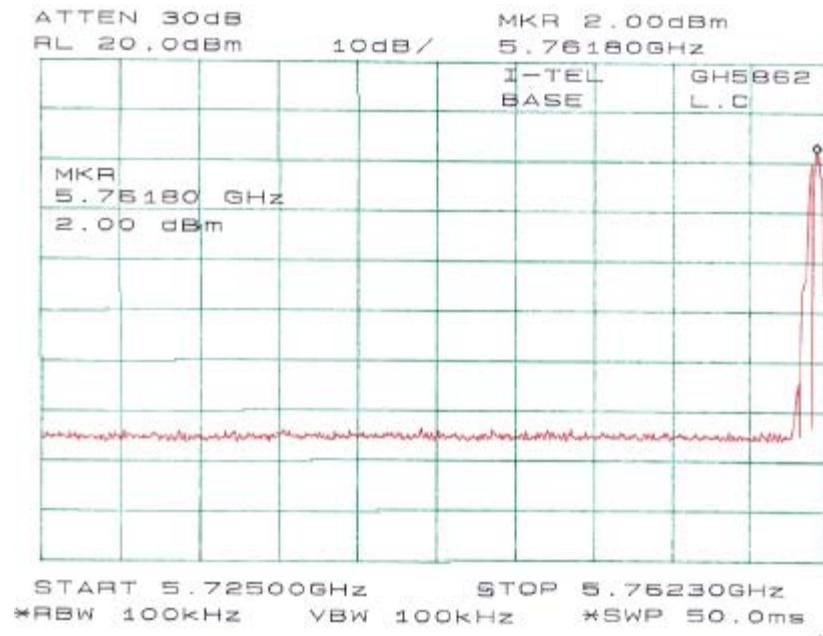
### Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

*The testing was performed by Ming Jin on 2004-10-25*

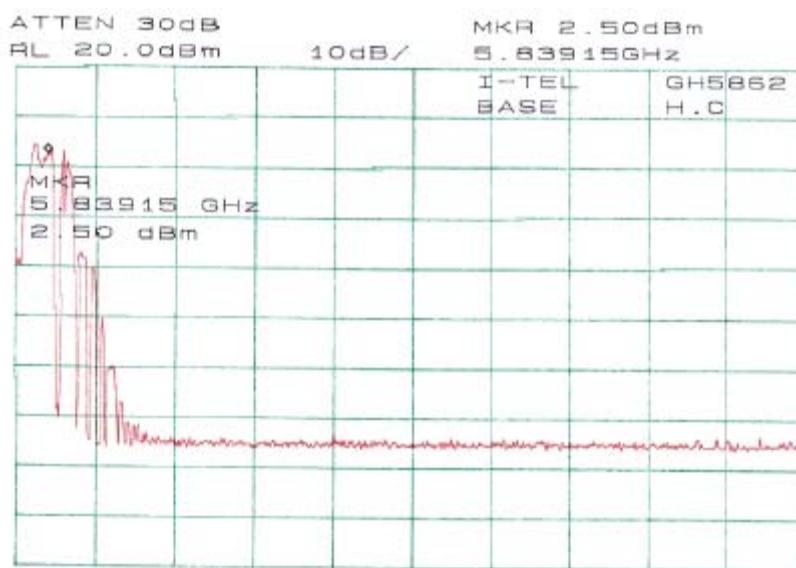
### Plots of 100kHz Bandwidth of Band Edge

Please refer the following plots.



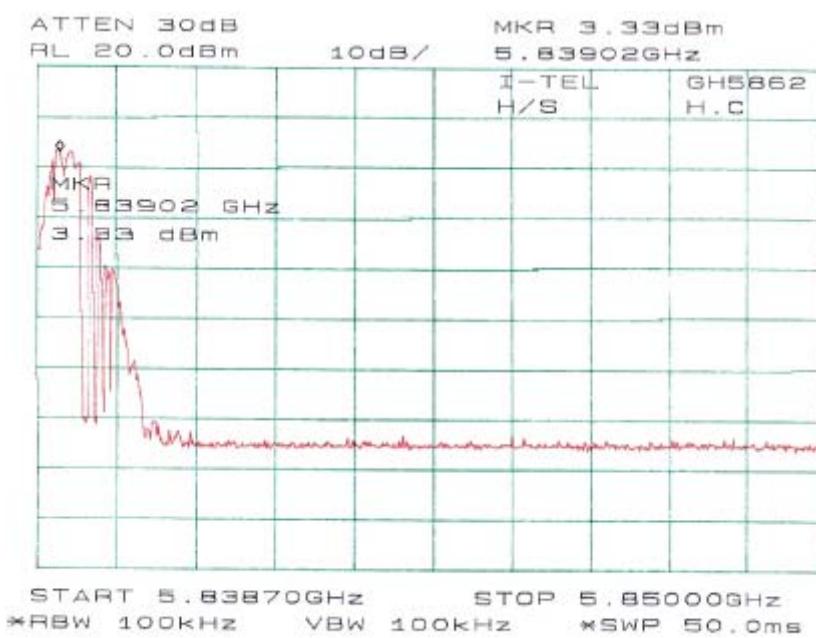
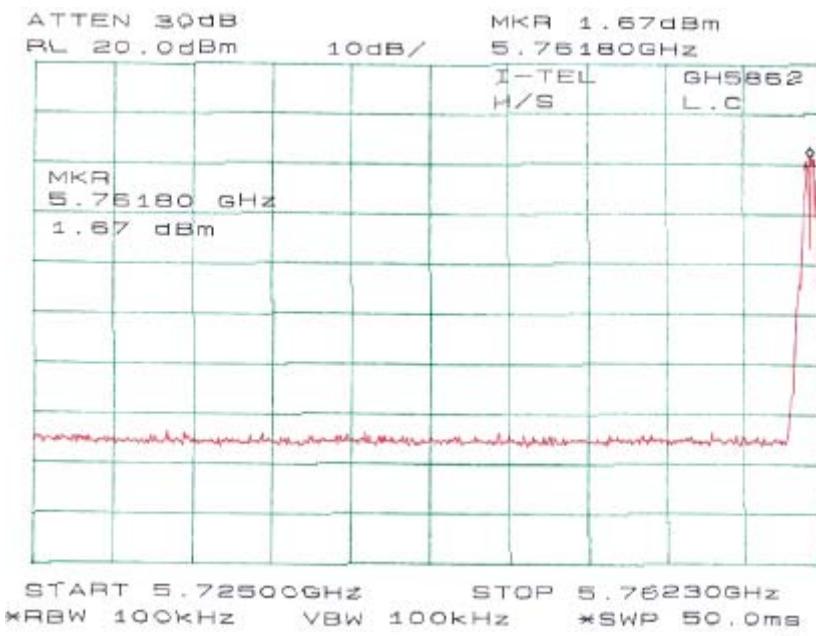
START 5.72500GHz                            STOP 5.76230GHz  
\*RBW 100kHz                                    VBW 100kHz                            \*SWP 50.0ms

*2.00 dBm*



START 5.83870GHz                            STOP 5.85000GHz  
\*RBW 100kHz                                    VBW 100kHz                            \*SWP 50.0ms

*2.50 dBm*



## 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	Model No.	Serial No.	Calibration Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Environmental Conditions

Temperature:	28° C
Relative Humidity:	37%
ATM Pressure:	1032 mbar

*The testing was performed by Ming Jin on 2004-10-25*

### Measurement Results

Please refer to the following plots.

