

Test Report

Prepared for: Interface, Inc.

Model: WTS-BS-1925-2

Description: Base Station

Serial Number: FCC#3

FCC ID: 27048-1925B1

IC:

To

FCC Part 15.247 DTS

And

RSS 247, Issue 2

Date of Issue: March 26, 2021

On the behalf of the applicant:

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Attention of:

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Poona Saber
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	3/26/2020	Poona Saber	Original Document
2.0	3/31/2020	Poona Saber	Change Ronald to Ronan Updated antenna gain to 2.15 and updated the model number Added signal cable to cables info on page 7
3.0	April 1 st , 2021	Poona Saber	Modified ferrites for signal cable

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ANAB

Compliance Testing, LLC, has been accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. 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 below.

Please refer to <http://www.compliancetesting.com/labscope.html> for current scope of accreditation.



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 marked 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 Engineering Practices

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

In accordance with ANSI C63.10-2013 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 specified testing over a different temperature range. Also, unless otherwise indicated, the humidity levels were in the range of 10% to 90% relative humidity.

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

Environmental Conditions		
Temperature (°C)	Humidity (%)	Pressure (mbar)
24.7 – 27.9	44.9 – 51.5	963.5 – 970.4

EUT Description

Model: WTS-BS-1925-2

Description: Base Station

Firmware: NRF52840 processor: 0.14.6

NXP55S66 processor: 0.4.3

Serial Number: FCC#3

Additional Information: Base station is part of the system working with a remote load cell used in oil well pump jacks. It is located in the electronics cabinet around 100 ft away from the remote load cell and uses the data from the remote to calculate the load and position of the well string. It communicated on the 2.5 GHz frequency bands using Bluetooth low energy and enhanced shock burst protocols.

The base station comes with a power cable and a Signal Cable. The cables provided by Interface need to be used in order to comply with FCC regulations.

The signal cable is used in the final configuration of the device on site, and It contains analog outputs that are connected to our customer's electronics.

EUT Operation during Tests

The power cable on the base station is an 18-inch cable connected to a 12 VDC battery. The signal cable was not used or terminated during testing.

The base station contains a pre certified radio with FCC ID# XPYNINAB30 and ISED # 8595A-NINAB30. In this report some characteristics of the radio within 2402-4280 MHz frequency band like the spurious emission in restricted bands plus band edge limits of the radio in the new host device being the base station is evaluated. The radio is being put on its maximum power capability.

For other characteristics of the radio the original data from the FCC and ISED ID above is being used and referenced.

Base station is tested with a 2.15 dBi Omni directional antenna (SKU A2D2RAV3H) connected to a 13 ft long cable on low, mid and high channel with highest power and enhanced shock burst protocol.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	2.15 dBi Omni Antenna	Data alliance	A2D2RAV3H	-
1	12V Battery	Interstate Batteries	850281	-
1	Ferrite-on power cable	Laird signal integrity	28b0563-200	-
1	Ferrite-on Signal cable	Laird signal integrity	28b0562-200	-

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	RP-SMA extension LMR200 low loss cable	3.96	Y	NA	N
1	Signal cable	0.723	NA	NA	Y

Modifications:

- 1- Ferrite (model# 28b0563-200) with one wrap on the power cord.
- 2- Ferrite (model# 28b0562-200) on the signal cable.
- 3- Following items from the schematic has been changed
 - SPI Bus: Changed R119, R120, R121, R122 and R123 to 47.5 Ohm part number ERJ-2RK-F47R5X
 - I2C Bus: Changed R42, R43, R46, R47, R124 and R125 to 59 Ohm part number ERJ-2RK-F59R0X
 - Removed R68
 - Changed zero-Ohm resistors R21, R23, R29, R54, R55 to Ferrites 240-2371-6-ND 600 Ohm 0603
 - Changed R82 and R83 to 47.5 Ohm part number ERJ-2RK-F47R5X

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	N/A	Not tested-use data from the original testing of the module
15.247(b)	Conducted Spurious Emissions	N/A	Not tested-use data from the original testing of the module
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Emissions at Band Edges	Pass	
15.247(a)(2)	Occupied Bandwidth	N/A	Not tested-use data from the original testing of the module
15.247(e)	Transmitter Power Spectral Density	N/A	Not tested-use data from the original testing of the module
15.207	A/C Powerline Conducted Emissions	N/A	Not tested-use data from the original testing of the module
RSS-Gen §7	Receiver Spurious Emission Limits	N/A	Not tested-use data from the original testing of the module

Radiated Spurious Emissions

Engineer: Poona Saber

Test Date: 3/24/2021

Test Procedure

Radiated Spurious Emissions: 30 – 1000 MHz

The EUT was tested in a semi-anechoic test chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for Radiated Emissions. The EUT was tested by rotating it 360° with the antennas in both the vertical and horizontal orientation and was raised from 1 to 4 meters to ensure the TX signal levels were maximized.

All emissions from 30 MHz to 1 GHz were examined against the restricted frequency bands of 15.205 and 15.209 limits at radio being put on low, mid and high channels at the maximum power setting.

Measured Level includes receive antenna and receiver cable and pre-amplifier correction factors.

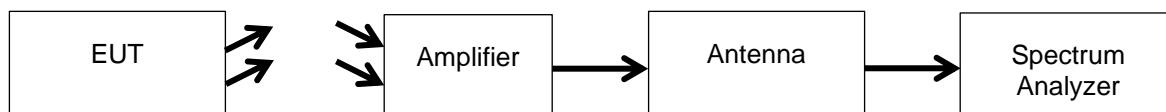
Correction factors were input into the spectrum analyzer before recording "Measured Level".

RBW = 100 KHz

VBW = 300 KHz

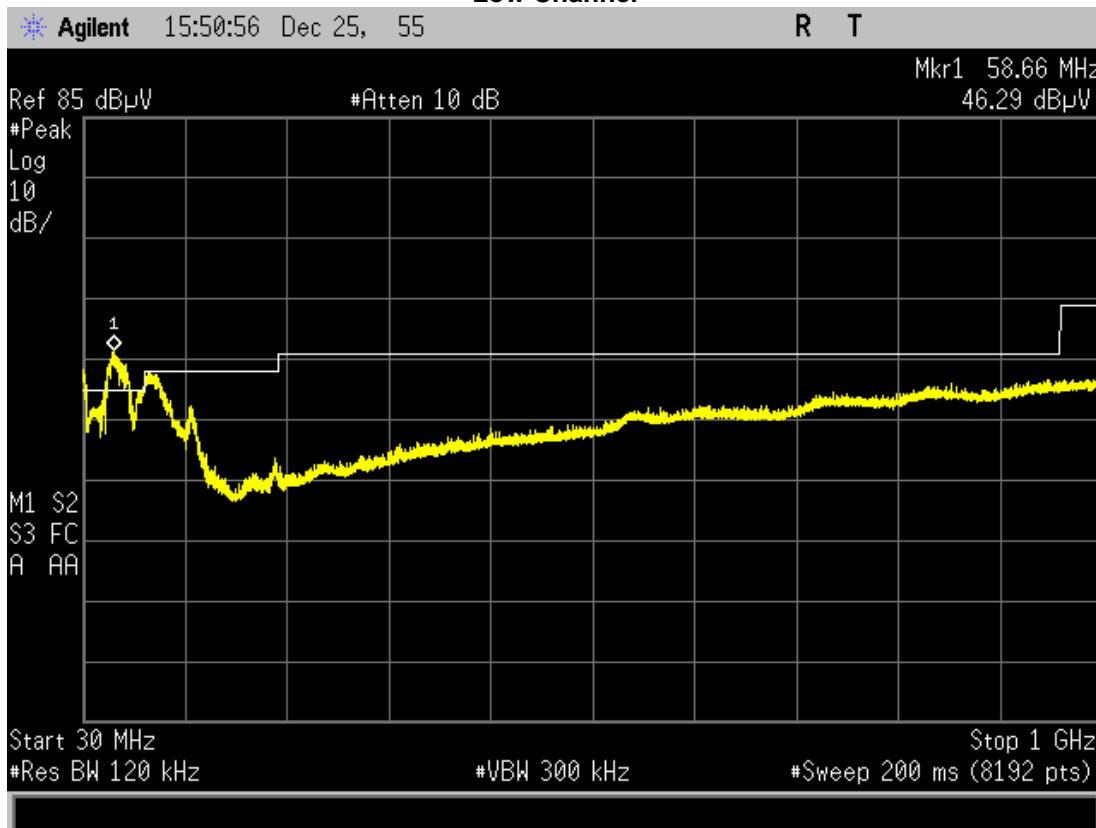
Detector – Peak

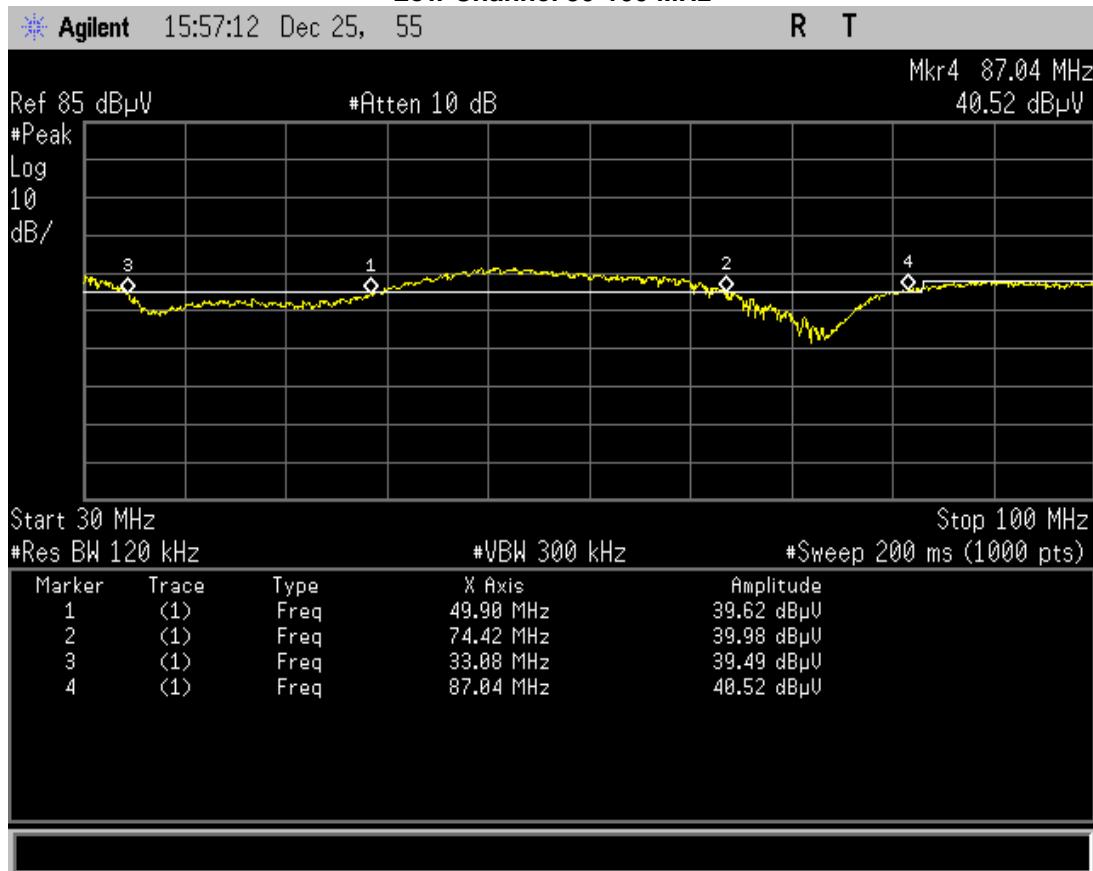
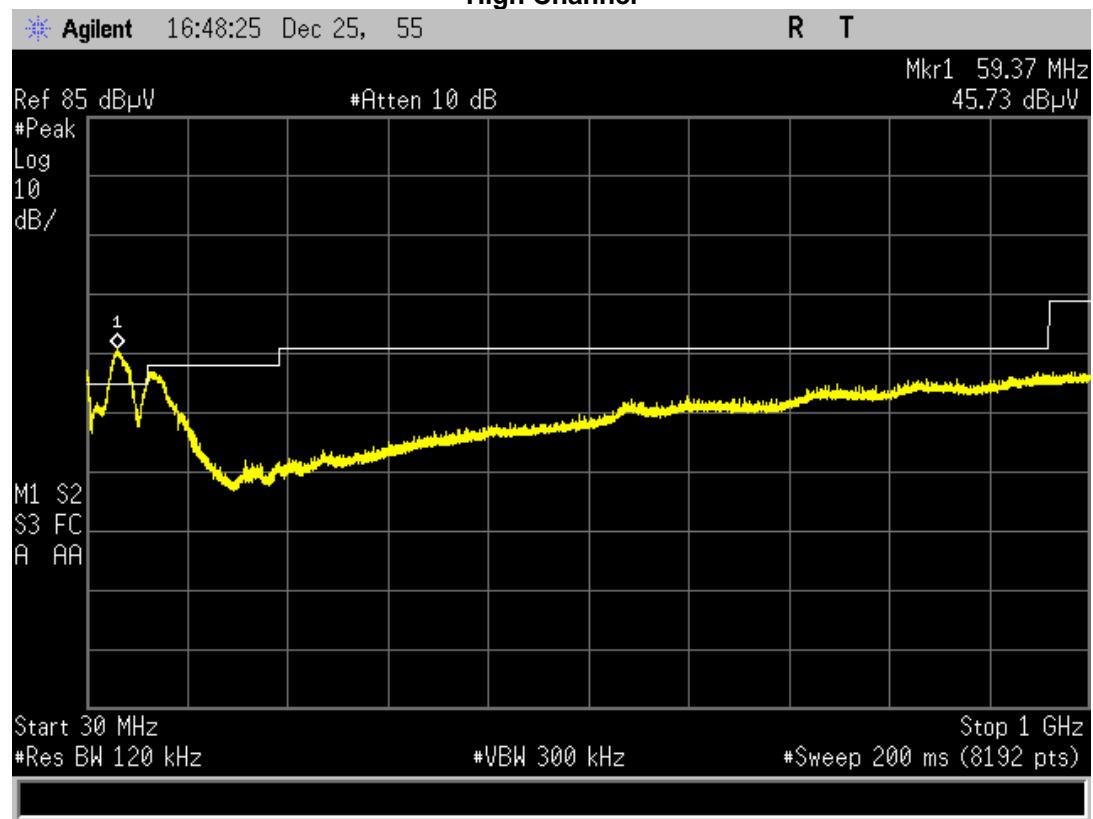
Test Setup

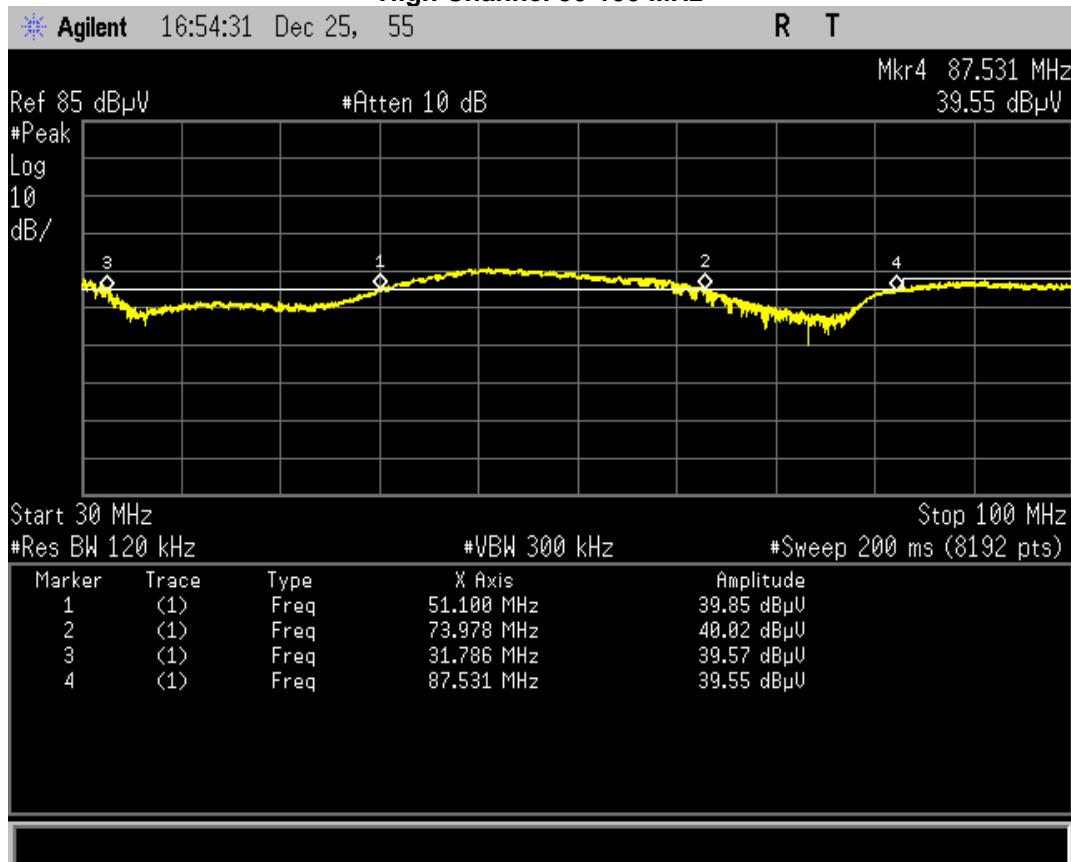
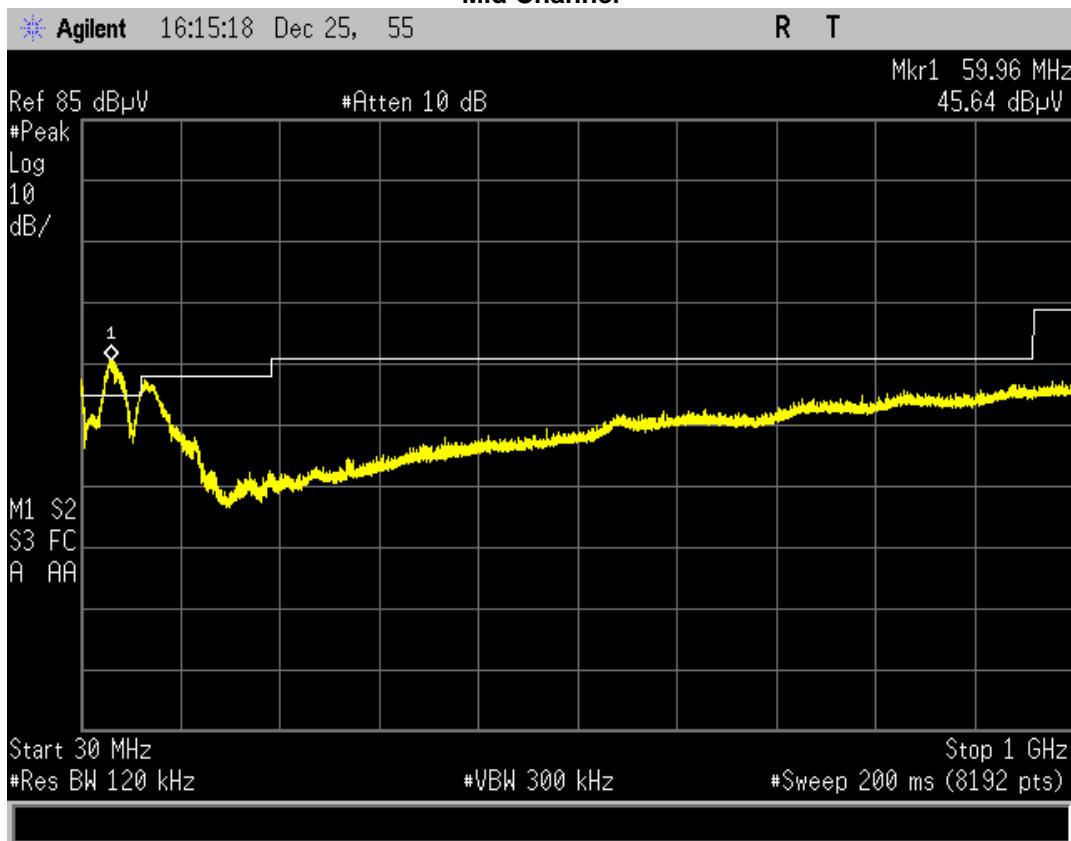


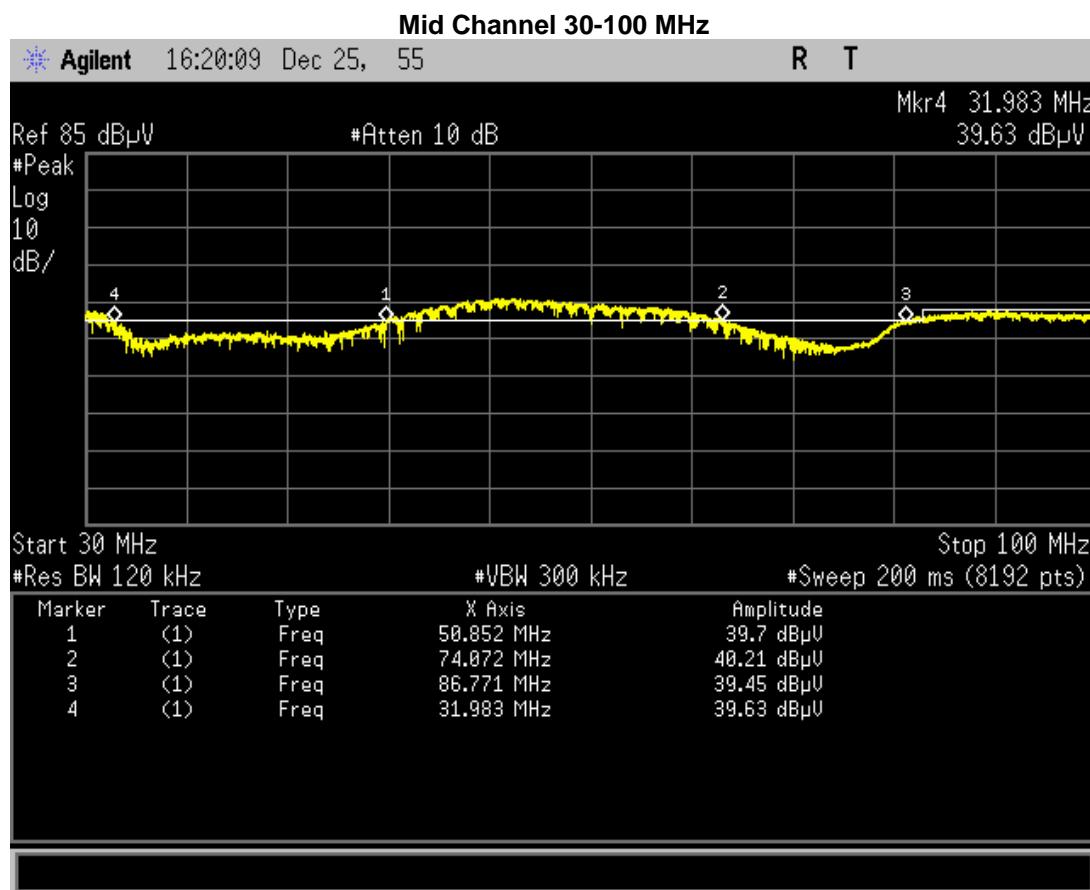
Radiated Spurious Emissions Test Data: 30 MHz – 1000 MHz

Low Channel



Low Channel 30-100 MHz

High Channel


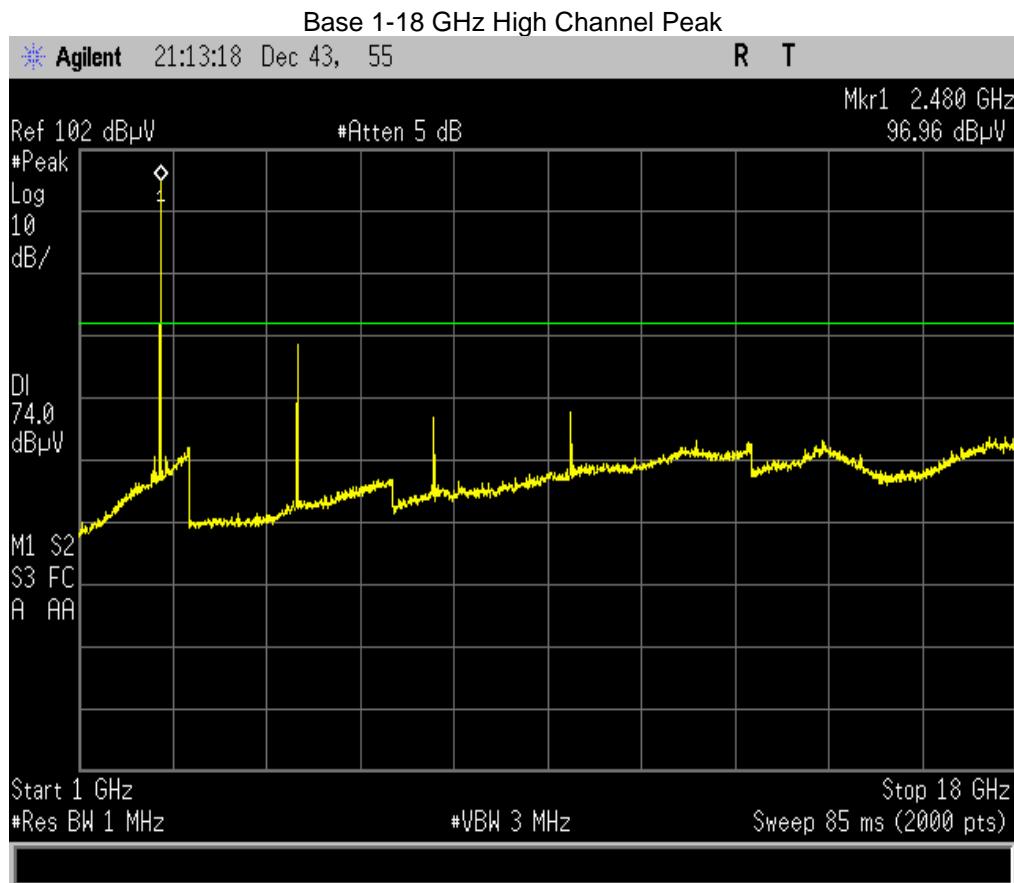
High Channel 30-100 MHz

Mid Channel




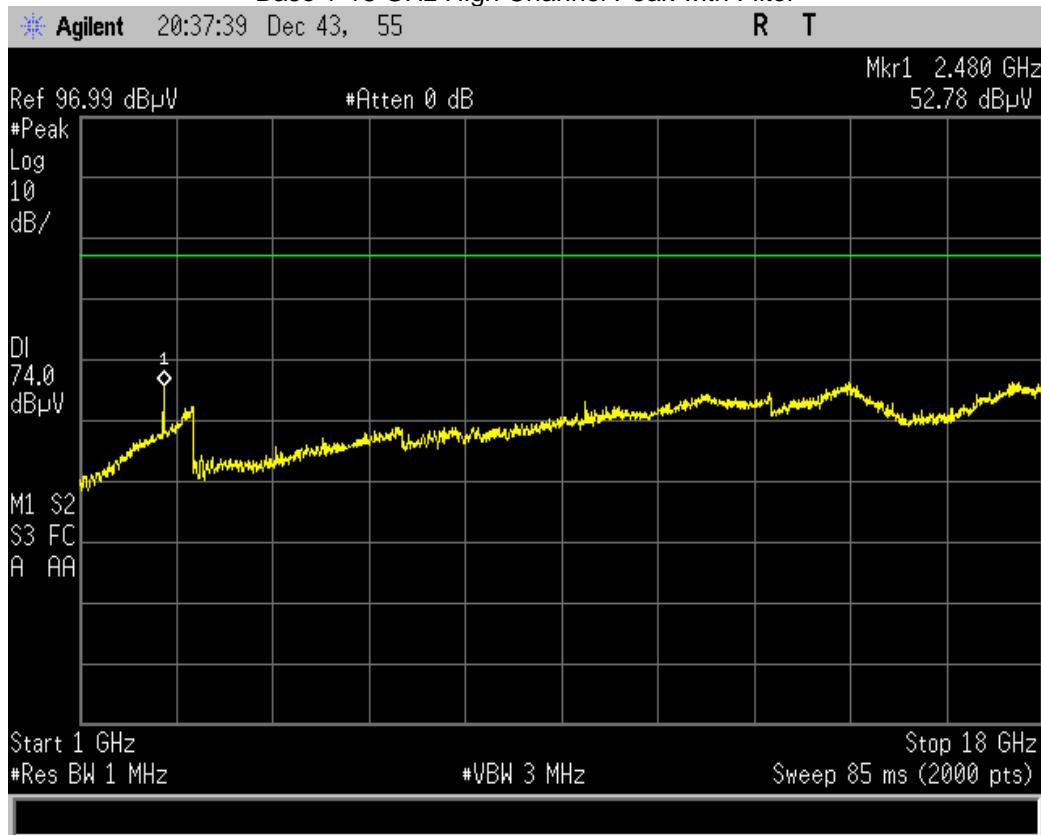
Test Procedure for Radiated Spurious Emissions above 1 GHz

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. The antenna, band reject filter, amplifier and cable correction factors were input into the spectrum analyzer before recording the Measured Level to ensure accurate readings. The spectrum for each tuned frequency was examined to the 10th harmonic.

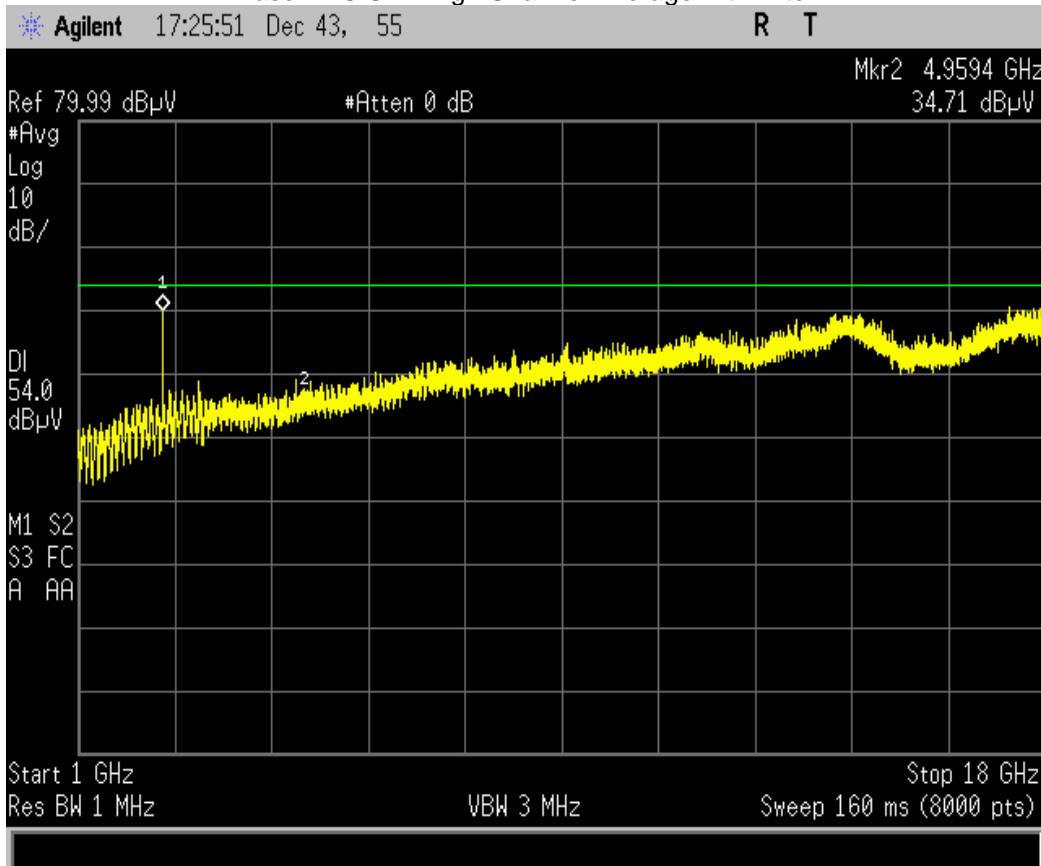
Test Setup



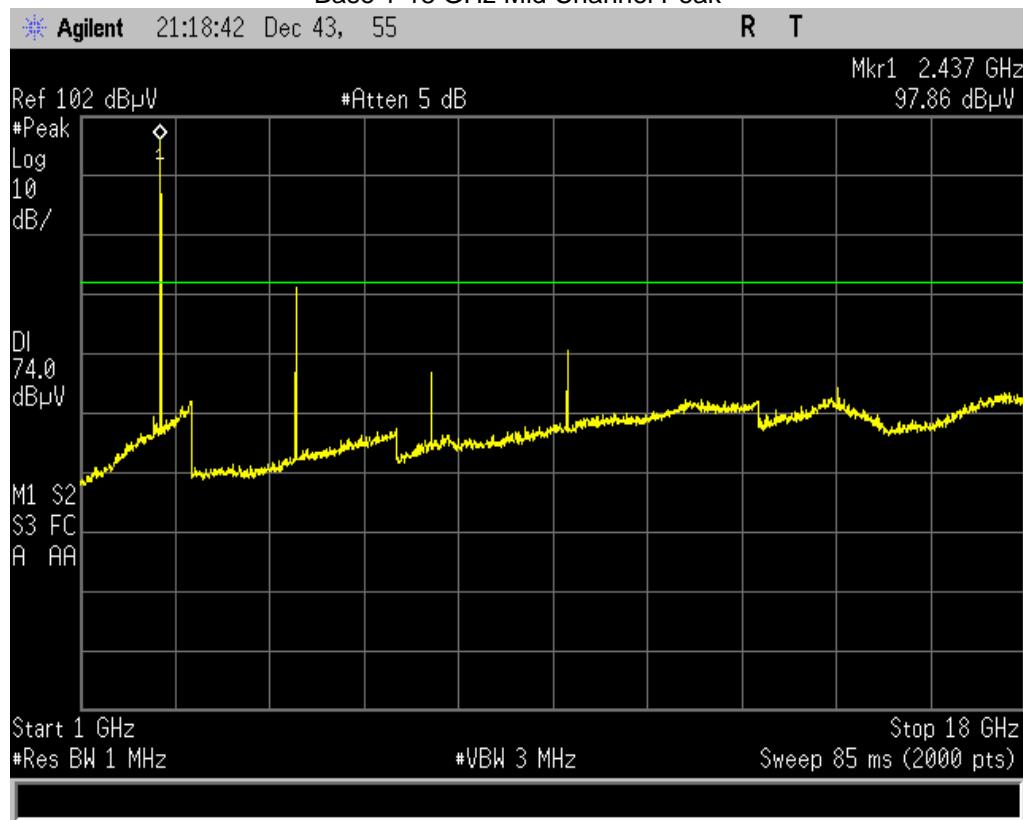
Base 1-18 GHz High Channel Peak with Filter



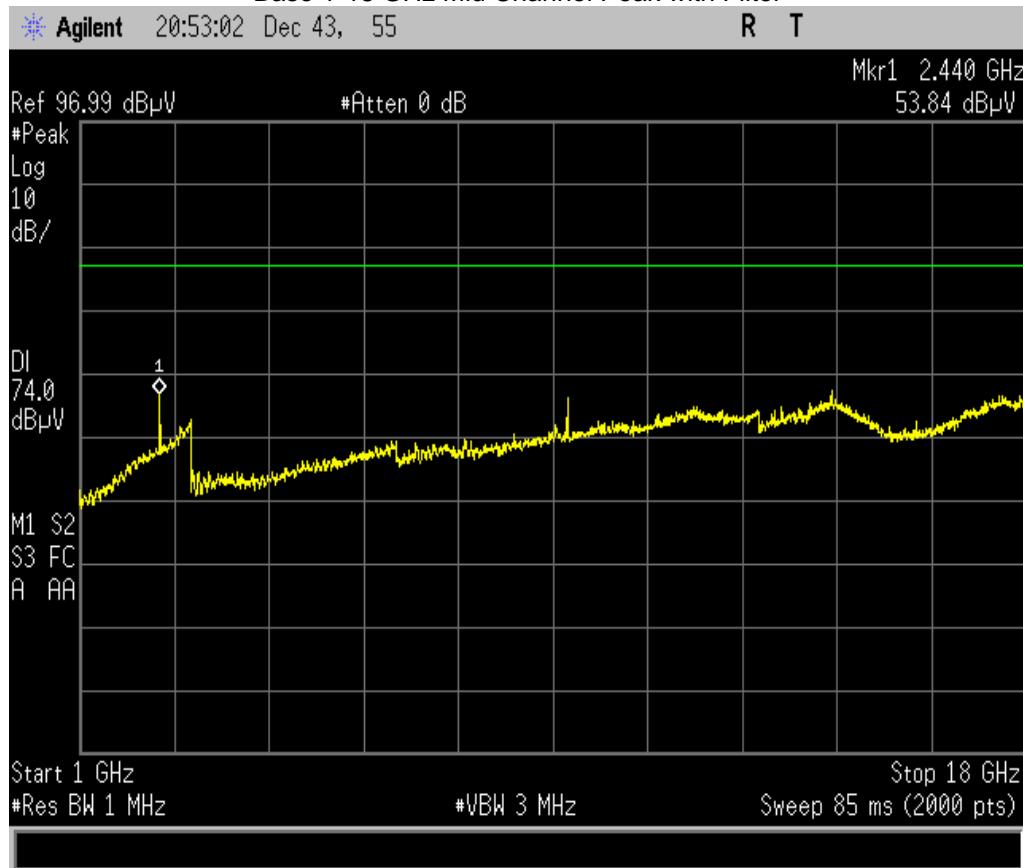
Base 1-18 GHz High Channel Average with Filter



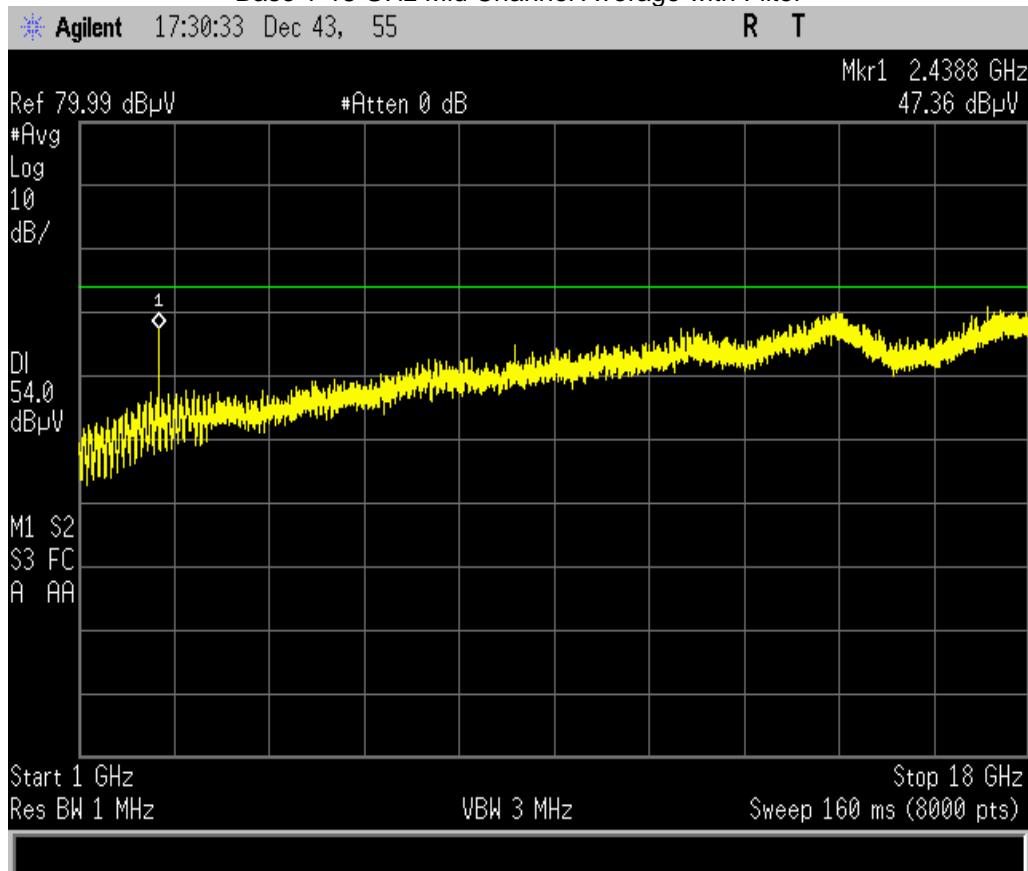
Base 1-18 GHz Mid Channel Peak



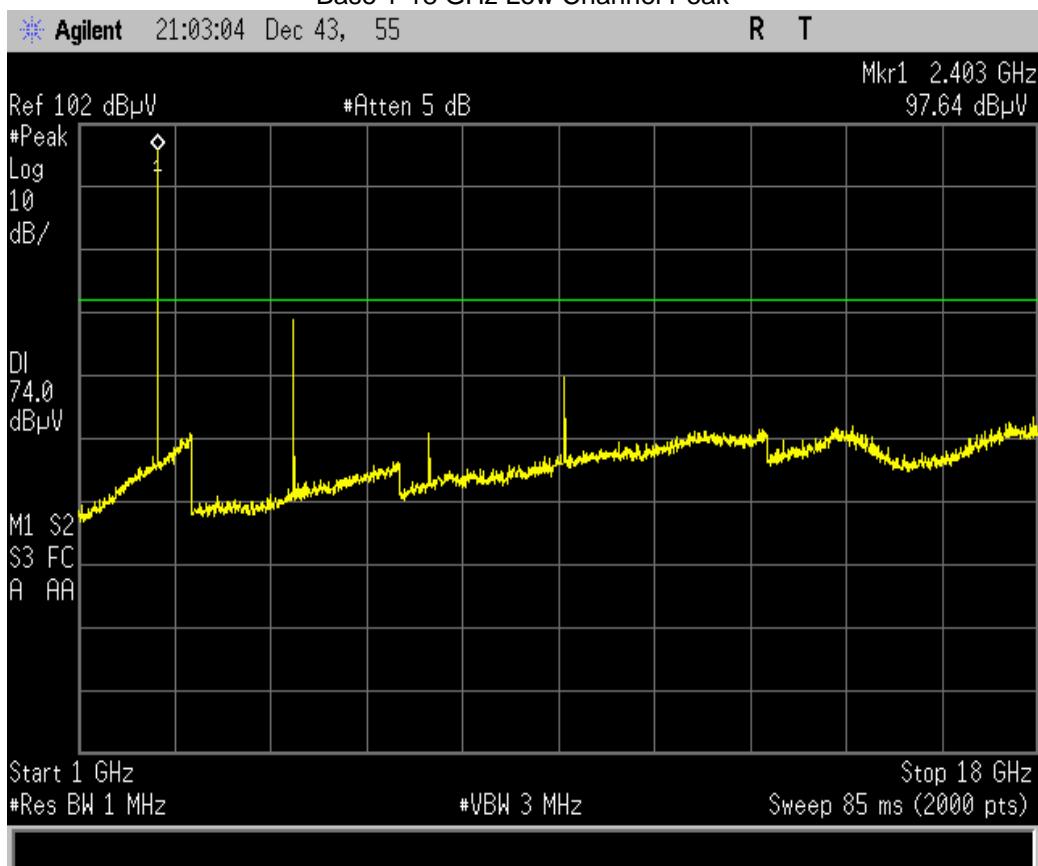
Base 1-18 GHz Mid Channel Peak with Filter



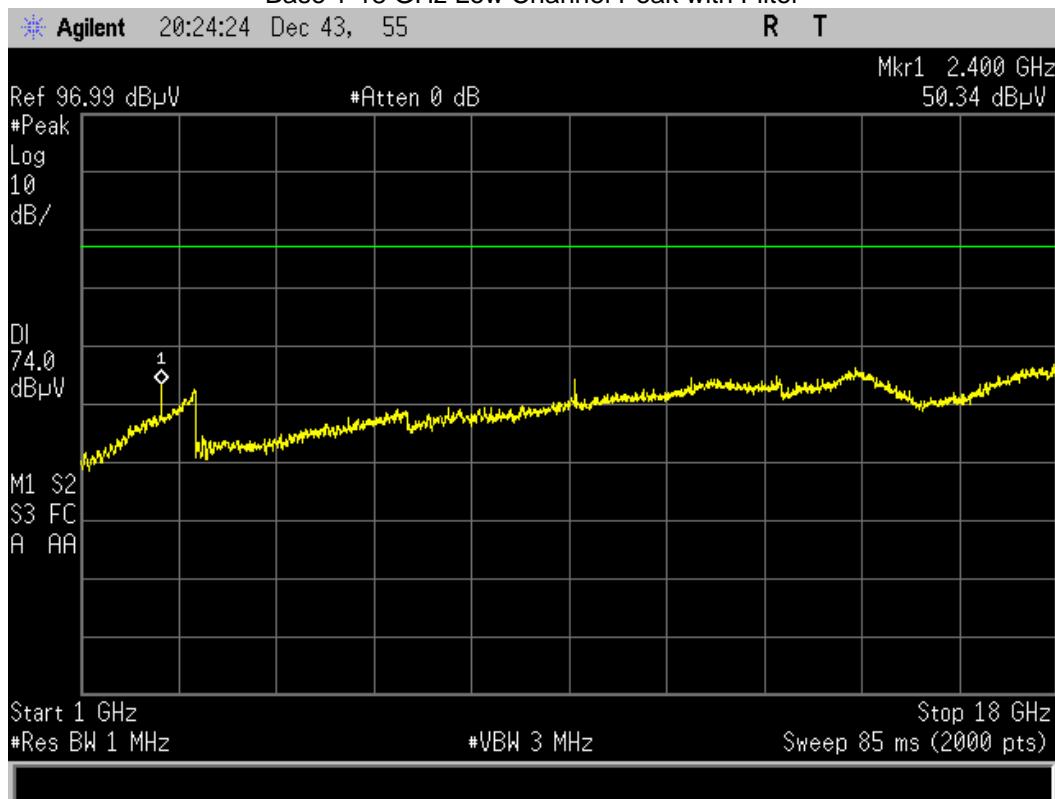
Base 1-18 GHz Mid Channel Average with Filter



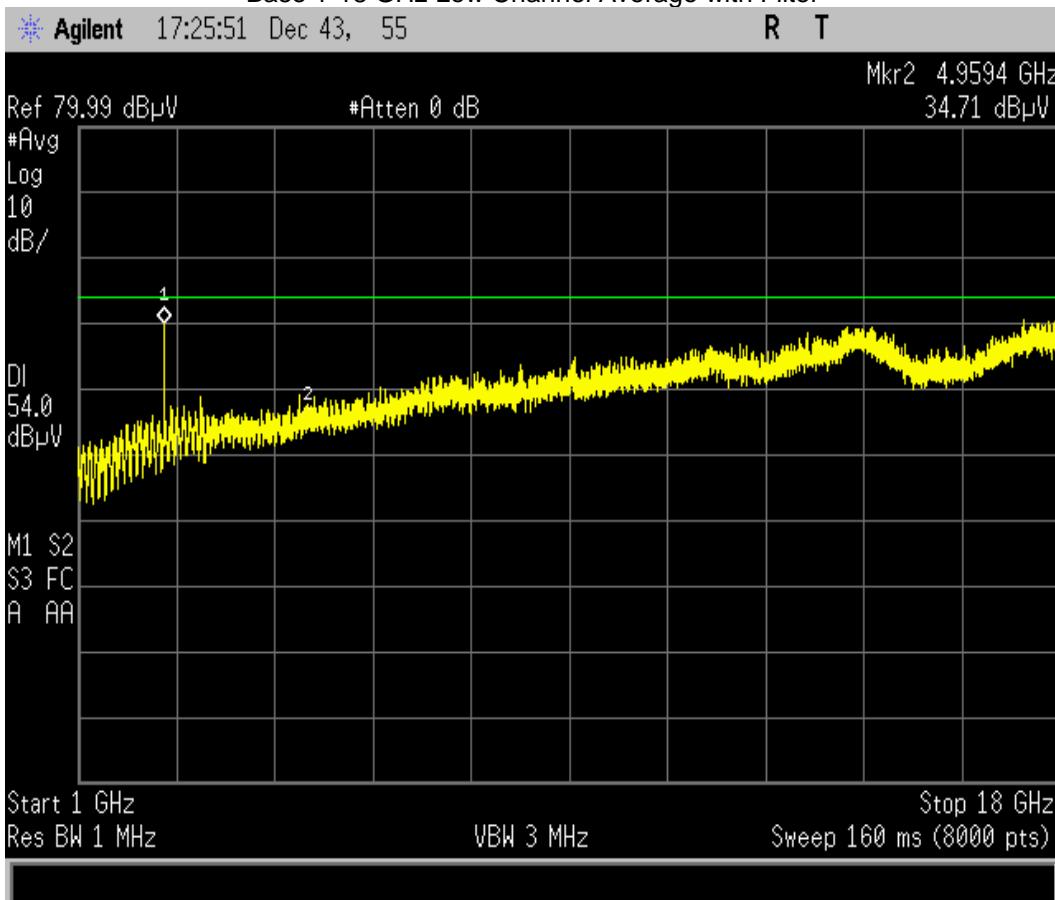
Base 1-18 GHz Low Channel Peak



Base 1-18 GHz Low Channel Peak with Filter



Base 1-18 GHz Low Channel Average with Filter



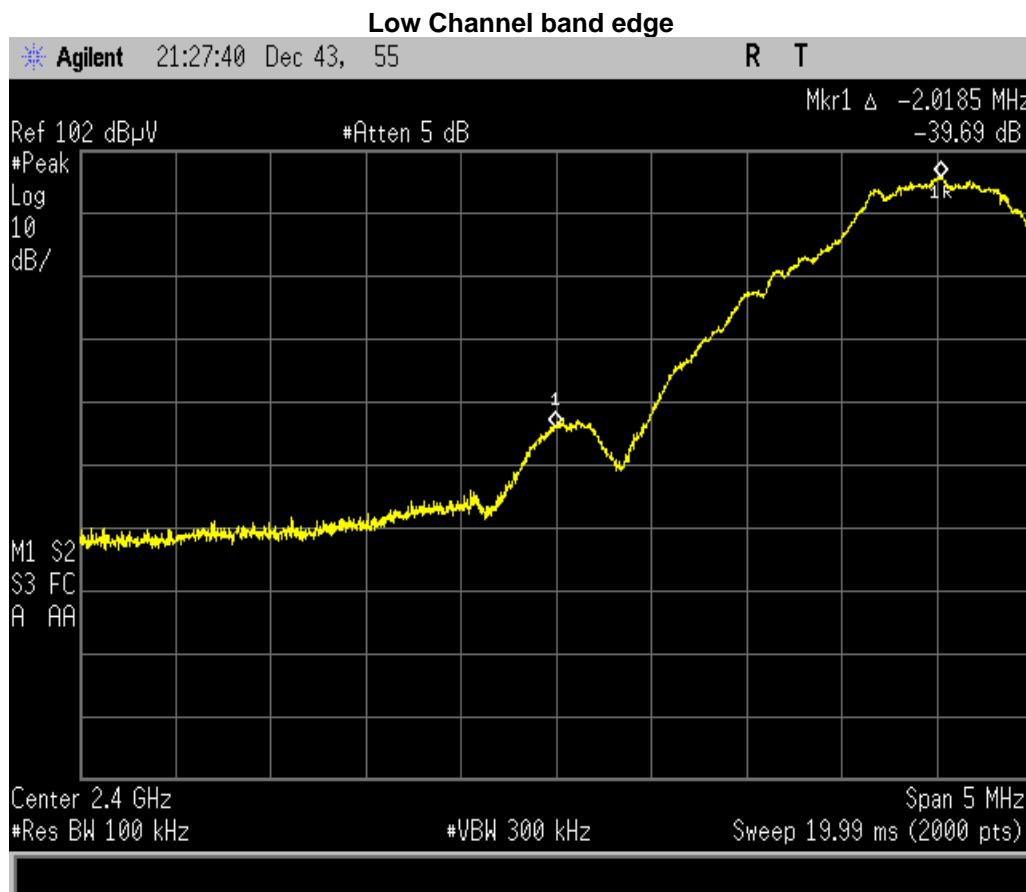
Emissions at Band Edges
Engineer: Poona Saber

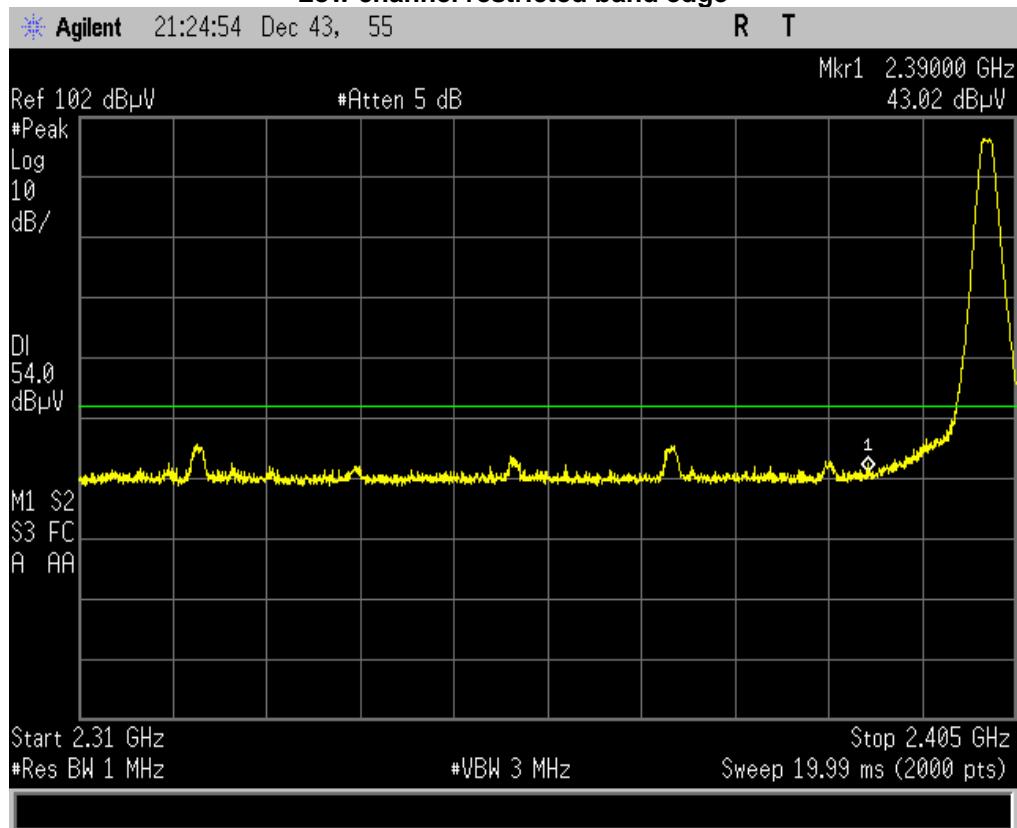
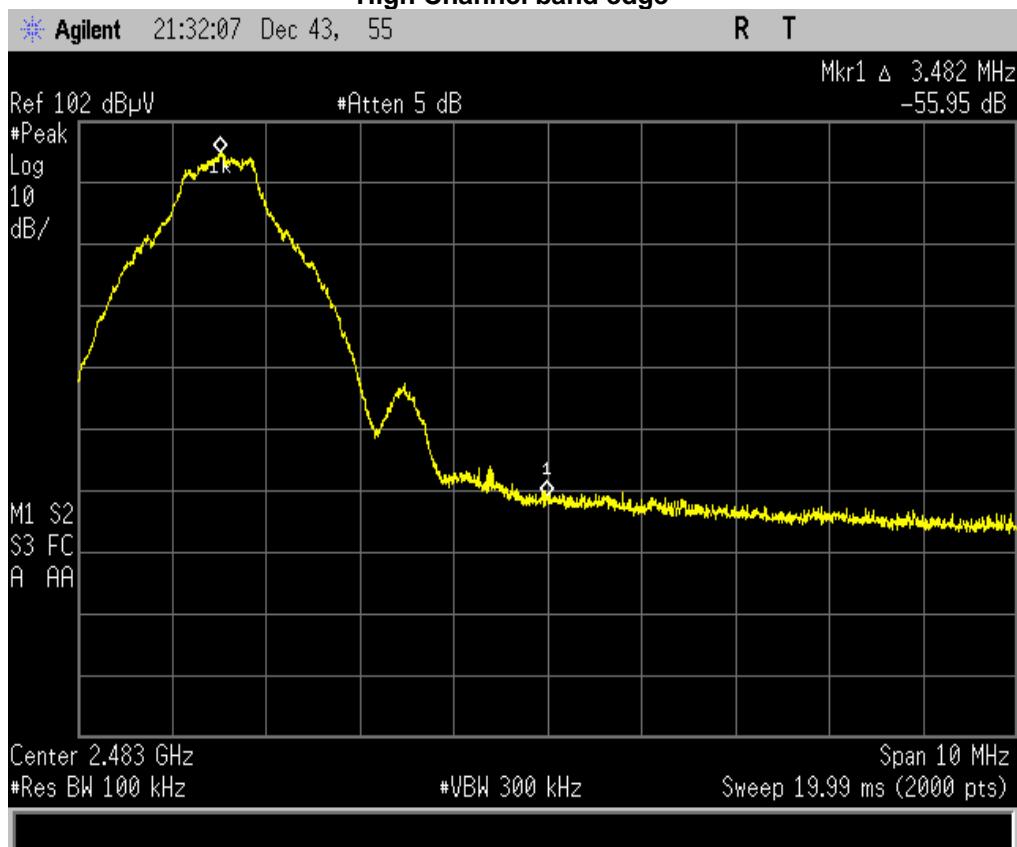
Test Date: 3/23/2021

Test Procedure

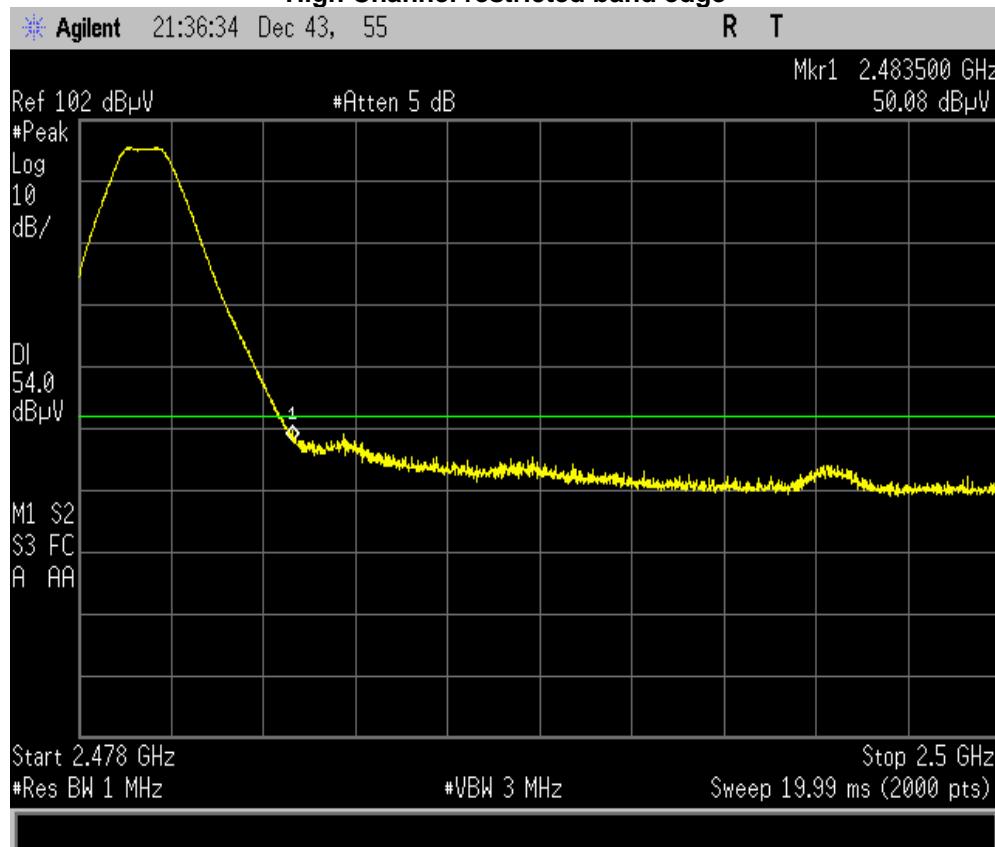
The EUT was tested in a semi-anechoic chamber set 3m from the receiving antenna. A spectrum analyzer was used to verify that the EUT met the requirements for band edge and restricted band for both peak and average measurements. The cable and antenna correction factors were input into the analyzer as a reference level offset to ensure accurate readings. For the restricted band the amplifier and band reject filter correction factors were also input to the spectrum analyzer.

Band Edge Test Setup

Band Edge Emissions


Low channel restricted band edge

High Channel band edge


High Channel restricted band edge



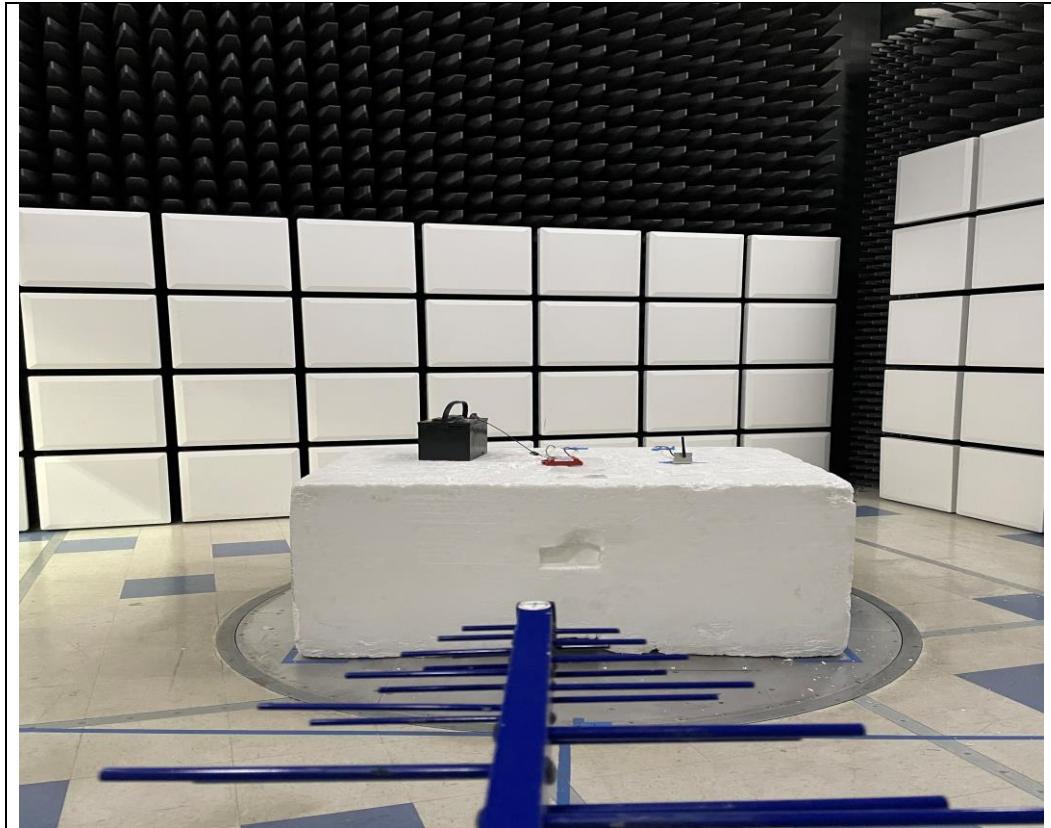
Test Equipment Utilized

Description	MFG	Model Number	CT Asset Number	Last Cal Date	Cal Due Date
Bi-Log antenna	Chase	CBL6111C	i00267	8/28/20	8/28/22
Horn Antenna	ARA	DRG-118/A	i00271	8/3/20	8/3/21
Horn Antenna 18-40 GHz	EMCO	3116	I00085	2/22/21	2/22/23
Spectrum Analyzer	Agilent	E4407B	i00331	12/28/20	12/28/21
Ultra Wideband LNA 10MHz-45GHz	RF-Lambda USA	RLNA00M45GA	I00555	Functional Verification	Functional Verification
1-40GHz preamplifier	Miteq	AMF-6F-18004000-29-8P	I00461	Functional Verification	Functional Verification

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.

RF Radiated test setup photos

30 MHz - 1GHz



1-18 GHz



18-26 GHz

