



Test Report

Prepared for: Freewave Technologies

Model: GXM-T14

Description:

Serial Number: N/A

FCC ID: KNYARN2110AT

To

FCC Part 15.247 FHSS

Date of Issue: October 21, 2016

On the behalf of the applicant:

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Kenneth Lee
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	August 24, 2016	Kenneth Lee	Original Document
2.0	October 21, 2016	Kenneth Lee	Updated Band Edges

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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)
26.4	29.7	946.8

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

EUT Description

Model: GXM-T14

Description:

Firmware: N/A

Software: N/A

Serial Number: N/A

Additional Information: The EUT was fully tested while in two data rates.

EUT Operation during Tests

The EUT was put into a test mode via Tera Term and was set to transmit at the low, middle and high channel of operation.

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



Accessories:

Qty	Description	Manufacturer	Model	S/N
1	AC Adaptor	Tamuracorp	420AS12050	N/A
1	Communication Board	N/A	N/A	N/A

Cables:

Qty	Description	Length (M)	Shielding Y/N	Shielded Hood Y/N	Ferrite Y/N
1	Serial to USB	0.25	Y	N	N
1	Proprietary Test Harness	1	N	N	N

Modifications: None

Test Results Summary

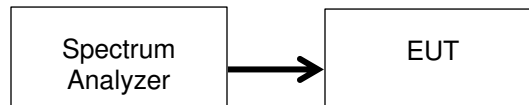
Specification	Test Name	Pass, Fail, N/A	Comments
15.247(b)	Peak Output Power	Pass	
15.247(d)	Conducted Spurious Emissions	Pass	
15.247(d), 15.209(a), 15.205	Radiated Spurious Emissions	Pass	
15.209(a), 15.205	Emissions At Band Edges	Pass	
15.247(a)	Occupied Bandwidth	N/A	Class II Permissive Change
15.247(a)	Dwell Time	N/A	Class II Permissive Change
15.247(a)	Number of Hopping Channels	N/A	Class II Permissive Change
15.207	A/C Powerline Conducted Emissions	N/A	Class II Permissive Change

Peak Output Power
Engineer: Kenneth Lee
Test Date: 08/24/2016

Test Procedure

The EUT was connected directly to the input of a spectrum analyzer. The peak readings were taken and the result was then compared to the limit.

Test Setup



Transmitter Peak Output Power

115 kbps Data Rate

Tuned Frequency (MHz)	Recorded Measurement (mW)	Specification Limit (W)	Result
2400.6582	434.01	1	Pass
2441.7792	408.7	1	Pass
2482.2144	367.03	1	Pass

154 kbps Data Rate

Tuned Frequency (MHz)	Recorded Measurement (mW)	Specification Limit (W)	Result
2400.6582	428.06	1	Pass
2441.7792	403.18	1	Pass
2482.2144	368.81	1	Pass

Conducted Spurious Emissions

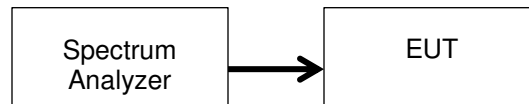
Engineer: Kenneth Lee

Test Date: 08/24/2016

Test Procedure

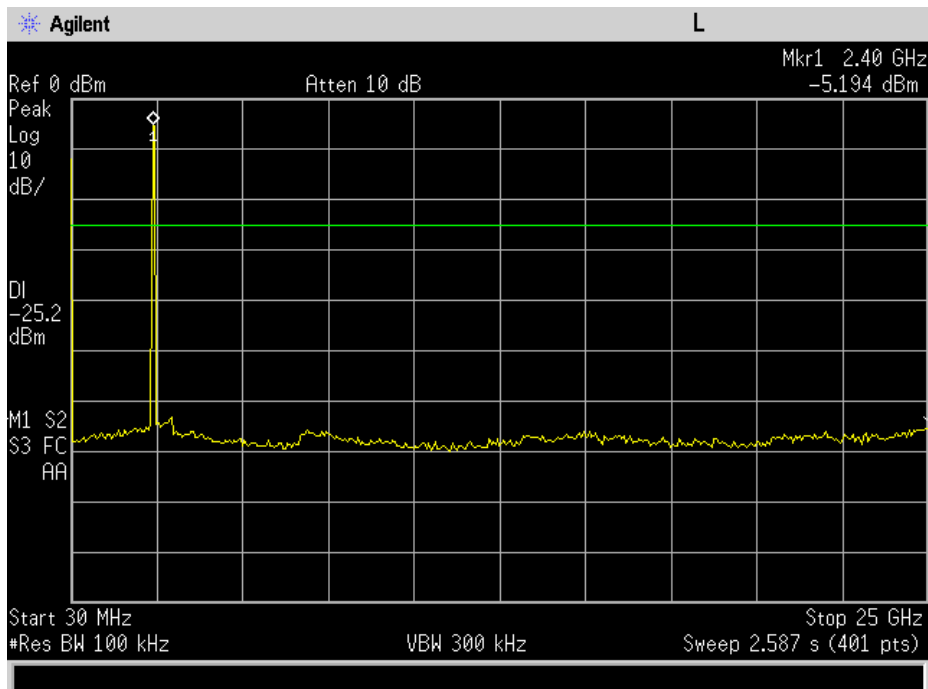
The EUT was connected directly to a spectrum analyzer to verify that the EUT met the requirements for spurious emissions. The frequency range from 30 MHz to the 10th harmonic of the fundamental transmitter was observed. Only detectable spurious emissions were recorded and plotted. The reference level is added to the recorded measurement to provide the corrected level dBc.

Test Setup

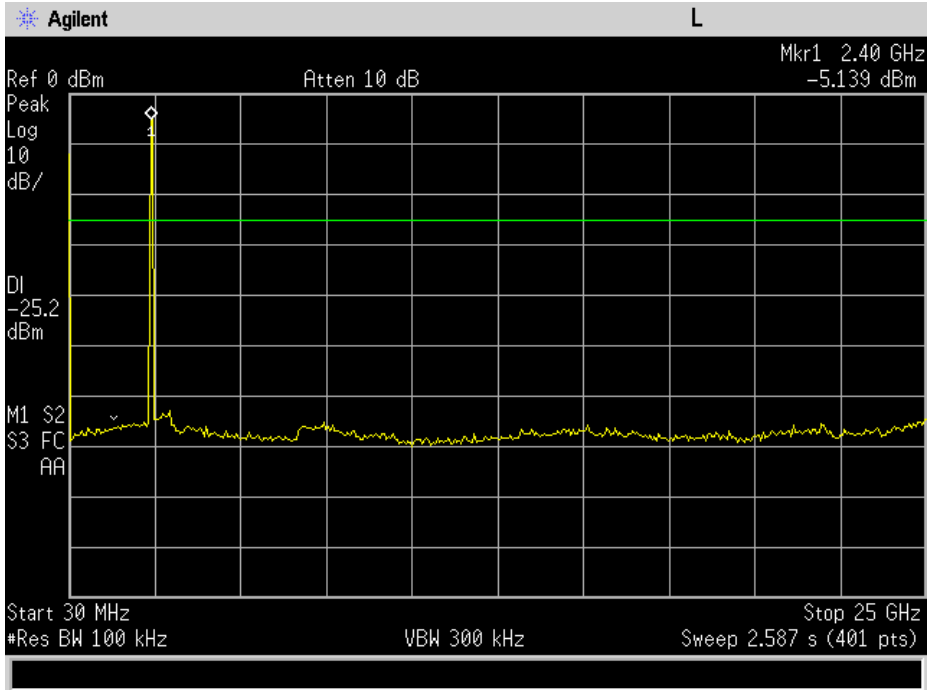


Conducted Spurious Emissions Test Results

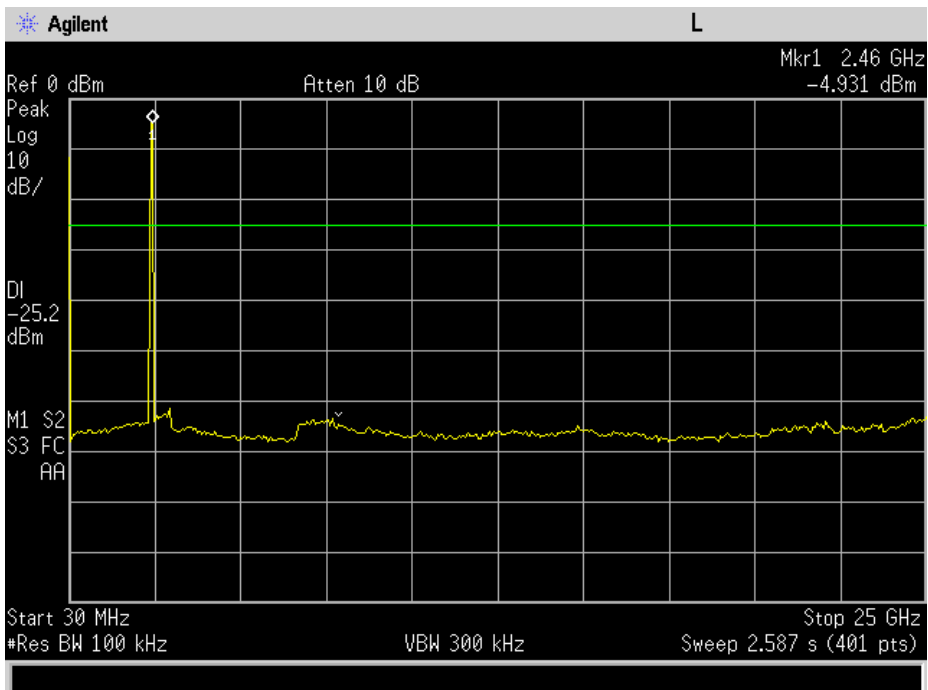
Conducted Spurious Emissions 2400.6528 MHz – 115 kbps Data Rate



Conducted Spurious Emissions 2441.7792 MHz – 115 kbps Data Rate

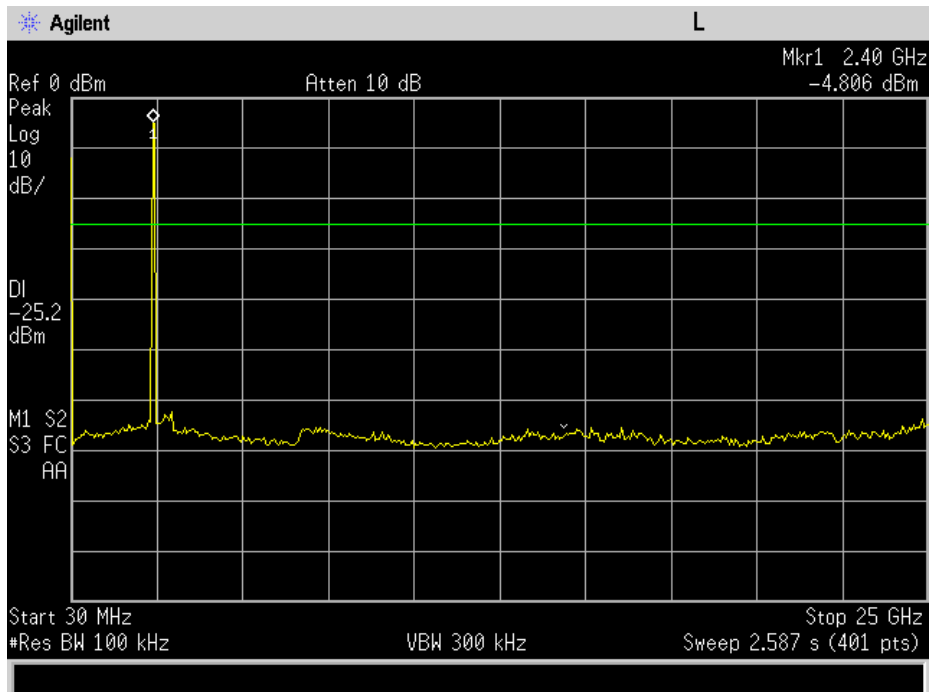


Conducted Spurious Emissions 2482.2144 MHz – 115 kbps Data Rate

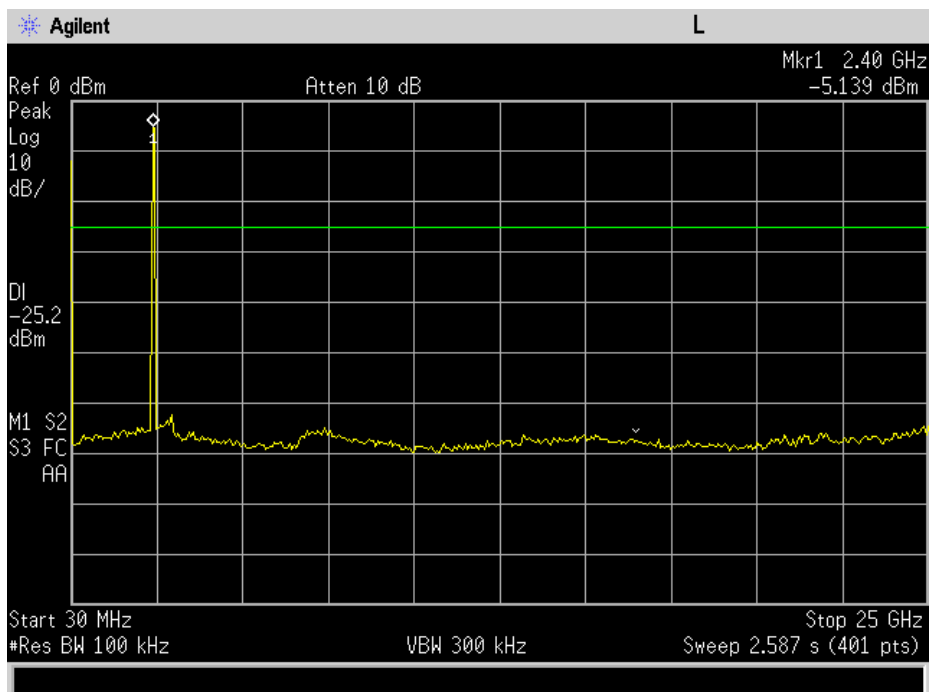




Conducted Spurious Emissions 2400.6528 MHz – 154 kbps Data Rate

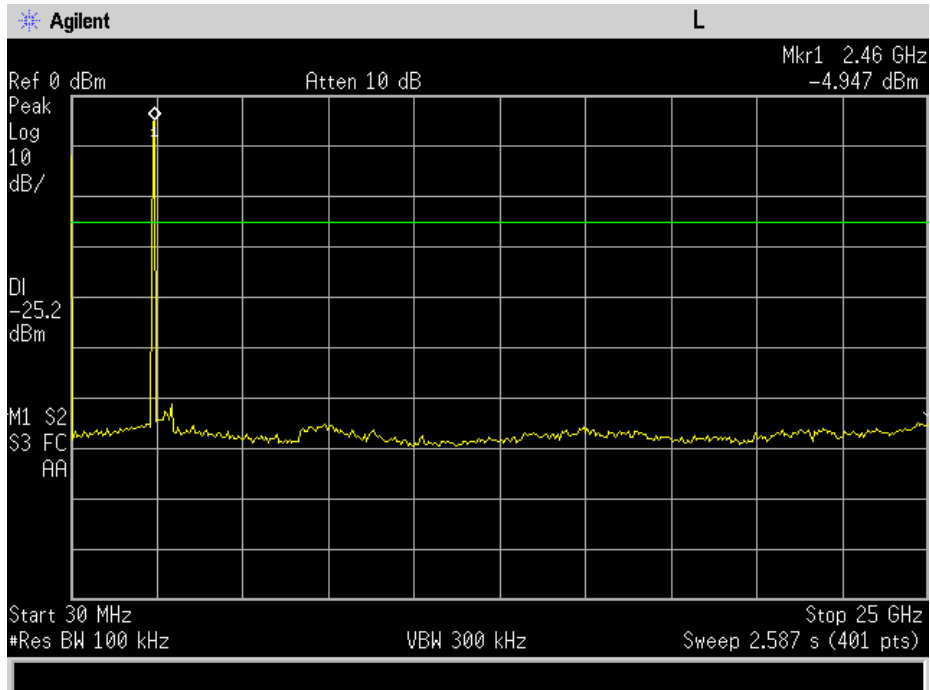


Conducted Spurious Emissions 2441.7792 MHz – 154 kbps Data Rate





Conducted Spurious Emissions 2482.2144 MHz – 154 kbps Data Rate



Radiated Spurious Emissions

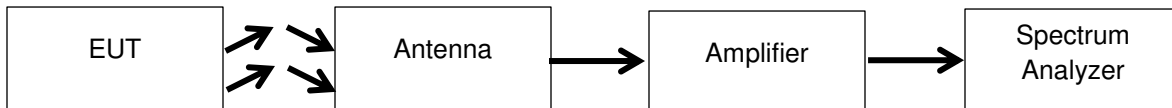
Engineer: Kenneth Lee

Test Date: 08/24/2016

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. The antenna and cable correction factors were summed with the 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



Detector Settings	RBW	VBW	Span
Peak	1 MHz	1 MHz	As Necessary
Average	1 MHz	10 Hz	0 Hz

Radiated Spurious Emissions

See Annex A for test data

Emissions at Band Edges

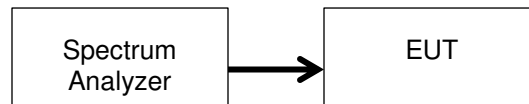
Engineer: Kenneth Lee

Test Date: 08/24/2016

Test Procedure

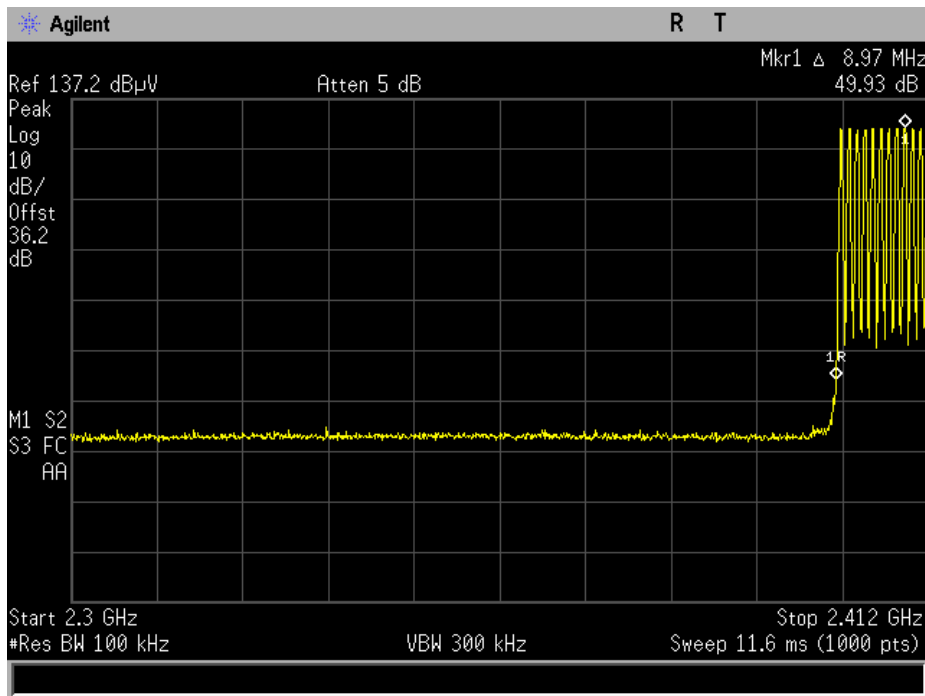
The EUT was connected to a spectrum analyzer, which was used to verify that the EUT met the requirements for band edge. The cable and transducer correction factors were input into the analyzer as a reference level offset to ensure accurate readings.

Test Setup

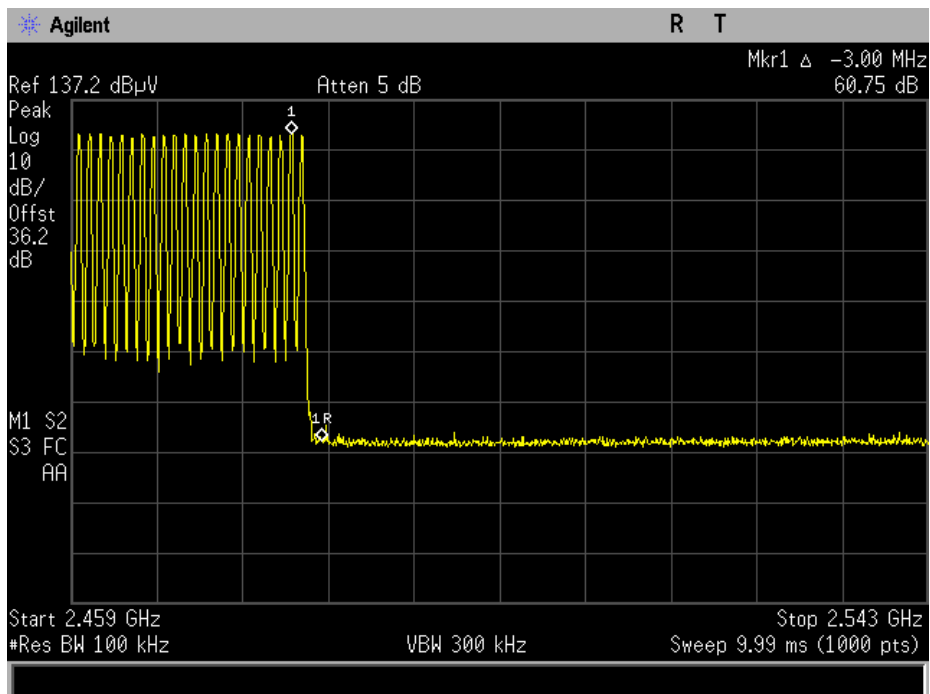




Band Edge – Low Ch – 115kbs – Hopping

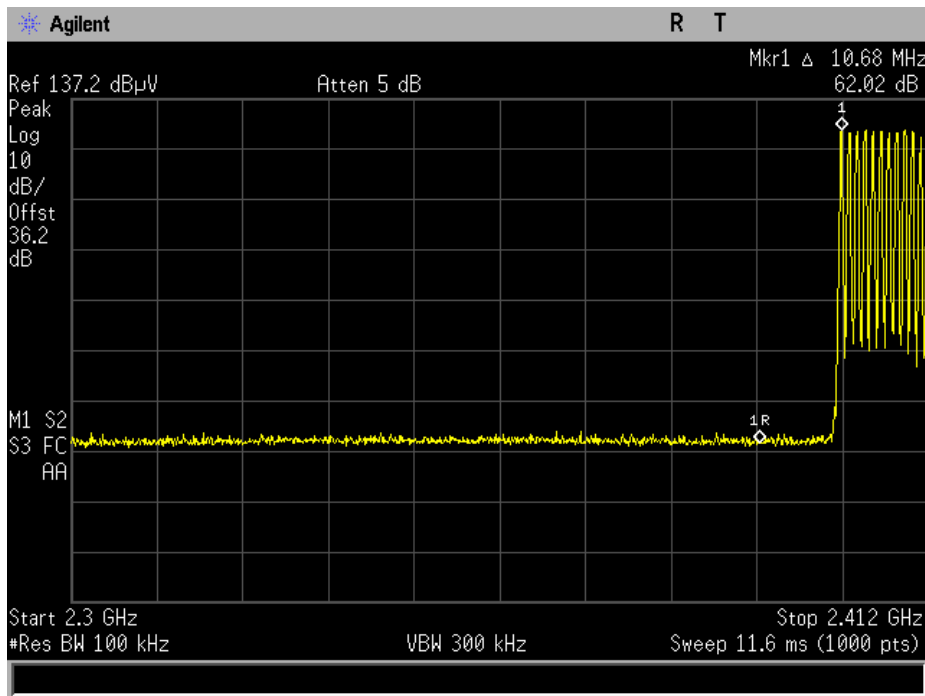


Band Edge – High Ch – 154kbs – Hopping

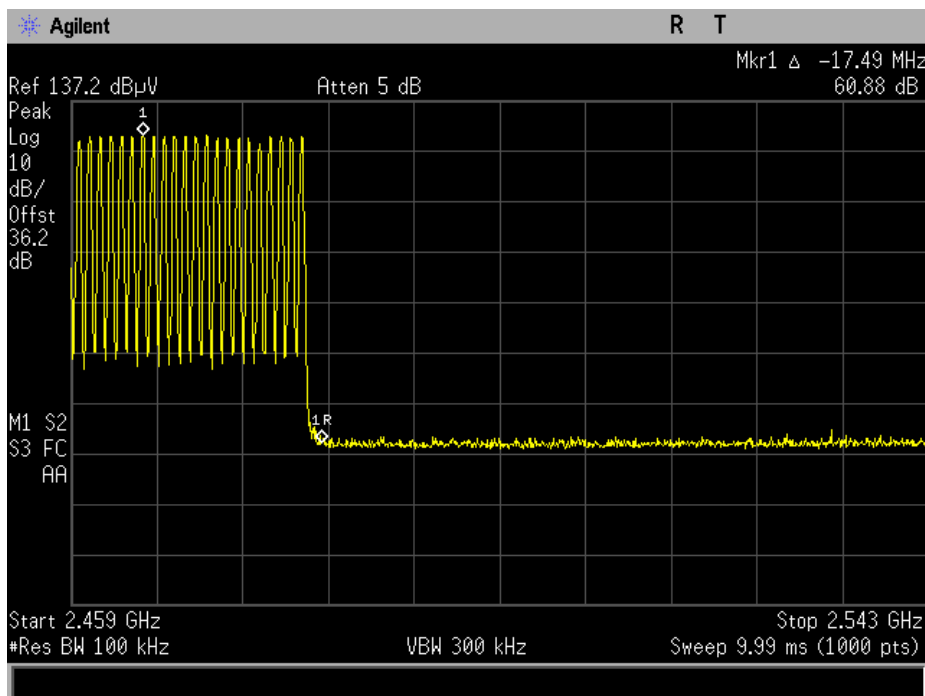




Band Edge – Low Ch – 115kbs – Hopping

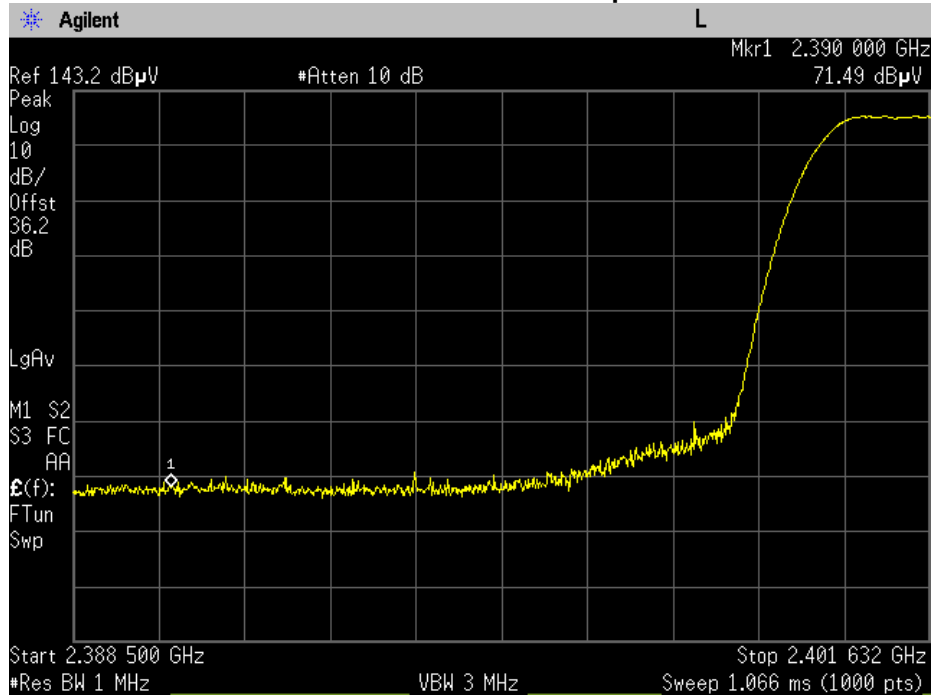


Band Edge – High Ch – 154kbs – Hopping



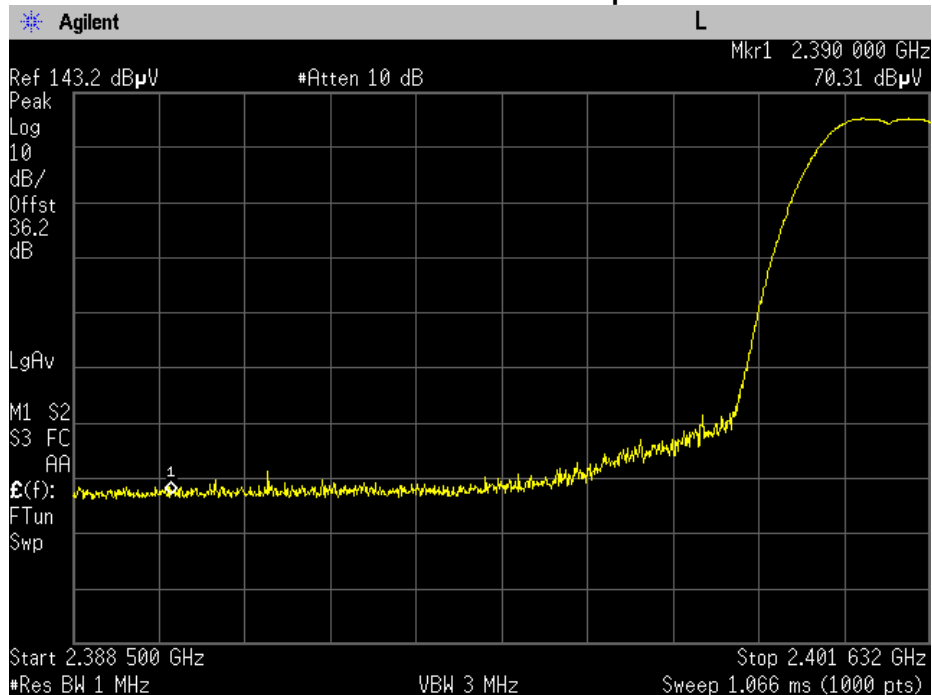


Restricted Band 2390 MHz – 115 kbps Data Rate



$71.49 - 17.8 = 53.69 \text{ dB}\mu\text{V}$ (Low Channel Band Edge)

Restricted Band 2390 MHz – 154 kbps Data Rate

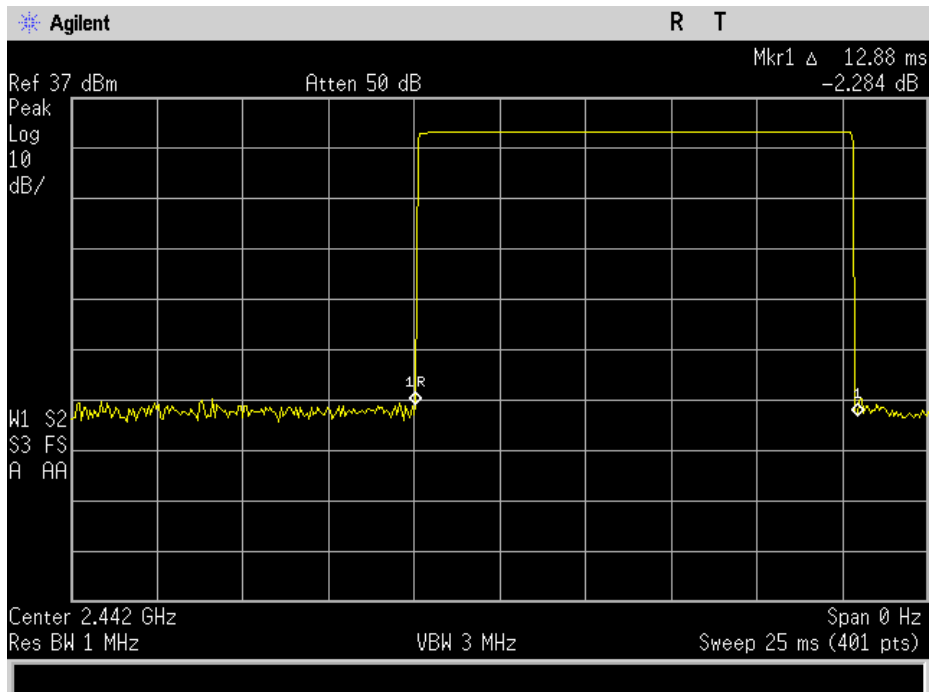


$70.31 - 17.8 = 52.51 \text{ dB}\mu\text{V}$ (Low Channel Band Edge)

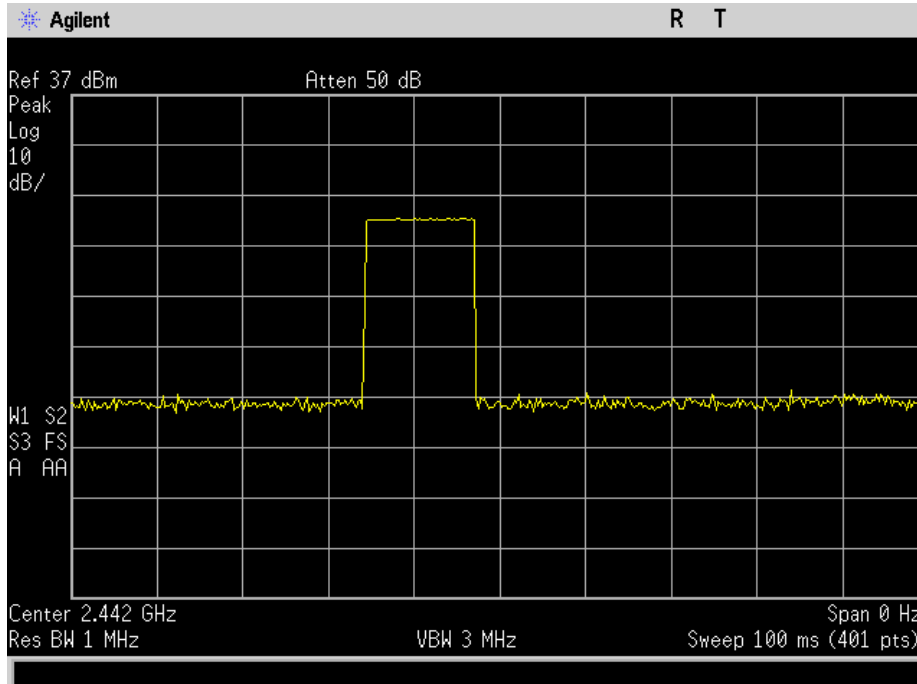


Duty Cycle Correction

Time of One Pulse = 12.88 ms



Number of Pulses in 100 ms = 1

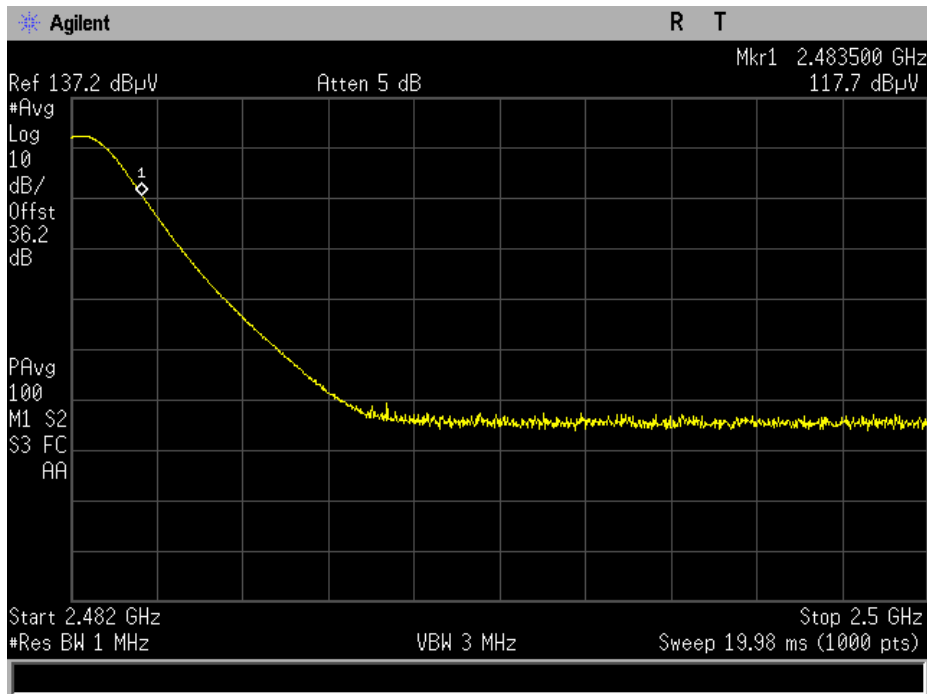


$$\text{Duty Cycle Correction Factor} = \frac{12.88 \text{ ms}}{100 \text{ ms}} = 0.1288$$

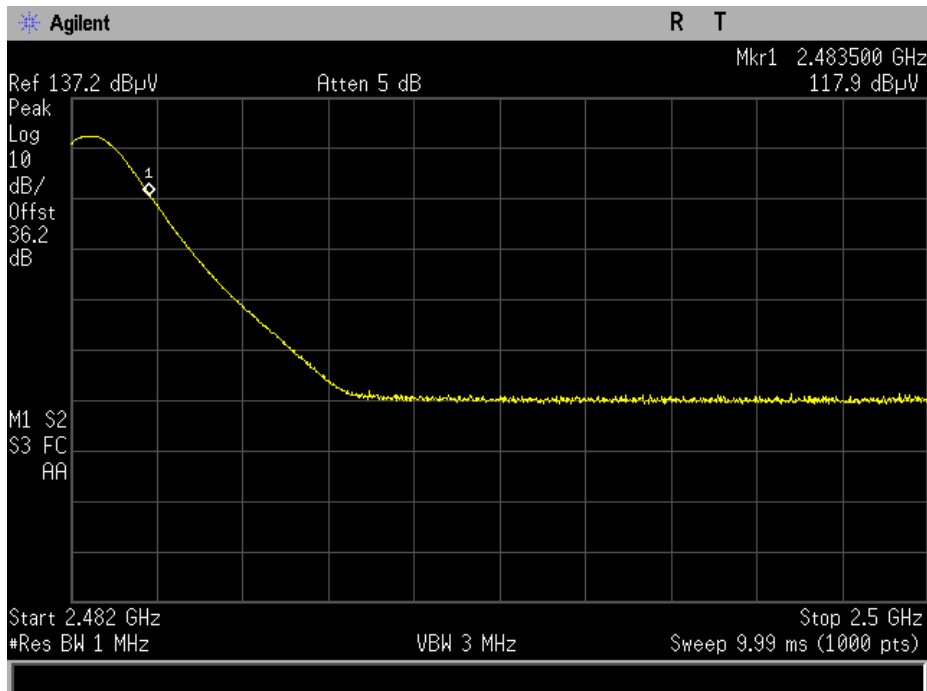
$$20 \text{ Log} (0.1288) = -17.8$$



Restricted Band Edge – 2483.5 MHz – 115kbs



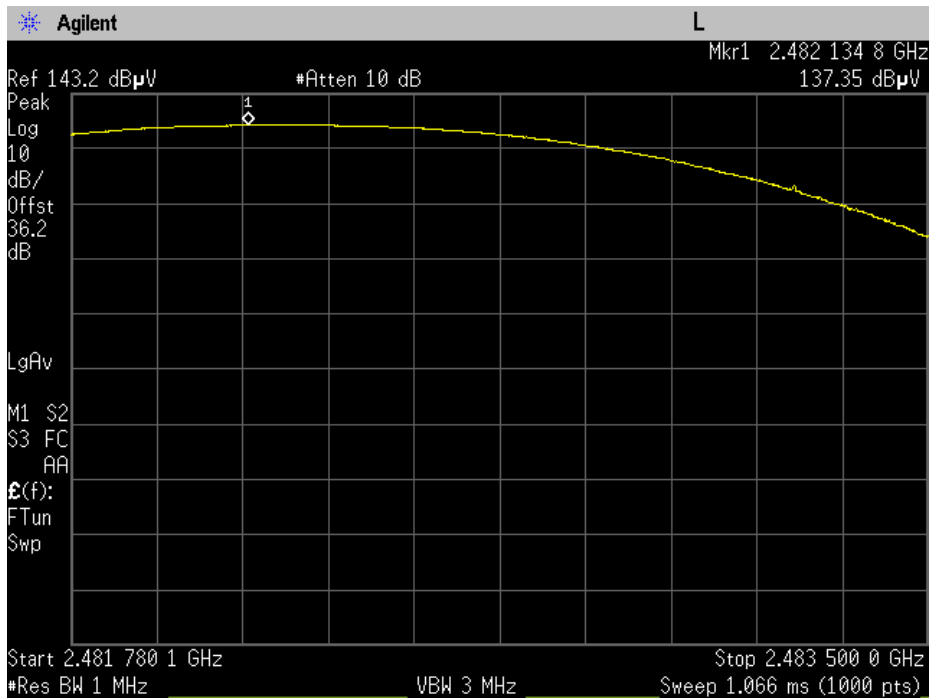
Restricted Band Edge – 2483.5 MHz – 154kbs



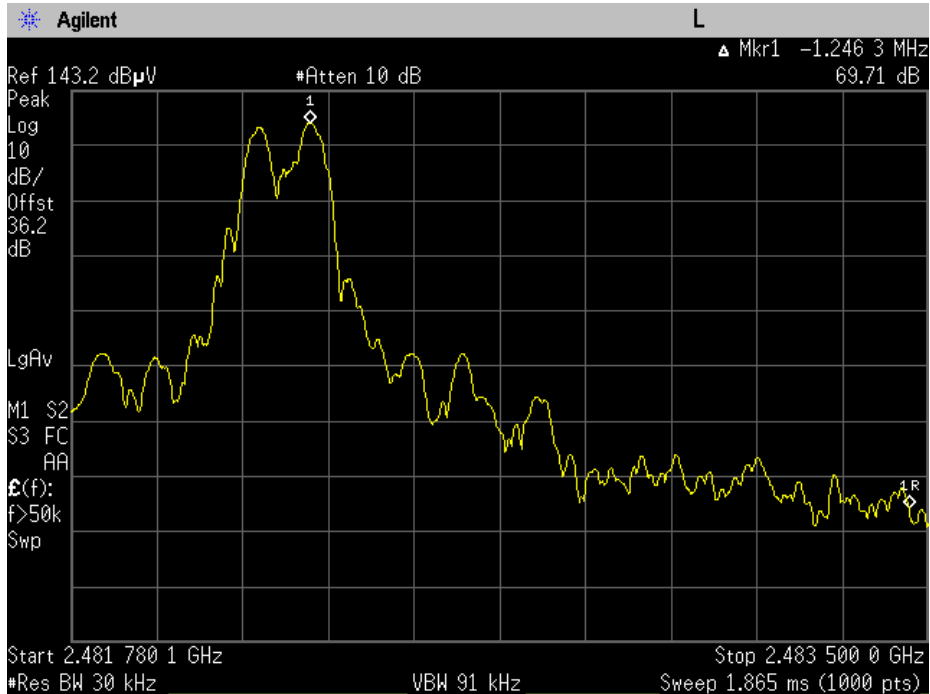


Marker Delta Method – 115 kbps Data Rate

Highest in Band Emission = 137.35



Delta at 30 kHz = 69.71

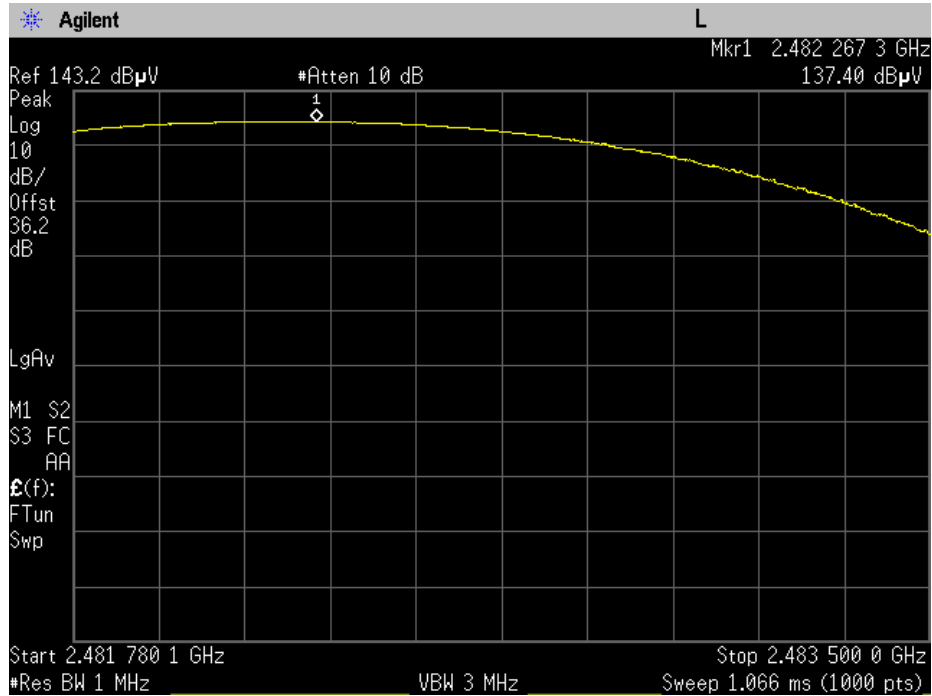


$$137.35 - 69.71 + (-17.8) = 49.84 \text{ dBuV (High Channel Band Edge)}$$

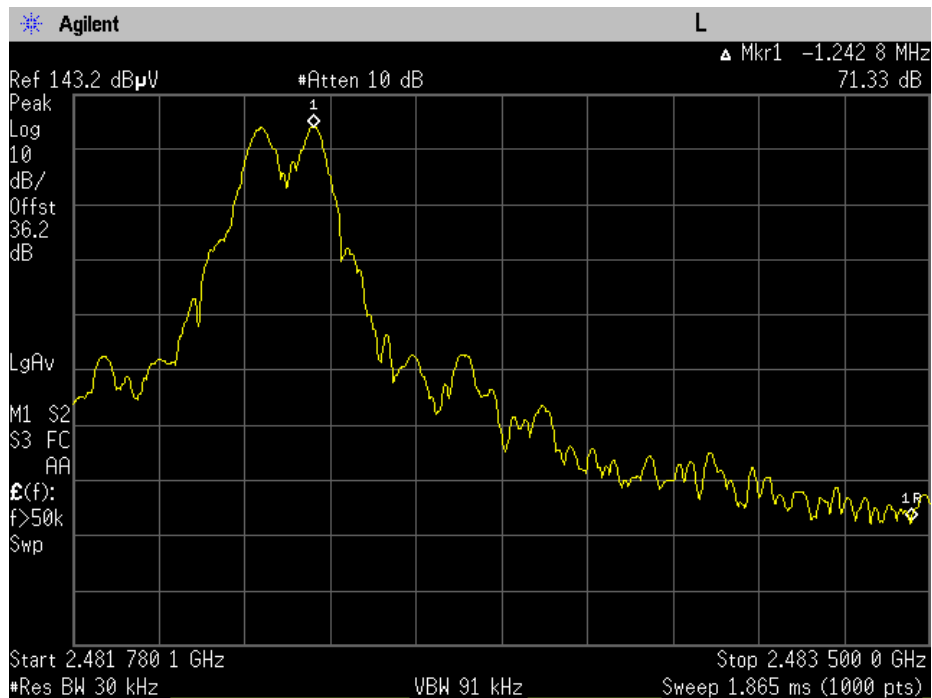


Marker Delta Method – 154 kbps Data Rate

Highest in Band Emission = 137.40



Delta at 30 kHz = 71.33



$$137.40 - 71.33 + (-17.8) = 48.27 \text{ dB}\mu\text{V} \text{ (High Channel Band Edge)}$$

Test Equipment Utilized

Description	Manufacturer	Model #	CT Asset #	Last Cal Date	Cal Due Date
Bilog Antenna	Schaffner	CBL6111C	i00267	3/1/16	3/1/18
Horn Antenna	ARA	DRG-118/A	i00271	6/16/16	6/16/18
Humidity / Temp Meter	Newport	IBTHX-W-5	i00282	5/26/16	5/26/17
EMI Analyzer	Agilent	E7405A	i00379	2/11/16	2/11/17
3 Meter Semi-Anechoic Chamber	Panashield	3 Meter Semi-Anechoic Chamber	i00428	8/15/16	8/15/17
PSA Spectrum Analyzer	Agilent	E4445A	i00471	8/26/15	8/26/16
Preamplifier for 1-18GHz horn antenna	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