RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

FCC Part 15.231 Test Data

319.5 MHz Sensor

Model: 56-0098-01_HS Rev-01 A01

for

Alula
1402 Heggen Street
Hudson, WI 54016
Contact: Chris Weltzien

Testing Conducted By:

Rhein Tech Laboratories, Inc.
360 Herndon Parkway, Suite 1400
Herndon, VA 20170

RTL Test Engineer: Khue Do

RTL Project/Report Number: 2018216

October 8, 2018

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.

Radiated Spurious Harmonics Emissions

The data and limits presented in this report are for radiated emissions per 15.231(b)(2) which references 15.35(b), and peak limiting for restricted bands per 15.209(e), which again references 15.35(b)(2), as procured by Alula. No average data is presented in this report. Data (if applicable) is also presented for spurious, non-harmonic radiated emissions per 15.209. The Equipment Under Test (EUT) was the **319.5 MHz 56-0098-01_HS Rev-01 A01 Sensor (RTL Bar Code 22238).**

Test Procedure

Radiated fundamental and spurious emissions were tested at 3 m. The EUT was tested in the three orthogonal planes with the receive antenna in both polarities. The emissions were maximized; that is, the measurement antenna height was varied between 1 and 4 m, and the EUT was rotated through 360° on a rotating turntable until the maximum emissions were found. Both horizontal and vertical measurement antenna polarizations were used. A resolution bandwidth of 120 kHz was used for frequencies less than 1000 MHz, and a resolution bandwidth of 1 MHz was used for frequencies greater than or equal to 1000 MHz. The video bandwidth was set to a value at least three times greater than the resolution bandwidth.

EUT Disposition

The EUT was adapted to continuously transmit for testing purposes.

15.231 Radiated Spurious Emissions Test Data – Peak: 56-0098-01_HS Rev-01 A01

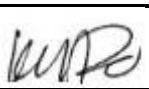
Frequency (MHz)	Antenna Polarity (H / V)	Raw Emission (dBµV/m)	SCF[1] (dB/m)	Corrected Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
319.500	H	98.8	-13.1	85.7	95.9	-10.2	Pass
639.000	H	55.7	-5.2	50.5	75.9	-25.4	Pass
958.500	V	40.9	-1.5	39.4	75.9	-36.5	Pass
1278.000	H	55.6	-0.1	55.5	74.0	-18.5	Pass
1597.500	H	54.5	7.3	61.8	74.0	-12.2	Pass
1917.000	H	53.5	10.2	63.7	75.9	-12.2	Pass

Note 1: SCF – Site Correction Factor

Radiated Emissions Test Equipment

Part	Manufacturer	Model	Serial Number	RTL Bar Code	Calibration Due Date
Amplifier (20 MHz – 2 GHz)	Rhein Tech Laboratories, Inc.	PR-1040	900905	900905	8/20/19
Amplifier (1 GHz – 26.5 GHz)	Hewlett Packard	8449B	3008A00762	901723	5/22/19
Antenna (30 MHz – 2 GHz)	Chase	CBL6112	2099	900791	10/4/20
Horn Antenna (2 GHz – 4 GHz)	EMCO	3161-02	9804-1044	900772	5/17/21
Horn Antenna (4.0 GHz – 8.2 GHz)	EMCO	3161-03	9508-1020	900321	5/17/21
EMI Receiver (9 kHz – 6.5 GHz)	Hewlett Packard	85462A	3325A00159	900913	4/4/19
RF Filter Section (100 kHz – 6.5 GHz)	Hewlett Packard	85460A	3330A00107	900914	4/4/19

Test Personnel:

Khue Do		September 28, 2018
EMC Test Engineer	Signature	Date of Test

FCC/IC Cross Reference

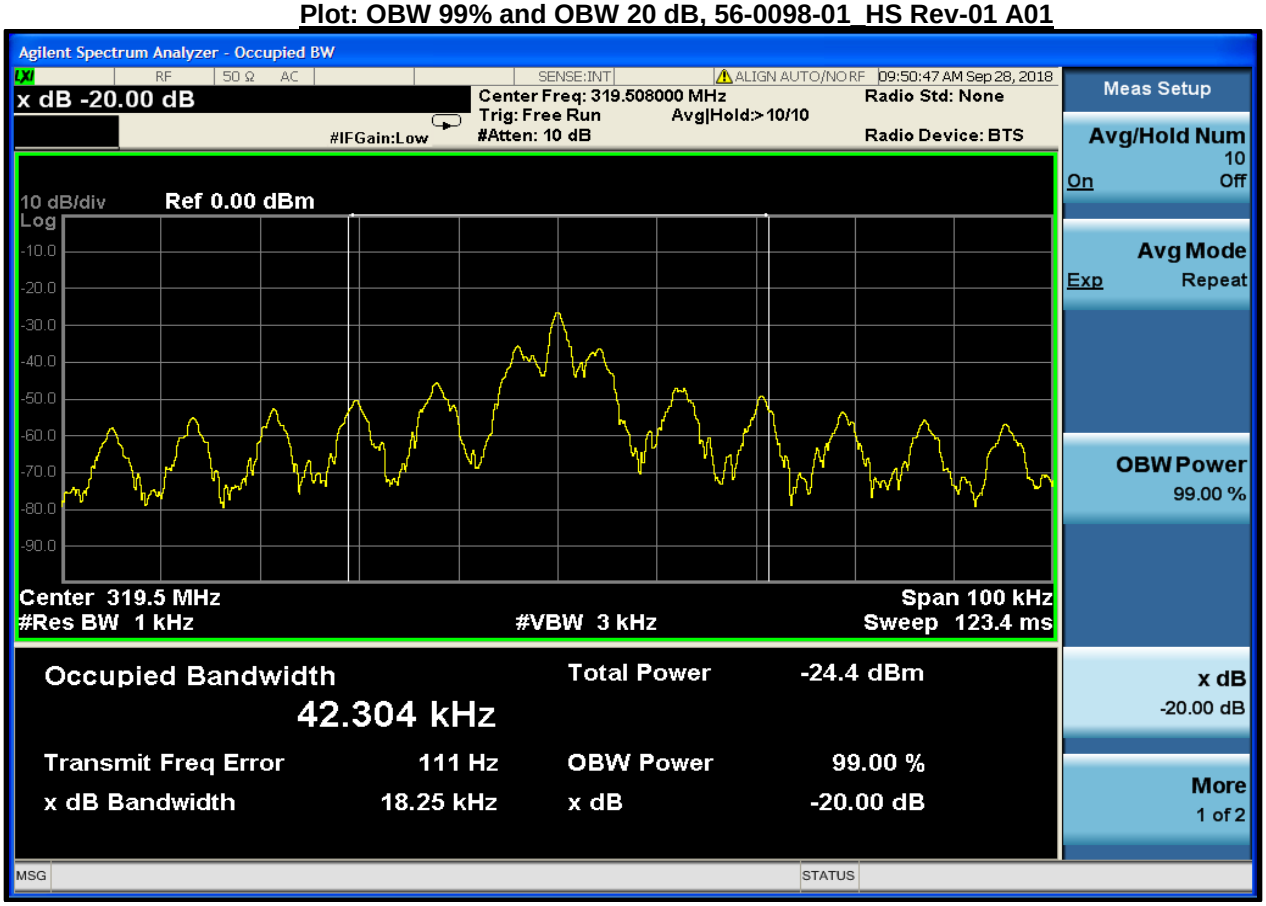
5 second timing	FCC 15.231(a)	RSS-210 Issue 9 A1.1
Field Strength	FCC 15.231(b)(2)	RSS-210 Issue 9 A1.2
Restricted Band	FCC 15.205	RSS-Gen Issue 5 8.10
General Field Strength	FCC 15.209	RSS-Gen Issue 5 8.9
Bandwidth	FCC 15.231(c)	RSS-210 Issue 9 A1.3

Occupied Bandwidth

15.231(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz

56-0098-01_HS Rev-01 A01:
Limit = 319.5 MHz * 0.25% = 0.798750 MHz = 798.750 kHz
OBW 99% = 42.304 kHz
OBW 20 dB = 18.250 kHz

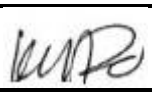
Plot: OBW 99% and OBW 20 dB, 56-0098-01_HS Rev-01 A01



Occupied Bandwidth Test Equipment

Part	Manufacturer	Model	Serial Number	RTL Bar Code	Calibration Due Date
EXA Signal Analyzer (10 Hz – 26.5 GHz)	Agilent Technologies	N9010A	MY51250846	901583	2/06/20

Test Personnel:

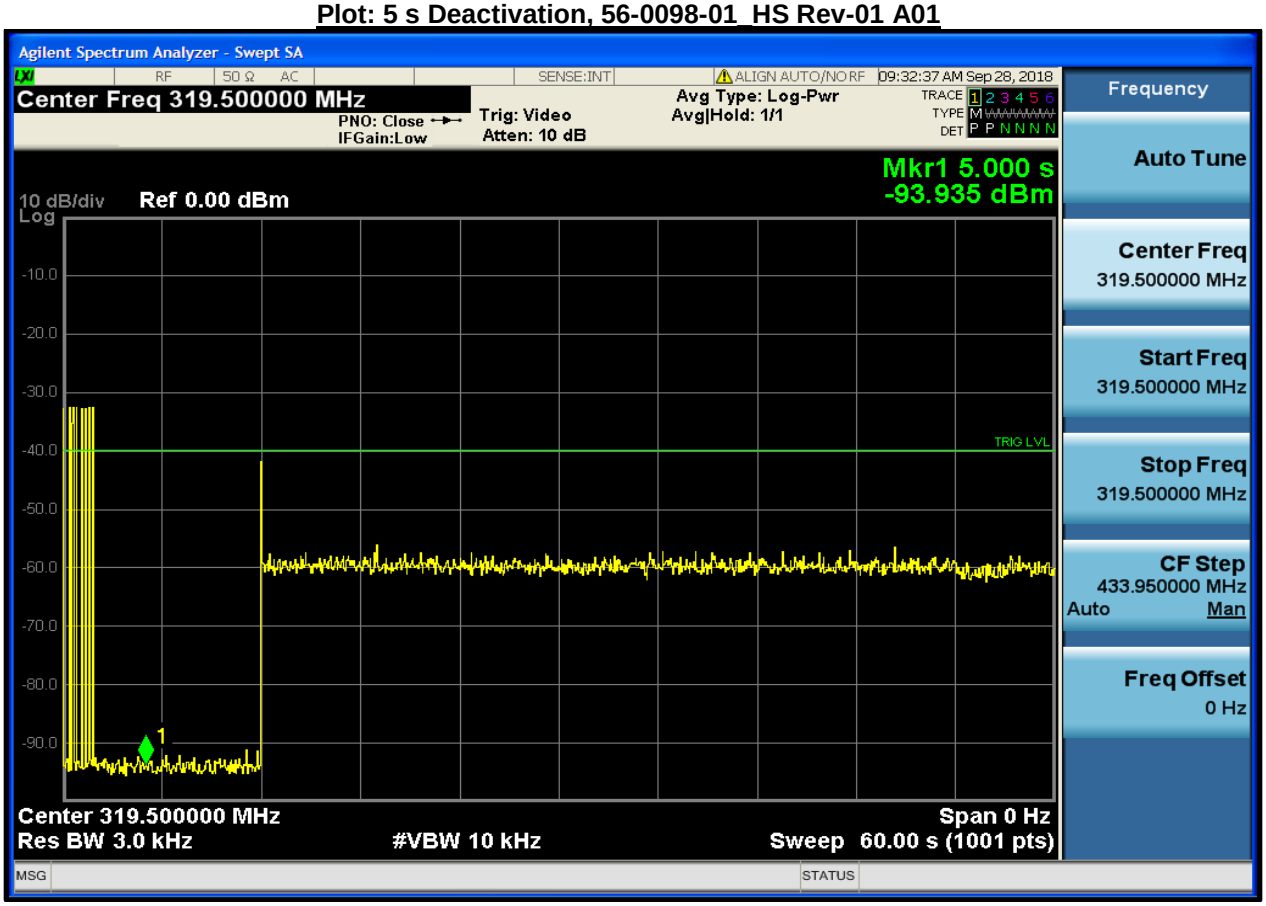
Khue Do		September 28, 2018
EMC Test Engineer	Signature	Date of Test

Transmitter Deactivation

15.231(a)
(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Plot: 5 s Deactivation, 56-0098-01_HS Rev-01 A01



5 s Deactivation Test Equipment

Part	Manufacturer	Model	Serial Number	RTL Bar Code	Calibration Due Date
EXA Signal Analyzer (10 Hz – 26.5 GHz)	Agilent Technologies	N9010A	MY51250846	901583	2/06/20

Test Personnel:

Khue Do		September 28, 2018
EMC Test Engineer	Signature	Date of Test

Test Configuration Photographs

Photograph: Radiated Emission, 30 MHz – 1 GHz, Rear

Photograph: Radiated Emission, 30 MHz – 1 GHz, Front

Photograph: Radiated Emission, Above 1 GHz, Rear

Photograph: Radiated Emission, Above 1 GHz, Front