



RF TEST REPORT

Report No.: SET2019-15743

Product: LTE Base Station

FCC ID: 2AG32PBS212096

Model No. : pBS2120

Applicant: Baicells Technologies Co., Ltd.

Address: 3F, Hui Yuan Development Building, No.1 Shangdi Information
Industry Base, Haidian Dist., Beijing, China.

Dates of Testing: 11/20/2019 —01/10/2020

Issued by: CCIC Southern Testing Co., Ltd.

Lab Location: Electronic Testing Building, No. 43 Shahe Road, Xili Street,
Nanshan District, Shenzhen, Guangdong, China.

Tel: 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

Product.....: LTE Base Station

Brand Name.....: BaiCells

Trade Name.....: BaiCells

Applicant.....: Baicells Technologies Co., Ltd.

Applicant Address.....: 3F, Hui Yuan Development Building, No.1 Shangdi
Information Industry Base, Haidian Dist., Beijing, China.

Manufacturer.....: Baicells Technologies Co., Ltd.

Manufacturer Address.....: 3F, Hui Yuan Development Building, No.1 Shangdi
Information Industry Base, Haidian Dist., Beijing, China.

Test Standards.....: 47 CFR FCC Part 2/96

Test Result.....: PASS

Tested by.....: Vincent 2020.03.24

Vincent, Test Engineer

Reviewed by.....: Chris You 2020.03.24

Chris You, Senior Engineer

Approved by.....: Shuangwen Zhang 2020.03.24

ShuangwenZhang, Manager



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Change History		
Issue	Date	Reason for change
1.0	2020.03.24	First edition

1. GENERAL INFORMATION

1.1 EUT Description

EUT Type	LTE Base Station
EUT supports Radios application	LTE Band 48
Frequency Range	LTE Band 48: 3550MHz-3700MHz
Support Channel Bandwidth	10MHz, 20MHz
Maximum Output Power to Antenna	25.68dBm
Type of Modulation	QPSK, 16QAM, 64QAM
Antenna Type	Internal Antenna
Antenna Gain	13dBi
Category of CBSD	Category B

1.2 Maximum ERP/EIRP Power, Frequency Tolerance, and Emission Designator

System	Type of Modulation	Emission Designator	Frequency Tolerance (ppm)	Maximum EIRP(W)
LTE Band48 10MHz Bandwidth	QPSK	9M43G7D	0.032	6.75
	64QAM	9M50W7D	0.032	6.70
LTE Band48 20MHz Bandwidth	QPSK	18M7G7D	0.032	7.38
	64QAM	18M8W7D	0.032	7.28

1.3 Test Standards and Results

1. 47 CFR Part 2, 96
2. ANSI C63.26: 2015
3. KDB 971168 D01 Power Meas License Digital Systems v03r01
4. KDB 662911 D01 Multiple Transmitter Output v02r01
5. KDB 940660 D01 Part 96 CBRS Equipment v01
6. ANSI/TIA/EIA-603-E 2016

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Result	Remarks
	FCC			
1	2.1046 96.41(b)	Max EIRP and maximum Spectral density	PASS	Meet the requirement of Limit
2	96.41(g)	Peak to Average Ratio	PASS	Meet the requirement of Limit
3	2.1049	Emission Bandwidth	PASS	Meet the requirement of Limit
4	2.1055	Frequency Stability	PASS	Meet the requirement of Limit
5	2.1051 96.41(e)	Conducted Spurious Emission	PASS	Meet the requirement of Limit
6	96.41(e)	Emission Mask	PASS	Meet the requirement of Limit
7	2.1051 96.41(e)	Radiated Spurious Emission	PASS	Meet the requirement of Limit

1.4 Test Configuration of Equipment under Test

Antenna port conducted and radiated test items were performed according to ANSI C63.26:2015, with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

Test Items	Band	Bandwidth(MHz)						Modulation		RB#			Test Channel		
		1.4	3	5	10	15	20	QPSK	64QAM	1	Half	Full	L	M	H
EIRP	48				√		√	√	√			√	√	√	√
PSD	48				√		√	√	√			√	√	√	√
Peak to Average Ratio	48				√			√				√	√	√	√
Occupied Bandwidth	48				√		√	√	√			√	√	√	√
Frequency Stability	48				√		√	√				√		√	
Conducted Emission	48				√		√	√				√	√	√	√
Radiated Emission	48	Worst case												√	
Note	1. The mark “√” means that this configuration is chosen for testing. 2. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 3.All supported modulation types were evaluated. The worst case of QPSK was selected. Therefore, the Frequency Stability, Peak to Average Ration, Conducted Emission and Radiated Emission were presented under QPSK mode only.														

1.5 Channel list

10MHz		20MHz	
Channel	Frequency	Channel	Frequency
Low	3555	Low	3560
Middle	3625	Middle	3625
High	3695	High	3690



1.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss, duty cycle correction and attenuator factor.

The duty cycle correction = $10 \log(1/\text{duty cycle}) = 10 \log(1/(6.75/10)) = 1.7(\text{dB})$

Offset factory = ATT loss + Cable loss + Duty cycle correction = $10 + 0.3 + 1.7 = 12(\text{dB})$

1.7 Facilities and Accreditations

1.7.1 Test Facilities

NVLAP Lab Code: 201008-0

CCIC-SET is a third party testing organization accredited by NVLAP according to ISO/IEC 17025. The accreditation certificate number is 201008-0.

FCC- Designation Number: CN5031

CCIC Southern Testing 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. Designation Number: CN5031, valid time is until December 31, 2020.

ISED Registration: 11185A-1

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until Dec. 31, 2020

1.7.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15°C - 35°C
Relative Humidity (%):	30% - 60%
Atmospheric Pressure (kPa):	86KPa - 106KPa

2. 47 CFR PART 2, PART 96 REQUIREMENTS

2.1 Max EIRP and maximum spectral density

2.1.1 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.1.2 Limit of Max EIRP and maximum spectral density

Device	EIRP (dBm/10MHz)	PSD (dBm/MHz)
☐ End User Device	23	N/A
☐ Category A CBSD	30	20
☒ Category B CBSD	47	37

2.1.3 Test Procedures

For Maximum EIRP

1. Connect the transmitter to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
2. Set span to $2 \times$ to $3 \times$ the OBW.
3. Set RBW = 1% to 5% of the OBW.
4. Set VBW $\geq 3 \times$ RBW.
5. Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
6. Sweep time:
 - 1) Set = auto-couple, or
 - 2) Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ 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 $10 \log (1/\text{duty cycle})$ to the measured power level to compute the average power during continuous transmission.
12. $\text{EIRP} = P_{\text{Meas}} + G_T$.

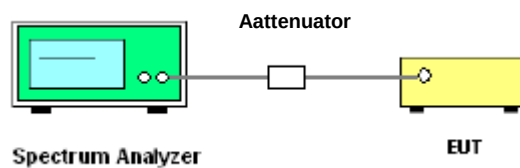
P_{Meas} measured transmitter output power or PSD.

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.

2.1.4 Test Setup



2.1.5 Test Results



EIRP:

Transmit Output power								
Bandwidth	Modulation	Test Channel	Chain 0 Output power (dBm/10MHz)	Chain 1 Output power (dBm/10MHz)	Total Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP LIMIT (dBm/10MHz)
10MHz	QPSK	Low	22.45	21.51	25.02	13	38.02	47
		Middle	22.81	21.55	25.24	13	38.24	
		High	22.86	21.62	25.29	13	38.29	
	64QAM	Low	22.43	21.59	25.04	13	38.04	
		Middle	22.14	21.19	24.70	13	37.70	
		High	22.41	22.08	25.26	13	38.26	

Transmit Output power								
Bandwidth	Modulation	Test Channel	Chain 0 Output power (dBm/10MHz)	Chain 1 Output power (dBm/10MHz)	Total Power (dBm/10MHz)	Antenna Gain (dBi)	EIRP (dBm/10MHz)	EIRP LIMIT (dBm/10MHz)
20MHz	QPSK	Low	19.77	18.75	22.30	13	35.30	47
		Middle	19.96	19.21	22.61	13	35.61	
		High	20.44	19.23	22.89	13	35.89	
	64QAM	Low	19.77	18.72	22.29	13	35.29	
		Middle	19.71	19.02	22.39	13	35.39	
		High	20.27	19.24	22.80	13	35.80	

Transmit Output power								
Bandwidth	Modulation	Test Channel	Chain 0 Output power (dBm/20MHz)	Chain 1 Output power (dBm/20MHz)	Total Power (dBm/20MHz)	Antenna Gain (dBi)	EIRP (dBm/20MHz)	EIRP LIMIT (dBm/20MHz)
20MHz	QPSK	Low	22.89	21.59	25.30	13	38.30	-
		Middle	22.74	22.32	25.55	13	38.55	
		High	22.87	22.46	25.68	13	38.68	
	64QAM	Low	22.74	21.64	25.24	13	38.24	
		Middle	22.67	21.57	25.17	13	38.17	
		High	22.83	22.37	25.62	13	38.62	



PSD:

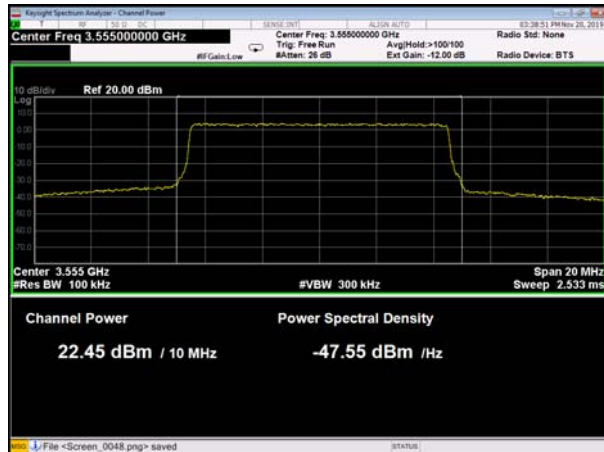
PSD								
Bandwidth	Modulation	Test Channel	Chain 0 PSD (dBm/MHz)	Chain 1 PSD (dBm/MHz)	Total PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP Density (dBm/MHz)	EIRP Density LIMIT (dBm/MHz)
10MHz	QPSK	Low	14.87	13.26	17.15	13	30.15	37
		Middle	14.61	12.93	16.86	13	29.86	
		High	14.58	13.80	17.22	13	30.22	
	64QAM	Low	14.16	13.27	16.75	13	29.75	
		Middle	13.77	12.80	16.32	13	29.32	
		High	14.32	13.26	16.83	13	29.83	
PSD								
Bandwidth	Modulation	Test Channel	Chain 0 PSD (dBm/MHz)	Chain 1 PSD (dBm/MHz)	Total PSD (dBm/MHz)	Antenna Gain (dBi)	EIRP Density (dBm/MHz)	EIRP Density LIMIT (dBm/MHz)
20MHz	QPSK	Low	11.54	10.57	14.09	13	27.09	37
		Middle	11.29	10.96	14.14	13	27.14	
		High	11.11	11.19	14.16	13	27.16	
	64QAM	Low	11.38	10.30	13.88	13	26.88	
		Middle	11.29	11.20	14.26	13	27.26	
		High	12.29	11.65	14.99	13	27.99	

Note: EIRP/EIRP Density=Total power /PSD+ Directional gain

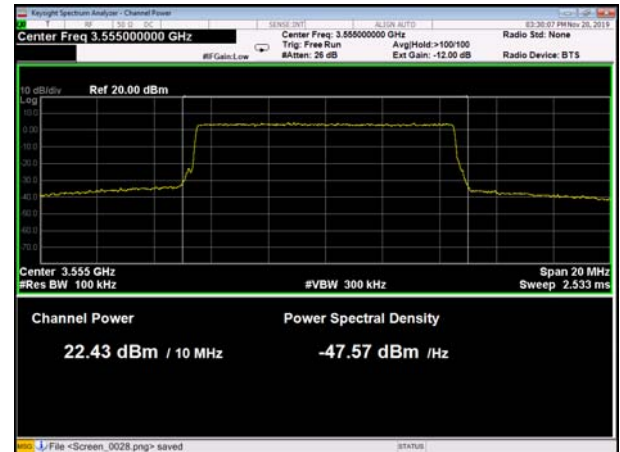
2.1.6 Test plots

EIRP Chain0

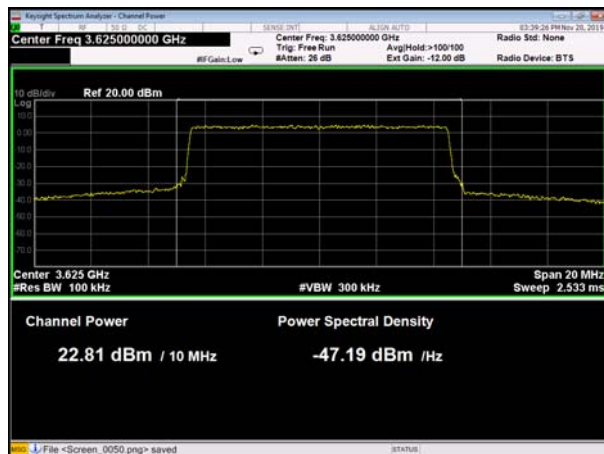
10MHz- Low CH QPSK



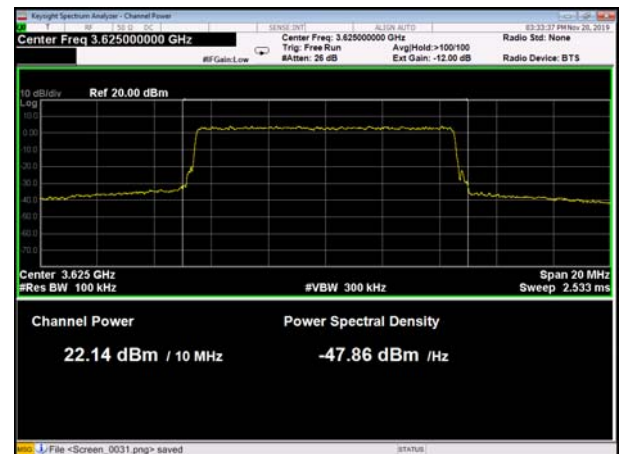
10MHz- Low CH 64QAM



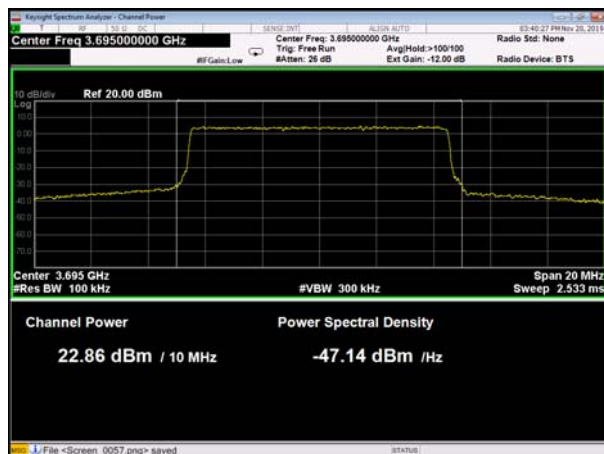
10MHz- Middle CH QPSK



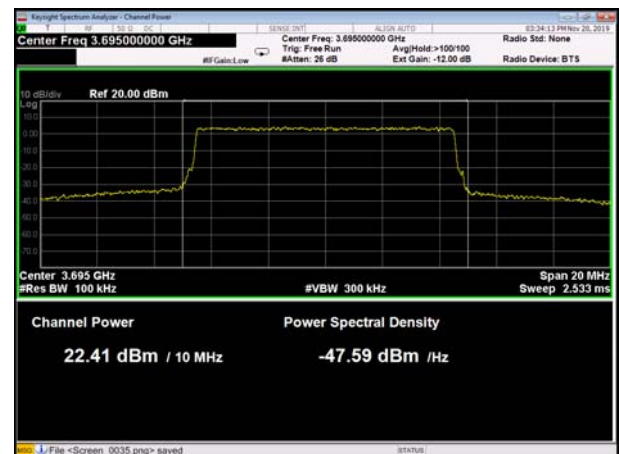
10MHz- Middle CH 64QAM



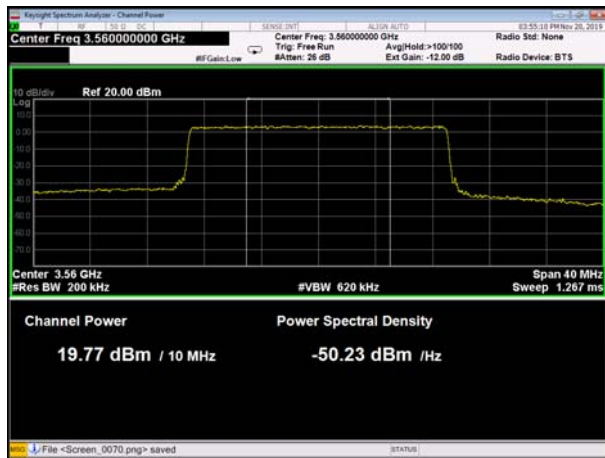
10MHz- High CH QPSK



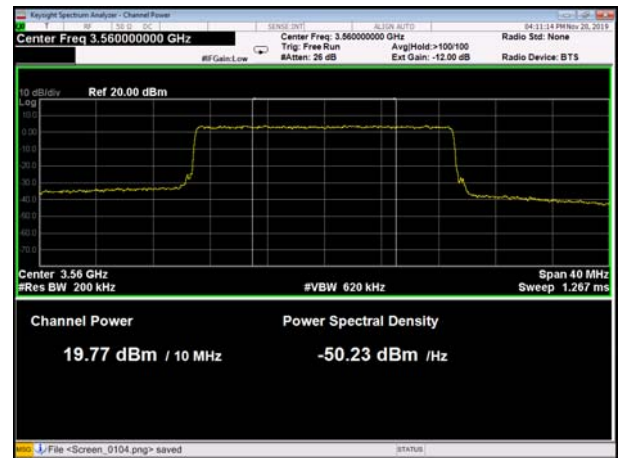
10MHz- High CH 64QAM



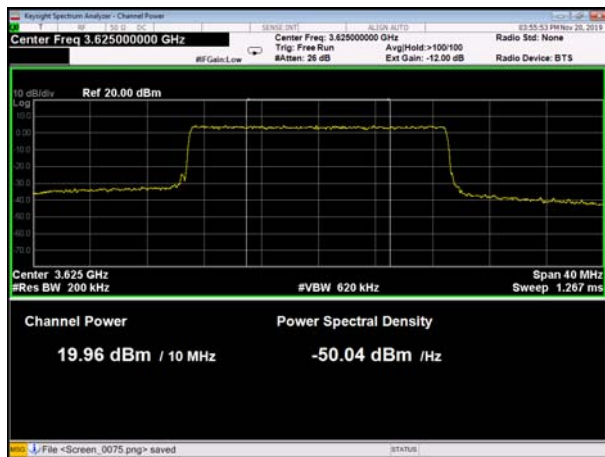
20MHz- Low CH QPSK



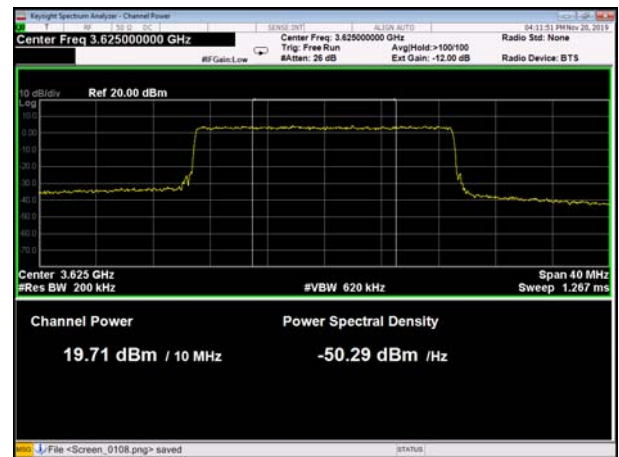
20MHz- Low CH 64QAM



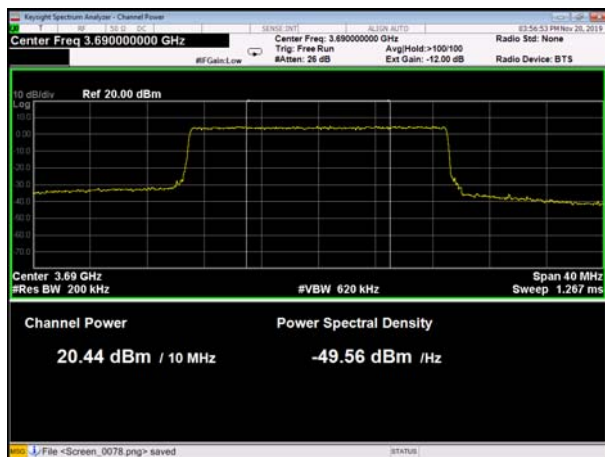
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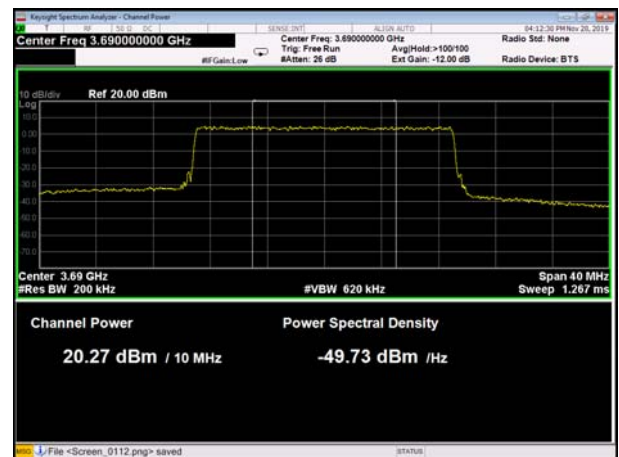
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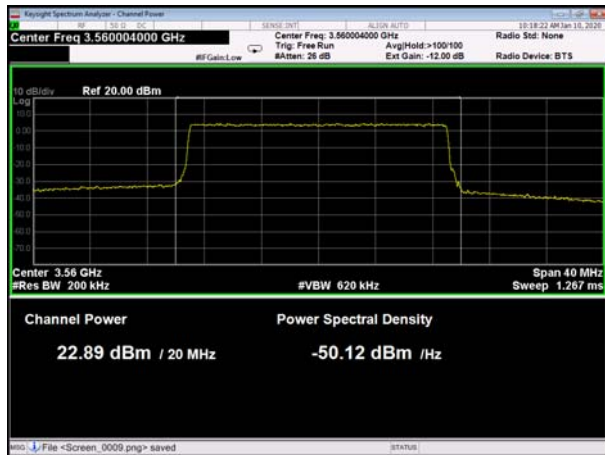
20MHz- High CH QPSK



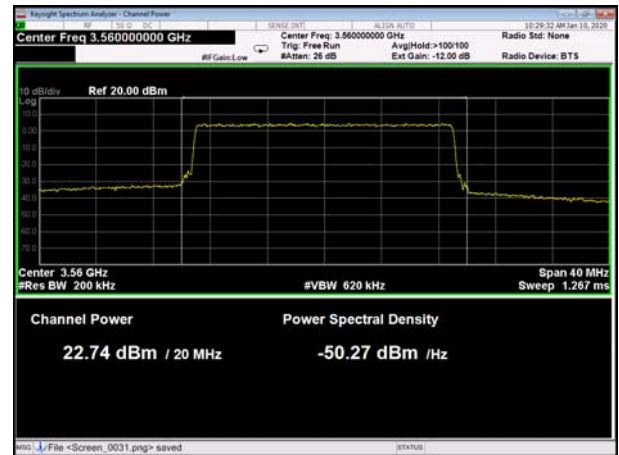
20MHz- High CH 64QAM



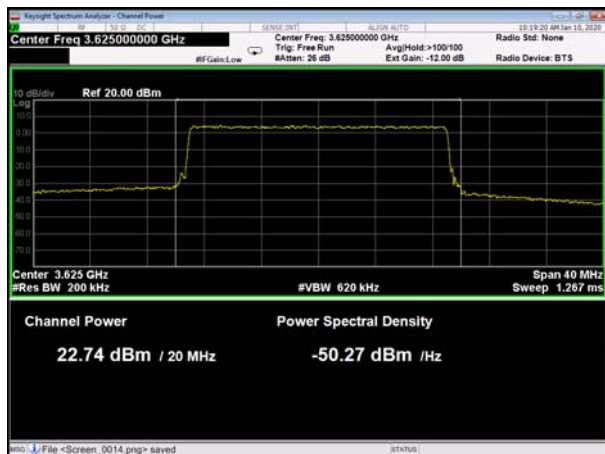
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(Channel power BW=20MHz)



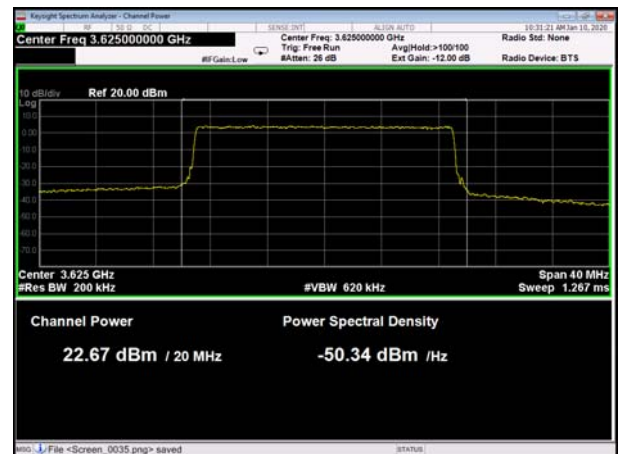
20MHz- Low CH 64QAM
(Channel power BW=20MHz)



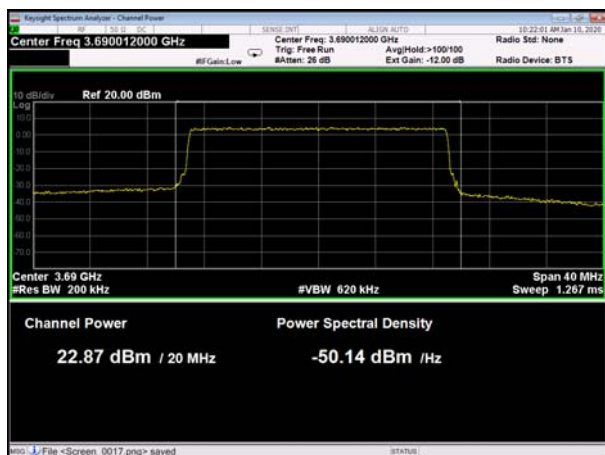
20MHz- Middle CH QPSK
(Channel power BW=20MHz)



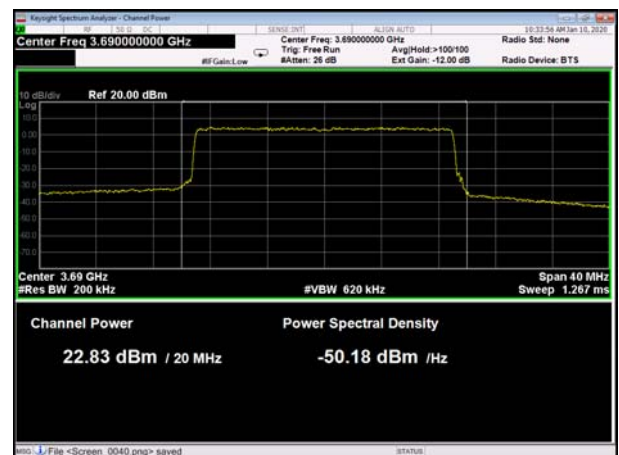
20MHz- Middle CH 64QAM
(Channel power BW=20MHz)



20MHz- High CH QPSK
(Channel power BW=20MHz)



20MHz- High CH 64QAM
(Channel power BW=20MHz)

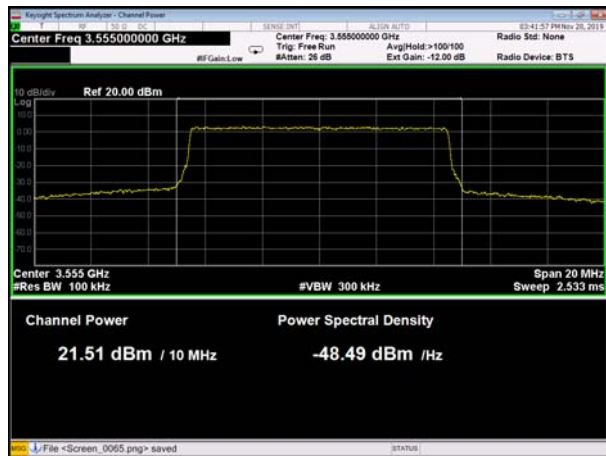




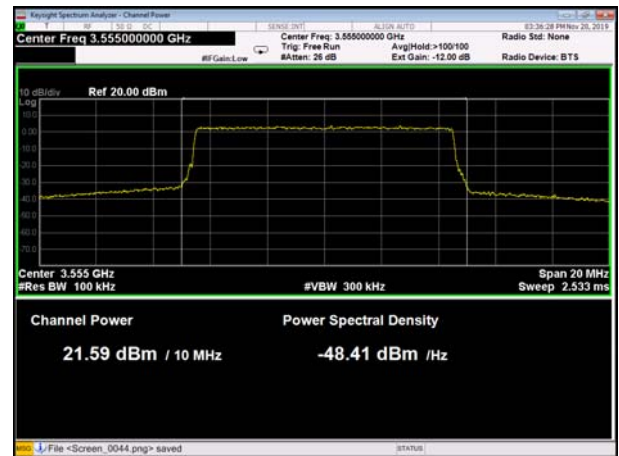
EIRP

Chain1

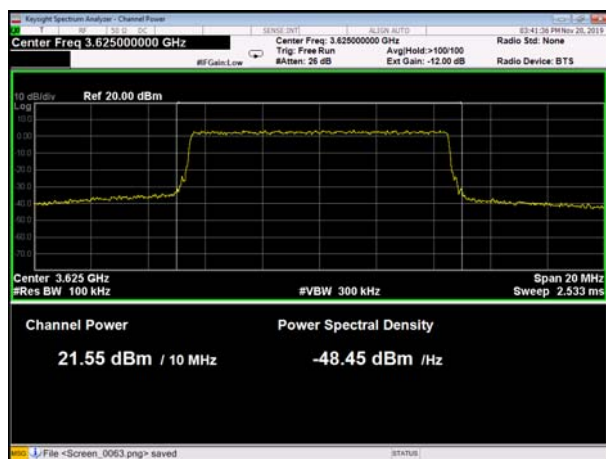
10MHz- Low CH QPSK



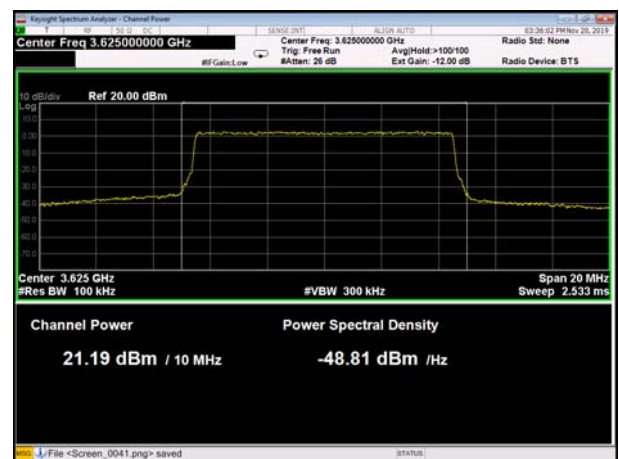
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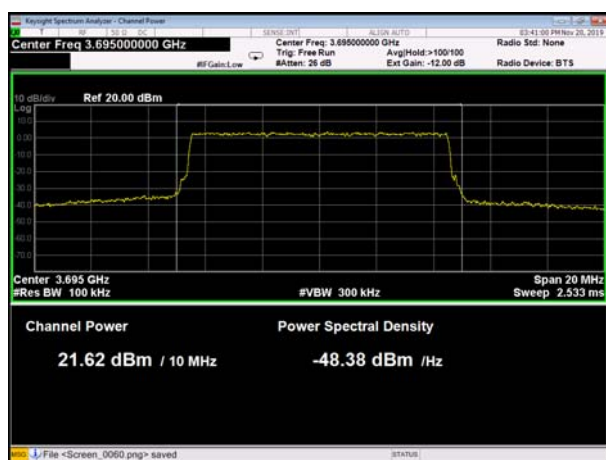
10MHz- Middle CH QPSK



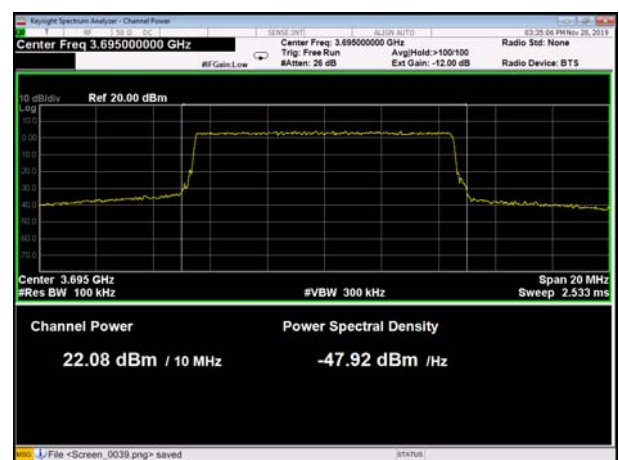
10MHz- Middle CH 64QAM



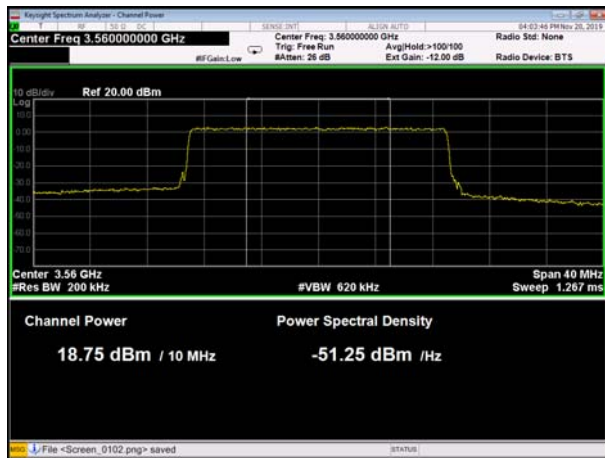
10MHz- High CH QPSK



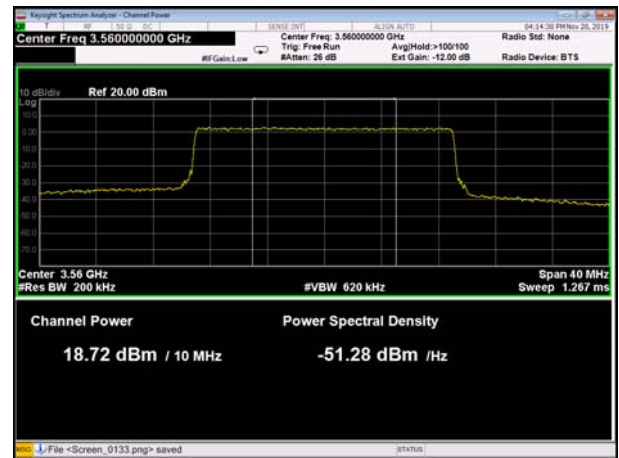
10MHz- High CH 64QAM



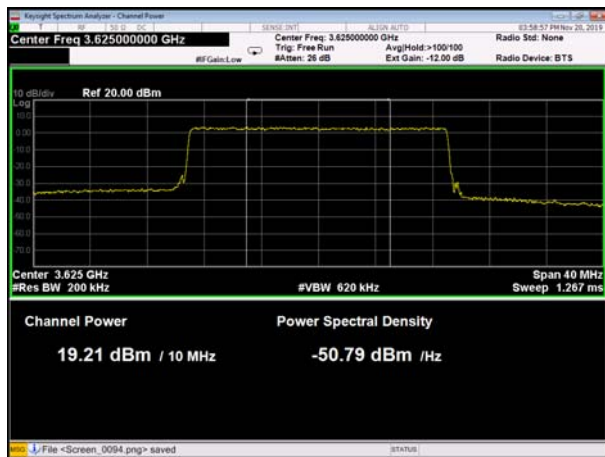
20MHz- Low CH QPSK



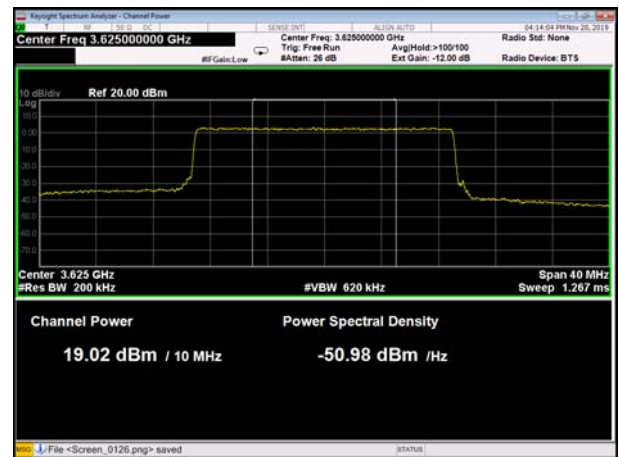
20MHz- Low CH 64QAM



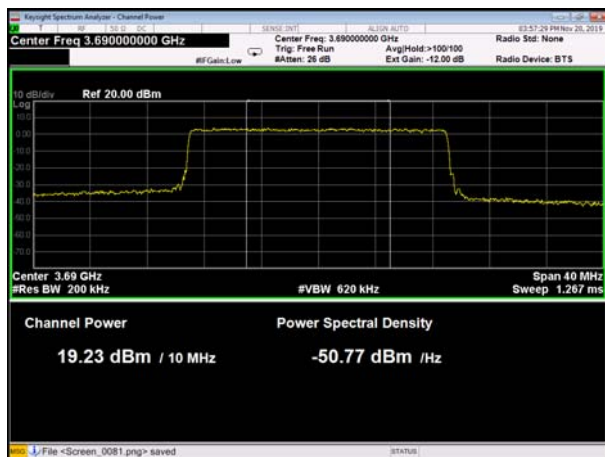
20MHz- Middle CH QPSK



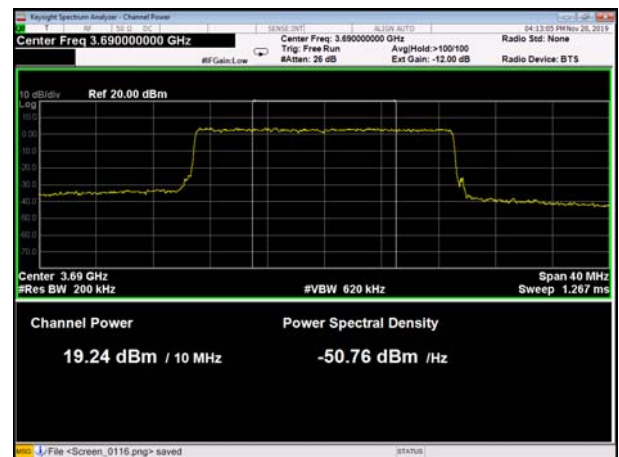
20MHz- Middle CH 64QAM



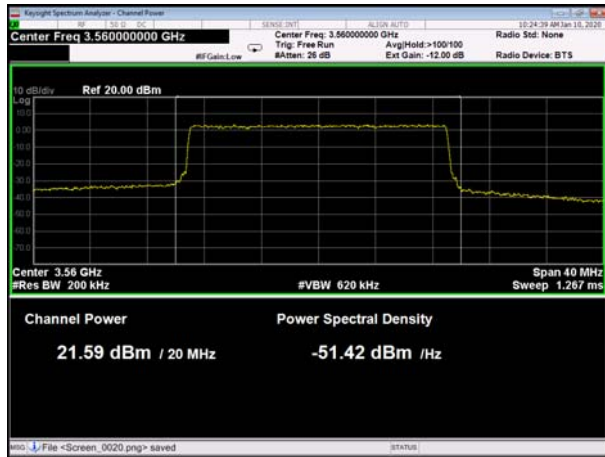
20MHz- High CH QPSK



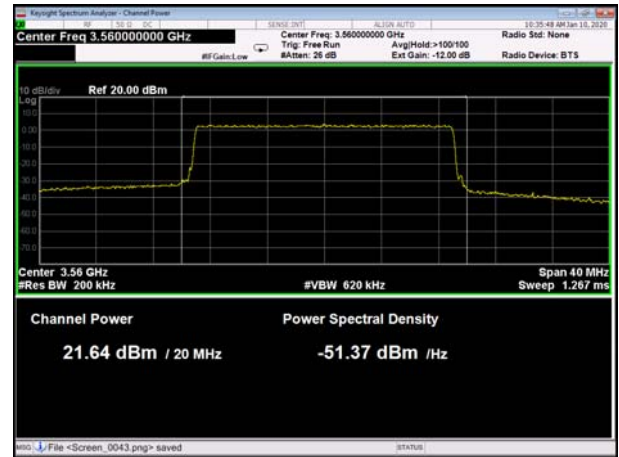
20MHz- High CH 64QAM



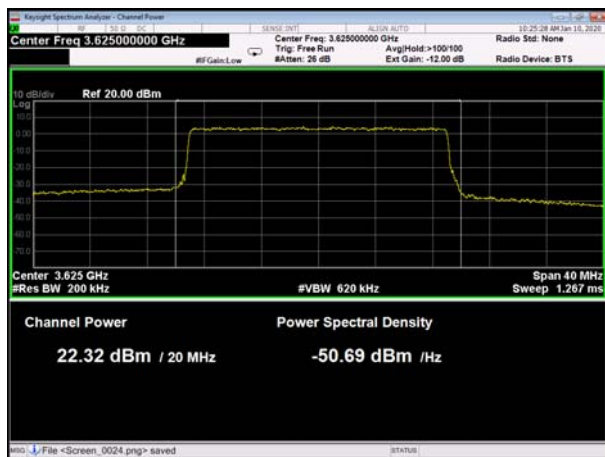
20MHz- Low CH QPSK
(Channel power BW=20MHz)



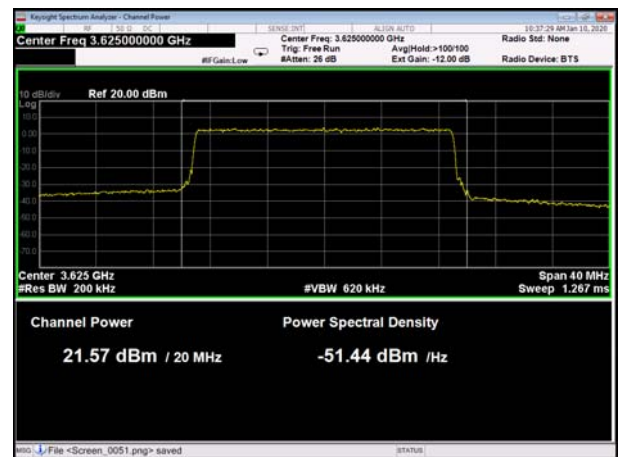
20MHz- Low CH 64QAM
(Channel power BW=20MHz)



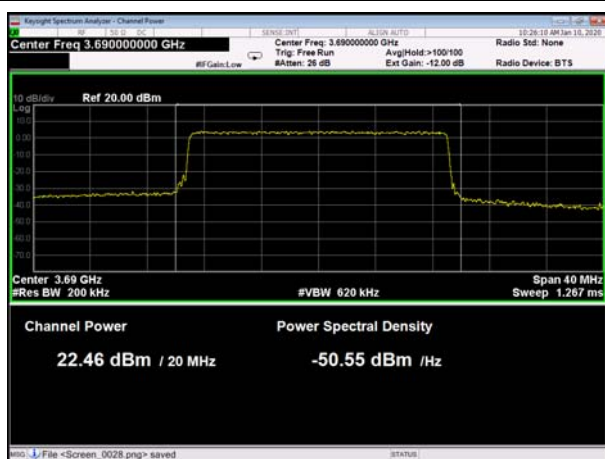
20MHz- Middle CH QPSK
(Channel power BW=20MHz)



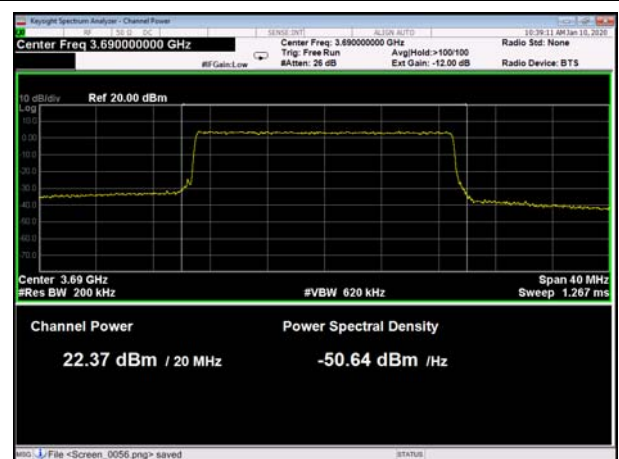
20MHz- Middle CH 64QAM
(Channel power BW=20MHz)



20MHz- High CH QPSK
(Channel power BW=20MHz)



20MHz- High CH 64QAM
(Channel power BW=20MHz)

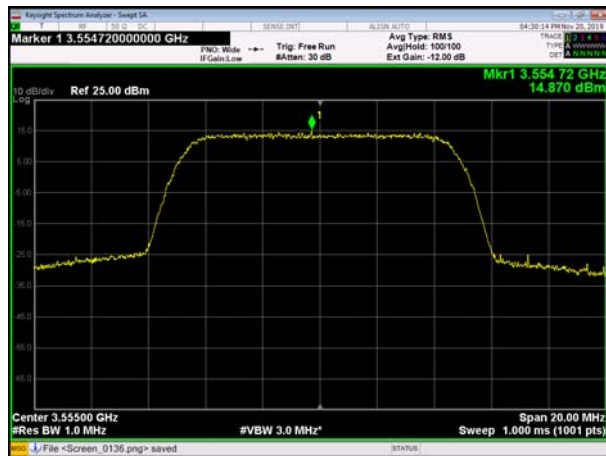




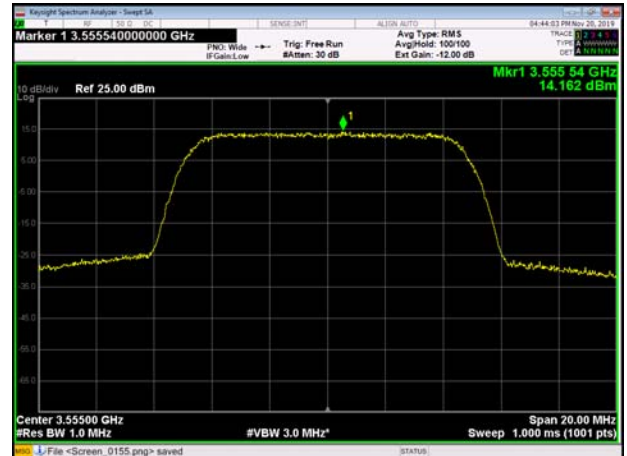
PSD

Chain0

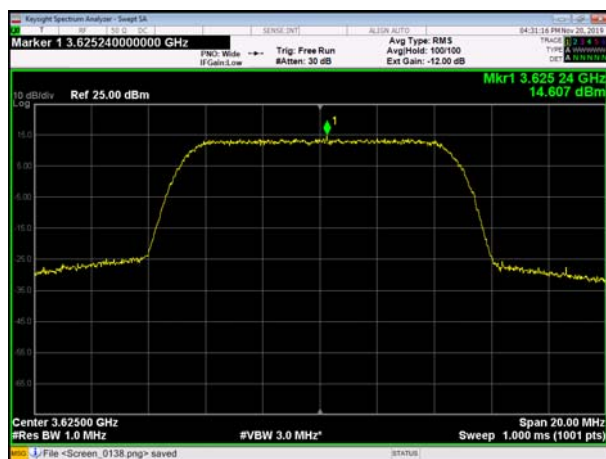
10MHz- Low CH QPSK



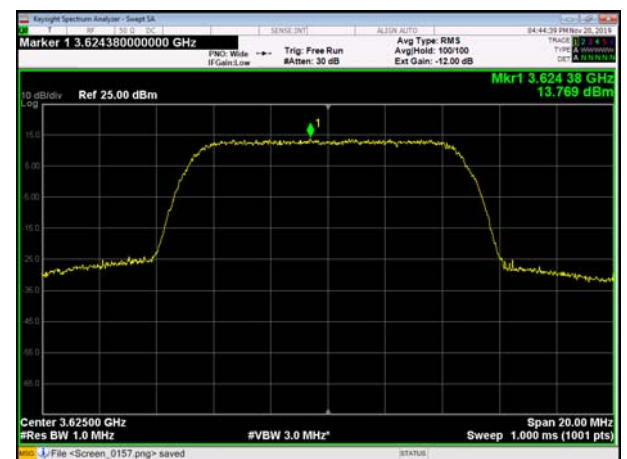
10MHz- Low CH 64QAM



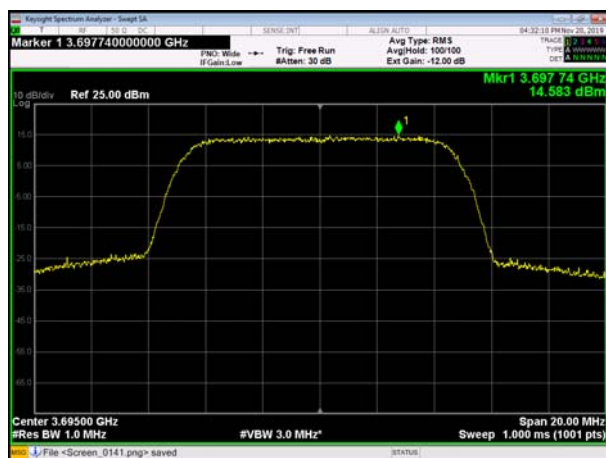
10MHz- Middle CH QPSK



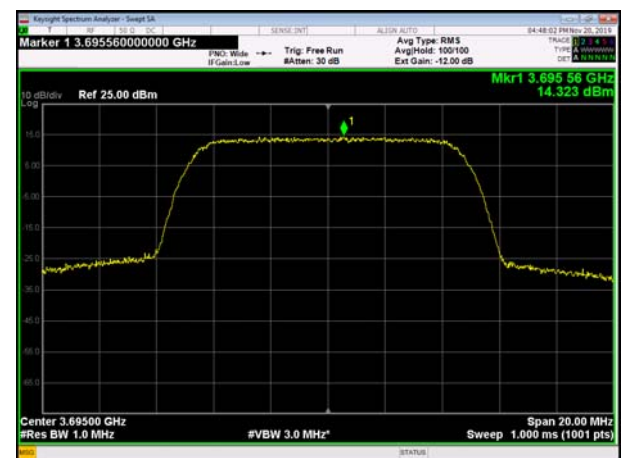
10MHz- Middle CH 64QAM



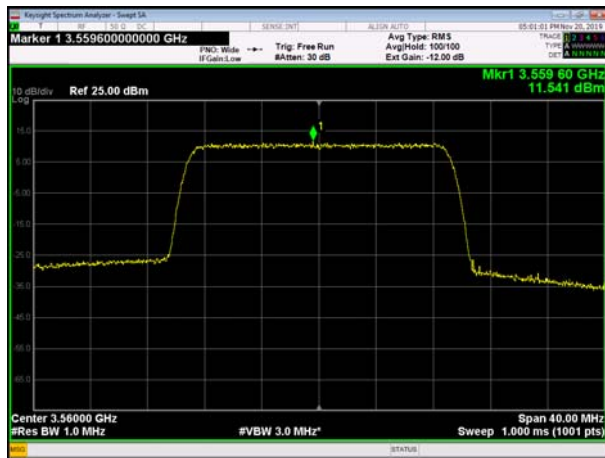
10MHz- High CH QPSK



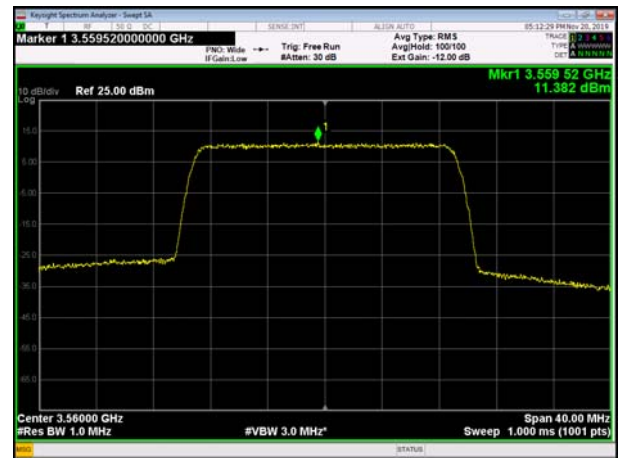
10MHz- High CH 64QAM



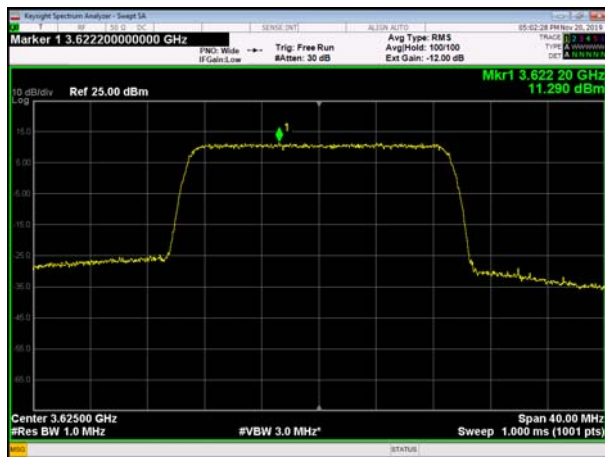
20MHz- Low CH QPSK



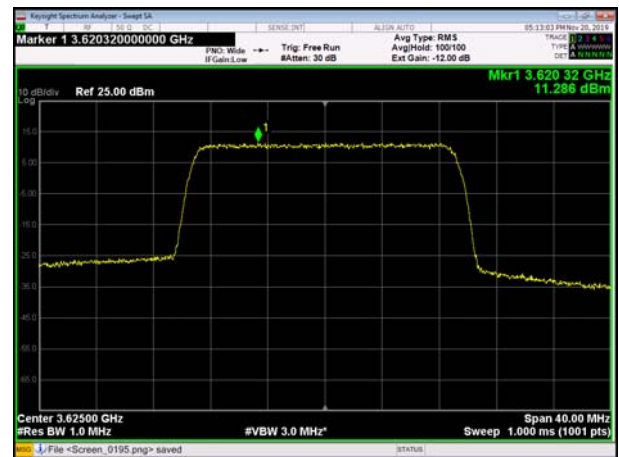
20MHz- Low CH 64QAM



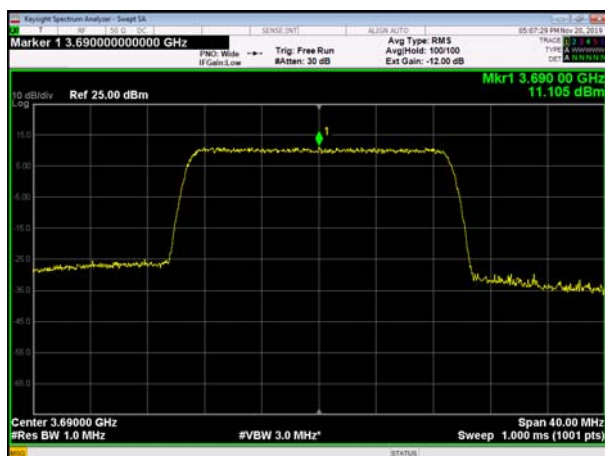
20MHz- Middle CH QPSK



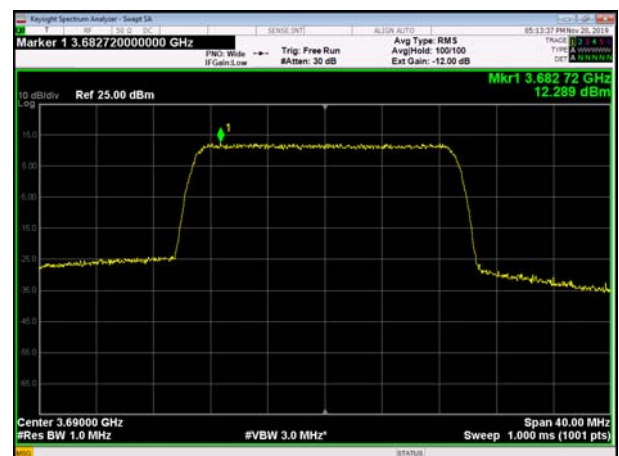
20MHz- Middle CH 64QAM



20MHz- High CH QPSK

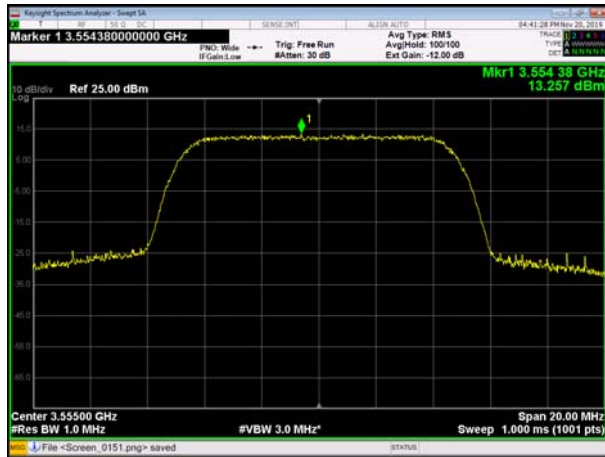


20MHz- High CH 64QAM

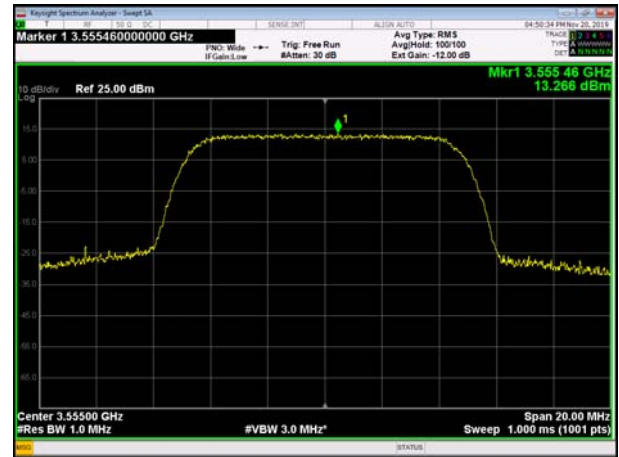


Chain1

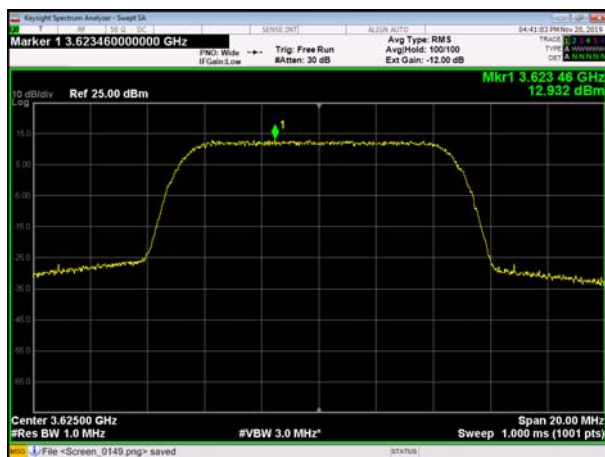
10MHz- Low CH QPSK



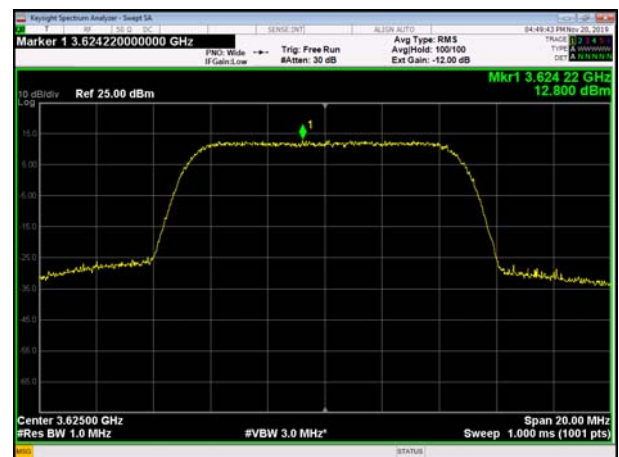
10MHz- Low CH 64QAM



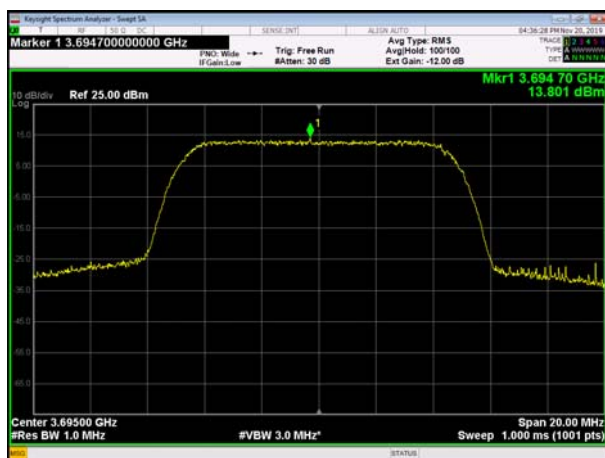
10MHz- Middle CH QPSK



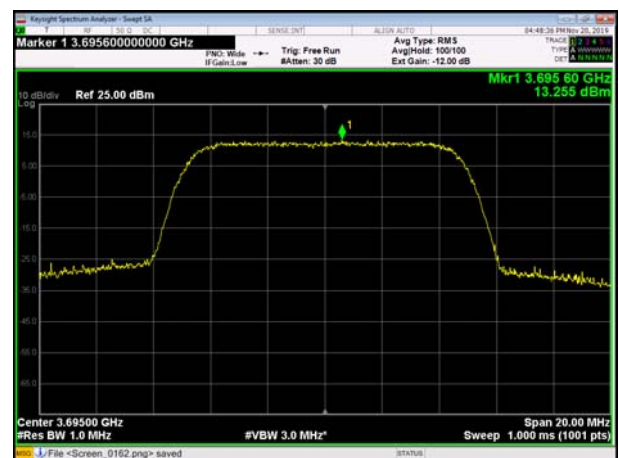
10MHz- Middle CH 64QAM



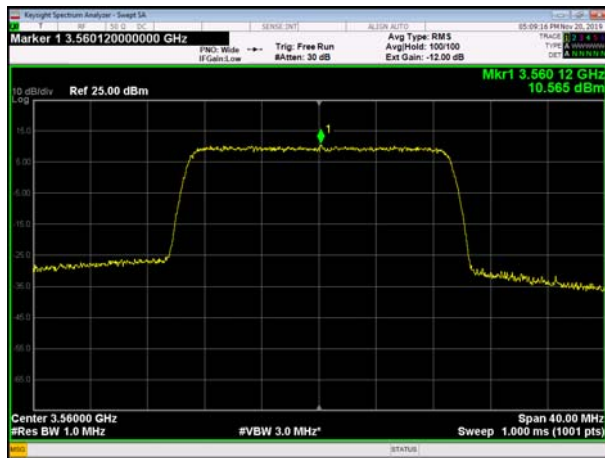
10MHz- High CH QPSK



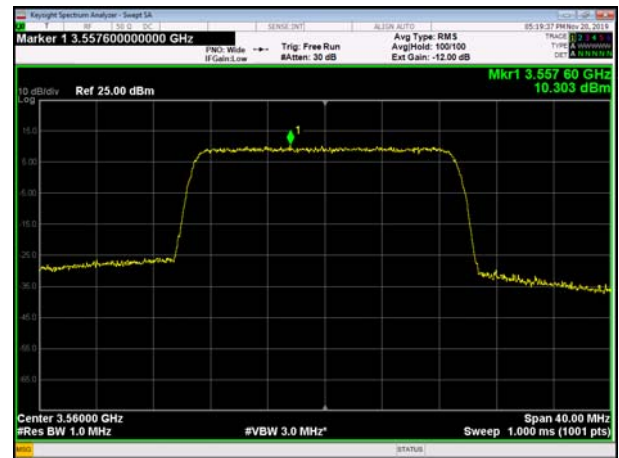
10MHz- High CH 64QAM



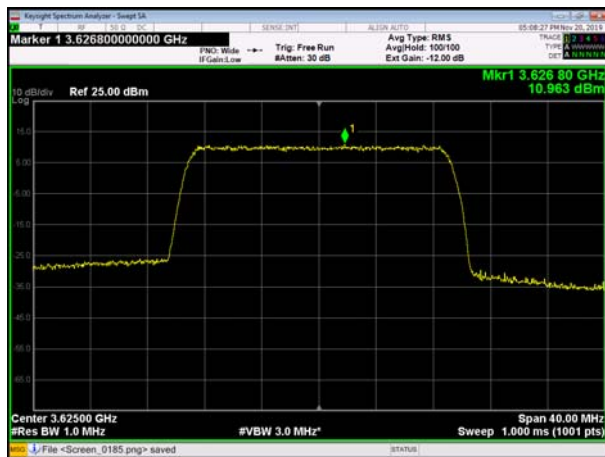
20MHz- Low CH QPSK



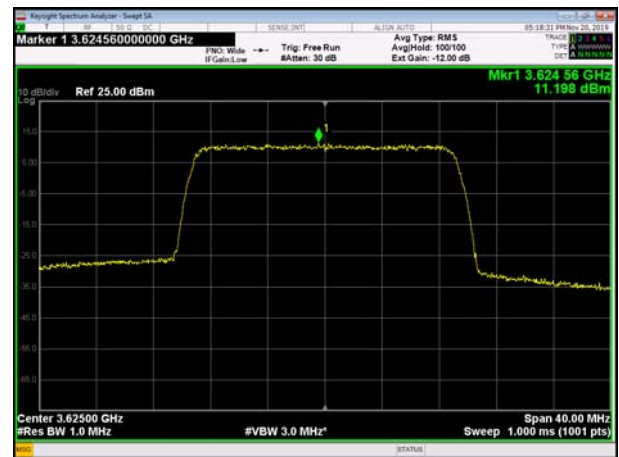
20MHz- Low CH 64QAM



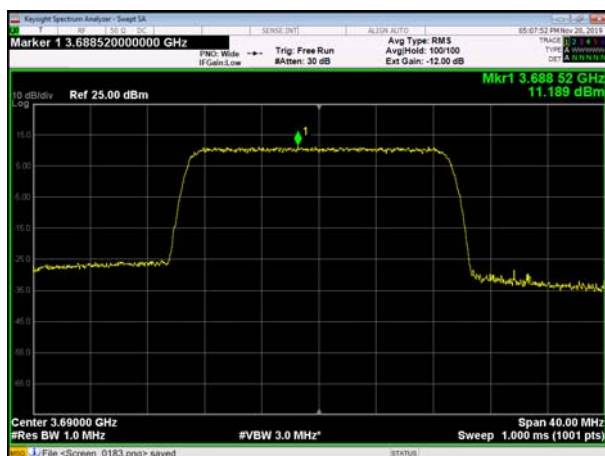
20MHz- Middle CH QPSK



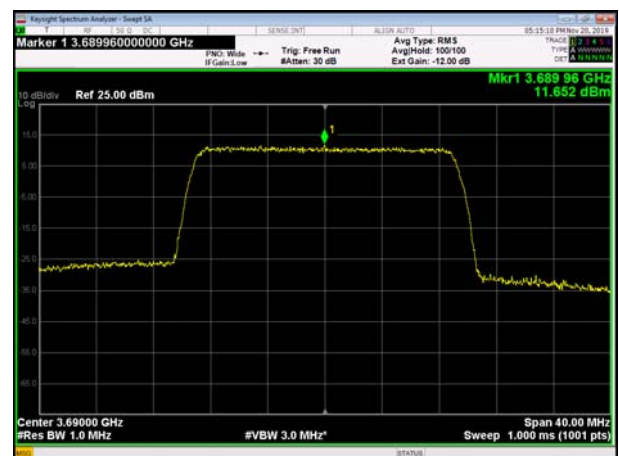
20MHz- Middle CH 64QAM



20MHz- High CH QPSK



20MHz- High CH 64QAM



2.2 Peak to Average Ratio

2.2.1 Definition

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

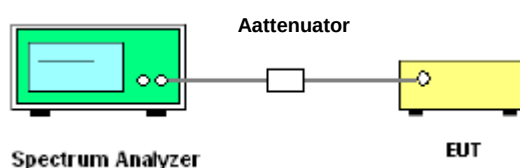
2.2.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.2.3 Test Procedures

1. The EUT was connected to the spectrum analyzer .
2. Set the CCDF (Complementary Cumulative Distribution Function) option on the spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio.

2.2.4 Test Setup



2.2.5 Test Results of Peak-to-Average Ratio

10MHz Bandwidth

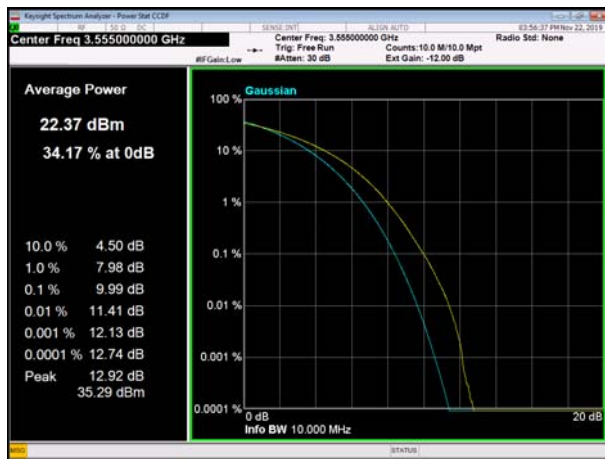
Mode	Chain 0			Chain 1			Limit (dB)
Channel	Low	Middle	High	Low	Middle	High	13
Peak-to-Average Ratio (dB)	9.99	10.01	9.96	9.73	9.94	9.9	

20MHz Bandwidth

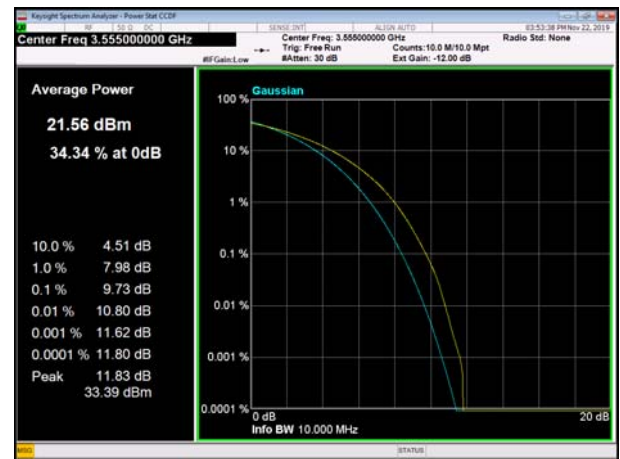
Mode	Chain 0			Chain 1			Limit (dB)
Channel	Low	Middle	High	Low	Middle	High	13
Peak-to-Average Ratio (dB)	9.96	9.98	9.93	9.74	9.95	9.88	

2.2.6 Test plot

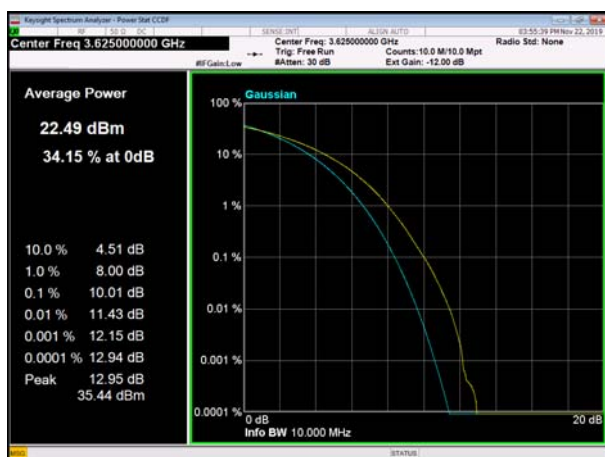
Chain0, 10MHz- Low CH QPSK



Chain1, 10MHz- Low CH QPSK



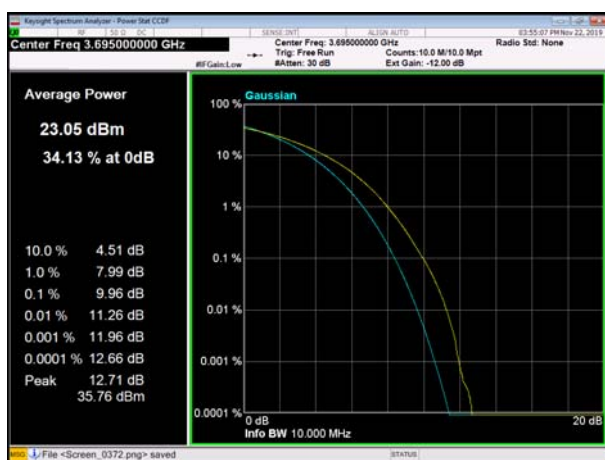
Chain0, 10MHz- Middle CH QPSK



Chain1, 10MHz- Middle CH QPSK



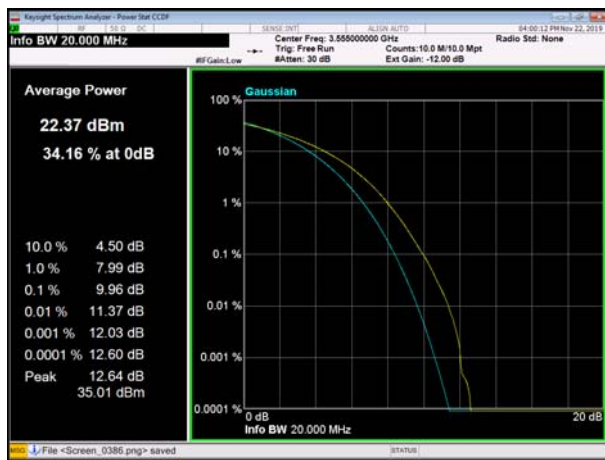
Chain0, 10MHz- High CH QPSK



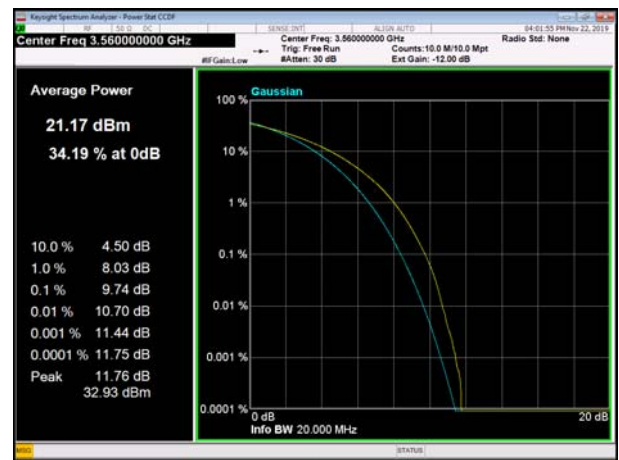
Chain1, 10MHz- High CH QPSK



Chain0, 20MHz- Low CH QPSK



Chain1, 20MHz- Low CH QPSK



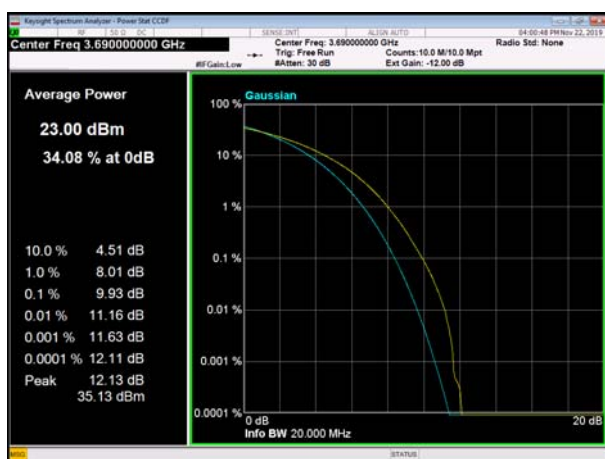
Chain0, 20MHz- Middle CH QPSK



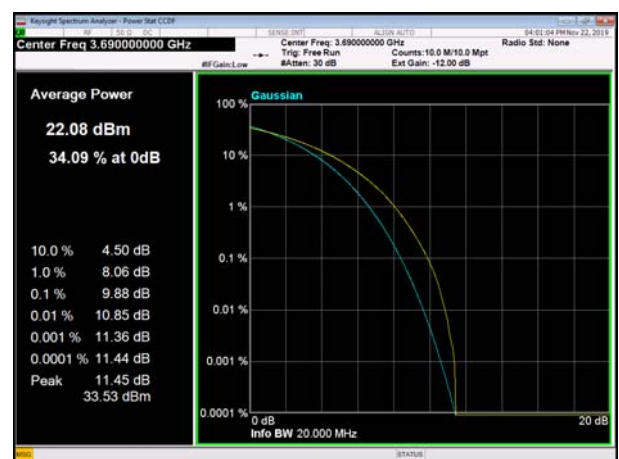
Chain1, 20MHz- Middle CH QPSK



Chain0, 20MHz- High CH QPSK



Chain1, 20MHz- High CH QPSK



2.3 Occupied Bandwidth

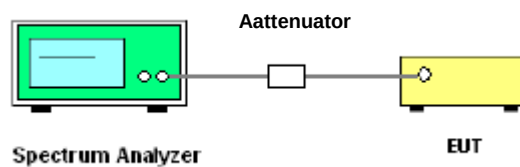
2.3.1 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.3.2 Test Procedures

1. The EUT was connected to the spectrum analyzer
2. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set RBW= 1% to 5% of the occupied bandwidth, VBW= 3*RBW, peak detector, trace maximum hold.

2.3.3 Test Setup



2.3.4 Test Results of 26dB Down Bandwidth

Chain 0

Band width (MHz)	Modulation	Test channel	26dB Down Bandwidth (MHz)
10MHz	QPSK	Low	9.339
		Middle	9.356
		High	9.425
	64QAM	Low	9.374
		Middle	9.381
		High	9.363
Band width (MHz)	Modulation	Test channel	26dB Down Bandwidth (MHz)
20MHz	QPSK	Low	18.52
		Middle	18.52
		High	18.68
	64QAM	Low	18.75
		Middle	18.63
		High	18.76

Chain 1

Band width (MHz)	Modulation	Test channel	26dB Bandwidth (MHz)
10MHz	QPSK	Low	9.373
		Middle	9.419
		High	9.357
	64QAM	Low	9.425
		Middle	9.498
		High	9.404
Band width (MHz)	Modulation	Test channel	26dB Bandwidth (MHz)
20MHz	QPSK	Low	18.59
		Middle	18.66
		High	18.59
	64QAM	Low	18.67
		Middle	18.62
		High	18.59

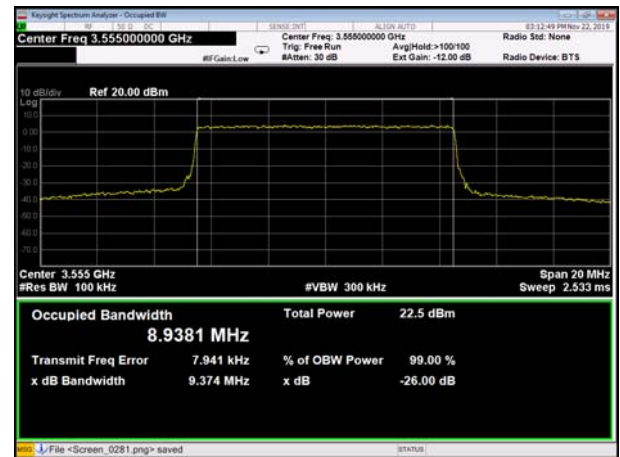
2.3.5 Test Results (Plots)

Chain 0

10MHz- Low CH QPSK



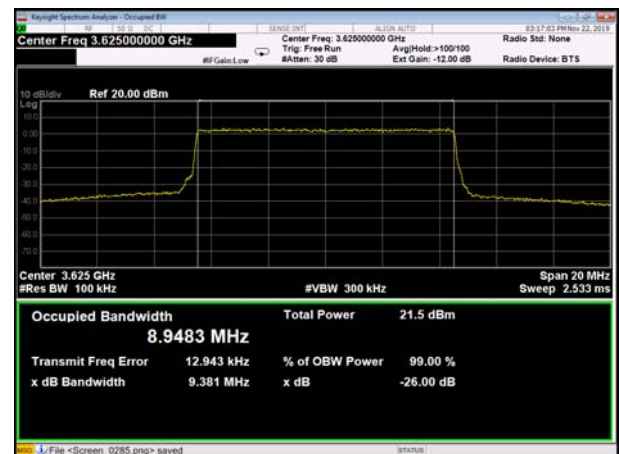
10MHz- Low CH 64QAM



10MHz- Middle CH QPSK



10MHz- Middle CH 64QAM



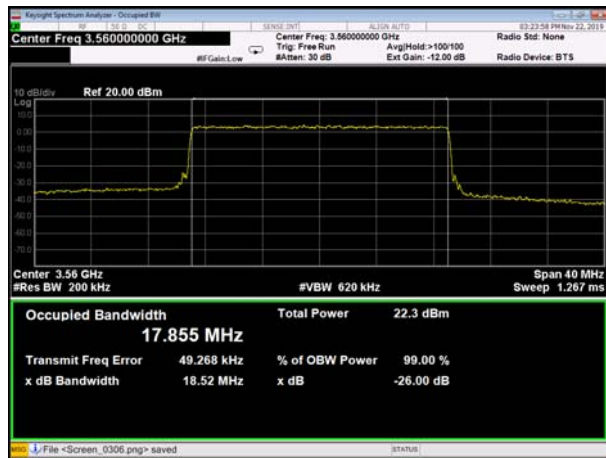
10MHz- High CH QPSK



10MHz- High CH 64QAM



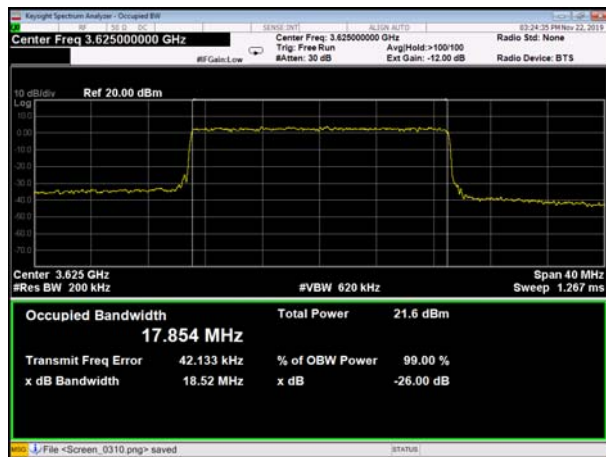
20MHz- Low CH QPSK



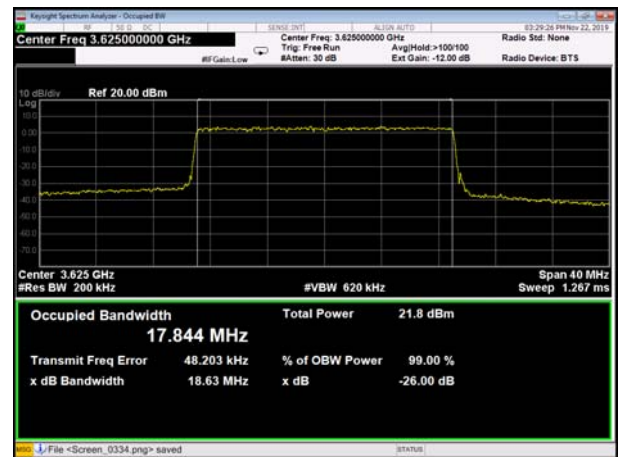
20MHz- Low CH 64QAM



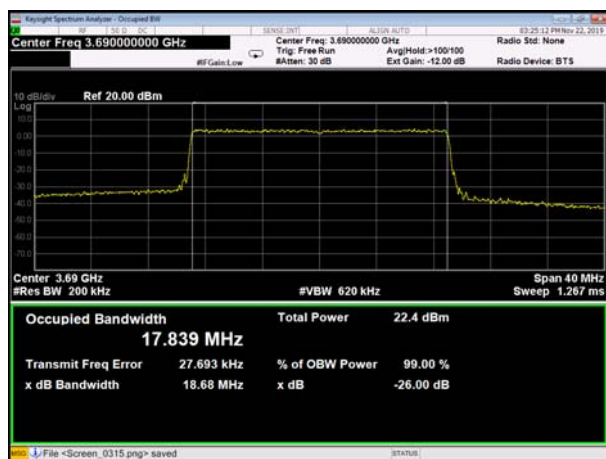
20MHz- Middle CH QPSK



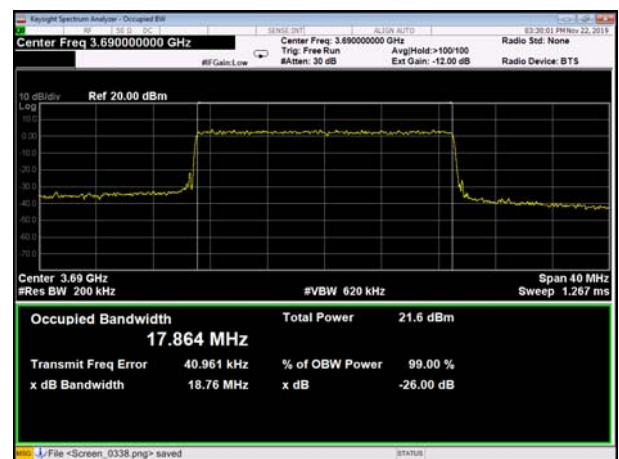
20MHz- Middle CH 64QAM



20MHz- High CH QPSK



20MHz- High CH 64QAM

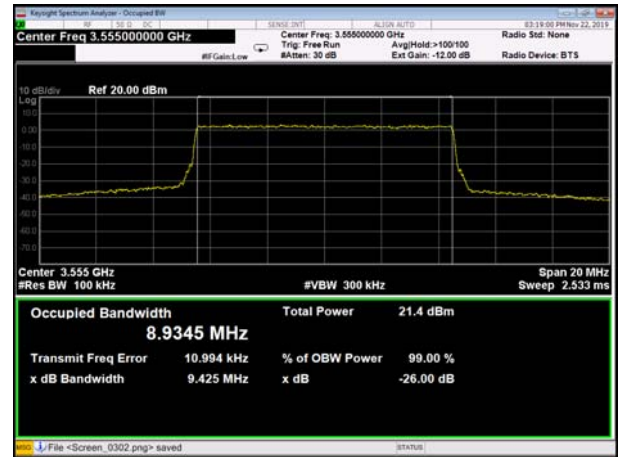


Chain1

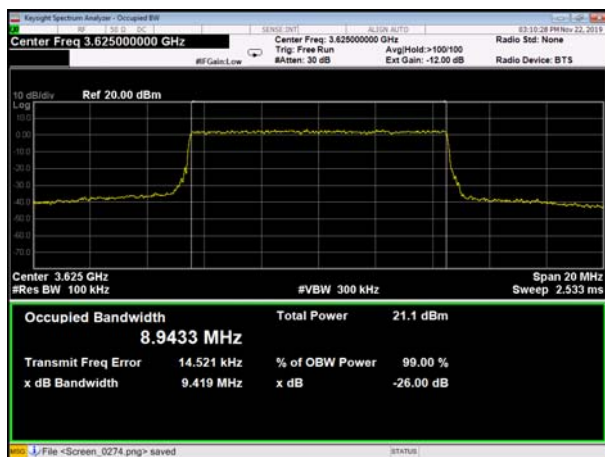
10MHz- Low CH QPSK



10MHz- Low CH 64QAM



10MHz- Middle CH QPSK



10MHz- Middle CH 64QAM



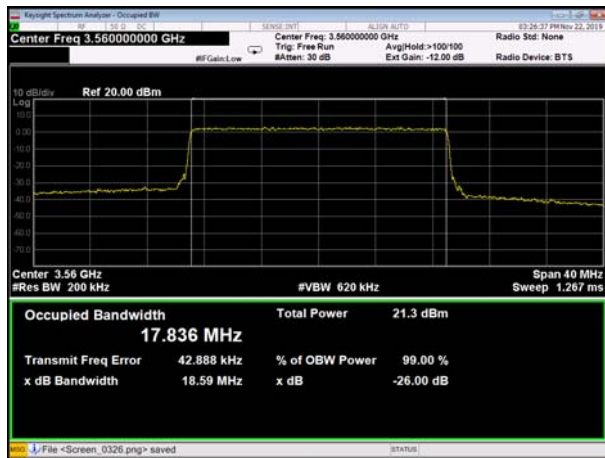
10MHz- High CH QPSK



10MHz- High CH 64QAM



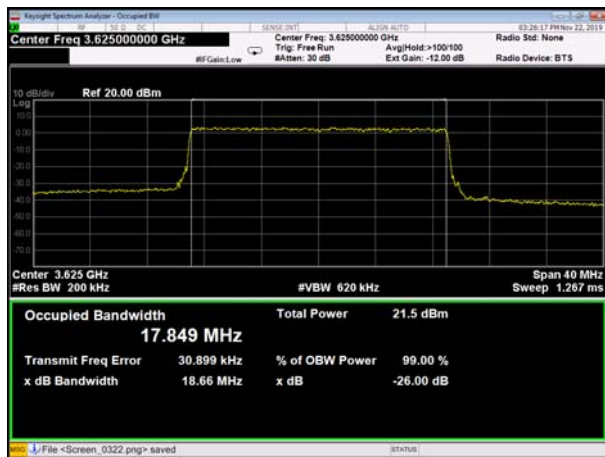
20MHz- Low CH QPSK



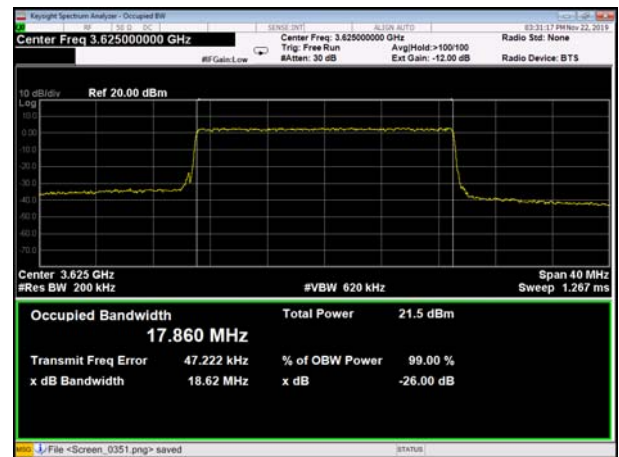
20MHz- Low CH 64QAM



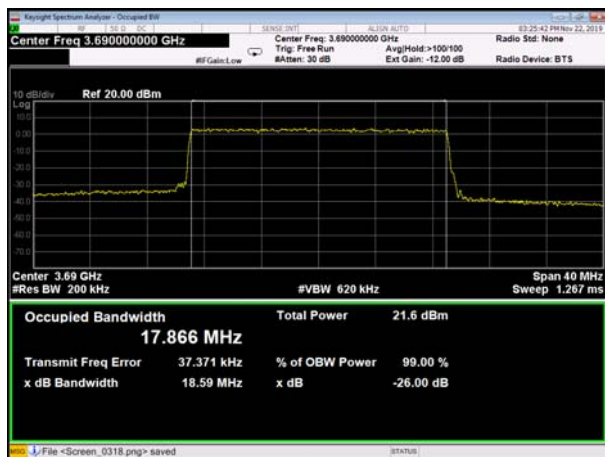
20MHz- Middle CH QPSK



20MHz- Middle CH 64QAM



20MHz- High CH QPSK



20MHz- High CH 64QAM



2.4 Frequency Stability

2.4.1 Requirement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block.

2.4.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

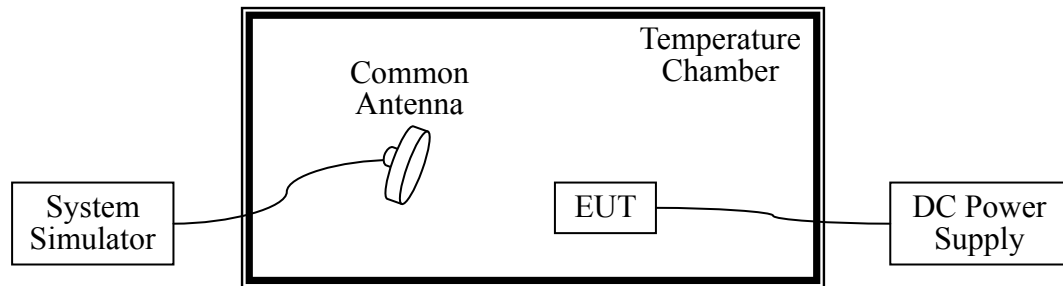
2.4.3 Test Procedures for Temperature Variation

1. The EUT was set up in the thermal chamber and connected with the system simulator.
2. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in 10°C steps up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

2.4.4 Test Procedures for Voltage Variation

1. The EUT was placed in a temperature chamber at $25 \pm 5^\circ \text{C}$ and connected with the system simulator.
2. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

2.4.5 Test Setup



2.4.6 Test Results of Frequency Stability

Chain 0

Test Frequency:3555MHz 10MHz				
Power (V _{DC})	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Result
48	-30	85	0.024	PASS
	-20	96	0.027	
	-10	101	0.028	
	0	102	0.029	
	+10	98	0.028	
	+20	99	0.028	
	+30	108	0.030	
	+40	110	0.031	
	+50	97	0.027	
43	+25	100	0.028	
52	+25	113	0.032	



Chain 1

Test Frequency:3555MHz 10MHz				
Power (V _{DC})	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Result
48	-30	106	0.030	PASS
	-20	110	0.031	
	-10	89	0.025	
	0	88	0.025	
	+10	97	0.027	
	+20	103	0.029	
	+30	97	0.027	
	+40	99	0.028	
	+50	98	0.028	
43	+25	107	0.030	
52	+25	100	0.028	

2.5 Conducted Out of Band Emissions

2.5.1 Requirement

According to FCC Part 96.41(e) requirement

2.5.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.5.3 Limit of Conducted Spurious Emission Measurement

Power of any emissions outside the fundamental	Limit
With 0-10MHz above the Assigned channel	-13dBm/MHz
With 0-10MHz below the Assigned channel	
Greater than 0-10MHz above the Assigned channel	-25dBm/MHz
Greater than 0-10MHz below the Assigned channel	
Power of any emissions below 3530MHz	-40dBm/MHz
Power of any emissions above 3720MHz	

Note:

This device can be implement MIMO function, so the limit of spurious emissions need to reduced by $10\log(\text{Numbers}_{\text{ANT}})$ according to FCC KDB 662911 D01 guidance.

{The limit is adjusted to $-13\text{dBm}-10\log(2)=-16.01\text{dBm}$ }

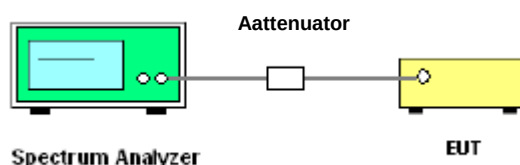
{The limit is adjusted to $-25\text{dBm}-10\log(2)=-28.01\text{dBm}$ }

{The limit is adjusted to $-40\text{dBm}-10\log(2)=-43.01\text{dBm}$ }

2.5.4 Test Procedures

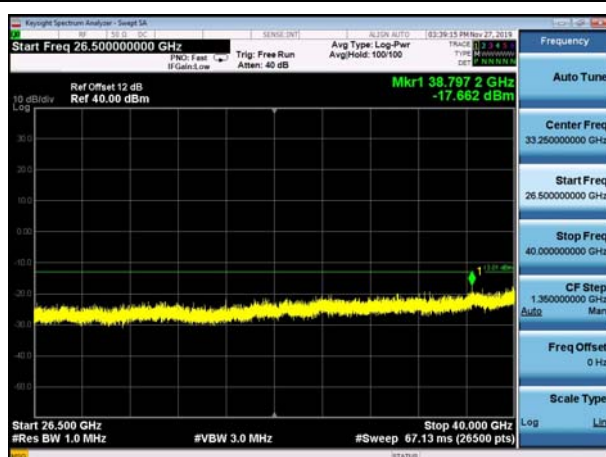
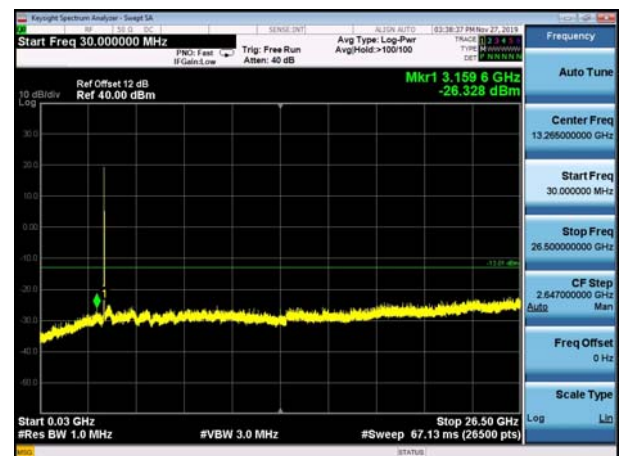
1. The EUT was connected to the spectrum analyzer , all measurements were done at low, middle and high operational frequency range
2. Measuring frequency range is from 30MHz to 37GHz.
3. RBW=1MHz and VBW=3MHz is used for conducted emission measurement.
4. Measuring frequency and bandedge, 1% of the fundamental emission bandwidth is used for conducted emission measurement.

2.5.5 Test Setup

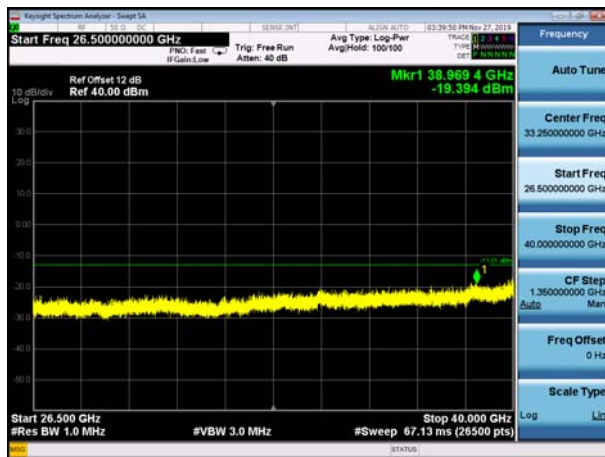
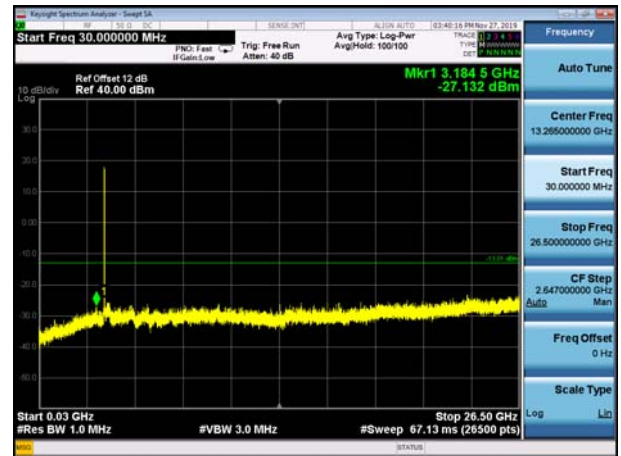
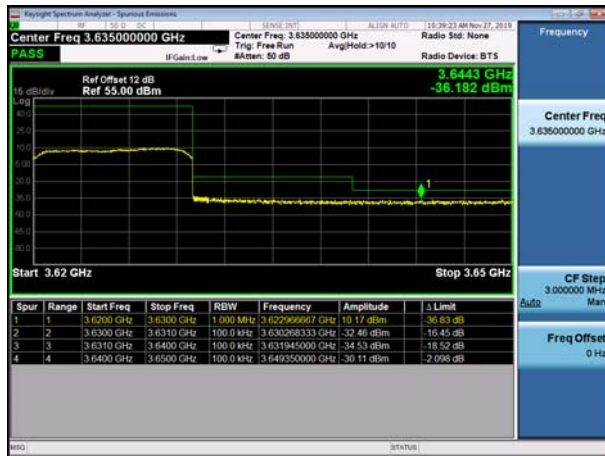
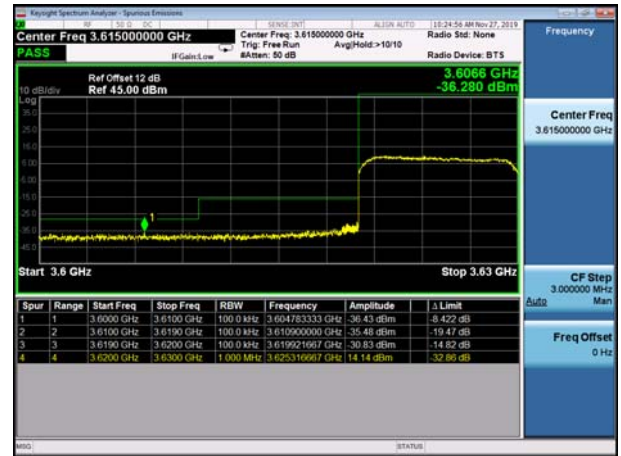


2.5.6 Test Result

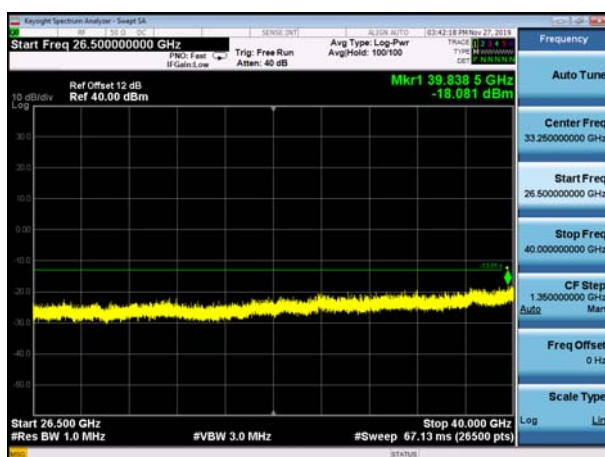
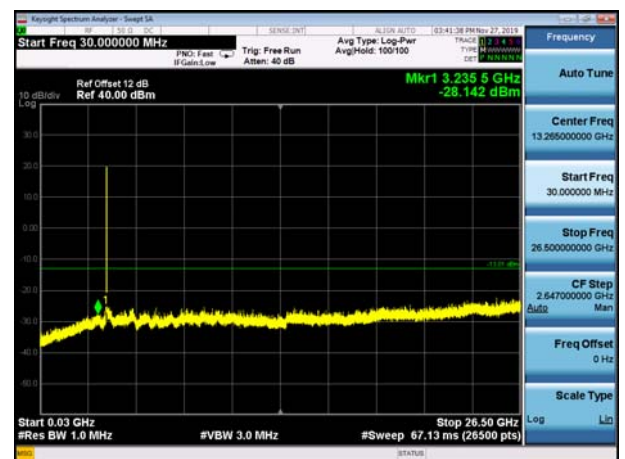
10M-QPSK-Low Chain0



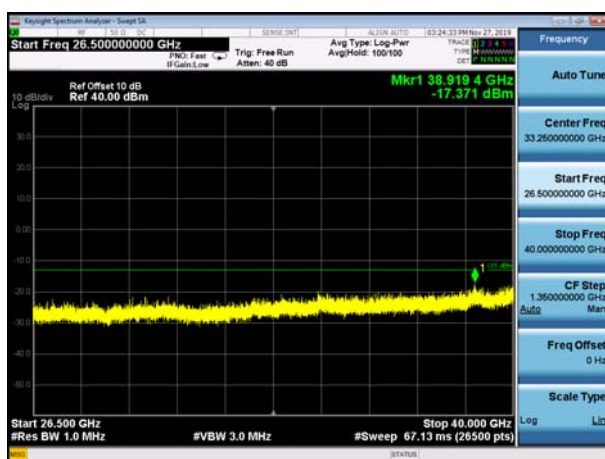
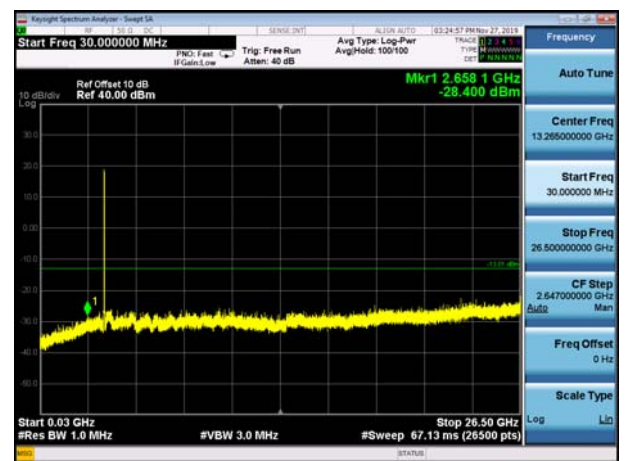
10M-QPSK-Middle Chain0



10M-QPSK-High Chain0

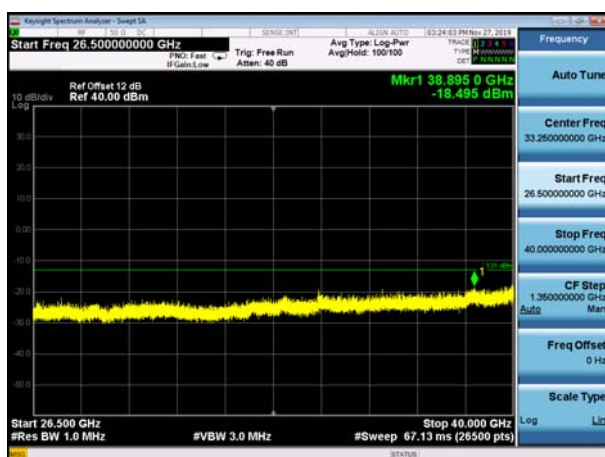
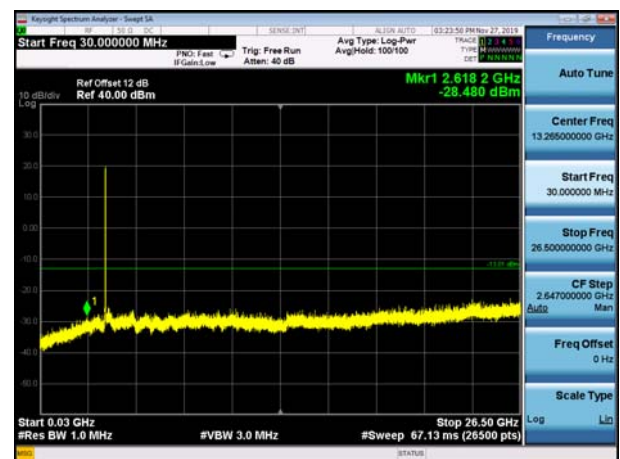
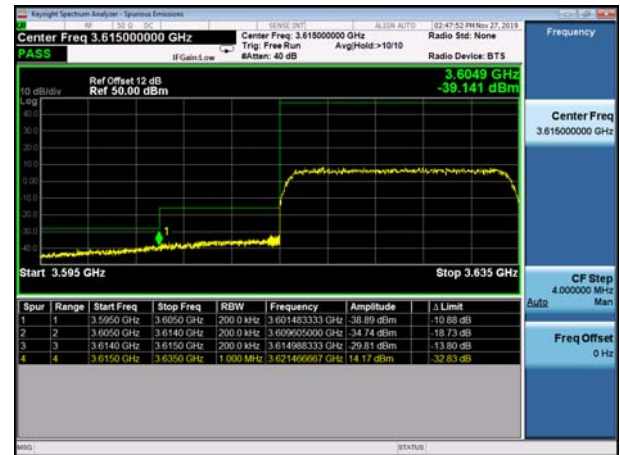
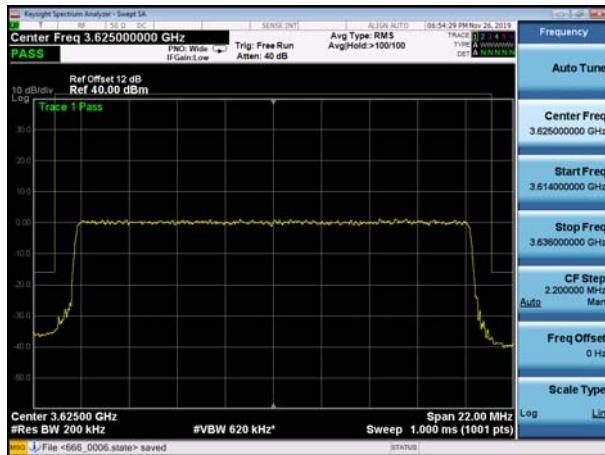


20M-QPSK-Low Chain0

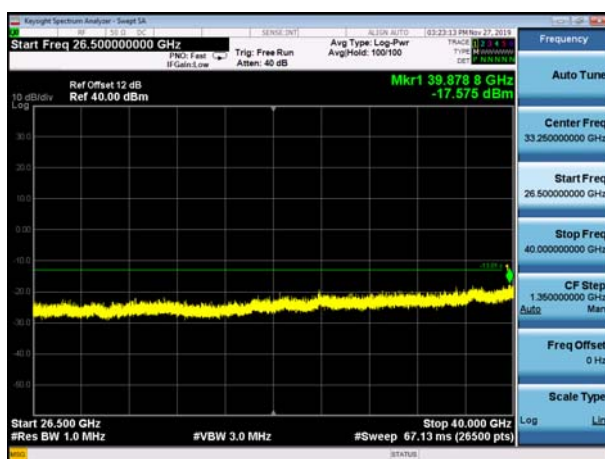
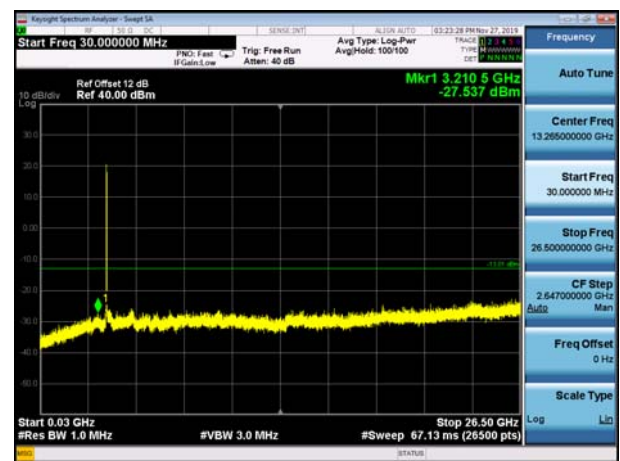
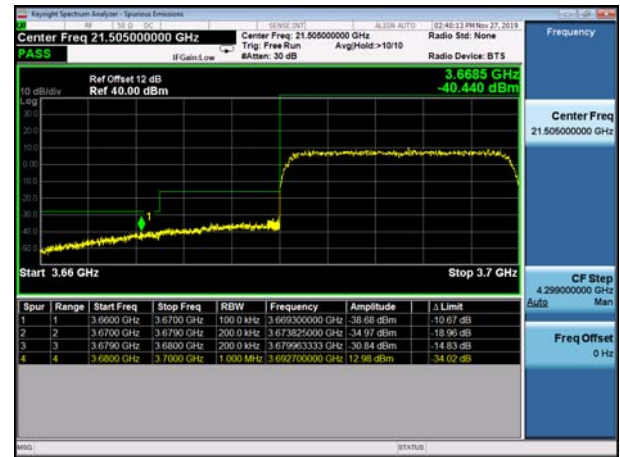
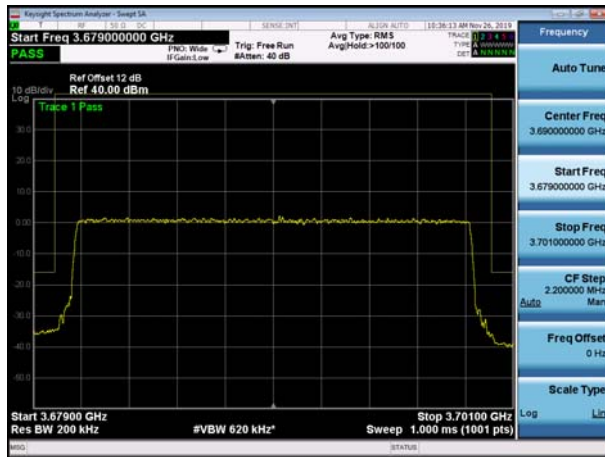




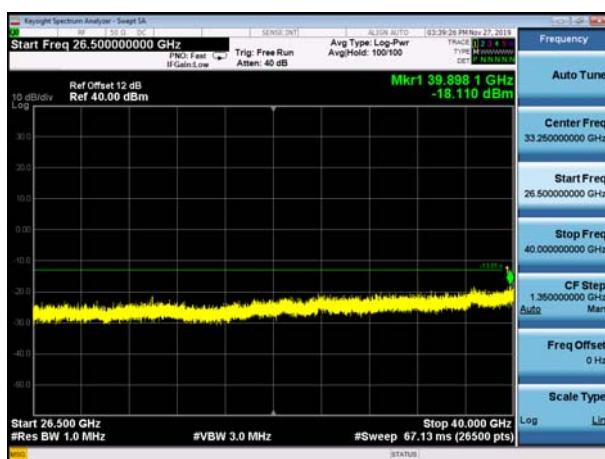
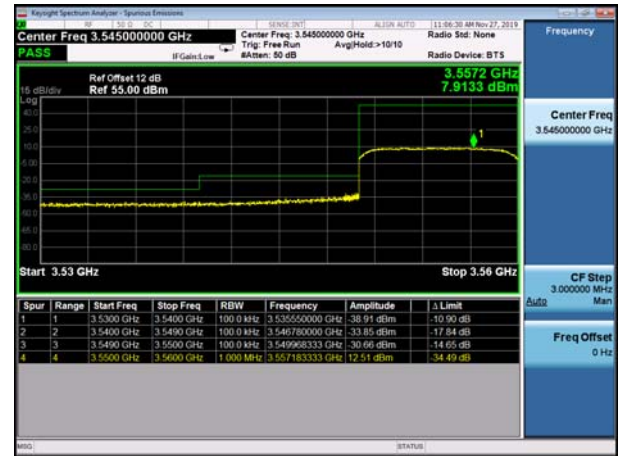
20M-QPSK-Middle Chain0



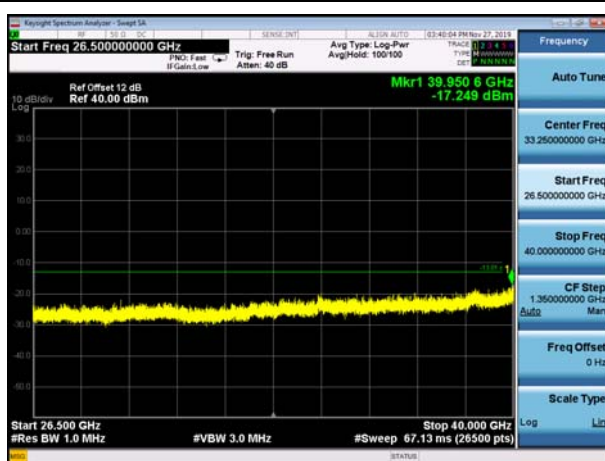
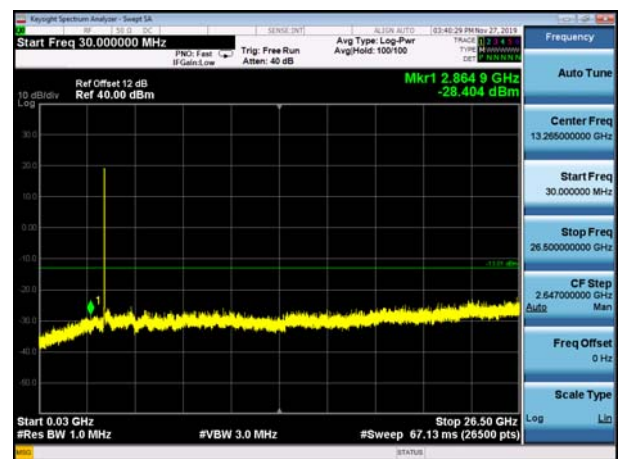
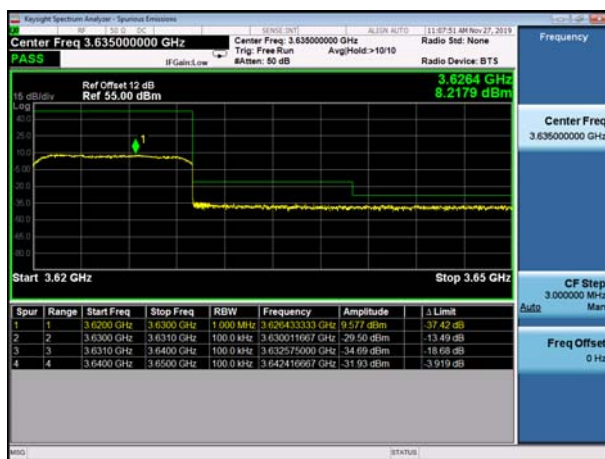
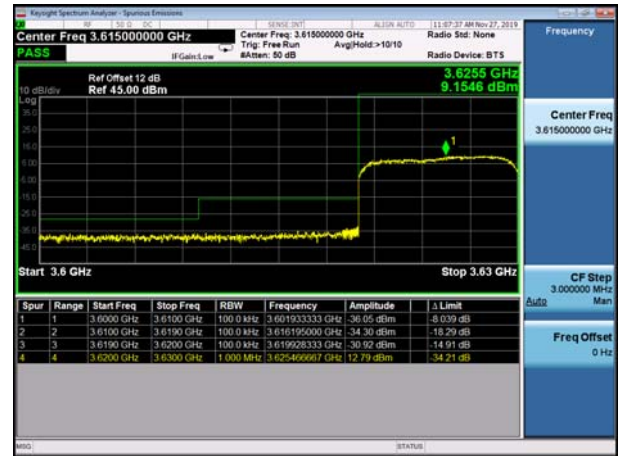
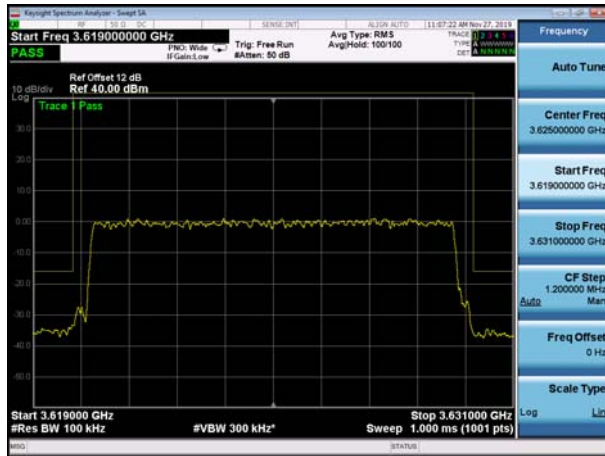
20M-QPSK-High Chain0



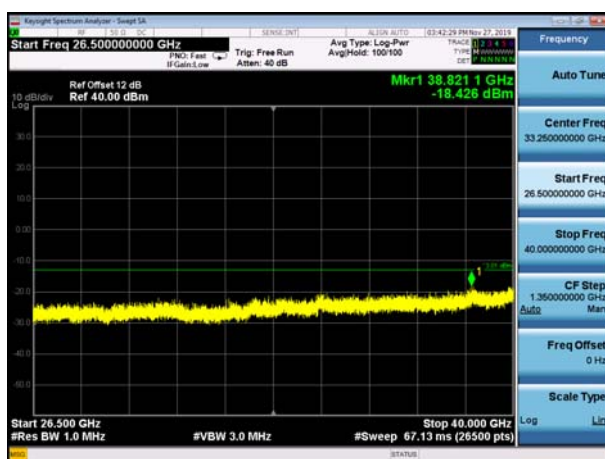
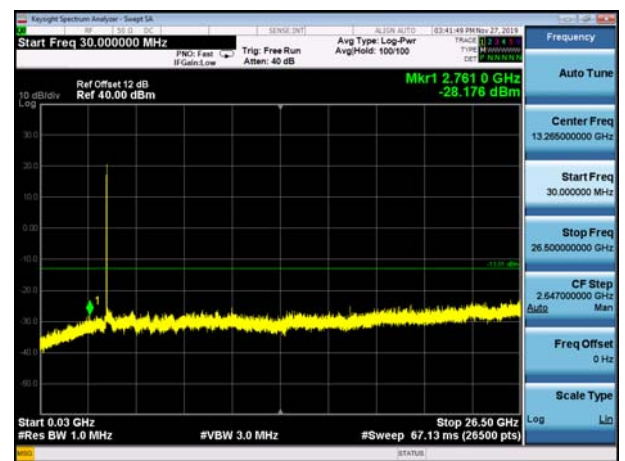
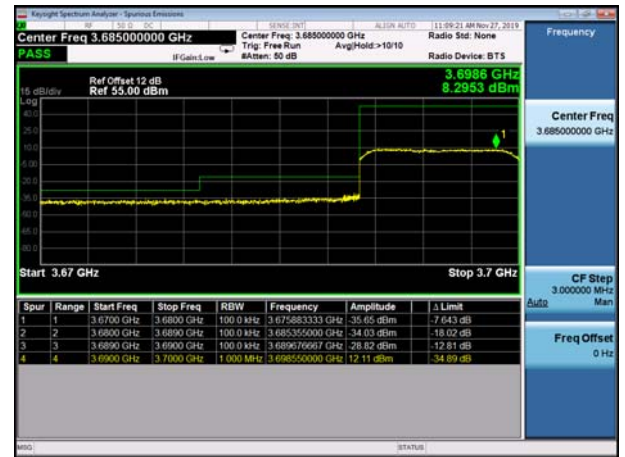
10M-QPSK-Low Chain1



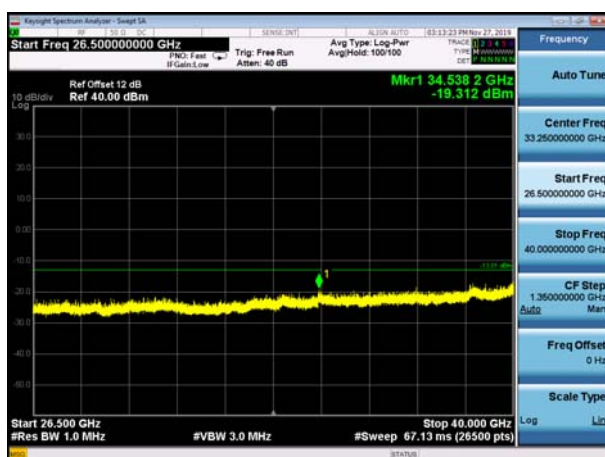
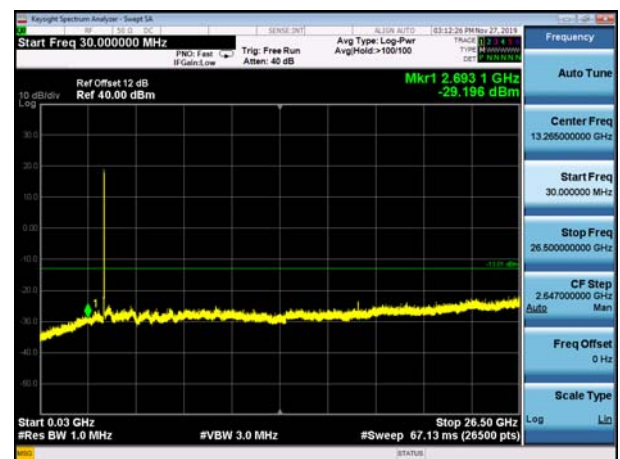
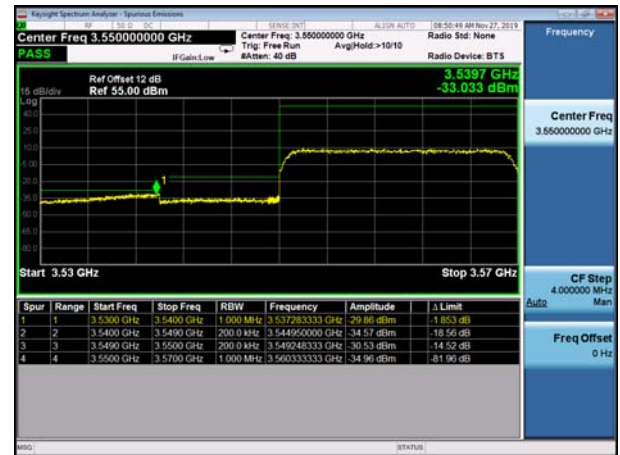
10M-QPSK-Middle Chain1



10M-QPSK-High Chain1

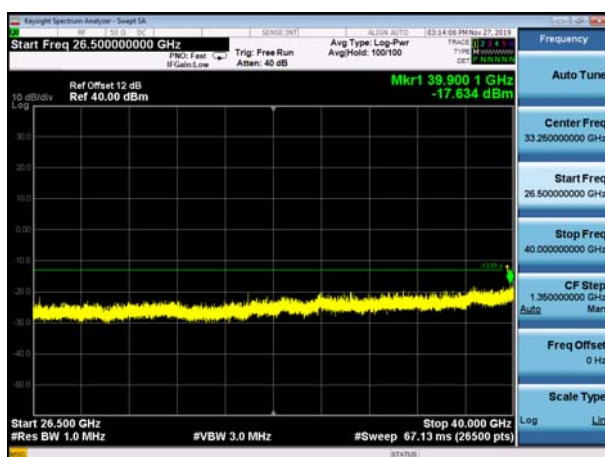
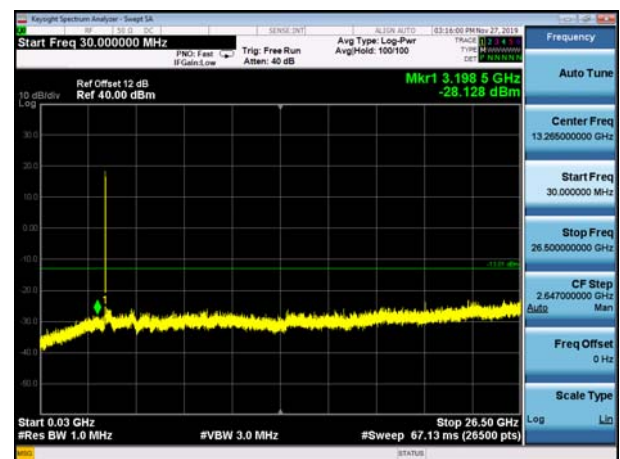
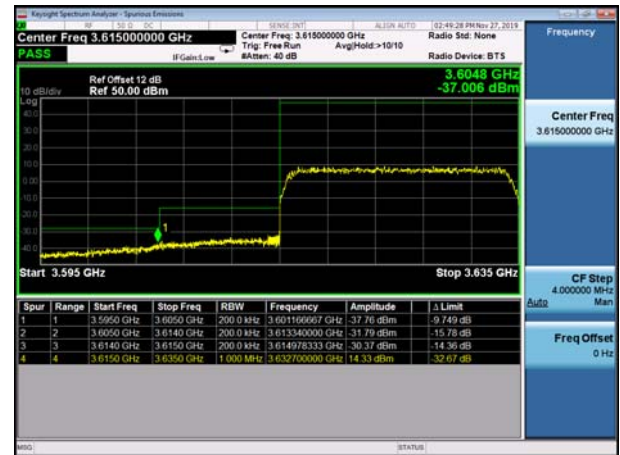
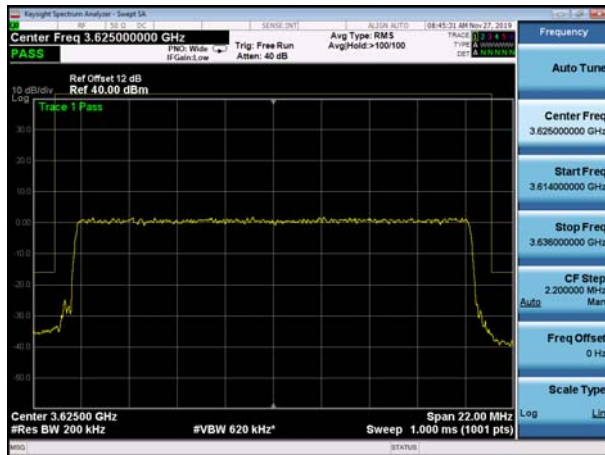


20M-QPSK-Low Chain1

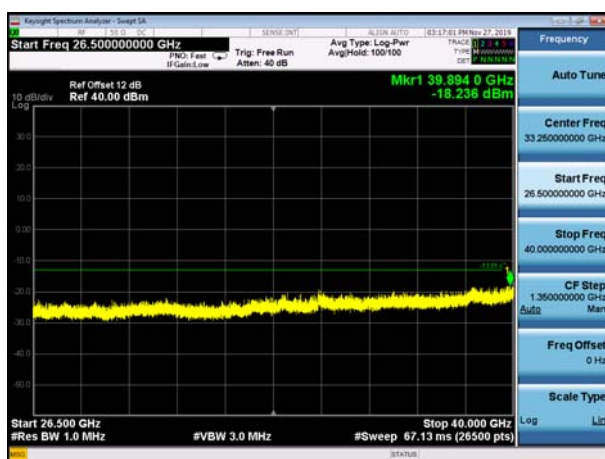
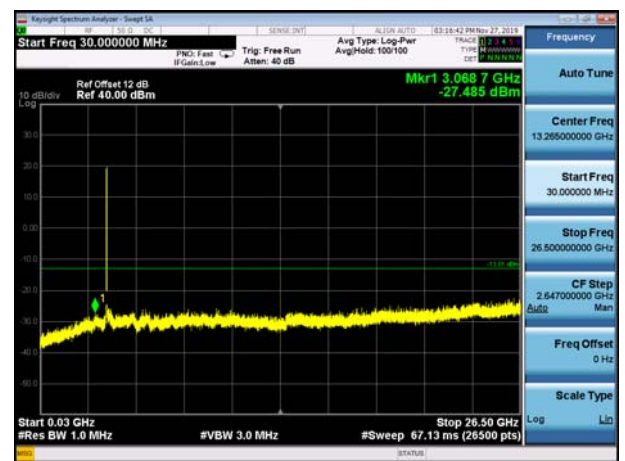
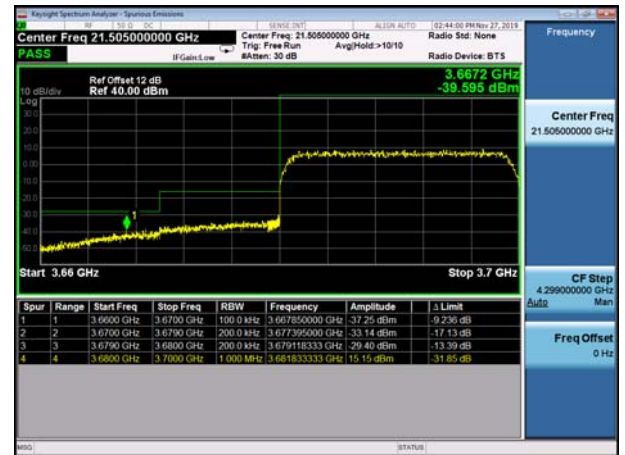




20M-QPSK-Middle Chain1



20M-QPSK-High Chain1



2.6 Emission Mask

2.6.1 Requirement

According to FCC Part 96.41(e)

2.6.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

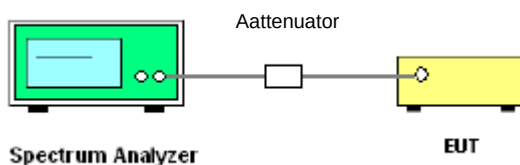
2.6.3 Limit of Conducted Spurious Emission Measurement

Power of any emissions outside the fundamental	Limit
With 0-10MHz above the Assigned channel	-13dBm/MHz
With 0-10MHz below the Assigned channel	
Greater than 0-10MHz above the Assigned channel	-25dBm/MHz
Greater than 0-10MHz below the Assigned channel	
Power of any emissions below 3530MHz	-40dBm/MHz
Power of any emissions above 3720MHz	

2.6.4 Test Procedures

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.
4. Trace average at least 100 traces

Test Setup

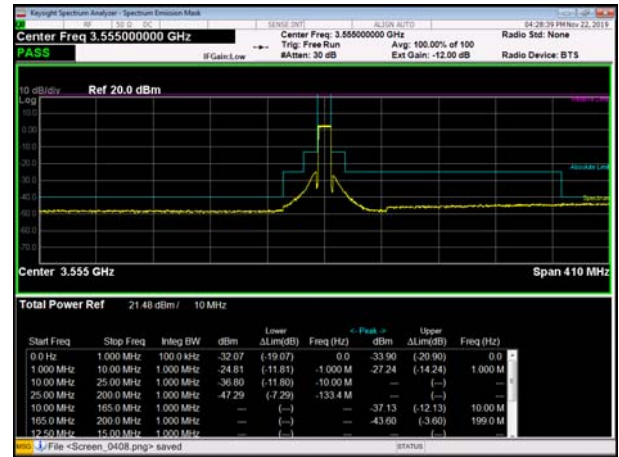


2.6.5 Test Result

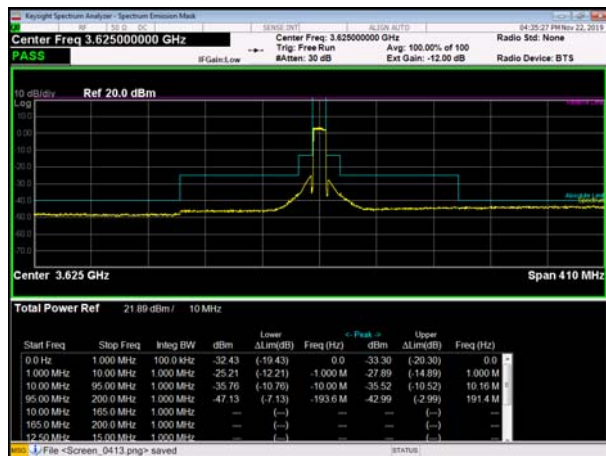
Chain0-10M-QPSK Low CH



Chain1-10M-QPSK Low CH



Chain0-10M-QPSK Middle CH



Chain1-10M-QPSK Middle CH



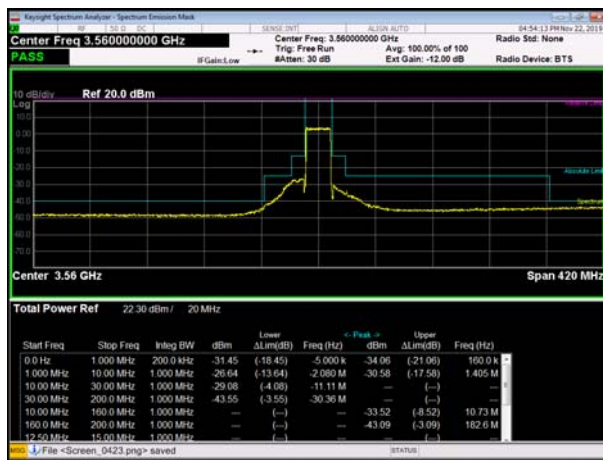
Chain0-10M-QPSK High CH



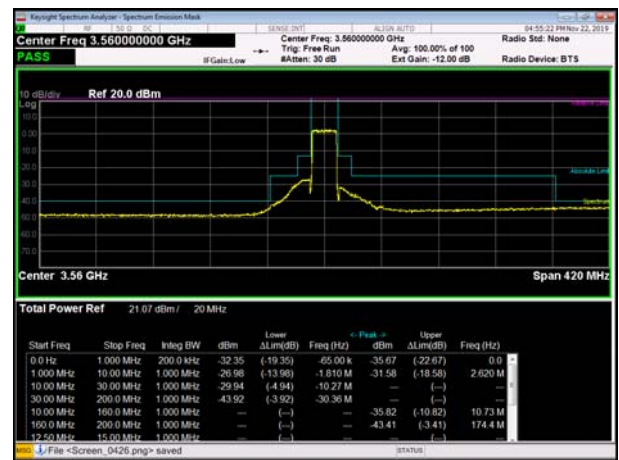
Chain1-10M-QPSK High CH



Chain0-20M-QPSK Low CH



Chain1-20M-QPSK Low CH



Chain0-20M-QPSK Middle CH



Chain1-20M-QPSK Middle CH



Chain0-20M-QPSK High CH



Chain1-20M-QPSK High CH



2.7 Radiated Spurious Emissions

2.7.1 Requirement

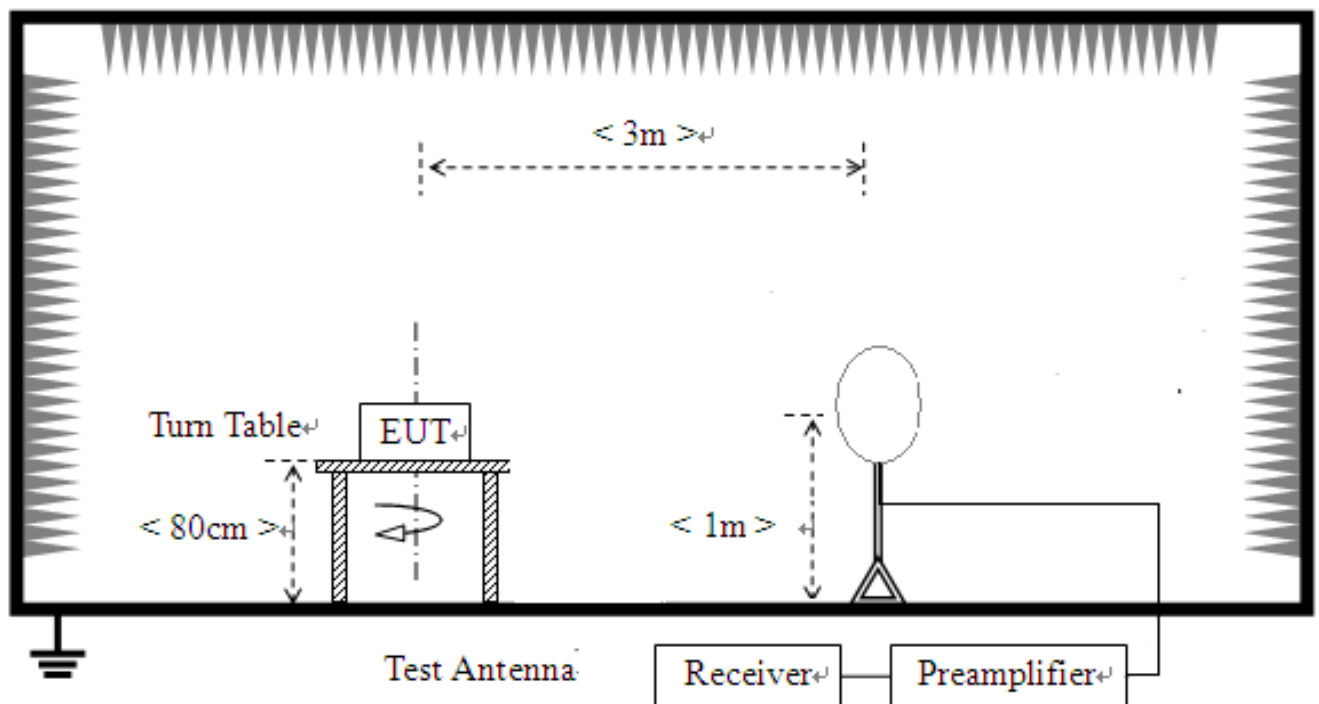
The power of any emission below 3530MHz or above 3720MHz shall not exceed -40dBm/MHz

2.7.2 Measuring Instruments

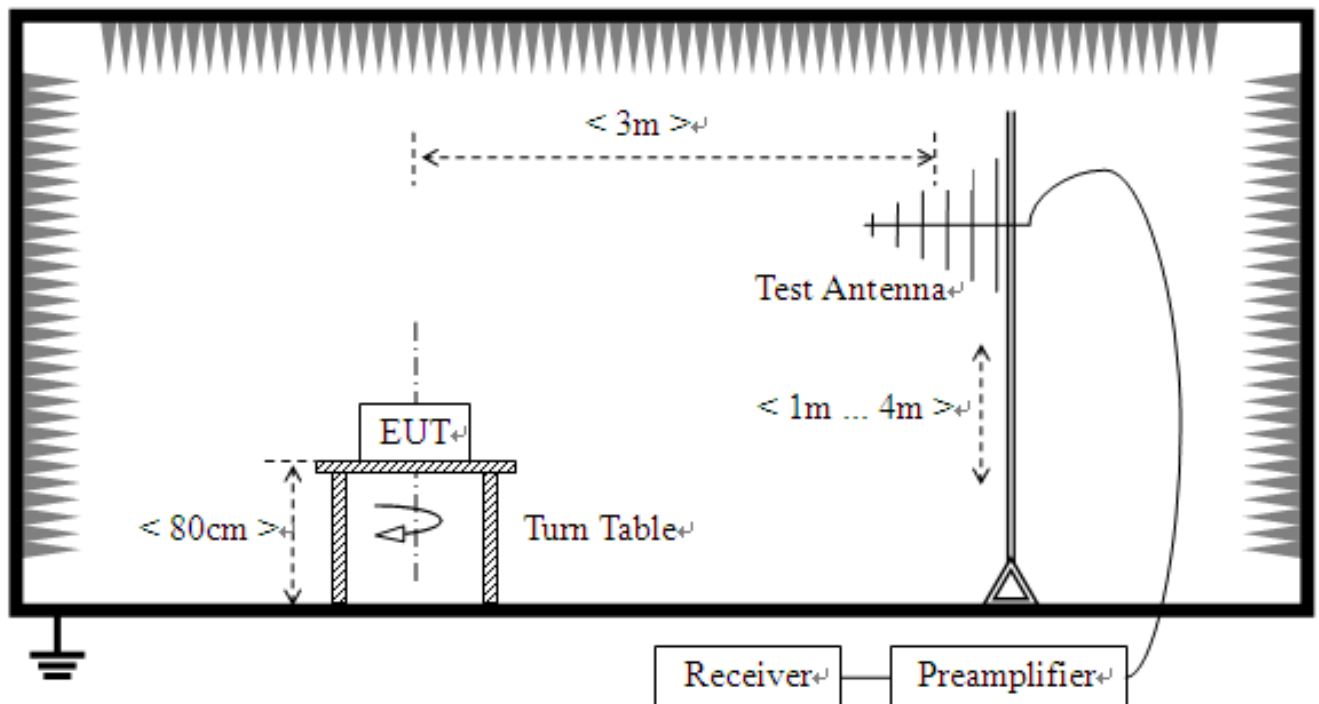
The measuring equipment is listed in the section 3 of this test report.

2.7.3 Test Setup

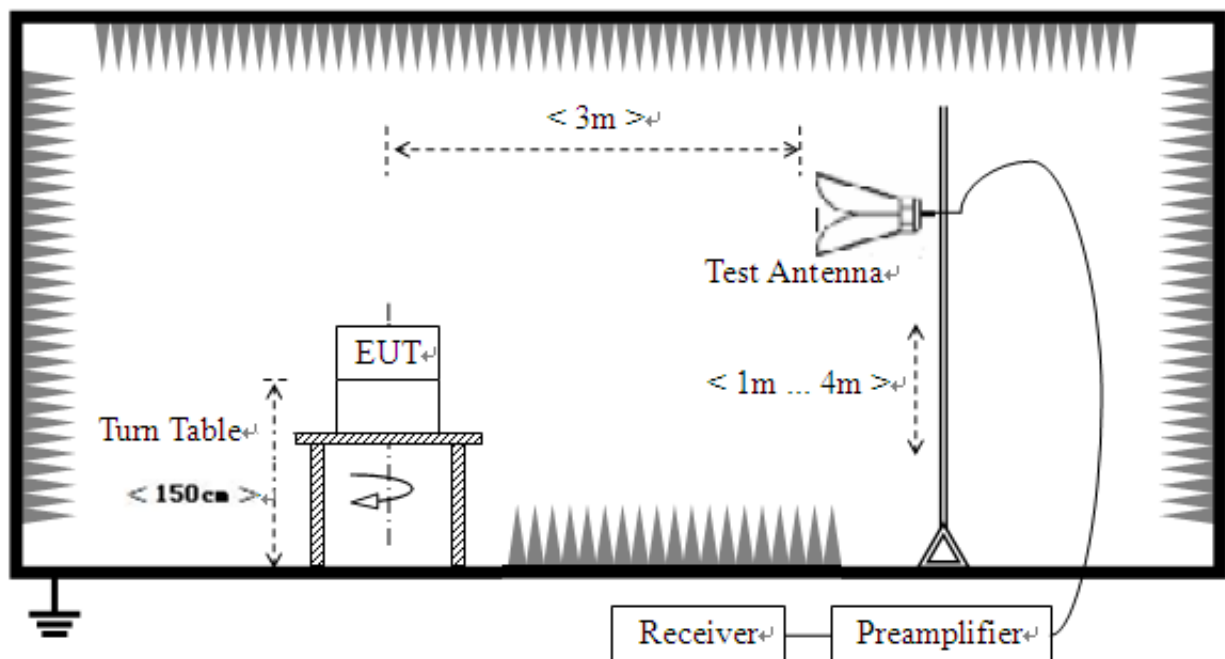
For radiated emissions from 9 kHz to 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.7.4 Test Procedures

1. The testing follows ANSI C63.26:2015
2. The EUT was placed on a rotatable wooden table 0.8m(below 1G) or 1.5m(above 1G) above the ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
13. All Spurious Emission tests were performed in X, Y, Z axis direction and low, middle, high channel. And only the worst axis test condition was recorded in this test report.
14. The spectrum is measured from 9 KHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. The worst case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
15. For 9KHz to 30MHz: the amplitude of spurious emissions are attenuated by more than 20dB below the permissible value has no need to be reported.

2.7.5 Test Results of Radiated Spurious Emissions

Worst-Case test data provide as below:

Note: 1. within 30MHz-1GHz were found more than 20dB below limit line

Note: 2. Absolute Level=Reading Level + Factor

30MHz~20GHz:

Band 48 (Low Channel BW:10MHz)

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	59.1146	-79.99	-60.94	-40.00	20.94	19.05	Vertical
2	91.1406	-82.38	-59.84	-40.00	19.84	22.54	Vertical
3	236.228	-82.72	-61.15	-40.00	21.15	21.57	Vertical
4	5063.53	-65.4	-51.46	-40.00	11.46	13.94	Vertical
5	7112.05	-65.6	-49.22	-40.00	9.22	16.38	Vertical
6	10038.5	-70	-46.55	-40.00	6.55	23.45	Vertical

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	59.5998	-80.10	-61.69	-40.00	21.69	18.41	Horizontal
2	187.218	-82.19	-60.71	-40.00	20.71	21.48	Horizontal
3	491.951	-87.25	-57.69	-40.00	17.69	29.56	Horizontal
4	2882.94	-56.68	-49.27	-40.00	9.27	7.41	Horizontal
5	7104.55	-63.34	-46.83	-40.00	6.83	16.51	Horizontal
6	9700.85	-71.32	-46.76	-40.00	6.76	24.56	Horizontal

Band 48 (Middle Channel BW:10MHz)

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	42.1311	-81.15	-60.74	-40.00	20.74	20.41	Horizontal
2	76.0980	-81.12	-62.75	-40.00	22.75	18.37	Horizontal
3	188.189	-83.47	-61.93	-40.00	21.93	21.54	Horizontal
4	2108.55	-56.59	-53.76	-40.00	13.76	2.83	Horizontal
5	6234.11	-60.48	-46.14	-40.00	6.14	14.34	Horizontal
6	10023.5	-70.73	-46.99	-40.00	6.99	23.74	Horizontal

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	42.1311	-80.82	-61.62	-40.00	21.62	19.20	Vertical
2	1491.24	-49.97	-52.66	-40.00	12.66	-2.69	Vertical
3	2671.83	-56.02	-48.57	-40.00	8.57	7.45	Vertical
4	5101.05	-59.47	-45.22	-40.00	5.22	14.25	Vertical
5	7262.13	-63.64	-46.99	-40.00	6.99	16.65	Vertical
6	10143.5	-70.29	-46.89	-40.00	6.89	23.40	Vertical

Band 48 (High Channel BW:10MHz)

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	90.1701	-79.74	-57.30	-40.00	17.3	22.44	Horizontal
2	234.287	-82.06	-60.64	-40.00	20.64	21.42	Horizontal
3	4913.45	-58.05	-45.17	-40.00	5.17	12.88	Horizontal
4	6519.25	-60.98	-46.6	-40.00	6.60	14.38	Horizontal
5	7614.80	-63.12	-46.5	-40.00	6.50	16.62	Horizontal
6	10211.1	-70.33	-46.74	-40.00	6.74	23.59	Horizontal

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	59.1146	-78.71	-60.29	-40.00	20.29	18.42	Vertical
2	184.792	-82.81	-61.46	-40.00	21.46	21.35	Vertical
3	5161.08	-59.11	-47.25	-40.00	7.25	11.86	Vertical
4	6316.65	-61.46	-46.79	-40.00	6.79	14.67	Vertical
5	7397.19	-62.88	-46.25	-40.00	6.25	16.63	Vertical
6	10008.5	-69.94	-46.19	-40.00	6.19	23.75	Vertical

Band 48 (Low Channel BW:20MHz)

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	58.1441	-79.39	-60.94	-40.00	20.94	18.45	Horizontal
2	817.548	-89.25	-55.47	-40.00	15.47	33.78	Horizontal
3	5108.55	-58.71	-46.57	-40.00	6.57	12.14	Horizontal
4	7119.55	-63.66	-47.07	-40.00	7.07	16.59	Horizontal
5	7907.45	-65.07	-47.90	-40.00	7.90	17.17	Horizontal
6	9903.45	-70.18	-46.83	-40.00	6.83	23.35	Horizontal

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	2226.61	-56.03	-53.44	-40.00	13.44	2.59	Vertical
2	2963.98	-54.31	-47.51	-40.00	7.51	6.80	Vertical
3	5093.54	-60.94	-46.72	-40.00	6.72	14.22	Vertical
4	6354.17	-61.43	-46.59	-40.00	6.59	14.84	Vertical
5	7412.20	-63.02	-46.78	-40.00	6.78	16.24	Vertical
6	10166.0	-70.18	-46.71	-40.00	6.71	23.47	Vertical

Band 48 (Middle Channel BW:20MHz)

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	79.9800	-81.60	-60.29	-40.00	20.29	21.31	Vertical
2	237.198	-85.35	-63.71	-40.00	23.71	21.64	Vertical
3	2970.98	-53.79	-46.94	-40.00	6.94	6.85	Vertical
4	5183.59	-58.57	-46.28	-40.00	6.28	12.29	Vertical
5	7239.61	-64.28	-47.63	-40.00	7.63	16.65	Vertical
6	10091.0	-69.74	-46.45	-40.00	6.45	23.29	Vertical

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	813.666	-88.52	-54.75	-40.00	14.75	33.77	Horizontal
2	2089.54	-56.88	-54.15	-40.00	14.15	2.73	Horizontal
3	2976.98	-54.49	-46.95	-40.00	6.95	7.54	Horizontal
4	5108.55	-58.77	-46.63	-40.00	6.63	12.14	Horizontal
5	7262.13	-63.36	-46.54	-40.00	6.54	16.82	Horizontal
6	9670.83	-70.76	-46.66	-40.00	6.66	24.10	Horizontal

Band 48 (High Channel BW:20MHz)

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	831.135	-88.81	-55.03	-40.00	15.03	33.78	Horizontal
2	2468.73	-48.53	-45.69	-40.00	5.69	2.84	Horizontal
3	5408.70	-58.40	-46.89	-40.00	6.89	11.51	Horizontal
4	7374.68	-64.50	-47.85	-40.00	7.85	16.65	Horizontal
5	10188.5	-70.44	-46.63	-40.00	6.63	23.81	Horizontal
6	12042.0	-72.86	-47.43	-40.00	7.43	25.43	Horizontal

Suspected List							
NO.	Freq. [MHz]	Reading [dBm]	Level [dBm]	Limit [dBm]	Margin [dB]	Factor [dB]	Polarity
1	75.6128	-81.56	-60.71	-40.00	20.71	20.85	Vertical
2	2077.53	-55.15	-53.38	-40.00	13.38	1.77	Vertical
3	2701.85	-55.09	-47.07	-40.00	7.07	8.02	Vertical
4	5101.05	-60.41	-46.16	-40.00	6.16	14.25	Vertical
5	6294.14	-62.47	-47.39	-40.00	7.39	15.08	Vertical
6	10233.6	-70.02	-46.40	-40.00	6.40	23.62	Vertical

3. LIST OF MEASURING EQUIPMENT

Description	Manufacturer	Model	Serial No.	Cal. Date	Due Date	Remark
EMI Test Receiver	R&S	ESIB26	A0304218	2019.05.20	2020.05.19	Radiation
Loop Antenna	Schwarz beck	HFH2-Z2	100047	2019.04.26	2022.04.25	Radiation
Broadband antenna (30MHz~1GHz)	R&S	HL562	101341	2017.07.14	2020.07.13	Radiation
Broadband antenna (30MHz~1GHz)	R&S	HL562	101339	2017.07.14	2020.07.13	Radiation
Double ridge horn antenna (1GHz~18GHz)	R&S	HF906	100150	2019.04.27	2022.04.26	Radiation
Double ridge horn antenna (1GHz~18GHz)	R&S	HF906	100149	2019.04.17	2022.04.16	Radiation
Horn antenna (18GHz~26.5GHz)	AR	AT4002A	305753	2017.07.12	2020.07.11	Radiation
Horn antenna (18GHz~26.5GHz)	AR	AT4003A	0329293	2018.09.17	2020.09.16	Radiation
Amplifier 1GHz-18GHz	AR	25S1G4AM1	22018	2018.09.17	2020.09.16	Radiation
Amplifier 20M~3GHz	MILMEGA	80RF1000-250	1064573	2017.10.09	2020.10.08	Radiation
Spectrum Analyzer	KEYSIGHT	N9030A	A160702554	2019.06.05	2020.06.04	Conducted
LISN	ROHDE&SC HWARZ	ESH2-Z5	A0304221	2019.04.30	2020.04.29	Conducted
Test Receiver	R&S	ESCS30	A0304260	2019.05.25	2020.05.24	Conducted
Temperature chamber	Dongguan gaoda instrument CO.LTD	GD-7005-100	130130101	2019.04.22	2020.04.21	Conducted
Power Supply	R&S	NGMO1	101037	2019.08.03	2020.08.02	Conducted



4. UNCERTAINTY OF EVALUATION

Measuring Uncertainty for a level of confidence of 95%($U=2U_c(y)$)	2.6dB
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Uncertainty of Radiated Emission Measurement (30MHz~1GHz)

Measuring Uncertainty for a level of confidence of 95%($U=2U_c(y)$)	2.4dB
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Uncertainty of Radiated Emission Measurement (1GHz~40GHz)

Measuring Uncertainty for a level of confidence of 95%($U=2U_c(y)$)	2.8dB
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**** END OF REPORT ****