



DATE: 14 August 2013

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

FCC Radio Test Report

for


Corning MobileAccess


Equipment under test:

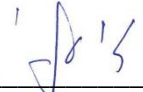
ONE - Optical Network Evolution DAS

**Remote Antenna Unit RAU-R-G-C85P19L70A17-ME
Consisting of RXU P/N:RXU-L70A17-M, GEM and RAU
P/N: RAU-C85P19L70A17**

**CELL-PCS-LTE-AWS
(CELL-PCS Section)**

Written by: 
R. Pinchuck, Documentation

Approved by: 
A. Sharabi, Test Engineer

Approved by: 
I. Raz, EMC Laboratory Manager

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This report relates only to items tested.



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Measurement/Technical Report for
Corning MobileAccess
ONE - Optical Network Evolution DAS

FCC ID: OJF1C85P19L70A17

This report concerns:	Original Grant: X
	Class II change:
	Class I change:

Equipment type:	PCS Licensed Transmitter
Limits used:	
47CFR Parts 2, 22, 24, 27	

Measurement procedure used is ANSI C63.4-2003.

Substitution Method used as in ANSI/TIA-603-C: 2004

Application for Certification prepared by:	Applicant for this device: (different from "prepared by")
Ishaishou Raz	Steve Blum
ITL (Product Testing) Ltd.	Corning MobileAccess
1 Batsheva St.	8391 Old Courthouse Rd., Suite #300
Lod 71100	Vienna, VA. 22182
Israel	U.S.A.
e-mail sraz@itl.co.il	Tel: +1-541-758-2880
	Fax: +1-703-848-0260
	e-mail: sblum@mobileaccess.com



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1. General Information

1.1 Administrative Information

Manufacturer: Corning MobileAccess

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): ONE - Optical Network Evolution
DAS

Equipment Model No.: Remote Antenna Unit RAU-R-G-
C85P19L70A17-ME Consisting of
RXU P/N:RXU-L70A17-M, GEM and
RAU P/N: RAU-C85P19L70A17

Equipment Serial No.: Not Designated

Date of Receipt of E.U.T: 03/04/13

Start of Test: 03/04/13

End of Test: 24/04/13

Test Laboratory Location: I.T.L (Product Testing) Ltd.
1 Batsheva St,
Lod,
Israel 7116002

Test Specifications: FCC Parts 22, 24, 27



1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by/registered with 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. 861911.
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-3006, R-2729, T-1877, G-245.
5. Industry Canada (Canada), IC File No.: 46405-4025; Site No. IC 4025A-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

The Optical Network Platform (ONE™) by Corning provides a flexible in-building RF and network digital coverage solution based on a fiber optic transport backbone.

The fiber-optics infrastructure is easily deployable via a wide range of pre-terminated composite cables and advanced end-to-end equipment. Easy to design, Plug and Play™ connectors, significantly reduce installation cost and deployment time.

The ONE™ solution is an ideal fit for large, high-rise or campus-style deployments. It generates significant CAPEX savings and OPEX savings through the use of user configurable sectorization and an infrastructure that is simple to deploy and efficient in usage.

Dynamic sectorization management allows precise service distribution control to meet changing density needs, and provides further savings by enabling sharing of equipment at various levels for service providers.

Radio source agnostic, remote units can be used as network extenders. Ethernet capability with dedicated fiber link for Wi-Fi offload brings a higher level of granularity and support for devices and applications with very high speed requirements.

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 in Lod, 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):

± 4.98 dB



2. System Test Configuration

2.1 *Justification*

The test setup was configured to closely resemble the standard installation. The EUT consists of the HEU, the OIU and the RAU.

All source signals are represented in the setup by appropriate signal generators. An “Exercise” SW on the computer was used to enable / disable transmission of the RAU, while the EUT output was connected to the spectrum analyzer.

All channels transmitted during the testing.

The CELL and PCS output antenna ports are SISO bands and the LTE and AWS antenna ports are MIMO. Since the RF heads for the MIMO ports are not identical, testing was performed on each port separately.

RF input signal level was 0 dBm for all bands.

There is neither an intermediate amplifier nor donor antenna in the uplink. All components included in the UL path are connected by cables.

2.2 *EUT Exercise Software*

The HCM ver. 0.2 build 19 used for commands delivery.

ACM – ACM_2A00_00.62

RIM – RIM_6A00_00.51

RIM-M – RMM_5A00_00.52

OIM – OIM_7A00_03.50

RAU – RAU_8A00_03.54

RXU – RXU_AA00_00.44

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

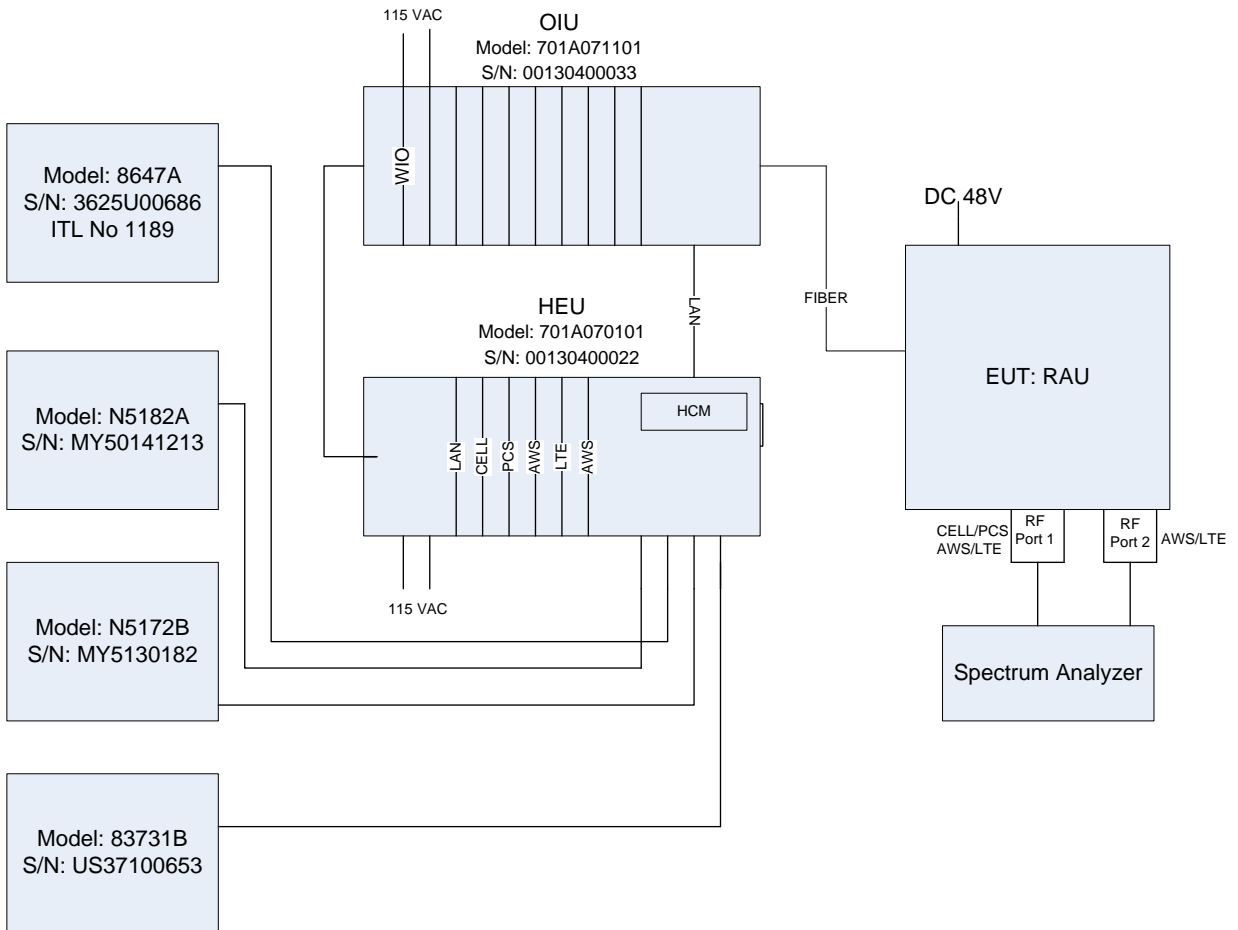


Figure 1. Test Set-up

3. Test Set-up Photos

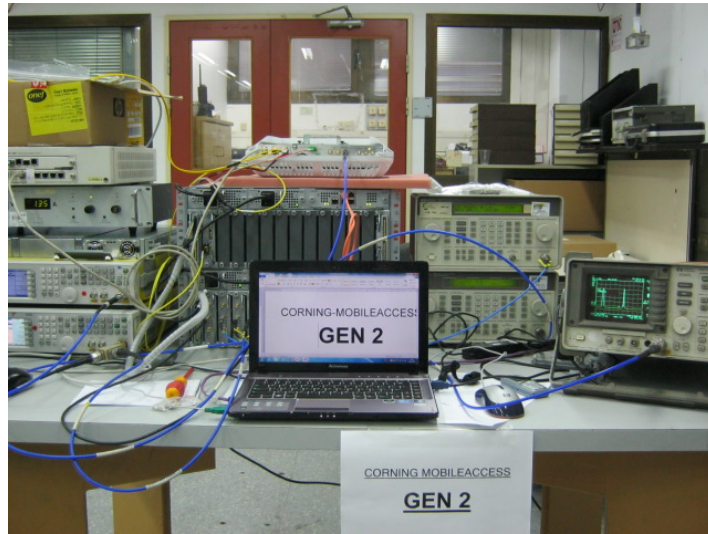


Figure 2. Conducted Emission From Antenna Port Tests



Figure 3. Radiated Emission Test



Figure 4. Radiated Emission Test



Figure 5. Radiated Emission Test

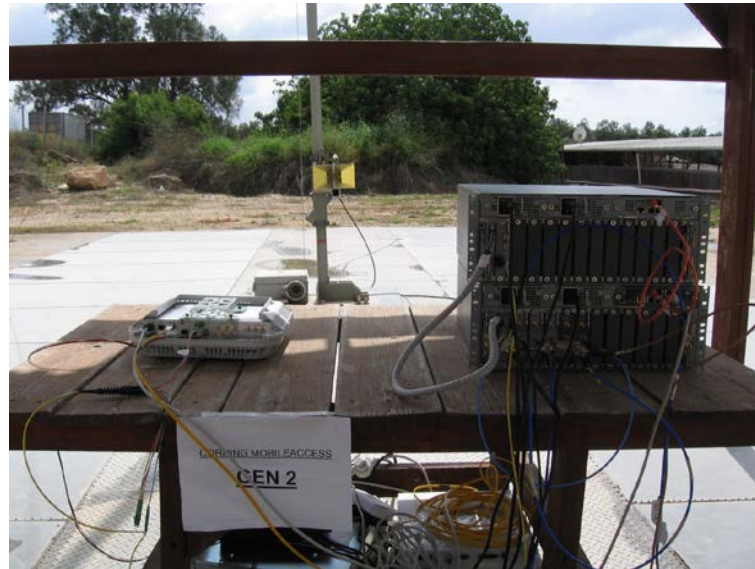


Figure 6. Radiated Emission Test



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 and an appropriate coaxial cable (loss=30.7 dB). 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 100 kHz RBW. The output power level was measured at the low, mid and high channels of each modulation.

4.3 Test Results


Modulation	Operation Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	874.0	15.94	57.00	-41.06
	881.0	16.69	57.00	-40.31
	889.0	16.35	57.00	-40.65
CDMA	870.2	16.75	57.00	-40.25
	881.0	16.34	57.00	-40.66
	892.8	16.61	57.00	-40.39
GSM	870.2	15.59	57.00	-41.41
	881.0	15.44	57.00	-41.56
	892.8	15.01	57.00	-41.99
W-CDMA	871.5	16.47	57.00	-40.53
	881.0	17.78	57.00	-39.22
	891.5	16.78	57.00	-40.22

Figure 7 Peak Output Power CELL

See additional information in Figure 8 to Figure 19.

JUDGEMENT: Passed by 39.22 dB

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13.

Typed/Printed Name: A. Sharabi



LTE 64QAM:

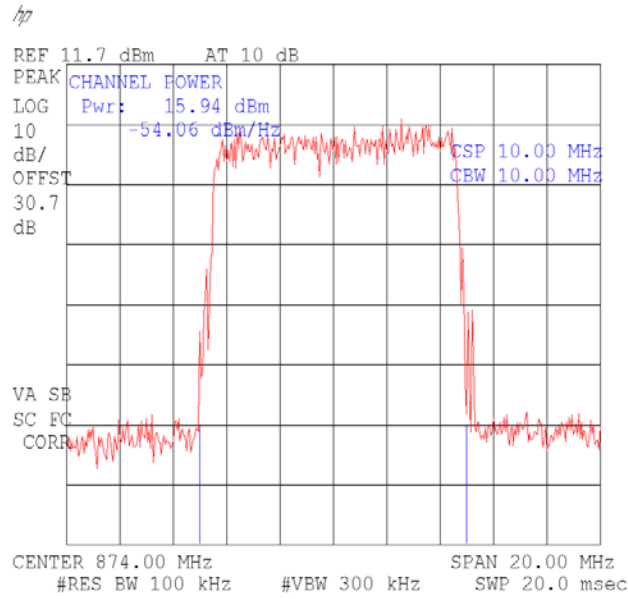


Figure 8.— 874.00 MHz

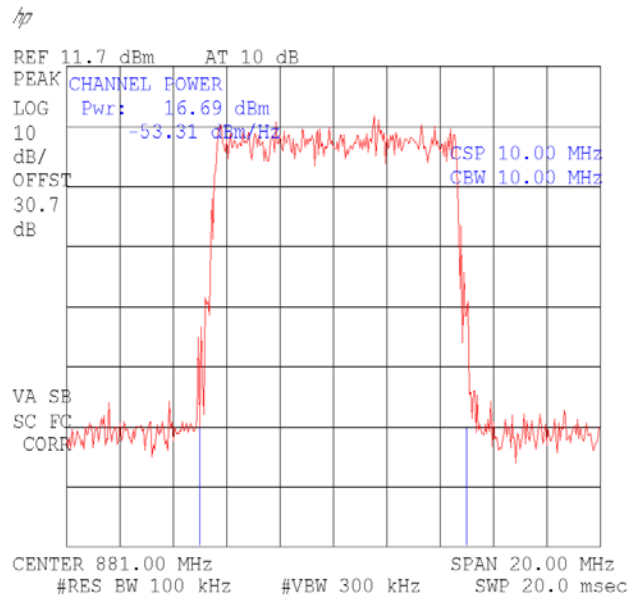


Figure 9.— 881.00 MHz

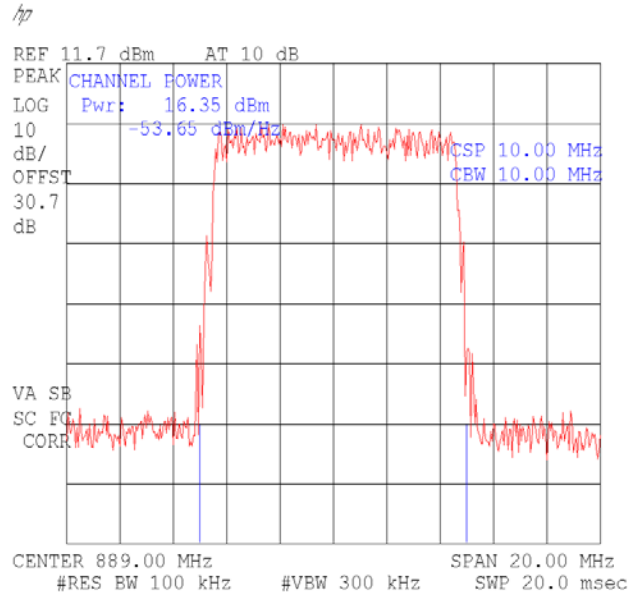


Figure 10.— 889.0 MHz

CDMA:

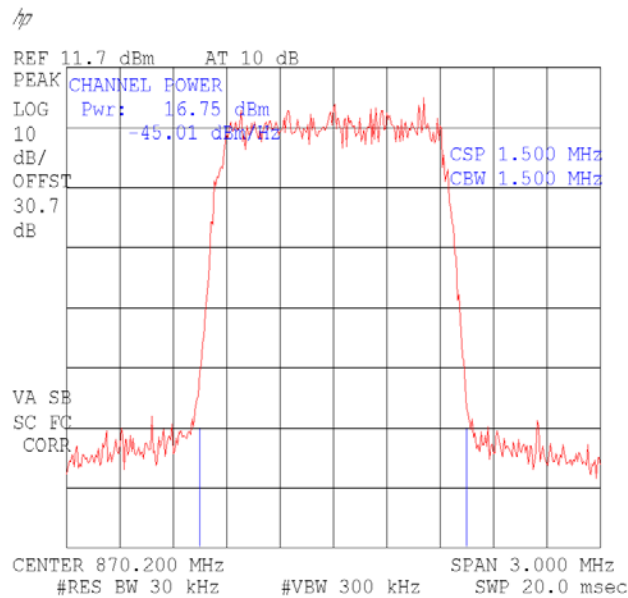


Figure 11.— 870.20 MHz

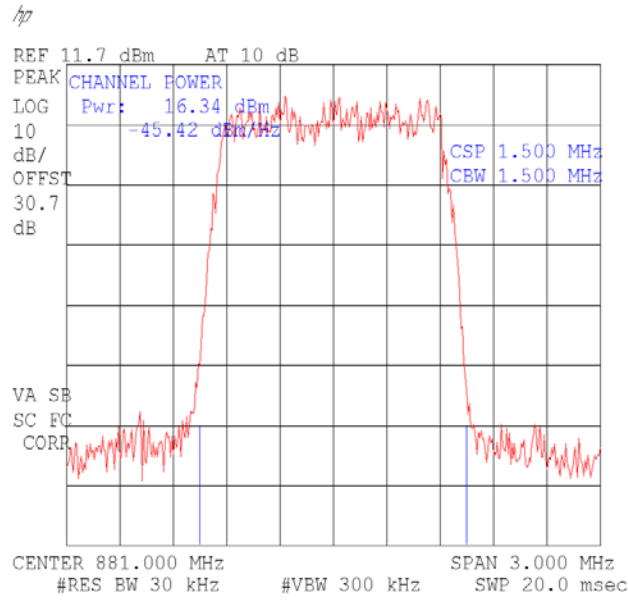


Figure 12.— 881.00 MHz

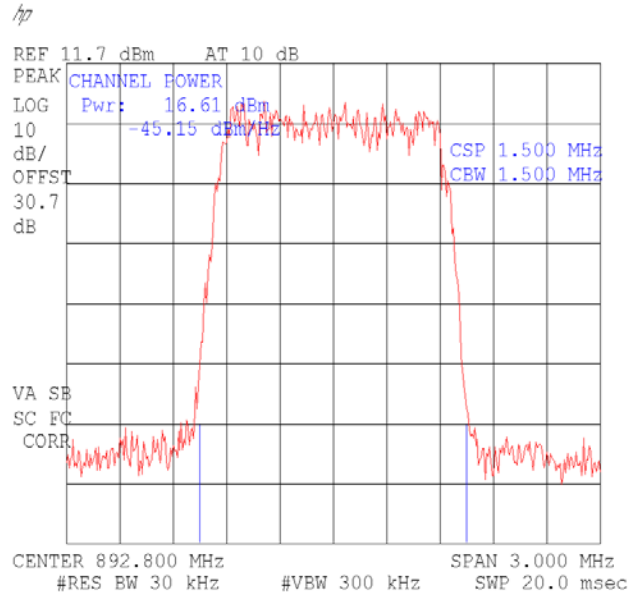


Figure 13.— 892.80 MHz



GSM:

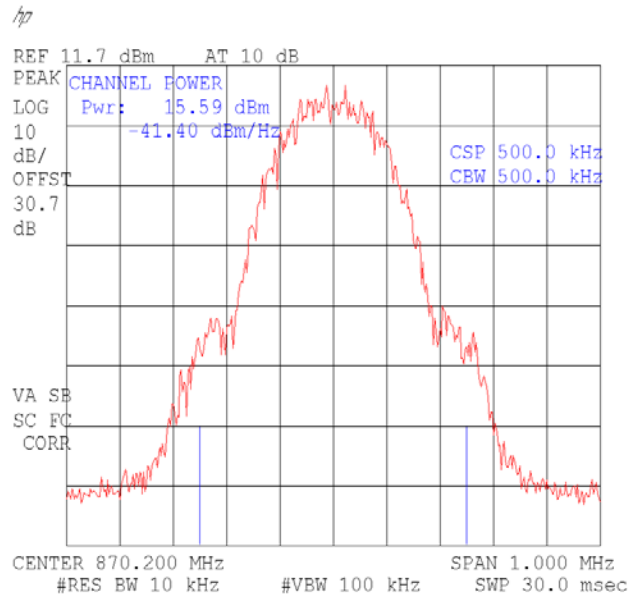


Figure 14.— 870.20 MHz

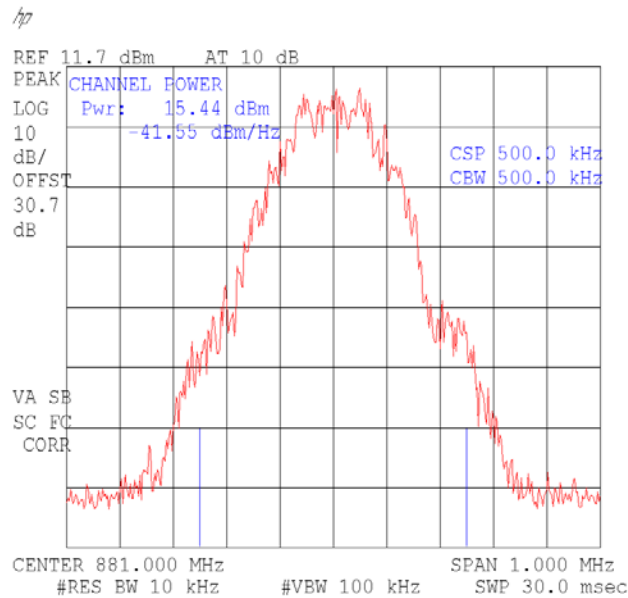


Figure 15.— 881.00 MHz

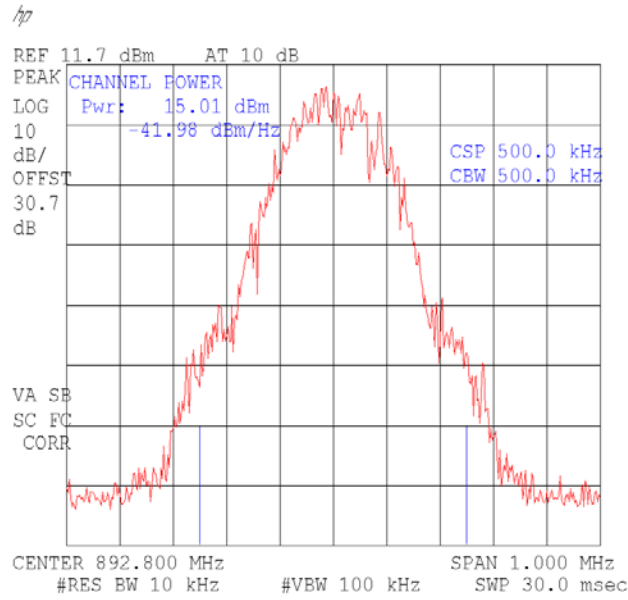


Figure 16.— 892.80 MHz

W-CDMA:

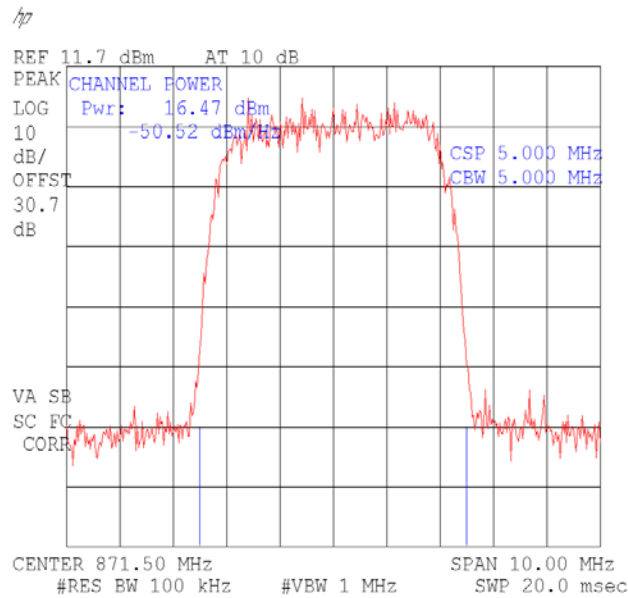


Figure 17.— 871.50 MHz

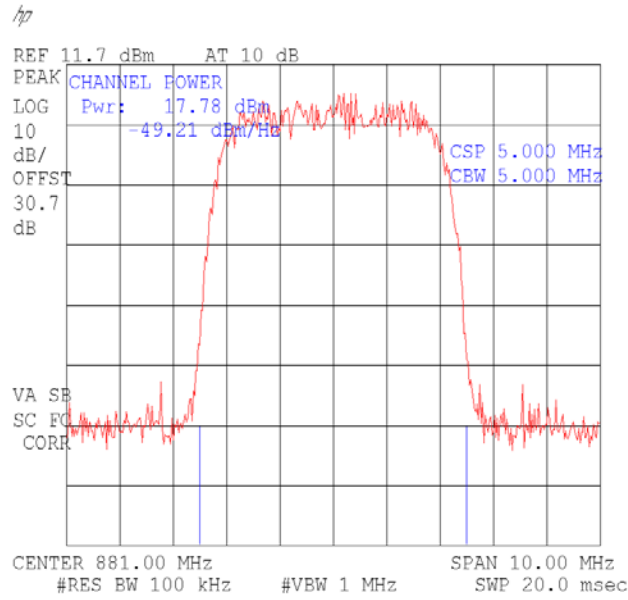


Figure 18.— 881.00 MHz

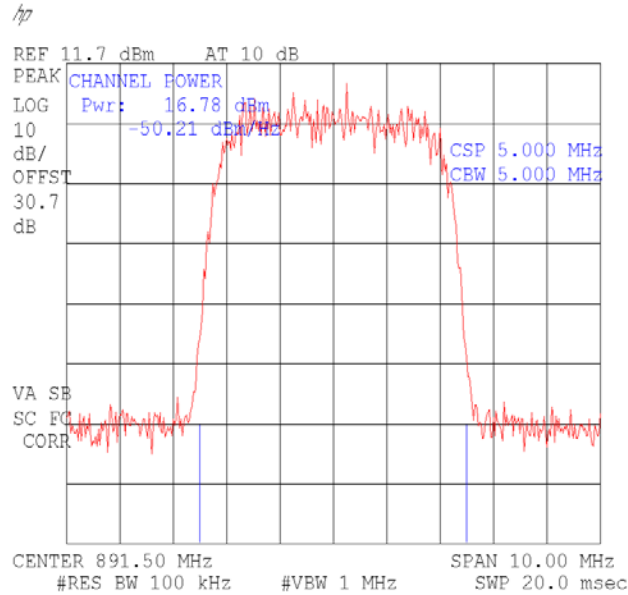


Figure 19.— 891.50 MHz



4.4 Test Equipment Used

Peak Output Power CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 20 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 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 Test Results


Modulation		Operating Frequency (MHz)	Reading (MHz)
LTE 64QAM	Input	874.0	9.35
LTE 64QAM	Output	874.0	9.30
LTE 64QAM	Input	881.0	9.25
LTE 64QAM	Output	881.0	9.38
LTE 64QAM	Input	889.0	9.25
LTE 64QAM	Output	889.0	9.26
GSM	Input	870.2	0.2825
GSM	Output	870.2	0.2775
GSM	Input	881.0	0.2875
GSM	Output	881.0	0.280
GSM	Input	892.8	0.2725
GSM	Output	892.8	0.280
CDMA	Input	870.2	1.36
CDMA	Output	870.2	1.34
CDMA	Input	881.0	1.35
CDMA	Output	881.0	1.34
CDMA	Input	892.8	1.34
CDMA	Output	892.8	1.34
W-CDMA	Input	871.5	4.6
W-CDMA	Output	871.5	4.58
W-CDMA	Input	881.0	4.60
W-CDMA	Output	881.0	4.53
W-CDMA	Input	891.5	4.60
W-CDMA	Output	891.5	4.60

Figure 21 Occupied Bandwidth CELL

See additional information in Figure 22 to Figure 45.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13

Typed/Printed Name: A. Sharabi



LTE:

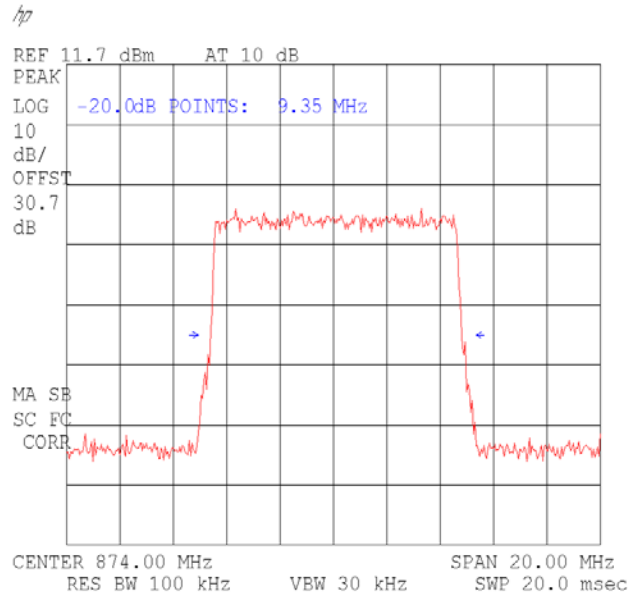


Figure 22.— 64QAM Input 874.0MHz.

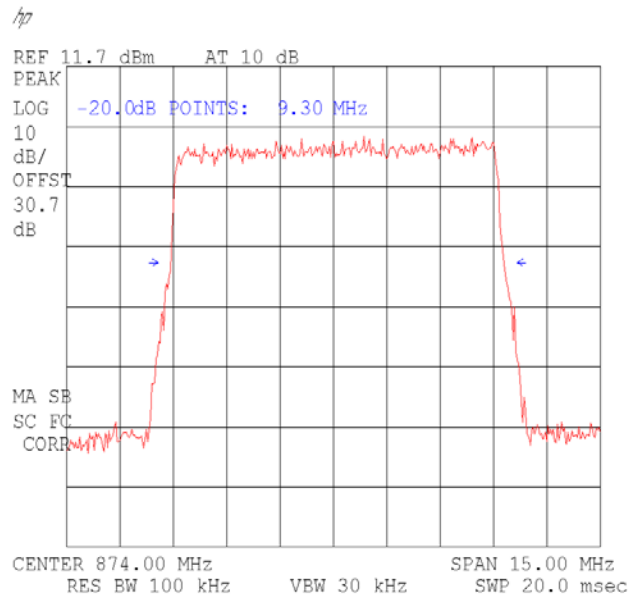


Figure 23.— 64QAM Output 874.0MHz.

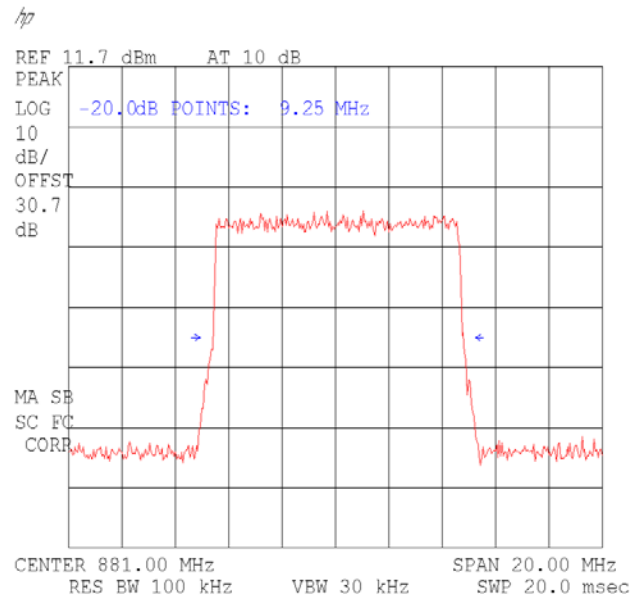


Figure 24.— 64QAM Input 881.0 MHz

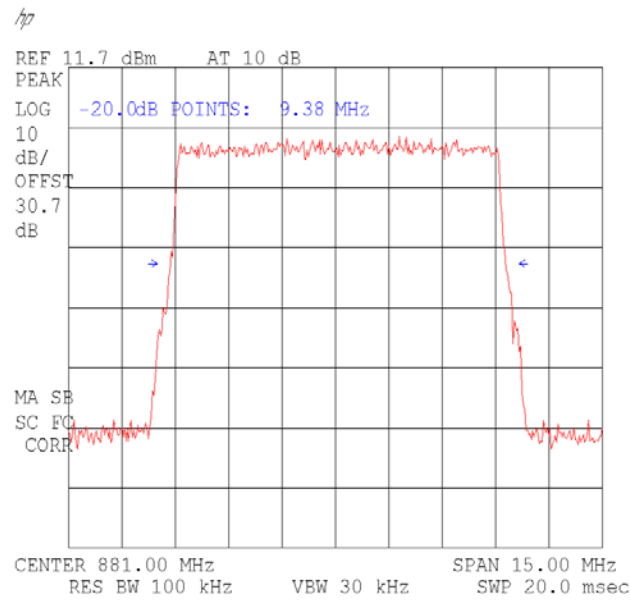


Figure 25.— 64QAM Output 881.0MHz.

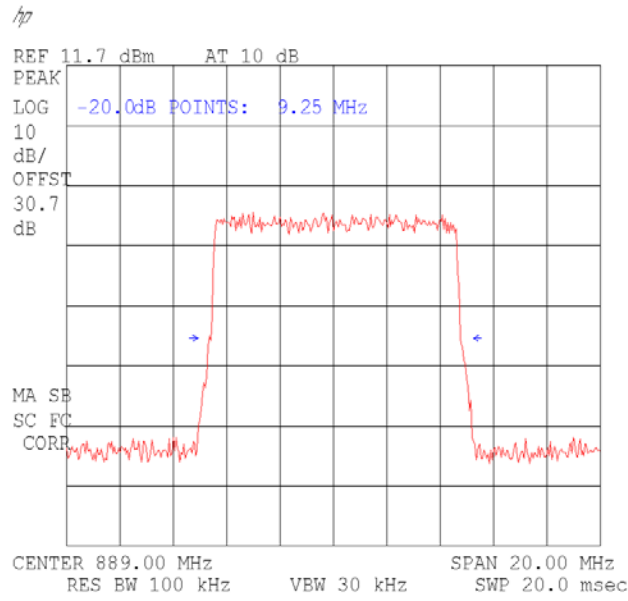


Figure 26.— 64QAM Input 889.00 MHz

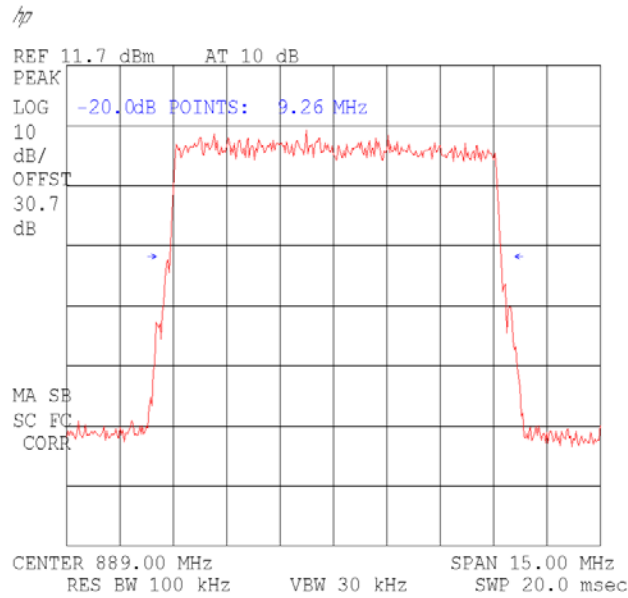


Figure 27.— 64QAM Output 889.00 MHz



GSM:

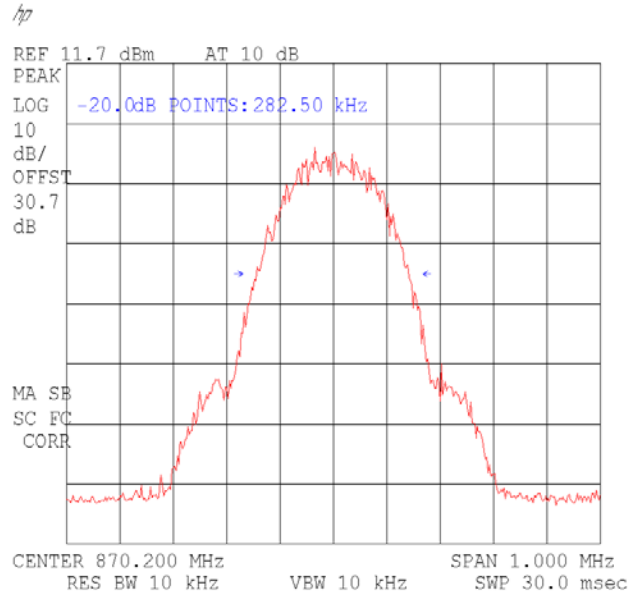


Figure 28.— Input 870.20MHz.

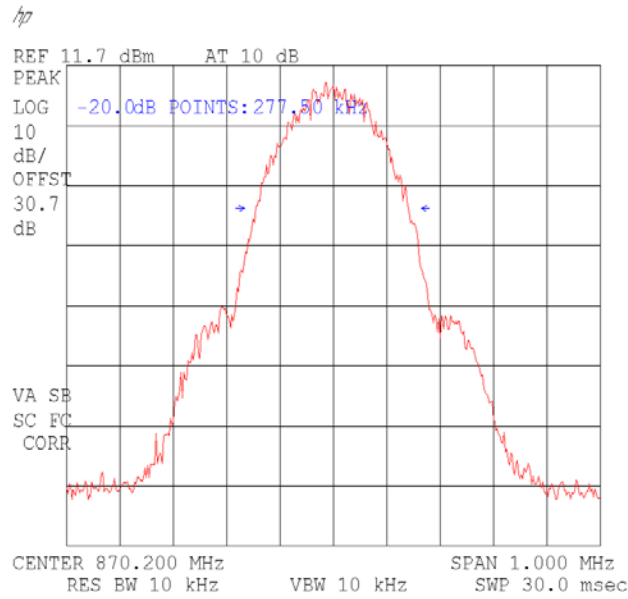


Figure 29.— Output 870.20MHz.

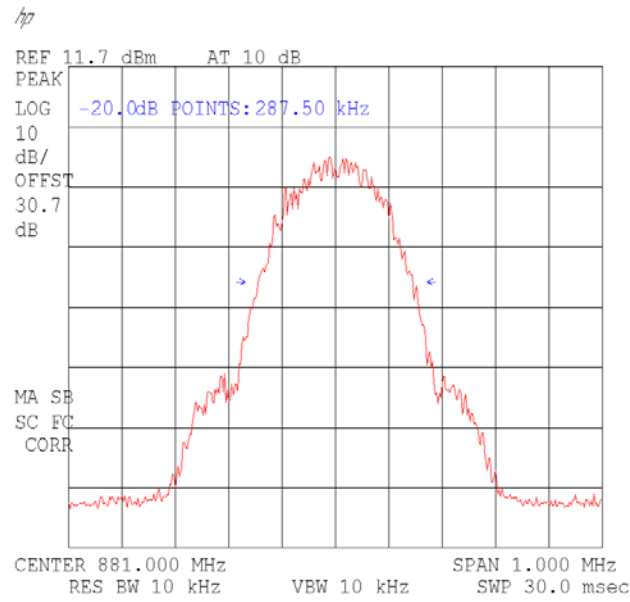


Figure 30.— Input 881.0 MHz .

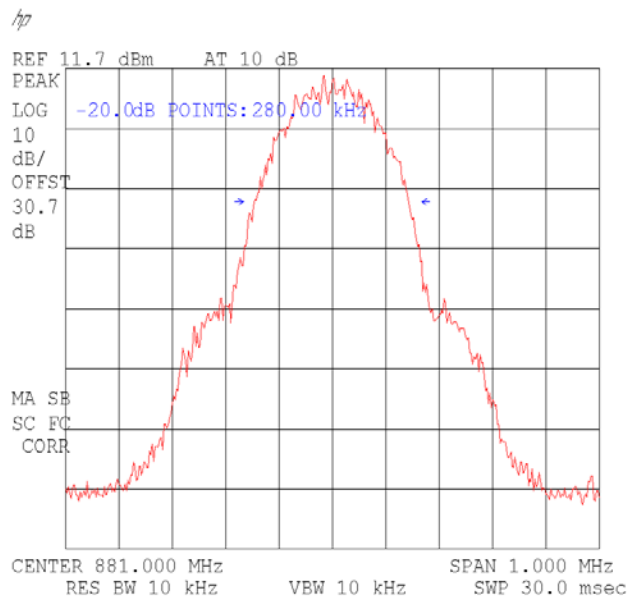


Figure 31.—Output 881.0MHz.

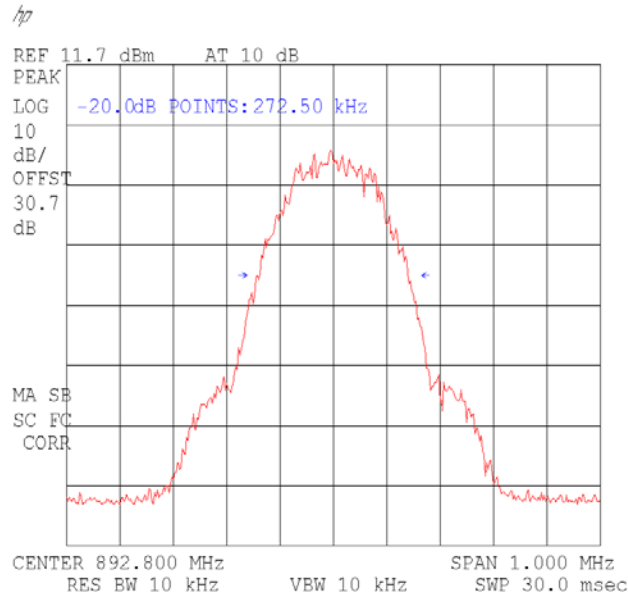


Figure 32.— Input 892.8 MHz.

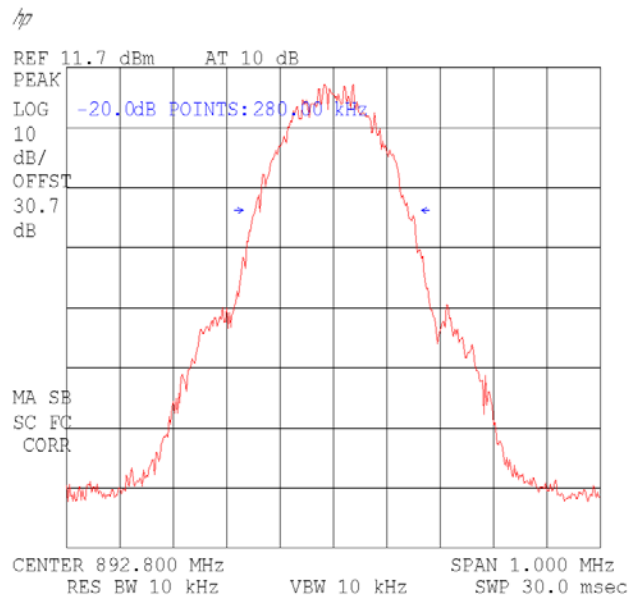


Figure 33.— Output 892.8 MHz.



CDMA:

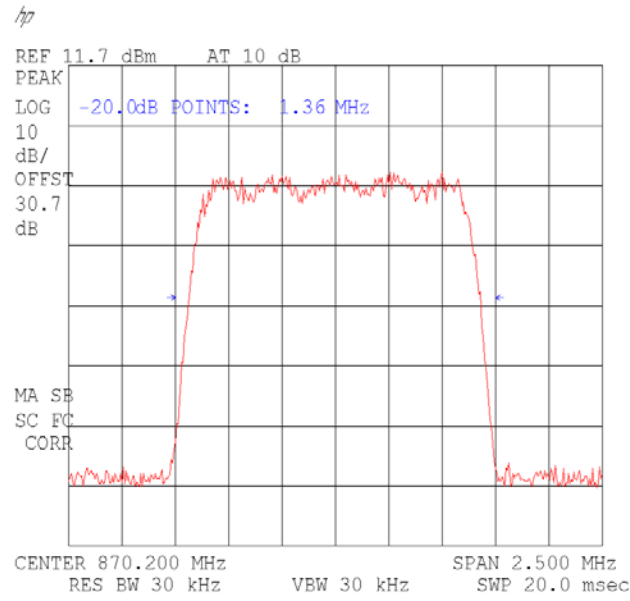


Figure 34.— Input 870.20MHz

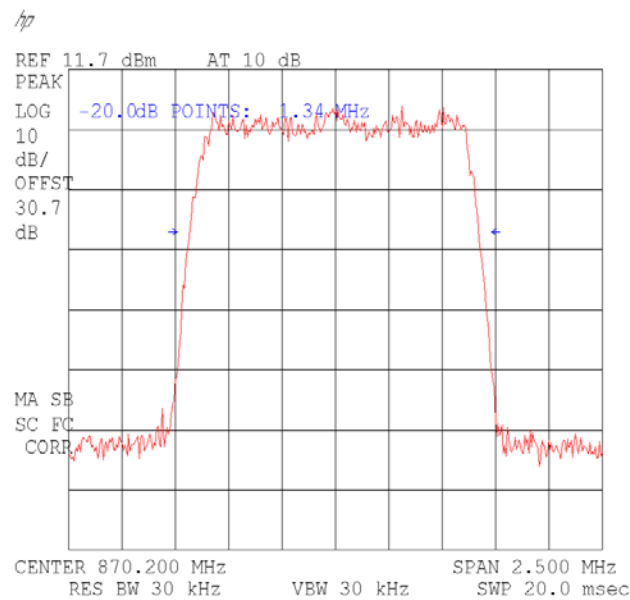


Figure 35.— Output 870.20MHz

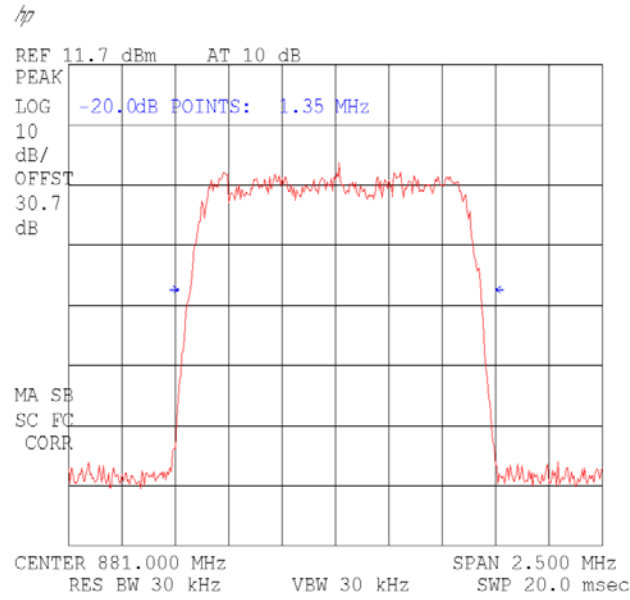


Figure 36.— Input 881.0 MHz.

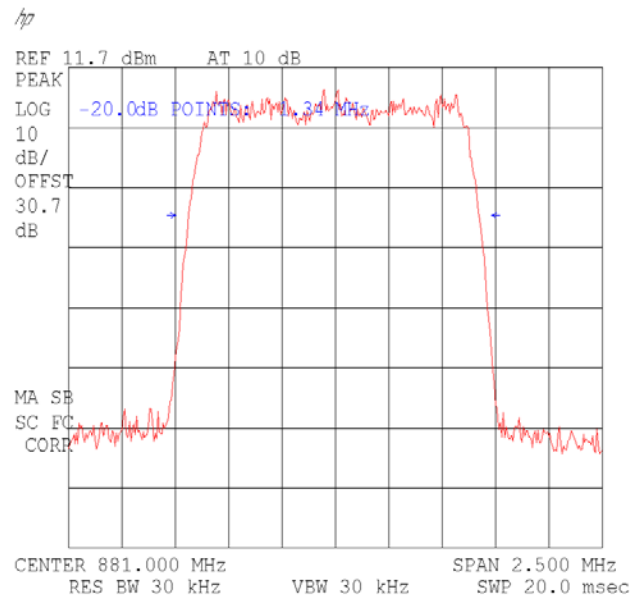


Figure 37.—Output 881.0MHz.

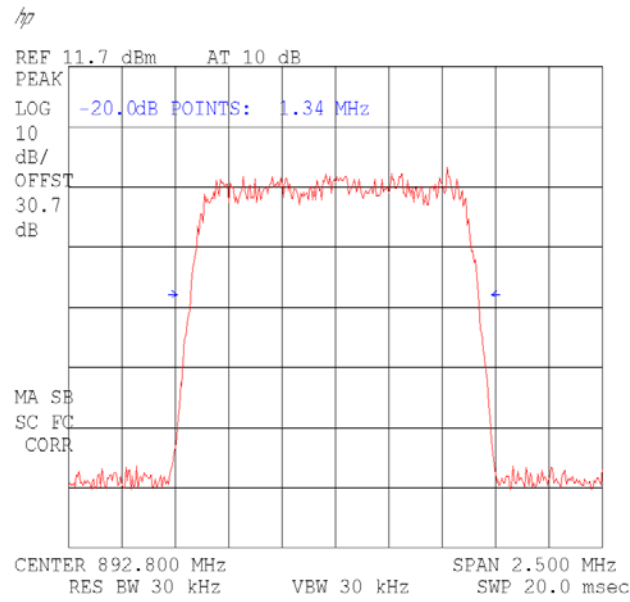


Figure 38.— Input 892.8 MHz.

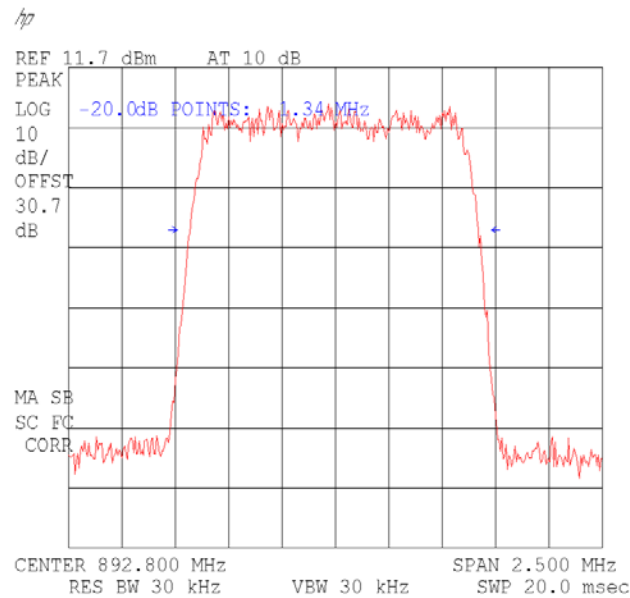


Figure 39.— Output 892.8 MHz.



W-CDMA:

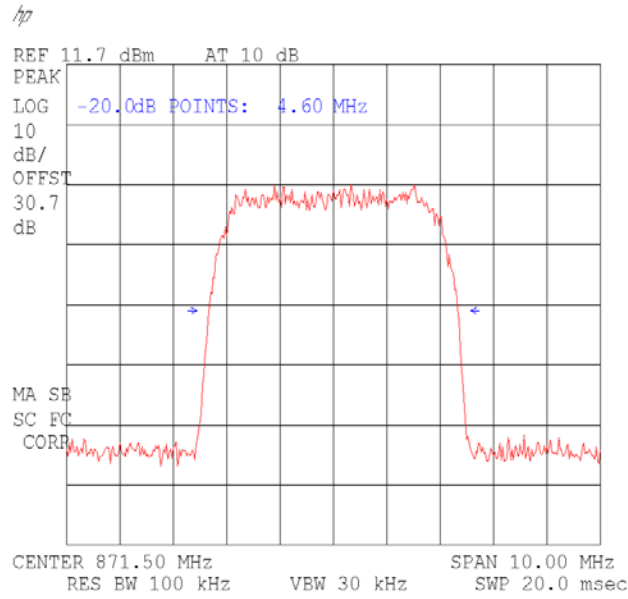


Figure 40.— Input 871.50MHz

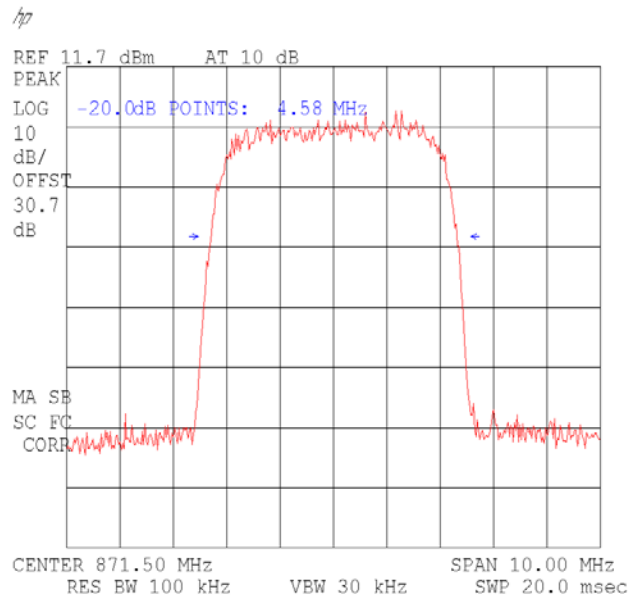


Figure 41.— Output 871.50MHz

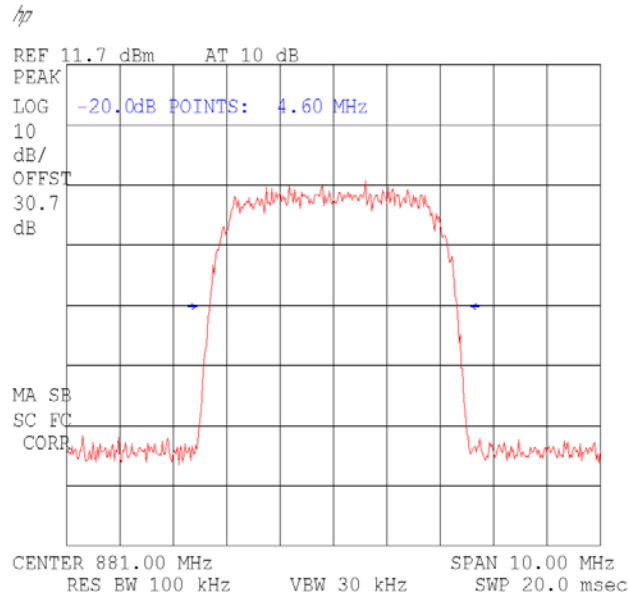


Figure 42.— Input 881.0 MHz.

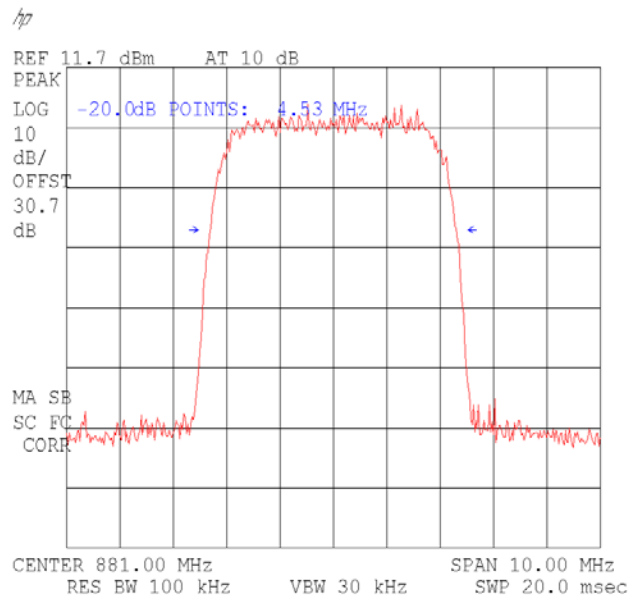


Figure 43.—Output 881.0MHz.

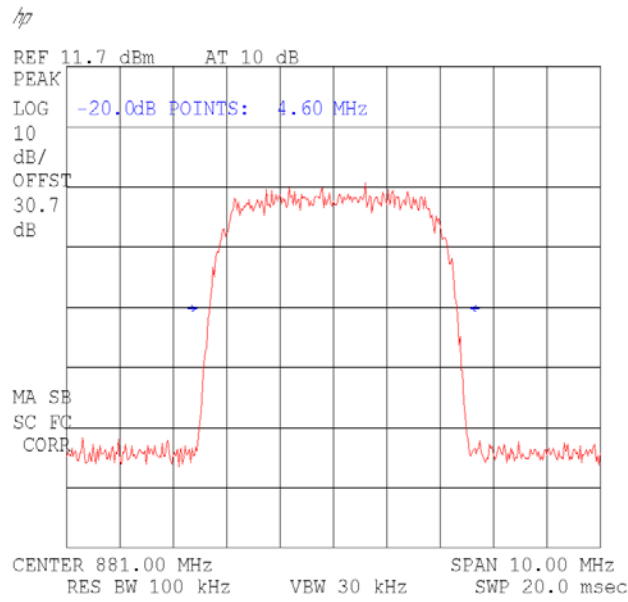


Figure 44.— Input 891.50 MHz.

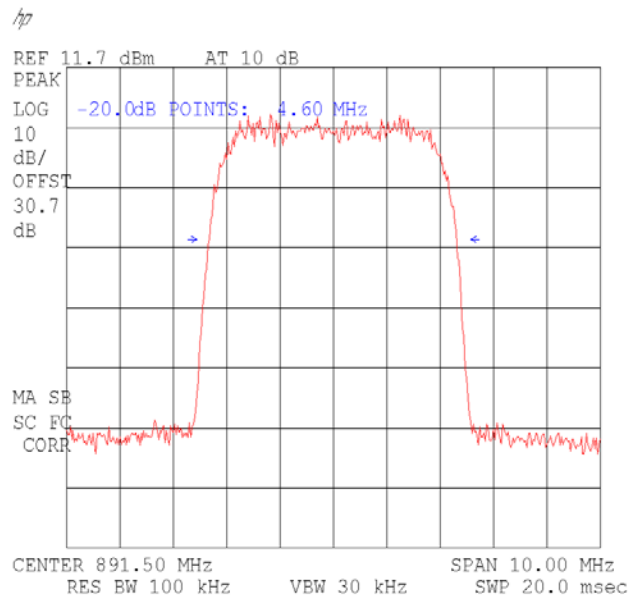


Figure 45.— Output 891.50 MHz.



5.4 Test Equipment Used

Occupied Bandwidth CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 46 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 (31.0 dB).


The spectrum analyzer was set to 1 kHz R.B.W. for the frequency range of 9 kHz – 1 MHz, 100 kHz for the frequency range of 1 – 30 MHz, and 1 MHz for the frequency range of 30 MHz – 10 GHz.

6.3 Test Results

See additional information in Figure 47 to Figure 58.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13

Typed/Printed Name: A. Sharabi



LTE 64QAM:

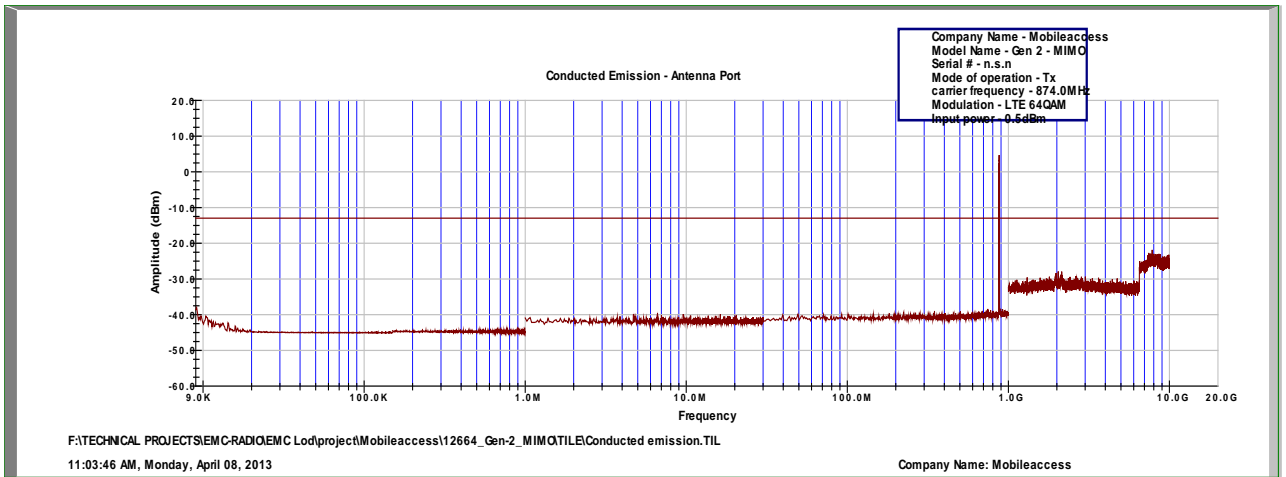


Figure 47.— 874.0 MHz

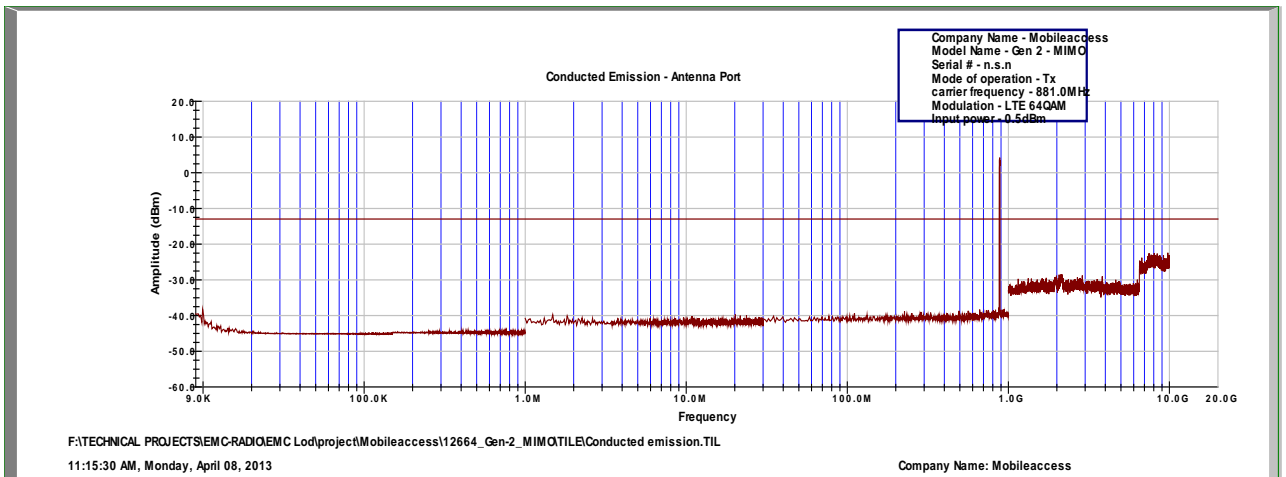


Figure 48.— 881.0 MHz

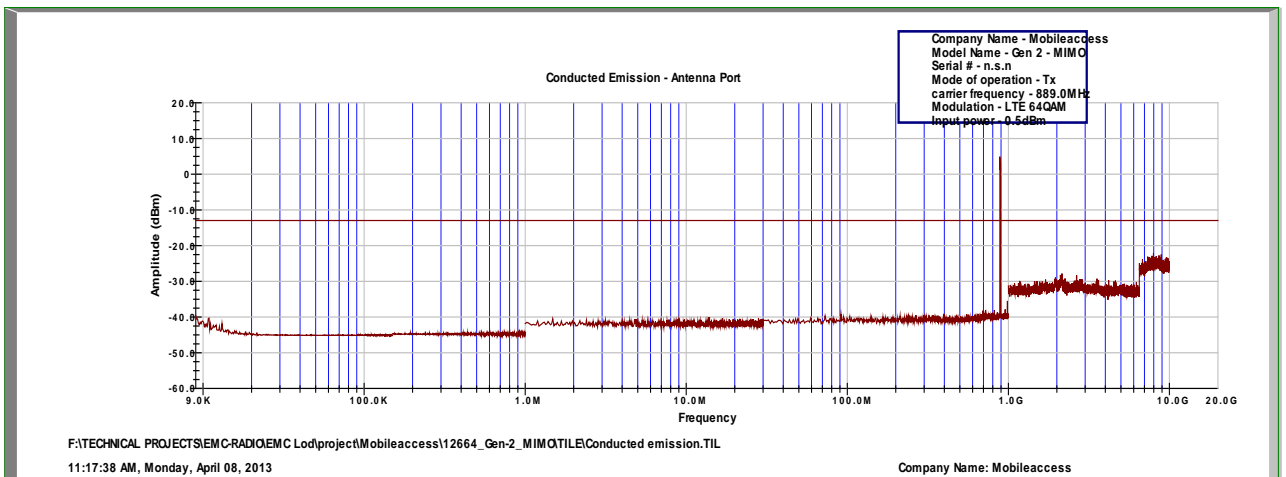


Figure 49.— 889.0 MHz



CDMA:

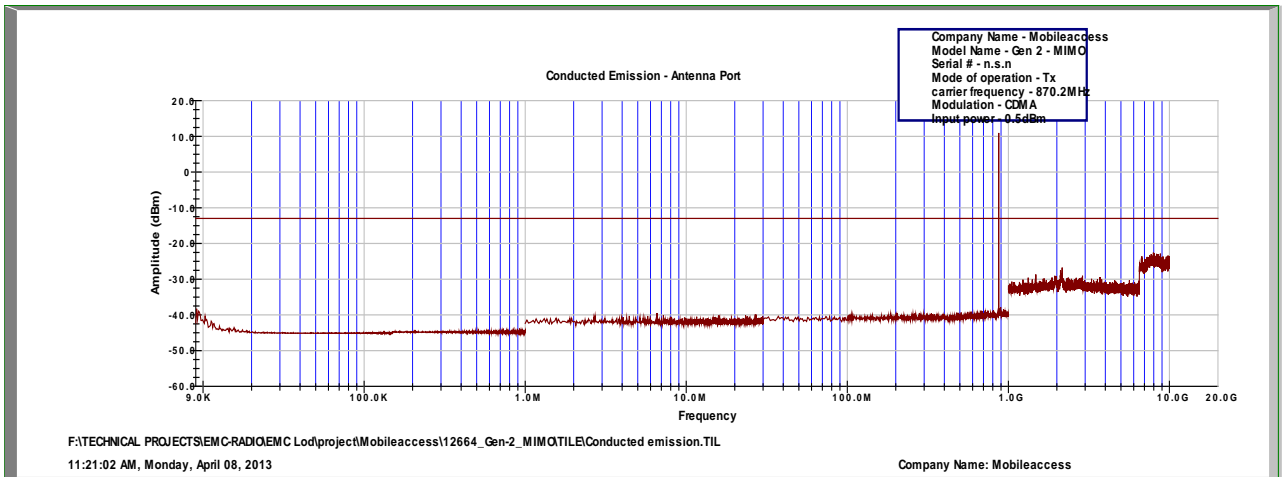


Figure 50.— 870.2 MHz

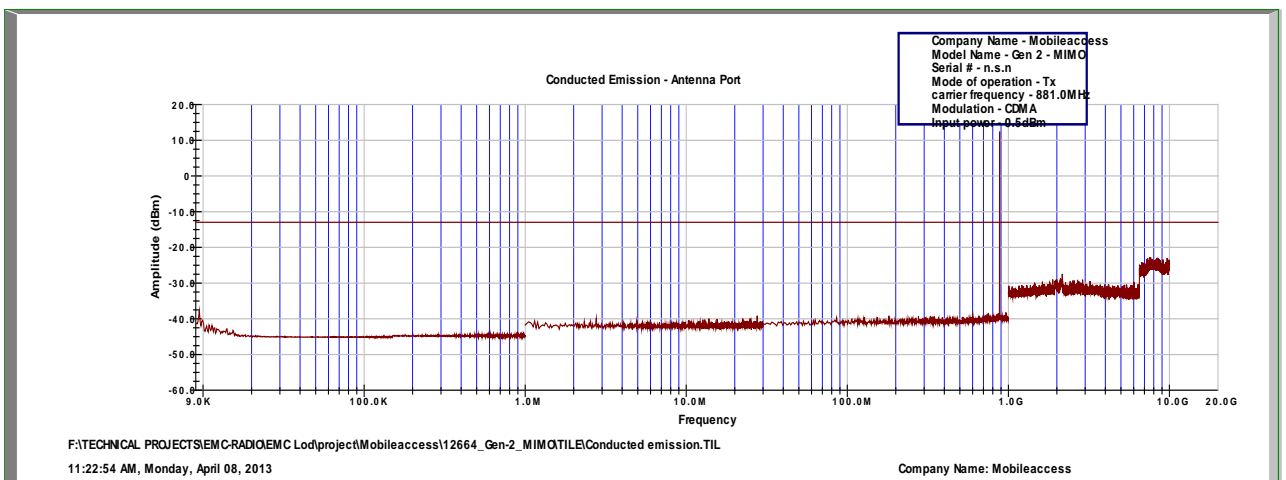


Figure 51.— 881.0 MHz

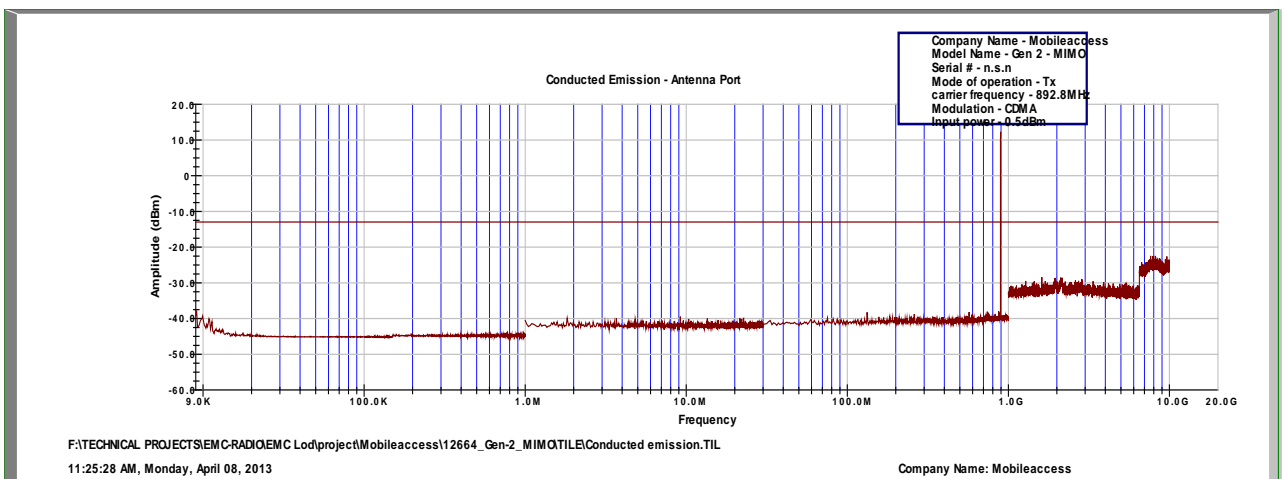


Figure 52.— 892.8 MHz



GSM:

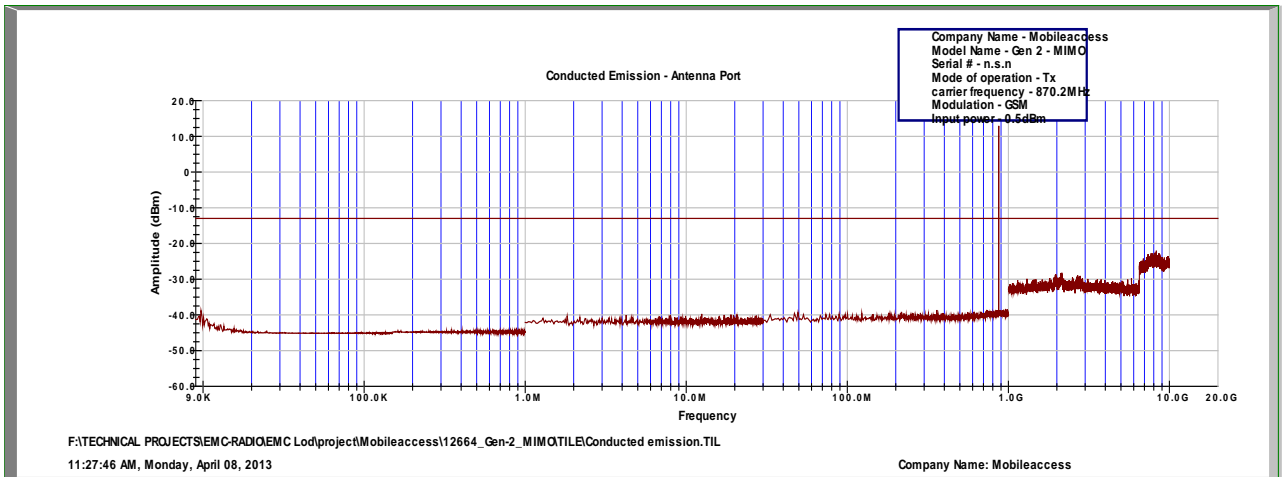


Figure 53.— 870.2 MHz

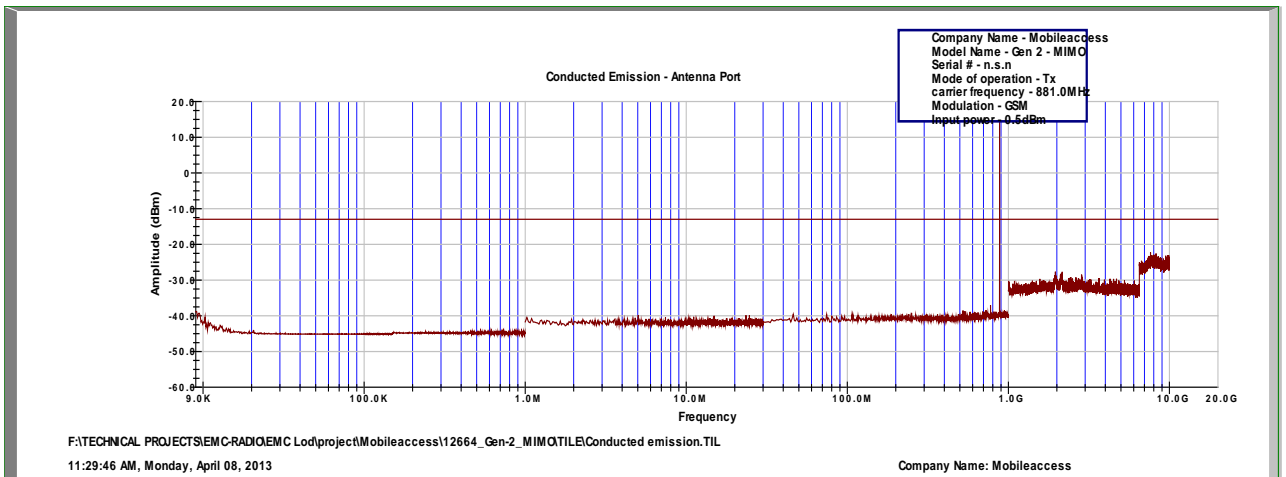


Figure 54.— 881.0 MHz

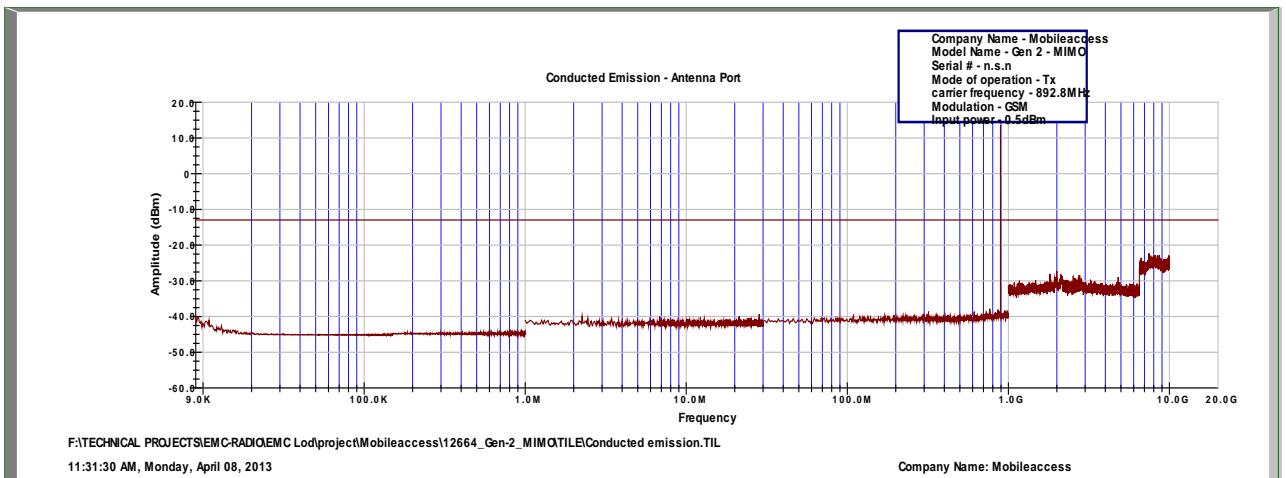


Figure 55.— 892.8 MHz



WCDMA:

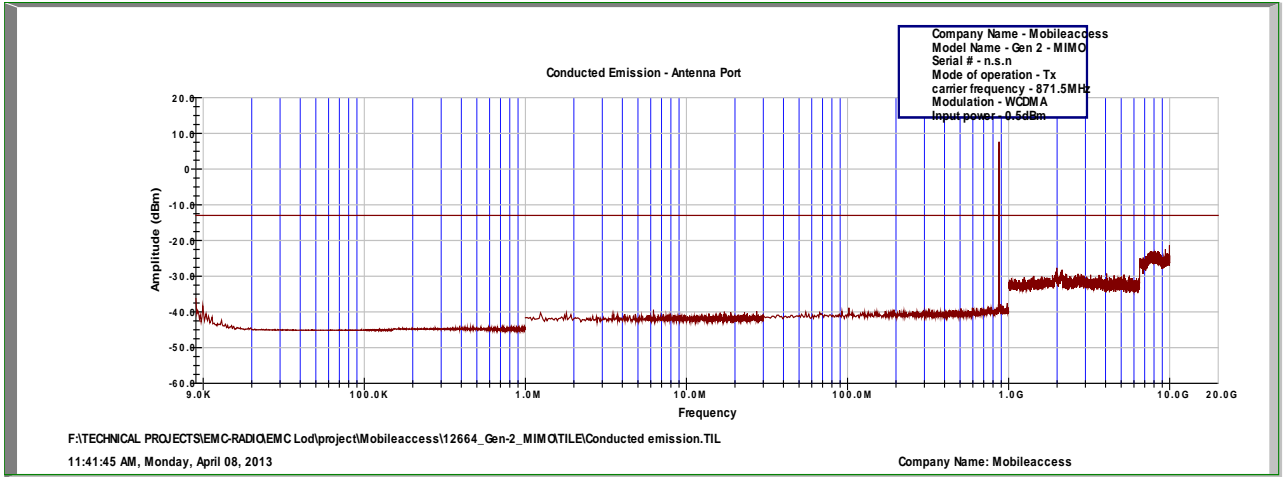


Figure 56.— 871.5 MHz

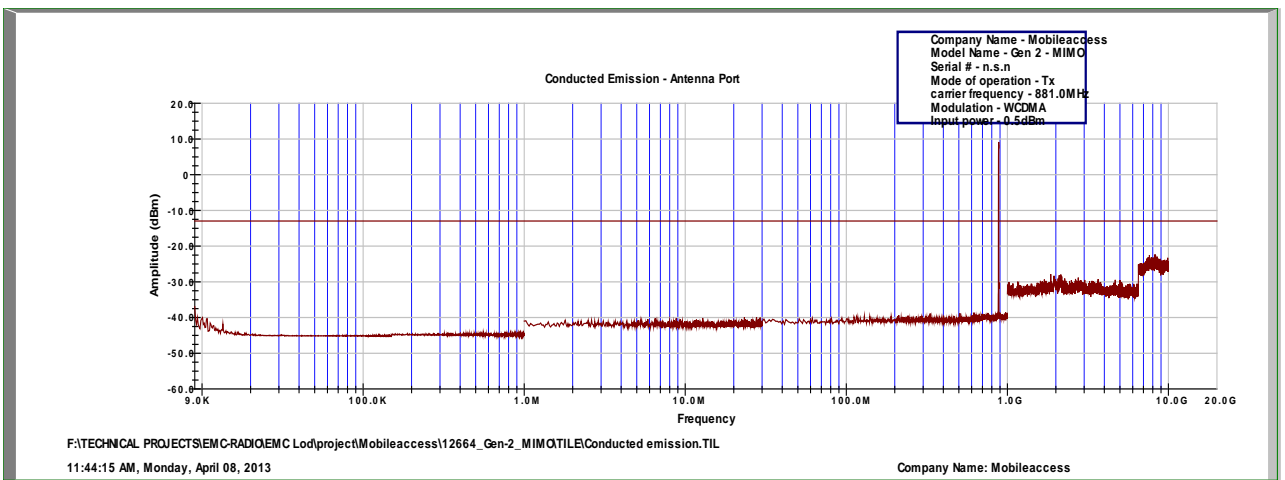


Figure 57.— 881.0 MHz

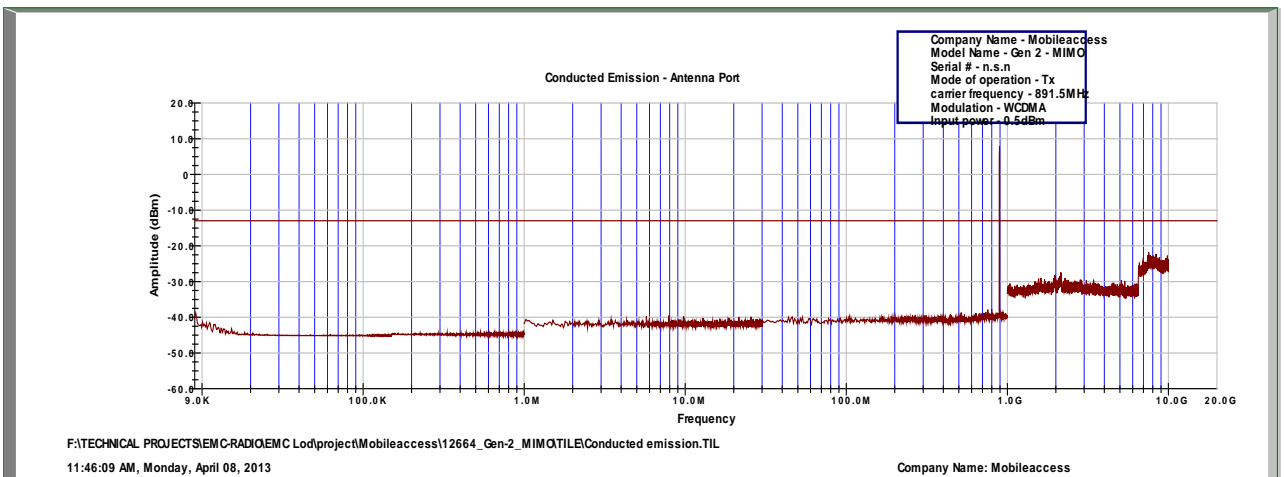


Figure 58.— 891.5 MHz



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	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 59 Test Equipment Used



7. Band Edge Spectrum CELL

7.1 Test Specification

FCC Part 22, 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 (30.7 dB).

The spectrum analyzer was set to 100 kHz R.B.W.



7.3 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	874.00	869.00	-23.87	-13.0	-10.87
	889.00	894.00	-23.65	-13.0	-10.65
CDMA	870.20	869.00	-43.11	-13.0	-30.11
	892.80	894.00	-43.23	-13.0	-30.23
GSM	870.20	869.00	-44.30	-13.0	-31.30
	892.80	894.00	-46.77	-13.0	-33.77
W-CDMA	871.50	869.00	-36.96	-13.0	-23.96
	891.50	894.00	-34.89	-13.0	-21.89

Figure 60 Band Edge Spectrum Results CELL

See additional information in Figure 61 to Figure 68.

JUDGEMENT: Passed by 10.65 dB

TEST PERSONNEL:

Tester Signature:  _____

Date: 07.05.13

Typed/Printed Name: A. Sharabi



LTE:

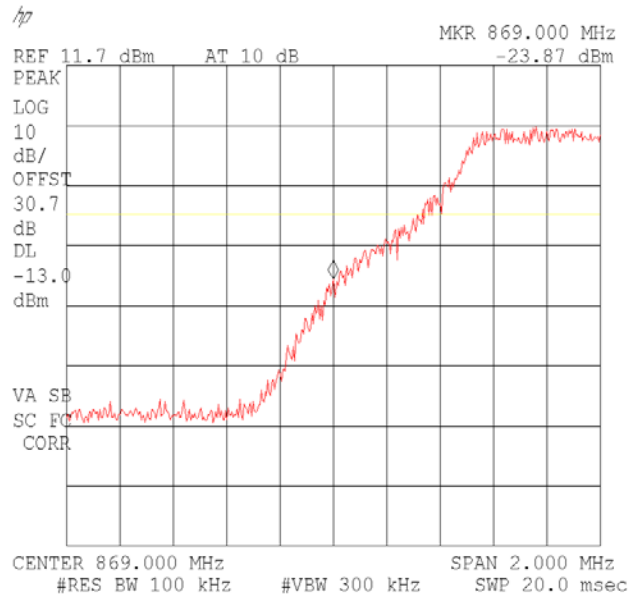


Figure 61.— 64QAM 874.00 MHz

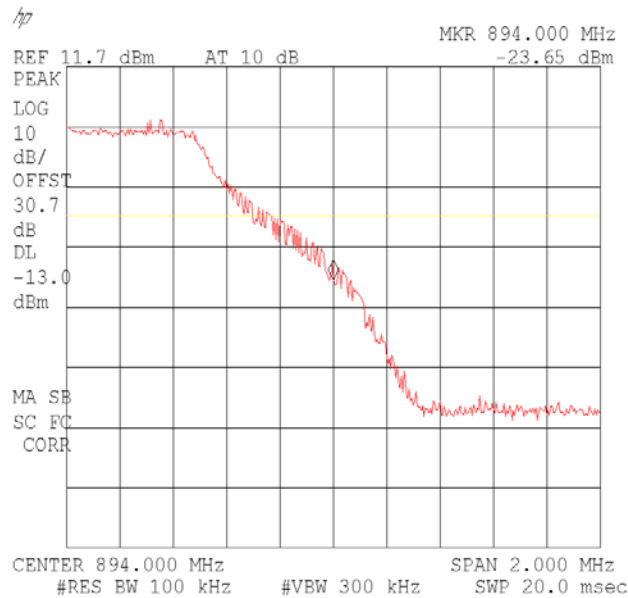


Figure 62.— 64QAM 889.00 MHz



CDMA:

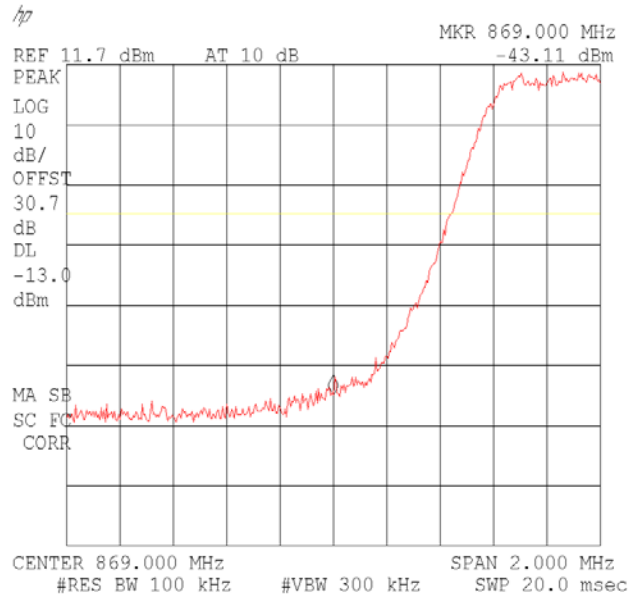


Figure 63.— 870.20 MHz

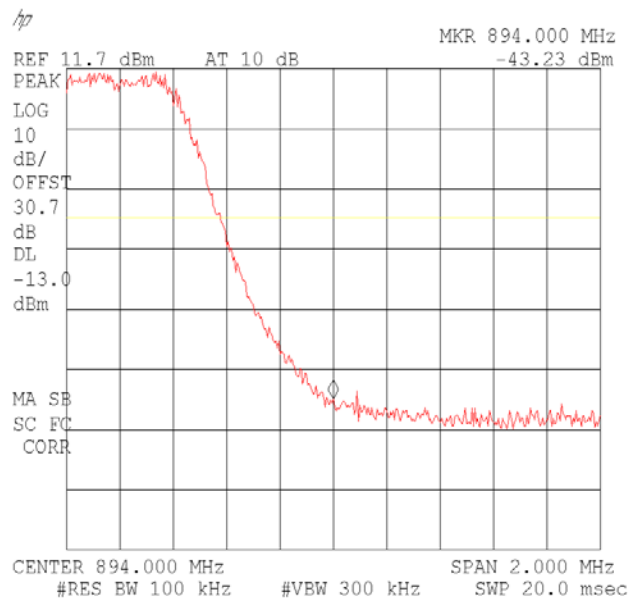


Figure 64.— 892.80 MHz



GSM:

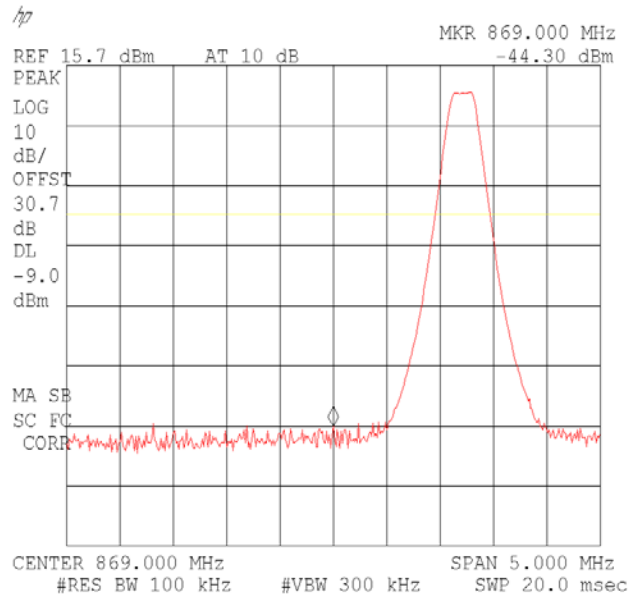


Figure 65.— 870.20 MHz

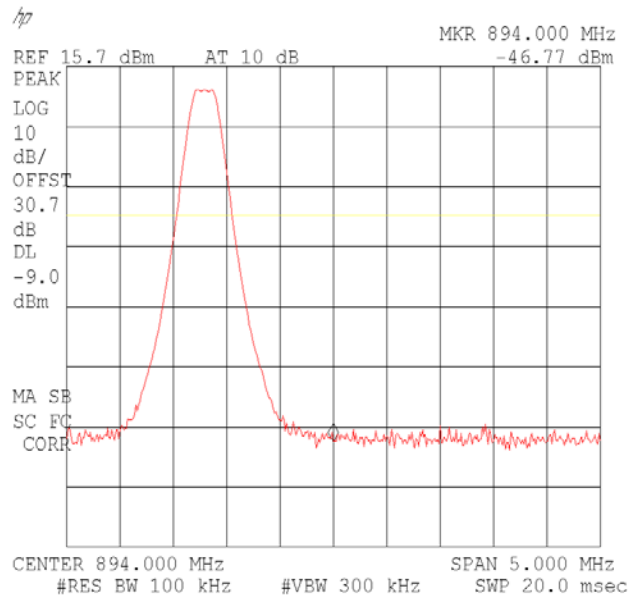


Figure 66.— 892.80 MHz



W-CDMA:

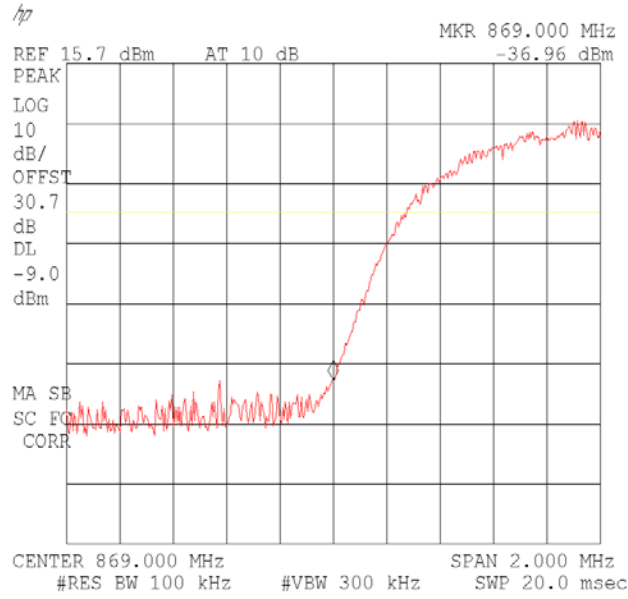


Figure 67.— 871.50 MHz

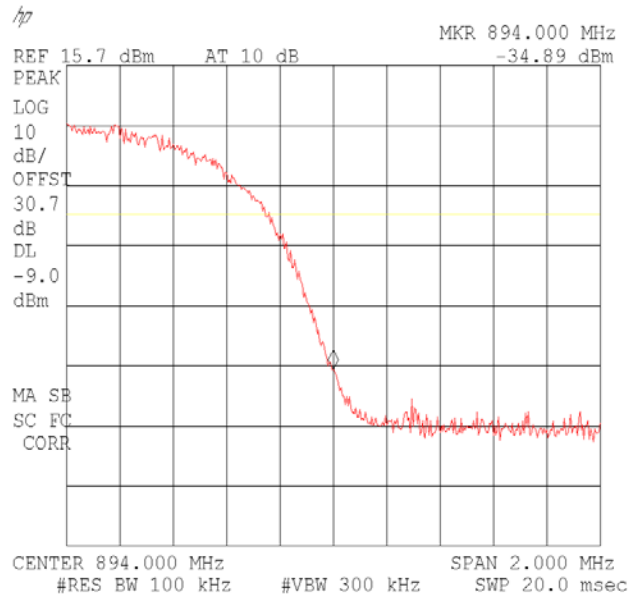


Figure 68.— 891.50 MHz



7.4 Test Equipment Used

Band Edge Spectrum CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 69 Test Equipment Used



8. Out of Band Emissions (Radiated) CELL

8.1 Test Specification

FCC Part 22, Section 917; FCC Part 2.1053

8.2 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 $0-360^\circ$, 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:

$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{Cable Loss (dB)} + \text{Substitution Antenna Gain (dB)}$$

P_d = Dipole equivalent power (result).

P_g = Signal generator output level.



8.3 Test Results

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Spec.	Margin
(MHz)	(MHz)		(dB μ V/m)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
870.20	1740.40	V	47.6	-53.21	5.45	7.64	-51.02	-13.0	-38.02
870.20	1740.40	H	46.7	-53.94	5.45	7.64	-51.75	-13.0	-38.75
881.00	1762.00	V	48.0	-51.79	5.6	7.66	-49.73	-13.0	-36.73
881.00	1762.00	H	48.6	-51.45	5.6	7.66	-49.39	-13.0	-36.39
892.80	1785.60	V	48.0	-51.79	5.6	7.66	-49.73	-13.0	-36.73
892.80	1785.60	H	48.4	-51.65	5.6	7.66	-49.59	-13.0	-36.59

Figure 70 Out of Band (Radiated) CELL

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

JUDGEMENT; Passed by 36.39 dB

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13

Typed/Printed Name: A. Sharabi



8.4 Test Instrumentation Used, Radiated Measurements CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Signal Generator	Agilent	N5182A	MY50141213	July 9, 2012	1 year
Signal Generator	Agilent	83731B	US37100653	October 23, 2012	1 year
Signal Generator	Agilent	8647A	3625U00686	March 5, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A



9. Peak Output Power PCS

9.1 Test Specification

FCC Part 24, Subpart E

9.2 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 and an appropriate coaxial cable (loss = 30.7 dB). The E.U.T. RF output was modulated with W-CDMA, CDMA, GSM and LTE 64QAM. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 100 kHz RBW.

9.3 Test Results


Modulation	Operation Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	1935.0	19.85	50.0	-30.15
	1962.5	20.22	50.0	-29.78
	1990.0	19.46	50.0	-30.54
CDMA	1931.2	18.03	50.0	-31.97
	1960.0	20.18	50.0	-29.82
	1993.8	19.16	50.0	-30.84
GSM	1931.2	19.52	50.0	-30.48
	1960.0	21.55	50.0	-28.45
	1993.8	19.77	50.0	-30.23
W-CDMA	1932.5	19.91	50.0	-30.09
	1960.0	20.77	50.0	-29.23
	1992.5	19.83	50.0	-30.17

Figure 71 Peak Output Power PCS

See additional information in Figure 72 to Figure 83.

JUDGEMENT: Passed by 28.45 dB

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13

Typed/Printed Name: A. Sharabi



LTE 64QAM:

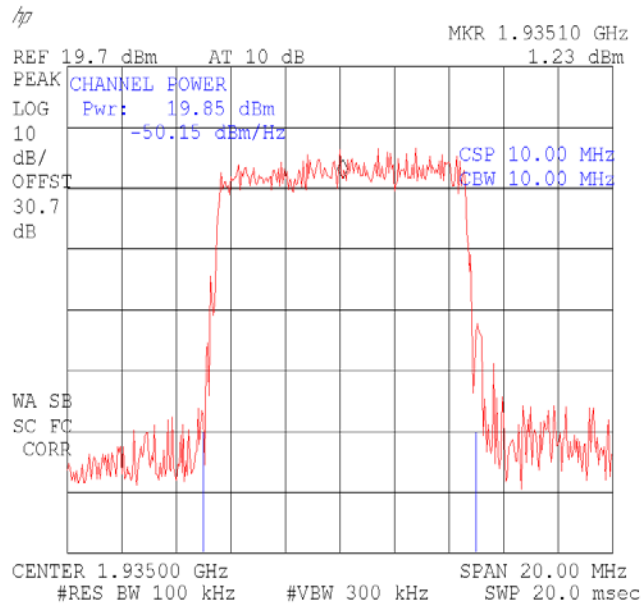


Figure 72.— 64QAM 1935.00 MHz

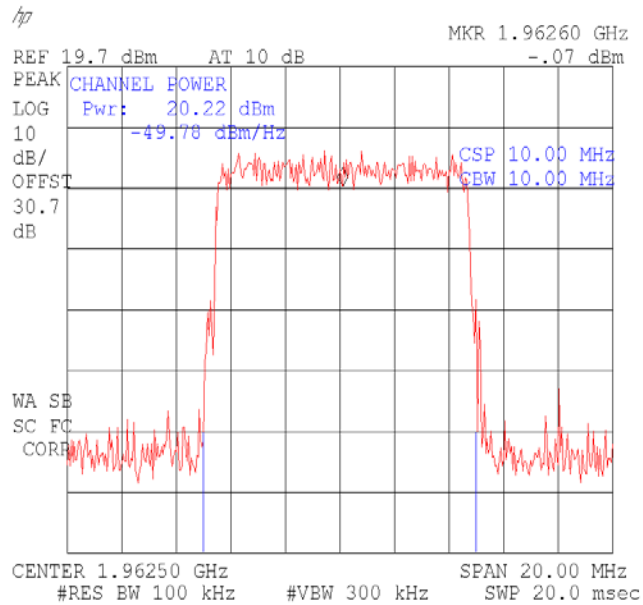


Figure 73.— 64QAM 1962.50 MHz

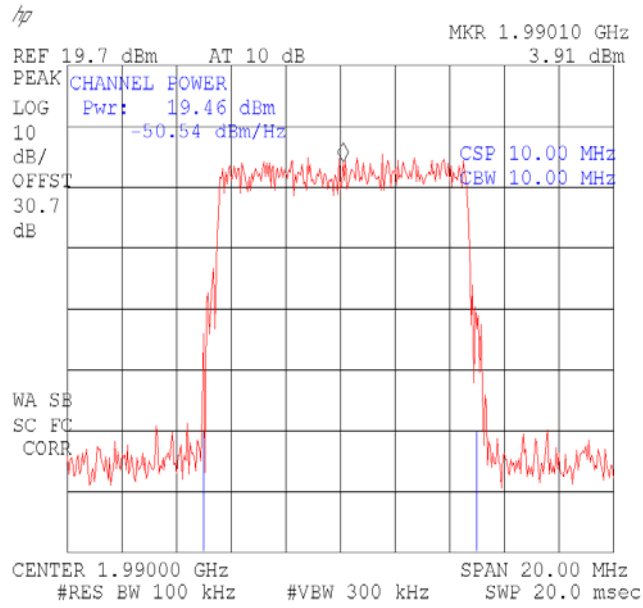


Figure 74.— 64QAM 1990.00 MHz

CDMA:

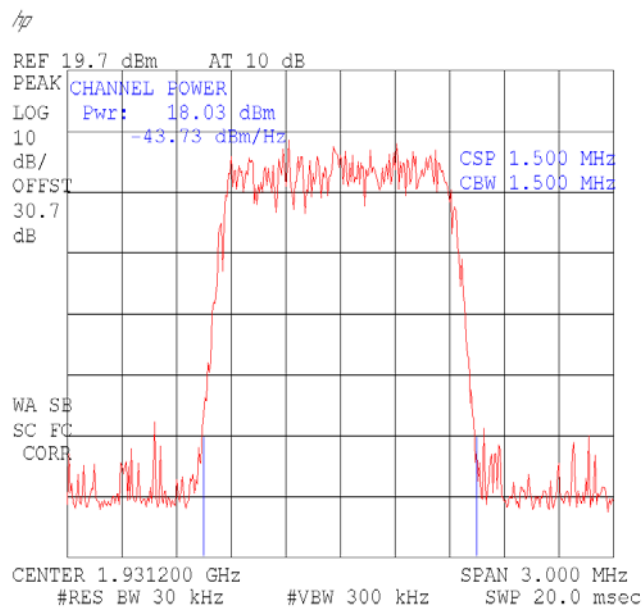


Figure 75.— 1931.20 MHz

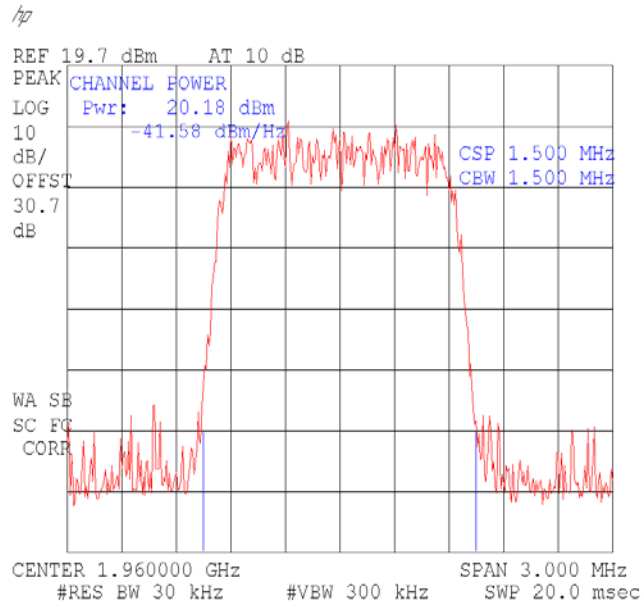


Figure 76.— 1960.00 MHz

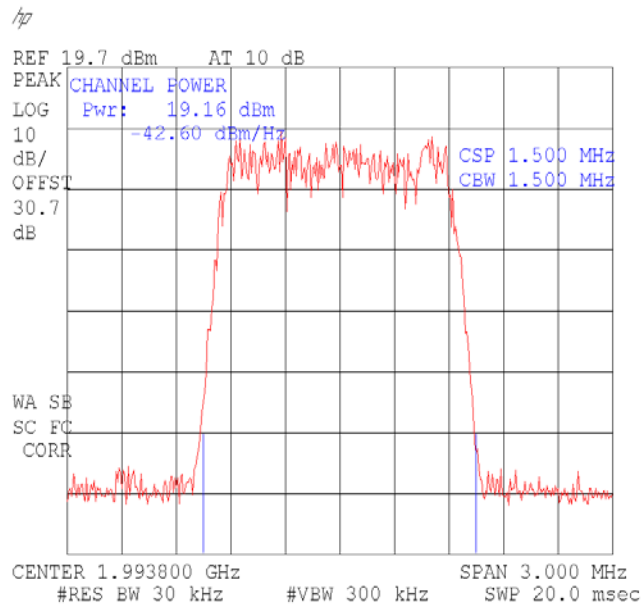


Figure 77.— 1993.80 MHz



GSM:

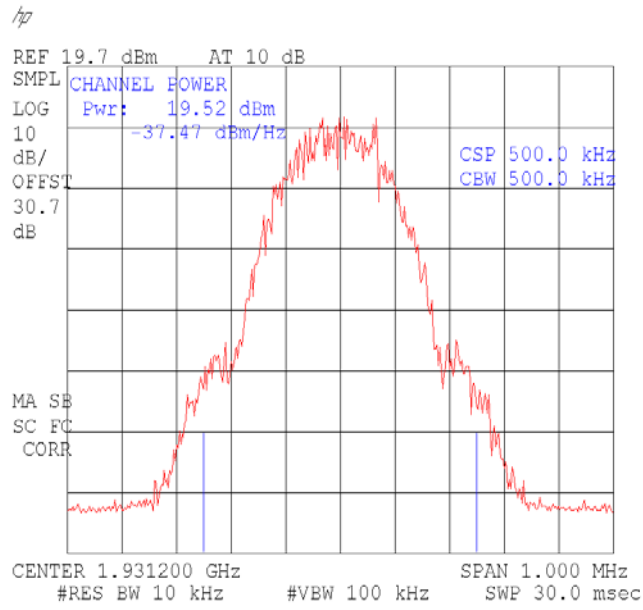


Figure 78.— 1931.20 MHz

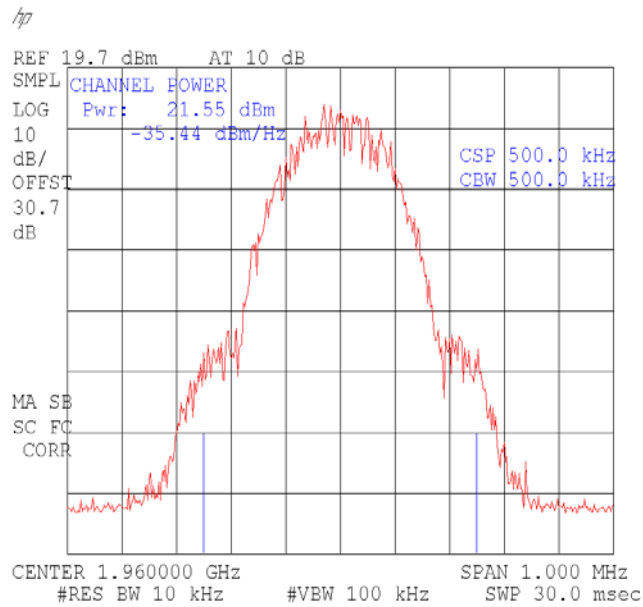


Figure 79.— 1960.00 MHz

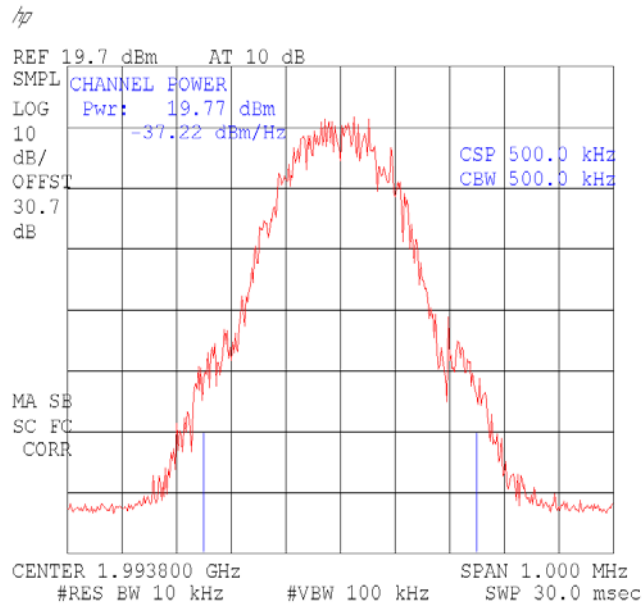


Figure 80.— 1993.80 MHz

W-CDMA:

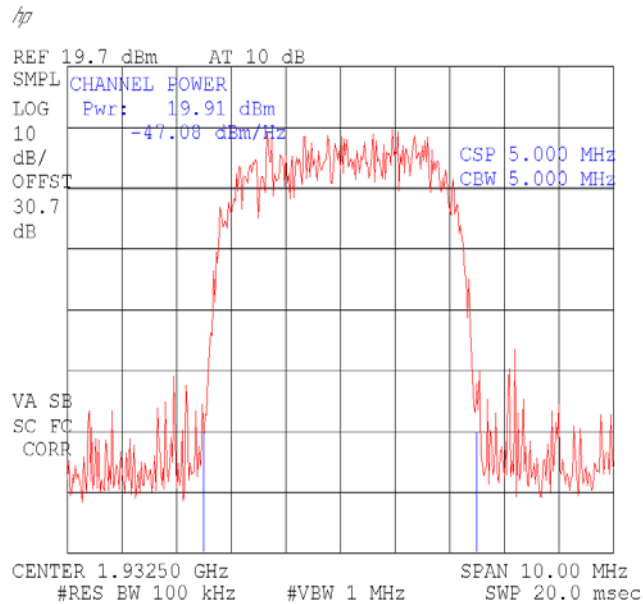


Figure 81.— 1932.50 MHz

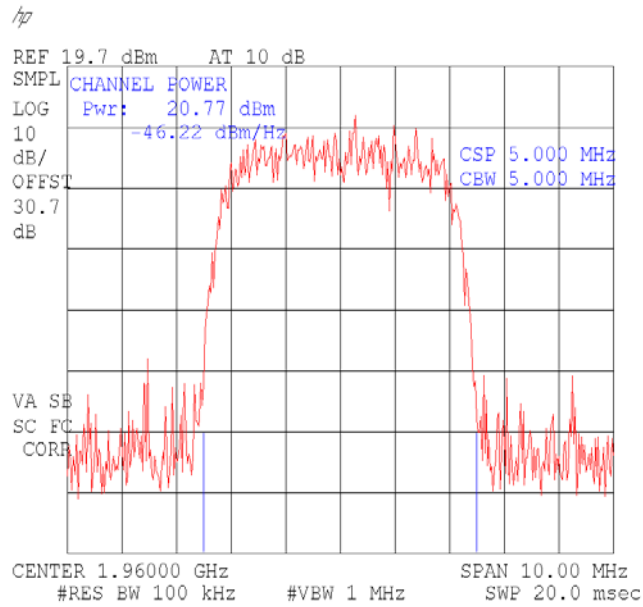


Figure 82.— 1960.00 MHz

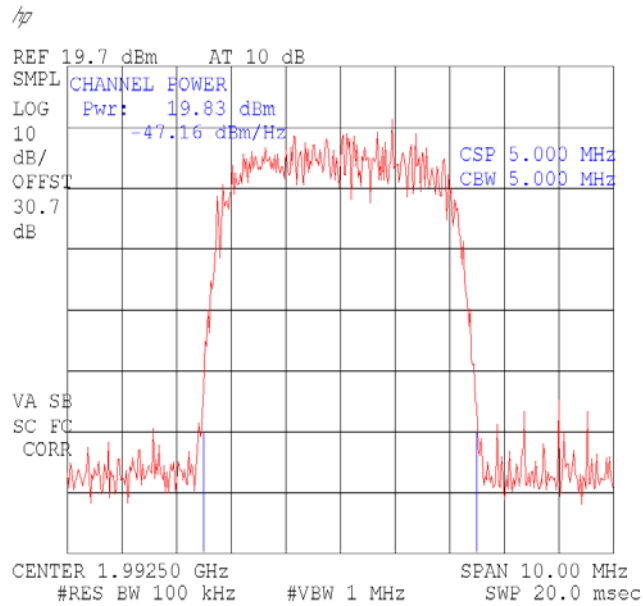


Figure 83.— 1992.50 MHz



9.4 Test Equipment Used

Peak Output Power PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 84 Test Equipment Used



10. Occupied Bandwidth PCS

10.1 *Test Specification*

FCC Part 2, Section 1049

10.2 *Test Procedure*

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

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.



10.3 Test Results


Modulation		Operating Frequency (MHz)	Reading (MHz)
LTE 64QAM	Input	1935.00	9.35
	Output	1935.00	9.40
	Input	1962.50	9.35
	Output	1962.50	9.40
	Input	1990.00	9.35
	Output	1990.00	9.35
CDMA	Input	1931.20	1.33
	Output	1931.20	1.33
	Input	1960.00	1.34
	Output	1960.00	1.34
	Input	1993.80	1.34
	Output	1993.80	1.33
GSM	Input	1931.20	0.275
	Output	1931.20	0.280
	Input	1960.00	0.285
	Output	1960.00	0.2875
	Input	1993.80	0.275
	Output	1993.80	0.280
W-CDMA	Input	1932.50	4.53
	Output	1932.50	4.58
	Input	1960.00	4.58
	Output	1960.00	4.58
	Input	1992.50	4.60
	Output	1992.50	4.60

Figure 85 Occupied Bandwidth PCS

See additional information in Figure 86 to Figure 109.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13.

Typed/Printed Name: A. Sharabi



LTE:

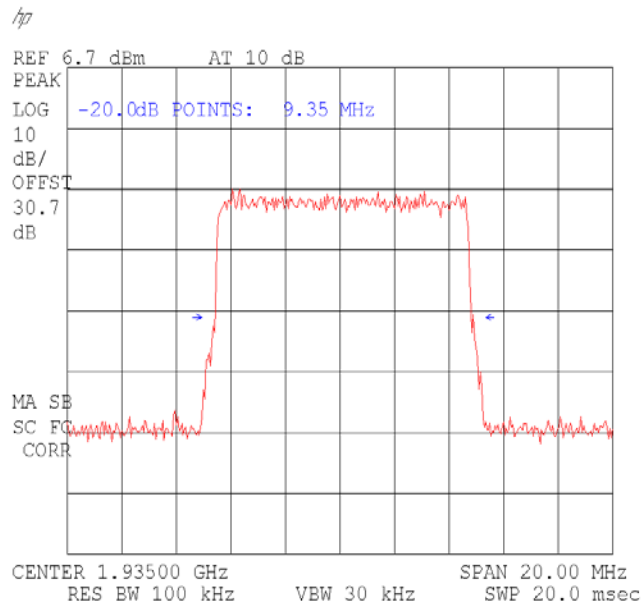


Figure 86.— 64QAM Input 1935.00 MHz

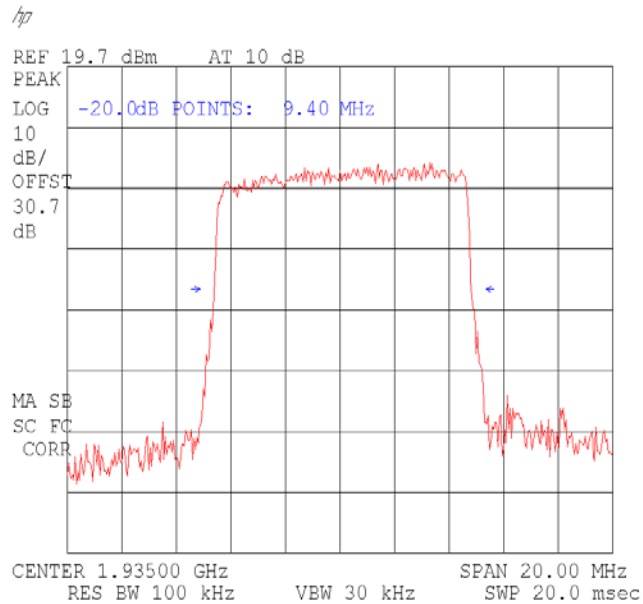


Figure 87.— 64QAM Output 1935.00 MHz

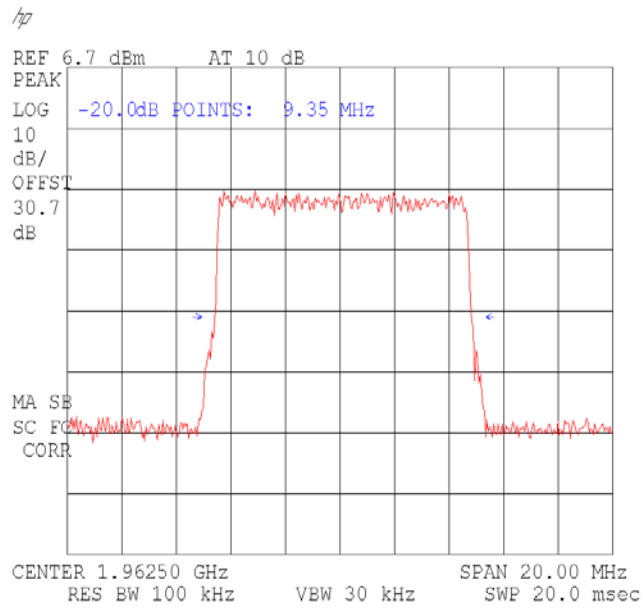


Figure 88.— 64QAM Input 1962.50 MHz

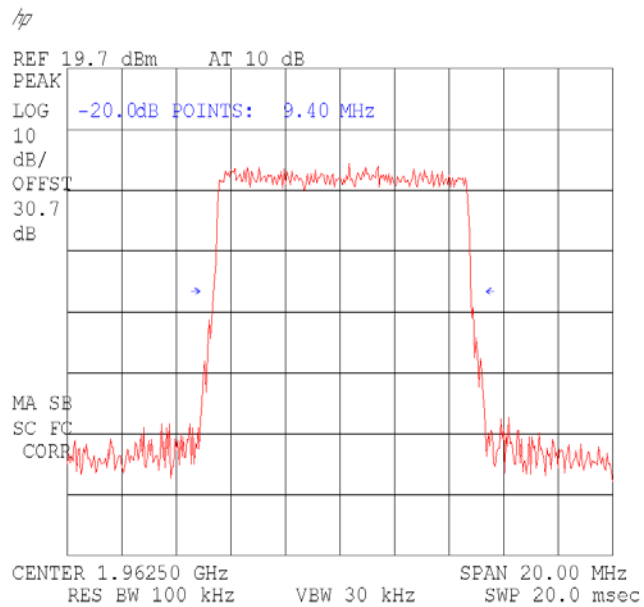


Figure 89.— 64QAM Output 1962.50 MHz

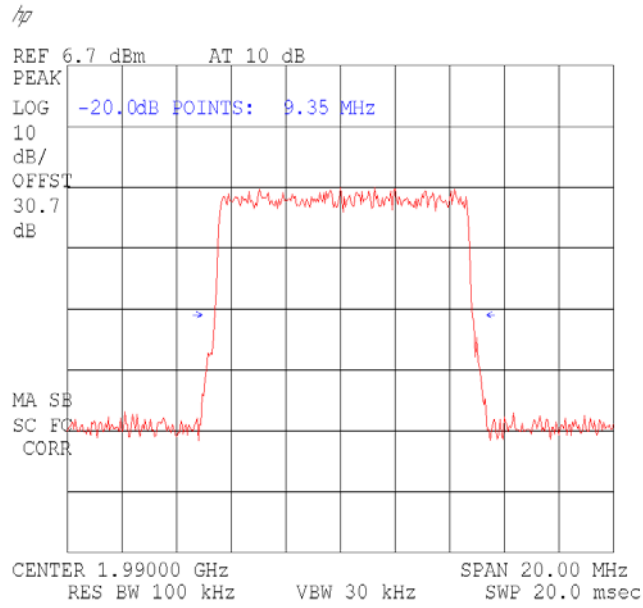


Figure 90.— 64QAM Input 1990.00 MHz

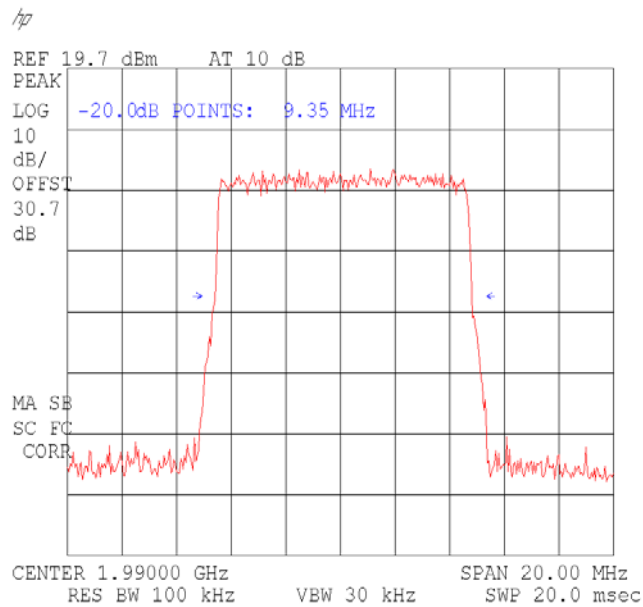


Figure 91.— 64QAM Output 1990.00 MHz



CDMA:

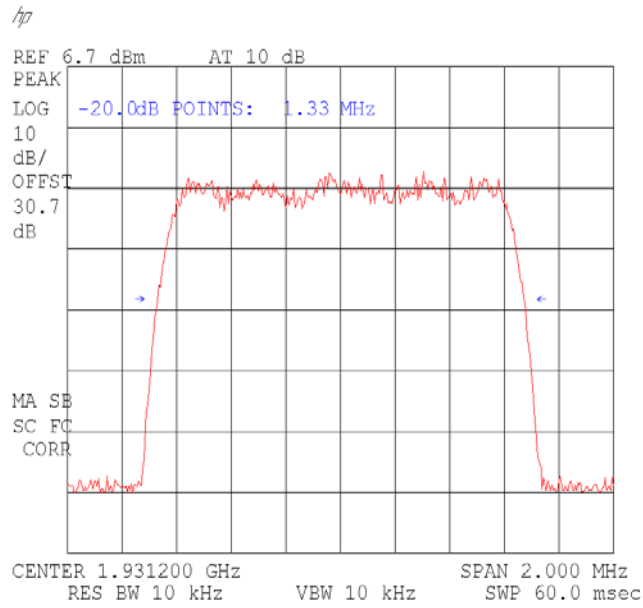


Figure 92.— Input 1931.20 MHz

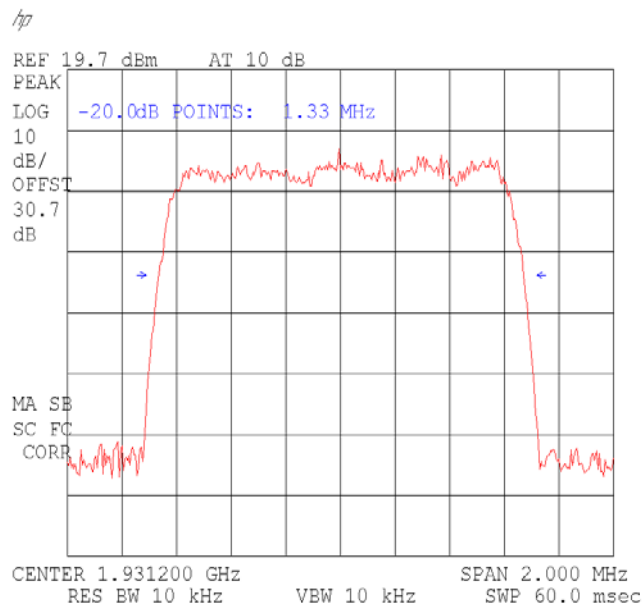


Figure 93.— Output 1931.20 MHz

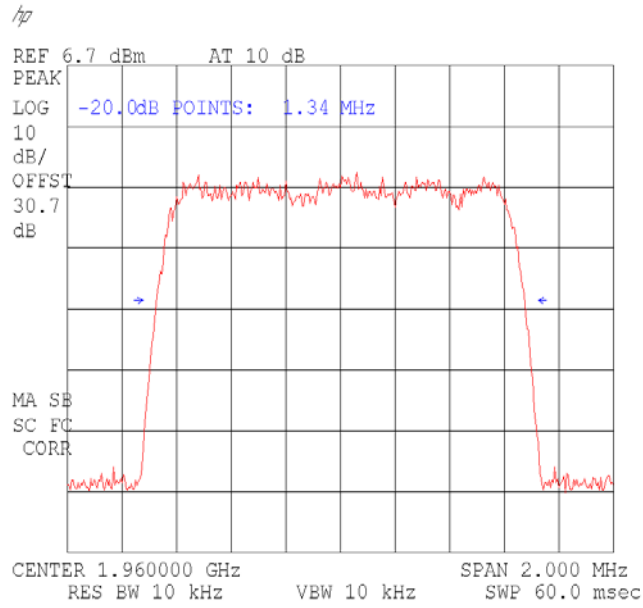


Figure 94.— Input 1960.00 MHz

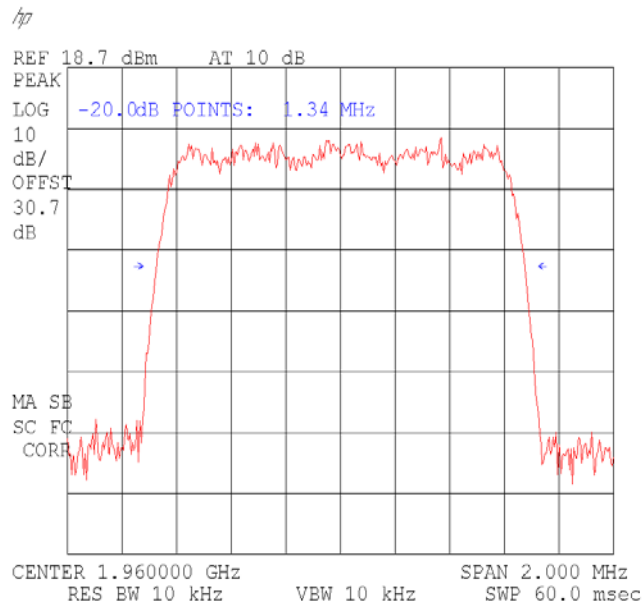


Figure 95.— Output 1960.00 MHz

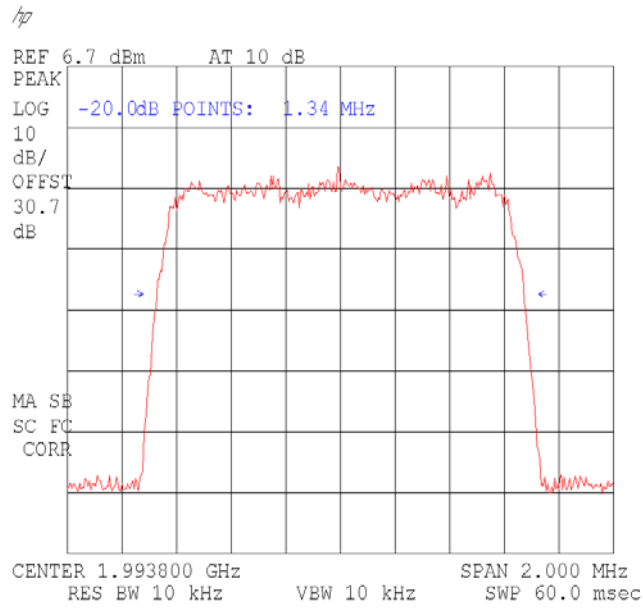


Figure 96.— Input 1993.80 MHz

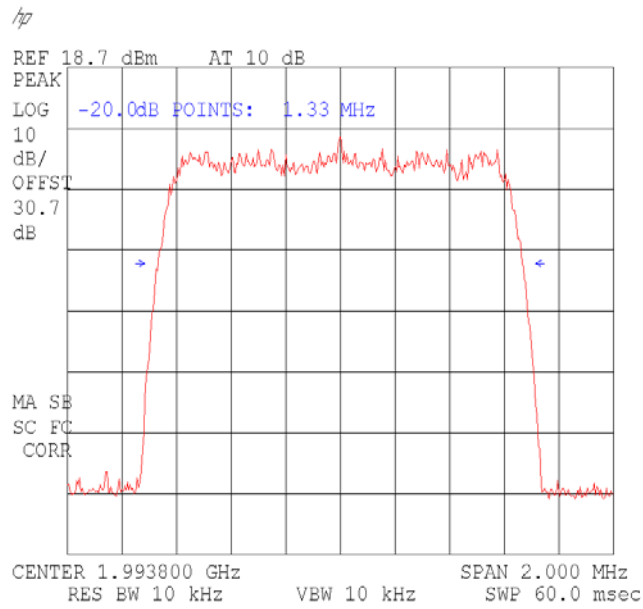


Figure 97.— Output 1993.80 MHz



GSM:

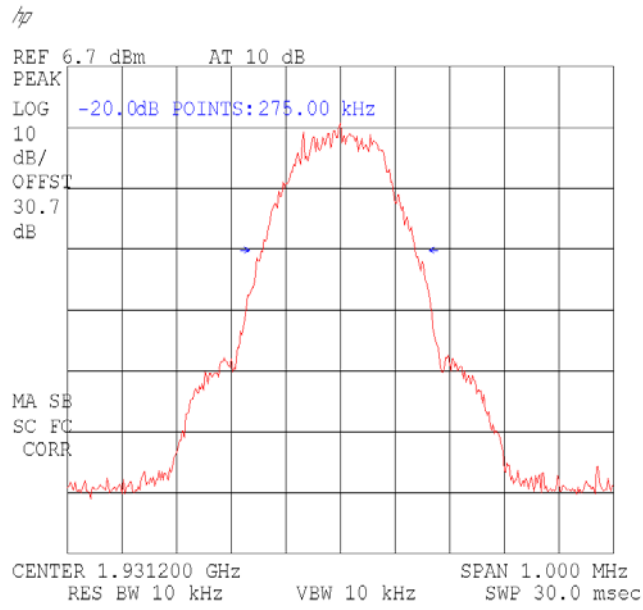


Figure 98.— Input 1931.20 MHz

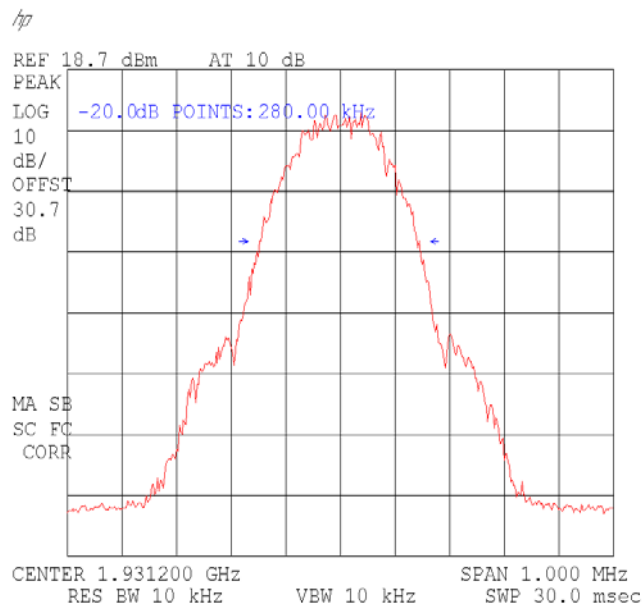


Figure 99.— Output 1931.20 MHz

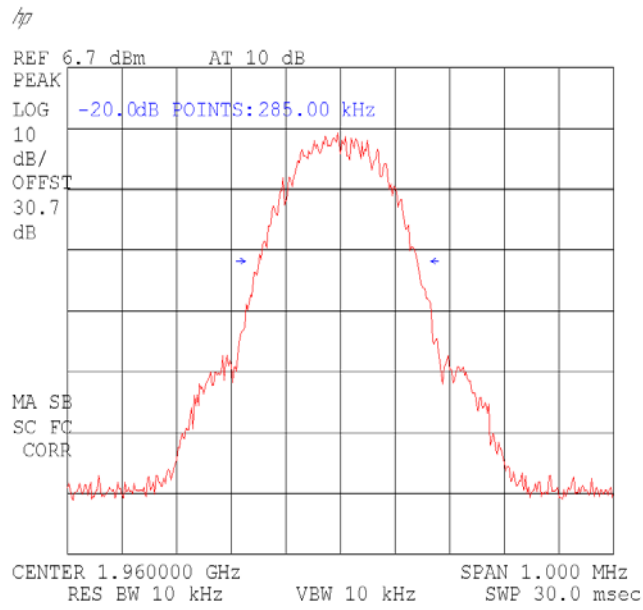


Figure 100.— Input 1960.00 MHz

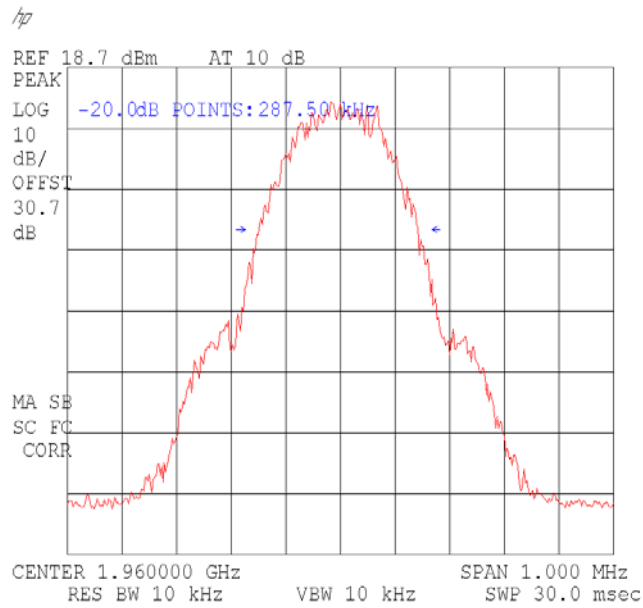


Figure 101.— Output 1960.00 MHz

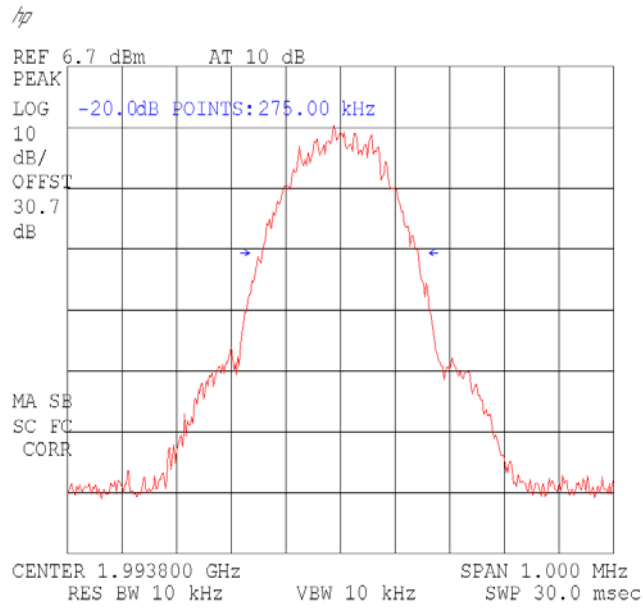


Figure 102.— Input 1993.80 MHz

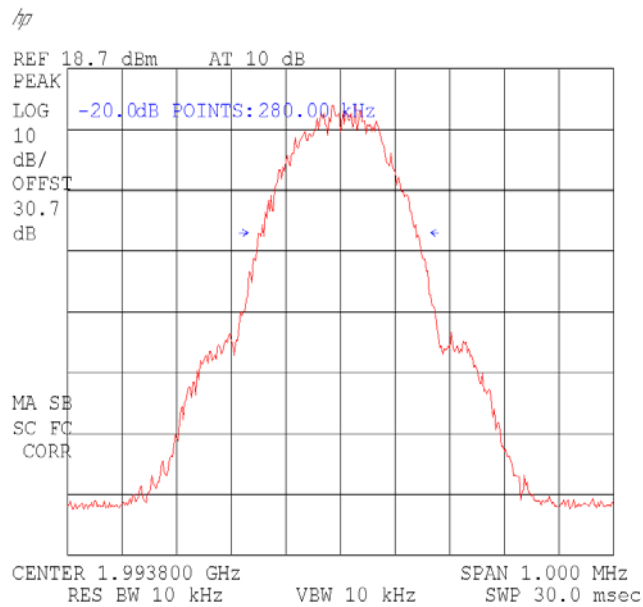


Figure 103.— Output 1993.80 MHz



W-CDMA:

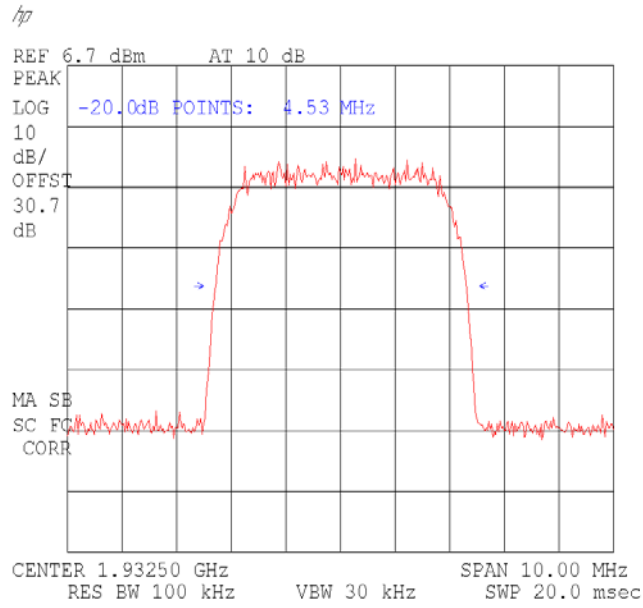


Figure 104.— Input 1932.50 MHz

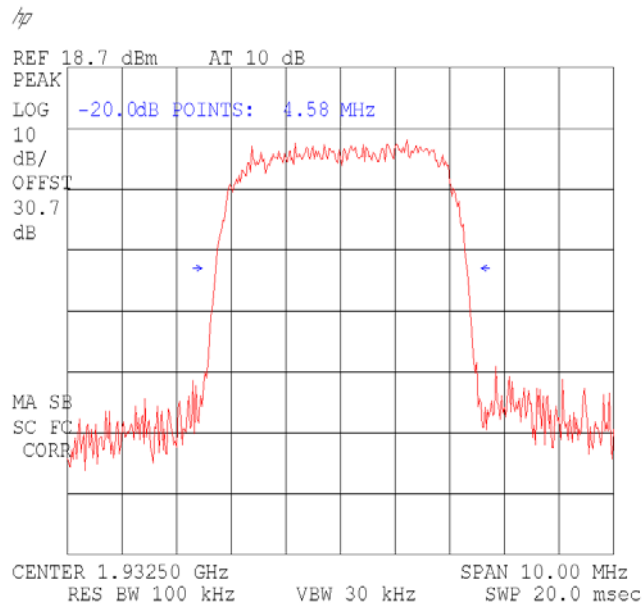


Figure 105.— Output 1932.50 MHz

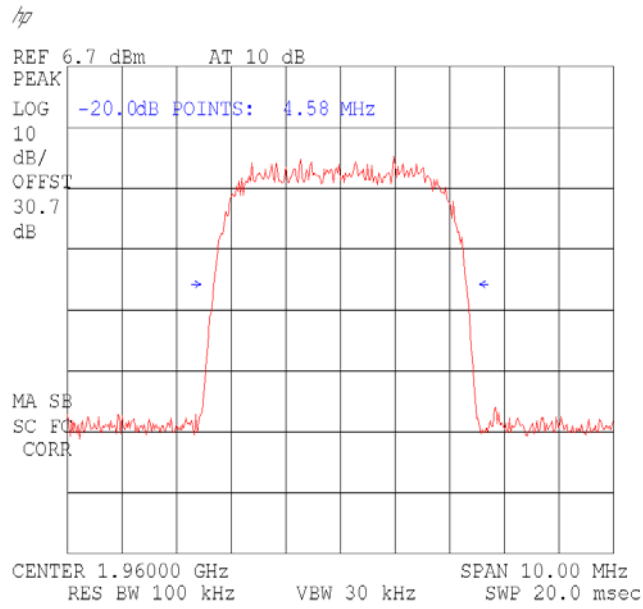


Figure 106.— Input 1960.00 MHz

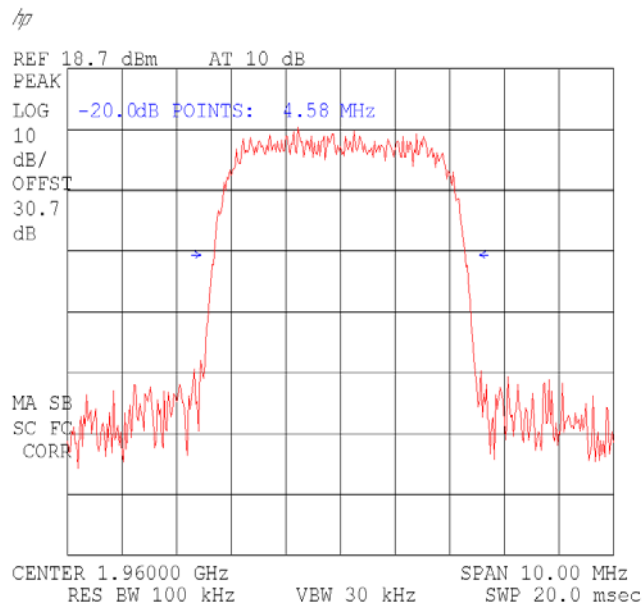


Figure 107.— Output 1960.00 MHz

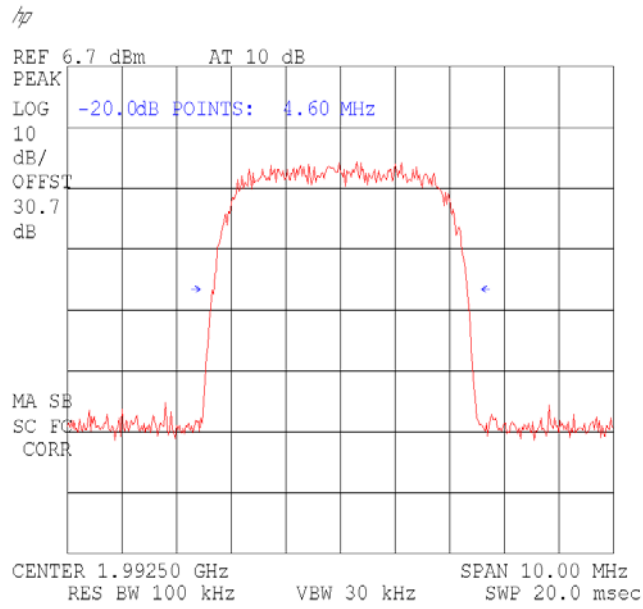


Figure 108.— Input 1992.50 MHz

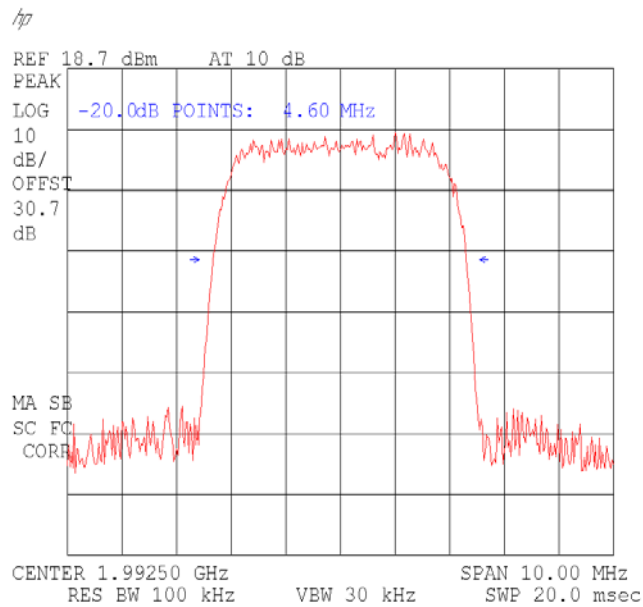


Figure 109.— Output 1992.50 MHz



10.4 Test Equipment Used

Occupied Bandwidth PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 110 Test Equipment Used



11. Out of Band Emissions at Antenna Terminals PCS

11.1 Test Specification

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

11.2 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 (31.0 dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10 kHz for the frequency range 150 kHz-1.0 MHz, 100 kHz for the frequency range 1.0 MHz - 30 MHz, and 1MHz for the frequency range 30 MHz - 20.0 GHz. Signal power was +10 dBm to EUT.

11.3 Test Results

See additional information in Figure 111 to Figure 122.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature:  _____

Date: 07.05.13

Typed/Printed Name: A. Sharabi



LTE 64QAM:

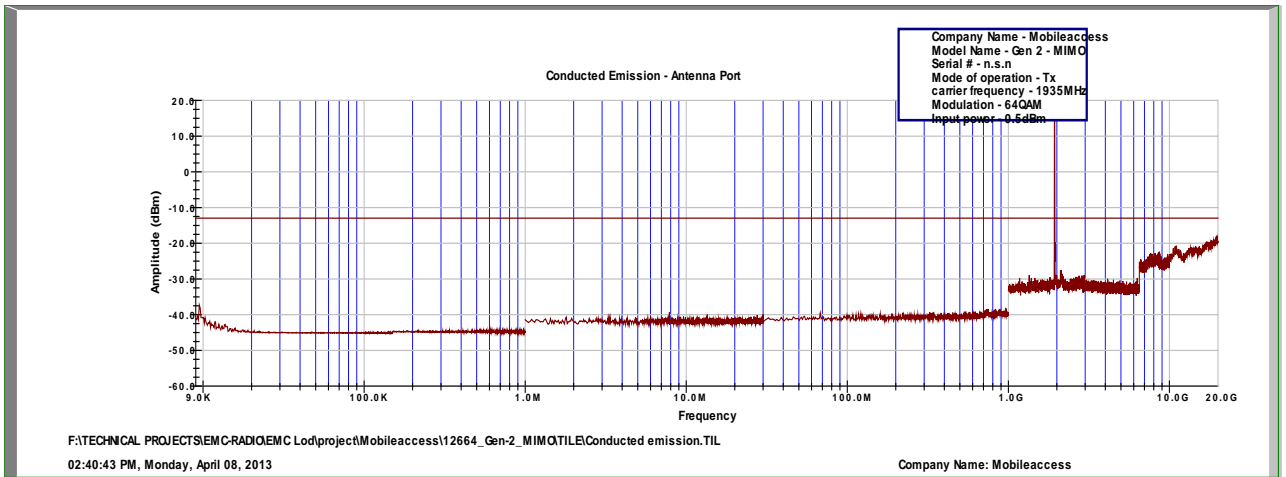


Figure 111.— 1935.0 MHz

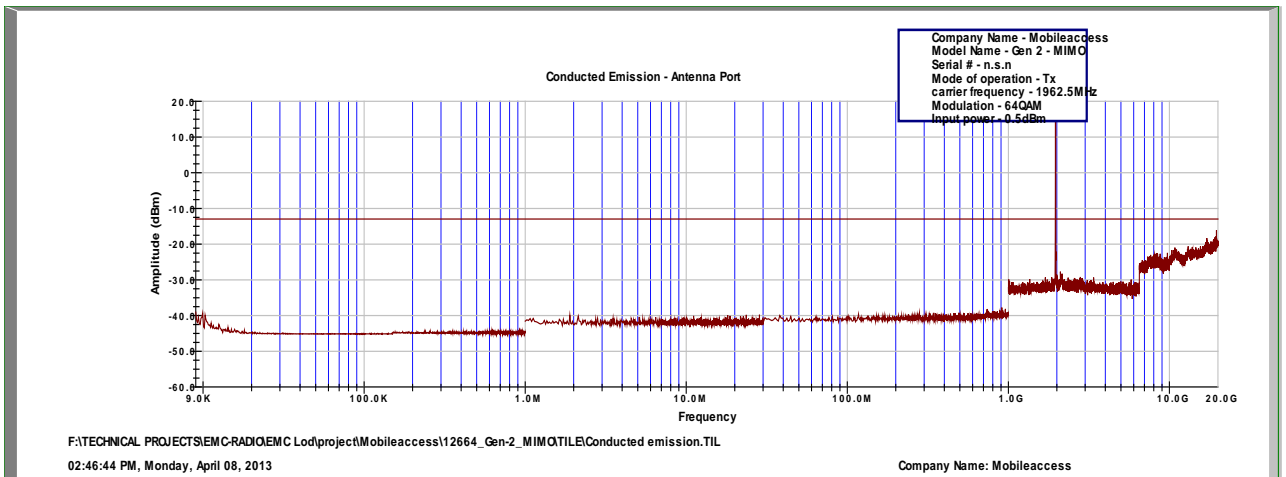


Figure 112.— 1962.5 MHz

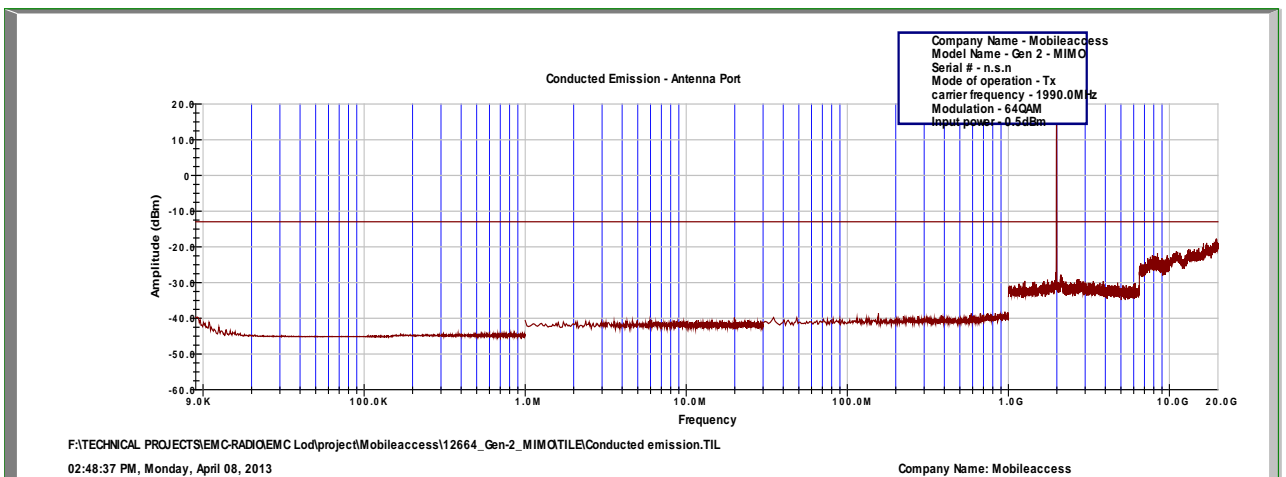


Figure 113.— 1990.0 MHz



CDMA:

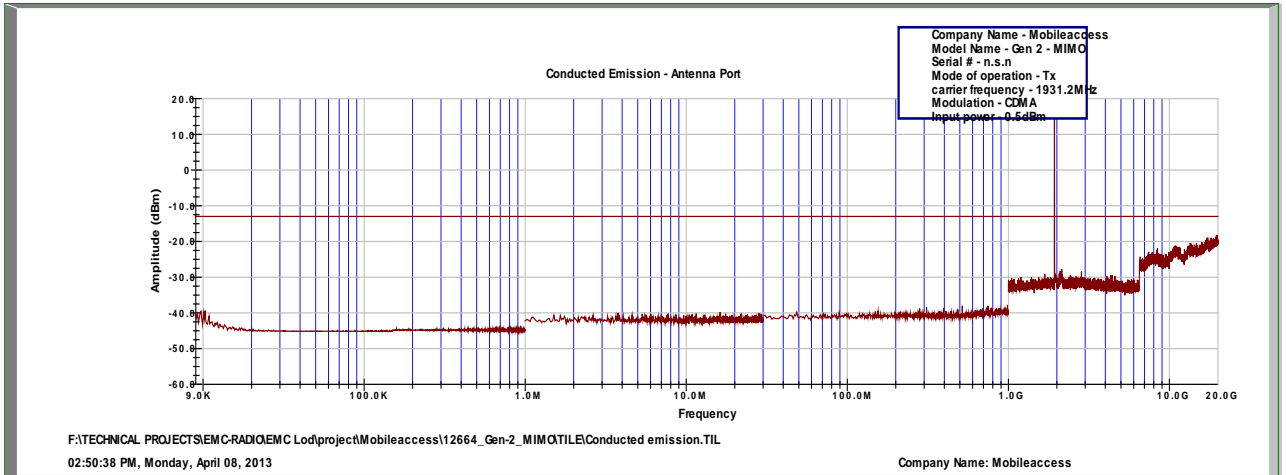


Figure 114.— 1931.2 MHz

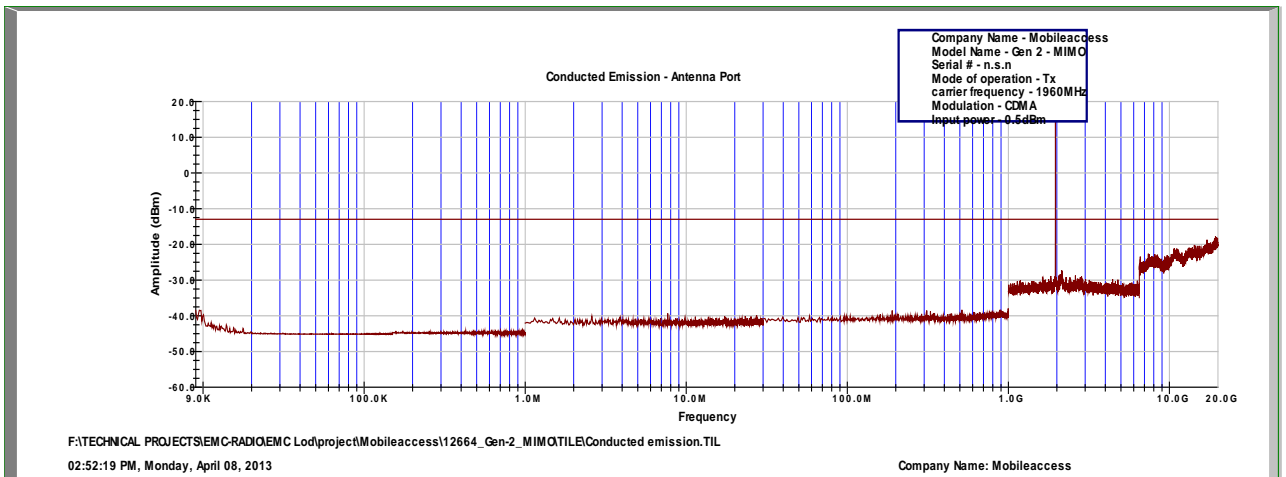


Figure 115.— 1960.0 MHz

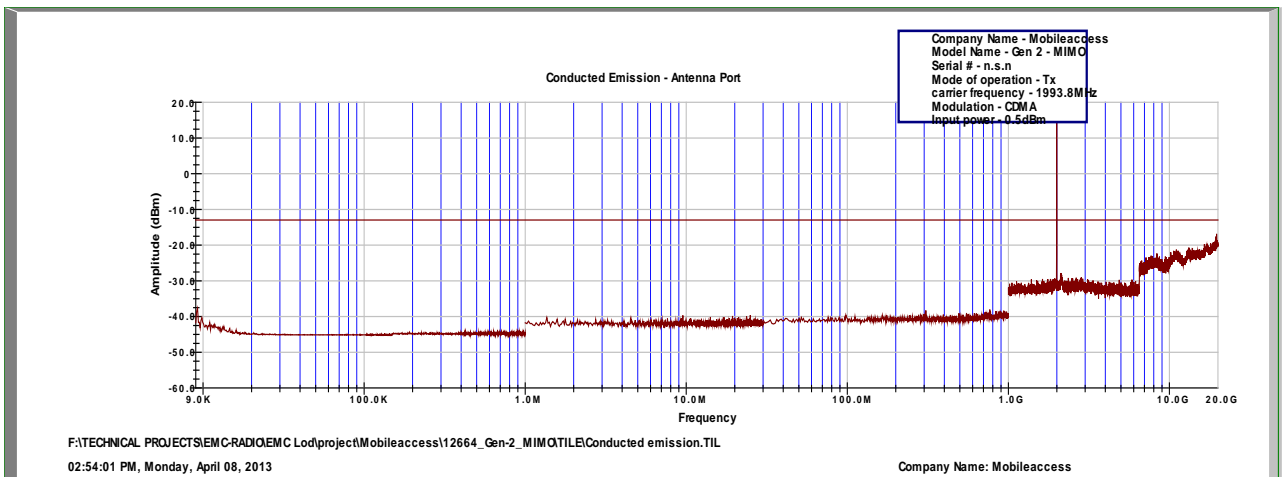


Figure 116.— 1993.8 MHz



GSM:

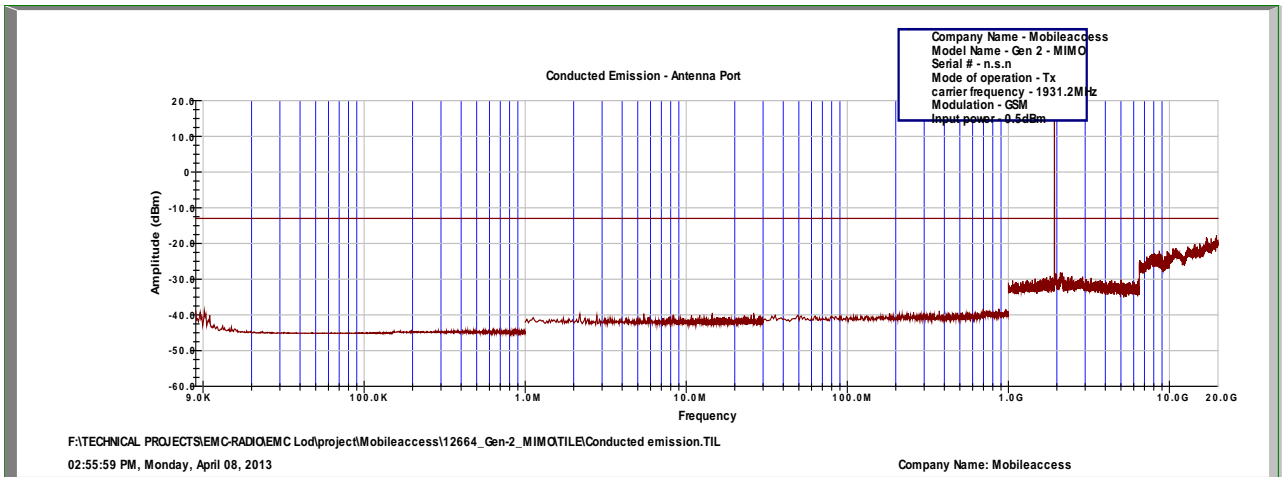


Figure 117.— 1931.2 MHz

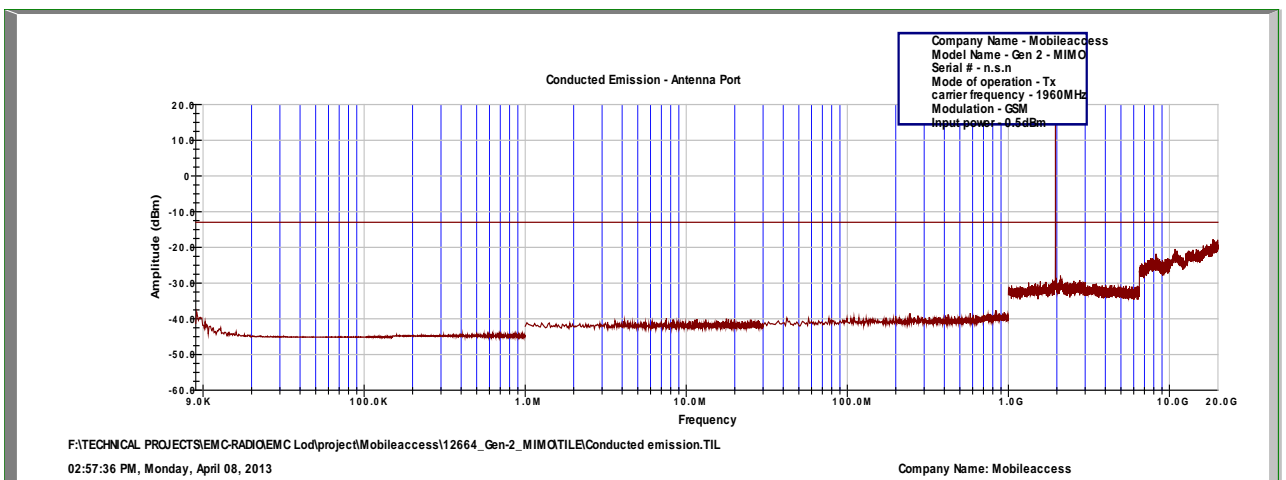


Figure 118.— 1960.0 MHz

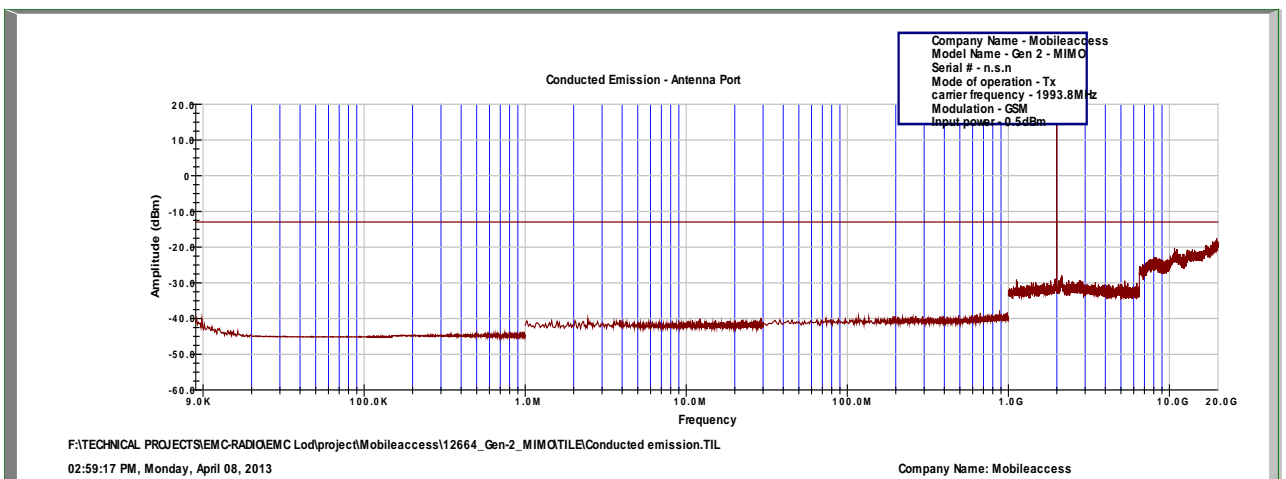


Figure 119.— 1993.8 MHz



WCDMA:

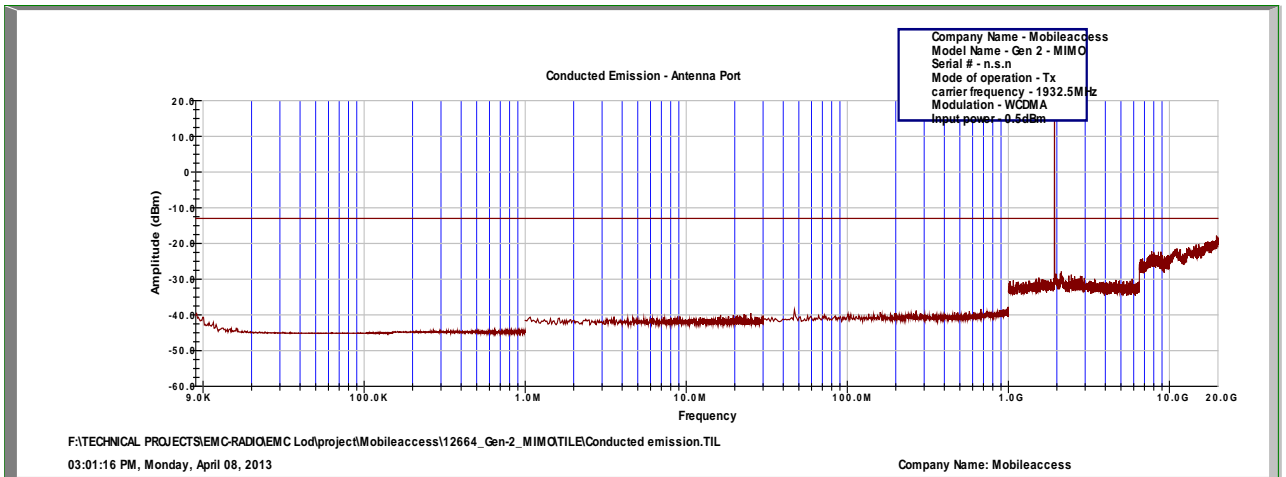


Figure 120.— 1932.5 MHz

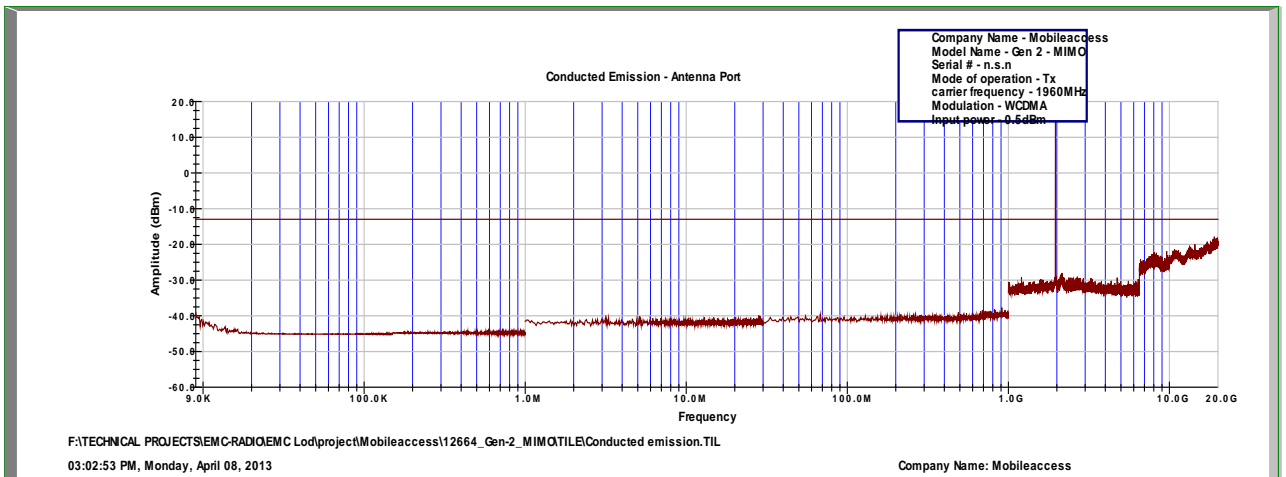


Figure 121.— 1960.0 MHz

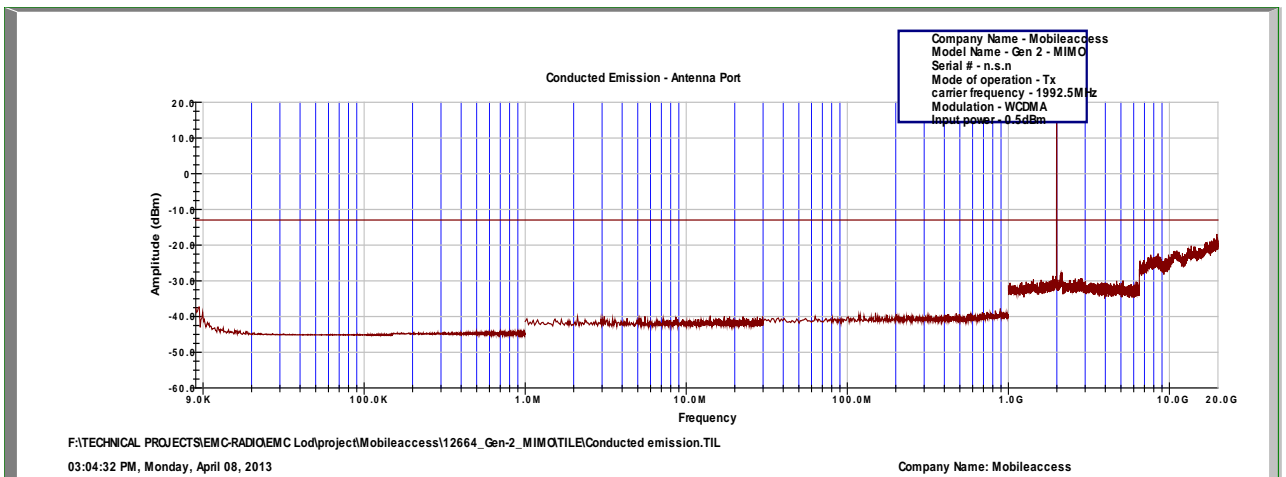


Figure 122.— 1992.5 MHz



11.4 Test Equipment Used.

Out of Band Emission at Antenna Terminals PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 123 Test Equipment Used



12. Band Edge Spectrum 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 (1930.00-1995.00 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 (30.7 dB).

The spectrum analyzer was set to 100 kHz R.B.W.

12.1 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	1935.00	1930.00	-20.60	-13.0	-7.60
	1990.00	1995.00	-16.88	-13.0	-3.88
CDMA	1931.20	1930.00	-29.63	-13.0	-16.63
	1993.80	1995.00	-40.40	-13.0	-27.40
GSM	1931.20	1930.00	-45.12	-13.0	-32.12
	1993.80	1995.00	-42.65	-13.0	-29.65
W-CDMA	1932.50	1930.00	-23.91	-13.0	-10.91
	1992.50	1995.00	-28.07	-13.0	-15.07

Figure 124 Band Edge Spectrum Results PCS

See additional information in Figure 125 to Figure 132.

JUDGEMENT: Passed by 3.88 dB

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13

Typed/Printed Name: A. Sharabi



LTE:

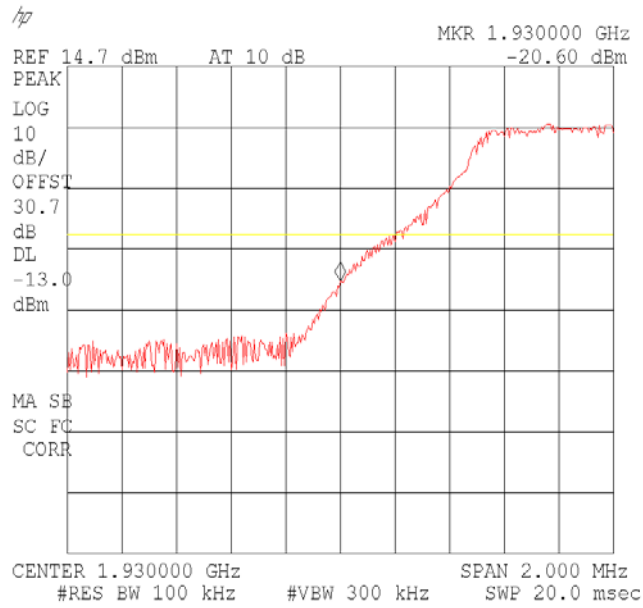


Figure 125.— 64QAM 1935.00 MHz

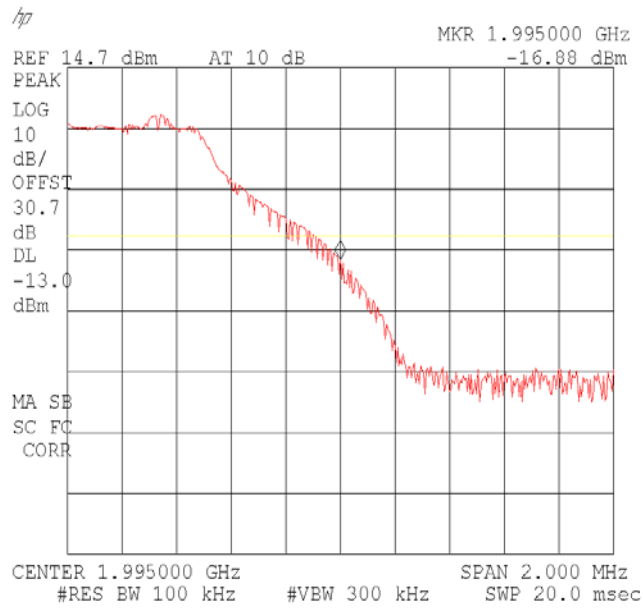


Figure 126.— 64QAM 1990.00 MHz



GSM:

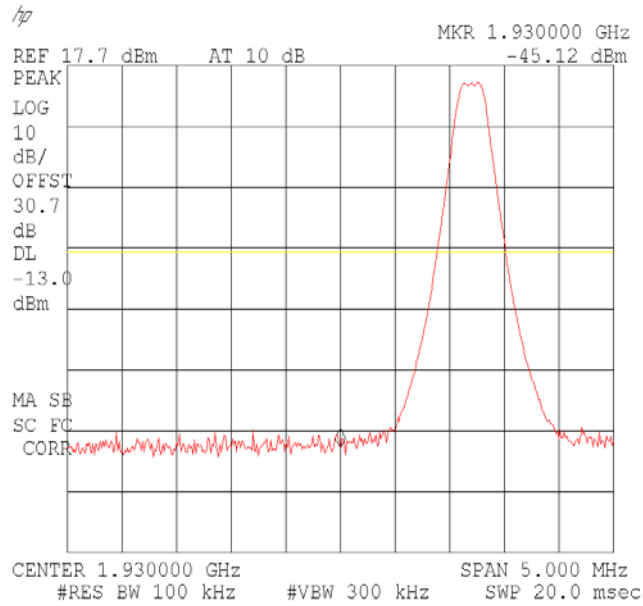


Figure 127.— 1931.20 MHz

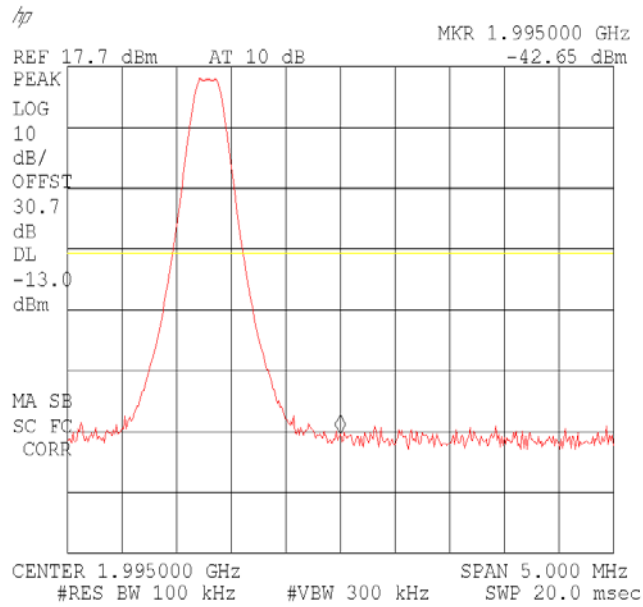


Figure 128.— 1993.80 MHz



CDMA:

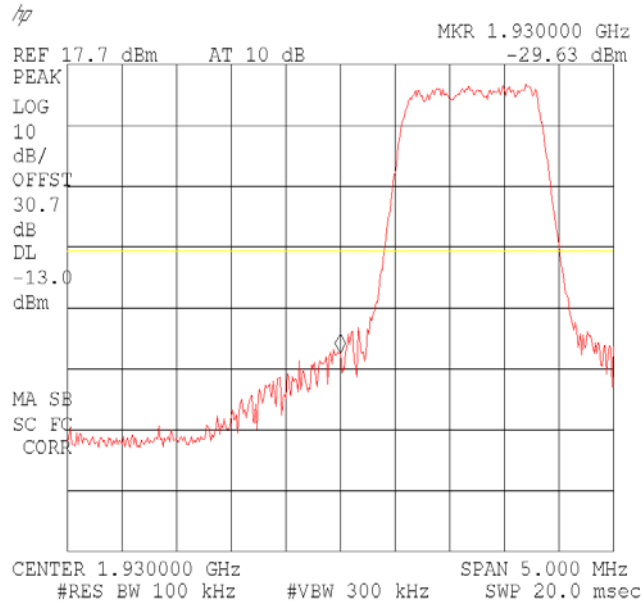


Figure 129.— 1931.20 MHz

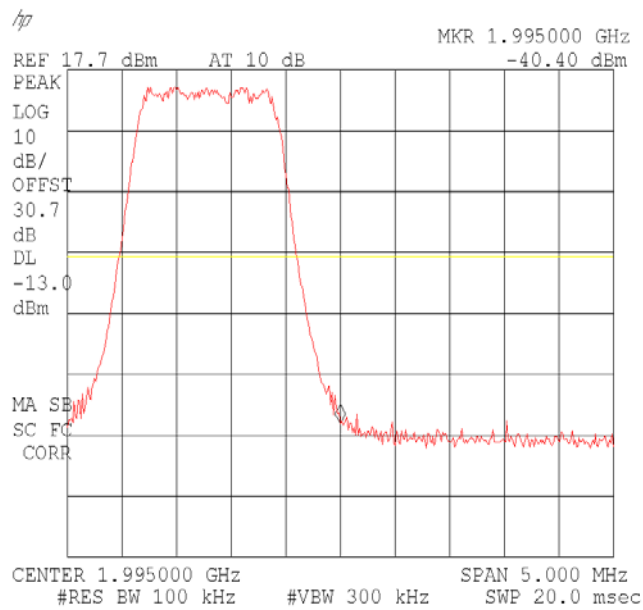


Figure 130.— 1993.80 MHz



W-CDMA:

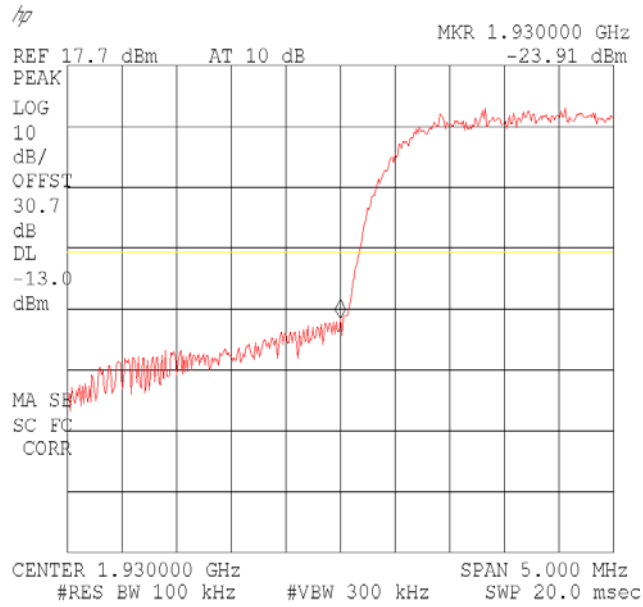


Figure 131.— 1932.50 MHz

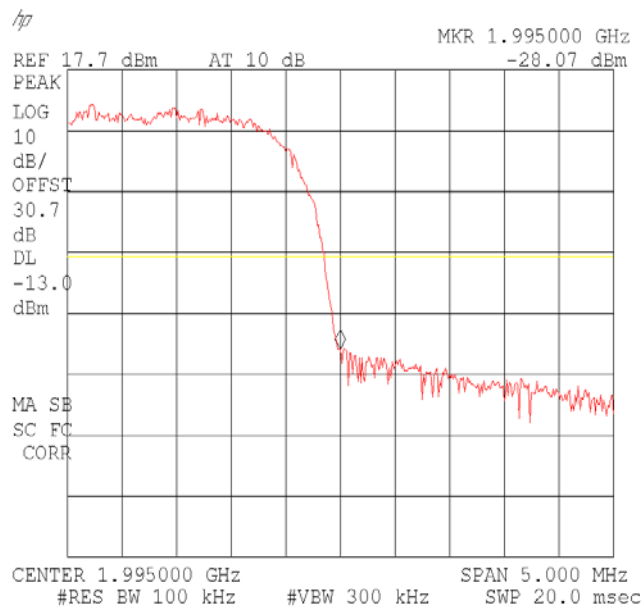


Figure 132.— 1992.50 MHz



12.2 Test Equipment Used.

Band Edge Spectrum PCS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A

Figure 133 Test Equipment Used



13. Out of Band Emissions (Radiated) PCS

13.1 Test Specification

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

13.2 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 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 $0-360^\circ$, 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:

$$P_d(\text{dBm}) = P_g(\text{dBm}) - \text{Cable Loss (dB)} + \text{Substitution Antenna Gain (dB)}$$

P_d = Dipole equivalent power (result).

P_g = Signal generator output level.



13.3 Results Table


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)
1931.20	3862.4	V	53.5	-48.32	4.3	8.62	-44.00	-13.0	-31.00
1931.20	3862.4	H	55.2	-45.76	4.3	8.62	-41.44	-13.0	-28.44
1960.00	3920.0	V	52.5	-49.32	4.3	8.62	-45.00	-13.0	-32.00
1960.00	3920.0	H	53.8	-47.16	4.3	8.62	-42.84	-13.0	-29.84
1993.80	3987.6	V	53	-49.3	4.3	8.6	-45.00	-13.0	-32.00
1993.80	3987.6	H	52.2	-49.15	4.3	8.6	-44.85	-13.0	-31.85

Figure 134 Out of Band (Radiated) PCS

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

JUDGEMENT: Passed by 28.44 dB

TEST PERSONNEL:

Tester Signature: 

Date: 07.05.13

Typed/Printed Name: A. Sharabi



13.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	February 13, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	May 31, 2012	2 years
Signal Generator	Agilent	N5182A	MY50141213	July 9, 2012	1 year
Signal Generator	Agilent	83731B	US37100653	October 23, 2012	1 year
Signal Generator	Agilent	8647A	3625U00686	March 5, 2012	2 years
Attenuator	Mini-circuit	UNAT-30+	N/A	April 3, 2013	1 year
Cable	Mini-circuit	DCB	N/A	April 3, 2013	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	N/A	N/A	N/A



14. APPENDIX A - CORRECTION FACTORS

14.1 Correction factors for CABLE
from EMI receiver
to test antenna
at 3 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	7.3
20.0	0.6	1400.0	7.8
30.0	0.8	1600.0	8.4
40.0	0.9	1800.0	9.1
50.0	1.1	2000.0	9.9
60.0	1.2	2300.0	11.2
70.0	1.3	2600.0	12.2
80.0	1.4	2900.0	13.0
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		

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".



14.2 Correction factors for Bilog ANTENNA

Model: 3142

Antenna serial number: 1250

3 meter range

FREQUENCY	AFE	FREQUENCY	AFE
(MHz)	(dB/m)	(MHz)	(dB/m)
30	18.4	1100	25
40	13.7	1200	24.9
50	9.9	1300	26
60	8.1	1400	26.1
70	7.4	1500	27.1
80	7.2	1600	27.2
90	7.5	1700	28.3
100	8.5	1800	28.1
120	7.8	1900	28.5
140	8.5	2000	28.9
160	10.8		
180	10.4		
200	10.5		
250	12.7		
300	14.3		
400	17		
500	18.6		
600	19.6		
700	21.1		
800	21.4		
900	23.5		
1000	24.3		



14.3 Correction factors for Horn ANTENNA

Model: 3115

Antenna serial number: 6142

3 meter range

FREQUENCY	Antenna Factor	FREQUENCY	Antenna Factor
(MHz)	(dB/m)	(MHz)	(dB/m)
1000	23.9	10500	38.4
1500	25.4	11000	38.5
2000	27.3	11500	39.4
2500	28.5	12000	39.2
3000	30.4	12500	39.4
3500	31.6	13000	40.7
4000	33	14000	42.1
4500	32.7	15000	40.1
5000	34.1	16000	38.2
5500	34.5	17000	41.7
6000	34.9	17500	45.7
6500	35.1	18000	47.7
7000	35.9		
7500	37.5		
8000	37.6		
8500	38.3		
9000	38.5		
9500	38.1		
10000	38.6		



14.1 Correction factors for Horn ANTENNA

Model: SWH-28

Antenna serial number: 1007

1 meter range

FREQUENCY	Antenna Factor
(MHz)	(dB/m)
18000	33.0
18500	32.9
19000	33.1
19500	33.3
20000	33.6
20500	33.6
21000	33.4
21500	33.8
22000	33.7
22500	33.9
23000	34.8
23500	34.5
24000	34.2
24500	34.8
25000	34.4
25500	35.2
26000	35.9
26500	36.0



14.2 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