Compliance Testing, LLC
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http://www.ComplianceTesting.com
info@ComplianceTesting.com

Test Report

Prepared for: Freewave Technologies

Model: LRS455-C-MS

Description: 435-470MHz transceiver designed for industrial use

Serial Number: 460-2456

FCC ID: KNY821191151819
IC: 2329B-LRS455

To

FCC Part 90
And
RSS-119

Date of Issue: May 17, 2018

On the behalf of the applicant:	**Freewave Technologies** **5395 Pearl Parkway** **Suite 100** **Boulder, CO 80301**
Attention of:	**Riaz Momand, Sr. Compliance Engineer** **Ph: (510)304-7460** **E-Mail: rmomand@freewave.com**

Prepared By
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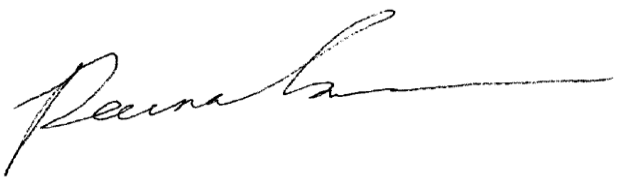
Project No: p1840012



Poona Saber
Project Test Engineer

Test Report Revision History

Revision	Date	Revised By	Reason for Revision
1.0	May 17, 2018	Poona Saber	Original Document
2.0	May 21, 2018	Poona Saber	-Revised test procedure on page 17 -Added attenuator on page 10 -Added comment regarding using previous data for modular approval -Added comment on page 6 regarding referencing previous data for non-modular to modular certification

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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 below.

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

Testing Certificate Number: **2152.01**

ACCREDITED
TESTING CERT
#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 the 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.

Test and Measurement Data

All tests and measurement data shown were performed in accordance with FCC Rules and Regulations, Volume II, Part 2, Subpart J, Sections 2.947, 2.1033(c), 2.1041, 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, and the following individual Parts: FCC Part 90.

Standard Test Conditions and Engineering Practices

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

In accordance with ANSI/TIA 603C, 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.

Environmental Conditions		
Temp (ºC)	**Humidity (%)**	**Pressure (mbar)**
25.3	28.6	969

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

EUT Description
Model: LRS455-C-MS
Description: 435-470MHz transceiver designed for industrial use
Firmware: NA
Software: 1.74b1
Serial Number: 460-2456
Additional Information:
The EUT is a 435-470 MHz transceiver designed for industrial use. It has an FCC ID: KBY821191151819 and per changing of some parts it is getting tested again for OBW, power and conducted spurious to get class II permissive change.
Per KDB 996369 part VIII. Changes from a non-modular to modular application are permitted if the changes meet the requirements for a permissive change and other tests for part 90 as like field strength of spurious emissions, frequency stability and transient frequency behavior is referenced from FCC ID: KBY821191151819 test report and results.

Unit is powered up with a 120 V AC adapter and is put on continuous mode of transmit for 2 modes of 2-GFSK and 4-GFSK for above mentioned testing.

Accessories:

Qty	Description	Manufacturer	Model	S/N
1	Laptop with tera term	Dell	Latitude	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Termination
1	Serial to USB	< 3	N/A	N/A	N/A

Modifications: None

Test Result Summary

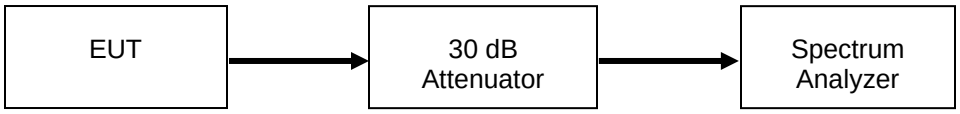
Specification	Test Name	Pass, Fail, N/A	Comments
2.1046	Carrier Output Power (Conducted)	Pass	
2.1051	Unwanted Emissions (Transmitter Conducted)	Pass	
2.1053	Field Strength of Spurious Radiation	N/A	Not tested for C2PC
90.210, 2.1049	Emission Masks (Occupied Bandwidth)	Pass	
2.1047	Audio Low Pass Filter (Voice Input)	N/A	Unit does not have audio input
2.1047	Audio Frequency Response	N/A	Unit does not have audio input
2.1047(a)	Modulation Limiting	N/A	Unit does not have audio input
90.213	Frequency Stability (Temperature Variation)	N/A	Not tested for C2PC
90.213	Frequency Stability (Voltage Variation)	N/A	Not tested for C2PC
90.214	Transient Frequency Behavior	N/A	Not tested for C2PC
RSS-Gen	Receiver Spurious Emissions	N/A	Not tested for C2PC
2.202	Necessary Bandwidth Calculation	N/A	Not tested for C2PC

Carrier Output Power (Conducted)
Engineer: Poona Saber
Test Date: 5/16/2018

Measurement Procedure

The Equipment Under Test (EUT) was connected to a spectrum analyzer through a 30 dB Power attenuator. All cable and attenuator losses were input into the spectrum analyzer as a reference level offset to ensure accurate readings were obtained.

Test Setup



High Power Transmitter Peak Output Power

2-GFSK

Tuned Frequency (MHz)	Recorded Measurement (dBm)	Result
435	32.03	Pass
450	32.85	Pass
470	32.18	Pass

4-GFSK

Tuned Frequency (MHz)	Recorded Measurement (dBm)	Result
435	32.56	Pass
450	32.57	Pass
470	32	Pass

Conducted Spurious Emissions

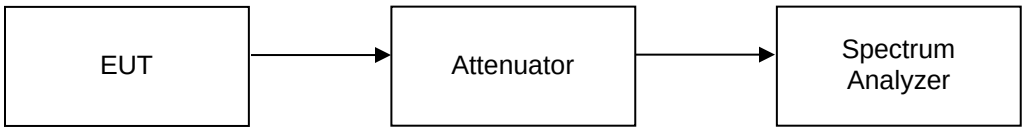
Engineer: Poona Saber

Test Date: 5/16/2018

Test Procedure

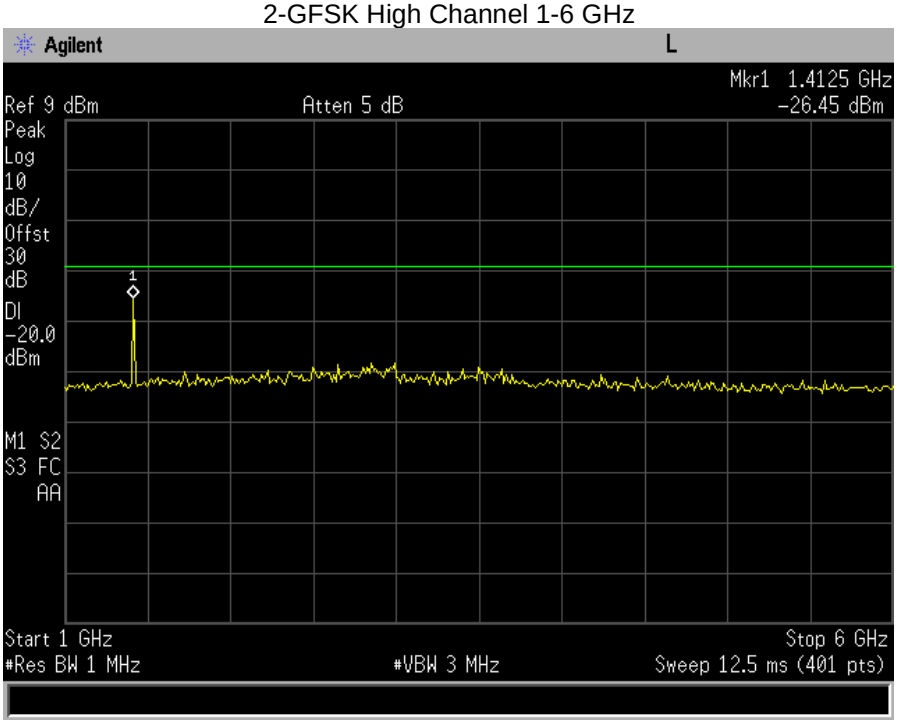
The EUT was connected directly to a spectrum analyzer to verify that the UUT met the requirements for spurious emissions. The resolution bandwidth set for 100 kHz and the reference level was adjusted to ensure the system had sufficient dynamic range to measure spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed and plotted.

Test Setup

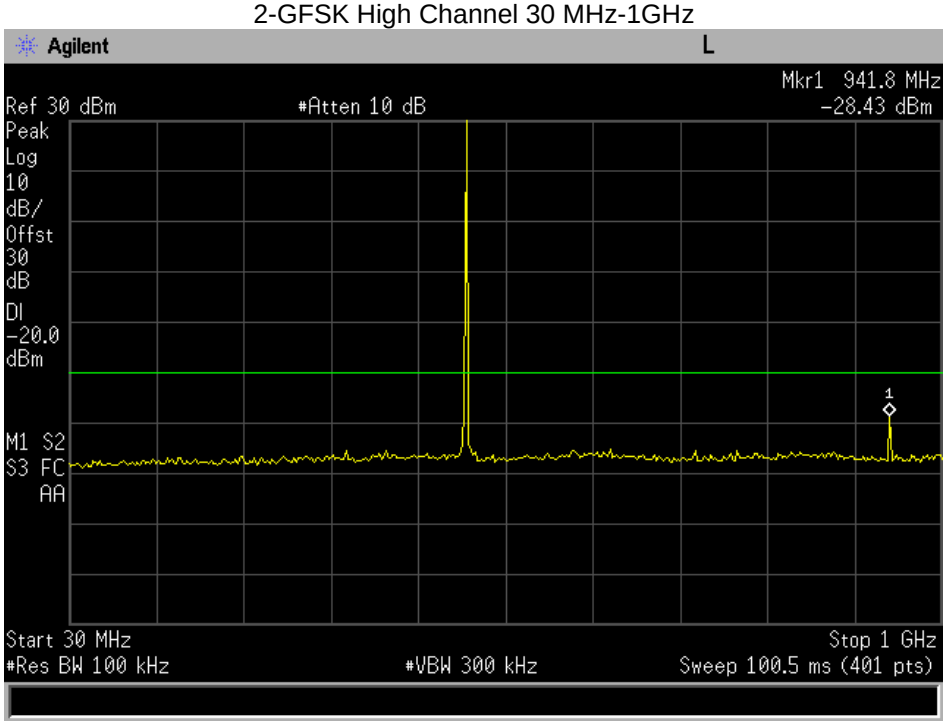


Test Plots

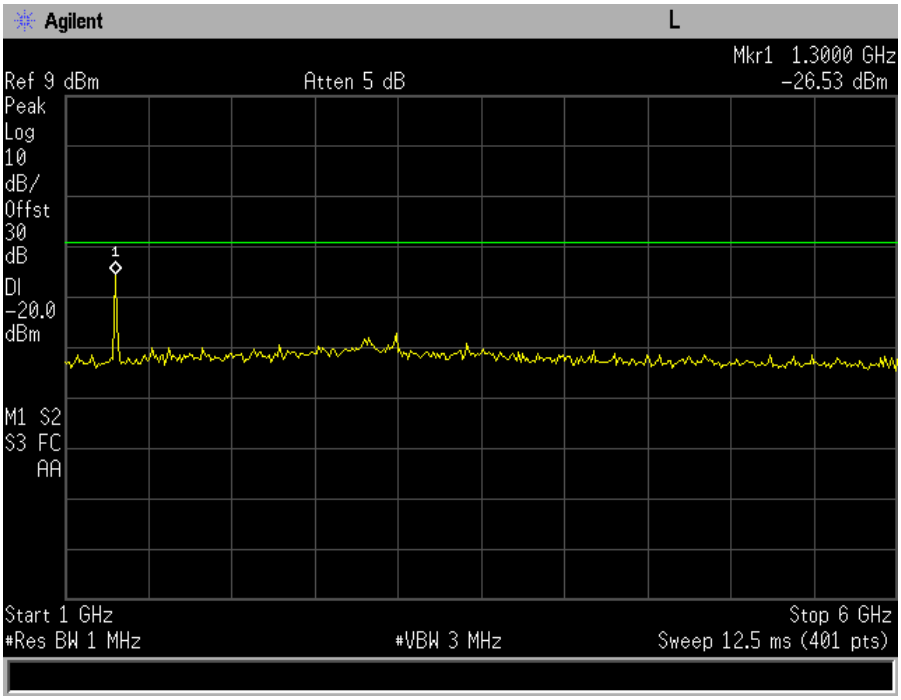
2-GFSK High Channel 1-6 GHz



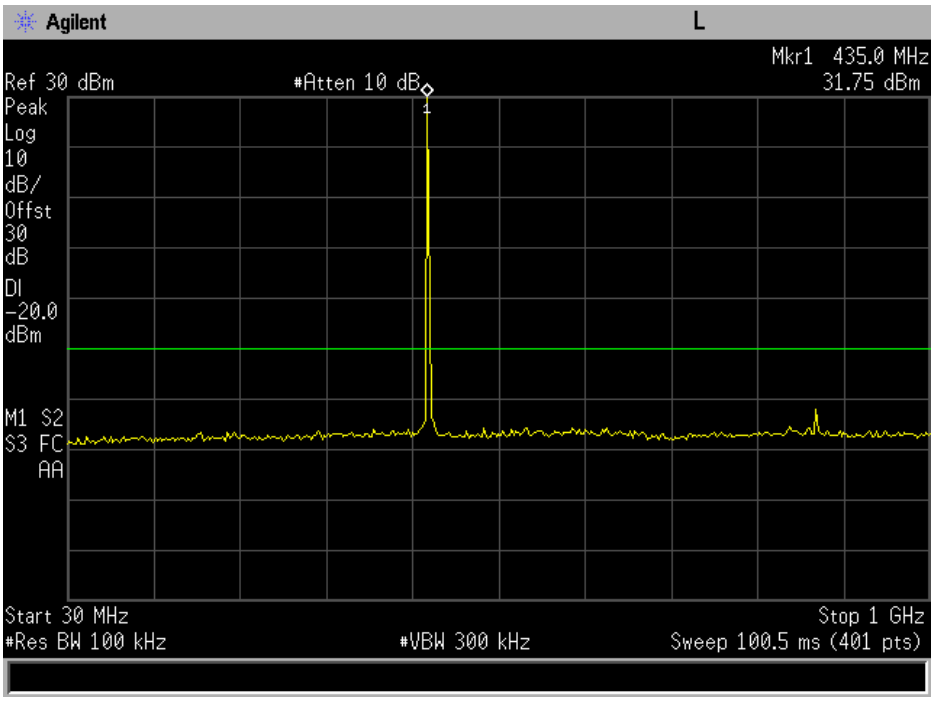
2-GFSK High Channel 30 MHz-1GHz



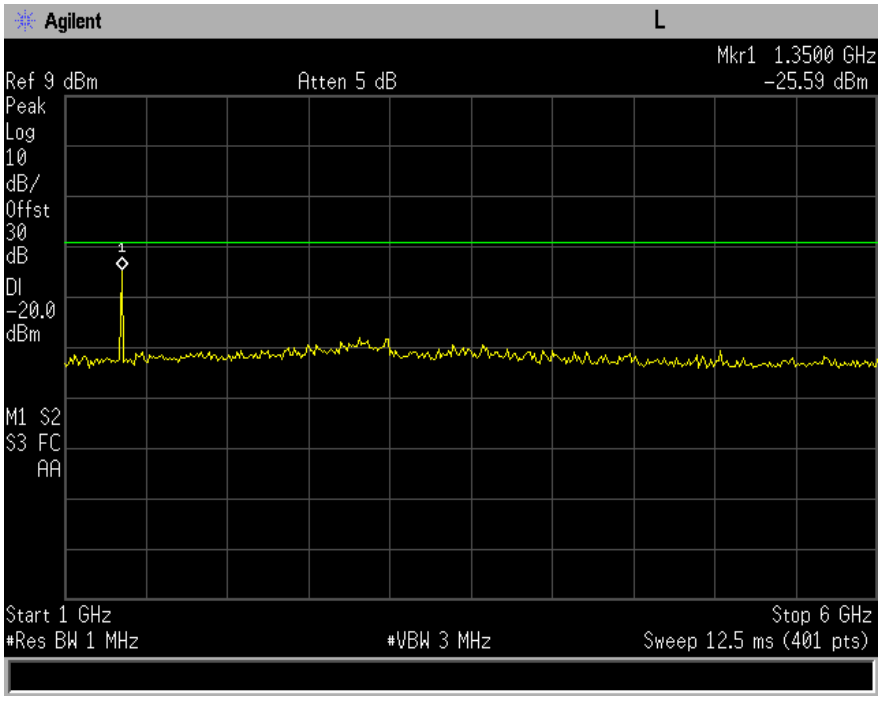
2-GFSK Low Channel 1-6 GHz



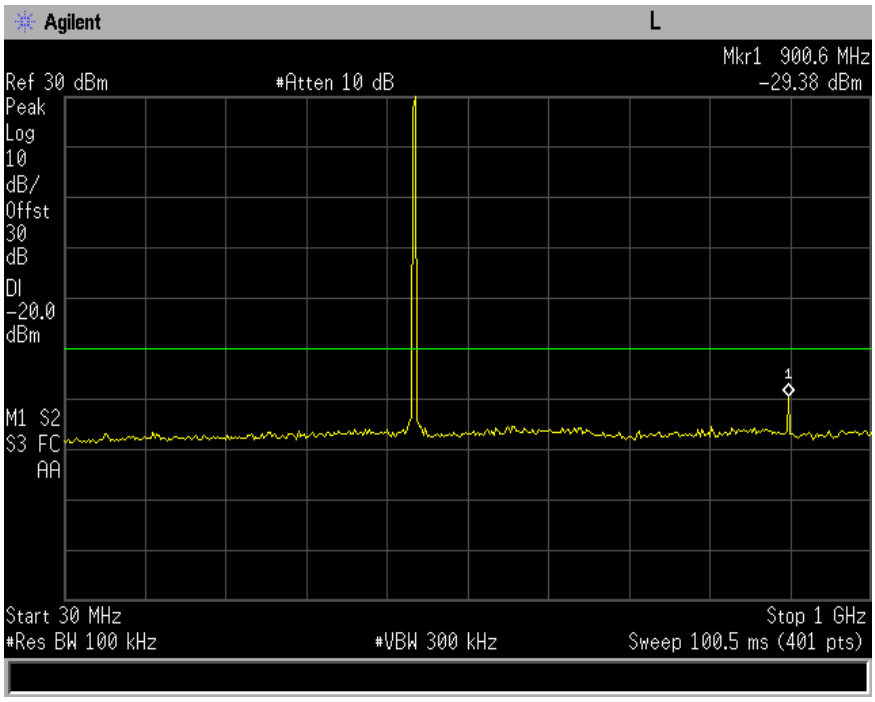
2-GFSK Low Channel 30 MHz-1GHz



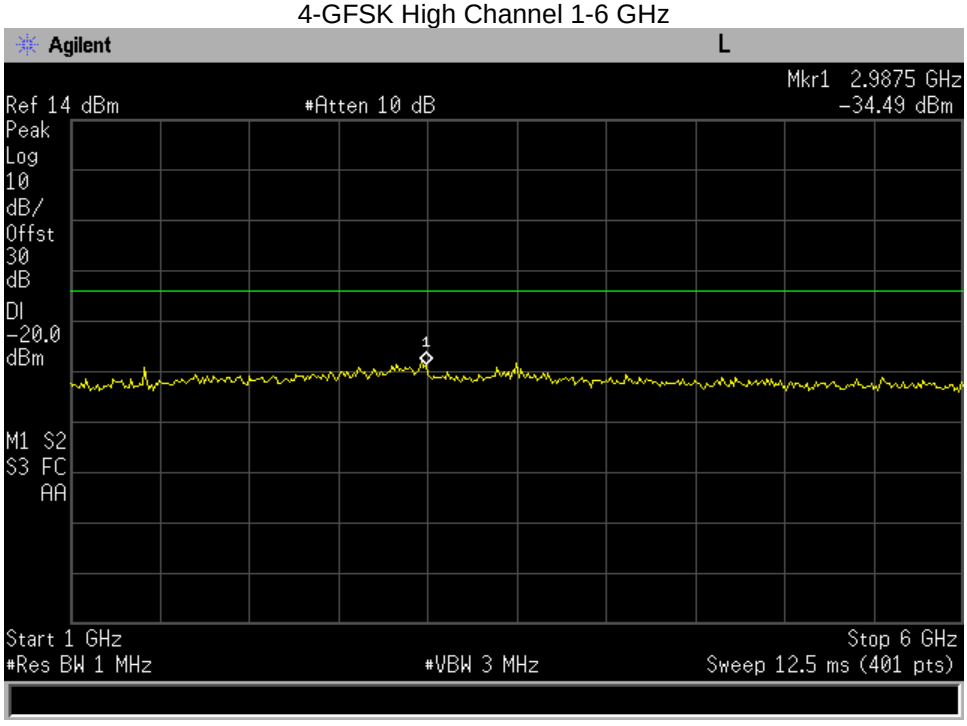
2-GFSK Mid Channel 1-6 GHz



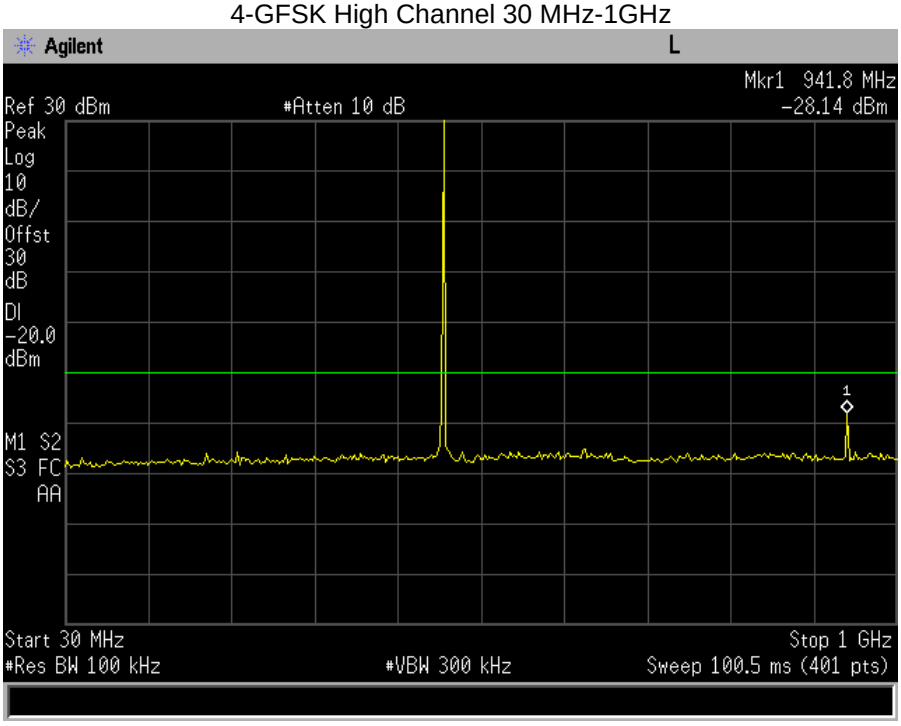
2-GFSK Mid Channel 30 MHz-1GHz



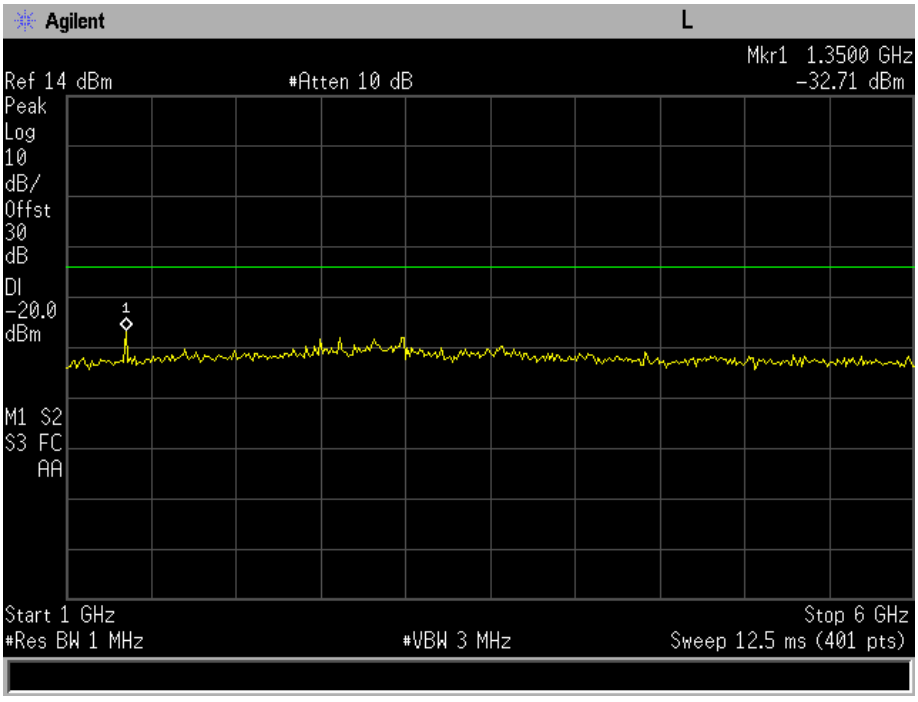
4-GFSK High Channel 1-6 GHz



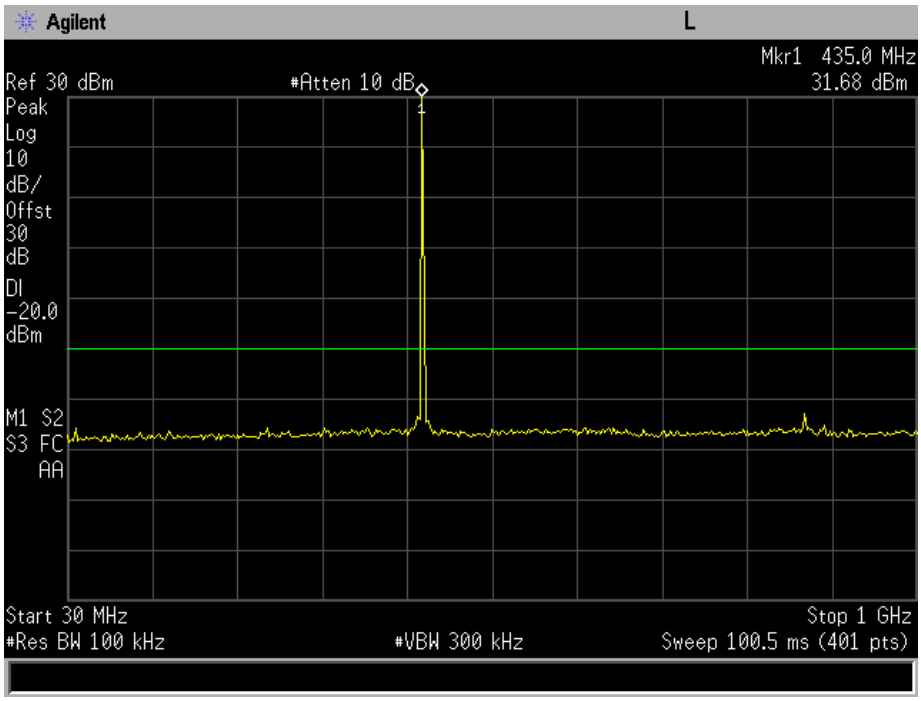
4-GFSK High Channel 30 MHz-1GHz



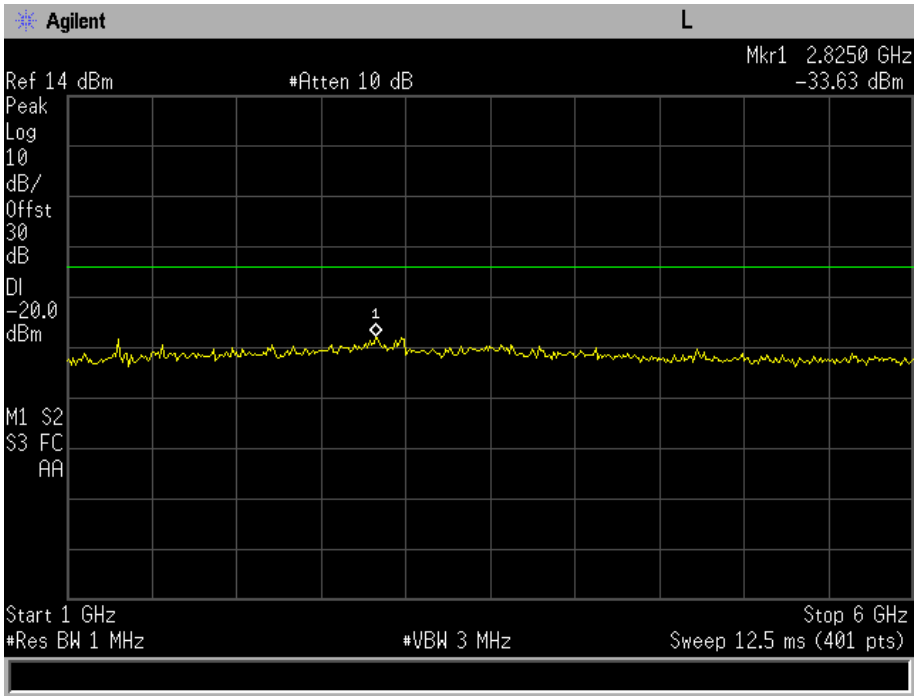
4-GFSK Low Channel 1-6 GHz



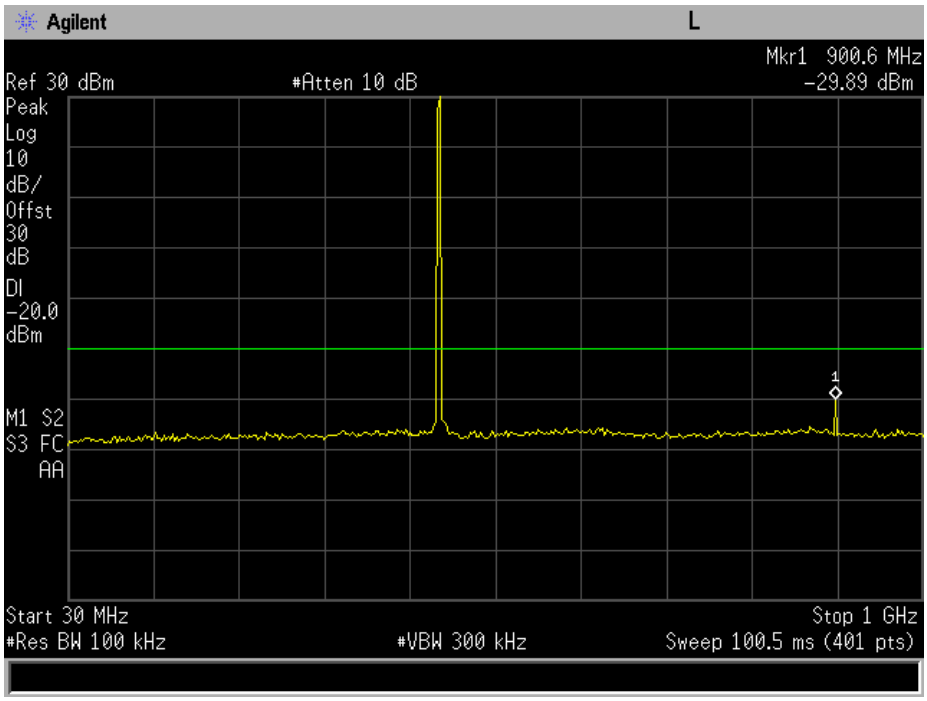
4-GFSK Low Channel 30 MHz-1GHz



4-GFSK Mid Channel 1-6 GHz



4-GFSK Mid Channel 30 MHz-1GHz



Emission Masks (Occupied Bandwidth)
Engineer: Poona Saber
Test Date: 5/16/2018

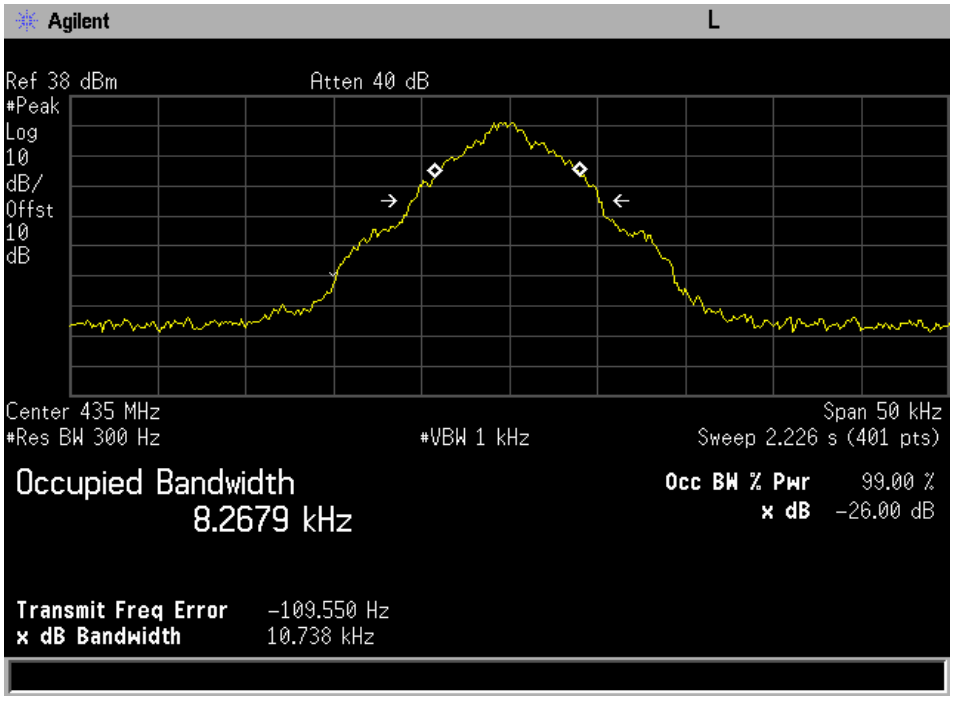
Measurement Procedure

The EUT was connected directly to a spectrum analyzer to verify that the EUT meets the required emissions mask. A reference level point for the emissions mask is set to the value of the peak power measurement of the fundamental.

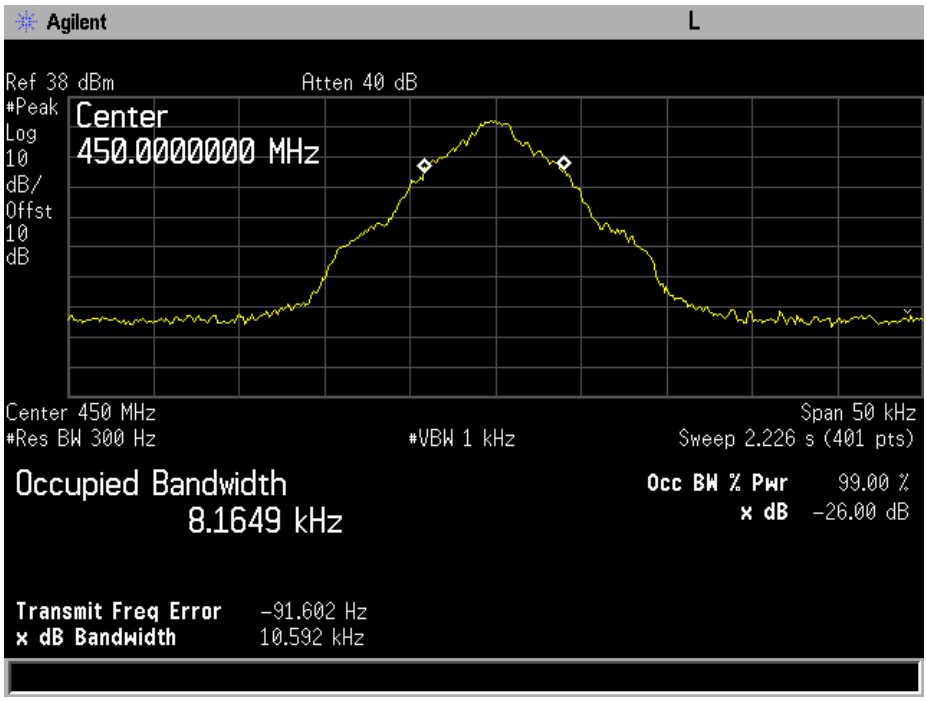
Test Setup

Occupied Bandwidth Plots

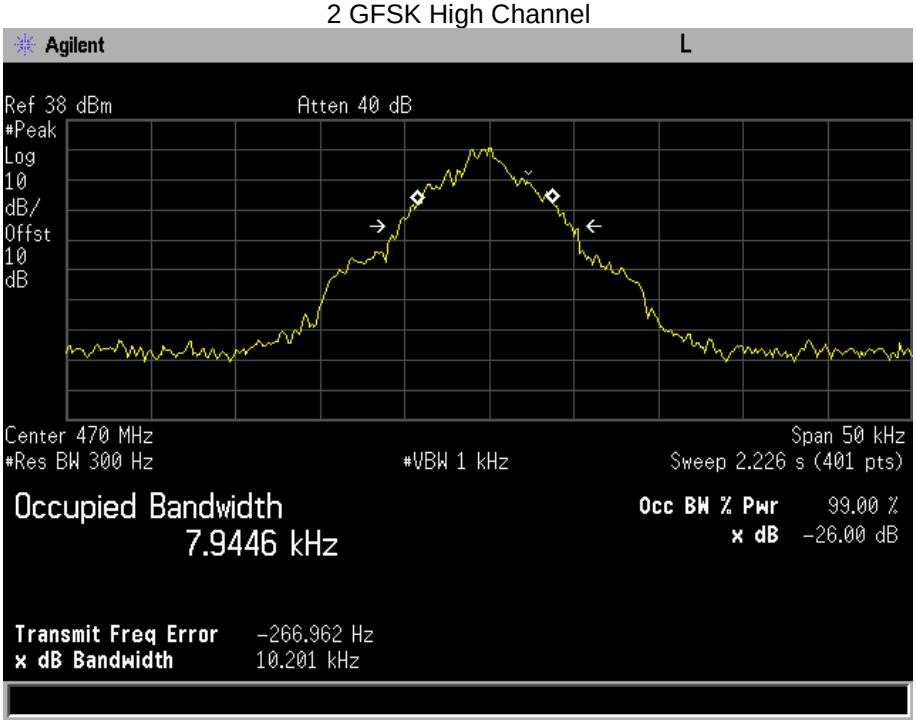
2 GFSK Low Channel



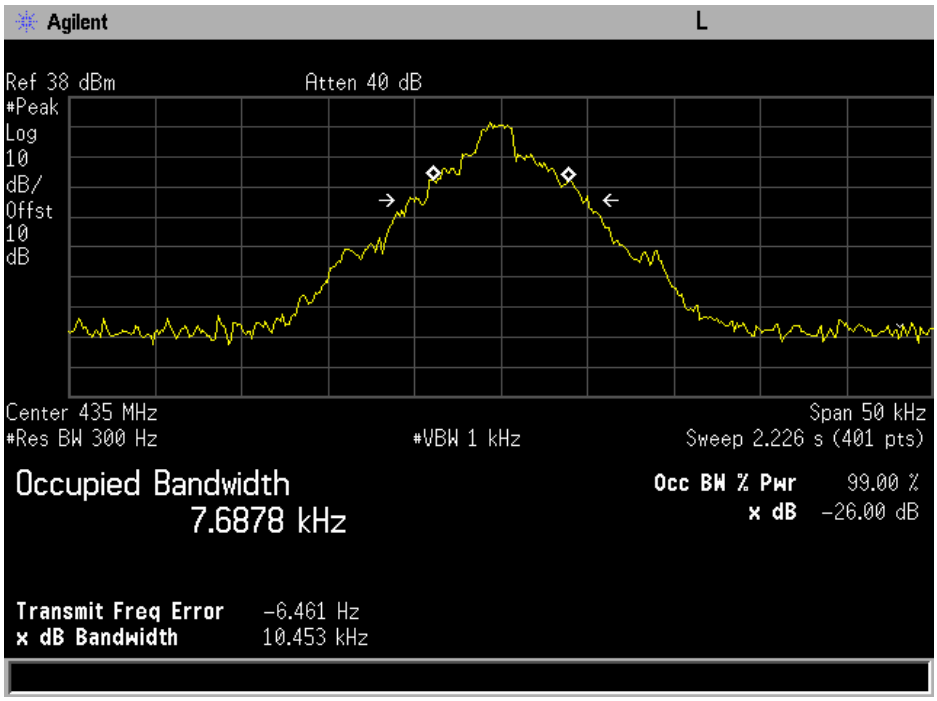
2 GFSK Mid Channel



2 GFSK High Channel



4 GFSK Low Channel



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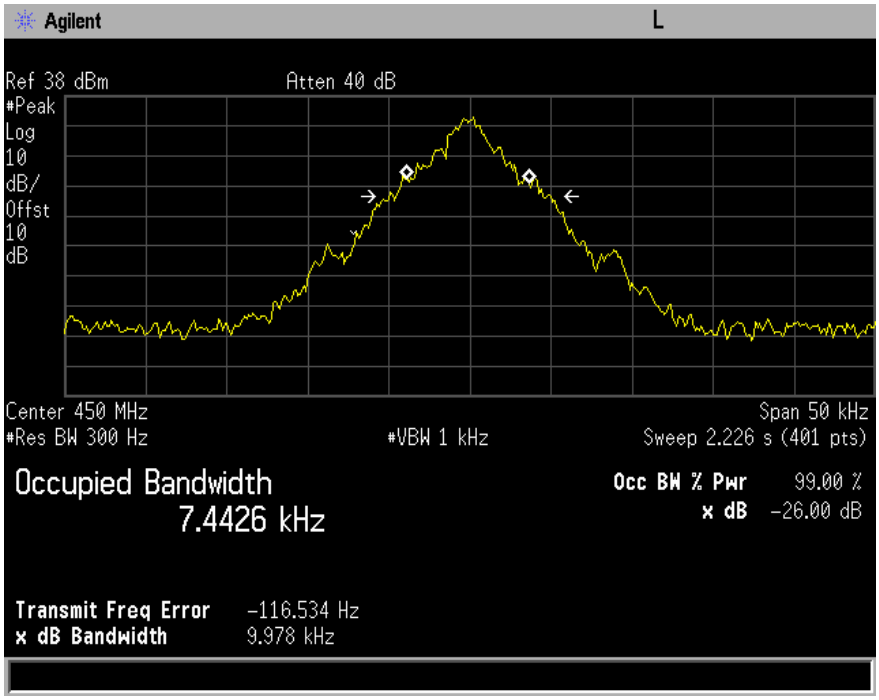
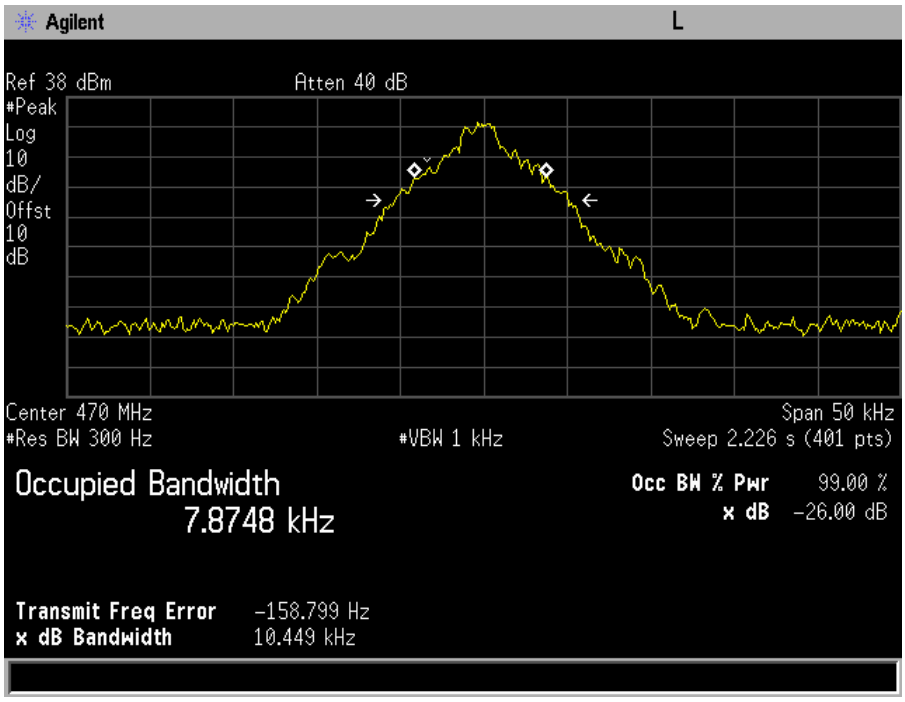
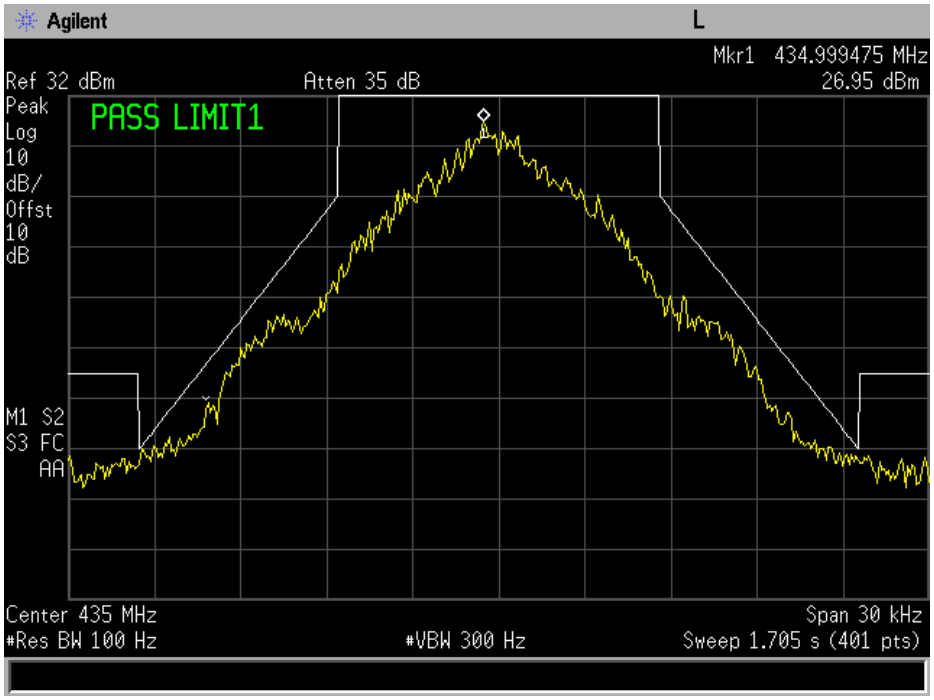


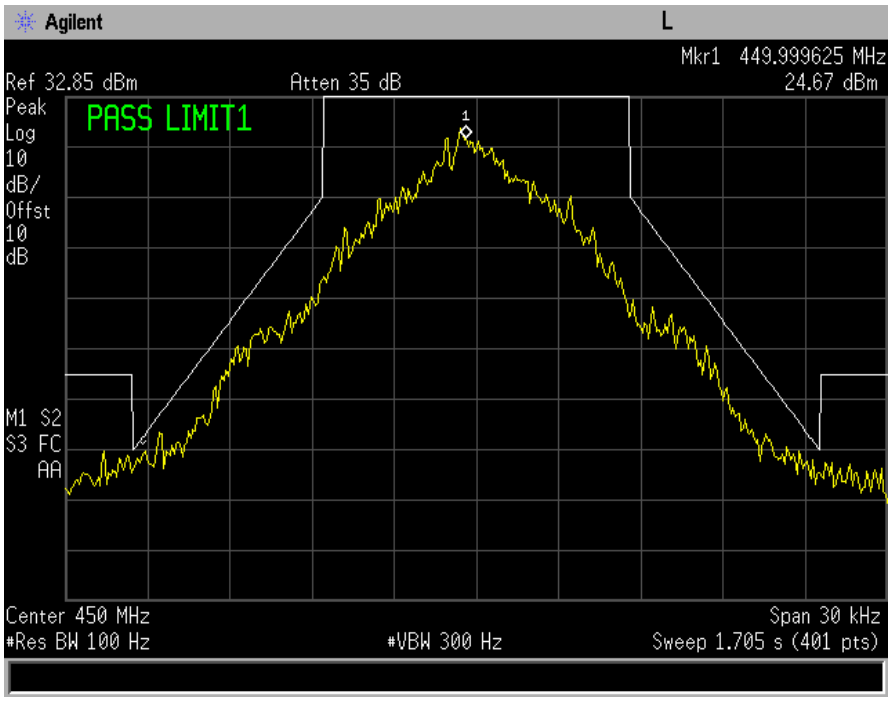
4 GFSK High Channel



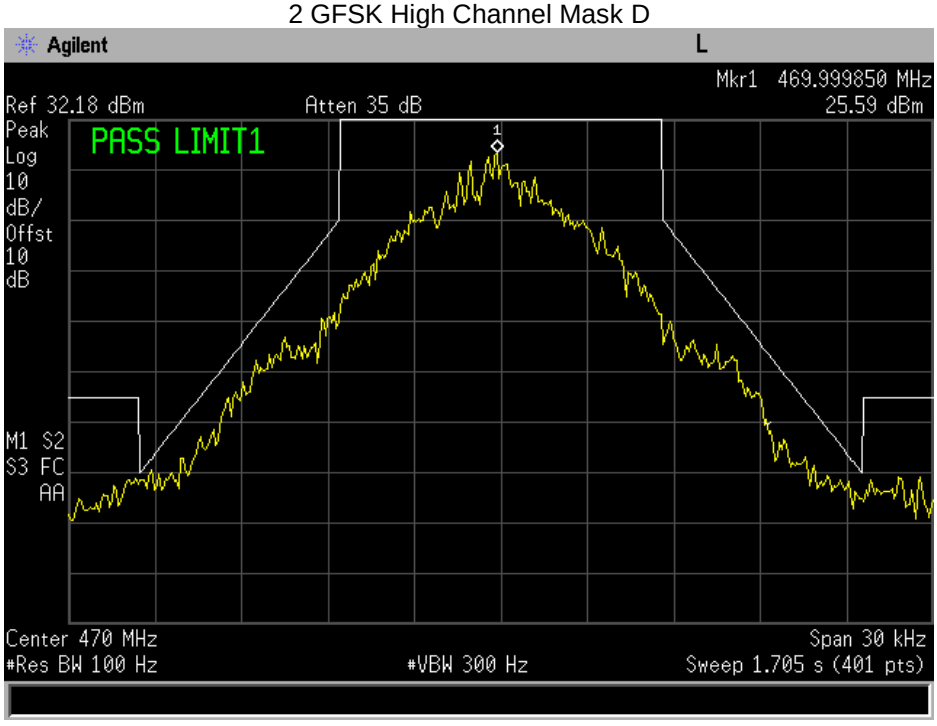
2 GFSK Low Channel Mask D



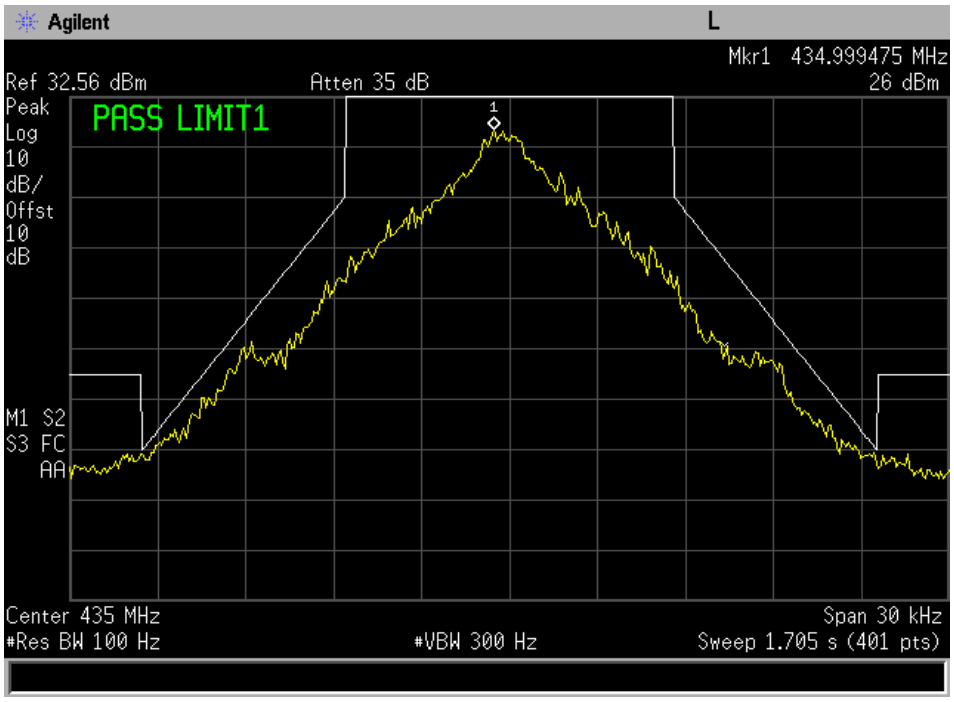
2 GFSK Mid Channel Mask D



2 GFSK High Channel Mask D



4 GFSK Low Channel Mask D



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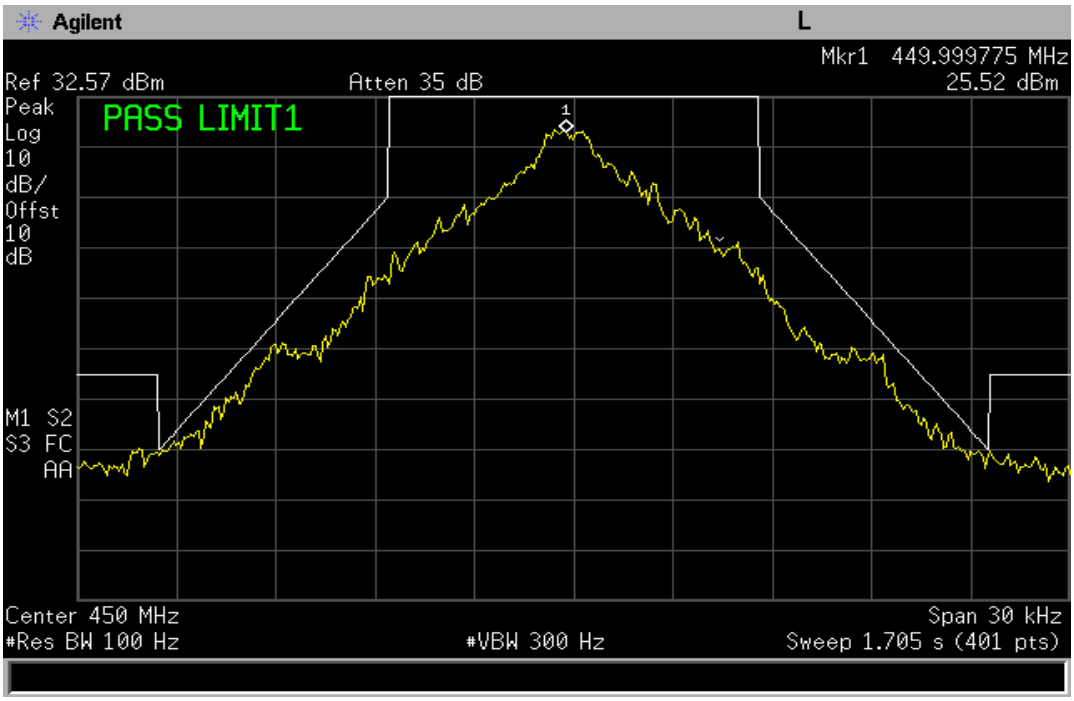

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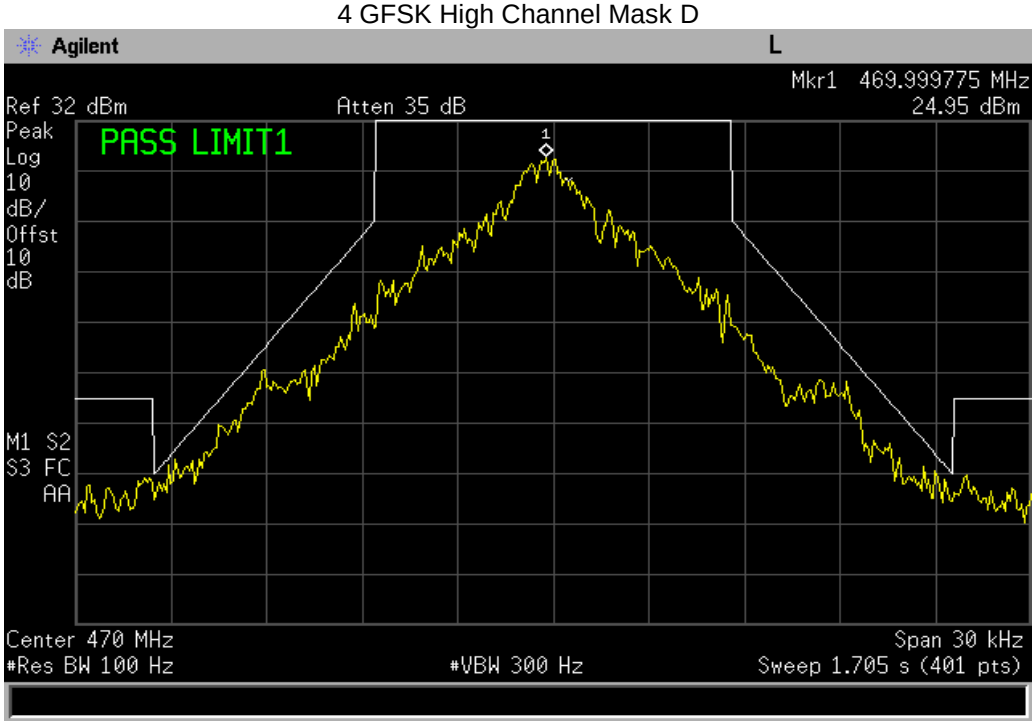

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
ESA Spectrum Analyzer	Agilent	E4407B	i00379	11/21/17	11/21/18

END OF TEST REPORT