Compliance Testing, LLC
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Test Report

Prepared for: EMS Technologies Canada, Ltd

Model: A781-200

FCC ID: K6KA781-MK3

Description: A781-200 Satcom Transceiver

To

FCC Part 87

Date of Issue: May 25, 2012

On the behalf of the applicant:	**EMS Technologies Canada, Ltd.** **400 Maple Grove Rd.** **Ottawa, Ontario K2V 1B8** **Canada**
Attention of:	**Gilles Robitaille, Certification REA** **Ph: (613) 591-9064, ext. 3244** **E-Mail: Robitaille.g@emsaviation.com**

Prepared by

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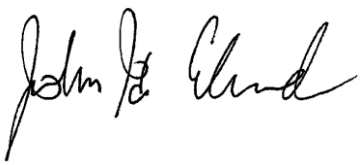
Project No: p1250003



John Erhard

Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	May 25, 2012	John Erhard	Original Document
1.0	June 13, 2012	John Erhard	Update emissions designator in necessary BW calculations

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ILAC / A2LA

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated January 2009)

The tests results contained within this test report all fall within our scope of accreditation, unless noted below

Please refer to http://www.compliancetesting.com/labscope.html for current scope of accreditation.

Testing Certificate Number: **2152.01**

FCC OATS Reg, #933597

IC Reg. #2044A-1

Non-accredited tests contained in this report:

N/A

Standard Test Conditions Engineering Practices

Except as noted herein, the following conditions and procedures were observed during the testing.

In accordance with ANSI C63.10-2009 and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10° to 40°C (50° to 104°F) unless the particular equipment requirements specify testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

Measurement results, unless otherwise noted, are worst-case measurements.

Environmental Conditions		
Temperature (° C)	**Humidity (%)**	**Pressure (mbar)**
23.50	**32.90**	**965.200**

EUT Description

Model: A781-200
Description: A781-200 Satcom Transceiver
Firmware: N/A
Software: N/A
Additional Information:

Aircraft born satellite communication system

EUT Operation during Testing:

The EUT was in a normal hardware configuration with test software for manual operation of the EUT.

Accessories: None

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	Standard aircraft equipment tray with associated cabling	Various	Y	Y	No

Modifications: None

Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
2.1046, 87.131	Carrier Output Power (Conducted)	Pass	
2.1051, 87.139(i)(1)	Unwanted Emissions (Transmitter Conducted)	Pass	
2.1053	Field Strength of Spurious Radiation	Pass	
2.1049, 87.139(i)(3)	Emission Masks (Occupied Bandwidth)	Pass	See FCC waiver for allowable variance
2.1047	Audio Low Pass Filter (Voice Input)	N/A	The EUT does not contain an audio input
2.1047	Audio Frequency Response	N/A	The EUT does not contain an audio input
2.1047	Modulation Limiting	N/A	The EUT does not contain an audio input
2.1055, 87.133(a)	Frequency Stability (Temperature Variation)	Pass	
2.1055, 87.133(a)	Frequency Stability (Voltage Variation)	Pass	

A waiver has been granted for this device which includes QAM modulation and extended operational bandwidth. See the waiver for specific details.

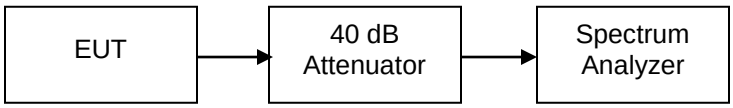
Carrier Output Power (Conducted)

Name of Test:	Carrier Output Power (Conducted)	**Engineer:**	John Erhard
Test Equipment Utilized:	06143, i00331, Weinschel #48-40-43	**Test Date:**	5/16/2012

Test Procedure

The Equipment Under Test (EUT) was connected directly to a spectrum analyzer with the RBW set to 1 MHz and the VBW set to 3 X RBW which set the RBW greater than the transmit signal ensuring there was no signal suppression while measuring a modulated signal. The peak readings were taken for each modulation type and the result was then compared to the limit.

Test Setup



BPSK Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Power (dBm)	Measured Power (W)	Limit (W)	Result
1626.5	45.02	31.77	60	Pass
1643.5	44.95	31.26	60	Pass
1660.5	45.00	31.62	60	Pass

QPSK Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Power (dBm)	Measured Power (W)	Limit (W)	Result
1626.5	45.01	31.70	60	Pass
1643.5	44.92	31.06	60	Pass
1660.5	45.03	31.84	60	Pass

QAM Transmitter Peak Output Power

Tuned Frequency (MHz)	Measured Power (dBm)	Measured Power (W)	Limit (W)	Result
1626.5	44.99	31.55	60	Pass
1643.5	45.05	31.99	60	Pass
1660.5	44.92	31.05	60	Pass

A waiver has been granted for QAM modulation.

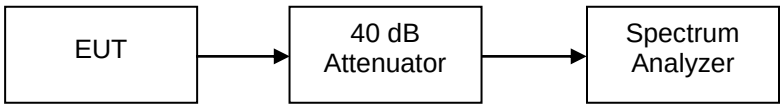
Conducted Spurious Emissions

Name of Test:	Conducted Spurious Emissions	Engineer: John Erhard
Test Equipment Utilized:	06143, i00331, Weinschel #48-40-43	Test Date: 5/17/2012

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the UUT met the requirements for spurious emissions. The RBW was set according to the requirements of 87139 (i)(1). The power was corrected for the measurement RBW bandwidth. The dBc limit, the DLNA rejection, and corrected power were summed together to determine the necessary dBm value of the EUT to provide a system rejection greater than the FCC limit. This necessary value was compared to the measured value to ensure compliance to the specification, which is expressed as the margin. A negative value indicates a passing result.

Test Setup



BPSK 1626.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.79	46.04	-8.96	-49.23	-40.27
1525 to 1559	-203	0.004	120	44.79	46.04	-36.96	-55.52	-18.56
1559 to 1585	-155	1	111	45	45.00	1.00	-28.8	-29.80
1585 to 1605	-143	1	95	45	45.00	-3.00	-29.03	-26.03
1605 to1610	-117	1	62	45	45.00	-10.00	-27.93	-17.93
1610 to 1610.6	-95	1	40	45	45.00	-10.00	-28.13	-18.13
1610.6 to 1613.8	-49	1	40	45	45.00	36.00	-25.27	-61.27
1613.8 to 1614	-95	1	40	45	45.00	-10.00	-24.36	-14.36
1614 to 1620	-70	0.004	30	44.79	46.04	6.04	-30.07	-36.11
1620 to 1624.5	-70	0.004	20	44.79	46.04	-3.96	-38.1	-34.14
1624.5 to 1625.5	-70	0.004	10	44.79	46.04	-13.96	-36.12	-22.16
1625.5 to 1626.5	-70	0.004	1.3	44.79	46.04	-22.66	-35.93	-13.27
1626.5 to 1660	-70	0.004	0.8	44.79	46.04	-23.16	-34.25	-11.09
1660 to 1670	-19.5	0.02	0.8	44.89	43.13	24.43	-25.15	-49.58
1670 to 1735	-60	0.004	0.8	44.79	46.04	-13.16	-42.17	-29.01
1735 to 1865	-105	0.004	50	44.79	46.04	-8.96	-39.73	-30.77
1865 to 3250	-105	0.004	20	44.79	46.04	-38.96	-52.21	-13.25
3250 to 3330	-105	0.004	50	44.79	46.04	-8.96	-28.95	-19.99
3330 to 4000	-105	0.004	40	44.79	46.04	-18.96	-54.86	-35.90
4000 to 12000	-105	0.004	50	44.79	46.04	-8.96	-27.78	-18.82
12000 to 18000	-70	0.004	15	44.79	46.04	-8.96	-50.23	-41.27

BPSK 1643.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.78	46.03	-8.97	-52.13	-43.16
1525 to 1559	-203	0.004	120	44.78	46.03	-36.97	-54.83	-17.86
1559 to 1585	-155	1	111	44.95	44.95	0.95	-25.65	-26.60
1585 to 1605	-143	1	95	44.95	44.95	-3.05	-24.86	-21.81
1605 to1610	-117	1	62	44.95	44.95	-10.05	-25.39	-15.34
1610 to 1610.6	-95	1	40	44.95	44.95	-10.05	-24.77	-14.72
1610.6 to 1613.8	-49	1	40	44.95	44.95	35.95	-23.72	-59.67
1613.8 to 1614	-95	1	40	44.95	44.95	-10.05	-79	-68.95
1614 to 1620	-70	0.004	30	44.78	46.03	6.03	-31.09	-37.12
1620 to 1624.5	-70	0.004	20	44.78	46.03	-3.97	-36.63	-32.66
1624.5 to 1625.5	-70	0.004	10	44.78	46.03	-13.97	-42.66	-28.69
1625.5 to 1626.5	-70	0.004	1.3	44.78	46.03	-22.67	-43.41	-20.74
1626.5 to 1660	-70	0.004	0.8	44.78	46.03	-23.17	-31.21	-8.04
1660 to 1670	-19.5	0.02	0.8	44.79	43.03	24.33	-30.12	-54.45
1670 to 1735	-60	0.004	0.8	44.78	46.03	-13.17	-32.45	-19.28
1735 to 1865	-105	0.004	50	44.78	46.03	-8.97	-39.76	-30.79
1865 to 3250	-105	0.004	20	44.78	46.03	-38.97	-52.51	-13.54
3250 to 3330	-105	0.004	50	44.78	46.03	-8.97	-29.67	-20.70
3330 to 4000	-105	0.004	40	44.78	46.03	-18.97	-54.85	-35.88
4000 to 12000	-105	0.004	50	44.78	46.03	-8.97	-31.15	-22.18
12000 to 18000	-70	0.004	15	44.78	46.03	-8.97	-50.24	-41.27

BPSK 1660.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	44.74	45.99	-9.01	-52.72	-43.71
1525 to 1559	-203	0.004	120	44.74	45.99	-37.01	-54.51	-17.50
1559 to 1585	-155	1	111	45	45.00	1.00	-30.19	-31.19
1585 to 1605	-143	1	95	45	45.00	-3.00	-29.23	-26.23
1605 to1610	-117	1	62	45	45.00	-10.00	-28.23	-18.23
1610 to 1610.6	-95	1	40	45	45.00	-10.00	-28.18	-18.18
1610.6 to 1613.8	-49	1	40	45	45.00	36.00	-26.41	-62.41
1613.8 to 1614	-95	1	40	45	45.00	-10.00	-25.01	-15.01
1614 to 1620	-70	0.004	30	44.74	45.99	5.99	-35.8	-41.79
1620 to 1624.5	-70	0.004	20	44.74	45.99	-4.01	-43.52	-39.51
1624.5 to 1625.5	-70	0.004	10	44.74	45.99	-14.01	-40.99	-26.98
1625.5 to 1626.5	-70	0.004	1.3	44.74	45.99	-22.71	-44.01	-21.30
1626.5 to 1660	-70	0.004	0.8	44.74	45.99	-23.21	-30.7	-7.49
1660 to 1670	-19.5	0.02	0.8	44.77	43.01	24.31	-26.06	-50.37
1670 to 1735	-60	0.004	0.8	44.74	45.99	-13.21	-41.25	-28.04
1735 to 1865	-105	0.004	50	44.74	45.99	-9.01	-39.35	-30.34
1865 to 3250	-105	0.004	20	44.74	45.99	-39.01	-52.13	-13.12
3250 to 3330	-105	0.004	50	44.74	45.99	-9.01	-29.05	-20.04
3330 to 4000	-105	0.004	40	44.74	45.99	-19.01	-54.56	-35.55
4000 to 12000	-105	0.004	50	44.74	45.99	-9.01	-31.5	-22.49
12000 to 18000	-70	0.004	15	44.74	45.99	-9.01	-48.83	-39.82

QPSK 1626.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	34.5	35.75	-19.25	-53.91	-34.66
1525 to 1559	-203	0.004	120	34.5	35.75	-47.25	-56.88	-9.63
1559 to 1585	-155	1	111	45.01	45.01	1.01	-28.47	-29.48
1585 to 1605	-143	1	95	45.01	45.01	-2.99	-26.25	-23.26
1605 to1610	-117	1	62	45.01	45.01	-9.99	-27.91	-17.92
1610 to 1610.6	-95	1	40	45.01	45.01	-9.99	-27.43	-17.44
1610.6 to 1613.8	-49	1	40	45.01	45.01	36.01	-26.20	-62.21
1613.8 to 1614	-95	1	40	45.01	45.01	-9.99	-24.80	-14.81
1614 to 1620	-70	0.004	30	34.5	35.75	-4.25	-32.86	-28.61
1620 to 1624.5	-70	0.004	20	34.5	35.75	-14.25	-41.44	-27.19
1624.5 to 1625.5	-70	0.004	10	34.5	35.75	-24.25	-39.68	-15.43
1625.5 to 1626.5	-70	0.004	1.3	34.5	35.75	-32.95	-35.68	-2.73
1626.5 to 1660	-70	0.004	0.8	34.5	35.75	-33.45	-40.13	-6.68
1660 to 1670	-19.5	0.02	0.8	40.63	38.87	20.17	-29.98	-50.15
1670 to 1735	-60	0.004	0.8	34.5	35.75	-23.45	-48.56	-25.11
1735 to 1865	-105	0.004	50	34.5	35.75	-19.25	-39.72	-20.47
1865 to 3250	-105	0.004	20	34.5	35.75	-49.25	-54.69	-5.44
3250 to 3330	-105	0.004	50	34.5	35.75	-19.25	-44.55	-25.30
3330 to 4000	-105	0.004	40	34.5	35.75	-29.25	-54.64	-25.39
4000 to 12000	-105	0.004	50	34.5	35.75	-19.25	-42.44	-23.19
12000 to 18000	-70	0.004	15	34.5	35.75	-19.25	-49.58	-30.33

QPSK 1643.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	34.59	35.84	-19.16	-53.54	-34.38
1525 to 1559	-203	0.004	120	34.59	35.84	-47.16	-56.44	-9.28
1559 to 1585	-155	1	111	44.92	44.92	0.92	-29.61	-30.53
1585 to 1605	-143	1	95	44.92	44.92	-3.08	-28.18	-25.10
1605 to1610	-117	1	62	44.92	44.92	-10.08	-29.45	-19.37
1610 to 1610.6	-95	1	40	44.92	44.92	-10.08	-27.52	-17.44
1610.6 to 1613.8	-49	1	40	44.92	44.92	35.92	-26.98	-62.90
1613.8 to 1614	-95	1	40	44.92	44.92	-10.08	-25.49	-15.41
1614 to 1620	-70	0.004	30	34.59	35.84	-4.16	-32.26	-28.10
1620 to 1624.5	-70	0.004	20	34.59	35.84	-14.16	-46.16	-32.00
1624.5 to 1625.5	-70	0.004	10	34.59	35.84	-24.16	-46.23	-22.07
1625.5 to 1626.5	-70	0.004	1.3	34.59	35.84	-32.86	-45.7	-12.84
1626.5 to 1660	-70	0.004	0.8	34.59	35.84	-33.36	-38.29	-4.93
1660 to 1670	-19.5	0.02	0.8	40.76	39.00	20.30	-35.37	-55.67
1670 to 1735	-60	0.004	0.8	34.59	35.84	-23.36	-44.12	-20.76
1735 to 1865	-105	0.004	50	34.59	35.84	-19.16	-40.09	-20.93
1865 to 3250	-105	0.004	20	34.59	35.84	-49.16	-52.35	-3.19
3250 to 3330	-105	0.004	50	34.59	35.84	-19.16	-43.7	-24.54
3330 to 4000	-105	0.004	40	34.59	35.84	-29.16	-54.78	-25.62
4000 to 12000	-105	0.004	50	34.59	35.84	-19.16	-46.34	-27.18
12000 to 18000	-70	0.004	15	34.59	35.84	-19.16	-50.41	-31.25

QPSK 1660.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	35.46	36.71	-18.29	-53.21	-34.92
1525 to 1559	-203	0.004	120	35.46	36.71	-46.29	-56.67	-10.38
1559 to 1585	-155	1	111	45	45	1.00	-29.23	-30.23
1585 to 1605	-143	1	95	45	45	-3.00	-28.44	-25.44
1605 to1610	-117	1	62	45	45	-10.00	-27.17	-17.17
1610 to 1610.6	-95	1	40	45	45	-10.00	-29.93	-19.93
1610.6 to 1613.8	-49	1	40	45	45	36.00	-25.8	-61.80
1613.8 to 1614	-95	1	40	45	45	-10.00	-25.93	-15.93
1614 to 1620	-70	0.004	30	35.46	36.71	-3.29	-35.08	-31.79
1620 to 1624.5	-70	0.004	20	35.46	36.71	-13.29	-46.29	-33.00
1624.5 to 1625.5	-70	0.004	10	35.46	36.71	-23.29	-45.96	-22.67
1625.5 to 1626.5	-70	0.004	1.3	35.46	36.71	-31.99	-45.6	-13.61
1626.5 to 1660	-70	0.004	0.8	35.46	36.71	-32.49	-38.77	-6.28
1660 to 1670	-19.5	0.02	0.8	41.13	39.37	20.67	-27.09	-47.76
1670 to 1735	-60	0.004	0.8	35.46	36.71	-22.49	-47.65	-25.16
1735 to 1865	-105	0.004	50	35.46	36.71	-18.29	-39.57	-21.28
1865 to 3250	-105	0.004	20	35.46	36.71	-48.29	-52.02	-3.73
3250 to 3330	-105	0.004	50	35.46	36.71	-18.29	-48.82	-30.53
3330 to 4000	-105	0.004	40	35.46	36.71	-28.29	-54.75	-26.46
4000 to 12000	-105	0.004	50	35.46	36.71	-18.29	-48.64	-30.35
12000 to 18000	-70	0.004	15	35.46	36.71	-18.29	-50.27	-31.98

QAM 1626.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	32.77	34.02	-20.98	-53.31	-32.33
1525 to 1559	-203	0.004	120	32.77	34.02	-48.98	-53.91	-4.93
1559 to 1585	-155	1	111	44.99	44.99	0.99	-28.91	-29.90
1585 to 1605	-143	1	95	44.99	44.99	-3.01	-28.93	-25.92
1605 to1610	-117	1	62	44.99	44.99	-10.01	-27.92	-17.91
1610 to 1610.6	-95	1	40	44.99	44.99	-10.01	-26.73	-16.72
1610.6 to 1613.8	-49	1	40	44.99	44.99	35.99	-25.89	-61.88
1613.8 to 1614	-95	1	40	44.99	44.99	-10.01	-25.48	-15.47
1614 to 1620	-70	0.004	30	32.77	34.02	-5.98	-33.43	-27.45
1620 to 1624.5	-70	0.004	20	32.77	34.02	-15.98	-42.13	-26.15
1624.5 to 1625.5	-70	0.004	10	32.77	34.02	-25.98	-42.02	-16.04
1625.5 to 1626.5	-70	0.004	1.3	32.77	34.02	-34.68	-38.85	-4.17
1626.5 to 1660	-70	0.004	0.8	32.77	34.02	-35.18	-40.57	-5.39
1660 to 1670	-19.5	0.02	0.8	39.1	37.34	18.64	-29.94	-48.58
1670 to 1735	-60	0.004	0.8	32.77	34.02	-25.18	-48.83	-23.65
1735 to 1865	-105	0.004	50	32.77	34.02	-20.98	-40.16	-19.18
1865 to 3250	-105	0.004	20	32.77	34.02	-50.98	-52.99	-2.01
3250 to 3330	-105	0.004	50	32.77	34.02	-20.98	-49.17	-28.19
3330 to 4000	-105	0.004	40	32.77	34.02	-30.98	-55.09	-24.11
4000 to 12000	-105	0.004	50	32.77	34.02	-20.98	-52.16	-31.18
12000 to 18000	-70	0.004	15	32.77	34.02	-20.98	-50.56	-29.58

A waiver has been granted for this modulation type.

QAM 1643.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	32.28	33.53	-21.47	-54.19	-32.72
1525 to 1559	-203	0.004	120	32.28	33.53	-49.47	-53.78	-4.31
1559 to 1585	-155	1	111	45	45	1.00	-29.15	-30.15
1585 to 1605	-143	1	95	45	45	-3.00	-28.88	-25.88
1605 to1610	-117	1	62	45	45	-10.00	-28	-18.00
1610 to 1610.6	-95	1	40	45	45	-10.00	-27.3	-17.30
1610.6 to 1613.8	-49	1	40	45	45	36.00	-26.57	-62.57
1613.8 to 1614	-95	1	40	45	45	-10.00	-25.57	-15.57
1614 to 1620	-70	0.004	30	32.28	33.53	-6.47	-32.81	-26.34
1620 to 1624.5	-70	0.004	20	32.28	33.53	-16.47	-45.88	-29.41
1624.5 to 1625.5	-70	0.004	10	32.28	33.53	-26.47	-44.71	-18.24
1625.5 to 1626.5	-70	0.004	1.3	32.28	33.53	-35.17	-45.25	-10.08
1626.5 to 1660	-70	0.004	0.8	32.28	33.53	-35.67	-39.42	-3.75
1660 to 1670	-19.5	0.02	0.8	39.99	38.23	19.53	-36.02	-55.55
1670 to 1735	-60	0.004	0.8	32.28	33.53	-25.67	-44.28	-18.61
1735 to 1865	-105	0.004	50	32.28	33.53	-21.47	-39.65	-18.18
1865 to 3250	-105	0.004	20	32.28	33.53	-51.47	-53.29	-1.82
3250 to 3330	-105	0.004	50	32.28	33.53	-21.47	-46.5	-25.03
3330 to 4000	-105	0.004	40	32.28	33.53	-31.47	-54.6	-23.13
4000 to 12000	-105	0.004	50	32.28	33.53	-21.47	-52.45	-30.98
12000 to 18000	-70	0.004	15	32.28	33.53	-21.47	-50.11	-28.64

A waiver has been granted for this modulation type.

QAM 1660.5 MHz Conducted Spurious Emissions

Freq (MHz)	Limit (dBc)	RBW (MHz)	F Type DLNA Rejection (dB)	Measured Power (dBm)	Corrected Power (dBm)	Necessary Level (dBm)	Measured Level (dBm)	Margin (dB)
.010 to 1525	-135	0.004	80	33.51	34.76	-20.24	-53.35	-33.11
1525 to 1559	-203	0.004	120	33.51	34.76	-48.24	-56.09	-7.85
1559 to 1585	-155	1	111	44.92	44.92	0.92	-29.17	-30.09
1585 to 1605	-143	1	95	44.92	44.92	-3.08	-27.82	-24.74
1605 to1610	-117	1	62	44.92	44.92	-10.08	-27.83	-17.75
1610 to 1610.6	-95	1	40	44.92	44.92	-10.08	-27.54	-17.46
1610.6 to 1613.8	-49	1	40	44.92	44.92	35.92	-26.42	-62.34
1613.8 to 1614	-95	1	40	44.92	44.92	-10.08	-25.85	-15.77
1614 to 1620	-70	0.004	30	33.51	34.76	-5.24	-39.14	-33.90
1620 to 1624.5	-70	0.004	20	33.51	34.76	-15.24	-46.37	-31.13
1624.5 to 1625.5	-70	0.004	10	33.51	34.76	-25.24	-45.89	-20.65
1625.5 to 1626.5	-70	0.004	1.3	33.51	34.76	-33.94	-46.81	-12.87
1626.5 to 1660	-70	0.004	0.8	33.51	34.76	-34.44	-41.01	-6.57
1660 to 1670	-19.5	0.02	0.8	40.09	38.33	19.63	-29.34	-48.97
1670 to 1735	-60	0.004	0.8	33.51	34.76	-24.44	-46.92	-22.48
1735 to 1865	-105	0.004	50	33.51	34.76	-20.24	-39.94	-19.70
1865 to 3250	-105	0.004	20	33.51	34.76	-50.24	-52.31	-2.07
3250 to 3330	-105	0.004	50	33.51	34.76	-20.24	-46.67	-26.43
3330 to 4000	-105	0.004	40	33.51	34.76	-30.24	-55.09	-24.85
4000 to 12000	-105	0.004	50	33.51	34.76	-20.24	-51.96	-31.72
12000 to 18000	-70	0.004	15	33.51	34.76	-20.24	-50.12	-29.88

A waiver has been granted for this modulation type.

Field Strength of Spurious Radiation

Name of Test:	Field Strength of Spurious Radiation	**Engineer:**	John Erhard
Test Equipment Utilized:	06143, i00331, i00134, i00103	**Test Date**:	5/17/2012

Test Procedure

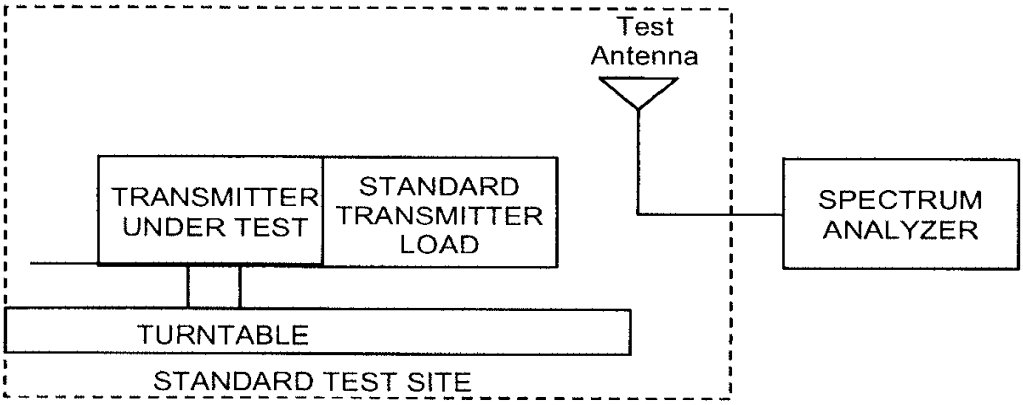
A) Connect the equipment as illustrated
B) Adjust the spectrum analyzer for the following settings:
1) Resolution Bandwidth 100 kHz (<1 GHZ), 1 MHZ (> 1GHz).
2) Video Bandwidth ≥ 3 times Resolution Bandwidth, or 30 kHz
3) Sweep Speed ≤2000 Hz/second
4) Detector Mode = Mean or Average Power

Place the transmitter to be tested on the turntable in the standard test site. The transmitter is transmitting into a non-radiating load that is placed on the turntable. The RF cable to this load should be of minimum length.
D) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to ± the test bandwidth (see section 1.3.4.4).
E) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
F) Repeat step E) for each spurious frequency with the test antenna polarized vertically.
G) Reconnect the equipment as illustrated.
H) Keep the spectrum analyzer adjusted as in step B).
I) Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.
J) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
K) Repeat step J) with both antennas vertically polarized for each spurious frequency.
L) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps J) and K) by the power loss in the cable between the generator and the antenna and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna.
M) The levels recorded in step L) are absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

Radiated spurious emissions dB = **$10\log_{10}$(TX power in watts/0.001) – the levels in step l)**

NOTE: It is permissible that other antennas provided can be referenced to a dipole.

Test Setup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Antenna
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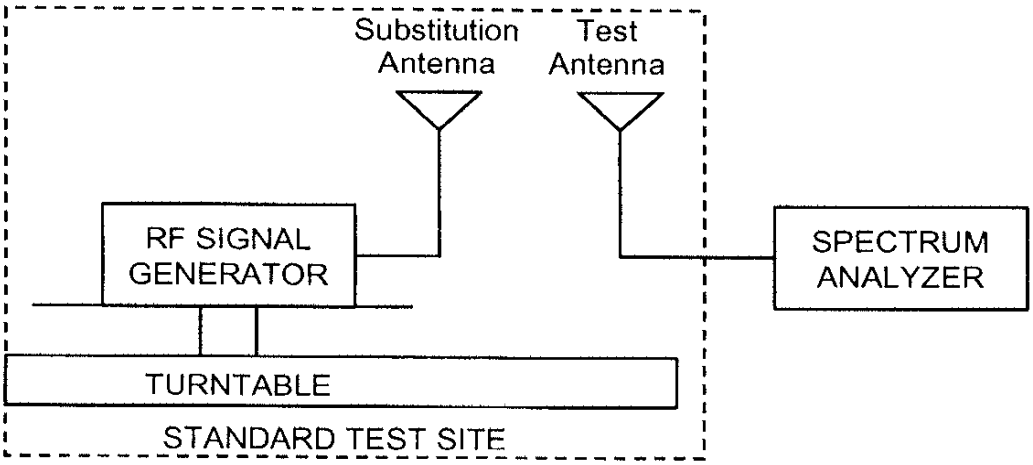
UNDER TEST
STANDARD
TRANSMITTER
LOAD
SPECTRUM
ANALYZER
TURNTABLE
STANDARD TEST SITE


Substitution
Antenna
Test
Antenna
RF SIGNAL
GENERATOR
SPECTRUM
ANALYZER
TURNTABLE
STANDARD TEST SITE

BPSK 1626.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3253.0	-53.93	-13	Pass
4879.5	-50.26	-13	Pass
6506.0	-52.98	-13	Pass

BPSK 1643.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3287.0	-52.84	-13	Pass
4930.5	-50.60	-13	Pass
6574.0	-52.92	-13	Pass

BPSK 1660.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3321.0	-50.93	-13	Pass
4981.5	-51.18	-13	Pass
6642.0	-51.72	-13	Pass

QPSK 1626.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3253.0	-50.04	-13	Pass
4879.5	-48.68	-13	Pass
6506.0	-42.95	-13	Pass

QPSK 1643.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3287.0	-58.73	-13	Pass
4930.5	-48.56	-13	Pass
6574.0	-45.39	-13	Pass

QPSK 1660.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3321.0	-49.37	-13	Pass
4981.5	-52.27	-13	Pass
6642.0	-49.78	-13	Pass

QAM 1626.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3253.0	-51.02	-13	Pass
4879.5	-50.95	-13	Pass
6506.0	-46.89	-13	Pass

QAM 1643.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3287.0	-46.91	-13	Pass
4930.5	-48.06	-13	Pass
6574.0	-47.54	-13	Pass

QAM 1660.5 MHz Radiated Spurious Emissions

Emission Frequency (MHz)	Measured Level (dBm)	Limit (dBm)	Result
3321.0	-53.81	-13	Pass
4981.5	-46.08	-13	Pass
6642.0	-47.48	-13	Pass

A waiver has been granted for this modulation type.

Emission Masks (Occupied Bandwidth)

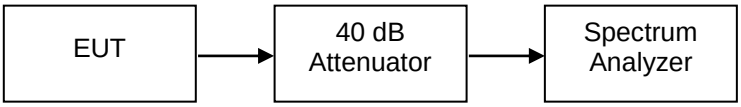
Name of Test:	Emission Masks (Occupied Bandwidth)	**Engineer:** John Erhard
Test Equipment Utilized:	06143, i00331, Weinschel # 48-40-43	**Test Date:** 5/17/2012

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask. The reference level was set to the peak power prior to testing the emission mask. The transmitter is digital modulation therefore no data input is required to measure the emission mask. The RBW was set as close as possible to 1% of the span without being under that level to ensure accurate readings.

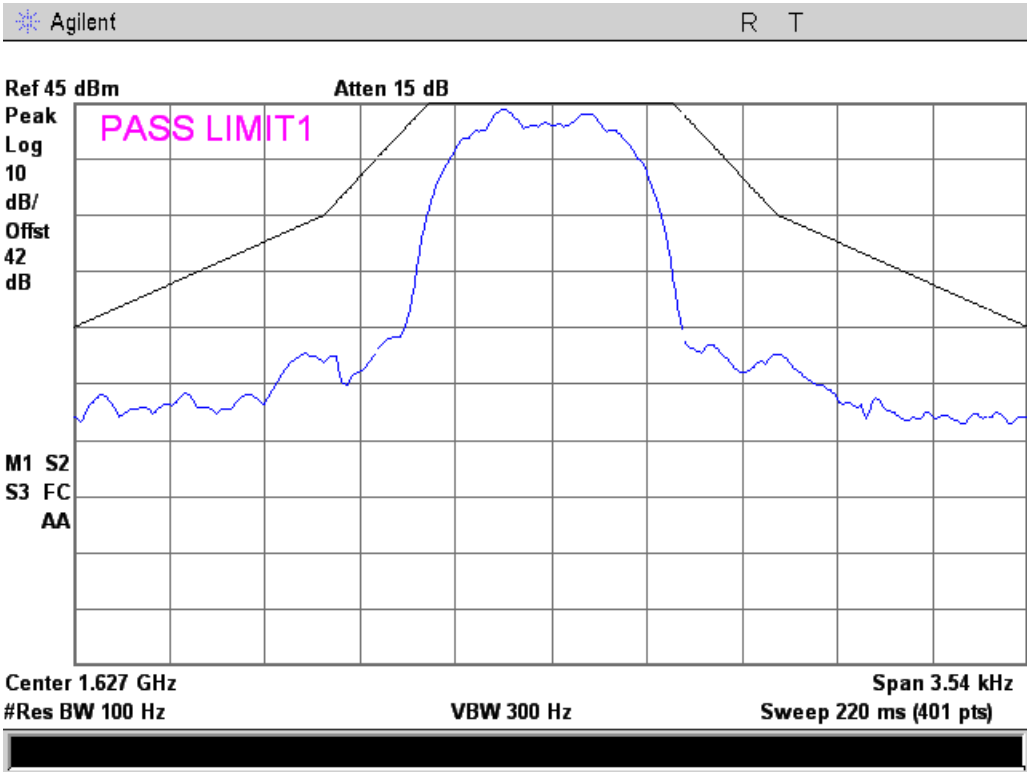
The FCC waiver for this device allows for the higher order modulations and wide bandwidths.

Test Setup

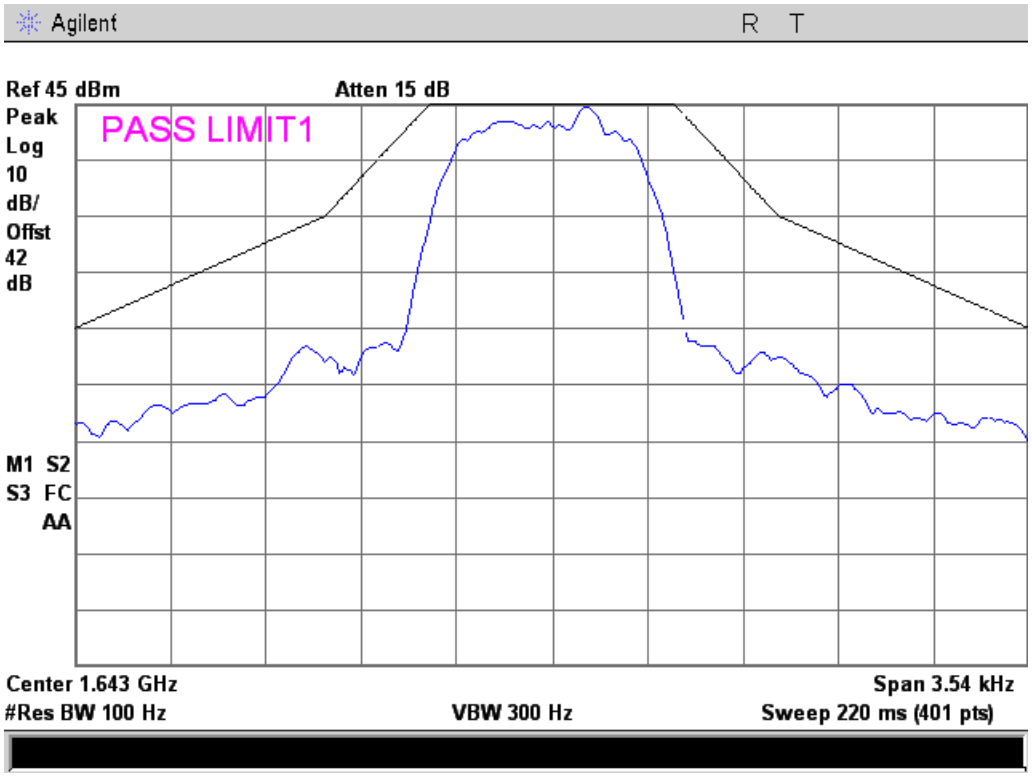


BPSK Emissions Mask

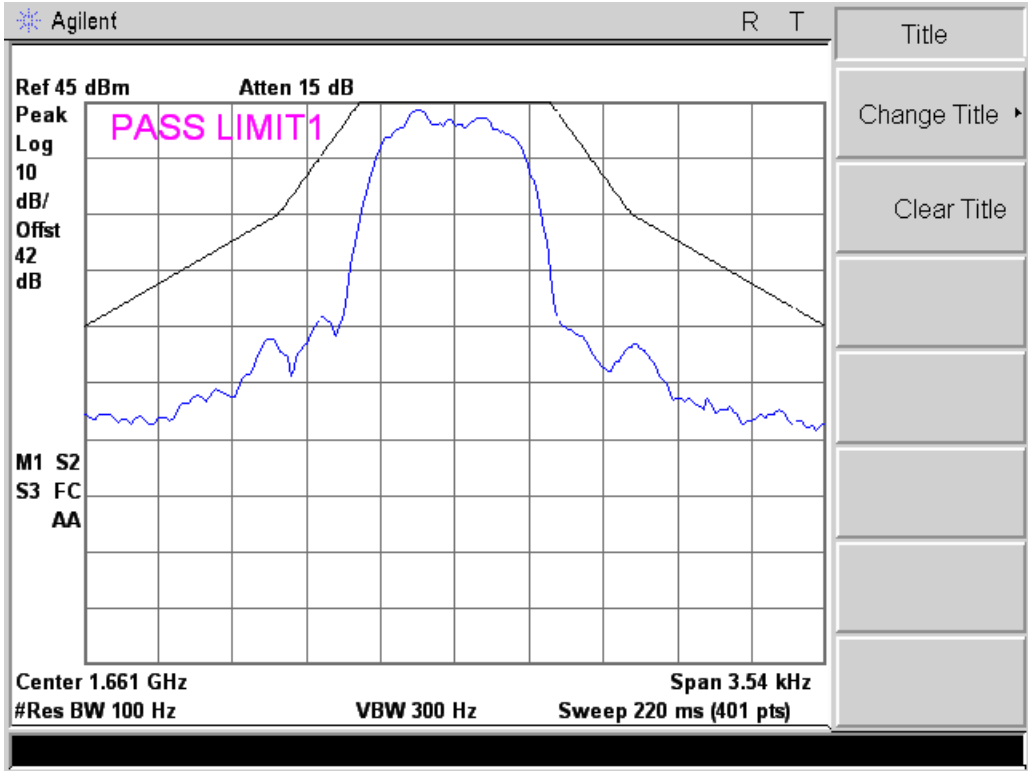
BPSK 1626.5 MHz 840HG1D



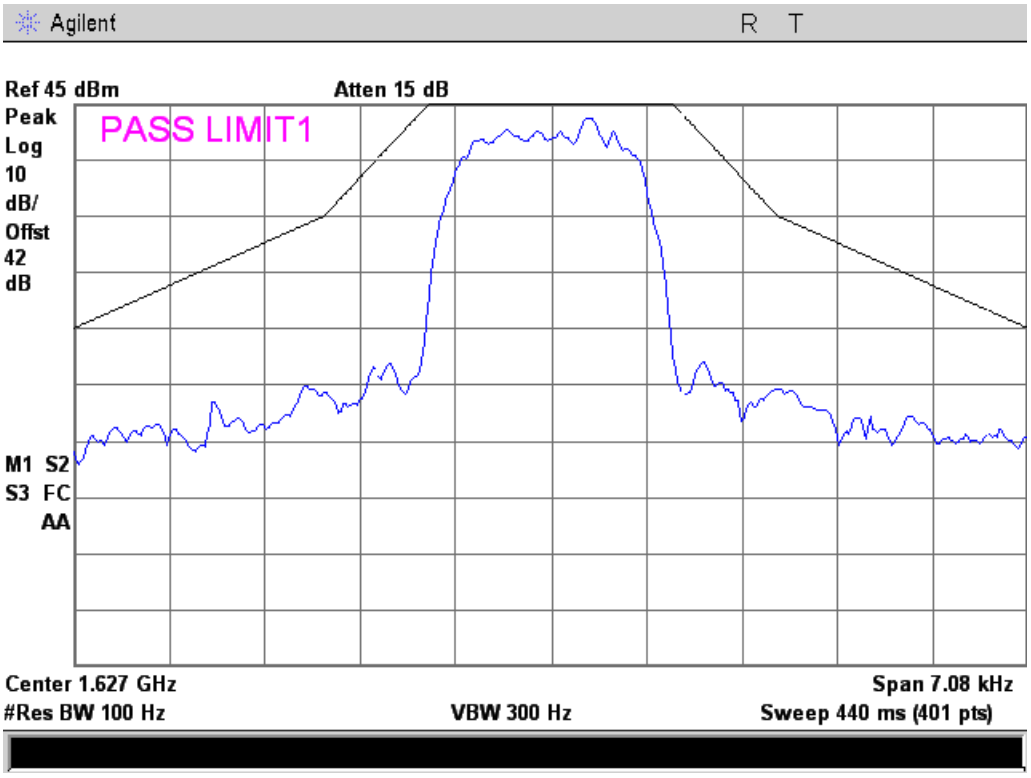
BPSK 1643.5 MHz 840HG1D



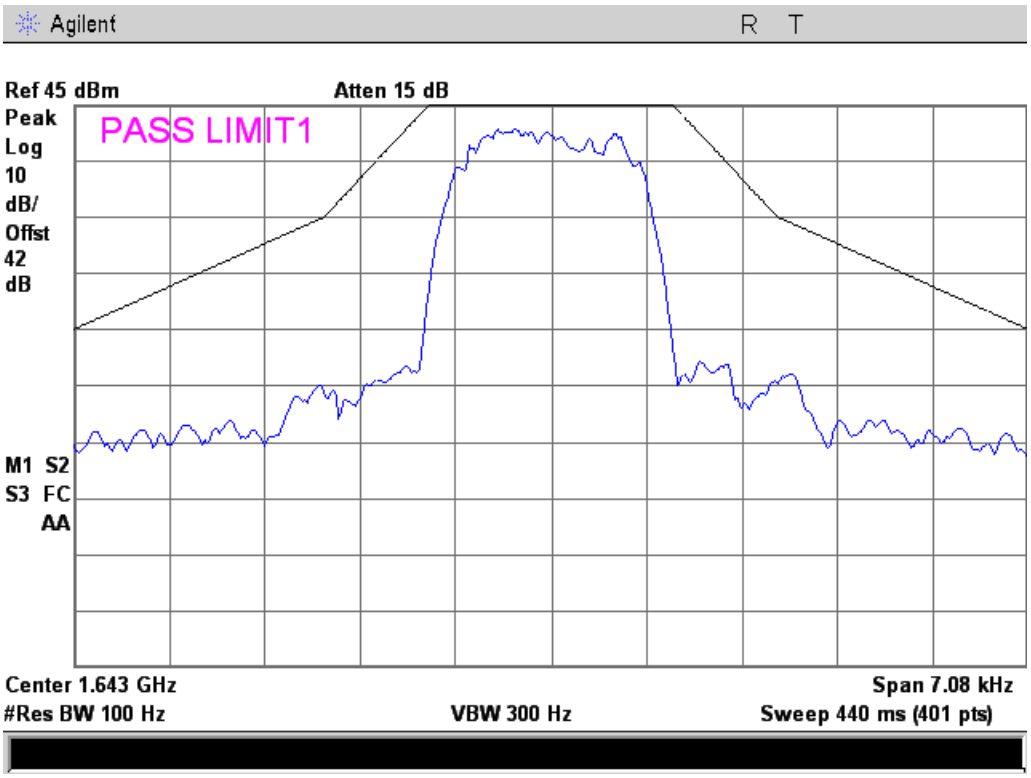
BPSK 1660.5 MHz 840HG1D



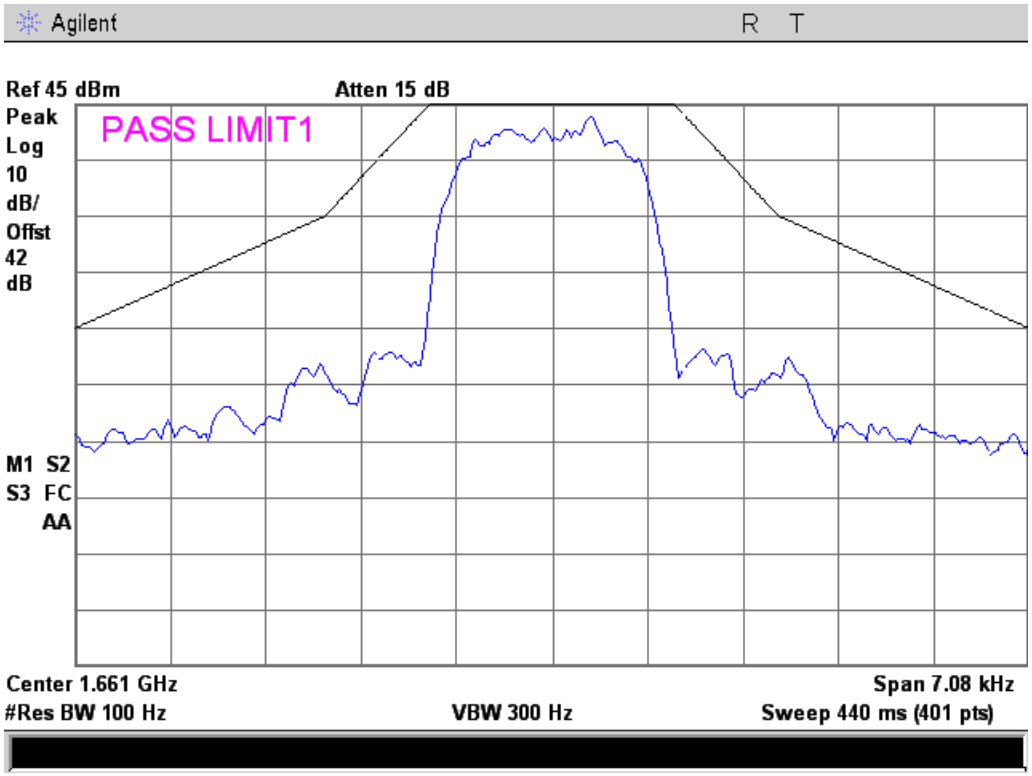
BPSK 1626.5 MHz 1K68G1D



BPSK 1643.5 MHz 1K68G1D

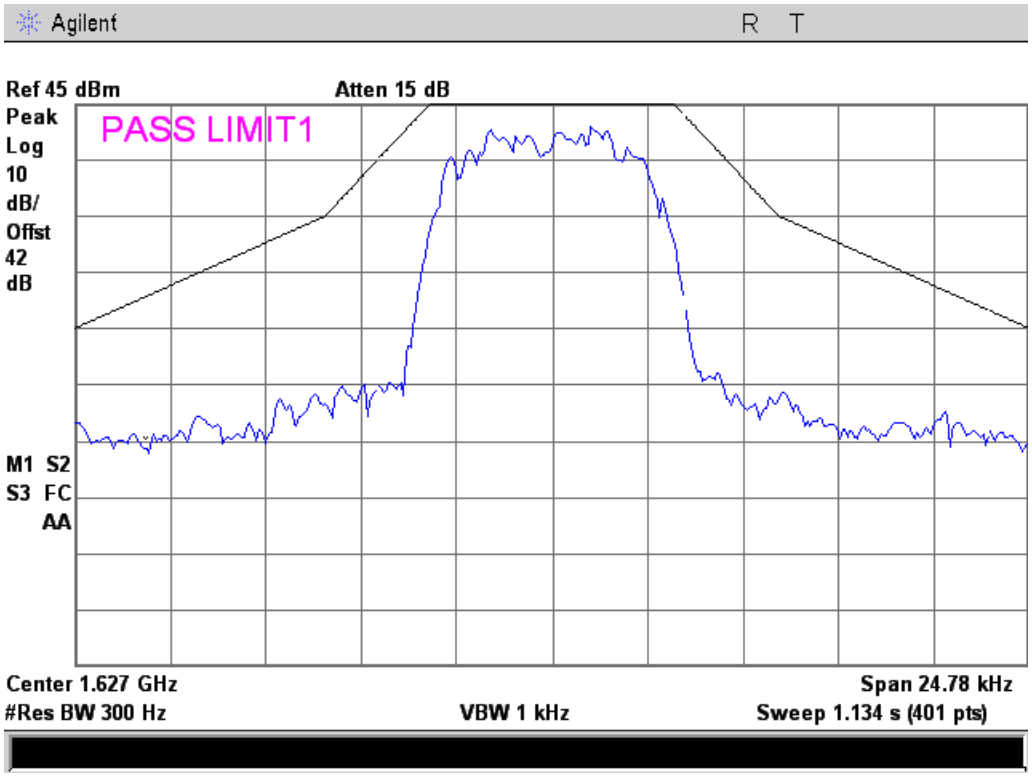


BPSK 1660.5 MHz 1K68G1D

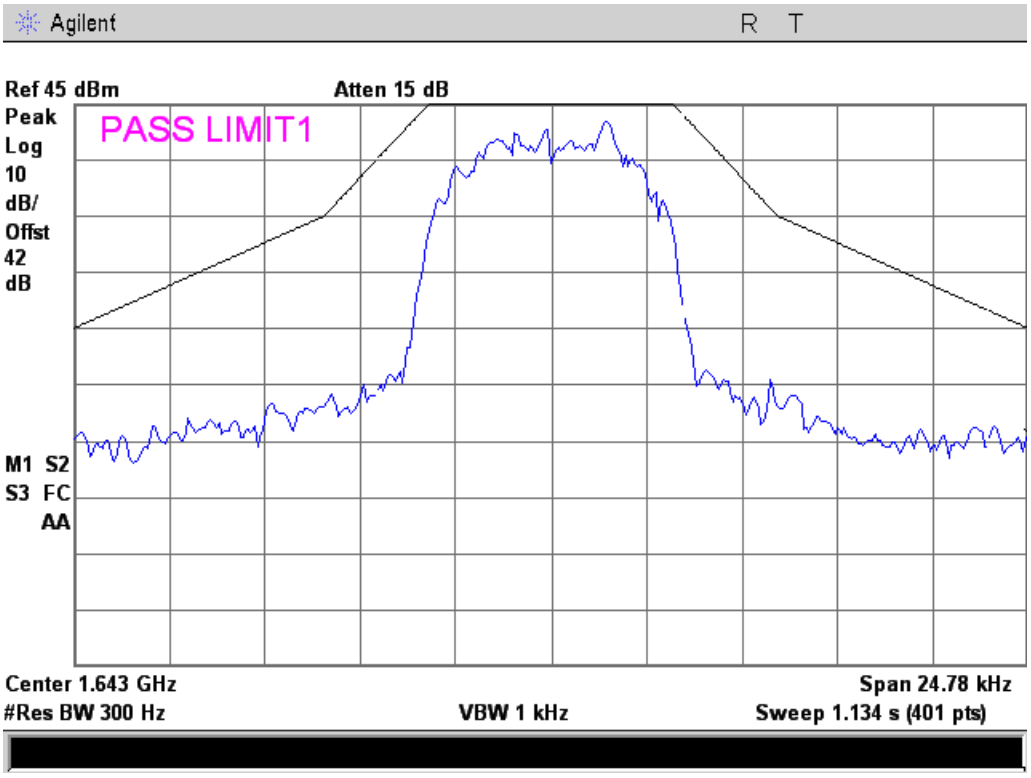


QPSK Emissions Mask

QPSK 1626.5 MHz 6K80G1E



QPSK 1643.5 MHz 6K80G1E



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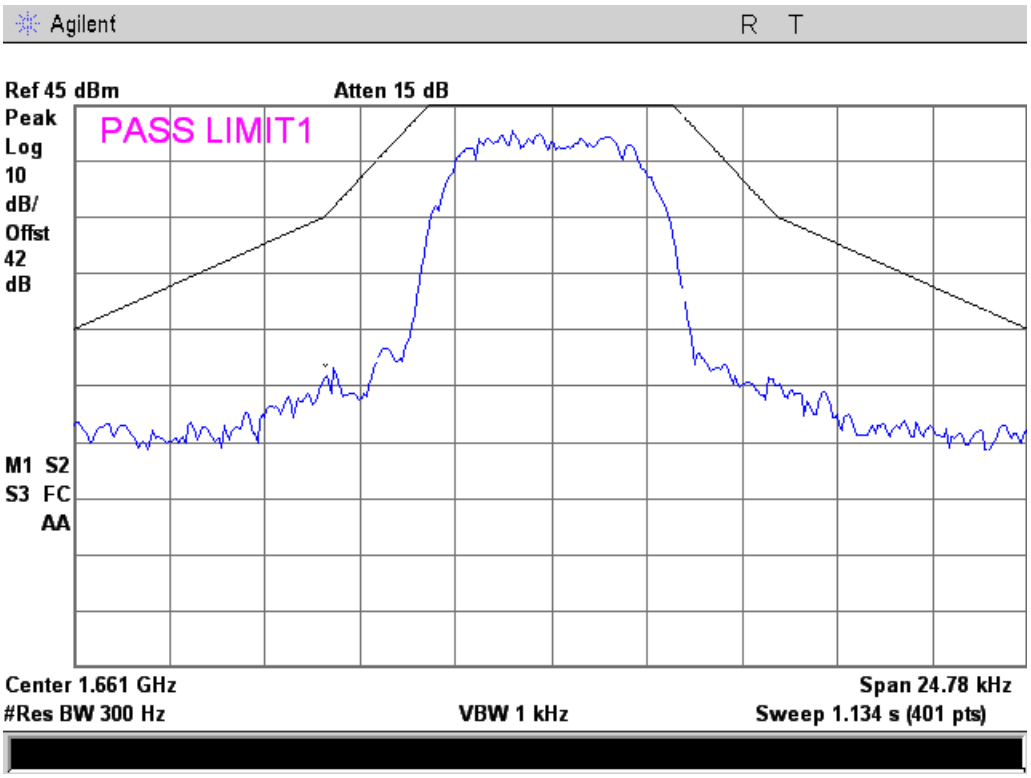
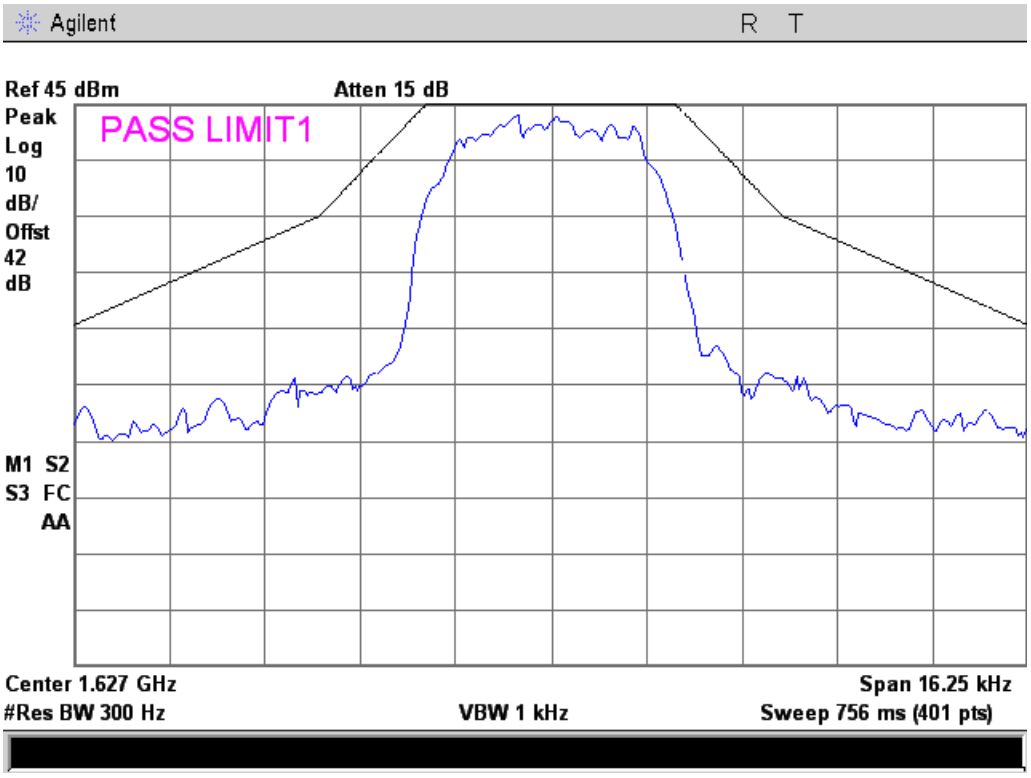
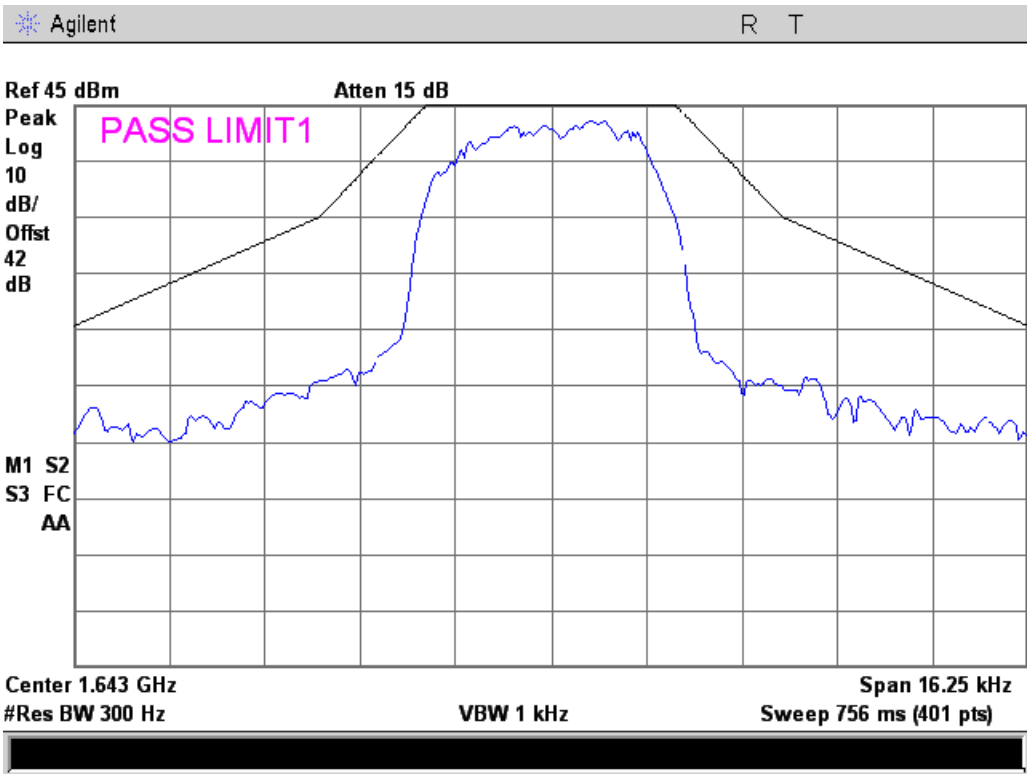


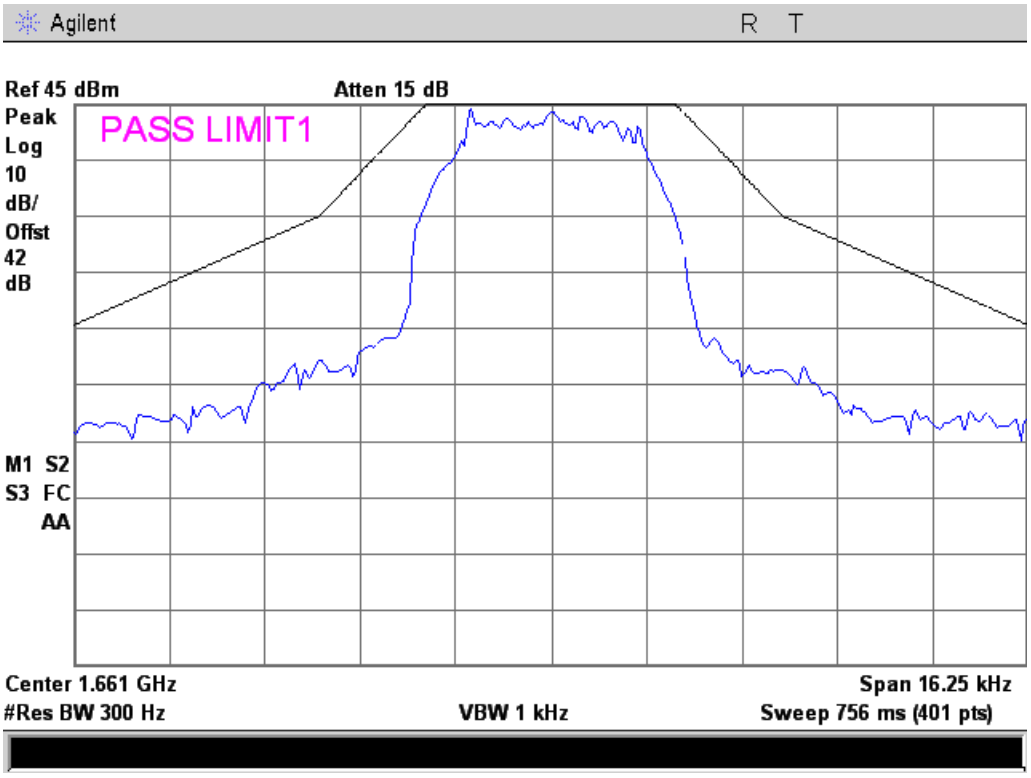
QPSK 1626.5 MHz 7K20G1E



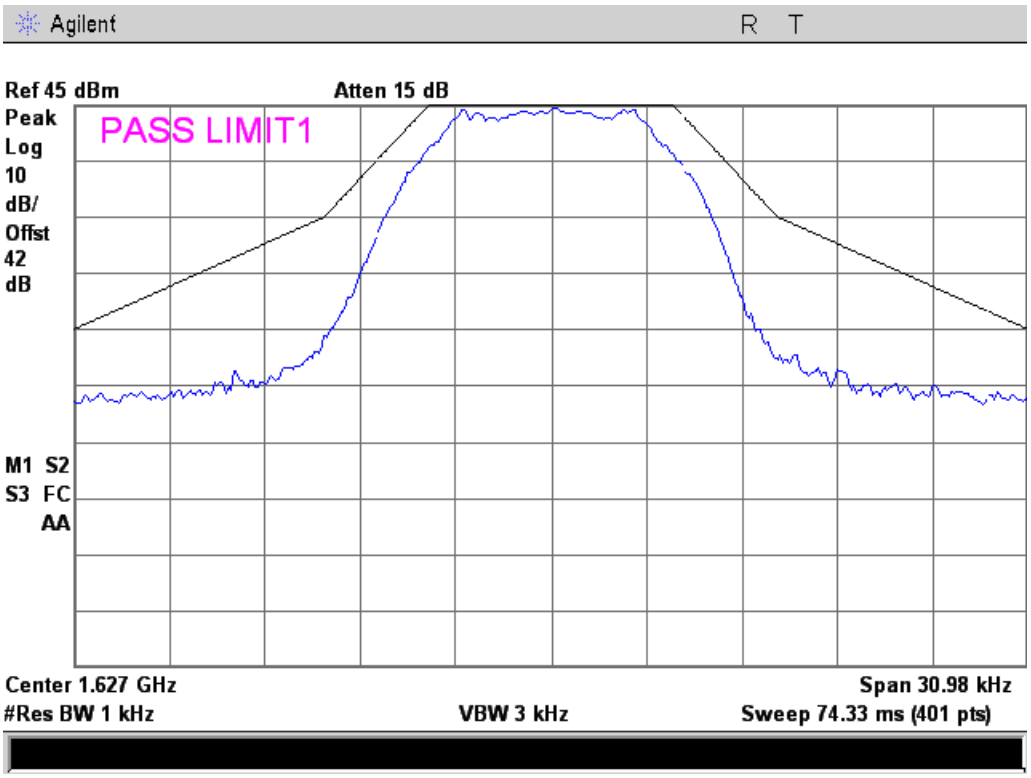
QPSK 1643.5 MHz 7K20G1E



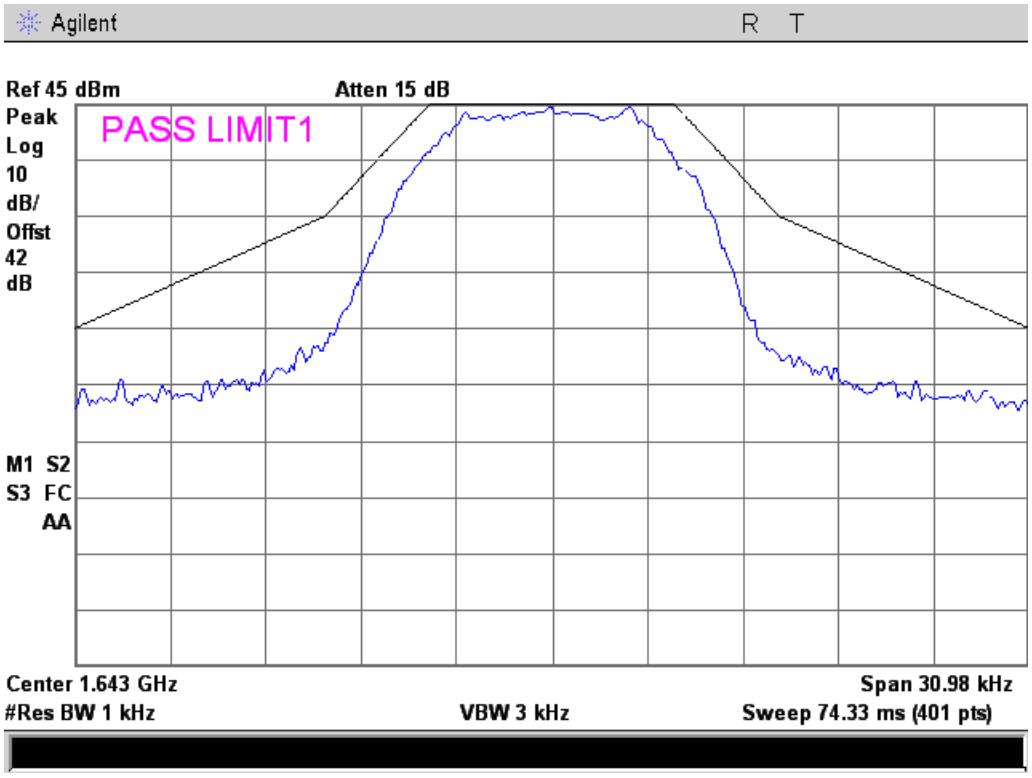
QPSK 1660.5 MHz 7K20G1E



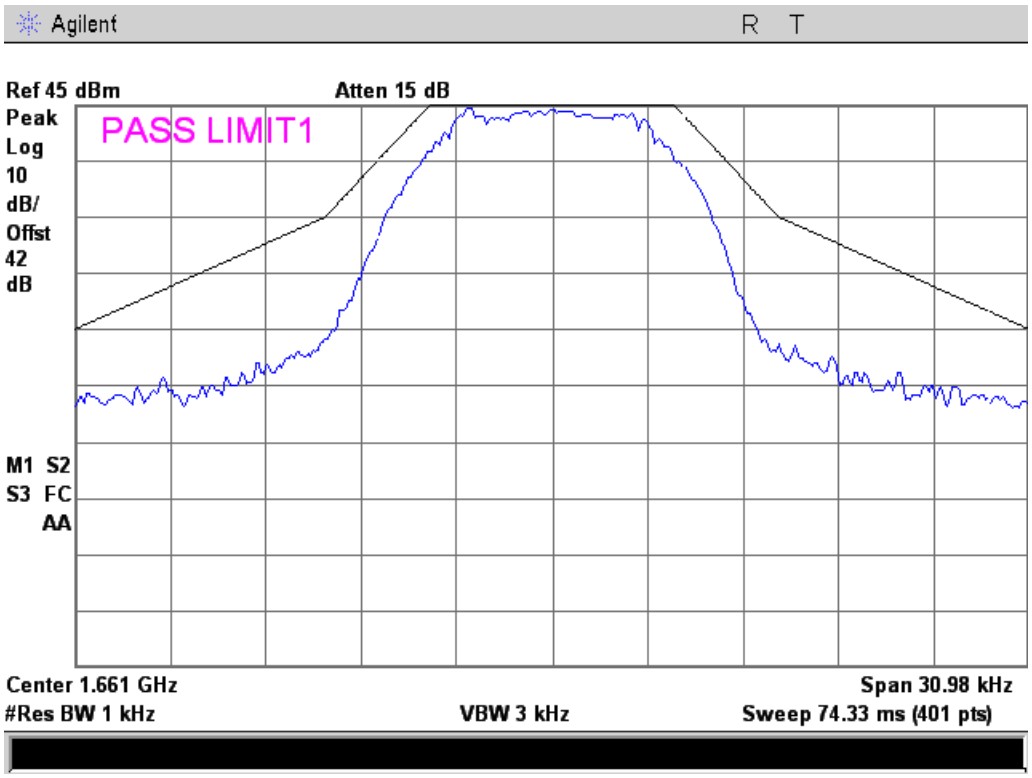
QPSK 1626.5 MHz 10K5G1D



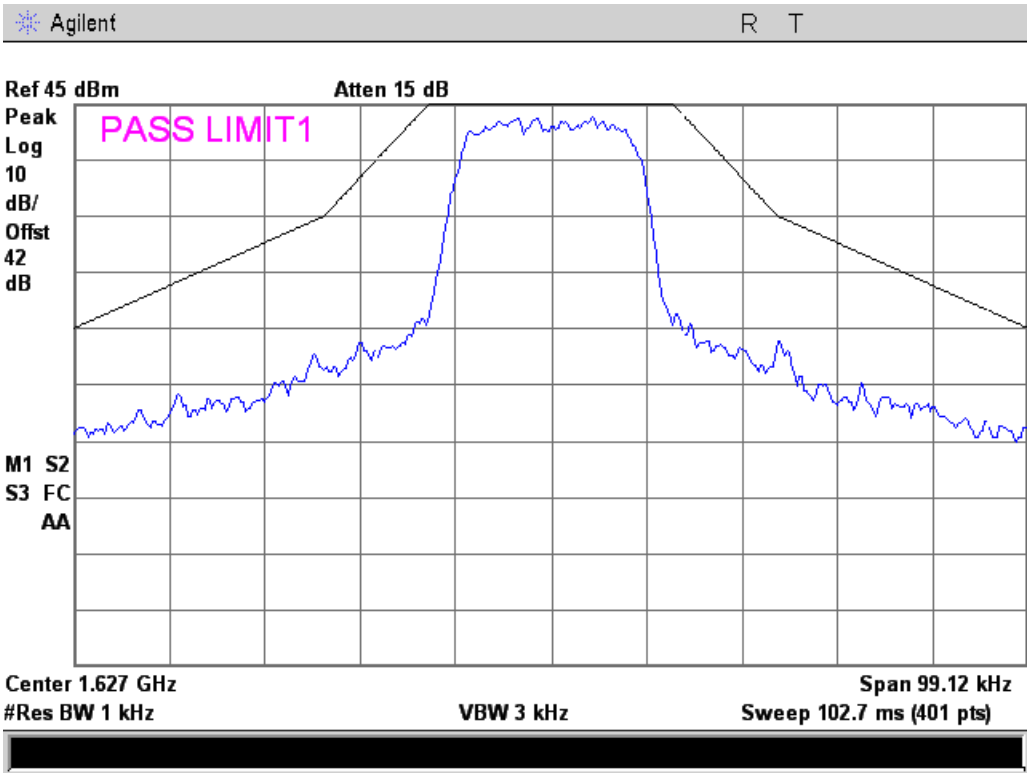
QPSK 1643.5 MHz 10K5G1D



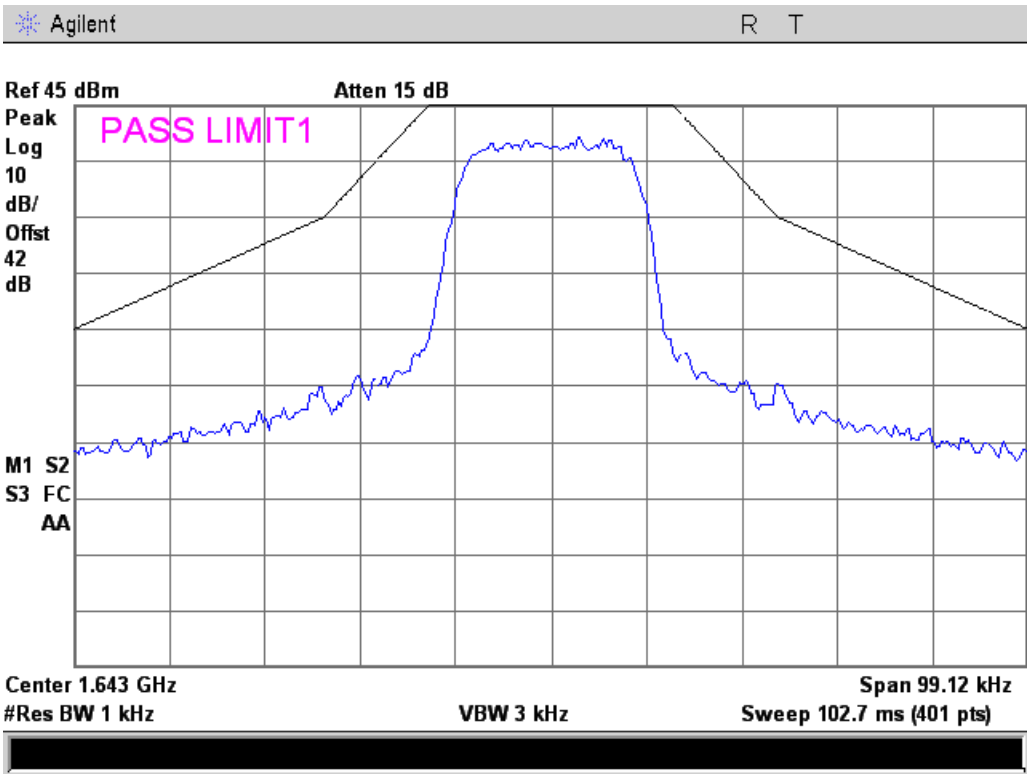
QPSK 1660.5 MHz 10K5G1D



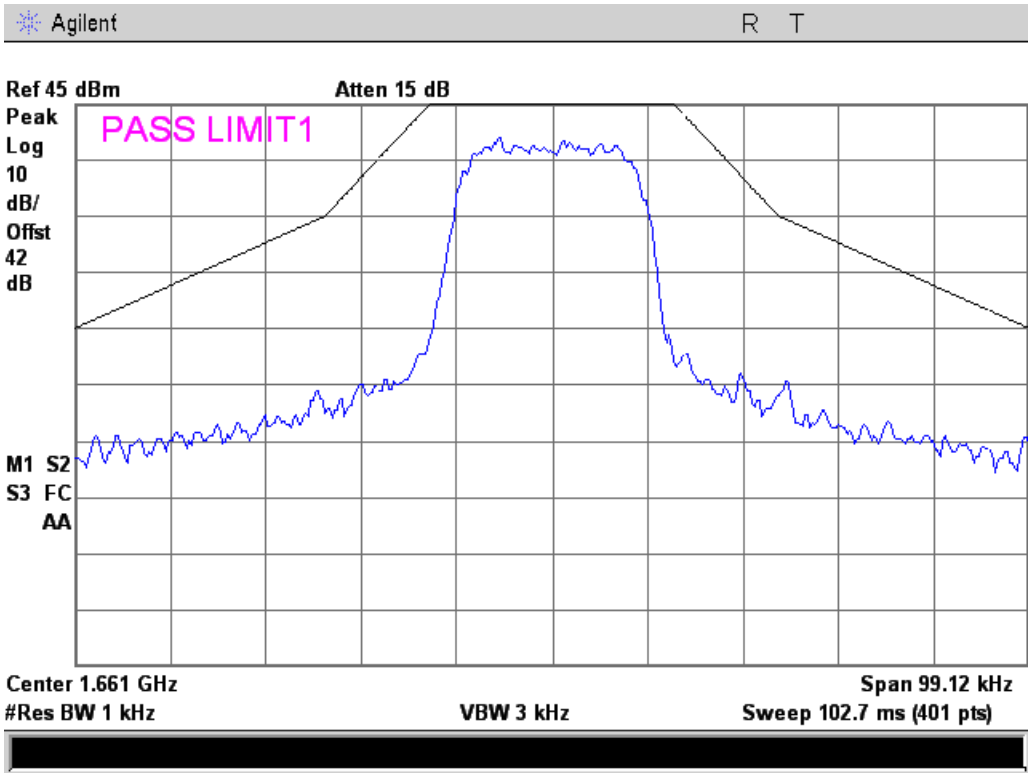
QPSK 1626.5 MHz 25K0G7W



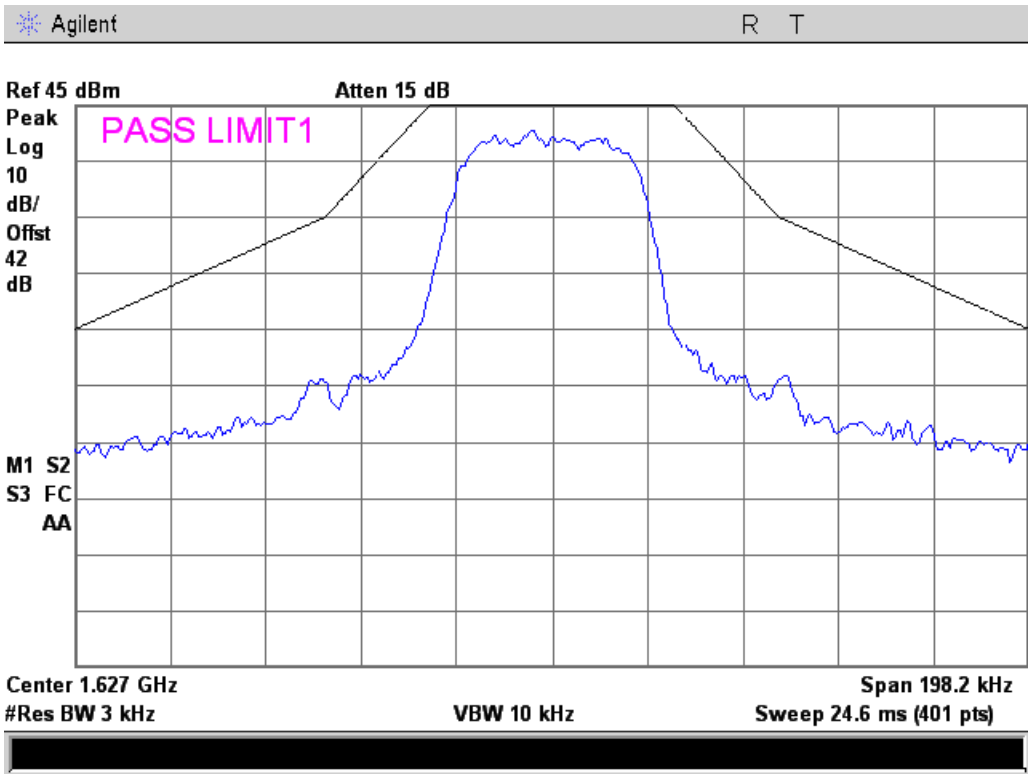
QPSK 1643.5 MHz 25K0G7W



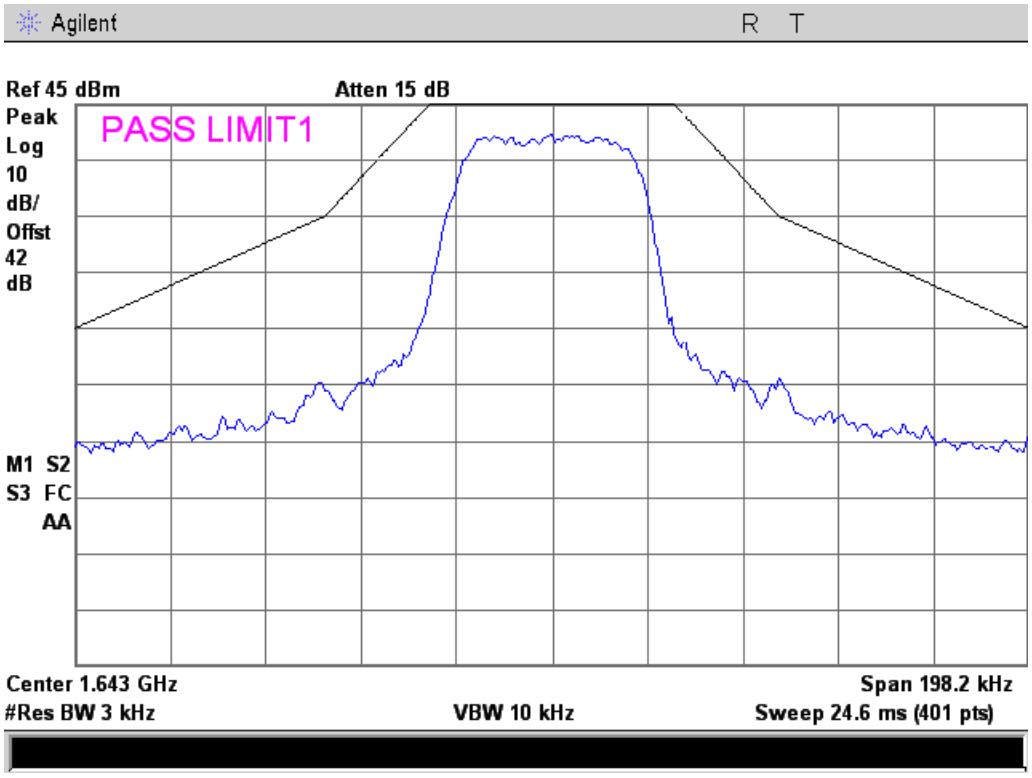
QPSK 1660.5 MHz 25K0G7W



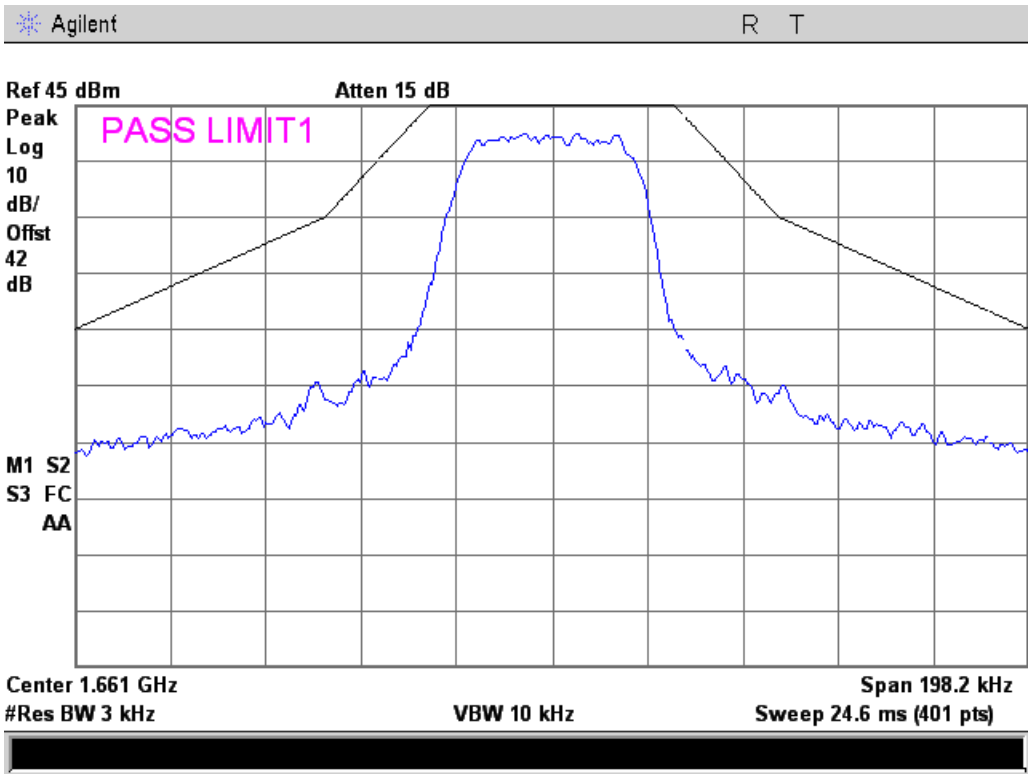
QPSK 1626.5 MHz 50K0G7W



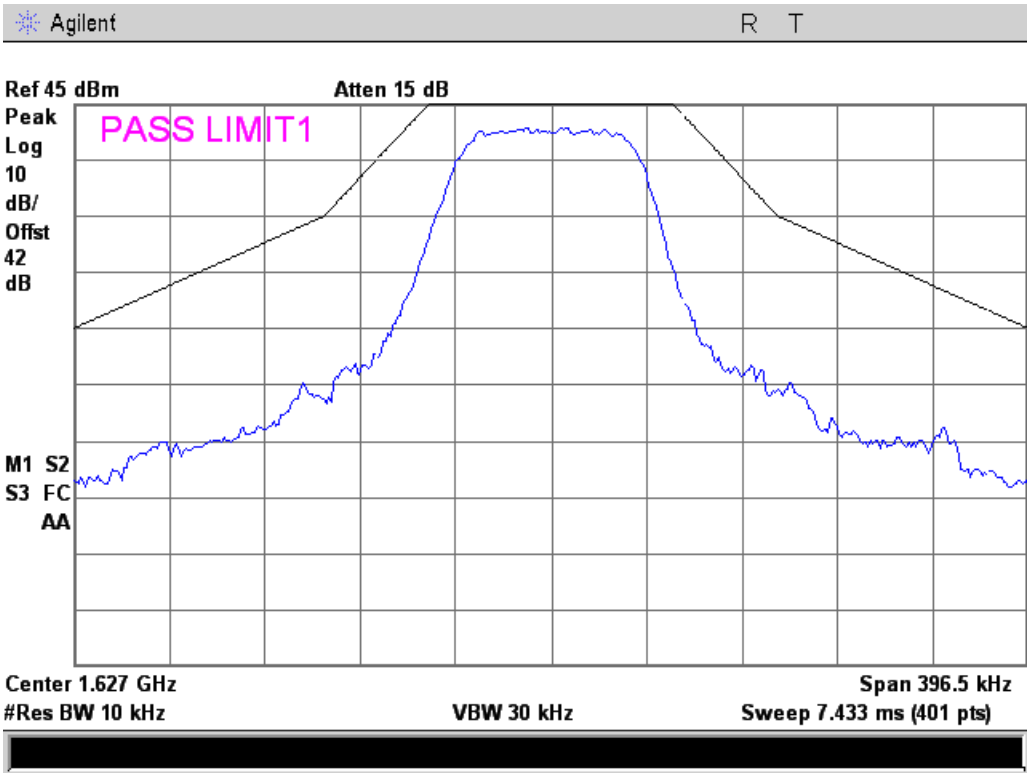
QPSK 1643.5 MHz 50K0G7W



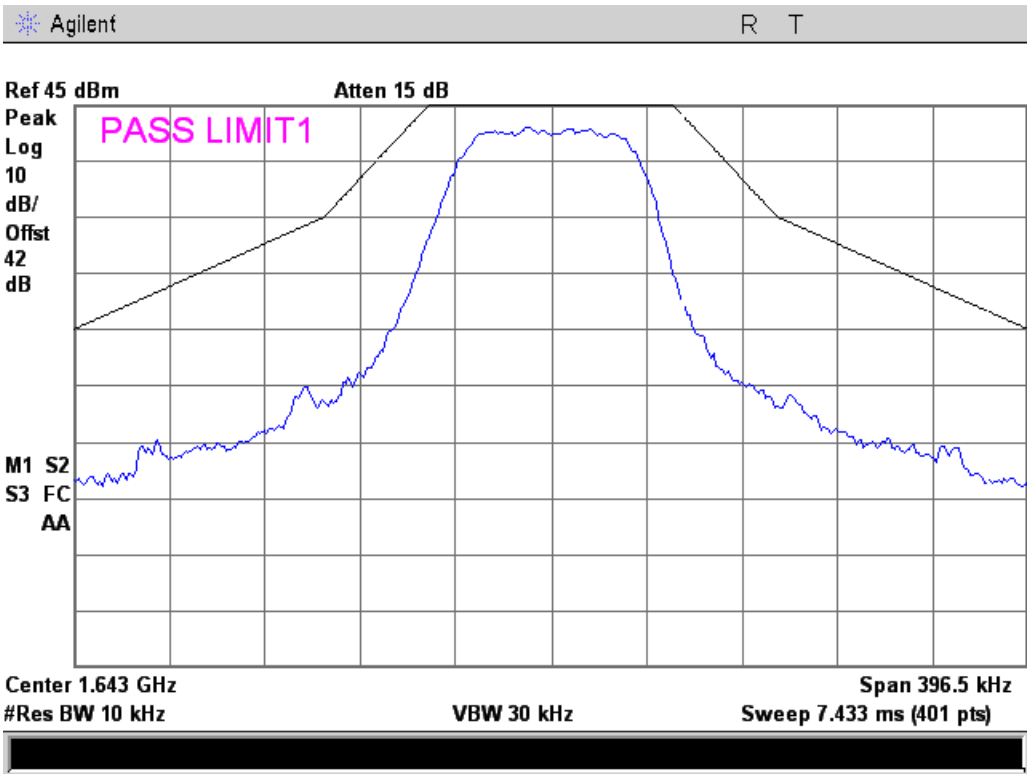
QPSK 1660.5 MHz 50K0G7W



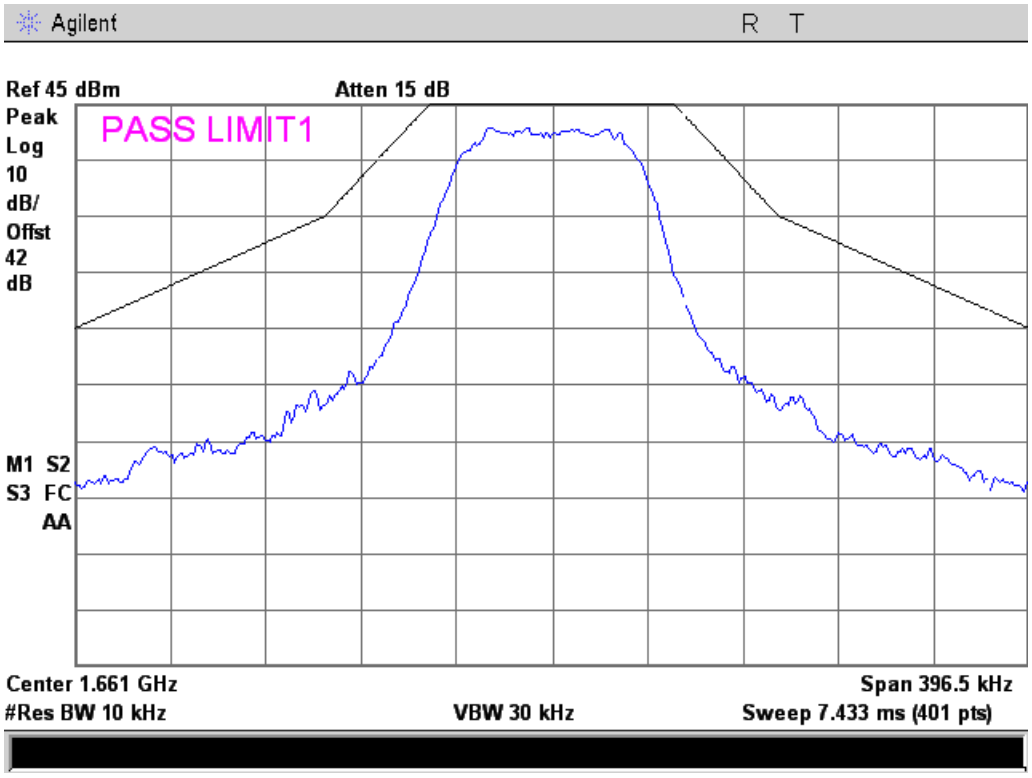
QPSK 1626.5 MHz 100KG7W



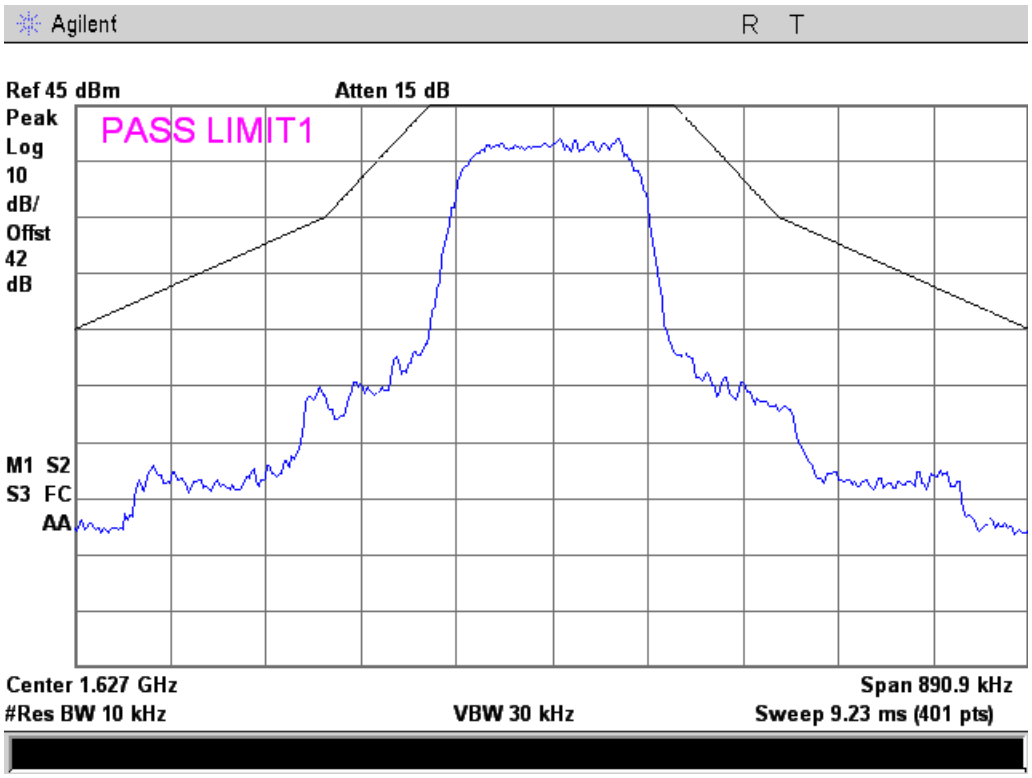
QPSK 1643.5 MHz 100KG7W



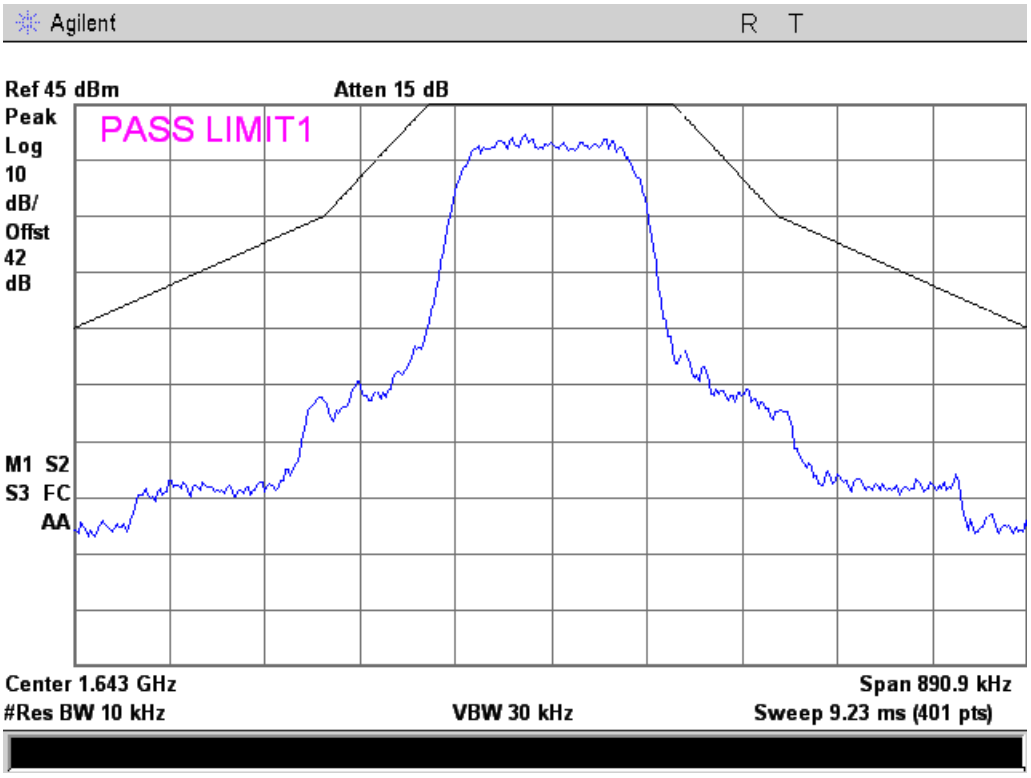
QPSK 1660.5 MHz 100KG7W



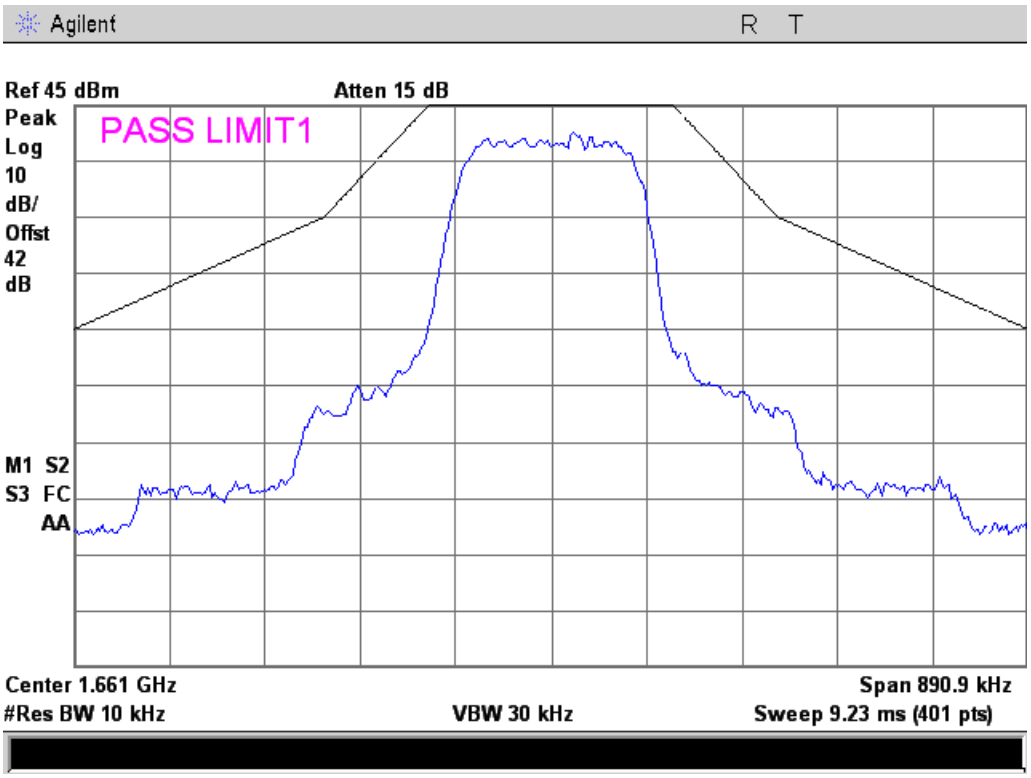
QPSK 1626.5 MHz 200KG7W



QPSK 1643.5 MHz 200KG7W

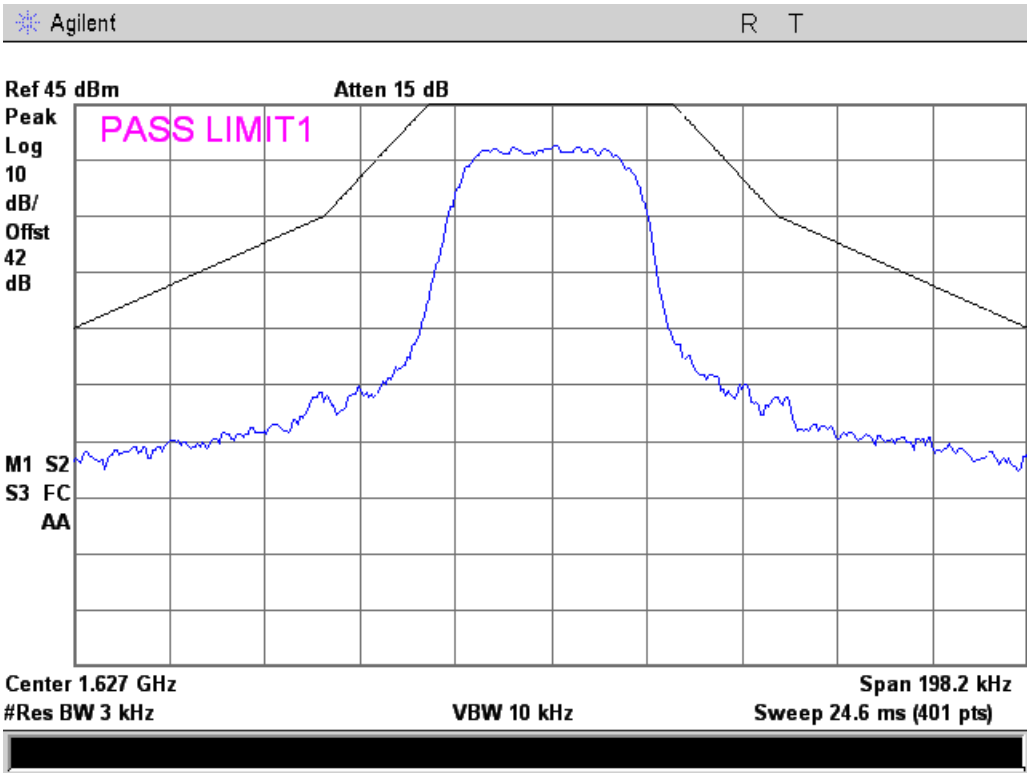


QPSK 1660.5 MHz 200KG7W

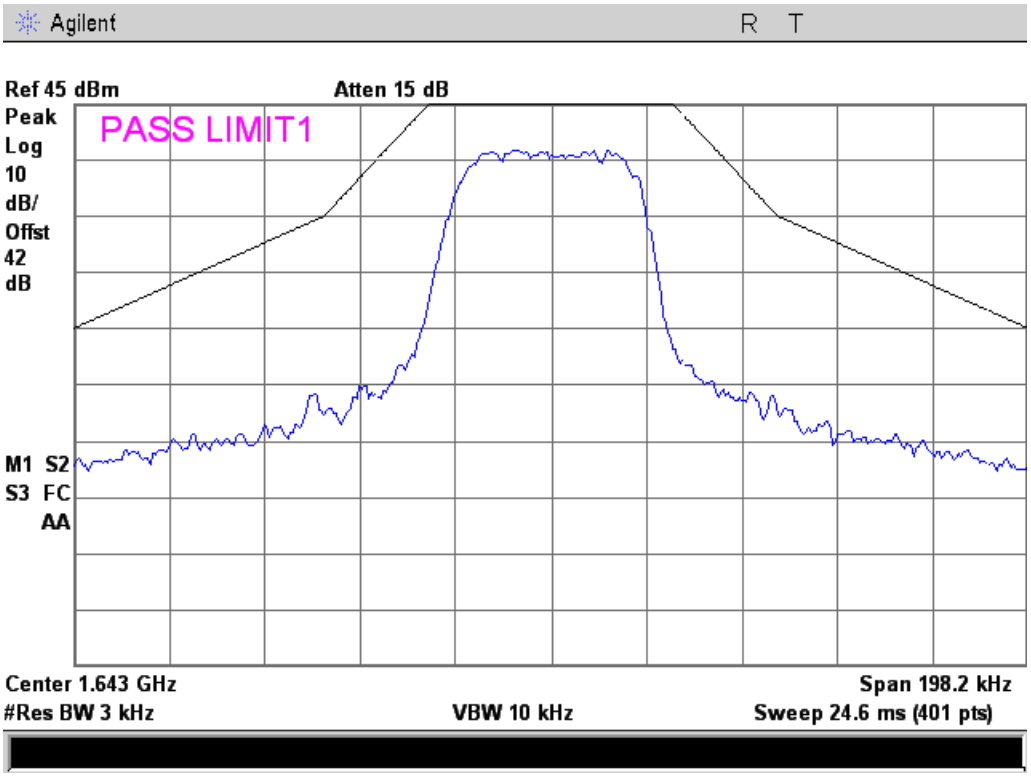


QAM Emissions Mask

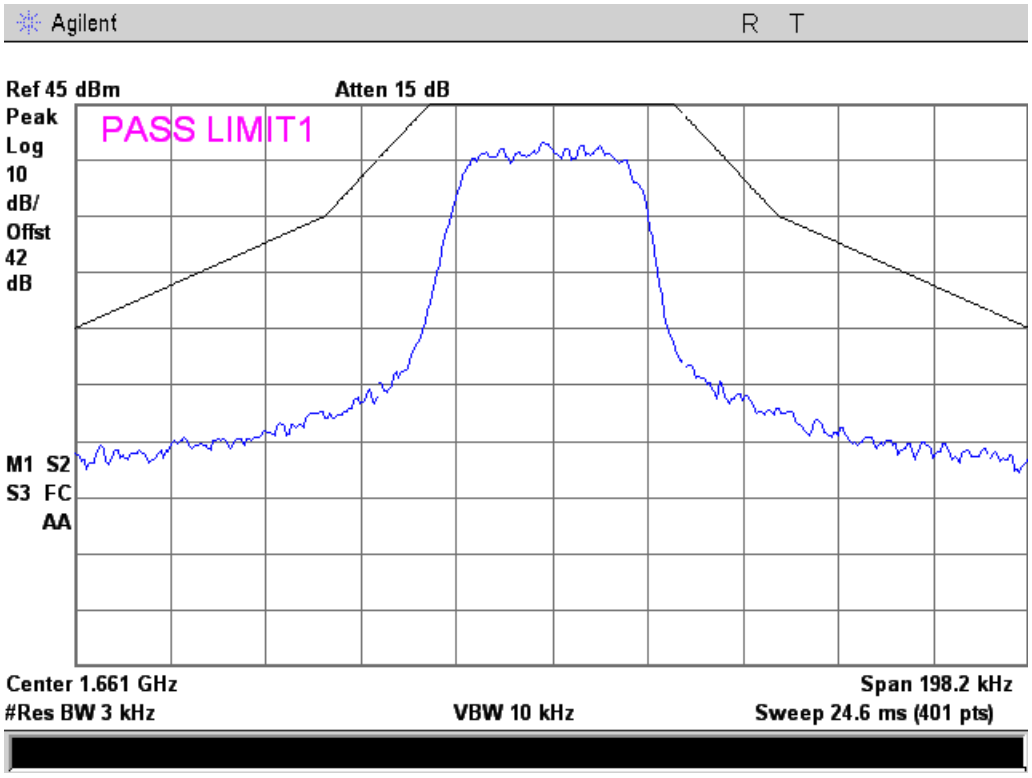
QAM 1626.5 MHz 50K0D7W



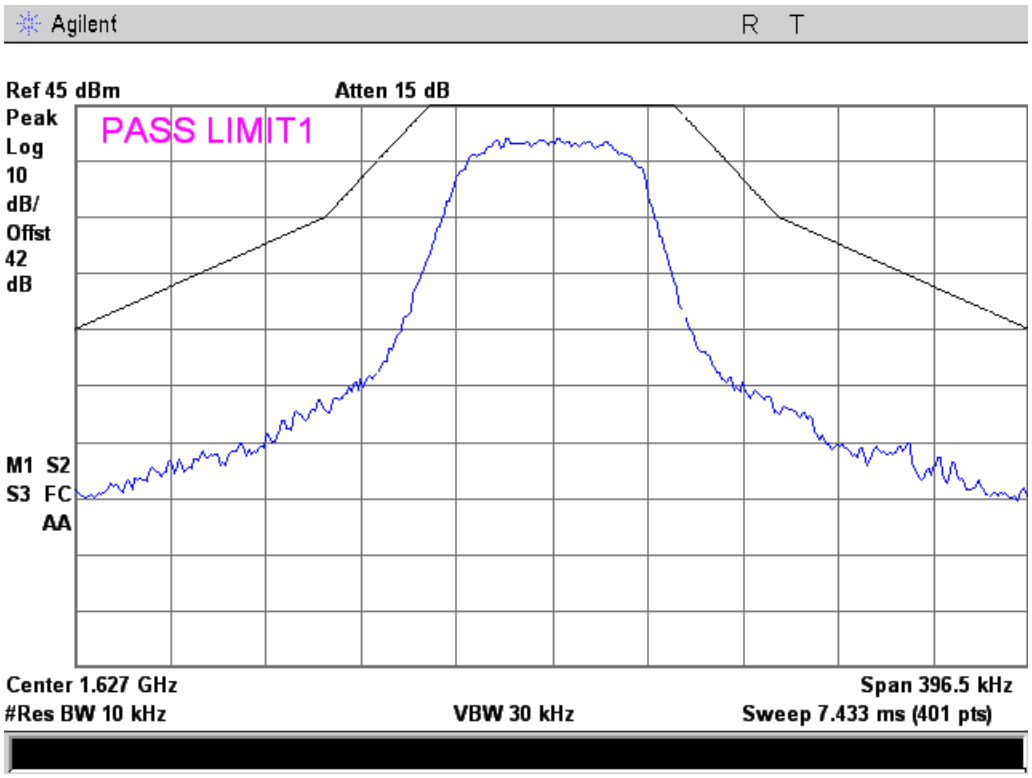
QAM 1643.5 MHz 50K0G7W



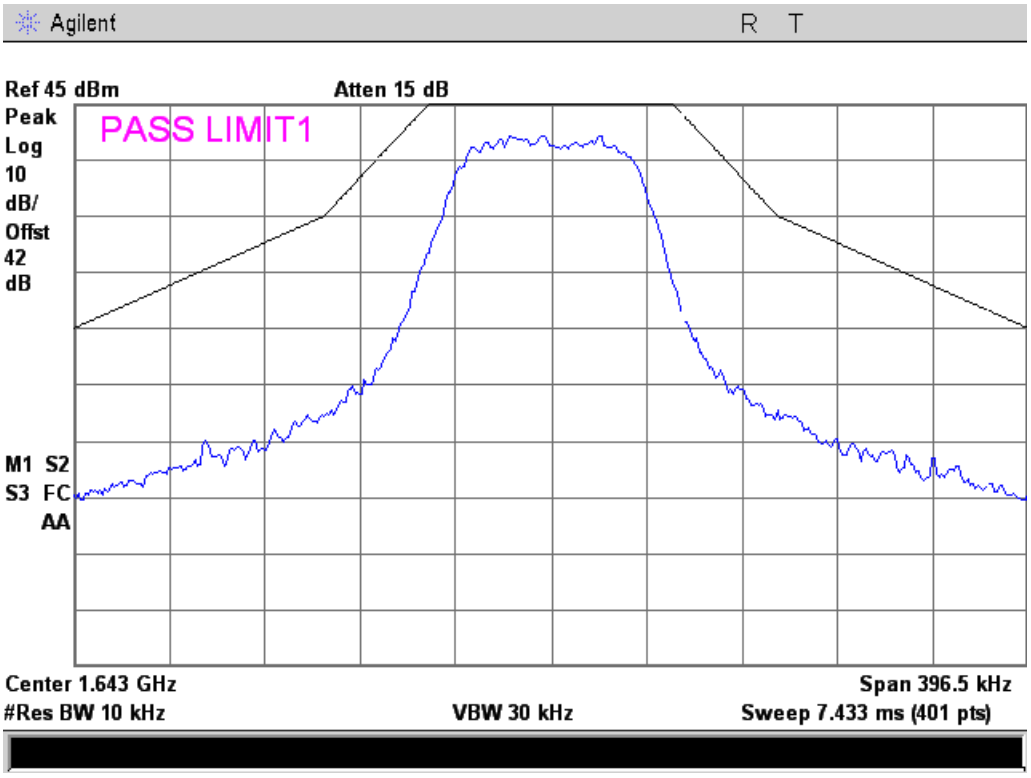
QAM 1660.5 MHz 50K0D7W



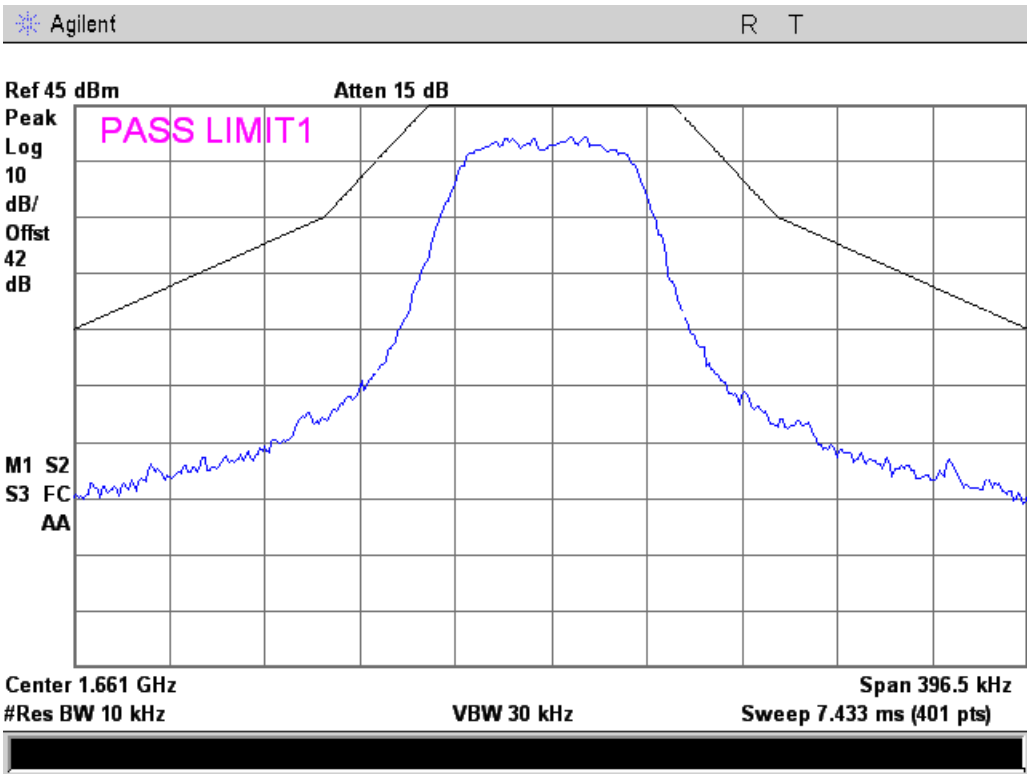
QAM 1626.5 MHz 100KD7W



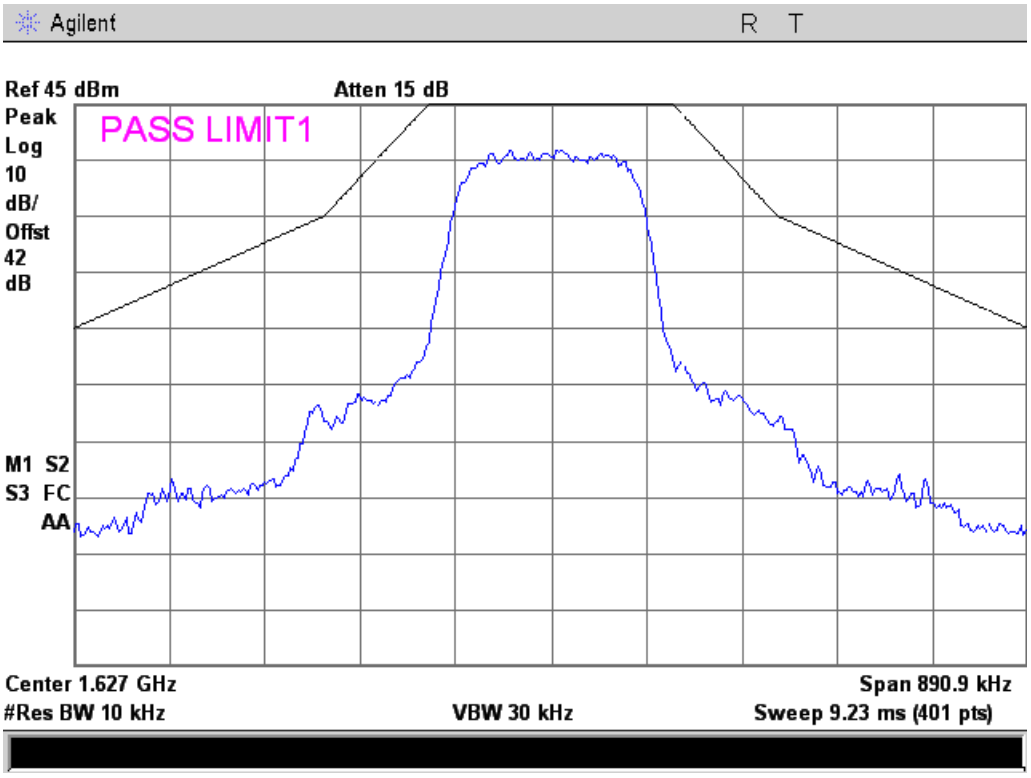
QAM 1643.5 MHz 100KD7W



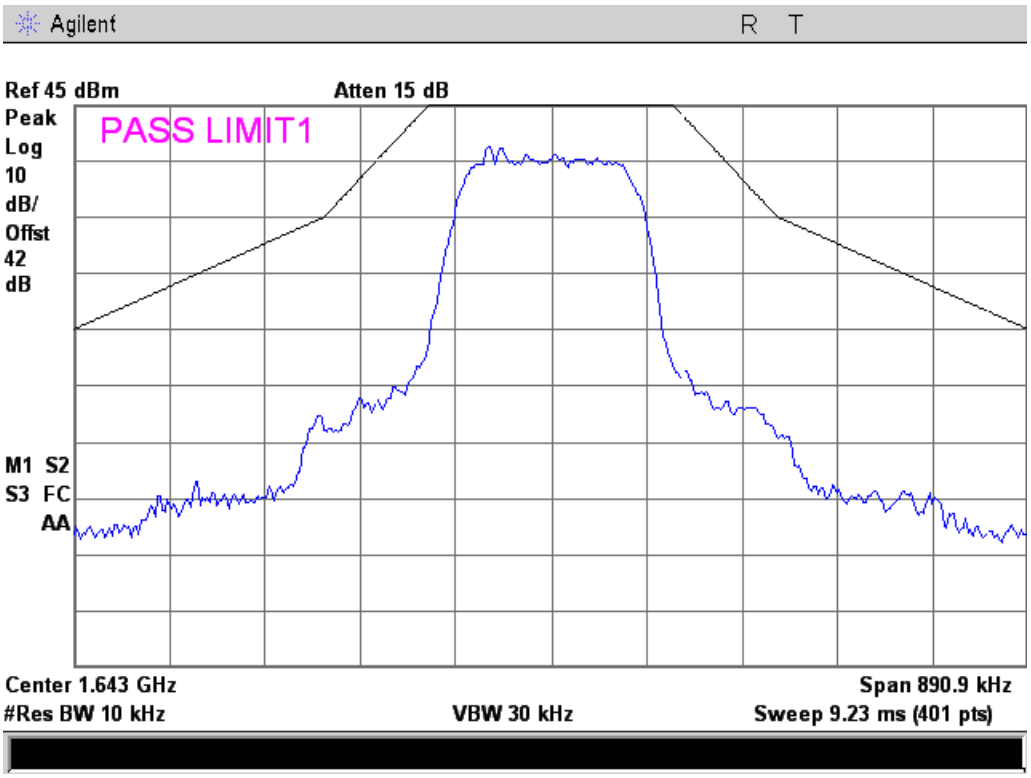
QAM 1660.5 MHz 100KD7W



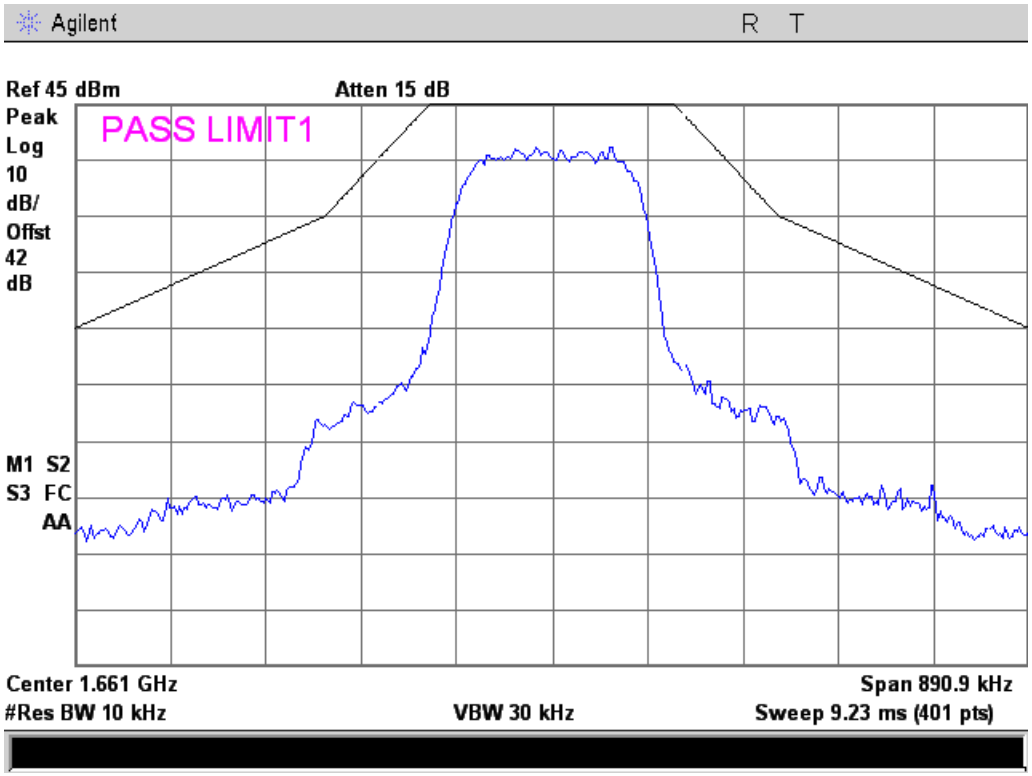
QAM 1626.5 MHz 200KD7W



QAM 1643.5 MHz 200KD7W



QAM 1660.5 MHz 200KD7W



A waiver has been granted for this modulation type**.**

Frequency Stability (Temperature Variation)

Name of Test: Frequency Stability (Temperature Variation) **Engineer:** John Erhard

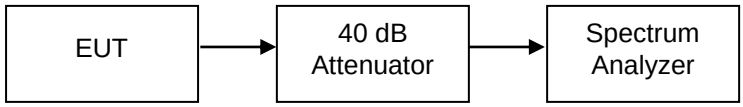
Test Equipment Utilized: 06143,i00287, i00343, i00331, Weinschel #48-40-43 **Test Date:** 5/21/2012

Test Procedure

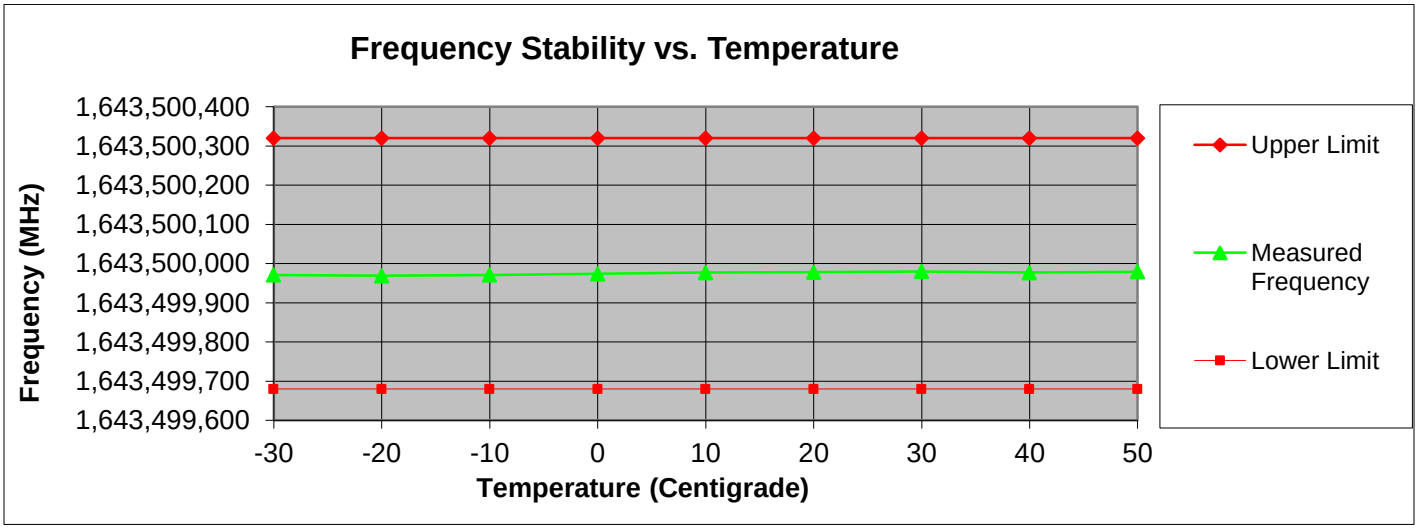
The EUT was placed in an environmental test chamber and the RF output was connected directly to a frequency counter. The temperature was varied from -30ºC to 50ºC in 10ºC increments. After a sufficient time for temperature stabilization the RF output frequency was measured.

The limit for this device type is 320 Hz.

Test Setup



Measurement Results



Frequency Stability (Voltage Variation)

Name of Test: Frequency Stability (Voltage Variation) **Engineer:** John Erhard

Test Equipment Utilized: 06143,i00287, i00343, i00331,Weinschel #48-40-43 **Test Date:** 5/21/2012

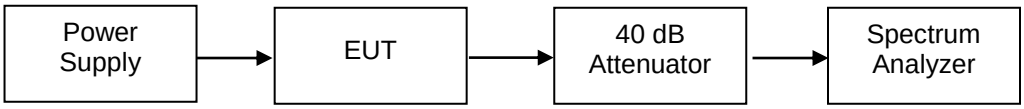
Test Procedure

The EUT was placed in a temperature chamber at 20±5°C and connected directly to a spectrum analyzer. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output was measured. This was measured with 400 Hz 115 VAC variable voltage source.

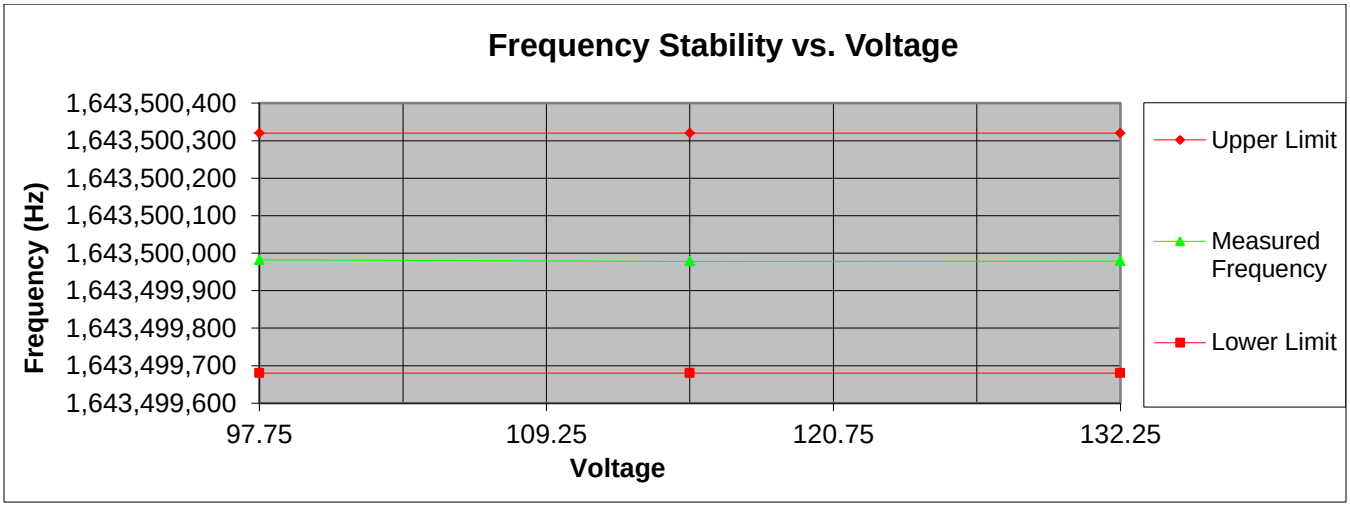
The limit for this device type is 320 Hz.

The EUT nominal voltage is 115 VAC at 400 HZ. The +/- 15% voltage variation is 97.75 to 132.25.

Test Setup



Test Results



Necessary Bandwidth and Emission Bandwidth

Name of Test: Necessary Bandwidth and Emission Bandwidth **Engineer:** John Erhard

Test Date: 5/21/2012

BPSK

Modulation = 840HG1D

Necessary Bandwidth Calculation:

Signal States (S)	=	2
Data Rate (D)	=	0.6
Constant Factor (K)	=	0.7
Necessary Bandwidth (B_N), kHz	=	2*D*K / LOG_2(S)

Modulation = 1K68G1D

Necessary Bandwidth Calculation:

Signal States (S)	=	2
Data Rate (D)	=	1.2
Constant Factor (K)	=	0.7
Necessary Bandwidth (B_N), kHz	=	2*D*K / LOG_2(S)

Modulation = 21K0G1D

Necessary Bandwidth Calculation:

Signal States (S)	=	2
Data Rate (D)	=	3
Constant Factor (K)	=	3.5
Necessary Bandwidth (B_N), kHz	=	2*D*K / LOG_2(S)

QPSK

Modulation = 6K80G1E

Necessary Bandwidth Calculation:

Signal States (S)	=	4
Data Rate (D)	=	8.4
Constant Factor (K)	=	0.81
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 7K20G1E

Necessary Bandwidth Calculation:

Signal States (S)	=	4
Data Rate (D)	=	5.6
Constant Factor (K)	=	1.29
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 10K5G1D

Necessary Bandwidth Calculation:

Signal States (S)	=	4
Data Rate (D)	=	10.5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 25K0G7W

Necessary Bandwidth Calculation:

Signal States (S)	=	4
Data Rate (D)	=	33.6
Constant Factor (K)	=	0.74
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 50K0G7W

Necessary Bandwidth Calculation:

Signal States (S)	=	4
Data Rate (D)	=	67.2
Constant Factor (K)	=	0.74
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 100KG7W

Necessary Bandwidth Calculation:

Signal States (S)	=	4
Data Rate (D)	=	134.4
Constant Factor (K)	=	0.74
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 200KG7W

Necessary Bandwidth Calculation:

Signal States (S)	=	4
Data Rate (D)	=	302.4
Constant Factor (K)	=	0.66
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

QAM

Modulation = 40K0G1E

Necessary Bandwidth Calculation:

Signal States (S)	=	16
Data Rate (D)	=	134.4
Constant Factor (K)	=	0.6
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 40K0G1D

Necessary Bandwidth Calculation:

Signal States (S)	=	16
Data Rate (D)	=	134.4
Constant Factor (K)	=	0.6
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 50K0D7W

Necessary Bandwidth Calculation:

Signal States (S)	=	16
Data Rate (D)	=	134.4
Constant Factor (K)	=	0.74
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 100KD7W

Necessary Bandwidth Calculation:

Signal States (S)	=	16
Data Rate (D)	=	268.8
Constant Factor (K)	=	0.74
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Modulation = 200KD7W

Necessary Bandwidth Calculation:

Signal States (S)	=	16
Data Rate (D)	=	604.8
Constant Factor (K)	=	0.66
Necessary Bandwidth (B_N), kHz	=	$2*D*K / LOG_2(S)$

Test Equipment Utilized

Compliance Testing

Asset#	Manufacturer	Model	Description	Last Calibration	Calibration Due
i00287	Tenny		Temperature Test Chamber	Verified on: 5/21/2012	
i00343	Fluke	Hydra	Data Bucket	12/15/2011	12/15/2012
i00103	EMCO	3115	Horn Antenna	11/5/2010	11/5/2012
i00331	Agilent	E4407B	Spectrum Analyzer	4/20/2012	4/20/2013
i00134	Termaline	8201	RF Load	Verified on: 5/18/2012	

EMS

Asset#	Manufacturer	Model	Description	Last Calibration	Calibration Due
N/A	Weinschel	48-40-43	40 dB attenuator	Verified on: 5/17/2012	
06143	California Instruments	801RP	400 Hz AC Supply	3/16/2012	3/16/2013

In addition to the above listed equipment standard RF connectors and cables were utilized in the testing of the described equipment. Prior to testing these components were tested to verify proper operation.

END OF REPORT