

TEST REPORT

Reference No...... : WTS17S0989524-1E V10
FCC ID : 2AG32PBS2120
IC No...... : 20982-PBS2120
Applicant..... : Baicells Technologies Co., Ltd.
Address..... : 3F, Hui Yuan Development Building, No.1 Shangdi Information Industry Base, Haidian Dist., Beijing, China
Manufacturer : The same as above
Address..... : The same as above
Product..... : LTE-TDD Base Station
Model(s)..... : pBS2120
Brand Name..... : BaiCells
Standards..... : FCC CFR Title 47 Part 2
FCC CFR Title 47 Part 90 Subpart Z
RSS-Gen Issue 4, November 2014
RSS-197 Issue 1, February 2010
Date of Receipt sample : 2017-09-06
Date of Test : 2017-09-06 to 2017-11-15
Date of Issue..... : 2017-11-15
Test Result..... : **Pass**

Remarks:

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

Prepared By:

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2 Laboratories Introduction

Waltek Services Test Group Ltd. is one of the largest and the most comprehensive third party testing organizations in China, our headquarter located in Shenzhen (CNAS Registration No. L3110, A2LA Certificate Number: 4243.01) and have branches in Foshan (CNAS Registration No. L6478), Dongguan (CNAS Registration No. L9950), Zhongshan, Suzhou (CNAS Registration No. L7754), Ningbo and Hong Kong, Our test capability covered four large fields: safety test. Electronic Magnetic Compatibility(EMC), reliability and energy performance, Chemical test. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CPSC(Consumer Product Safety Commission), CEC(California energy efficiency), IC(Industry Canada) and ELI(Efficient Lighting Initiative). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as UL, Intertek(ETL-SEMKO), CSA, TÜV Rheinland, TÜV SÜD, etc. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

Waltek Services (Shenzhen) Co., Ltd.

A. Accreditations for Conformity Assessment (International)

Country/Region	Accreditation Body	Scope	Note
USA	CNAS (Registration No.: L3110) A2LA (Certificate No.: 4243.01)	FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India	International Services	WPC	-
Thailand		NTC	-
Singapore		IDA	-
Note:			
1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.			
2. IC Canada Registration No.: 7760A			

B. TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

3 Contents

	Page
1 COVER PAGE.....	1
2 LABORATORIES INTRODUCTION.....	2
3 CONTENTS.....	4
4 REVISION HISTORY.....	6
5 GENERAL INFORMATION.....	7
5.1 GENERAL DESCRIPTION OF E.U.T.....	7
5.2 DETAILS OF E.U.T.....	7
5.3 CHANNEL LIST.....	7
5.4 TEST MODE.....	7
5.5 SUBCONTRACTED.....	8
6 TEST SUMMARY.....	9
7 EQUIPMENT USED DURING TEST.....	10
7.1 EQUIPMENTS LIST.....	10
7.2 MEASUREMENT UNCERTAINTY.....	11
7.3 TEST EQUIPMENT CALIBRATION.....	11
8 TRANSMIT OUTPUT POWER AND PSD.....	12
8.1 EUT OPERATION.....	12
8.2 TEST PROCEDURE.....	12
8.3 TEST RESULT.....	13
9 OCCUPY BANDWIDTH.....	22
9.1 EUT OPERATION.....	22
9.2 TEST PROCEDURE.....	22
9.3 TEST RESULT.....	23
10 EMISSION MASK.....	28
10.1 EUT OPERATION.....	28
10.2 TEST PROCEDURE.....	28
10.3 TEST RESULT.....	29
11 OUT OF BAND EMISSION AT ANTENNA TERMINALS.....	33
11.1 EUT OPERATION.....	33
11.2 TEST PROCEDURE.....	33
11.3 TEST RESULT.....	33
12 FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT.....	53
12.1 EUT OPERATION.....	53
12.2 TEST SETUP.....	53
12.3 SPECTRUM ANALYZER SETUP.....	54
12.4 TEST PROCEDURE.....	55
12.5 TEST RESULT.....	56
13 FREQUENCY STABILITY V.S. TEMPERATURE MEASUREMENT.....	57
13.1 EUT OPERATION.....	57
13.2 TEST PROCEDURE.....	57
13.3 TEST RESULT.....	59
14 FREQUENCY STABILITY V.S. VOLTAGE MEASUREMENT.....	61
14.1 EUT OPERATION.....	61

14.2	TEST PROCEDURE.....	61
14.3	TEST RESULT	63
15	PHOTOGRAPHS OF TEST SETUP AND EUT.....	64
15.1	TEST SETUP	64
15.2	EUT - EXTERNAL VIEW	66
15.3	EUT - INTERNAL VIEW	71

4 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S09895 24-1E	2017-09-06	2017-09-06 to 2017-09-11	2017-09-12	original	-	Replaced
WTS17S09895 24-1E V1	-	2017-09-06 to 2017-09-11	2017-09-27	Version 1	Updated	Replaced
WTS17S09895 24-1E V2	-	2017-09-06 to 2017-09-29	2017-09-29	Version 2	Updated	Replaced
WTS17S09895 24-1E V3	-	2017-09-06 to 2017-10-10	2017-10-10	Version 3	Updated	Replaced
WTS17S09895 24-1E V4	-	2017-09-06 to 2017-10-10	2017-10-12	Version 4	Updated	Replaced
WTS17S09895 24-1E V5	-	2017-09-06 to 2017-10-10	2017-10-18	Version 5	Updated	Replaced
WTS17S09895 24-1E V6	-	2017-09-06 to 2017-10-10	2017-10-21	Version 6	Updated	Replaced
WTS17S09895 24-1E V7	-	2017-09-06 to 2017-10-10	2017-10-30	Version 7	Updated	Replaced
WTS17S09895 24-1E V8	-	2017-09-06 to 2017-10-31	2017-10-31	Version 8	Updated	Replaced
WTS17S09895 24-1E V9	-	2017-09-06 to 2017-10-31	2017-11-07	Version 9	Updated	Replaced
WTS17S09895 24-1E V10	-	2017-09-06 to 2017-11-15	2017-11-15	Version 10	Updated	Valid

5 General Information

5.1 General Description of E.U.T.

Product:	LTE-TDD Base Station
Model(s):	pBS2120
Model Description:	N/A
Storage Location:	Internal Storage
Note:	N/A

5.2 Details of E.U.T.

Operation Frequency:	3655MHz~3695MHz
Type of Modulation:	QPSK, 16QAM, 64QAM
Antenna installation:	Internal antenna
Antenna Gain:	9.0dBi
Ratings:	AC 120V/60Hz
Number of transmitter chains:	2*2 (MIMO)

The device supports MIMO 2*2, and the MIMO works with STBC(Space-Time Block Coding).The antenna is omnidirectional, does not support any directional gain in any modes.

MIMO rate, antennas use two different streams, from this side, if RX side need to decode MIMO, data between the two stream should be correlated. The device transmits simultaneously in multiple channels in single frequency bands and uses carrier aggregation techniques.

Directional gain = GANT + 10 log (NANT) dBi

5.3 Channel List

Normal

10MHz		20MHz	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
Low	3655	Low	3660
Middle	3675	Middle	3675
High	3695	High	3690

5.4 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). (10MHz, 20MHz)

Data Mode (64QAM)	Keep the EUT in data communicating mode (64QAM). (10MHz, 20MHz)
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5.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

Yes No

If Yes, list the related test items and lab information:

Test Lab: Shenzhen BALUN Technology Co.,Ltd.

Lab address: Block B,1st FL,Baisha Science and Technology Park ,Shahe Xi Road,, Nanshan District, Shenzhen, Guangdong Province, China. 518055

Test items: Radiation Spurious Emissions(18-40GHz) and Conducted Spurious Emissions(18-40GHz).

Designation Number: CN1196

6 Test Summary

Test Items	Test Requirement		Result
	FCC	IC	
RF Output Power	Part 2.1046 Part 90.1321	RSS Gen Section 6.12 RSS 197 section 5.6	PASS
Modulation Characteristics	Part 2.1047	RSS 197 section 5.1	PASS
99% & -26 dB Occupied Bandwidth	Part 2.1049 Part 90.209	RSS Gen section 6.6	PASS
Emission Mask	Part 90.210(b)	Not applicable	PASS
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 90.1323	RSS Gen Section 6.13 RSS 197 section 5.7	PASS
Field Strength of Spurious Radiation	Part 2.1053 Part 90.1323	RSS Gen Section 6.13 RSS 197 section 5.7	PASS
Frequency stability vs. temperature	Part 2.1055(a)(1)(b) Part 90.213(a)	RSS Gen section 6.11 RSS 197 section 5.3	PASS
Frequency stability vs. voltage	Part 2.1055(d)(1)(2) Part 90.213(a)	RSS Gen section 6.11 RSS 197 section 5.3	PASS

Pass: The EUT complies with the essential requirements in the standard.

Note 1: According to FCC KDB 662911 D01 Multiple Transmitter Output v02r01 & KDB 971168 D01 Power Means License Digital Systems v02r02.

Note 2: EUT was on continue transmit mode, the duty cycle was 100%.

7 Equipment Used during Test

7.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	2017-09-12	2018-09-11
2.	LISN	R&S	ENV216	101215	2017-09-12	2018-09-11
3.	Cable	Top	TYPE16(3.5M)	-	2017-09-12	2018-09-11
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	2017-09-12	2018-09-11
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2017-09-12	2018-09-11
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2017-09-12	2018-09-11
4.	Cable	LARGE	RF300	-	2017-09-12	2018-09-11
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	2017-04-29	2018-04-28
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2017-04-09	2018-04-08
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2017-04-09	2018-04-08
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2017-09-12	2018-09-11
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2017-04-09	2018-04-08
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2017-04-09	2018-04-08
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2017-04-13	2018-04-12
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2017-04-13	2018-04-12
9	Universal Radio Communication Tester	R&S	CMU 200	112461	2017-04-13	2018-04-12
10	Signal Generator	R&S	SMR20	100046	2017-09-12	2018-09-11
11	Smart Antenna	SCHWARZBECK	HA08	-	2017-04-09	2018-04-08
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date

1	Test Receiver	R&S	ESCI	101296	2017-04-13	2018-04-12
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2017-04-09	2018-04-08
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2017-04-13	2018-04-12
4	Cable	HUBER+SUHNER	CBL2	525178	2017-04-13	2018-04-12
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2017-09-12	2018-09-11
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2017-09-12	2018-09-11
3.	Universal Radio Communication Tester	R&S	CMU 200	112461	2017-04-13	2018-04-12
4	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2017-09-12	2018-09-11

7.2 Measurement Uncertainty

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

7.3 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.

8 Transmit Output Power and PSD

Test Requirement:	FCC part90.1321(a) and RSS-197 Clause 5.6.2
Test Method:	FCC part2.1046 and RSS Gen section 6.12
Test Mode:	Data communicating mode
Limit:	<p>FCC:</p> <p>(a) Base and fixed stations are limited to 25 watts/25 MHz equivalent isotropically radiated power (EIRP). In any event, the peak EIRP powerdensity shall not exceed 1 Watt in any one-megahertz slice of spectrum.</p> <p>(b) In addition to the provisions in paragraph (a) of this section, transmitters operating in the 3650-3700 MHz band that emit multipledirectional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided theemissions comply with the following:</p> <p>(1) Different information must be transmitted to each receiver.</p> <p>(2) If the transmitter employs an antenna system that emits multiple directional beams but does not emit multiple directional beamssimultaneously, the total output power conducted to the array or arrays that comprise the device, <i>i.e.</i>, the sum of the power supplied to allantennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph(a) of this section, as applicable. The directional antenna gain shall be computed as follows:</p> <p>(i) The directional gain, in dBi, shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain, in dBi,of the individual element or stave having the highest gain.</p> <p>(ii) A lower value for the directional gain than that calculated in paragraph (b)(2)(i) of this section will be accepted if sufficient evidence ispresented, <i>e.g.</i>, due to shading of the array or coherence loss in the beam-forming.</p> <p>(3) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequencychannels and if transmitted beams overlap, the power shall be reduced to ensure that the aggregate power from the overlapping beams does notexceed the limit specified in paragraph (b)(2) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall notexceed the limit specified in paragraph (b)(2) of this section by more than 8 dB.</p> <p>(4) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (b)(2) of this section.</p> <p>IC:</p> <p>5.6.2 The maximum transmitter output power density of equipment, other than mobile and portalebquipment, shall not exceed 1W in any 1 MHz bandwidth.</p> <p>5.6.3 In addition, equipment, other than mobile and portable equipment, employing antenna systemsthat emit multiple directional beams, simultaneously or sequentially, for the purpose ofdirecting signals to individual receivers or to groups of receivers, shall comply with therequirements in SRSP-303.65.</p>

8.1 EUT Operation

Operating Environment :

Temperature:	22.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

8.2 Test Procedure

RBW=1MHz, VBW=3MHz, Detector mode= RMS ,

Trace mode: Power averaging over 100 sweeps

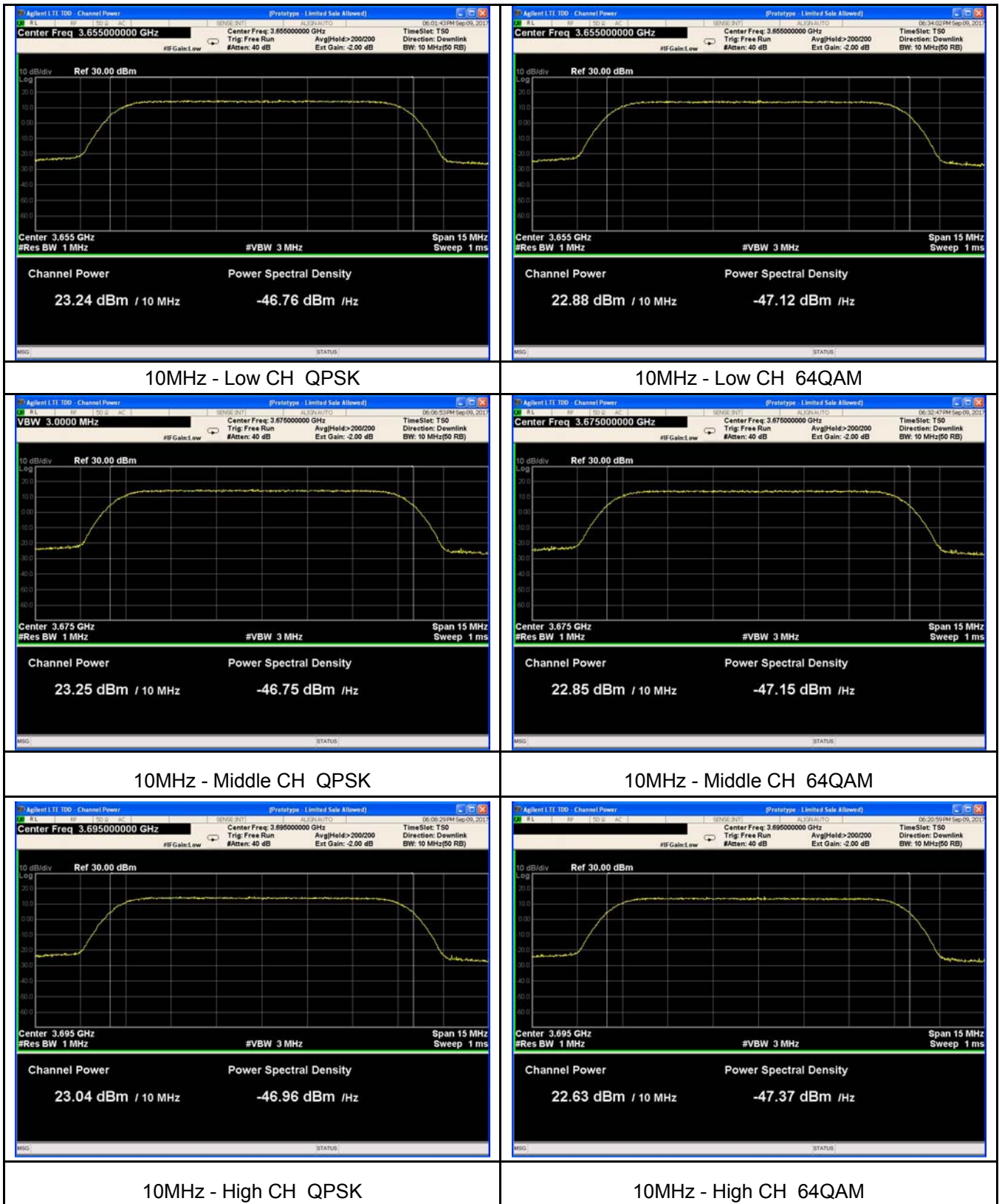
8.3 Test Result

Transmit Output Power								
Bandwidth (MHz)	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)
10	QPSK	Low	23.24	23.86	26.57	12	38.57	40.0
		Middle	23.25	23.85	26.57	12	38.57	
		High	23.04	23.58	26.33	12	38.33	
	64QAM	Low	22.88	23.85	26.40	12	38.40	
		Middle	22.85	23.90	26.42	12	38.42	
		High	22.63	23.64	26.17	12	38.17	
Bandwidth (MHz)	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)
20	QPSK	Low	22.75	23.56	26.18	12	38.18	40.0
		Middle	22.88	23.68	26.31	12	38.31	
		High	22.60	23.44	26.05	12	38.05	
	64QAM	Low	22.69	23.70	26.23	12	38.23	
		Middle	22.66	23.65	26.19	12	38.19	
		High	22.55	23.58	26.11	12	38.11	

PSD								
Bandwidth (MHz)	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)
10	QPSK	Low	14.53	14.24	17.40	12	29.40	30.0
		Middle	14.54	14.66	17.61	12	29.61	
		High	14.27	14.72	17.51	12	29.51	
	64QAM	Low	14.35	14.65	17.51	12	29.51	
		Middle	14.40	14.82	17.63	12	29.63	
		High	14.59	14.55	17.58	12	29.58	
Bandwidth (MHz)	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)
20	QPSK	Low	11.71	12.24	14.99	12	26.99	30.0
		Middle	11.58	12.69	14.93	12	26.93	
		High	11.11	12.56	14.91	12	26.91	
	64QAM	Low	11.34	12.53	14.99	12	26.99	
		Middle	11.64	12.45	15.07	12	27.07	
		High	11.15	12.80	15.06	12	27.06	

Remark: Directional antenna Gain = Antenna Gain + 10 lg (ANT_N) = 9+10 lg (2)=12dBi

Test Plots
Output Power at antenna terminal
Chain 0

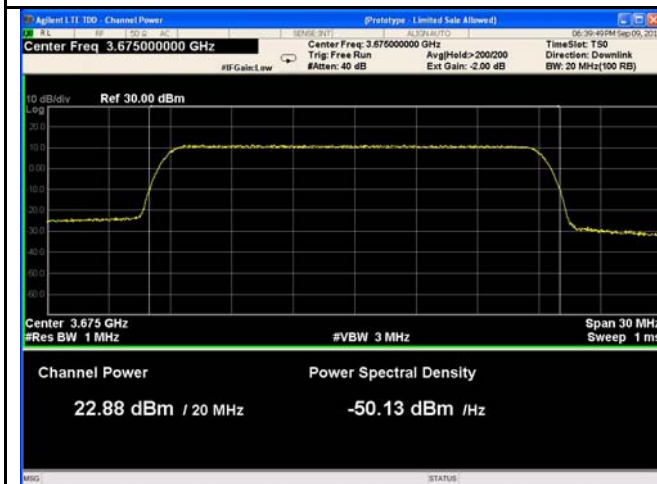




20MHz - Low CH QPSK



20MHz - Low CH 64QAM



20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM

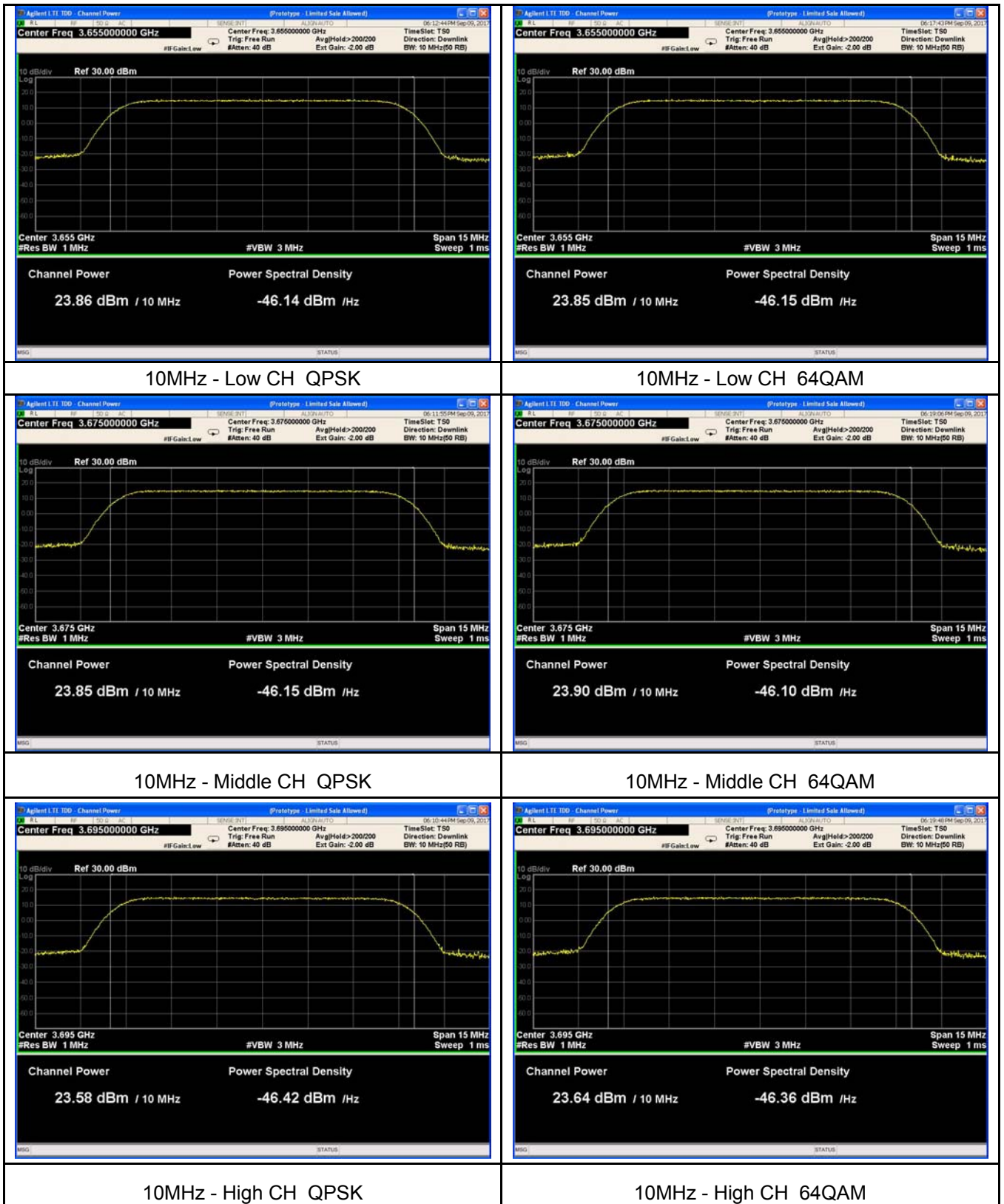


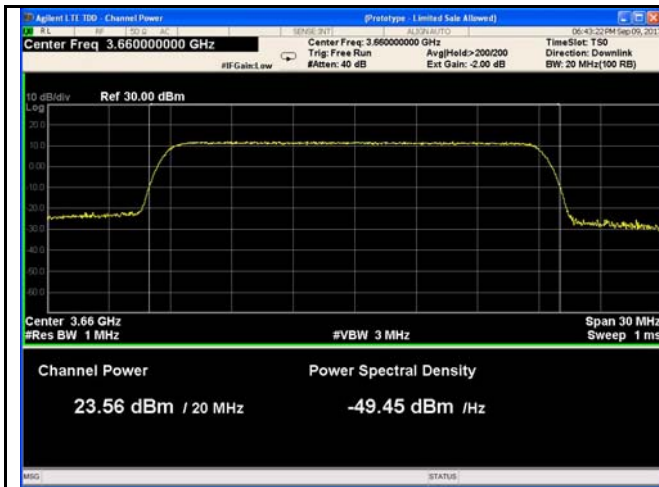
20MHz - High CH QPSK



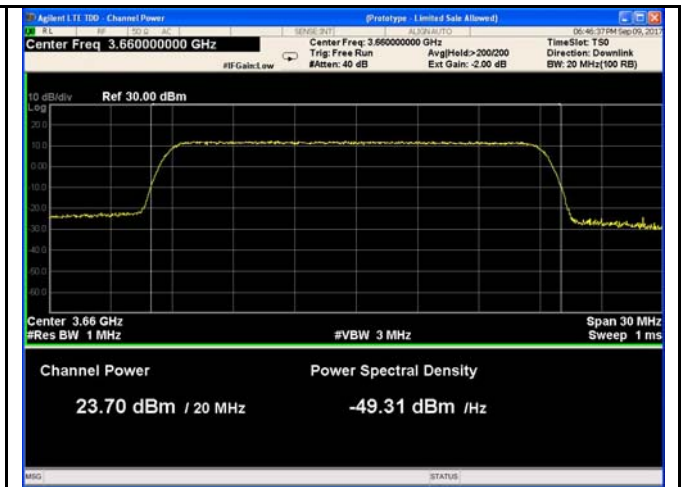
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Chain 1

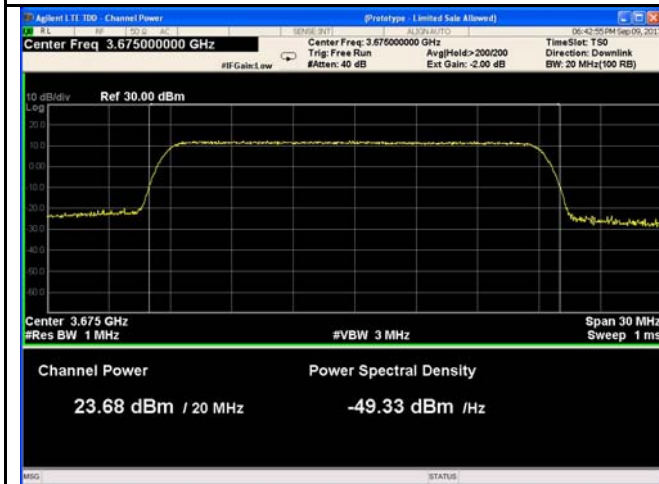




20MHz - Low CH QPSK



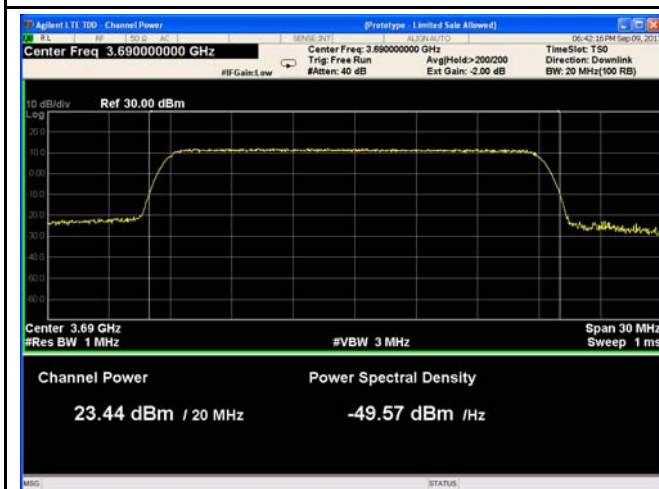
20MHz - Low CH 64QAM



20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM



20MHz - High CH QPSK



20MHz - High CH 64QAM

PSD
Chain 0



10MHz - Low CH QPSK



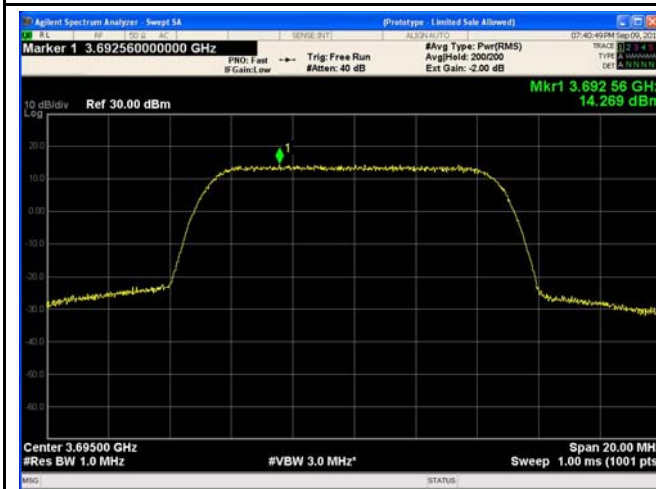
10MHz - Low CH 64QAM



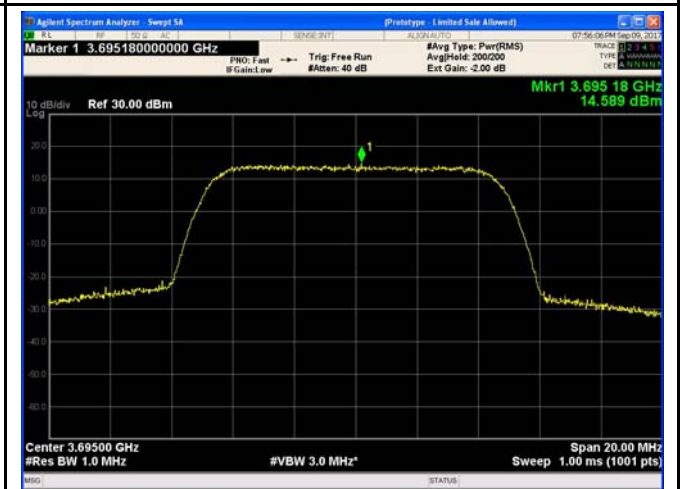
10MHz - Middle CH QPSK



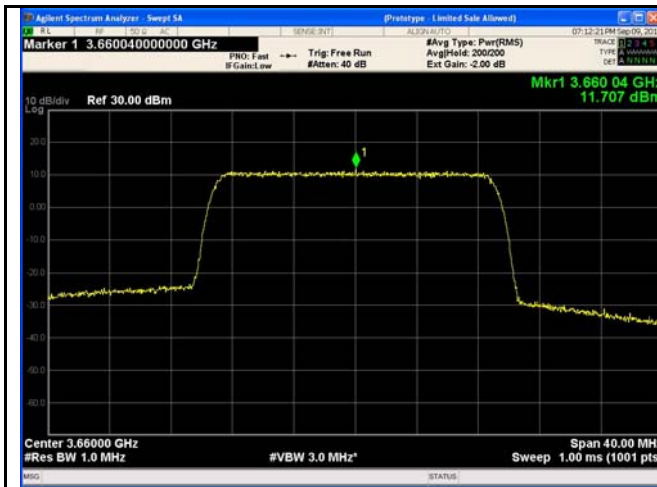
10MHz - Middle CH 64QAM



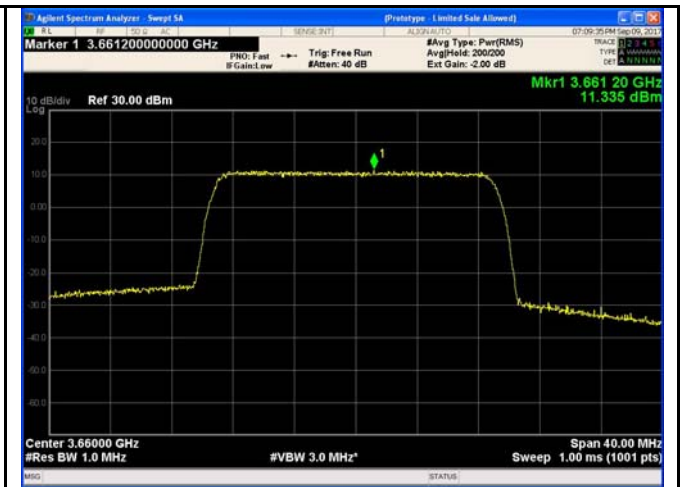
10MHz - High CH QPSK



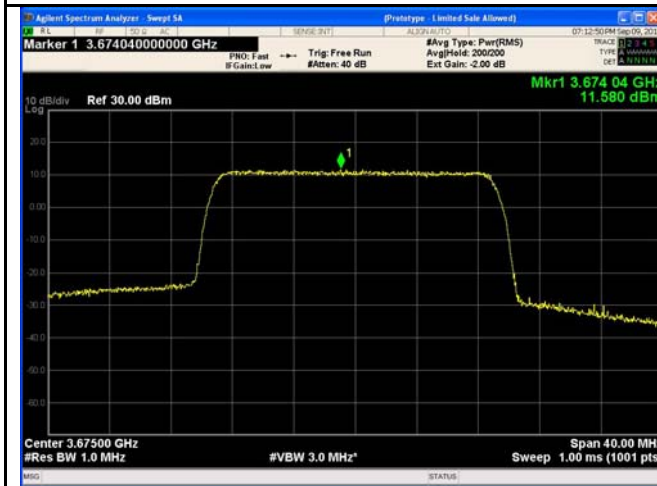
10MHz - High CH 64QAM



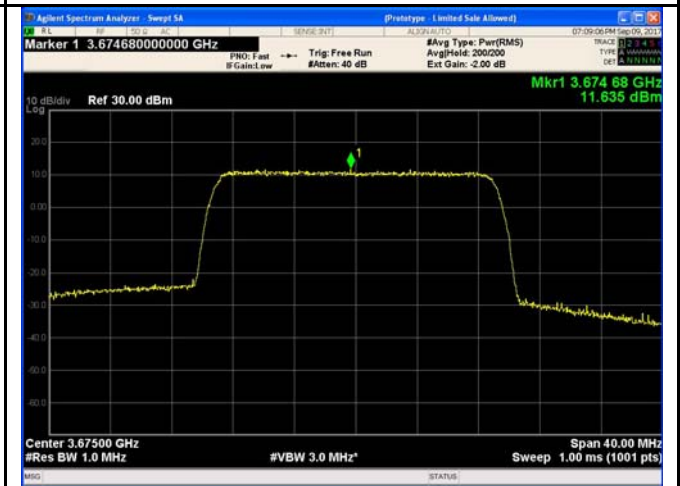
20MHz - Low CH QPSK



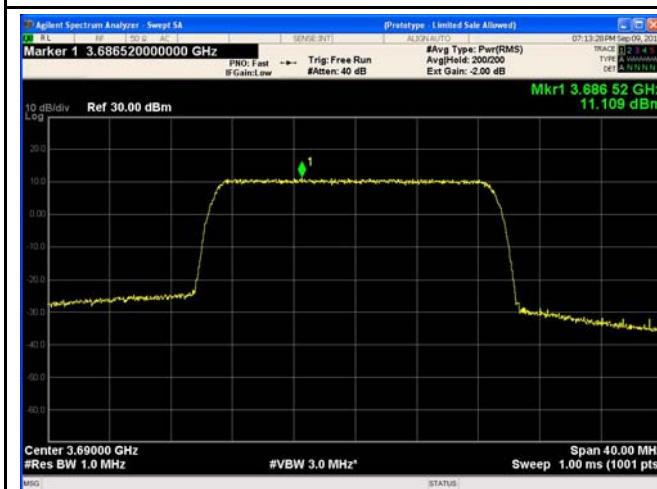
20MHz - Low CH 64QAM



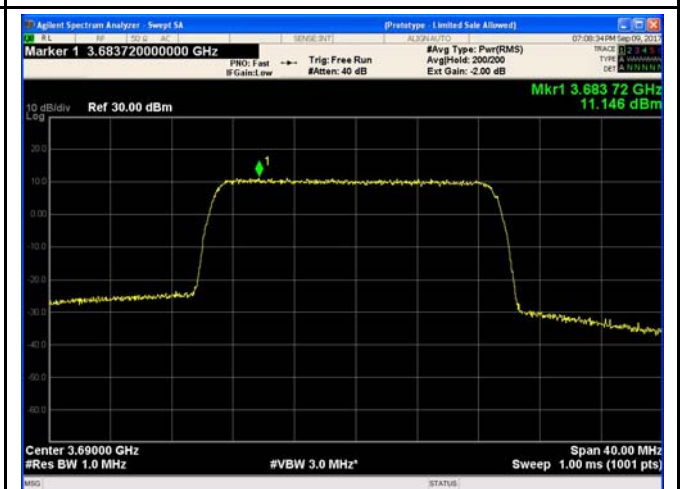
20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM

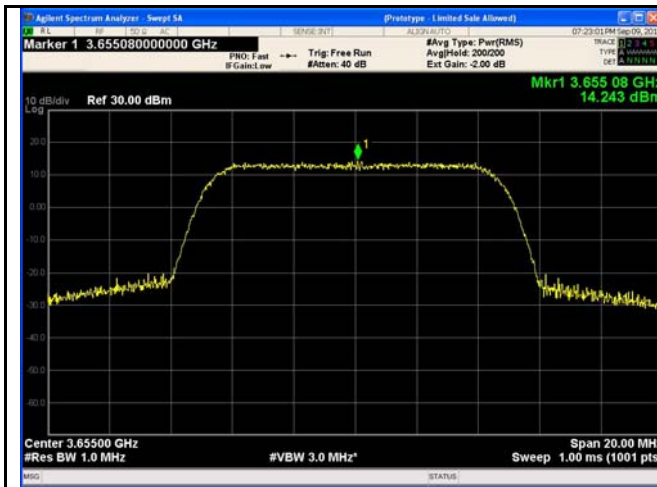


20MHz - High CH QPSK

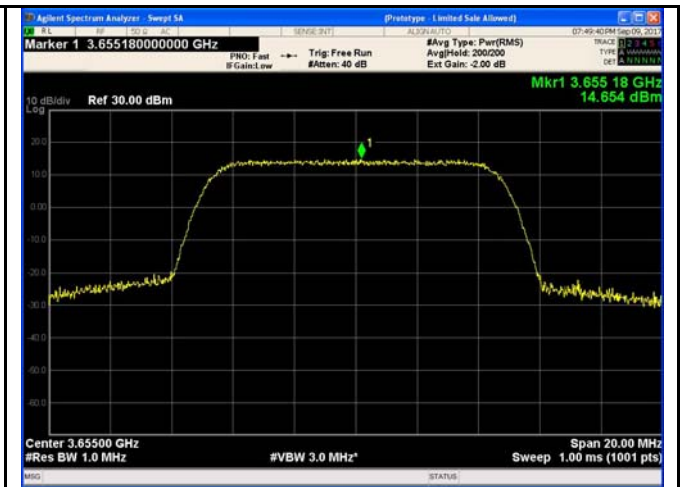


20MHz - High CH 64QAM

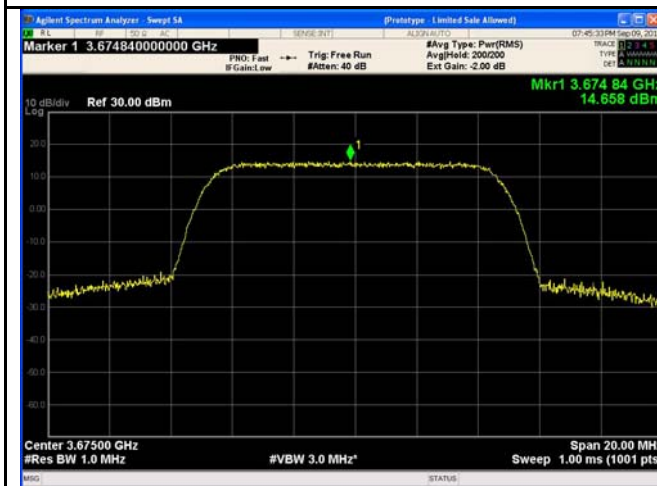
Chain 1



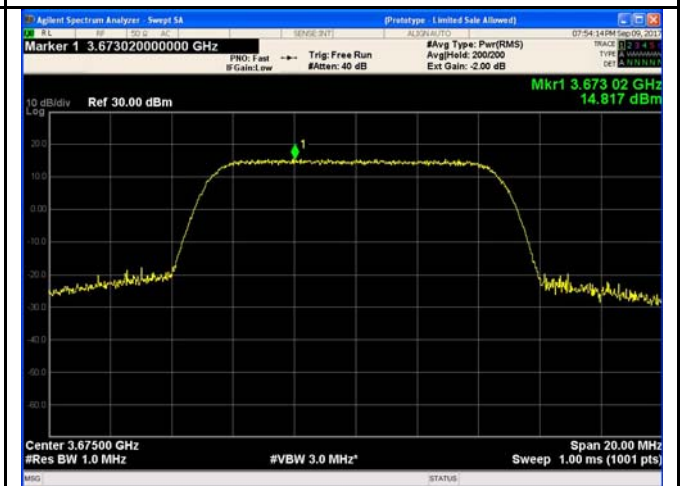
10MHz - Low CH QPSK



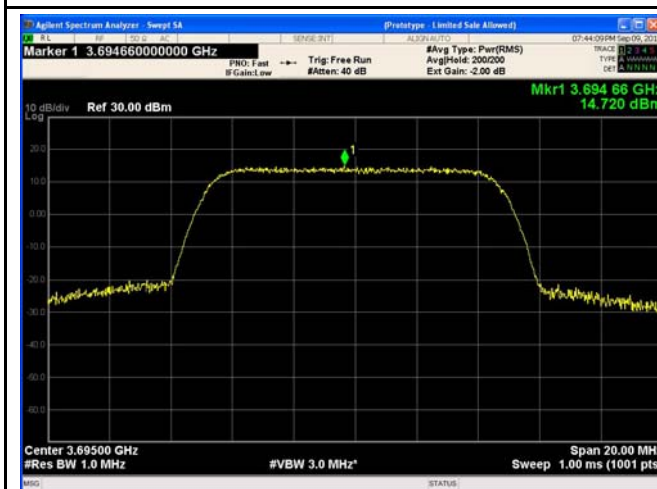
10MHz - Low CH 64QAM



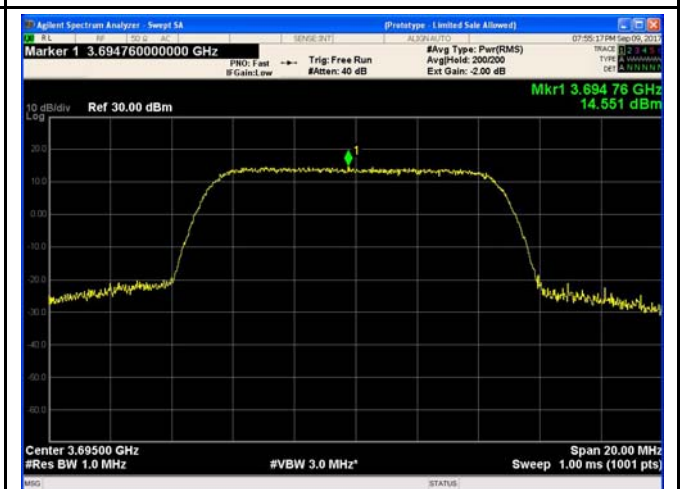
10MHz - Middle CH QPSK



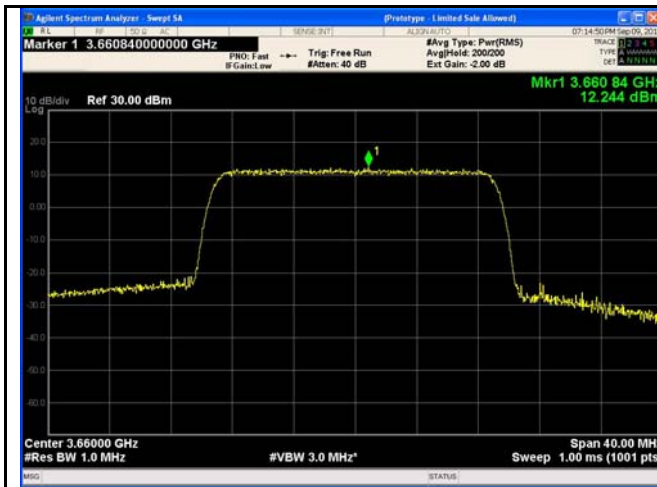
10MHz - Middle CH 64QAM



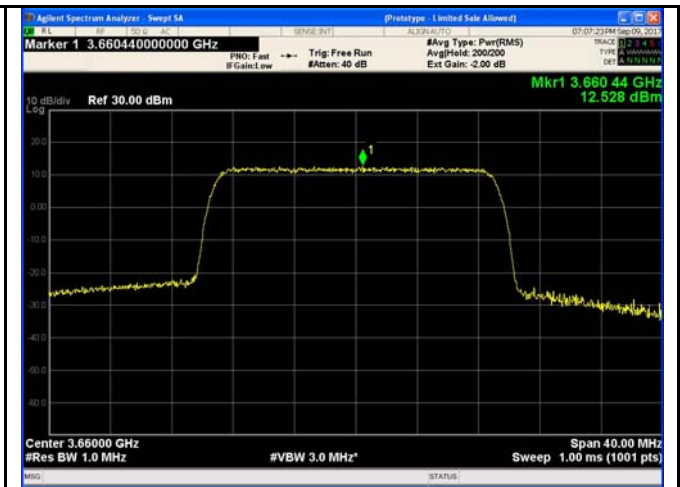
10MHz - High CH QPSK



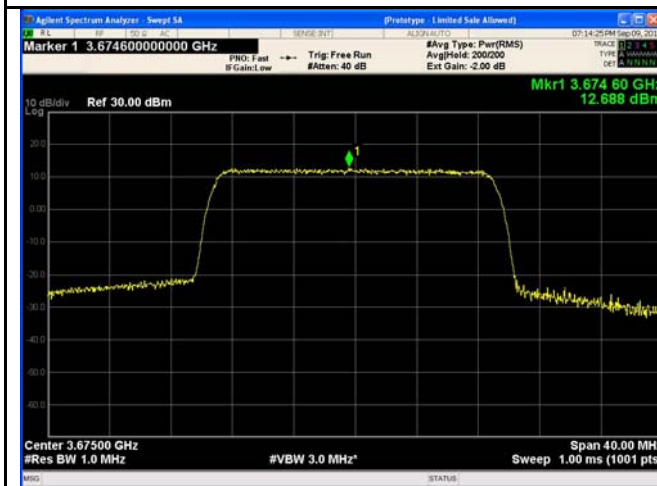
10MHz - High CH 64QAM



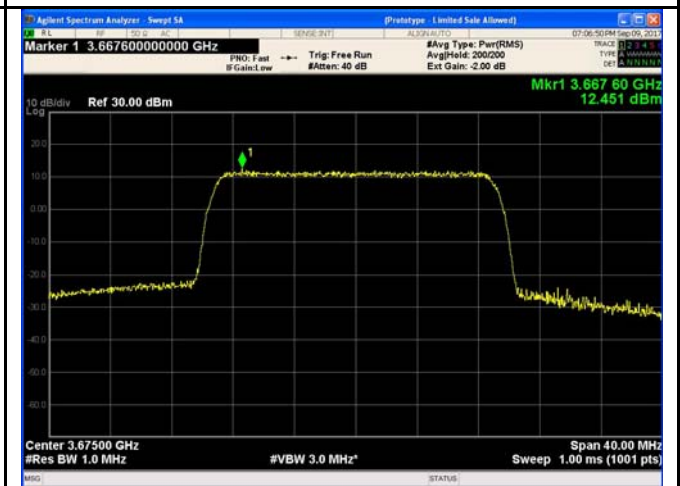
20MHz - Low CH QPSK



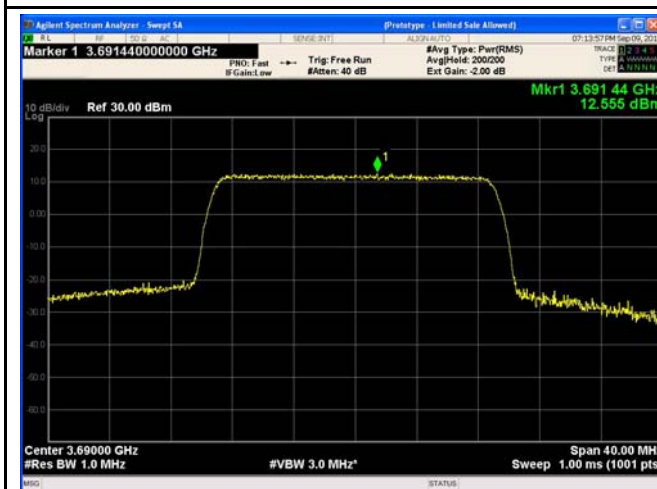
20MHz - Low CH 64QAM



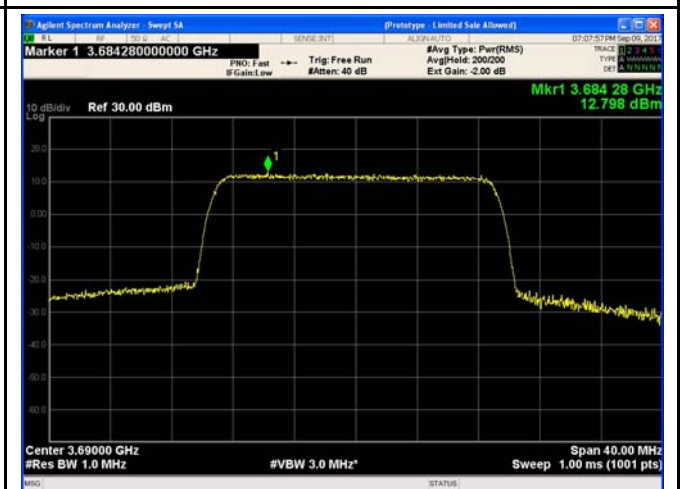
20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM



20MHz - High CH QPSK



20MHz - High CH 64QAM

9 Occupy Bandwidth

Test Requirement:	FCC part 90.209 and RSS-Gen 6.6
Test Method:	FCC part 2.1049 and RSS-Gen 6.6
Test Mode:	Data communicating mode

9.1 EUT Operation

Operating Environment :

Temperature:	22.5 °C
Humidity:	52.3% RH
Atmospheric Pressure:	101.2kPa

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

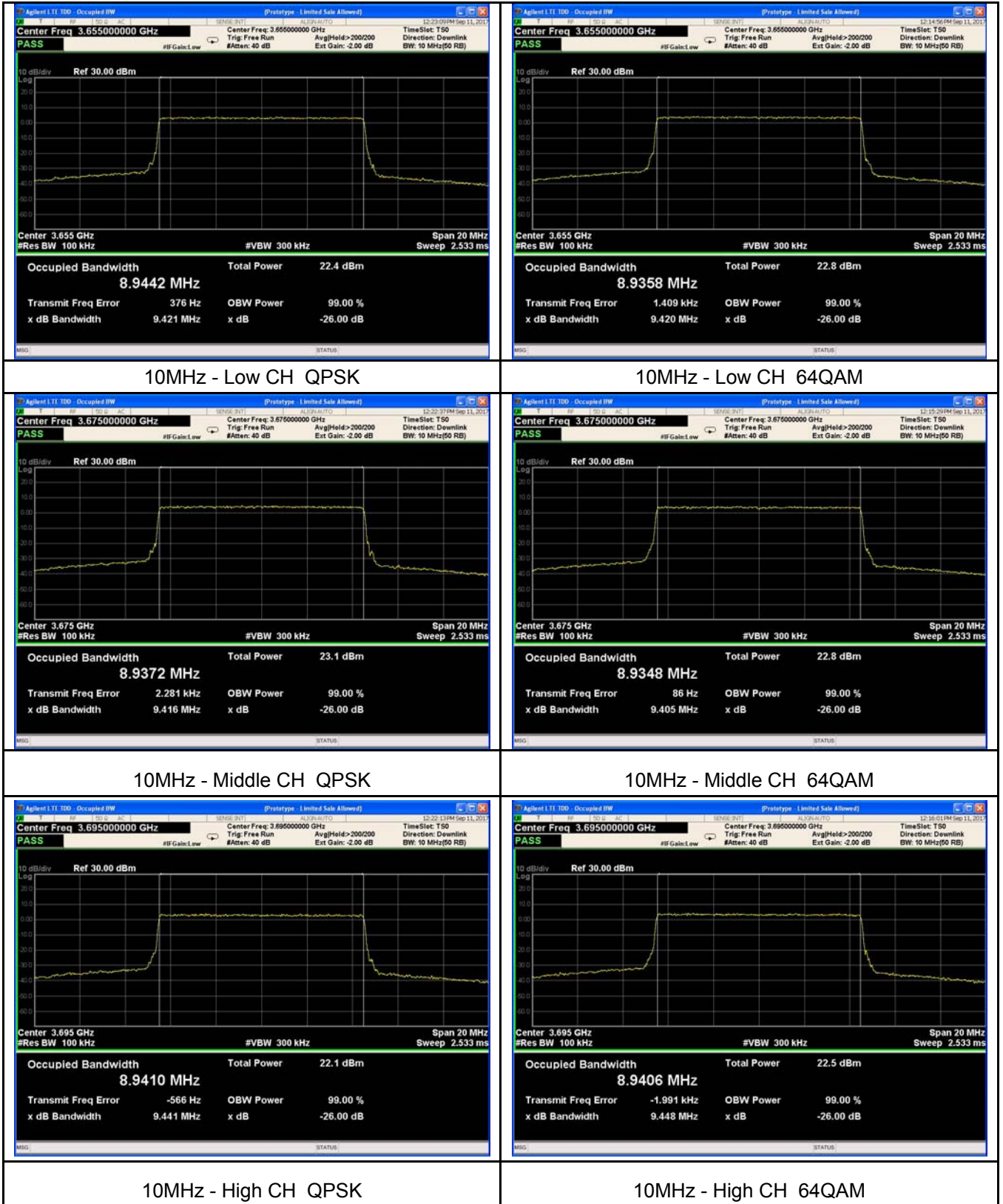
Chain 0

Bandwidth (MHz)	Modulation	Test Channel	26dB Occupy bandwidth (MHz)	99% Occupy bandwidth (MHz)
10	QPSK	Low	9.42	8.94
		Middle	9.42	8.94
		High	9.44	8.94
	64QAM	Low	9.42	8.94
		Middle	9.41	8.93
		High	9.45	8.94
Bandwidth (MHz)	Modulation	Test Channel	26dB Occupy bandwidth (MHz)	99% Occupy bandwidth (MHz)
20	QPSK	Low	18.58	17.86
		Middle	18.59	17.86
		High	18.57	17.84
	64QAM	Low	18.56	17.85
		Middle	18.82	17.86
		High	18.58	17.86

Chain 1

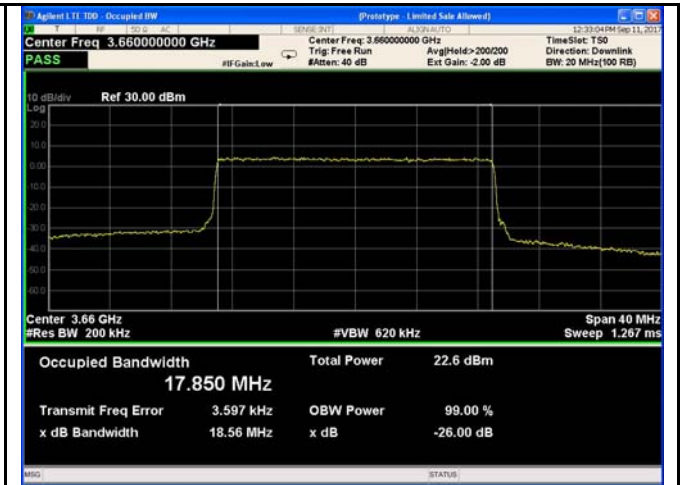
Bandwidth (MHz)	Modulation	Test Channel	26dB Occupy bandwidth (MHz)	99% Occupy bandwidth (MHz)
10	QPSK	Low	9.50	8.94
		Middle	9.38	8.93
		High	9.38	8.94
	64QAM	Low	9.42	8.94
		Middle	9.42	8.94
		High	9.41	8.94
Bandwidth (MHz)	Modulation	Test Channel	26dB Occupy bandwidth (MHz)	99% Occupy bandwidth (MHz)
20	QPSK	Low	18.61	17.86
		Middle	18.56	17.85
		High	18.59	17.84
	64QAM	Low	18.68	17.85
		Middle	18.59	17.84
		High	18.55	17.86

Test Plots
Chain 0





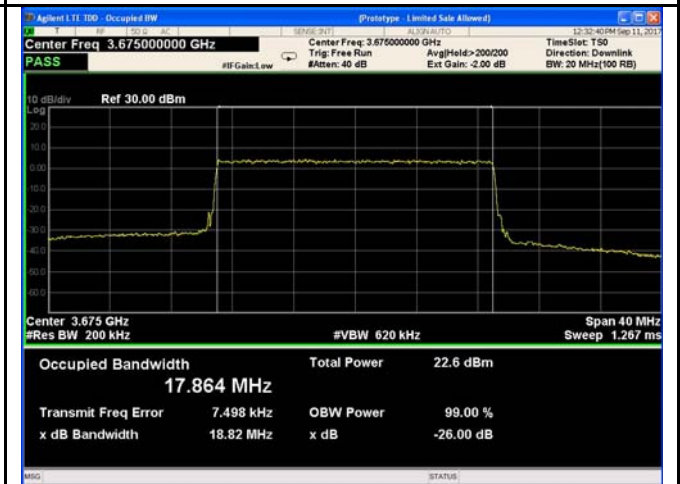
20MHz - Low CH QPSK



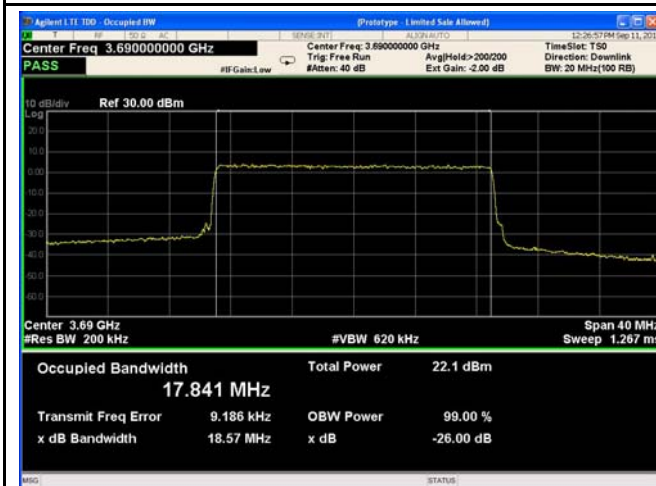
20MHz - Low CH 64QAM



20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM



20MHz - High CH QPSK

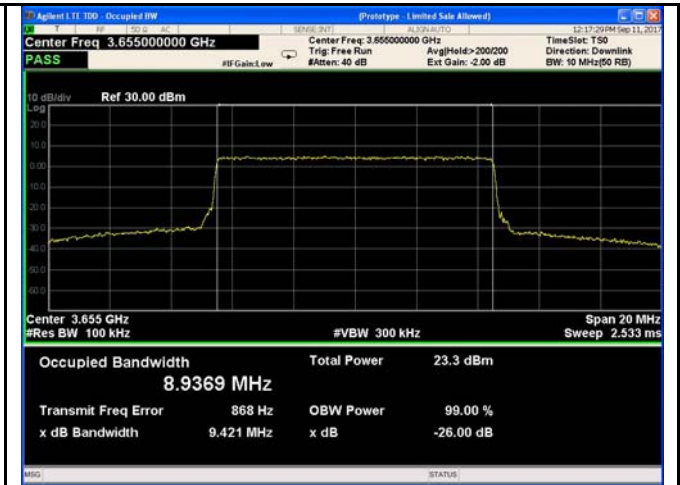


20MHz - High CH 64QAM

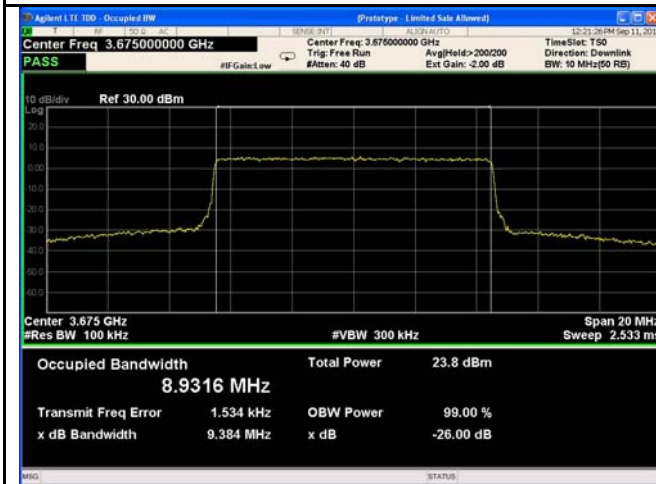
Chain 1



10MHz - Low CH QPSK



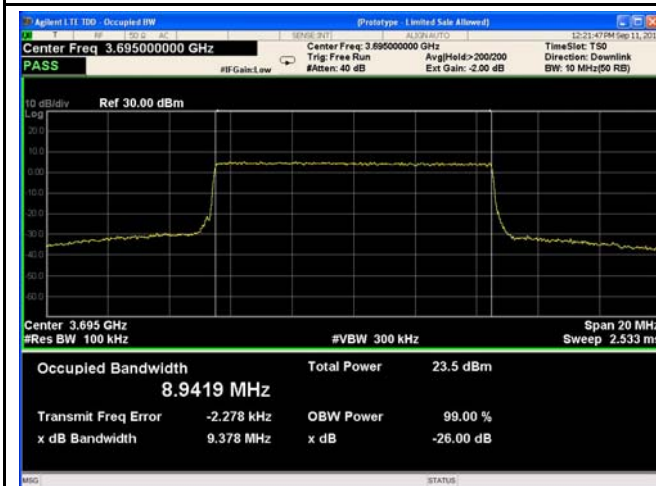
10MHz - Low CH 64QAM



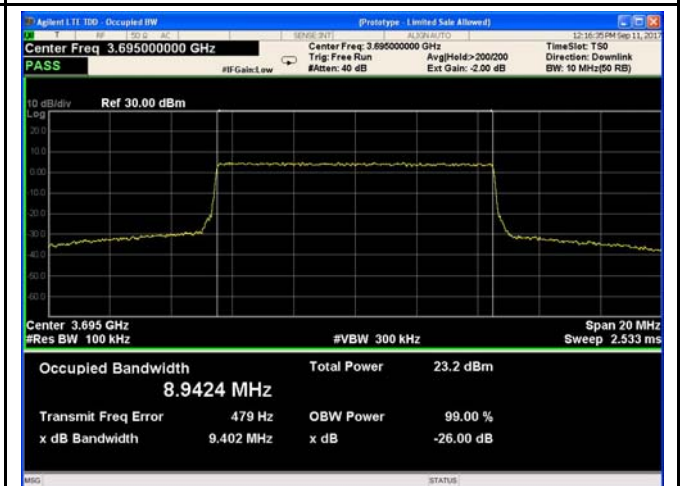
10MHz - Middle CH QPSK



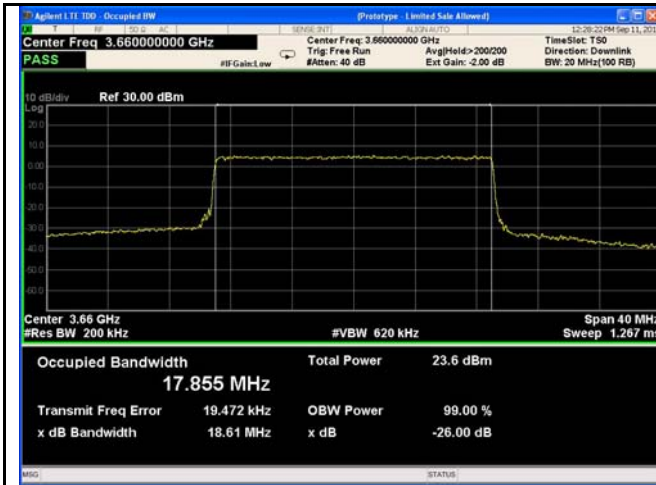
10MHz - Middle CH 64QAM



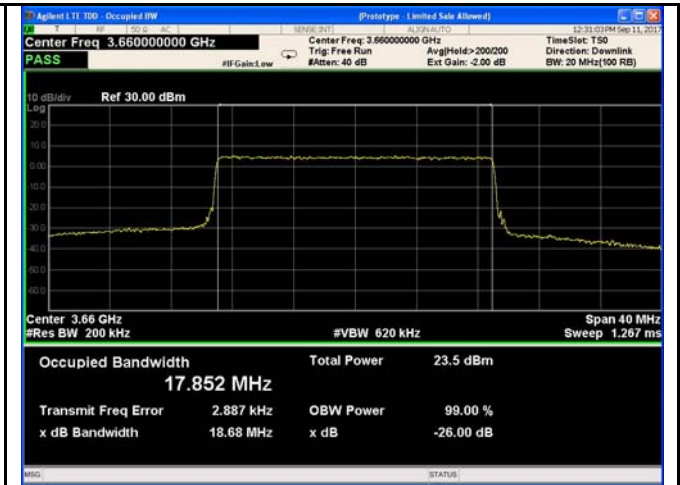
10MHz - High CH QPSK



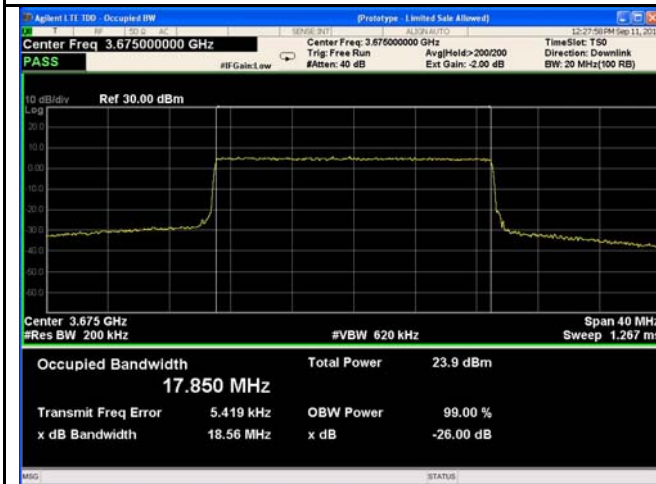
10MHz - High CH 64QAM



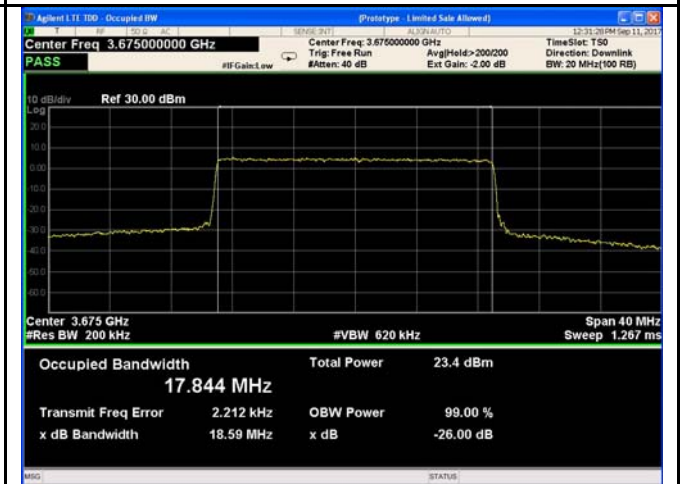
20MHz - Low CH QPSK



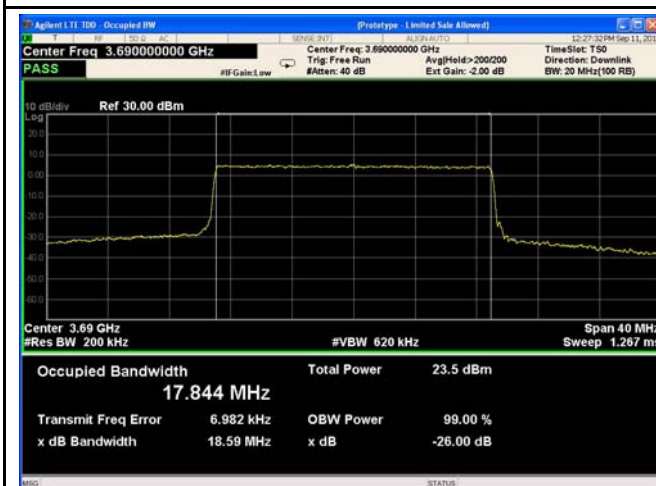
20MHz - Low CH 64QAM



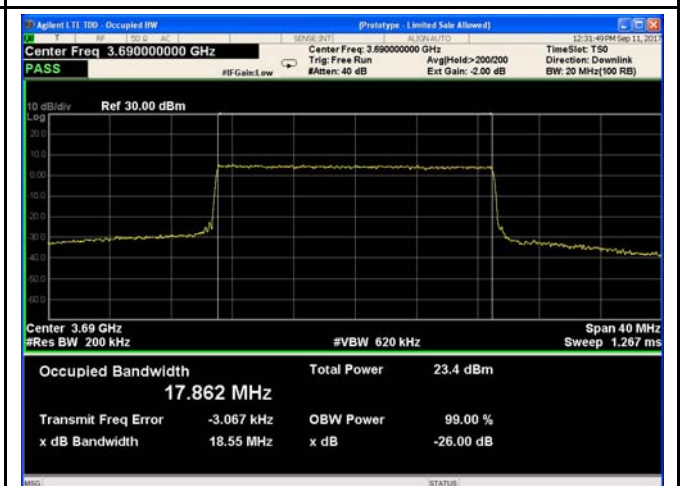
20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM



20MHz - High CH QPSK



20MHz - High CH 64QAM

10 Emission Mask

Test Requirement:	FCC part 90.210(b)
Test Mode:	Data communicating mode
Limit:	Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows: (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB. (2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB. (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB

10.1 EUT Operation

Operating Environment :	
Temperature:	22.5 °C
Humidity:	52.3% RH
Atmospheric Pressure:	101.2kPa

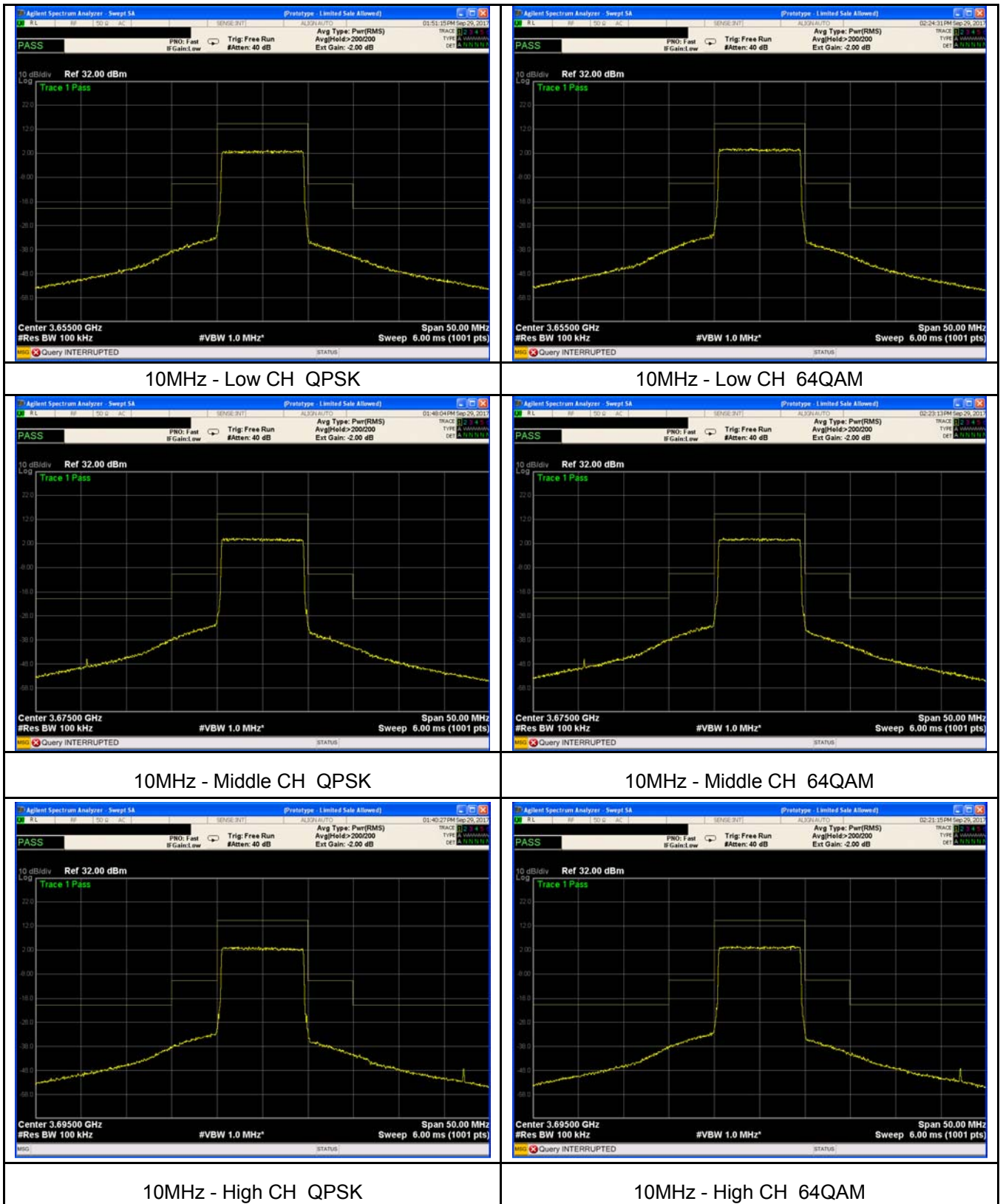
10.2 Test Procedure

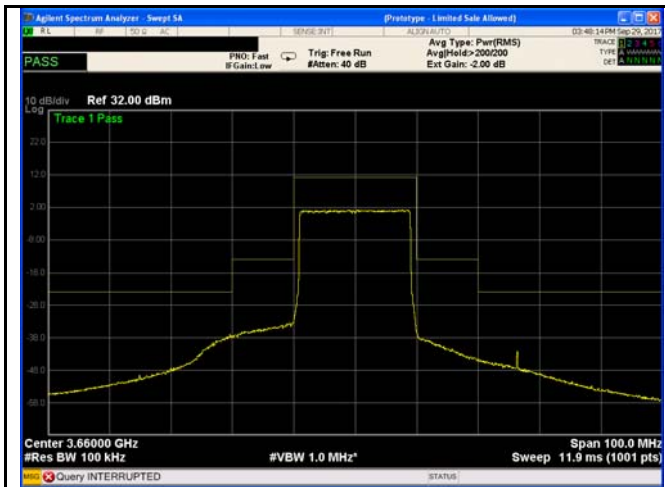
1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. RBW=100kHz, VBW=1MHz, Detector mode= RMS,
Trace mode: Power averaging over 100 sweeps

Note: For FCC part 90.210(b) 3, more than 250 percent emission was considered in radiated emission test items.

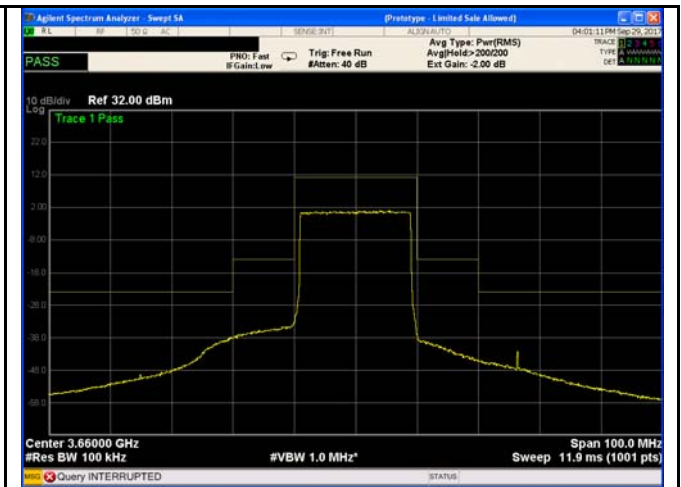
10.3 Test Result

Test Plots Chain 0

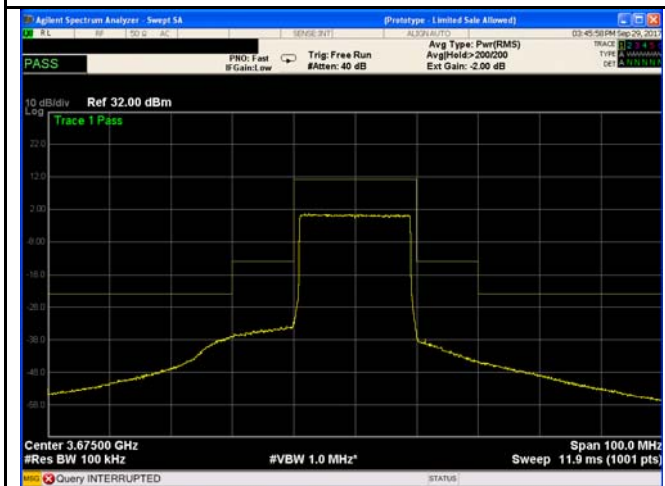




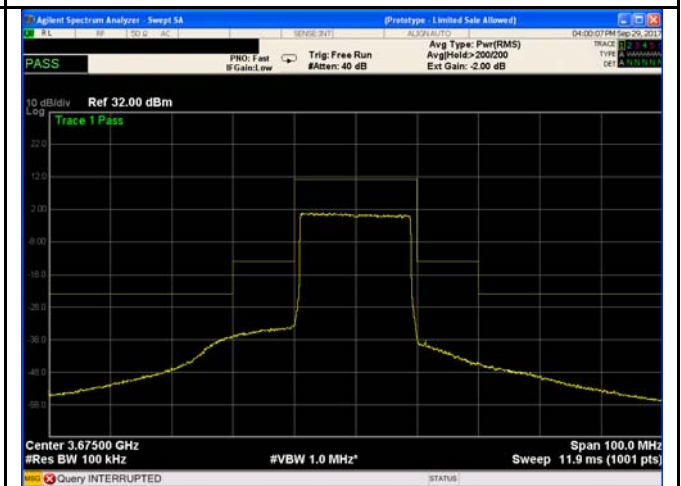
20MHz - Low CH QPSK



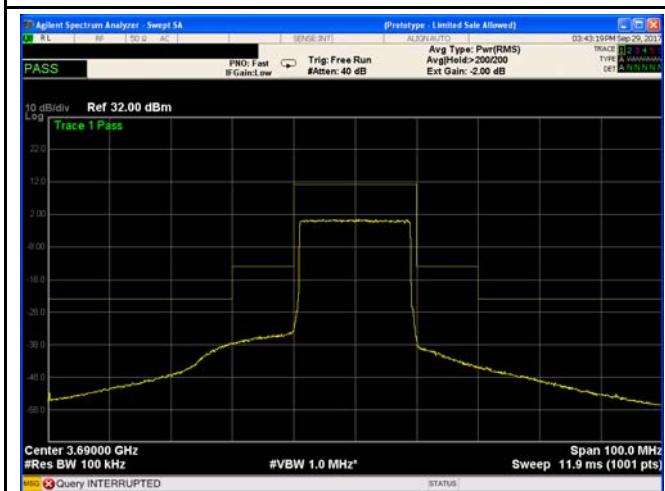
20MHz - Low CH 64QAM



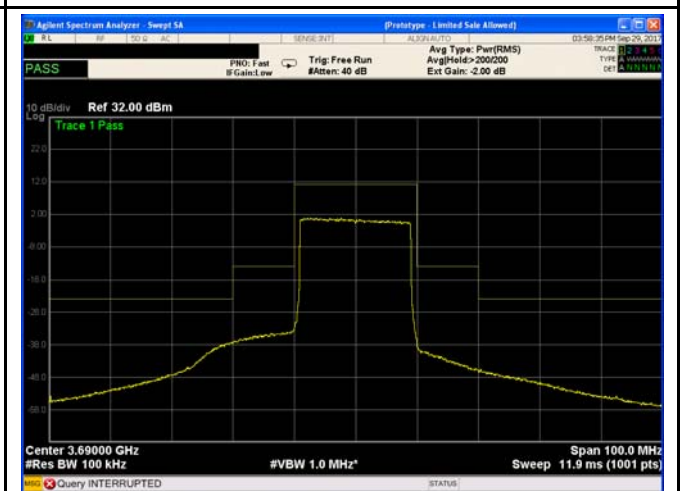
20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM

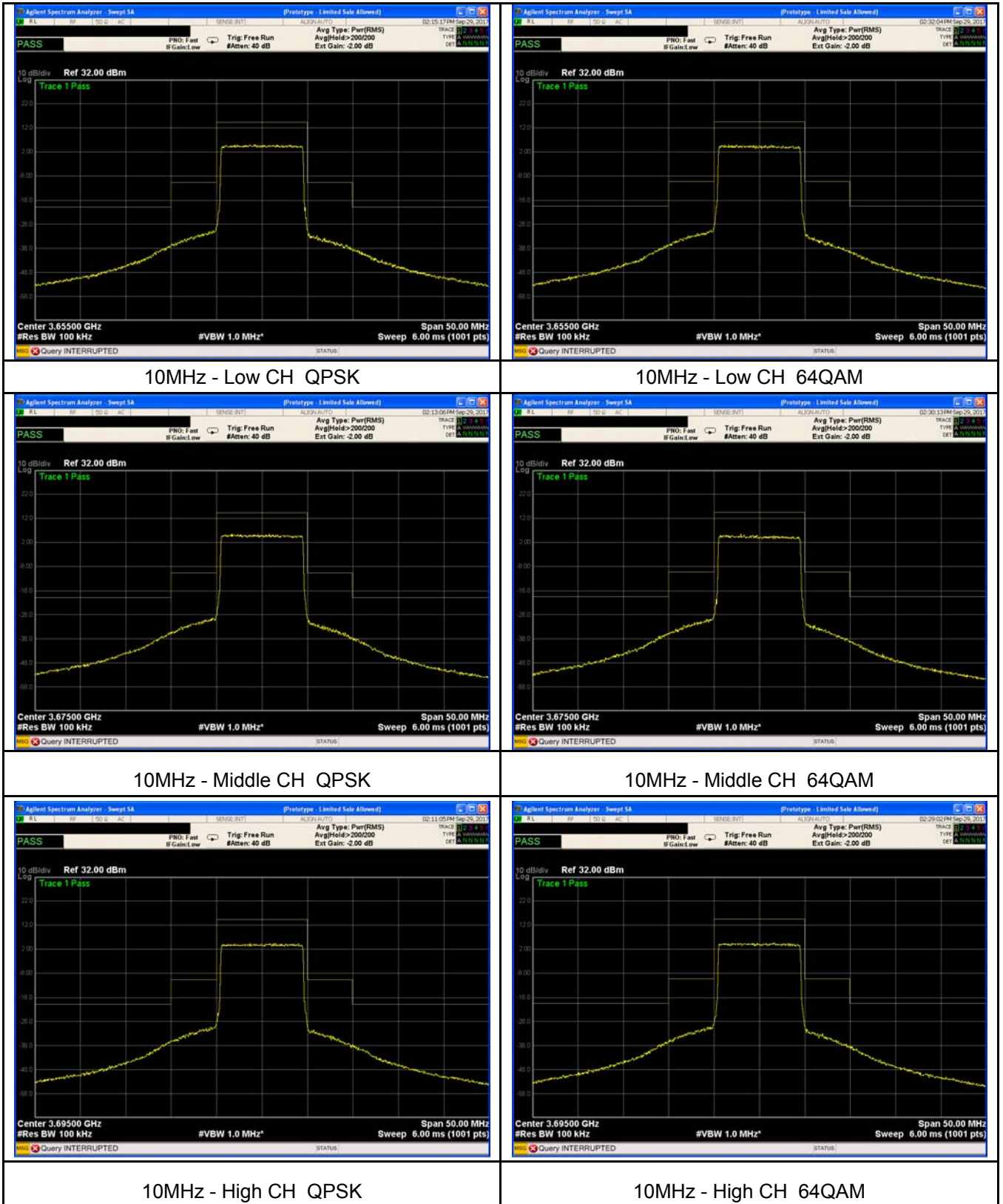


20MHz - High CH QPSK



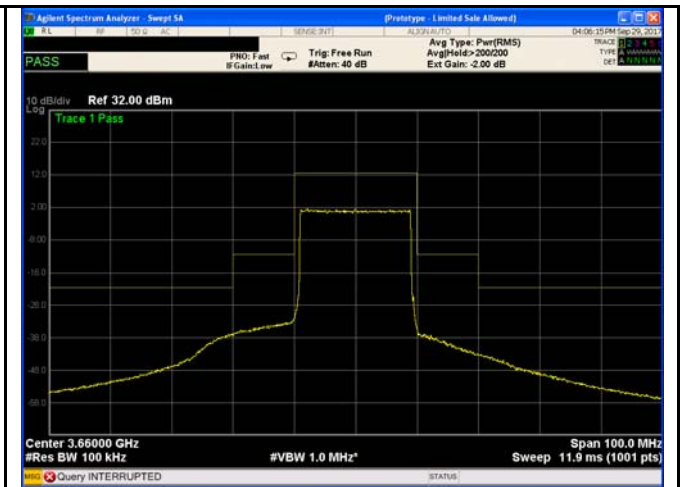
20MHz - High CH 64QAM

Chain 1

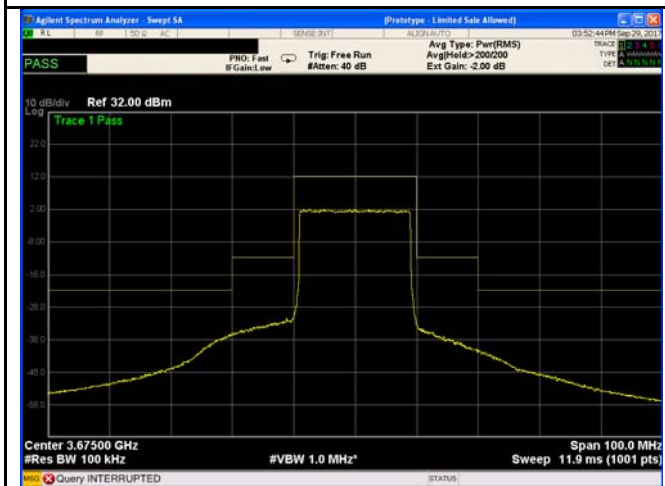




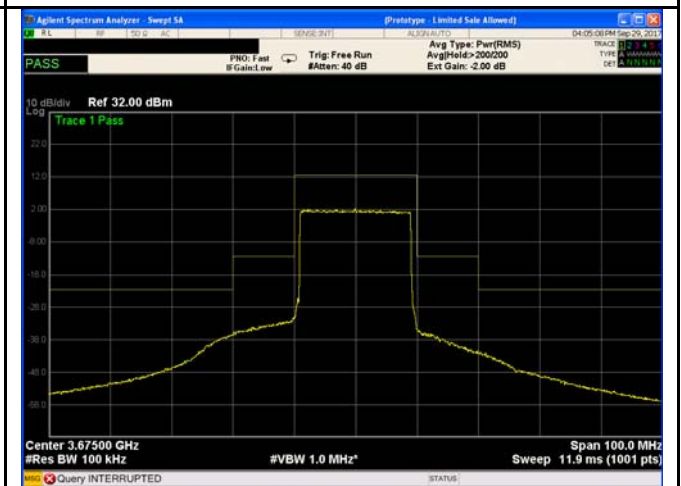
20MHz - Low CH QPSK



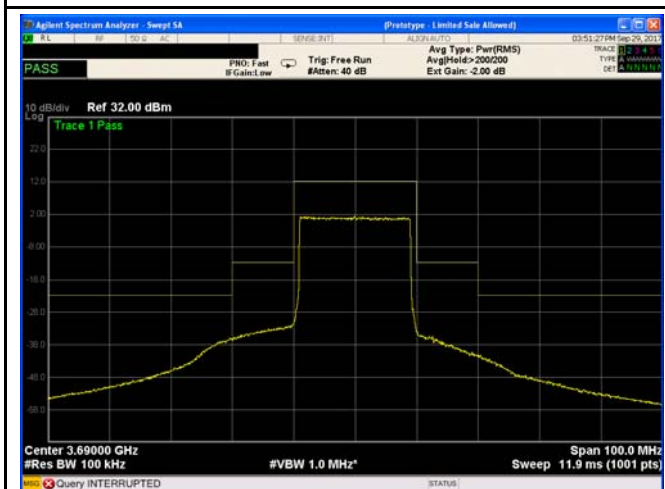
20MHz - Low CH 64QAM



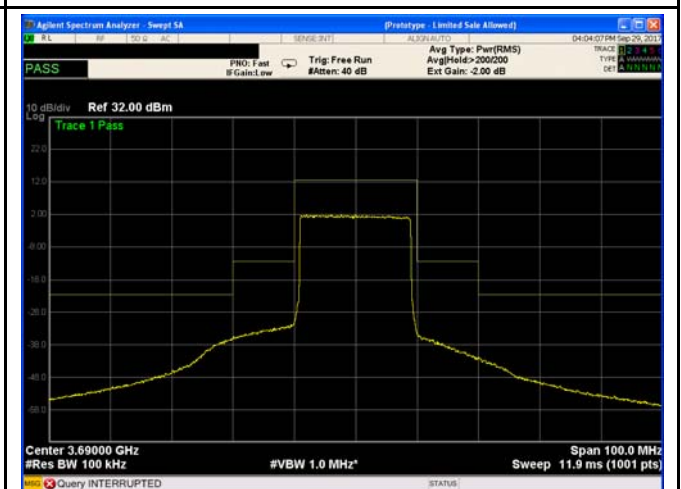
20MHz - Middle CH QPSK



20MHz - Middle CH 64QAM



20MHz - High CH QPSK



20MHz - High CH 64QAM

11 Out of band emission at antenna terminals

Test Requirement:	FCC part90.1323 and RSS-197 Clause 5.7
Test Method:	FCC part2.1051 and RSS Gen Section 6.13
Test Mode:	Data communicating mode
Limit:	-13dBm

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 set at 100 kHz when below 1GHz, 1MHz when above 1 GHz; sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.
3. For the out of band: Set the RBW=100 kHz, VBW=300 kHz when below 1 GHz, RBW =1 MHz, VBW=3 MHz when above 1 GHz, Start=30MHz, Stop= 10th harmonic.
4. Band Edge Requirements: In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.

11.3 Test Result

Remark: During the test, pre-scan the QPSK, 64QAM modulation, and found the QPSK modulation(10MHz/20MHz middle channel) is the worst case.

The permit frequency range of Part 90Z is from 3650-3700MHz. according the frequency table of the device on page 7. Notes as below:

1. The frequency star and stop for band edge test instruction as below:

bandwidth	Left > 1MHz	Left 1MHz immediately	Low channel	Middle Channel	High channel	Right 1MHz immediately	Right > 1MHz
10MHz	3644-3649	3649-3650	3655	3675	3695	3700-3701	3701-3706
20MHz	3639-3649	3649-3650	3660	3675	3690	3700-3701	3701-3711

Note 1:

For **low** channel, we test left 1 MHz immediately and more than 1MHz away (5 MHz for 10 MHz bandwidth & 10MHz for 20MHz bandwidth) from the permit left band 3650 MHz; the emission above right of 3700MHz has no intentional.

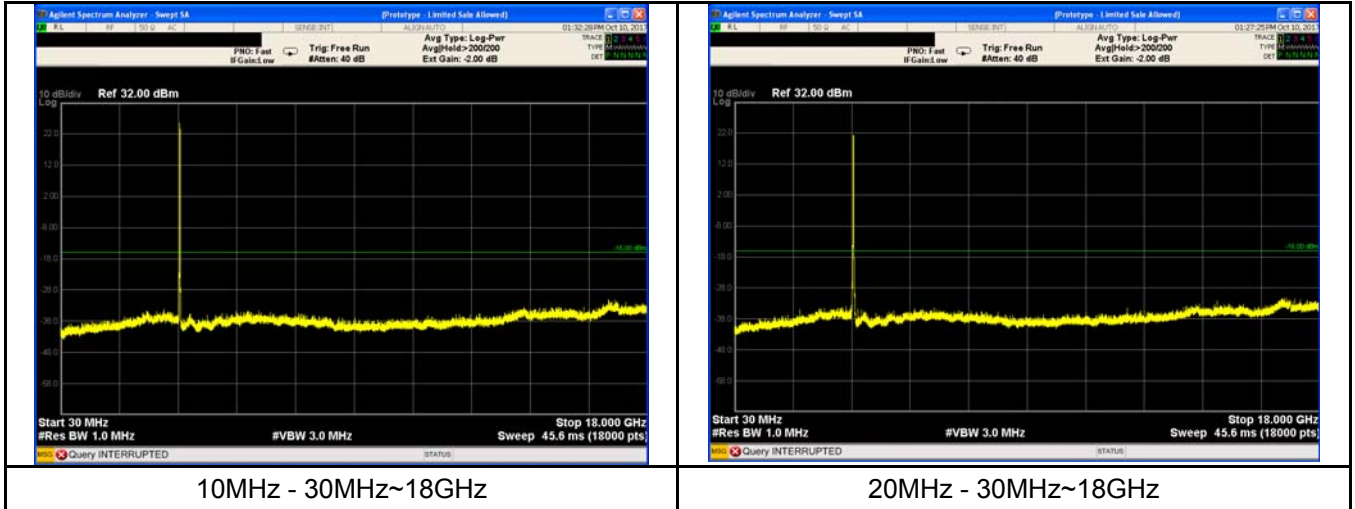
For **high** channel, we test right 1 MHz immediately and more than 1MHz away (5 MHz for 10 MHz bandwidth & 10MHz for 20MHz bandwidth) from the permit right band 3700 MHz; the emission below left of 3650MHz has no intentional.

For **middle** channel, we both test left and right 1 MHz immediately and more than 1MHz away (5 MHz for 10 MHz bandwidth & 10MHz for 20MHz bandwidth) from the permit band 3650 MHz to 3700 MHz; see above table.

2. The RBW and the limit instruction as below: (The general limit = -13dBm)

1. For 2x2 MIMO, the limit=-13dBm -10 log 2=-16dBm.
2. For RBW=100kHz, the limit = -16dBm – 10log(1MHz/100kHz)= -26dBm
3. For RBW=50kHz, the limit= -16dBm – 10log(1MHz/50kHz)= -29dBm
(The spectrum of N9020A only display the RBW=51kHz, and RBW=50kHz limit is lower than RBW=51kHz.)
4. For RBW=200kHz, the limit= -16dBm - 10log(1MHz/200kHz)= -23dBm

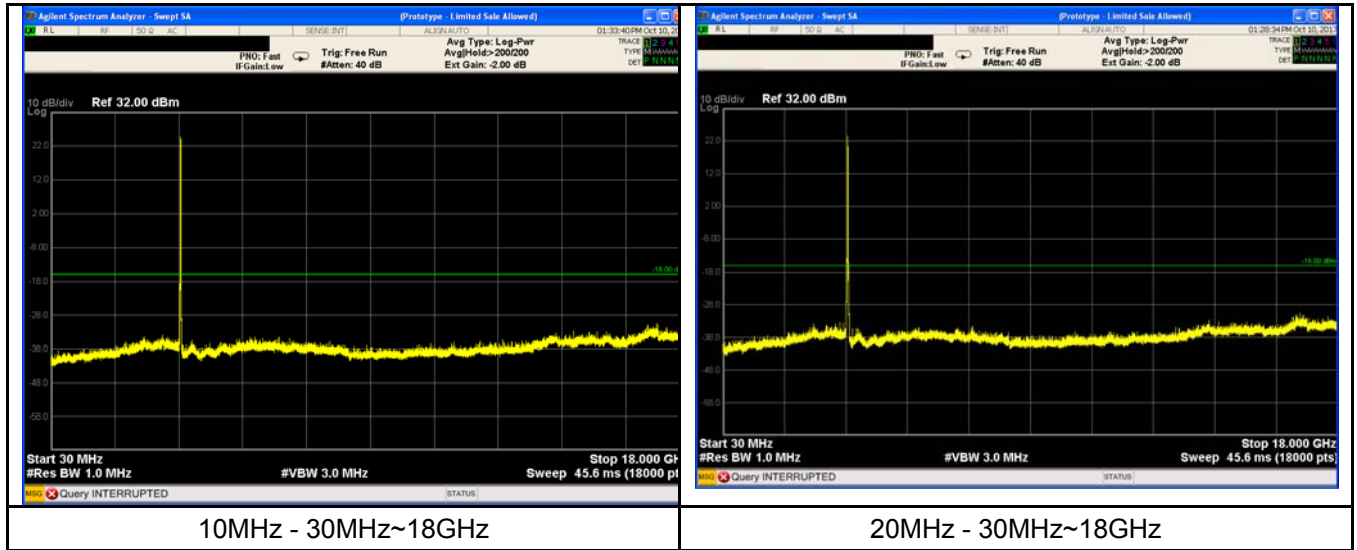
Test Plots

Spurious emission
Chain 0

Remark:

The emission levels of above 18 GHz have been tested Shenzhen BALUN Technology Co.,Ltd. Refer to report: BL-SZ17A0379-501.

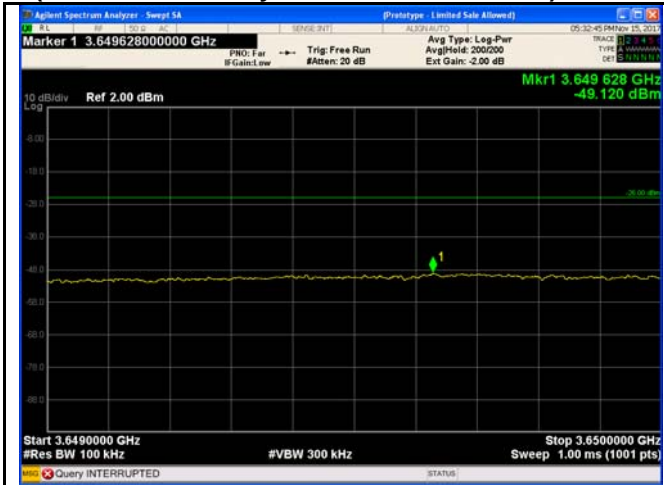
Chain 1



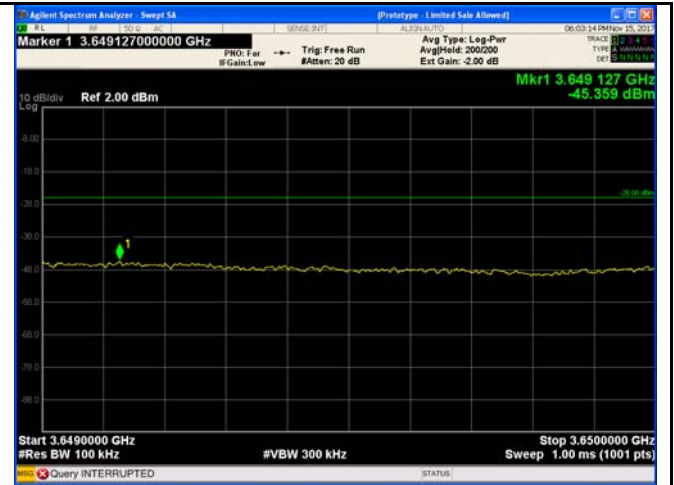
Remark:

The emission levels of above 18 GHz have been tested Shenzhen BALUN Technology Co.,Ltd. Refer to report: BL-SZ17A0379-501.

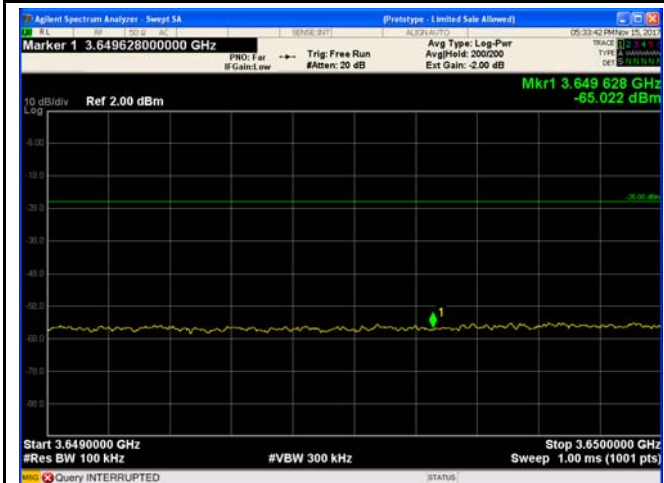
Band edge emission
Chain 0
(1MHz immediately for 10MHz bandwidth)



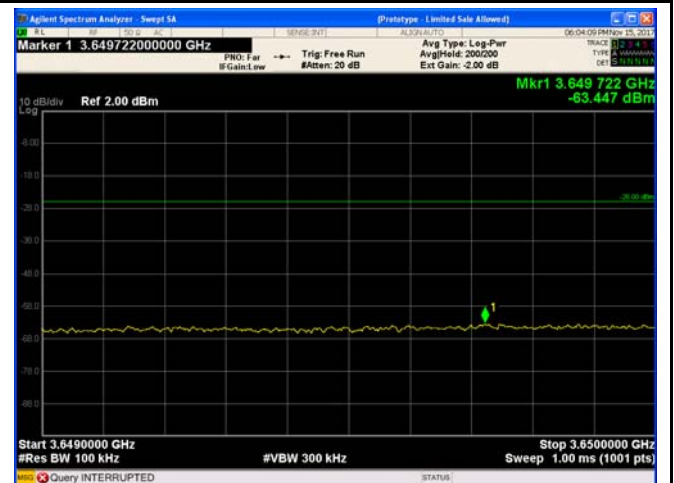
10MHz – 3649MHz-3650MHz Low CH QPSK



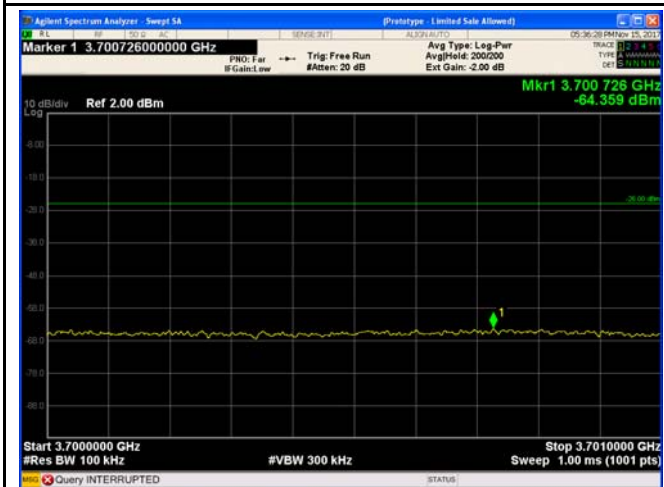
10MHz – 3649MHz-3650MHz Low CH 64QAM



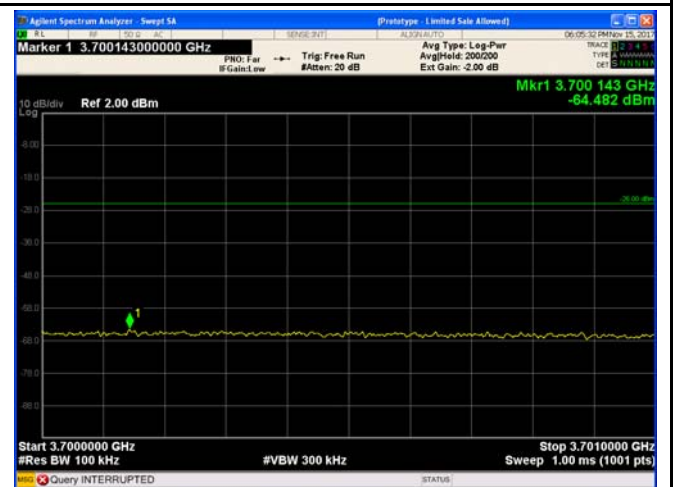
10MHz - 3649MHz -3650MHz Mid CH QPSK



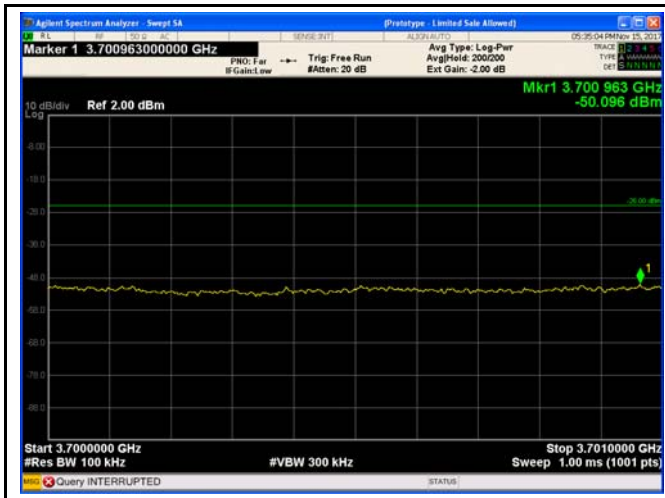
10MHz - 3649MHz -3650MHz Mid CH 64QAM



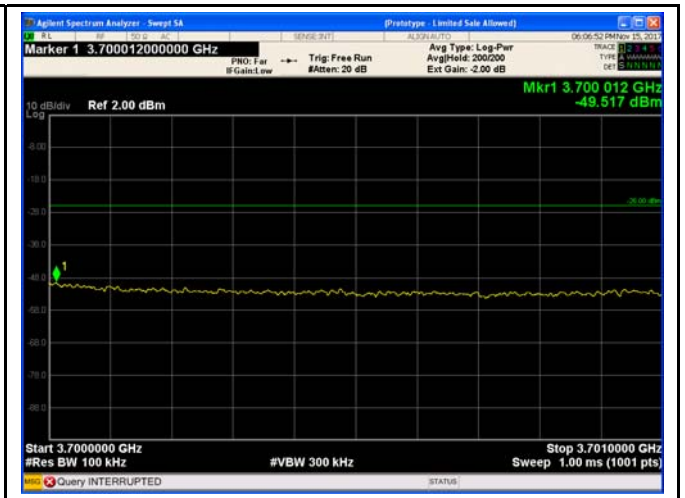
10MHz - 3700MHz -3701MHz Mid CH QPSK



10MHz - 3700MHz -3701MHz Mid CH 64QAM

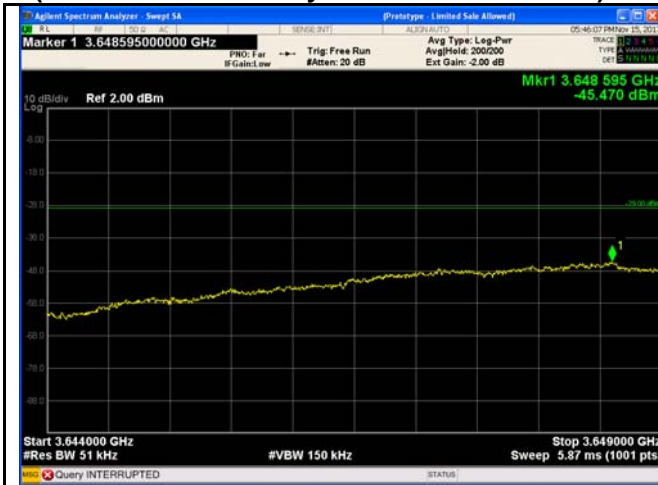


10MHz - 3700MHz -3701MHz High CH QPSK



10MHz - 3700MHz -3701MHz High CH 64QAM

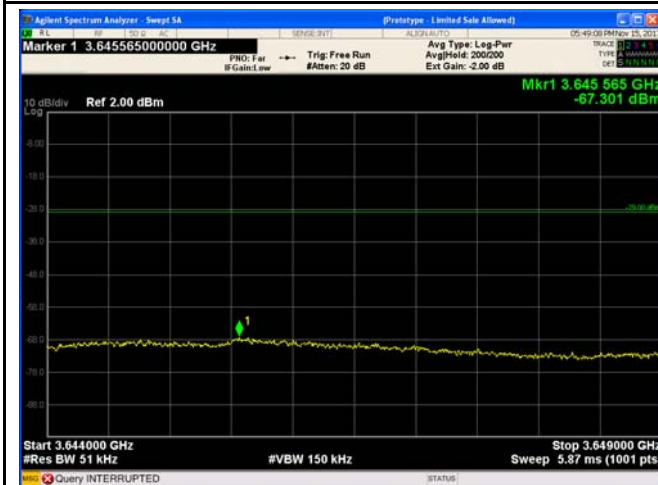
(more than 1MHz away for 10MHz bandwidth)



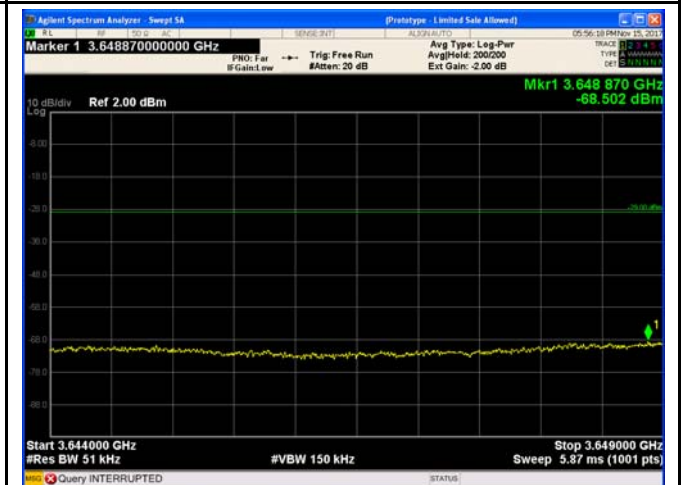
10MHz – 3644M-3649M Low CH QPSK



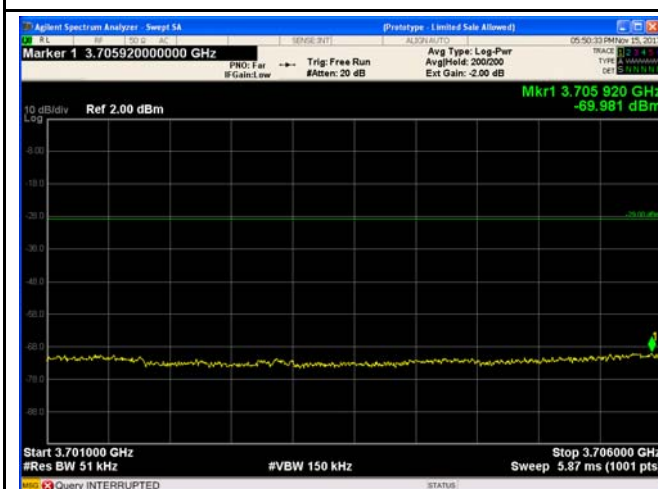
10MHz – 3644M-3649M Low CH 64QAM



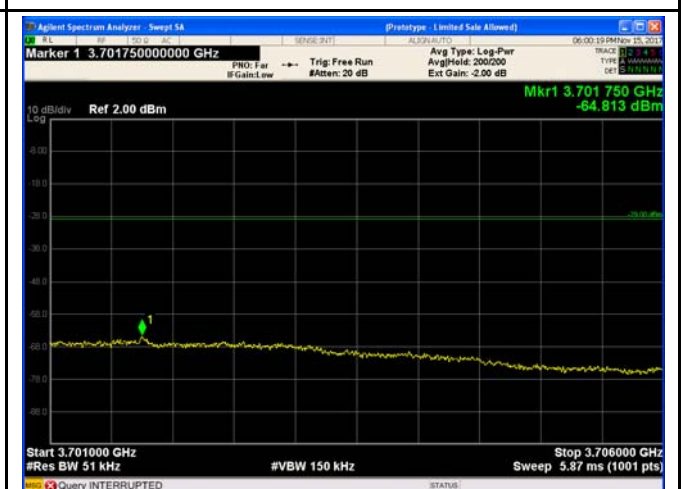
10MHz – 3644M-3649M Mid CH QPSK



10MHz – 3644M-3649M Mid CH 64QAM



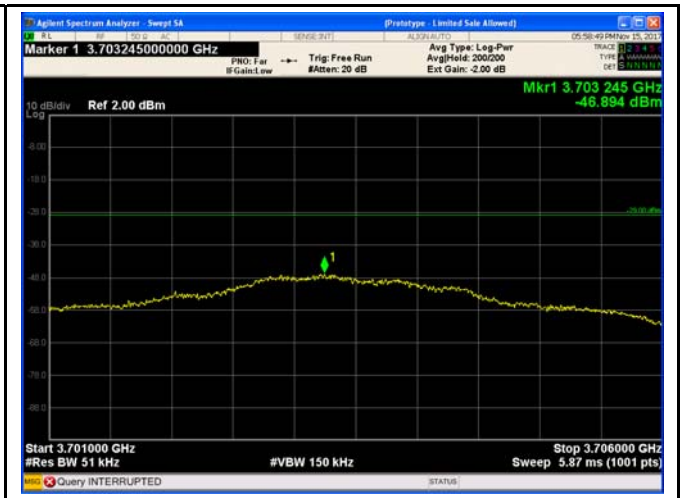
10MHz - 3701M-3706M Mid CH QPSK



10MHz - 3701M-3706M Mid CH 64QAM

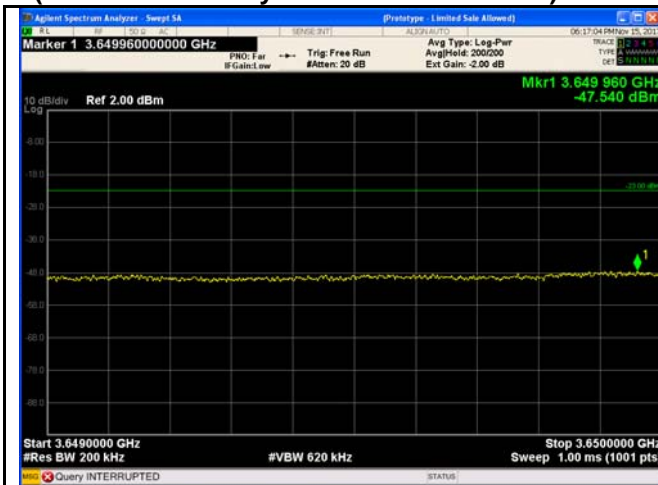


10MHz - 3701M-3706M High CH QPSK

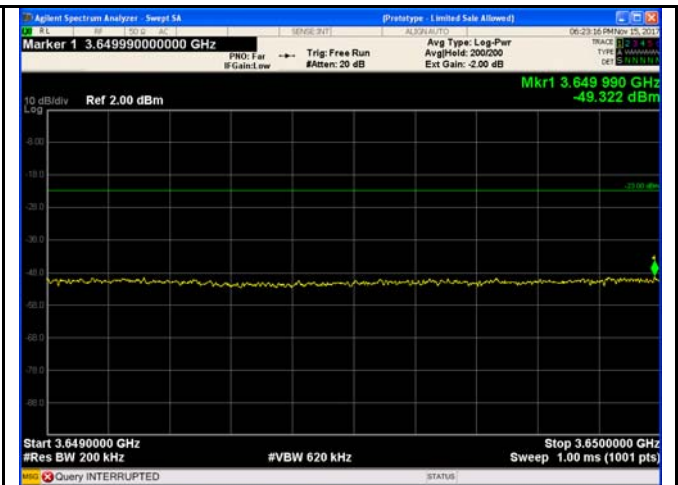


10MHz - 3701M-3706M High CH 64QAM

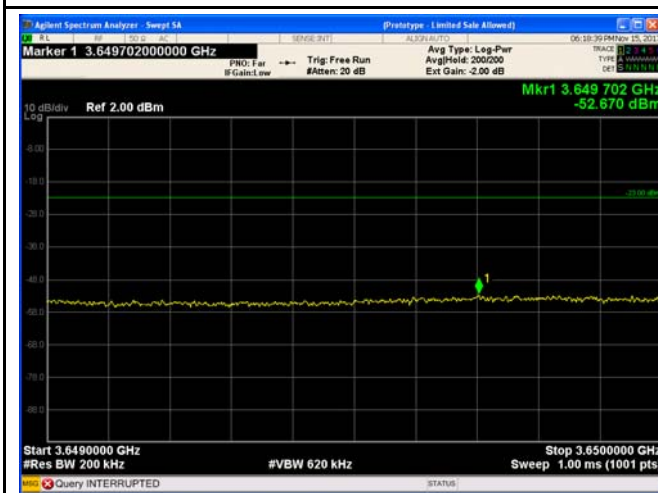
(1MHz immediately for 20MHz bandwidth)



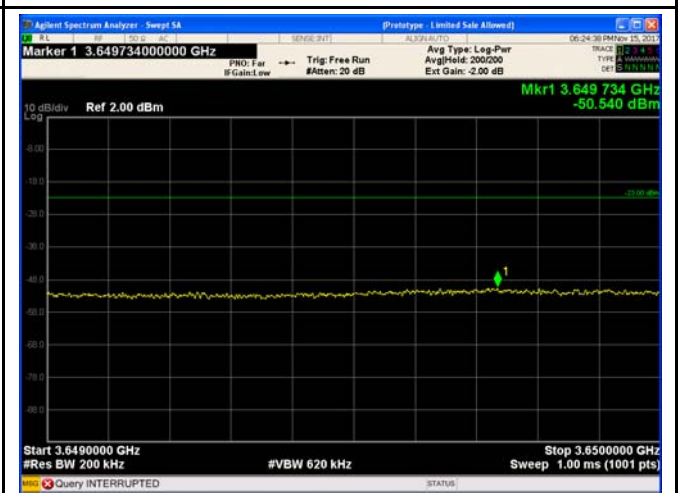
20MHz – 3649MHz-3650MHz Low CH QPSK



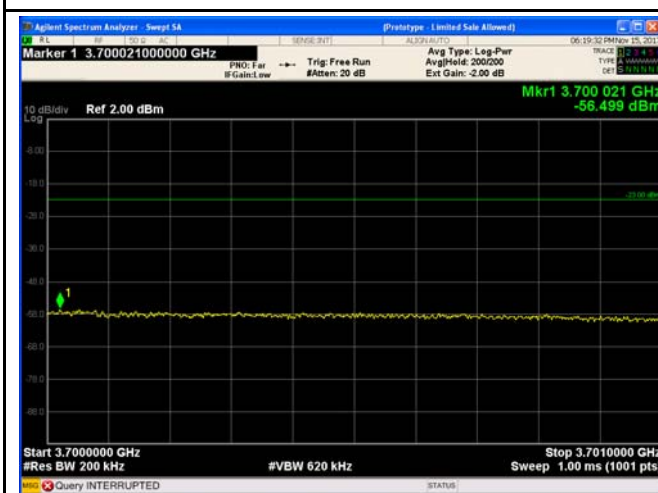
20MHz – 3649MHz-3650MHz Low CH 64QAM



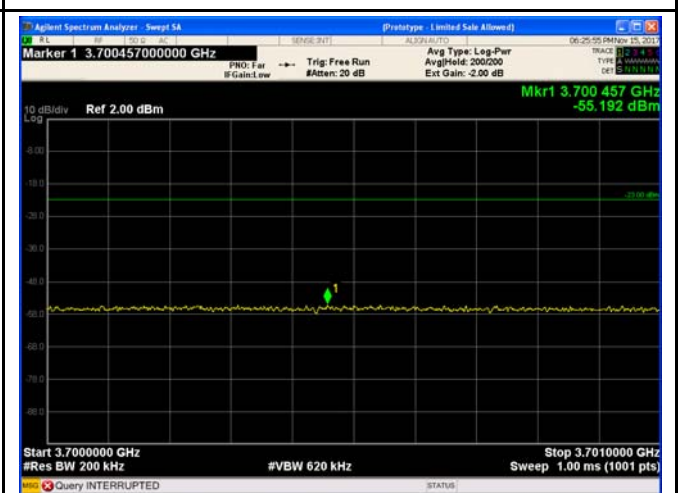
20MHz – 3649MHz-3650MHz Mid CH QPSK



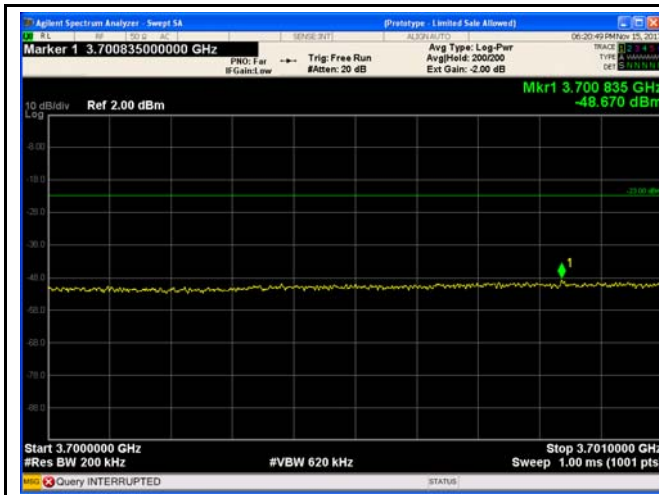
20MHz – 3649MHz-3650MHz Mid CH 64QAM



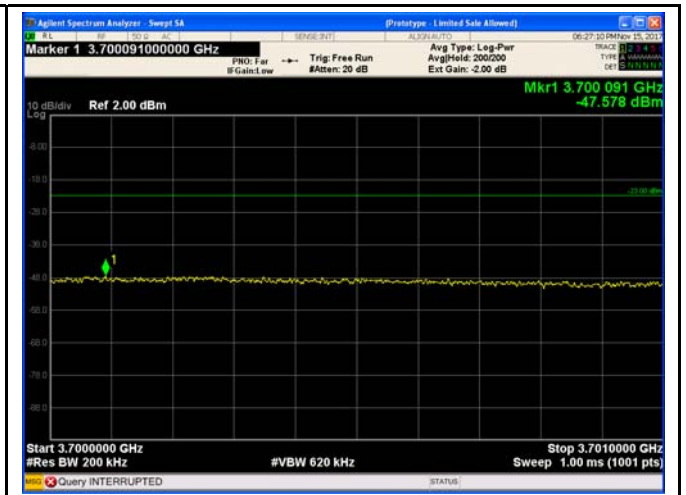
20MHz - 3700MHz -3701MHz Mid CH QPSK



20MHz - 3700MHz -3701MHz Mid CH 64QAM

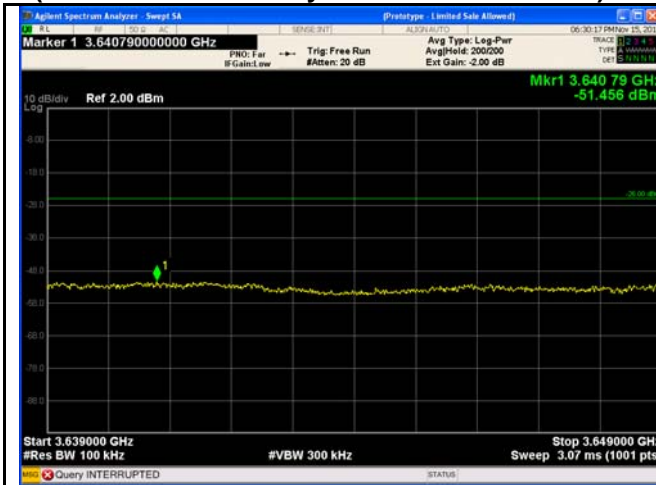


20MHz - 3700MHz -3701MHz High CH QPSK

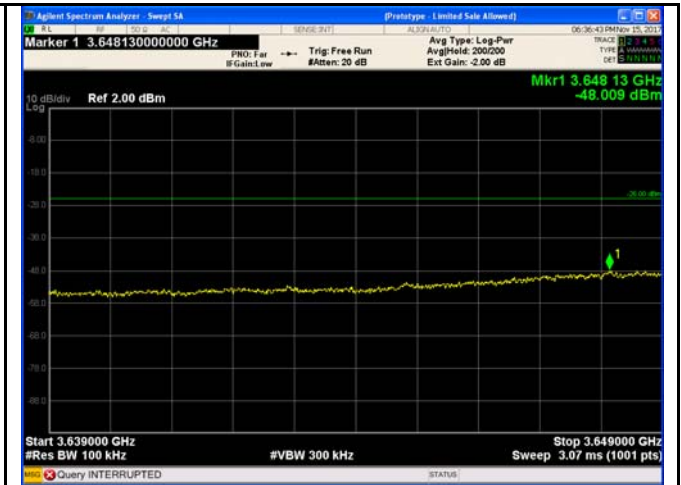


20MHz - 3700MHz -3701MHz High CH 64QAM

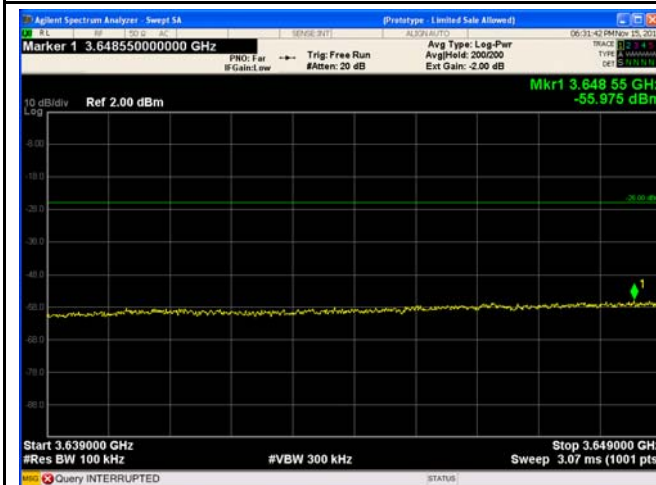
(more than 1MHz away for 20MHz bandwidth)



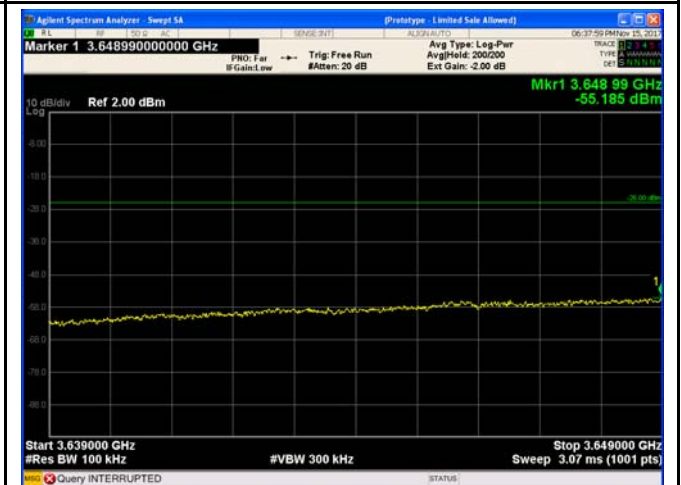
20MHz -3639M-3649M Low CH QPSK



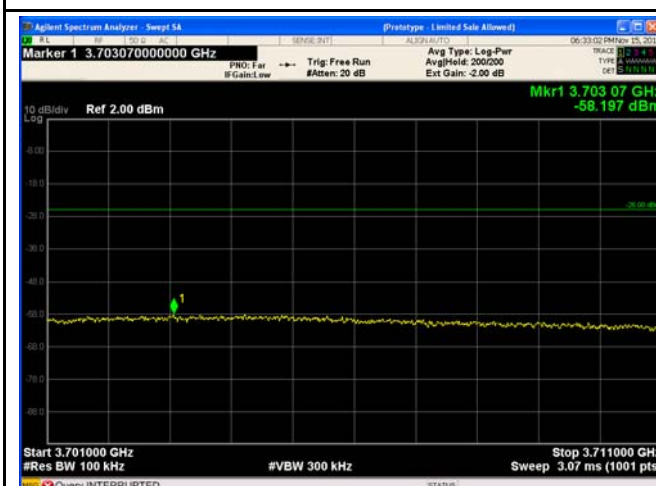
20MHz -3639M-3649M Low CH 64QAM



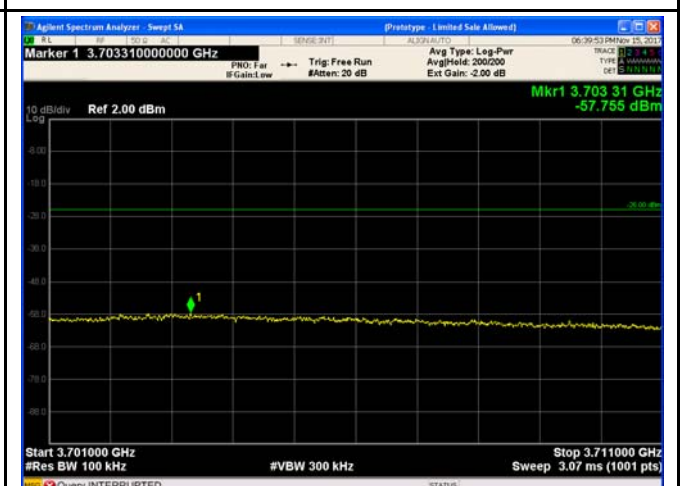
20MHz -3639M-3649M Mid CH QPSK



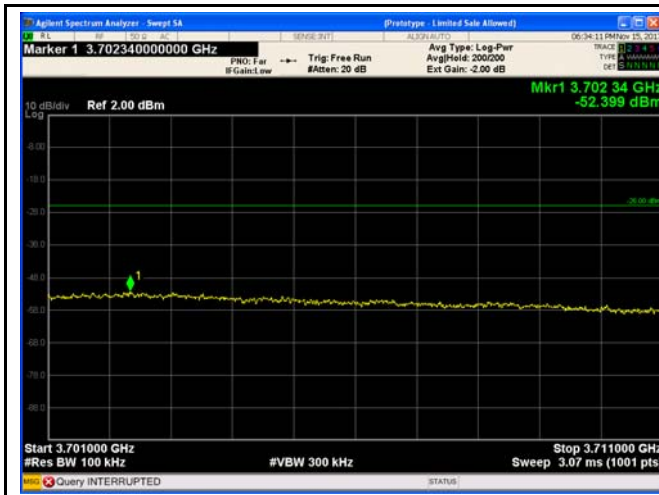
20MHz -3639M-3649M Mid CH 64QAM



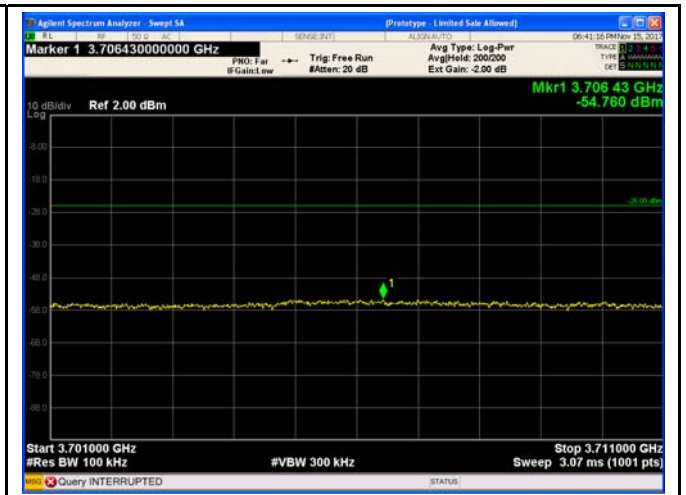
20MHz - 3701M-3711M Mid CH QPSK



20MHz - 3701M-3711M Mid CH 64QAM

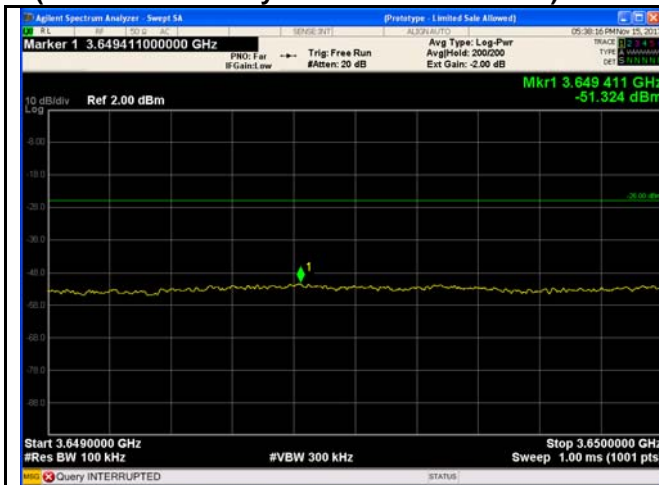


20MHz - 3701M-3711M High CH QPSK

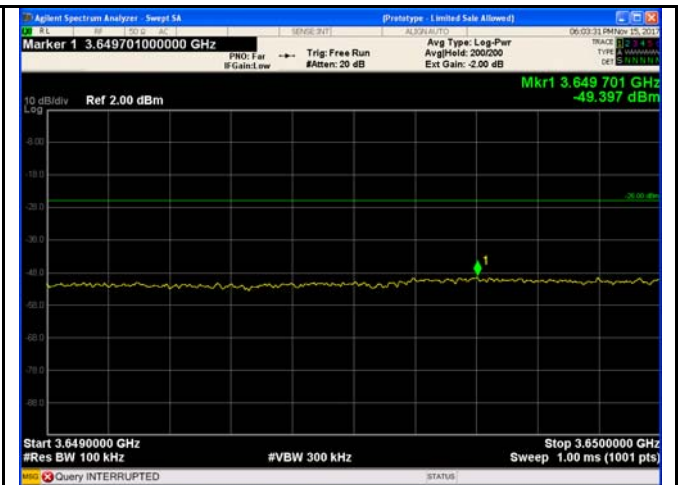


20MHz - 3701M-3711M High CH 64QAM

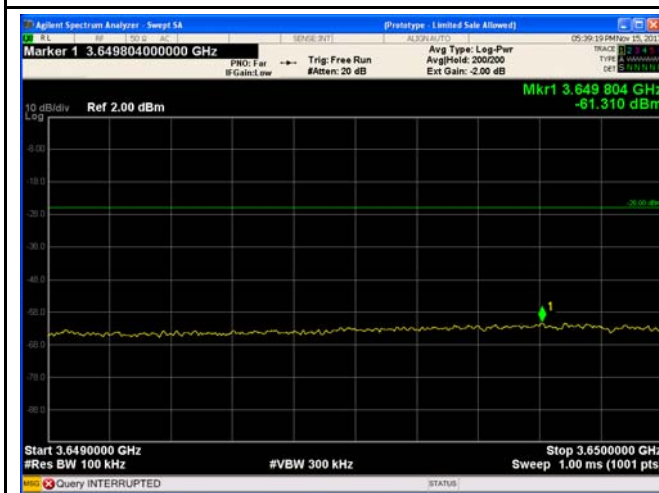
Chain 1
(1MHz immediately for 10MHz bandwidth)



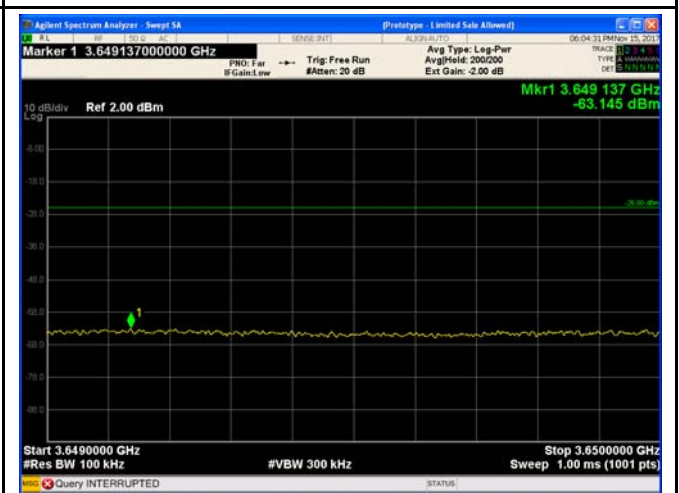
10MHz – 3649MHz-3650MHz Low CH QPSK



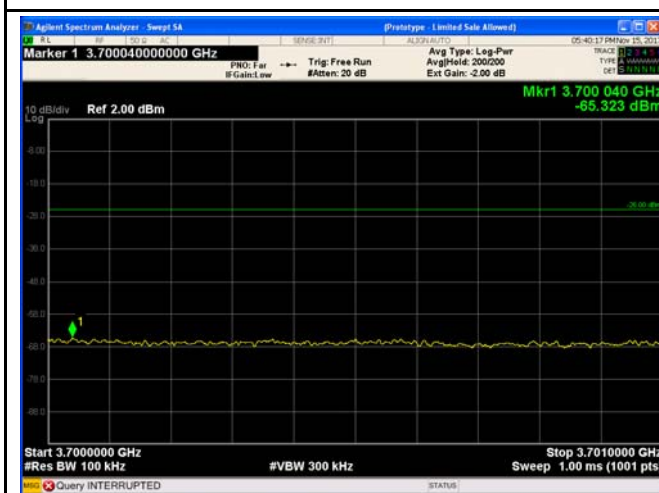
10MHz –3649MHz-3650MHz Low CH 64QAM



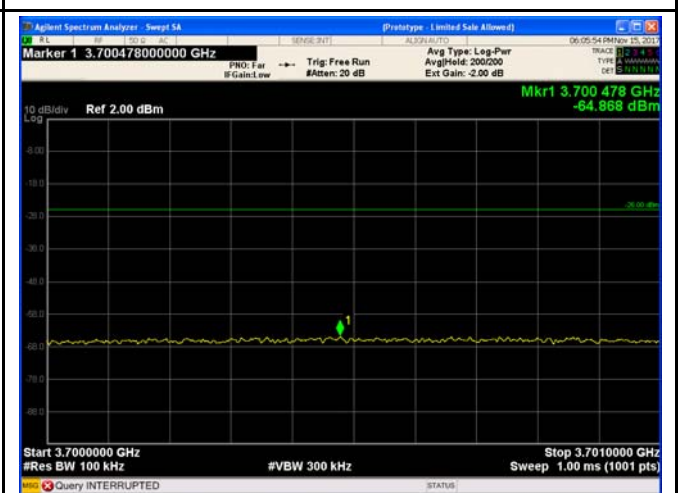
10MHz - 3649MHz -3650MHz Mid CH QPSK



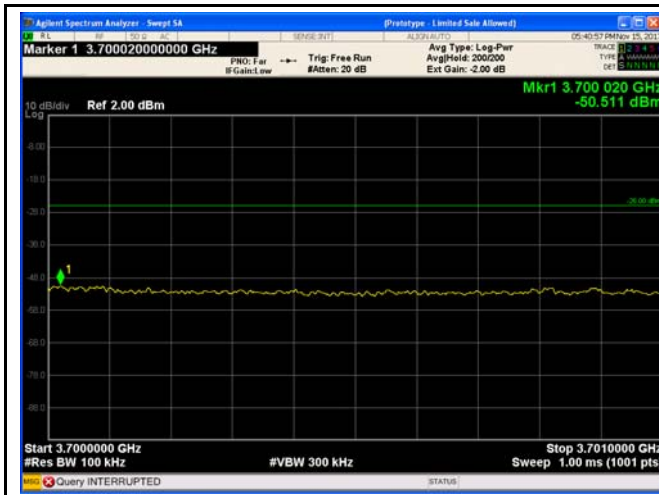
10MHz - 3649MHz -3650MHz Mid CH 64QAM



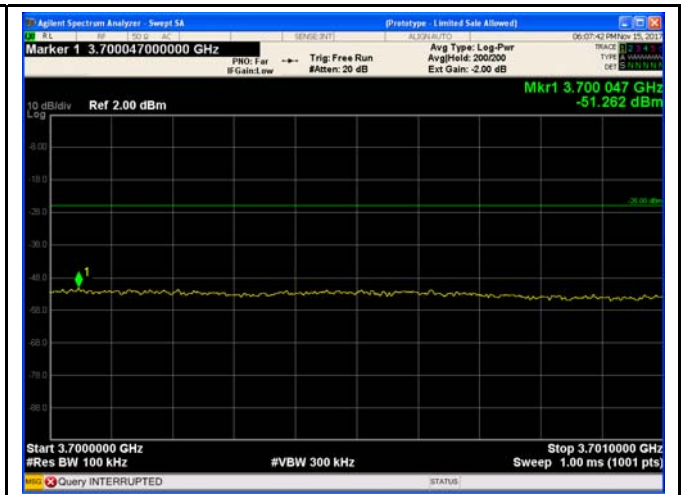
10MHz - 3700MHz -3701MHz Mid CH QPSK



10MHz - 3700MHz -3701MHz Mid CH 64QAM

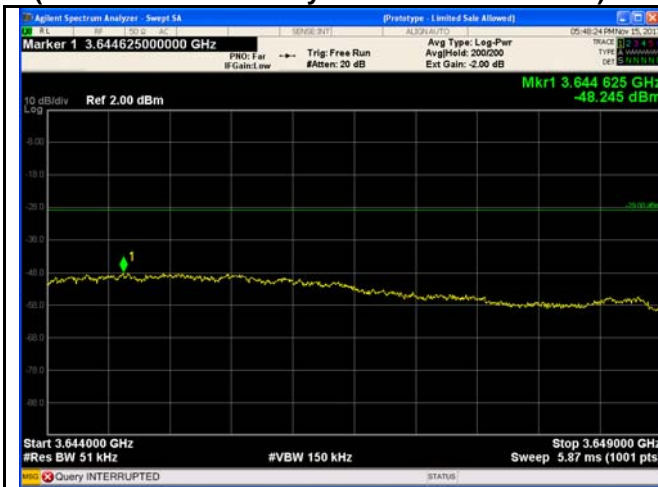


10MHz - 3700MHz -3701MHz High CH QPSK

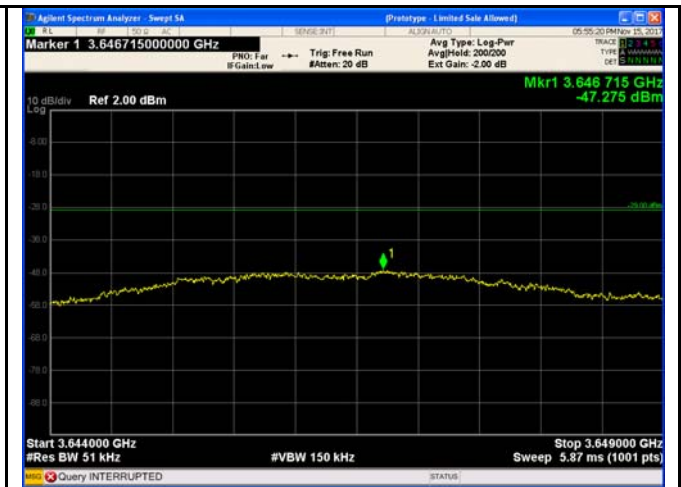


10MHz - 3700MHz -3701MHz High CH 64QAM

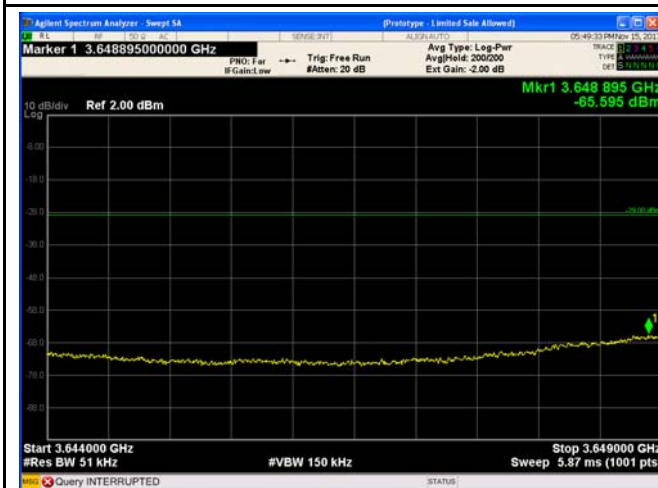
(more than 1MHz away for 10MHz bandwidth)



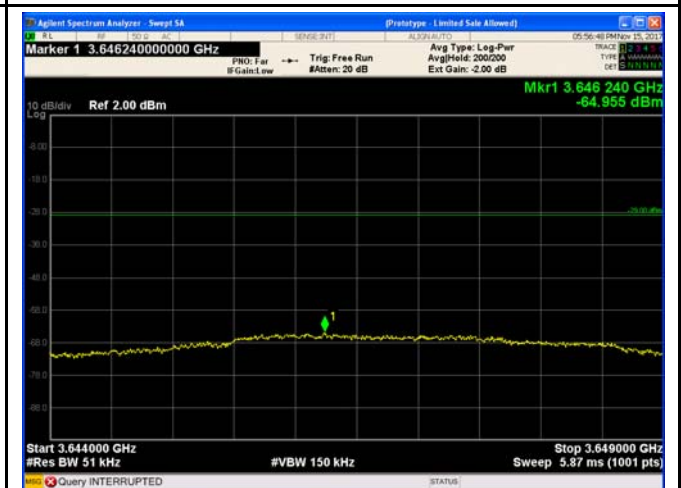
10MHz – 3644M-3649M Low CH QPSK



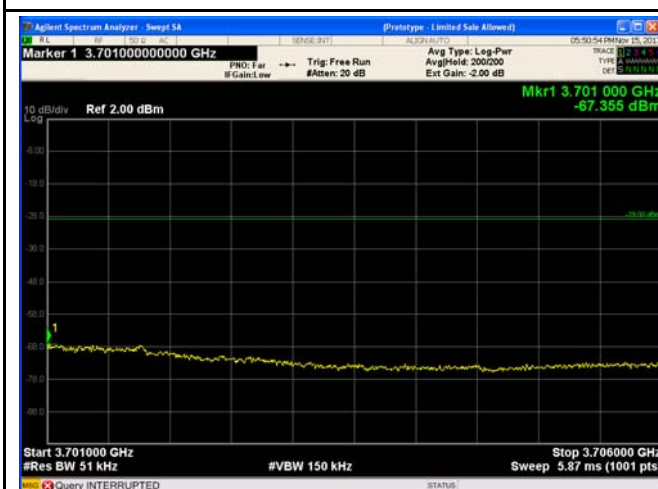
10MHz – 3644M-3649M Low CH 64QAM



10MHz – 3644M-3649M Mid CH QPSK



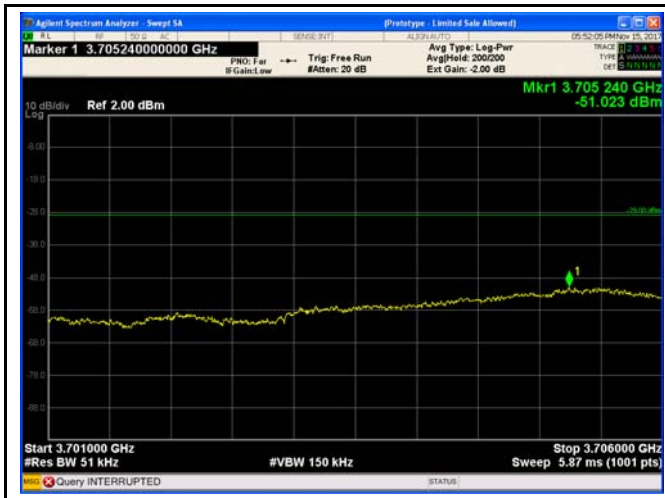
10MHz – 3644M-3649M Mid CH 64QAM



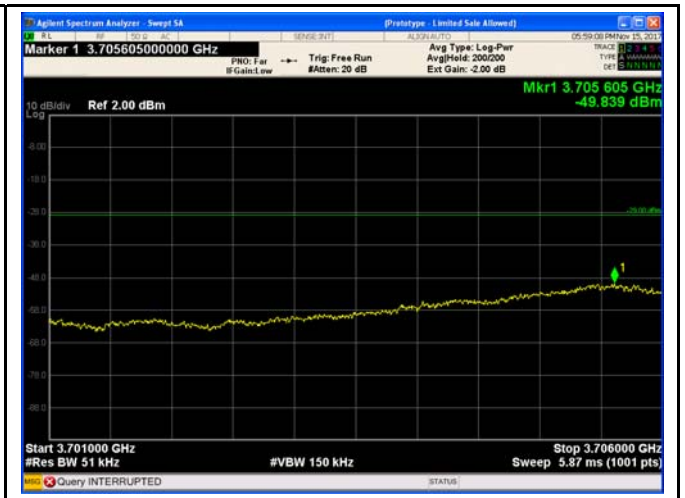
10MHz - 3701M-3706M Mid CH QPSK



10MHz - 3701M-3706M Mid CH 64QAM

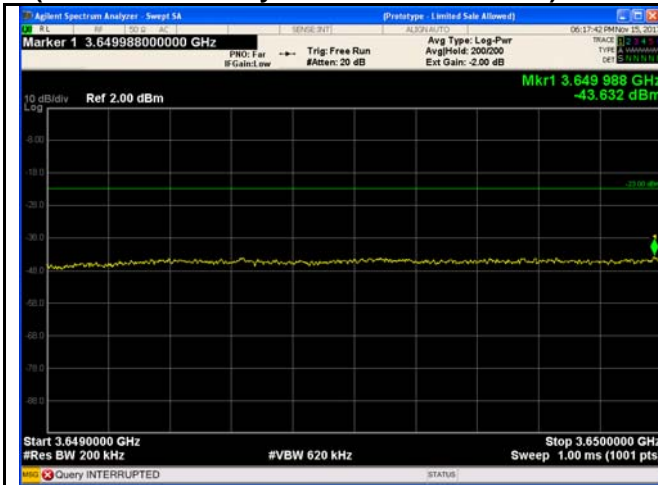


10MHz - 3701M-3706M High CH QPSK

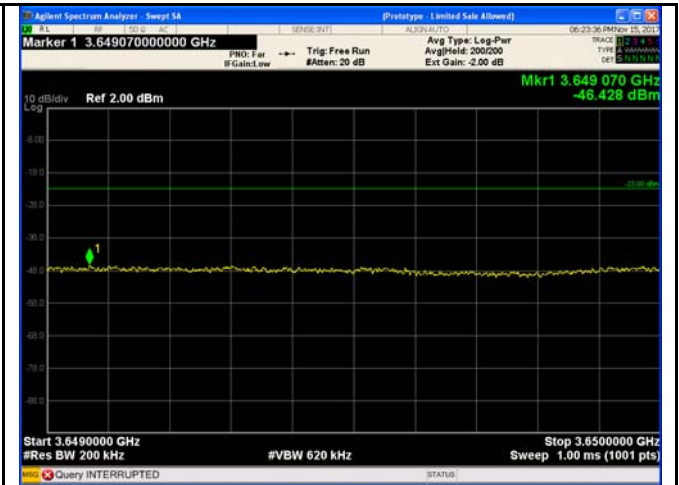


10MHz - 3701M-3706M High CH 64QAM

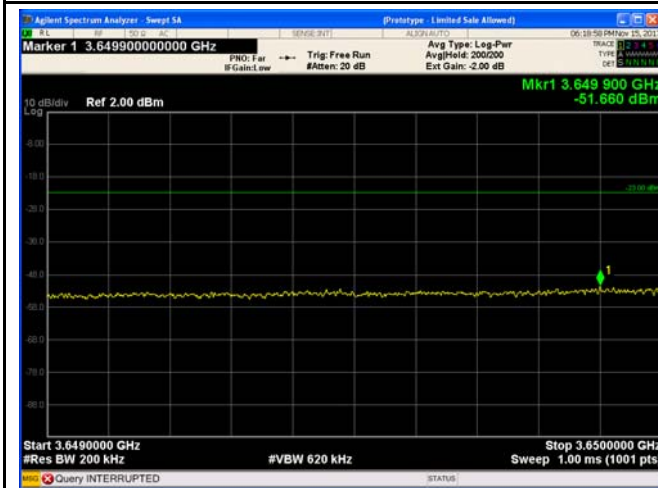
(1MHz immediately for 20MHz bandwidth)



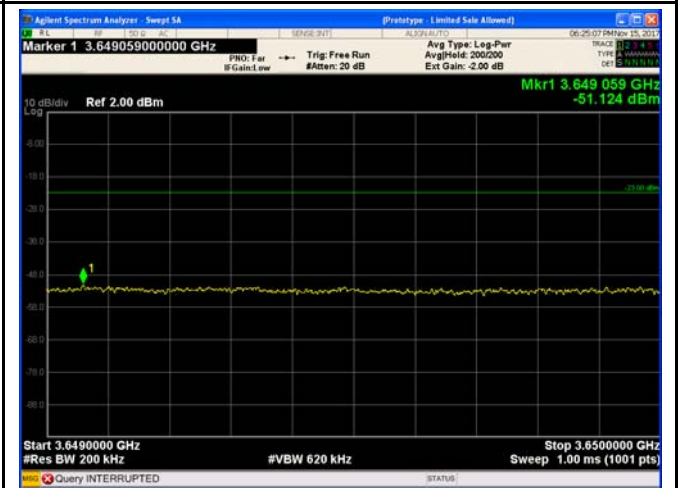
20MHz – 3649MHz-3650MHz Low CH QPSK



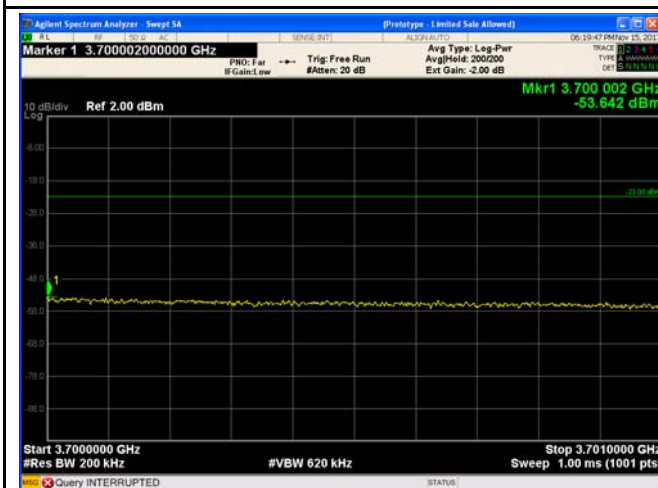
20MHz – 3649MHz-3650MHz Low CH 64QAM



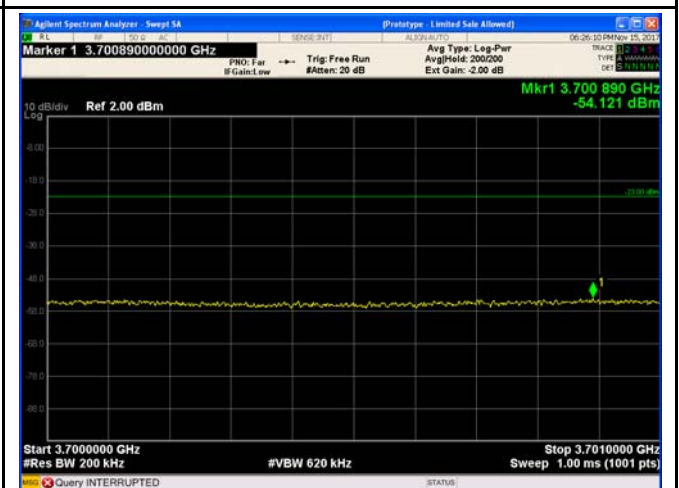
20MHz – 3649MHz-3650MHz Mid CH QPSK



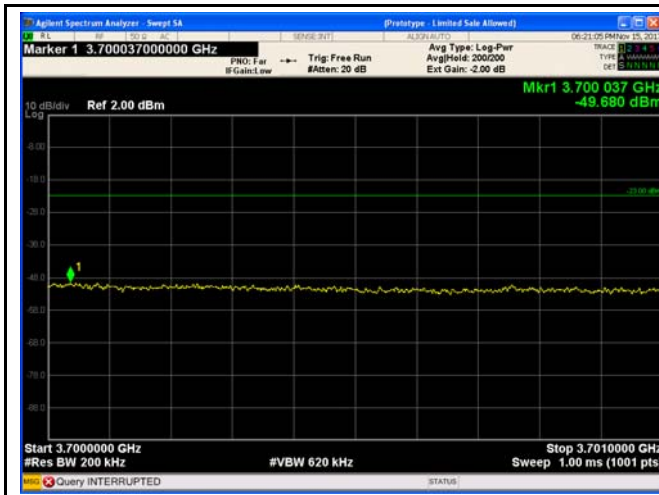
20MHz – 3649MHz-3650MHz Mid CH 64QAM



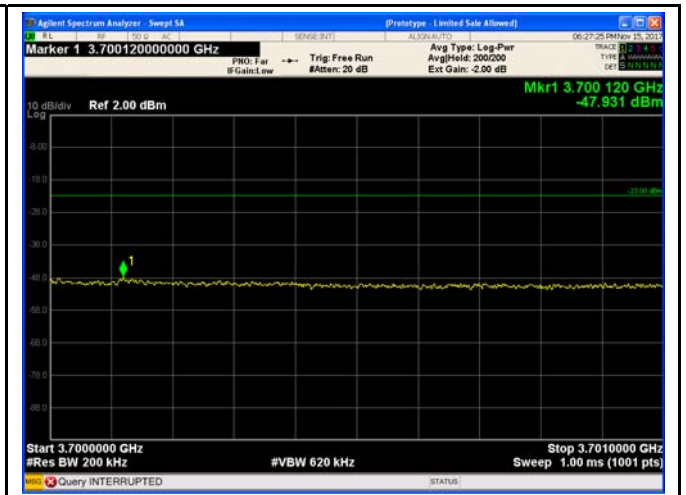
20MHz - 3700MHz -3701MHz Mid CH QPSK



20MHz - 3700MHz -3701MHz Mid CH 64QAM

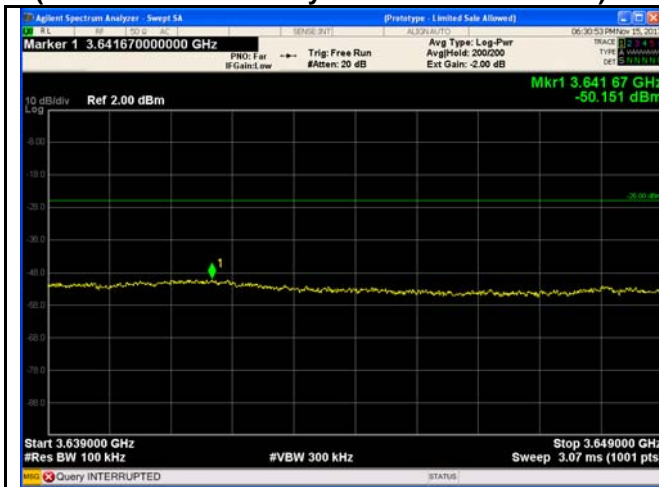


20MHz - 3700MHz -3701MHz High CH QPSK

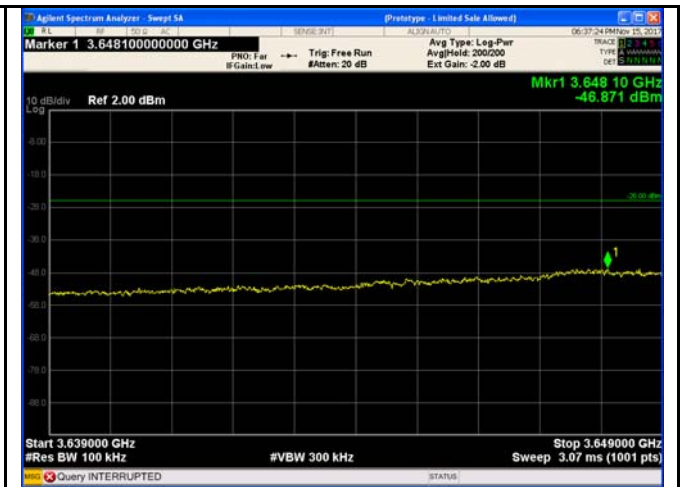


20MHz - 3700MHz -3701MHz High CH 64QAM

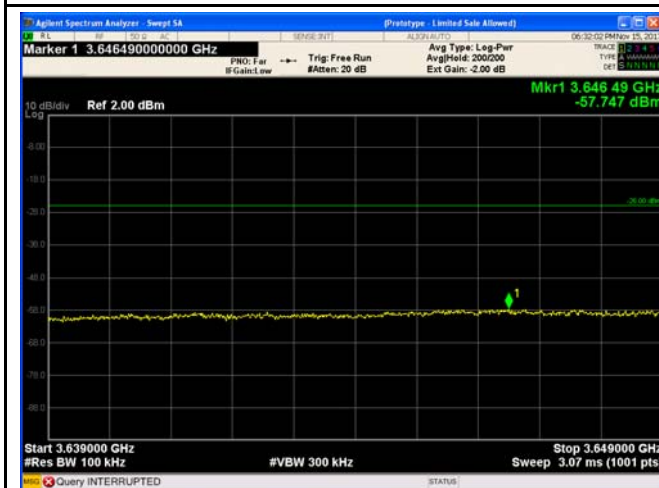
(more than 1MHz away for 20MHz bandwidth)



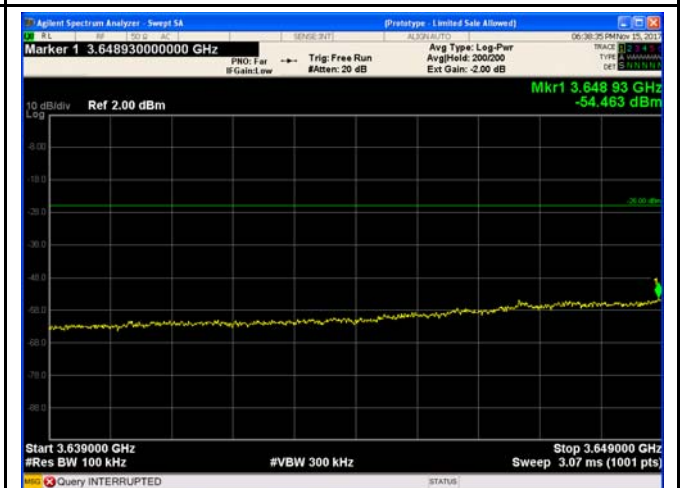
20MHz -3639M-3649M Low CH QPSK



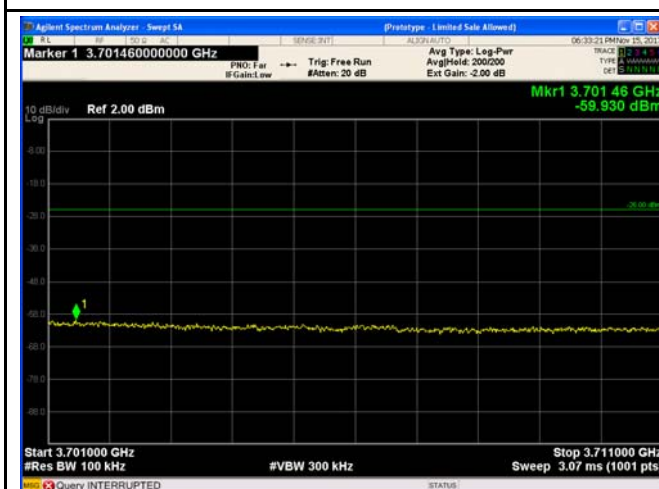
20MHz -3639M-3649M Low CH 64QAM



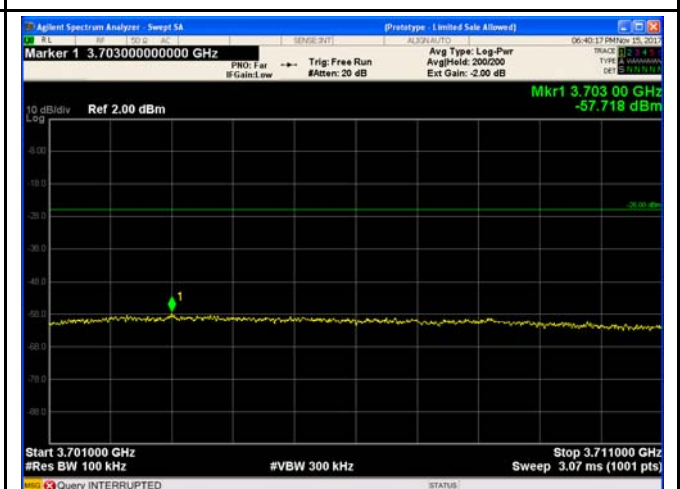
20MHz -3639M-3649M Mid CH QPSK



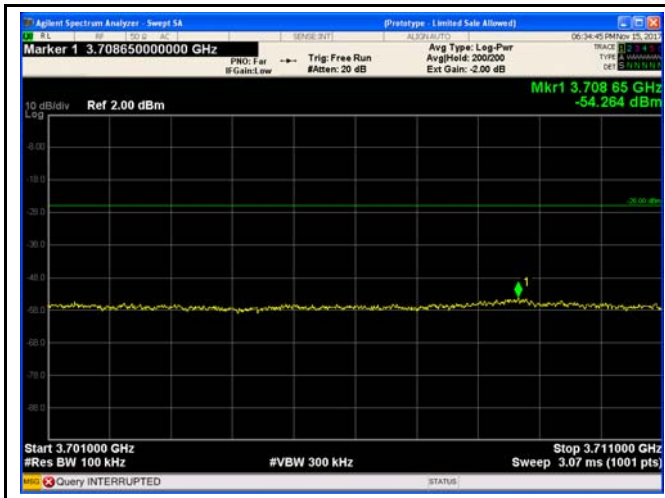
20MHz -3639M-3649M Mid CH 64QAM



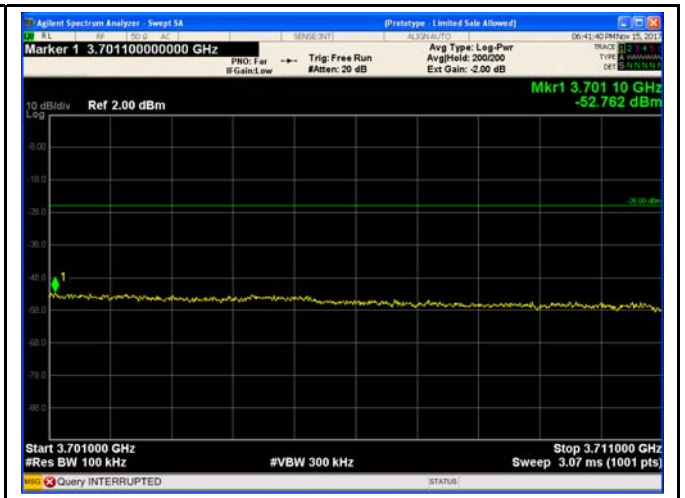
20MHz - 3701M-3711M Mid CH QPSK



20MHz - 3701M-3711M Mid CH 64QAM



20MHz - 3701M-3711M High CH QPSK



20MHz - 3701M-3711M High CH 64QAM

12 Field strength of spurious radiation measurement

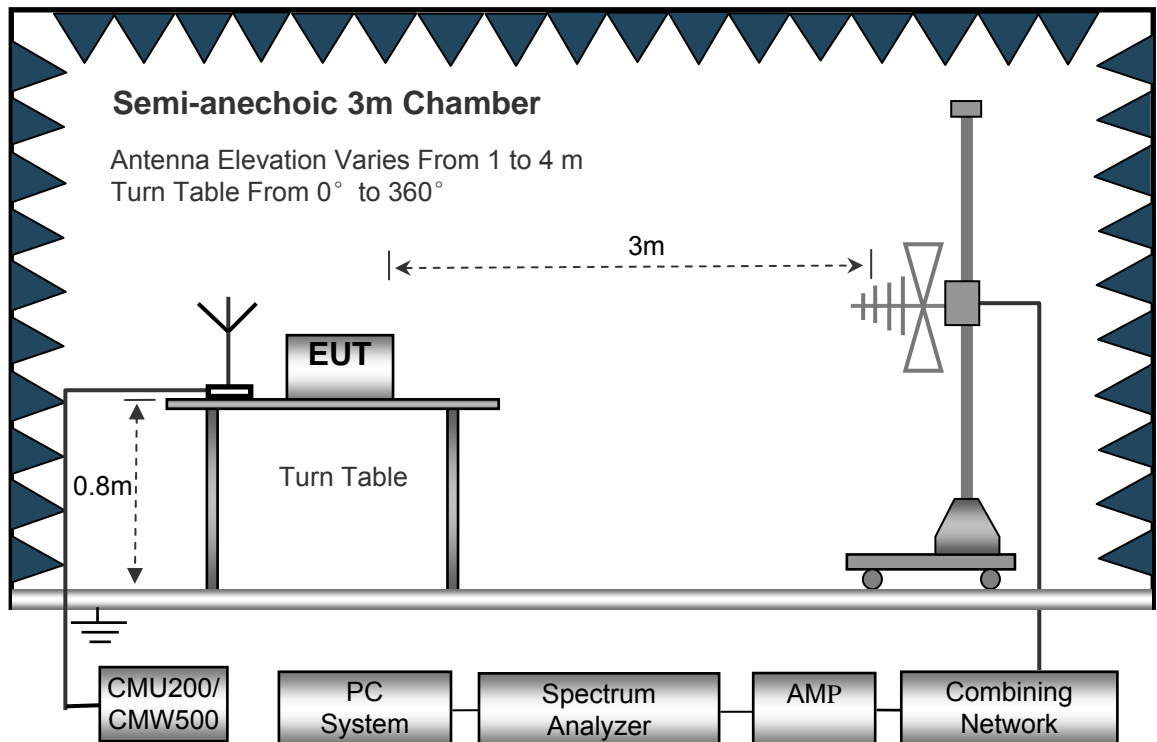
Test Requirement:	FCC part90.1323 and RSS-197 Clause 5.7
Test Method:	FCC part2.1051 and RSS Gen Section 6.13
Test Mode:	Data communicating mode
Limit:	-13dBm

12.1 EUT Operation

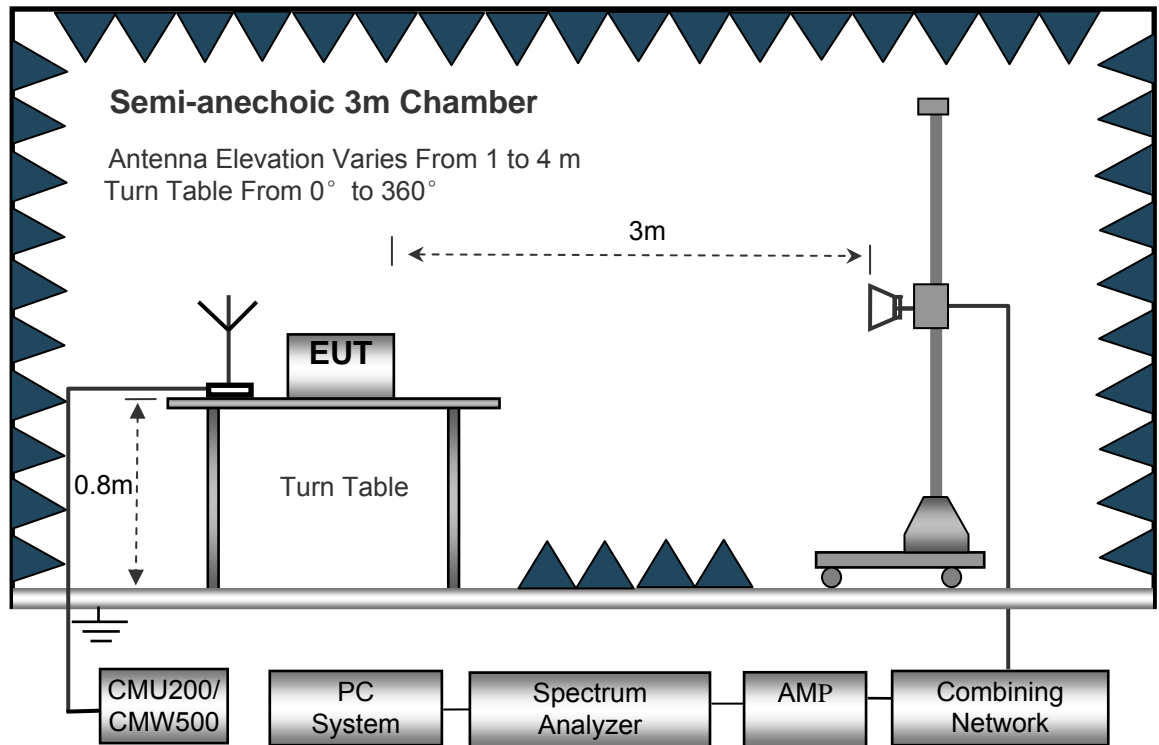
Operating Environment :	
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

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..... 100kHz
 Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 3MHz
 Detector Ave.
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 10Hz

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, 64QAM modulation, and found the QPSK modulation and 10MHz 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										
199.38	40.60	189	1.4	H	-69.91	0.15	0.00	-70.06	-13.00	-57.06
199.38	30.55	157	1.4	V	-77.04	0.15	0.00	-77.19	-13.00	-64.19
7310.00	65.95	226	1.5	H	-47.10	2.79	12.70	-37.19	-13.00	-24.19
7310.00	59.98	227	1.8	V	-51.17	2.79	12.70	-41.26	-13.00	-28.26
10965.00	53.58	197	1.3	H	-55.83	3.25	13.13	-45.95	-13.00	-32.95
10965.00	44.73	345	1.5	V	-64.04	3.25	13.13	-54.16	-13.00	-41.16
Middle channel										
199.38	39.96	17	1.6	H	-70.55	0.15	0.00	-70.70	-13.00	-57.70
199.38	31.40	134	1.6	V	-76.19	0.15	0.00	-76.34	-13.00	-63.34
7350.00	58.70	65	1.3	H	-54.35	2.37	12.50	-44.22	-13.00	-31.22
7350.00	53.54	42	1.7	V	-57.61	2.37	12.50	-47.48	-13.00	-34.48
11025.00	46.69	133	1.1	H	-62.72	2.79	12.70	-52.81	-13.00	-39.81
11025.00	37.43	107	2.2	V	-71.34	2.79	12.70	-61.43	-13.00	-48.43
High channel										
199.38	39.06	198	1.8	H	-71.45	0.15	0.00	-71.60	-13.00	-58.60
199.38	31.42	11	1.1	V	-76.17	0.15	0.00	-76.32	-13.00	-63.32
7390.00	50.90	41	1.2	H	-61.74	2.37	12.50	-51.61	-13.00	-38.61
7390.00	46.66	187	1.6	V	-64.07	2.37	12.50	-53.94	-13.00	-40.94
11085.00	39.52	123	1.8	H	-70.06	2.81	12.80	-60.07	-13.00	-47.07
11085.00	31.01	75	2.1	V	-77.79	2.81	12.80	-67.80	-13.00	-54.80

Remark:

The emission levels of above 18 GHz have been tested Shenzhen BALUN Technology Co.,Ltd.Refer to report: BL-SZ17A0379-501.

13 Frequency stability V.S. Temperature measurement

Test Requirement:	FCC Part90.213(a) and RSS 197 section 5.3
Test Method:	FCC Part2.1055(a)(1)(b) and RSS Gen section 6.1.1
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
806-808	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			

IC:

The transmitter frequency stability limit shall be determined as follows:

- The frequency offset shall be measured according to the procedure described in RSS-Gen and recorded;
- Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level specified in Section 5.7 on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as fL and fH respectively.

The applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the 3650-3700 MHz band.

13.1 EUT Operation

Operating Environment :

Temperature:	23.5 °C
Humidity:	52.3 % RH
Atmospheric Pressure:	101.3kPa

13.2 Test Procedure

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