



DATE: 11 March 2014

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

FCC Radio Test Report

for

Corning Mobile Access

Equipment under test:

Mid Power Remote Unit

HX-5

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

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Approved by:

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This report relates only to items tested.



Measurement/Technical Report for Corning Mobile Access Mid Power Remote Unit

FCC ID: OJFHXP19S80A17L70

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, 90

Measurement procedure used is ANSI C63.4-2003.

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

Application for Certification
prepared by:

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1. General Information

1.1 Administrative Information

Manufacturer:	Corning Mobile Access
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):	Mid Power Remote Unit
Equipment Model No.:	HX-5
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	23.02.14
Start of Test:	23.02.14
End of Test:	12.03.14
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	FCC Parts 22, 24, 27, 90



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. 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**

HX-5 is a mid-power, remote solution for the MA1000 and MA2000 Distributed Antenna Systems (DAS). It is a fiber fed, compact and scalable multi-service platform designed to complement the MA1000 and MA2000 while providing complete RF open space coverage for large-scale public venues such as campuses, stadiums, convention centers, hotels, airports and train stations. The solution can be deployed in new sites or alongside existing lower power MA1000 and MA2000 systems, sharing a common headend and element management system.

Features and Capabilities:

Multi-Service Platform: Accommodates GSM, UMTS, HSPA, LTE, EDGE, EV-DO, AWS and more. Provides MIMO configuration for LTE700 and AWS bands, excluding the HX-5 unit which is SISO only.

Cost-Effective High Power: Optimizes and reduces the number of antennas required to cover open areas by offering up to 33dBm (2W) composite power per frequency band.

Indoor Models: Supports either SISO or MIMO (excluding HX-5 units) service in a single compact enclosure.

Outdoor Models: Outdoor enclosures are compliant to NEBS OSP Class 4 standards.

Operator-Grade Operation: Advanced signal handling and management ensures carrier-grade performance in multi-operator deployments.

Backwards compatible: connects to an existing MobileAccess1000 or MobileAccess 2000 deployment and shares a common headend and Element Management System (EMS) in a single deployment.

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.

For radiated spurious emissions, the Substitution Method as per ANSI/TIA-603-C: 2004 was used.

1.5 **Test Facility**

Both conducted and radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing 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

The test setup was configured to closely resemble the standard installation. The EUT consists of the HX (High Power Remote Module) which is connected with the head-end DAS equipment using fiber optic cable.

The RF 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 EUT, while the EUT output was connected to the spectrum analyzer.

The system was tested under maximum gain conditions while input power level to the BU is -20dBm and output power level at HX antenna port is 33dBm.

The device cannot work in saturation.

Testing was performed on the following configurations:

	Band		Part	Modulation
Cell	869.0	894.0	22	GSM
	869.0	894.0	22	WCDMA
	869.0	894.0	22	LTE (1 Modulation)
iDEN	862.0	869.0	90	GSM
	862.0	869.0	90	WCDMA
	862.0	869.0	90	LTE (1 Modulation)
PCS	1930.0	1995.0	24	GSM
	1930.0	1995.0	24	WCDMA
	1930.0	1995.0	24	LTE (1 Modulation)
LTE700	728.0	758.0	27	LTE (3 Modulations)
AWS	2110.0	2155.0	27	GSM
	2110.0	2155.0	27	WCDMA
	2110.0	2155.0	27	LTE (1 Modulation)

2.2 EUT Exercise Software

The Element Management System EngGui ver. 1.00 build 10 used for commands delivery. These commands are used to enable/disable the EUT transmission. EUT Embedded SW version 01.00 build 14.

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

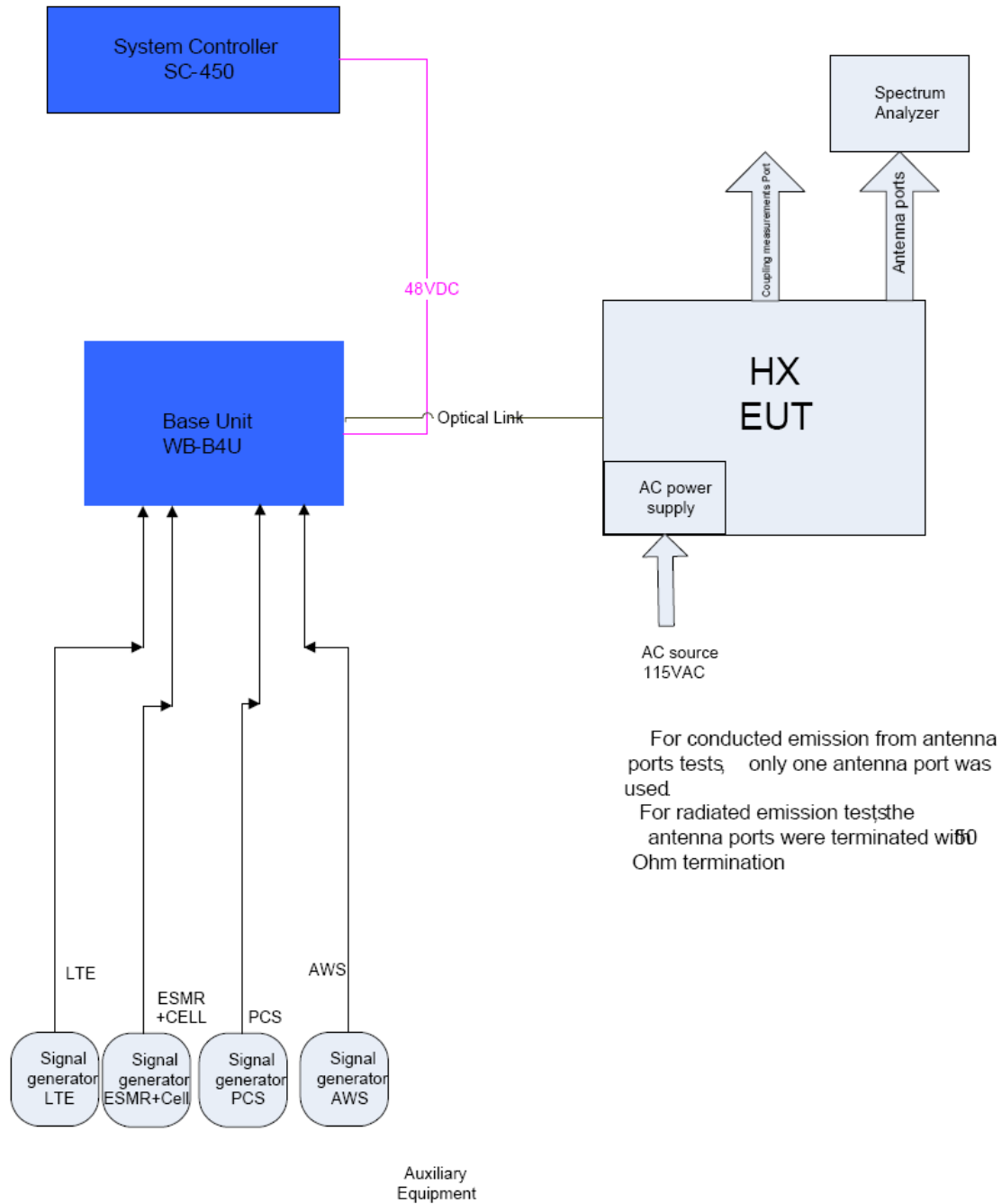


Figure 1. Test Set-up

3. Conducted and Radiated Measurement Test Set-ups Photos



Figure 2. Conducted Emission From AC Mains Test



Figure 3. Conducted Emission From Antenna Ports Tests



Figure 4. Radiated Emission Test

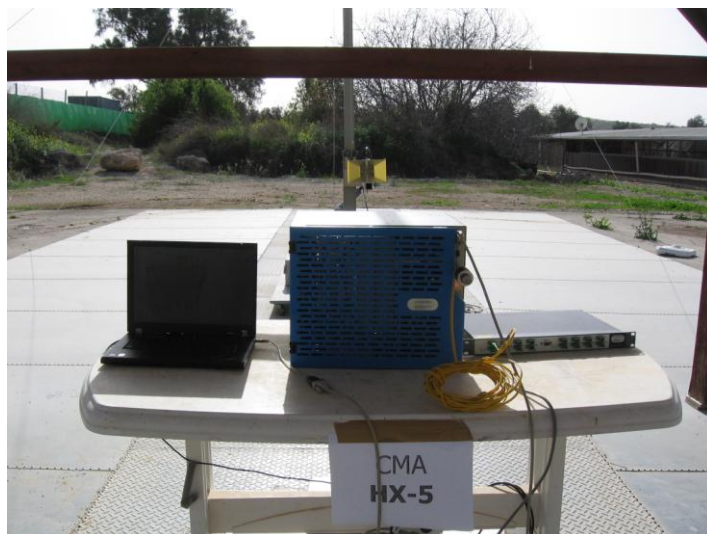


Figure 5. Radiated Emission Test



Figure 6. Radiated Emission Test

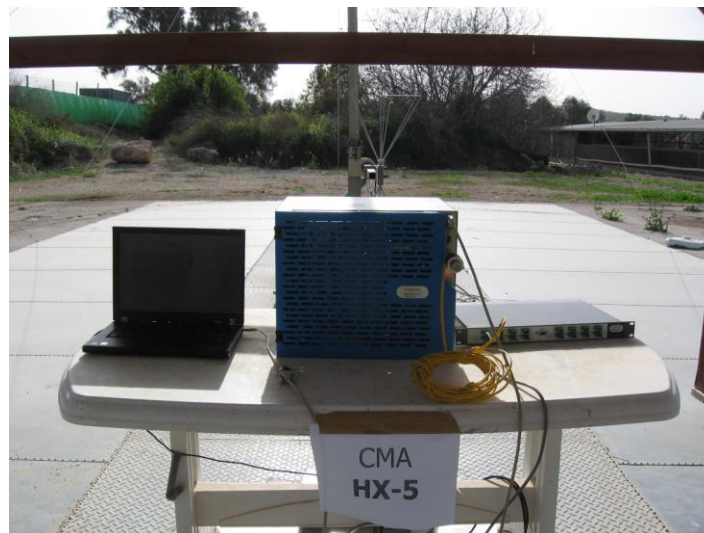


Figure 7. Radiated Emission Test

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=30.6 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	36.89	57.00	-20.11
	881.5	36.84	57.00	-20.16
	889.0	36.20	57.00	-20.80
GSM	870.2	34.86	57.00	-22.14
	881.0	35.49	57.00	-21.51
	892.8	33.70	57.00	-23.30
W-CDMA	871.5	37.39	57.00	-19.61
	881.0	37.49	57.00	-19.51
	891.5	36.22	57.00	-20.78

Figure 8 Peak Output Power CELL

See additional information in Figure 9 to Figure 17.

JUDGEMENT: Passed by 19.51 dB

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A. Sharabi

LTE 64QAM:

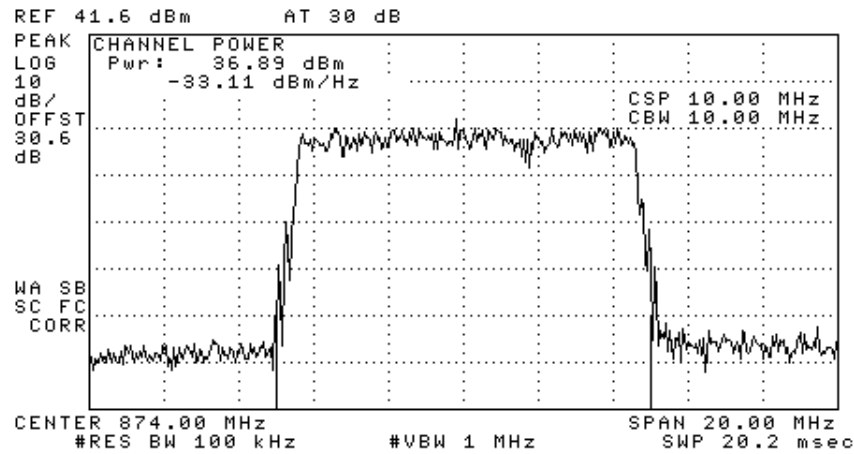


Figure 9.— 874.00 MHz

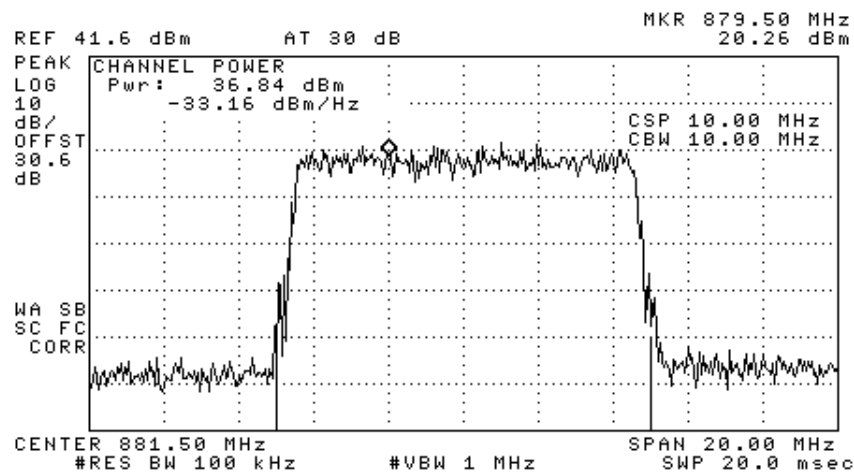


Figure 10.— 881.50 MHz

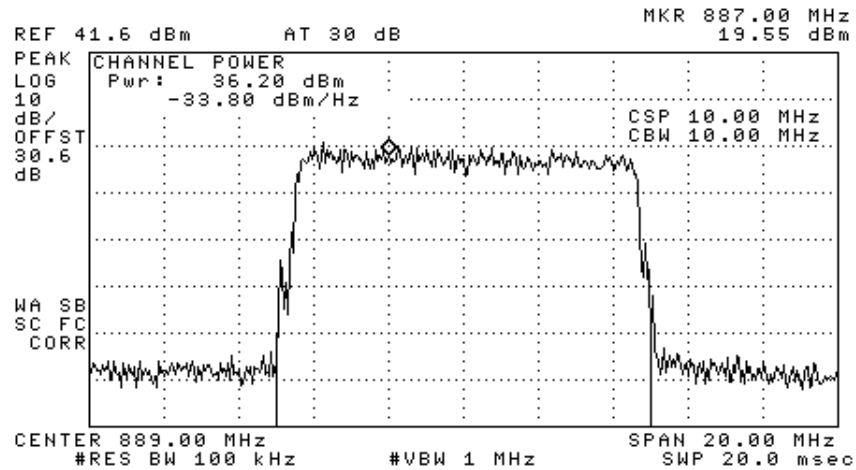


Figure 11.— 889.0 MHz

GSM:

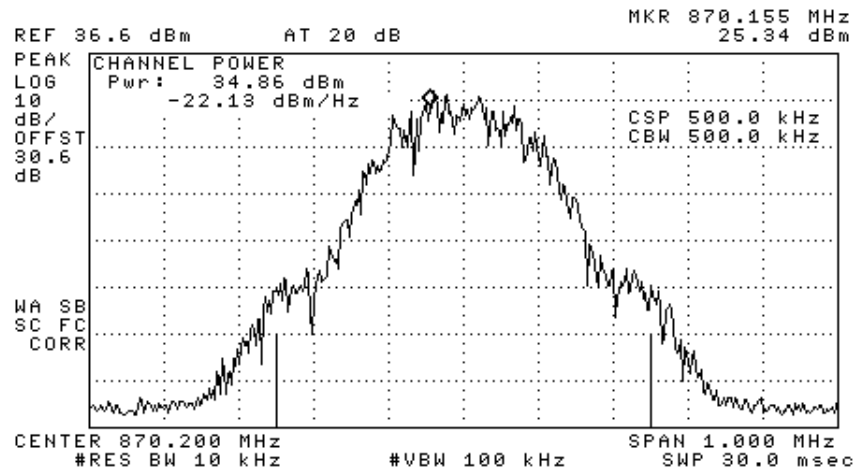


Figure 12.— 870.20 MHz

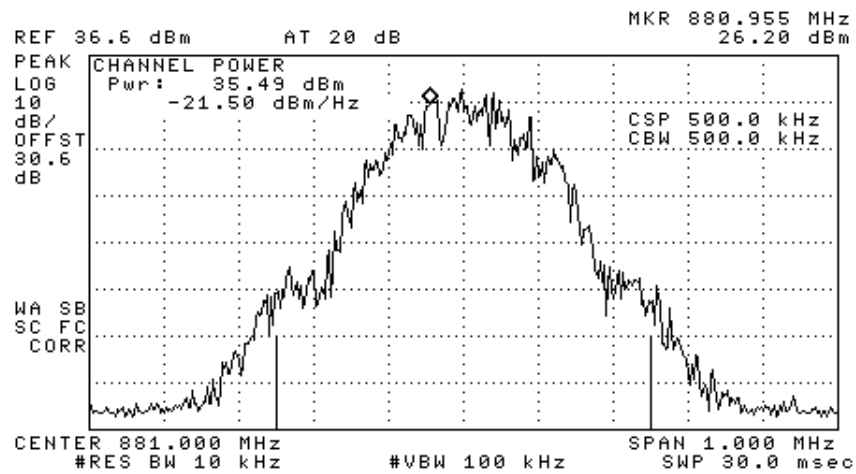


Figure 13.— 881.00 MHz

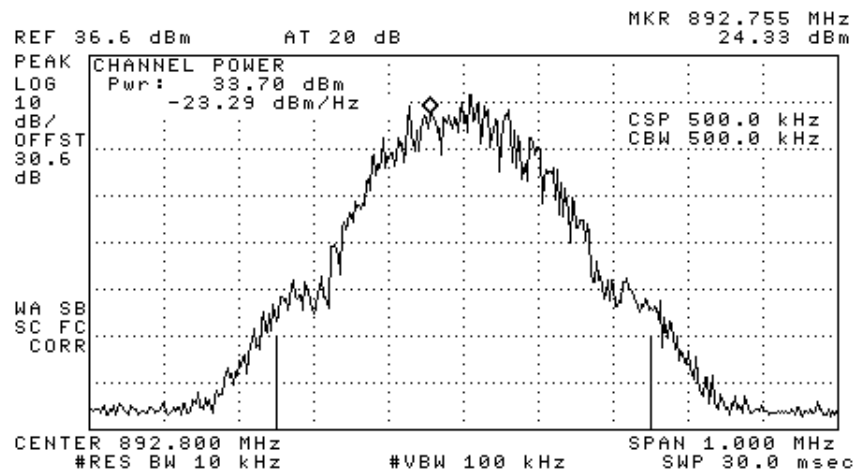


Figure 14.— 892.80 MHz

W-CDMA:

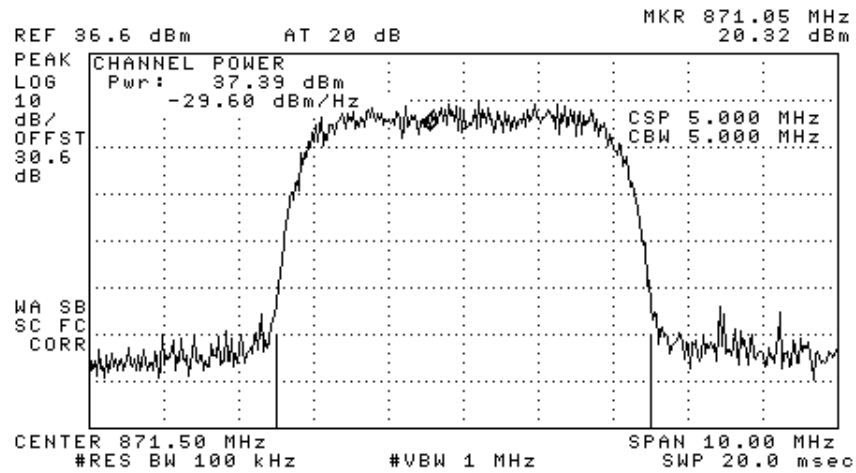


Figure 15.— 871.50 MHz

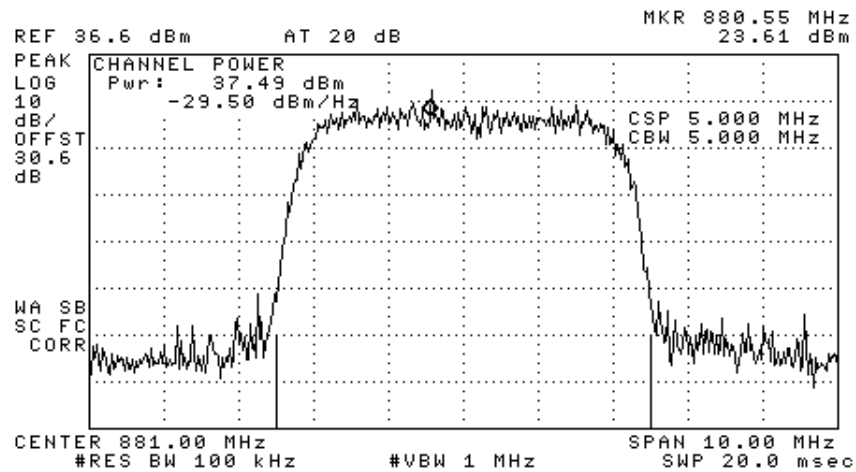


Figure 16.— 881.00 MHz

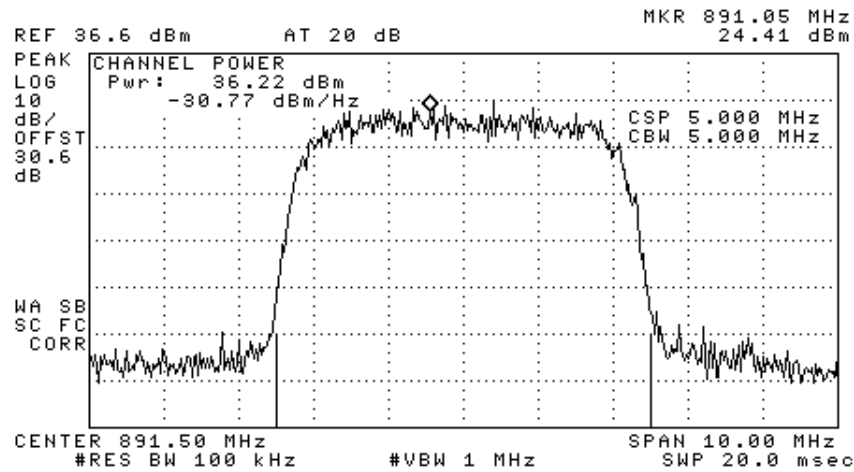


Figure 17.— 891.50 MHz

4.4 Test Equipment Used; Peak Output Power CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8595E	4115A5143	January 1, 2014	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603-5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10-NNN-02	-	N/A	N/A

Figure 18 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	9.55
LTE 64QAM	Output	874.0	9.35
LTE 64QAM	Input	881.0	9.40
LTE 64QAM	Output	881.0	9.40
LTE 64QAM	Input	889.0	9.45
LTE 64QAM	Output	889.0	9.50
GSM	Input	870.2	0.275
GSM	Output	870.2	0.282
GSM	Input	881.0	0.282
GSM	Output	881.0	0.280
GSM	Input	890.0	0.285
GSM	Output	890.0	0.287
W-CDMA	Input	871.5	4.53
W-CDMA	Output	871.5	4.55
W-CDMA	Input	881.0	4.58
W-CDMA	Output	881.0	4.63
W-CDMA	Input	891.5	4.58
W-CDMA	Output	891.5	4.58

Figure 19 Occupied Bandwidth CELL

JUDGEMENT: Passed

See additional information in Figure 20 to Figure 37.

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A. Sharabi

LTE:

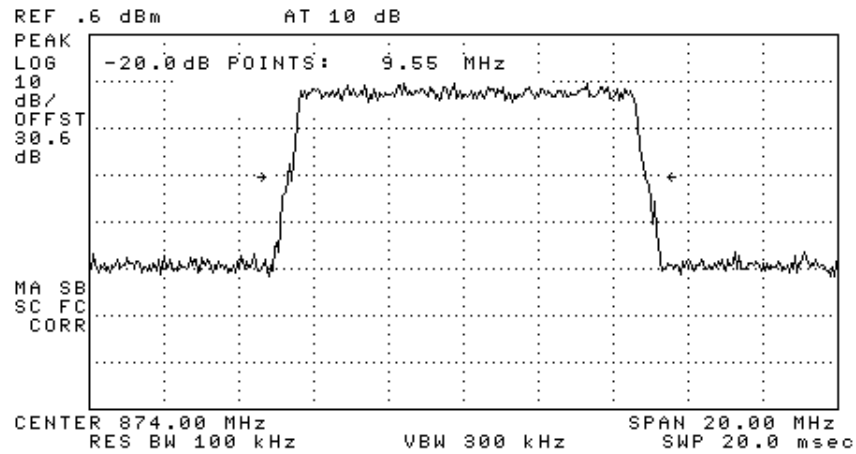


Figure 20.— 64QAM Input 874.00

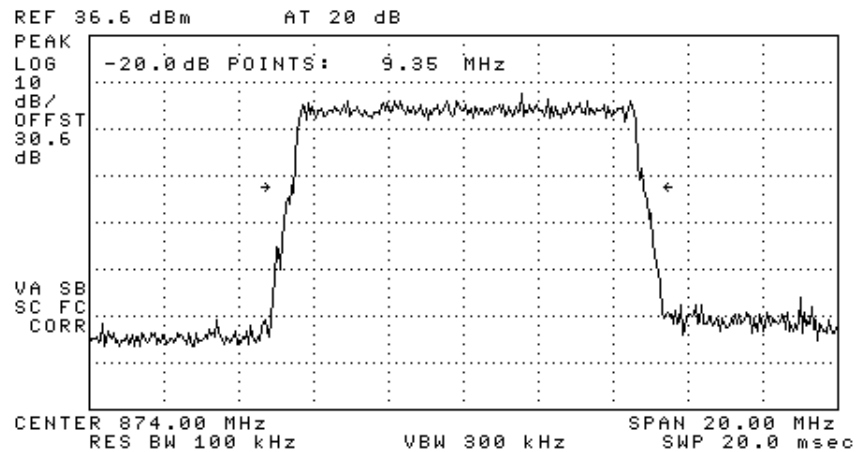


Figure 21.— 64QAM Output 874.00

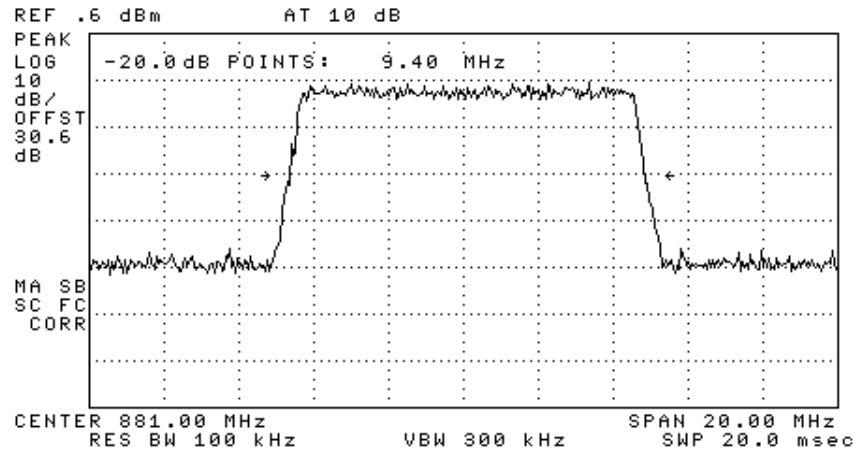


Figure 22.— 64QAM Input 881.0 MHz.

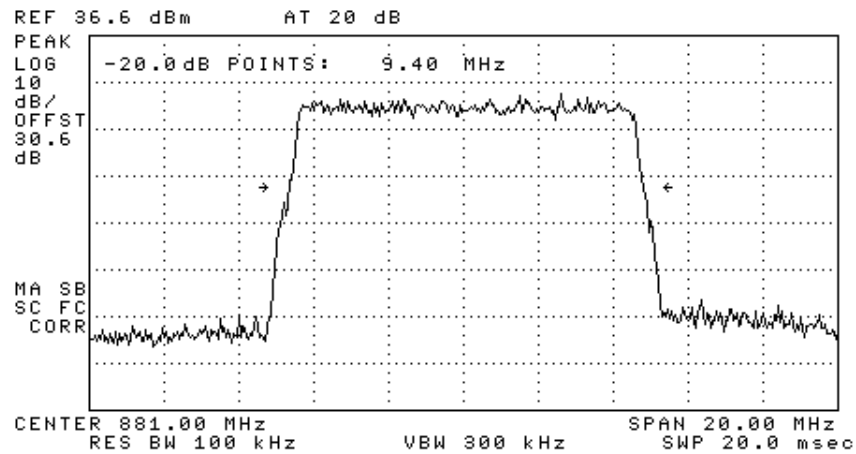


Figure 23.— 64QAM Output 881.0Hz.

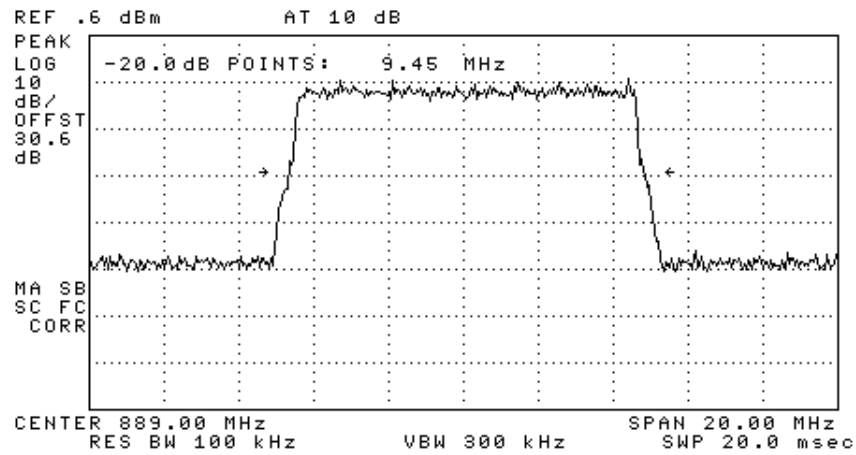


Figure 24.— 64QAM Input 889.00 MHz.

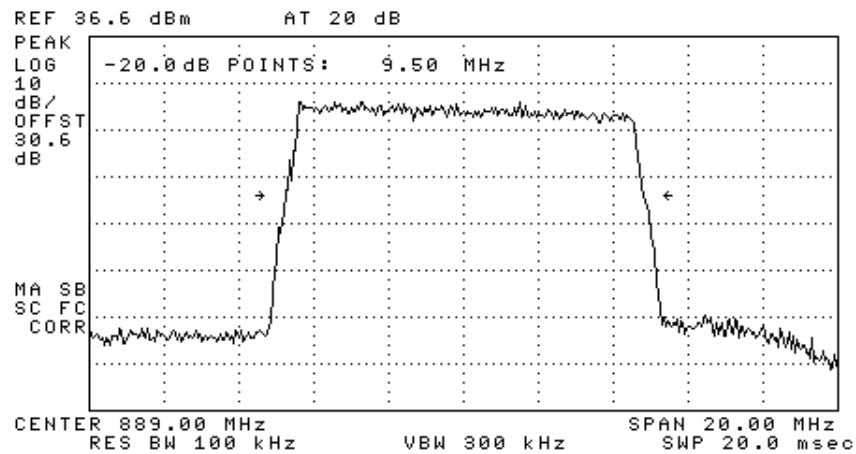


Figure 25.— 64QAM Output 889.00 MHz.

GSM:

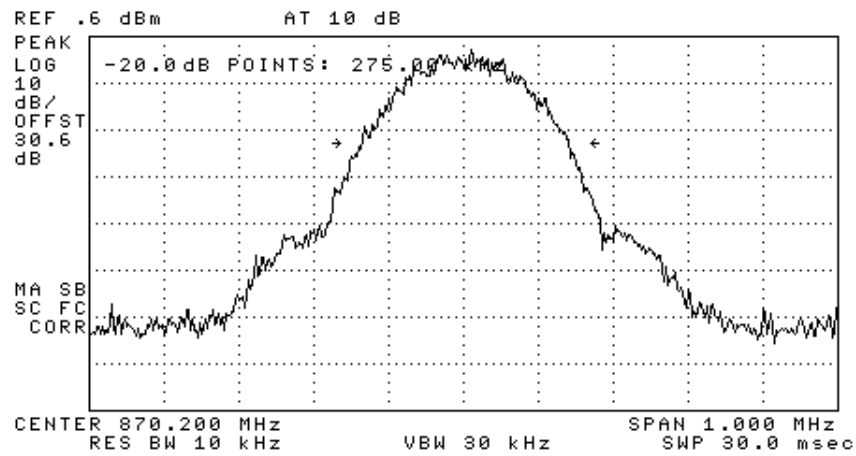


Figure 26.— Input 870.20

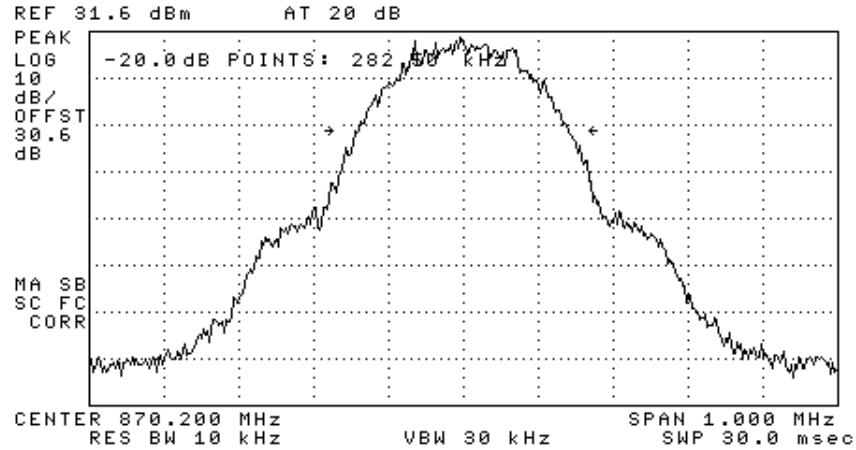


Figure 27.— Output 870.20

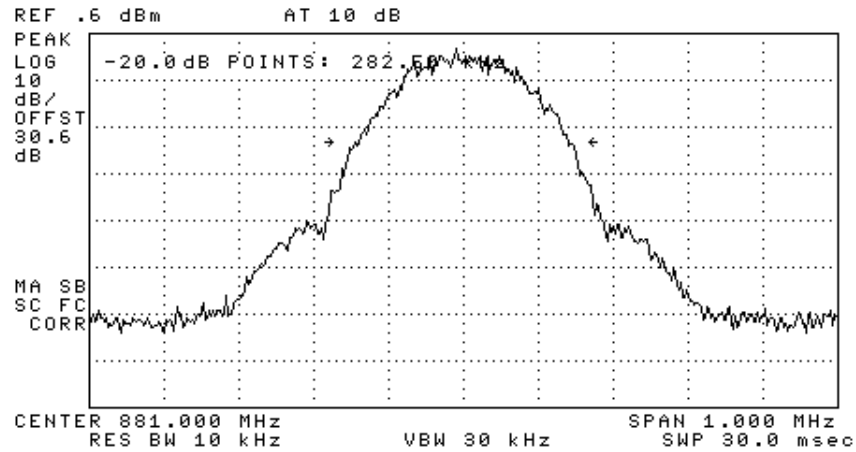


Figure 28.—Input 881.0 MHz.

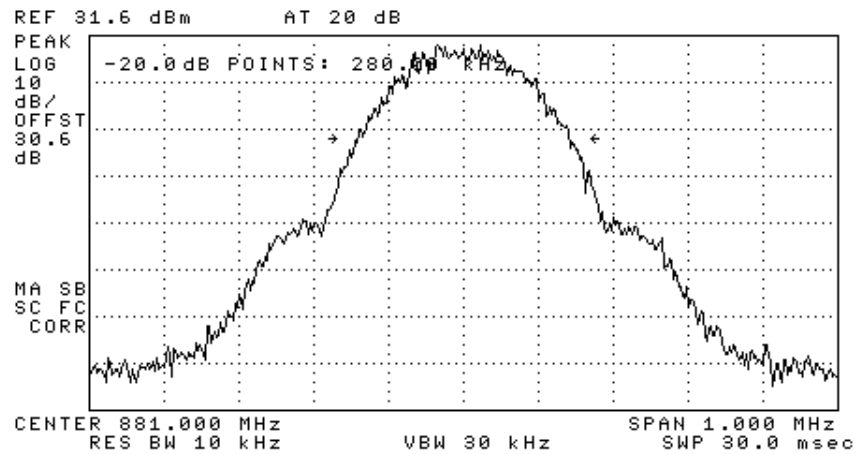


Figure 29.—Output 881.0Hz.

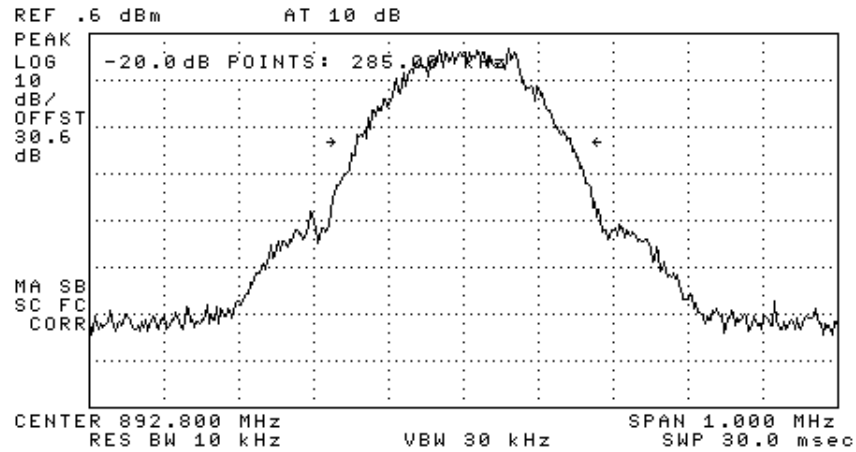


Figure 30.— Input 892.8 MHz.

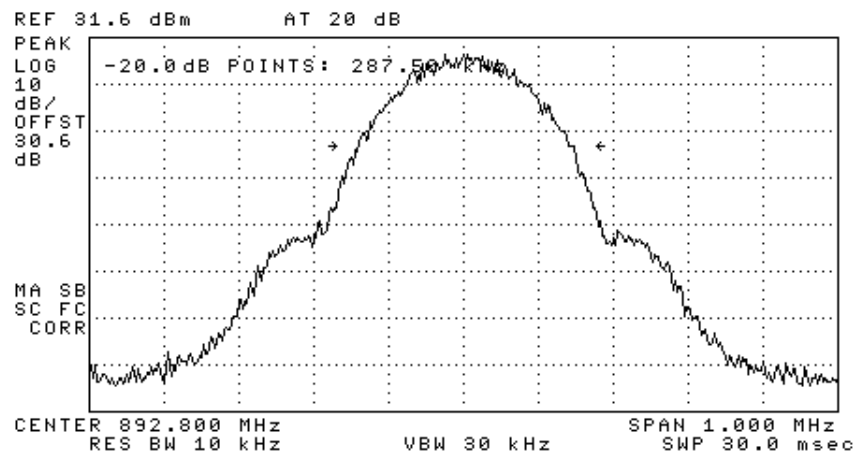


Figure 31.— Output 892.8 MHz.

W-CDMA:

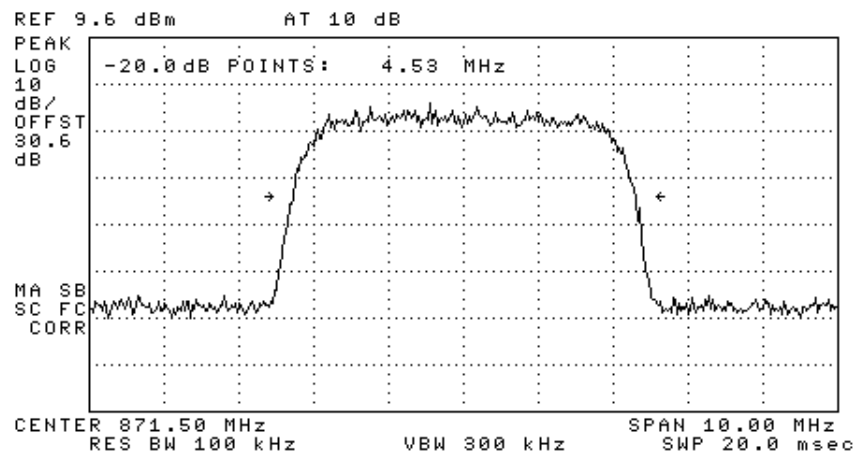


Figure 32.— Input 871.50

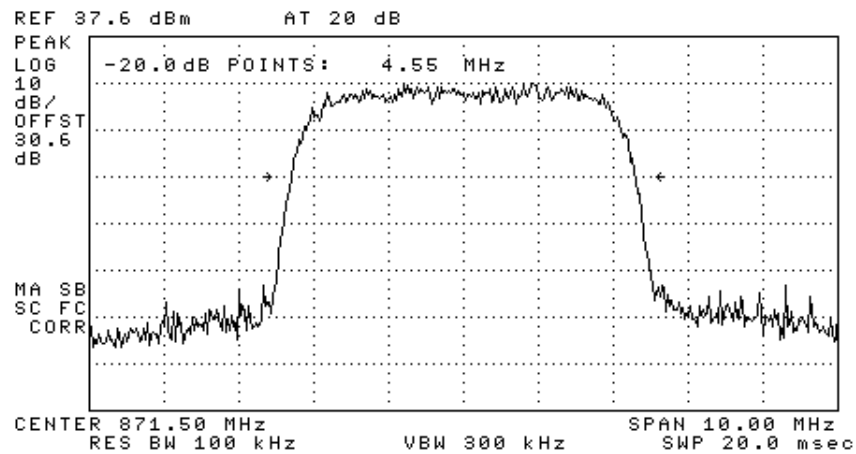


Figure 33.— Output 871.50

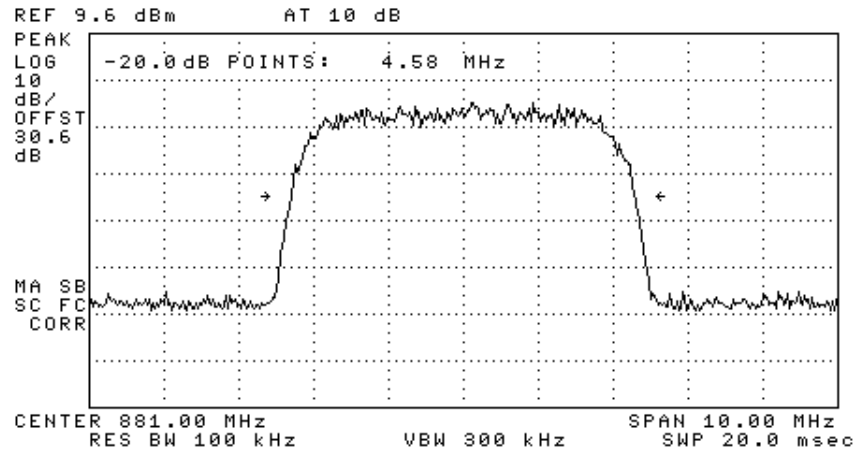


Figure 34.— Input 881.0 MHz.

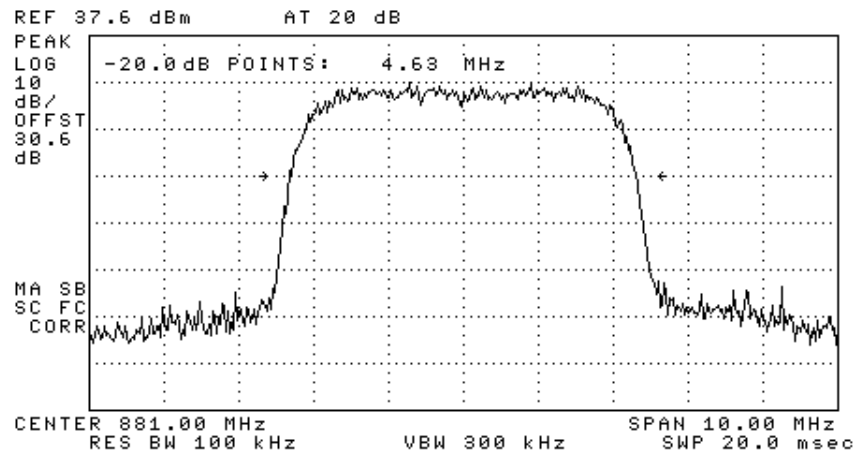


Figure 35.—Output 881.0Hz.

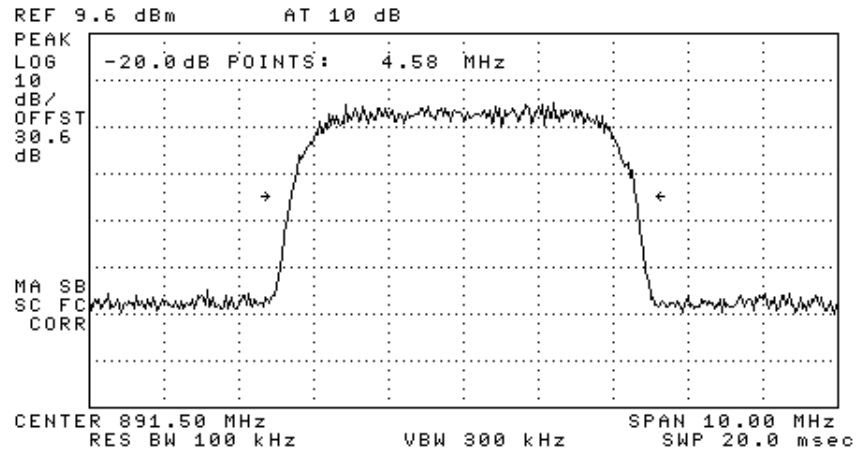


Figure 36.— Input 891.50 MHz.

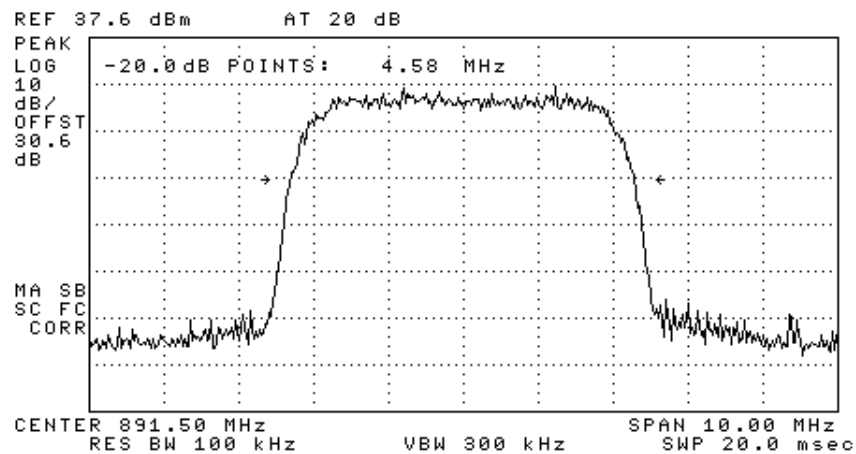


Figure 37.— Output 891.50 MHz.



5.4

Test Equipment Used; Occupied Bandwidth CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8595E	4115A5143	January 1, 2014	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603- 5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	-	N/A	N/A

Figure 38 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 (30.6 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

Modulation	Operation Frequency (MHz)	Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE	874.00	2162	-14.5	-13.0	-1.5
	881.00	2162	-15.5	-13.0	-2.5
	889.00	2127	-15.7	-13.0	-2.7
GSM	870.20	2126	-16.4	-13.0	-3.4
	881.00	2154	-15.0	-13.0	-2.0
	892.80	2133	-15.6	-13.0	-2.6
W-CDMA	871.50	2141	-16.2	-13.0	-3.2
	881.00	2142	-16.1	-13.0	-3.1
	891.50	2142	-16.4	-13.0	-3.4

Figure 39 Out of Band Emission Results CELL

See additional information in Figure 40 to Figure 48.

JUDGEMENT: Passed by 1.5 dB

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A.Sharabi



LTE:

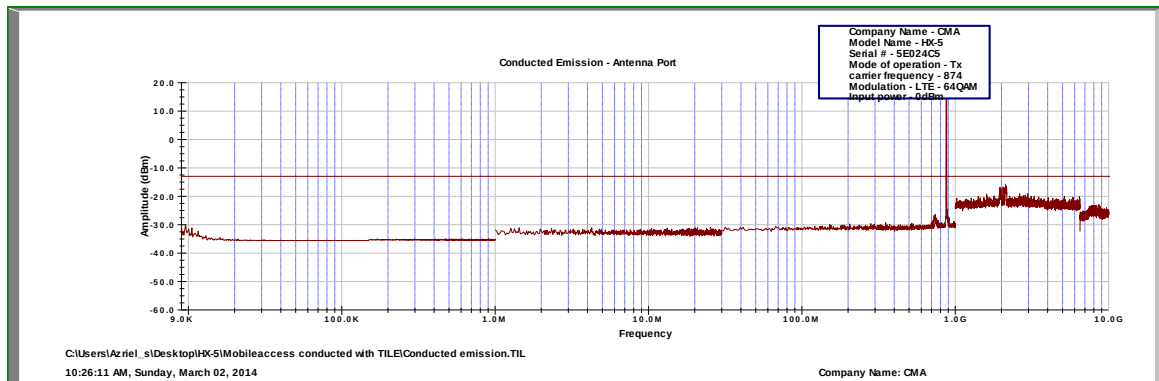


Figure 40.— 874.00 MHz

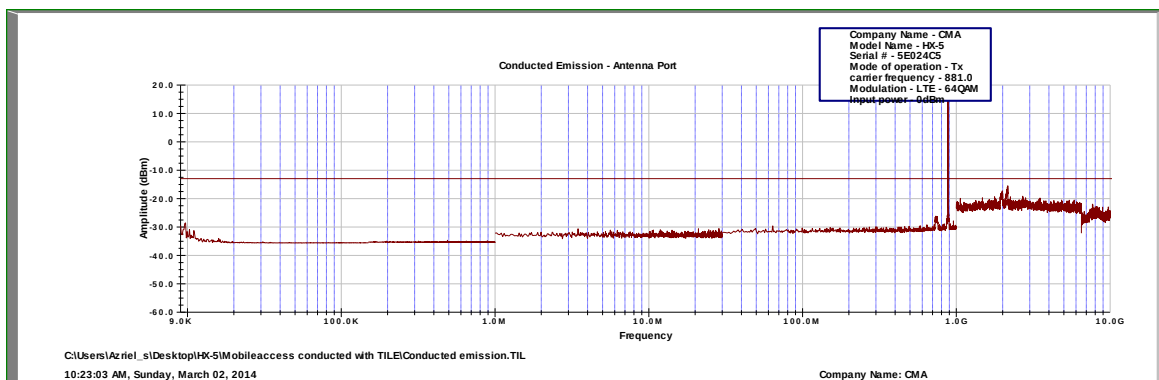


Figure 41.— 881.00 MHz

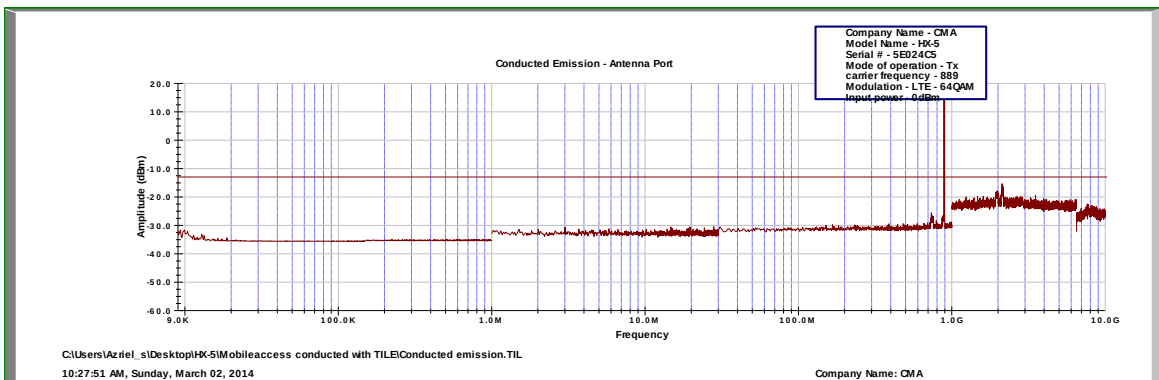


Figure 42.— 889.00 MHz

GSM:

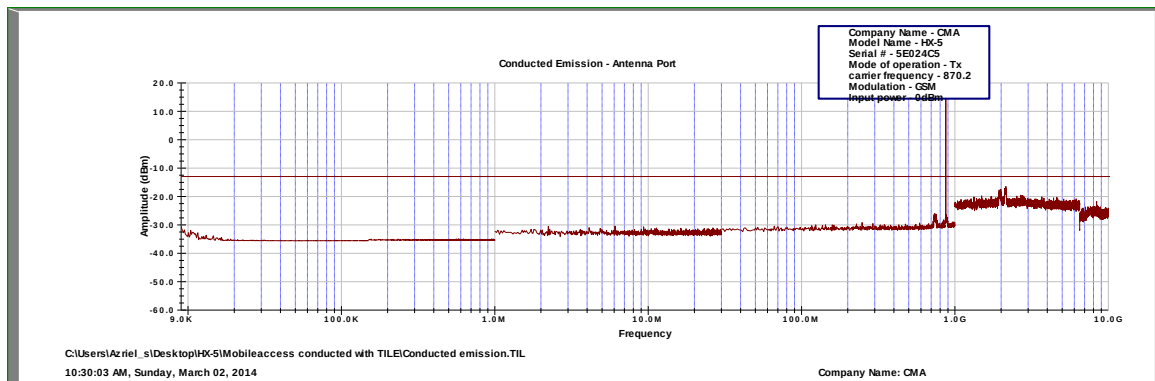


Figure 43.— 870.20 MHz

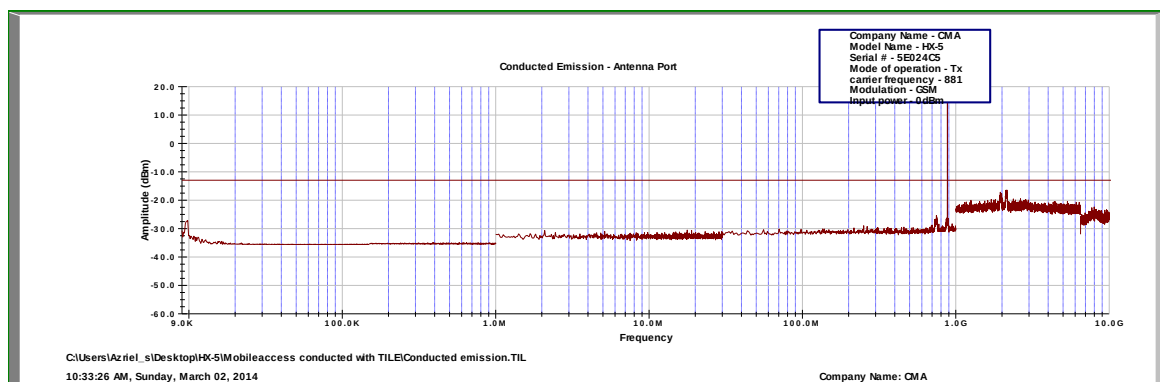


Figure 44.— 881.00 MHz

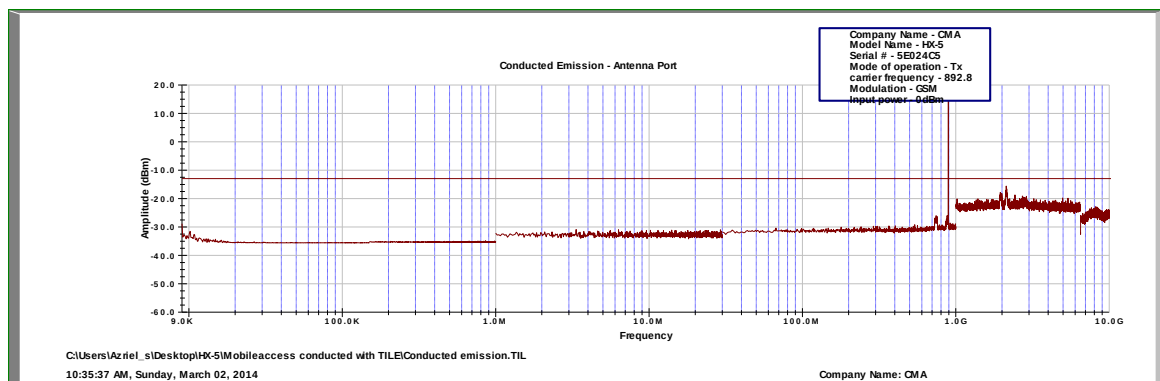


Figure 45.— 892.80 MHz



W-CDMA:

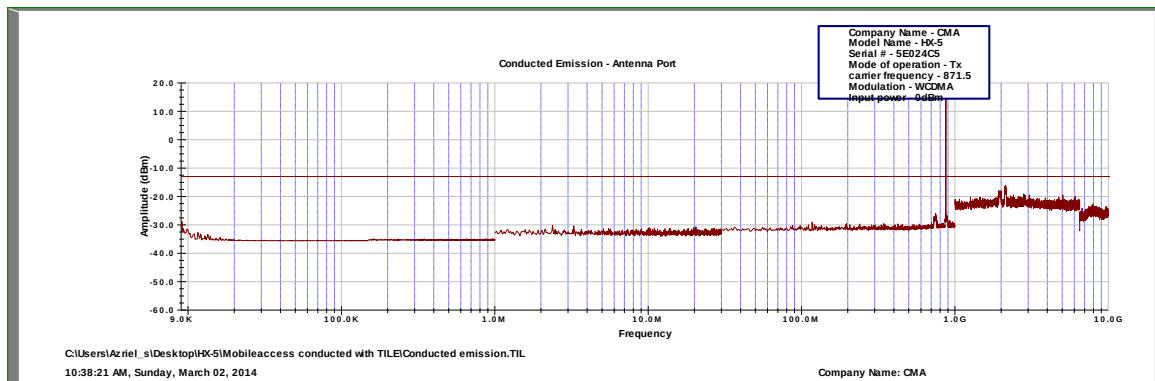


Figure 46.— 871.50 MHz

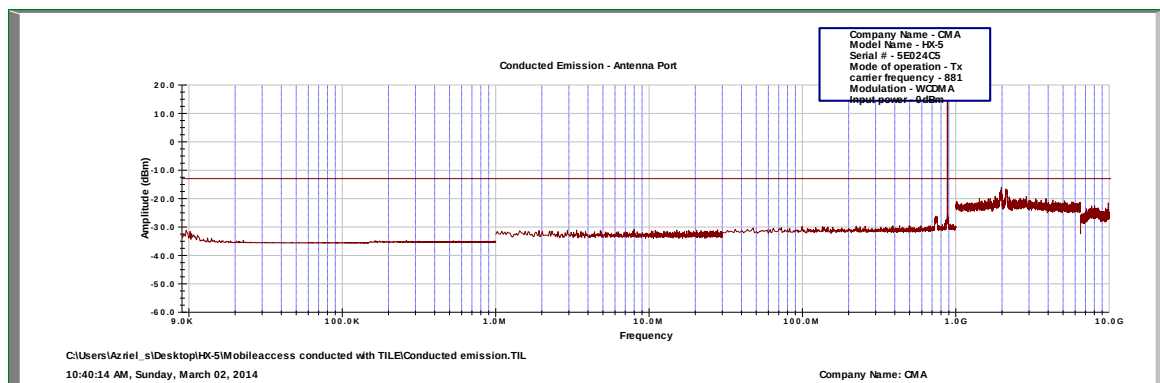


Figure 47.— 881.00 MHz

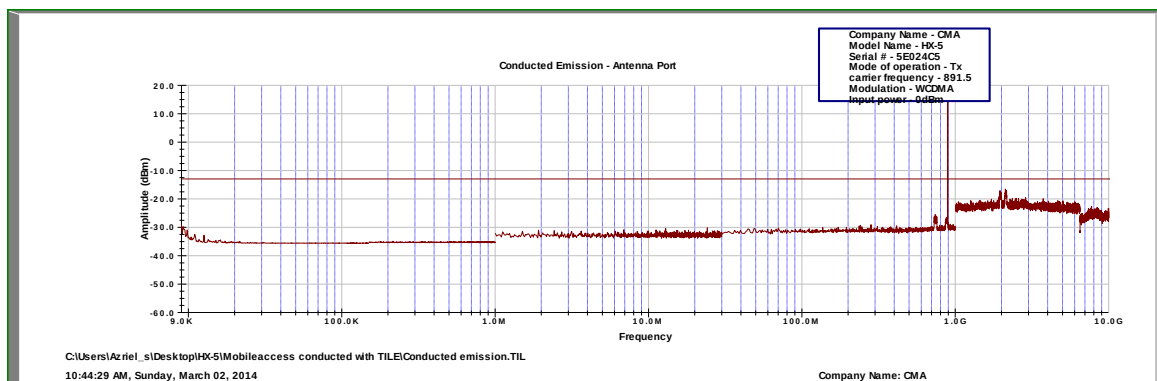


Figure 48.— 891.50 MHz



**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	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603-5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10-NNN-02	-	N/A	N/A

Figure 49 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 and the highest operation frequency 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 (30.6 dB).

7.3 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	874.00	869.00	-13.47	-13.0	-0.47
	889.00	894.00	-15.48	-13.0	-2.48
GSM	870.20	894.00	-32.35	-13.0	-19.35
	892.80	869.00	-33.37	-13.0	-20.37
W-CDMA	871.50	869.00	-25.80	-13.0	-12.80
	891.50	894.00	-26.47	-13.0	-13.47

Figure 50 Band Edge Spectrum Results CELL

See additional information in Figure 51 to Figure 56.

JUDGEMENT: Passed by 0.47 dB

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A. Sharabi

LTE:

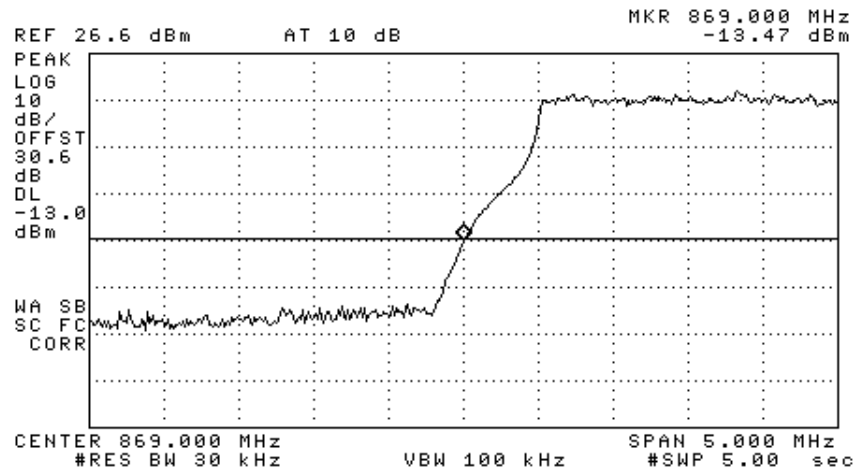


Figure 51.— 64QAM 874.00 MHz

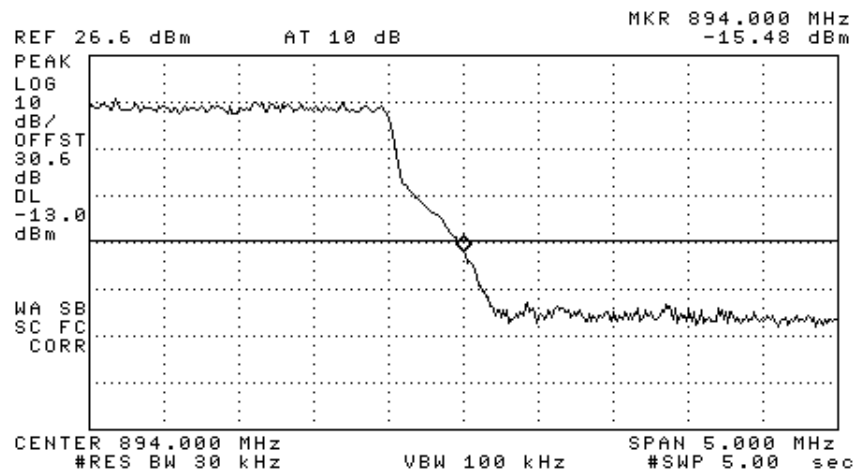


Figure 52.— 64QAM 889.00 MHz

GSM:

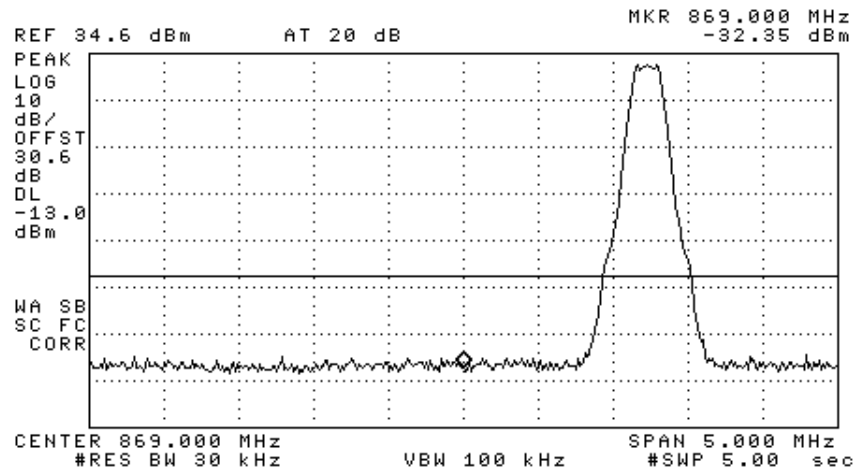


Figure 53.— 870.20 MHz

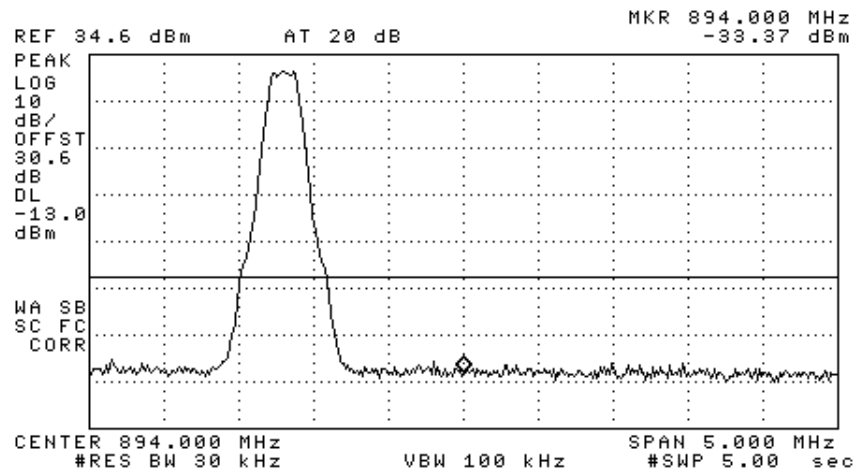


Figure 54.— 892.80 MHz

W-CDMA:

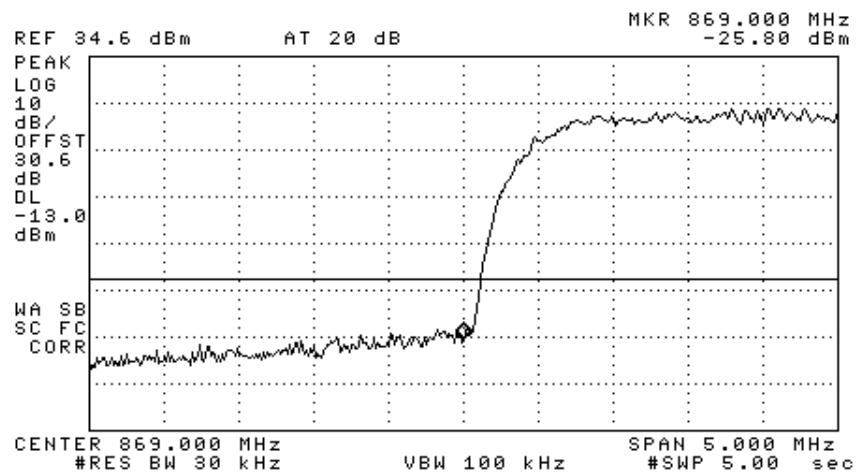


Figure 55.— 871.50 MHz

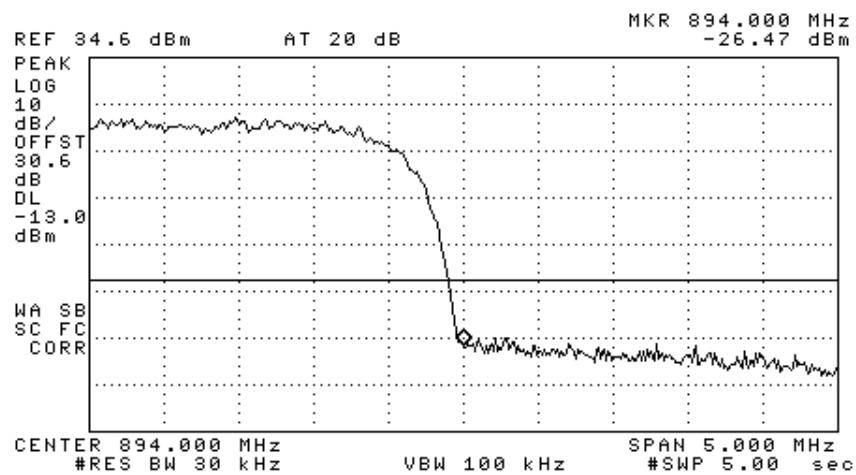


Figure 56.— 891.50 MHz



7.4

Test Equipment Used; Band Edge Spectrum CELL

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8595E	4115A5143	January 1, 2014	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603-5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10-NNN-02	-	N/A	N/A

Figure 57 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°, 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	54.5	-46.31	5.45	7.64	-44.12	-13.0	-31.12
870.20	1740.40	H	54.4	-46.24	5.45	7.64	-44.05	-13.0	-31.05
881.00	1762.00	V	54.7	-45.09	5.6	7.66	-43.03	-13.0	-30.03
881.00	1762.00	H	54.3	-45.75	5.6	7.66	-43.69	-13.0	-30.69
892.80	1785.60	V	55.9	-43.89	5.6	7.66	-41.83	-13.0	-28.83
892.80	1785.60	H	54.7	-45.35	5.6	7.66	-43.29	-13.0	-30.29

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

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A.Sharabi

8.4 Test Instrumentation Used, Radiated Measurements CELL

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 Year
RF Filter Section	HP	85420E	3705A00248	January 15, 2014	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	2 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 58 Test Equipment Used Radiated Measurements CELL

9. Peak Output Power (iDEN)

9.1 Test Specification

FCC Part 90 Section 90.219

9.2 Test Procedure

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through a 30 dB external attenuator and an appropriate coaxial cable (Cable Loss = 0.6 dB). Special attention was taken to prevent Spectrum Analyzer RF input overload.

9.3 Test Results

Modulation	Operation Frequency (MHz)	Reading (dBm)
LTE 5MHz 64QAM	864.5	32.99
	866.5	33.17
GSM	863.2	33.05
	867.8	33.15
WCDMA	864.5	33.08
	866.5	33.10

Figure 59 Peak Output Power Test Results Table

See additional information in Figure 60 to Figure 65.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 12.03.14

Typed/Printed Name: A.Sharabi

Peak Output Power (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

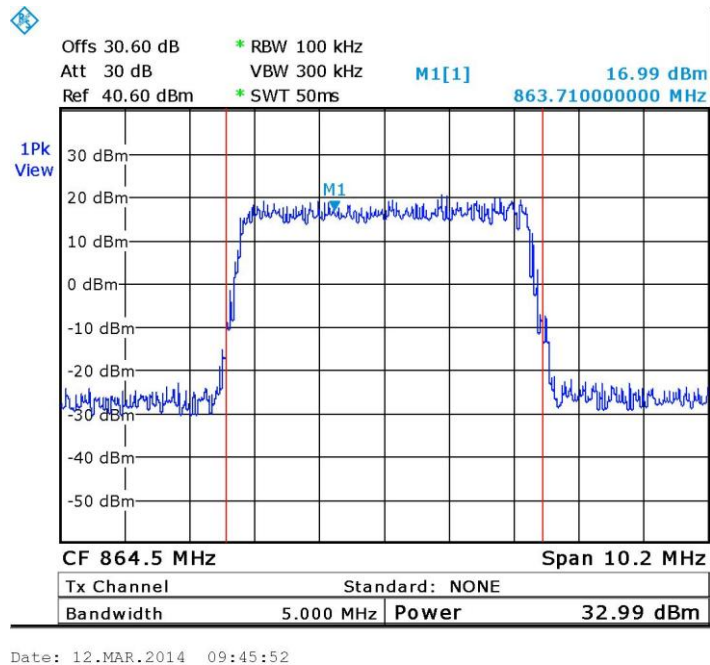


Figure 60.—864.5 MHz – LTE 64QAM

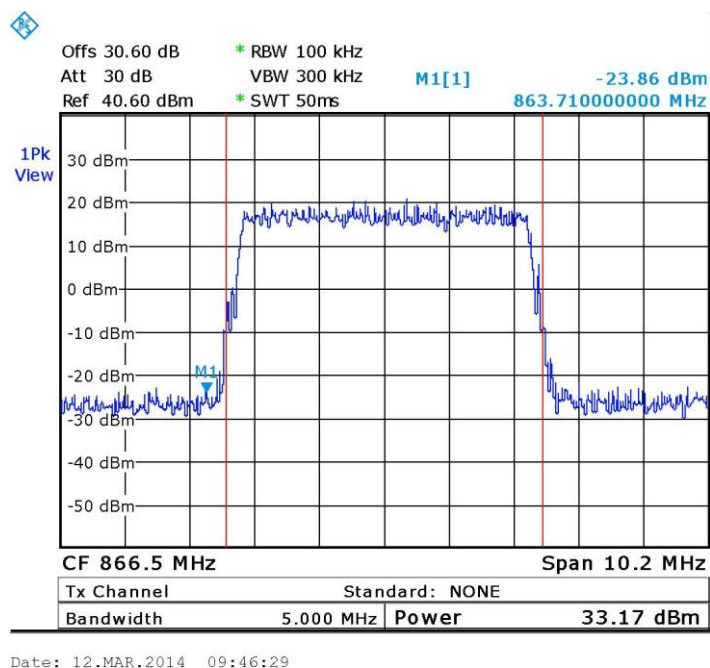


Figure 61.— 866.5 MHz – LTE 64QAM

Peak Output Power (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

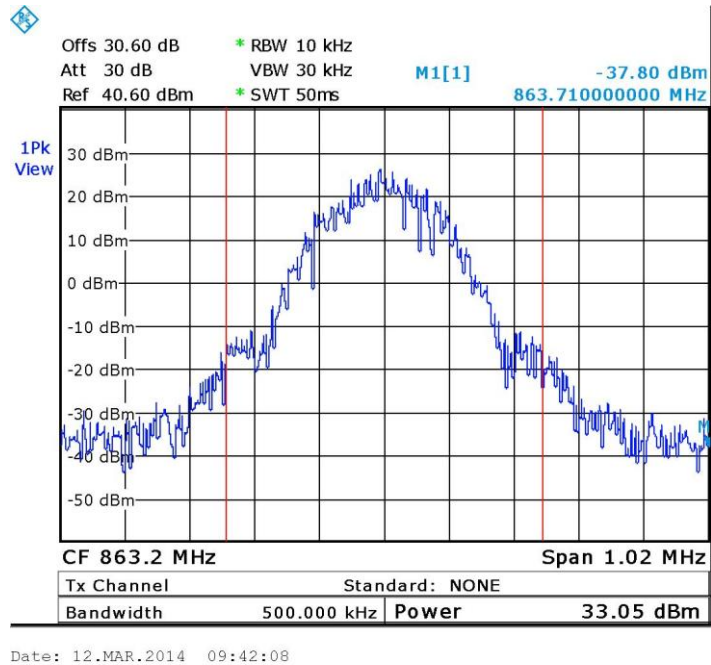


Figure 62.—863.2 MHz – GSM

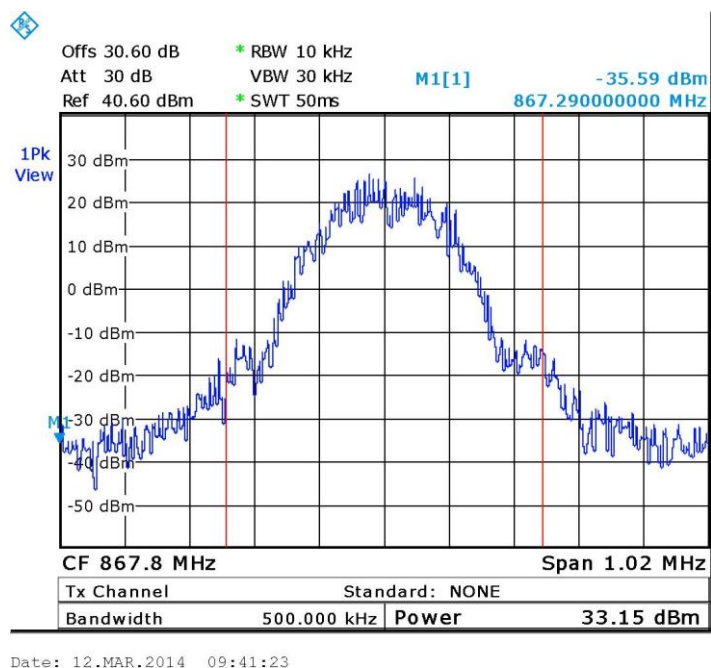


Figure 63.— 867.8 MHz – GSM



Peak Output Power (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

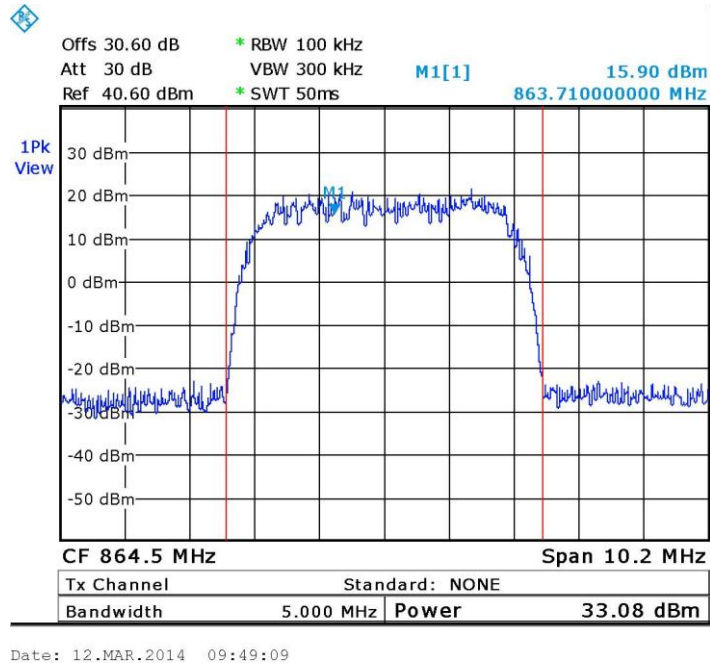


Figure 64.—864.5 MHz – WCDMA

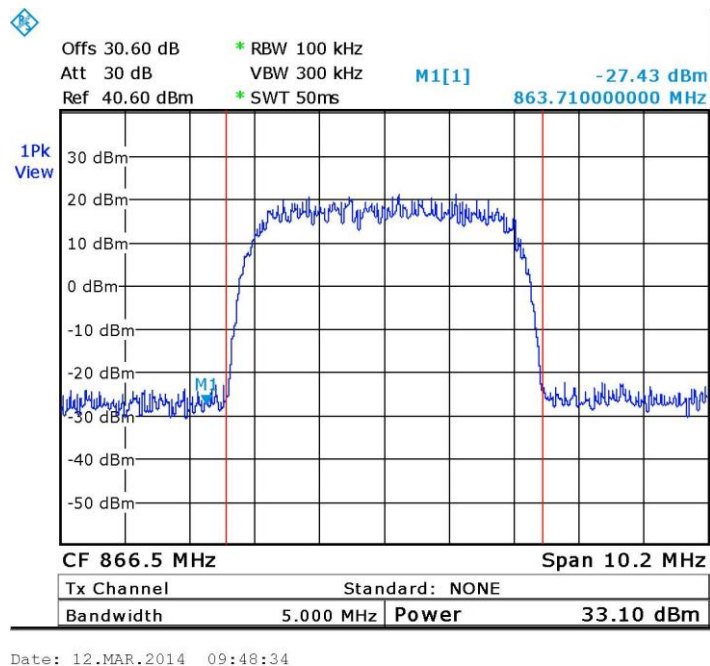


Figure 65.— 866.5 MHz – WCDMA



9.4 Test Equipment Used; Peak Power (iDEN)

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	R&S	FSL6	100194	December 1, 2013	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603- 5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAV E	DCDB-3624-10- NNN-02	-	N/A	N/A

Figure 66 Test Equipment Used Peak Output Power (iDEN)

10. Occupied Bandwidth (iDEN)

10.1 Test Specification

FCC Parts 2.1049; 90.2.09

10.2 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 a 30 dB external attenuator and appropriate coaxial cable (Cable Loss 0.6 dB). 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	Reading (kHz)
LTE	Input	864.5	4.83
LTE	Output	864.5	4.85
LTE	Input	866.5	4.78
LTE	Output	866.5	4.80
W-CDMA	Input	864.5	4.60
W-CDMA	Output	864.5	4.58
W-CDMA	Input	866.5	4.55
W-CDMA	Output	866.5	4.55
GSM	Input	863.2	0.282
GSM	Output	863.2	0.285
GSM	Input	867.8	0.280
GSM	Output	867.8	0.282

Figure 67 Occupied Bandwidth Test Results Table

See additional information in Figure 68 to Figure 79.

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A.Sharabi

Occupied Bandwidth (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

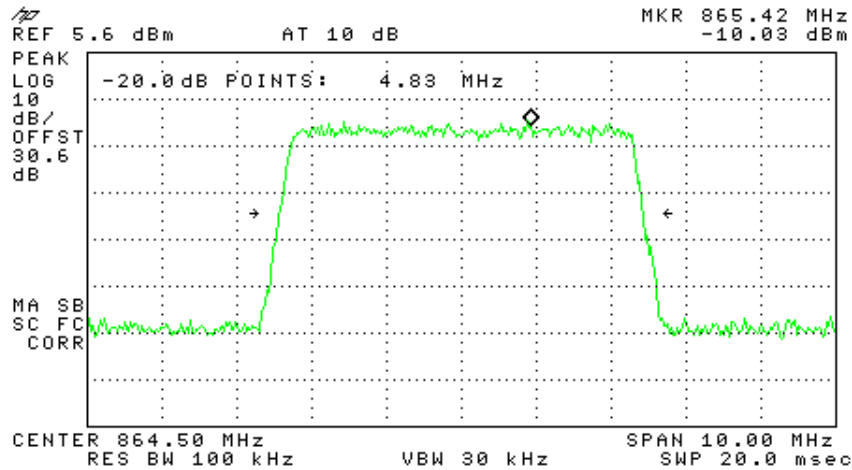


Figure 68.— 864.5MHz LTE 64QAM Input

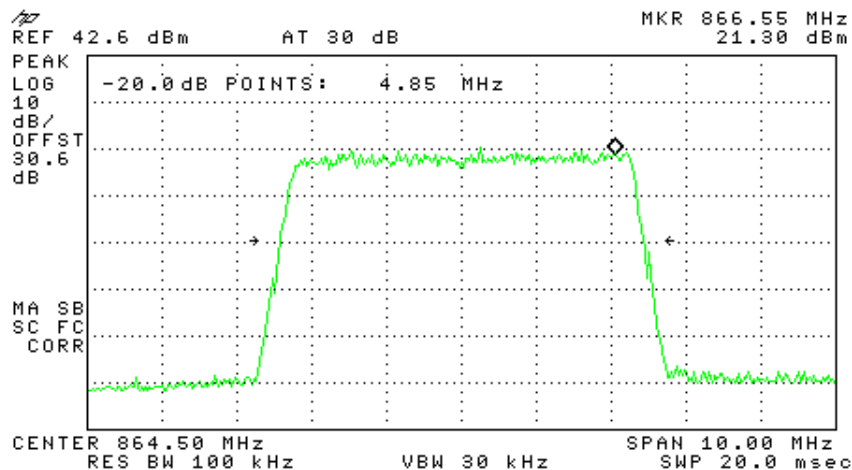


Figure 69.— 864.5MHz LTE 64QAM Output

Occupied Bandwidth (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

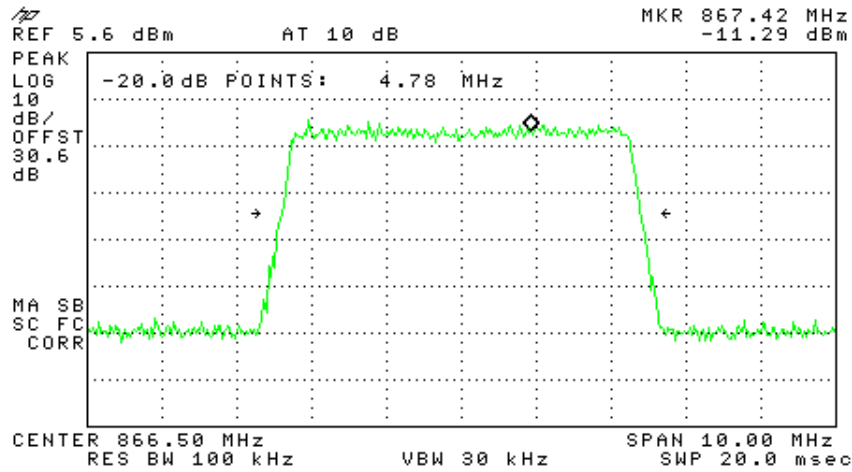


Figure 70.— 866.5MHz LTE 64QAM Input

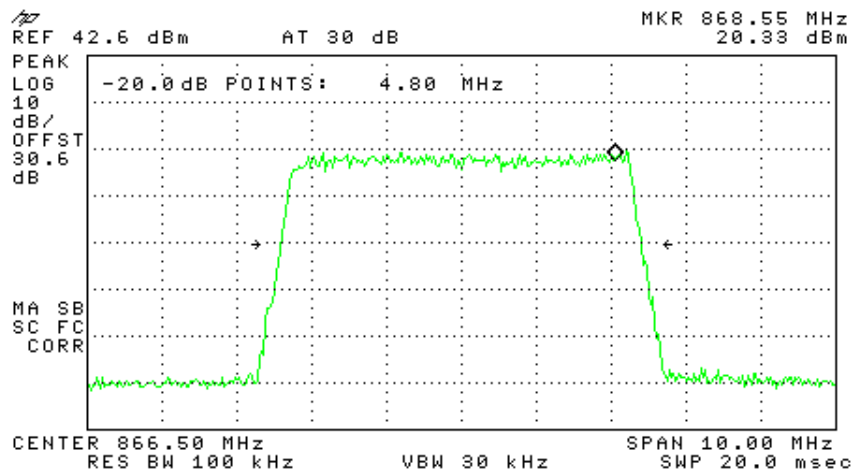


Figure 71.— 866.5MHz LTE 64QAM Output

Occupied Bandwidth (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

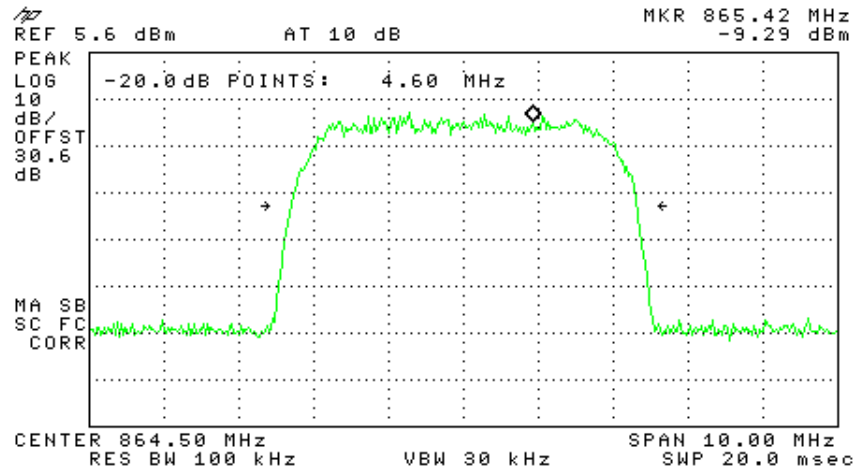


Figure 72.— 864.5MHz WCDMA Input

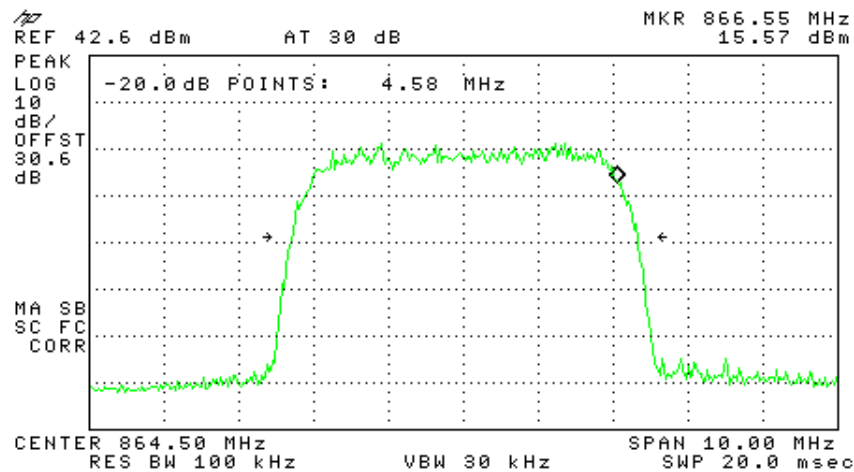


Figure 73.— 864.5MHz WCDMA Output

Occupied Bandwidth (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

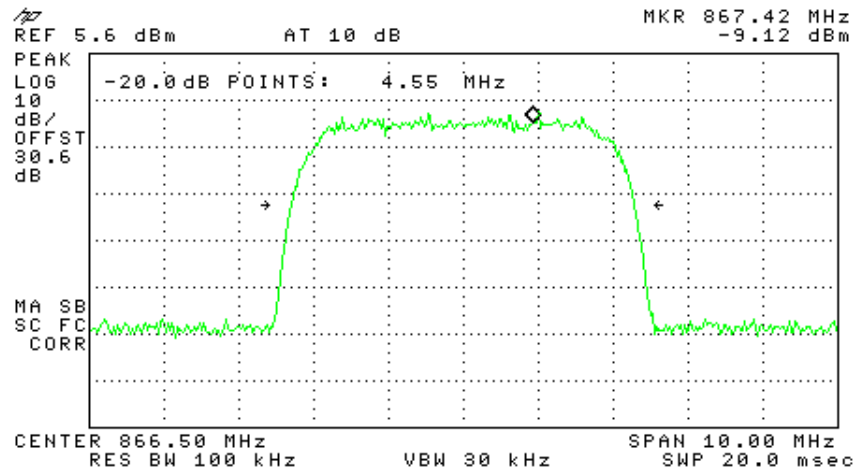


Figure 74.— 866.5MHz WCDMA Input

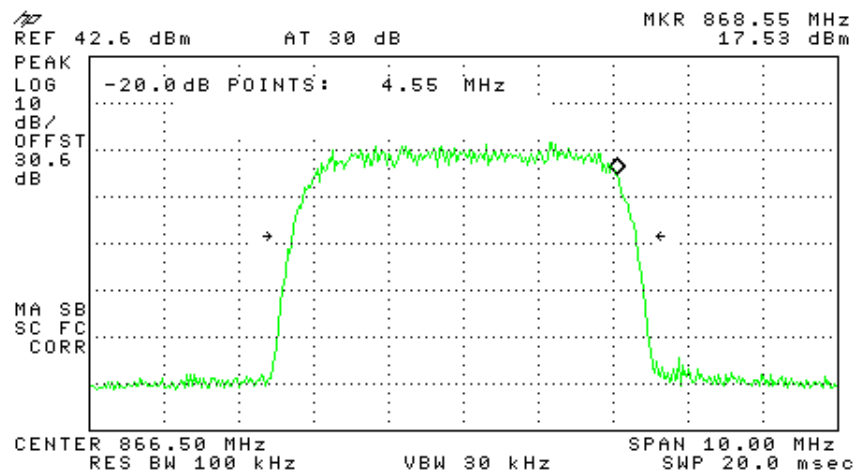


Figure 75.— 866.5MHz WCDMA Output

Occupied Bandwidth (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

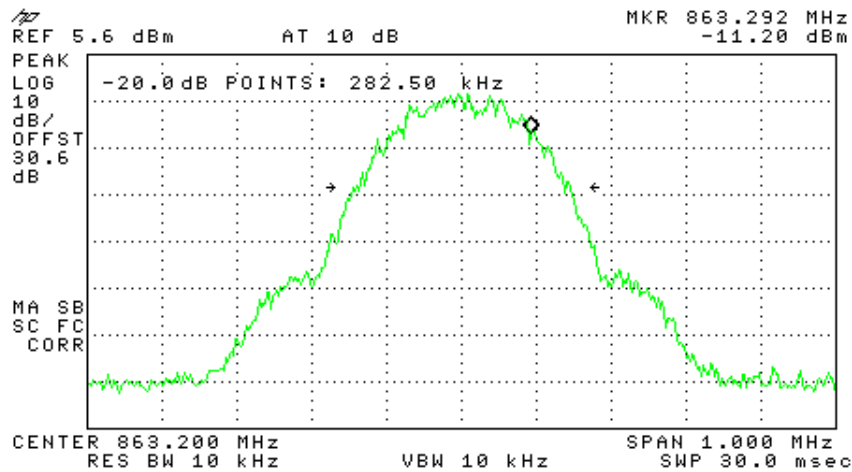


Figure 76.— 863.2MHz GSM Input

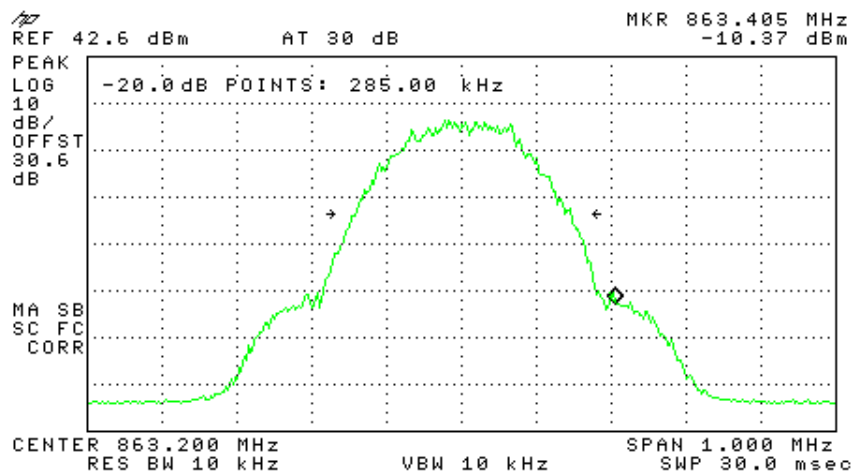


Figure 77.— 863.2MHz GSM Output

Occupied Bandwidth (iDEN)

E.U.T Description Mid Power Remote Unit
Type HX-5
Serial Number: Not Designated

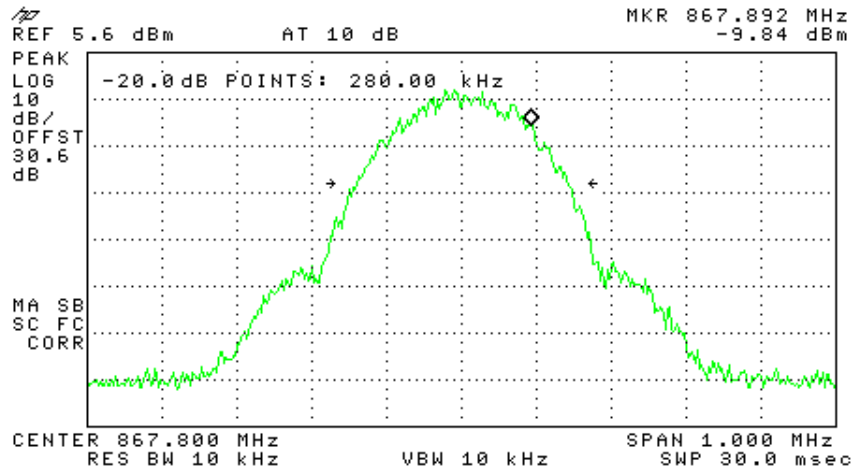


Figure 78.— 867.8MHz GSM Input

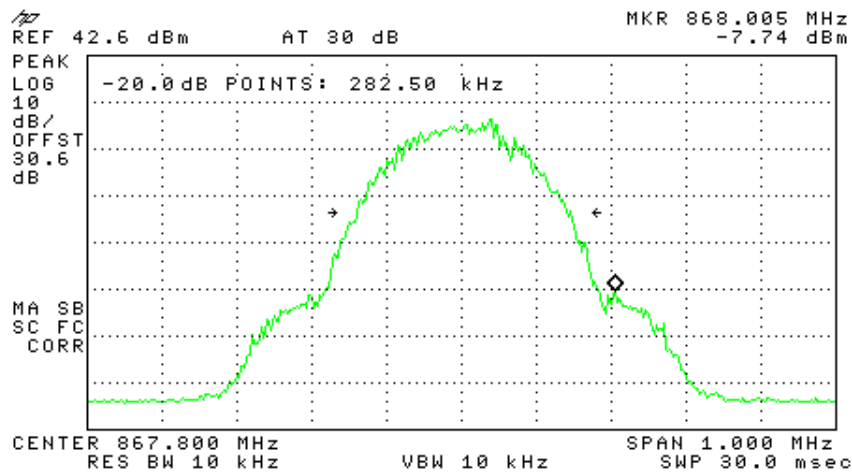


Figure 79.— 867.8MHz GSM Output



Occupied Bandwidth (iDEN)

10.4 Test Equipment Used; Occupied Bandwidth (iDEN)

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603- 5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	-	N/A	N/A

Figure 80 Test Equipment Used Occupied Bandwidth (iDEN)



11. Out of Band Emissions at Antenna Terminals (iDEN)

11.1 Test Specification

FCC Part 90, Section 90.210

11.2 Test Procedure

The power of any emission outside of the authorized bandwidth must be attenuated below the transmitting power (P) by a factor of at least $43 + \log(P)$ dB, yielding -13dBm. The resolution bandwidth was set to 1.0 kHz for the frequency range 9 kHz – 1 MHz, 100 kHz for the frequency range 1 MHz to 1 GHz, and 1 MHz in the frequency range 1 – 9 GHz.

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 30 dB external attenuator and an appropriate coaxial cable (Cable Loss= 0.6 dB).

11.3 Test Results

Modulation	Operation Frequency (MHz)	Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 5MHz 64QAM	864.5	2151	-15.6	-13.0	-2.6
	866.5	2160	-16.0	-13.0	-3.0
GSM	863.2	2116	-16.6	-13.0	-3.6
	867.8	2149	-15.0	-13.0	-2.0
WCDMA	864.5	2140	-15.6	-13.0	-2.6
	866.5	2159	-16.1	-13.0	-3.1

Figure 81 Out of Band Emission at Antenna Terminals (iDEN) Test Results Table

See additional information in Figure 82 to Figure 87.

JUDGEMENT: Passed by 2.0 dB

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A.Sharabi



Out of Band Emissions at Antenna Terminals (iDEN)

E.U.T Description	Mid Power Remote Unit
Type	HX-5
Serial Number:	Not Designated

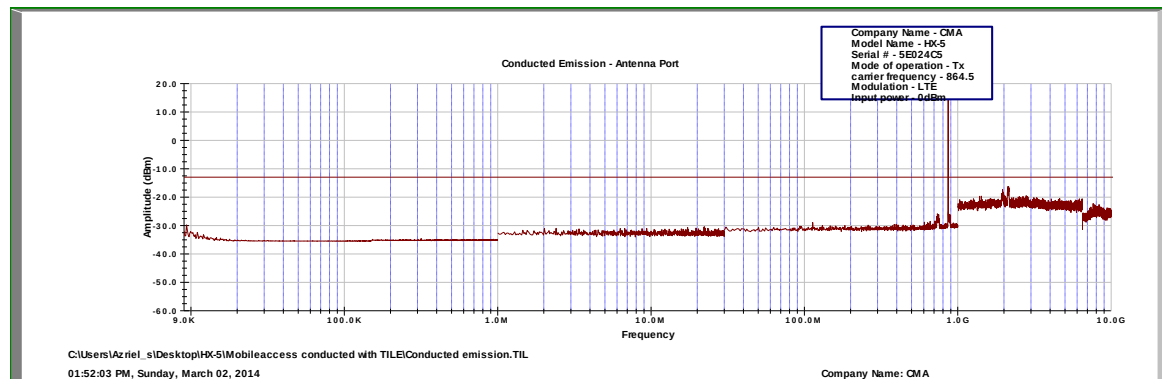


Figure 82.— 864.5 LTE 5MHz 64QAM

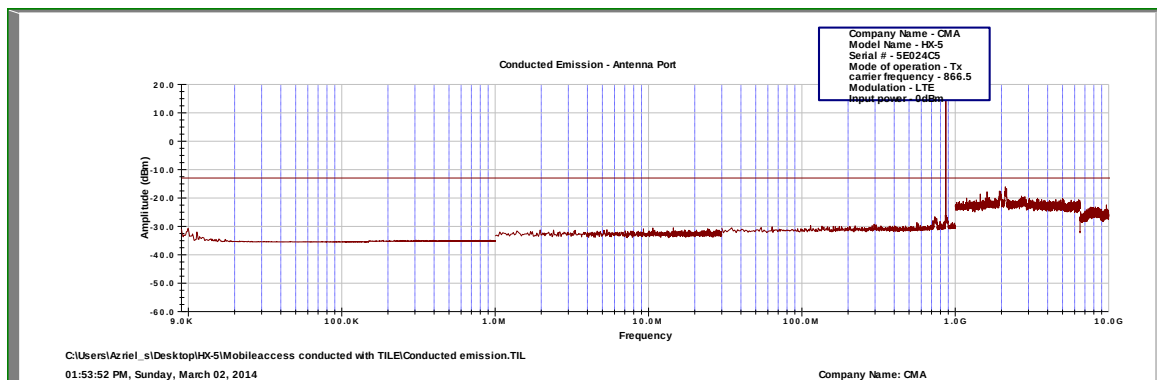


Figure 83.— 866.5 LTE 5MHz 64QAM

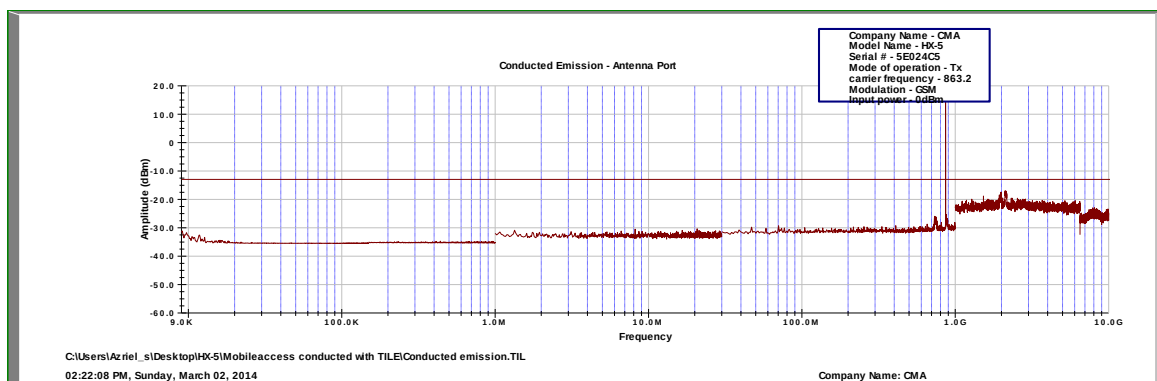


Figure 84.— 863.2 GSM

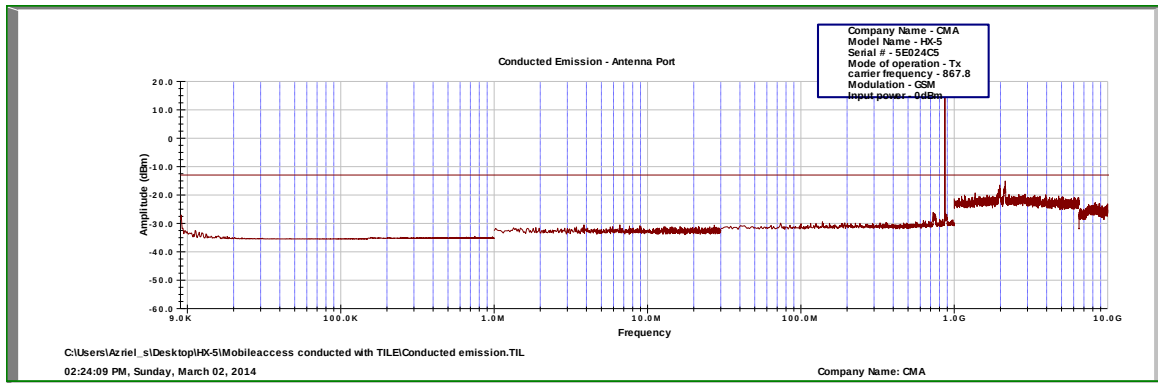


Figure 85.— 867.8 GSM

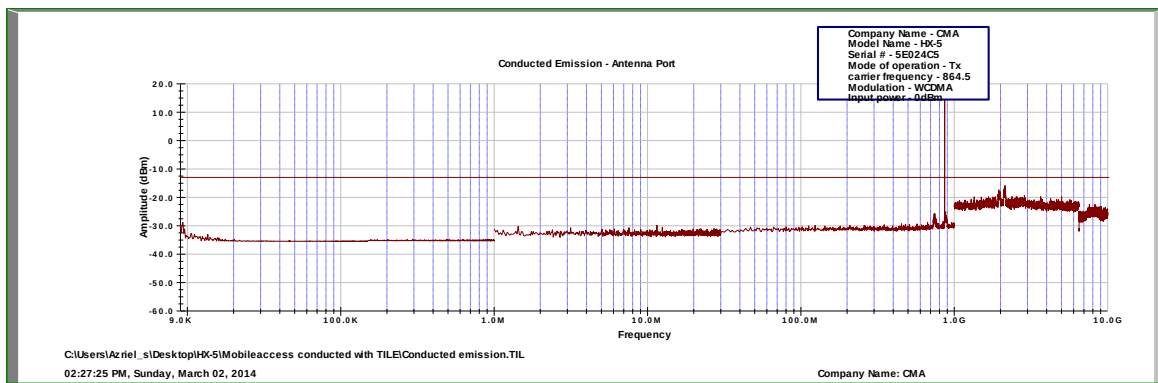


Figure 86.— 864.5 WCDMA

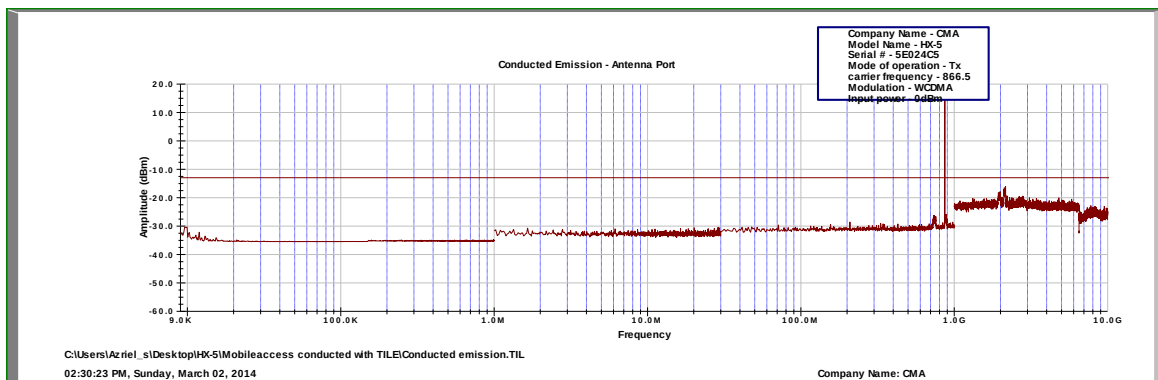


Figure 87.— 866.5 WCDMA



Out of Band Emissions at Antenna Terminals (iDEN)

11.4 Test Equipment Used; Out of Band Emissions at Antenna Terminals (iDEN)

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603- 5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	-	N/A	N/A

Figure 88 Test Equipment Used Out of Band Emissions at Antenna Terminals (iDEN)

12. Band Edge Spectrum iDEN

12.1 Test Specification

FCC Part 2.1051

12.2 Test procedure

Enclosed are spectrum analyzer plots for the lowest operation frequency and the highest operation frequency in which the E.U.T. is planned to be used. The power of any emission outside of the authorized operating frequency ranges 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 (30.6 dB).

12.3 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	864.5	862.0	-21.53	-13.0	-8.53
	866.5	869.0	-18.86	-13.0	-5.86
GSM	863.2	862.0	-29.80	-13.0	-16.80
	867.8	869.0	-27.34	-13.0	-14.34
W-CDMA	864.5	862.0	-17.55	-13.0	-4.55
	866.5	869.0	-16.41	-13.0	-3.41

Figure 89 Band Edge Spectrum Results iDEN

See additional information in Figure 90 to Figure 95.

JUDGEMENT: Passed by 3.41 dB

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A. Sharabi

LTE:

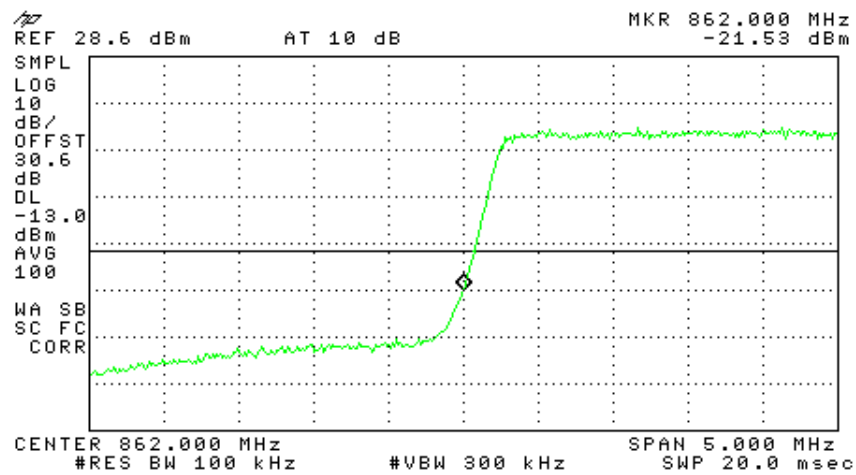


Figure 90.— 64QAM 864.5MHz

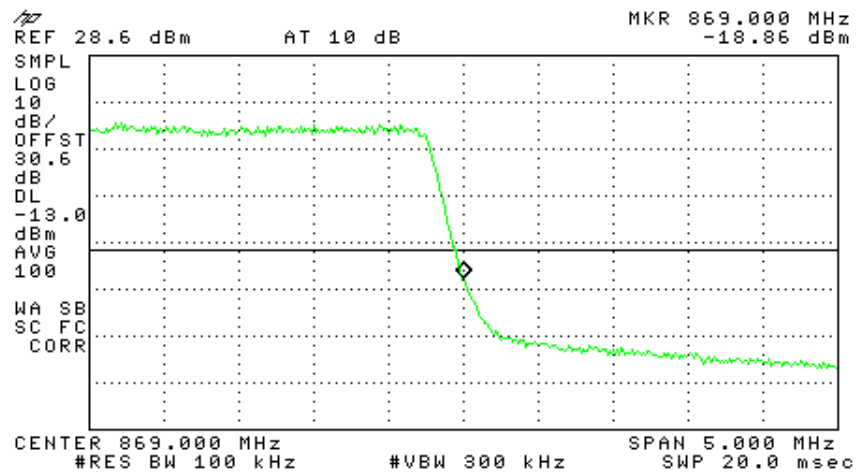


Figure 91.— 64QAM 866.5 MHz

GSM:

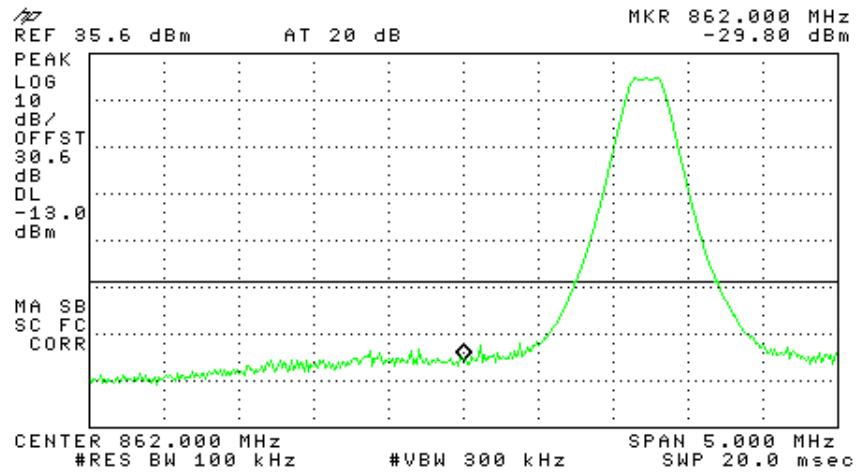


Figure 92.— 863.2MHz

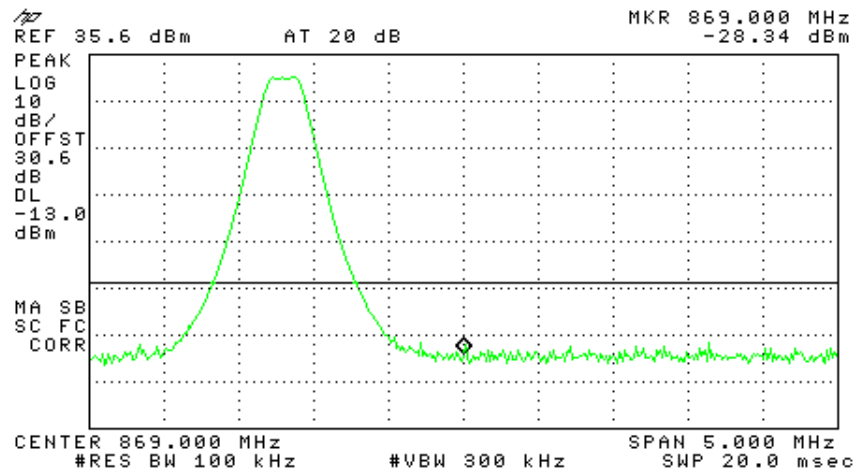


Figure 93.— 867.8 MHz

W-CDMA:

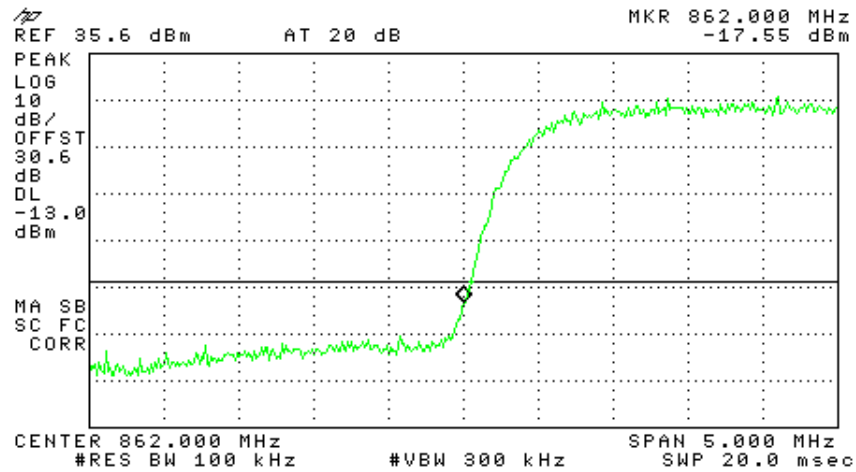


Figure 94.— 864.5 MHz

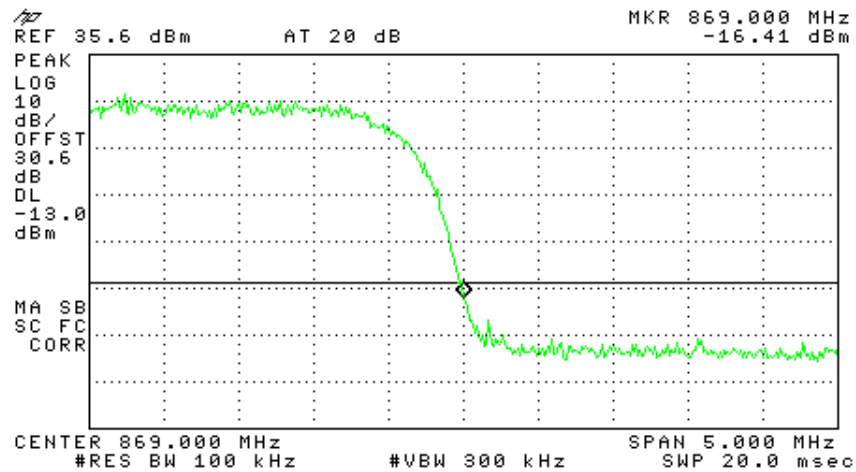


Figure 95.— 866.5 MHz



12.4

Test Equipment Used; Band Edge Spectrum iDEN

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603- 5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	-	N/A	N/A

Figure 96 Test Equipment Used

13. Out of Band Emissions (Radiated) (iDEN)

13.1 Test Specification

FCC, Part 90, Section 90.210

13.2 Test Procedure

The power of any emission outside of the authorized bandwidth must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB, yielding -13dBm .

- (a) The E.U.T. operation mode and test set-up are as described in Section 3.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The configuration tested is shown in Figure 3.5.

The frequency range 30 MHz-10 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization. The emissions were measured at a distance of 3 meters.

- (b) The E.U.T. was replaced by a substitution antenna (dipole 30MHz-1GHz, Horn Antenna above 1GHz) driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).

The signals observed in step (a) were converted to radiated power using:

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

P = Equivalent Isotropic Radiated Power.

P_g = Signal Generator Output Level.



Out of Band Emissions (Radiated) (iDEN)

13.3 Test Results

JUDGEMENT: Passed by 29.82 dB

The E.U.T met the requirements of the FCC, Part 90, Section 90.210 specifications.

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A.Sharabi

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)
863.2	1726.4	V	55.8	-45.01	5.45	7.64	-42.82	-13.0	-29.82
863.2	1726.4	H	54.4	-46.24	5.45	7.64	-44.05	-13.0	-31.05
867.8	1735.9	V	53.5	-47.31	5.45	7.64	-45.20	-13.0	-32.20
867.8	1735.9	H	54.0	-46.64	5.45	7.64	-44.45	-13.0	-31.45

Figure 97 Out of Band (Radiated) (iDEN) Test Results Table

Out of Band Emissions (Radiated) (iDEN)

13.4 Test Equipment Used; Out of Band Emissions (Radiated) (iDEN)

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	February 26, 2013	1 Year
RF Filter Section	HP	85420E	3705A00248	February 26, 2013	1 Year
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	2 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2013	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 98 Test Equipment Used Out of Band Emissions (Radiated) (iDEN)

14. Peak Output Power PCS

14.1 Test Specification

FCC Part 24, Subpart E

14.2 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 = 30.6 dB). The E.U.T. RF output was W-CDMA and GSM and LTE modulated. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 100 kHz RBW.

14.3 Test Results

Modulation	Operation Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	1935.0	36.50	50.0	-13.50
	1962.5	33.65	50.0	-16.35
	1990.0	33.89	50.0	-16.11
GSM	1931.2	32.44	50.0	-17.56
	1960.0	33.13	50.0	-16.87
	1993.8	32.59	50.0	-17.41
W-CDMA	1932.5	34.67	50.0	-15.33
	1960.0	35.36	50.0	-14.64
	1992.5	34.92	50.0	-15.08

Figure 99 Peak Output Power PCS

See additional information in Figure 100 to Figure 108.

JUDGEMENT: Passed by 13.50 dB

TEST PERSONNEL:

Tester Signature: _____

Date: 10.03.14

Typed/Printed Name: A. Sharabi

LTE

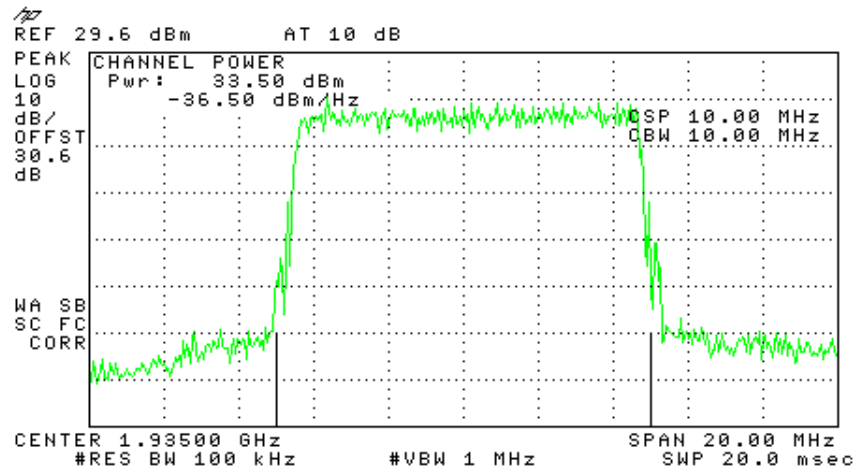


Figure 100.— 64QAM 1935.00 MHz

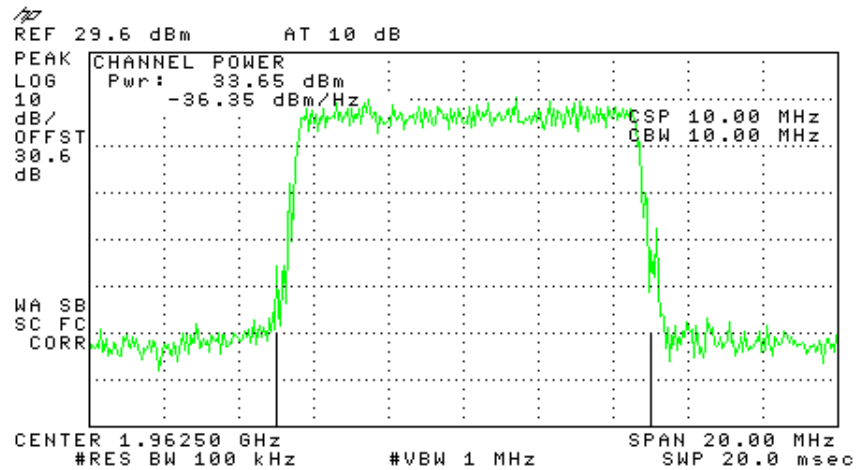


Figure 101.— 64QAM 1962.50 MHz

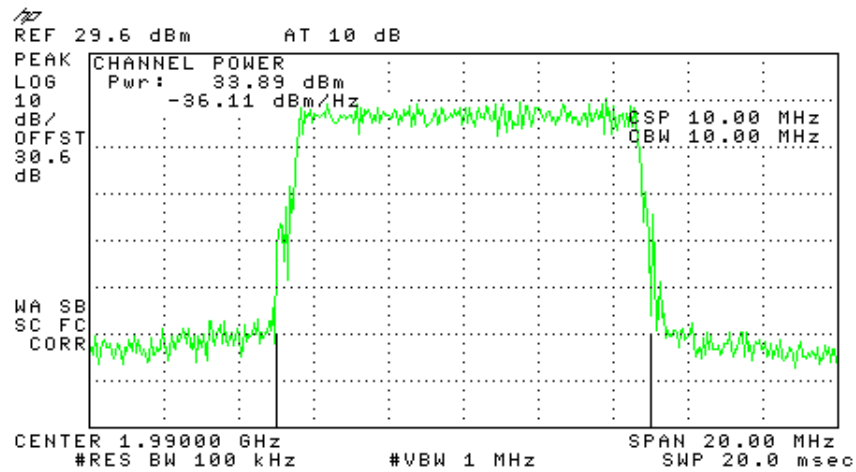


Figure 102.— 64QAM 1990.00 MHz

GSM:

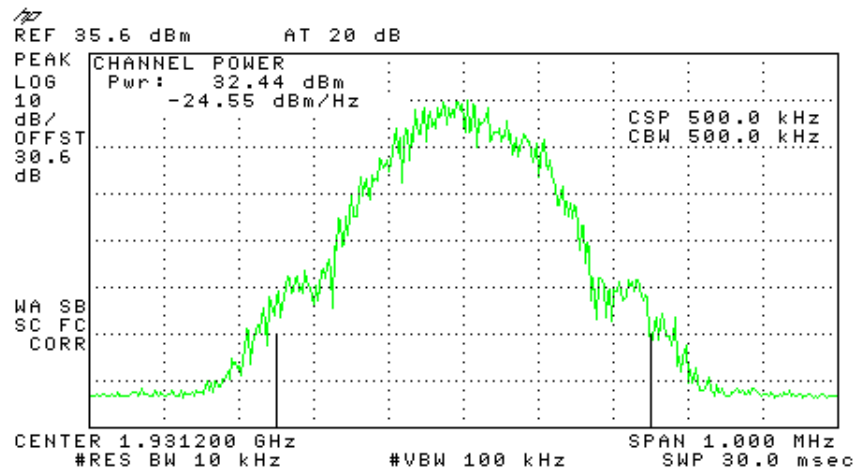


Figure 103.— 1931.20 MHz

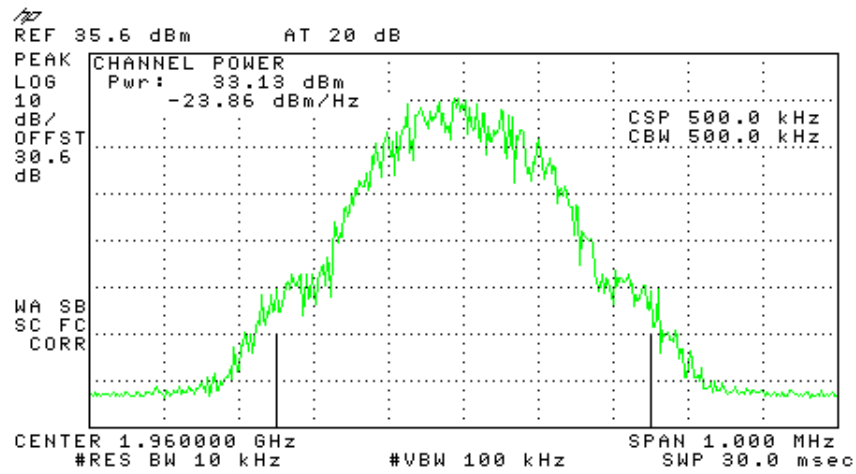


Figure 104.— 1960.00 MHz

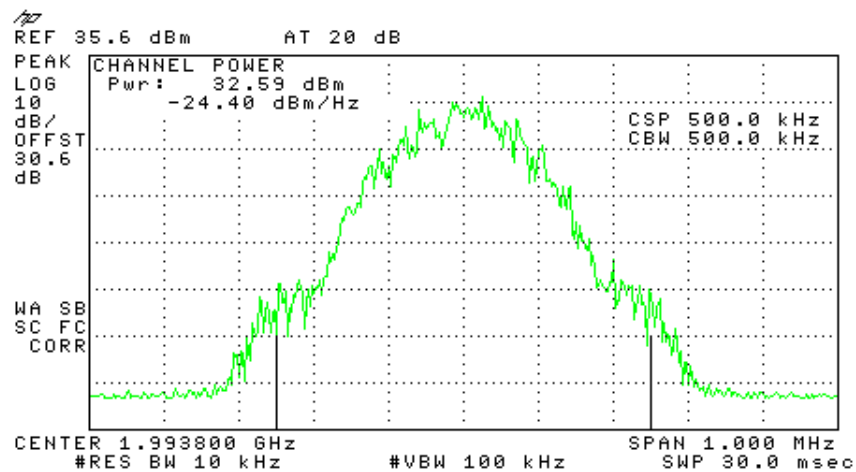


Figure 105.— 1993.80 MHz

W-CDMA:

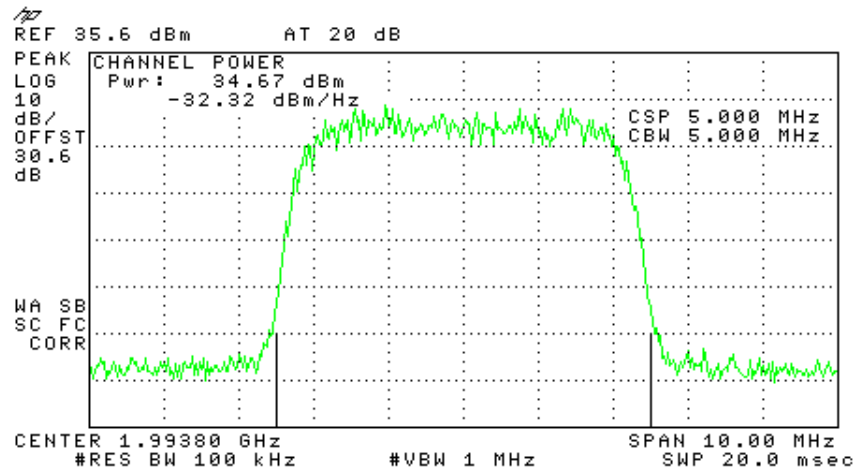


Figure 106.— 1932.50 MHz

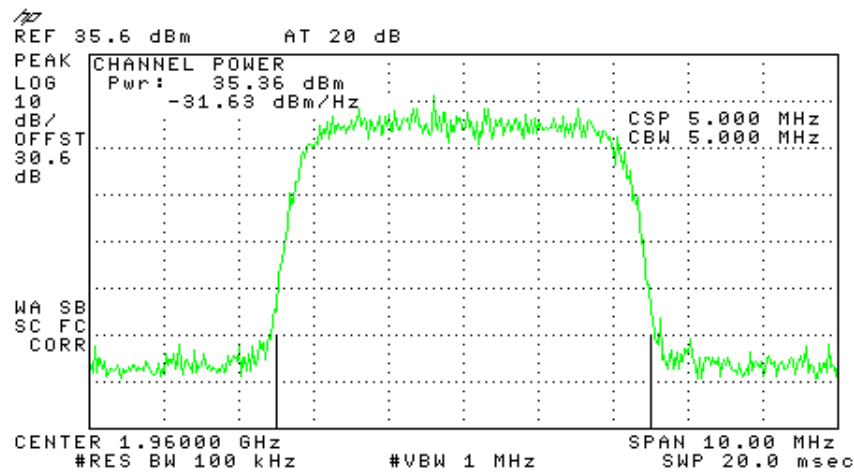


Figure 107.— 1960.00 MHz

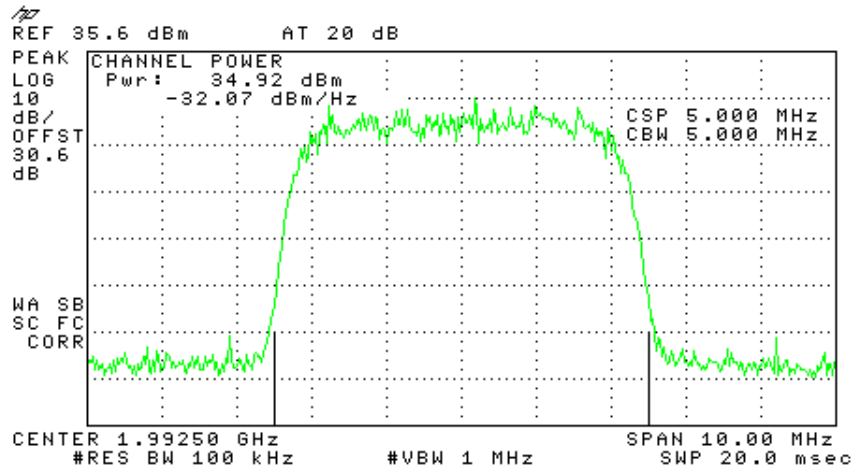


Figure 108.— 1992.50 MHz

14.4 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	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603-5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10-NNN-02	-	N/A	N/A

Figure 109 Test Equipment Used

15. Occupied Bandwidth PCS

15.1 Test Specification

FCC Part 2, Section 1049

15.2 Test Procedure

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.

15.3 Test Results

Modulation		Operating Frequency (MHz)	Reading (MHz)
LTE 64QAM	Input	1935.00	9.58
	Output	1935.00	9.45
	Input	1962.50	9.63
	Output	1962.50	9.50
	Input	1990.00	9.47
	Output	1990.00	9.40
GSM	Input	1931.20	0.290
	Output	1931.20	0.285
	Input	1960.00	0.285
	Output	1960.00	0.285
	Input	1993.80	0.280
	Output	1993.80	0.285
W-CDMA	Input	1932.50	4.53
	Output	1932.50	4.55
	Input	1960.00	4.60
	Output	1960.00	4.55
	Input	1992.50	4.58
	Output	1992.50	4.60

Figure 110 Occupied Bandwidth PCS

See additional information in Figure 111 to Figure 128.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A. Sharabi

LTE

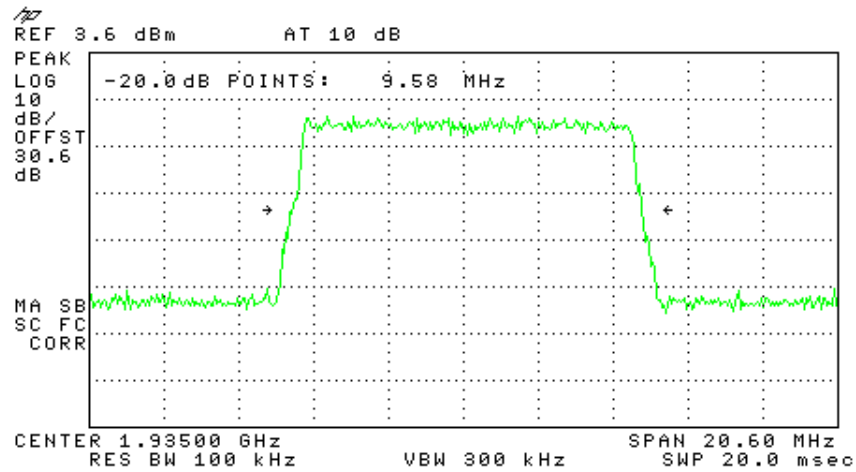


Figure 111.— 64QAM Input 1935.00 MHz

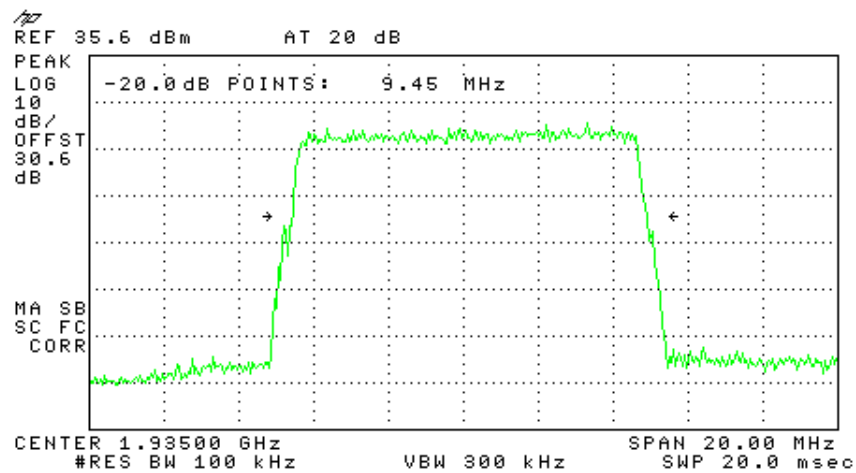


Figure 112.— 64QAM Output 1935.00 MHz

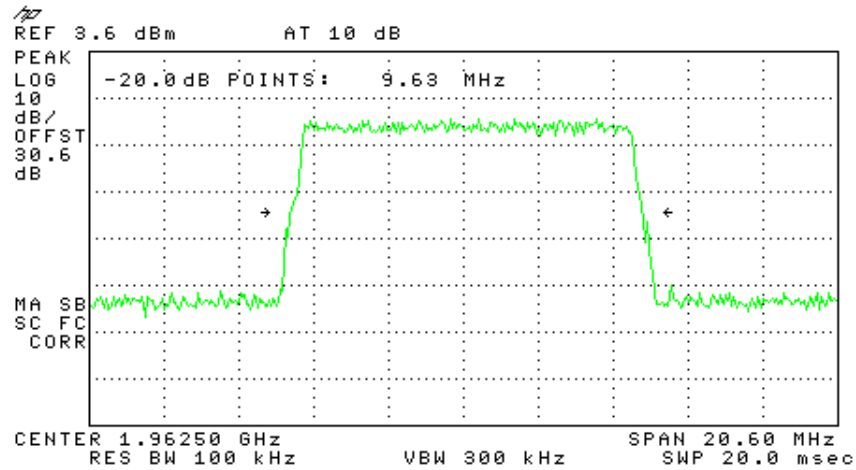


Figure 113.— 64QAM Input 1962.50 MHz

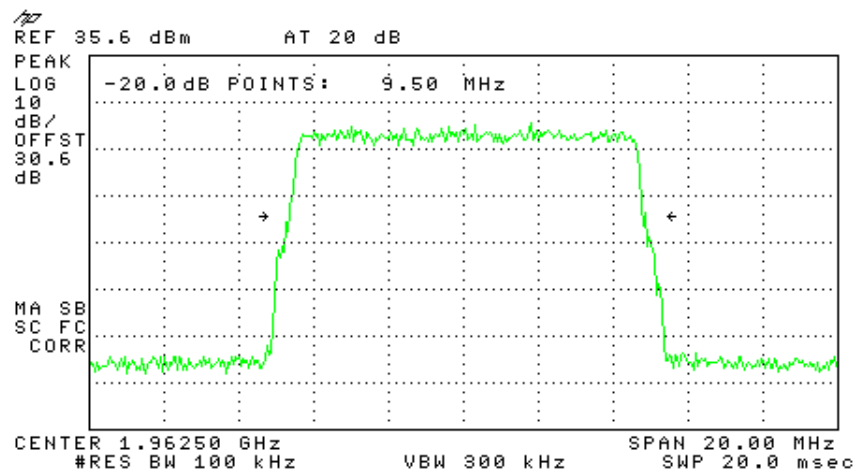


Figure 114.— 64QAM Output 1962.50 MHz

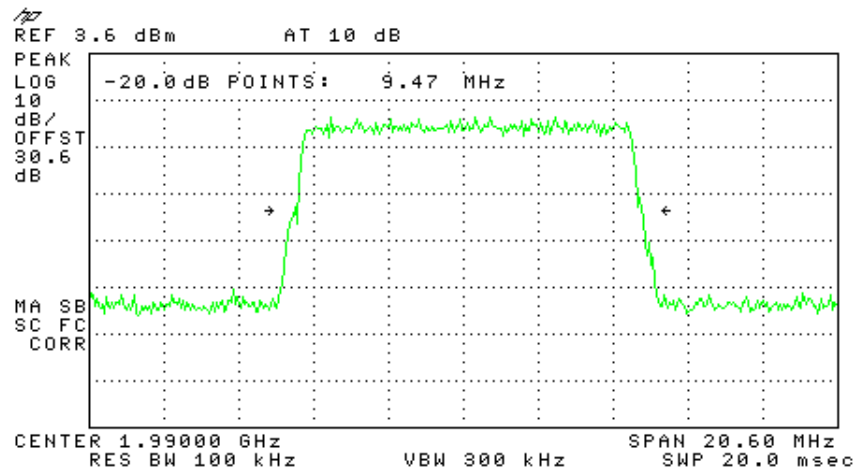


Figure 115.— 64QAM Input 1990.00 MHz

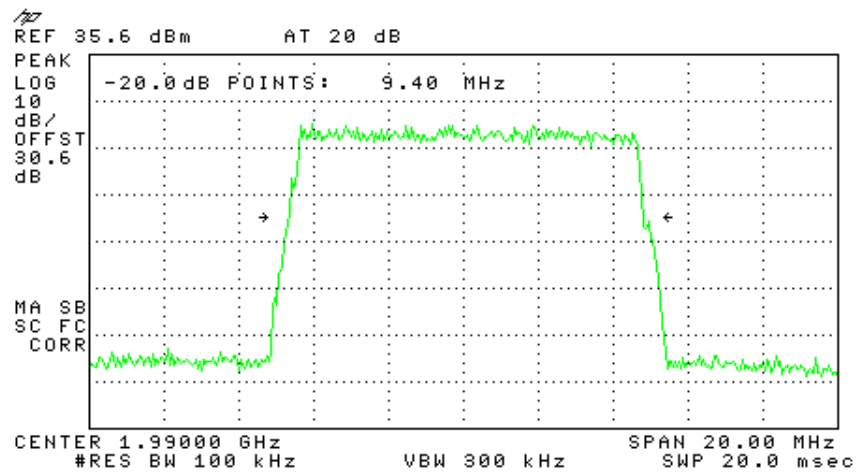


Figure 116.— 64QAM Output 1990.00 MHz

GSM:

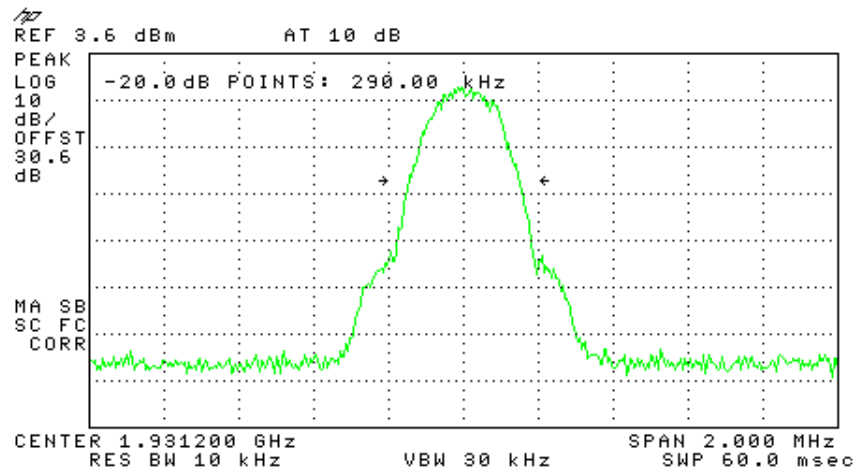


Figure 117.— Input 1931.20 MHz

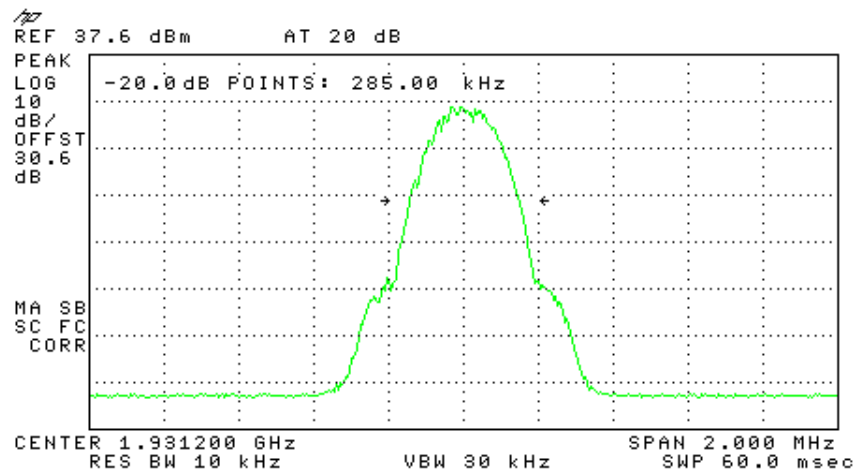


Figure 118.— Output 1931.20 MHz

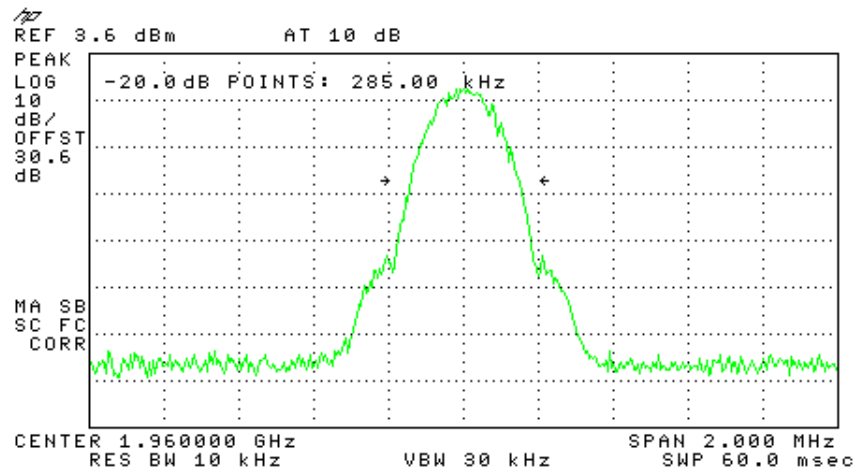


Figure 119.— Input 1960.00 MHz

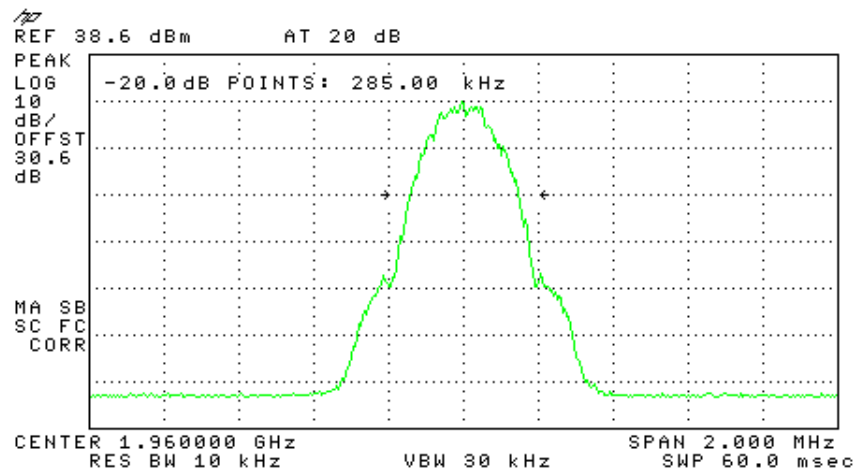


Figure 120.— Output 1960.00 MHz

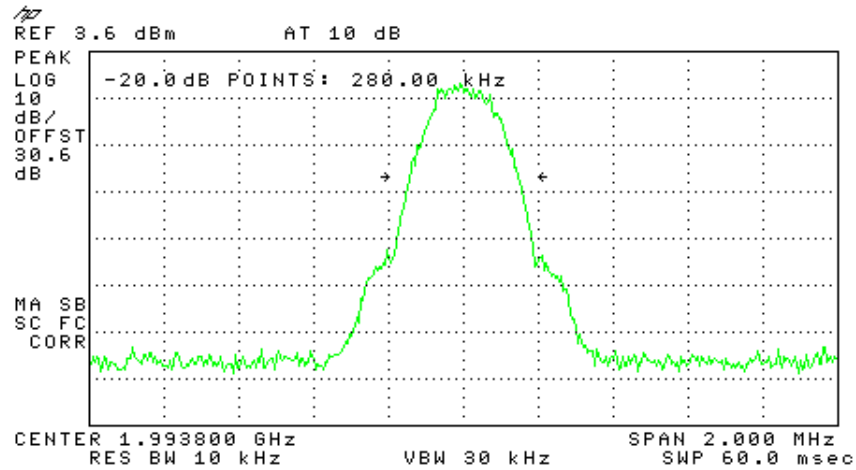


Figure 121.— Input 1993.80 MHz

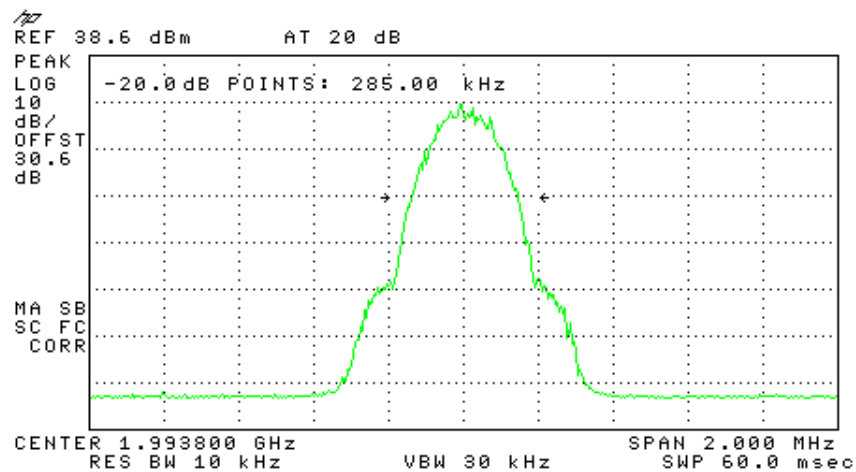


Figure 122.— Output 1993.80 MHz

W-CDMA:

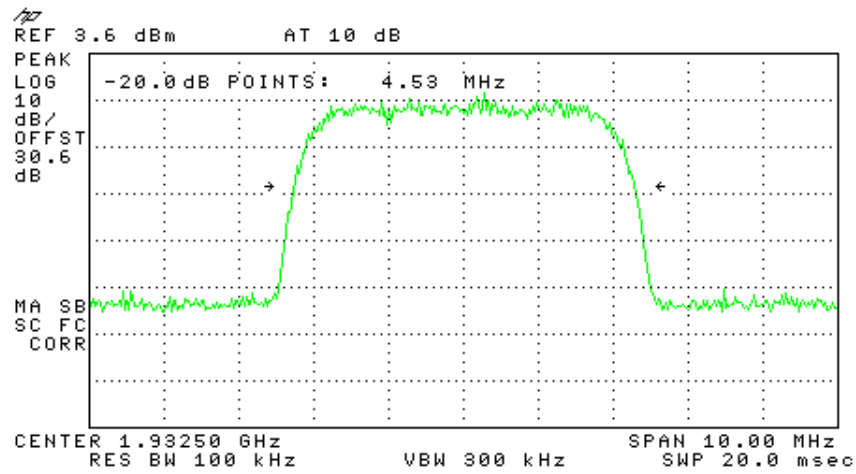


Figure 123.— Input 1932.50 MHz

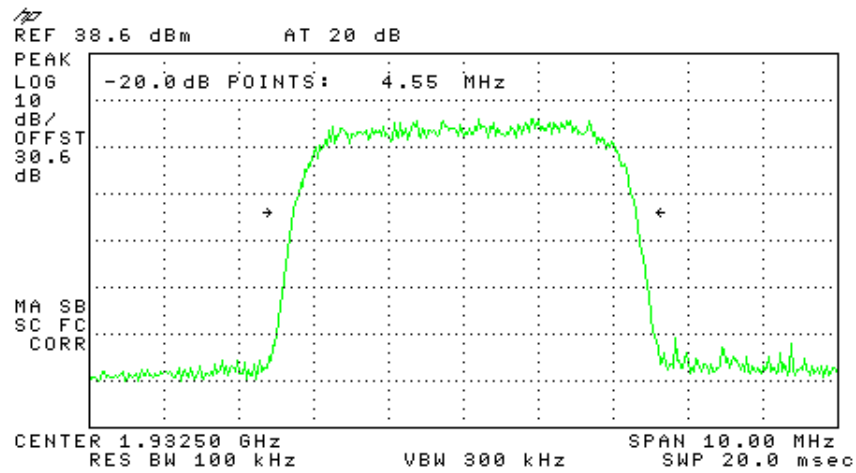


Figure 124.— Output 1932.50 MHz

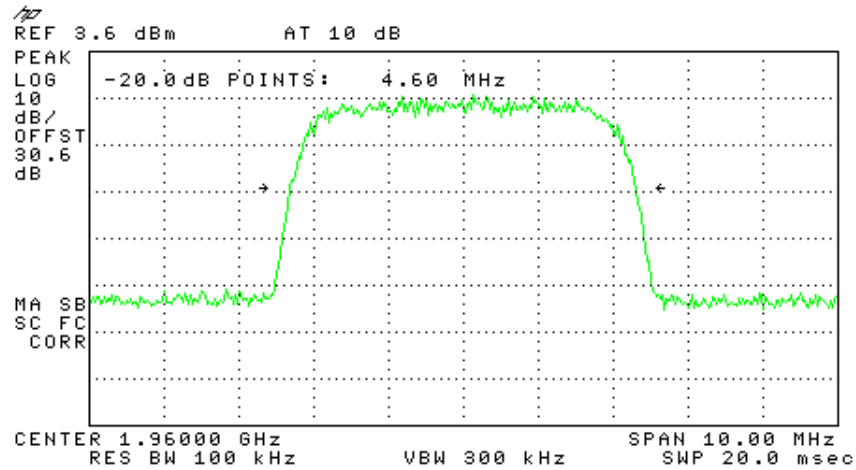


Figure 125.— Input 1960.00 MHz

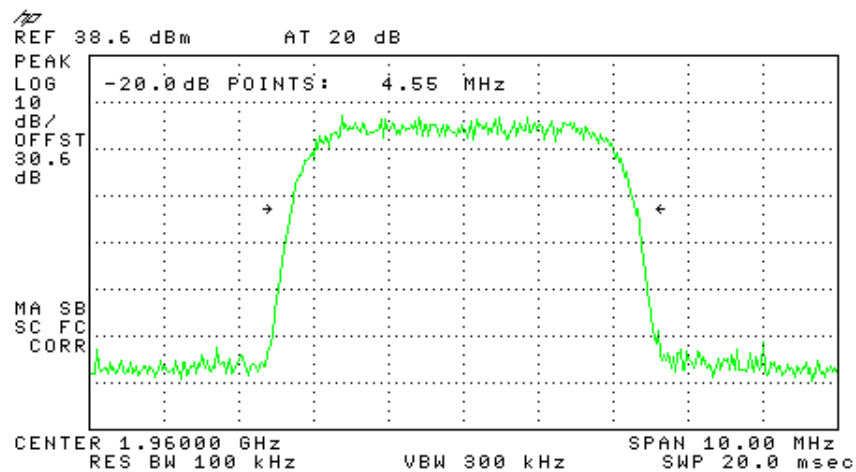


Figure 126.— Output 1960.00 MHz

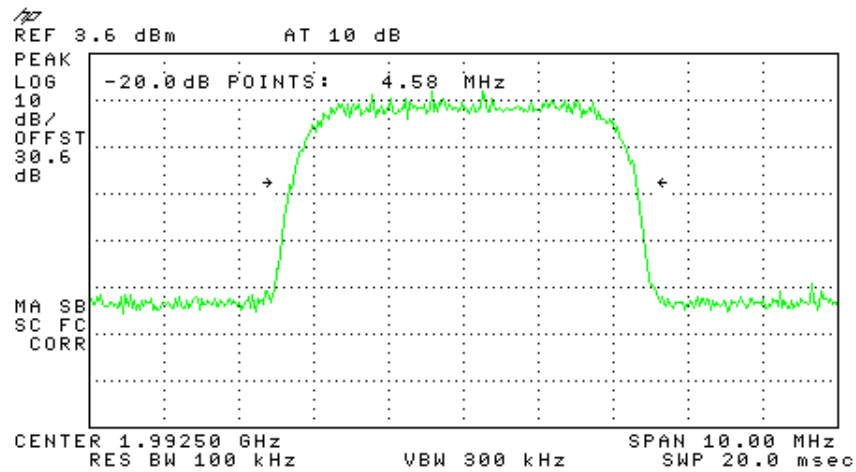


Figure 127.— Input 1992.50 MHz

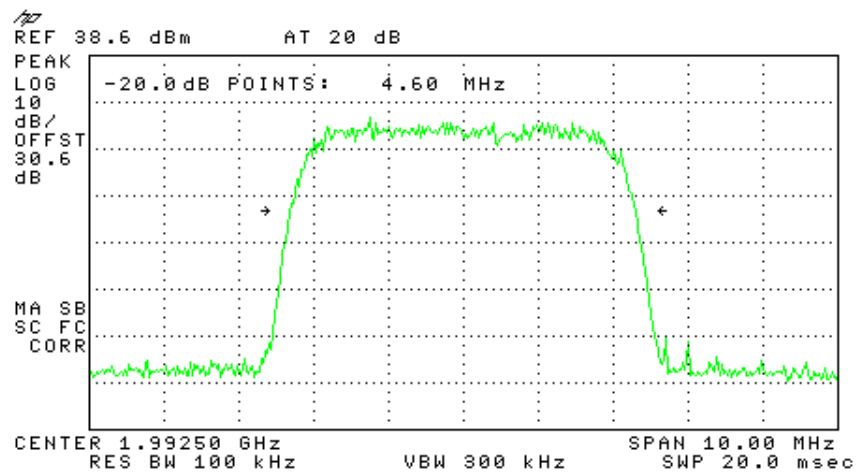


Figure 128.— Output 1992.50 MHz



15.4 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	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603-5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10-NNN-02	-	N/A	N/A

Figure 129 Test Equipment Used

16. Out of Band Emissions at Antenna Terminals PCS

16.1 Test Specification

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

16.2 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 (30.6 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.

16.3 Test Results

Modulation	Operation Frequency (MHz)	Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE	1935.00	2159	-17.1	-13.0	-4.1
	1962.50	2160	-16.7	-13.0	-3.7
	1990.00	2158	-16.4	-13.0	-3.4
GSM	1931.20	2157	-17.0	-13.0	-4.0
	1960.00	2143	-16.7	-13.0	-3.7
	1993.80	2150	-17.0	-13.0	-4.0
W-CDMA	1932.50	2124	-16.0	-13.0	-3.0
	1960.00	2133	-16.7	-13.0	-3.7
	1992.50	2150	-17.2	-13.0	-4.2

Figure 130 Out of Band Emission Results PCS

See additional information in Figure 131 to Figure 139.

JUDGEMENT: Passed by 3.0 dB

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A.Sharabi



LTE:

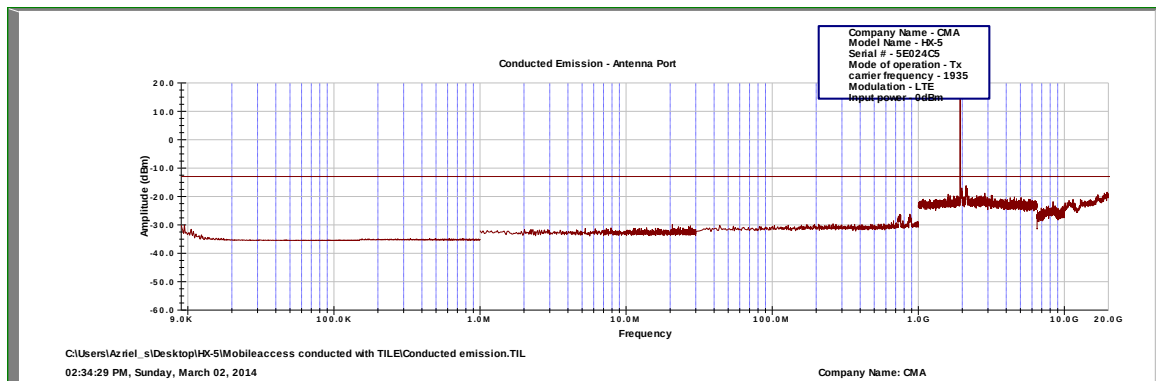


Figure 131.— 1935.00 MHz

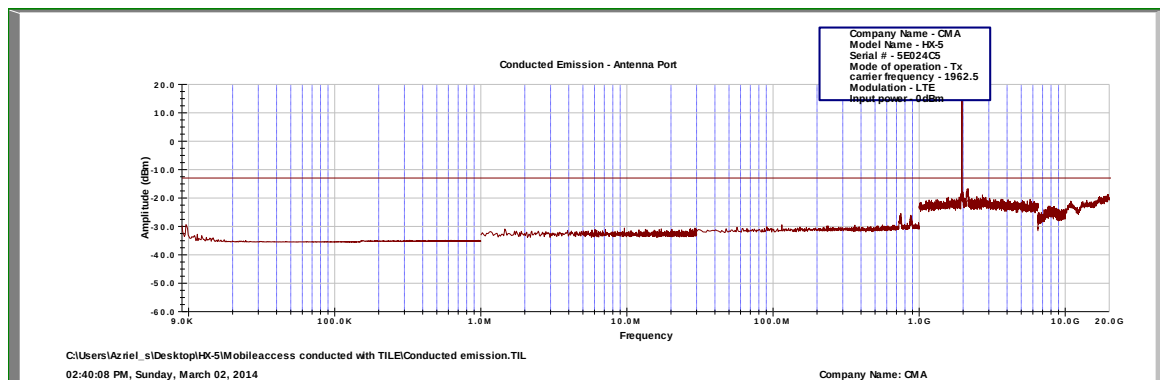


Figure 132.— 1962.50 MHz

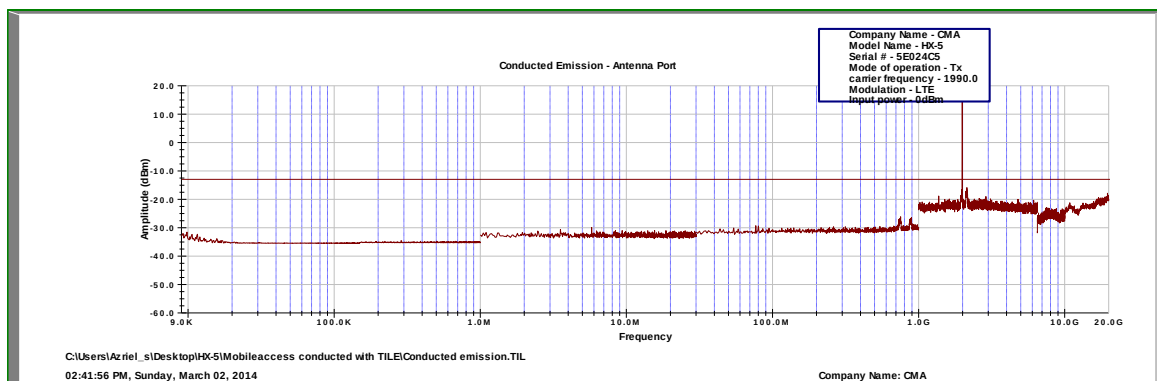


Figure 133.— 1990.00 MHz



GSM:

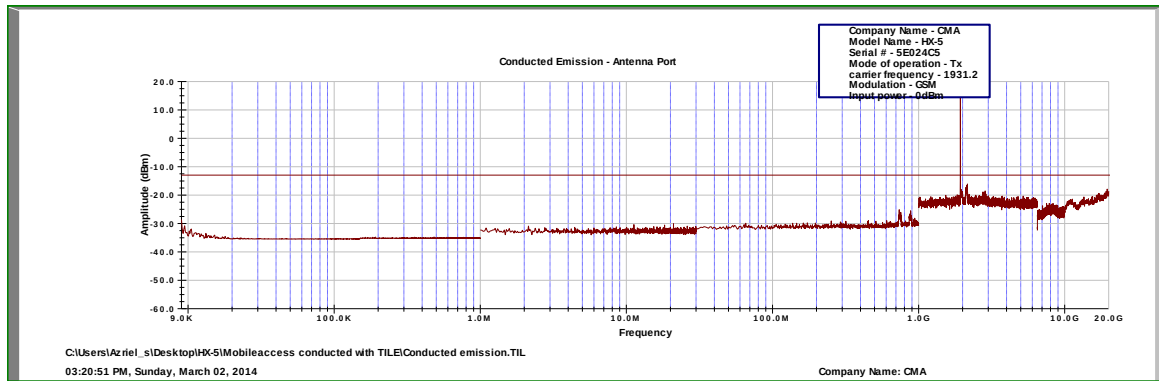


Figure 134.— 1931.20 MHz

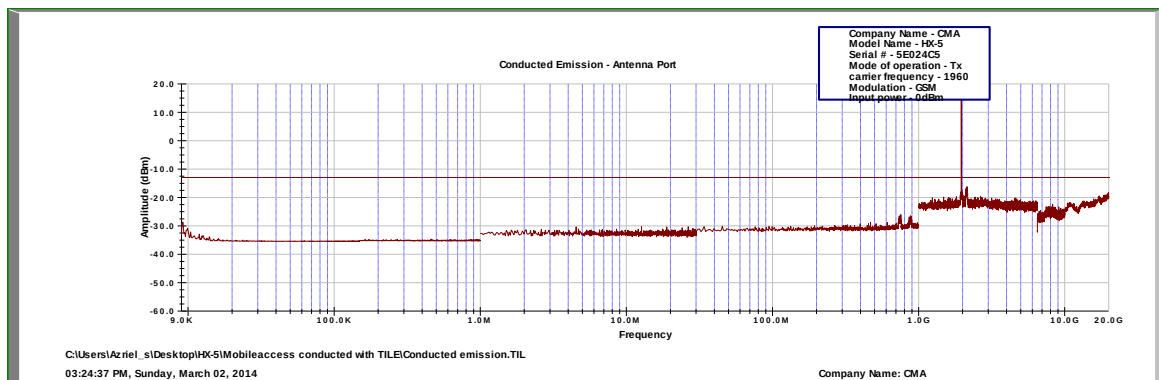


Figure 135.— 1960.00 MHz

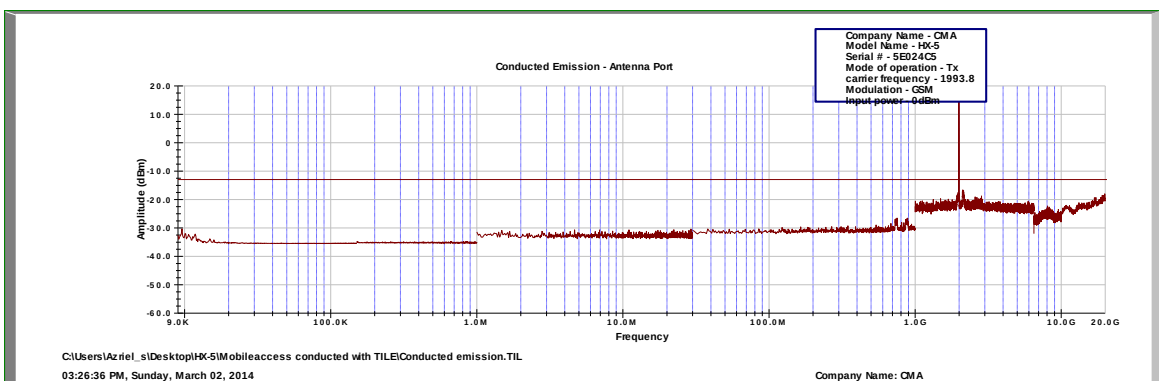


Figure 136.— 1993.80 MHz

W-CDMA:

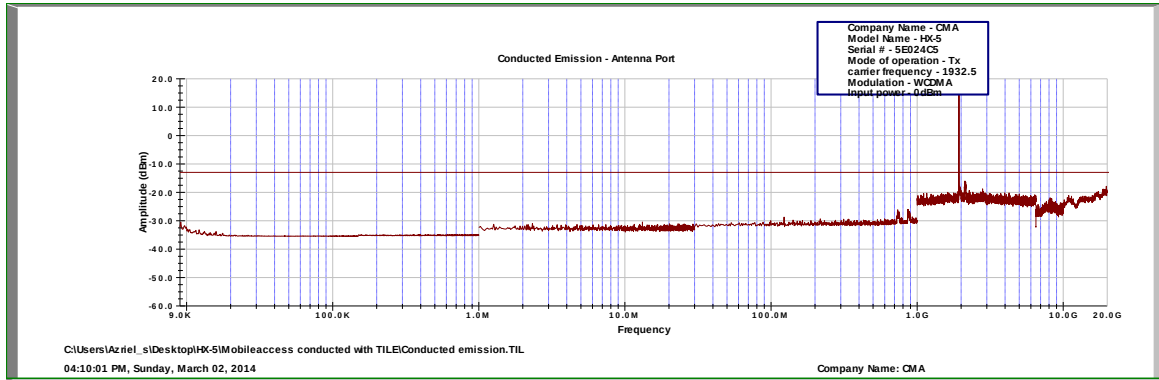


Figure 137.— 1932.50 MHz

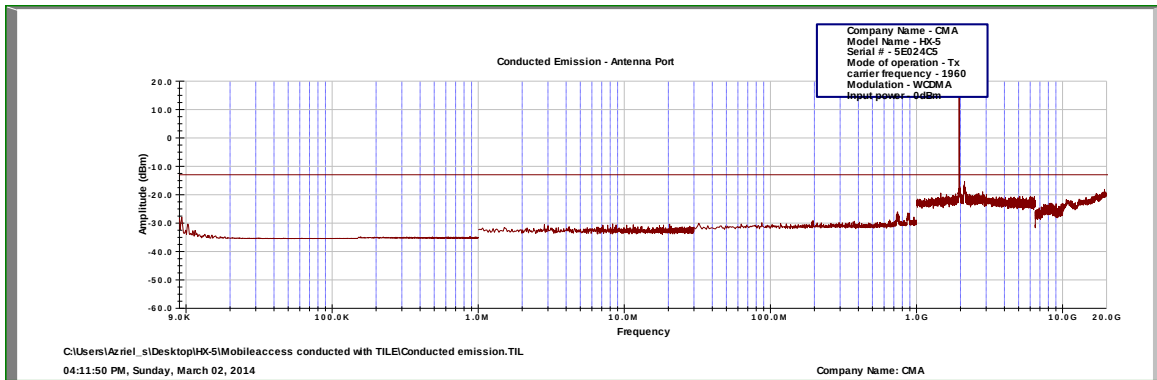


Figure 138.— 1960.00 MHz

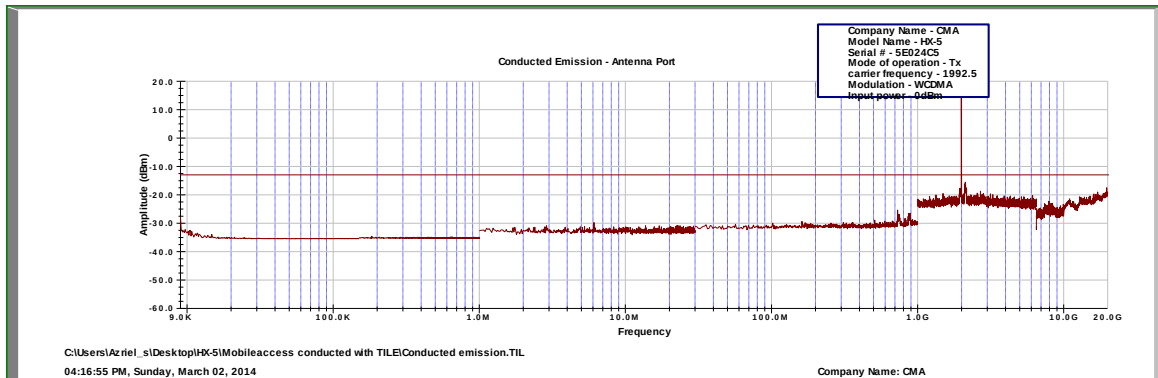


Figure 139.— 1992.50 MHz



**16.4 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	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603- 5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10- NNN-02	-	N/A	N/A

Figure 140 Test Equipment Used

17. Band Edge Spectrum PCS

17.1 Test Specification

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

17.2 Test procedure

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

The power of any emission outside of the authorized operating frequency ranges (1930.00-1990.00 MHz) must be attenuated below the transmitting power (P) by a factor of at least $43 + \log(P)$ dB, yielding -13dBm .

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (30.6 dB).



17.3 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	1935.00	1930.00	-34.31	-13.0	-21.31
	1990.00	1995.00	-33.47	-13.0	-20.47
GSM	1931.20	1930.00	-31.43	-13.0	-18.43
	1993.80	1995.00	-30.54	-13.0	-17.54
W-CDMA	1932.50	1930.00	-20.38	-13.0	-7.38
	1992.50	1995.00	-19.38	-13.0	-6.38

Figure 141 Band Edge Spectrum Results PCS

See additional information in Figure 142 to Figure 147.

JUDGEMENT: Passed by 6.38 dB

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A. Sharabi

LTE:

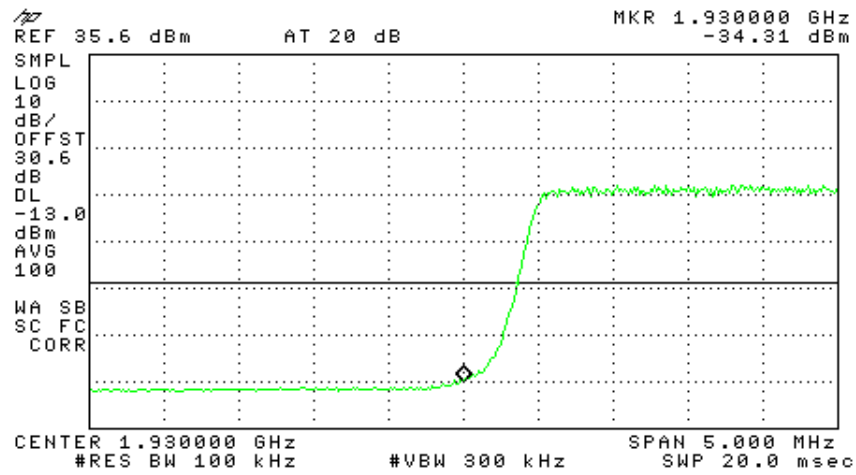


Figure 142.— 64QAM 1935.00 MHz

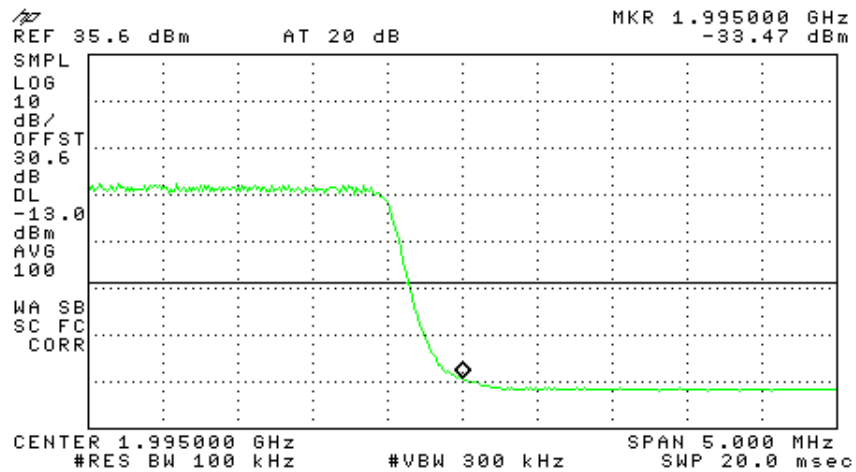


Figure 143.— 64QAM 1990.00 MHz

GSM:

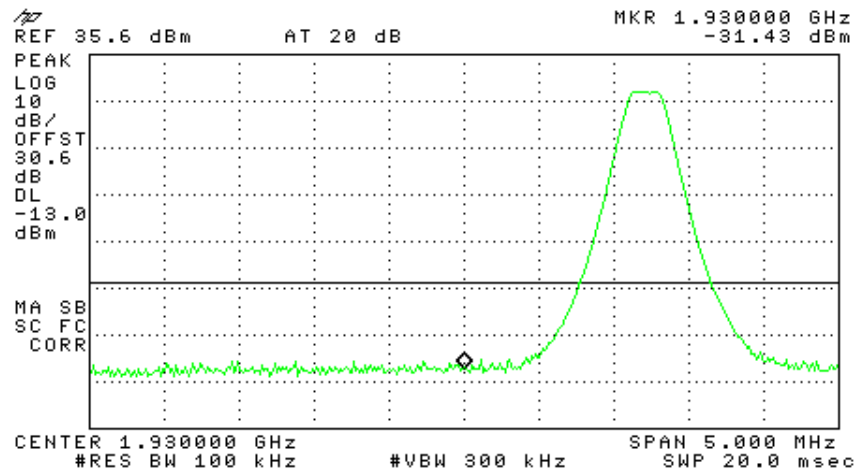


Figure 144.— 1931.20 MHz

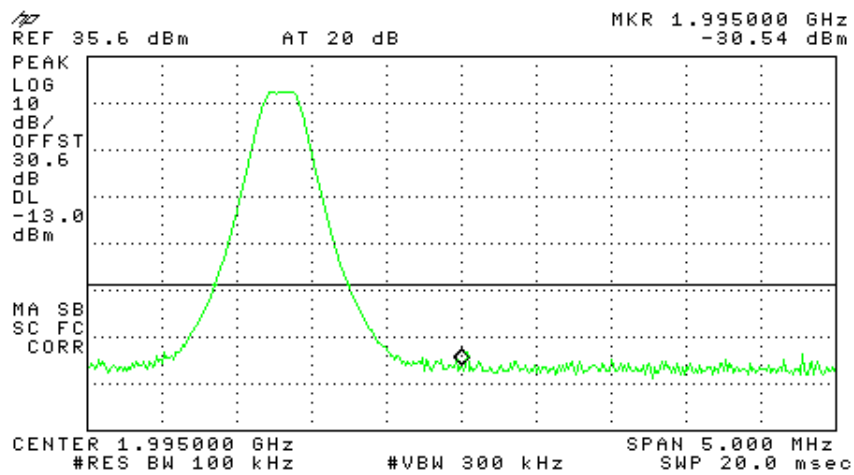


Figure 145.— 1993.80 MHz

W-CDMA:

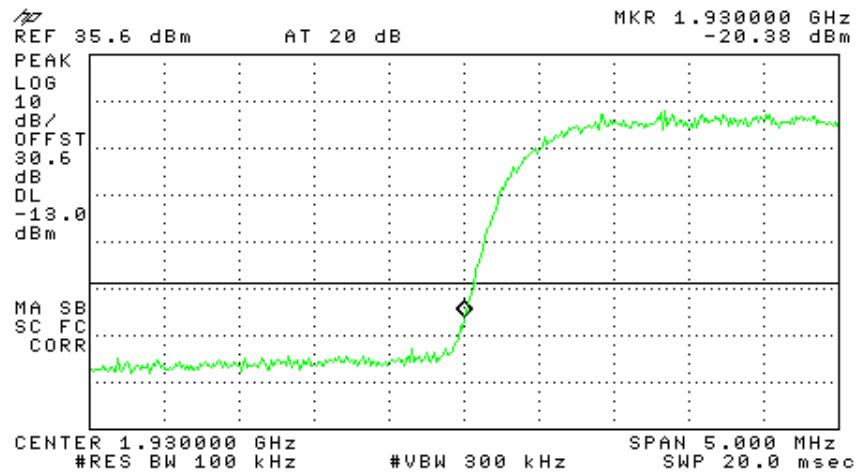


Figure 146.— 1932.50 MHz

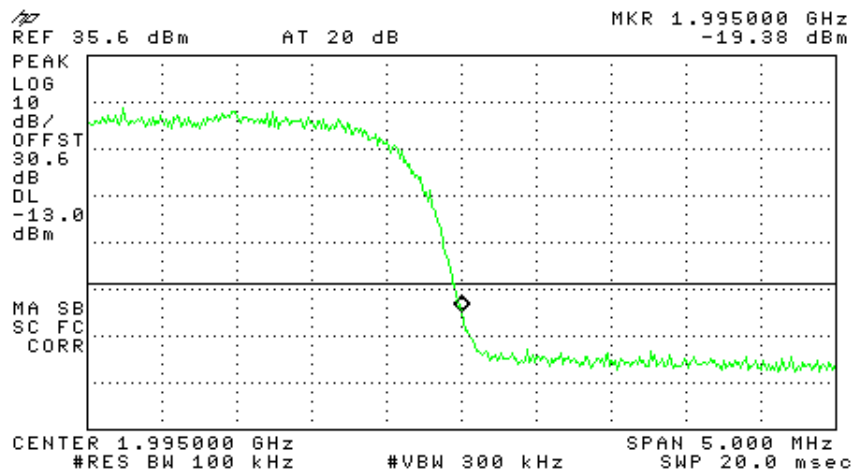


Figure 147.— 1992.50 MHz



17.4

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	Agilent	N5172B ATO 10210	MY51350182	January 1, 2014	2 years
Attenuator	MCE	46-30-34	-	February 23, 2014	1 year
Cable	Avnet MTS	P-3636-603-5236	-	February 23, 2014	1 year
DC Block	MIDWEST MICROWAVE	DCDB-3624-10-NNN-02	-	N/A	N/A

Figure 148 Test Equipment Used

18. Out of Band Emissions (Radiated) PCS

18.1 Test Specification

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

18.2 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°, 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.



18.3 Results Table

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Spec.	Margin
(MHz)	(MHz)		(dBμV/m)	(dBm)	(dB)	(dBi)	(dBm)	(dBm)	(dB)
1931.20	3862.4	V	54.0	-47.82	4.3	8.62	-43.50	-13.0	-30.50
1931.20	3862.4	H	54.1	-46.86	4.3	8.62	-42.54	-13.0	-29.54
1960.00	3920	V	56.9	-44.92	4.3	8.62	-40.60	-13.0	-27.60
1960.00	3920	H	52.7	-48.26	4.3	8.62	-43.94	-13.0	-30.94
1993.80	3987.6	V	54.5	-47.8	4.3	8.6	-43.50	-13.0	-30.50
1993.80	3987.6	H	52.7	-48.65	4.3	8.6	-44.35	-13.0	-31.35

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

TEST PERSONNEL:

Tester Signature: 

Date: 10.03.14

Typed/Printed Name: A.Sharabi

18.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial No.	Last Calibration Date	Period
EMI Receiver	HP	85422E	3906A00276	January 15, 2014	1 Year
RF Filter Section	HP	85420E	3705A00248	January 15, 2014	
Antenna Biconical	EMCO	3104	2606	August 30, 2013	1 Year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 2, 2013	1 Year
Horn Antenna	ETS	3115	29845	March 14, 2012	2 Years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	2 Years
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	August 21, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 28, 2013	1 Year
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 Year
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 Year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	LaserJet 2200	JPKG19982	N/A	N/A

Figure 149 Test Equipment Used

19. APPENDIX A - CORRECTION FACTORS

19.1 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".

19.2 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.

19.3 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.

19.4 Correction factors for CABLE
from EMI receiver
to test antenna
at 10 meter range.

FREQUENCY (MHz)	CORRECTION FACTOR (dB)	FREQUENCY (MHz)	CORRECTION FACTOR (dB)
10.0	0.3	1200.0	9.8
20.0	0.8	1400.0	10.0
30.0	0.9	1600.0	11.3
40.0	1.2	1800.0	12.2
50.0	1.4	2000.0	13.1
60.0	1.6	2300.0	14.5
70.0	1.8	2600.0	15.9
80.0	1.9	2900.0	16.4
90.0	2.0		
100.0	2.1		
150.0	2.6		
200.0	3.2		
250.0	3.8		
300.0	4.2		
350.0	4.6		
400.0	5.1		
450.0	5.3		
500.0	5.6		
600.0	6.3		
700.0	7.0		
800.0	7.6		
900.0	8.0		
1000.0	8.7		

NOTES:

1. The cable type is RG-214.
2. The overall length of the cable is 34 meters.
3. The above data is located in file 34M10MO.CBL on the disk marked "Radiated Emissions Tests EMI Receiver".

19.5 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 38M30.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".

19.6 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".

**19.7 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".

19.8 Correction factors for BICONICAL ANTENNA
Type BCD-235/B,
10 meter range

FREQUENCY (MHz)	AFE (dB/m)
30.0	12.1
40.0	10.6
50.0	10.6
60.0	8.9
70.0	8.5
80.0	9.6
90.0	9.4
100.0	9.6
110.0	10.3
120.0	10.7
130.0	12.6
140.0	12.7
150.0	12.7
160.0	13.8
170.0	13.7
180.0	14.9
190.0	13.4
200.0	13.1
210.0	14.0
220.0	14.5
230.0	15.8
240.0	16.0
250.0	16.6
260.0	16.7
270.0	18.3
280.0	18.5
290.0	19.3
300.0	20.9

NOTES:

1. Antenna serial number is 1041.
2. The above list is located in file 41BC10M1.ANT on the disk marked "Radiated Emissions Tests EMI Receiver".



**19.9 Correction factors for
Horn**

Double-Ridged Waveguide

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

FREQUENCY	ANTENNA	ANTENNA	FREQUENCY	ANTENNA	ANTENNA
(GHz)	FACTOR	Gain	(GHz)	FACTOR	Gain
	(dB 1/m)	(dBi)		(dB 1/m)	(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			



19.10 Correction factors for

**Horn Antenna
Model: SWH-28
at 1 meter range.**

FREQUENCY (GHz)	APE (dB /m)	Gain (dB1)
18.0	40.3	16.1
19.0	40.3	16.3
20.0	40.3	16.1
21.0	40.3	16.3
22.0	40.4	16.8
23.0	40.5	16.4
24.0	40.5	16.6
25.0	40.5	16.7
26.0	40.6	16.4

19.11 Correction factors for

**Horn Antenna
Model: V637**

FREQUENCY (GHz)	APE (dB /m)	Gain (dB1)
26.0	43.6	14.9
27.0	43.7	15.1
28.0	43.8	15.3
29.0	43.9	15.5
30.0	43.9	15.8
31.0	44.0	16.0
32.0	44.1	16.2
33.0	44.1	16.4
34.0	44.1	16.7
35.0	44.2	16.9
36.0	44.2	17.1
37.0	44.2	17.4
38.0	44.2	17.6
39.0	44.2	17.8
40.0	44.2	18.0



19.12 Correction factors for ACTIVE LOOP ANTENNA

Model 6502

S/N 9506-2950

FREQUENCY	Magnetic Antenna Factor	Electric Antenna Factor
(MHz)	(dB)	(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