

RF TEST REPORT



Report No.: FCC_RF_SL18071903-SPC-006-LAA
Supersede Report No.:

Applicant	:	SpiderCloud Wireless, Inc.
Product Name	:	SpiderCloud Radio Node
Model No.	:	SCRN-320-0246-EQ
Test Standard	:	47 CFR 15.407
Test Method	:	ANSI C63.4: 2014 789033 D02 General UNII Test Procedures New Rules v02
FCC ID	:	Y47RN320B246
Dates of test	:	01/18/2017 - 08/24/2018
Issue Date	:	08/28/2018
Test Result	:	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
Equipment complied with the specification	[X]	
Equipment did not comply with the specification	[]	

This Test Report is Issued Under the Authority of:

Gary Chou	
Gary Chou	Chen Ge
Test Engineer	Engineer Reviewer
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only	

Issued By:
SIEMIC Laboratories
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Laboratory Introduction

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Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & Radio Equipment Directive (RED)
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_RF_SI18071903-SPC-006-LAA	None	Original	08/28/2018

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: SpiderCloud Wireless, Inc.
Product: SpiderCloud Radio Node
Model: SCRN-320-0246-EQ

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	SpiderCloud Wireless
Applicant Address	:	475 Sycamore Dr, Milpitas, CA, 95035, USA
Manufacturer Name	:	Sanmina-SCI Systems de Mexico SA de CV
Manufacturer Address	:	Carretera Chapala-Guadalajara 45640 Tlajomulco de Zuniga, Jalisco, Mexico

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	SpiderCloud Radio Node
Model No.	SCRN-320-0246-EQ
Trade Name	SpiderCloud
Serial No.	18169S03643
Input Power	56VDC (PoE)
Power Adapter Manu/Model	PHIHONG/POE36U-1AT-R
Power Adapter SN	N/A
Date of EUT received	08/14/2018
Equipment Class/ Category	UNII
Port/Connectors	PoE, Ethernet

6.2 Radio Description

Radio Type	LAA/LTE-U
Operating Frequency	5160-5240MHz 5735-5825MHz
Modulation	QPSK, 16QAM, 64QAM
Channel Spacing	20MHz
Number of Channels	10
Antenna Type	External Dipole antenna
Antenna Gain (Peak)	4 dBi
Antenna Connector Type	U.FL
Note	N/A

EUT Power level setting

Mode	Frequency	Power Setting
QPSK	5160	26
	5200	26
	5240	26
64QAM	5160	26
	5200	26
	5240	26
QPSK	5735	26
	5785	26
	5825	26
64QAM	5735	26
	5785	26
	5825	26

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	10MHz Clock	OX200-SC	141871594391	Metric Test	-
2	POE	POE36U-1AT-R	N/A	PHIHONG	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
RJ45	EUT	RJ45	POE	RJ45	2	Unshielded	-
RJ45	POE	RJ45	Laptop	RJ45	3	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF testing	TMciDvtClient	Enable EUT continuous TX mode and change to different channel

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Restricted Band of Operation	FCC	15.205	ANSI C63.4 – 2014 789033 D02 General UNII Test Procedures New Rules v01r02	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A
AC Conducted Emissions Voltage	FCC	15.207(a)	ANSI C63.4 – 2014	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A

Test Item	Test standard		Test Method/Procedure	Pass / Fail
26 & 6 dB Emission Bandwidth	FCC	15.407 (a) (1) 15.407 (a) (3)	789033 D02 General UNII Test Procedures New Rules v02	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A
Maximum conducted Output Power	FCC	15.407 (a) (1) 15.407 (a) (3)	789033 D02 General UNII Test Procedures New Rules v02	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A
Power reduction (Antenna Gain > 6 dBi)	FCC	15.407 (a) (1) 15.407 (a) (3)	662911 D01 Multiple Transmitter Output v02r01	<input type="checkbox"/> Pass <input checked="" type="checkbox"/> N/A
Band Edge and Radiated Spurious Emissions	FCC	15.407(b)(1), 15.407(b)(6)	789033 D02 General UNII Test Procedures New Rules v02	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A
Emission Mask	FCC	15.407(b)(4) 15.407(b)(6)	789033 D02 General UNII Test Procedures New Rules v02	
Power Spectral Density	FCC	15.407 (a) (1) 15.407 (a) (3)	789033 D02 General UNII Test Procedures New Rules v02	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A
Frequency Stability	FCC	15.407 (g)	789033 D02 General UNII Test Procedures New Rules v02	<input type="checkbox"/> Pass <input checked="" type="checkbox"/> N/A
Transmit Power Control (TPC)	FCC	15.407 (h)(1)	789033 D02 General UNII Test Procedures New Rules v02	<input type="checkbox"/> Pass <input checked="" type="checkbox"/> N/A
User Manual	FCC	-	-	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> N/A
Remark	1. All measurement uncertainties are not taken into consideration for all presented test result. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual.			

9 Measurement Uncertainty

9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
LISN Insertion Loss	0.40	Normal	2	1	0.20
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch LISN - Receiver	0.25	U-Shape	1.414	1	0.1768033
LISN Impedance	2.5	Triangular	2.449	1	1.0208248
Combined Standard Uncertainty					1.928133
Expanded Uncertainty (K=2)					3.856266

The total derived measurement uncertainty is +/- 3.86 dB.

9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					6.0118262

The total derived measurement uncertainty is +/- 6.00 dB.

9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					8.4726

The total derived measurement uncertainty is +/- 8.47 dB.

9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					0.952174

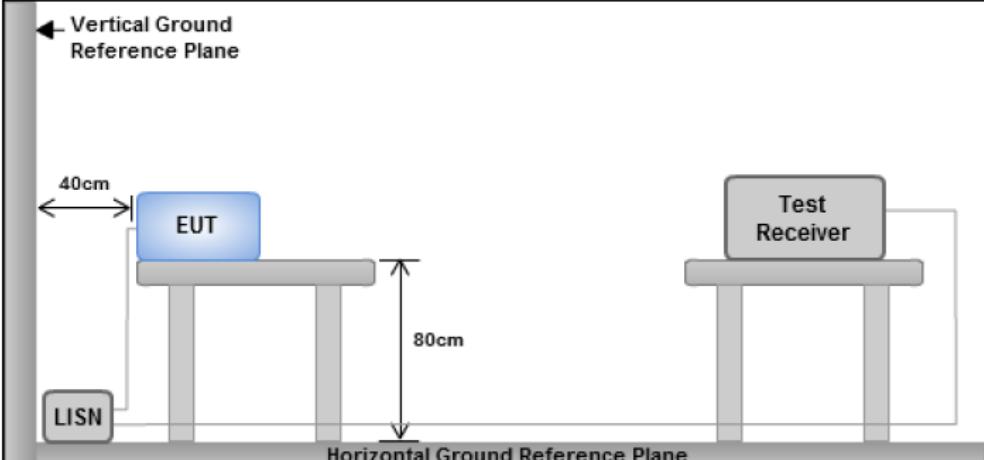
The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, Examination and Derived Results

10.1 Conducted Emissions

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBuV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

Spec	Item	Requirement	Applicable
RSS247(A8.1)	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequency ranges.	<input checked="" type="checkbox"/>
Test Setup		 <p>Note: 1. Support units were connected to second LISN. 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes</p>	
Procedure			<ul style="list-style-type: none"> - The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B. - The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment was powered separately from another main supply.
Remark	EUT was tested at 120VAC, 60Hz		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

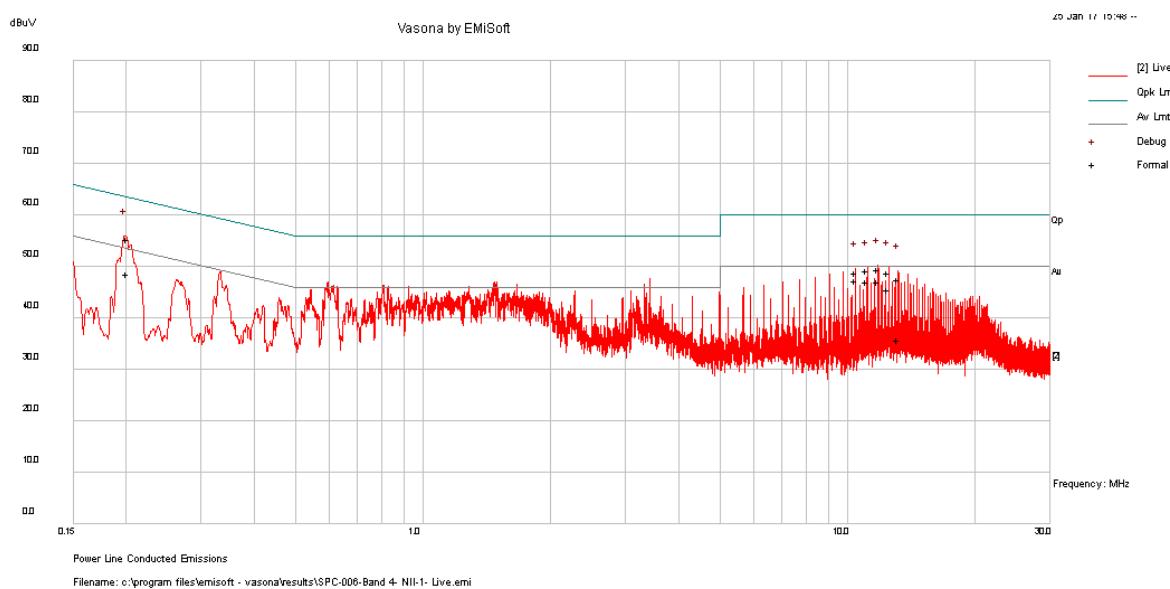
Test Data Yes N/A

Test Plot Yes (See below) N/A

Test was done by Gary Chou at Conducted Emission test site.

Conducted Emission Test Results

Test specification:		Conducted Emissions	
Environmental Conditions:	Temp(°C):	21	Result: <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
	Humidity (%):	42	
	Atmospheric(mbar):	1021	
	Mains Power:	120Vac, 60Hz	
Tested by:	Gary Chou		
Test Date:	01/25/2017		
Remarks	POE, Line		

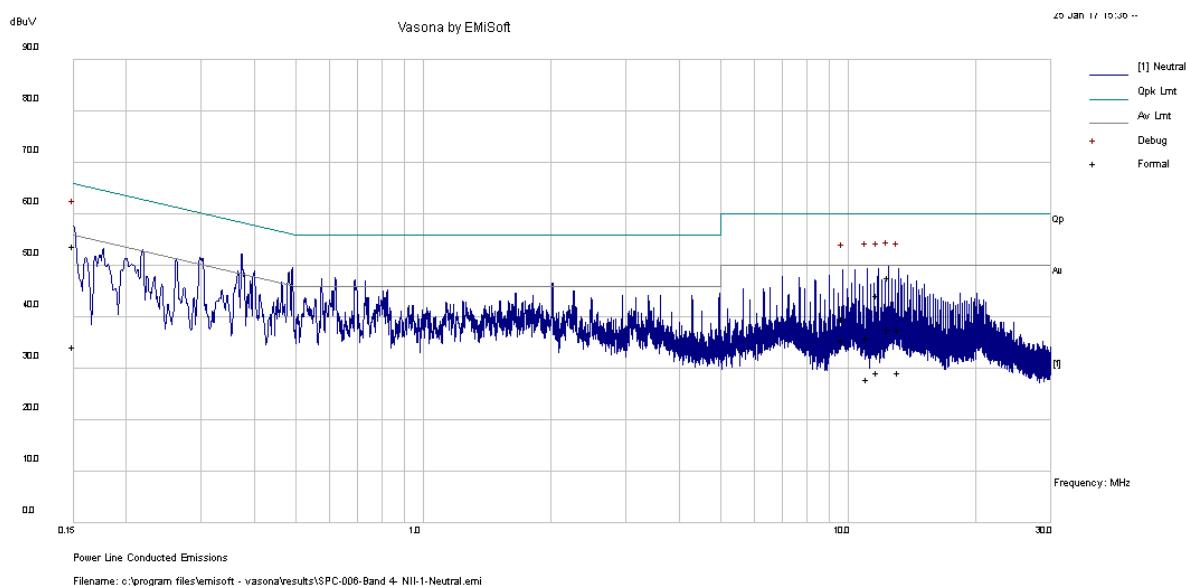


Line Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
11.81	38.92	10.05	0.53	49.51	Quasi Peak	Live	60	-10.49	Pass
0.20	44.03	10	1.25	55.28	Quasi Peak	Live	63.59	-8.31	Pass
11.13	38.65	10.05	0.52	49.22	Quasi Peak	Live	60	-10.78	Pass
12.50	38.36	10.05	0.54	48.95	Quasi Peak	Live	60	-11.05	Pass
10.45	38.32	10.05	0.52	48.89	Quasi Peak	Live	60	-11.11	Pass
13.18	37.01	10.06	0.54	47.61	Quasi Peak	Live	60	-12.39	Pass
11.81	36.44	10.05	0.53	47.03	Average	Live	50	-2.97	Pass
0.20	37.37	10	1.25	48.62	Average	Live	53.59	-4.97	Pass
11.13	36.56	10.05	0.52	47.13	Average	Live	50	-2.87	Pass
12.50	35.06	10.05	0.54	45.65	Average	Live	50	-4.35	Pass
10.45	36.85	10.05	0.52	47.42	Average	Live	50	-2.58	Pass
13.18	25.19	10.06	0.54	35.79	Average	Live	50	-14.21	Pass

Conducted Emission Test Results

Test specification:		Conducted Emissions	
Environmental Conditions:	Temp(°C):	21	Result: <input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail
	Humidity (%):	42	
	Atmospheric(mbar):	1021	
Mains Power:	120Vac, 60Hz		
Tested by:	Gary Chou		
Test Date:	01/25/2017		
Remarks	POE, Neutral		

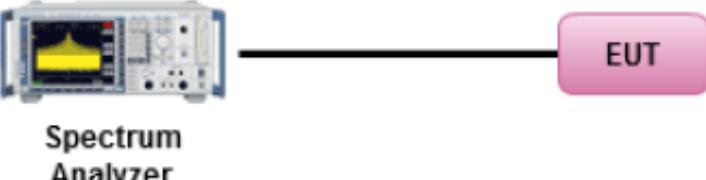


Neutral Plot at 120Vac, 60Hz

Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Measurement Type	Line / Neutral	Limit (dBuV)	Margin (dB)	Pass /Fail
0.15	42.18	10	1.74	53.93	Quasi Peak	Neutral	66	-12.07	Pass
12.44	37.17	10.05	0.54	47.76	Quasi Peak	Neutral	60	-12.24	Pass
11.76	33.65	10.05	0.53	44.23	Quasi Peak	Neutral	60	-15.77	Pass
13.12	26.95	10.06	0.54	37.55	Quasi Peak	Neutral	60	-22.45	Pass
11.07	25.39	10.05	0.52	35.96	Quasi Peak	Neutral	60	-24.04	Pass
9.69	29.23	10.05	0.51	39.79	Quasi Peak	Neutral	60	-20.21	Pass
0.15	22.65	10	1.74	34.4	Average	Neutral	56	-21.6	Pass
12.44	27.22	10.05	0.54	37.81	Average	Neutral	50	-12.19	Pass
11.76	18.63	10.05	0.53	29.21	Average	Neutral	50	-20.79	Pass
13.12	18.69	10.06	0.54	29.29	Average	Neutral	50	-20.71	Pass
11.07	17.39	10.05	0.52	27.97	Average	Neutral	50	-22.03	Pass
9.69	25.09	10.05	0.51	35.65	Average	Neutral	50	-14.35	Pass

10.2 26 dB Bandwidth & 6 dB Bandwidth

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	-	26 dB Emission BW: Report only for reference.	<input checked="" type="checkbox"/>
	a) (2)	26 dB Emission BW: Report only for power limit calculation.	<input type="checkbox"/>
	e)	Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.	<input checked="" type="checkbox"/>
Test Setup			
Test Procedure	<p>789033 D02 General UNII Test Procedures New Rules v01r02</p> <p><u>26dB Emission bandwidth measurement procedure (Other than 5.725-5.85 GHz)</u></p> <ul style="list-style-type: none"> - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 26dB BW. <ul style="list-style-type: none"> o Set RBW = around 1% of emission bandwidth o Set VBW > RBW o Detector = Peak o Trace mode = max hold - Capture the plot. - Repeat above steps for different test channel and other modulation type. <p><u>6 dB Minimum emission bandwidth measurement procedure (for 5.725-5.85 GHz)</u></p> <ul style="list-style-type: none"> - Allow the trace to stabilize. - Use the spectrum analyzer built-in measurement function to determine the 6dB BW. <ul style="list-style-type: none"> o Set RBW = 100 KHz o Set VBW \geq 3 x RBW o Detector = Peak o Trace mode = max hold o Sweep = auto couple - Capture the plot. - Repeat above steps for different test channel and other modulation type. 		
Test Date	01/18/2017 – 02/10/2017	Environmental condition	Temperature 22°C Relative Humidity 38% Atmospheric Pressure 1020mbar
Remark	N/A		
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	

Test Data Yes N/A

Test Plot Yes N/A

Test was done by Chen Ge at RF test site.

26dB Bandwidth measurement result for 5.2GHz

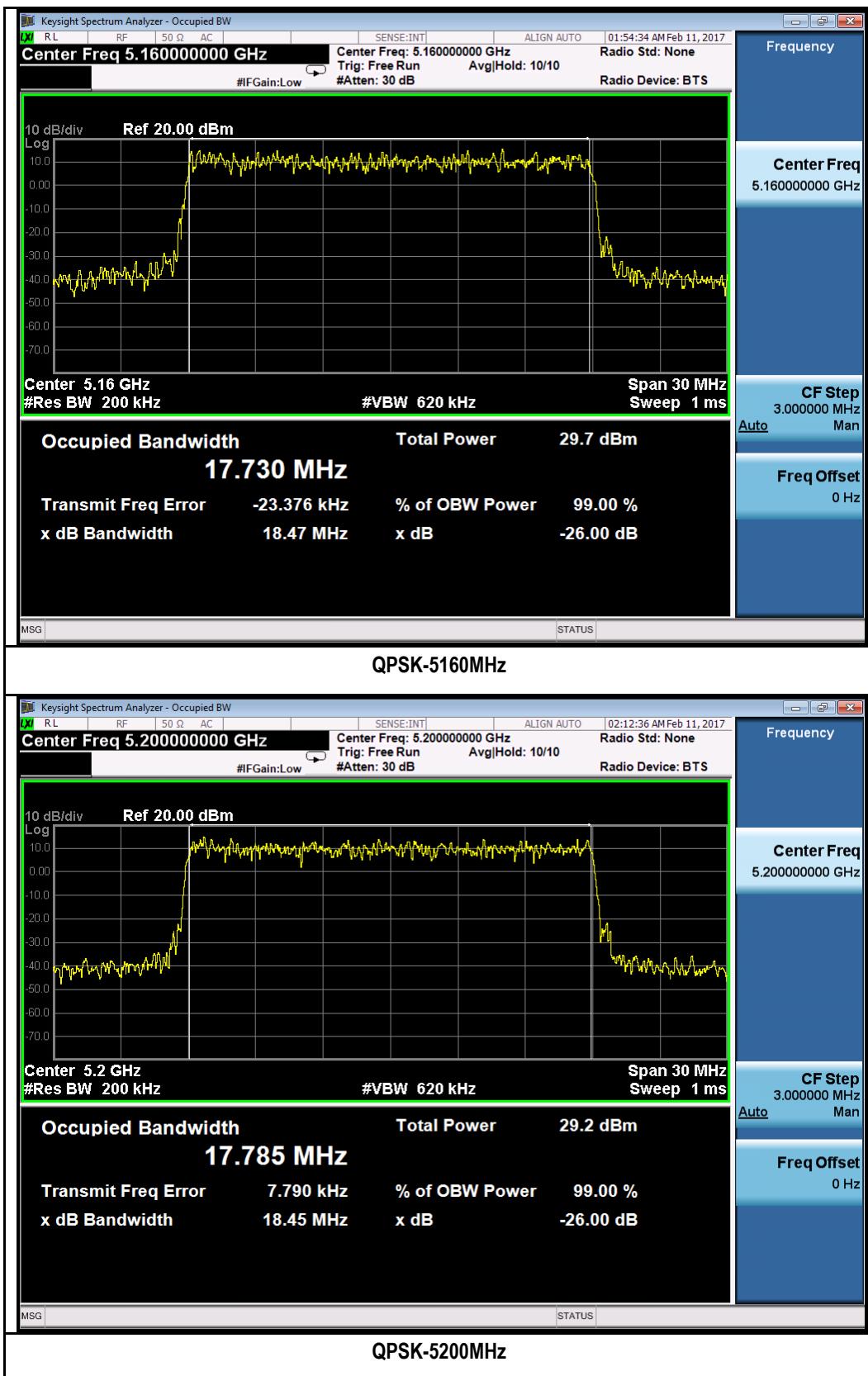
Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)
26dB BW	QPSK	5160	Low	18.47	-
		5200	Mid	18.45	-
		5240	High	18.43	-
	64QAM	5160	Low	18.71	-
		5200	Mid	18.40	-
		5240	High	18.46	-

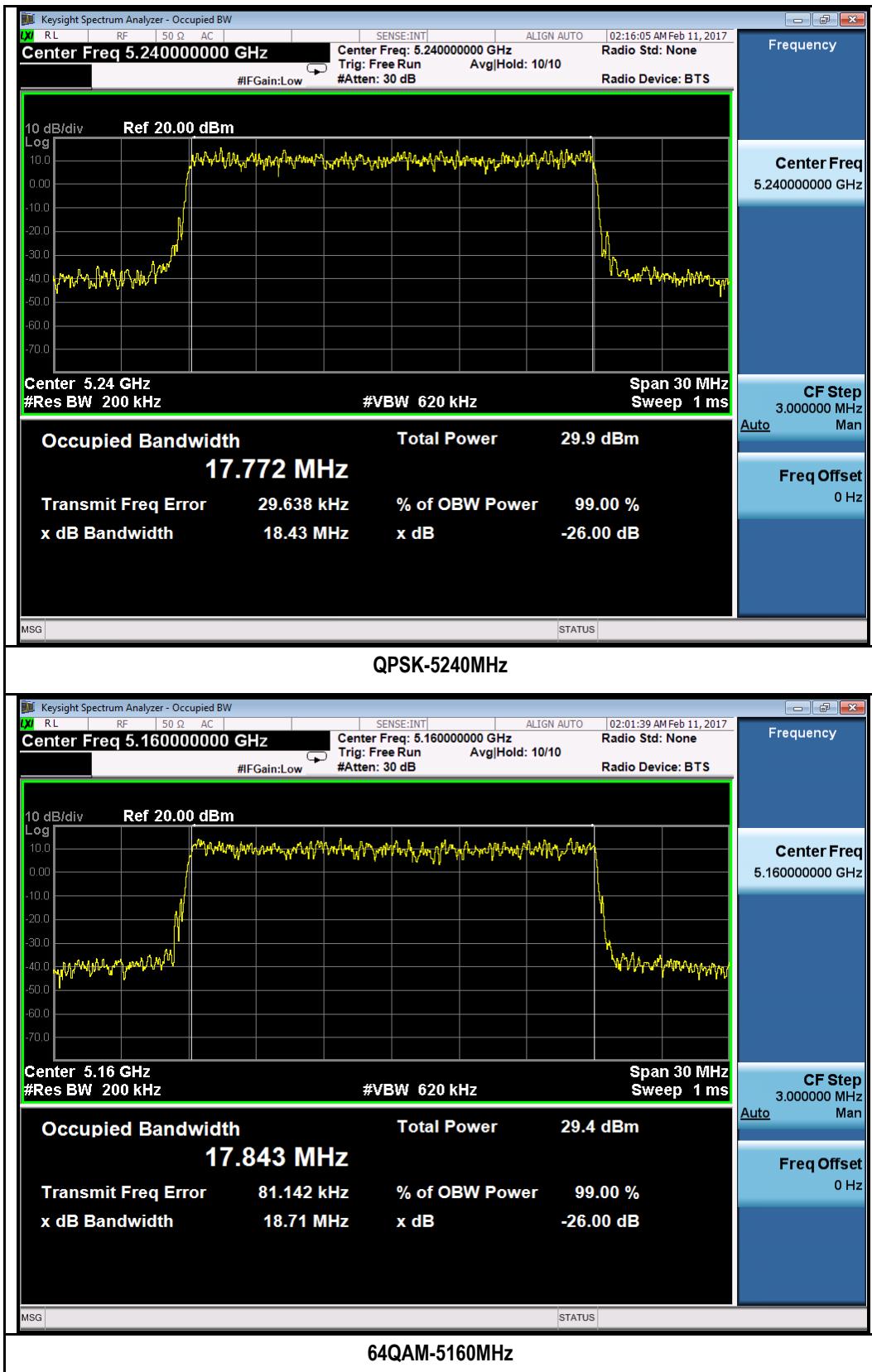
6dB Bandwidth measurement result for 5.8GHz

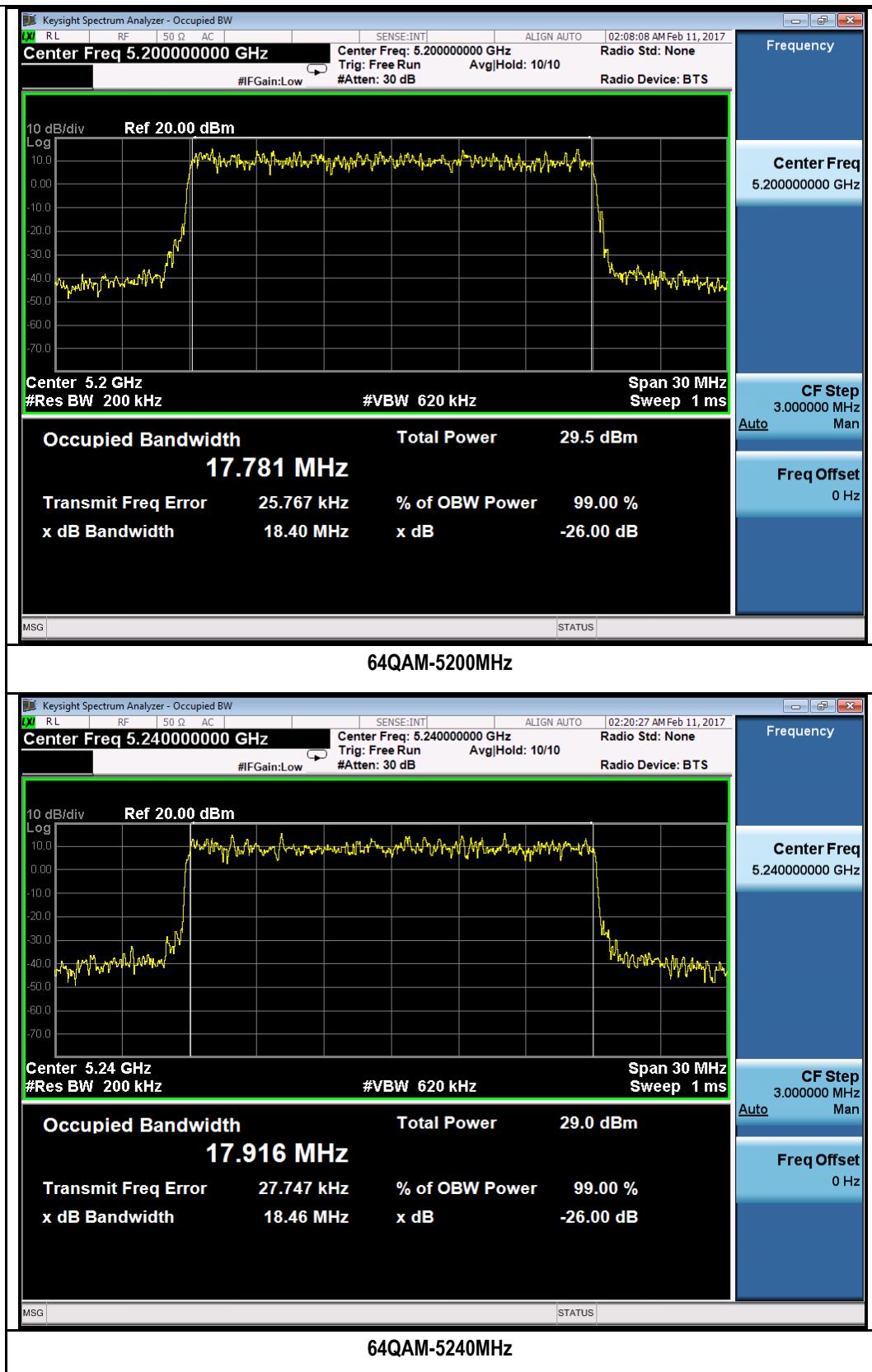
Type	Test mode	Freq (MHz)	CH	Result (MHz)	Limit (MHz)	Result
6dB BW	QPSK	5745	Low	17.96	≥ 0.5	Pass
		5785	Mid	17.97	≥ 0.5	Pass
		5825	High	17.99	≥ 0.5	Pass
	64QAM	5745	Low	17.98	≥ 0.5	Pass
		5785	Mid	18.00	≥ 0.5	Pass
		5825	High	17.94	≥ 0.5	Pass

26dB Bandwidth Test Plots

W52:

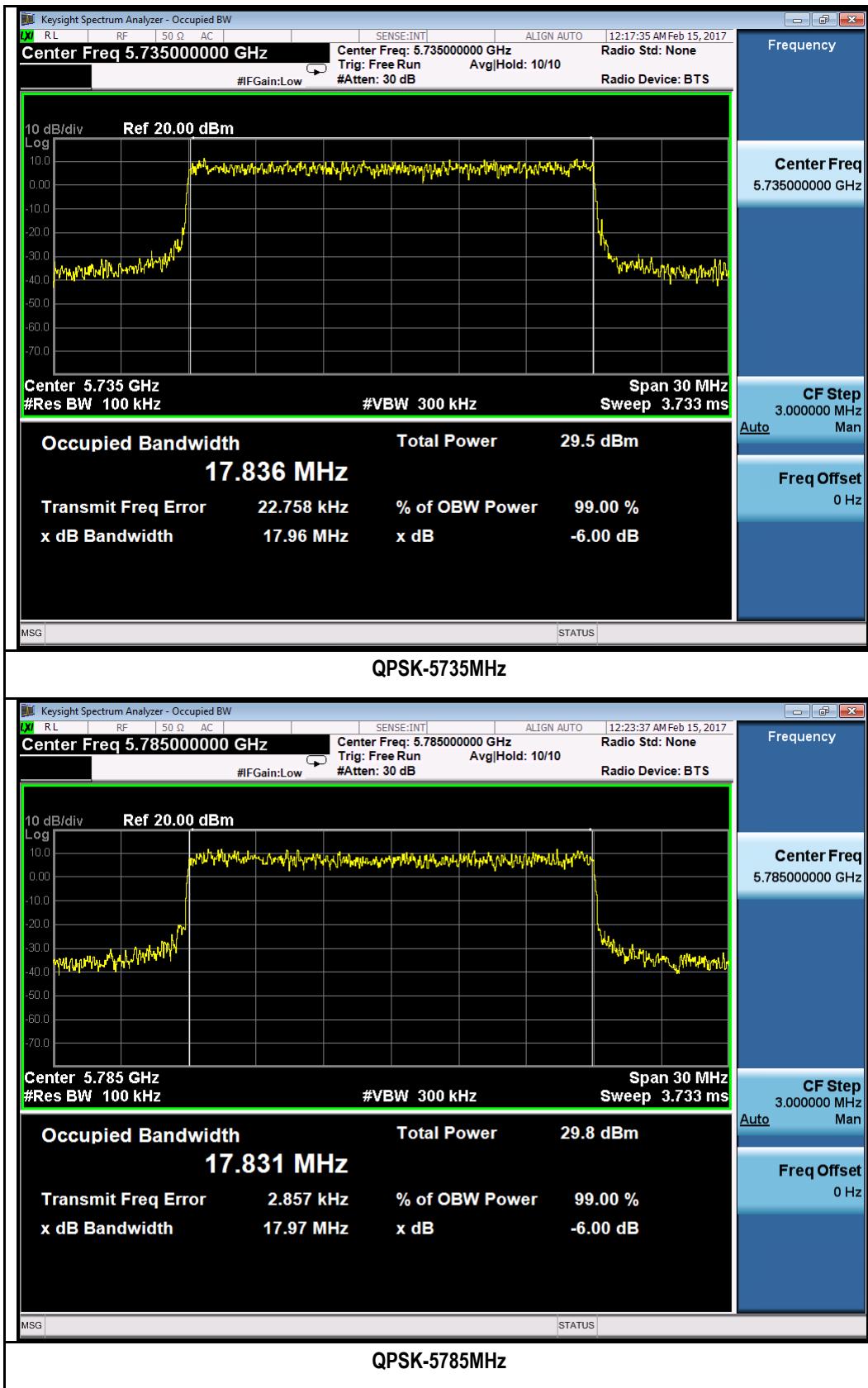


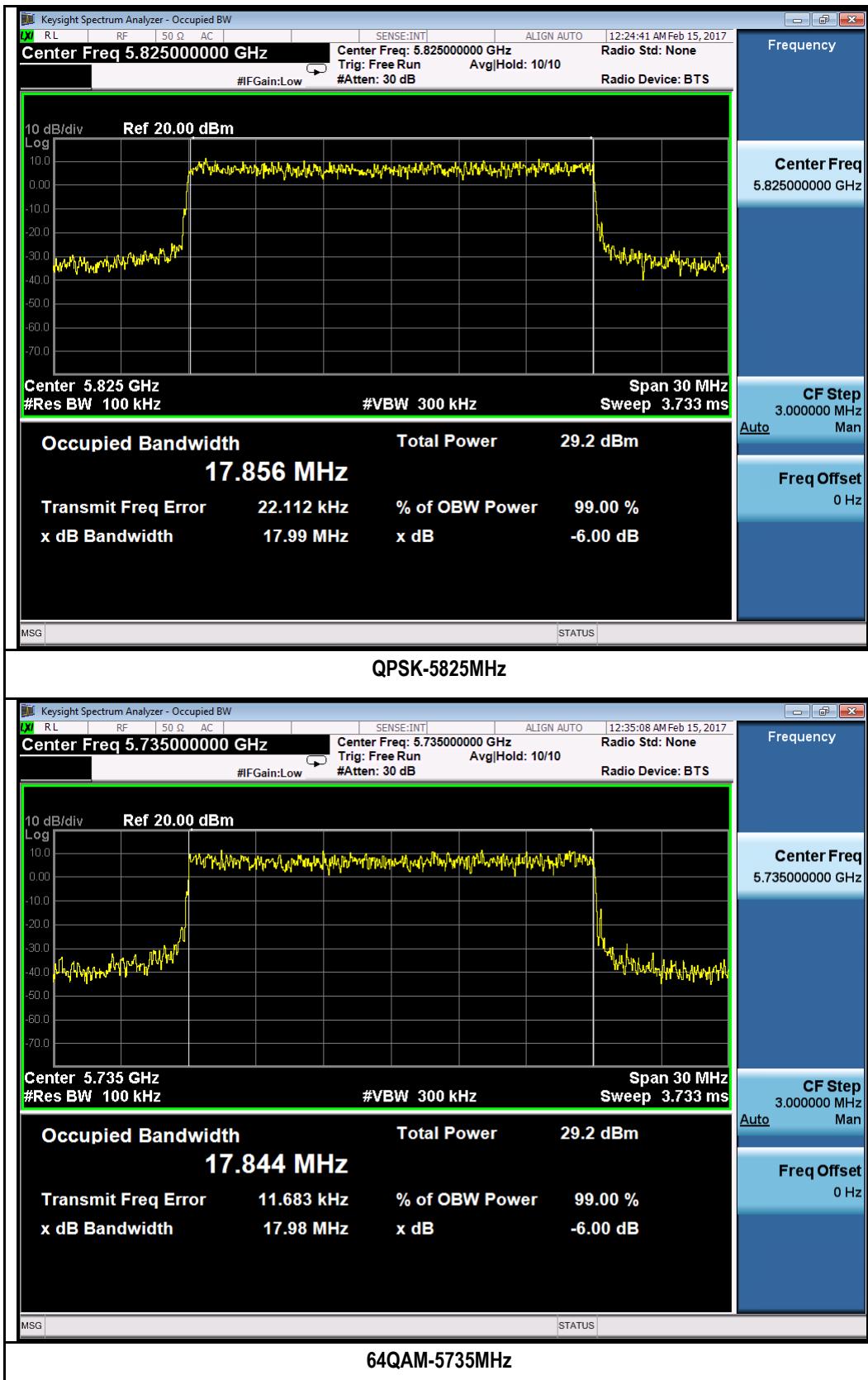


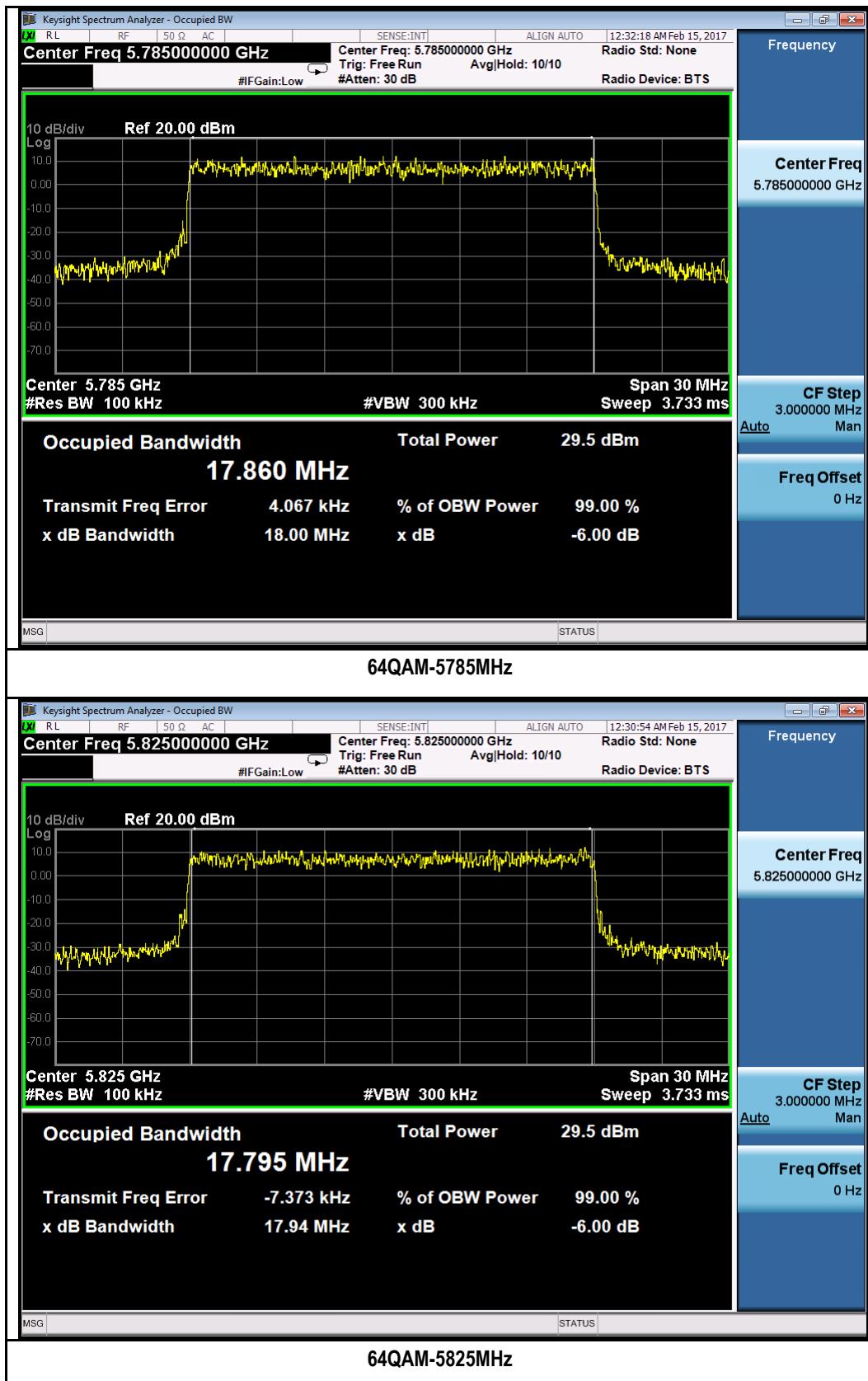


6dB Bandwidth Test Plots

W58:

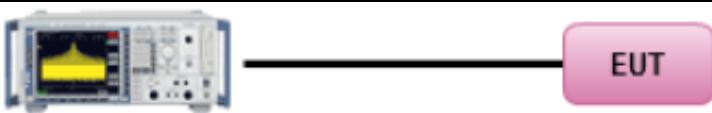






10.3 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	a)(1)(ii)	For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.	<input checked="" type="checkbox"/>
	a)(3)	For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.	<input checked="" type="checkbox"/>
	a)(1)(i)	The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).	<input checked="" type="checkbox"/>
Test Setup	 <p>Spectrum Analyzer ————— EUT</p>		
Test Procedure	<p>789033 D02 General UNII Test Procedures New Rules v01r02</p> <p><u>Measurement using a Spectrum Analyzer or EMI Receiver (SA)</u></p> <p>Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep):</p> <ul style="list-style-type: none"> (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal. (ii) Set RBW = 1 MHz (iii) Set VBW = 3 MHz (iv) Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$. (This ensures that bin-to-bin spacing is $\leq \text{RBW}/2$, so that narrowband signals are not lost between frequency bins.) (v) Sweep time = auto. (vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode. (vii) If transmit duty cycle $< 98\%$, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq 98\%$, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run." (viii) Trace average at least 100 traces in power averaging (rms) mode. (ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum. 		
Test Date	01/18/2017 – 02/10/2017	Environmental condition	Temperature 21°C Relative Humidity 40% Atmospheric Pressure 1019mbar
Remark	Two antennas are used for this band. The highest directional gain of the antenna is 6dBi, no limit adjust is required.		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

Test Data Yes N/A

Test Plot Yes (See below) N/A

Test was done by Chen Ge at RF test site.

Output Power measurement result for 5.2GHz

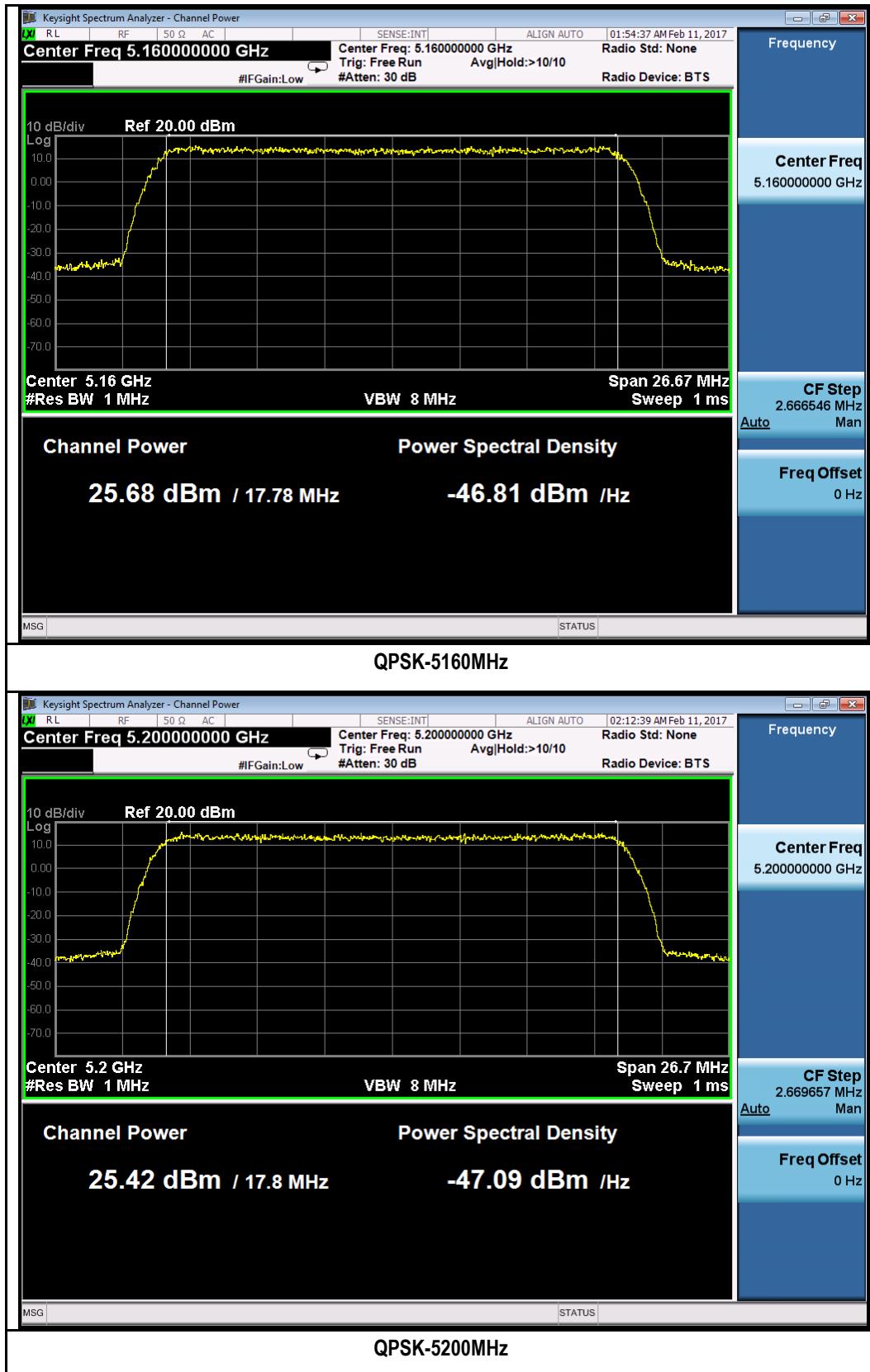
Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain 1	Chain 2	Combined Power		
Output power	QPSK	5160	Low	25.68	25.64	28.67	30	Pass
		5200	Mid	25.42	25.40	28.42	30	Pass
		5240	High	25.54	25.46	28.51	30	Pass
	64QAM	5160	Low	25.74	25.81	28.79	30	Pass
		5200	Mid	25.38	25.36	28.38	30	Pass
		5240	High	25.57	25.59	28.59	30	Pass

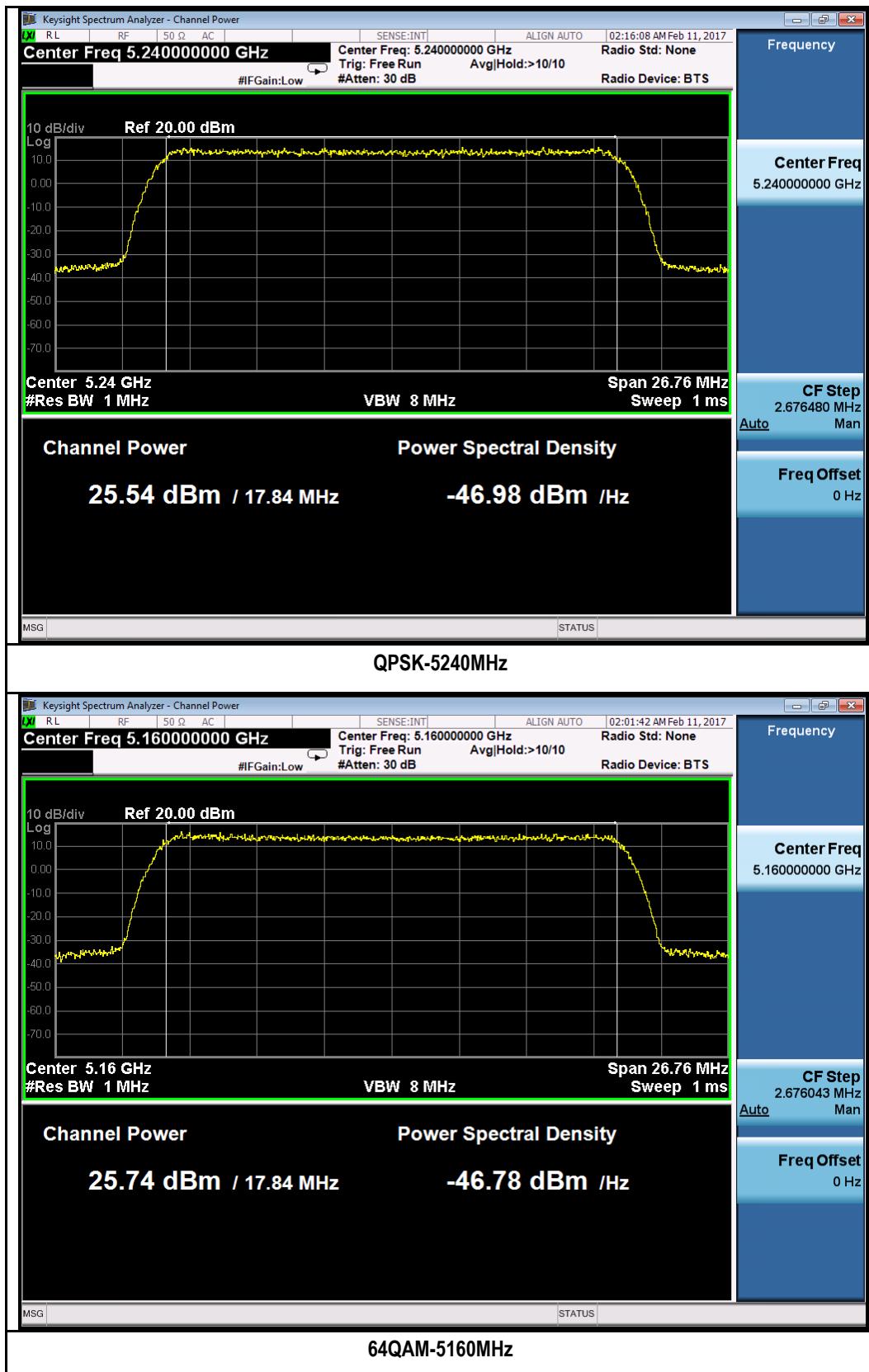
Output Power Measurement Results for 5.8GHz

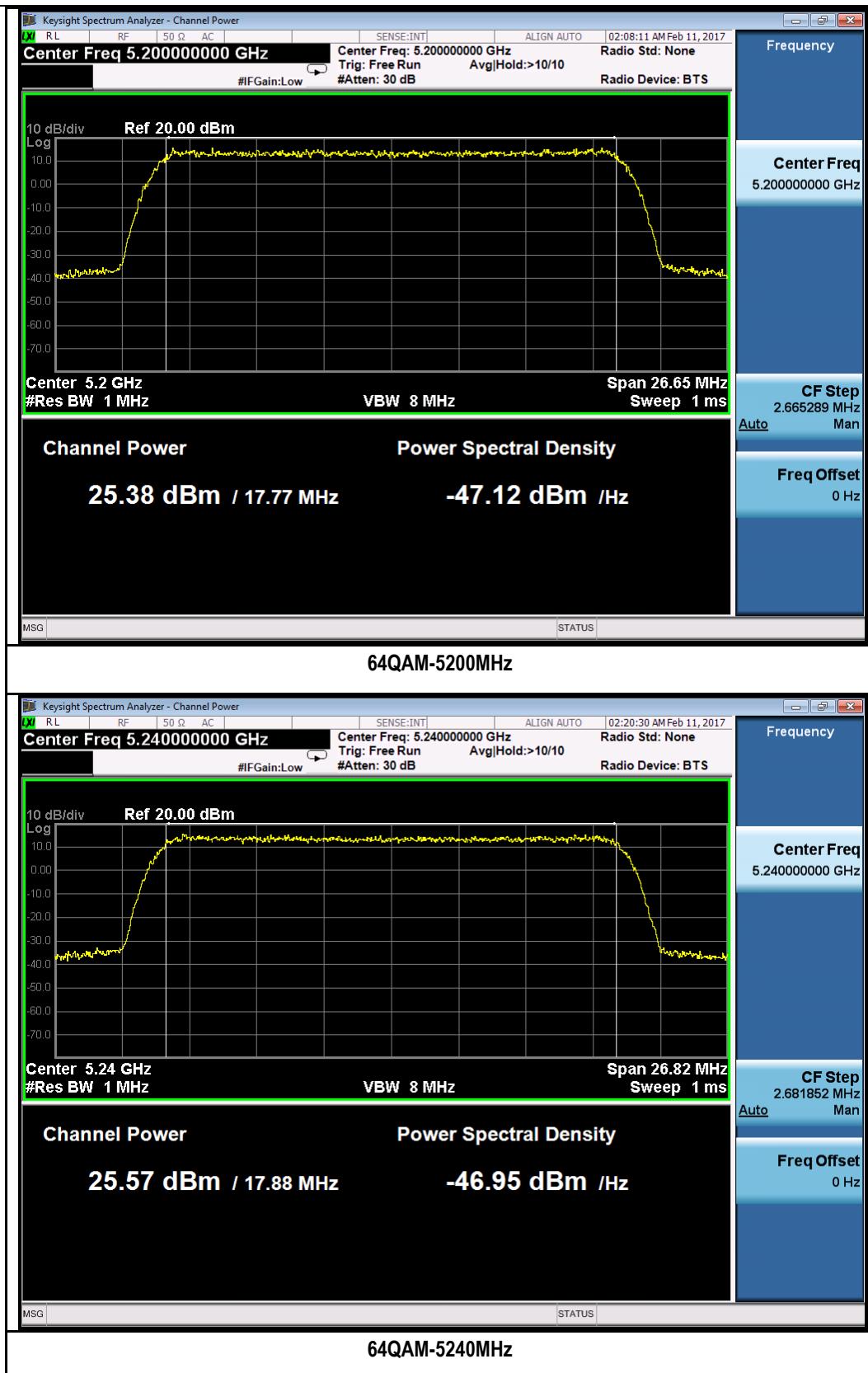
Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain 1	Chain 2	Combined Power		
Output power	QPSK	5735	Low	25.52	25.51	28.53	30	Pass
		5785	Mid	25.66	25.67	28.68	30	Pass
		5825	High	25.29	25.26	28.29	30	Pass
	64QAM	5735	Low	25.74	25.68	28.72	30	Pass
		5785	Mid	25.74	25.71	28.74	30	Pass
		5825	High	25.30	25.36	28.34	30	Pass

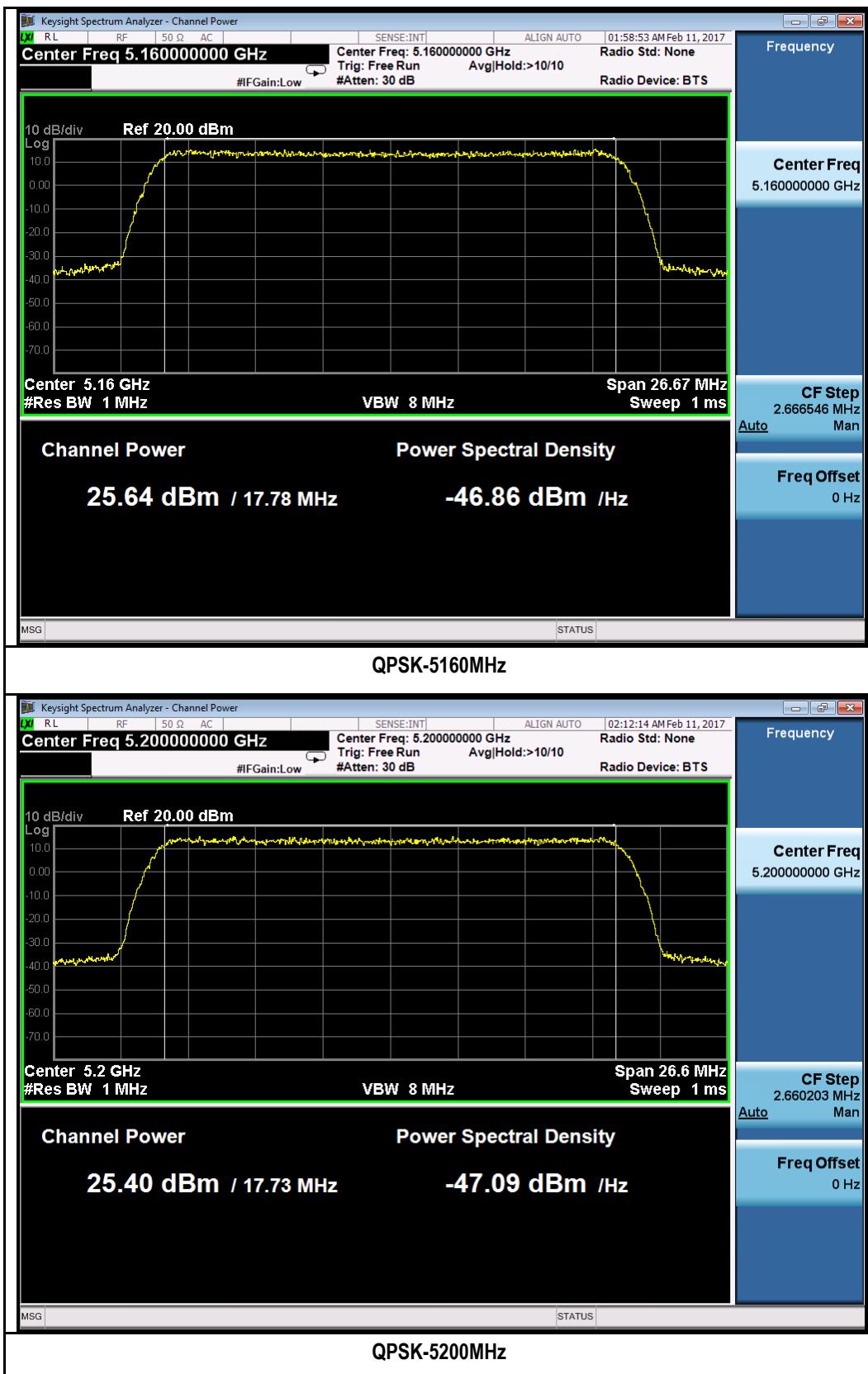
Test Plot for W52:

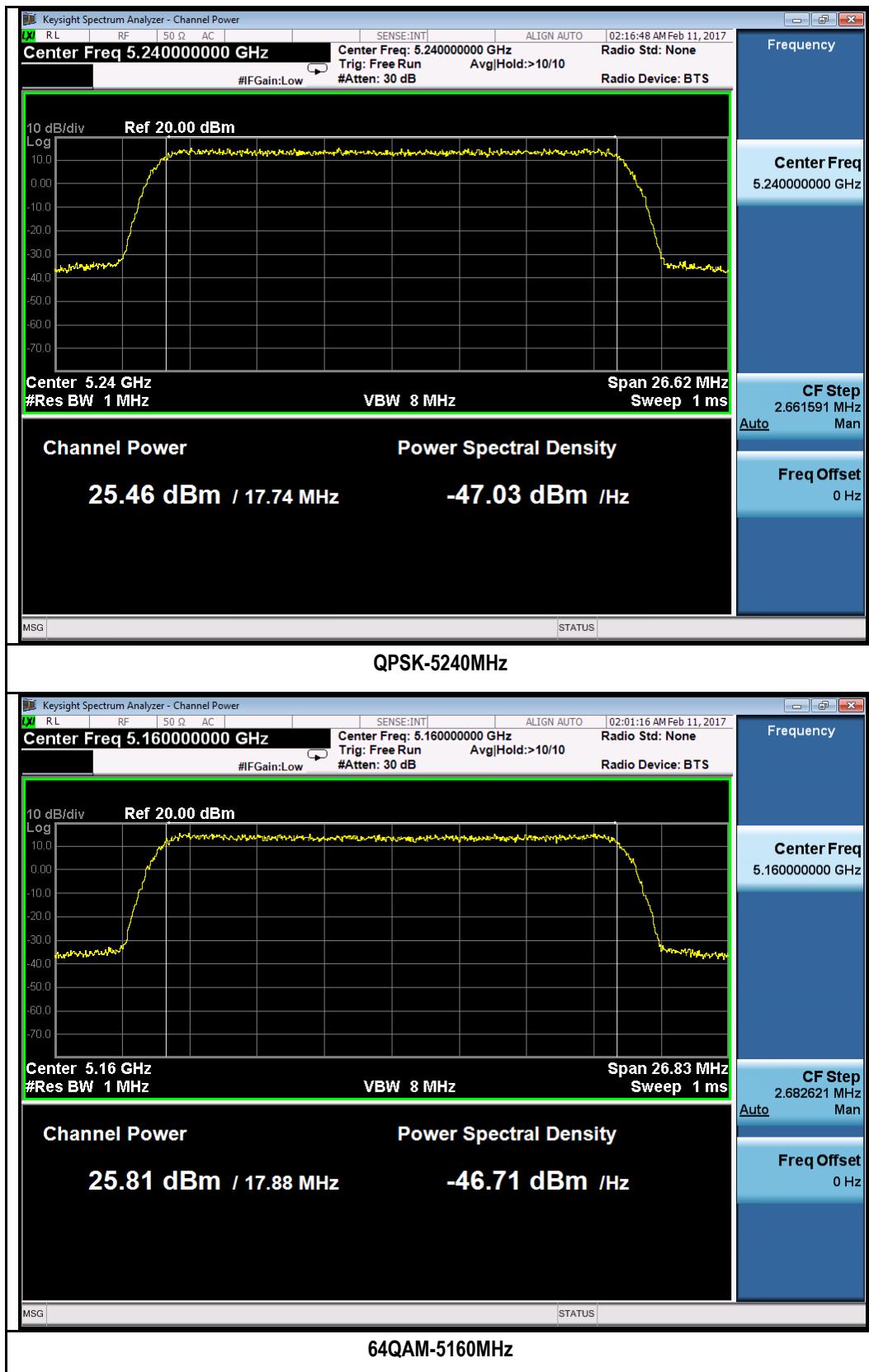
Chain 1:

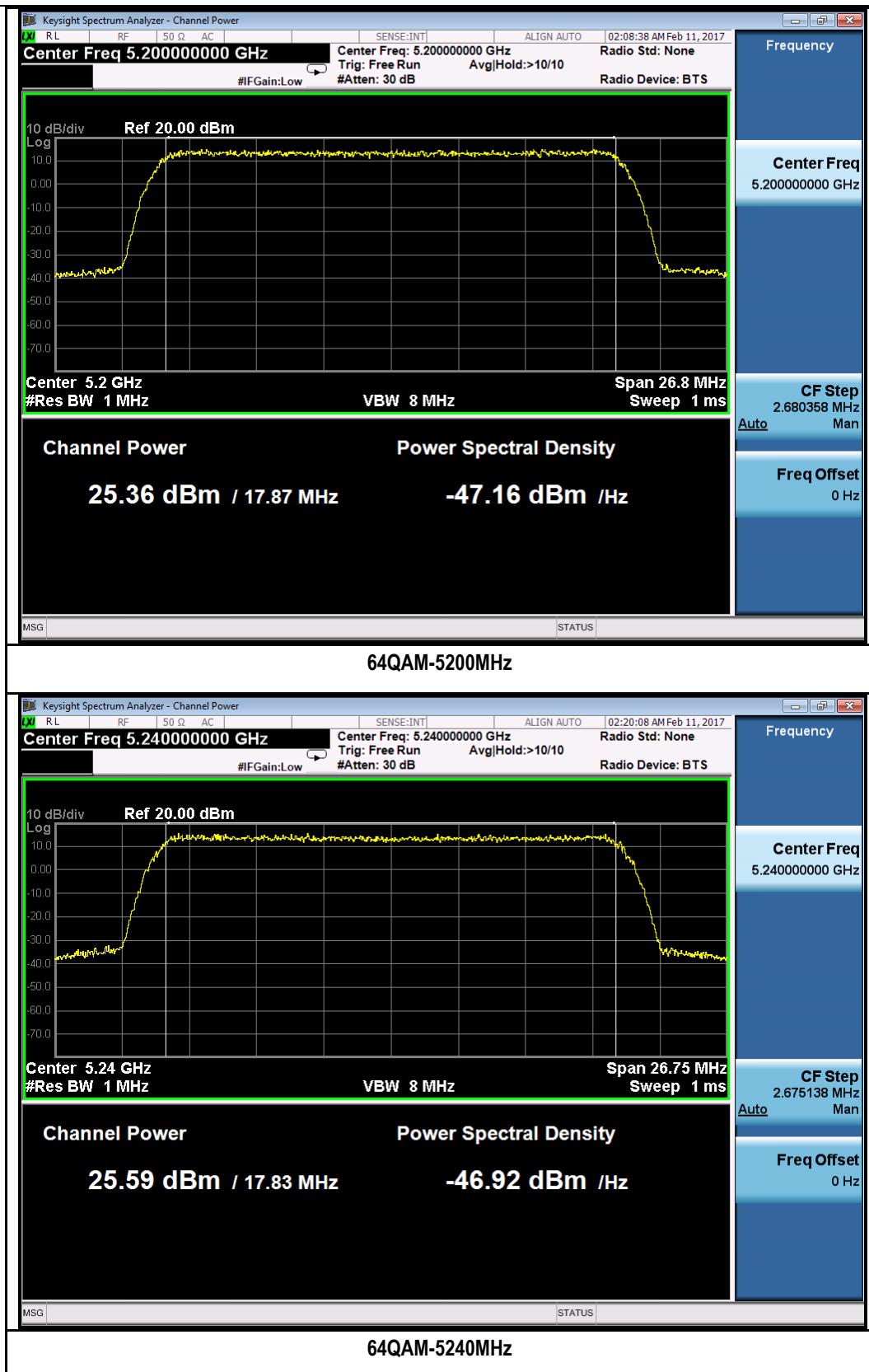






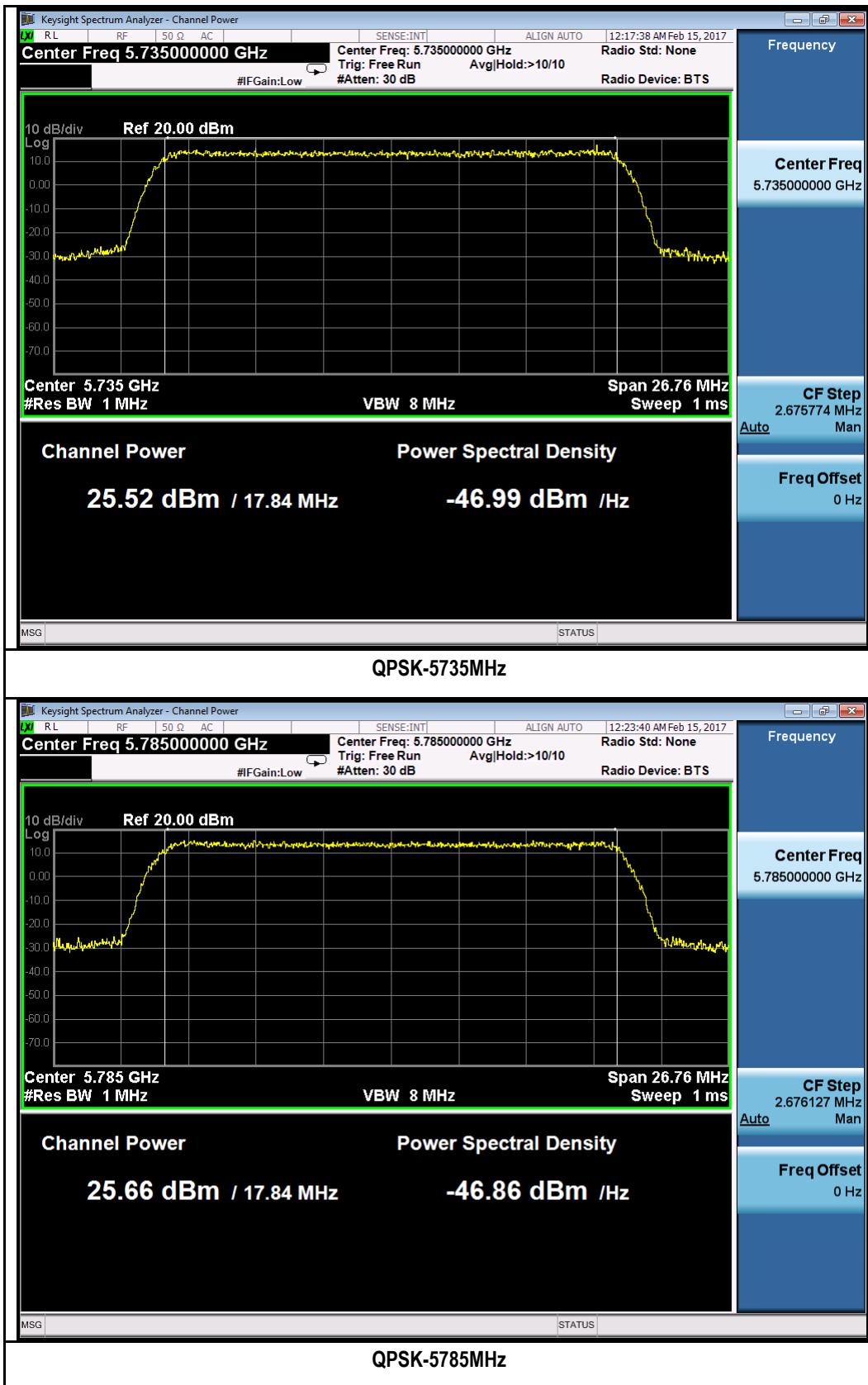
Chain 2:


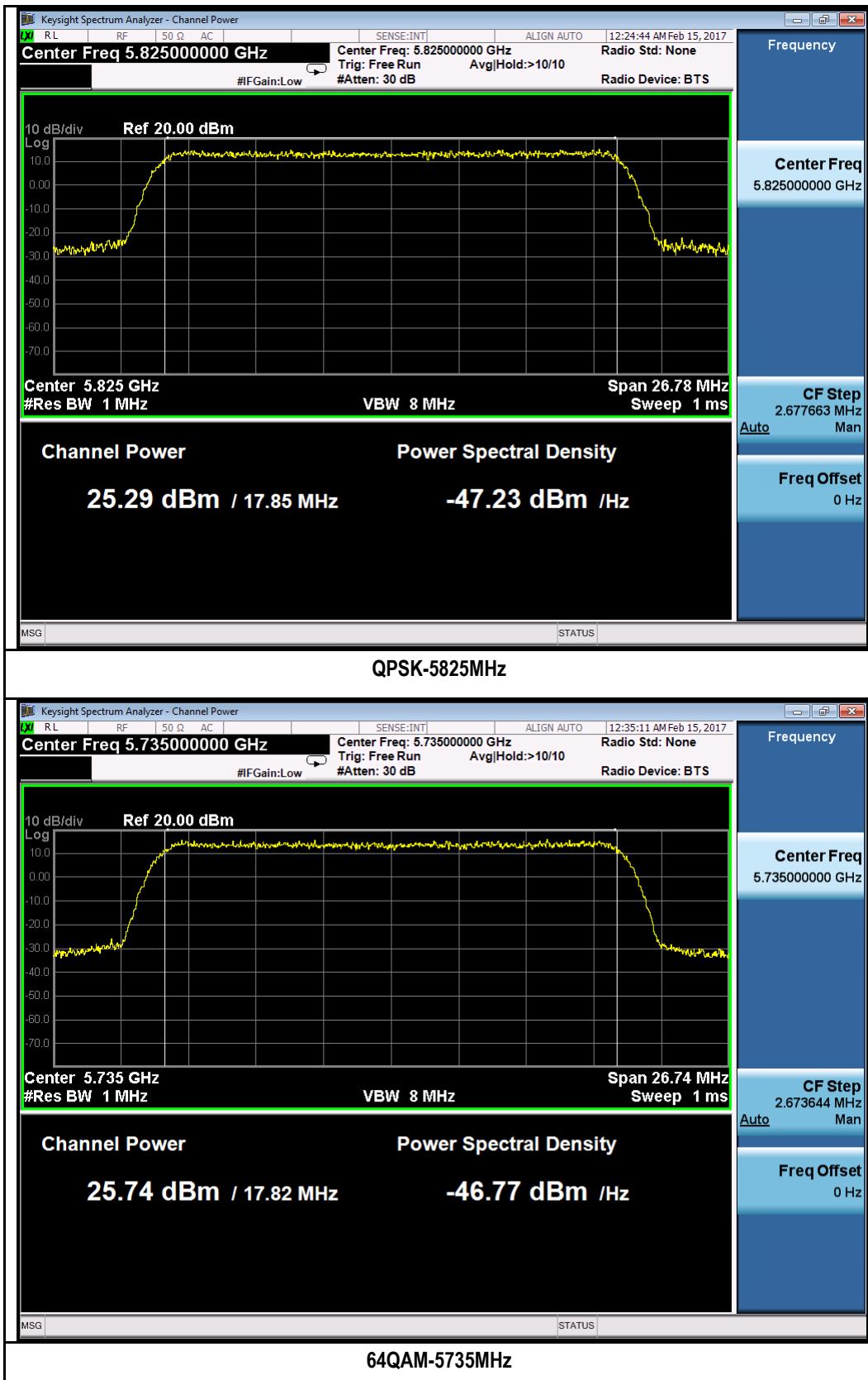


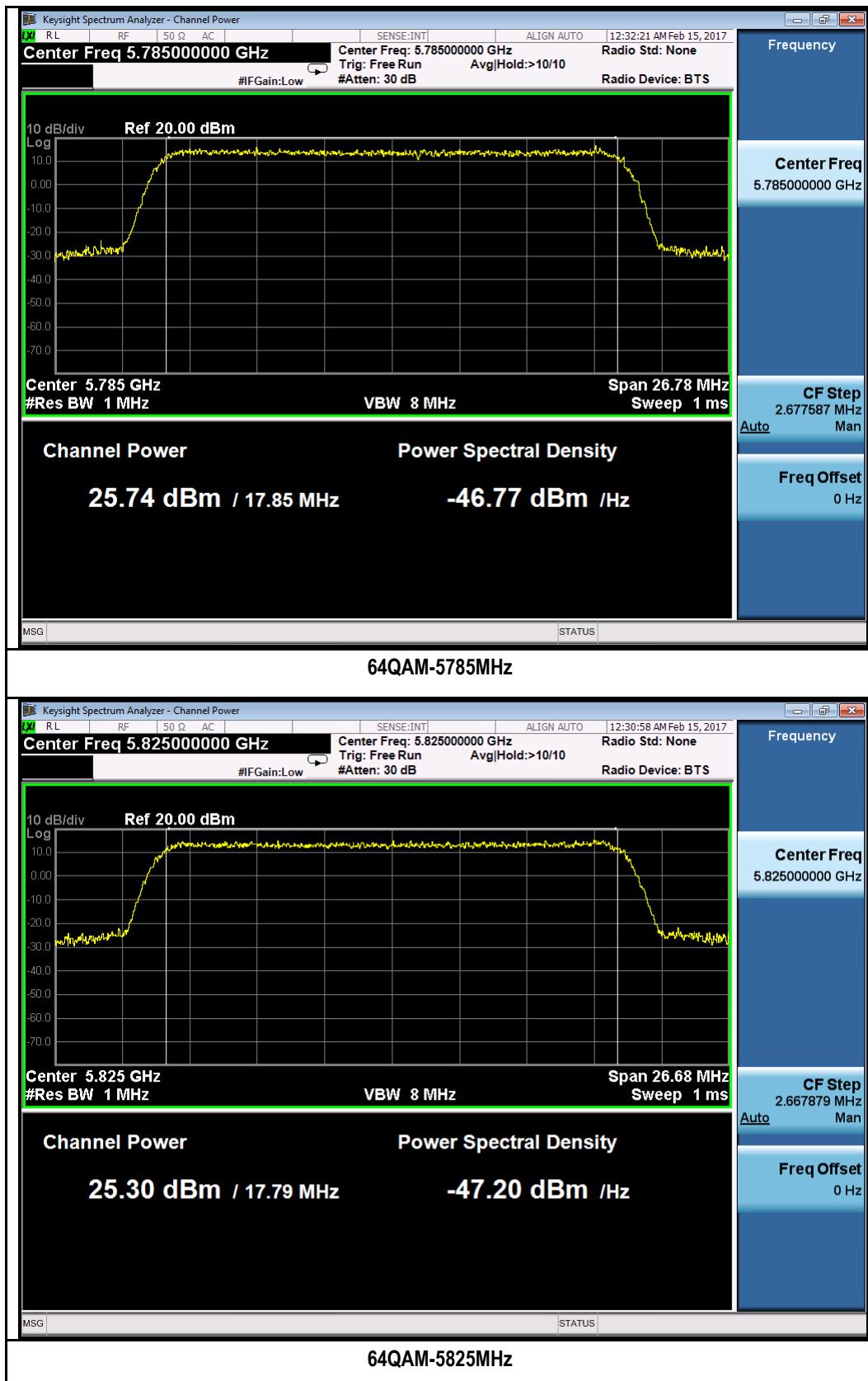


Test Plot for W58:

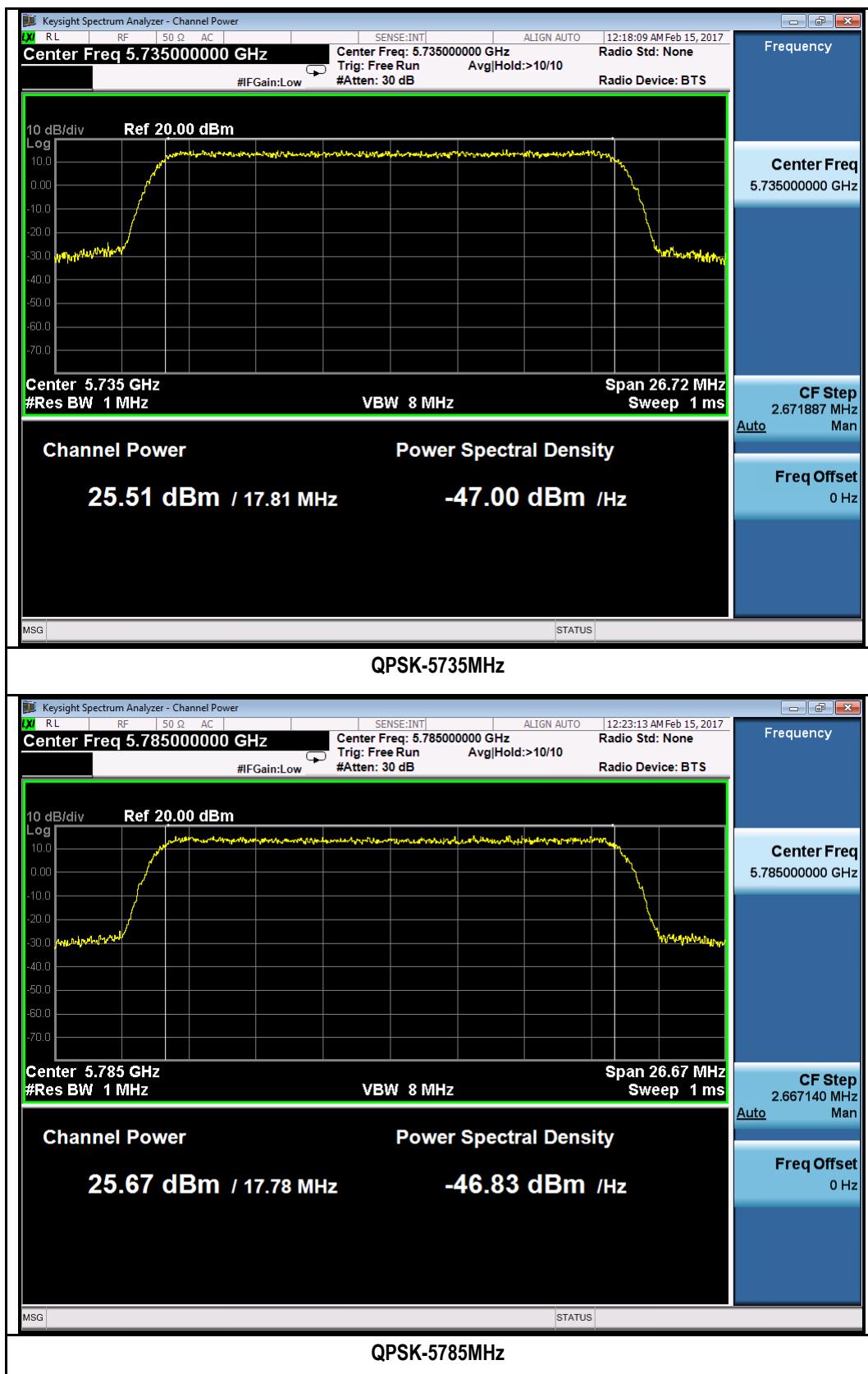
Chain 1:



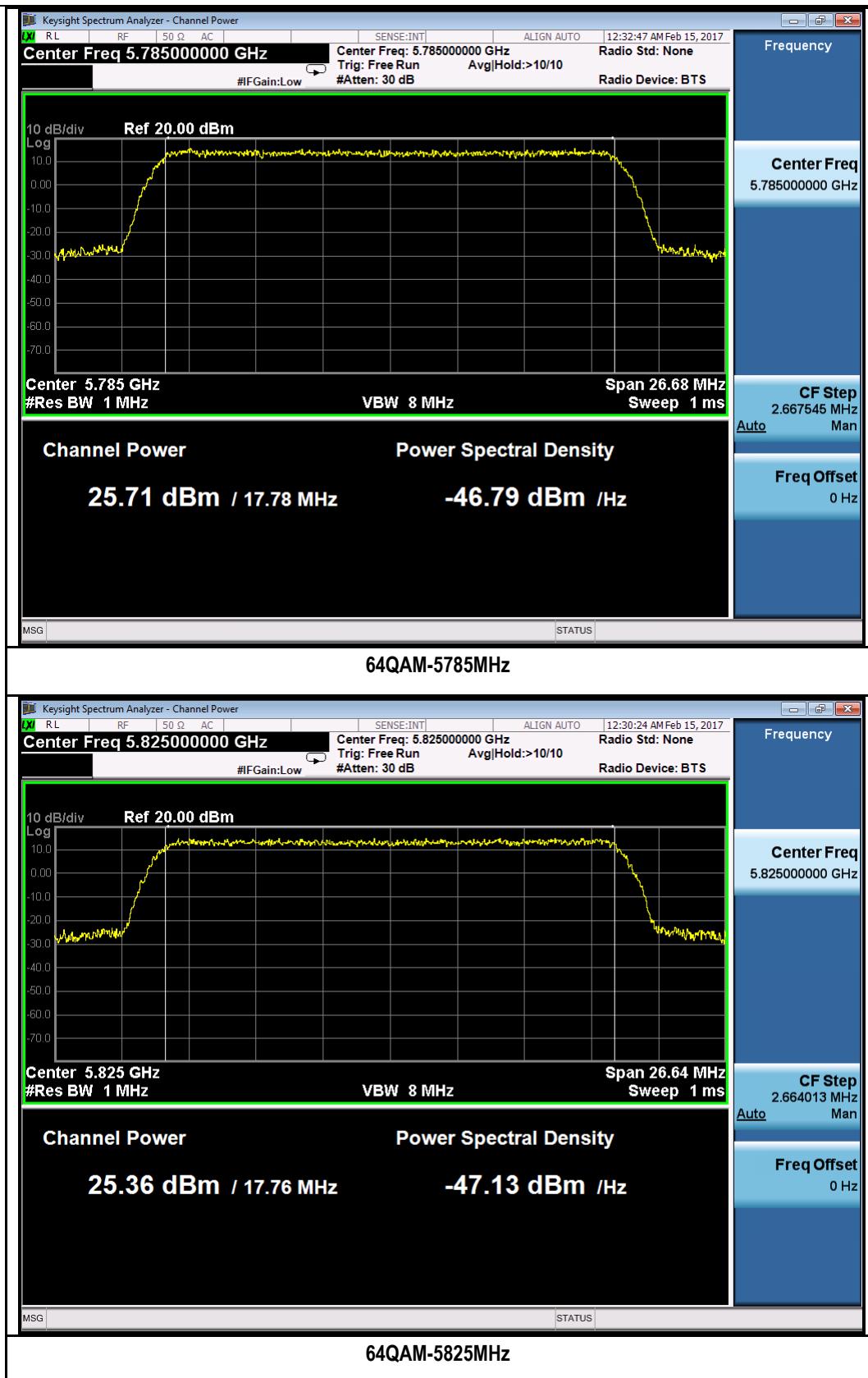




Chain 2:

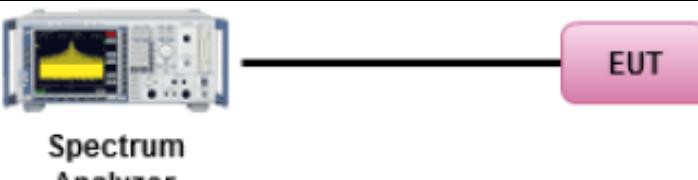






10.4 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	a)(1)(i)	For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.	<input checked="" type="checkbox"/>
	a)(3)	For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.	<input checked="" type="checkbox"/>
Test Setup	 Spectrum Analyzer ————— EUT		
Test Procedure	<p>789033 D02 General UNII Test Procedures New Rules v01r02, II.F. Method SA-1</p> <p><u>Maximum spectral density measurement procedure</u></p> <ul style="list-style-type: none"> - Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal. - Set RBW = 1 MHz - Set VBW \geq 3 MHz - Detector = RMS. - Sweep time = auto couple. - Trace mode = max hold. - Trace average at least 100 traces in power averaging - Use the peak marker function to determine the maximum amplitude level within the RBW. Apply correction to the result if different RBW is used. 		
Test Date	01/18/2017 – 02/10/2017	Environmental condition	Temperature 22°C Relative Humidity 42% Atmospheric Pressure 1020mbar
Remark	Two antennas are used for this band. The highest directional gain of the antenna is 6dBi, no limit adjust is required.		
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	

Test Data Yes N/A

Test Plot Yes (See below) N/A

Test was done by Chen Ge at RF test site.

PSD measurement result

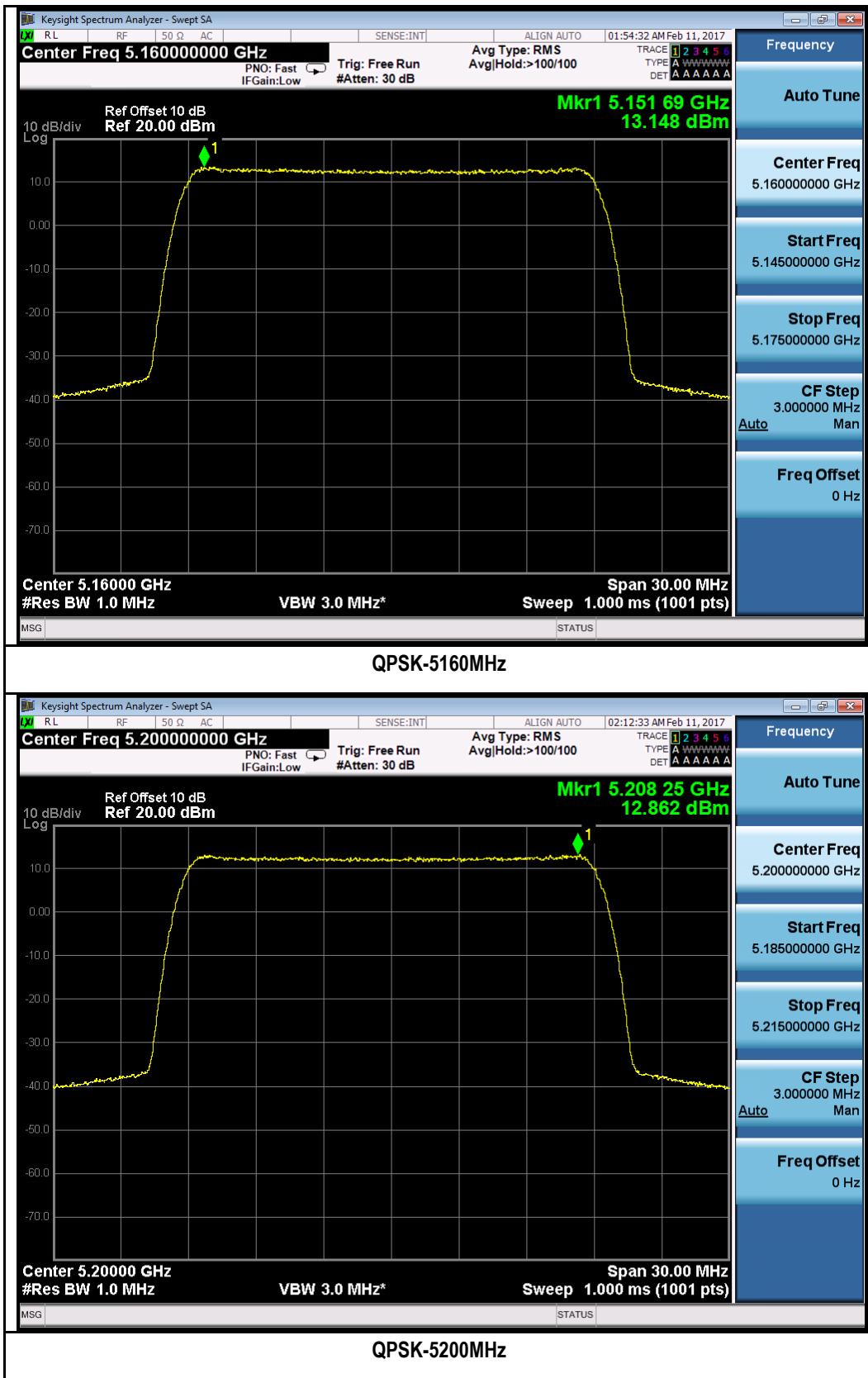
Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/MHz)			Limit (dBm/MHz)	Result
				Chain 1	Chain 2	Combined PSD		
PSD	QPSK	5160	Low	13.14	13.60	16.39	17	Pass
		5200	Mid	12.86	12.87	15.88	17	Pass
		5240	High	12.85	12.87	15.87	17	Pass
	64QAM	5160	Low	13.11	13.32	16.23	17	Pass
		5200	Mid	12.85	12.93	15.90	17	Pass
		5240	High	13.10	13.31	16.22	17	Pass

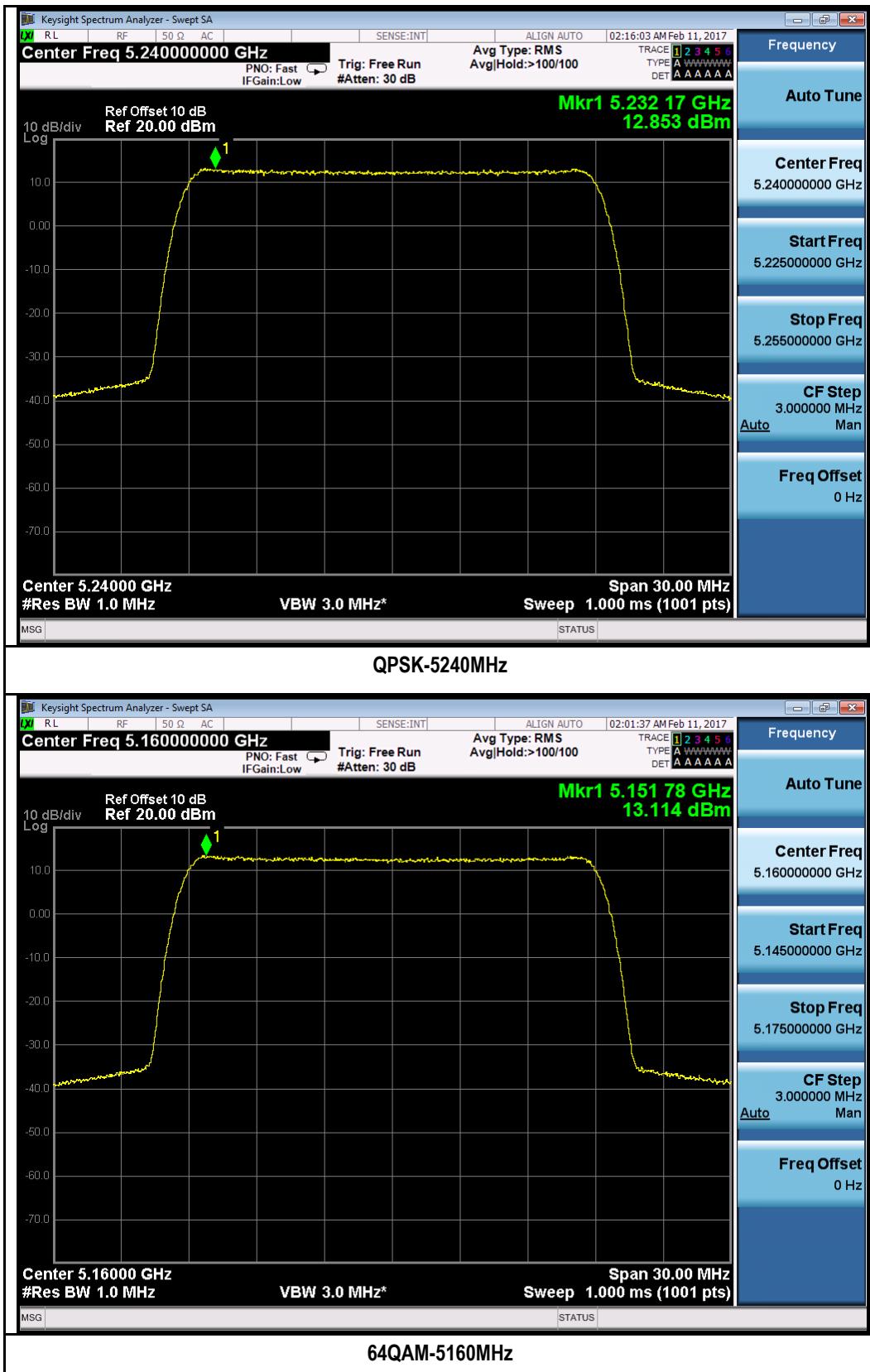
Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/100kHz)			Combined PSD(dBm/500kHz)	Limit (dBm/500kHz)	Result
				Chain 1	Chain 2	correction factor (dB)			
PSD	QPSK	5735	Low	4.38	4.83	6.99	14.61	30	Pass
		5785	Mid	4.64	5.09	6.99	14.87	30	Pass
		5825	High	4.65	4.24	6.99	14.45	30	Pass
	64QAM	5735	Low	4.93	4.64	6.99	14.79	30	Pass
		5785	Mid	4.61	5.02	6.99	14.82	30	Pass
		5825	High	4.40	4.73	6.99	14.57	30	Pass

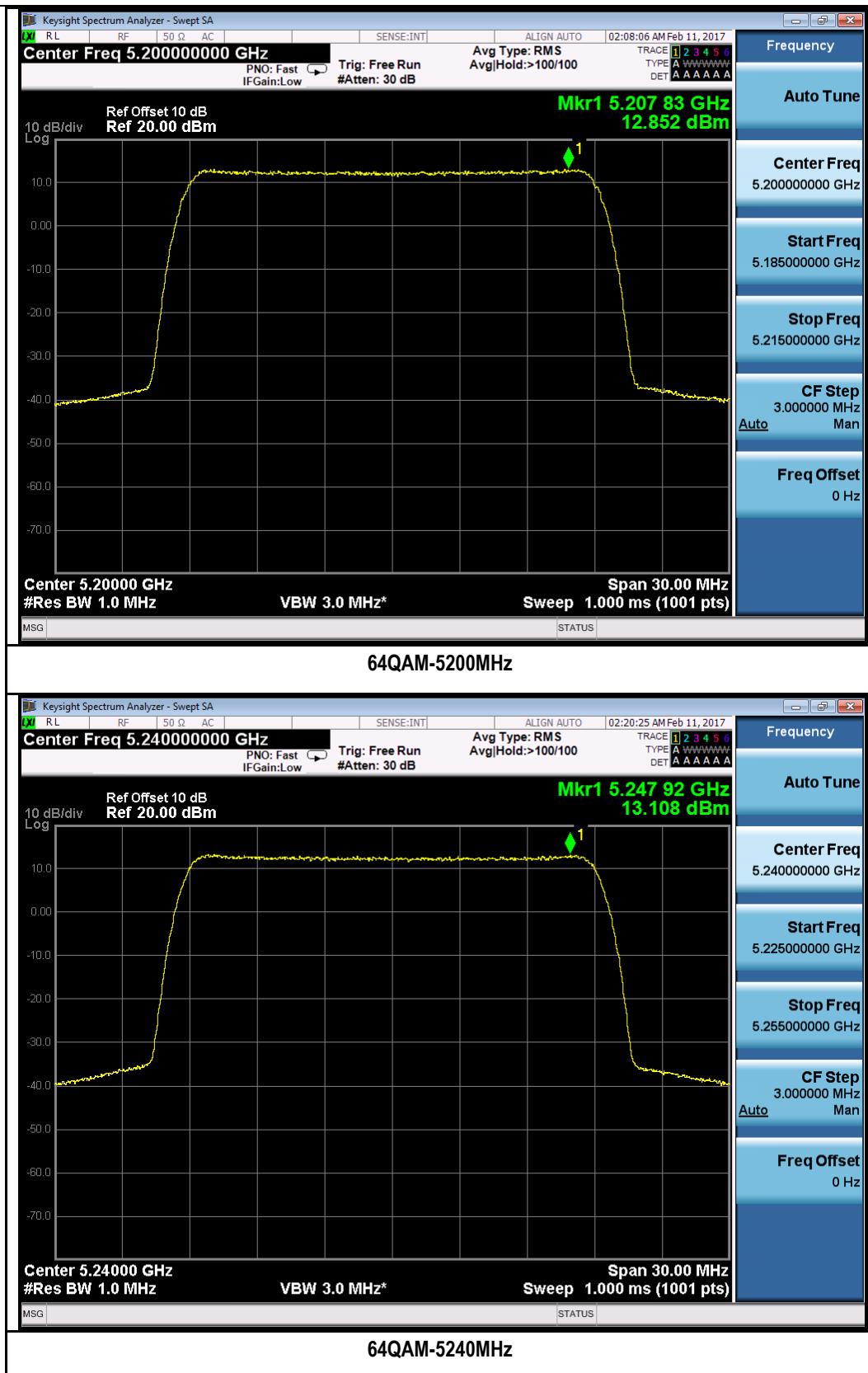
Note BW correction factor = $10\log(500\text{kHz}/\text{RBW})$, RBW was set to 100kHz during test.

Test Plot for W52:

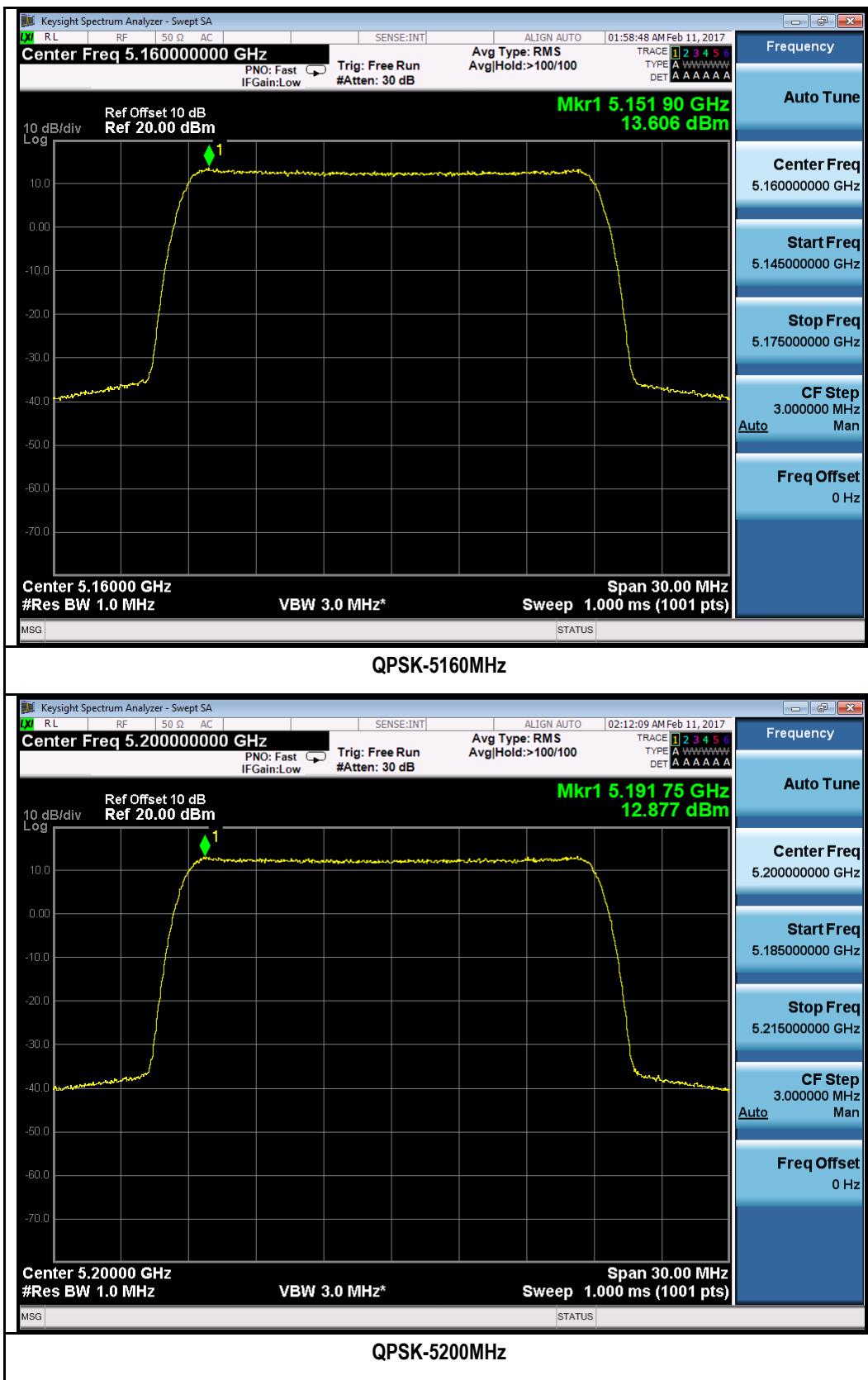
Chain 1:

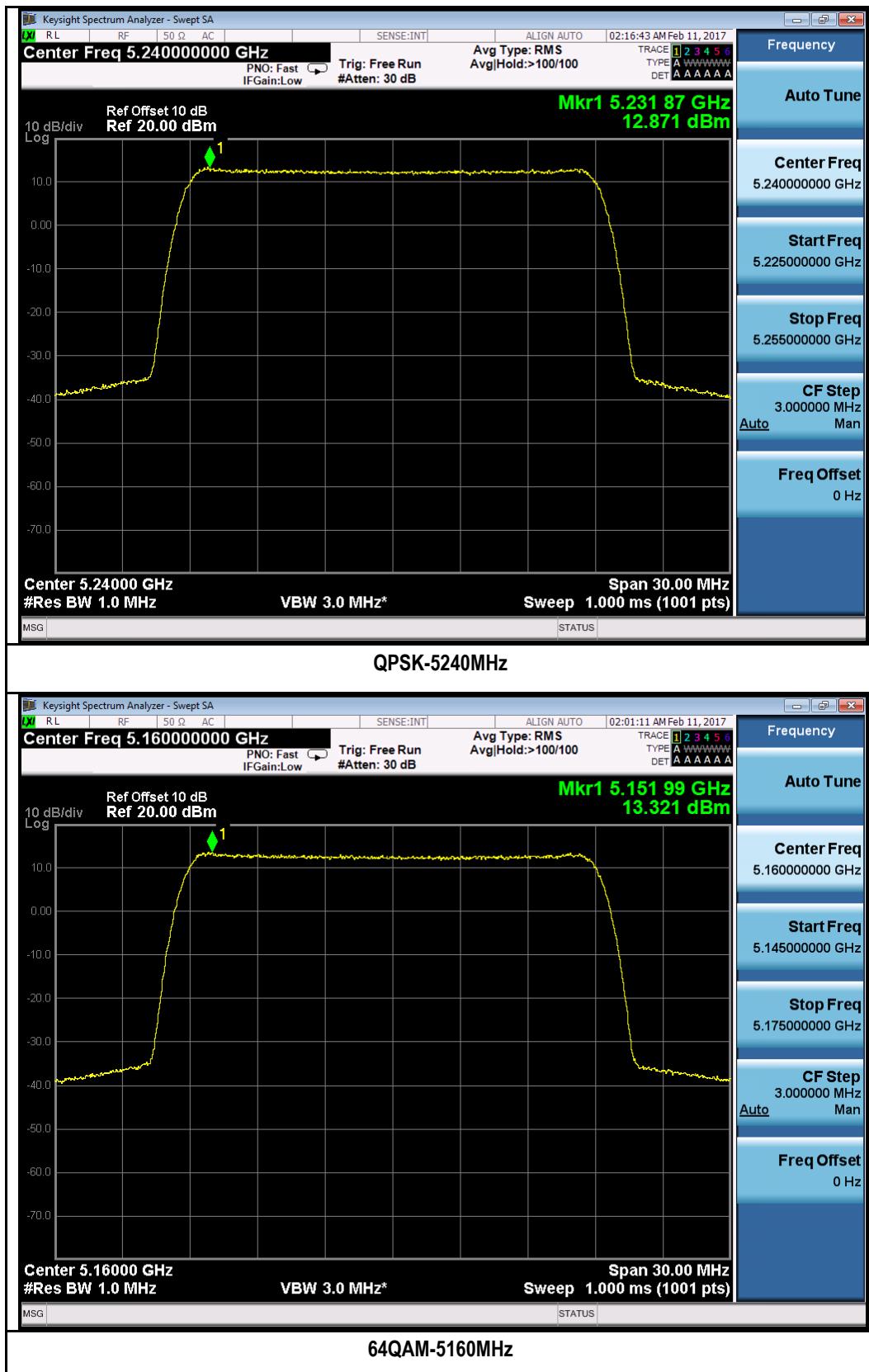


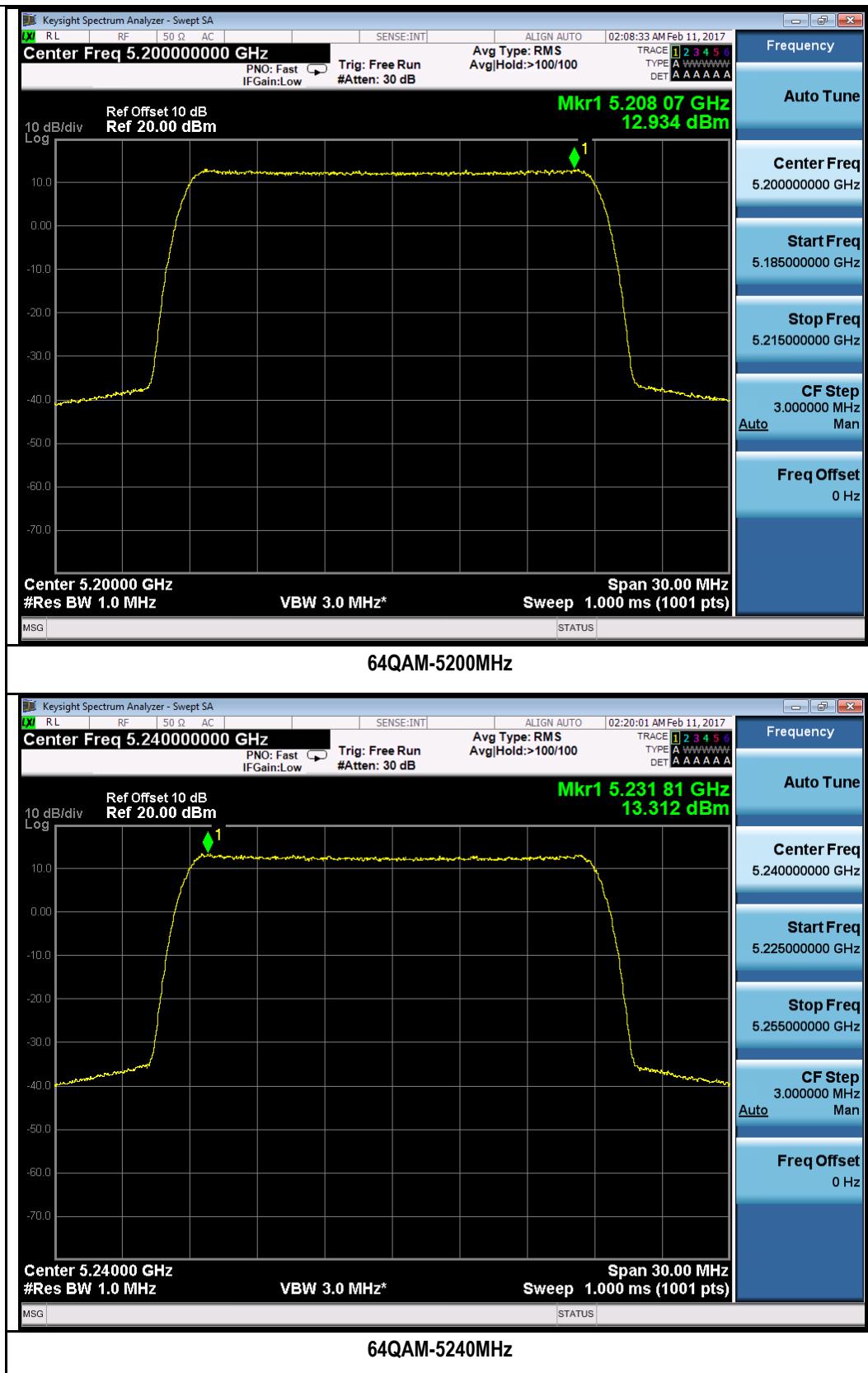




Chain 2:

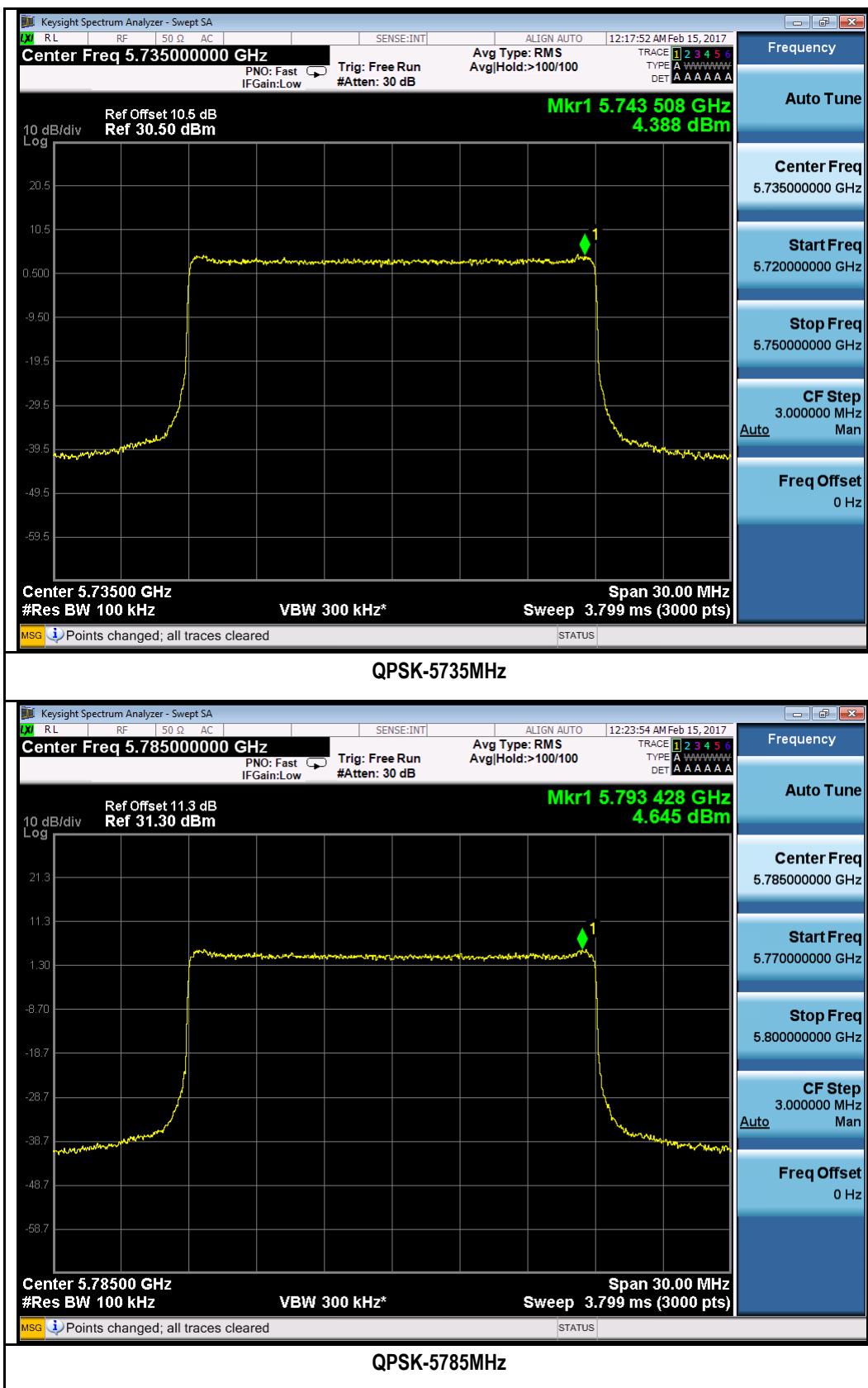


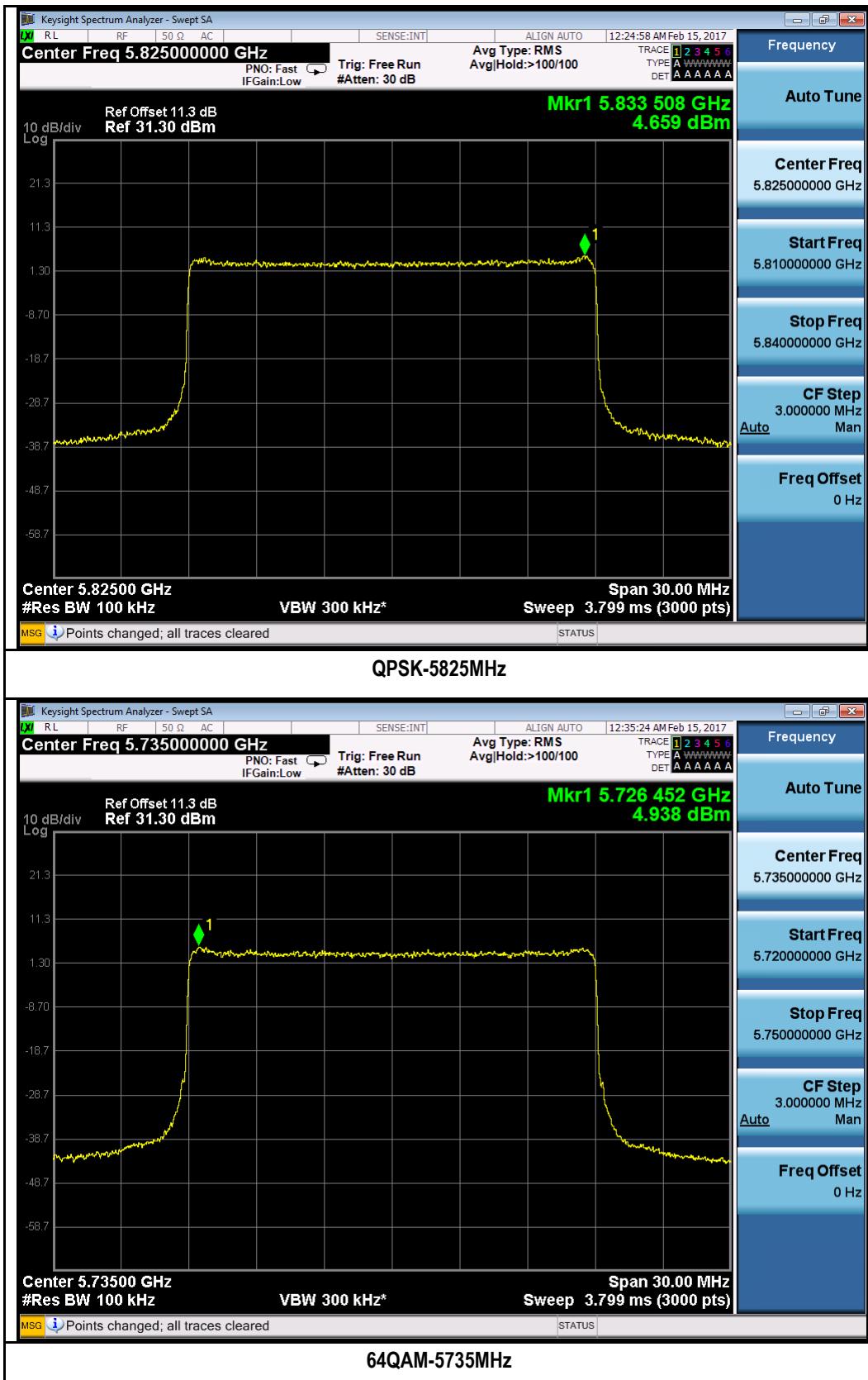


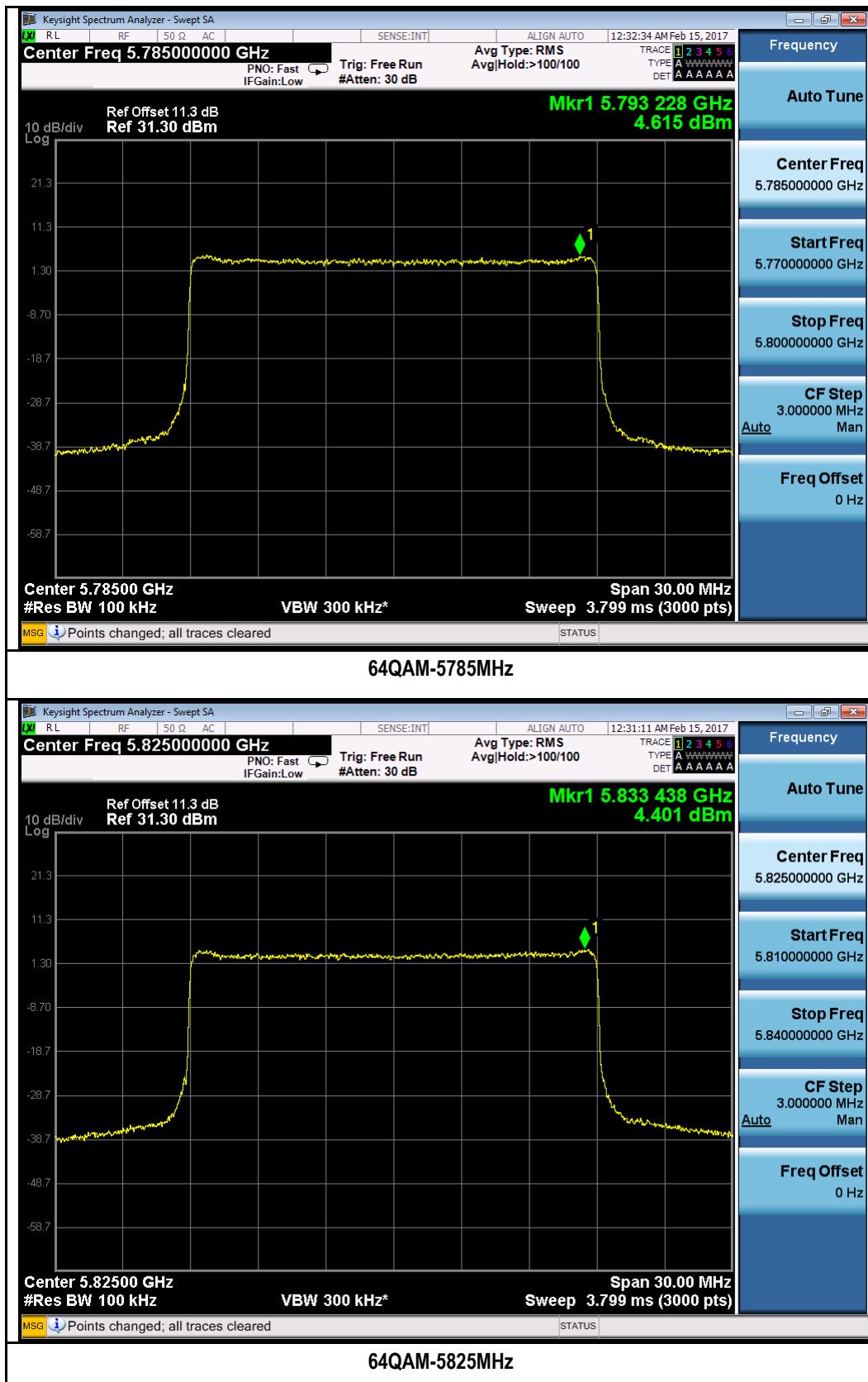


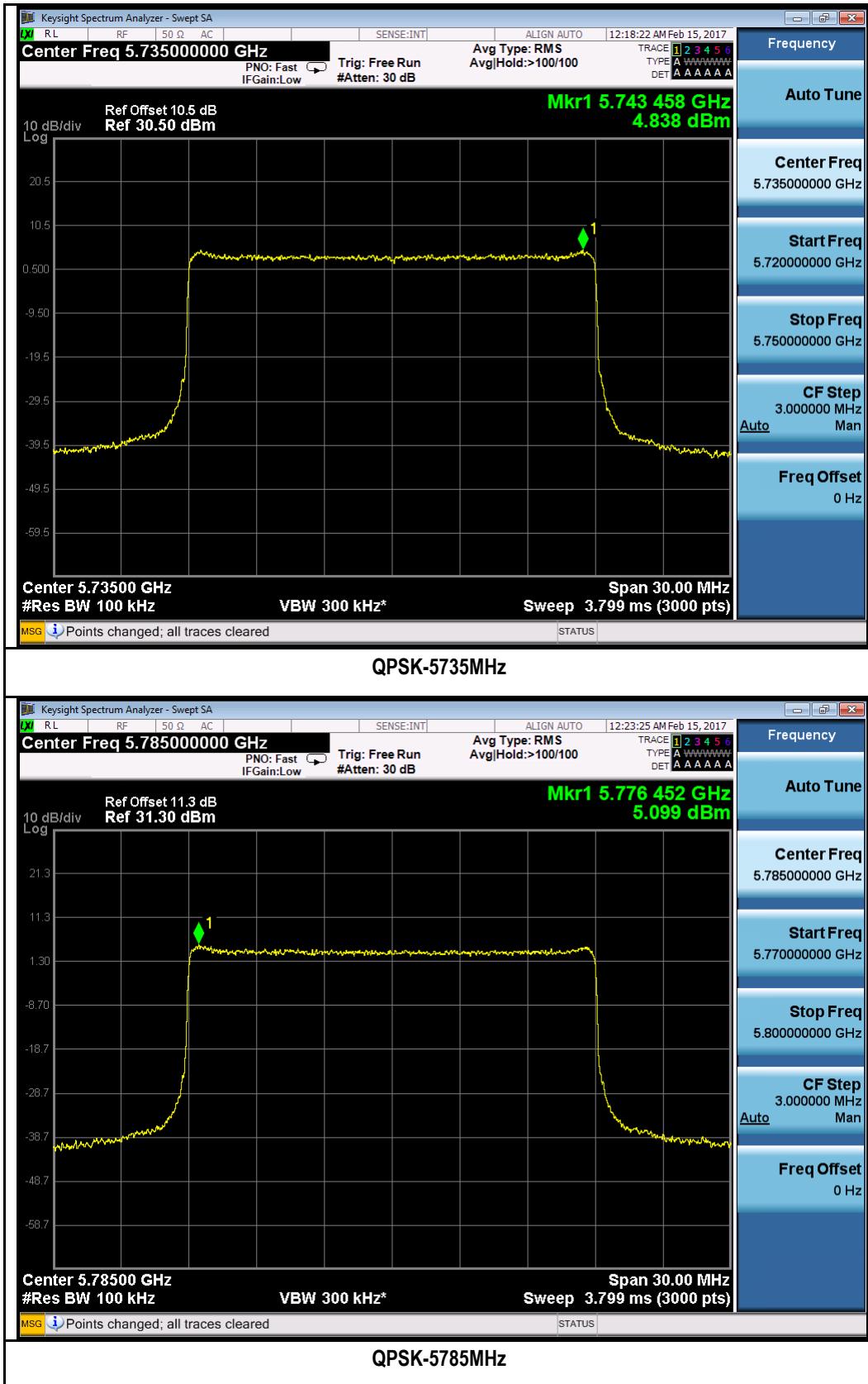
Test Plot for W58:

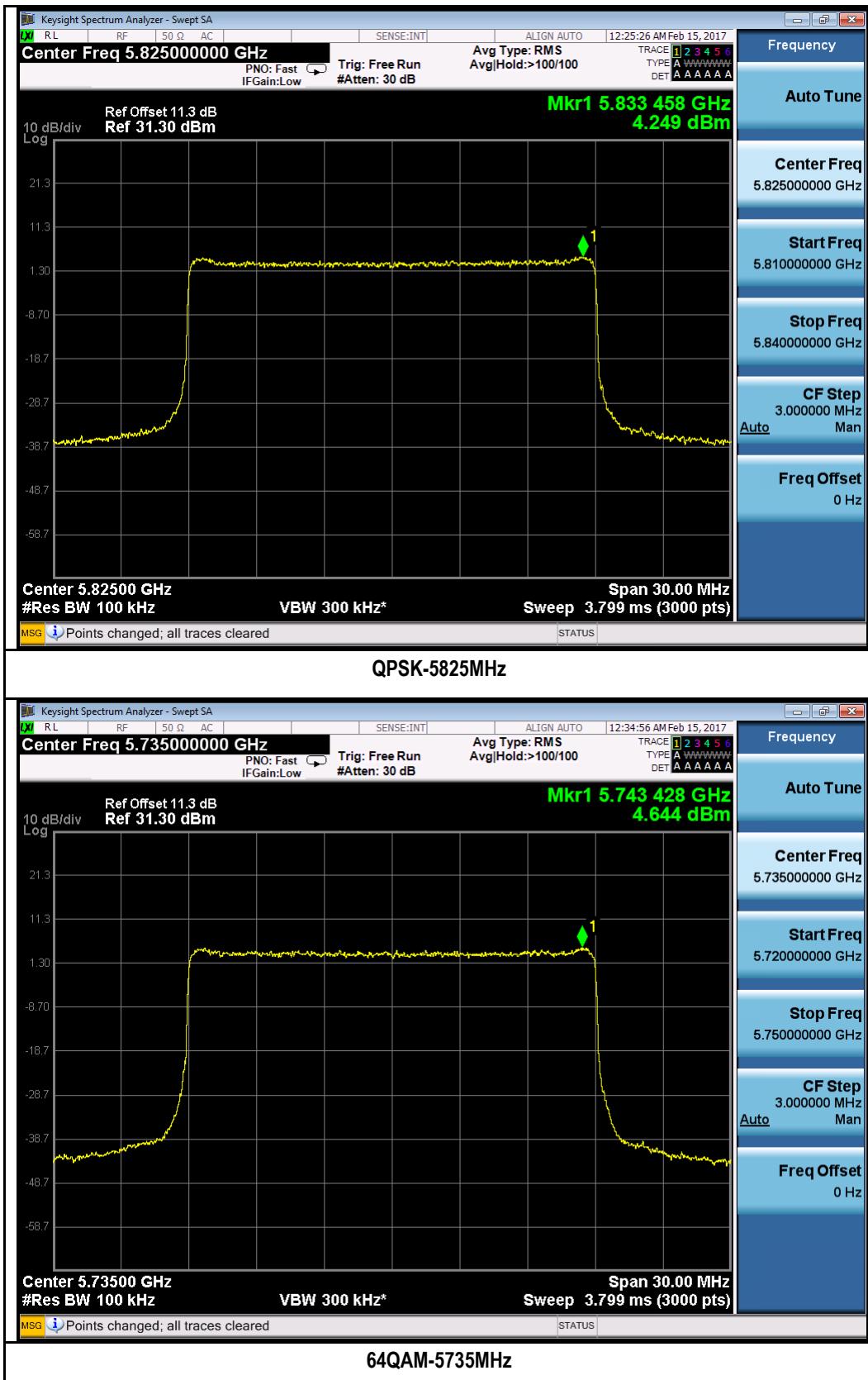
Chain 1:

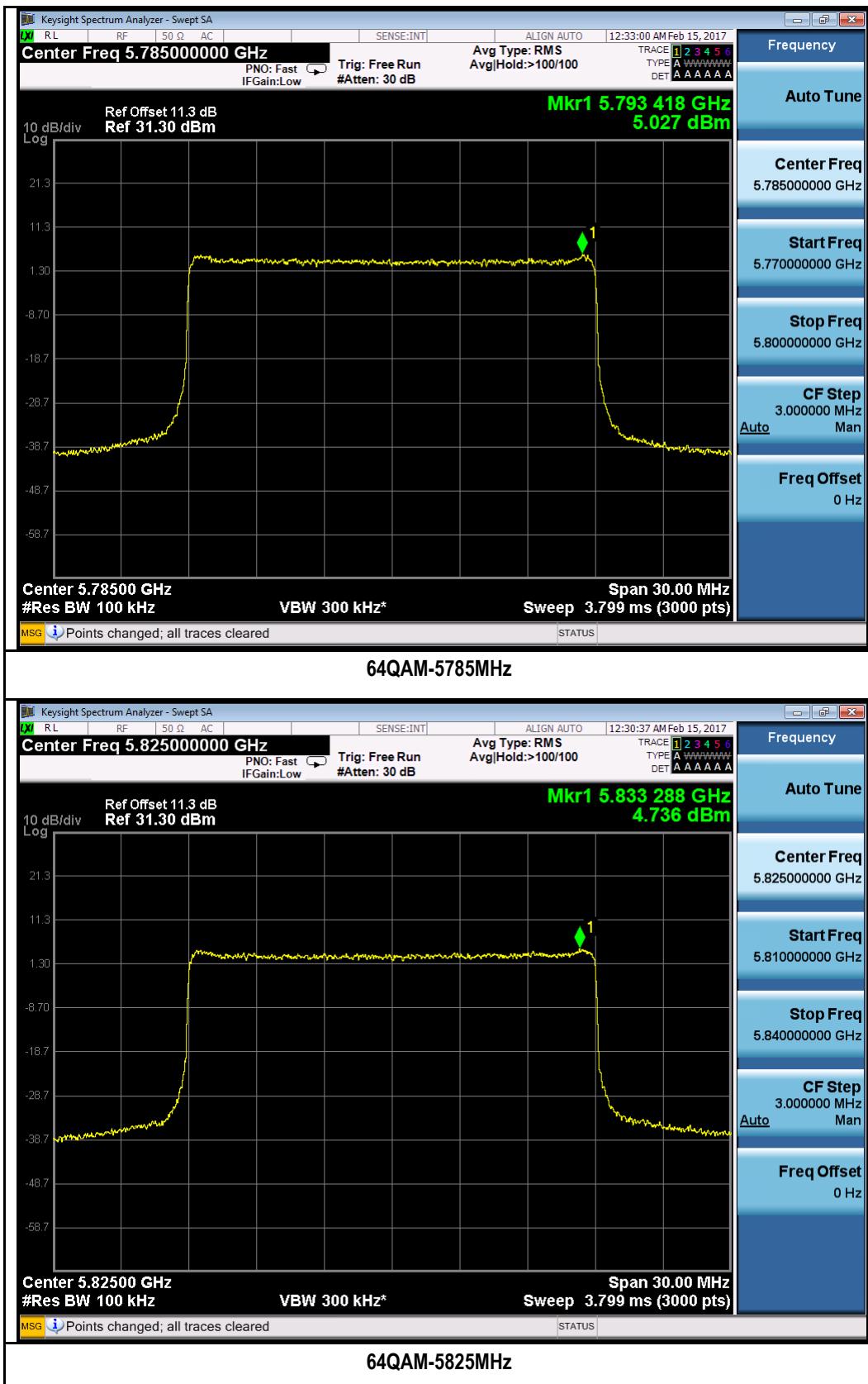






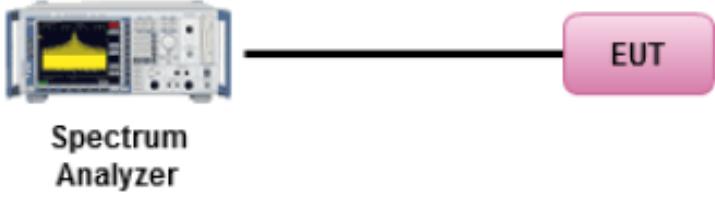
Chain 2:






10.5 Band Edge and Emission Mask Measurement

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§ 15.407(b)(2), 15.407(b)(6)	(1)	For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.	<input checked="" type="checkbox"/>
	(4)	For transmitters operating in the 5.725-5.825 GHz band: all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	<input checked="" type="checkbox"/>
Test Setup	 <p>Spectrum Analyzer → EUT</p>		
Procedure	<p>789033 D02 General UNII Test Procedures New Rules v01r02, II.F. Method SA-1</p> <p><u>Band Edge measurement:</u></p> <ul style="list-style-type: none"> - For average emissions measurements, follow the procedures described in section II.G.6., "Procedures for Average Unwanted Emissions Measurements above 1000 MHz", except for the following changes: - Set RBW=100kHz - Set VBW=300kHz - Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. 		
Remark	Antenna gain was added to the offset.		
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

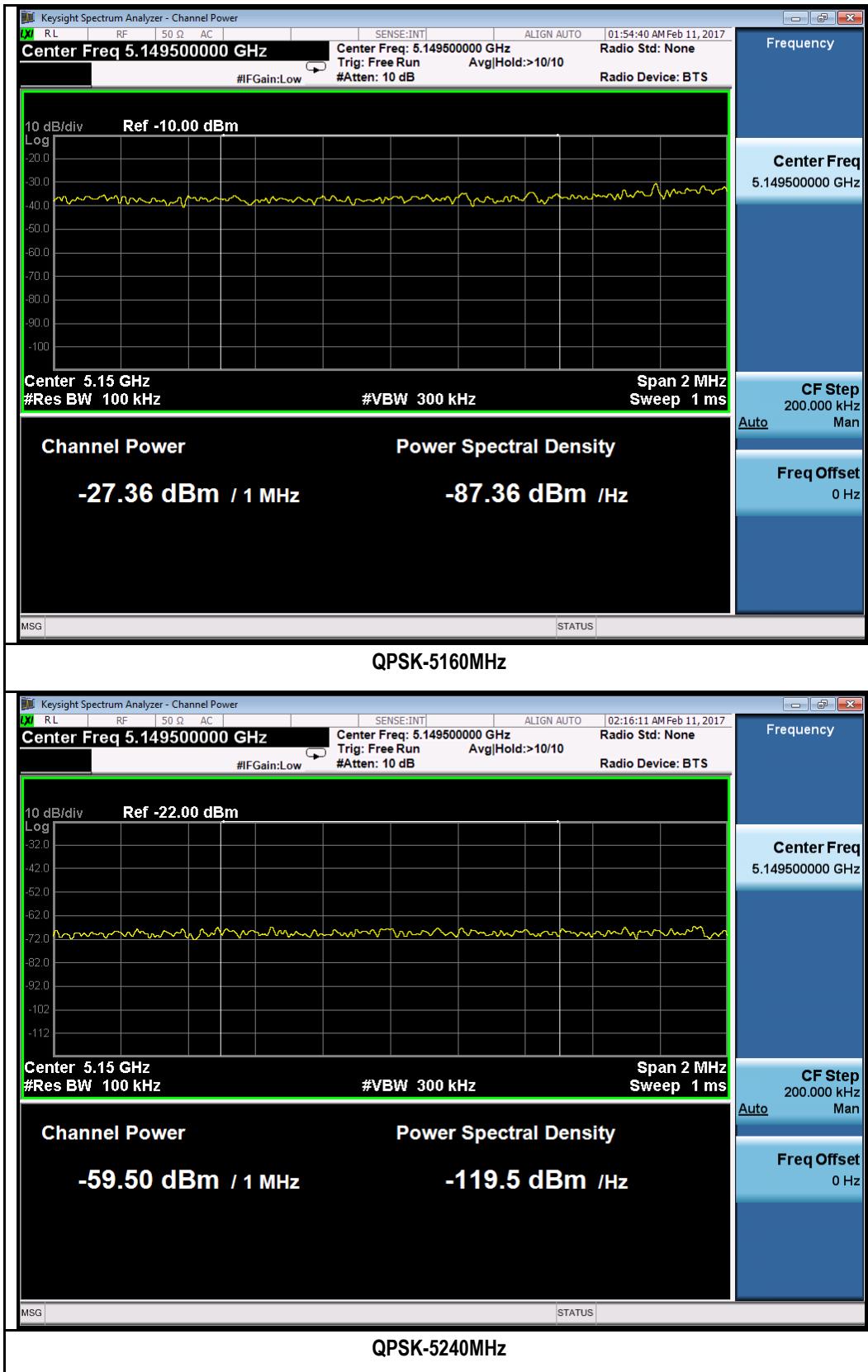
Test Data Yes (See below) N/A

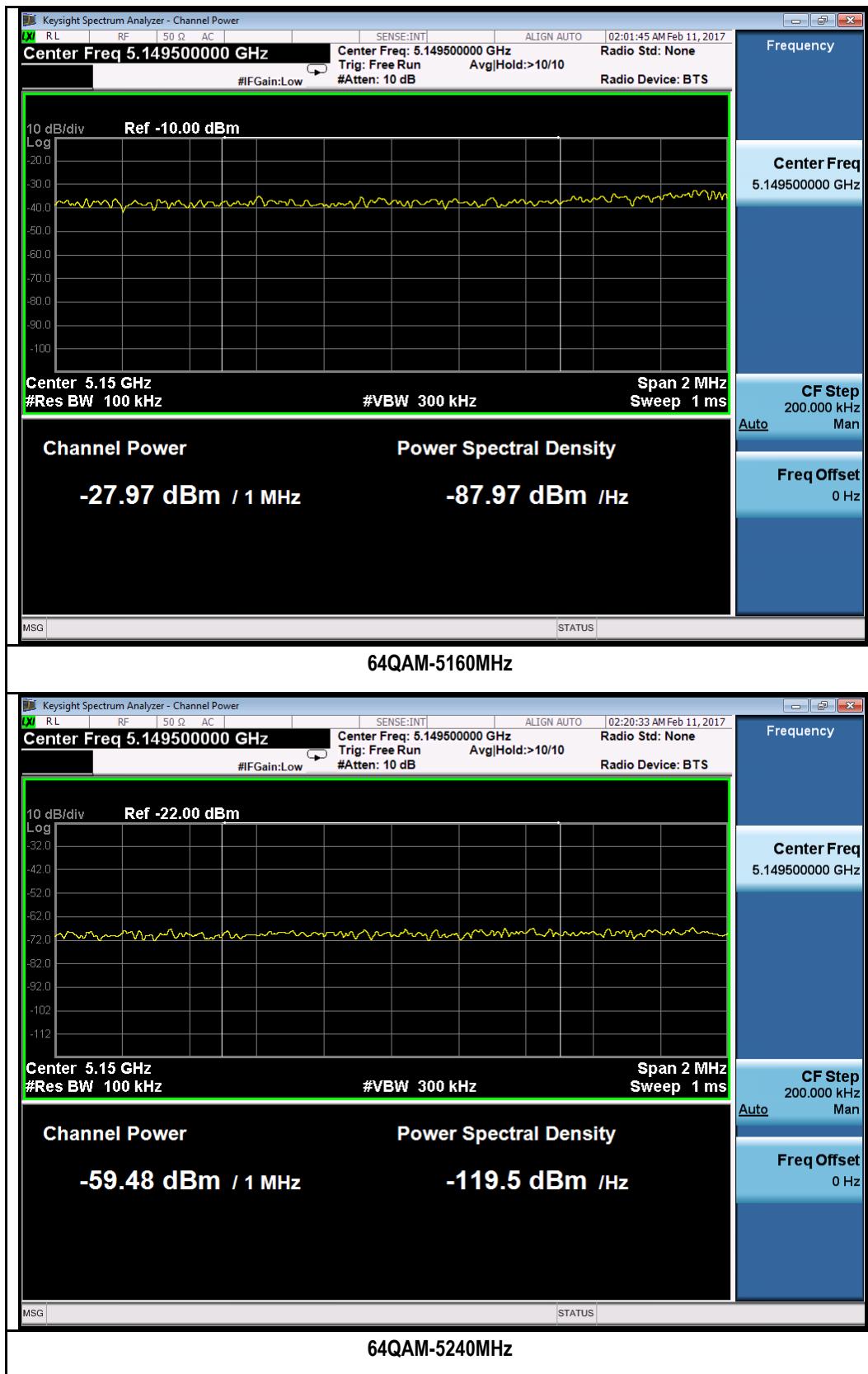
Test Plot Yes (See below) N/A

Test was done by Chen Ge at RF test site.

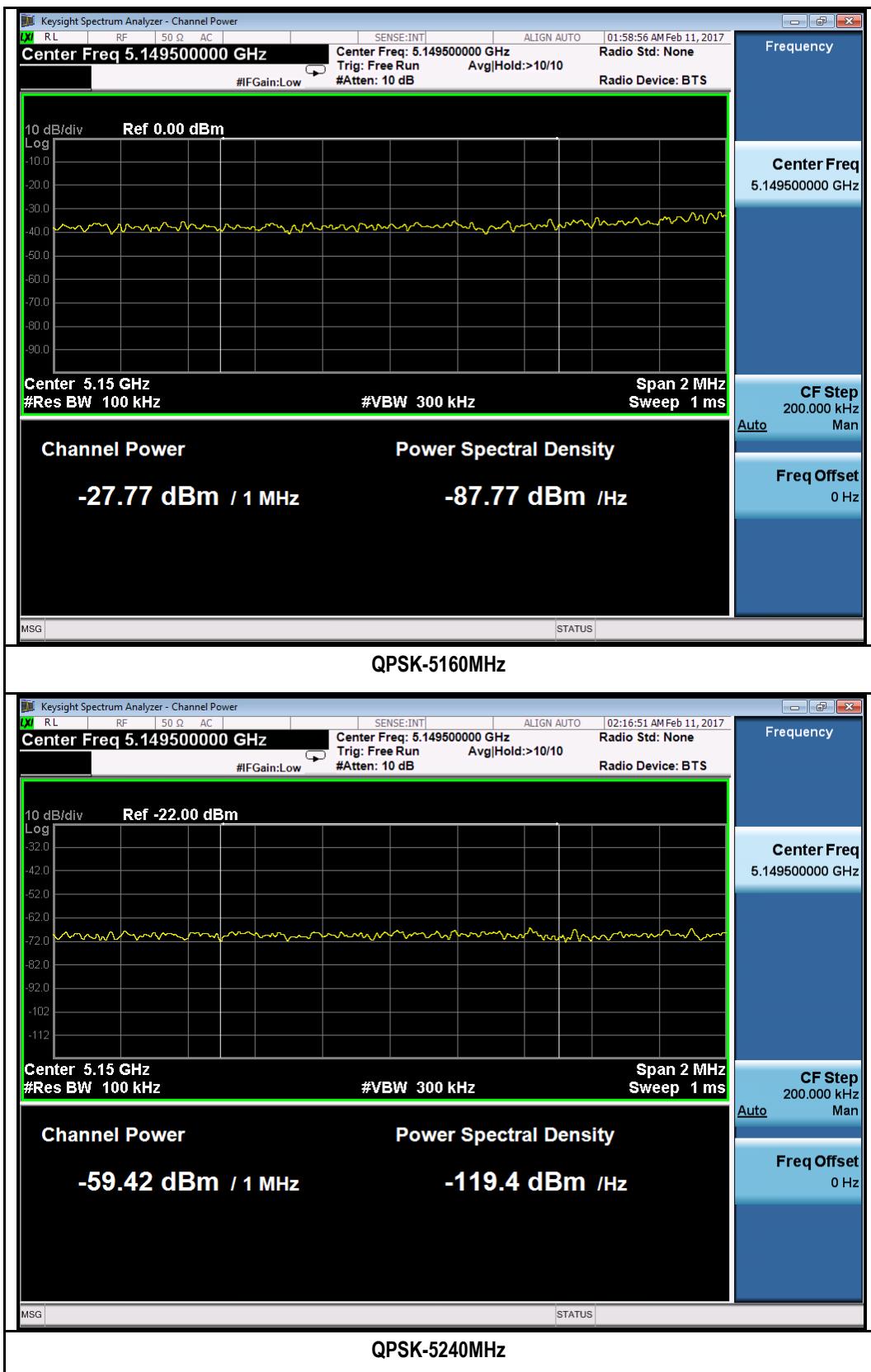
Test Plot for W52:

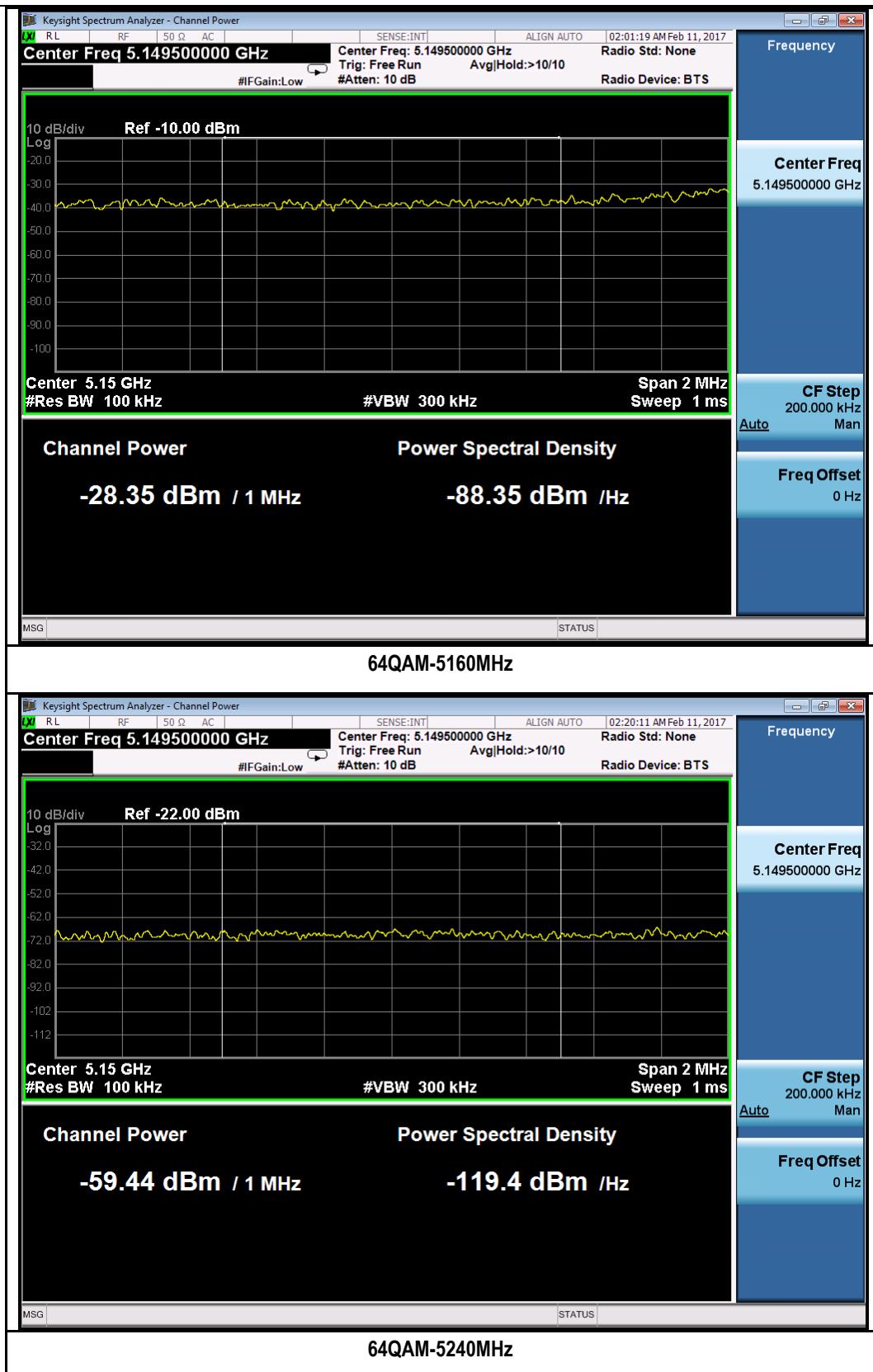
Chain 1:





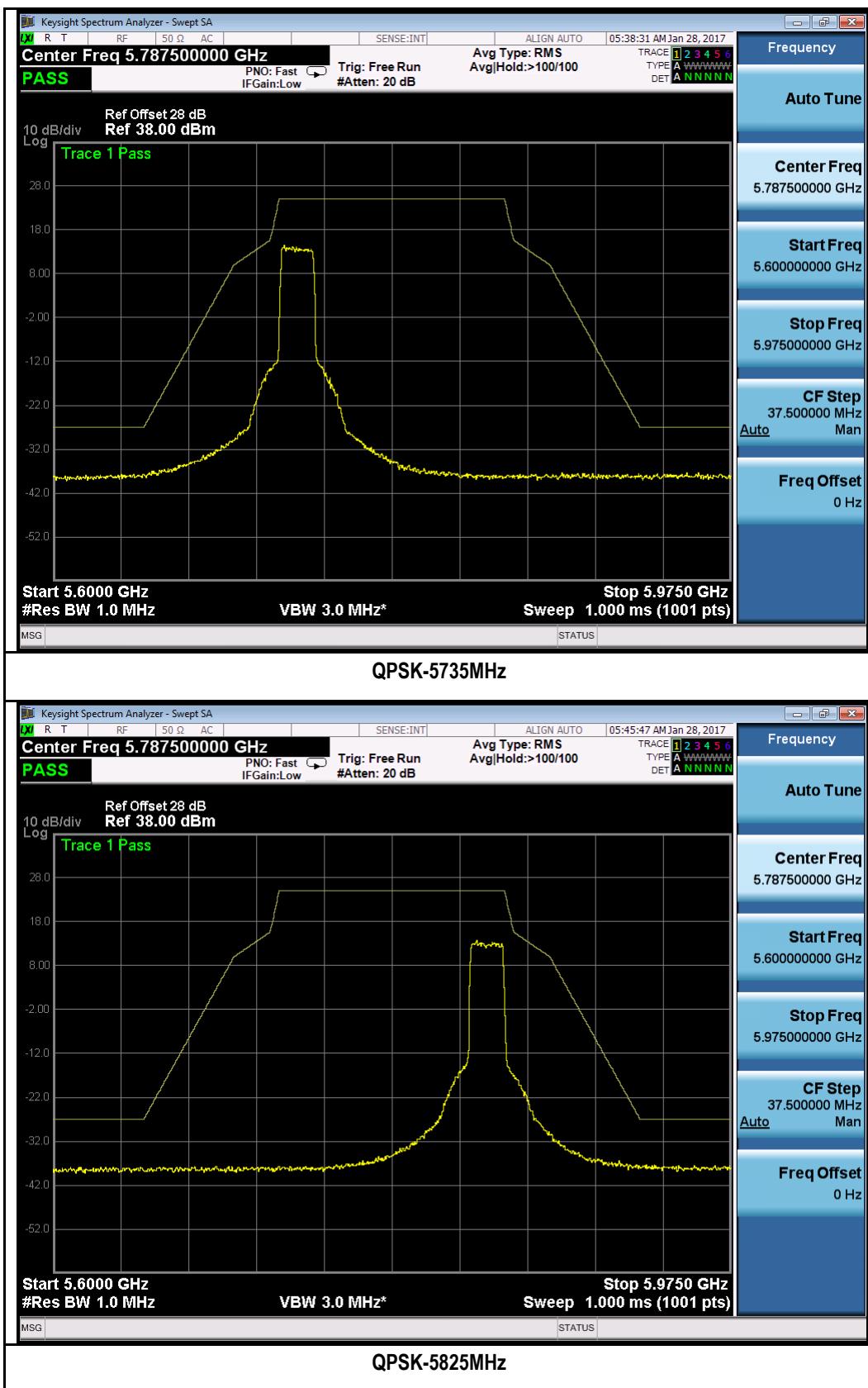
Chain 2:

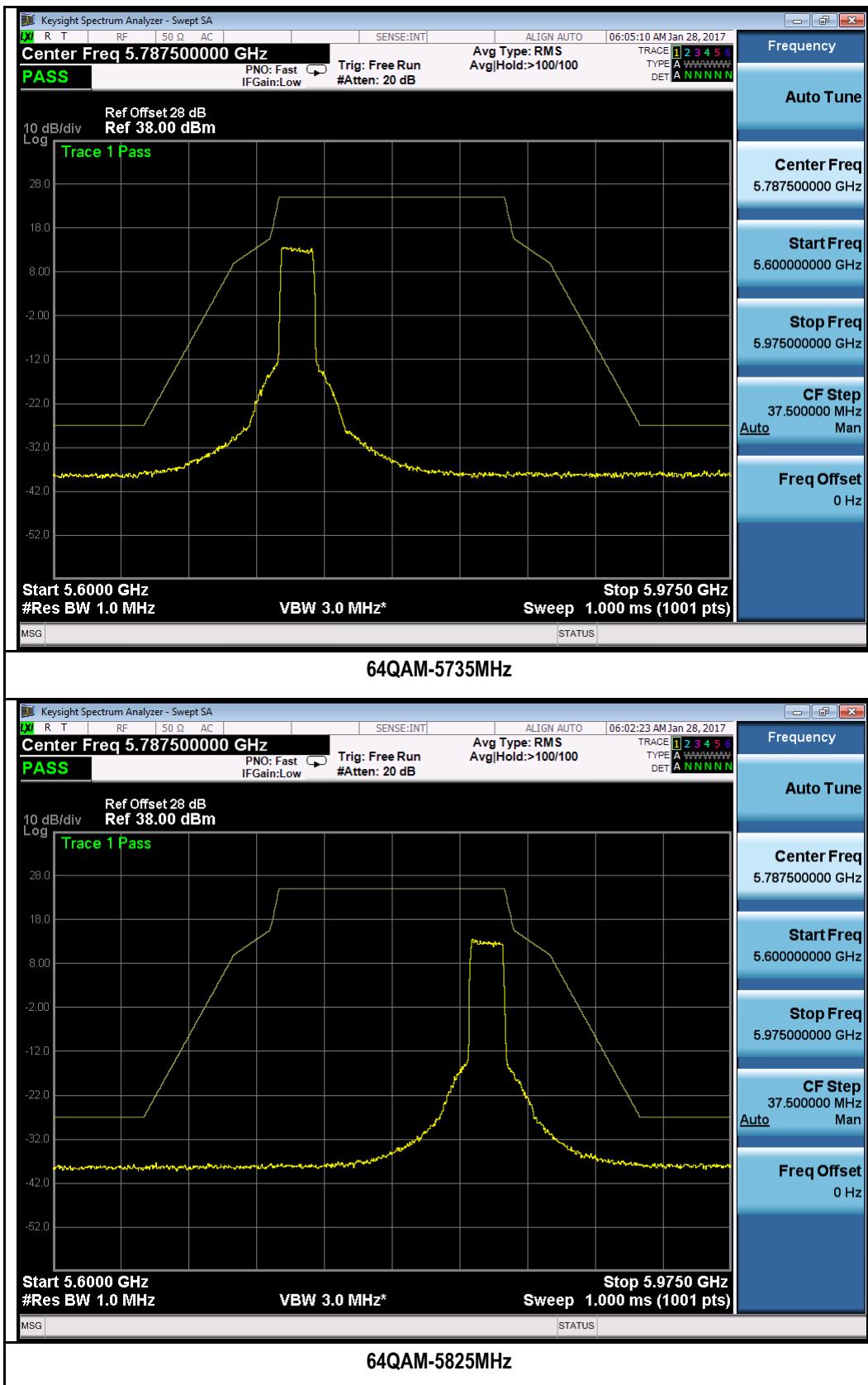




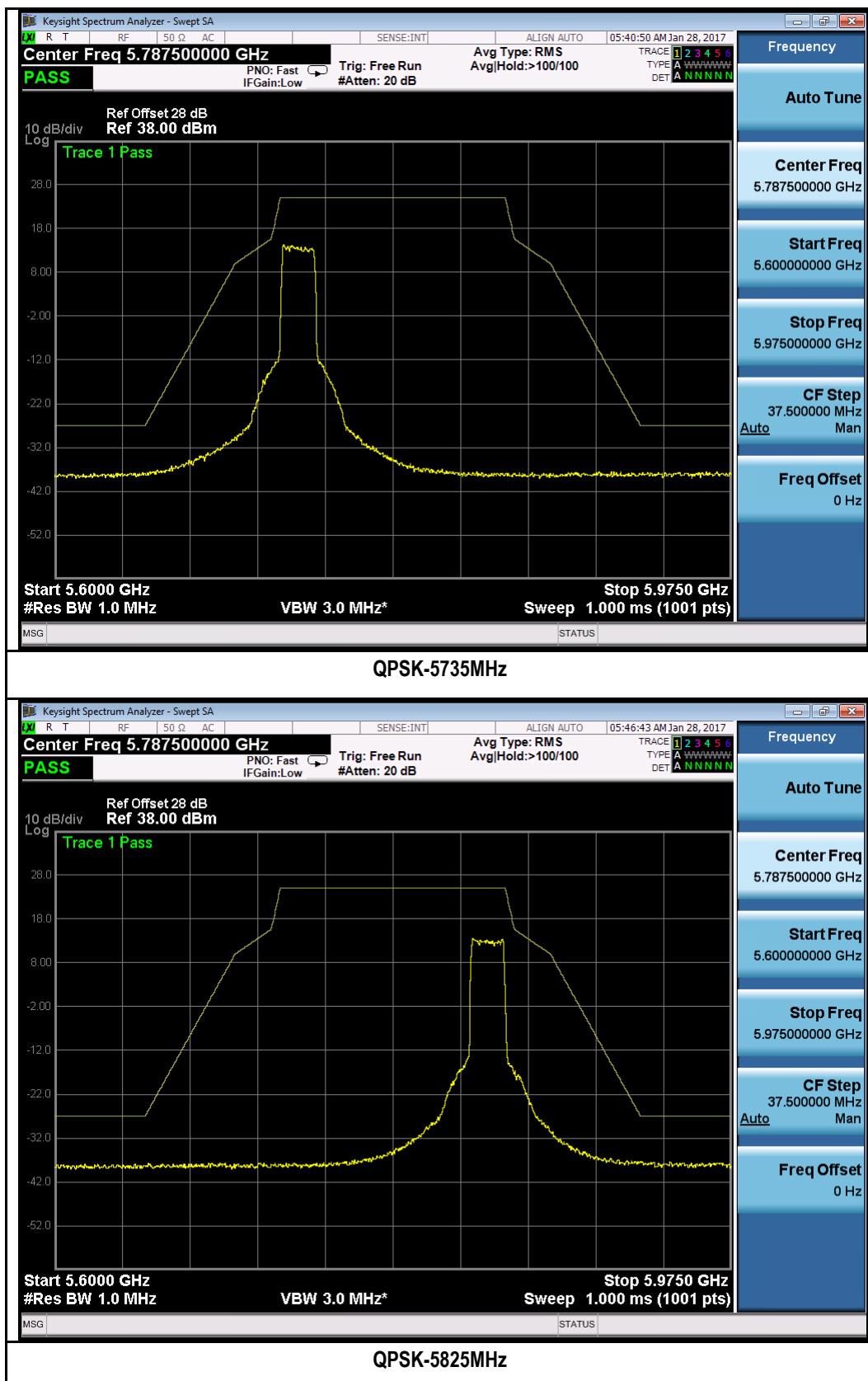
Test Plot for W58:

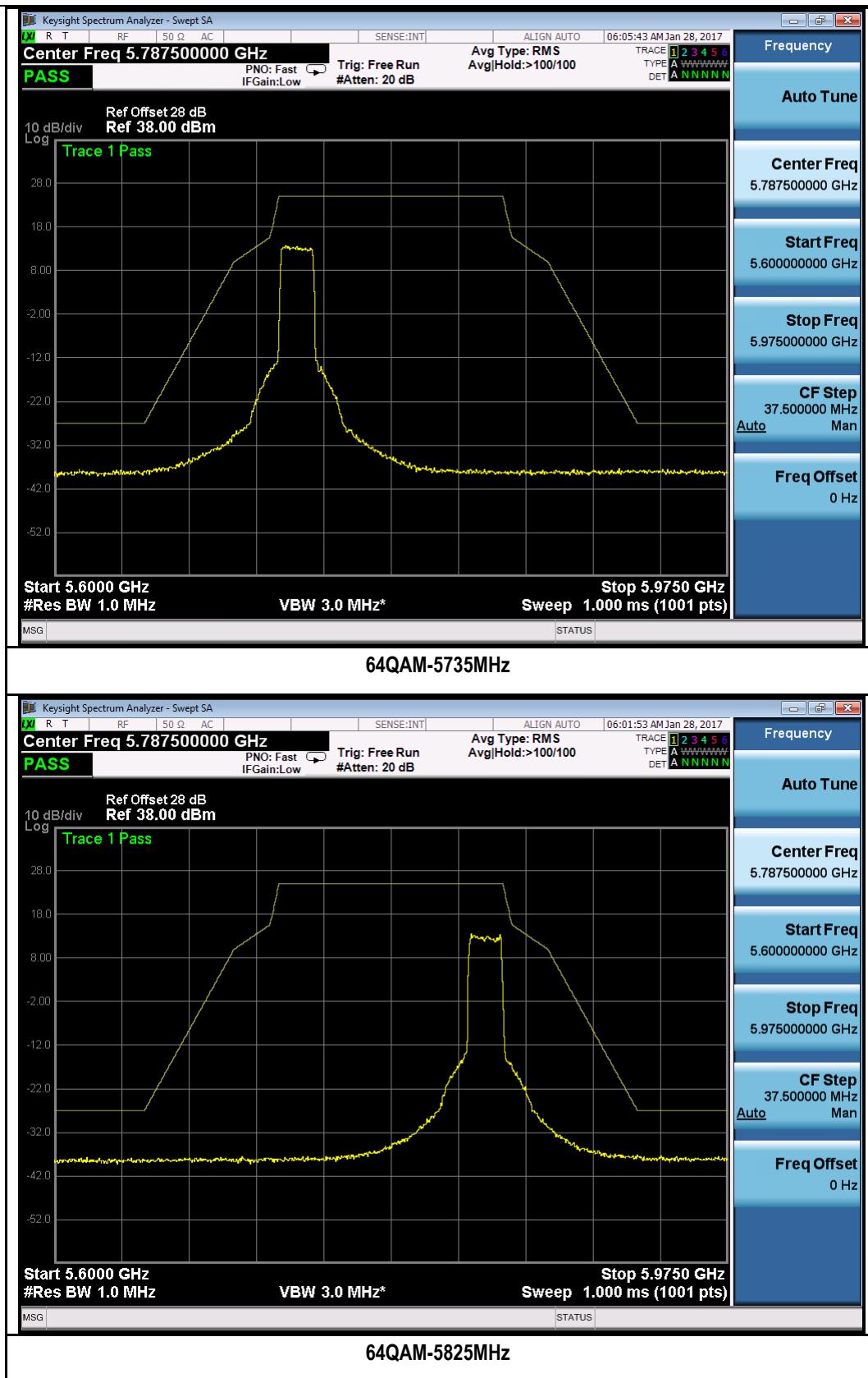
Chain 1:





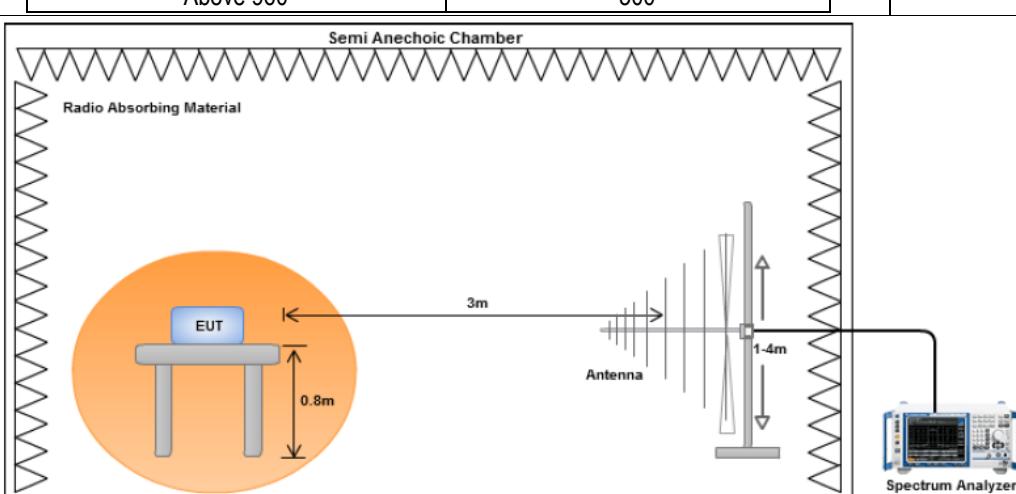
Chain 2:





10.6 Radiated Emissions below 1GHz

Requirement(s):

Spec	Requirement	Applicable										
47CFR§ 15.407(b) 15.209 (a)	<p>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges</p> <table border="1"> <thead> <tr> <th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr> </thead> <tbody> <tr> <td>30 – 88</td><td>100</td></tr> <tr> <td>88 – 216</td><td>150</td></tr> <tr> <td>216 – 960</td><td>200</td></tr> <tr> <td>Above 960</td><td>500</td></tr> </tbody> </table>	Frequency range (MHz)	Field Strength (uV/m)	30 – 88	100	88 – 216	150	216 – 960	200	Above 960	500	<input checked="" type="checkbox"/>
Frequency range (MHz)	Field Strength (uV/m)											
30 – 88	100											
88 – 216	150											
216 – 960	200											
Above 960	500											
Test Setup												
Procedure	<ol style="list-style-type: none"> 1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: <ol style="list-style-type: none"> a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. A Quasi-peak measurement was then made for that frequency point. 3. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured. 											
Remark	The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.											
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail											

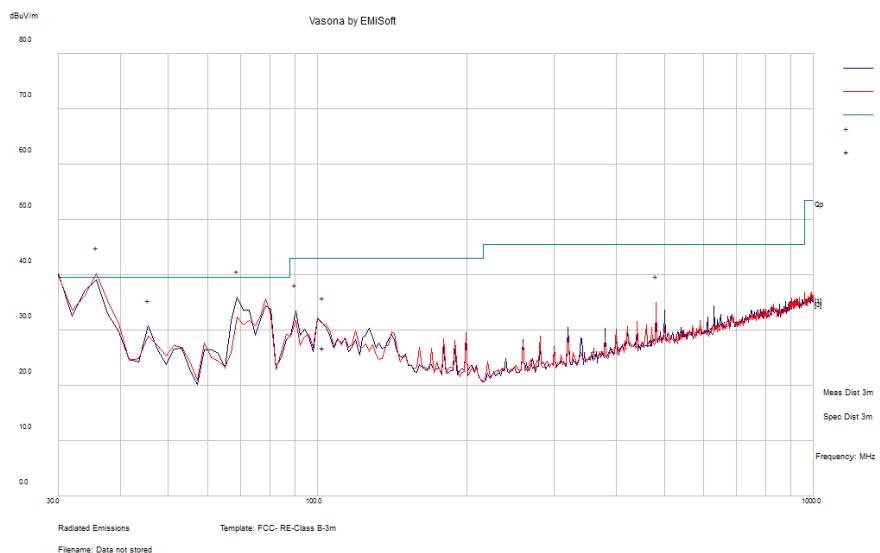
Test Data Yes (See below) N/A

Test Plot Yes (See below) N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification		below 1GHz	
Environmental Conditions:	Temp (°C):	26	Result Pass
	Humidity (%)	47	
	Atmospheric (mbar):	1020	
	Mains Power:	120VAC, 60Hz	
	Tested by:	Gary Chou	
	Test Date:	01/31/2017	
Remarks:		20MHz BW, 5200MHz	

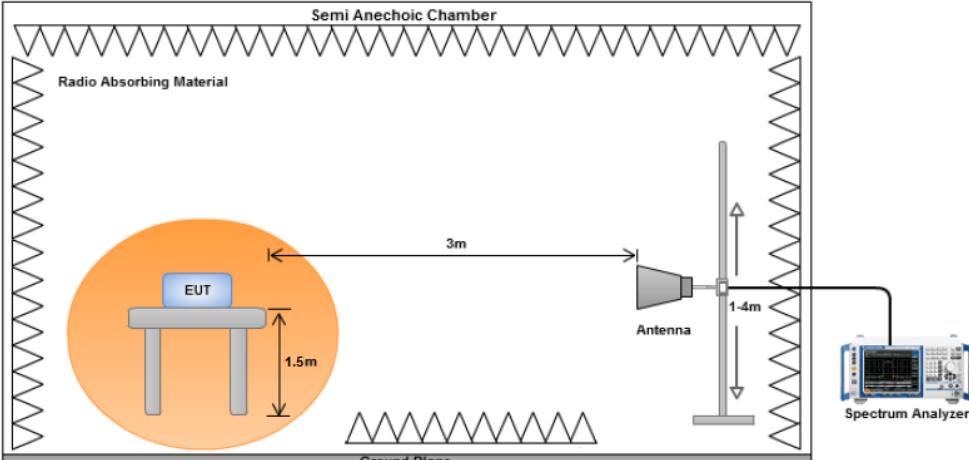


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
102.40	36.46	1.68	-11.35	26.78	Quasi Max	V	116	337	43	-16.22	Pass
35.67	31.99	1.1	-4.56	28.53	Quasi Max	V	391	258	39.5	-10.97	Pass
69.10	39.47	1.47	-14.04	26.9	Quasi Max	H	99	276	39.5	-12.6	Pass
45.34	29.37	1.25	-11.26	19.36	Quasi Max	H	99	118	39.5	-20.14	Pass
90.01	49.39	1.59	-13.99	36.98	Quasi Max	H	301	357	43	-6.02	Pass
481.14	24.37	3.54	-4.49	23.41	Quasi Max	V	253	119	45.5	-22.09	Pass

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

10.7 Radiated Spurious Emissions above 1GHz

Requirement(s):

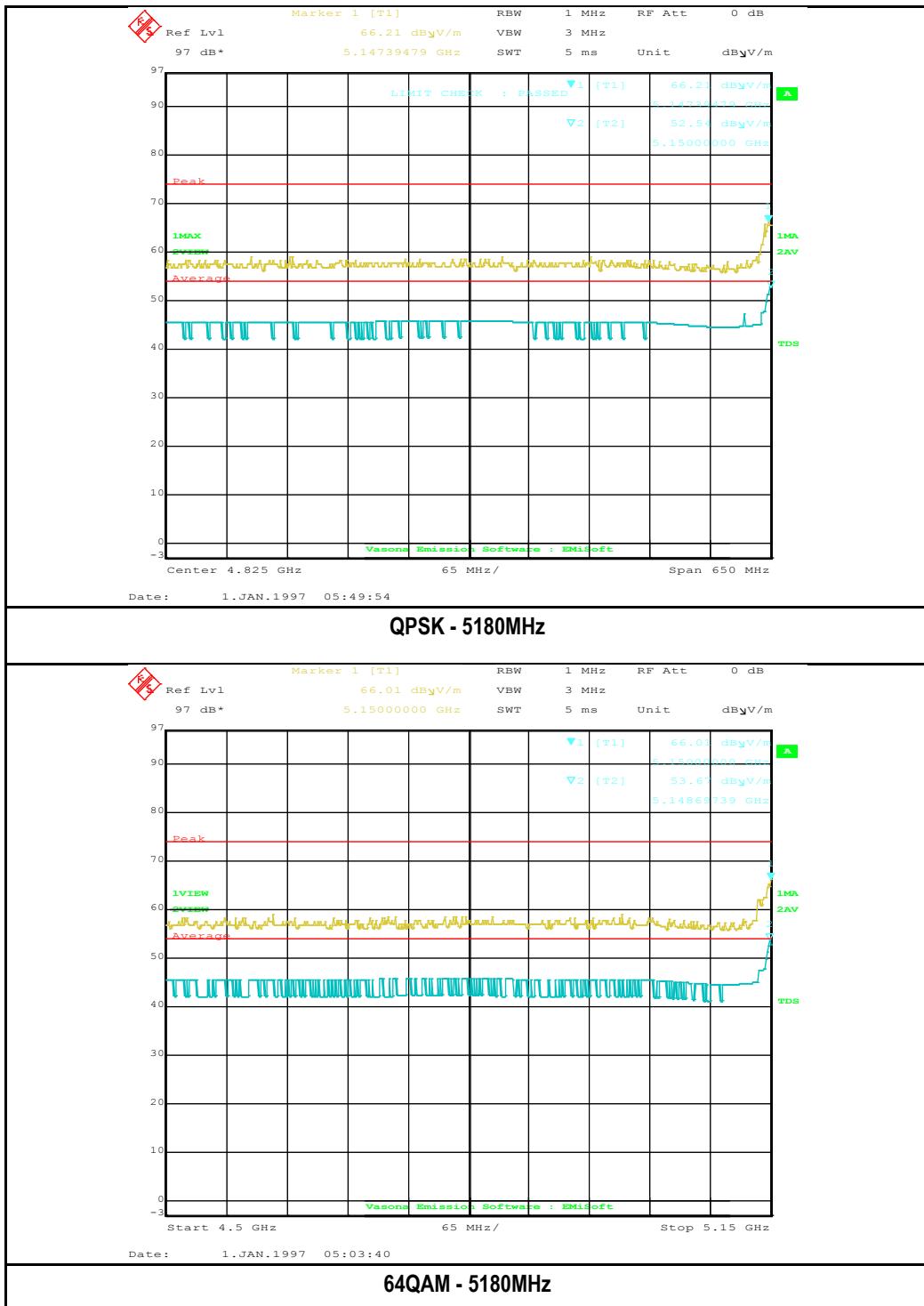
Spec	Item	Requirement	Applicable
47CFR§ 15.407(b)(2), 15.407(b)(6)	(1)	For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.	<input checked="" type="checkbox"/>
	(2)	For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.	<input type="checkbox"/>
	(3)	For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.	<input type="checkbox"/>
	(4)	For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.	<input checked="" type="checkbox"/>
	(5)	Restricted band, emission must also comply with the radiated emission limits specified in 15.209	<input checked="" type="checkbox"/>
Test Setup			
Procedure	1. 2. 3. 4.	<p>The EUT was switched on and allowed to warm up to its normal operating condition.</p> <p>The test was carried out at the selected frequency points obtained from the EUT characterisation.</p> <p>Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:</p> <ol style="list-style-type: none"> Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. The EUT was then rotated to the direction that gave the maximum emission. Finally, the antenna height was adjusted to the height that gave the maximum emission. <p>An average measurement was then made for that frequency point.</p> <p>Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</p>	
Remark	The EUT was scanned up to 40GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	<input checked="" type="checkbox"/> Pass	<input type="checkbox"/> Fail	

Test Data Yes (See below) N/A

Test Plot Yes (See below) N/A

Test was done by Gary Chou at 10m chamber.

Restricted Band Measurement Plots:



Radiated Emission Test Results (Above 1GHz)

1GHz-40GHz – 5160MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1885.25	44.99	3.15	-12.38	35.75	Peak Max	V	164	338	74	-38.25	Pass
3550.57	43.35	4.31	-7.2	40.47	Peak Max	V	180	72	74	-33.53	Pass
10320.20	39.84	7.88	2.1	49.83	Peak Max	V	120	72	74	-24.17	Pass
1885.25	33.48	3.15	-12.38	24.24	Average Max	V	164	338	54	-29.76	Pass
3550.57	31.54	4.31	-7.2	28.66	Average Max	V	180	72	54	-25.35	Pass
10320.20	28.29	7.88	2.1	38.28	Average Max	V	120	72	54	-15.72	Pass

1GHz-40GHz – 5200MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1884.03	45.45	3.15	-12.39	36.21	Peak Max	V	194	283	74	-37.79	Pass
3552.64	43.26	4.31	-7.19	40.38	Peak Max	V	190	42	74	-33.62	Pass
10400.53	40.57	7.68	2.36	50.61	Peak Max	V	107	19	74	-23.39	Pass
1884.03	33.52	3.15	-12.39	24.27	Average Max	V	194	283	54	-29.73	Pass
3552.64	31.84	4.31	-7.19	28.96	Average Max	V	190	42	54	-25.04	Pass
10400.53	29.03	7.68	2.36	39.07	Average Max	V	107	19	54	-14.93	Pass

1GHz-40GHz – 5240MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1869.92	45.17	3.13	-12.49	35.81	Peak Max	V	137	132	74	-38.19	Pass
3552.99	43.67	4.31	-7.19	40.79	Peak Max	V	126	326	74	-33.21	Pass
10480.61	41.24	7.61	1.86	50.71	Peak Max	V	171	290	74	-23.29	Pass
1869.92	33.18	3.13	-12.49	23.82	Average Max	V	137	132	54	-30.18	Pass
3552.99	31.62	4.31	-7.19	28.74	Average Max	V	126	326	54	-25.26	Pass
10480.61	28.86	7.61	1.86	38.34	Average Max	V	171	290	54	-15.67	Pass

1GHz-40GHz – 5735MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1869.92	45.17	3.13	-12.49	35.81	Peak Max	V	137	132	74	-38.19	Pass
3550.51	43.2	4.31	-7.2	40.32	Peak Max	V	145	187	74	-33.69	Pass
11470.65	40.06	7.56	1.98	49.6	Peak Max	V	182	276	74	-24.4	Pass
1869.92	33.18	3.13	-12.49	23.82	Average Max	V	137	132	54	-30.18	Pass
3550.51	31.46	4.31	-7.2	28.58	Average Max	V	145	187	54	-25.42	Pass
11470.65	28.44	7.56	1.98	37.98	Average Max	V	182	276	54	-16.02	Pass

1GHz-40GHz – 5785MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1915.66	45.09	3.18	-12.2	36.07	Peak Max	V	175	356	74	-37.93	Pass
3551.22	44.08	4.31	-7.2	41.19	Peak Max	V	198	296	74	-32.81	Pass
11575.66	39.22	7.52	1.88	48.62	Peak Max	V	110	126	74	-25.39	Pass
1915.66	33.17	3.18	-12.2	24.15	Average Max	V	175	356	54	-29.85	Pass
3551.22	31.92	4.31	-7.2	29.03	Average Max	V	198	296	54	-24.97	Pass
11575.66	27.79	7.52	1.88	37.18	Average Max	V	110	126	54	-16.82	Pass

1GHz-40GHz – 5825MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
1918.23	44.16	3.18	-12.19	35.15	Peak Max	V	115	213	74	-38.85	Pass
3533.48	43.76	4.3	-7.25	40.8	Peak Max	V	172	271	74	-33.2	Pass
11680.98	39.99	7.24	0.17	47.4	Peak Max	V	150	336	74	-26.6	Pass
1918.23	33	3.18	-12.19	24	Average Max	V	115	213	54	-30.01	Pass
3533.48	31.88	4.3	-7.25	28.92	Average Max	V	172	271	54	-25.08	Pass
11680.98	28.23	7.24	0.17	35.63	Average Max	V	150	336	54	-18.37	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	06/08/2018	1 Year	06/08/2019	<input checked="" type="checkbox"/>
CHASE LISN	MN2050B	1018	08/07/2018	1 Year	08/07/2019	<input checked="" type="checkbox"/>
Radiated Emissions						
Keysight EXA 44GHz Spectrum Analyzer	N9030B(PXA)	MY57140374	09/06/2017	1 Year	09/06/2018	<input checked="" type="checkbox"/>
Keysight Signal Generator	MXG N5182A	MY47071065	07/12/2018	1 Year	07/12/2019	<input checked="" type="checkbox"/>
Pre-Amplifier (1-26.5GHz)	8449B	3008A00715	08/16/2018	1 Year	08/16/2019	<input checked="" type="checkbox"/>
RF Preamplifier (100KHz-7GHz)	LPA-6-30	11170602	05/09/2018	1 Year	05/09/2019	<input checked="" type="checkbox"/>
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	03/09/2018	2 Year	03/09/2020	<input checked="" type="checkbox"/>
Horn Antenna (1GHz~26GHz)	3115	100059	11/09/2017	1 Year	11/09/2018	<input checked="" type="checkbox"/>
Horn Antenna (700MHz-18GHz)	SAS-571	411	05/13/2018	1 Year	05/13/2019	<input checked="" type="checkbox"/>
RF Conducted Measurement						
Keysight EXA 44GHz Spectrum Analyzer	N9030B(PXA)	MY57140374	09/06/2017	1 Year	09/06/2018	<input checked="" type="checkbox"/>

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		Radio & Telecommunications Terminal Equipment: EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)	 	Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		(Phase II) OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		Radio: Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		<p>Radio: A1. Terminal equipment for purpose of calling</p> <p>Telecom: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law</p>
Korea CAB Accreditation		<p>EMI: KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI</p> <p>EMS: KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS</p>
Taiwan NCC CAB Recognition		<p>Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68</p> <p>Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4</p>
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		<p>R-3083: Radiation 3 meter site</p> <p>C-3421: Main Ports Conducted Interference Measurement</p> <p>T-1597: Telecommunication Ports Conducted Interference Measurement</p>
Australia CAB Recognition		<p>EMC: AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4</p> <p>Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771</p> <p>Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1</p>
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016, AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2