Compliance Testing, LLC
Previously Flom Test Lab
EMI, EMC, RF Testing Experts Since 1963

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http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Xetawave, LLC

Model: Xeta4m-HP

Description: 406 to 512 MHz Wireless Data Transceiver Module

FCC ID: PEJ-93824-XETA4HP
IC: 11169A-XETA4X

To

FCC Part 90

Date of Issue: September 9, 2014

On the behalf of the applicant:	**Xetawave, LLC** **258 South Taylor Ave** **Louisville, CO 80027**
Attention of:	**Craig Held, Executive Vice President** **Ph: (303) 447-2745** **E-Mail: craig@xetawave.com**

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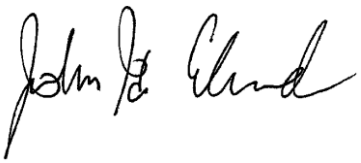
Project No: p1460014



John Erhard
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	June 20, 2014	John Erhard	Original Document
2.0	September 9, 2014	Amanda Reed	Updated FCC & IC ID, environmental conditions table, EUT description

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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 Site Reg. #349717

IC Site Reg. #2044A-2

Non-accredited tests contained in this report:

N/A

The Applicant has been cautioned as to the following:

15.21: **Information to the User**

The user's manual or instruction manual for an intentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

15.27(a): **Special Accessories**

Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without an additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in § 2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II, Part 2, Subpart J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, and the following individual Parts 90.

Standard Test Conditions and Engineering Practices

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

In accordance with ANSI/TIA 603C, 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.

Environmental Conditions		
Temp (ºC)	**Humidity (%)**	**Pressure (mbar)**
22.3 – 28.9	48.7 – 56.8	960.2 – 971.4

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

EUT Description
Model: Xeta4m-HP
Description: 406 to 512 MHz Wireless Data Transceiver Module
Firmware: N/A
Software: N/A
Additional Information: N/A

Accessories: None
Cables: None
Modifications: None

Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
2.1046	Carrier Output Power (Conducted)	Pass	
2.1051	Unwanted Emissions (Transmitter Conducted)	Pass	
2.1053	Field Strength of Spurious Radiation	Pass	
90.210, 2.1049	Emission Masks (Occupied Bandwidth)	Pass	
2.1047	Audio Low Pass Filter (Voice Input)	N/A	The EUT is a custom protocol digital radio with no audio input
2.1047	Audio Frequency Response	N/A	The EUT is a custom protocol digital radio with no audio input
2.1047(a)	Modulation Limiting	N/A	The EUT is a custom protocol digital radio with no audio input
90.213	Frequency Stability (Temperature Variation)	Pass	
90.213	Frequency Stability (Voltage Variation)	Pass	
90.214	Transient Frequency Behavior	Pass	
2.202	Necessary Bandwidth Calculation	Pass	

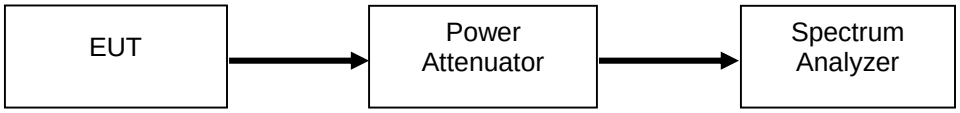
Carrier Output Power (Conducted)

Name of Test:	Carrier Output Power (Conducted)	**Engineer:** John Erhard
Test Equipment Utilized:	i00054, i00331	**Test Date:** 6/17/2014

Measurement Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a reference level offset to ensure accurate readings were obtained.

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Recorded Measurement (dBm)	Recorded Measurement (W)	Result
450.5	40.00	10.00	Pass
460.5	39.76	9.46	Pass
469.95	39.69	9.31	Pass

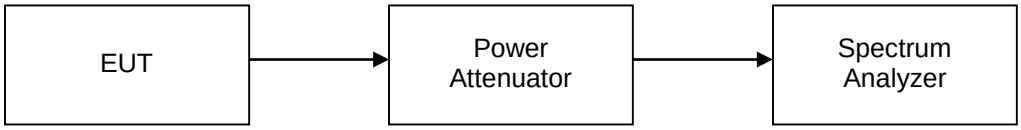
Conducted Spurious Emissions

Name of Test:	Conducted Spurious Emissions	**Engineer:** John Erhard
Test Equipment Utilized:	i00054, i00379	**Test Date:** 6/17/2014

Test Procedure

The EUT was connected directly to a spectrum analyzer to verify that the UUT met the requirements for spurious emissions. The system was adjusted to ensure sufficient dynamic range to measure spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed and plotted.

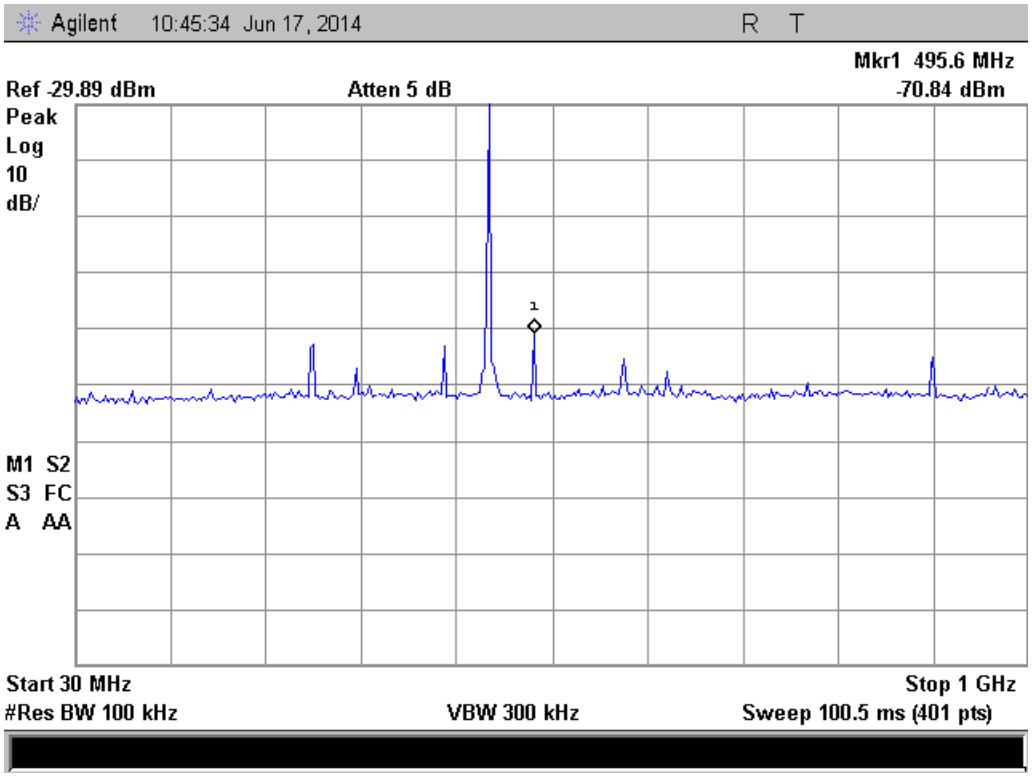
Test Setup

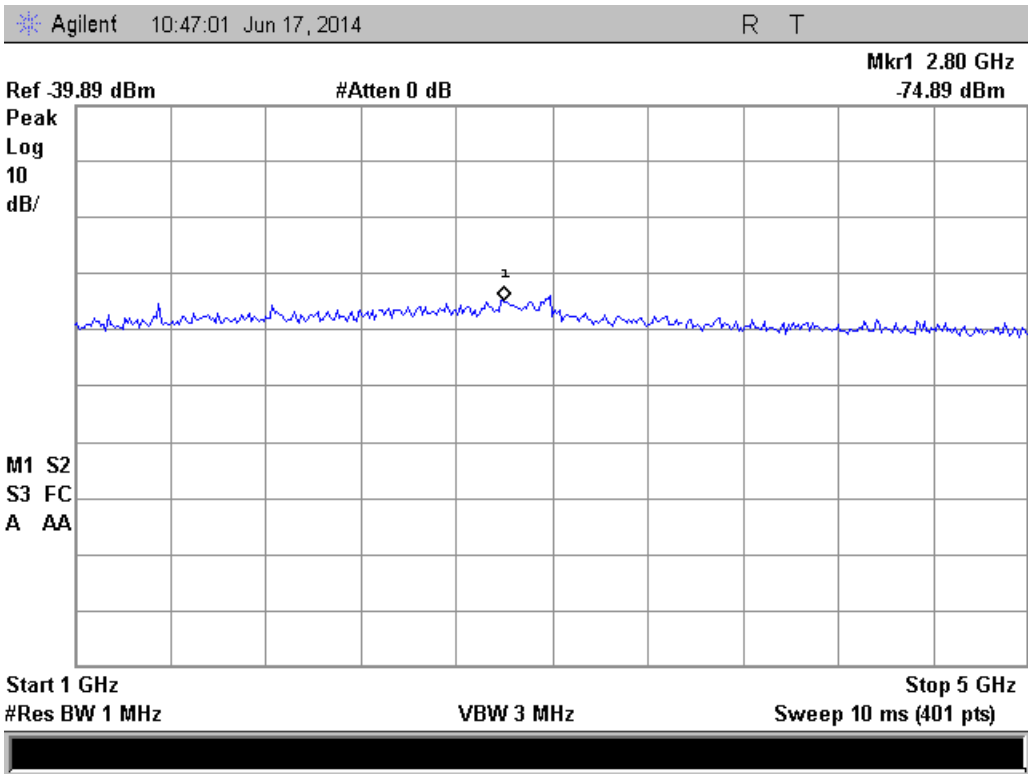


Conducted Spurious Emissions Summary Test Table

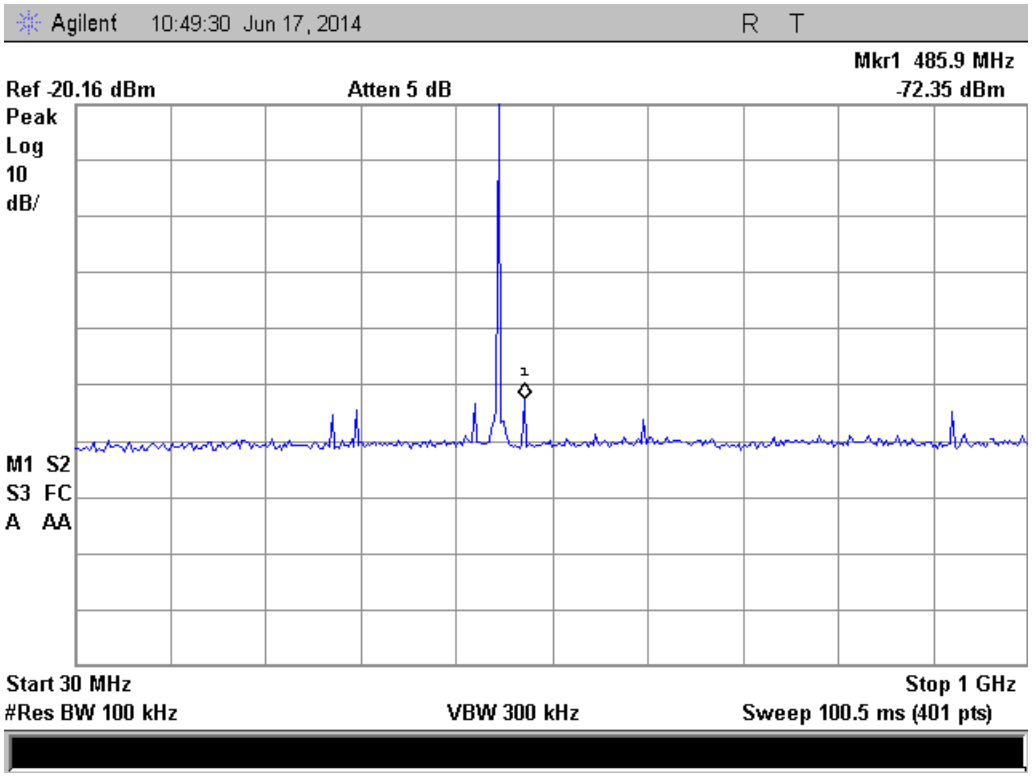
Tuned Frequency (MHz)	Spurious Frequency (MHz)	Measured Spurious Level (dBm)	Specification Limit (dBm)	Result
450.5	495.6	-70.84	-20	Pass
460.5	485.9	-72.35	-20	Pass
469.95	313.3	-71.35	-20	Pass

450.50 MHz


Agilent 10:45:34 Jun 17, 2014
R T
Mkr1 495.6 MHz
Ref -29.89 dBm
Atten 5 dB
-70.84 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Start 30 MHz
#Res BW 100 kHz
VBW 300 kHz
Stop 1 GHz
Sweep 100.5 ms (401 pts)


Agilent 10:47:01 Jun 17, 2014
R T
Mkr1 2.80 GHz
Ref -39.89 dBm
#Atten 0 dB
-74.89 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Start 1 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 5 GHz
Sweep 10 ms (401 pts)

460.50 MHz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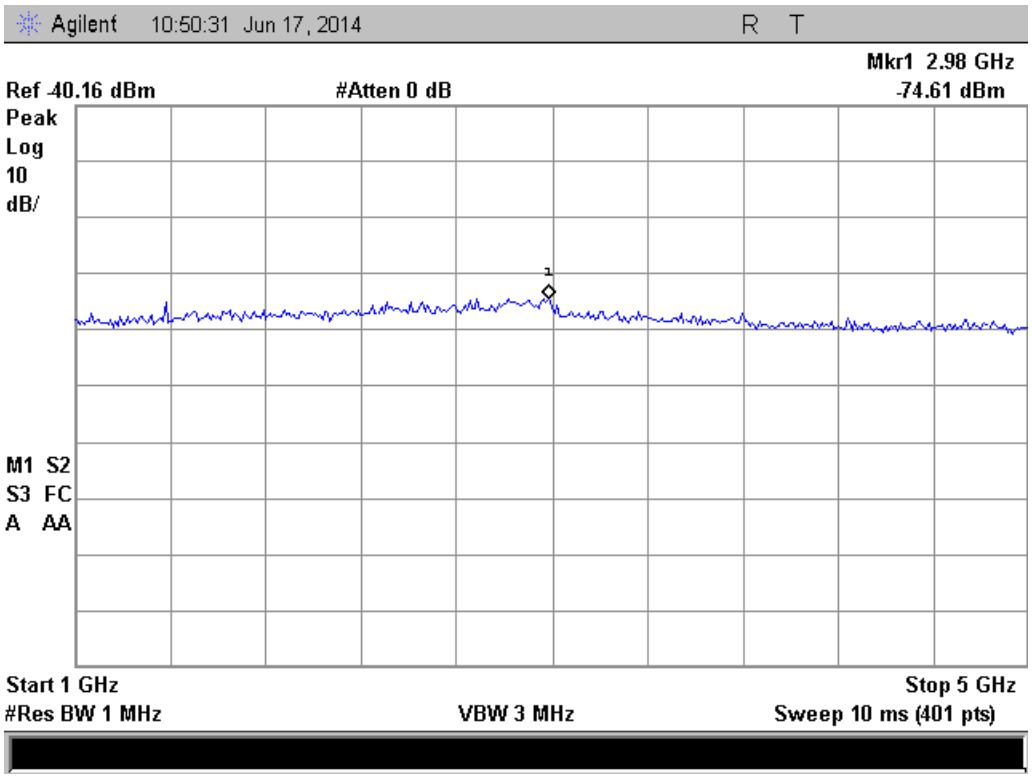
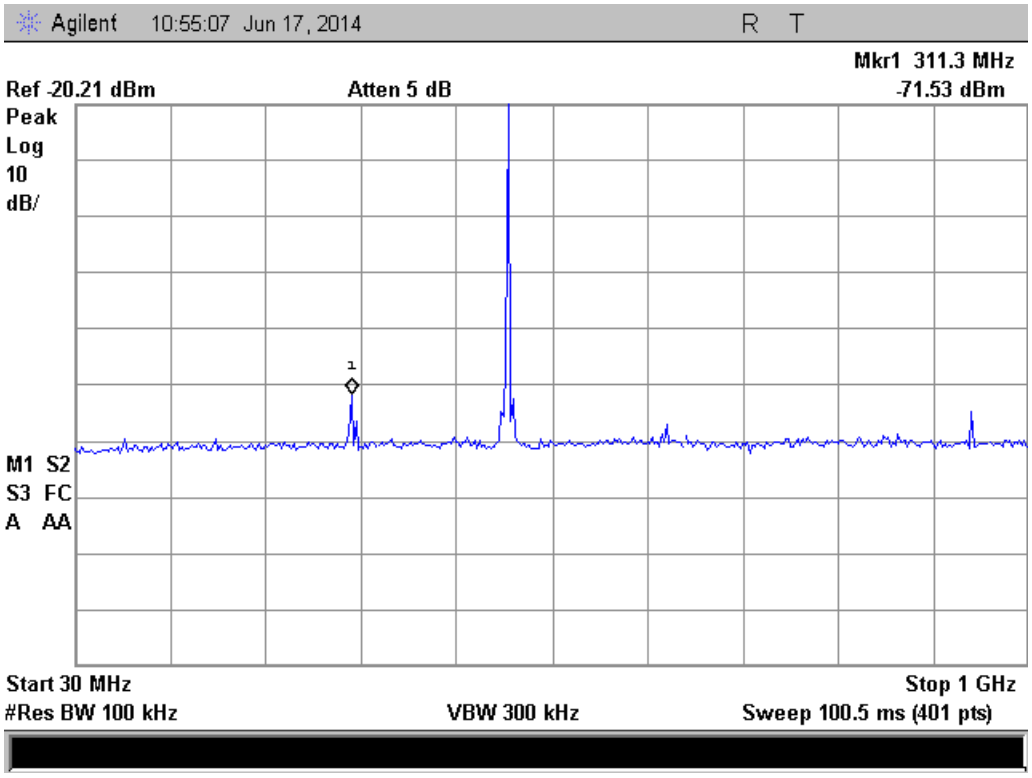
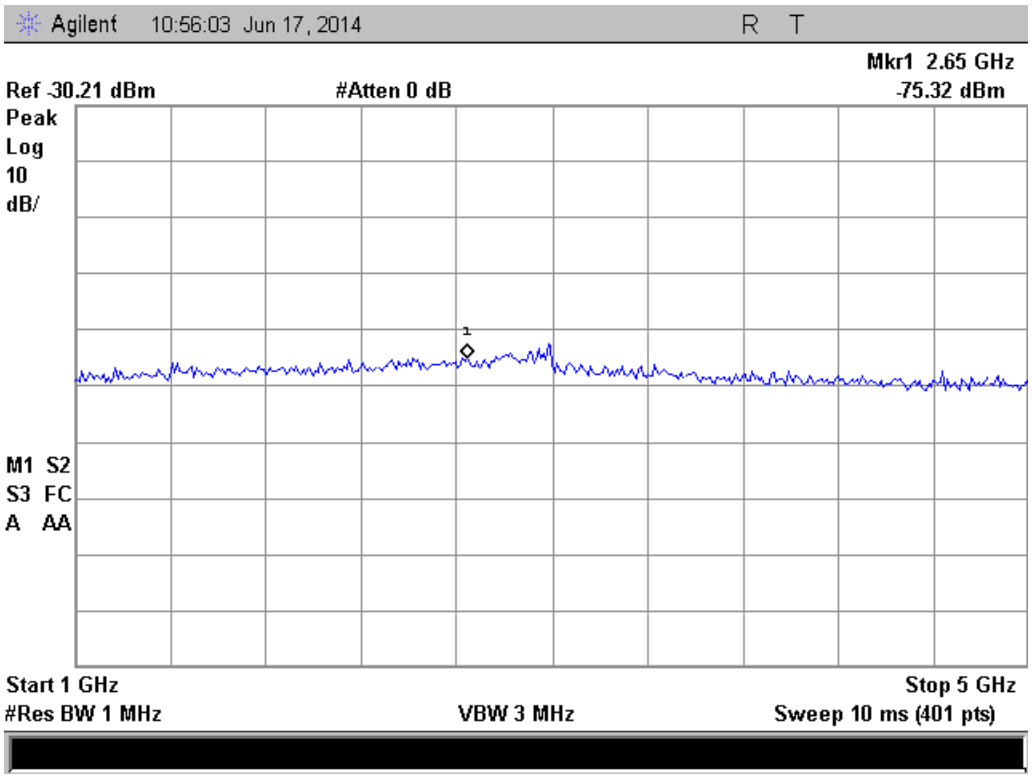
R T
Mkr1 485.9 MHz
Ref -20.16 dBm
Atten 5 dB
-72.35 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Start 30 MHz
#Res BW 100 kHz
VBW 300 kHz
Stop 1 GHz
Sweep 100.5 ms (401 pts)


Agilent 10:50:31 Jun 17, 2014
R T
Mkr1 2.98 GHz
Ref -40.16 dBm
#Atten 0 dB
-74.61 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Start 1 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 5 GHz
Sweep 10 ms (401 pts)

469.95 MHz


Agilent 10:55:07 Jun 17, 2014
R T
Mkr1 311.3 MHz
Ref -20.21 dBm
Atten 5 dB
-71.53 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Start 30 MHz
#Res BW 100 kHz
VBW 300 kHz
Stop 1 GHz
Sweep 100.5 ms (401 pts)


Agilent 10:56:03 Jun 17, 2014
R T
Mkr1 2.65 GHz
Ref -30.21 dBm
#Atten 0 dB
-75.32 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
A AA
Start 1 GHz
#Res BW 1 MHz
VBW 3 MHz
Stop 5 GHz
Sweep 10 ms (401 pts)

Field Strength of Spurious Radiation

Name of Test:	Field Strength of Spurious Radiation	**Engineer:**	John Erhard
Test Equipment Utilized:	i00054, i00103, i00349, i0037	**Test Date:**	6/18/2014

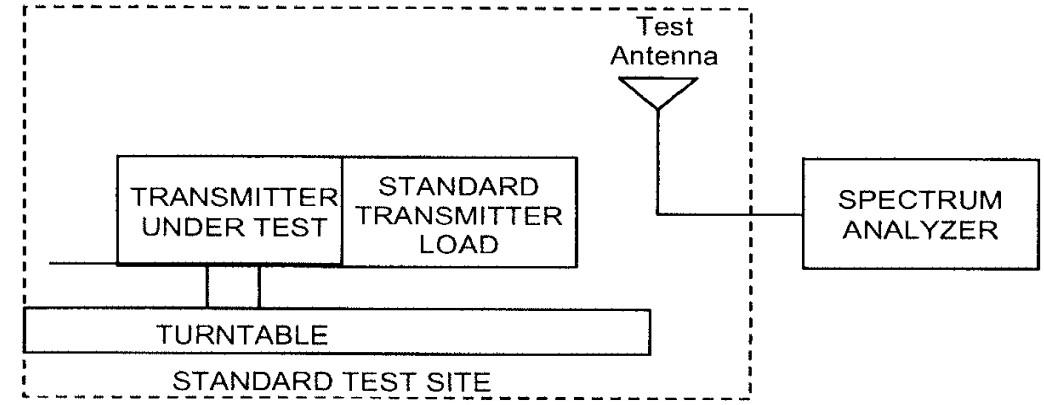
Test Procedure

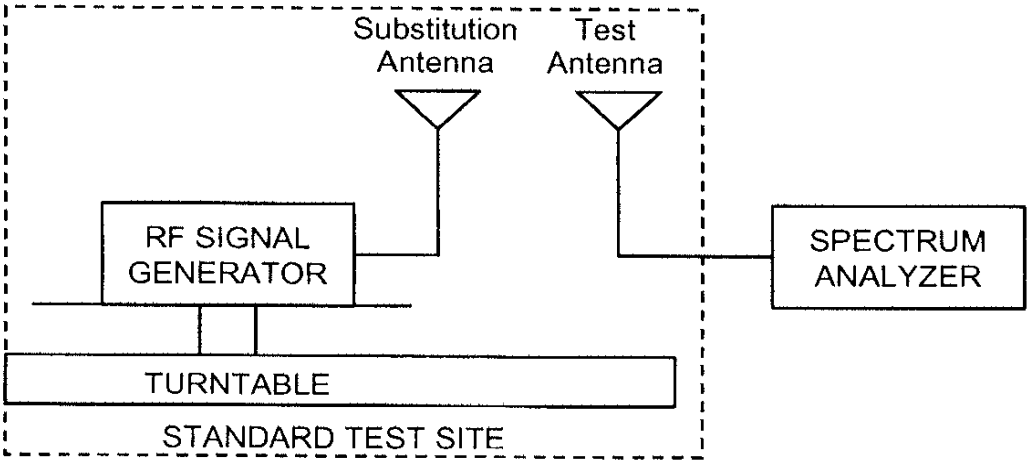
A) Connect the equipment as illustrated below.
B) Adjust the spectrum analyzer to the following settings:
    1) Resolution Bandwidth 100 kHz (< 1 GHZ), 1 MHZ (> 1GHz)
    2) Video Bandwidth ≥ 3 times Resolution Bandwidth, or 30 kHz
    3) Sweep Speed ≤2000 Hz/second
    4) Detector Mode = Mean or Average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

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

Test Setup


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


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

450.5 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit ERP/EIRP (dBm)	Result
901.0	-66.89	-20	Pass
1351.4	-56.06	-20	Pass
1801.45	-56.34	-20	Pass

460.5 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit ERP/EIRP (dBm)	Result
921.0	-53.4	-20	Pass
1381.4	-53.95	-20	Pass
1841.9	-54.61	-20	Pass

469.95 Test Results

Emission Frequency (MHz)	Measured Level (dBm)	Limit ERP/EIRP (dBm)	Result
939.9	-49.8	-20	Pass
1409.8	-54.81	-20	Pass
1879.7	-55.26	-20	Pass

No other emissions were detected. All emissions were lower than –20 dBm.

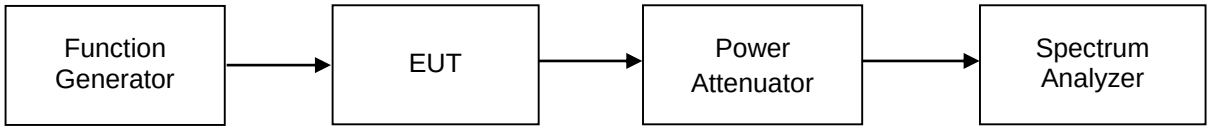
Emission Masks (Occupied Bandwidth)

Name of Test:	Emission Masks (Occupied Bandwidth)	**Engineer:** John Erhard
Test Equipment Utilized	i00054, i00331	**Test Date:** 6/18/2014

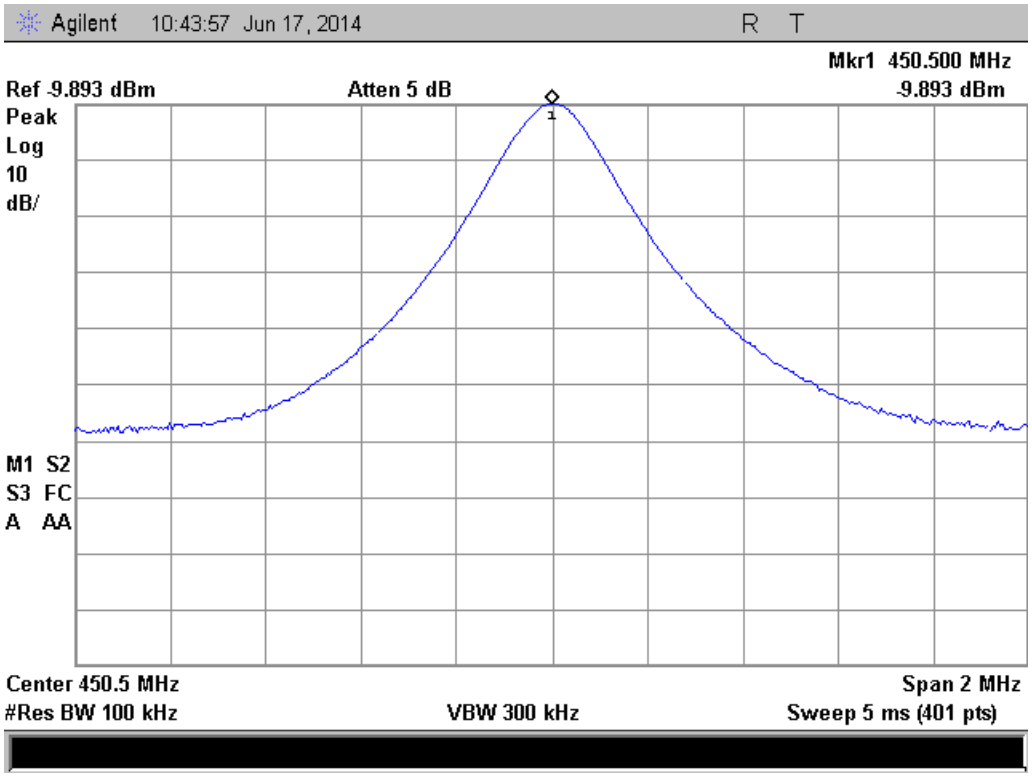
Measurement Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask. A reference level plot is provided to verify that the peak power was established prior to testing the mask. The EUT is a digitally modulated radio with no audio input. All modulation types use Mask D for 12.5 KHz channel spacing.

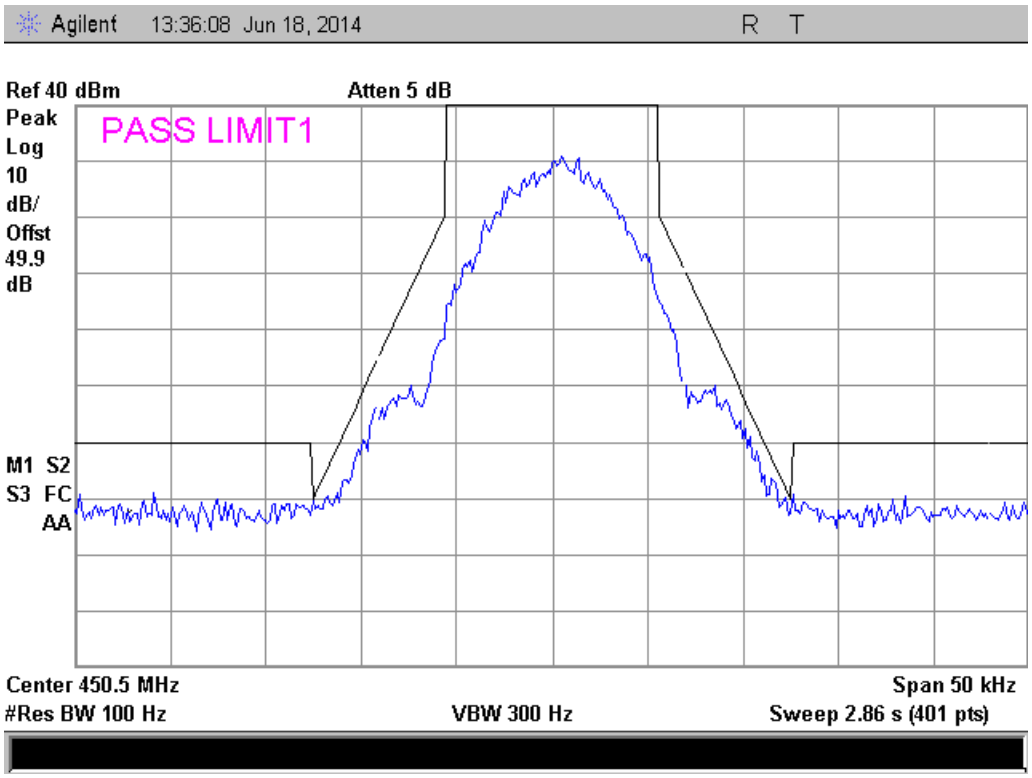
Test Setup



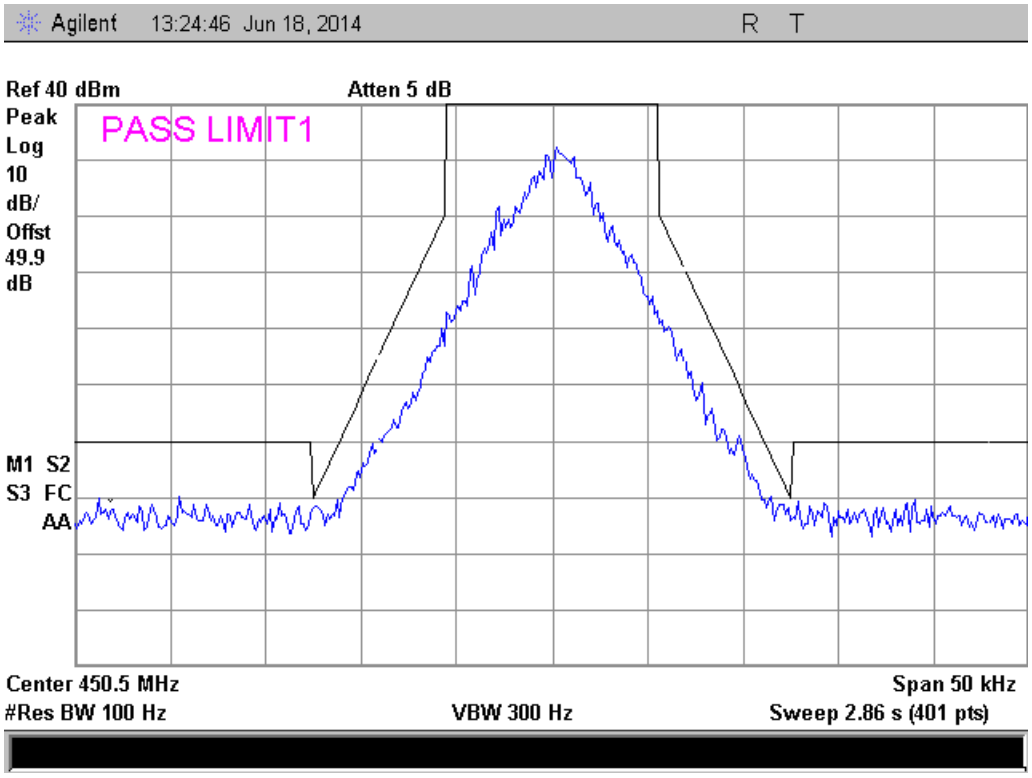
450.5 Reference



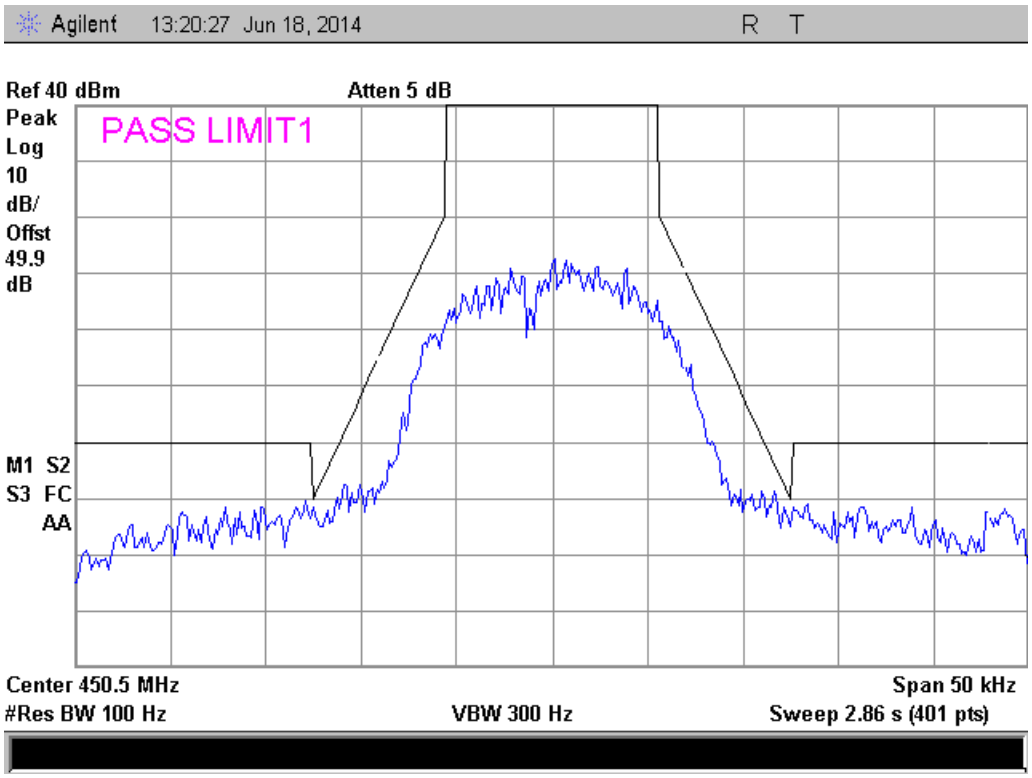
2 FSK Mask



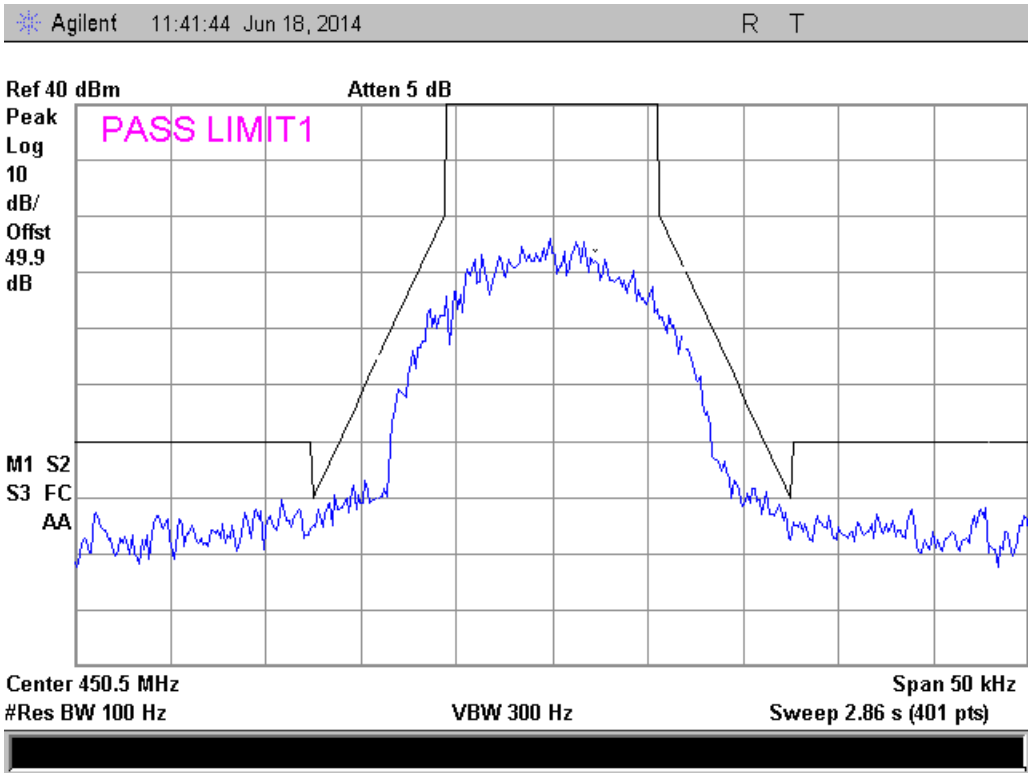
4 FSK Mask



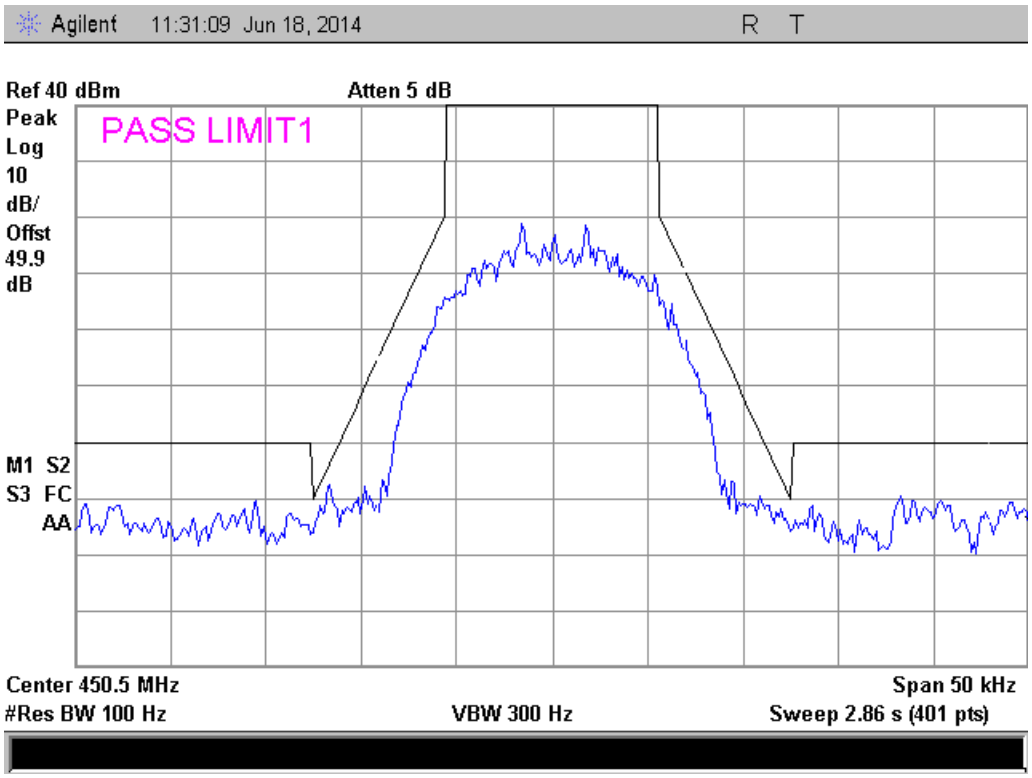
8 PSK Mask



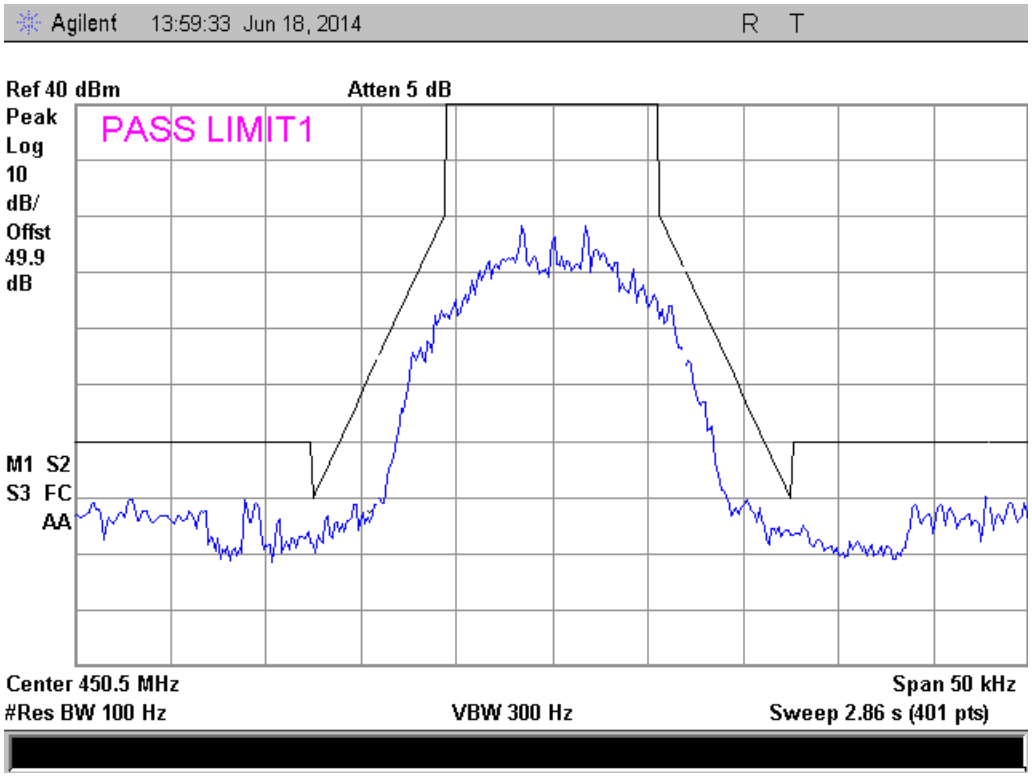
16 QAM Mask



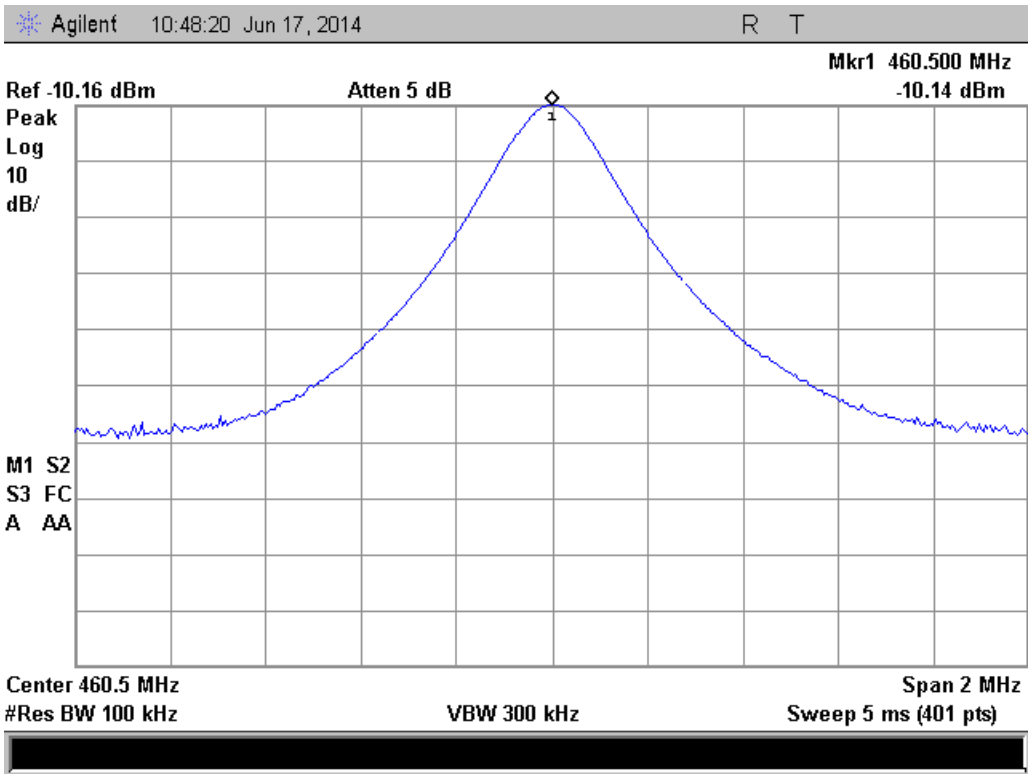
32 QAM Mask



64 QAM Mask



460.5 Reference



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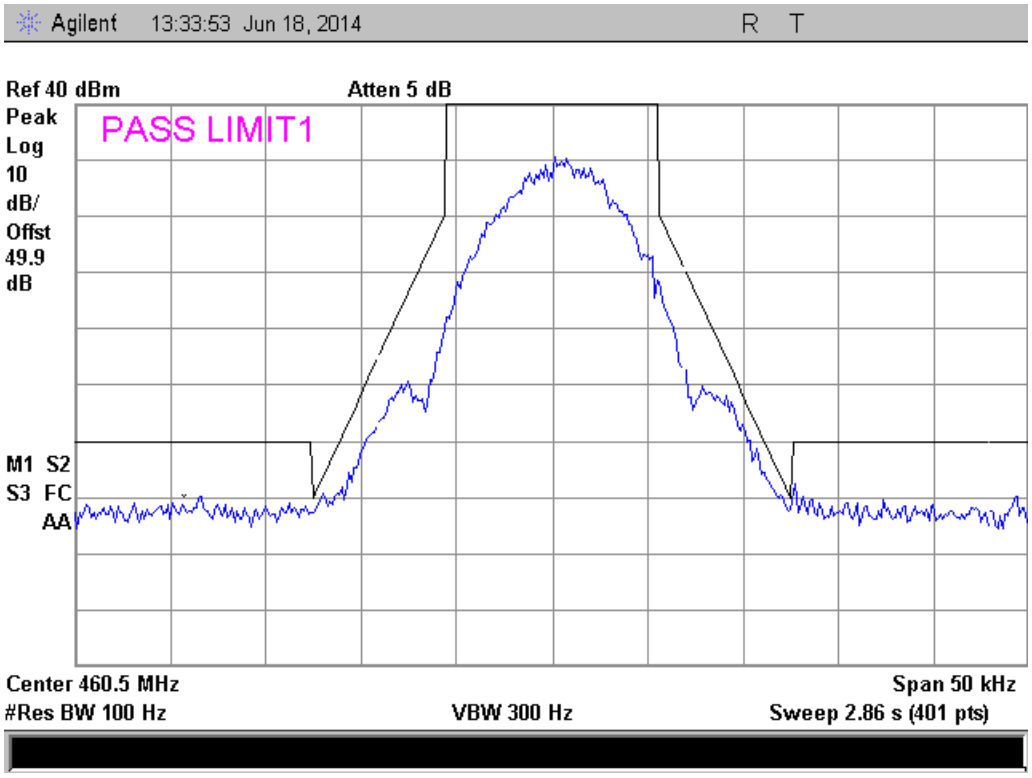

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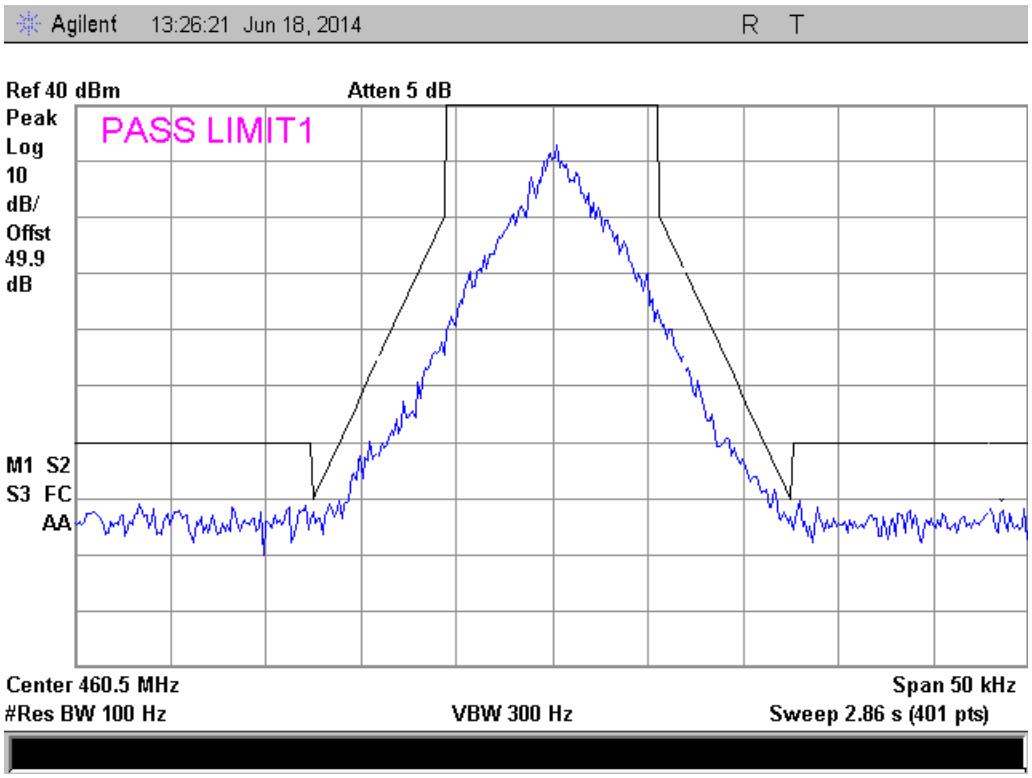
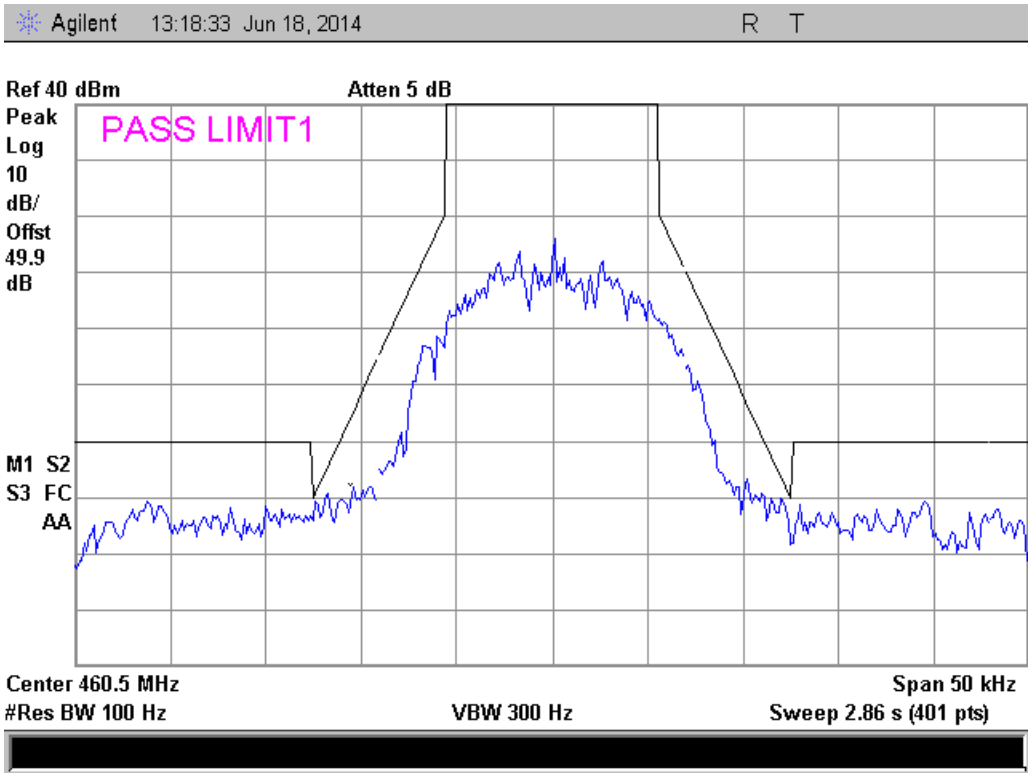


8 PSK Mask



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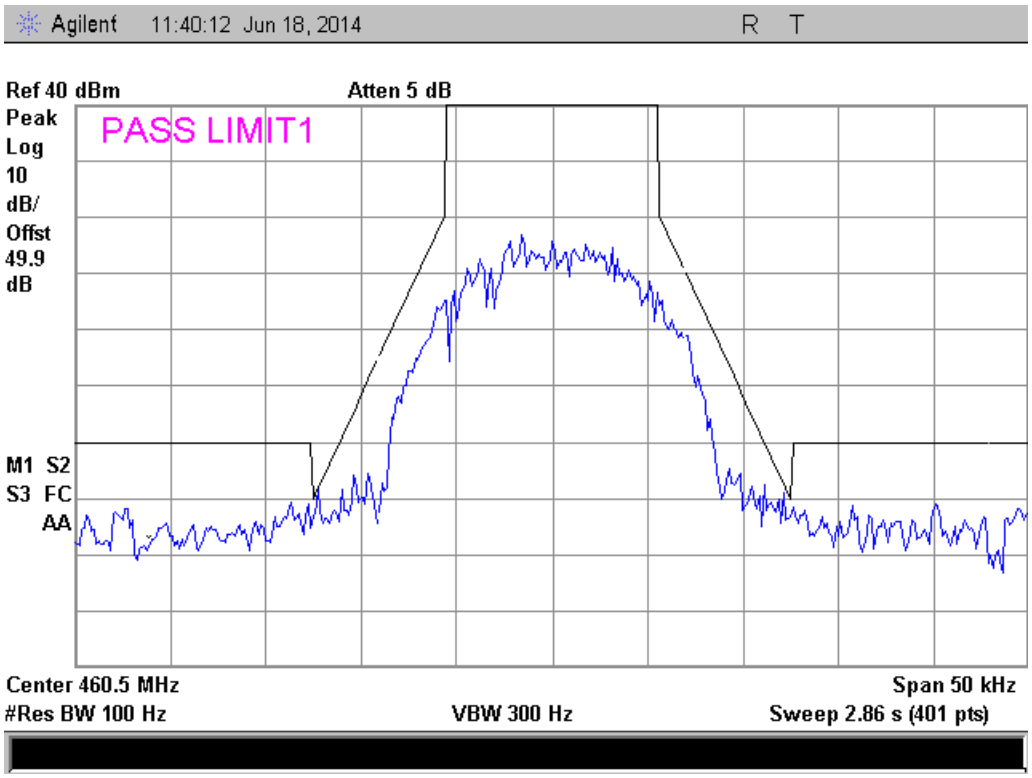

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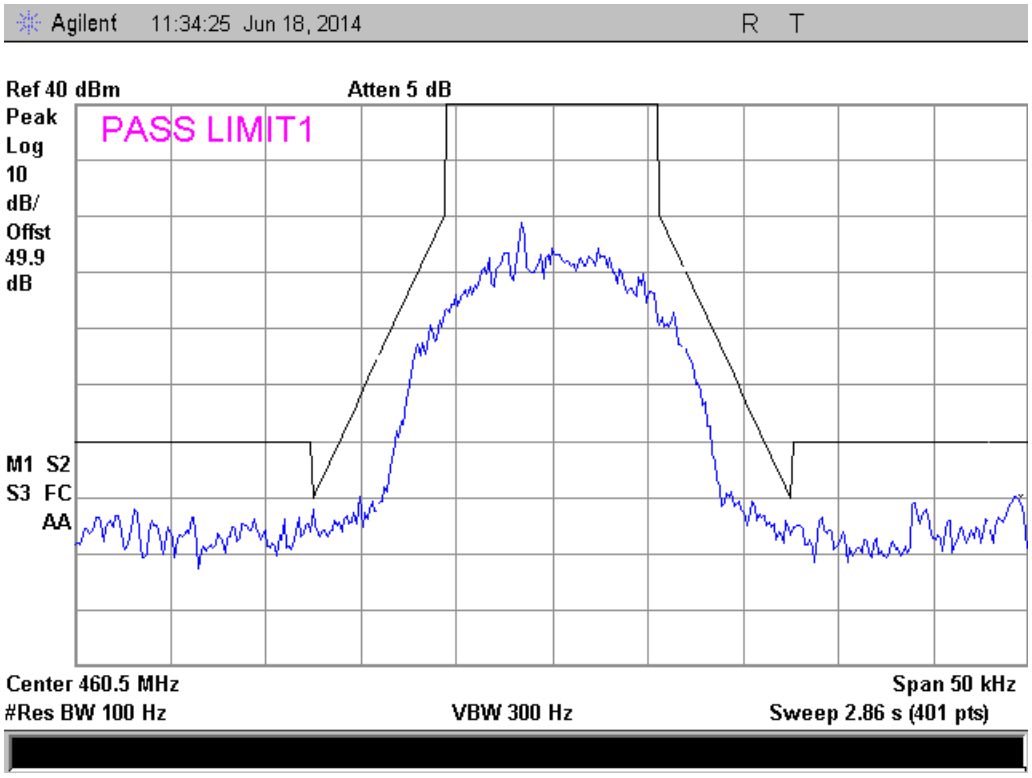

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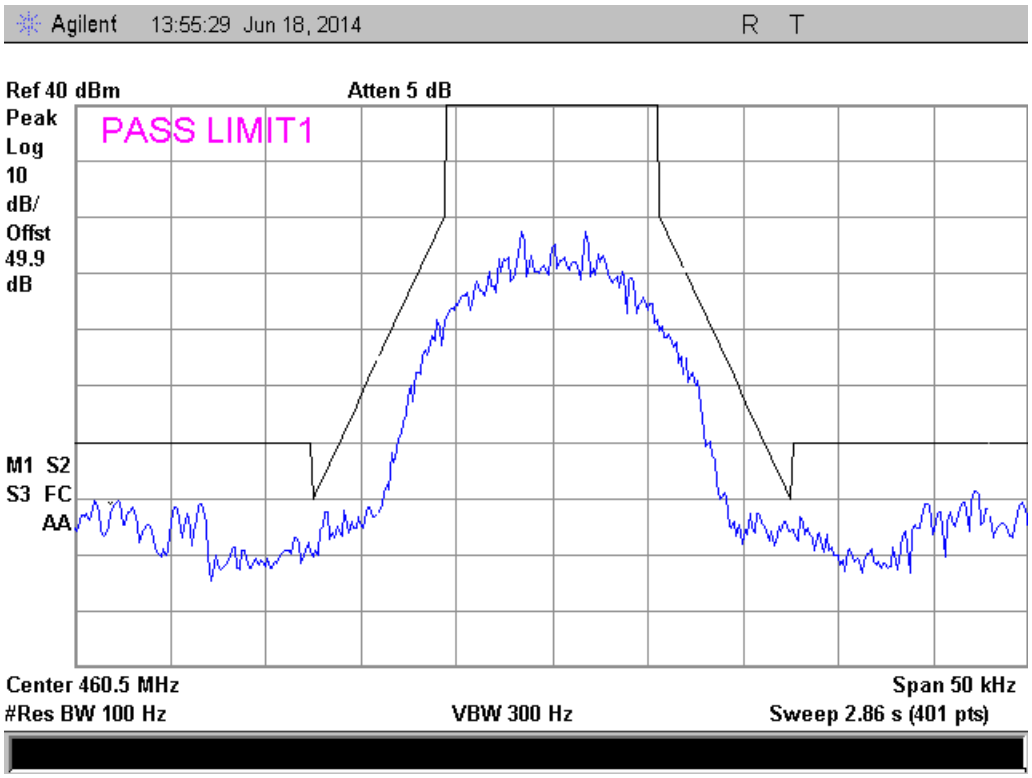
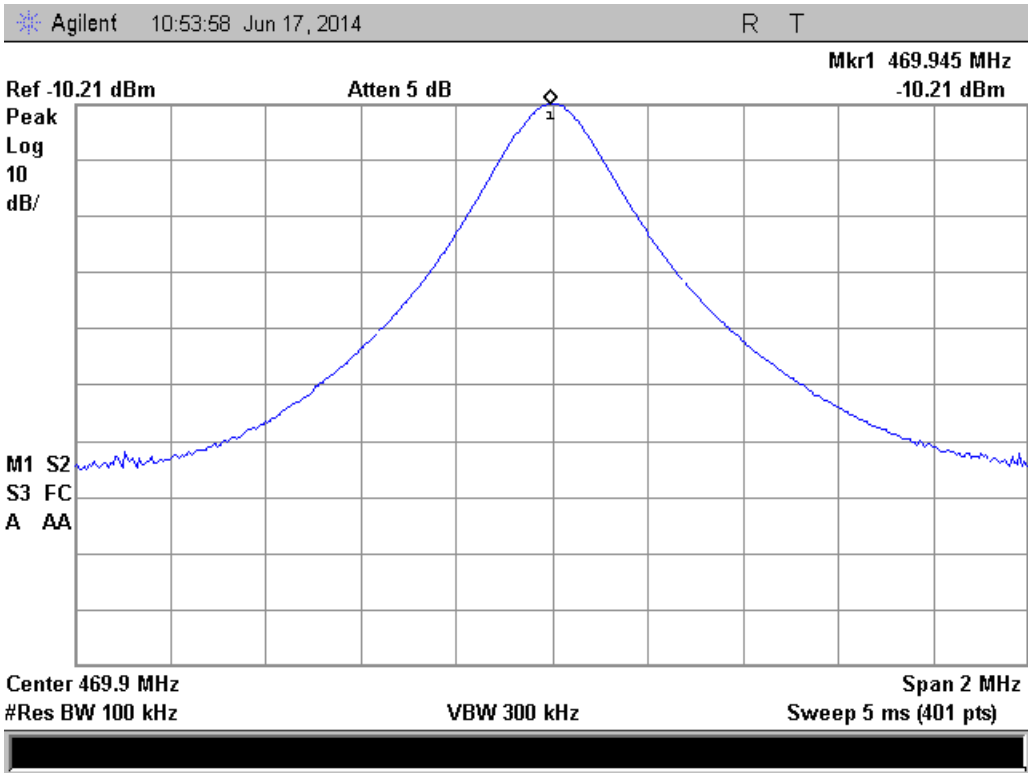
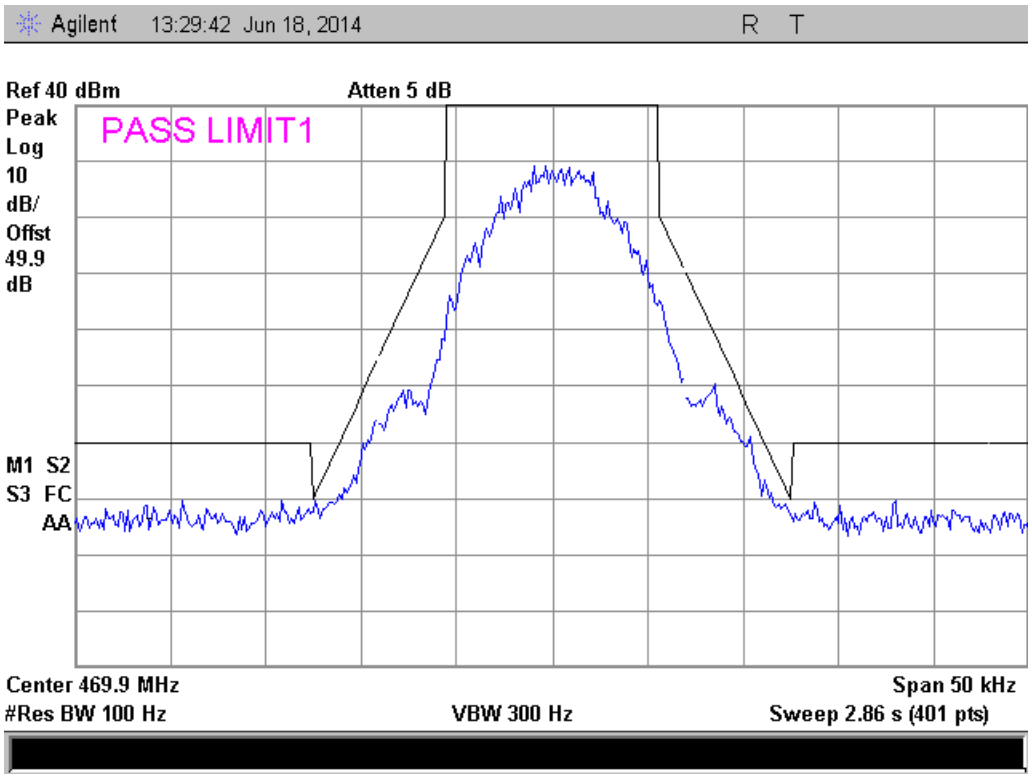


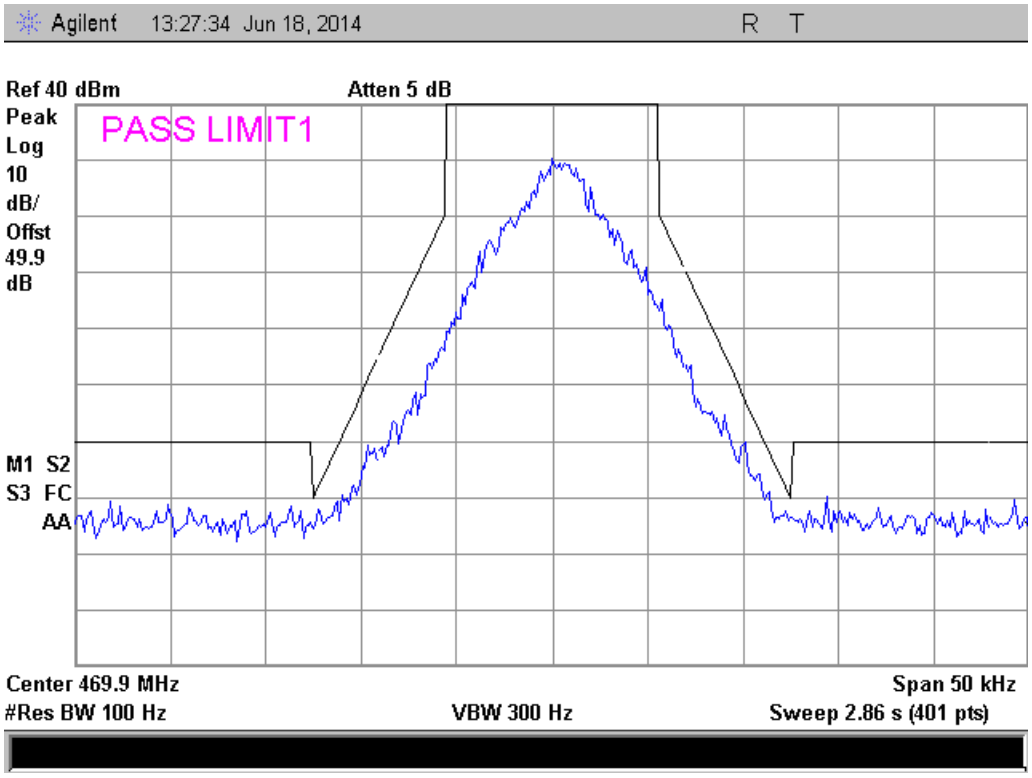
469.95 Reference



2 FSK Mask



4 FSK Mask



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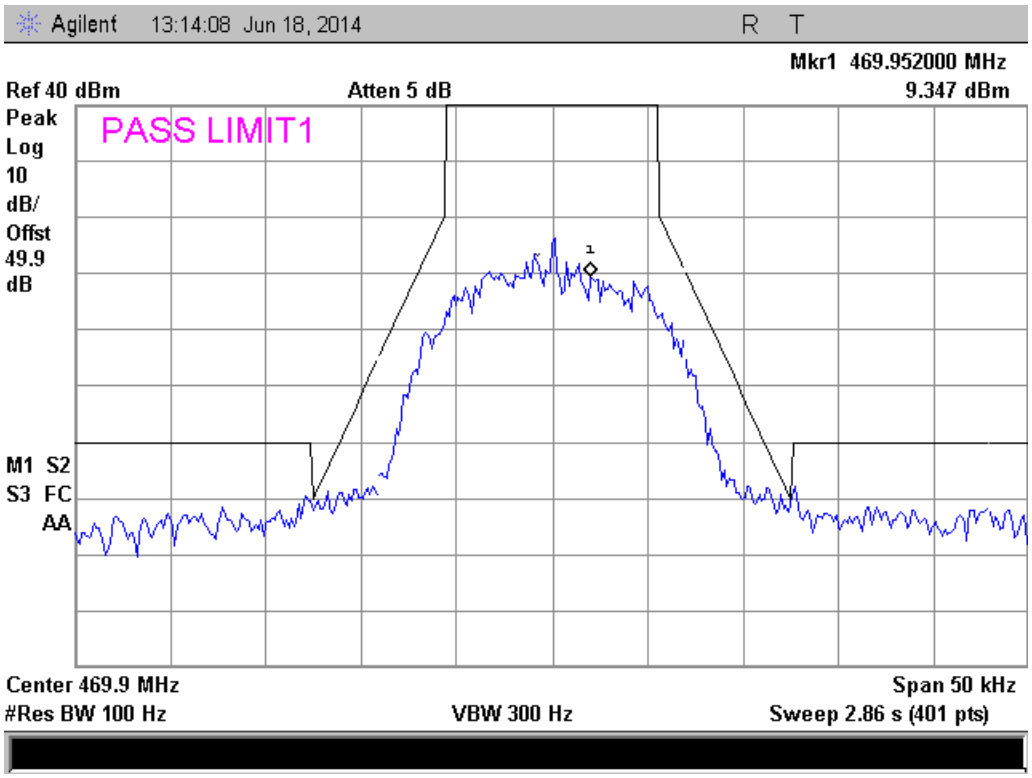

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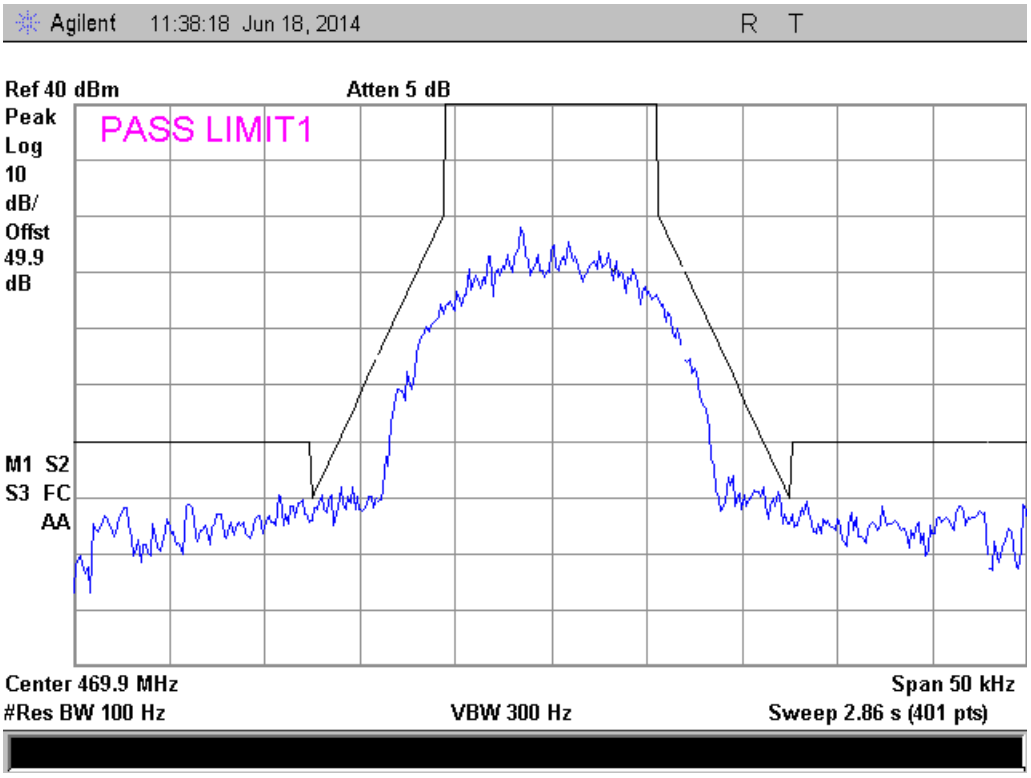

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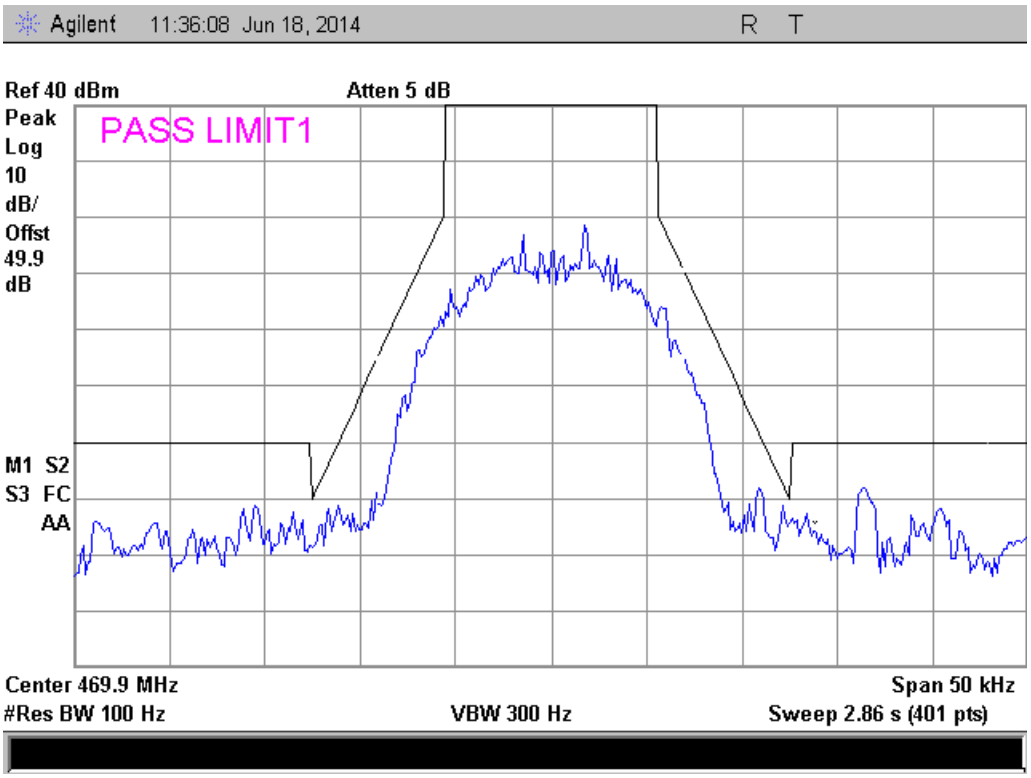
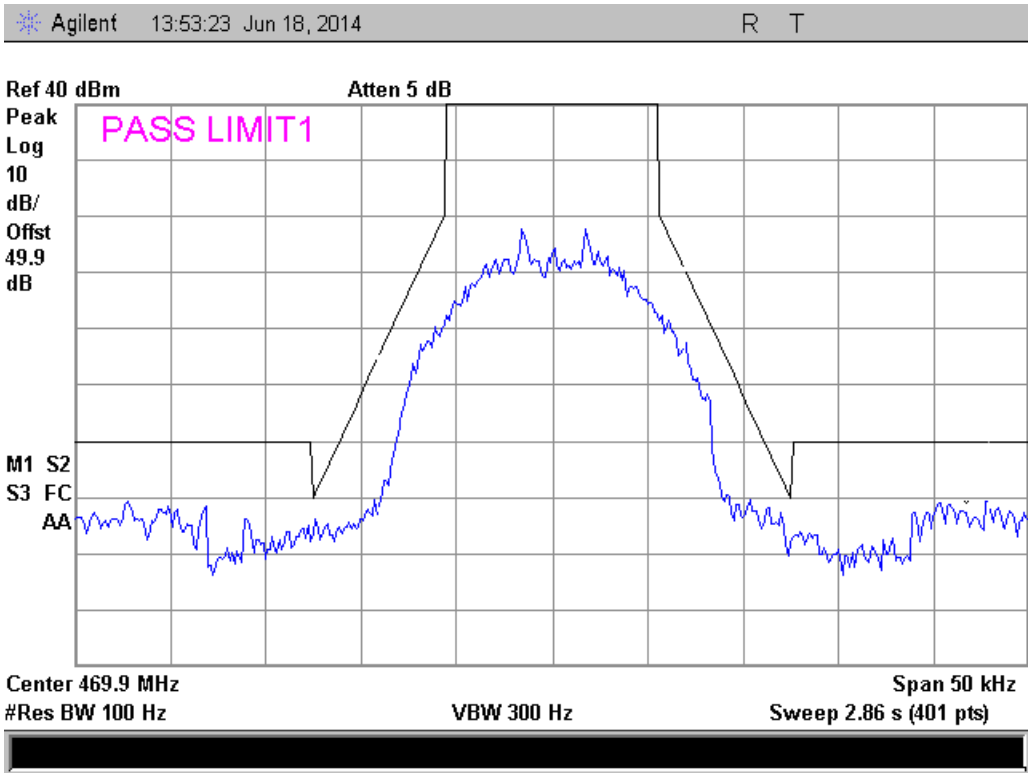


64 QAM Mask


Agilent 13:53:23 Jun 18, 2014
R T
Ref 40 dBm
Atten 5 dB
Peak
Log
10
dB/
Offst
49.9
dB
PASS LIMIT1
M1 S2
S3 FC
AA
Center 469.9 MHz
Span 50 kHz
#Res BW 100 Hz
VBW 300 Hz
Sweep 2.86 s (401 pts)

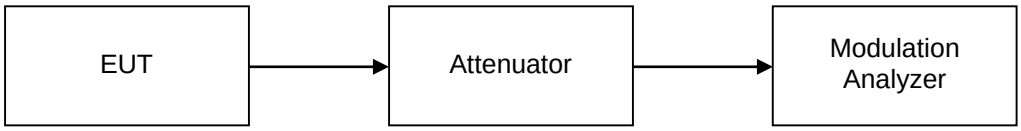
Transient Frequency Behavior

Name of Test:	Transient Frequency Behavior	**Engineer:** John Erhard
Test Equipment Utilized:	i00054, i00345	**Test Date:** 6/17/2014

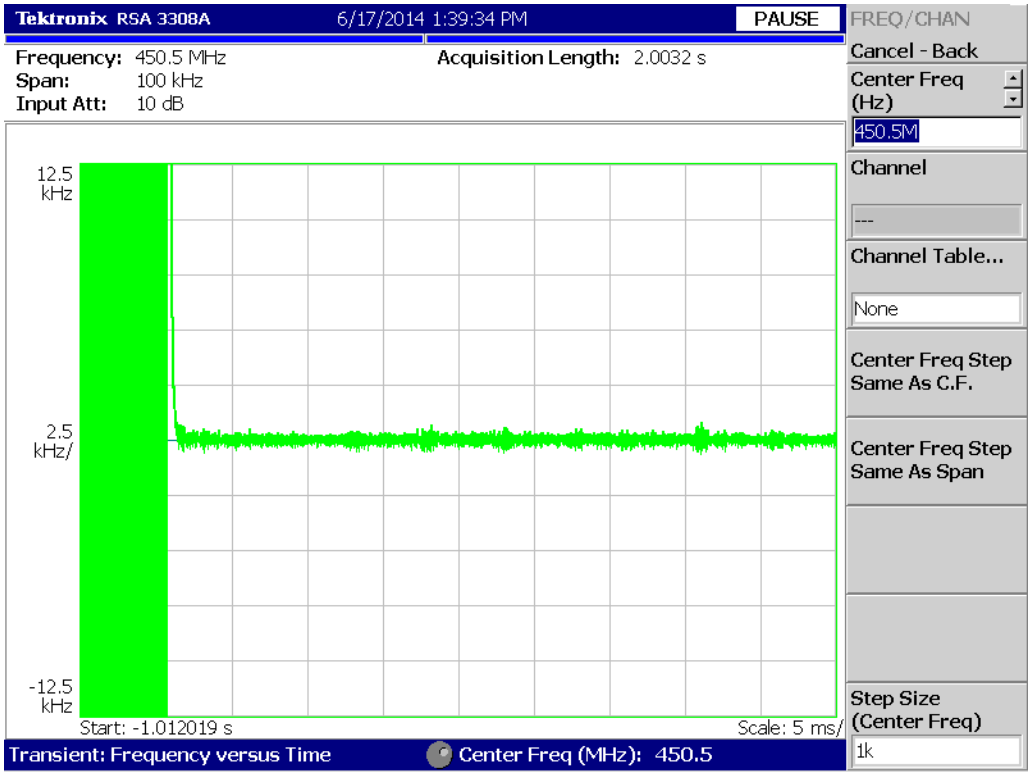
Measurement Procedure

The EUT was connected directly to a modulation analyzer through an attenuator to verify that the EUT meets the required Transient Frequency Behavior response per the specification. The modulation analyzer is a real time spectrum analyzer with integrated demodulation, audio measurement capabilities, and timing analysis.
The turn on and turn off transient timing was measured and recorded.

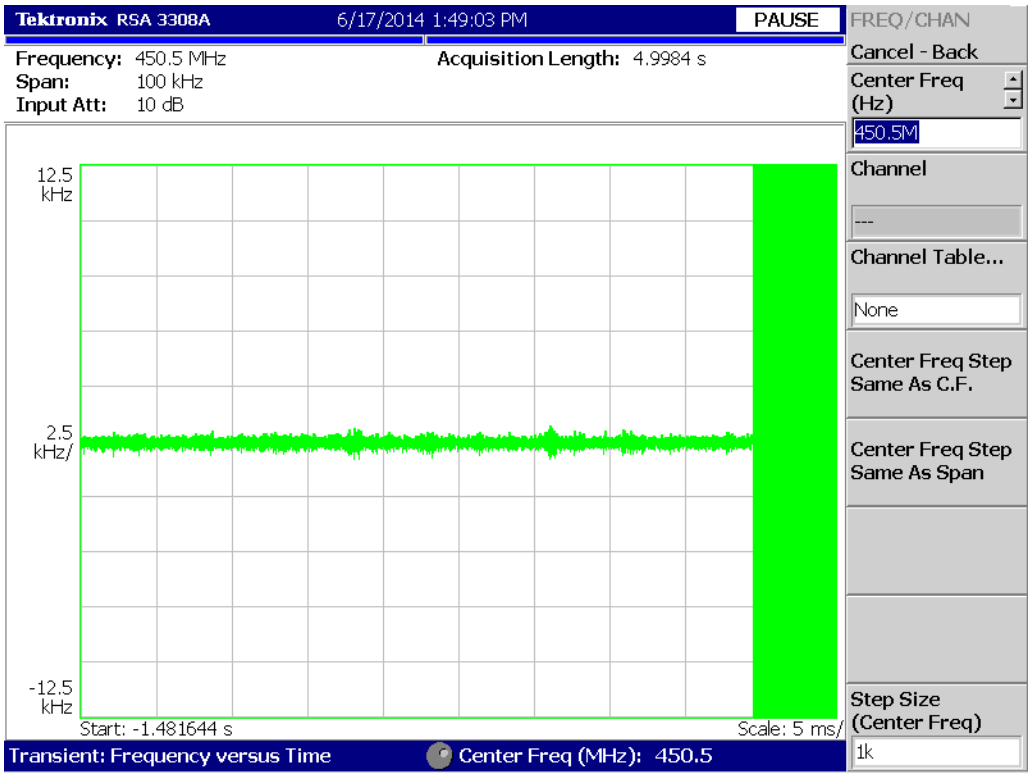
Test Setup



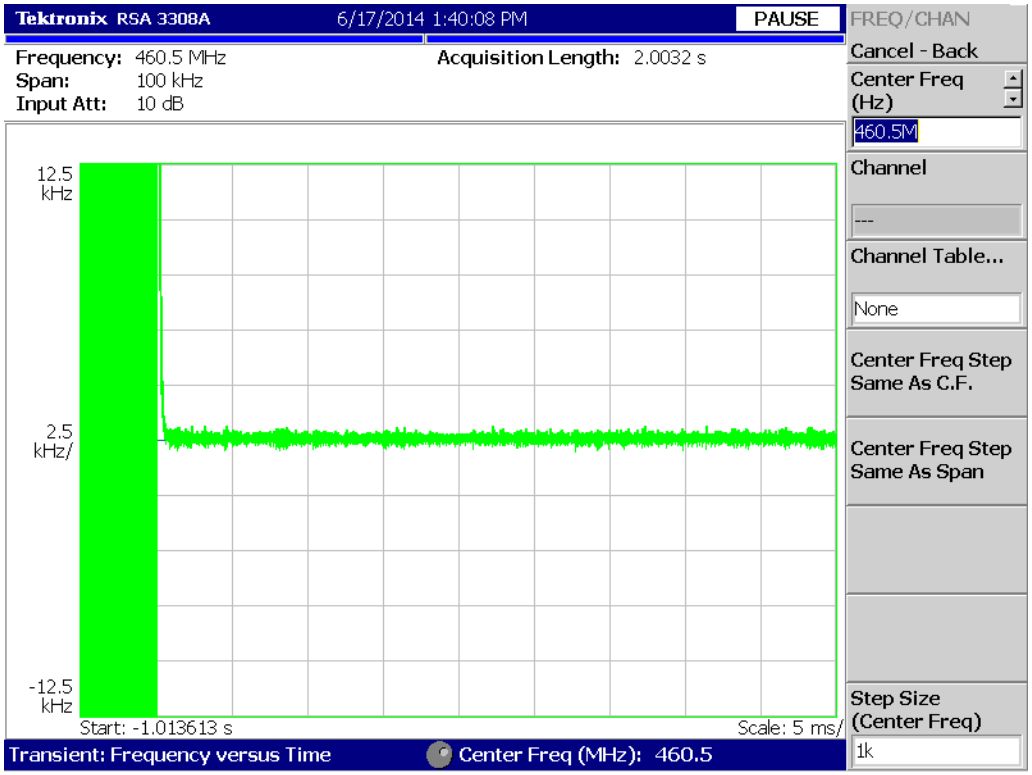
450.5 MHz On Time



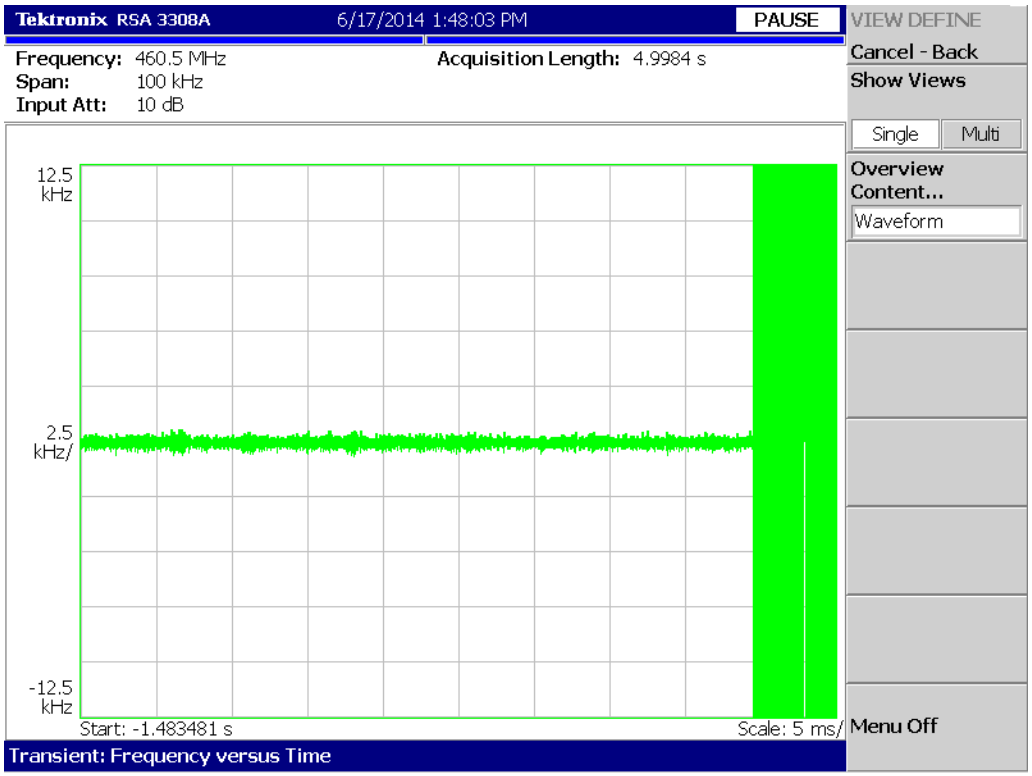
450.5 MHz Off Time



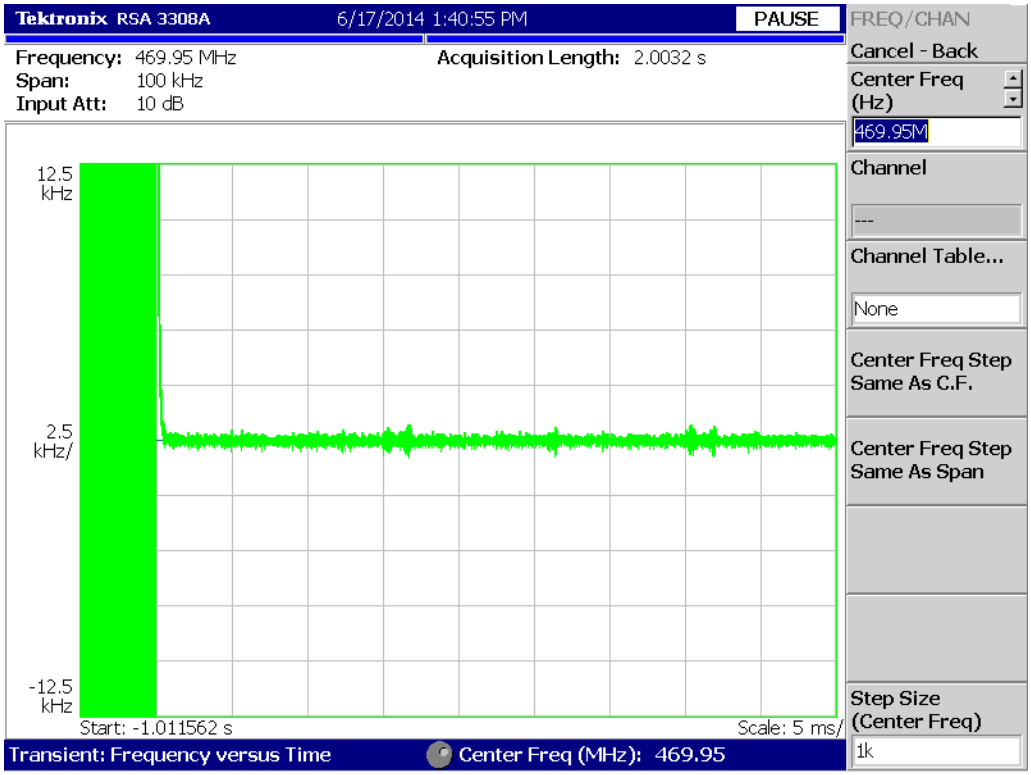
460.5 MHz On Time



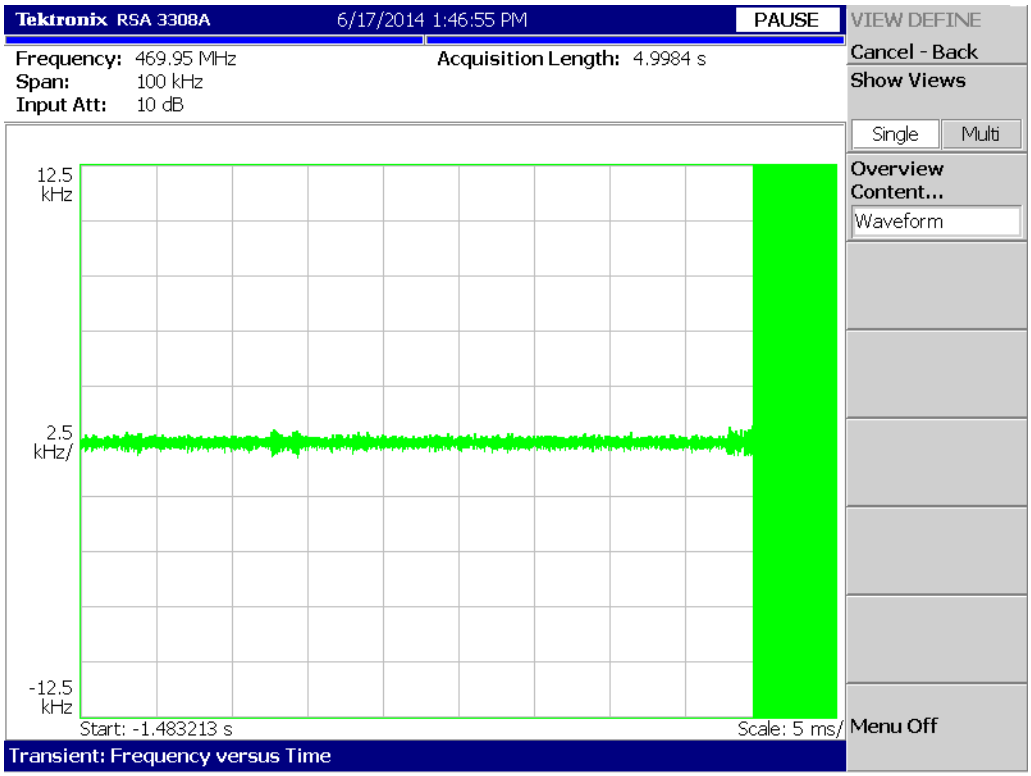
460.5 MHz Off Time



469.95 MHz On Time



469.95 MHz Off Time



Frequency Stability (Temperature Variation)

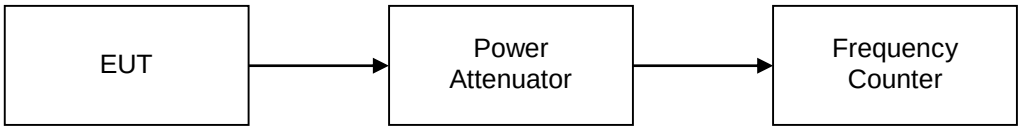
Name of Test: Frequency Stability (Temperature Variation) **Engineer:** John Erhard
Test Equipment Utilized: i00019, i00027, i00054, i00320, i00343 **Test Date:** 6/19/2014

Measurement Procedure

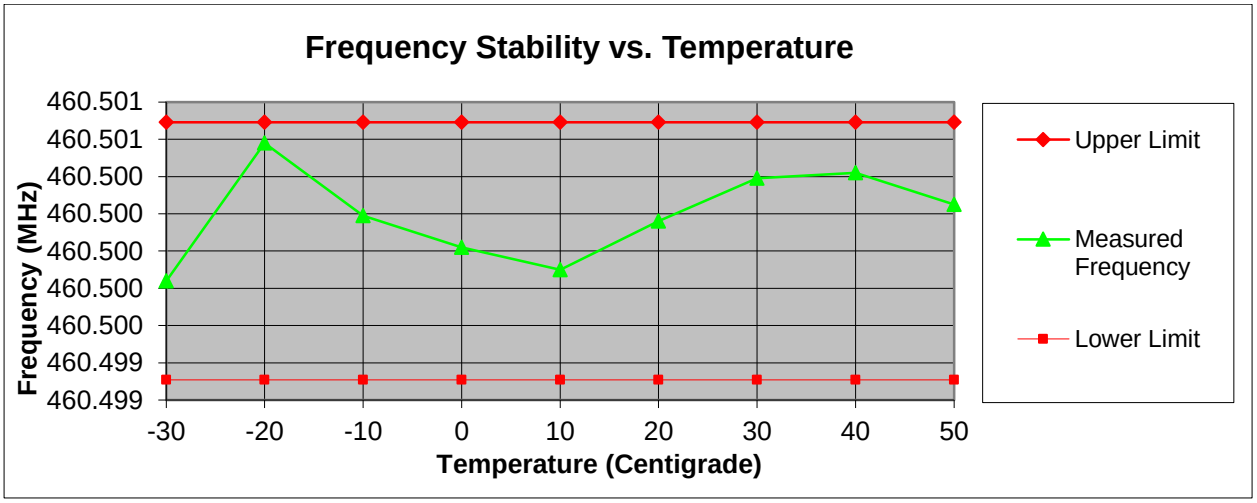
The EUT was placed in an environmental test chamber and the RF output was connected directly to a frequency counter. The temperature was varied from -30°C to 50°C in 10°C increments. After a sufficient time for temperature stabilization the RF output frequency was measured. At 20°C the power supply voltage to the EUT was varied from 85% to 115% of the nominal value and the RF output was measured.

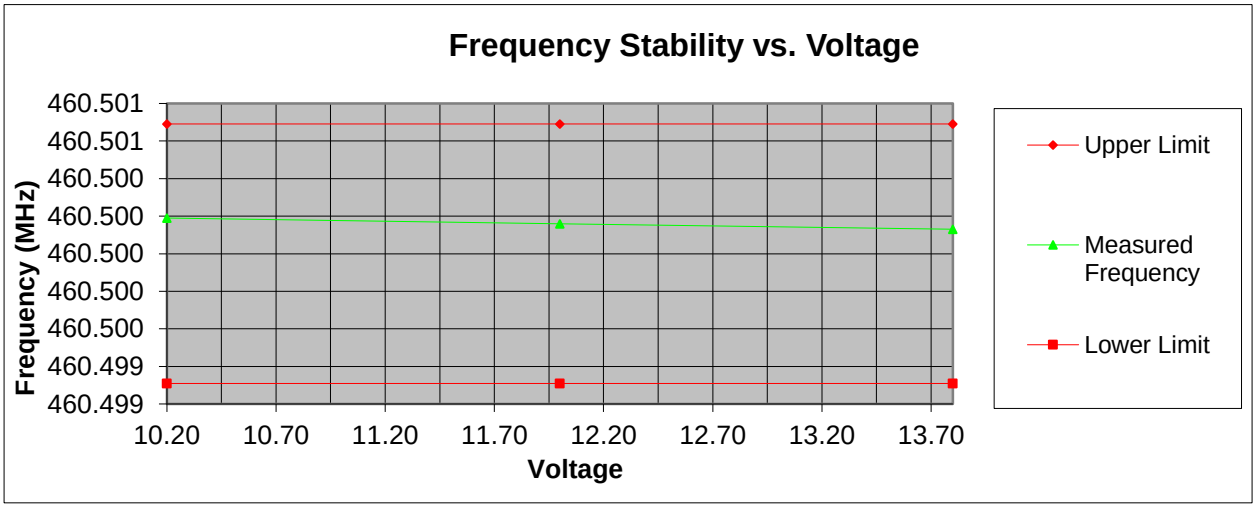
Tuned Frequency – 460.5
Tolerance – 1.5 PPM
Upper Limit –460.500691
Lower Limit - 460.499309

Measurement Setup



Measurement Results





Necessary Bandwidth Calculations

Name of Test: Necessary Bandwidth Calculations **Engineer:** Alex Macon
Test Specification: 2.202 **Test Date:** 6/20/2014

Modulation = 11K0F3E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M), kHz	=	3
Maximum Deviation (D), kHz	=	2.5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	11.0

Modulation = 16K0F3E (RSS-119 Only)		
Necessary Bandwidth Calculation:		
Maximum Modulation (M) kHz	=	3
Maximum Deviation (D), kHz	=	5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	16.0

Modulation = 8K30F1E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M), kHz	=	1.65
Maximum Deviation (D), kHz	=	2.5
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	8.3

Modulation = 8K30F1D		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	2.3
Maximum Deviation (D), kHz	=	2.5
Necessary Bandwidth (B_N), kHz	=	2.4D+1.0R
	=	8.3

Modulation = 8K30F7W		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	3.973
Maximum Deviation (D), kHz	=	2.5
Signaling States	=	4
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	$(R/\log_2 S)+2DK$
	=	8.3

Modulation =4K00F1E		
Necessary Bandwidth Calculation:		
Maximum Modulation (M), kHz	=	.75
Maximum Deviation (D), kHz	=	1.25
Constant Factor (K)	=	1
Necessary Bandwidth (B_N), kHz	=	(2xM)+(2xDxK)
	=	4.0

Modulation =4K00F1D		
Necessary Bandwidth Calculation:		
Data Rate (R) Kbps	=	1.0
Maximum Deviation (D), kHz	=	1.25
Necessary Bandwidth (B_N), kHz	=	2.4D+1.0R
	=	4.0

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Frequency Counter	HP	5334B	i00019	2/19/14	2/19/15
Temperature Chamber	Tenney	Tenney Jr	i00027	Verified on:6/19/2014	
Power Supply	HP	6286A	i00054	Verified on:6/17/2014	
Horn Antenna	EMCO	3115	i00103	12/11/12	12/11/14
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	3/24/14	3/24/15
Voltmeter	Fluke	75III	i00320	3/24/14	3/24/15
Spectrum Analyzer	Agilent	E4407B	i00331	4/23/13	4/23/14
Data Logger	Fluke	Hydra Data Bucket	i00343	3/7/14	3/7/15
Spectrum Analyzer	Tektronix	RSA3308A	i00345	3/18/14	3/18/15
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/8/13	10/8/15
EMI Analyzer	Agilent	E7405A	i00379	1/14/14	1/14/15
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	11/26/13	11/26/15

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 TEST REPORT