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Test Report

Prepared for: sci_Zone, Inc.

Model: LinkStar-STX3-ME

Description: Radio for Low Earth Orbit Communication

Serial Number: 0-2357850

FCC ID: 2ANKS-LINKSTAR-STX3

To

FCC Part 25

Date of Issue: October 18, 2017

On the behalf of the applicant:

sci_Zone, Inc.
5108 Alberta Avenue
Rio Rancho, New Mexico 87144

Attention of:

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Project No: p1780007

Poona Saber
Project Test Engineer

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Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	8/21/2017	Poona Saber	Original Document
2.0	10/13/2017	Poona Saber	Revised the power table and removed the bandwidth correction factor statement from page 7, Revised the Frequency Stability data format
3.0	10/17/2017	Poona Saber	Updated frequency stability versus Voltage Updated test procedure for average power measurement

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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**



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 C63.4-2014, 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: LinkStar-STX3-ME

Description: LinkStar is a radio designed for use in space that interfaces with the GlobalStar Satellite network

Firmware: NA

Software: QuickSAT/VMS 4.0

Serial Number: 0-2357850

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. Emission type of the Unit is G1D

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

Engineer: Poona Saber

Test Date: 8/21/2017

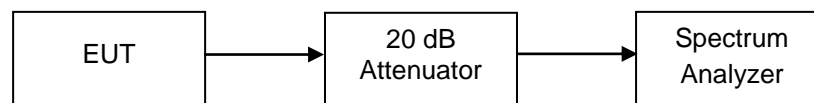
Test Procedure

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. The EIRP is a summation of the conducted power and the antenna gain.

The following setting on spectrum analyzer is used for measuring average power of the fundamental:

- 1- Set span to at least 1.5 times the OBW
- 2- Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- 3- Set VBW $\geq 3 \times$ RBW
- 4- Set number of points in sweep $\geq 2 \times$ span / RBW
- 5- Sweep time = auto-couple
- 6- Detector = RMS (power averaging)
- 8- Trace average at least 100 traces in power averaging (i.e., RMS) mode
- 9- Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with the band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Test Setup



Transmitter Average Output Power

Tuned Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP Output Power (dBm)	Specification Limit
1611.25	18.62	4.25	22.87	No limit for Mobile Earth Stations
1613.75	19.16	4.25	23.41	No limit for Mobile Earth Stations
1616.25	19.43	4.25	23.68	No limit for Mobile Earth Stations
1618.75	19.90	4.25	24.15	No limit for Mobile Earth Stations

Emissions Limitations for Mobile Earth Stations

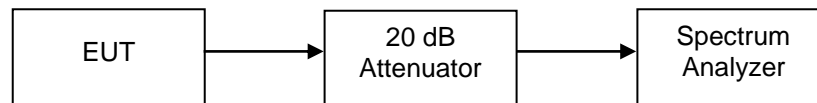
Engineer: Poona Saber

Test Date: 8/18/2017

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.

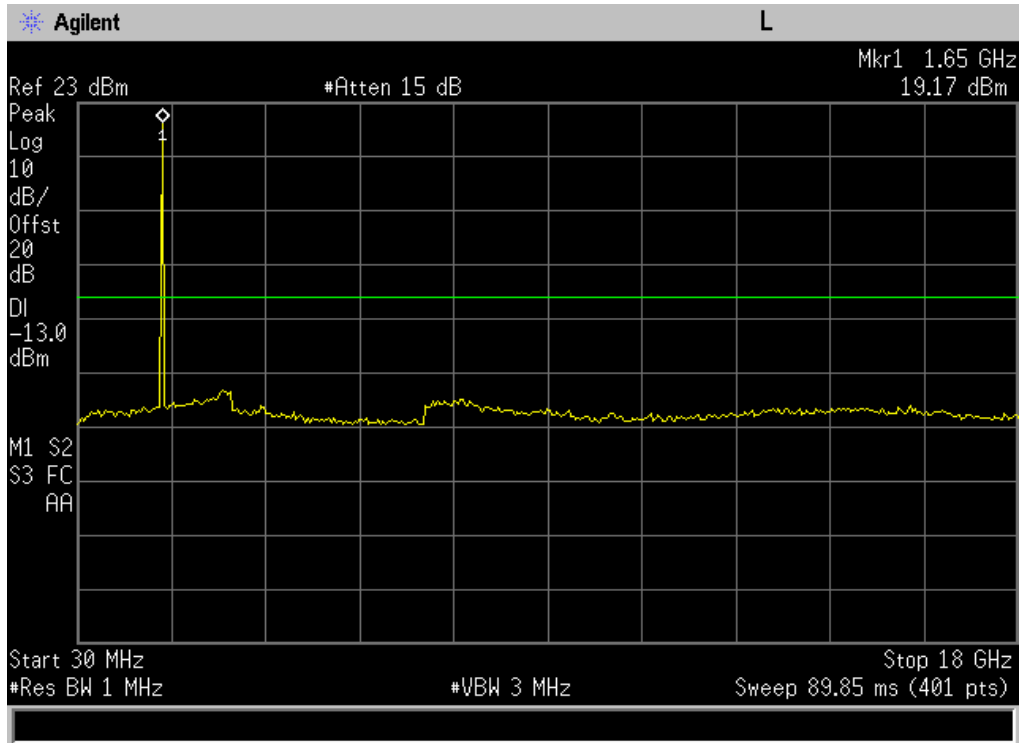
Test Setup



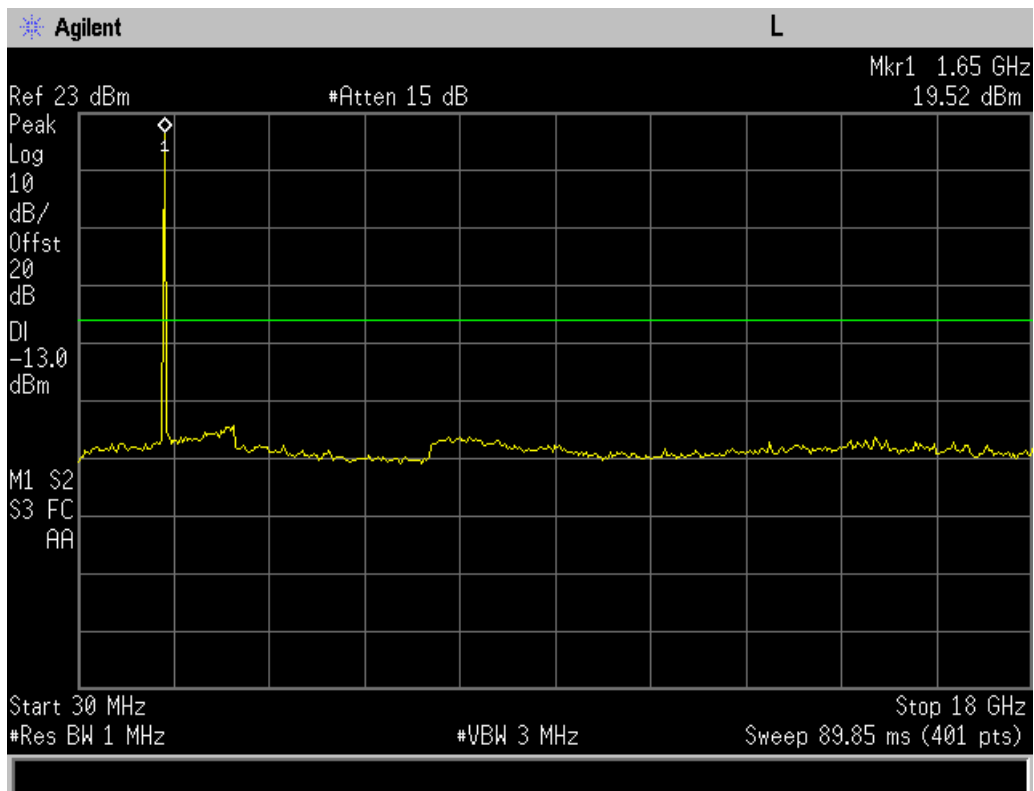
Emissions Limitations Summary Table

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

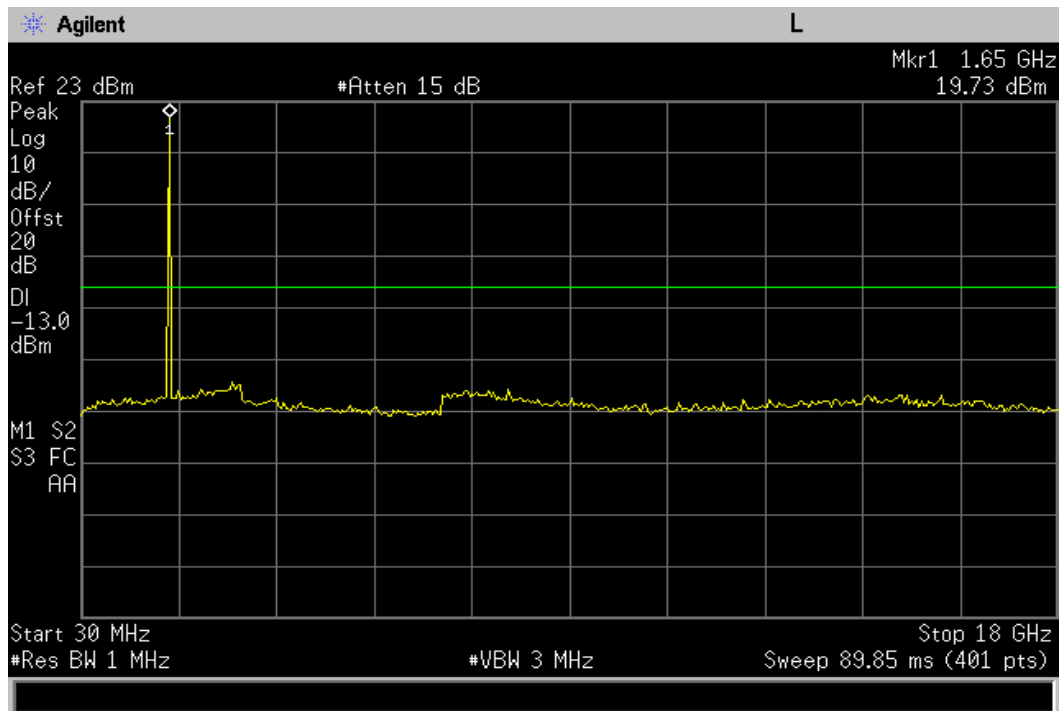
Emissions Limitations Plot 1611.25 MHz



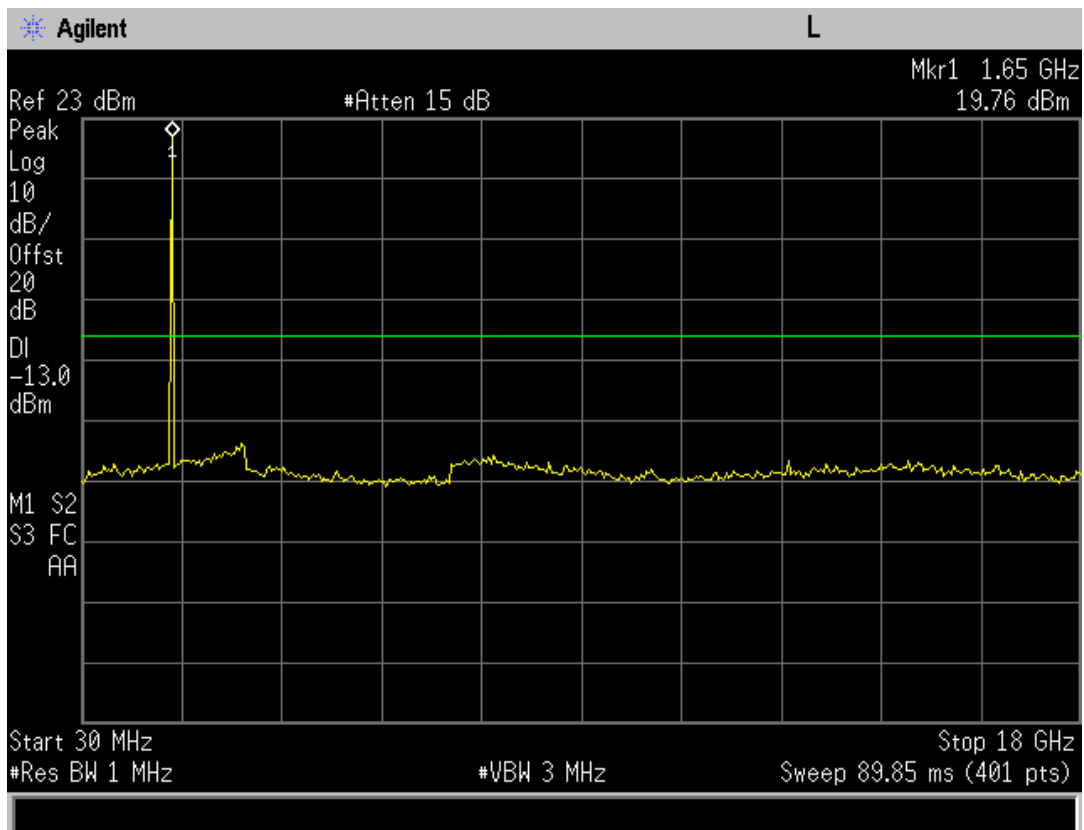
Emissions Limitations Plot 1613.75 MHz



Emissions Limitations Plot 1616.25 MHz



Emissions Limitations Plot 1618.75 MHz



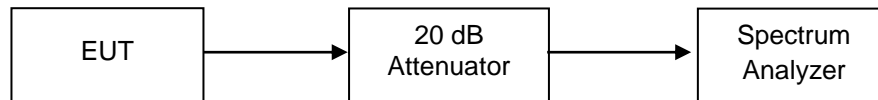
Occupied Bandwidth

Engineer: Poona Saber

Test Date: 8/18/2017

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.

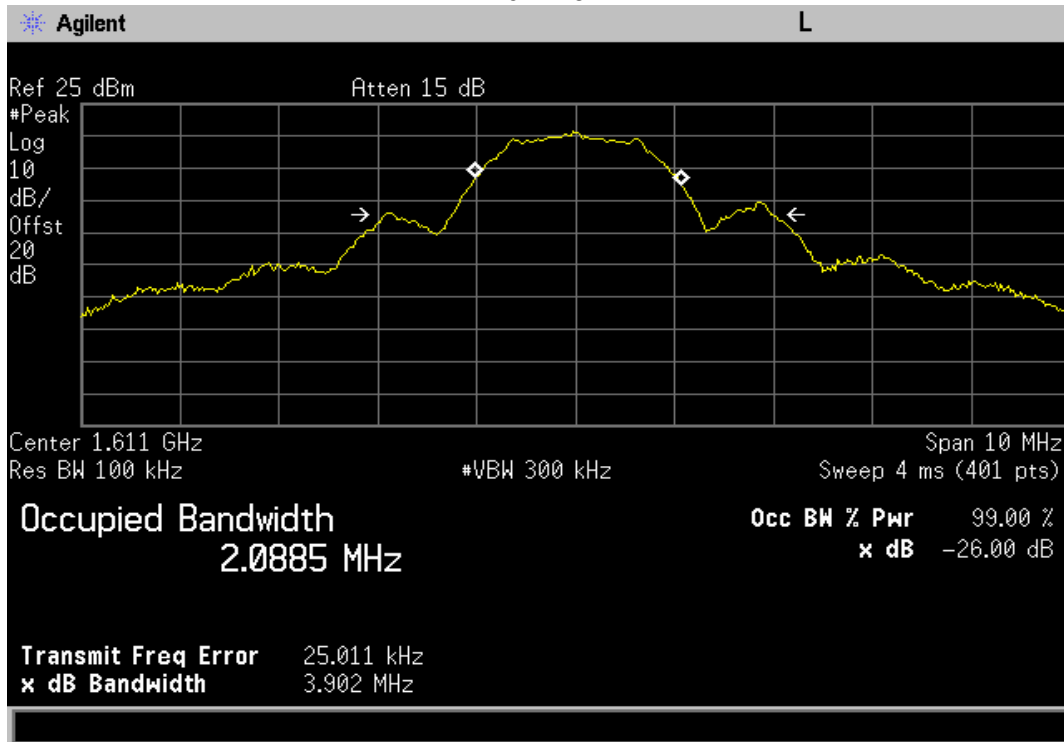


Note: There is no requirement for occupied bandwidth in Part 25 for Mobile Earth Stations. However, the emissions masks are based upon the occupied bandwidth. This information is reported for reference only.

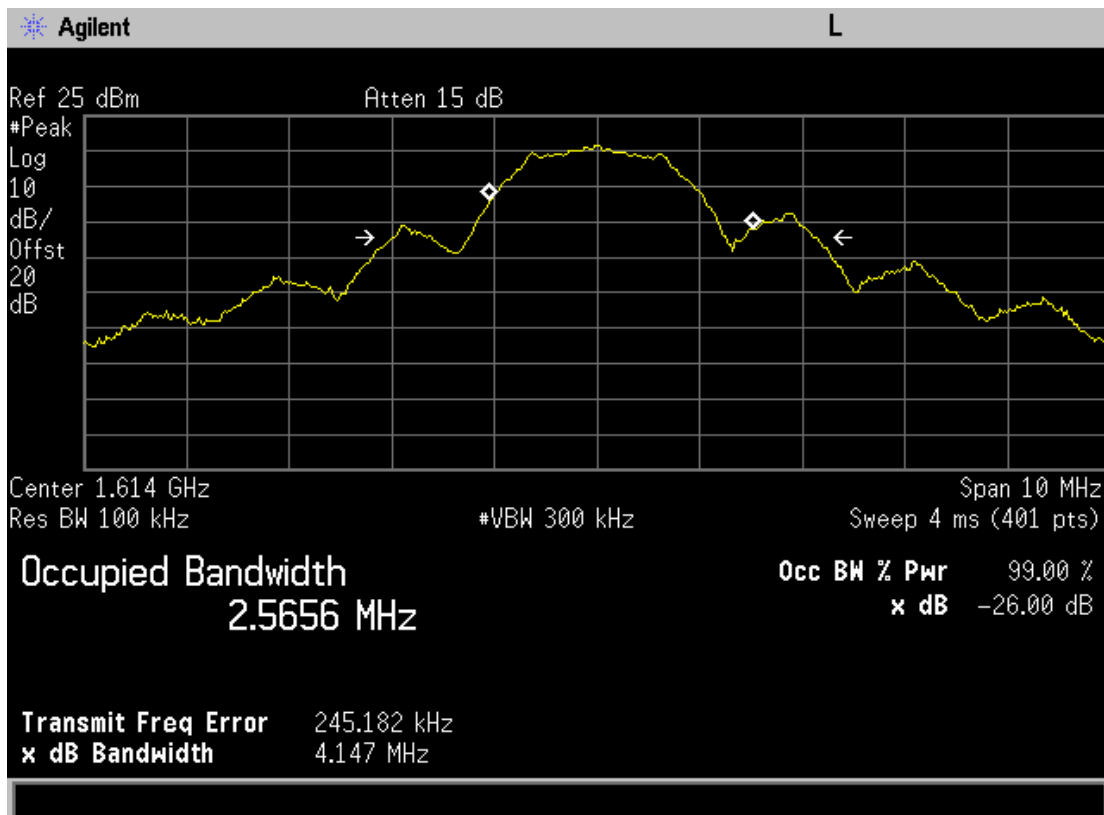
Test Results

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

1611.25

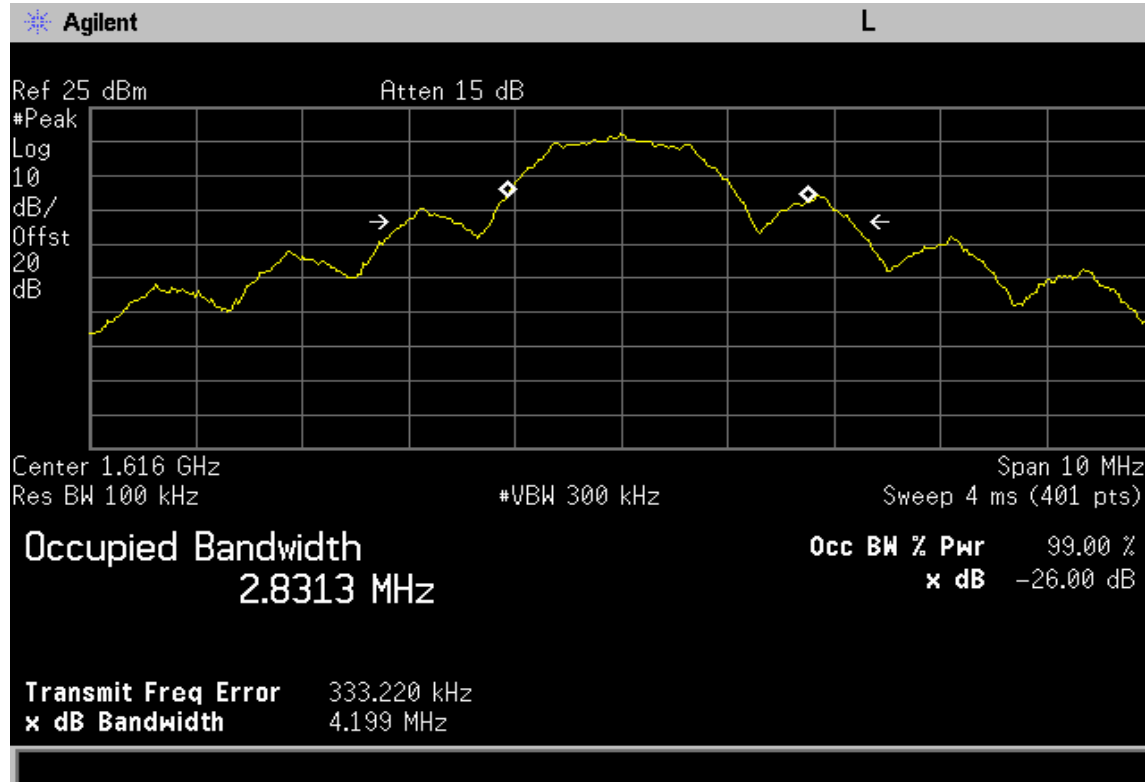


1613.75

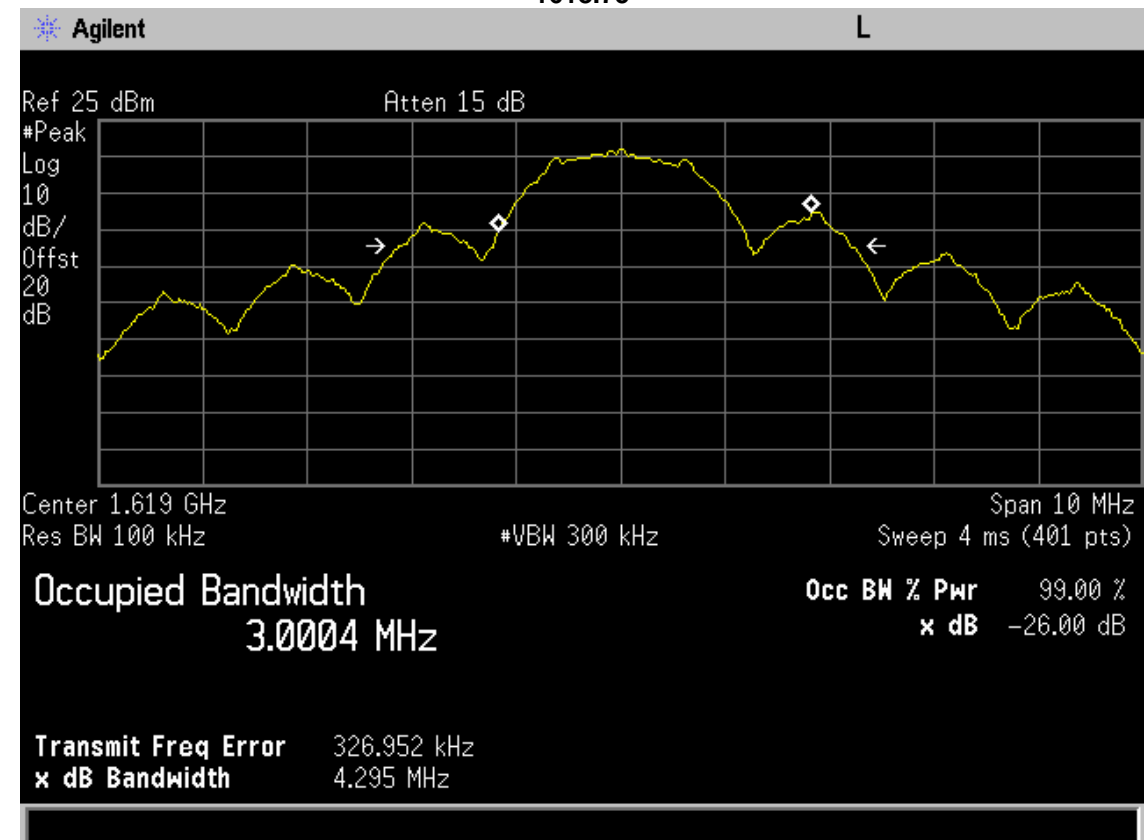




1616.25



1618.75



Emission Masks

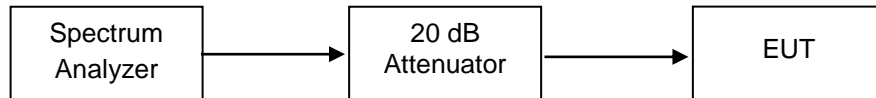
Engineer: Poona Saber

Test Date: 8/18/2017

Test Procedure

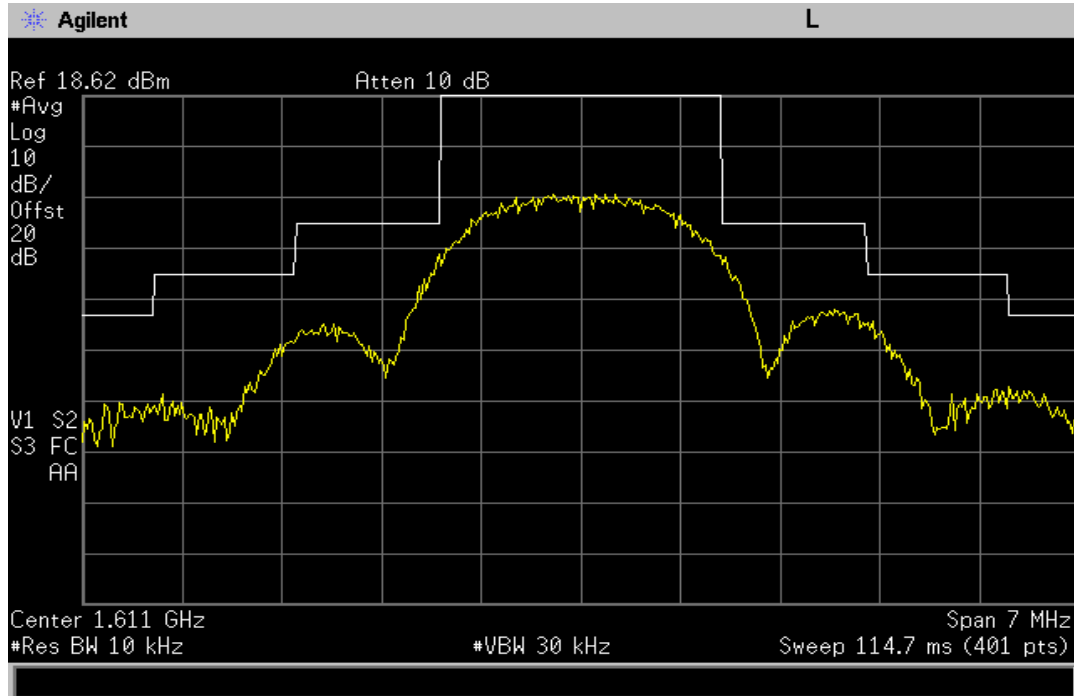
The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for emission mask. Attenuator and cable losses were input into the analyzer as a reference level offset to ensure accurate measurements were obtained.

Test Setup

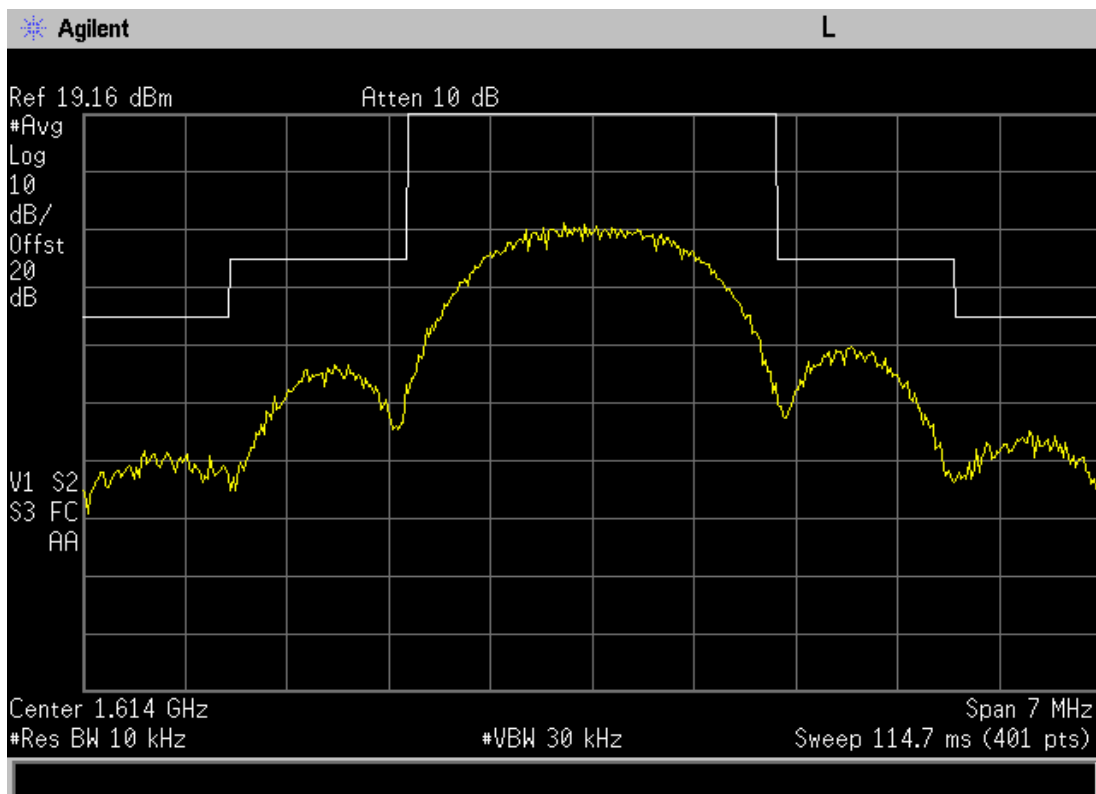


Emission Mask Plots

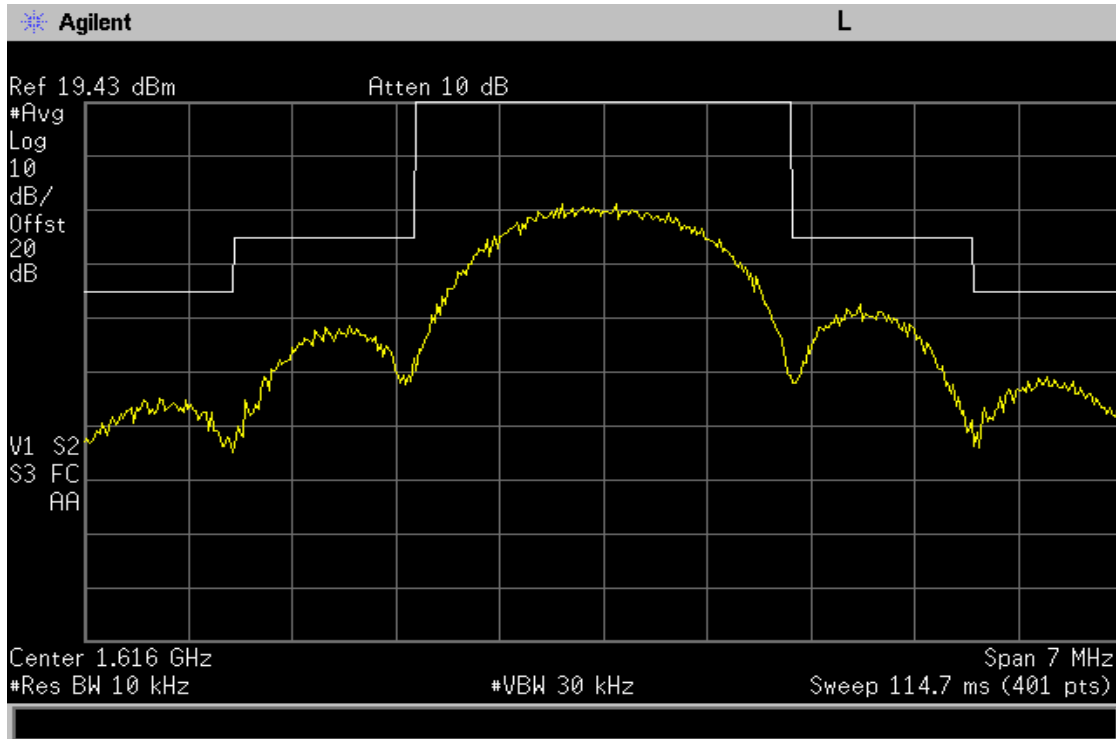
1611.25 MHz Mask



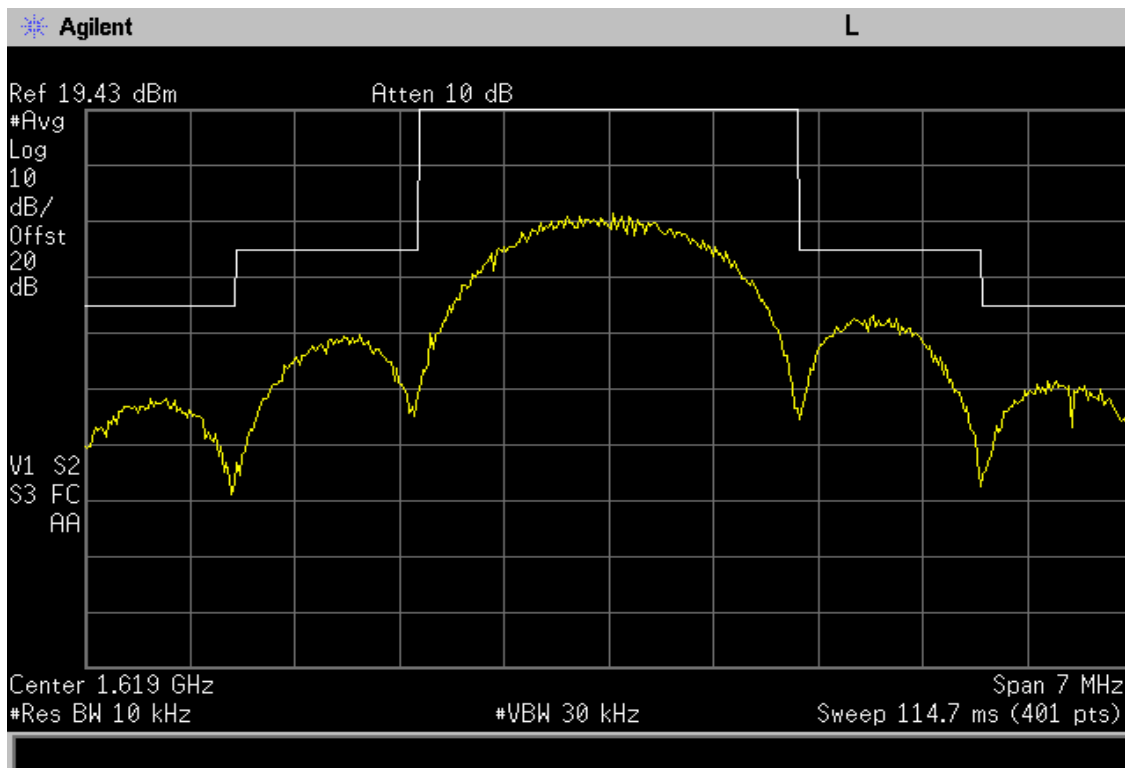
1613.75 MHz Mask



1616.25 MHz Mask



1618.75 MHz Mask



Emissions Limits for Mobile Earth Stations

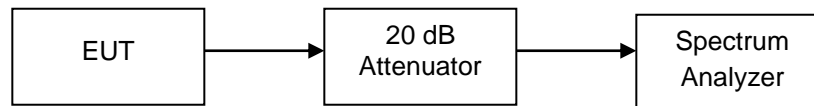
Engineer: Poona Saber

Test Date: 8/18/2017

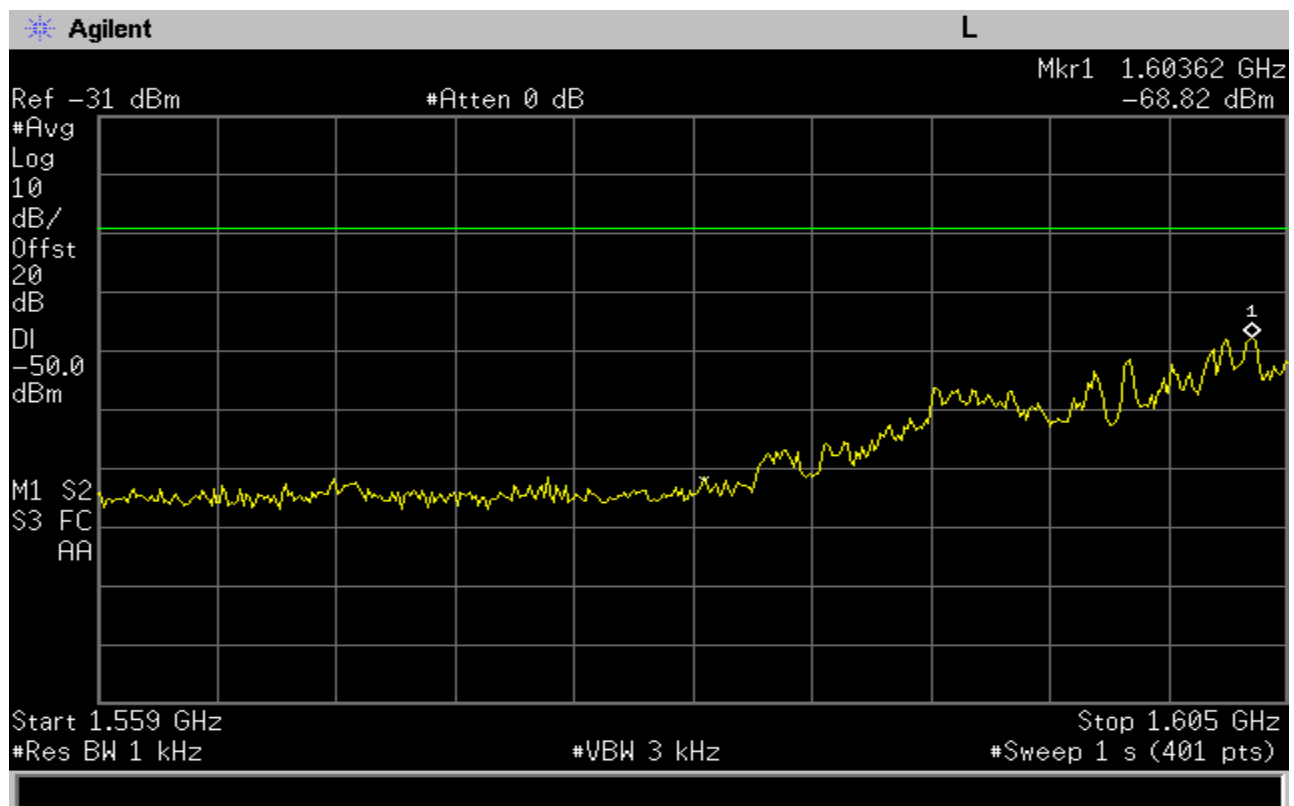
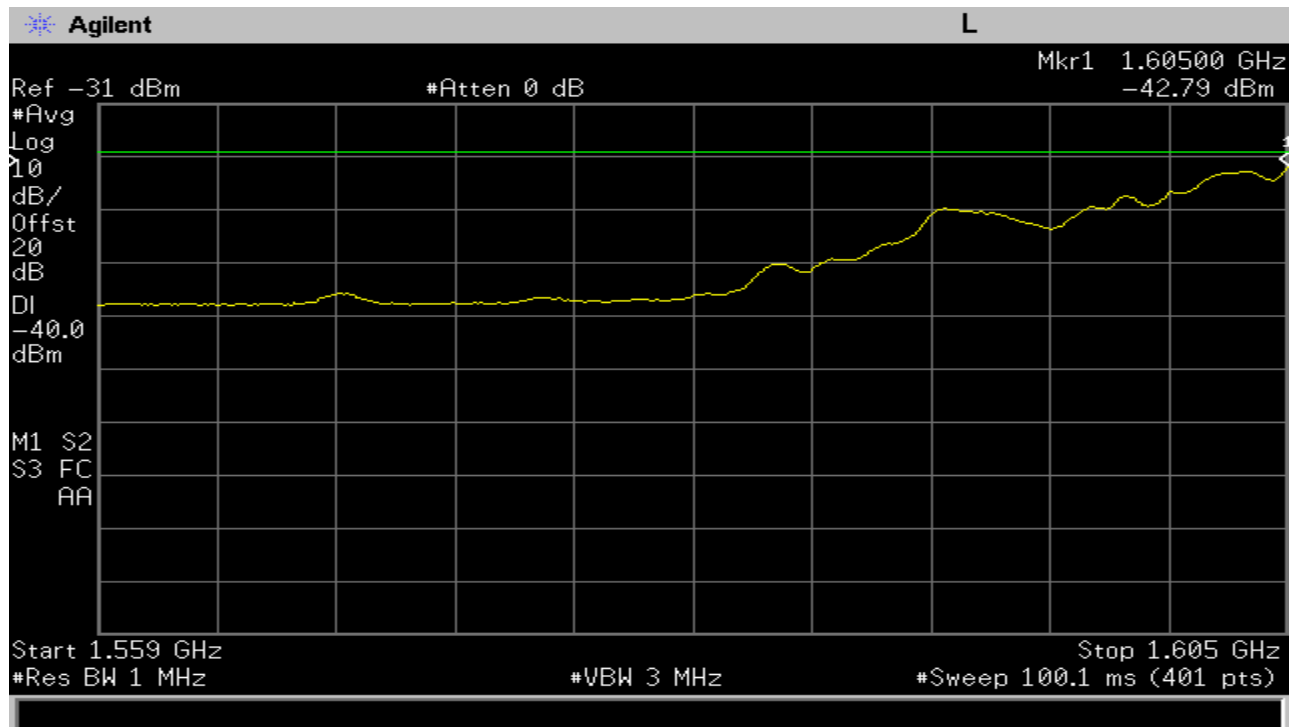
Test Procedure

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

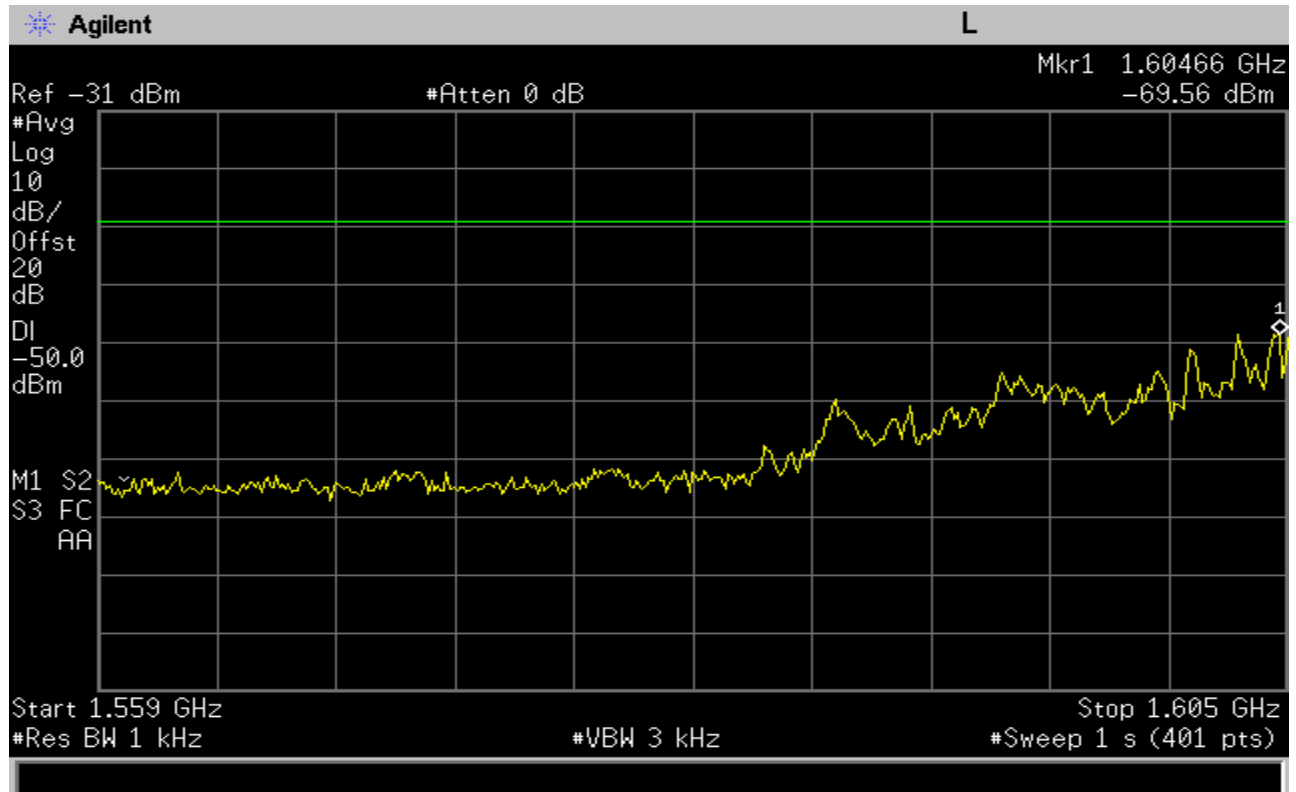
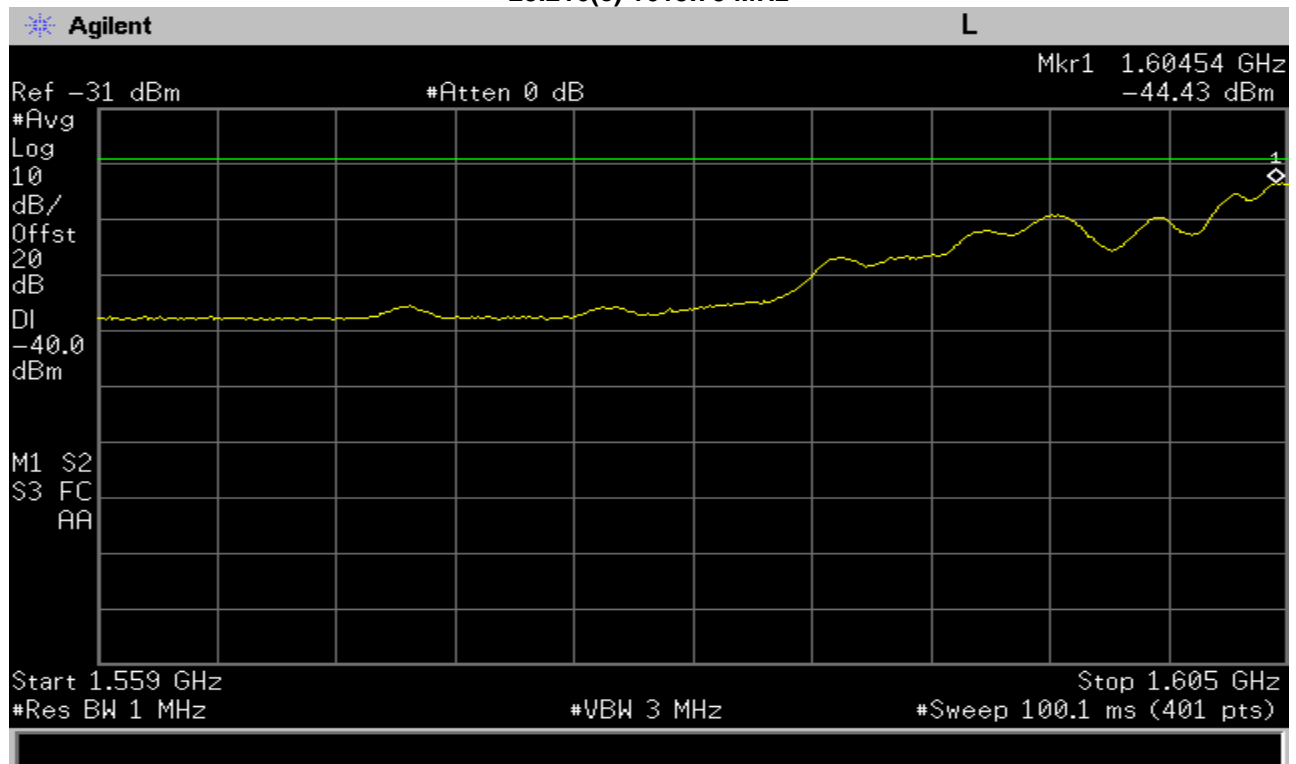


25.216(c) 1611.25 MHz

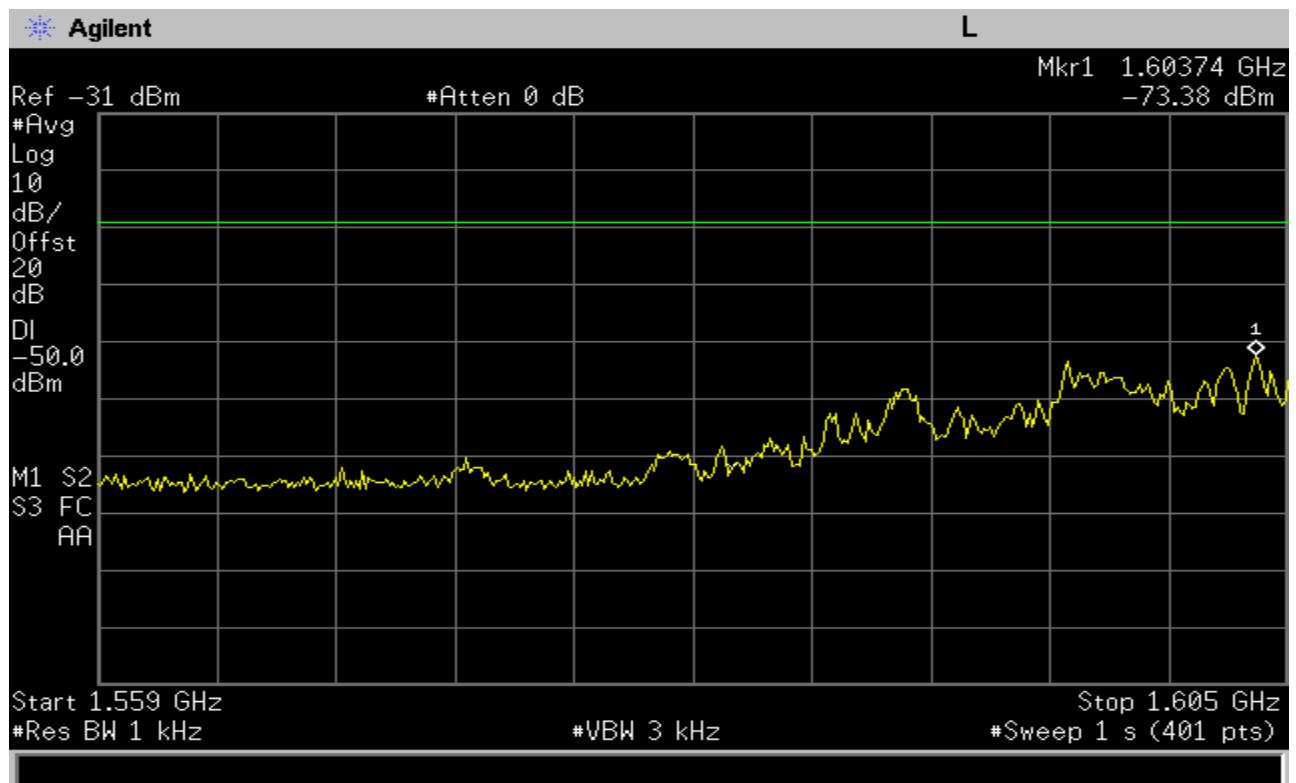
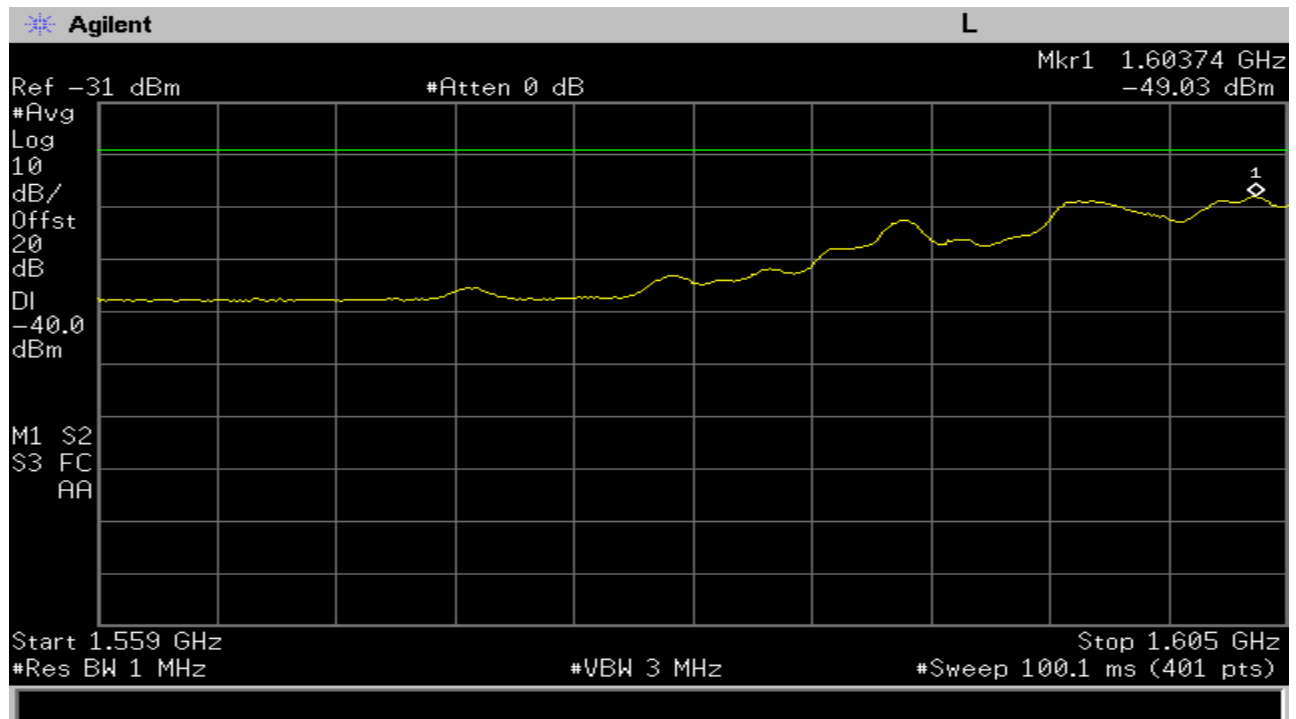




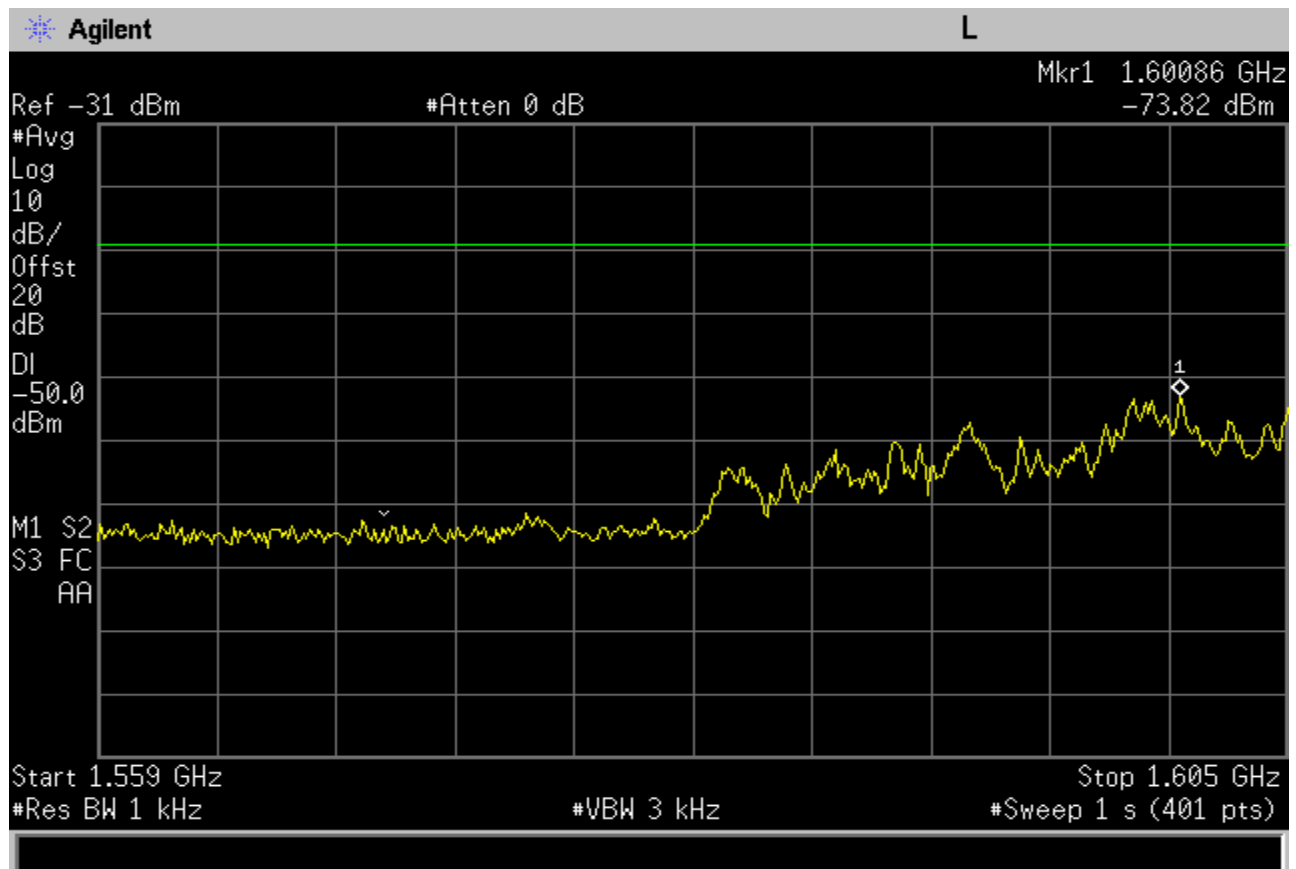
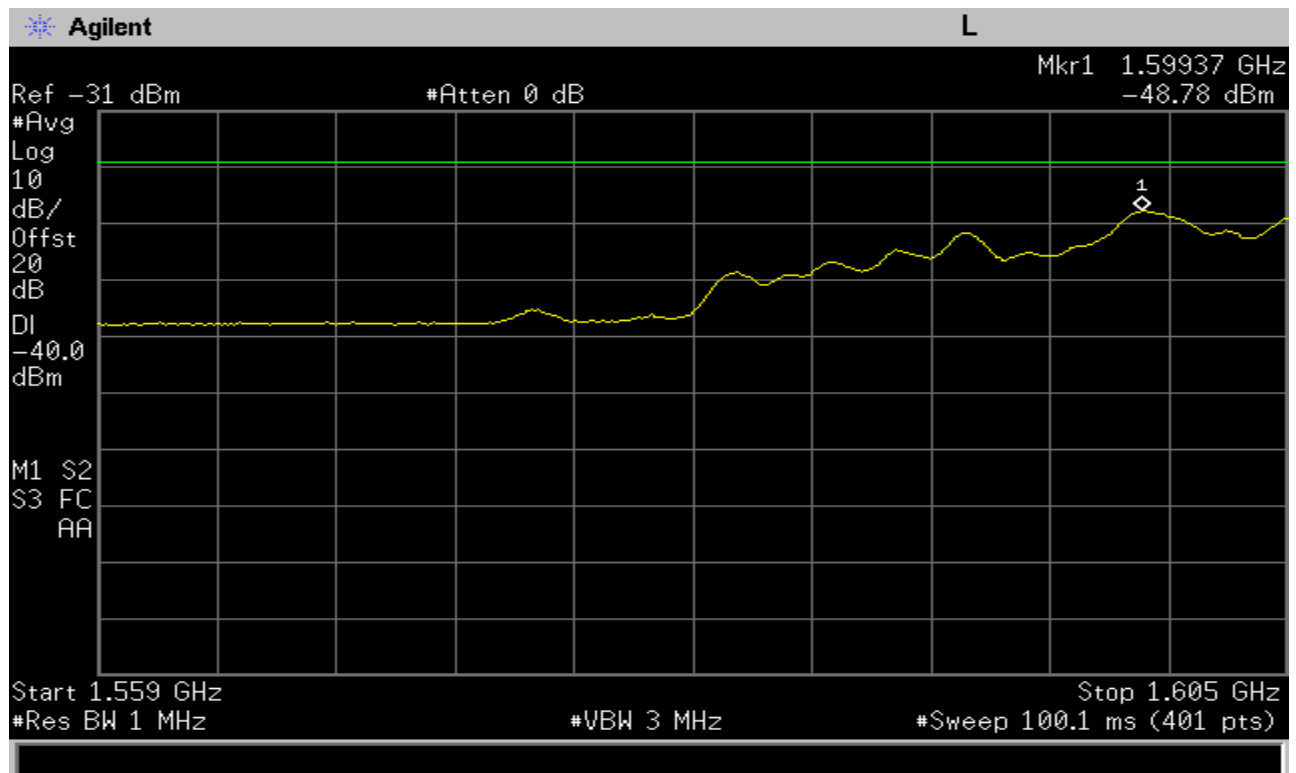
25.216(c) 1613.75 MHz



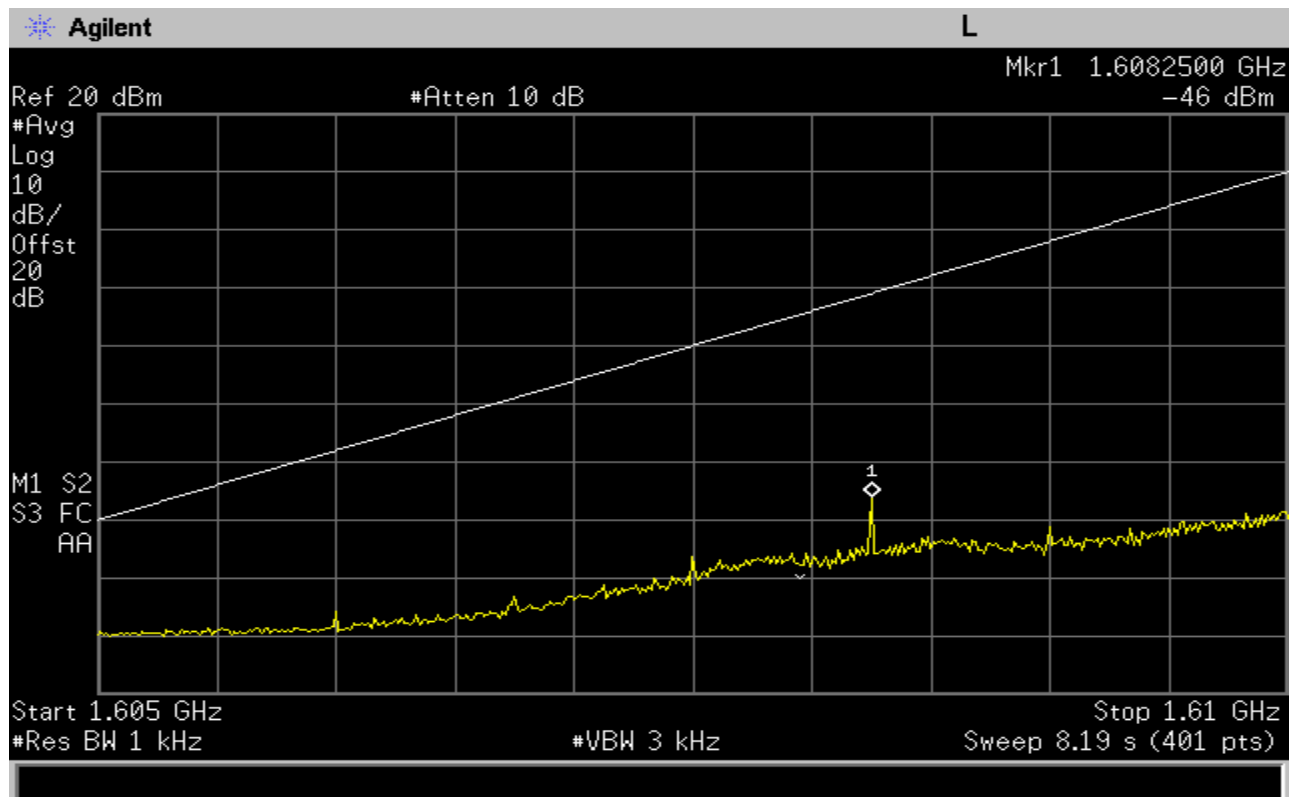
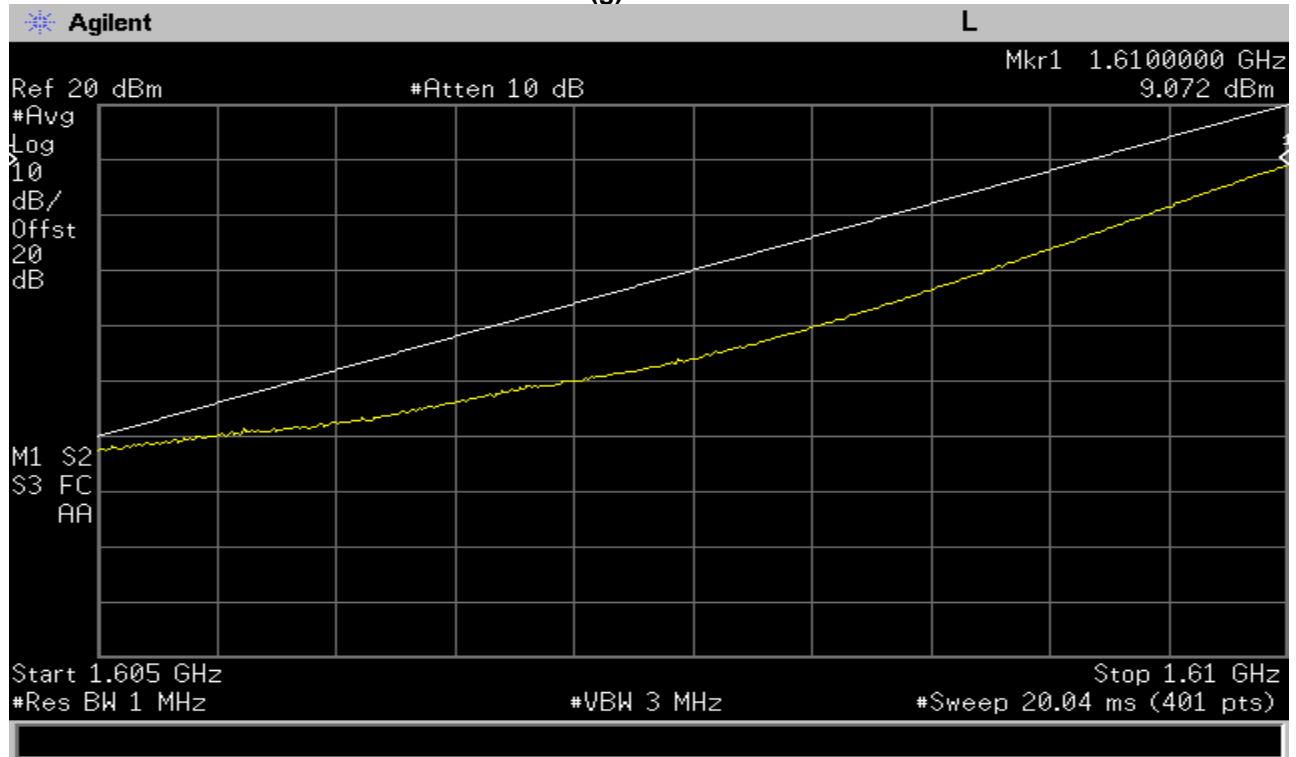
25.216(c) 1616.75 MHz



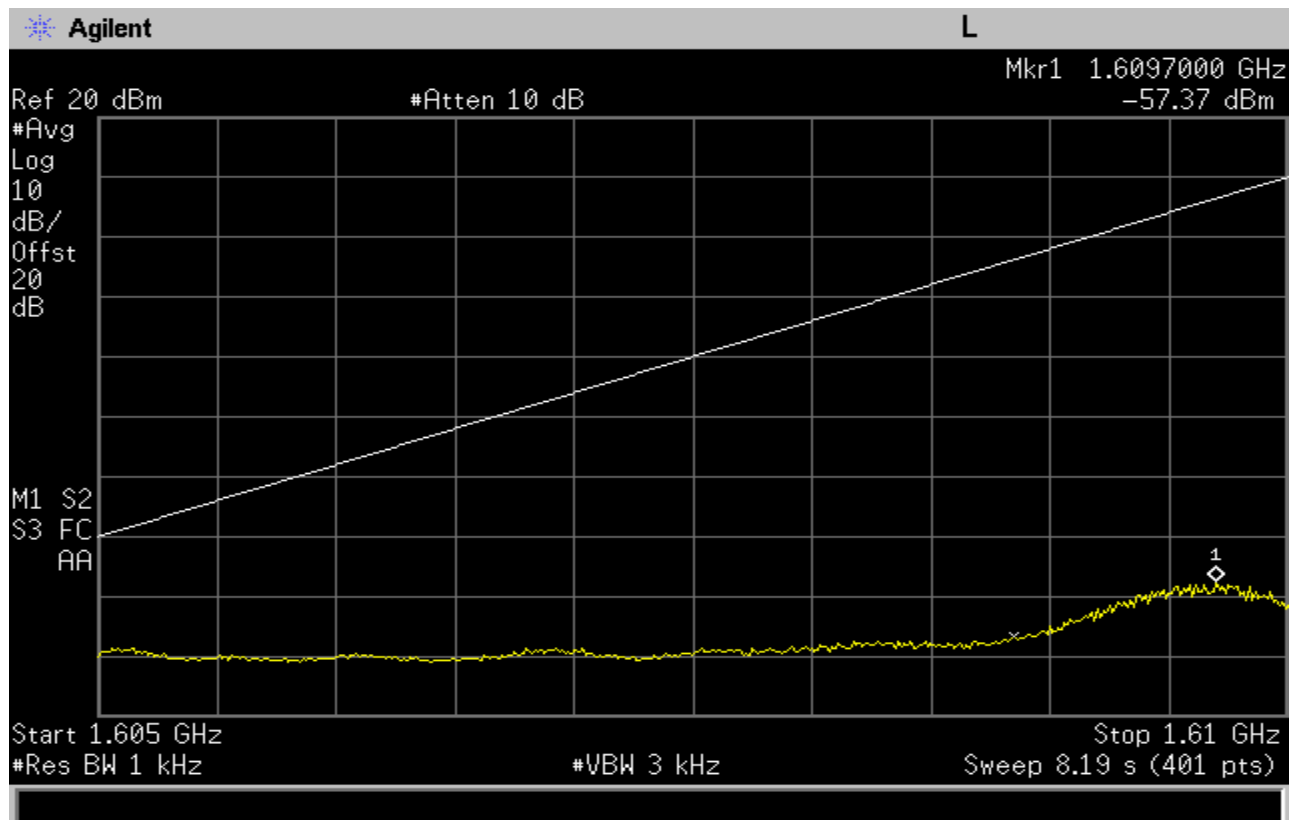
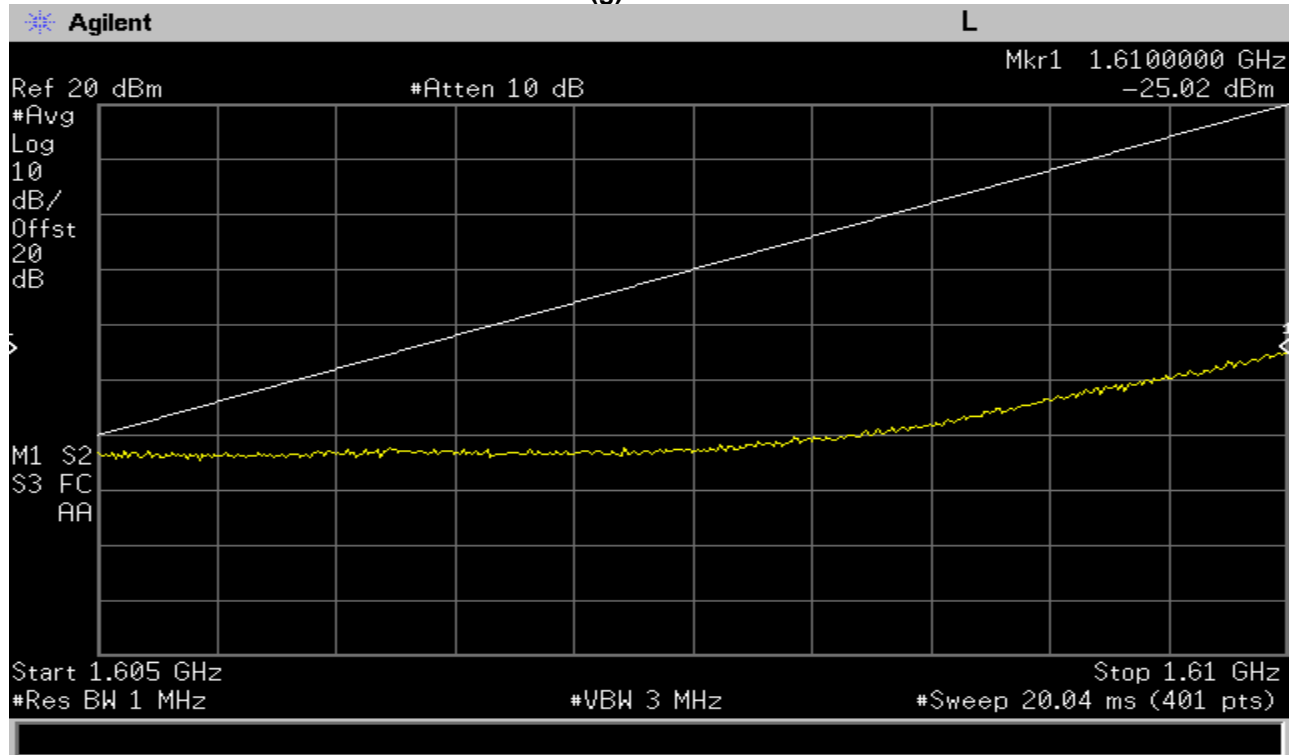
25.216(c) 1618.25 MHz



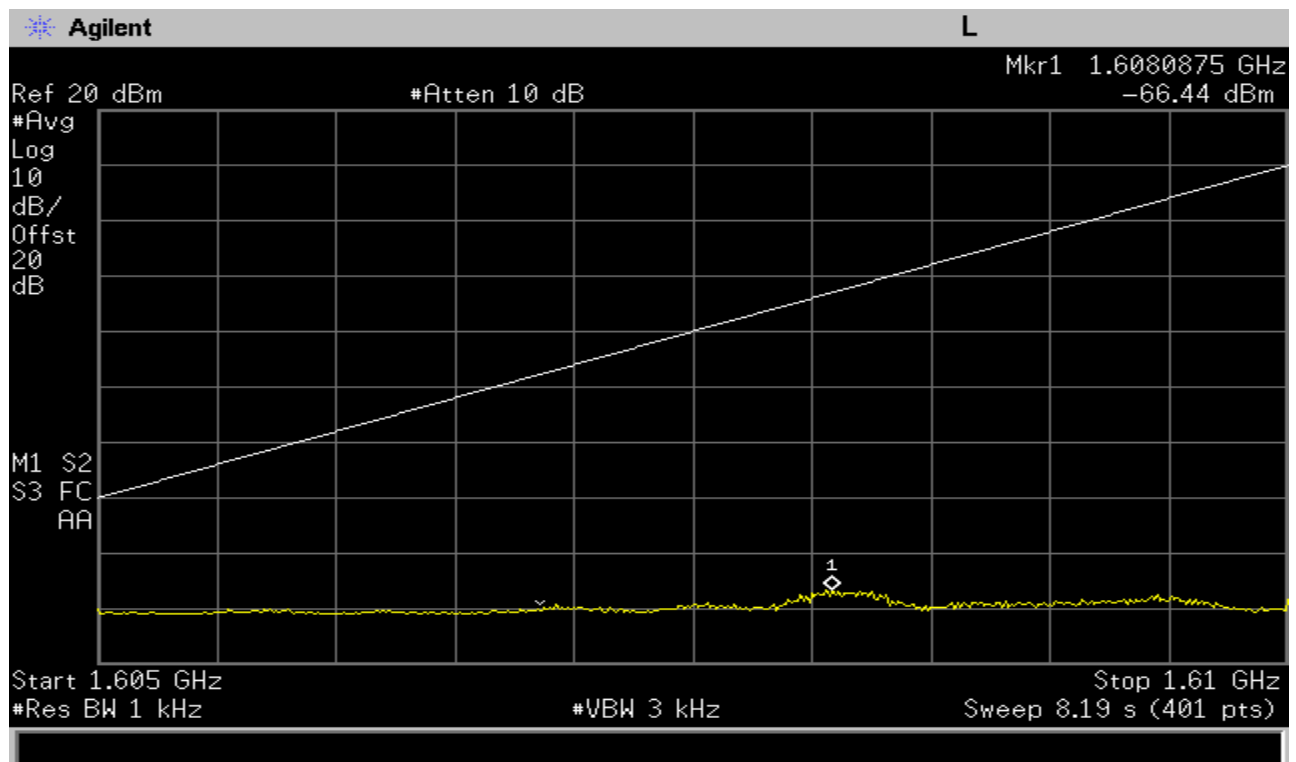
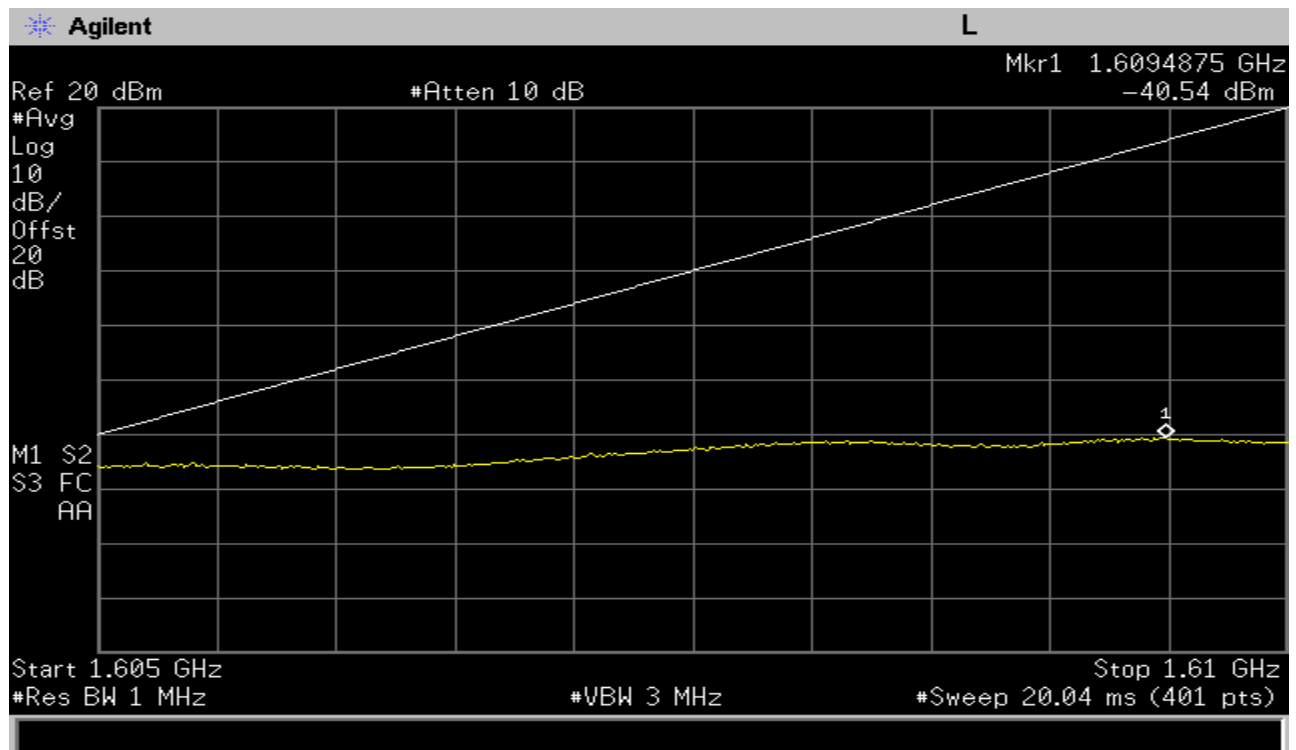
25.216(g) 1611.25 MHz



25.216(g) 1613.75 MHz

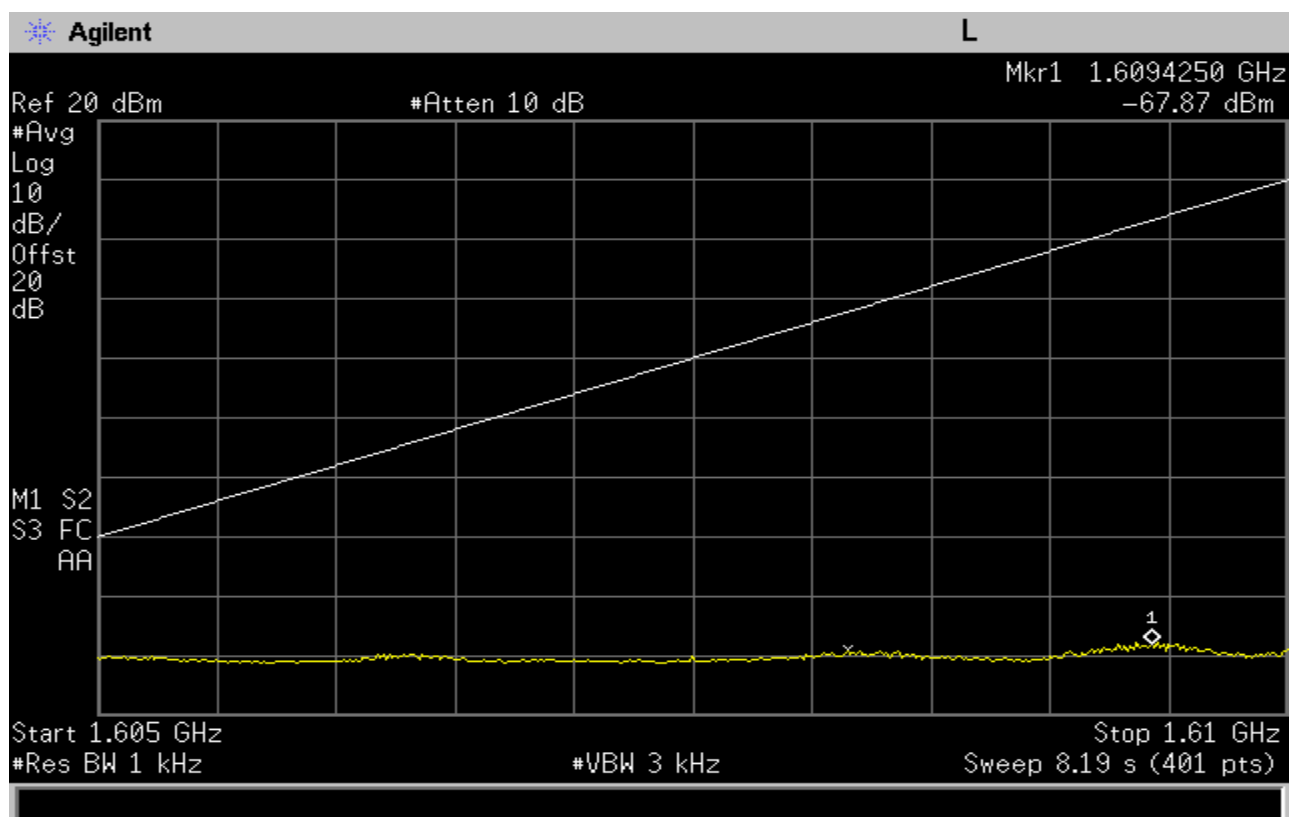
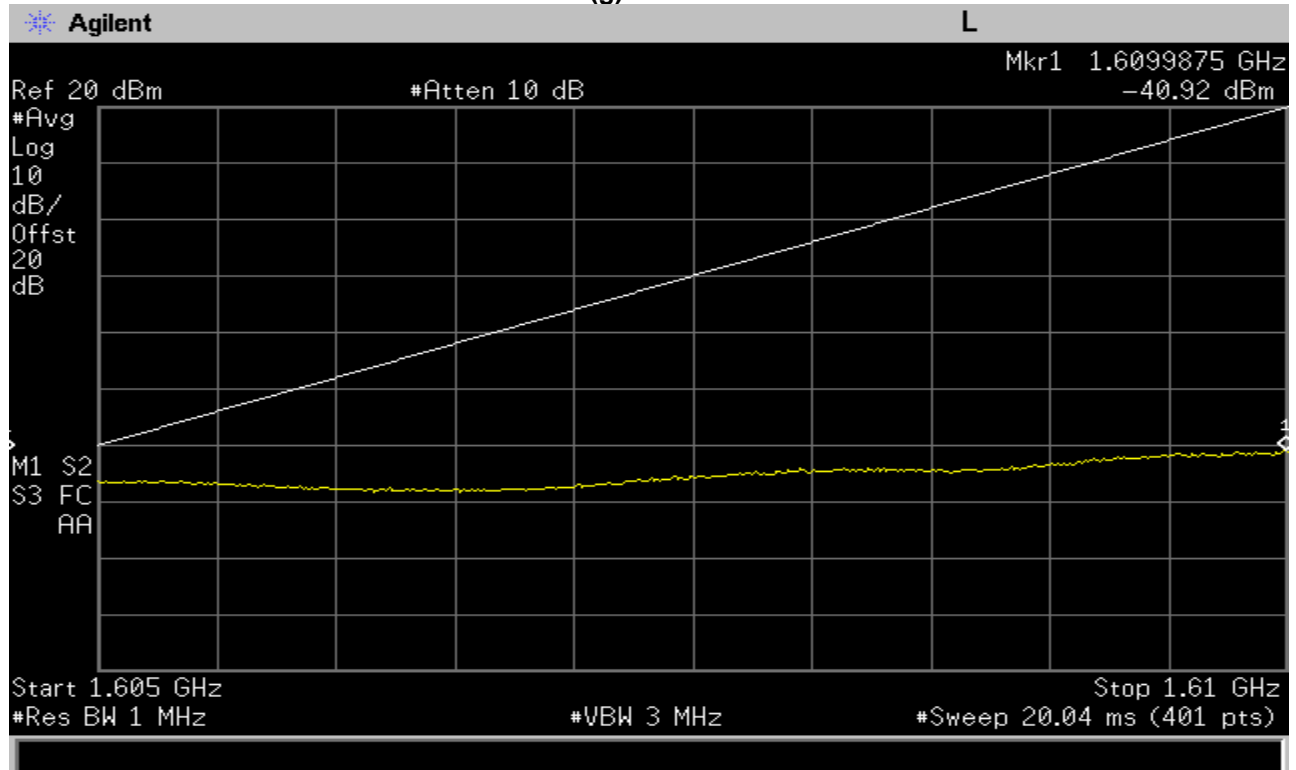


25.216(g) 1616.75 MHz

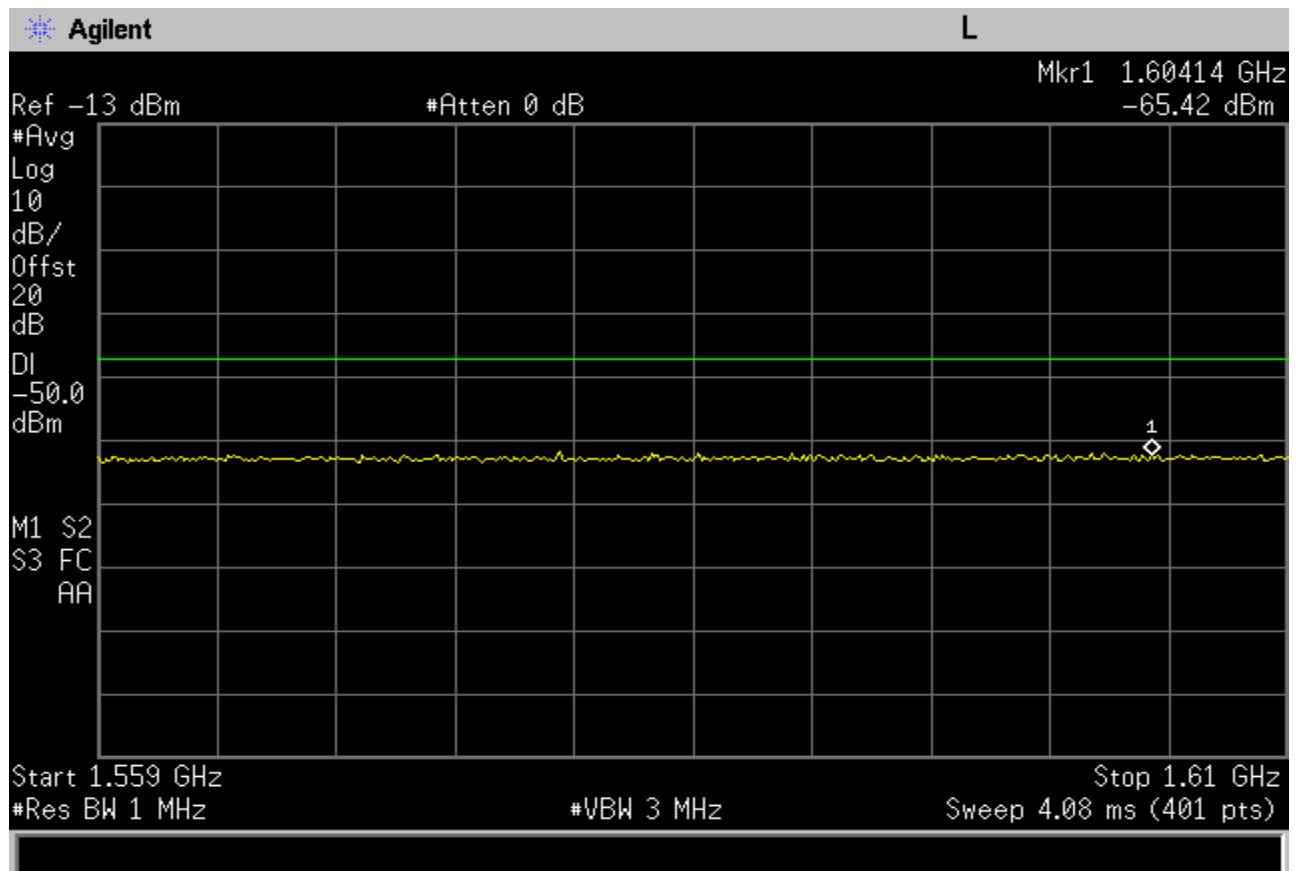




25.216(g) 1618.25 MHz



25.216(i)



Frequency Tolerance (Temperature Variation)

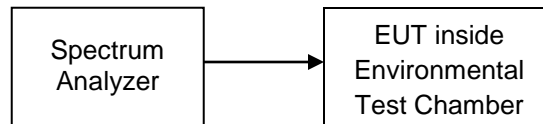
Test Engineer: Poona Saber

Test Date: 8/22/2017

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



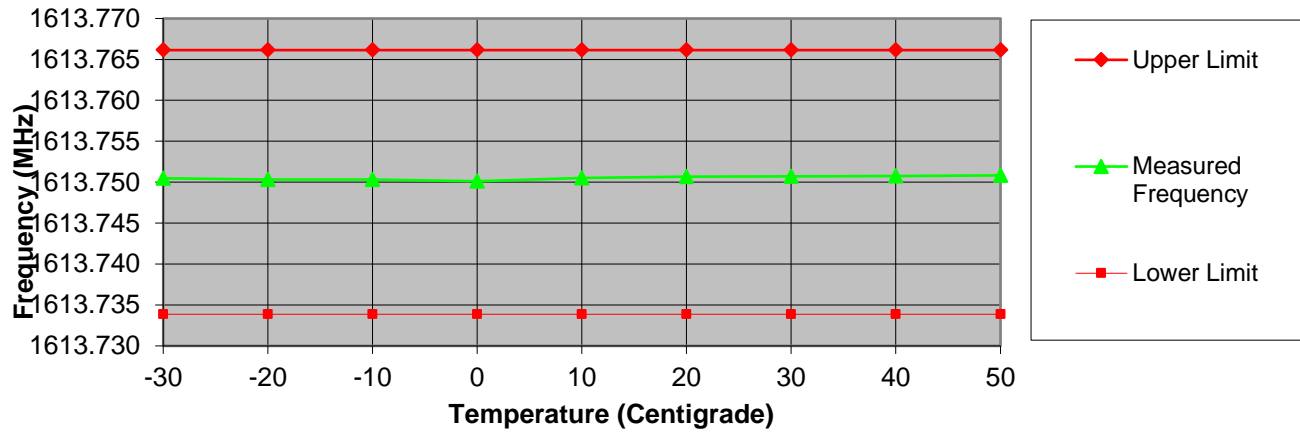
Frequency Versus Temperature

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Temperature centigrade	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
1613.75	0.0010	1613.7661375	1613.7338625	-30	1,613.750462	0.0156755	0.0165995
		1613.7661375	1613.7338625	-20	1,613.750332	0.0158055	0.0164695
		1613.7661375	1613.7338625	-10	1,613.750314	0.0158235	0.0164515
		1613.7661375	1613.7338625	0	1,613.750113	0.0160245	0.0162505
		1613.7661375	1613.7338625	10	1,613.750522	0.0156155	0.0166595
		1613.7661375	1613.7338625	20	1,613.750691	0.0154465	0.0168285
		1613.7661375	1613.7338625	30	1,613.750728	0.0154095	0.0168655
		1613.7661375	1613.7338625	40	1,613.750754	0.0153835	0.0168915
		1613.7661375	1613.7338625	50	1,613.750832	0.0153055	0.0169695

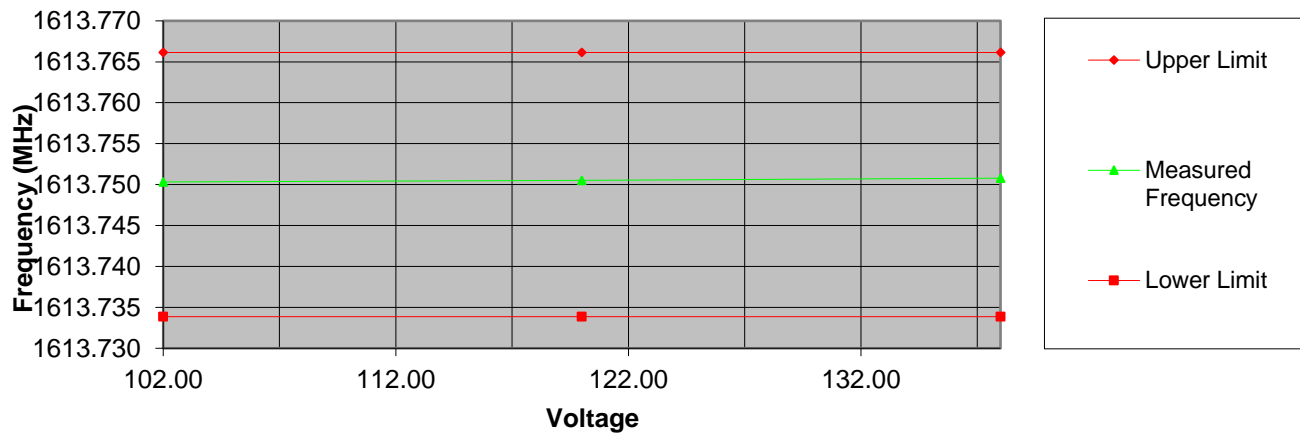
Frequency Versus Voltage

Tuned Frequency (MHz)	Frequency Tolerance %	Upper Limit (MHz)	Lower Limit (MHz)	Nominal Voltatge	Voltage	Measured Frequency (MHz)	Upper Margin (MHz)	Lower Margin (MHz)
1613.750	0.0010	1613.7661375	1613.7338625	120.00	102.00	1613.750320	0.0158175	0.016458
		1613.7661375	1613.7338625		120.00	1613.750500	0.0156375	0.016638
		1613.7661375	1613.7338625		138.00	1613.750783	0.0153545	0.016920

Frequency Stability vs. Temperature



Frequency Stability vs. Voltage



Field Strength of Spurious Radiation

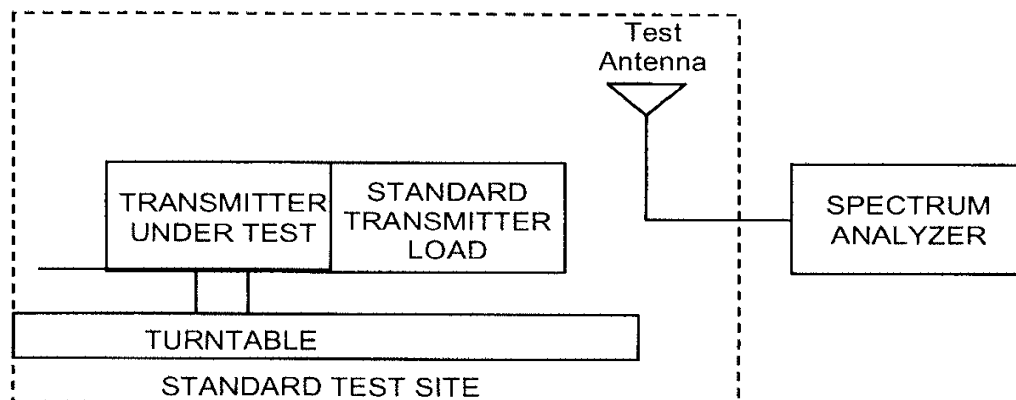
Engineer: Poona Saber

Test Date: 8/21/2017

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 \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.

Test Setup



See Annex A for test plots

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Horn Antenna, Amplified	ARA	MWH-1826/B	i00273	4/22/15	4/22/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	6/9/17	6/9/18
Spectrum Analyzer	Agilent	E4407B	i00331	10/19/16	10/19/17
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	8/3/16	8/3/18
EMI Analyzer	Agilent	E7405A	i00379	2/22/17	2/22/18
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/19
PSA Spectrum Analyzer	Agilent	E4445A	i00471	8/30/16	8/30/17
Temperature Chamber	Tenney	Tenney Jr	i00027	Verified on: 8/22/17	
Preamplifier	Miteq	AFS44 00101 400 23-10P-44	i00509	N/A	N/A

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