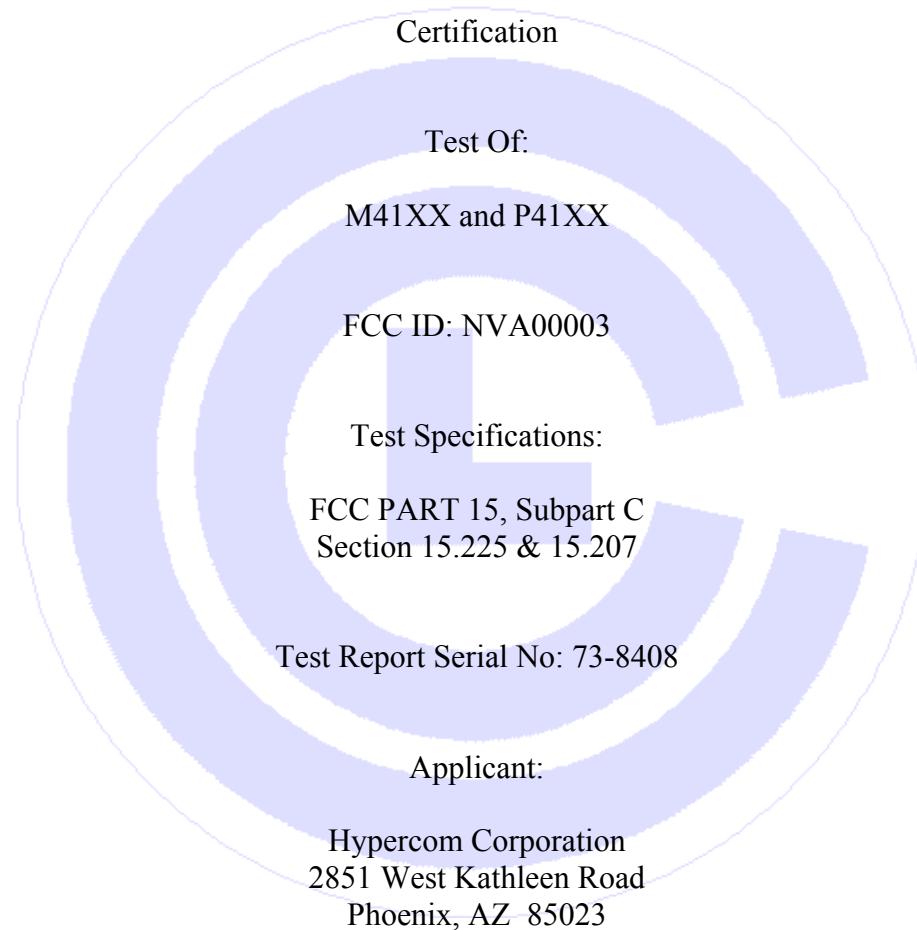


COMMUNICATION CERTIFICATION LABORATORY
1940 West Alexander Street
Salt Lake City, UT 84119
801-972-6146

Test Report



Dates of Test: October 5 – 10, 2006

Issue Date: October 11, 2006

Accredited Testing Laboratory By:



NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Communication Certification Laboratory to determine compliance of the device described below with the certification requirements of FCC Part 15, Subpart C. This report may be reproduced in full, partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: Hypercom Corporation
- Manufacturer: Hypercom Corporation
- Trade Name: Hypercom
- Model Number: M41XX and P41XX
- FCC ID: NVA00003

On this 11th day of October 2006, I, individually, and for Communication Certification Laboratory, certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has recognized that the Communication Certification Laboratory EMC testing facilities are in good standing, NVLAP does not endorse the product described in this report.

COMMUNICATION CERTIFICATION LABORATORY



Tested by: Norman P. Hansen
EMC Technician

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SECTION 1.0 CLIENT INFORMATION

1.1 Client Information:

Company Name: Hypercom Corporation
2851 West Kathleen Road
Phoenix, AZ 85023

Contact Name: Ron Pickard
Title: Compliance Engineer

1.2 Manufacturer:

Company Name: Hypercom Corporation
2851 West Kathleen Road
Phoenix, AZ 85023

Contact Name: Ron Pickard
Title: Compliance Engineer

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)**2.1 Identification of EUT:**

Trade Name: Hypercom
Model Number: M41XX
Serial Number: 10000601826 & 10000601808
Options Fitted: N/A
Country of Manufacture: China

2.2 Description of EUT:

The M41XX is a series of high-security palm-sized 32-bit wireless credit/debit terminals with signature capture touch screens for mobile merchants. Payment types including cash, magnetic strip, chip, and contactless cards are supported. The M41XX has a 200 MHz 32-bit Intel Xscale processor, 240 x 320 pixel, 2 1/4" VGA touchscreen display. Wireless interfaces include GSM/GPRS, Wifi, Bluetooth, and RFID. A USB port is provided on the M41XX but is used only for upgrading software and problem diagnosis at this date. An optional printer and docking station/charger may be used with the M41XX. The docking station includes a telephone port for modem communications.

The P41XX models are physically identical to the M41XX except that the certified communication modules are not installed.

This report covers the RFID circuitry subject to the requirements of FCC Part 15.225. The other wireless modules are FCC certified transmitter modules. The circuitry of the M41XX subject to FCC Part 15 Subpart B is to be tested and covered in separate testing and reports.

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES**3.1 Test Specification:**

Title: FCC PART 15, Subpart C (47 CFR 15).
Section 15.225 and 15.207

Operation within the band 13.110 - 14.010 MHz
Conducted emission limits at the AC Mains

Purpose of Test: The tests were performed to demonstrate
initial compliance.

3.2 Methods & Procedures:**3.2.1 §15.225**

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

3.2.2 §15.207 Conducted Limits

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5*	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

*Decreases with the logarithm of the frequency.

3.3 Test Procedure

The line conducted and radiated emissions testing was performed according to the procedures in ANSI C63.4 (2003). Testing was performed at CCL's Wanship open area test site #2, located at 550 West Wanship Road, Wanship, UT. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated June 6, 2006 (90504).

CCL participates in the National Voluntary Laboratory Accreditation Program (NVLAP) and has been accepted under NVLAP Lab Code:100272-0, which is effective until September 30, 2007.

For radiated emissions testing at 30 MHz or above that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance. At frequencies below 30 MHz, an inverse proportionality factor of 40 dB per decade is used to normalize the measured data.

SECTION 4.0 OPERATION OF EUT DURING TESTING**4.1 Operating Environment:**

Power Supply: 4.2 VDC from battery or dock/charger unit

4.2 Operating Modes:

The M4100 when connected to the Pilot Printer and Dock/Charger was tested when placed horizontally on the tabletop as if mounted on a counter and also placed vertically as if mounted on a wall. The M4100 when connected to the Pilot Printer and also as a stand-alone device was tested when placed flat on the table, on edge on the table, and placed vertical in a test fixture. The transmitter was in a constant transmit state. An M4100 with a dummy load installed at the antenna was used for measuring conducted emissions at the AC mains port.

4.3 EUT Exercise Software:

Hypercom test software was used to exercise the EUT.

SECTION 5.0 SUMMARY OF TEST RESULTS**5.1 FCC PART 15, Subpart C Section 15.231****5.1.1 Summary of Tests:**

Section	Test Performed	Frequency Range (MHz)	Result
15.225 (a)	Radiated Emissions	13.553 – 13.567	Complied
15.225 (b)	Radiated Emissions	13.410 – 13.553 and 13.567 – 13.710	Complied
15.225 (c)	Radiated Emissions	13.110 – 13.410 and 13.710 – 14.010	Complied
15.225 (d)	Radiated Emissions	1.705 – 1000 excluding the frequency bands of paragraphs (a) through (c)	Complied
15.225 (e)	Frequency Stability	13.56	Complied
15.207	Line Conducted Emissions (Hot Lead to Ground)	0.15 to 30	Complied
15.207	Line Conducted Emissions (Neutral Lead to Ground)	0.15 to 30	Complied

5.2 Result

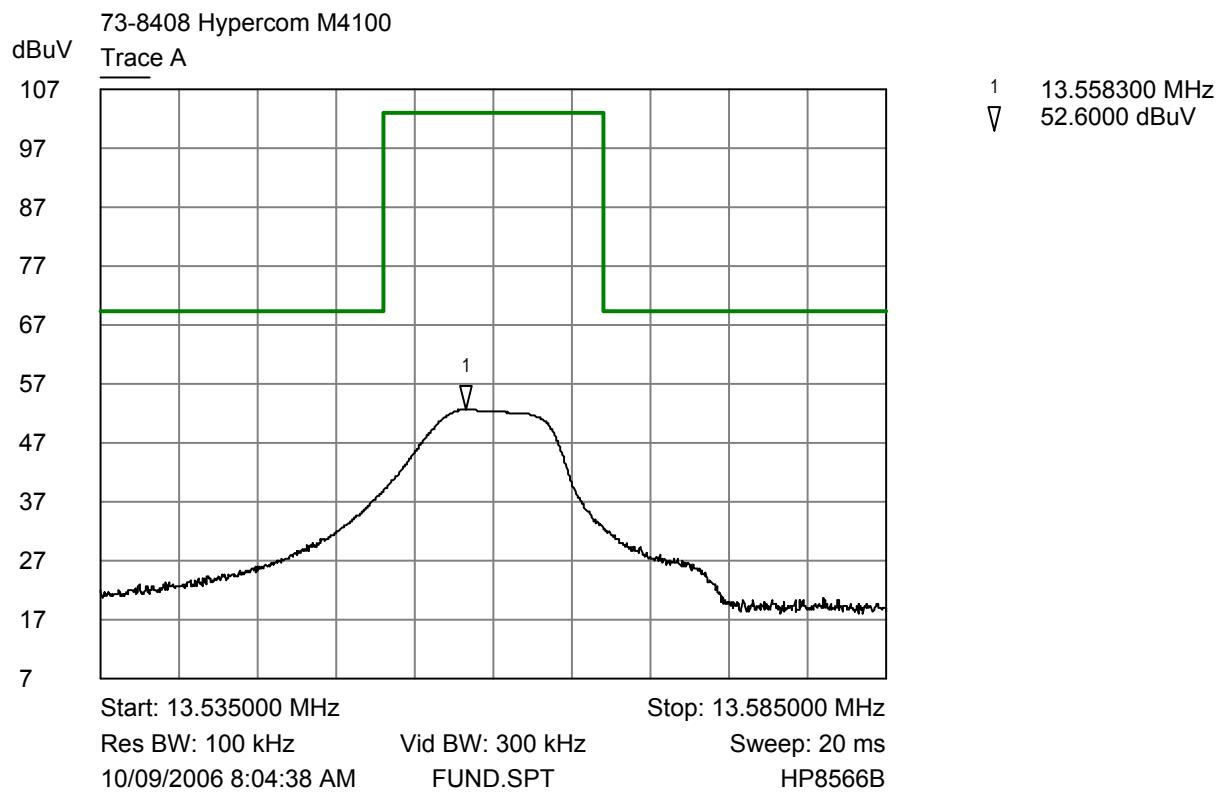
In the configuration tested, the EUT complied with the requirements of the specification.

SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS**6.1 General Comments:**

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

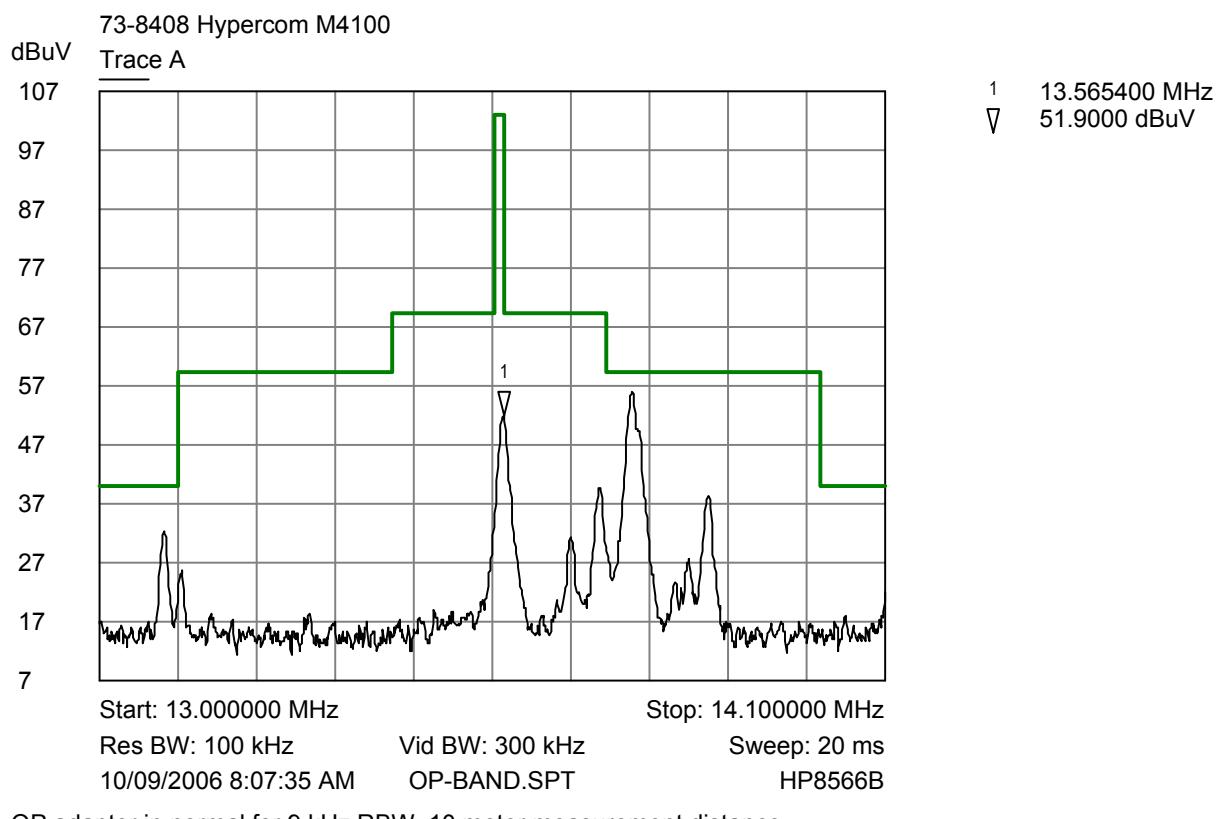
6.2 Test Results:**6.2.1 §15.225 (a) - (d)**

The emissions from the M4100 must meet the emission mask specified in §15.225. The plots of the fundamental frequency and operating band of the transmitter are shown below. The data of spurious emissions seen is shown in a tabular format after the plots.



QP adapter in normal for 9 kHz RBW, 10 meter measurement distance - Vertical placement on table

Trace A Peak Detection - Corrected Trace - Antenna and Cable CF of 10.8 dB



QP adapter in normal for 9 kHz RBW, 10 meter measurement distance

Trace A Peak Detection - Corrected Trace - Antenna and Cable CF of 10.8 dB

Radiated Interference Level Data

Frequency (MHz)	Detector (Note 1)	Antenna Polarity	Receiver Reading (dB μ V)	Correction Factor (dB/m)	Field Strength (dB μ V/m)	Limit (dB μ V/m) (Note 3)	Margin (dB)
13.56	Peak	(Note 2)	41.8	10.8	52.6	103.1	-50.5
27.12	Peak	(Note 2)	13.6	9.4	23.0	48.6	-25.6
40.68	Peak	Vertical	13.3	13.7	27.0	40.0	-13.0
40.68	Peak	Horizontal	2.8	13.7	16.5	40.0	-23.5
54.24	Peak	Vertical	13.2	9.2	22.4	40.0	-17.6
54.24	Peak	Horizontal	3.4	9.2	12.6	40.0	-27.4
67.8	Peak	Vertical	21.9	8.0	29.9	40.0	-10.1
67.8	Peak	Horizontal	8.0	8.0	16.0	40.0	-24.0
81.36	Peak	Vertical	13.5	8.2	21.7	40.0	-18.3
81.36	Peak	Horizontal	2.9	8.2	11.1	40.0	-28.9
94.92	Peak	Vertical	15.6	9.4	25.0	43.5	-18.5
94.92	Peak	Horizontal	8.5	9.4	17.9	43.5	-25.6
108.48	Peak	Vertical	19.8	9.4	29.2	43.5	-14.3
108.48	Peak	Horizontal	10.8	9.4	20.2	43.5	-23.3
122.04	Peak	Vertical	15.2	8.8	24.0	43.5	-19.5
122.04	Peak	Horizontal	1.7	8.8	10.5	43.5	-33.0
135.60	Peak	Vertical	19.7	9.0	28.7	43.5	-14.8
135.60	Peak	Horizontal	8.6	9.0	17.6	43.5	-25.9

Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor) and the Average Factor to the measured level of the receiver. The receiver amplitude reading is compensated for any amplifier gain.

The basic equation with a sample calculation is shown below:

FS = RA + CF + AV Where

FS = Field Strength

RA = Receiver Amplitude Reading

CF = Correction Factor (Antenna Factor + Cable Factor)

AV = Averaging Factor

Assume a receiver reading of 44.2 dB μ V is obtained from the receiver, with an average factor of -8.6 dB and a correction factor of 17.5 dB. The field strength is calculated by adding the correction factor and the average factor, giving a field strength of 53.1 dB μ V/m, $FS = 44.2 + 17.5 + (-8.6) = 53.1$ dB μ V/m

RESULT

In the configuration tested, the EUT complied with the requirements of §15.225 (a) - (d) with a nearest margin to the limit of 9 dB.

6.2.2 §15.225 (e) Frequency Stability Over Temperature and Voltage Fluctuations

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20°C to $+50^{\circ}\text{C}$ at normal voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C . For battery operated equipment, the equipment tests shall be performed using a new battery. A lithium rechargeable battery is used in this device and was fully charged for all testing.

The operating frequency of the M4100 is 13.56 MHz; therefore, the frequency must be maintained between 13.558644 MHz and 13.561,356 MHz.

$$13.56 \text{ MHz} \times 0.0001 = 1.356 \text{ kHz}$$

$$\begin{aligned} \text{Lower edge of range} &= 13.56 \text{ MHz} - 1.356 \text{ kHz} = 13.558644 \text{ MHz} \\ \text{Upper edge of range} &= 13.56 \text{ MHz} + 1.356 \text{ kHz} = 13.561356 \text{ MHz} \end{aligned}$$

Condition	Start up ---	2 minutes ---	5 minutes ---	10 minutes ---
Fully Charged Battery @ 20°C	13560178	13560172	13560156	13560160
Fully Charged Battery @ -20°C	13560178	13560190	13560186	13560188
Fully Charged Battery @ $+50^{\circ}\text{C}$	13560138	13560124	13560126	13560120
Power from Charger at 120 VAC @ 20°C	13560186	13560176	13560166	13560166
Power from Charger at 120 VAC @ -20°C	13560182	13560190	13560192	13560190
Power from Charger at 120 VAC @ $+50^{\circ}\text{C}$	13560134	13560122	13560122	13560130
Power from Charger at 102 VAC @ 20°C	13560182	13560178	13560168	13560168
Power from Charger at 138 VAC @ 20°C	13560185	13560178	13560170	13560168
Note: The dock/charger provides a regulated DC voltage to the EUT so testing at the upper and lower voltage levels should not change the characteristics of the transmitter.				

RESULT

The maximum deviation from the fundamental frequency of operation was 72 Hz or 0.0005%; therefore, the EUT meets the requirement of §15.225 (e).

6.2.3 §15.207 Conducted Emissions at the AC Mains Port

Frequency (MHz)	Mains Lead	Detector	Measured Level (dB μ V)	Limit (dB μ V)	Margin (dB)
0.15	Hot Lead	Peak (Note 1)	50.0	56.0	-6.0
0.20	Hot Lead	Peak (Note 1)	49.7	53.6	-3.9
0.59	Hot Lead	Peak (Note 1)	38.4	46.0	-7.6
0.66	Hot Lead	Peak (Note 1)	37.8	46.0	-8.2
0.99	Hot Lead	Peak (Note 1)	37.9	46.0	-8.1
1.64	Hot Lead	Peak (Note 1)	36.5	46.0	-9.5
0.15	Neutral Lead	Peak (Note 1)	51.6	56.0	-4.4
0.19	Neutral Lead	Peak (Note 1)	47.8	54.1	-6.3
0.53	Neutral Lead	Peak (Note 1)	37.6	46.0	-8.4
0.92	Neutral Lead	Peak (Note 1)	36.8	46.0	-9.2
1.18	Neutral Lead	Peak (Note 1)	35.3	46.0	-10.7
1.58	Neutral Lead	Peak (Note 1)	35.1	46.0	-10.9

Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

Measurement Uncertainty

The measurement uncertainty (with a 95% confidence level) for this test was: ± 3.3 dB.

RESULT

The EUT complied with the specification limit by a margin of 3.9 dB.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT**A.1.1 Radiated Interference Emissions**

The radiated emission from the intentional radiator was measured using a spectrum analyzer. The resolution bandwidth was set to 100 kHz and using the Quasi-Peak Adapter, a resolution bandwidth of 9 kHz was used for measurements below 30 MHz. For frequencies above 30 MHz and below 1000 MHz, the resolution bandwidth was set at 100 kHz and the video bandwidth was set at 300 kHz, bypassing the Quasi-Peak Adapter.

An active loop antenna was used to measure frequencies below 30 MHz at a distance of 10 meters from the EUT. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz at a distance of 3 meters from the EUT. The readings obtained by the antenna are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors.

The configuration of the intentional radiator was varied to find the maximum radiated emission. The intentional radiator was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

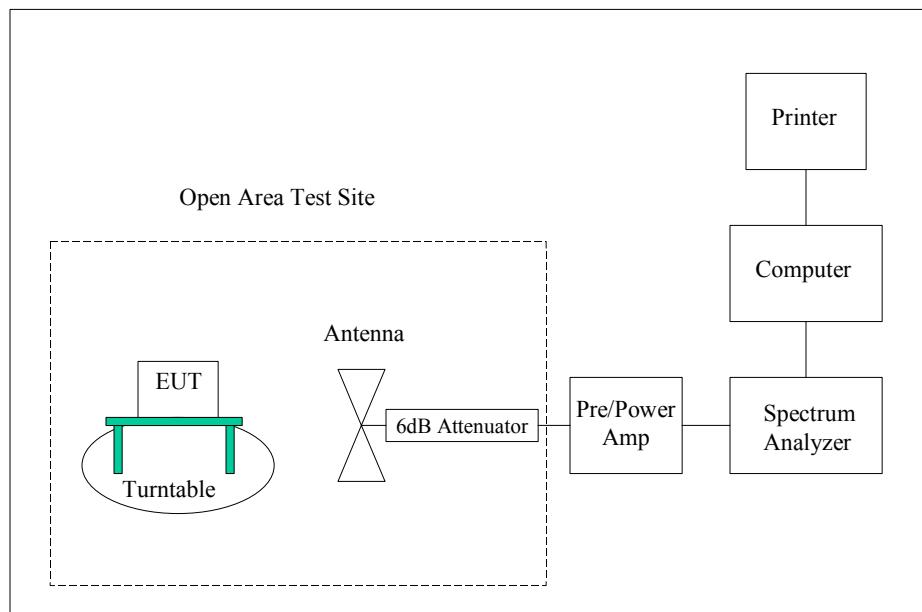
Desktop intentional radiators are measured on a non-conducting table 0.8 meter above the ground plane. The table is placed on a turntable which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/28/2005
Test Software	CCL	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2332A02726	03/06/2006
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00287	03/23/2006
Biconilog Antenna	EMCO	3142	9601-1009	12/28/2005

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Active Loop Antenna	EMCO	6502	2011	04/21/2005
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/12/2005
10 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable L	N/A	12/12/2005
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	09/06/2006
6 dB Attenuator	Hewlett Packard	8491A	32835	12/12/2005

An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Radiated Emissions Test Setup



A.1.2 Conducted Disturbance at Mains Ports

The conducted disturbance at mains ports from the ITE was measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted disturbance at mains ports measurements are performed in a screen room using a (50 Ω /50 μ H) Line Impedance Stabilization Network (LISN).

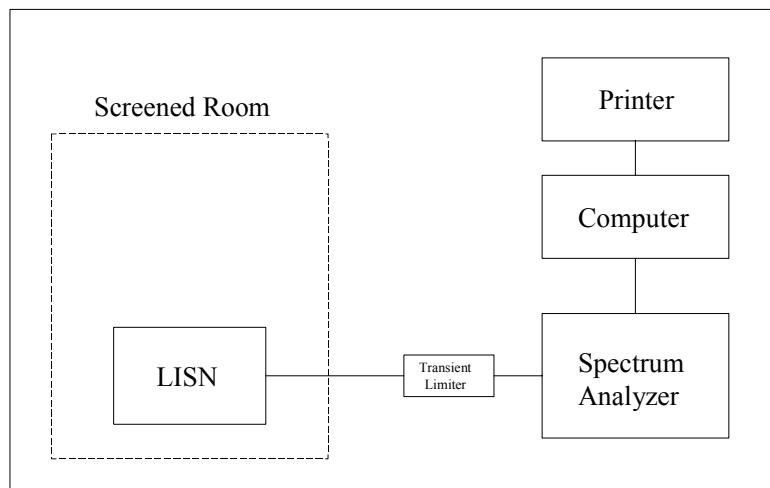
Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

For AC mains port testing the desktop ITE are placed on a non-conducting table at least 0.8 meters from the metallic floor. The equipment is placed a minimum of 40 cm from all walls.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/28/2005
Test Software	CCL	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2332A02726	03/06/2006
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00287	03/23/2006
LISN	EMCO	3825/2	9508-2435	03/15/2006
Conductance Cable Wanship Site #2	CCL	Cable J	N/A	12/12/2005
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/12/2005

An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Conducted Emissions Test Setup



APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Vertical Stand-Alone Test Configuration



Photograph 2 - Horizontal Flat Stand-Alone Test Configuration



Photograph 3 - Horizontal On-Edge Stand-Alone Test Configuration



Photograph 4 – Vertical Placement with Printer Attached



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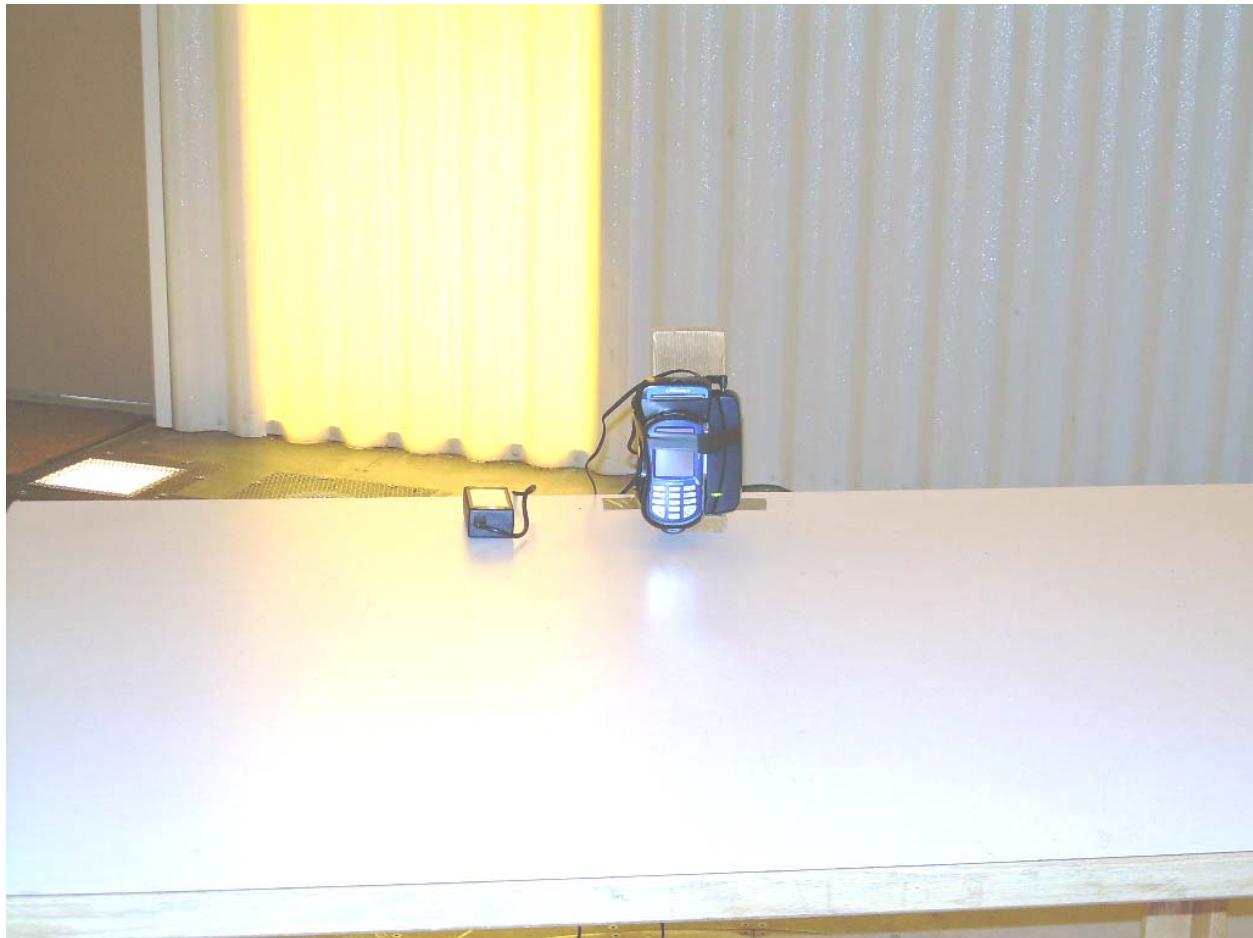
Photograph 5 - Horizontal Flat Placement with Printer Attached



Photograph 6 - Horizontal On-Edge Placement with Printer Attached



Photograph 7 - Front View of the Vertical Configuration with the M4100 in Dock/Charger



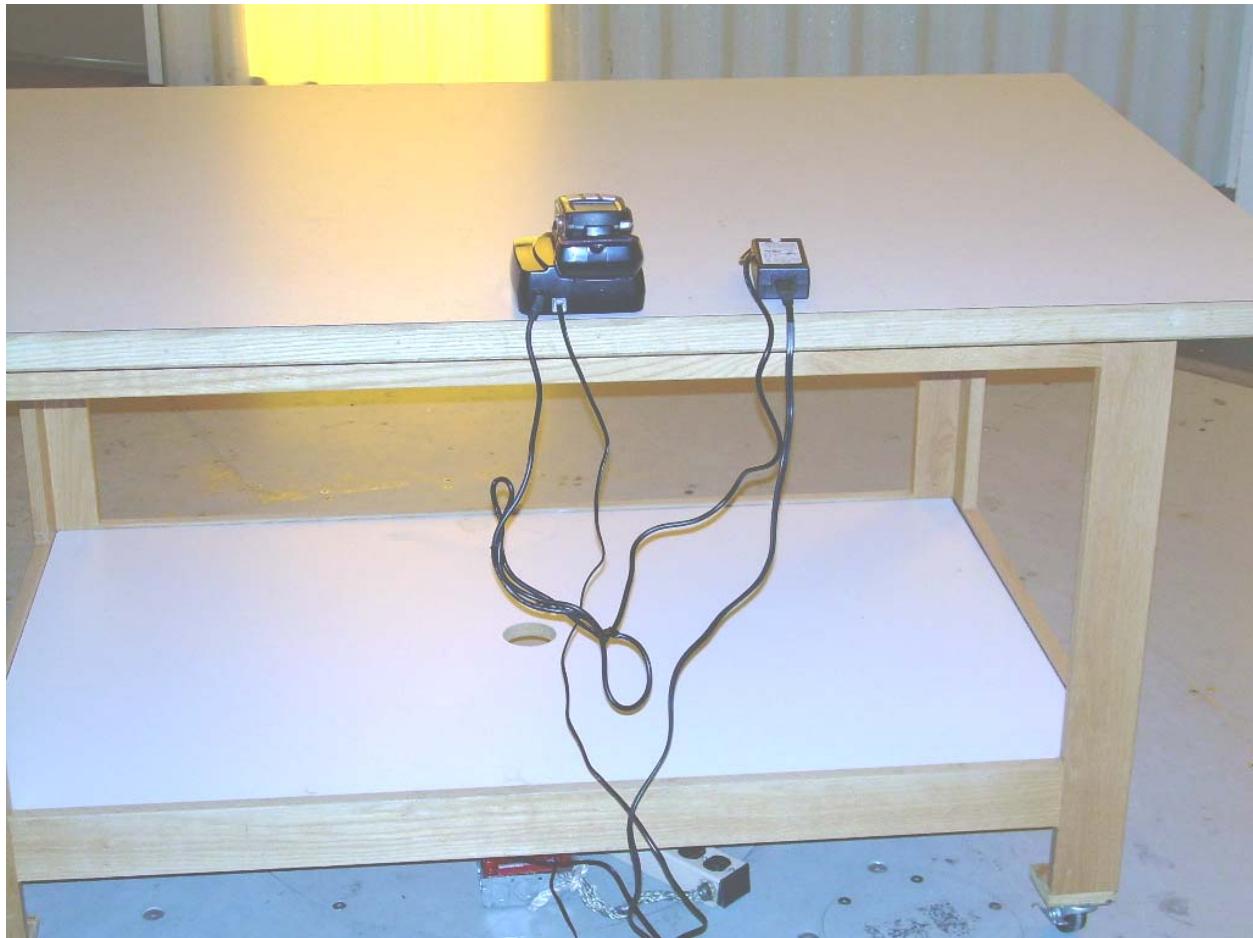
Photograph 8 - Back View of the Vertical Configuration with the M4100 in Dock/Charger



Photograph 9 - Front View of the Horizontal Configuration with the M4100 in the Dock/Charger



Photograph 10 - Back View of the Horizontal Configuration with the M4100 in the Dock/Charger



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Photograph 11 - Front View of the Conducted Emission Setup



Photograph 12 - Back View of the Conducted Emission Setup



Photograph 13 - Front View of the M4100



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Photograph 14 - Back View of the M4100



Photograph 15 - Back View of the EUT with Cover Removed



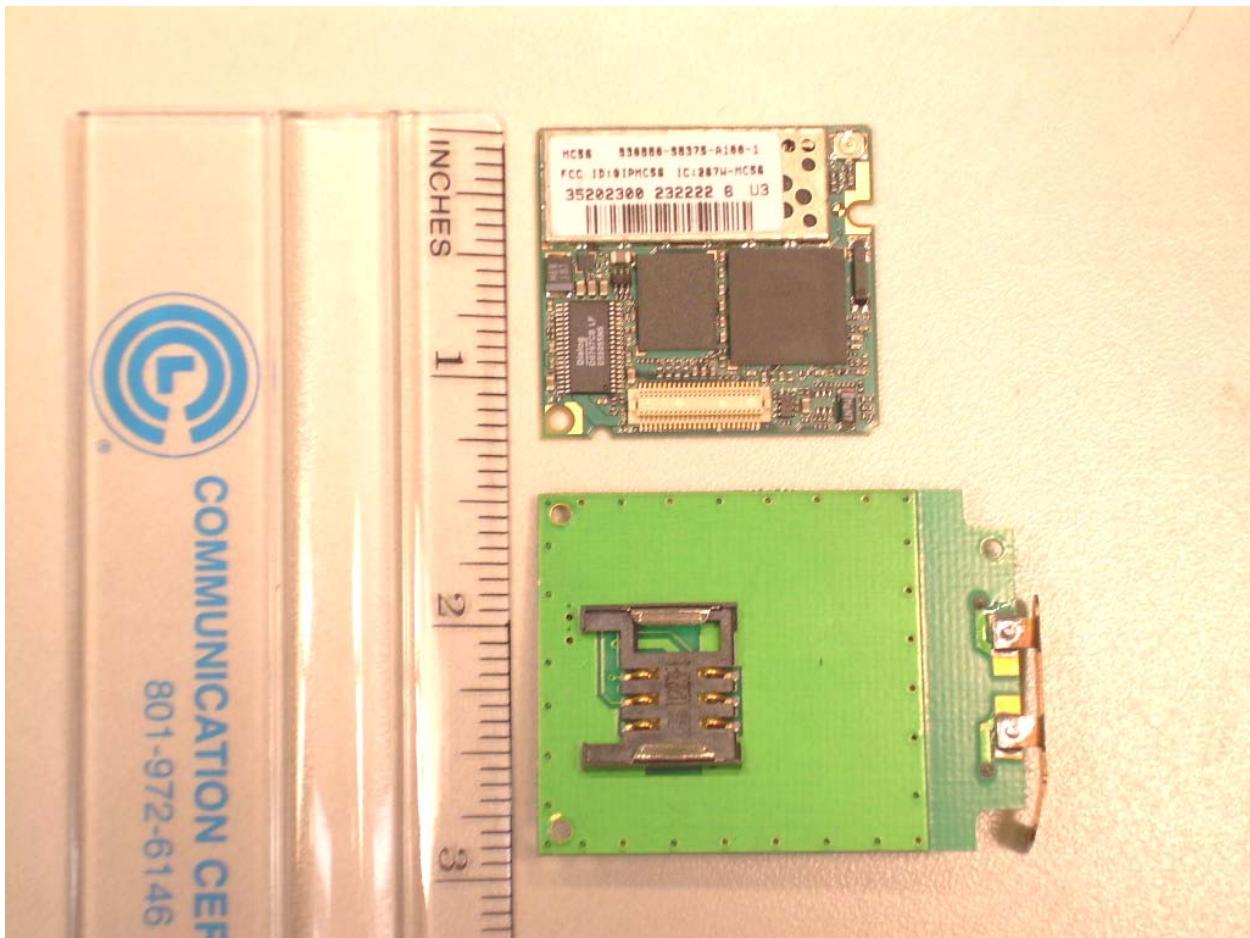
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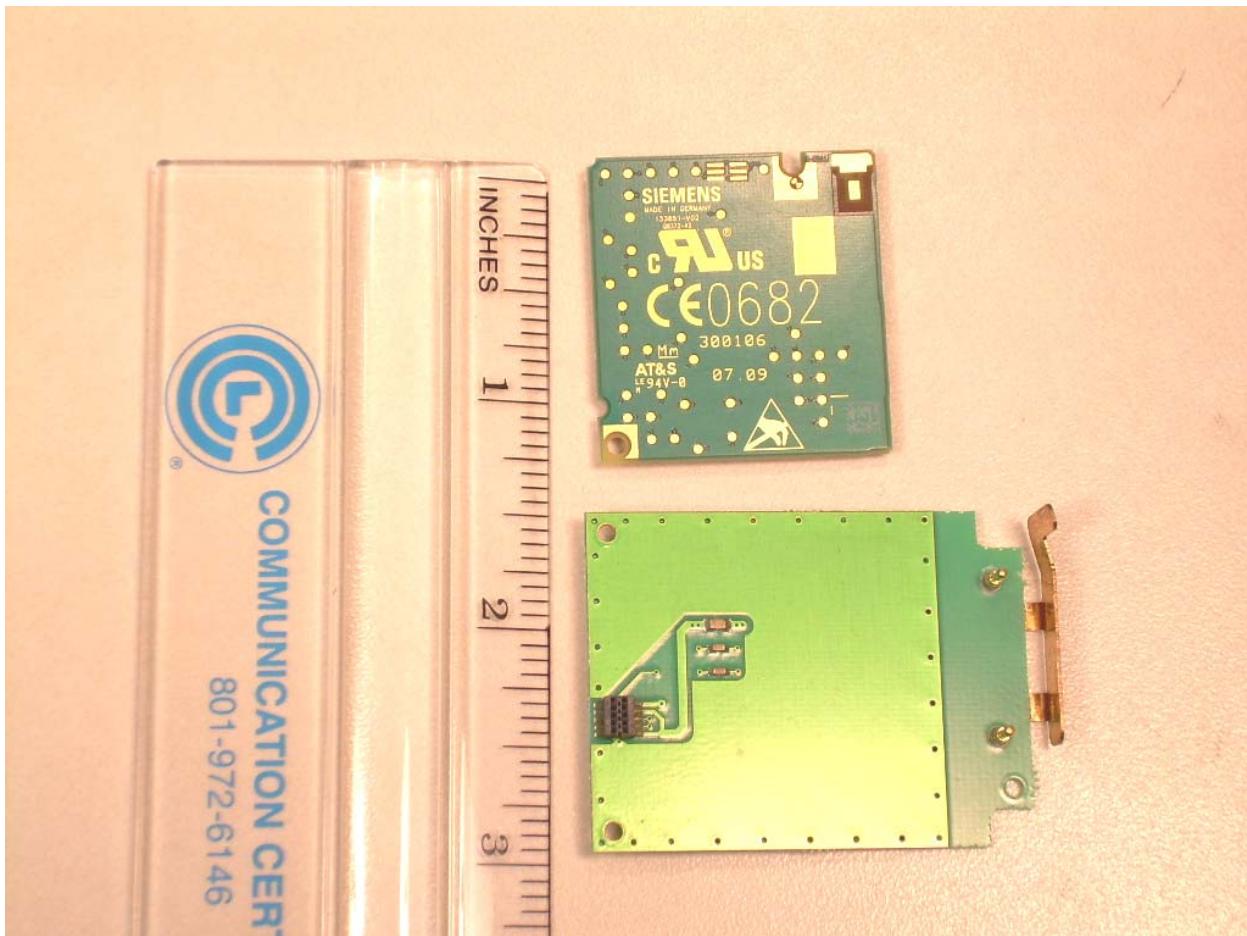
FCC ID: NVA00003

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Photograph 16 - Top View of the Cell Phone Module and Antenna PCB



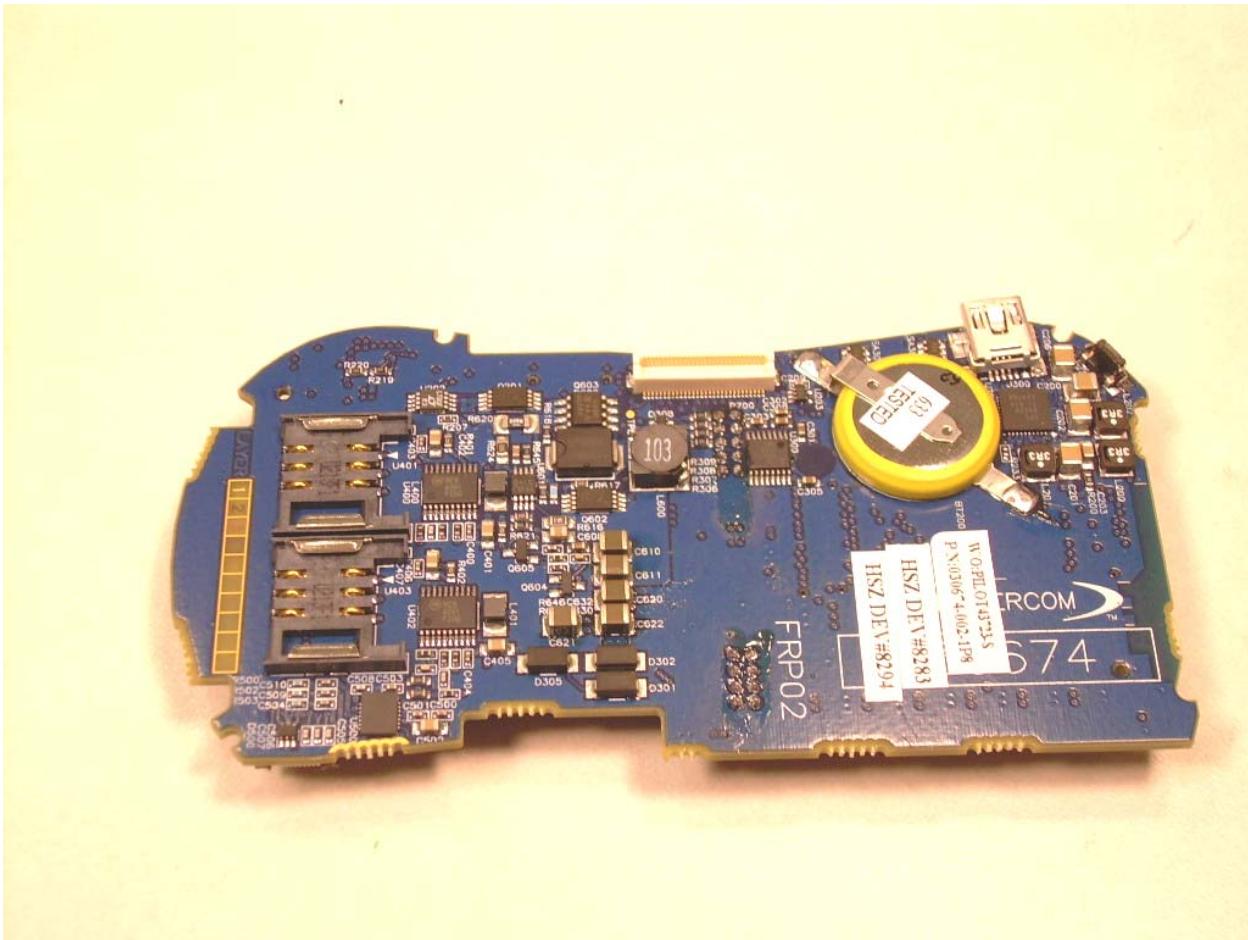
Photograph 17 - Bottom View of the Cell Phone Module and Antenna PCB



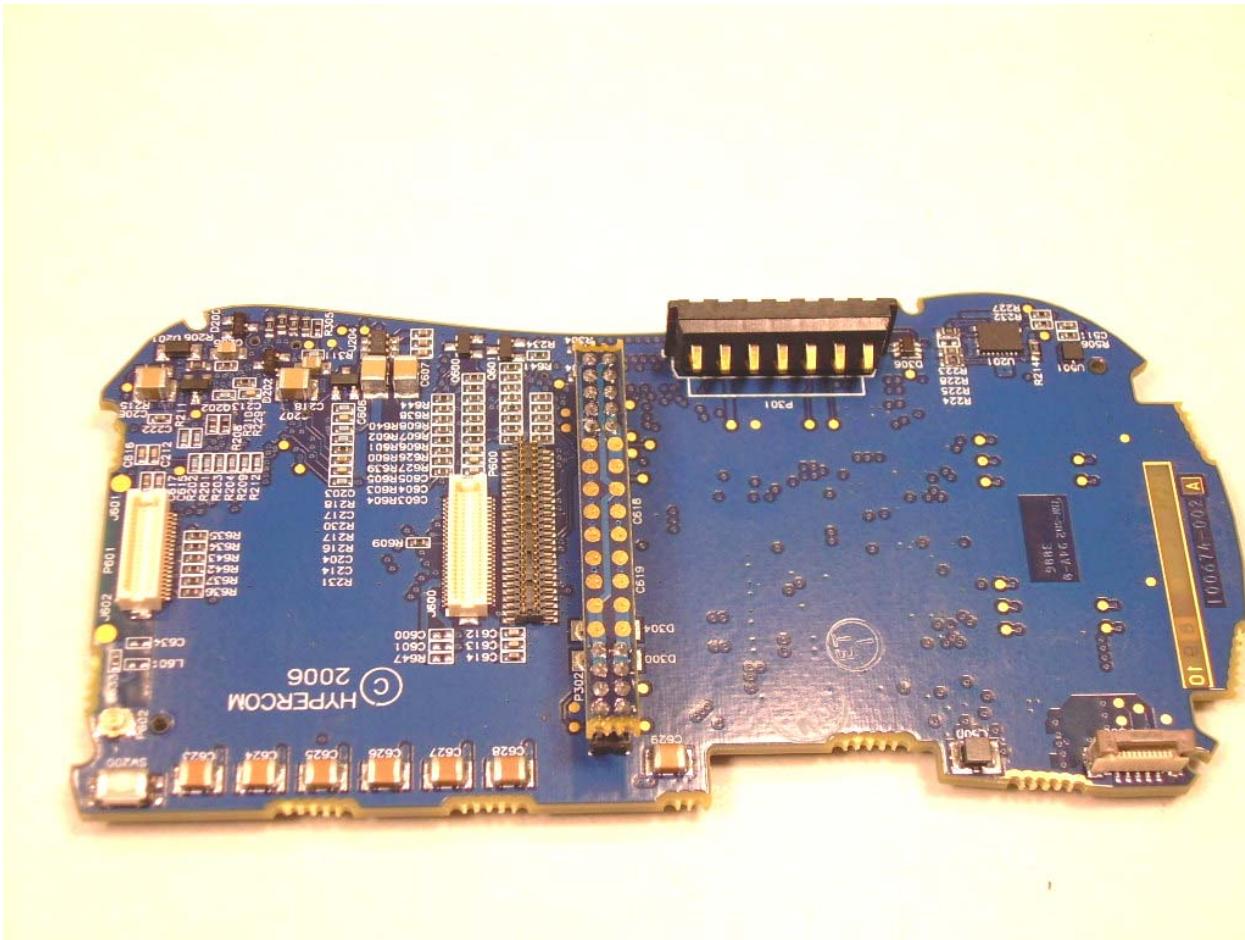
Photograph 18 - View with the Front Cover Removed



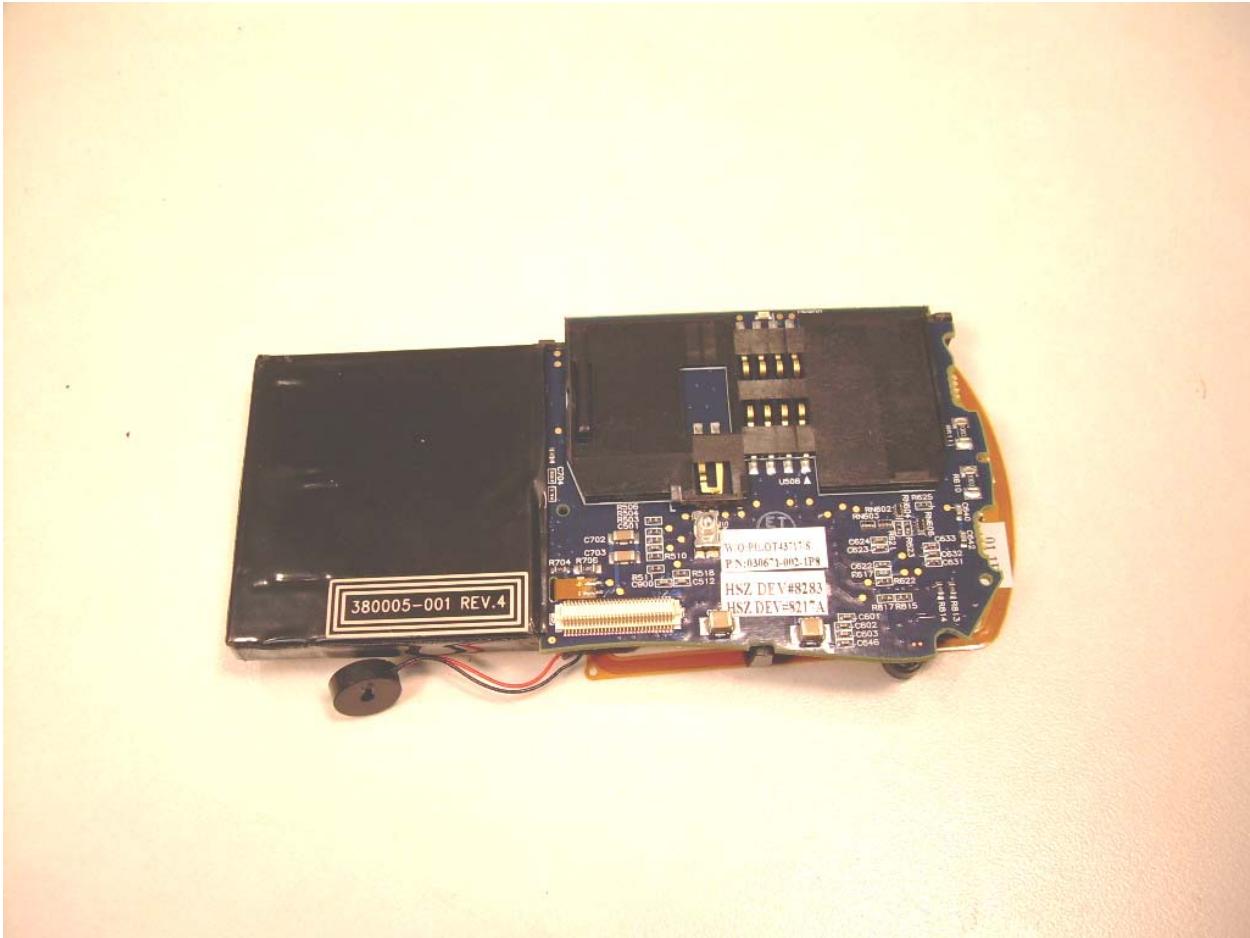
Photograph 19 - Top Side of the Main PCB



Photograph 20 - Bottom View of the Main PCB



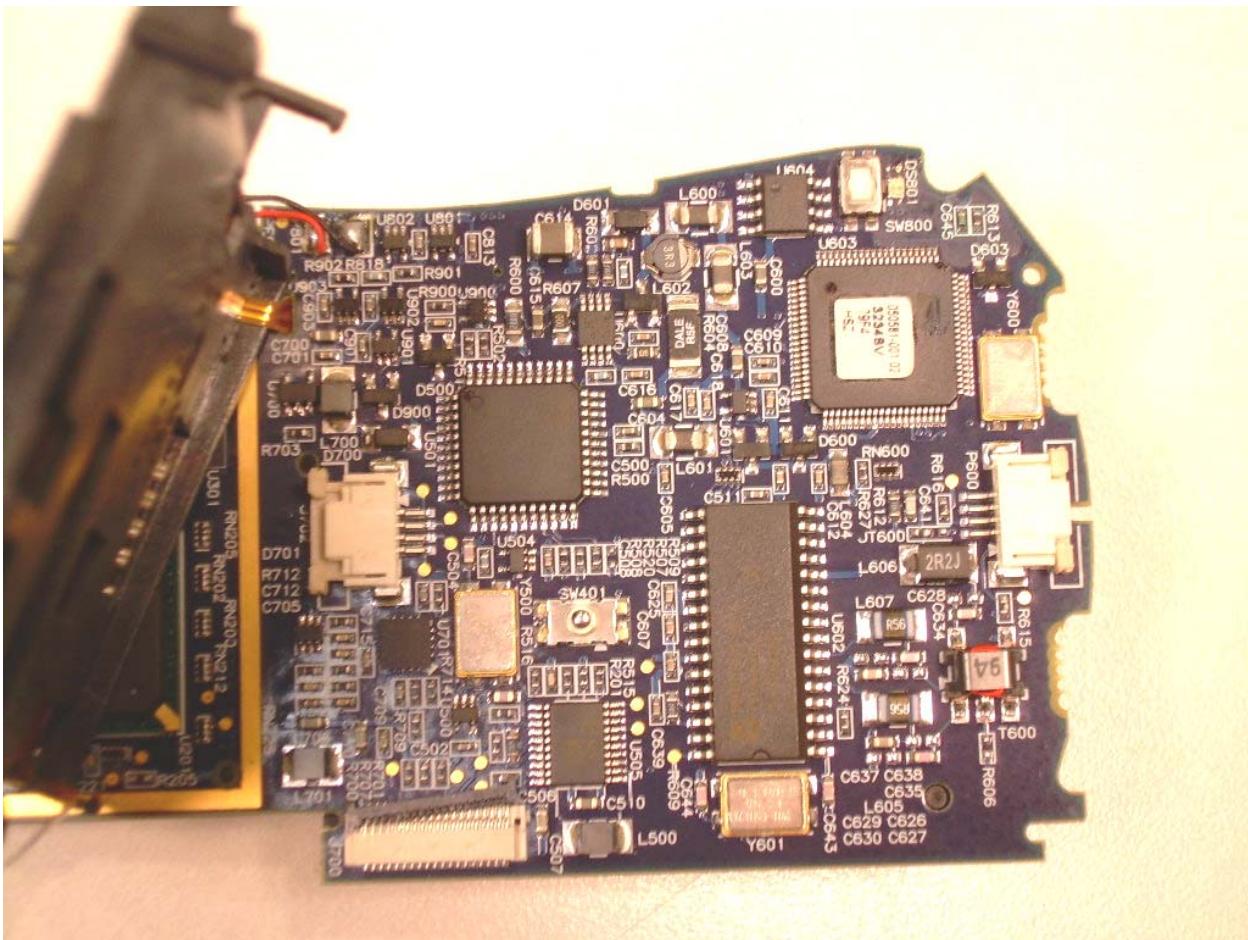
Photograph 21 - Bottom Side of the Display PCB with Covers in Place



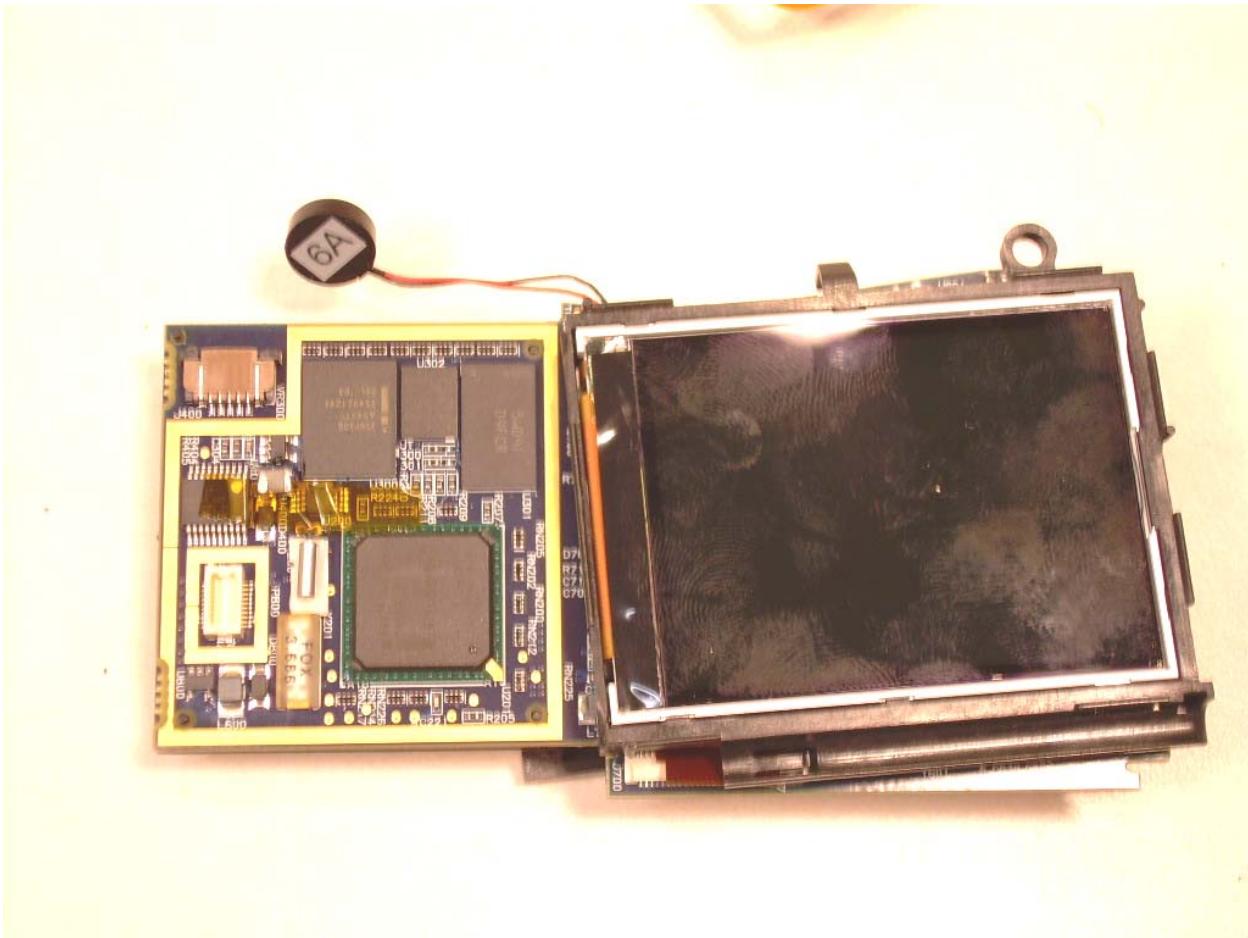
Photograph 22 - Top View of the Keypad/Display Unit



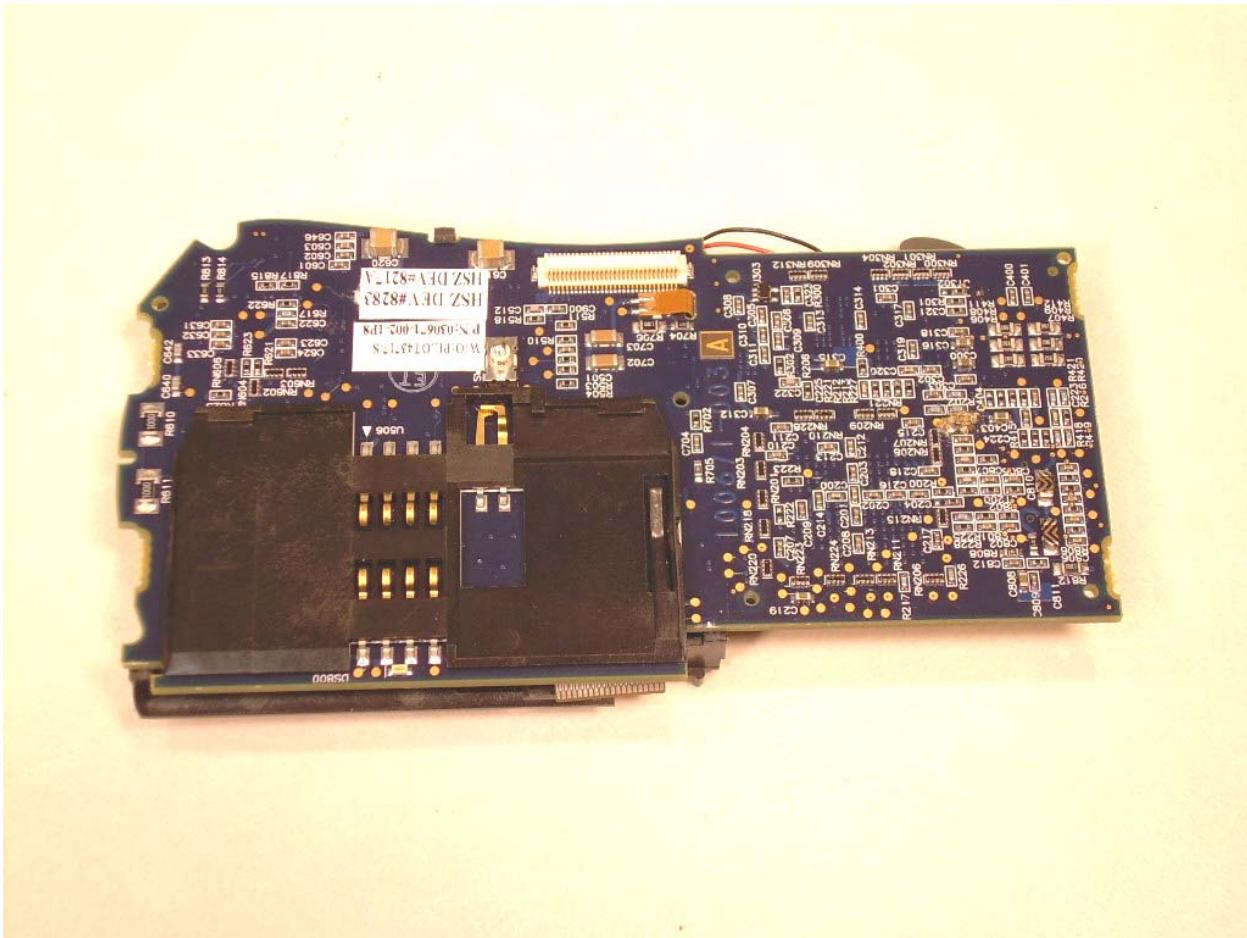
Photograph 23 - Front View of the Display PCB with Display Lifted



Photograph 24 - View of the Front Side of the Display PCB with Plastic Cover Removed



Photograph 25 - View of the Back Side of the Display PCB with Plastic Cover Removed



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Photograph 26 - View of the 400036-001 Lithium Battery



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Photograph 27 - Top View of the Printer Module



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Photograph 28 - Back View of the Printer Module



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Photograph 29 - Top View of the Dock/Charging Unit



Photograph 30 - Back View of the Dock/Charging Unit



Photograph 31 - View of the Dock/Charger Power Supply

