

TEST REPORT

Reference No...... : WTS20S02005770W001
FCC ID : 2AG32EG7035L96
Applicant..... : Baicells Technologies Co., Ltd.
Address..... : 3F, Hui Yuan Development Building, No.1 Shangdi Information Industry Base, Haidian Dist., Beijing, China
Manufacturer : Baicells Technologies Co., Ltd.
Address..... : 3F, Hui Yuan Development Building, No.1 Shangdi Information Industry Base, Haidian Dist., Beijing, China
Product..... : LTE Outdoor CPE
Model(s) : EG7035L-M11, EG7035L-M2
Brand Name..... : BaiCells
Standards..... : FCC CFR Title 47 Part 2
FCC CFR Title 47 Part 96
Date of Receipt sample : 2020-02-26
Date of Test : 2020-02-27 to 2020-04-13
Date of Issue..... : 2020-04-14
Test Result..... : **Pass**

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS20S02005 770W001	2020-02-26	2020-02-27 to 2020-04- 13	2020-04-14	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	LTE Outdoor CPE
Model(s):	EG7035L-M11, EG7035L-M2
Model Description:	Only different for the model names.
Storage Location:	Internal Storage
Category of CBSD:	Category B

4.2 Details of E.U.T.

Operation Frequency:	LTE Band 48:3550MHz-3700MHz
Type of Modulation:	LTE: Uplink: QPSK, 16QAM;Downlink: QPSK, 16QAM, 64QAM
Antenna installation:	LTE: Internal antenna
Antenna Gain:	14.0dBi
Ratings:	DC 24V 0.5A

4.3 Channel List

Normal

5MHz		10MHz	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
Low	3552.5	Low	3555
Middle	3625	Middle	3625
High	3697.5	High	3695
15MHz		20MHz	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
Low	3557.5	Low	3560
Middle	3625	Middle	3625
High	3692.5	High	3690

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test Mode	Description
Data Mode (QPSK)	Keep the EUT in data communicating mode (QPSK). (5MHz ,10MHz, 15MHz, 20MHz)
Data Mode (16QAM)	Keep the EUT in data communicating mode (16QAM). (5MHz ,10MHz, 15MHz, 20MHz)

4.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

47 CFR FCC Part 96
 KDB 971168 D01 Power Meas License Digital Systems v03r01
 KDB 940660 D01 Part 96 CBRS Equipment v01
 ANSI/TIA/EIA-603-E 2016
 ANSI C63.26-2015

4.6 Test Facility

The test facility has a test site registered with the following organizations:

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Services(Shenzhen) Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

5 Test Summary

Test Items	Available Channel (MHz)	Tested Channel (MHz)	Channel Bandwidth	Modulation
EIRP	3552.5 to 3697.5	3552.5 to 3697.5	5MHz	QPSK, 16QAM
	3555 to 3695	3555 to 3695	10MHz	QPSK, 16QAM
	3557.5 to 3692.5	3557.5 to 3692.5	15MHz	QPSK, 16QAM
	3560 to 3690	3560 to 3690	20MHz	QPSK, 16QAM
PSD	3552.5 to 3697.5	3552.5 to 3697.5	5MHz	QPSK, 16QAM
	3555 to 3695	3555 to 3695	10MHz	QPSK, 16QAM
	3557.5 to 3692.5	3557.5 to 3692.5	15MHz	QPSK, 16QAM
	3560 to 3690	3560 to 3690	20MHz	QPSK, 16QAM
Frequency stability	3552.5 to 3697.5	3625	5MHz	QPSK
	3555 to 3695	3625	10MHz	QPSK
	3557.5 to 3692.5	3625	15MHz	QPSK
	3560 to 3690	3625	20MHz	QPSK
Occupied Bandwidth	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK, 16QAM
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK, 16QAM
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK, 16QAM
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK, 16QAM
Peak to Average Ratio	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK
Radiated Emission	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK
Conducted Emission	3552.5 to 3697.5	3552.5, 3625, 3697.5	5MHz	QPSK
	3555 to 3695	3555, 3625, 3695	10MHz	QPSK
	3557.5 to 3692.5	3557.5, 3625, 3692.5	15MHz	QPSK
	3560 to 3690	3560, 3625, 3690	20MHz	QPSK

NOTE 1: All supported modulation types were evaluated. The Worst case of QPSK was selected. Therefore, the Frequency Stability, Peak to Average Ratio, Conducted Emission and Radiated Emission were presented under QPSK mode only.

NOTE 2: The duty cycle correction= $10 \log(1/\text{duty cycle})=10 \log(1/(1.98/5.01))=4(\text{dB})$

Offset factory=ATT loss+Cable loss+Duty cycle correction=3.5+1+4=8.5(dB)

6 Equipment Used during Test

6.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2019-04-20	2020-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2019-05-24	2020-05-24
3	Cable	HUBER+SUHNER	CBL2	525178	2019-04-20	2020-04-19
4	Amplifier	ANRITSU	MH648A	M43381	2019-04-19	2020-04-18
5	Universal Radio Communication Tester	R&S	CMW500	116543	2019-09-17	2020-09-16
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP40	100501	2019-11-13	2020-11-12
2	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2019-04-19	2020-04-18
3	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2019-04-19	2020-04-18
4	Coaxial Cable	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	NA	2019-04-19	2020-04-18
5	Broad-band Horn Antenna	SCHWARZBECK	BBV 9721	100472	2019-10-25	2020-10-24
6	Coaxial Cable	ZT40-2.92J-2.92J-2.0M	10MHz-40GHz	17100919	2019-10-15	2020-10-14
5	Universal Radio Communication Tester	R&S	CMW500	116543	2019-09-17	2020-09-16
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EXA Signal Analyzer	Malaysia Keysight	N9010A	MY50520207	2019-04-19	2020-04-19
2.	Spectrum Analyzer	R&S	FSP40	100501	2019-11-13	2020-11-12
5	Universal Radio Communication Tester	R&S	CMW500	116543	2019-09-17	2020-09-16

6.2 Measurement Uncertainty

Parameter	Uncertainty
Conducted Emission	± 3.64 dB(AC mains 150KHz~30MHz)
Radiated Spurious Emissions	± 5.08 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Radio Frequency	$\pm 1 \times 10^{-7}$ Hz
RF Power	± 0.42 dB
RF Power Density	± 0.7 dB
Conducted Spurious Emissions	± 2.76 dB (9kHz~26500MHz)
Confidence interval: 95%. Confidence factor:k=2	

6.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

7 Max EIRP and maximum spectral density

Test Requirement:	FCC part96.41(b)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	

Device	Maximum EIRP(dBm/10MHz)	Maximum PSD(dBm/MHz)
End User Device	23	n/a
Category A CBSD	30	20
Category B CBSD	47	37

7.1 EUT Operation

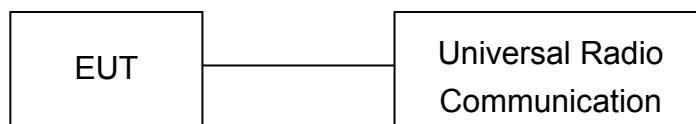
Operating Environment :

Temperature:	22.4 °C
Humidity:	52.2 % RH
Atmospheric Pressure:	101.3kPa

7.2 Test Procedure

Conducted method for 15M&20M bandwidth:

The RF output of the transmitter was connected to the wireless test set and the spectrum analyzer through sufficient attenuation.



For Maximum EIRP

1. Connect the transmitter to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
2. Set span to 2 × to 3 × the OBW.
3. Set RBW = 1% to 5% of the OBW.
4. Set VBW ≥ 3 × RBW.
5. Set number of measurement points in sweep ≥ 2 × span / RBW.
6. Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set ≥ [10 × (number of points in sweep) × (transmission symbol period)] for single sweep (automation-compatible) measurement.
7. Detector = power averaging (rms).
8. Set sweep trigger to "free run."
9. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.
10. Compute power by integrating the spectrum across the OBW(10MHz) of the signal using the instrument's band or channel power measurement function with band/channel limits set equal to the OBW(10MHz) band edges.
11. Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission.
12. $EIRP = P_{Meas} + G_T$.

P_{Meas} measured transmitter output power or PSD.

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<http://www.waltek.com.cn>

G_T gain of the transmitting antenna.

For Maximum PSD

The PSD is measured following the same procedures described for measuring the maximum EIRP but with the RBW set to the reference bandwidth specified(eg.1MHz) by the applicable regulatory requirement, and by using the marker function to identify the maximum PSD instead of summing the power across the OBW.

7.3 Test Result

Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP Limit (dBm/10MHz)
5	QPSK	Low	23.77	14.0	37.77	47
		Middle	23.56	14.0	37.56	
		High	23.60	14.0	37.60	
	16QAM	Low	23.64	14.0	37.64	
		Middle	23.23	14.0	37.23	
		High	23.24	14.0	37.24	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
5	QPSK	Low	17.179	14.0	31.179	37
		Middle	17.331	14.0	31.331	
		High	17.057	14.0	31.057	
	16QAM	Low	17.127	14.0	31.127	
		Middle	17.168	14.0	31.168	
		High	17.055	14.0	31.055	

Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP Limit (dBm/10MHz)
10	QPSK	Low	23.09	14.0	37.09	47
		Middle	22.90	14.0	36.90	
		High	22.53	14.0	36.53	
	16QAM	Low	22.96	14.0	36.96	
		Middle	22.50	14.0	36.50	
		High	22.19	14.0	36.19	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
10	QPSK	Low	14.963	14.0	28.963	37
		Middle	14.707	14.0	28.707	
		High	14.616	14.0	28.616	
	16QAM	Low	14.908	14.0	28.908	
		Middle	14.614	14.0	28.614	
		High	14.234	14.0	28.234	

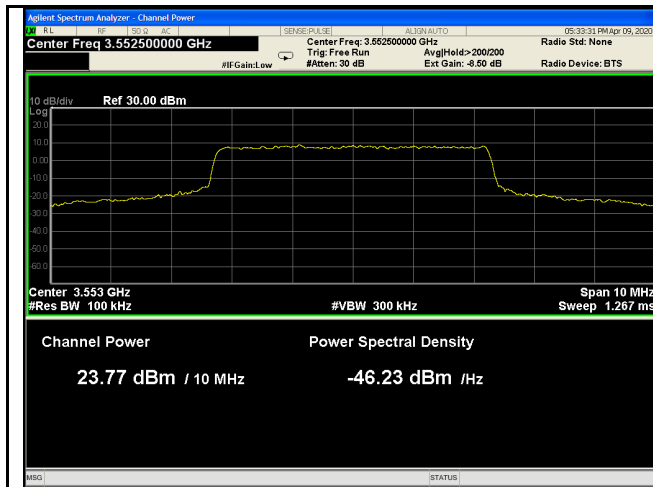
Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP Limit (dBm/10MHz)
15	QPSK	Low	22.09	14.0	36.09	47
		Middle	22.17	14.0	36.17	
		High	22.05	14.0	36.05	
	16QAM	Low	21.84	14.0	35.84	
		Middle	21.75	14.0	35.75	
		High	22.02	14.0	36.02	
Full Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/15MHz)	Antenna Gain (dBi)	EIRP (dBm/15MHz)	EIRP Limit (dBm/15MHz)
15	QPSK	Low	23.13	14.0	37.13	-
		Middle	23.57	14.0	37.57	
		High	23.03	14.0	37.03	
	16QAM	Low	22.45	14.0	36.45	
		Middle	22.87	14.0	36.87	
		High	22.56	14.0	36.56	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
15	QPSK	Low	13.371	14.0	27.371	37
		Middle	13.141	14.0	27.141	
		High	12.964	14.0	26.964	
	16QAM	Low	12.926	14.0	26.926	
		Middle	12.980	14.0	26.980	
		High	12.582	14.0	26.582	

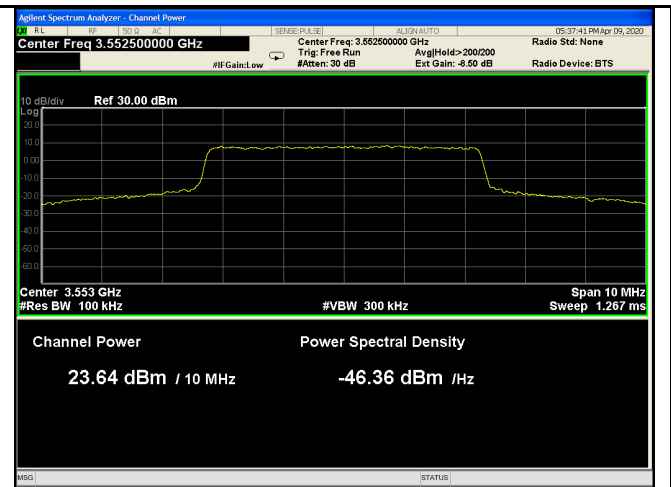
Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP Limit (dBm/10MHz)
20	QPSK	Low	22.18	14.0	36.18	47
		Middle	21.99	14.0	35.99	
		High	21.51	14.0	35.51	
	16QAM	Low	21.89	14.0	35.89	
		Middle	21.56	14.0	35.56	
		High	21.52	14.0	35.52	
Full Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/20MHz)	Antenna Gain (dBi)	EIRP (dBm/20MHz)	EIRP Limit (dBm/20MHz)
20	QPSK	Low	23.05	14.0	37.05	-
		Middle	23.55	14.0	37.55	
		High	23.43	14.0	37.43	
	16QAM	Low	22.98	14.0	36.98	
		Middle	23.32	14.0	37.32	
		High	22.81	14.0	36.81	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
20	QPSK	Low	12.072	14.0	26.072	37
		Middle	11.788	14.0	25.788	
		High	12.204	14.0	26.204	
	16QAM	Low	11.732	14.0	25.732	
		Middle	11.775	14.0	25.775	
		High	11.745	14.0	25.745	

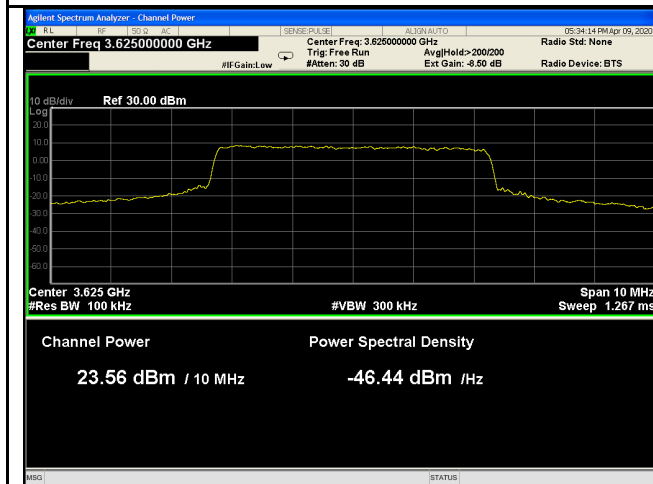
Transmit Output Power Test Plots



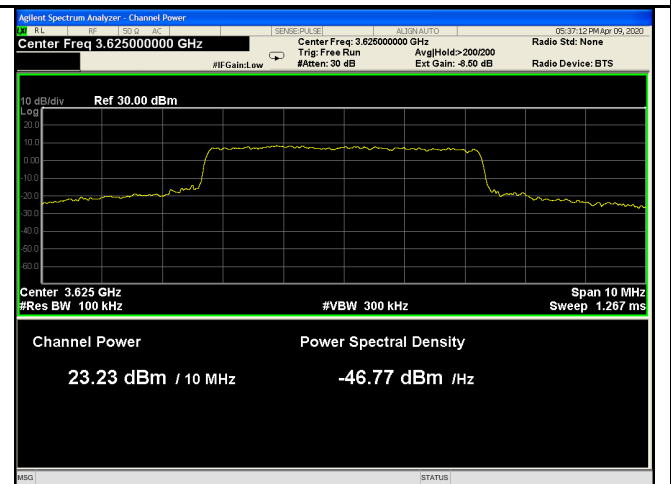
5MHz - Low CH QPSK



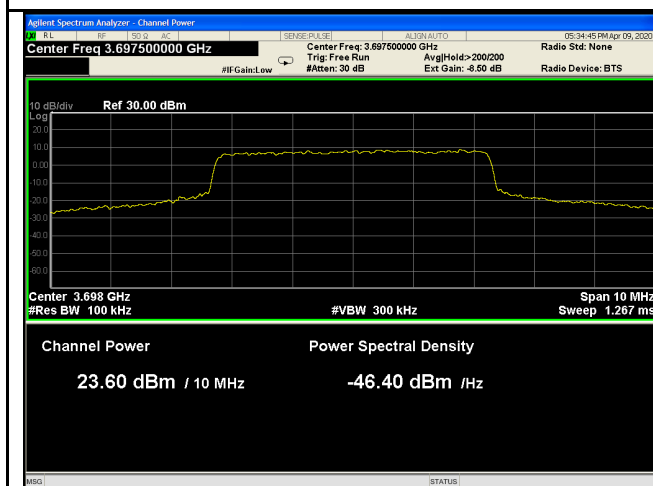
5MHz - Low CH 16QAM



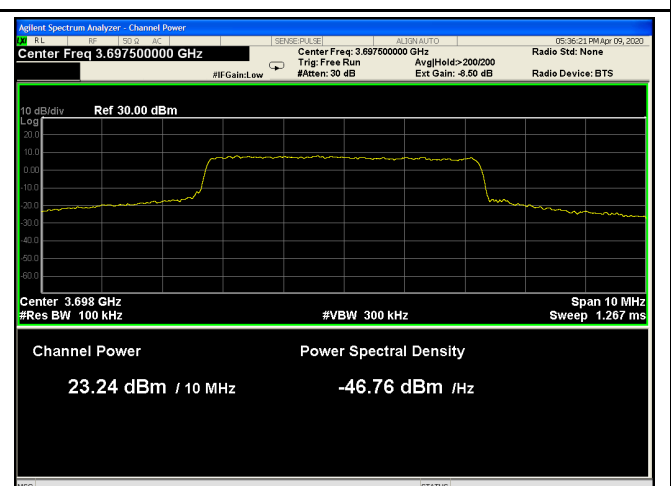
5MHz - Middle CH QPSK



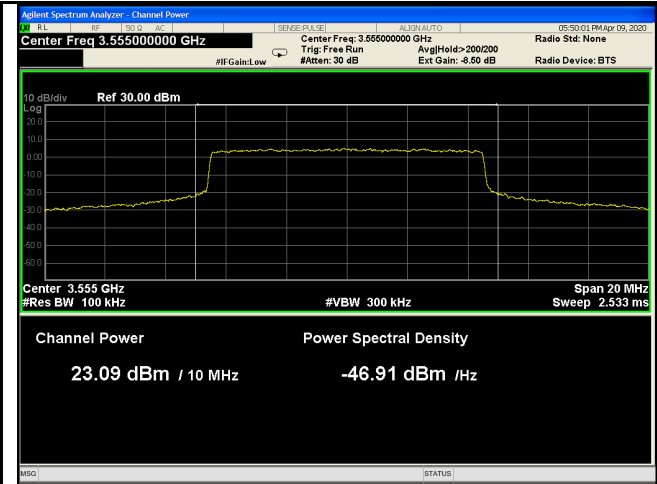
5MHz - Middle CH 16QAM



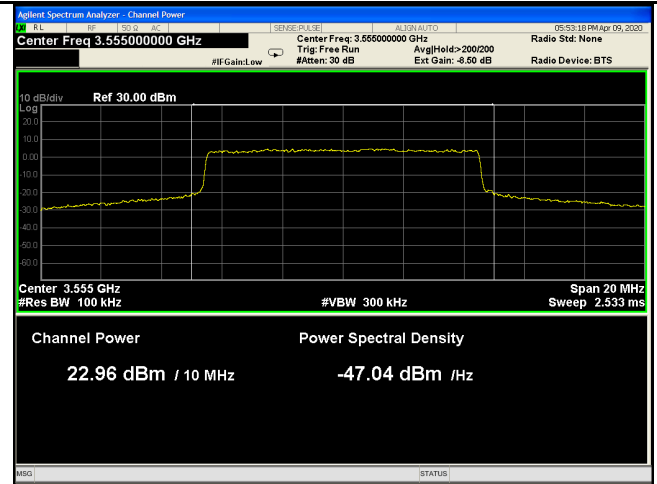
5MHz - High CH QPSK



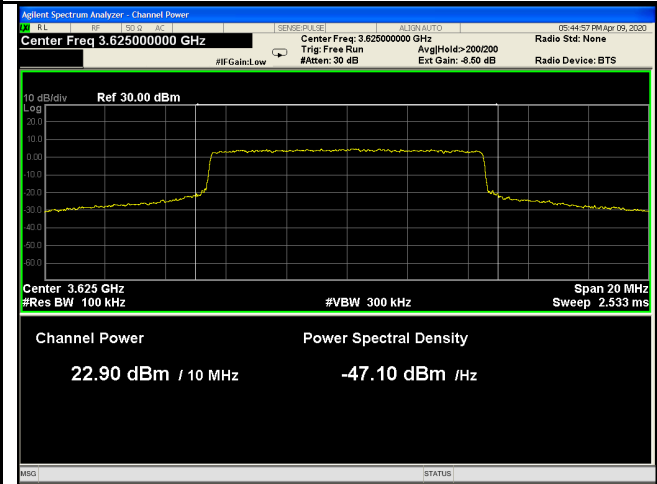
5MHz - High CH 16QAM



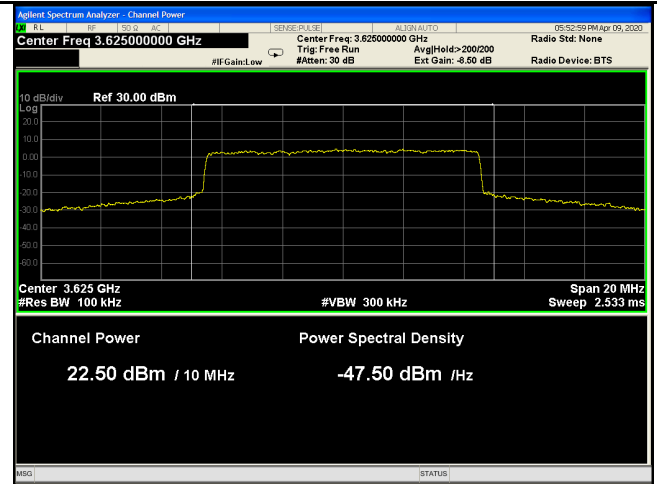
10MHz - Low CH QPSK



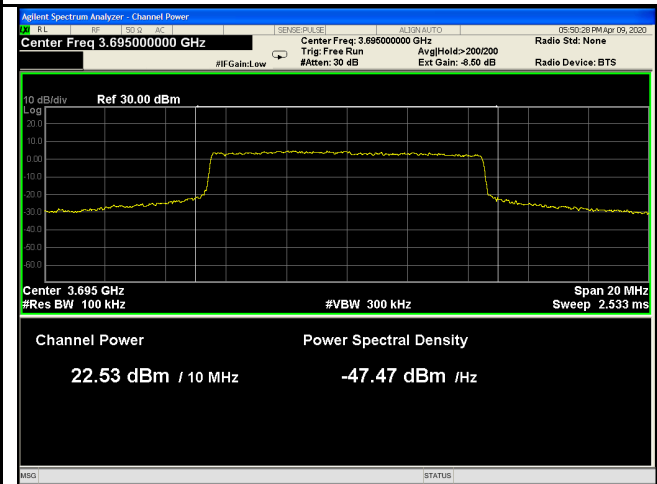
10MHz - Low CH 16QAM



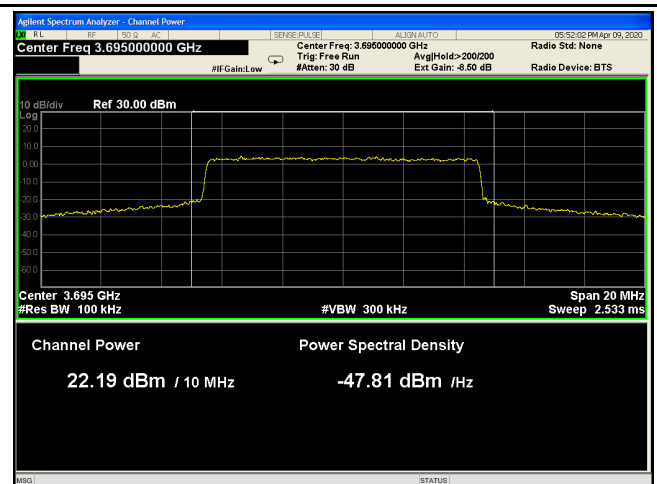
10MHz - Middle CH QPSK



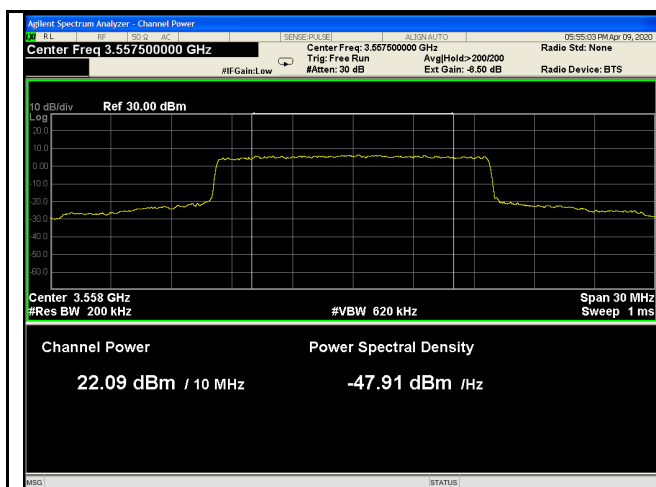
10MHz - Middle CH 16QAM



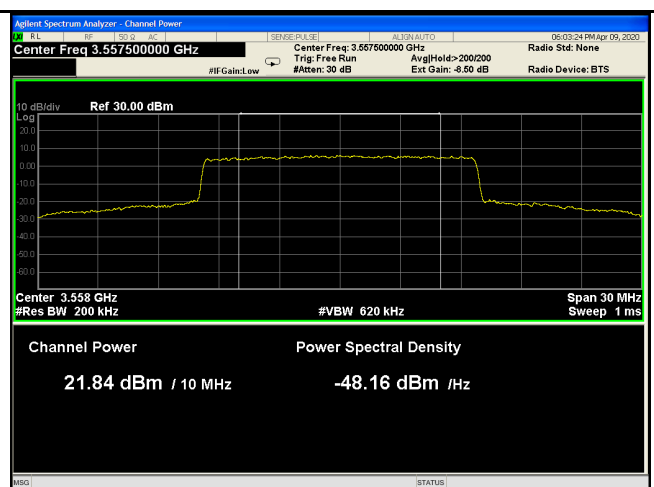
10MHz - High CH QPSK



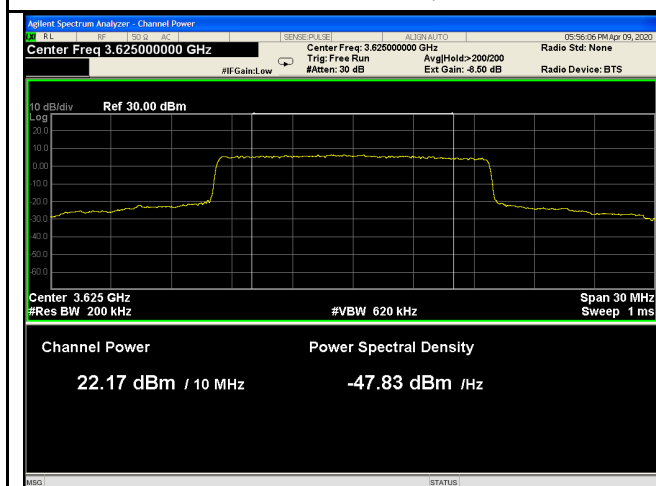
10MHz - High CH 16QAM



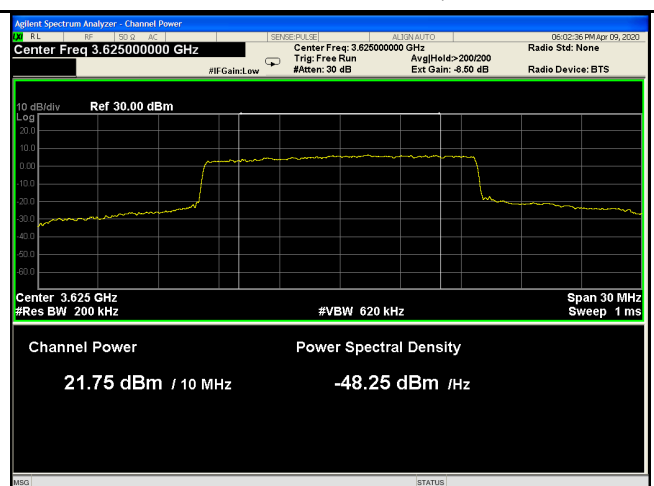
15MHz - Low CH QPSK



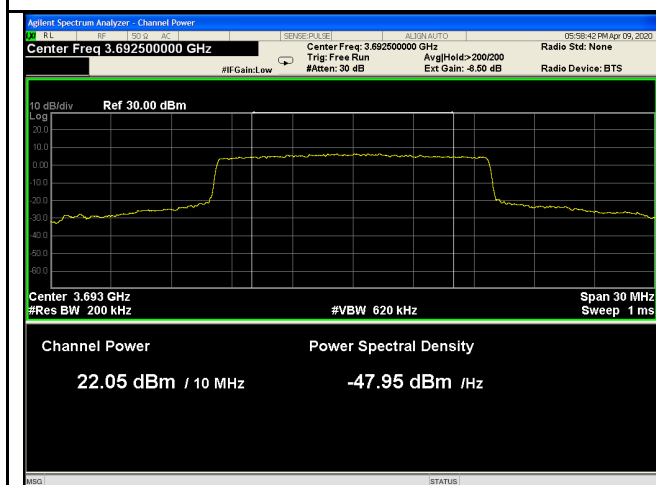
15MHz - Low CH 16QAM



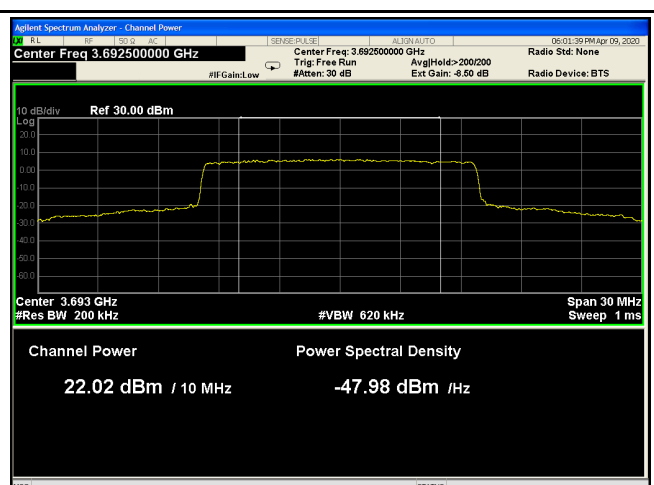
15MHz - Middle CH QPSK



15MHz - Middle CH 16QAM

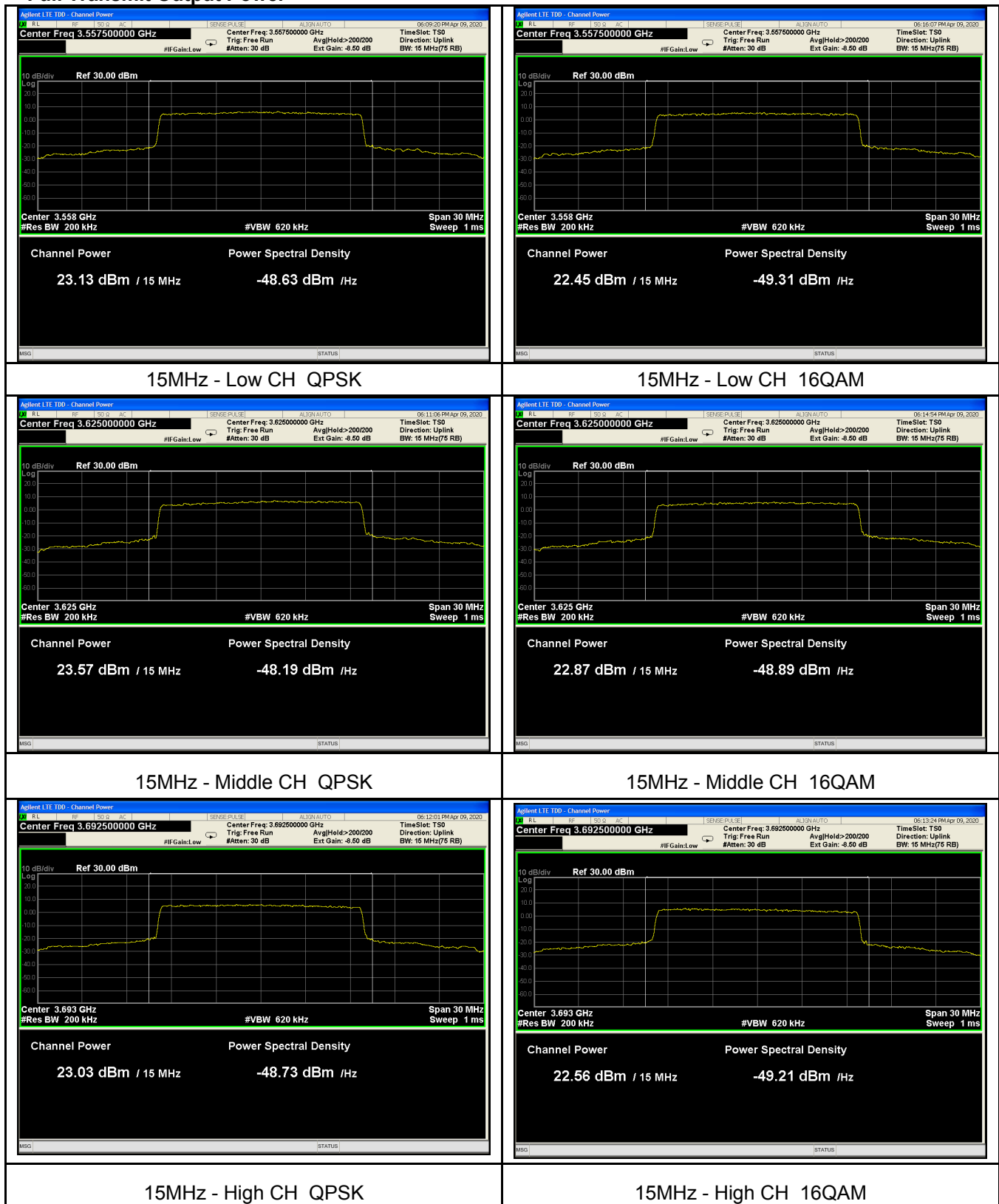


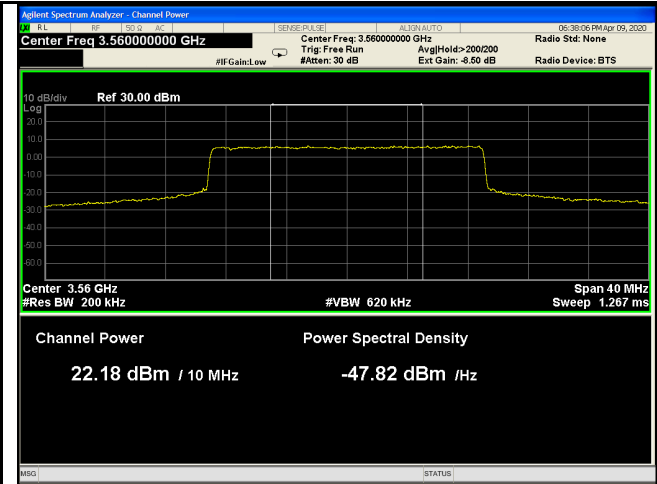
15MHz - High CH QPSK



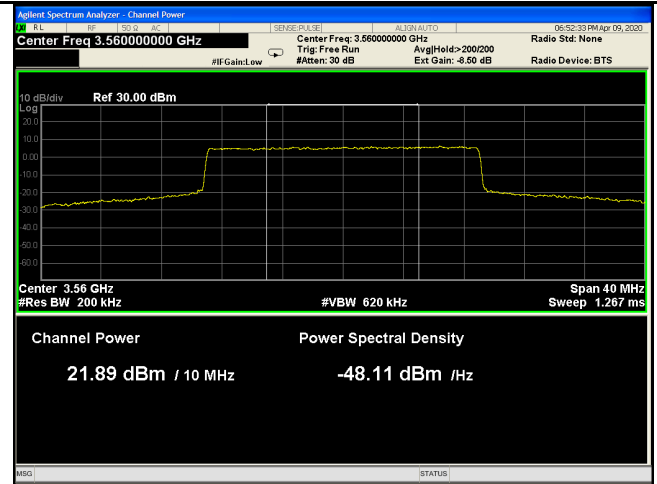
15MHz - High CH 16QAM

Full Transmit Output Power

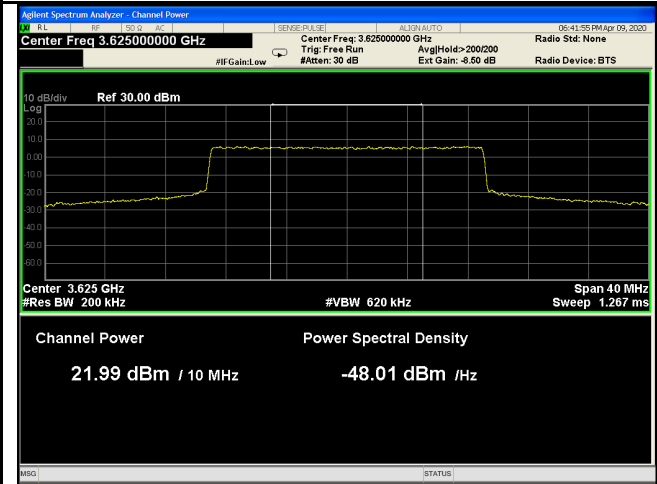




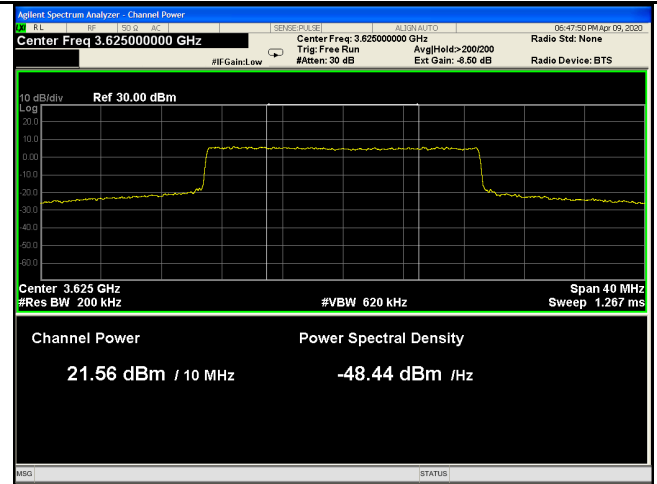
20MHz - Low CH QPSK



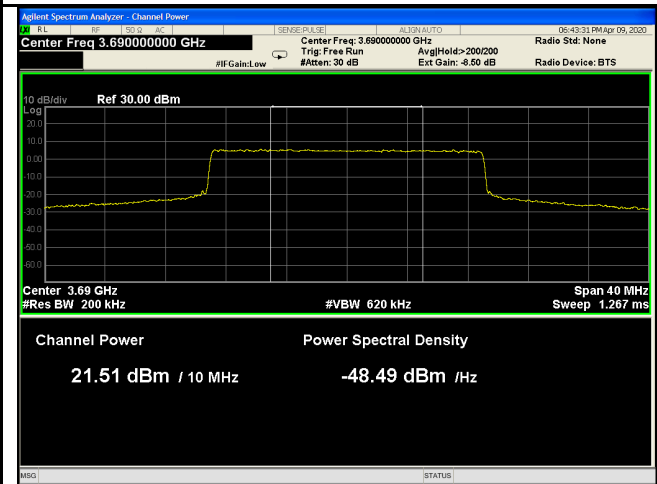
20MHz - Low CH 16QAM



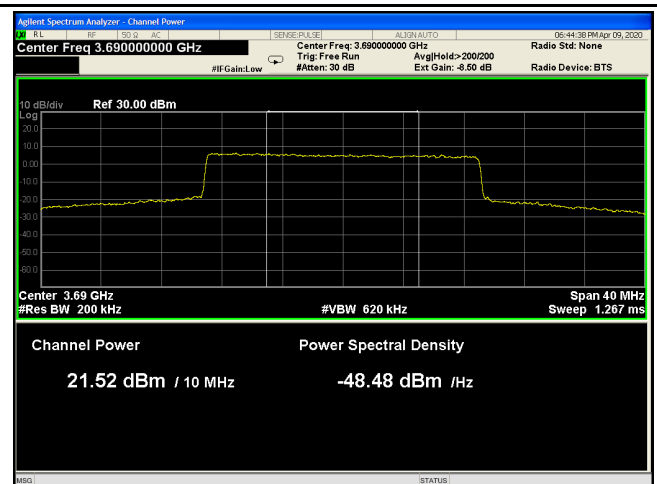
20MHz - Middle CH QPSK



20MHz - Middle CH 16QAM

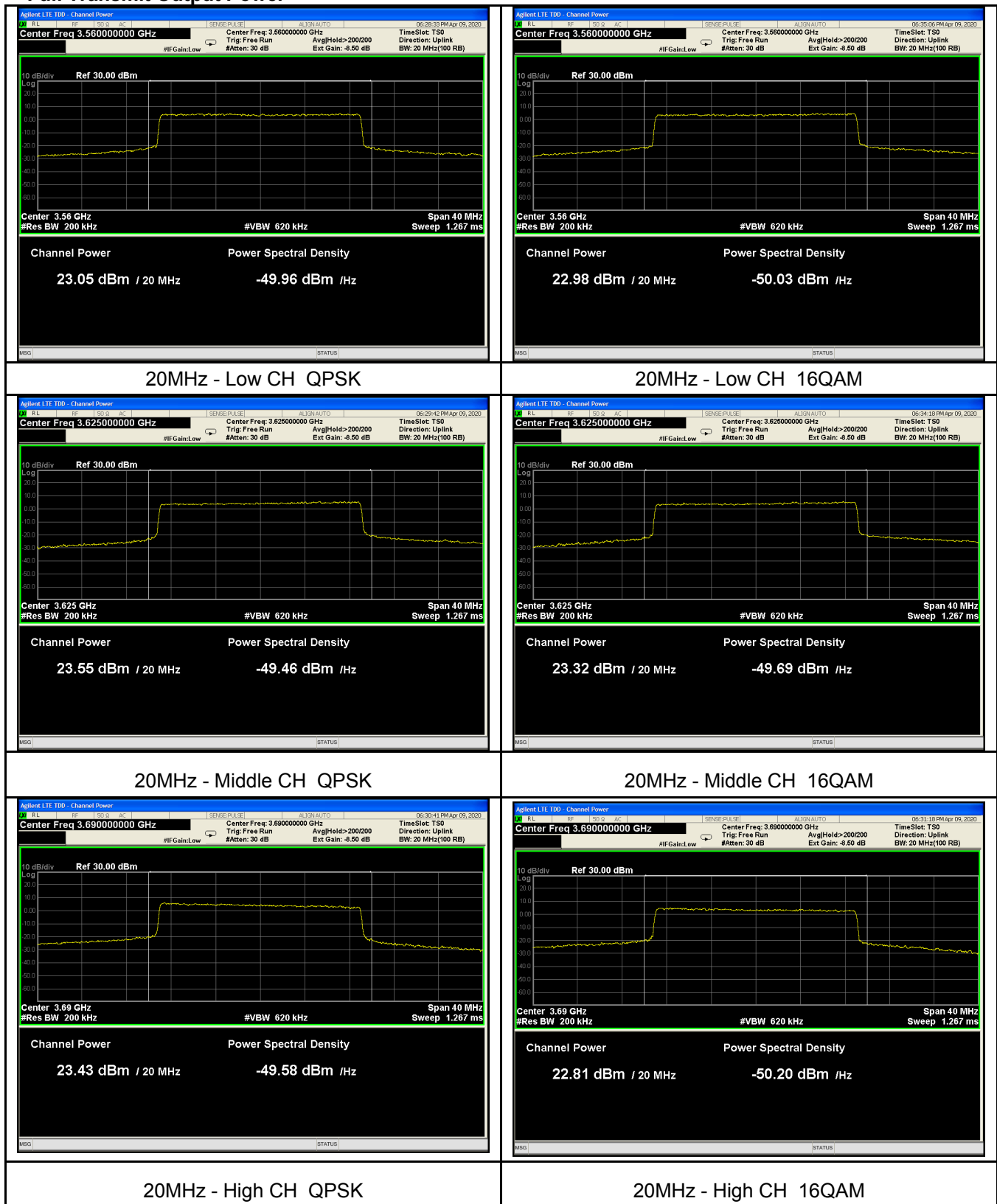


20MHz - High CH QPSK

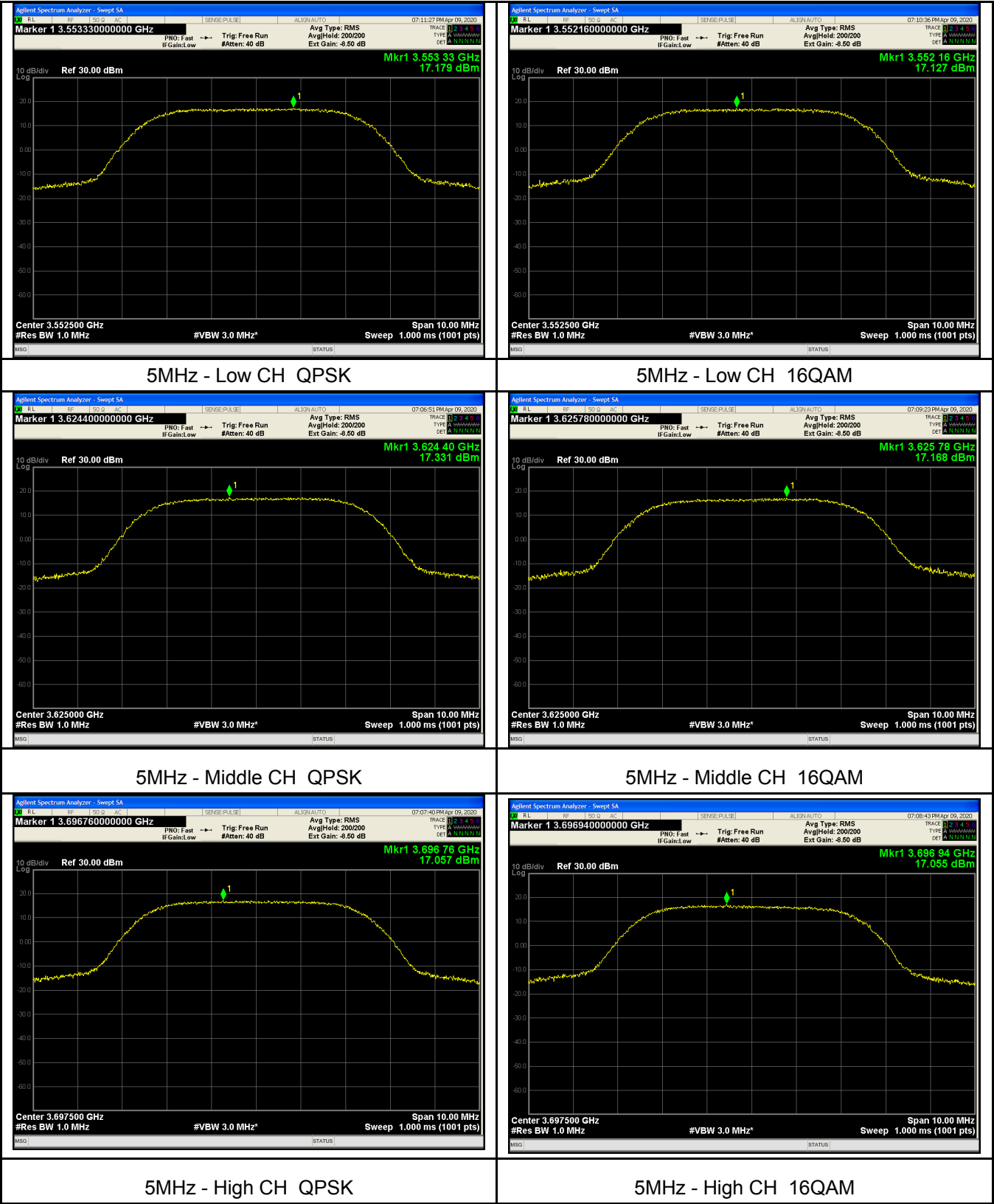


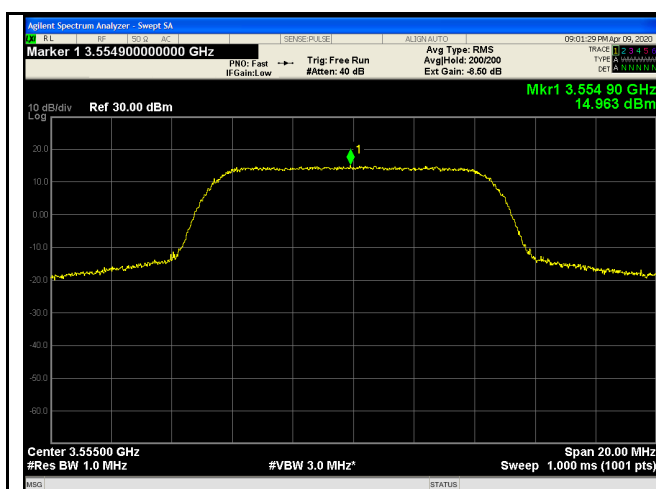
20MHz - High CH 16QAM

Full Transmit Output Power

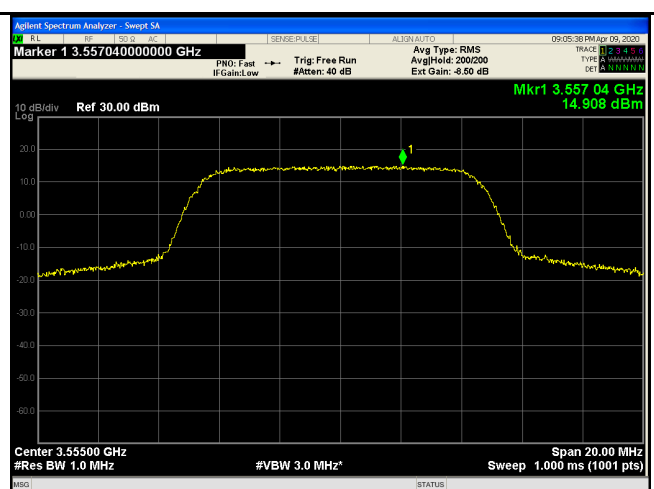


PSD Test Plots

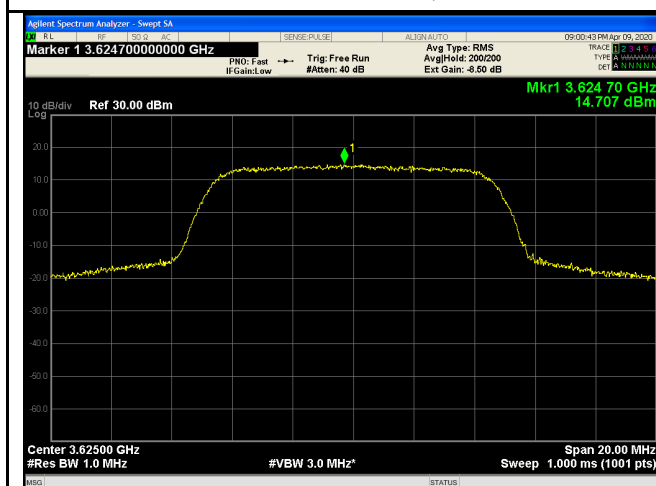




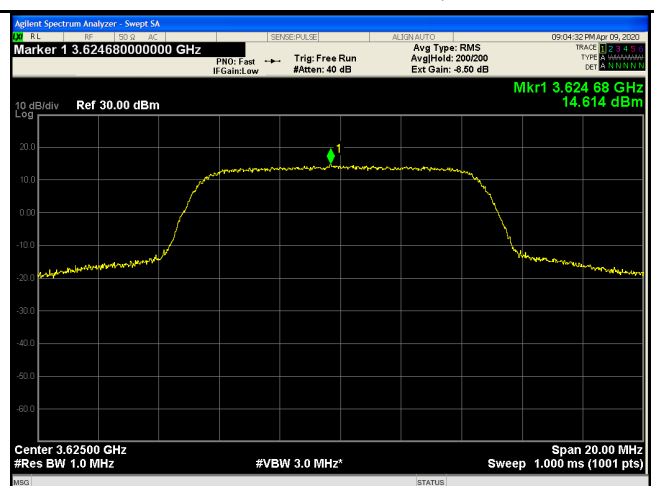
10MHz - Low CH QPSK



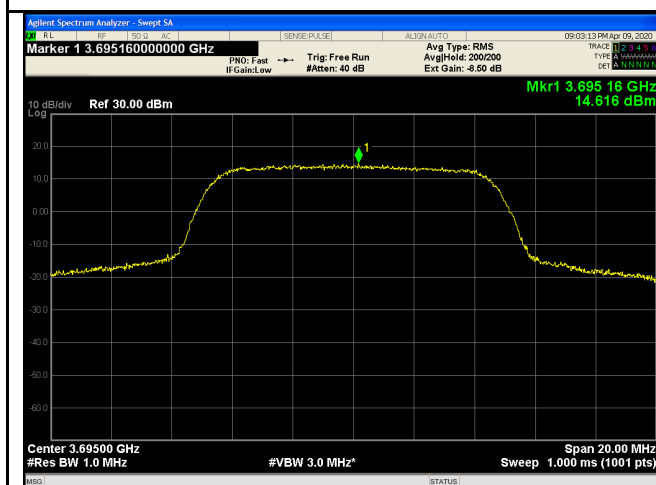
10MHz - Low CH 16QAM



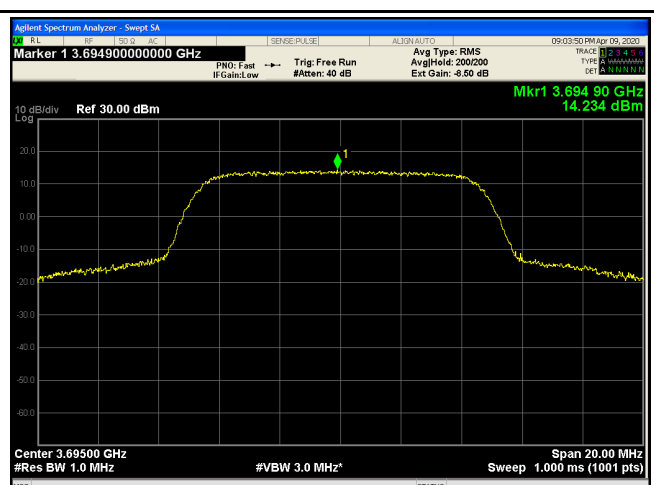
10MHz - Middle CH QPSK



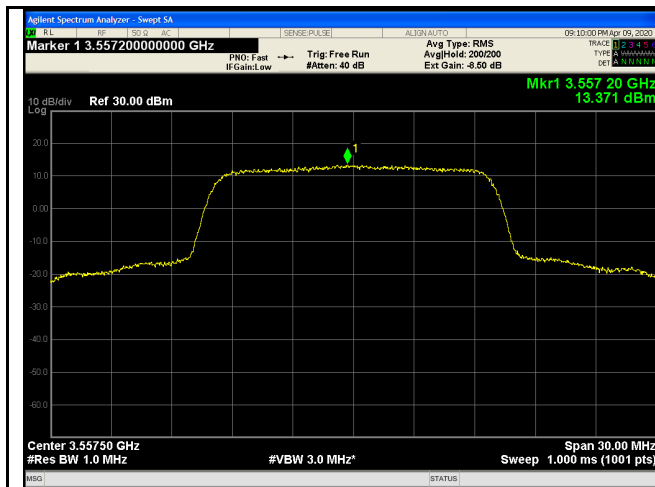
10MHz - Middle CH 16QAM



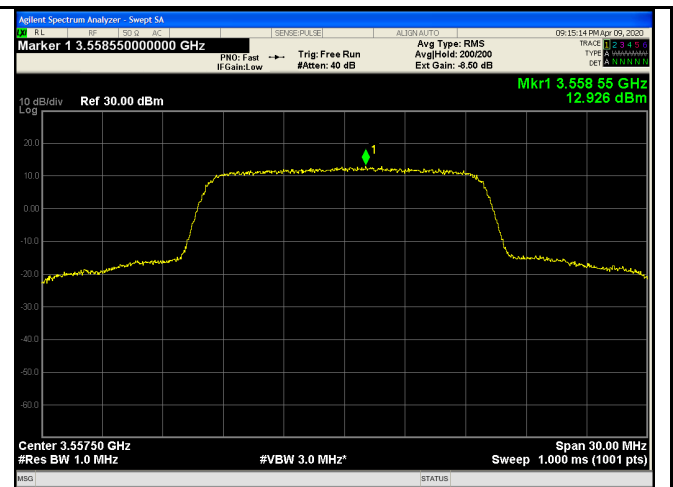
10MHz - High CH QPSK



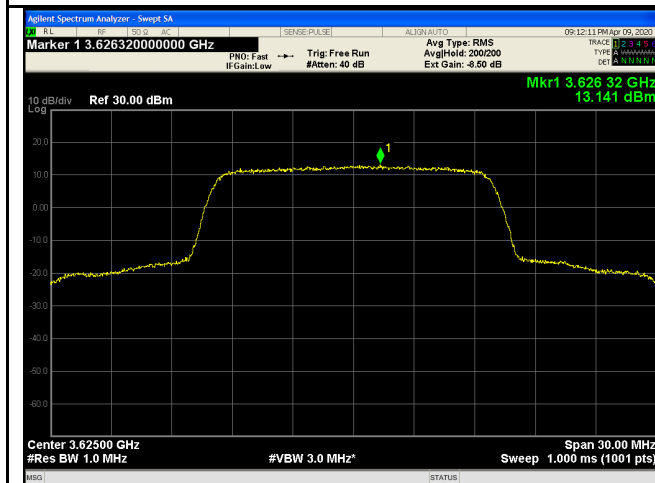
10MHz - High CH 16QAM



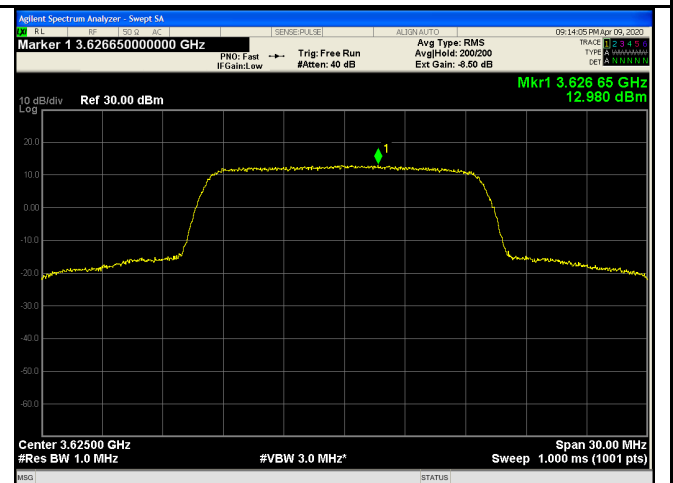
15MHz - Low CH QPSK



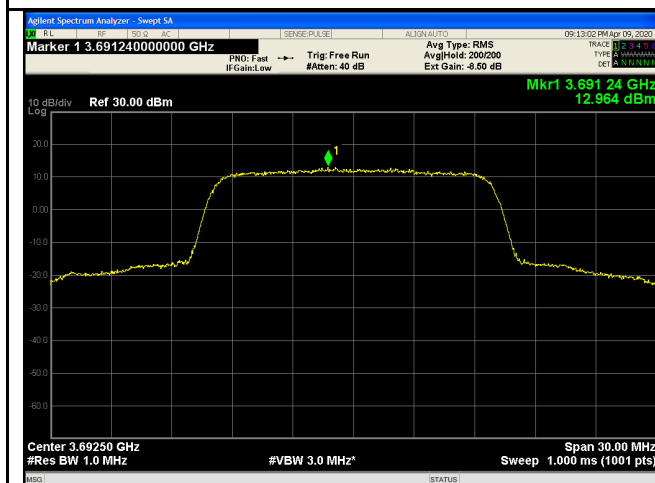
15MHz - Low CH 16QAM



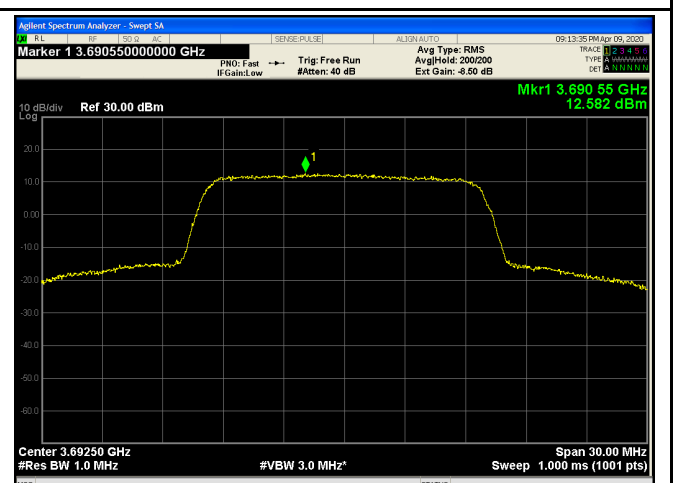
15MHz - Middle CH QPSK



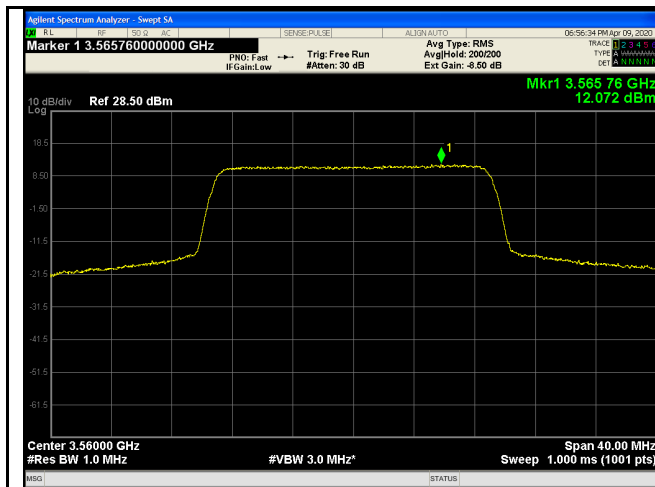
15MHz - Middle CH 16QAM



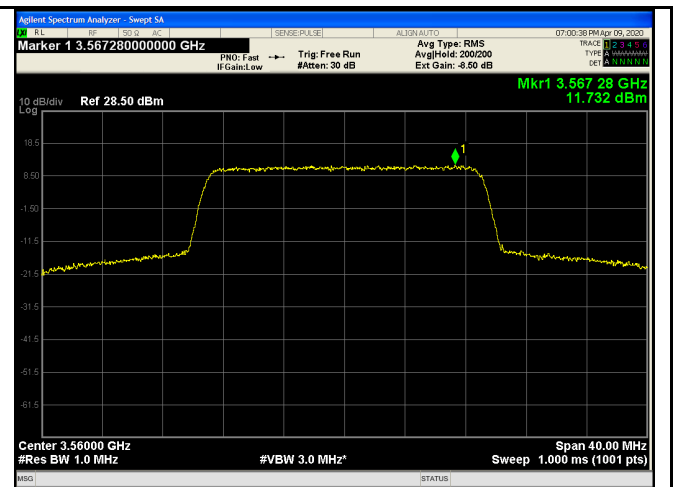
15MHz - High CH QPSK



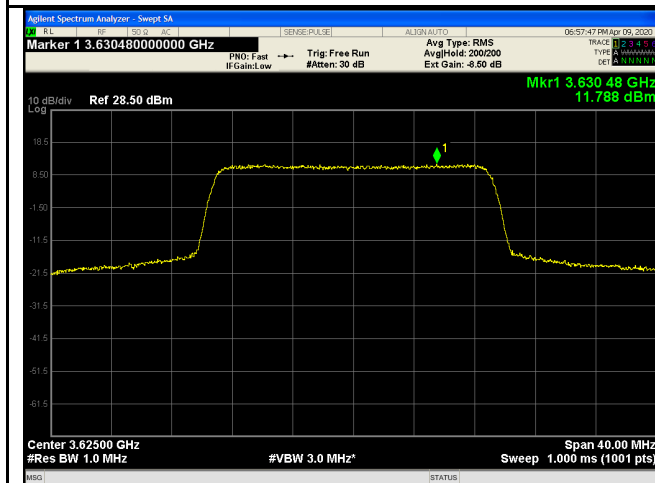
15MHz - High CH 16QAM



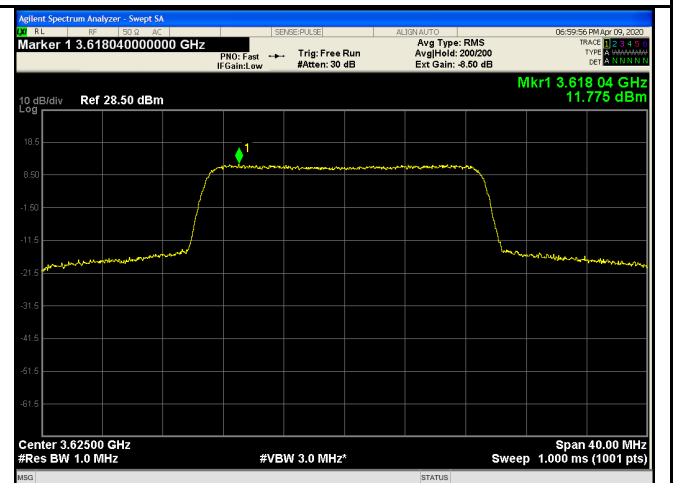
20MHz - Low CH QPSK



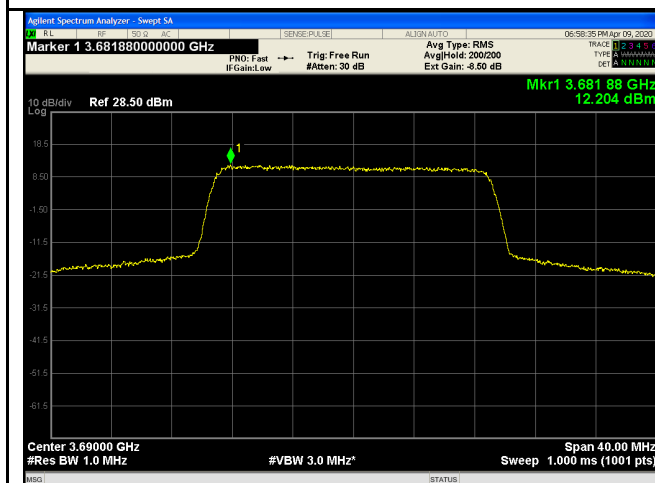
20MHz - Low CH 16QAM



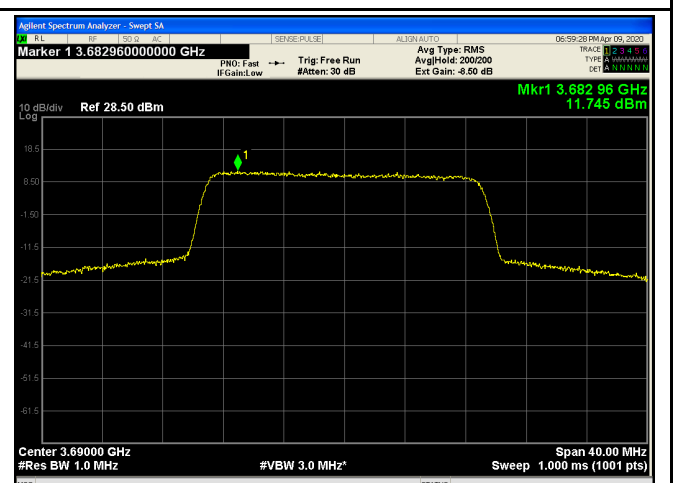
20MHz - Middle CH QPSK



20MHz - Middle CH 16QAM



20MHz - High CH QPSK



20MHz - High CH 16QAM

8 Peak-to-average power ratio

Test Requirement:	FCC part96.41(g)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	

Probability, %	dB
0.1	13

8.1 EUT Operation

Operating Environment :

Temperature:	22.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	102.3kPa

Note: Data that only reflects the worst mode is reported

8.2 Test Procedure

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. Set EUT to transmit at maximum output power.
3. When the duty cycle is less than 98%, then signal gating will be implemented on the spectrum analyzer by triggering from the system simulator.
4. Set the CCDF (Complementary Cumulative Distribution Function) option of the spectrum analyzer. Record the maximum PAPR level associated with a probability of 0.1%.

8.3 Test Result

5MHz bandwidth

Mode	QPSK			Limit (dB)
Channel	Low	Middle	High	
Peak-to-Average Ratio (dB)	7.94	7.97	7.88	13

10MHz bandwidth

Mode	QPSK			Limit (dB)
Channel	Low	Middle	High	
Peak-to-Average Ratio (dB)	7.66	7.64	7.53	13

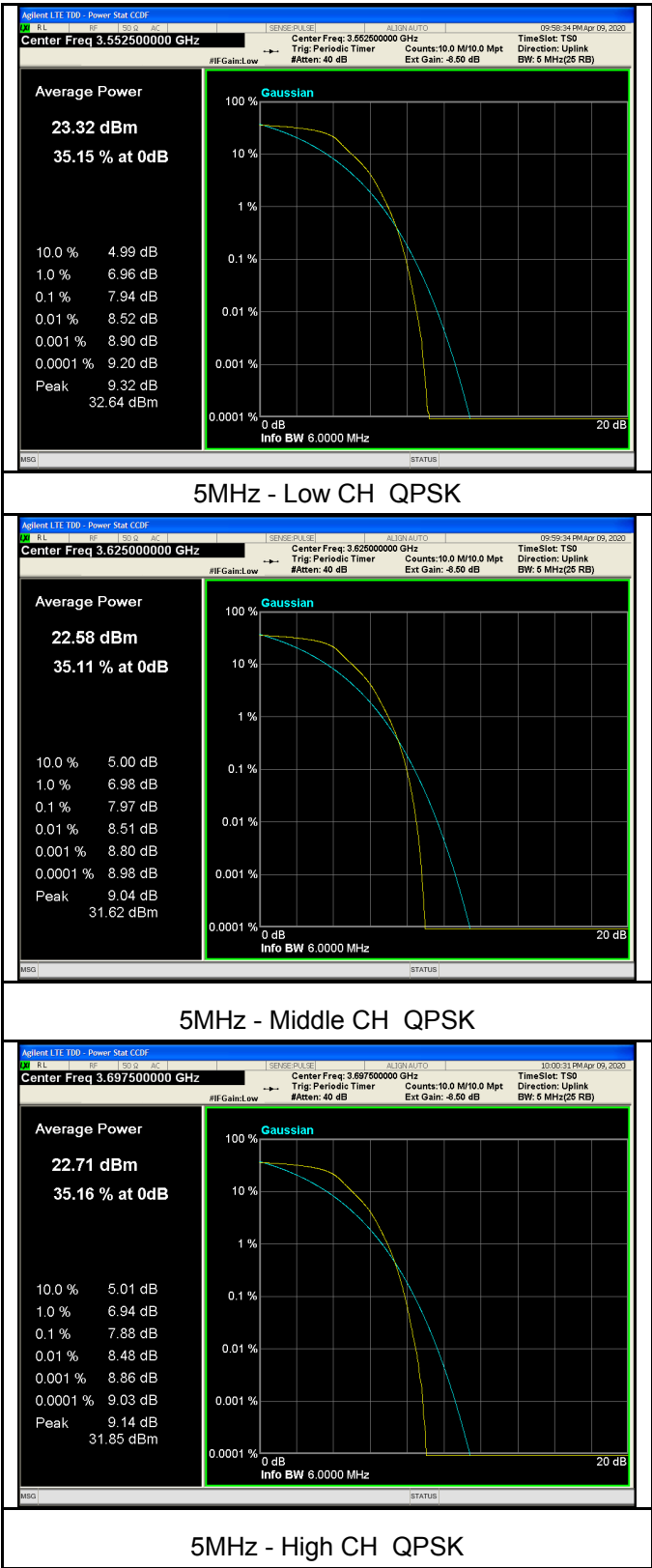
15MHz bandwidth

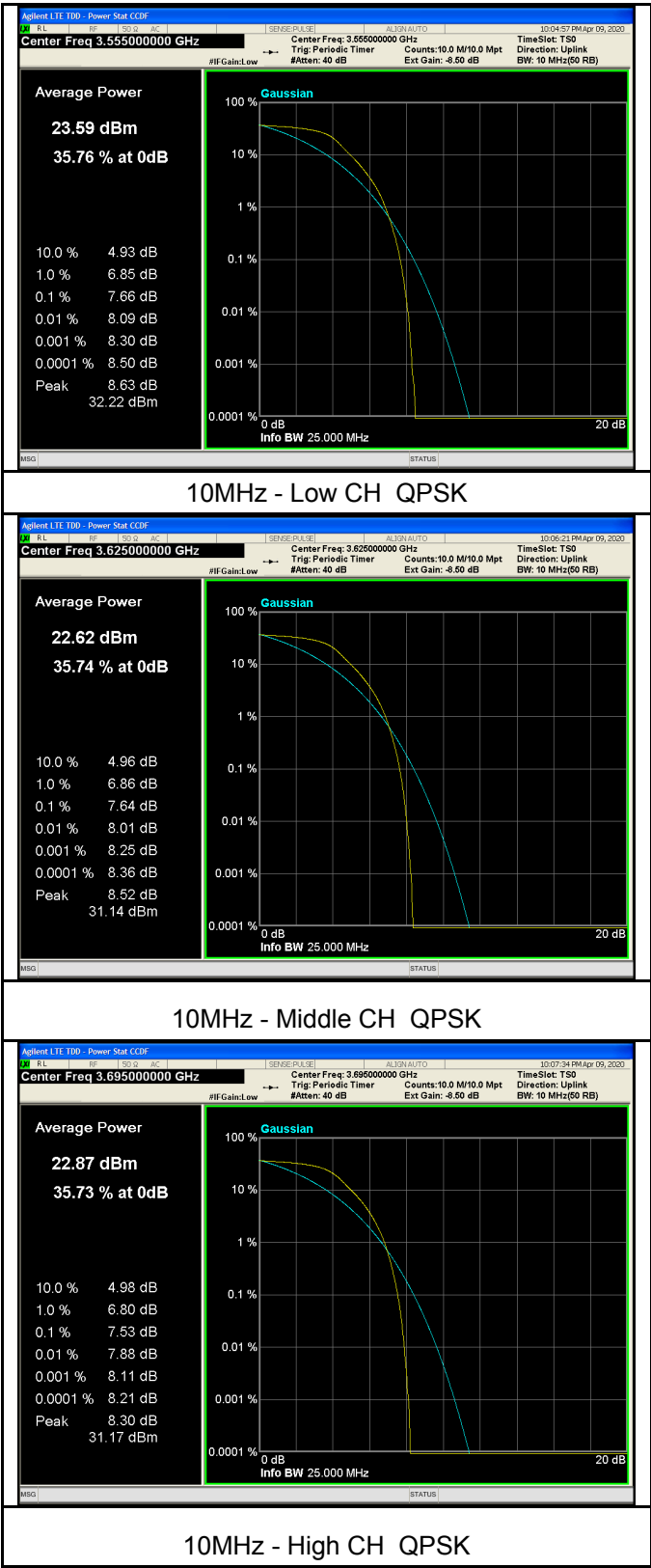
Mode	QPSK			Limit (dB)
Channel	Low	Middle	High	
Peak-to-Average Ratio (dB)	8.07	8.07	8.05	13

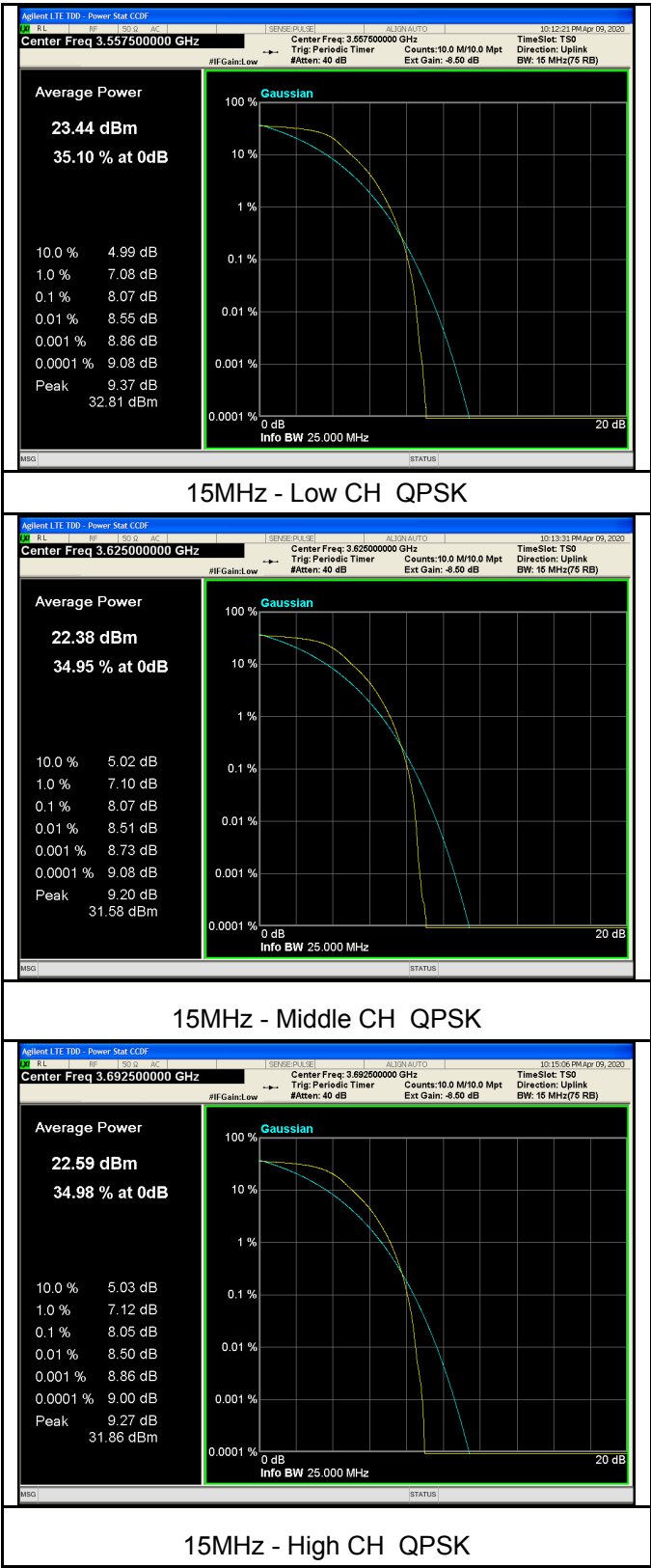
20MHz bandwidth

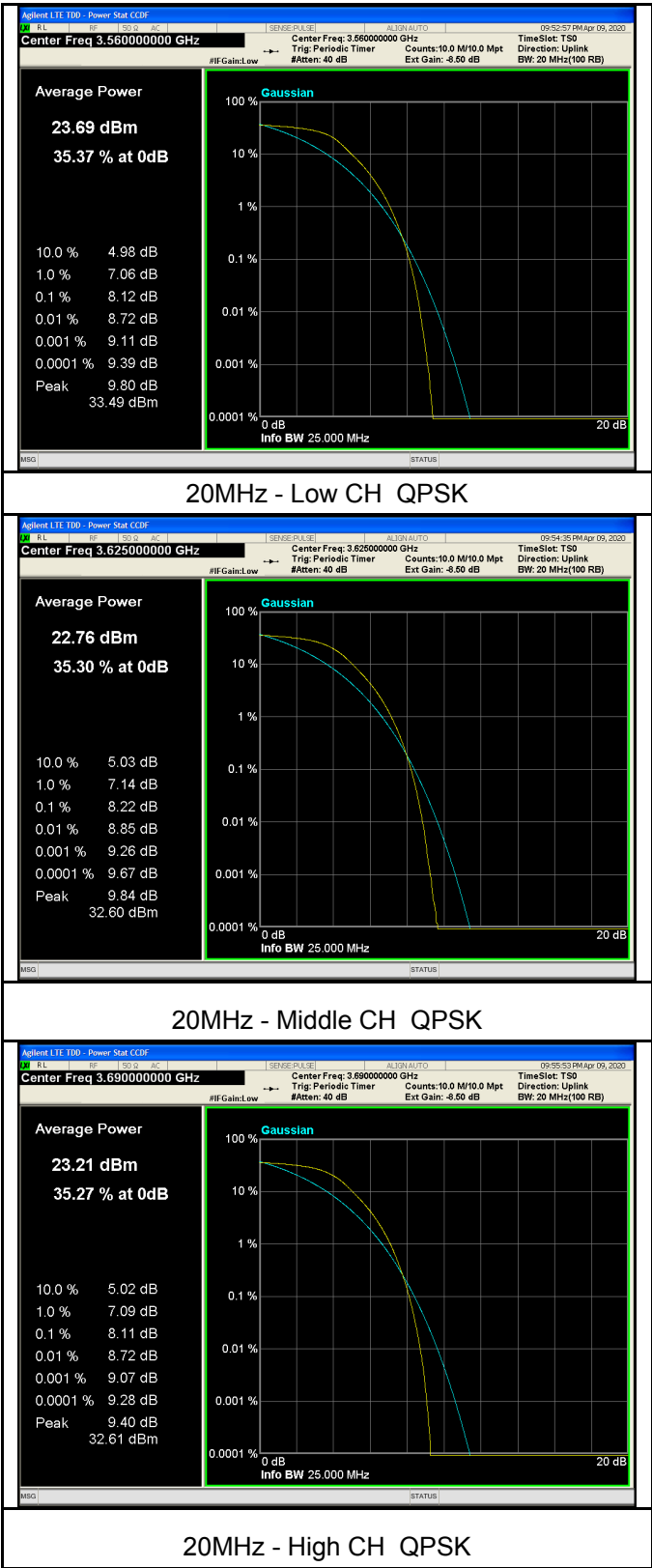
Mode	QPSK			Limit (dB)
Channel	Low	Middle	High	
Peak-to-Average Ratio (dB)	8.12	8.22	8.11	13

Test Plots









9 Occupy Bandwidth

Test Requirement:	FCC part 2.1049
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode

9.1 EUT Operation

Operating Environment :

Temperature:	22.6 °C
Humidity:	52.4 % RH
Atmospheric Pressure:	103.3kPa

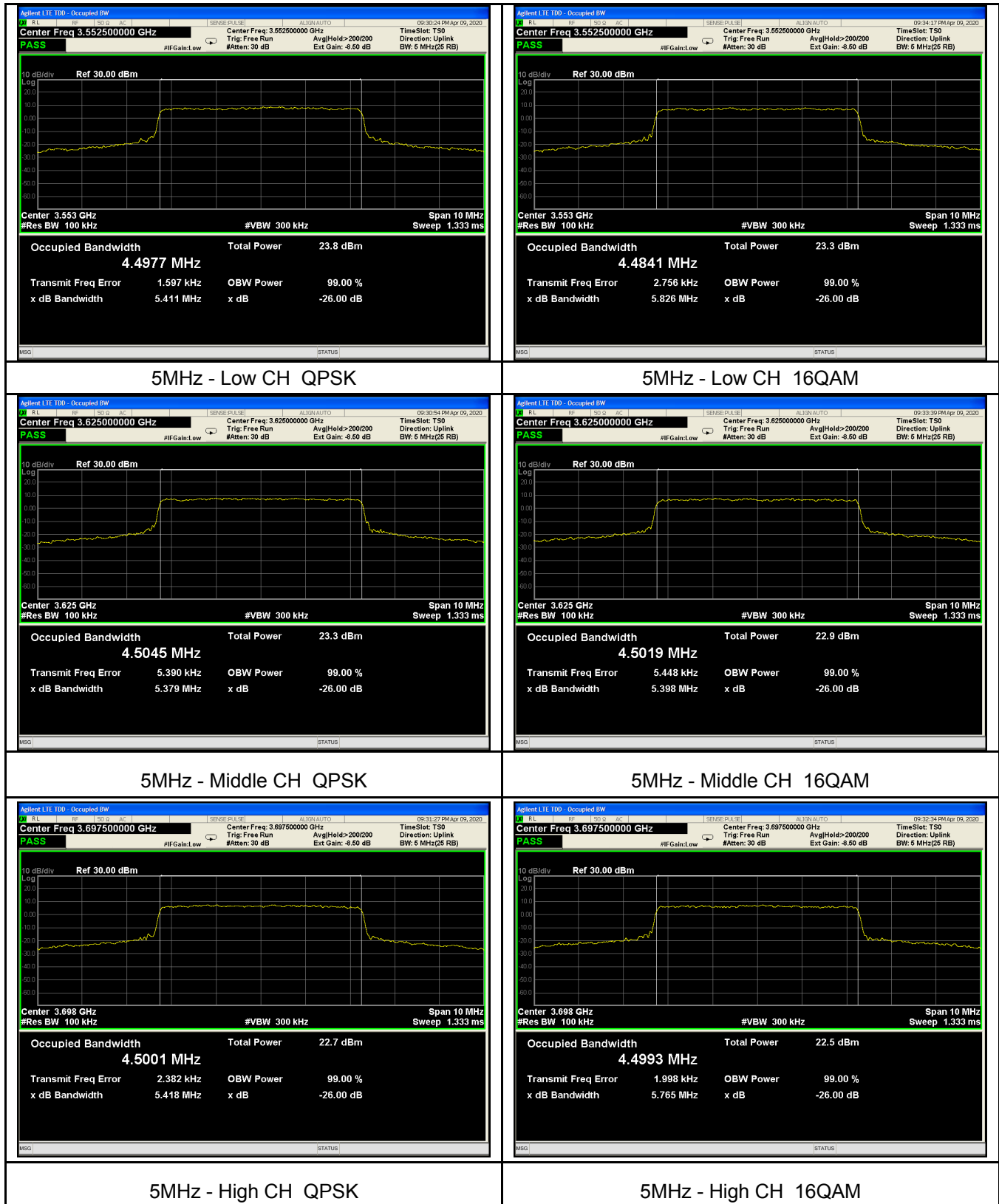
9.2 Test Procedure

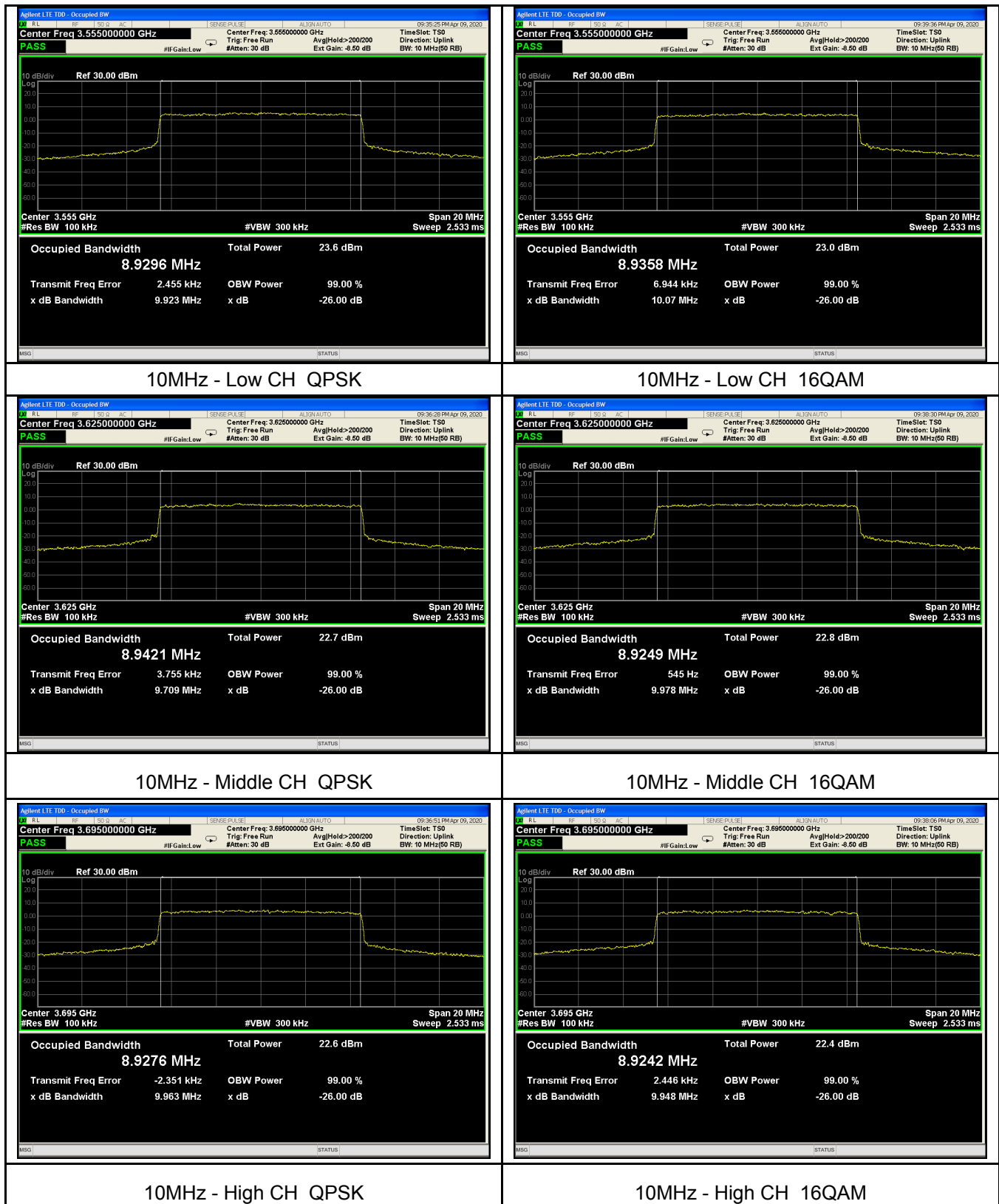
1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer.
2. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
3. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
4. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

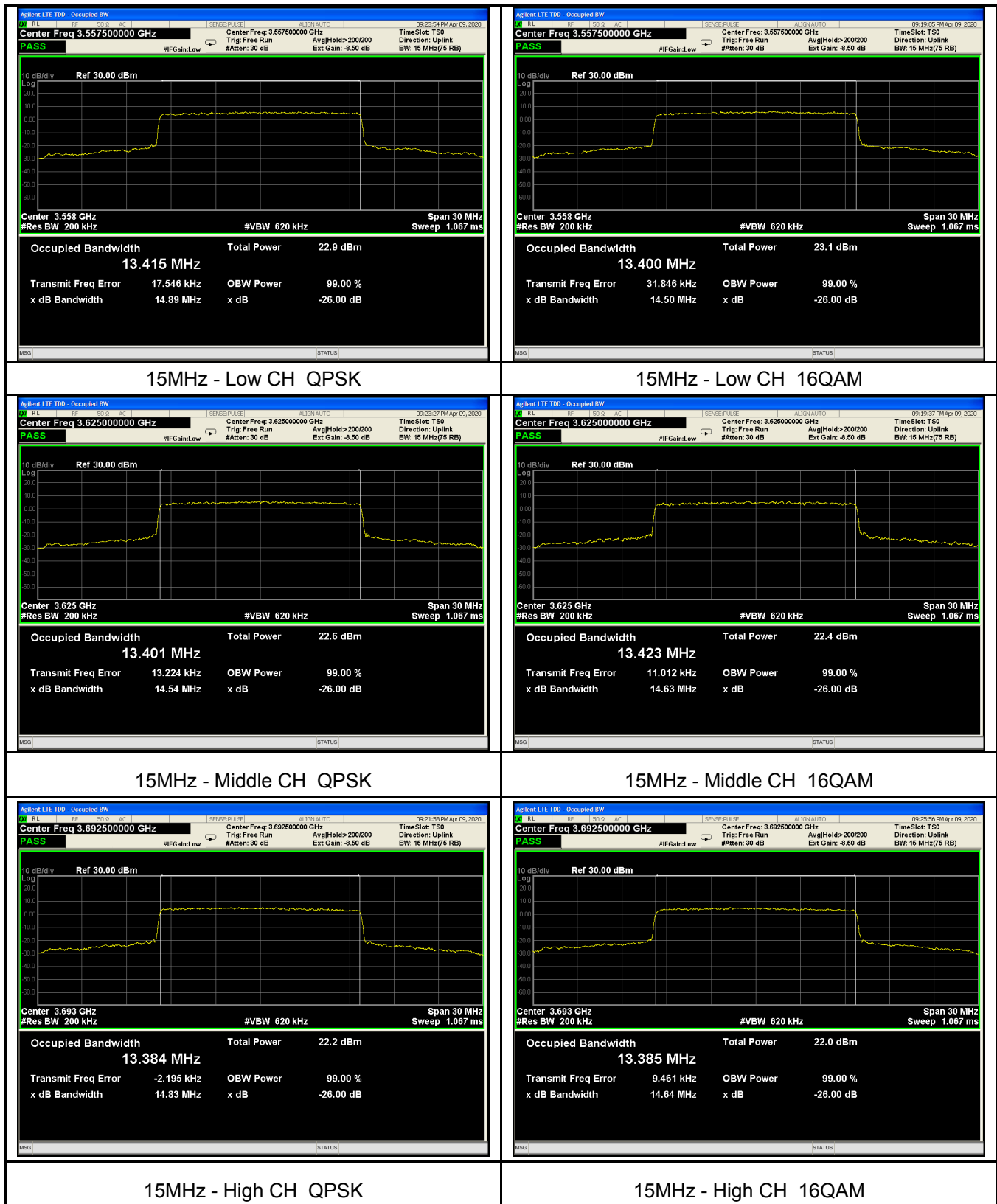
9.3 Test Result

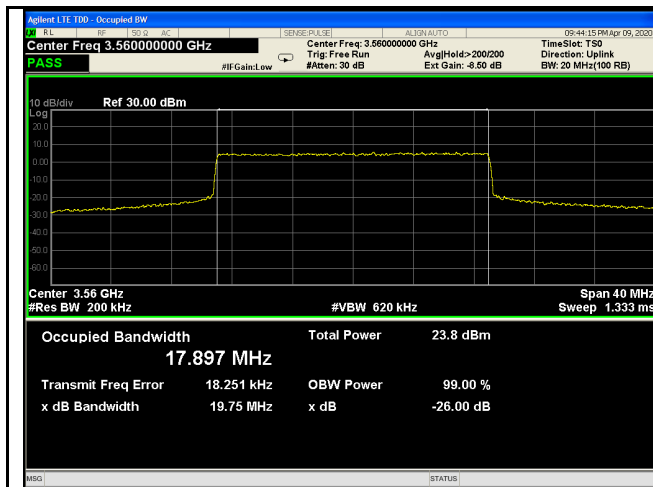
Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
5	QPSK	Low	5.411	4.4977
		Middle	5.379	4.5045
		High	5.418	4.5001
	16QAM	Low	5.826	4.4841
		Middle	5.398	4.5019
		High	5.765	4.4993
Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
10	QPSK	Low	9.923	8.9296
		Middle	9.709	8.9421
		High	9.963	8.9276
	16QAM	Low	10.070	8.9358
		Middle	9.978	8.9249
		High	9.948	8.9242
Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
15	QPSK	Low	14.89	13.415
		Middle	14.54	13.401
		High	14.83	13.384
	16QAM	Low	14.50	13.400
		Middle	14.63	13.423
		High	14.64	13.385
Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
20	QPSK	Low	19.75	17.897
		Middle	19.88	17.904
		High	19.50	17.895
	16QAM	Low	19.92	17.922
		Middle	19.82	17.896
		High	19.93	17.898

Test Plots

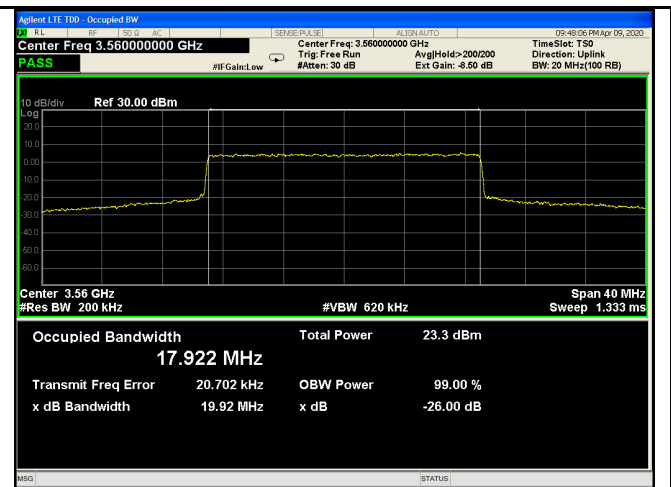




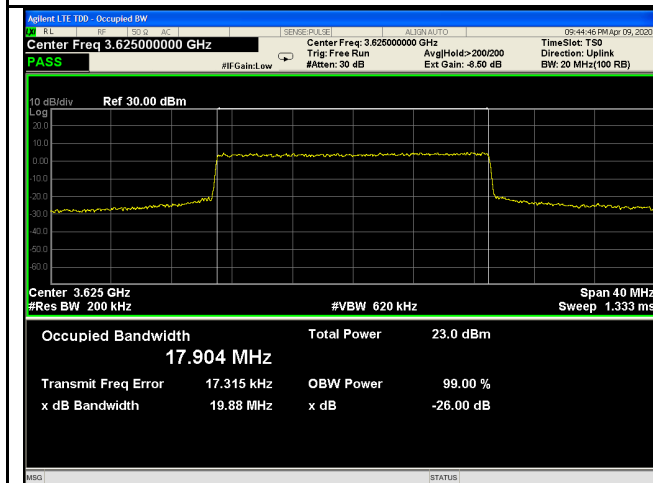




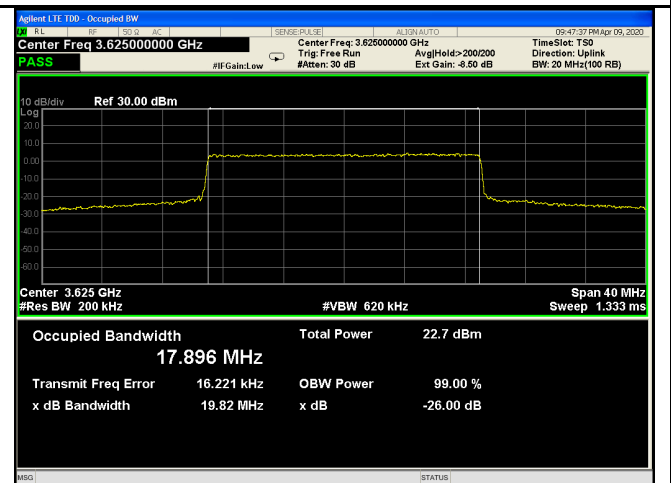
20MHz - Low CH QPSK



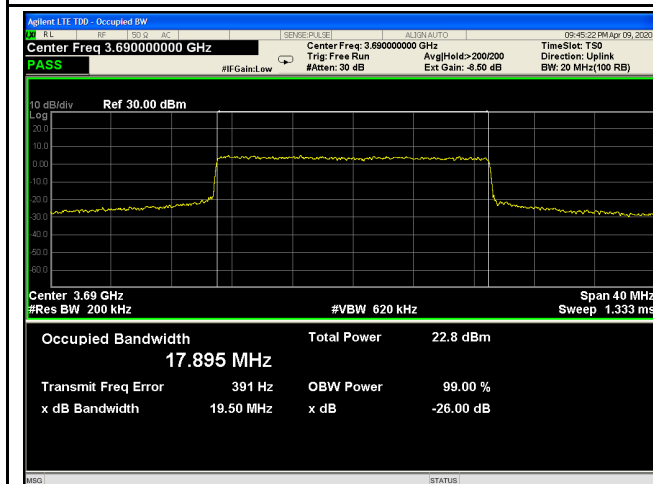
20MHz - Low CH 16QAM



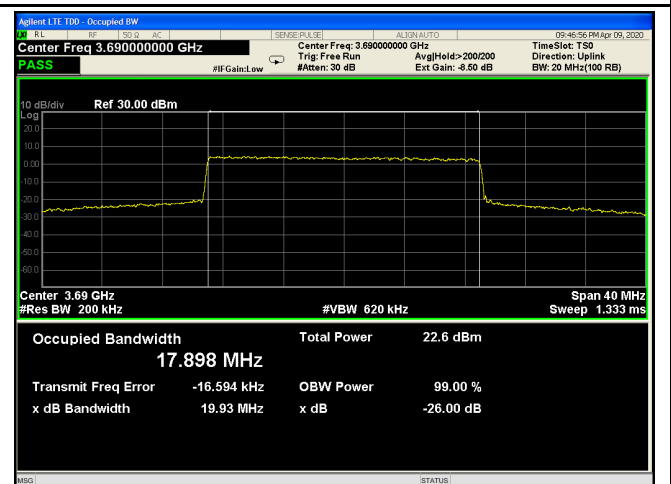
20MHz - Middle CH QPSK



20MHz - Middle CH 16QAM



20MHz - High CH QPSK



20MHz - High CH 16QAM

10 Emission outside the fundamental

Test Requirement:	FCC part 96.41(e)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	• within 0 MHz to 10 MHz above and below the assigned channel ≤ -13 dBm/MHz • greater than 10 MHz above and below the assigned channel ≤ -25 dBm/MHz • any emission below 3530 MHz and above 3720 MHz ≤ -40 dBm/MHz

10.1 EUT Operation

Operating Environment :

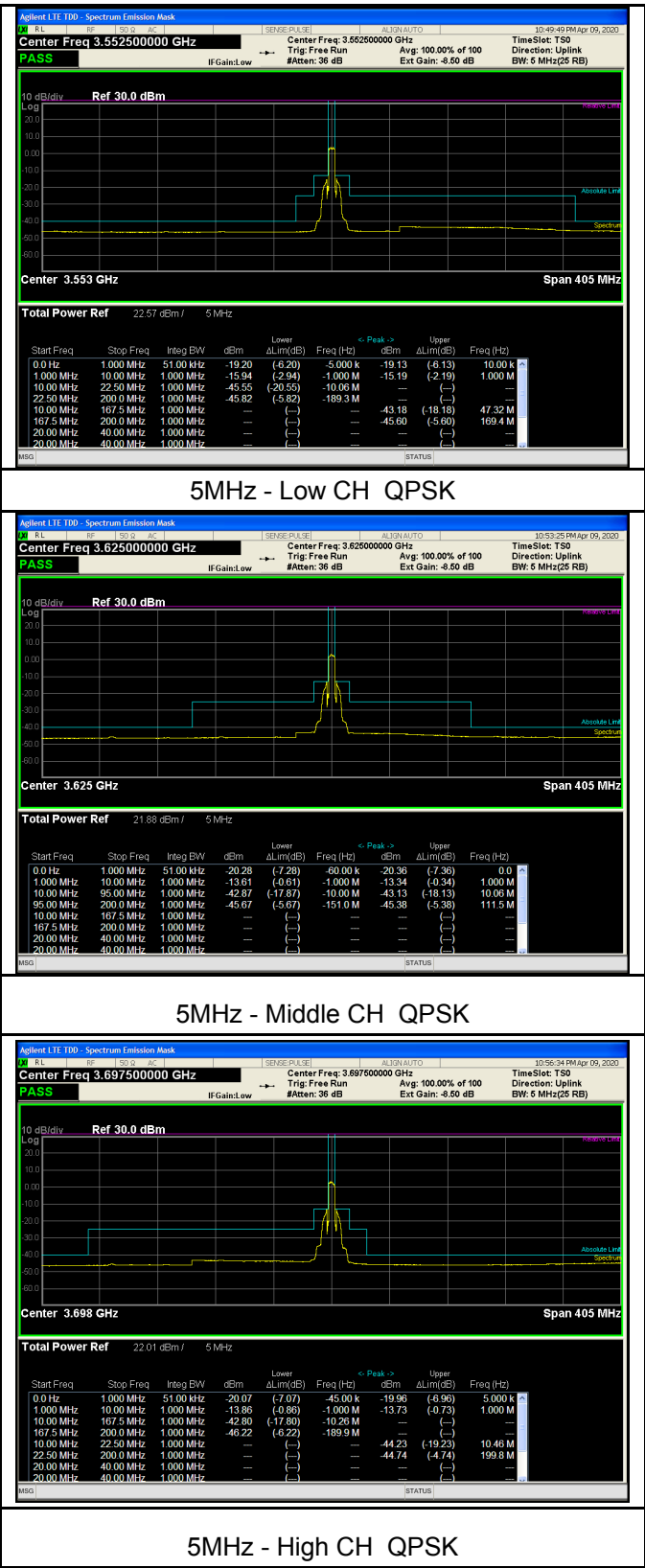
Temperature:	22.7 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	102.3kPa

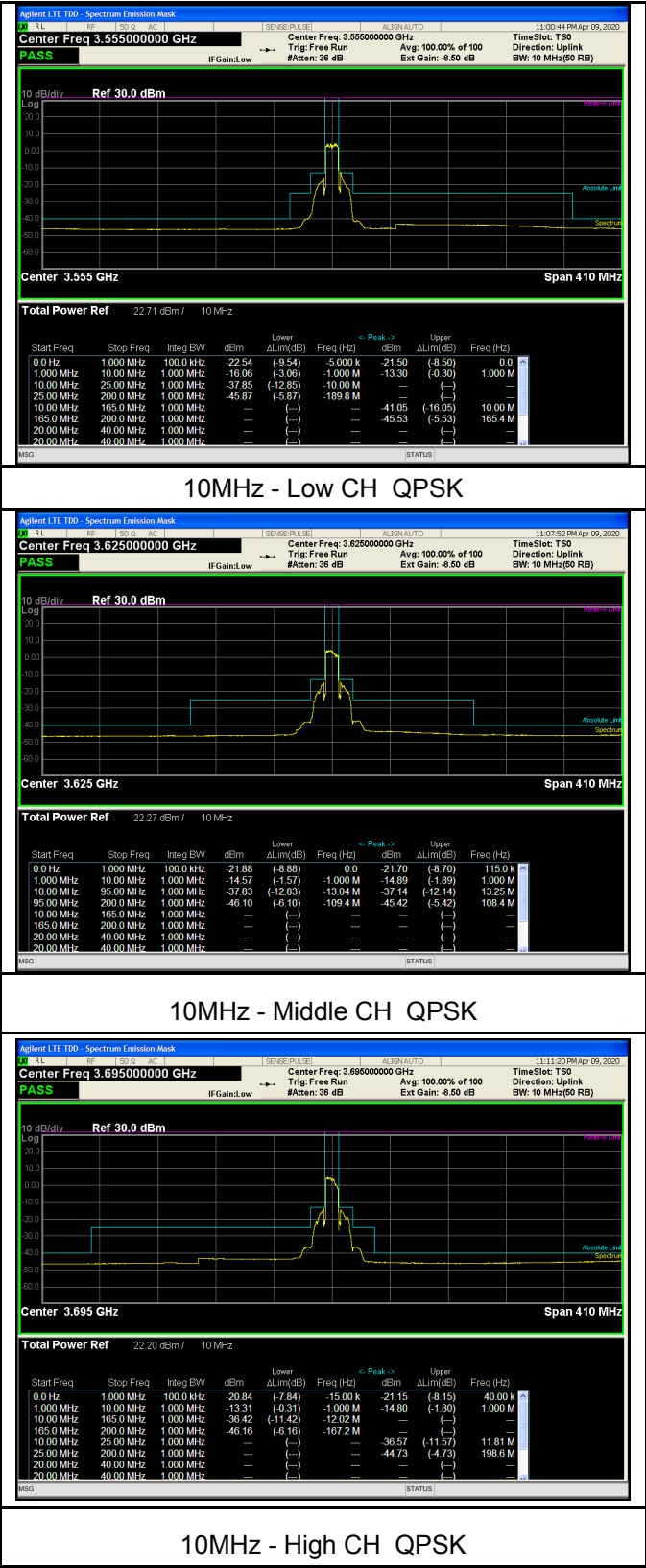
10.2 Test Procedure

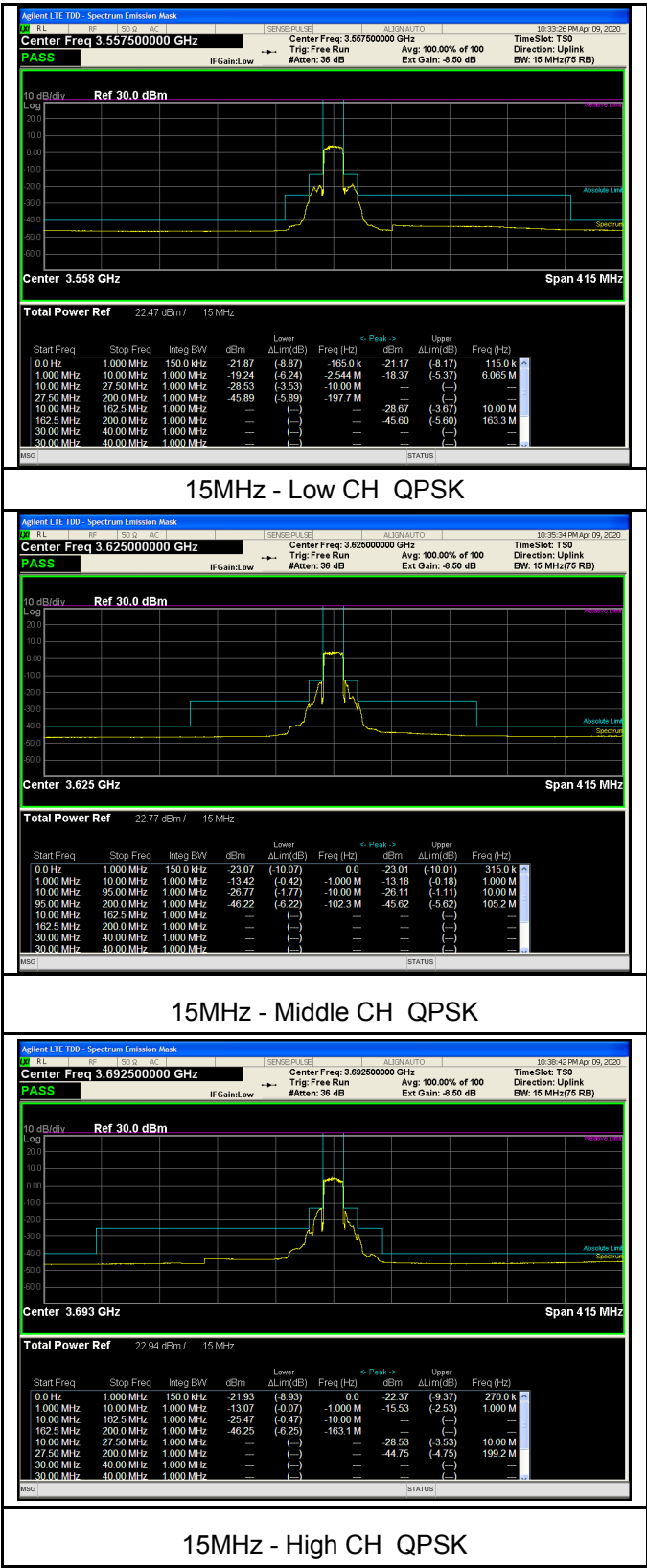
1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. Measurements must be performed for low, mid, and high channels.
3. RBW=1% of fundamental for measurements within 1 MHz immediately outside the authorized channel; and 1 MHz for beyond 1 MHz outside the authorized channel. (eg. For 5MHz, RBW=51KHz within 1 MHz immediately outside the authorized channel)
4. Trace average at least 100 traces

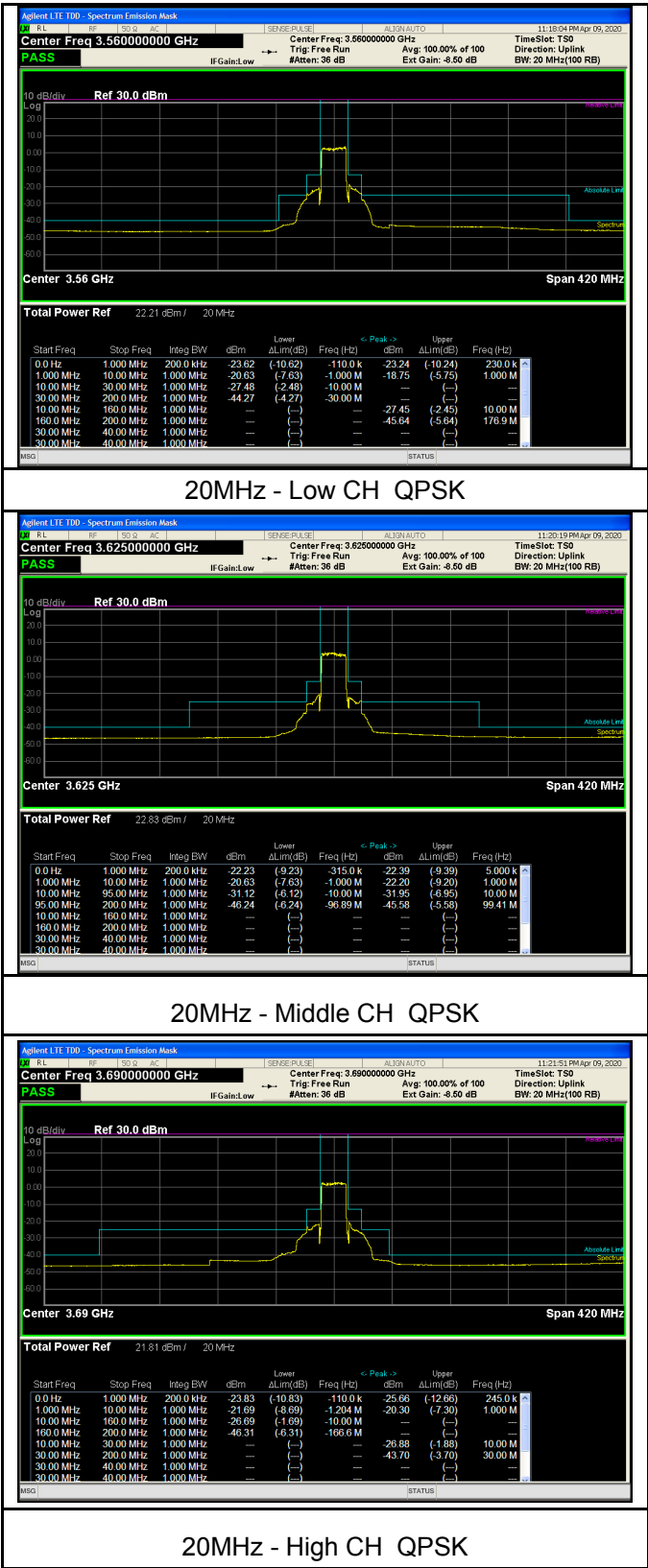
10.3 Test Result

Test Plots









11 Out of band emission at antenna terminals

Test Requirement:	FCC part 96.41(e)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	below 3530 MHz and above 3720 MHz $\leq$ -40dBm

11.1 EUT Operation

Operating Environment :

Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.3kPa

11.2 Test Procedure

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was 1MHz; sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

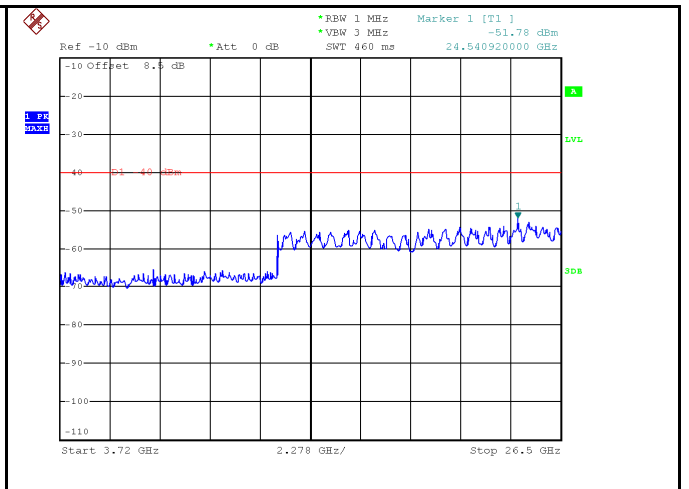
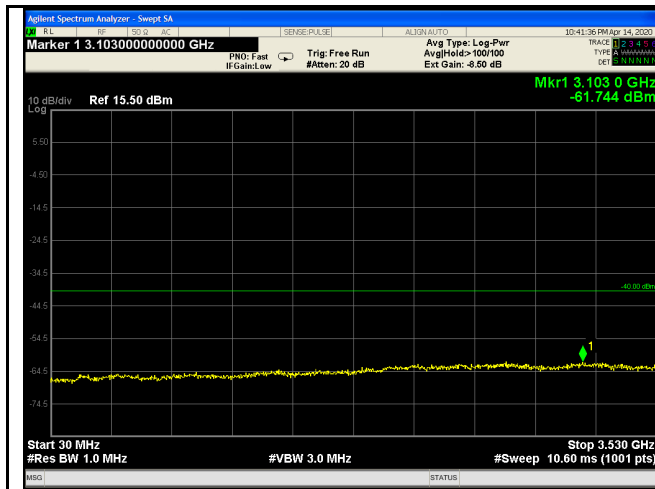
11.3 Test Result

Remark: During the test, pre-scan the QPSK, 16QAM modulation, and found the QPSK modulation(5MHz/10MHz/15MHz/20MHz) is the worst case.

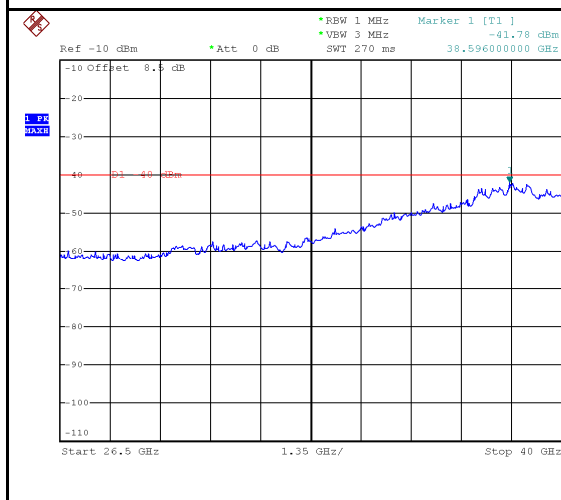
The permit frequency range of Part 96 is from 3550-3700MHz. Notes as below:

Test Plots

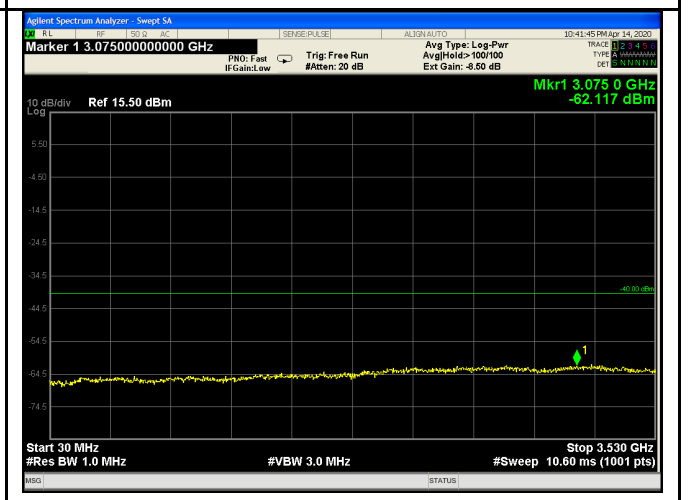
Spurious emission



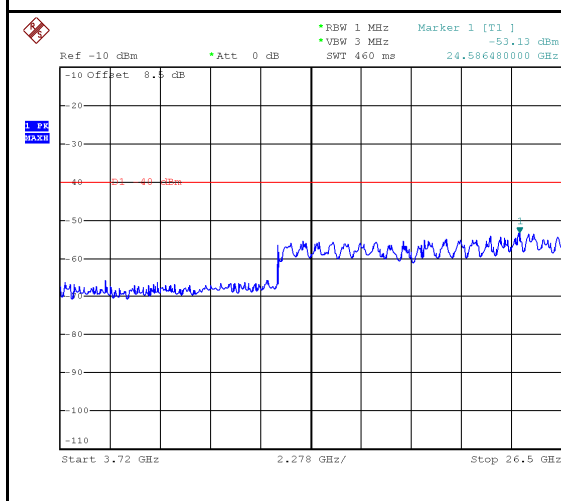
5MHz - Low CH 30MHz~3.53GHz



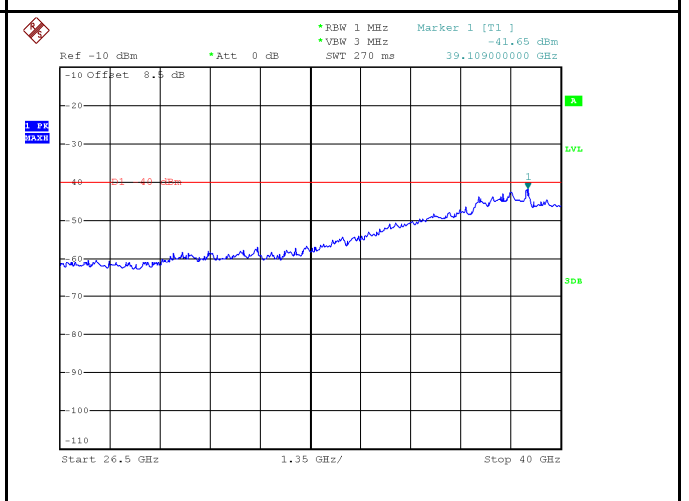
5MHz - Low CH 3.72GHz~26.5GHz



5MHz - Low CH 26.5GHz~40GHz

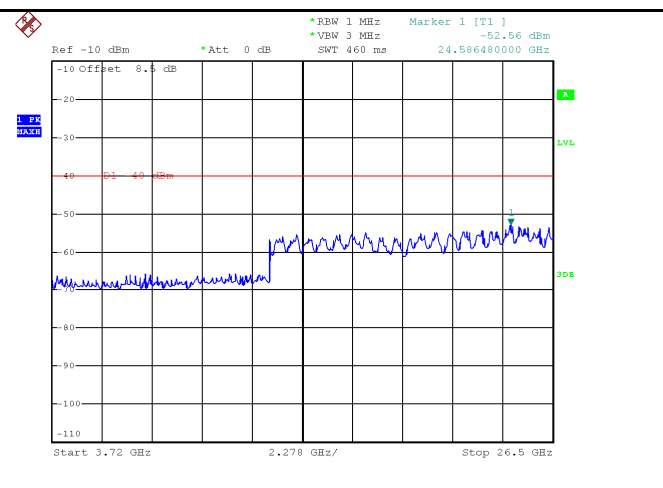
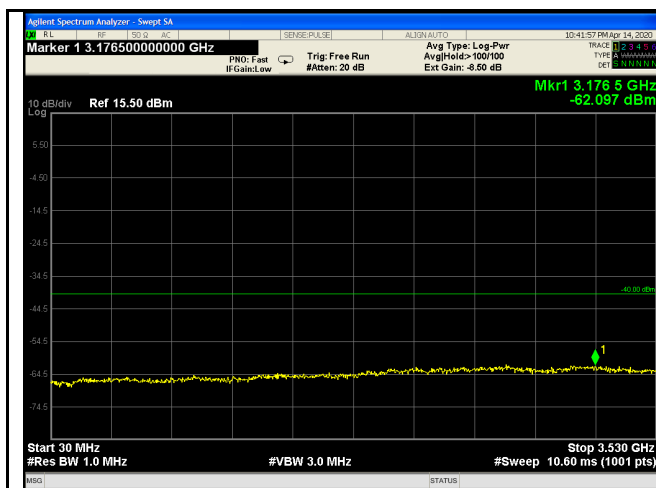


5MHz - Middle CH 30MHz~3.53GHz

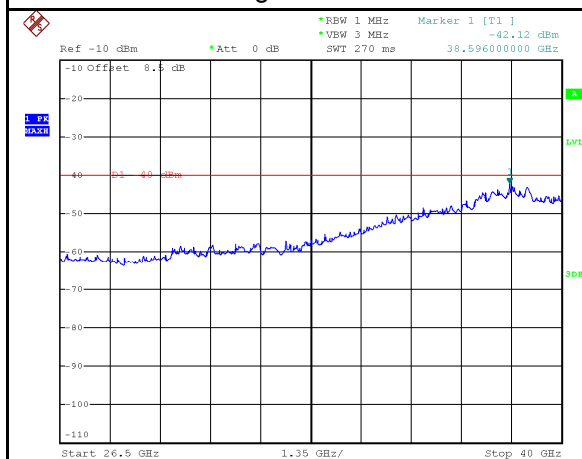


5MHz - Middle CH 3.72GHz~26.5GHz

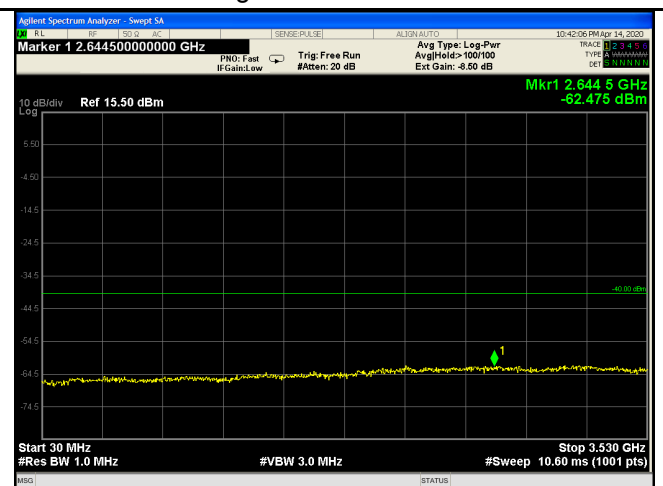
5MHz - Middle CH 26.5GHz~40GHz



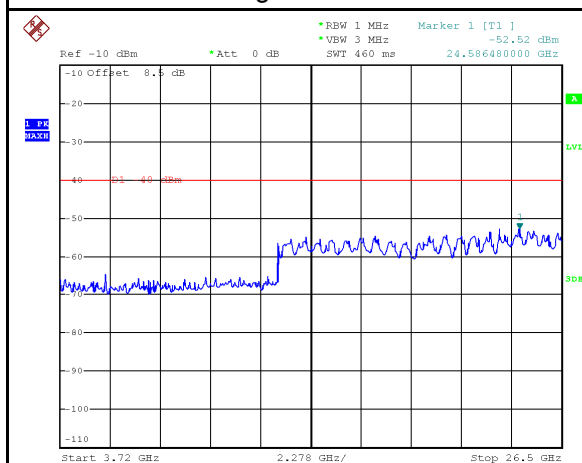
5MHz - High CH 30MHz~3.53GHz



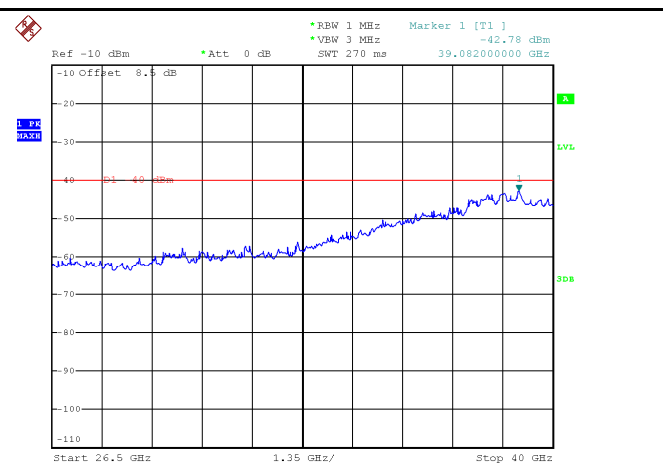
5MHz - High CH 3.72GHz~26.5GHz



5MHz - High CH 26.5GHz~40GHz

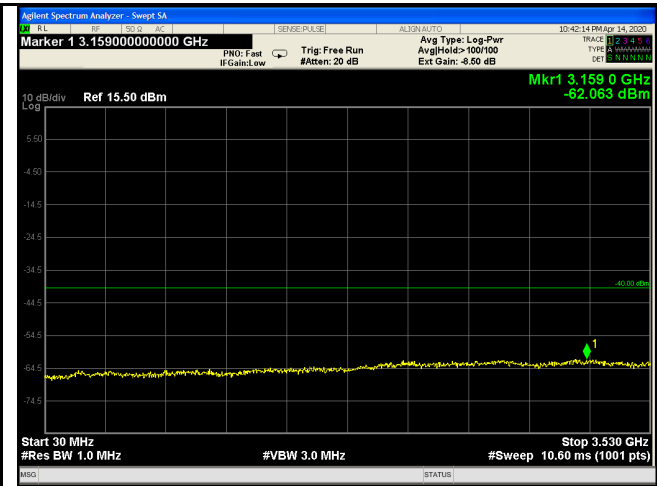


10MHz - Low CH 30MHz~3.53GHz

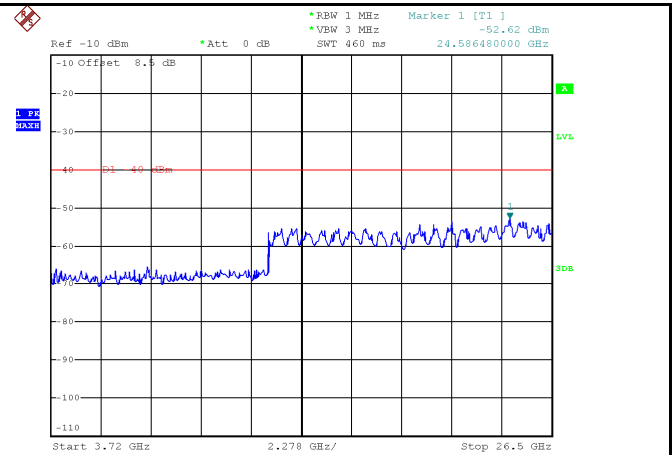


10MHz - Low CH 3.72GHz~26.5GHz

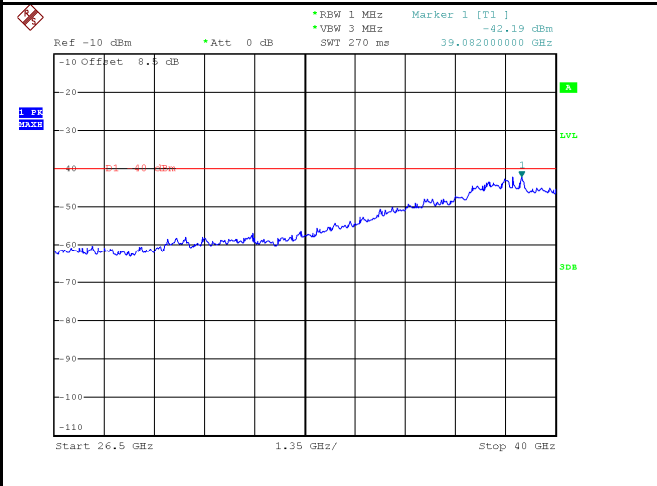
10MHz - Low CH 26.5GHz~40GHz



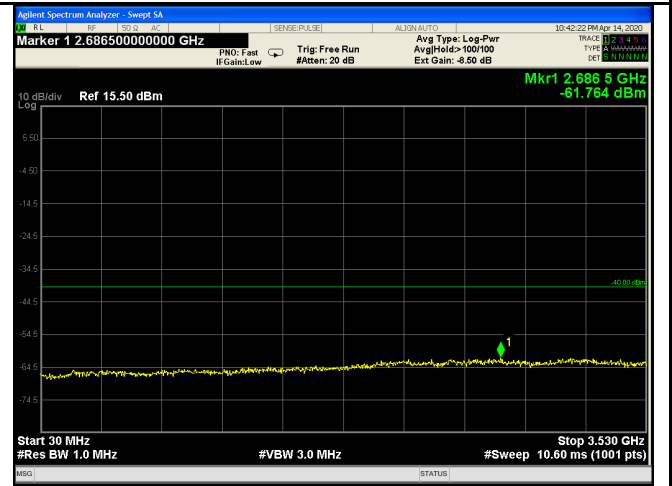
10MHz - Middle CH 30MHz~3.53GHz



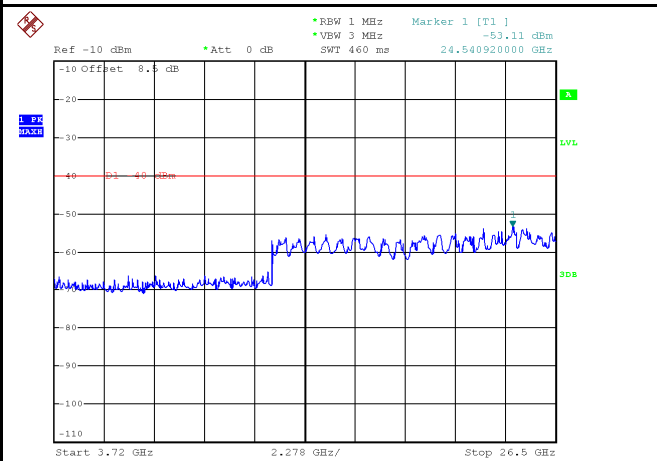
10MHz - Middle CH 3.72GHz~26.5GHz



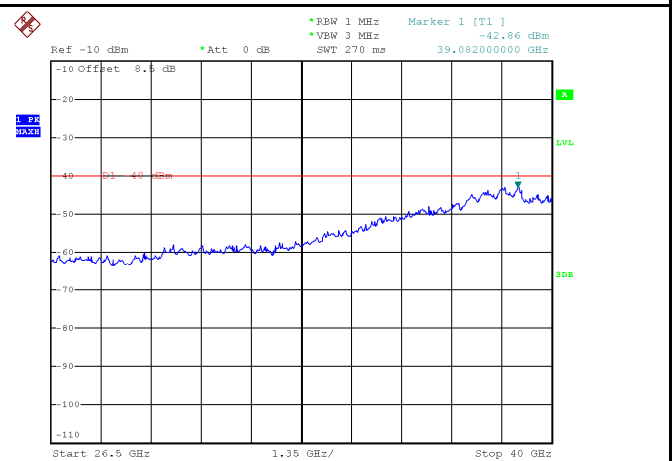
10MHz - Middle CH 26.5GHz~40GHz



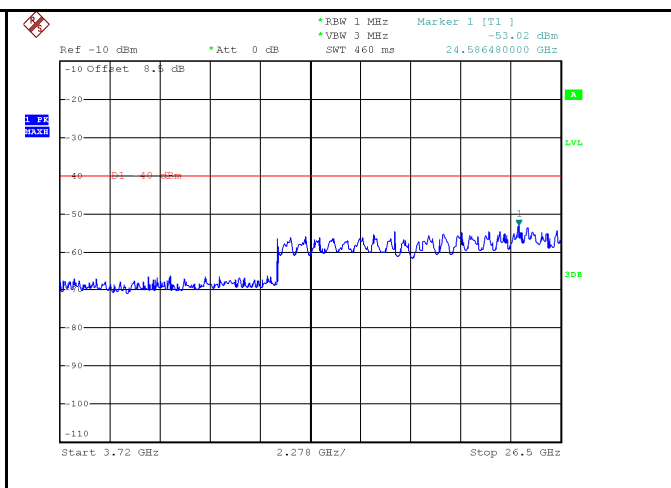
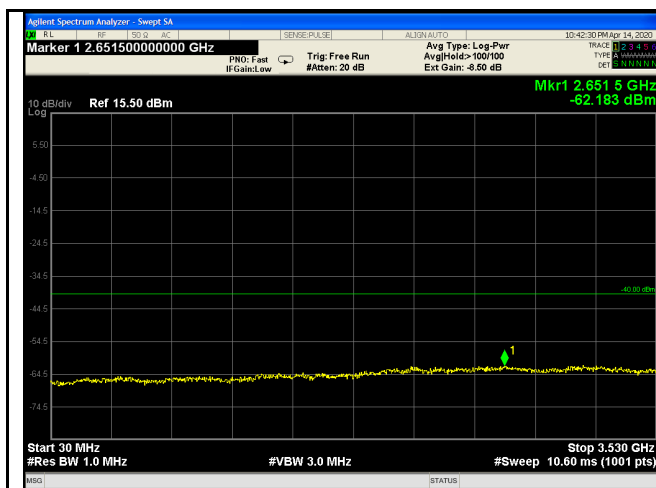
10MHz - High CH 30MHz~3.53GHz



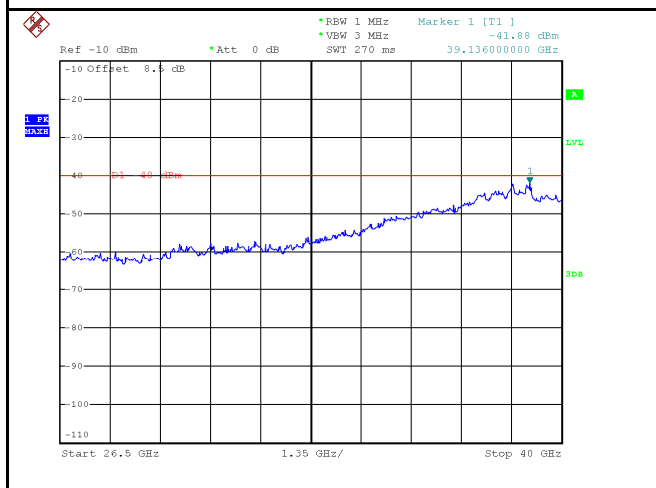
10MHz - High CH 3.72GHz~26.5GHz



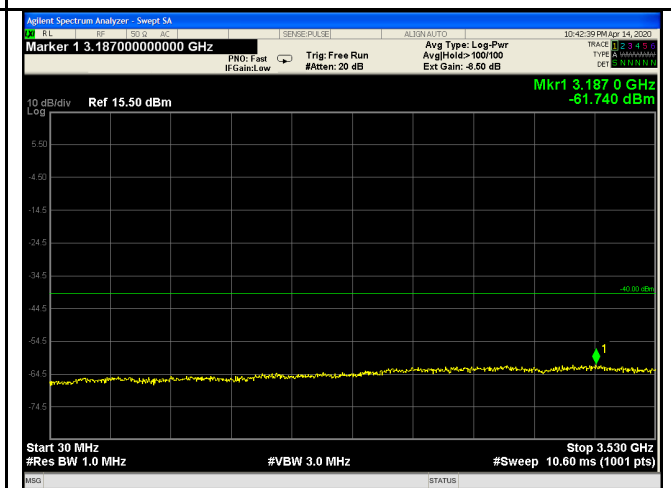
10MHz - High CH 26.5GHz~40GHz



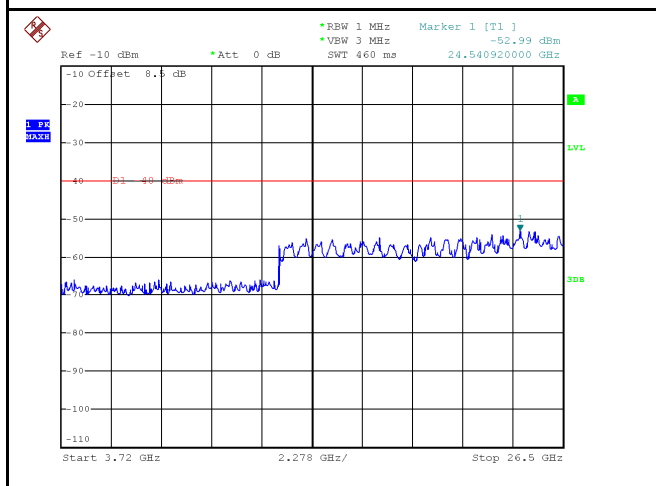
15MHz - Low CH 30MHz~3.53GHz



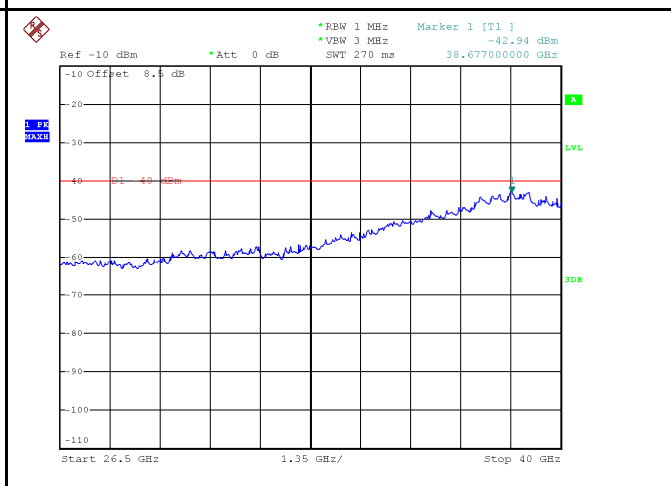
15MHz - Low CH 3.72GHz~26.5GHz



15MHz - Low CH 26.5GHz~40GHz

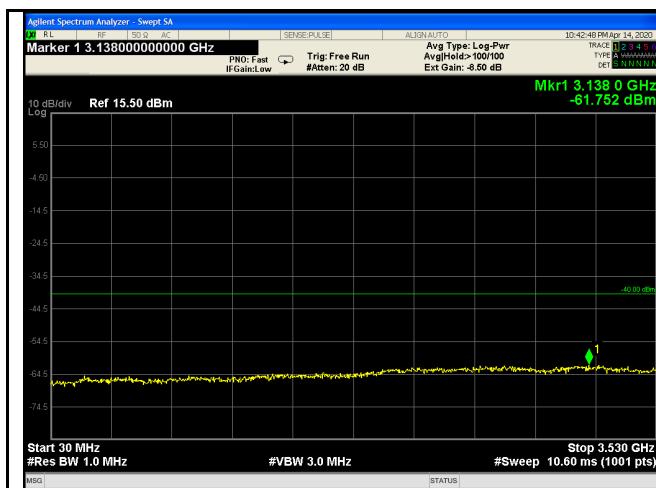


15MHz - Middle CH 30MHz~3.53GHz

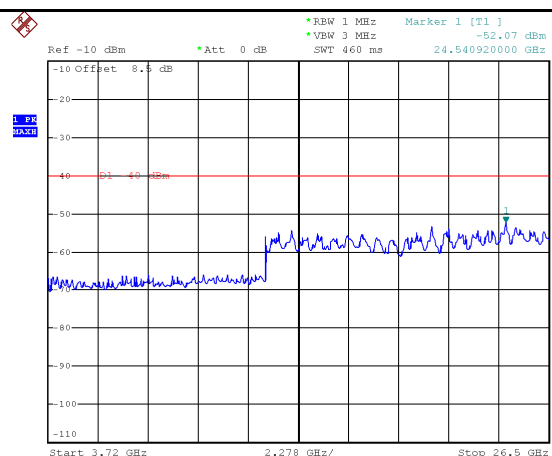


15MHz - Middle CH 3.72GHz~26.5GHz

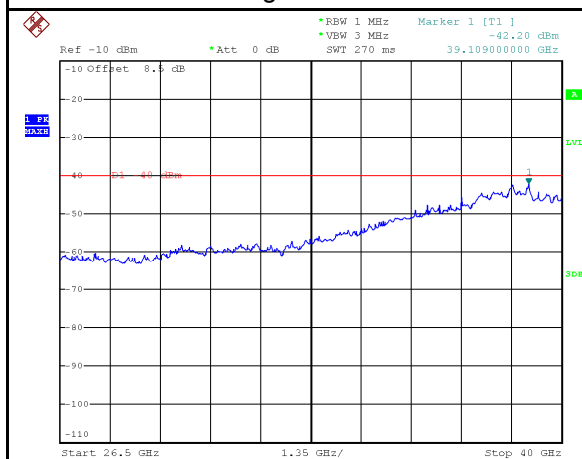
15MHz - Middle CH 26.5GHz~40GHz



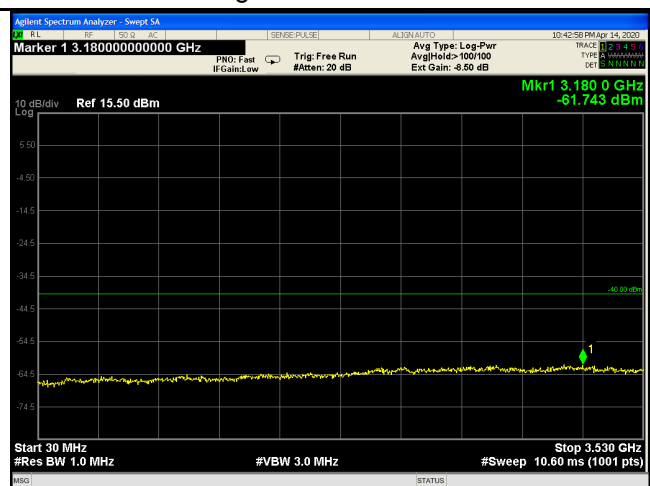
15MHz - High CH 30MHz~3.53GHz



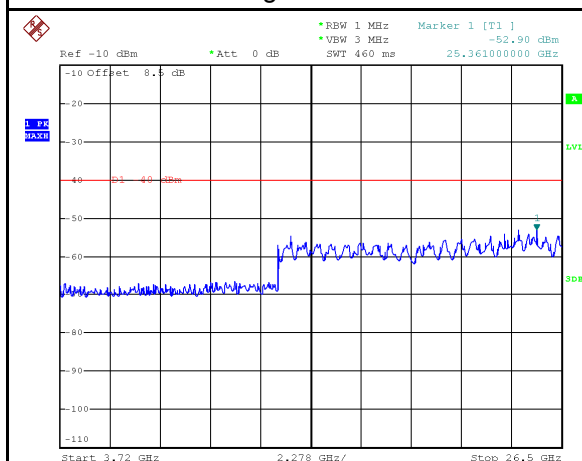
15MHz - High CH 3.72GHz~26.5GHz



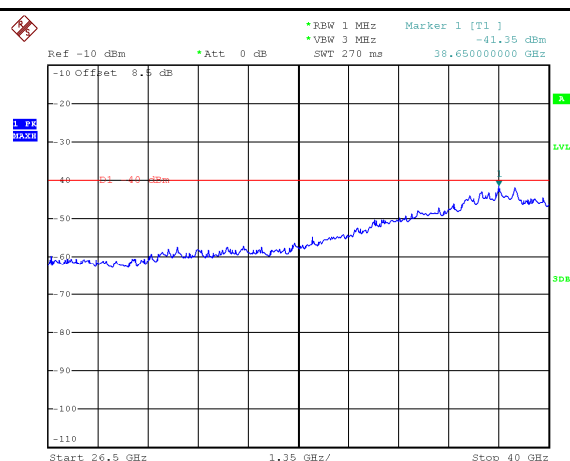
15MHz - High CH 26.5GHz~40GHz



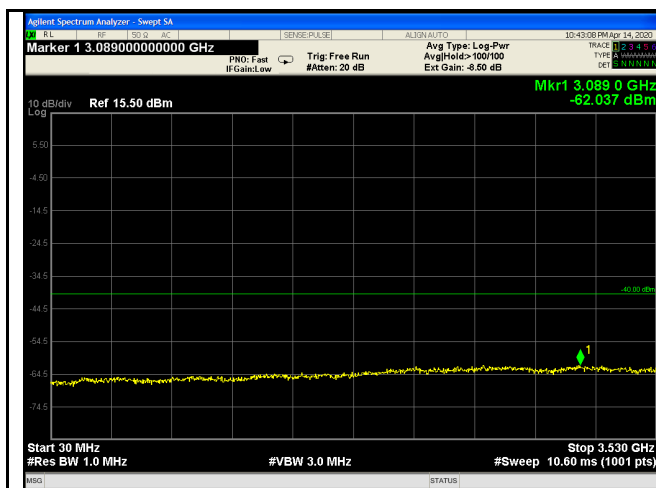
20MHz - Low CH 30MHz~3.53GHz



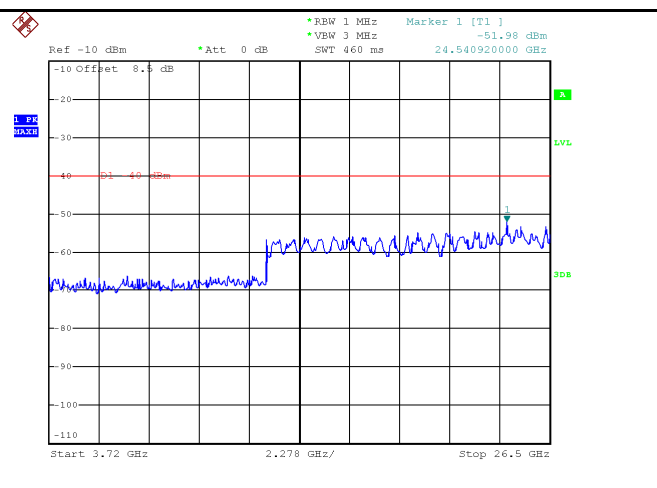
20MHz - Low CH 3.72GHz~26.5GHz



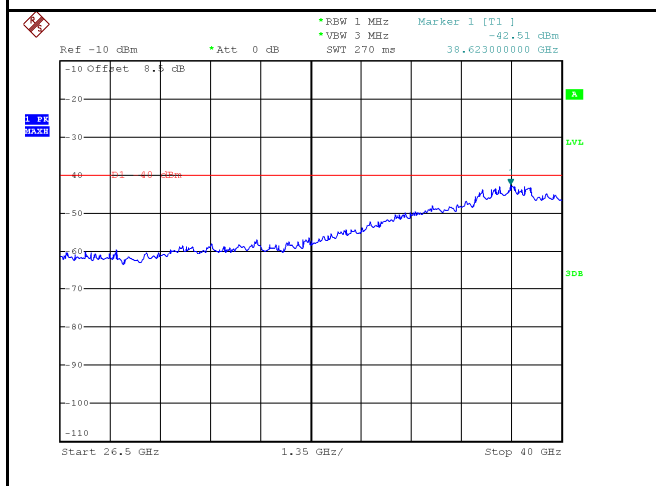
20MHz - Low CH 26.5GHz~40GHz



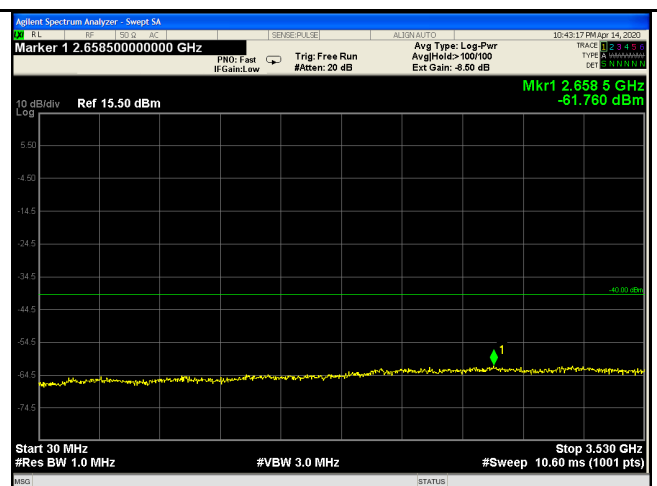
20MHz - Middle CH 30MHz~3.53GHz



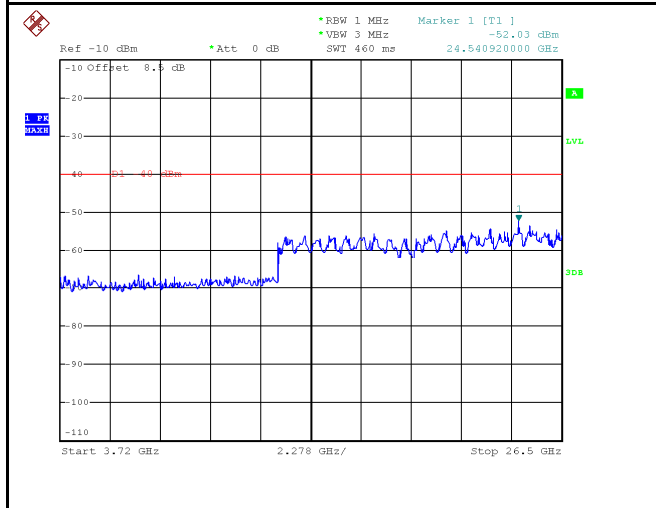
20MHz - Middle CH 3.72GHz~26.5GHz



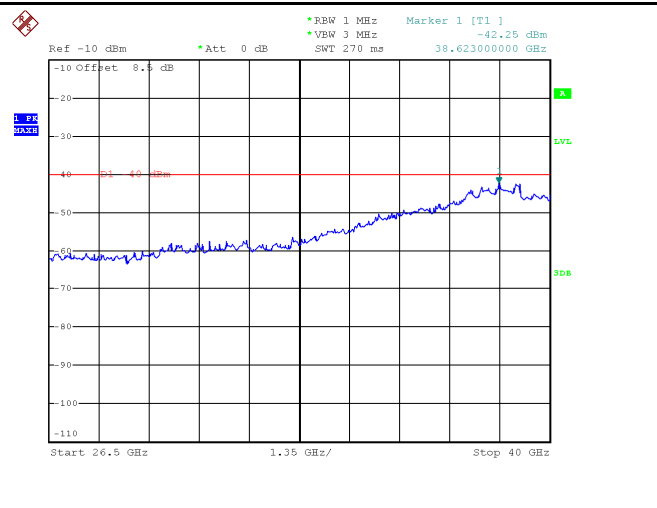
20MHz - Middle CH 26.5GHz~40GHz



20MHz - High CH 30MHz~3.53GHz



20MHz - High CH 3.72GHz~26.5GHz



20MHz - High CH 26.5GHz~40GHz

12 Field strength of spurious radiation measurement

Test Requirement:	FCC part 96.41(e)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	-40dBm

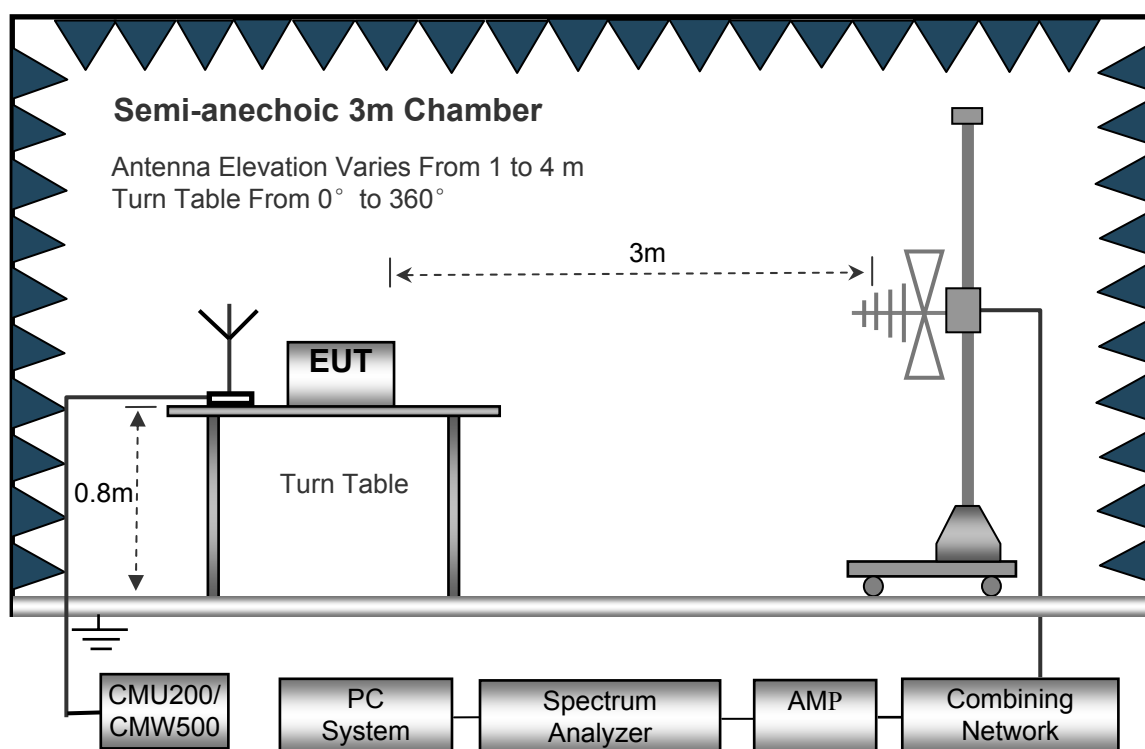
12.1 EUT Operation

Operating Environment :

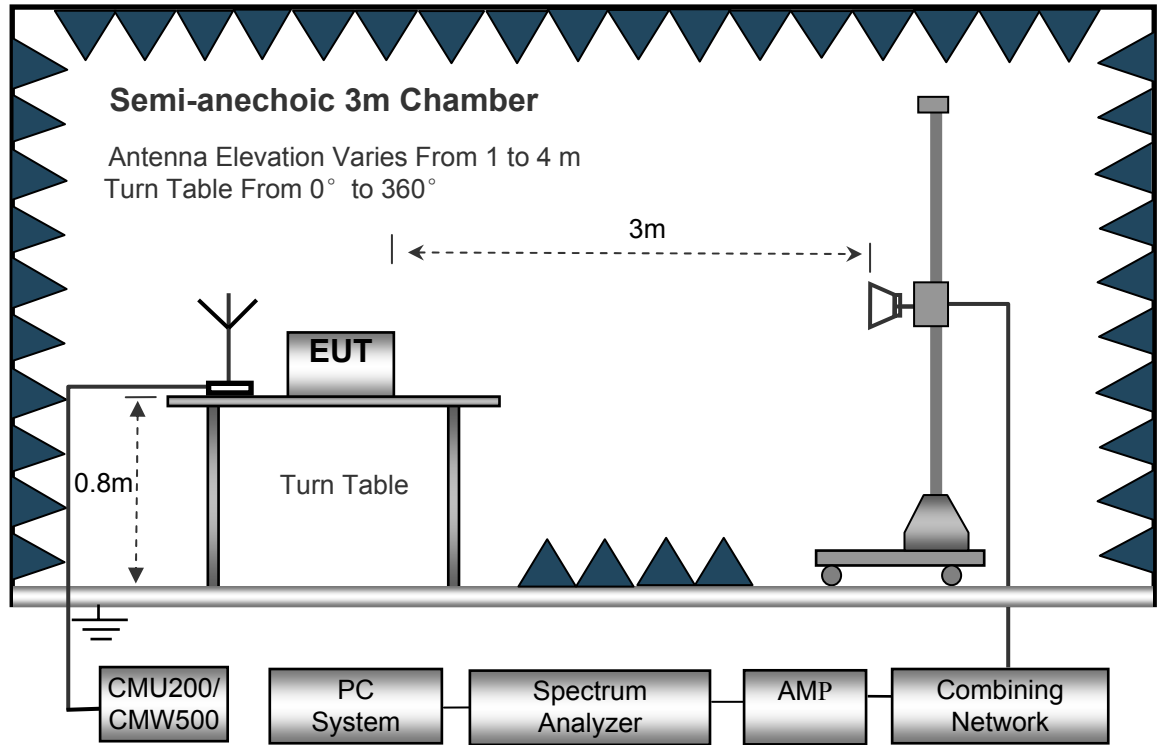
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

12.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site. The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



12.3 Spectrum Analyzer Setup

30MHz ~ 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz

Above 1GHz

Sweep Speed Auto
Detector PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz

12.4 Test Procedure

1. The EUT was placed on a non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.
2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.
3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method.
4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency.

$$\text{ERP / EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain(dB/dBi)} - \text{Cable Loss (dB)}$$

12.5 Test Result

30MHz-18GHz

Remark: During the test, pre-scan the QPSK, 16QAM modulation, and found the QPSK modulation and 20MHz bandwidth is the worst case.

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
Low channel										
223.12	52.85	358	1.5	H	-57.66	0.15	0.00	-57.81	-13.00	-44.81
223.12	45.04	301	1.4	V	-62.55	0.15	0.00	-62.70	-13.00	-49.70
7110.00	65.95	251	1.3	H	-47.10	2.34	12.40	-37.04	-13.00	-24.04
7110.00	59.98	53	1.2	V	-51.17	2.34	12.40	-41.11	-13.00	-28.11
10665.00	53.58	229	1.3	H	-55.83	2.79	12.70	-45.92	-13.00	-32.92
10665.00	44.73	134	2.2	V	-64.04	2.79	12.70	-54.13	-13.00	-41.13
Middle channel										
223.12	52.20	269	1.7	H	-58.31	0.15	0.00	-58.46	-13.00	-45.46
223.12	45.13	61	1.8	V	-62.46	0.15	0.00	-62.61	-13.00	-49.61
7250.00	59.38	103	1.1	H	-53.67	2.37	12.50	-43.54	-13.00	-30.54
7250.00	52.39	257	1.4	V	-58.76	2.37	12.50	-48.63	-13.00	-35.63
10875.00	45.94	213	1.8	H	-63.47	2.79	12.70	-53.56	-13.00	-40.56
10875.00	37.61	210	1.2	V	-71.16	2.79	12.70	-61.25	-13.00	-48.25
High channel										
223.12	51.75	358	1.4	H	-58.76	0.15	0.00	-58.91	-13.00	-45.91
223.12	46.09	178	1.4	V	-61.50	0.15	0.00	-61.65	-13.00	-48.65
7390.00	51.82	172	1.7	H	-60.82	2.37	12.50	-50.69	-13.00	-37.69
7390.00	44.67	56	1.1	V	-66.06	2.37	12.50	-55.93	-13.00	-42.93
11085.00	39.41	320	2.1	H	-70.17	2.81	12.80	-60.18	-13.00	-47.18
11085.00	31.52	202	2.0	V	-77.28	2.81	12.80	-67.29	-13.00	-54.29

Remark:

Test Frequency: 18GHz~40GHz

The measurements were more than 20 dB below the limit and not recorded.

13 Frequency stability V.S. Temperature measurement

Test Requirement: FCC Part2.1055
 Test Method: FCC Part2.1055
 Test Mode: Data communicating mode
 Limit:

Frequency range (MHz)	Fixed and base stations (ppm)	Mobile stations (ppm)	
		Over 2 watts output power	2 watts or less output power
Below 25	100	100	200
25-50	20	20	50
72-76	5		50
150-174	5	5	50
216-220	1.0		1.0
220-222	0.1	1.5	1.5
421-512	2.5	5	5
806-809	1.0	1.5	1.5
809-824	1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450			

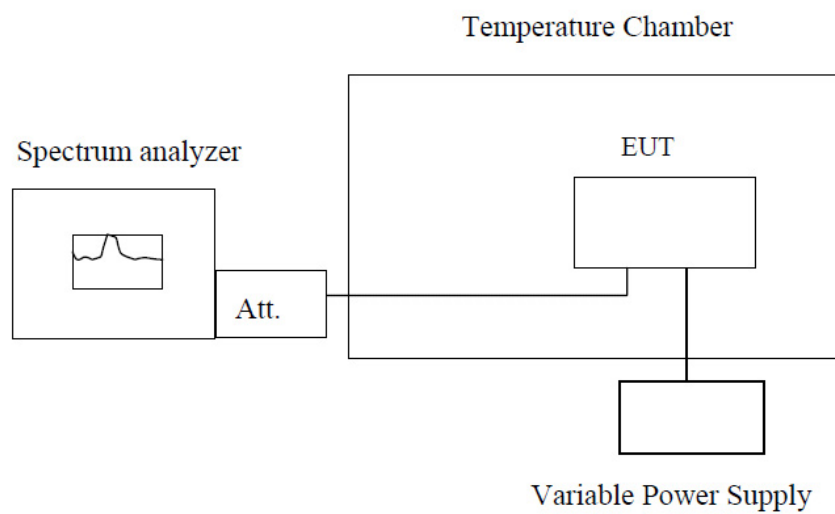
13.1 EUT Operation

Operating Environment :

Temperature: 23.6 °C
 Humidity: 52.2 % RH
 Atmospheric Pressure: 101.3kPa

13.2 Test Procedure

1. The equipment under test was connected to an external DC power supply and input rated voltage.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to -30°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.



Note : Measurement setup for testing on Antenna connector

13.3 Test Result

Remark: All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Test Frequency: 3552.5MHz QPSK 5MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	93	0.0268
-25		88	0.0249
-10		97	0.0263
0		95	0.0275
10		96	0.0242
20		94	0.0296
30		94	0.0244
40		96	0.0255
55		102	0.0287

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	104	0.0263
-25		93	0.0275
-10		102	0.0299
0		97	0.0285
10		96	0.0263
20		92	0.0244
30		94	0.0264
40		92	0.0290
55		105	0.0284

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	105	0.0255
-25		107	0.0369
-10		97	0.0234
0		101	0.0285
10		106	0.0299
20		102	0.0260
30		98	0.0243
40		99	0.0285
55		96	0.0274

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	90	0.0253
-25		98	0.0320
-10		97	0.0268
0		99	0.0251
10		105	0.0284
20		96	0.0288
30		95	0.0247
40		96	0.0266
55		102	0.0270

14 Frequency stability V.S. Voltage measurement

Test Requirement: FCC Part2.1055
 Test Method: FCC Part2.1055
 Test Mode: Data communicating mode
 Limit: FCC:

Frequency range (MHz)	Fixed and base stations (±ppm)	Mobile stations (±ppm)	
		Over 2 watts output power	2 watts or less output power
Below 25	100	100	200
25-50	20	20	50
72-76	5		50
150-174	5	5	50
216-220	1.0		1.0
220-222	0.1	1.5	1.5
421-512	2.5	5	5
806-809	1.0	1.5	1.5
809-824	1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	300	300	300
Above 2450			

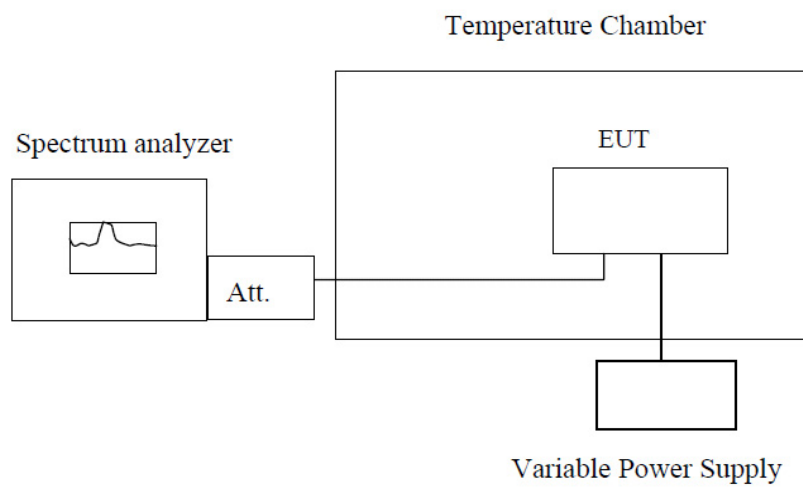
14.1 EUT Operation

Operating Environment :

Temperature: 23.7 °C
 Humidity: 52.9 % RH
 Atmospheric Pressure: 101.4kPa

14.2 Test Procedure

1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage.
2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
3. Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.



Note : Measurement setup for testing on Antenna connector

14.3 Test Result

Remark: All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Test Frequency: 3552.5MHz QPSK 5MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	94	0.0265
	120	99	0.0279
	144	97	0.0273

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	98	0.0276
	120	104	0.0293
	144	106	0.0298

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	99	0.0278
	120	94	0.0264
	144	105	0.0295

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	103	0.0289
	120	103	0.0289
	144	101	0.0284

15 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-EG7035L-Photos.

===== End of Report =====