



Compliance Testing, LLC

Previously Flom Test Lab

EMI, EMC, RF Testing Experts Since 1963

toll-free: (866) 311-3268

fax: (480) 926-3598

<http://www.ComplianceTesting.com>

info@ComplianceTesting.com

Test Report

Prepared for: Digital Monitoring Products Inc.

Model: 1115

Description: Water and Temperature Sensor

Serial Number: N/A

FCC ID: CCKPC0192

IC: 5251A-PC0191

To

FCC Part 15.247 FHSS

And

IC RSS-247

Date of Issue: December 5, 2016

On the behalf of the applicant:

Digital Monitoring Products Inc.
2500 North Partnership Blvd
Springfield, MO 65802

Attention of:

James Wilson
Ph: (417)831-9362
E-mail: jwilson@dmp.com

Prepared by
Compliance Testing, LLC
1724 S. Nevada Way
Mesa, AZ 85204
(480) 926-3100 phone / (480) 926-3598 fax
www.compliancetesting.com
Project No: p16a0004

Poona Saber
Test Engineer

This report may not be reproduced, except in full, without written permission from Compliance Testing.
All results contained herein relate only to the sample tested.



Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	October 20, 2016	Poona Saber	Original Document
2.0	November 28, 2016	Poona Saber	Revised the frequency of operation range and conducted spurious test procedure
3.0	December 2, 2016	Poona Saber	Added authorized band edge section
4.0	December 2, 2016	Poona Saber	Added plots taken for number of points for radiated testing

Table of Contents

<u>Description</u>	<u>Page</u>
Standard Test Conditions and Engineering Practices	6
Test Results Summary	7
Peak Output Power.....	8
Conducted Spurious Emissions.....	9
Authorized Band-Edge Measurements.....	16
Radiated Spurious Emissions.....	19
Occupied Bandwidth.....	25
Average Time of Occupancy of Hopping Frequency.....	27
Number of Hopping Channels	29
Hopping Channel Carrier Frequencies Separation	30
Test Equipment Utilized.....	31

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 to the 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 in the table 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 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.

Standard Test Conditions and Engineering Practices

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II; Part 2 and the following individual Part: 15.247 Operation within bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

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

In accordance with ANSI C63.4-2009, ANSI C63.10-2009, FCC DA 00-705, and unless otherwise indicated in the specific measurement results, the ambient temperature of the actual EUT was maintained within the range of 10 to 40C (50 to 104F) unless the particular equipment requirements specified 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)
25.2	29.8	968.4

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

EUT Description

Frequency Range: 902 - 928 MHz

Range of Operation: 905.5-924.4 MHz

Modulation: FSK

Emission Designator: F1D

Transmitter Power Configuration: 3VDC from internal battery

Model: 1115 - Water and Temp Sensor

Description: Combination water and temperature sensor used in home automation system

Additional Information:

EUT Operation during Tests

EUT was tested on both fixed channel and hopping mode for different testing

15.203: Antenna Requirement:

- ☒ The antenna is permanently attached to the EUT
- ☐ The antenna uses a unique coupling
- ☐ The EUT must be professionally installed
- ☐ The antenna requirement does not apply



Test Results Summary

Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(a)	Occupied Bandwidth	Pass	
15.247 (e)	Average time of occupancy of hopping frequency	Pass	
15.247 (e)	Hopping channel carrier frequencies separation	Pass	
15.247 (e)	Number of hopping frequencies	Pass	
15.247(a)	Number of Hopping Channels	Pass	
15.207	A/C Powerline Conducted Emissions	N/A	Unit is DC powered
RSS-GEN §7	Receiver Spurious Emissions	N/A	Unit is not a standalone receiver



Peak Output Power

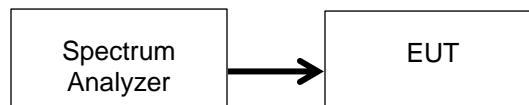
Engineer: Poona Saber

Test Date: 10/20/2016

Test Procedure

The EUT was connected directly to the input of a Spectrum Analyzer. The Maximum output peak readings were taken and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

Tuned Frequency (MHz)	Recorded Measurement Watts	Specification Limit (Watts)	Result
905.5	0.0108	1	Pass
914.9	0.011	1	Pass
924.39	0.0119	1	Pass



Conducted Spurious Emissions

Engineer: Poona Saber

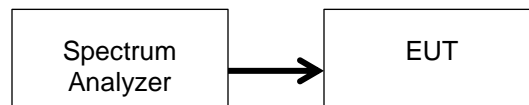
Test Date: 10/20/2016

Test Procedure

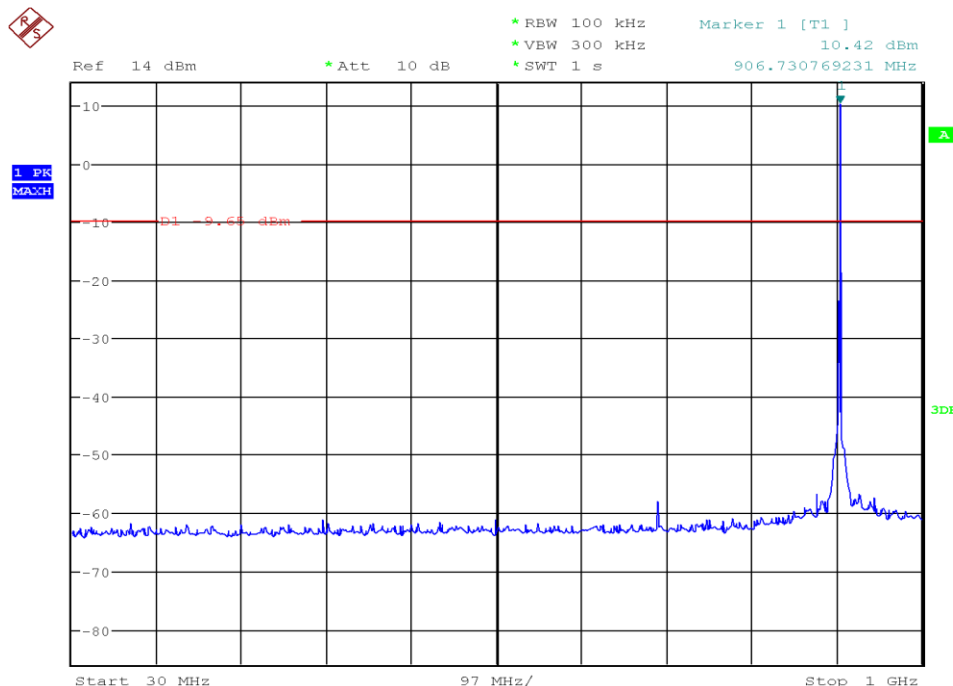
The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The reference level was offset for the peak power output with the resolution bandwidth set for 100 KHz. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted.

For emissions that fell within restricted bands extra measurement was taken to show compliance with 15.209 limit.

Test Setup

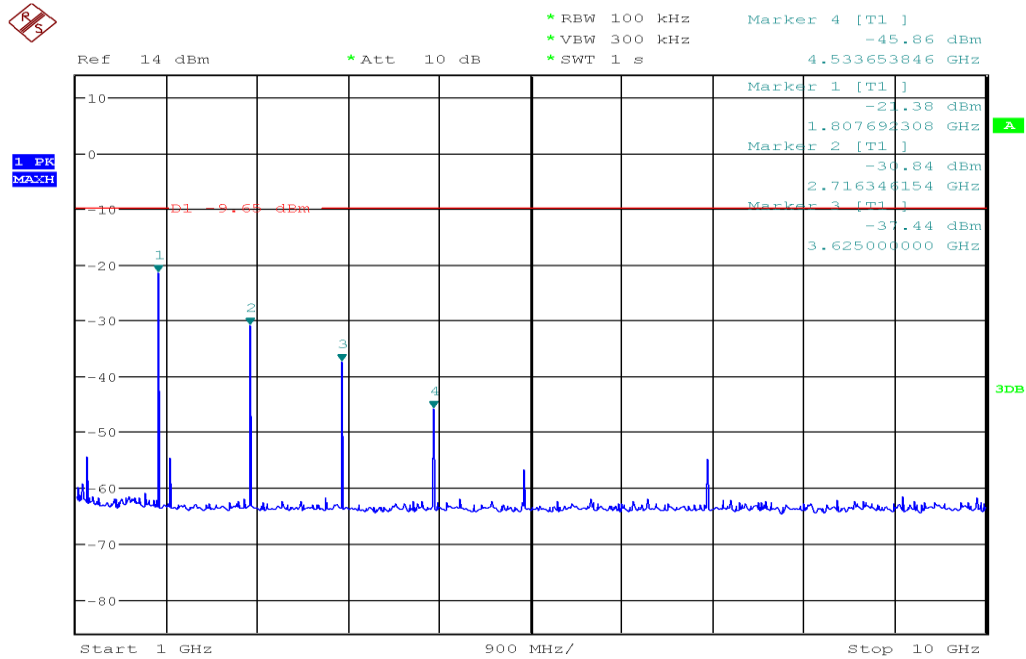


Conducted Spurious Emissions Plots



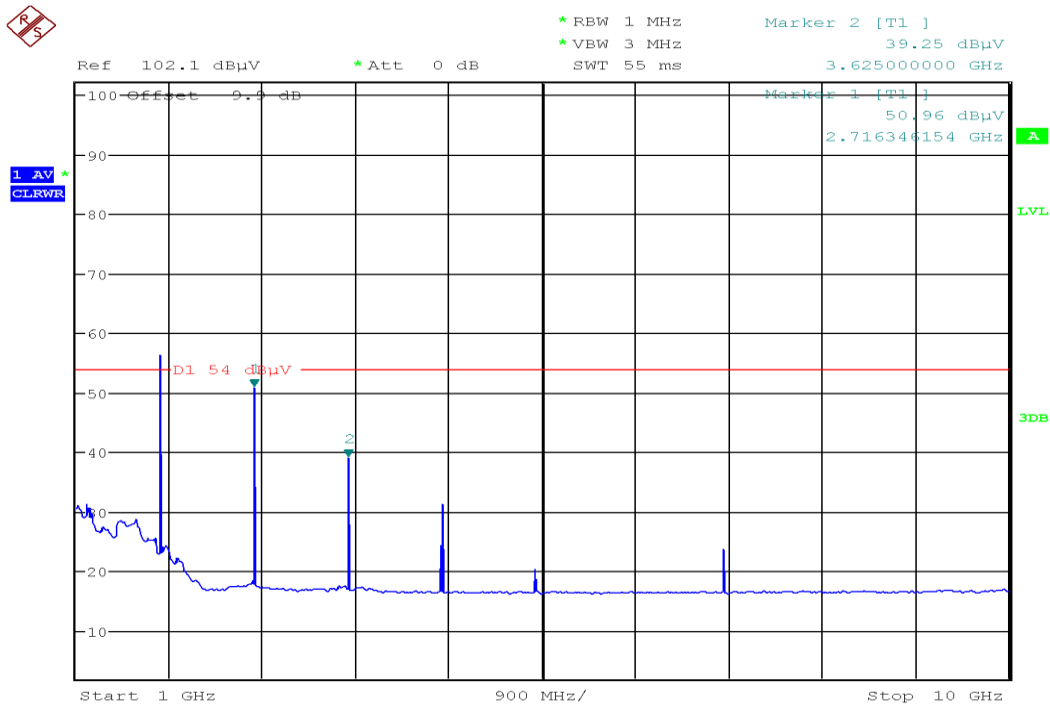
Date: 20.OCT.2016 02:01:17

Low Channel 30 MHz-1GHz -20dBc



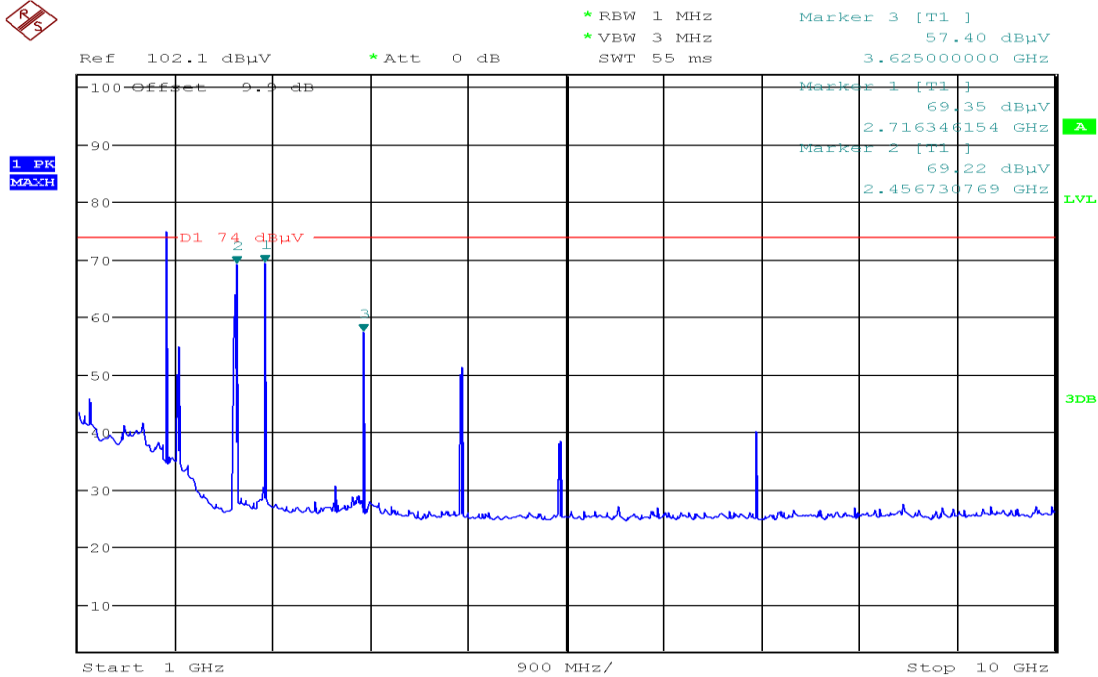
Date: 20.OCT.2016 03:02:12

Low Channel 1-10 GHz – 20 dBc



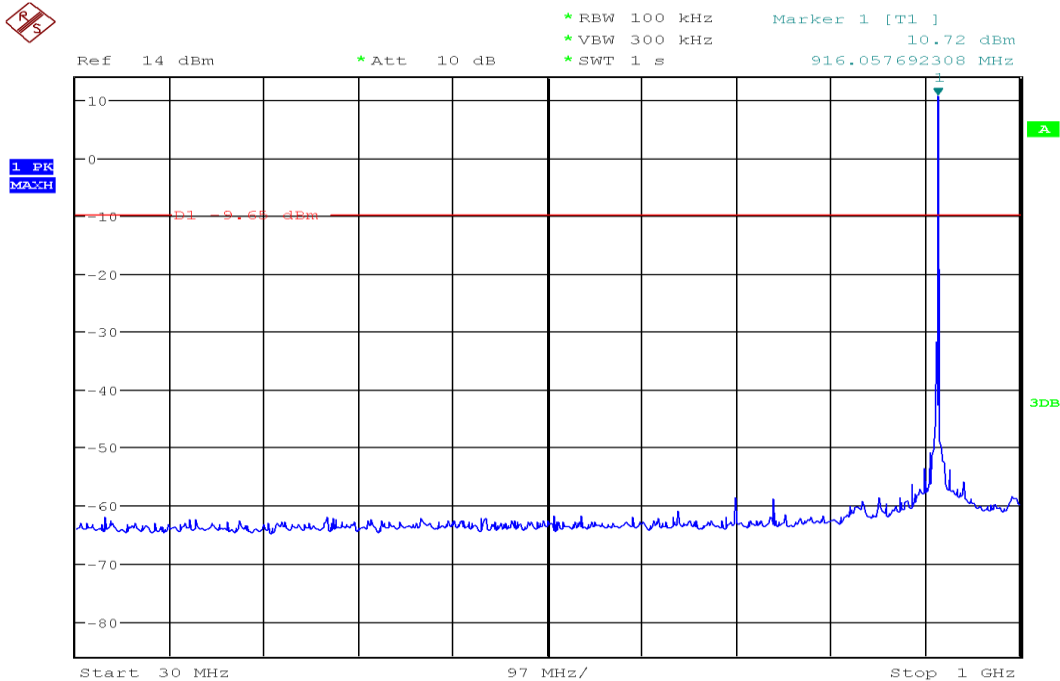
Date: 20.OCT.2016 23:22:51

Low Channel 1-10 GHz restricted band emissions Average



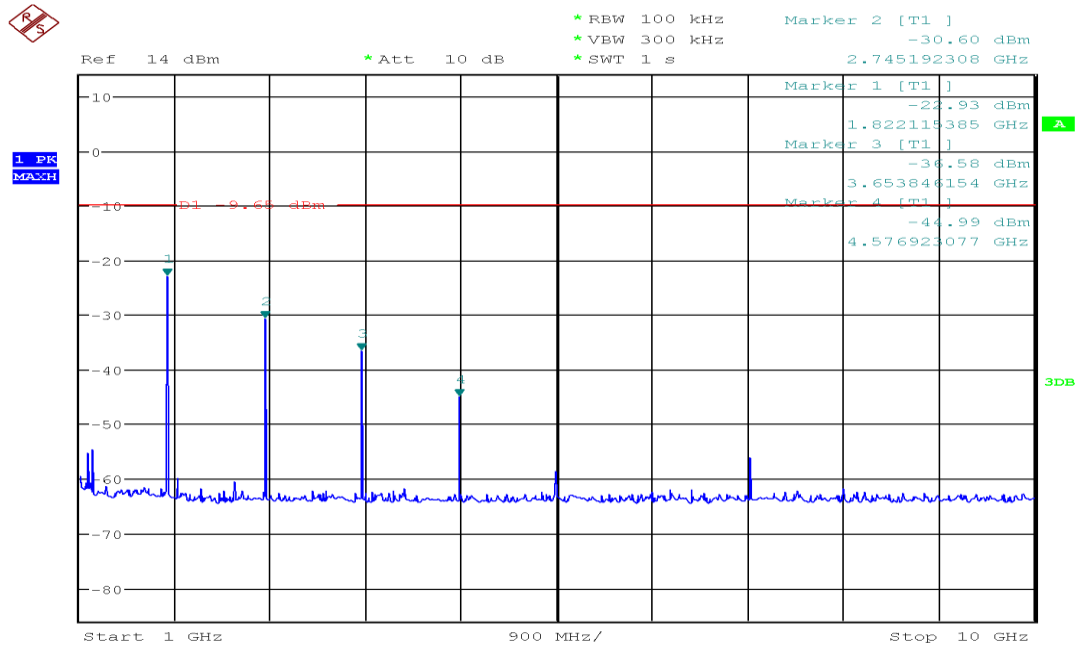
Date: 20.OCT.2016 23:31:39

Low Channel 1-10 GHz restricted band emissions Peak



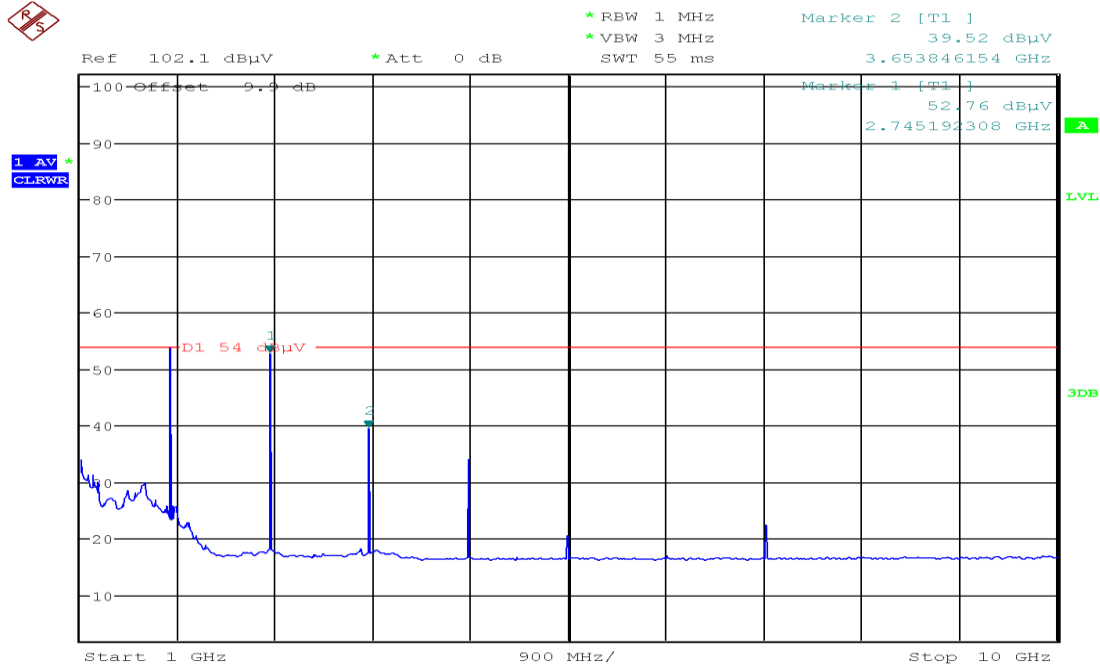
Date: 20.OCT.2016 03:06:49

Mid Channel 30 MHz-1GHz -20dBc



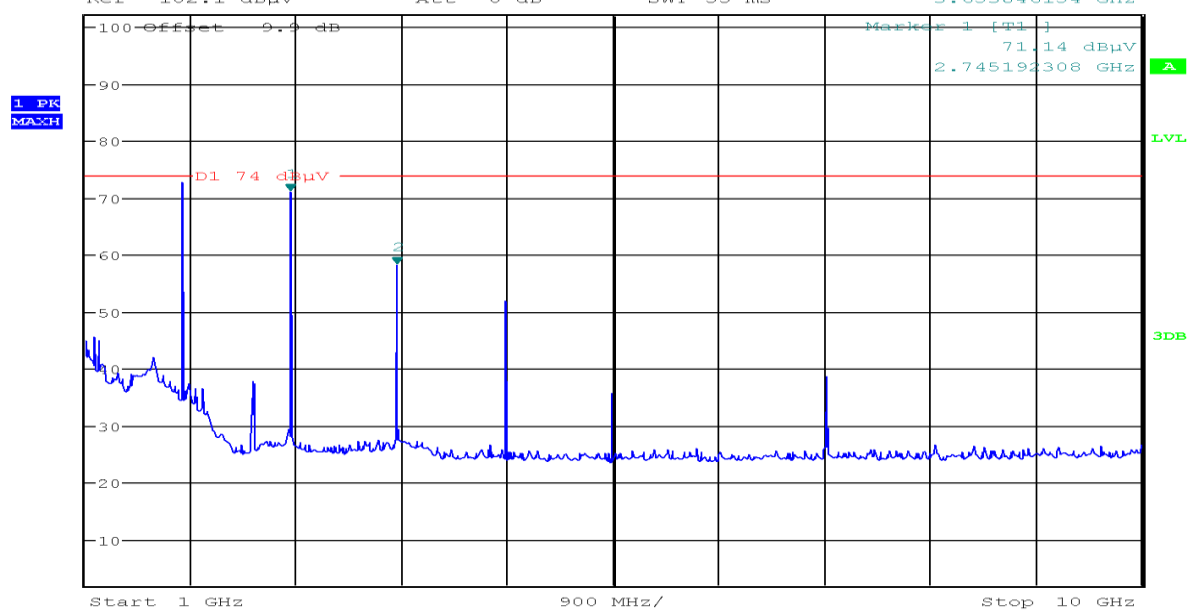
Date: 20.OCT.2016 03:08:32

Mid Channel 1-10 GHz – 20 dBc



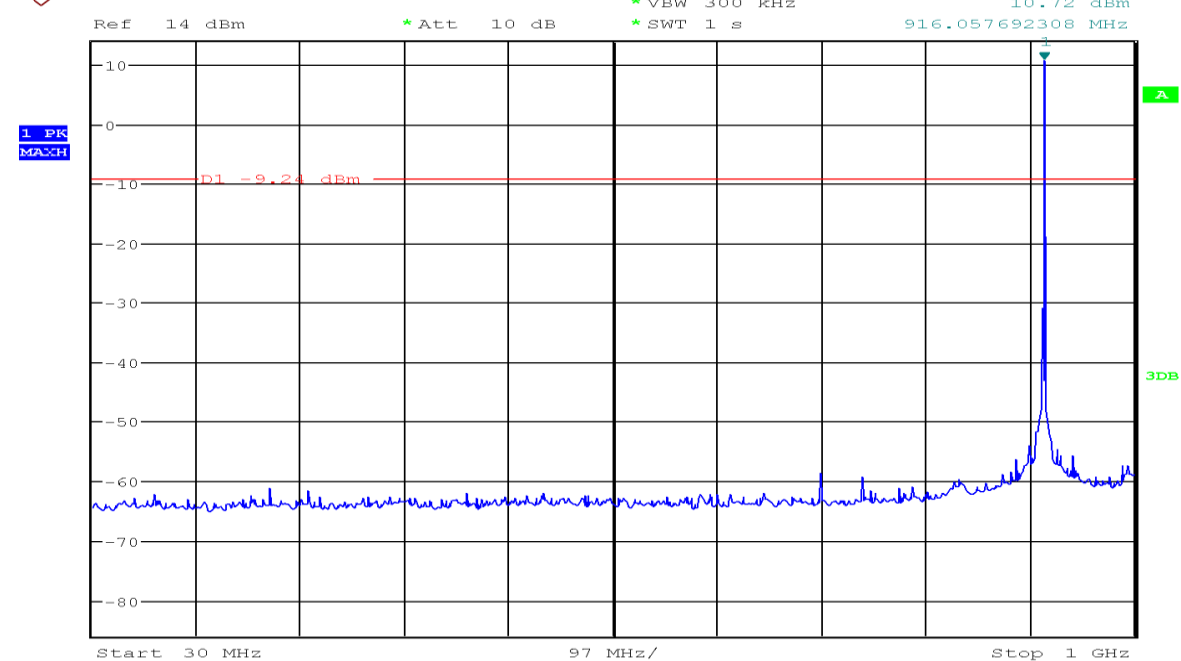
Date: 20.OCT.2016 23:24:45

Mid Channel 1-10 GHz restricted band emissions Average



Date: 20.OCT.2016 23:35:26

Mid Channel 1-10 Ghz restricted band emissions Peak

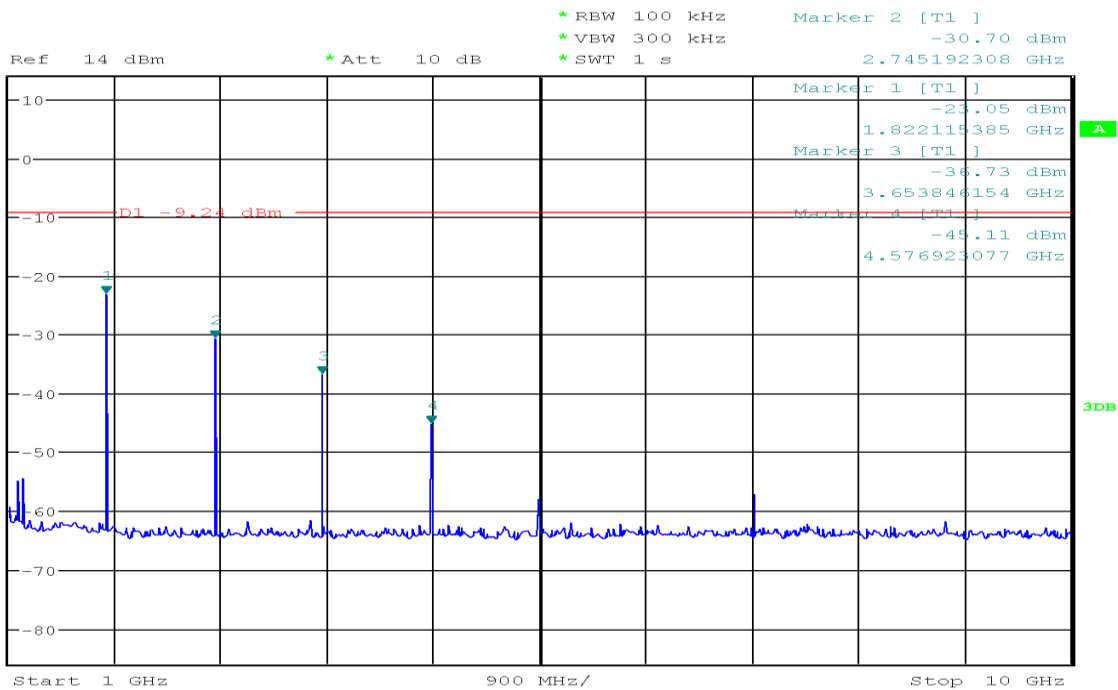


Date: 20.OCT.2016 03:14:51

High Channel 30 MHz-1GHz -20dBc



1 PK
MAXH

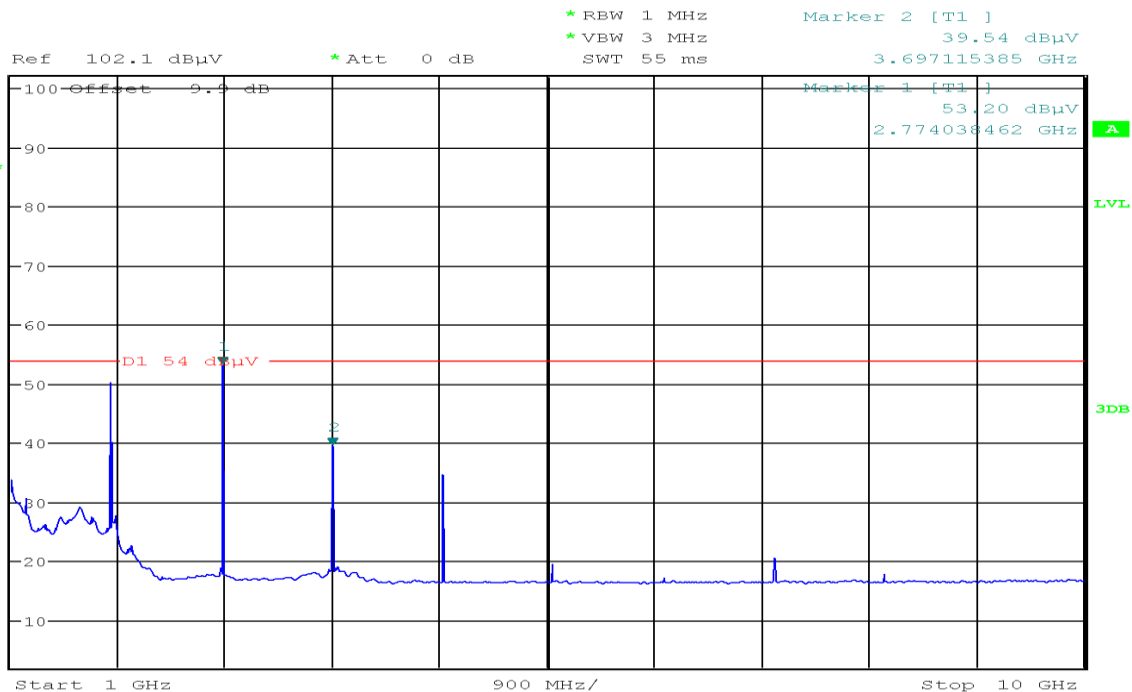


Date: 20.OCT.2016 03:16:39

High Channel 1-10 GHz – 20 dBc



1 AV *
CLRWR

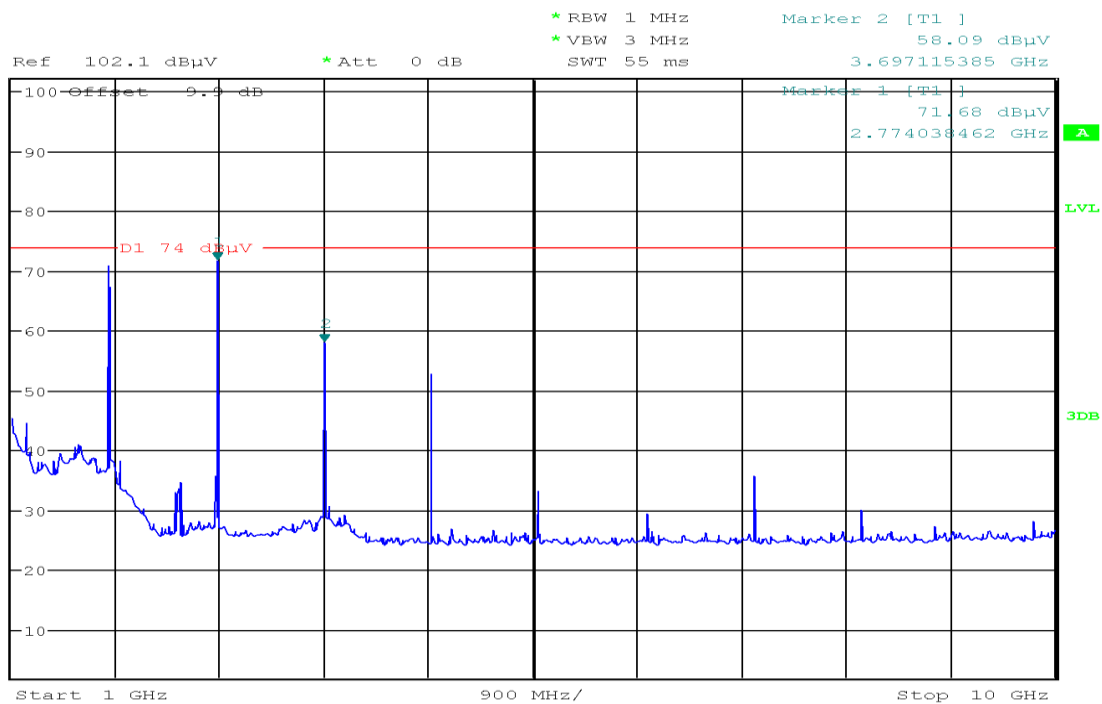


Date: 20.OCT.2016 23:26:58

High Channel 1-10 GHz restricted band emissions Average



1 PK
MAXH



Date: 20.OCT.2016 23:29:06

High Channel 1-10 Ghz restricted band emissions Peak

Authorized Band-Edge Measurements

Engineer: Poona Saber

Test Date: 10/19/2016

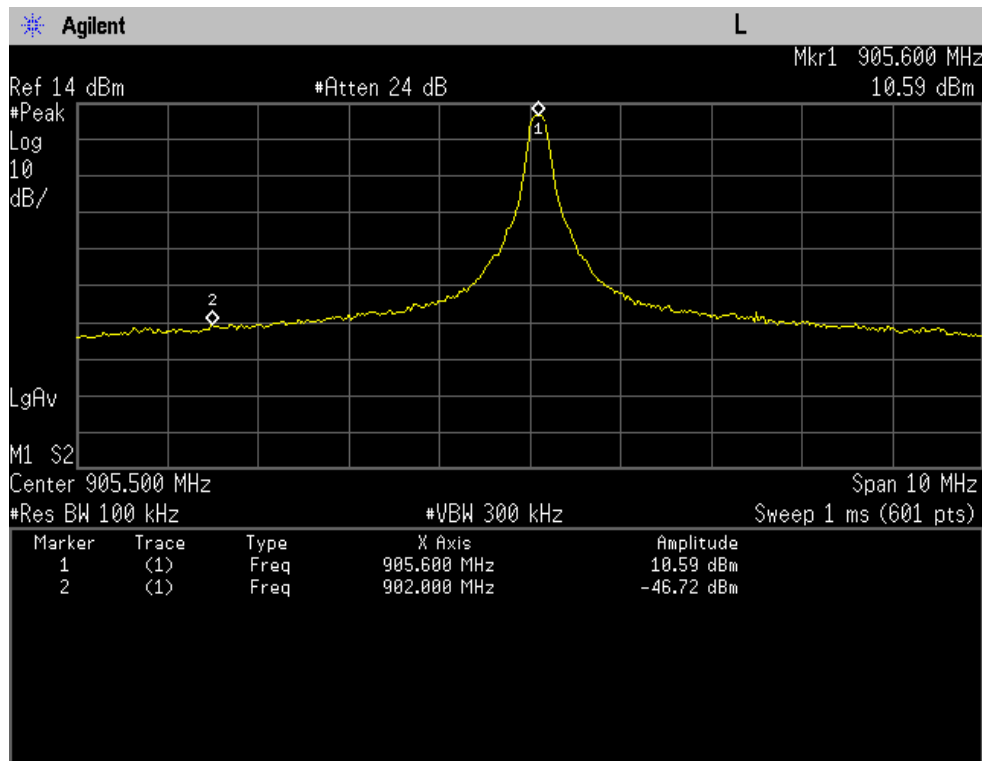
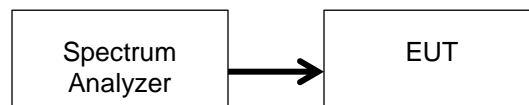
Test Procedure

This test is performed two times. Once with the hopping function turned OFF and then repeated with the hopping function turned On to make sure that the RF power remains OFF while the device is changing frequencies and that the oscillator stabilizes at the new frequency before RF power is turned back ON and overshoot of any oscillator wouldn't cause any transmission occur during temporary periods.

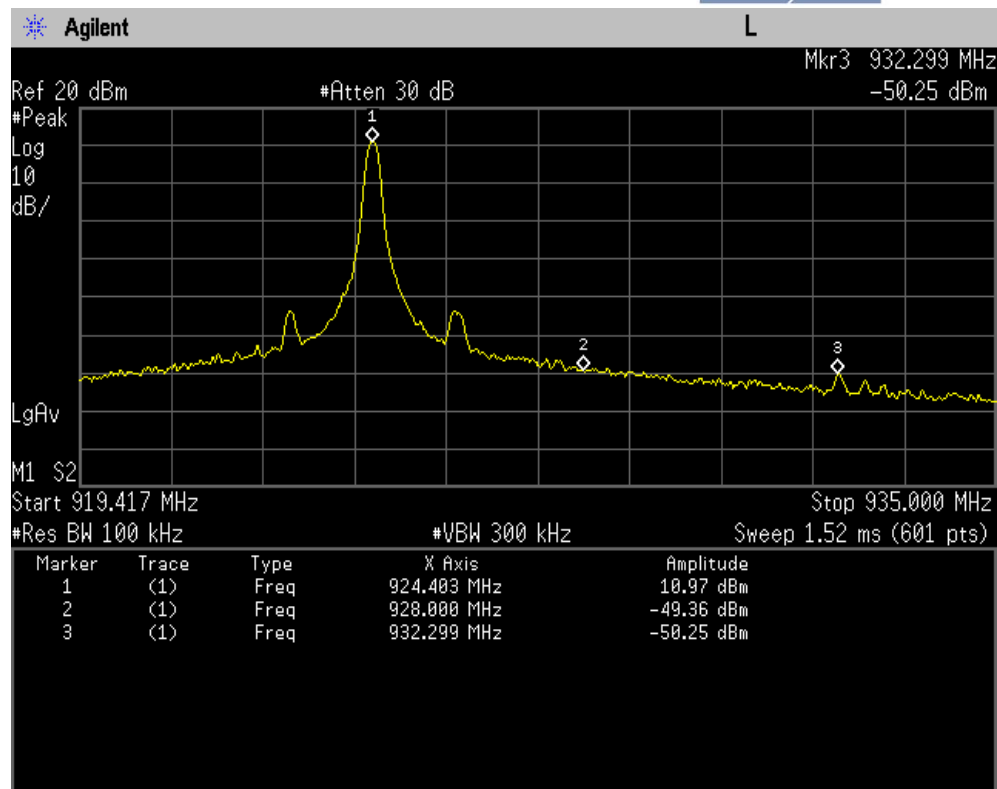
Following measurement setup was used and emissions at the band edge and beyond were checked to not be less than 20 dBc. For hopping mode the trace was allowed to stabilize before any measurements were taken.

Sweep time: Coupled
 Resolution bandwidth: 100 KHz
 Video bandwidth: 300 KHz
 Detector: Peak
 Trace: Max hold

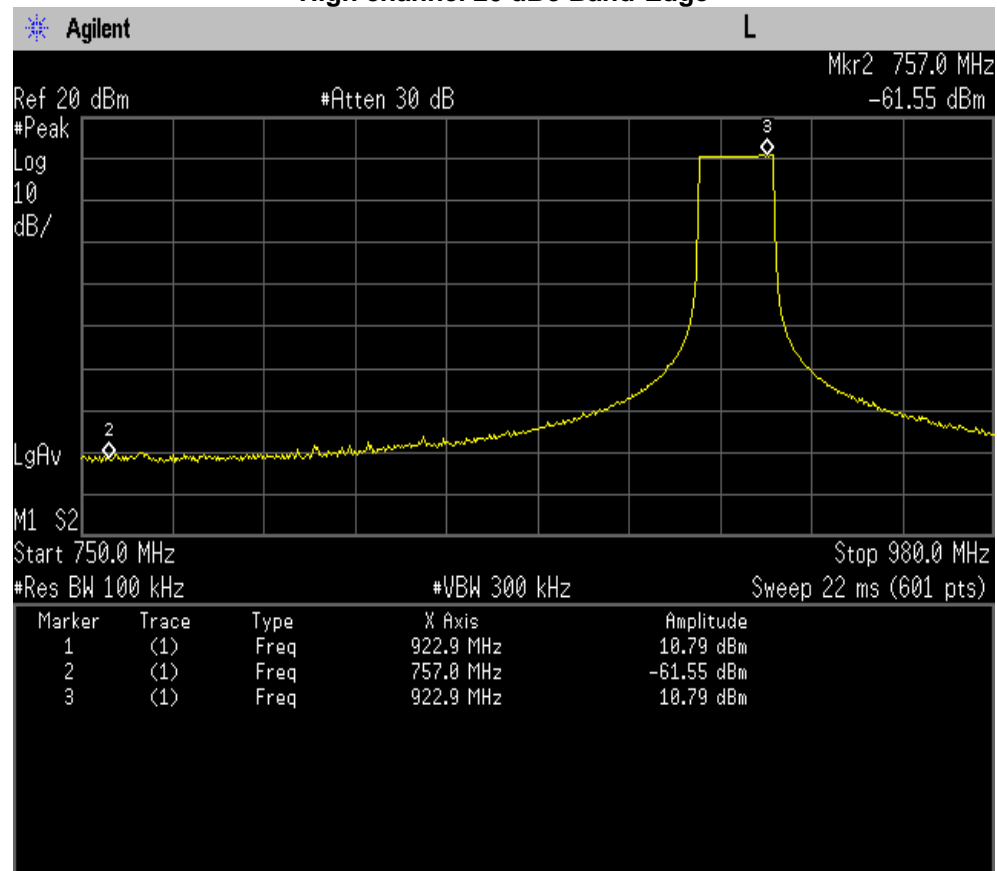
Test Setup



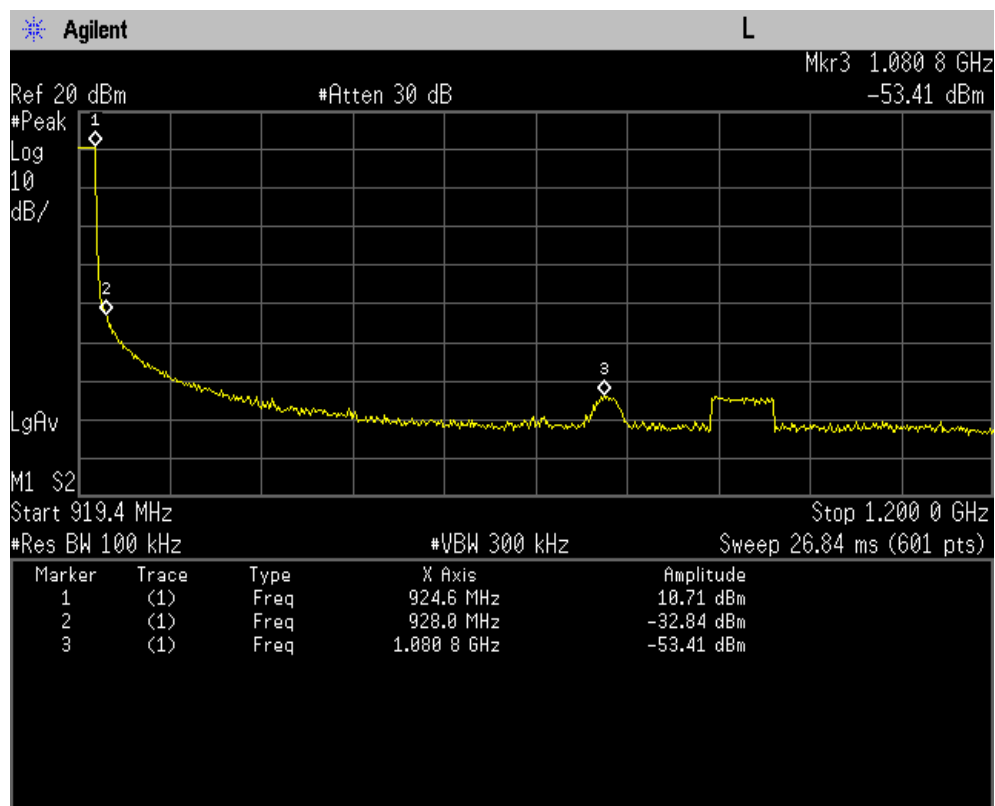
Low channel 20 dBc Band-Edge



High channel 20 dBc Band-Edge



Low Channel Hopping Band Edge



High Channel Hopping Band-Edge

Radiated Spurious Emissions

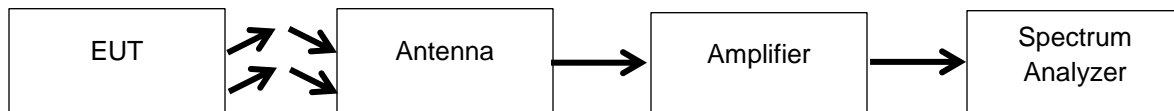
Engineer: Poona Saber

Test Date: 10/19/2016

Test Procedure

The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Spurious Emissions that fall in restricted bands per 15.209 limits. The antenna and cable correction factors were summed with the pre-amplifier gain and entered into the spectrum analyzer as an offset to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

Test Setup

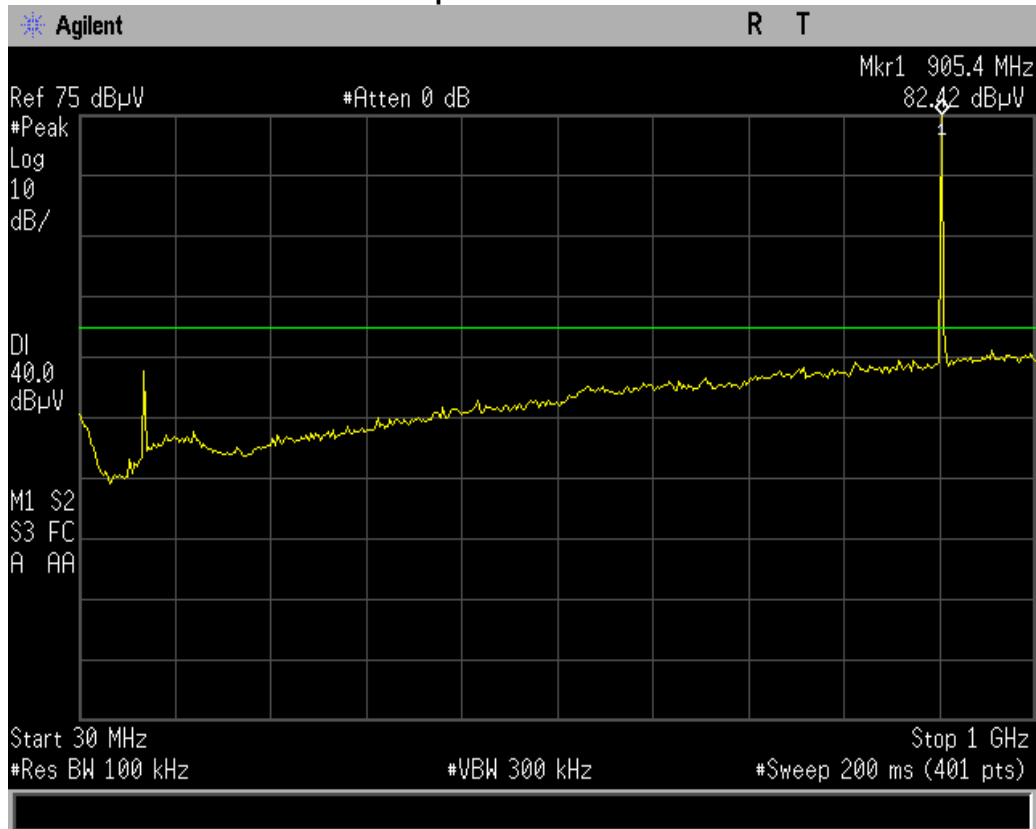


No other emissions were detectable. All emissions were greater than -20 dBc.

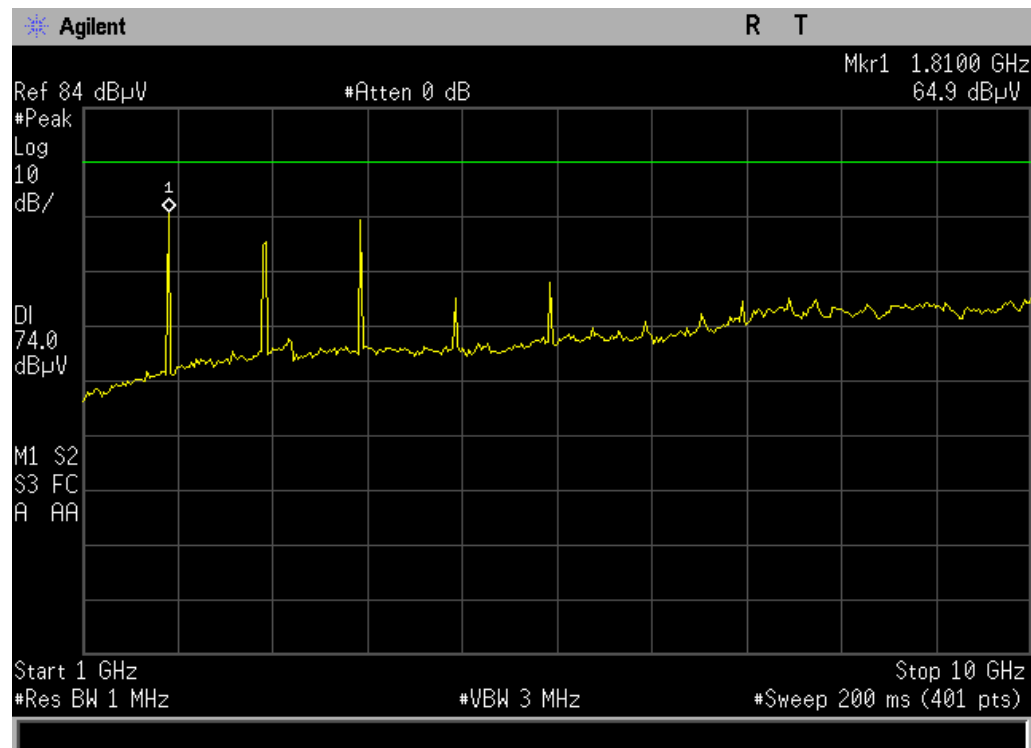
Extra plot on the emission at 3.6 GHz was taken with lower span to show meeting the number of points requirement per ANSI C63.10 which requires the number of points be higher than $2 \times \text{span} / \text{RBW}$ with average detector and further investigation has been done to meet this requirement on all the other spurious emissions.



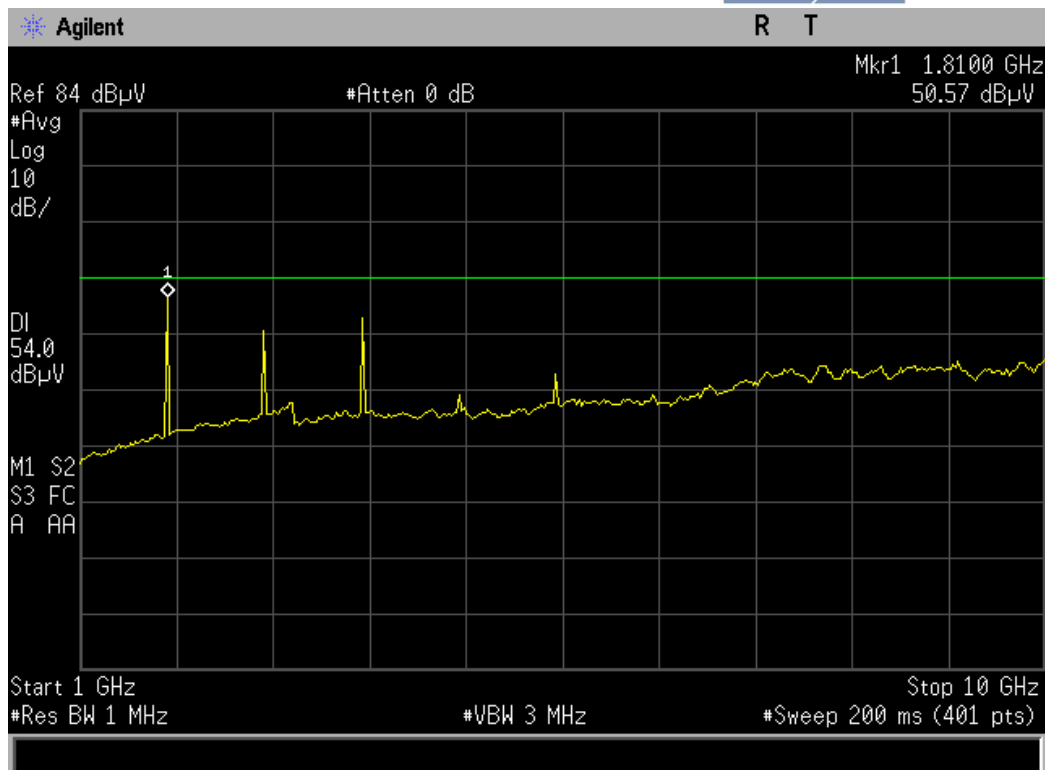
Radiated Spurious Emissions Plots



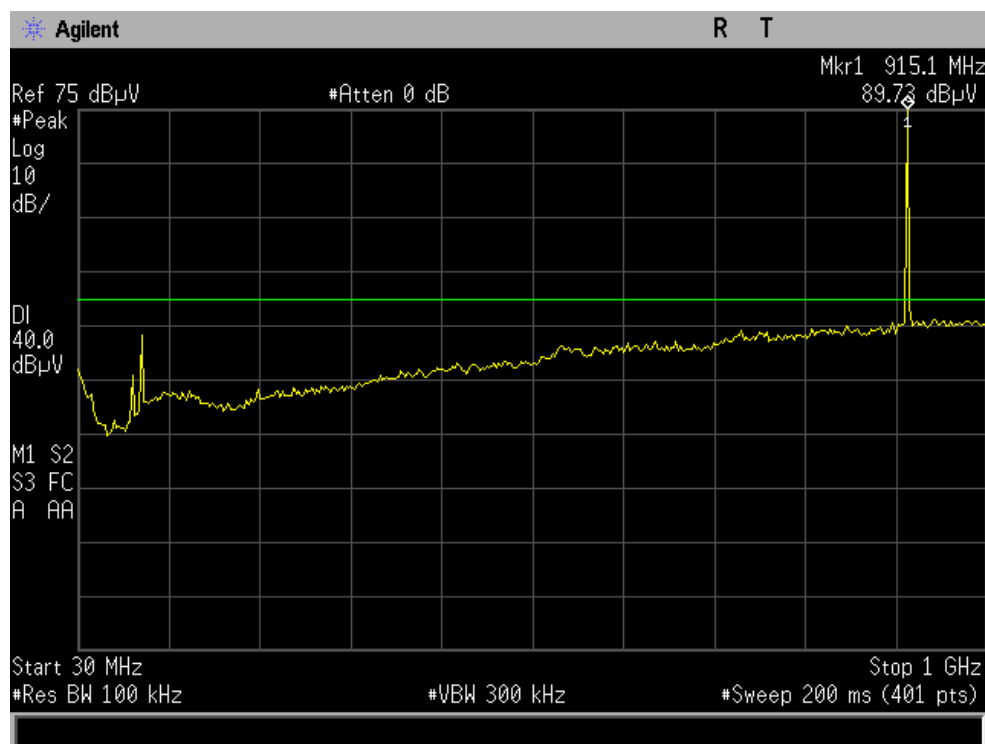
Low channel 30MHz - 1GHz



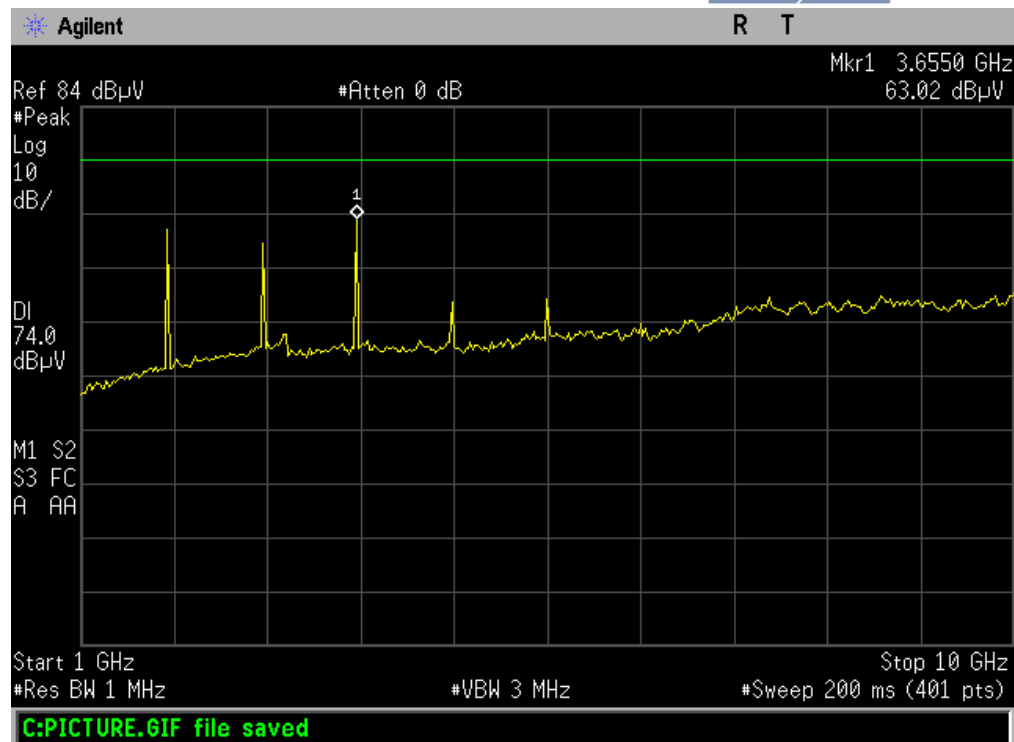
Low channel 1-10 GHz Peak



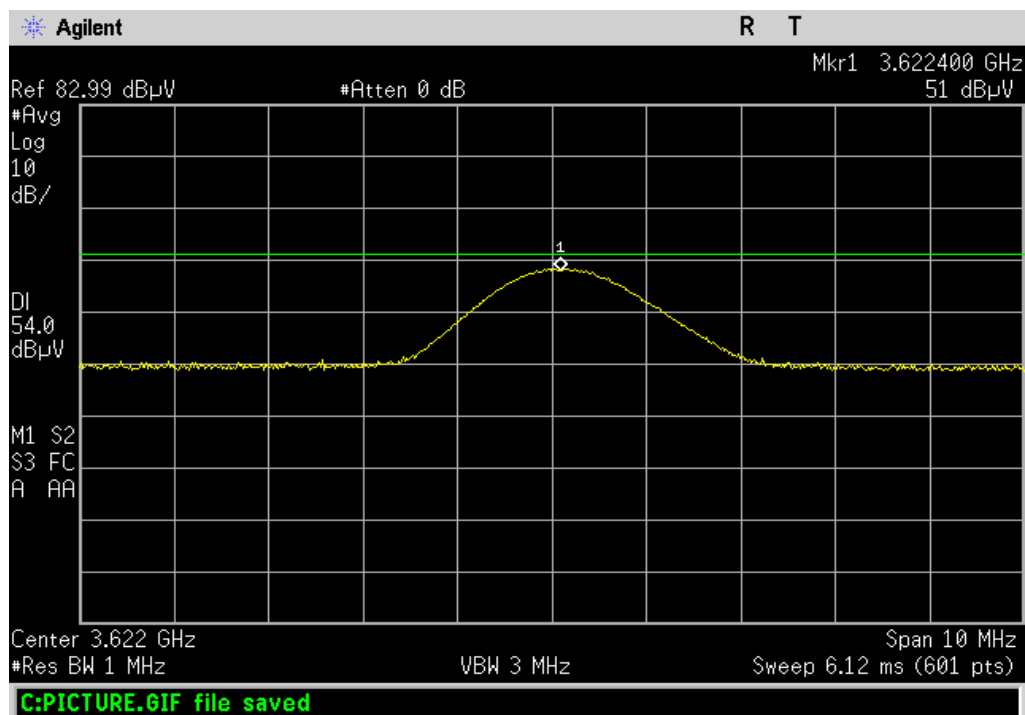
Low channel 1-10 GHz Average



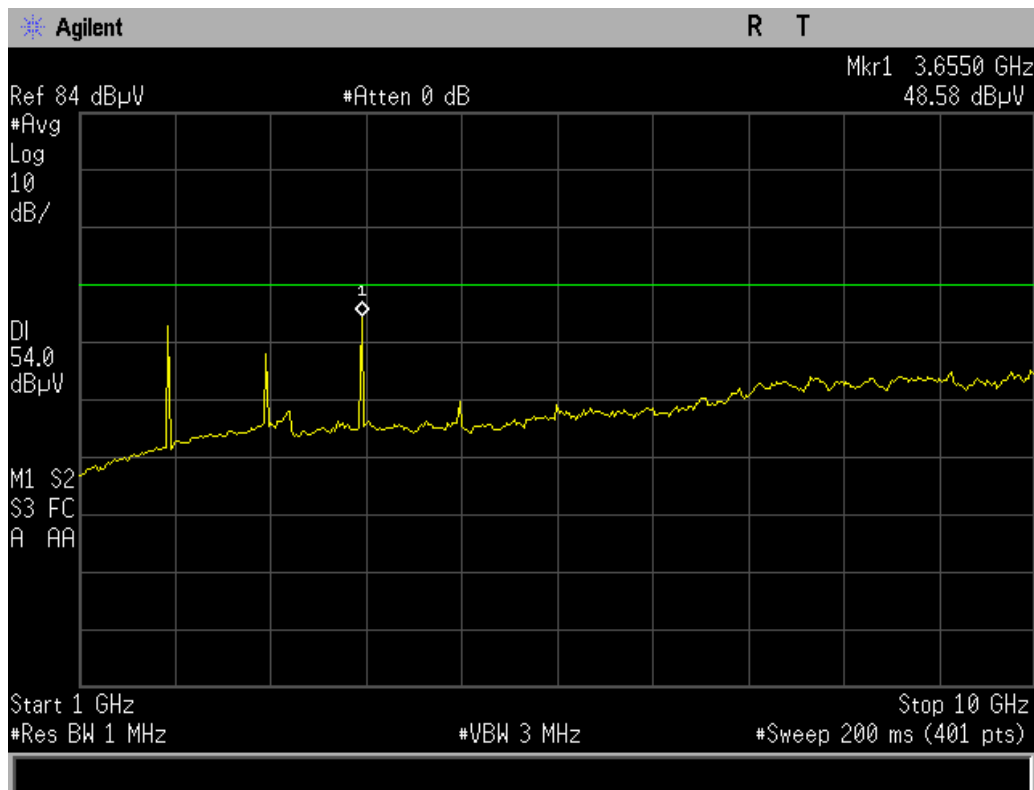
Mid channel 30MHz - 1GHz



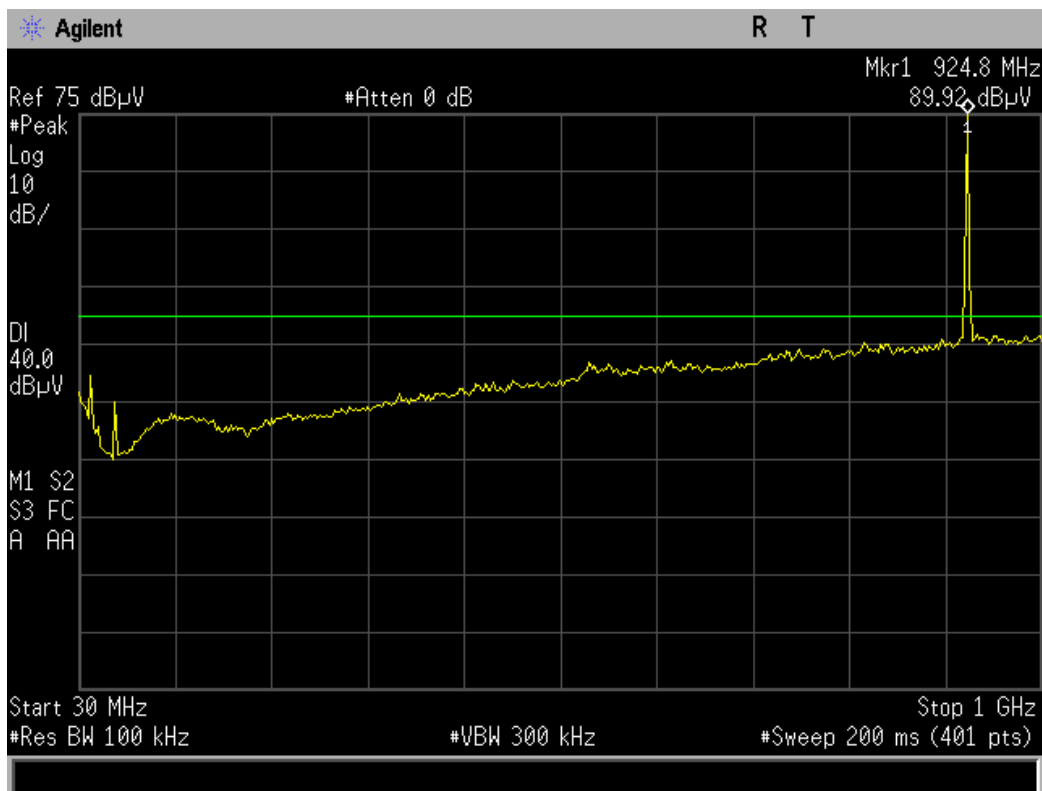
Mid channel 1-10 GHz Peak



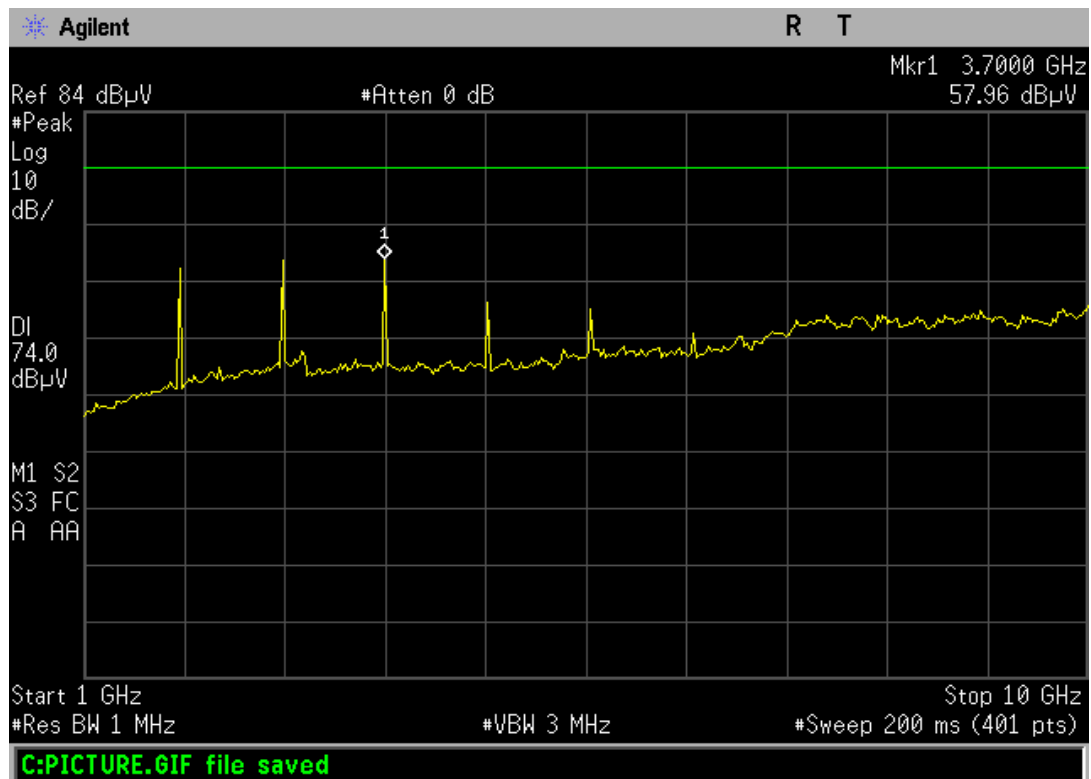
Mid channel 3.6 GHz (number of points > 2*span/RBW)



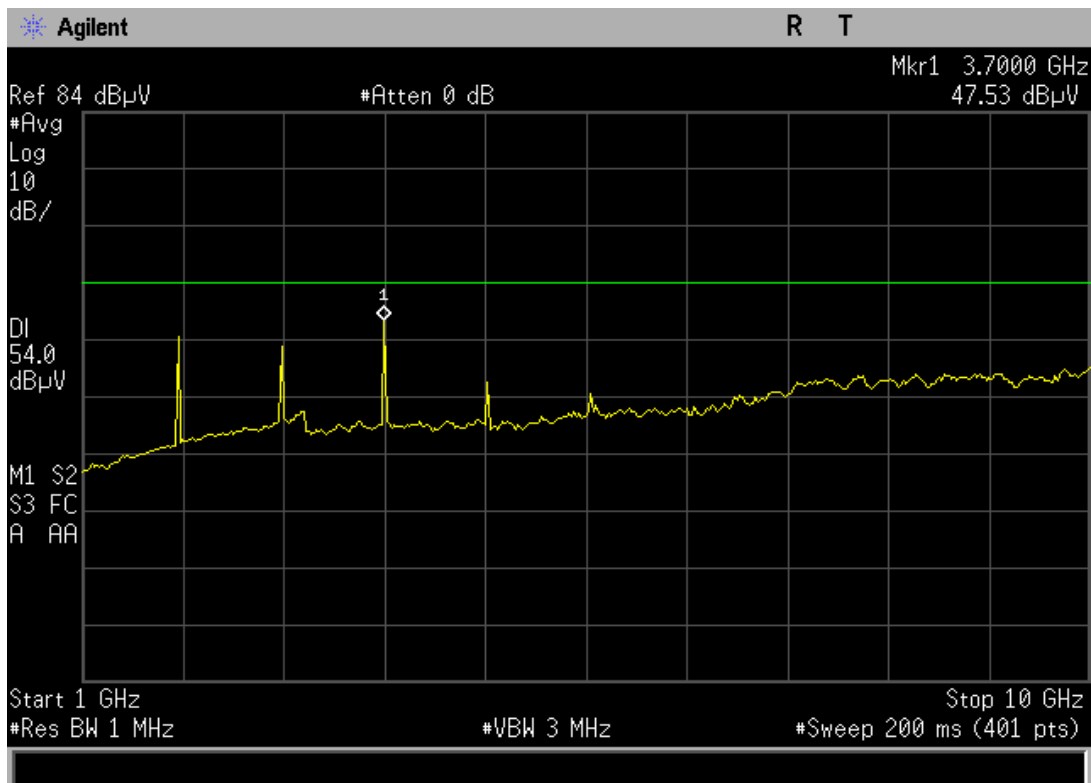
Mid channel 1-10 GHz Average



High channel 30MHz - 1GHz



High channel 1-10 GHz Peak



High channel 1-10 GHz Average



Occupied Bandwidth

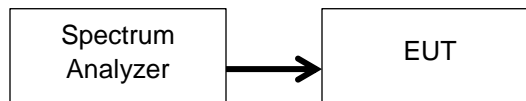
Engineer: Poona Saber

Test Date: 10/18/2016

Test Procedure

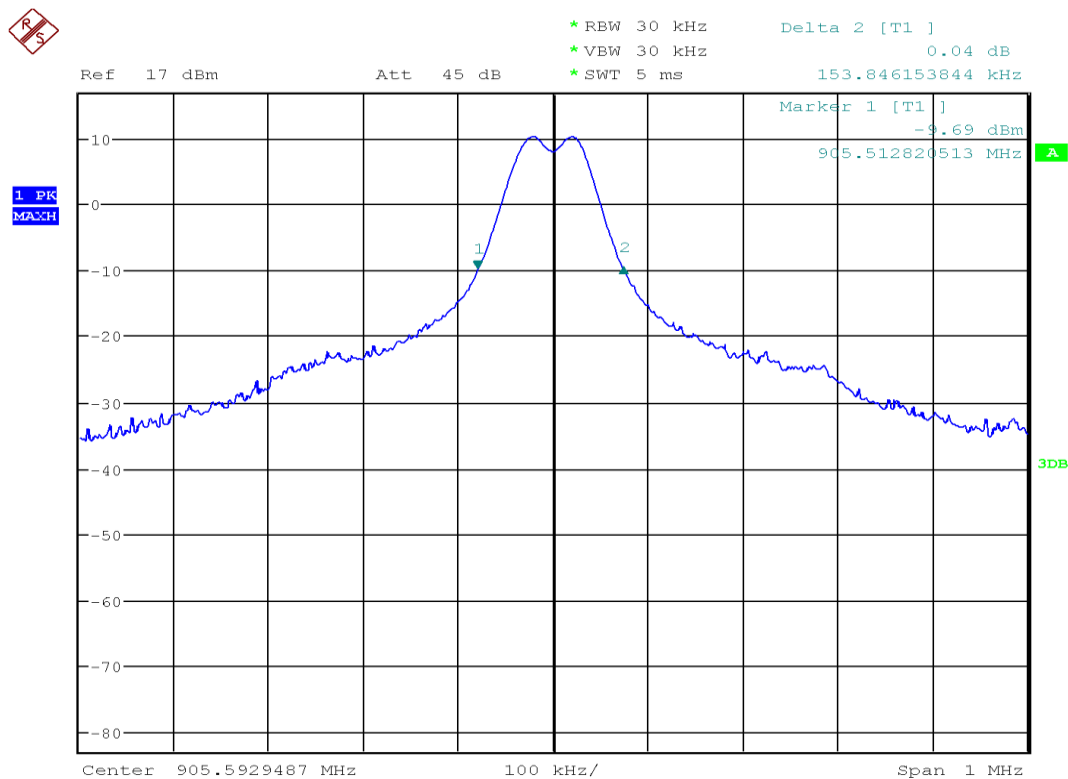
The EUT was connected directly to a spectrum analyzer. The Span was set wide enough to capture the entire transmitting spectrum and the resolution bandwidth was set to at least 1% of the span. The analyzer was set to max hold and when the entire spectrum was captured, the 20dB bandwidth was measured to verify that the bandwidth met the specification.

Test Setup



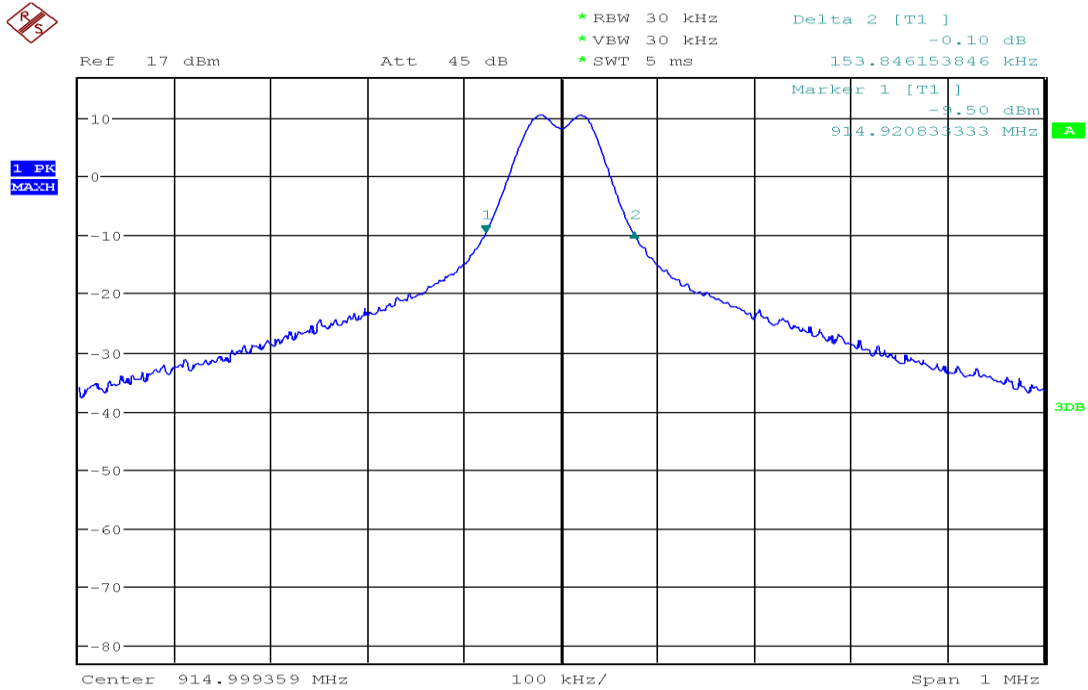
20 dB Bandwidth Summary

Frequency (MHz)	Recorded Measurement	Specification Limit	Result
905.5	153.84 KHz	500 KHz	Pass
914.99	153.84 KHz	500 KHz	Pass
924.407	155.44 KHz	500 KHz	Pass



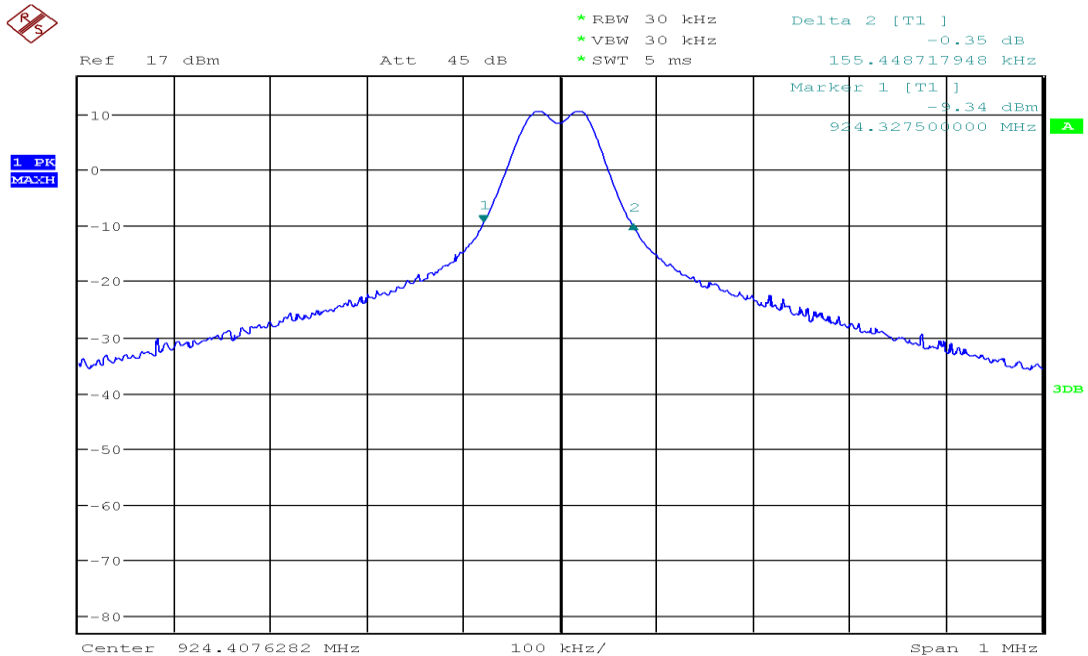
Date: 19.OCT.2016 02:22:33

Bandwidth Low channel



Date: 19.OCT.2016 02:26:08

Bandwidth Mid channel



Date: 19.OCT.2016 02:29:48

Bandwidth High channel

Average Time of Occupancy of Hopping Frequency

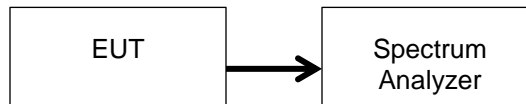
Engineer: Poona Saber

Test Date: 10/18/2016

Test Procedure

The EUT was connected directly to a spectrum analyzer. The EUT was set to hopping mode with the spectrum analyzer set to a 0 Hz span.

Test Setup



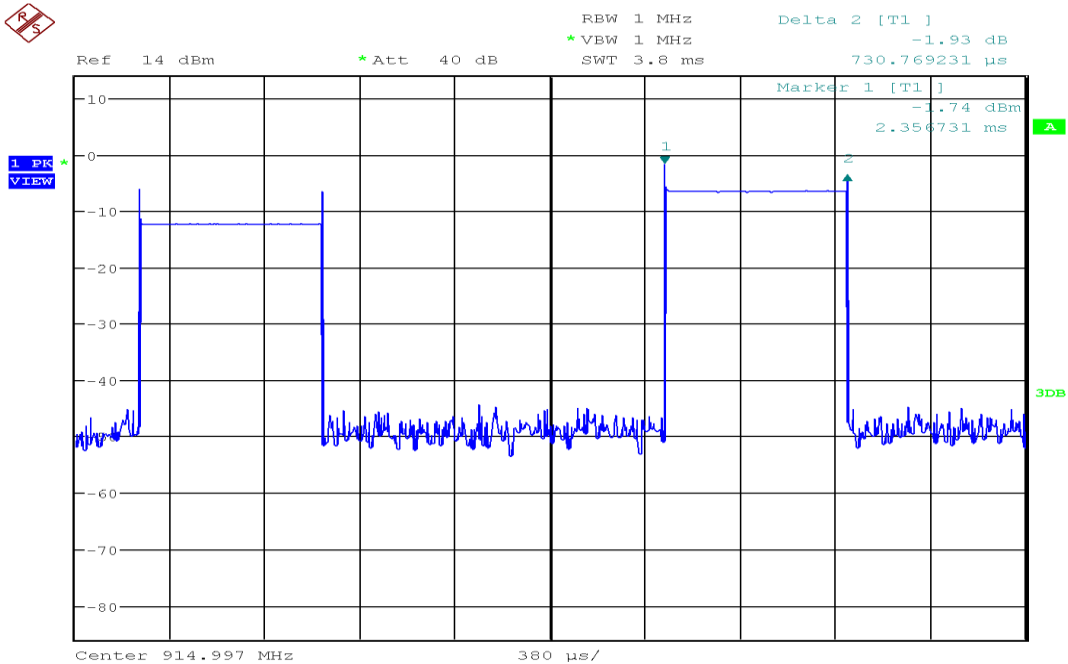
Measured/Calculated Time (Sec)	Period (Sec)	Limit (Sec)	Result
0.132	20	0.4	Pass
Channel 20dB Bandwidth	<250KHz		

Time of occupancy Calculation:

1- Single occupancy duration = 0.73 ms

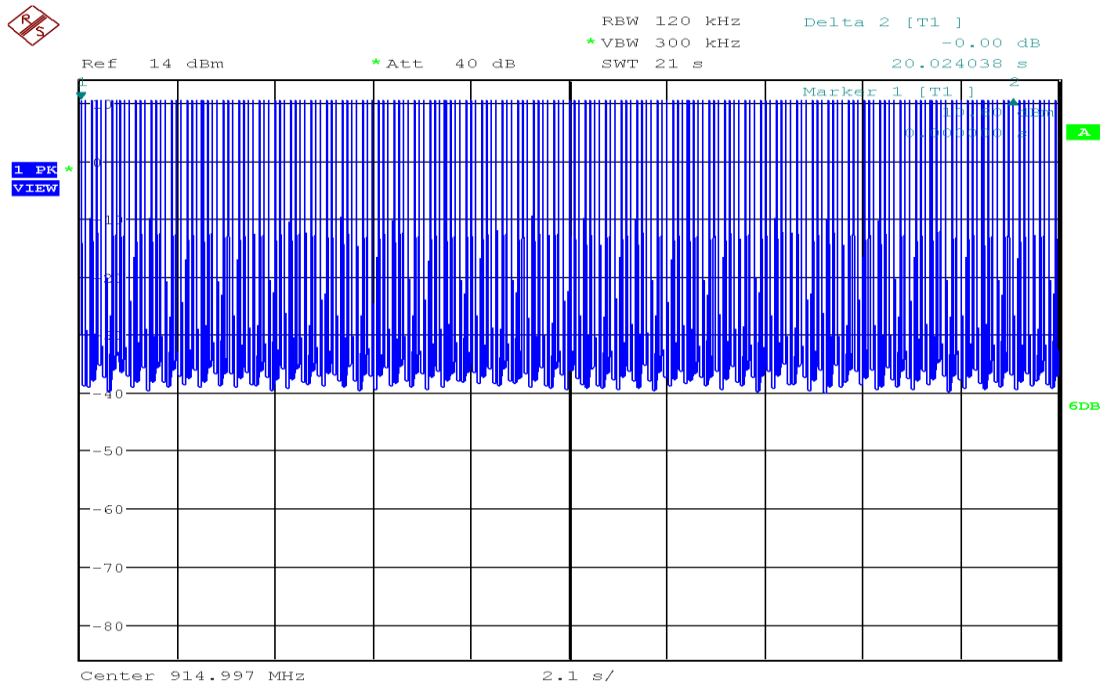
2- The minimum measured repetition of the channel occupancy in period of 20 seconds = 182

3- Time of occupancy= (single duration) x (repetition) = 132.86 ms



Date: 19.OCT.2016 02:56:07

Single Occupancy Time



Date: 19.OCT.2016 03:08:11

Minimum repetition over 20 seconds



Number of Hopping Channels

Engineer: Poona Saber

Test Date: 10/18/2016

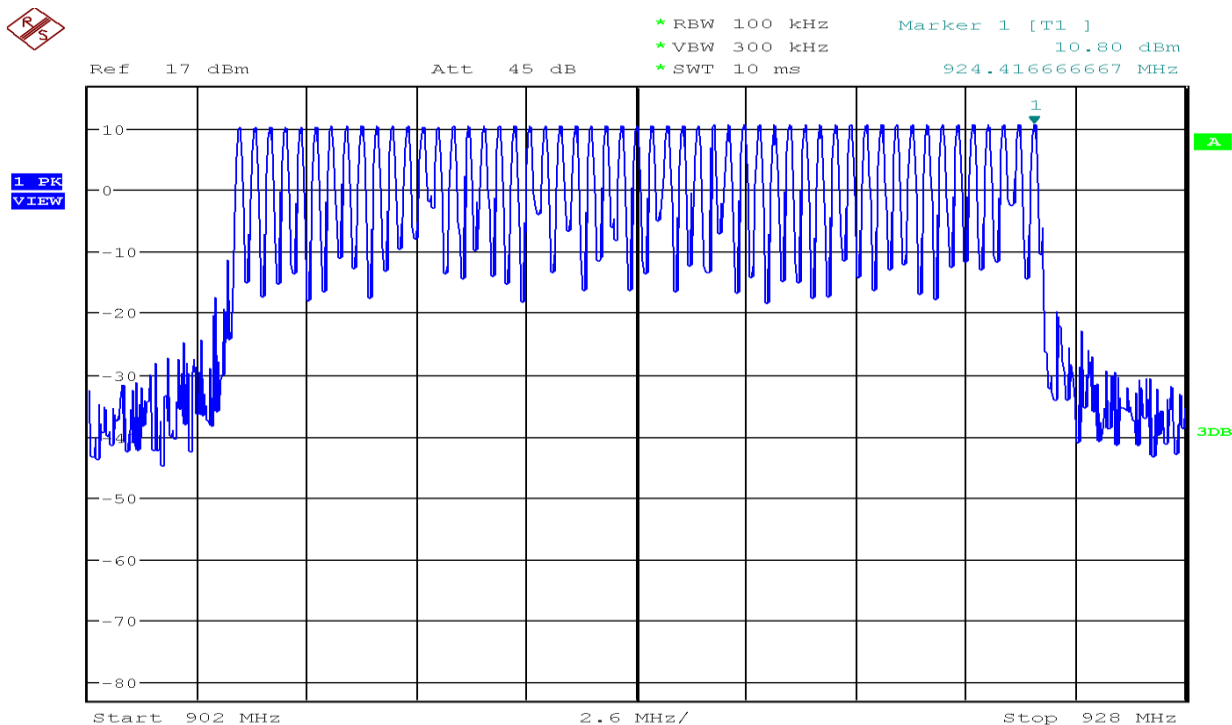
Test Procedure

The EUT was connected directly to a spectrum analyzer. The Span was set to the specified band end points. The EUT was then set to operate in hopping mode. The MAX HOLD function of the spectrum analyzer was utilized to verify the number of hopping channels.

Test Setup



Measured Number	Limit	Result
53	At least 50	Pass



Date: 19.OCT.2016 02:34:54

Number of Hopping Channels



Hopping Channel Carrier Frequencies Separation

Engineer: Poona Saber

Test Date: 10/18/2016

Test Procedure

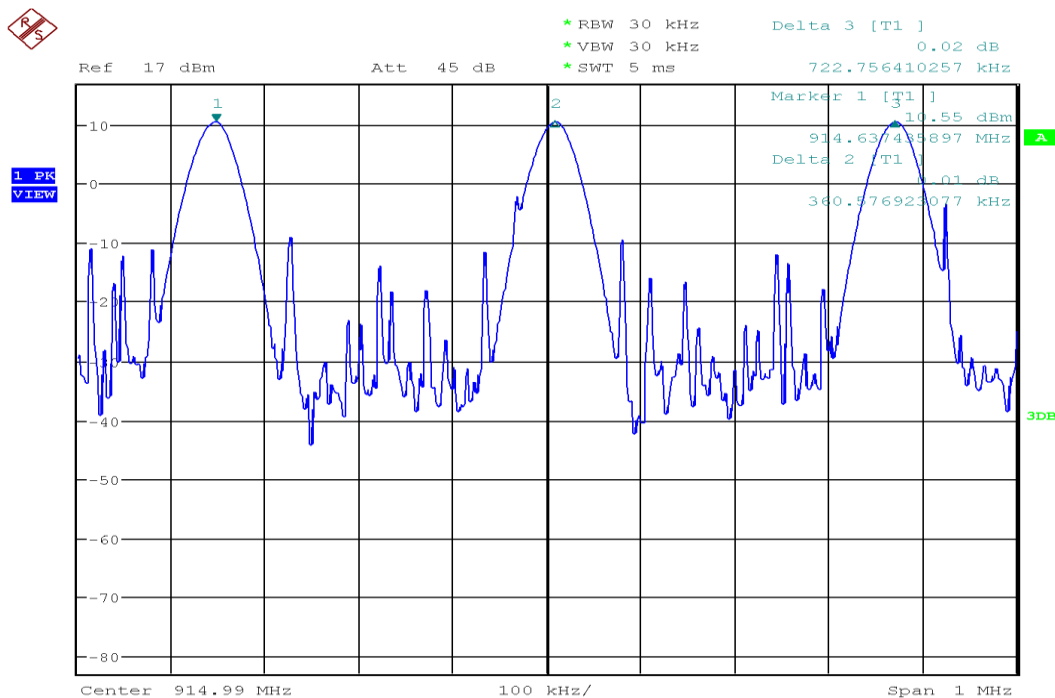
The EUT was connected directly to a spectrum analyzer.

Test Setup



Receiver Spurious Emissions Summary

Measured Separation (KHz)	Limit (KHz)	Result
350.57	Minimum 25	Pass



Date: 19.OCT.2016 01:52:18

Carrier frequency separation



Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Bi-Log Antenna	Schaffner	CBL 6111D	i00349	10/19/15	10/19/17
Horn Antenna	ARA	DRG-118/A	i00271	06/16/16	06/16/18
Spectrum Analyzer	Rohde & Schwartz	FSU	i00501	03/25/16	03/25/17
LISN	COM POWER	L1-125A	i00446	04/29/16	04/29/17
AC Power Source	Behlman	BL 6000	i00362	Verified on: 5/13/16	
EMI Analyzer	Agilent	E7405A	i00379	2/11/16	2/11/17
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/10/16	8/10/18

END OF TEST REPORT