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DATE: 28 July 2020

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

FCC Radio Test Report

For

Corning Optical Communication Wireless

Equipment under test:

Building Wireless Systems (BWS) v1.0

Low Power Radio (LPR)

(WCS Section 2350-2360MHz Band)

Tested by: _____
A. Shelly

Approved by: _____
D. Shidlowsky

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Measurement/Technical Report for
Corning Optical Communication Wireless
Building Wireless Systems (BWS) v1.0

FCC ID: OJF1LPR

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

Measurement procedure used is KDB 935210 D05 v01r03 April 2019 and ANSI IEEE C63.26-2015

Substitution Method used as in ANSI TIA-603-E-2016

Application for Certification prepared by:

D. Shidlowsky
ITL (Product Testing) Ltd.
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Israel
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Applicant for this device: (different from "prepared by")

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e-mail: NissanI@corning.com

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1 General Information

1.1 Administrative Information

Manufacturer:	Corning Optical Communication Wireless
Manufacturer's Address:	8253 1st Street Vienna, VA 22812 U.S.A. Tel: +1-703 855-1773
Manufacturer's Representative:	Isaac Nissan
Equipment Under Test (E.U.T):	Building Wireless Systems (BWS) v1.0
Equipment Model No.:	Low Power Radio (LPR)
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	21.05.2020
Start of Test:	21.05.2020
End of Test:	21.07.2020
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-20025, R-2729, T-20028, G-20068.
5. Department of Innovation, Science and Economic Development (ISED) Canada, CAB identifier: IL1002.

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 BWS™ platform 1.0 is the first fully-digital, end-to-end in-building cellular solution, for medium size venues.

Corning's Low Power Radio (LPR) units are the end-point antennas connected by optical cable to the BWS system Digital Router Unit (DRU) (distribution/routing of RF samples via CPRI stream), and to the system Power Supply Unit (PSU) for power.

LPR is the first release of Corning's fully-digital radio remote unit, providing plug-and-play, cost-effective processing, minimizing power loss and noise.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in KDB 935210 D05 v01r03 April 2019 and ANSI/TIA-603-E-2016. 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 32, EN 55032, ANSI C63.4)
0.15 – 30 MHz:
Expanded Uncertainty (95% Confidence, K=2):
± 3.44 dB

Radiated Emission (CISPR 11, EN 55011, CISPR 32, EN 55032, 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 E.U.T. was previously tested for FCC certification as follows:
The EUT consists of the LPR (Low-Power Remote Module) which is connected with the head-end ICRAN equipment (BBU and DRU) using fiber optic cable.
The RF source signals are represented in the setup by BBU unit.
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.
Only peak power testing was done on the both ports, all other testing was performed 1 port (see customer declaration on following page regarding the identical ports).
Presently the following tests were performed in order to allow the use of 5G:
RF output power, occupied bandwidth, and spurious emissions.
Testing was performed on the following configuration:

Frequency Range (MHz)		
Service/Band	**Downlink (DL)**	**Technology**
WCS	2350-2360	LTE

2.2 EUT Exercise Software

vHCM SW ver. 1.0 used for commands delivery. These commands are used to enable/disable the EUT transmission.
EUT Embedded SW versions are:

DRU ver dru_d719_10_25
LPR ver LPR_D803_01.63

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.

CORNING

Declaration

Date: December 25, 2019

RE: Corning Optical Communication Wireless
P/N: LPR-3C-2A2P2W-10
FCC ID: OJF1LPR

I hereby declare that the MIMO stream 1 and MIMO stream 2 of the LPR-3C-2A2P2W-10 have the identical RF chain including antenna gain of 2dBi.

Authorized Signature:

Printed Name: Isaac Nissan

2.5 Configuration of Tested System

Product Name	Building Wireless Systems (BWS) v1.0
Model Name	Low Power Radio (LPR)
Working voltage	100-240VAC/ 48VDC
Mode of operation	Industrial Booster for WCS band
Modulations	16QAM, 64QAM, 256QAM, QPSK
Operating Frequency Range	2350.0MHz -2360.0MHz
Transmit power	~15.0 dBm
Antenna Gain	2dBi
DATA rate	N/A
Modulation BW	5MHz, 10.0MHz
DC Voltage and DC current applied to the final amplifying device	36-60VDC, (nominal voltage 48V)/ 2A

3 Test Set-Up Photos

Figure 1. Conducted Emission From Antenna Port Tests

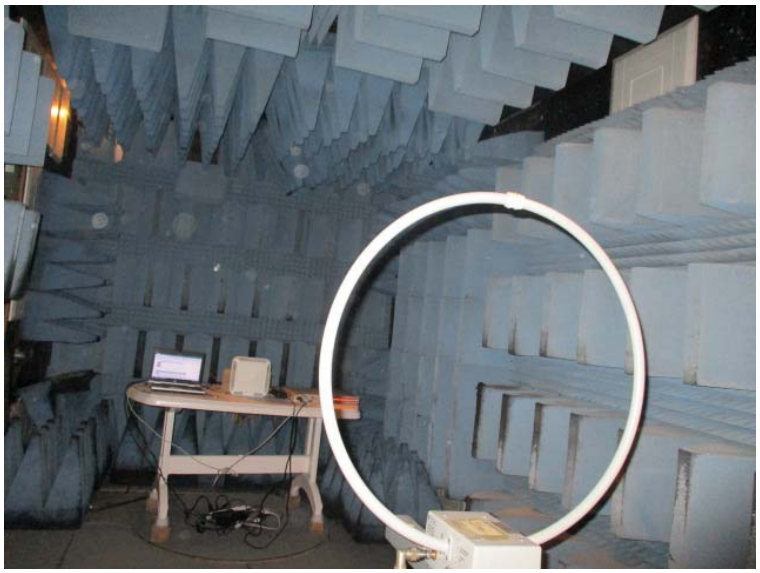

Figure 2. Radiated Emission Test 9kHz - 30MHz

Figure 3. Radiated Emission Test 30 - 200 MHz

Figure 4. Radiated Emission Test 200 - 1000MHz

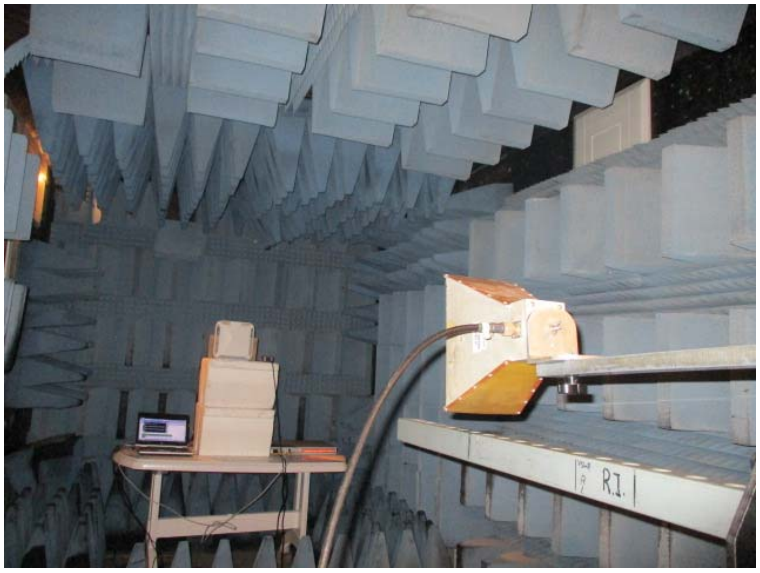

Figure 5. Radiated Emission Test 1-18GHz

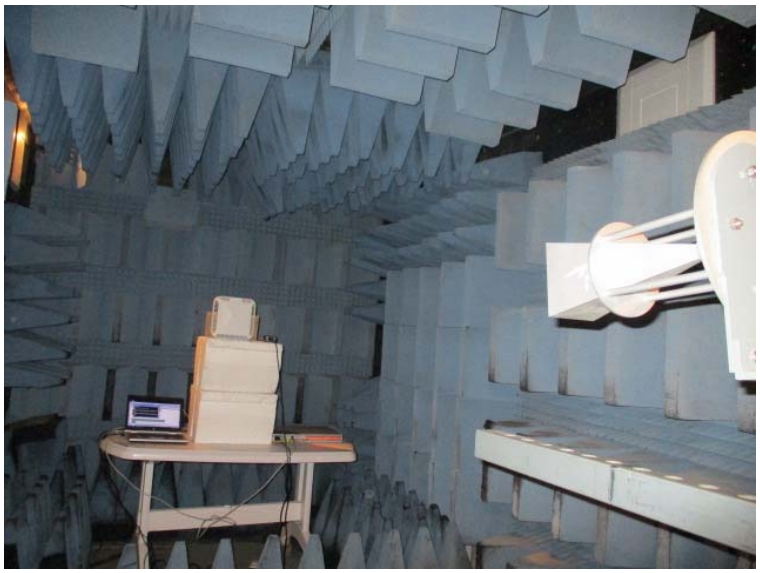

Figure 6. Radiated Emission Test 18-24GHz

4 RF Power Output

4.1 Test Specification

FCC Part 27, Subpart C (27.50) (a)(ii)

4.2 Test Procedure

(Temperature (24°C)/ Humidity (31%RH))

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload.

4.3 Test Limit

Peak Power Output must not exceed 2000 Watts (63dBm).

4.4 Test Results

JUDGEMENT: Passed

See additional information in Table 1 to Table 2 and Figure 7 to Figure 60.

Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading	Antenna Gain	EIRP	Limit	Margin
	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
16QAM	5	15	2352.5	17.12	2	19.12	63.0	-43.9
		30	2352.5	17.06		19.06	63.0	-43.9
		15	2355.0	17.19		19.19	63.0	-43.8
		30	2355.0	17.09		19.09	63.0	-43.9
		15	2357.5	17.32		19.32	63.0	-43.7
		30	2357.5	17.27		19.27	63.0	-43.7
	10	15	2355.0	17.12		19.12	63.0	-43.9
		30	2355.0	16.97		18.97	63.0	-44.0
		60	2355.0	17.19		19.19	63.0	-43.8
64QAM	5	15	2352.5	17.11	2	19.11	63.0	-43.9
		30	2352.5	16.99		18.99	63.0	-44.0
		15	2355.0	17.17		19.17	63.0	-43.8
		30	2355.0	17.12		19.12	63.0	-43.9
		15	2357.5	17.27		19.27	63.0	-43.7
		30	2357.5	17.31		19.31	63.0	-43.7
	10	15	2355.0	17.22		19.22	63.0	-43.8
		30	2355.0	17.29		19.29	63.0	-43.7
		60	2355.0	17.27		19.27	63.0	-43.7
256QAM	5	15	2352.5	17.08	2	19.08	63.0	-43.9
		30	2352.5	17.23		19.23	63.0	-43.8
		15	2355.0	17.23		19.23	63.0	-43.8
		30	2355.0	17.14		19.14	63.0	-43.9
		15	2357.5	17.30		19.30	63.0	-43.7
		30	2357.5	17.30		19.30	63.0	-43.7
	10	15	2355.0	17.27		19.27	63.0	-43.7
		30	2355.0	17.15		19.15	63.0	-43.9
		60	2355.0	17.13		19.13	63.0	-43.9

Table 1 RF Power Output 16QAM; 64QAM; 256QAM, Port 1 SISO

Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading	Antenna Gain	EIRP	Limit	Margin
	(MHz)	(kHz)	(MHz)	(dBm)	(dBi)	(dBm)	(dBm)	(dB)
16QAM	5	15	2352.5	17.05	2	19.05	63.0	-44.0
		30	2352.5	17.13		19.13	63.0	-43.9
		15	2355.0	17.12		19.12	63.0	-43.9
		30	2355.0	17.03		19.03	63.0	-44.0
		15	2357.5	17.13		19.13	63.0	-43.9
		30	2357.5	17.21		19.21	63.0	-43.8
	10	15	2355.0	17.10		19.10	63.0	-43.9
		30	2355.0	17.08		19.08	63.0	-43.9
		60	2355.0	17.10		19.10	63.0	-43.9
64QAM	5	15	2352.5	16.89	2	18.89	63.0	-44.1
		30	2352.5	17.15		19.15	63.0	-43.9
		15	2355.0	16.94		18.94	63.0	-44.1
		30	2355.0	17.14		19.14	63.0	-43.9
		15	2357.5	16.94		18.94	63.0	-44.1
		30	2357.5	17.04		19.04	63.0	-44.0
	10	15	2355.0	17.24		19.24	63.0	-43.8
		30	2355.0	17.20		19.20	63.0	-43.8
		60	2355.0	17.07		19.07	63.0	-43.9
256QAM	5	15	2352.5	16.89	2	18.89	63.0	-44.1
		30	2352.5	17.15		19.15	63.0	-43.9
		15	2355.0	16.94		18.94	63.0	-44.1
		30	2355.0	17.14		19.14	63.0	-43.9
		15	2357.5	16.94		18.94	63.0	-44.1
		30	2357.5	17.04		19.04	63.0	-44.0
	10	15	2355.0	17.24		19.24	63.0	-43.8
		30	2355.0	17.20		19.20	63.0	-43.8
		60	2355.0	17.07		19.07	63.0	-43.9

Table 2 RF Power Output 16QAM; 64QAM; 256QAM, Port 2 MIMO

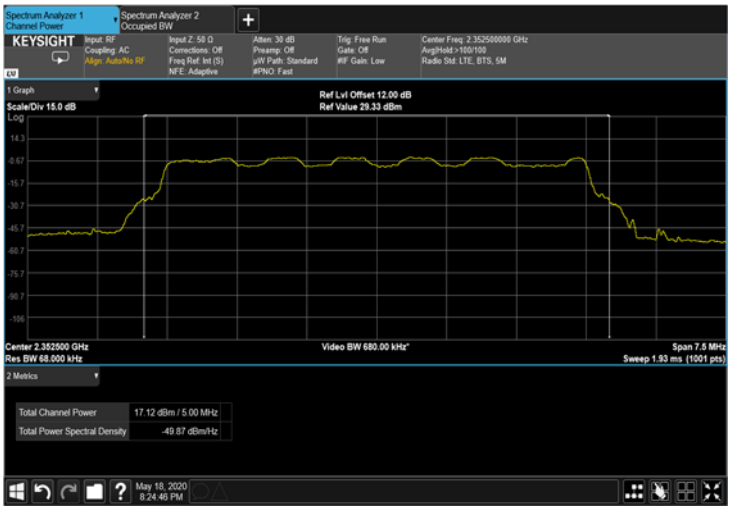

Figure 7: 16QAM 5MHz B.W.; 2352.5MHz, 15kHz

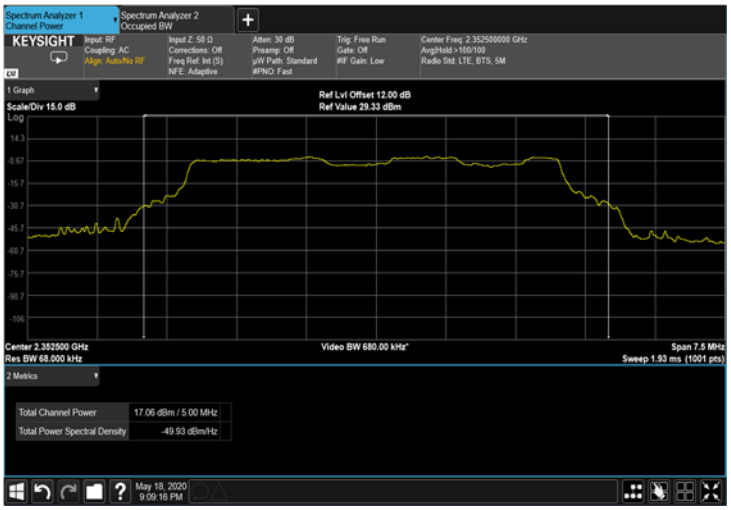

Figure 8: 16QAM 5MHz B.W.; 2352.5MHz, 30kHz

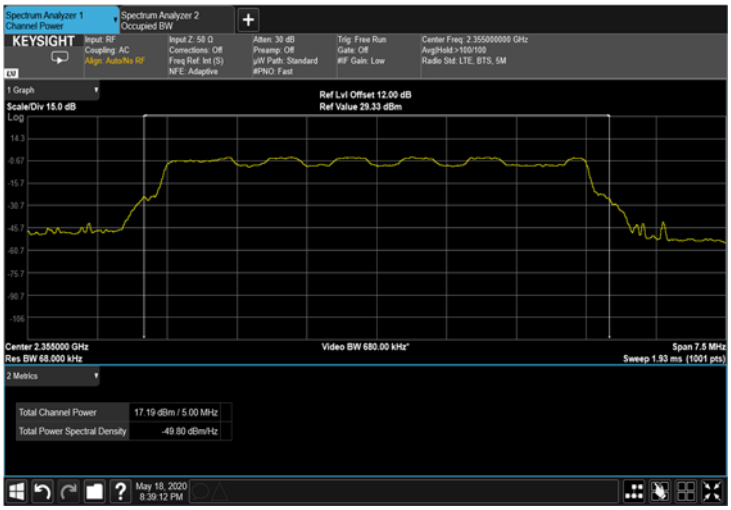

Figure 9: 16QAM 5MHz B.W.; 2355.0MHz, 15kHz

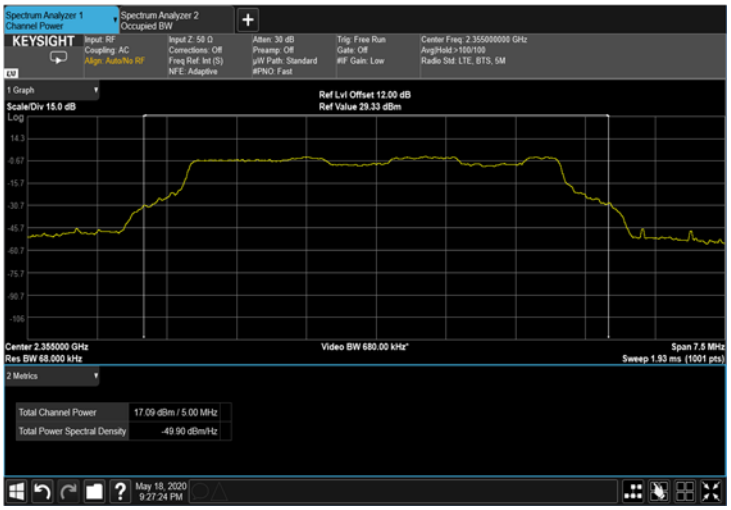

Figure 10: 16QAM 5MHz B.W.; 2355.0MHz, 30kHz

Figure 11: 16QAM 5MHz B.W.; 2357.5MHz, 15kHz

Figure 12: 16QAM 5MHzC.S; 2357.5MHz, 30kHz

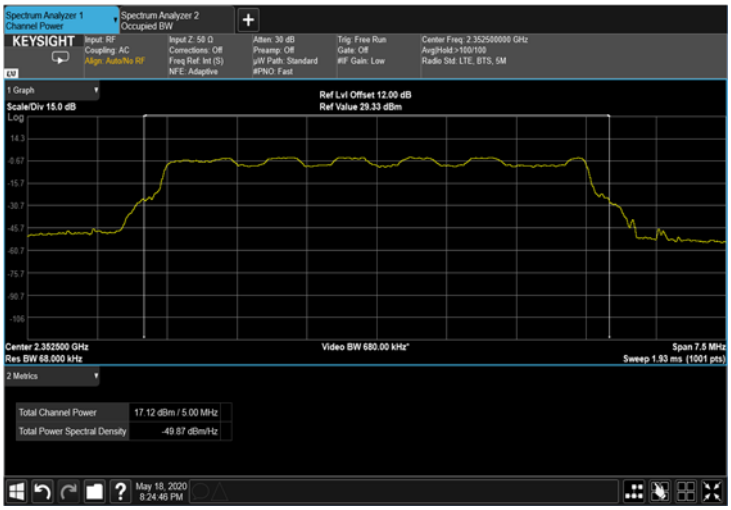

Figure 13: 16QAM 10MHz B.W.; 2355.0MHz, 15kHz

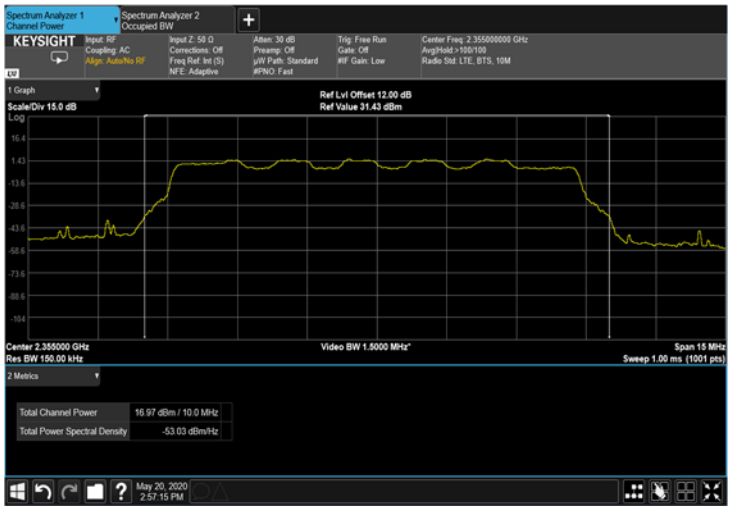

Figure 14: 16QAM 10MHz B.W.; 2355.0MHz, 30kHz

Figure 15: 16QAM 10MHz B.W.; 2355.0MHz, 60kHz

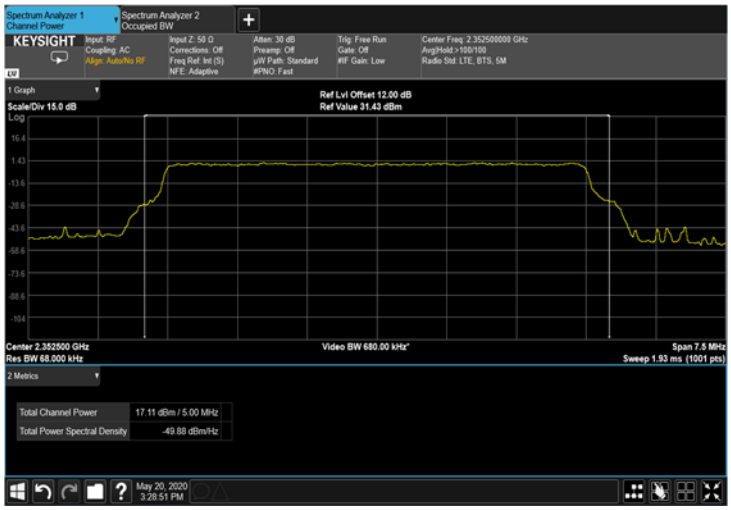

Figure 16: 64QAM 5MHz B.W.; 2352.5MHz, 15kHz

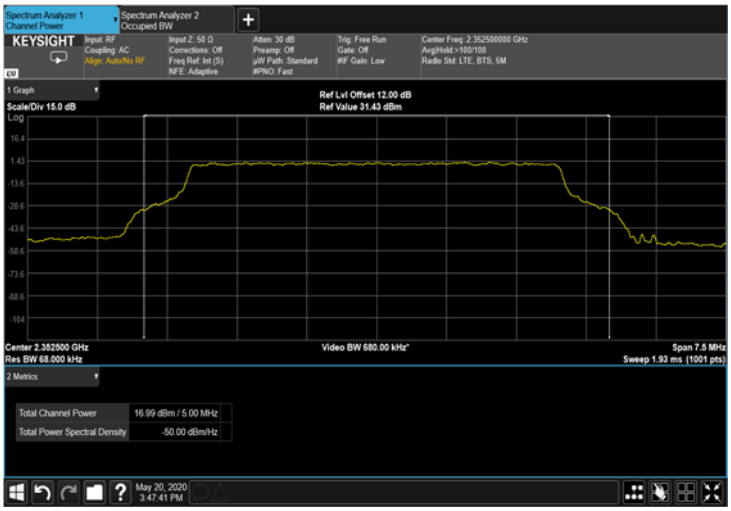

Figure 17: 64QAM 5MHz B.W.; 2352.2MHz, 30kHz

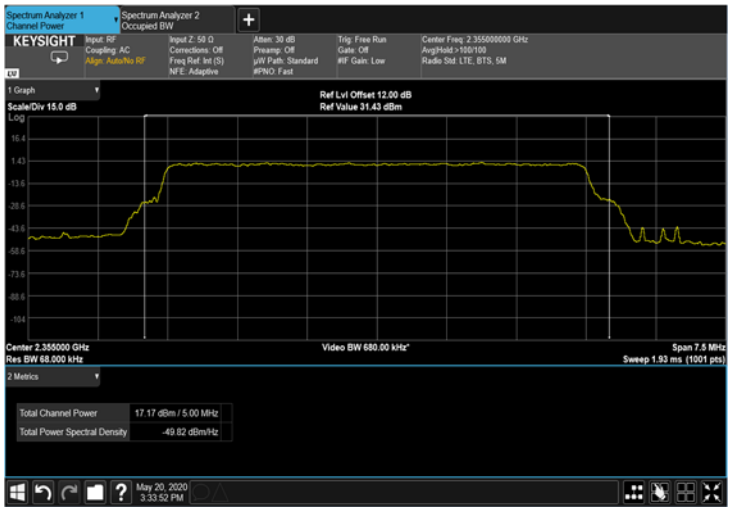

Figure 18: 64QAM 5MHz B.W.; 2355.0MHz, 15kHz

Figure 19: 64QAM 5MHz B.W.; 2355.0MHz, 30kHz

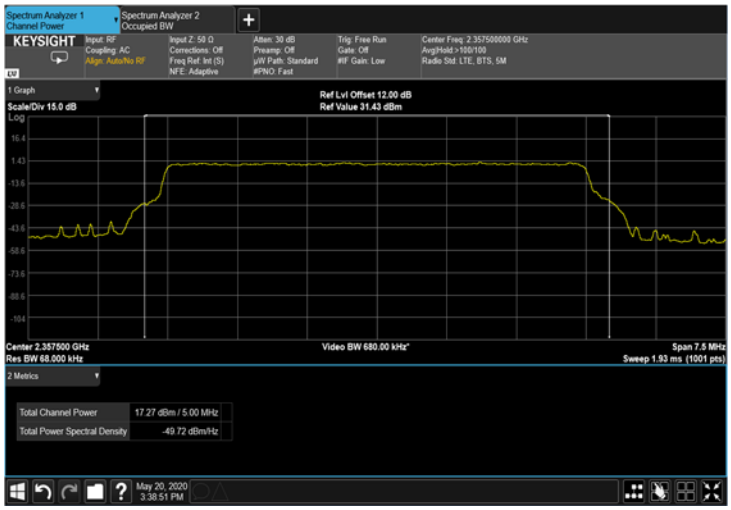

Figure 20: 64QAM 5MHz B.W.; 2357.5MHz, 15kHz

Figure 21: 64QAM 5MHz B.W.; 2357.5MHz, 30kHz

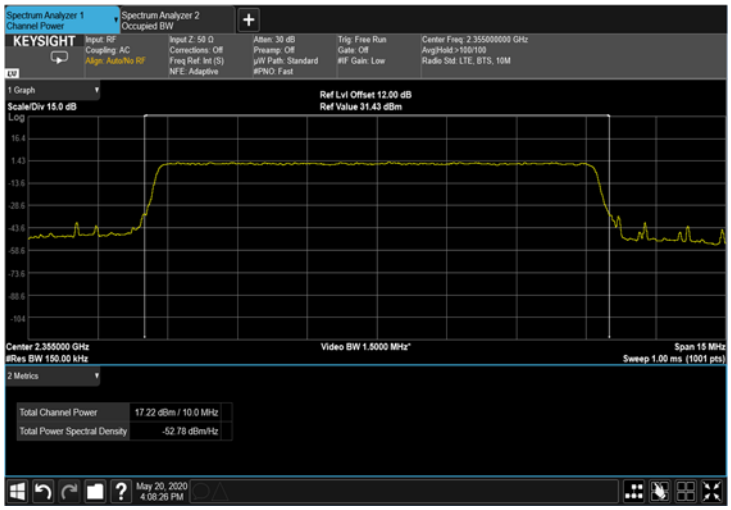

Figure 22: 64QAM 10MHz B.W.; 2355.0MHz, 15kHz

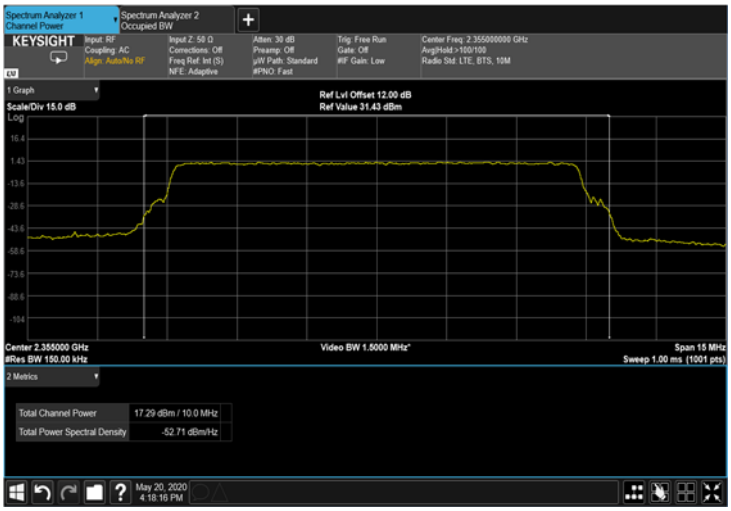

Figure 23: 64QAM 10MHz B.W.; 2355.0MHz, 30kHz

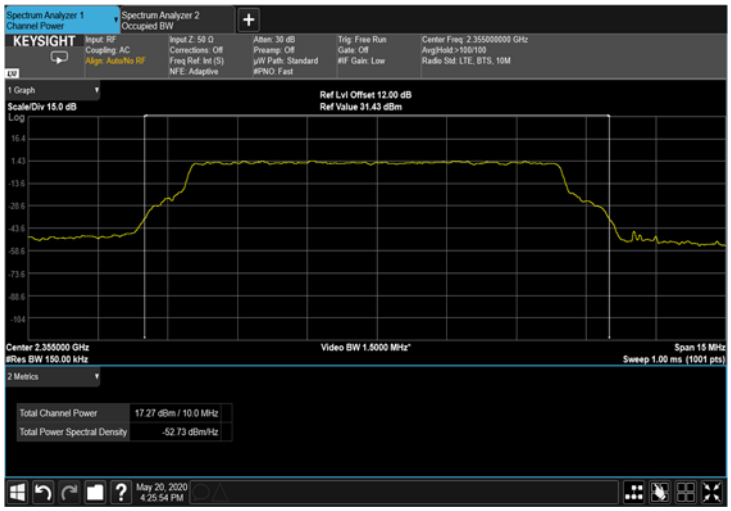

Figure 24: 64QAM 10MHz B.W.; 2355.0MHz, 60kHz

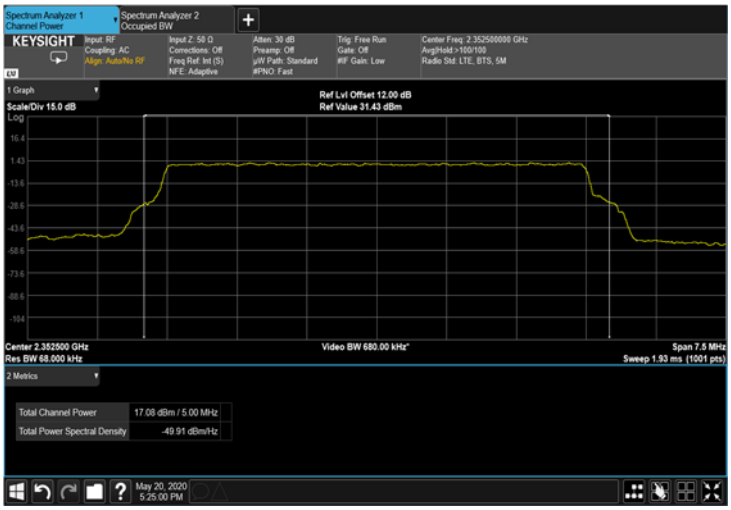

Figure 25: 256QAM 5MHz B.W.; 2352.5MHz, 15kHz

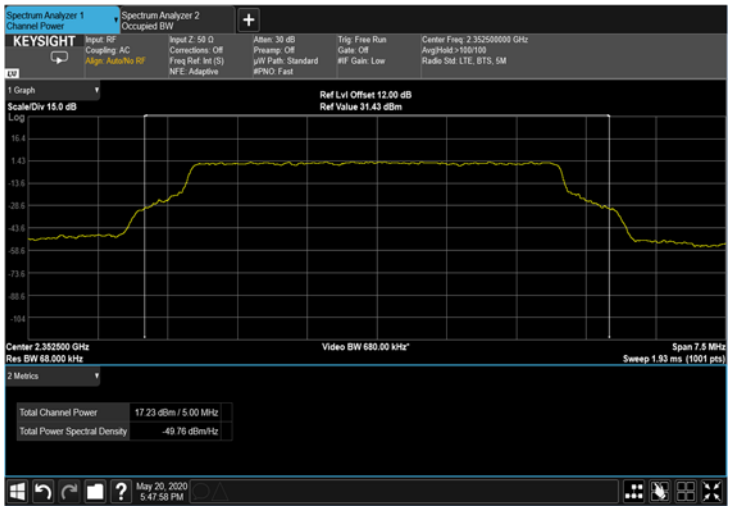

Figure 26: 256QAM 5MHz B.W.; 2352.5MHz, 30kHz

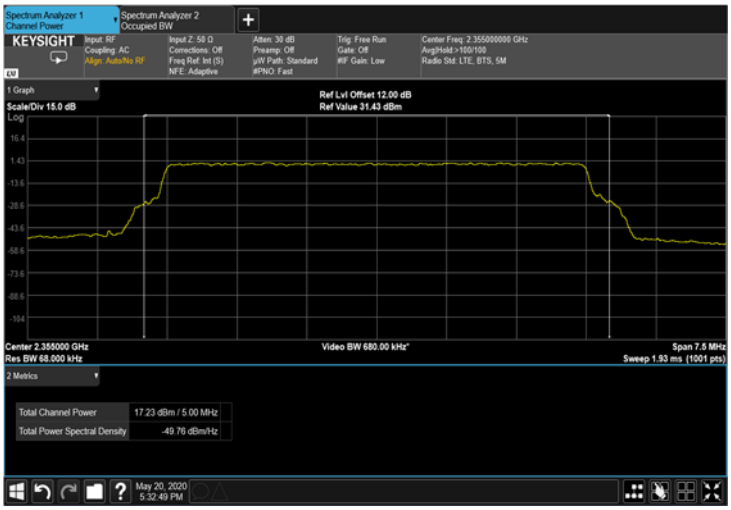

Figure 27: 256QAM 5MHz B.W.; 2355.0MHz, 15kHz

Figure 28: 256QAM 5MHz B.W.; 2355.0MHz, 30kHz

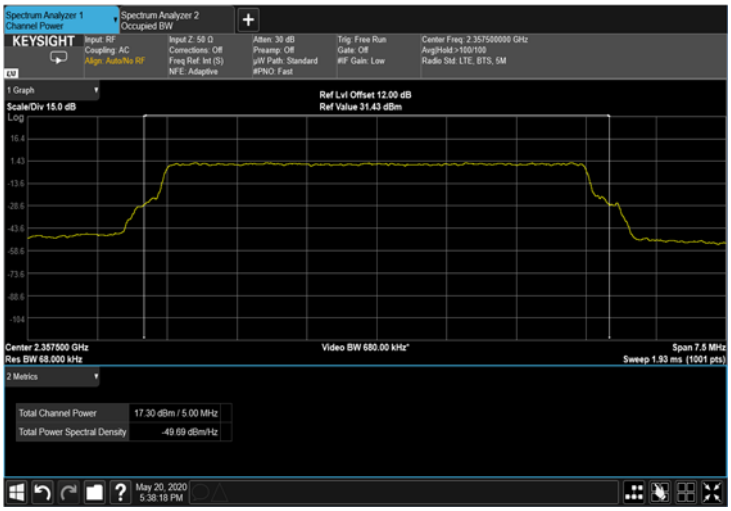

Figure 29: 256QAM 5MHz B.W.; 2357.5MHz, 15kHz

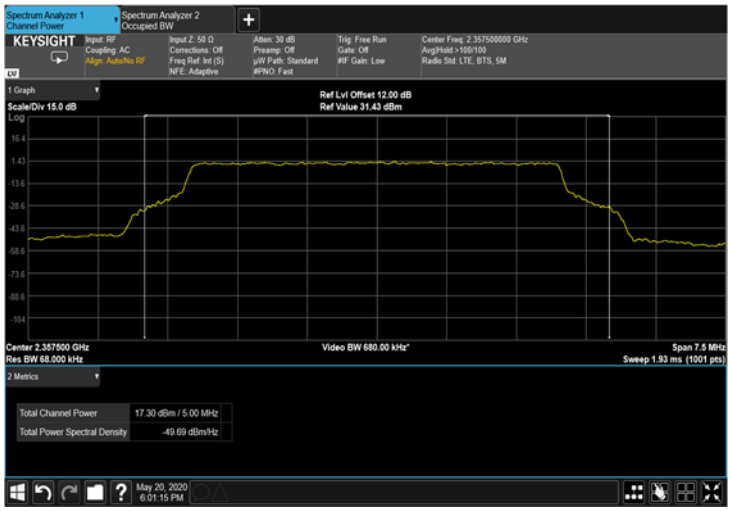

Figure 30: 256QAM 5MHz B.W.; 2357.5MHz, 30kHz

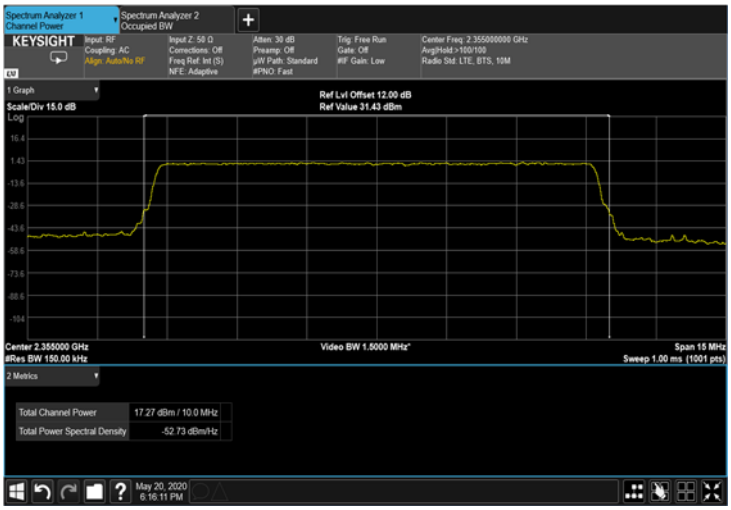

Figure 31: 256QAM 10MHz B.W.; 2355.0MHz, 15kHz

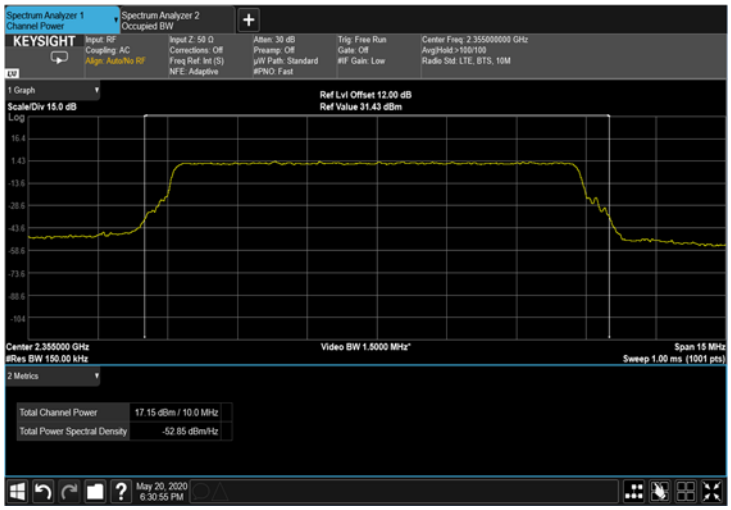

Figure 32: 256QAM 10MHz B.W.; 2355.0MHz, 30kHz

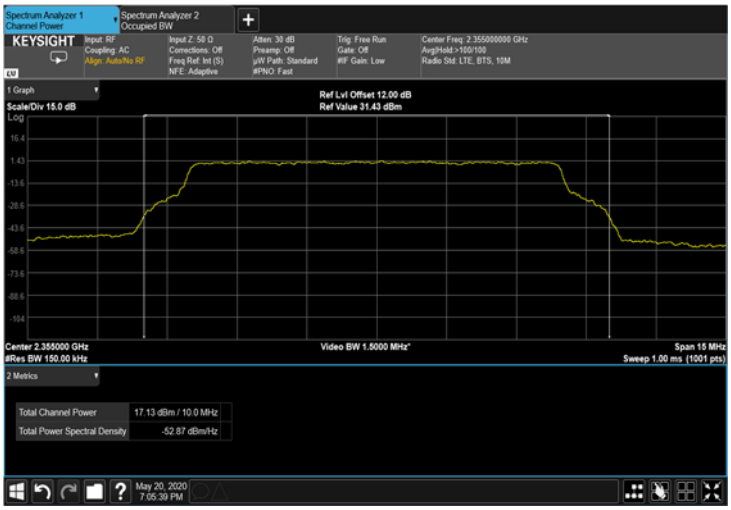

Figure 33: 256QAM 10MHz B.W.; 2355.0MHz, 60kHz

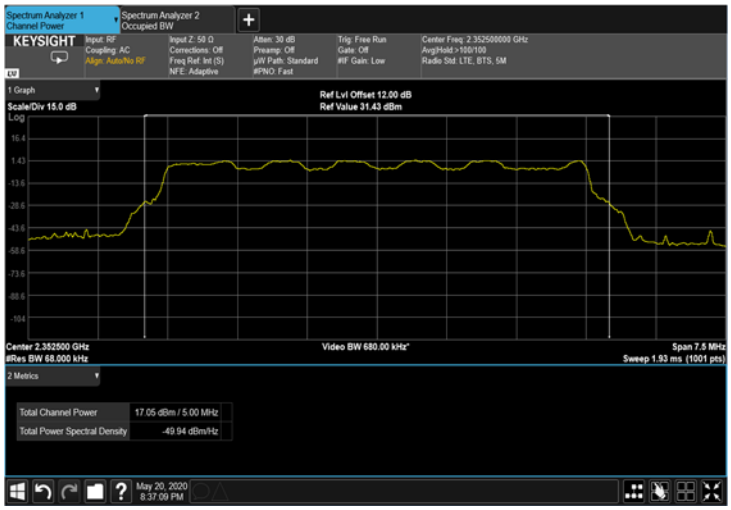

Figure 34: 16QAM 5MHz B.W.; 2352.5MHz, 15kHz

Figure 35: 16QAM 5MHz B.W.; 2352.5MHz, 30kHz

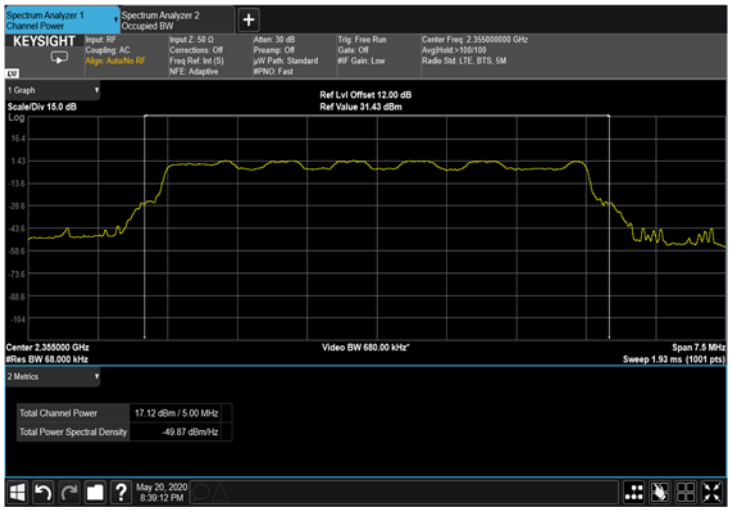

Figure 36: 16QAM 5MHz B.W.; 2355.0MHz, 15kHz

Figure 37: 16QAM 5MHz B.W.; 2355.0MHz, 30kHz

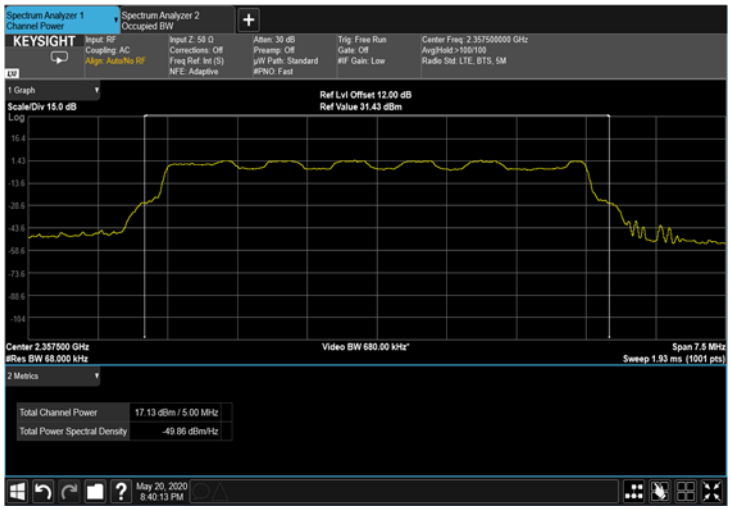

Figure 38: 16QAM 5MHz B.W.; 2357.5MHz, 15kHz

Figure 39: 16QAM 5MHz B.W.; 2357.5MHz, 30kHz

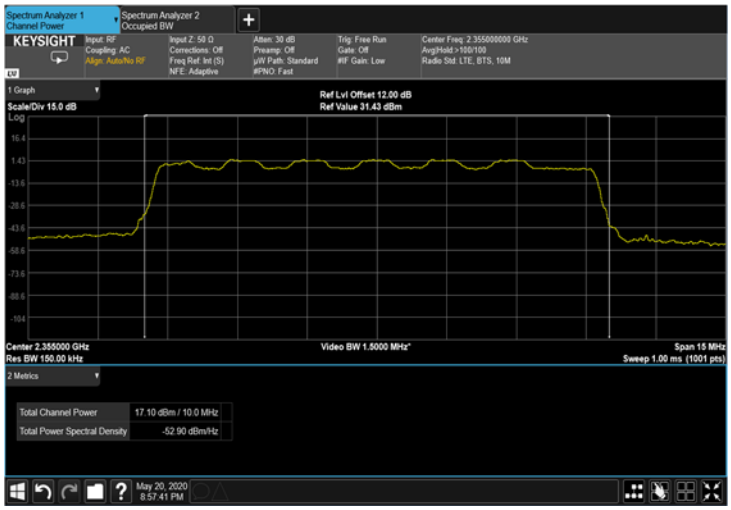

Figure 40: 16QAM 10MHz B.W.; 2355.0MHz, 15kHz

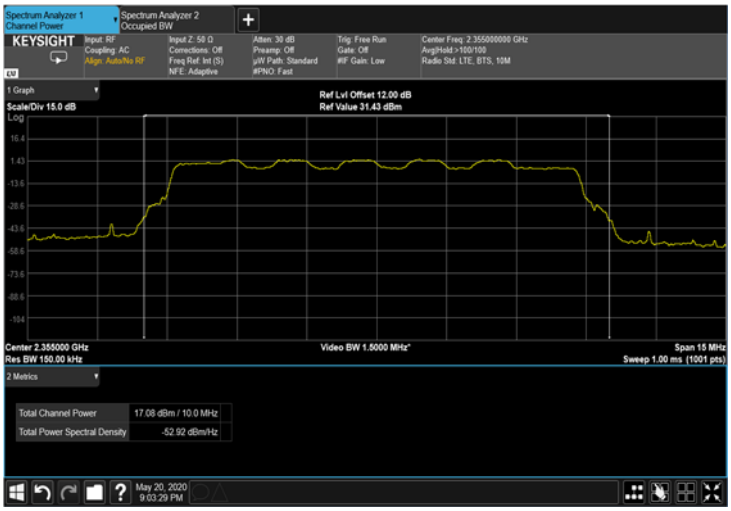

Figure 41: 16QAM 10MHz B.W.; 2355.0MHz, 30kHz

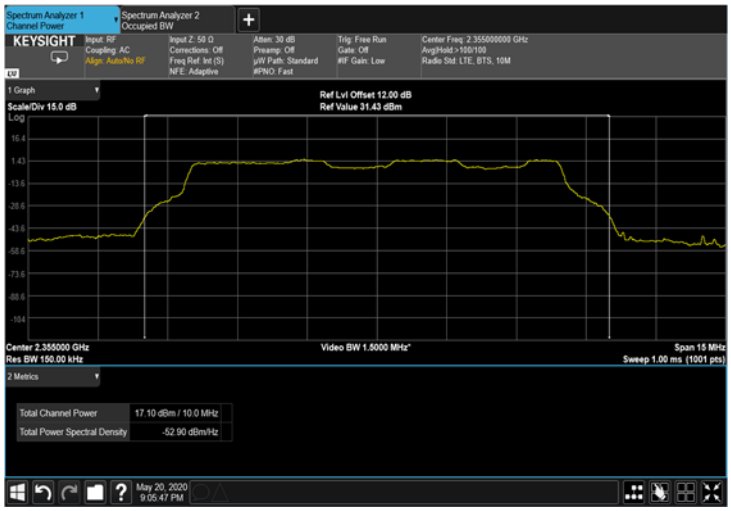

Figure 42: 16QAM 10MHz B.W.; 2355.0MHz, 60kHz

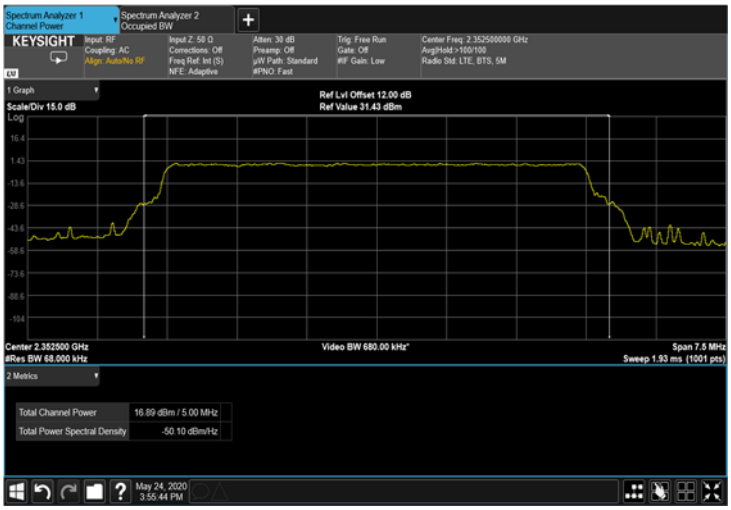

Figure 43: 64QAM 5MHz B.W.; 2352.5MHz, 15kHz

Figure 44: 64QAM 5MHz B.W.; 2352.5MHz, 30kHz

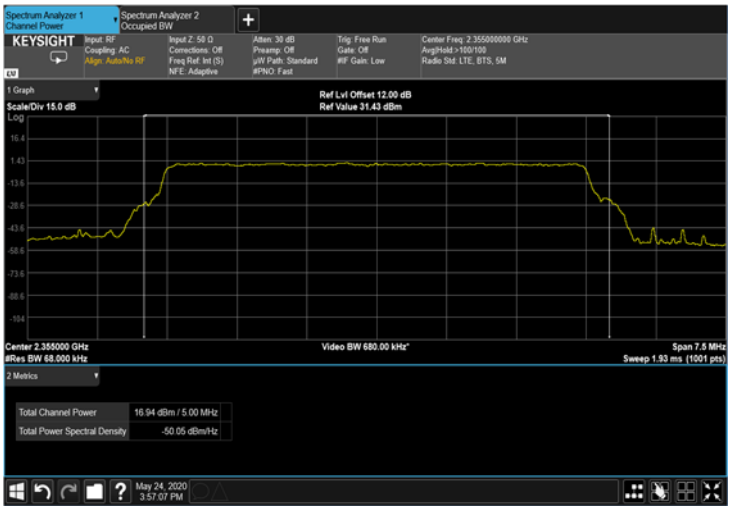

Figure 45: 64QAM 5MHz B.W.; 2355.0MHz, 15kHz

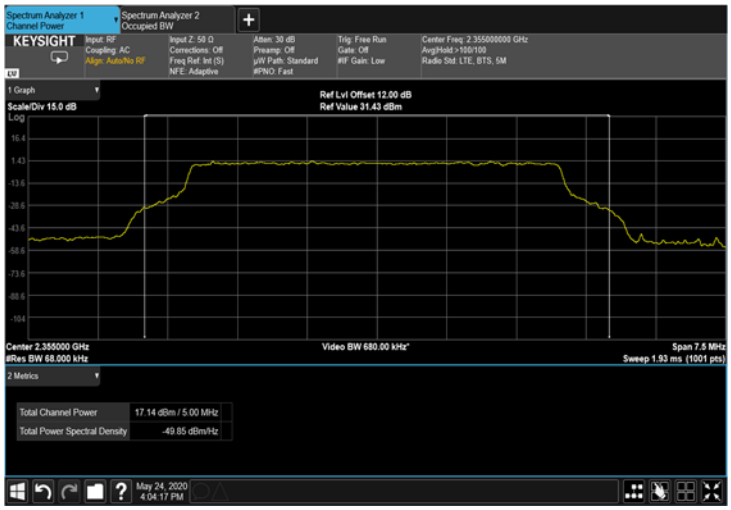

Figure 46: 64QAM 5MHz B.W.; 2355.0MHz, 30kHz

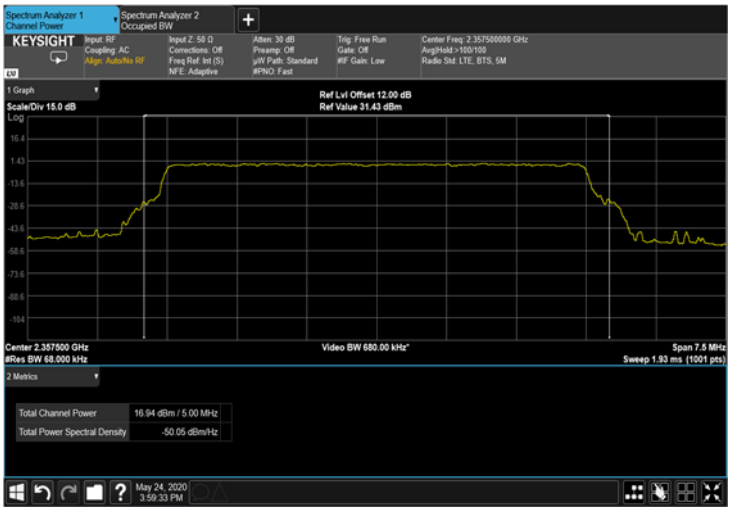

Figure 47: 64QAM 5MHz B.W.; 2357.5MHz, 15kHz

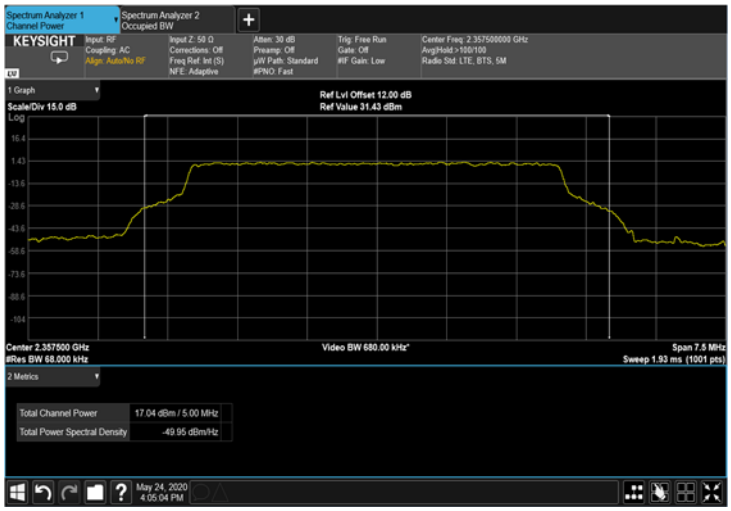

Figure 48: 64QAM 5MHz B.W.; 2357.5MHz, 30kHz

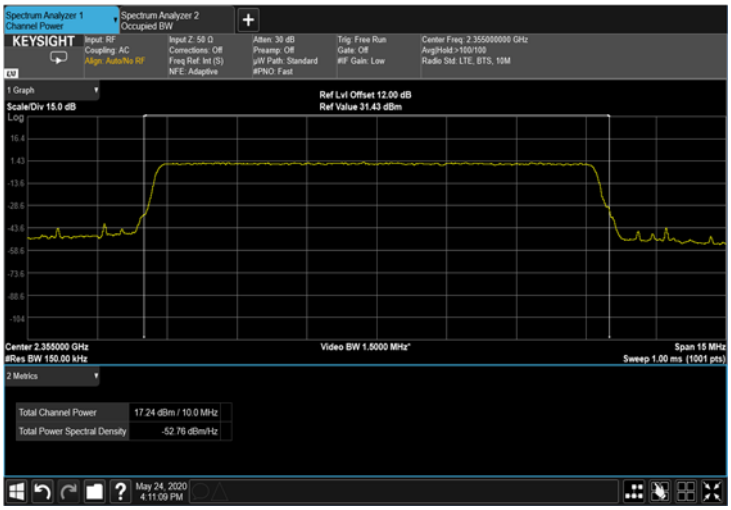

Figure 49: 64QAM 10MHz B.W.; 2355.0MHz, 15kHz

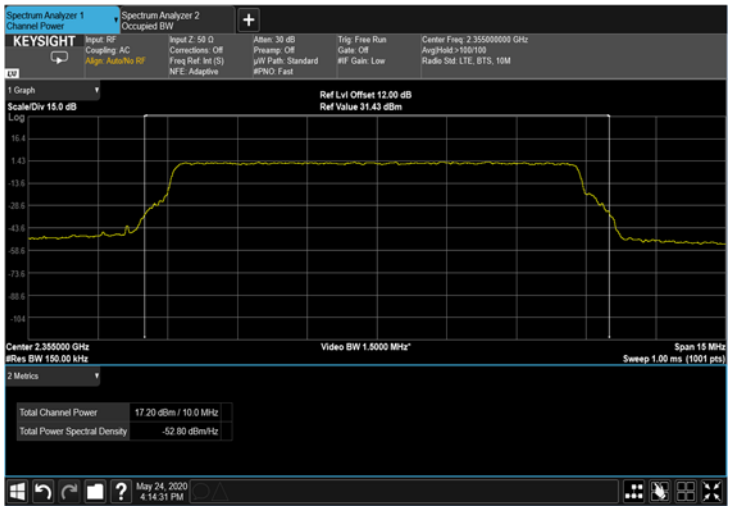

Figure 50: 64QAM 10MHz B.W.; 2355.0MHz, 30kHz

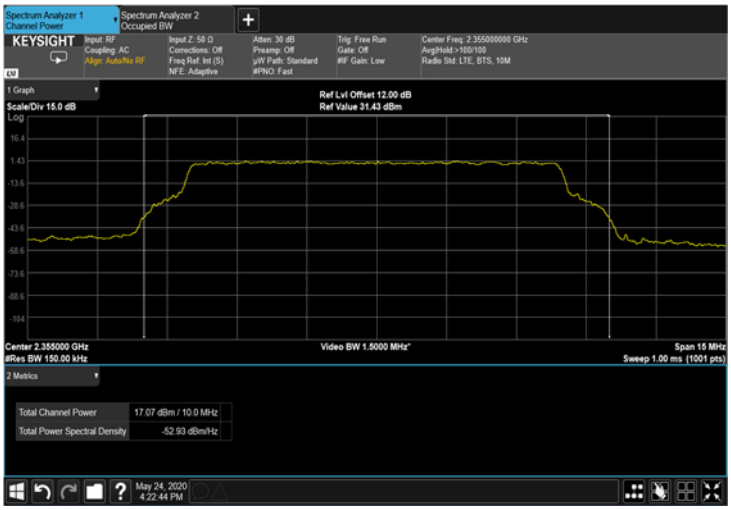

Figure 51: 64QAM 10MHz B.W.; 2355.0MHz, 60kHz

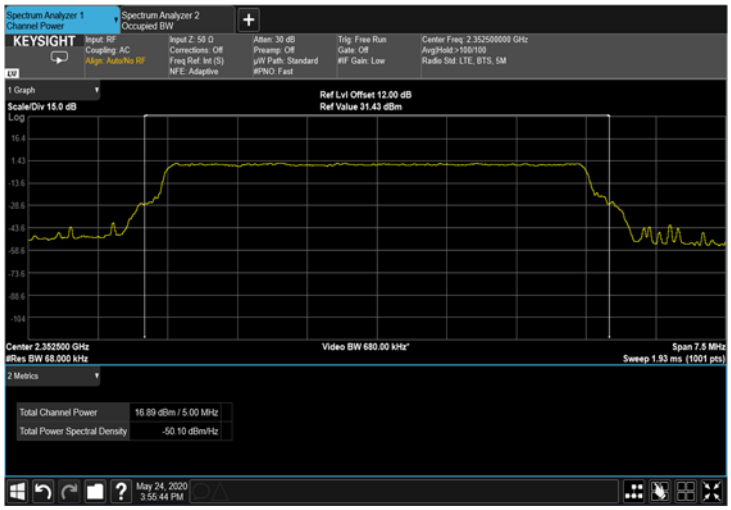

Figure 52: 256QAM 5MHz B.W.; 2352.5MHz, 15kHz

Figure 53: 256QAM 5MHz B.W.; 2352.5MHz, 30kHz

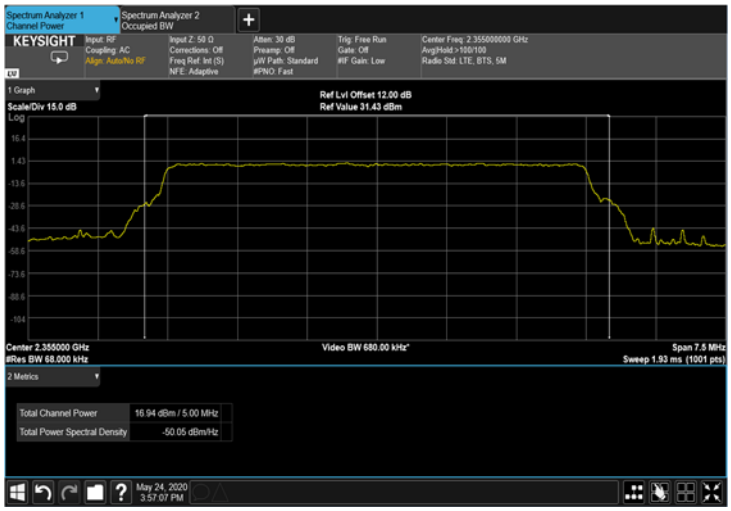

Figure 54: 256QAM 5MHz B.W.; 2355.0MHz, 15kHz

Figure 55: 256QAM 5MHz B.W.; 2355.0MHz, 30kHz

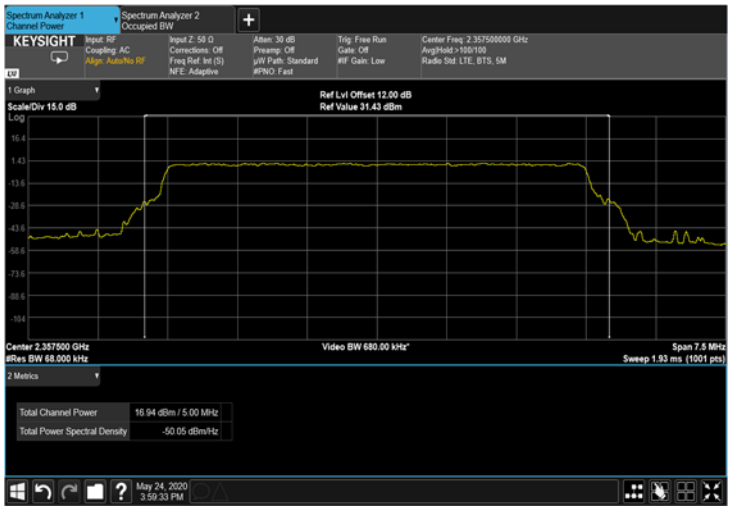

Figure 56: 256QAM 5MHz B.W.; 2357.5MHz, 15kHz

Figure 57: 256QAM 5MHz B.W.; 2357.5MHz, 30kHz

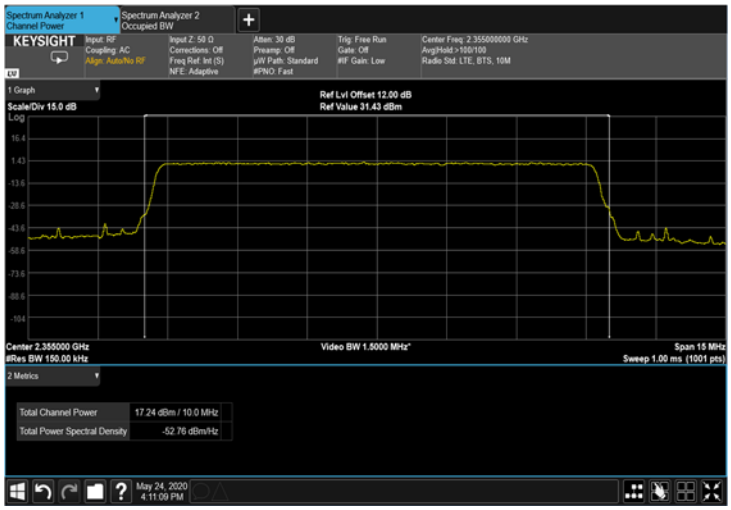

Figure 58: 256QAM 10MHz B.W.; 2355.0MHz, 15kHz

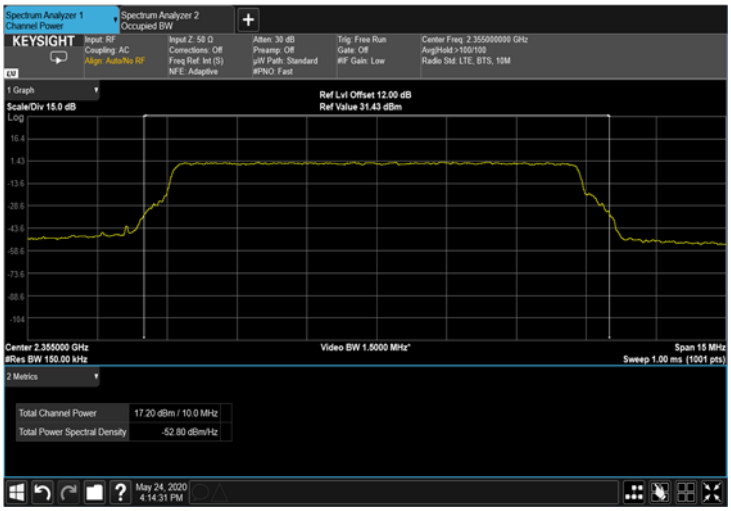

Figure 59: 256QAM 10MHz B.W.; 2355.0MHz, 30kHz

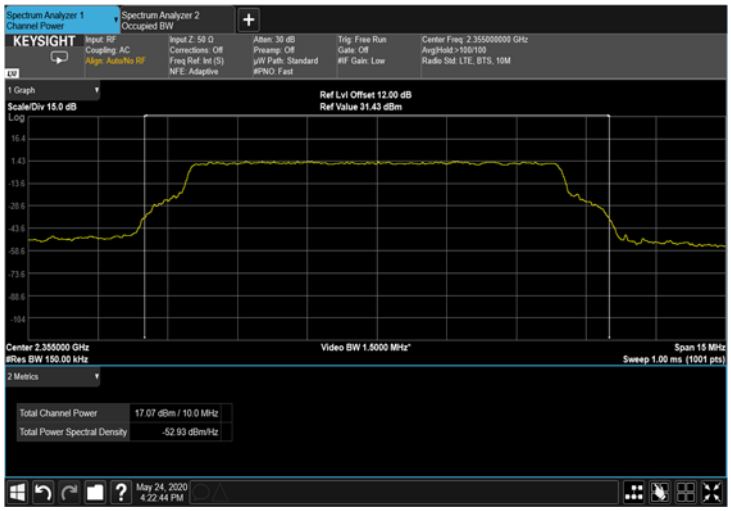

Figure 60: 256QAM 10MHz B.W.; 2355.0MHz, 60kHz

4.5 Test Equipment Used; RF Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Agilent Technologies	N9010A	MY52220686	28 November 2018	28 November 2020
Sarokal Signal Generator	Mentor® (A Siemens Business)	X-Step-V	1904008	*	*
30 dB Attenuator	MCL	BW-S30W5	533	24 December 2019	24 December 2020

Table 3 Test Equipment Used

* New test equipment, purchased during January 2020.

5 Occupied Bandwidth

5.1 Test Specification

FCC Part 2, Section 1049

5.2 Test Procedure

(Temperature (22°C)/ Humidity (33%RH))
The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable. The spectrum analyzer was set to proper resolution B.W.
OBW function (99%) was employed for this evaluation.
Occupied bandwidth measured was repeated for each modulation.

5.3 Test Limit

N/A

5.4 Test Results

JUDGEMENT: Passed

See additional information in Table 4 to Table 6 and Figure 61 to Figure 87.

Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading
	(MHz)	(kHz)	(MHz)	(MHz)
16 QAM	5	15	2352.5	4.5503
		30	2352.5	4.0435
		15	2355.0	4.5507
		30	2355.0	4.0407
		15	2357.5	4.550
		30	2357.5	4.0438
	10	15	2355.0	9.2496
		30	2355.0	8.6201
		60	2355.0	8.1160

Table 4 Occupied Bandwidth 16QAM Output

Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading
	(MHz)	(kHz)	(MHz)	(MHz)
64 QAM	5	15	2352.5	4.5149
		30	2352.5	4.0097
		15	2355.0	4.5149
		30	2355.0	4.0105
		15	2357.5	4.5147
		30	2357.5	4.0107
	10	15	2355.0	9.3607
		30	2355.0	8.7109
		60	2355.0	8.0491

Table 5 Occupied Bandwidth 64QAM Output

Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading
	(MHz)	(kHz)	(MHz)	(MHz)
256 QAM	5	15	2352.5	4.5096
		30	2352.5	4.0283
		15	2355.0	4.5099
		30	2355.0	4.0289
		15	2357.5	4.5088
		30	2357.5	4.0299
	10	15	2355.0	9.3348
		30	2355.0	8.6312
		60	2355.0	8.0732

Table 6 Occupied Bandwidth 256QAM Output

Figure 61: 16QAM 5MHz B.W.; 2352.5MHz, 15kHz Output

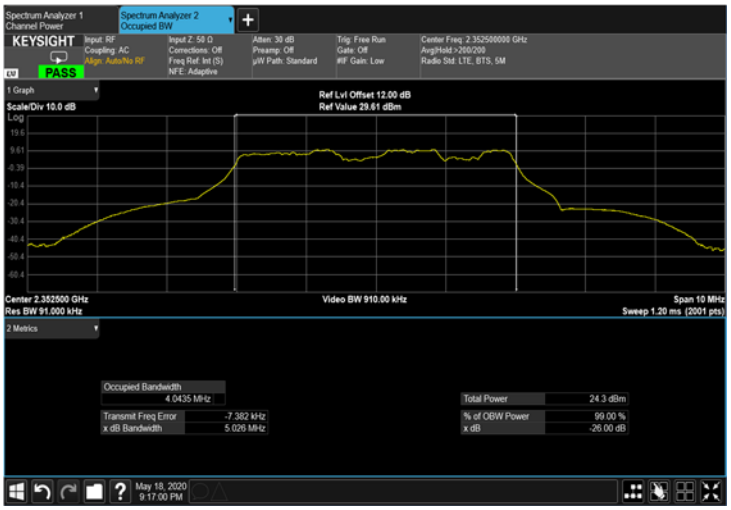

Figure 62: 16QAM 5MHz B.W.; 2352.5MHz, 30kHz Output

Figure 63: 16QAM 10MHz B.W.; 2355.0MHz, 15kHz Output

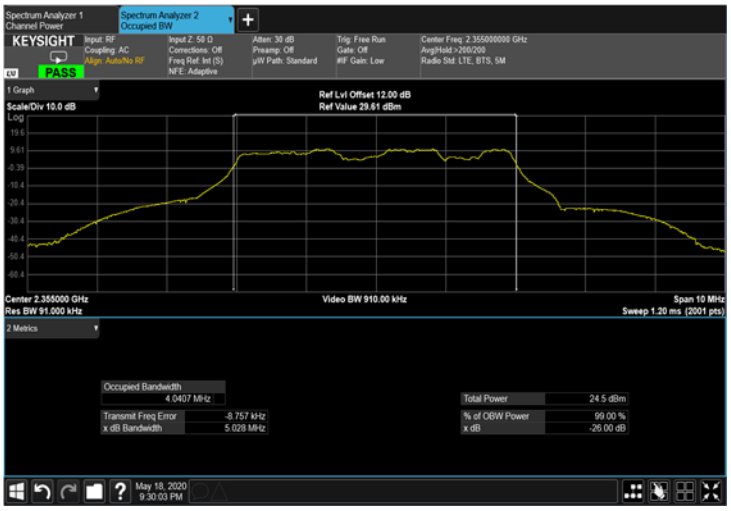

Figure 64: 16QAM 10MHz B.W.; 2355.0MHz, 30kHz Output

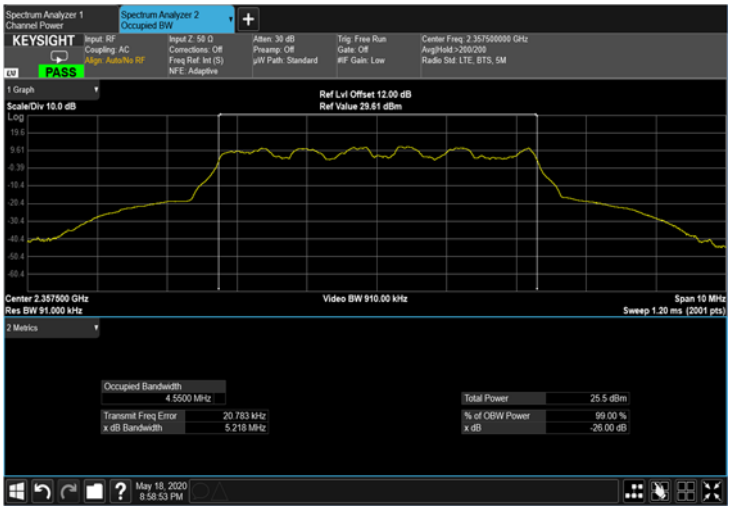

Figure 65: 16QAM 5MHz B.W.; 2357.5MHz, 15kHz Output

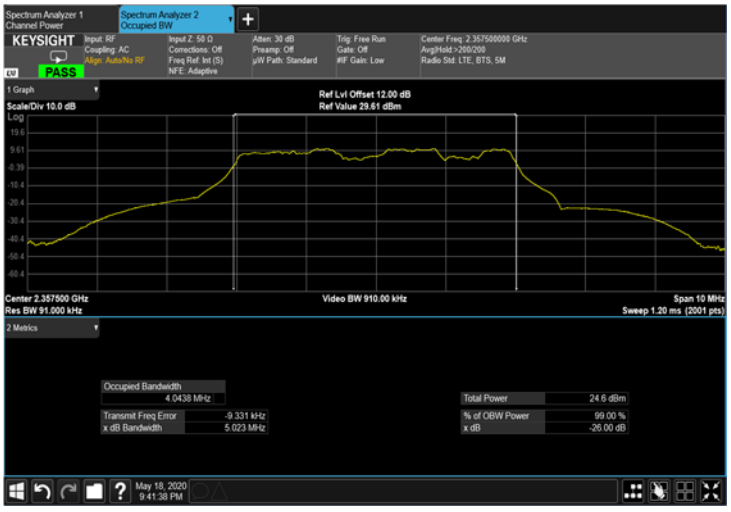

Figure 66: 16QAM 5MHz B.W.; 2357.5MHz, 30kHz Output

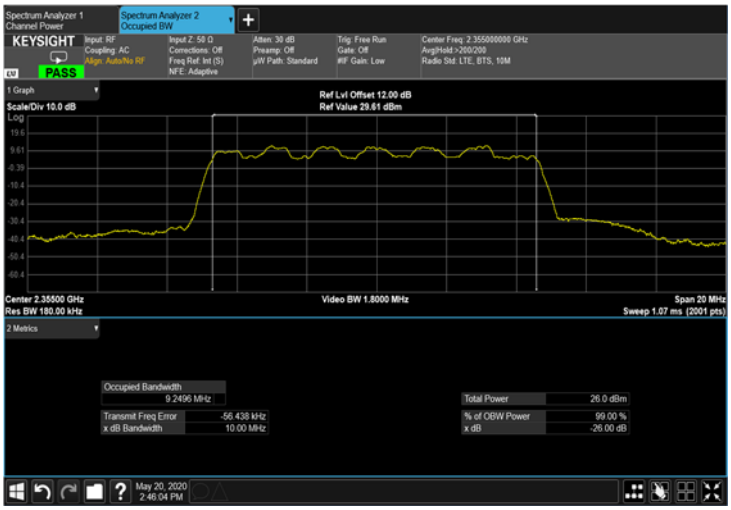

Figure 67: 16QAM 10MHz B.W.; 2355.0MHz, 15kHz Output

Figure 68: 16QAM 10MHz B.W.; 2355.0MHz, 30kHz Output

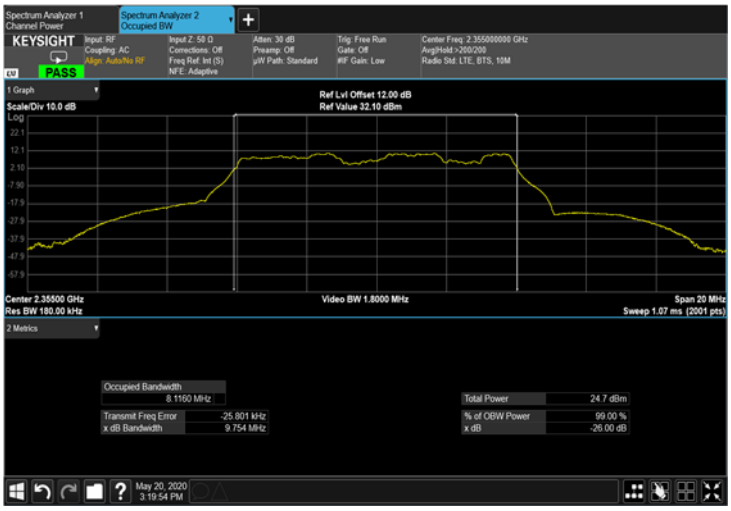

Figure 69: 16QAM 10MHz B.W.; 2355.0MHz, 60kHz Output

Figure 70: 64QAM 5MHz B.W.; 2352.5MHz, 15kHz Output

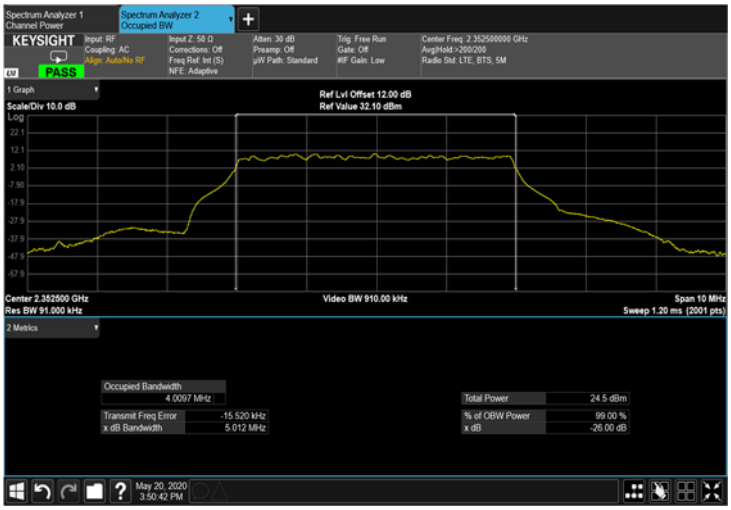

Figure 71: 64QAM 5MHz B.W.; 2352.5MHz, 30kHz Output

Figure 72: 64QAM 5MHz B.W.; 2355.0MHz, 15kHz Output

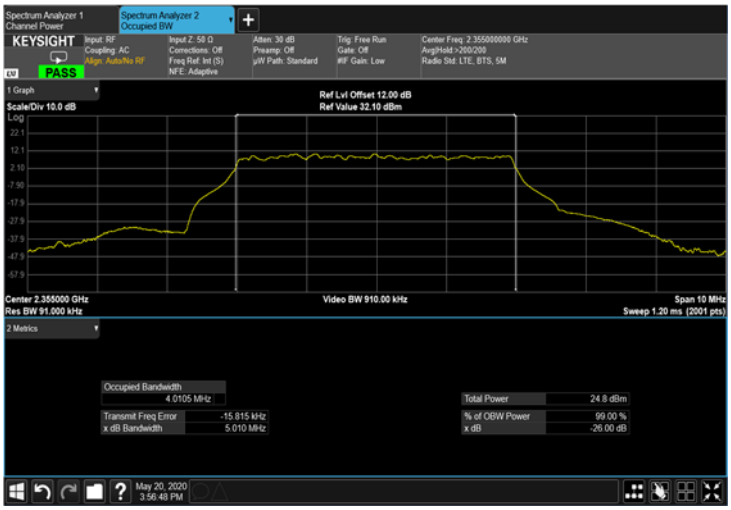

Figure 73: 64QAM 5MHz B.W.; 2355.0MHz, 30kHz Output

Figure 74: 64QAM 5MHz B.W.; 2357.5MHz, 15kHz Output

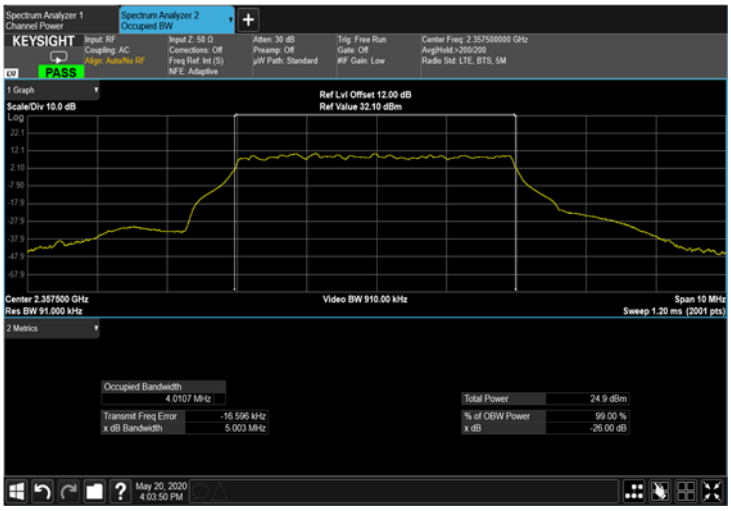

Figure 75: 64QAM 5MHz B.W.; 2357.5MHz, 30kHz Output

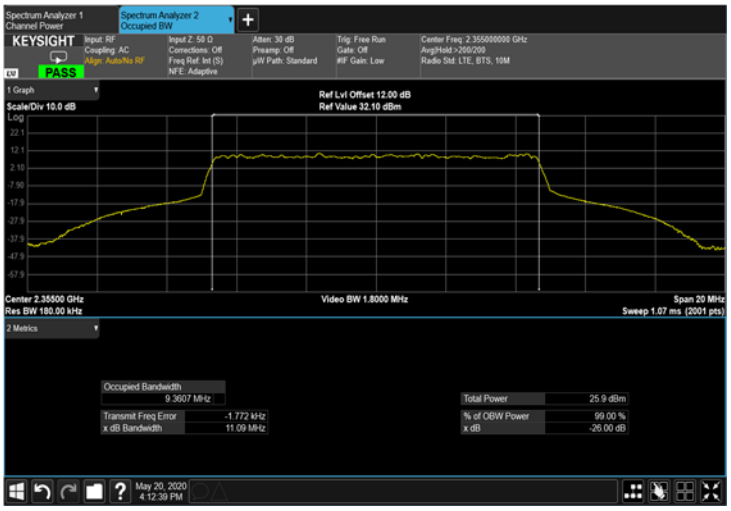

Figure 76: 64QAM 10MHz B.W.; 2355.0MHz, 15kHz Output

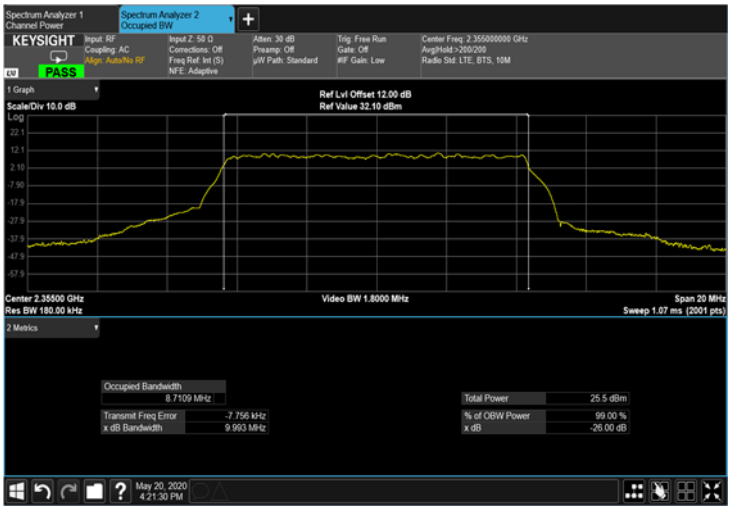

Figure 77: 64QAM 10MHz B.W.; 2355.0MHz, 30kHz Output

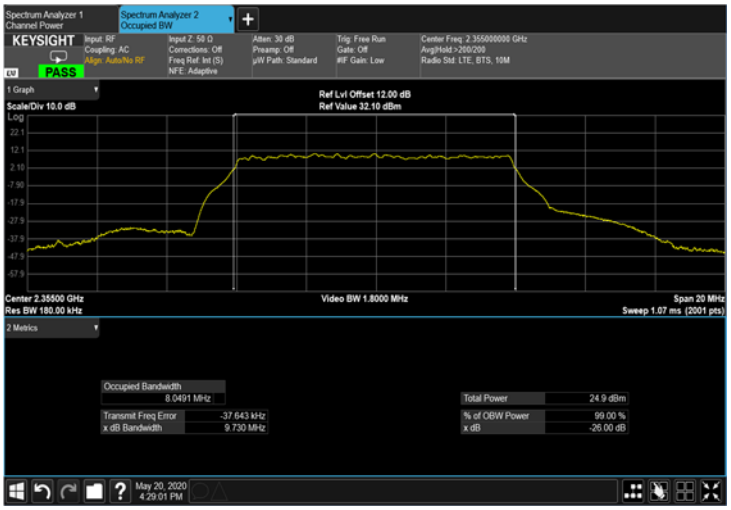

Figure 78: 64QAM 10MHz B.W.; 2355.0MHz, 60kHz Output

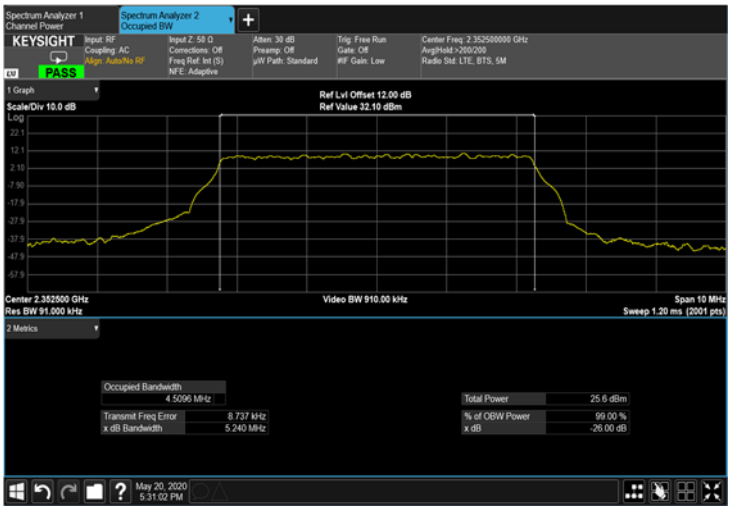

Figure 79: 256QAM 5MHz B.W.; 2352.5MHz, 15kHz Output

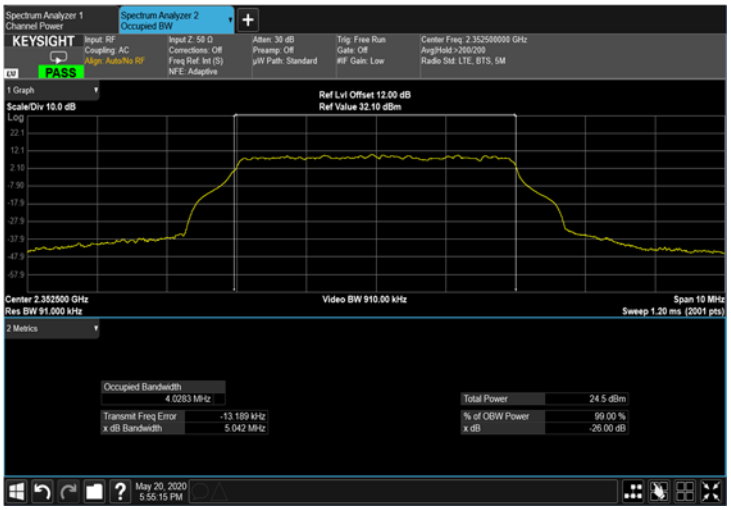

Figure 80: 256QAM 5MHz B.W.; 2352.5MHz, 30kHz Output

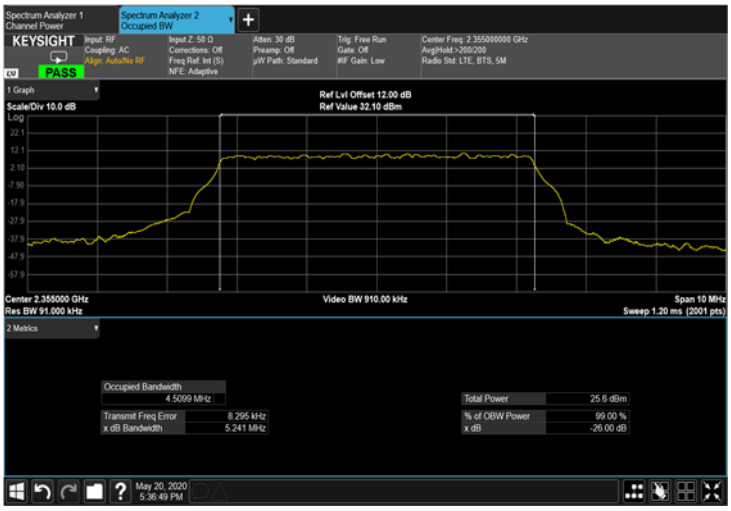

Figure 81: 256QAM 5MHz B.W.; 2355.0MHz, 15kHz Output

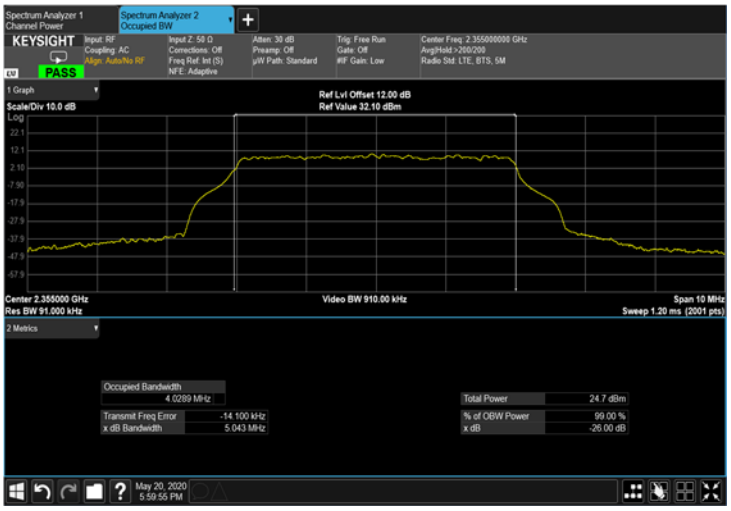

Figure 82: 256QAM 5MHz B.W.; 2355.0MHz, 30kHz Output

Figure 83: 256QAM 5MHz B.W.; 2357.5MHz, 15kHz Output

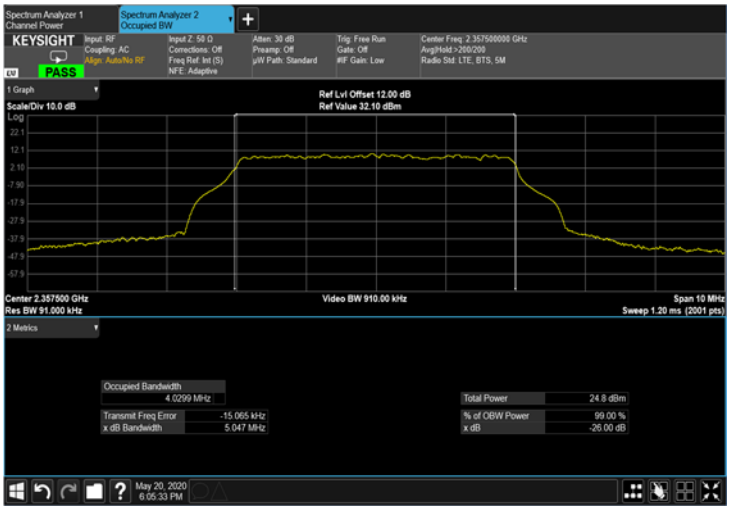

Figure 84: 256QAM 5MHz B.W.; 2357.5MHz, 30kHz Output

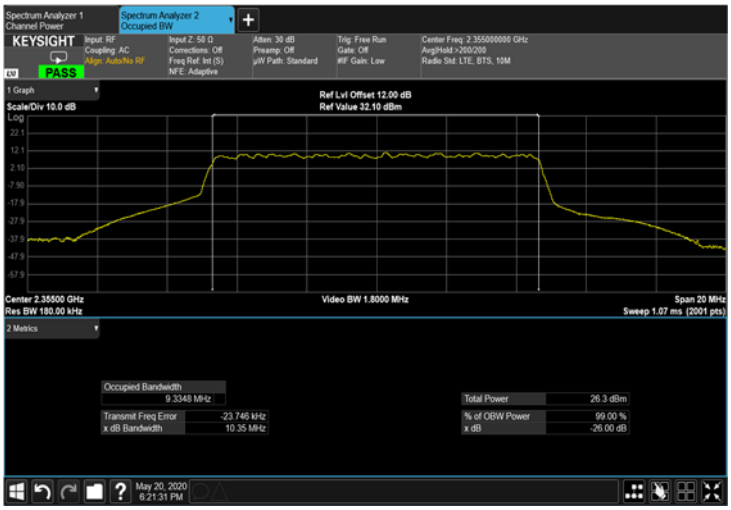

Figure 85: 256QAM 10MHz B.W.; 2355.0MHz, 15kHz Output

Figure 86: 256QAM 10MHz B.W.; 2355.0MHz, 30kHz Output

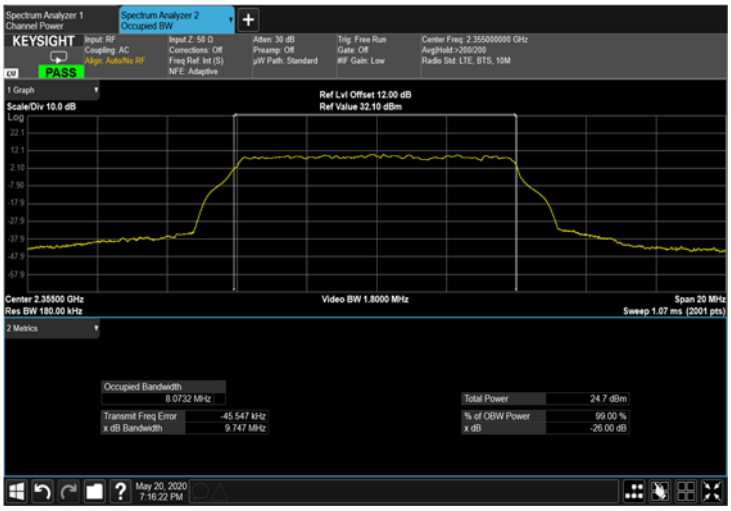

Figure 87: 256QAM 10MHz B.W.; 2355.0MHz, 60kHz Output

5.5 Test Equipment Used; Occupied Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Agilent Technologies	N9010A	MY52220686	28 November 2018	28 November 2020
Sarokal Signal Generator	Mentor® (A Siemens Business)	X-Step-V	1904008	*	*
30 dB Attenuator	MCL	BW-S30W5	533	24 December 2019	24 December 2020

Table 7 Test Equipment Used

* New test equipment, purchased during January 2020.