



## Test Report

Prepared for: Spot, LLC

Model: STX3

Description: Transmitter, Modular Satellite

FCC ID: L2V-STX3

To

FCC Part 25

Date of Issue: May 20, 2013

On the behalf of the applicant:

Spot, LLC  
300 Holiday Square Blvd.  
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Attention of:

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Project No: p1320003

**Alex Macon**  
Project Test Engineer

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### Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	5/20/13	Alex Macon	Original Document
2.0	10/3/13	Alex Macon	Updated Power limit



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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**



## Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2 and the following individual Parts: FCC Part 25 Satellite Communications.

## Standard Test Conditions and Engineering Practices

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

In accordance with ANSI C63.4-2009, section 6.1.9, 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 (°C)	Humidity (%)	Pressure (mbar)
26.9 – 28.0	25.5 – 28.7	966.0 – 970.5

Measurement results, unless otherwise noted, are worst case measurement.

### EUT Description

**Model:** STX3

**Description:** Transmitter, Modular Satellite

**FCC ID:** L2V-STX3

### Additional Information:

The STX 3 is a simplex Satellite transmitter designed to send small packets of user defined data to a network of low earth orbiting (LEO) satellites using the Globalstar simplex satellite network. The received data is then forwarded to a user defined network interface that may be in the form of an FTP host, email account, or HTTP host where the user will interpret the data for further processing.

### EUT Operation during Tests

EUT is placed in “Modulation Mode” using the Manufacturer’s supplied jumper connections which enable the unit to continuously transmit a test packet. The EUT is connected to a DC power supply and is supplied with a measured 3.3 volts.

**Accessories:** None

**Cables:** None

**Modifications:** None



## Test Result Summary

Specification	Test Name	Pass, Fail, N/A	Comments
25.204	Power Limits	Pass	
25.202(f)	Emissions Limitations for Mobile Earth Stations	Pass	
25.202(f)	Emissions Mask	Pass	
25.216(c)(g)(i)	Emissions Limits for Mobile Earth Stations	Pass	
25.202(d)	Frequency Tolerance	Pass	



**Power Limits**

**Name of Test:** Power Limits  
**Test Equipment Utilized:** i00008, i00331

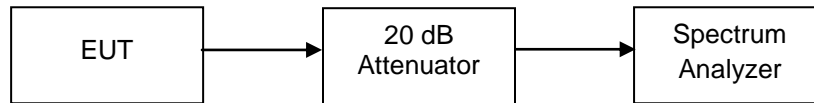
**Engineer:** Alex Macon  
**Test Date:** 5/7/2013

**Test Procedure**

The UUT was connected to a Spectrum analyzer through a 20 dB attenuator. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained. All measurements were made in a 1 MHz RBW. The EIRP is a summation of the conducted power, the antenna gain, and the bandwidth correction factor.

Bandwidth correction formula:  
 $10 \log(1/2.3) = 3.6\text{dBm}$

**Test Setup**



**Transmitter Peak Output Power**

Tuned Frequency (MHz)	Conducted Output Power (dBm)	Bandwidth CF (dB)	Antenna Gain (dBi)	EIRP Output Power (dBm)	Specification Limit
1611.25	16.23	3.6	3.0	22.83	No limit for Mobile Earth Stations
1613.75	15.71	3.6	3.0	22.31	No limit for Mobile Earth Stations
1616.25	15.39	3.6	3.0	21.99	No limit for Mobile Earth Stations
1618.75	15.35	3.6	3.0	21.95	No limit for Mobile Earth Stations



### Emissions Limitations for Mobile Earth Stations

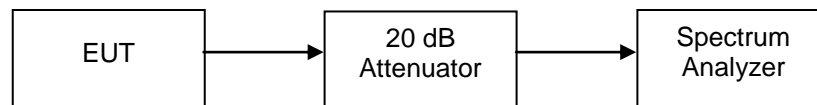
**Name of Test:** Emissions Limitations for  
Mobile Earth Stations  
**Test Equipment Utilized:** i00008, i00331

**Engineer:** Alex Macon  
**Test Date:** 5/13/2013

#### Test Procedure

The EUT was connected directly to a spectrum analyzer and the conducted spurious emissions were measured to ensure that the EUT met the requirements specified. Only the worst case emission at each frequency was reported. Notch and high pass filters were utilized to ensure that the fundamental power did not force the input of the spectrum analyzer into compressions. These losses in addition to cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained.

#### Test Setup



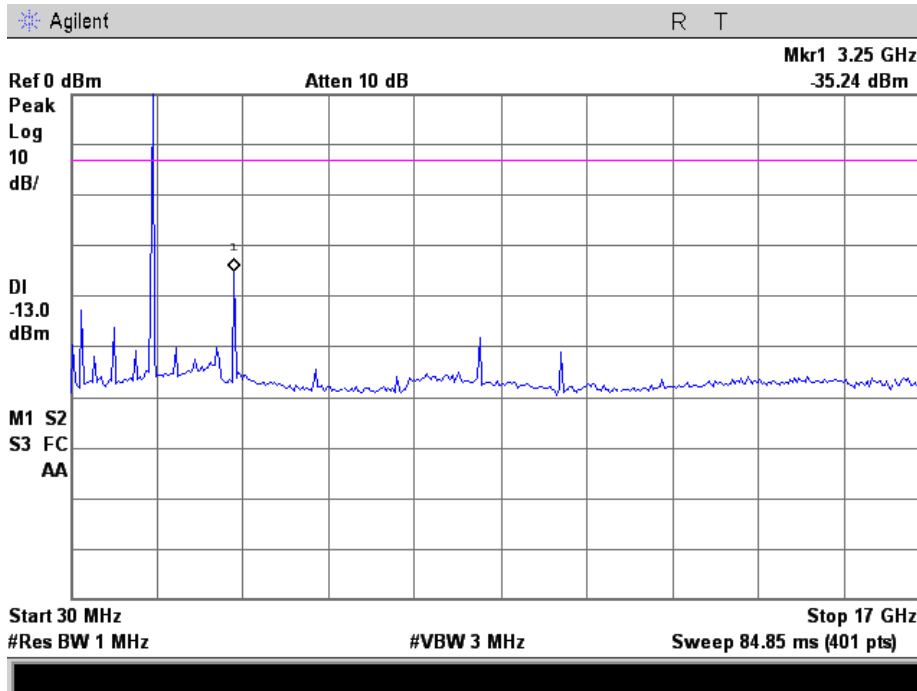
#### Emissions Limitations Summary Table

Tuned Frequency (MHz)	Result	Comments
1611.25	Pass	See Plots
1613.75	Pass	See Plots
1616.20	Pass	See Plots
1618.75	Pass	See Plots

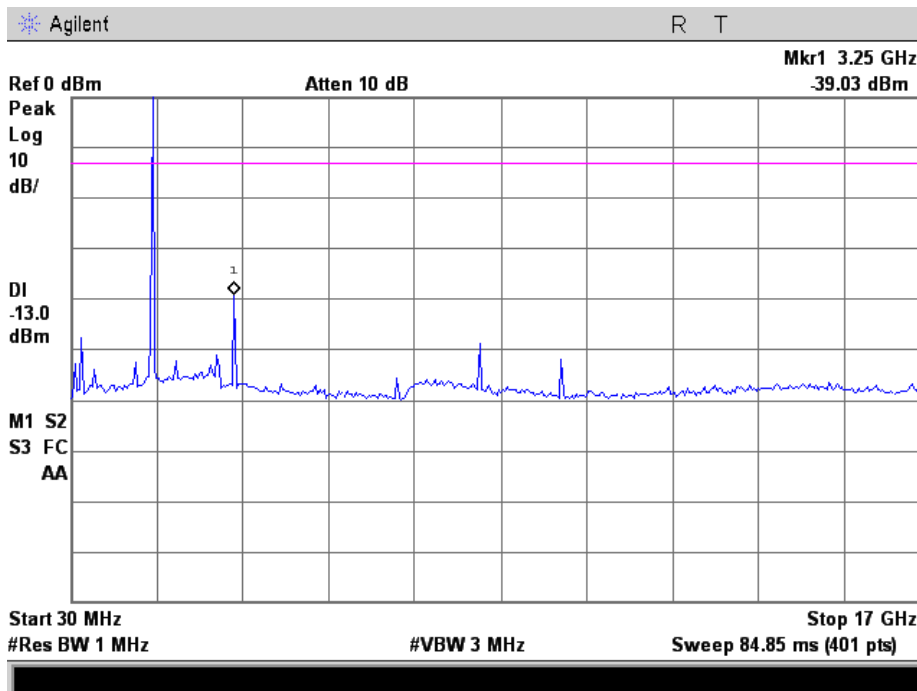




### Emissions Limitations Plot 1611.25 MHz

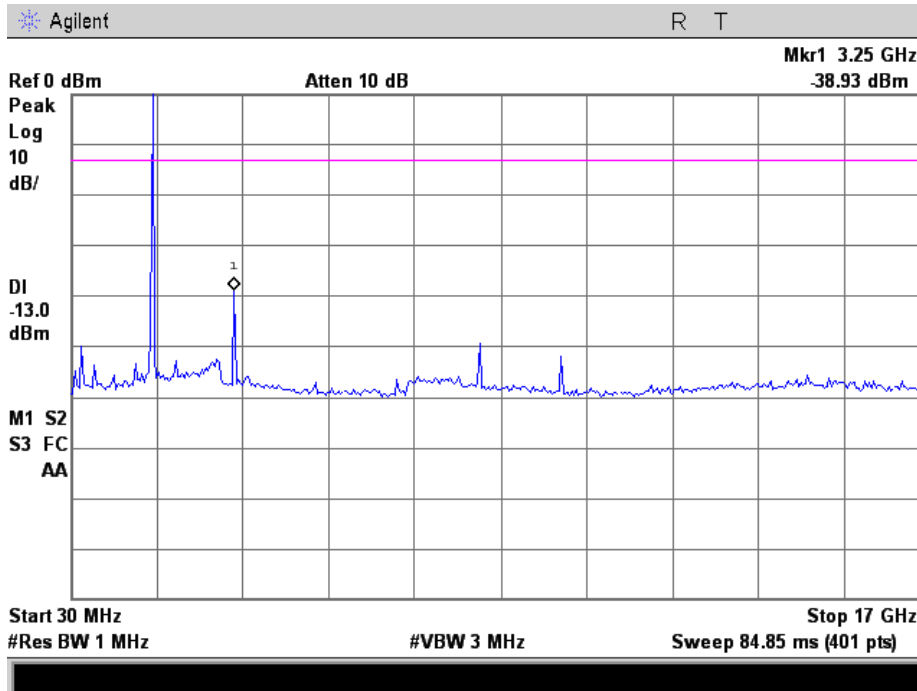


### Emissions Limitations Plot 1613.75 MHz

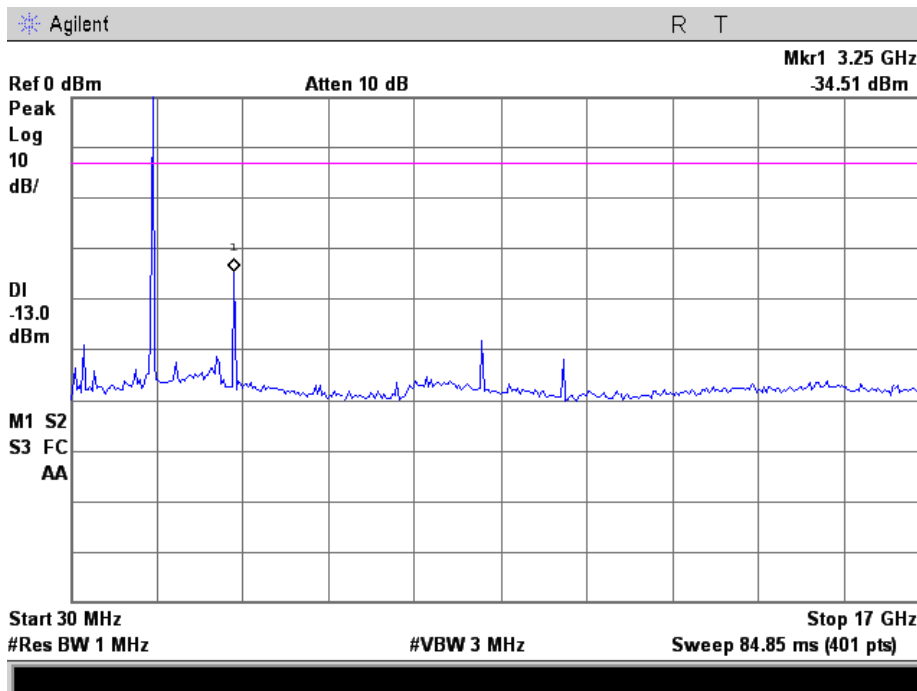




### Emissions Limitations Plot 1616.25 MHz



### Emissions Limitations Plot 1618.75 MHz





### Occupied Bandwidth

**Name of Test:**

Occupied Bandwidth

**Engineer:** Alex Macon

**Test Equipment:**

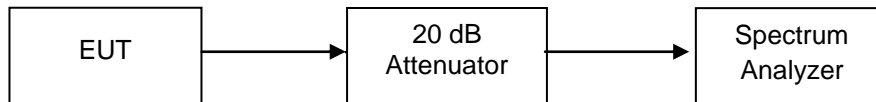
i00008, i00331

**Test Date:** 5/7/2013

**Note:** There is no requirement for occupied bandwidth in Part 25 for Mobile Earth Stations. However, the emissions masks are based upon the occupied bandwidth. This information is reported for reference only.

### Test Procedure

The EUT was connected directly to a spectrum analyzer. The occupied bandwidth of the modulated output was measured and plotted. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained.

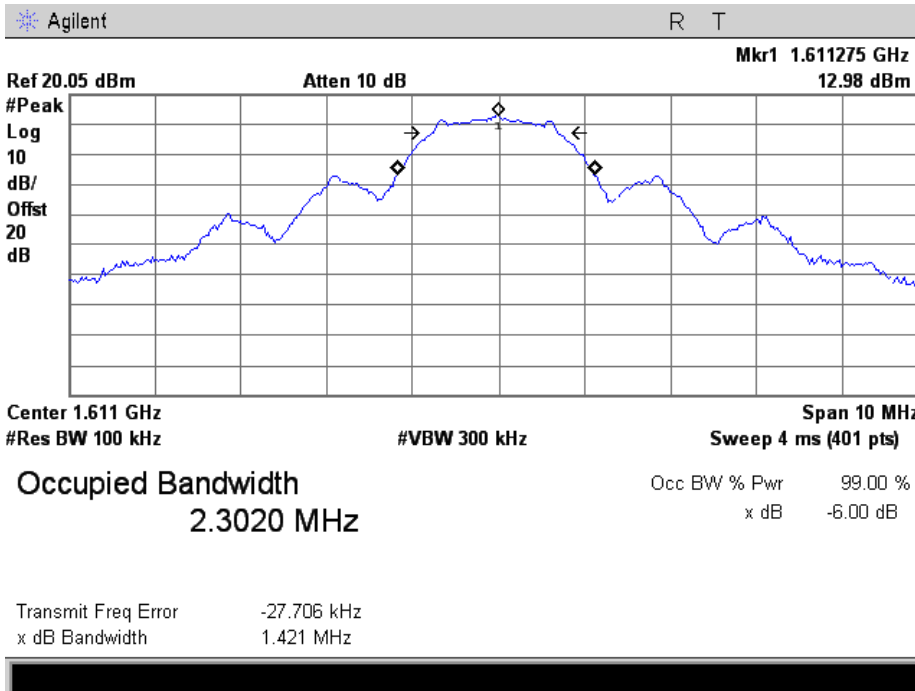


### Test Results

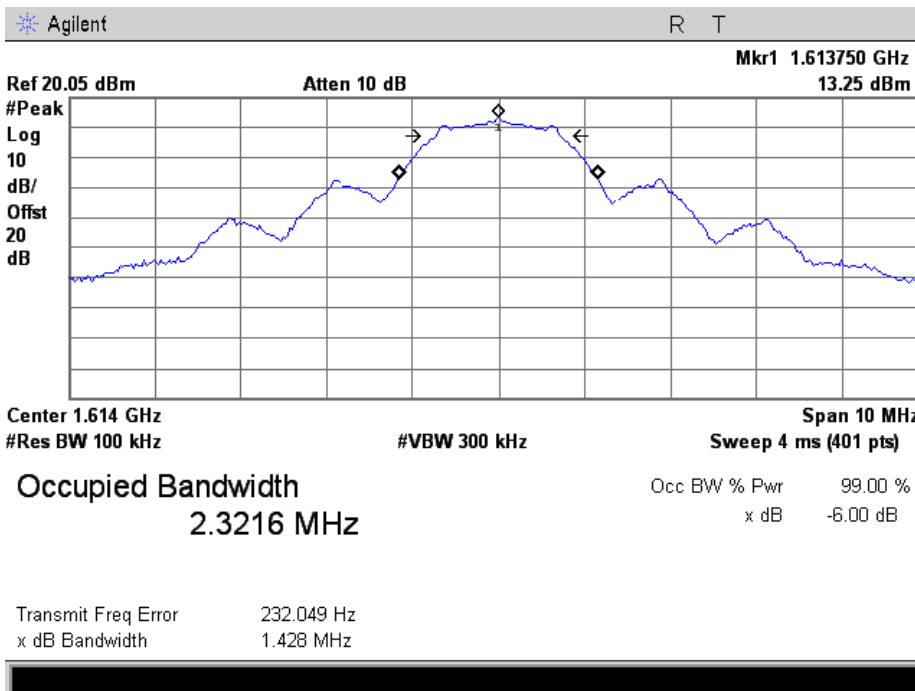
Frequency (MHz)	Measured Bandwidth (MHz)
1611.25	2.3020
1613.75	2.3216
1616.25	2.3277
1618.75	2.2986



**1611.25**

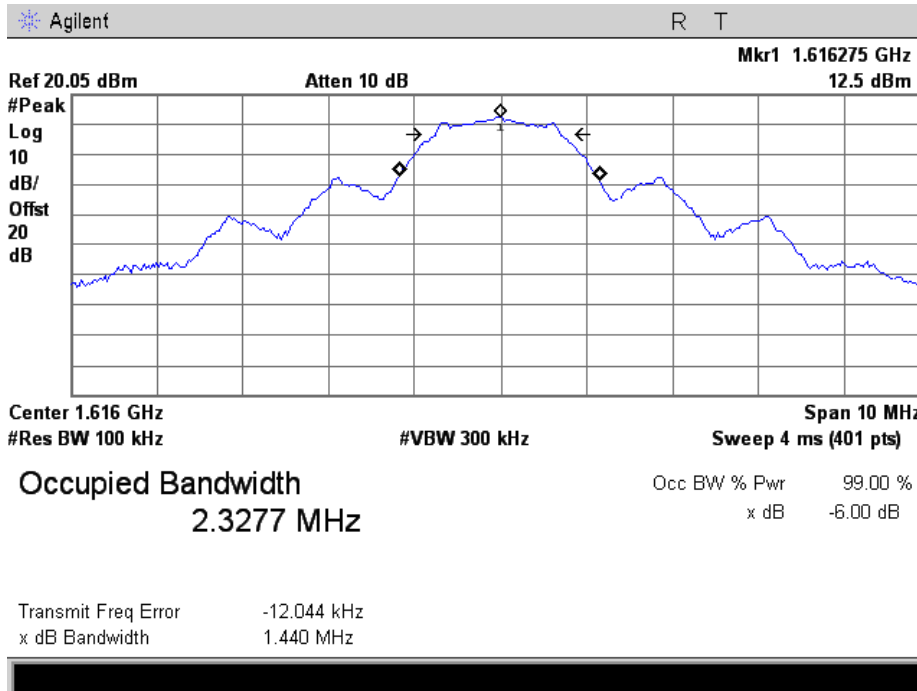


**1613.75**

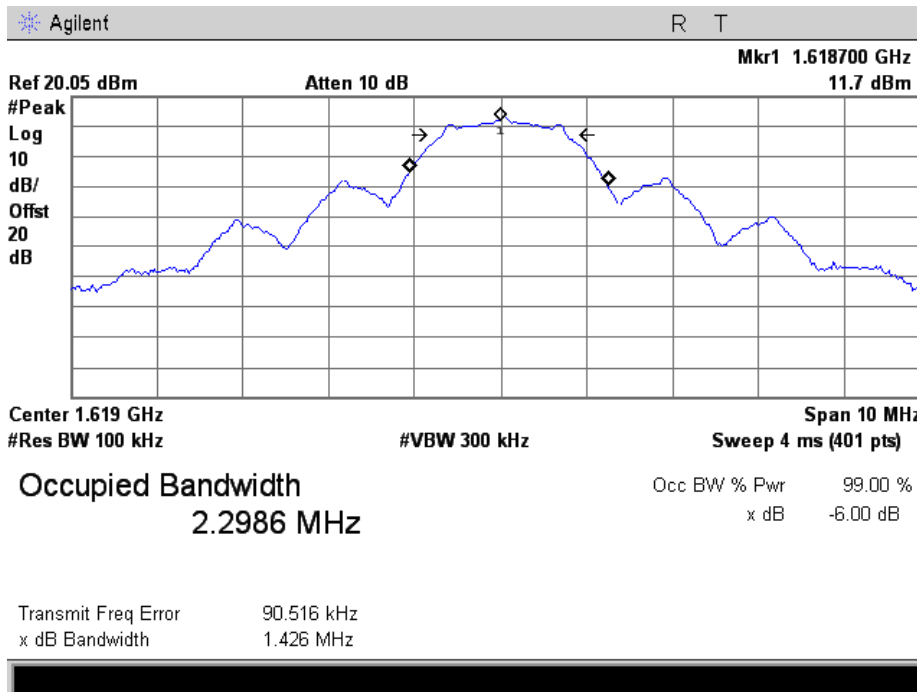




**1616.25**



**1618.75**





**Emission Masks**

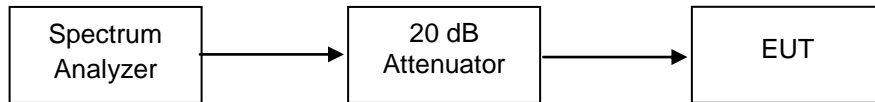
**Name of Test:** Emission Masks  
**Test Equipment Utilized:** i00008, i00331

**Engineer:** Alex Macon  
**Test Date:** 5/13/13

**Test Procedure**

The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for emission mask. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained.

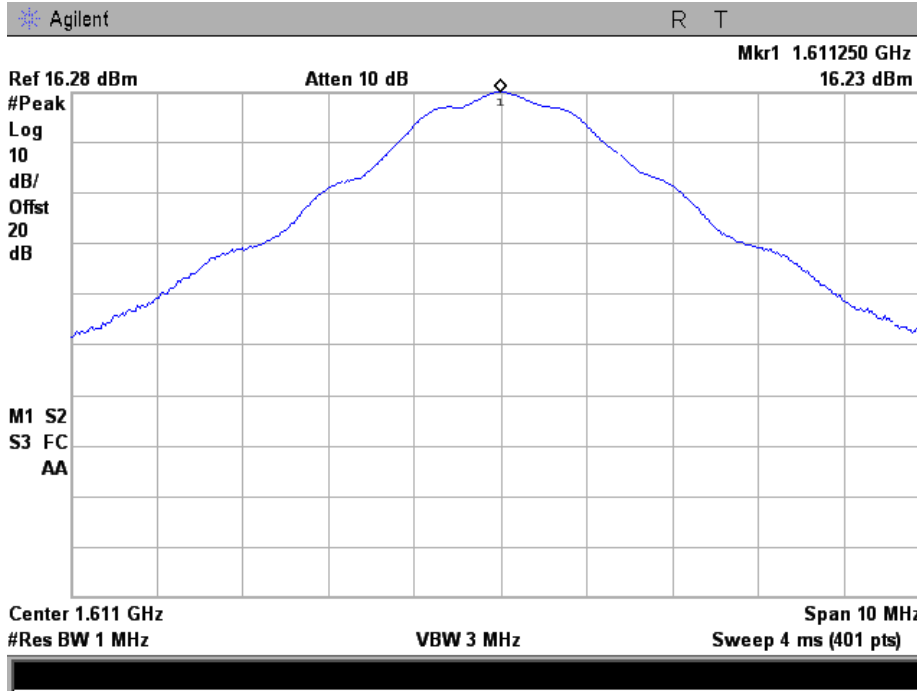
**Test Setup**



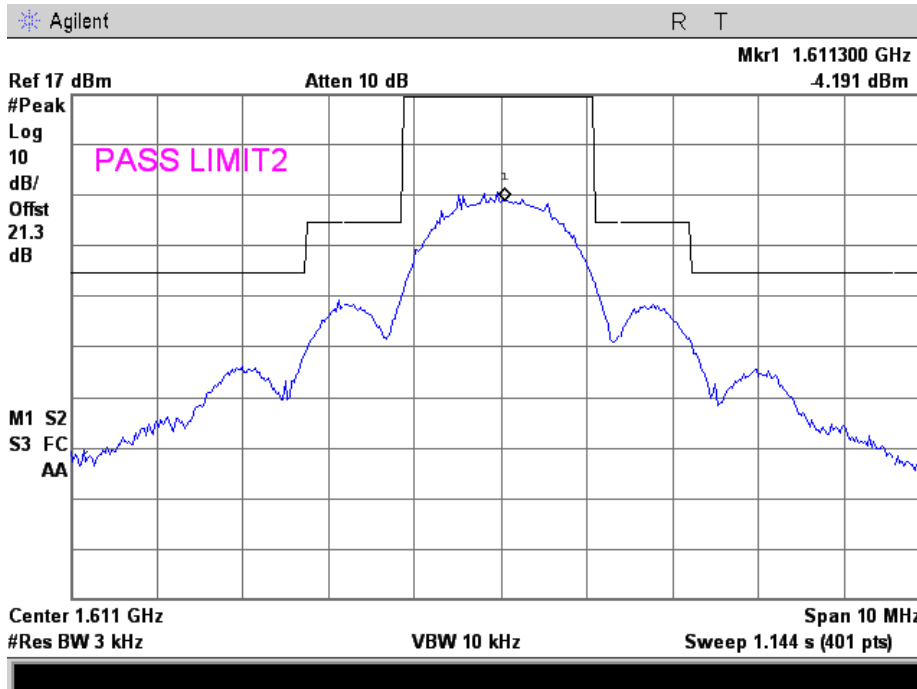


### Emission Mask Plots

#### 1611.25 MHz Reference

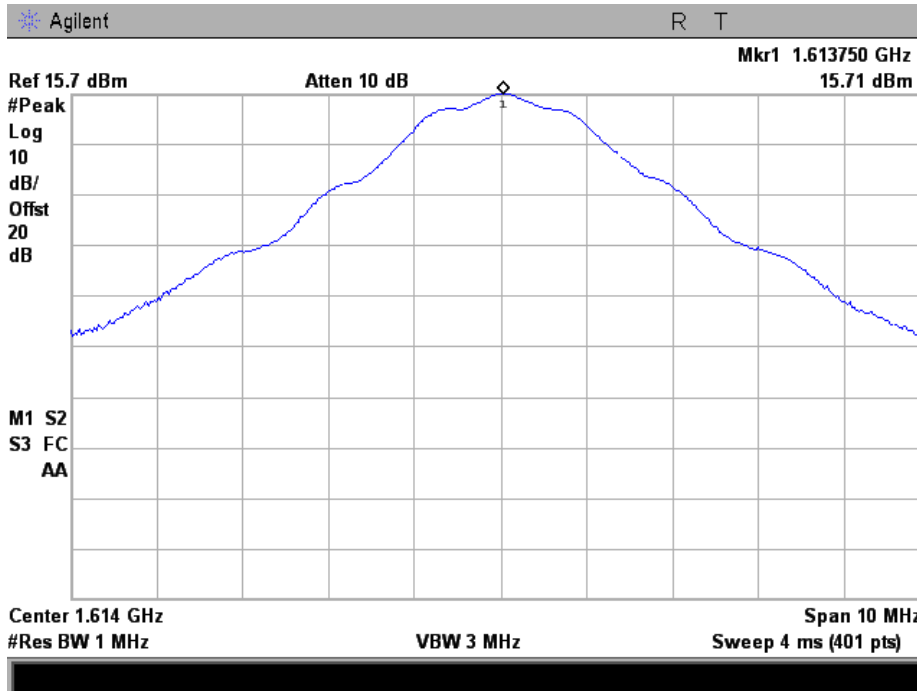


#### 1611.25 MHz Mask

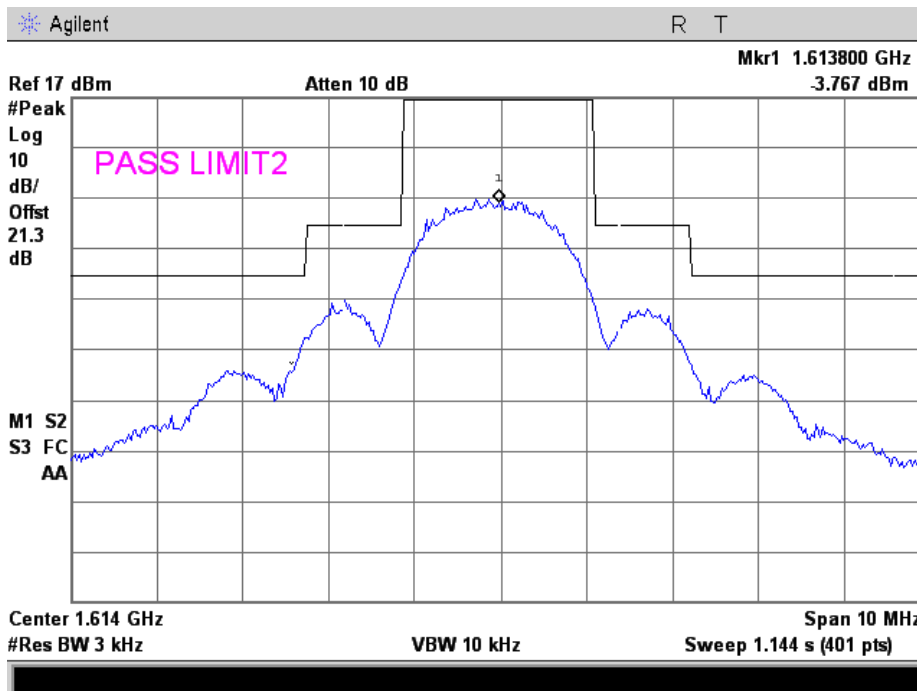




### 1613.75 MHz Reference



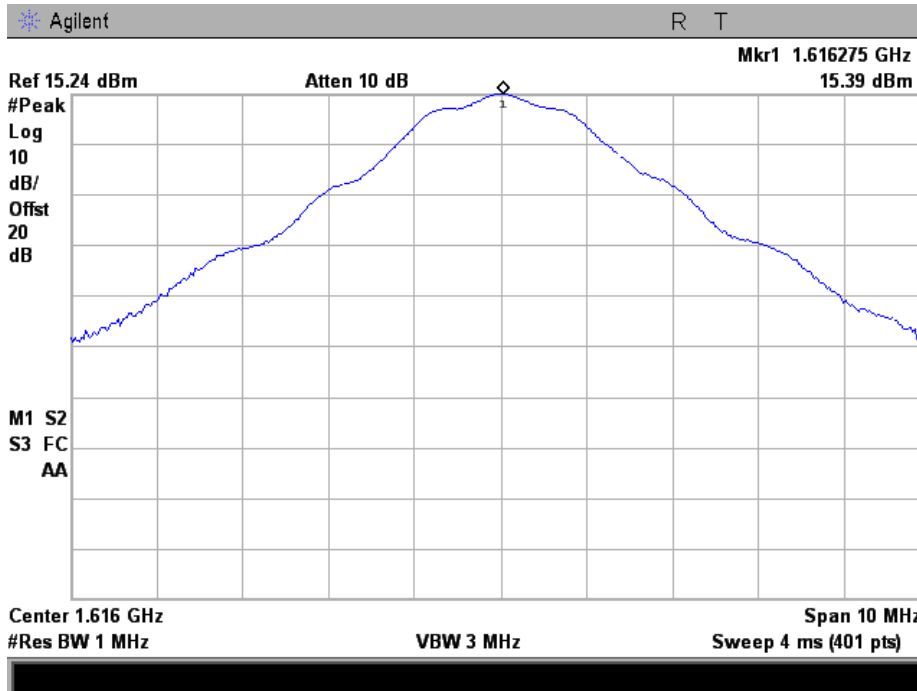
### 1613.75 MHz Mask



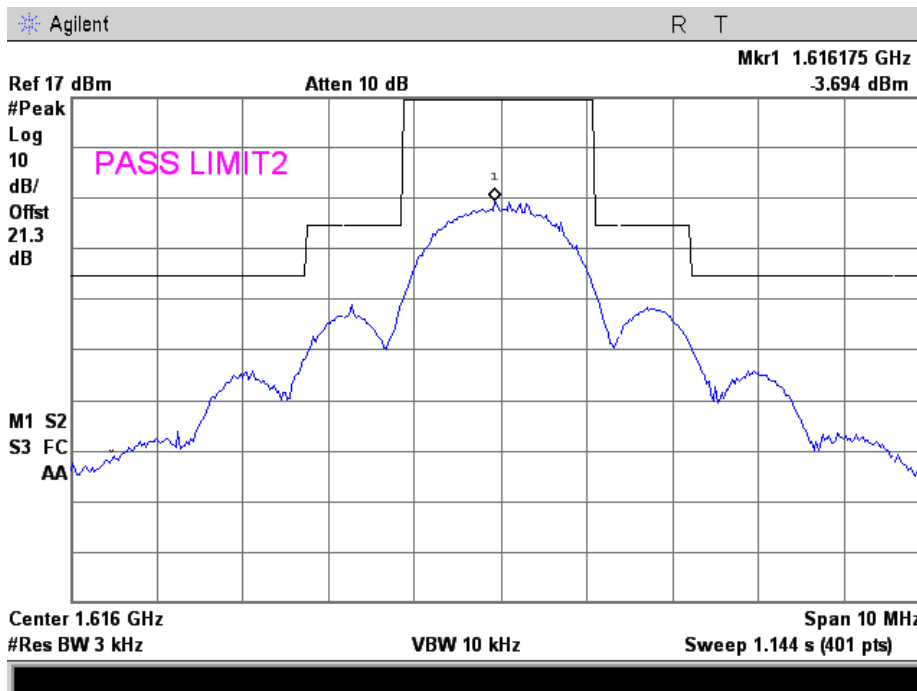




### 1616.25 MHz Reference

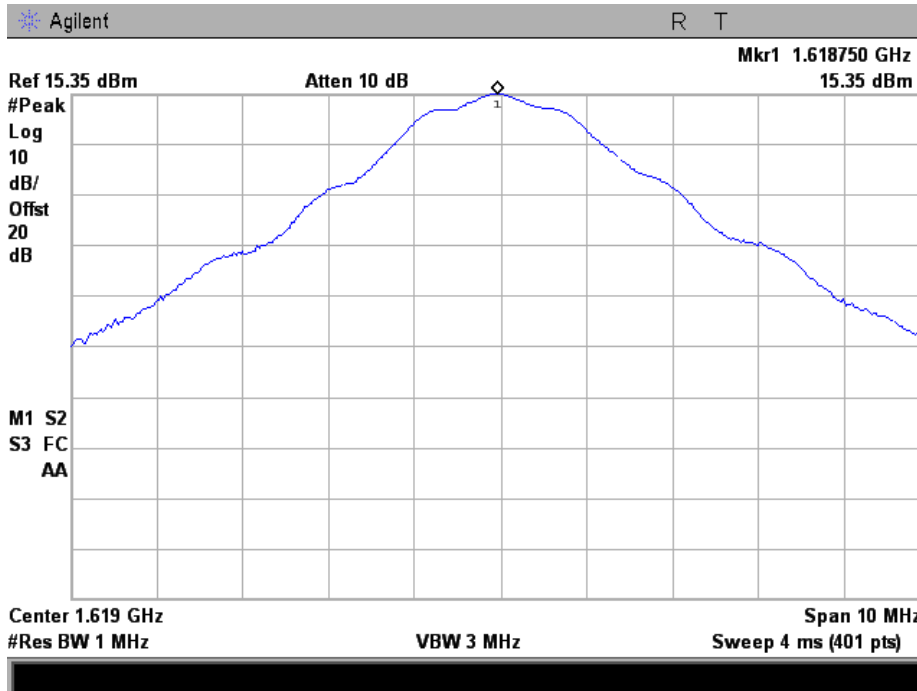


### 1616.25 MHz Mask

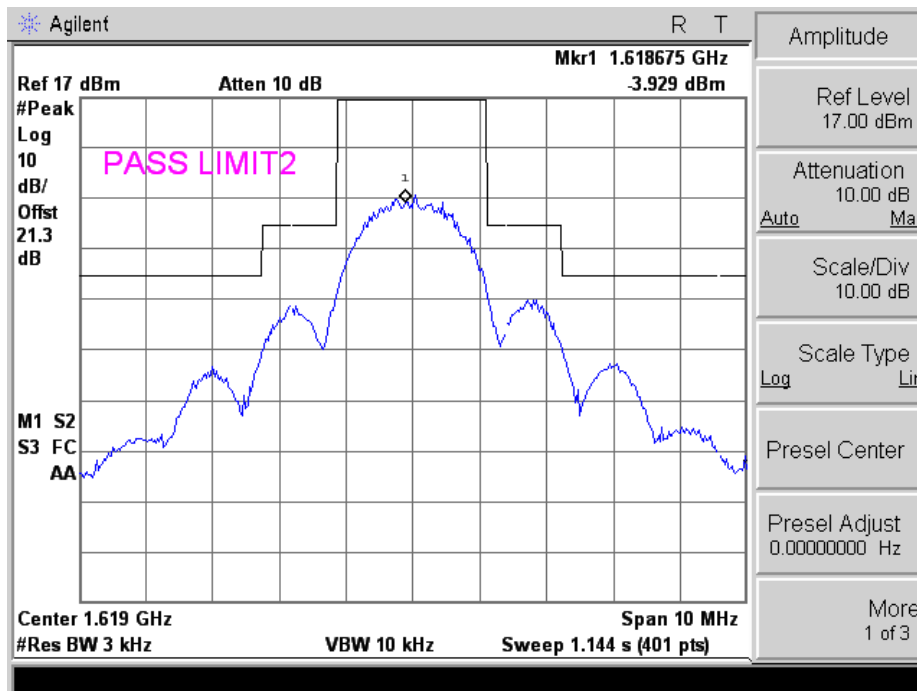




### 1618.75 MHz Reference



### 1618.75 MHz Mask





### Emissions Limits for Mobile Earth Stations

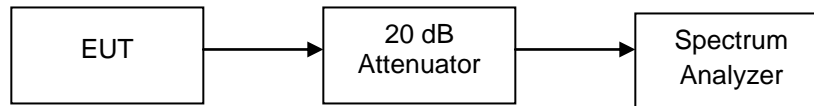
**Name of Test:** Emissions Limits for  
Mobile Earth Stations  
**Test Equipment Utilized:** i00008, i00331

**Engineer:** Alex Macon  
**Test Date:** 5/13/13

### Test Procedure

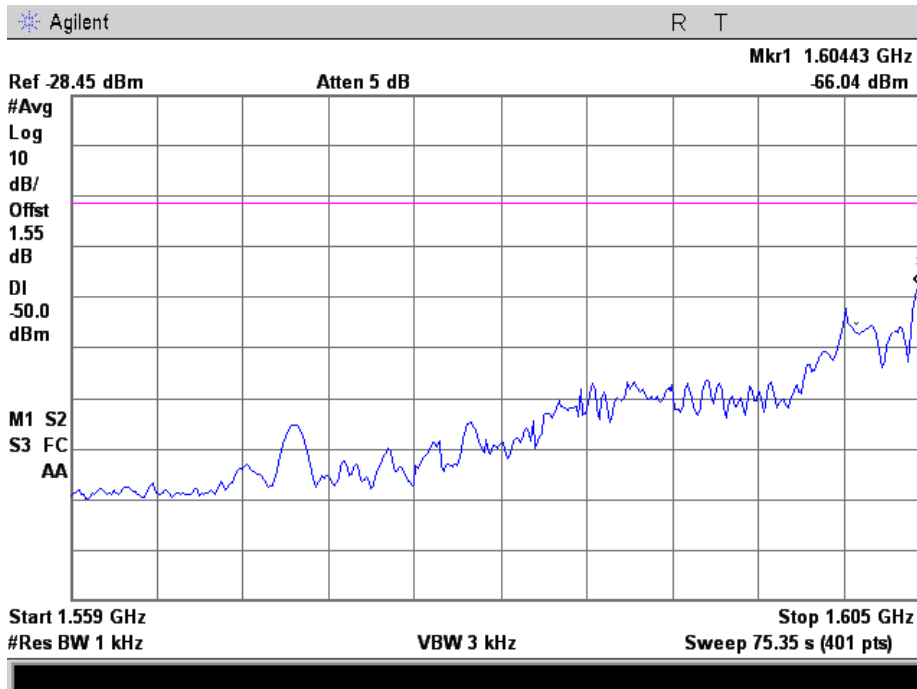
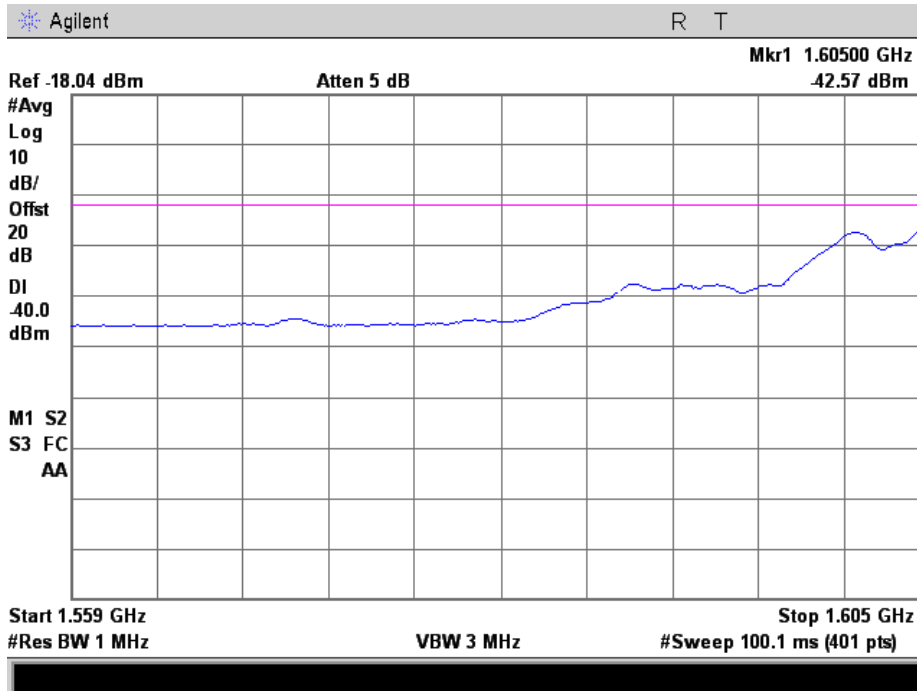
The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for emission limits. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained.

### Test Setup



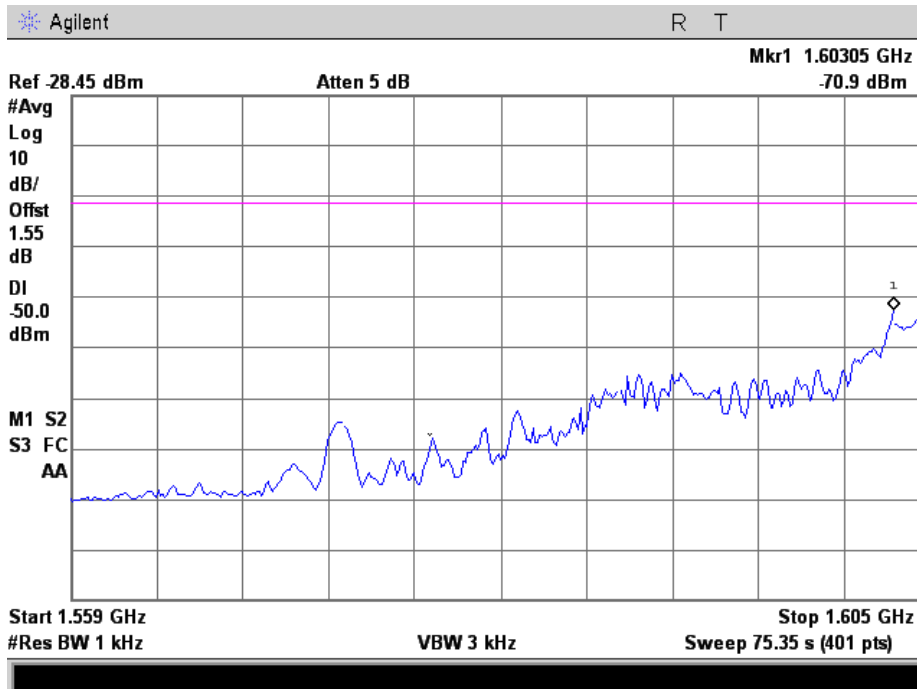
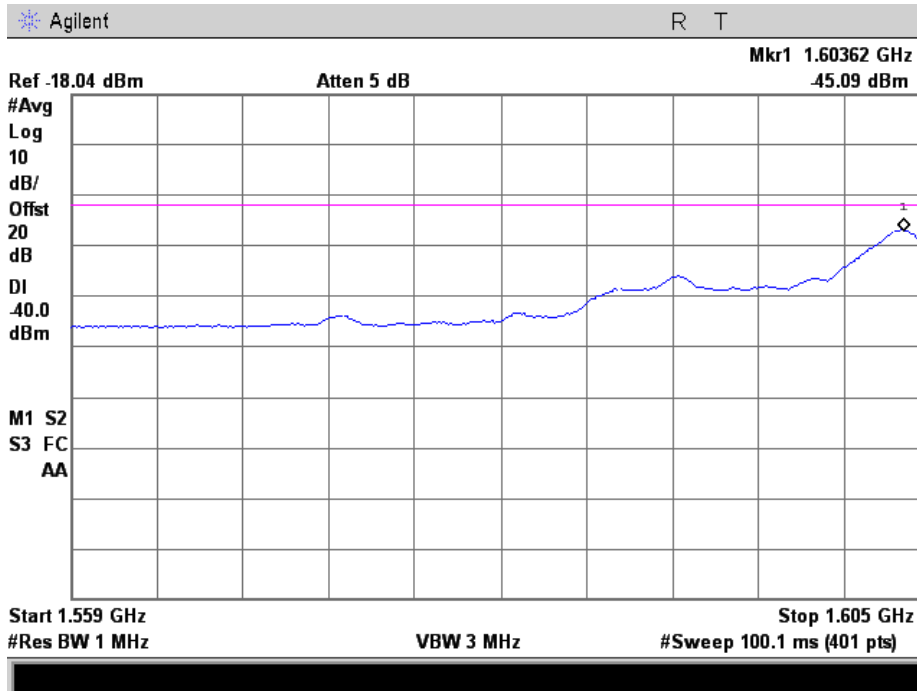


### 25.216(c) 1611.25 MHz



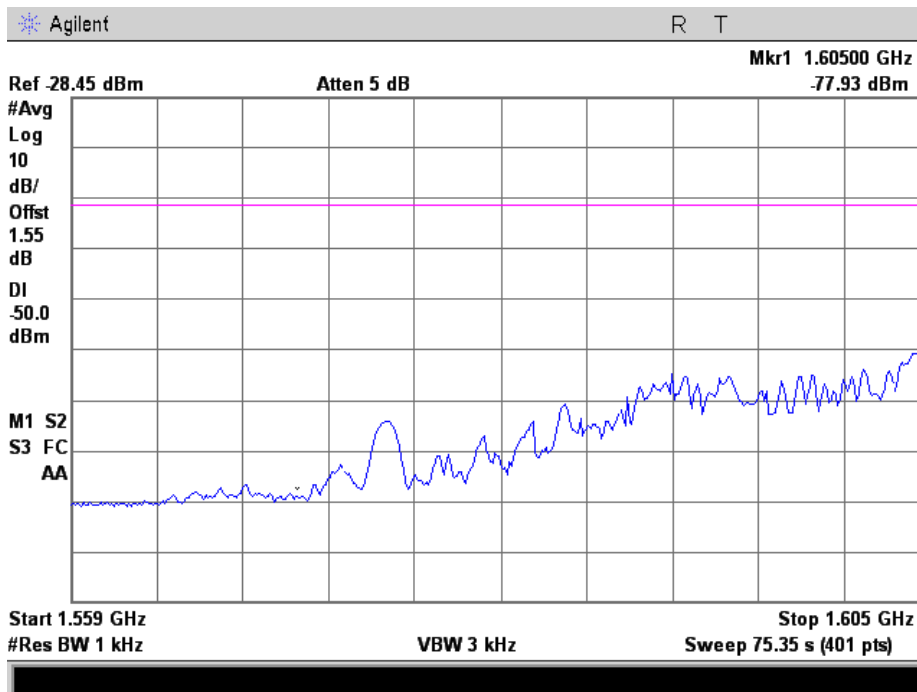
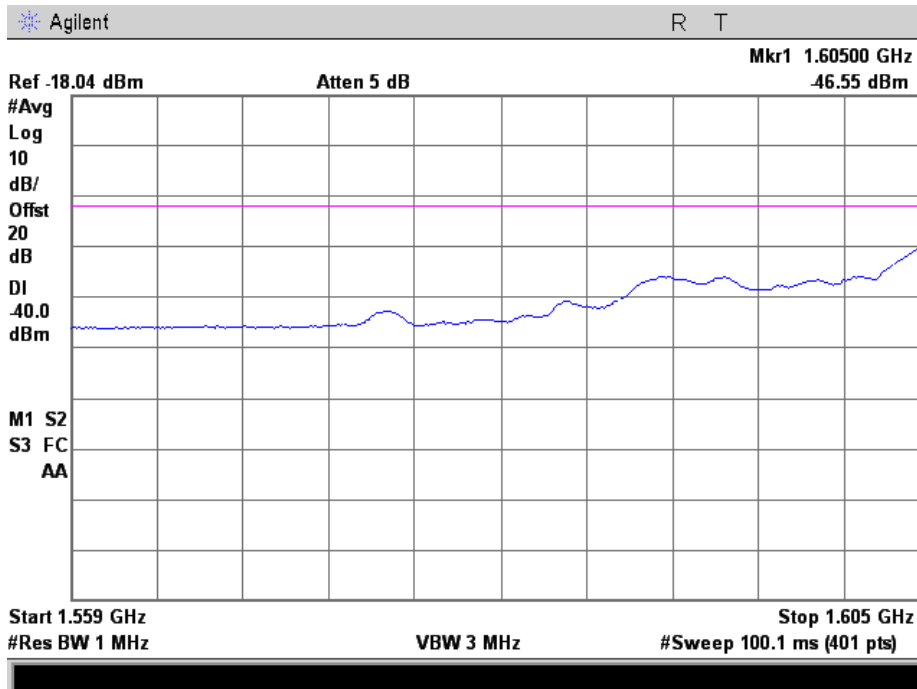


### 25.216(c) 1613.75 MHz



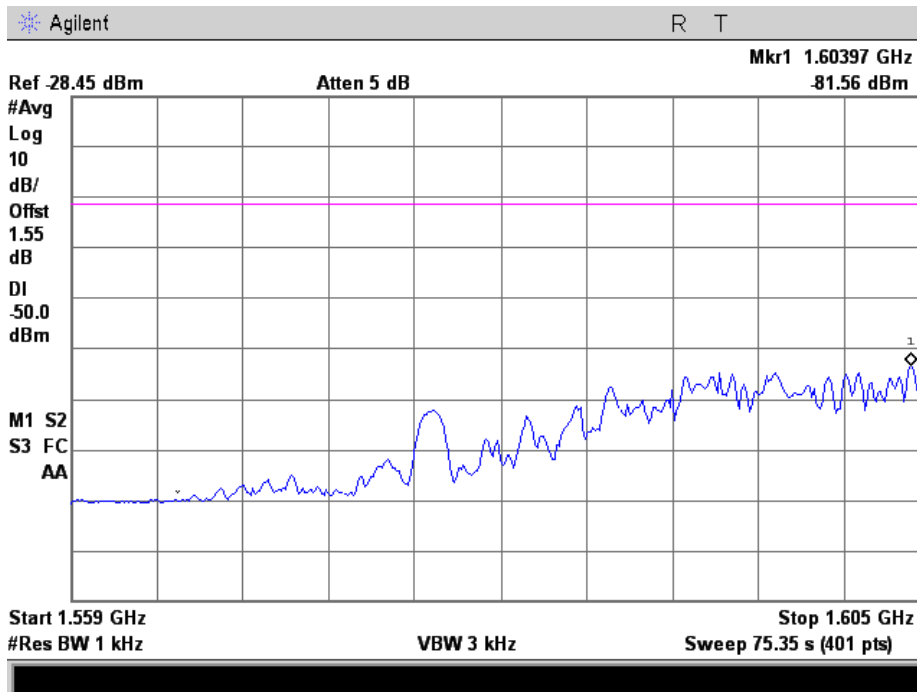
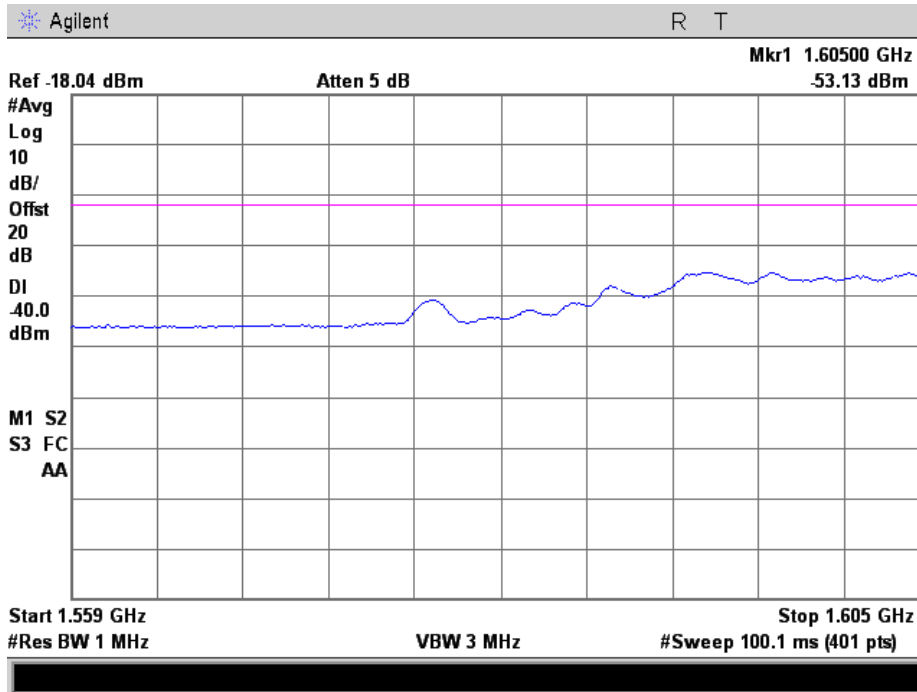


### 25.216(c) 1616.75 MHz



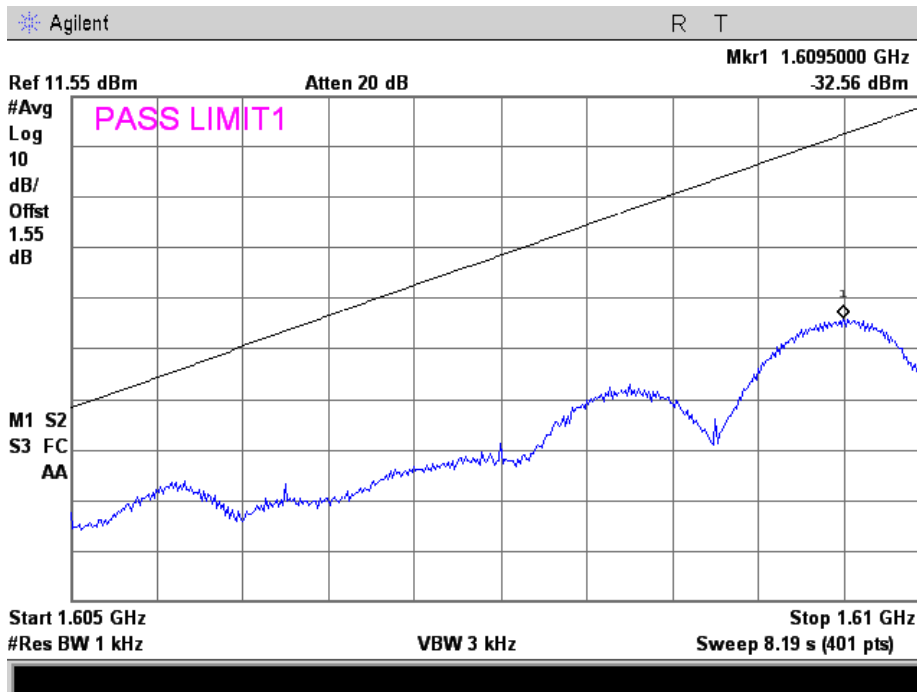
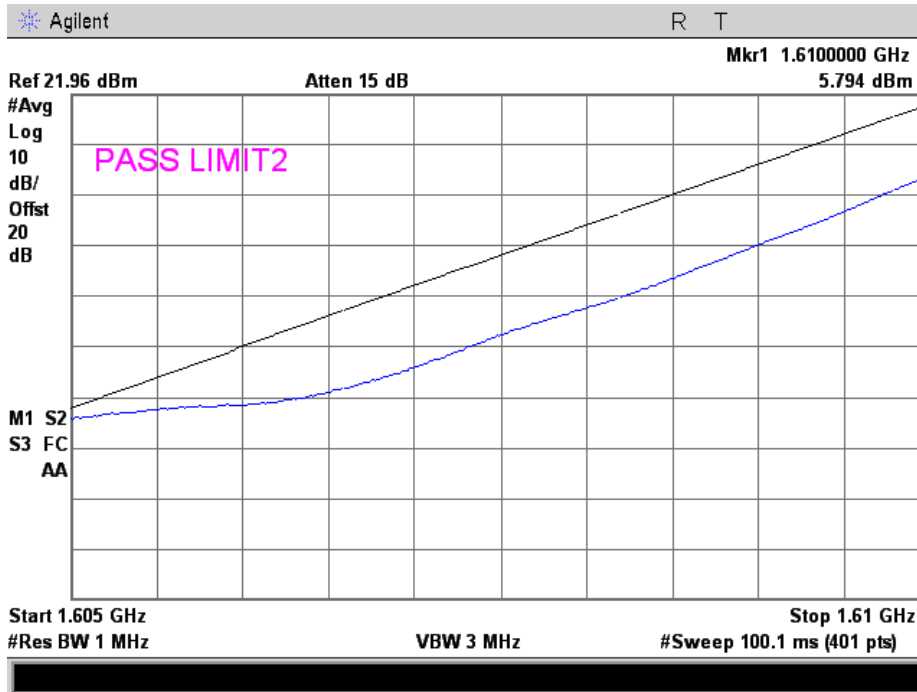


### 25.216(c) 1618.25 MHz





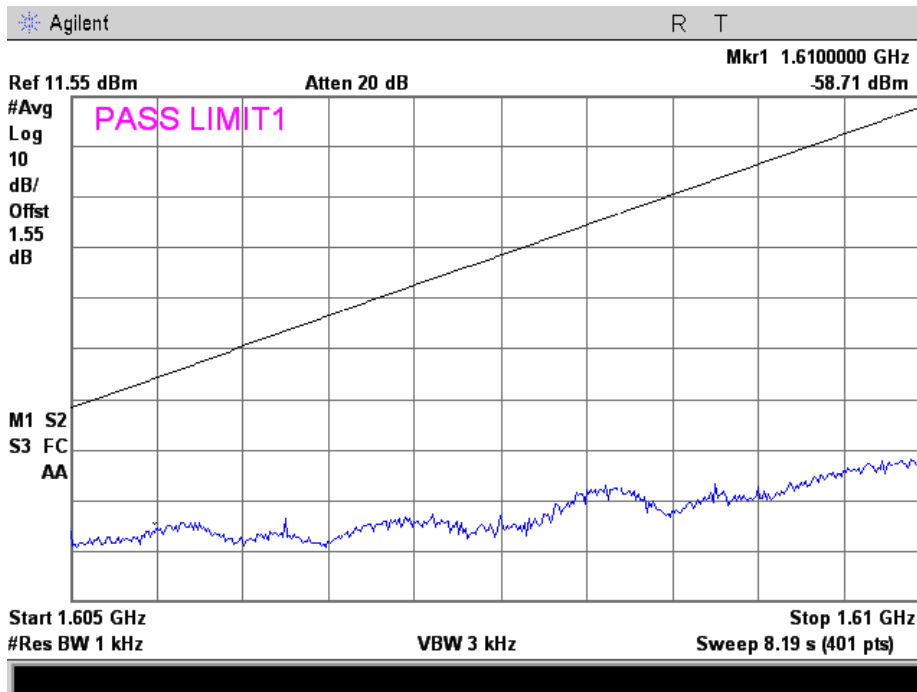
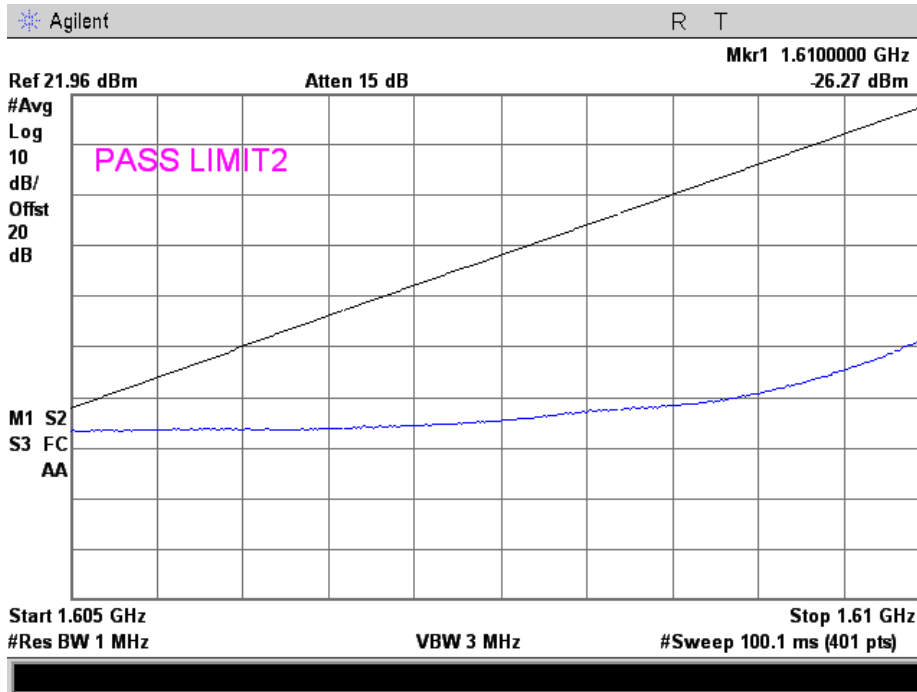
### 25.216(g) 1611.25 MHz





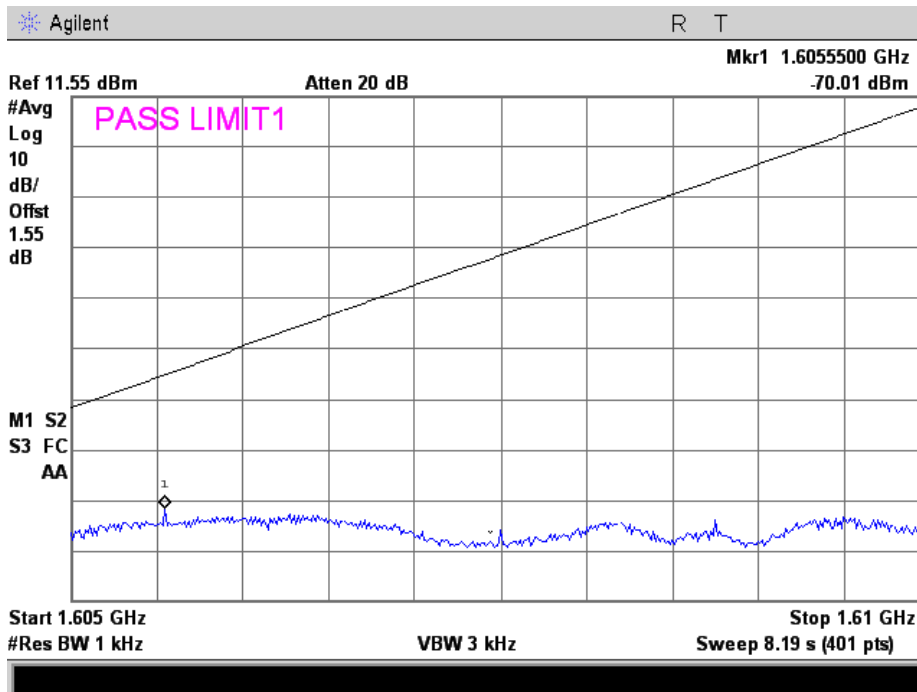
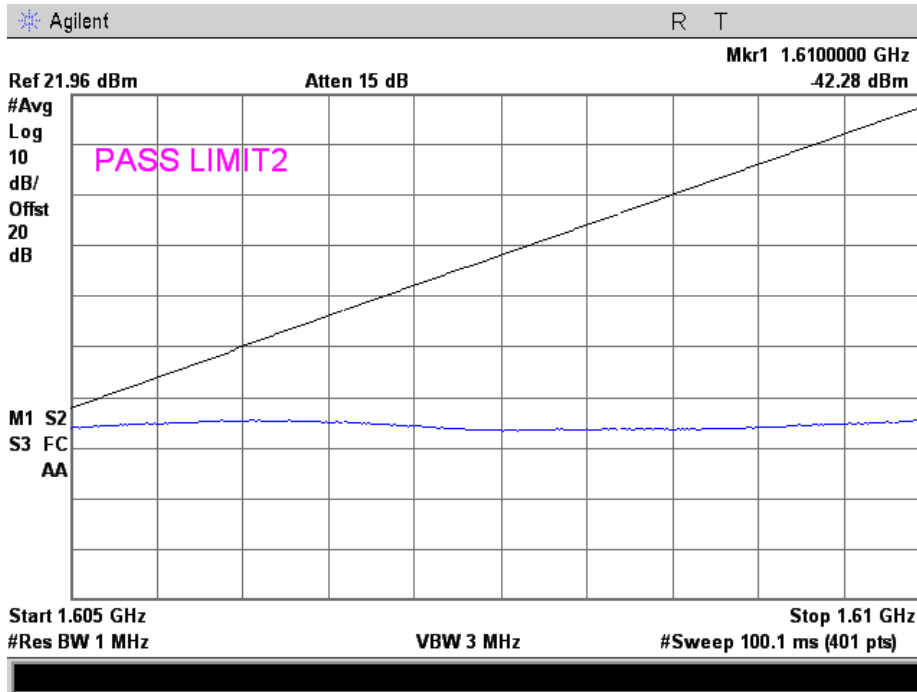


### 25.216(g) 1613.75 MHz



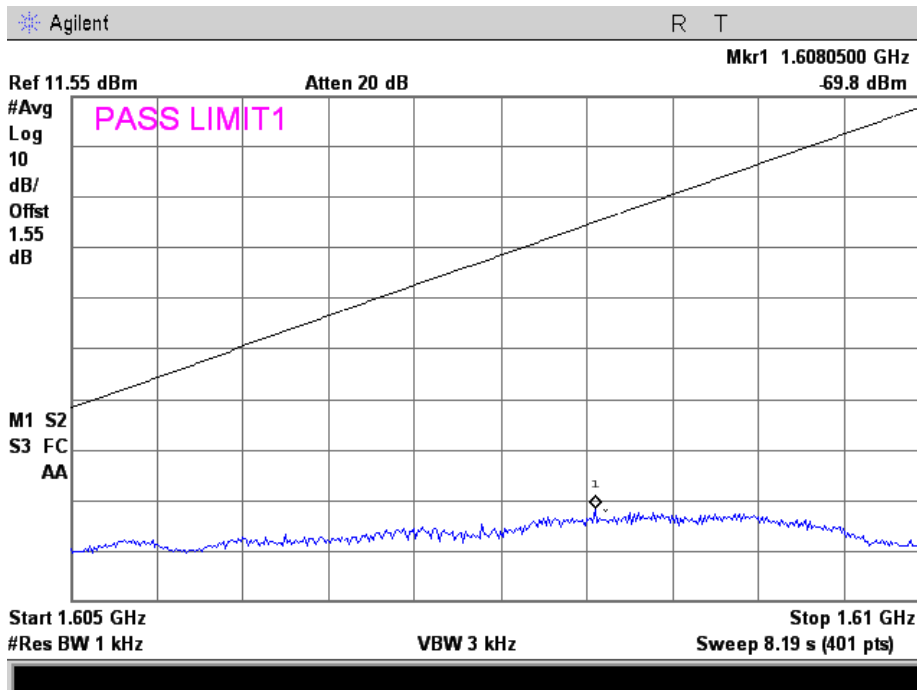
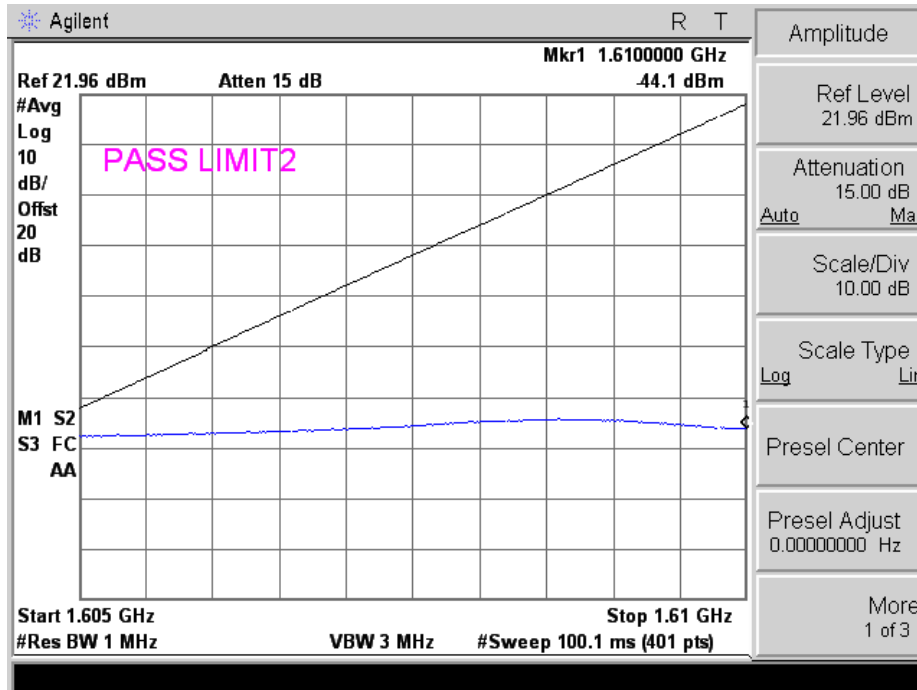


### 25.216(g) 1616.75 MHz



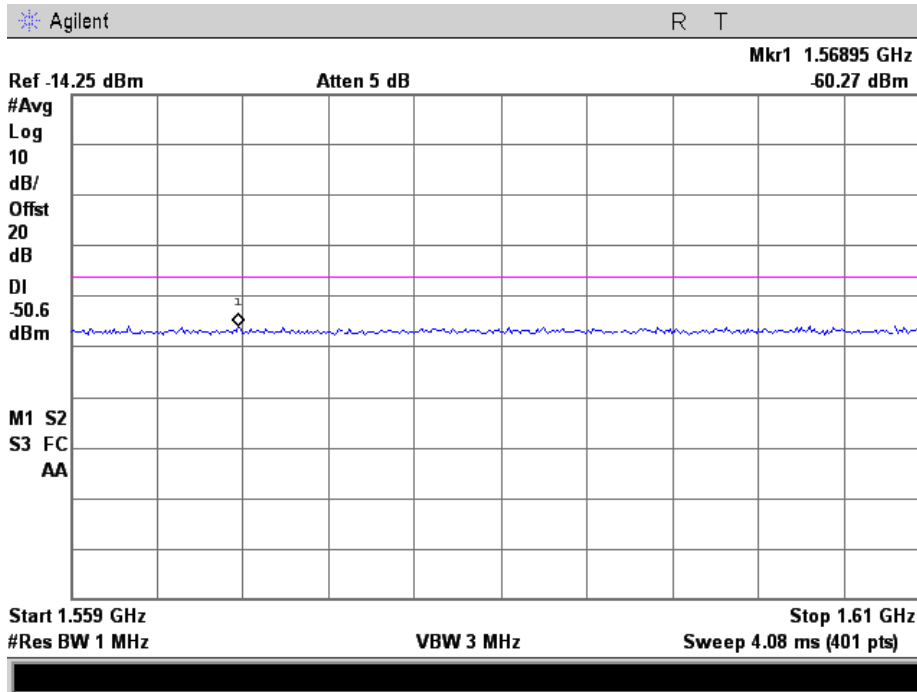


### 25.216(g) 1618.25 MHz





### 25.216(i)





### Frequency Tolerance (Temperature Variation)

**Name of Test:** Frequency Tolerance (Temperature Variation)  
**Limit:** 0.001%  
**Test Equipment Utilized:** i00008, i00027, i00331

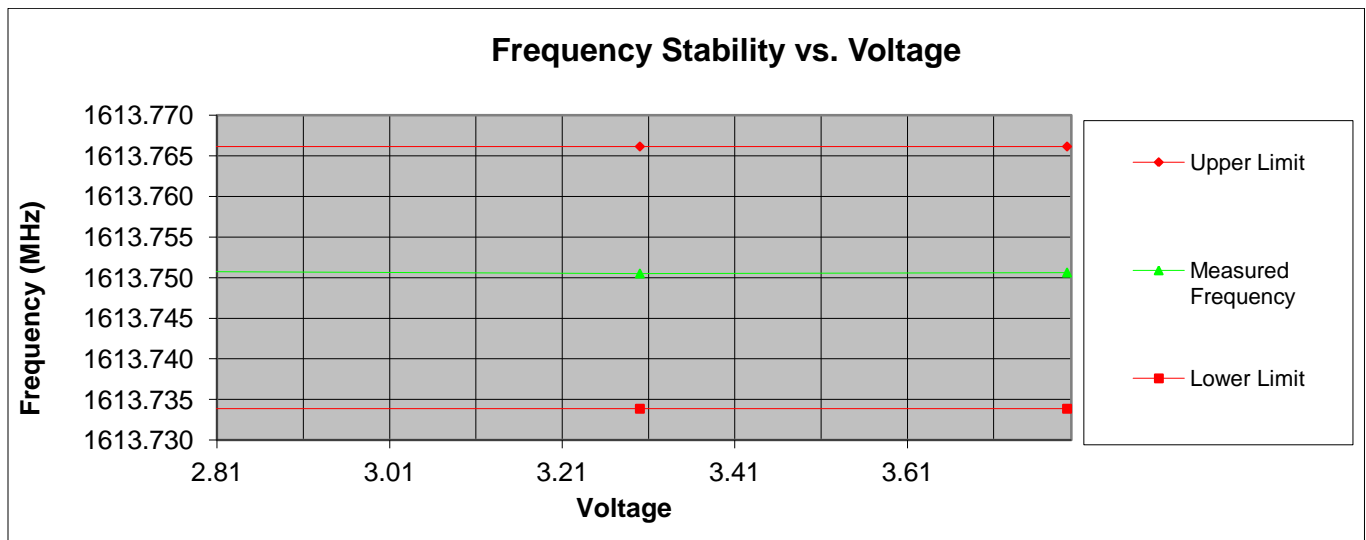
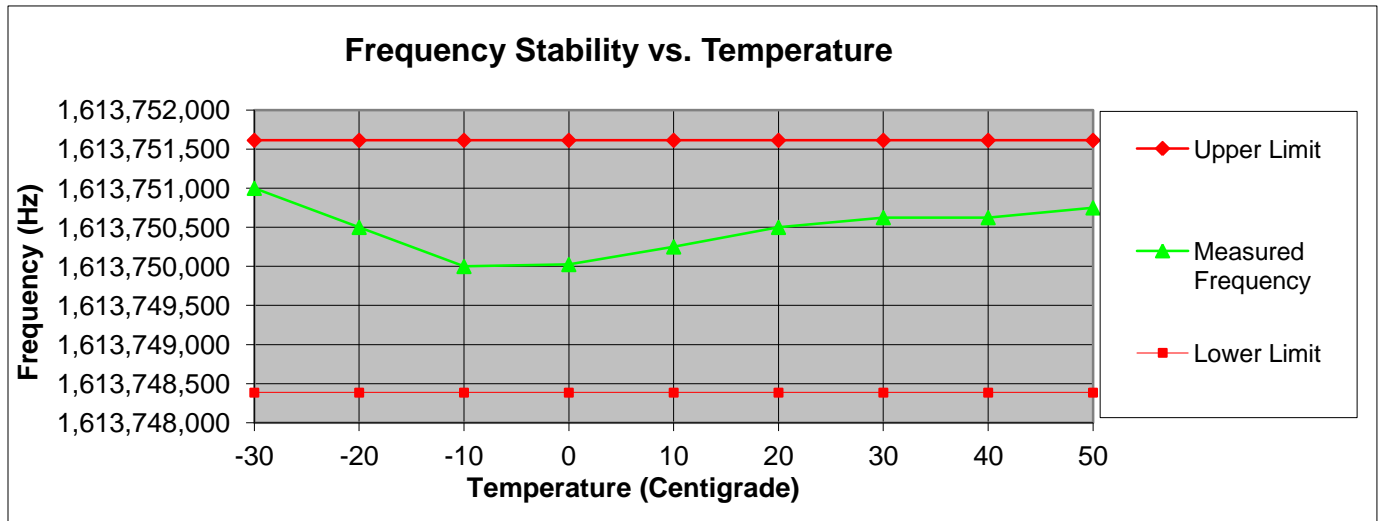
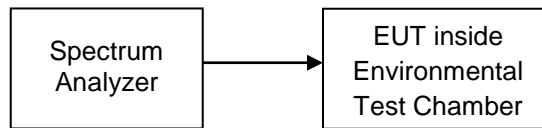
**Test Engineer:** Alex Macon

**Test Date:** 5/14/2013

### Test Procedure

The EUT was placed inside an environmental test chamber, and connected to a spectrum analyzer. The span and RBW was adjusted for narrowband operation to ensure an accurate measurement of the CW signal. The temperature was varied from -30 to +50°C in 10°C increments. After a 30-minute soak time the output frequency was measured. At 20°C the voltage was varied +/- 15% from the nominal voltage.

### Test Setup





## Field Strength of Spurious Radiation

**Name of Test:** Field Strength of Spurious Radiation  
**Test Equipment Utilized:** i00008, i00271, i00331

**Engineer:** Alex Macon  
**Test Date:** 5/15/2013

### Test Procedure

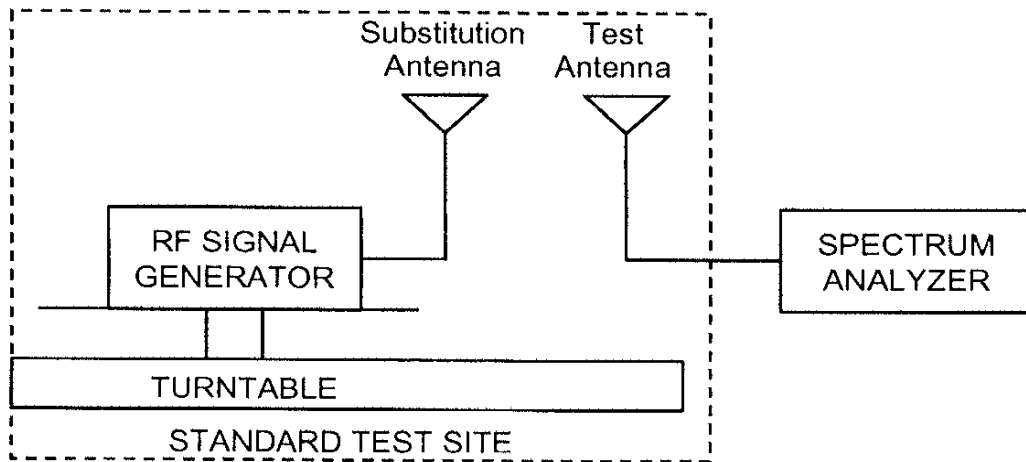
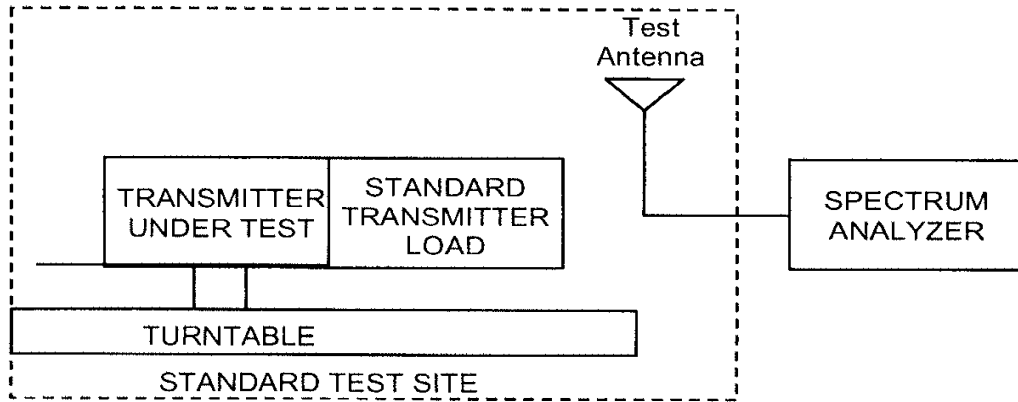
- A) Connect the equipment as illustrated
- B) Adjust the spectrum analyzer for the following settings:
  - 1) Resolution Bandwidth 100 kHz (< 1 GHz), 1 MHz (> 1GHz)
  - 2) Video Bandwidth  $\geq 3$  times Resolution Bandwidth, or 30 kHz
  - 3) Sweep Speed  $\leq 2000$  Hz/second
  - 4) Detector Mode = 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  $\pm$  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





**Part 2 Test Results**

**1611.25 MHz**

<b>Emission Frequency (GHz)</b>	<b>Measured Level (dBm)</b>	<b>Limit (dBm)</b>	<b>Result</b>
3.222475	-50	-13	Pass
8.056225	-49.9	-13	Pass
9.667450	-50.69	-13	Pass

**1618.75 MHz**

<b>Emission Frequency (GHz)</b>	<b>Measured Level (dBm)</b>	<b>Limit (dBm)</b>	<b>Result</b>
3.237500	-46.55	-13	Pass
8.093700	-51.22	-13	Pass
9.712375	-51.82	-13	Pass

No other emissions were detected. All emissions were less than -25 dBm.





### Test Equipment Utilized

Description	MFG	Model	CT Asset #	Last Cal Date	Cal Due Date
Power Supply	Kenwood	PR18-3A	i00008	Verified on: 5/7/13	
Temperature Chamber	Tenney	Tenney Jr	i00027	Verified on: 5/7/13	
Horn Antenna, Amplified	ARA	DRG-118/A	i00271	4/19/12	4/19/14
Spectrum Analyzer	Agilent	E4407B	i00331	4/23/13	4/23/14

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