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DATE: 17 February 2016

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

FCC Radio Test Report

for

Corning Optical Communication Wireless

Equipment under test:

ONE- Optical Network Evolution DAS

RAU-5x Remote Antenna Unit PN: RAU5xUS/RAU5xUS-A

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

Tested by: _____
M. Zohar

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for

Corning Optical Communication Wireless

ONE- Optical Network Evolution DAS

RAU-5x Remote Antenna Unit PN: RAU5xUS/RAU5xUS-A

(LTE-AWS Section)

FCC ID: OJF1RAU5X

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, KDB 935210 and KDB 971168 D01

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

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):	ONE- Optical Network Evolution DAS
Equipment Model No.:	RAU-5x Remote Antenna Unit PN: RAU5xUS/RAU5xUS-A
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	29 November 2015
Start of Test:	29 November 2015
End of Test:	10 December 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 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

Model name	RAU5x ONE wireless platform
Working voltage	48VDC
Mode of operation	DAS Remote Unit
Modulations	**ESMR/CELL/PCS/AWS bands:** GSM,WCDMA,LTE **LTE700 band:** QPSK,16QAM,64QAM
Frequency Range	**ESMR:** 862M-869M **CELL:** 869M-894M **PCS:** 1930M-1995M **LTE :**728M-758M **AWS:** 2110M-2180M
Transmit power	**ESMR/CELL/LTE:** ~15dBm **PCS/AWS:** ~20dBm
Antenna Gain	12.5dBi
DATA rate	N/A
Modulation BW	**GSM:** 500KHz **WCDMA:** 5MHz **LTE:** 10MHz/5MHz(for ESMR band)
Temperature (°C)/ Humidity (%RH)	26°C / 35%

The Optical Network Platform (ONE™) by Corning provides a flexible in-building RF and network digital coverage solution based on a fiber optic transport backbone.

The fiber-optics infrastructure is easily deployable via a wide range of pre-terminated composite cables and advanced end-to-end equipment. Easy to design, Plug and Play™ connectors, significantly reduce installation cost and deployment time.

The ONE™ solution is an ideal fit for large, high-rise or campus-style deployments. It generates significant CAPEX savings and OPEX savings through the use of user configurable sectorization and an infrastructure that is simple to deploy and efficient in usage.

Dynamic sectorization management allows precise service distribution control to meet changing density needs, and provides further savings by enabling sharing of equipment at various levels for service providers.

Radio source agnostic, remote units can be used as network extenders. Ethernet capability with dedicated fiber link for Wi-Fi offload brings a higher level of granularity and support for devices and applications with very high speed requirements.

1.4 Test Methodology

Radiated testing was performed according to the procedures in ANSI C63.4: 2003, KDB 935210 and KDB 971168 D01. 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 HEU, the OIU and the RAU5x.
All source signals are represented in the setup by appropriate signal generators.
An "Exercise" SW on the computer was used to enable / disable transmission of the RAU5x, while the EUT output was connected to the spectrum analyzer.
All channels transmitted during the testing.
There is neither an intermediate amplified nor donor antenna in the uplink.
All components included in the UL path are connected by cables.

2.2 EUT Exercise Software

HCM_2.0 Build2 RC1
ACM_2a00_18_01.bin
RMM_5a00_18_01.bin
OIM_7a03_18_01.bin
RAU5_9a64_18_03.bin

2.3 Special Accessories

No special accessories were needed in order to achieve compliance.

2.4 Equipment Modifications

No modifications were necessary in order to achieve compliance.

2.5 Configuration of Tested System

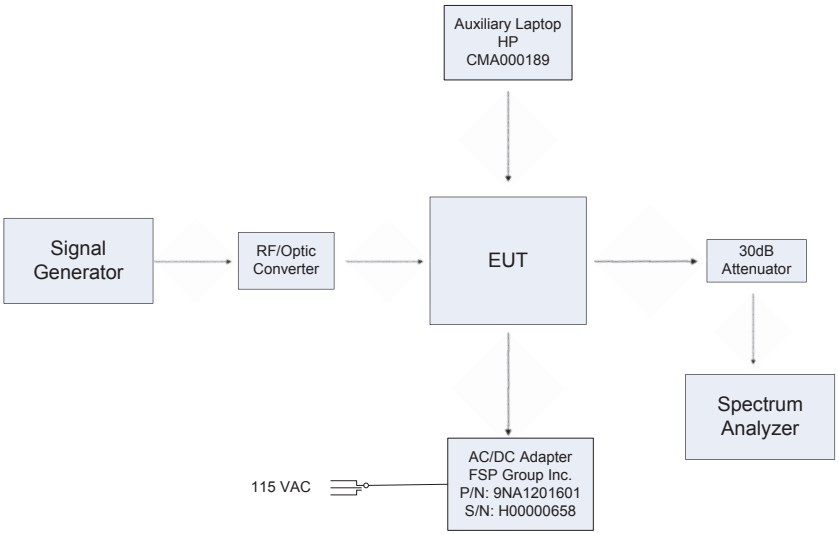

Figure 1. Conducted Test Set-Up

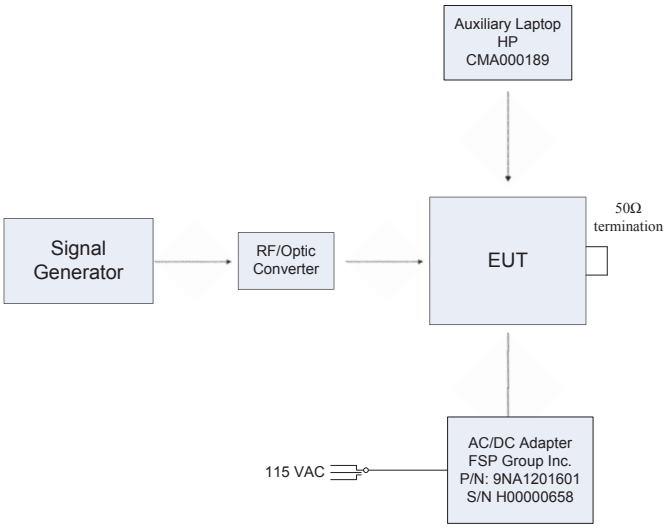

Figure 2. Radiated Test Set-Up

3. Test Set-up Photos

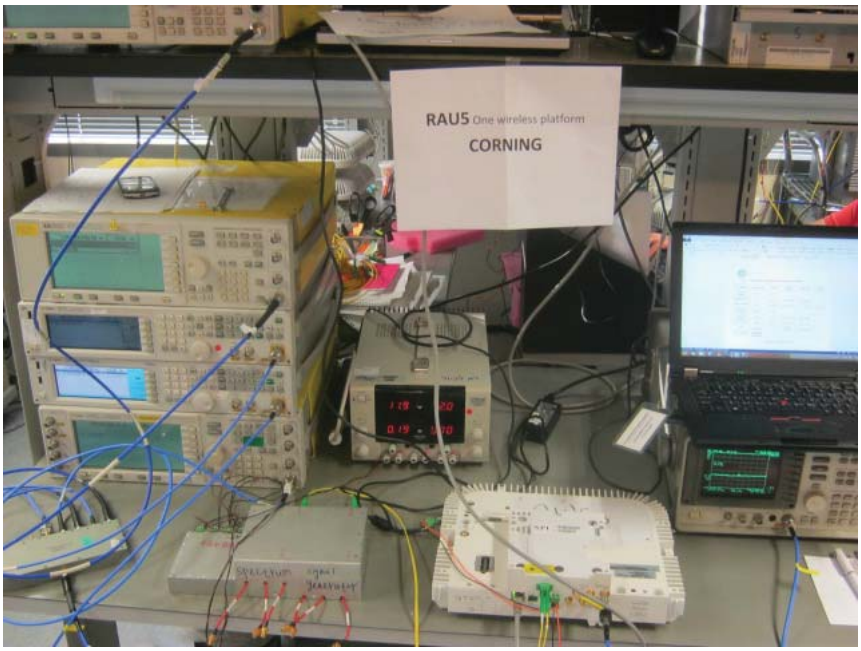

Figure 3. Intermodulation Conducted Tests

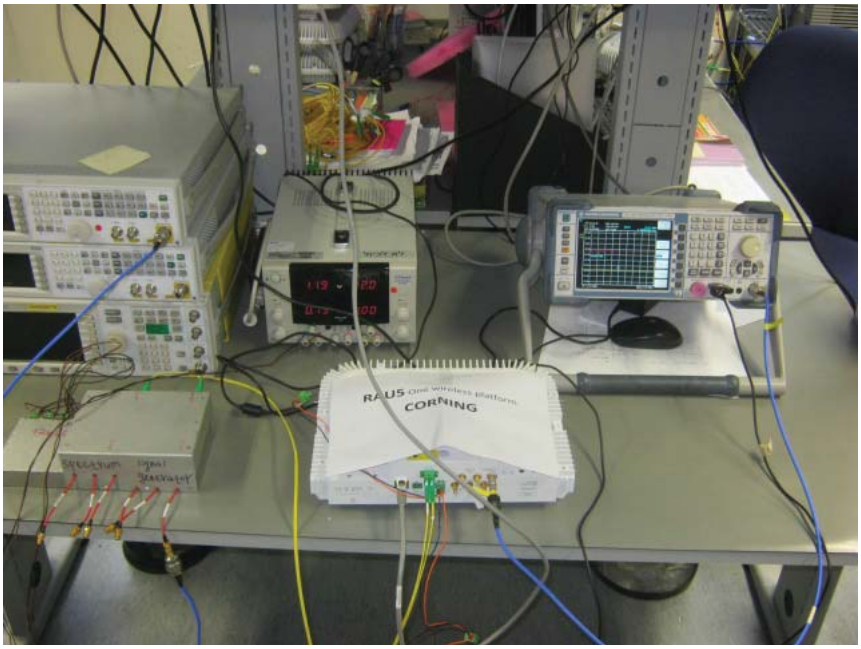

Figure 4. Conducted Emission From Antenna Port Tests

Figure 5. Radiated Emission Test

Figure 6. Radiated Emission Test

Figure 7. Radiated Emission Test

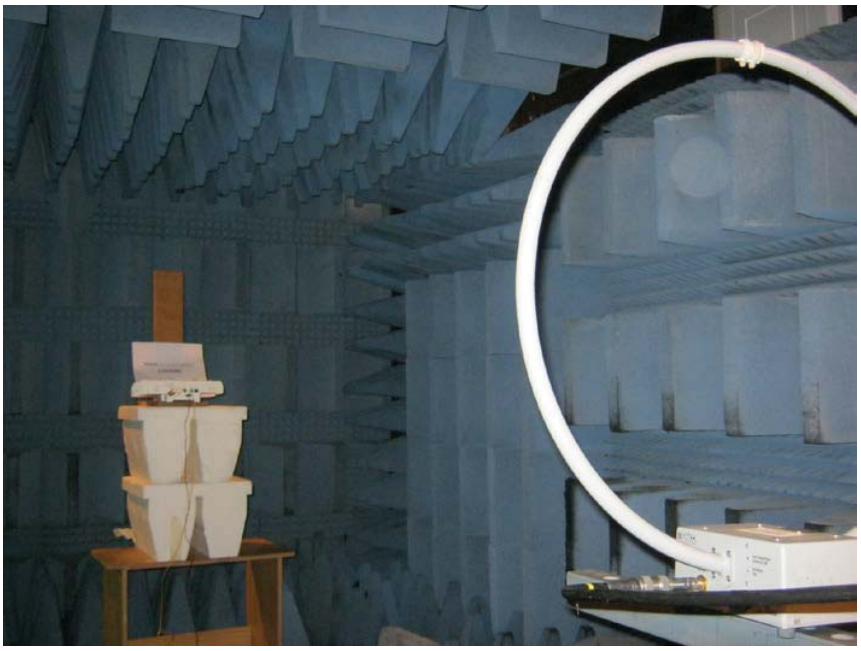

Figure 8. Radiated Emission Test

4. RF Power Output LTE

4.1 Test Specification

FCC Part 27, Subpart C, Section 50

4.2 Test procedure

Peak Power Output must not exceed 1000W. The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (loss=30.5 dB) and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload. RBW was set to 1% from OBW. E.U.T was evaluated in 3 modulations: 64QAM, 16QAM, QPSK as well as at the low, mid and high channels of each modulation.

4.3 Test Results

modulation	Operation Frequency (MHz)	Reading (dBm)
LTE 64QAM	733.0	16.2
LTE 64QAM	747.0	16.2
LTE 64QAM	753.0	16.3
LTE 16QAM	733.0	16.4
LTE 16QAM	747.0	16.4
LTE 16QAM	753.0	16.1
LTE QPSK	733.0	16.6
LTE QPSK	747.0	16.6
LTE QPSK	753.0	15.9

Figure 9 RF Power Output LTE band

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

JUDGEMENT: Passed

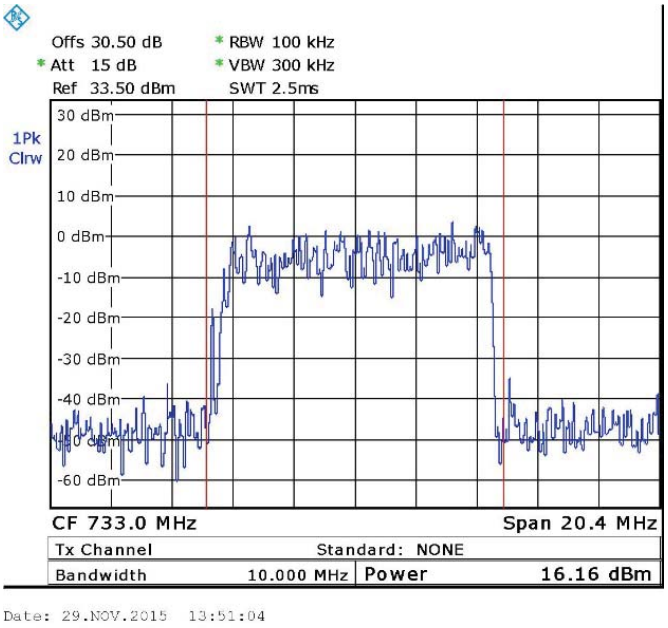

Figure 10. — 64QAM, 733.0 MHz

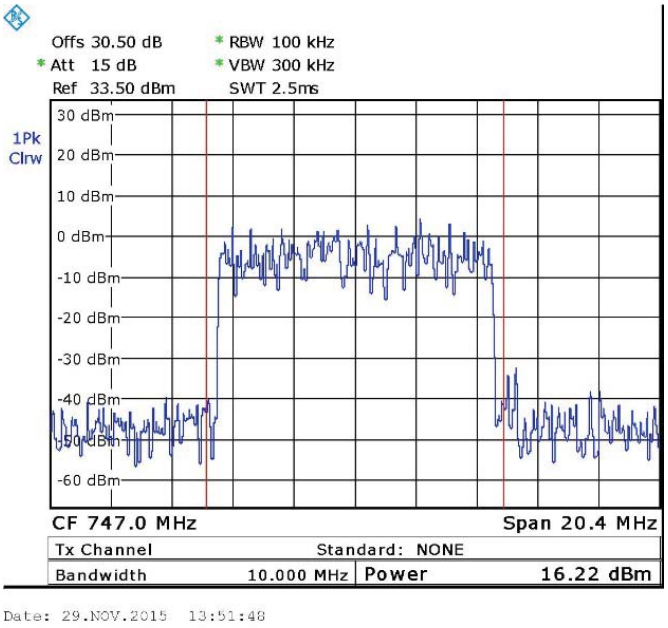

Figure 11. — 64QAM 747.0 MHz

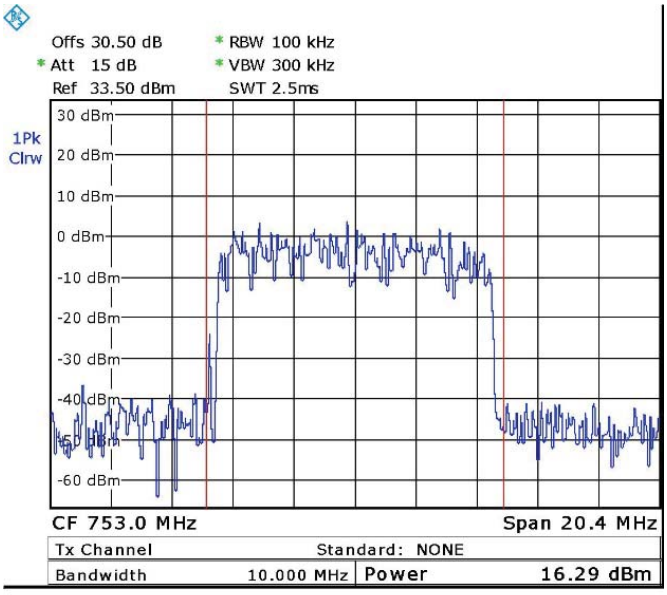

Figure 12. — 64QAM 753.0 MHz

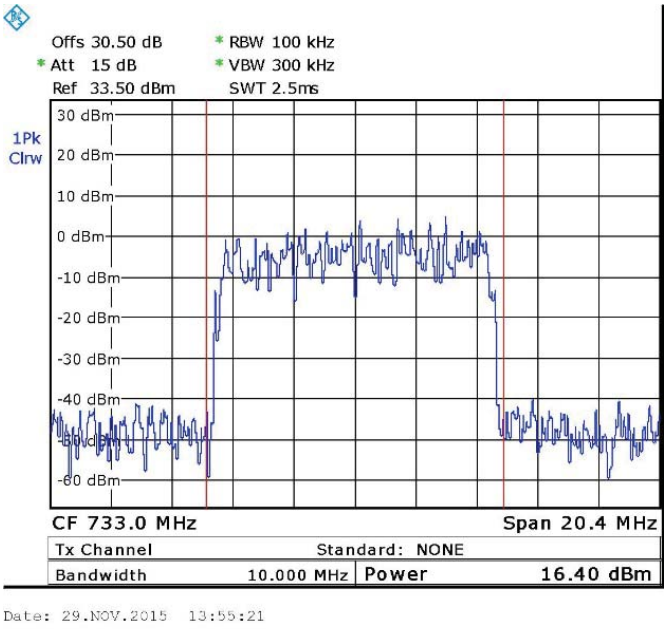

Figure 13. — 16QAM 733.0 MHz

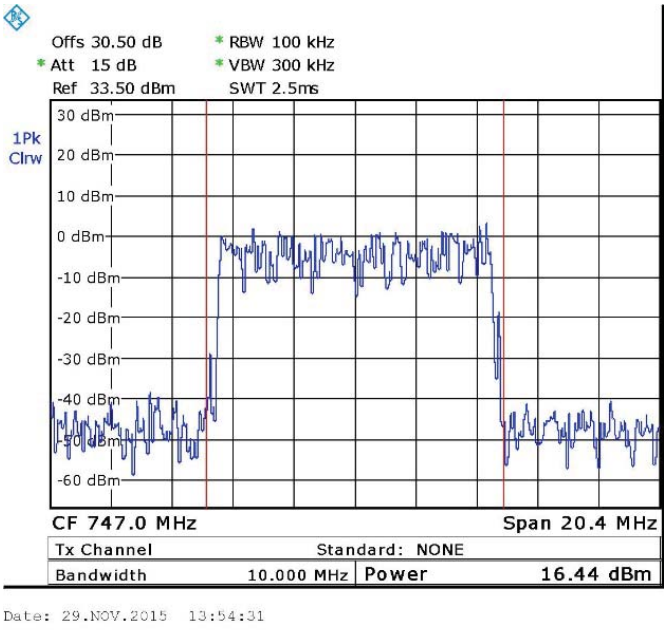

Figure 14. — 16QAM 747.0 MHz

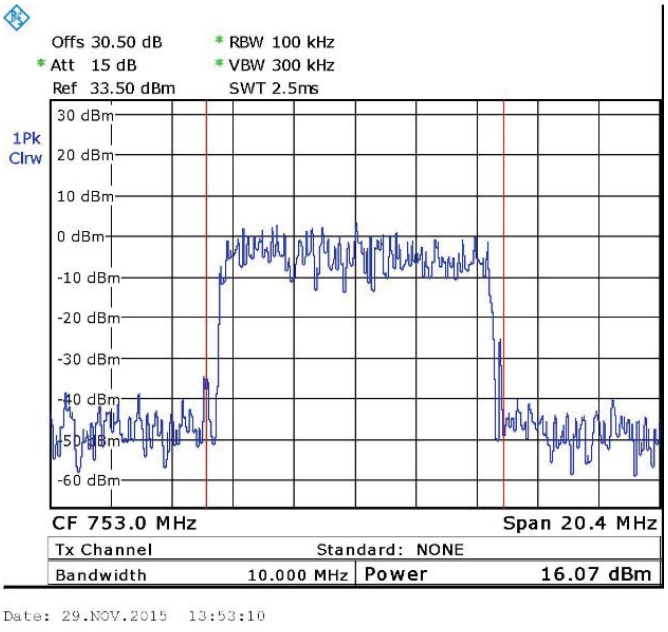

Figure 15. — 16QAM 753.0 MHz

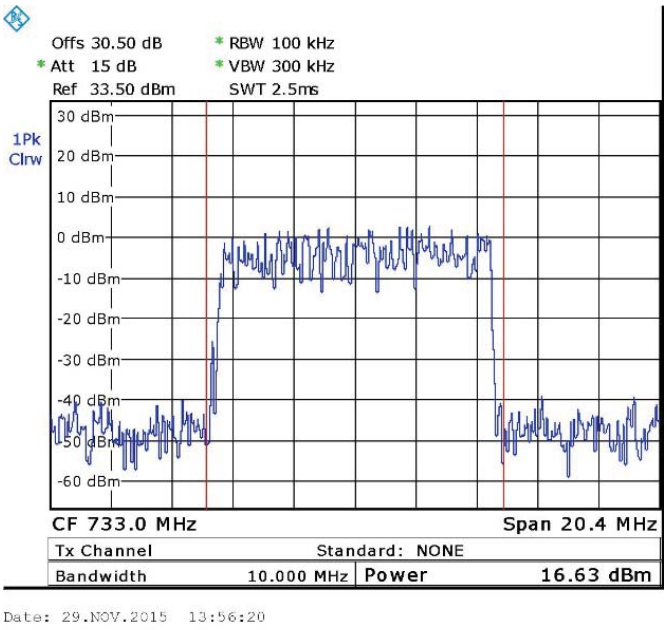

Figure 16. — QPSK 733.0 MHz

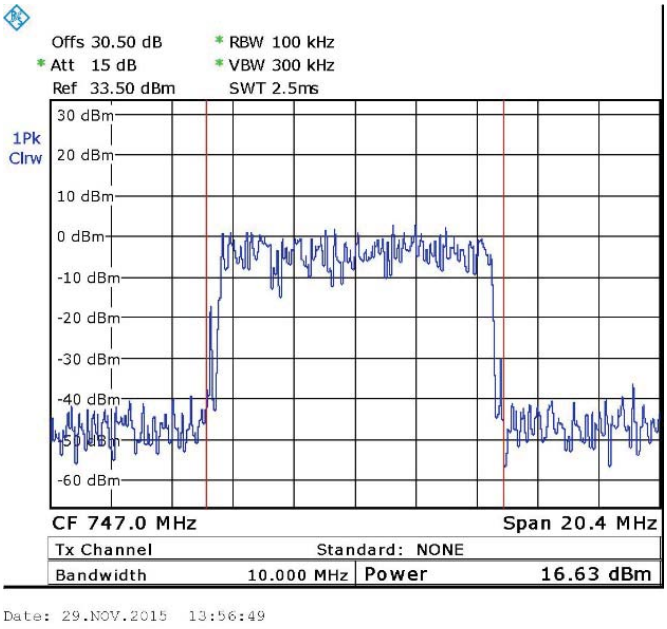

Figure 17. — QPSK 747.0 MHz

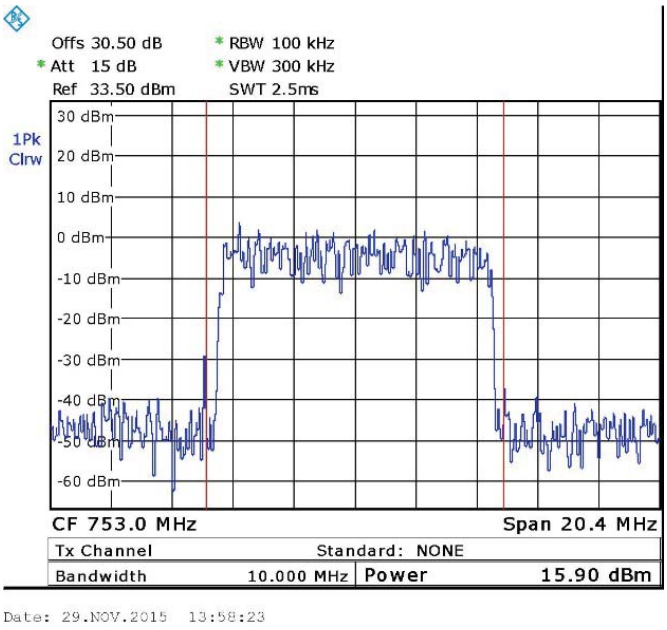

Figure 18. — QPSK 753.0 MHz

4.4 Test Equipment Used; RF Power Output (LTE)

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2015	1 year
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	January 14, 2015	1 year

Figure 19 Test Equipment Used

5. Occupied Bandwidth (LTE)

5.1 Test Specification

FCC Part 2, Section 1049

5.2 Test Procedure

The E.U.T. was set to the applicable test frequency with modulation. The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator (at the output port test) and an appropriate coaxial cable. RBW was set to 1%-5% from OBW.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limit, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.

The function 99% power bandwidth was used for this evaluation

Occupied bandwidth measured was repeated in the input terminal of the E.U.T. The E.U.T was evaluated in 3 modulations: 64QAM, 16QAM and QPSK and at the low, mid and high channels of each modulation.

5.3 Test Results

Modulation	port	Operating Frequency (MHz)	Reading (MHz)
LTE 64QAM	Input	733.0	8.98
LTE 64QAM	Output	733.0	8.98
LTE 64QAM	Input	747.0	8.98
LTE 64QAM	Output	747.0	8.98
LTE 64QAM	Input	753.0	8.98
LTE 64QAM	Output	753.0	8.90
LTE 16QAM	Input	733.0	8.98
LTE 16QAM	Output	733.0	8.94
LTE 16QAM	Input	747.0	8.98
LTE 16QAM	Output	747.0	8.98
LTE 16QAM	Input	753.0	8.98
LTE 16QAM	Output	753.0	8.90
LTE QPSK	Input	733.0	8.98
LTE QPSK	Output	733.0	8.94
LTE QPSK	Input	747.0	8.98
LTE QPSK	Output	747.0	8.98
LTE QPSK	Input	753.0	8.98
LTE QPSK	Output	753.0	8.90

Figure 20 Occupied Bandwidth LTE

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

JUDGEMENT: Passed

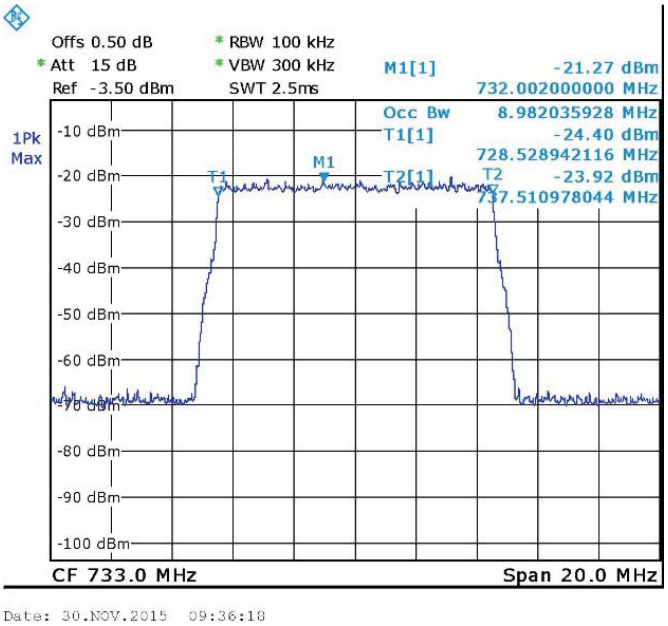

Figure 21. — 64QAM 733 MHz IN

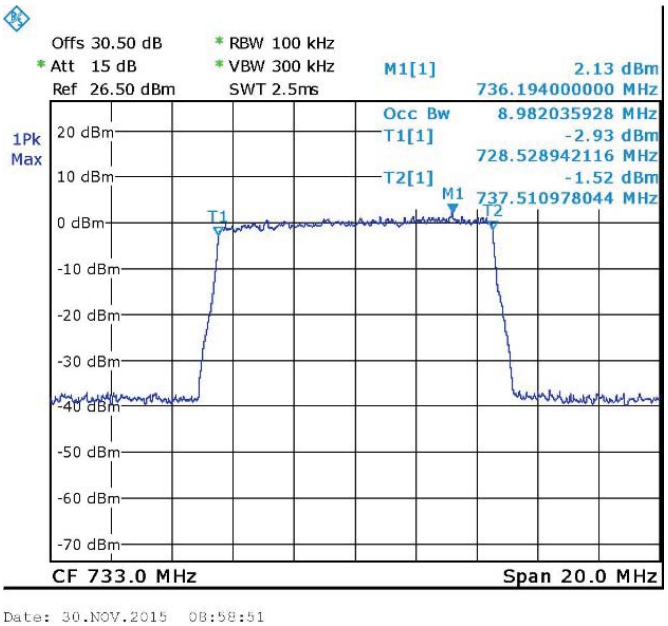

Figure 22. — 64QAM 733 MHz OUT

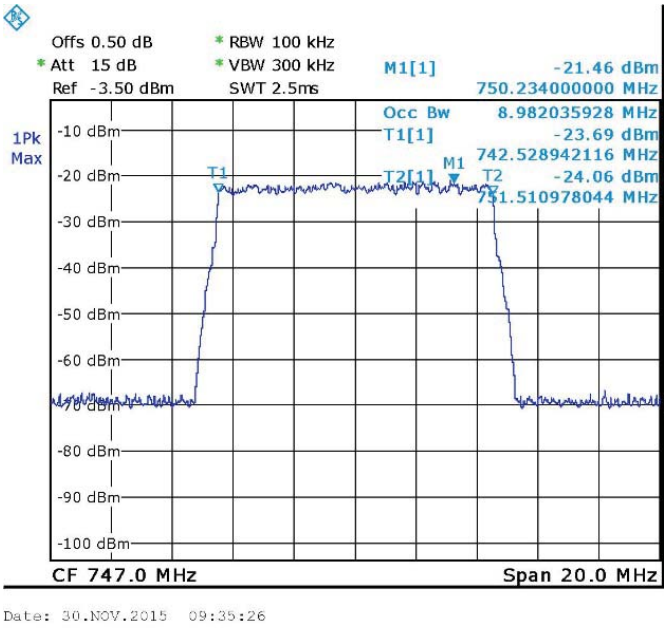

Figure 23. — 64QAM 747 MHz IN

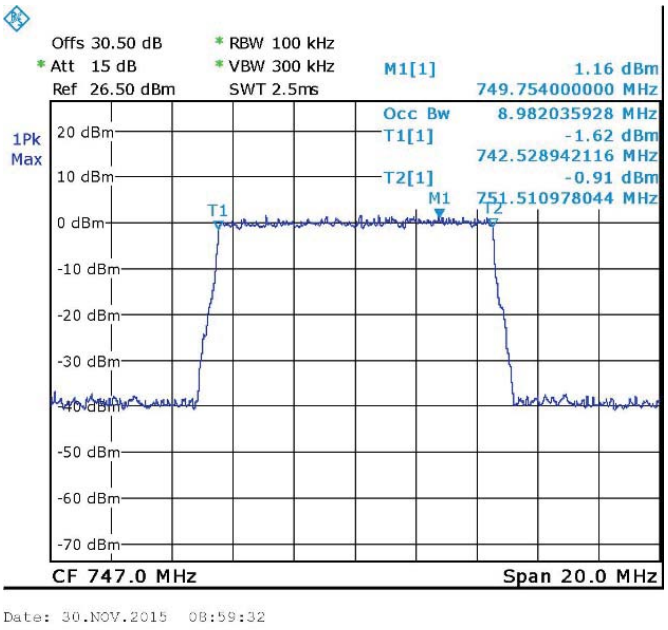

Figure 24. — 64QAM 747 MHz OUT

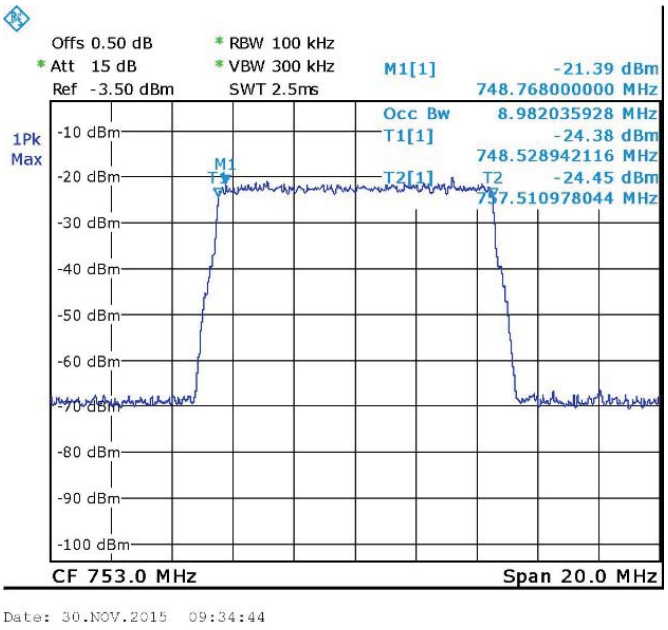

Figure 25. — 64QAM 753 MHz IN

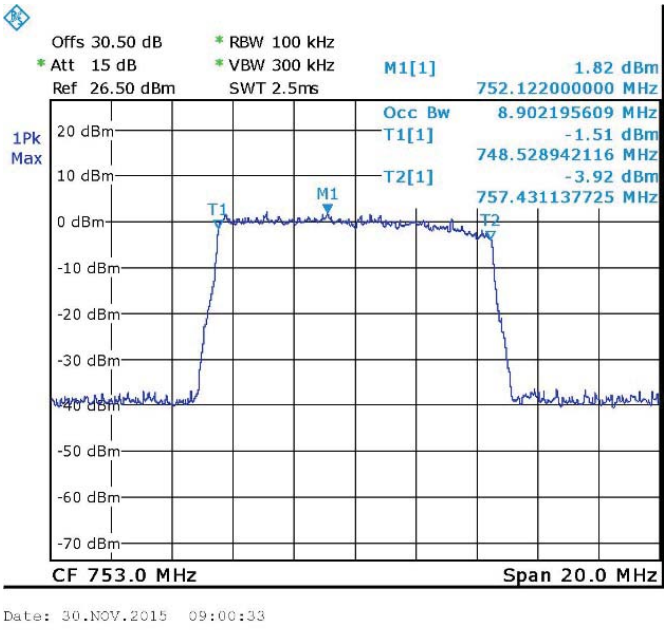

Figure 26. — 64QAM 753 MHz OUT

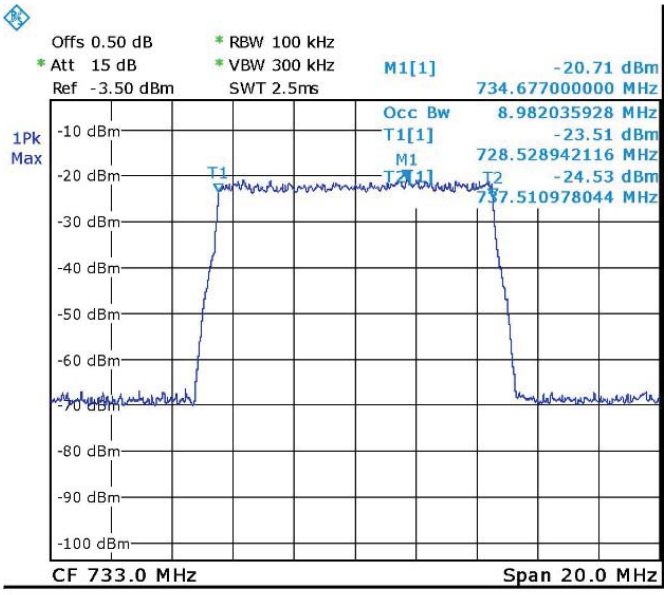

Figure 27. — 16QAM 733 MHz IN

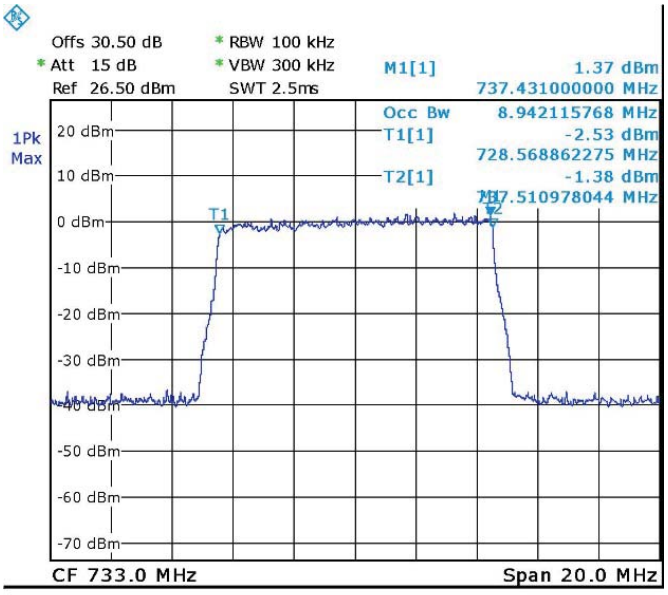

Figure 28. — 16QAM 733 MHz OUT

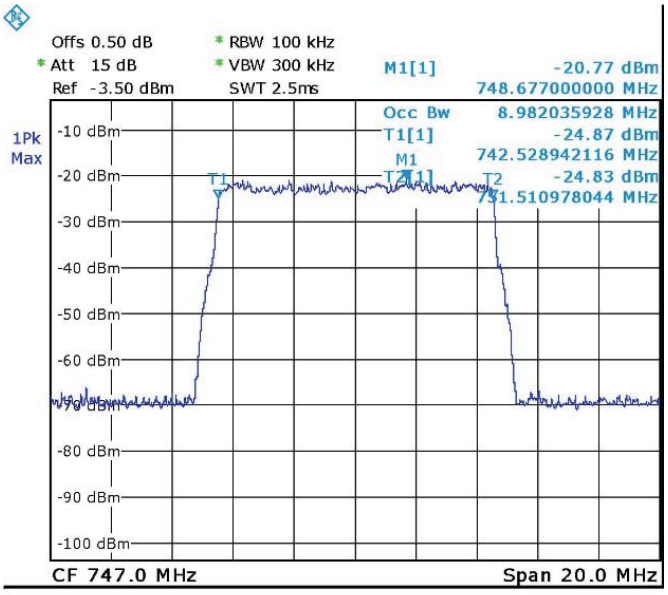

Figure 29. — 16QAM 747 MHz IN

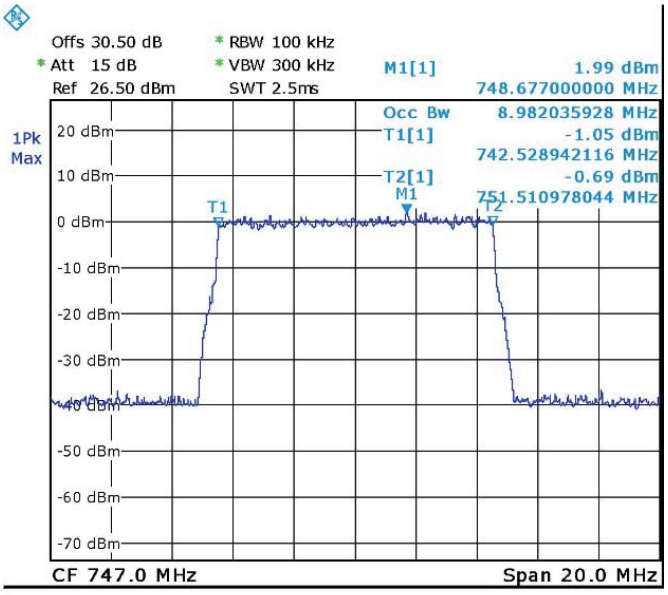

Figure 30. — 16QAM 747 MHz OUT

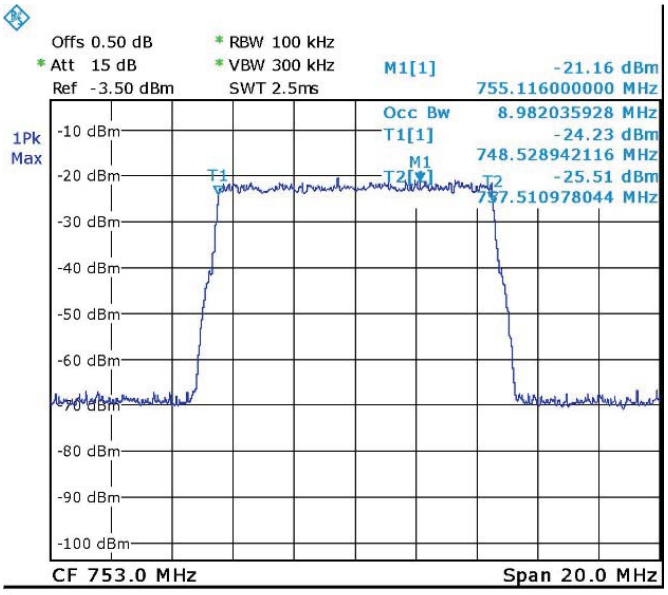

Figure 31. — 16QAM 753 MHz IN

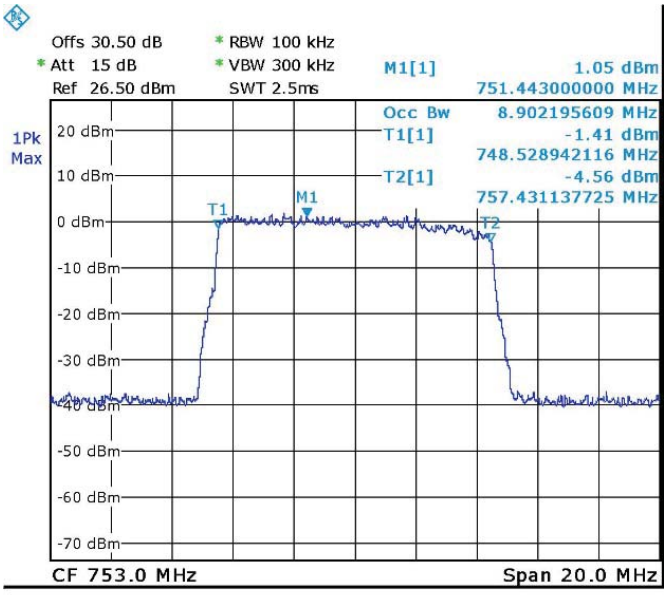

Figure 32. — 16QAM 753 MHz OUT

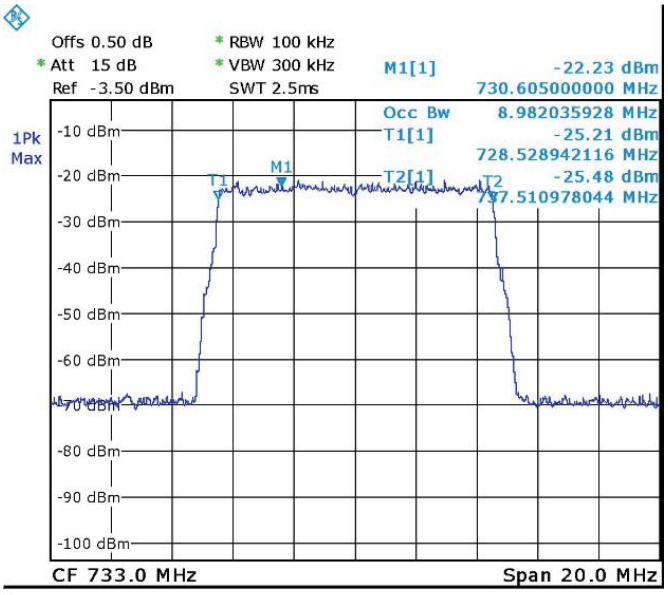

Figure 33. — QPSK 733 MHz IN

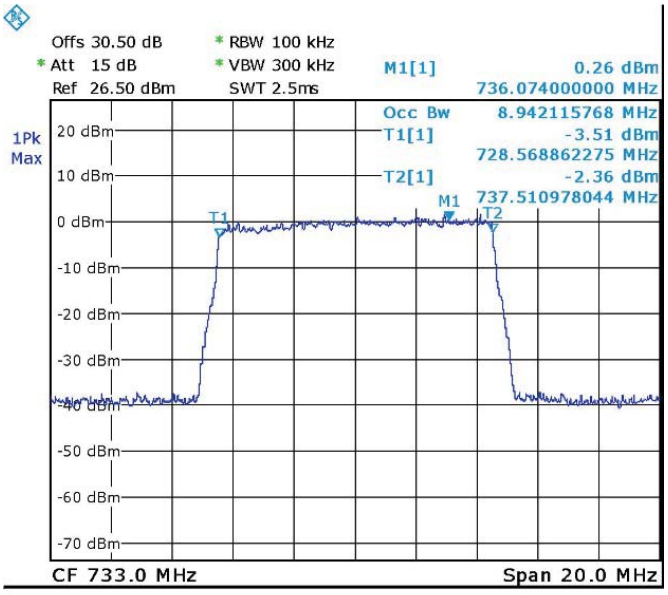

Figure 34. — QPSK 733 MHz OUT

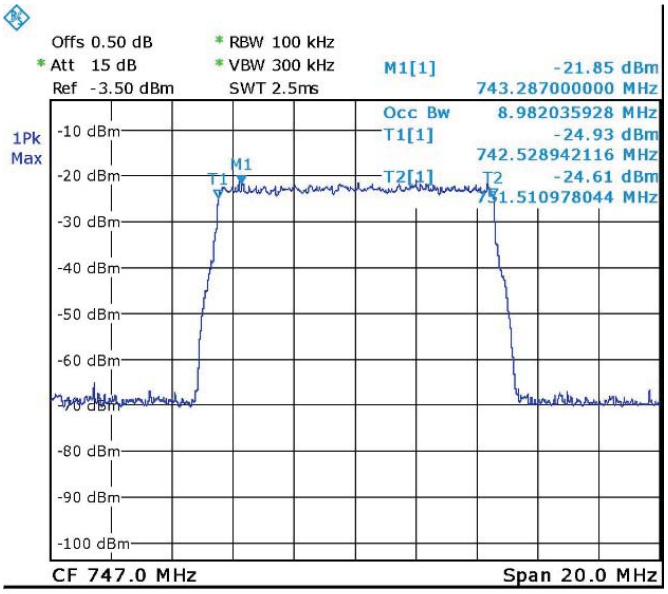

Figure 35. — QPSK 747 MHz IN

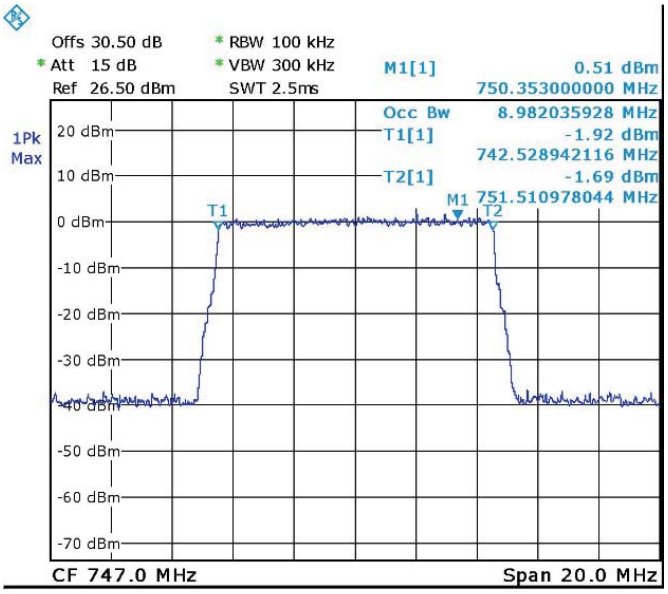

Figure 36. — QPSK 747 MHz OUT

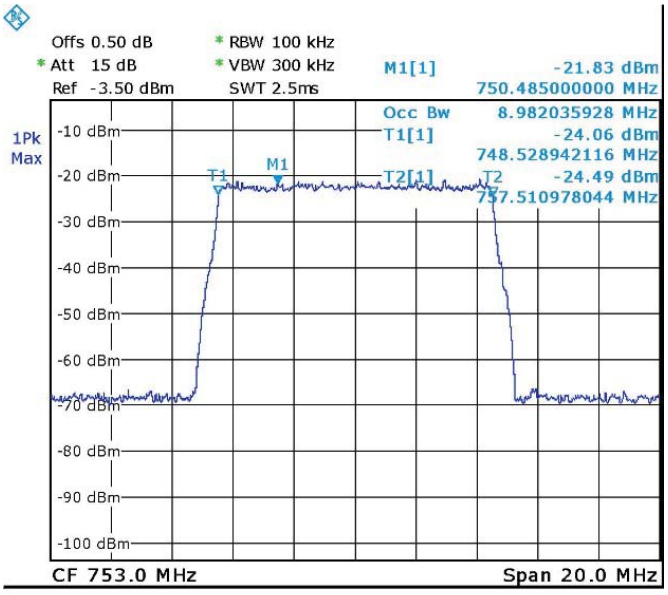

Figure 37. — QPSK 753 MHz IN

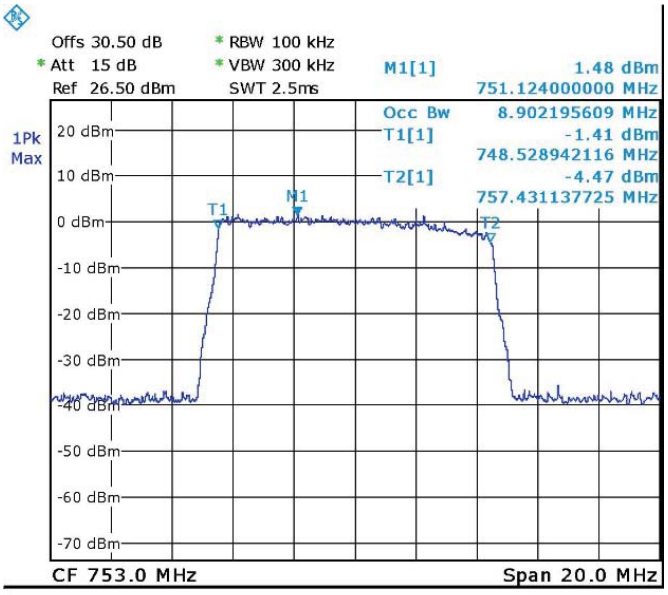

Figure 38. — QPSK 753 MHz OUT

5.4 Test Equipment Used; Occupied Bandwidth LTE

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2015	1 year
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	January 14, 2015	1 year

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

The power of any emission outside of the authorized bandwidth must be attenuated below the transmitting power (P) by a factor of at least

43 + log (P) dB, yielding –13dBm.

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (max total Loss= 33.0 dB).

The resolution bandwidth was set to 1.0 kHz for the frequency range 9 kHz – 1 MHz, 100 kHz for the frequency range 1 MHz to 1 GHz, and 1 MHz in the frequency range 1 – 22 GHz.

The E.U.T was evaluated in 3 modulations: 64QAM, 16QAM, QPSK and at the low, mid and high channels of each modulation.

6.3 Test Results

See additional information in *Figure 40* to *Figure 48.*

JUDGEMENT: Passed

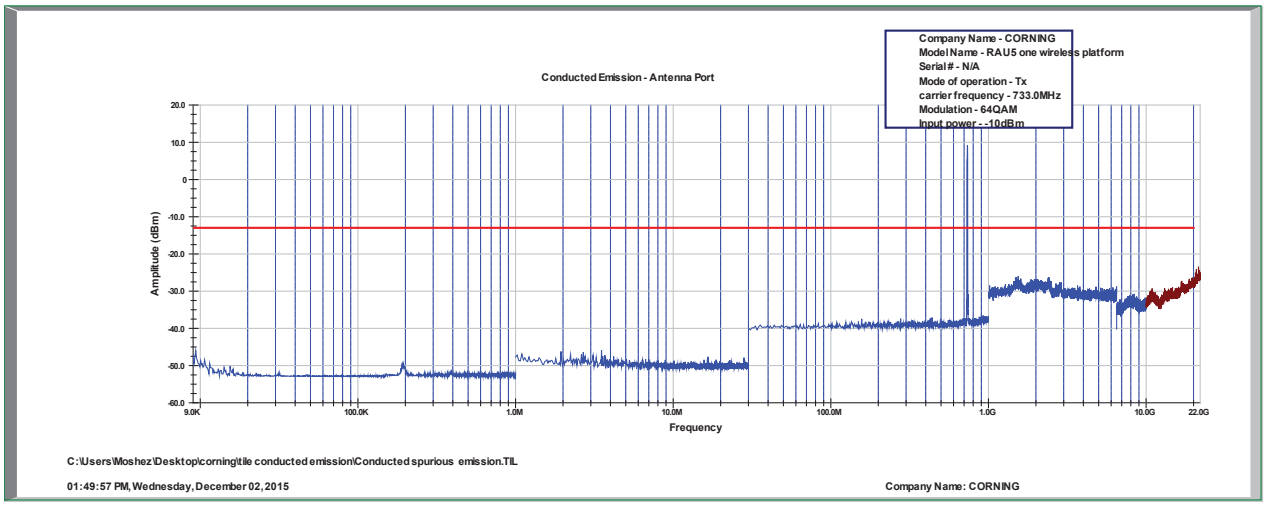

Figure 40 Spurious Emissions at Antenna Terminals 64QAM, 733MHz

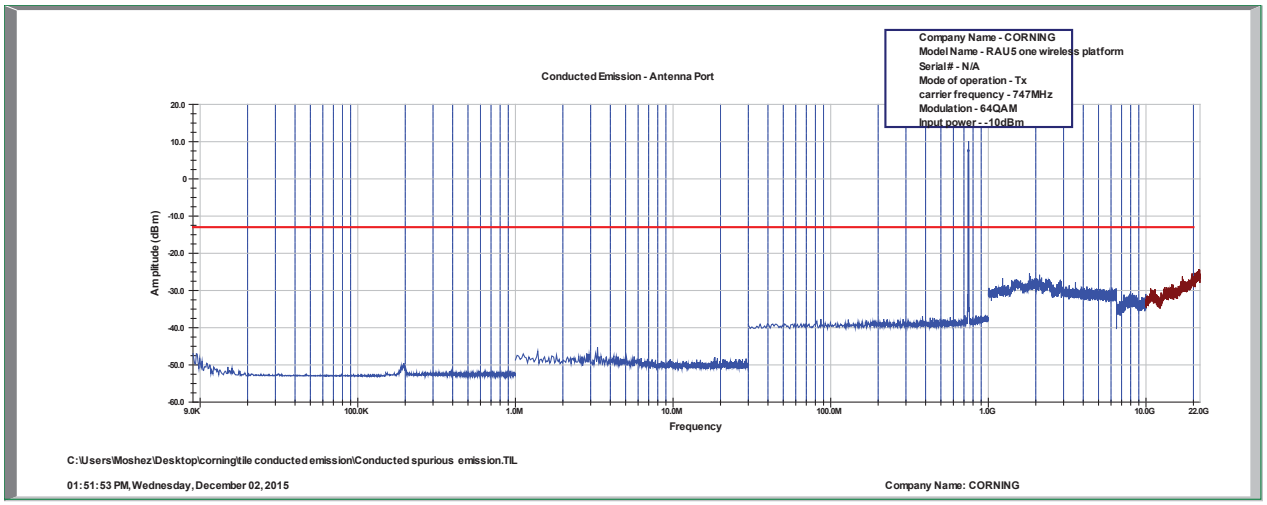

Figure 41 Spurious Emissions at Antenna Terminals 64QAM, 747MHz

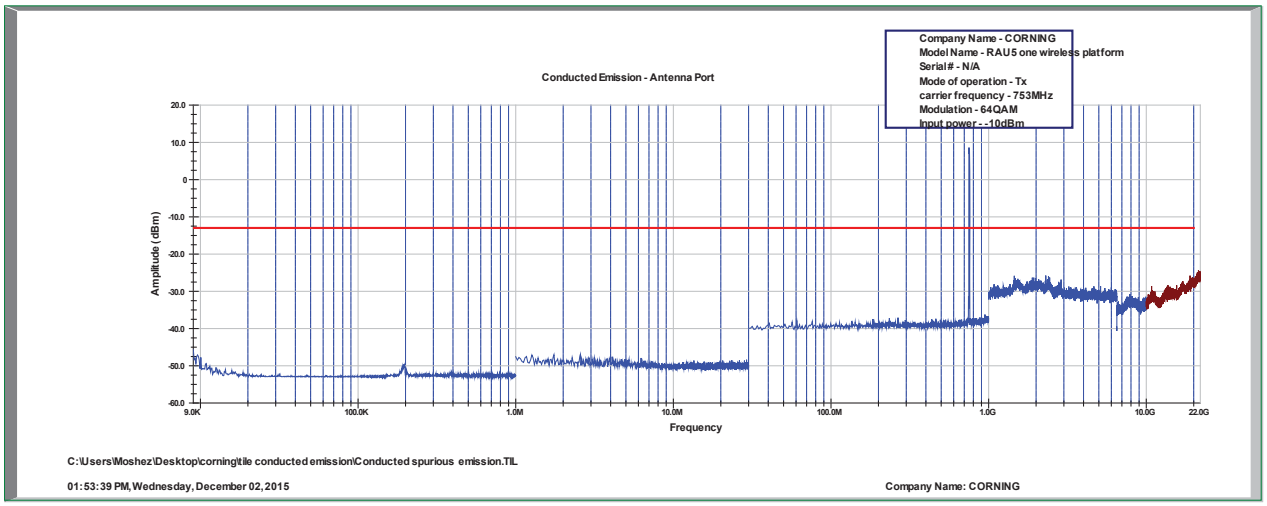

Figure 42 Spurious Emissions at Antenna Terminals 64QAM, 753MHz

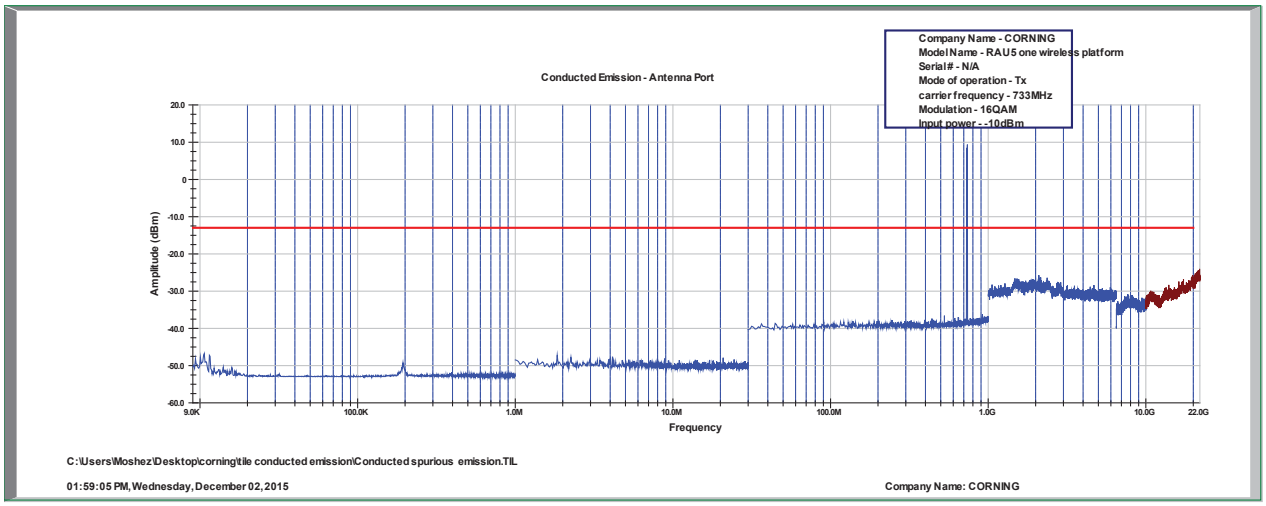

Figure 43 Spurious Emissions at Antenna Terminals 16QAM, 733MHz

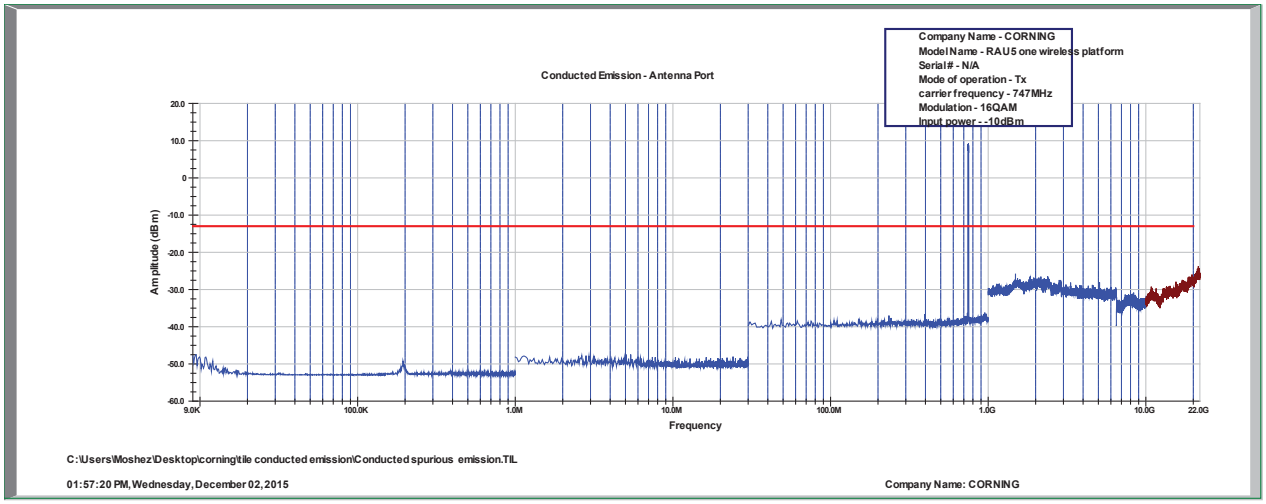

Figure 44 Spurious Emissions at Antenna Terminals 16QAM, 747MHz

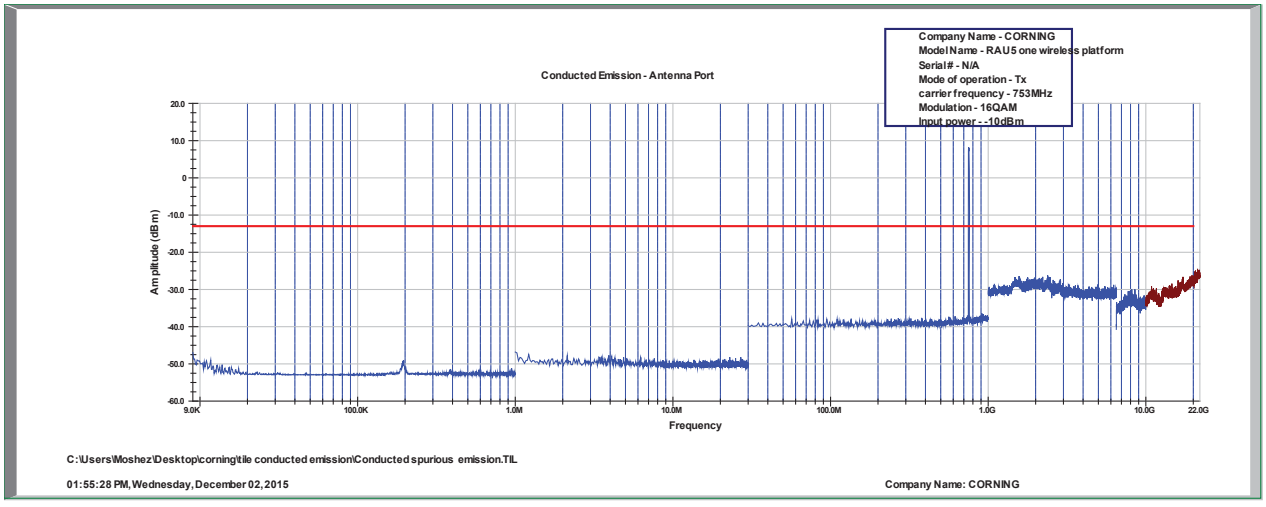

Figure 45 Spurious Emissions at Antenna Terminals 16QAM, 753MHz

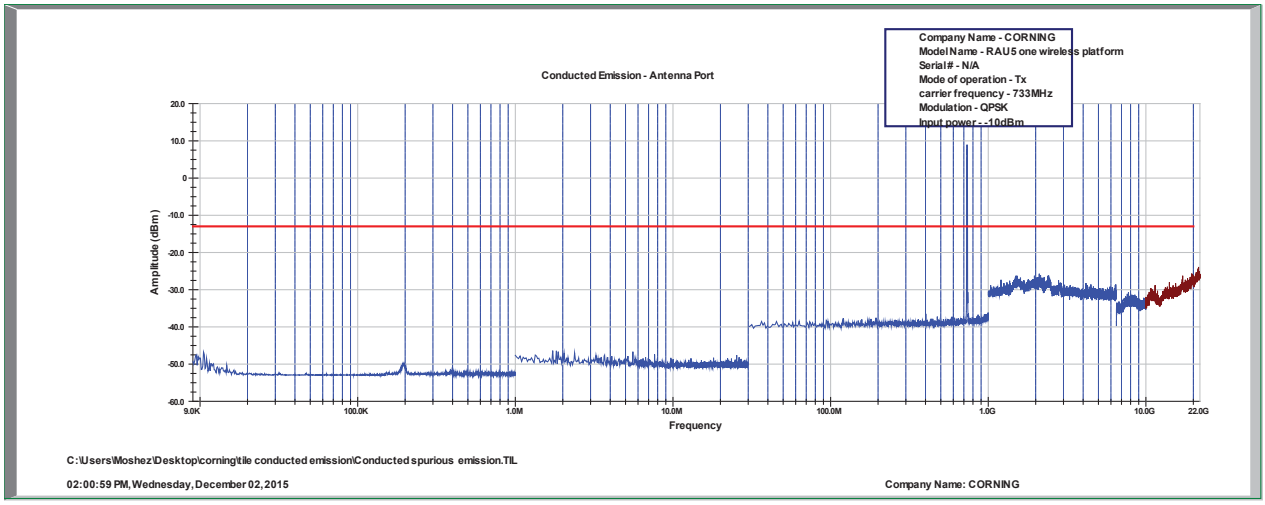

Figure 46 Spurious Emissions at Antenna Terminals QPSK, 733MHz

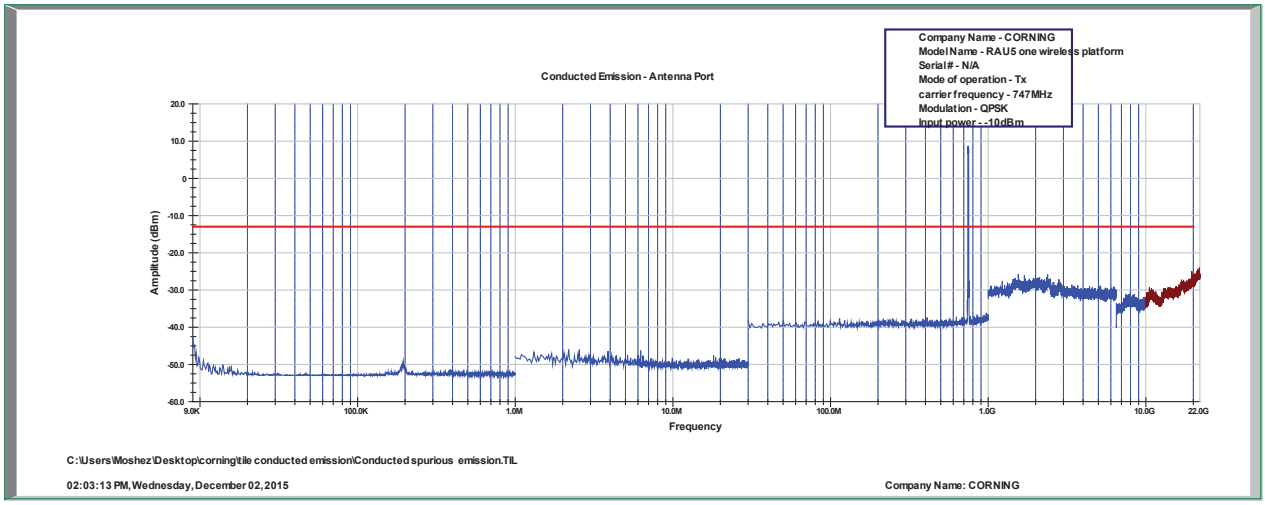

Figure 47 Spurious Emissions at Antenna Terminals QPSK, 747MHz

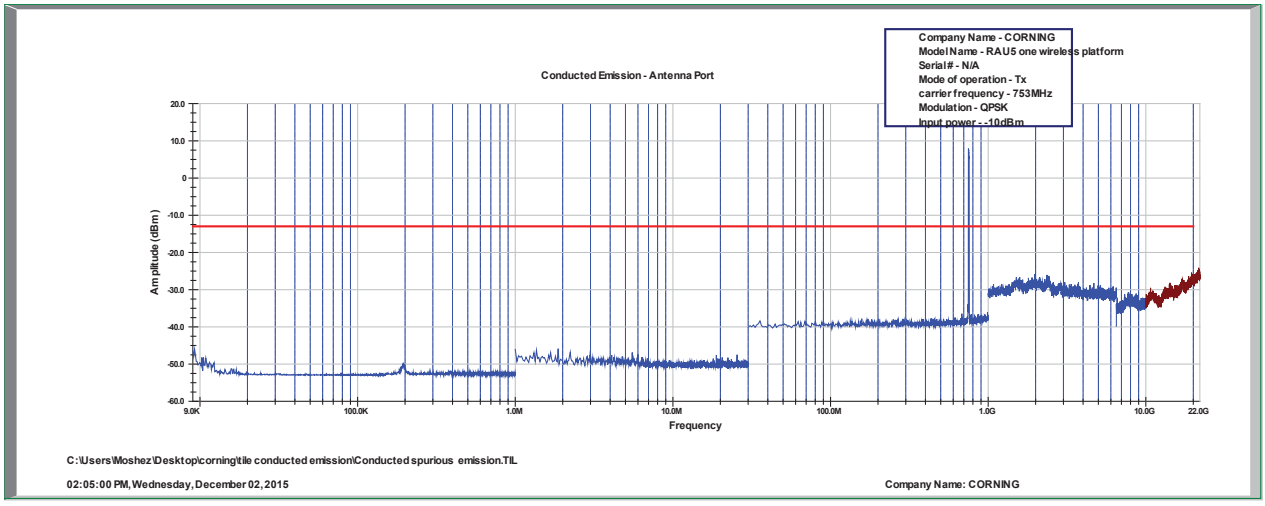

Figure 48 Spurious Emissions at Antenna Terminals QPSK, 753MHz

6.4 Test Equipment Used; Spurious Emissions at Antenna Terminals LTE

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, 2015	1 year
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	January 14, 2015	1 year

Figure 49 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

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + log (P) dB, yielding –13dBm.
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (30.5 dB).
RBW was set to 100 kHz.

The E.U.T was evaluated in 3 modulations: 64QAM, 16QAM, QPSK and at the low and high channels of each modulation.

7.3 Results

Modulation	Operation Frequency (MHz)	Band Edge Frequency (MHz)	Reading (dBm)	Specification (dBm)	Margin (dB)
64QAM	733.0	728.0	-40.0	-13.0	-27.0
64QAM	753.0	758.0	-41.4	-13.0	-28.4
16QAM	733.0	728.0	-40.4	-13.0	-27.4
16QAM	753.0	758.0	-40.5	-13.0	-27.5
QPSK	733.0	728.0	-38.1	-13.0	-25.1
QPSK	753.0	758.0	-41.6	-13.0	-28.6

Figure 50 Band Edge Spectrum Results LTE

JUDGEMENT: Passed by 25.1 dB

See additional information in *Figure 51* to *Figure 56*.

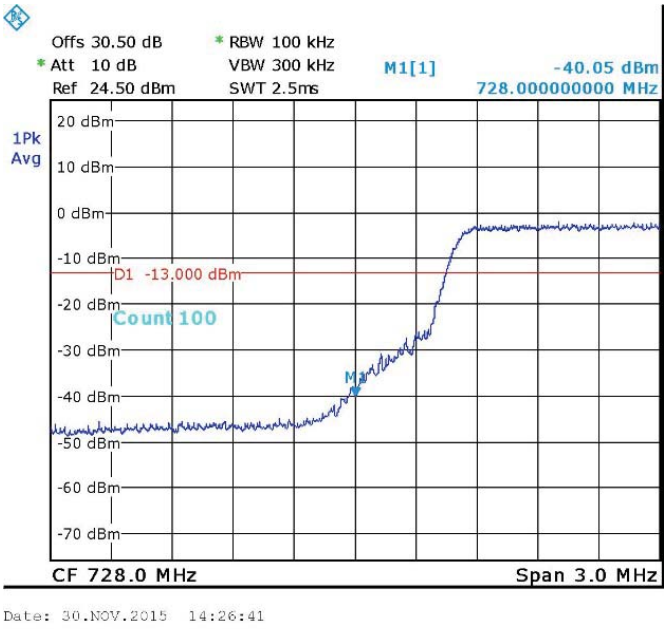

Figure 51. — 64QAM 733.0 MHz

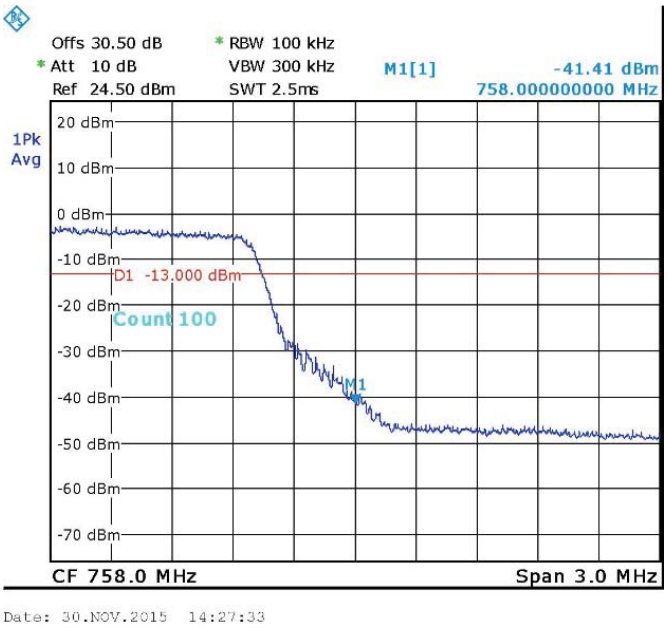

Figure 52. — 64QAM 753.0 MHz

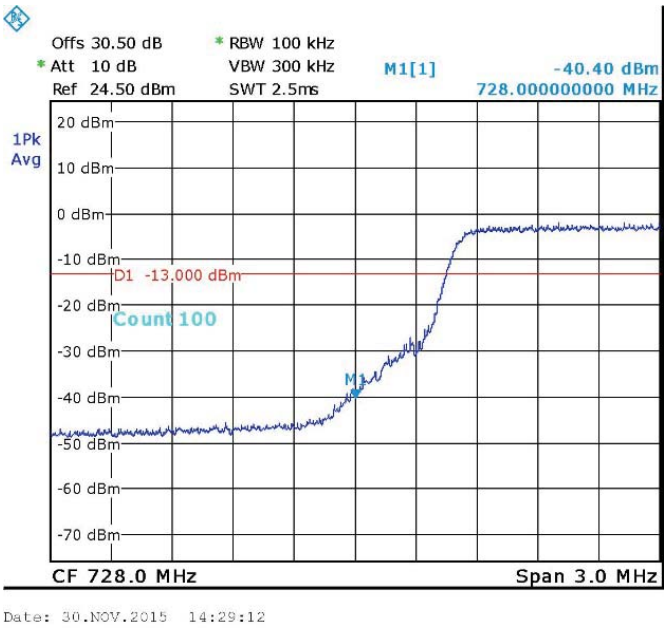

Figure 53. — 16QAM 733.0 MHz

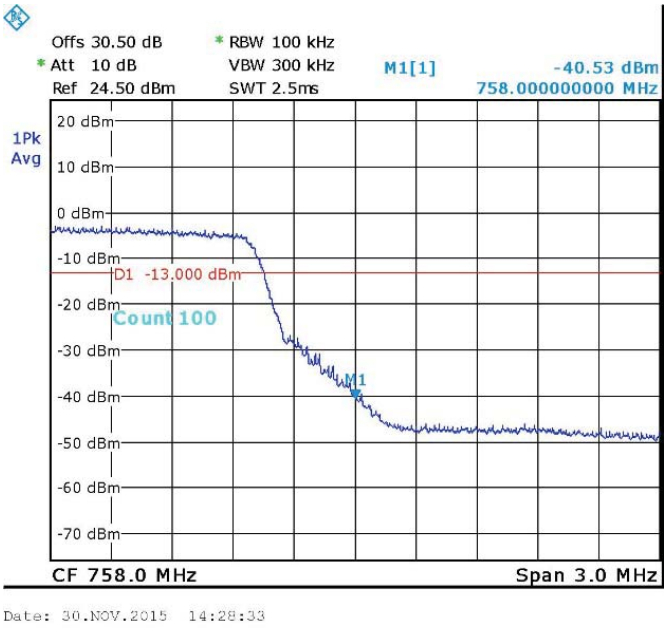

Figure 54. — 16QAM 753.0 MHz

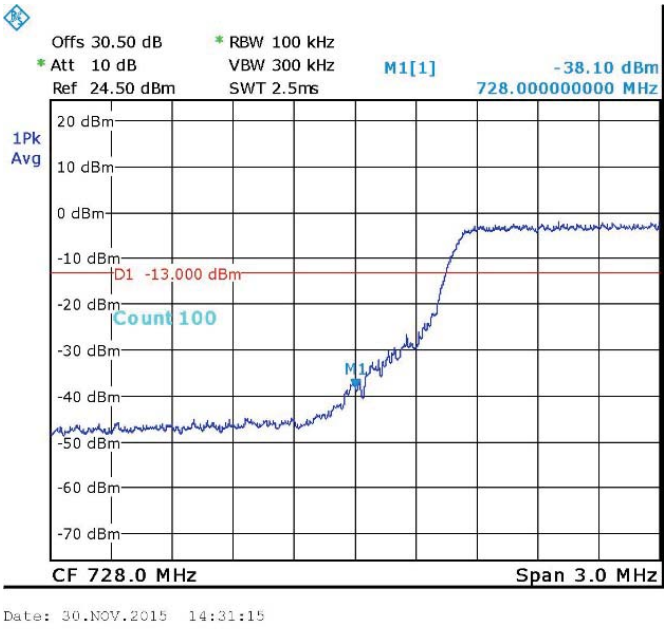

Figure 55. — QPSK 733.0 MHz

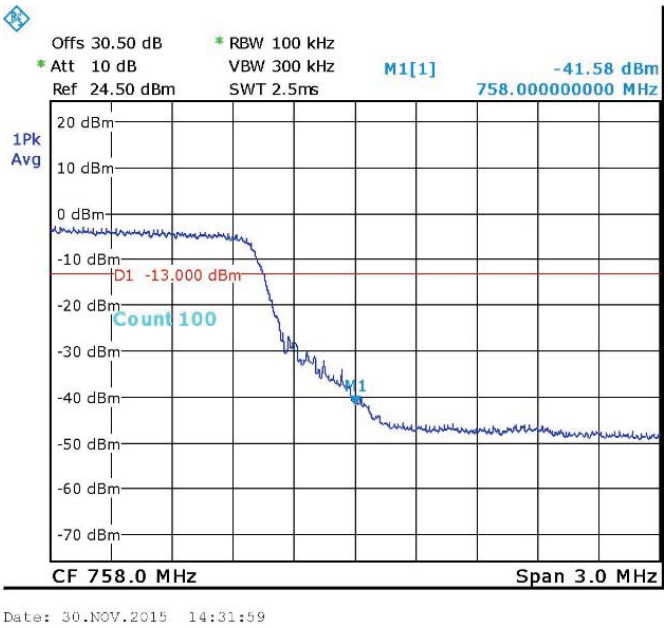

Figure 56. — QPSK 753.0 MHz

7.4 Test Equipment Used; Band Edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration	Period
Spectrum Analyzer	R&S	FSL6	100194	January 1, 2015	1 year
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2015	1 year
30 dB Attenuator	Weinschel Engineering	49-30-34	PD426	January 14, 2015	1 year

Figure 57 Test Equipment Used

8. Spurious Radiated Emission (LTE)

8.1 Test Specification

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

8.2 Test Procedure

The test method was based on ANSI/TIA-603-C: 2004, Section 2.2.12 Unwanted Emissions: Radiated Spurious.
The power of any emission outside of the authorized operating frequency ranges 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 of this report.

For measurements between 0.009MHz-30MHz:

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 30MHz-1GHz:
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 loop/broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 1.0 meters above the ground. The frequency range 30MHz -1GHz 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 1GHz-22GHz:

The E.U.T was performed 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 1GHz -22GHz 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.

(b) The E.U.T. was replaced by a substitution antenna driven by a signal generator. The height was readjusted for maximum reading. The signal generator level was adjusted to obtain the same reading on the EMI receiver as in step (a).
The signals observed in step (a) were converted to radiated power using:

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

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

8.3 Test Results

Carrier Channel (MHz)	Freq. (MHz)	Antenna Pol. (V/H)	Maximum Peak Level (dBµV/m)	Signal Generator RF Output (dBm)	Cable Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)	Spec. (dBm)	Margin (dB)
733.00	1466.0	V	34.5	-65.1	0.5	6.0	-59.6	-13.00	-46.6
733.00	1150.0	H	35.0	-64.6	0.5	6.0	-59.1	-13.00	-46.1
747.00	1494.0	V	34.1	-65.5	0.5	6.0	-60.0	-13.00	-47.0
747.00	1150.0	H	36.6	-63	0.5	6.0	-57.5	-13.00	-44.5
753.00	1506.0	V	33.6	-66	0.5	6.0	-60.5	-13.00	-47.5
753.00	1150.0	H	35.6	-64	0.5	6.0	-58.5	-13.00	-45.5

Figure 58 Spurious Radiated Emission LTE

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

JUDGEMENT: Passed by 44.5 dB

8.4 Test Instrumentation Used; Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMC Analyzer	HP	8593EM	3536A00120ADI	February 24, 2015	1 year
EMI Receiver	HP	8542E	3906A00276	March 11, 2015	1 year
RF Filter Section	HP	85420E	3705A00248	March 19, 2015	1 year
Semi Anechoic Civil Chamber	ETS	S81	SL 11643	N/A	N/A
Active Loop Antenna	EMCO	6502	9506-2950	November 4, 2015	1 year
Biconical Antenna	EMCO	3104	2606	December 28, 2014	1 year
Log Periodic Antenna	EMCO	3146	9505-4081	December 28, 2014	1 year
Horn Antenna	ETS	3115	29845	May 19, 2015	3 years
Horn Antenna	ARA	SWH-28	1007	March 3, 2014	2 years
Vector Signal Generator	Agilent	N5182A	MY48180244	July 16, 2015	1 year
Low Noise Amplifier	Sophia Wireless	LNA 28-B	232	March 1, 2015	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	March 1, 2015	1 year
Antenna Mast	ETS	2070-2	-	N/A	N/A
Turntable	ETS	2087	-	N/A	N/A
Mast & Table Controller	ETS/EMCO	2090	9608-1456	N/A	N/A

Figure 59 Test Equipment Used