RHEIN TECH LABORATORIES, INC.

Engineering Solutions & Electromagnetic Compatibility Services

FCC/ISED Class 2 Permissive Change Report

for

Connect+Pro 433.92 MHz

FCC ID: U5X-HUBPLUS
IC: 8310A-HUBPLUS

Alula, LLC
428 Minnesota Street
Suite 300
St. Paul, MN 55101 (USA)

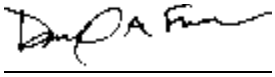
Results: PASS

Standards Referenced for this Report	
FCC Part 15 10-01-23	Radio Frequency Devices
ISED RSS-210, Issue 10, 2019	Licence-Exempt Radio Apparatus: Category I Equipment
ANSI C63.10-2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Report Prepared By: Daniel W. Baltzell

RTL Project/Document Number: 2024065

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from the applicable parts of FCC Part 2, FCC Part 15, ANSI C63.10, ISED RSS-210, and RSS-Gen.

Signature: 

Date: January 9, 2025

Typed/Printed Name: Desmond A. Fraser

Position: President

This/these test(s) is/are accredited under Rhein Tech Laboratories, Inc. ISO/IEC 17025 accreditation issued by ANAB. Refer to certificate and scope of accreditation AT-1445.

This report replaces Report R1.2.

Table of Contents

Table Index

Plot Index

Appendix Index

Photograph Index

1 General Information

1.1 Scope

This test report is prepared on behalf of Alula, LLC in accordance with the applicable FCC and ISED rules and regulations. The measurement procedure used was ANSI C63.10. The Equipment Under test (EUT) was the Connect+Pro.

The test results reported in this document relate only to the item(s) that were tested.

1.2 Test Facility

The open area test site (OATS) and conducted measurement facility used to collect the conducted and radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170 (USA).

CAB ID: US0079

1.3 Measurement Uncertainty

The measurement uncertainty complies with CISPR 16-4-2 limits and is not used to adjust measurements for compliance determination. Expanded uncertainty (U) for each scope, calculated per ANSI/NCSL Z540-2-1997 (R2002) with a type B evaluation, is provided in this RTL report. While this demonstrates RTL's commitment to transparency, compliance decisions are based solely on comparing measured values directly to the relevant standards' limits.

1.4 Deviations from Standards

There were no deviations from the test standards or methods.

1.5 Related Submitted(s)/Grants(s)

This is a Class 2 permissive change application for the Alula Connect+Pro, FCC ID: U5X-HUBPLUS; IC: 8310A-HUBPLUS.

2 Test Information

2.1 Description of Change

Part changes were made in the balun and the matching networks for the 433.92 MHz antennas. The changes are detailed in the C2PC Change Description Letter and reflected in the schematics and internal photo exhibits submitted with this application.

2.2 Description of EUT

The Connect+Pro is a multi-transmitter residential wireless security system that manages other Alula alarm and security devices. It has two transmitting diversity antennas, antenna 1 and antenna 2.

The Connect+Pro has a 433 MHz TX and the following transmitter modules:

1. Espressif Wi-Fi; FCC ID: 2AC7Z-ESP32WROOM32E; IC: 21098-ESPWROOM32E
2. Telit Cellular Modem; FCC ID: RI7ME310G1WW; IC: 5131A-ME310G1WW
3. Alula Z-Wave; FCC ID: U5X-RE934Z; IC: 8310A-RE934Z

The EUT was investigated for C2PC compliance with no emissions worthy of reporting found, in addition to collocation testing with the Z-Wave module installed.

2.3 Exercising the EUT

For all testing, the EUT was set up to operate as intended in the field with the WiFi (802.11b/g/n) and cellular (LTE) modules transmitting simultaneously with the EUT per the Operational Description. The Connect+Pro was powered with a 12VDC AC Adapter provided by Alula.

For all tests, the EUT was operated in its most EMC-sensitive configuration.

2.4 Modification(s) to EUT

No modifications were made during testing.

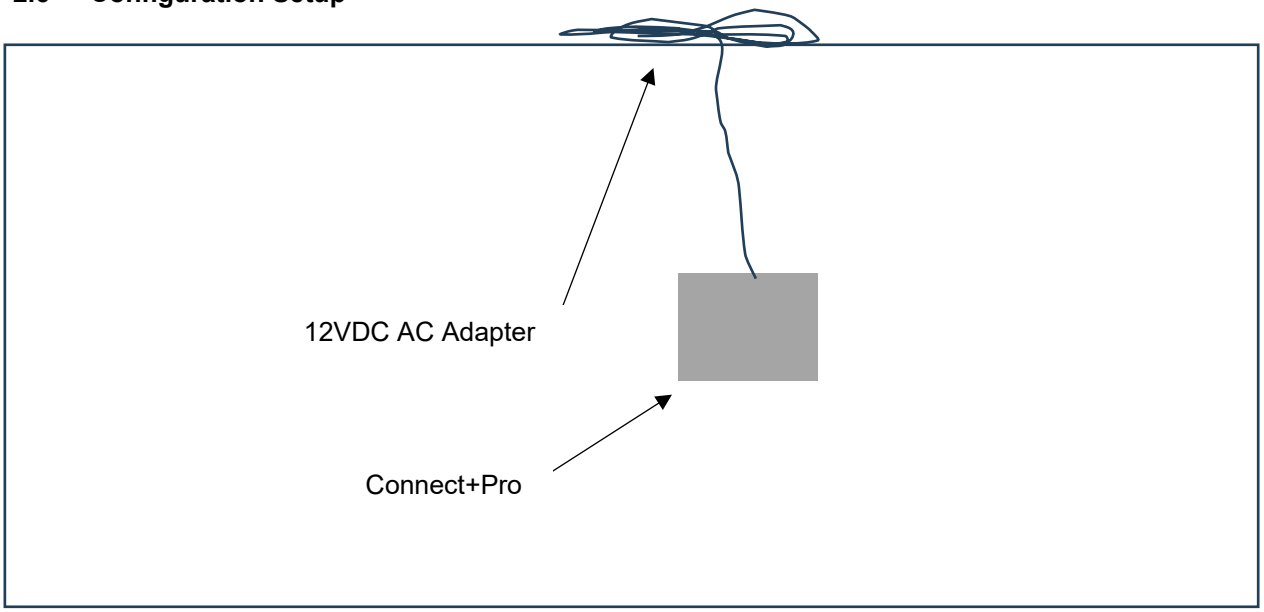
2.5 Test System Details

The test sample was received on August 12, 2024. The FCC identifiers for all applicable equipment, and cable descriptions used in the tested system, are listed in the following table.

Table 2-1: Equipment Under Test

Part	Manufacturer	Model	FCC ID	Serial Number	Cable Description	RTL Bar Code
Security Hub	Alula, LLC	Connect+Pro	U5X-HUBPLUS	N/A	Unshielded	24443
AC Adapter	Amigo	AMS135-1201000FU	N/A	22075004813	Unshielded	NA

2.6 Configuration Setup



3 Radiated Emissions – FCC 15.231(b)(2);15.205; 15.209; RSS-210; RSS-Gen

3.1 Radiated Emissions Test Procedure

ANSI C63.10 §6.3, 6.10

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. Before final measurements of radiated emissions were made on the OATS, the EUT was scanned indoors at 1 meter. This was done to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied to determine the effect on the EUT's emissions in amplitude, direction, and frequency. process was repeated during final radiated emissions measurements on the OATS, at each frequency, to ensure that maximum amplitudes were attained. Final radiated emissions measurements were made on the OATS. The EUT was placed on a non-conductive turntable 80 cm high. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered between 1 and 4 meters to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarization. For frequencies between 30 and 1000 MHz, the SA 6 dB bandwidth was set to 120 kHz, and the SA was operated in the CISPR QPK detection mode. For emissions above 1 GHz, measurements were taken using the AVG detector function with a minimum RBW of 1 MHz. The VBW was set to at least 3 times the RBW. The highest emission amplitudes relative to the appropriate limit were measured and recorded.

3.2 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FI(dB\mu V/m) = SAR(dB\mu V) + SCF(dB/m)$$

FI = Field Intensity
SAR = Spectrum Analyzer Reading
SCF = Site Correction Factor

The Site Correction Factor (SCF) used in the above equation is determined empirically, and is expressed in the following equation:

$$SCF(dB/m) = - PG(dB) + AF(dB/m) + CL(dB)$$

SCF = Site Correction Factor
PG = Pre-amplifier Gain
AF = Antenna Factor
CL = Cable Loss

The field intensity in microvolts per meter can then be determined according to the following equation:

$$FI(\mu V/m) = 10^{FI(dB\mu V/m)/20}$$

For example, assume a signal at a frequency of 125 MHz has a received level measured as 49.3 dBuV. The total Site Correction Factor (antenna factor plus cable loss minus preamplifier gain) for 125 MHz is -11.5 dB/m. The actual radiated field strength is calculated as follows:

$$49.3\ dB\mu V - 11.5\ dB = 37.8\ dB\mu V/m$$
$$10^{37.8/20} = 10^{1.89} = 77.6\ \mu V/m$$

3.3 Radiated Emissions Test Data

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). No average data is presented in this report. Data (if applicable) is also presented for spurious, non-harmonic radiated emissions per 15.209.

15.231(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

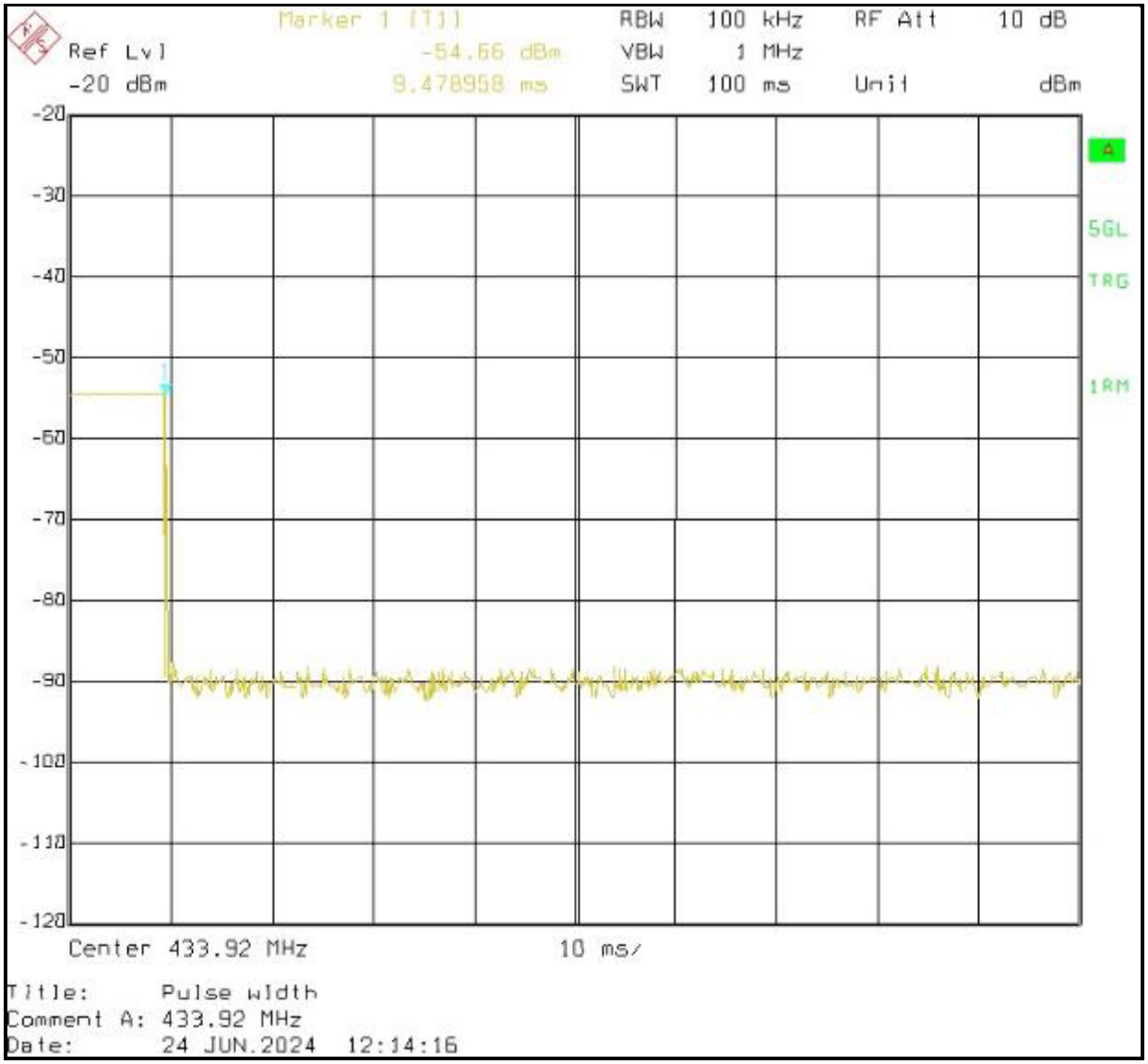
Fundamental Frequency (MHz)	Field Strength of Fundamental (µV/m)	Field Strength of Spurious Emissions (µV/m)
40.66 – 40.70	2 250	225
70 – 130	1 250	125
130 – 174	1 250 to 3 750	125 to 375
174 – 260	3 750	375
260 – 470	3 750 to 12 500[1]	375 to 1 250[1]
Above 470	12 500	1 250

[1] Linear Interpolation

Table 3-1: Environmental Conditions

Temperature (°C)	Humidity (%)	Air Pressure (kPa)
27.8°	42	102.4

Plot 3-1: Duty Cycle Timing Plot



1- 9.5ms pulse per 100 ms

20log(.095)= -20.4 dB

Table 3-2: Radiated Spurious Emissions Test Data – Peak; Antenna #1

Frequency (MHz)	Antenna Polarity (H / V)	Raw Emission (dBµV/m)	Site Correction Factor (dB/m)	Corrected Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
433.92	V	75.5	24.4	99.9	100.8	-0.9	Pass
867.84	H	40.9	31.0	71.9	80.8	-8.9	Pass
1301.76	H	23.0	34.3	57.3	74.0	-16.7	Pass
1735.68	H	21.8	38.1	59.9	80.8	-20.9	Pass
2169.60	V	22.7	27.7	50.4	80.8	-30.4	Pass
2603.52	H	39.0	28.2	67.2	80.8	-13.6	Pass
3037.44	H	26.1	28.7	54.8	80.8	-26.0	Pass
3471.36	H	22.9	29.2	52.1	80.8	-28.7	Pass
3905.28	H	14.3	29.7	44.0	74.0	-30.0	Pass
4339.20	H	17.0	36.2	53.2	74.0	-20.8	Pass

Table 3-3: Radiated Spurious Emissions Test Data – Average; Antenna #1

Frequency (MHz)	Antenna Polarity (H / V)	Raw Emission (dBµV/m)	Site Correction Factor (dB/m)	Corrected Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
433.92	V	55.1	24.4	79.5	80.8	-1.3	Pass
867.84	H	20.5	31.0	51.5	60.8	-9.3	Pass
1301.76	H	2.6	34.3	36.9	54.0	-17.1	Pass
1735.68	H	1.3	38.1	39.4	60.8	-21.4	Pass
2169.60	V	2.2	27.7	29.9	60.8	-30.9	Pass
2603.52	H	18.6	28.2	46.8	60.8	-14.0	Pass
3037.44	H	5.7	28.7	34.4	60.8	-26.4	Pass
3471.36	H	2.4	29.2	31.6	60.8	-29.2	Pass
3905.28	H	-6.1	29.7	23.6	54.0	-30.4	Pass
4339.20	H	-3.5	36.2	32.7	54.0	-21.3	Pass

Table 3-4: Radiated Spurious Emissions Test Data – Peak; Antenna #2

Frequency (MHz)	Antenna Polarity (H / V)	Raw Emission (dBµV/m)	Site Correction Factor (dB/m)	Corrected Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
433.92	V	75.9	24.4	100.3	100.8	-0.5	Pass
867.84	V	40.0	31.0	71.0	80.8	-9.8	Pass
1301.76	H	23.0	34.3	57.3	74.0	-16.7	Pass
1735.68	H	19.5	38.1	57.6	80.8	-23.2	Pass
2169.60	V	19.6	27.7	47.3	80.8	-33.5	Pass
2603.52	V	34.9	28.2	63.1	80.8	-17.7	Pass
3037.44	H	24.6	28.7	53.3	80.8	-27.5	Pass
3471.36	V	22.8	29.2	52.0	80.8	-28.8	Pass
3905.28	V	2.8	29.7	32.5	74.0	-41.5	Pass
4339.20	H	11.3	36.2	47.5	74.0	-26.5	Pass

Table 3-5: Radiated Spurious Emissions Test Data – Average; Antenna #2

Frequency (MHz)	Antenna Polarity (H / V)	Raw Emission (dBµV/m)	Site Correction Factor (dB/m)	Corrected Emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result (Pass / Fail)
433.92	V	55.5	24.4	79.9	80.8	-0.9	Pass
867.84	V	19.6	31.0	50.6	60.8	-10.2	Pass
1301.76	H	2.6	34.3	36.9	54.0	-17.1	Pass
1735.68	H	-1.0	38.1	37.1	60.8	-23.7	Pass
2169.60	V	-0.9	27.7	26.8	60.8	-34.0	Pass
2603.52	V	14.5	28.2	42.7	60.8	-18.1	Pass
3037.44	H	4.2	28.7	32.9	60.8	-27.9	Pass
3471.36	V	2.4	29.2	31.6	60.8	-29.2	Pass
3905.28	V	-17.7	29.7	12.0	54.0	-42.0	Pass
4339.20	H	-9.2	36.2	27.0	54.0	-27.0	Pass

Measurement uncertainty: 30 MHz – 6 GHz = ±4.8 dB; from 6 GHz and above = ±5.2 dB: This measurement uncertainty is expanded for a 95% confidence level received with a coverage factor k=2 for the entire frequency range.

Table 3-6: Radiated Emissions Test Equipment

RTL Asset #	Part Type	Manufacturer	Model	Serial Number	Calibration Due Date
900321	Horn Antennas (4.0 – 8.2 GHz)	EMCO	3161-03	9508-1020	08/05/2025
900772	Horn Antenna (2 – 4 GHz)	EMCO	3161-02	9804-1044	08/05/2025
901669	Biconilog Antenna (30 MHz – 6000 MHz)	ETS-Lindgren	3142E	00166065	07/11/2025
901727	SMK RF Cables 36”	Insulated Wire Inc.	KPS-1503-360-KPR	NA	11/30/2024
901729	SMK RF Cables 20’	Insulated Wire Inc.	KPS-1503-3150-KPR	NA	12/29/2024
901672	Rohde & Schwarz	FSW	Spectrum Analyzer	833063/13	05/30/2025

Result: PASS

Test Personnel:

Daniel W. Baltzell		August 23, 2024
EMC Test Engineer	**Signature**	**Date of Test**

4 Conclusion

The data presented in this report shows that the EUT as tested, **Connect+Pro**, complies with the applicable requirements of FCC Rules and Regulations Parts 2 and 15 and ISED RSS-210.