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Test Report

Prepared for: FLYHT Aerospace Solutions Ltd.

Model: AFIRS 228S Automated Flight Information Reporting System

Description: Dual Channel Iridium Satcom System that incorporates Iridium 9523 and 9602

FCC ID: 2ABRJ-228S

To

FCC Part 25

Date of Issue: October 16, 2013

On the behalf of the applicant:	**FLYHT Aerospace Solutions Ltd.** **200W, 1144-29th Avenue NE** **Calgary, Alberta T2E 7P1**
Attention of:	**Derek Graham** **Ph: (403) 250-9956** **E-Mail: dgraham@flyht.com**

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Project No: p1380011

Alex Macon
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	10/16/13	Alex Macon	Original Document
2.0	1/21/14	Amanda Reed	Updated FCC ID
3.0	1/30/14	Amanda Reed	Updated FCC ID

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ILAC / A2LA

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

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Testing Certificate Number: **2152.01**

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#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		
Temperature (˚C)	**Humidity (%)**	**Pressure (mbar)**
26.5 – 33.5	10.1 – 36.2	959.3 – 967.2

EUT Description
Model: AFIRS 228S Automated Flight Information Reporting System
Description: Dual Channel Satcom System
SN: N/A
Firmware: N/A

Additional Information:
Dual channel Iridium satcom system used in aircrafts that incorporates Iridium 9523 and 9602.

EUT Operation during Tests

EUT is placed into a modulated transmit mode which the manufacturer supplied

Accessories: None

Cables: None

Modifications: None

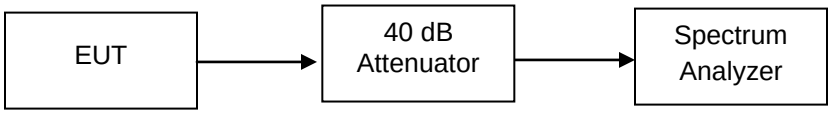
Power Limits

Name of Test:	Power Limits	**Engineer:** Alex Macon
Test Equipment Utilized:	i00331, i00350	**Test Date:** 10/15/13

Test Procedure

The UUT was connected to a Spectrum analyzer through a 40 dB attenuator. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained. The EIRP is a summation of the conducted power and the worst case antenna gain.

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP Output Power (dBm)	Specification Limit
1618.725	36.26	3	39.26	No limit for Earth Stations
1622.354	36.65	3	39.65	No limit for Earth Stations
1625.979	36.03	3	39.03	No limit for Earth Stations

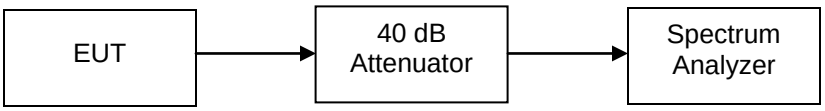
Emissions Limitations for Mobile Earth Stations

Name of Test:	Emissions Limitations for Mobile Earth Stations	**Engineer:**	Alex Macon
Test Equipment Utilized:	i00331, i00350	**Test Date:**	10/16/13

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.

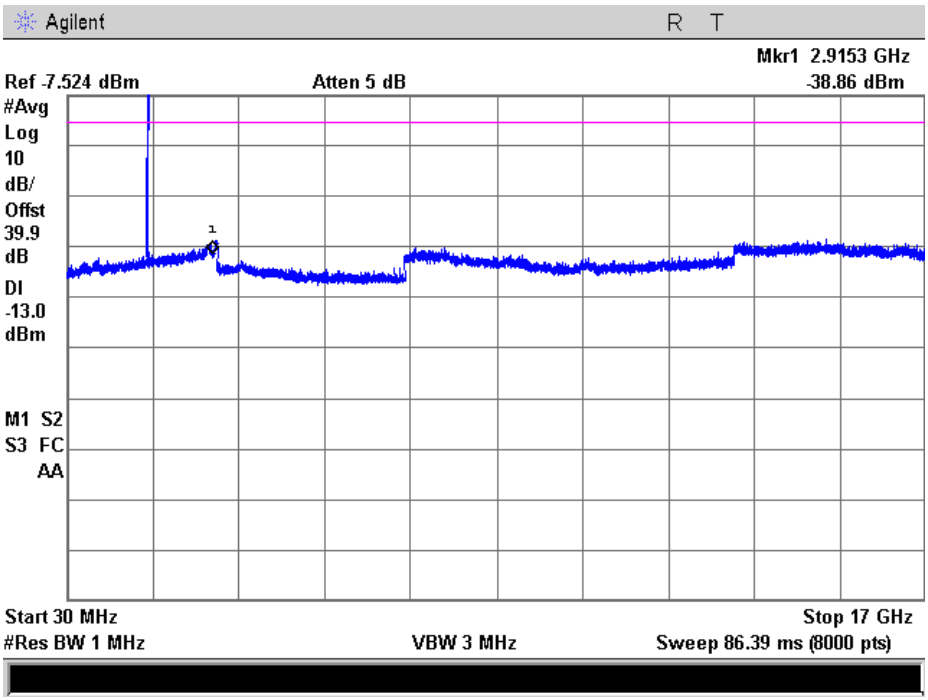
Test Setup



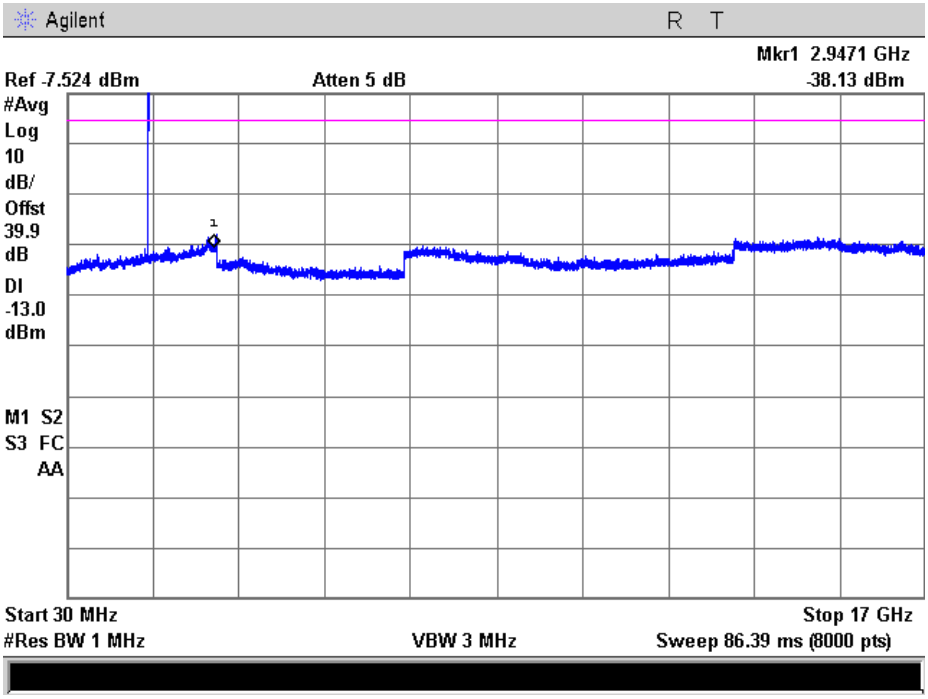
Emissions Limitations Summary Table

Tuned Frequency (MHz)	Result	Comments
1618.72	Pass	See Plots
1622.35	Pass	See Plots
1625.98	Pass	See Plots

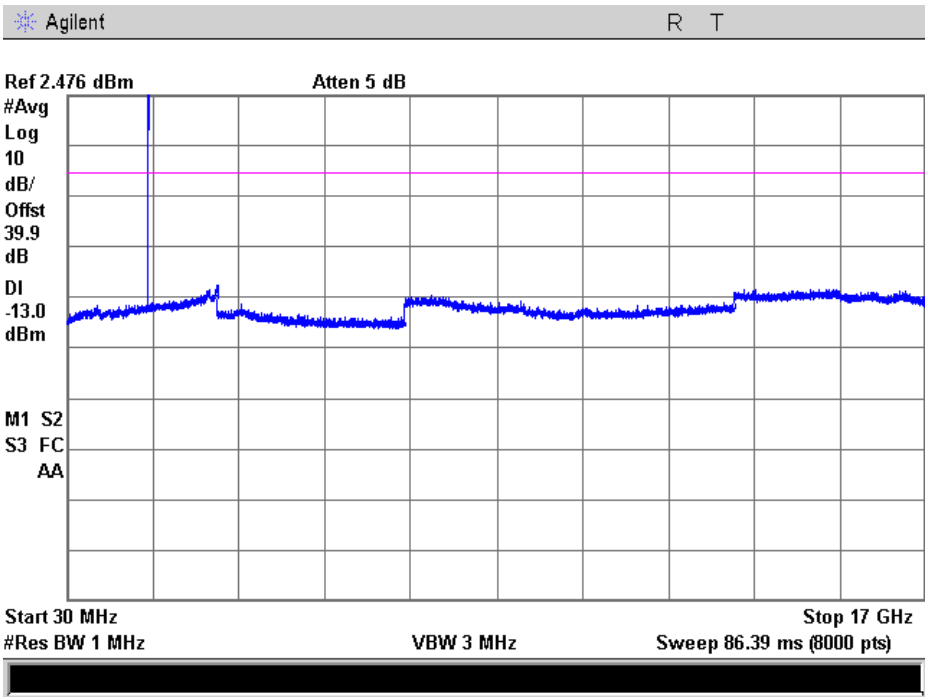
Emissions Limitations Plot 1618.72 MHz



Emissions Limitations Plot 1622.35 MHz



Emissions Limitations Plot 1625.98 MHz



Emission Masks

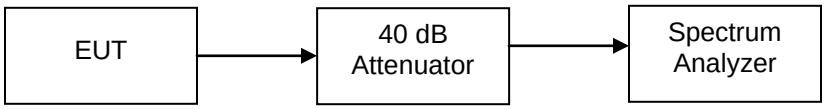
Name of Test:	Emissions Masks	**Engineer:** Alex Macon
Test Equipment Utilized:	i00331, i00350	**Test Date:** 10/15/13

Test Procedure

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

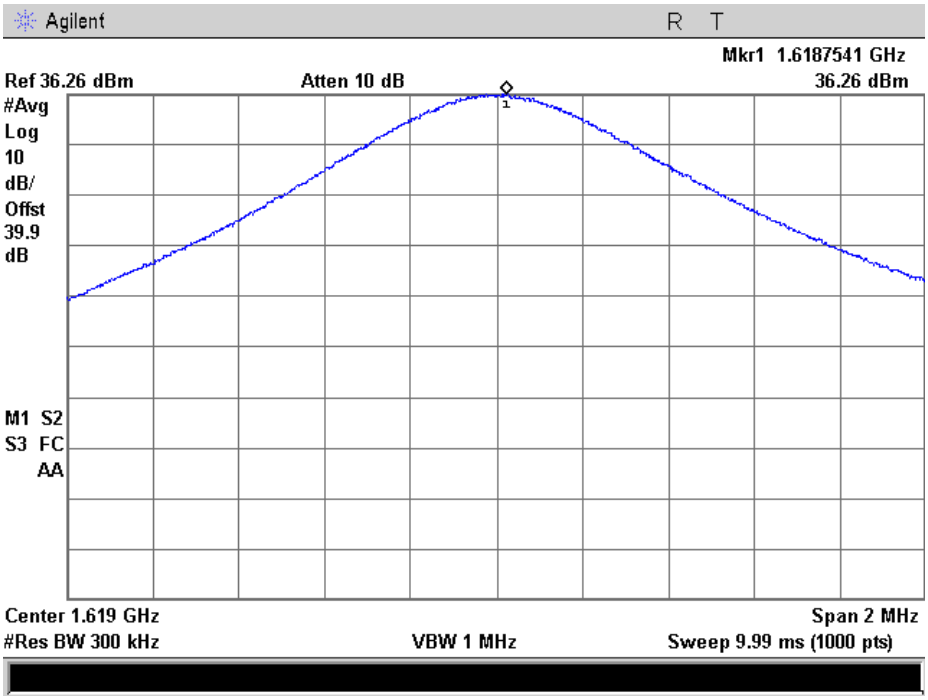
Section 25.202(f)

Test Setup

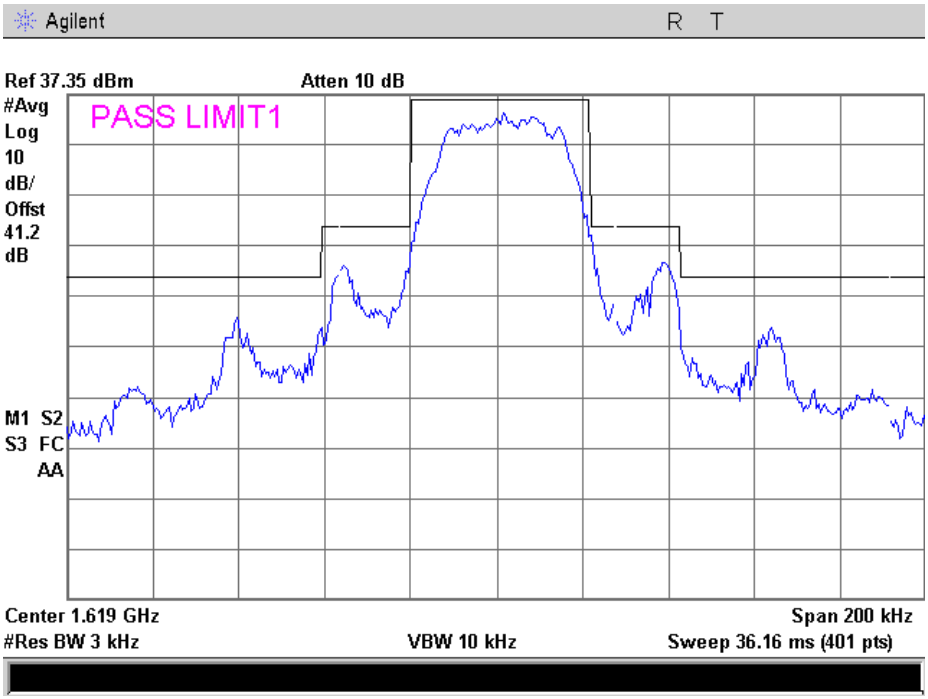


Emission Mask Plots

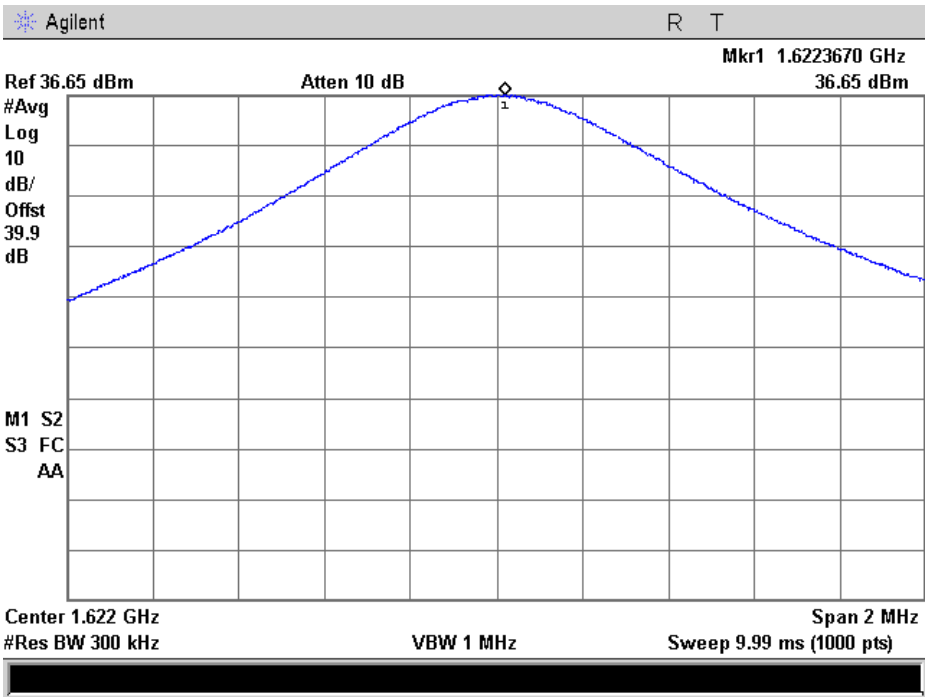
1618.72 MHz Reference



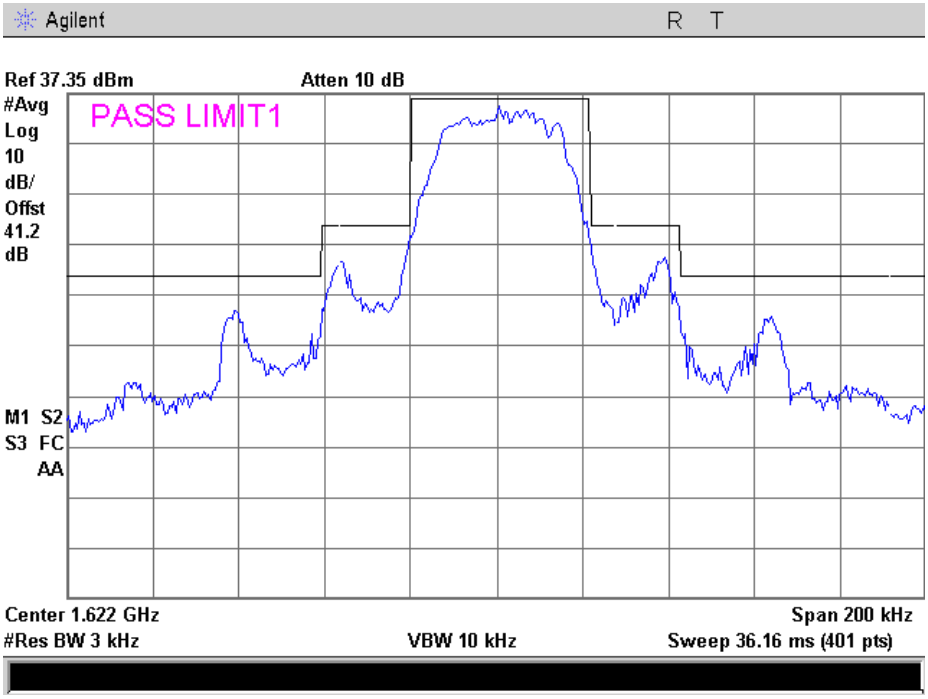
1618.72 MHz Mask



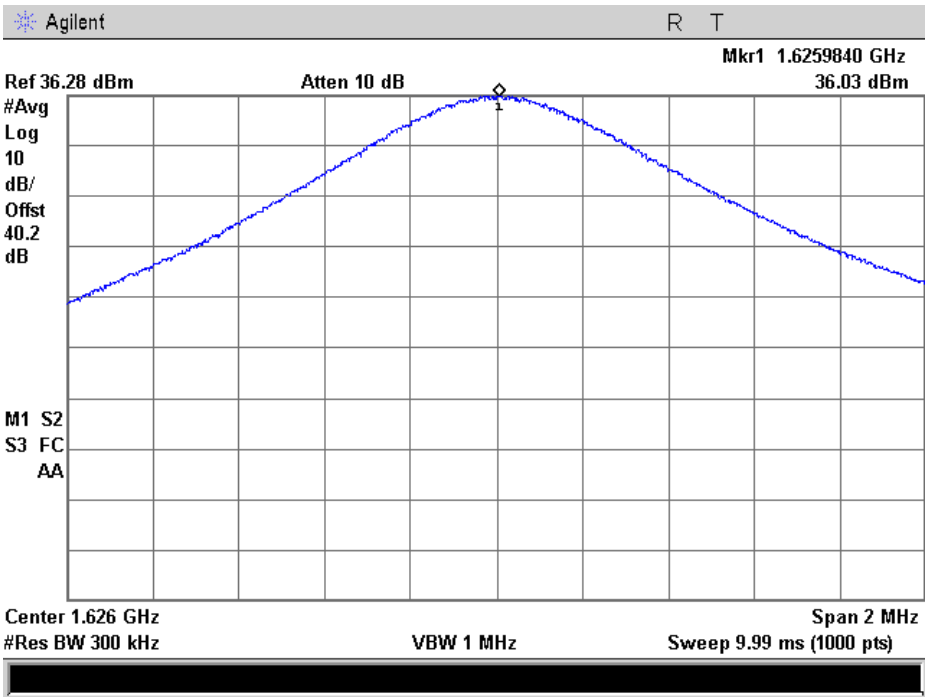
1622.35 MHz Reference



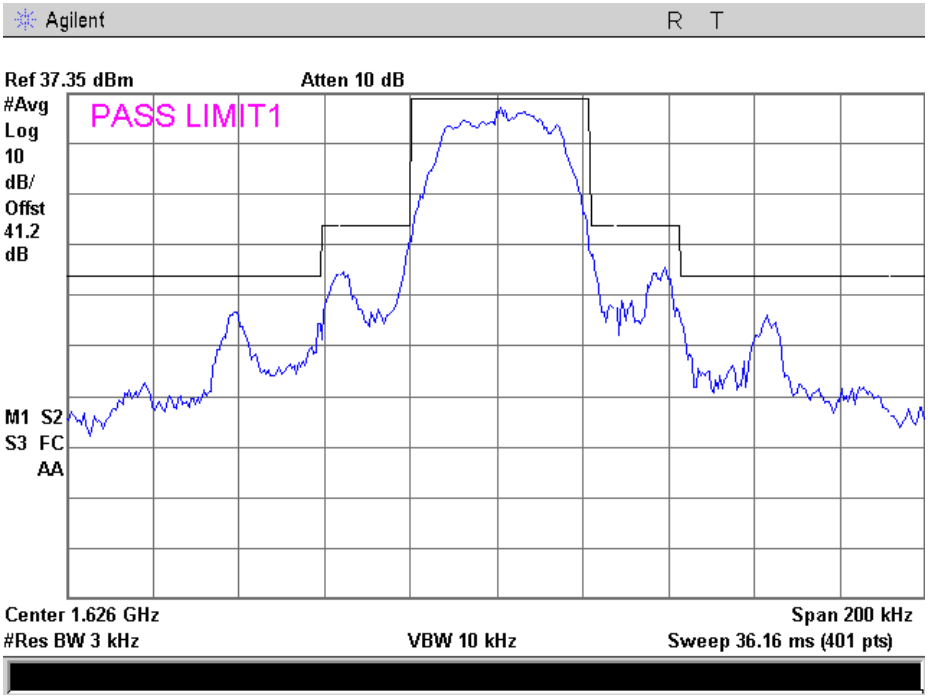
1622.35 Mask



1625.98 MHz Reference



1625.98 MHz Mask



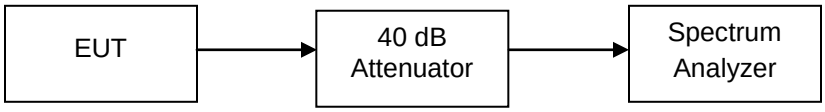
Emissions Limits for Mobile Earth Stations

Name of Test:	Emissions Limits for Mobile Earth Stations	**Engineer:** Alex Macon
Test Equipment Utilized:	i00331, i00350	**Test Date:** 10/16/13

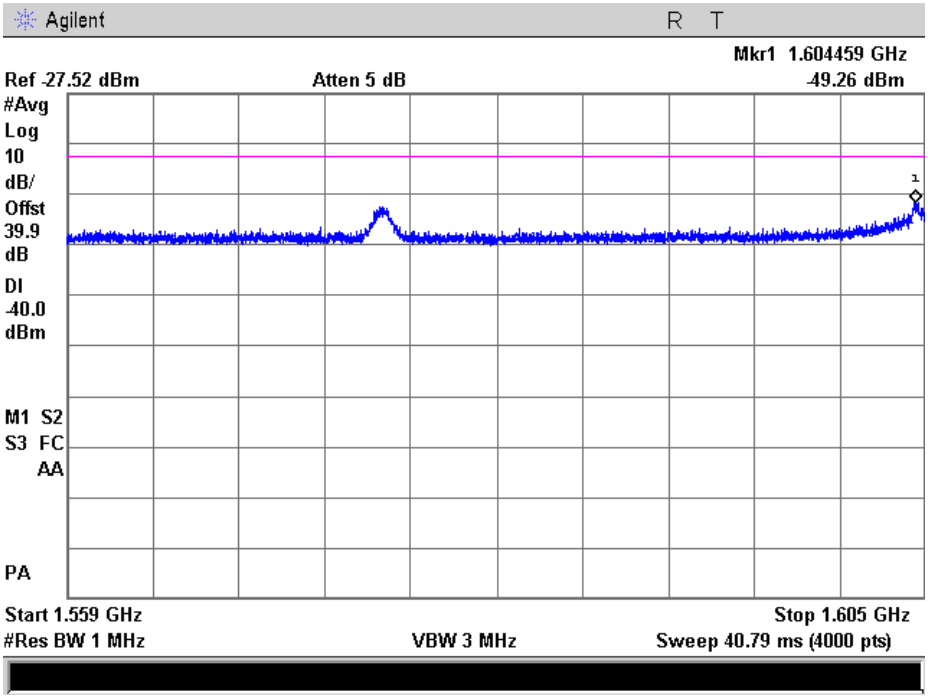
Test Procedure

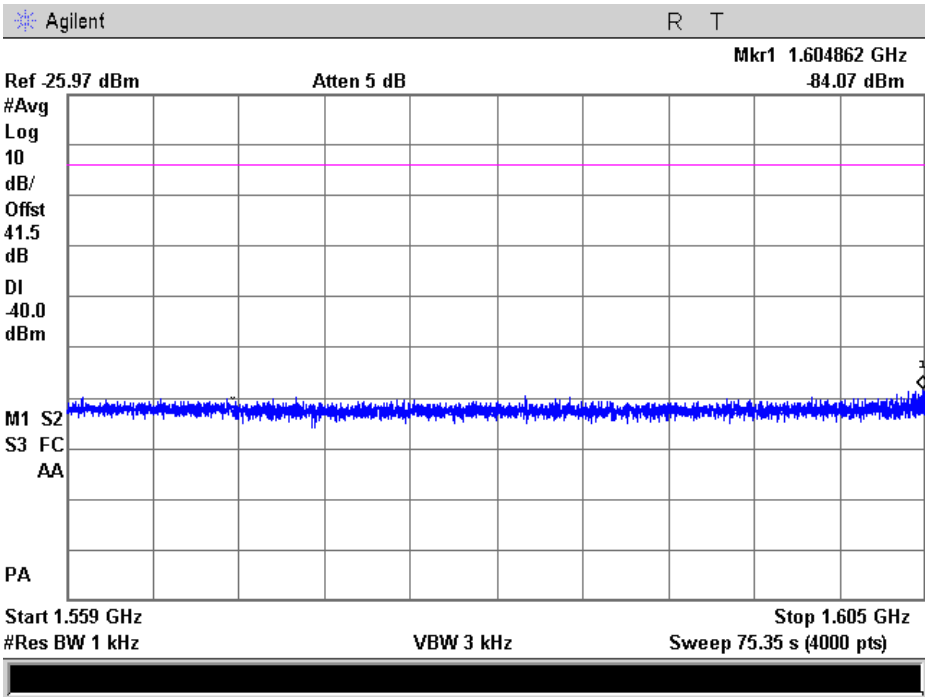
The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for emission limits. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained.

Test Setup

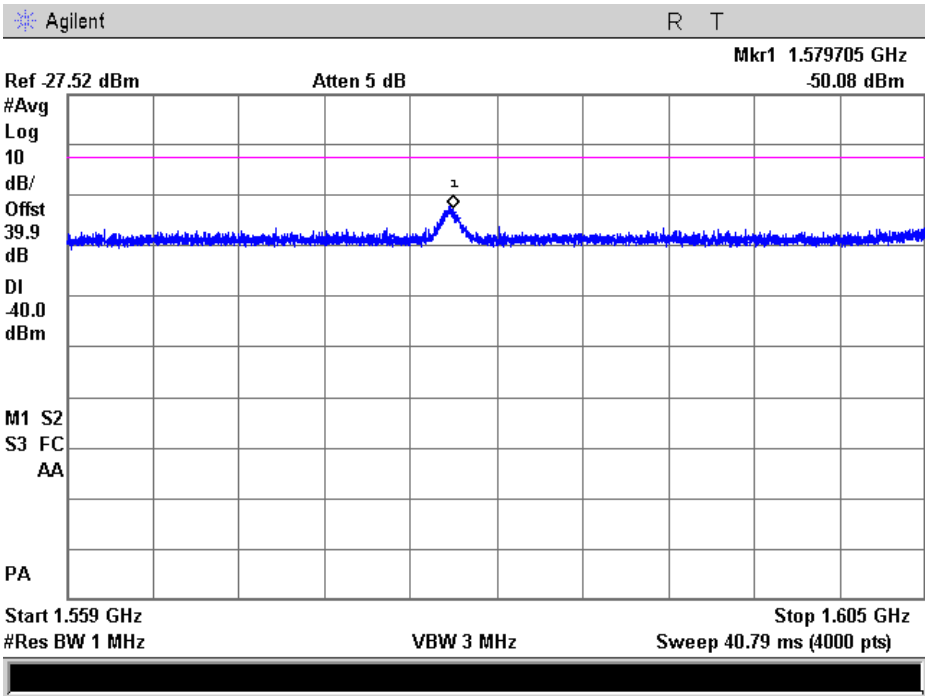


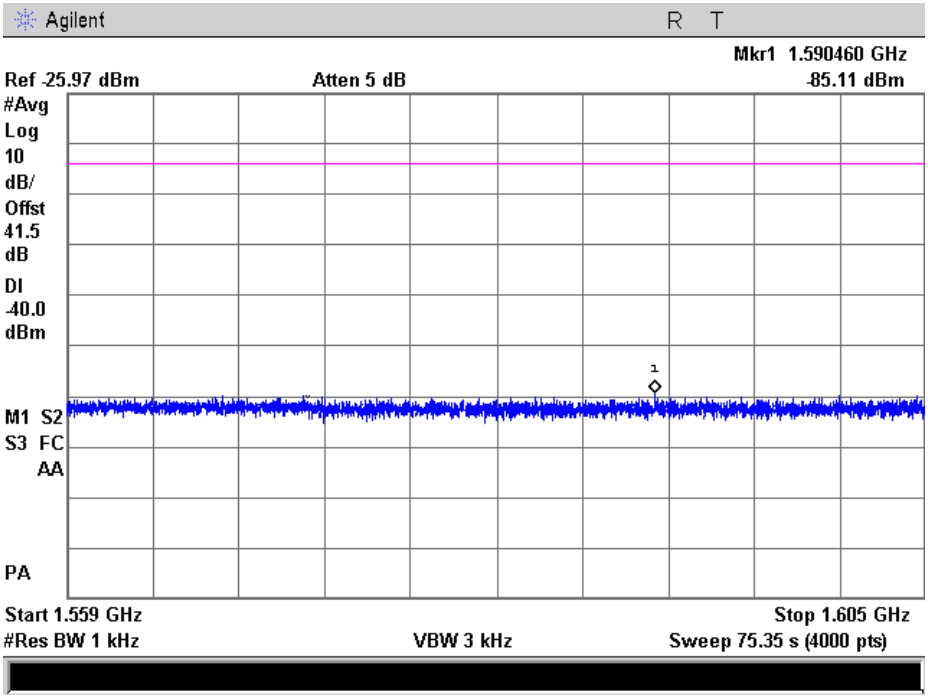
25.216(c) 1618.72 MHz



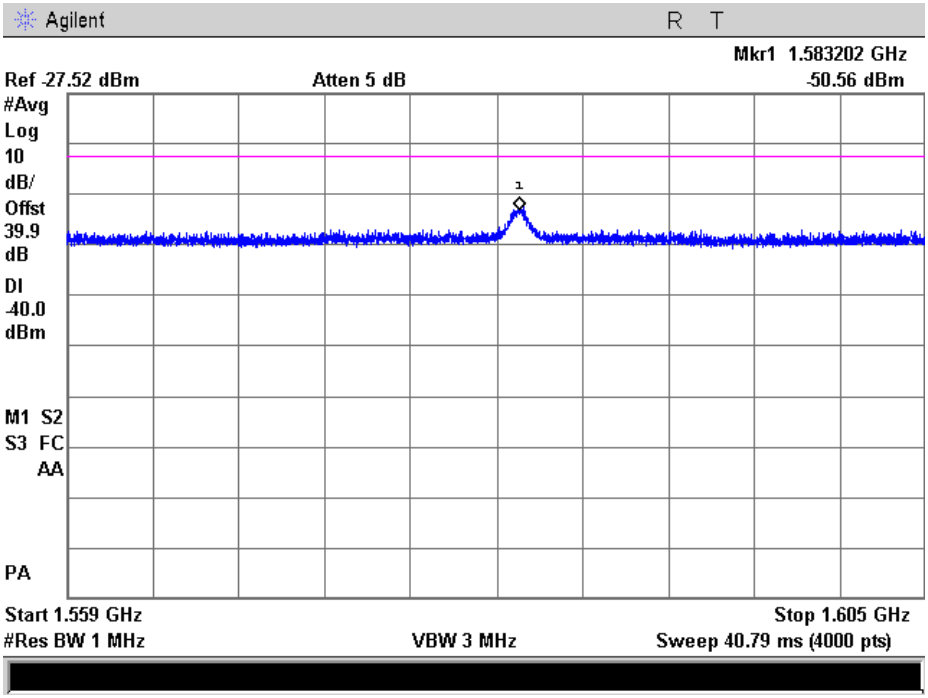


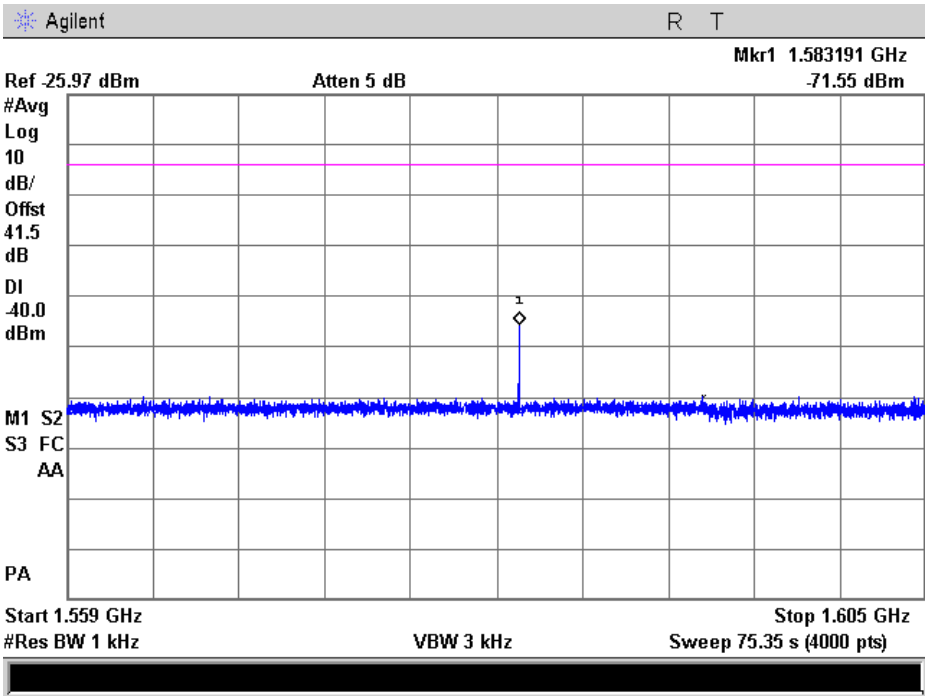
25.216(c) 1622.35 MHz



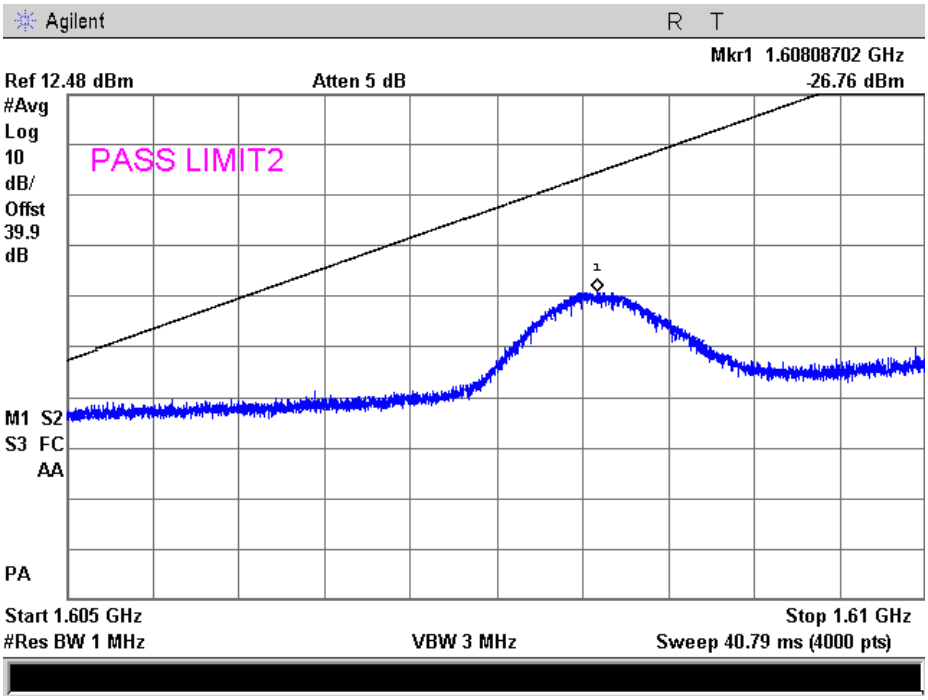


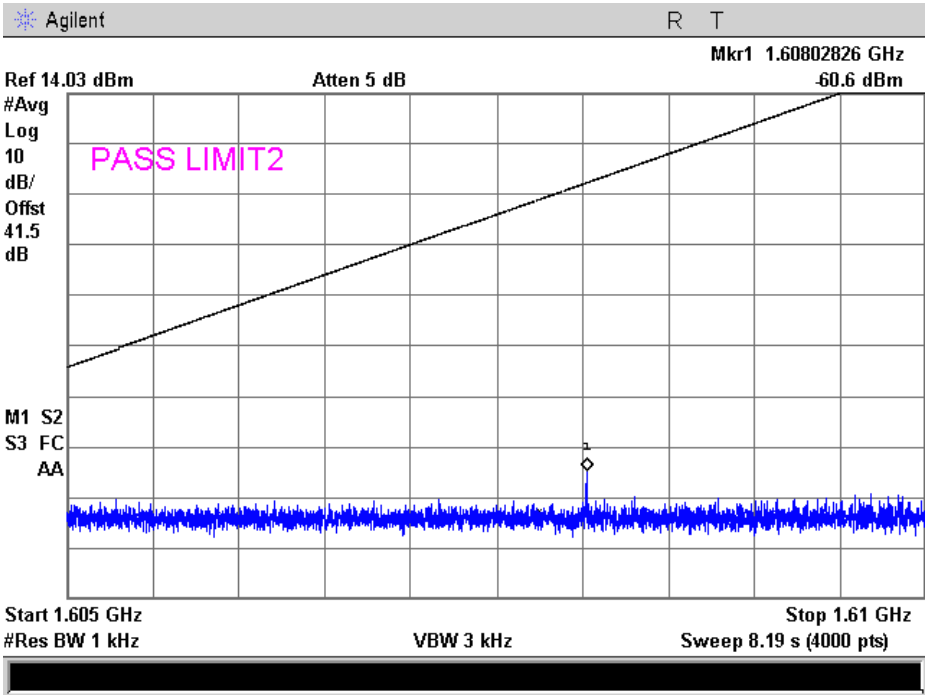
25.216(c) 1625.98 MHz



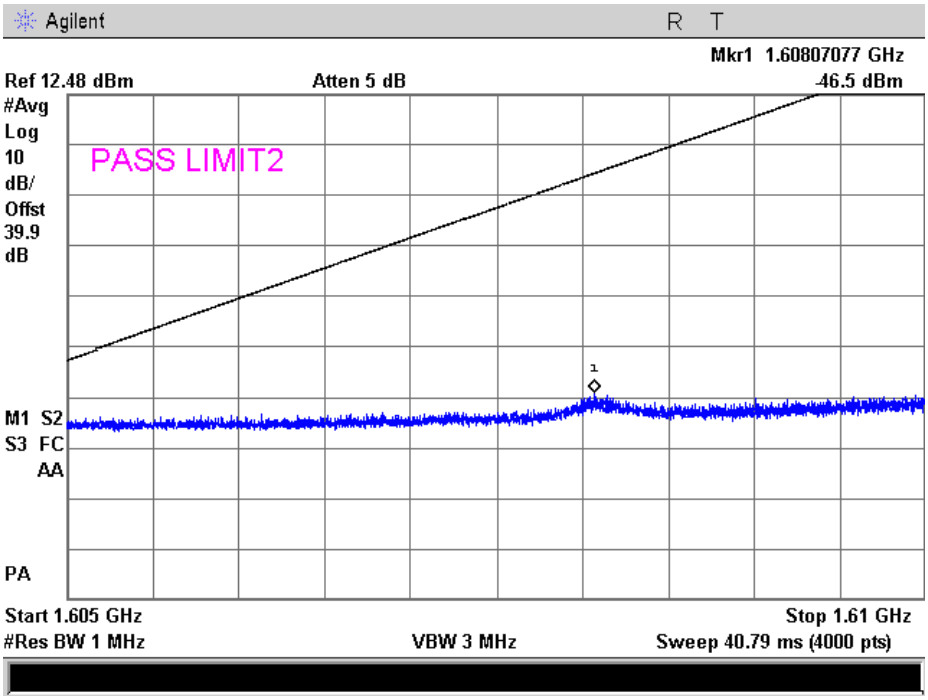


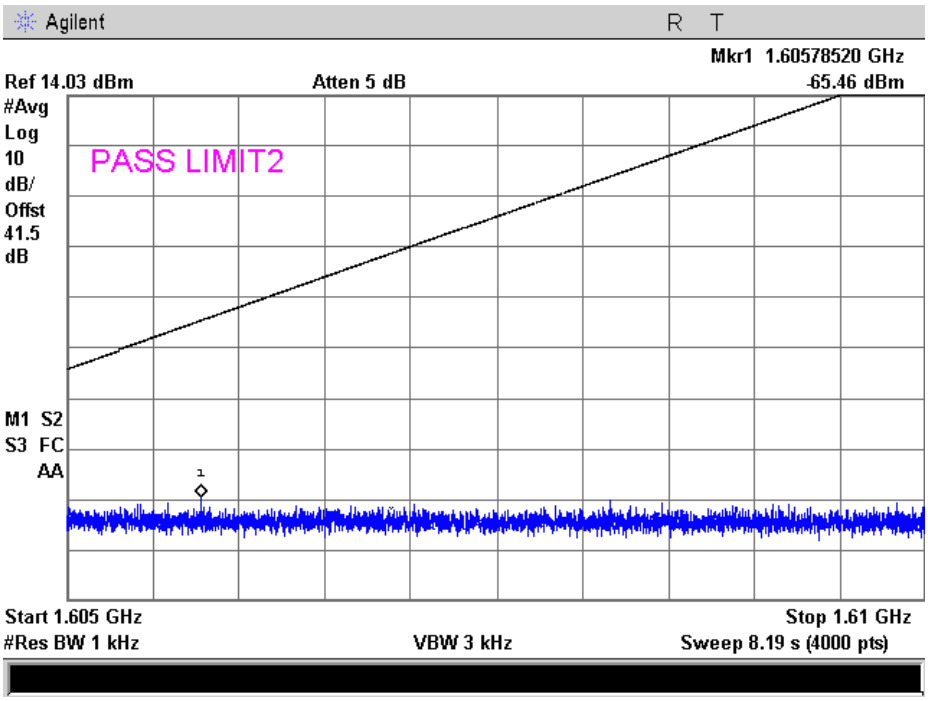
25.216(g) 1618.72 MHz



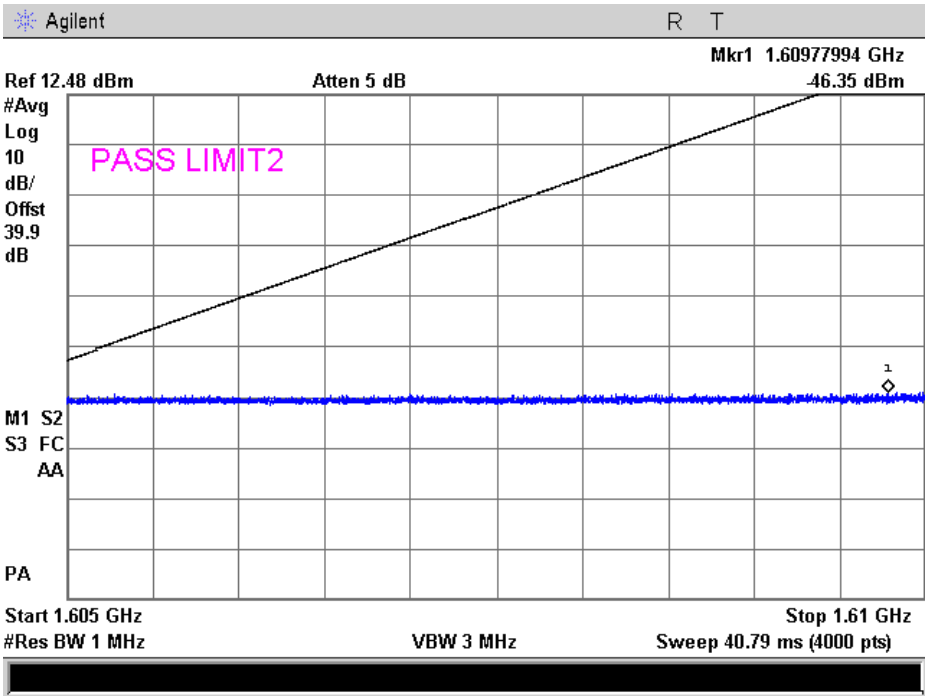


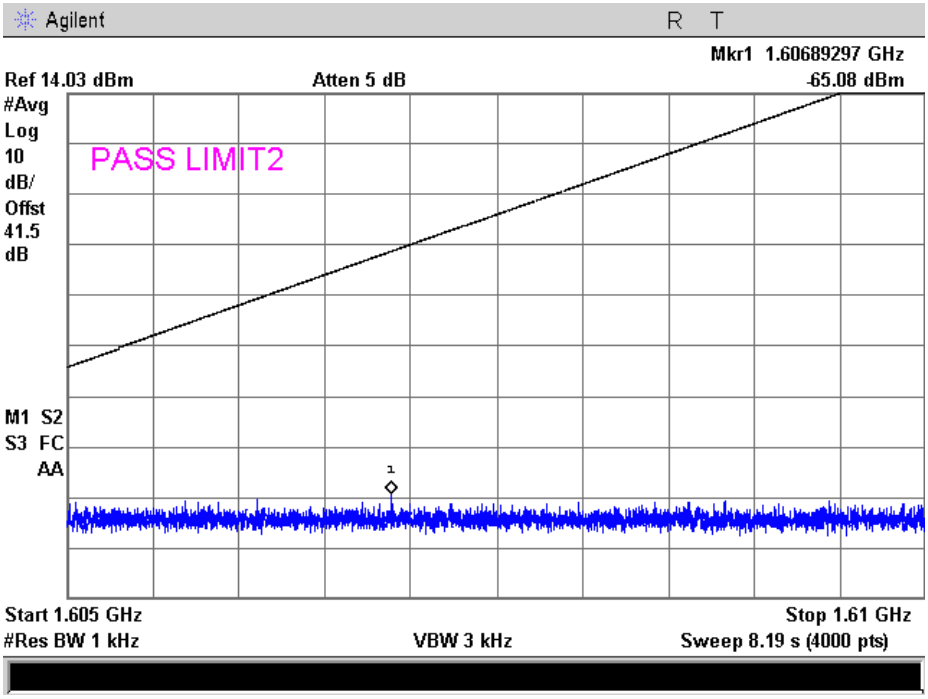
25.216(g) 1622.35 MHz



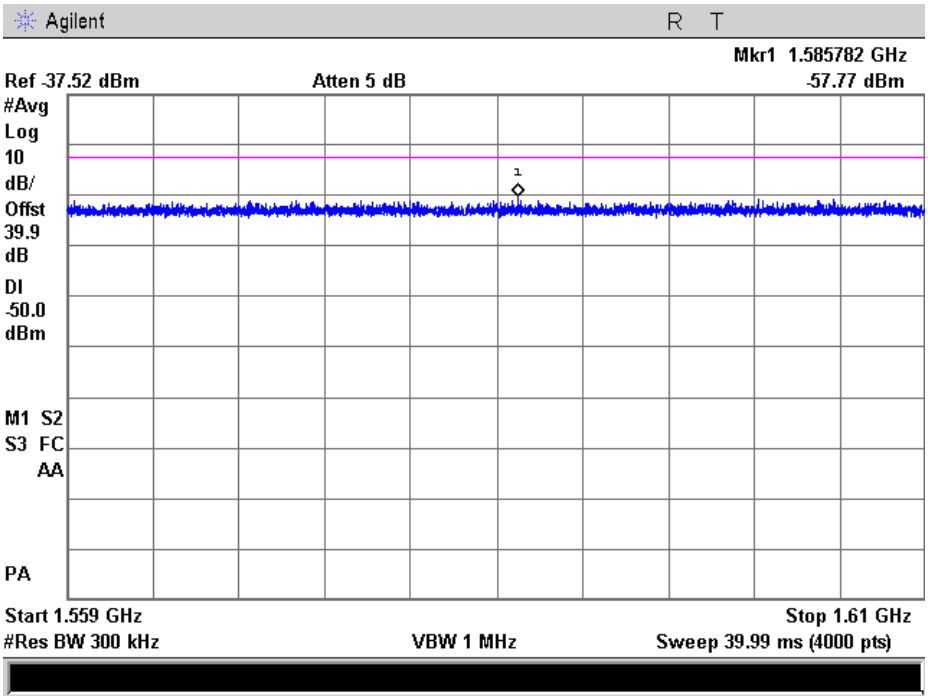


25.216(g) 1625.98 MHz





25.216(i)


Agilent
R T
Mkr1 1.585782 GHz
Ref -37.52 dBm
Atten 5 dB
-57.77 dBm
#Avg
Log
10
dB/
Offst
39.9
dB
Dl
-50.0
dBm
M1 S2
S3 FC
AA
PA
Start 1.559 GHz
Stop 1.61 GHz
#Res BW 300 kHz
VBW 1 MHz
Sweep 39.99 ms (4000 pts)

Frequency Tolerance

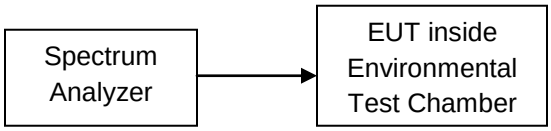
Name of Test: Frequency Tolerance (Temperature Variation) **Test Engineer:** Alex Macon

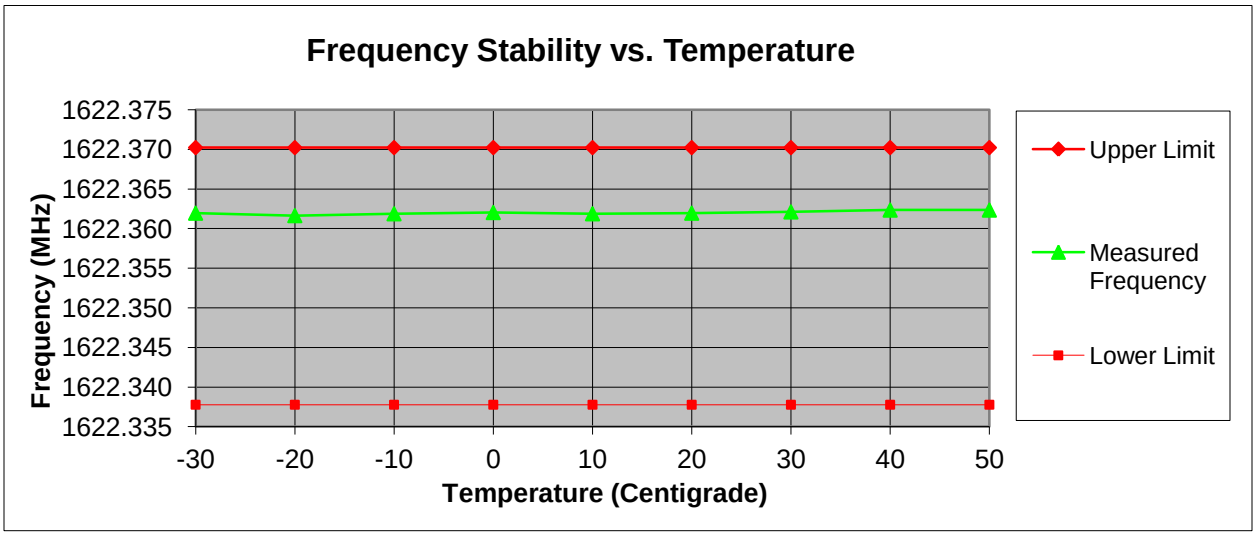
Limit: 0.001%

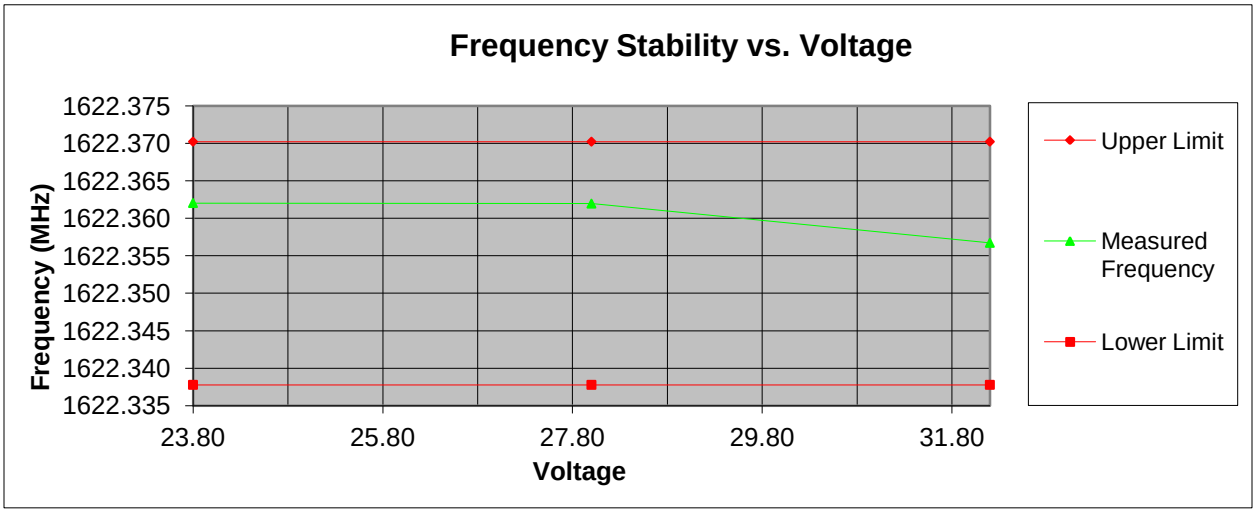
Test Equipment Utilized i00027, i00331, i00350 **Test Date:** 10/16/13

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. Section 25.202(d)







Field Strength of Spurious Radiation

Name of Test:	Field Strength of Spurious Radiation	**Engineer:** Alex Macon
Test Equipment Utilized:	i00271, i00331, i00350	**Test Date:** 10/15/13

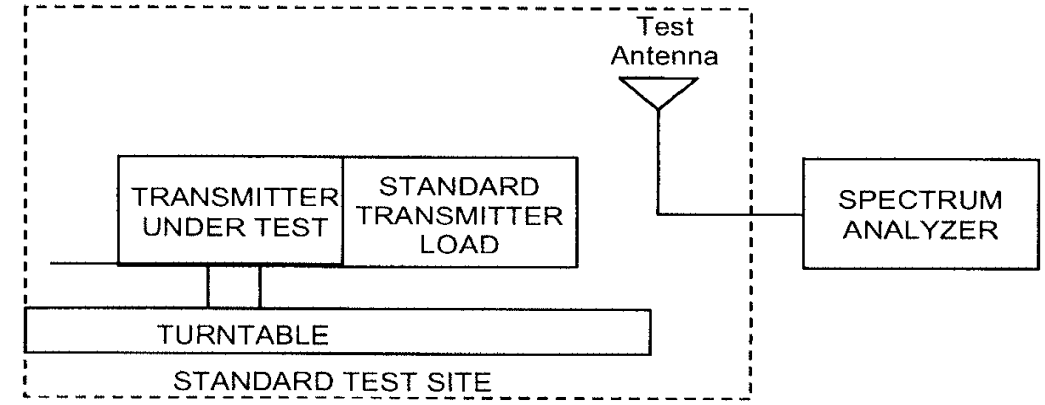
Test Procedure

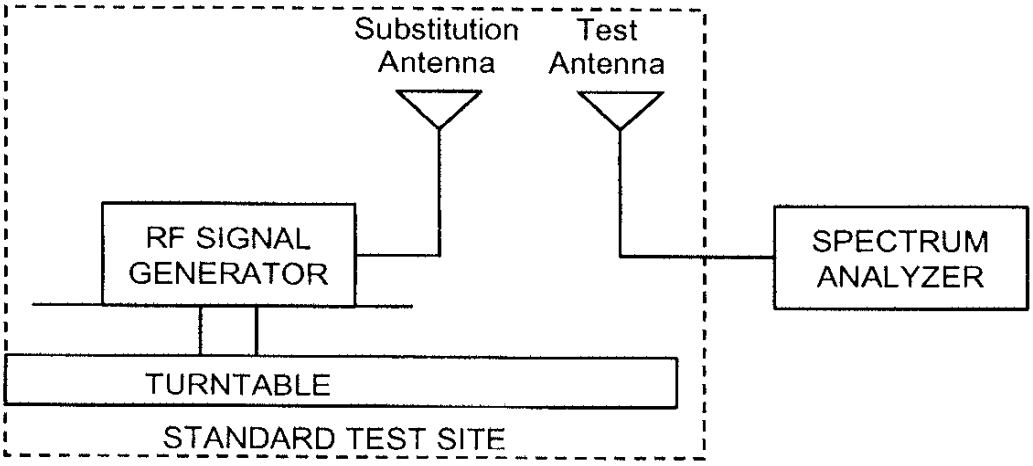
A) Connect the equipment as illustrated
B) Adjust the spectrum analyzer for the following settings:
   1) Resolution Bandwidth 100 kHz (< 1 GHZ), 1 MHZ (> 1GHz)
   2) Video Bandwidth ≥ 3 times Resolution Bandwidth, or 30 kHz
   3) Sweep Speed ≤2000 Hz/second
   4) Detector Mode = Mean or Average Power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

Part 2 Test Results

1618.725 MHz

Emission Frequency (GHz)	Measured Level (dBm)	Limit (dBm)	Result
3.237	-31.17	-25	Pass
4.856	-32.07	-25	Pass
6.475	-32.10	-25	Pass
8.093	-49.47	-25	Pass

1625.98 MHz

Emission Frequency (GHz)	Measured Level (dBm)	Limit (dBm)	Result
3.252	-36.7	-25	Pass
4.877	-45.38	-25	Pass
6.503	-52.64	-25	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	HP	6654A	i00350	Verified on: 10/15/13	
Temperature Chamber	Tenney	Tenney Jr	i00027	Verified on: 10/16/13	
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