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TESTING Cert No.1152.01

DATE: 19 January 2017

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)

(LTE Section)

Tested: _____
M. Zohar

Approved by: _____
D. Shidlowsky

Measurement/Technical Report for
Corning Optical Communication Wireless
ONE- Optical Network Evolution Wireless Platform
(LTE SECTION)

FCC ID: OJF1MRU70CR

This report concerns:	Original Grant: X Class II change: Class I change:
Equipment type:	B21 – Part 20 Industrial Booster (CMRS)
Limits used:	47CFR Parts 2, 27

Measurement procedure used is KDB 971168 D03 v01 and
KDB 935210 D05 v01r01

Substitution Method used as in ANSI/TIA-603-D: 2010

Application for Certification
prepared by:
R. Pinchuck
ITL (Product Testing) Ltd.
1 Bat Sheva St.
Lod 7120101
Israel
e-mail rpinchuck@itl.co.il

Applicant for this device:
(different from "prepared by")
Habib Riazi
Corning Optical Communication Wireless
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Herndon, VA. 20171
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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 Wireless Platform
Equipment Model No.:	MRU (Mid Power Remote Unit)
Equipment Serial No.:	05154901B9
Date of Receipt of E.U.T:	November 16, 2016
Start of Test:	November 16, 2016
End of Test:	December 7, 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 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

Mid Power Remote Unit for Neutral Host Solution.

Modular architecture supports LTE700, ESMR+CELL, PCS, AWS, WCS

Integrated 2.5 GHz expansion ready

Composite Output Power
AWS: 34dBm
PCS, WCS: 33dBm
700, ESMR & CELL: 30dBm

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in KDB 971168 D03 v01, KDB 935210 D05 v01r01 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 IL1005.

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.
Testing was performed on the following configuration:

Frequency Range (MHz)		
Service/Band	**Downlink (DL)**	**Technology**
700 MHz	728-757	LTE

2.2 EUT Exercise Software

The Element Management System ver. 2.0 used for commands delivery. These commands are used to enable/disable the EUT transmission. EUT Embedded SW versions is mru_da64_20_02.bin.

2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

2.4 Equipment Modifications

No modifications were needed in order to achieve compliance.

2.5 Configuration of Tested System

Product Name	ONE Wireless Platform
Model Name	MRU (Mid Power Remote Unit)
Working voltage	115.0VAC/48.0VDC
Mode of operation	Industrial Booster for LTE band
Modulations	QPSK, 16QAM, 64QAM
Assigned Frequency Range	728.0-758.0MHz
Transmit power	~30.0 dBm
DATA rate	N/A
Modulation BW	10.0MHz

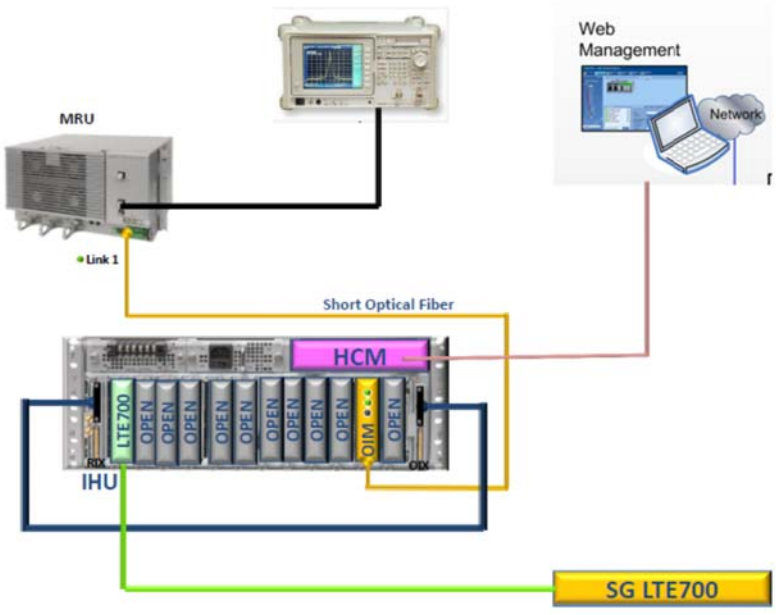

Figure 1. Test Set-Up Conducted

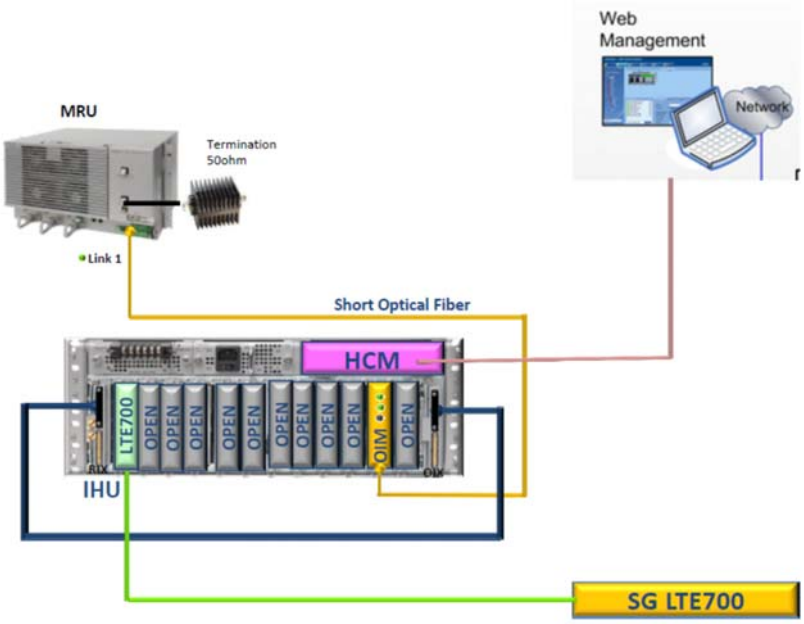

Figure 2. Test Set-Up Radiated

3. Test Set-up Photos

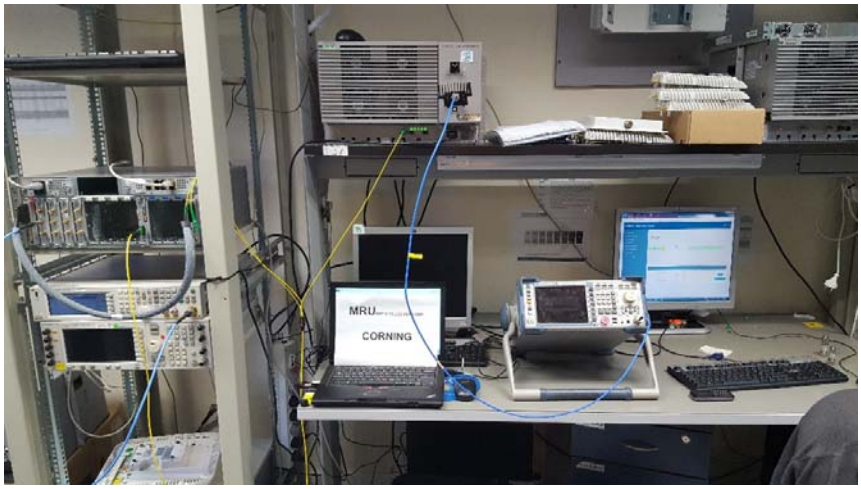

Figure 3. Conducted Emission From Antenna Port Tests

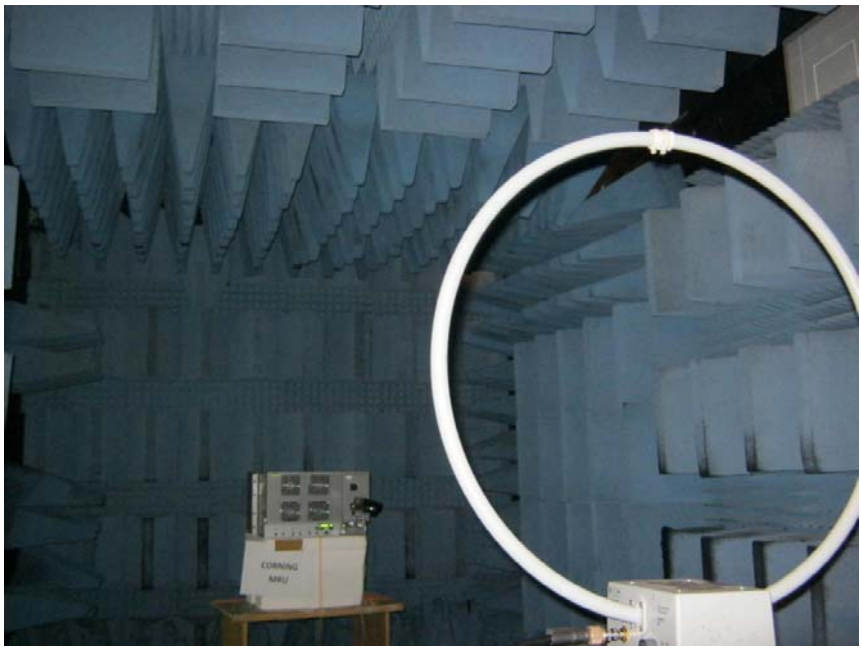

Figure 4. Radiated Emission Test

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

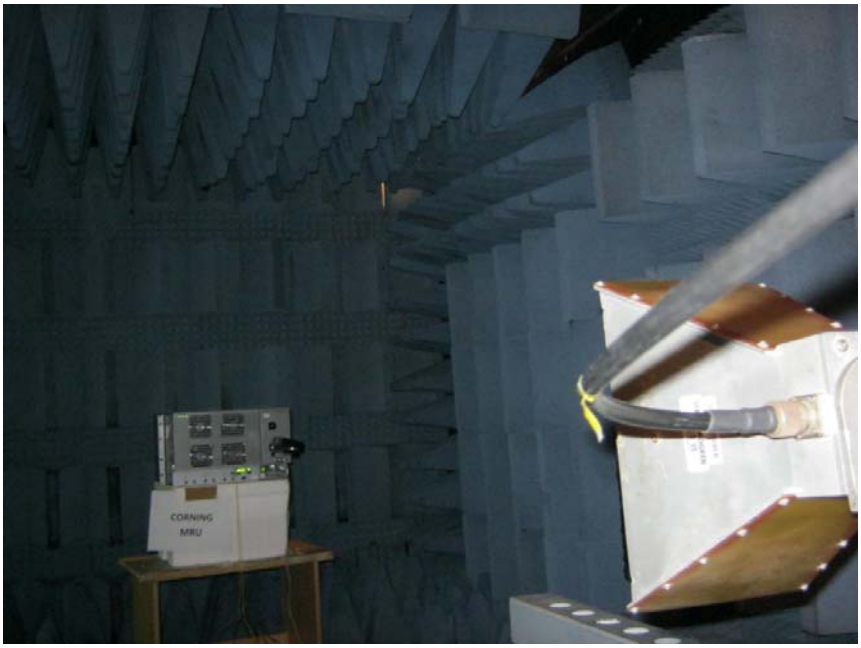

Figure 7. Radiated Emission Test

Figure 8. Intermodulation Conducted Emission Test

4. Peak Output Power LTE

4.1 Test Specification

FCC Part 27, Subpart C (27.50)

4.2 Test Procedure

(Temperature (22°C)/ Humidity (39%RH))

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. The Spectrum Analyzer was set to 100 kHz RBW.

4.3 Test Limit

Peak Power Output must not exceed 1000W (60 dBm).

4.4 Test Results

modulation	Operation Frequency	Reading	Antenna Gain	EIRP	Limit	Margin
	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
LTE 64QAM	733.0	30.5	12.5	43.0	60.0	-17.0
LTE 64QAM	747.0	30.6	12.5	43.1	60.0	-16.9
LTE 64QAM	753.0	31.2	12.5	43.7	60.0	-16.3
LTE 16QAM	733.0	31.0	12.5	43.5	60.0	-16.5
LTE 16QAM	747.0	30.8	12.5	43.3	60.0	-16.7
LTE 16QAM	753.0	30.6	12.5	43.1	60.0	-16.9
LTE QPSK	733.0	31.0	12.5	43.5	60.0	-16.5
LTE QPSK	747.0	30.9	12.5	43.4	60.0	-16.6
LTE QPSK	753.0	30.8	12.5	43.3	60.0	-16.7

Figure 9 Peak Output Power

JUDGEMENT: Passed by 16.3 dB

See additional information in *Figure 10* to *Figure 18.*

Peak Output Power (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

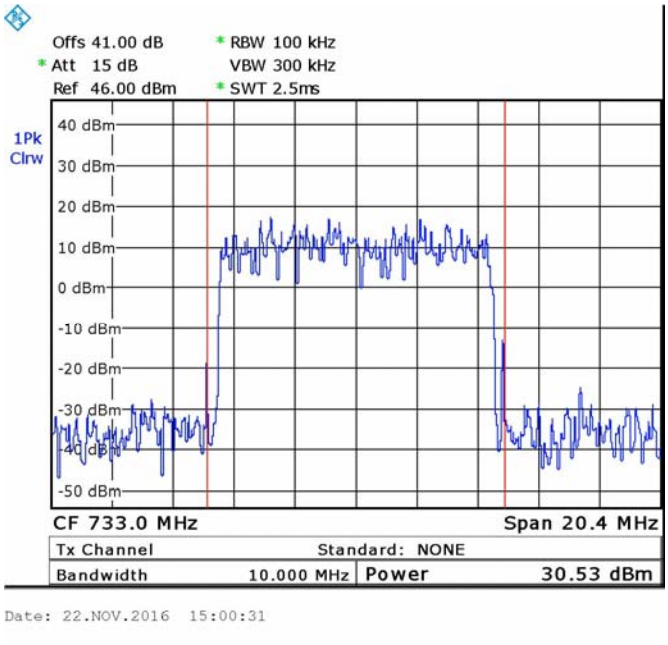

Figure 10. — 64QAM, 733 MHz

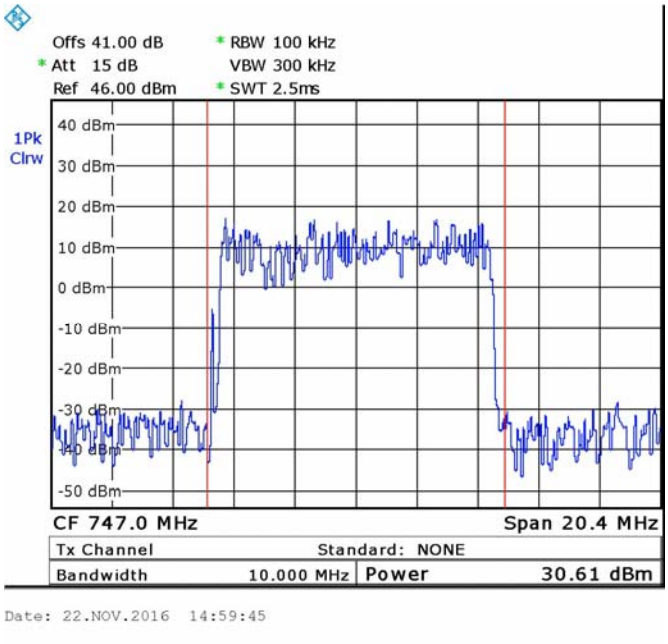

Figure 11. — 64QAM 747 MHz

Peak Output Power (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

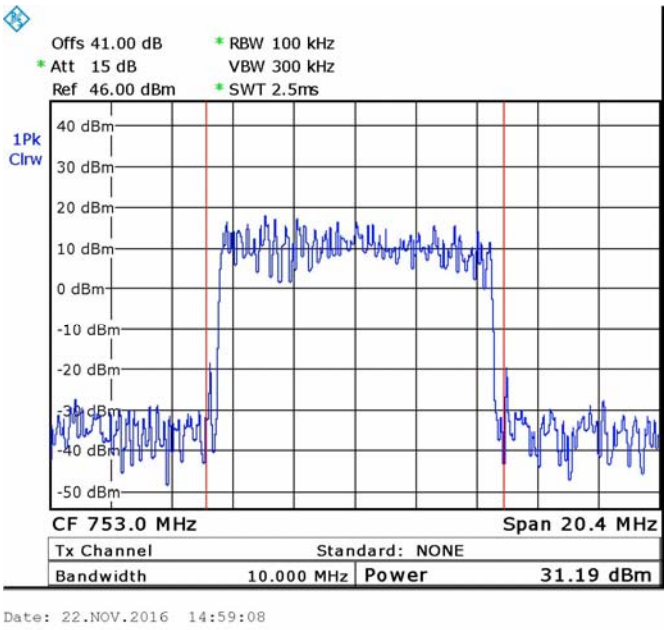

Figure 12. — 64QAM 753 MHz

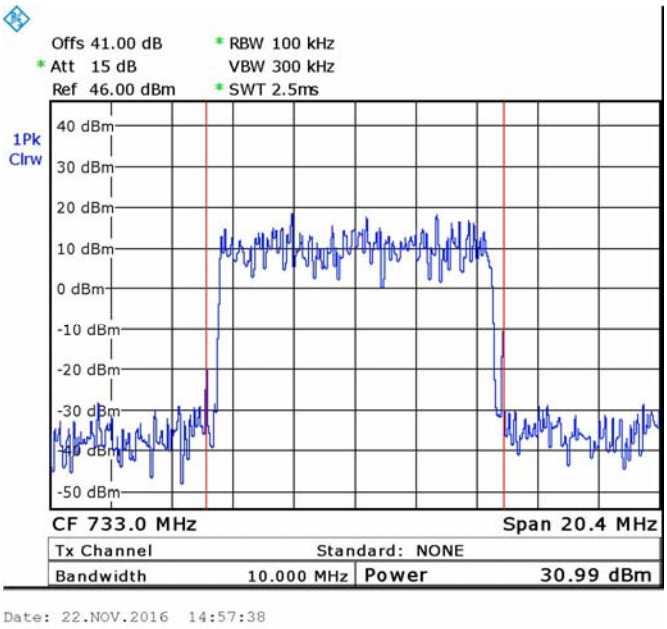

Figure 13. — 16QAM 733 MHz

Peak Output Power (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

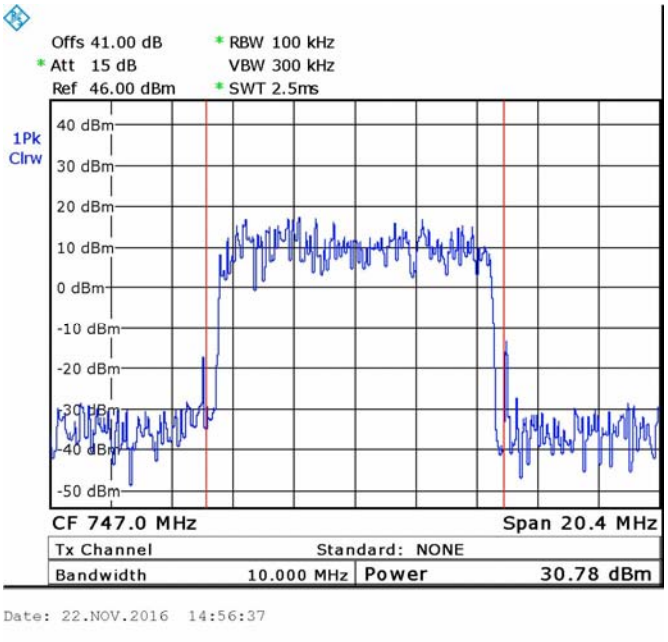

Figure 14. — 16QAM 747 MHz

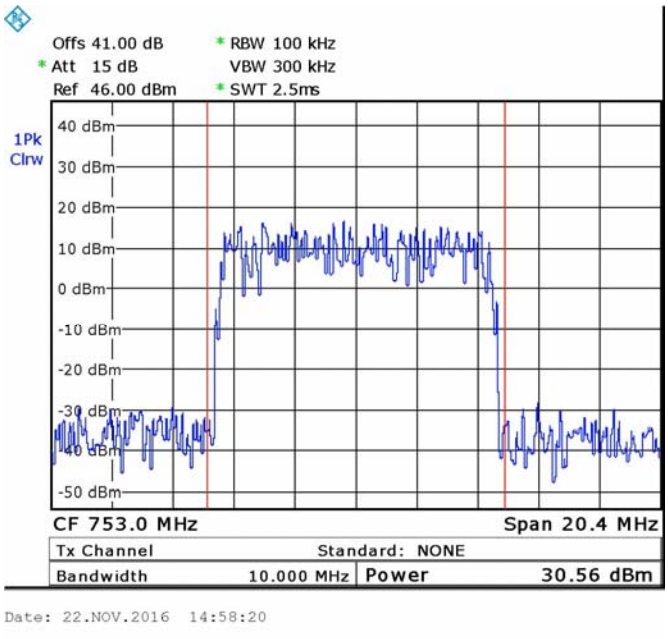

Figure 15. — 16QAM 753 MHz

Peak Output Power (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

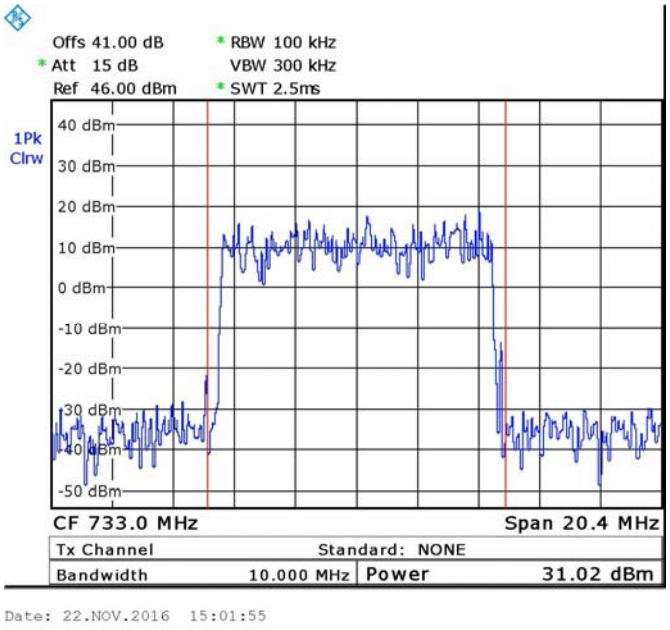

Figure 16. — QPSK 733 MHz

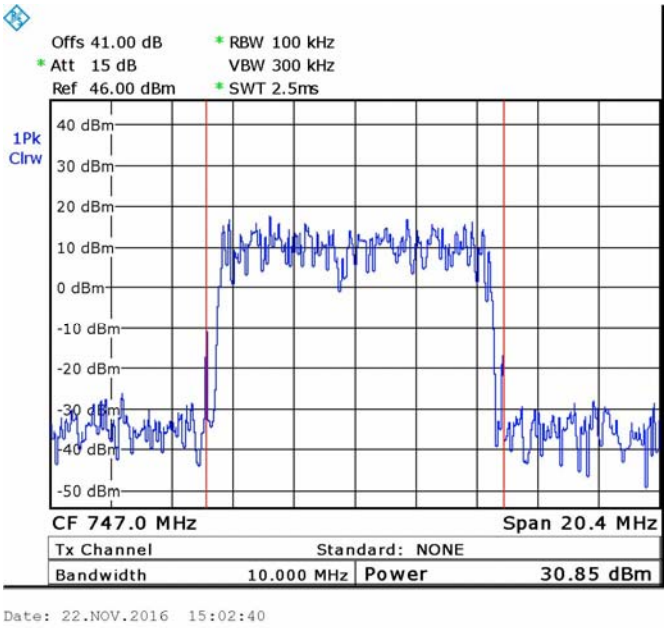

Figure 17. — QPSK 747 MHz

Peak Output Power (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

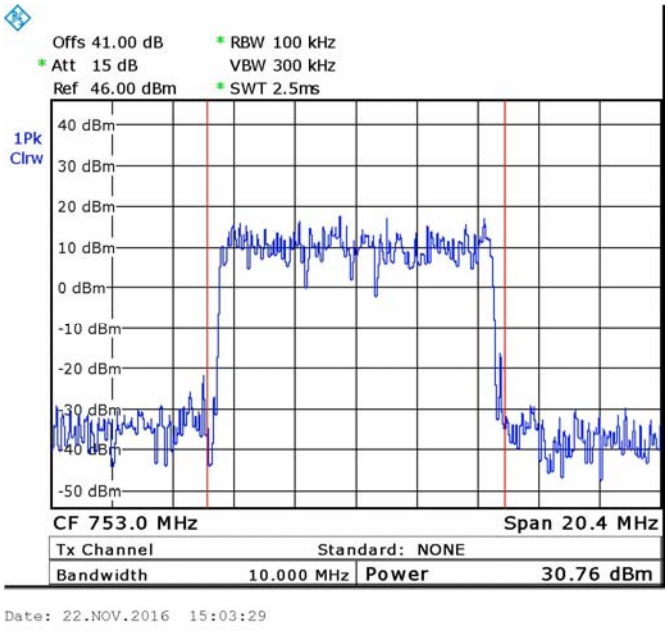

Figure 18. — QPSK 753 MHz

4.5 Test Equipment Used; Peak Output Power LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Date
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
MXG Vector Signal Generator	Agilent	N5182A	MY48180244	August 2, 2016	November 2, 2019
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	August 8, 2016	August 8, 2017

Figure 19 Test Equipment Used

5. Occupied Bandwidth (LTE)

5.1 Test Specification

FCC Part 2, Section 1049

5.2 Test Procedure

(Temperature (23°C)/ Humidity (39%RH))
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (loss=31.0 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 Test Limit

N/A

5.4 Test Results

Modulation	Port	Operating Frequency	Reading
	(Input/ Output)	(MHz)	(MHz)
LTE 64QAM	Input	733.0	8.9
LTE 64QAM	Output	733.0	8.9
LTE 64QAM	Input	747.0	8.9
LTE 64QAM	Output	747.0	8.9
LTE 64QAM	Input	753.0	8.9
LTE 64QAM	Output	753.0	8.9
LTE 16QAM	Input	733.0	8.9
LTE 16QAM	Output	733.0	8.9
LTE 16QAM	Input	747.0	8.9
LTE 16QAM	Output	747.0	8.9
LTE 16QAM	Input	753.0	8.9
LTE 16QAM	Output	753.0	8.9
LTE QPSK	Input	733.0	8.9
LTE QPSK	Output	733.0	8.9
LTE QPSK	Input	747.0	8.9
LTE QPSK	Output	747.0	8.9
LTE QPSK	Input	753.0	8.9
LTE QPSK	Output	753.0	8.9

Figure 20 Occupied Bandwidth

JUDGEMENT: Passed

See additional information in *Figure 21* to *Figure 38.*

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

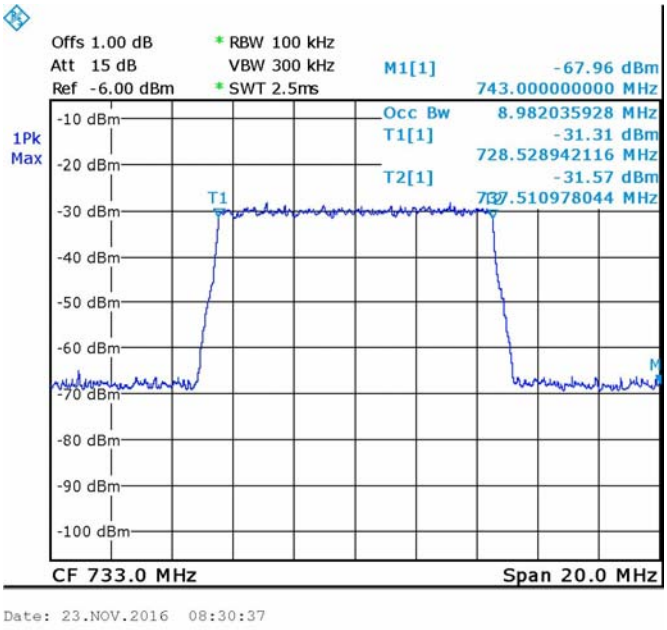

Figure 21. — 64QAM 733 MHz IN

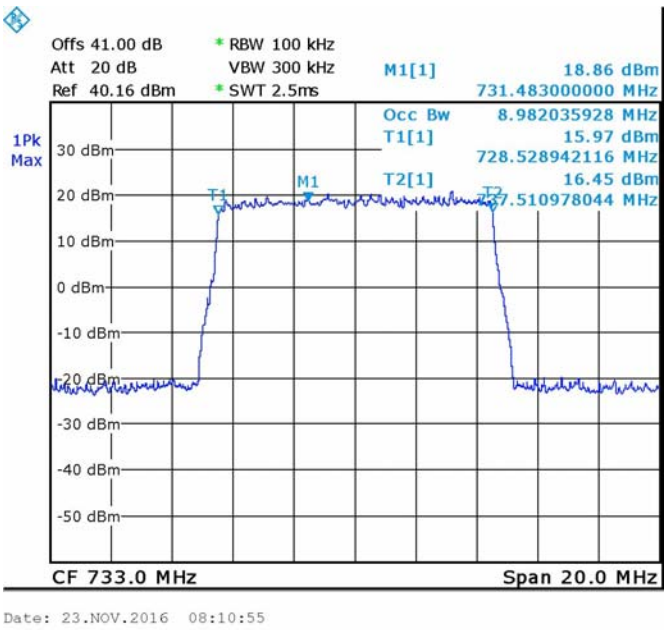

Figure 22. — 64QAM 733 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

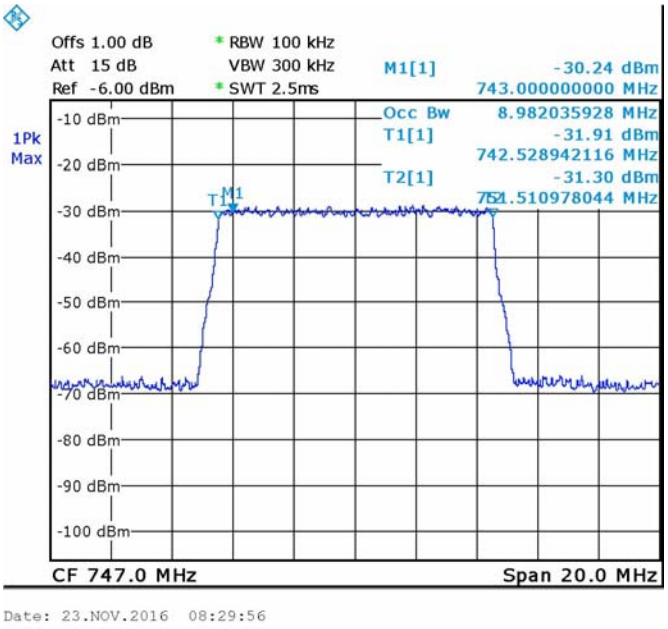

Figure 23. — 64QAM 747 MHz IN

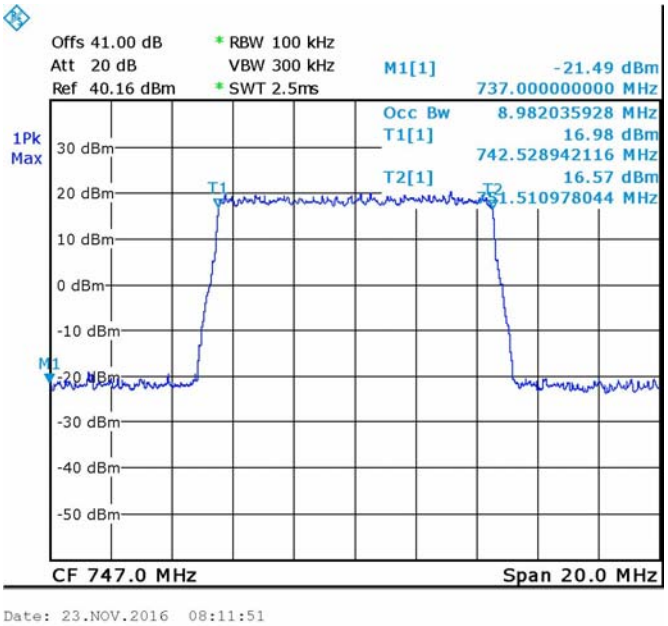

Figure 24. — 64QAM 747 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

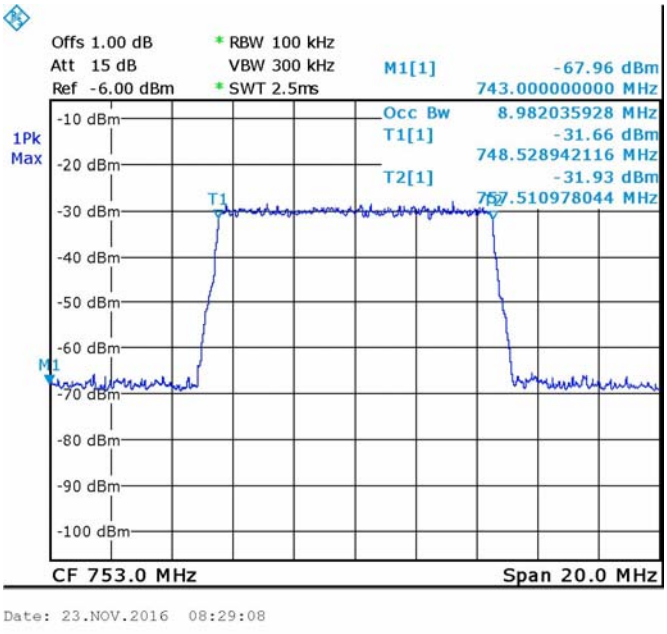

Figure 25. — 64QAM 753 MHz IN

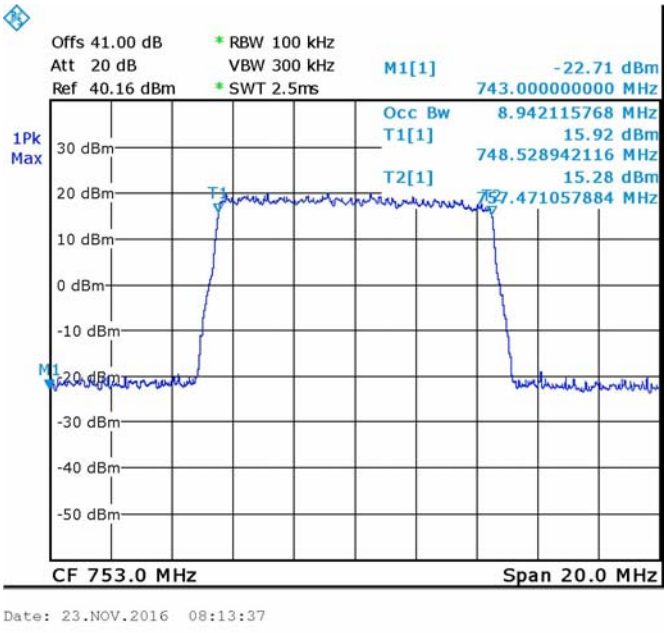

Figure 26. — 64QAM 753 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

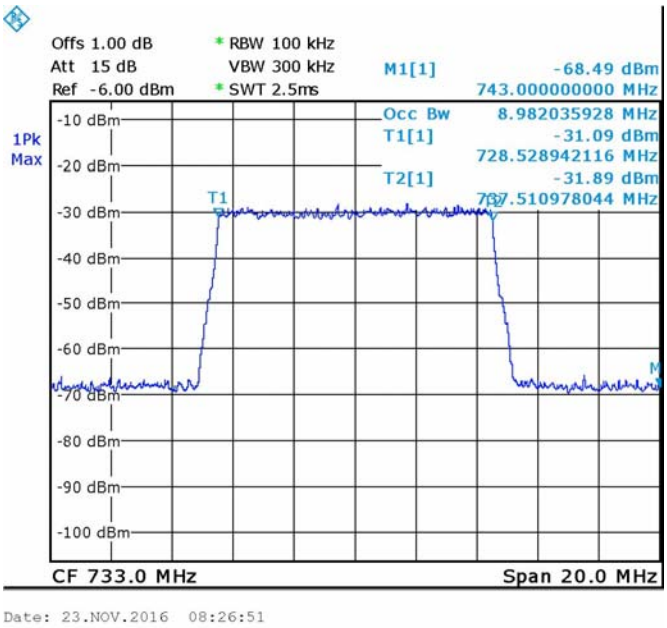

Figure 27. — 16QAM 733 MHz IN

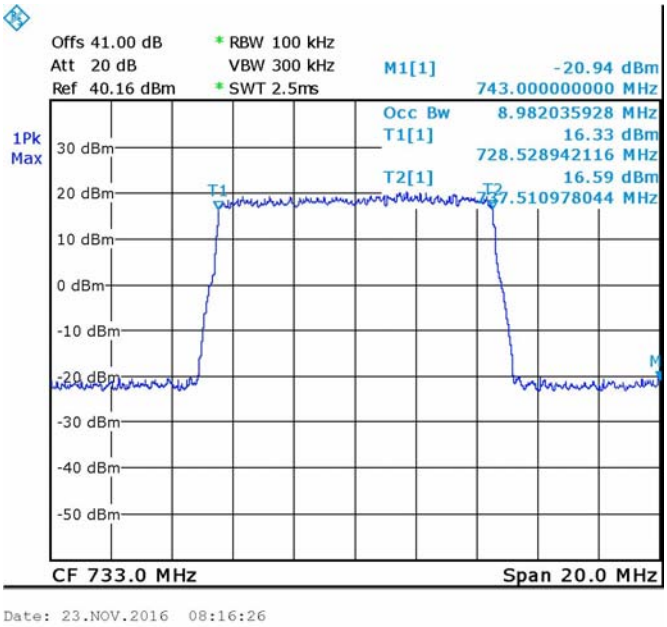

Figure 28. — 16QAM 733 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

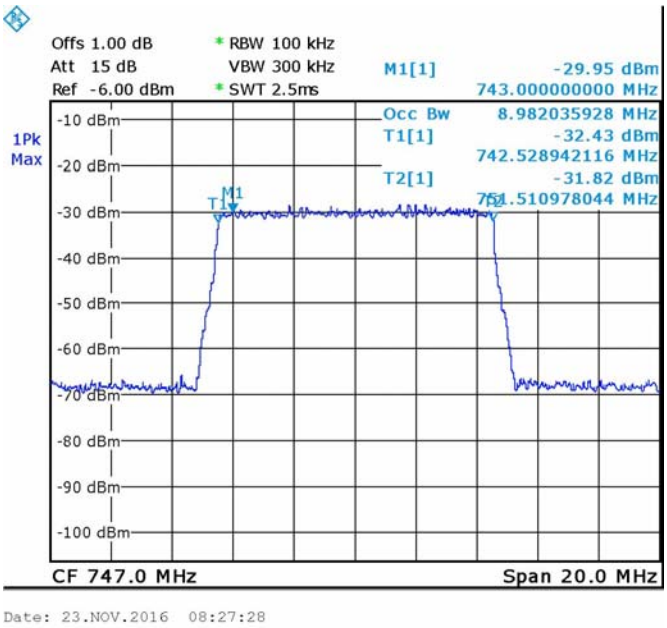

Figure 29. — 16QAM 747 MHz IN

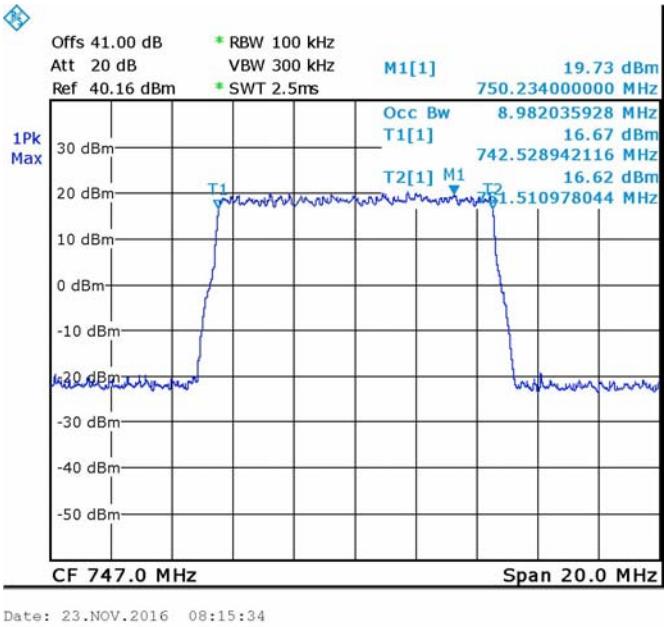

Figure 30. — 16QAM 747 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

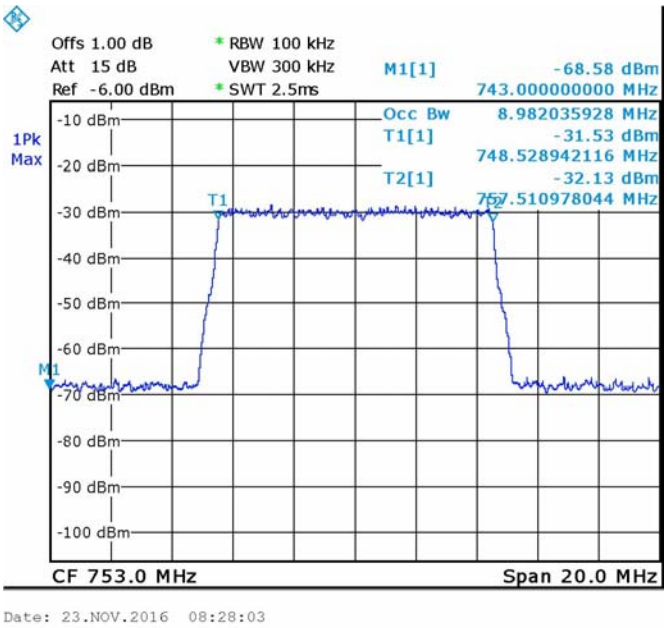

Figure 31. — 16QAM 753 MHz IN

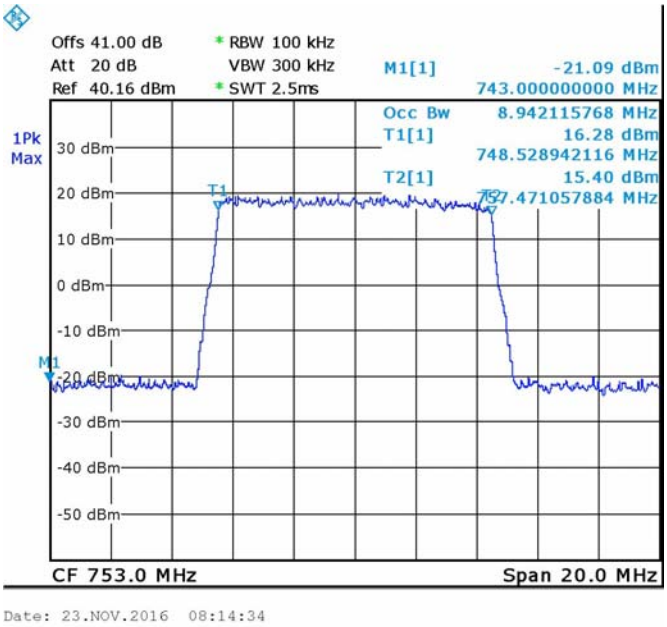

Figure 32. — 16QAM 753 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

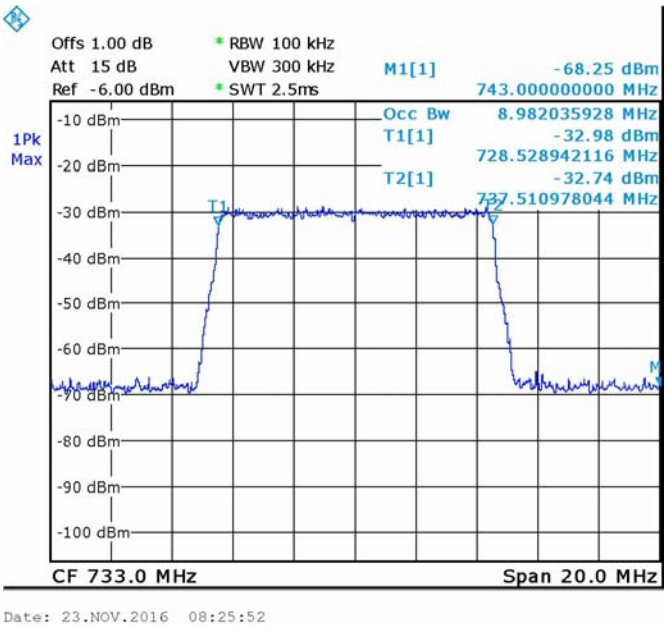

Figure 33. — QPSK 733 MHz IN

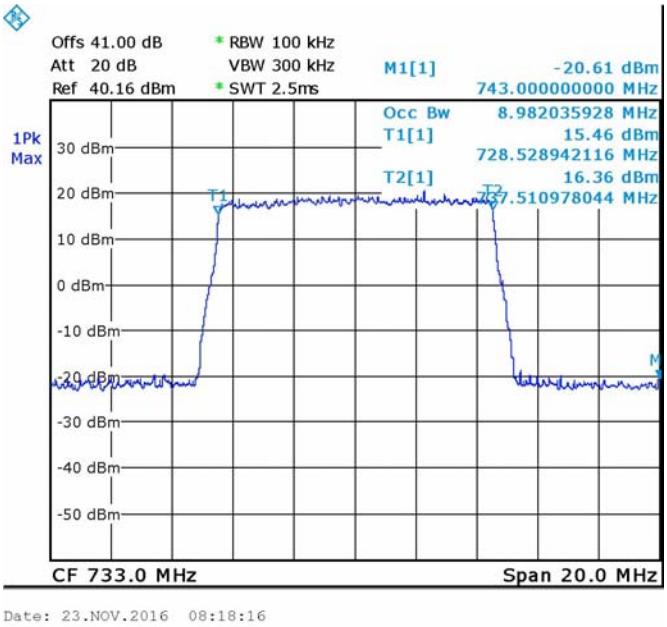

Figure 34. — QPSK 733 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

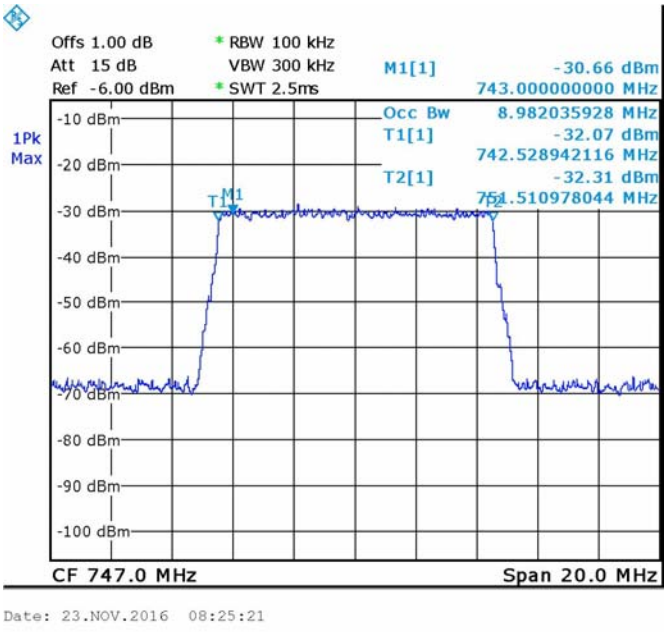

Figure 35. — QPSK 747 MHz IN

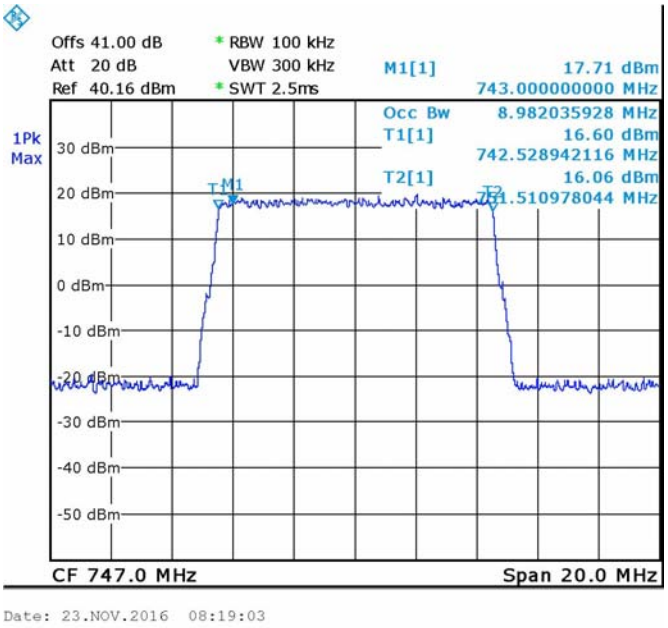

Figure 36. — QPSK 747 MHz OUT

Occupied Bandwidth (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

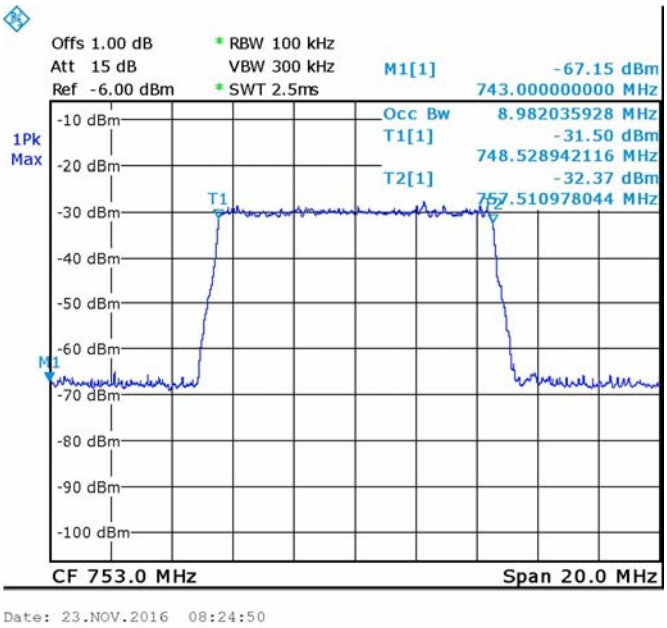

Figure 37. — QPSK 753 MHz IN

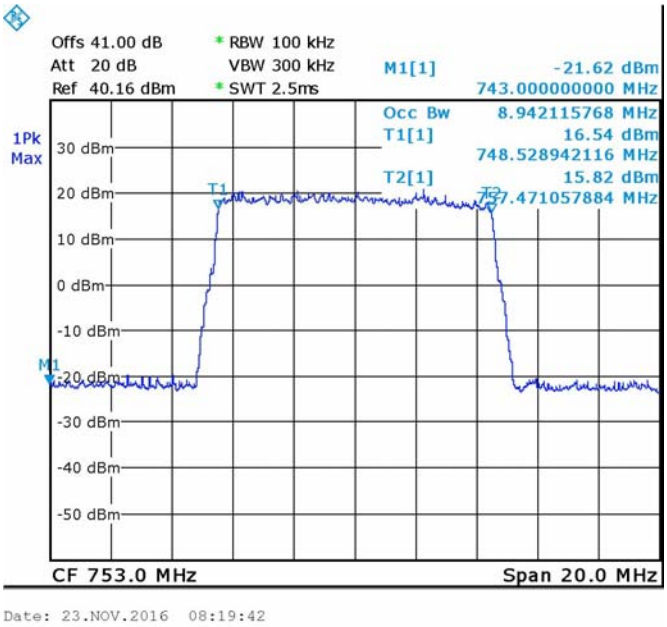

Figure 38. — QPSK 753 MHz OUT

5.5 Test Equipment Used; Occupied Bandwidth LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Date
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
MXG Vector Signal Generator	Agilent	N5182A	MY48180244	August 2, 2016	November 2, 2019
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	August 8, 2016	August 8, 2017

Figure 39 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

(Temperature (22°C)/ Humidity (37%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max loss 42.0 dB). The spectrum analyzer was set to 1 kHz resolution BW for the frequency range 9.0-150.0 kHz, 10 kHz for the frequency range 150 kHz–30.0 MHz and 1MHz for the frequency range 30MHz - 8GHz.

6.3 Test Limit

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 43+ 10 log (P) dB.

6.4 Test Results

JUDGEMENT: Passed

See additional information in *Figure 40* to *Figure 66.*

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

Figure 40 Spurious Emissions at Antenna Terminals 64QAM, 733MHz

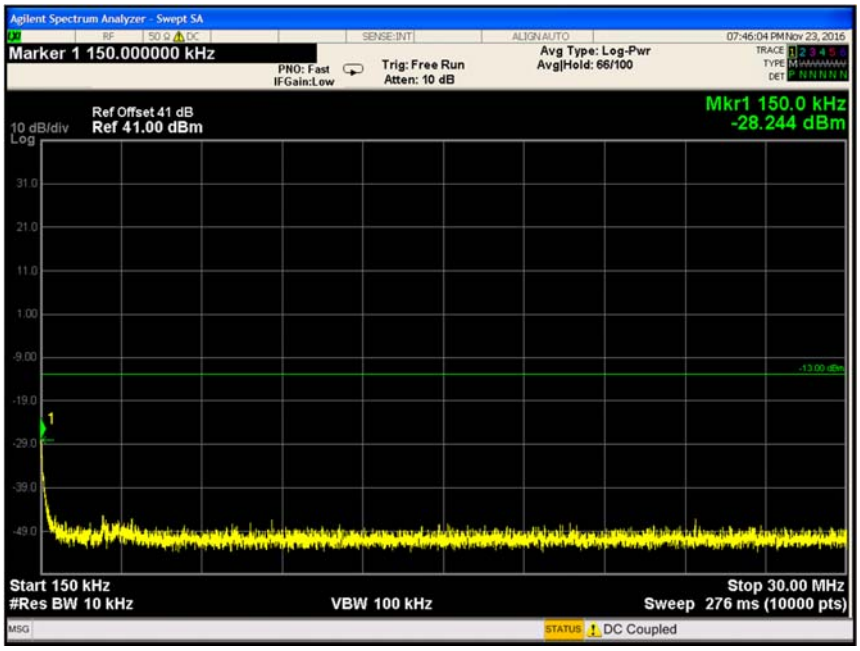

Figure 41 Spurious Emissions at Antenna Terminals 64QAM, 733MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

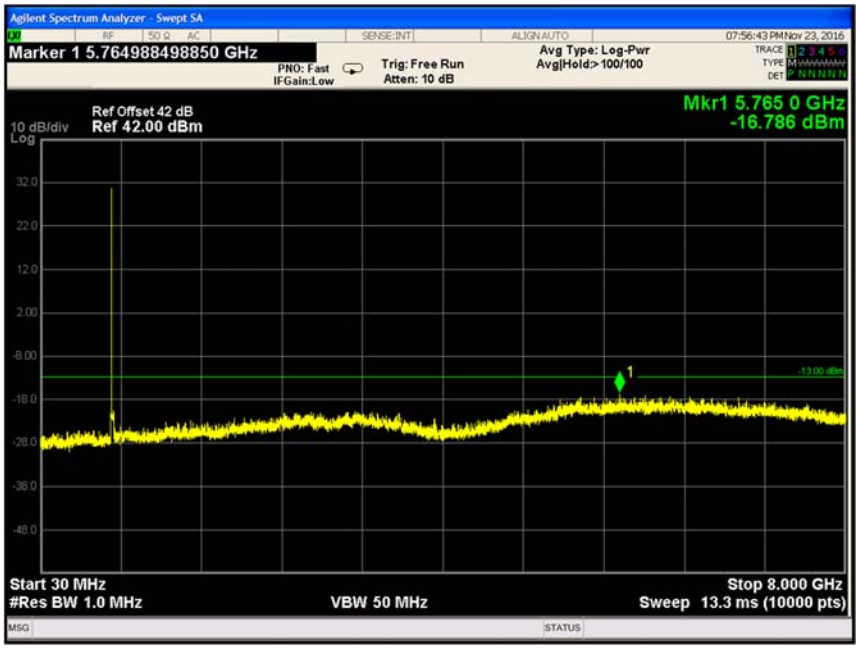

Figure 42 Spurious Emissions at Antenna Terminals 64QAM, 733MHz

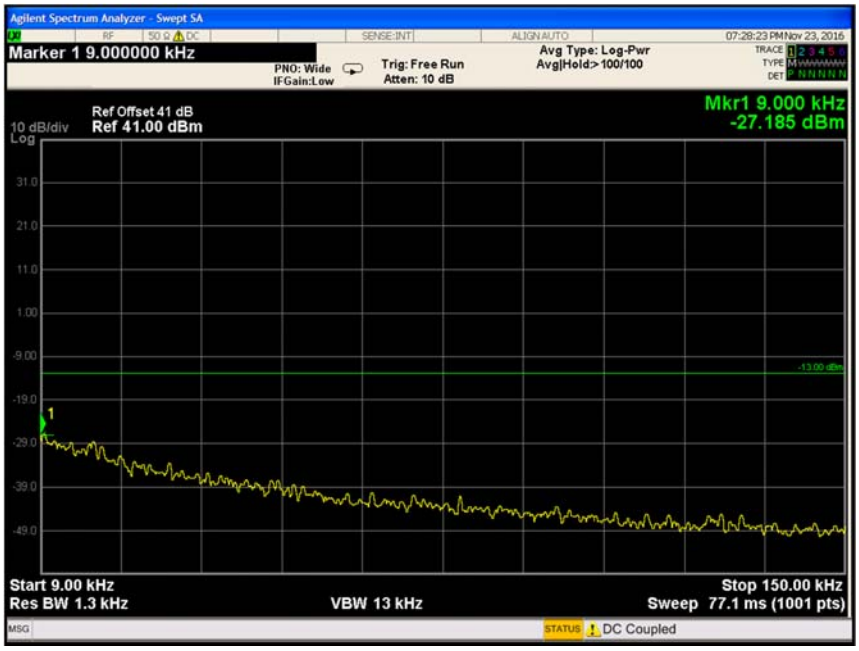

Figure 43 Spurious Emissions at Antenna Terminals 64QAM, 747MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

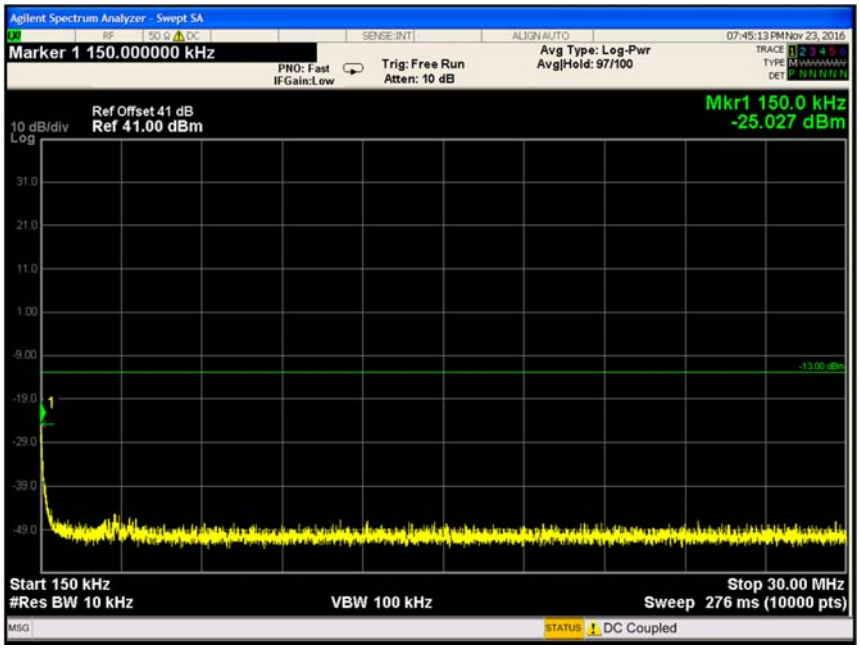

Figure 44 Spurious Emissions at Antenna Terminals 64QAM, 747MHz

Figure 45 Spurious Emissions at Antenna Terminals 64QAM, 747MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

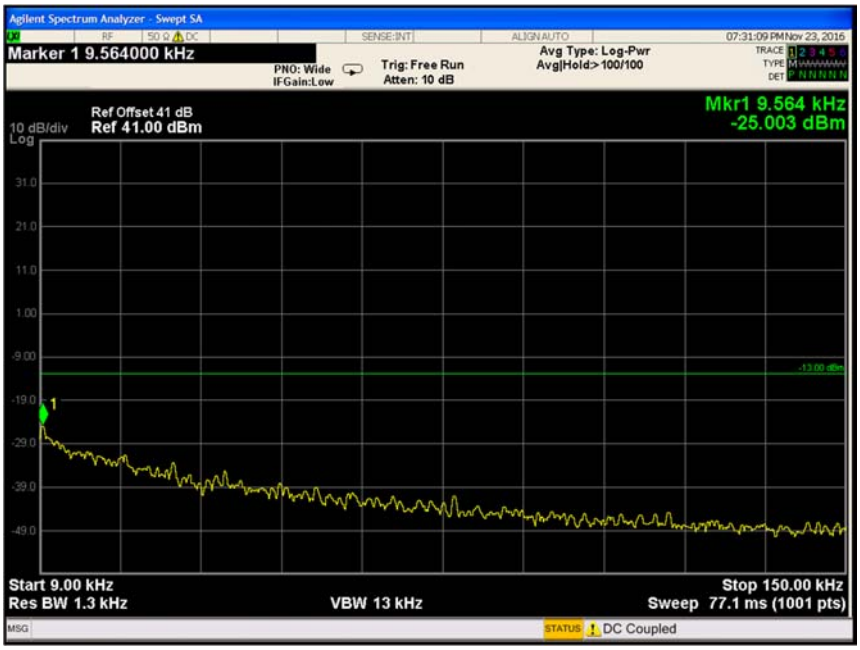

Figure 46 Spurious Emissions at Antenna Terminals 64QAM, 753MHz

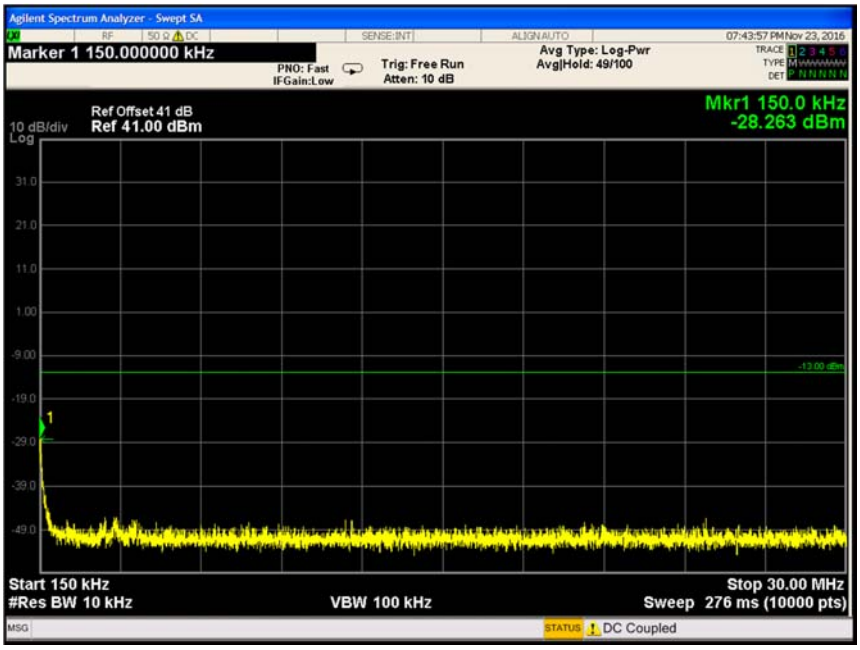

Figure 47 Spurious Emissions at Antenna Terminals 64QAM, 753MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

Figure 48 Spurious Emissions at Antenna Terminals 64QAM, 753MHz

Figure 49 Spurious Emissions at Antenna Terminals QPSK, 733MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

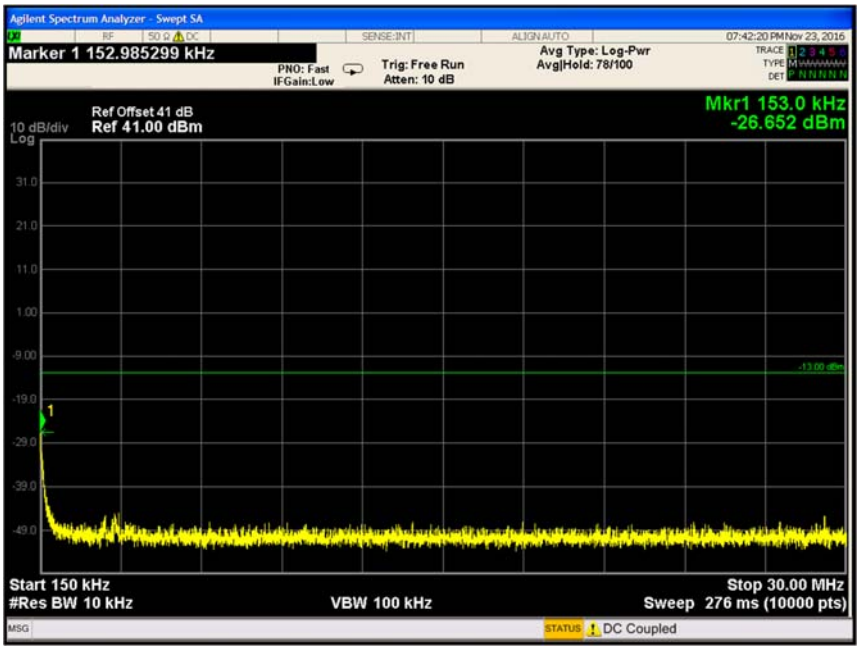

Figure 50 Spurious Emissions at Antenna Terminals QPSK, 733MHz

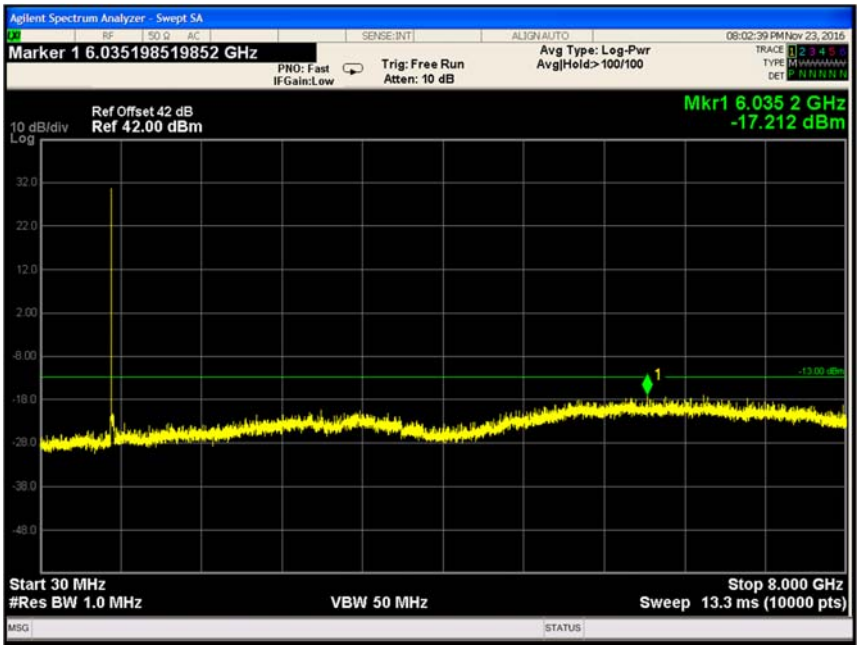

Figure 51 Spurious Emissions at Antenna Terminals QPSK, 733MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

Figure 52 Spurious Emissions at Antenna Terminals QPSK, 747MHz

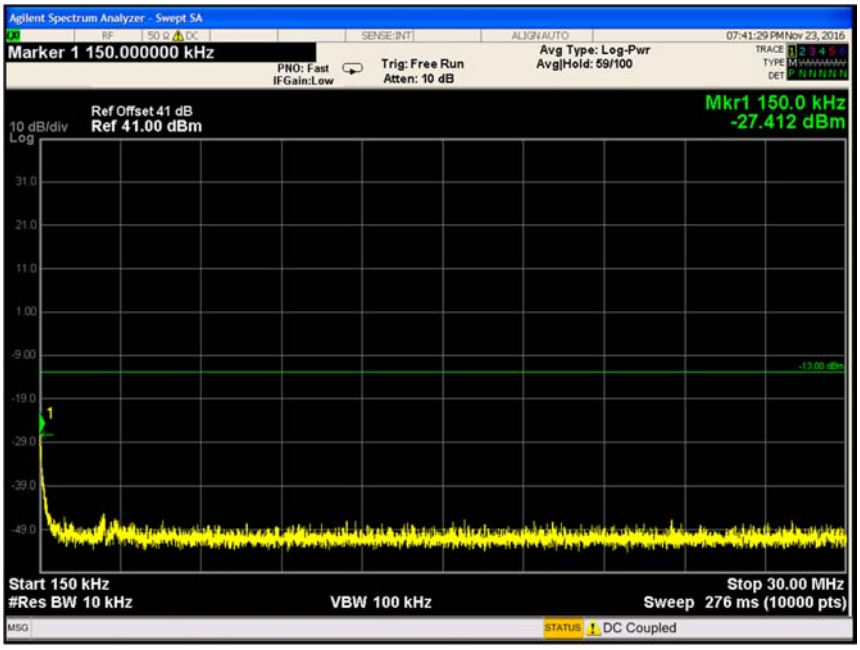

Figure 53 Spurious Emissions at Antenna Terminals QPSK, 747MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

Figure 54 Spurious Emissions at Antenna Terminals QPSK, 747MHz

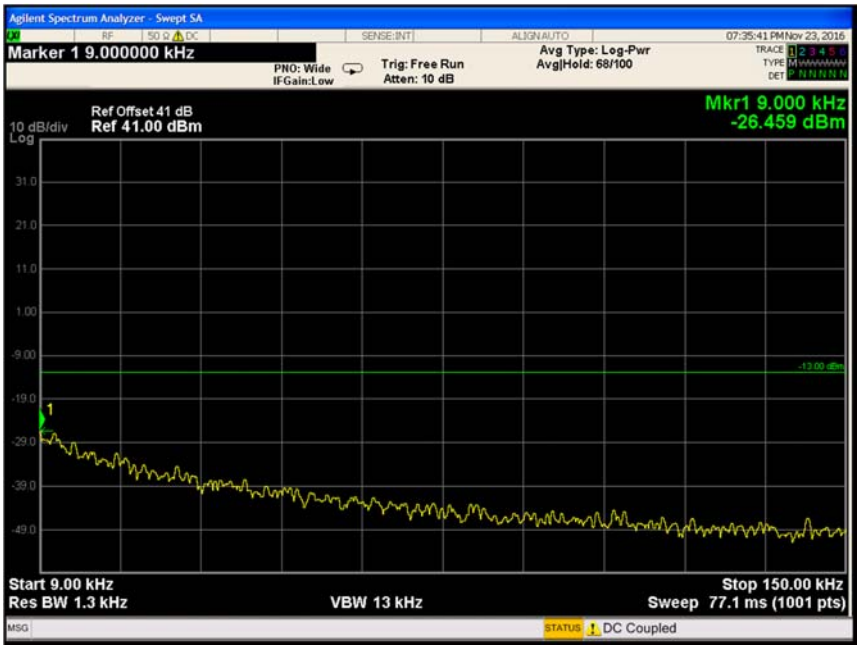

Figure 55 Spurious Emissions at Antenna Terminals QPSK, 753MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

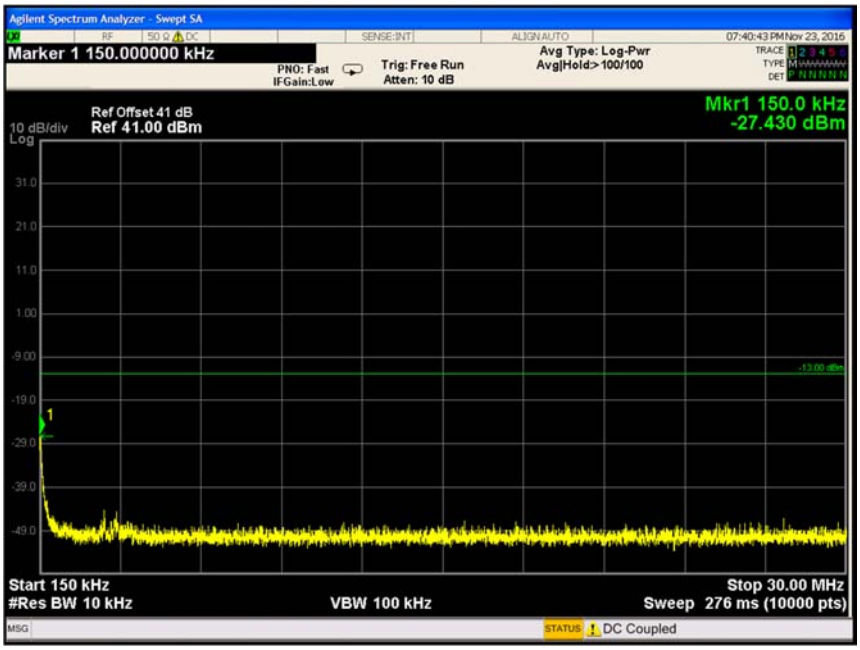

Figure 56 Spurious Emissions at Antenna Terminals QPSK, 753MHz

Figure 57 Spurious Emissions at Antenna Terminals QPSK, 753MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

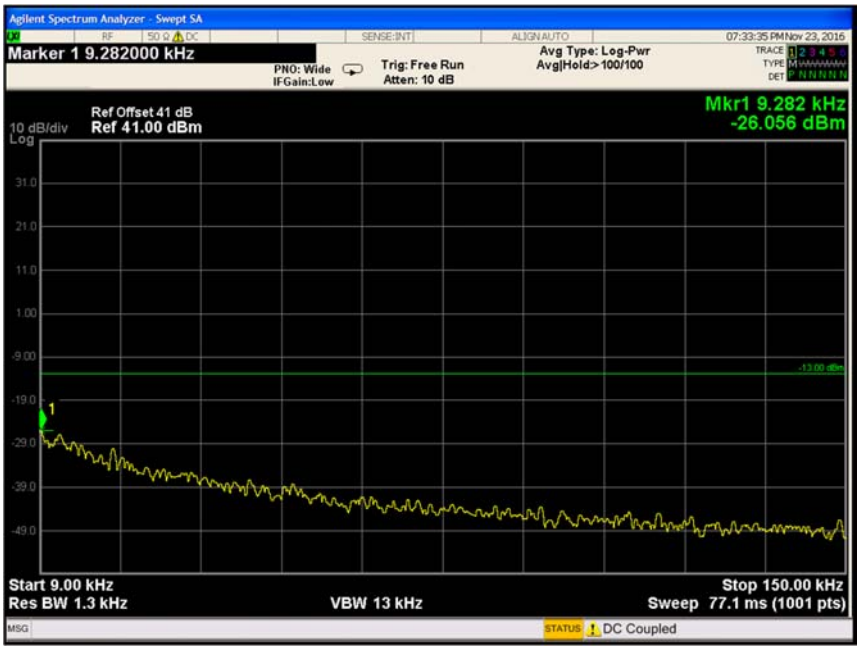

Figure 58 Spurious Emissions at Antenna Terminals 16QAM, 733MHz

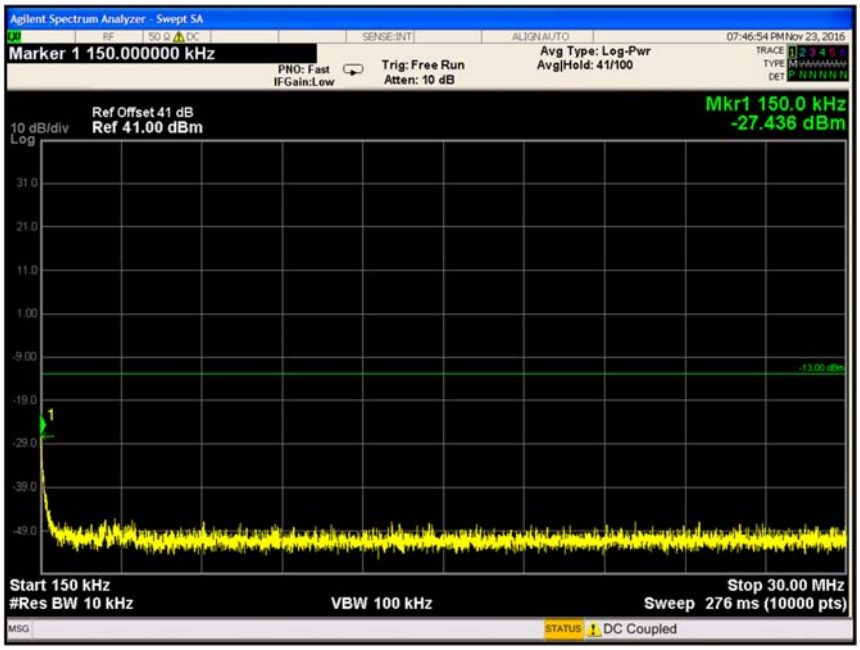

Figure 59 Spurious Emissions at Antenna Terminals 16QAM, 733MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

Figure 60 Spurious Emissions at Antenna Terminals 16QAM, 733MHz

Figure 61 Spurious Emissions at Antenna Terminals 16QAM, 747MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

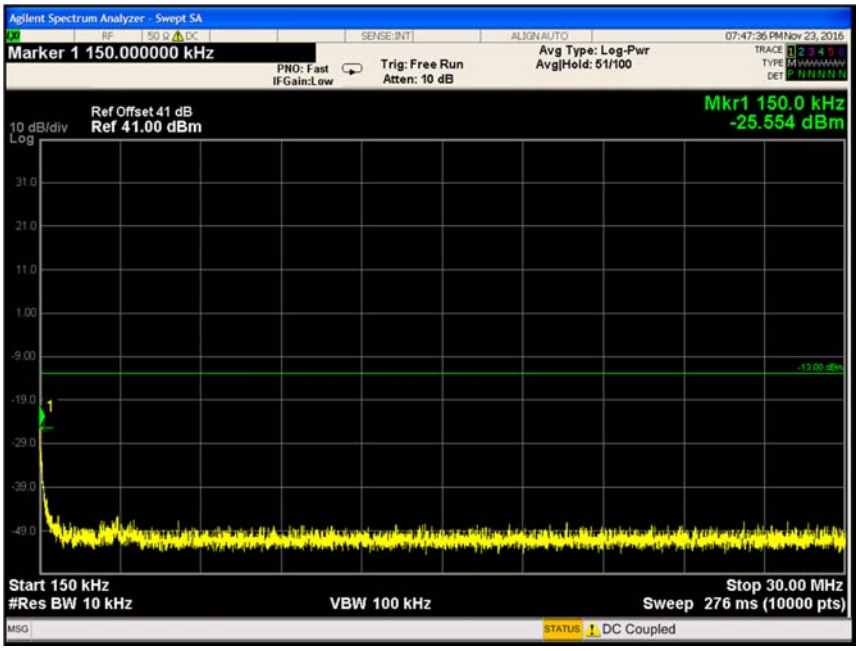

Figure 62 Spurious Emissions at Antenna Terminals 16QAM, 747MHz

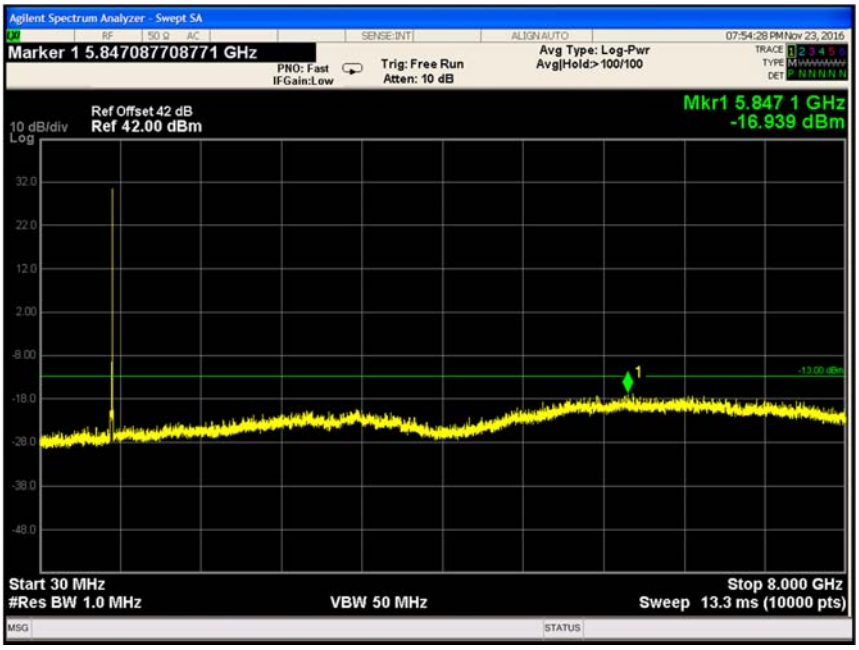

Figure 63 Spurious Emissions at Antenna Terminals 16QAM, 747MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

Figure 64 Spurious Emissions at Antenna Terminals 16QAM, 753MHz

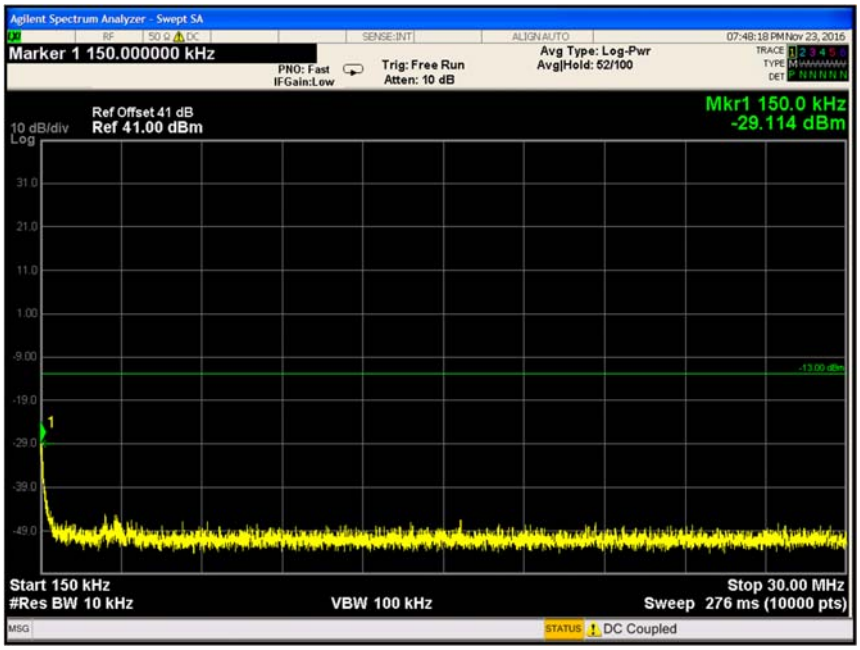

Figure 65 Spurious Emissions at Antenna Terminals 16QAM, 753MHz

Spurious Emissions at Antenna Terminals (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

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

6.5 Test Equipment Used; Out of Band Emission at Antenna Terminals LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Date
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
MXG Vector Signal Generator	Agilent	N5182A	MY48180244	August 2, 2016	November 2, 2019
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	August 8, 2016	August 8, 2017

Figure 67 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

(Temperature (22°C)/ Humidity (37%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (41.0 dB).
The spectrum analyzer was set to 100 kHz R.B.W.

7.3 Test Limit

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 + log (P) dB, yielding –13dBm.

7.4 Test Results

Modulation	Operation Frequency	Band Edge Frequency	Reading	Limit	Margin
	(MHz)	(MHz)	(dBm)	(dBm)	(dB)
LTE64QAM	733.0	728.0	-26.0	-13.0	-13.0
LTE64QAM	753.0	758.0	-25.5	-13.0	-12.5
LTE16QAM	733.0	728.0	-27.1	-13.0	-14.1
LTE16QAM	753.0	758.0	-24.8	-13.0	-11.8
LTEQPSK	733.0	728.0	-24.1	-13.0	-11.1
LTEQPSK	753.0	758.0	-24.1	-13.0	-11.1

Figure 68 Band Edge Spectrum Results

JUDGEMENT: Passed by 11.1 dB

See additional information in *Figure 69* to *Figure 74*.

Band Edge Spectrum (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

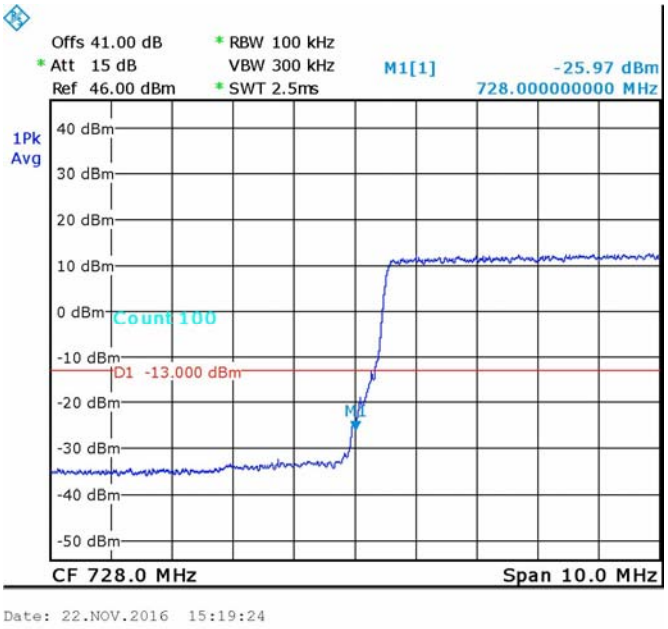

Figure 69.—64QAM, 733.0 MHz

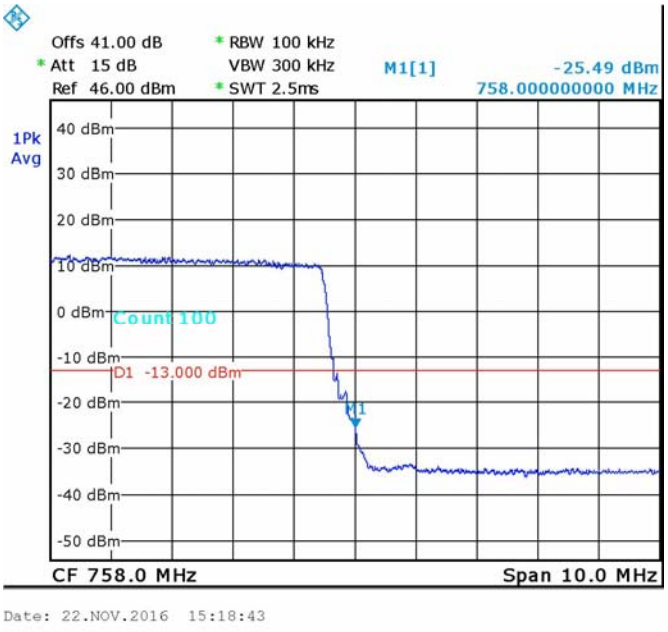

Figure 70. — 64QAM, 753.0 MHz

Band Edge Spectrum (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

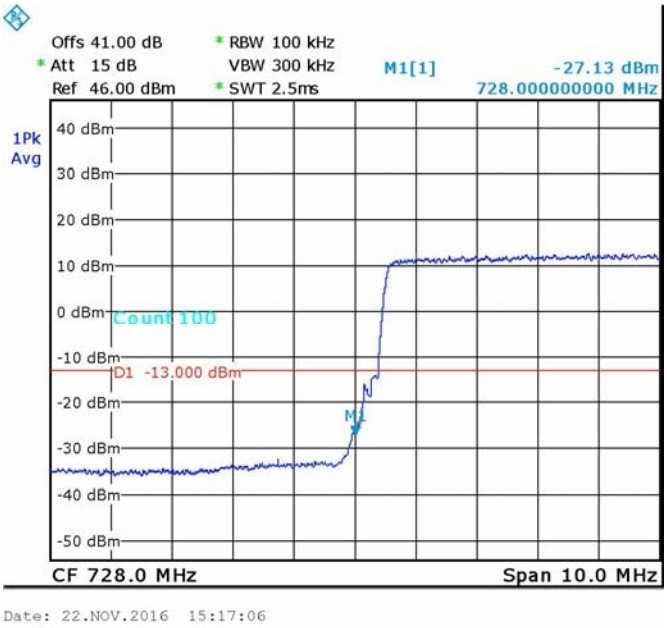

Figure 71.—16QAM, 733.0 MHz

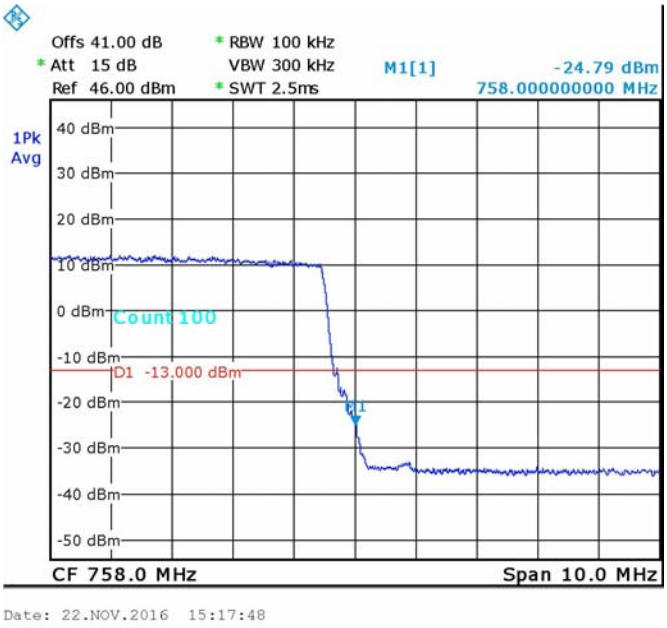

Figure 72. — 16QAM, 753.0 MHz

Band Edge Spectrum (LTE)

E.U.T Description	ONE- Optical Network Evolution Wireless Platform
Type	MRU (Mid Power Remote Unit)
Serial Number:	05154901B9

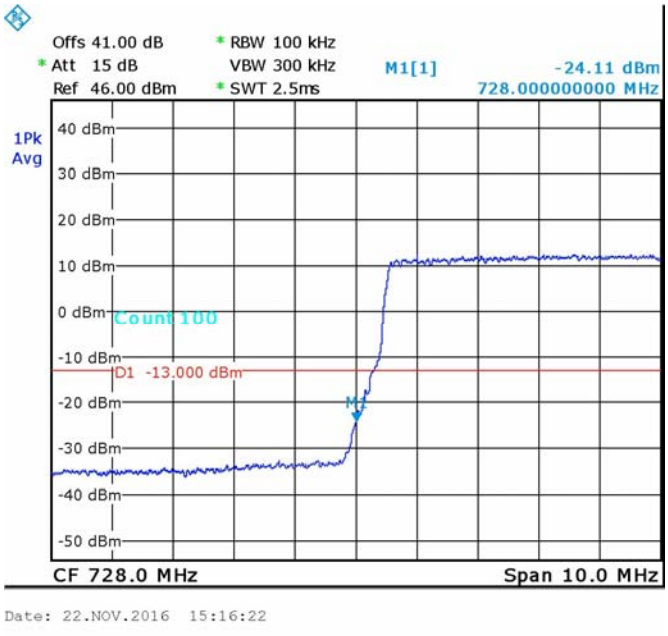

Figure 73. — QPSK, 733.0 MHz

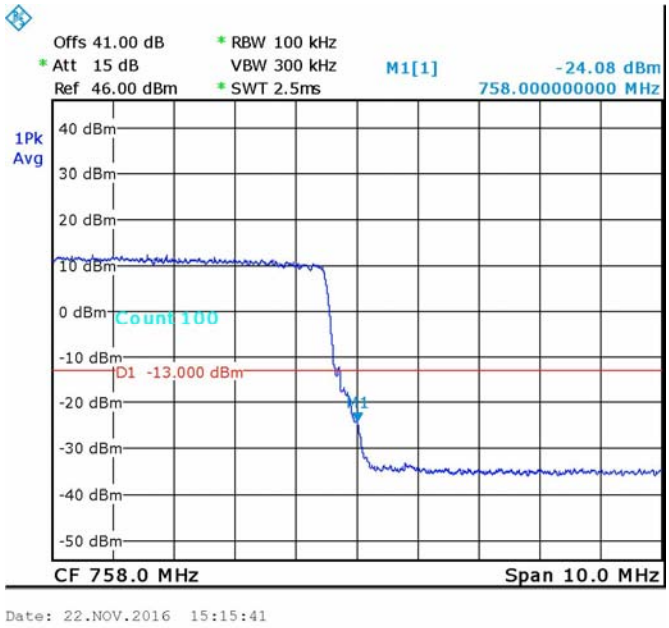

Figure 74. — QPSK, 753.0 MHz

7.5 Test Equipment Used; Band Edge Spectrum LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Date
Spectrum Analyzer	R&S	FSL6	100194	February 29, 2016	March 1, 2017
MXG Vector Signal Generator	Agilent	N5182A	MY48180244	August 2, 2016	November 2, 2019
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	August 8, 2016	August 8, 2017

Figure 75 Test Equipment Used

8. Spurious Emissions (Radiated) LTE

8.1 Test Specification

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

8.2 Test Procedure

(Temperature (20°C)/ Humidity (61%RH))

The test method was based on ANSI/TIA-603-D: 2010, Section 2.2.12 Unwanted Emissions: Radiated Spurious.

For measurements between 0.009MHz-30.0MHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:
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 frequency range 30.0MHz -1.0GHz 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.

For measurements between 1.0GHz-8.0GHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -8.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

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:

$P_d(dBm) = P_g(dBm) – Cable\ Loss\ (dB) + Substitution\ Antenna\ Gain\ (dBd)$

P_d = Dipole equivalent power (result).
P_g = Signal generator output level.

A Peak detector was used for this test.

The test was performed in 3 operational frequencies: low, mid and high and each at 3 modulations: QPSK, 16QAM and 64QAM.

Testing was performed when the RF port was connected to 50 Ω termination.

The test results table below describe only results with the highest emission.

8.3 Test Limit

The power of any emission outside of the authorized operating frequency ranges (728-758MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm

8.4 Test Results

Carrier Channel	Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Limit	Margin
(MHz)	(MHz)	(V/H)	(dBµV/m)	(dBm)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
733.00	7330.0	V	70.9	-36.1	1.0	10.0	-27.1	-13.00	-14.1
733.00	7330.0	H	70.5	-31.6	1.0	10.0	-22.6	-13.00	-9.6
747.00	7470.0	V	71.5	-35.6	1.0	10.0	-26.6	-13.00	-13.6
747.00	7470.0	H	71.1	-33.1	1.0	10.0	-24.1	-13.00	-11.1
753.00	753.0	V	70.8	-36.1	1.0	10.0	-27.1	-13.00	-14.1
753.00	7530.0	H	71.2	-32.6	1.0	10.0	-23.6	-13.00	-10.6

Figure 76 Spurious Emission (Radiated) LTE (Highest Emission)

JUDGEMENT: Passed by 9.6 dB

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

8.5 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EMI Receiver	HP	85422E	3906A00276	March 3, 2016	March 3, 2017
RF Filter Section	HP	85420E	3705A00248	March 3, 2016	March 3, 2017
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8593EM	3536A00120ADI	March 10, 2016	March 10, 2017
Active Loop Antenna	EMCO	6502	9506-2950	September 14, 2016	September 14, 2017
Antenna Biconical	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Antenna Log Periodic	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
Horn Antenna 1G-18G	ETS	3115	29845	May 19, 2015	May 19, 2018
40dB Attenuator	Weinschel Engineering	WA 39-40-33	A1323	August 8, 2016	August 8, 2017
EXG Vector Signal Generator	Agilent	N5172B	MY51350584	July 1, 2016	July 1, 2017
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A
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 77 Test Equipment Used

9. Intermodulation Conducted

9.1 Test Procedure

(Temperature (22°C)/ Humidity (37%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max loss = 44.0dB). 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 - 24GHz.

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

LTE band: 742.0 MHz, 0 dBm

CELL & ESMR band: 878.0 MHz, 0 dBm

PCS band: 1962.5 MHz, 0 dBm

AWS band: 2132.5 MHz, 0 dBm

WCS band: 2355.0MHz, 0 dBm

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

9.2 Test Results

JUDGEMENT: Passed

See additional information in *Figure 78.*

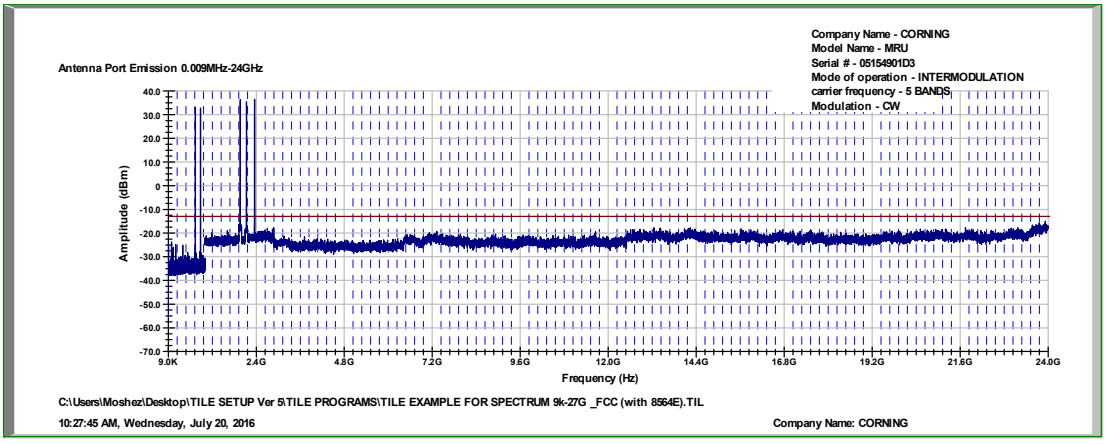

Figure 78 Intermodulation Conducted

9.3 Test Equipment Used; Intermodulation Conducted

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
Spectrum Analyzer	HP	8564E	3442A00275	March 10, 2016	March 10, 2017
EXG Vector Signal Generator	Agilent	N5172B	TE4384	July 1, 2016	July 1, 2017
EXG Vector Signal Generator	Agilent	N5172B	MY513500584	July 1, 2016	July 1, 2017
MXG Vector Signal Generator	Agilent	N5182A	MY48180244	August 2, 2016	November 2, 2019
MXG Vector Signal Generator	Agilent	N5182A	MY49060440	July 1, 2016	July 1, 2017
Signal Generator	HP	E4432B	GB40050998	July 1, 2016	July 1, 2017
40 dB Attenuator	Weinschel Engineering	WA 39-40-33	A1323	August 8, 2016	August 8, 2017

Figure 79 Test Equipment Used

10. Intermodulation Radiated

10.1 Test Procedure

The test method was based on ANSI/TIA-603-D: 2010, Section 2.2.12 Unwanted Emissions: Radiated Spurious.

For measurements between 0.009MHz-30.0MHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 0.009MHz-30MHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

For measurements between 30.0MHz-1.0GHz:

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 frequency range 30.0MHz -1.0GHz 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.

For measurements between 1.0GHz-24.0GHz:

The E.U.T was tested inside the shielded room at a distance of 3 meters and the E.U.T was placed on a non-metallic table, 1.5 meters above the ground. The frequency range 1.0GHz -24.0GHz was scanned. The readings were maximized by the turntable azimuth between 0-360°, and the antenna polarization.
The emissions were measured at a distance of 3 meters.

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:

$P_d(dBm) = P_g(dBm) – Cable\ Loss\ (dB) + Substitution\ Antenna\ Gain\ (dBd)$

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 band: 742.0 MHz, 0 dBm

CELL & ESMR band: 878.0 MHz, 0 dBm

PCS band: 1962.5 MHz, 0 dBm

AWS band: 2132.5 MHz, 0 dBm

WCS band: 2355.0MHz, 0 dBm

A Peak detector was used for this test.

Testing was performed when the RF port was connected to 50 Ω termination.

The test results table below describe only results with the highest radiation.

10.2 Test Limit

The power of any emission outside of the authorized operating frequency ranges (MHz) must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log (P) dB, yielding –13dBm.

10.3 Test Results

JUDGEMENT: Passed

For additional information see *Figure 80.*

Freq.	Antenna Pol.	Maximum Peak Level	Signal Generator RF Output	Cable Loss	Antenna Gain	Effective Radiated Power Level	Limit	Margin
(MHz)	(V/H)	(dBµV/m)	(dBm)	(dB)	(dBd)	(dBm)	(dBm)	(dB)
1565.0	V	55.0	-45.7	0.5	7.0	-39.2	-13.0	-26.2
1565.0	H	54.5	-45.5	0.5	7.0	-39.0	-13.0	-26.0
3039.0	V	51.3	-53.9	0.5	10.0	-44.4	-13.0	-31.4
3039.0	H	51.5	-53.0	0.5	10.0	-43.5	-13.0	-30.5
3434.0	V	51.9	-53.5	0.5	10.0	-44.0	-13.0	-31.0
3434.0	H	52.0	-52.0	0.5	10.0	-42.5	-13.0	-29.5
4118.0	V	51.7	-47.1	0.5	9.5	-38.1	-13.0	-25.1
4118.0	H	51.9	-50.0	0.5	10.8	-39.7	-13.0	-26.7
4688.0	V	59.3	-43.2	0.5	10.8	-32.9	-13.0	-19.9
4688.0	H	57.2	-45.0	0.5	10.8	-34.7	-13.0	-21.7
3523.0	V	53.1	-51.9	0.5	10.0	-42.4	-13.0	-29.4
3523.0	H	53.5	-50.5	0.5	10.0	-41.0	-13.0	-28.0
2249.0	V	51.8	-48.7	0.5	7.0	-42.2	-13.0	-29.2
2249.0	H	50.6	-49.4	0.5	7.0	-42.9	-13.0	-29.9
1915.0	V	59.6	-40.7	0.5	7.0	-34.2	-13.0	-21.2
1915.0	H	50.8	-49.0	0.5	7.0	-42.5	-13.0	-29.5
5571.0	V	57.6	-46.2	0.5	10.8	-35.9	-13.0	-22.9
5571.0	H	57.7	-42.9	1.0	9.7	-34.2	-13.0	-21.2
3303.0	V	52.2	-52.9	0.5	10.0	-43.4	-13.0	-30.4
3303.0	H	52.5	-52.5	0.5	10.0	-43.0	-13.0	-30.0

Figure 80 Intermodulation Radiated Results

10.4 Test Instrumentation Used; Radiated Measurements Intermodulation

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EMI Receiver	HP	85422E	3906A00276	March 3, 2016	March 3, 2017
RF Filter Section	HP	85420E	3705A00248	March 3, 2016	March 3, 2017
EMI Receiver	R&S	ESCI7	100724	February 29, 2016	March 1, 2017
Spectrum Analyzer	HP	8593EM	3536A00120ADI	March 10, 2016	March 10, 2017
Active Loop Antenna	EMCO	6502	9506-2950	September 14, 2016	September 14, 2017
Antenna Biconical	EMCO	3110B	9912-3337	March 24, 2016	March 24, 2018
Antenna Log Periodic	EMCO	3146	9505-4081	April 23, 2016	April 23, 2017
Horn Antenna 1G-18G	ETS	3115	29845	May 19, 2015	May 19, 2018
Horn Antenna 18G-26G	ARA	SWH-28	1007	March 30, 2016	March 30, 2018
Low Noise Amplifier	Narda	LNA-DBS-0411N313	013	May 25, 2016	May 25, 2017
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	March 1, 2016	March 1, 2017
Signal Generator	Marconi	2022D	119196015	March 1, 2016	March 1, 2017
Signal Generator	HP	8648C	3623A04126	February 29, 2016	March 1, 2017
Signal Generator	HP	ESG-4000A/E4422A	US36220118	February 29, 2016	March 1, 2017
MXG Vector Signal Generator	Agilent	N5182A	MY49060440	July 1, 2016	July 1, 2017
ESG Vector Signal Generator	Agilent	E4438C	MY45094064	July 1, 2016	July 1, 2017
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A
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 81 Test Equipment Used

11. Out-of-Band Rejection (LTE)

11.1 Test Specification

KDB 935210 D05 v01r01, Section 3.3

11.2 Test Procedure

(Temperature (22°C)/ Humidity (37%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max Loss= 41.5 dB).

The signal and spectrum analyzer frequency range was set to ±250% of the passband, Dwell time set to approximately 10msec

RBW was set between 1% to 5% of the E.U.T passband and VBW set to ≥3*RBW.

11.3 Test Limit

N/A

11.4 Test Results

JUDGEMENT: Passed

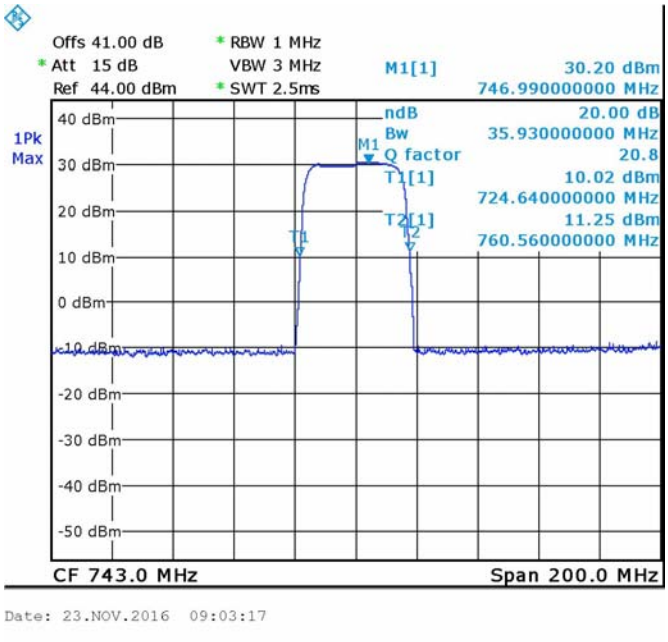

Figure 82. — Out-of-Band Rejection Plot

11.5 Test Equipment Used; Out-of-Band Rejection

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Date
EXA Spectrum Analyzer	Agilent	N9010A	MY49061070	July 21, 2016	July 21, 2017
EXG Vector Signal Generator	Agilent	N5172B	MY51350584	July 1, 2016	July 1, 2017
40 dB Attenuator	Weinschel	WA 39-40-33	A1323	August 8, 2016	August 8, 2017

Figure 83 Test Equipment Used

12. APPENDIX A - CORRECTION FACTORS

12.1 Correction factors for RF OATS Cable 35m ITL #1784

Frequency (MHz)	Cable loss (dB)
10.0	0.3
20.0	0.2
50.0	-0.1
100.0	-0.6
200.0	-1.2
500.0	-2.3
1000.0	-3.6

12.2 Correction factors for RF OATS Cable 10m

ITL #1794

Frequency(MHz)	Cable loss(dB)
10.0	-0.3
20.0	-0.3
50.0	-0.5
100.0	-0.7
200.0	-1.1
500.0	-1.8
1000.0	-2.7

12.3 Correction factors for RF cable for Semi Anechoic Chamber

FREQ (MHz)	LOSS (dB)
1000.0	1.5
2000.0	2.1
3000.0	2.7
4000.0	3.1
5000.0	3.5
6000.0	4.1
7000.0	4.6
8000.0	4.9
9000.0	5.7
10000.0	5.7
11000.0	6.1
12000.0	6.1
13000.0	6.2
14000.0	6.7
15000.0	7.4
16000.0	7.5
17000.0	7.9
18000.0	8.1
19000.0	8.8
20000.0	9.1

12.4 Correction factors for Horn Antenna

Model: SWH-28
at 1 meter range.

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

12.5 Correction factors for Horn ANTENNA

Model: 3115

Antenna serial number: 29845

3 meter range

f(GHz)	AF(dB/m)	GA(dB)
0.75	25	3
1G	23.5	7
1.5G	26	8
2G	29	7
2.5G	27.5	10
3G	30	10
3.5G	31.5	10
4G	32.5	9.5
4.5G	32.5	10.5
5G	33	10.5
5.5G	35	10.5
6G	36.5	9.5
6.5G	36.5	10
7G	37.5	10
7.5G	37.5	10
8G	37.5	11
8.5G	38	11
9G	37.5	11.5
9.5G	38	11.5
10G	38.5	11.5
10.5G	38.5	12
11G	38.5	12.5
11.5G	38.5	13
12G	38	13.5
12.5G	38.5	13
13G	40	12
13.5G	41	12
14G	40	13
14.5G	39	14
15G	38	15.5
15.5G	37.5	16
16G	37.5	16
16.5G	39	15
17G	40	15
17.5G	42	13.5
18G	42.5	13

12.6 Correction factors for Log Periodic Antenna EMCO, Model 3146, Serial #9505-4081

Frequency [MHz]	AF [dB/m]
200.0	11.47
250.0	12.06
300.0	14.77
400.0	15.77
500.0	18.01
600.0	18.84
700.0	20.93
800.0	21.27
900.0	22.44
1000.0	24.10

12.7 Correction factors for Biconical Antenna EMCO, Model 3110B, Serial #9912-3337

Frequency [MHz]	AF [dB/m]
30.0	14.18
35.0	13.95
40.0	12.84
45.0	11.23
50.0	11.10
60.0	10.39
70.0	9.34
80.0	9.02
90.0	9.31
100.0	8.95
120.0	11.53
140.0	12.20
160.0	12.56
180.0	13.49
200.0	15.27

12.8 Correction factors for ACTIVE LOOP ANTENNA

Model 6502
S/N 9506-2950

f(MHz)	MAF(dBs/m)	AF(dB/m)
0.01	-33.1	18.4
0.02	-37.2	14.3
0.03	-38.2	13.3
0.05	-39.8	11.7
0.1	-40.1	11.4
0.2	-40.3	11.2
0.3	-40.3	11.2
0.5	-40.3	11.2
0.7	-40.3	11.2
1	-40.1	11.4
2	-40	11.5
3	-40	11.5
4	-40.1	11.4
5	-40.2	11.3
6	-40.4	11.1
7	-40.4	11.1
8	-40.4	11.1
9	-40.5	11
10	-40.5	11
20	-41.5	10
30	-43.5	8