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DATE: 19 May 2016

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

FCC Radio Test Report

for

Corning Optical Communication Wireless

Equipment under test:

MRU – Mid-Power Remote Unit with AWS-3 Support

Chassis MRU-E-ASM-AC-B
Chassis MRU-E-ASM-DC-B
Power Amplifier Module MRU-PAM-17E

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for

Corning Optical Communication Wireless

MRU – Mid-Power Remote Unit with AWS-3 Support

Chassis MRU-E-ASM-AC-B
Chassis MRU-E-ASM-DC-B
Power Amplifier Module MRU-PAM-17E

FCC ID: OJF1MRU21-3

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 KDB 935210 D03 v04 and ANSI/TIA 603-D: 2010

Application for Certification
prepared by:
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Applicant for this device:
(different from "prepared by")
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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):	MRU – Mid-Power Remote Unit with AWS-3 Support
Equipment Model No.:	Chassis MRU-E-ASM-AC-B Chassis MRU-E-ASM-DC-B Power Amplifier Module MRU-PAM-17E
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	13.03.2016
Start of Test:	13.03.2016
End of Test:	15.03.2016
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 IL1005.
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, IC 4025A-2.

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

Corning's mid-power remote unit (MRU) provides remote indoor and outdoor coverage for the Corning ONE™ wireless platform. It is a fiber-fed, compact, and scalable multiservice solution designed to complement the Corning ONE wireless platform by providing complete RF open space coverage for large-scale public venues such as campus applications.

1.4 Test Methodology

Radiated testing was performed according to the procedures in KDB 935210 D03 v04 and ANSI/TIA 603-D: 2010. 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 34dBm.
Testing was performed on the following configuration:

Frequency Range (MHz)		
Service/Band	**Downlink (DL)**	**Technology**
AWS 2100	2110-2180	WCDMA, LTE, GSM

2.2 EUT Exercise Software

The Element Management System ver. 1.9 used for commands delivery. These commands are used to enable/disable the EUT transmission. EUT Embedded SW versions is mru_da64_19_01.bin.

2.3 Special Accessories

IHU.

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) with AWS-3 support consists of Chassis MRU-E-ASM-AC-B Chassis MRU-E-ASM-DC-B Power Amplifier Module MRU-PAM-17E
Working voltage	115VAC/48VDC
Mode of operation	Industrial Booster for AWS3 band
Modulations	WCDMA, LTE(64QAM), GSM
Frequency Range	2110MHz-2180MHz
Transmit power	34.0 dBm
Antenna Gain	12.5 dBi
DATA rate	N/A
Modulation BW	0.5MHz(GSM), 5MHz(WCDMA); 10MHz(LTE)
Temperature (°C)/ Humidity (%RH)	20.5°C/30.0%

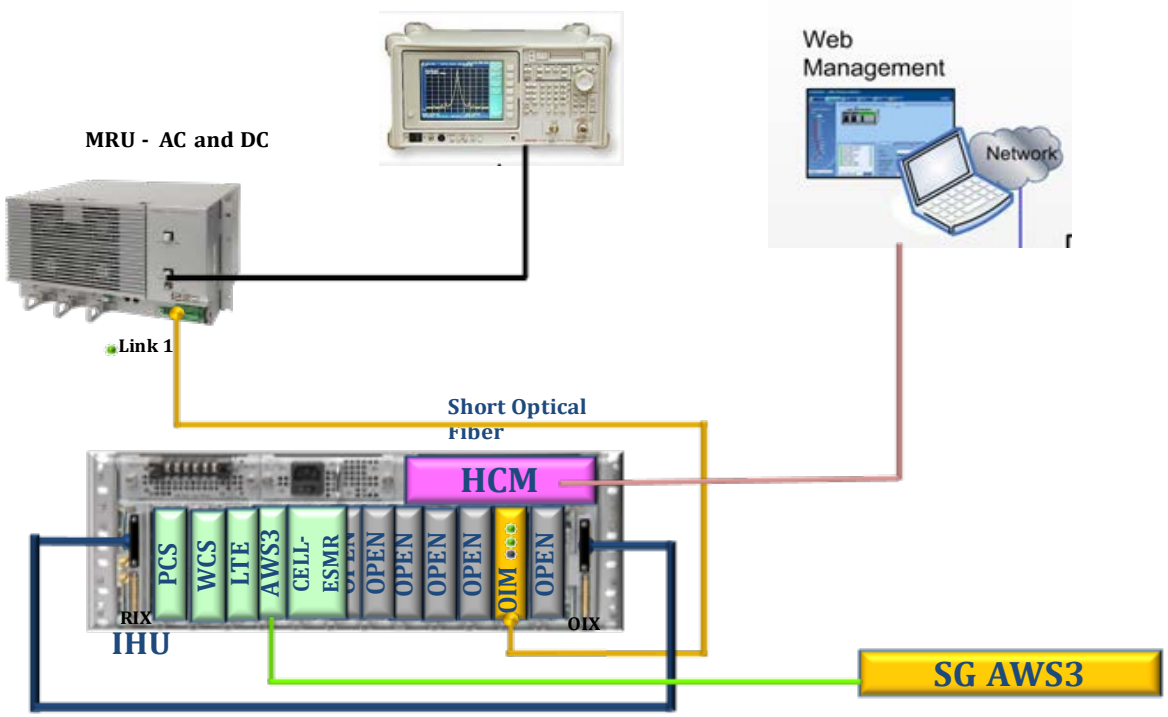

Figure 1. Conducted Test Set-Up

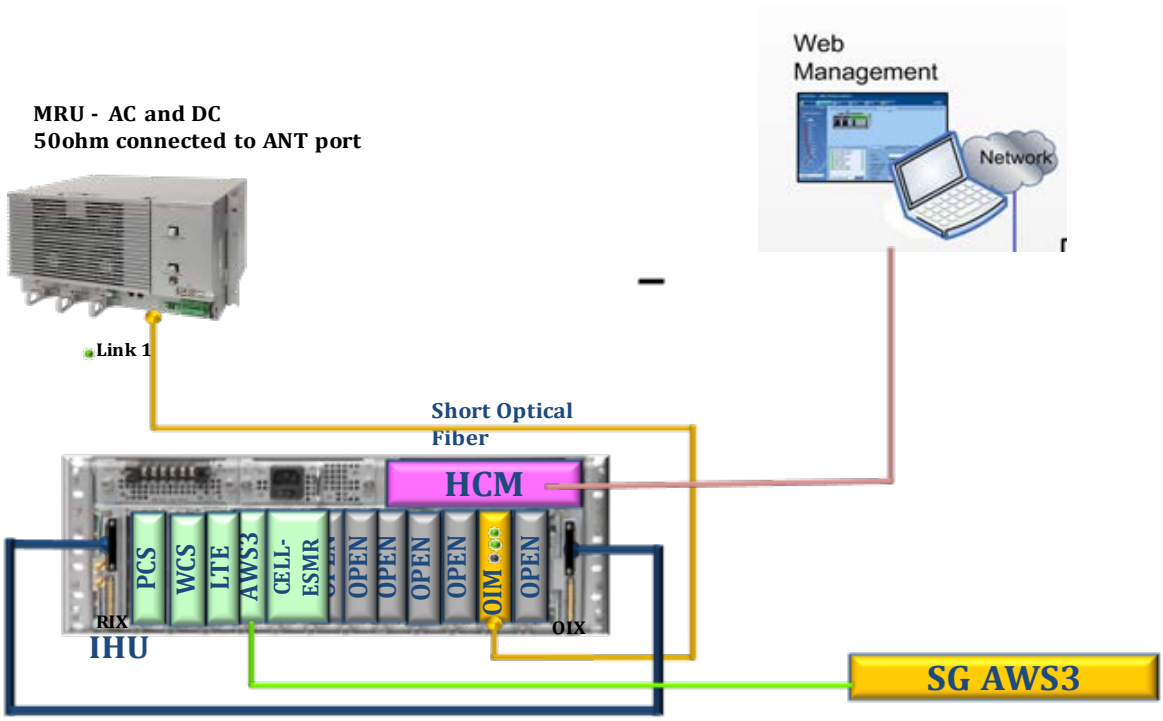

Figure 2. Radiated Test Set-Up

3. Test Set-Up Photos

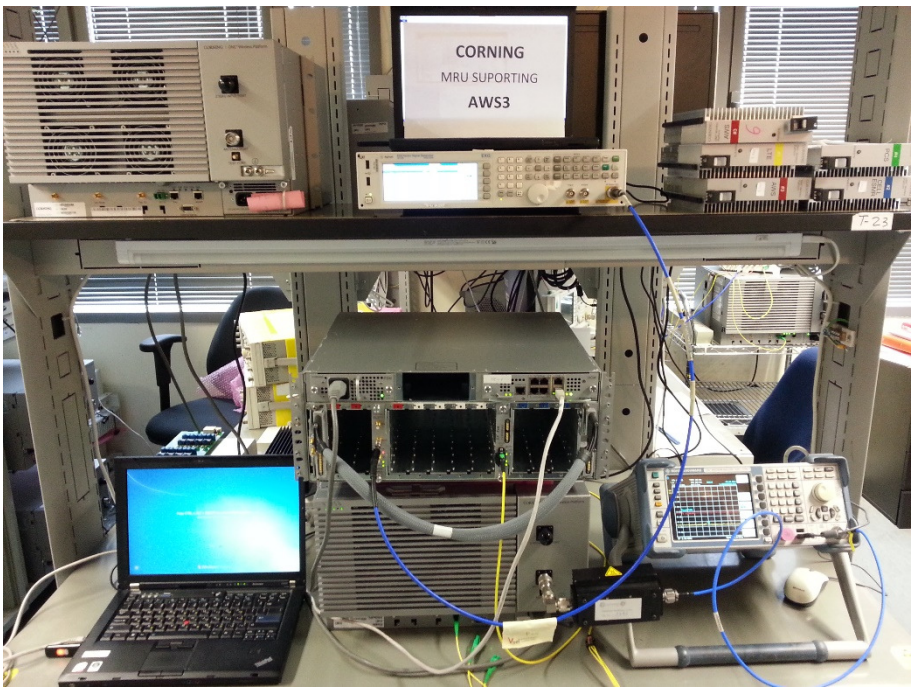

Figure 3. Conducted Emission from Antenna Ports Test

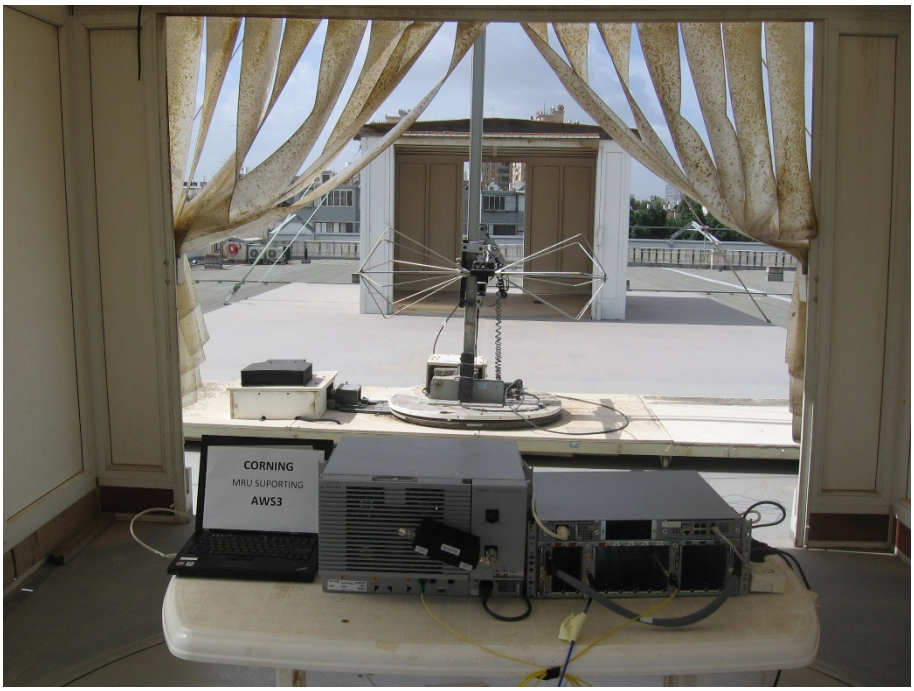

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

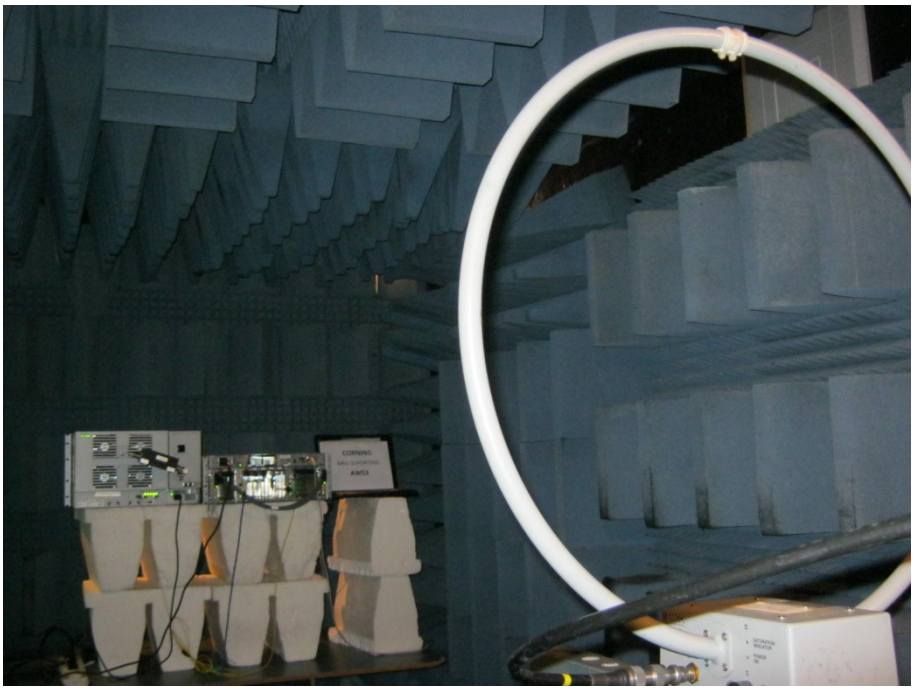

Figure 6. Radiated Emission Test

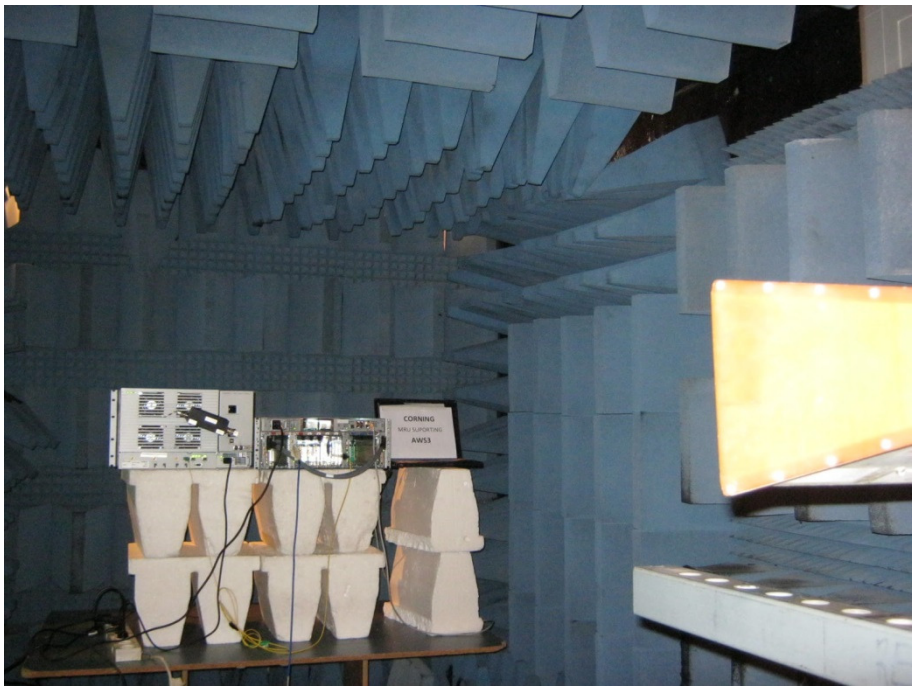

Figure 7. Radiated Emission Test

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 (41.0 dB) and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload.

4.3 Limit

The power limit is 1640W (62.1 dBm).

4.4 Results

Modulation	Operation Frequency (MHz)	Reading (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Specification (dBm)	Margin (dB)
GSM	2111.2	35.2	12.5	47.7	62.1	-14.4
GSM	2145.0	34.9	12.5	47.4	62.1	-14.7
GSM	2178.8	34.4	12.5	46.9	62.1	-15.2
LTE 64QAM	2115.0	34.4	12.5	46.9	62.1	-15.2
LTE 64QAM	2145.0	34.8	12.5	47.3	62.1	-14.8
LTE 64QAM	2175.0	34.6	12.5	47.1	62.1	-15.0
WCDMA	2112.5	34.5	12.5	47.0	62.1	-15.1
WCDMA	2145.0	34.3	12.5	46.8	62.1	-15.3
WCDMA	2177.5	34.8	12.5	47.3	62.1	-14.8

Figure 8 RF Power Output AWS

See additional information in *Figure 9* to *Figure 17*.

JUDGEMENT: Passed

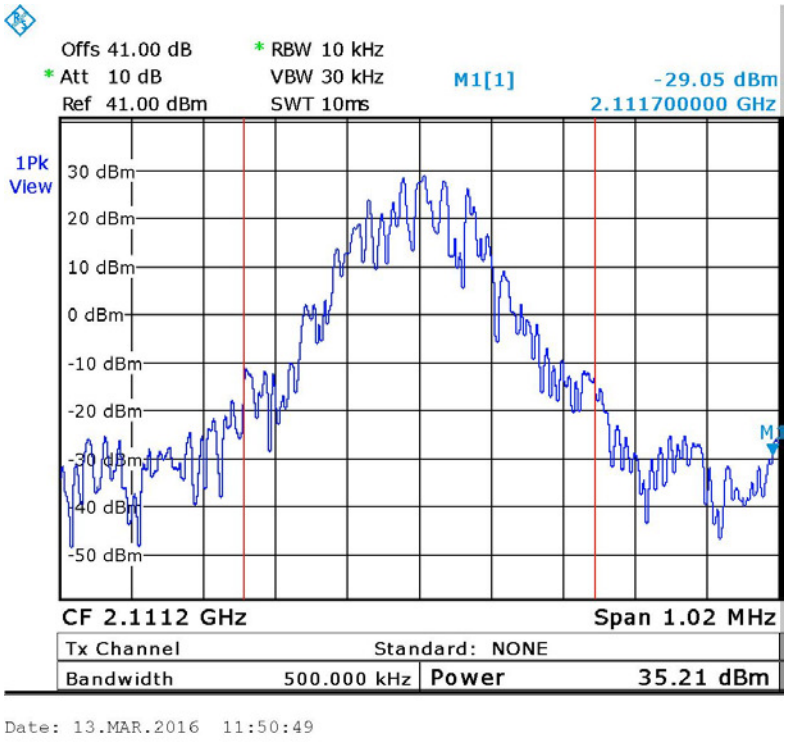

Figure 9. — GSM (2111.2 MHz)

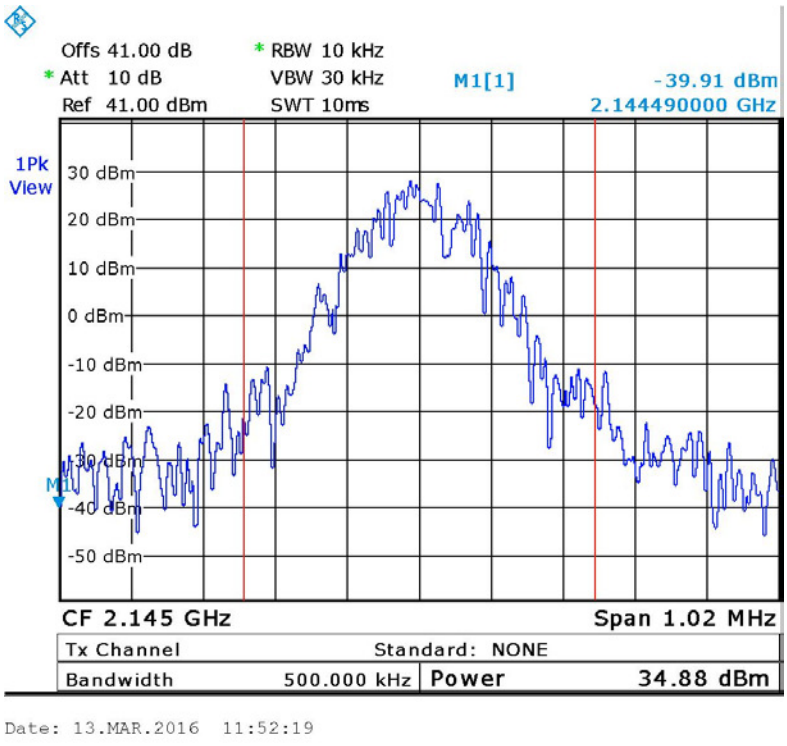

Figure 10. — GSM (2145.0MHz)

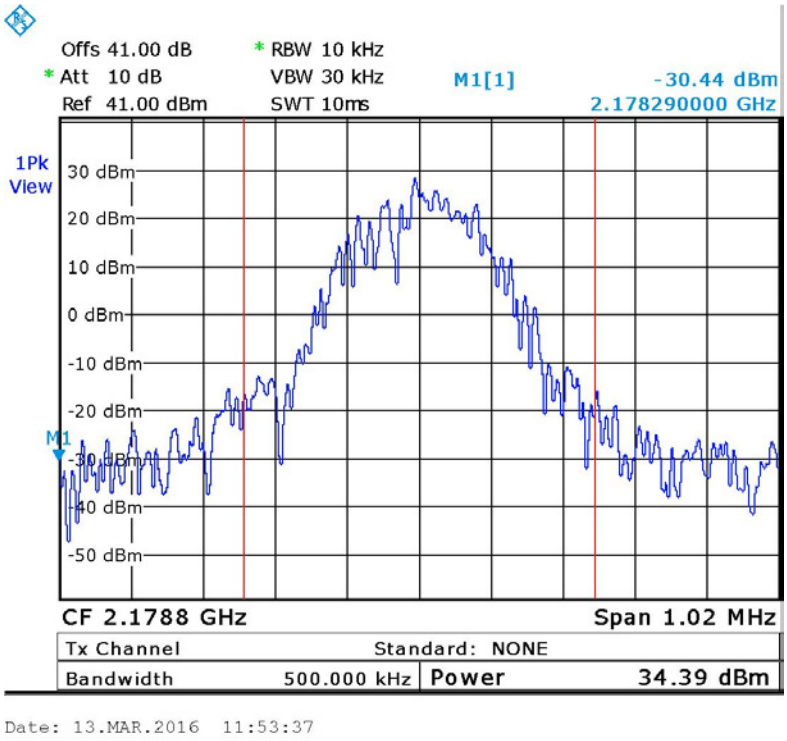

Figure 11. — GSM (2178.8 MHz)

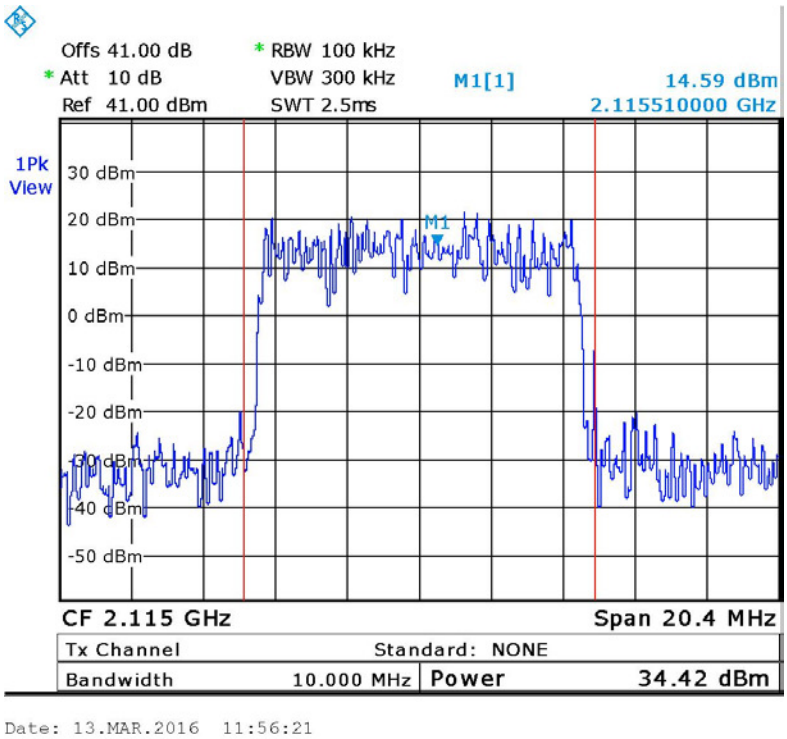

Figure 12. — LTE 64QAM (2115.0 MHz)

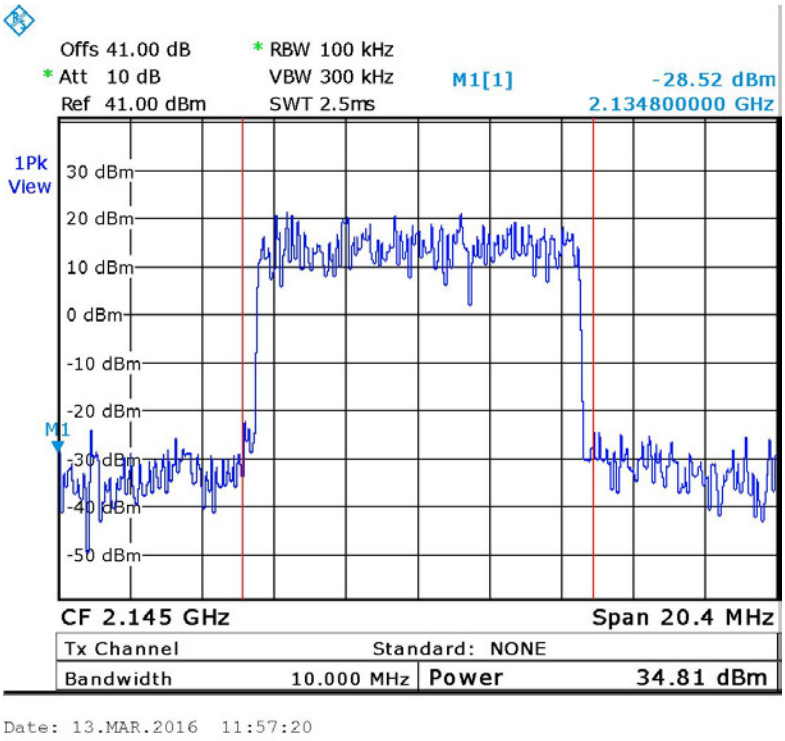

Figure 13. — LTE 64QAM (2145.0MHz)

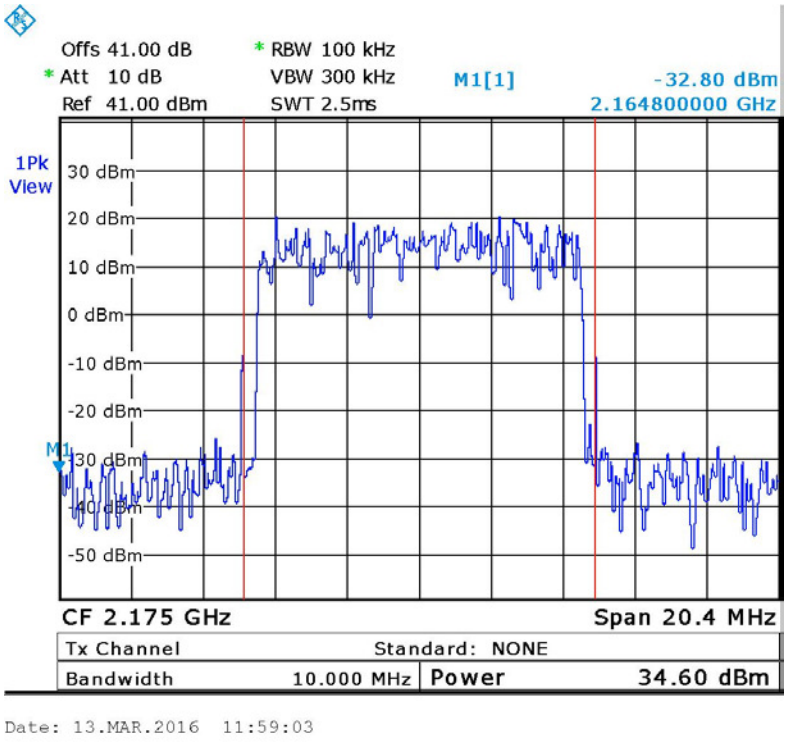

Figure 14. — LTE 64QAM (2175.0MHz)

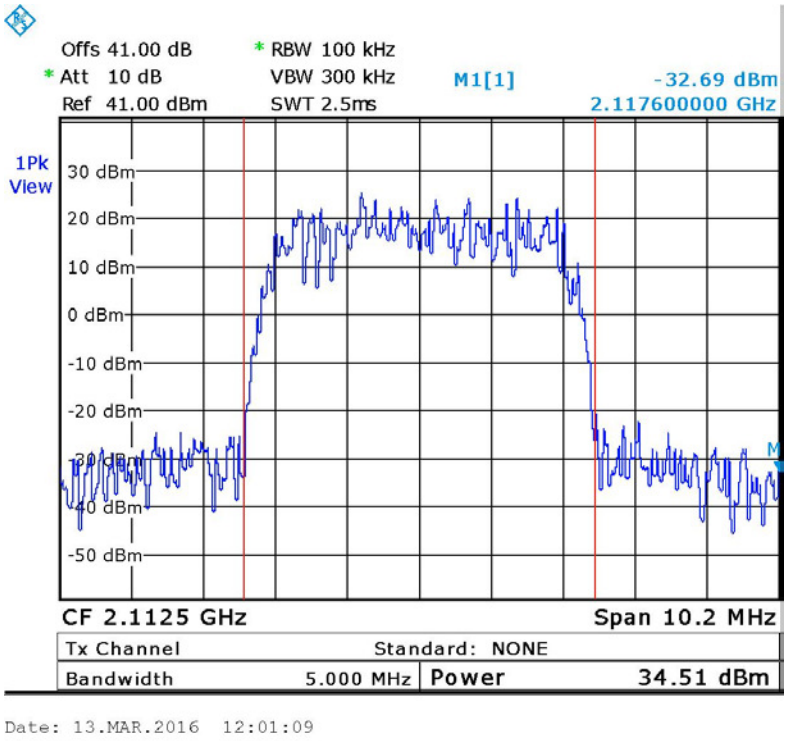

Figure 15. — W-CDMA (2112.5 MHz)

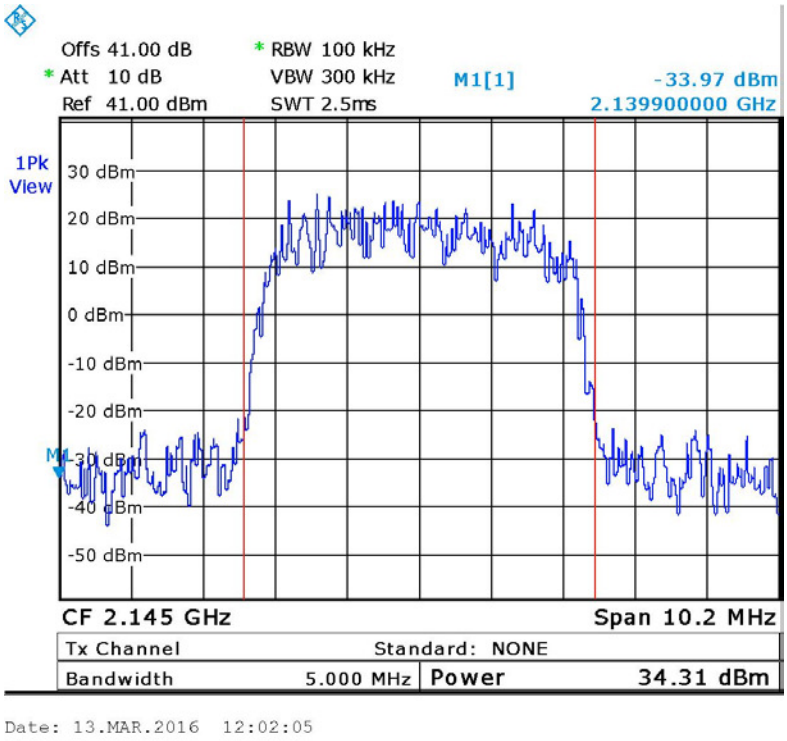

Figure 16. — W-CDMA (2145.0MHz)

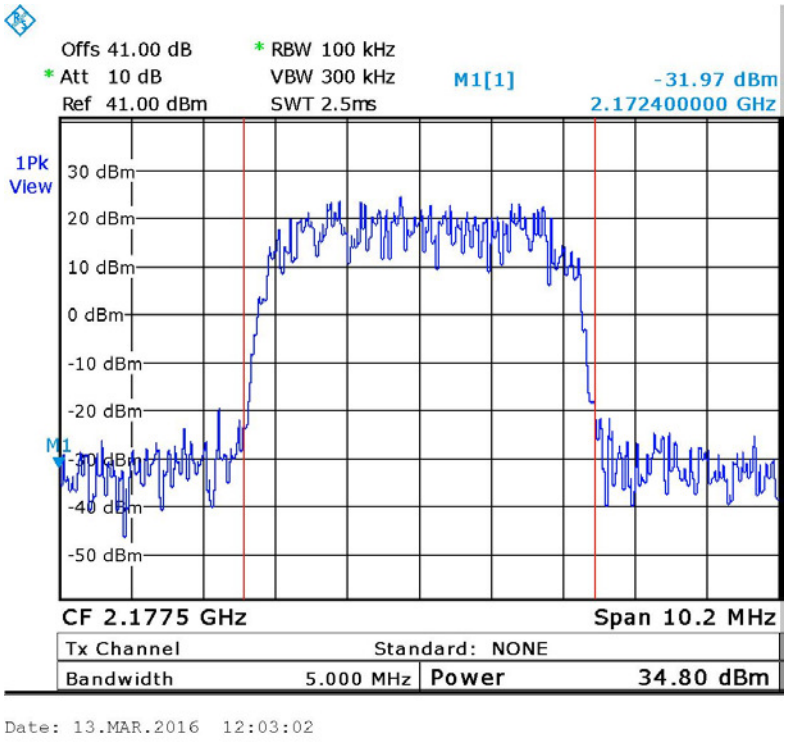

Figure 17. — W-CDMA (2177.5MHz)

4.5 Test Equipment Used; RF Power Output AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXG Vector Signal Generator	Agilent	N5172B	MY51350518	May 3, 2013	May 3, 2016
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	February 28, 2017
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	March 1, 2015	March 31, 2016

Figure 18 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=41.0 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 Limit

N/A

5.4 Results

Modulation	Port	Operating Frequency (MHz)	Reading (MHz)
LTE 64QAM	Input	2115.0	8.90
	Output	2115.0	8.90
	Input	2145.0	8.90
	Output	2145.0	8.90
	Input	2175.0	8.90
	Output	2175.0	8.94
GSM	Input	2111.2	0.24
	Output	2111.2	0.24
	Input	2145.0	0.24
	Output	2145.0	0.24
	Input	2178.8	0.24
	Output	2178.8	0.24
WCDMA	Input	2112.5	4.19
	Output	2112.5	4.17
	Input	2145.0	4.19
	Output	2145.0	4.17
	Input	2177.5	4.19
	Output	2177.5	4.17

Figure 19 Occupied Bandwidth AWS

See additional information in *Figure 20* to *Figure 37*.

JUDGEMENT: Passed

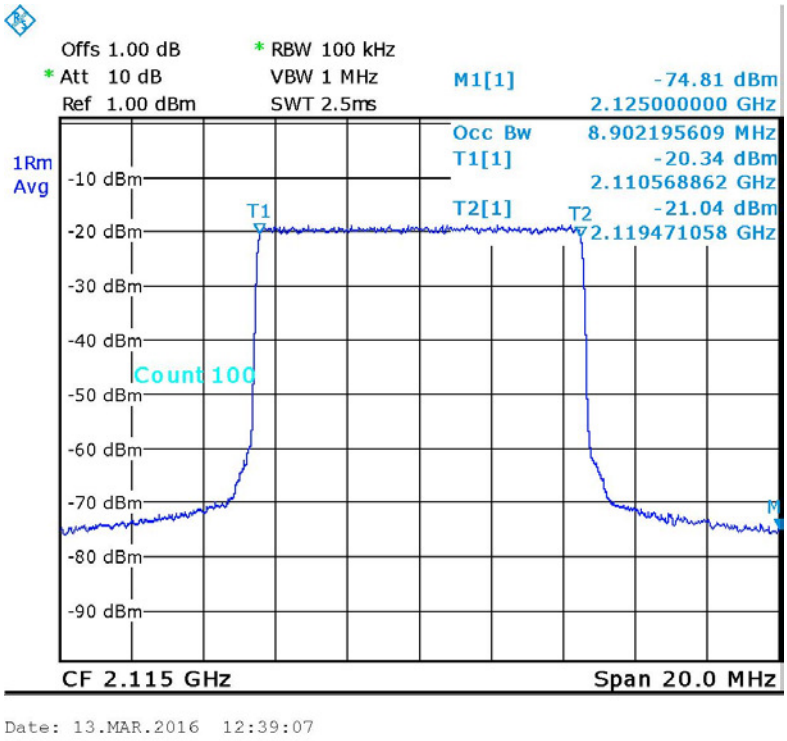

Figure 20. — LTE 64QAM (2115.0 MHz) IN

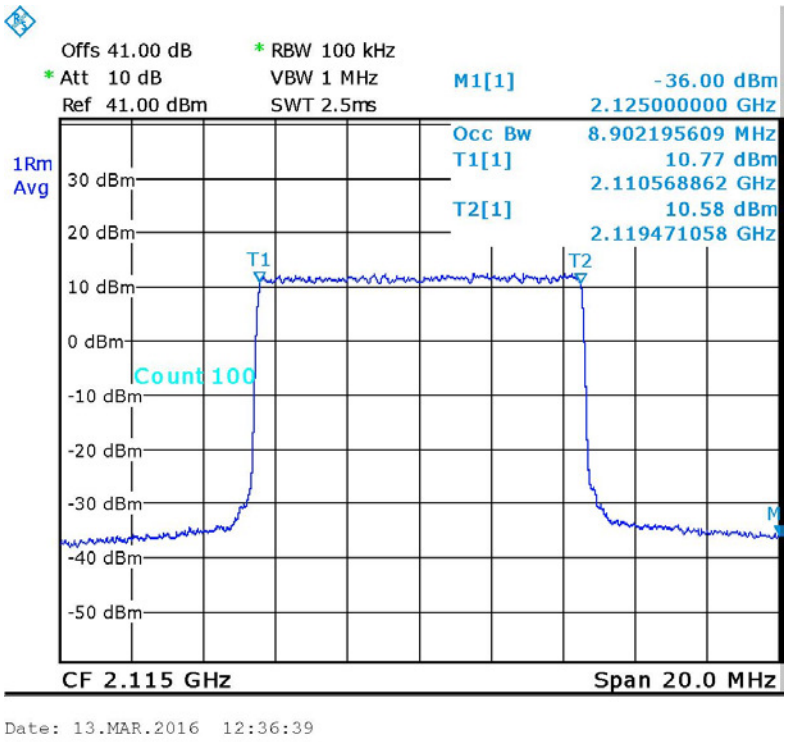

Figure 21. — LTE 64QAM (2115.0 MHz) OUT

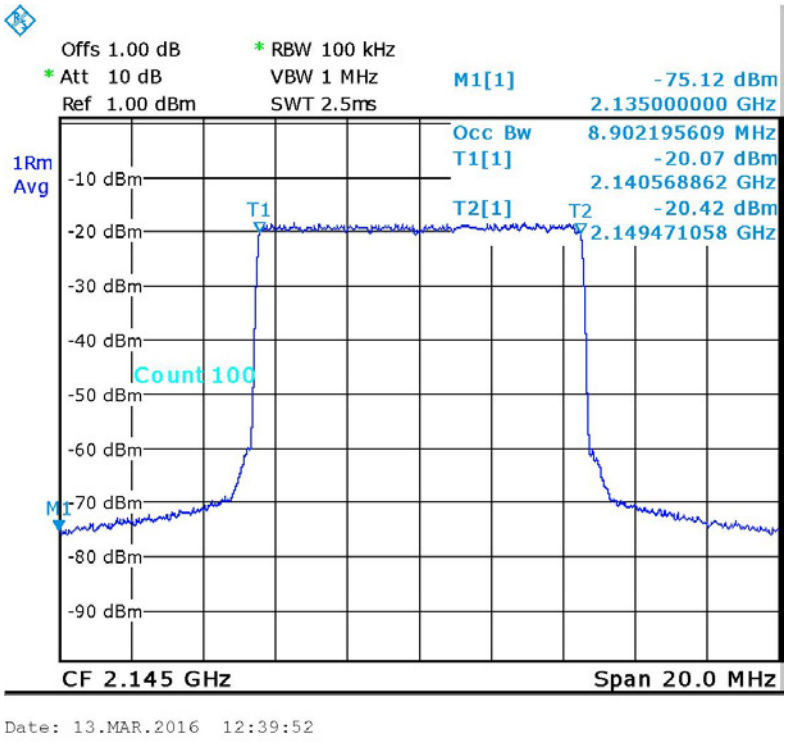

Figure 22. — LTE 64QAM (2145.0MHz) IN

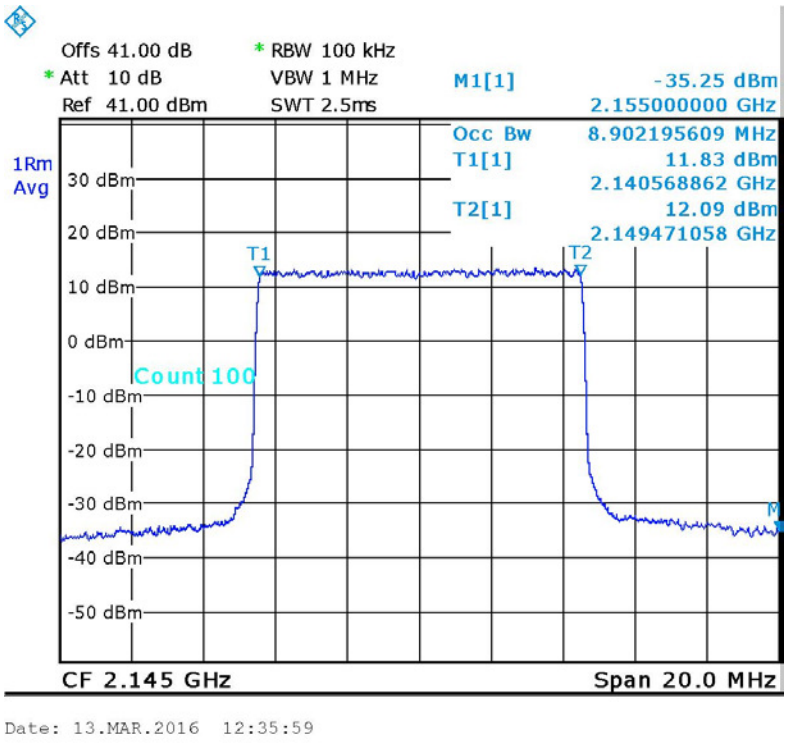

Figure 23. — LTE 64QAM (2145.0MHz) OUT

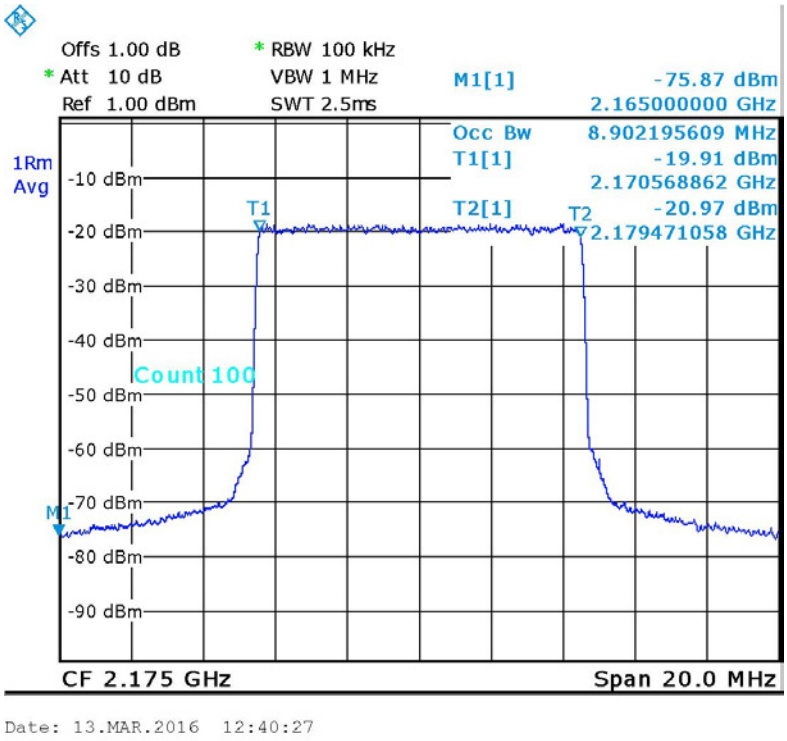

Figure 24. — LTE 64QAM (2175.0 MHz) IN

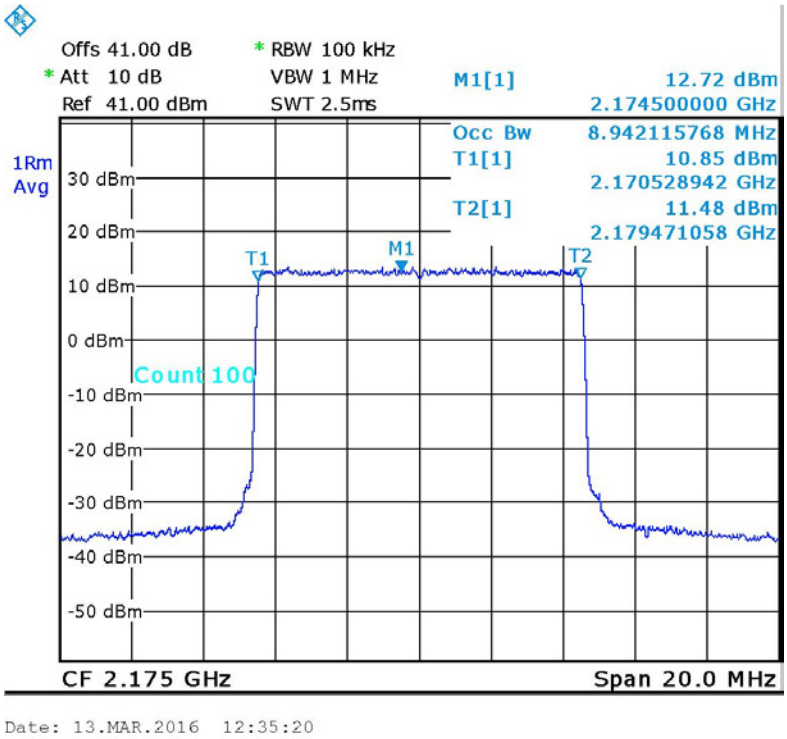

Figure 25. — LTE 64QAM (2175.0 MHz) OUT

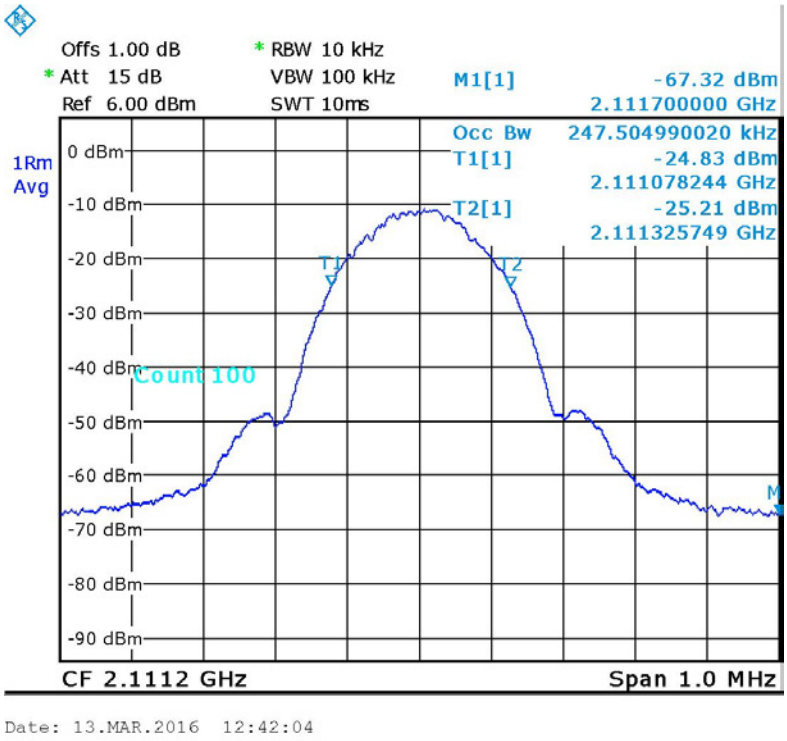

Figure 26. — GSM (2111.2 MHz) IN

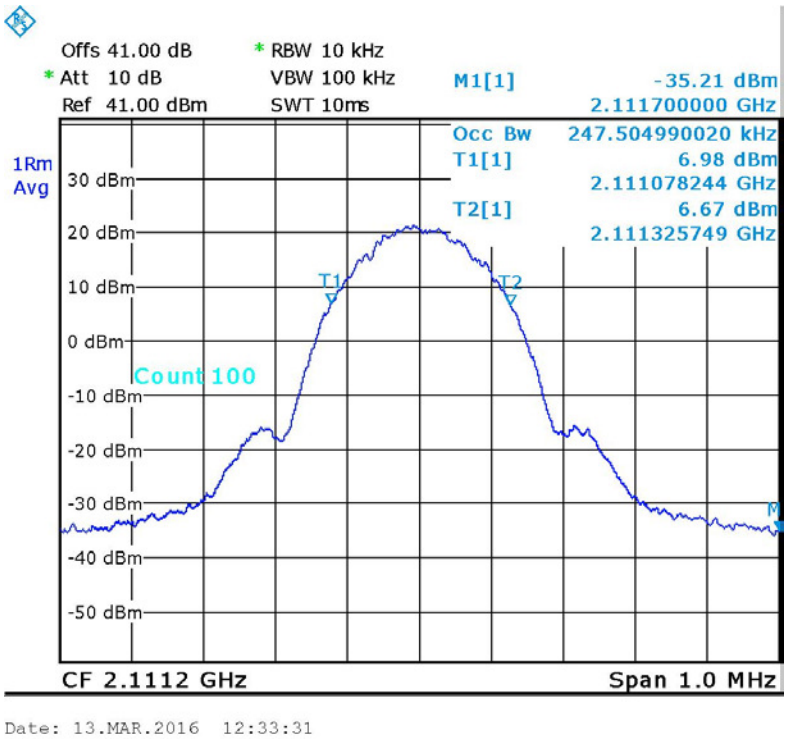

Figure 27. — GSM (2111.2 MHz) OUT

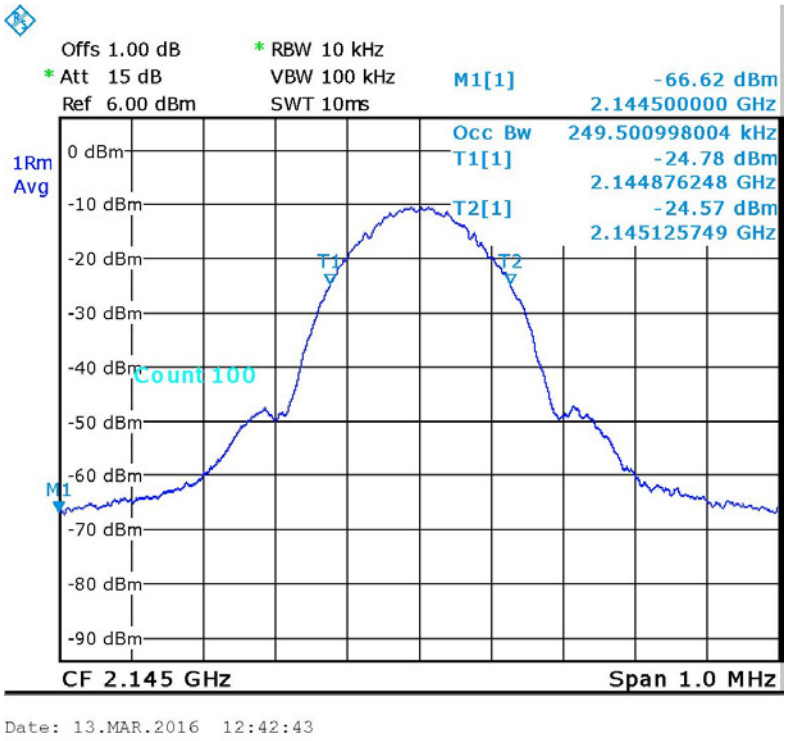

Figure 28. — GSM (2145.0MHz) IN

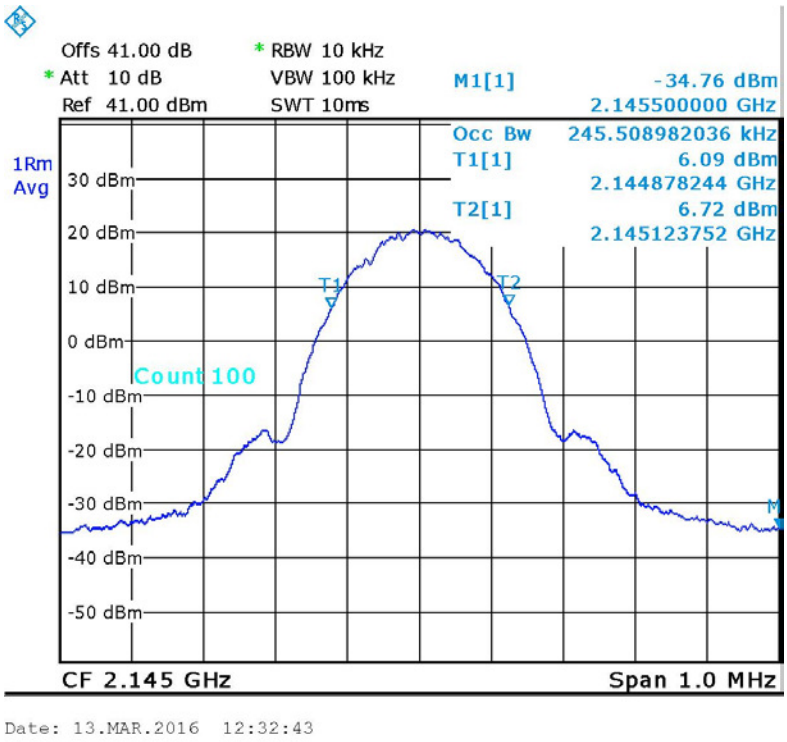

Figure 29. — GSM (2145.0MHz) OUT

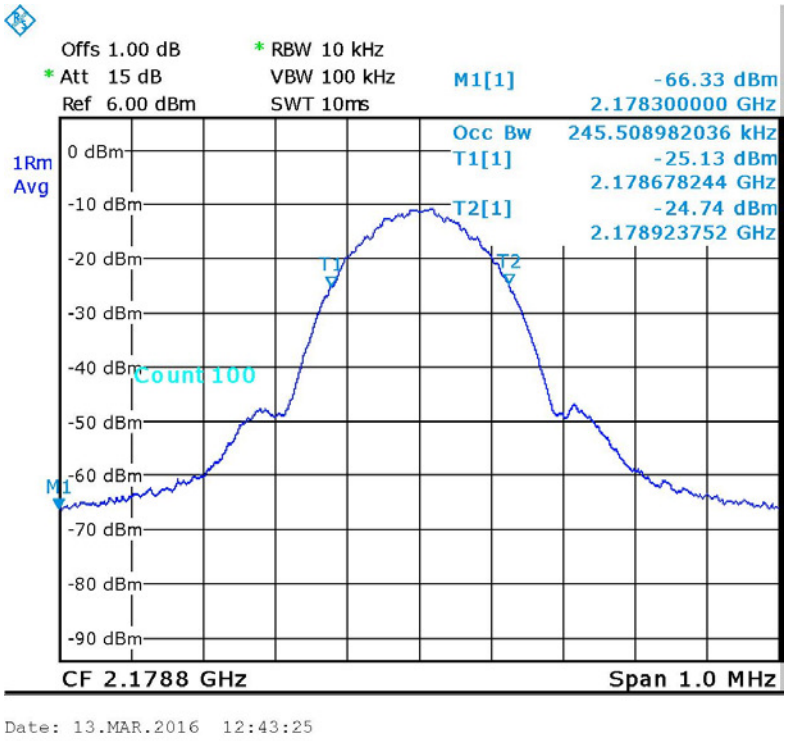

Figure 30. — GSM (2178.8 MHz) IN

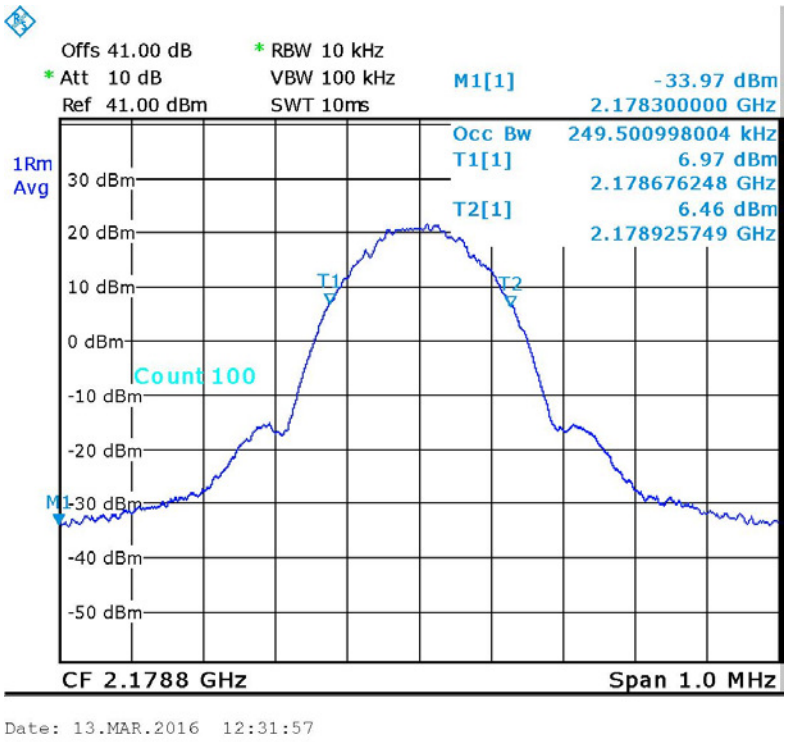

Figure 31. — GSM (2178.8 MHz) OUT

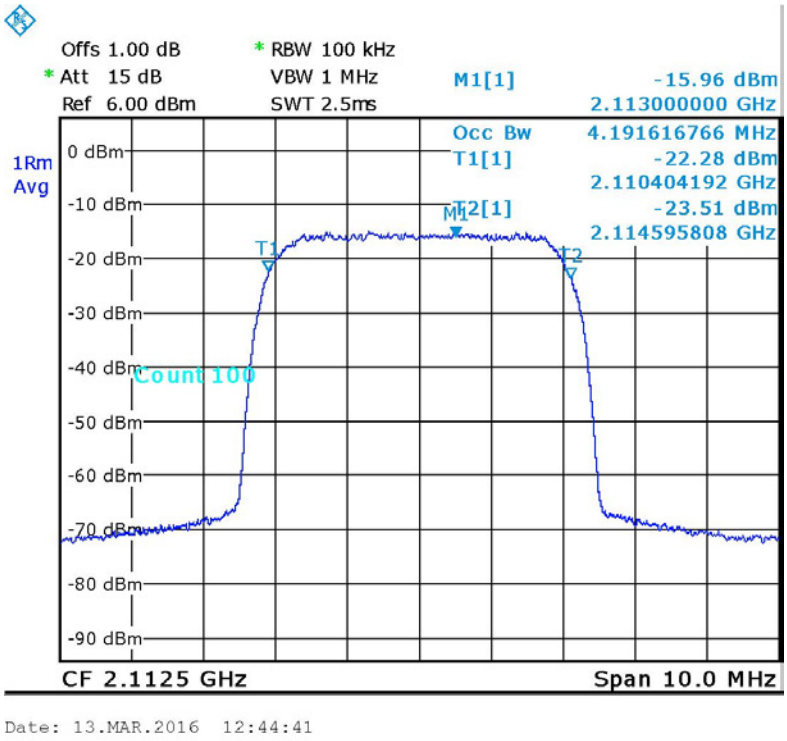

Figure 32. — W-CDMA (2112.5 MHz) IN

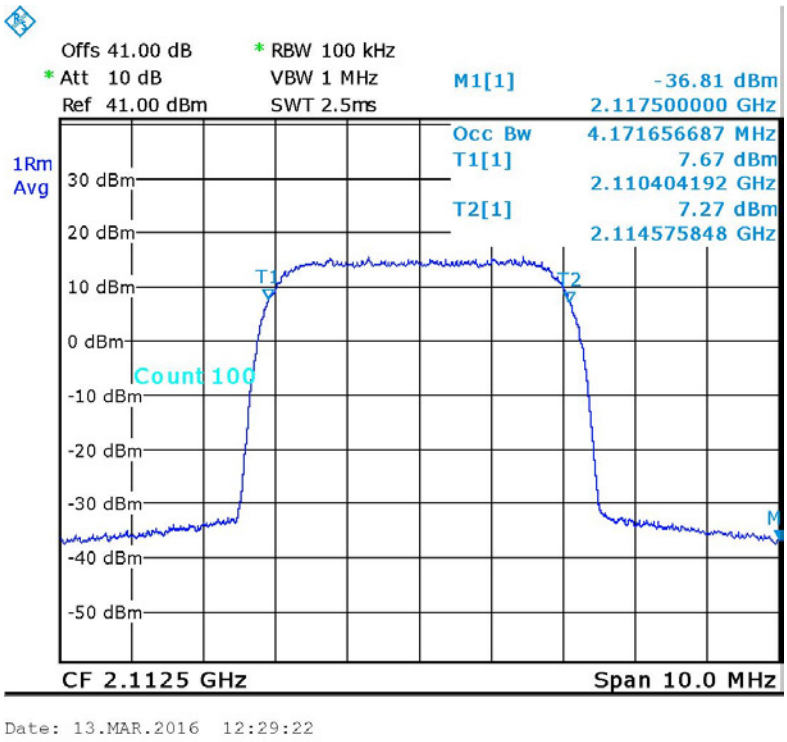

Figure 33. — W-CDMA (2112.5 MHz) OUT

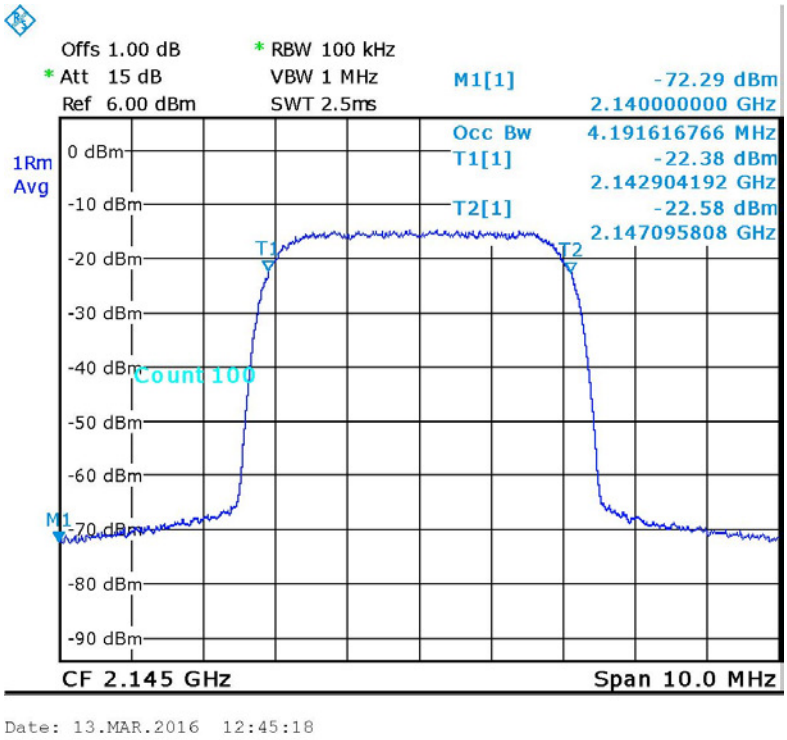

Figure 34. — W-CDMA (2145.0MHz) IN

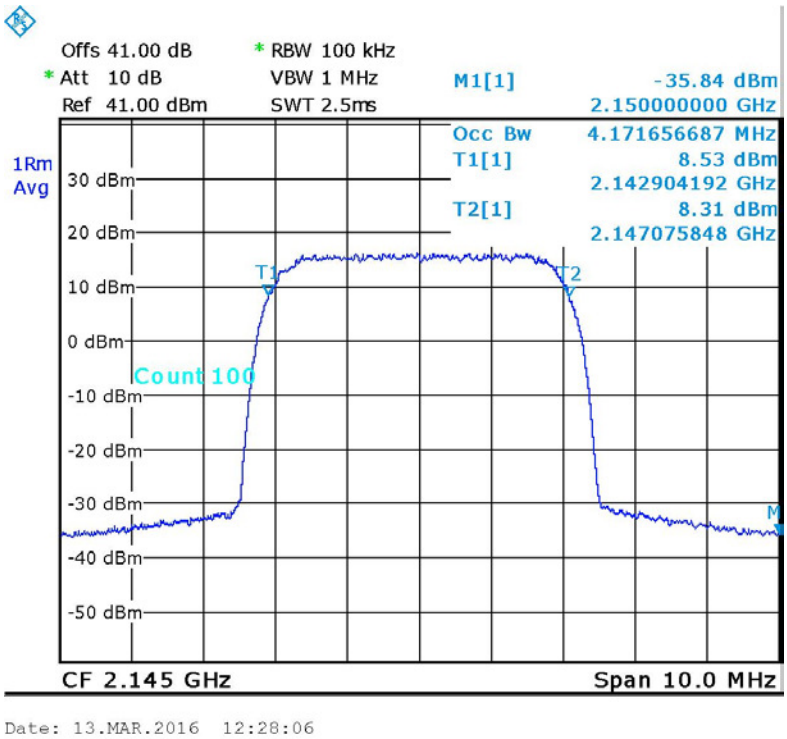

Figure 35. — W-CDMA (2145.0MHz) OUT

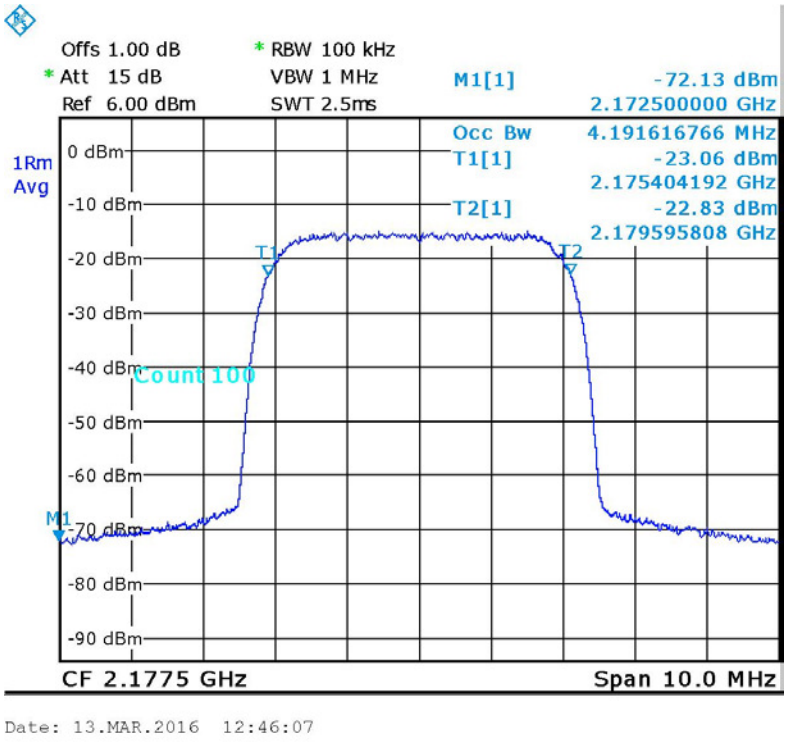

Figure 36. — W-CDMA (2177.5 MHz) IN

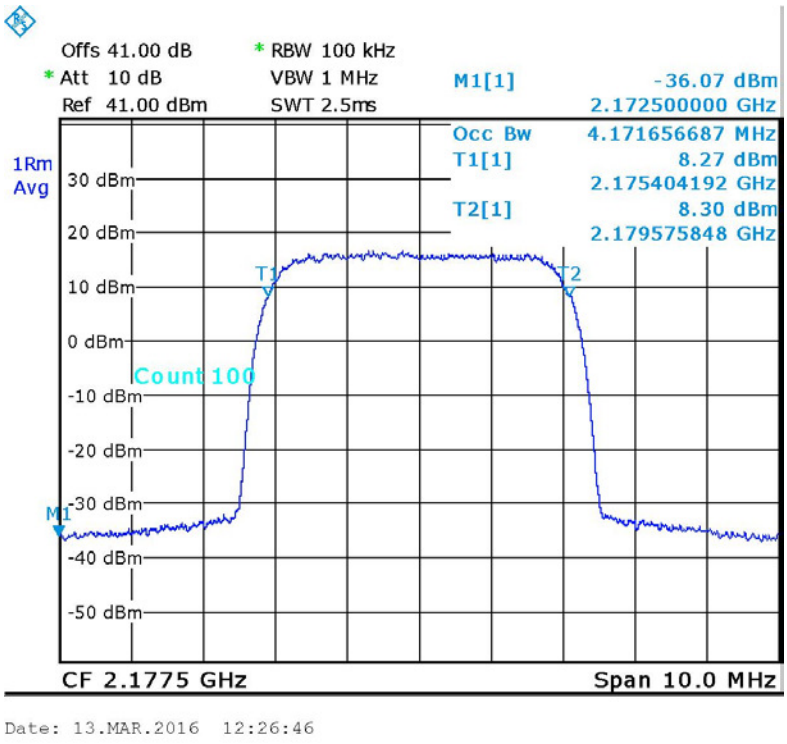

Figure 37. — W-CDMA (2177.5 MHz) OUT

5.5 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXG Vector Signal Generator	Agilent	N5172B	MY51350518	May 3, 2013	May 3, 2016
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	February 28, 2017
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	March 1, 2015	March 31, 2016

Figure 38 Test Equipment Used

6. Spurious Emissions at Antenna Terminals AWS

6.1 Test Specification

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

6.2 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max loss = 44.0 dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10.0 kHz for the frequency range
150.0 kHz–1.0 MHz, 100.0 kHz for the frequency range 1.0 MHz – 30.0 MHz, and 1.0MHz for the frequency range 30.0 MHz - 22.0 GHz.

6.3 Limit

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.

6.4 Results

See additional information in *Figure 39* to *Figure 47*.

JUDGEMENT: Passed

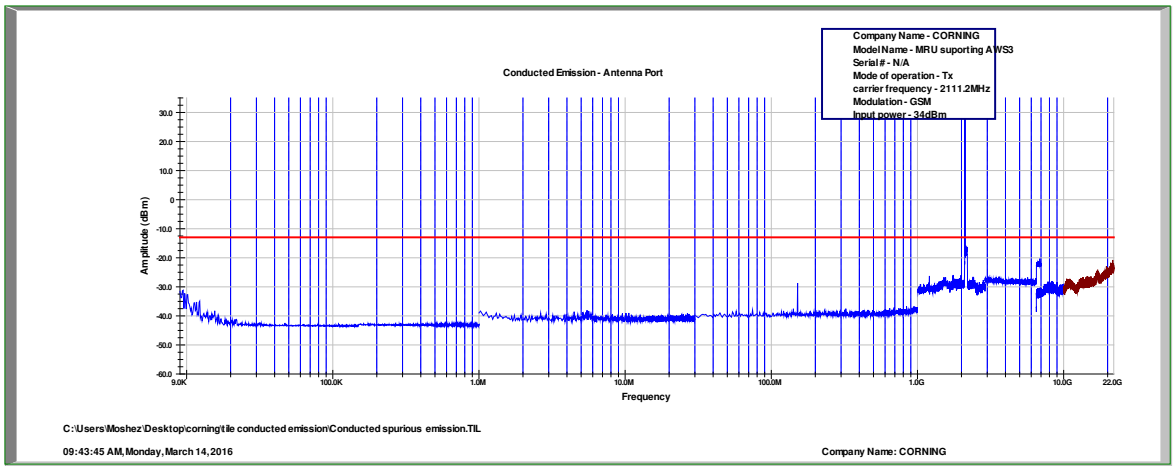

Figure 39 Spurious Emissions at Antenna Terminals GSM, 2111.2MHz

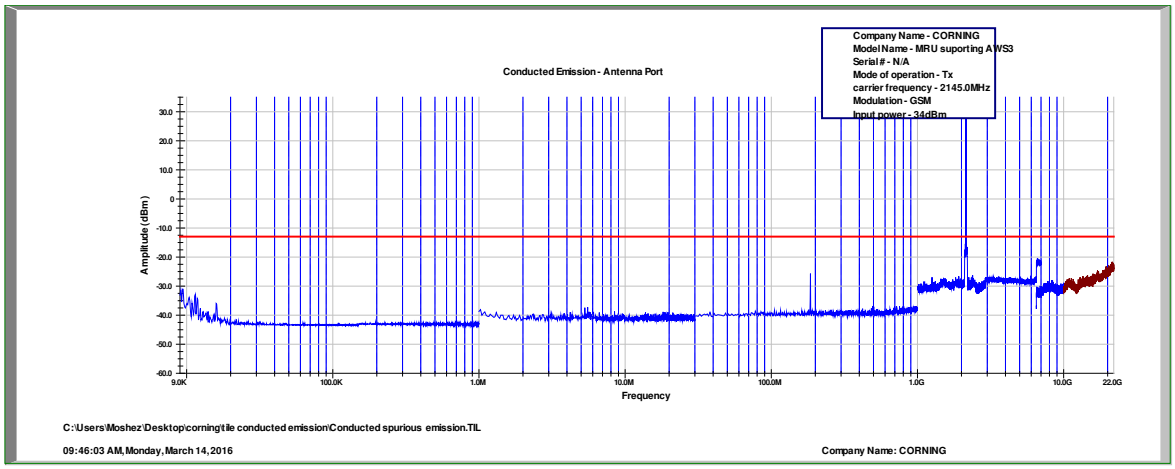

Figure 40 Spurious Emissions at Antenna Terminals GSM, 2145.0MHz

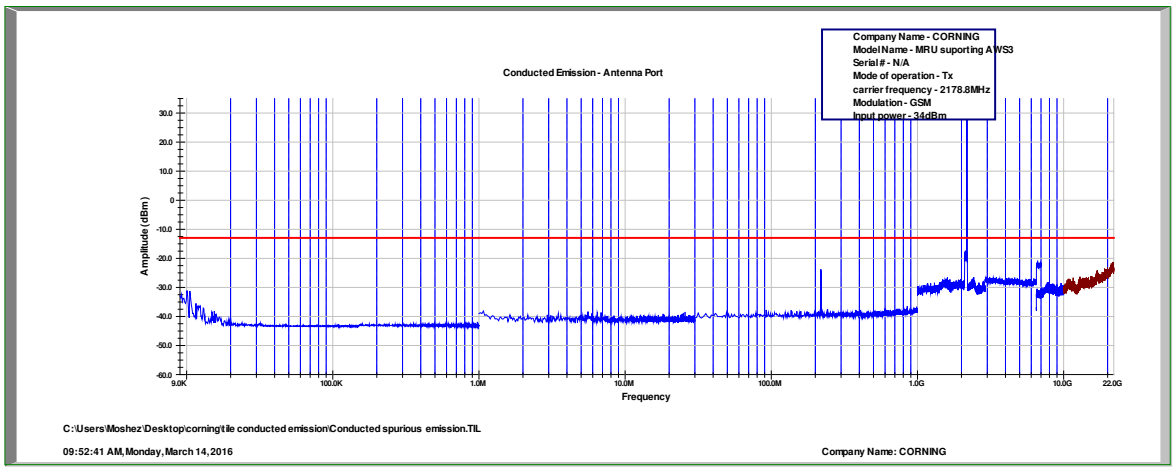

Figure 41 Spurious Emissions at Antenna Terminals GSM, 2178.8MHz

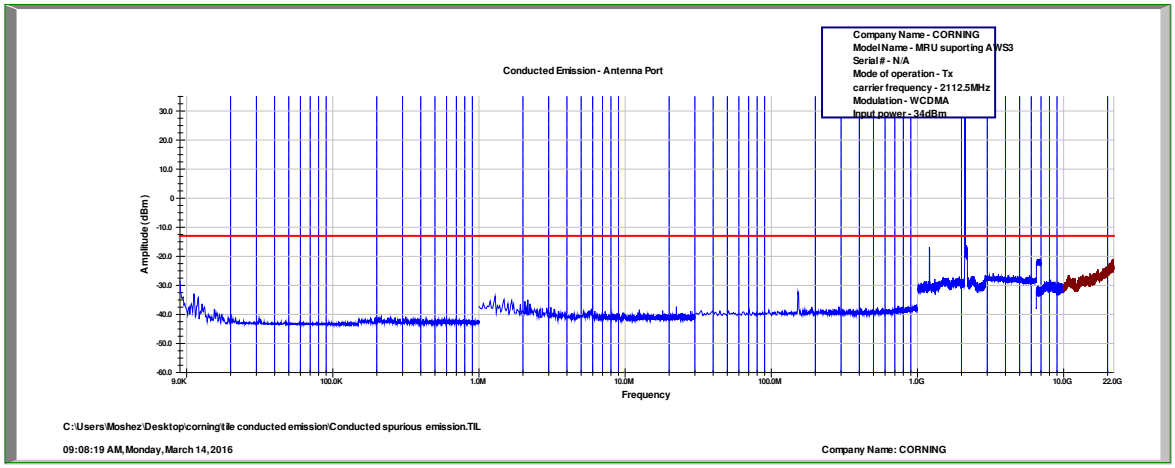

Figure 42 Spurious Emissions at Antenna Terminals WCDMA, 2112.5MHz

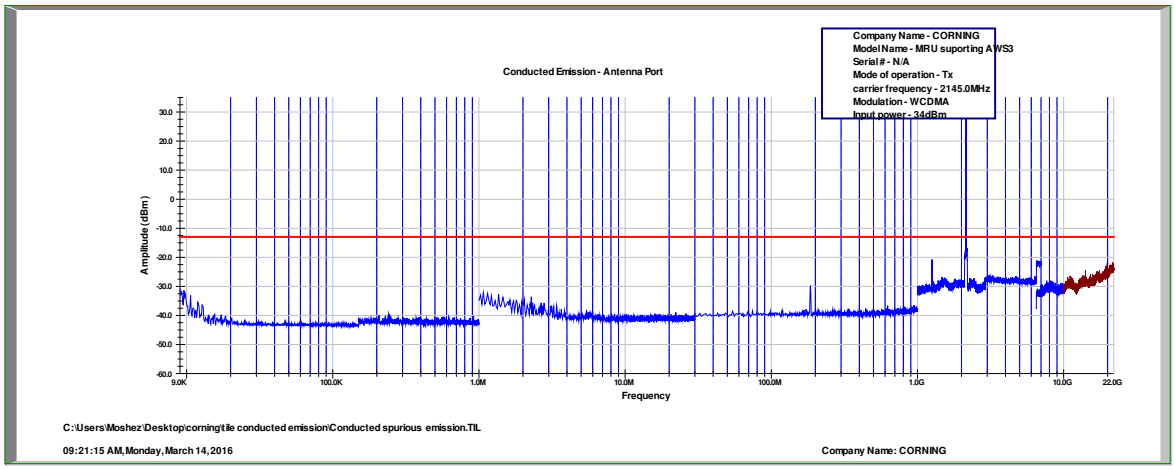

Figure 43 Spurious Emissions at Antenna Terminals WCDMA, 2145.0MHz

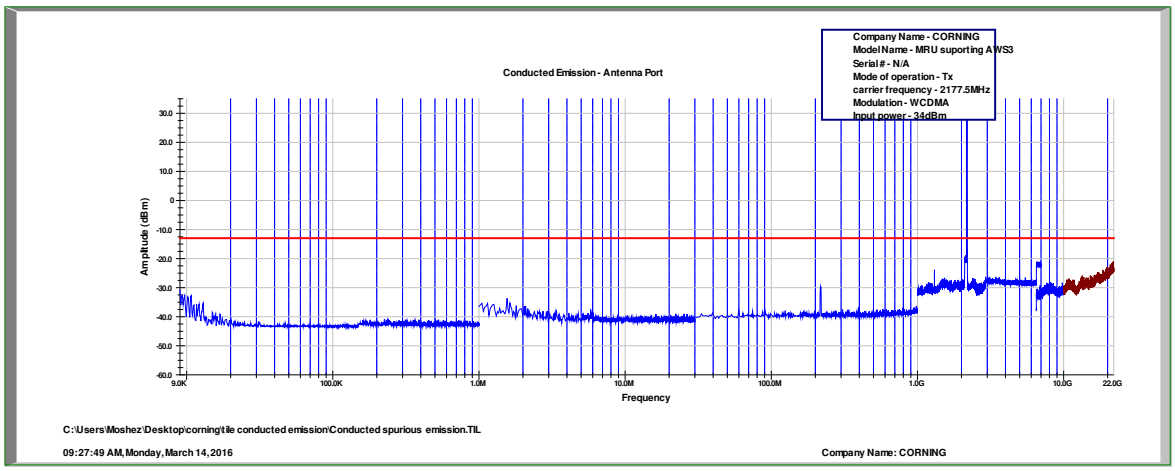

Figure 44 Spurious Emissions at Antenna Terminals WCDMA, 2177.5MHz

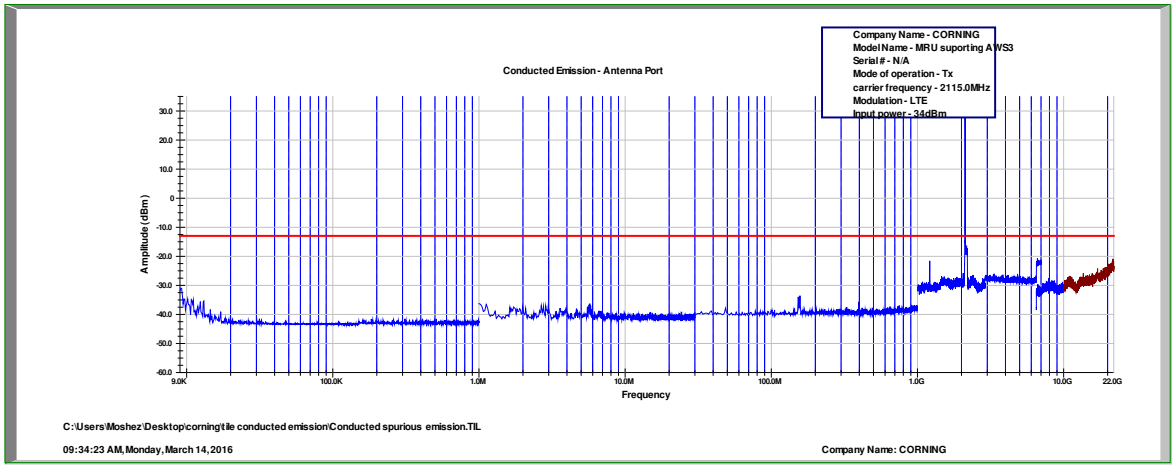

Figure 45 Spurious Emissions at Antenna Terminals LTE, 2115.0MHz

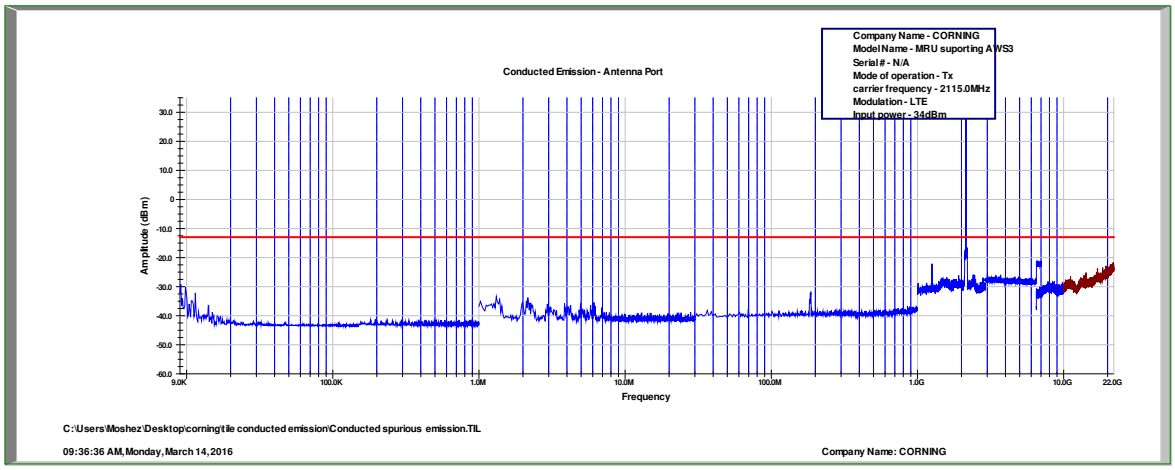

Figure 46 Spurious Emissions at Antenna Terminals LTE, 2145.0MHz

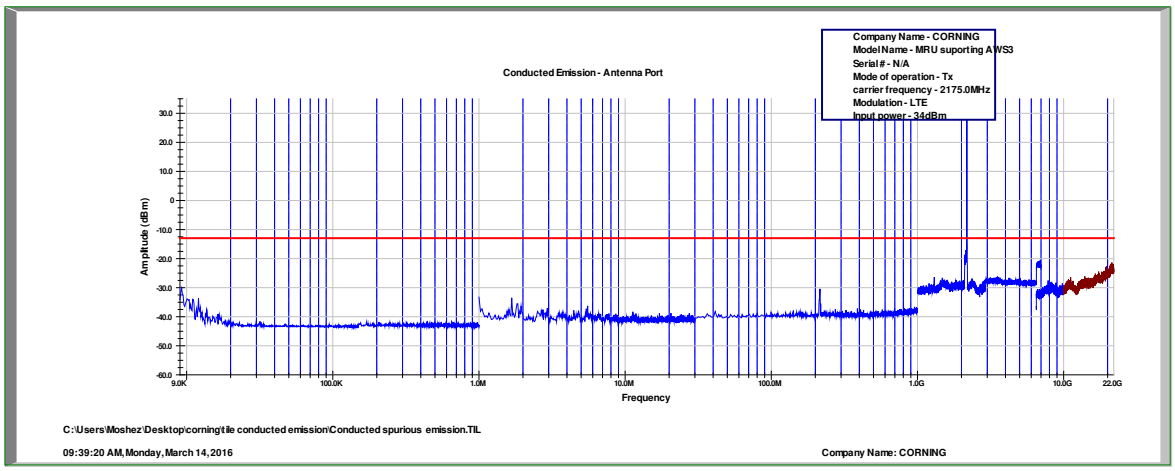

Figure 47 Spurious Emissions at Antenna Terminals LTE, 2175.0MHz

6.5 Test Equipment Used; Spurious Emissions at Antenna Terminals AWS

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXG Vector Signal Generator	Agilent	N5172B	MY51350518	May 3, 2013	May 3, 2016
Spectrum Analyzer	HP	8592L	3826A01204	March 13, 2016	March 13, 2017
30 dB Attenuator	MCL	BW-S30W5	533	June 1, 2014	June 1, 2016

Figure 48 Test Equipment Used