

Test Report #: TR 317117 A

Equipment Under Test: Help Alert Mass Notification Pendant

Test Date(s): 6/20/17 – 6/22/17

Prepared for: RF Technologies
Attn: Paul Larson
3125 North 126th Street
Brookfield, WI 53005

Report Issued by: Adam Alger, Quality Systems Engineer

Signature: *Adam Alger*

Date: 9/20/2017

Report Reviewed by: Adam Alger, Quality Systems Engineer

Signature: *Adam Alger*

Date: 7/27/2017

Report Constructed by: Michael Hintzke, EMC Engineer III

Signature: *Michael Hintzke*

Date: 7/25/2017

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Laird Technologies Test Services in Review

The Laird Technologies, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025: 2005 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

Scope of accreditation includes all test methods listed herein, unless otherwise noted.



Federal Communications Commission (FCC) – USA

Accredited recognition of two 3-meter Semi-Anechoic Chambers

Accredited Test Firm Registration Number: 953492



**Government
of Canada**

Innovation, Science and Economic Development Canada

ISED Site listing of two 3-meter Semi-Anechoic Chambers based on RSS-GEN – Issue 4

File Number: IC 3088A-2

File Number: IC 3088A-3

Company: RF Technologies	Page 3 of 23	Name: Help Alert Mass Notification Pendant
Report: TR 317117 A		Model: 0830-0198
Job: C-2708		Serial: Engineering Sample

1 TEST REPORT SUMMARY

From 6/20/17 to 6/22/17 the Equipment Under Test (EUT), Help Alert Mass Notification Pendant, as provided by RF Technologies was tested to the following requirements:

Requirements	Description	Method	Compliant
FCC: 15.247 (d)	Spurious Radiated Emissions in Restricted Bands	FCC 15.209	ANSI C63.10

Note: The test data represented within this report is to support the requirements for a Class 2 Permissive Change to add a new antenna layout to the existing modular approval. Conducted measurements will be leveraged from Microchip filing.

Notice:

The results relate only to the item tested and described in this report. Any modifications made to the equipment under test after the specified test date(s) may invalidate the data herein.

If the resulting measurement margin is seen to be within the uncertainty value, as listed in this report, the possibility exists that this unit may not meet the required limit specification if subsequently tested.

2 CLIENT INFORMATION

Company Name	RF Technologies
Contact Person	Paul Larson
Address	3125 North 126 th Street, Brookfield WI 53005

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	Help Alert Mass Notification Pendant
Model Number	0830-0198
Serial Number	Engineering Sample
FCC ID	KXU-1000-9161

2.2 Product Description

Help Alert Mass Notification Pendant for staff duress alerting

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Additional Information

Testing was performed on channels 1 (2412 MHz), 7 (2437 MHz) and 11 (2462 MHz) at 1 Mbps, 6 Mbps, 11 Mbps and 54 Mbps. The EUT was configured by the client to cycle through test modes through button pushes on the EUT. The EUT was powered internally with 2-AAA batteries.

3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15.247	-	2017
RSS-247	2	2017
CFR 47 Part 15.209	-	2017
CFR 47 Part 15.207	-	2017
RSS-Gen	4	2014
ANSI C63.10	-	2013

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k = 2.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty ±
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	1x10 ⁻⁷	0.55x10 ⁻⁷
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Radiated Emissions

<p>Description of Measurement</p>	<p>The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna.</p> <p>The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values.</p> <p>The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.</p>
<p>Example Calculations</p>	<p>Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m)</p> <p>Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m)</p> <p>Example at 4000 MHz: Reading = 40 dBμV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBμV/m Average Limit = 20 log (500) = 54 dBμV/m Margin = 54 dBμV/m - 50.8 dBμV/m = 3.2 dB</p>

Block Diagram



5.1.1 Duty Cycle

Operator	Michael Hintzke
QA	Aidi Zainal
Test Dates	6/20/17
Location	Chamber 3
Temp. / R.H.	70°F / 55%
Method	ANSI C63.10-2013 section 11.6

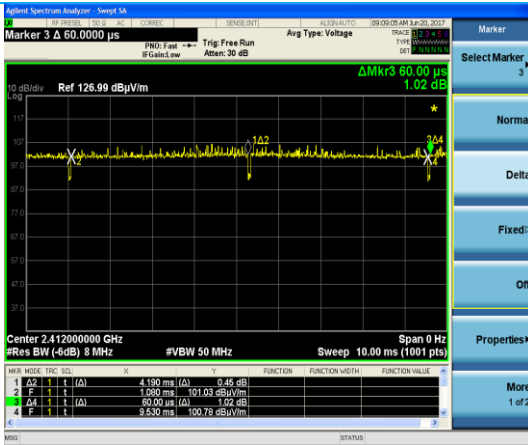
Test Parameters

Frequency	2412 MHz
Distance	3 meters
RBW Settings	≤1 GHz: 120 kHz >1 GHz: 1 MHz
VBW Settings	≤1 GHz: 1.2 MHz >1 GHz: 3 MHz (Peak)
Duty Cycle Measurement Settings	<ul style="list-style-type: none"> • 8 MHz RBW / 50 MHz VBW • Peak Detector
Duty Cycle Calculation	Duty Cycle = (Transmit On Time) / (Transmit On Time + Transmit Off Time)

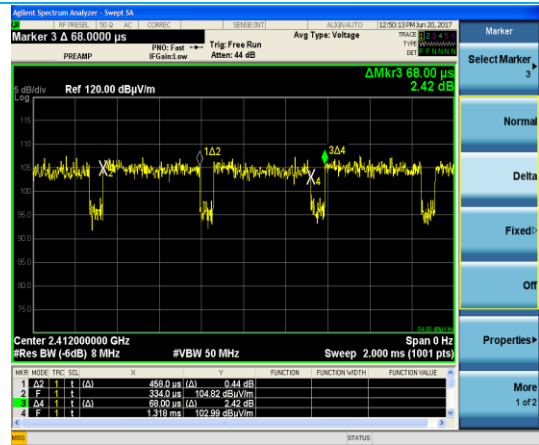
Table – Duty Cycle

Data Rate	Channel Frequency (MHz)	On-time (ms)	Total Time (ms)	Duty	1/(Tx On Time) (Hz)
1 Mbps	2412	4.19E-03	6.00E-05	98.59	238.66
11 Mbps	2412	4.68E-04	6.80E-05	87.31	2136.75
6 Mbps	2412	6.94E-04	7.20E-05	90.60	1440.92
54 Mbps	2412	9.60E-05	7.10E-05	57.49	10416.67

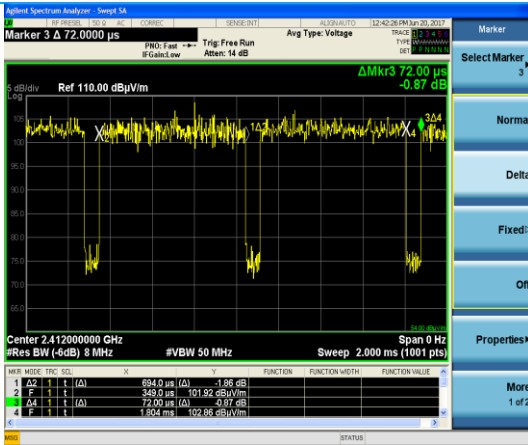
Plots – Duty Cycle



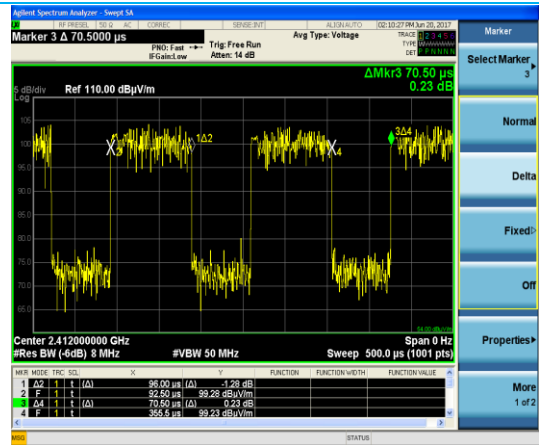
1 Mbps



11 Mbps



6 Mbps



54 Mbps

5.1.2 Radiated Spurious Emissions

Operator	Michael Hintzke
QA	Adam Alger, Shane Dock
Test Date	6/20/17, 6/21/17
Location	Chamber 3
Temp. / R.H.	70°F / 55% 71°F / 51%
Requirement	CFR 47 Part 15 209 CFR 47 Part 15.205 RSS-Gen section 6.13
Method	ANSI C63.10

Limits:

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
>960	500	3

Test Parameters

Frequency	30 MHz – 25000 MHz
Distance	3 meters
RBW Settings	≤1 GHz: 120 kHz >1 GHz: 1 MHz
VBW Settings	≤1 GHz: 1.2 MHz >1 GHz: 3 MHz (Peak);
Notes	<p>Average measurements for FCC 15.205(a) compliance from 1-4 GHz were performed with the following VBW settings determined by the following equation [1/(minimum transmitter on time)] as specified in ANSI C63.10 section 4.1.4.2.3 f).</p> <ul style="list-style-type: none"> • 240 Hz for 1 Mbps • 2.2 kHz for 11 Mbps • 1.5 kHz for 6 Mbps • 11 kHz for 54 Mbps <p>Emissions from 4-25 GHz were determined to be worse case at 1 Mbps and were measured at 1 Mbps.</p>

Instrumentation



Date : 22-Jun-2017

Test : Radiated Spurious Emissions

Job # : C-2708

PE: Mike Hintzke

Customer : RF Technologies

Quote #: 31717

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N8038A	MY51210148	5/12/2017	5/12/2018	Active Calibration
2	AA 960007	Double Fidge Horn Antenna	EMCO	315	9311-4138	7/22/2016	7/22/2017	Active Calibration
3	EE 960160	Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	97771030	7/22/2016	7/22/2017	Active Calibration
4	AA 960171	Cable - low loss 6m	A.H. Systems, Inc.	SAC-26G-6	386	3/31/2016	8/13/2017	Active Verification
5	AA 960154	High Pass Filter 2.4 GHz	KWM	HPF-L-14186	7272-02	7/29/2016	7/29/2017	Active Calibration
6	AA 960174	Small Horn Antenna	ETS Lindgren	316C-PA	00206880	5/12/2017	5/12/2018	Active Calibration

Table – 30 MHz – 1000 MHz

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation	Notes
197.1	1.00	0	30.209	43.5	13.3	H	V	1,2
198.0	1.00	0	30.261	43.5	13.2	V	V	1,2
194.6	1.00	0	29.98	43.5	13.5	H	S	1,2
198.3	1.00	0	30.804	43.5	12.7	V	S	1,2
196.9	1.00	0	30.337	43.5	13.2	H	F	1,2
198.7	1.00	0	30.626	43.5	12.9	V	F	1,2
997.6	1.00	0	34.914	54.0	19.1	H	V	1,2
999.3	1.00	0	35.108	54.0	18.9	V	V	1,2
995.4	1.00	0	34.668	54.0	19.3	H	S	1,2
970.2	1.00	0	34.476	54.0	19.5	V	S	1,2
996.3	1.00	0	34.496	54.0	19.5	H	F	1,2
999.1	1.00	0	35.175	54.0	18.8	V	F	1,2

Note 1: Peak data is compared to the quasi-peak limit

- Peak Reading (dBµV/m) – Quasi-peak Limit (dBµV/m) = Quasi-Peak Margin (dB)

Note 2: System noise floor measurement

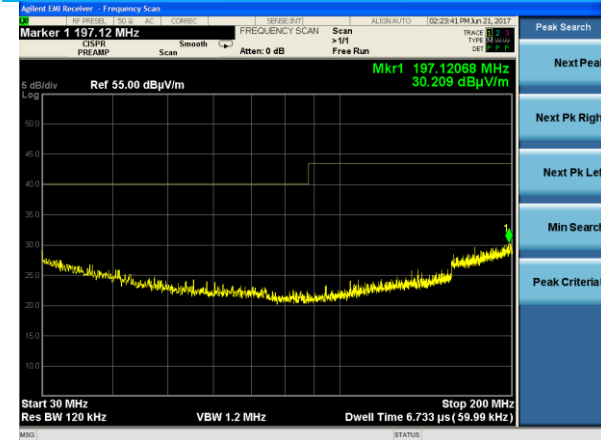
Table – 1000 MHz - 4000 MHz

Peak Frequency (MHz)	Peak Measurement (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	Average Frequency (MHz)	Average Measurement (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)	Data Rate (Mbps)
2385.04	55.672	74	18.328	2334.00	36.530	54	17.47	1
2386.88	55.114	74	18.886	2331.84	37.778	54	16.222	11
2389.68	58.991	74	15.009	2390.00	41.723	54	12.277	6
2389.52	58.027	74	15.973	2389.76	42.925	54	11.075	54

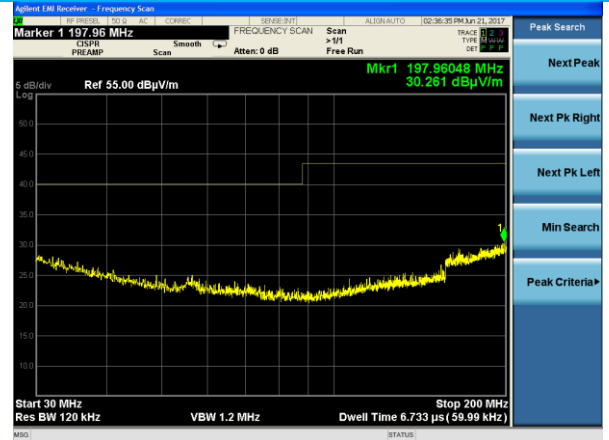
Table – 4000 MHz – 18000 MHz

Frequency (MHz)	Height (m)	Azimuth (degree)	Peak Reading (dBµV/m)	Avg Reading (dBµV/m)	Avg Limit (dBµV/m)	Margin (dB)	Antenna Polarity	EUT orientation
4824	3.71	179	40.01	30.72	54	23.28	Horizontal	Vertical
4824	1.00	320	40.25	30.89	54	23.11	Vertical	Vertical
4824	1.00	136	41.01	32.40	54	32.60	Horizontal	Side
4824	1.00	329	50.86	31.59	54	22.41	Vertical	Side
4824	1.00	215	42.01	33.78	54	20.22	Horizontal	Flat
4824	1.00	40	40.15	29.23	54	24.77	Vertical	Flat
4874	1.00	0	40.67	31.90	54	22.10	Horizontal	Vertical
4874	1.00	332	41.04	33.42	54	20.59	Vertical	Vertical
4874	1.00	220	41.93	34.00	54	20	Horizontal	Side
4874	1.12	11	41.48	33.59	54	20.41	Vertical	Side
4874	1.00	219	42.00	35.14	54	18.86	Horizontal	Flat
4874	1.00	40	40.51	29.30	54	34.70	Vertical	Flat
4924	1.00	0	43.25	35.14	54	18.86	Horizontal	Vertical
4924	3.76	219	43.39	36.53	54	17.47	Vertical	Vertical
4924	1.00	224	42.98	35.323	54	18.69	Horizontal	Side
4924	1.39	13	43.23	37.17	54	16.83	Vertical	Side
4924	1.00	221	43.21	37.06	54	16.94	Horizontal	Flat
4924	3.00	181	41.45	32.38	54	21.62	Vertical	Flat

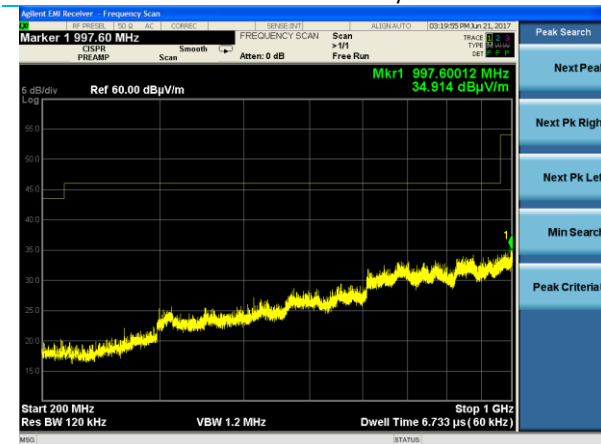
Plots – 30 MHz – 2310 MHz



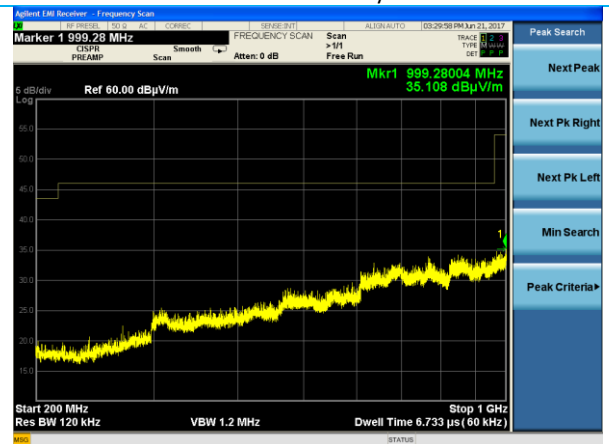
30 MHz – 200 MHz
Horizontal Polarity



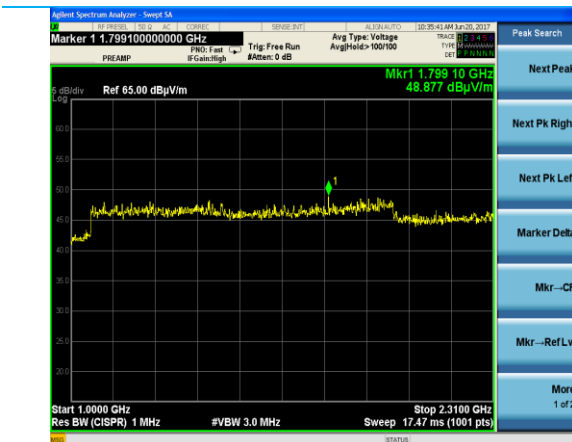
30 MHz – 200 MHz
Vertical Polarity



200 MHz – 1000 MHz
Horizontal Polarity



200 MHz – 1000 MHz
Vertical Polarity

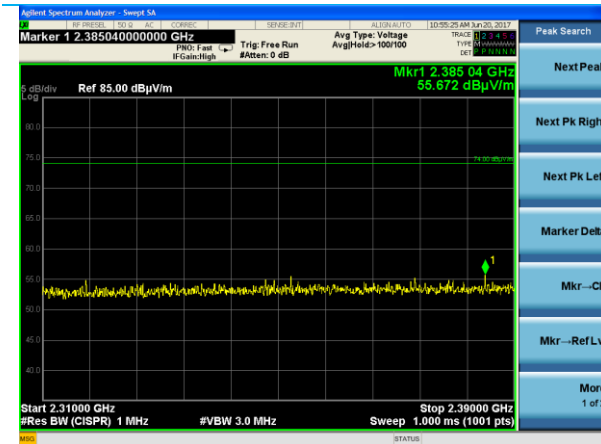


1 Mbps
Peak



1 Mbps
Reduced VBW

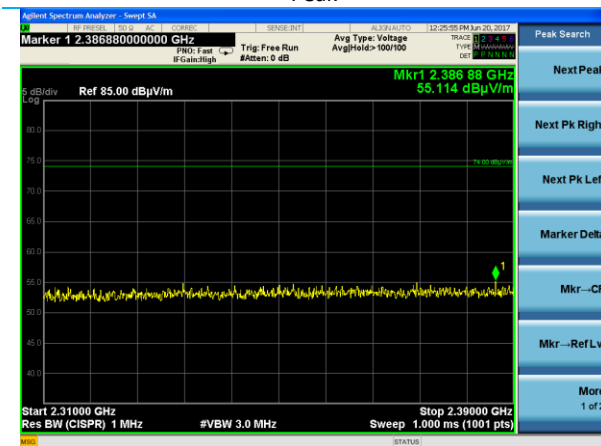
Plots – 2310 MHz - 2390 MHz



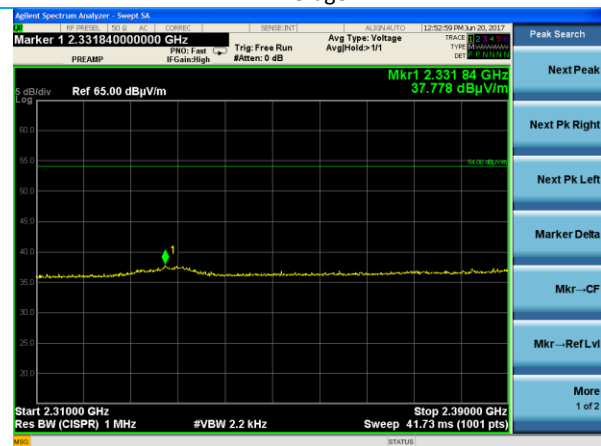
1 Mbps
Peak



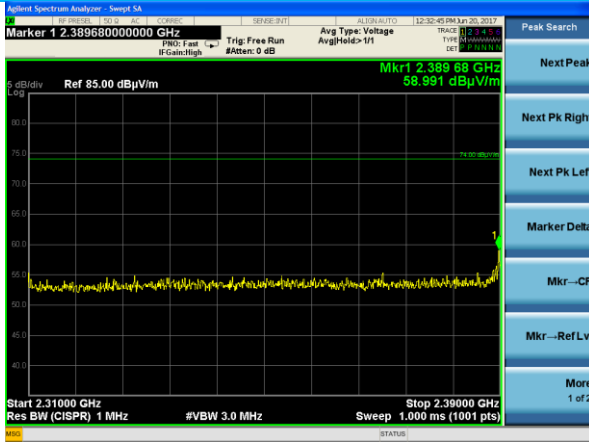
1 Mbps
Average



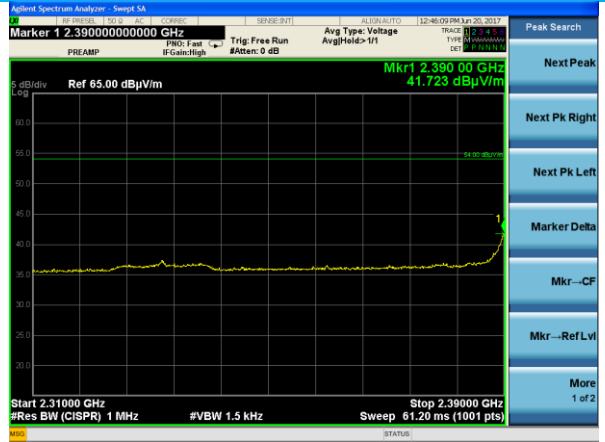
11 Mbps
Peak



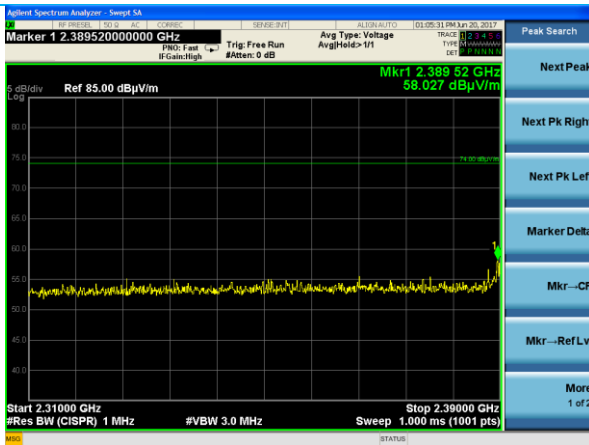
11 Mbps
Average



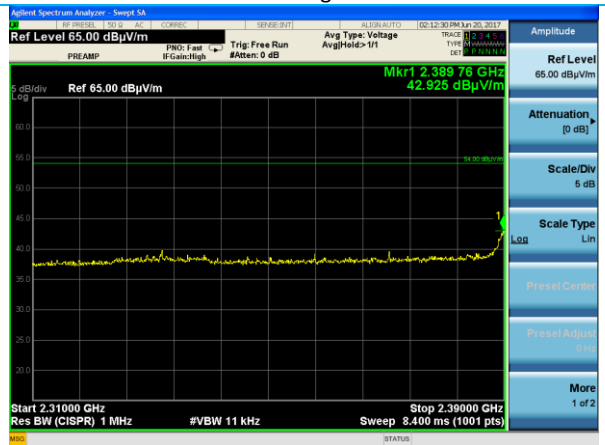
6 Mbps Peak



6 Mbps Average

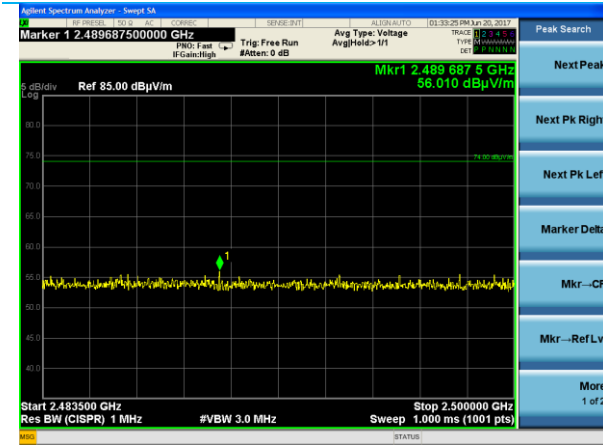


54 Mbps Peak

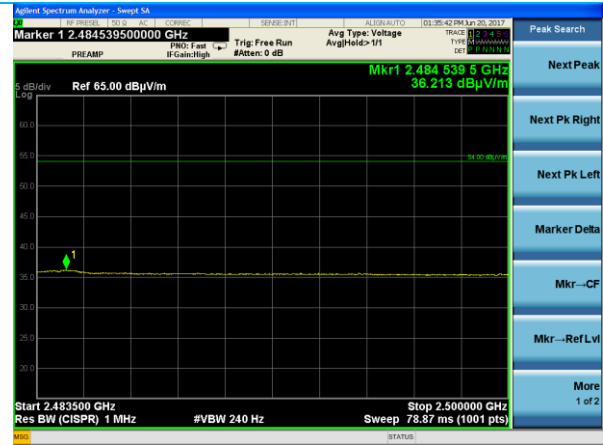


54 Mbps Average

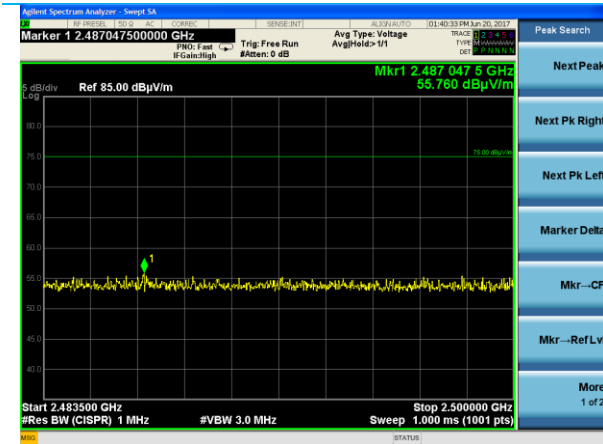
Plots – 2483.5 MHz - 2500 MHz



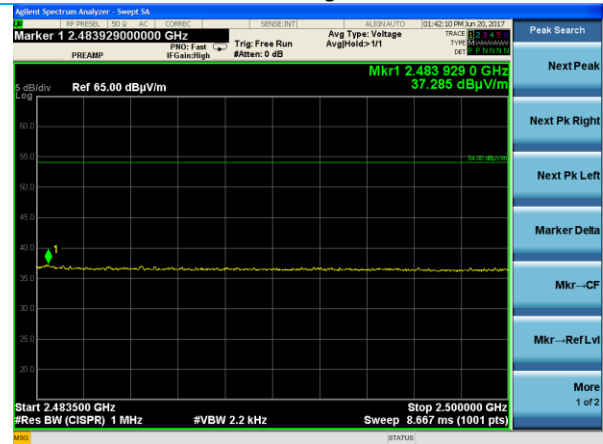
1 Mbps
Peak



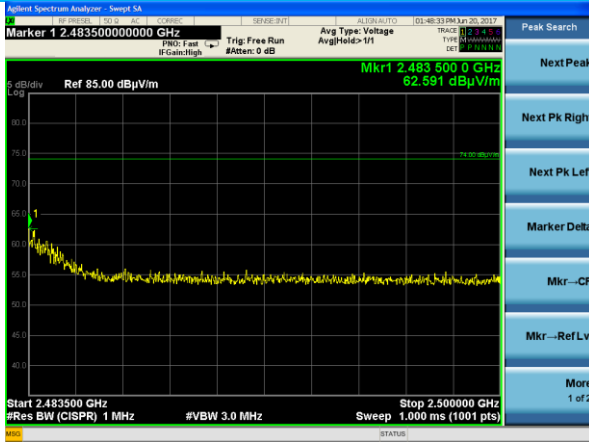
1 Mbps
Average



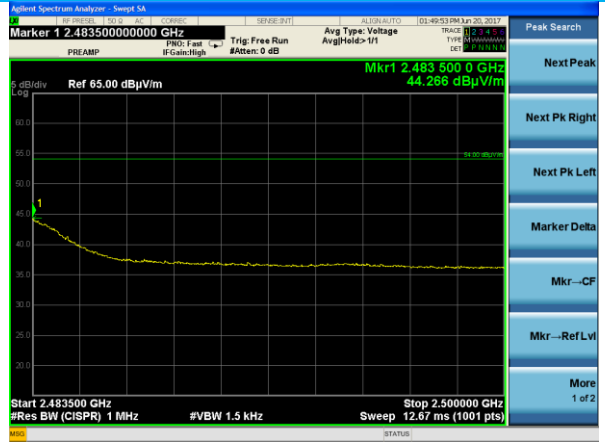
11 Mbps
Peak



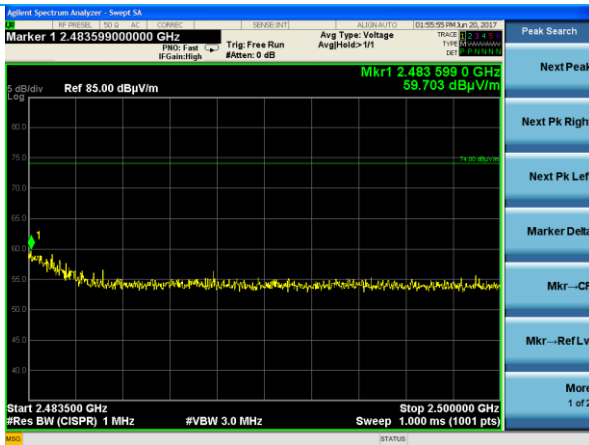
11 Mbps
Average



6 Mbps
Peak



6 Mbps
Average

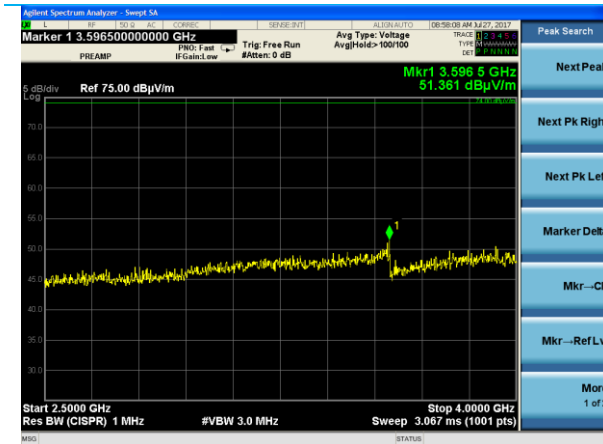


54 Mbps
Peak



54 Mbps
Average

Plots – 2500 MHz – 4000 MHz



1 Mbps
Peak



1 Mbps
Reduced VBW

Plots – 4000 MHz – 18000 MHz



1 Mbps
Horizontal Polarity
Low Channel



1 Mbps
Vertical Polarity
Low Channel



1 Mbps
Horizontal Polarity
Mid Channel



1 Mbps
Vertical Polarity
Mid Channel

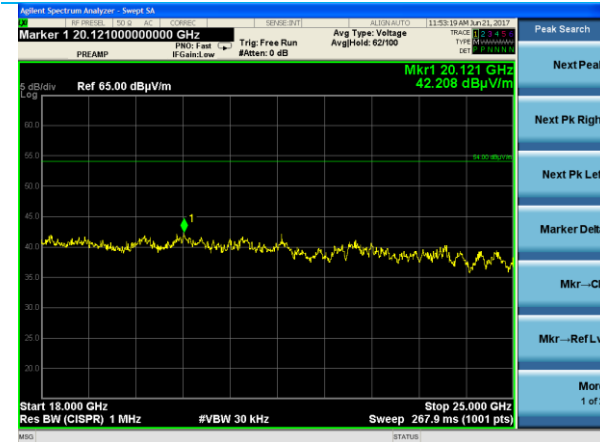


1 Mbps
Horizontal Polarity
High Channel

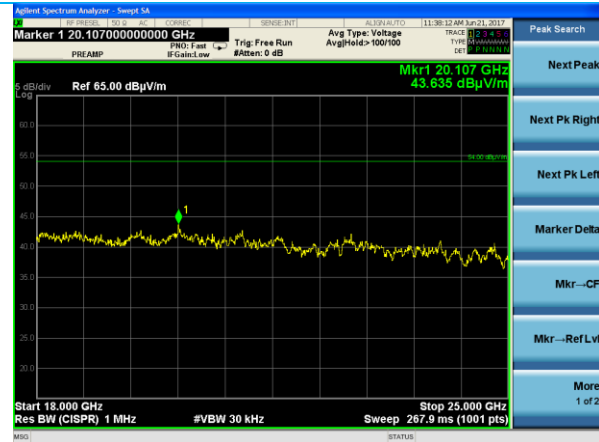


1 Mbps
Vertical Polarity
High Channel

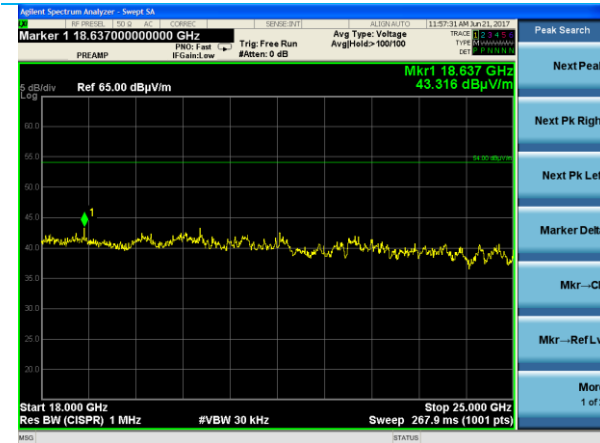
Plots – 18000 MHz – 25000 MHz



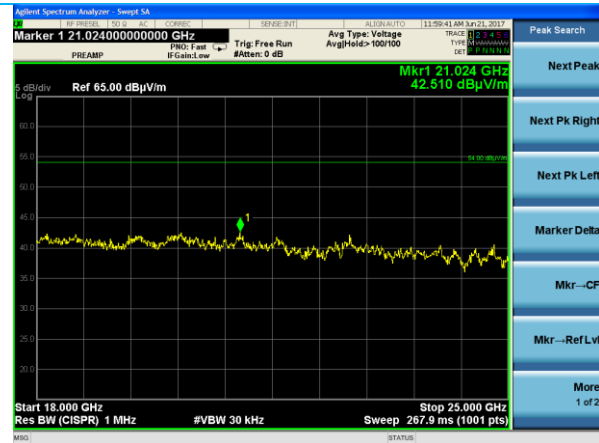
1 Mbps
Horizontal Polarity
Low Channel



1 Mbps
Vertical Polarity
Low Channel



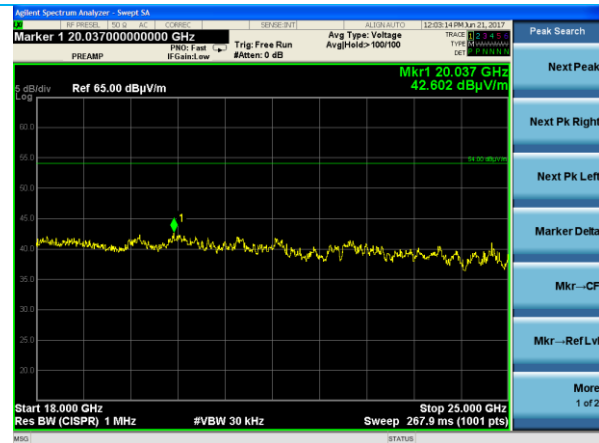
1 Mbps
Horizontal Polarity
Mid Channel



1 Mbps
Vertical Polarity
Mid Channel



1 Mbps
Horizontal Polarity
High Channel



1 Mbps
Vertical Polarity
High Channel

6 REVISION HISTORY

Version	Date	Notes	Person
0	7/24/17	Initial Draft	Mike Hintzke
1	7/27/17	Draft Revisions	Mike Hintzke
2	9/20/17	Added EUT information and Final	Adam Alger

END OF REPORT