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DATE: 20 August 2015

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

FCC Radio Test Report

for

Corning Optical Communication Wireless

Equipment under test:

ONE - Optical Network Evolution Wireless Platform

MRU (Mid Power Remote Unit)

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

Tested by: _____

M. Zohar

Approved by: _____

D. Shidlowsky

Measurement/Technical Report for

Corning Optical Communication Wireless

ONE - Optical Network Evolution Wireless Platform

MRU (Mid Power Remote Unit)

(AWS Section)

FCC ID: OJF1MRU21

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
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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 Wireless Platform
Equipment Model No.:	MRU (Mid Power Remote Unit)
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	08.03.2015
Start of Test:	08.03.2015
End of Test:	22.03.2015
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

Modular 7 band Enabled Mid Power Neutral Host Solution –

Supported modular frequency bands

700, ESMR+CELL, PCS, AWS, WCS

Integrated 2.5 GHz expansion ready

Composite Output Power

700, ESMR & CELL: 30dBm

PCS, AWS WCS: 33dBm

Specifications

100% Modularity

NEBS Class 2 Compliant

Small Footprint – 6 Rack Units

Highlights:

Extended ONE platform design Diversity

100% modular component design

Composite output power: 2W

Small Compact Form Factor (6U)

Non-Service Impacting Upgrades

Lower initial deployment costs

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% Confidence, K=2):

± 3.44 dB

Radiated Emission (CISPR 11, EN 55011, CISPR 22, EN 55022, ANSI C63.4) for open site 30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):

± 4.98 dB

2. System Test Configuration

2.1 Justification

The test setup was configured to closely resemble the standard installation.
The EUT consists of the MRU (Mid-Power Remote Module) which is connected with the head-end ONE 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 RIM is 0 dBm and output power at the antenna port of MRU is 33dBm for high frequency bands and 30dBm for low frequency bands.
Testing was performed on the following configurations:

Frequency Range (MHz)		
Service/Band	**Downlink (DL)**	**Technology**
700 MHz	728-757	LTE
ESMR 800	862- 869	WCDMA, LTE, GSM
CELL 850	869-894	WCDMA, LTE, GSM
PCS + G 1900	1930-1995	WCDMA, LTE, GSM
AWS 2100	2110-2155	WCDMA, LTE, GSM
WCS	2350-2360	WCDMA, LTE, GSM

2.2 EUT Exercise Software

The Element Management System ver. 1.6 used for commands delivery. These commands are used to enable/disable the EUT transmission. EUT Embedded SW versions is mru_da64_16_02.bin.

2.3 Special Accessories

OIU and HEU.

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

Product Name	ONE Wireless Platform
Model Name	MRU (Mid Power Remote Unit)
Working voltage	115VAC/48VDC
Mode of operation	Repeater
Modulations	WCDMA, LTE(64QAM), GSM
Frequency Range	2110MHz-2155MHz
Transmit power	33 dBm
Antenna Gain	12.5 dBi
DATA rate	N/A
Modulation BW	0.5MHz(GSM),10MHz(LTE), 5MHz(WCDMA)
Temperature (°C)/ Humidity (%RH)	22°C/32%

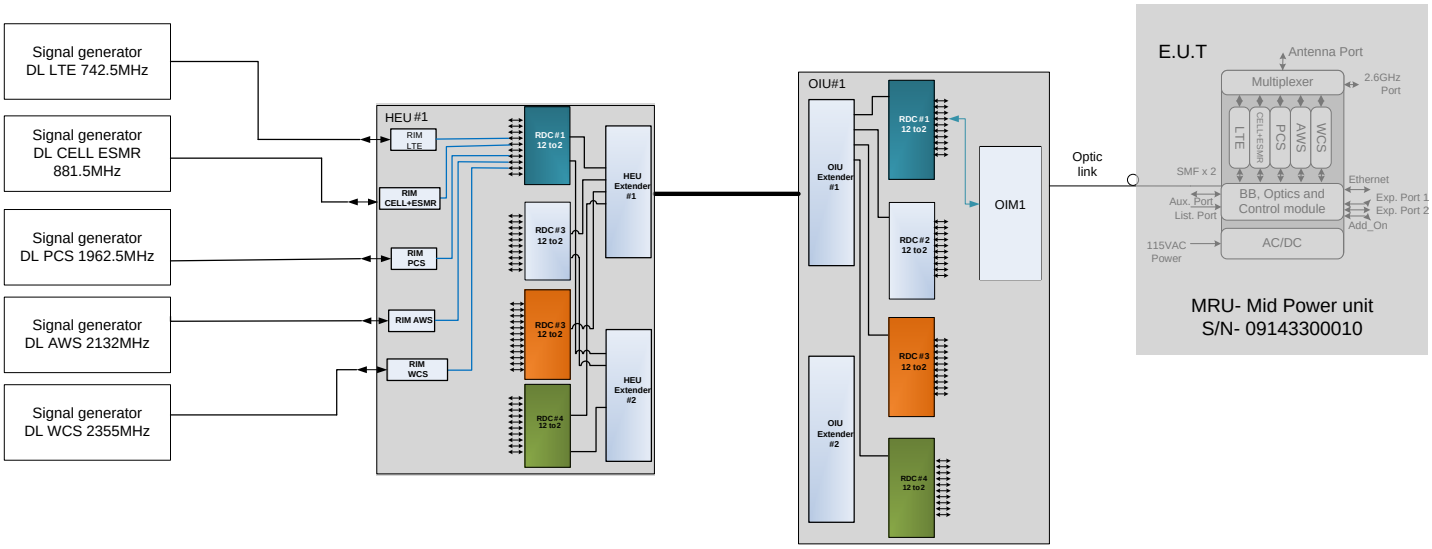

Figure 1. Test Set-up

3. Test Set-up Photos

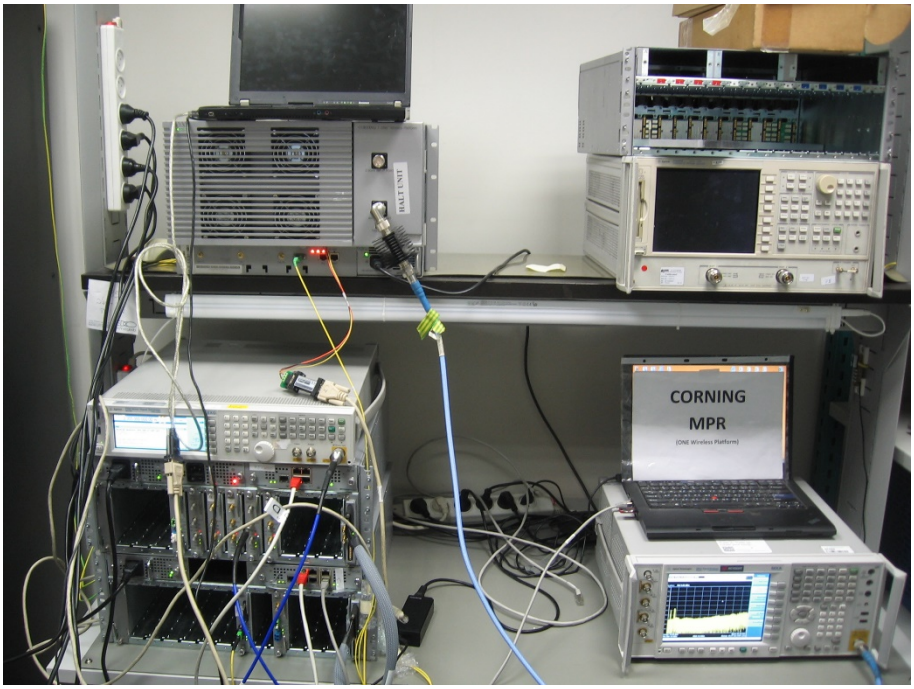

Figure 2. Conducted Emission From Antenna Port Tests

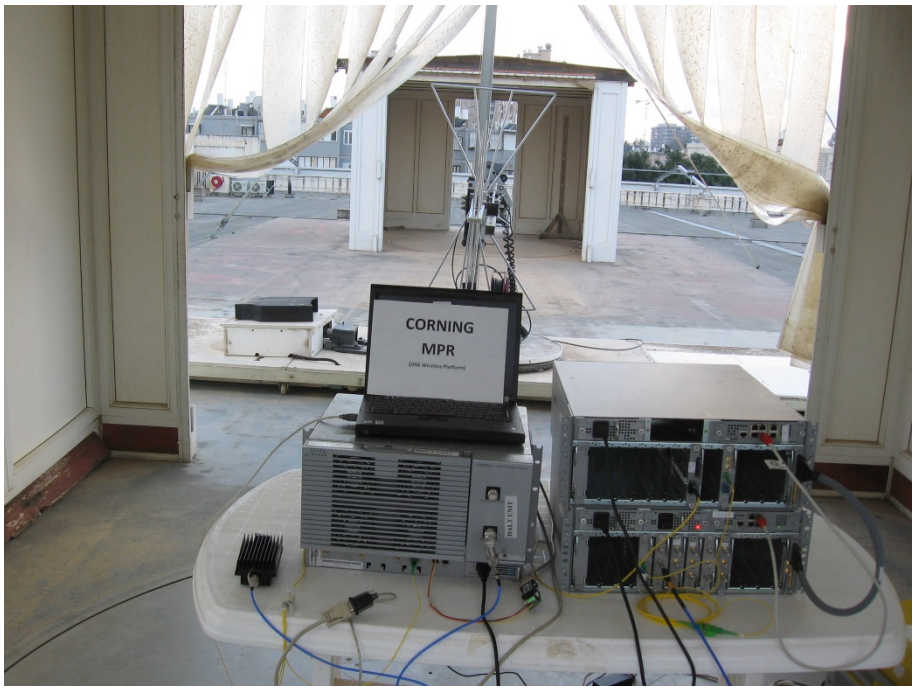

Figure 3. Radiated Emission Test

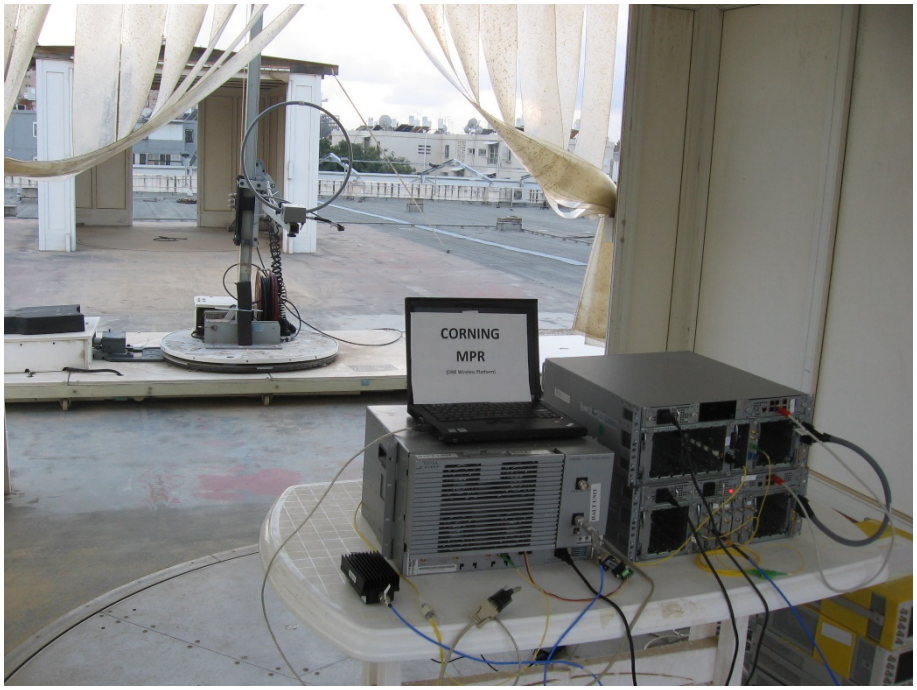

Figure 4. Radiated Emission Test

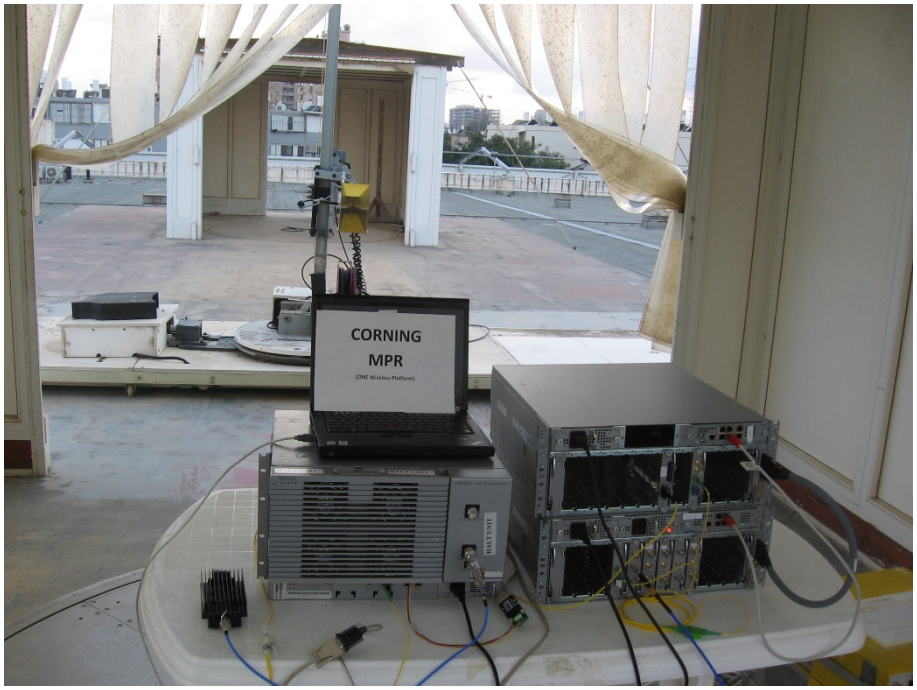

Figure 5. Radiated Emission Test

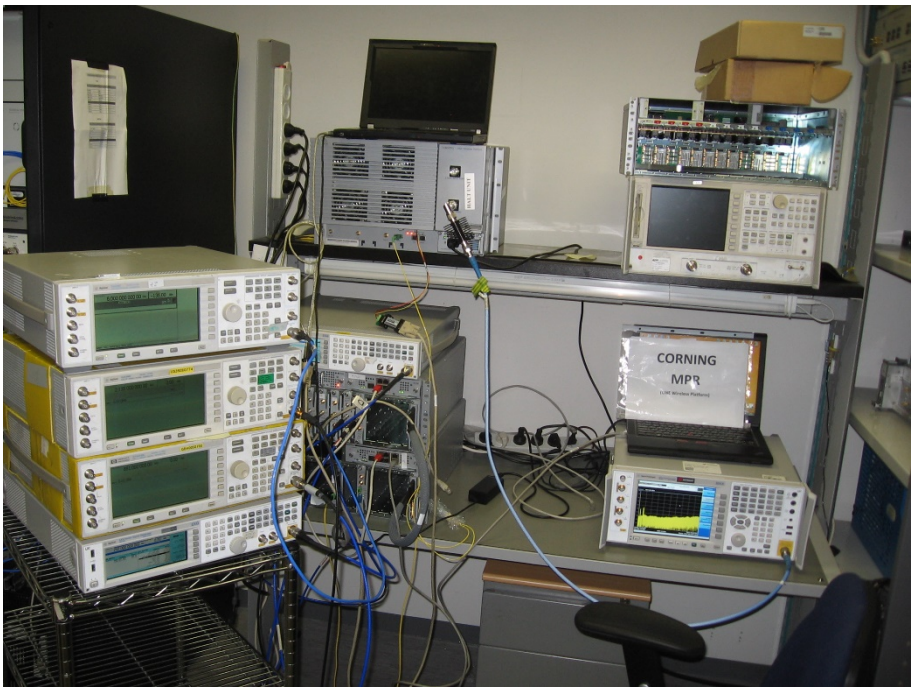

Figure 6. Intermodulation Conducted Emission Test

4. RF Power Output AWS

4.1 Test Specification

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

4.2 Test Procedure

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 power limit is 1640W (62.1 dBm).

4.3 Results

Modulation	Operation Frequency (MHz)	Reading (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Specification (dBm)	Margin (dB)
GSM	2111.2	37.6	12.5	50.1	62.1	-12.0
GSM	2132.5	36.0	12.5	48.5	62.1	-13.6
GSM	2153.8	34.5	12.5	47.0	62.1	-15.1
LTE 64QAM	2115.0	35.0	12.5	47.5	62.1	-14.6
LTE 64QAM	2132.5	33.8	12.5	46.3	62.1	-15.8
LTE 64QAM	2150.0	33.9	12.5	46.4	62.1	-15.7
WCDMA	2112.5	37.0	12.5	49.5	62.1	-12.6
WCDMA	2132.5	36.2	12.5	48.7	62.1	-13.4
WCDMA	2152.5	36.0	12.5	48.5	62.1	-13.6

Figure 7 RF Power Output AWS

See additional information in *Figure 7* to *Figure 15*.

JUDGEMENT: Passed

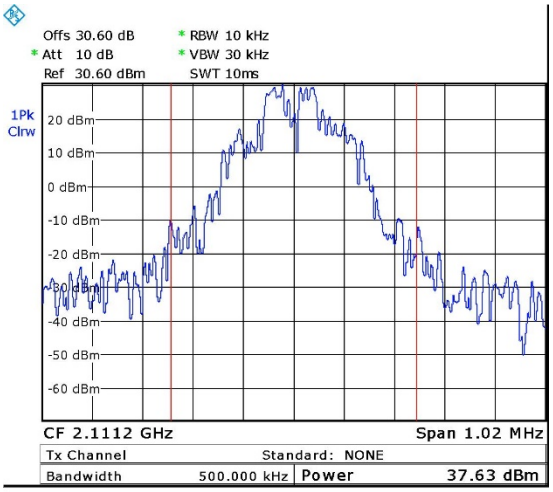

Figure 8. — GSM (2111.2 MHz)

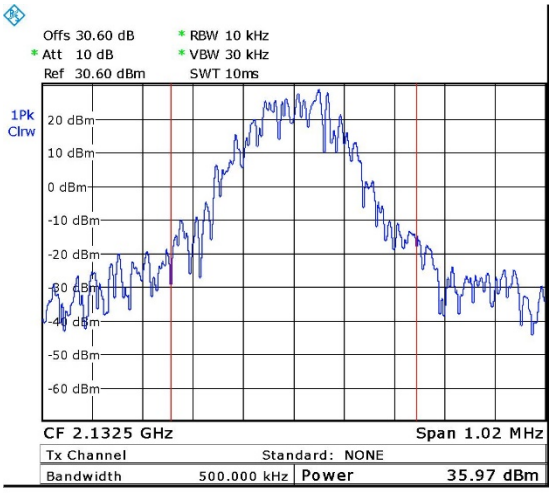

Figure 9. — GSM (2132.5 MHz)

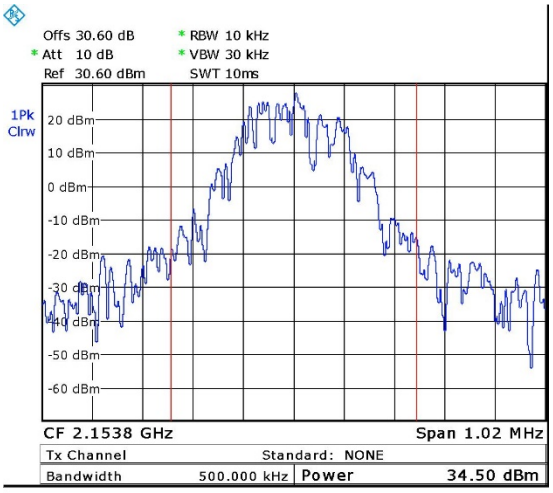

Figure 10. — GSM (2153.8 MHz)

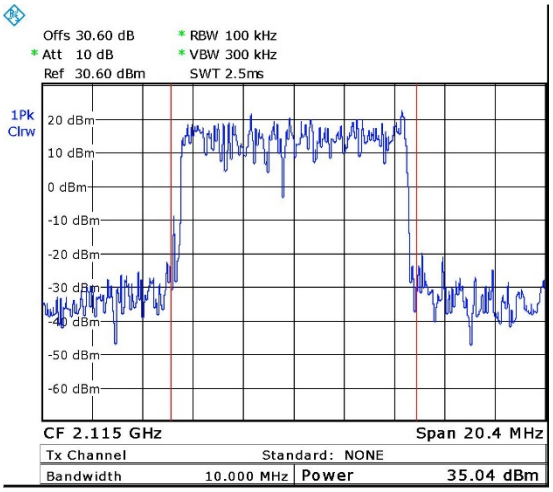

Figure 11. — LTE 64QAM (2115.0 MHz)

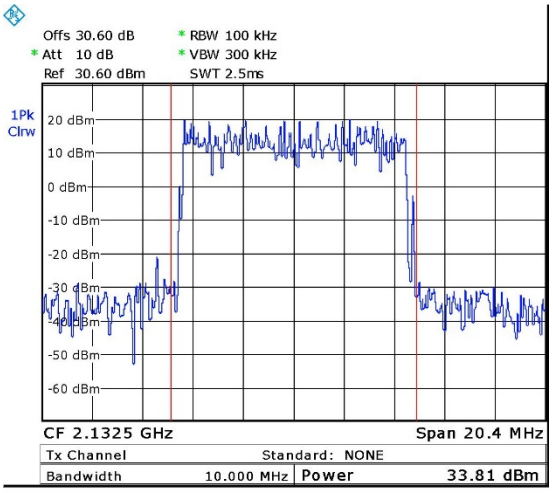

Figure 12. — LTE 64QAM (2132.5 MHz)

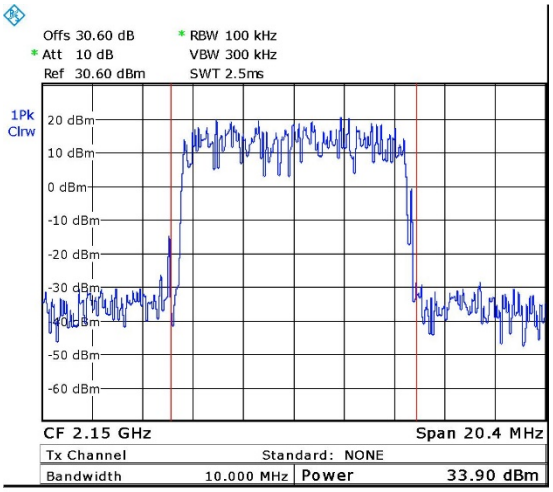

Figure 13. — LTE 64QAM (2150.0MHz)

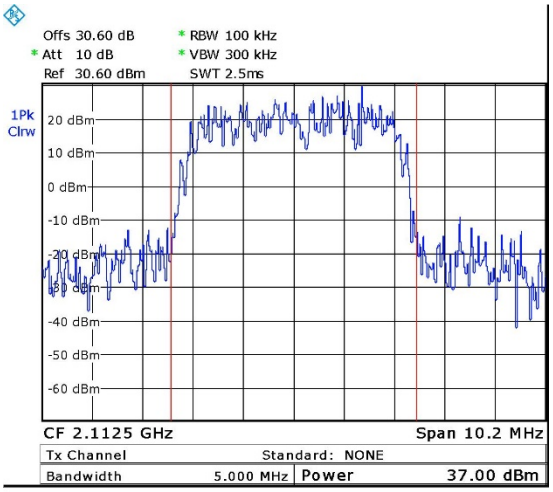

Figure 14. — W-CDMA (2112.5 MHz)

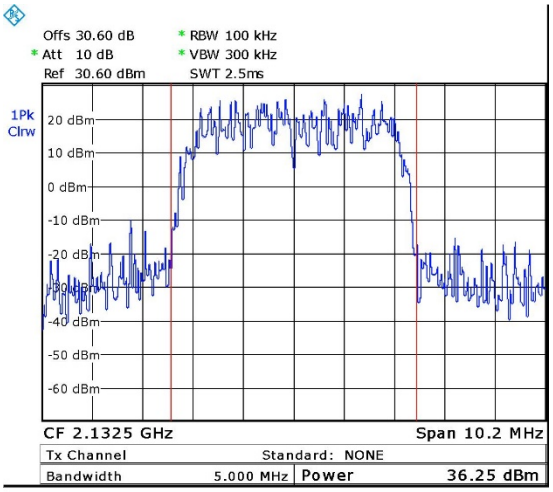

Figure 15. — W-CDMA (2132.5 MHz)

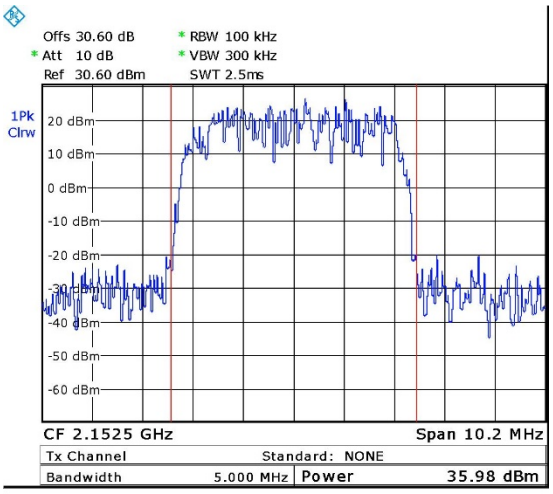

Figure 16. — W-CDMA (2152.5 MHz)

4.4 Test Equipment Used; RF Power Output AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

Figure 17 Test Equipment Used

5. Occupied Bandwidth AWS

5.1 Test Specification

FCC Part 2, Section 1049

5.2 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 (loss=30.6 dB). The spectrum analyzer was set to proper resolution B.W.
OBW function (99%) was employed for these evaluation
Occupied bandwidth measured was repeated in the input terminal of the E.U.T.

5.3 Results

Modulation	Port	Operating Frequency (MHz)	Reading (MHz)
LTE 64QAM	Input	2115.0	8.94
	Output	2115.0	8.94
	Input	2132.5	8.94
	Output	2132.5	8.94
	Input	2150.0	8.94
	Output	2150.0	8.94
GSM	Input	2111.2	0.24
	Output	2111.2	0.24
	Input	2132.5	0.24
	Output	2132.5	0.24
	Input	2153.8	0.24
	Output	2153.8	0.24
WCDMA	Input	2112.5	4.19
	Output	2112.5	4.17
	Input	2132.5	4.19
	Output	2132.5	4.19
	Input	2152.5	4.19
	Output	2152.5	4.19

Figure 18 Occupied Bandwidth AWS

See additional information in *Figure 18* to *Figure 35*.

JUDGEMENT: Passed

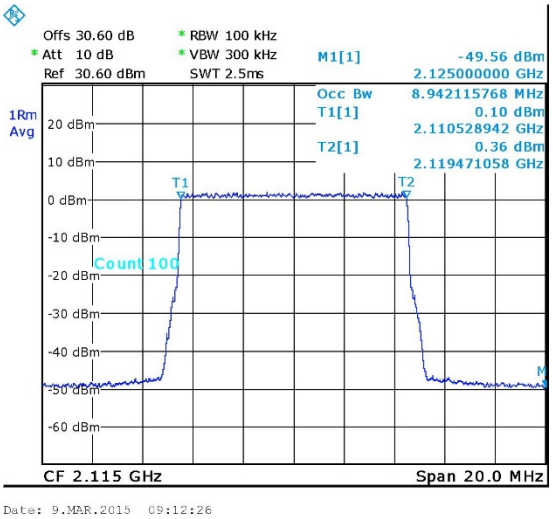

Figure 19. — LTE 64QAM (2115.0 MHz) IN

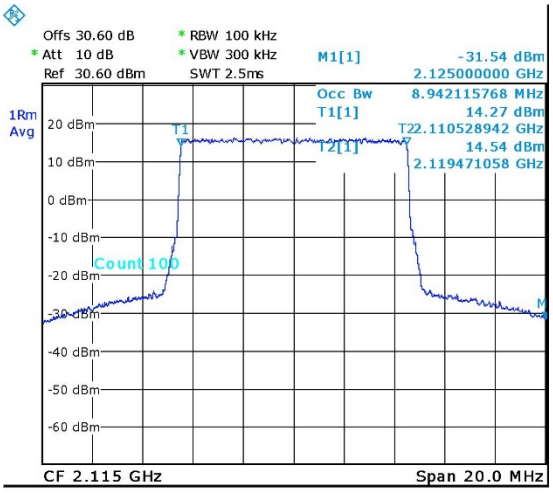

Figure 20. — LTE 64QAM (2115.0 MHz) OUT

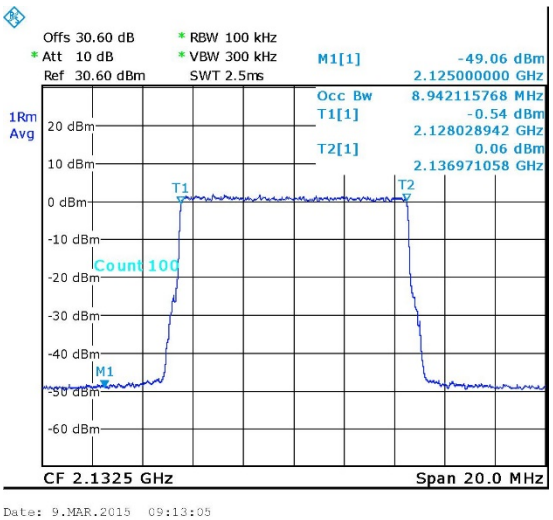

Figure 21. — LTE 64QAM (2132.5 MHz) IN

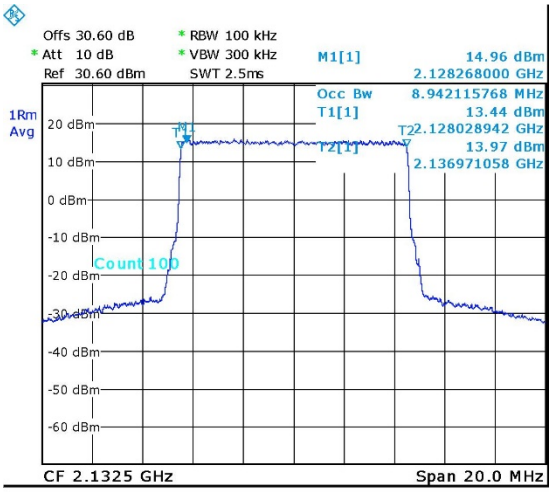

Figure 22. — LTE 64QAM (2132.5 MHz) OUT

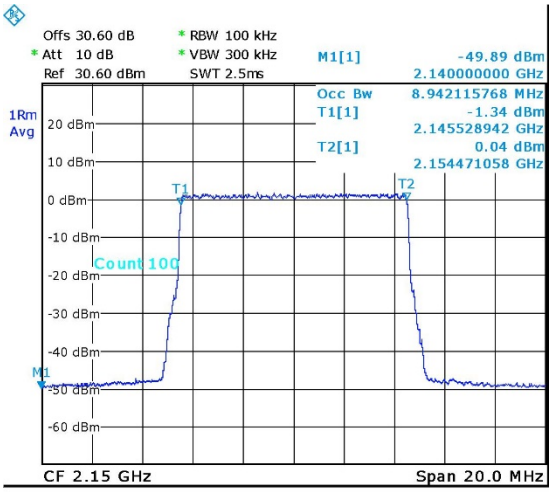

Figure 23. — LTE 64QAM (2150.0 MHz) IN

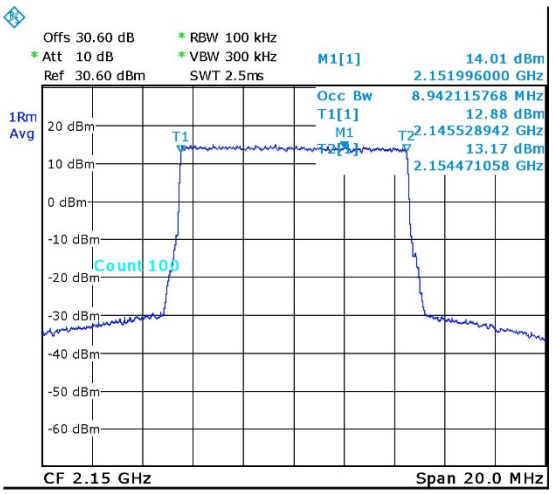

Figure 24. — LTE 64QAM (2150.0 MHz) OUT

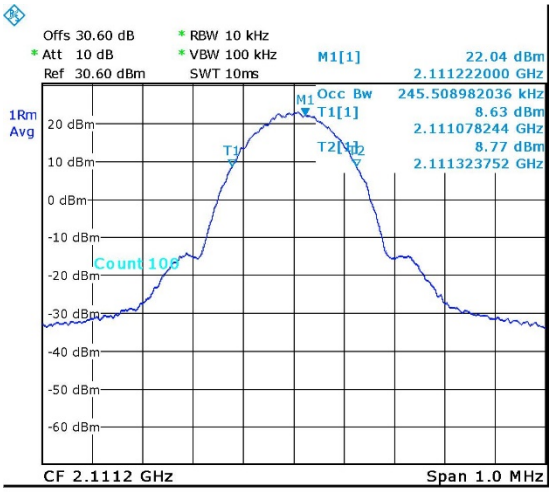

Figure 25. — GSM (2111.2 MHz) IN

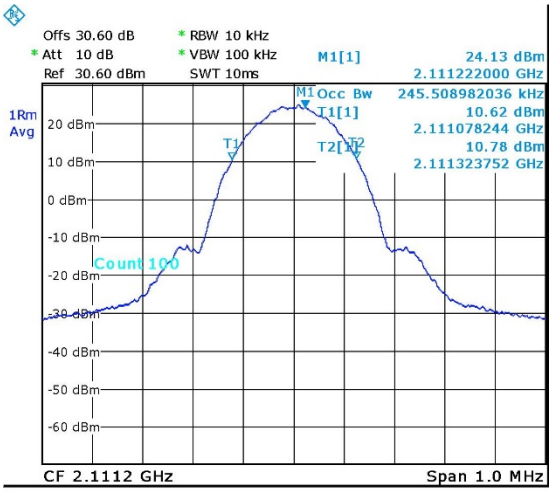

Figure 26. — GSM (2111.2 MHz) OUT

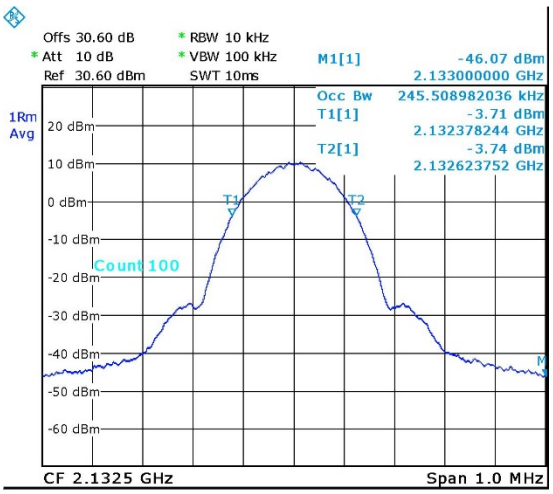

Figure 27. — GSM (2132.5 MHz) IN

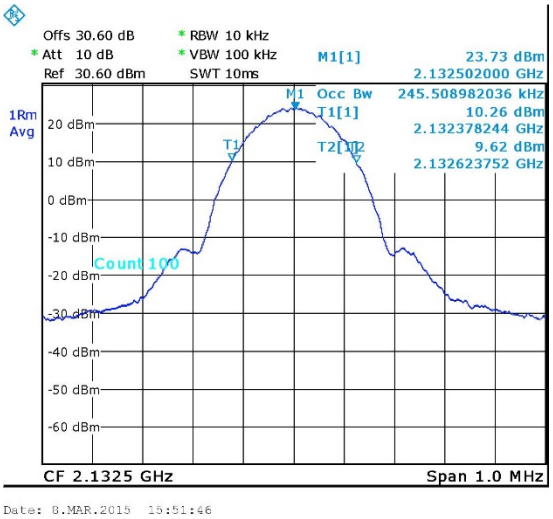

Figure 28. — GSM (2132.5 MHz) OUT

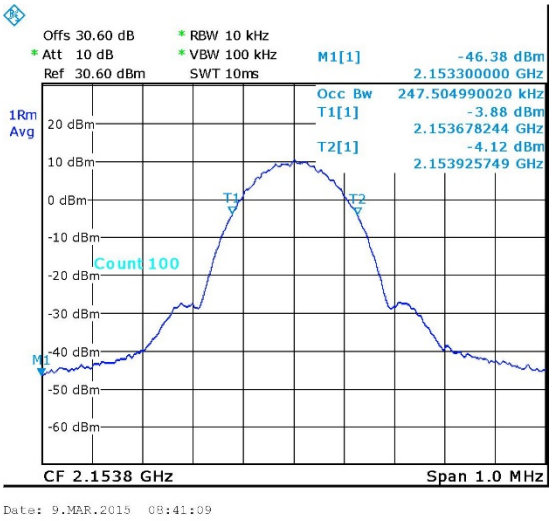

Figure 29. — GSM (2153.8 MHz) IN

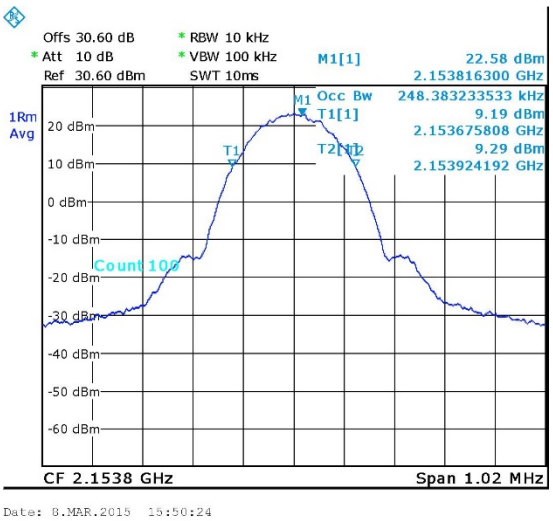

Figure 30. — GSM (2153.8 MHz) OUT

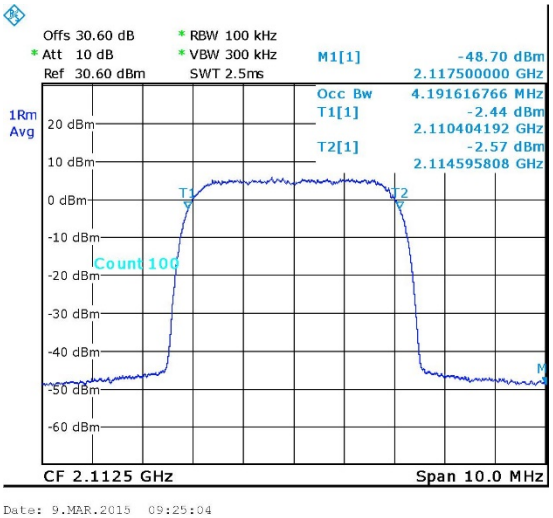

Figure 31. — W-CDMA (2112.5 MHz) IN

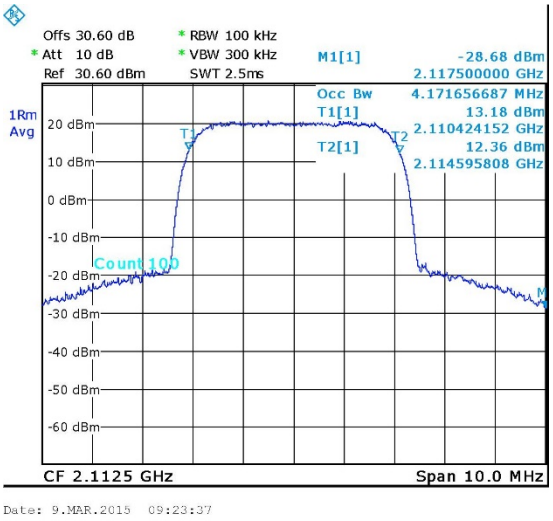

Figure 32. — W-CDMA (2112.5 MHz) OUT

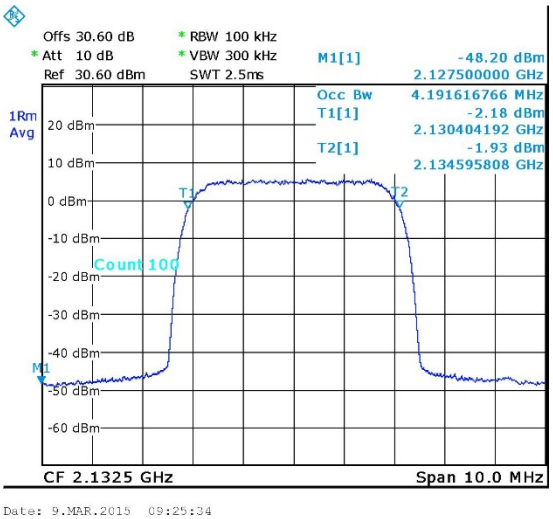

Figure 33. — W-CDMA (2132.5 MHz) IN

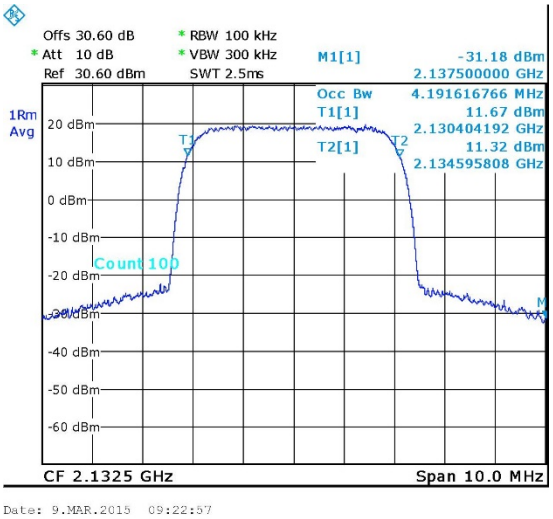

Figure 34. — W-CDMA (2132.5 MHz) OUT

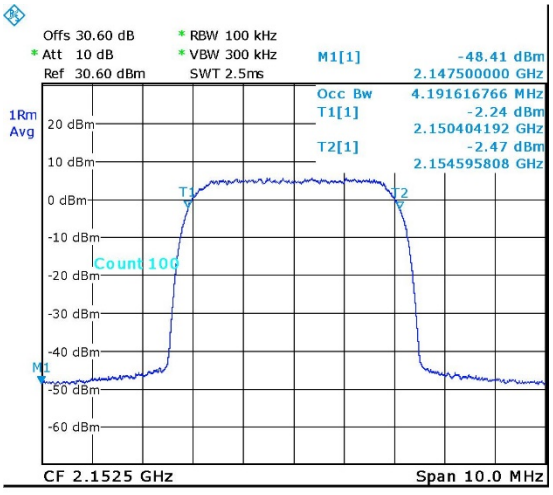

Figure 35. — W-CDMA (2152.5 MHz) IN

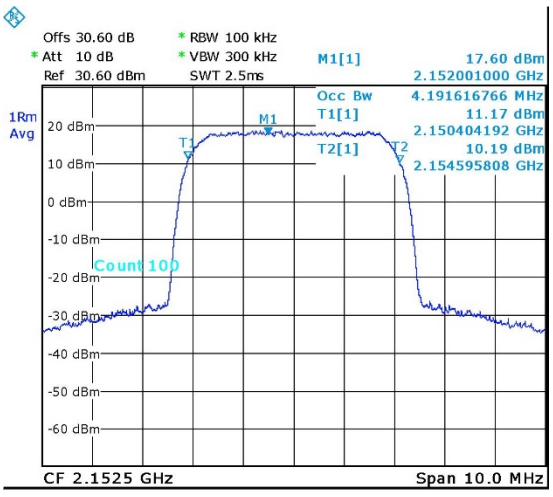

Figure 36. — W-CDMA (2152.5 MHz) OUT

5.4 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

Figure 37 Test Equipment Used

6. Spurious Emissions at Antenna Terminals AWS

6.1 Test Specification

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

6.2 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 - 24.0 GHz.

6.3 Results

See additional information in *Figure 37* to *Figure 45*.

JUDGEMENT: Passed

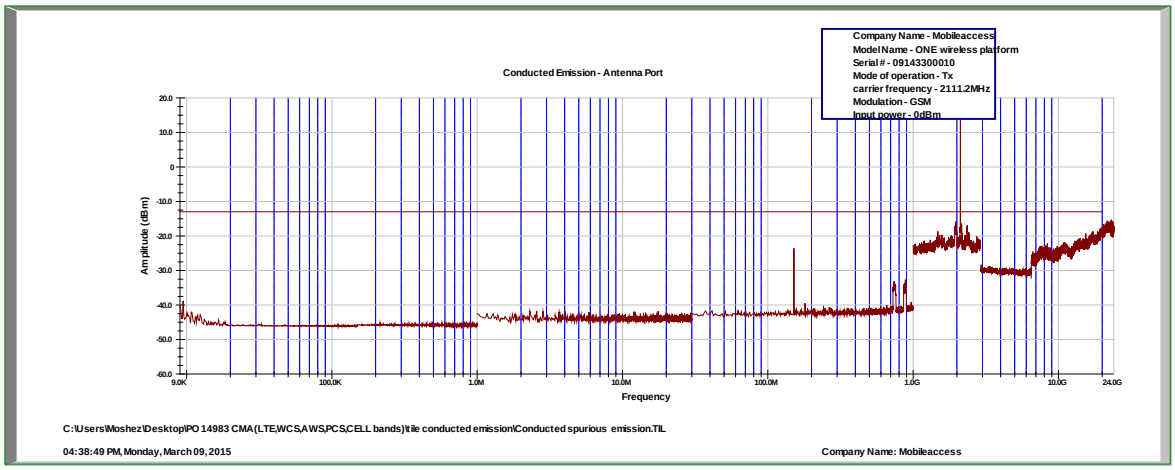

Figure 38 Spurious Emissions at Antenna Terminals GSM, 2111.2MHz

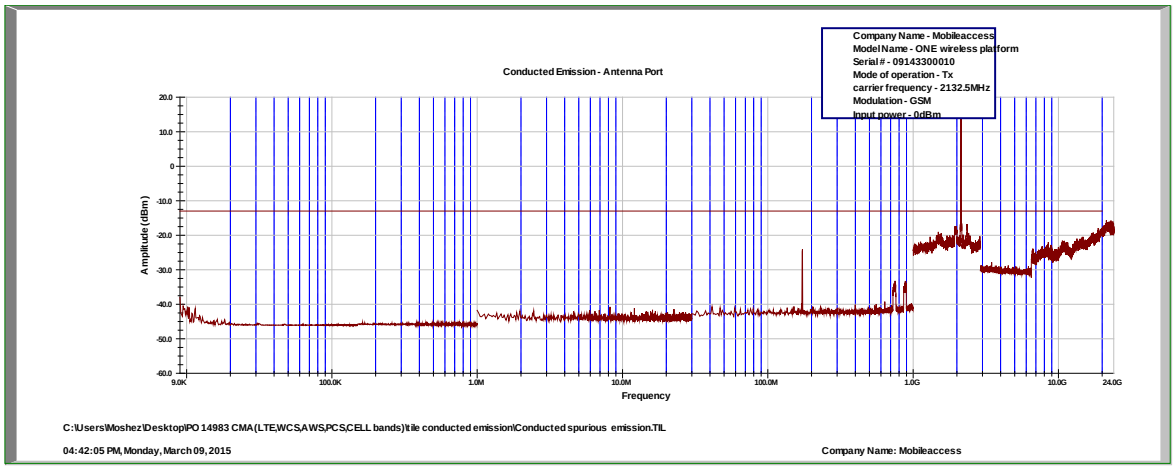

Figure 39 Spurious Emissions at Antenna Terminals GSM, 2132.5MHz

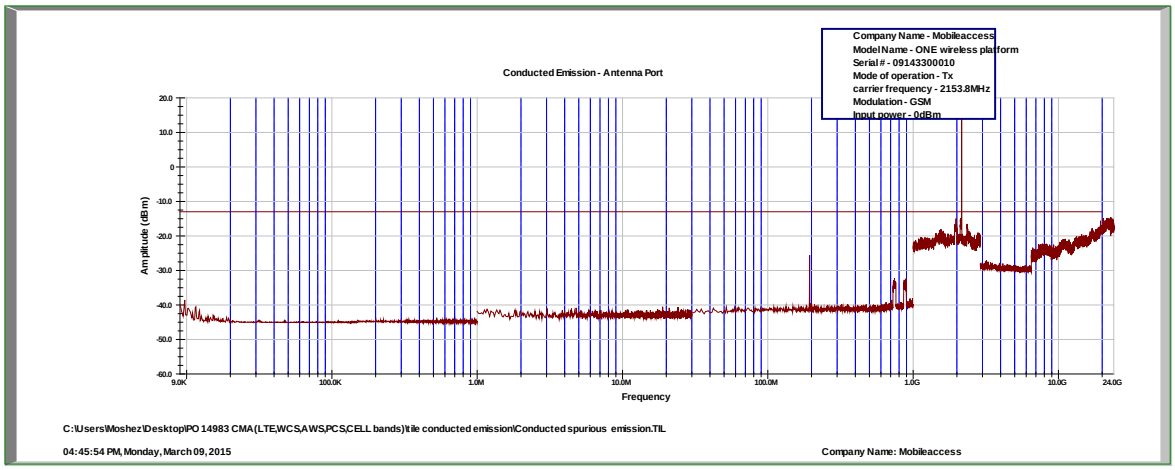

Figure 40 Spurious Emissions at Antenna Terminals GSM, 2153.8MHz

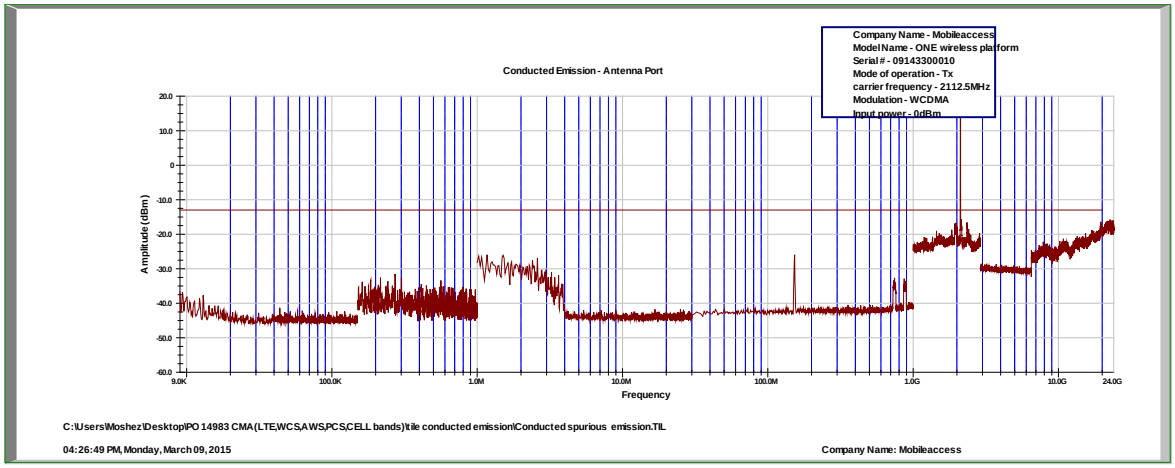

Figure 41 Spurious Emissions at Antenna Terminals WCDMA, 2112.5MHz

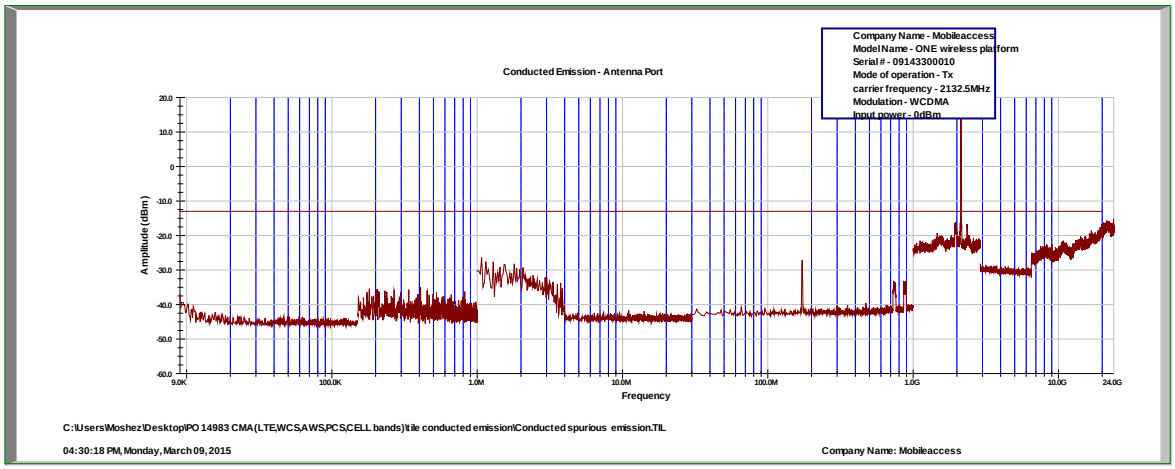

Figure 42 Spurious Emissions at Antenna Terminals WCDMA, 2132.5MHz

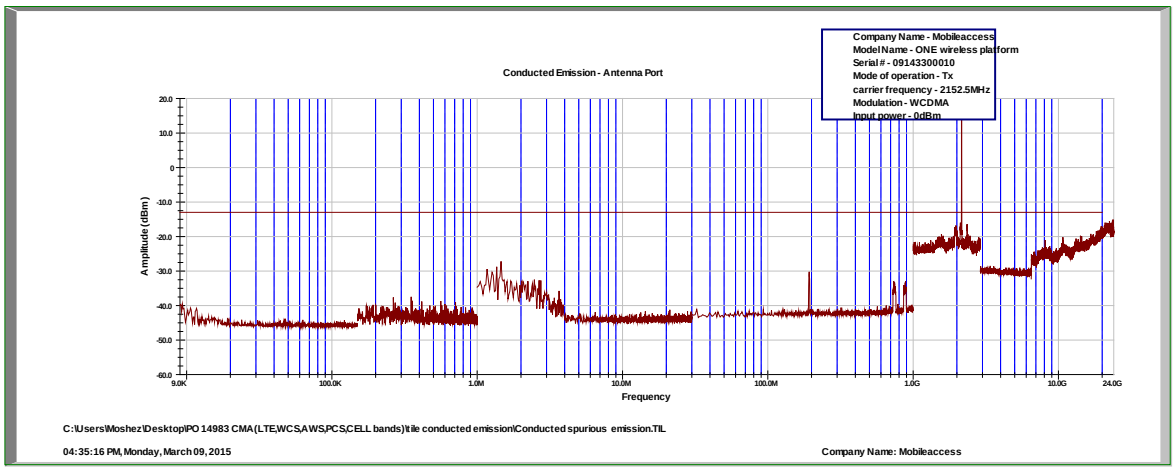

Figure 43 Spurious Emissions at Antenna Terminals WCDMA, 2152.5MHz

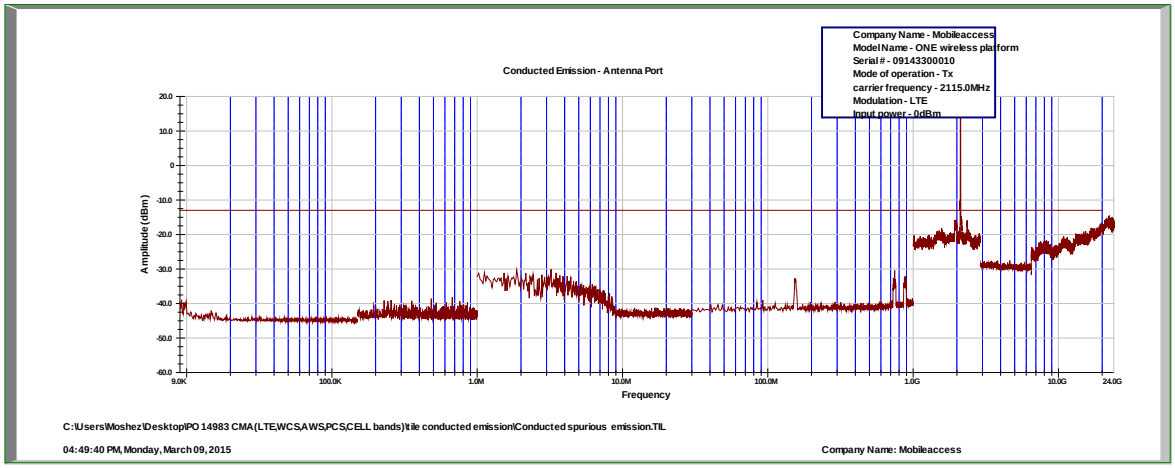

Figure 44 Spurious Emissions at Antenna Terminals LTE, 2115.0MHz

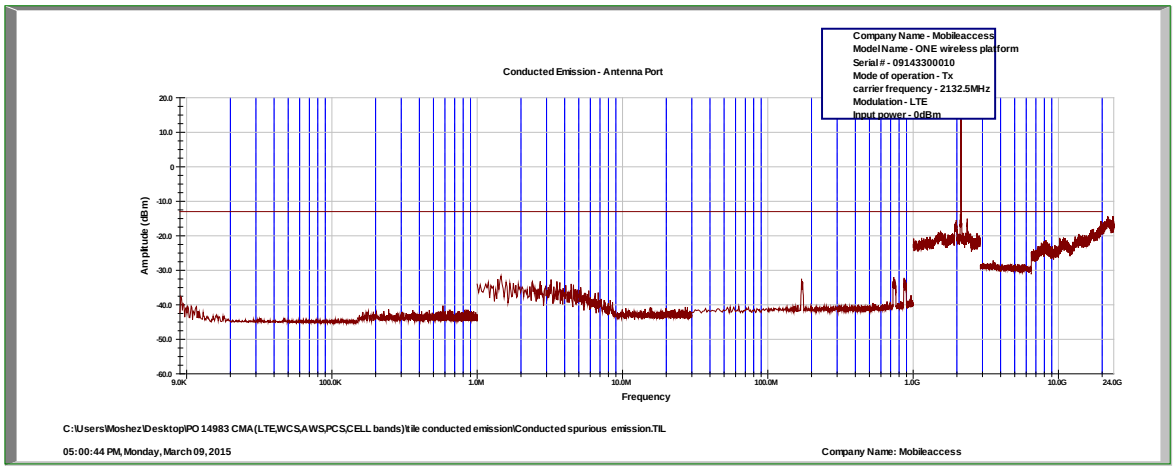

Figure 45 Spurious Emissions at Antenna Terminals LTE, 2132.5MHz

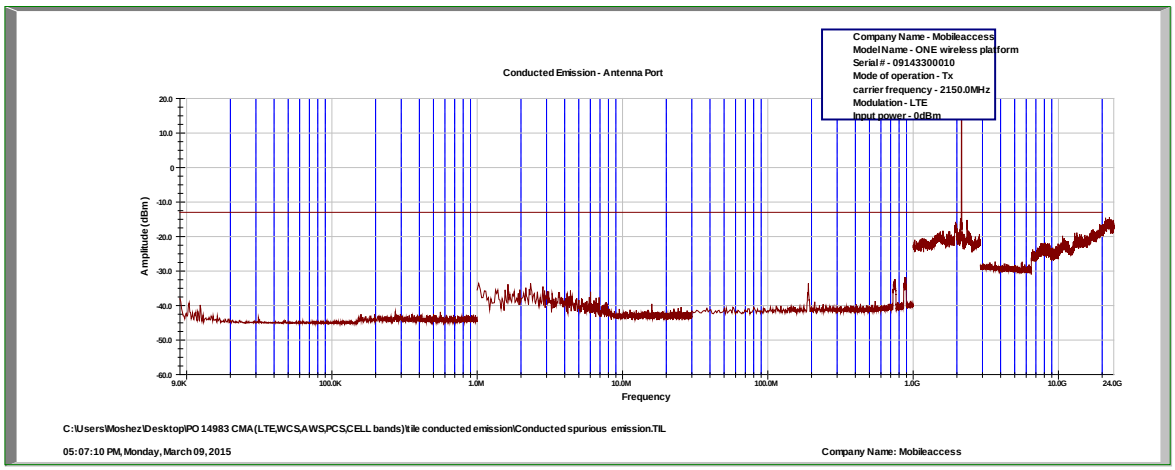

Figure 46 Spurious Emissions at Antenna Terminals LTE, 2150.0MHz

6.4 Test Equipment Used; Spurious Emissions at Antenna Terminals AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

Figure 47 Test Equipment Used

7. Band Edge Spectrum AWS

7.1 Test Specification

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

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 (loss = 30.6 dB).

7.3 Test Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
LTE 64QAM	2115.0	2110.00	-29.1	-13.0	-16.1
LTE 64QAM	2150.0	2155.00	-32.0	-13.0	-19.0
GSM	2111.2	2110.00	-19.3	-13.0	-6.3
GSM	2153.8	2155.00	-22.6	-13.0	-9.6
W-CDMA	2112.5	2110.00	-14.0	-13.0	-1.0
W-CDMA	2152.5	2155.00	-19.0	-13.0	-6.0

Figure 48 Band Edge Spectrum Results AWS

See additional information in *Figure 48* to *Figure 53.*

JUDGEMENT: Passed by 1.0 dB

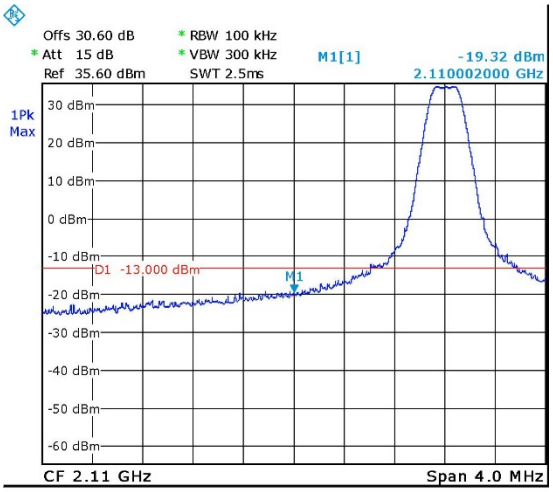

Figure 49. — GSM 2111.20 MHz

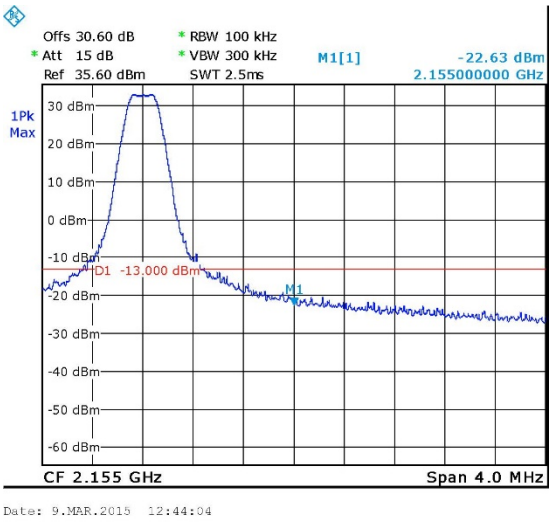

Figure 50. — GSM 2153.80 MHz

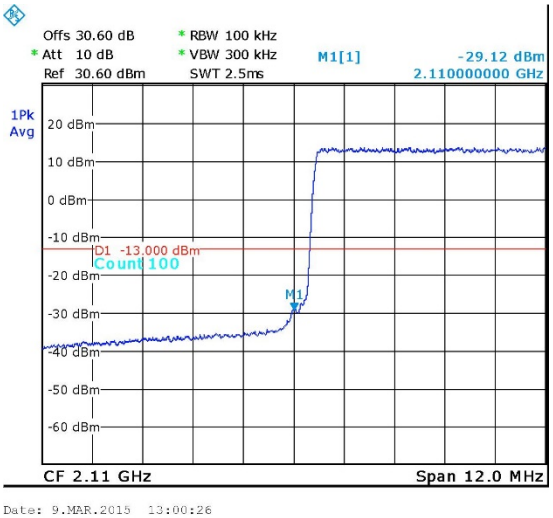

Figure 51. — LTE 64QAM 2115.00 MHz

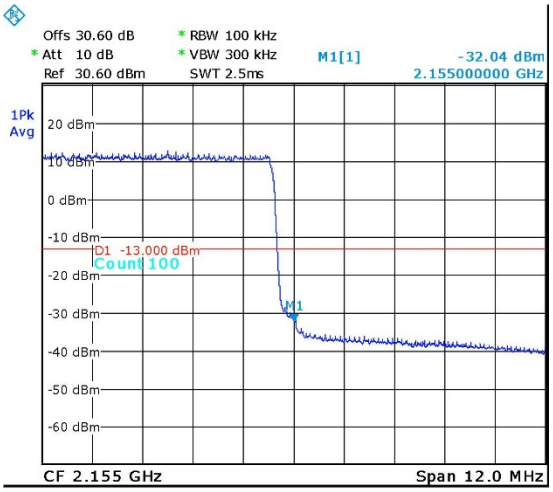

Figure 52. — LTE 64QAM 2150.00 MHz

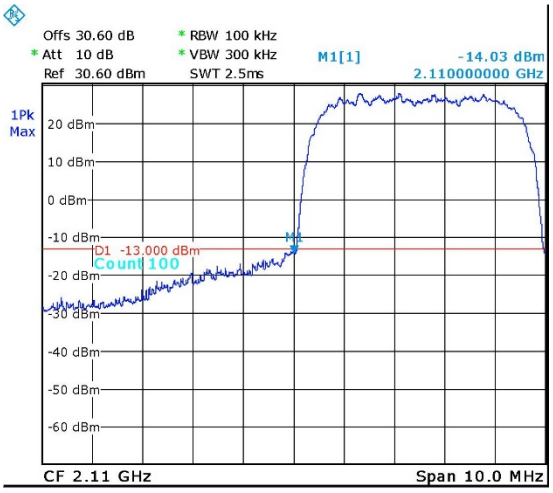

Figure 53. — W-CDMA 2112.50 MHz

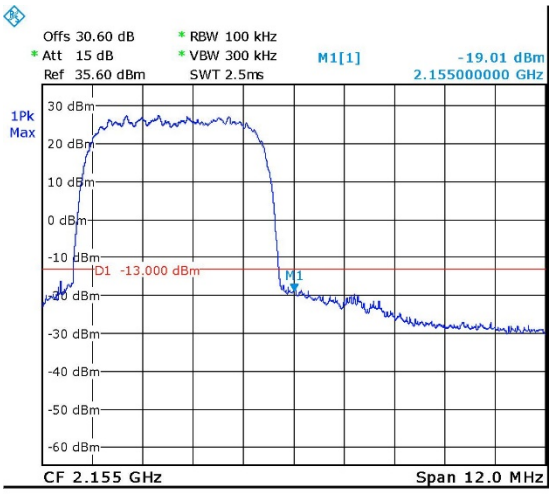

Figure 54. — W-CDMA 2152.50 MHz

7.4 Test Equipment Used; Band Edge Spectrum AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

Figure 55 Test Equipment Used

8. Spurious Radiated Emission AWS

8.1 Test Specification

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

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 (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.

(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.

A Peak detector was using for this test.

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)
2111.20	4222.4	V	80.0	-15.4	11.2	9.5	-17.1	-13.0	-4.1
2111.20	4222.4	H	80.9	-15.8	11.2	8.6	-18.4	-13.0	-5.4
2135.00	4270.0	V	79.2	-15.9	11.2	9.5	-17.6	-13.0	-4.6
2135.00	4270.0	H	81.0	-15.6	11.2	8.6	-18.3	-13.0	-5.3
2153.80	4307.6	V	81.6	-14.4	11.2	9.5	-16.1	-13.0	-3.1
2153.80	4307.6	H	81.7	-15.1	11.2	8.6	-17.7	-13.0	-4.7

Figure 56 Spurious Radiated Emission AWS

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

JUDGEMENT: Passed by 3.1 dB

8.4 Test Instrumentation Used, Radiated Measurements AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	R&S	ESIB7	100120	December 15, 2014	1 year
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	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	6142	March 14, 2012*	3 years
Horn Antenna	A.R.A	SWH-28	1007	March 30, 2014	2 years
40dB attenuator	Weinschel Engineering	WA-39-40-33	A1323	March 1, 2015	1 year
Signal Generator	HP	E4433B	GB40051245	July 16, 2014	1 year
Signal Generator	MARCONI	2022D	119196015	February 23, 2015	1 year
Signal Generator	HP	E4433B	GB40050702	May 16, 2013	2 years
Signal Generator	HP	E4436B	US39260774	January 7, 2015	2 years
Signal Generator	HP	ESG-4000A	1782	February 24, 2015	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

*Note – Extended to May 19, 2015

Figure 57 Test Equipment Used

9. Intermodulation Conducted

9.1 Test Procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (loss = 31.3dB). 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 - 24.0 GHz.

5 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

WCS: 2355MHz CW 0 dBm

The frequency range of 9 kHz – 24.0 GHz was scanned for unwanted signals.

9.2 Test Results

See additional information in Figure 57.

JUDGEMENT: Passed

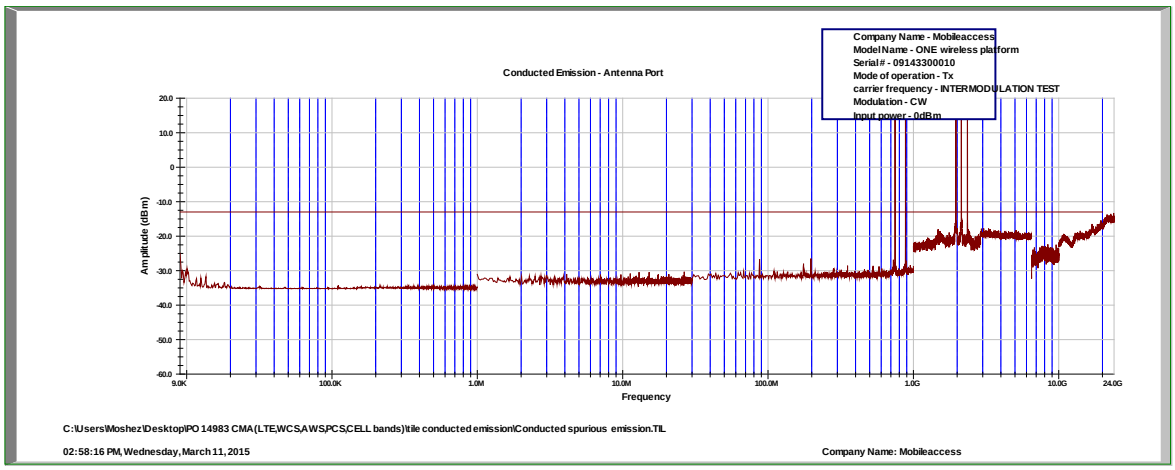

Figure 58 Intermodulation

9.3 Test Equipment Used; Intermodulation Conducted

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2014	1 year
Vector Signal Generator	Agilent	N5172B	MY51350518	May 03, 2013	3 years
Vector Signal Generator	Agilent	N5172B	MY51350584	May 07, 2013	3 years
Signal Generator	HP	E4433B	GB40050702	May 16, 2013	2 years
Signal Generator	HP	E4436B	US39260774	January 07 2015	2 years
30 dB Attenuator	JFW	50FHC-030-50	43608 46-140-1	March 8, 2015	1 month

Figure 59 Test Equipment Used

10. Intermodulation Radiated

10.1 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; 2350-2360MHz) 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.

(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.

5 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
WCS : 2355MHz 0 dBm

10.2 Test Results

JUDGEMENT: Passed

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)
1565.0	V	68.0	-31.9	6.7	7.6	-30.9	-13.0	-17.9
1565.0	H	66.6	-30.7	6.7	8.0	-29.4	-13.0	-16.4
3039.0	V	75.7	-22.0	9.9	8.4	-23.6	-13.0	-10.6
3039.0	H	75.8	-22.8	9.9	9.6	-23.1	-13.0	-10.1
3434.0	V	75.0	-21.1	9.9	8.4	-22.7	-13.0	-9.7
3434.0	H	76.9	-20.8	9.9	9.6	-21.1	-13.0	-8.1
4118.0	V	79.9	-16.3	11.2	9.5	-18.0	-13.0	-5.0
4118.0	H	79.1	-16.6	11.2	8.6	-19.2	-13.0	-6.2
5303.0	V	81.5	-14.0	13.1	9.7	-17.4	-13.0	-4.4
5303.0	H	82.1	-12.8	13.1	10.4	-15.5	-13.0	-2.5
3523.0	V	74.9	-20.0	13.1	9.7	-23.4	-13.0	-10.4
3523.0	H	77.0	-16.8	13.1	10.4	-19.5	-13.0	-6.5
2249.0	V	69.8	-27.6	9.0	7.7	-28.9	-13.0	-15.9
2249.0	H	69.3	-28.4	9.0	8.5	-28.9	-13.0	-15.9
1915.0	V	70.6	-27.1	6.7	7.6	-26.2	-13.0	-13.2
1915.0	H	68.3	-28.6	6.7	8.0	-27.3	-13.0	-14.3
5571.0	V	82.3	-11.7	13.5	9.9	-15.3	-13.0	-2.3
5571.0	H	82.5	-12.4	13.5	10.8	-15.0	-13.0	-2.0
3303.0	V	75.6	-20.1	9.9	8.4	-21.6	-13.0	-8.6
3303.0	H	75.9	-21.5	9.9	9.6	-21.7	-13.0	-8.7

Figure 60 Intermodulation Radiated Results

10.3 Test Instrumentation Used; Radiated Measurements Intermodulation

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	R&S	ESIB7	100120	December 15, 2014	1 year
Spectrum Analyzer	HP	8592L	3826A01204	March 4, 2015	1 year
Active Loop Antenna	EMCO	6502	2950	November 4, 2014	1 year
Biconical Log Antenna	EMCO	3142B	1078	May 22, 2014	2 years
Horn Antenna	ETS	3115	6142	March 14, 2012	3 years*
Horn Antenna	A.R.A	SWH-28	1007	March 30, 2014	2 years
40dB attenuator	Weinschel Engineering	WA 39-40-33	A1323	March 1, 2015	1 year
Signal Generator	HP	E4433B	GB40051245	July 16, 2014	1 year
Signal Generator	MARCONI	2022D	119196015	February 23, 2015	1 year
Signal Generator	HP	E4433B	GB40050702	May 16, 2013	2 years
Signal Generator	HP	E4436B	US39260774	January 7, 2015	2 years
Signal Generator	HP	ESG-4000A	1782	February 24, 2015	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

*Note – Extended to May 19, 2015

Figure 61 Test Equipment Used

11. APPENDIX A - CORRECTION FACTORS

11.1 Correction factors for CABLE

from EMI receiver to test antenna at 3 meter range.

Frequency (MHz)	Cable Loss (dB)	Frequency (MHz)	Cable Loss (dB)
0.010	0.4	50.00	1.2
0.015	0.2	100.00	0.7
0.020	0.2	150.00	20.1
0.030	0.3	200.00	2.3
0.050	0.3	300.00	2.9
0.075	0.3	500.00	3.8
0.100	0.2	750.00	4.8
0.150	0.2	1000.00	5.4
0.200	0.3	1500.00	6.7
0.500	0.4	2000.00	9.0
1.00	0.4	2500.00	9.4
1.50	0.5	3000.00	9.9
2.00	0.5	3500.00	10.2
5.00	0.6	4000.00	11.2
10.00	0.8	4500.00	12.1
15.00	0.9	5000.00	13.1
20.00	0.8	5500.00	13.5
		6000.00	14.5

NOTES:

1. The cable type is SPUMA400 RF-11N(X2) and 39m long

2. The cable is manufactured by Huber + Suhner

11.2 Correction factors for Bilog ANTENNA

Model: 3142
Antenna serial number: 1250
3 meter range

FREQUENCY (MHz)	AFE (dB/m)	FREQUENCY (MHz)	AFE (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		

11.3 Correction factors for Horn ANTENNA

Model: 3115
Antenna serial number: 6142
3 meter range

FREQUENCY (MHz)	Antenna Factor (dB/m)	FREQUENCY (MHz)	Antenna Factor (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		

11.4 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**

11.5 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