

## Engineering Solutions & Electromagnetic Compatibility Services

### FCC Part 15.247 Certification Report

Test Lab:		Applicant:		
Rhein Tech Laboratories, Inc.Phone: 703-689-0368360 Herndon ParkwayFax: 703-689-2056Suite 1400www.rheintech.comHerndon, VA 20170		i1 SensorTech, Inc. Phone: 425-372-7811 733 7th Avenue Suite 215 Kirkland, WA 98033 USA		
FCC ID	2ADZF-S0002	Test Report Date	April 25, 2022	
Platform N/A		RTL Work Order Number	2021077	
Model	Model SLR+		QRTL21-077A	
American National Standard Institute	ANSI C63.10-2013: Ameri Compliance Testing of Un	can National Standard of F licensed Wireless Devices	Procedures for	
FCC Classification	DTS – Digital Transmissio	n System		
FCC Rule Part(s)	Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz (10-01-2020)			
Frequency Range (MHz)	Output Power (W)*	Frequency Tolerance	Emission Designator	
915 – 923	0.087	N/A	1M66F1D	

\*Power is conducted peak

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, and ANSI C63.10.

Signature:

Dupation

Date: <u>April 25, 2022</u>

Typed/Printed Name: <u>Desmond A. Fraser</u>

Position: President

This report may not be reproduced, except in full, without the written approval of Rhein Tech Laboratories, Inc. and i1 SensorTech, Inc. The test results relate only to the item(s) tested. Replaces R2.1.

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.

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

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Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

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## 1 General Information

## 1.1 Scope

Applicable Standards:

FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz

## 1.2 Description of EUT

Model #	SLR+
Power Supply	Internal rechargeable 3.7VDC 300mAh Lithium Ion battery
Modulation Type	FSK
Frequency Range	915 – 923 MHz
Antenna Type	Hinged Dipole (2 dBi)

### 1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.10 2013).

### 1.4 Related Submittal(s)/Grant(s)

This is an original application for certification for i1 SensorTech, Inc., Model SLR+; FCC ID: 2ADZF-S0002.

### 1.5 Modifications

Ferrite FAIR-RITE brand #10461178181 was added to the interior antenna cables.

## 2 Test Information

### 2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band less than 10 MHz, the following frequencies were tested:

#### Table 2-1:Frequencies Tested

Channel	Frequency
Low	915
High	923

### 2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to transmit during testing. The carrier was also checked to verify that information was being transmitted. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

### 2.3 Test Result Summary

#### Table 2-2: Test Result Summary – FCC Part 15, Subpart C (Section 15.247)

FCC Reference	C63.10 Procedure	Test	Pass/Fail or N/A
FCC 15.207	6.2	AC Power Conducted Emissions	Pass
FCC 15.209	11.12.1	Radiated Emissions	Pass
FCC 15.247(b)(3)	11.2	Maximum Peak Power Output	Pass
FCC 15.247(d)	6.7	Antenna Conducted Spurious Emissions	Pass
FCC 15.247(d)	6.10	Band Edge	Pass
FCC 15.247(a)(2)	11.8	6 dB Bandwidth	Pass
15.247(e)	11.10.2	Power Spectral Density	Pass

### 2.4 Test System Details

The test samples were received on July 20, 2021. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

### Table 2-3: Equipment Under Test

Part	Manufacturer	Model	Serial Number	FCC ID	RTL Bar Code
Transceiver	i1 SensorTech, Inc.	SLR+	N/A	2ADZF-S0002	23893

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

# 2.5 Configuration of Tested System



## 3 Maximum Conducted Output Power – FCC 15.247(b)(3)

## 3.1 Power Output Test Procedure

A conducted power measurement of the EUT was taken using a Rhode & Schwarz spectrum analyzer.

Procedure: C63.10-2013 11.2

### Table 3-1: Power Output Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	101021	08/16/22
901772	Pasternack	PE7087-10	10 dB 2W, DC-26GHz Attenuator	1011	08/10/22

### 3.2 Power Output Test Data

### Table 3-2: Power Output Test Data

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)
915	19.4	87.1
923	19.0	78.5

Worst-case summed power delivered to all antenna elements:

87.1 mW X 2 = 174.2 mW, which meets the FCC 15.247 1 W limit.

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

MultiView	- Spectr	um							-
Ref Level 30.	.00 dBm Off	fset 10.00 dB 🖷 RF	3W 3 MHz Co	mpatible 8	566B				
Att	30 dB <b>SW</b>	/T 1.01 ms 🗢 VE	3W 10 MHz Mo	de Auto Si	weep				o t Dk Manu
1 Frequency S	sweep		1	1	1			M1[1]	01PK View
				M	1			MILI	915.000 0 MHz
20 dBm			man man man		and a second	an March			
10 dBm						1.1.1	man		
		annan an anna an anna an an anna an an a					M. M. Marine	ma.	
0 dBm	WWWWW							New Wey Wey Wey	
-10 dBm	ww							μ <sup>ν</sup> η	al Ann
1 mar Mar Mary									and have a
7120 aBm									Why
-30 dBm									
-40 dBm									
-50 dBm									
-60 dBm			+						
CF 915.0 MHz			1001 pt	S	1	.3 MHz/			Span 13.0 MHz
	~						Measuring		<b>25.04.2022</b> 13:51:20
13:51:21 25.0	4.2022								

## Plot 3-1: Maximum Conducted Output Power (915 MHz) – Port One

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

MultiView	- Spe	ctrum	I									•
Ref Level 30.	.00 dBm	Offset	: 10.00 dB 🔍	■ RBW	V 3 MHz	Cor	npatible 8	3566B				
Att	30 dB	SWT	1.01 ms 🖲	● VBW	/ 10 MHz	Moo	de Auto S	Sweep				
1 Frequency S	Sweep										141543	O1Pk View
											MILI	18.95 dBn
							M1					922.286 U MH.
20 dBm						www.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	man.			
				- mar	www.				mount	_		
10 dBm			Walter Walt	M.M.						Mar Mar		
		Ani	NW WWW							www		
0 d8m		MANN'								~	Mury	
o ubiii	Lunnt	e v									www.	
	MANNON										ma	
-10 dBm	1											M.
alundar												- Aller and
₩20 dвm												- Marina
n''												
-30 dBm												
-40 dBm												
50 IS												
-50 dBm												
-60 dBm												
CF 923.0 MHz	·				100	1 pts	6		1.3 MHz/			Span 13.0 MHz
										Measuring		25.04.2022 14:07:52
14:07:52 25.0	4.2022											

#### Maximum Conducted Output Power (923 MHz) - Port One Plot 3-2:

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty =  $\pm 0.8 \text{ dB}$ .

**Results: Pass** 

**Test Personnel:** 

Daniel W. Bolgel

Daniel W. Baltzell Test Engineer

Signature

April 25, 2022 Date of Test

## 4 Band Edge Compliance of RF Conducted Emissions – FCC 15.247(d)

## 4.1 Band Edge Test Procedure

Procedure: C63.10-2013 6.10 Peak detection

The EUT was connected to the spectrum analyzer through suitable attenuation. The spectrum analyzer was set to the following:

Center Frequency:	Frequency of the emissions to be measured
Span:	Able to see emission
RBW:	100 kHz
VBW:	3 x RBW
Detector:	Peak
Sweep:	Auto
Trace:	Max Hold

The trace was allowed to stabilize. The marker was set on the emission. The amplitude of the fundamental was used to establish the 20 dB to the band edge limit, the 20 dBc requirement of 15.247(d).

RTL Asset #	Manufacturer	Model Part Type		Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22
901235	IW Microwave Products	KPS-1503-360- KPS	High Frequency 36" RF Cables	N/A	09/20/22
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	09/21/22
901773	Rohde & Schwarz	FSW50	Analyzer	101021	08/16/22
901772	Pasternack	PE7087-10	10 dB 2 W 26 GHz Attenuator	1011	08/10/22

#### Table 4-1:Test Equipment

## 4.2 Test Results



## Plot 4-1: Lower Band Edge (902 MHz Band Edge, 915 MHz Carrier) – Port One

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

## Plot 4-2: Upper Band Edge (928 MHz Band Edge, 923 MHz Carrier) – Port One

MultiView	Spectrum	1							•
Ref Level 30.0	00 dBm Offset	: 10.00 dB 🖷 RB	<b>W</b> 100 kHz Co	mpatible 8	3566B				
Att	30 dB SWT	1.04 ms 👄 VB	<b>W</b> 300 kHz Me	ode Auto S	Sweep				
1 Frequency S	weep	1				1			●1Pk View
								M1[1]	15.04 dBm
an daw									922.755 U MHZ
20 dBm			M1						
10 40 m			M						
IU dBm									
0 dBm									
	——H1 -4.960 dBm	1							
-10 dBm									
		$ $ $\mathcal{N}$	M						
-20 dBm		1	<sup>1</sup>						
		N°.		In m.					
-30 dBm		N <sup>r</sup>		- Mary					
	. mm			V Y	Mar .				
-40 dBm	Jul				Winny				
MANN					Ma	WM was			
-50 dBm							month	Amman	1 As son abo
								- NOVE 1 1 (210)	0000 000 000 00 00 00
-60 dBm									
CF 928.0 MHz			1001 pt	<u> </u>	3	.0 MHz/		<u> </u>	Span 30.0 MHz
	÷					<b>,</b>	Measuring		19.04.2022
									14:22:58
14:22:58 19.04	4.2022								

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty =  $\pm 0.8$  dB.

#### **Results: Pass**

Test Personnel:

Daniel W. Bolgel

July 29, 2021 & April 19, 2022 Dates of Test

Daniel W. Baltzell Test Engineer

Signature

## 5 Antenna Conducted Spurious Emissions – FCC 15.247(d)

### 5.1 Antenna Conducted Spurious Emissions Test Procedures

Procedure: C63.10-2013 6.7, 11.11

Antenna spurious emissions per FCC 15.247(d) were measured from the EUT antenna port using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The modulated carrier was identified at the following frequencies: 915 MHz and 923 MHz. The carrier to the 10<sup>th</sup> harmonic of the carrier frequency was investigated.

### Table 5-1: Antenna Conducted Spurious Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901773	Rohde & Schwarz	FSW50	Spectrum Analyzer	101021	08/16/22
901772	Pasternack	PE7087-10	10 dB 2 W 26 GHz Attenuator	1011	08/10/22
901132	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	10/15/22

### 5.2 Antenna Conducted Spurious Emissions Test Results

All spurious emissions were below the limit. Those frequencies less than 20 dB below the limit are shown in the tables below the plots.

## Plot 5-1: Antenna Conducted Spurious Emissions (915 MHz) Port One

MultiView	Spectrum	I							•
Ref Level 40	.00 dBm Offset	: 10.00 dB 🖷 RB	<b>W</b> 100 kHz						
Att	40 dB SWT	100 ms 👄 VB	<b>W</b> 300 kHz 🛛 <b>M</b> o	ode Auto Sweep					
1 Frequency	Sweep					1		1	o 1Pk Max
								M1[1]	-19.28 dBm
									1.83321 GHz
30 dBm									
20 dBm									
10 dBm									
0 dBm									
	H1 -5.640 dBn								
-10 dBm									
10 0.011									
	M1								
-20 dBm									
-30 dBm									
-40vdBmlongary	A second second has a second second	1 a Marketman	alori.			humanstal	Martin Martin	, man and	there and a mark
love			- marken and the	New Mar Mar Mar Mar Carlow Contraction	and an an and the	Andronation		Maryon manufa	
-50 dBm									
						l			
9.0 kHz	-		1001 pts	5	1	.0 GHz/			10.0 GHz
							Measuring		18.11.2021 11:11:58

### Table 5-2: Conducted Spurious Emissions (915 MHz) Port One

Emission Frequency (MHz)	Analyzer Level (dBm)	Limit (dBuV/m)	Margin (dB)
1830	-19.3	-5.6	-13.7



## Plot 5-2: Antenna Conducted Spurious Emissions (923 MHz) Port One

### Table 5-3: Conducted Spurious Emissions (923 MHz) Port One

Emission Frequency	Analyzer Level	Limit	Margin
(MHz)	(dBm)	(dBuV/m)	(dB)
1846	-17.2	-5.6	-11.6

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

MultiView	- Spectrum	1							•
Ref Level 0.0	10 dBm Co	mpatible 8566B	Mode Auto St	weep					
1 Spurious Em	nissions								o1 View
SPURIOUS LINE	ABS_002	ABS 002	PA	<del>55</del> 55					
-10 dBm									
	Note	hed Funda	mental						
-20 dBm									
-30 dBm	*								
-40 dBm									
			1						
-50 dBm									
-60 dBm									
						1			
-70 dBm									
								1 martin	marken and and a
-80 dBm	Marin Liven in mary ler	and the second second second	un and a second and a		monortun	man and a stranger	and the second s		
Agini dem									
9.0 kHz			4004 pt	s		1.0 GHz/			10.0 GHz
2 Result Sumr	mary								
Range L		Range Up	RE		Freque	ency 43 kHz	Power Abs	_9/	∆Limit 1.98 dB
150.000	kHz	30.000 MHz	10.00	0 kHz	164.910	09 kHz	-91.56 dBm	-9	D.26 dB
30.000	MHz GHz	1.000 GHz	100.00	)0 kHz 0 MHz	922.9620	D4 MHz 65 GHz	-26.94 dBm -34.16 dBm	-2.	5.64 dB 2.86 dB
1.000		10.000 012	1.00	<u> </u>			Measuring		19.04.2022
									16:07:43
16:07:44 19.0	4.2022								

## Plot 5-3: Antenna Conducted Spurious Emissions (915 MHz) Port Two

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

MultiView	Spectrun	1								•
Ref Level 0.0	OdBm Co	mpatible 856	5B Mode Auto S	Sweep						
1 Spurious Em	issions									o1 View
SPURIOUS	85 002		P	ASS						
Line _SPU	IRIOUS_LINE_	ABS_002	P	ASS						
	Note	hed Fund	lamental							
-20 dBm										
-30 dBm										
-40 dBm										
-50 dBm										
-60 dBm										
-70 dBm										
										harman harman
-80 dBm	فتعملها ومستعده منارهما أسالا	mannewer	wer war war have	- alabara manda tita	and the second	Munune	and and a second second second	and the second descent of the second descent of the second descent descent descent descent descent descent des		
-90 dBm-										
			400.4							10.0.011-
9.0 KHZ			4004 p	ts		1	.0 GHZ/			10.0 GHZ
Z Result Sumi Range I		Range Un	R	BW		Frequen	CV.	Power Ab	s	AL imit
9.000	kHz	150.000 kHz	1.0	00 kHz	15	.972 5	3 kHz	-96.23 dB	m -9	94.73 dB
150.000	kHz	30.000 MHz	10.C	00 kHz	164	.9100	9 kHz	-90.33 dB	m -§	38.83 dB
30.000 N	/Hz	1.000 GHz	100.0	100 kHz	920	831 6	7 GH7	-28.40 ab	m -2 m -3	26.90 dB 21 23 dB
1.000 (	JIIZ ▼	10.000 GHZ	1.0	50 1411 12		10010	JIL	Measuring		19.04.2022 16:03:58
16:03:59 19.0	4.2022									10.03.30

## Plot 5-4: Antenna Conducted Spurious Emissions (923 MHz) Port Two

Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty: ±0.8 dB.

### **Results: Pass**

**Test Personnel:** 

Daniel W. Bolgel

Daniel W. Baltzell Test Engineer

Signature

November 18, 2021 & April 19, 2022 Dates of Test

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## 6 6 dB Bandwidth – FCC 15.247(a)(2)

## 6.1 6 dB Bandwidth Test Procedure

Procedure: C63.10-2013 11.8.

The minimum 6 dB bandwidths per FCC 15.247(a)(2) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz. The device was modulated. The minimum 6 dB bandwidths are presented below.

Table 6-1:	6 dB Bandwidth Test	Equipment
		Equipilion

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22
901235	IW Microwave Products	KPS-1503-360- KPS	High Frequency 36" RF Cables	N/A	09/20/22
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	09/21/22
901773	Rohde & Schwarz	FSW50	Analyzer	101021	08/16/22
901772	Pasternack	PE7087-10	10 dB 2 W 26 GHz Attenuator	1011	08/10/22

### 6.2 Bandwidth Test Results

### Table 6-2:6 dB Bandwidth Test Data

Frequency (MHz)	Bandwidth (kHz)	Minimum Limit (kHz)	Pass/Fail
915	1512	500	Pass
923	1637	500	Pass

## Plot 6-1: 6 dB Bandwidth – 915 MHz – Port One

MultiView	Spe	ectrum									•
Ref Level 30.0	00 dBm	Offset	10.00 dB 🖷 RB	W 100 kHz	Compatible	8566B					
Att	30 dB	SWT	1.09 ms 👄 VB	<b>W</b> 300 kHz	Mode Au	to Sweep					
1 Occupied Ba	ndwidth	า		I						0	1Pk Max
									MILI		4.16 dBm
20 dBm										915.1	.43 U MHZ
					т1 ~/	M1 T2					
10 dBm	H1 8.	160 dBm-				~					
							$\setminus$				
U dBm—							$\mathbf{n}$				
-10 dBm				+ /							
-20 dBm				$\sim$			h				
-30 dBm			کسر					h			
50 0511	m	nn	mont					han	mm		
-40 dBm	-								~	mon	mm
10 dbin											
-50 dBm											
-60 dBm										_	
CE 915.0 MHz				1001	nts		1 1 MHz/			Span 1	11.0 MHz
2 Marker Table	e			1001						Sparri	
Type Ref	Trc		X-Value		Y-Value		Function		Function	Result	
M1	1		915.143 M	Hz	14.16 dBn	Occ Bw			1.511 625	804 N	1Hz
T1 T2	1		914.2023 M 915 7139 M	IHz IHz	8.27 dBn 8.16 dBn	ו Occ Bw סרב Dcc Bw	Centroid Fred Offset		914.958 -41 894	105655	MHz kHz
12	~		510.710.914	11 12	0.10 dbh	, OCC DW		- Measuring	41.094	* 1	12:11:08
12:11:09 19.04	4.2022										

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077



### Plot 6-2: 6 dB Bandwidth – 923 MHz – Port One

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty = 12 Hz.

Results: Pass

**Test Personnel:** 

Daniel W. Bolgel

Daniel W. Baltzell Test Engineer

Signature

August 3, 2021 & April 19, 2022 Dates of Test

## 7 Power Spectral Density – FCC 15.247(e)

## 7.1 Power Spectral Density Test Procedure

Procedure: C63.10-2013 11.10.2 Peak PSD

The power spectral density per FCC 15.247(e) was measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 3 kHz and the video bandwidth set at 10 kHz. Peak detector and max hold were used to resolve the spectral density for the modulated carriers at 915 and 923 MHz. These levels are below the +8 dBm limit. See the power spectral density table and plots that follow.

## Table 7-1: Power Spectral Density Test Equipment

RTL Asset #	Manufacturer	Model Part Type		Serial Number	Calibration Due Date
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22
901235	IW Microwave Products	KPS-1503-360- KPS	High Frequency 36" RF Cables	N/A	09/20/22
900819	Weinschel Corp	2	10 dB Attenuator; 5 W	BF0830	09/21/22

### 7.2 Power Spectral Density Test Data

### Table 7-2: Power Spectral Density Test Data

Frequency (MHz)	RF Power Level (dBm)	Maximum Limit +8 dBm	Pass/Fail
915	3.0	8	Pass
923	4.0	8	Pass

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077



## Plot 7-1: Power Spectral Density – 915 MHz – Port One

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077



## Plot 7-2: Power Spectral Density – 923 MHz - Port One

Measurement uncertainties shown for these tests are expanded Gaussian uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty =  $\pm 0.8$  dB.

Results: Pass

**Test Personnel:** 

Daniel W. Bolgel

Daniel W. Baltzell Test Engineer

Signature

April 19, 2022 Date of Test

### 8 Conducted Emissions Measurement Limits – FCC 15.207

### 8.1 Limits of Conducted Emissions Measurement

Frequency of Emission (MHz)	Conducted Limit (dBuV)			
Frequency of Emission (MHZ)	Quasi-peak	Average		
0.15-0.5	66-56	56-46		
0.5-5.0	56	46		
5.0-30.0	60	50		

### 8.2 Conducted Emissions Measurement Test Procedure

Procedure: C63.10-2009 6.2

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50-ohm / 50 micro Henry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901083	AFJ International	LS16	LS16 16A LISN (110 V)		02/14/23
900930	Hewlett Packard	85662A	Spectrum Analyzer Display Section	3144A20839	02/26/23
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz - 22 GHz)	3138A07771	02/26/23
900728	Solar	8130	Filter	947305	04/30/23
900339	Hewlett Packard	85650A	Quasi-Peak Adapter (30 Hz - 1 GHz)	2521A00743	04/24/22

Table 8-1:	<b>Conducted Emissions</b>	<b>Test Equipment</b>
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Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

## 8.3 Conducted Line Emissions Test Data



### Plot 8-1: Conducted Line Emissions – Phase – Receive Mode

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077



## Plot 8-2: Conducted Line Emissions – Neutral – Receive Mode

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077



## Plot 8-3: Conducted Line Emissions – Phase – Transmit Mode

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077



## Plot 8-4: Conducted Line Emissions – Neutral – Transmit Mode

Measurement uncertainty: Measurement uncertainties shown for these tests are expanded uncertainties expressed at 95% confidence level using a coverage factor k = 2. Measurement uncertainty:  $\pm 3.6$  dB.

### **Results: Pass**

**Test Personnel:** 

Daniel W. Baley

Daniel W. Baltzell EMC Test Engineer

Signature

August 2-3, 2021

Dates of Test

### 9 Radiated Emissions – FCC 15.209

## 9.1 Limits of Radiated Emissions Measurement

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	24000/f (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

### 9.2 Radiated Emissions Measurement Test Procedure

### Procedure: C63.10-2013 11.12.1

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10<sup>th</sup> harmonic of the highest fundamental transmitter frequency (9 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1,000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report. Additionally, radiated emissions were investigated with both transmitters transmitting simultaneously and all emissions were compliant.

Client: i1 SensorTech, Inc. Model #: SLR+ Standards: 15.247 FCC ID: 2ADZF-S0002 Report #: 2021077

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900878	Rhein Tech Laboratories, Inc.	AM3-1197- 0005	3 meter Antenna Mast, polarizing	Outdoor Range 1	N/A
901235	IW Microwave Products	KPS-1503-360- KPS	High Frequency 36" RF Cables	N/A	09/17/21
901729	Insulated Wire Inc.	KPS-1503- 3150-KPR	SMK RF Cables 20'	NA	10/29/21
901242	Rhein Tech Laboratories, Inc.	WRT-000-0003	Wood rotating table	N/A	N/A
901672	Rohde & Schwarz	FSEM30	Spectrum Analyzer	FSEM30	04/25/22
901669	ETS-Lindgren	3142E	Biconilog Antenna (30 MHz – 6000 MHz)	00166065	04/24/22
900932	Hewlett Packard	8449B OPT H02	Preamplifier (1 - 26.5 GHz)	3008A00505	02/16/22
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	05/17/22
900321	EMCO	3161-03	Horn Antennas (4.0 – 8.2 GHz)	9508-1020	05/17/22
900323	EMCO	3160-7	Horn Antennas (8.2 – 12.4 GHz)	9605-1054	05/17/22
901128	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	09/14/21
901132	Par Electronics	806-902 (25W)	UHF Notch Filter	N/A	09/14/21

## Table 9-1: Radiated Emissions Test Equipment

## 9.3 Radiated Emissions Test Results

## 9.3.1 Radiated Emissions Unintentional

### Table 9-2: Radiated Emissions Unintentional

Emission Frequency (MHz)	Analyzer Detector (QP/AV)	Analyzer Level (dBuV) (1 MHz RBW/ 3 MHz VBW)	Site Correction Factor (dB/m)	Corrected Analyzer Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
30.400	QP	51.8	-19.3	32.5	40.0	-7.5
47.561	QP	56.0	-28.7	27.3	40.0	-12.7
48.558	QP	53.5	-29.1	24.4	40.0	-15.6
78.026	QP	50.5	-28.7	21.8	40.0	-18.2
81.848	QP	54.1	-29.0	25.1	40.0	-14.9
546.293	QP	43.2	-13.2	30.0	46.0	-16.0
650.701	QP	52.2	-12.7	39.5	46.0	-6.5
722.244	QP	36.6	-10.4	26.2	46.0	-19.8
831.062	QP	44.8	-9.8	35.0	46.0	-11.0
906.212	QP	34.6	-8.8	25.8	46.0	-20.2
1016.246	AV	33.5	-8.4	25.1	54.0	-28.9
2000.000	AV	32.3	-0.1	32.2	54.0	-21.8

## 9.3.2 Radiated Emissions Harmonics/Spurious

Emission Frequency (MHz)	Peak Detector Level (dBuV) (1 MHz RBW/ 3 MHz VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
2745.0	72.7	-8.8	63.9	74.0	-10.1
3660.0	74.7	-6.0	68.7	74.0	-5.3
4575.0	67.6	0.0	67.6	74.0	-6.4
7320.0	49.2	2.8	52.0	74.0	-22.0
8235.0	41.1	8.5	49.6	74.0	-24.4
9150.0	36.5	7.4	43.9	74.0	-30.1

## Table 9-3: Peak Radiated Emissions Harmonics/Spurious TX Frequency; 915 MHz

## Table 9-4: Average Radiated Emissions Harmonics/Spurious TX Frequency; 915 MHz

Emission Frequency (MHz)	Average Detector Level (dBuV)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2745.0	43.8	1.9	45.7	54.0	-8.3
3660.0	47.8	5.0	52.8	54.0	-1.2
4575.0	41.8	7.6	49.4	54.0	-4.6
7320.0	29.4	10.8	40.2	54.0	-13.8
8235.0	31.5	11.1	42.6	54.0	-11.4
9150.0	28.3	10.8	39.1	54.0	-14.9

Table 9-5:	Peak Radiated Emissions	Harmonics/Spurious	TX Frequency; 923 MHz
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Emission Frequency (MHz)	Peak Detector Level (dBuV) (1 MHz RBW/ 3 MHz VBW)	Site Correction Factor (dB/m)	Peak Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)
2769.0	68.8	-8.8	60.0	74.0	-14.0
3692.0	67.4	-5.8	61.6	74.0	-12.4
4615.0	68.2	0.0	68.2	74.0	-5.8
7384.0	50.5	2.9	53.4	74.0	-20.6
8307.0	43.2	8.5	51.7	74.0	-22.3

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Emission Frequency (MHz)	Average Detector Level (dBuV)	Site Correction Factor (dB/m)	Average Emission Level (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)
2768.9	38.8	1.8	40.6	54.0	-13.4
3692.0	46.5	5.2	51.7	54.0	-2.3
4615.0	31.5	7.7	39.2	54.0	-14.8
7384.0	31.8	10.7	42.5	54.0	-11.5
8307.0	31.3	11.2	42.5	54.0	-11.5

## Table 9-6: Average Radiated Emissions Harmonics/Spurious TX Frequency; 923 MHz

## Test Personnel:

Daniel W. Bolgs

Daniel W. Baltzell EMC Test Engineer

Signature

July 27 - August 6, 2021 Dates of Test

## 10 Conclusion

The data in this measurement report shows the i1 SensorTech, Inc. Model SLR+, FCC ID: 2ADZF-S0002, complies with the applicable requirements of Parts 2 and 15 of the FCC rules and regulations.