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TESTING Cert No.1152.01

DATE: 23 December 2014

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

FCC Radio Test Report

for

Corning Optical Communication Wireless

Equipment under test:

ONE - Optical Network Evolution DAS

RAU-5 Remote Antenna Unit P/N: RAU5US-AME consisting of RXU P/N: RXU-L70A17-M and GEM

ESMR-CELL-PCS-LTE-AWS (LTE/AWS Section)

Written by: ______________________
R. Pinchuck, Documentation

Approved by: ______________________
M. Zohar, Test Engineer

Approved by: ______________________
I. Raz, EMC Laboratory Manager

Measurement/Technical Report for
Corning Optical Communication Wireless

ONE - Optical Network Evolution DAS

RAU-5 Remote Antenna Unit P/N: RAU5US-AME consisting of RXU P/N: RXU-L70A17-M and GEM

(LTE-AWS Section)

FCC ID: OJF1RAU5

This report concerns:	Original Grant: X
	Class II change:
	Class I change:
Equipment type:	PCS Licensed Transmitter
Limits used:	47CFR Parts 2; 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")
R. Pinchuck	Habib Riazi
ITL (Product Testing) Ltd. 1 Bat Sheva St.	Corning Optical Communication Wireless 13221 Woodland Park Rd., Suite #400
Lod 7120101	Herndon, VA. 20171
Israel	U.S.A.
e-mail rpinchuck@itl.co.il	Tel: +1-541-758-2880 Fax: +1-703-848-0260 e-mail: RiaziH@corning.com

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1. General Information

1.1 Administrative Information

Manufacturer:	Corning Optical Communication Wireless
Manufacturer's Address:	13221 Woodland Park Rd., Suite #400 Herndon, VA. 20171 U.S.A. Tel: +1-541-758-2880 Fax: +1-703-848-0260
Manufacturer's Representative:	Habib Riazi
Equipment Under Test (E.U.T):	ONE - Optical Network Evolution DAS
Equipment Model No.:	RAU-5 Remote Antenna Unit P/N: RAU5US-AME consisting of RXU P/N: RXU-L70A17-M and GEM
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	14.09.14
Start of Test:	14.09.14
End of Test:	22.09.14
Test Laboratory Location:	I.T.L (Product Testing) Ltd. 1 Batsheva St, Lod, Israel 7116002
Test Specifications:	FCC Parts 2; 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.), FCC Designation Number is US1004.
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.

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

Radiated testing was 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. I.T.L.'s EMC Laboratory is accredited by A2LA, certificate No. 1152.01 and its FCC Designation Number is US1004.

1.6 Measurement Uncertainty

Conducted Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4)
0.15 – 30 MHz:
Expanded Uncertainty (95% ConfESMRce, 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% ConfESMRce, 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-5.
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-5, while the EUT output was connected to the spectrum analyzer.
All channels transmitted during the testing.
The CELL-ESMR and PCS output antenna ports are SISO bands and the LTE and AWS antenna ports are MIMO.
There is neither an intermediate amplified nor donor antenna in the uplink.
All components included in the UL path are connected by cables.

2.2 EUT Exercise Software

HCM – 1.3 build 10
ACM_2A00_13.01
RIM_6A00_13.01
RMM_5A00_13.01
OIM_7A03_13.01
RAU5_9A64_13.01
RXU_AA00_13.01

2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

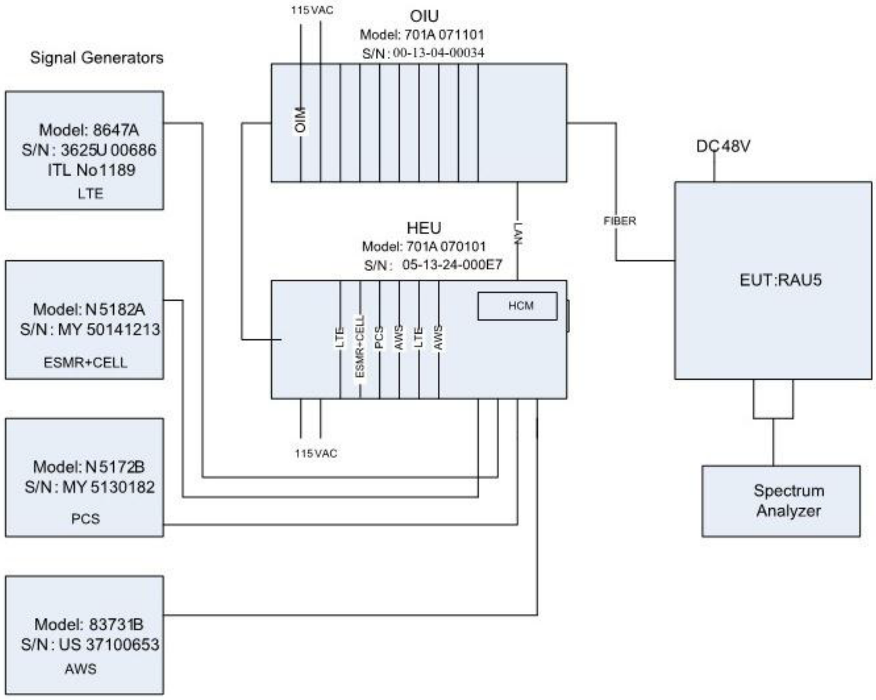

Figure 1. Test Set-up

3. Test Set-up Photos

Figure 2. Conducted Emission From Antenna Port Tests

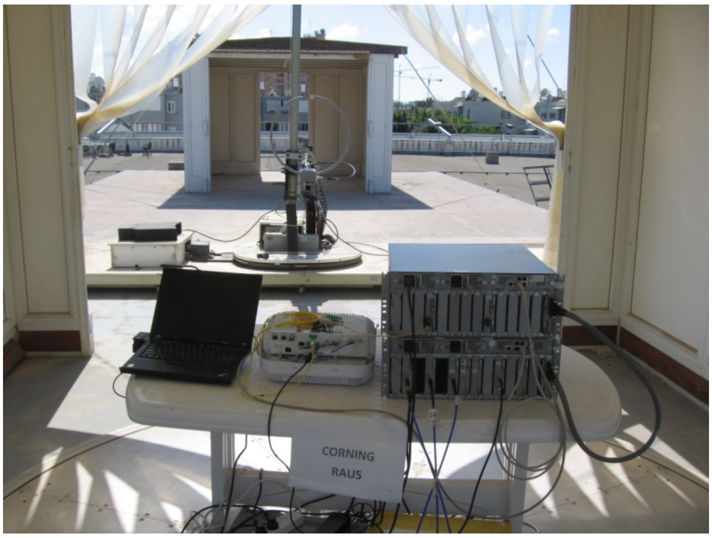

Figure 3. Radiated Emission Test

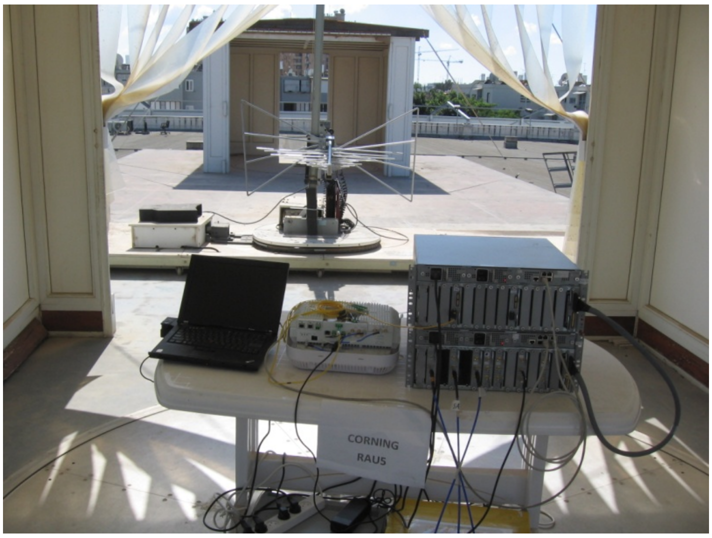

Figure 4. Radiated Emission Test

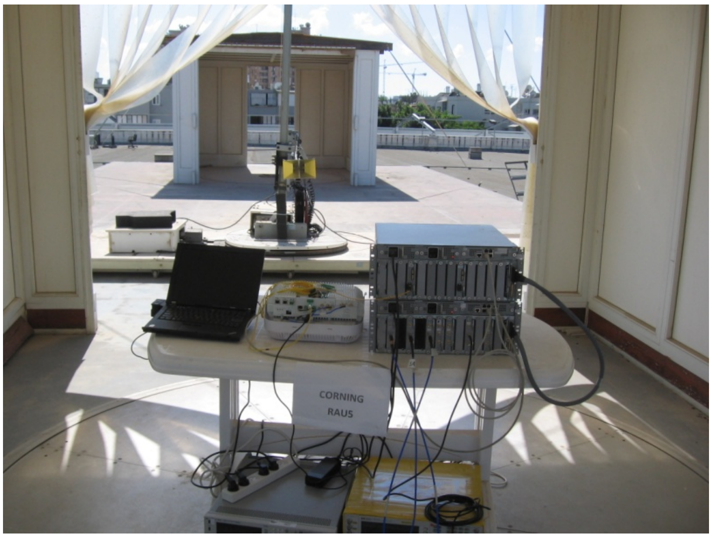

Figure 5. Radiated Emission Test

4. RF Power Output LTE

4.1 Test Specification

FCC Part 27, Subpart C (27.50)

4.2 Test procedure

Peak Power Output must not exceed 1000W. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (30.6 dB) and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload. The Spectrum Analyzer was set to 100 kHz RBW.

4.3 Test Results

	Operation Frequency (MHz)	Reading Port 1 (dBm)	Reading Port 2 (dBm)	MIMO Calculation for Port 1 and Port 2 Readings (dBm)
LTE 64QAM	733	18.6	17.4	21.1
LTE 64QAM	747	17.5	17.3	20.4
LTE 64QAM	753	17.7	16.7	20.2
LTE 16QAM	733	19.5	17.1	21.5
LTE 16QAM	747	18.6	17.2	21.0
LTE 16QAM	753	17.7	16.6	20.2
LTE QPSK	733	18.9	17.0	21.1
LTE QPSK	747	17.5	17.2	20.4
LTE QPSK	753	17.8	16.5	20.2

Figure 6 RF Power Output LTE

See additional information in Figure 7 to Figure 24.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ __ Date: 4.12.14

Typed/Printed Name: M. Zonar

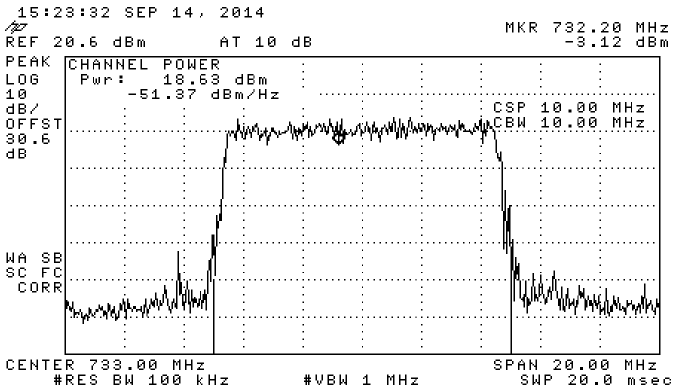

Figure 7.— 64QAM, 733 MHz, Port 1

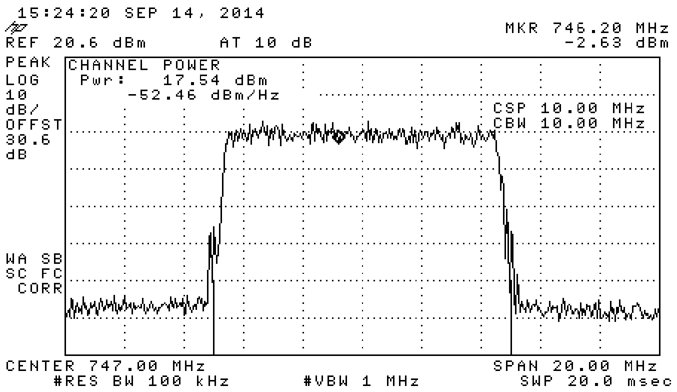

Figure 8.— 64QAM 747 MHz, Port 1

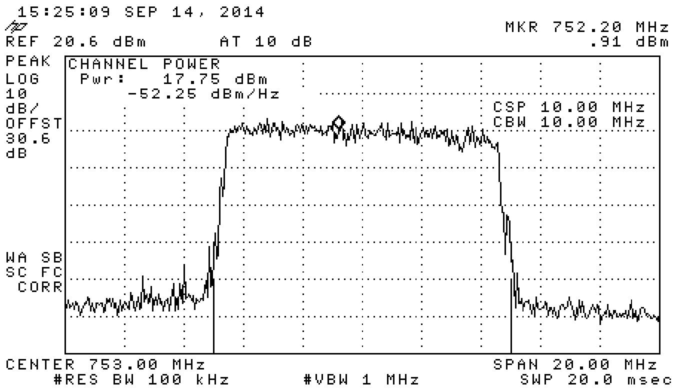

Figure 9.— 64QAM 753 MHz, Port 1

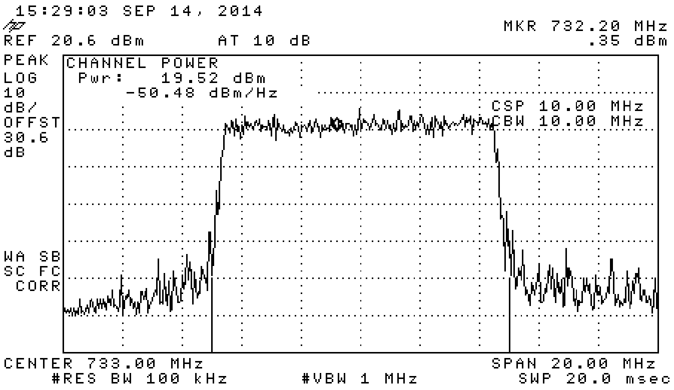

Figure 10.— 16QAM 733 MHz , Port 1

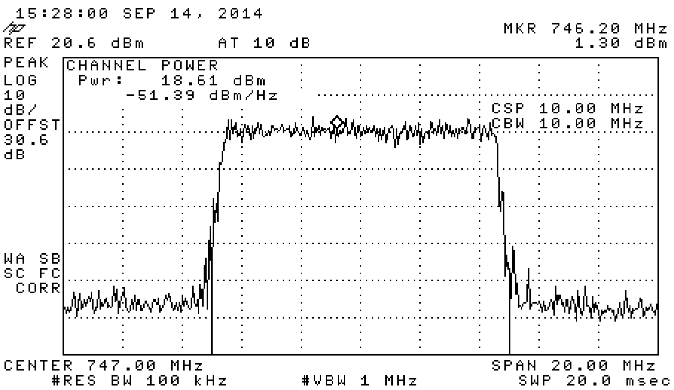

Figure 11.— 16QAM 747 MHz, Port 1

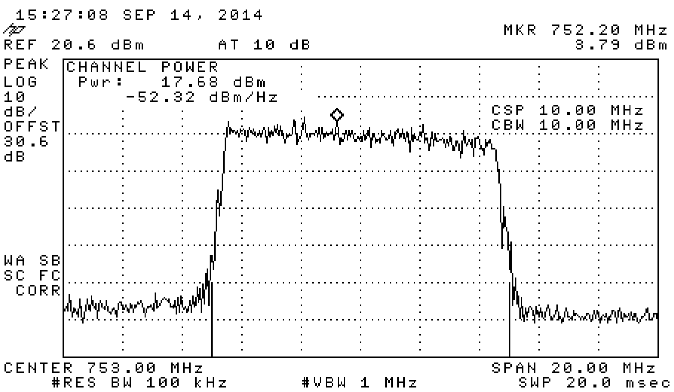

Figure 12.— 16QAM 753 MHz, Port 1

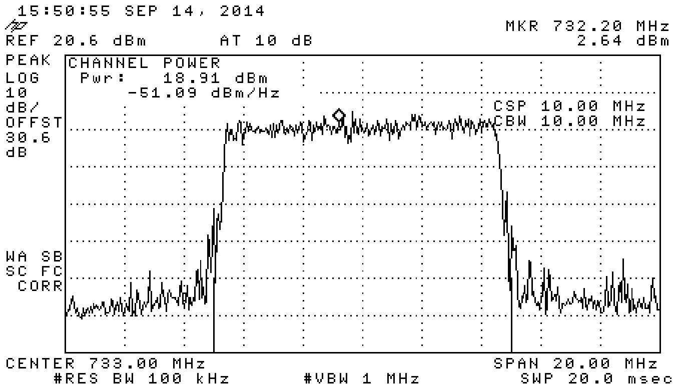

Figure 13.— QPSK 733 MHz , Port 1

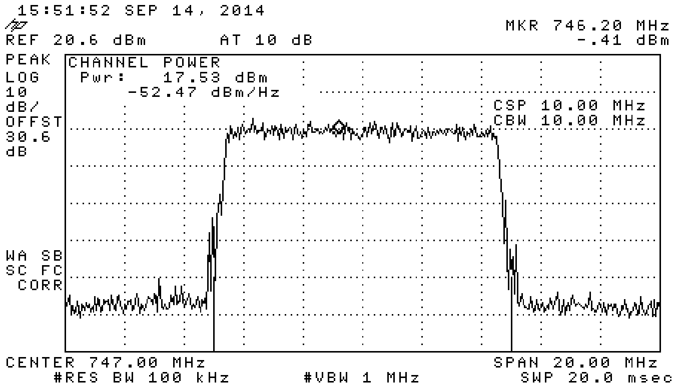

Figure 14.— QPSK 747 MHz , Port 1

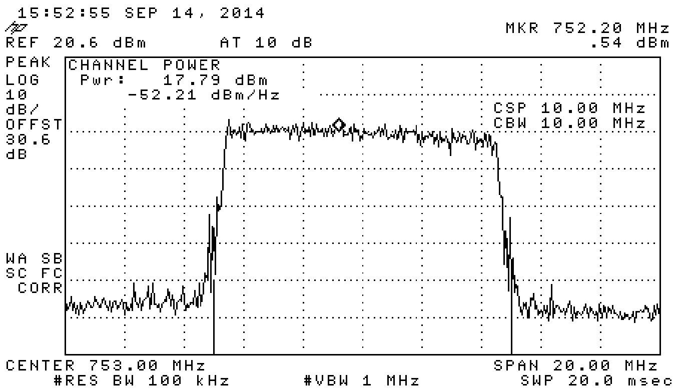

Figure 15.— QPSK 753 MHz, Port 1

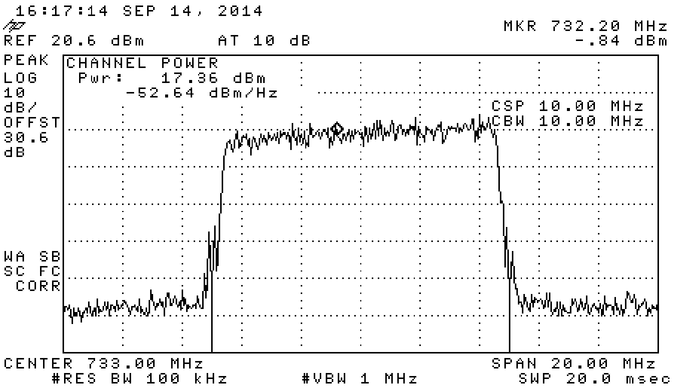

Figure 16.— 64QAM, 733 MHz, Port 2

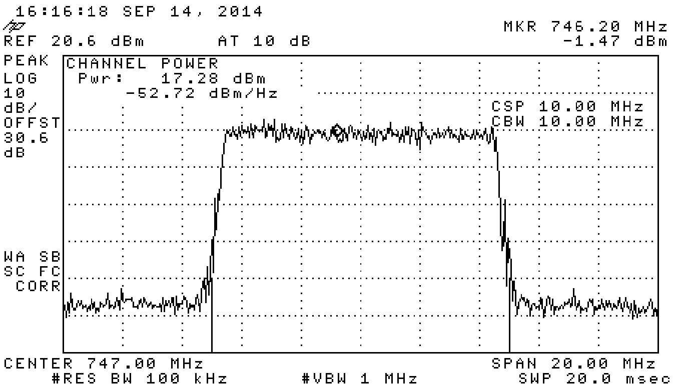

Figure 17.— 64QAM 747 MHz, Port 2

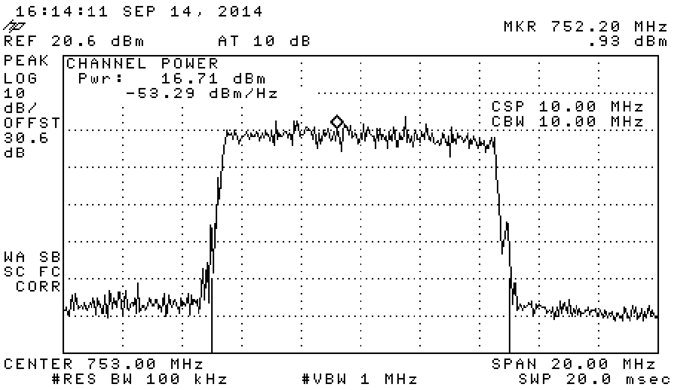

Figure 18.— 64QAM 753 MHz, Port 2

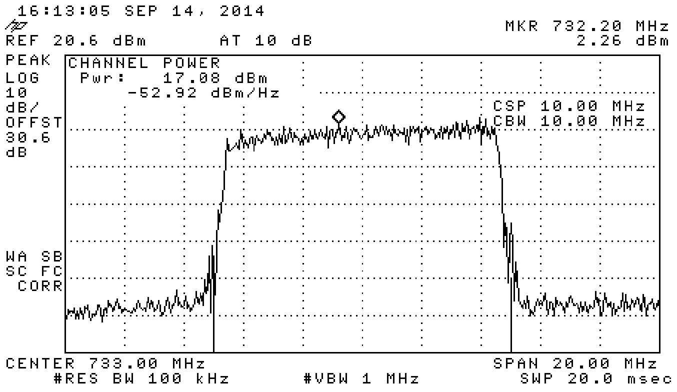

Figure 19.— 16QAM 733 MHz , Port 2

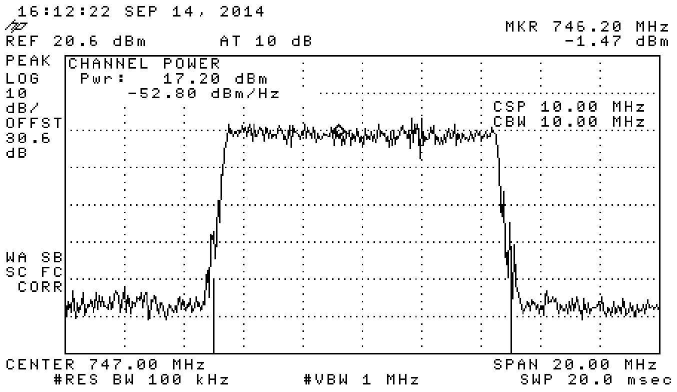

Figure 20.— 16QAM 747 MHz, Port 2

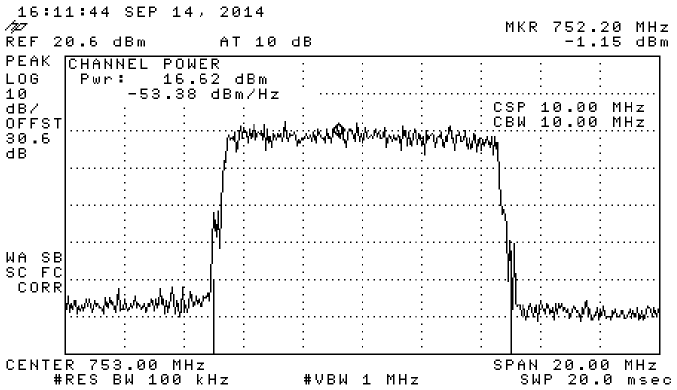

Figure 21.— 16QAM 753 MHz, Port 2

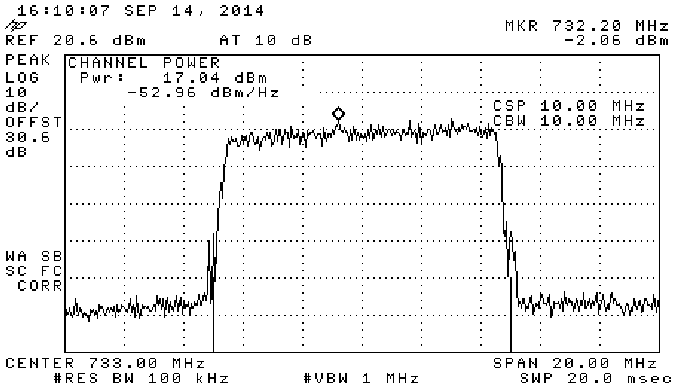

Figure 22.— QPSK 733 MHz , Port 2

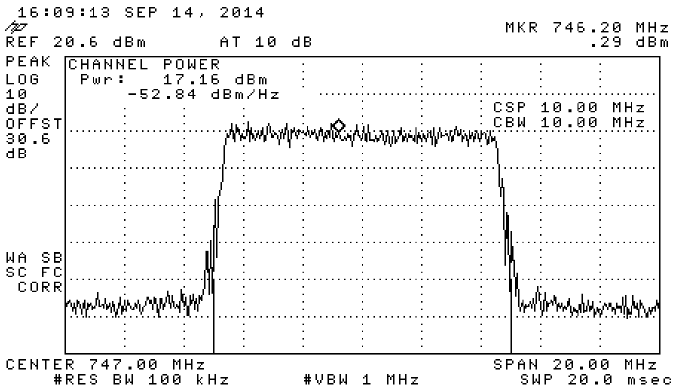

Figure 23.— QPSK 747 MHz , Port 2

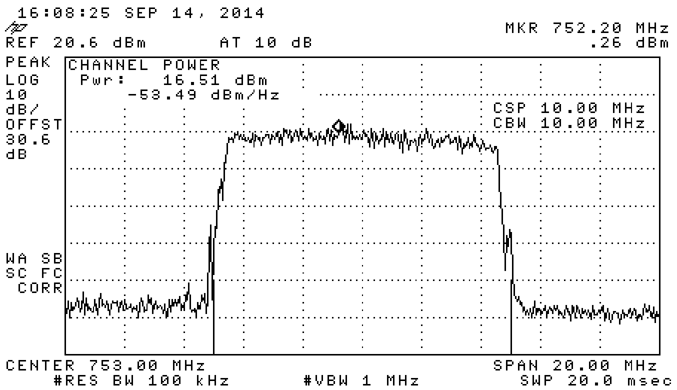

Figure 24.— QPSK 753 MHz, Port 2

4.4 Test Equipment Used; RF Power Output LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8594E	3313U000346	March 6, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 25 Test Equipment Used

5. Occupied Bandwidth LTE

5.1 Test Specification

FCC Part 2, Section 1049

5.2 Test Procedure

The E.U.T. was set to the applicable test frequency in the 728-757 MHz band.
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 (30.6 dB). The spectrum analyzer was set to proper 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.
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

5.3 Test Results

		Operating Frequency (MHz)	Reading Port 1 (MHz)	Reading Port 2 (MHz)
LTE 64QAM	Input	733	9.35	9.35
LTE 64QAM	Output	733	9.35	9.35
LTE 64QAM	Input	747	9.35	9.35
LTE 64QAM	Output	747	9.35	9.40
LTE 64QAM	Input	753	9.40	9.40
LTE 64QAM	Output	753	9.40	9.35
LTE 16QAM	Input	733	9.30	9.30
LTE 16QAM	Output	733	9.35	9.35
LTE 16QAM	Input	747	9.40	9.40
LTE 16QAM	Output	747	9.40	9.35
LTE 16QAM	Input	753	9.35	9.35
LTE 16QAM	Output	753	9.40	9.40
LTE QPSK	Input	733	9.35	9.35
LTE QPSK	Output	733	9.40	9.35
LTE QPSK	Input	747	9.35	9.35
LTE QPSK	Output	747	9.35	9.35
LTE QPSK	Input	753	9.35	9.35
LTE QPSK	Output	753	9.35	9.35

Figure 26 Occupied Bandwidth LTE

See additional information in *Figure 27* to *Figure 53*.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: ________ Date: 4.12.14

Typed/Printed Name: M. Zohar

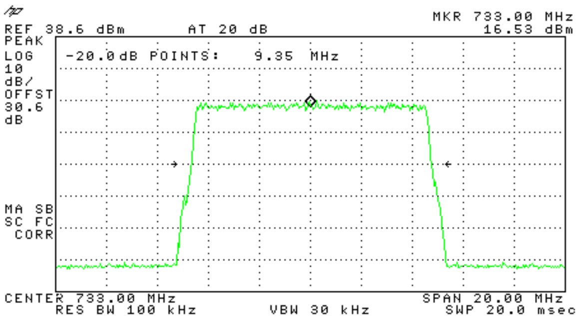

Figure 27.— 64QAM 733 MHz IN

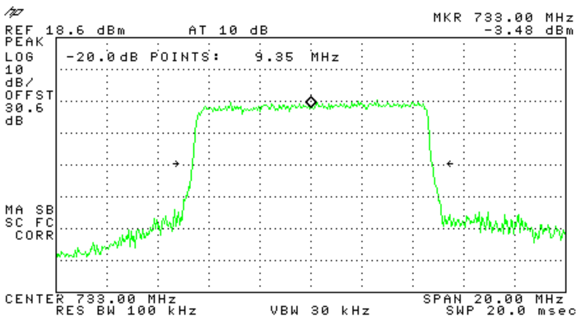

Figure 28.— 64QAM 733 MHz OUT, Port 1

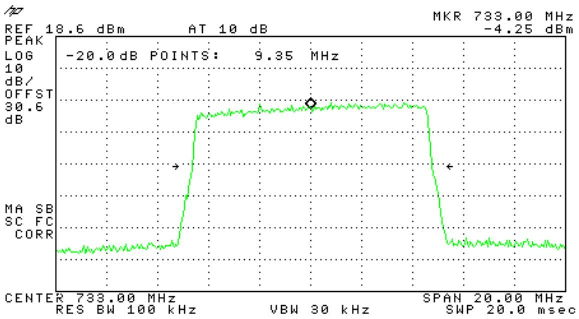

Figure 29.— 64QAM 733 MHz OUT, Port 2

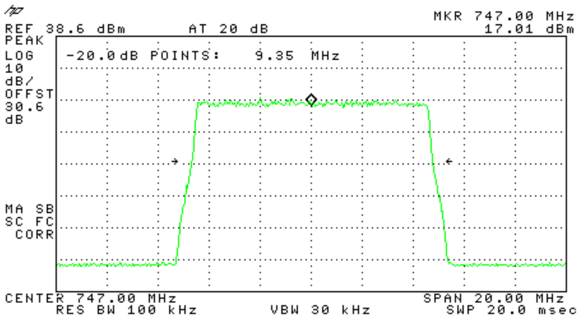

Figure 30.— 64QAM 747 MHz IN

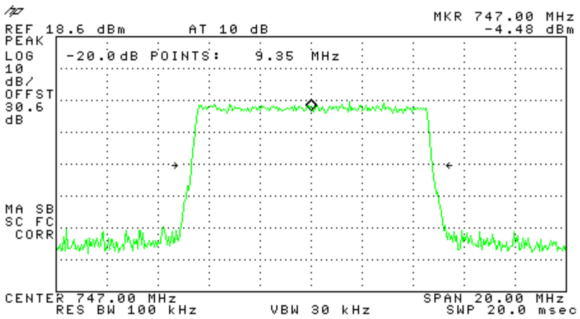

Figure 31.— 64QAM 747 MHz OUT, Port 1

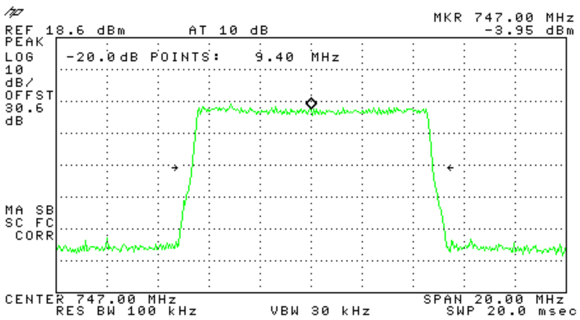

Figure 32.— 64QAM 747 MHz OUT, Port 2

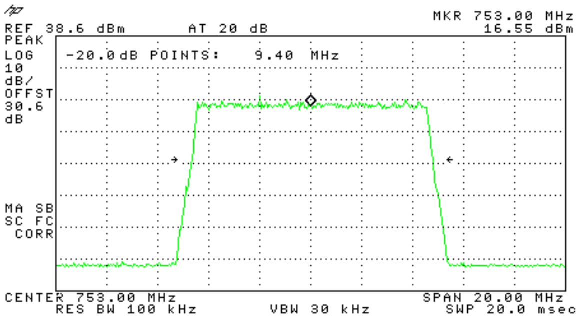

Figure 33.— 64QAM 753 MHz IN

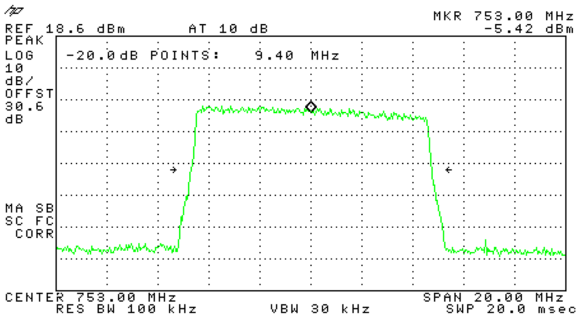

Figure 34.— 64QAM 753 MHz OUT, Port 1

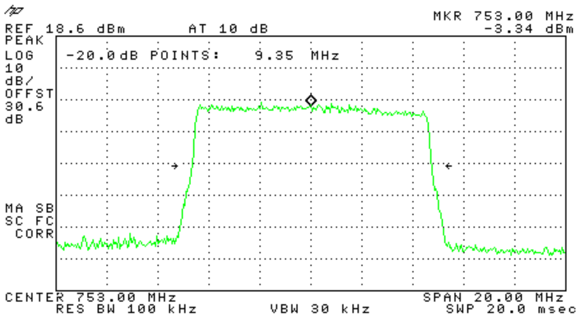

Figure 35.— 64QAM 753 MHz OUT, Port 2

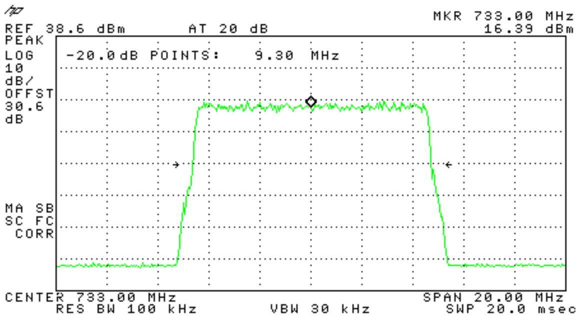

Figure 36.— 16QAM 733 MHz IN

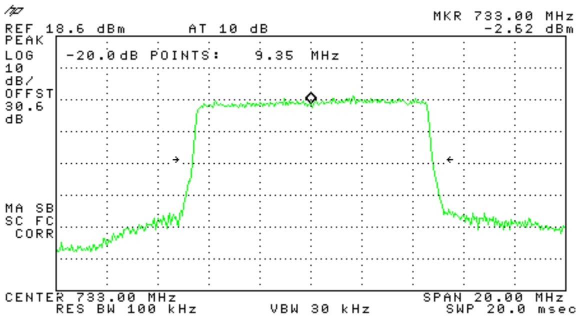

Figure 37.— 16QAM 733 MHz OUT, Port 1

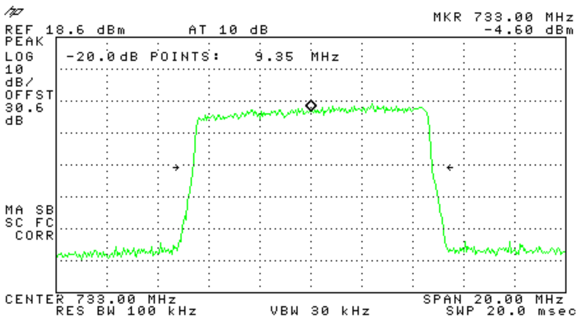

Figure 38.— 16QAM 733 MHz OUT, Port 2

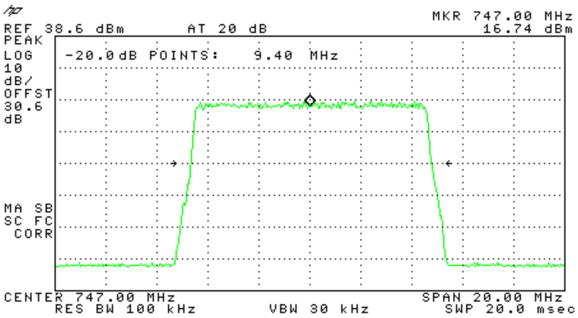

Figure 39.— 16QAM 747 MHz IN

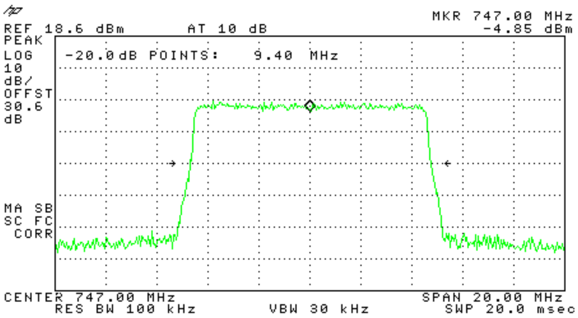

Figure 40.— 16QAM 747 MHz OUT, Port 1

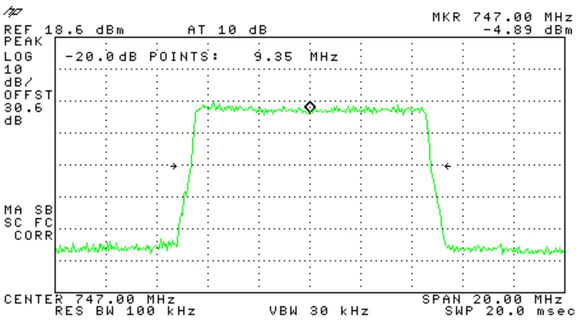

Figure 41.— 16QAM 747 MHz OUT, Port 2

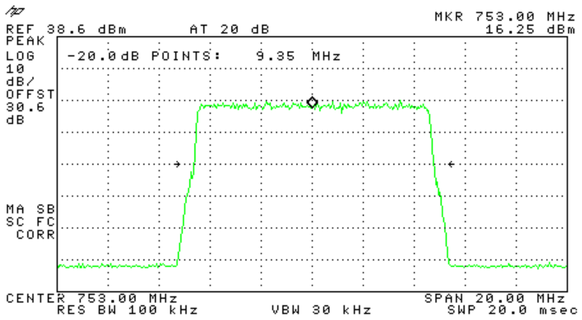

Figure 42.— 16QAM 753 MHz IN

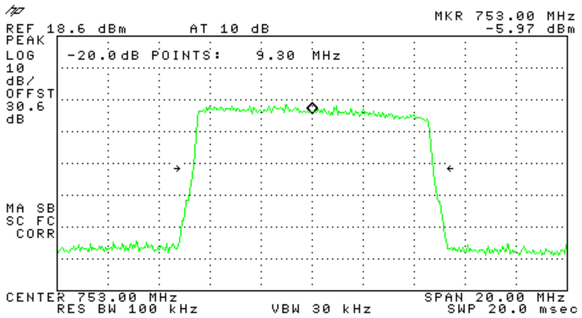

Figure 43.— 16QAM 753 MHz OUT, Port 1

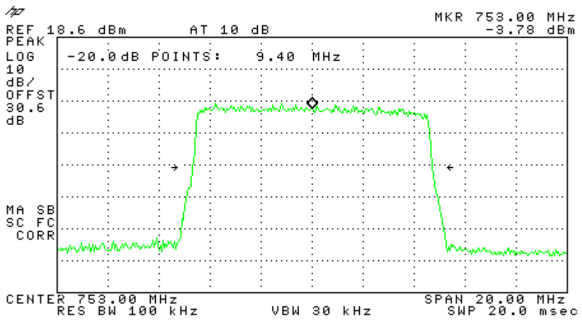

Figure 44.— 16QAM 753 MHz OUT, Port 2

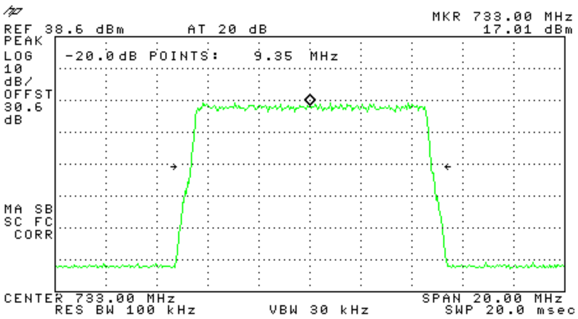

Figure 45.— QPSK 733 MHz IN

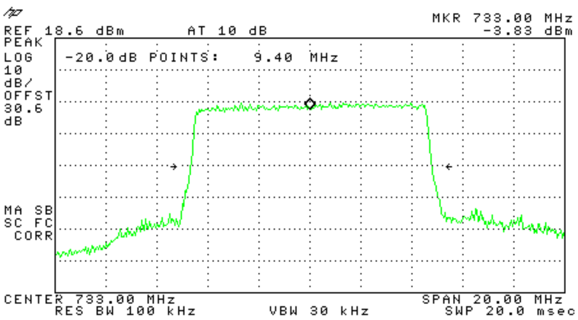

Figure 46.— QPSK 733 MHz OUT, Port 1

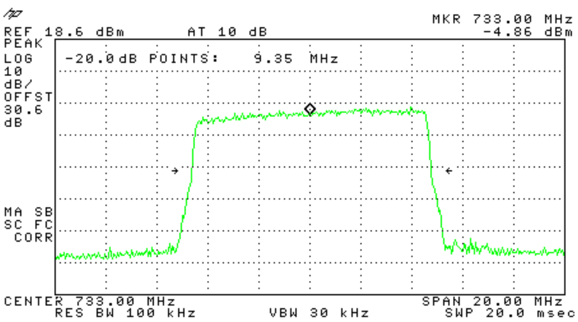

Figure 47.— QPSK 733 MHz OUT, Port 2

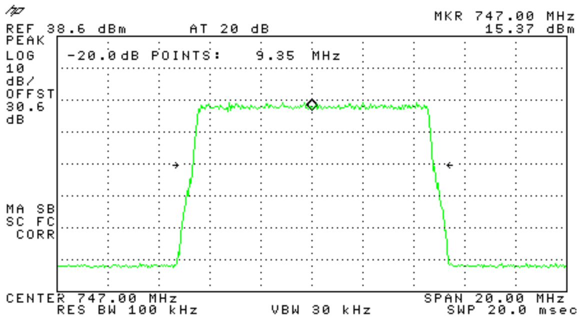

Figure 48.— QPSK 747 MHz IN

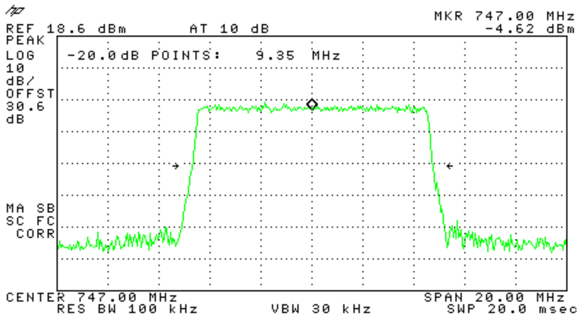

Figure 49.— QPSK 747 MHz OUT, Port 1

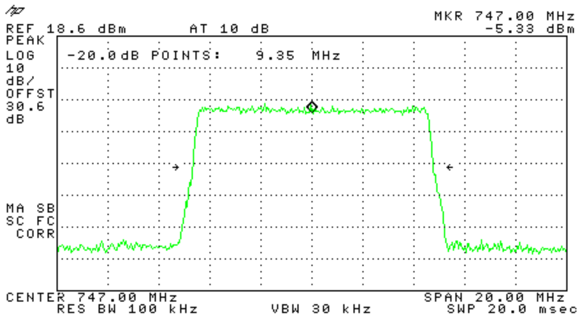

Figure 50.— QPSK 747 MHz OUT, Port 2

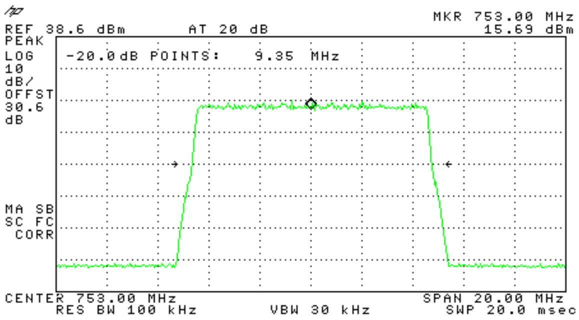

Figure 51.— QPSK 753 MHz IN

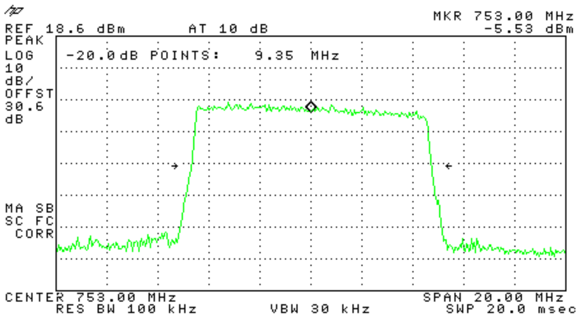

Figure 52.— QPSK 753 MHz OUT, Port 1

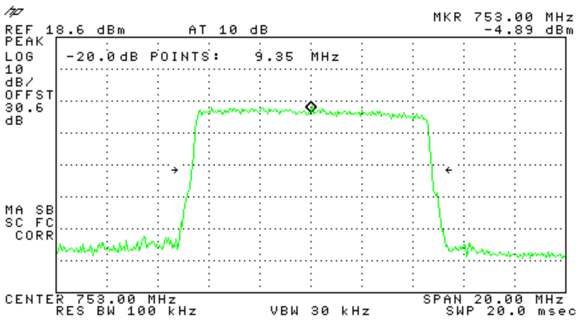

Figure 53.— QPSK 753 MHz OUT, Port 2

5.4 Test Equipment Used; Occupied Bandwidth LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 54 Test Equipment Used

6. Spurious Emissions at Antenna Terminals LTE

6.1 Test Specification

FCC Part 27, Subpart C, Sections 27.53(c)(1) (3) 27.53 (g)

6.2 Test procedure

The power of any emission outside of the authorized operating frequency ranges 728 MHz-758 MHz must be attenuated below the transmitting power (P) by a factor of 43+ 10 log (P) dB.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (30.6dB). 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 1GHz - 22.0 GHz.

6.3 Test Results

See additional information in Figure 55 to Figure 72.

JUDGEMENT: Passed

TEST PERSONNI

Tester Signature: _  _____ Date: 4.12.14

Typed/Printed Nai

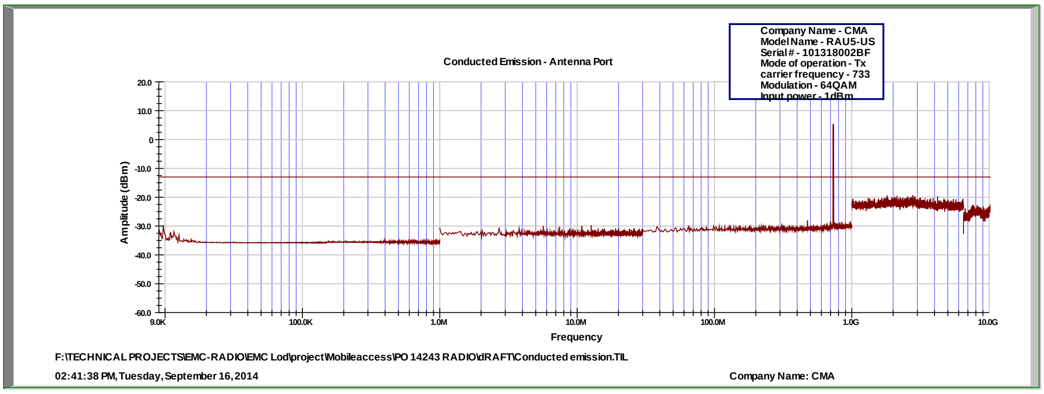

Figure 55 Spurious Emissions at Antenna Terminals 64QAM, 733MHz, Port 1

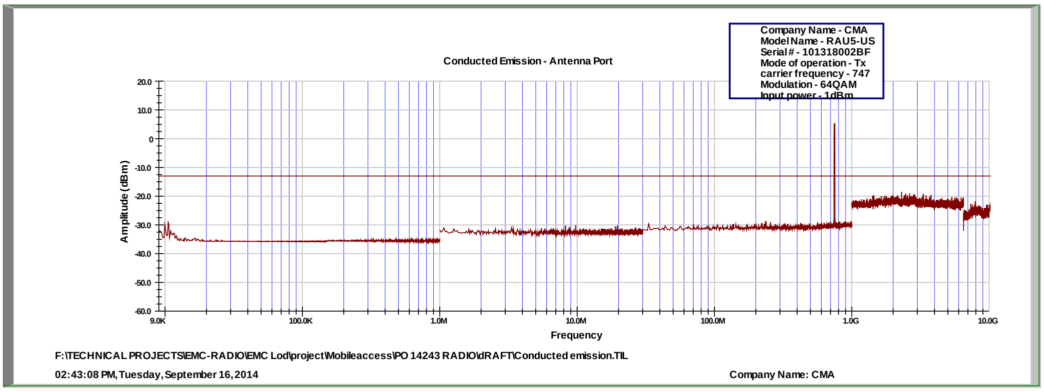

Figure 56 Spurious Emissions at Antenna Terminals 64QAM, 747MHz, Port 1

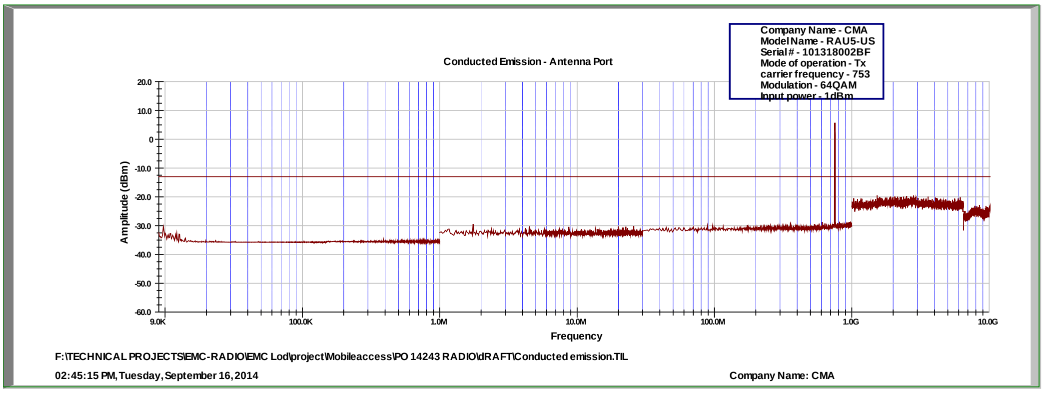

Figure 57 Spurious Emissions at Antenna Terminals 64QAM, 753MHz, Port 1

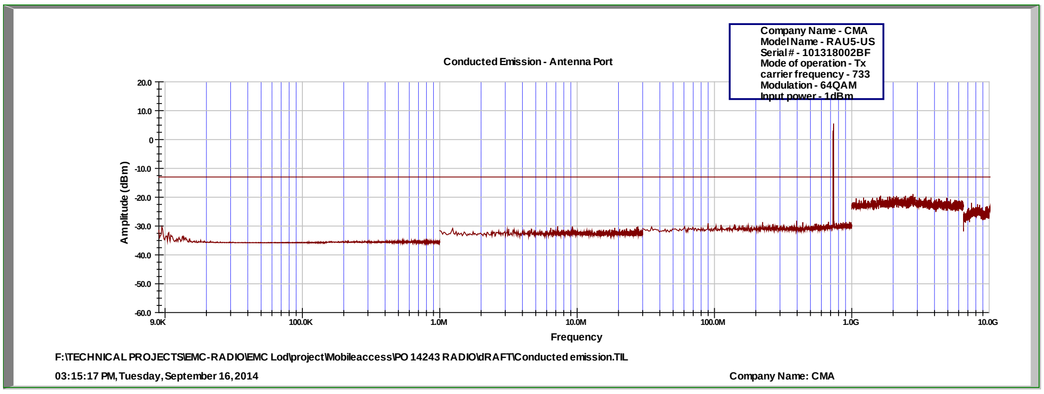

Figure 58 Spurious Emissions at Antenna Terminals 64QAM, 733MHz, Port 2

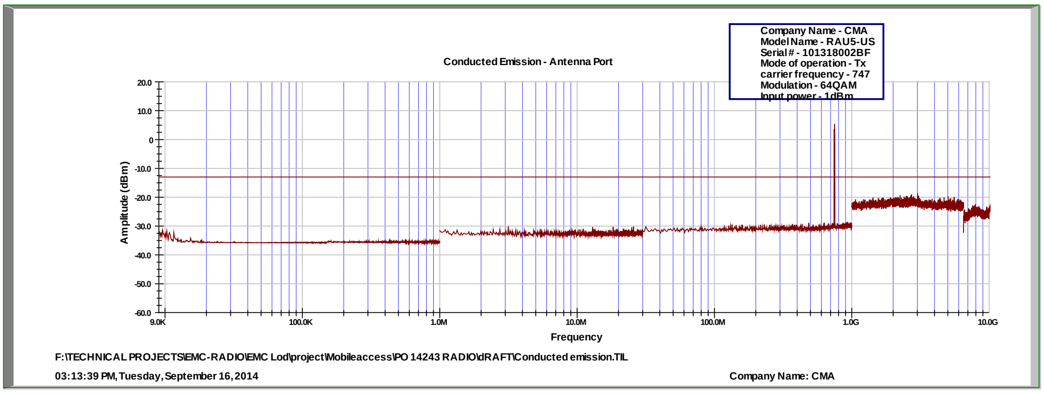

Figure 59 Spurious Emissions at Antenna Terminals 64QAM, 747MHz, Port 2

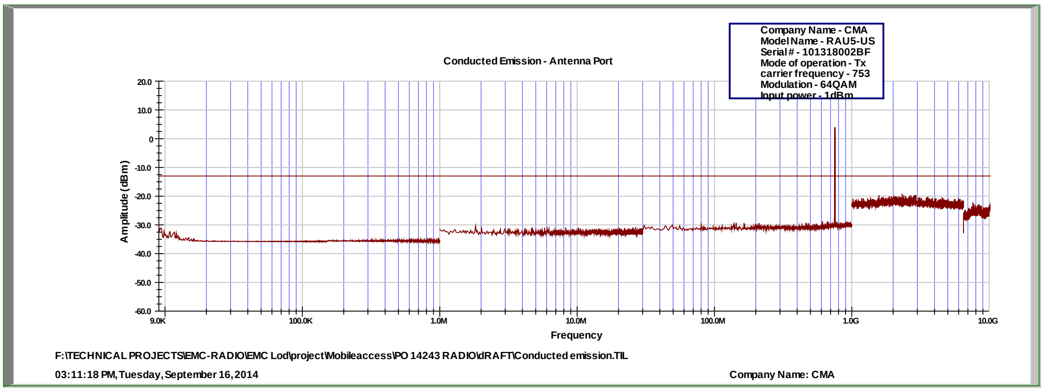

Figure 60 Spurious Emissions at Antenna Terminals 64QAM, 753MHz, Port 2

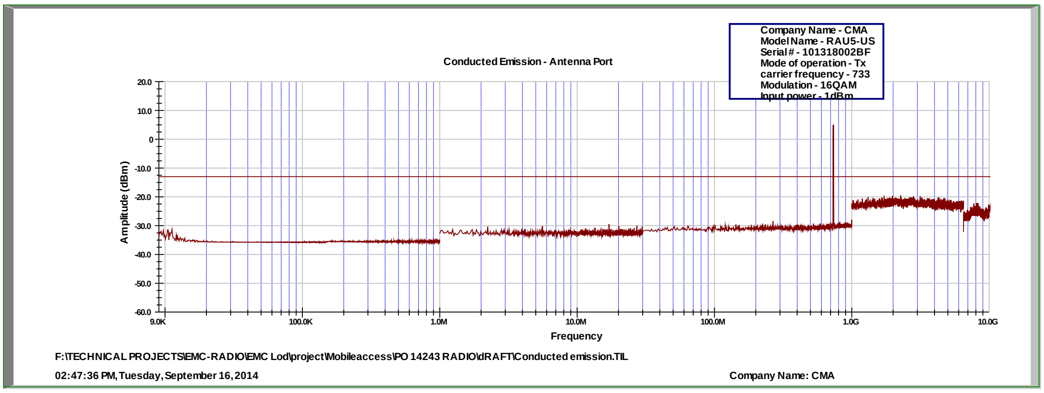

Figure 61 Spurious Emissions at Antenna Terminals 16QAM, 733MHz, Port 1

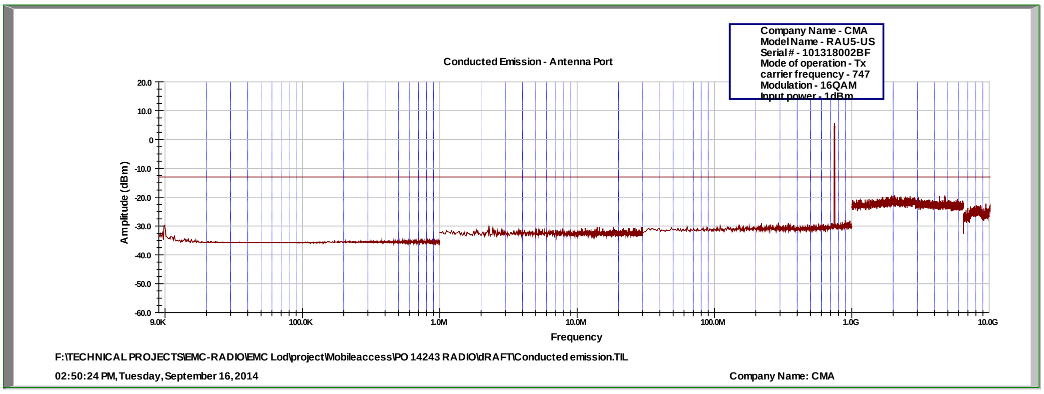

Figure 62 Spurious Emissions at Antenna Terminals 16QAM, 747MHz, Port 1

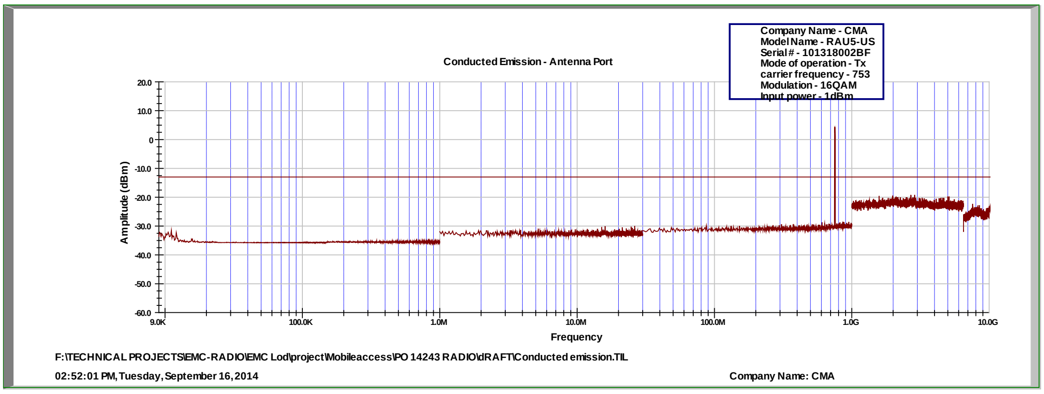

Figure 63 Spurious Emissions at Antenna Terminals 16QAM, 753MHz, Port 1

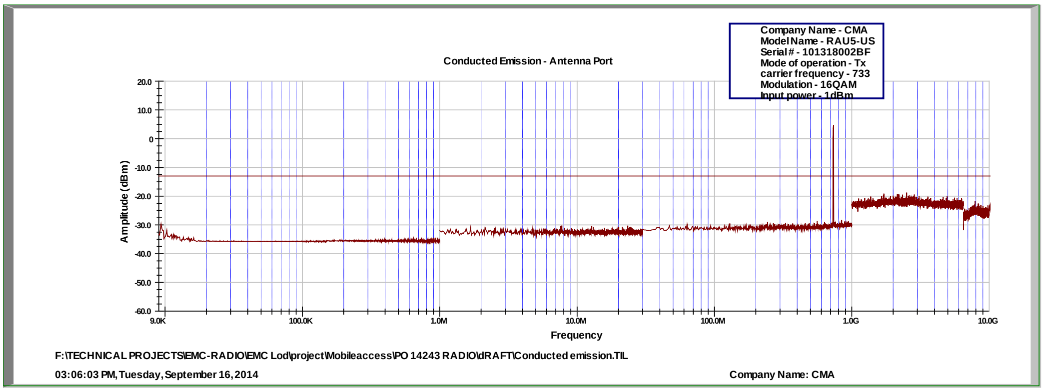

Figure 64 Spurious Emissions at Antenna Terminals 16QAM, 733MHz, Port 2

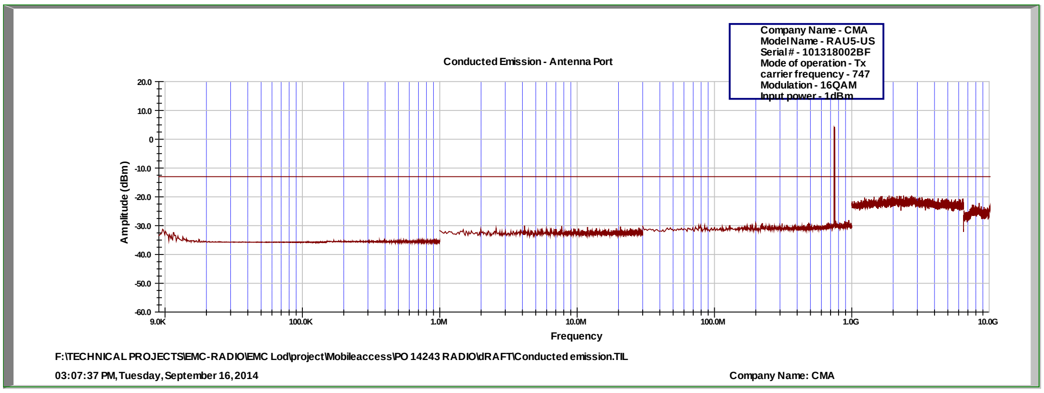

Figure 65 Spurious Emissions at Antenna Terminals 16QAM, 747MHz, Port 2

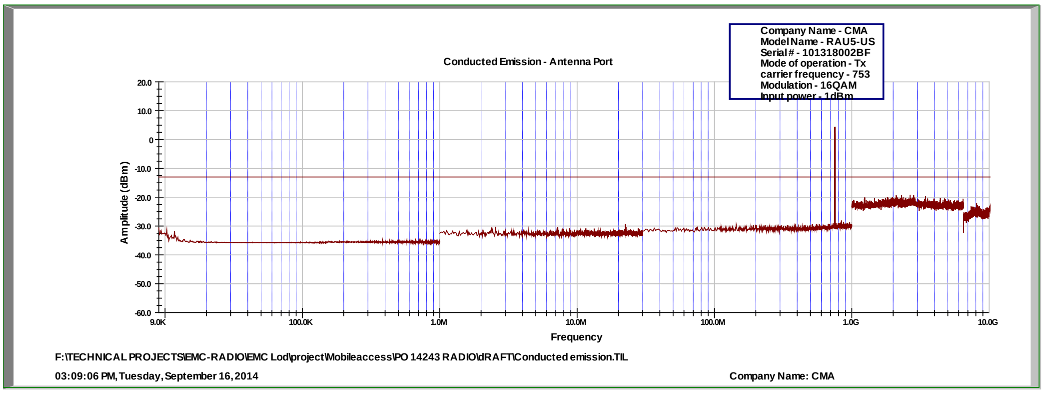

Figure 66 Spurious Emissions at Antenna Terminals 16QAM, 753MHz, Port 2

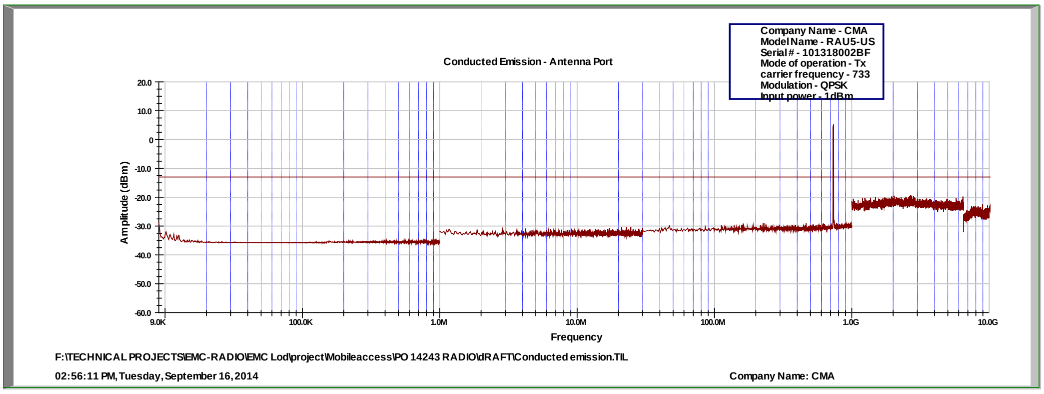

Figure 67 Spurious Emissions at Antenna Terminals QPSK, 733MHz, Port 1

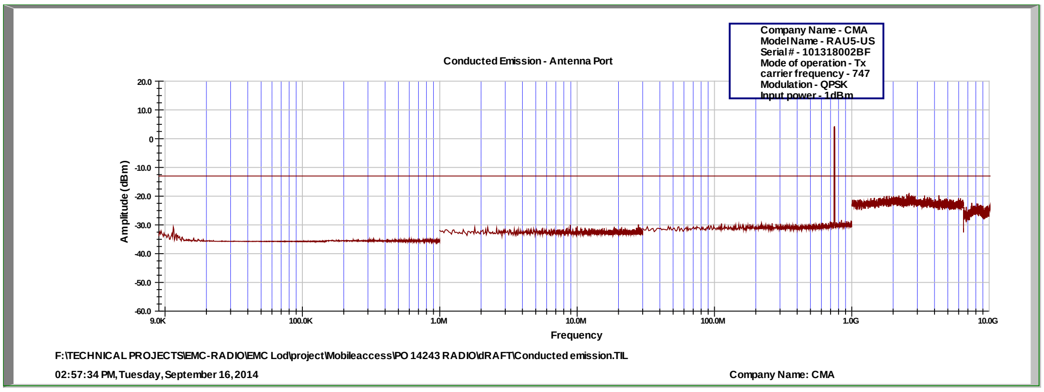

Figure 68 Spurious Emissions at Antenna Terminals QPSK, 747MHz, Port 1

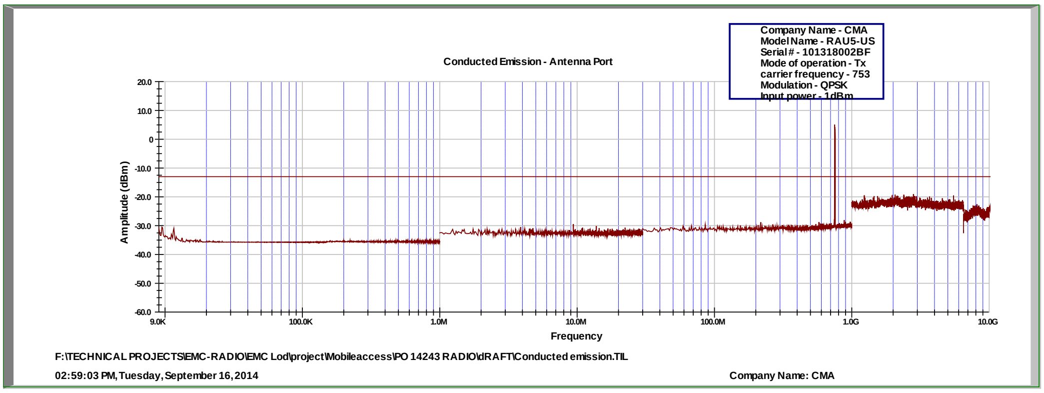

Figure 69 Spurious Emissions at Antenna Terminals QPSK, 753MHz, Port 1

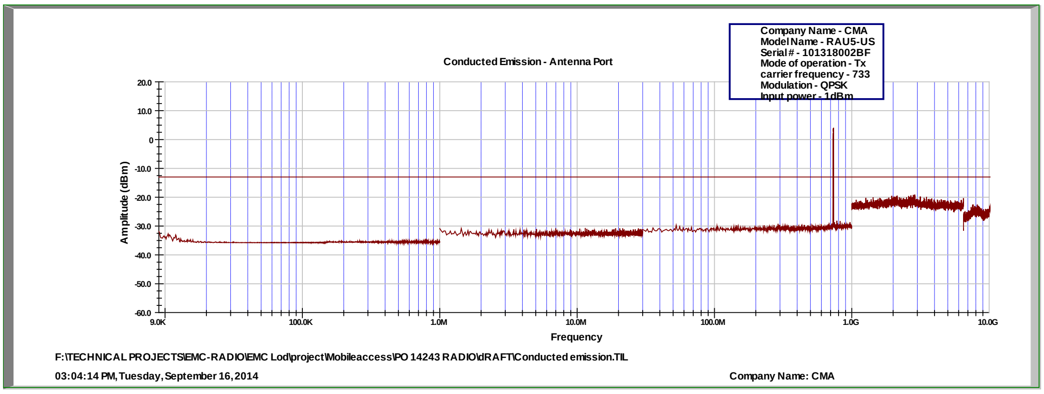

Figure 70 Spurious Emissions at Antenna Terminals QPSK, 733MHz, Port 2

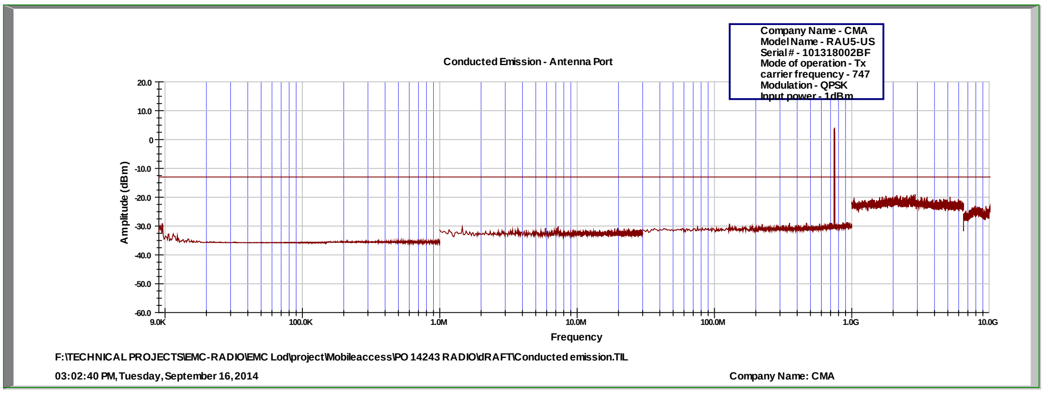

Figure 71 Spurious Emissions at Antenna Terminals QPSK, 747MHz, Port 2

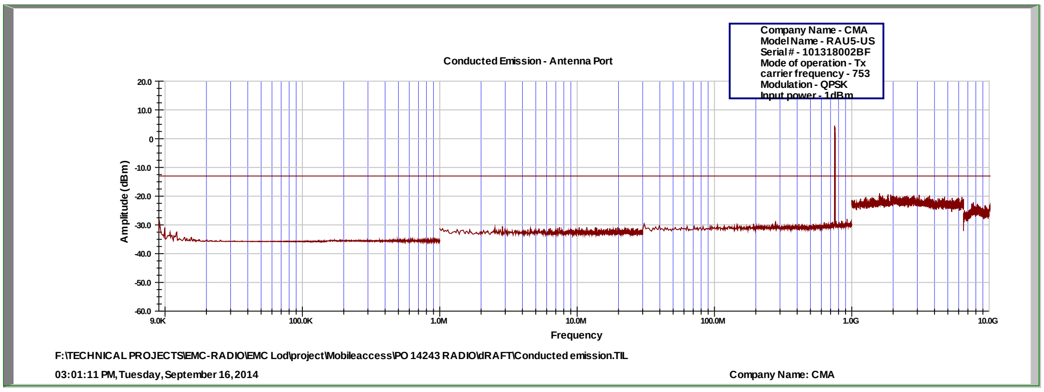

Figure 72 Spurious Emissions at Antenna Terminals QPSK, 753MHz, Port 2

6.4 Test Equipment Used; Spurious Emissions at Antenna Terminals LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8594L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 73 Test Equipment Used

7. Band Edge Spectrum LTE

7.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (c)(1)

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 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 30kHz R.B.W.

7.3 Results

	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading Port 1 (dBm)	Reading Port 2 (dBm)	Specification (dBm)	Port 1 Margin (dB)	Port 2 Margin (dB)
LTE64QAM	733.00	728.00	-33.76	-37.16	-13.0	-20.76	-24.16
LTE64QAM	753.00	758.00	-35.92	-37.78	-13.0	-22.92	-24.78
LTE16QAM	733.00	728.00	-34.03	-36.39	-13.0	-21.03	-23.39
LTE16QAM	753.00	758.00	-37.75	-36.78	-13.0	-24.75	-23.78
LTEQPSK	733.00	728.00	-32.80	-36.74	-13.0	-19.80	-23.74
LTEQPSK	753.00	758.00	-34.98	-35.51	-13.0	-21.98	-22.51

Figure 74 Band Edge Spectrum Results LTE

JUDGEMENT: Passed by 20.76 dB

See additional inform[illegible] 75 to Figure 86.

TEST PERSONNEL

Tester Signature: ___ ____ Date: 4.12.14

Typed/Printed Name: M. Zohar

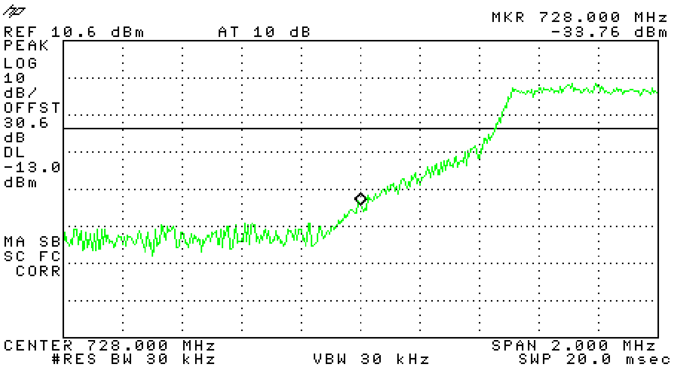

Figure 75.—64QAM 733.0 MHz, Port 1

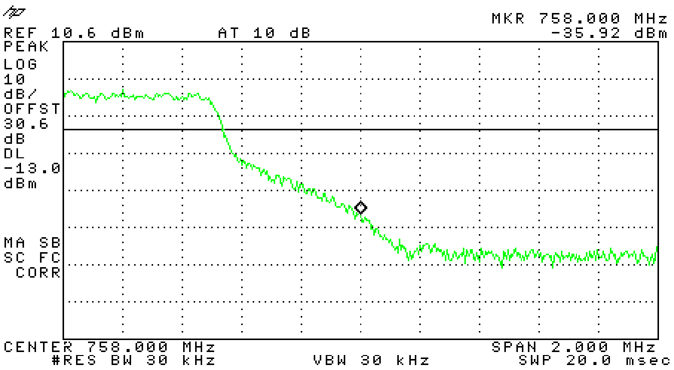

Figure 76.— 64QAM 753.0 MHz, Port 1

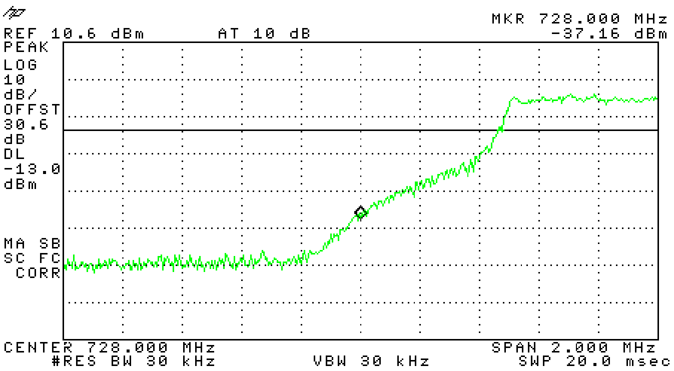

Figure 77.—64QAM 733.0 MHz, Port 2

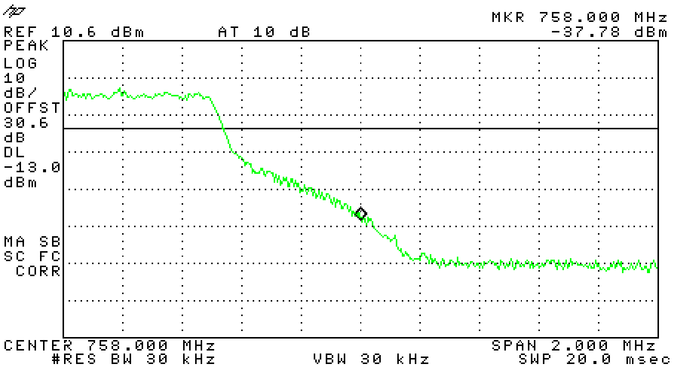

Figure 78.— 64QAM 753.0 MHz, Port 2

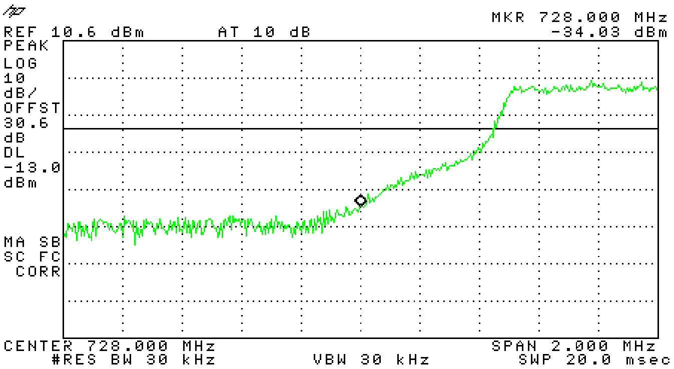

Figure 79.—16QAM 733.0 MHz, Port 1

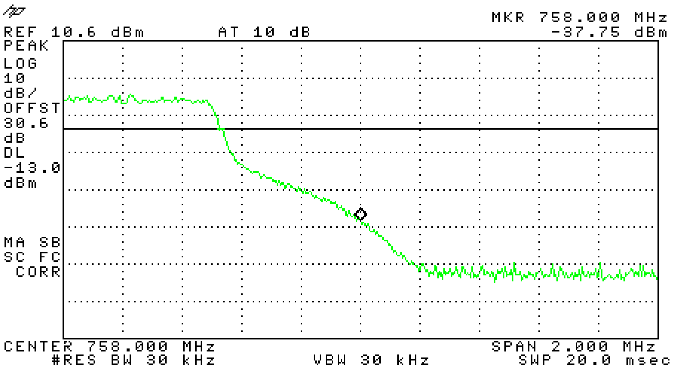

Figure 80.— 16QAM 753.0 MHz, Port 1

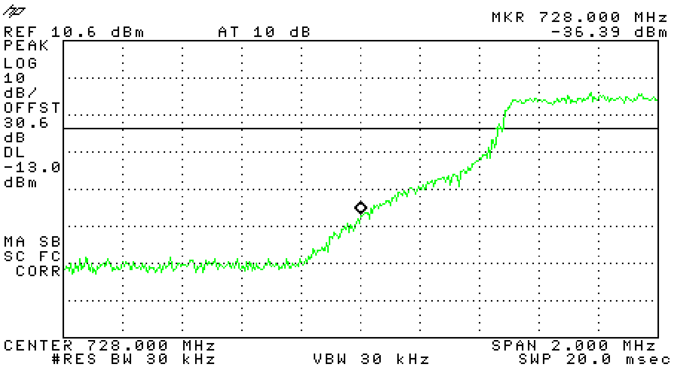

Figure 81.—16QAM 733.0 MHz, Port 2

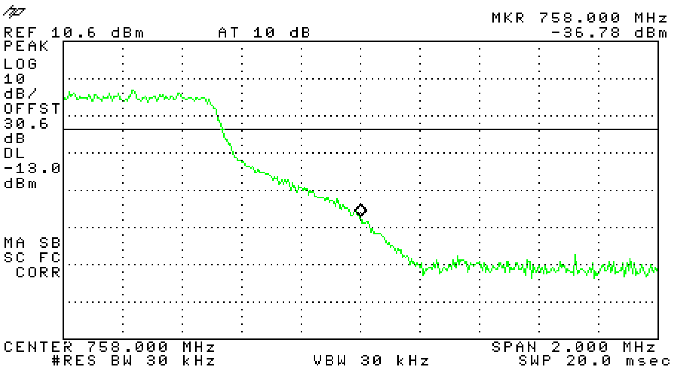

Figure 82.— 16QAM 753.0 MHz, Port 2

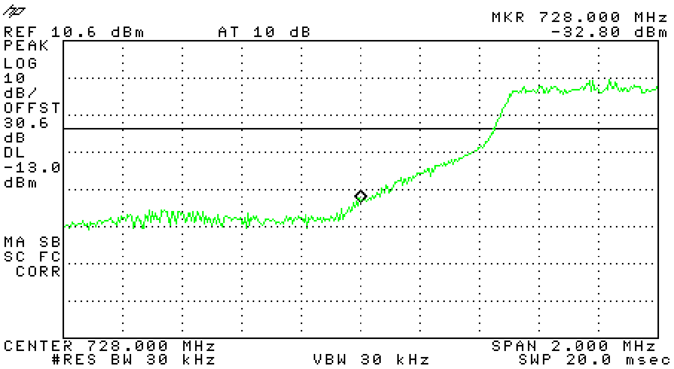

Figure 83.— QPSK 733.0 MHz, Port 1

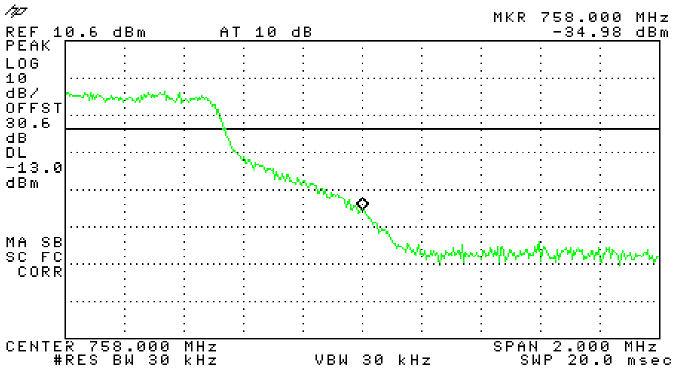

Figure 84.—QPSK 753.0 MHz, Port 1

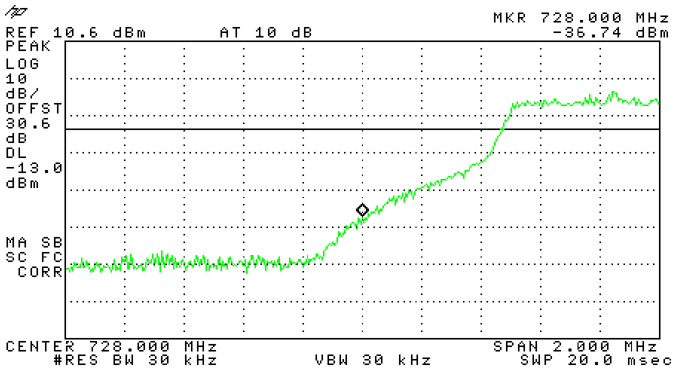

Figure 85.— QPSK 733.0 MHz, Port 2

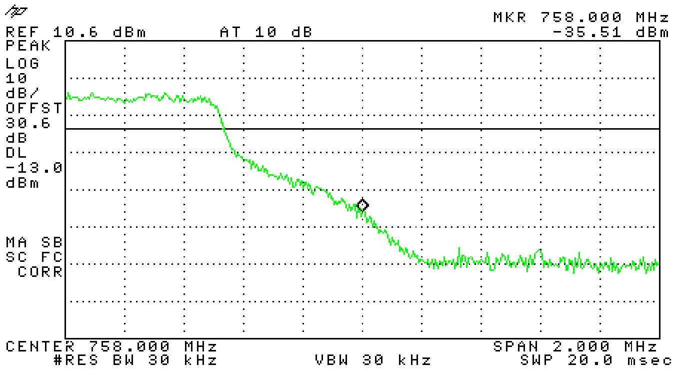

Figure 86.—QPSK 753.0 MHz, Port 2

7.4 Test Equipment Used; Band Edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 87 Test Equipment Used

8. Spurious Radiated Emission LTE

8.1 Test Specification

FCC, Part 27, Subpart C Section 27.53 (g)

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 (728-758 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, 0.8 meters above the ground. The configuration tested is shown in Figure 1.
The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

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

8.3 Test Results

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)
733.00	1466	V	60.4	-39.5	6.7	7.6	-38.6	-13.00	-25.6
733.00	1466	H	59.2	-39.9	6.7	8.0	-38.6	-13.00	-25.6
747.00	1494	V	57.5	-42.7	6.7	7.6	-41.8	-13.00	-28.8
747.00	1494	H	57.2	-42.3	6.7	8.0	-41.0	-13.00	-28.0
753.00	1506	V	57.9	-42.0	6.7	7.6	-41.1	-13.00	-28.1
753.00	1506	H	57.1	-42.4	6.7	8.0	-38.9	-13.00	-25.9

Figure 88 Spurious Radiated Emission LTE

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.53 (g) specifications.

JUDGEMENT: Passed by 25.6 dB

TEST PERSONNEL:

Tester Signature: ____ ___ Date: 4.12.14

Typed/Printed Name: M. Zohar

8.4 Test Instrumentation Used; Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 years
Horn Antenna	ETS	3115	29845	March 14, 2012	3 years
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
EMI Receiver	R&S	FSL6	100194	December 1, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Antenna Mast	ETS	2070-2	-	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 89 Test Equipment Used

9. RF Power Output AWS

9.1 Test Specification

FCC Part 27, Subpart C (27.50(d))

9.2 Test procedure

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 as follows:

LTE, WCDMA and GSM.

Special attention was taken to prevent Spectrum Analyzer RF input overload.

9.3 Results

Modulation	Operation Frequency (MHz)	Reading Port 1 (dBm)	Reading Port 2 (dBm)	MIMO Calculation for Port 1 and Port 2 Readings (dBm)
GSM	2111.2	18.0	18.9	21.5
GSM	2132.5	19.1	19.2	22.2
GSM	2153.8	18.8	19.3	22.1
LTE 64QAM	2115.0	18.9	20.0	22.5
LTE 64QAM	2132.5	18.3	21.9	23.5
LTE 64QAM	2150.0	18.5	21.4	23.2
WCDMA	2112.5	20.8	21.4	24.1
WCDMA	2132.5	19.2	22.7	24.3
WCDMA	2152.5	19.4	21.7	23.7

Figure 90 RF Power Output AWS

See additional information in Figure 91 to Figure 108.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: ____ ___ Date: 4.12.14

Typed/Printed Name: M. Zonar

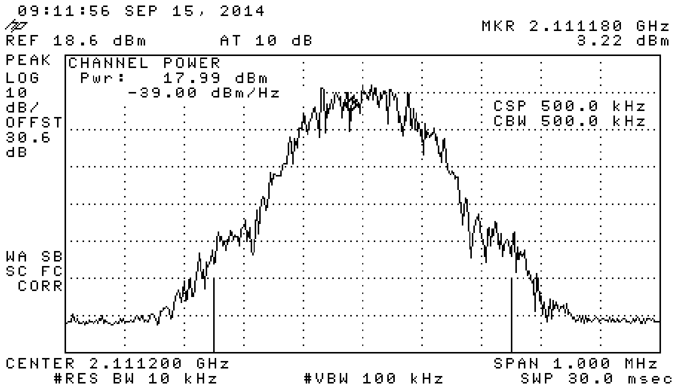

Figure 91.— GSM (2111.2 MHz), Port 1

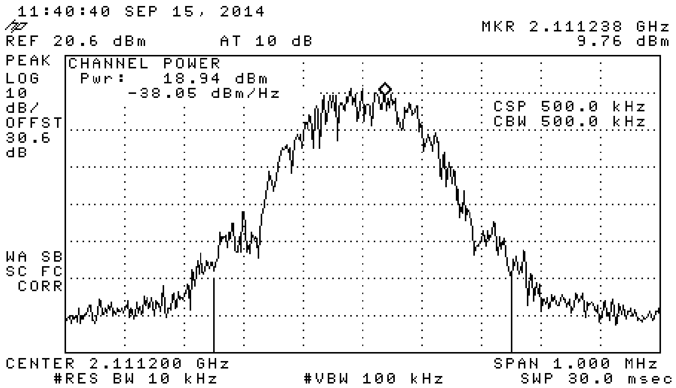

Figure 92.— GSM (2111.2 MHz), Port 2

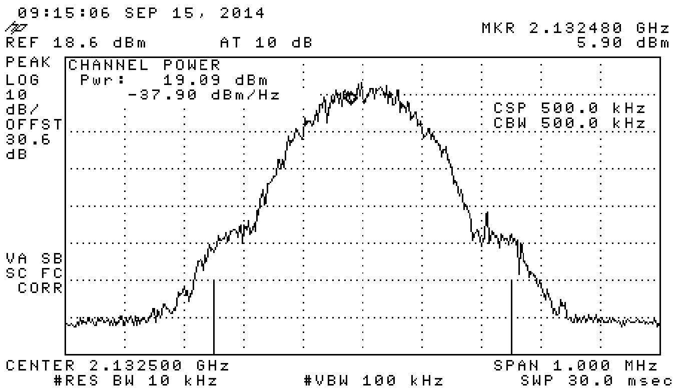

Figure 93.— GSM (2132.5 MHz) , Port 1

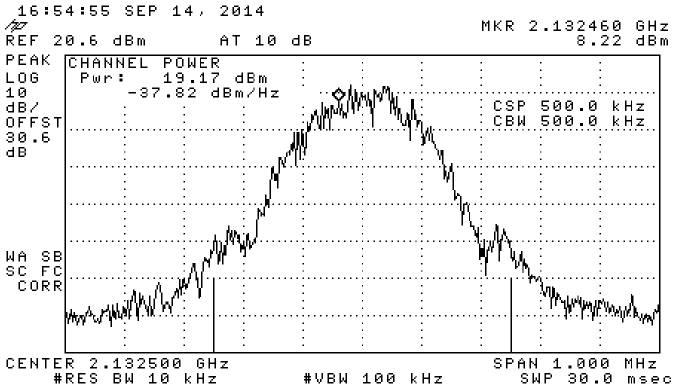

Figure 94.— GSM (2132.5 MHz) , Port 2

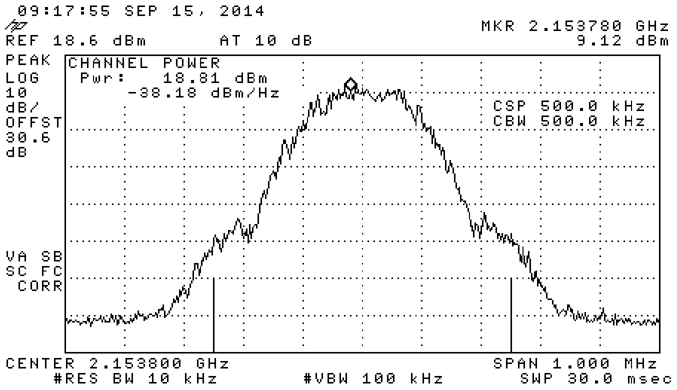

Figure 95.— GSM (2153.8 MHz) , Port 1

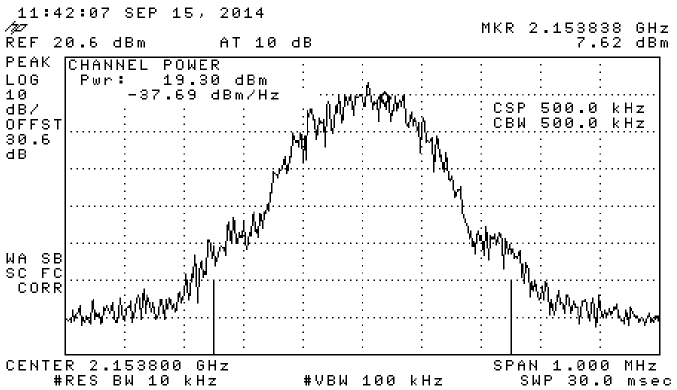

Figure 96.— GSM (2153.8 MHz) , Port 2

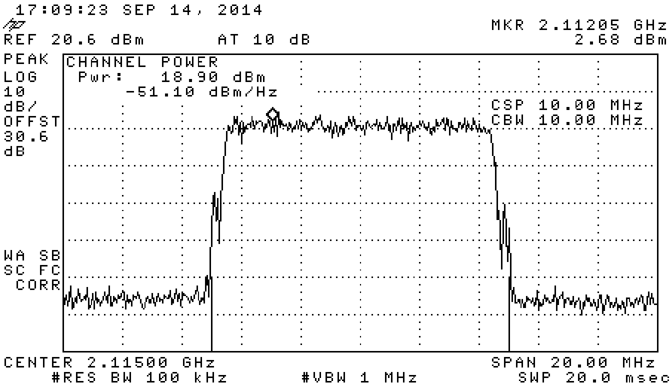

Figure 97.— LTE 64QAM(2115.0 MHz) , Port 1

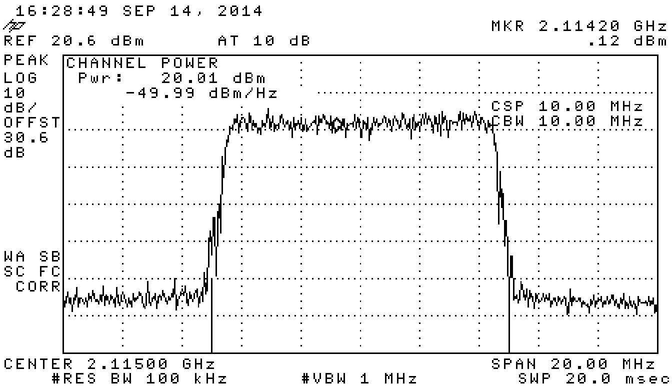

Figure 98.— LTE 64QAM(2115.0 MHz) , Port 2

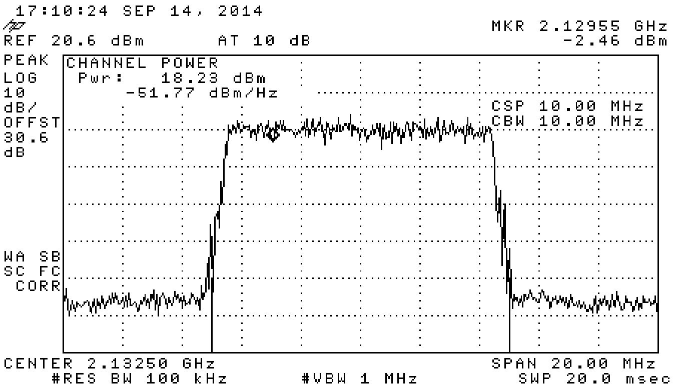

Figure 99.— LTE 64QAM (2132.5 MHz) , Port 1

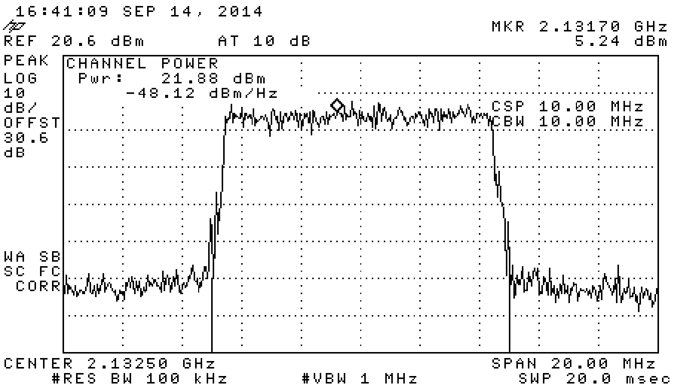

Figure 100.— LTE 64QAM (2132.5 MHz) , Port 2

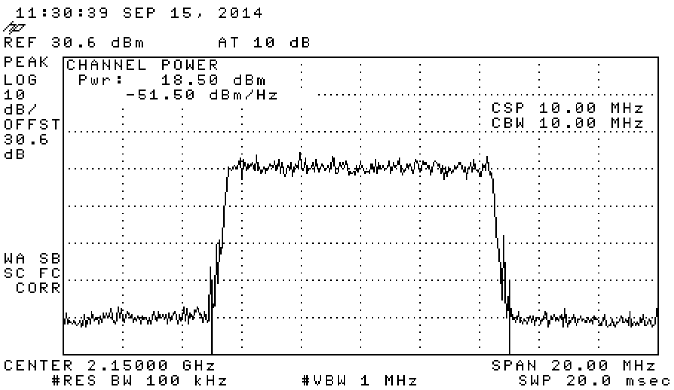

Figure 101.— LTE 64QAM (2150.0 MHz) , Port 1

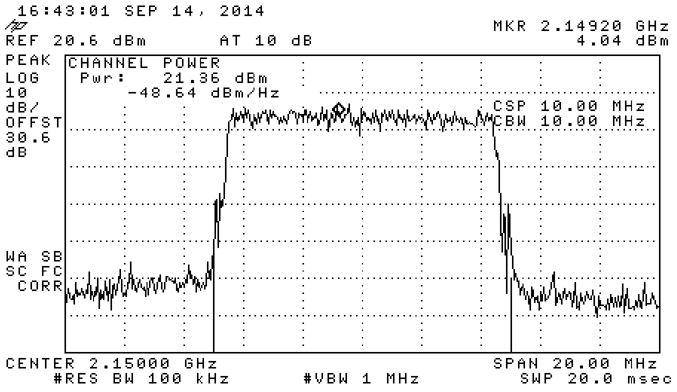

Figure 102.— LTE 64QAM (2150.0 MHz) , Port 2

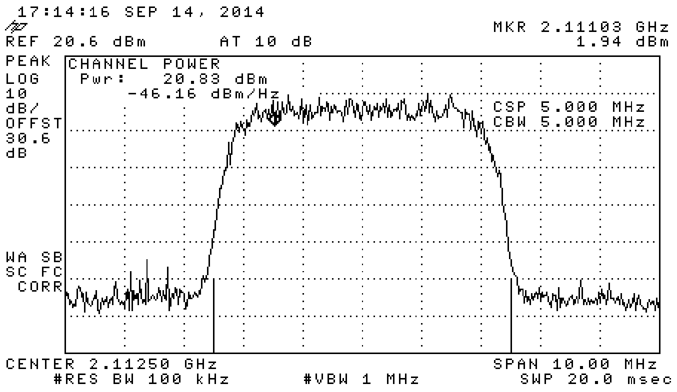

Figure 103.— W-CDMA (2112.5 MHz) , Port 1

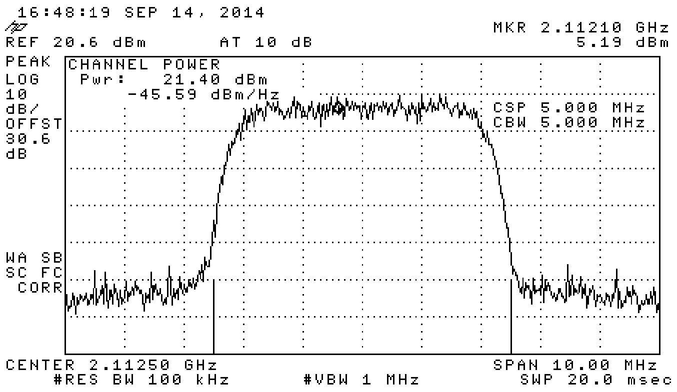

Figure 104.— W-CDMA (2112.5 MHz) , Port 2

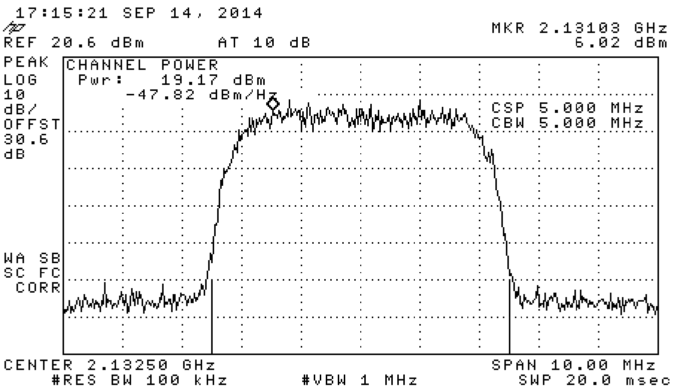

Figure 105.— W-CDMA (2132.5 MHz) , Port 1

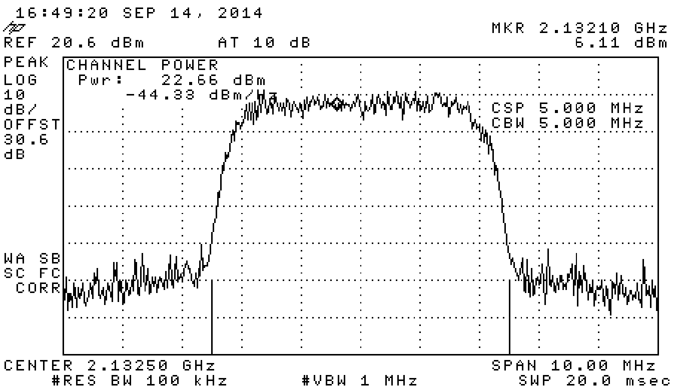

Figure 106.— W-CDMA (2132.5 MHz) , Port 2

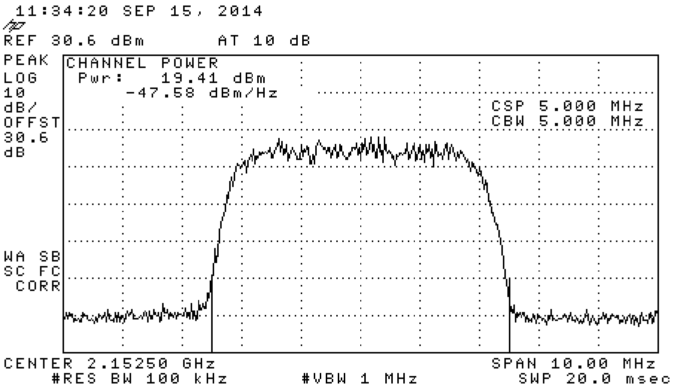

Figure 107.— W-CDMA (2152.5 MHz) , Port 1

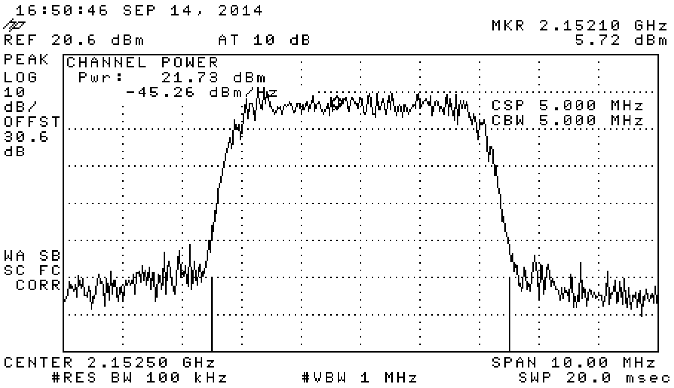

Figure 108.— W-CDMA (2152.5 MHz) , Port 2

9.4 Test Equipment Used; RF Power Output AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8594E	3313U000346	March 6, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 109 Test Equipment Used

10. Occupied Bandwidth AWS

10.1 Test Specification

FCC Part 2, Section 1049

10.2 Test Procedure

The E.U.T. was set to the applicable test frequency and 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 proper 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.
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

10.3 Results

Modulation		Operating Frequency (MHz)	Reading Port 1 (MHz)	Reading Port 2 (MHz)
LTE 64QAM	Input	2115.0	9.6	9.6
	Output	2115.0	9.65	9.55
	Input	2132.5	9.65	9.65
	Output	2132.5	9.60	9.70
	Input	2150.0	9.65	9.65
	Output	2150.0	9.60	9.60
GSM	Input	2111.2	0.28	0.28
	Output	2111.2	0.28	0.27
	Input	2132.5	0.28	0.28
	Output	2132.5	0.28	0.28
	Input	2153.8	0.28	0.28
	Output	2153.8	0.27	0.27
WCDMA	Input	2112.5	4.58	4.58
	Output	2112.5	4.60	4.58
	Input	2132.5	4.55	4.55
	Output	2132.5	4.55	4.58
	Input	2152.5	4.58	4.58
	Output	2152.5	4.58	4.55

Figure 110 Occupied Bandwidth AWS

See additional information in Figure 111to Figure 137.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: ______ _ Date: 4.12.14

Typed/Printed Name: M. Zohar

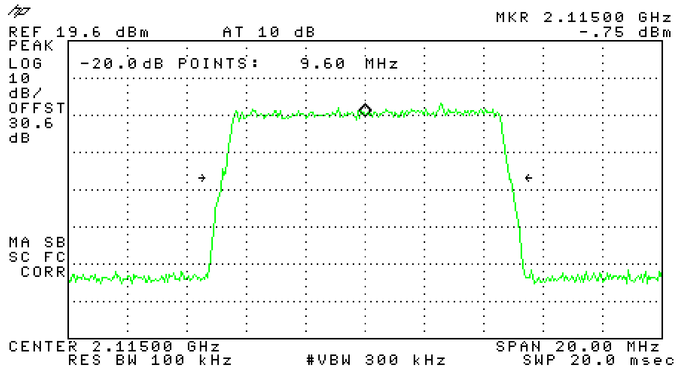

Figure 111.— LTE 64QAM(2115.0 MHz) IN

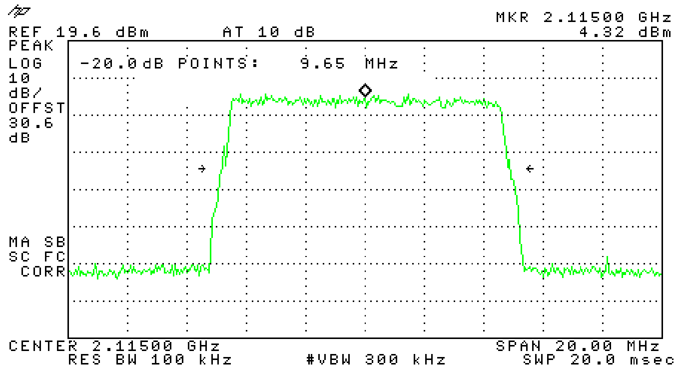

Figure 112.— LTE 64QAM (2115.0 MHz) OUT, Port 1

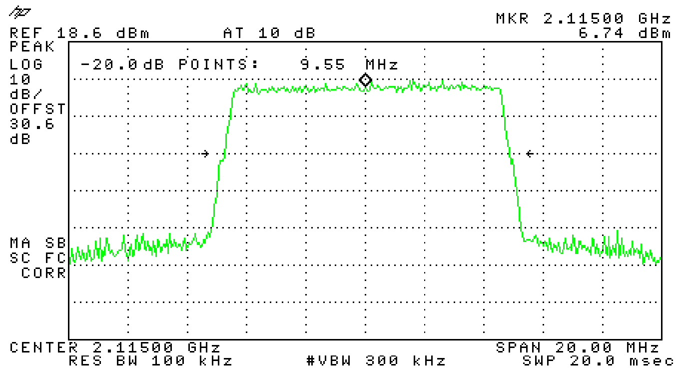

Figure 113.— LTE 64QAM (2115.0 MHz) OUT, Port 2

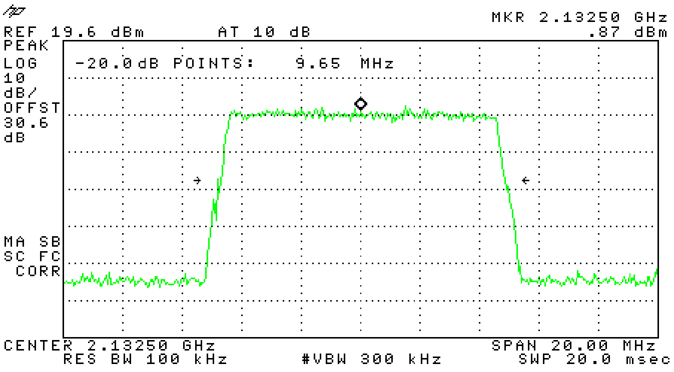

Figure 114.— LTE 64QAM (2132.5 MHz) IN

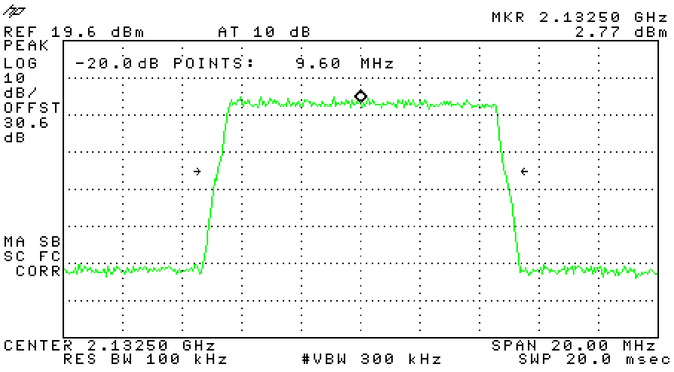

Figure 115.— LTE 64QAM (2132.5 MHz) OUT, Port 1

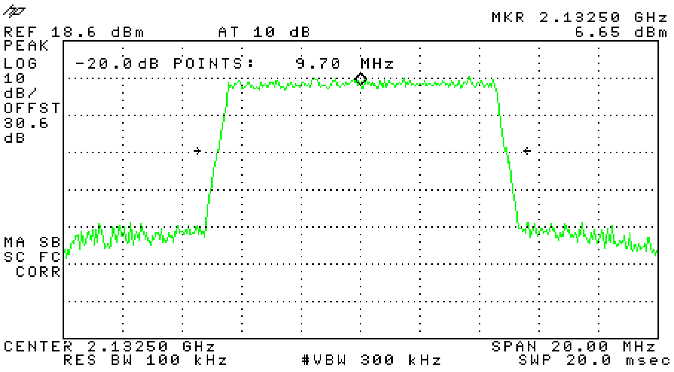

Figure 116.— LTE 64QAM (2132.5 MHz) OUT, Port 2

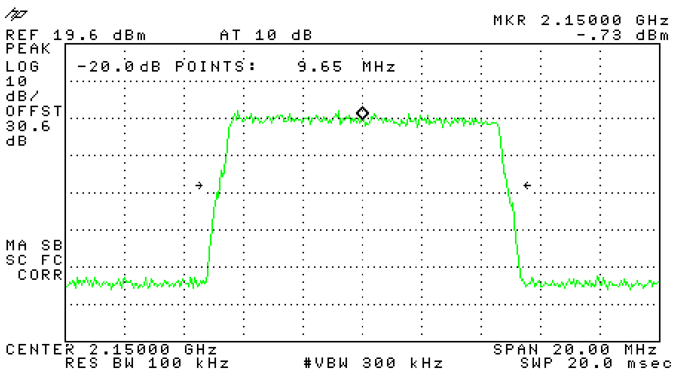

Figure 117.— LTE 64QAM (2150.0 MHz) IN

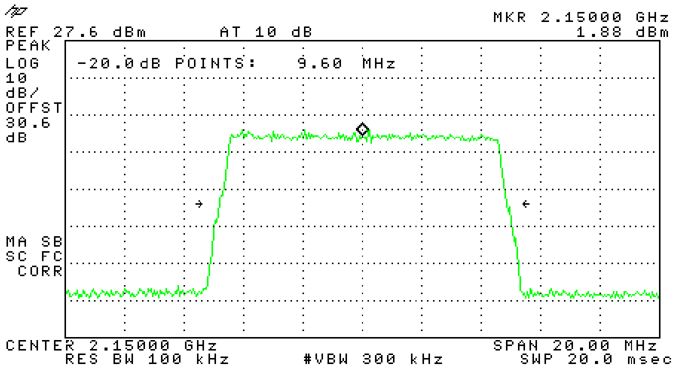

Figure 118.— LTE 64QAM (2150.0 MHz) OUT, Port 1

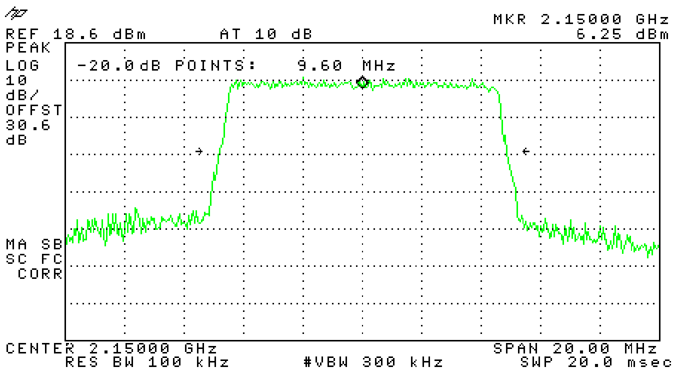

Figure 119.— LTE 64QAM (2150.0 MHz) OUT, Port 2

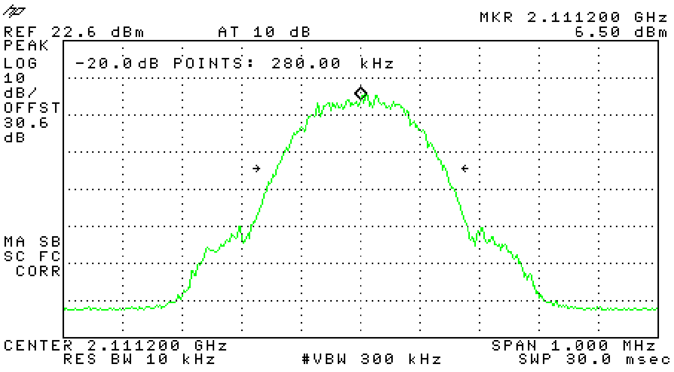

Figure 120.— GSM (2111.2 MHz) IN

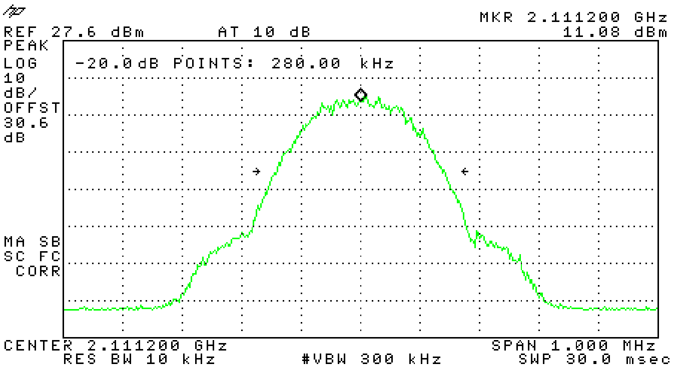

Figure 121.— GSM (2111.2 MHz) OUT, Port 1

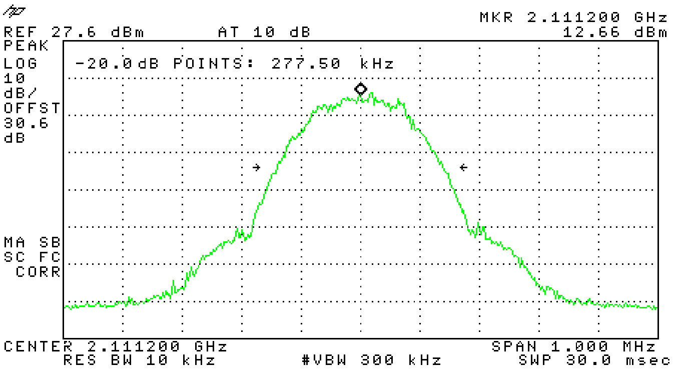

Figure 122.— GSM (2111.2 MHz) OUT, Port 2

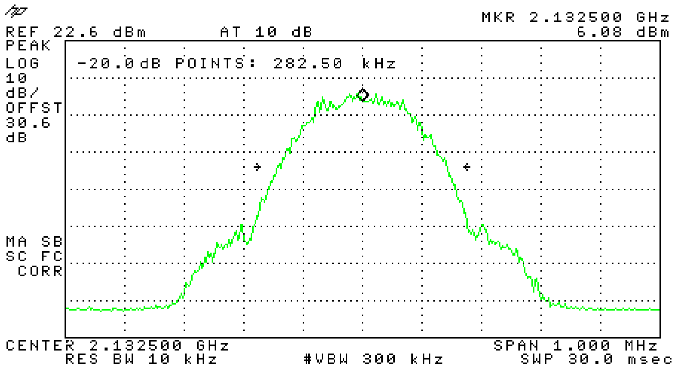

Figure 123.— GSM (2132.5 MHz) IN

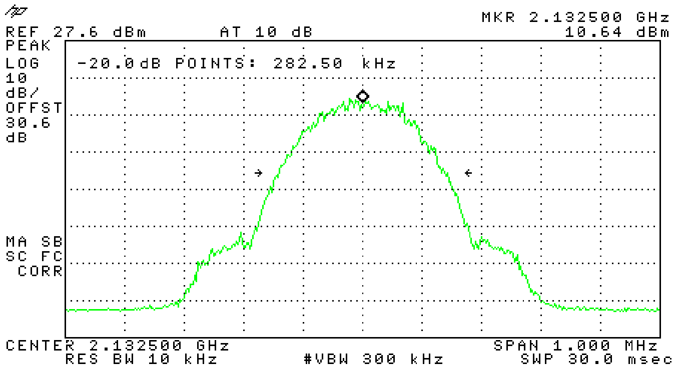

Figure 124.— GSM (2132.5 MHz) OUT, Port 1

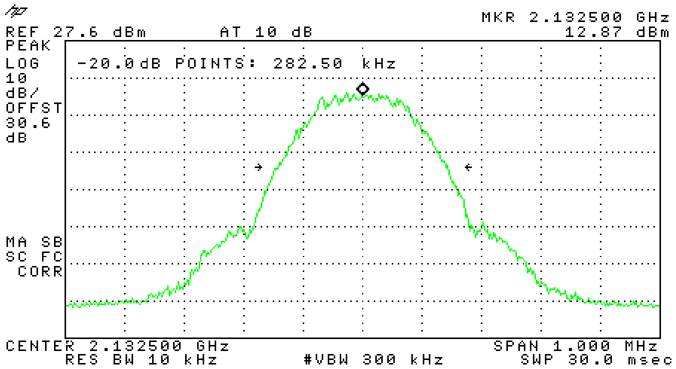

Figure 125.— GSM (2132.5 MHz) OUT, Port 2

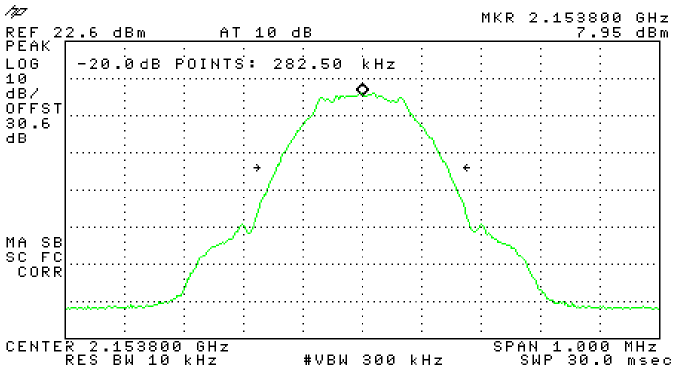

Figure 126.— GSM (2153.8 MHz) IN

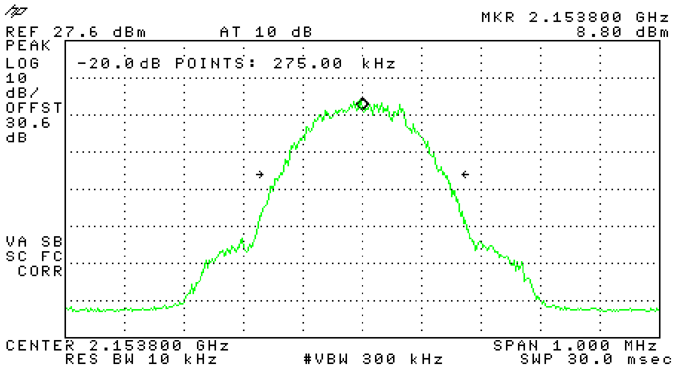

Figure 127.— GSM (2153.8 MHz) OUT, Port 1

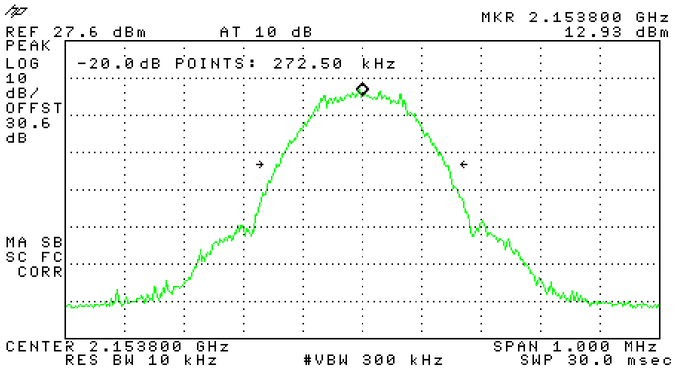

Figure 128.— GSM (2153.8 MHz) OUT, Port 2

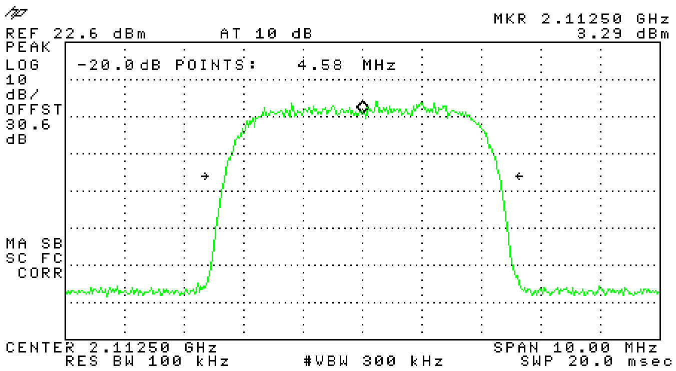

Figure 129.— W-CDMA (2112.5 MHz) IN

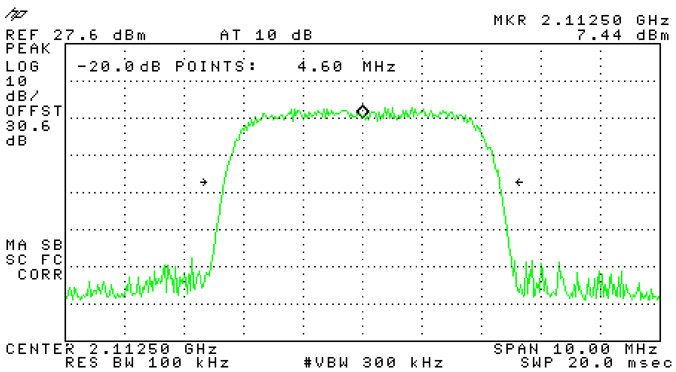

Figure 130.— W-CDMA (2112.5 MHz) OUT, Port 1

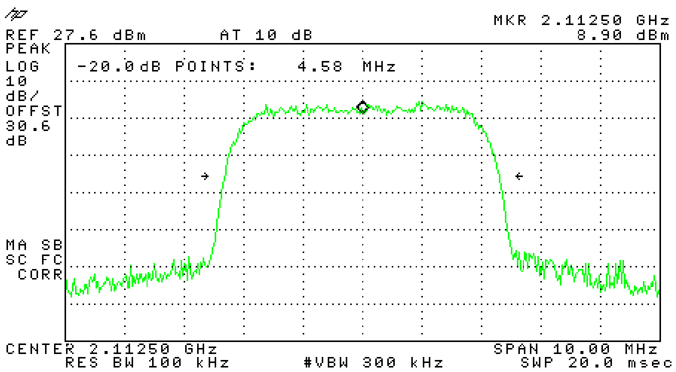

Figure 131.— W-CDMA (2112.5 MHz) OUT, Port 2

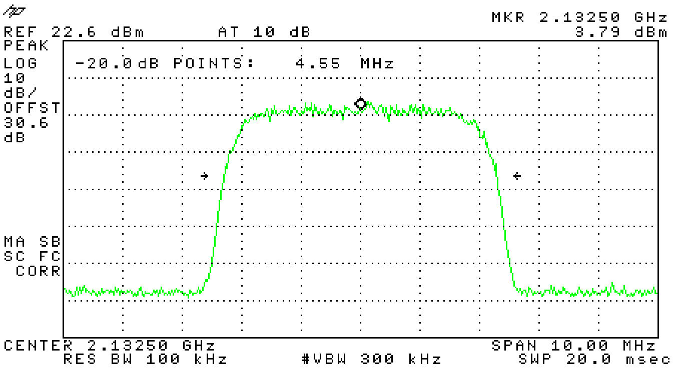

Figure 132.— W-CDMA (2132.5 MHz) IN

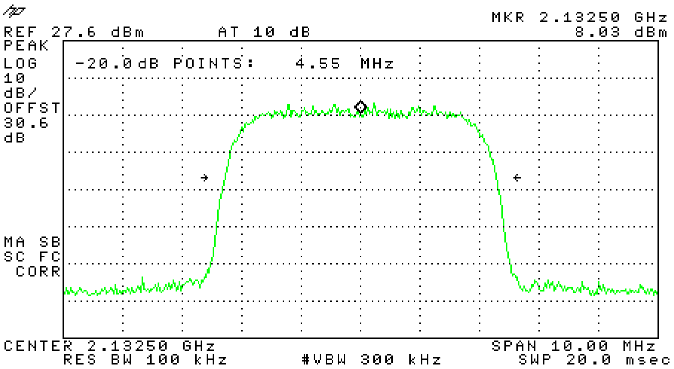

Figure 133.— W-CDMA (2132.5 MHz) OUT, Port 1

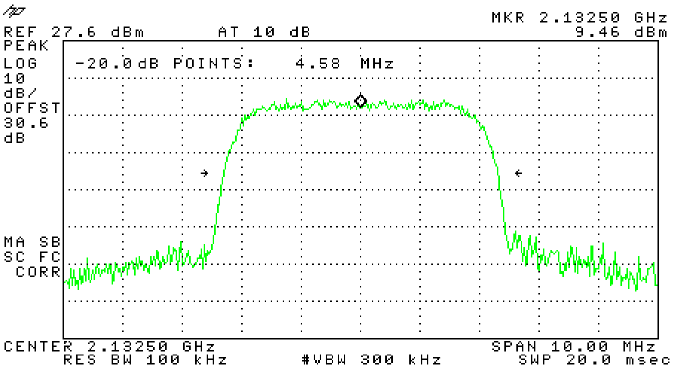

Figure 134.— W-CDMA (2132.5 MHz) OUT, Port 2

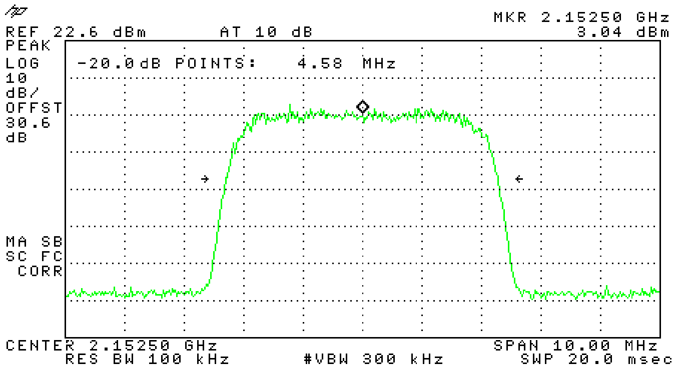

Figure 135.— W-CDMA (2152.5 MHz) IN

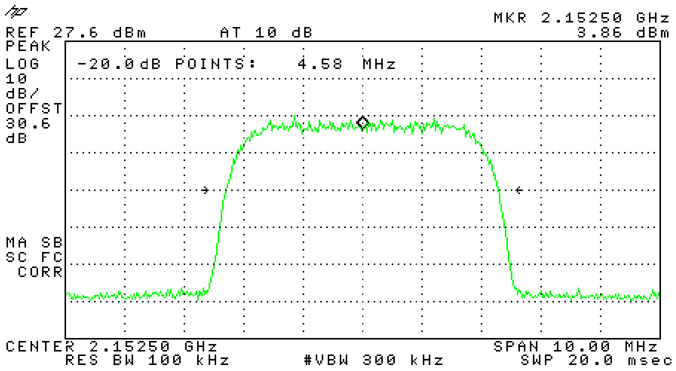

Figure 136.— W-CDMA (2152.5 MHz) OUT, Port 1

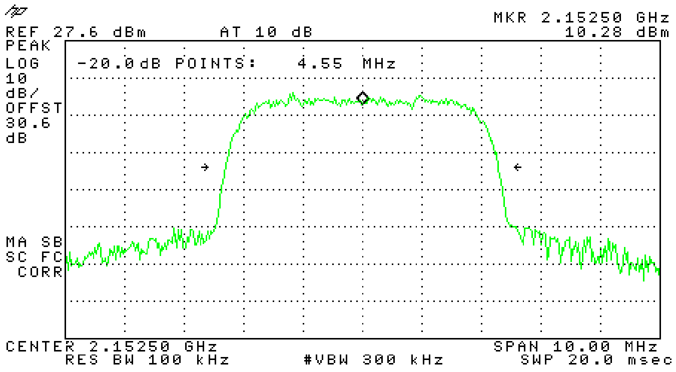

Figure 137.— W-CDMA (2152.5 MHz) OUT, Port 2

10.4 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 138 Test Equipment Used

11. Spurious Emissions at Antenna Terminals AWS

11.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (g)

11.2 Test procedure

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 (loss = 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 - 22.0 GHz.

11.3 Results

See additional information in *Figure 139* to *Figure 156*.

JUDGEMENT: Passed

TEST PERSONNEL:

Tester Signature: _____ _ Date: 4.12.14

Typed/Printed Name: M. Zonar

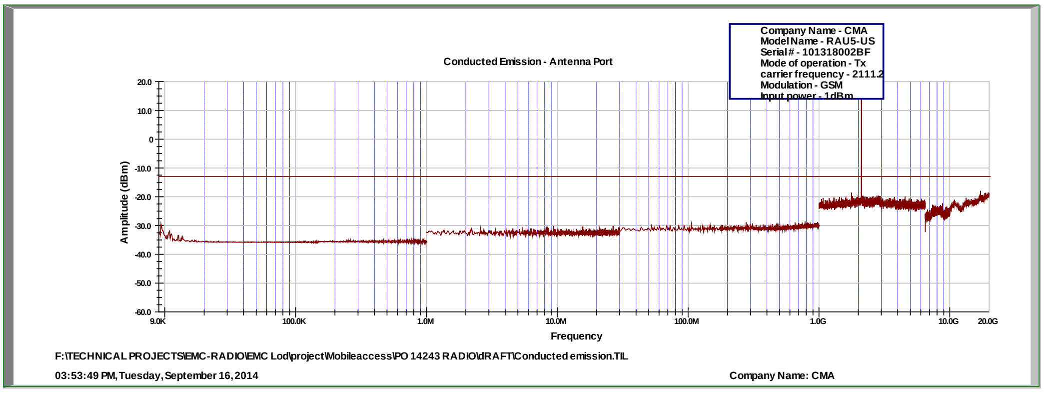

Figure 139 Spurious Emissions at Antenna Terminals GSM, 2111.2MHz, Port 1

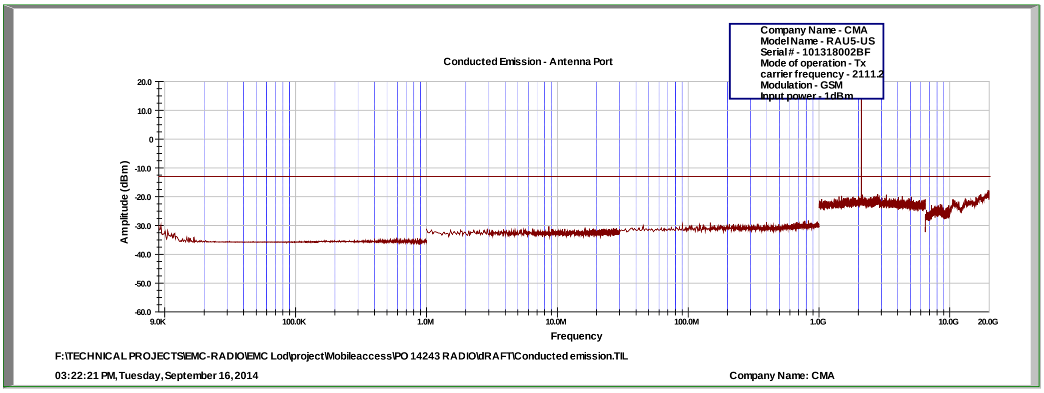

Figure 140 Spurious Emissions at Antenna Terminals GSM, 2111.2MHz, Port 2

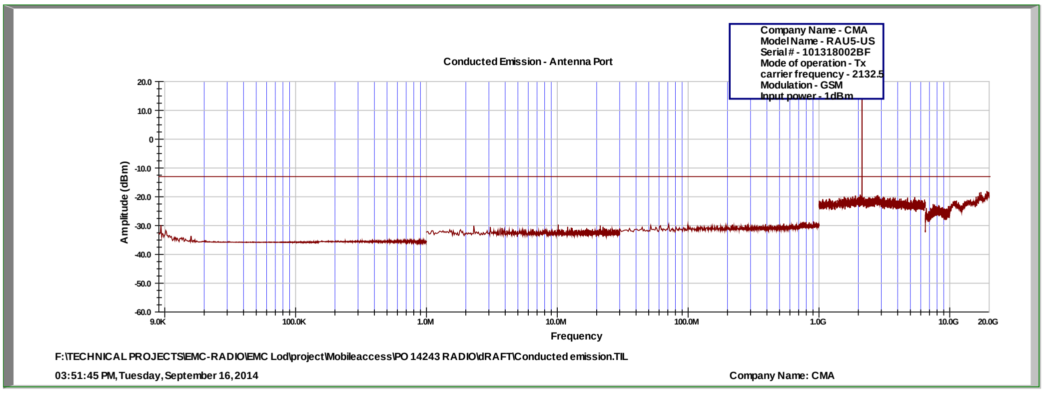

Figure 141 Spurious Emissions at Antenna Terminals GSM, 2132.5MHz, Port 1

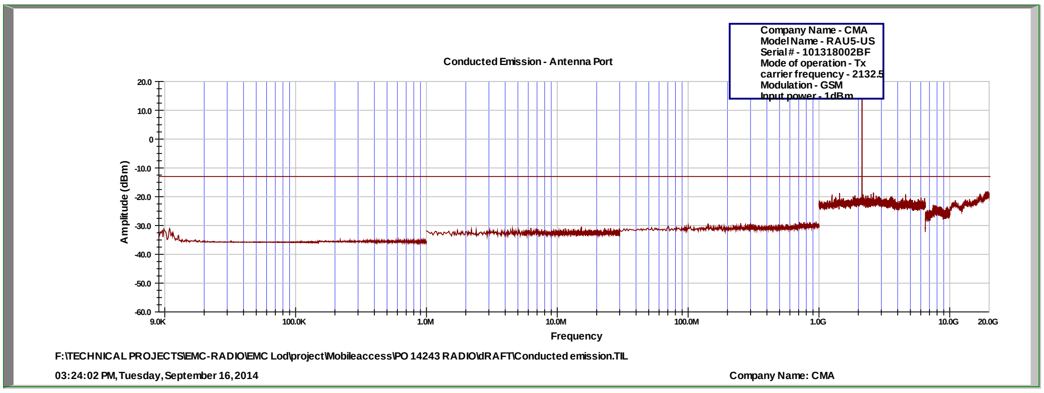

Figure 142 Spurious Emissions at Antenna Terminals GSM, 2132.5MHz, Port 2

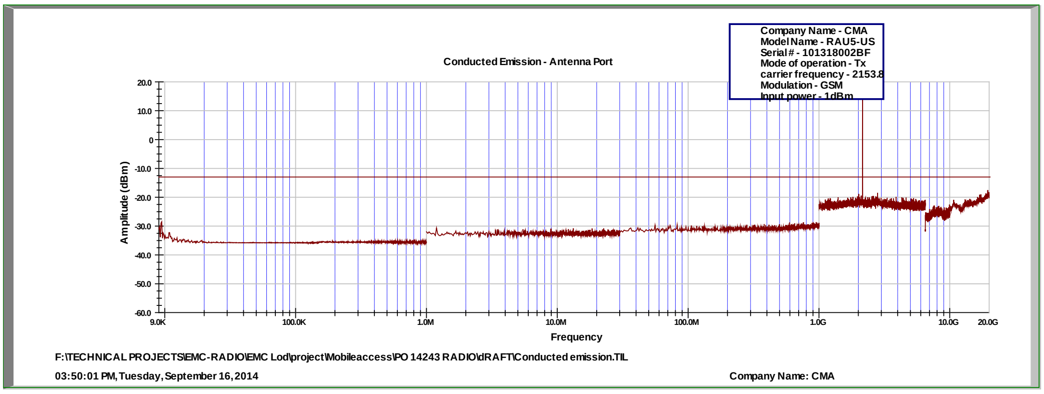

Figure 143 Spurious Emissions at Antenna Terminals GSM, 2153.8MHz, Port 1

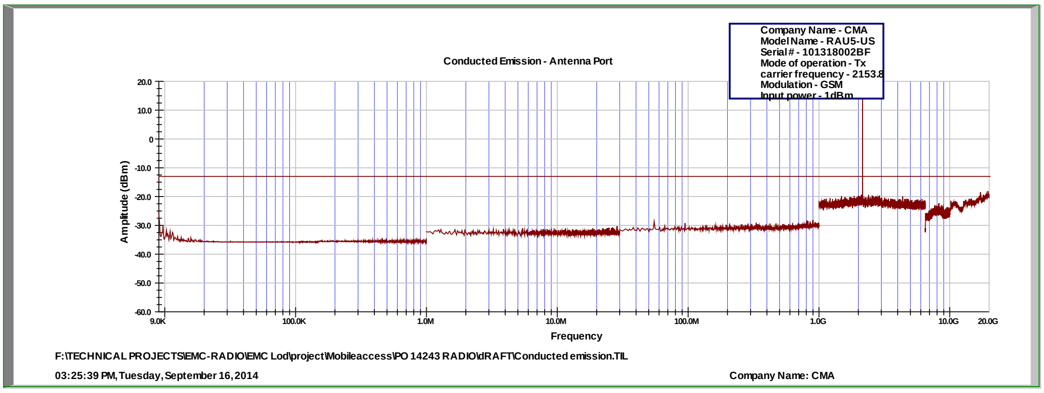

Figure 144 Spurious Emissions at Antenna Terminals GSM, 2153.8MHz, Port 2

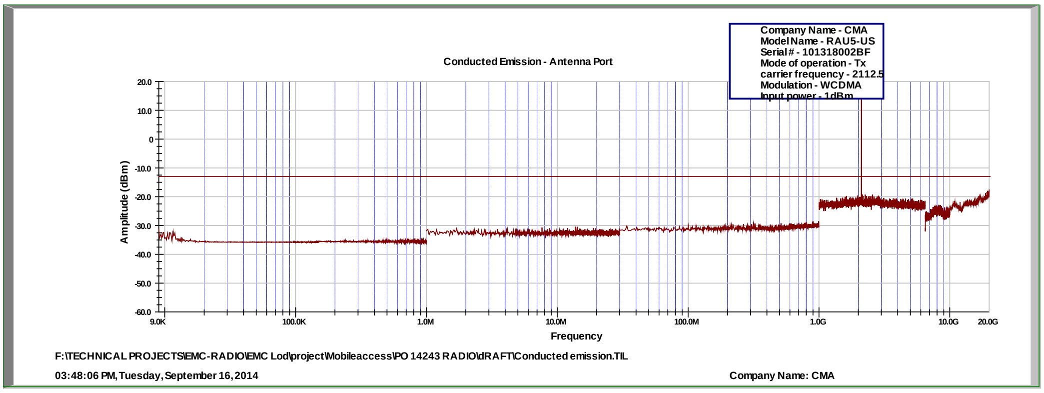

Figure 145 Spurious Emissions at Antenna Terminals WCDMA, 2112.5MHz, Port 1

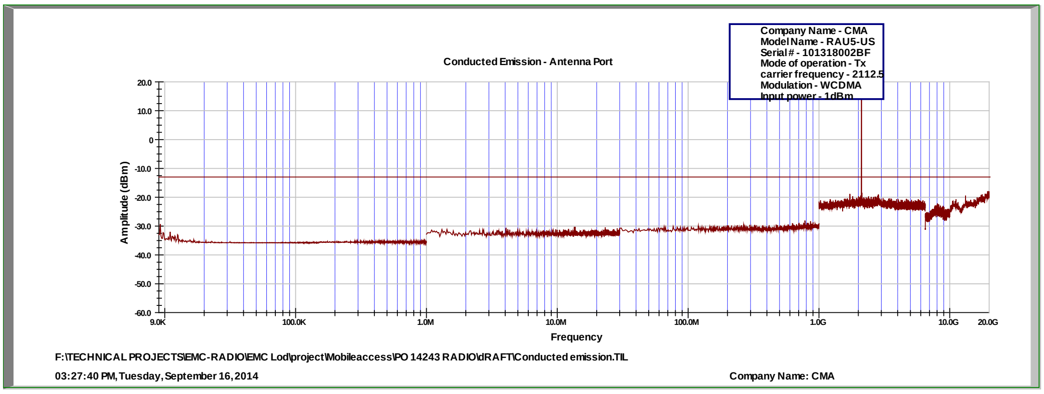

Figure 146 Spurious Emissions at Antenna Terminals WCDMA, 2112.5MHz, Port 2

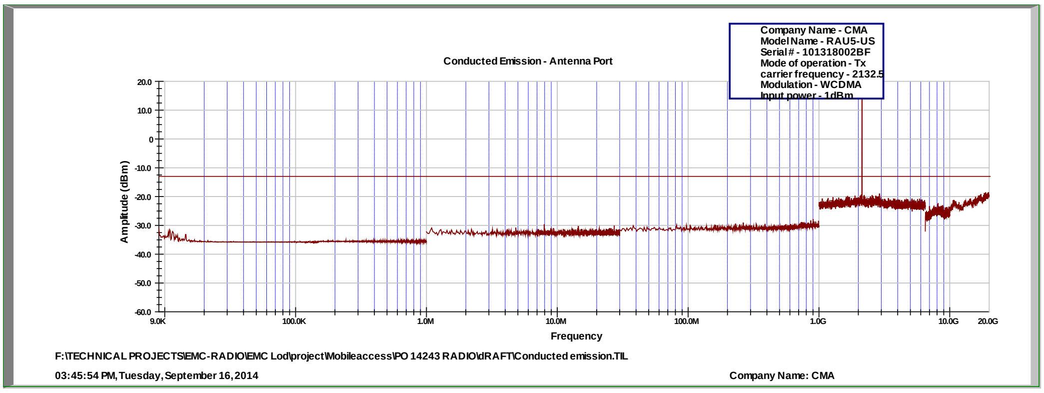

Figure 147 Spurious Emissions at Antenna Terminals WCDMA, 2132.5MHz, Port 1

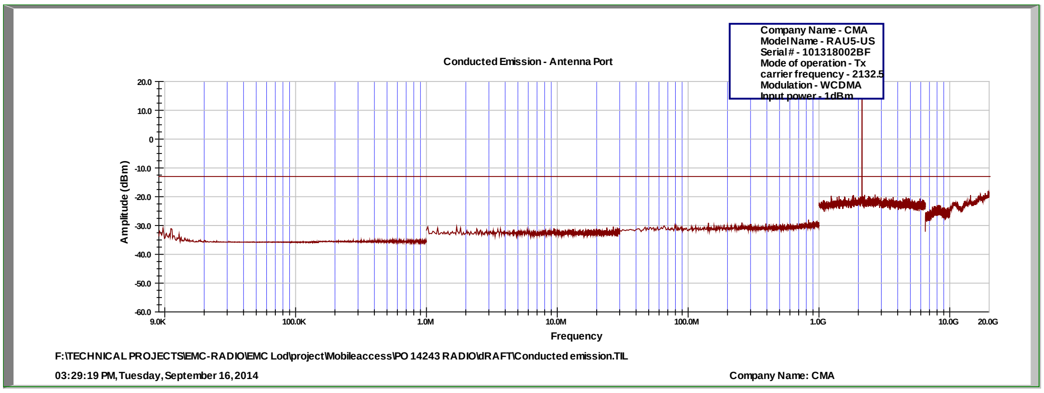

Figure 148 Spurious Emissions at Antenna Terminals WCDMA, 2132.5MHz, Port 2

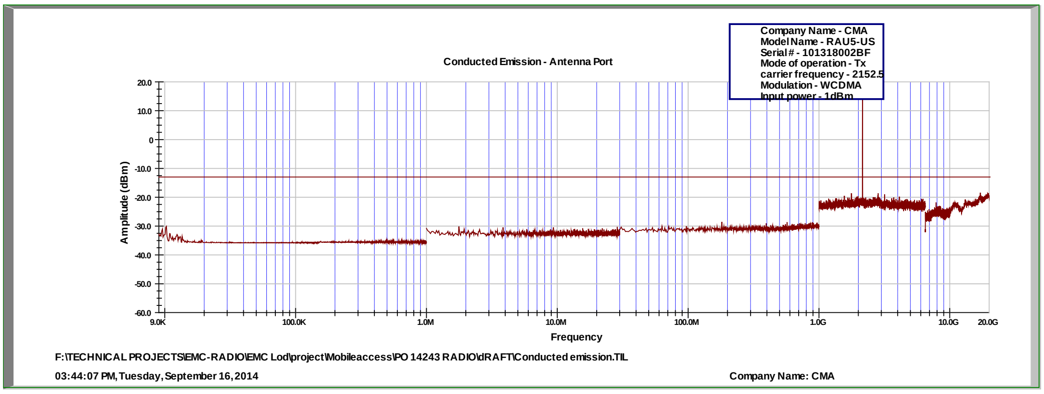

Figure 149 Spurious Emissions at Antenna Terminals WCDMA, 2152.5MHz, Port 1

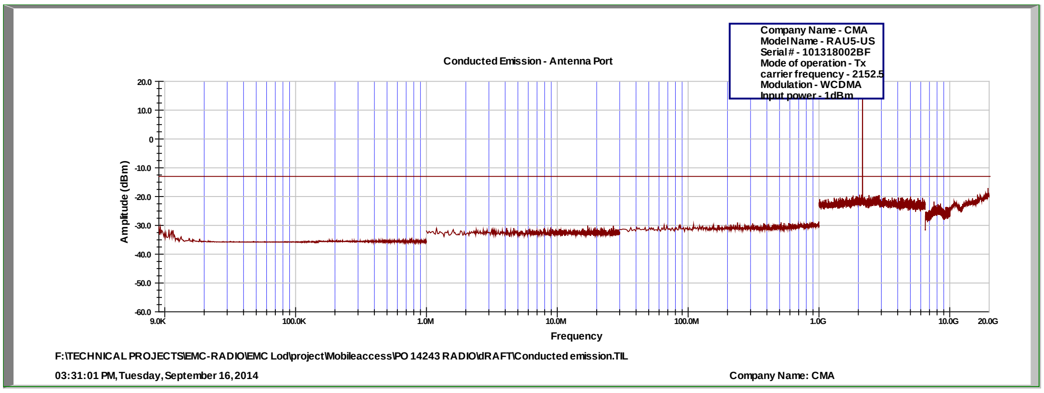

Figure 150 Spurious Emissions at Antenna Terminals WCDMA, 2152.5MHz, Port 2

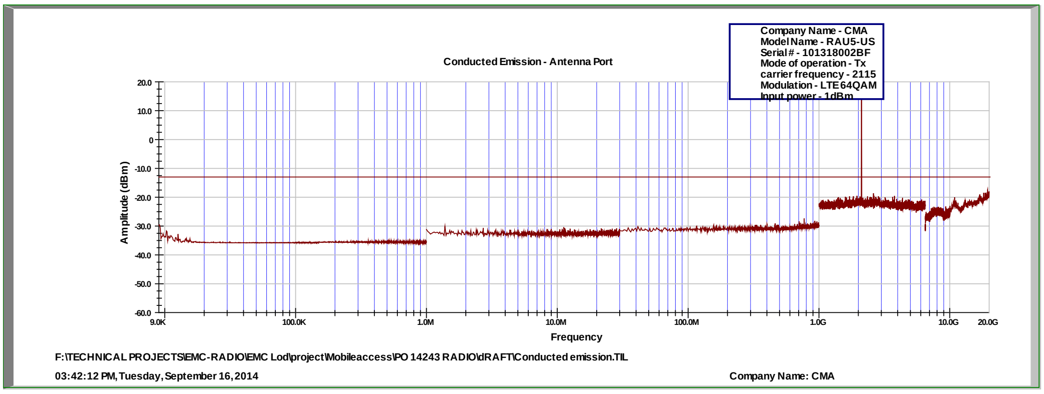

Figure 151 Spurious Emissions at Antenna Terminals LTE, 2115.0MHz, Port 1

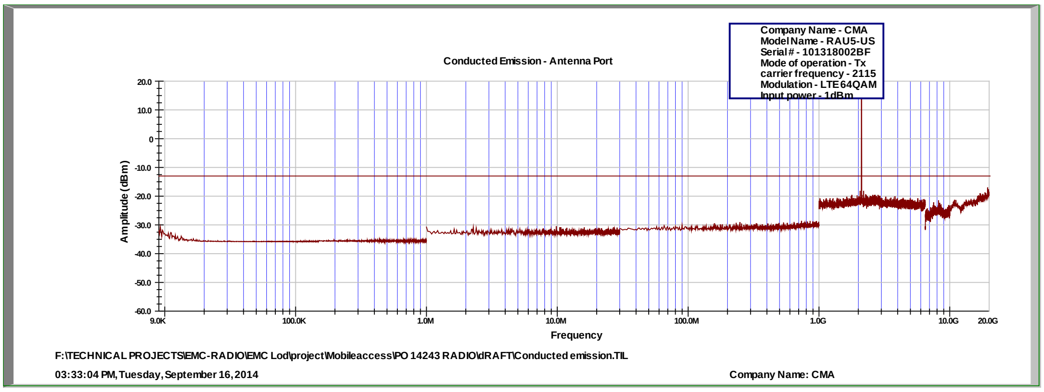

Figure 152 Spurious Emissions at Antenna Terminals LTE, 2115.0MHz, Port 2

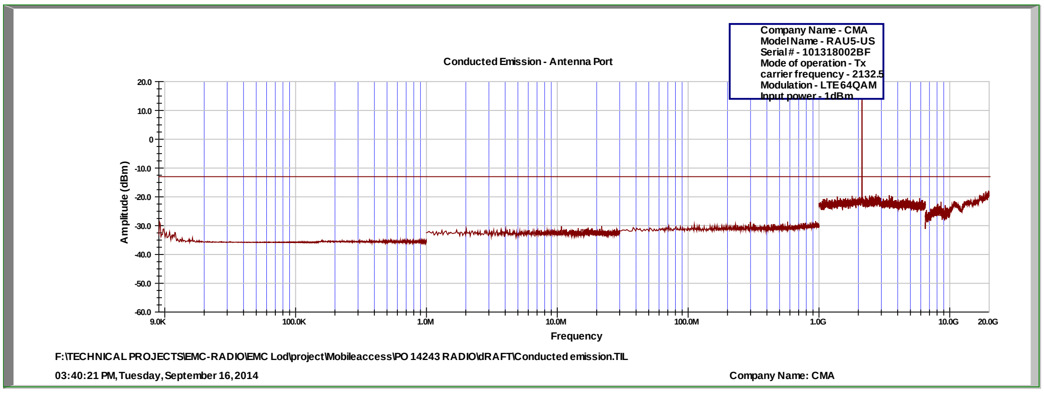

Figure 153 Spurious Emissions at Antenna Terminals LTE, 2132.5MHz, Port 1

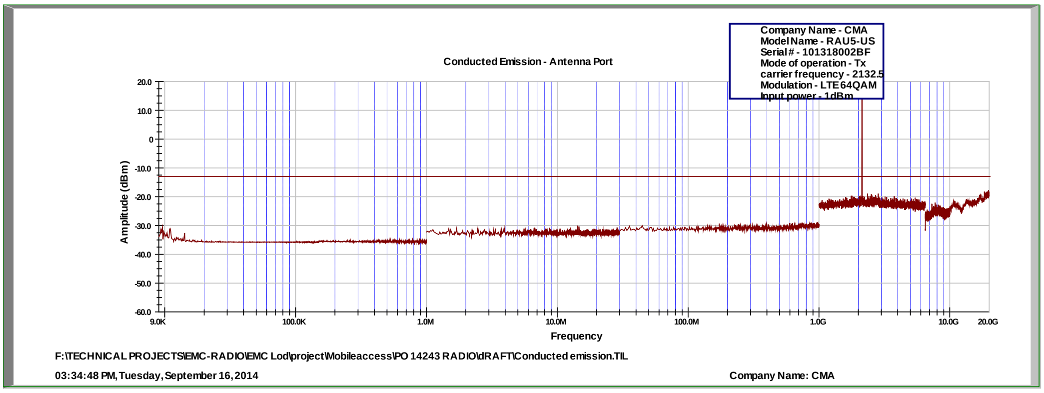

Figure 154 Spurious Emissions at Antenna Terminals LTE, 2132.5MHz, Port 2

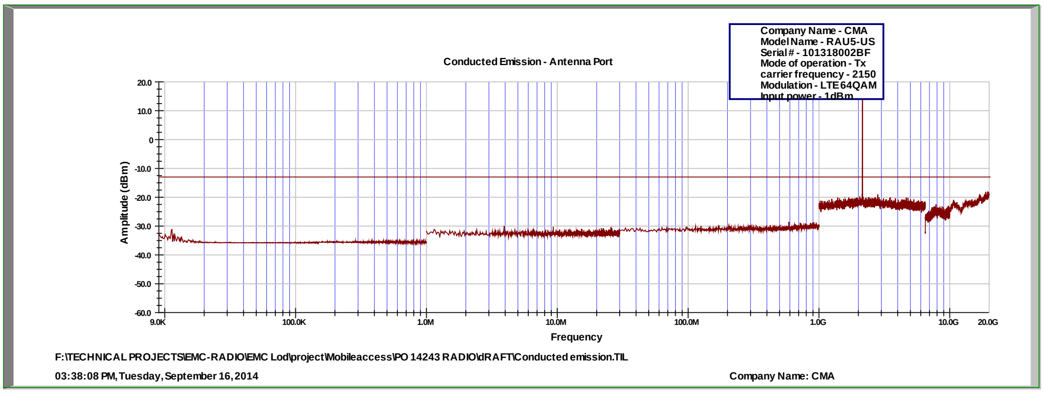

Figure 155 Spurious Emissions at Antenna Terminals LTE, 2150.0MHz, Port 1

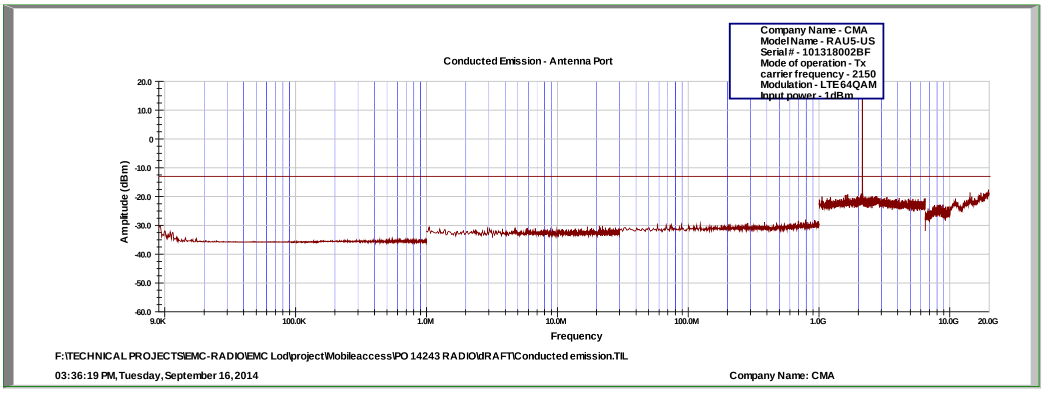

Figure 156 Spurious Emissions at Antenna Terminals LTE, 2150.0MHz, Port 2

11.4 Test Equipment Used; Spurious Emissions at Antenna Terminals AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8564E	3442A00275	March 2, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 157 Test Equipment Used

12. Band Edge Spectrum AWS

12.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (m 4-6)

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 (loss = 30.6 dB).

12.3 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading Port 1 (dBm)	Reading Port 2 (dBm)	Specification (dBm)	Port 1 Margin (dB)	Port 2 Margin (dB)
LTE 64QAM	2115.0	2110.00	-19.42	-18.30	-13.0	-6.42	-5.3
LTE 64QAM	2150.0	2155.00	-24.12	-19.60	-13.0	-11.12	-6.6
GSM	2111.2	2110.00	-41.57	-42.19	-13.0	-28.57	-29.19
GSM	2153.8	2155.00	-43.61	-40.99	-13.0	-30.61	-27.99
W-CDMA	2112.5	2110.00	-28.98	-28.68	-13.0	-15.98	-15.68
W-CDMA	2152.5	2155.00	-33.48	-22.85	-13.0	-20.48	-9.85

Figure 158 Band Edge Spectrum Results AWS

See additional information in *Figure 159* to *Figure 170.*

JUDGEMENT: Passed by 5.3 dB

TEST PERSONNEL:

Tester Signature: ____ __ Date: 4.12.14

Typed/Printed Name: M. Zohar

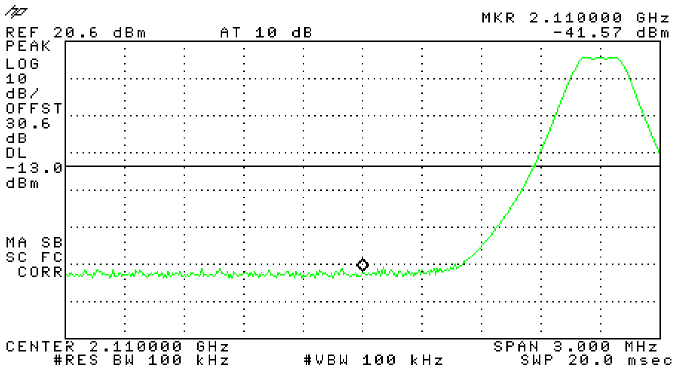

Figure 159.— GSM 2111.20 MHz, Port 1

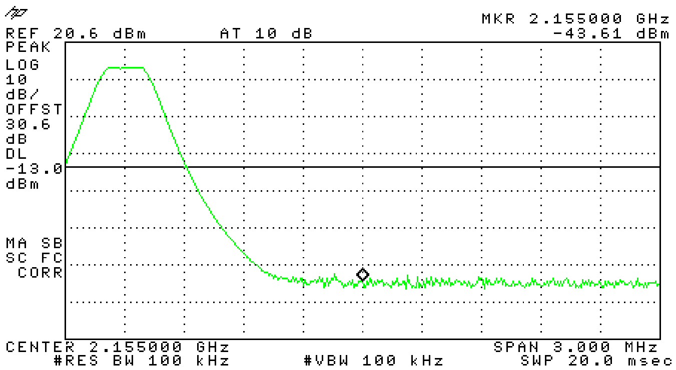

Figure 160.— GSM 2153.80 MHz, Port 1

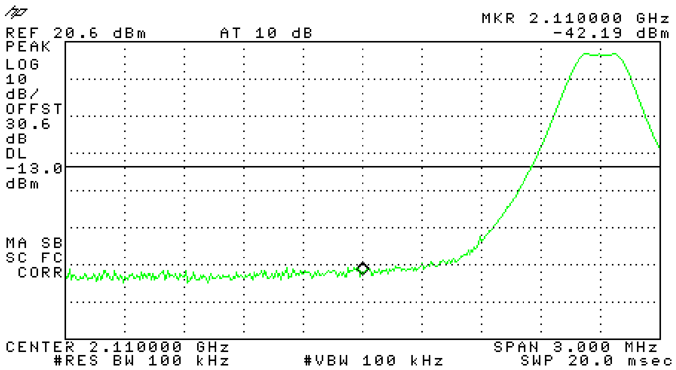

Figure 161.— GSM 2111.20 MHz, Port 2

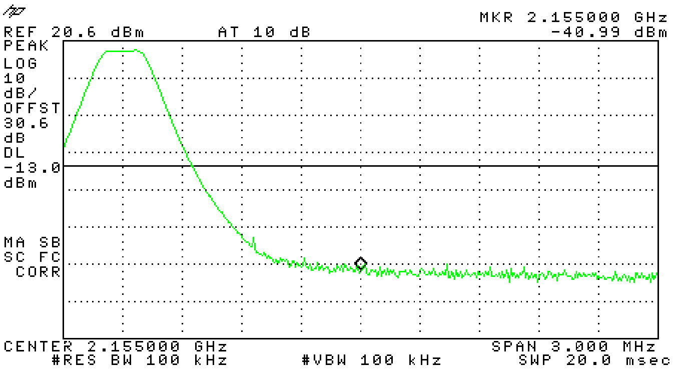

Figure 162.— GSM 2153.80 MHz, Port 2

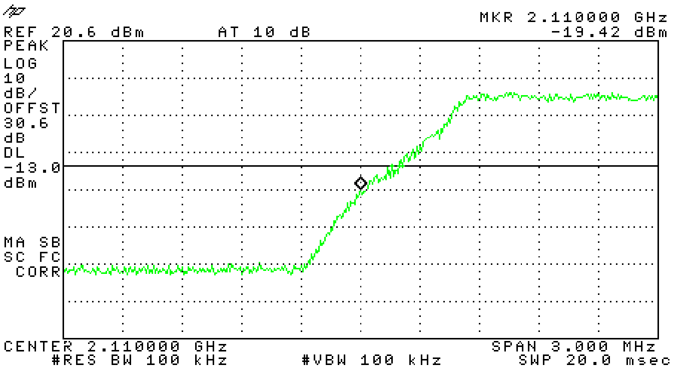

Figure 163.— LTE 64QAM 2115.00 MHz, Port 1

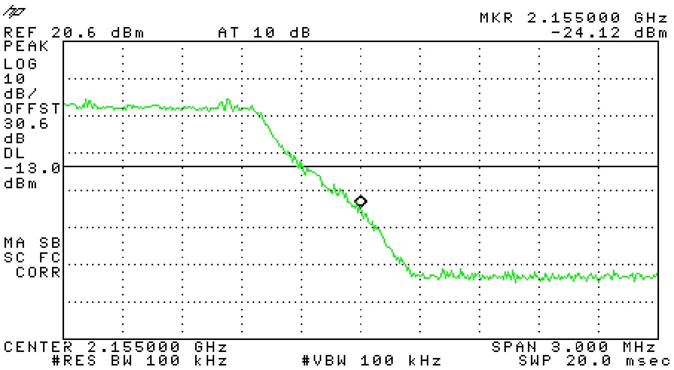

Figure 164.— LTE 64QAM 2150.00 MHz, Port 1

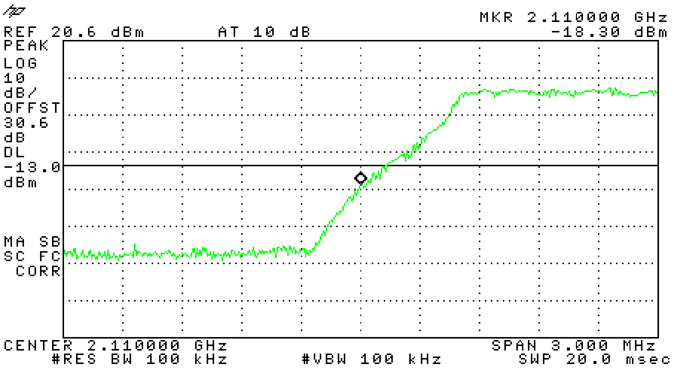

Figure 165.— LTE 64QAM 2115.00 MHz, Port 2

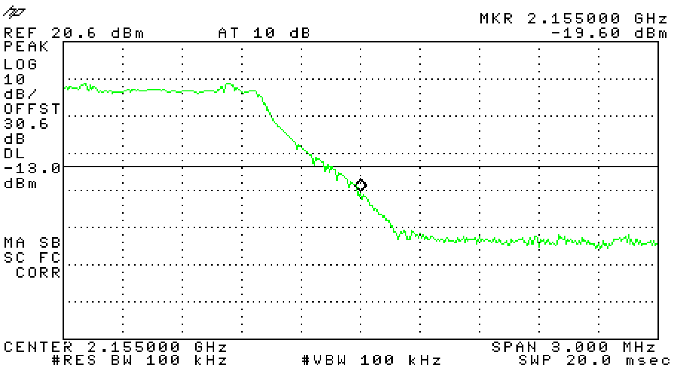

Figure 166.— LTE 64QAM 2150.00 MHz, Port 2

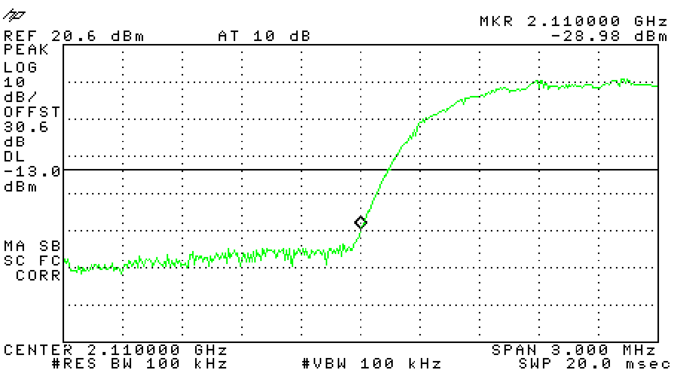

Figure 167.— W-CDMA 2112.50 MHz, Port 1

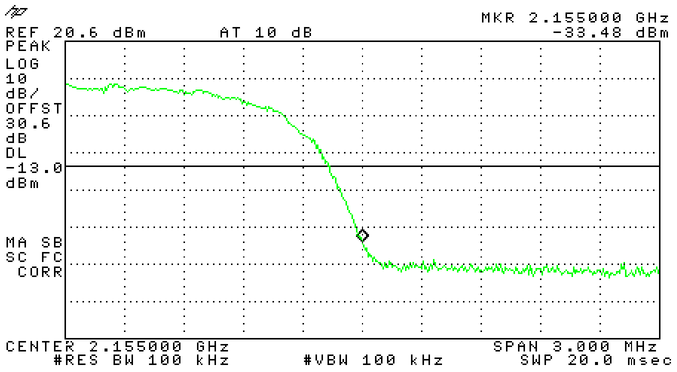

Figure 168.— W-CDMA 2152.50 MHz, Port 1

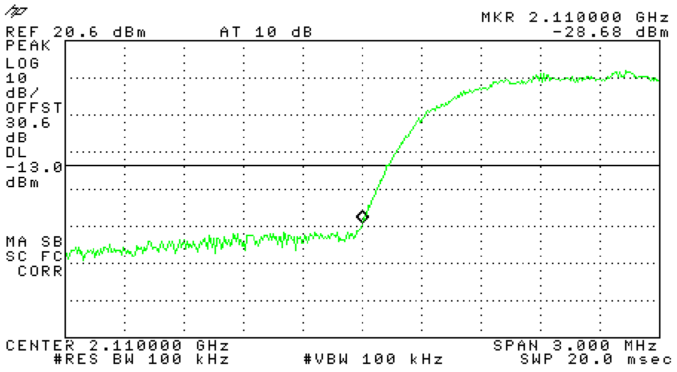

Figure 169.— W-CDMA 2112.50 MHz, Port 2

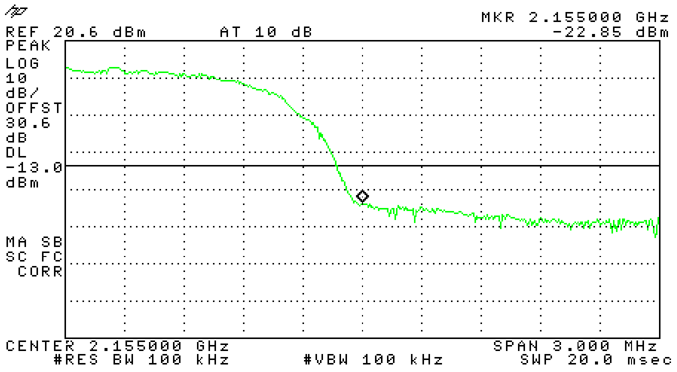

Figure 170.— W-CDMA 2152.50 MHz, Port 2

12.4 Test Equipment Used; Band Edge Spectrum AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8594L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 171 Test Equipment Used

13. Spurious Radiated Emission AWS

13.1 Test Specification

FCC, Part 27, Subpart C Section 27.53 (g)

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 (2110-2155 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

(a) The E.U.T. operation mode and test set-up are as described in Section 2.
A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 1.
The frequency range 9 kHz-20 GHz was scanned, and the list of the highest emissions was verified and updated accordingly.
The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

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

13.3 Test Results

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)
2111.20	4222.4	V	72.4	-24.0	11.2	9.5	-25.6	-13.0	-12.6
2111.20	4222.4	H	70.4	-26.4	11.2	8.6	-29.0	-13.0	-16.0
2135.00	4270.0	V	72.5	-24.1	11.2	9.5	-25.5	-13.0	-12.5
2135.00	4270.0	H	68.6	-28.0	11.2	8.6	-30.6	-13.0	-27.6
2153.80	4307.6	V	71.9	-23.9	11.2	9.5	-25.6	-13.0	-12.6
2153.80	4307.6	H	68.5	-28.0	11.2	8.6	-30.6	-13.0	-17.6

Figure 172 Spurious Radiated Emission AWS

JUDGEMENT: Passed by 12.5 dB

The E.U.T met the requirements of the FCC, Part 27, Subpart C, Section 27.53 (g) specifications.

TEST PERSONNEL:

Tester Signature: _____ Date: 4.12.14

Typed/Printed Name: M. Zohar

13.4 Test Instrumentation Used, Radiated Measurements AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 years
Horn Antenna	ETS	3115	29845	March 14, 2012	3 years
Horn Antenna	ARA	SWH-28	1007	March 30, 2014	3 years
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
EMI Receiver	R&S	FSL6	100194	December 1, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Antenna Mast	ETS	2070-2	-	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 173 Test Equipment Used

14. Intermodulation Conducted

14.1 *Test procedure*

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable(loss = 30.6dB). 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 - 22.0 GHz.

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

LTE 747 MHz CW 0 dBm

CELL 881 MHz CW 0 dBm

PCS 1960 MHz CW 0 dBm

AWS: 2135 MHz CW 0 dBm

The frequency range of 9 kHz – 22.0 GHz was scanned for unwanted signals.

14.2 *Test Results*

See additional information in Figure 174 to Figure 175.

JUDGEMENT:
TEST PERSONNEL:

Tester Signature: ___ __ Date: 4.12.14

Typed/Printed Name: M. Zohar

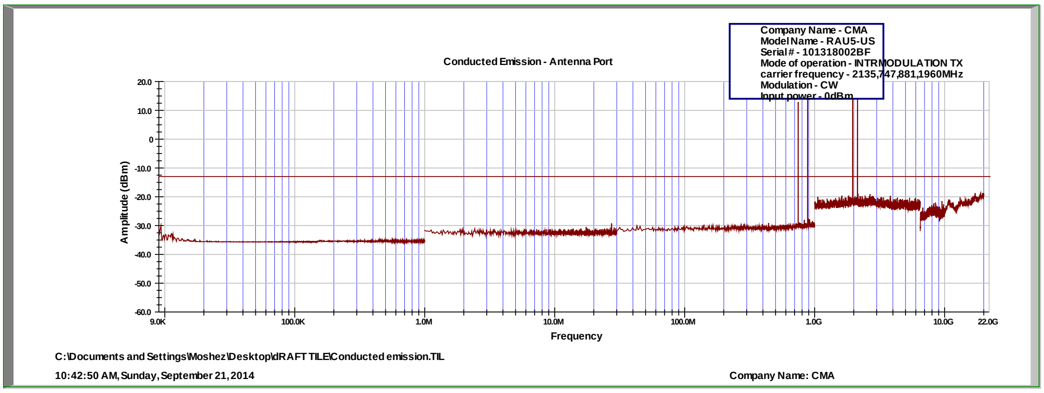

Figure 174 Intermodulation, Port 1

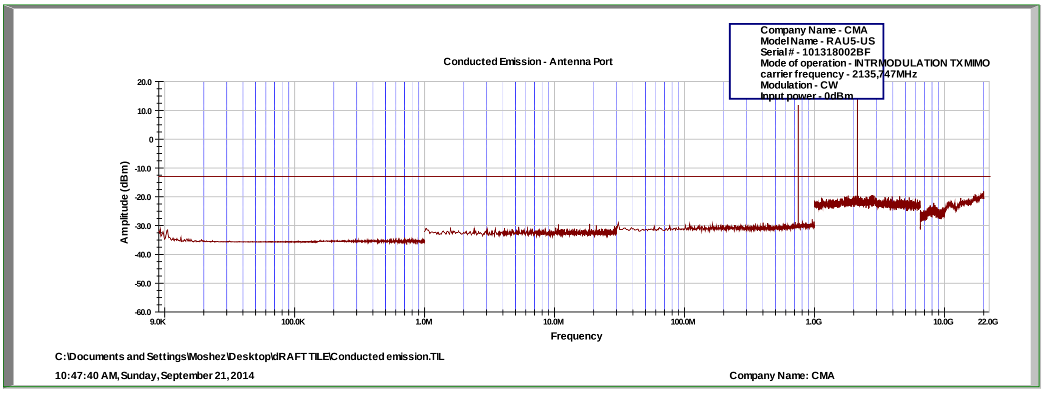

Figure 175 Intermodulation, Port 2

14.3 Test Equipment Used; Intermodulation Conducted

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	December 19, 2013	1 year

Figure 176 Test Equipment Used

15. Intermodulation Radiated

15.1 Test procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges (728-758; 869-894; 1930-1990; 2110-2155 MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

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

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

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

In the frequency range 7-22.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100 Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.

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

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

LTE 747 MHz 0 dBm
CELL 881 MHz 0 dBm
PCS 1960 MHz 0 dBm
AWS: 2135 MHz 0 dBm

15.2 Test Results

JUDGEMENT: Passed

TEST PERSONNEL

Tester Signature: ______ Date: 4.12.14

Typed/Printed Name: M. Zonar

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)
2*747+881	2375	V	63.2	-32.4	9	7.7	-33.8	-13.0	-20.8
2*747+881	2375	H	61.3	-34.1	9	8.5	-34.6	-13.0	-21.6
2*747-881	613	V	49.7	-45.6	4.2	1.6	-48.2	-13.0	-35.2
2*747-881	613	H	48.7	-47.3	4.2	1.6	-49.9	-13.0	-36.9
2*881-747	1015	V	56.2	-42.2	5.4	5.4	-42.2	-13.0	-29.2
2*881-747	1015	H	56.1	-42.6	5.4	5.8	-42.2	-13.0	-29.2
2*881+747	2509	V	63.6	-33.6	9.4	8.4	-34.6	-13.0	-21.6
2*881+747	2509	H	63.4	-35.7	9.4	9.7	-35.4	-13.0	-22.4
3*747-2*881	579	V	49.8	-45.5	4.2	1.6	-48.2	-13.0	-35.2
3*747-2*881	579	H	49.1	-47.3	4.2	1.6	-49.9	-13.0	-36.9
3*881-2*747	1149	V	55.8	-44.5	5.4	5.4	-44.5	-13.0	-31.5
3*881-2*747	1149	H	52.3	-45.7	5.4	5.8	-45.3	-13.0	-32.3
2*1960-2135	1785	V	59.3	-37.4	6.7	7.6	-36.5	-13.0	-23.5
2*1960-2135	1785	H	58.3	-38.2	6.7	8.0	-36.9	-13.0	-23.9
2*2135-1960	2310	V	64.8	-31.8	9.0	7.7	-33.3	-13.0	-20.3
2*2135-1960	2310	H	61.4	-33.0	9.0	8.5	-33.5	-13.0	-20.5
3*2135-2*1960	2485	V	65.6	-30.6	9.4	8.4	-31.6	-13.0	-18.6
3*2135-2*1960	2485	H	62.9	-35.7	9.4	9.7	-35.4	-13.0	-22.4
2*2135-3*1960	1610	V	60.9	-39.9	6.7	7.6	-40.0	-13.0	-27.0
2*2135-3*1960	1610	H	57.4	-41.7	6.7	8.0	-40.4	-13.0	-27.4

Figure 177 Intermodulation Radiated Results

15.3 Test Instrumentation Used; Radiated Measurements Intermodulation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	February 28, 2014	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2013	1 year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 years
Horn Antenna	ETS	3115	29845	March 14, 2012	3 years
Signal Generator	HP	8647A	3623U00686	March 6, 2014	1 year
Signal Generator	HP	83731B	US37100653	March 6, 2014	1 year
Signal Generator	Agilent	N5182A	MY50141213	May 15, 2014	3 years
Signal Generator	Agilent	N5172B	MY5130182	May 15, 2014	3 years
EMI Receiver	R&S	FSL6	100194	December 1, 2013	1 Year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	August 29, 2014	1 Year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	August 22, 2014	1 Year
Antenna Mast	ETS	2070-2	-	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 178 Test Equipment Used

16. APPENDIX A - CORRECTION FACTORS

16.1 Correction factors for CABLE

from EMI receiver
to test antenna
at 3 meter range.

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

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

NOTES:

1. The cable type is RG-214.

2. The overall length of the cable is 27 meters.

3. The above data is located in file 27MO3MO.CBL on the disk marked "Radiated Emission Tests EMI Receiver".

16.2 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		

16.3 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		

16.4 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

16.5 Correction factors forACTIVE 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