

# TEST REPORT

**Reference No.**..... : WTS20S02005768W001 V1  
**FCC ID** ..... : 2AG32EG7035E96  
**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)** ..... : EG7035E-M11, EG7035E-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 2020-04-01  
**Date of Issue**..... : 2020-06-19  
**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.

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### 3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS20S02005 768W001	2020-02-26	2020-02-27 to 2020-04-01	2020-04-02	original	-	Replaced
WTS20S02005 768W001 V1	2020-02-26	2020-02-27 to 2020-04-01	2020-06-19	Version 1	Updated	Valid

## 4 General Information

### 4.1 General Description of E.U.T.

Product:	LTE Outdoor CPE
Model(s):	EG7035E-M11, EG7035E-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:	19.5dBi
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= $3.5+1+4=8.5(\text{dB})$

## 6 Equipment Used during Test

### 6.1 Equipments List

<b>3m Semi-anechoic Chamber for Radiation Emissions Test site 1#</b>						
<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
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
<b>3m Semi-anechoic Chamber for Radiation Emissions Test site 2#</b>						
<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
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
<b>RF Conducted Testing</b>						
<b>Item</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Last Calibration Date</b>	<b>Calibration Due Date</b>
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	$\pm 3.64$ dB(AC mains 150KHz~30MHz)
Radiated Spurious Emissions	$\pm 5.08$ dB (Bilog antenna 30M~1000MHz)
	$\pm 5.47$ dB (Horn antenna 1000M~25000MHz)
Radio Frequency	$\pm 1 \times 10^{-7}$ Hz
RF Power	$\pm 0.42$ dB
RF Power Density	$\pm 0.7$ dB
Conducted Spurious Emissions	$\pm 2.76$ 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

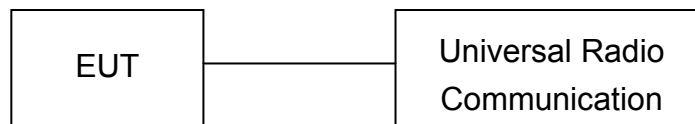
Operating Environment :

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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$G_T$  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	23.61	19.5	43.11	47
		Middle	23.66	19.5	<b>43.16</b>	
		High	23.40	19.5	42.90	
	16QAM	Low	23.79	19.5	<b>43.29</b>	
		Middle	23.55	19.5	43.05	
		High	23.33	19.5	42.83	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
5	QPSK	Low	16.55	19.5	36.05	37
		Middle	17.19	19.5	36.69	
		High	16.99	19.5	36.49	
	16QAM	Low	17.21	19.5	36.71	
		Middle	17.25	19.5	36.75	
		High	17.15	19.5	36.65	

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	23.89	19.5	<b>43.39</b>	47
		Middle	23.87	19.5	43.37	
		High	23.32	19.5	42.82	
	16QAM	Low	23.54	19.5	43.04	
		Middle	23.60	19.5	<b>43.10</b>	
		High	23.51	19.5	43.01	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
10	QPSK	Low	15.01	19.5	34.51	37
		Middle	15.00	19.5	34.50	
		High	14.52	19.5	34.02	
	16QAM	Low	14.67	19.5	34.17	
		Middle	14.90	19.5	34.40	
		High	14.33	19.5	33.83	

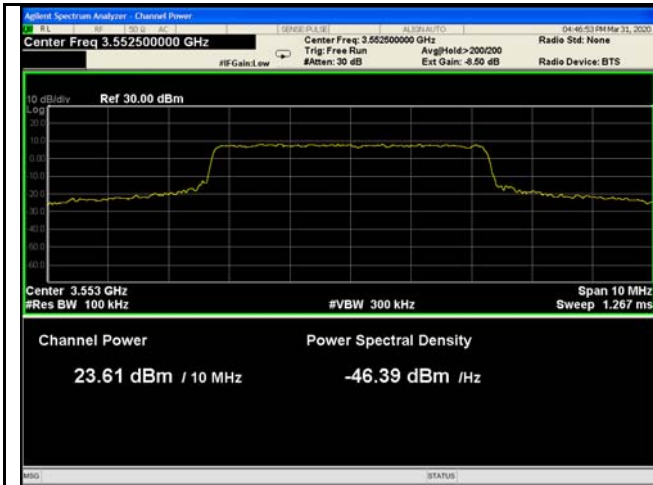
Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP Limit (dBm/10MHz)
15	QPSK	Low	22.56	19.5	42.06	47
		Middle	22.68	19.5	42.18	
		High	22.67	19.5	42.17	
	16QAM	Low	22.63	19.5	42.13	
		Middle	22.56	19.5	42.06	
		High	22.14	19.5	41.64	
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	23.50	19.5	43.00	-
		Middle	23.83	19.5	<b>43.33</b>	
		High	23.44	19.5	42.94	
	16QAM	Low	23.67	19.5	<b>43.17</b>	
		Middle	23.15	19.5	42.65	
		High	23.11	19.5	42.61	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
15	QPSK	Low	13.68	19.5	33.18	37
		Middle	13.93	19.5	33.43	
		High	13.35	19.5	32.85	
	16QAM	Low	13.32	19.5	32.82	
		Middle	13.55	19.5	33.05	
		High	13.59	19.5	33.09	

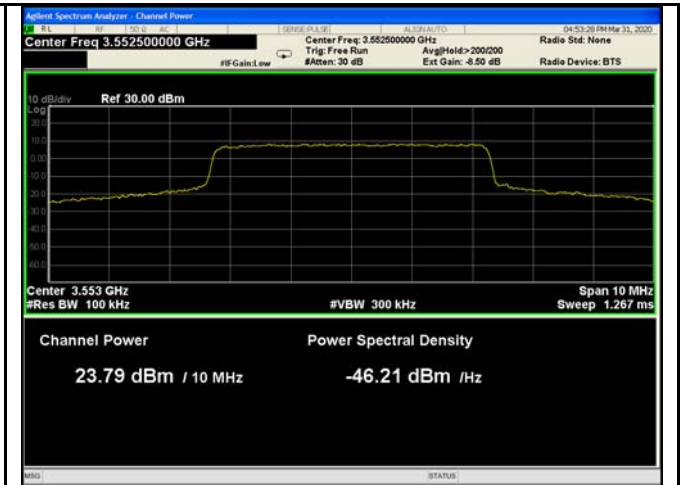
Transmit Output Power						
Bandwidth (MHz)	Modulation	Test Channel	Output Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP Limit (dBm/10MHz)
20	QPSK	Low	22.50	19.5	42.00	47
		Middle	22.21	19.5	41.71	
		High	22.05	19.5	41.55	
	16QAM	Low	21.82	19.5	41.32	
		Middle	22.13	19.5	41.63	
		High	21.94	19.5	41.44	
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	23.85	19.5	43.35	-
		Middle	23.92	19.5	43.42	
		High	23.93	19.5	<b>43.43</b>	
	16QAM	Low	23.36	19.5	<b>42.86</b>	
		Middle	23.24	19.5	42.74	
		High	23.00	19.5	42.50	

PSD						
Bandwidth (MHz)	Modulation	Test Channel	PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP density (dBm/MHz)	EIRP density Limit (dBm/MHz)
20	QPSK	Low	12.43	19.5	31.93	37
		Middle	12.27	19.5	31.77	
		High	12.38	19.5	31.88	
	16QAM	Low	11.98	19.5	31.48	
		Middle	11.62	19.5	31.12	
		High	11.65	19.5	31.15	

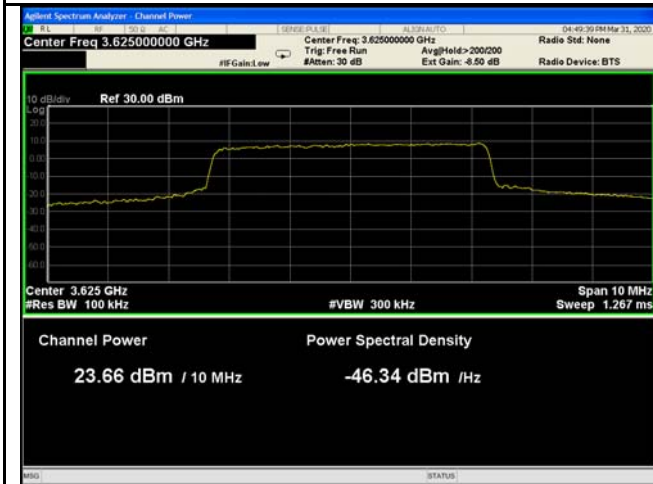
Transmit Output Power Test Plots



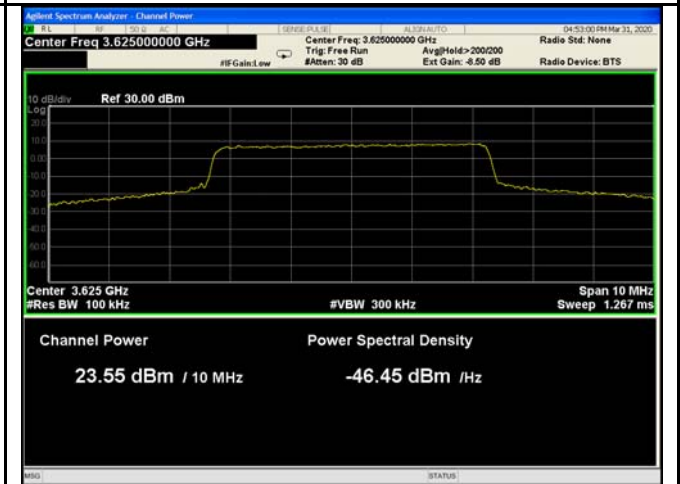
5MHz - Low CH QPSK



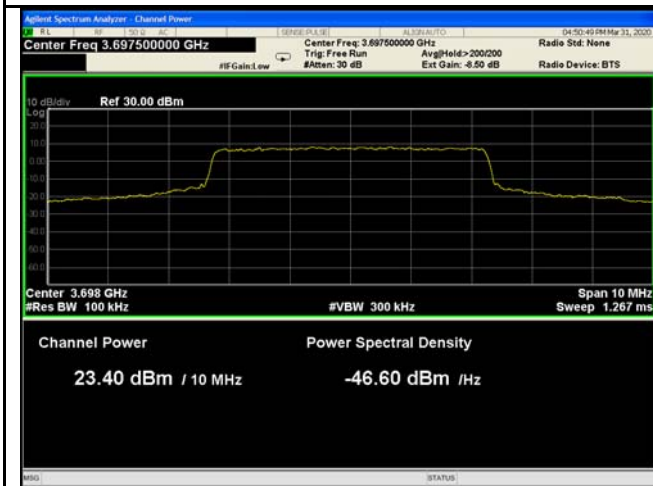
5MHz - Low CH 16QAM



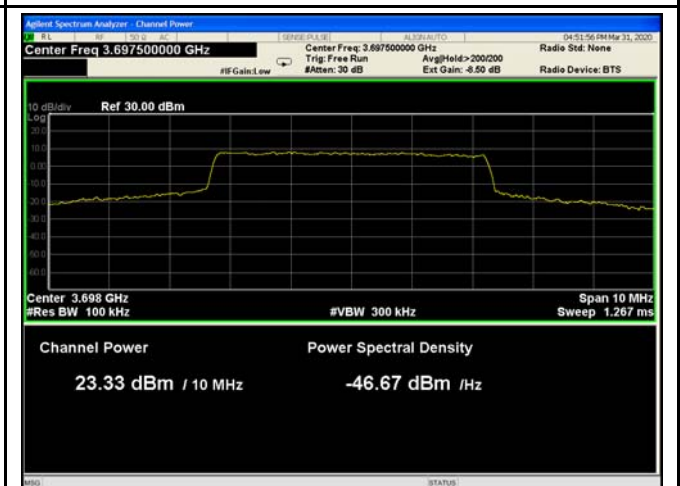
5MHz - Middle CH QPSK



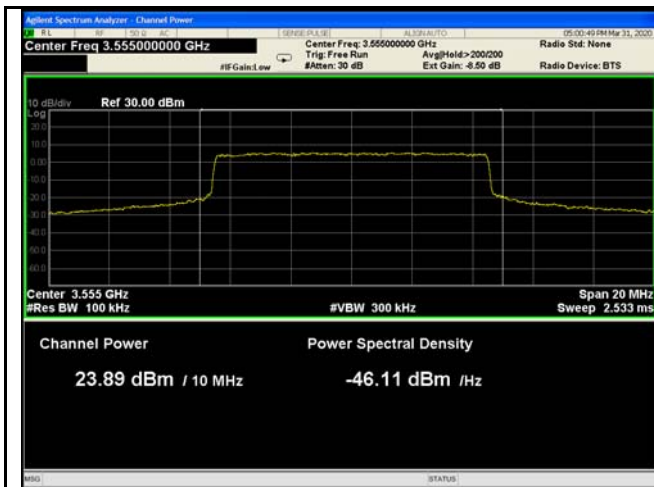
5MHz - Middle CH 16QAM



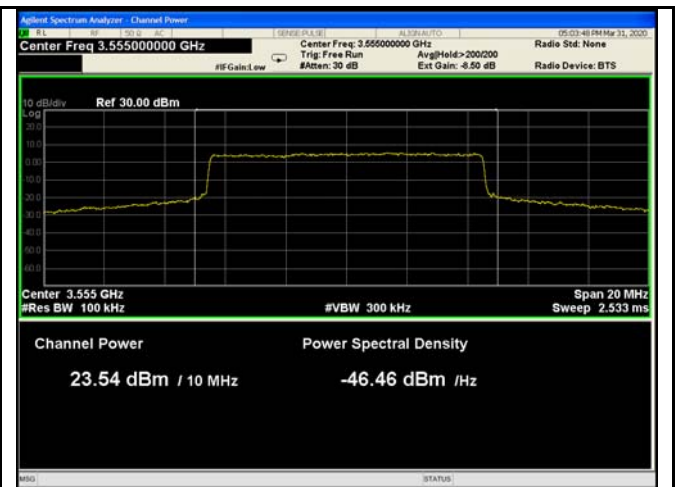
5MHz - High CH QPSK



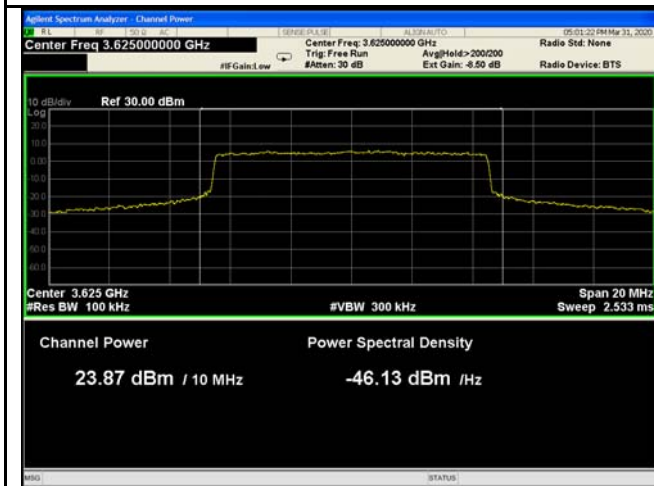
5MHz - High CH 16QAM



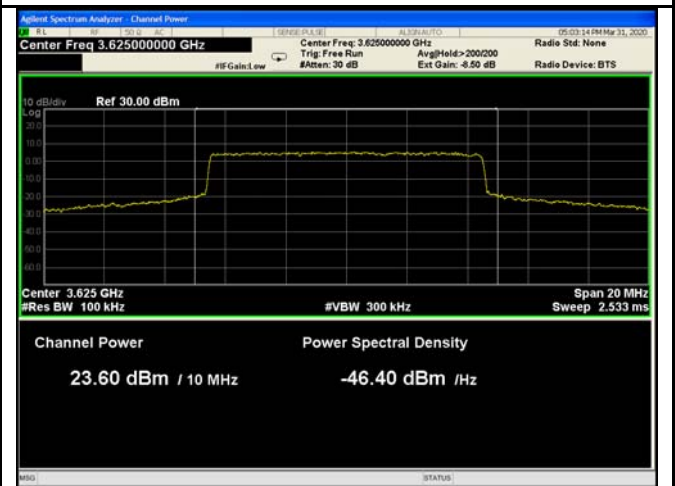
10MHz - Low CH QPSK



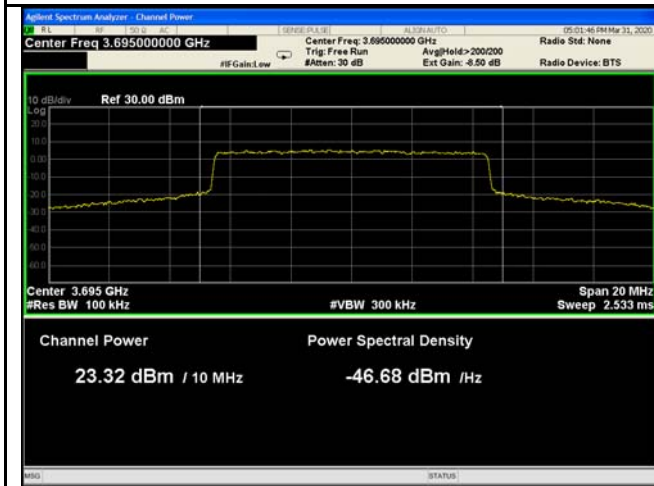
10MHz - Low CH 16QAM



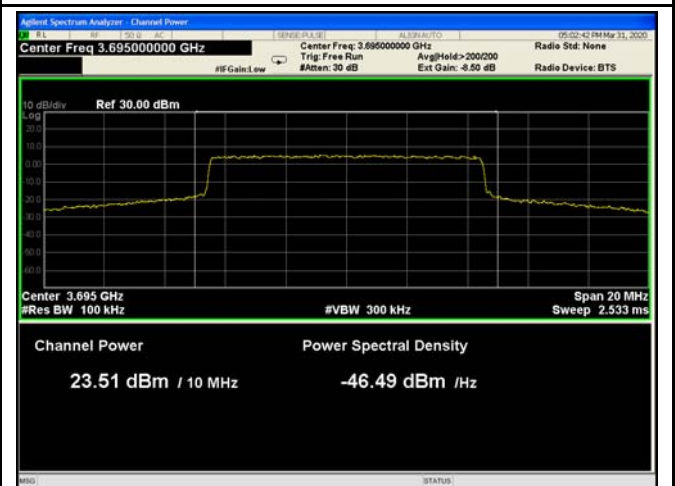
10MHz - Middle CH QPSK



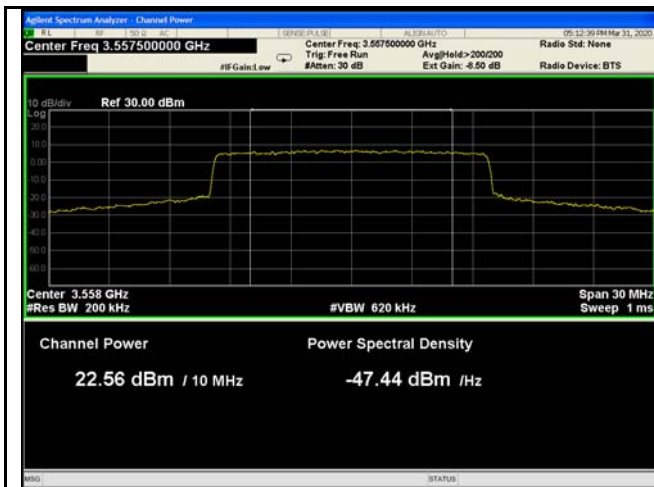
10MHz - Middle CH 16QAM



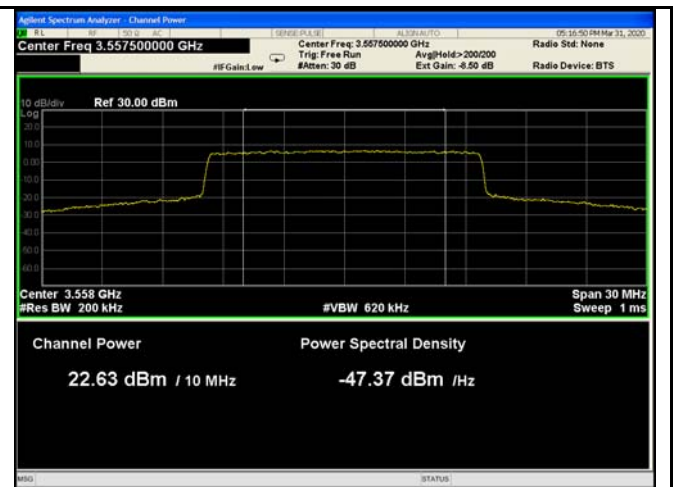
10MHz - High CH QPSK



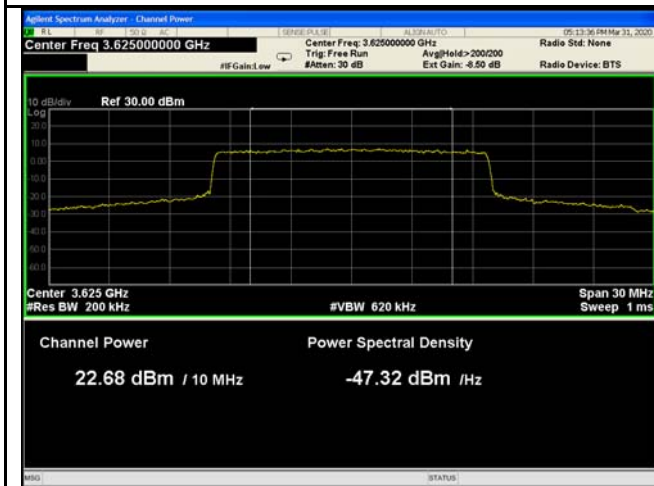
10MHz - High CH 16QAM



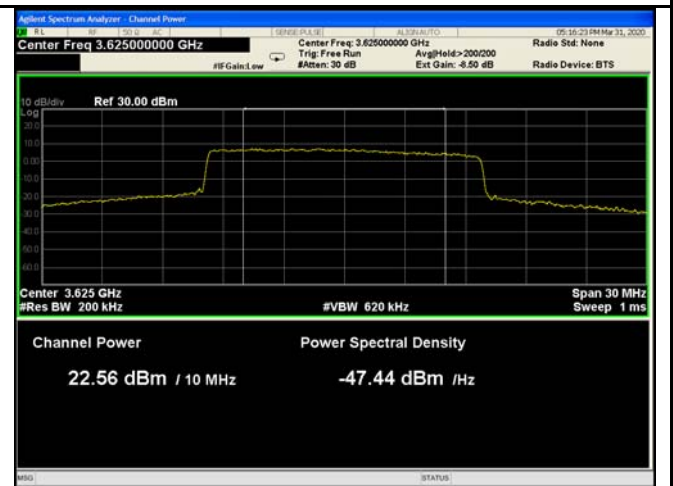
15MHz - Low CH QPSK



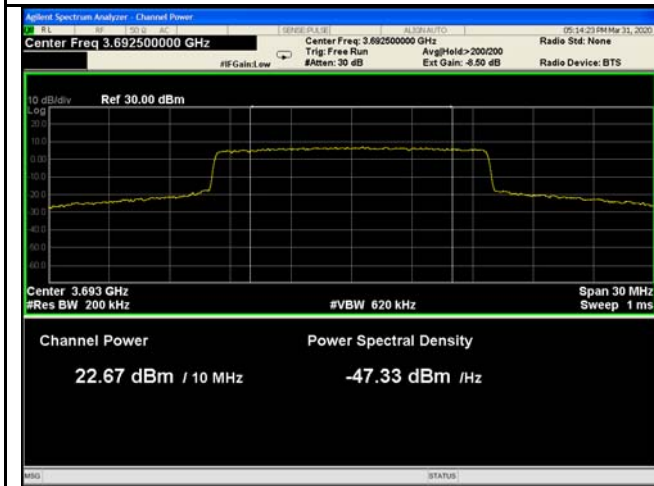
15MHz - Low CH 16QAM



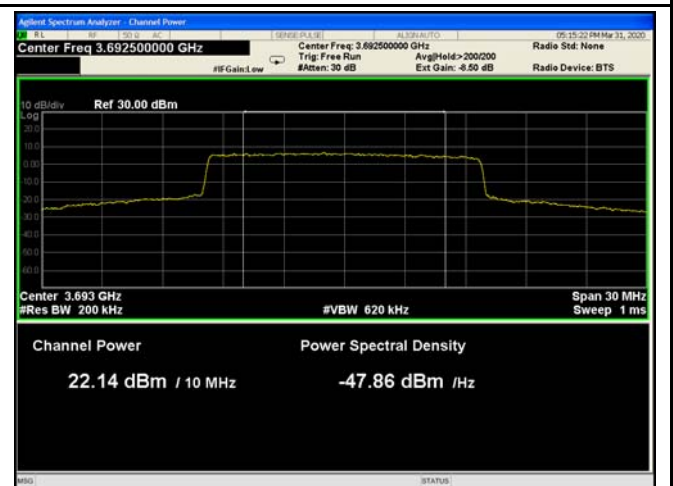
15MHz - Middle CH QPSK



15MHz - Middle CH 16QAM



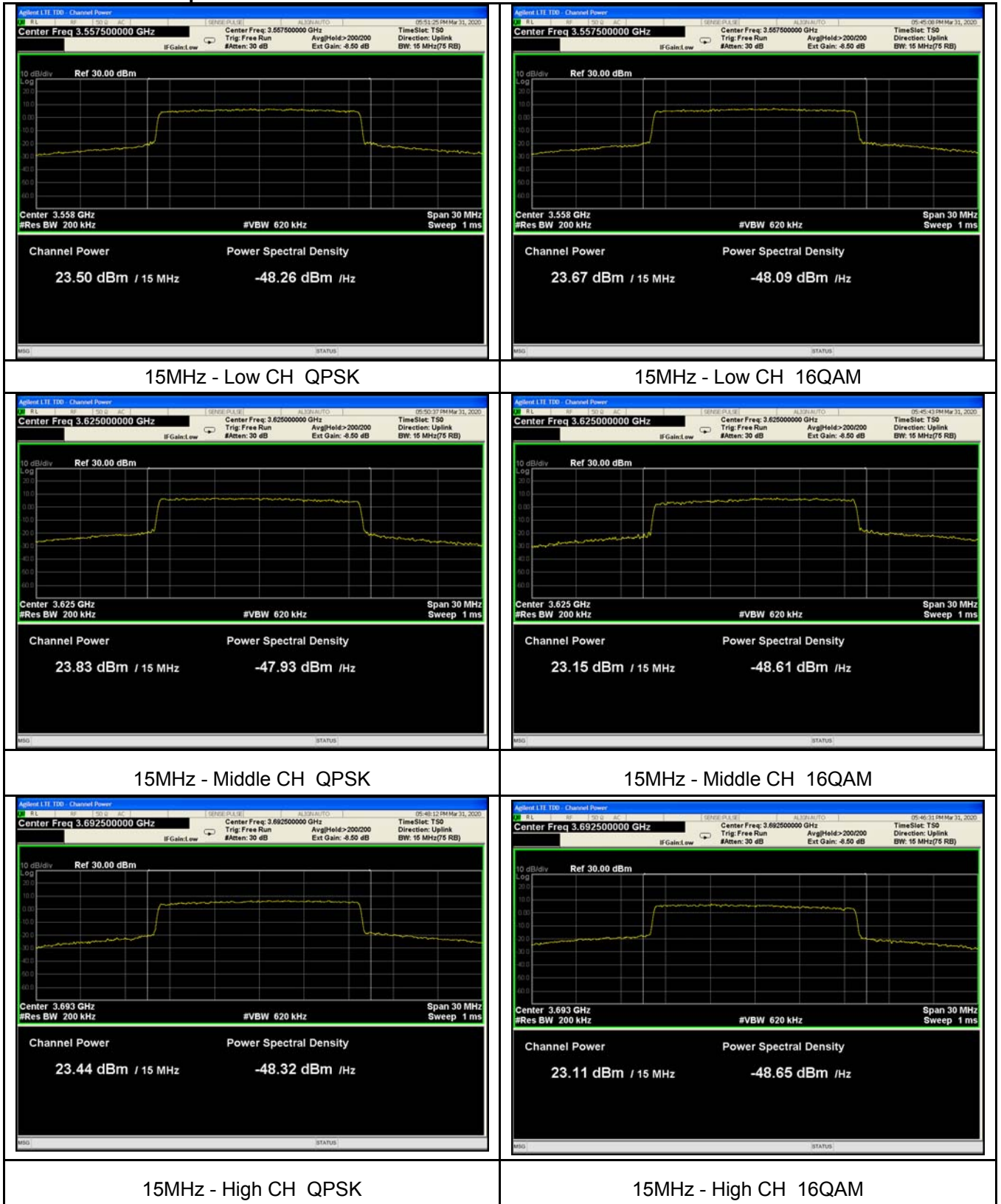
15MHz - High CH QPSK

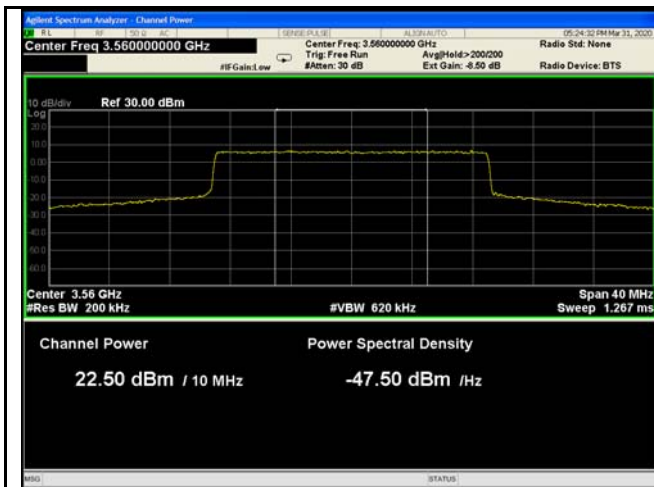


15MHz - High CH 16QAM

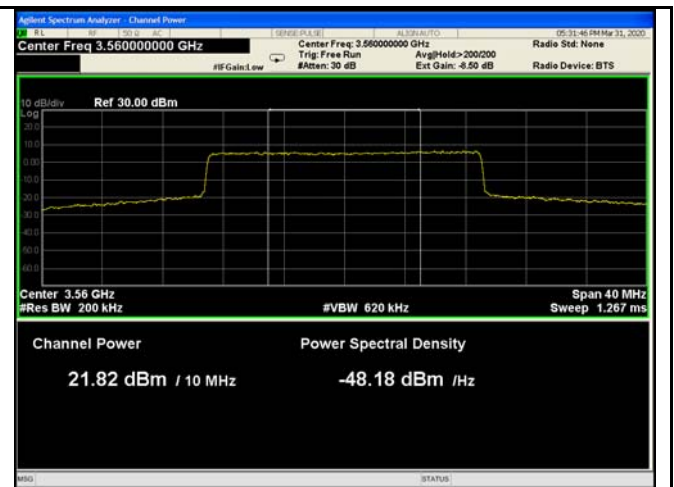


**Full Transmit Output Power**

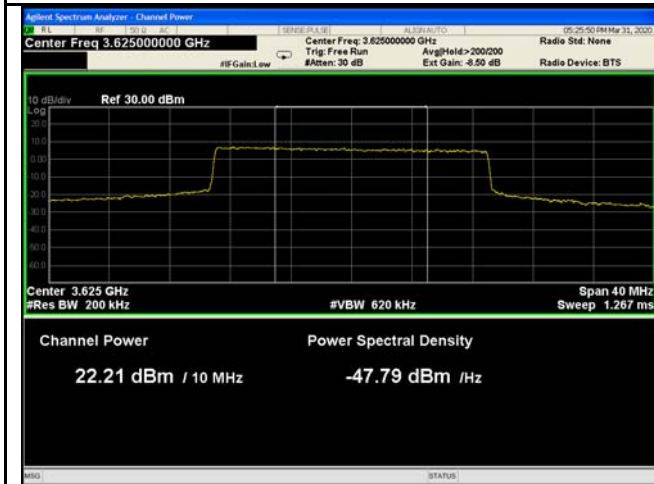




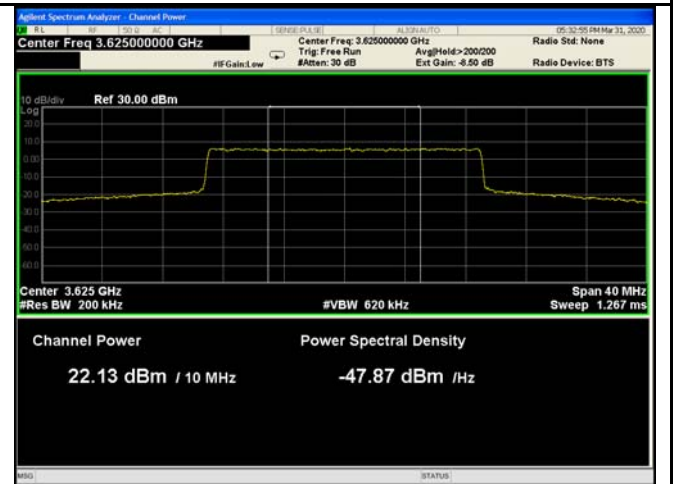
20MHz - Low CH QPSK



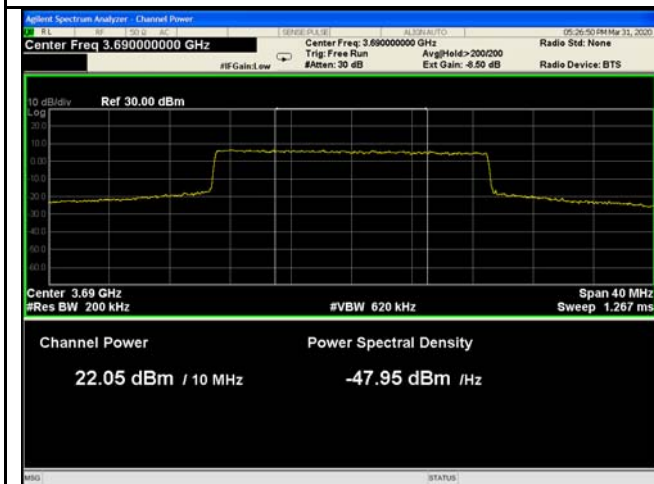
20MHz - Low CH 16QAM



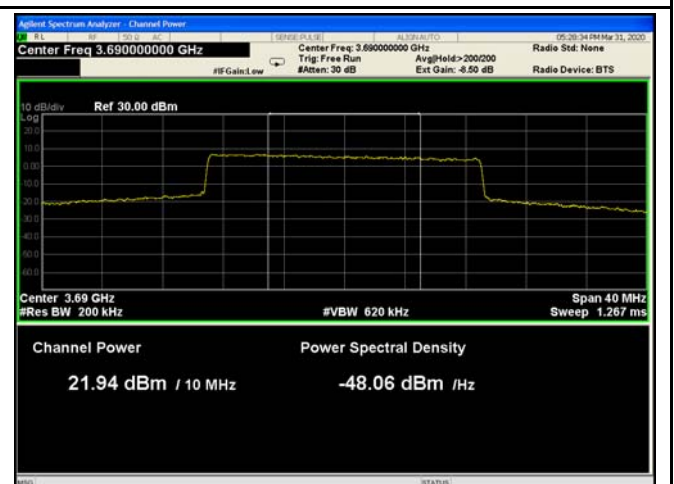
20MHz - Middle CH QPSK



20MHz - Middle CH 16QAM

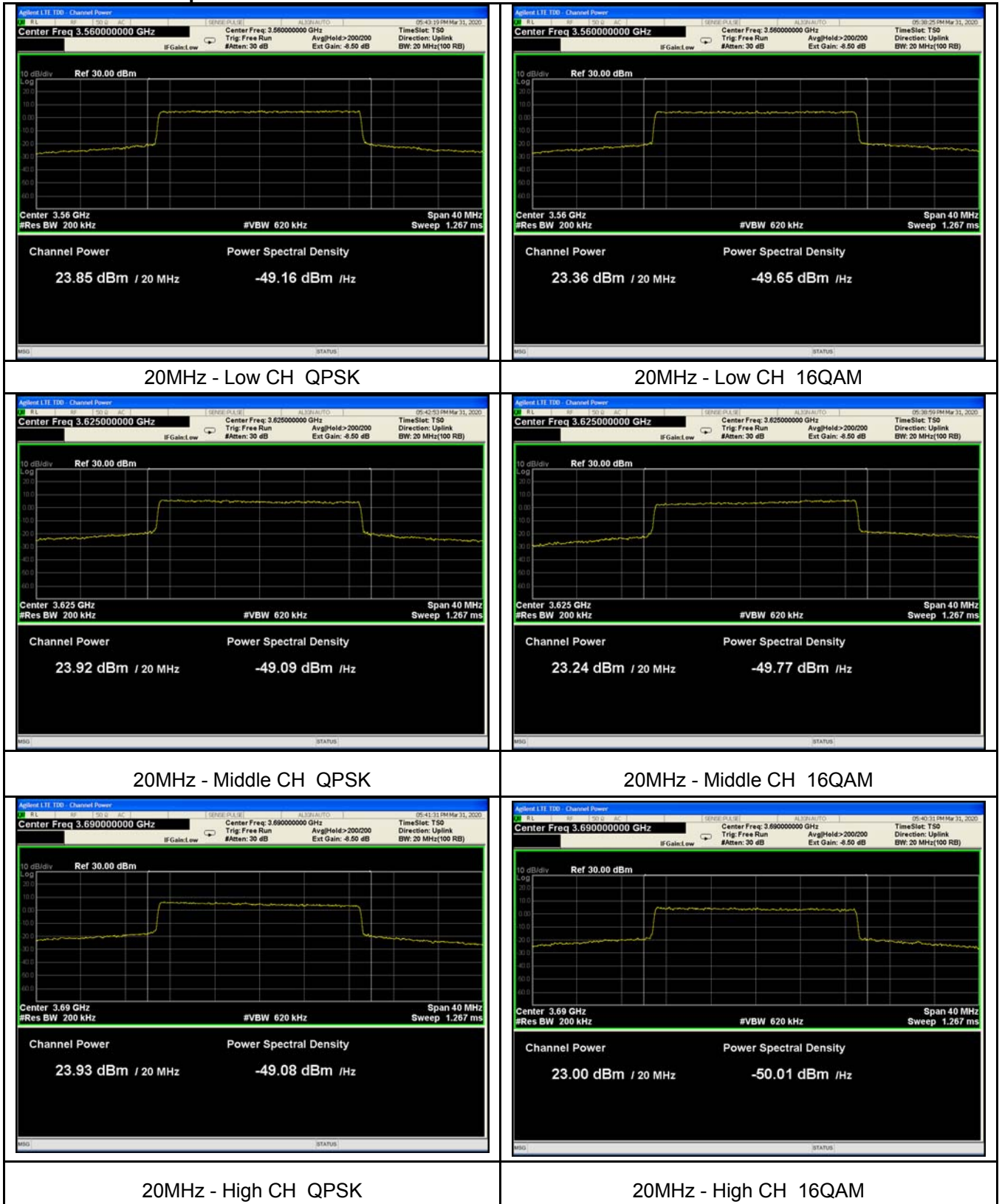


20MHz - High CH QPSK

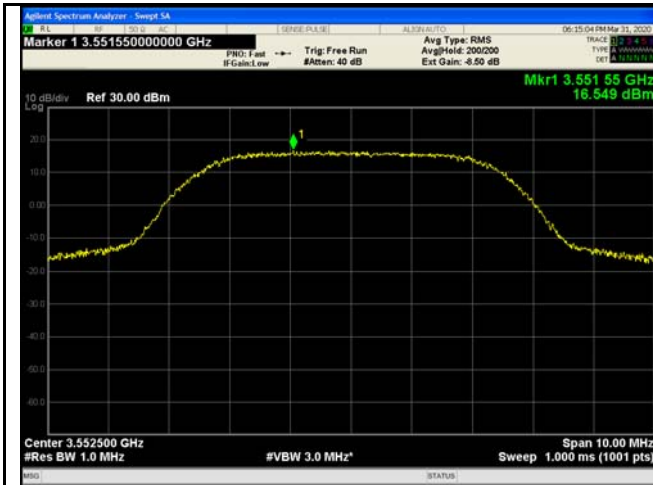


20MHz - High CH 16QAM

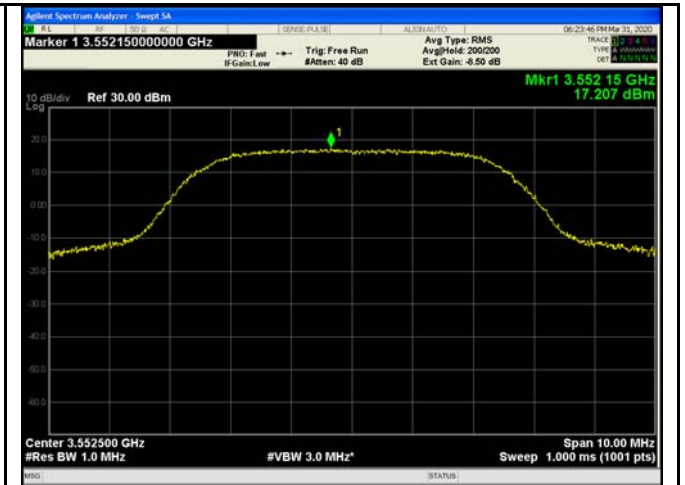
**Full Transmit Output Power**



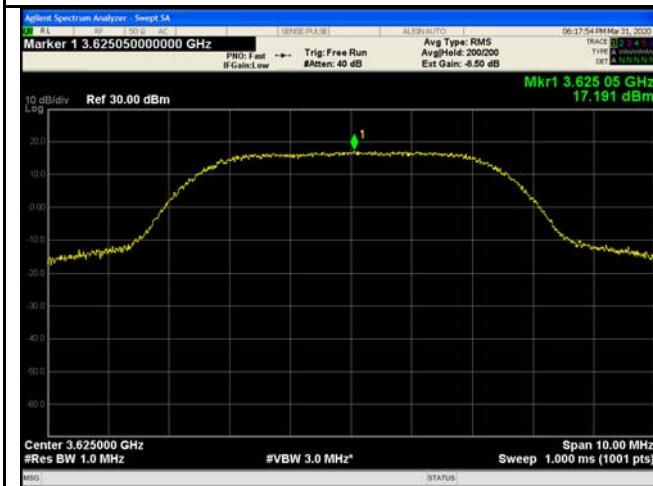
PSD Test Plots



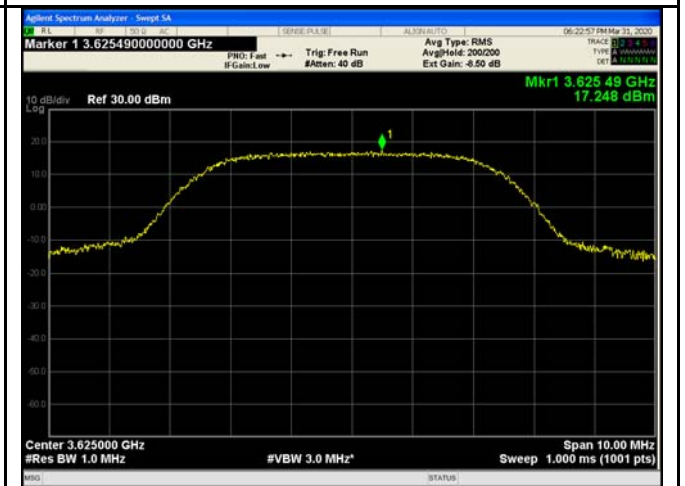
5MHz - Low CH QPSK



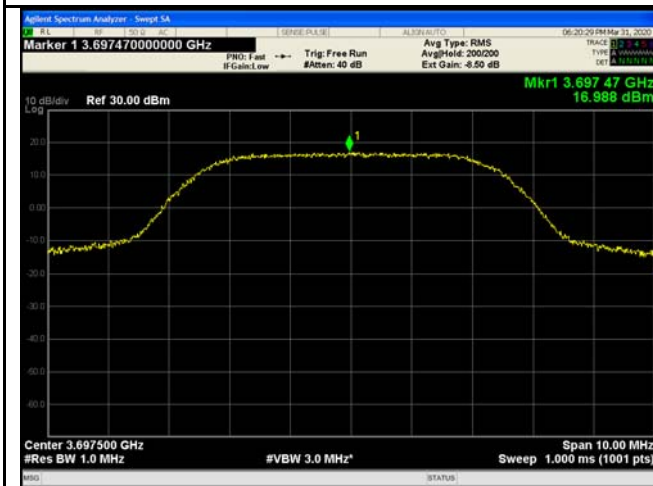
5MHz - Low CH 16QAM



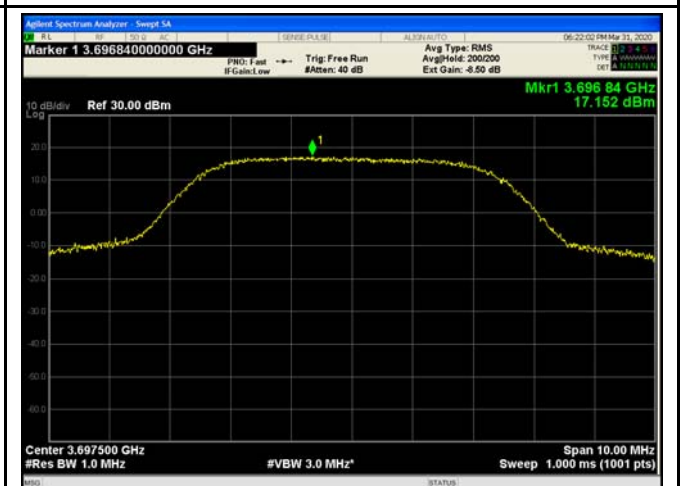
5MHz - Middle CH QPSK



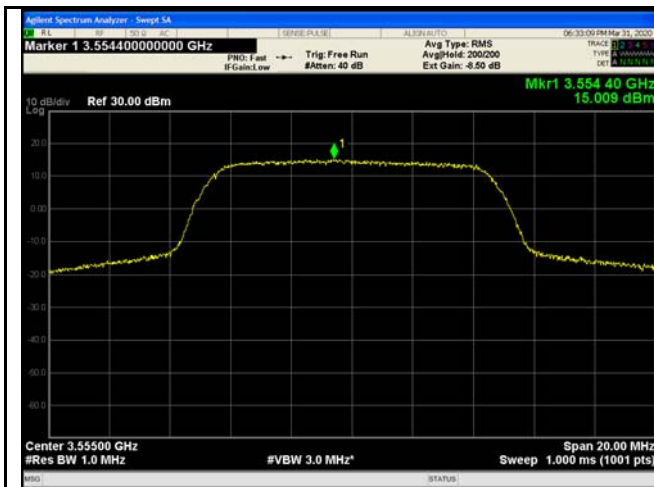
5MHz - Middle CH 16QAM



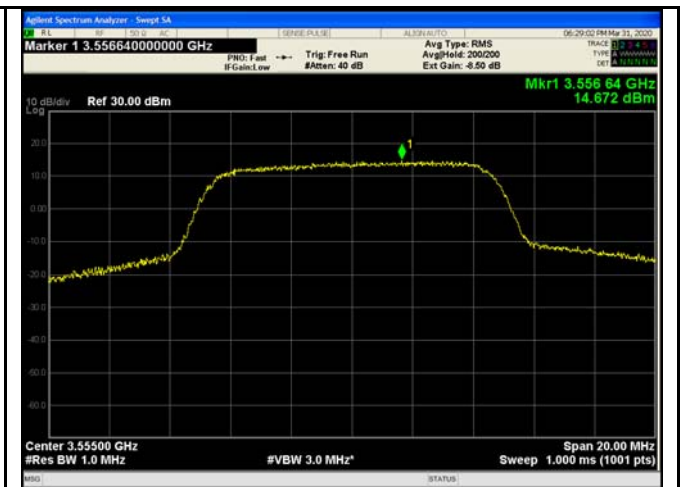
5MHz - High CH QPSK



5MHz - High CH 16QAM



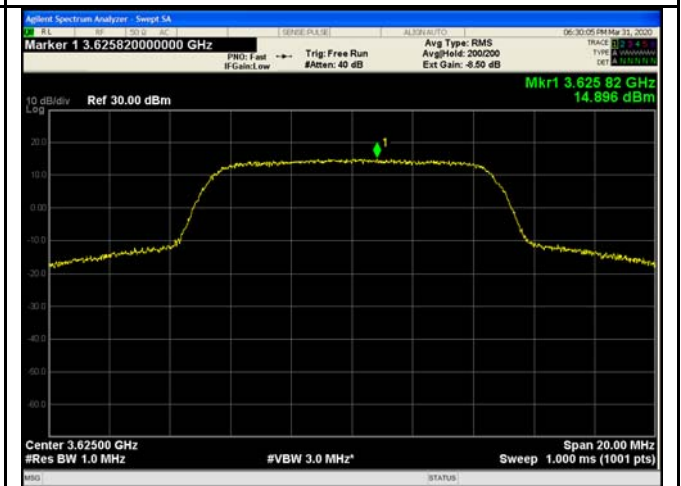
10MHz - Low CH QPSK



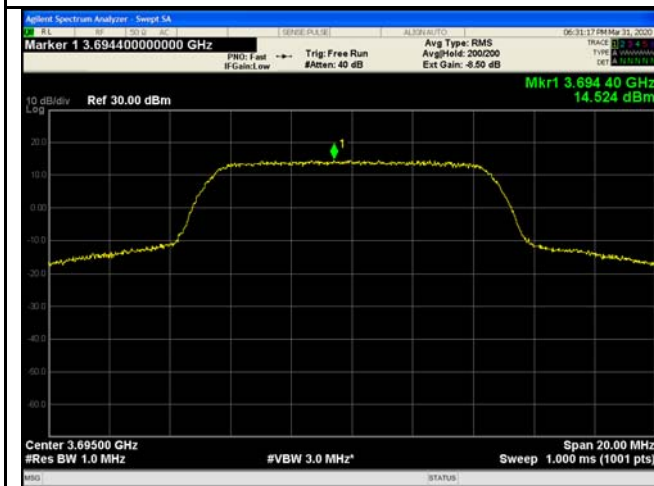
10MHz - Low CH 16QAM



10MHz - Middle CH QPSK



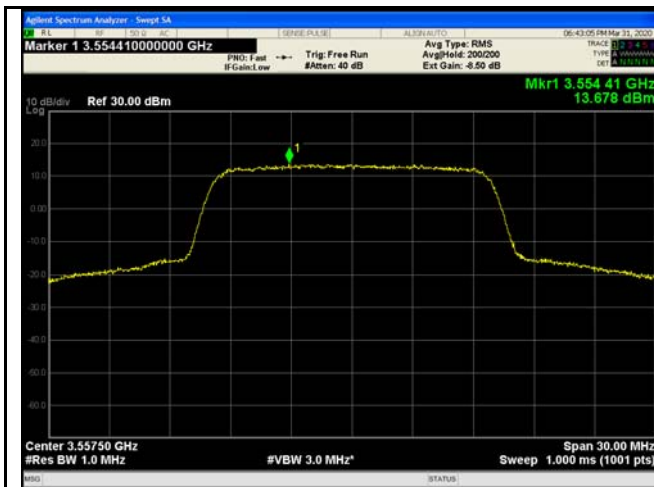
10MHz - Middle CH 16QAM



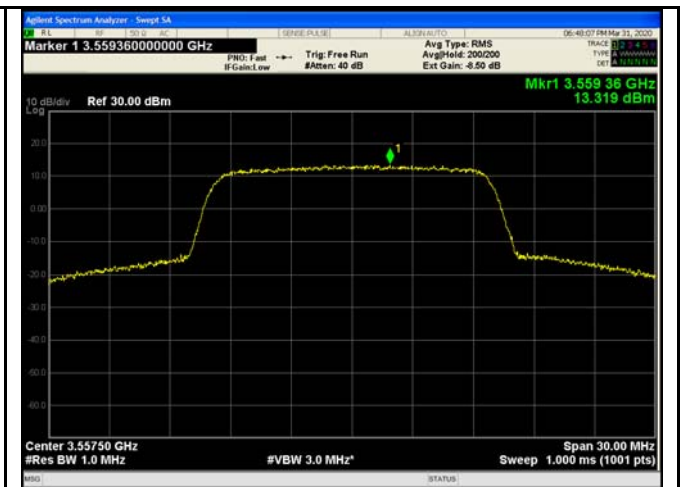
10MHz - High CH QPSK



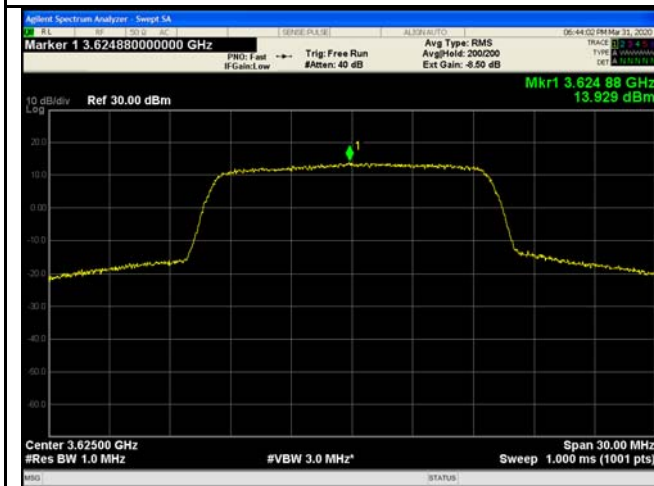
10MHz - High CH 16QAM



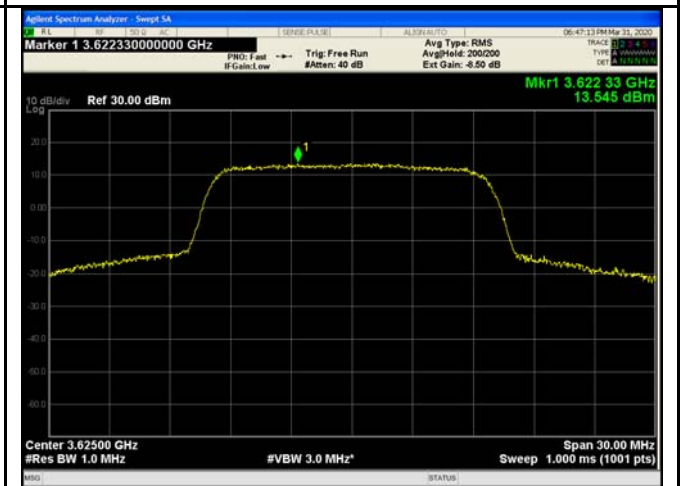
15MHz - Low CH QPSK



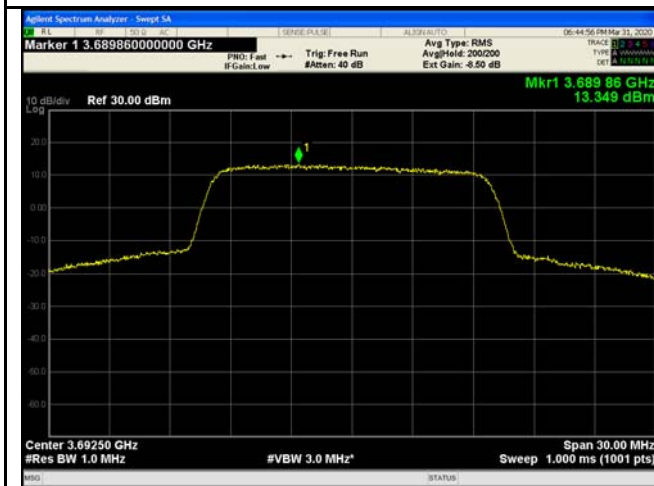
15MHz - Low CH 16QAM



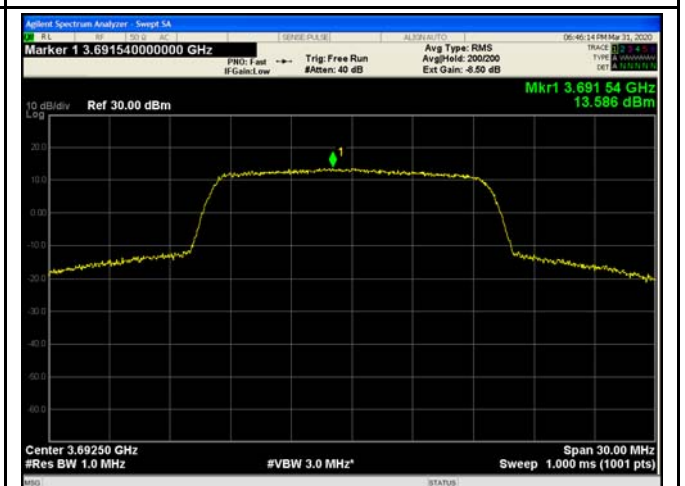
15MHz - Middle CH QPSK



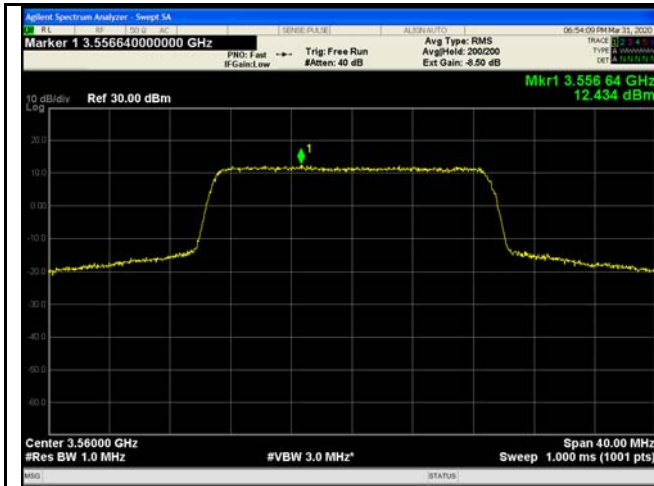
15MHz - Middle CH 16QAM



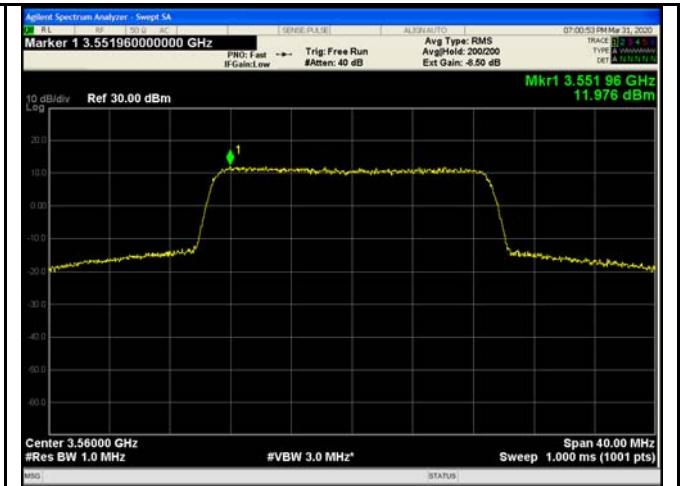
15MHz - High CH QPSK



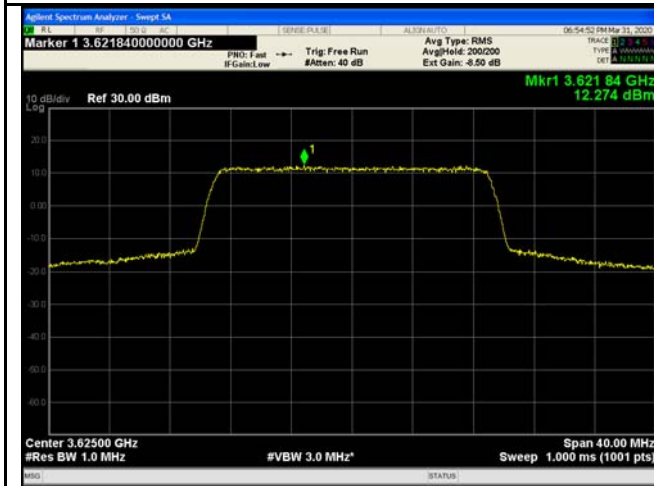
15MHz - High CH 16QAM



20MHz - Low CH QPSK



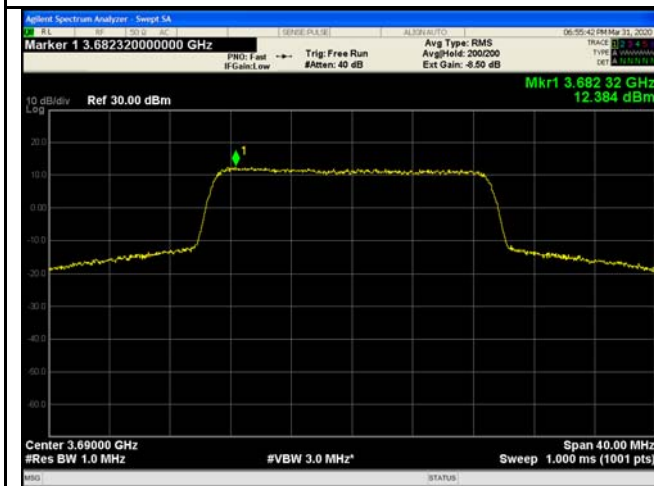
20MHz - Low CH 16QAM



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)		7.93	7.79	7.54	13

#### 10MHz bandwidth

Mode	QPSK			Limit (dB)	
	Channel	Low	Middle		High
Peak-to-Average Ratio (dB)		7.66	7.47	7.27	13



## 15MHz bandwidth

<b>Mode</b>	<b>QPSK</b>			<b>Limit (dB)</b>
<b>Channel</b>	<b>Low</b>	<b>Middle</b>	<b>High</b>	
Peak-to-Average Ratio (dB)	7.80	7.68	7.63	13

## 20MHz bandwidth

<b>Mode</b>	<b>QPSK</b>			<b>Limit (dB)</b>
<b>Channel</b>	<b>Low</b>	<b>Middle</b>	<b>High</b>	
Peak-to-Average Ratio (dB)	8.13	8.14	7.90	13

Test Plots



5MHz - Low CH QPSK



5MHz - Middle CH QPSK



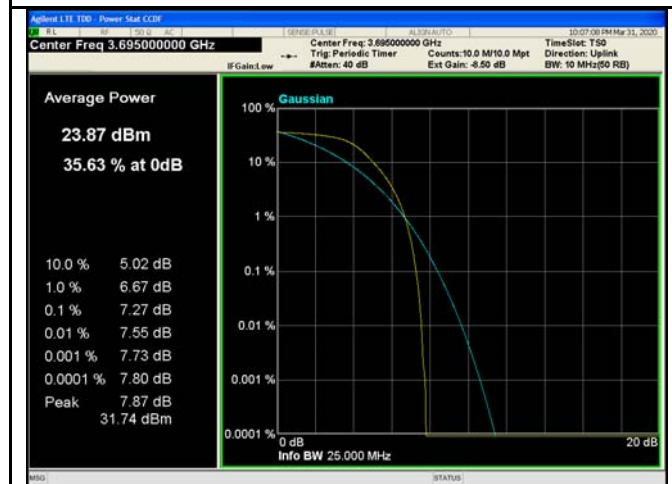
5MHz - High CH QPSK



10MHz - Low CH QPSK



10MHz - Middle CH QPSK



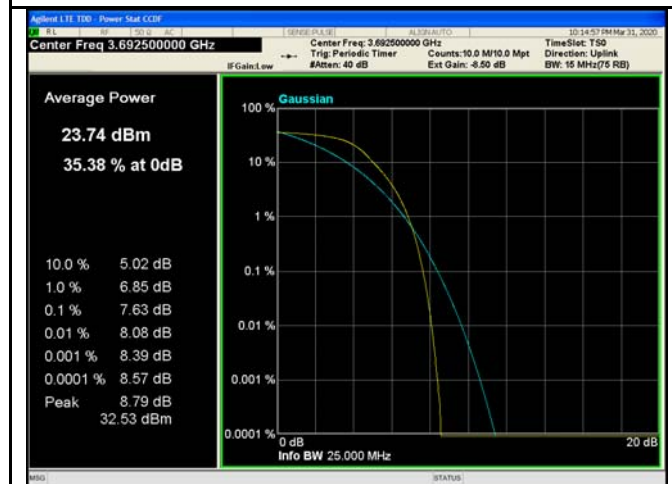
10MHz - High CH QPSK



15MHz - Low CH QPSK



15MHz - Middle CH QPSK



15MHz - High CH QPSK



20MHz - Low CH QPSK



20MHz - Middle CH QPSK



20MHz - High CH QPSK

## 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

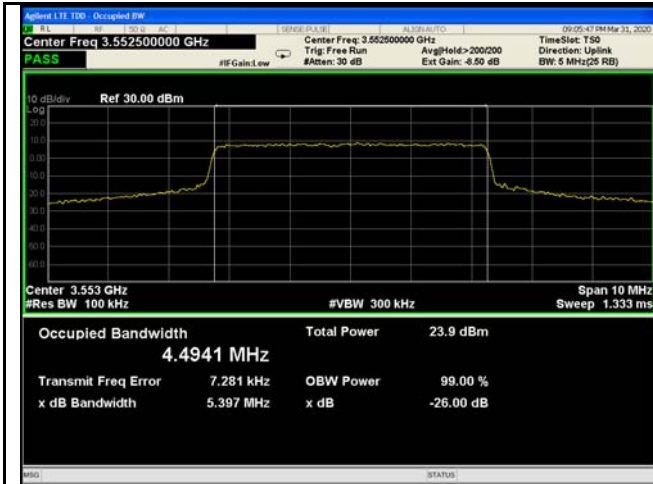
### 9.2 Test Procedure

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.

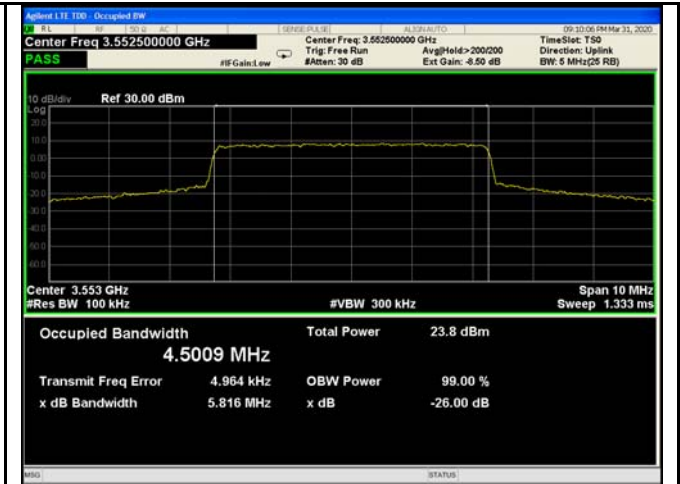
### 9.3 Test Result

Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
5	QPSK	Low	5.397	4.494
		Middle	5.419	4.495
		High	6.426	4.519
	16QAM	Low	5.816	4.501
		Middle	5.818	4.508
		High	6.924	4.524
Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
10	QPSK	Low	9.87	8.924
		Middle	10.74	8.944
		High	11.27	8.937
	16QAM	Low	10.07	8.938
		Middle	10.58	8.941
		High	13.03	8.943
Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
15	QPSK	Low	14.45	13.394
		Middle	14.54	13.375
		High	15.27	13.403
	16QAM	Low	14.96	13.411
		Middle	14.98	13.414
		High	16.43	13.420
Bandwidth (MHz)	Modulation	Test Channel	26dB Down Bandwith	99% Occupy bandwidth (MHz)
20	QPSK	Low	20.10	17.889
		Middle	21.68	17.897
		High	22.98	17.920
	16QAM	Low	22.19	17.908
		Middle	24.52	17.908
		High	27.81	17.935

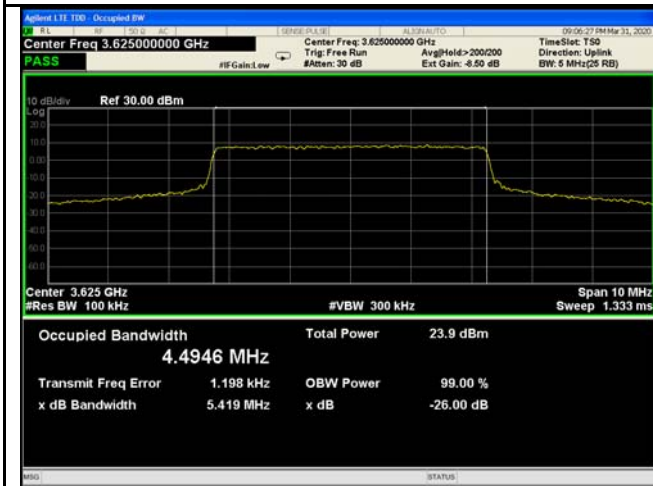
Test Plots



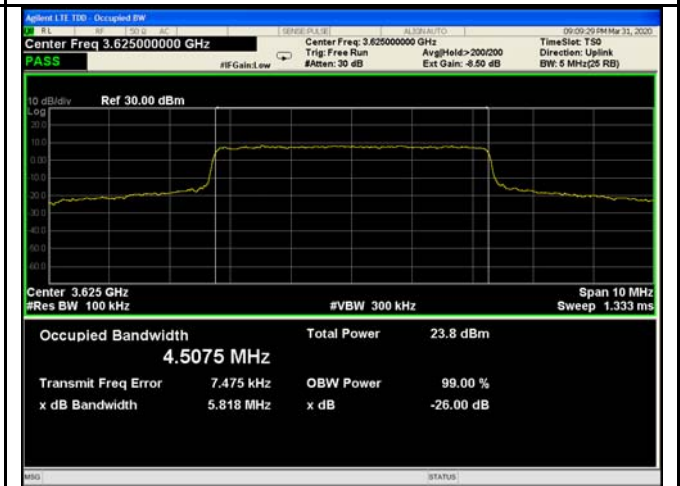
5MHz - Low CH QPSK



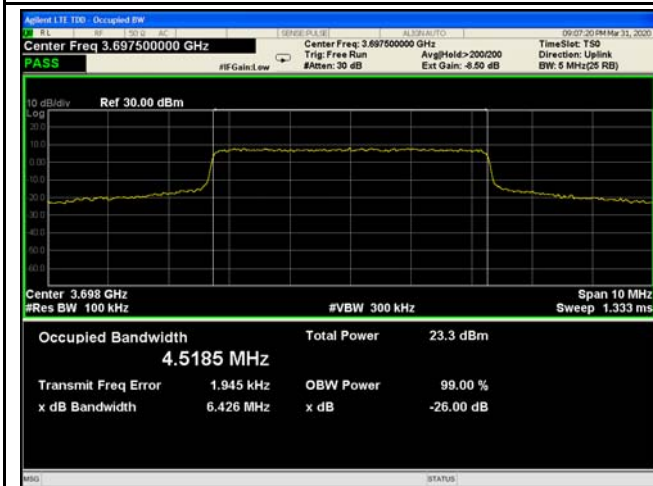
5MHz - Low CH 16QAM



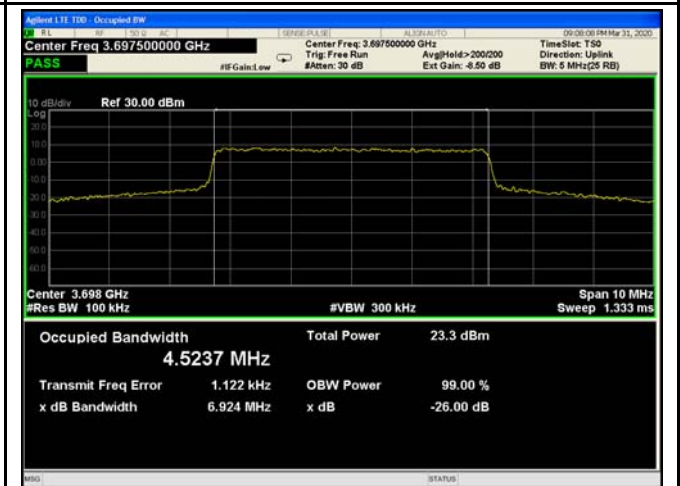
5MHz - Middle CH QPSK



5MHz - Middle CH 16QAM



5MHz - High CH QPSK

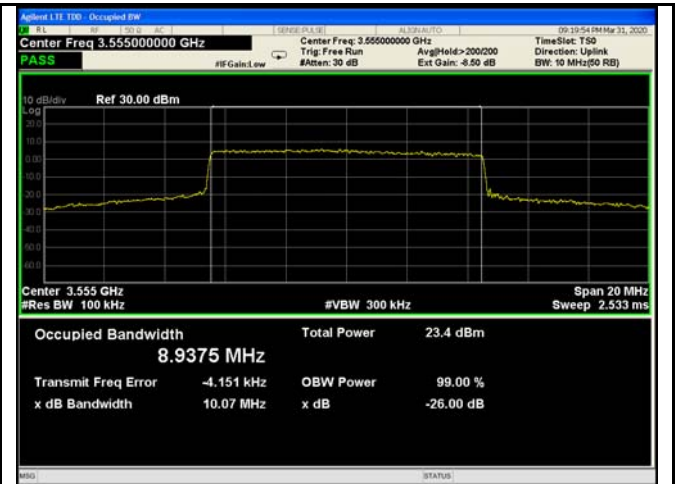


5MHz - High CH 16QAM

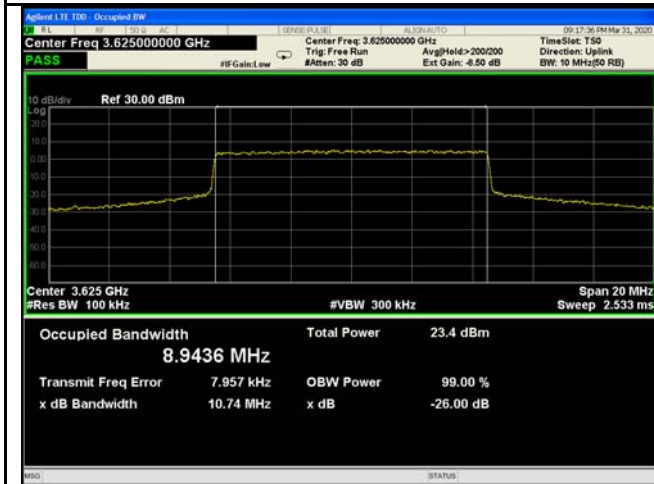




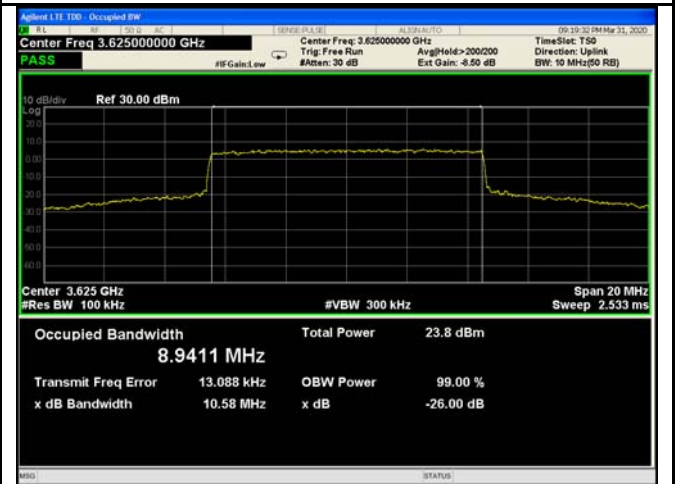
10MHz - Low CH QPSK



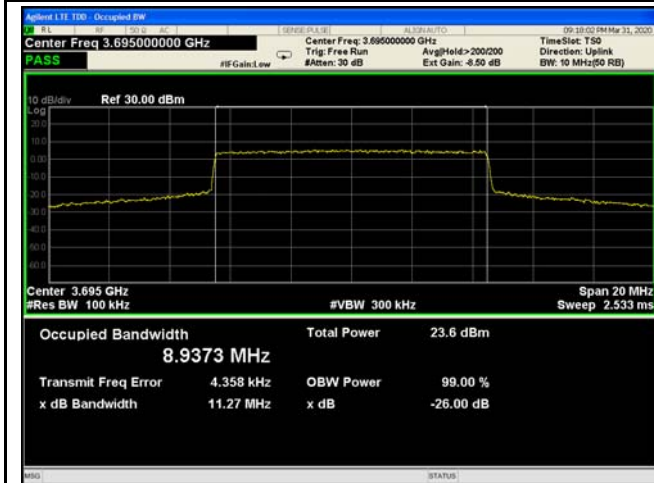
10MHz - Low CH 16QAM



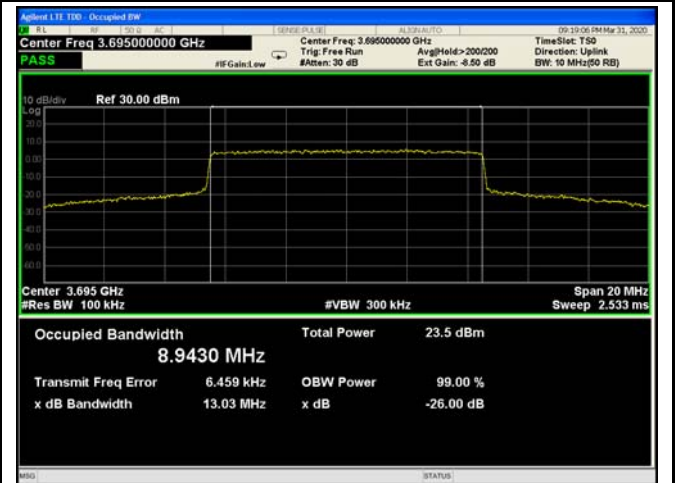
10MHz - Middle CH QPSK



10MHz - Middle CH 16QAM



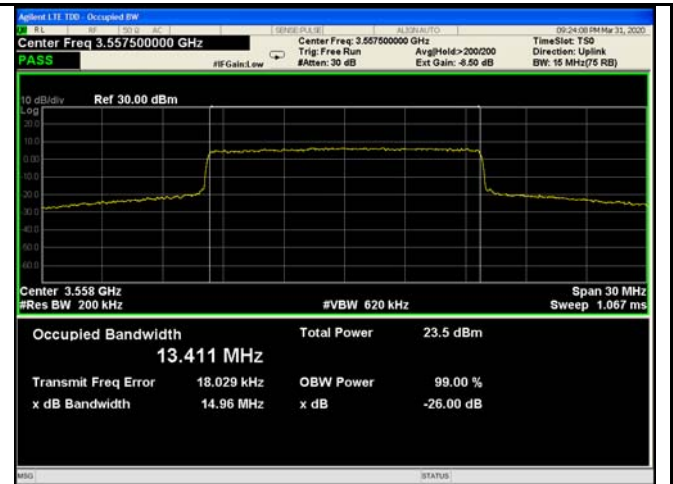
10MHz - High CH QPSK



10MHz - High CH 16QAM



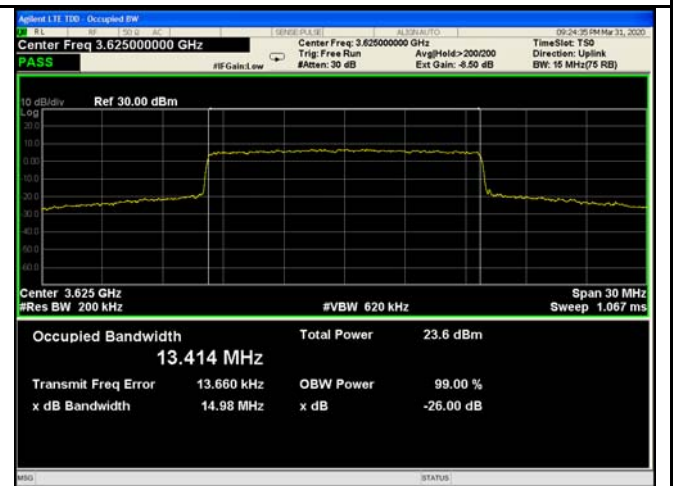
15MHz - Low CH QPSK



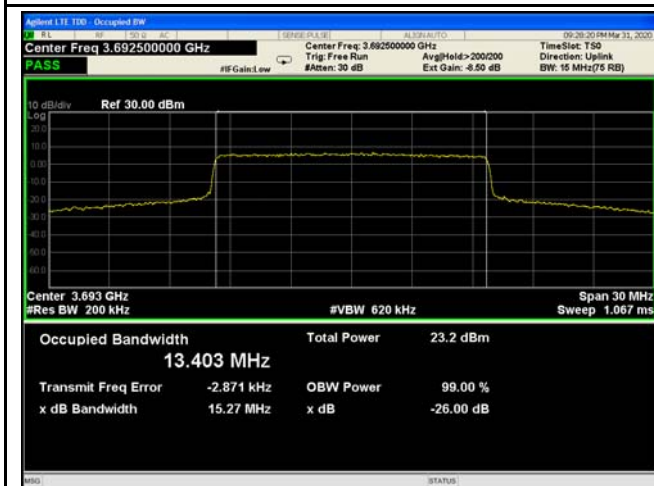
15MHz - Low CH 16QAM



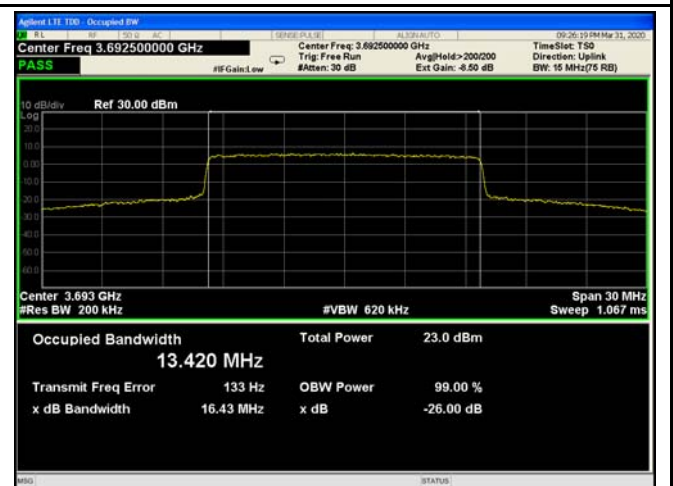
15MHz - Middle CH QPSK



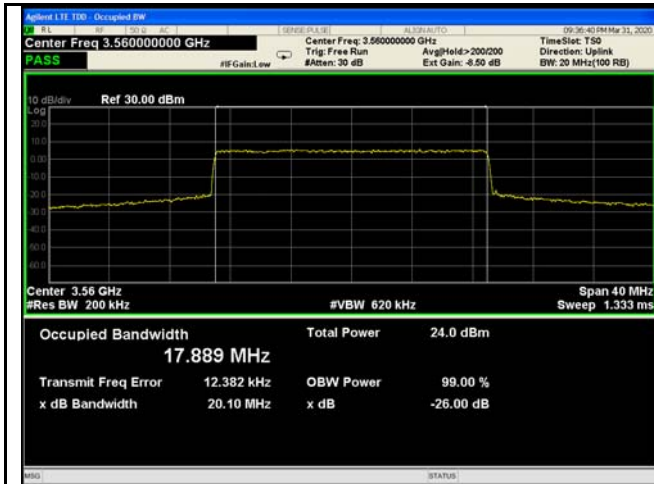
15MHz - Middle CH 16QAM



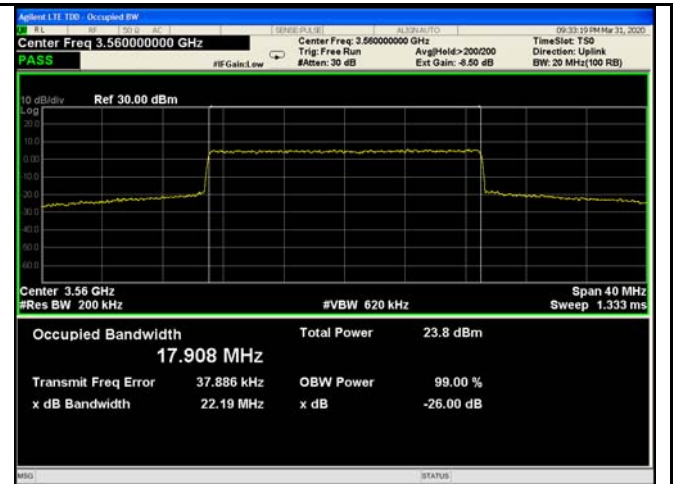
15MHz - High CH QPSK



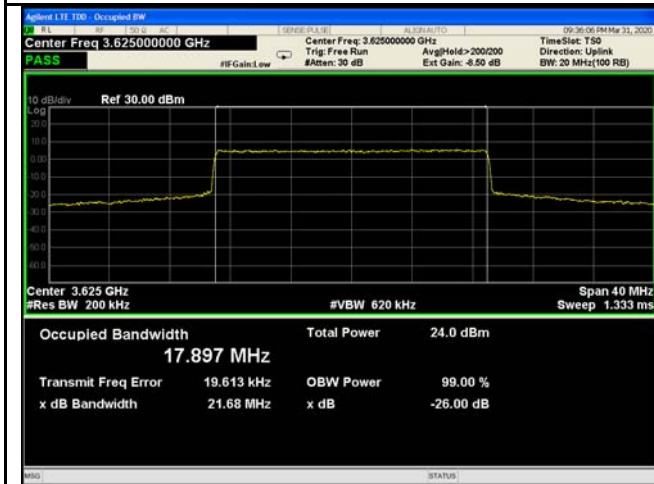
15MHz - High CH 16QAM



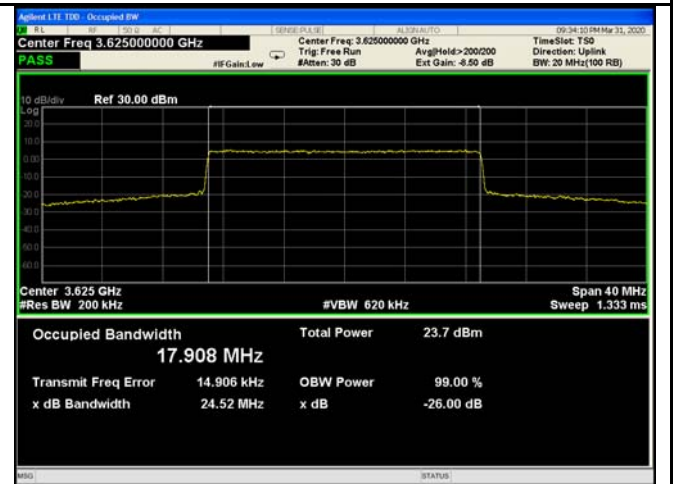
20MHz - Low CH QPSK



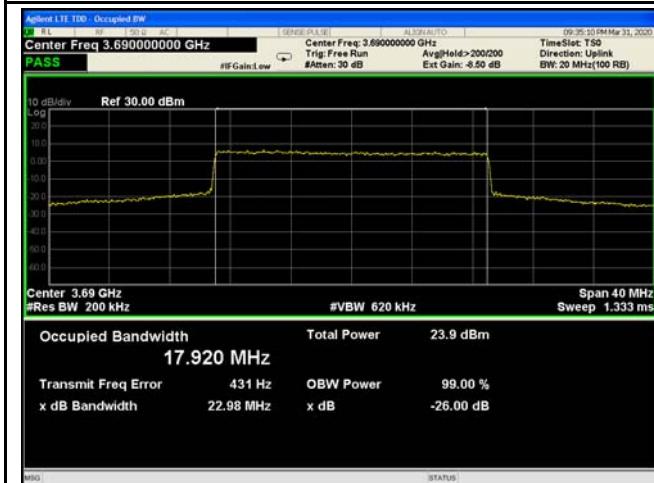
20MHz - Low CH 16QAM



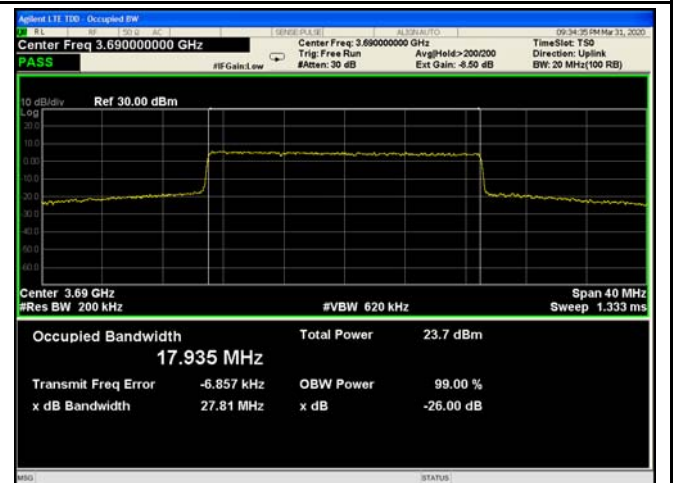
20MHz - Middle CH QPSK



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:	<ul style="list-style-type: none"><li>•within 0 MHz to 10 MHz above and below the assigned channel <math>\leq</math> -13 dBm/MHz</li><li>• greater than 10 MHz above and below the assigned channel <math>\leq</math> -25 dBm/MHz</li><li>• any emission below 3530 MHz and above 3720 MHz <math>\leq</math> -40 dBm/MHz</li></ul>

### 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



5MHz - Low CH QPSK



5MHz - Middle CH QPSK



5MHz - High CH QPSK



10MHz - Low CH QPSK



10MHz - Middle CH QPSK



10MHz - High CH QPSK



15MHz - Low CH QPSK



15MHz - Middle CH QPSK



15MHz - High CH QPSK



20MHz - Low CH QPSK



20MHz - Middle CH QPSK



20MHz - High CH QPSK



## 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.

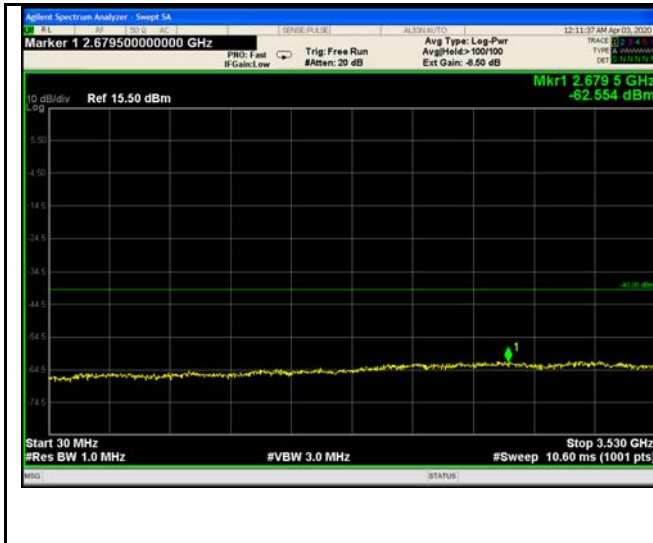
### 11.3 Test Result

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

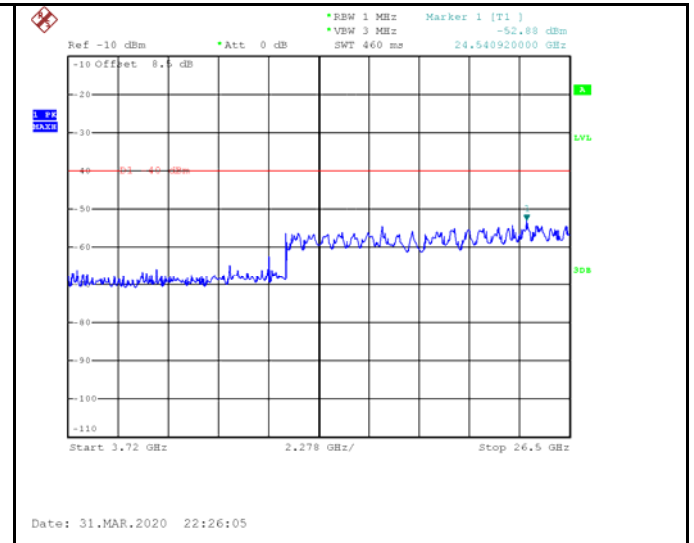
The permit frequency range of Part 96 is from 3550-3700MHz. Notes as below:

Test Plots

Spurious emission

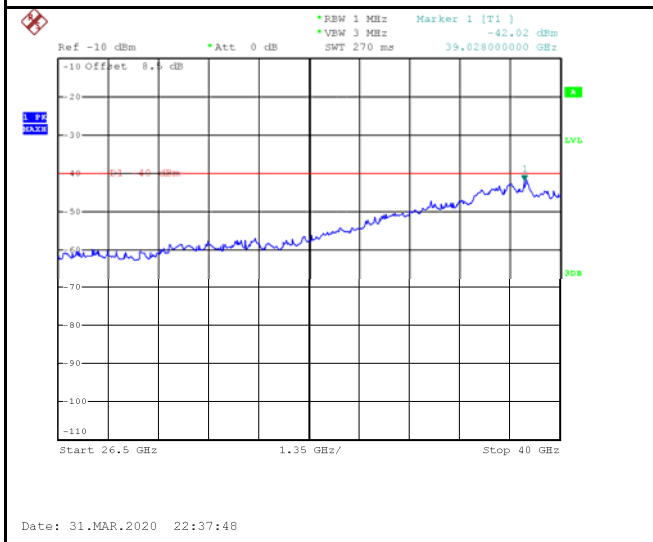


5MHz - Low CH 30MHz~3.53GHz



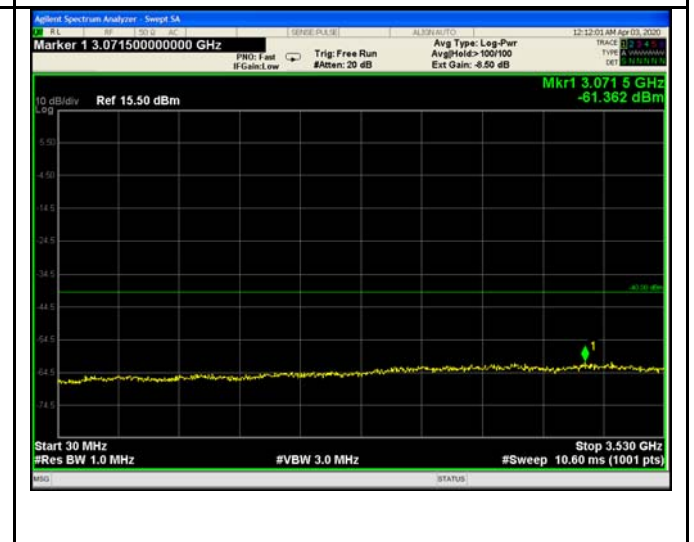
Date: 31.MAR.2020 22:26:05

5MHz - Low CH 3.72GHz~26.5GHz

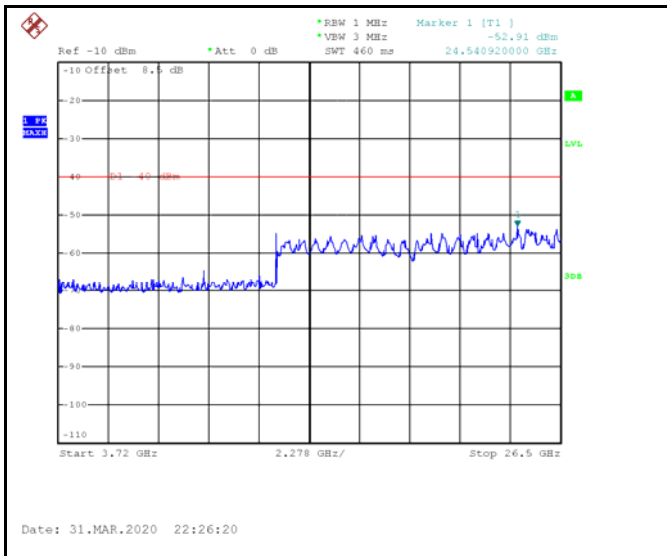


Date: 31.MAR.2020 22:37:46

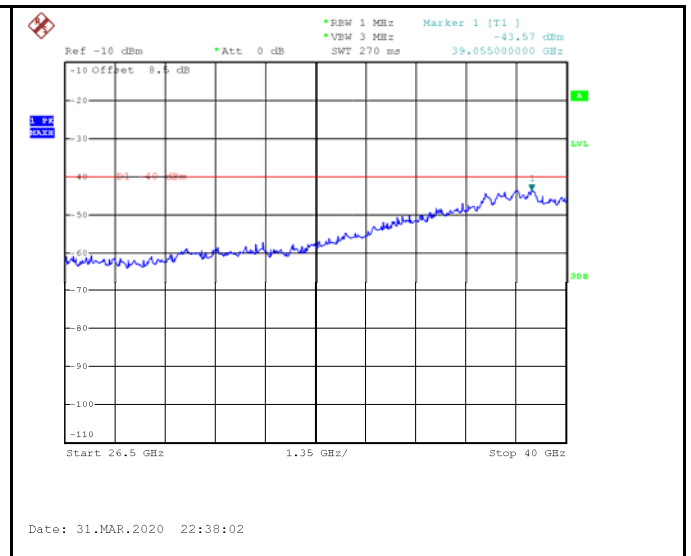
5MHz - Low CH 26.5GHz~40GHz



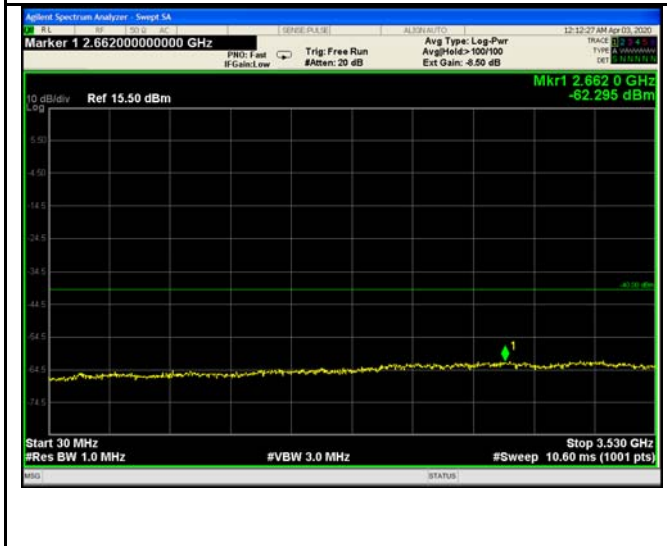
5MHz - Middle CH 30MHz~3.53GHz



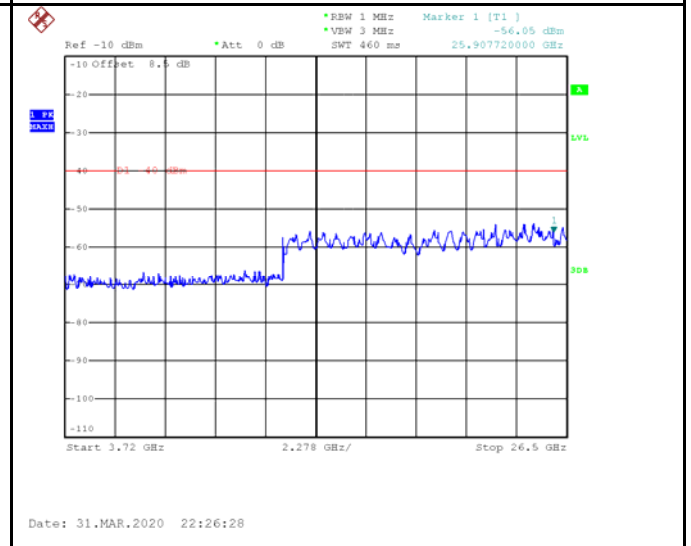
5MHz - Middle CH 3.72GHz~26.5GHz



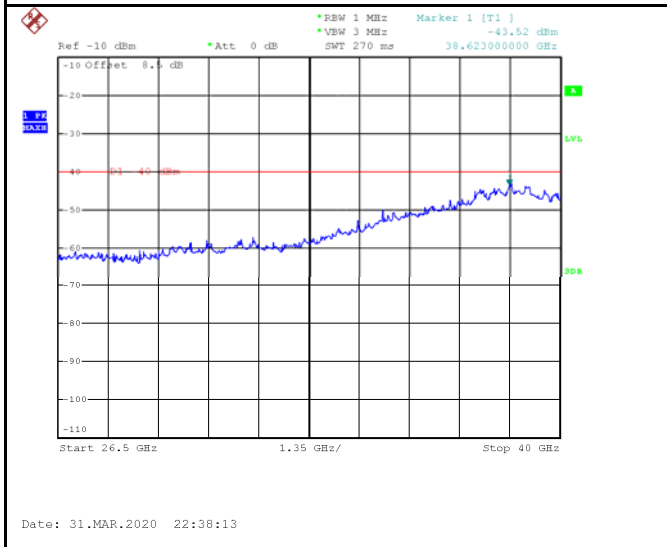
5MHz - Middle CH 26.5GHz~40GHz



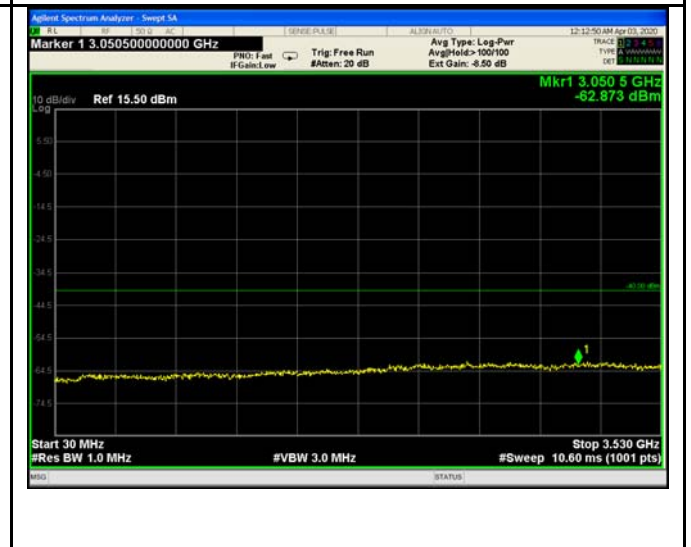
5MHz - High CH 30MHz~3.53GHz



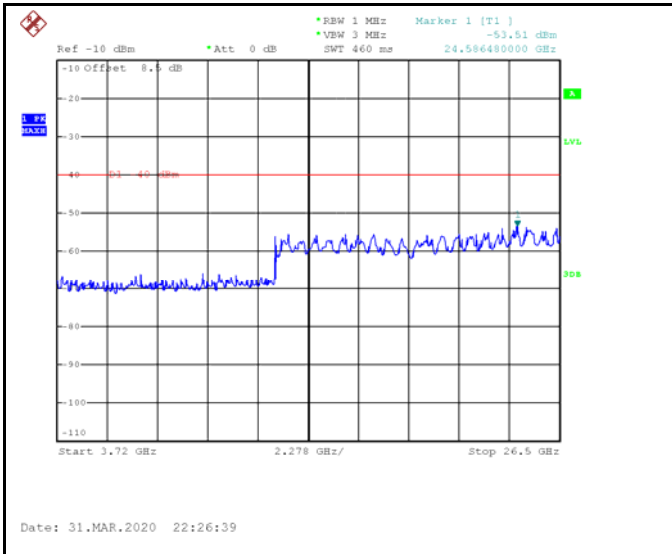
5MHz - High CH 3.72GHz~26.5GHz



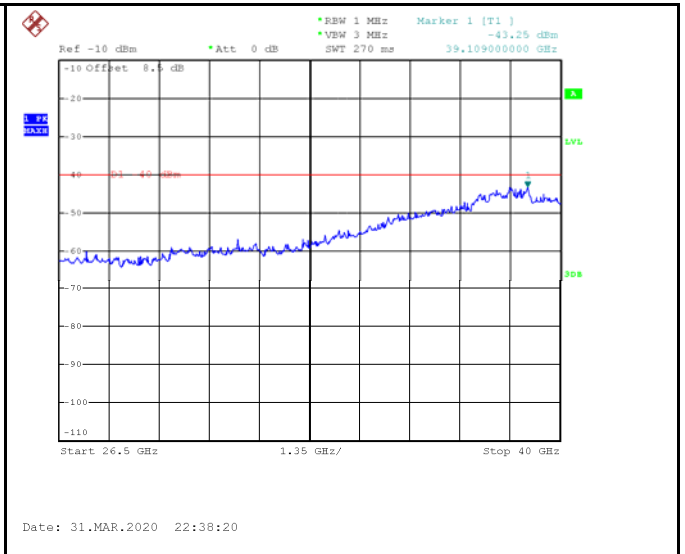
5MHz - High CH 26.5GHz~40GHz



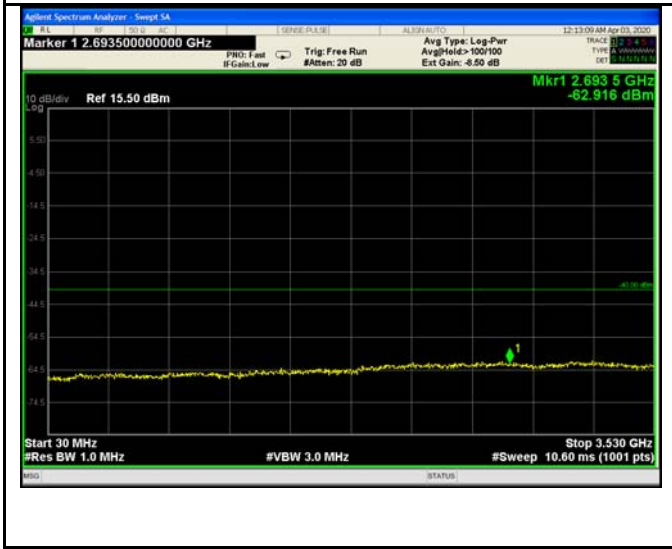
10MHz - Low CH 30MHz~3.53GHz



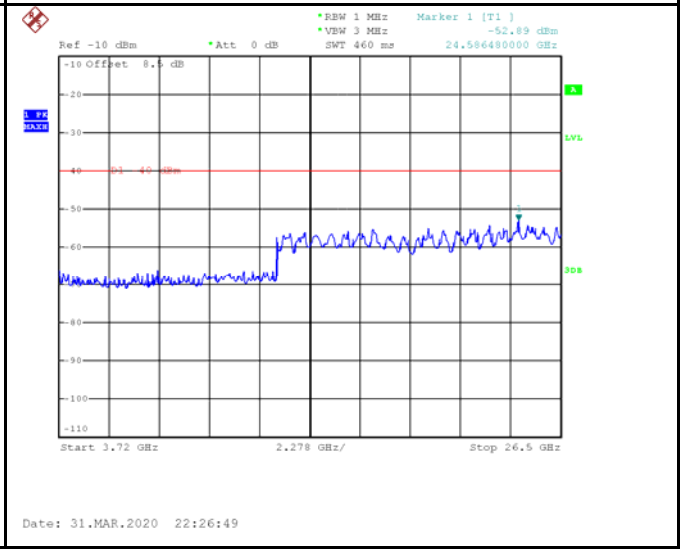
10MHz - Low CH 3.72GHz~26.5GHz



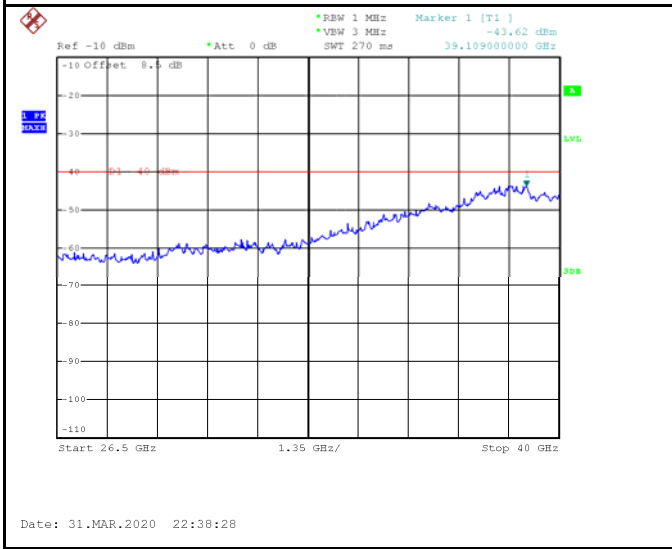
10MHz - Low CH 26.5GHz~40GHz



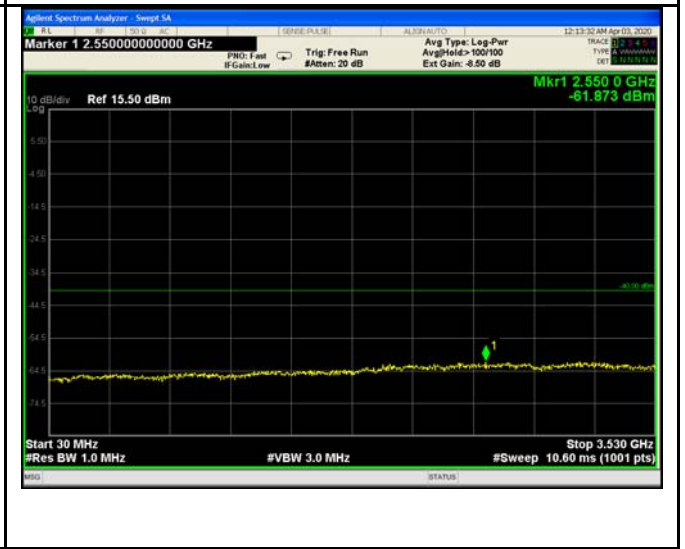
10MHz - Middle CH 30MHz~3.53GHz



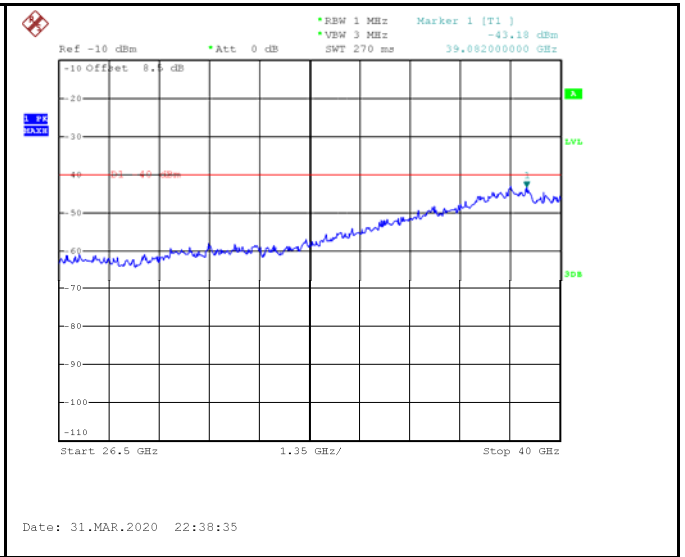
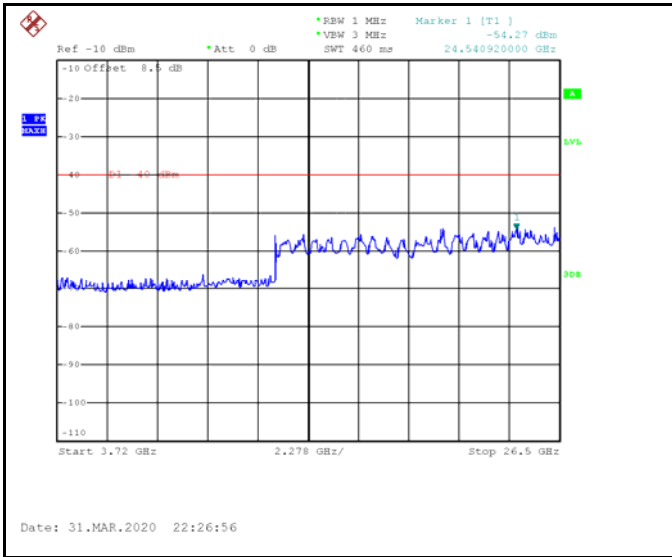
10MHz - Middle CH 3.72GHz~26.5GHz



10MHz - Middle CH 26.5GHz~40GHz

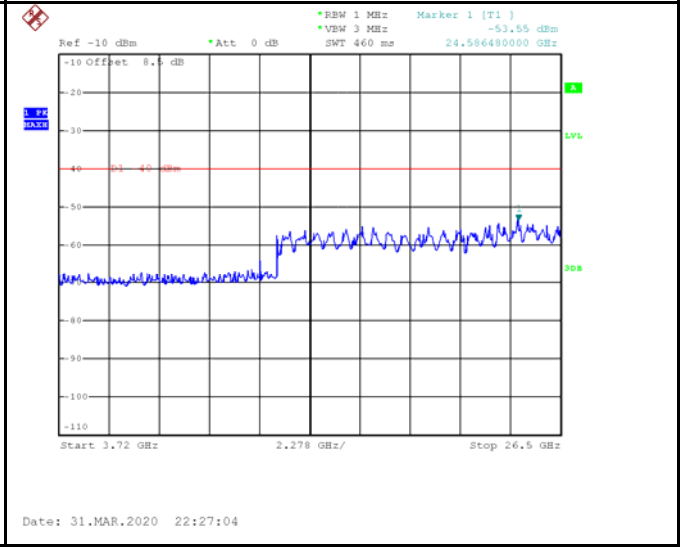
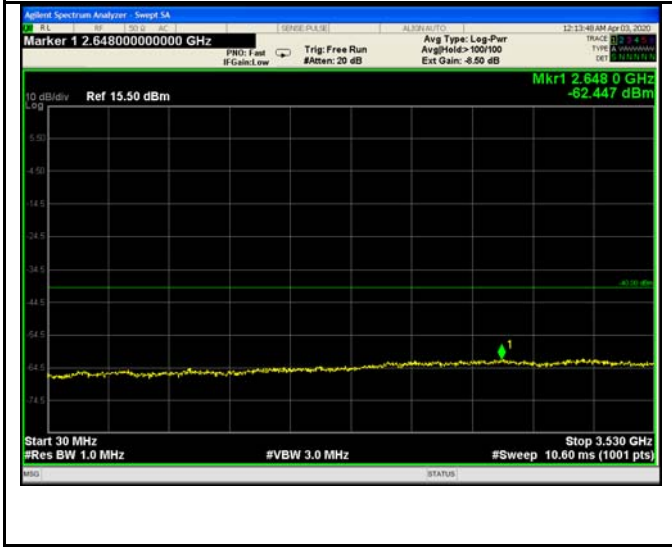


10MHz - High CH 30MHz~3.53GHz



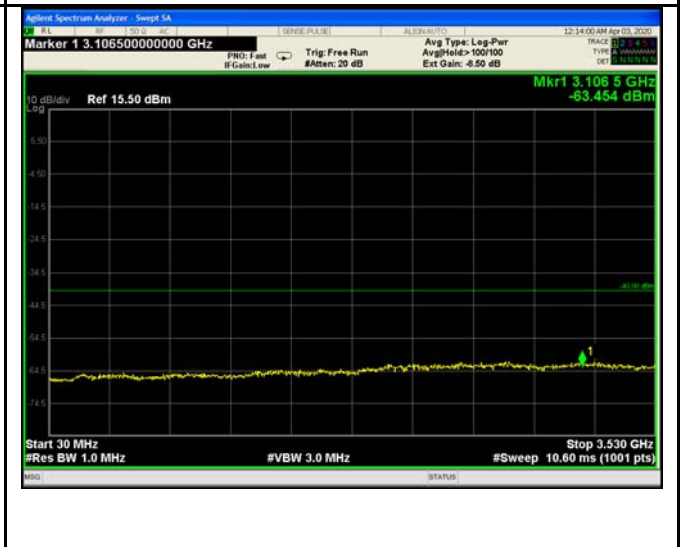
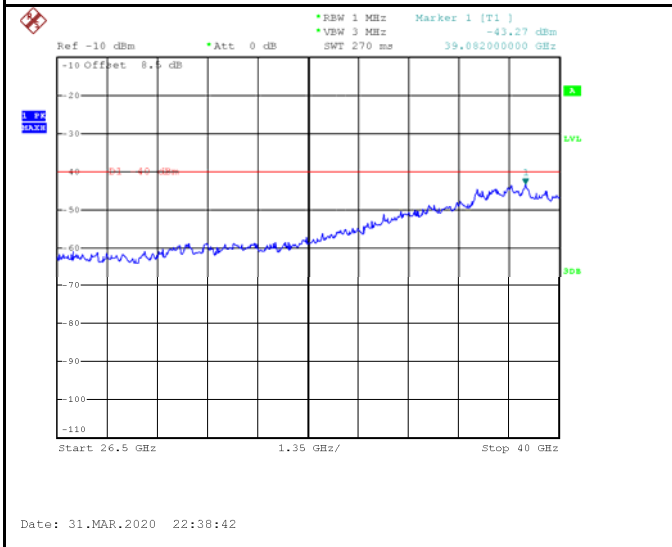
10MHz - High CH 3.72GHz~26.5GHz

10MHz - High CH 26.5GHz~40GHz



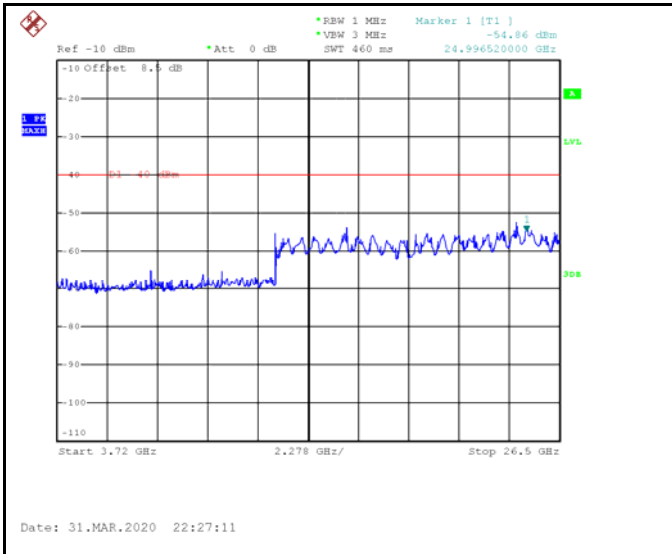
15MHz - Low CH 30MHz~3.53GHz

15MHz - Low CH 3.72GHz~26.5GHz

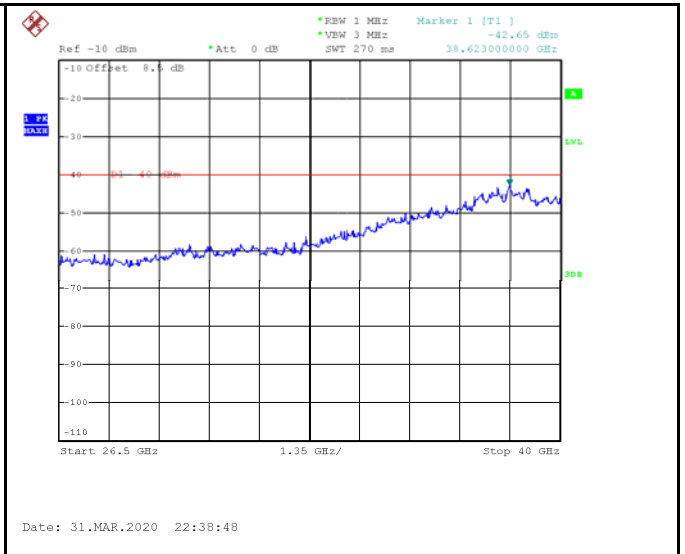


15MHz - Low CH 26.5GHz~40GHz

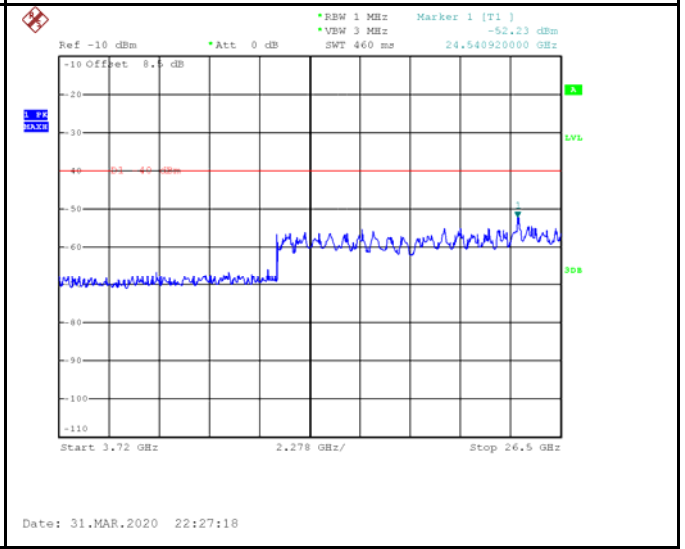
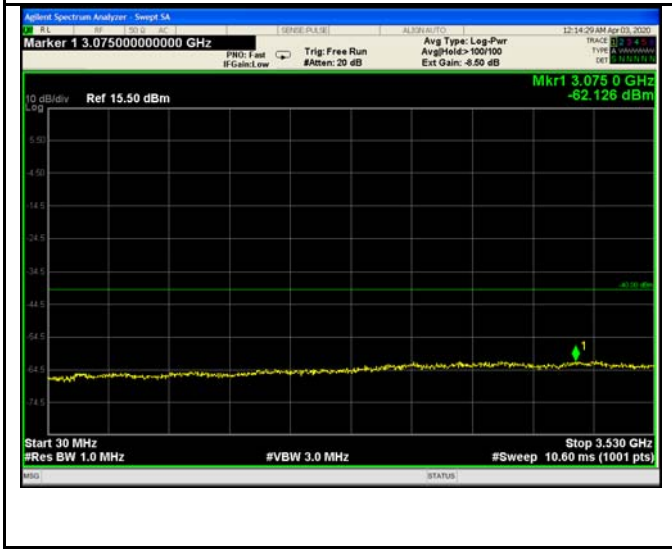
15MHz - Middle CH 30MHz~3.53GHz



15MHz - Middle CH 3.72GHz~26.5GHz

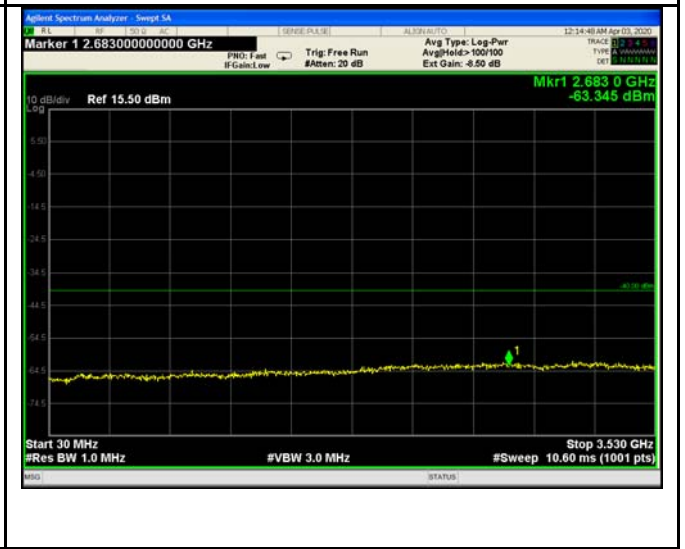
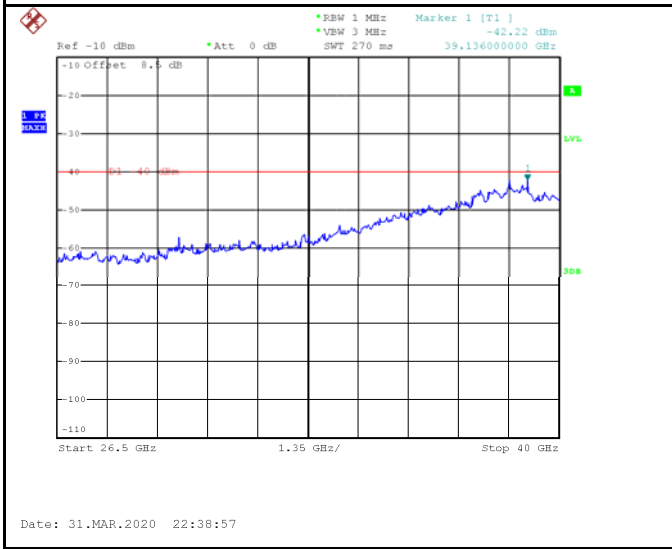


15MHz - Middle CH 26.5GHz~40GHz



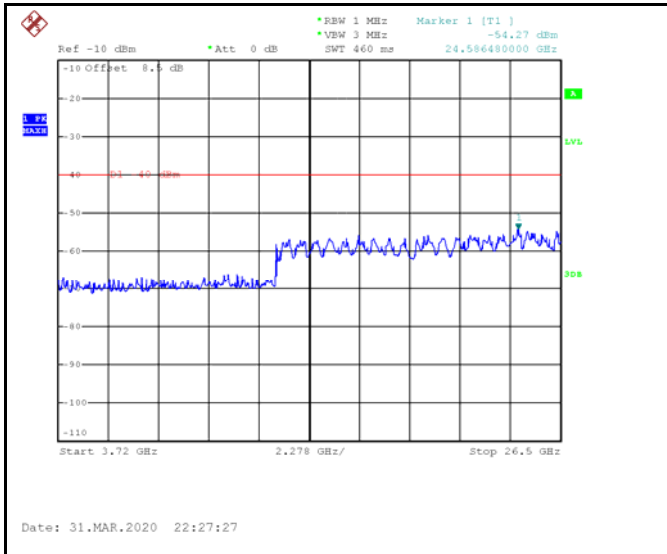
15MHz - High CH 30MHz~3.53GHz

15MHz - High CH 3.72GHz~26.5GHz

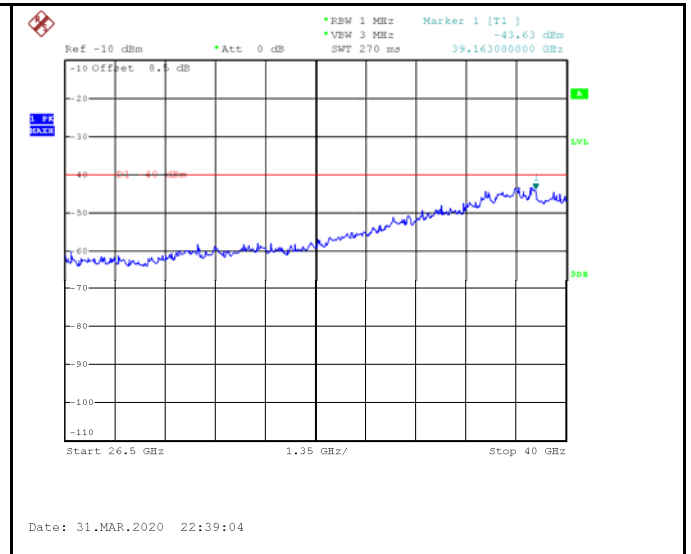


15MHz - High CH 26.5GHz~40GHz

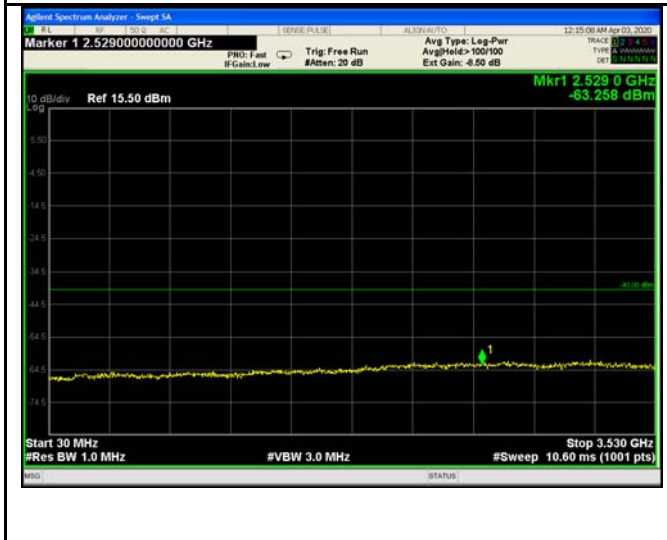
20MHz - Low CH 30MHz~3.53GHz



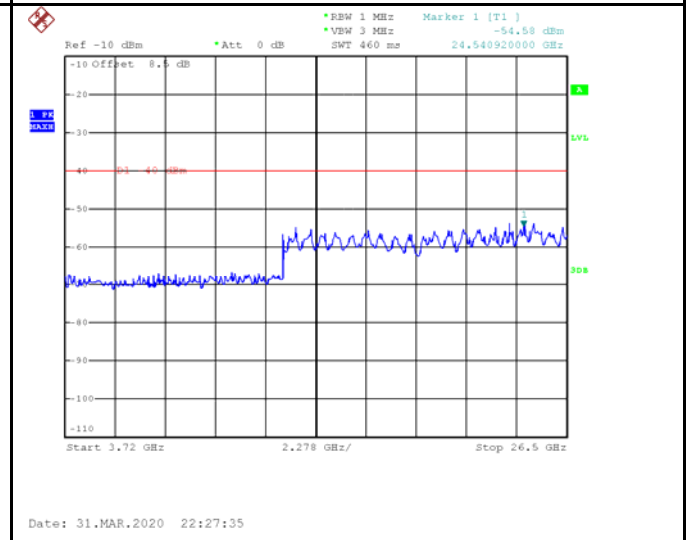
20MHz - Low CH 3.72GHz~26.5GHz



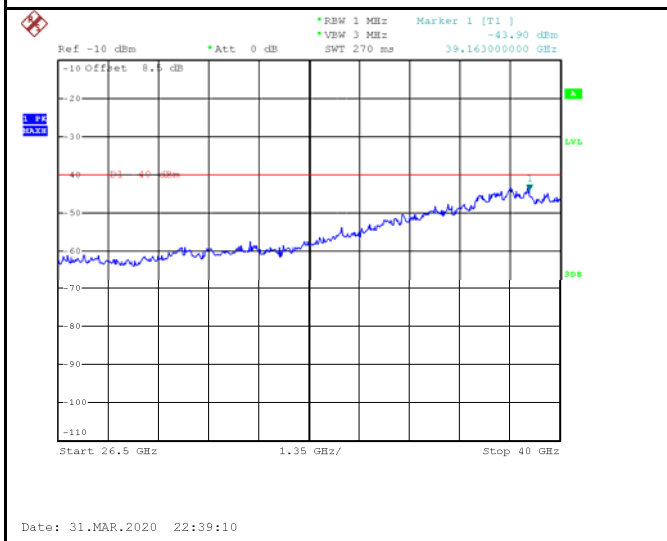
20MHz - Low CH 26.5GHz~40GHz



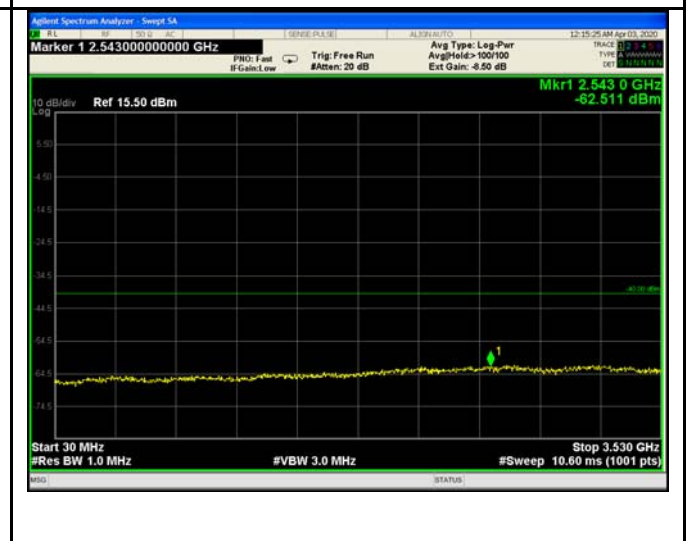
20MHz - Middle CH 30MHz~3.53GHz



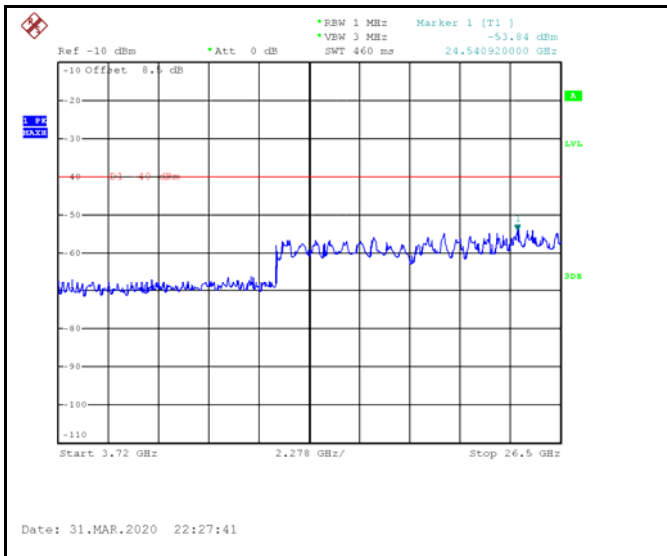
20MHz - Middle CH 3.72GHz~26.5GHz



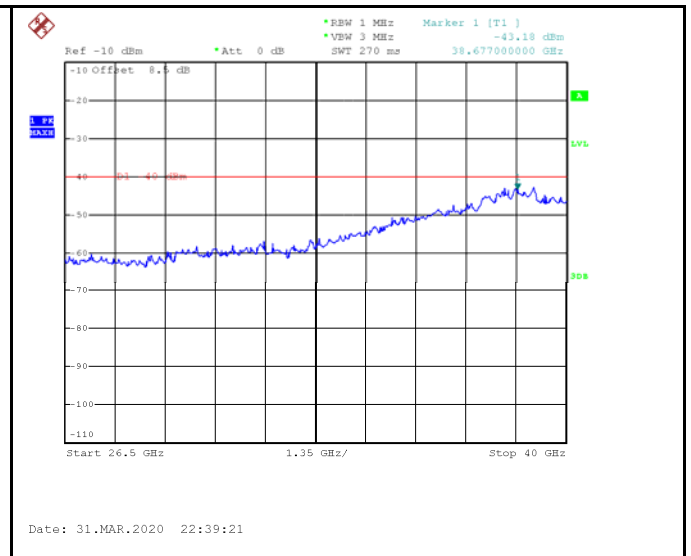
20MHz - Middle CH 26.5GHz~40GHz



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

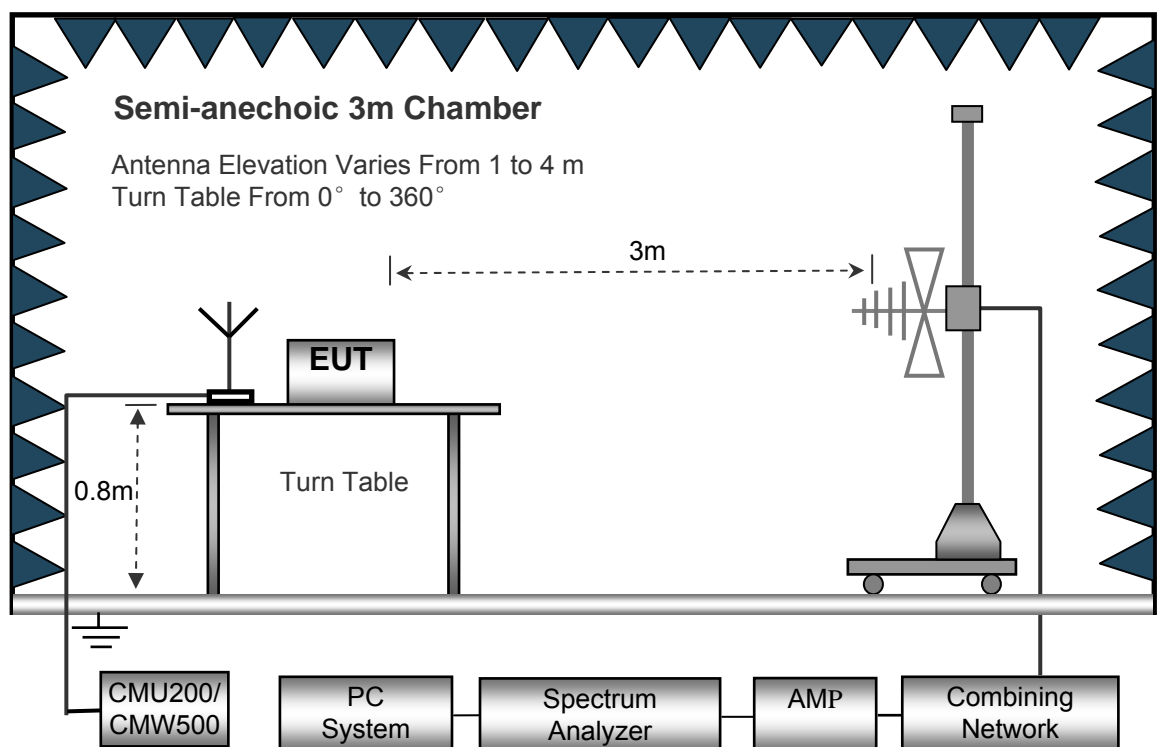
### 12.1 EUT Operation

Operating Environment :

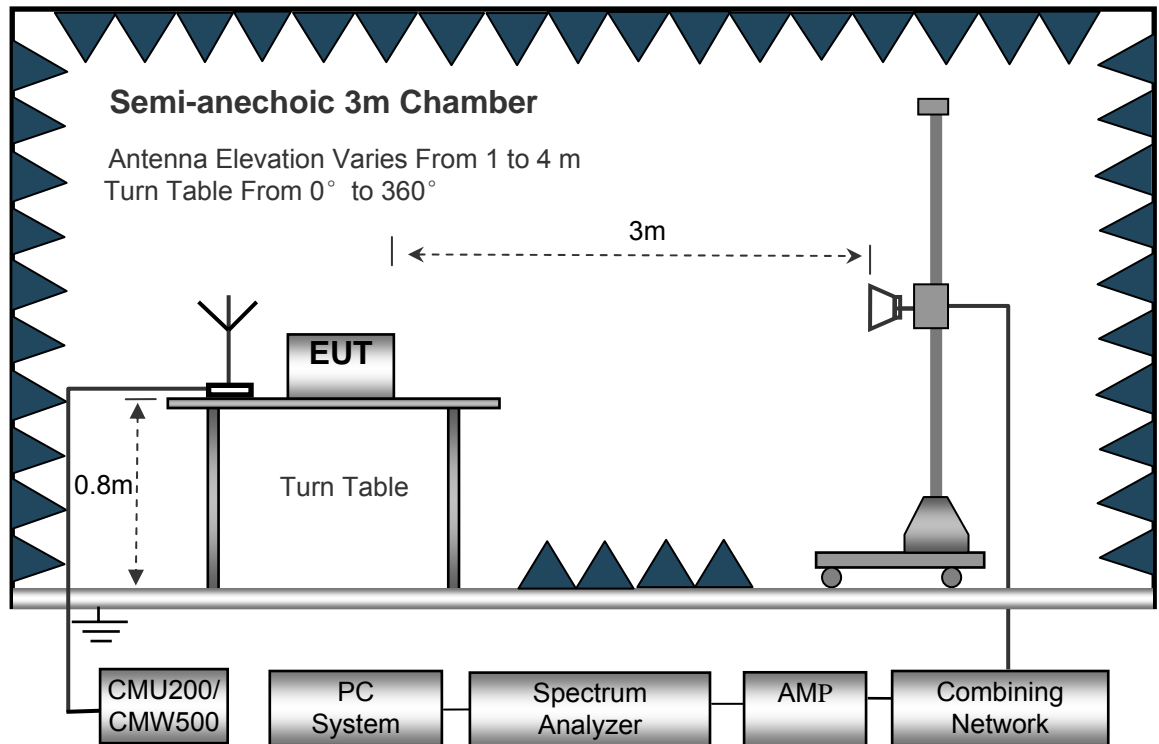
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

### 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										
222.58	47.59	237	1.2	H	-62.92	0.15	0.00	-63.07	-40	-23.07
222.58	44.54	173	2.0	V	-63.05	0.15	0.00	-63.20	-40	-23.20
7110	50.36	115	1.8	H	-63.61	0.30	9.40	-54.51	-40	-14.51
7110	48.59	358	1.1	V	-64.94	0.30	9.40	-55.84	-40	-15.84
10665	49.68	103	1.1	H	-64.32	0.43	10.60	-54.15	-40	-14.15
10665	46.59	86	1.4	V	-63.69	0.43	10.60	-53.52	-40	-13.52
Middle channel										
200.36	48.69	164	1.0	H	-61.82	0.15	0.00	-61.97	-40	-21.97
200.36	46.25	328	1.3	V	-61.34	0.15	0.00	-61.49	-40	-21.49
7250	47.58	43	1.1	H	-66.39	0.30	9.40	-57.29	-40	-17.29
7250	45.26	108	1.1	V	-68.27	0.30	9.40	-59.17	-40	-19.17
10875	48.58	328	1.1	H	-65.42	0.43	10.60	-55.25	-40	-15.25
10875	47.59	343	1.8	V	-62.69	0.43	10.60	-52.52	-40	-12.52
High channel										
201.32	49.65	279	1.1	H	-60.86	0.15	0.00	-61.01	-40	-21.01
201.32	46.87	83	1.0	V	-60.72	0.15	0.00	-60.87	-40	-20.87
7390	48.57	352	2.2	H	-65.40	0.30	9.40	-56.30	-40	-16.30
7390	44.25	355	1.7	V	-69.28	0.30	9.40	-60.18	-40	-20.18
11085	49.58	312	1.3	H	-64.42	0.43	10.60	-54.25	-40	-14.25
11085	46.87	190	1.3	V	-63.41	0.43	10.60	-53.24	-40	-13.24

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			

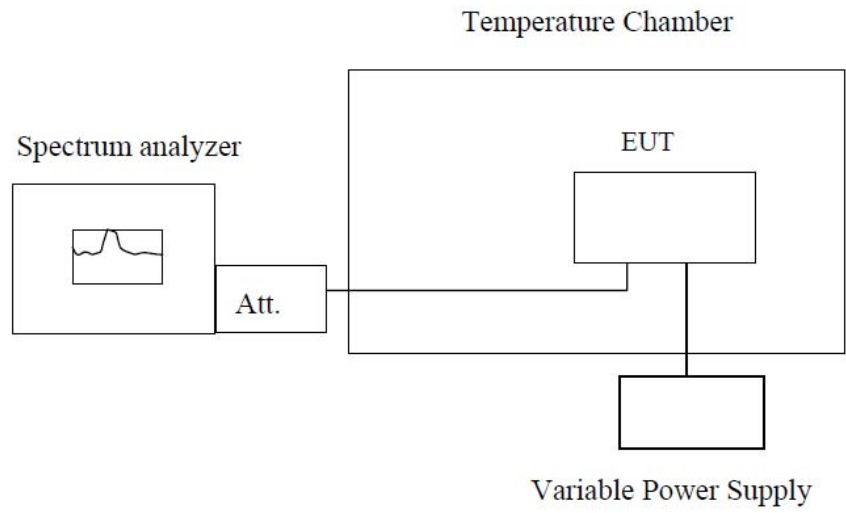
### 13.1 EUT Operation

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	0.0262
-25		88	0.0248
-10		97	0.0273
0		95	0.0267
10		96	0.0270
20		94	0.0265
30		94	0.0265
40		96	0.0270
55		102	0.0287

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	104	0.0293
-25		93	0.0262
-10		102	0.0287
0		97	0.0273
10		96	0.0270
20		92	0.0259
30		94	0.0264
40		92	0.0259
55		105	0.0295

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	105	0.0295
-25		107	0.0301
-10		97	0.0273
0		101	0.0284
10		106	0.0298
20		102	0.0287
30		98	0.0275
40		99	0.0278
55		96	0.0270

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	90	0.0253
-25		98	0.0275
-10		97	0.0272
0		99	0.0278
10		105	0.0295
20		96	0.0270
30		95	0.0267
40		96	0.0270
55		102	0.0287



## 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			

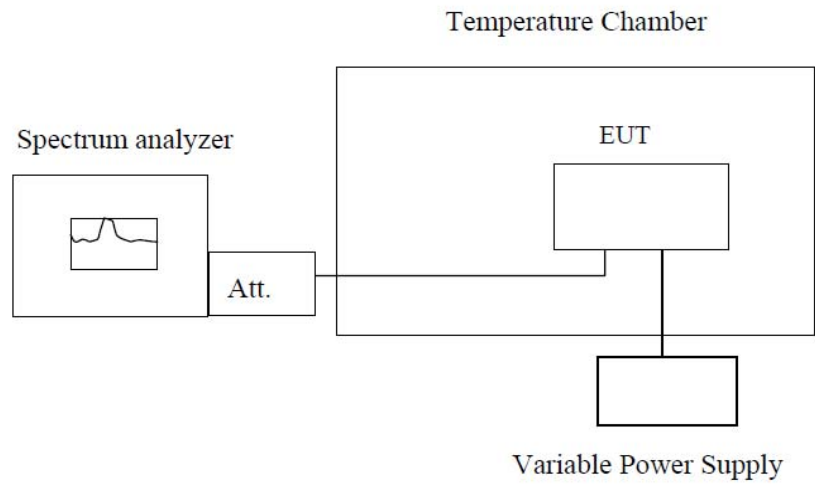
### 14.1 EUT Operation

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	102	0.0287
	120	92	0.0259
	144	90	0.0253

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	96	0.0270
	120	93	0.0262
	144	89	0.0250

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	106	0.0298
	120	107	0.0301
	144	99	0.0278

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (°C)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	95	0.0267
	120	108	0.0303
	144	101	0.0284

