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DATE: 3 August 2014

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

FCC Radio Test Report

for

Corning Optical Communication Wireless

Equipment under test:

Remote Hub Unit

2000-CELL-PCSH

Written by: _____

R. Pinchuck, Documentation

Approved by: _____

A. Sharabi, Test Engineer

Approved by: _____

I. Raz, EMC Laboratory Manager

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Measurement/Technical Report for
Corning Optical Communication Wireless

Remote Hub Unit

FCC ID: OJFMA2K-CELL-PCSH

This report concerns:	Original Grant: Class II change: X 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-B: 2002

Application for Certification
prepared by:
R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva St.
Lod 7120101
Israel
e-mail rpinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")
Habib Riazi
Corning Optical Communication Wireless
13221 Woodland Park Rd., Suite #400
Herndon, VA. 20171
U.S.A.
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Fax: +1-703-848-0260
e-mail: RiaziH@corning.com

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1. General Information

1.1 Administrative Information

Manufacturer:	Corning Optical Communication Wireless
Manufacturer's Address:	13221 Woodland Park Rd., Suite #400 Herndon, VA. 20171 U.S.A. Tel: +1-541-758-2880 Fax: +1-703-848-0260
Manufacturer's Representative:	Habib Riazi
Equipment Under Test (E.U.T):	Remote Hub Unit
Equipment Model No.:	2000-CELL-PCSH
Equipment Serial No.:	0822372
Date of Receipt of E.U.T:	25.05.14
Start of Test:	25.05.14
End of Test:	29.05.14
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Parts 2, 22, 24

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.

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

Data Sheet

mobileaccess.

MobileAccess2000
Data Sheet

The MobileAccess**2000** provides enterprise level indoor coverage for a wide range of wireless services over a single broadband infrastructure.

The MA2000 is a multi-operator, multi-service system based on combining a number of services, voice and data, and distributing them to each remote location through a common antenna infrastructure.

Wireless RF services are bi-directionally transmitted between the capacity source (BTS/BDA) and remote locations using low loss fiber and broadband coax.

WLAN services from WiFi Access Points (802.11a/b/g/n) can be integrated with the Wireless RF services at the remote locations for transport over a single cabling infrastructure to the antenna.

Two types of MA2000 deployment solutions are available:

- **MA2000-Lite** – Coverage solution for up to six cellular services.
- **MA2000 Modular Remote Cabinet (MRC)** - Coverage solution for greater than six cellular services.

Features & Benefits:

- **Multi-Operator Platform:** Accommodates multiple operators seamlessly and transparently on one in-building network.
- **Multi-Service Platform:** Accommodates virtually any mix of wireless voice and data services, eliminating the need for separate overlay networks. Supported services and technologies include: GSM, CDMA, TDMA, iDEN, LMR, SMR, Paging, UMTS, DCS, EDGE, EV-DO, UHF/VHF, WMTS, and more.
- **Modular Design:** With its modular packaging, the MA2000 enables new wireless services to be added easily and cost-effectively without disruption to work spaces or existing services.
- **Scalable Packaging:** The MA2000 is available in two variants, the MA2000 Modular Remote Cabinet (MRC) and the MA2000-Lite. Customers can expand from the MA2000-Lite to the MA2000 MRC while re-purposing all components.
- **Carrier-Class Operation:** Advanced signal handling and management ensures optimal performance for all services involved in a multi-operator environment.
- **Robust Management:** Proactive, centralized end-to-end monitoring and management of MA2000 equipment and RF signals.
- **Reduce Operating Expenses:** Multi-operator, multi-service across common infrastructure; supports multimode fiber.

Figure 1: MA2000-Lite

Figure 2: MA2000 MRC

mobileaccess.

System Architecture

The MobileAccess**2000** solution deployment is comprised of the following elements. For more detailed information, refer to the MA2000 User Manual and Installation Guide.

Head End Equipment

Radio Interface Unit (RIU): The RIU conditions the RF Downlink signals from base-transceiver stations (BTS) or bi-directional amplifiers (BDA) provided by the Wireless Service Providers (WSPs), ensuring a constant level of RF before passing them on to the Base Units (BU). RF Uplink signals from subscribers are received from the BU and transported back to the BTS or BDA.

Base Unit (BU): The BU converts the RF Downlink signals received from the RIU to an optical signal for transport on single or multi-mode fiber to the Remote Hub Units (RHU) located at the remote locations. Uplink optical signals from subscribers are received from the RHU and converted back to RF before passing them on to the RIU.

System Controller: The system controller enables remote management and control of all MA2000 elements from a single location. Refer to the System Controller datasheet for more information.

Remote Location Equipment

MA2000-Lite: The MA2000-Lite is an entry level platform for deploying a multi-operator solution. It supports up to two RHUs, each with an Add-On, for a total of six services.

MA2000 Modular Remote Cabinet (MRC): The MRC is a cabinet capable of housing up to five RHUs (or two RHUs, each with an Add-On), power and appropriate filtration.

Remote Hub Unit (RHU): The RHU is a service specific module that performs optical to RF conversion on signals received from the BU. The signals are then filtered and amplified for transport across broadband coax to the antenna. Uplink signals from the antenna are then converted to optical signals before being transmitted back to the BU. Each RHU supports up to two services.

Add-On (AO): The Add-On is a single service unit that is coupled with an RHU to support an additional service. The Add-On receives filtered RF signal from the RHU and amplifies it for transport across the broadband coax.

860 WLAN Module (860): The 860 is mounted outside the MRC or MA200-Lite. It combines WLAN and cellular signals for transport across the broadband coax. The 860 is used with Wireless Coverage Expanders (WCE). Refer to the 860 WLAN Solution datasheet for more information.

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

The 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 November 21, 2012).
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

A FCC Grant and Revised Grant were issued for the E.U.T. on 04/26/2010. The LTE modulation has been added to the CELL and PCS band requiring a C2PC. The following tests were performed:

RF power output

Occupied bandwidth

Spurious emissions at antenna terminals

Band edge spectrum

2.2 EUT Exercise Software

RHU Embedded SW version: V4.1B01
EngGui version: Setup_EngGui_Suite_1_26_08.exe
MCT Version: Setup_Mct_10_27_07.exe
NMS Version: Setup_NMS_Server_22_07_01.exe

2.3 Special Accessories

No special accessories were needed to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order o achieve compliance.

2.5 Configuration of Tested System

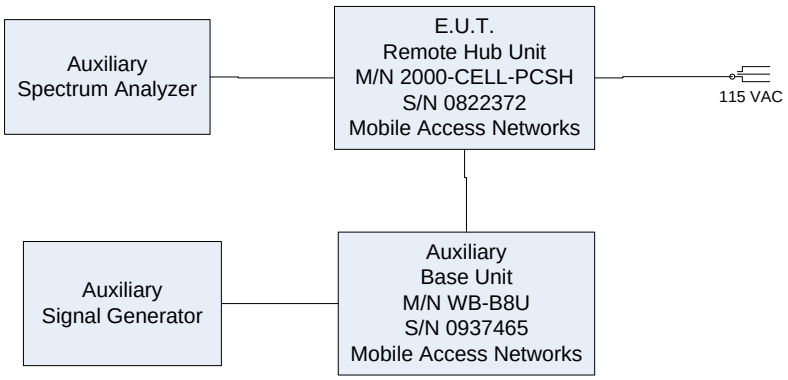

Figure 1. Test Set-up

3. Test Setup Photos

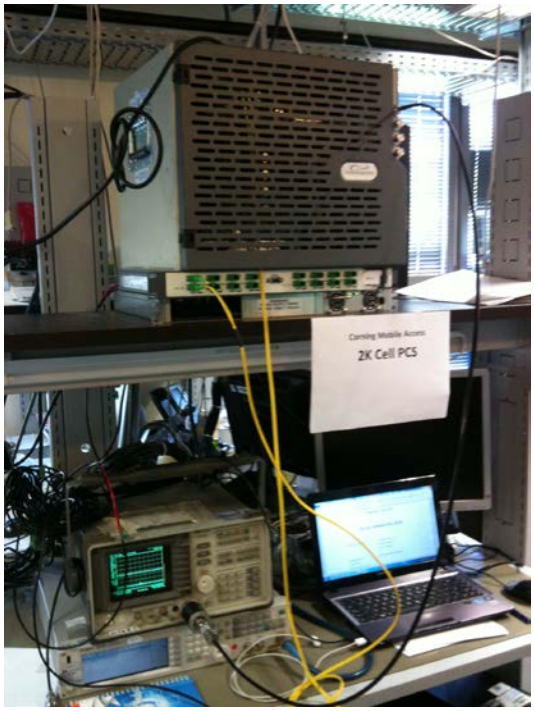

Figure 2. Conducted Emission From Antenna Port Test Set-up

4. Peak Output Power CELL

4.1 Test Specification

FCC Part 22.913

4.2 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 (0.5dB). The E.U.T. RF output was LTE modulated. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 1.0 MHz RBW. The output power level was measured at 874, 881, and 889 MHz. Signal generator output power 1dbm.

4.3 Results table

Modulation	Channel	Reading (dBm)	Specification (dBm)	Margin (dB)
QPSK	874	20.04	57.0	-36.96
	881	21.26	57.0	-35.74
	889	19.63	57.0	-37.37
16QAM	874	20.23	57.0	-36.77
	881	20.23	57.0	-36.77
	889	19.68	57.0	-37.32
64QAM	874	20.27	57.0	-36.73
	881	21.36	57.0	-35.64
	889	19.43	57.0	-37.57

Figure 3 Peak Output Power CELL Test Results Table

See additional information in Figure 4 to Figure 12.

JUDGEMENT: Passed by 35.64 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK:

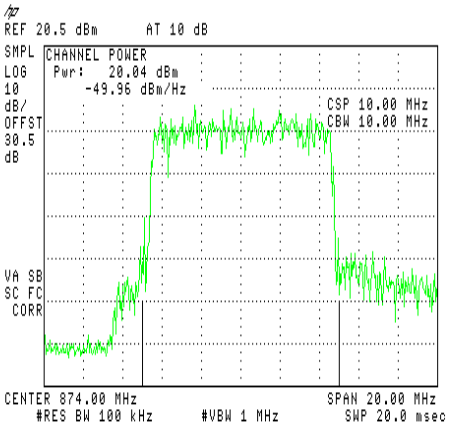

Figure 4.— 874 MHz

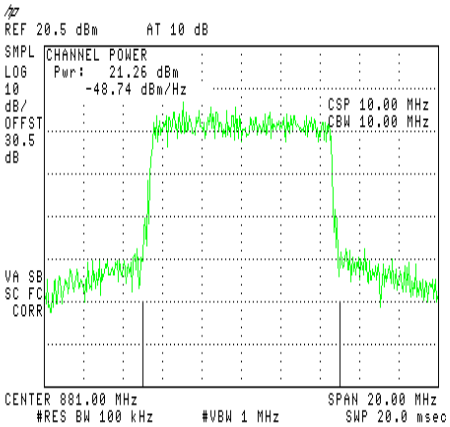

Figure 5.— 881 MHz

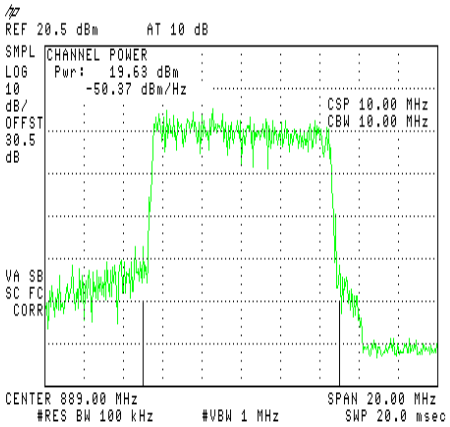

Figure 6.— 889 MHz

16QAM:

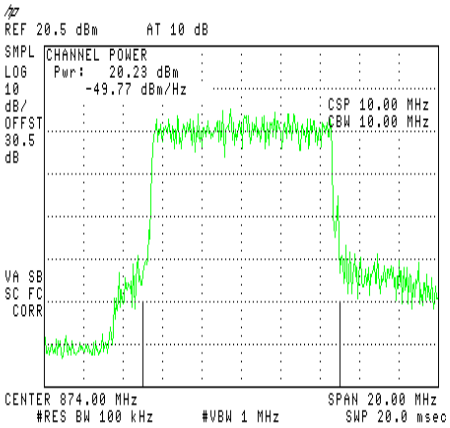

Figure 7.— 874 MHz

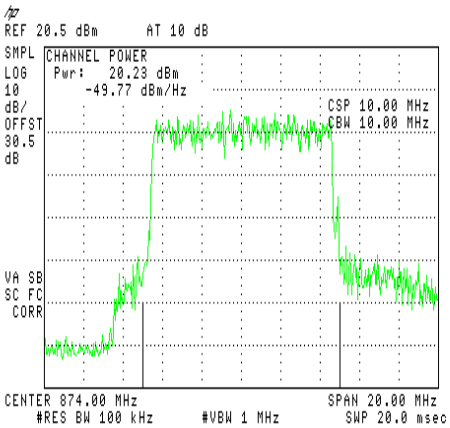

Figure 8.— 881 MHz

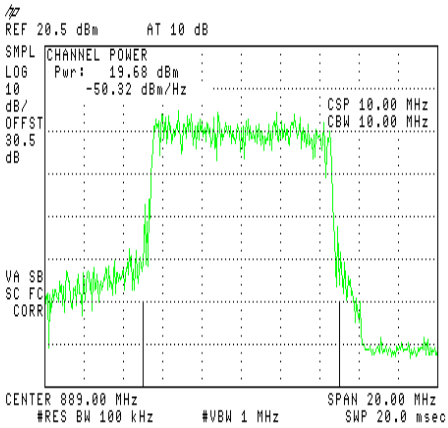

Figure 9.— 889 MHz

64QAM:

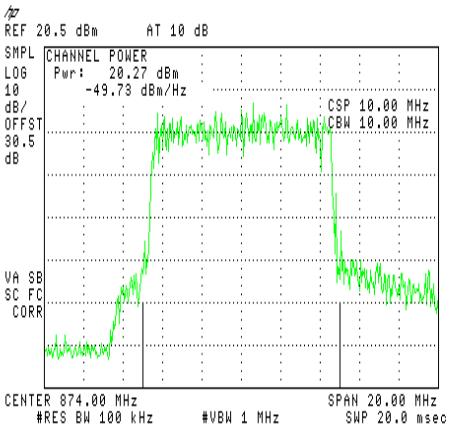

Figure 10.— 874 MHz

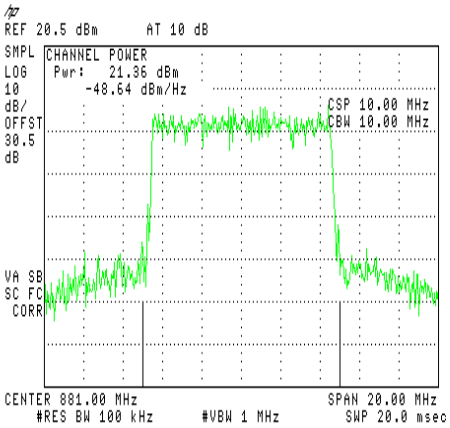

Figure 11.— 881 MHz

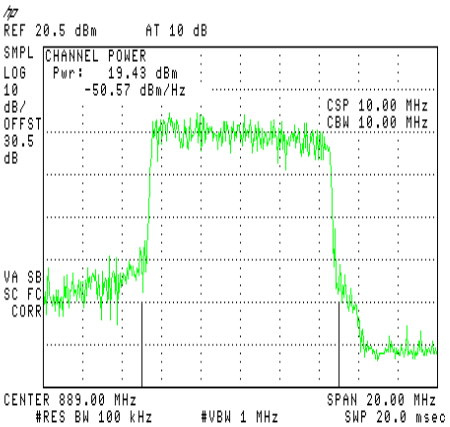

Figure 12.— 889 MHz

4.4 Test Equipment Used; Peak Output Power CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 13 Test Equipment Used

5. Occupied Bandwidth CELL

5.1 Test Specification

FCC Part 2, Section 1049

5.2 Test Procedure

The E.U.T. was set to the applicable test frequency with LTE 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.

5.3 Results Table

Modulation		Operating Frequency (MHz)	Reading (MHz)
QPSK	Input	874	9.38
	Output	874	9.34
	Input	881	9.34
	Output	881	9.30
	Input	889	9.38
	Output	889	9.34
16QAM	Input	874	9.38
	Output	874	9.34
	Input	881	9.38
	Output	881	9.30
	Input	889	9.38
	Output	889	9.30
64QAM	Input	874	9.34
	Output	874	9.34
	Input	881	9.34
	Output	881	9.30
	Input	889	9.34
	Output	889	9.26

Figure 14 Occupied Bandwidth CELL

See additional information in Figure 15 to Figure 32.

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK:

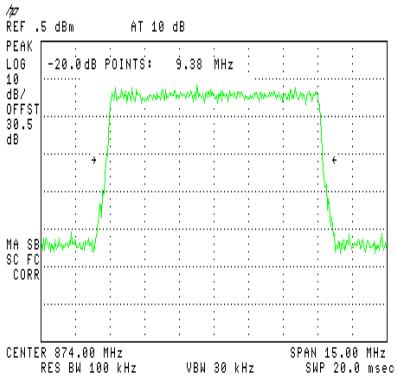

Figure 15.— Input 874

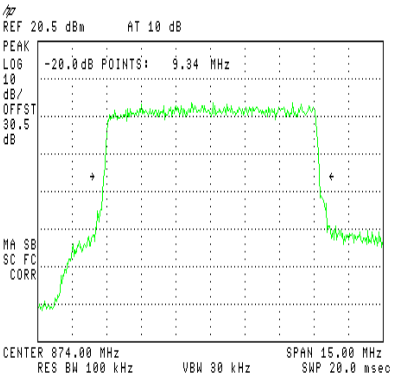

Figure 16.— Output 874

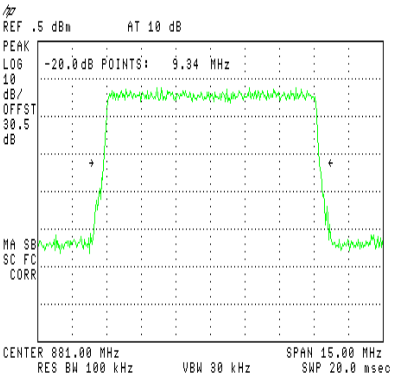

Figure 17.— Input 881 MHz.

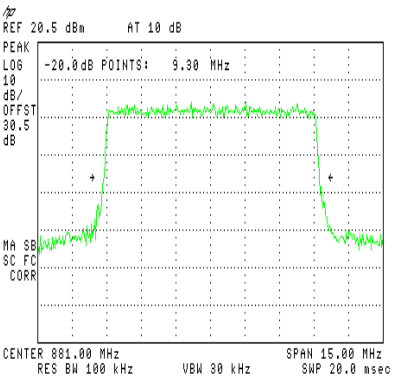

Figure 18.—Output 881MHz.

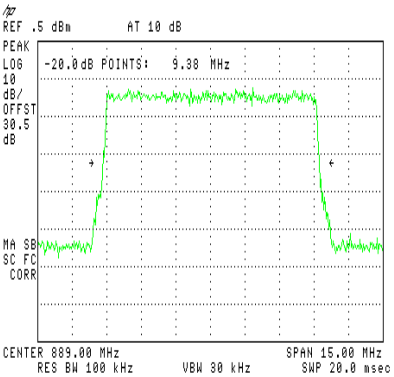

Figure 19.— Input 889 MHz.

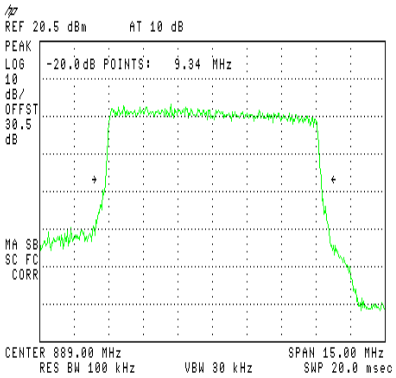

Figure 20.— Output 889 MHz.

16QAM:

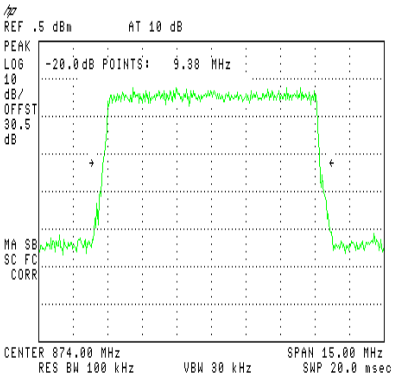

Figure 21.— Input 874

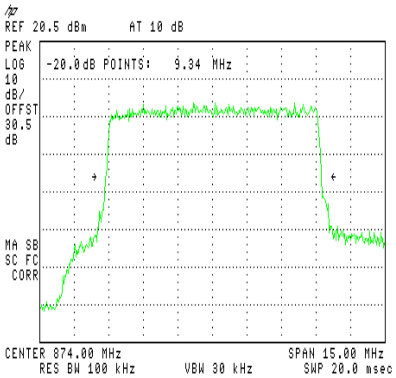

Figure 22.— Output 874

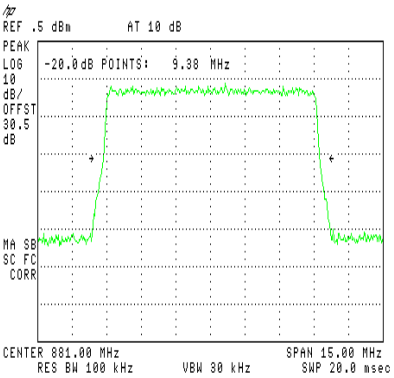

Figure 23.— Input 881 MHz.

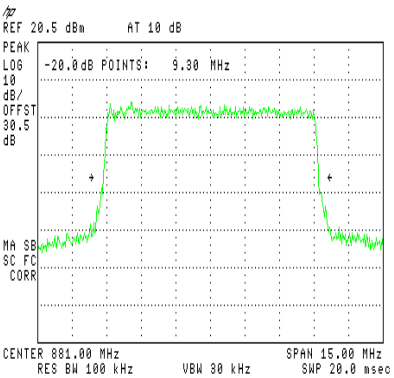

Figure 24.—Output 881MHz.

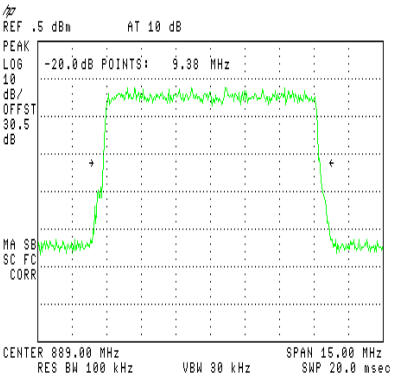

Figure 25.— Input 889 MHz.

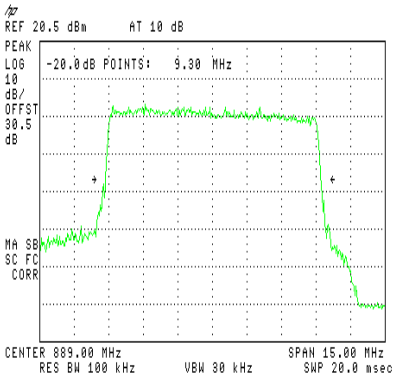

Figure 26.— Output 889 MHz.

64QAM:

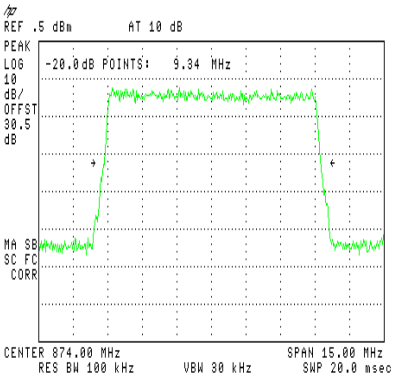

Figure 27.— Input 874

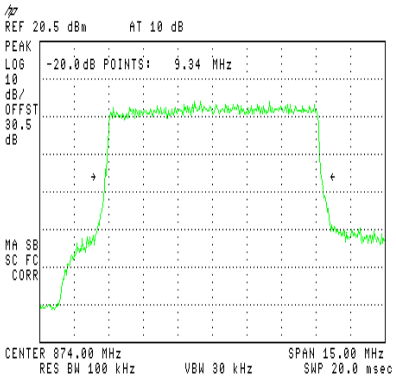

Figure 28.— Output 874

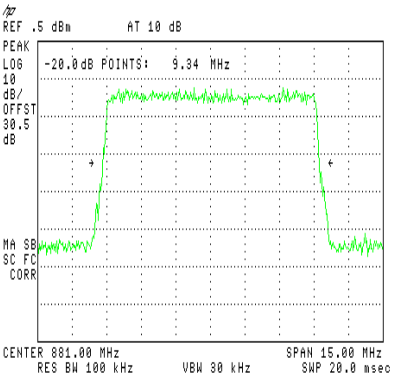

Figure 29.— Input 881 MHz.

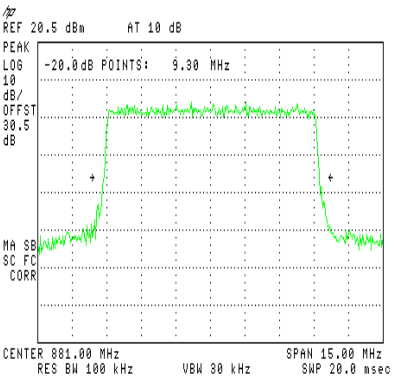

Figure 30.—Output 881MHz.

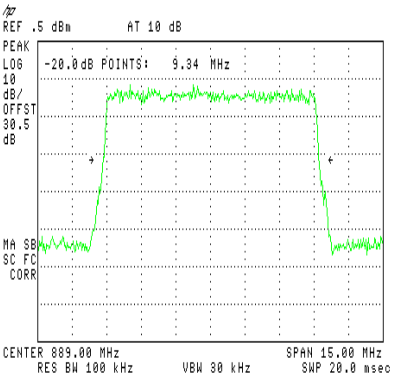

Figure 31.— Input 889 MHz.

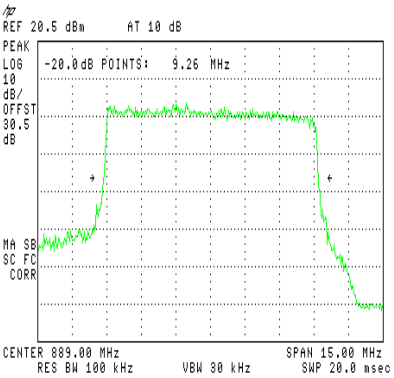

Figure 32.— Output 889 MHz.

5.4 Test Equipment Used; Occupied Bandwidth CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 33 Test Equipment Used

6. Out of Band Emissions at Antenna Terminals CELL

6.1 Test Specification

FCC Part 22, Section 917; FCC Part 2.1051

6.2 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 (30.5 dB).

6.3 Results

See additional information in Figure 34 to Figure 42.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK:

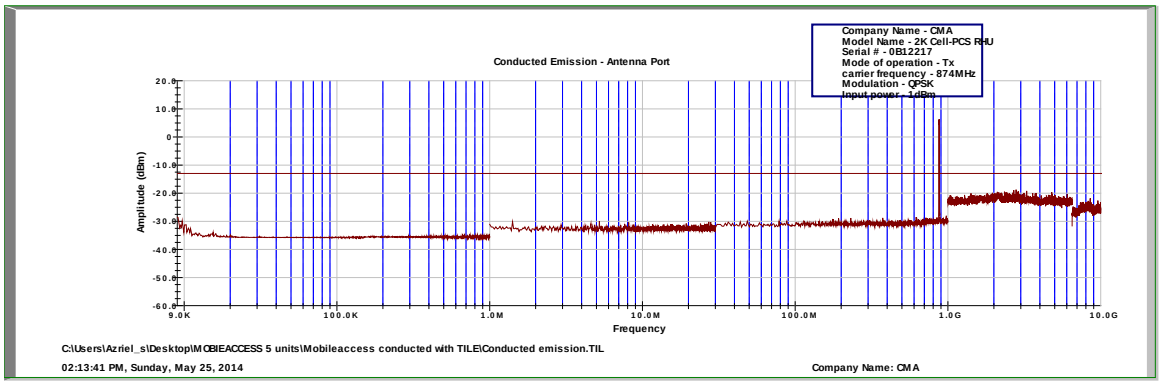

Figure 34.— 874 MHz

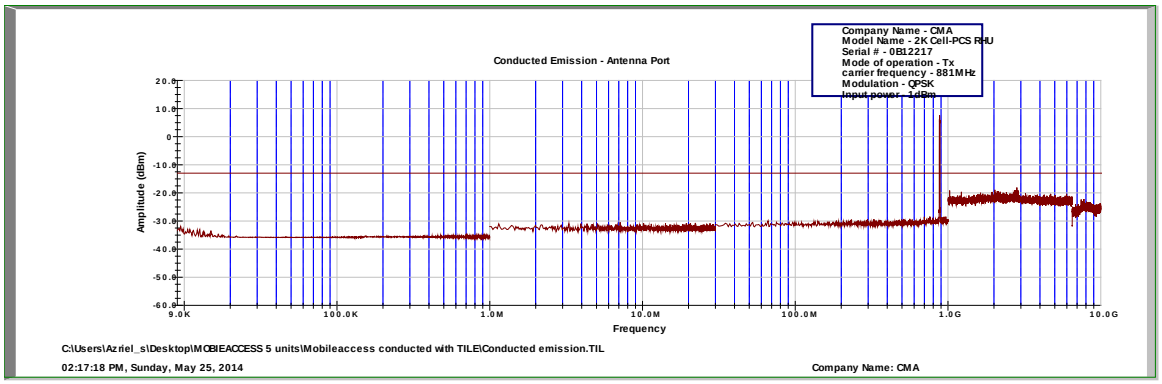

Figure 35.— 881 MHz

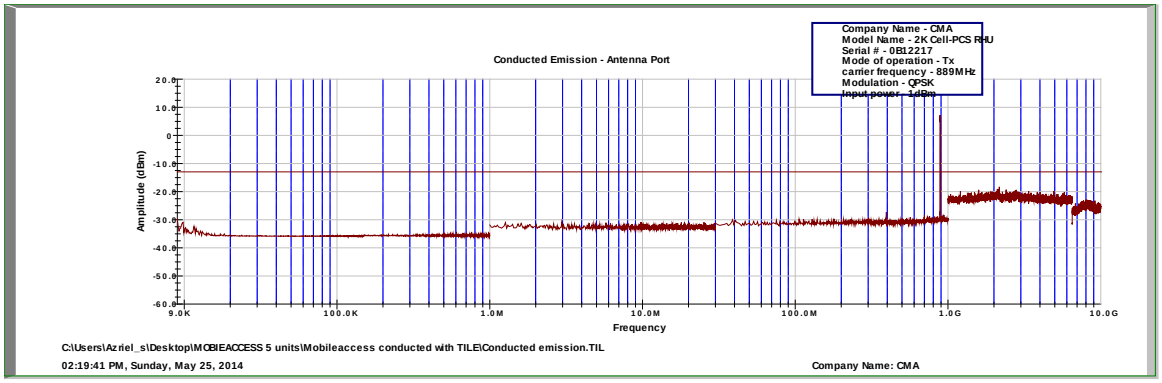

Figure 36.— 889 MHz

16QAM:

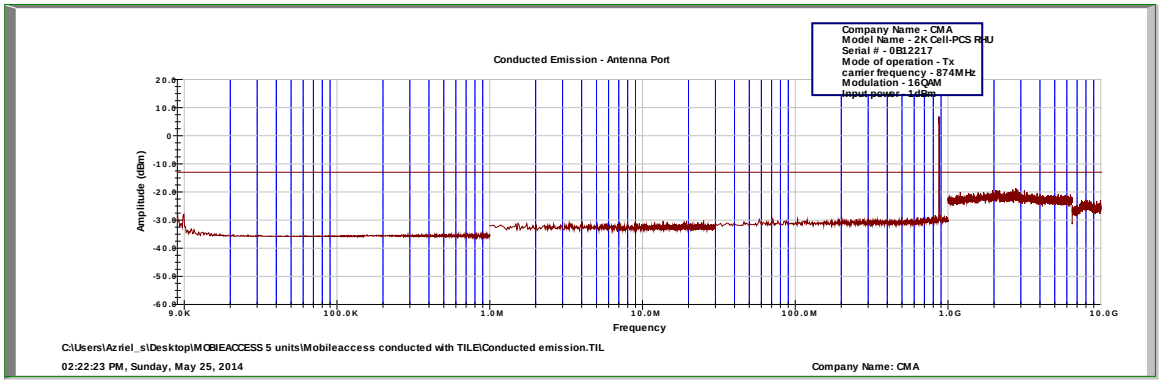

Figure 37.— 874 MHz

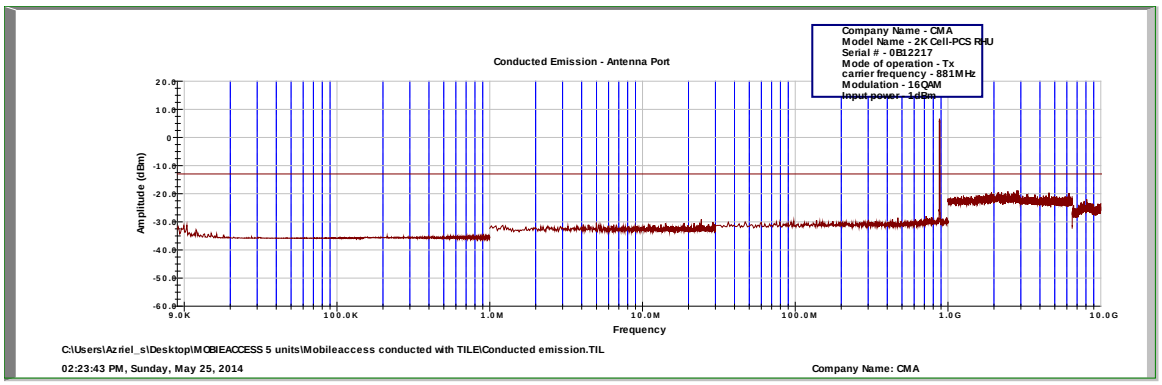

Figure 38.— 881 MHz

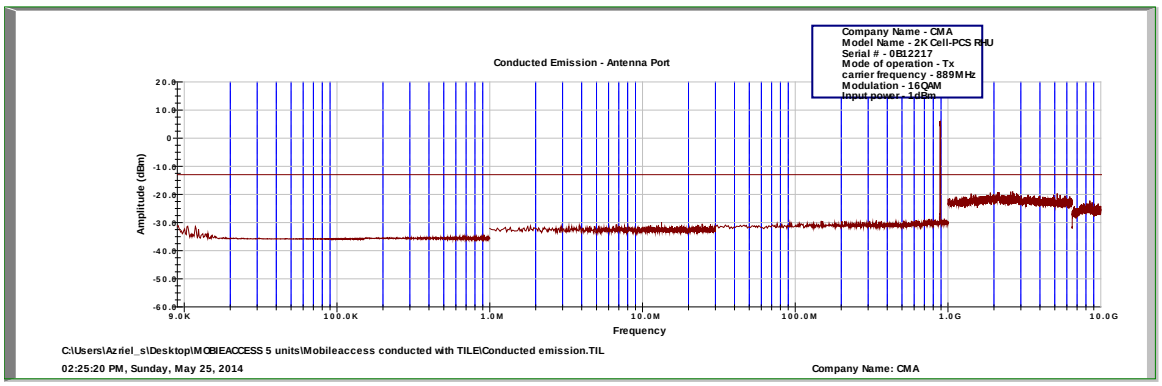

Figure 39.— 889 MHz

64QAM:

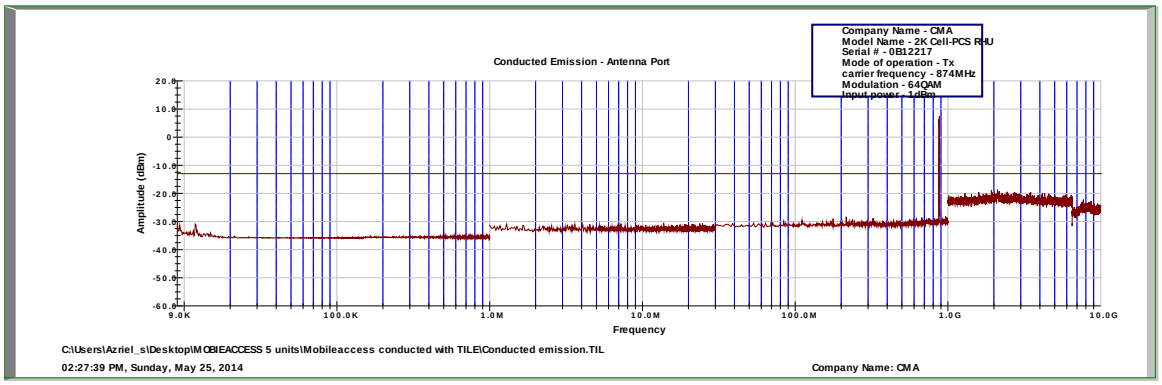

Figure 40.— 874 MHz

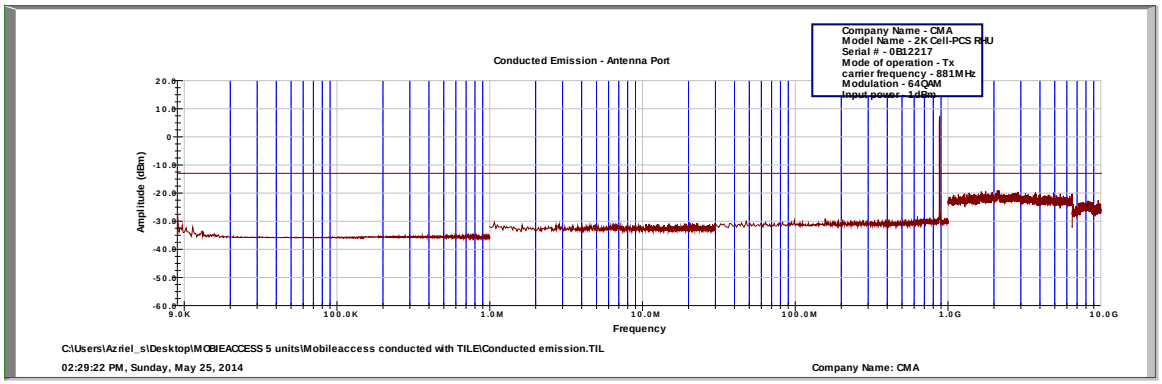

Figure 41.— 881 MHz

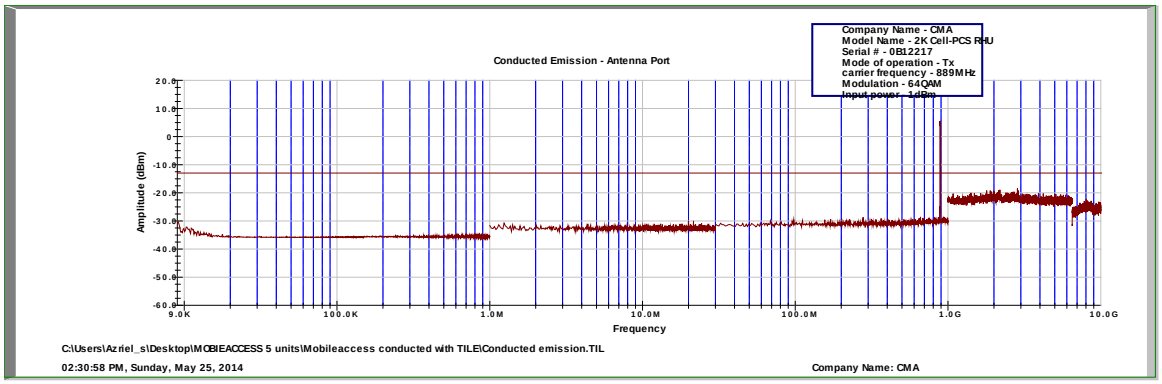

Figure 42.— 889 MHz

6.4 Test Equipment Used; Out of Band Emission at Antenna Terminals CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 43 Test Equipment Used

7. Band Edge Spectrum CELL

7.1 Test Specification

FCC Part 22, FCC Part 2.1051

7.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (874 MHz) and the highest operation frequency (889 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 (30.5 dB).
The spectrum analyzer was set to 100 kHz R.B.W.

7.3 Results table

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
QPSK	874.00	869.00	-19.82	-13.0	-6.82
	889.00	894.00	-24.66	-13.0	-11.66
16QAM	874.00	869.00	-23.95	-13.0	-10.95
	889.00	894.00	-24.90	-13.0	-11.90
64QAM	874.00	869.00	-22.39	-13.0	-9.39
	889.00	894.00	-25.46	-13.0	-12.46

Figure 44 Band Edge Spectrum Results CELL

See additional information in Figure 45 to Figure 50.

JUDGEMENT: Passed by 6.82 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK:

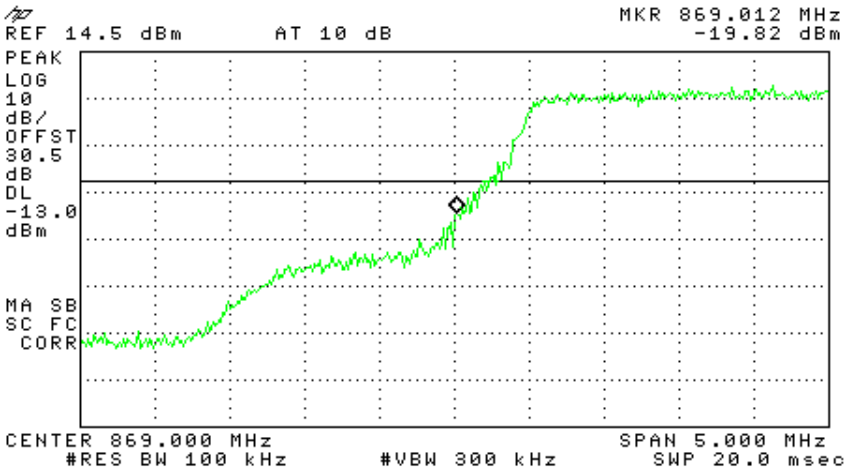

Figure 45.— 874 MHz

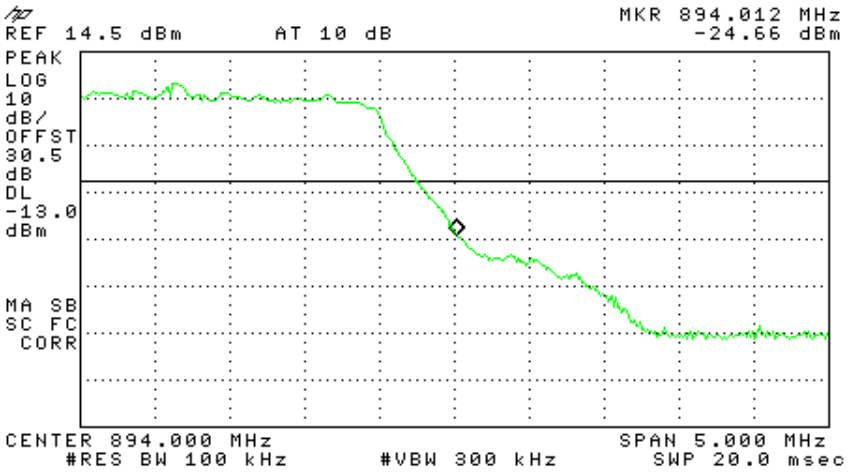

Figure 46.— 889 MHz

16QAM:

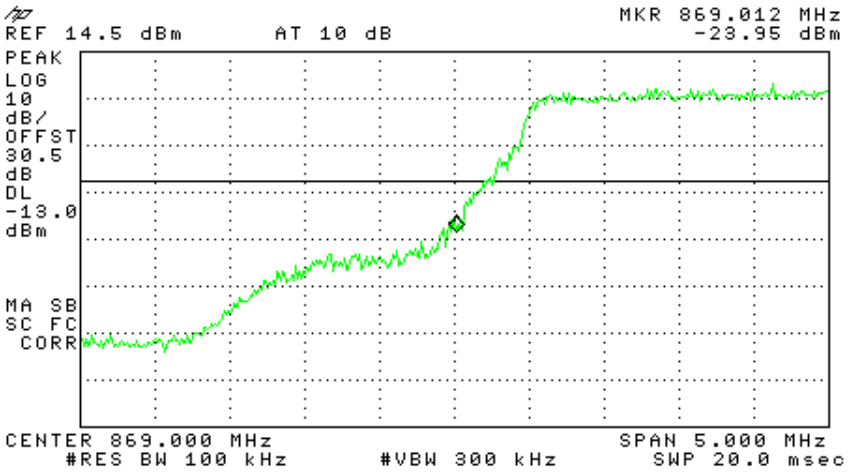

Figure 47.— 874 MHz

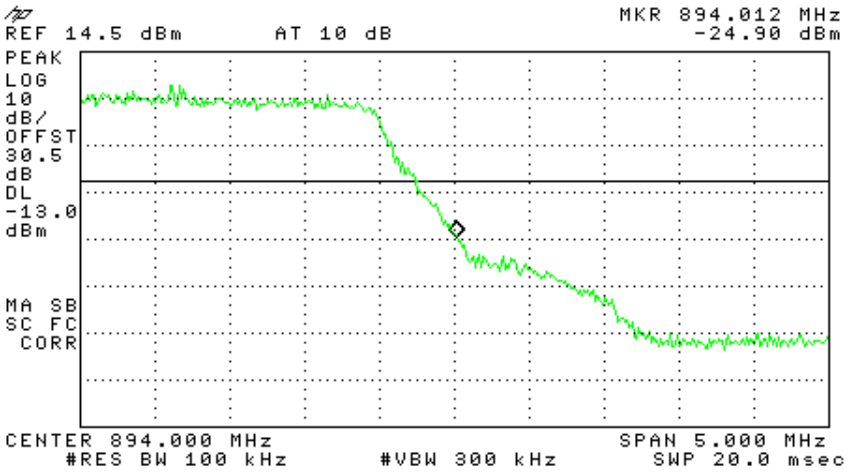

Figure 48.— 889 MHz

64QAM:

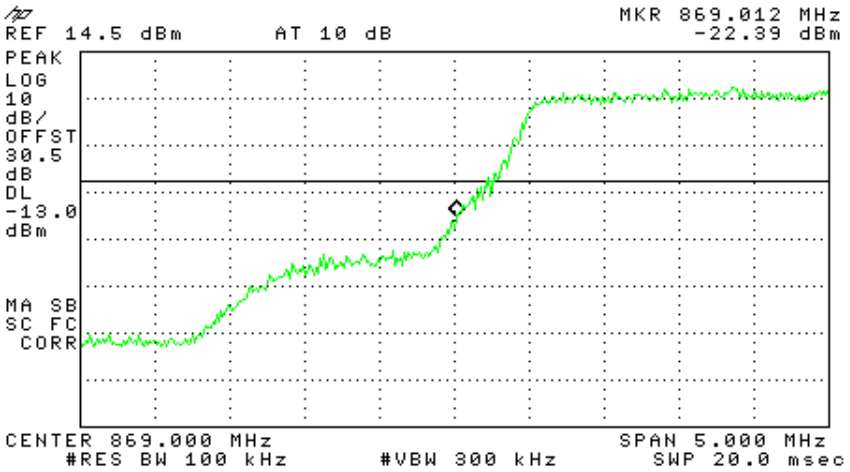

Figure 49.— 874 MHz

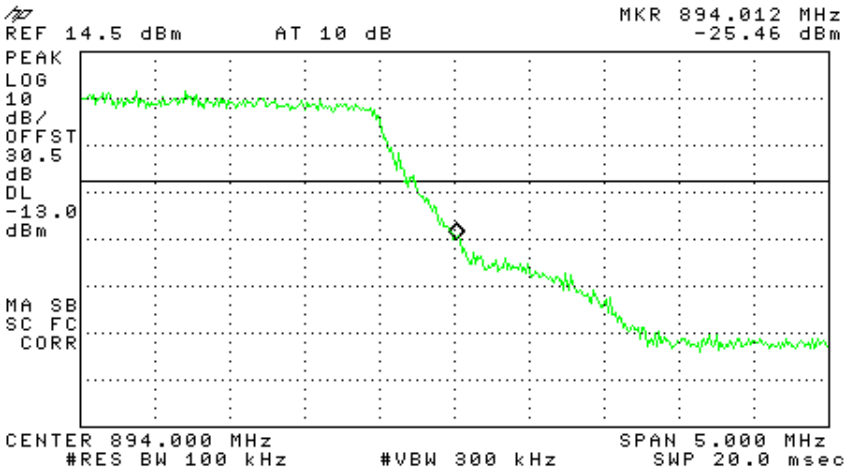

Figure 50.— 889 MHz

7.4 Test Equipment Used; Band Edge Spectrum CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 51 Test Equipment Used

8. Peak Output Power PCS

8.1 Test Specification

FCC Part 24, Subpart E

8.2 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 (0.5dB). The E.U.T. RF output was LTE modulated. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 1.0 MHz RBW. The output power level was measured at 1935, 1960, and 1990 MHz. Signal generator output power 1dbm.

8.3 Results table

Modulation	Operation Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
QPSK	1935	19.76	50.0	-30.24
	1960	20.78	50.0	-29.22
	1990	18.89	50.0	-31.11
16QAM	1935	19.92	50.0	-30.08
	1960	20.57	50.0	-29.43
	1990	19.05	50.0	-30.95
64QAM	1935	20.23	50.0	-29.77
	1960	21.52	50.0	-28.48
	1990	19.70	50.0	-30.30

Figure 52 Peak Output Power PCS

See additional information in Figure 53 to Figure 61.

JUDGEMENT: Passed by 28.48 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK:

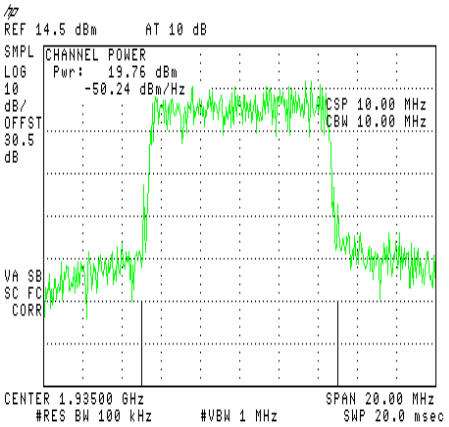

Figure 53.— 1935 MHz

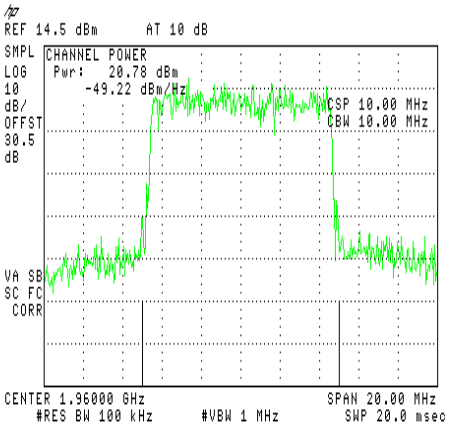

Figure 54.— 1960 MHz

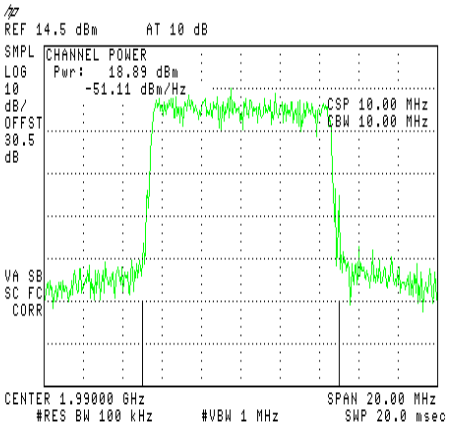

Figure 55.— 1990MHz

16QAM:

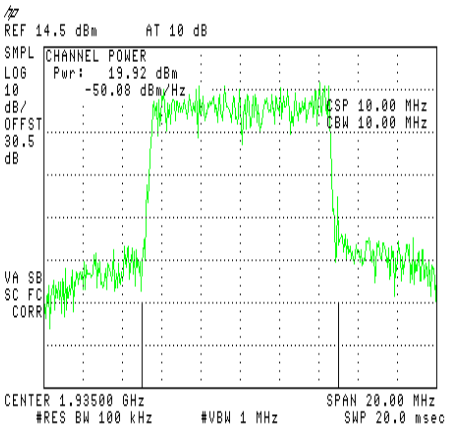

Figure 56.— 1935 MHz

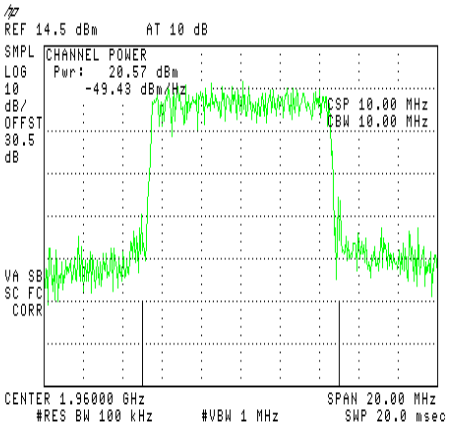

Figure 57.— 1960 MHz

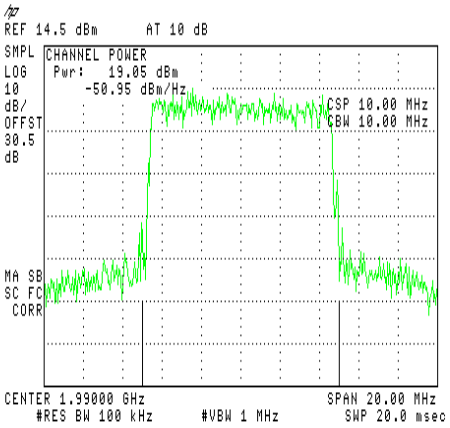

Figure 58.— 1990MHz

64QAM:

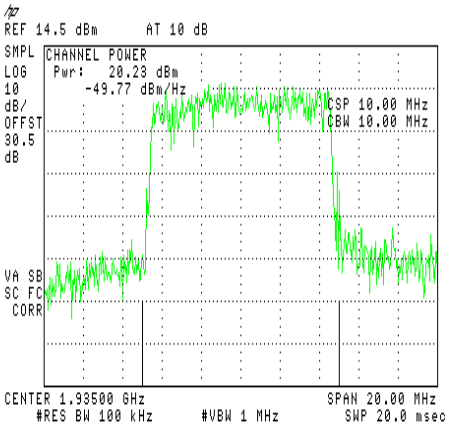

Figure 59.— 1935 MHz

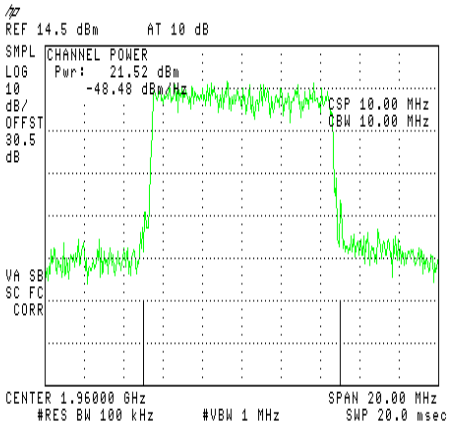

Figure 60.— 1960 MHz

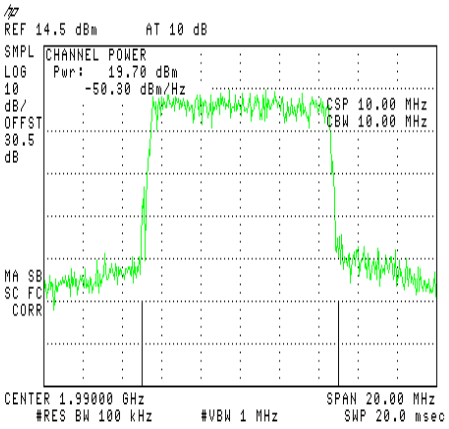

Figure 61.— 1990MHz

8.4 Test Equipment Used; Peak Output Power PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 62 Test Equipment Used

9. Occupied Bandwidth PCS

9.1 Test Specification

FCC Part 2, Section 1049

9.2 Test Procedure

The E.U.T. was set to the applicable test frequency with LTE 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.

9.3 Results Table

Modulation		Operating Frequency	Reading (MHz)
QPSK	Input	1935	9.50
	Output	1935	9.70
	Input	1960	9.75
	Output	1960	9.65
	Input	1990	9.55
	Output	1990	9.65
16QAM	Input	1935	9.55
	Output	1935	9.65
	Input	1960	9.60
	Output	1960	9.55
	Input	1990	9.55
	Output	1990	9.60
64QAM	Input	1935	9.70
	Output	1935	9.60
	Input	1960	9.60
	Output	1960	9.60
	Input	1990	9.60
	Output	1990	9.60

Figure 63 Occupied Bandwidth PCS

See additional information in Figure 64 to Figure 81.

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK

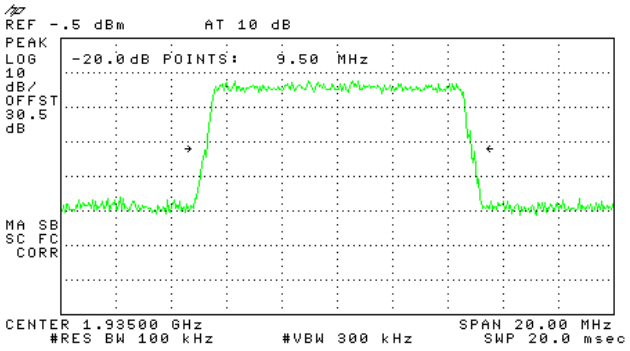

Figure 64.— Input 1935 MHz

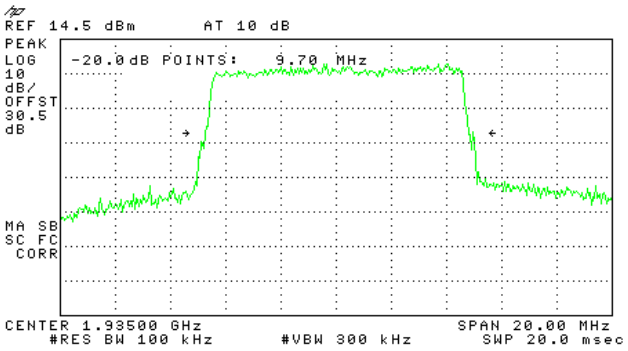

Figure 65.— Output 1935MHz

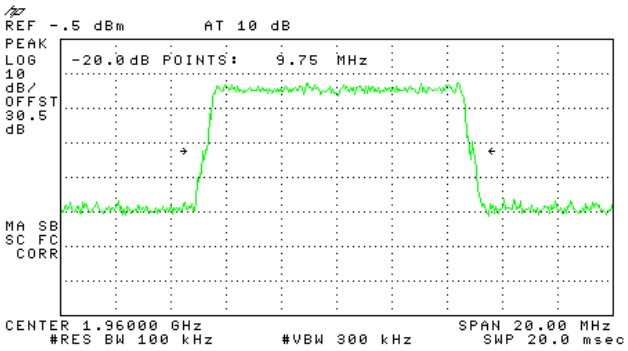

Figure 66.— Input 1960 MHz

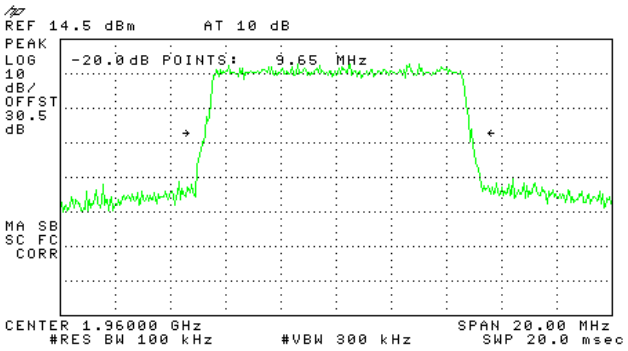

Figure 67.— Output 1960MHz

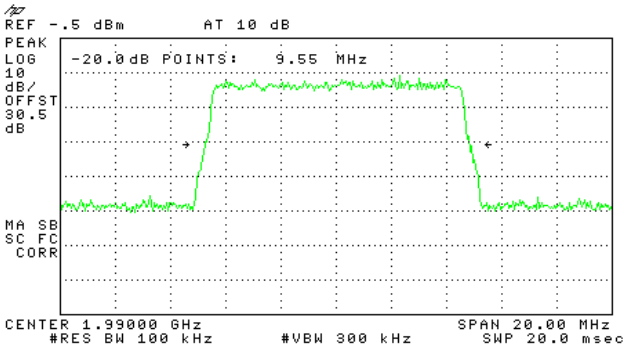

Figure 68.— Input 1990 MHz

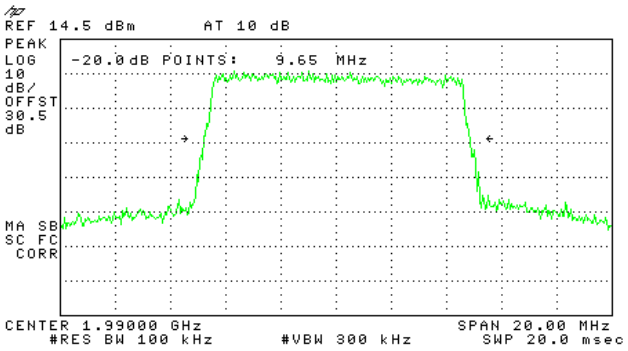

Figure 69.— Output 1990MHz

16QAM

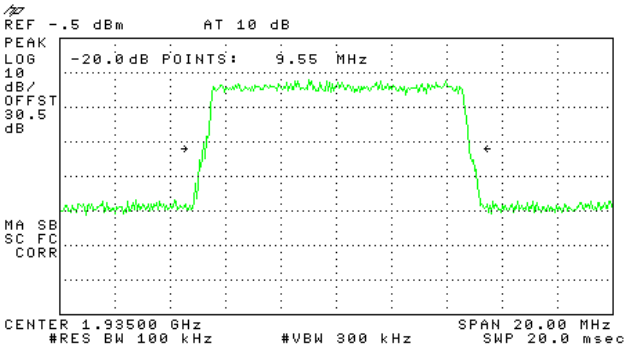

Figure 70.— Input 1935 MHz

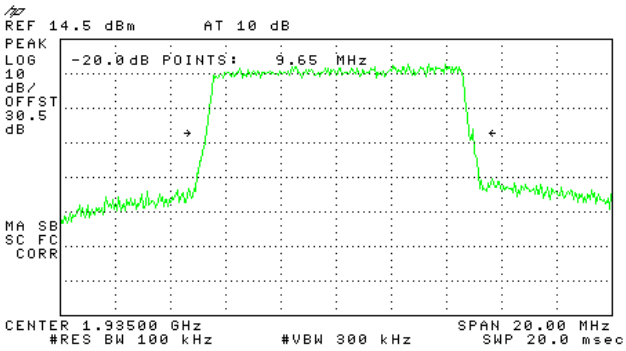

Figure 71.— Output 1935MHz

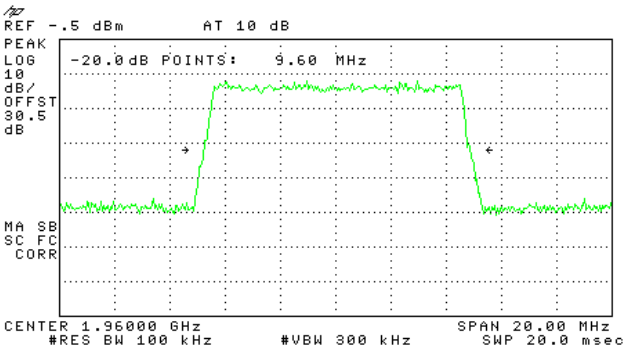

Figure 72.— Input 1960 MHz

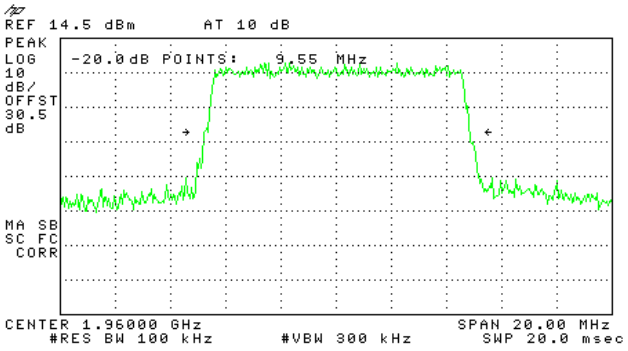

Figure 73.— Output 1960MHz

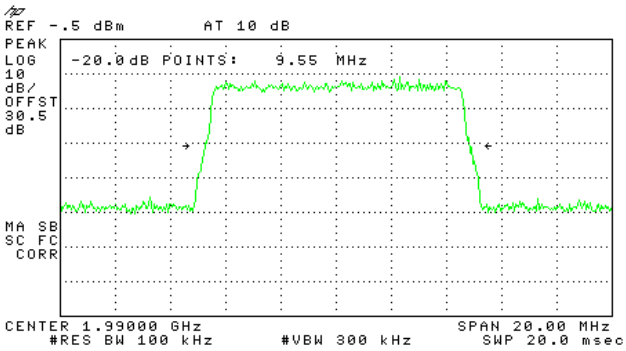

Figure 74.— Input 1990 MHz

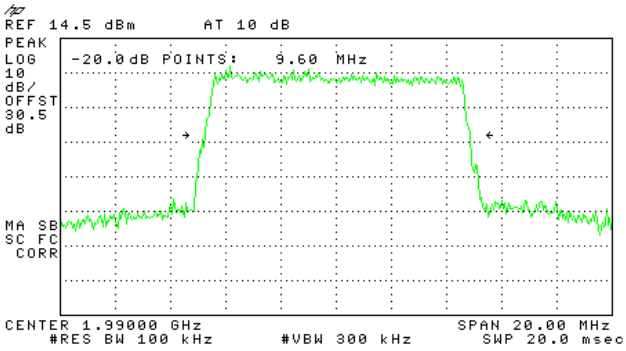

Figure 75.— Output 1990MHz

64QAM

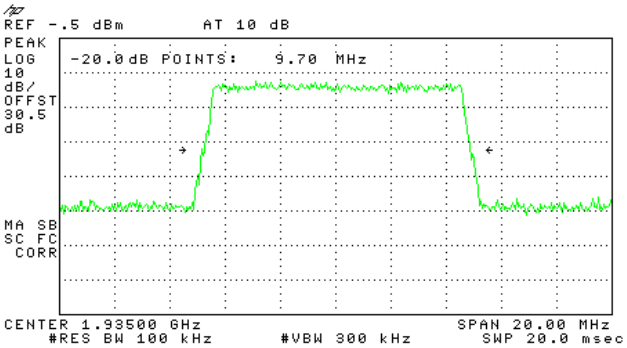

Figure 76.— Input 1935 MHz

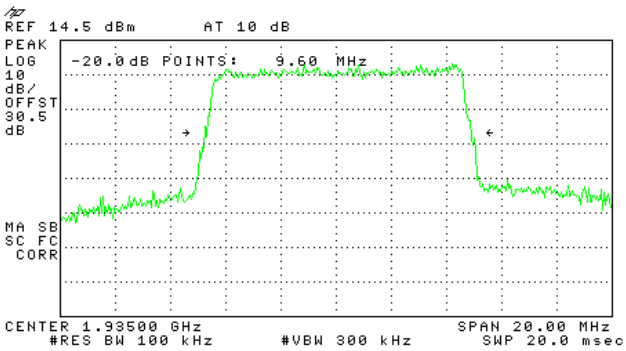

Figure 77.— Output 1935MHz

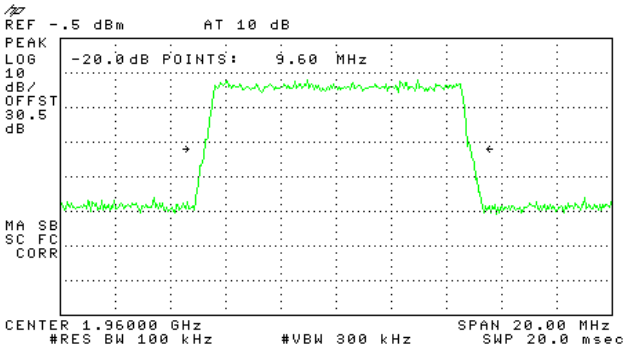

Figure 78.— Input 1960 MHz

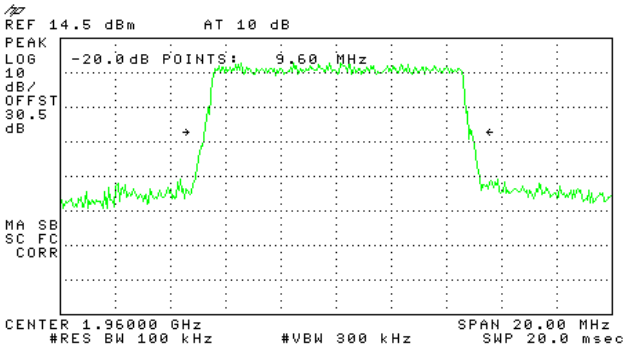

Figure 79.— Output 1960MHz

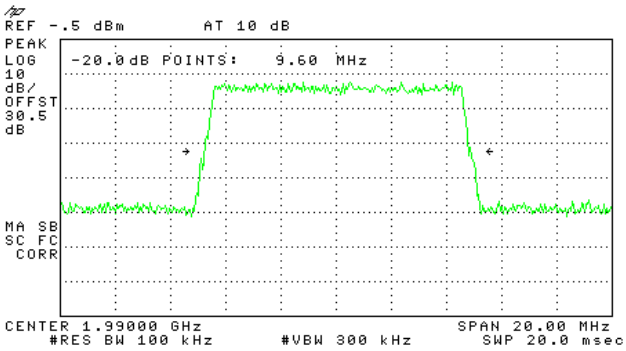

Figure 80.— Input 1990 MHz

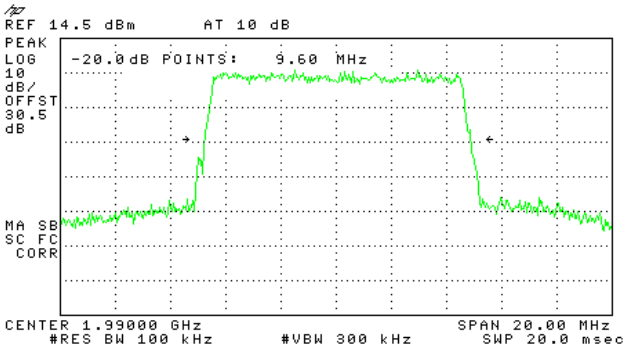

Figure 81.— Output 1990MHz

9.4 Test Equipment Used; Occupied Bandwidth PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 82 Test Equipment Used

10. Out of Band Emissions at Antenna Terminals PCS

10.1 Test Specification

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

10.2 Test procedure

The power of any emission outside of the authorized operating frequency ranges (1930-1995 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 (30.5 dB).

10.3 Test Results

See plots in figure Figure 83 to Figure 91.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK:

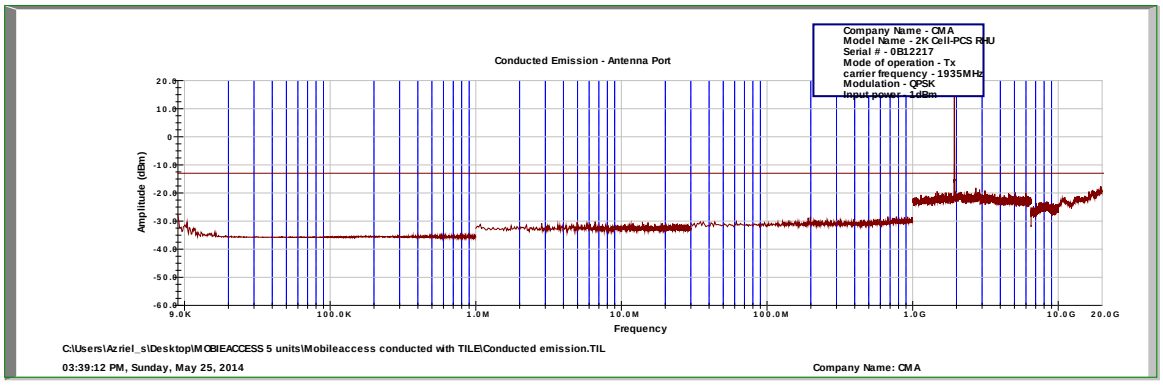

Figure 83.— 1935MHz

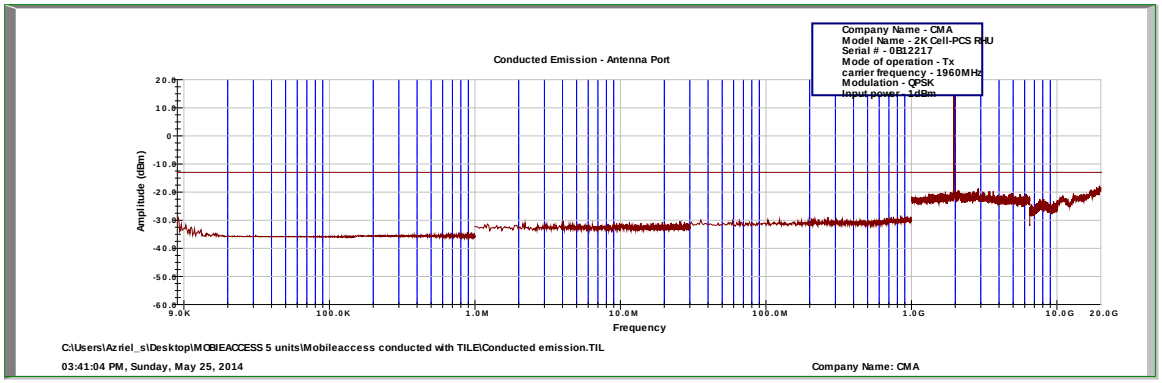

Figure 84.— 1960MHz

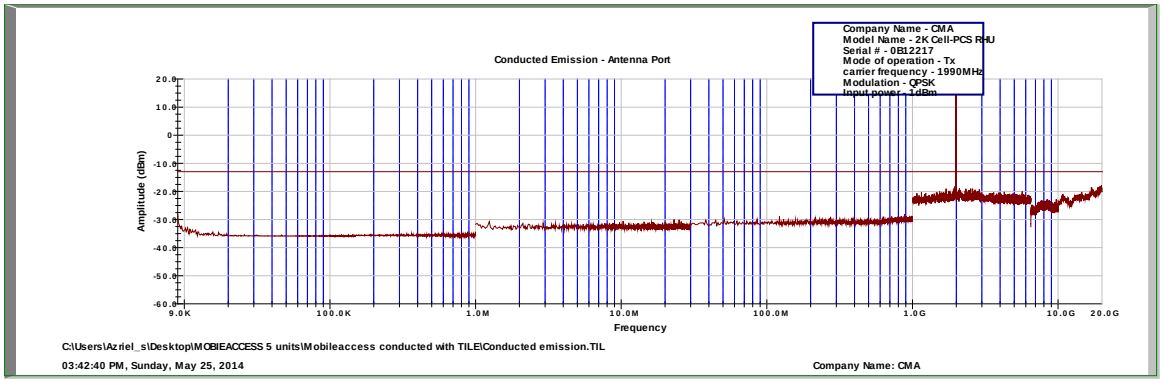

Figure 85.— 1990MHz

16QAM:

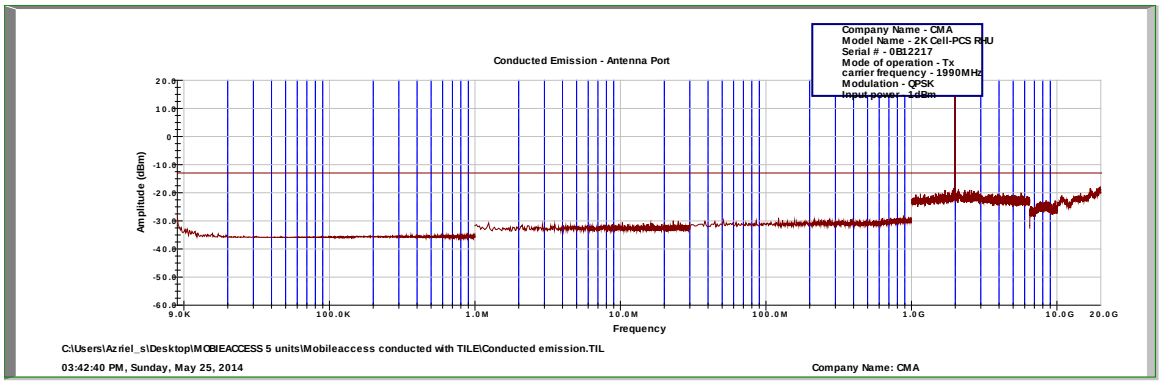

Figure 86.— 1935MHz

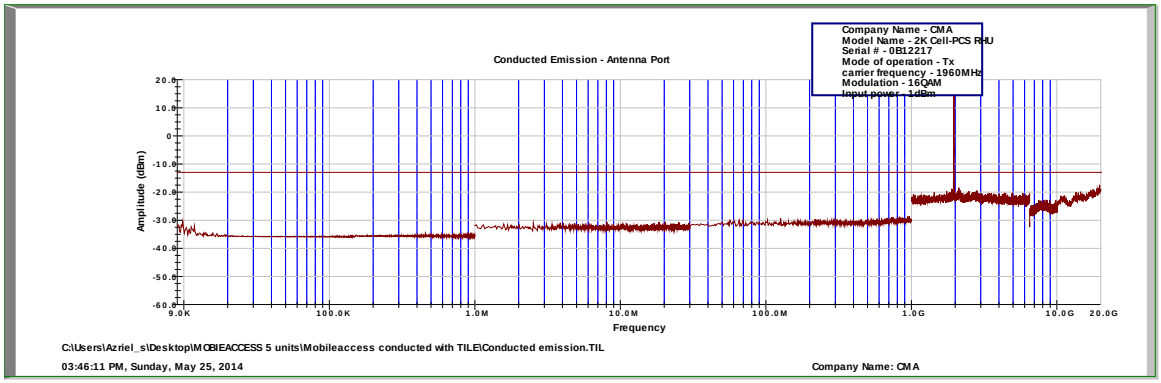

Figure 87.— 1960MHz

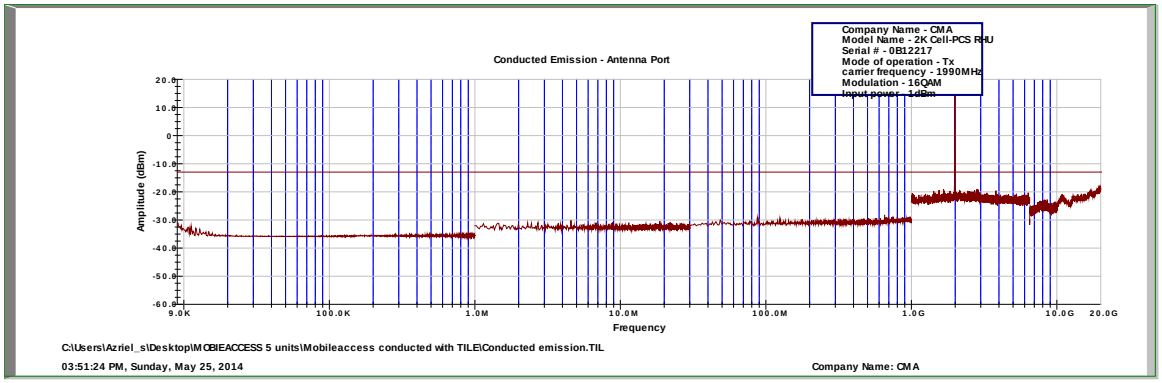

Figure 88.— 1990MHz

64QAM:

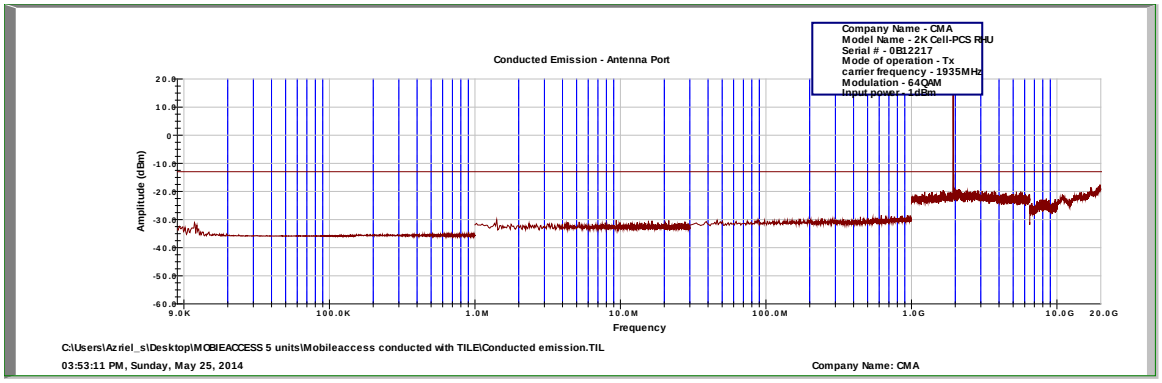

Figure 89.— 1935MHz

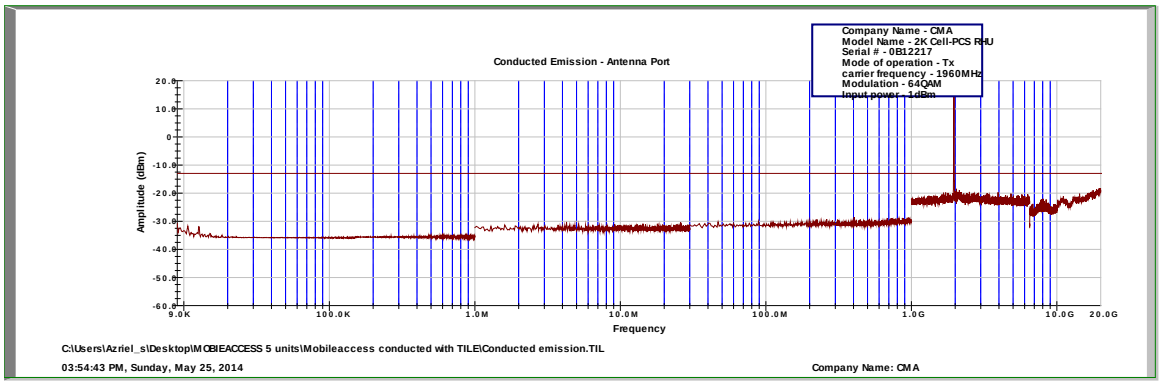

Figure 90.— 1960MHz

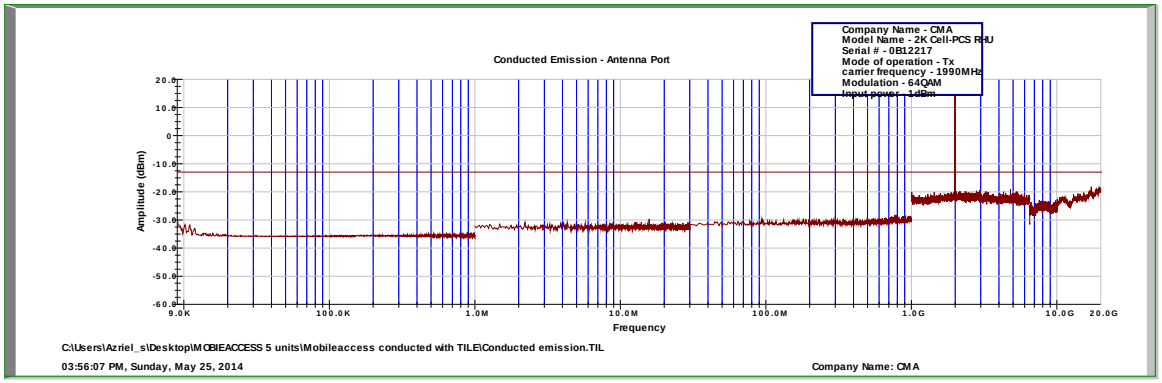

Figure 91. — 1990MHz

10.4 Test Equipment Used; Out of Band Emission at Antenna Terminals PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 92 Test Equipment Used

11. Band Edge Spectrum

11.1 Test Specification

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

11.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency (1935 MHz) and the highest operation frequency (1990 MHz) in which the E.U.T. is planned to be used.

The power of any emission outside of the authorized operating frequency ranges (1930.00-1995.00 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 (30.5 dB).
The spectrum analyzer was set to 100 kHz R.B.W.

11.3 Results Table

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
QPSK	1935	1930	-20.65	-13.0	-7.65
	1985	1990	-21.05	-13.0	-8.05
16QAM	1935	1930	-20.15	-13.0	-7.15
	1985	1990	-21.05	-13.0	-8.05
64QAM	1935	1930	-20.47	-13.0	-7.47
	1985	1990	-21.98	-13.0	-8.98

Figure 93 Band Edge Spectrum Results PCS

See additional information in Figure 94 to Figure 99.

JUDGEMENT: Passed by 7.15 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 03.08.14

Typed/Printed Name: A. Sharabi

QPSK:

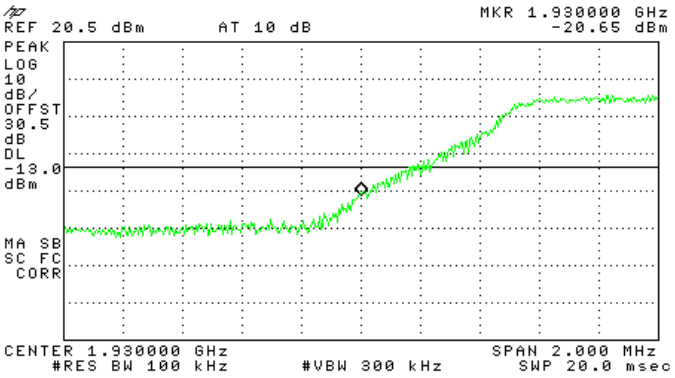

Figure 94.— 1935 MHz

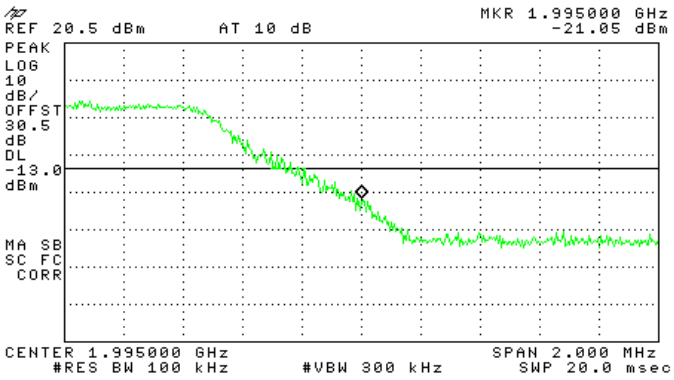

Figure 95.— 1990MHz

16QAM:

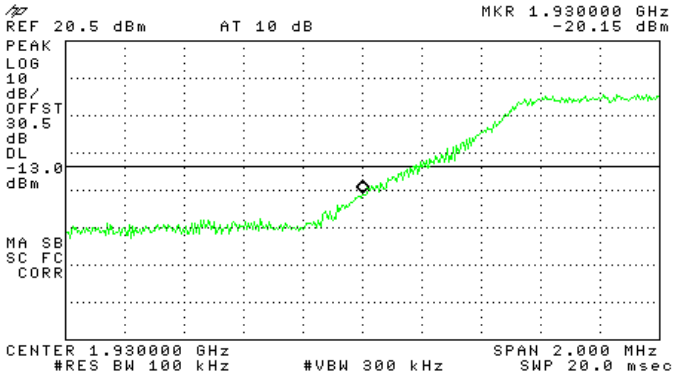

Figure 96.— 1935 MHz

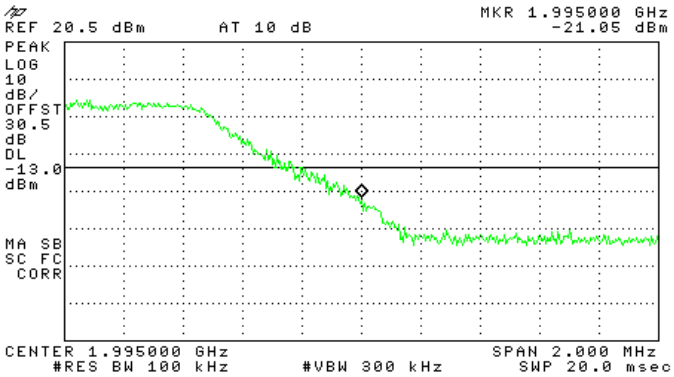

Figure 97.— 1990MHz

64QAM:

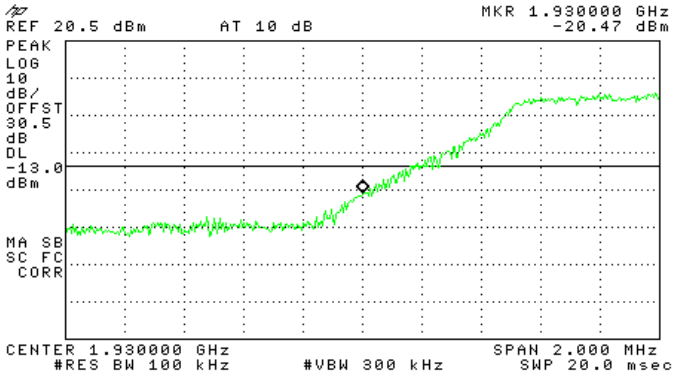

Figure 98.— 1935 MHz

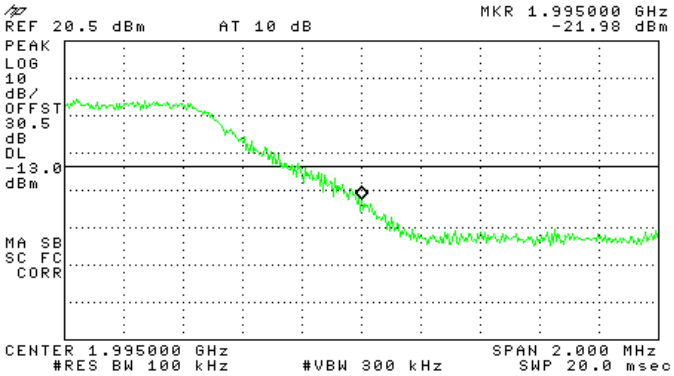

Figure 99.— 1990MHz

11.4 Test Equipment Used; Band Edge Spectrum PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	N5182A	MY48180244	July 28, 2013	1 year
Attenuator	MCE	46-30-34	-	May 25, 2014	1 year
Cable	Rhophase	KPS-5000-KPS	A1674	May 25, 2014	1 year

Figure 100 Test Equipment Used

12. APPENDIX A - CORRECTION FACTORS

12.1 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".

12.2 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.

12.3 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.

12.4 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".*

12.5 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".*

12.6 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".

12.7 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			

12.8 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