Mercury Wireless

REVISED EMC TEST REPORT TO 103300-10

3.5GHz Base Station
Model: QUANTUM 6636

Tested to The Following Standards:

FCC Part 96 Subpart E

Report No.: 103300-10A

Date of issue: September 16, 2020

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Test Certificate # 803.01

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Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:	REPORT PREPARED BY:
Mercury Wireless 1111 Main St. Suite 600 Kansas City, Missouri 64105	Terri Rayle CKC Laboratories, Inc. 5046 Sierra Pines Drive Mariposa, CA 95338
Representative: Matthew Sams	Project Number: 103300

DATE OF EQUIPMENT RECEIPT:	February 26, 2020
DATE(S) OF TESTING:	February 26, 2020 – April 23, 2020

Revision History

Original: Testing of the 3.5GHz Base Station Model: QUANTUM 6636 to FCC Part 96 Subpart E.
Revision A: Updated list of declared antennas. Updated maximum EIRP and Spectral Density with revised maximum antenna gain. Added clarification to manufacturer's specifications.

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

1120 Fulton Place
Fremont, CA 94539

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12
EMITest Immunity	5.03.10

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	A-0136

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

SUMMARY OF RESULTS

Standard / Specification: FCC Part(s) 2 / 96 Subpart E – 96.41

Test Procedure	Description	Modifications	Results
2.1049	Occupied Bandwidth	NA	Pass
96.41b	Maximum EIRP	NA	Pass
96.41b	Maximum Power Spectral Density	NA	Pass
96.41e	Emissions Mask	NA	Pass
96.41e	Radiated Spurious Emissions	NA	Pass
96.41e	Conducted Spurious Emissions	NA	Pass
96.41g	Peak to Average Power Ratio (PAPR)	NA	Pass
2.1055	Frequency Stability	NA	Pass

NA = Not Applicable

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
3.5GHz Base Station	Mercury Networks	QUANTUM 6636	164899400032

Support Equipment:

Device	Manufacturer	Model #	S/N
GPS Antenna	PCTEL	GPSL1-TMG-SP1-40N	141037/0163
Mouse	DELL	MS116t	CN-OXWP60-L0300-85L-OLIU
Keyboard	Dell	KB4021	CN-ODJ454-71581-2CU-004M-A00
Desktop PC	DELL	Optiplex 3010	36952834933
Monitor	Lenovo	6135-AB1	V1177358

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
3.5GHz Base Station	Mercury Networks	QUANTUM 6636	164899400032

Support Equipment:

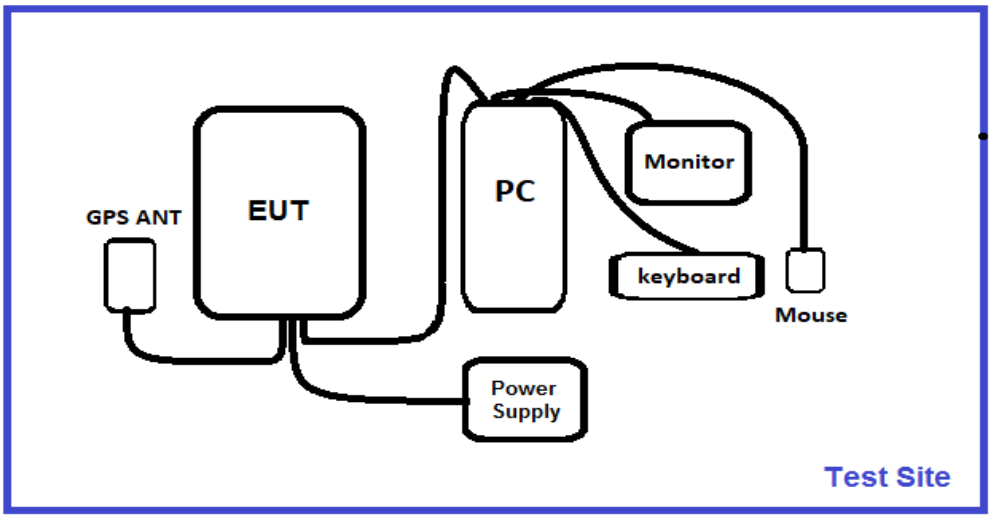
Device	Manufacturer	Model #	S/N
GPS Antenna	PCTEL	GPSL1-TMG-SP1-40N	141037/0163
Mouse	DELL	MS116t	CN-OXWP60-L0300-85L-OLIU
Keyboard	Dell	KB4021	CN-ODJ454-71581-2CU-004M-A00
Desktop PC	DELL	Optiplex 3010	36952834933
Monitor	Lenovo	6135-AB1	V1177358
USB-Ethernet Adapter	Insignia	NS-PU98505	NA
Laptop Power Supply	Lenovo	ADL45WCC	8SSA10M42697C1SG9550BY3
Laptop	Lenovo	81MV	PF1P2H32
Customer Premises Equipment (CPE)	Mercury Networks	QTS-36-S	QTS05C15EA7E

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Citizens Broadband Radio Service Device (CBSD)
Operating Frequency Range:	3555 – 3695 MHz
Modulation Type(s):	QAM16 QAM64 QPSK
Maximum Duty Cycle:	72%
RF Output	6 Ports for connection to three antennas arranged 120° apart 2 ports connected to each antenna with orthogonal polarities
Antenna Type(s) and Gain:	15dBi Dual Slant Polarized Antenna Array 90 Degrees (6 port) 17dBi Dual Polarized Antenna Array 90 Degrees (2 port)
Beamforming Type:	NA –Antenna installation is cross-polarized with no phase shifting.
Antenna Connection Type:	Type N
Nominal Input Voltage:	-48 VDC
Firmware / Software used for Test:	Putty (All testing except PAPR) iPerf3 (Communication between CPE and Base Station for PAPR

Block Diagram(s) of Test Setup

Test Setup Block Diagram



FCC PART(S) 2 / 96

2.1049 Occupied Bandwidth

Test Setup/Conditions			
Test Location:	Mariposa Lab A	Test Engineer:	Benny Lovan
Test Method:	ANSI C63.26 (2015)	Test Date(s):	2/26/2020 – 3/4/2020
Configuration:	1		
Test Setup:	The EUT is connected directly to the spectrum analyzer through 10.9dB of loss from the attenuator/cable chain used for measurement.		
Declaration:	Software output power setting was varied dependent upon channel bandwidth setting. See tables below for software setting.		

Environmental Conditions			
Temperature (ºC)	20-6-24.8	Relative Humidity (%):	28-33

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02668	Spectrum Analyzer	Agilent	E4446A	12/17/2019	12/17/2020
03356	Cable	AstroLab	32026-2-29094K-48TC	3/14/2019	3/14/2021
P06239	Attenuator	Weinschel	54A-10	12/18/2018	12/18/2020

-26dB Occupied Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (MHz)	Limit (MHz)	Results
3.5 MHz Channel Spacing - (Software Output Setting 31)					
3552.5	1	QPSK	3.554	NA	Pass
3625	1	QPSK	3.543	NA	Pass
3697.5	1	QPSK	3.547	NA	Pass
3552.5	1	QAM16	3.528	NA	Pass
3625	1	QAM16	3.548	NA	Pass
3697.5	1	QAM16	3.527	NA	Pass
3552.5	1	QAM64	3.537	NA	Pass
3625	1	QAM64	3.546	NA	Pass
3697.5	1	QAM64	3.530	NA	Pass
5 MHz Channel Spacing - (Software Output Setting 32)					
3552.5	1	QPSK	4.919	NA	Pass
3625	1	QPSK	4.916	NA	Pass
3697.5	1	QPSK	4.916	NA	Pass
3552.5	1	QAM16	4.921	NA	Pass
3625	1	QAM16	4.898	NA	Pass
3697.5	1	QAM16	4.904	NA	Pass
3552.5	1	QAM64	4.927	NA	Pass
3625	1	QAM64	4.896	NA	Pass
3697.5	1	QAM64	4.922	NA	Pass
7 MHz Channel Spacing - (Software Output Setting 32)					
3553.5	1	QPSK	7.032	NA	Pass
3625	1	QPSK	6.977	NA	Pass
3696.5	1	QPSK	7.005	NA	Pass
3553.5	1	QAM16	7.002	NA	Pass
3625	1	QAM16	7.046	NA	Pass
3696.5	1	QAM16	7.044	NA	Pass
3553.5	1	QAM64	7.014	NA	Pass
3625	1	QAM64	7.041	NA	Pass
3696.5	1	QAM64	7.045	NA	Pass
10 MHz Channel Spacing - (Software Output Setting 33)					
3555	1	QPSK	9.763	NA	Pass
3625	1	QPSK	9.690	NA	Pass
3695	1	QPSK	9.744	NA	Pass
3555	1	QAM16	9.749	NA	Pass
3625	1	QAM16	9.743	NA	Pass
3695	1	QAM16	9.752	NA	Pass
3555	1	QAM64	9.732	NA	Pass
3625	1	QAM64	9.718	NA	Pass
3695	1	QAM64	9.737	NA	Pass

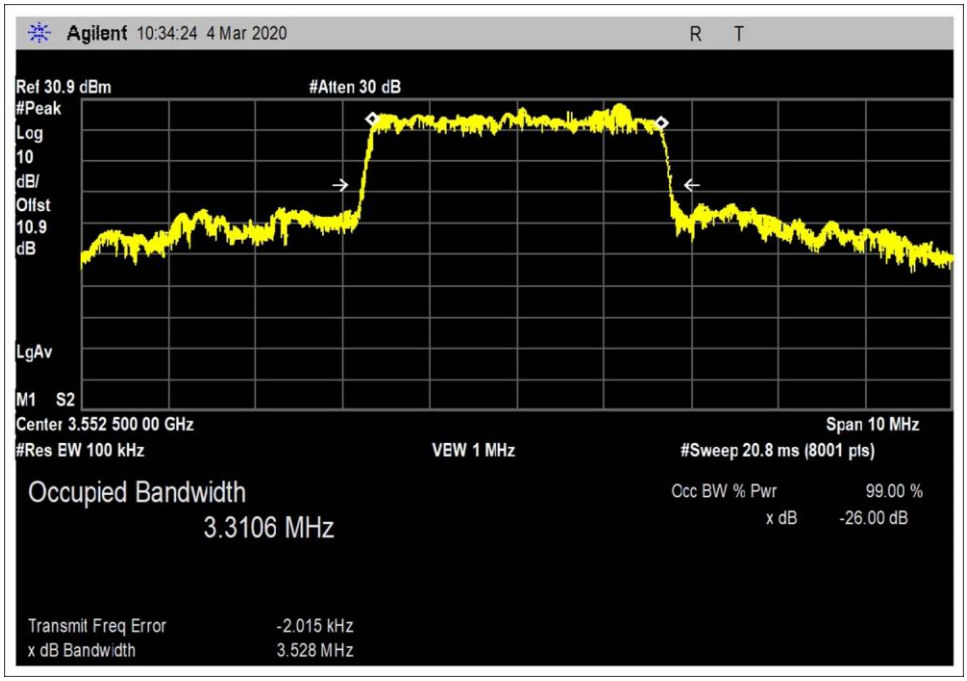
99% Occupied Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (MHz)	Limit (MHz)	Results
3.5 MHz Channel Spacing - (Software Output Setting 31)					
3552.5	1	QPSK	3.3126	NA	Pass
3625	1	QPSK	3.3092	NA	Pass
3697.5	1	QPSK	3.3109	NA	Pass
3552.5	1	QAM16	3.3106	NA	Pass
3625	1	QAM16	3.3100	NA	Pass
3697.5	1	QAM16	3.3136	NA	Pass
3552.5	1	QAM64	3.3182	NA	Pass
3625	1	QAM64	3.3119	NA	Pass
3697.5	1	QAM64	3.3071	NA	Pass
5 MHz Channel Spacing - (Software Output Setting 32)					
3552.5	1	QPSK	4.6322	NA	Pass
3625	1	QPSK	4.6232	NA	Pass
3697.5	1	QPSK	4.6192	NA	Pass
3552.5	1	QAM16	4.6328	NA	Pass
3625	1	QAM16	4.6015	NA	Pass
3697.5	1	QAM16	4.6264	NA	Pass
3552.5	1	QAM64	4.6207	NA	Pass
3625	1	QAM64	4.6223	NA	Pass
3697.5	1	QAM64	4.6176	NA	Pass
7 MHz Channel Spacing - (Software Output Setting 32)					
3553.5	1	QPSK	6.5712	NA	Pass
3625	1	QPSK	6.5255	NA	Pass
3696.5	1	QPSK	6.5375	NA	Pass
3553.5	1	QAM16	6.5676	NA	Pass
3625	1	QAM16	6.5730	NA	Pass
3696.5	1	QAM16	6.5634	NA	Pass
3553.5	1	QAM64	6.5883	NA	Pass
3625	1	QAM64	6.4886	NA	Pass
3696.5	1	QAM64	6.5609	NA	Pass
10 MHz Channel Spacing - (Software Output Setting 33)					
3555	1	QPSK	9.1930	NA	Pass
3625	1	QPSK	9.1575	NA	Pass
3695	1	QPSK	9.1845	NA	Pass
3555	1	QAM16	9.1689	NA	Pass
3625	1	QAM16	9.1714	NA	Pass
3695	1	QAM16	9.1781	NA	Pass
3555	1	QAM64	9.1926	NA	Pass
3625	1	QAM64	9.1707	NA	Pass
3695	1	QAM64	9.1804	NA	Pass

Plot(s)

Channel Bandwidth 3.5MHz

QAM16



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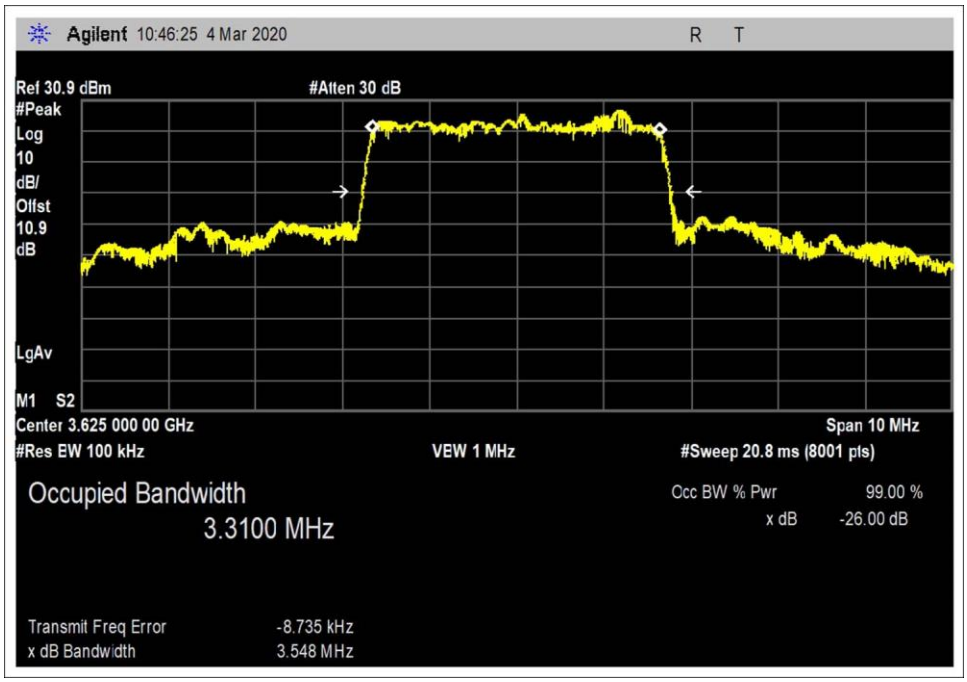

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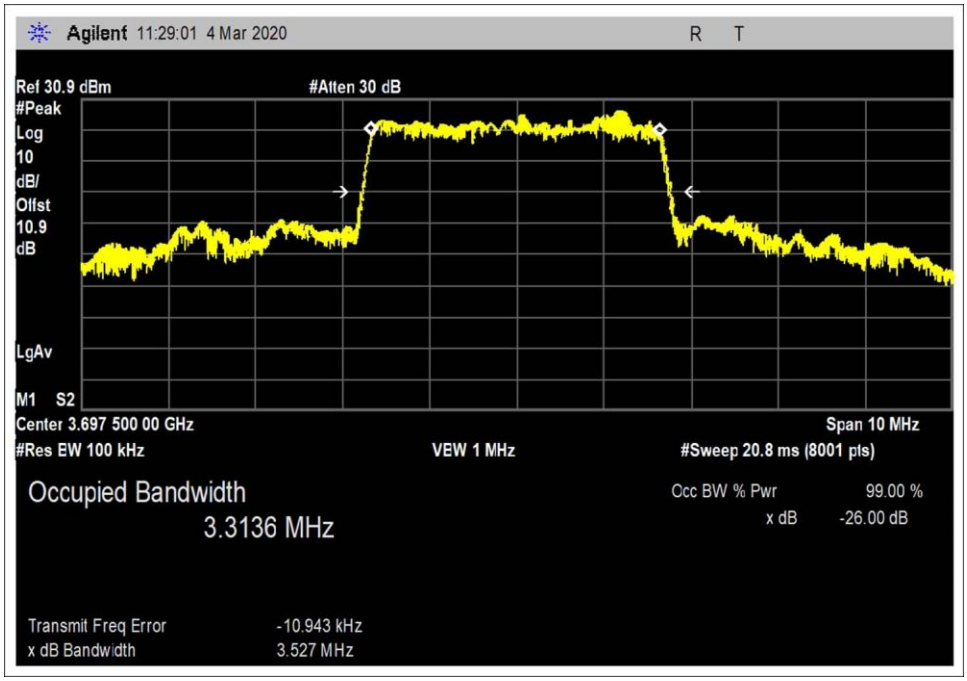
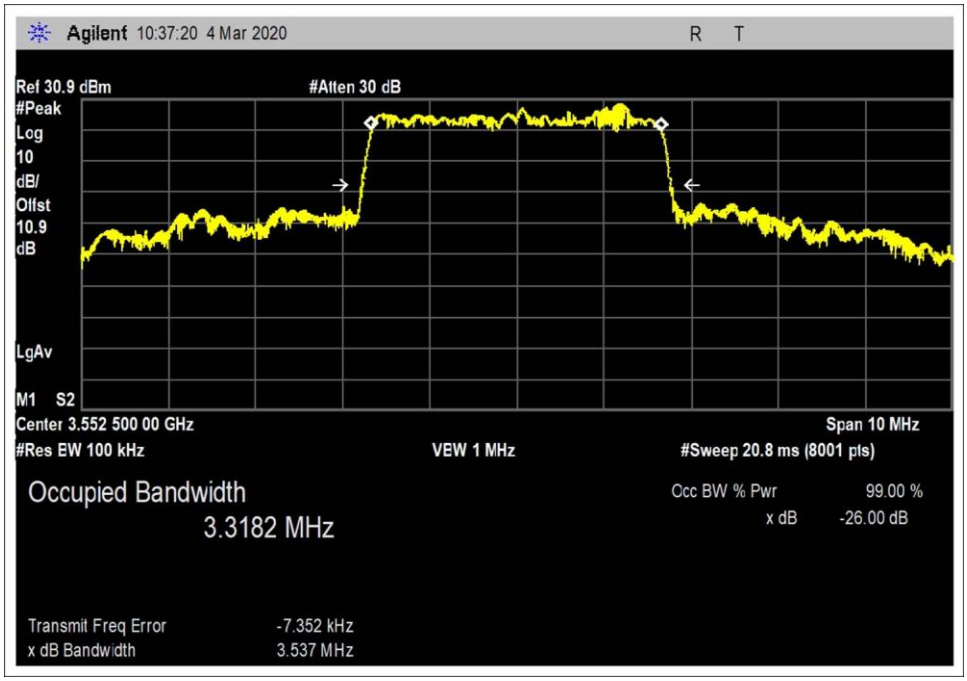


High Channel

QAM64



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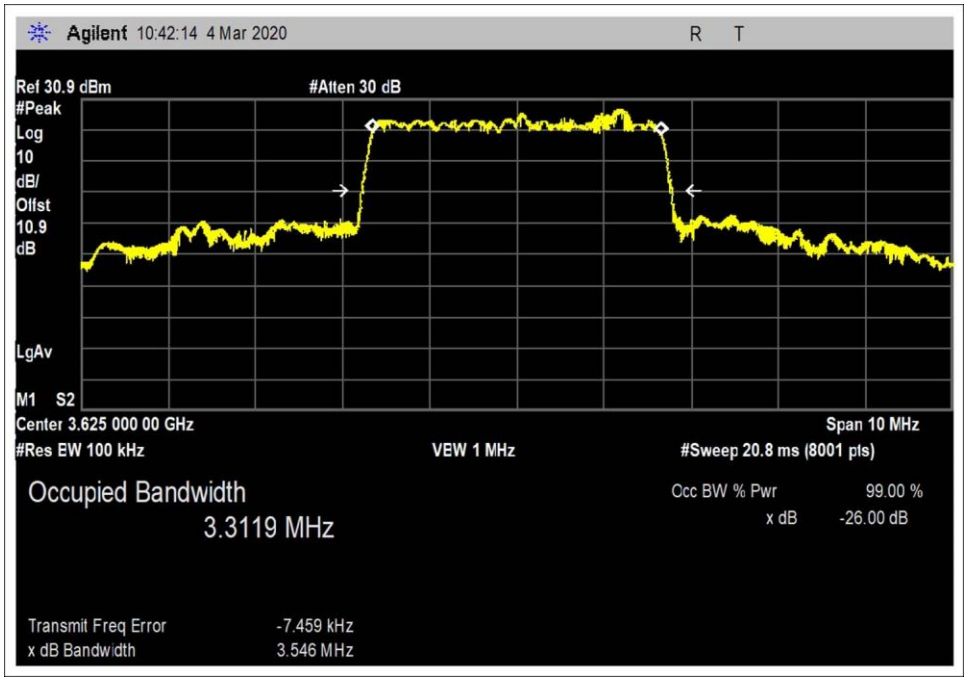

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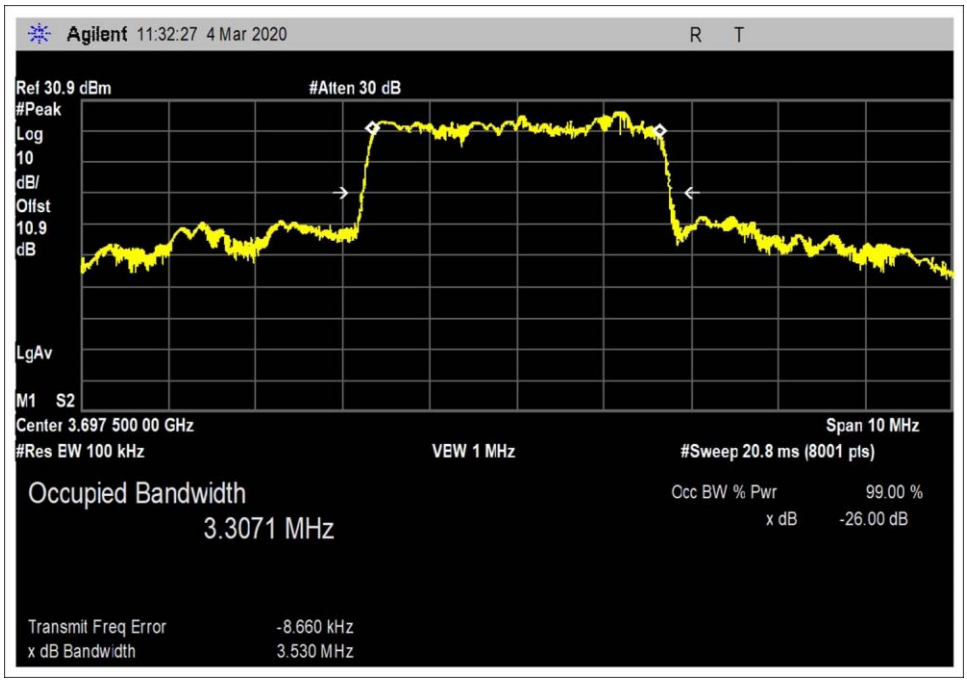
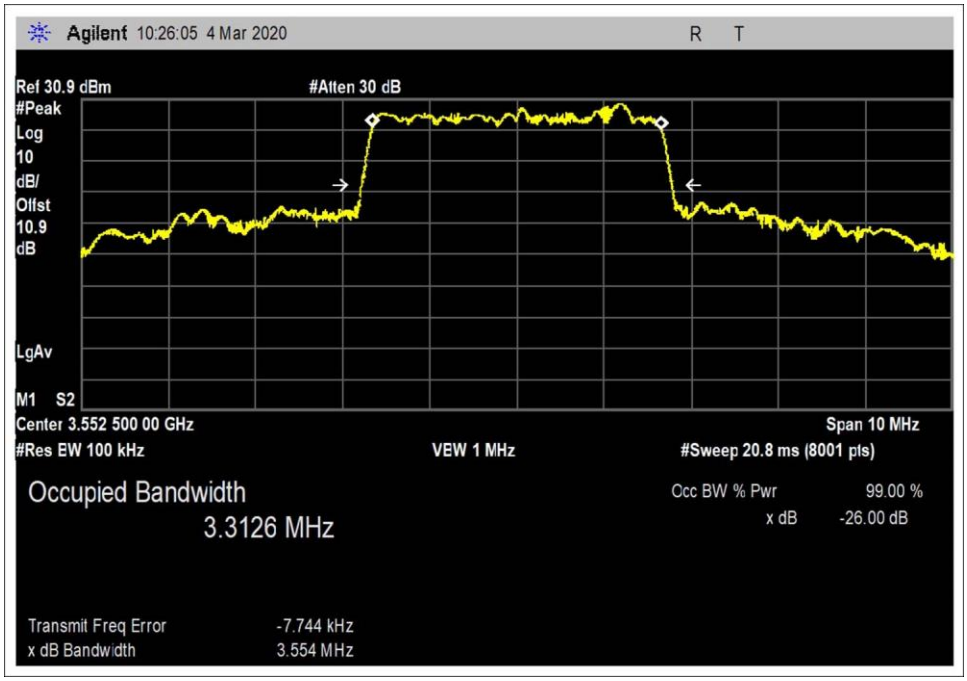


High Channel

QPSK



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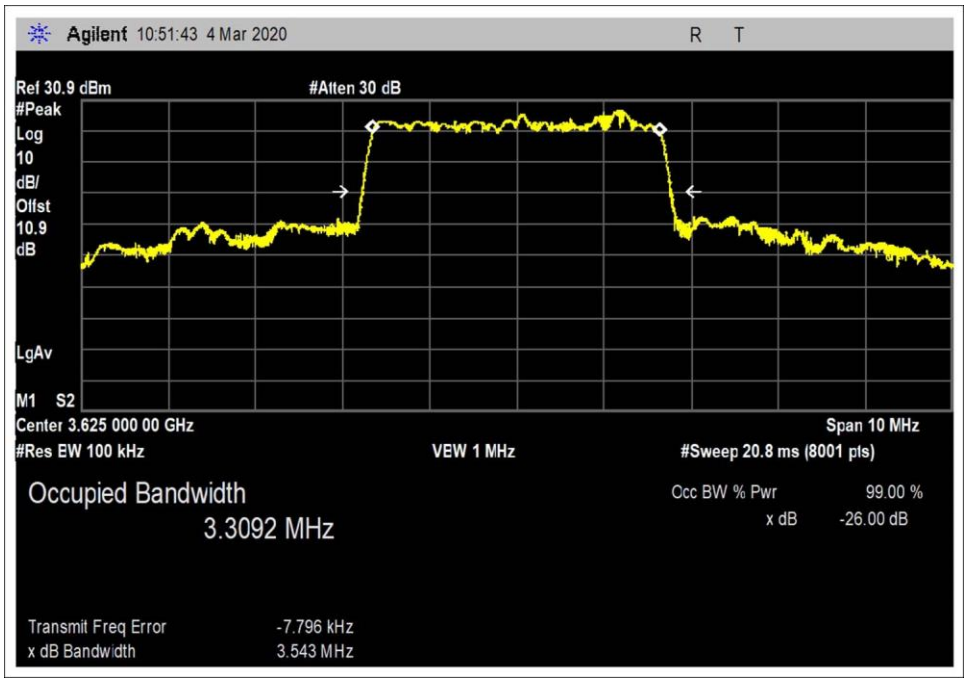
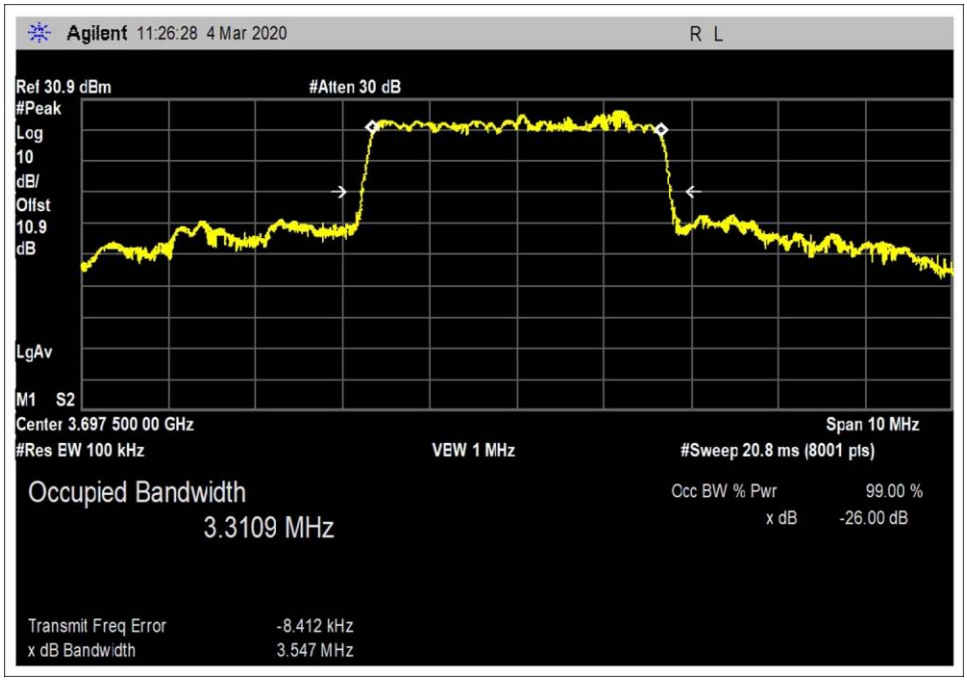


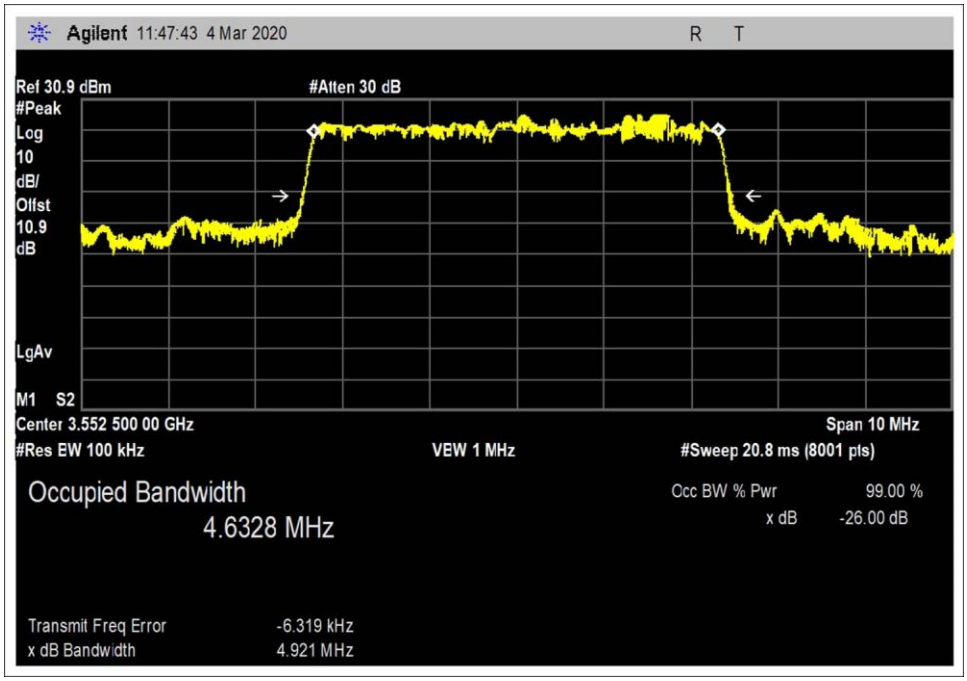
Middle Channel



High Channel

Channel Bandwidth 5MHz

QAM16



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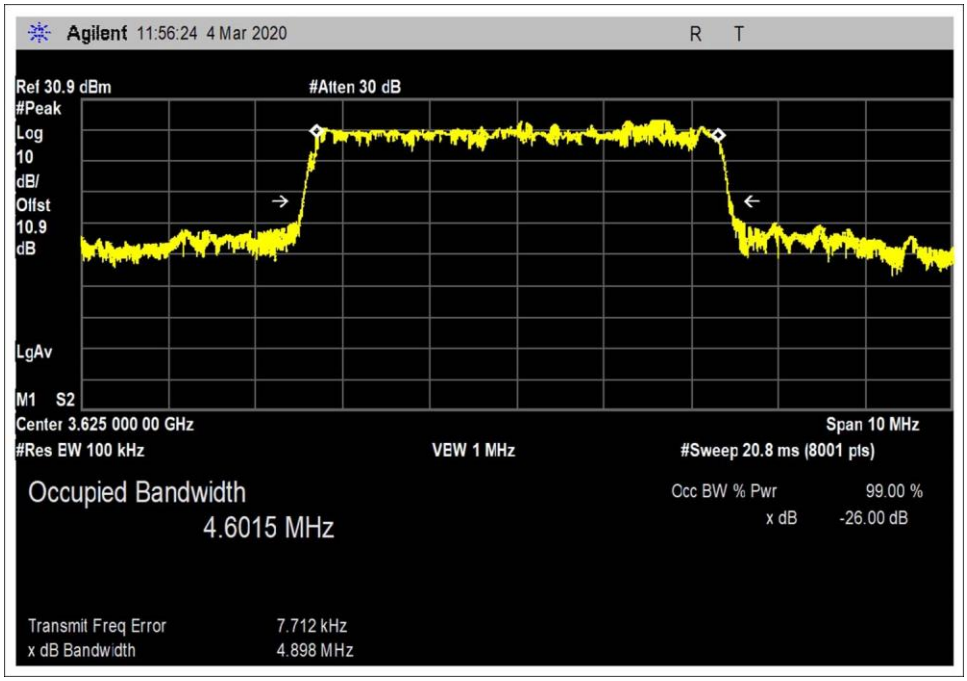

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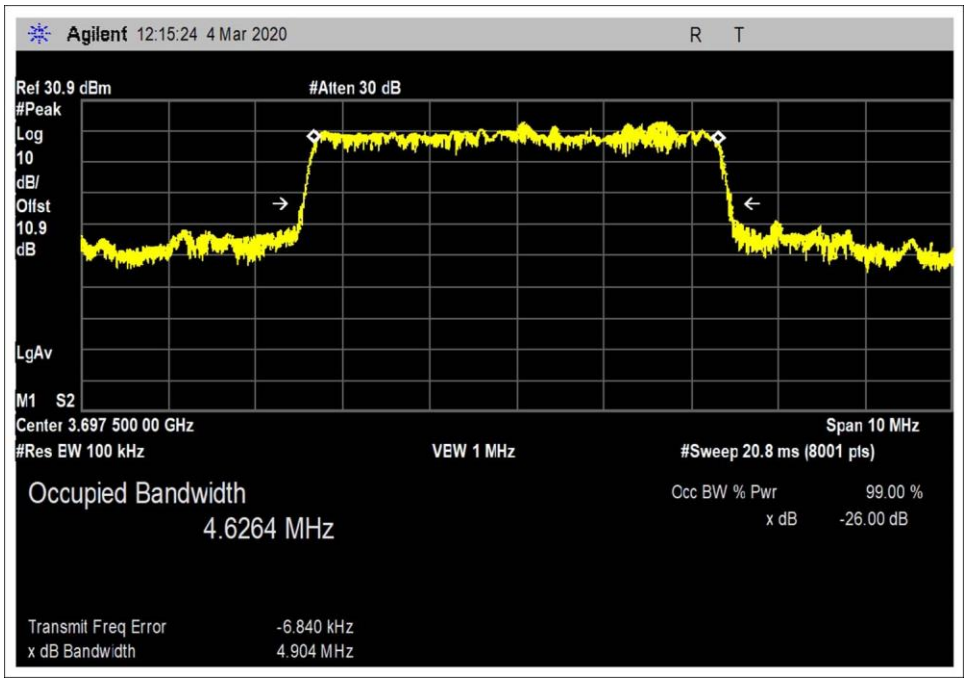
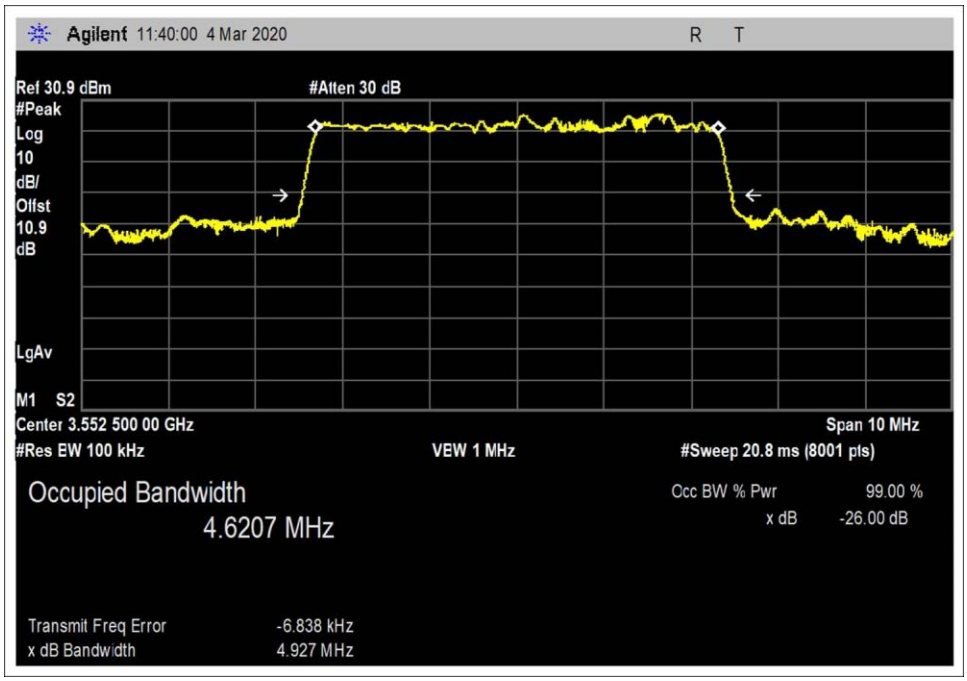


High Channel

QAM64



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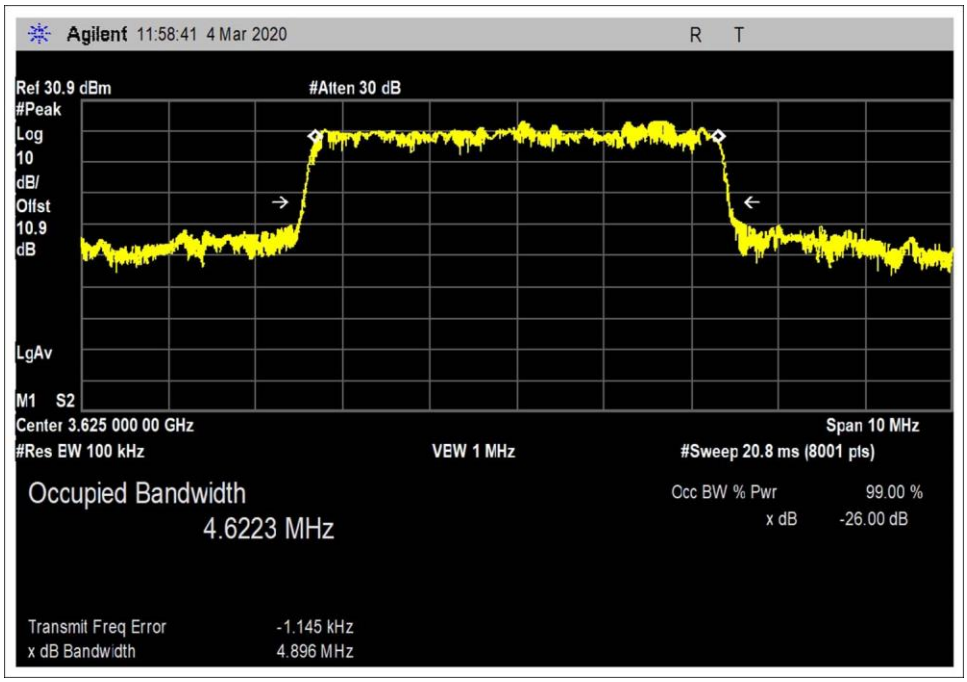

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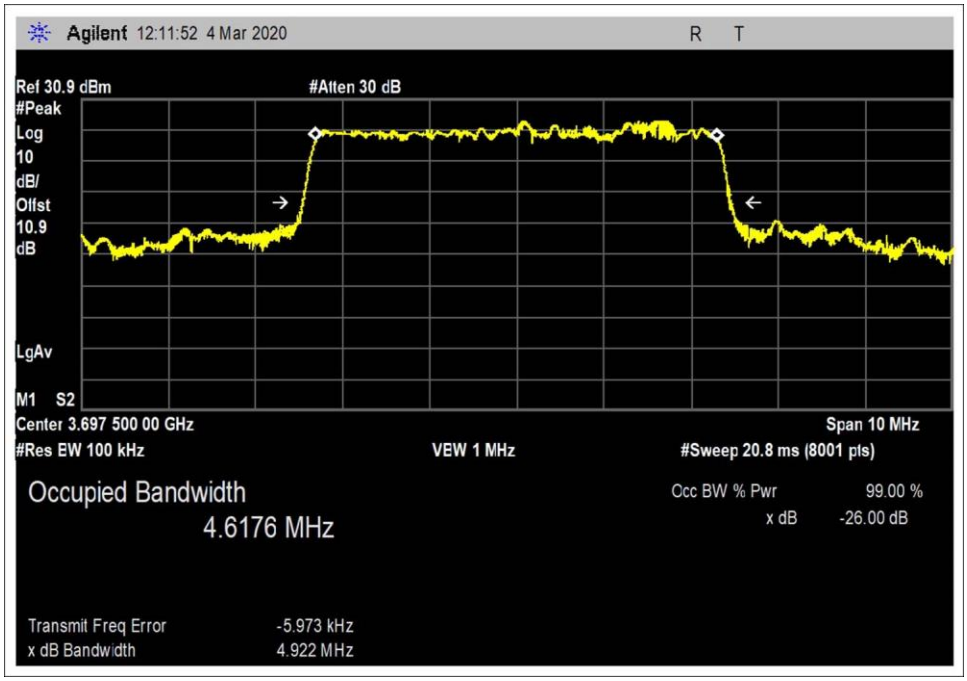
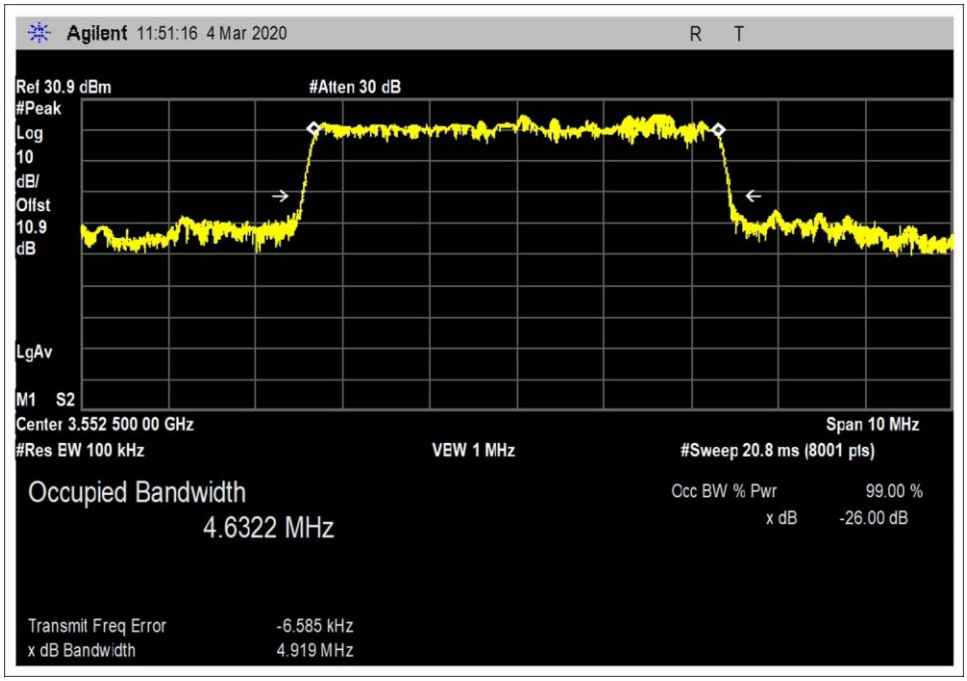


High Channel

QPSK



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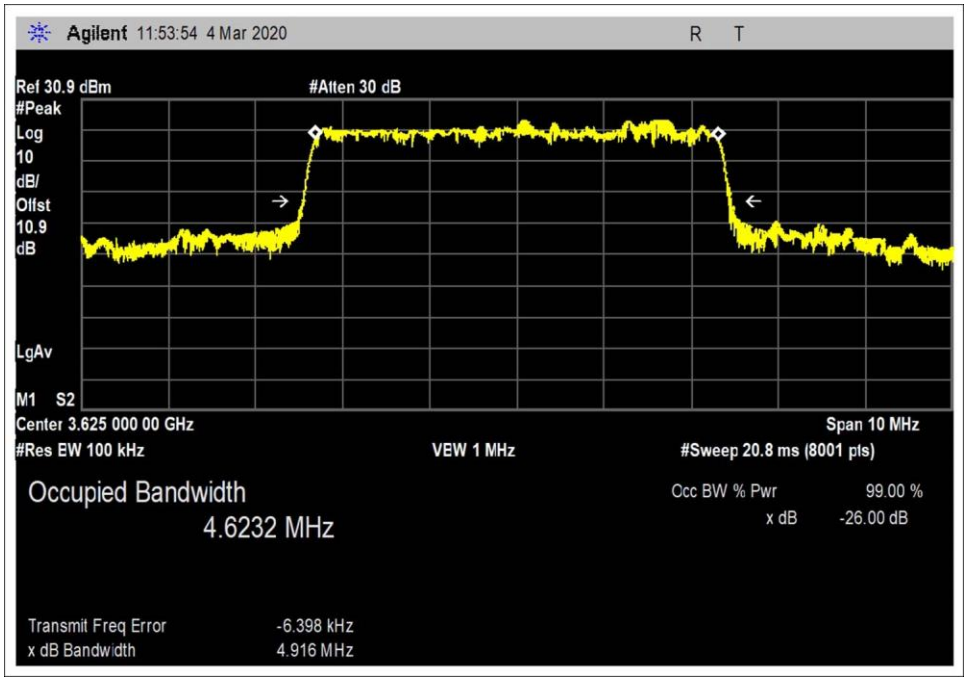

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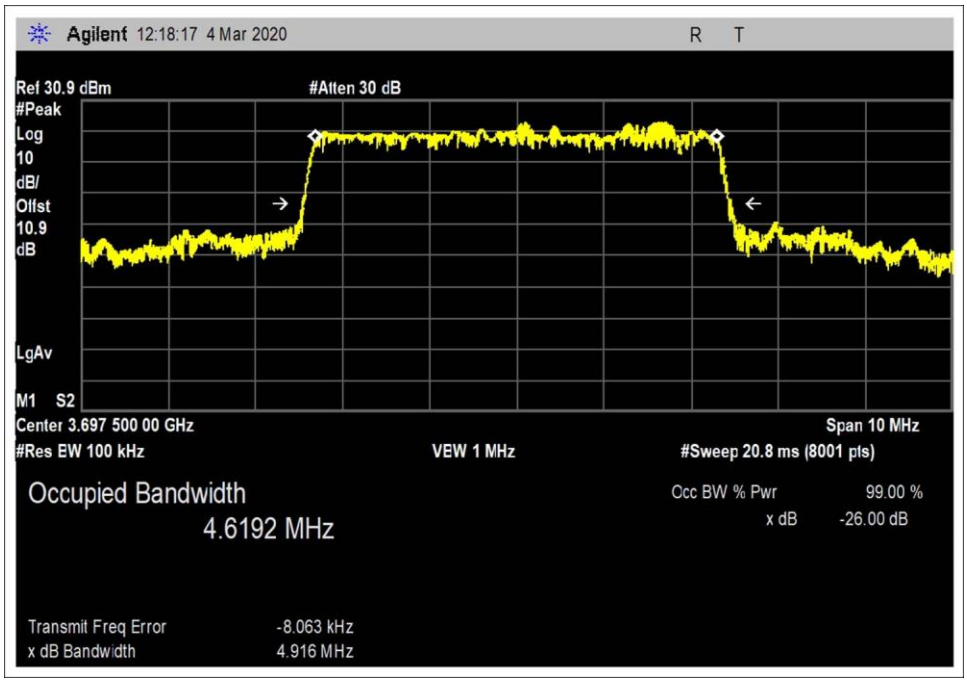
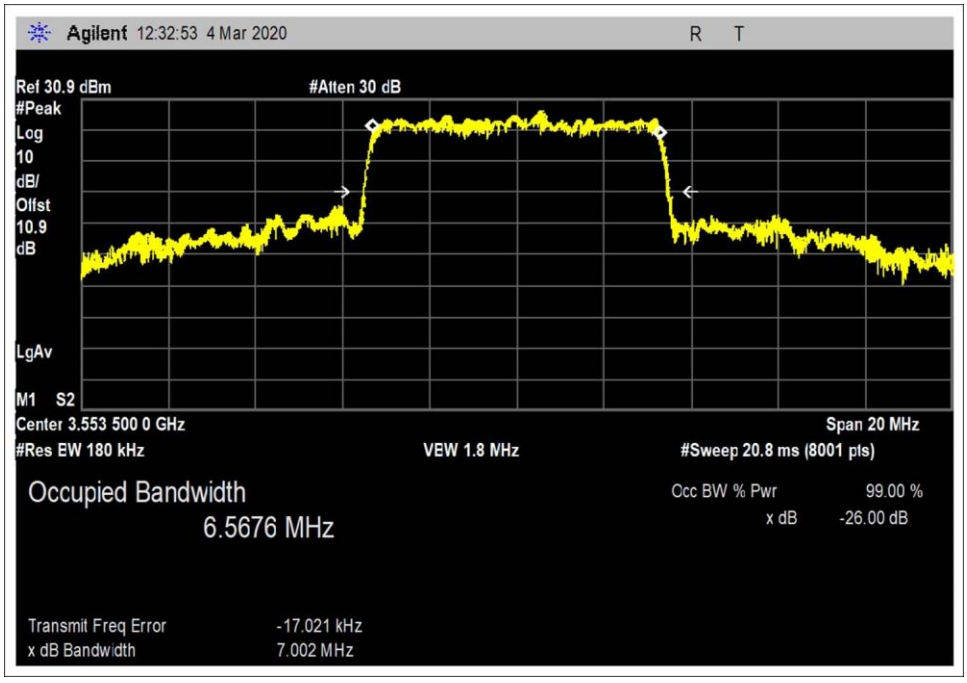


High Channel

Channel Bandwidth 7MHz

QAM16



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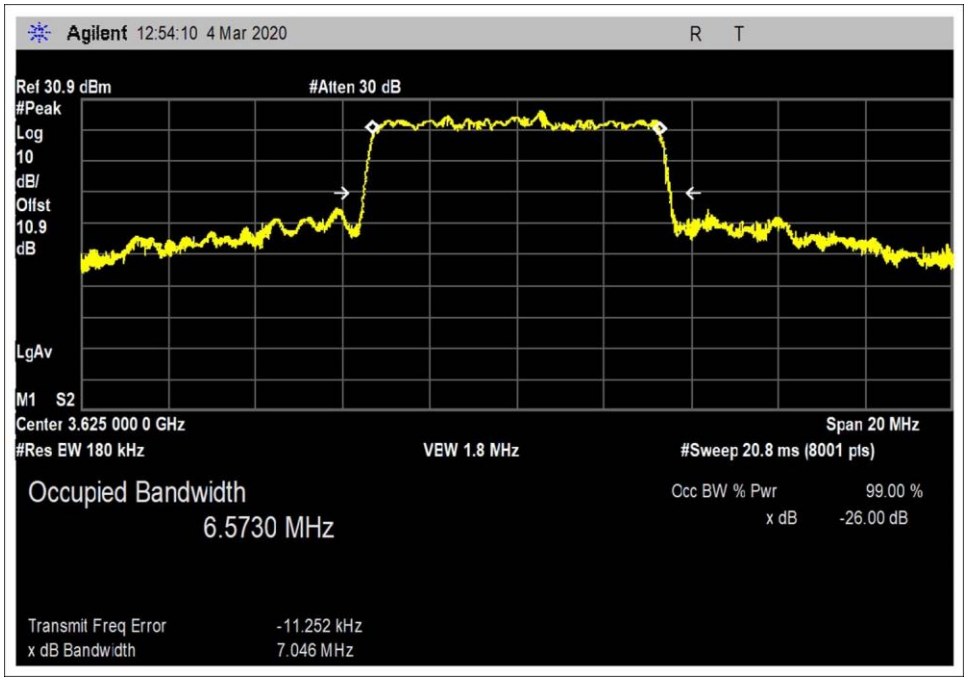

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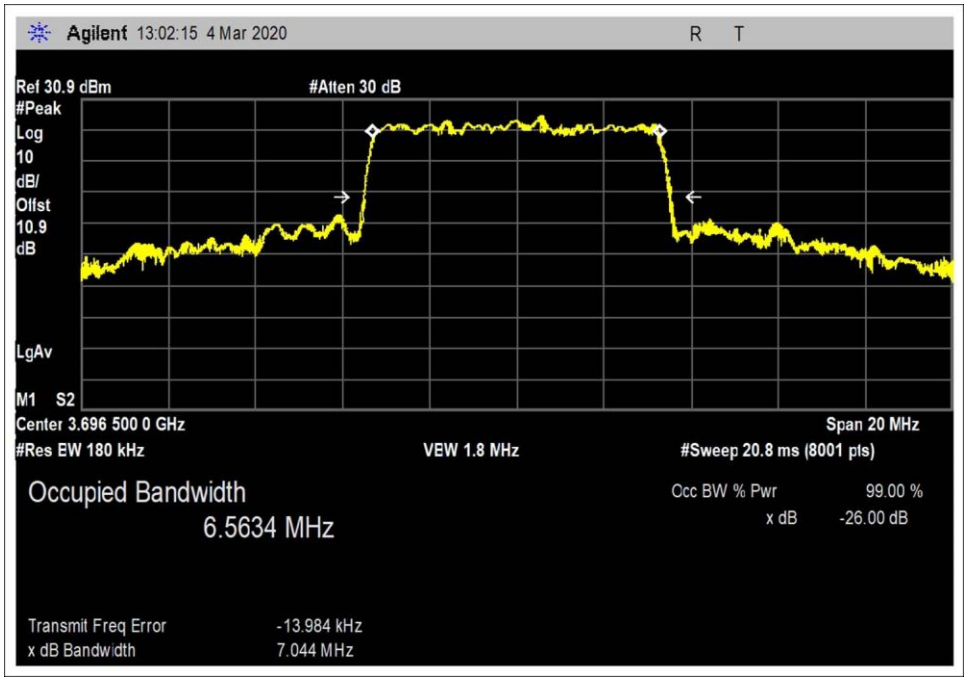
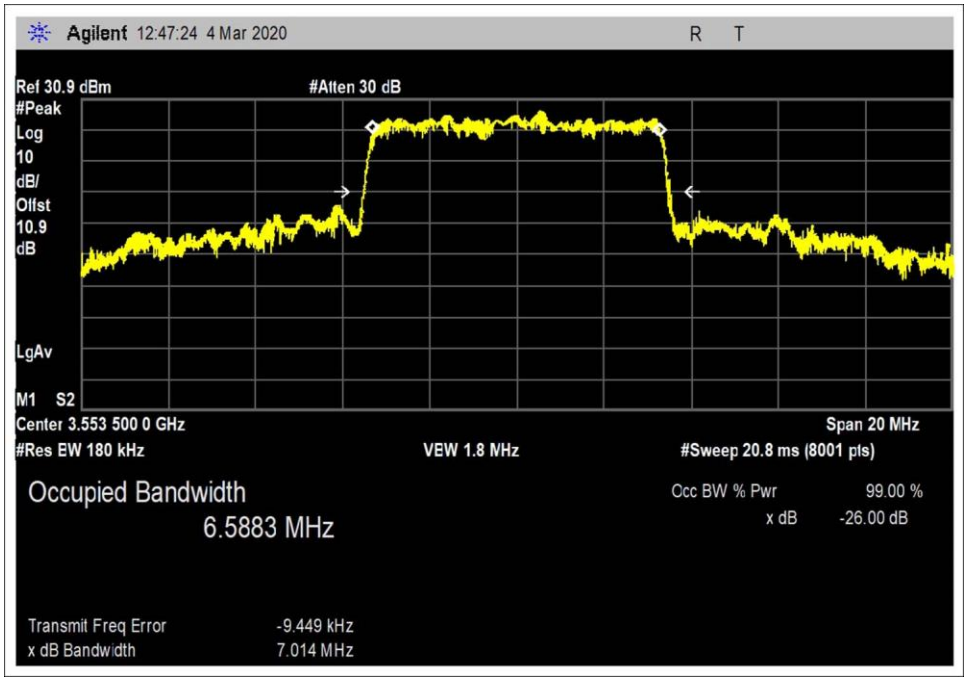
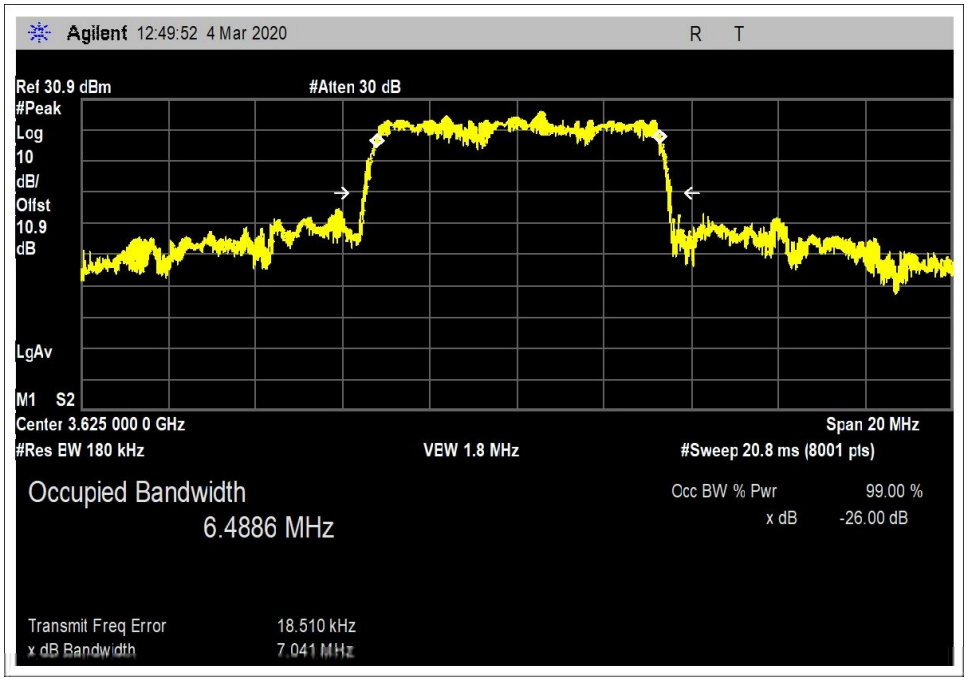


High Channel

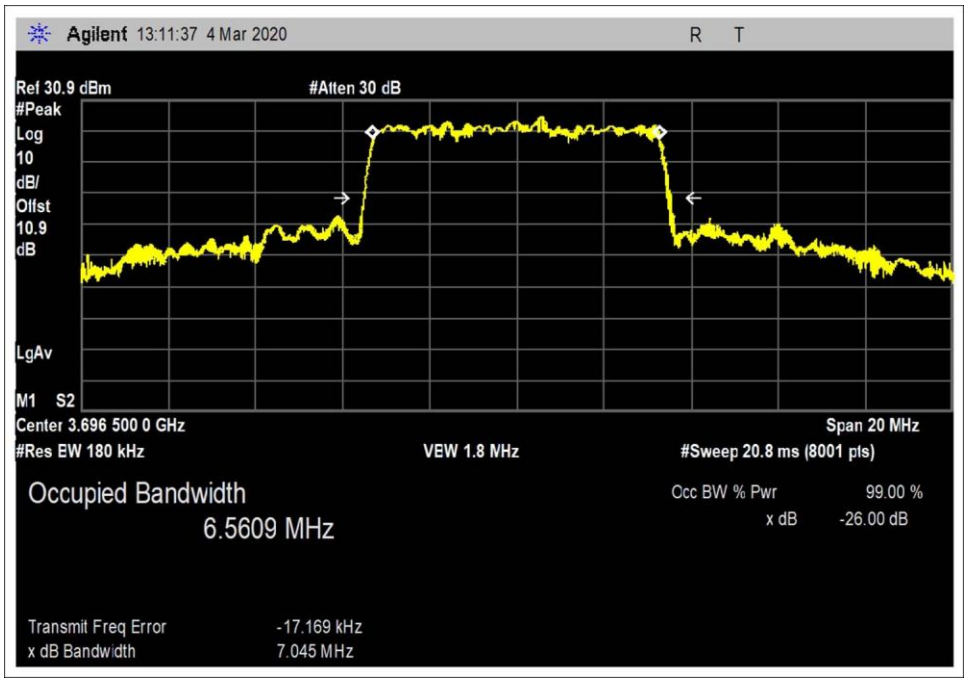
QAM64



Low Channel

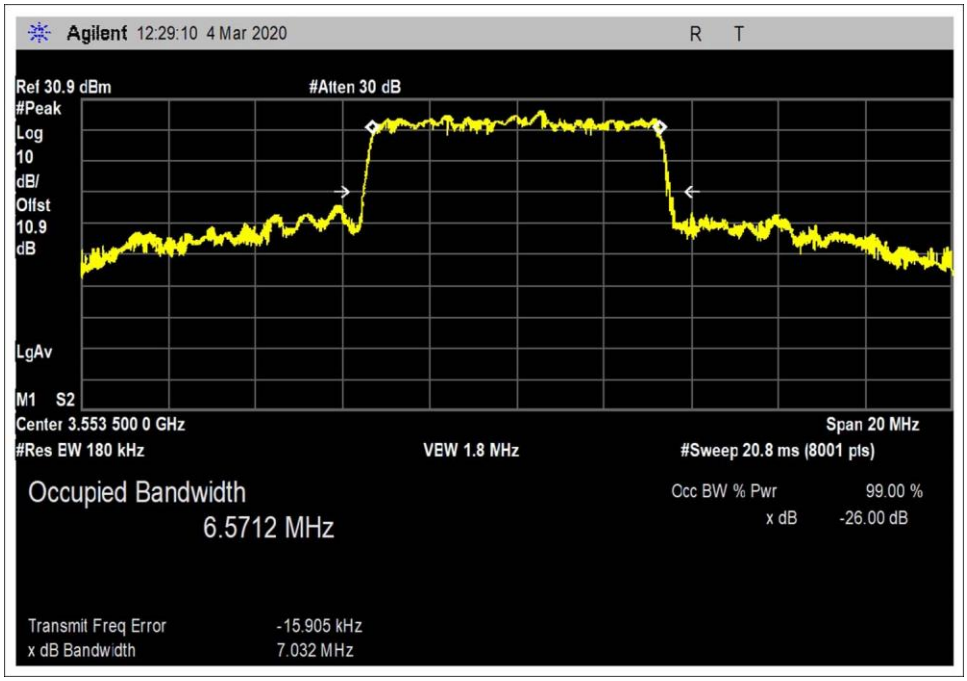


Middle Channel



High Channel

QPSK



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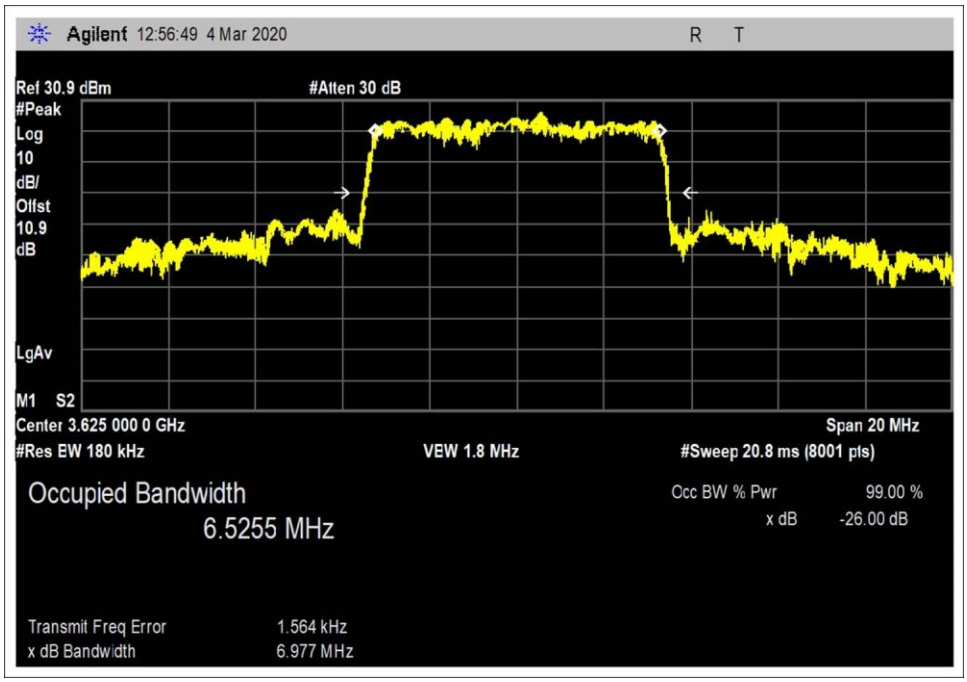
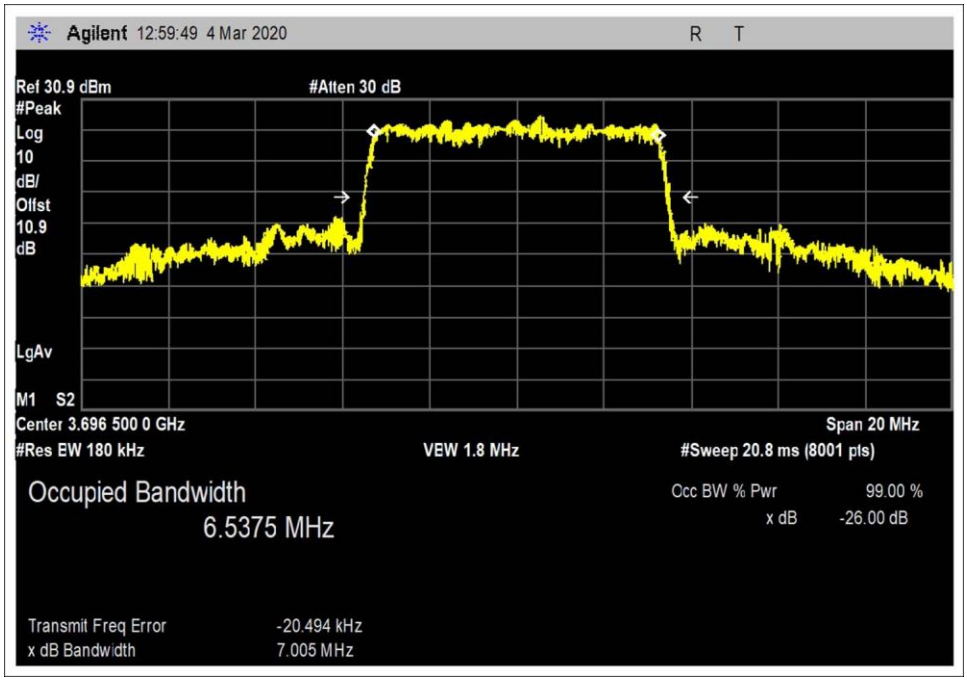


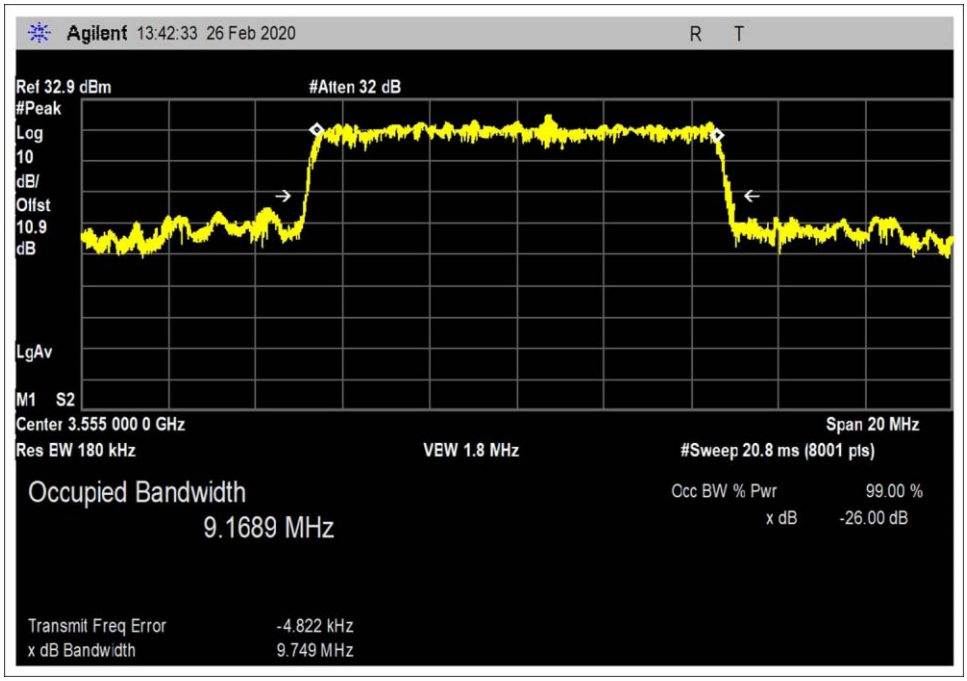
Middle Channel



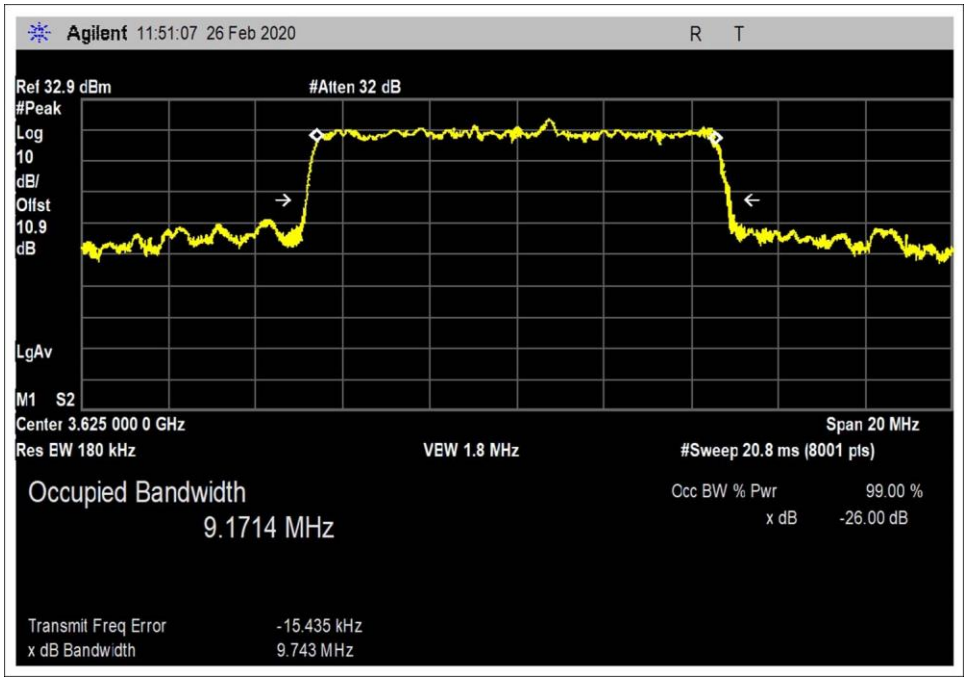
High Channel

Channel Bandwidth 10MHz

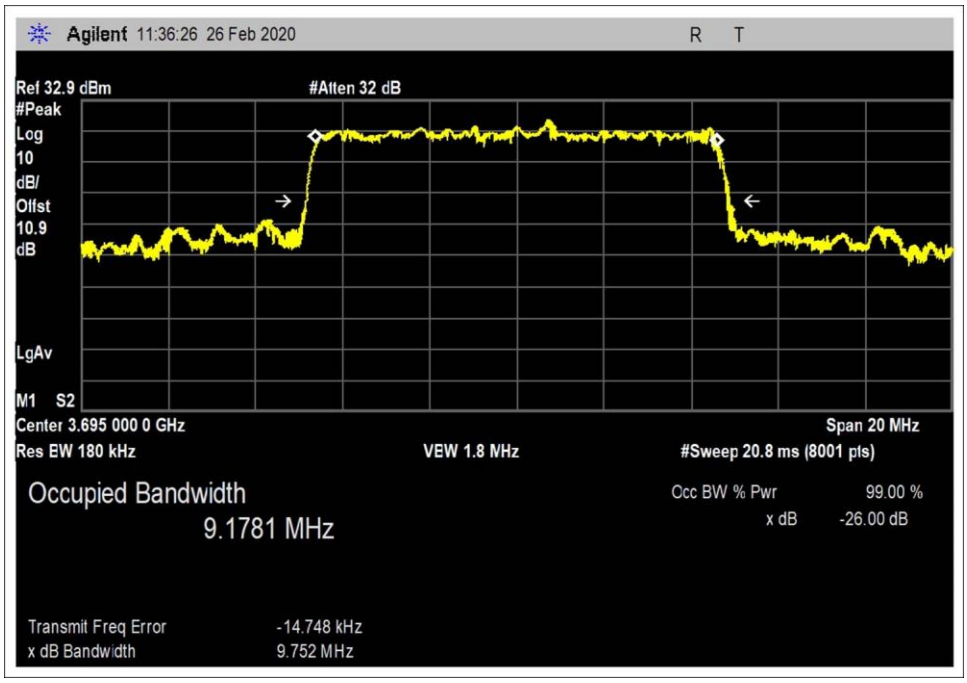
QAM16



Low Channel

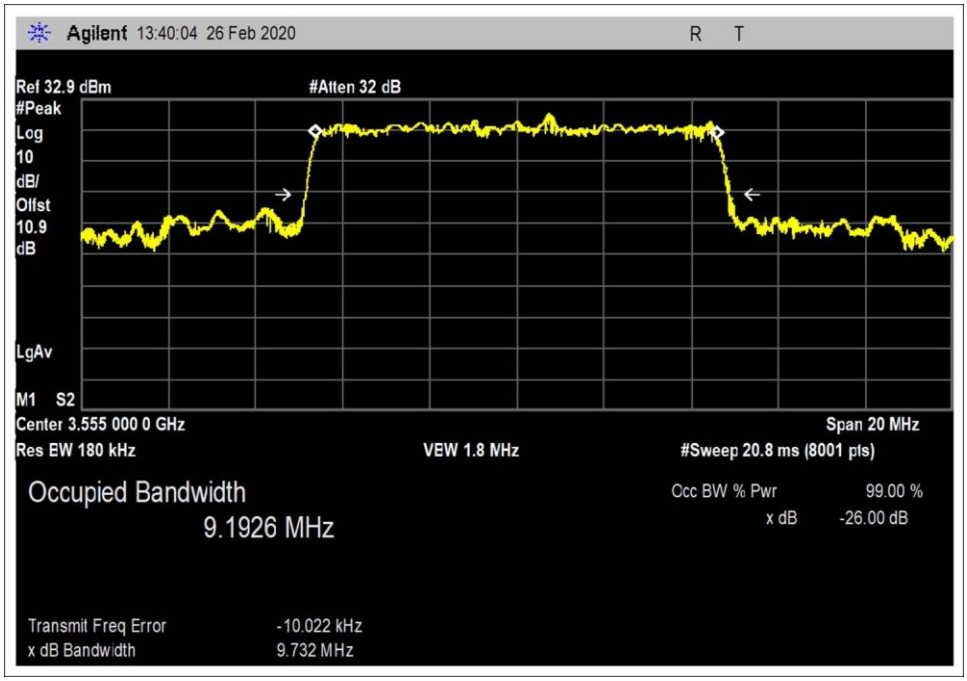


Middle Channel

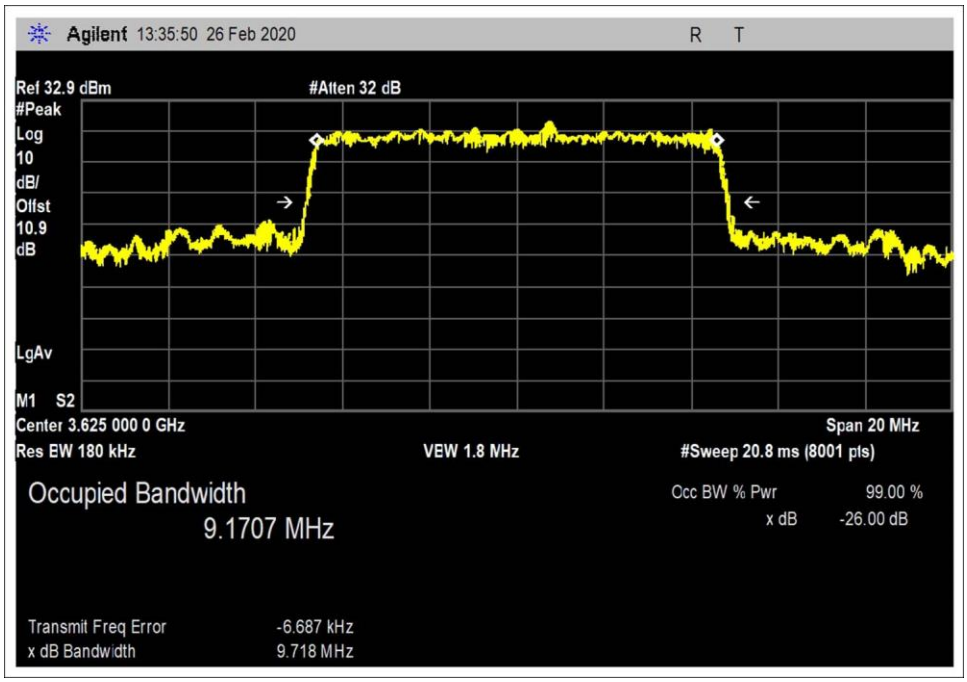


High Channel

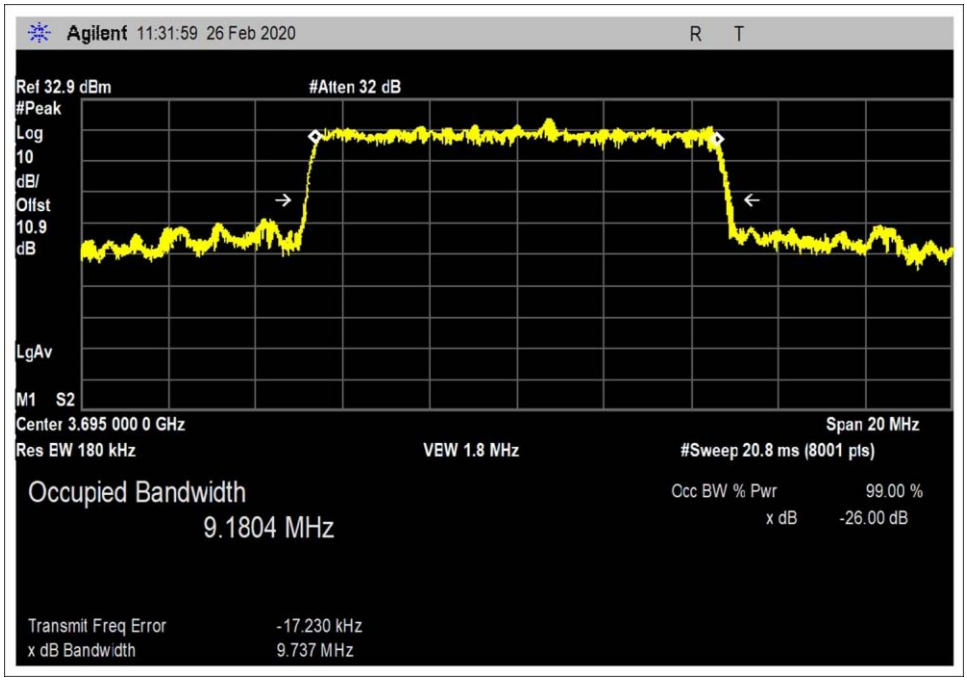
QAM64



Low Channel

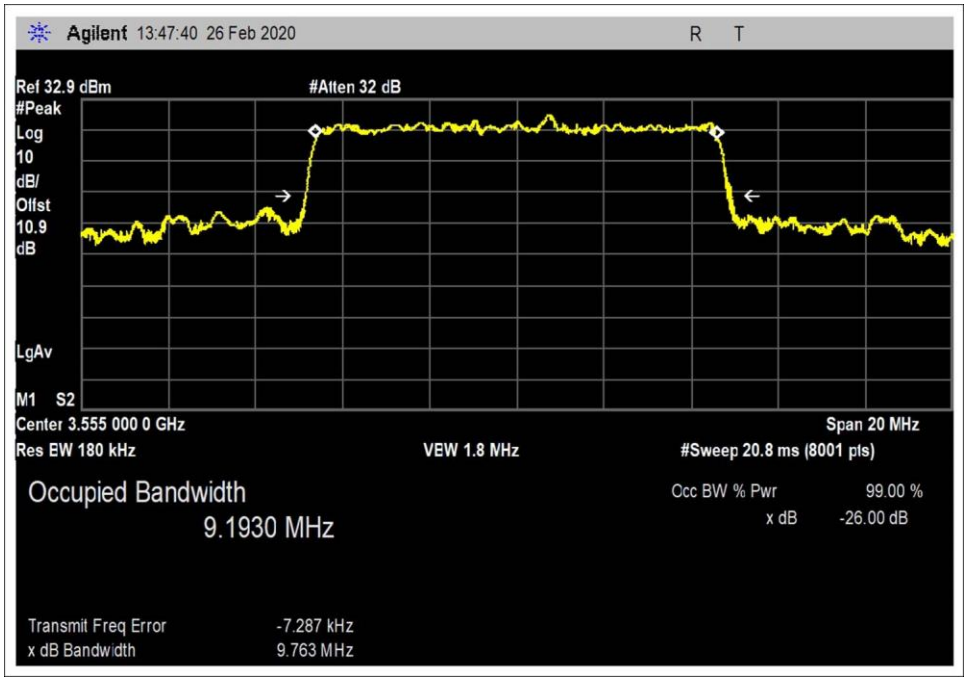


Middle Channel

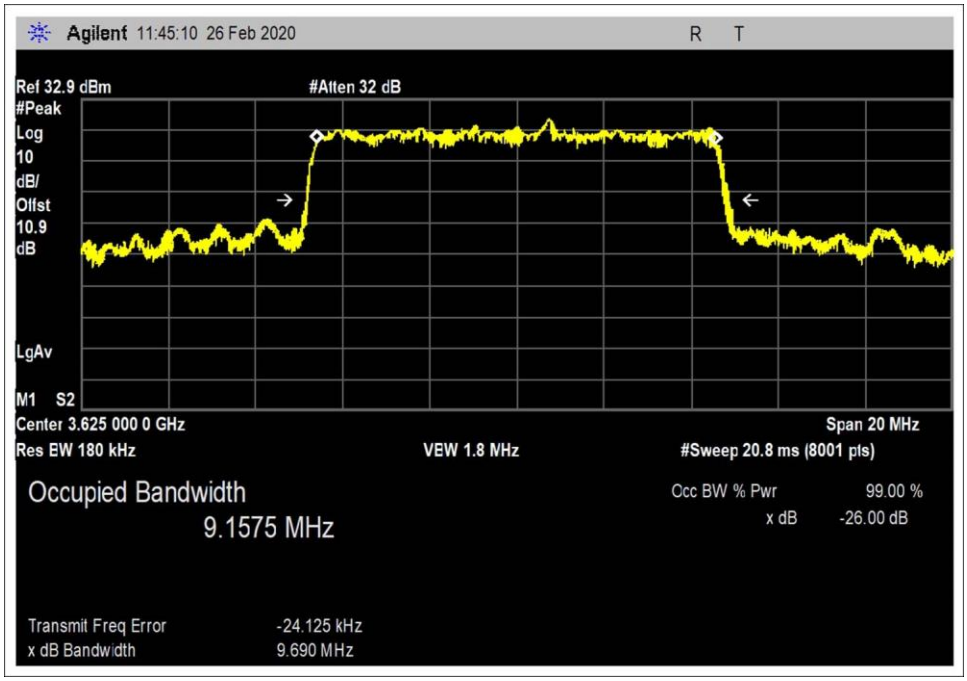


High Channel

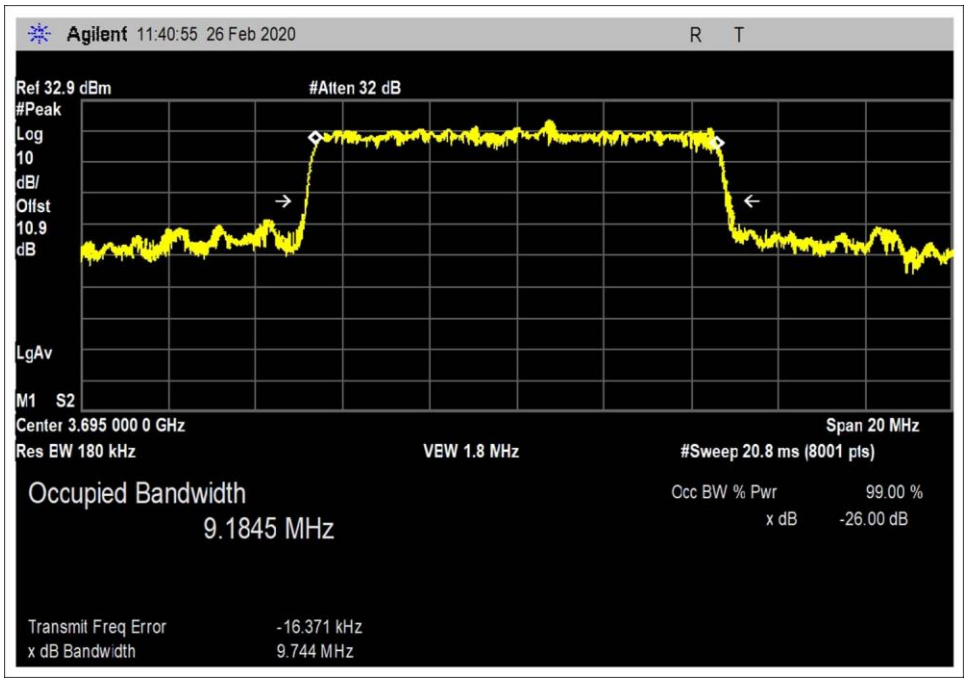
QPSK



Low Channel

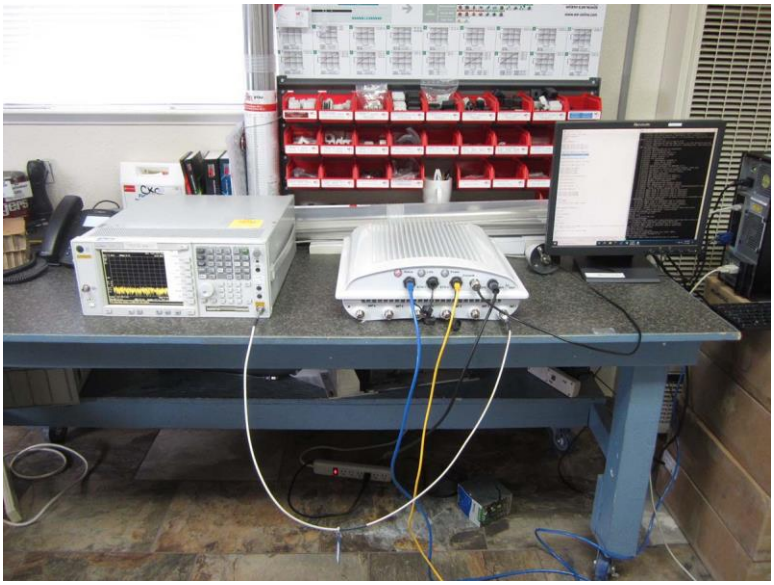


Middle Channel



High Channel

Test Setup Photo(s)



96.41b Maximum EIRP

Test Setup/Conditions			
Test Location:	Mariposa Lab A	Test Engineer:	Benny Lovan
Test Method:	ANSI C63.26 (2015), KDB 940660 DO1 Part 96 CBRS Eqpt v02 (April 19, 2019)	Test Date(s):	3/4/2020
Configuration:	1		
Test Setup:	The EUT is connected directly to the spectrum analyzer through 10.9dB of loss from the attenuator/cable chain used for measurement. The loss of the attenuator/cable chain is accounted for with a reference level offset in the analyzer.		
Declaration:	Software output power setting was varied dependent upon channel bandwidth setting. See tables below for software setting. All measurements reported are from Antenna Port 1. The EUT has 6 antenna ports. The client declares that there is one radio distributed through a multiplexor to 6 antenna ports simultaneously. All ports were verified to be identical. Worst case declared antenna gain utilized for calculation of Maximum EIRP.		

Environmental Conditions			
Temperature (ºC)	24.2	Relative Humidity (%):	30

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02668	Spectrum Analyzer	Agilent	E4446A	12/17/2019	12/17/2020
03356	Cable	AstroLab	32026-2-29094K-48TC	3/14/2019	3/14/2021
P06239	Attenuator	Weinschel	54A-10	12/18/2018	12/18/2020

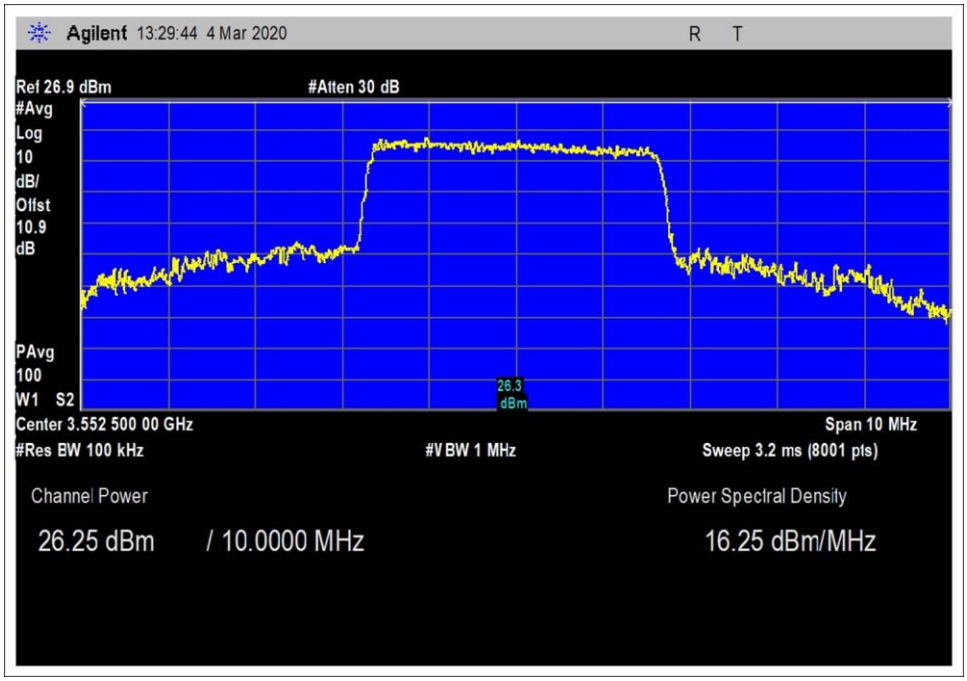
Test Data Summary - RF Conducted Measurement						
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured RF Output Power (dBm)	*EIRP (dBm/10MHz)	Category B Limit (dBm)	Results
3.5 MHz Channel Spacing - (Software Output Setting 31)						
3552.5	QPSK	Panel / 17dBi	25.54	43.967	47	PASS
3625	QPSK	Panel / 17dBi	23.99	42.417	47	PASS
3697.5	QPSK	Panel / 17dBi	23.19	41.617	47	PASS
3552.5	QAM16	Panel / 17dBi	26.25	44.677	47	PASS
3625	QAM16	Panel / 17dBi	23.85	42.277	47	PASS
3697.5	QAM16	Panel / 17dBi	24.08	42.507	47	PASS
3552.5	QAM64	Panel / 17dBi	24.46	42.887	47	PASS
3625	QAM64	Panel / 17dBi	24.47	42.897	47	PASS
3697.5	QAM64	Panel / 17dBi	23.94	42.367	47	PASS
5 MHz Channel Spacing - (Software Output Setting 32)						
3552.5	QPSK	Panel / 17dBi	26.39	44.817	47	PASS
3625	QPSK	Panel / 17dBi	24.18	42.607	47	PASS
3697.5	QPSK	Panel / 17dBi	24.08	42.507	47	PASS
3552.5	QAM16	Panel / 17dBi	26.21	44.637	47	PASS
3625	QAM16	Panel / 17dBi	24.17	42.597	47	PASS
3697.5	QAM16	Panel / 17dBi	23.80	42.227	47	PASS
3552.5	QAM64	Panel / 17dBi	26.57	44.997	47	PASS
3625	QAM64	Panel / 17dBi	24.06	42.487	47	PASS
3697.5	QAM64	Panel / 17dBi	23.31	41.737	47	PASS
7 MHz Channel Spacing - (Software Output Setting 32)						
3553.5	QPSK	Panel / 17dBi	25.20	43.627	47	PASS
3625	QPSK	Panel / 17dBi	22.98	41.407	47	PASS
3696.5	QPSK	Panel / 17dBi	22.93	41.357	47	PASS
3553.5	QAM16	Panel / 17dBi	24.91	43.337	47	PASS
3625	QAM16	Panel / 17dBi	23.32	41.747	47	PASS
3696.5	QAM16	Panel / 17dBi	22.61	41.037	47	PASS
3553.5	QAM64	Panel / 17dBi	24.55	42.977	47	PASS
3625	QAM64	Panel / 17dBi	22.78	41.207	47	PASS
3696.5	QAM64	Panel / 17dBi	22.19	40.617	47	PASS
10 MHz Channel Spacing - (Software Output Setting 33)						
3555	QPSK	Panel / 17dBi	27.22	45.647	47	PASS
3625	QPSK	Panel / 17dBi	25.11	43.537	47	PASS
3695	QPSK	Panel / 17dBi	24.15	42.577	47	PASS
3555	QAM16	Panel / 17dBi	27.29	45.717	47	PASS
3625	QAM16	Panel / 17dBi	25.76	44.187	47	PASS
3695	QAM16	Panel / 17dBi	24.61	43.037	47	PASS
3555	QAM64	Panel / 17dBi	27.36	45.787	47	PASS
3625	QAM64	Panel / 17dBi	24.69	43.117	47	PASS
3695	QAM64	Panel / 17dBi	24.16	42.587	47	PASS

*- EIRP = Measured RF Output Power + Gain (dBi) + Duty Cycle Correction Factor (1.427)
Duty Cycle Correction Factor = 10 Log (1/Duty Cycle), where duty cycle = 72%

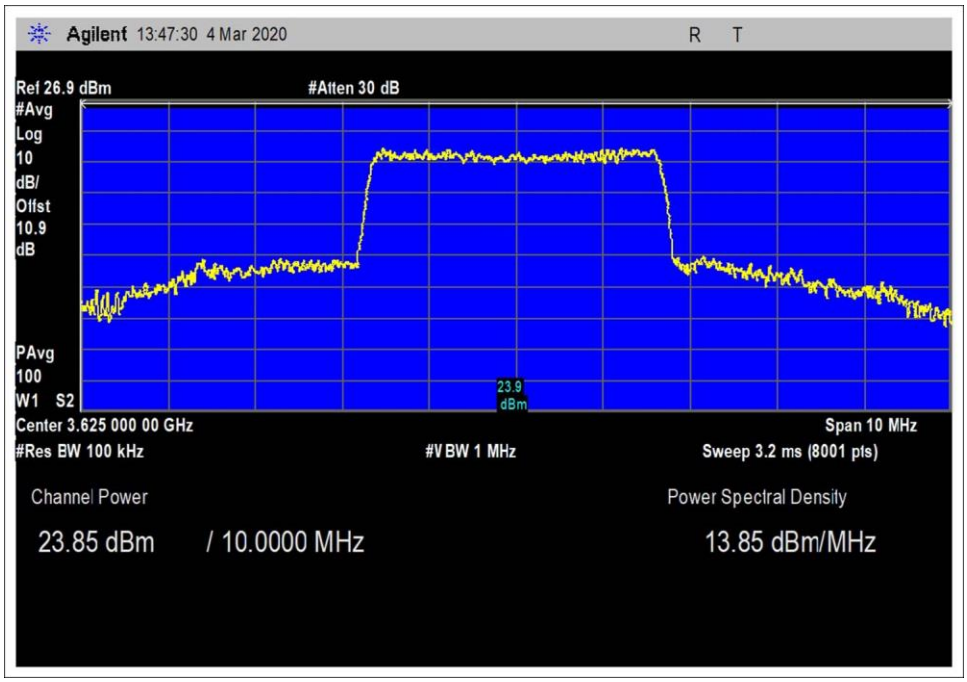
Plot(s)

Channel Bandwidth 3.5MHz

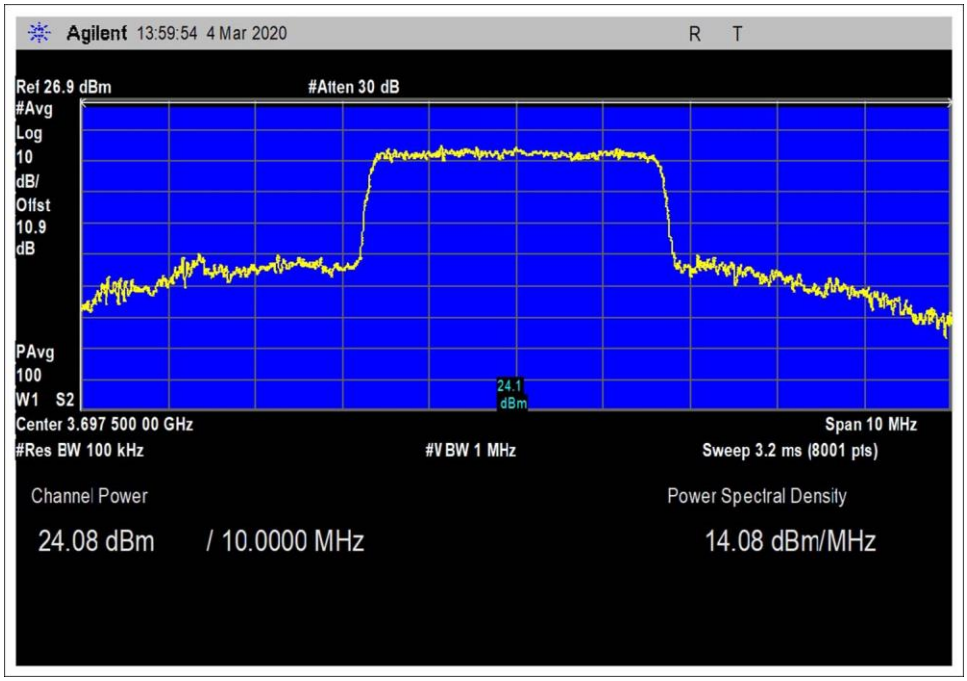
QAM16



Low Channel

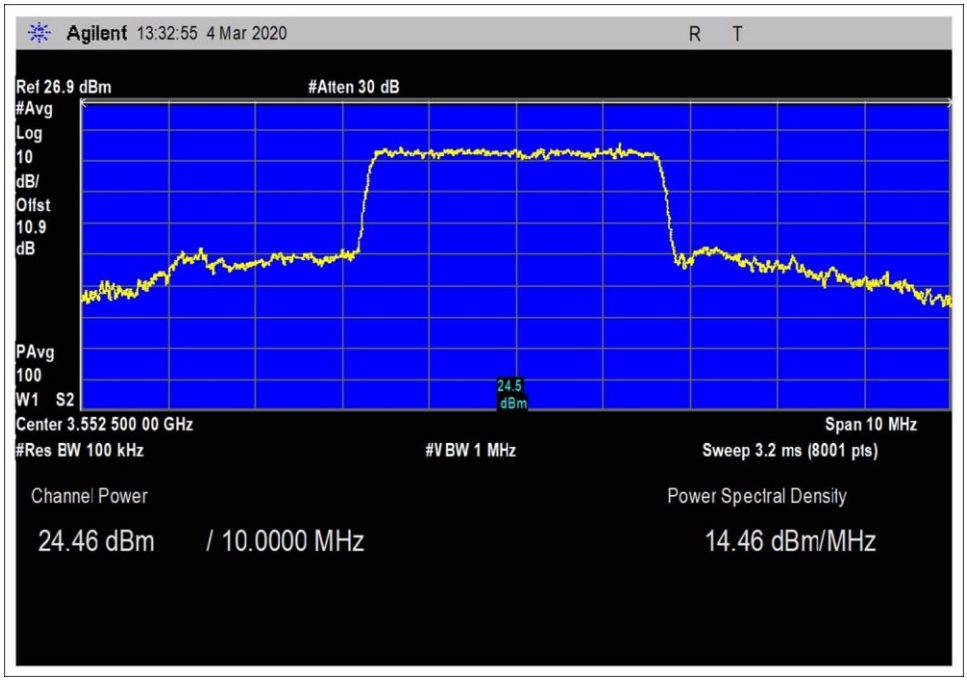


Middle Channel

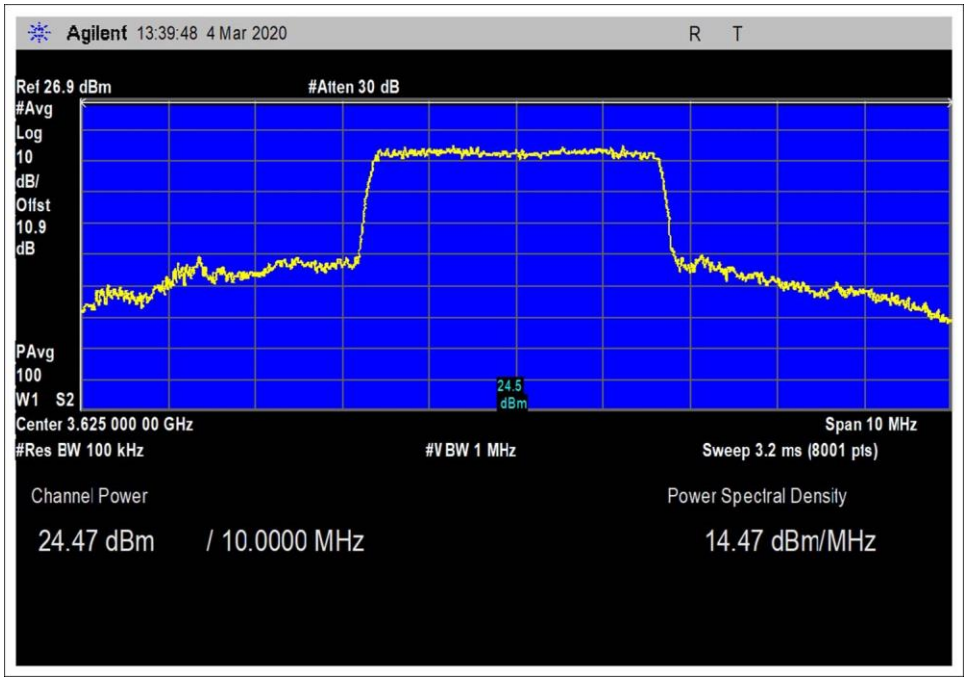


High Channel

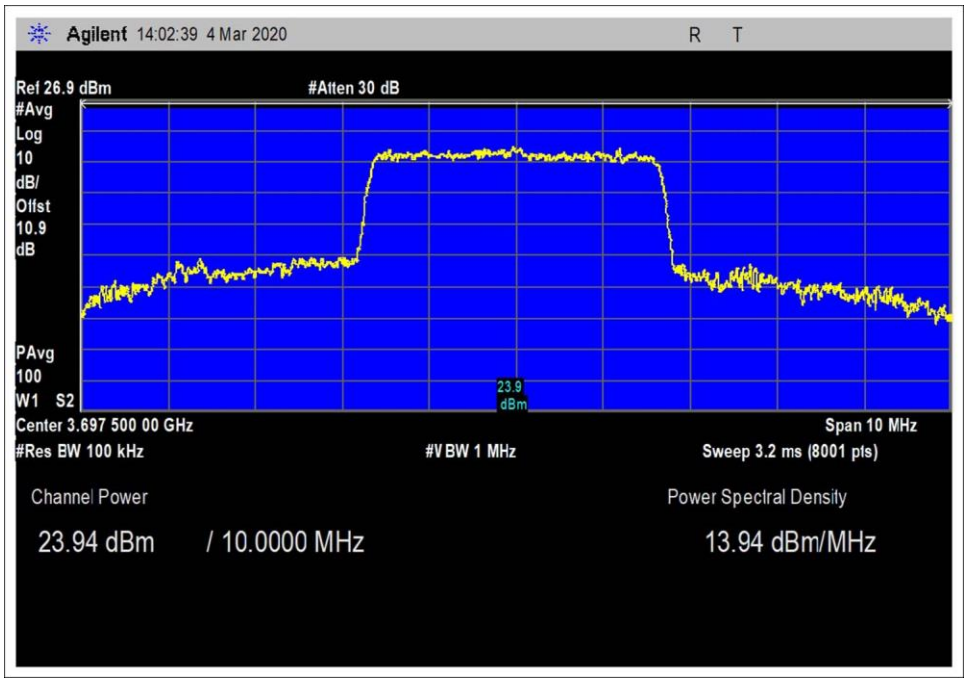
QAM64



Low Channel

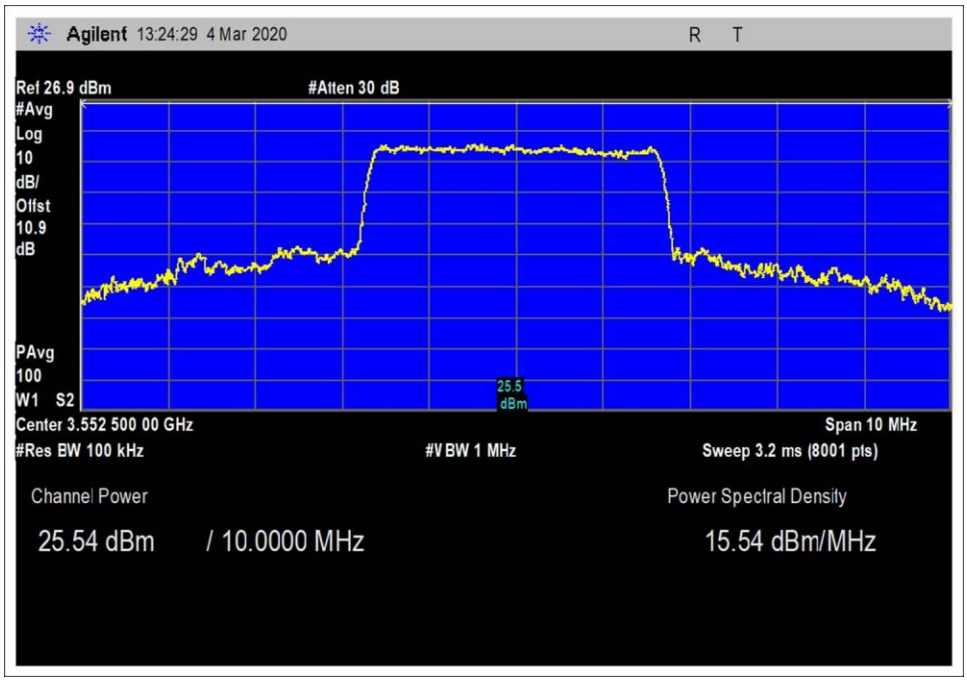


Middle Channel

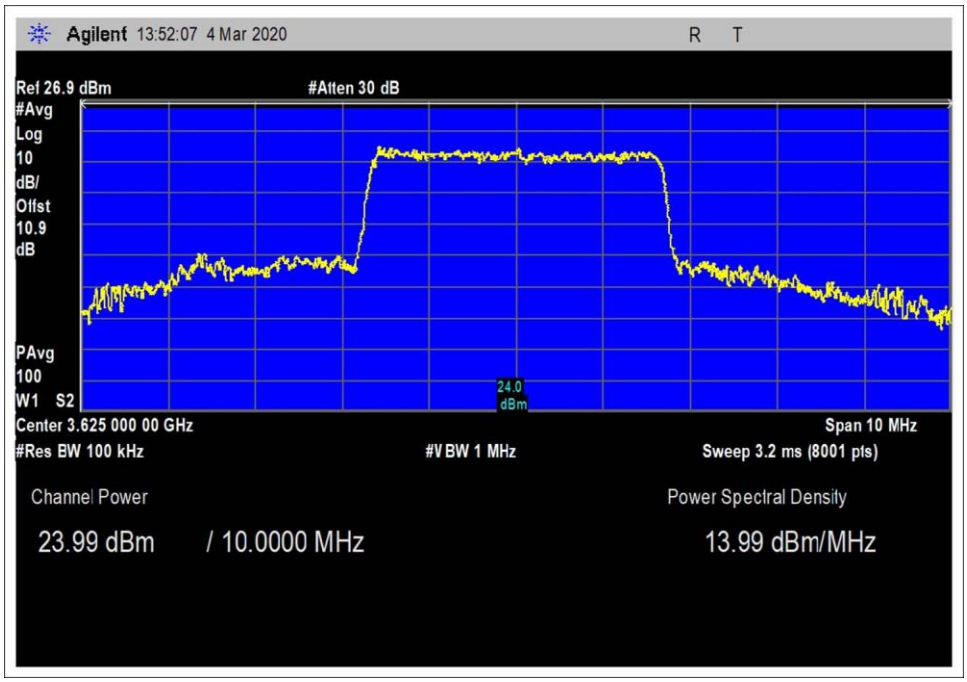


High Channel

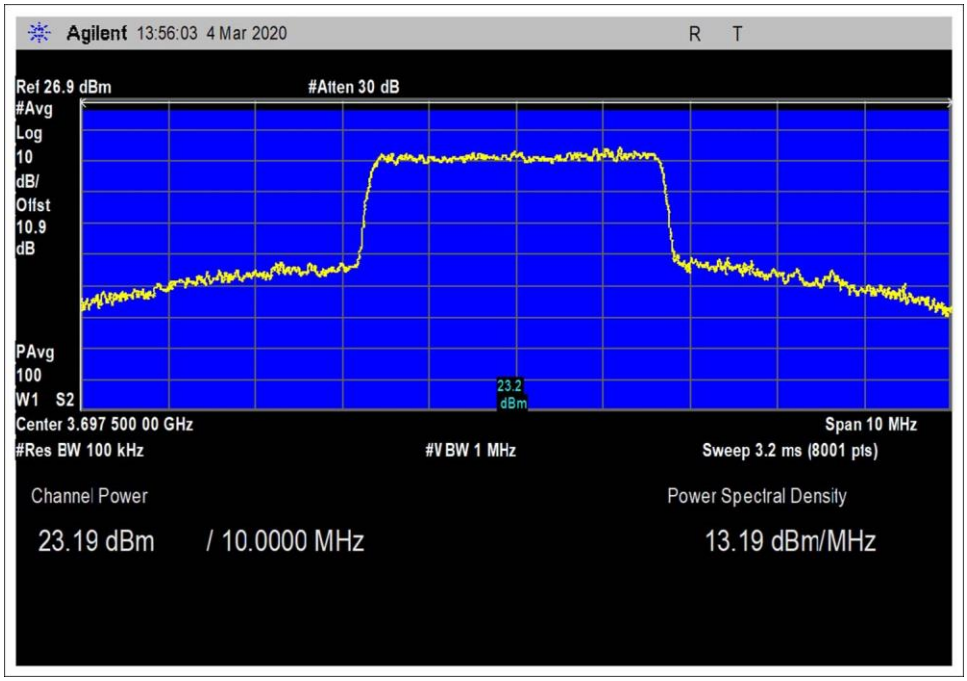
QPSK



Low Channel



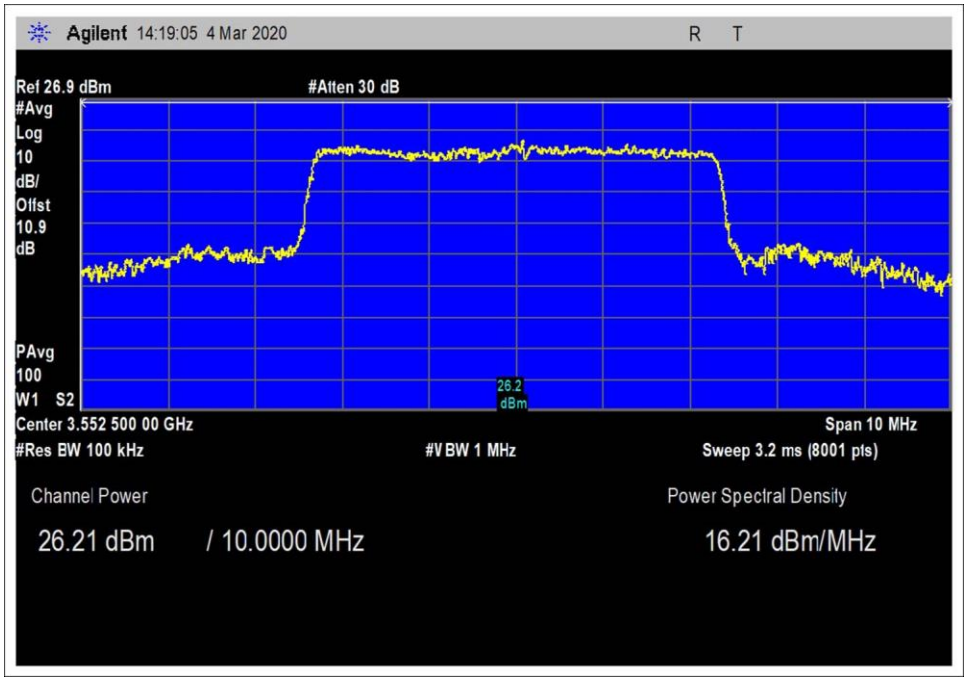
Middle Channel



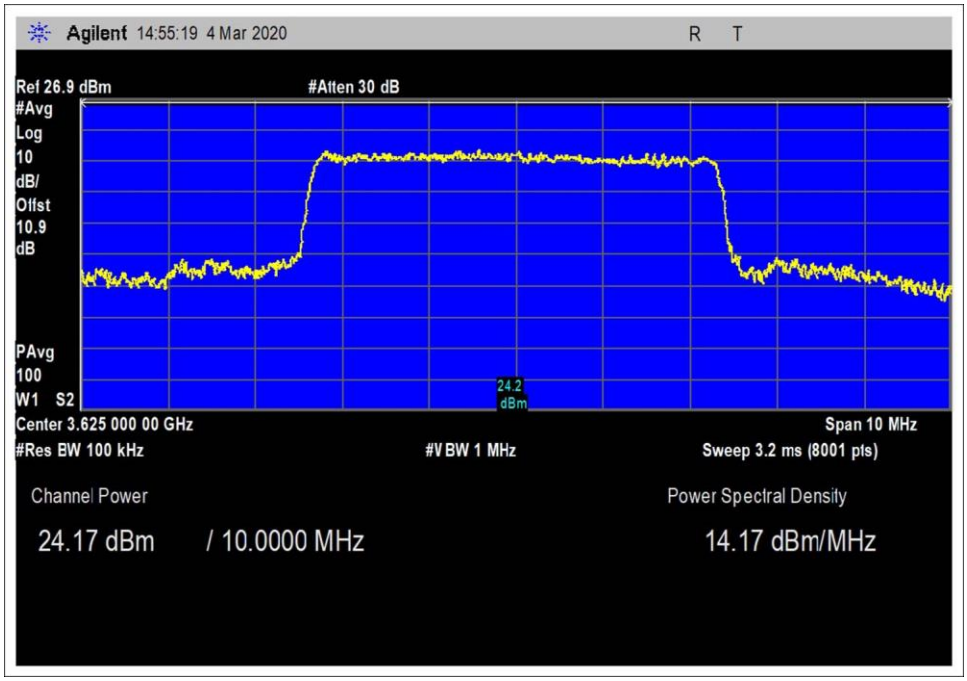
High Channel

Channel Bandwidth 5MHz

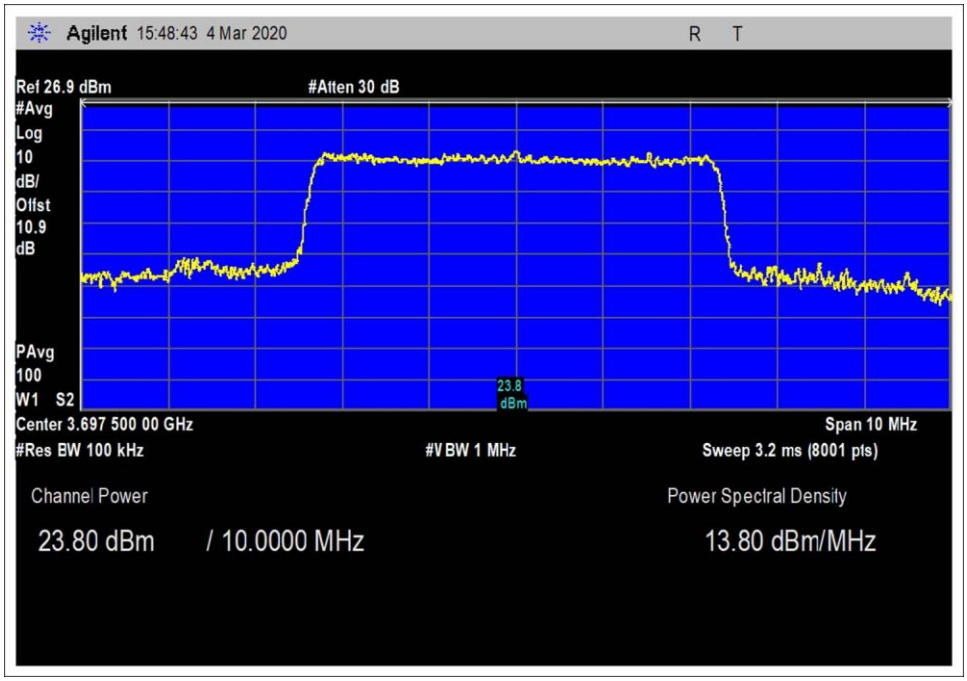
QAM16



Low Channel

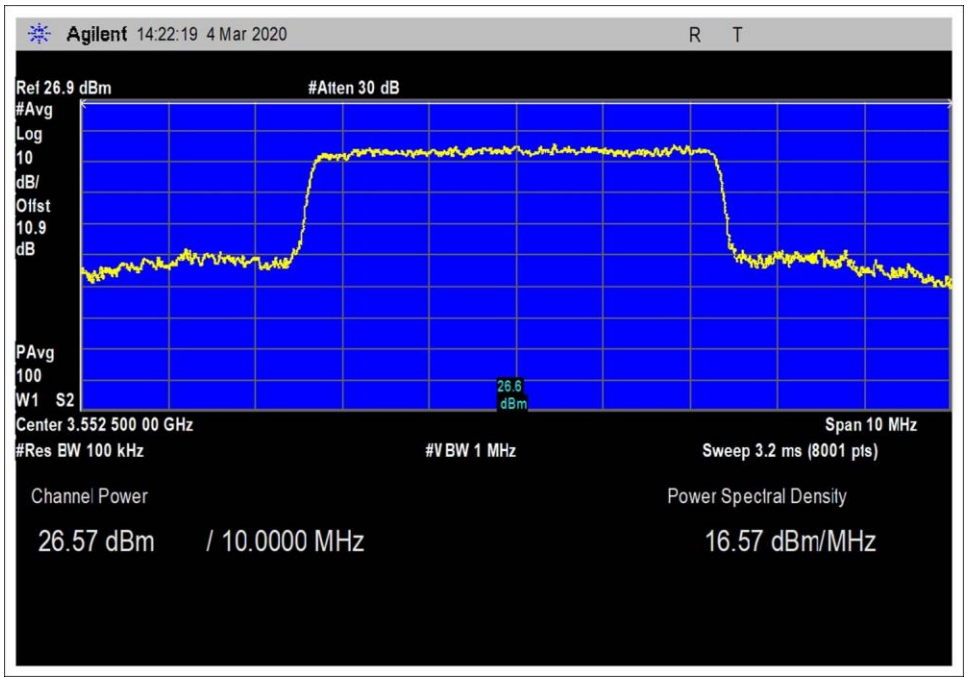


Middle Channel

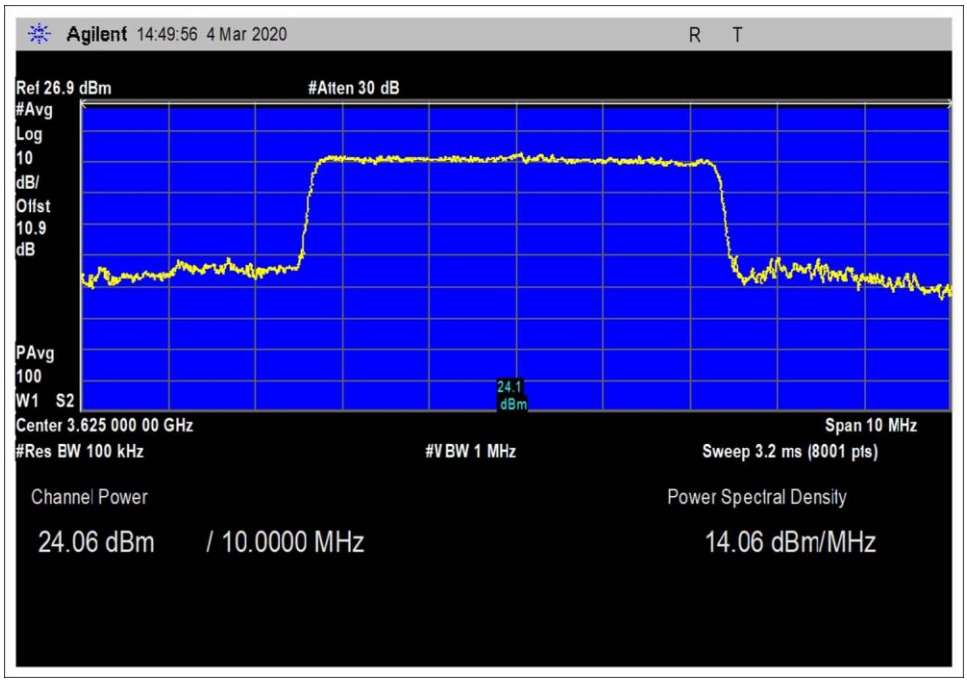


High Channel

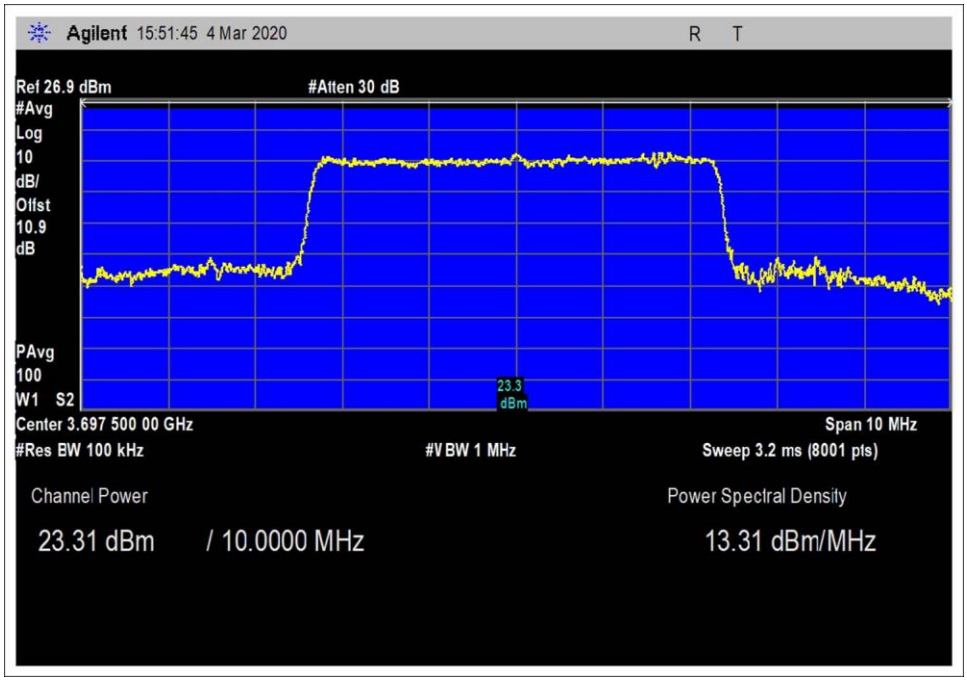
QAM64



Low Channel

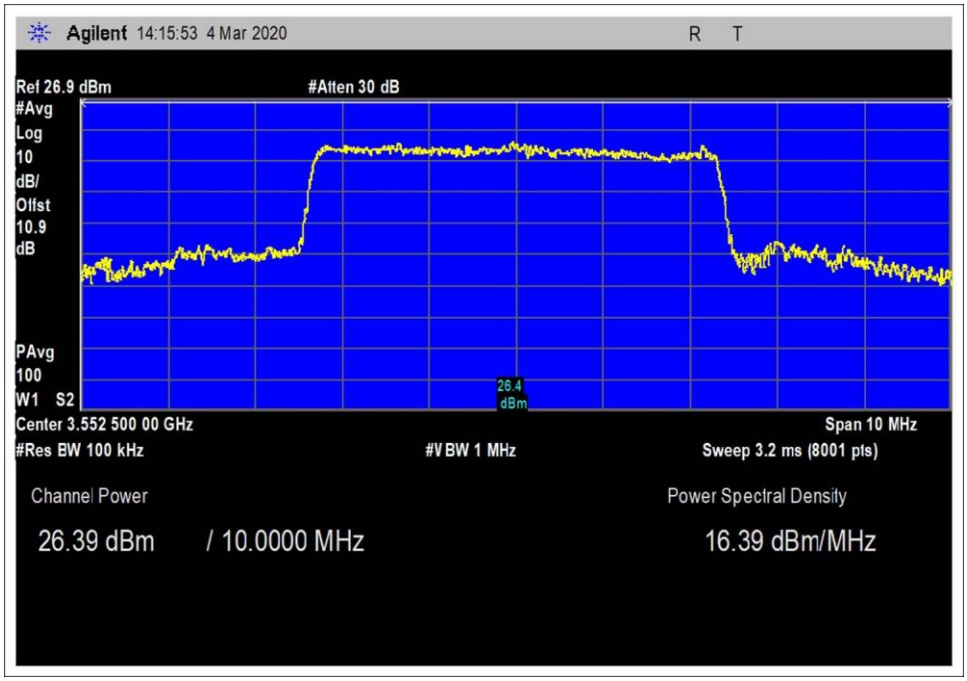


Middle Channel



High Channel

QPSK



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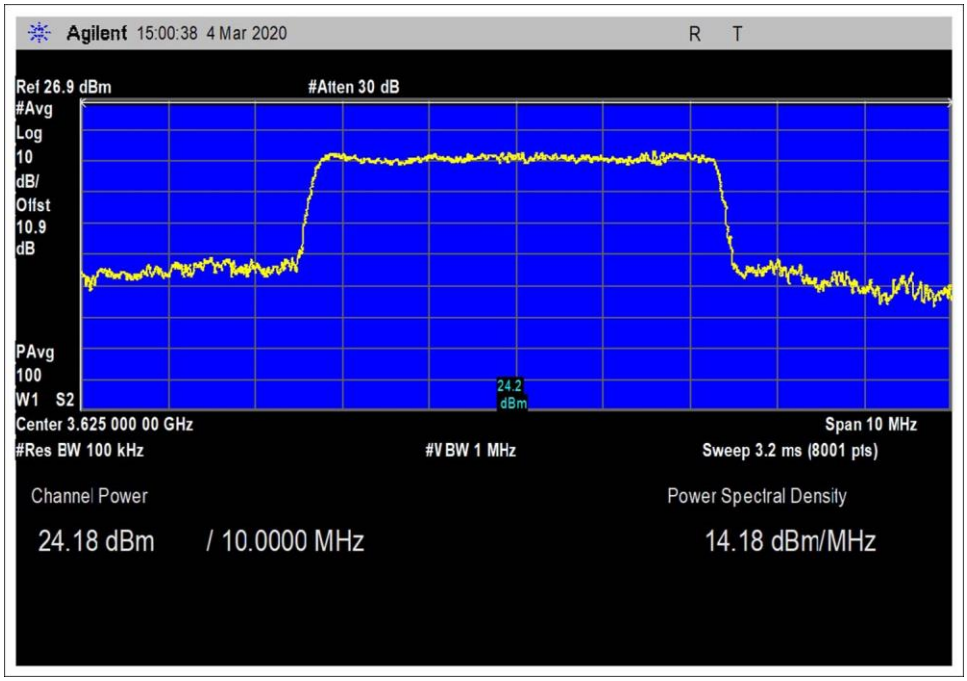
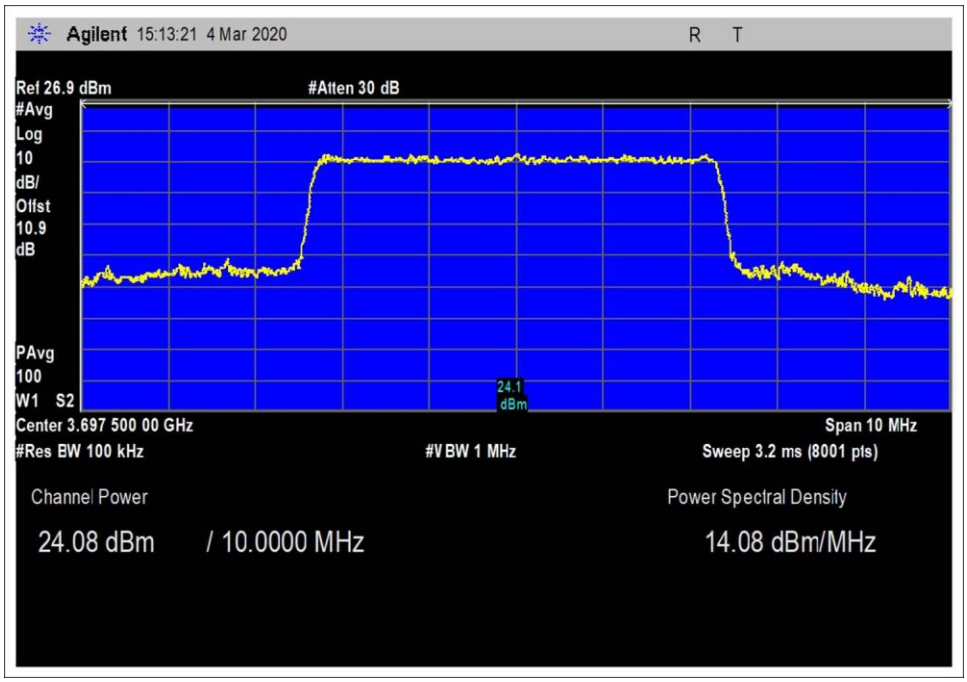


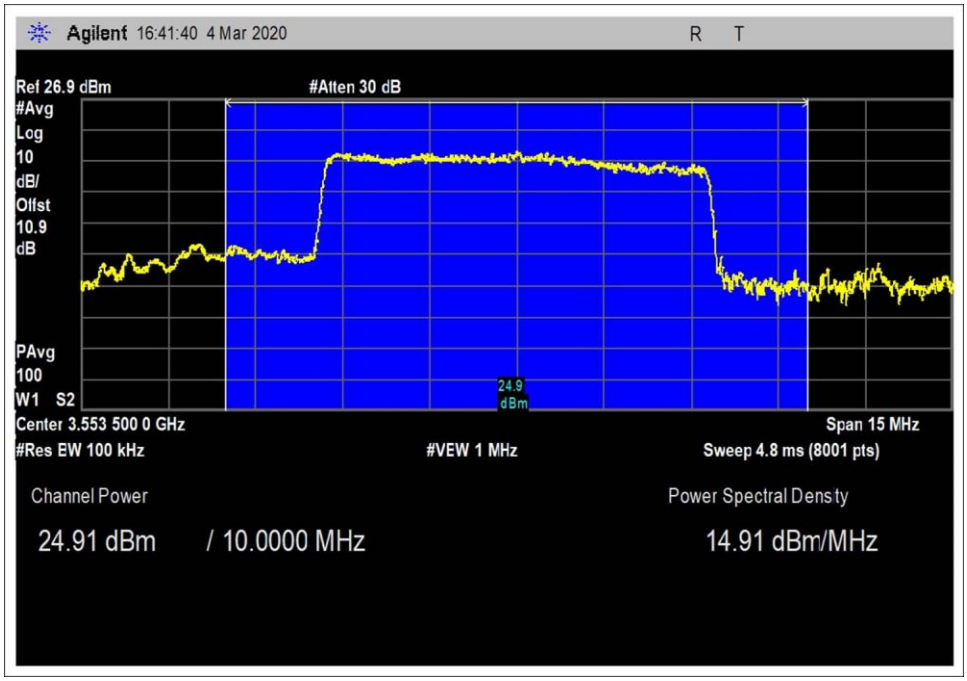
Middle Channel



High Channel

Channel Bandwidth 7MHz

QAM16



Low Channel