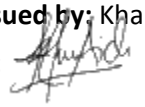
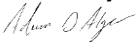
Test Report # 317246 A

Equipment Under Test:	RM191-SM
Test Date(s):	2/17/16 to 3/18/16 9/28/17 to 9/29/17
Prepared for:	Laird Technologies, Inc. W66N220 Commerce Ct Cedarburg WI. 53012

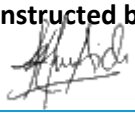
Report Issued by: Khairul Aidi Zainal, Laboratory Manager

Signature:  Date: 10/24/2017

Report Reviewed by: Adam Alger, Quality Systems Engineer

Signature:  Date: 10/24/17

Report Constructed by: Khairul Aidi Zainal, Laboratory Manager

Signature:  Date: 10/23/2017

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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:

TESTING CERT #1255.01

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

1 TEST REPORT SUMMARY

During 2/17/2016 to 3/18/2016 and 8/1/2017 to 8/13/2017, the Equipment Under Test (EUT), **RM191-SM**, as provided by **Laird Technologies, Inc.** was tested to the following requirements:

Requirement	Description	Specification	Method	Result
FCC: 15.247 (d) IC: RSS-247 Sect. 3.3	Spurious Radiated Emissions in Restricted Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Pass

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	Laird Technologies, Inc
Contact Person	Bill Steineke
Address	W66N220 Commerce Ct. Cedarburg WI. 53012

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	RM191-SM
Model Number	RM191-SM
Serial Number	LEN DVT 20 (conducted Testing) LEN DVT 7 (Radiated Testing)

2.2 Product Description

The LoRa radio, as described in this report is separated into two sets of modes, which differ in their modulation bandwidths and operating channels. The 500kHz bandwidth channels form a traditional DTS modulation system. The 500kHz channels can have a spreading factor (SF) between 7 and 12, with a higher spreading factor corresponding to a lower data rate. Where data is taken in this report for a 500kHz channel, unless stated otherwise, the measurements were taken with a spreading factor of 12 as this constitutes the worst case scenario for emissions. The given 500kHz channels used were:

Low – 903 MHz

Mid – 907.8 MHz

High – 914.2 MHz

The 125kHz channels form a hybrid DTS and frequency hopping system, which meets part 15.247's requirements for a hybrid system. 125kHz channels can have a spreading factor between 7 and 10, with 10 representing the worst case-emissions. The 125kHz channels used were:

Low – 902.3 MHz

Mid – 908.5 MHz

High – 914.9 MHz

The Antenna being added is a PCB notch antenna with a peak gain of -1.5dB in the operating range of 902 to 928MHz

2.3 Modifications Incorporated for Compliance

None at time of test

2.4 Deviations and Exclusions from Test Specifications

None at time of test

2.5 Additional Information

The EUT was put into the appropriate test mode by connecting to the EUT using UwTerminalX and Going through the menu option. Example:

To demonstrate the LoRa radio transmitter sending modulated packets, use the following steps…

- First set up the LoRa frequency by pressing **5**, then entering the 6 digit center frequency (in kHz).
- Press option **4** to set up the transmitter output power. For US, it should be set to 15 (full power), for EU it should be set to 14 (about 14dBm), the default on power up is 15 for US.
- Press option **6** to set up the transmitter spreading factor- valid options are 7 thru 12 (the default on power up is 7).
- Press option **7** to set up the transmitter modulation bandwidth (125,250, or 500 kHz), 125kHz is the default at power up.
- Press option **9** to start packet transmission. The firmware will be locked up and no other keys will be recognized, until you press **1** to break the transmit loop (which also resets the LoRa radio into receive mode)

The EUT is capable of operating on 2 supply voltages (3.6VDC and 1.8 VDC) and was investigated for both operations.

3 REFERENCES

Publication	Edition	Date
CFR 47 Part 15	-	2017
ANSI C63.10	-	2013
RSS-247	2	2017
RSS GEN	4	2014
KDB 558074 D01	4	2017

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

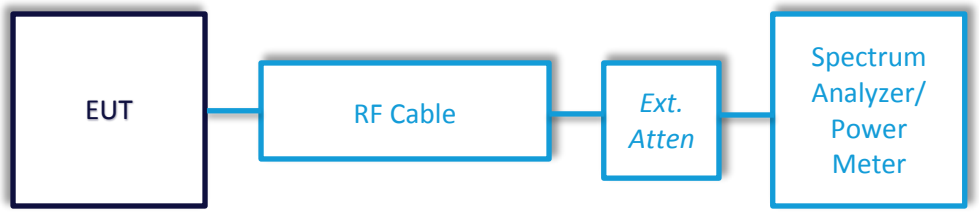
Parameter	ETSI U.C. ±	U.C. ±
Radio Frequency, from F0	$1x10^{-7}$	$0.55x10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %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

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



5.1.1 Antenna Port Conducted Emissions – Emissions in Restricted Frequency Bands

Operator	Shane Dock
QA	Aidi Zainal
Test Date	2/17/16 to 3/18/16
Location	Conducted measurement area
Temp. / R.H.	70F / 71%
Requirement	15.247 (d)
Method	ANSI C63.10 section 11.12.2

Limits:

	30-88 MHz	88-216 MHz	216 – 960 MHz	960+ MHz
Field Strength (µV/m)	100	150	200	500
Field Strength (dBµV/m)	40.0	43.5	46.0	54.0

Instrumentation

LSR a Laird Business

Date : 18-Feb-2016 Type Test : Conducted Radio Job # : C-2401

Prepared By: Shane Dock Customer : Laird Quote #: 316054

No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960144	Phaseflex	Gore	EKD01D010720	5800373	Verification	Verification	System
2	EE 960087	44GHz EXA Spectrum Analyzer	Agilent	N9010A	MY53400296	12/18/2015	12/18/2016	Active Calibration
3	AA 960156	900MHz High Pass Filter	KWM	HPF-L-14185	unknown	8/4/2015	8/4/2016	Active Calibration

Test Parameters

Frequency	30MHz to 10000MHz
Settings	Below 1GHz: Quasi Peak detector
Settings	Above 1GHz: Peak detector and RMS detector
Notes	1. Continuous transmit modulated used for this test. 2. Measurements performed using Peak detector. These Peak emissions are compared to non-peak limits, i.e. quasi peak limit or average limit depending on the frequency per section 11.12 of C63.10 (Restricted band emissions) 3. In Restricted band emissions measurements below 1 GHz, ground reflection factor of 4.7dB and antenna gain of 2dBi was added to emissions measurement. 4. In Restricted band emissions measurements above 1 GHz, antenna gain of 2dBi was added to emissions measurement. Calculation of restricted band limits: From ANSI C63.10 section 11.12.2.2; $E = \mathrm{EIRP} - 20 \log d + 104.8$ where E is the electric field strength in dBµV/m EIRP is the equivalent isotropically radiated power in dBm d is the specified measurement distance in m Restricted band Limit in dBm (EIRP) = Restricted band Limit in dBµV/m (E) + 20log$d$ – 104.8 Example: Restricted band limit (E) = 46dBµV/m at d = 3m Limit (dBm) = 54 dBµV/m + 20log (3m) -104.8 = **-41.2 dBm**

Emissions in Restricted Frequency bands:

1. **DTS mode (500kHz bandwidth channel).**

   a. **3.6 VDC**

Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
High - 500k	12	964.7	-65.2	2.0	4.7	-58.5	-41.2	17.3
Mid - 500k	12	1015.5	-57.7	2.0	0.0	-55.7	-41.2	14.4
High - 500k	12	256.0	-67.6	2.0	4.7	-60.9	-49.2	11.7

Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
Low	12	8126.5	-50.6	2.0	0.0	-48.6	-41.2	7.4
Low	12	7225.5	-55.5	2.0	0.0	-53.5	-41.2	12.2
Low	12	3875.9	-57.9	2.0	0.0	-55.9	-41.2	14.7
Mid	12	8170.6	-54.3	2.0	0.0	-52.3	-41.2	11.0
Mid	12	7262.0	-55.6	2.0	0.0	-53.6	-41.2	12.4
Mid	12	3774.1	-58.1	2.0	0.0	-56.1	-41.2	14.9
High	12	8229.3	-44.1	2.0	0.0	-42.1	-41.2	0.9
High	12	7315.1	-50.6	2.0	0.0	-48.6	-41.2	7.4
High	12	3657.9	-56.7	2.0	0.0	-54.7	-41.2	13.5

Note:

1. Measurements are Peak and compared to quasi peak limit for below 1GHz and Average limit for above 1 GHz.

b. 1.8 VDC

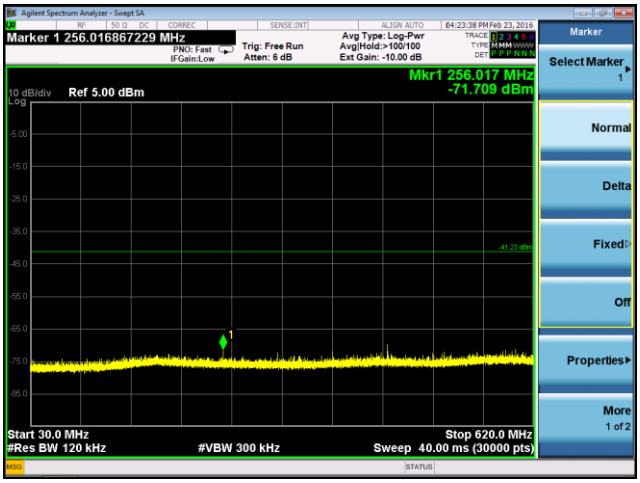
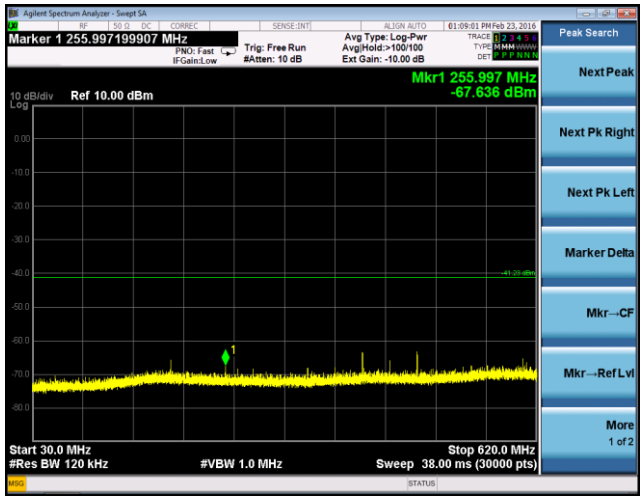
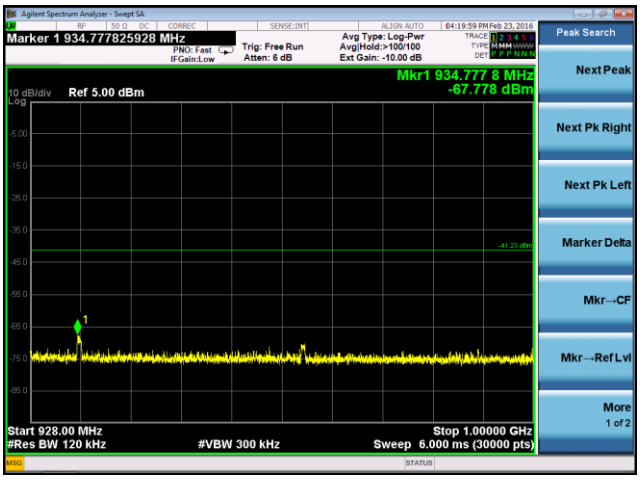
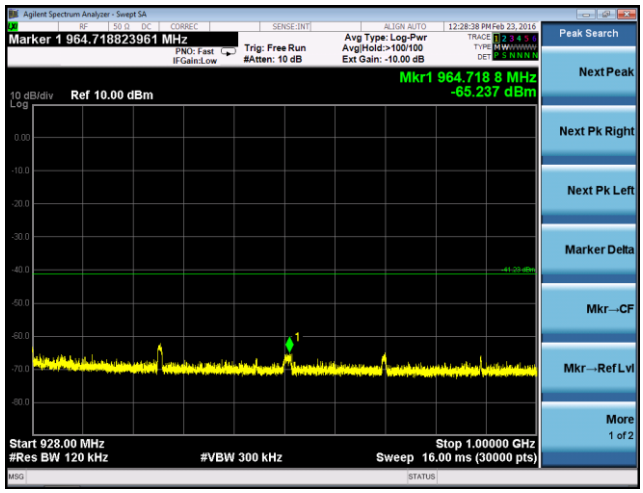
Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
Low-500k	12	934.8	-67.8	2.0	4.7	-61.1	-49.2	11.8
Mid-500k	12	1097.4	-62.5	2.0	0.0	-60.5	-41.2	19.3
High-500k	12	256.0	-71.7	2.0	4.7	-65.0	-49.2	15.8

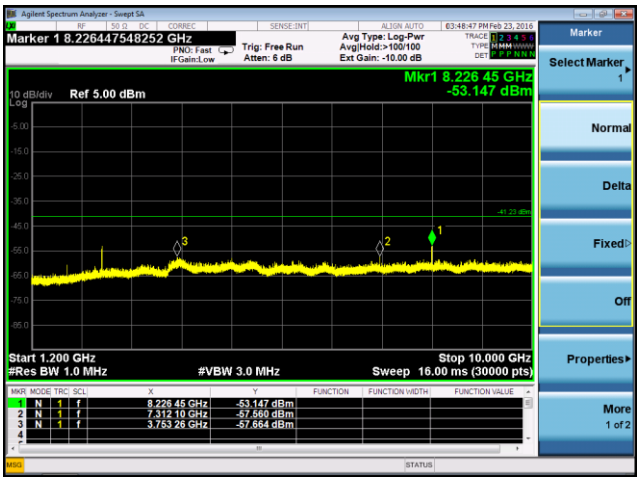
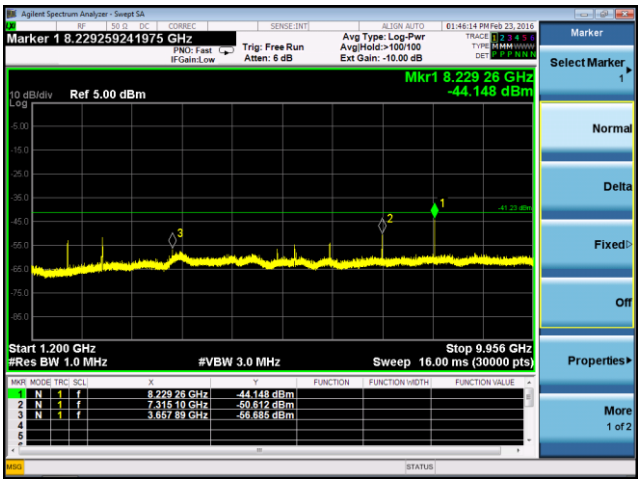
Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
Low	12	8128.5	-53.3	2.0	0.0	-51.3	-41.2	10.1
Low	12	3838.6	-57.9	2.0	0.0	-55.9	-41.2	14.7
Low	12	8362.0	-58.1	2.0	0.0	-56.1	-41.2	14.9
Low	12	7653.0	-58.9	2.0	0.0	-56.9	-41.2	15.7
Mid	12	8170.1	-51.9	2.0	0.0	-49.9	-41.2	8.7
Mid	12	3748.6	-57.6	2.0	0.0	-55.6	-41.2	14.4
Mid	12	4686.7	-57.9	2.0	0.0	-55.9	-41.2	14.7
Mid	12	7261.9	-58.3	2.0	0.0	-56.3	-41.2	15.0
High	12	8226.5	-53.1	2.0	0.0	-51.1	-41.2	9.9
High	12	7312.1	-57.6	2.0	0.0	-55.6	-41.2	14.3
High	12	3753.3	-57.7	2.0	0.0	-55.7	-41.2	14.4

Note:

1. Measurements are Peak and compared to quasi peak limit for below 1GHz and Average limit for above 1 GHz.

Screen Captures

	
30 to 620 MHz (1.8 VDC)	30 to 620 MHz (3.6 VDC)
	
928 to 1000 MHz (1.8 VDC)	928 to 1000 MHz (3.6 VDC)

	
1200 to 10000 MHz (1.8 VDC)	1200 to 10000 MHz (3.6 VDC)

Notes:

1. **Display lines on the plot are not limit lines.**
2. **Captures included are only for ranges where emissions were seen.**

2. Hybrid mode (125kHz bandwidth channel).

c. 3.6 VDC

Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
Low - 125k	10	966.3	-64.0	2.0	4.7	-57.3	-41.2	16.1

Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
Low	10	3727.1	-57.3	2.0	0.0	-55.3	-41.2	14.0
Low	10	4676.3	-58.4	2.0	0.0	-56.4	-41.2	15.2
Mid	10	8177.0	-51.1	2.0	0.0	-49.1	-41.2	7.9
Mid	10	7268.4	-55.5	2.0	0.0	-53.5	-41.2	12.3
Mid	10	9085.6	-56.6	2.0	0.0	-54.6	-41.2	13.3
High	10	8234.2	-43.7	2.0	0.0	-41.7	-41.2	0.4
High	10	7319.2	-49.6	2.0	0.0	-47.6	-41.2	6.4
High	10	3659.6	-55.3	2.0	0.0	-53.3	-41.2	12.1

Note:

1. Measurements are Peak and compared to quasi peak limit for below 1GHz and Average limit for above 1 GHz.

d. 1.8 VDC

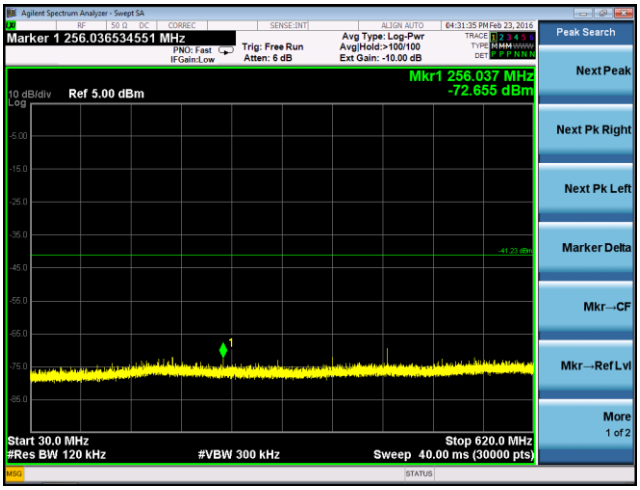
Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
Mid-125k	10	940.5	-67.8	2.0	4.7	-61.1	-49.2	11.9
Low-125k	10	1018.5	-61.8	2.0	0.0	-59.8	-41.2	18.6
Low-125k	10	256.0	-72.7	2.0	4.7	-66.0	-49.2	16.8

Channel	Spreading Factor	Peak data Frequency (MHz)	Peak Measurement	Antenna gain (dBi)	Total Additional Gains (dBi)	Final peak (dBm)	Limit (dBm)	Margin (dB)
Low	10	8121.1	-53.0	2.0	0.0	-51.0	-41.2	9.7
Low	10	3807.2	-57.7	2.0	0.0	-55.7	-41.2	14.5
Low	10	4772.3	-58.4	2.0	0.0	-56.4	-41.2	15.2
Mid	10	8177.2	-52.1	2.0	0.0	-50.1	-41.2	8.9
Mid	10	7267.8	-57.6	2.0	0.0	-55.6	-41.2	14.4
Mid	10	3675.8	-57.8	2.0	0.0	-55.8	-41.2	14.6
High	10	8234.7	-53.6	2.0	0.0	-51.6	-41.2	10.4

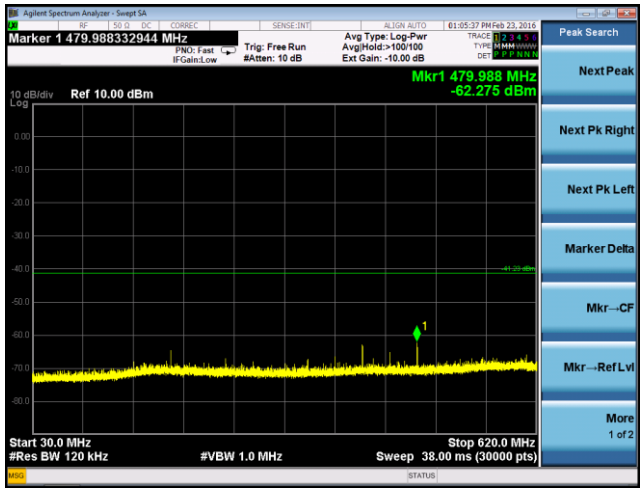
Note:

1. Measurements are Peak and compared to quasi peak limit for below 1GHz and Average limit for above 1 GHz.

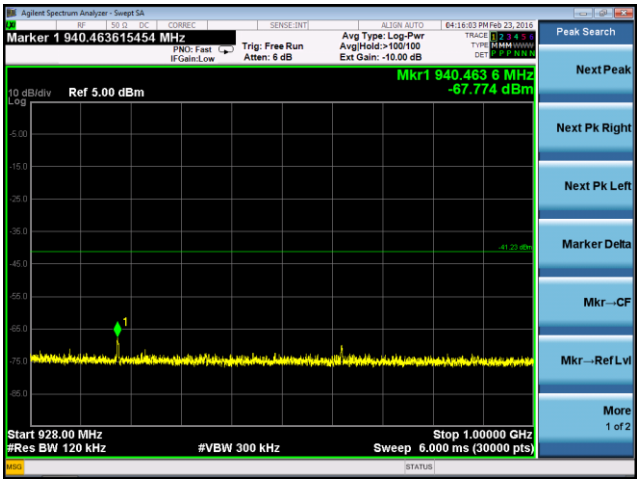
Screen Captures



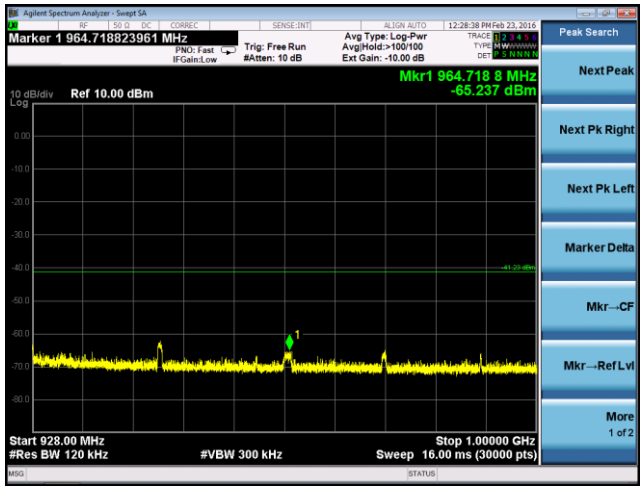
30 to 620 MHz (1.8 VDC)



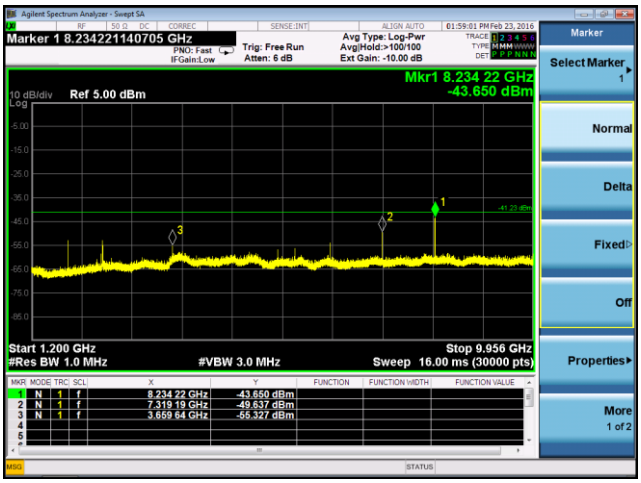
30 to 620 MHz (3.6 VDC)



928 to 1000 MHz (1.8 VDC)



928 to 1000 MHz (3.6 VDC)

	
1200 to 10000 MHz (1.8 VDC)	1200 to 10000 MHz (3.6 VDC)

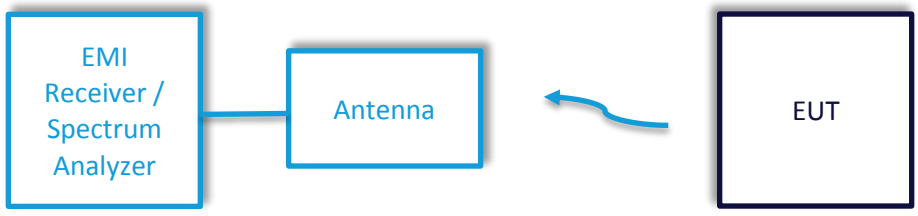
Notes:

1. **Display lines on the plot are not limit lines.**
2. **Captures included are only for ranges where emissions were seen.**

5.2 Radiated Emissions

Description of Measurement	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. 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. 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.
Example Calculations	Measurement (dBµV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBµV/m) Margin (dB) = Limit (dBµV/m) - Corrected Reading (dBµV/m) 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

Block Diagram



5.2.1 Radiated Emissions

Operator	Zach Wilson, Aidi Zainal, Shane Dock
QA	Aidi Zainal, Coty Hammerer
Test Date	9/28/2017-9/29/2017
Location	Chamber 5
Temp. / R.H.	75 °F / 55%
Requirement	15.247 (d)
Method	ANSI C63.10 Sections 6.3, 6.5, 6.6

Limits:

	30-88 MHz	88-216 MHz	216 – 960 MHz	960+ MHz
Field Strength (µV/m)	100	150	200	500
Field Strength (dBµV/m)	40.0	43.5	46.0	54.0

Instrumentation

Laird
Smart Technology. Delivered.

Date : 28-Sep-2017 Test : Radiated emissions Job : C-2844

PE : Aidi Zainal Customer : Laird Quote : 317380

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2017	5/12/2018	Active Calibration
2	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	3/17/2017	3/17/2018	Active Calibration
3	EE 960096	Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	40201429	3/17/2017	3/17/2018	Active Calibration
4	AA 960177	Cable - low loss 10m	A.H. Systems, Inc.	SAC-18G-10	1704	12/19/2016	12/19/2017	Active Verification
5	EE 960085	EMI Receiver	Agilent	N9038A	MY51210148	5/12/2017	5/12/2018	Active Calibration
6	AA 960078	Log Periodic Antenna	EMCO	93146	9701-4855	4/17/2017	4/17/2018	Active Calibration
7	AA 960150	Biconical Antenna	ETS Lindgren	3110B	0003-3346	3/3/2017	3/3/2018	Active Calibration
8	AA 960155	High Pass Filter 900 MHz	KWM	HPF-L-14185	7272-03	5/2/2017	5/2/2018	Active Calibration

Test Parameters

Frequency	30MHz to 25000MHz
Distance	3 meters
RBW	1 MHz
VBW	Avg 30 Hz, Peak 50 MHz
Notes	1. EUT tested in 3 orthogonal orientations 2. Antenna port terminated with 50 ohms 3. Only worst case plots presented in this report 4. All three channels for both Hybrid (125kHz) and DTS (500kHz) mode were investigated 5. Pre-scans confirmed that emissions does not change with supply voltage.

Table

A. Emissions between 30MHz and 1000MHz:

1. 125kHz Hybrid mode

Frequency (MHz)	Polarization	EUT	Height (cm)	Azimuth (degrees)	Q. Peak (dBuV/m)	Q. Peak Limit (dBuV/m)	Q.Peak Margin (dB)
848.4	V	V	100.0	0.0	27.8	46.0	18.2
300.0	H	V	100.0	0.0	18.8	46.0	27.2
980.0	H	V	100.0	0.0	28.7	54.0	25.3

Note:

a. Measurement above are those of the system noise floor

2. 500kHz DTS mode

Frequency (MHz)	Polarization	EUT	Height (cm)	Azimuth (degrees)	Q. Peak (dBuV/m)	Q. Peak Limit (dBuV/m)	Q.Peak Margin (dB)
848.4	V	V	100.0	0.0	27.8	46.0	18.2
300.0	H	V	100.0	0.0	18.8	46.0	27.2
980.0	H	V	100.0	0.0	28.7	54.0	25.3

Note:

a. Measurement above are those of the system noise floor

B. Emissions between 1000MHz and 100000MHz:

1. 125kHz Hybrid mode

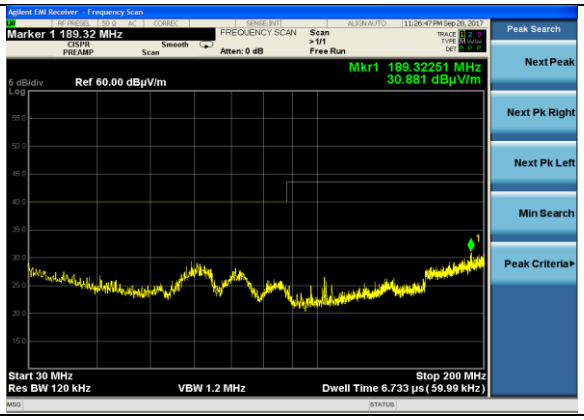
Frequency (MHz)	Polarization	EUT	Height (cm)	Azimuth (degrees)	Peak (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
8120.3	H	S	154.0	315.3	47.3	74.0	26.7	40.8	54.0	13.2
8176.3	H	V	164.0	319.8	46.6	74.0	27.4	39.9	54.0	14.1
7319.1	H	V	172.0	324.9	45.6	74.0	28.4	40.4	54.0	13.6
3659.7	V	H	154.0	348.7	41.6	74.0	32.4	36.7	54.0	17.3
3634.0	V	H	191.0	357.2	42.2	74.0	31.8	37.0	54.0	17.0

2. 500kHz DTS mode

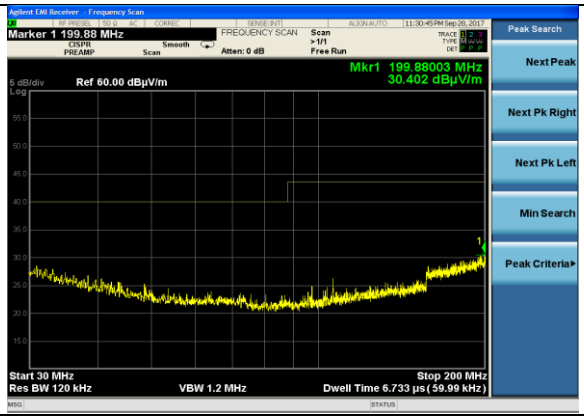
Frequency (MHz)	Polarization	EUT	Height (cm)	Azimuth (degrees)	Peak (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
8126.9	H	V	181.0	309.4	46.7	74.0	27.3	41.4	54.0	12.6
8171.7	H	S	147.0	313.0	46.0	74.0	28.0	40.3	54.0	13.7
7313.6	H	V	136.0	319.4	46.1	74.0	27.9	40.7	54.0	13.3
3657.2	V	V	150.0	350.8	42.4	74.0	31.6	33.6	54.0	20.4
3630.6	V	V	150.0	351.5	42.1	74.0	31.9	34.1	54.0	19.9
3611.9	V	V	150.0	351.6	42.7	74.0	31.3	34.2	54.0	19.8

Plots

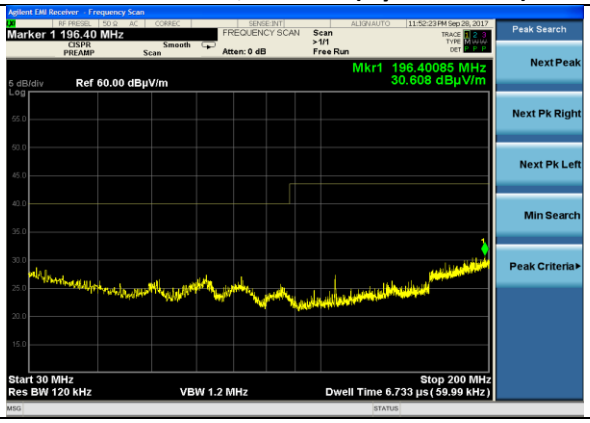
30MHz to 200 MHz



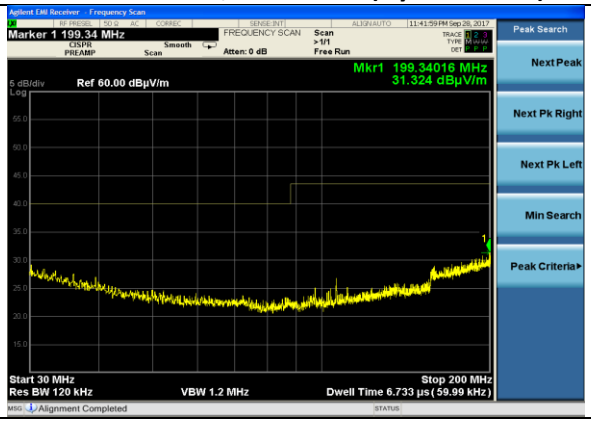
30 to 200 MHz, Vertical (Hybrid mode)



30 to 200 MHz, Horizontal (Hybrid mode)

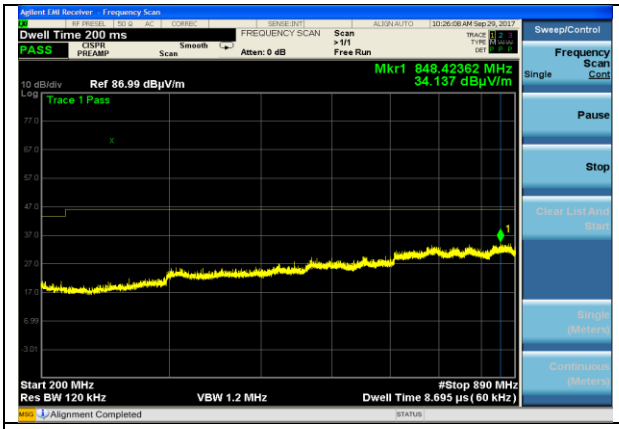


30 to 200 MHz, Vertical (DTS mode)



30 to 200 MHz, Horizontal (DTS mode)

200MHz to 860MHz



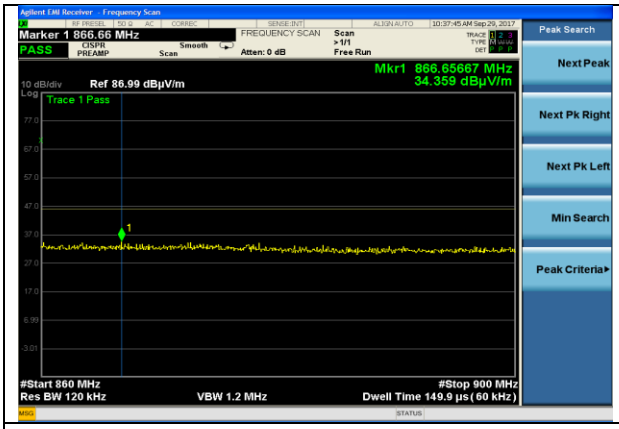
Vertical polarization (Hybrid Mode)

Horizontal polarization (Hybrid Mode)

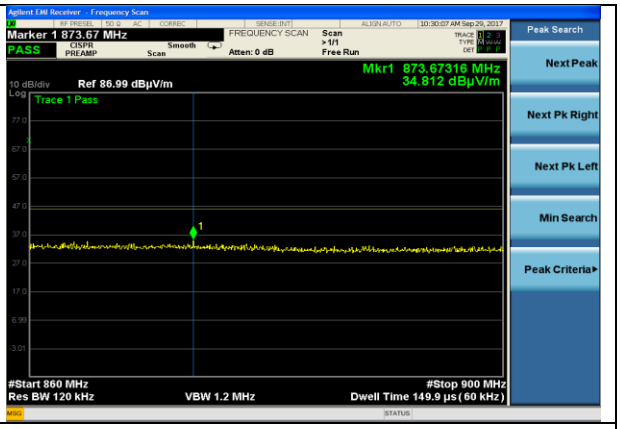
Vertical polarization (DTS Mode)

Horizontal polarization (DTS Mode)

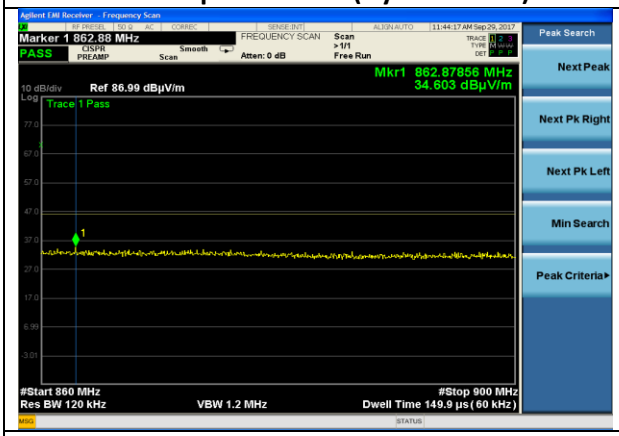
860MHz to 900MHz



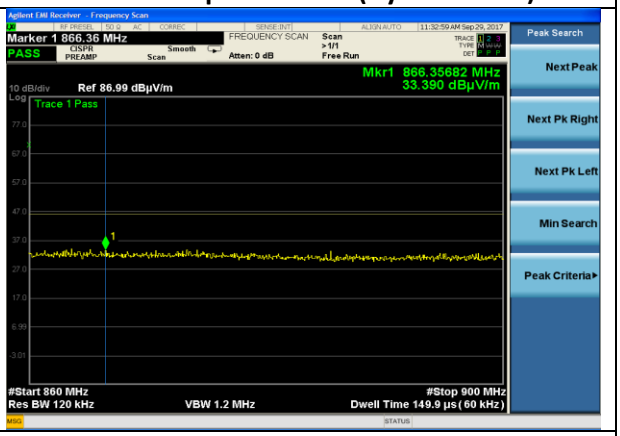
Vertical polarization (Hybrid Mode)



Horizontal polarization (Hybrid Mode)

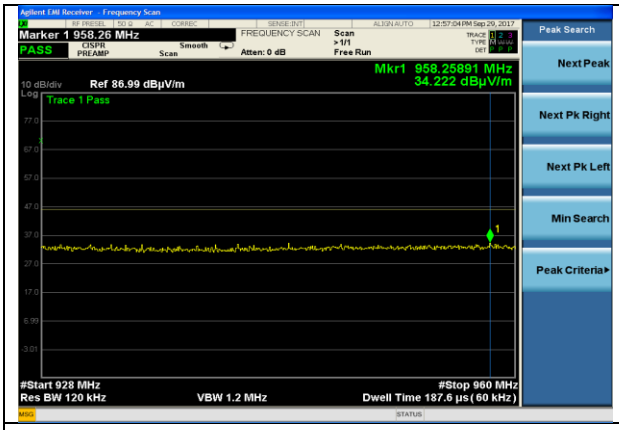


Vertical polarization (DTS Mode)

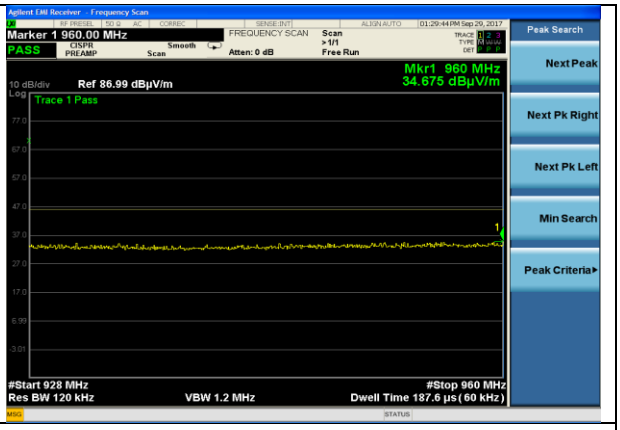


Horizontal polarization (DTS Mode)

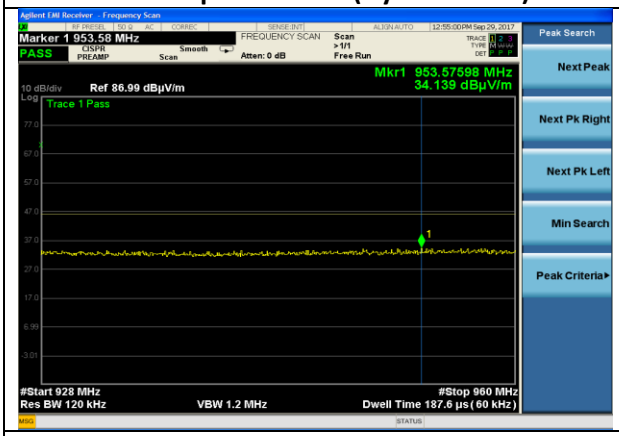
928MHz to 960MHz



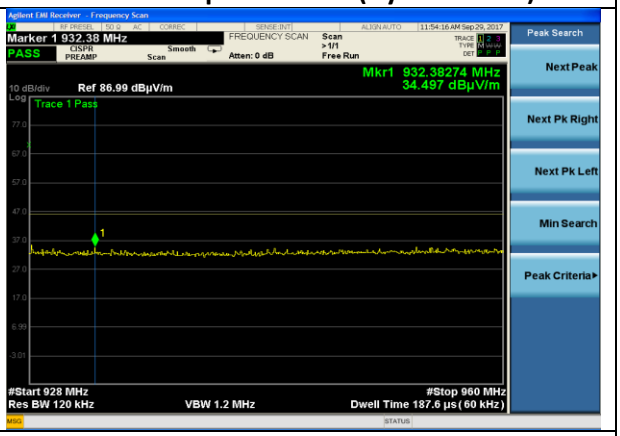
Vertical polarization (Hybrid Mode)



Horizontal polarization (Hybrid Mode)

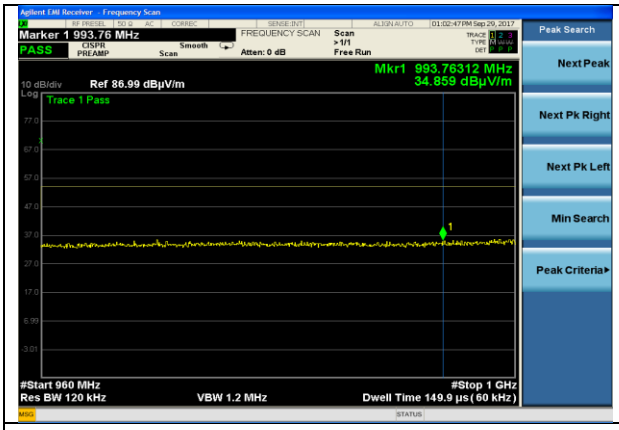


Vertical polarization (DTS Mode)

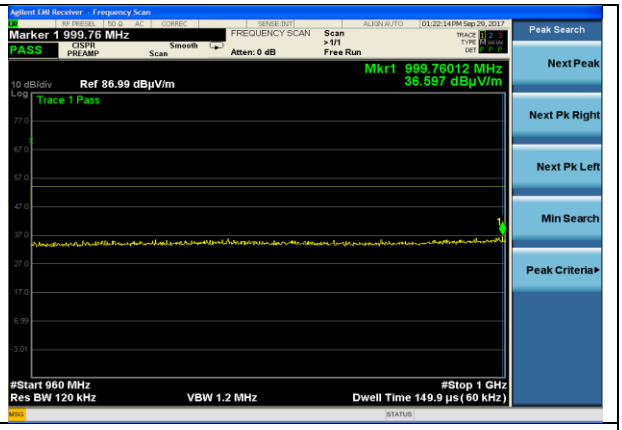


Horizontal polarization (DTS Mode)

960MHz to 1000MHz

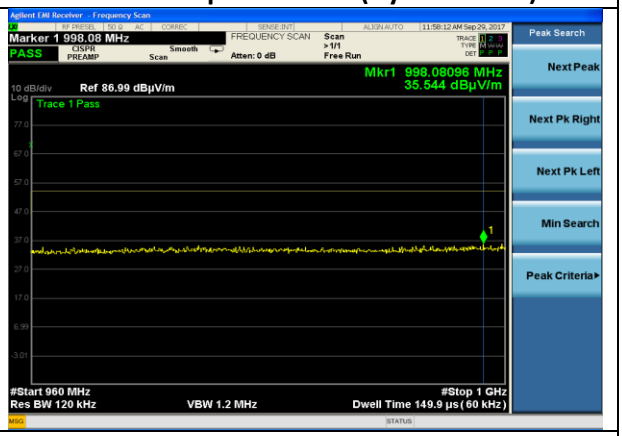


Vertical polarization (Hybrid Mode)



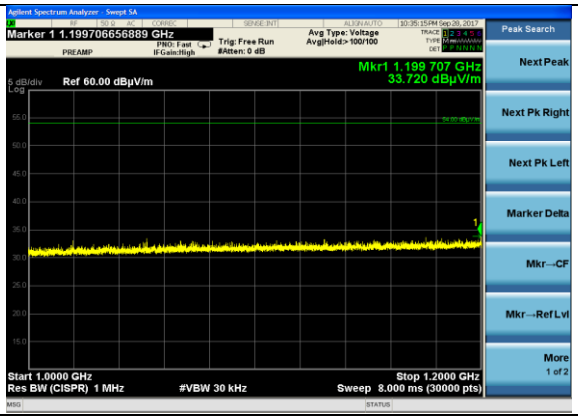
Horizontal polarization (Hybrid Mode)

Vertical polarization (DTS Mode)

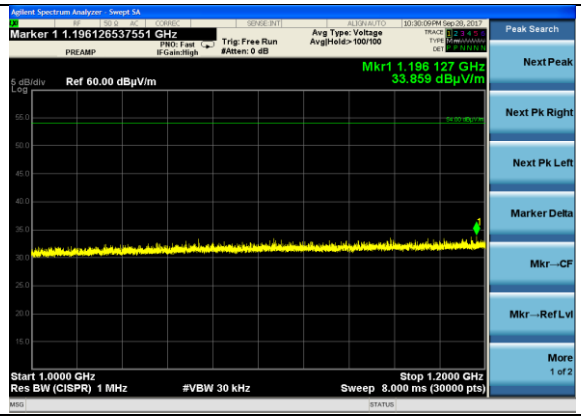


Horizontal polarization (DTS Mode)

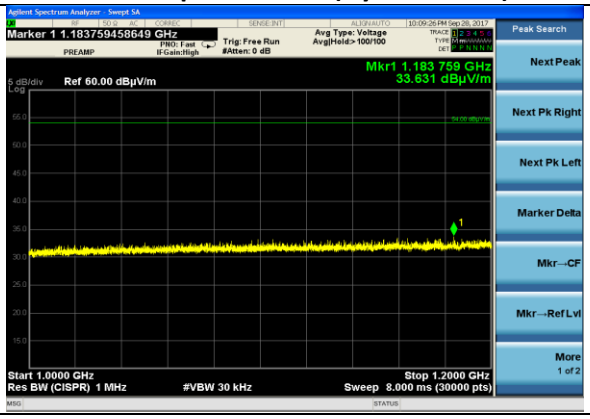
1000MHz to 1200MHz



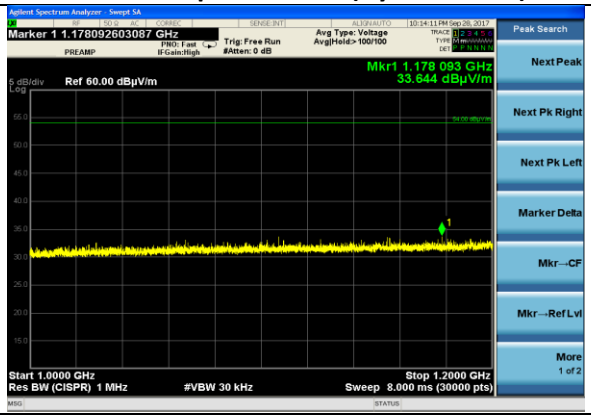
Vertical polarization (Hybrid Mode)



Horizontal polarization (Hybrid Mode)



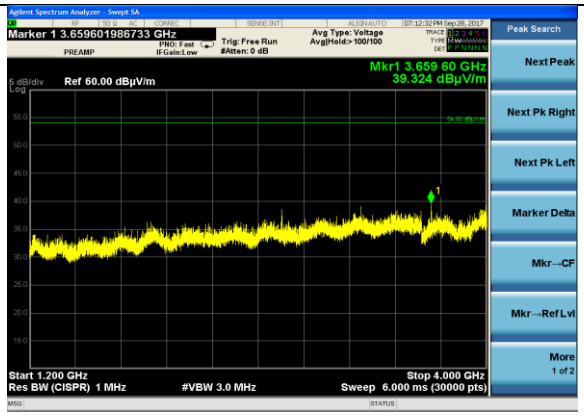
Vertical polarization (DTS Mode)



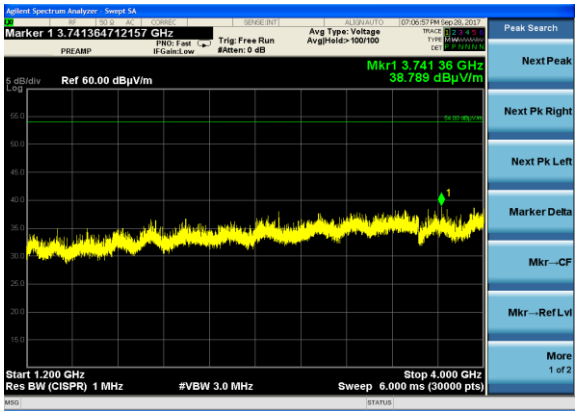
Horizontal polarization (DTS Mode)

Plots are taken with reduced video bandwidth in the interest of dynamic range

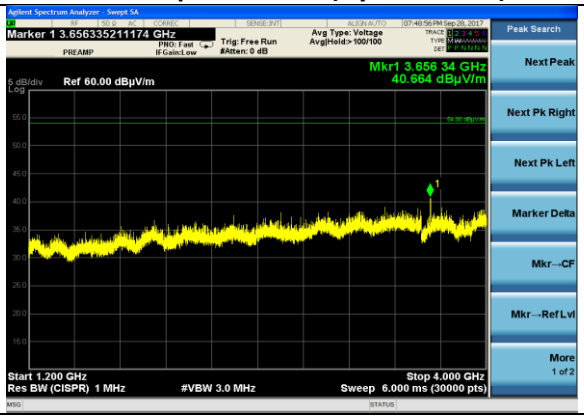
1200MHz to 4000MHz



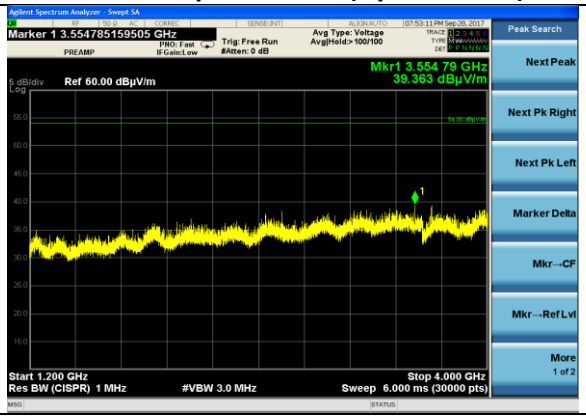
Vertical polarization (Hybrid Mode)



Horizontal polarization (Hybrid Mode)



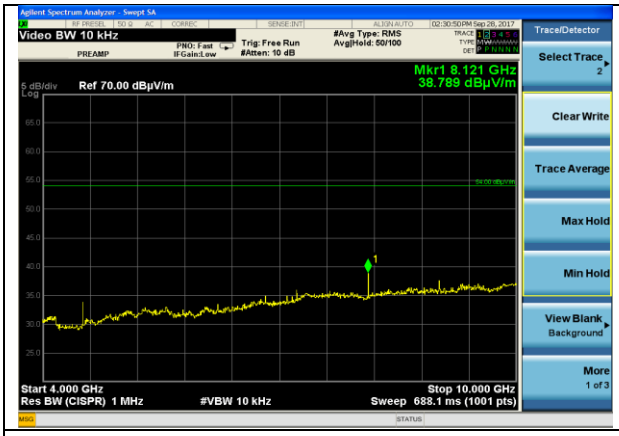
Vertical polarization (DTS Mode)



Horizontal polarization (DTS Mode)

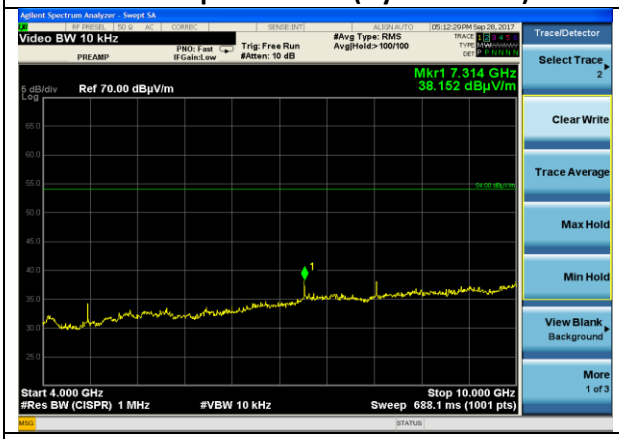
Plots are taken with reduced video bandwidth in the interest of dynamic range

4000MHz to 10000MHz



Vertical polarization (Hybrid Mode)

Horizontal polarization (Hybrid Mode)



Vertical polarization (DTS Mode)

Horizontal polarization (DTS Mode)

Plots are taken with reduced video bandwidth in the interest of dynamic range

6 REVISION HISTORY

Version	Date	Notes	Person
V0	10/23/17	Draft	Aidi Zainal
V1	10/24/2017	Final	Aidi Zainal

END OF REPORT