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DATE: 3 March 2021

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

FCC Radio Test Report For

Corning Optical Communication Wireless

Equipment under test:

Corning Everon 6000 DAS - dMRU

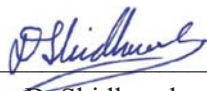
dMRU Medium Power Modular Remote Unit

(AWS)

Tested by:


M. Zohar

Approved by:


D. Shidlow

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This report relates only to items tested.



Measurement/Technical Report for Corning Optical Communication Wireless

Corning Everon 6000 DAS - dMRU dMRU Medium Power Modular Remote Unit (AWS)

FCC ID: OJFDMRUDPAM17

This report concerns: Original Grant: X
 Class II change:
 Class I change:

Equipment type: Part 20 Industrial Booster (CMRS)

Limits used: 47CFR Parts 2; 27

Measurement procedure used is KDB 935210 D05 v01r04 April 2020 and
ANSI IEEE C63.26-2015

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

Application for Certification

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1 General Information

1.1 Administrative Information

Manufacturer:	Corning Optical Communication Wireless
Manufacturer's Address:	8253 1st Avenue Vienna, VA 22812 U.S.A. Tel: +1-703 855-1773
Manufacturer's Representative:	Isaac Nissan
Equipment Under Test (E.U.T):	Corning Everon 6000 DAS - dMRU
Equipment Model No.:	dMRU Medium Power Modular Remote Unit
Equipment Serial No.:	Not Designated
Date of Receipt of E.U.T:	November 1, 2020
Start of Test:	November 2, 2020
End of Test:	February 27 , 2021
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

DMRU - Digital Medium-power Remote Unit.

The MRU is a medium power modular remote antenna unit with a single antenna port.

The Output power for the lower bands: 600/700 MHz Low/700 MHz High/FirstNet, 800/850 MHz is 33 dBm and the output power for the medium bands EAWS, PCS, WCS and 2.5GHz TDD is 37dBm.

The MRU modular structure and integrated high-performance cavity based multiplexing functionalities, enable setups of up to 6 RF modules, for a variety of licensed frequency bands within a single cabinet.

The MRU also provides CBRS/C-Band ready RF interface for future field upgrades.

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

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

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

30-1000MHz:

Expanded Uncertainty (95% Confidence, K=2):
 ± 4.96 dB

1 GHz to 6 GHz

Expanded Uncertainty (95% Confidence, K=2):
 ± 5.19 dB

>6 GHz

Expanded Uncertainty (95% Confidence, K=2):
 ± 5.51 dB



2 System Test Configuration

2.1 *Justification*

The dMRU is a repeater supporting a broad range of cellular generations: 3G, 4G and 5G in the AWS band.

Evaluation was performed at the low, mid and high channels each one defined per the operation BW.

Evaluation was performed at 115VAC as the nominal power source.

Conducted tests were performed with an external attenuator connected to the spectrum analyzer.

Radiated emission tests were performed with a 50Ω termination connected to the E.U.T output terminal.

2.2 *EUT Exercise Software*

The Element Management System ver. 1.4 used for commands delivery. These commands are used to enable/disable the EUT transmission. SW Ver. is 1.4 .

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

Product Name	Corning Everon 6000 DAS - dMRU
Model Name	dMRU medium power modular remote unit (AWS band)
Working voltage	48 VDC ,115/230 VAC
Mode of operation	Repeater Booster supporting 3G, 4G and 5G
Modulations	3G: WCDMA 4G: 16QAM, 64QAM, QPSK 5G: 16QAM, 64QAM, 256QAM, QPSK
Frequency Range	AWS (DL: 2110-2200, UL:1710-1780)
Transmit power	~38 dBm (Max) per band
DATA rate	N/A
Modulation BW	5; 10; 15MHZ
DC Voltage applied to final RF stage band board (Driver and PA)	28.5V
DC Current applied to final RF stage band board (Driver and PA)	1.2A

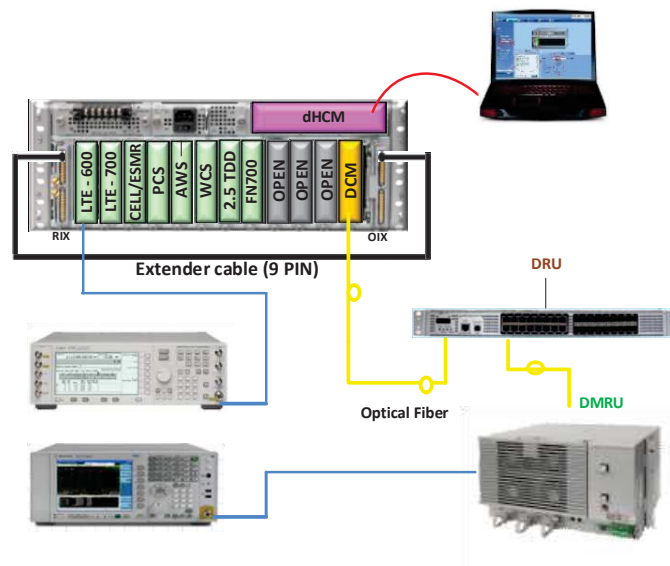


Figure 1. Conducted Test Set-Up

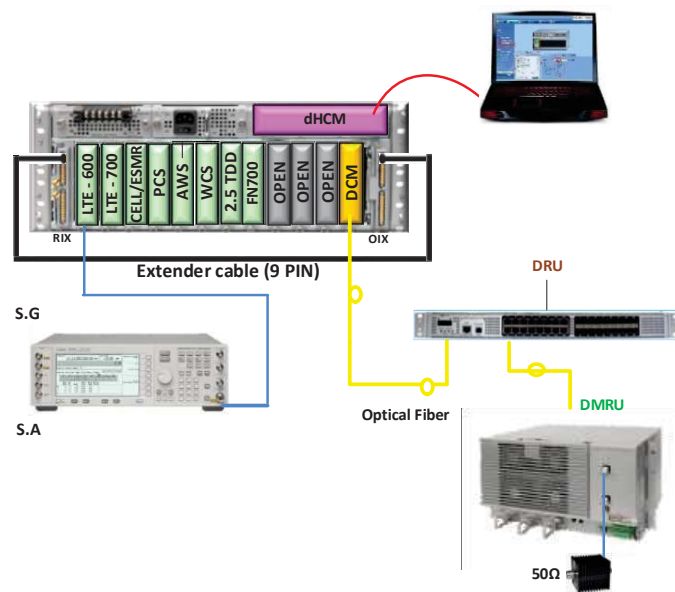


Figure 2. Radiated Test Set-Up

3 Test Set-Up Photos



Figure 3. Conducted Emission From Antenna Port Tests



Figure 4. Radiated Emission Test 9kHz - 30MHz



Figure 5. Radiated Emission Test 30 - 200 MHz



Figure 6. Radiated Emission Test 200 - 1000MHz



Figure 7. Radiated Emission Test 1.0 - 18.0GHz



Figure 8. Radiated Emission Test 18.0-22.0GHz



4 RF Power Output - 5G

4.1 Test Specification

FCC Part 27, Subpart C (27.50)

4.2 Test Procedure

(Temperature (20°C)/ Humidity (46%RH))

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (41.6dB) 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 1640W (62.1 dBm).

4.4 Test Results

JUDGEMENT: Passed

See additional information in Table 1 to Table 4 and Figure 9 to Figure 80.



Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading
	(MHz)	(kHz)	(MHz)	(dBm)
16QAM	5	15	2112.5	35.08
		30		35.44
		15	2155.0	37.90
		30		37.97
		15	2197.5	37.76
		30		37.76
	10	15	2115.0	37.21
		30		37.19
		15	2155.0	38.05
		30		38.08
		15	2195.0	37.94
		30		37.84
	15	15	2117.5	37.20
		30		37.19
		15	2155.0	37.64
		30		37.66
		15	2192.5	38.09
		30		38.12

Table 1 RF Power Output 16QAM – 5G



Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading
	(MHz)	(kHz)	(MHz)	(dBm)
64QAM	5	15	2112.5	34.98
		30		35.42
		15	2155.0	37.83
		30		37.84
		15	2197.5	37.84
		30		37.78
	10	15	2115.0	37.22
		30		37.34
		15	2155.0	38.07
		30		38.09
		15	2195.0	37.83
		30		37.74
	15	15	2117.5	37.34
		30		37.35
		15	2155.0	37.71
		30		37.65
		15	2192.5	38.22
		30		38.21

Table 2 RF Power Output 64QAM - 5G



Modulation	Bandwidth	Sub Carrier	Operation Frequency	Reading
	(MHz)	(kHz)	(MHz)	(dBm)
256QAM	5	15	2112.5	34.93
		30		35.34
		15	2155.0	37.74
		30		37.67
		15	2197.5	37.91
		30		37.95
	10	15	2115.0	37.35
		30		37.19
		15	2155.0	38.12
		30		38.15
		15	2195.0	37.66
		30		37.76
	15	15	2117.5	37.33
		30		37.32
		15	2155.0	37.67
		30		37.62
		15	2192.5	37.65
		30		37.69

Table 3 RF Power Output 256QAM -5G



Modulation	Bandwidth (MHz)	Sub Carrier (kHz)	Operation Frequency (MHz)	Reading (dBm)
QPSK	5	15	2112.5	35.29
		30		35.38
		15	2155.0	37.90
		30		37.95
		15	2197.5	37.87
		30		37.91
	10	15	2115.0	37.47
		30		37.26
		15	2155.0	37.92
		30		37.87
		15	2195.0	37.92
		30		37.94
	15	15	2117.5	37.22
		30		37.27
		15	2155.0	37.67
		30		37.67
		15	2192.5	38.19
		30		38.18

Table 4 RF Power Output QPSK -5G



Figure 9: 16QAM 5MHz B.W; 2112.5MHz, 15kHz



Figure 10: 16QAM 5MHz B.W; 2112.5MHz, 30kHz



Figure 11: 16QAM 5MHz B.W; 2155.0MHz, 15kHz



Figure 12: 16QAM 5MHz B.W; 2155.0MHz, 30kHz

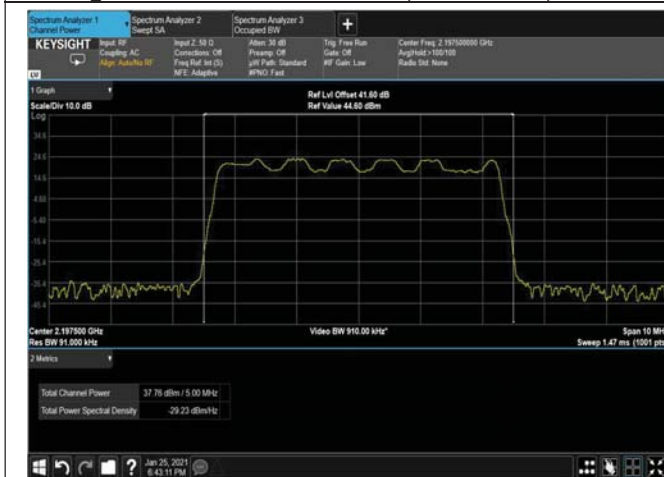


Figure 13: 16QAM 5MHz B.W; 2197.5MHz, 15kHz

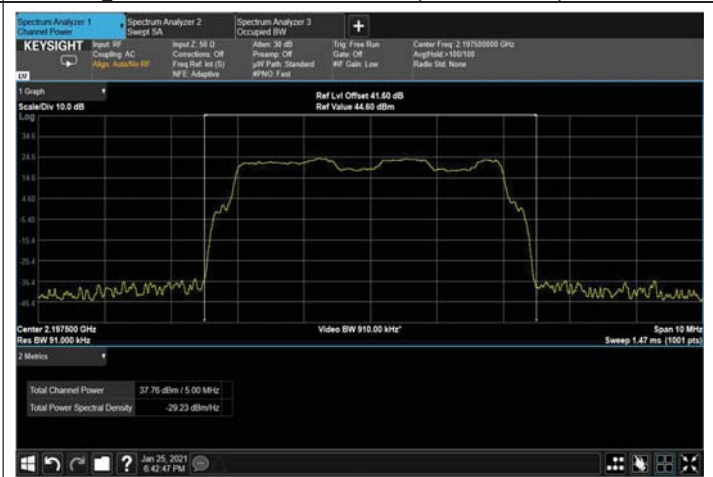


Figure 14: 16QAM 5MHz B.W; 2197.5MHz, 30kHz

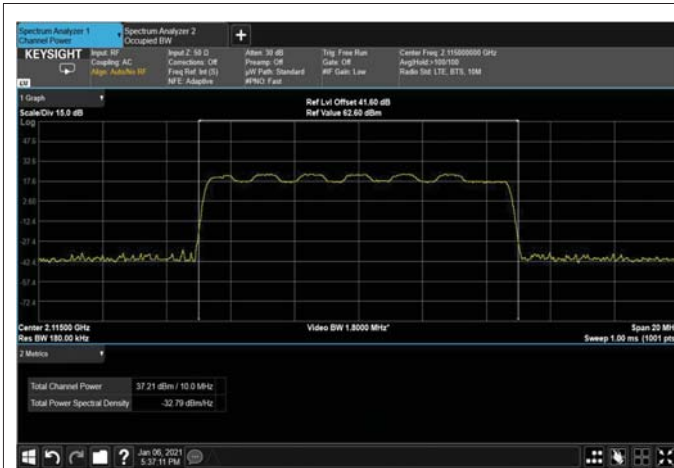




Figure 21: 16QAM 15MHz B.W; 2117.5MHz, 15kHz



Figure 22: 16QAM 15MHz B.W; 2117.5MHz, 30kHz



Figure 23: 16QAM 15MHz B.W; 2155.0MHz, 15kHz



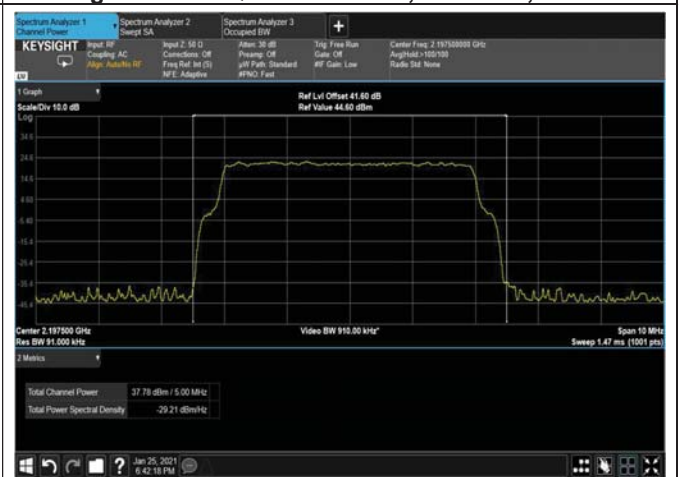
Figure 24: 16QAM 15MHz B.W; 2155.0MHz, 30kHz



Figure 25: 16QAM 15MHz B.W; 2192.5MHz, 15 kHz



Figure 26: 16QAM 15MHz B.W; 2192.5MHz, 30kHz



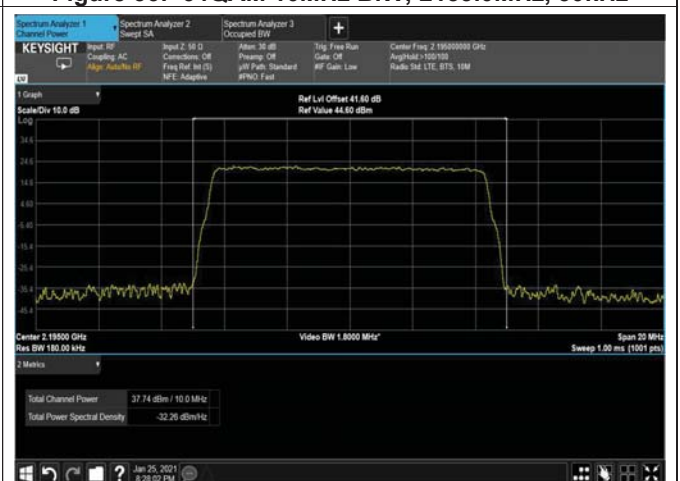
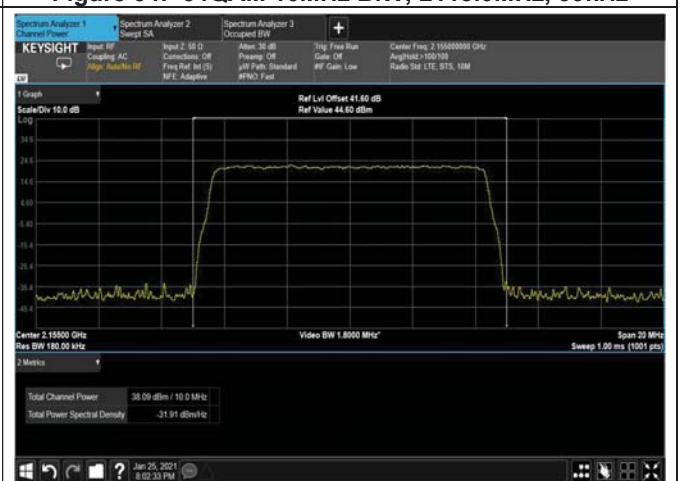
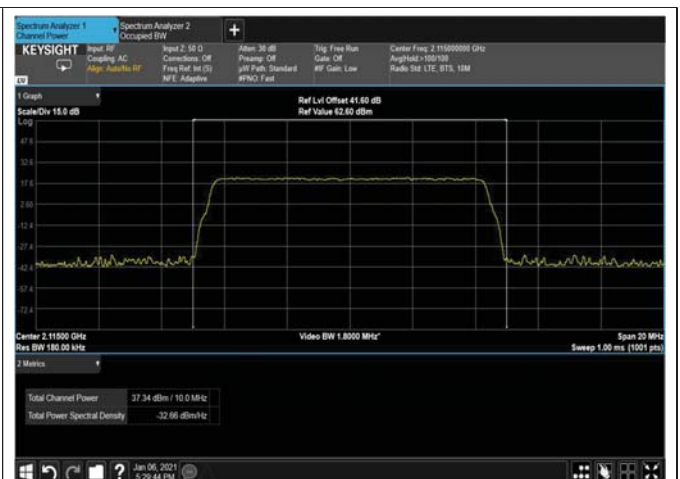




Figure 39: 64QAM 15MHz B.W; 2117.5MHz, 15kHz

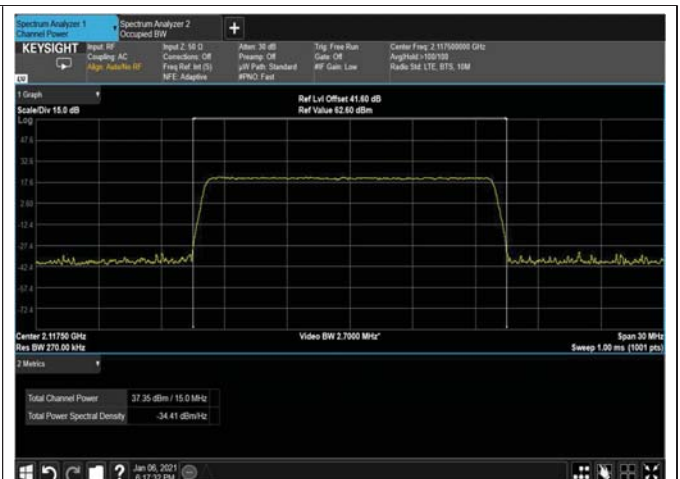


Figure 40: 64QAM 15MHz B.W; 2117.5MHz, 30kHz



Figure 41: 64QAM 15MHz B.W; 2155.0MHz, 15kHz



Figure 42: 64QAM 15MHz B.W; 2155.0MHz, 30kHz



Figure 43: 64QAM 15MHz B.W; 2192.5MHz, 15kHz

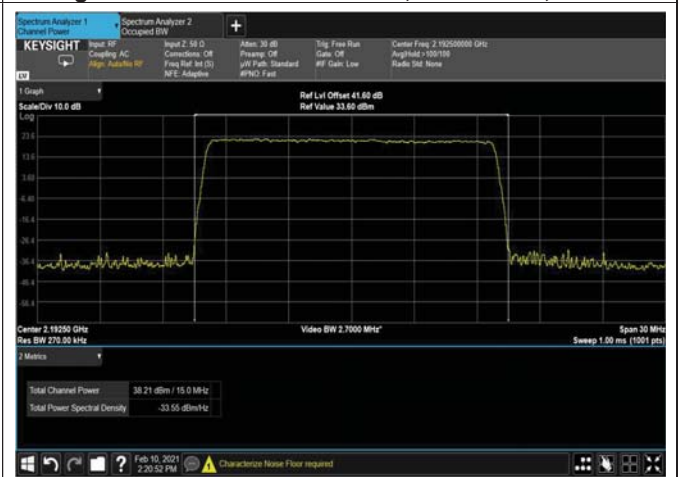
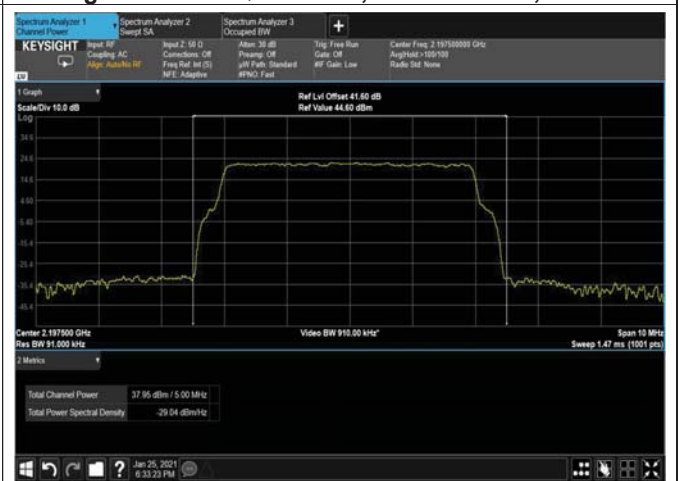
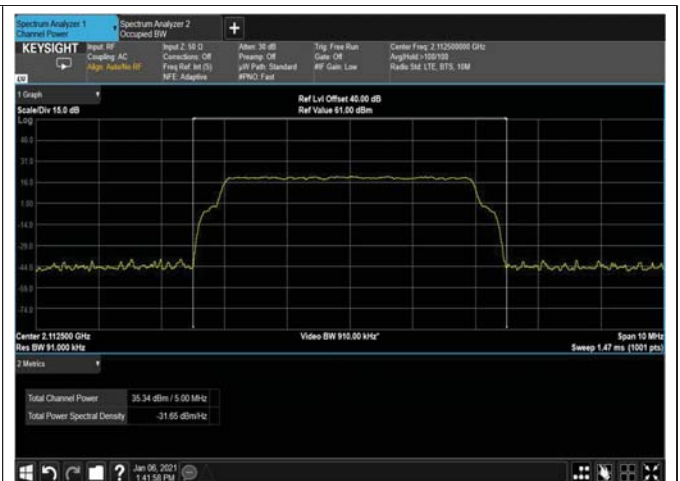


Figure 44: 64QAM 15MHz B.W; 2192.5MHz, 30kHz



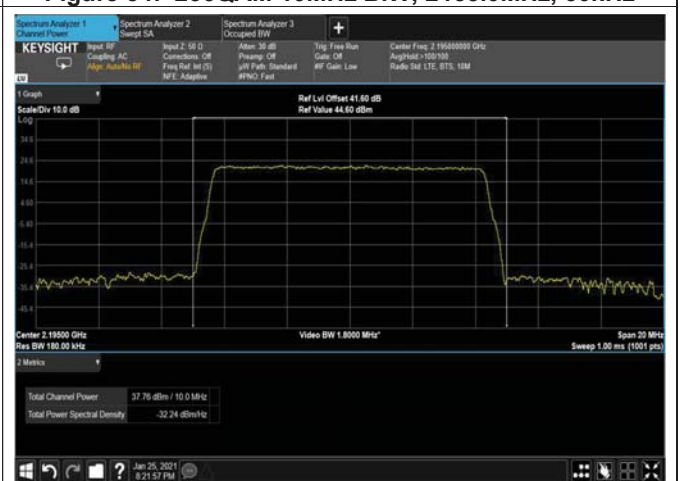
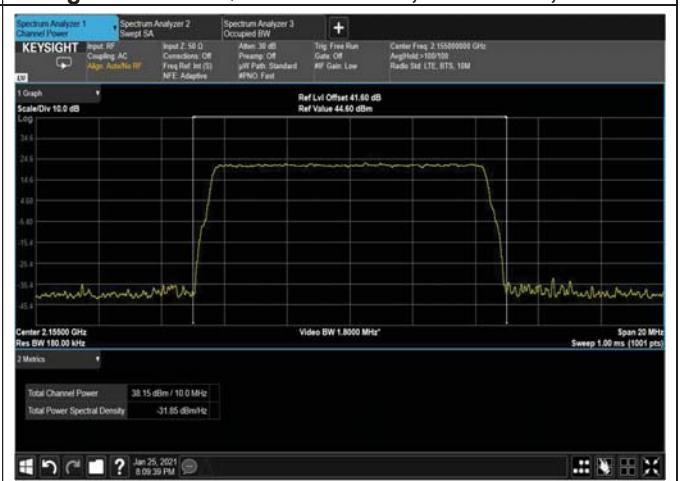




Figure 57: 256QAM 15MHz B.W; 2117.5MHz, 15kHz

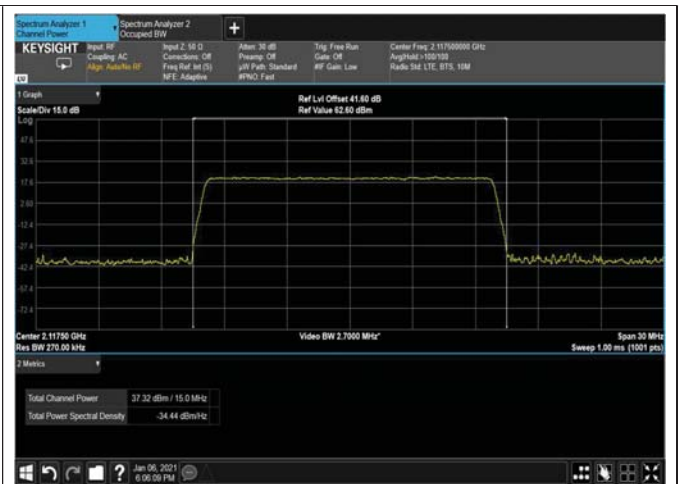


Figure 58: 256QAM 15MHz B.W; 2117.5MHz, 30kHz



Figure 59: 256QAM 15MHz B.W; 2155.0MHz, 15kHz



Figure 60: 256QAM 15MHz B.W; 2192.5MHz, 30kHz



Figure 61: 256QAM 15MHz B.W; 2192.5MHz, 15kHz

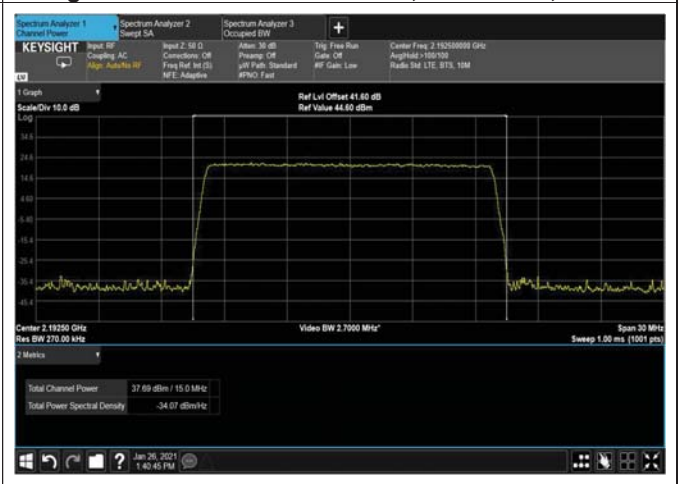


Figure 62: 256QAM 15MHz B.W; 2192.5MHz, 30kHz



Figure 63: QPSK 5MHz B.W; 2112.5MHz, 15kHz

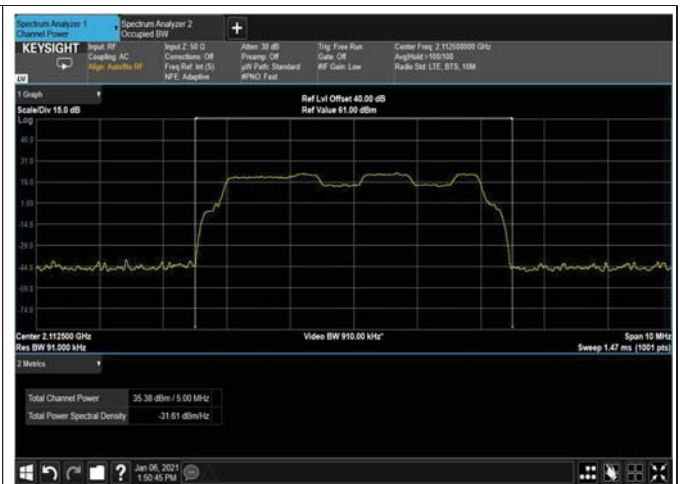


Figure 64: QPSK 5MHz B.W; 2112.5MHz, 30kHz



Figure 65: QPSK 5MHz B.W; 2155.0MHz, 15kHz



Figure 66: QPSK 5MHz B.W; 2155.0MHz, 30kHz



Figure 67: QPSK 5MHz B.W; 2197.5MHz, 15kHz



Figure 68: QPSK 5MHz B.W; 2197.5MHz, 30kHz

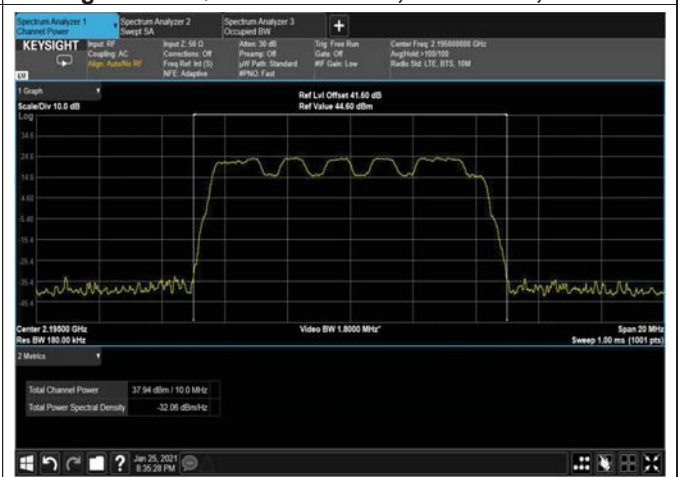
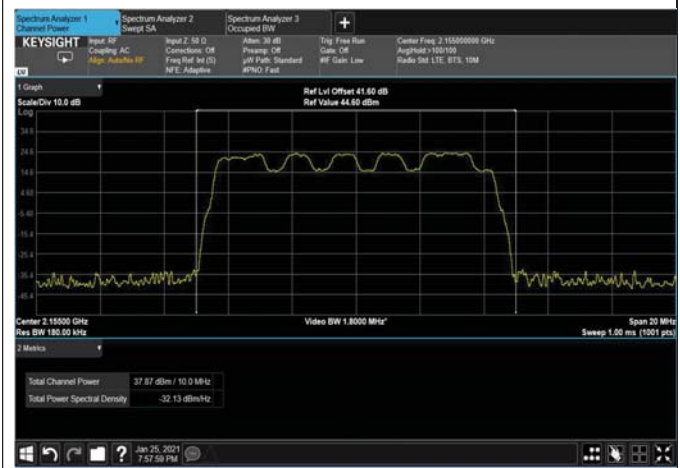
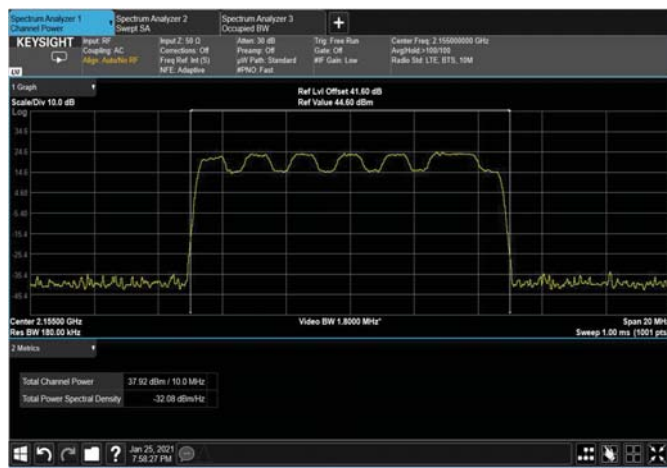
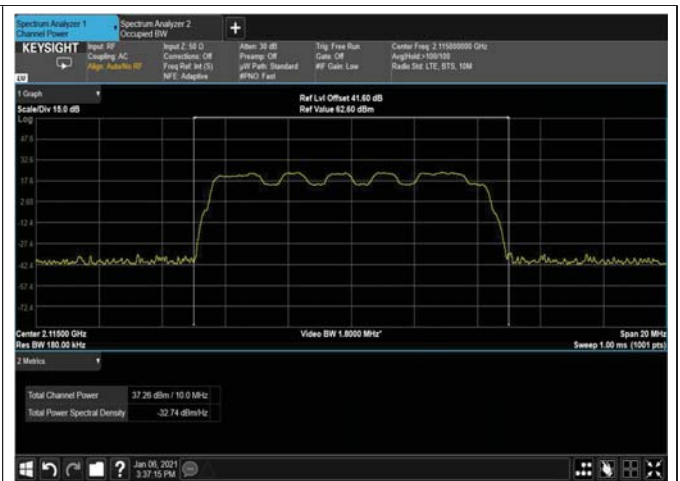




Figure 75: QPSK 15MHz B.W; 2117.5MHz, 15kHz

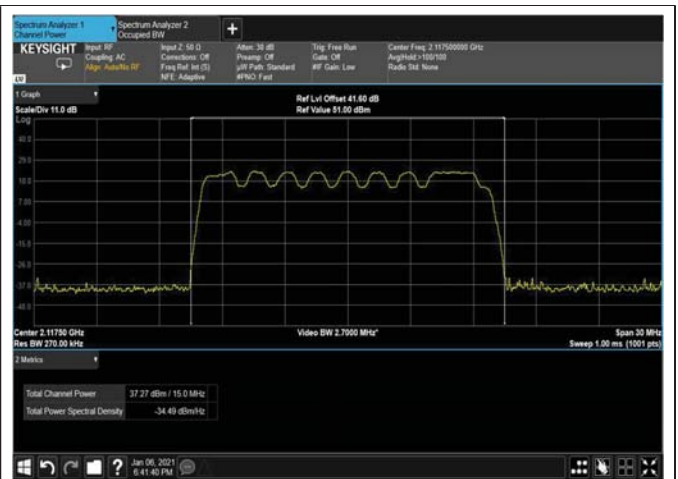


Figure 76: QPSK 15MHz B.W; 2117.5MHz, 30kHz



Figure 77: QPSK 15MHz B.W; 2155.0MHz, 15kHz



Figure 78: QPSK 15MHz B.W; 2155.0MHz, 30kHz



Figure 79: QPSK 15MHz B.W; 2192.5MHz, 15kHz



Figure 80: QPSK 15MHz B.W; 2192.5MHz, 30kHz



4.5 Test Equipment Used; RF Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Keysight	UXA N9040B	MY56080119	January 31, 2020	January 31, 2022
EXG Vector Signal Generator	Agilent Technologies	N5172B	MY53051952	January 17, 2019	January 17, 2022
40 dB Attenuator	Weinschel Associates	WA 39-40-33	-	November 1, 2020	November 1, 2021
RF Coaxial Cable	Huber-Suner	SLLS210B	-	November 1, 2020	November 1, 2021

Table 5 Test Equipment Used



5 RF Power Output – 3G and 4G

5.1 Test Specification

FCC Part 27, Subpart C (27.50)

5.2 Test Procedure

(Temperature (20°C)/ Humidity (46%RH))

The E.U.T. antenna terminal was connected to the Spectrum Analyzer through an external attenuator (41.6 dB) and an appropriate coaxial cable. Special attention was taken to prevent Spectrum Analyzer RF input overload.

5.3 Test Limit

Peak Power Output must not exceed 1640.0W (62.1 dBm).

5.4 Test Results

JUDGEMENT: Passed

See additional information in Table 6 to Table 9 and Figure 84 to Figure 110.



Modulation	Bandwidth	Operation Frequency	Reading
	(MHz)	(MHz)	(dBm)
WCDMA	5	2112.5	37.12
		2155.0	37.07
		2197.0	37.06

Table 6 RF Power Output WCDMA - 3G

Modulation	Bandwidth	Operation Frequency	Reading
	(MHz)	(MHz)	(dBm)
16QAM	5	2112.5	37.29
		2155.0	37.79
		2197.5	37.32
	10	2115.0	36.96
		2155.0	37.01
		2195.0	37.78
	15	2117.5	37.04
		2155.0	37.66
		2192.5	37.38

Table 7 RF Power Output 16QAM - 4G

Modulation	Bandwidth	Operation Frequency	Reading
	(MHz)	(MHz)	(dBm)
64QAM	5	2112.5	37.00
		2155.0	37.13
		2197.5	36.99
	10	2115.0	37.04
		2155.0	37.31
		2195.0	37.10
	15	2117.5	37.18
		2155.0	37.64
		2192.5	37.25

Table 8 RF Power Output 64AM - 4G



Modulation	Bandwidth	Operation Frequency	Reading
	(MHz)	(MHz)	(dBm)
QPSK	5	2112.5	37.07
		2155.0	37.44
		2197.5	37.09
	10	2115.0	37.00
		2155.0	37.36
		2195.0	37.58
	15	2117.5	37.04
		2155.0	37.69
		2192.5	37.04

Table 9 RF Power Output QPSK - 4G



Figure 81: WCDMA 5MHz B.W; 2112.5MHz – 3G



Figure 82: WCDMA 5MHz B.W; 2155.0MHz – 3G

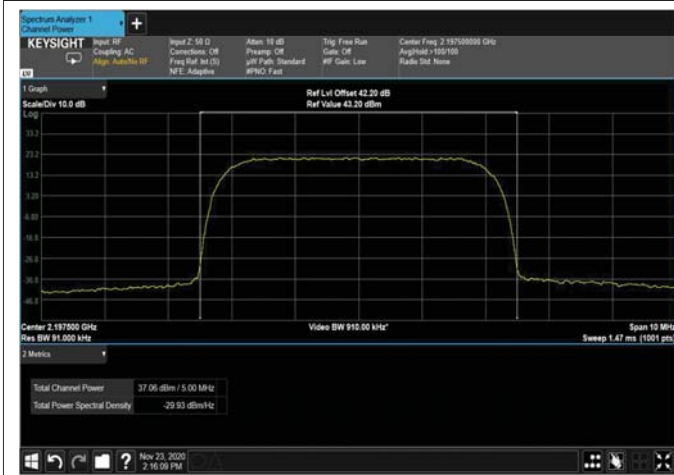


Figure 83: WCDMA 5MHz B.W; 2197.5MHz – 3G

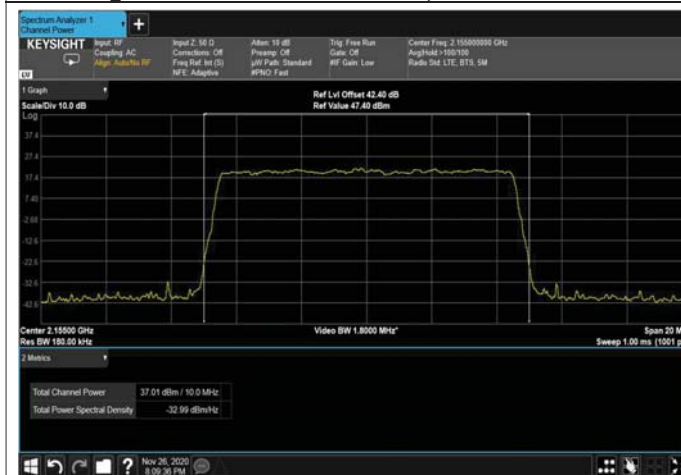




Figure 90: 16QAM 15MHz B.W; 2117.5MHz – 4G

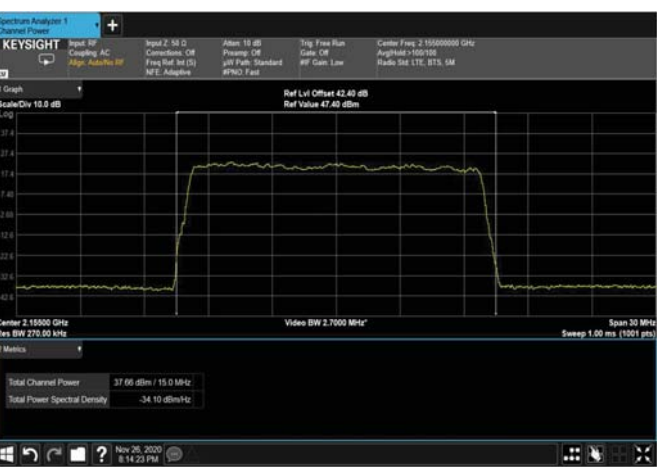


Figure 91: 16QAM 15MHz B.W; 2155MHz – 4G



Figure 92: 16QAM 15MHz B.W; 2192.5MHz – 4G

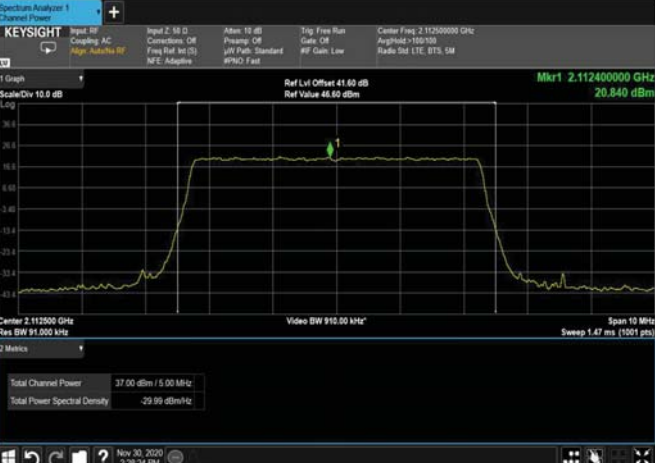


Figure 93: 64QAM 5MHz B.W; 2112.5MHz – 4G



Figure 94: 64QAM 5MHz B.W; 2155MHz – 4G

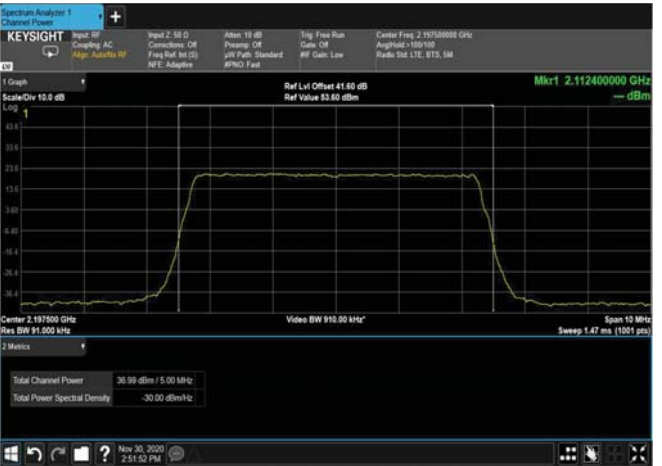


Figure 95: 64QAM 5MHz B.W; 2917.5MHz – 4G



Figure 96: 64QAM 10MHz B.W; 2115MHz – 4G



Figure 97: 64QAM 10MHz; 2155MHz – 4G



Figure 98: 64QAM 10MHz; 2195MHz – 4G



Figure 99: 64QAM 15MHz B.W; 2117.5MHz – 4G



Figure 100: 64QAM 15MHz B.W; 2155MHz – 4G



Figure 101: 64QAM 64MHz B.W; 2192.5MHz – 4G

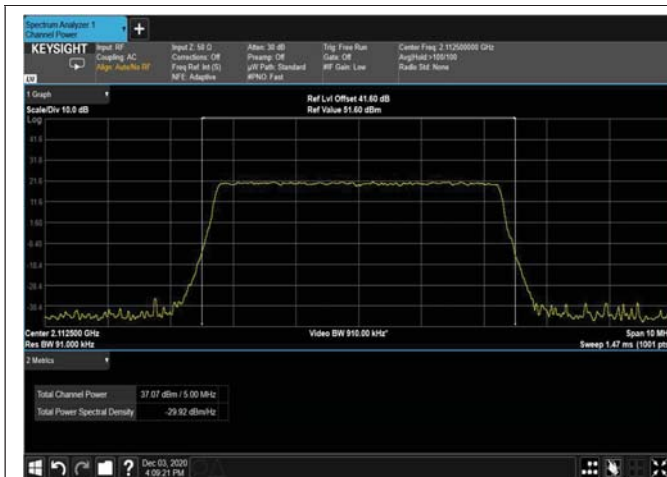


Figure 102: QPSK 5MHz B.W; 2112.5MHz – 4G

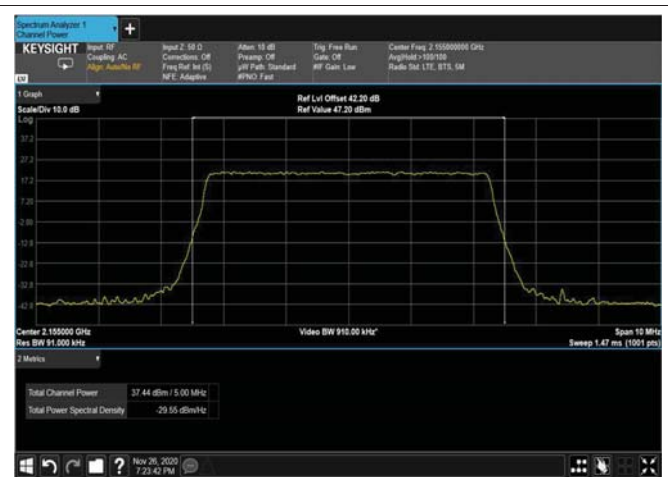


Figure 103: QPSK 5MHz B.W; 2155MHz – 4G

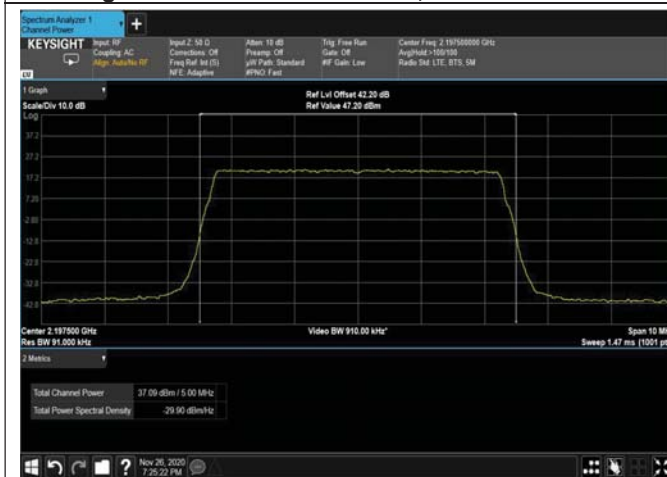


Figure 104: QPSK 5MHz B.W; 2197.5MHz – 4G



Figure 105: QPSK 10MHz B.W; 2115MHz – 4G



Figure 106: QPSK 10MHz; 2155MHz – 4G



Figure 107: QPSK 10MHz; 2195MHz – 4G



Figure 108: QPSK 15MHz B.W; 2117.5MHz – 4G



Figure 109: QPSK 15MHz B.W; 2155MHz – 4G

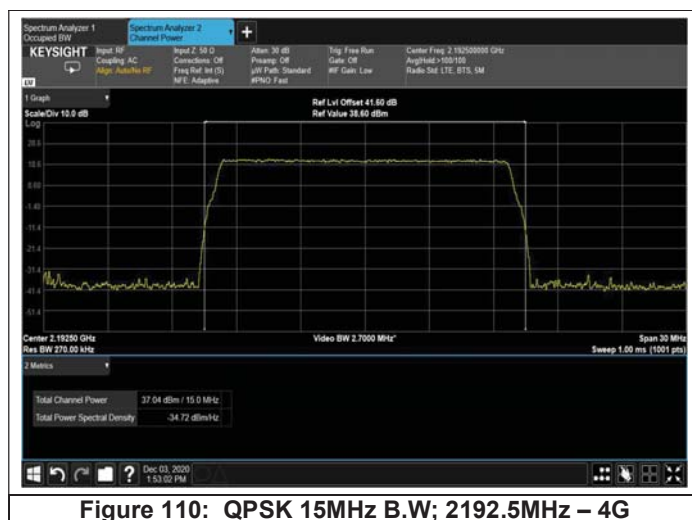


Figure 110: QPSK 15MHz B.W; 2192.5MHz – 4G

5.5 Test Equipment Used; RF Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Keysight	UXA N9040B	MY56080119	January 31, 2020	January 31, 2022
EXG Vector Signal Generator	Agilent Technologies	N5172B	MY53051952	January 17, 2019	January 17, 2022
40 dB Attenuator	Weinschel Associates	WA 39-40-33	-	November 1, 2020	November 1, 2021
RF Coaxial Cable	Huber-Sunier	SLLS210B	-	November 1, 2020	November 1, 2021

Table 10 Test Equipment Used



6 Band Edge Spectrum - 5G

6.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (c)(1)

6.2 Test Procedure

(Temperature (20°C)/ Humidity (48%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (41.6 dB).

resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter was employed

6.3 Test Limit

The power of any emission outside of the authorized operating frequency ranges (2110-2200 MHz) must be attenuated below the transmitting power (P) by a factor of at least $43 + \log(P)$ dB, yielding -13dBm.

6.4 Test Results

JUDGEMENT: Passed

See additional information in Table 11 to Table 14 and Figure 111 to Figure 158.



Modulation	Bandwidth	Sub Carrier	Band Edge Frequency	Reading	Limit
	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)
16QAM	5	15	2112.5	-20.140	-13.0
			2197.5	-18.206	
		30	2112.5	-35.607	
			2197.5	-35.760	
	10	15	2115.0	-36.398	
			2195.0	-38.822	
		30	2115.0	-40.443	
			2195.0	-38.225	
	15	15	2117.5	-36.925	
			2192.5	-38.220	
		30	2117.5	-35.291	
			2192.5	-40.577	

Table 11 Band Edge Spectrum Results 16QAM – 5G

Modulation	Bandwidth	Sub Carrier	Band Edge Frequency	Reading	Limit
	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)
64QAM	5	15	2112.5	-19.673	-13.0
			2197.5	-19.824	
		30	2112.5	-35.695	
			2197.5	-34.292	
	10	15	2115.0	-39.430	
			2195.0	-37.791	
		30	2115.0	-43.568	
			2195.0	-41.938	
	15	15	2117.5	-35.368	
			2192.5	-37.590	
		30	2117.5	-34.667	
			2192.5	-42.919	

Table 12 Band Edge Spectrum Results 64QAM – 5G



Modulation	Bandwidth	Sub Carrier	Band Edge Frequency	Reading	Limit
	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)
256QAM	5	15	2112.5	-20.812	-13.0
			2197.5	-18.563	
		30	2112.5	-35.460	
			2197.5	-36.874	
	10	15	2115.0	-40.399	
			2195.0	-36.412	
		30	2115.0	-40.905	
			2195.0	-41.594	
	15	15	2117.5	-35.321	
			2192.5	-39.166	
		30	2117.5	-35.633	
			2192.5	-39.361	

Table 13 Band Edge Spectrum Results 256QAM – 5G

Modulation	Bandwidth	Sub Carrier	Band Edge Frequency	Reading	Limit
	(MHz)	(kHz)	(MHz)	(dBm)	(dBm)
QPSK	5	15	2112.5	-19.933	-13.0
			2197.5	-18.552	
		30	2112.5	-35.045	
			2197.5	-33.204	
	10	15	2115.0	-38.065	
			2195.0	-36.416	
		30	2115.0	-37.343	
			2195.0	-39.994	
	15	15	2117.5	-35.299	
			2192.5	-39.697	
		30	2117.5	-35.707	
			2192.5	-39.022	

Table 14 Band Edge Spectrum Results QPSK – 5G



Figure 111: 16QAM 5MHz B.W.; 2112.5MHz, 15kHz Lower Edge

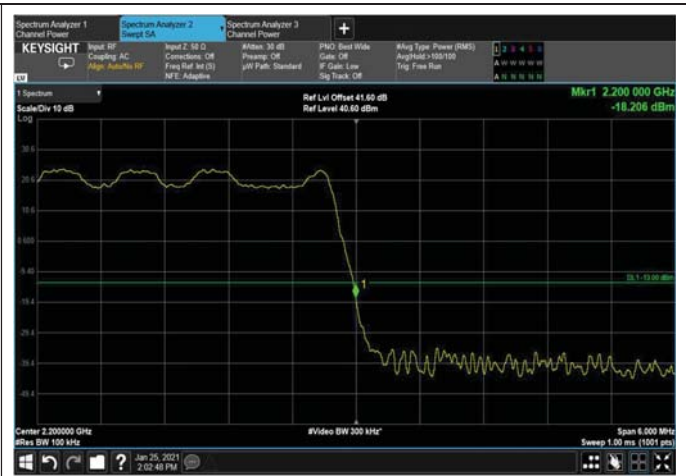


Figure 112: 16QAM 5MHz B.W.; 2197.5MHz, 15kHz Upper Edge

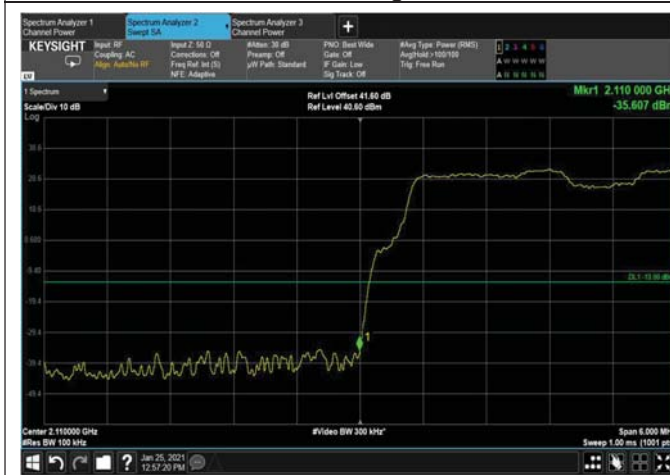


Figure 113: 16QAM 5MHz B.W.; 2112.5MHz, 30kHz Lower Edge



Figure 114: 16QAM 5MHz B.W.; 2197.5MHz, 30kHz Upper Edge



Figure 115: 16QAM 10MHz B.W.; 2115MHz, 15kHz Lower Edge



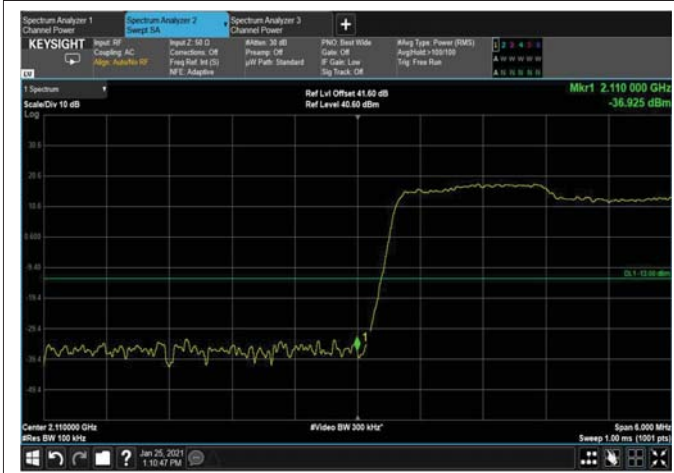
Figure 116: 16QAM 10MHz B.W.; 2195MHz, 15kHz Upper Edge



**Figure 117: 16QAM 10MHz B.W.; 2115MHz, 30kHz
Lower Edge**



**Figure 118: 16QAM 10MHz B.W.; 2195MHz, 30kHz
Upper Edge**



**Figure 119: 16QAM 15MHz B.W.; 2117.5MHz, 15kHz
Lower Edge**



**Figure 120: 16QAM 15MHz B.W.; 2192.5MHz, 15kHz
Upper Edge**



**Figure 121: 16QAM 15MHz B.W.; 2117.5MHz, 30kHz
Lower Edge**



**Figure 122: 16QAM 15MHz B.W.; 2192.5MHz, 30kHz
Upper Edge**

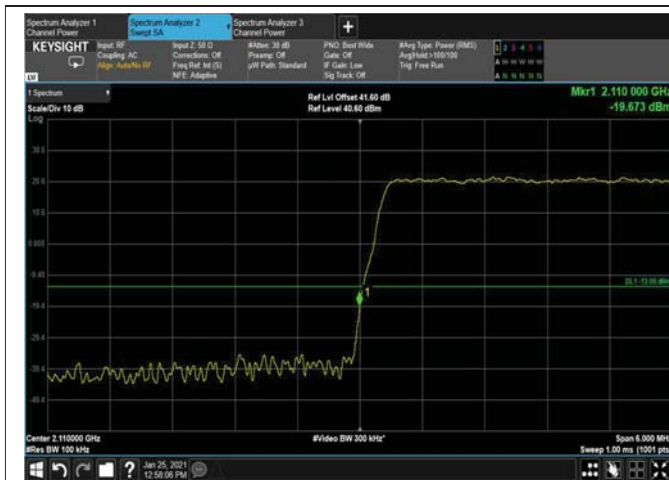


Figure 123: 64QAM 5MHz B.W.; 2112.5MHz, 15kHz
Lower Edge

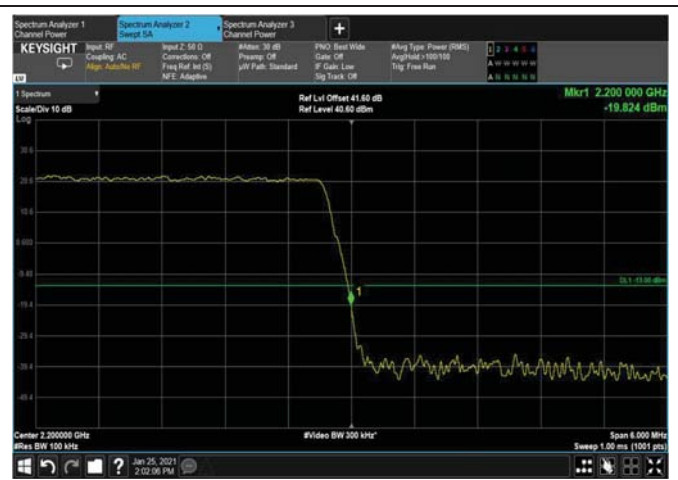


Figure 124: 64QAM 5MHz B.W.; 2197.5MHz, 15kHz
Upper Edge

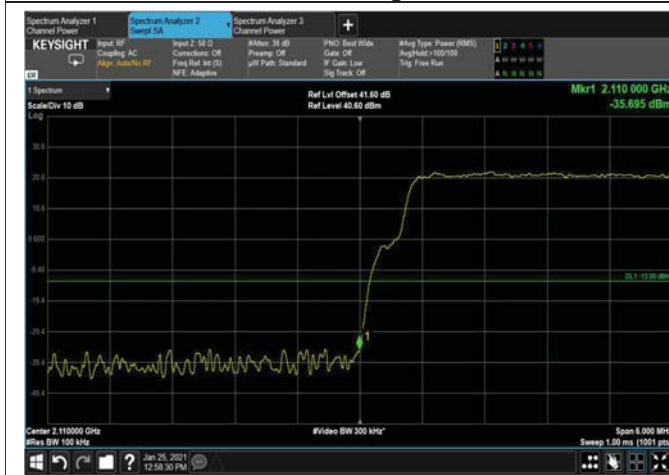


Figure 125: 64QAM 5MHz B.W.; 2112.5MHz, 30kHz
Lower Edge



Figure 126: 64QAM 5MHz B.W.; 2197.5MHz, 30kHz
Upper Edge

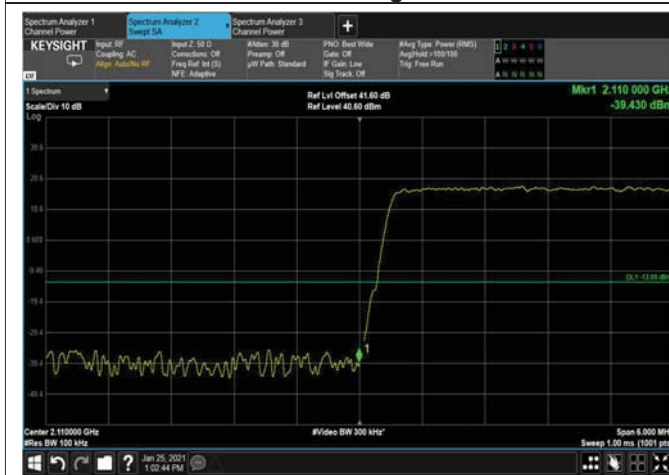


Figure 127: 64QAM 10MHz B.W.; 2115MHz, 15kHz
Lower Edge



Figure 128: 64QAM 10MHz B.W.; 2195MHz, 15kHz
Upper Edge



Figure 129: 64QAM 10MHz B.W.; 2115MHz, 30kHz Lower Edge



Figure 130: 64QAM 10MHz B.W.; 2195MHz, 30kHz Upper Edge

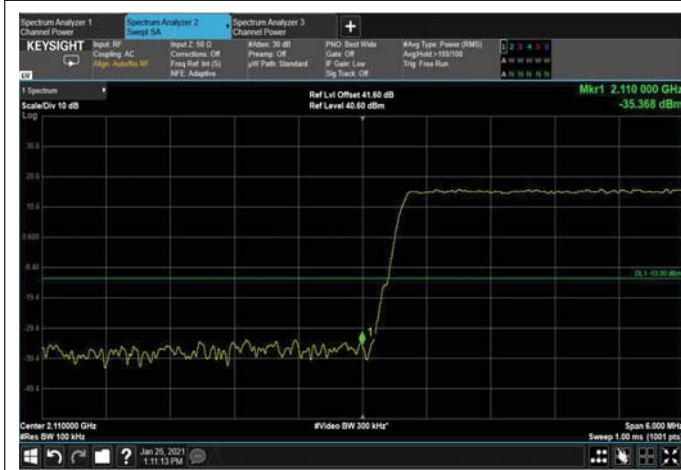


Figure 131: 64QAM 15MHz B.W.; 2117.5MHz, 15kHz Lower Edge

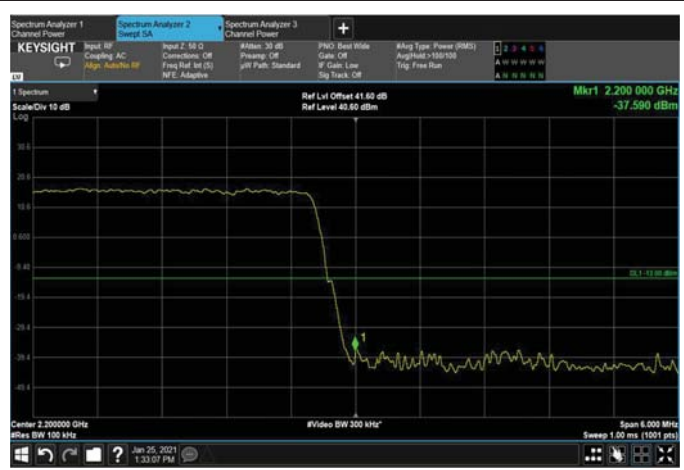


Figure 132: 64QAM 15MHz B.W.; 2192.5MHz, 15kHz Upper Edge



Figure 133: 64QAM 15MHz B.W.; 2117.5MHz, 30kHz Lower Edge

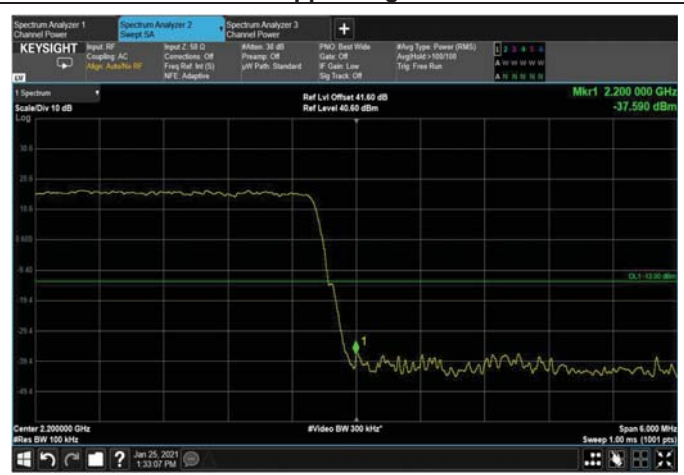


Figure 134: 64QAM 15MHz B.W.; 2192.5MHz, 30kHz Upper Edge



Figure 135: 256QAM 5MHz B.W.; 2112.5MHz, 15kHz
Lower Edge

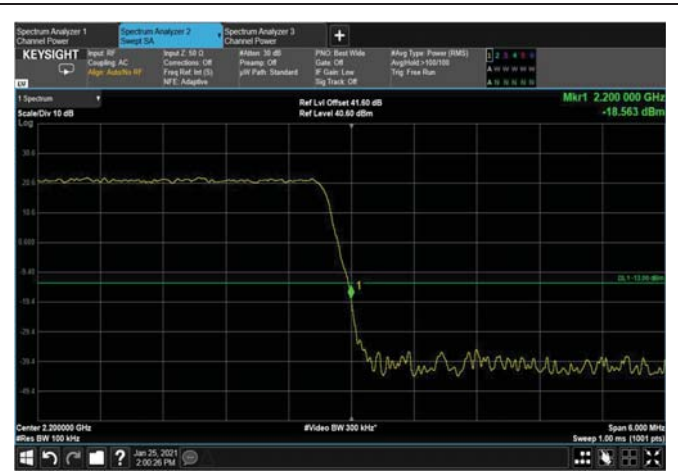


Figure 136: 256QAM 5MHz B.W.; 2197.5MHz, 15kHz
Upper Edge



Figure 137: 256QAM 5MHz B.W.; 2112.5MHz, 30kHz
Lower Edge



Figure 138: 256QAM 5MHz B.W.; 2197.5MHz, 30kHz
Upper Edge



Figure 139: 256QAM 10MHz B.W.; 2115MHz, 15kHz
Lower Edge



Figure 140: 256QAM 10MHz B.W.; 2195MHz, 15kHz
Upper Edge



Figure 141: 256QAM 10MHz B.W.; 2115MHz, 30kHz
Lower Edge



Figure 142: 256QAM 10MHz B.W.; 2195MHz, 30kHz
Upper Edge

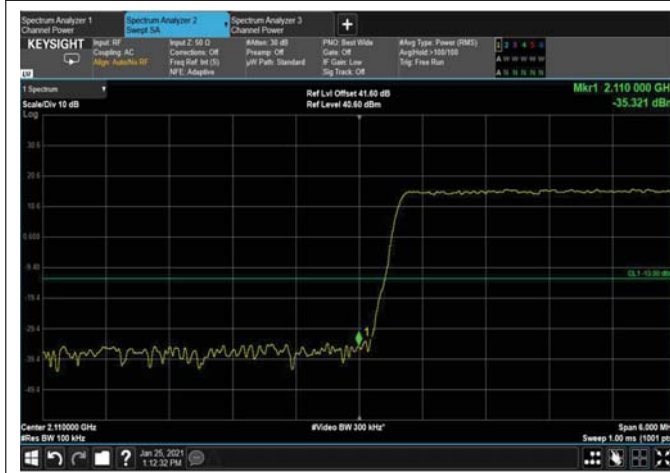


Figure 143: 256QAM 15MHz B.W.; 2117.5MHz, 15kHz
Lower Edge

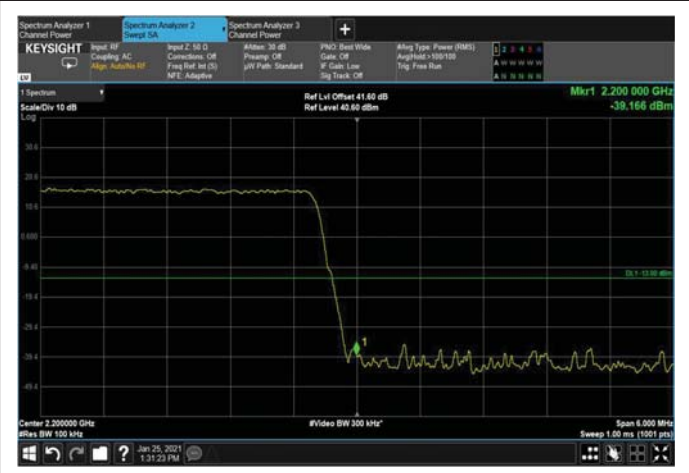


Figure 144: 256QAM 15MHz B.W.; 2192.5MHz, 15kHz
Upper Edge



Figure 145: 256QAM 15MHz B.W.; 2117.5MHz, 30kHz
Lower Edge



Figure 146: 256QAM 15MHz B.W.; 2192.5MHz, 30kHz
Upper Edge

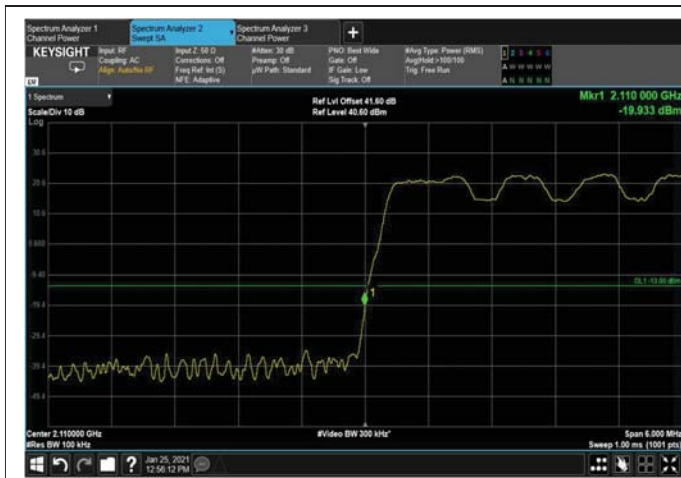


Figure 147: QPSK 5MHz B.W.; 2112.5MHz, 15kHz Lower Edge



Figure 148: QPSK 5MHz B.W.; 2197.5MHz, 15kHz Upper Edge



Figure 149: QPSK 5MHz B.W.; 2112.5MHz, 30kHz Lower Edge



Figure 150: QPSK 5MHz B.W.; 2197.5MHz, 30kHz Upper Edge

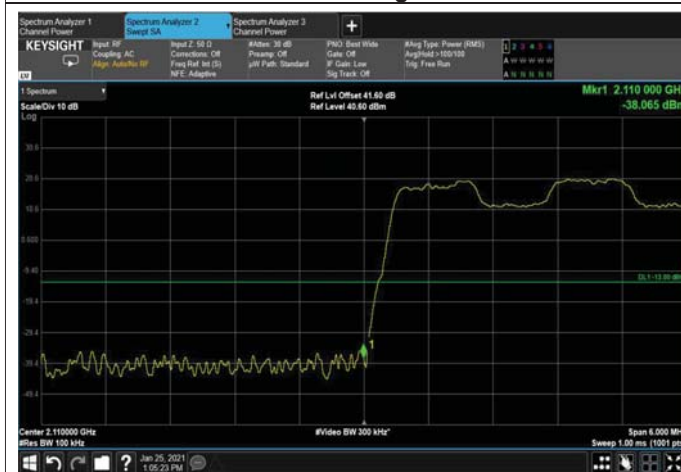


Figure 151: QPSK 10MHz B.W.; 2115MHz, 15kHz Lower Edge



Figure 152: QPSK 10MHz B.W.; 2195MHz, 15kHz Upper Edge



Figure 153: QPSK 10MHz B.W.; 2115MHz, 30kHz
Lower Edge



Figure 154: QPSK 10MHz B.W.; 2195MHz, 30kHz
Upper Edge



Figure 155: QPSK 15MHz B.W.; 2117.5MHz, 15kHz
Lower Edge

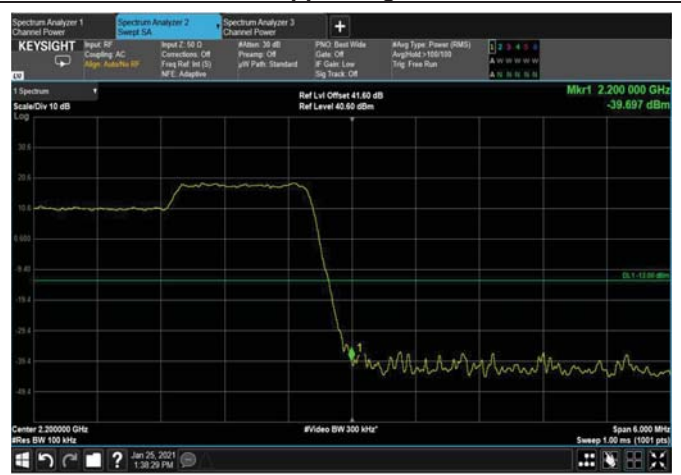


Figure 156: QPSK 15MHz B.W.; 2192.5MHz, 15kHz
Upper Edge



Figure 157: QPSK 15MHz B.W.; 2117.5MHz, 30kHz
Lower Edge



Figure 158: QPSK 15MHz B.W.; 2192.5MHz, 30kHz
Upper Edge



6.5 Test Equipment Used; Band Edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Keysight	UXA N9040B	MY56080119	January 31, 2020	January 31, 2022
EXG Vector Signal Generator	Agilent Technologies	N5172B	MY53051952	January 17, 2019	January 17, 2022
40 dB Attenuator	Weinschel Associates	WA 39-40-33	-	November 1, 2020	November 1, 2021
RF Coaxial Cable	Huber-Suner	SLLS210B	-	November 1, 2020	November 1, 2021

Table 15 Test Equipment Used



7 Band Edge Spectrum – 3G and 4G

7.1 Test Specification

FCC Part 27, Subpart C, Section 27.53 (c)(1)

7.2 Test Procedure

(Temperature (20°C)/ Humidity (48%RH))

The E.U.T. antenna terminal was connected to the spectrum analyzer through an external attenuator and an appropriate coaxial cable (41.6 dB).

resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter was employed

7.3 Test Limit

The power of any emission outside of the authorized operating frequency ranges (2110-2200 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

JUDGEMENT: Passed

See additional information in Table 16 to Table 19 and **Error! Reference source not found.** to Figure 176.



Modulation	Bandwidth	Band Edge Frequency	Reading	Limit
	(MHz)	(MHz)	(dBm)	(dBm)
WCDMA	5	2112.5	-22.310	-13.0
		2197.5	-22.405	

Table 16 Band Edge Spectrum Results WCDMA – 3G

Modulation	Bandwidth	Band Edge Frequency	Reading	Limit
	(MHz)	(MHz)	(dBm)	(dBm)
16QAM	5	2112.5	-15.935	-13.0
		2197.5	-19.413	
	10	2115.0	-43.950	
		2195.0	-25.353	
	15	2117.5	-34.759	
		2192.5	-29.792	

Table 17 Band Edge Spectrum Results 16QAM – 4G

Modulation	Bandwidth	Band Edge Frequency	Reading	Limit
	(MHz)	(MHz)	(dBm)	(dBm)
64QAM	5	2112.5	-16.090	-13.0
		2197.5	-17.549	
	10	2115.0	-43.828	
		2195.0	-26.019	
	15	2117.5	-34.023	
		2192.5	-29.788	

Table 18 Band Edge Spectrum Results 64QAM – 4G

Modulation	Bandwidth	Band Edge Frequency	Reading	Limit
	(MHz)	(MHz)	(dBm)	(dBm)
QPSK	5	2112.5	-15.914	-13.0
		2197.5	-17.934	
	10	2115.0	-37.413	
		2195.0	-25.553	
	15	2117.5	-34.938	
		2192.5	-28.552	

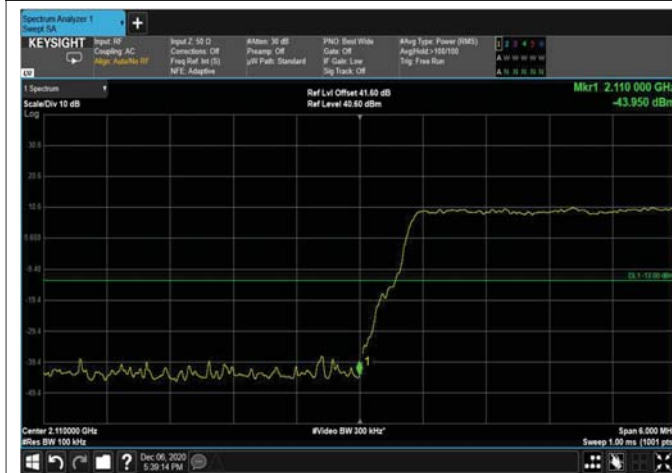
Table 19 Band Edge Spectrum Results QPSK – 4G



**Figure 159: 16QAM 5MHz B.W.; 2112.5MHz
Lower Edge – 4G**



**Figure 160: 16QAM 5MHz B.W.; 2197.5MHz
Upper Edge – 4G**



**Figure 161: 16QAM 10MHz B.W.; 2115MHz
Lower Edge – 4G**



**Figure 162: 16QAM 10MHz B.W.; 2195MHz
Upper Edge – 4G**



**Figure 163: 16QAM 15MHz B.W.; 2117.5MHz
Lower Edge – 4G**



**Figure 164: 16QAM 15MHz B.W.; 2192.5MHz
Upper Edge – 4G**



Figure 165: 64QAM 5MHz B.W.; 2112.5MHz
Lower Edge – 4G



Figure 166: 64QAM 5MHz B.W.; 2197.5MHz
Upper Edge – 4G

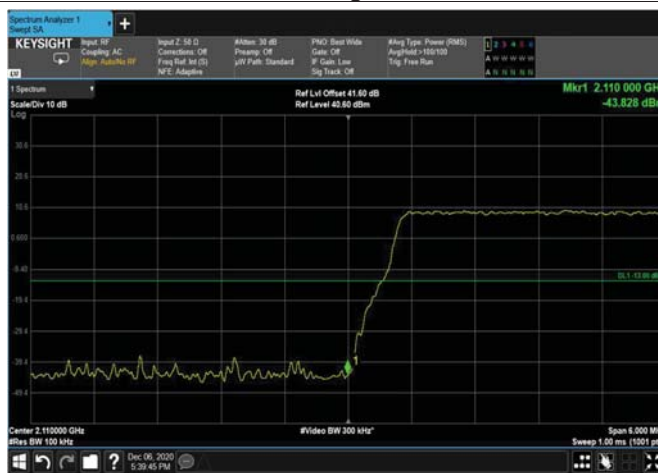


Figure 167: 64QAM 10MHz B.W.; 2115MHz
Lower Edge – 4G



Figure 168: 64QAM 10MHz B.W.; 2195MHz
Upper Edge – 4G

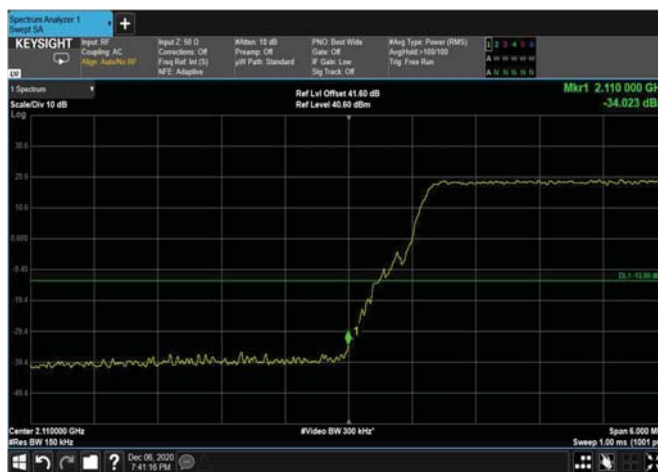


Figure 169: 64QAM 15MHz B.W.; 2117.5MHz
Lower Edge – 4G



Figure 170: 64QAM 15MHz B.W.; 2192.5MHz
Upper Edge – 4G

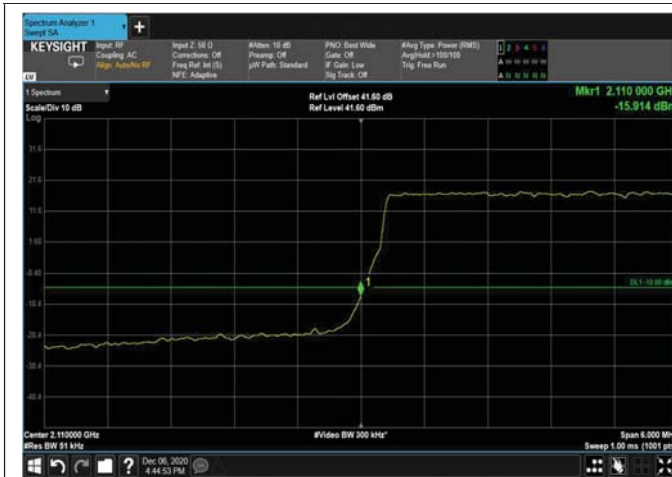


Figure 171: QPSK 5MHz B.W.; 2112.5MHz Lower Edge – 4G



Figure 172: QPSK 5MHz B.W.; 2197.5MHz Upper Edge – 4G

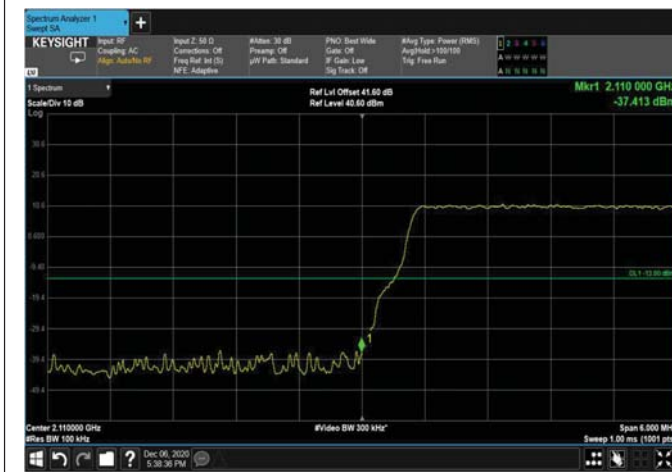


Figure 173: QPSK 10MHz B.W.; 2115MHz Lower Edge – 4G



Figure 174: QPSK 10MHz B.W.; 2195MHz Upper Edge – 4G

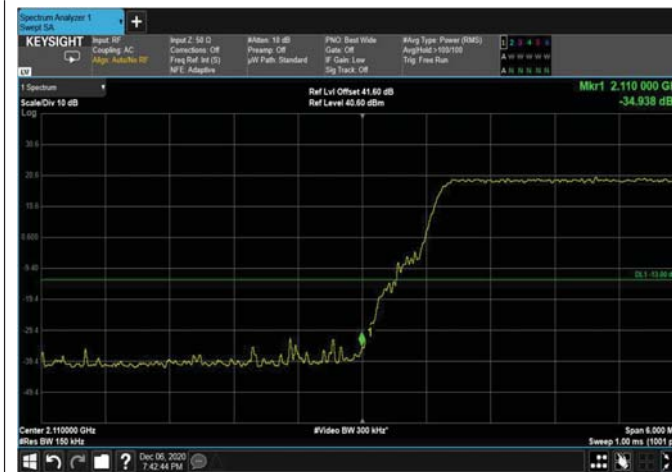


Figure 175: QPSK 15MHz B.W.; 2117.5MHz Lower Edge – 4G



Figure 176: QPSK 15MHz B.W.; 2192.5MHz Upper Edge – 4G



7.5 Test Equipment Used; Band Edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibration Date	Next Calibration Due
EXA signal Analyzer	Keysight	UXA N9040B	MY56080119	January 31, 2020	January 31, 2022
EXG Vector Signal Generator	Agilent Technologies	N5172B	MY53051952	January 17, 2019	January 17, 2022
40 dB Attenuator	Weinschel Associates	WA 39-40-33	-	November 1, 2020	November 1, 2021
RF Coaxial Cable	Huber-Suner	SLLS210B	-	November 1, 2020	November 1, 2021

Table 20 Test Equipment Used