

FCC/IC Test Report

Prepared for: **Independent Technologies, LLC**
26 1st Ave SE
New London, MN 56273

Product: **WESROC Satellite Tank Monitor**

Model: **MT-9100STM**
FCC ID: **RWB-MT9100STM**
IC: **115A-MT9100STM**

Test Report No: **R20150213-20-03**

Approved By:



Nic S. Johnson, NCE
Technical Manager
iNARTE Certified EMC Engineer #EMC-003337-NE

DATE: **24 February 2016**

Total Pages: **11**



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Revision Page

Rev. No.	Date	Description
Original	24 February 2016	Original – Njohnson

1 Summary of Test Results

The equipment under test (EUT) was tested for compliance to FCC Part 25 and Part 2 as well as Industry Canada RSS-170, Issue 3. Below is a summary of the test results. Complete results can be found in Section 3.

Report Section	FCC Rule Part	RSS-170 Section	Result
Power limits	§2.1046 §25.204	5.3	PASS
Emissions Limitations	§2.1053 §25.202(f)	5.4.3.1	PASS
Occupied Bandwidth	§2.1047(d)	5.4.3.1	PASS
Emissions Masks	§2.1053 §25.202(f)	5.4.3.1	PASS
Emissions Limits for Mobile Earth Stations	§2.1053 §25.216(c), (g) (i)	5.4.2.1	PASS
Frequency Tolerance	§2.1055 §25.202(d)	5.2	PASS
Field Strength of Spurious Emissions	§2.1053 §25.216	5.4.3	PASS

The testing was performed by Compliance Testing, LLC in May of 2013 and the test report was downloaded from the FCC website, FCC ID:L2V-STX3 (original grant). The EUT has modular approval remained un-modified from the time on testing with the exception of:

1. A new RF path
2. A new antenna
3. The addition of an RF switch in the antenna path.

NCEE Labs report R20150213-20-02A includes tests results for output power and spurious emissions, as these would be the only tests that would be affected by these changes.

The test report from Compliance Testing, LLC has been provided in this document in full.



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

toll-free: (866) 311-3268
fax: (480) 526-3558
<http://www.ComplianceTesting.com>
info@ComplianceTesting.com

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.
Covington, LA 70433

Attention of:

Ronnie Tanner, Principal Engineer
Ph: (985) 335-1513
E-Mail: ronnie.tanner@globalstar.com

Prepared By
Compliance Testing, LLC
3356 N San Marcos Pl, Suite 107
Chandler, AZ 85225-7176
(866) 311-3268 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p1320003

Alex Macon
Project Test Engineer

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All results contained herein relate only to the sample tested

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
			2013-07-11 10:39

Test Report Revision History



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Compliance Testing, LLC
Previously Flora Test Lab

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



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



Compliance Testing, LLC
Previously Flom Test Lab

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	

Final Test Report		
Test ID	2018-0003	Test Date
Test Type	EMI	Test Frequency
Test Standard	FCC ID: 2A9B2	Test Equipment

Test ID: 2018-0003 Test Date: 2018-03-06 Test Frequency: 8.450-8.475 MHz

Test Standard: FCC ID: 2A9B2
Test Equipment: Flom Test Lab Model 2000
Test Frequency: 8.450-8.475 MHz

Test ID: 2018-0003 Test Date: 2018-03-06 Test Frequency: 8.450-8.475 MHz
Test Standard: FCC ID: 2A9B2
Test Equipment: Flom Test Lab Model 2000
Test Frequency: 8.450-8.475 MHz

Test ID: 2018-0003 Test Date: 2018-03-06

Test ID: 2018-0003 Test Date: 2018-03-06 Test Frequency: 8.450-8.475 MHz
Test Standard: FCC ID: 2A9B2
Test Equipment: Flom Test Lab Model 2000
Test Frequency: 8.450-8.475 MHz

Test ID: 2018-0003 Test Date: 2018-03-06
Test Standard: FCC ID: 2A9B2
Test Equipment: Flom Test Lab Model 2000



Power Limits

Name of Test:

Power Limits

Engineer: Alex Macon

Test Equipment Utilized:

i00008, i00331

Test Date: 5/7/2013

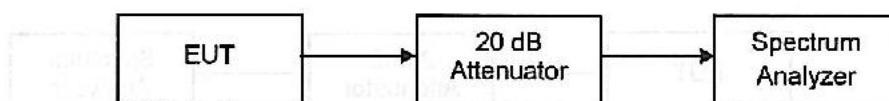
Test Procedure

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

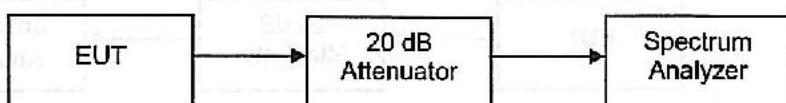
Name of Test: Emissions Limitations for Mobile Earth Stations
Test Equipment Utilized: i00008, i00331

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

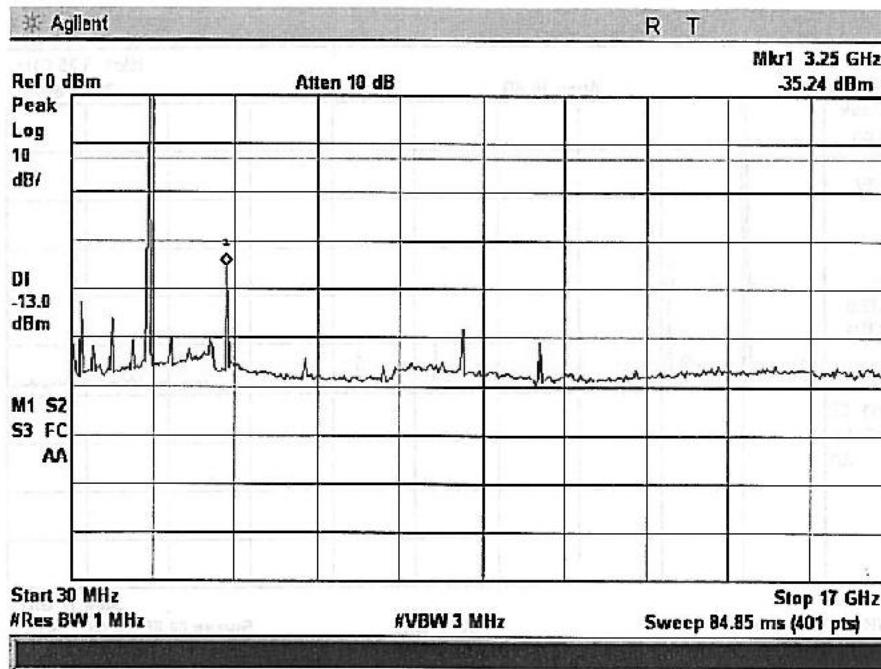


Emissions Limitations Summary Table

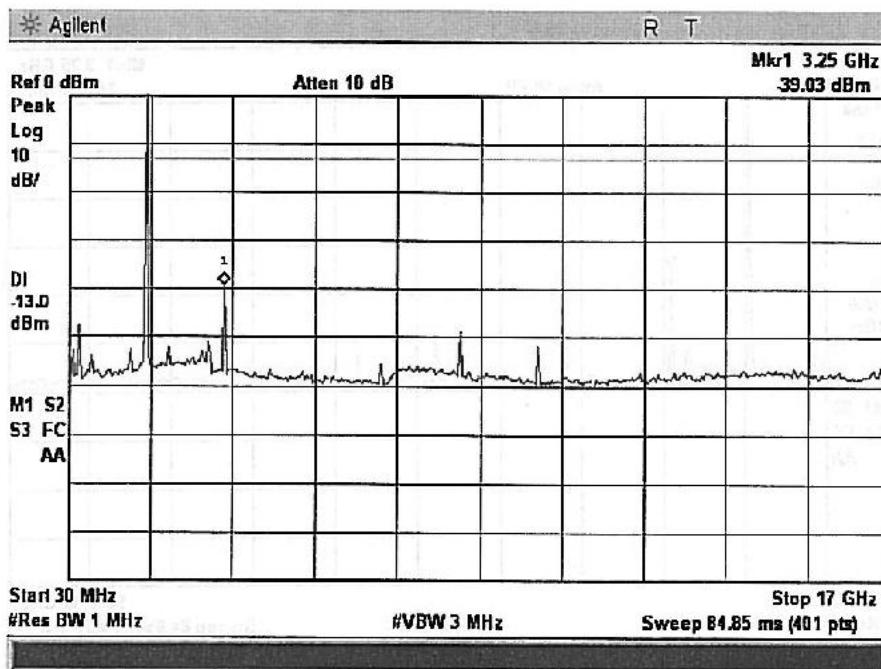
Tuned Frequency (MHz)	Result	Comments
1611.25	Pass	See Plots
1613.75	Pass	See Plots
1616.20	Pass	See Plots
1618.75	Pass	See Plots



Emissions Limitations Plot 1611.25 MHz

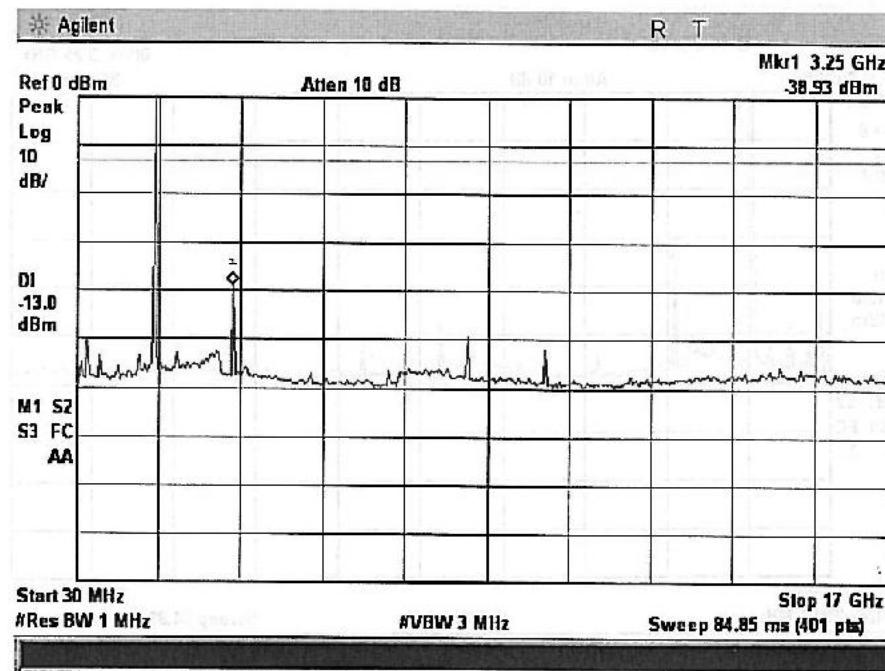


Emissions Limitations Plot 1613.75 MHz

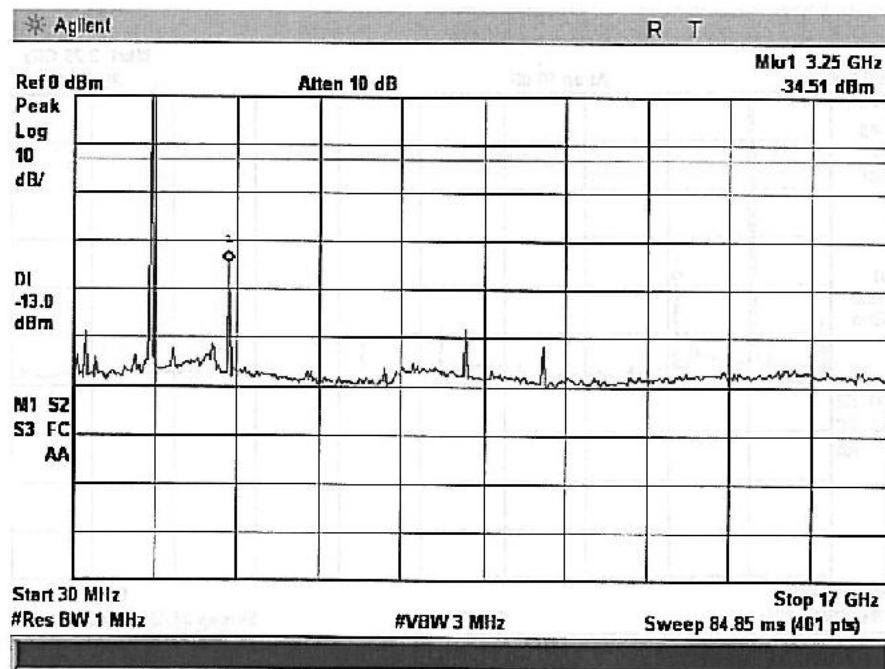




Emissions Limitations Plot 1616.25 MHz



Emissions Limitations Plot 1618.75 MHz





Occupied Bandwidth

Name of Test:

Occupied Bandwidth

Engineer: Alex Macon

Test Equipment:

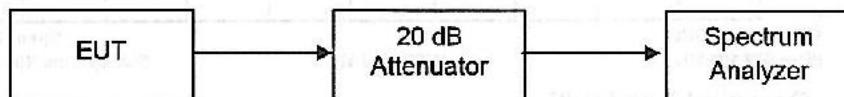
i00008, i00331

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.

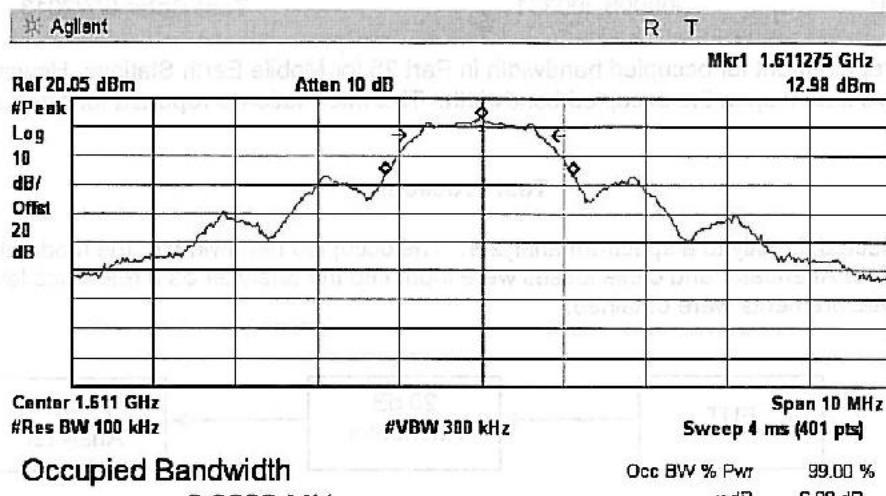


Test Results

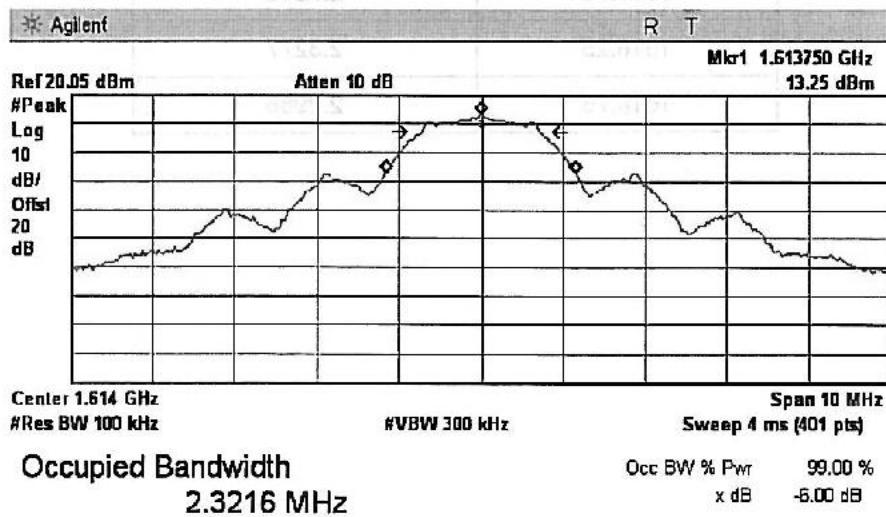
Frequency (MHz)	Measured Bandwidth (MHz)
1611.25	2.3020
1613.75	2.3216
1616.25	2.3277
1618.75	2.2986



1611.25

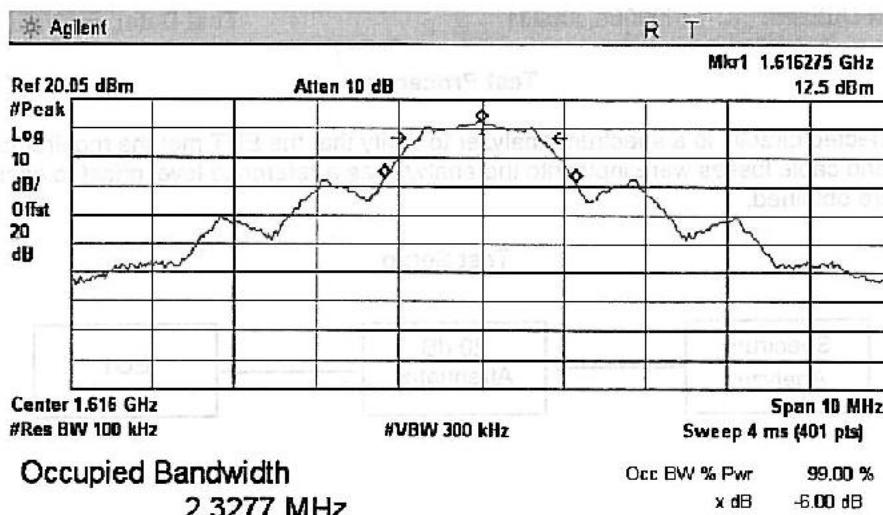


1613.75



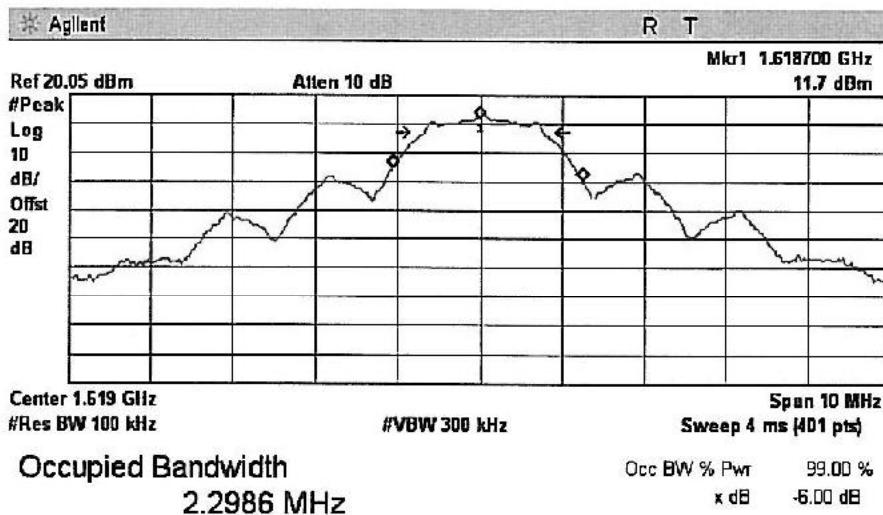


1616.25



Transmit Freq Error -12.044 kHz
x dB Bandwidth 1.440 MHz

1618.75



Transmit Freq Error 90.516 kHz
x dB Bandwidth 1.426 MHz



Emission Masks

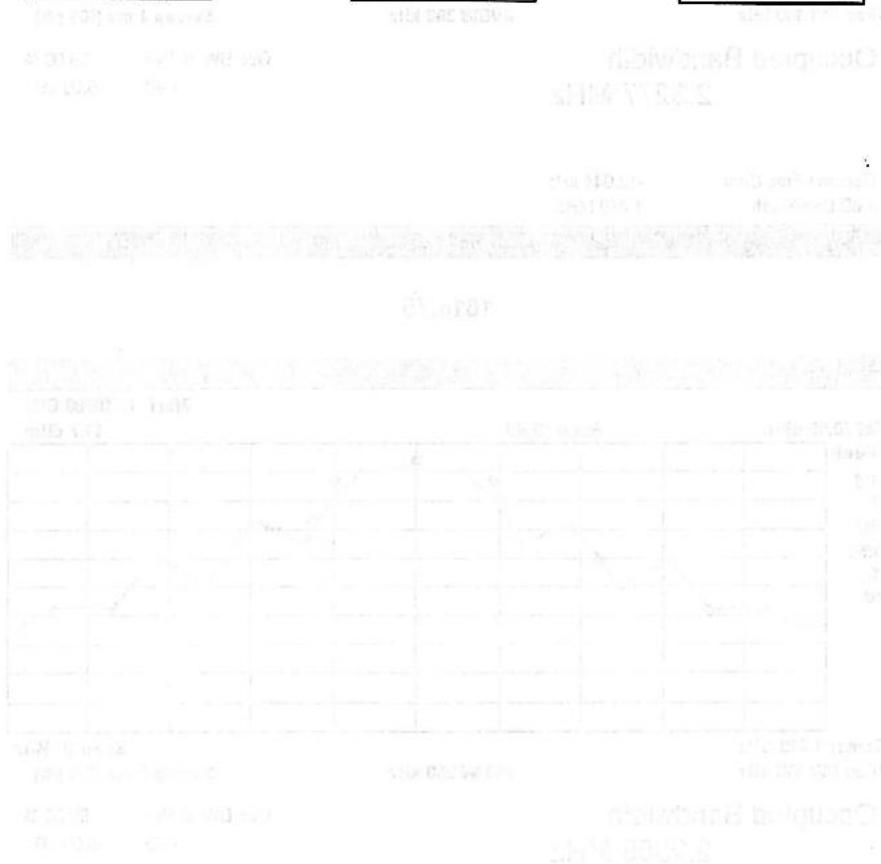
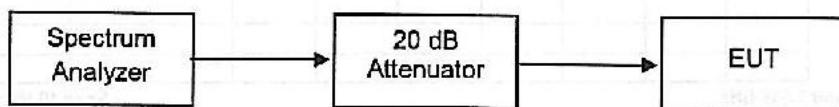
Name of Test: Emission Masks
Test Equipment Utilized: i00008, i00331

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.

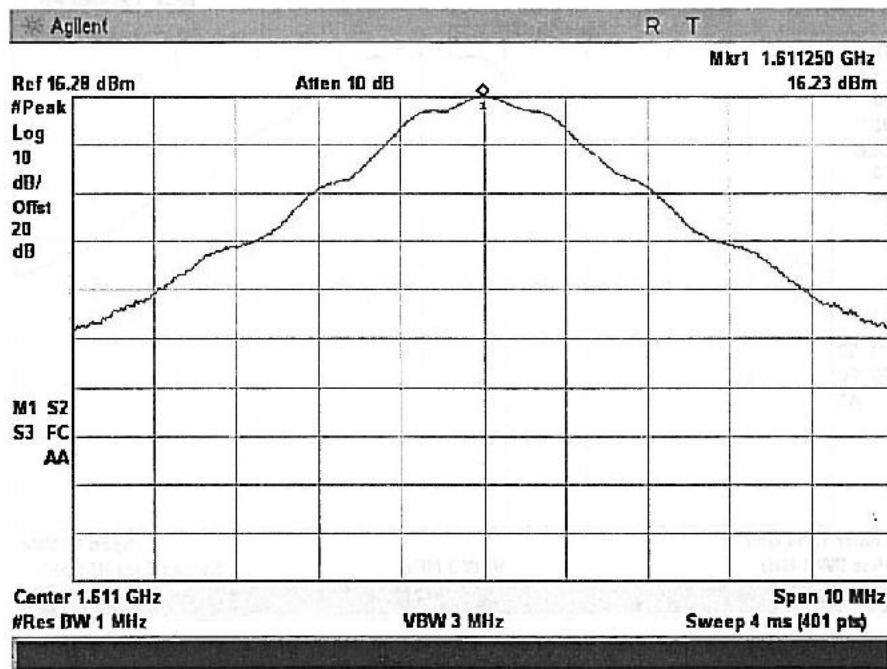
Test Setup



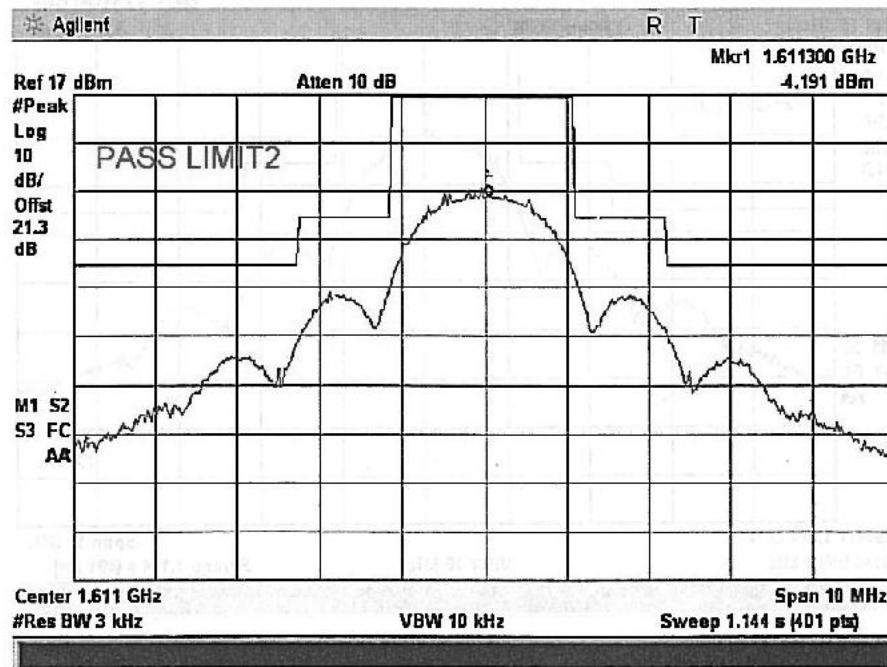


Emission Mask Plots

1611.25 MHz Reference

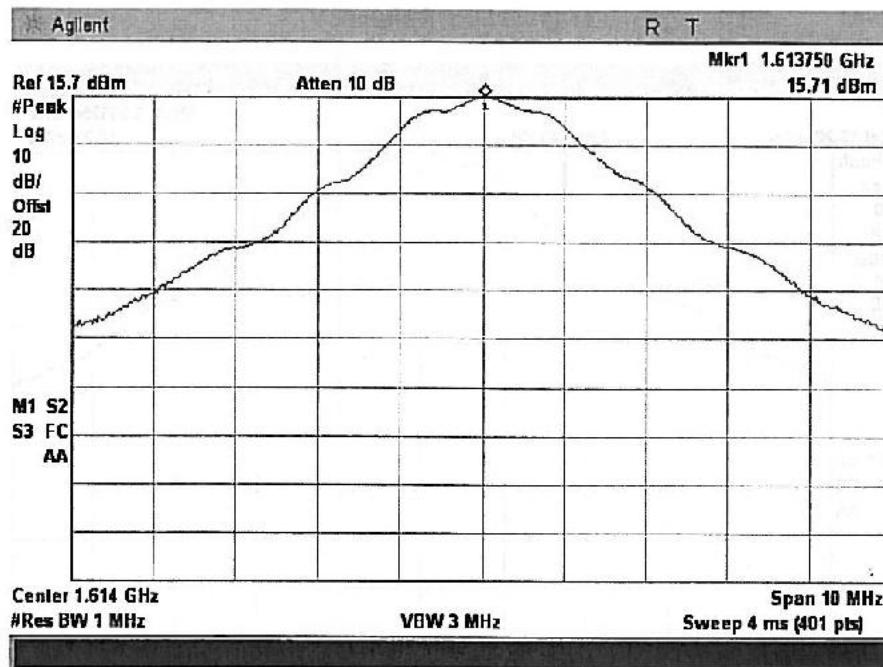


1611.25 MHz Mask

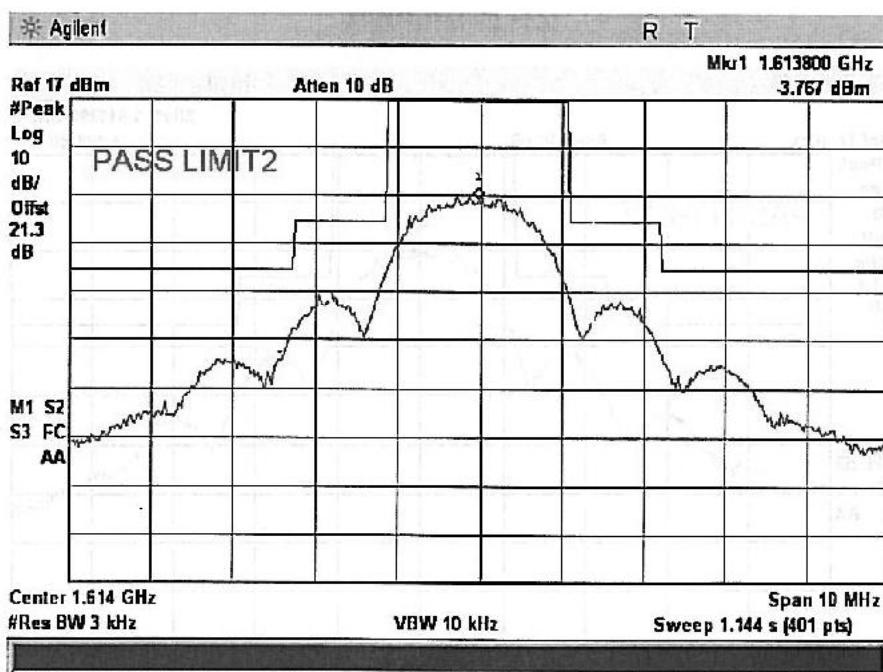




1613.75 MHz Reference

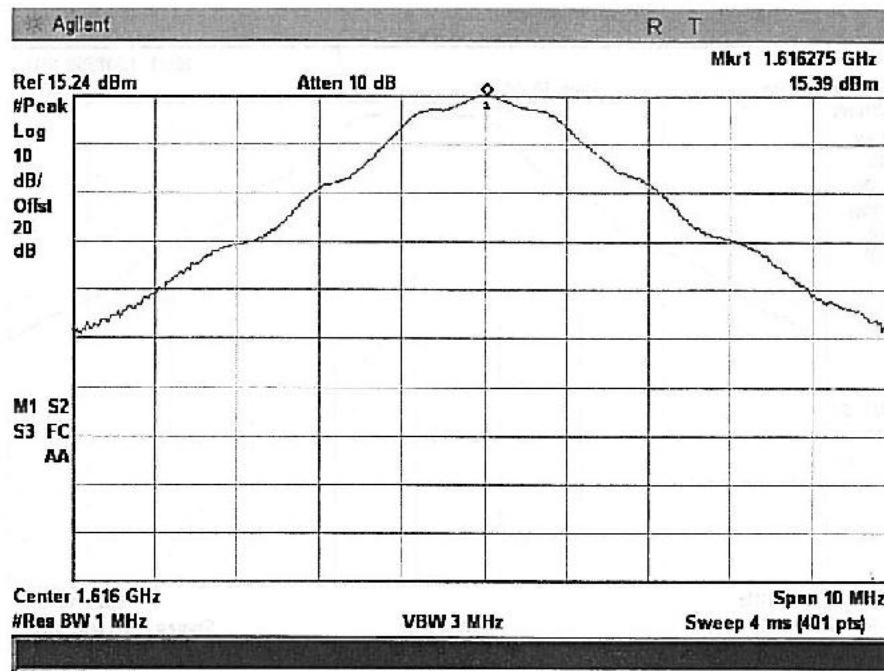


1613.75 MHz Mask

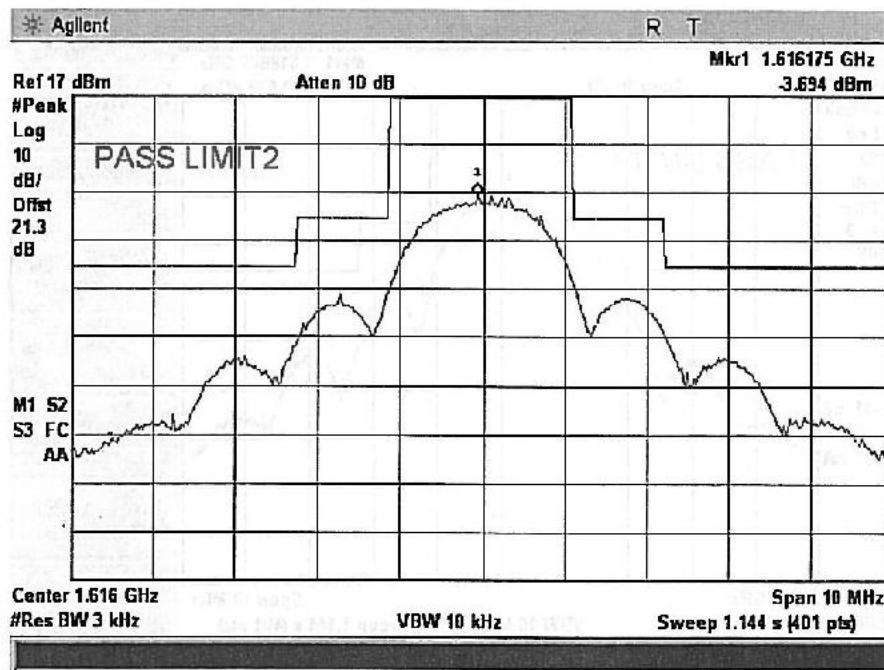




1616.25 MHz Reference

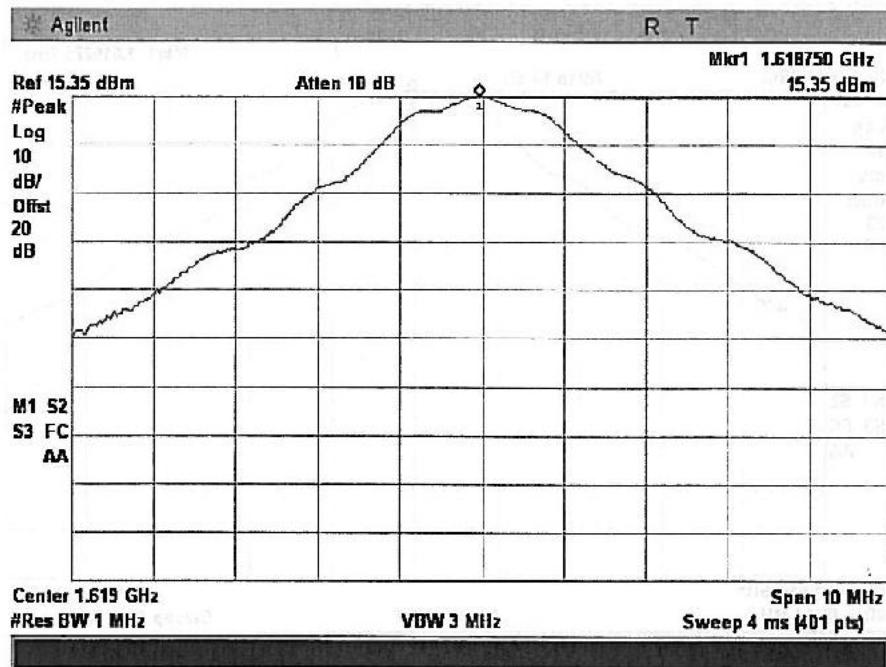


1616.25 MHz Mask

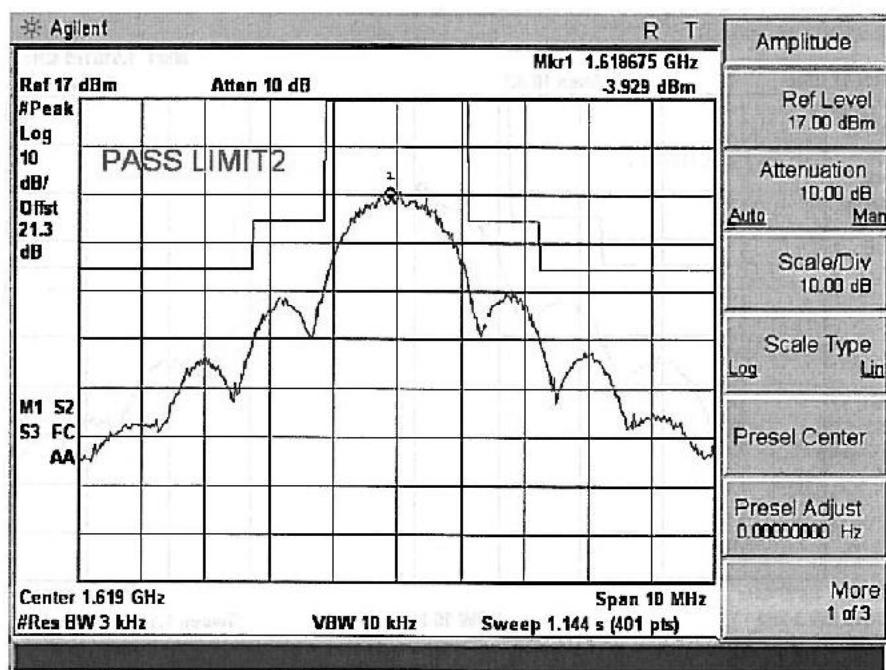




1618.75 MHz Reference



1618.75 MHz Mask





Emissions Limits for Mobile Earth Stations

Name of Test:

Emissions Limits for
Mobile Earth Stations

Engineer: Alex Macon

Test Equipment Utilized:

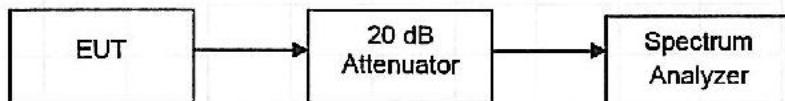
i00008, i00331

Test Date: 5/13/13

Test Procedure

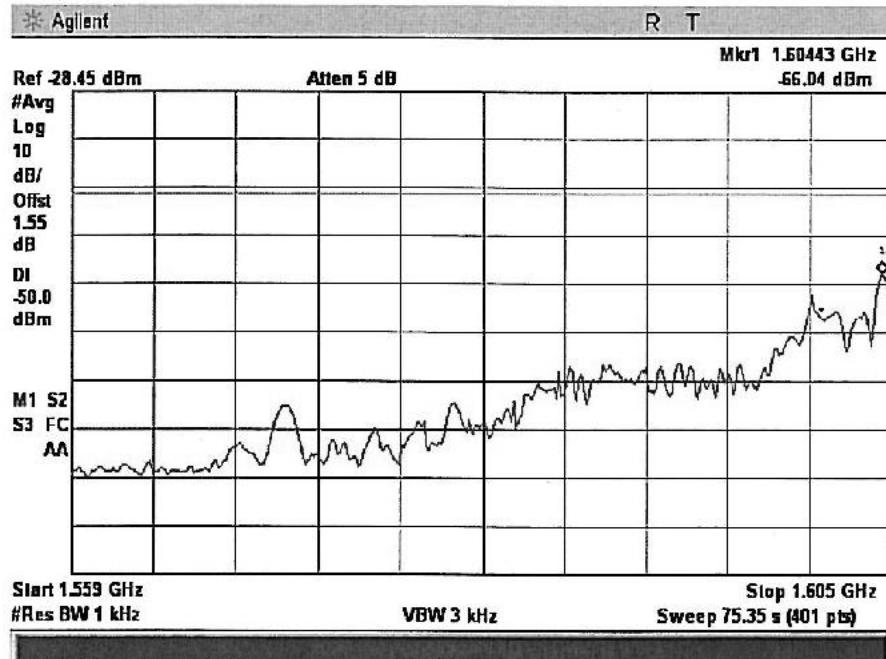
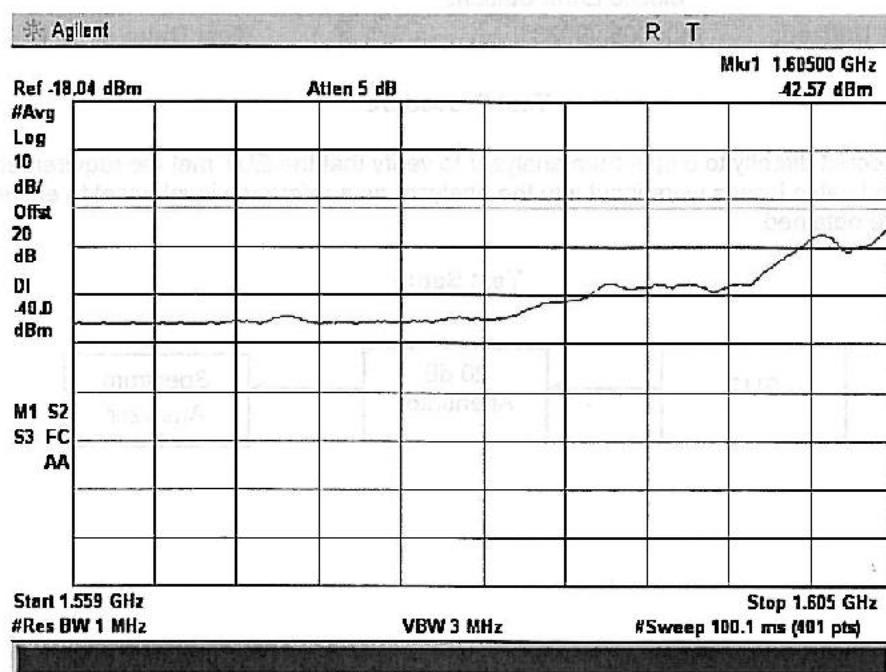
The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for emission limits. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained.

Test Setup



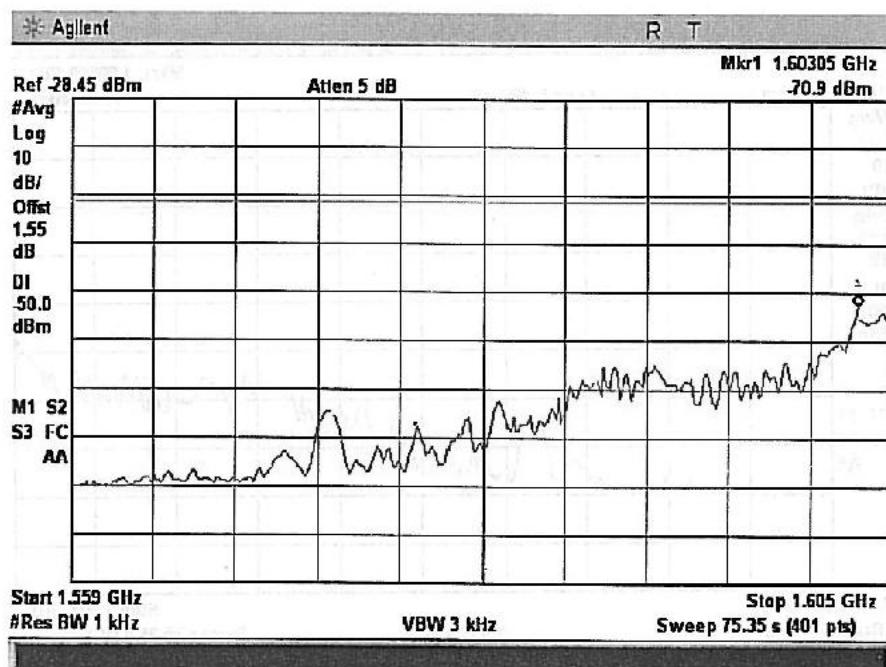
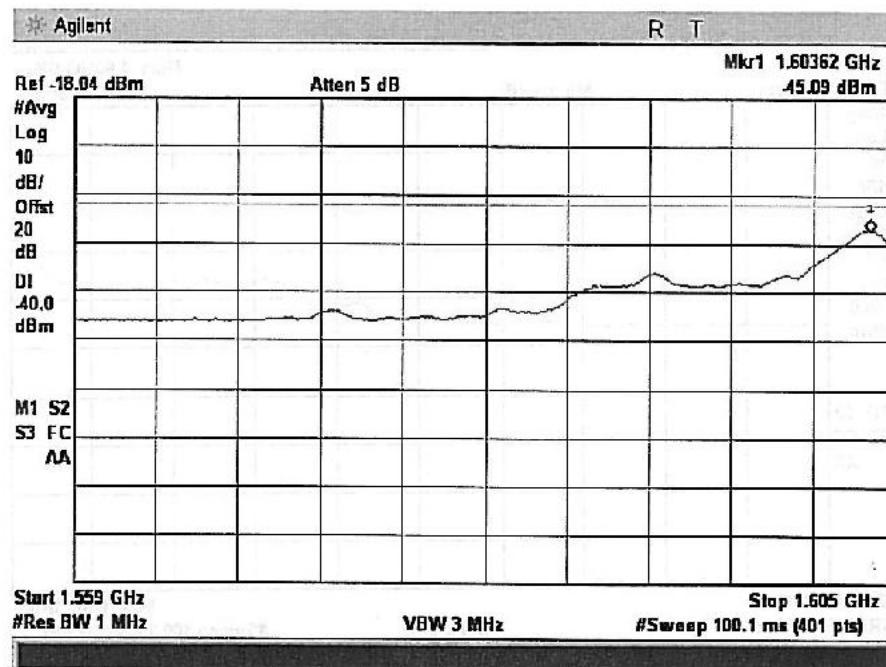


25.216(c) 1611.25 MHz



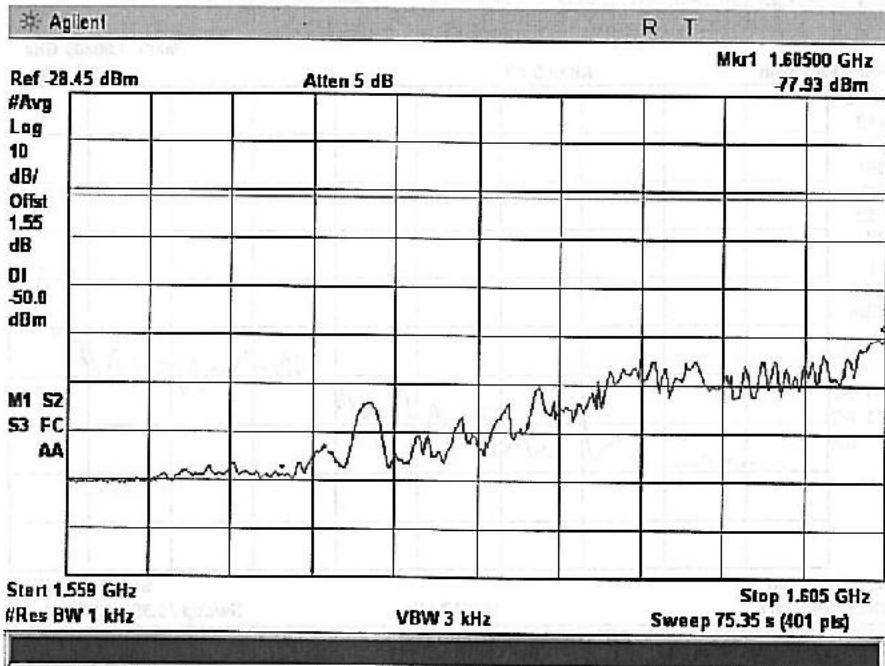
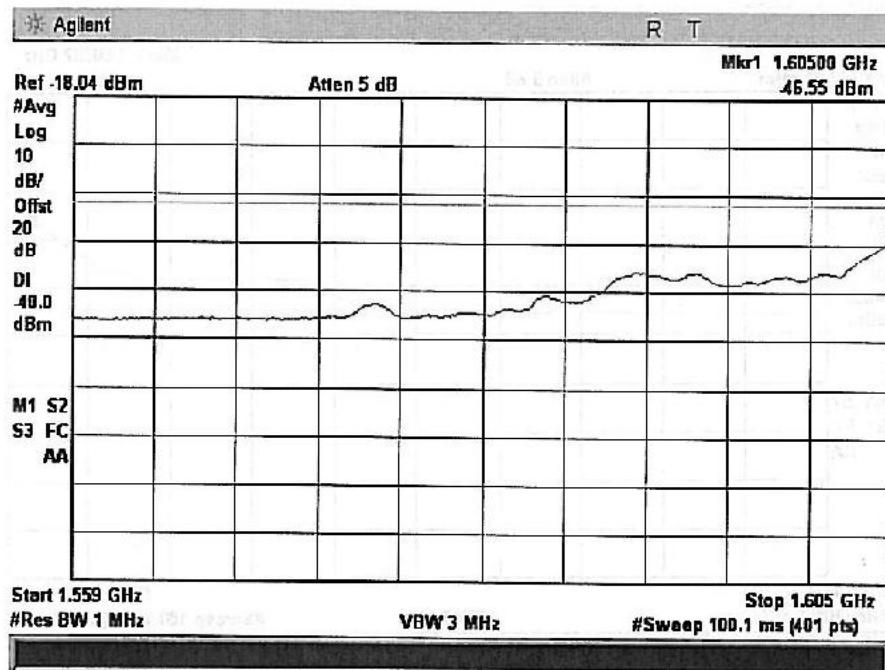


25.216(c) 1613.75 MHz



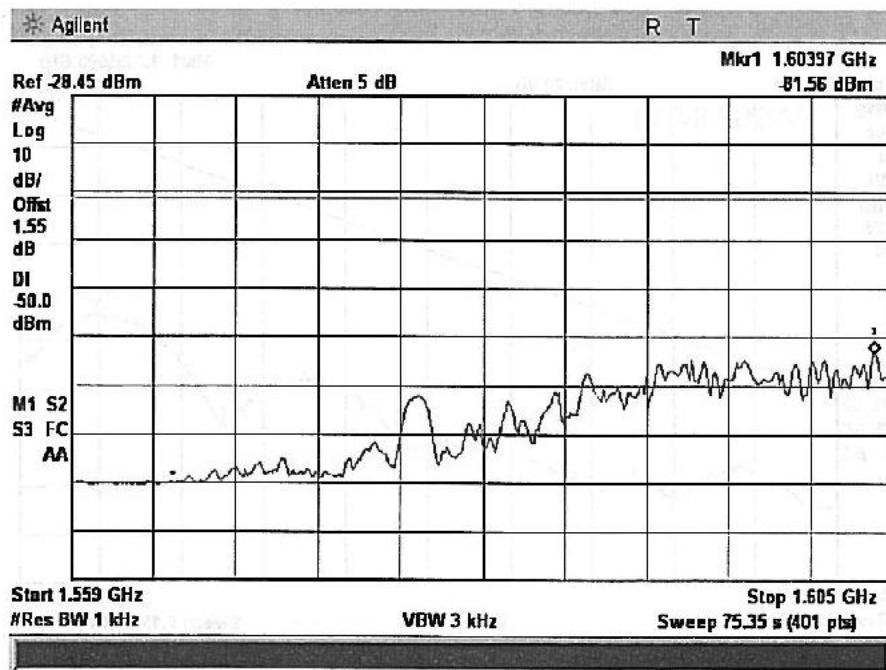
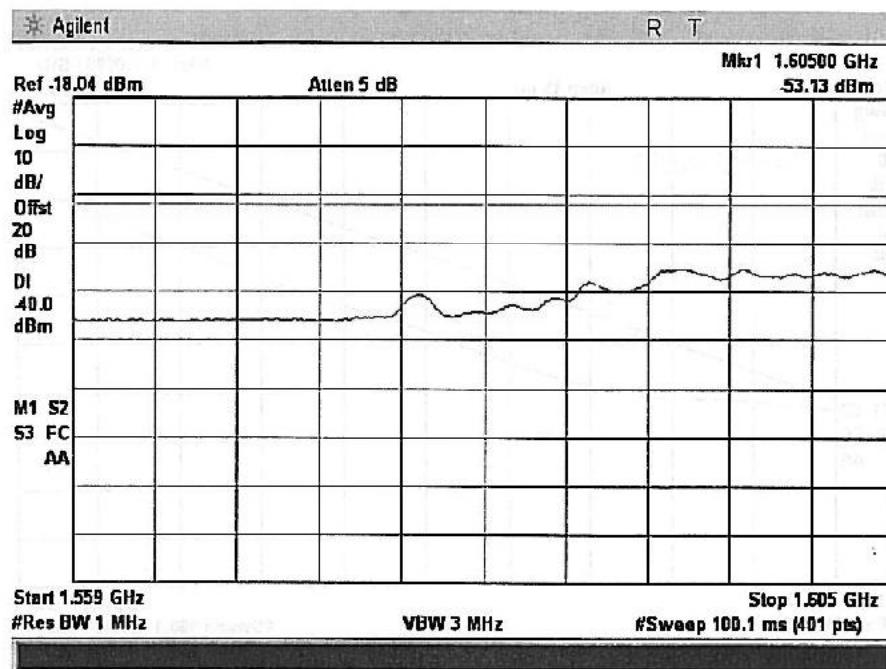


25.216(c) 1616.75 MHz



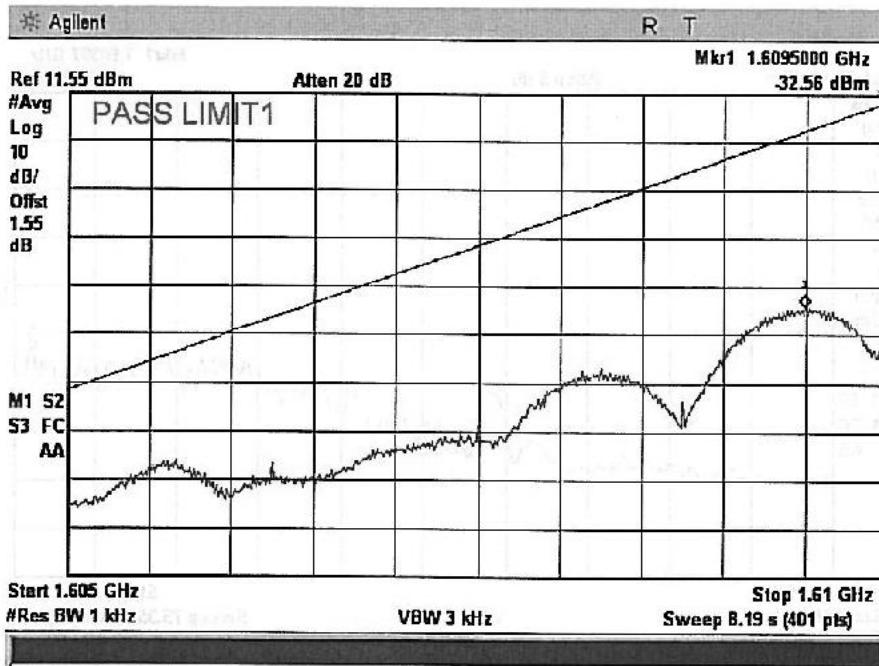
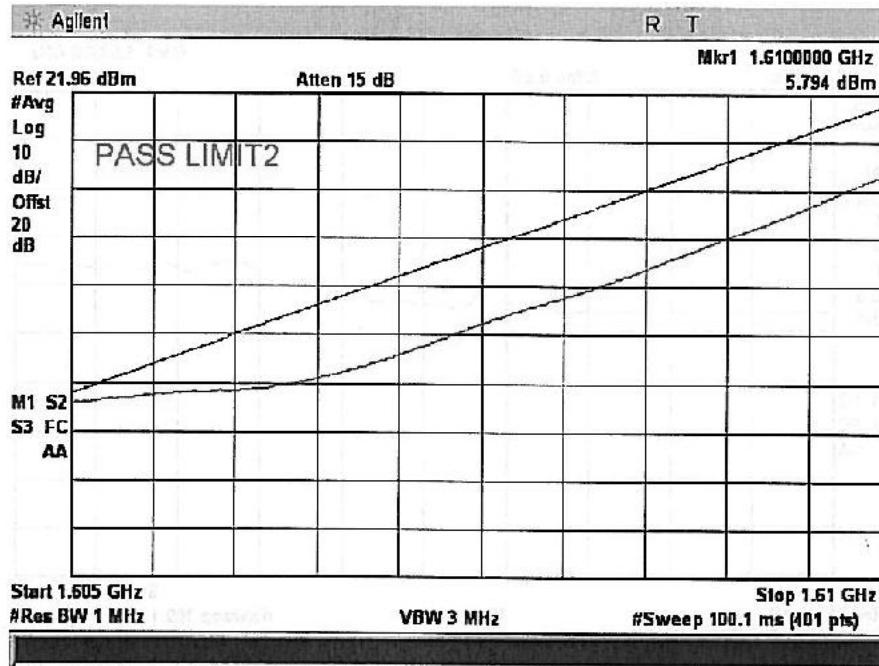


25.216(c) 1618.25 MHz



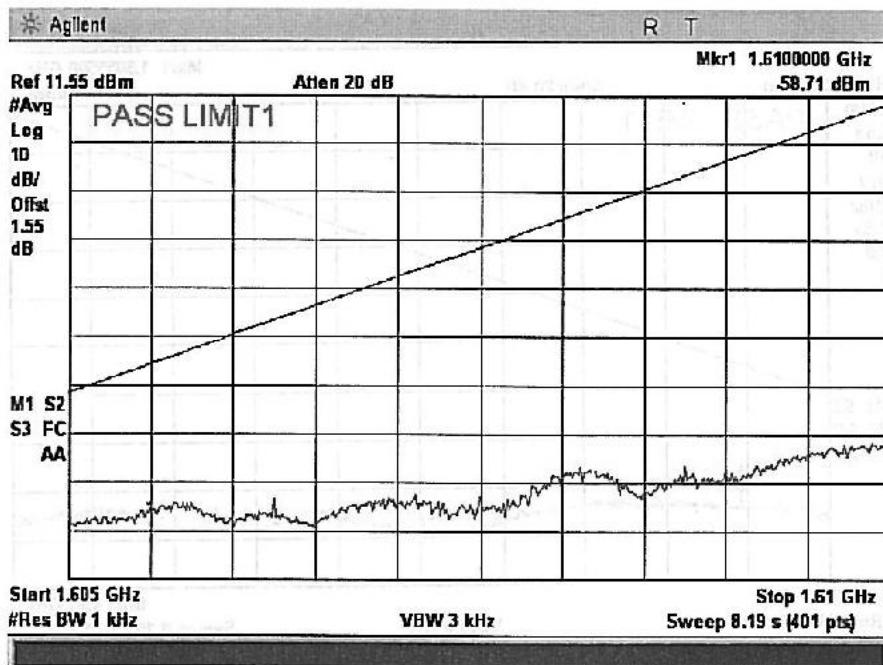
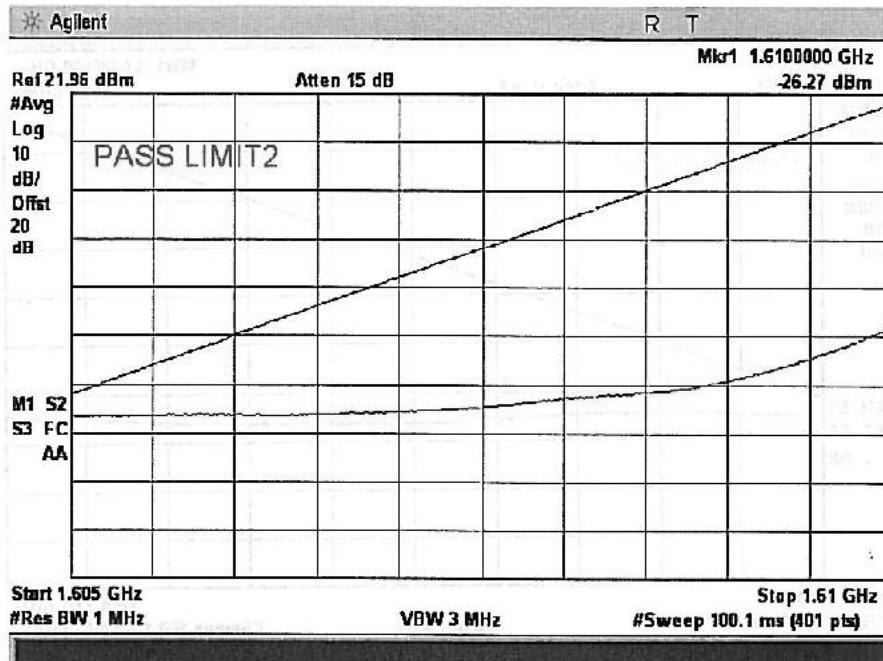


25.216(g) 1611.25 MHz



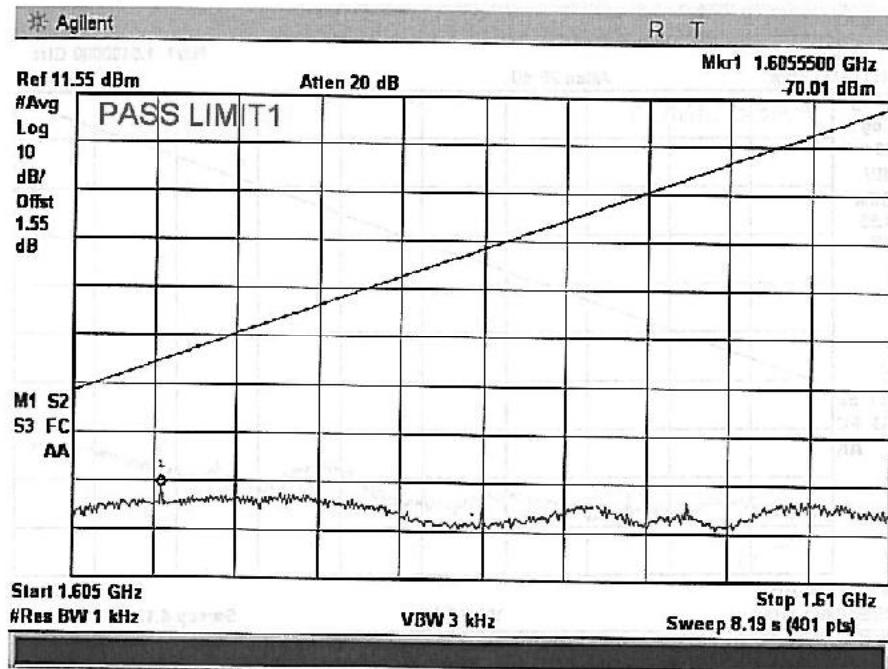
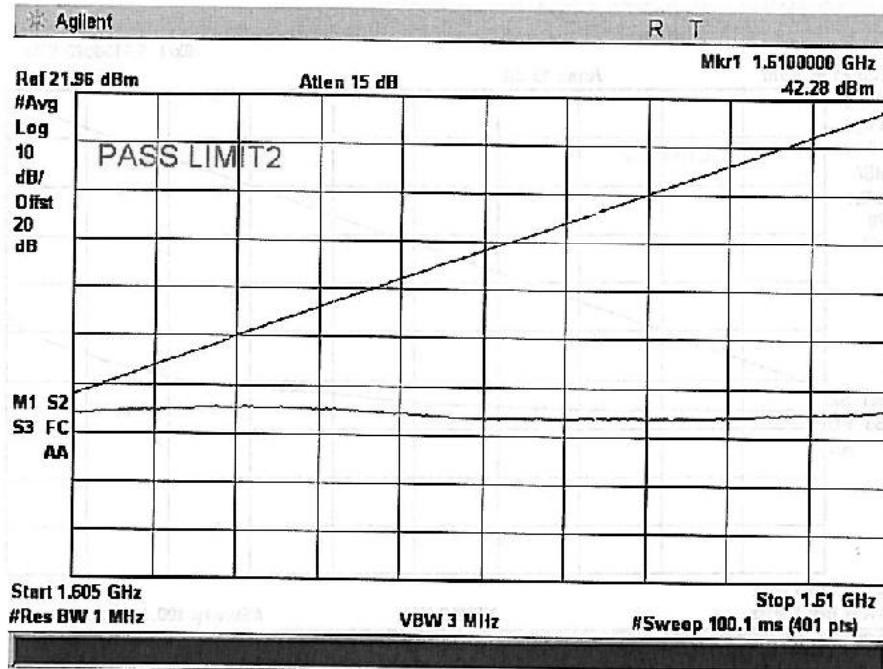


25.216(g) 1613.75 MHz



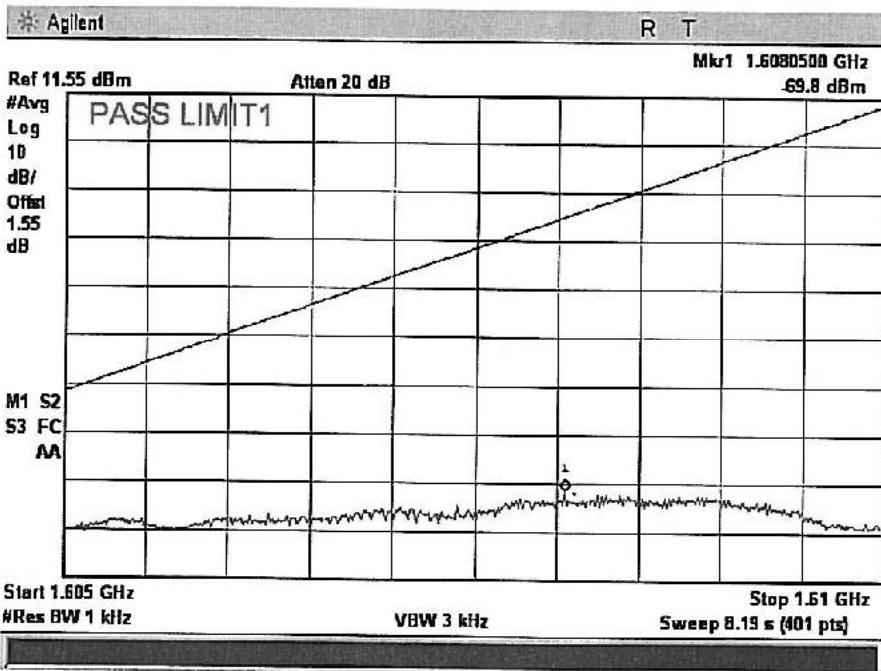
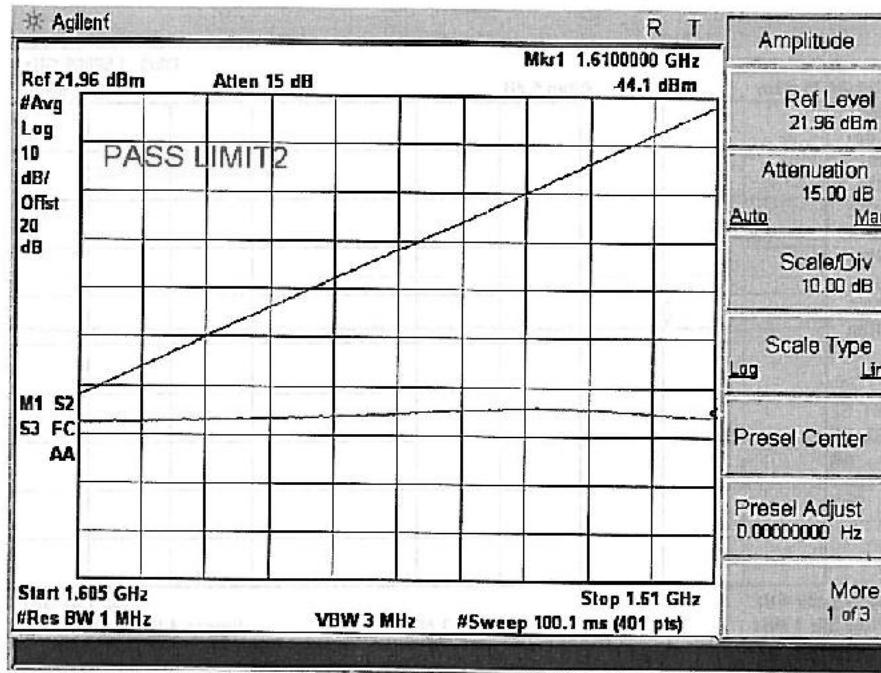


25.216(g) 1616.75 MHz



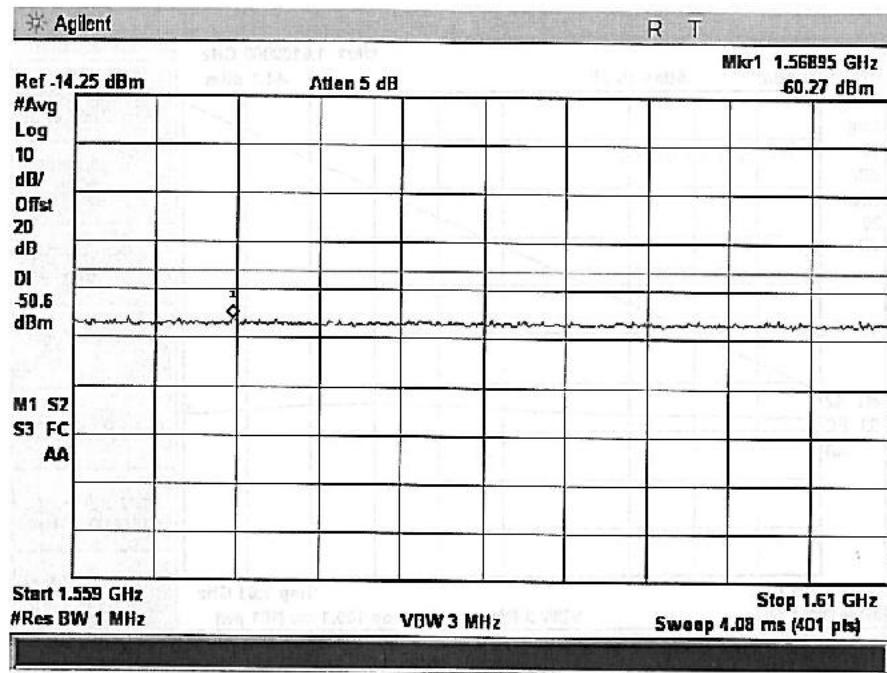


25.216(g) 1618.25 MHz





25.216(i)





Frequency Tolerance (Temperature Variation)

Name of Test: Frequency Tolerance

Frequency Tolerance
(Temperature Variation)

Limit:

0.001%

Test Equipment Utilized

i00008, i00027, i00331

Test Engineer: Alex Macon

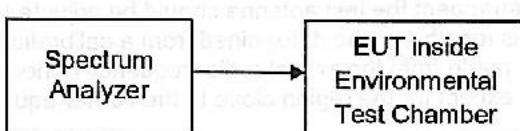
Test Date: 5/14/2013

Test Procedure

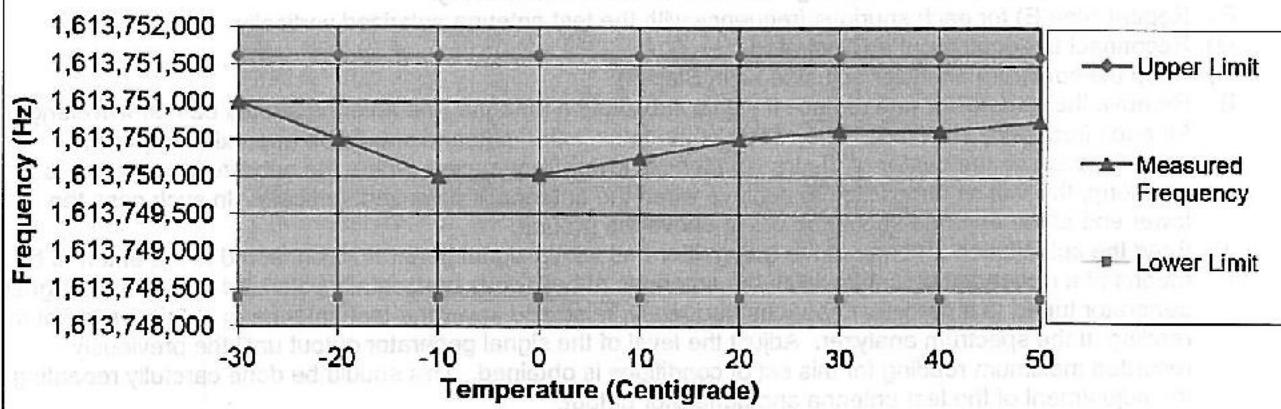
The EUT was placed inside an environmental test chamber, and connected to a spectrum analyzer. The span and RBW was adjusted for narrowband operation to ensure an accurate measurement of the CW signal.

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.

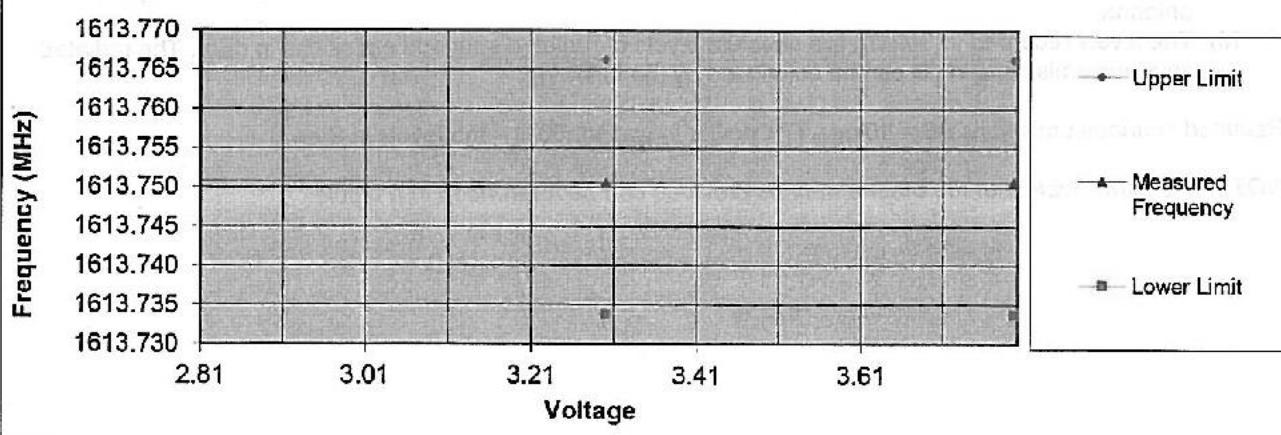
Test Setup



Frequency Stability vs. Temperature



Frequency Stability vs. Voltage





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

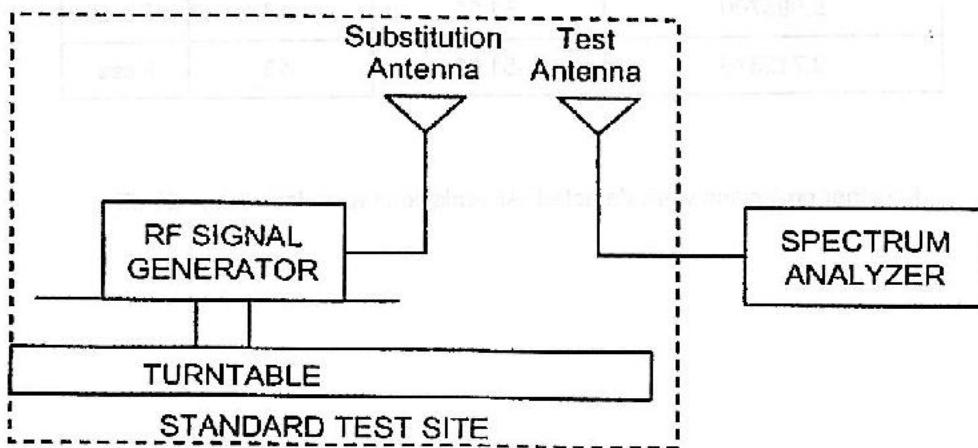
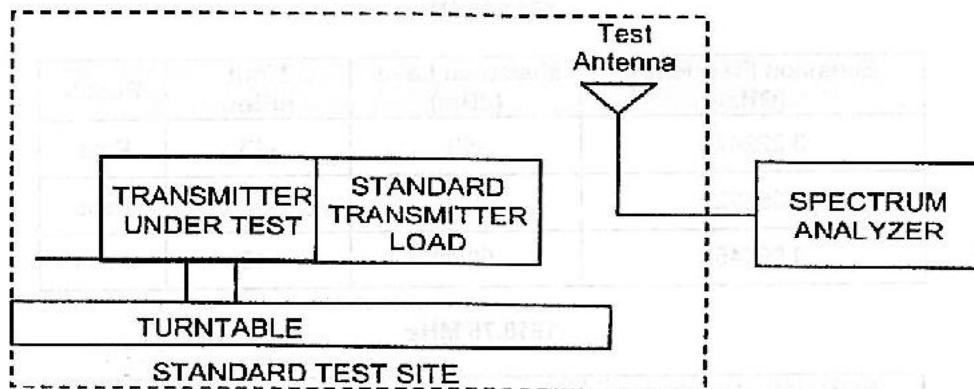
- A) Connect the equipment as illustrated
- B) Adjust the spectrum analyzer for the following settings:
 - 1) Resolution Bandwidth 100 kHz (< 1 GHZ), 1 MHz (> 1GHz)
 - 2) Video Bandwidth \geq 3 times Resolution Bandwidth, or 30 kHz
 - 3) Sweep Speed \leq 2000 Hz/second
 - 4) Detector Mode = Mean or Average 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 = $10\log_{10}(\text{TX power in watts}/0.001) - \text{the levels in Step I})$

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



Test Setup





Part 2 Test Results

1611.25 MHz

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

1618.75 MHz

Emission Frequency (GHz)	Measured Level (dBm)	Limit (dBm)	Result
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