

FCC PART 15 Subpart C
EMI MEASUREMENT AND TEST REPORT

For

Axesstel, Inc.

6305 Lusk Blvd.
San Diego, CA 92121

FCC ID: PH7VZ1-3DWCB

2003-08-18

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Cordless Phone
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Report Number: R0307291	
Test Date: 2003-08-02	
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Axesstel, Inc.*'s product, FCC ID:PH7VZ1-3DWCB or the "EUT" as referred to in this report is a hybrid cordless/cellular phone. The EUT is the handset part of the cordless phone which measures approximately 2.2"L x 0.9"W x 6.25"H.

** The test data gathered is from typical production samples provided by the manufacturer.*

1.2 Objective

This type approval report is prepared on behalf of *Axesstel, Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for Output Power, Antenna Requirements, 6 dB Bandwidth, power density, 100 kHz Bandwidth of Band Edges Measurement, and Conducted and Spurious Radiated Emission.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation 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 Bay Area Compliance Laboratory Corporation 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 C63.4-1992.

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, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	2517A01610	2003-10-30
HP	Spectrum Analyzer	8593A	29190A00242	2004-05-01
HP	Amplifier	8447E	1937A01054	2004-05-01
HP	Quasi-Peak Adapter	85650A	2521A00718	2004-05-01
Com-Power	Biconical Antenna	AB-100	14012	2004-05-01
Com-Power	LISN	LI-200	12005	2004-03-28
Com-Power	LISN	LI-200	12008	2004-03-28
Com-Power	Log Periodic Antenna	AL-100	16091	2004-05-01
Com-Power	Log Periodic Antenna	AB-900	15049	2004-05-01
Rohde & Schwarz	EMI Test Receiver	ESPI	1147 8007 07	2003-12-03
Agilent	Spectrum Analyzer (9KHz – 40GHz)	8564E	08303	2004-08-01
Agilent	Spectrum Analyzer (9KHz – 50GHz)	8565EC	06042	2004-05-03
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2004-03-14
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2004-05-31

* **Statement of Traceability: Bay Area Compliance Laboratory Corp.** certifies that all calibration has been performed using suitable standards traceable to the NATIONAL INSTITUTE of STANDARDS and TECHNOLOGY (NIST).

2 - SYSTEM TEST CONFIGURATION

2.1 Description of Test Configuration

The EUT was configured for testing in a typical fashion (as normally used by a typical user).

Handset being tested: The Cordless Telephone – Handset was placed on the wooden table and tested in three orthogonal axis. The Low, middle, and high channels were tested. The handset was transmitting to and receiving from the base unit. The EUT was investigated for emissions while off hook. The radiated data was taken in this mode of operation. All initial and final investigations were performed with the EMI receiver in manual mode scanning the frequency range continuously.

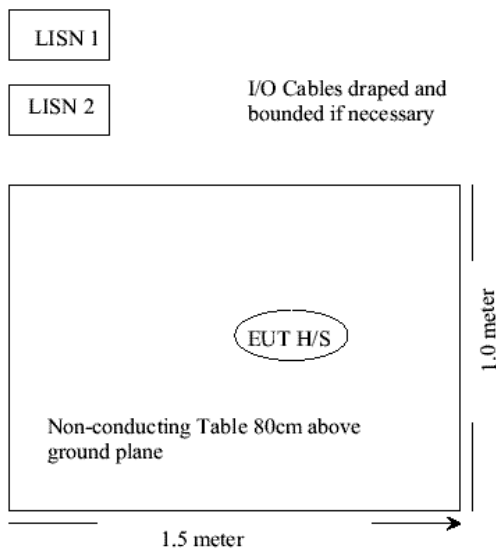
2.2 Equipment Modifications

No modification(s) was made by BAACL Corp. to ensure the EUT complies with the applicable limits and standards.

2.3 Configuration of Test System



2.4 Test Setup Block Diagram



3 - SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT	Section Reference
§ 15.205	Restricted Bands	Compliant	Section 12
§15.203	Antenna Requirement	Compliant	Section 9
§15.207 (a)	Conducted Emission	Compliant	Section 12
§15.209 (a)	Radiated Emission	Compliant	Section 11
§15.209 (f)	Spurious Emission	Compliant	Section 6
§15.247 (a) (2)	6 dB Bandwidth	Compliant	Section 5
§15.247 (b) (3)	Peak Output Power	Compliant	Section 4
§15.247 (b) (5)	RF Exposure	Compliant	Section 10
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edges	Compliant	Section 7
§15.247 (d)	Peak Power Spectral Density	Compliant	Section 8

4 - CONDUCTED OUTPUT POWER MEASUREMENT

4.1 Standard Applicable

According to §15.247(b) (3), for systems using digital modulation, the maximum peak output power of the intentional radiator shall not exceed 1 Watt.

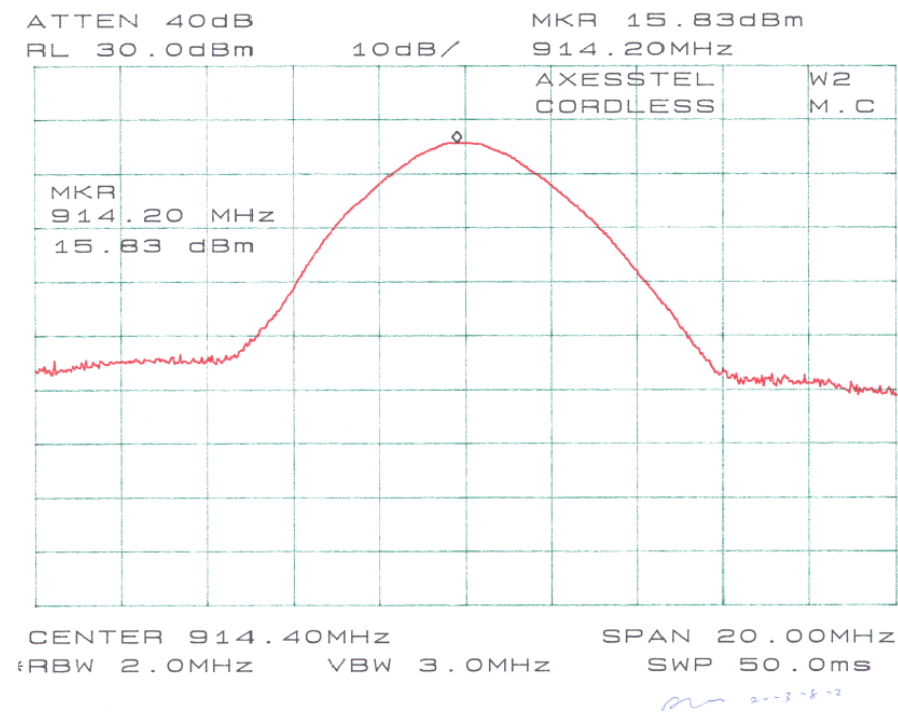
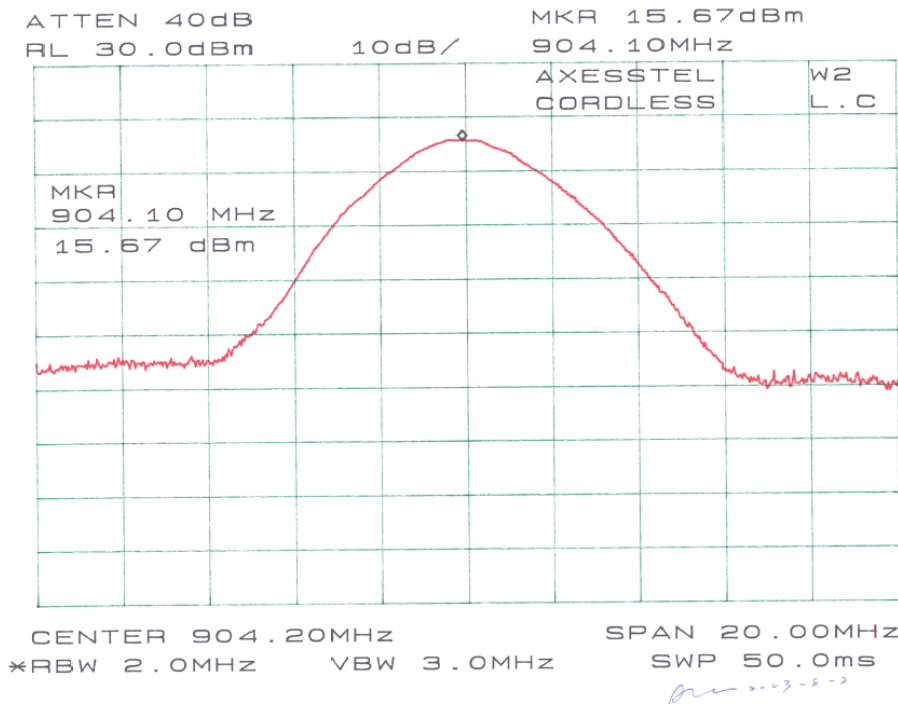
4.2 Measurement Procedure

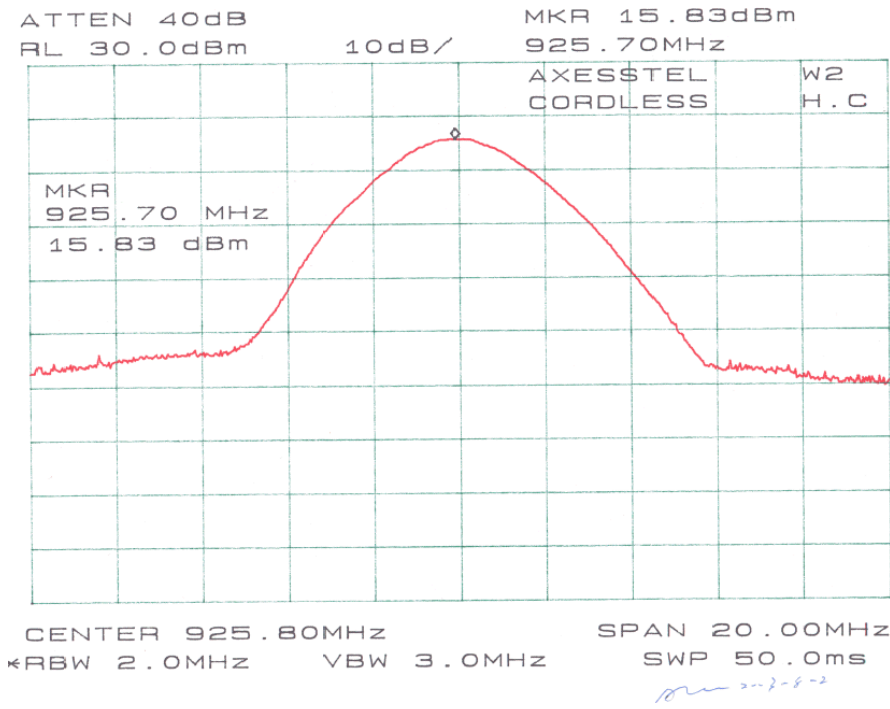
1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

4.3 Measurement Result

Please refer to the attached pictures for more information.

Unit	Channel	Output Power (dBm)	Output Power (W)	Standard (W)	Result
Handset	Low	15.67	0.037	≤ 1W	Compliant
Handset	Mid	15.83	0.038	≤ 1W	Compliant
Handset	High	15.83	0.038	≤ 1W	Compliant





5 - 6 DB BANDWIDTH

5.1 Standard Applicable

According to §15.247(a)(2), for digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

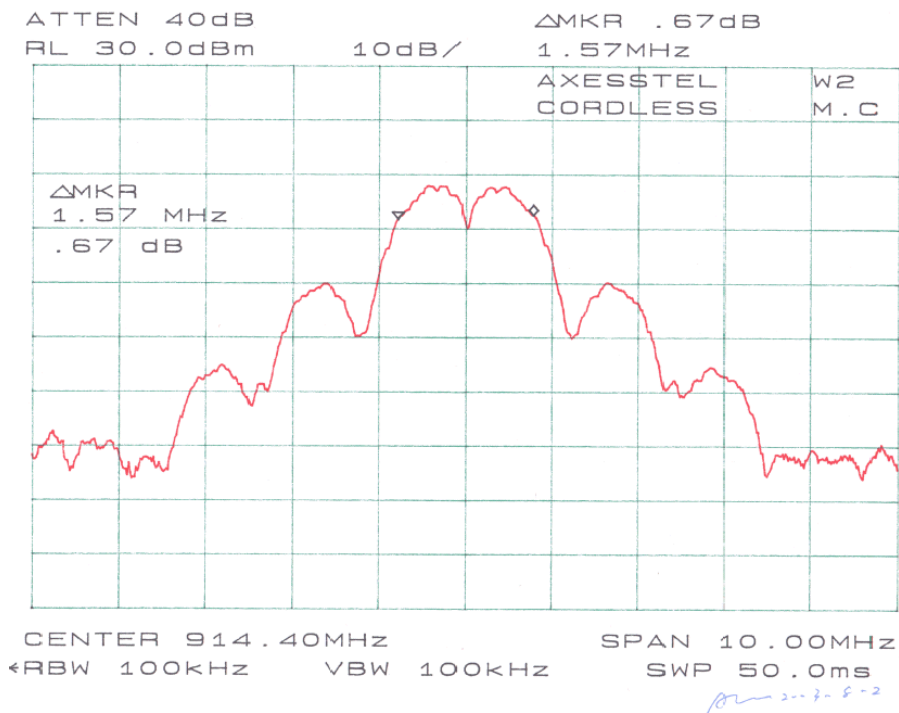
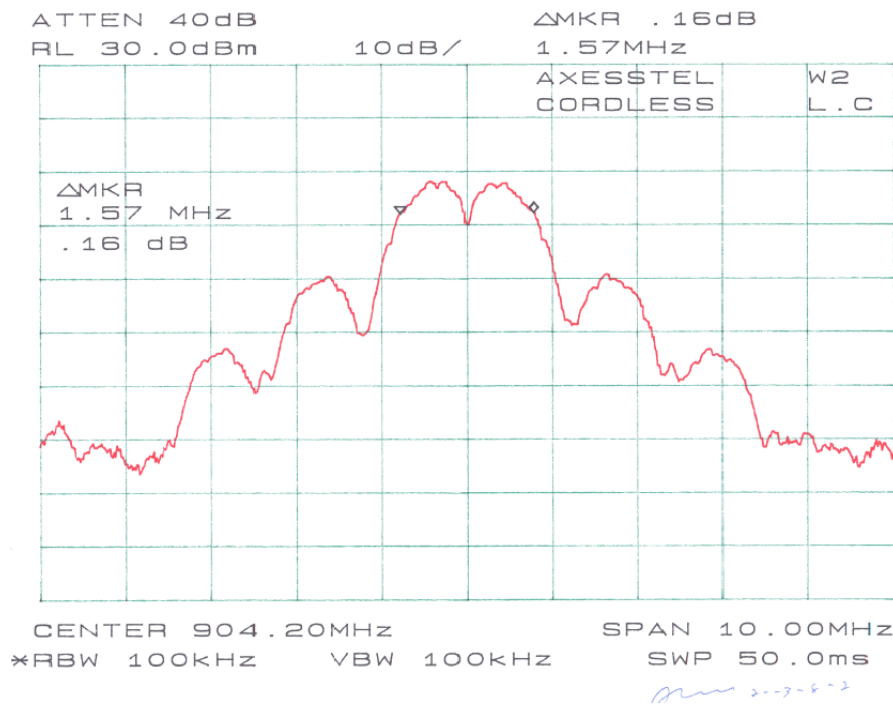
5.2 Measurement Procedure

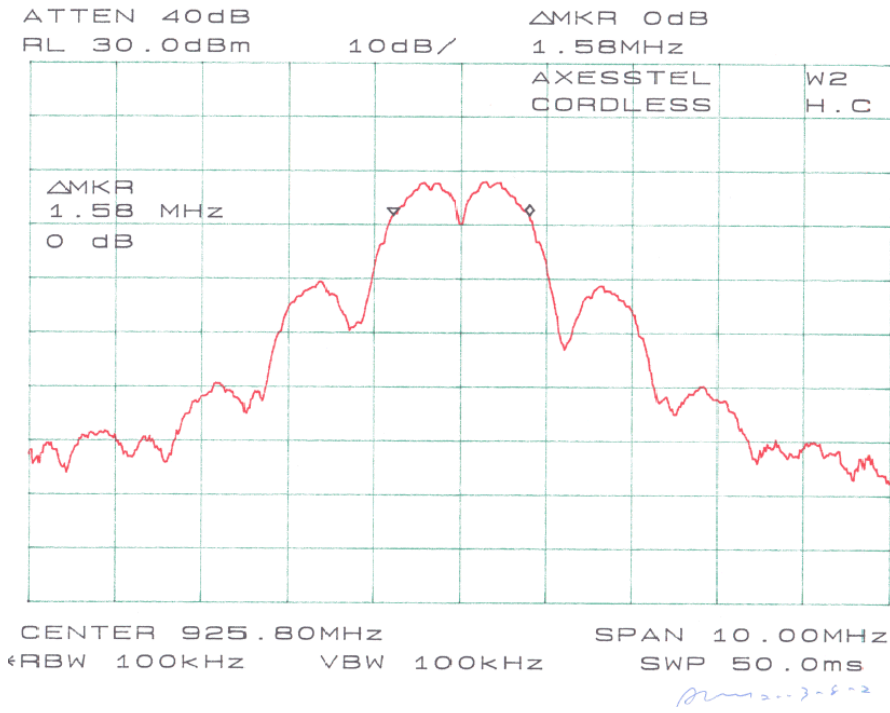
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency 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 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

5.3 Measurement Data

Please refer to the following pages.

Unit	Channel	6 DB Bandwidth (MHz)	6 DB Bandwidth (kHz)	Standard (kHz)	Result
Handset	Low	1.57	1570	≥ 500	Compliant
Handset	Mid	1.57	1570	≥ 500	Compliant
Handset	High	1.58	1580	≥ 500	Compliant





6 - SPURIOUS EMISSION

6.1 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.

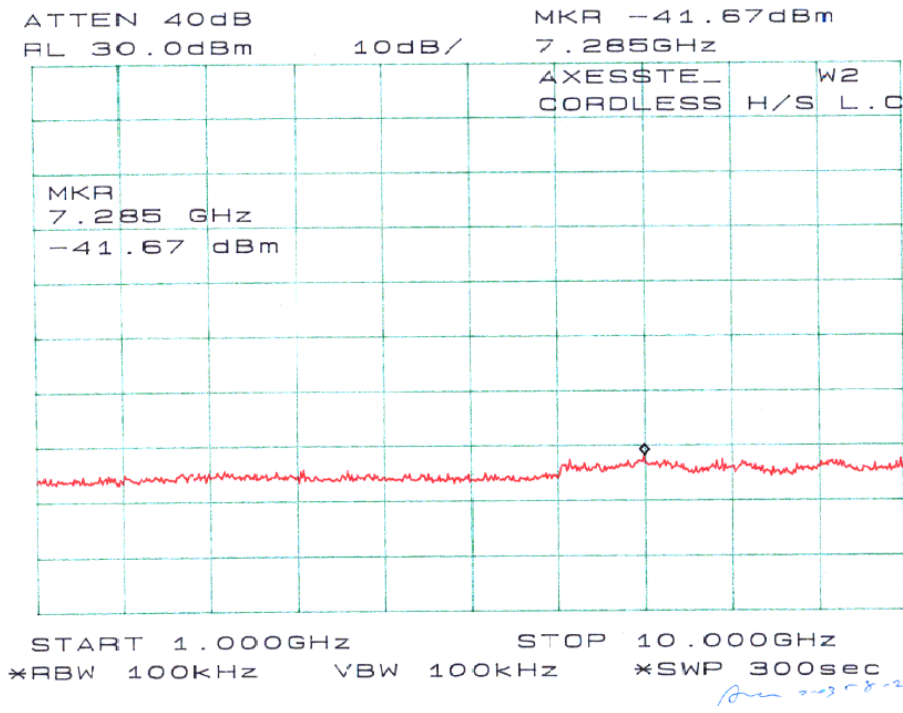
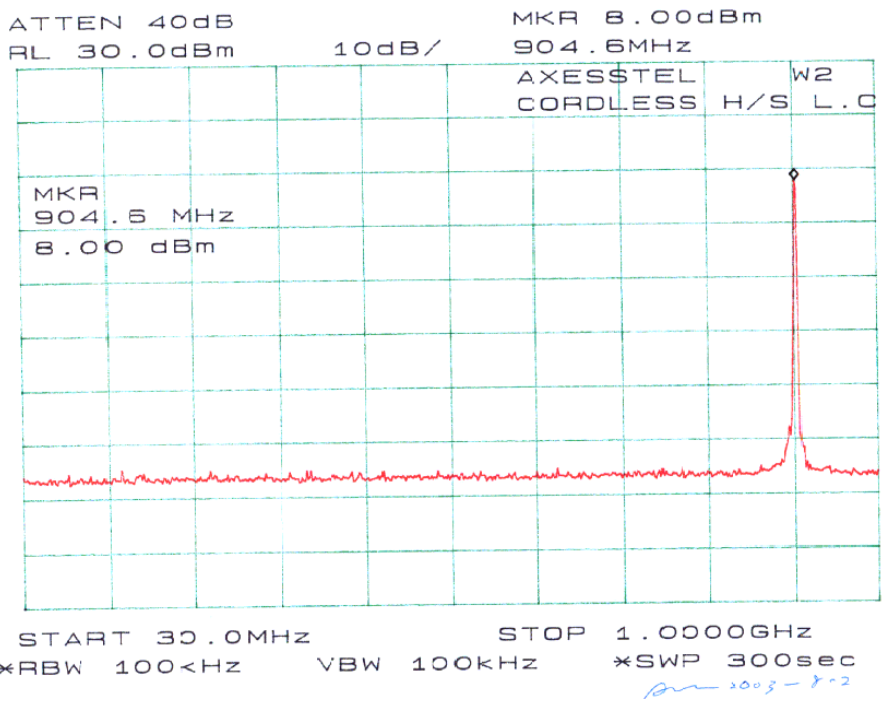
6.2 Measurement Procedure

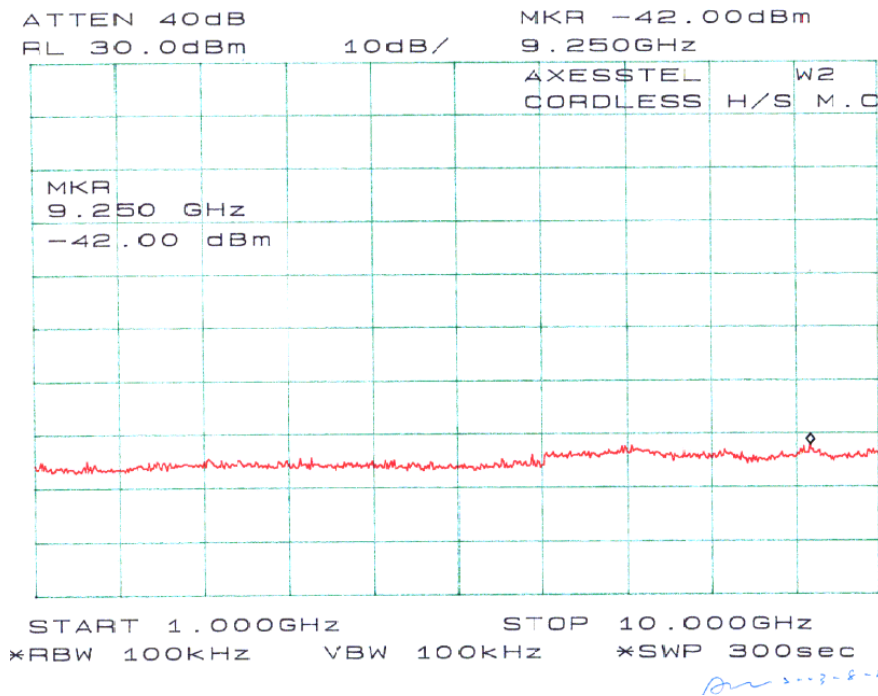
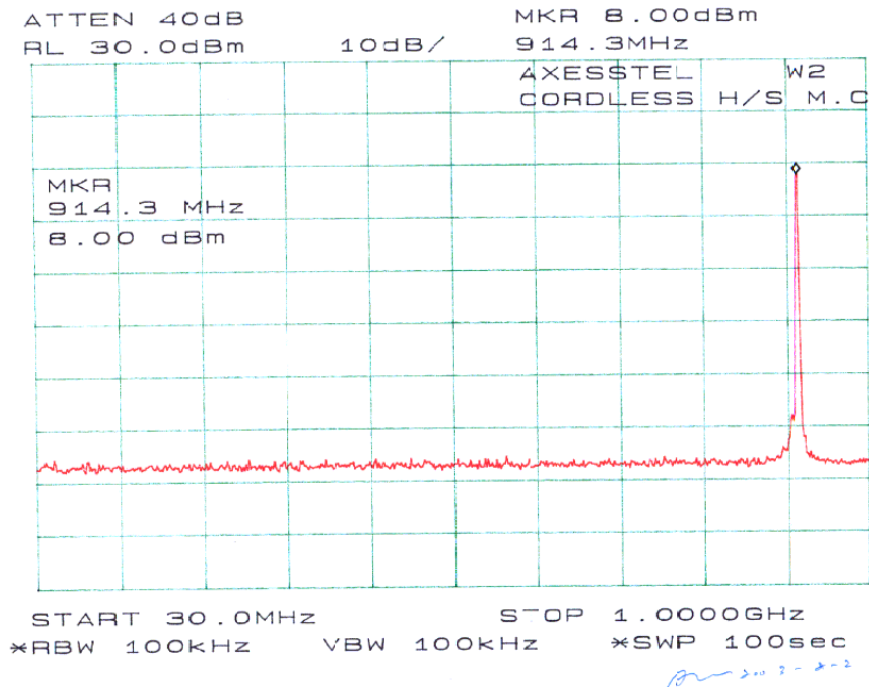
1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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.

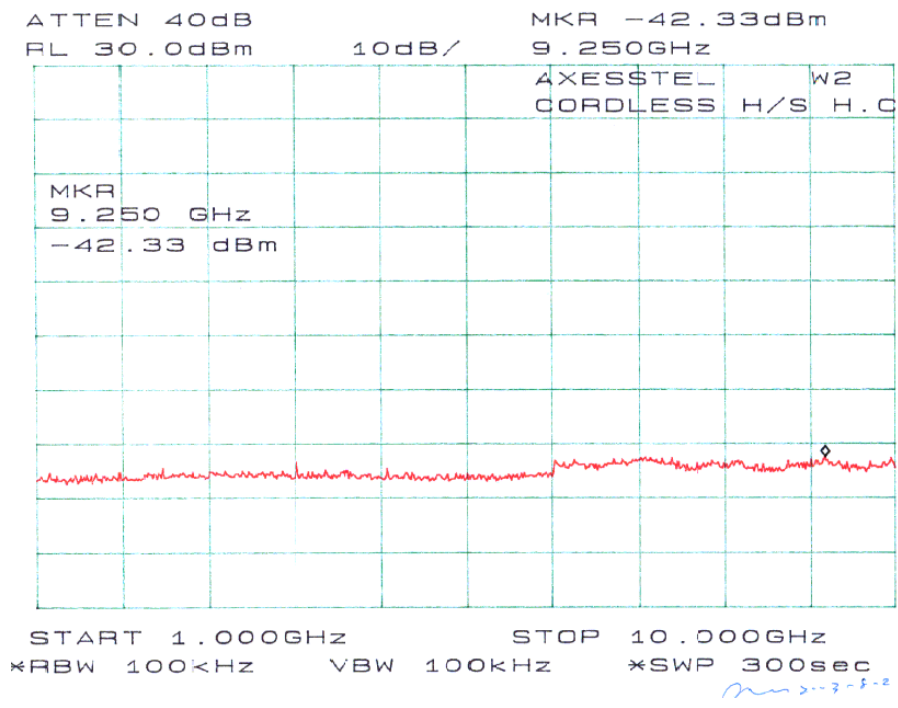
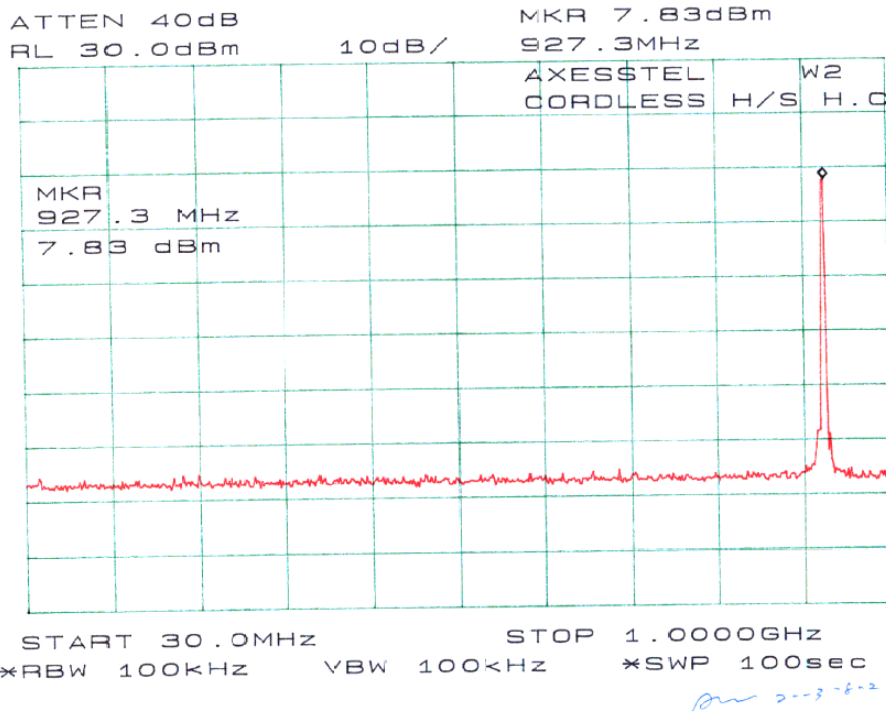
6.3 Measurement Data

Please refer to the following pages.

Spurious Emission	Test Result (Handset)
Low Channel	Compliant
Middle Channel	Compliant
High Channel	Compliant







7 - 100 KHZ BANDWIDTH OF BAND EDGES MEASUREMENT

7.1 Standard Applicable

According to §15.247(c), if *any* 100 kHz bandwidth outside these frequency band in which the spread spectrum or digitally modulated 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, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, must also comply wit the radiated emission limits specified in § 15.209(a).

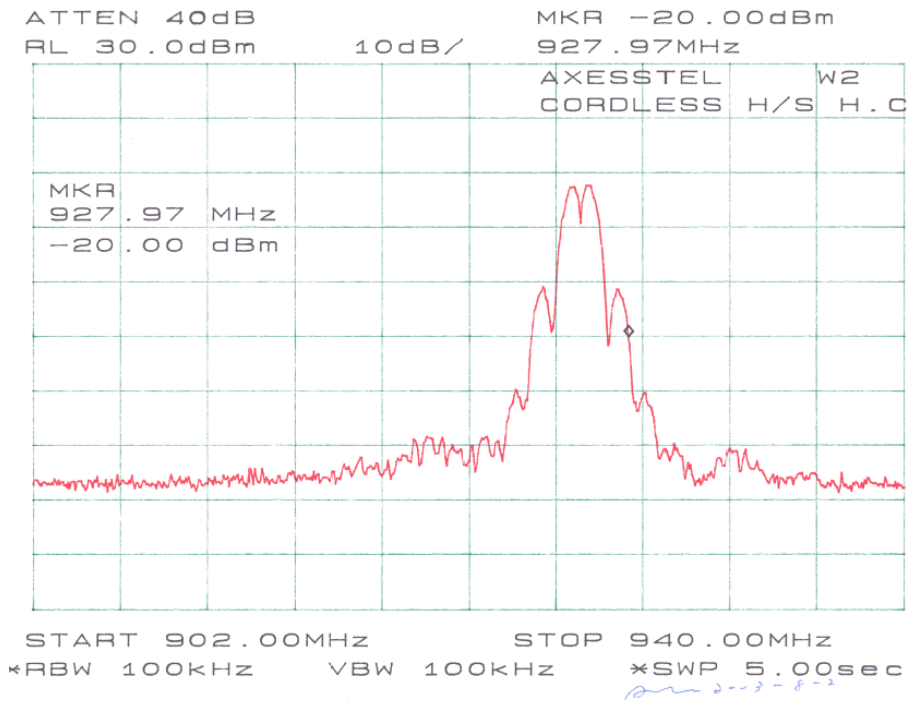
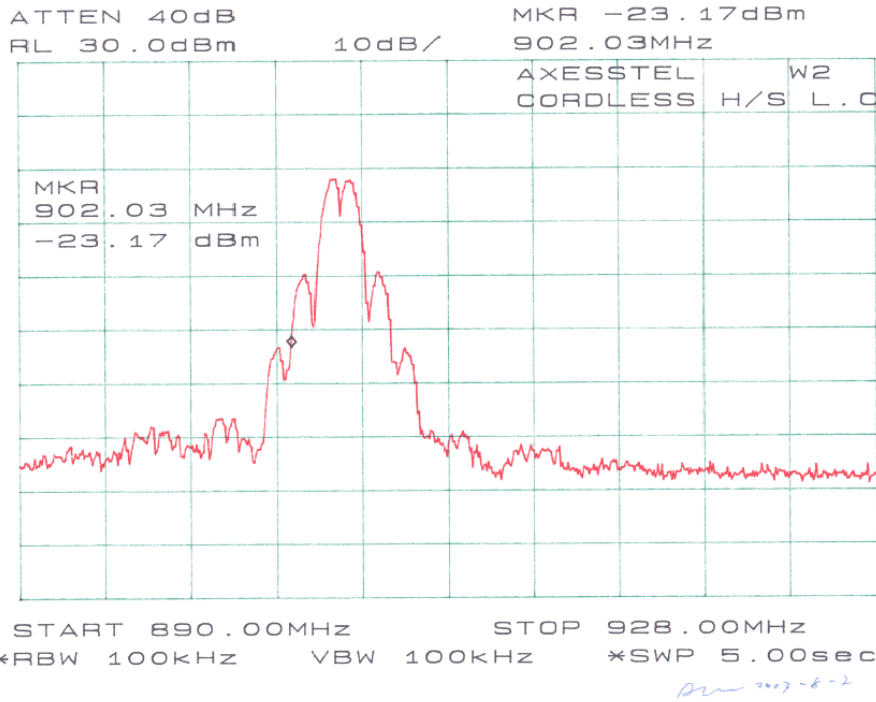
7.2 Measurement Procedure

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.

7.3 Test Results

Please refer to the following pages.

Band Edge Bandwidth	Test Result (Handset)
Low Channel	Compliant
Middle Channel	Compliant
High Channel	Compliant



8 - POWER SPECTRAL DENSITY

8.1 Standard Applicable

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

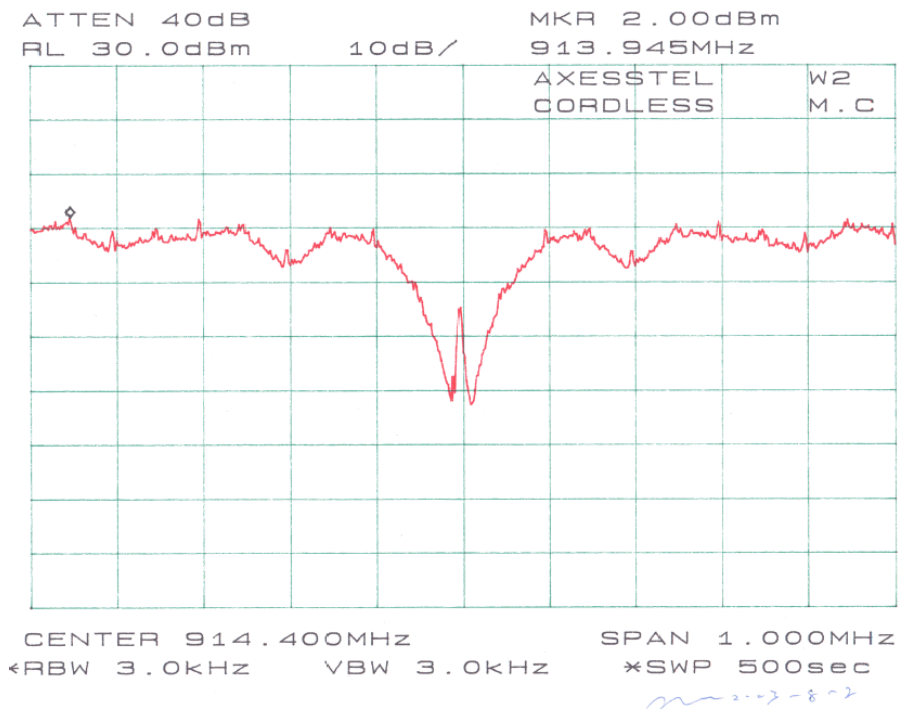
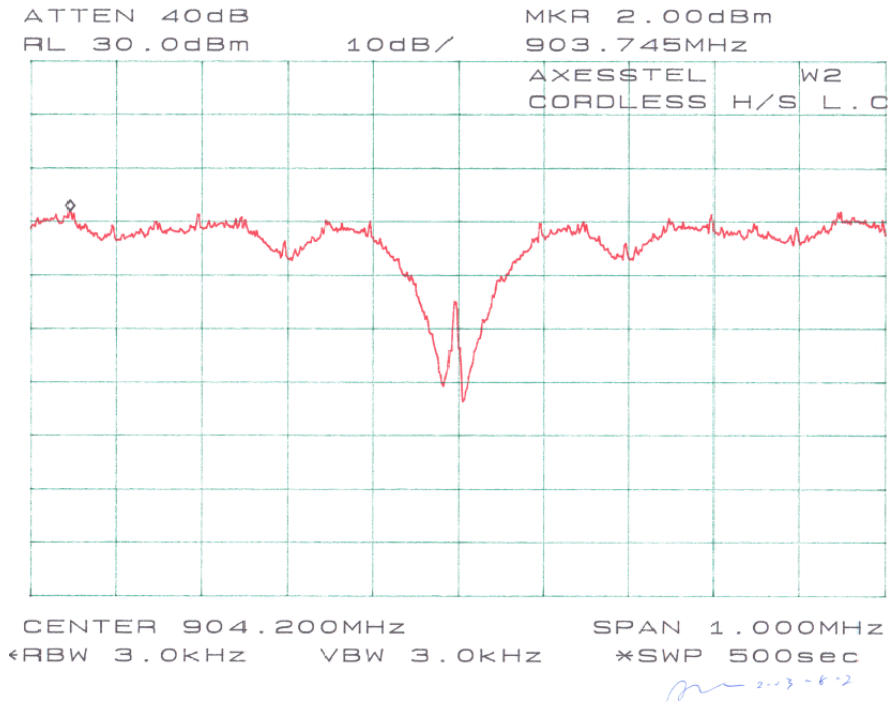
8.2 Measurement Procedure

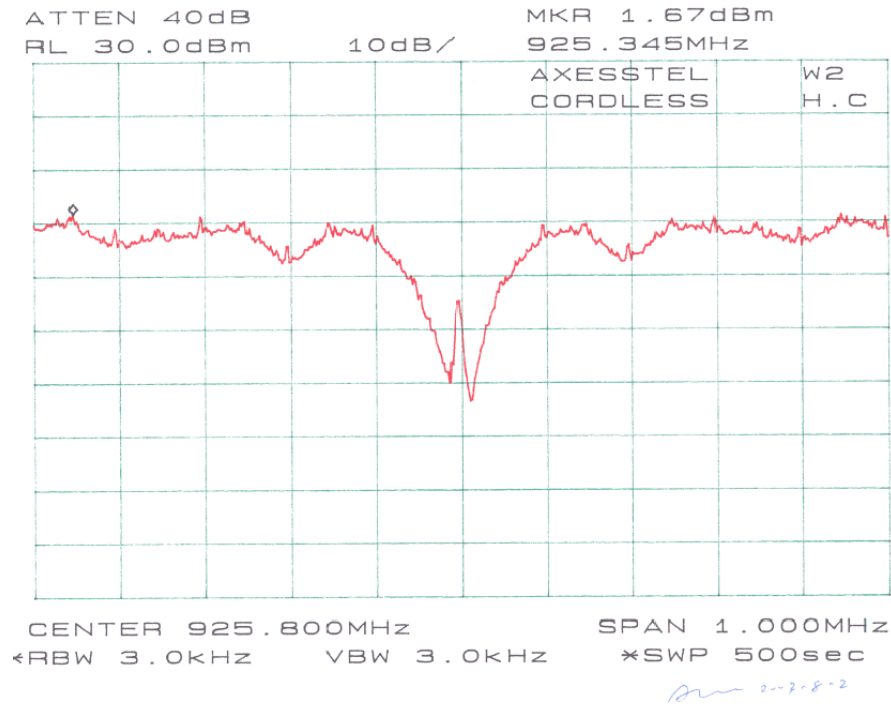
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. 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 1MHz span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Repeat above procedures until all frequencies measured were complete.

8.3 Test Results

Please refer to the following plot(s).

Power Density	Test Result (Handset)
Low Channel	Compliant
Middle Channel	Compliant
High Channel	Compliant





9 - ANTENNA REQUIREMENT

9.1 Standard Applicable

For intentional device, 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.

9.2 Antenna Connected Construction

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

10 - SPURIOUS RADIATED EMISSION DATA

10.1 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 BAACL is ± 4.0 dB.

10.2 EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4 - 1992. The specification used was the FCC 15 Subpart C limits.

The base of the EUT was connected to a 120 VAC / 60 Hz power source.

The spacing between the peripherals was 10 centimeters.

Input / Output cables were draped along the edge of the test table and bundle when necessary.

10.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 25000 MHz.

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

10.4 Test Procedure

For the radiated emissions test, both the EUT and all support equipment power cords were connected to the AC floor outlet since the power supply used in the EUT 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 μ V of specification limits), and are distinguished with a "Qp" in the data table.

10.5 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 μ V means the emission is 7dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

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

10.6 Summary of Test Results

According to the data in section 11.7, 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:

Handset, 900MHz to 10GHz, 3 meters

- 22.9 dB μ V at 2712.60 MHz in the Vertical polarization, Low Channel
- 20.5 dB μ V at 2743.20 MHz in the Vertical polarization, Middle Channel
- 22.7 dB μ V at 2777.4 MHz in the Vertical polarization, High Channel
- 12.0 dB μ V at 112.50 MHz in the Horizontal polarization, Unintentional Emission

10.7 Radiated Emission Test Data for Handset, 900MHz to 10GHz, 3 meters

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dB μ V/m	Comments	Angle Degree	Height Meter	Polar H/V	Antenna dB μ V/m	Cable DB	Amp. DB	Corr. Ampl. dB μ V/m	Limit dB μ V/m	Margin dB
Low Channel											
904.20	95.5	FUND/PEAK	150	1.8	V	23.6	3.8	25.0	97.9		
904.20	101.2	FUND/PEAK	60	1.5	H	23.6	3.8	25.0	103.6		
904.20	87.3	FUND/AVG	150	1.8	V	23.6	3.8	25.0	89.7		
904.20	97.2	FUND/AVG	60	1.5	H	23.6	3.8	25.0	99.6		
2712.60	29.2	AVG	180	1.5	V	29.0	3.7	30.7	31.1	54	-22.9
1808.40	34.3	AVG	180	1.5	V	25.3	2.6	31.2	31.0	54	-23.0
1808.40	34.3	AVG	45	1.2	H	25.3	2.6	31.2	31.0	54	-23.0
2712.60	25.2	AVG	330	2.0	H	29.0	3.7	30.7	27.1	54	-26.9
1808.40	47.5	PEAK	45	1.2	H	25.3	2.6	31.2	44.2	74	-29.8
1808.40	47.2	PEAK	180	1.5	V	25.3	2.6	31.2	43.9	74	-30.1
2712.60	38.0	PEAK	180	1.5	V	29.0	3.7	30.7	40.0	74	-34.0
2712.60	37.2	PEAK	330	2.0	H	29.0	3.7	30.7	39.1	74	-34.9
Middle Channel											
914.40	99.0	FUND/PEAK	45	1.8	V	23.2	3.9	25.0	101.1		
914.40	101.5	FUND/PEAK	90	1.2	H	23.2	3.9	25.0	103.6		
914.40	94.3	FUND/AVG	45	1.8	V	23.2	3.9	25.0	96.5		
914.40	97.7	FUND/AVG	90	1.2	H	23.2	3.9	25.0	99.8		
2743.20	31.5	AVG	160	1.2	V	29.0	3.7	30.7	33.5	54	-20.5
1828.80	34.5	AVG	180	1.5	V	25.3	2.6	31.2	31.2	54	-22.8
1828.80	34.2	AVG	120	1.2	H	25.3	2.6	31.2	30.9	54	-23.1
2743.20	27.5	AVG	270	1.5	H	29.0	3.7	30.7	29.5	54	-24.5
1828.80	47.6	PEAK	180	1.5	V	25.3	2.6	31.2	44.3	74	-29.7
1828.80	47.3	PEAK	120	1.2	H	25.3	2.6	31.2	44.0	74	-30.0
2743.20	40.7	PEAK	160	1.2	V	29.0	3.7	30.7	42.6	74	-31.4
2743.20	38.2	PEAK	270	1.5	H	29.0	3.7	30.7	40.1	74	-33.9

Radiated Emission Test Data for Handset, 30MHz to 25000MHz, 3 meters (Continued)

INDICATED			TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 15 SUBPART C	
Frequency MHz	Ampl. dBµV/m	Comments	Angle Degree	Height Meter	Polar H/V	Antenna dBµV/m	Cable DB	Amp. DB	Corr. Ampl. dBµV/m	Limit dBµV/m	Margin dB
High Channel											
925.80	90.8	FUND/PEAK	15	2.0	V	23.4	4.0	25.0	93.3		
925.80	94.8	FUND/PEAK	100	1.5	H	23.4	4.0	25.0	97.3		
925.80	87.3	FUND/AVG	15	2.0	V	23.4	4.0	25.0	89.8		
925.80	91.0	FUND/AVG	100	1.5	H	23.4	4.0	25.0	93.4		
2777.4	29.3	AVG	150	1.2	V	29.0	3.7	30.7	31.3	54	-22.7
1851.60	34.2	AVG	330	1.2	V	25.3	2.6	31.2	30.9	54	-23.1
1851.60	34.2	AVG	0	1.5	H	25.3	2.6	31.2	30.9	54	-23.1
2777.4	26.7	AVG	90	1.0	H	29.0	3.7	30.7	28.6	54	-25.4
1851.60	47.7	PEAK	0	1.5	H	25.3	2.6	31.2	44.4	74	-29.6
1851.60	47.0	PEAK	330	1.2	V	25.3	2.6	31.2	43.7	74	-30.3
2777.4	39.8	PEAK	150	1.2	V	29.0	3.7	30.7	41.8	74	-32.2
2777.4	36.7	PEAK	90	1.0	H	29.0	3.7	30.7	38.6	74	-35.4
Unintentional Emission, 30MHz to 1000MHz											
112.50	43.7		180	1.8	H	11.3	1.5	25.0	31.5	43.5	-12.0
389.48	34.7		0	1.5	V	15.6	2.4	25.0	27.7	46	-18.3
228.90	36.3		90	1.8	H	11.8	2.2	25.0	25.3	46	-20.7
214.53	32.8		45	1.2	V	11.9	2.2	25.0	21.9	43.5	-21.6
89.50	32.6		45	1.2	V	9.8	1.2	25.0	18.6	43.5	-24.9

11 – CONDUCTED EMISSIONS

Not Applicable to Handset.

