DATE: 26 July 2011

I.T.L. (PRODUCT TESTING) LTD.

FCC Radio Test Report

for

Mobile Access Networks

Equipment under test:

VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit
2. VE Access Pod

1. VCU-FB-CELL-PCS-12E
2. VAP-FB-CELL-PCSE

Written by: _____
D. Shidlowsky, Documentation

Approved by: _____
A. Moses, Test Engineer

Approved by: _____
I. Raz, EMC Laboratory Manager

Measurement/Technical Report for

Mobile Access Networks

VE CELL PCS Full Band Distributed Antenna System comprising:

1. VE Control Unit

2. VE Access Pod

FCC ID: OJFVECELLPCSFB

This report concerns:	Original Grant: X Class II change: Class I change:
Equipment type:	PCS Licensed Transmitter
Limits used: 47CFR Parts 2, 22, 24	

Measurement procedure used is ANSI C63.4-2003.
Substitution Method used as in ANSI/TIA-603-C: 2004

Application for Certification prepared by:

Ishaishou Raz
ITL (Product Testing) Ltd.
Kfar Bin Nun
D.N. Shimshon 99780
Israel
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Applicant for this device: (different from "prepared by")

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Mobile Access Networks
8391 Old Courthouse Rd., Suite #300
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e-mail: sblum@mobileaccess.com

TABLE OF CONTENTS

1 General Information

1.1 Administrative Information

Manufacturer:	Mobile Access Networks
Manufacturer's Address:	8391 Old Courthouse Rd. Suite #300 Vienna, VA 22182 U.S.A. Tel: +1-541-758-2880 Fax: +1-703-848-0260
Manufacturer's Representative:	Steve Blum
Equipment Under Test (E.U.T):	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Equipment Model No.:	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Equipment Serial No.:	1. 00112200068 2. 00110800002
Date of Receipt of E.U.T:	05.06.11
Start of Test:	05.06.11
End of Test:	26.06.11
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Parts 22, 24, 27

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025B-1.
6. TUV Product Services, England, ASLLAS No. 97201.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

MobileAccess VE™ Dual-Band solution provides enhanced, cost effective in-building coverage for enterprise environment. This solution is quickly and simply deployed using the existing cable infrastructure to provide instant coverage without requiring the installation of new cables and without affecting existing LAN services. MobileAccess VE™ minimizes disruption while providing a scalable and flexible solution at a significantly lower total installation cost.

The MobileAccess VE™ Solution

The MobileAccess VE™ solution consists of the following main components:

- **MobileAccess VE™ Control Unit (VCU)** - interfaces with the Service Provider's RF capacity sources and VE Access Pods (VAPs). It combines the wireless services with the Ethernet service and distributes them to the VAPs over CAT-5e/6 cables. Each VCU can support up to 12 VAPs. Coverage can be expanded by connecting (up to 12) Slave VCUs where the Master VCU interfaces to the RF capacity source and the Slave VCUs to the VAPs. Each VCU can serve as either Master or Slave depending on its connections.
- **MobileAccess VE™ Access Pods (VAPs)** – distribute wireless services and provide Ethernet/IP connectivity (and PoE pass-through) to connected IP appliances such as WiFi APs and IP Phones. VAPs are distributed at strategic locations over one or more floors, and plug into RJ-45 jacks which are connected to the VCU via exiting CAT-5e/6 infrastructure. VAPs are remotely powered by the VCU utilizing PoE, eliminating the need for local powering.

Key Features and Benefits

Low Deployment Cost

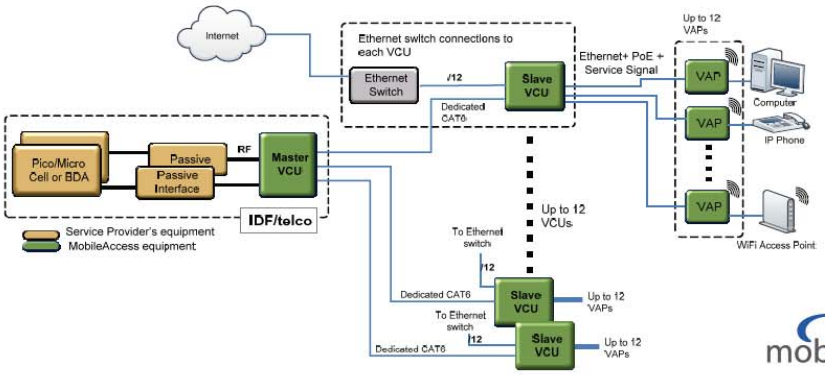
- Connects over existing Cat 5/6 cabling infrastructure and existing Ethernet jacks
- Simple installation - deployed in few hours, with minimum disturbance to the enterprise
- VAPs are remotely powered using Power-over-Ethernet (PoE) – no local power required
- Minimum macro-network impact with low power distributed coverage
- Seamlessly coexists with the Enterprise LAN and does not consume LAN capacity

Flexible & Scalable Architecture

- Connects to all types of capacity sources: BTS, Pico-cells, Femto-cells and BDAs
- VAPs can be easily relocated for coverage modifications as needed
- Ease of expansion provides 'pay as you grow' scalability
- Support of connected IP devices (WiFi APs, IP Phones etc) with Ethernet/IP pass through and PoE maximizes placement flexibility

Carrier-Grade Management

- Remote end-to-end system monitoring, management and configuration using a standard web browser



1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2003. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

Both conducted and radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing September 3, 2009).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
0.15 – 30 MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 3.44 dB

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
for open site 30-1000MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 4.96 dB

2 System Test Configuration

2.1 Justification

The test setup was configured to closely resemble the standard installation.

The EUT consists of the VCU and the VAP.

The CELL and PCS source signals are represented in the setup by signal generators with appropriate modulations.

An “Exercise” SW on the computer was used to enable / disable transmission of the VAP, while the EUT output was connected to the spectrum analyzer.

Both CELL and PCS channels transmit during the testing.

2.2 EUT Exercise Software

The Element Management System EngGUI ver. 3.0 build 10 used for commands delivery.

These commands are used to enable / disable of VAP transmission.

APod Embedded SW version 3.9 build 12

VCU Embedded SW version 3.0 build 09

2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

2.4 Equipment Modifications

No modifications were needed in order to achieve compliance.

2.5 Configuration of Tested System

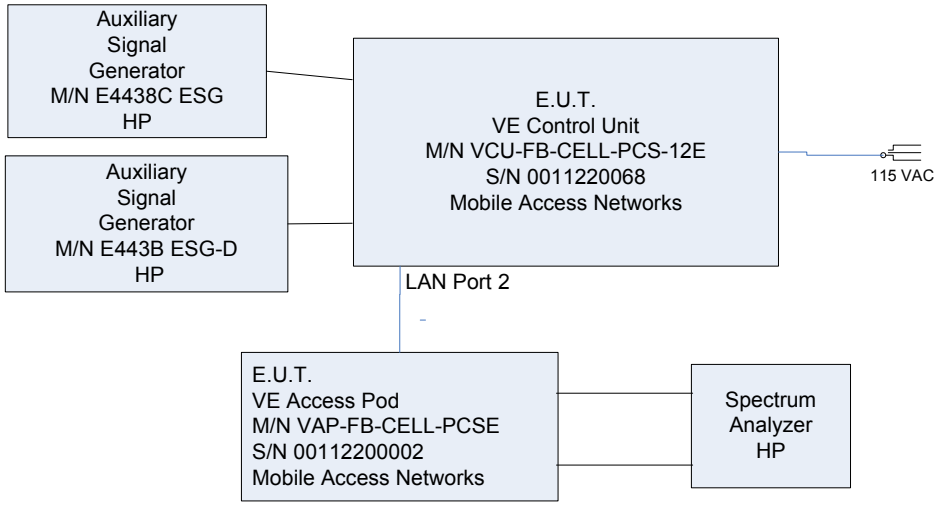


Figure 1. Tests Set-up

3 Conducted and Radiated Measurement Test Set-ups Photo

Figure 2. Conducted Emission From AC Mains Test

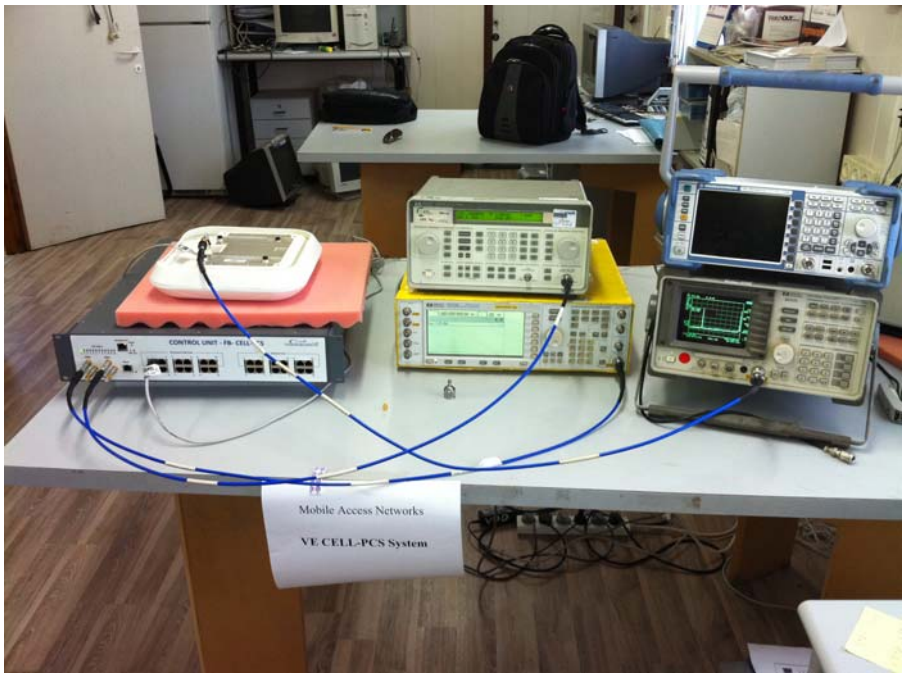


Figure 3. Conducted Emission From Antenna Ports Tests

Figure 4. Frequency Error Tests

Figure 5. Radiated Emission Test

4 Conducted Emission Data

4.1 Test Specification

F.C.C., Part 15, Subpart C

4.1 Test Procedure

The E.U.T operation mode and test set-up are as described in Section 3.1. In order to minimize background noise interference, the conducted emission testing was performed inside a shielded room, with the E.U.T placed on an 0.8 meter high wooden table, 0.4 meter from the room's vertical wall.

The E.U.T was powered from 115 V AC / 60 Hz via a 50 Ohm / 50 µHn Line Impedance Stabilization Network (LISN) on the phase and neutral lines. The LISN's were grounded to the shielded room ground plane (floor), and were kept at least 0.8 meters from the nearest boundary of the E.U.T

The center of the E.U.T AC cable was folded back and forth, in order to form a bundle less than 0.40 meters and a total cable length of 1 meter.

The emission voltages at the LISN's outputs were measured using a computerized receiver, complying with CISPR 16 requirements. The specification limits are loaded to the receiver via a 3.5" floppy disk and are displayed on the receiver's spectrum display.

A frequency scan between 0.15 and 30 MHz was performed at 9 kHz I.F. band width, and using peak detection.

The spectral components having the highest level on each line were measured using a quasi-peak and average detector.

4.2 Results

JUDGEMENT: Passed by 1.5 dB

The margin3 between the emission levels and the specification limit is, in the worst case, 1.5 dB for the phase line at 24.00 MHz and 7.25 dB at 38.25 MHz for the neutral line.

The EUT met the F.C.C. Part 15, Subpart C specification requirements.

The details of the highest emissions are given in *Figure 6* to *Figure 9*.

TEST PERSONNEL:

Tester Signature:  Date: 27.07.11

Typed/Printed Name: A. Moses

Conducted Emission

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: F.C.C., Part 15, Subpart C
Lead: Phase
Detectors: Peak, Quasi-peak, Average

Figure 6. Detectors: Peak, Quasi-peak, AVERAGE .

Note: Delta Limit refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: F.C.C., Part 15, Subpart C
Lead: Phase
Detectors: Peak, Quasi-peak, Average

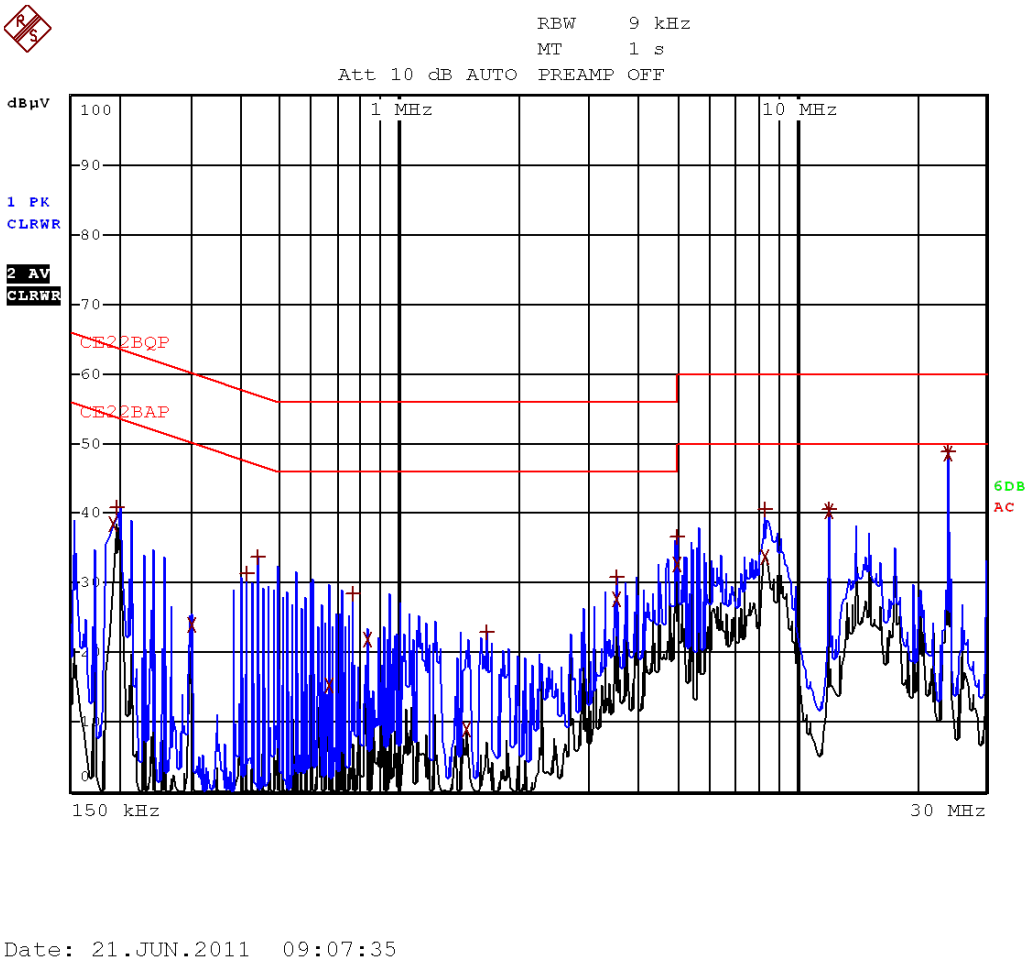


Figure 7. Detectors: Peak, Quasi-peak, Average

Conducted Emission

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: F.C.C., Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average

EDIT PEAK LIST (Final Measurement Results)

Trace1: CE22BQP
Trace2: CE22BAP
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	194 kHz	47.17	-16.68
2	Average	194 kHz	36.57	-17.29
1	Quasi Peak	294 kHz	27.22	-33.18
2	Average	294 kHz	21.83	-28.57
1	Quasi Peak	662 kHz	14.07	-41.92
2	Average	662 kHz	9.73	-36.26
1	Quasi Peak	834 kHz	23.76	-32.23
2	Average	834 kHz	15.58	-30.41
1	Quasi Peak	1.358 MHz	9.38	-46.61
2	Average	1.358 MHz	0.18	-45.81
1	Quasi Peak	3.534 MHz	27.73	-28.27
2	Average	3.538 MHz	16.47	-29.52
1	Quasi Peak	4.762 MHz	32.24	-23.75
2	Average	4.762 MHz	20.70	-25.30
1	Quasi Peak	15.382 MHz	44.11	-15.88
2	Average	15.382 MHz	42.74	-7.25

Date: 21.JUN.2011 09:11:56

Figure 8. Detectors: Peak, Quasi-peak, AVERAGE

Note: Delta Limit refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

Conducted Emission

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: F.C.C., Part 15, Subpart C
Lead: Neutral
Detectors: Peak, Quasi-peak, Average

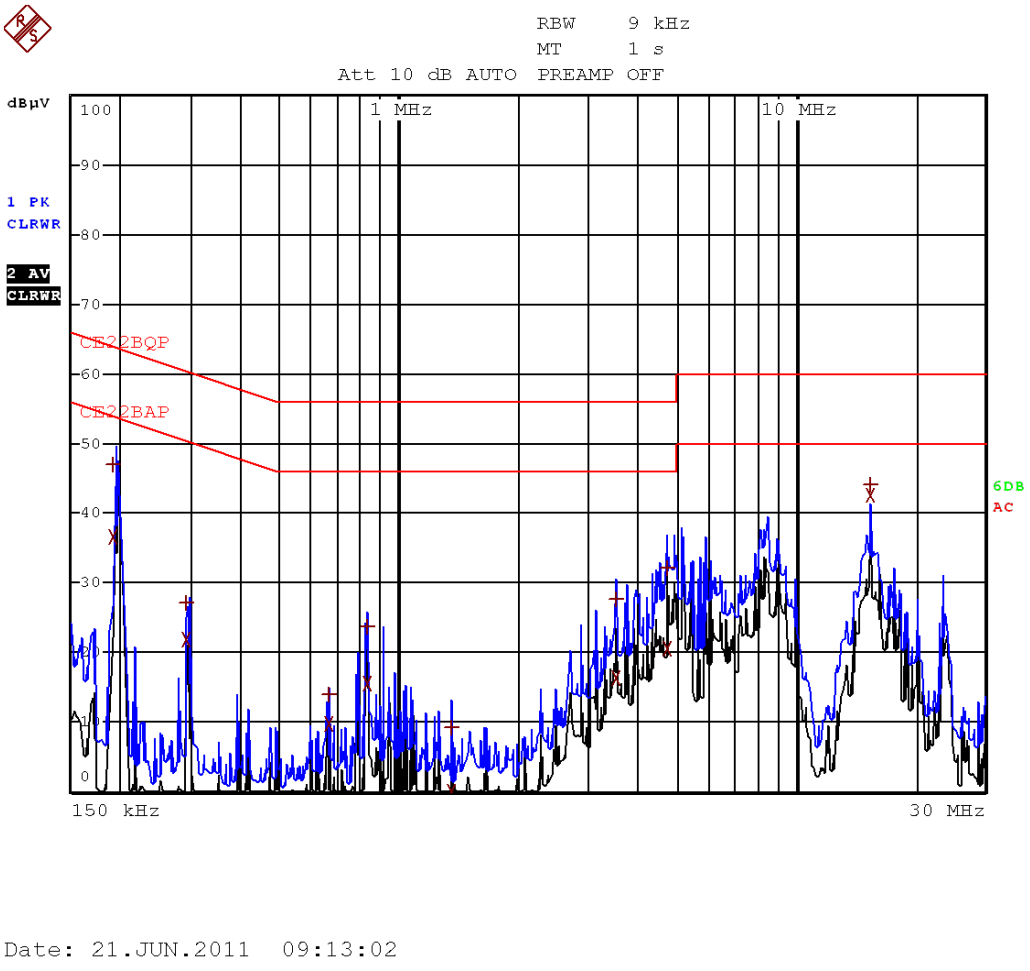


Figure 9 Conducted Emission: NEUTRAL
Detectors: Peak, Quasi-peak, Average

4.3 Test Instrumentation Used, Conducted Measurement

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
LISN	Fischer	FCC-LISN-2A	127	March 3, 2011	1 Year
EMI Receiver	HP	85422E	3906A00276	November 24, 2010	1Year
RF Filter Section	HP	85420E	3705A00248	November 24, 2010	1Year
Printer	HP	LaserJet 2200	JPKGC19982	N/A	N/A

5 Peak Output Power CDMA

5.1 Test Specification

FCC Part 22.913

5.2 Test procedure

Peak Power Output must not exceed 500 Watts (57dBm).

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (30 dB) and an appropriate coaxial cable (1dB). The E.U.T. RF output was modulated. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 30 kHz RBW. The output power level was measured at 870.20, 881.0, and 892.80 MHz.

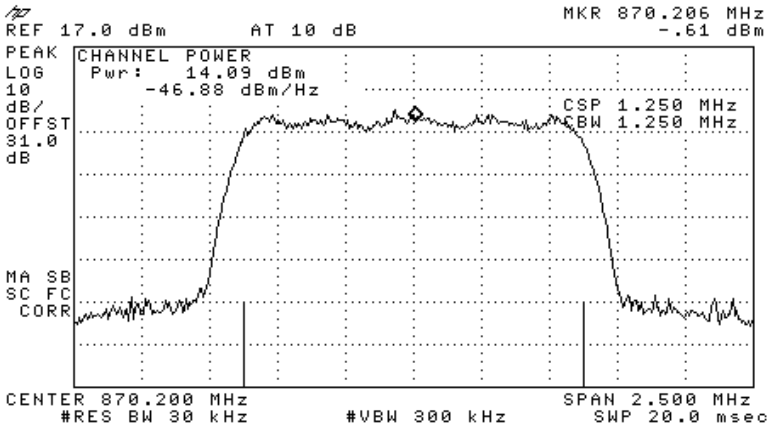


Figure 10.— 870.20 MHz

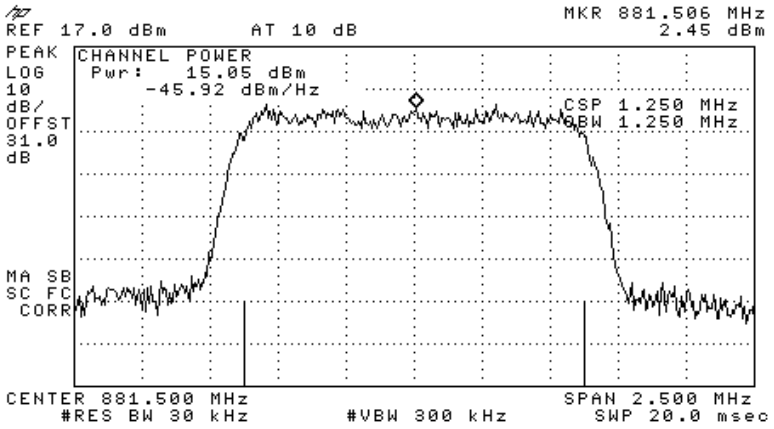


Figure 11.— 881.50 MHz

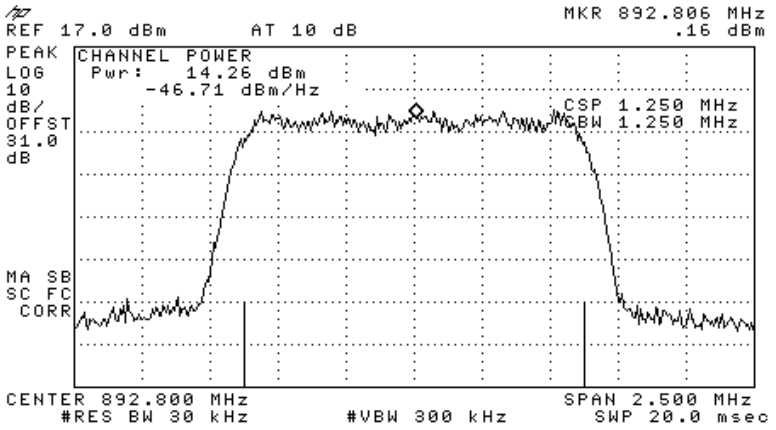


Figure 12.— 892.80 MHz

5.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
Specification: FCC Part 22 Section 913, FCC Part 2, Section 1046

Modulation	Operation Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
CDMA	870.20	14.09	57.0	-42.91
	881.50	15.05	57.0	-41.95
	892.80	14.26	57.0	-42.74

Figure 13 Peak Output Power CELL

JUDGEMENT: Passed by 41.95 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

5.4 Test Equipment Used.

Peak Output Power CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 14 Test Equipment Used

6 Occupied Bandwidth CDMA

6.1 Test Specification

FCC Part 2, Section 1049

6.2 Test Procedure

The E.U.T. was set to the applicable test frequency with CDMA modulation.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (at the output test) and an appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution B.W.
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.
The occupied bandwidth of the E.U.T. at the points of 20 dB below maximum peak power was measured and recorded.
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

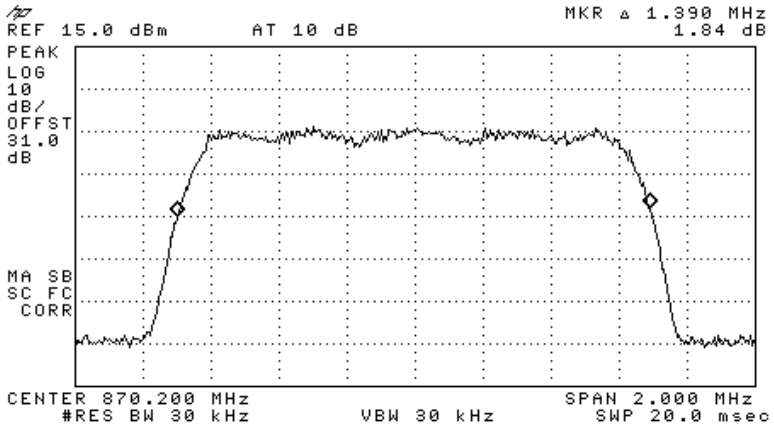


Figure 15.— Input 870.20

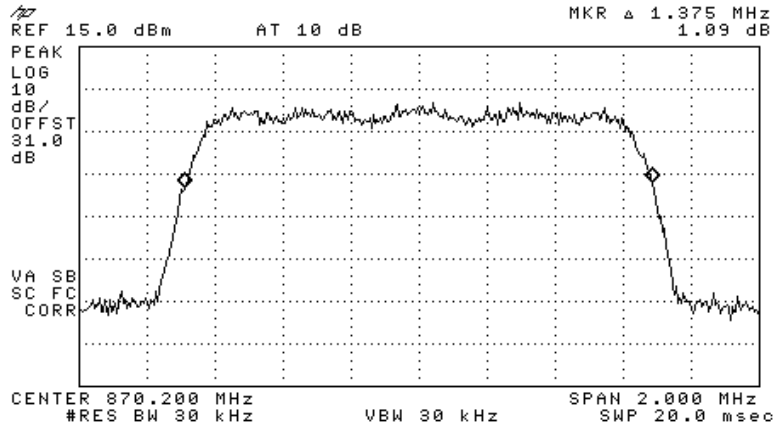


Figure 16.— Output 870.20

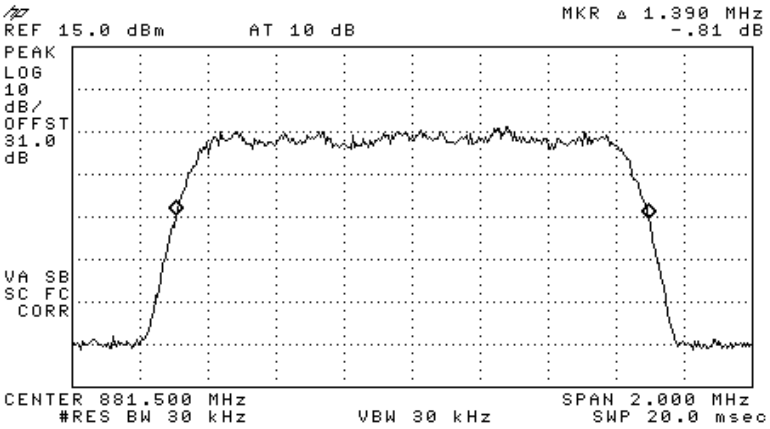


Figure 17.— Input 881.50 MHz.

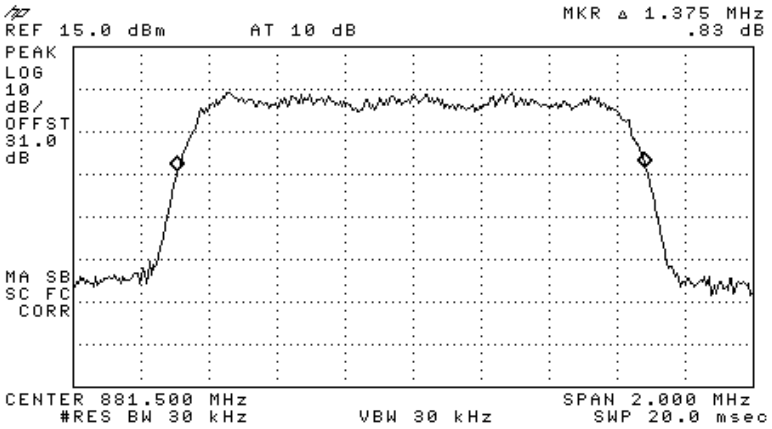


Figure 18.—Output 881.50 MHz.

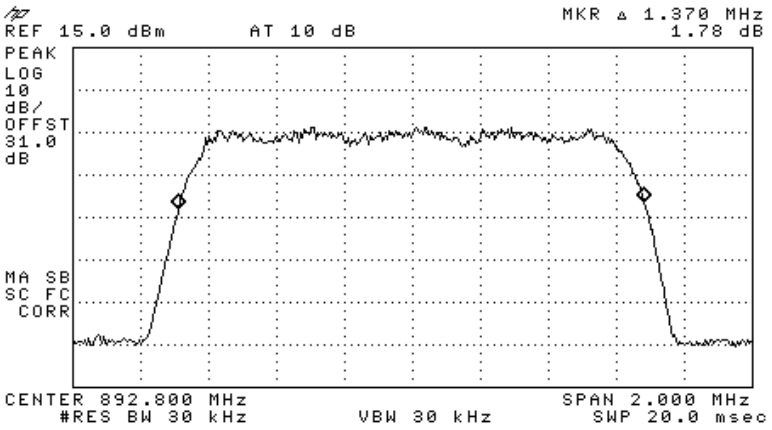


Figure 19.— Input 892.80 MHz.

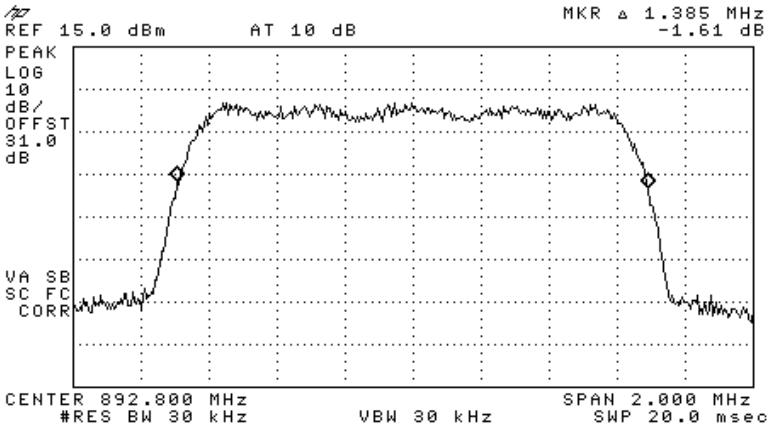


Figure 20.— Output 892.80 MHz.

6.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
Specification: FCC Part 2, Section 1049

Modulation		Operating Frequency (MHz)	Reading (MHz)
CDMA	Input	870.20	1.390
CDMA	Output	870.20	1.375
CDMA	Input	881.50	1.390
CDMA	Output	881.50	1.375
CDMA	Input	892.80	1.370
CDMA	Output	892.80	1.385

Figure 21 Occupied Bandwidth CDMA

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

6.4 Test Equipment Used.

Occupied Bandwidth CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8529L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 22 Test Equipment Used

7 Out of Band Emissions at Antenna Terminals CDMA

7.1 Test Specification

FCC Part 22, Section 917; FCC Part 2.1051

7.2 Test procedure

The power of any emission outside of the authorized operating frequency ranges (869 - 894 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31 dB).
The spectrum analyzer was set to 1.0 kHz RBW and 3 kHz VBW for the frequency range of 9.0 – 150 kHz, 10 kHz RBW and 30 kHz VBW for the frequency range of 150 kHz – 1 MHz, 100 kHz RBW and 300 kHz VBW for the frequency range of 1 MHz – 1 GHz and 1 MHz RBW and 3 MHz for the frequency range of 1 GHz – 10 GHz.

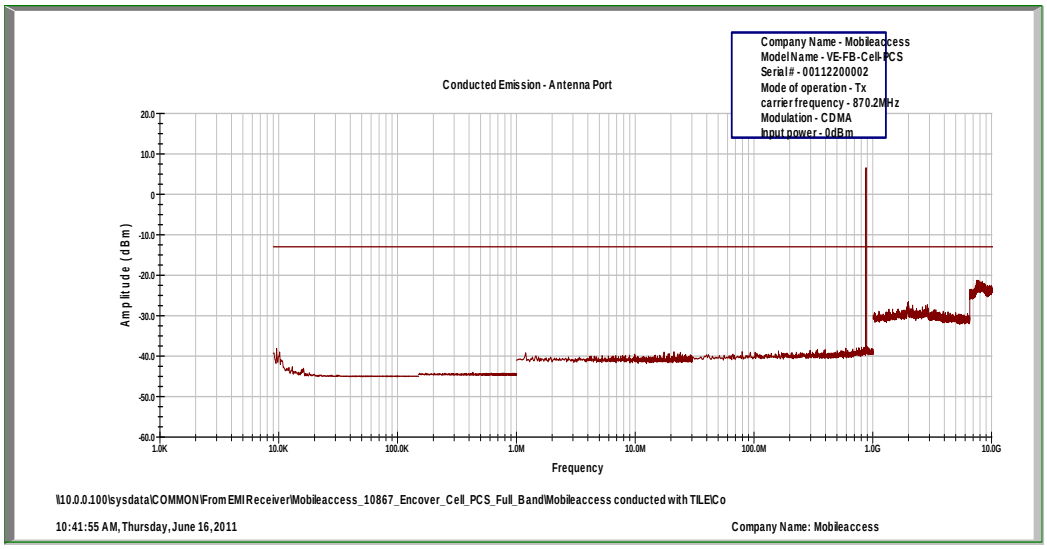


Figure 23.— 870.20 MHz

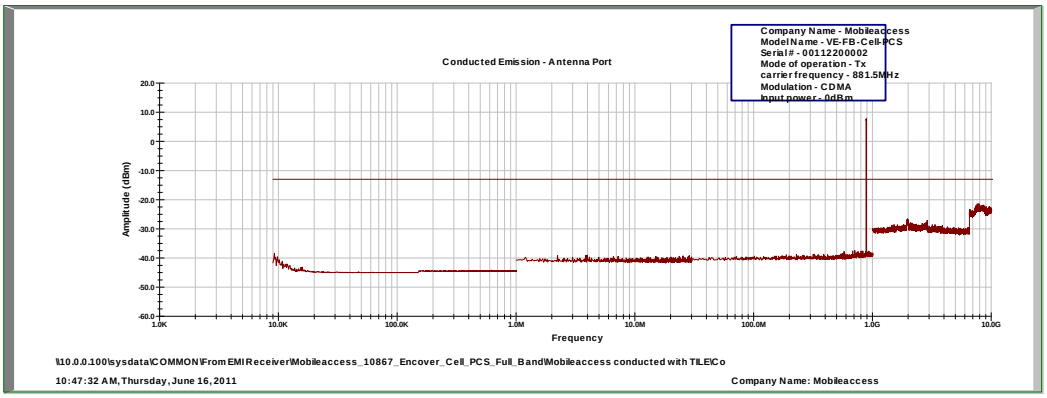


Figure 24.— 881.50 MHz

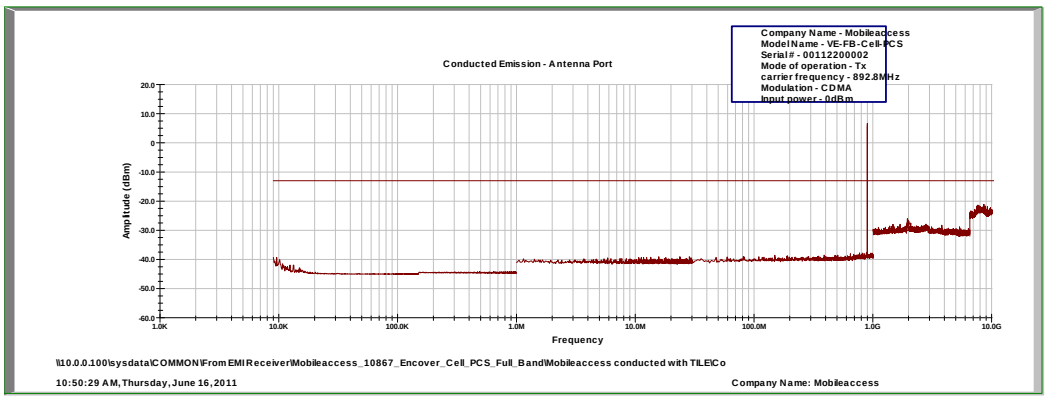


Figure 25.— 892.80 MHz

7.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
FCC Part 22, Section 917; FCC Part 2.1051

Modulation	Operation Frequency (MHz)	Frequency (GHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
CDMA	870.20	7.591	-21.3	-13.0	-8.3
	881.00	7.807	-21.3	-13.0	-8.3
	892.80	8.547	-21.2	-13.0	-8.2

Figure 26 Out of Band Emission Results CDMA

JUDGEMENT: Passed by 8.2 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

7.4 Test Equipment Used.

Out of Band Emission at Antenna Terminals CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8529L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 27 Test Equipment Used

8 Band Edge Spectrum CDMA

8.1 Test Specification

FCC Part 22, FCC Part 2.1051

8.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (870.20 MHz) and the highest operation frequency (892.8 MHz) in which the E.U.T. is planned to be used.

The power of any emission outside of the authorized operating frequency ranges (869 - 894 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (41 dB).
The spectrum analyzer was set to 100 kHz R.B.W.

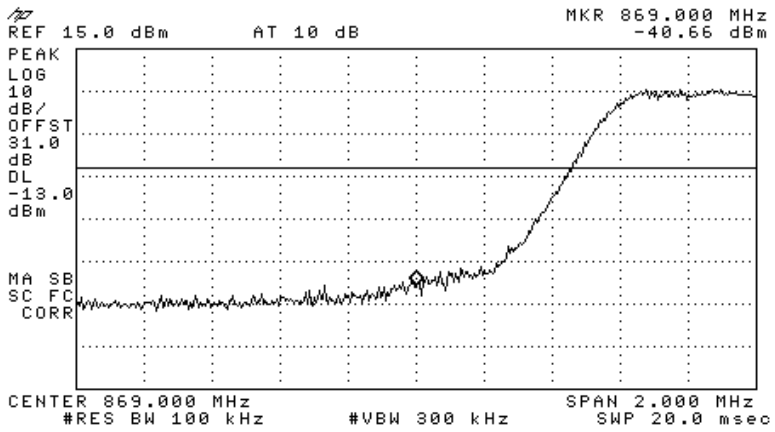


Figure 28.— 870.20 MHz

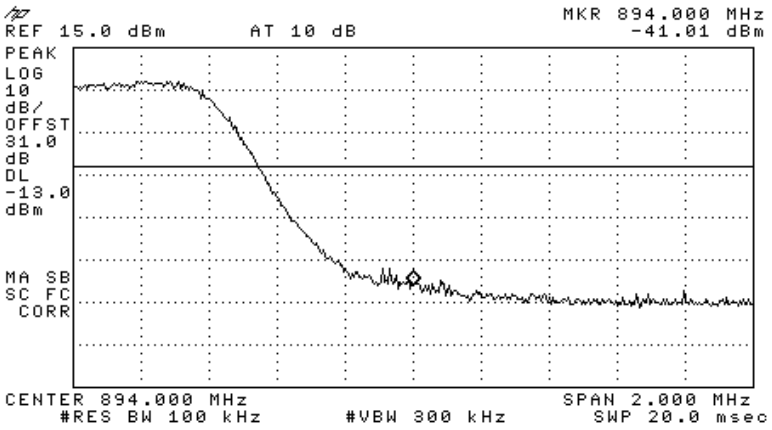


Figure 29.— 892.80 MHz

8.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
Specification: FCC Part 24, Subpart E, Section 238; Part 2 Section 1051

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
CDMA	870.20	869.00	-40.66	-13.0	-27.66
	892.80	894.00	-41.01	-13.0	-28.01

Figure 30 Band Edge Spectrum Results CDMA

JUDGEMENT: Passed by 27.7 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

8.4 Test Equipment Used.

Band Edge Spectrum CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8529L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 31 Test Equipment Used

9 Out of Band Emissions (Radiated) CDMA

9.1 Test Specification

FCC Part 22, Section 917; FCC Part 2.1053

9.2 Test Procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges (869 - 894 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 3. A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in Figure 1.
The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

(b) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:
P_d(dBm) = P_g(dBm) – Cable Loss (dB) + Substitution Antenna Gain (dB)
P_d = Dipole equivalent power (result).
P_g = Signal generator output level.

9.3 Results Table

Internal Vertical Antenna

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Spec.	Margin
(MHz)	(MHz)		(dBµV/m)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
870.2	1740.40	V	46.5	-54.31	5.45	7.64	-52.12	-13.0	-39.12
870.2	1740.40	H	45.2	-55.44	5.45	7.64	-53.25	-13.0	-40.25
881.0	1762.00	V	46.6	-53.19	5.6	7.66	-51.13	-13.0	-38.13
881.0	1762.00	H	45.5	-54.55	5.6	7.66	-52.49	-13.0	-39.49
892.8	1785.60	V	46.1	-53.69	5.6	7.66	-51.63	-13.0	-38.63
892.8	1785.60	H	45.6	-54.45	5.6	7.66	-52.39	-13.0	-39.39

Internal Horizontal

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Spec.	Margin
(MHz)	(MHz)		(dBµV/m)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
870.2	1740.40	0	46.6	-54.21	5.45	7.64	-52.02	-13.0	-39.02
870.2	1740.40	H	45.8	-54.84	5.45	7.64	-52.65	-13.0	-39.65
881.0	1762.00	V	45.0	-54.79	5.6	7.66	-52.73	-13.0	-39.73
881.0	1762.00	H	45.0	-55.05	-55.05	-55.05	-55.05	-13.0	-42.05
892.8	1785.60	V	46.5	-53.29	5.6	7.66	-51.23	-13.0	-38.23
892.8	1785.60	H	46.6	-53.45	5.6	7.66	-51.39	-13.0	-38.39

IF Band

7

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
870.2	458.80	V	75.9	-20.3	3.1	1.39	-22.01	-13.0	-9.01
870.2	458.80	H	79.6	-18.56	3.1	1.39	-20.27	-13.0	-7.27
881.0	448.00	V	80.1	-13.62	2.5	0.75	-15.37	-13.0	-2.37
881.0	448.00	H	79.9	-18.7	2.5	0.75	-20.45	-13.0	-7.45
892.8	436.19	V	78.0	-15.72	2.5	0.75	-17.47	-13.0	-4.47
892.8	436.19	H	81.2	-17.4	2.5	0.75	-19.15	-13.0	-6.15

The E.U.T met the requirements of the FCC Part 22, Section 917;
FCC Part 2.1053 specifications.

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

9.4 Test Instrumentation Used, Radiated Measurements CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010	1 year
Active Loop Antenna	Emco	6502	2950	October 19, 2010	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	August 1, 2010	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 23, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2010	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 4, 2011	1 Year
Signal Generator	HP	E4432B ESG-D	GB40050702	July 22, 2010	1 year
Signal Generator	HP	E4438C ESG	MY45091956	July 22, 2010	1 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2010	2 year

10 Peak Output Power PCS

10.1 Test Specification

FCC Part 24, Subpart E

10.2 Test procedure

Peak Power Output must not exceed 100 Watts (50dBm).

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (30 dB) and an appropriate coaxial cable (1dB). The E.U.T. RF output was W-CDMA and GSM. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 30 kHz RBW. The output power level was measured at 1932.50, 1960.00, and 1992.50 MHz.

GSM:

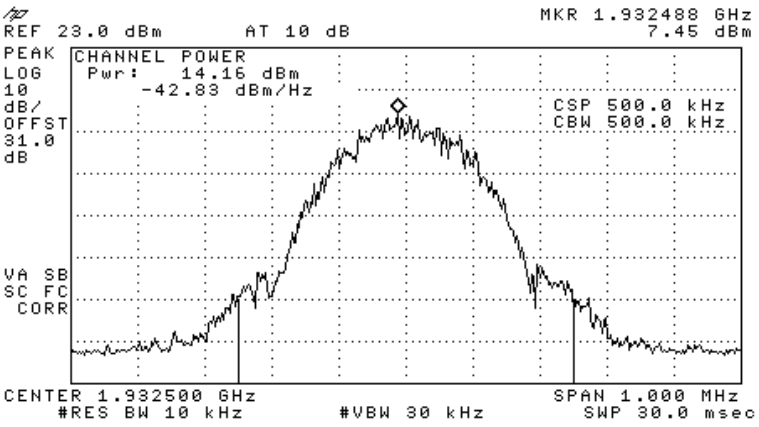


Figure 32.— 1932.50 MHz

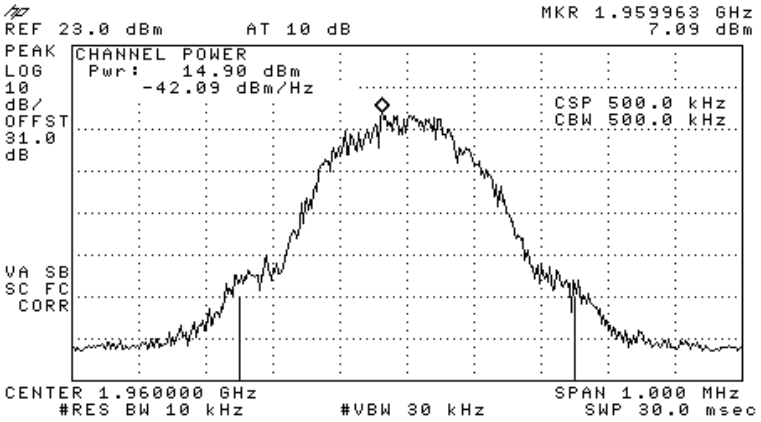


Figure 33.— 1960.00 MHz

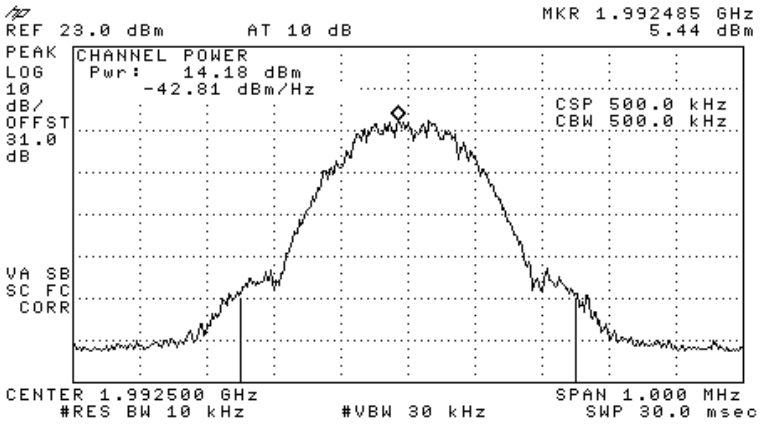


Figure 34.— 1992.50 MHz

W-CDMA:

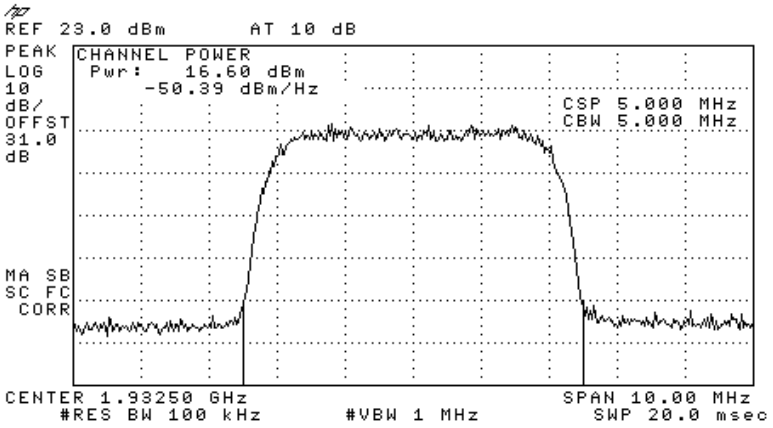


Figure 35.— 1932.50 MHz

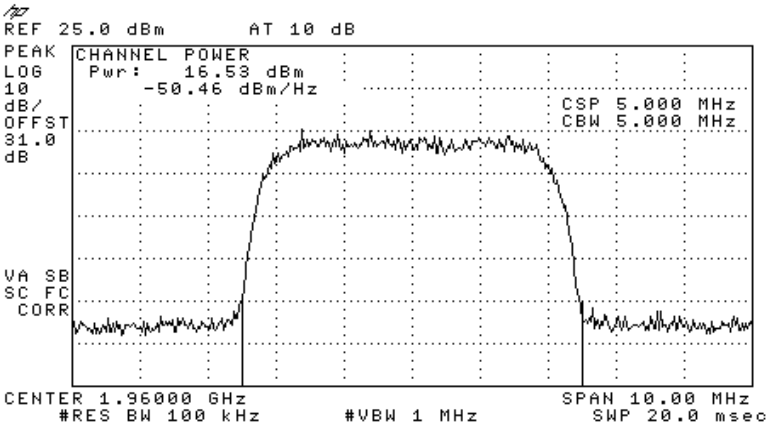


Figure 36.— 1960.00 MHz

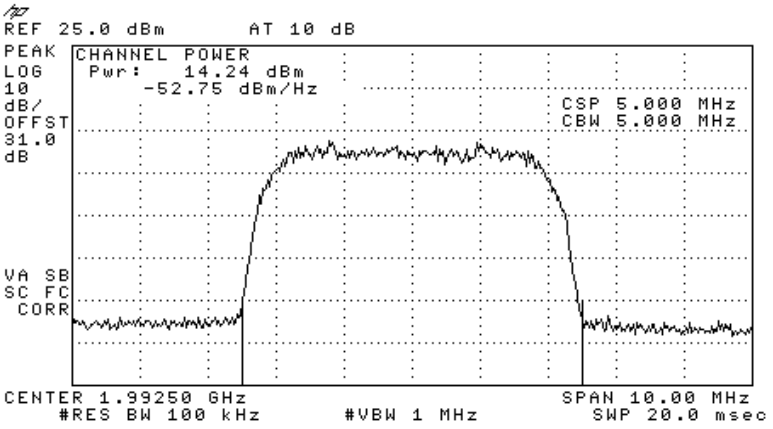


Figure 37.— 1992.50 MHz

10.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
Specification: FCC Part 24, Subpart E, Section 232, FCC Part 2, Section 1046

Modulation	Operation Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
GSM	1932.50	14.16	50.0	-35.84
	1960.00	14.90	50.0	-35.10
	1992.50	14.18	50.0	-35.82
W-CDMA	1932.50	16.60	50.0	-33.40
	1960.00	16.53	50.0	-33.47
	1992.50	14.24	50.0	-35.76

Figure 38 Peak Output Power PCS

JUDGEMENT: Passed by 33.40 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

10.4 Test Equipment Used.

Peak Output Power PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	8592L	3826A01204	8592L	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 39 Test Equipment Used

11 Occupied Bandwidth PCS

11.1 Test Specification

FCC Part 2, Section 1049

11.2 Test Procedure

The E.U.T. was set to the applicable test frequency with GSM and W-CDMA modulation. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (at the output test) and an appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution B.W. for GSM and W-CDMA.
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.
The occupied bandwidth of the E.U.T. at the points of 20 dB below maximum peak power was measured and recorded.
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

GSM:

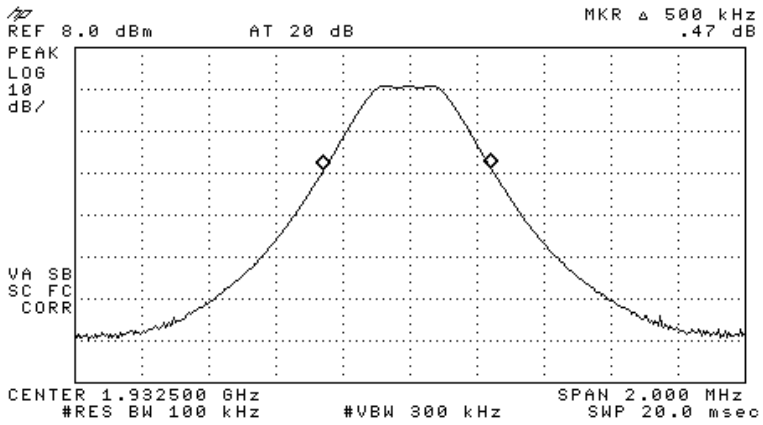


Figure 40.— Input 1932.50 MHz

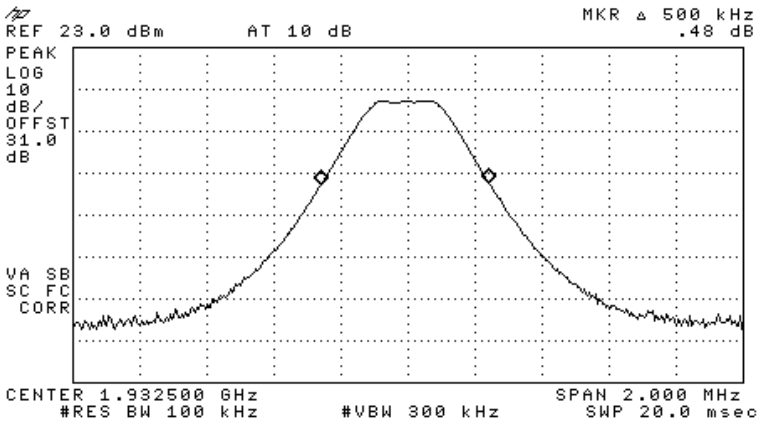


Figure 41.— Output 1932.50 MHz

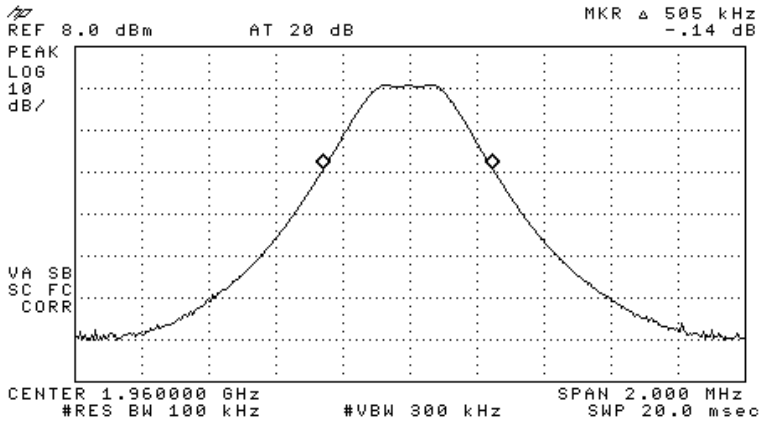


Figure 42.— Input 1960.00 MHz

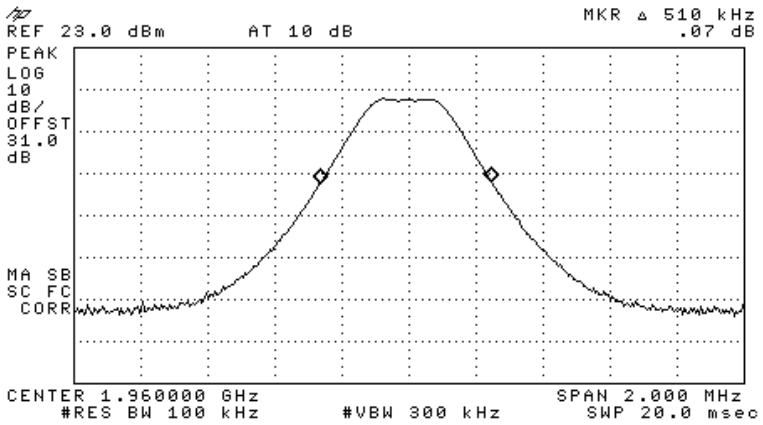


Figure 43.— Output 1960.00 MHz

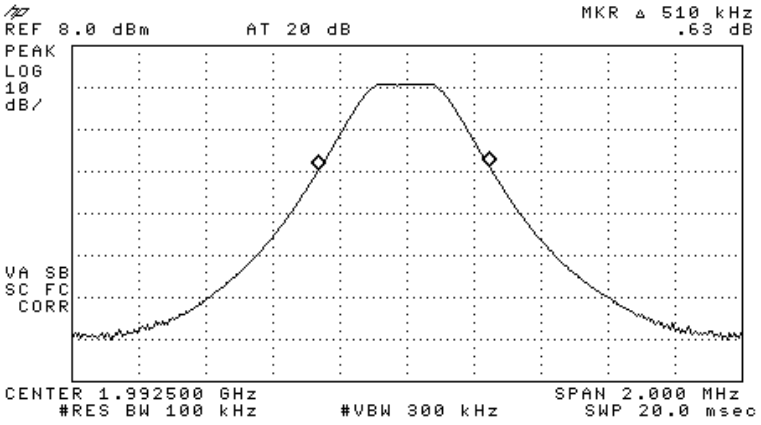


Figure 44.— Input 1992.50 MHz

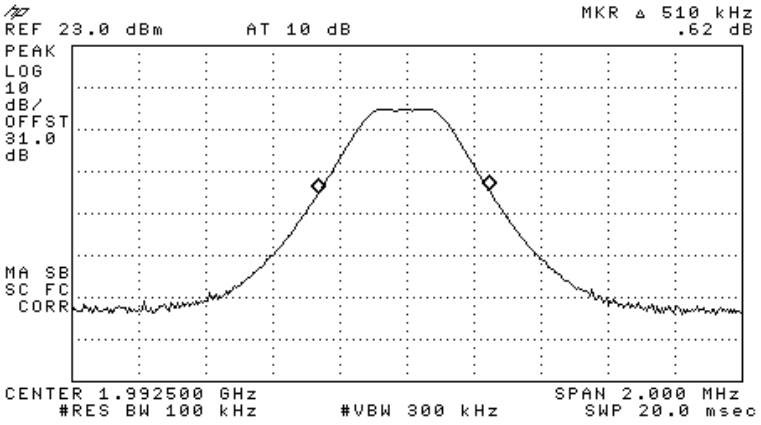


Figure 45.— Output 1992.50 MHz

W-CDMA:

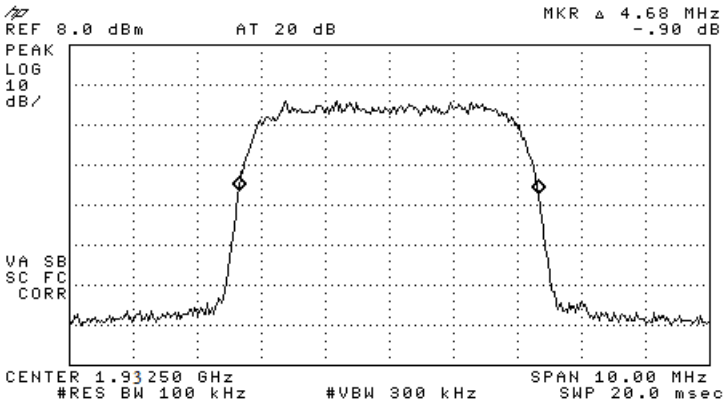


Figure 46.— Input 1932.50 MHz

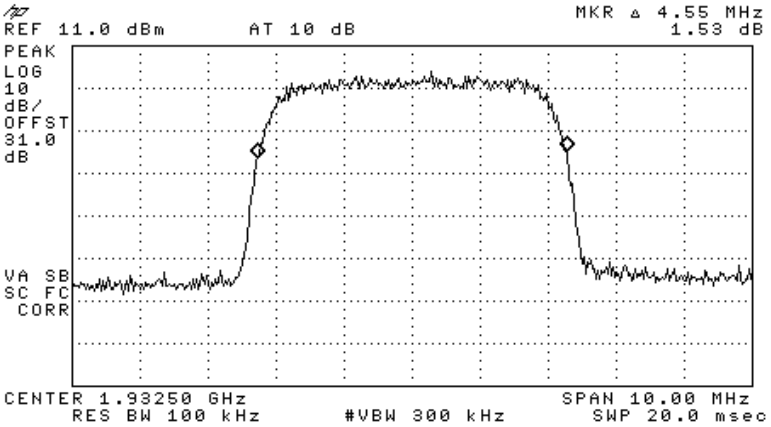


Figure 47.— Output 1932.50 MHz

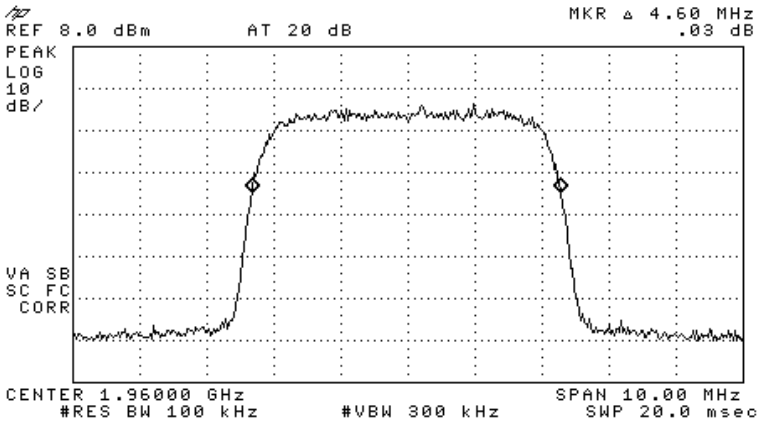


Figure 48.— Input 1960.00 MHz

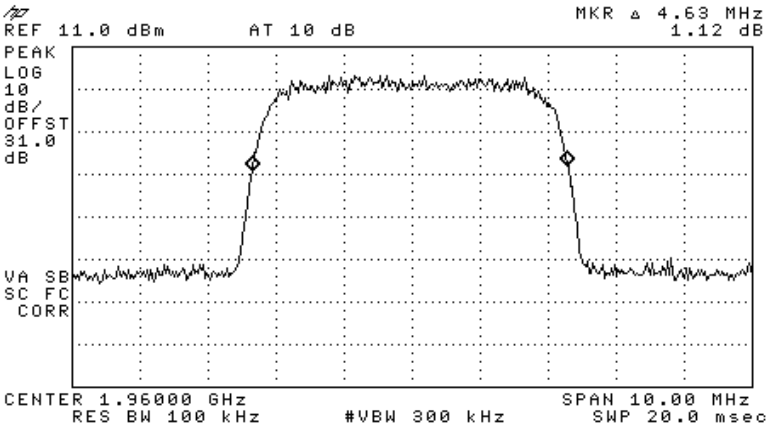


Figure 49.— Output 1960.00 MHz

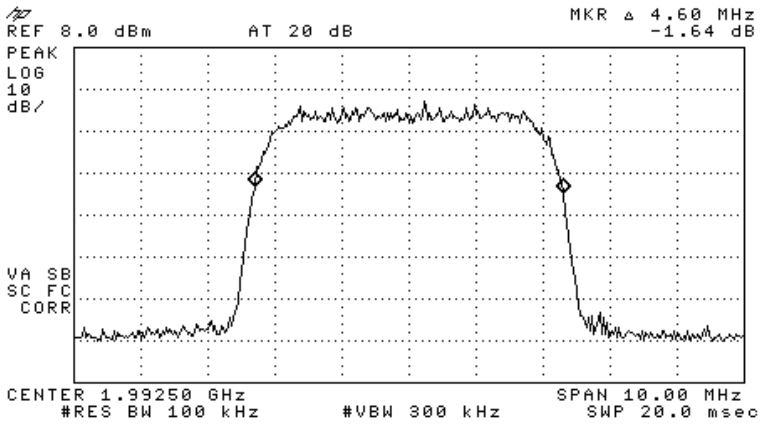


Figure 50.— Input 1992.50 MHz

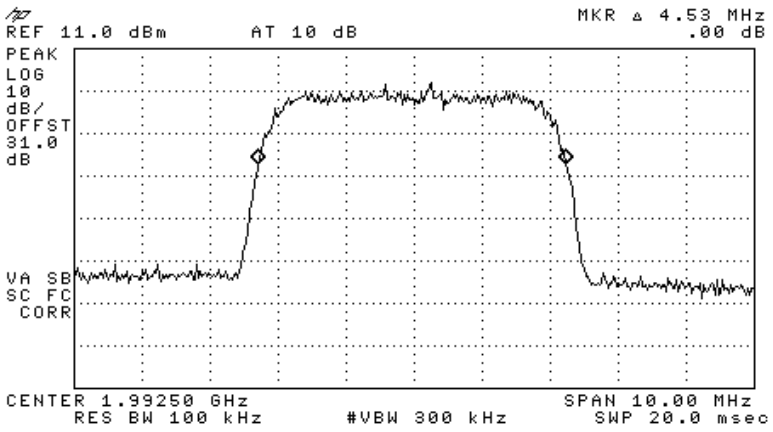


Figure 51.— Output 1992.50 MHz

11.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
Specification: FCC Part 2, Section 1049

Modulation		Operating Frequency (MHz)	Reading (MHz)
GSM	Input	1932.50	0.50
	Output	1932.50	0.50
	Input	1960.00	0.50
	Output	1960.00	0.51
	Input	1992.50	0.51
	Output	1992.50	0.51
W-CDMA	Input	1932.50	4.68
	Output	1932.50	4.55
	Input	1960.00	4.60
	Output	1960.00	4.63
	Input	1992.50	4.60
	Output	1992.50	4.53

0

Figure 52 Occupied Bandwidth PCS

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

11.4 Test Equipment Used.

Occupied Bandwidth PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8529L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 53 Test Equipment Used

12 Out of Band Emissions at Antenna Terminals PCS

12.1 Test Specification

FCC Part 24, Subpart E, Section 238; FCC Part 2.1051

12.2 Test procedure

The power of any emission outside of the authorized operating frequency ranges (1930-1990 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31 dB).
The spectrum analyzer was set to 100 kHz RBW

GSM:

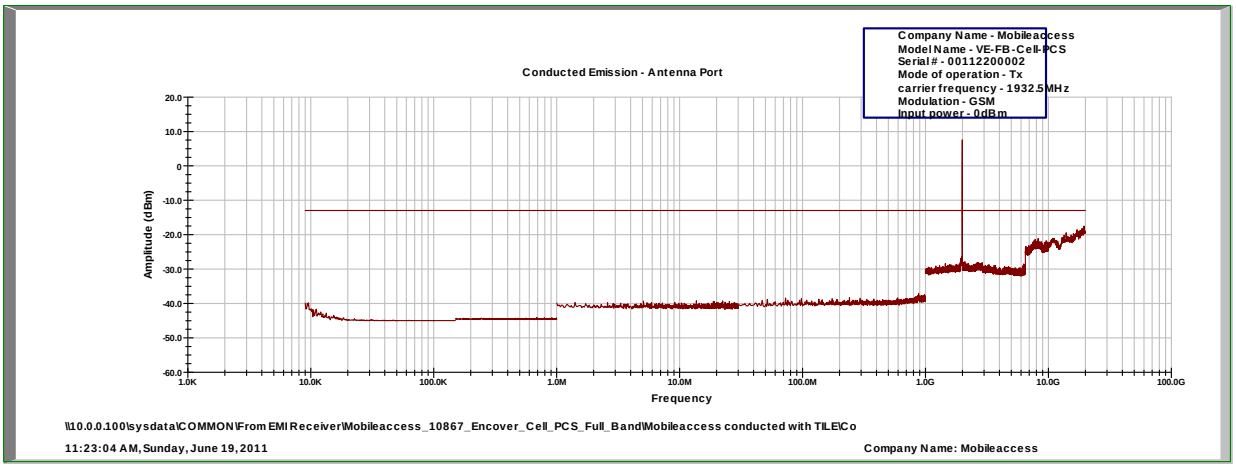


Figure 54.— 1932.50 MHz

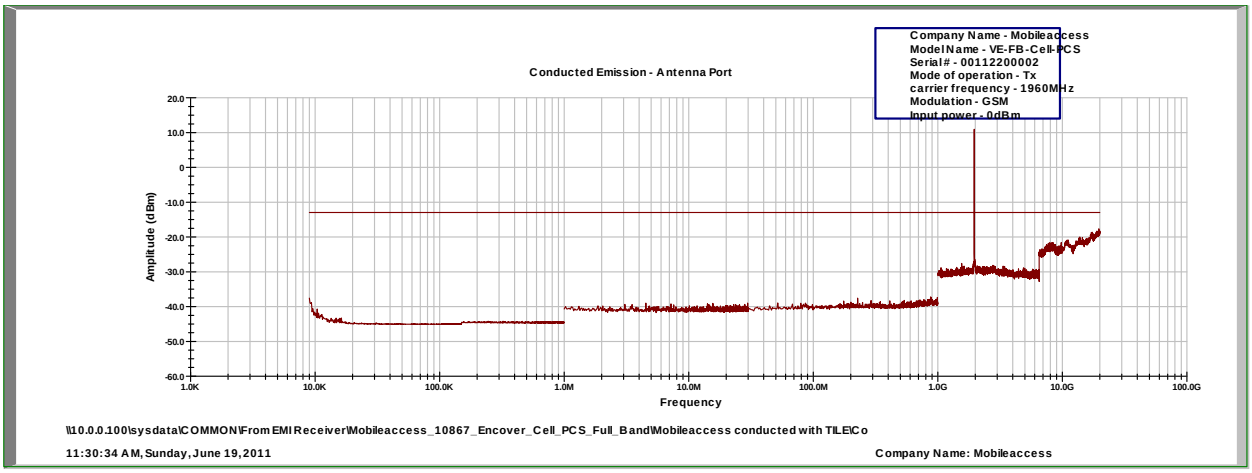


Figure 55.— 1960.00 MHz

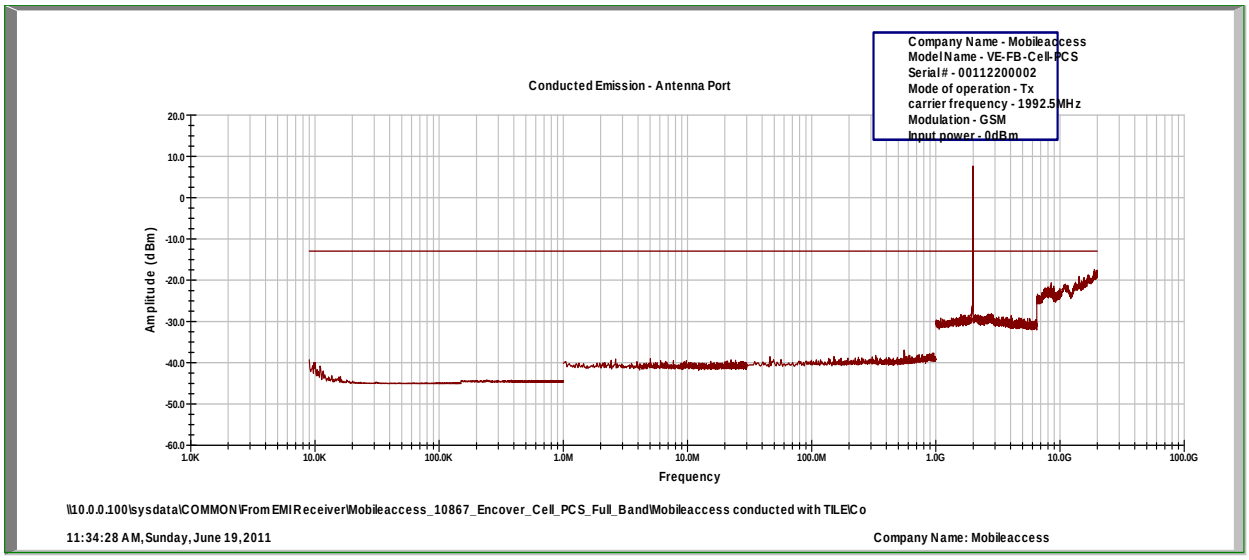


Figure 56.— 1992.50 MHz

W-CDMA:

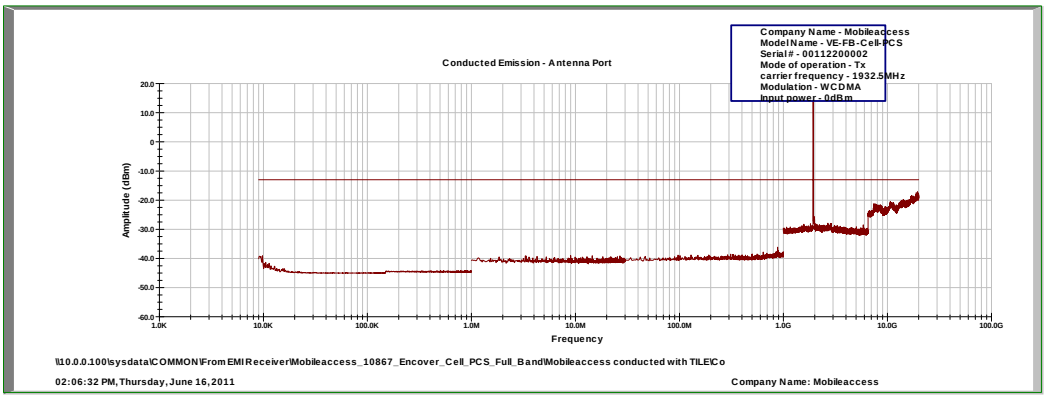


Figure 57.— 1932.50 MHz

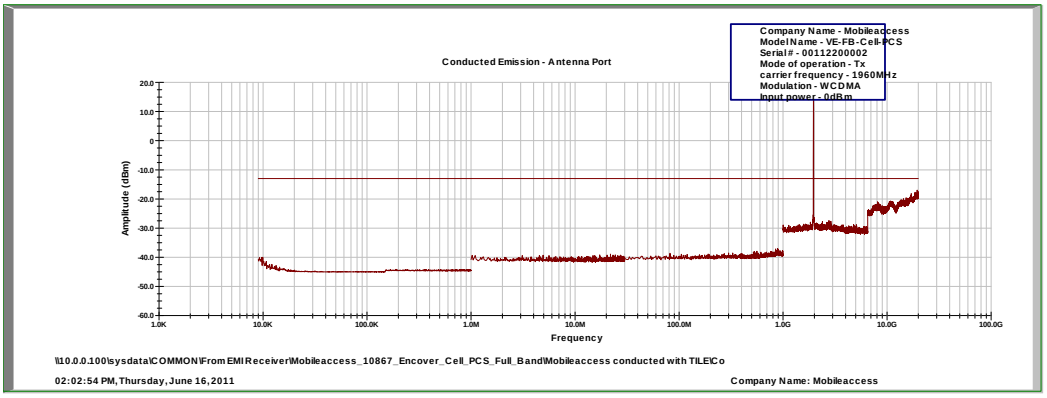


Figure 58.— 1960.00 MHz

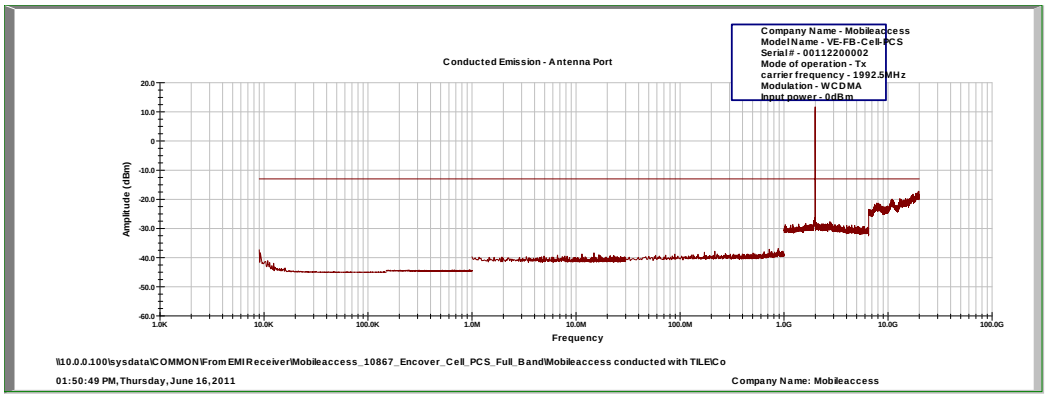


Figure 59.— 1992.50 MHz

12.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
Specification: FCC Part 24, Subpart E, Section 238; Part 2 Section 1051

Modulation	Operation Frequency (MHz)	Frequency (GHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
GSM	1932.50	19525	-17.5	-13.0	-4.5
	1960.00	19625	-17.6	-13.0	-4.6
	1987.50	18950	-17.4	-13.0	-4.4
W-CDMA	1932.50	19500	-17.5	-13.0	-4.5
	1960.00	18800	-17.2	-13.0	-4.2
	1987.50	19700	-17.5	-13.0	-4.5

Figure 60 Out of Band Emission Results PCS

JUDGEMENT: Passed by 4.2 dB

TEST PERSONNEL:

Tester Signature:  Date: 27.07.11

Typed/Printed Name: A. Moses

12.4 Test Equipment Used.

Out of Band Emission at Antenna Terminals PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8529L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 61 Test Equipment Used

13 Band Edge Spectrum PCS

13.1 Test Specification

FCC Part 24, Subpart E, Section 238; FCC Part 2.1051

13.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (1932.5 MHz) and the highest operation frequency (1992.5 MHz) in which the E.U.T. is planned to be used.

The power of any emission outside of the authorized operating frequency ranges (1930.00-1990.00 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (31 dB).
The spectrum analyzer was set to 100 kHz R.B.W.

GSM:

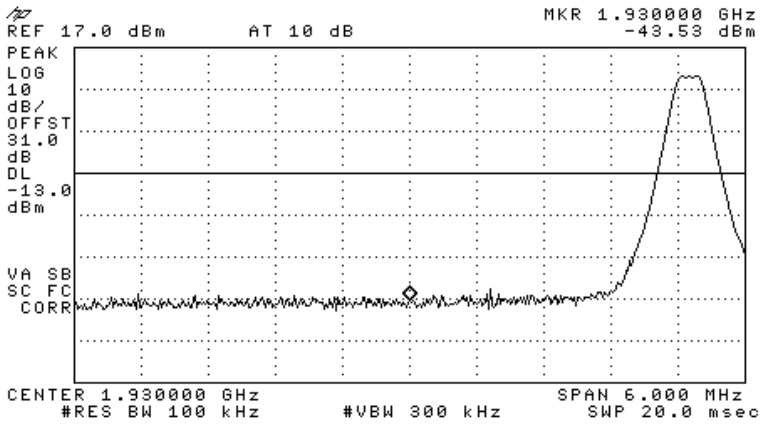


Figure 62.— 1932.50 MHz

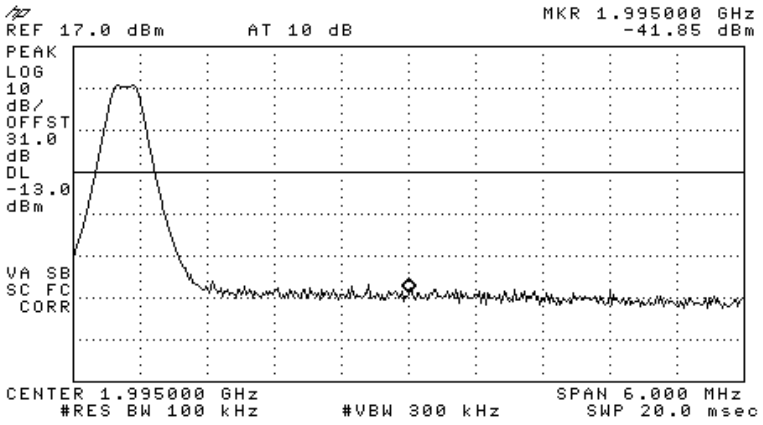


Figure 63.— 1992.50 MHz

W-CDMA:

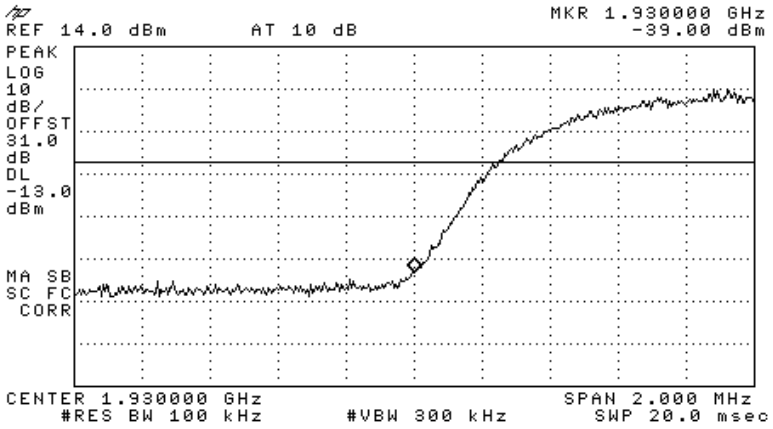


Figure 64.— 1932.50 MHz

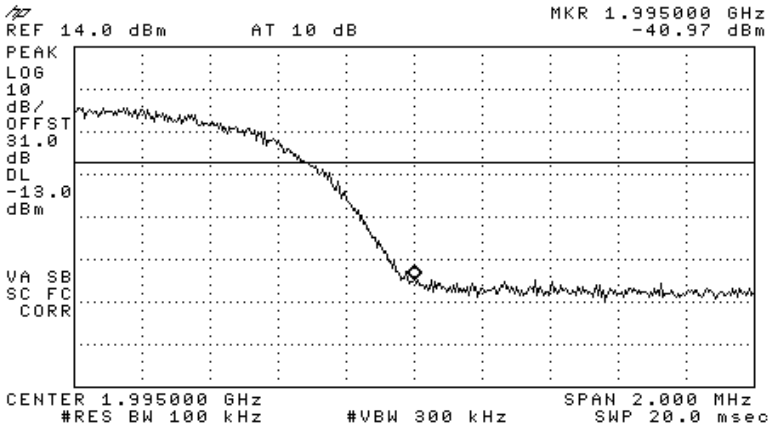


Figure 65.— 1992.50 MHz

13.3 Results Table

E.U.T. Description: VE CELL PCS Full Band Distributed Antenna System comprising:
1. VE Control Unit 2. VE Access Pod
Model No.: 1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number: 1. 00112200068 2. 00110800002
Specification: FCC Part 24, Subpart E, Section 238; Part 2 Section 1051

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
GSM	1932.50	1930.00	-43.53	-13.0	-30.53
	1992.50	1995.00	-41.85	-13.0	-28.85
W-CDMA	1932.50	1930.00	-39.00	-13.0	-26.00
	1992.50	1995.00	-40.97	-13.0	-27.97

Figure 66 Band Edge Spectrum Results PCS

JUDGEMENT: Passed by 26.00 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

13.4 Test Equipment Used.

Band Edge Spectrum PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8529L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 67 Test Equipment Used

14 Out of Band Emissions (Radiated) PCS

14.1 Test Specification

FCC, Part 24, Subpart E Section 238, FCC Part 2.1053

14.2 Test Procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges (1930-1990 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 3. A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in Figure 3.1.
The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

(c) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:
P_d(dBm) = P_g(dBm) – Cable Loss (dB) + Substitution Antenna Gain (dB)
P_d = Dipole equivalent power (result).
P_g = Signal generator output level.

14.3 Results Tables

Internal Vertical Antenna

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
1932.5	3865.0	V	51.8	-50.02	4.3	8.62	-45.7	-13.0	-32.70
1932.5	3865.0	H	50.5	-50.46	4.3	8.62	-46.14	-13.0	-33.14
1960.0	3920.0	V	50.8	-51.02	4.3	8.62	-46.7	-13.0	-33.70
1960.0	3920.0	H	50.6	-50.36	4.3	8.62	-46.04	-13.0	-33.04
1992.5	3985.0	V	50.8	-51.5	4.3	8.6	-47.2	-13.0	-34.20
1992.5	3985.0	H	50.9	-50.45	4.3	8.6	-46.15	-13.0	-33.15

Internal Horizontal Antenna

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
1932.5	3865.0	V	50.1	-51.72	4.3	8.62	-47.4	-13.0	-34.40
1932.5	3865.0	H	50.2	-50.76	4.3	8.62	-46.44	-13.0	-33.44
1960.0	3920.0	V	50.9	-50.92	4.3	8.62	-46.6	-13.0	-33.60
1960.0	3920.0	H	50.9	-50.06	4.3	8.62	-45.74	-13.0	-32.74
1992.5	3985.0	V	53.1	-49.2	4.3	8.6	-44.9	-13.0	-31.90
1992.5	3985.0	H	51.8	-49.55	4.3	8.6	-45.25	-13.0	-32.25

IF Band

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
1932.5	367.5	V	66.4	-27.32	2.5	0.75	-29.07	-13.0	-16.07
1932.5	367.5	H	73.6	-25	2.5	0.75	-26.75	-13.0	-13.75
1960.0	395.0	V	70.5	-23.22	2.5	0.75	-24.97	-13.0	-11.97
1960.0	395.0	H	72.9	-25.7	2.5	0.75	-27.45	-13.0	-14.45
1992.5	427.5	V	66.0	-27.72	2.5	0.75	-29.47	-13.0	-16.47
1992.5	427.5	H	68.8	-29.8	2.5	0.75	-31.55	-13.0	-18.55

The E.U.T met the requirements of the FCC, Part 24, Subpart E, Section 238; FCC Part 2.1053 specifications.

TEST PERSONNEL:

Tester Signature:  Date: 27.07.11

Typed/Printed Name: A. Moses

14.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010	1 year
Active Loop Antenna	Emco	6502	2950	October 19, 2010	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	August 1, 2010	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 23, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2010	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 4, 2011	1 Year
Signal Generator	HP	E4432B ESG-D	GB40050702	July 22, 2010	1 year
Signal Generator	HP	E4438C ESG	MY45091956	July 22, 2010	1 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2010	2 year

15 Frequency Stability

15.1 Test Specification

Part 24 Sub-part D Section 24.135

15.2 Test Procedure

The E.U.T operation mode and test setup are as described in Section 2. The E.U.T. was operated with a CW signal in the downlink path.

The E.U.T. was placed inside a temperature chamber. The E.U.T. was operated from 115 VAC at normal temperature and the chamber temperature was set to +20°C.

The spectrum analyzer was set to 50.0 kHz span and 1.0 kHz resolution B.W.

The carrier frequency was measured and recorded (reference frequency reading).

The carrier frequency measurement was repeated for:

(a). +20°C and 97.5 VAC

(b). +20°C and 132.5 VAC

(c). -30°C and 115 VAC

(d). -30°C and 97.5 VAC

(e). -30°C and 132.5 VAC

(f). +50°C and 115 VAC

(g). +50°C and 97.5 VAC

(h). +50°C and 132.5 VAC

The carrier frequency was measured and recorded after at least 20 minutes of exposing the E.U.T. to the temperature.

The E.U.T. was operated at 1932.50, 1960.00, and 1992.5 MHz.

and 870.2, 881.0, and 892.8 MHz

15.3 Test Results

The E.U.T met the requirements of Part 24 Sub-part D, Section 24.135 specification.

The details of the results are given in *Figure 69* to *Figure 68*.

For the operation frequency of 1932.50 MHz:

The frequency offset between the frequency measured under extreme conditions and the reference carrier frequency measured under normal test conditions, is in the worst case, 0.0 kHz at normal and extreme temperatures.

For the operation frequency of 1960.00 MHz:

The frequency offset between the frequency measured under extreme conditions and the reference carrier frequency measured under normal test conditions, is in the worst case, 0.0 kHz at normal and extreme temperatures.

For the operation frequency of 1992.5:

The frequency offset between the frequency measured under extreme conditions and the reference carrier frequency measured under normal test conditions, is in the worst case, 0.0 kHz at –normal and extreme temperatures.

For the operation frequency of 870.20 MHz:

The frequency offset between the frequency measured under extreme conditions and the reference carrier frequency measured under normal test conditions, is in the worst case, 0.1 kHz at -30 °C +50 °C at 132.5 VAC.

For the operation frequency of 881.00 MHz:

The frequency offset between the frequency measured under extreme conditions and the reference carrier frequency measured under normal test conditions, is in the worst case, 0.1 kHz at 20 °C at 97.5 and 132.5 VAC and +50°C at 97.5 VAC.

For the operation frequency of 892.80:

The frequency offset between the frequency measured under extreme conditions and the reference carrier frequency measured under normal test conditions, is in the worst case, 0.1 at + 50 °C.

JUDGEMENT: Passed by 0.1 kHz

TEST PERSONNEL:

Tester Signature: _____ Date: 27.07.11

Typed/Printed Name: A. Moses

Frequency Stability

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: FCC Part 24 Sub-part D Section 24.135

Operation Frequency (MHz)	Frequency Readings (MHz)			Δ f(max) (kHz)	Spec. (kHz)
	97.5 (VAC)	115 (VAC)	132.5 (VAC)		
1932.50	1932.4986	1932.4986	1932.4986	0.0	± 1.9
1960.00	1959.9985	1959.9985	1959.9985	0.0	± 1.9
1992.50	1992.4985	1992.4985	1992.4985	0.0	± 1.9

Figure 68. Frequency Stability 20°C

Operation Frequency (MHz)	Frequency Readings (MHz)			Δ f(max) (kHz)	Spec. (kHz)
	97.5 (VAC)	115 (VAC)	132.5 (VAC)		
1932.50	1932.4985	1932.4985	1932.4985	0.0	± 1.9
1960.00	1959.9985	1959.9985	1959.9985	0.0	± 1.9
1992.5	1992.4985	1992.4985	1992.4985	0.0	± 1.9

Figure 69. Frequency Stability -30°C

Notes:

1. Δ f = Reference frequency – frequency reading.
2. Reference reading measured at 115 VAC, + 20°C.
3. Specification: spec: ± 1 ppm =

Frequency Stability

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: FCC Part 24 Sub-part D Section 24.135

Operation Frequency (MHz)	Frequency Readings (MHz)			Δ f(max) (kHz)	Spec. (kHz)
	97.5 (VAC)	115 (VAC)	132.5 (VAC)		
1932.50	1932.4985	1932.4985	1932.4985	0.00	± 1.9
1960.00	1959.9985	1959.9985	1959.9985	0.00	± 1.9
1992.5	1992.4985	1992.4985	1992.4985	0.00	± 1.9

Figure 70. Frequency Stability +50°C

Notes:

1. Δ f = Reference frequency – frequency reading.
2. Reference reading measured at 115 VAC, + 20°C.
3. Specification: spec: ± 1 ppm

Frequency Stability

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: FCC Part 24 Sub-part D Section 24.135

Operation Frequency (MHz)	Frequency Readings (MHz)			Δ f(max) (kHz)	Spec. (kHz)
	97.5 (VAC)	115 (VAC)	132.5 (VAC)		
870.2	870.1994	870.1994	870.1994	0.0	± 0.87
881.0	880.9993	880.9994	880.9993	0.1	± 0.88
892.8	892.7994	892.7994	892.7994	0.0	± 0.89

Figure 71. Frequency Stability 20°C

Operation Frequency (MHz)	Frequency Readings (MHz)			Δ f(max) (kHz)	Spec. (kHz)
	97.5 (VAC)	115 (VAC)	132.5 (VAC)		
870.2	870.1993	870.1993	870.1994	0.1	± 0.87
881.0	880.9993	880.9993	880.9993	0.0	± 0.88
892.8	892.7994	892.7994	892.7994	0.0	± 0.89

Figure 72. Frequency Stability -30°C

Notes:

1. Δ f = Reference frequency – frequency reading.
2. Reference reading measured at 115 VAC, + 20°C.
3. Specification: spec: ± 1 ppm

Frequency Stability

E.U.T Description	VE CELL PCS Full Band Distributed Antenna System comprising: 1. VE Control Unit 2. VE Access Pod
Type	1. VCU-FB-CELL-PCS-12E 2. VAP-FB-CELL-PCSE
Serial Number:	1. 00112200068 2. 00110800002

Specification: FCC Part 24 Sub-part D Section 24.135

Operation Frequency (MHz)	Frequency Readings (MHz)			Δ f(max) (kHz)	Spec. (kHz)
	97.5 (VAC)	115 (VAC)	132.5 (VAC)		
870.2	870.1994	870.1994	870.1993	0.1	± 0.87
881.0	880.9994	880.9993	880.9993	0.1	± 0.88
892.8	892.7994	892.7993	892.7994	0.1	± 0.89

Figure 73. Frequency Stability +50°C

Notes:

1. Δ f = Reference frequency – frequency reading.
2. Reference reading measured at 115 VAC, + 20°C.
3. Specification: spec: ± 1 ppm

15.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Environmental Chamber	THERMOTRON CORP	SM 32C Mini Max	25-1030	December 06, 2010	1 Year
Digital Voltage Meter	Escort	EDM1111A	10313121	December 07, 2010	2 Years
Variable Voltage Transformer	Variac Voltage Co.	-	-	N/A	N/A
Spectrum Analyzer	HP	8594E	3809U03785	March 8, 2010	2 Years
Signal Generator	HP	83731B	US37100653	December 12, 2009	2 Years
Signal Generator	HP	86478	3625U00686	December 12, 2009	2 Years

16 Intermodulation Conducted

16.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable(31.0 dB). The spectrum analyzer was set to 100 kHz resolution BW.

2 input signals were sent simultaneously to the E.U.T. as follows:

CELL 811 MHz GSM 0 dBm

PCS 1960 MHz CW 0 dBm

The frequency range of 9 kHz – 20.0GHz was scanned for unwanted signals.

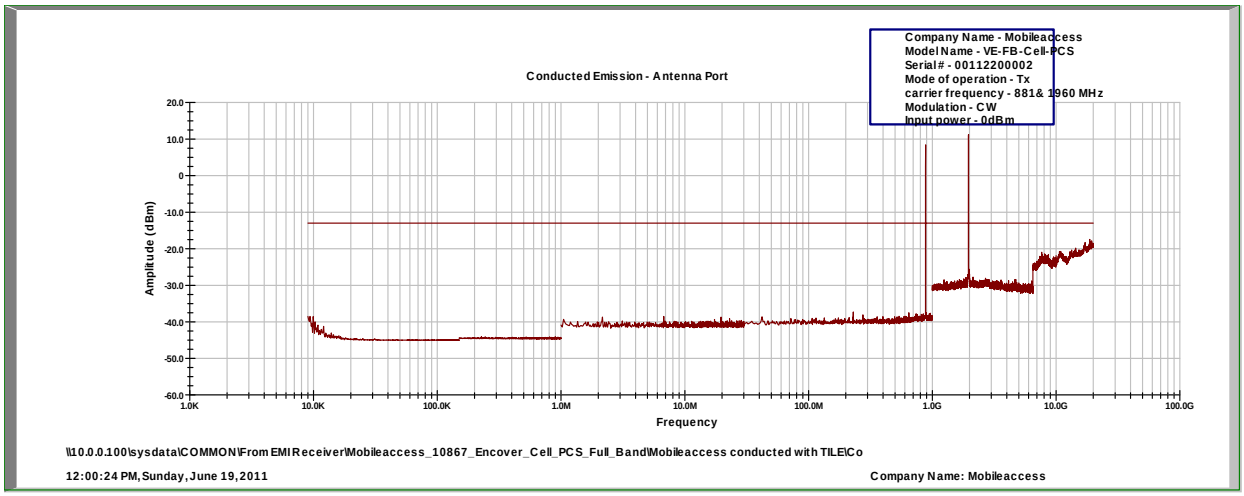


Figure 74 Intermodulation

Frequency	Reading (dBm)	Specification (dBm)	Margin (dB)
9 kHz	-38.5	-13.0	-25.5
227.2 kHz	-44.0	-13.0	-31.0
675 MHz	-38.5	-13.0	-25.5
4.72 GHz	-28.4	-13.0	-15.4
7.65 GHz	-20.9	-13.0	-7.9
18.72 GHz	-17.5	-13.0	-4.5

Figure 75 Intermodulation

16.2 Test Equipment Used.

Intermodulation Conducted

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8529L	3826A01204	February 21, 2011	1 year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Attenuator	Bird	8304-N30DB		December 09, 2010	1 year
Cable	Mini-Circuits	30091		February 10, 2011	1 year

Figure 76 Test Equipment Used

17 Intermodulation Radiated

17.1 Test procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges (869-894; 1930-1990 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 2.
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.

The E.U.T. was operated in Downlink mode at 4 different channels at center frequency of each band at the same time, transmitting at CW signal.

(b) The frequency range 9 kHz-25 GHz was scanned, and the list of the highest emissions was verified and updated accordingly. The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

(b) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:
$P_d(dBm) = P_g(dBm) – Cable\ Loss\ (dB) + Substitution\ Antenna\ Gain\ (dB)$
P_d = Dipole equivalent power (result).
P_g = Signal generator output level.

17.2 Test Results

JUDGEMENT: Passed

Internal Horizontal Antenna

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
(2X1930)-(2X892)	2079	H	62.4	-38.05	6.45	7.84	-36.66	-13.0	-23.66
1930-892	1038	H	51.8	-49.65	4.2	5.4	-48.45	-13.0	-35.45
(5X893.8)-1930	2535	H	64.2	-37.41	7.7	8.4	-36.71	-13.0	-23.71
(2X1930)-(3X870.2)	1181	H	54.6	-45.65	4.7	6.28	-44.07	-13.0	-31.07
1930+892	2823	H	68.0	-33.87	8.4	8.4	-33.87	-13.0	-20.87

Internal Vertical Antenna

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol.	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	Effective Radiated Power Level (dBm)	Spec. (dBm)	Margin (dB)
(2X1930)-(2X892)	2079	V	62.5	-37.61	6.45	7.84	-36.22	-13.0	-23.22
1930-892	1038	V	53.8	-47.99	4.2	5.4	-46.79	-13.0	-12.21
(5X893.8)-1930	2535	V	66.1	-34.66	7.7	8.4	-33.96	-13.0	-20.96
(2X1930)-(3X870.2)	1181	V	55.6	-45.18	4.7	6.28	-43.6	-13.0	-30.60
1930+892	2823	V	68.4	-32.4	8.4	8.4	-32.4	-13.0	-19.40

17.3 Test Instrumentation Used, Radiated Measurements Intermodulation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3906A00276	November 24, 2010	1 year
RF Section	HP	85420E	3705A00248	November 24, 2010	1 year
Active Loop Antenna	Emco	6502	2950	October 19, 2010	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	August 1, 2010	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	March 23, 2011	1 year
Antenna Log Periodic	A.H. Systems	SAS-200/511	253	January 27, 2011	2 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A
Spectrum Analyzer	HP	8592L	3826A01204	February 21, 2011	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	November 5, 2010	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	January 4, 2011	1 Year
Signal Generator	HP	E4438C ESG-	MY45091956	July 22, 2010	1 year
Signal Generator	HP	E4433B ESG-D	GB40050702	July 22, 2010	1 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	29845	March 14, 2010	2 year

18 APPENDIX A - CORRECTION FACTORS

18.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3
20.0	0.6
30.0	0.8
40.0	0.9
50.0	1.1
60.0	1.2
70.0	1.3
80.0	1.4
90.0	1.6
100.0	1.7
150.0	2.0
200.0	2.3
250.0	2.7
300.0	3.1
350.0	3.4
400.0	3.7
450.0	4.0
500.0	4.3
600.0	4.7
700.0	5.3
800.0	5.9
900.0	6.3
1000.0	6.7

FREQUENCY (MHz)	CORRECTION FACTOR (dB)
1200.0	7.3
1400.0	7.8
1600.0	8.4
1800.0	9.1
2000.0	9.9
2300.0	11.2
2600.0	12.2
2900.0	13.0

NOTES:

1. *The cable type is RG-214.*
2. *The overall length of the cable is 27 meters.*
3. *The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".*

18.2 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.2
2.0	1.6
3.0	2.0
4.0	2.4
5.0	3.0
6.0	3.4
7.0	3.8
8.0	4.2
9.0	4.6
10.0	5.0
12.0	5.8

NOTES:

1. The cable type is RG-8.

2. The overall length of the cable is 10 meters.

18.3 Correction factors for CABLE

from spectrum analyzer to test antenna above 2.9 GHz

FREQUENCY (GHz)	CORRECTION FACTOR (dB)	FREQUENCY (GHz)	CORRECTION FACTOR (dB)
1.0	1.9	14.0	9.1
2.0	2.7	15.0	9.5
3.0	3.5	16.0	9.9
4.0	4.2	17.0	10.2
5.0	4.9	18.0	10.4
6.0	5.5	19.0	10.7
7.0	6.0	20.0	10.9
8.0	6.5	21.0	11.2
9.0	7.0	22.0	11.6
10.0	7.5	23.0	11.9
11.0	7.9	24.0	12.3
12.0	8.3	25.0	12.6
13.0	8.7	26.0	13.0

NOTES:

1. The cable type is SUCOFLEX 104 E manufactured by SUHNER.

2. The cable is used for measurements above 2.9 GHz.

3. The overall length of the cable is 10 meters.

18.4 Correction factors for LOG PERIODIC ANTENNA

Type LPD 2010/A
at 3 and 10 meter ranges.

Distance of 3 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.1
250.0	10.2
300.0	12.5
400.0	15.4
500.0	16.1
600.0	19.2
700.0	19.4
800.0	19.9
900.0	21.2
1000.0	23.5

Distance of 10 meters

FREQUENCY (MHz)	AFE (dB/m)
200.0	9.0
250.0	10.1
300.0	11.8
400.0	15.3
500.0	15.6
600.0	18.7
700.0	19.1
800.0	20.2
900.0	21.1
1000.0	23.2

NOTES:

1. *Antenna serial number is 1038.*
2. *The above lists are located in file number 38M3O.ANT for a 3 meter range, and file number 38M100.ANT for a 10 meter range.*
3. *The files mentioned above are located on the disk marked "Radiated Emission Test EMI Receiver".*

18.5 Correction factors for LOG PERIODIC ANTENNA

Type SAS-200/511
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
1.0	24.9
1.5	27.8
2.0	29.9
2.5	31.2
3.0	32.8
3.5	33.6
4.0	34.3
4.5	35.2
5.0	36.2
5.5	36.7
6.0	37.2
6.5	38.1

FREQUENCY (GHz)	ANTENNA FACTOR (dB)
7.0	38.6
7.5	39.2
8.0	39.9
8.5	40.4
9.0	40.8
9.5	41.1
10.0	41.7
10.5	42.4
11.0	42.5
11.5	43.1
12.0	43.4
12.5	44.4
13.0	44.6

NOTES:

1. *Antenna serial number is 253.*
2. *The above lists are located in file number SAS3M0.ANT for a 3 meter range.*
3. *The files mentioned above are located on the disk marked "Antenna Factors".*

18.6 Correction factors for BICONICAL ANTENNA

Type BCD-235/B,
at 3 meter range

FREQUENCY (MHz)	AFE (dB/m)
20.0	19.4
30.0	14.8
40.0	11.9
50.0	10.2
60.0	9.1
70.0	8.5
80.0	8.9
90.0	9.6
100.0	10.3
110.0	11.0
120.0	11.5
130.0	11.7
140.0	12.1
150.0	12.6
160.0	12.8
170.0	13.0
180.0	13.5
190.0	14.0
200.0	14.8
210.0	15.3
220.0	15.8
230.0	16.2
240.0	16.6
250.0	17.6
260.0	18.2
270.0	18.4
280.0	18.7
290.0	19.2
300.0	19.9
310	20.7
320	21.9
330	23.4
340	25.1
350	27.0

NOTES:

1. Antenna serial number is 1041.

2. The above list is located in file 19BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".

18.7 Correction factors for Double-Ridged Waveguide Horn

Model: 3115, S/N 29845
at 3 meter range.

FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)	FREQUENCY (GHz)	ANTENNA FACTOR (dB 1/m)	ANTENNA Gain (dBi)
1.0	24.8	5.4	10.0	38.8	11.4
1.5	26.1	7.6	10.5	38.9	11.8
2.0	28.6	7.7	11.0	39.0	12.1
2.5	29.8	8.4	11.5	39.6	11.8
3.0	31.4	8.4	12.0	39.8	12.0
3.5	32.4	8.7	12.5	39.6	12.5
4.0	33.7	8.6	13.0	40.0	12.5
4.5	33.4	9.9	13.5	39.8	13.0
5.0	34.5	9.7	14.0	40.2	13.0
5.5	35.1	9.9	14.5	40.6	12.9
6.0	35.4	10.4	15.0	41.3	12.4
6.5	35.6	10.8	15.5	39.5	14.6
7.0	36.2	10.9	16.0	38.8	15.5
7.5	37.3	10.4	16.5	40.0	14.6
8.0	37.7	10.6	17.0	41.4	13.4
8.5	38.3	10.5	17.5	44.8	10.3
9.0	38.5	10.8	18.0	47.2	8.1
9.5	38.7	11.1			

18.8 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

FREQUENCY (MHz)	Magnetic Antenna Factor (dB)	Electric Antenna Factor (dB)
.009	-35.1	16.4
.010	-35.7	15.8
.020	-38.5	13.0
.050	-39.6	11.9
.075	-39.8	11.8
.100	-40.0	11.6
.150	-40.0	11.5
.250	-40.0	11.6
.500	-40.0	11.5
.750	-40.1	11.5
1.000	-39.9	11.7
2.000	-39.5	12.0
3.000	-39.4	12.1
4.000	-39.7	11.9
5.000	-39.7	11.8
10.000	40.2	11.3
15.000	-40.7	10.8
20.000	-40.5	11.0
25.000	-41.3	10.2
30.000	42.3	9.2