Hearing Aid Compatibility

FCC 47 CFR section 20.19 Test Report_Updated Version

Dual-Band CDMA Cellular Phone	
FCC ID:	**OVFKWC-KX5-5x0**
Model:	**KX5-5x0**

STATEMENT OF CERTIFICATION

The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the measurements of the sample's HAC RF emissions characteristics as of the dates and at the times of the test under the conditions herein specified.

STATEMENT OF COMPLIANCE

This product was tested in accordance with the measurement procedures specified in ANSI PC63.19-2005 and has been shown to be capable of compliance with the technical requirements of FCC 47 CFR section 20.19.

Test Location:	Kyocera Wireless Corp 10300 Campus Point Drive, CA 92121 USA		
Test performed by:	Jeff Flores, Peter Pereira Test Technician	Date of Test:	09/14/2005 – 09/20/2005
Report Prepared by:	Peter Pereira Engineering Technician	Date of Report:	09/20/2005
Report Reviewed by:	Lin Lu Engineer, Principal	Date of Review:	09/20/2005, updated on 10/14/05

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1 Introduction

This test report describes the Hearing Aid Compatibility (HAC) measurement of a wireless portable device manufactured by Kyocera Wireless Corp. (KWC). These measurements were performed for compliance with the rules and regulations of the U.S. Federal Communications Commission (FCC). The testing was performed in accordance with ANSI PC63.19-2005.

This report covers test and data on:

X	RF Emissions	ANSI PC63.19 Clause 4
	T-Coil	ANSI PC63.19 Clause 6

2 Equipment Under Test (EUT)

Product:	Dual-Band Tri-mode CDMA/AMPS Cellular Phone with Bluetooth	
FCC ID:	OVFKWC-KX5-5x0	
Model Number:	KX5-5x0	
EUT Serial Number:	A9DX----1CX32T / A9DX----1CX39G	
Type:	[ ] Prototype, [**X**] Pre-Production, [ ] Production	
Device Category:	Portable	
RF Exposure Environment:	General Population / Uncontrolled	
Antenna:	Fixed Helix	
Detachable Antenna:	Yes	
External Input:	Audio/Digital Data	
Quantity:	Quantity production is planned	
Modes:	800 CDMA	1900 CDMA
Multiple Access Scheme:	CDMA	CDMA
TX Frequency (MHz):	824 – 849	1850 - 1910
Rated RF Conducted Output Power (dBm)	25.5 Phone Open 24.0 Phone Closed	23.5 Phone Open 22.2 Phone Closed

The product has two versions. The only difference between them is the keypad color – silver keypad version and black keypad version. For compliance we fully tested the silver keypad version and performed the tests for the black keypad version in worse case from data of the silver keypad version.

Silver keypad version

Black keypad version

3 Summary of Test Results

ANSI PC63.19 (2005) Section 4 RF Emissions		
Test	**Test Results**	**Overall Category**
E-Field Emissions	M3	**M3**
H-Field Emissions	M3	

4 Test conditions

4.1 Ambient Conditions

All tests were performed under the following environmental conditions:

Ambient Temperature:	23 ± 2 Degrees C
Tissue simulating liquid temperature:	22 ± 1 Degrees C
Relative Humidity (RH):	0% <RH < 80%
Atmospheric Pressure:	101.3kPa + 10 to –5 kPa

4.2 RF characteristics of the test site

All HAC measurements were performed inside a shielded room that provide isolation from external EM fields, with the RF ambient at least 20 dB below the intended measurement limits.

4.3 Test Signal, Frequencies and Output Power

During tests, the EUT was put in in-call mode and controlled by a CDMA simulator to generate the required signal and power:

Protocol:	6 (IS-2000)
Radio Configuration:	3
Power Control:	All Up Bits
Service Option:	3
Data Rate:	Full

In all operating modes, the phone was set to rated maximum RF power level and the measurements were performed on low, mid and high channels.

The measurement system measures power drift during HAC testing by comparing E/H-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output during tests. Conducted RF power measurements were also performed before and after each HAC measurements to confirm the output power.

4.4 EUT Operating Conditions

The EUT was tested with the follow configurations and conditions, if applicable:

X	Fully charged standard battery as supplied with the handset
X	Both open and closed configurations, at ear use position.
	Both retracted and extended antenna positions
X	Back-light always ON
X	Simultaneous transmission with Bluetooth transmitter ON*

* note: we fully evaluated the HAC performance while Bluetooth transmitter was off and performed the tests for Bluetooth transmitter on in worse case from the full evaluation with Bluetooth transmitter off.

5 Description of the test equipment

5.1 Test Equipment Used

Below is a list of the calibrated equipment used for the measurements:

Description	Manufacturer	Model Number	Serial Number	Cal Due Date
Power Meter	Giga-tronics	8541C	1830971	05/27/06
Signal Generator	Agilent	E4421B	US38440337	06/20/07
Radio Communication Tester	Aglient	8960	US41070147	04/06/06
Data Acq	Speag	DAE4	675	02-12-06
E-field Probe	Speag	ER3DV6	2341	04-22-06
H-field Probe	Speag	H3DV5	6029	06/13/06
Dipole Antenna (835MHz)	Speag	CD835V3	1020	4/27/06
Dipole Antenna (1880MHz)	Speag	CD1880V3	1015	04/05/06

The calibration certificates of dipole antennas, E-field and H-field probes are attached in Appendix A.

5.2 Near Field Measurement System

The measurements were performed with Dasy4 automated near-field scanning system comprised of high precision robot, robot controller, computer, near-field probe, probe alignment sensor, non-conductive phone positioner, Test Arch and software extension. The overall expanded uncertainty (K=2) of the measurement system is ±10.9% and ±14.7% for H-field and E-field resp. The measurement uncertainty budget is given in section 8.

5.3 Isotropic E-Field Probe

Model	▪ ER3DV6
Construction	▪ One dipole parallel, two dipoles normal to probe axis ▪ Built-in shielding against static charges ▪ PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
Calibration	▪ In air from 100 MHz to 3.0 GHz (absolute accuracy ± 6%; k=2)
Frequency	▪ 100MHz to 6 GHz ▪ Linearity: ± 0.2dB (100MHz to 3GHz)
Directivity	▪ ± 0.2 dB in air (rotation around probe axis) ▪ ± 0.4 dB in air (rotation normal to probe axis)
Dynamic Range	▪ 2 V/m to > 1000 V/m ▪ Linearity: ± 0.2 dB
Dimensions	▪ Overall length: 330 mm (Tip: 16 mm) ▪ Tip diameter: 8 mm (Body: 12 mm) ▪ Distance from probe tip to dipole centers: 2.5 mm
Application	▪ General near-field measurements up to 6 GHz ▪ Field component measurements ▪ Fast automatic scanning in phantoms

5.4 Isotropic H-Field Probe

Model	▪ H3DV5
Construction	▪ Three concentric loop sensors with 3.8 mm loop diameters ▪ Resistively loaded detector diodes for linear response ▪ Built-in shielding against static charges ▪ PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
Frequency	▪ 200 MHz to 3 GHz (± 6.0%, k=2); Output linearized
Directivity	▪ ± 0.25 dB (spherical isotropy error)
Dynamic Range	▪ 10 mA/m to 2 A/m at 1 GHz
E-Field Interference	▪ < 10% at 3 GHz (for plane wave)
Dimensions	▪ Overall length: 330 mm (Tip: 40 mm) ▪ Tip diameter: 6 mm (Body: 12 mm) ▪ Distance from probe tip to dipole centers: 3 mm
Application	▪ General magnetic near-field measurements up to 3 GHz ▪ Field component measurements ▪ Surface current measurements ▪ Measurements in air or liquids ▪ Low interaction with the measured field

6 System Validation

The probes are calibrated annually by the manufacturer. The HAC measurements of the device were done within 24 hours of system accuracy verification, which was done using calibration dipoles. Unmodulated continous wave of power level of 20dBm was supplied to a dipole antenna placed under Test Arch. The measurement probes are positioned over the illuminated dipole at 10mm distance from the top surface of the dipole element to the calibration reference point of the sensor, defined by the probe manufacturer.

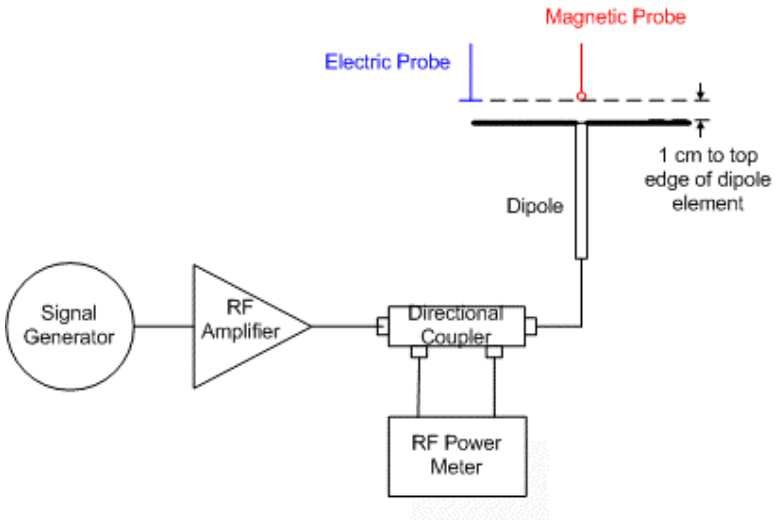


Figure 6 System Check Setup

The length of the dipole was scanned with both E and H-field probes and the maxim values for each were recorded. The validation results are in the table below and printouts of the validation test are attached in Appendix B. All the measured parameters were within the specification.

Freq. (MHz)	Parameter	Target	Measured	Delta (%)	Test date
835	**E dB(V/m)**	166.4	175.6	5.53%	9/15/05
			158.9	-4.51%	9/19/05
	H dB(A/m)	0.450	0.482	7.11%	9/14/05
			0.426	-5.33%	9/19/05
1880	**E dB(V/m)**	140.0	150.1	7.21%	9/15/05
			141.9	1.36%	9/20/05
	H dB(A/m)	0.458	0.475	3.76%	9/14/05
			0.474	3.49%	9/19/05

7 Description Of The Test Procedure

The device was positioned and setup according to ANSI PC63.19-2005.

7.1 Test Positions

The device was placed on a non-conductive phone positioner under the Test Arch.

7.2 RF Emission Measurements Reference and Plane

Figure 7.1 illustrates the references and reference plane that shall be used in the EUT emissions measurement:

- The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
- The grid is centered on the audio frequency output transducer (speaker) of the EUT.
- The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver of the EUT and is defined by the points of the receiver-end of the EUT, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 1.0 cm in front of, the reference plane.

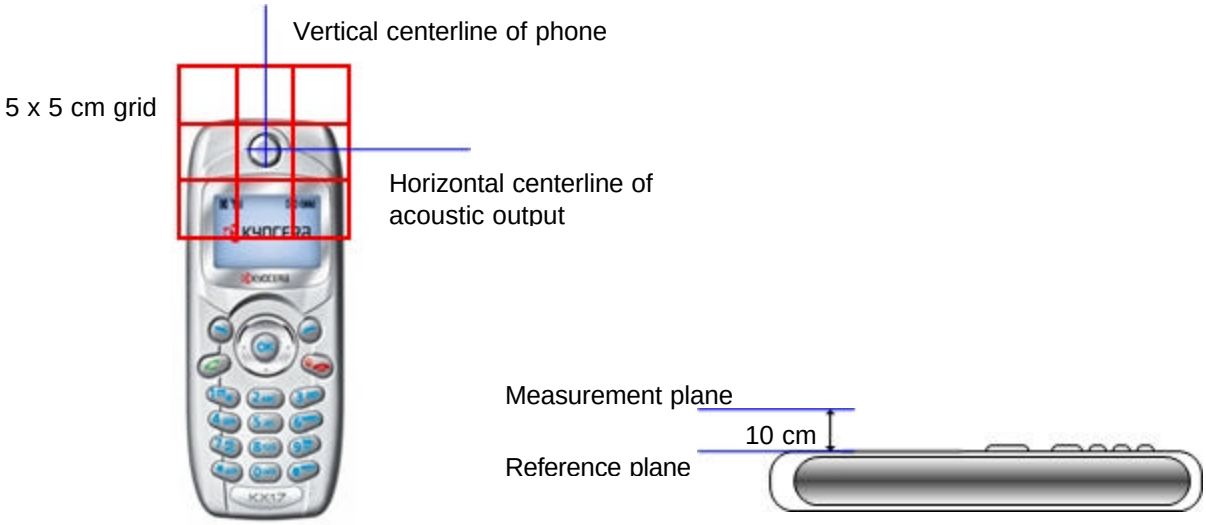


Figure 7.1 – Measurement Reference and Plane

7.3 RF Emissions Measurement Procedures

Figure 7.2 shows the near field emission measurement flowchart:

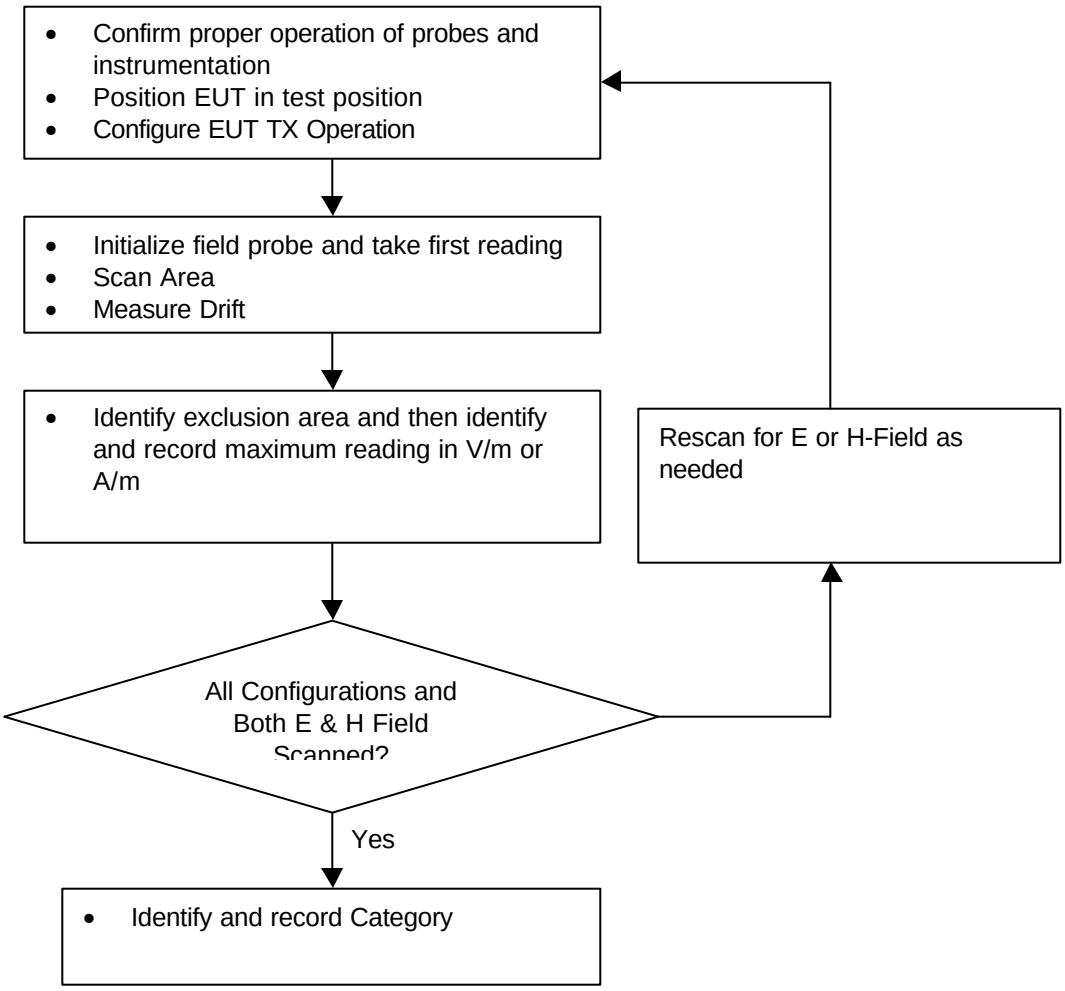


Figure 7.2 Near field emission measurement flowchart

1. The center of the probe was scan to the edges of the grid. Accordingly the total area covered by the outside edge of the probe was the 5 cm by 5 cm area, increased by half (½) the probe diameter on all sides.
2. The nearest point on the probe measurement element(s) was held 1.0 cm from the EUT reference plane.
3. The probe element is that portion of the probe that is designed to receive and sense the field being measured.
4. The physical body of the probe housing was not used when setting this 1.0 cm distance as this would place the sensing elements at an indeterminate distance from the reference plane.
5. The step size of the scan is set to 5 mm or less.
6. Up to three blocks were excluded for each field measurement.
    - The center block containing the EUT output was not excluded.
    - A maximum of five blocks were excluded for both E- and H-field measurements for the EUT output being measured. Stated differently, the center sub-grid or block and 3 other blocks were common to both the E- and H-field measurements for a given grid.

7.4 Probe Modulation Factor (PMF)

A calibration was made of the modulation response of the probe and its instrumentation chain. This calibration was performed with the field probe, attached to its instrumentation. The response of the probe system to a CW field at the frequency of interest is compared to its response to a modulated signal with equal peak amplitude to that of a CW signal. The field level of the test signals shall be more than 10 dB above the ambient level and the noise floor of the instrumentation being used. The ratio of the CW reading to that taken with a modulated reading was applied to the DUT measurements. The measurement procedures are as following:

1. Fix the field probe in a set location relative to the dipole antenna, as illustrated in Figure 7.3.
2. Setup the wireless device (EUT) with intended signal at the intended measurement frequency.
3. Record the reading of the probe measurement system.
4. Replace the wireless device with a RF signal generator producing an unmodulated CW signal and set to the wireless device operating frequency.
5. Set the peak power of the unmodulated signal to equal that recorded from the wireless device
6. Record the reading of the probe measurement system of the unmodulated CW signal.
7. The ratio of probe reading (CW) in step 6 to the probe reading (EUT) in step 3 is the modulation factor.

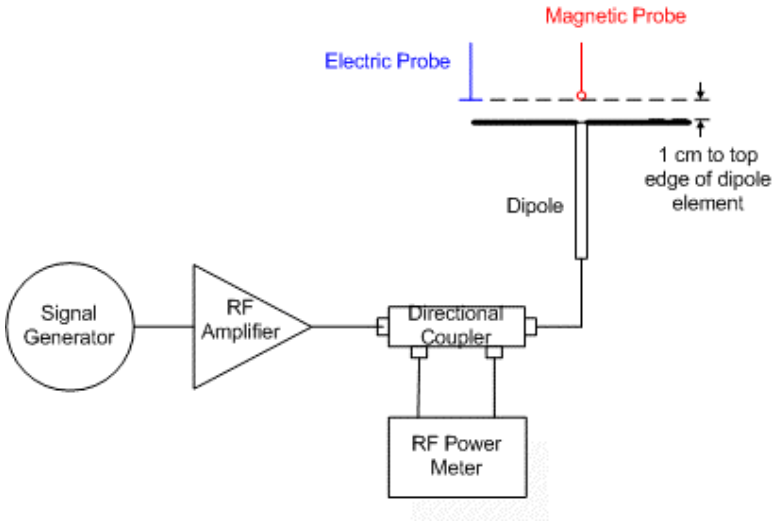


Figure 7.3 Probe Modulation Setup

The modulation factors obtained by above method shall be applied to readings taken of the actual WD, in order to obtain an accurate peak field reading.

E-Field				
Frequency (MHz)	**Peak Power (dBm)**	**CDMA Reading (V/m)**	**CW Reading (V/m)**	**Modulation Factor**
835	25.47	148.1	145.9	0.99
1880	23.44	68.38	66.98	0.98
H-Field				
Frequency (MHz)	**Peak Power (dBm)**	**CDMA Reading (A/m)**	**CW Reading (A/m)**	**Modulation Factor**
835	25.47	0.425	0.421	0.99
1880	23.44	0.233	0.220	0.95

7.5 Emission Data Extraction and Postprocessing

At the end of the measurements, the DASY4 system automatically evaluates the slot-averaged results, exclusion of the three highest subgrid, application of the AWF factor per ANSI-C63.19 requirements.

The following AWF factors were used for the standard transmission protocols:

Standard	Technology	AWF
TIA/EIA/IS-2000	CDMA	0
TIA/EIA-136	TDMA (50 Hz)	0
J-STD-007	GSM (217)	-5
T1/T1P1/3GPP	UMTS (WCDMA)	0
iDEN™	TDMA(22 and 11 Hz)	0

Table 7.4 Articulation Weighting Factor (AWF)

All DASY4 measurements are in RMS values. In this report, the probe modulation factor was applied *manually* per ANSI PC63.19 in the measurement tables. The equation below is used:

Peak Field = (DASY4 reading) x PMF

where DASY4 reading = measurement from DASY4 in V/m or A/m
PMF = Probe Modulation Factor in linear unit

Measurement Uncertainty

Table 7.5 shows the uncertainty budget for HAC free field assessment according to ANSI PC63.19-2005. The budget is valid for the frequency range 800 MHz - 3 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be smaller.

Uncertainty Description	Uncert. Value (± %)	Prob. Dist.	Div.	C_i (E)	C_i (H)	Stand. Uncert (E) (±%)	Stand. Uncert (H) (±%)
Measurement system							
Probe calibration	5.1	N	1	1	1	5.1	5.1
Axial isotropy of the probe	4.7	R	v3	1	1	2.7	2.7
Sensor displacement	16.5	R	v3	1	0.145	9.5	1.4
Boundary effects	2.4	R	v3	1	1	1.4	1.4
Probe linearity	4.7	R	v3	1	1	2.7	2.7
Scaling to Peak Envelope Power	2.0	R	v3	1	1	1.2	1.2
System Detection limit	1.0	R	v3	1	1	0.6	0.6
Readout electronics	0.3	N	1	1	1	0.3	0.3
Response time	0.8	R	v3	1	1	0.5	0.5
Integration time	2.6	R	v3	1	1	1.5	1.5
RF ambient conditions	3.0	R	v3	1	1	1.7	1.7
RF Reflections	12	R	v3	1	1	6.9	6.9
Probe Positioner	1.2	R	v3	1	0.67	0.7	0.5
Probe positioning	4.7	R	v3	1	0.67	2.7	1.8
Extrap. and integration	1.0	R	v3	1	1	0.6	0.6
Test Sample Related							
Device positioning vertical	4.7	R	v3	1	0.67	2.7	1.8
Device Positioning Lateral	1.0	R	v3	1	1	0.6	0.6
Device Holder and Phantom	2.4	R	v3	1	1	1.4	1.4
Power drift	5.0	R	v3	1	1	2.9	2.9
Phantom and Setup Related							
Phantom thickness	2.4	R	v3	1	0.67	1.4	0.9
					Combined Standard Uncertainty:	14.7	10.9
					Extended Standard Uncertainty on Power (k=2):	29.4	21.8
					Extended Standard Uncertainty on Field (k=2):	**14.7**	**10.9**

N: Normal
R: Rectangular

Table 7.5 Worst-Case uncertainty budget for HAC free field assessment

8 RF Emissions Tests

The tables in section 8.2 and 8.3 list the HAC results in both versions in every operating mode. Due to the similarity of the two versions, the black keypad version was tested based on the worst case at every test configurations of the silver keypad version. The configuration with Bluetooth transmitter on was also tested in similar manner. The maximum HAC results (in bold **blue** color) from the standard testing in each configuration are shown in Appendix C as field strength distribution printouts and methodology for determining HAC category. For the rest of cases, HAC rating is determined in the same manner.

8.1 Emission Limits

Table 8.1 shows the M-rating criteria from ANSCI C63.19. All digital transmission modes in all frequency bands contained in a HAC phone must meet M3 or M4 levels.

Category	Wireless Device RF Parameters		
Near Field	AWF	E-Field Emissions dB(V/m) Peak	H-Field Emissions dB(A/m) Peak
M1	AWF = 0	46.0 to 51.0	-4.4 to 0.6
M2	AWF = 0	41.0 to 46.0	-9.4 to -4.4
M3	AWF = 0	36.0 to 41.0	-14.4 to -9.4
M4	AWF = 0	< 36.0	< -14.4

Table 8.1 RF Emission Limits

8.2 CDMA 800 Test Results

CDMA 800 E-Field									
Configuration:	Open	Generic		**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**V/m**		**V/m**	**M**
Standard Test with Silver Keypad Version									
1013	ON	Standard	OFF	25.88	25.96	**98.1**	1.00	98.1	3
383	ON	Standard	OFF	25.69	25.71	91.5	1.00	91.5	3
777	ON	Standard	OFF	25.37	25.35	92.1	1.00	92.1	3
With Bluetooth Transmitter on									
1013	ON	Standard	ON	25.88	25.96	91.5	1.00	91.5	3
Black Keypad Version									
1013	ON	Standard	OFF	25.88	25.91	92.9	1.00	92.9	3

CDMA 800 H-Field									
Configuration:	Open			**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**A/m**		**A/m**	**M**
Standard Test with Silver Keypad Version									
1013	ON	Standard	OFF	25.88	25.96	**0.181**	1.00	0.181	4
383	ON	Standard	OFF	25.69	25.71	0.138	1.00	0.138	4
777	ON	Standard	OFF	25.37	25.35	0.155	1.00	0.155	4
With Bluetooth Transmitter on									
1013	ON	Standard	ON	25.88	25.96	0.164	1.00	0.164	4
Black Keypad Version									
1013	ON	Standard	OFF	25.88	25.91	0.169	1.00	0.169	4

CDMA 800 E-Field									
Configuration:	Closed			**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**V/m**		**V/m**	**M**
Standard Test with Silver Keypad Version									
1013	ON	Standard	OFF	24.48	24.53	**92.4**	1.00	92.4	3
383	ON	Standard	OFF	24.26	24.27	89.4	1.00	89.4	3
777	ON	Standard	OFF	24.00	23.97	74.5	1.00	74.5	3
With Bluetooth Transmitter on									
1013	ON	Standard	ON	24.48	24.53	71.9	1.00	71.9	3
Black Keypad Version									
1013	ON	Standard	OFF	24.42	24.48	72.6	1.00	72.6	3

CDMA 800 H-Field									
Configuration:	Closed			**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**A/m**		**A/m**	**M**
Standard Test with Silver Keypad Version									
1013	ON	Standard	OFF	24.48	24.53	**0.256**	1.00	0.256	3
384	ON	Standard	OFF	24.26	24.27	0.234	1.00	0.234	3
777	ON	Standard	OFF	24.00	23.97	0.242	1.00	0.242	3
With Bluetooth Transmitter on									
1013	ON	Standard	ON	24.48	24.53	0.267	1.00	0.267	3
Black Keypad Version									
1013	ON	Standard	OFF	24.42	24.48	0.259	1.00	0.259	3

8.3 CDMA 1900 Test Results

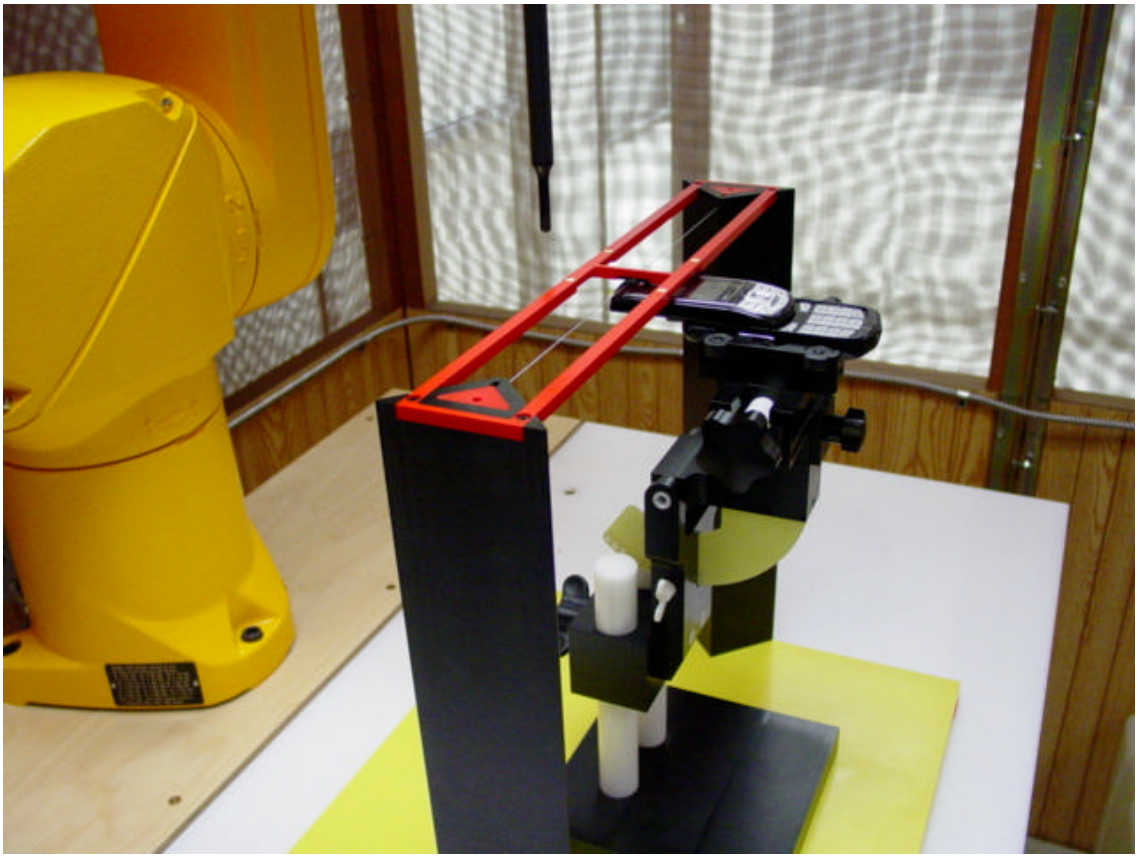
CDMA 1900 E-Field									
Configuration:	Open			**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**V/m**		**V/m**	**M**
Standard Test with Silver Keypad Version									
25	ON	Standard	OFF	23.68	23.85	**60.4**	1.00	60.4	4
600	ON	Standard	OFF	23.66	23.80	51.0	1.00	51.0	4
1175	ON	Standard	OFF	23.88	23.95	52.7	1.00	52.7	4
With Bluetooth Transmitter on									
25	ON	Standard	ON	23.68	23.85	59.2	1.00	59.2	4
Black Keypad Version									
25	ON	Extended	OFF	23.70	23.81	60.3	1.00	60.3	4

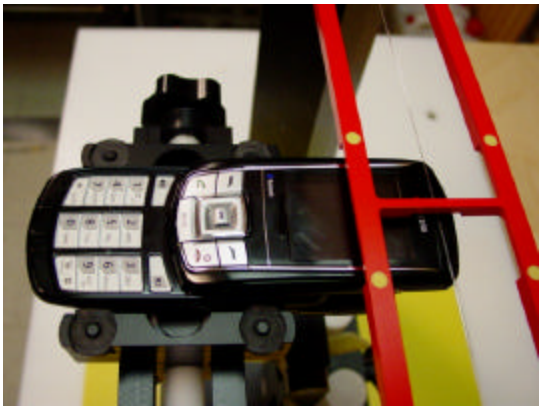
CDMA 1900 H-Field									
Configuration:	Open			**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**A/m**		**A/m**	**M**
Standard Test with Silver Keypad Version									
25	ON	Standard	OFF	23.68	23.85	**0.139**	1.00	0.139	4
600	ON	Standard	OFF	23.66	23.80	0.130	1.00	0.130	4
1175	ON	Standard	OFF	23.88	23.95	0.130	1.00	0.130	4
With Bluetooth Transmitter on									
25	ON	Standard	ON	23.68	23.85	0.146	1.00	0.146	4
Black Keypad Version									
25	ON	Standard	OFF	23.70	23.81	0.145	1.00	0.145	4

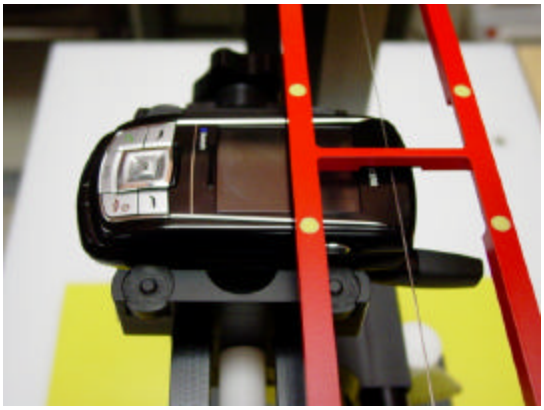
CDMA 1900 E-Field									
Configuration:	Closed			**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**V/m**		**V/m**	**M**
Standard Test with Silver Keypad Version									
25	ON	Standard	OFF	22.10	22.28	62.6	1.00	62.6	4
600	ON	Standard	OFF	22.08	22.26	57.1	1.00	57.1	4
1175	ON	Standard	OFF	22.46	22.53	**65.8**	1.00	65.8	3
With Bluetooth Transmitter on									
1175	ON	Standard	ON	22.46	22.53	64.2	1.00	64.2	3
Black Keypad Version									
1175	ON	Standard	OFF	22.39	22.44	63.2	1.00	63.2	3

CDMA 1900 H-Field									
Configuration:	Closed			**Antenna:**	Fixed				
Ch.	**Backlight**	**Battery**	**BT**	**Power before Test**	**Power after Test**	**Dasy4 Reading**	**PMF**	**Peak Field**	**Category**
#				**dBm**	**dBm**	**A/m**		**A/m**	**M**
Standard Test with Silver Keypad Version									
25	ON	Standard	OFF	22.10	22.28	0.203	1.00	0.203	3
600	ON	Standard	OFF	22.08	22.26	0.213	1.00	0.213	3
1175	ON	Standard	OFF	22.46	22.53	**0.223**	1.00	0.223	3
With Bluetooth Transmitter on									
1175	ON	Standard	ON	22.46	22.53	0.223	1.00	0.223	3
Black Keypad Version									
1175	ON	Standard	OFF	22.39	22.44	0.228	1.00	0.228	3

9 Test SETUP photos







Appendix A: Dipole and Probe Calibration Certification

(See attachment)

Appendix B: System Validation Data Plots

(See attachment)

Appendix C: Test Results/Plots

(See attachment)