

# Report on the Radio Testing of:

## FLEXLOCK SYSTEM

Model(s):

FXL1-SPLMSA00 (SENSOR)

FXL1-AF1 (ACTUATOR)

In accordance with

47 CFR FCC Part 15C



PSB Singapore

Add value.  
Inspire trust.

Prepared for:

SICK AG

Erwin-Sick-Str. 1

79183 Waldkirch

Germany

### COMMERCIAL-IN-CONFIDENCE

Document Number: 7191249437-EEC20/04 | Issue: 01

FCC ID: 2AHDRFXL1

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Foo Kai Maun	09 Apr 2021	
Authorised Signatory	Quek Keng Huat	10 Mar 2021	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD PSB document control rules.

#### EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with the mentioned standard(s).



LA-2007-0380-A LA-2007-0386-C  
LA-2007-0381-F LA-2010-0464-D  
LA-2007-0382-B LA-2018-0702-B  
LA-2007-0383-G LA-2018-0703-G  
LA-2007-0384-G LA-2020-0747-L  
LA-2007-0385-E

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

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TUV®



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# 1 Report Summary

## 1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	09 Apr 2021





## 1.2 Introduction

Applicant	:	SICK AG Erwin-Sick-Str. 1 79183 Waldkirch Germany
Manufacturer	:	Sick Product Center Asia Pte. Ltd. 8 Admiralty Street #04-11, Admirax Singapore 757438
Factory	:	SICK Sdn. Bhd. No. 16, Jalan Indah Gemilang 5 Taman Perindustrian Gemilang 81800, Ulu Tiram, Johor, Malaysia
Model Number(s)	:	<p><b><u>Sensors</u></b></p> <ol style="list-style-type: none"> <li>1. FXL1-SPLMSA00 (Tested)</li> <li>2. FXL1-SPBUSA00 (Declared)</li> <li>3. FXL1-SPBMSA00 (Declared)</li> <li>4. FXL1-SPLUAA00 (Declared)</li> <li>5. FXL1-SPLMAA00 (Declared)</li> <li>6. FXL1-SPBUSA00 (Declared)</li> </ol> <p><b><u>Actuators</u></b></p> <ol style="list-style-type: none"> <li>1. FXL1-AF1 (Tested)</li> <li>2. FXL1-AR1 (Declared)</li> </ol>
Serial Number(s)	:	110323
Number of Samples Tested	:	1
Test Sample(s) Condition	:	Good
Quotation Reference	:	5373705
Test Specification/Issue/Date	:	FCC 47 CFR Part 15C
Test Sample(s) Received Date	:	18 Feb 2021



Start of Test	:	18 Feb 2021
Finish of Test	:	22 Mar 2021





### 1.3 Brief Summary of Results

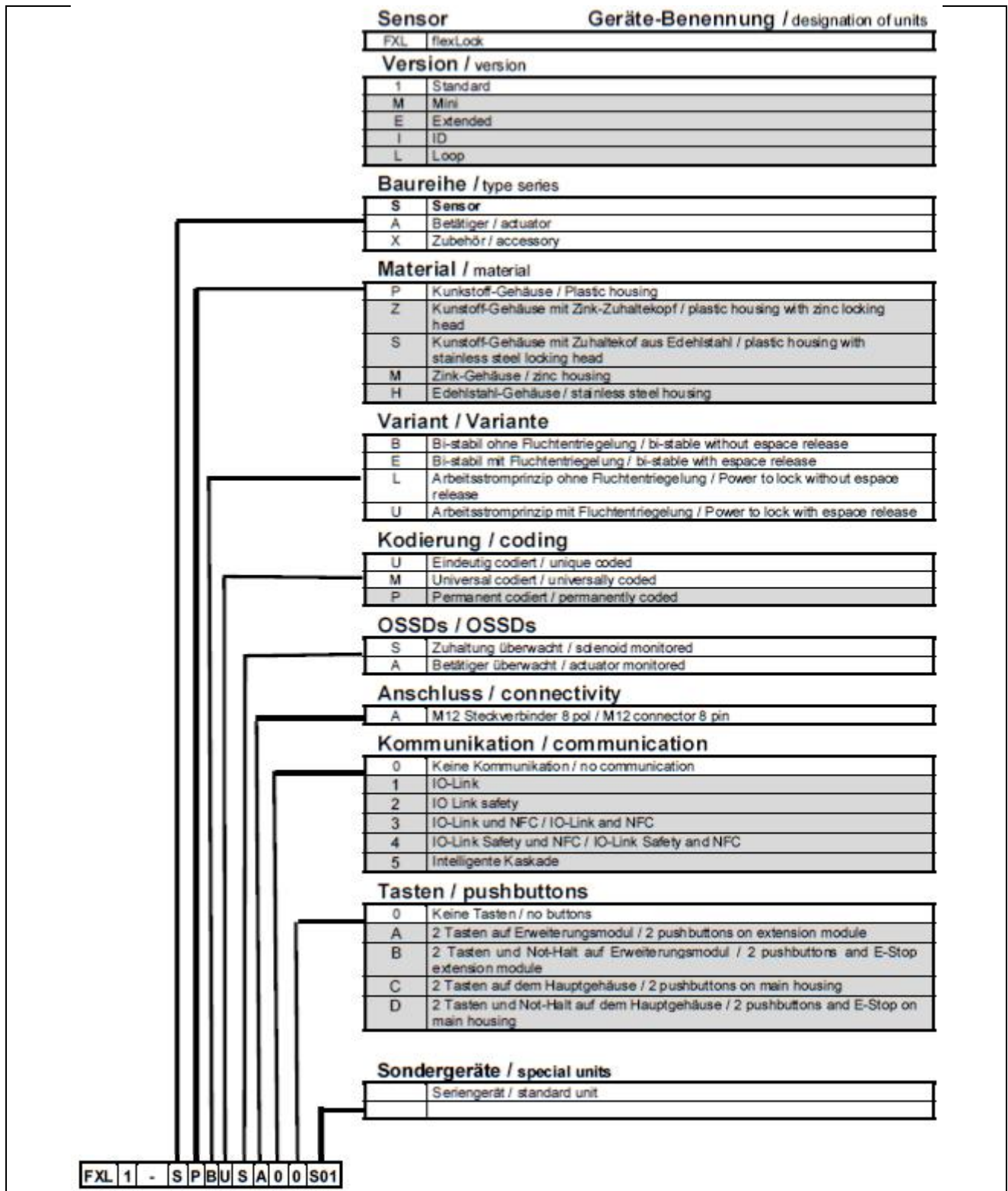
A brief summary of the tests carried out in accordance with specifications as shown below.

Specification Clause	Test Description	Result	Comments/Base Standard
<i>47 CFR FCC Part 15</i>			
15.107(a), 15.207	Conducted Emissions	Not Applicable *See Note 3	ANSI C63.4: 2014 ANSI C63.10: 2013
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass	ANSI C63.4: 2014 ANSI C63.10: 2013
15.215(c)	Spectrum Bandwidth	Not Applicable *See Note 4	ANSI C63.10: 2013

#### Notes

1. All test measurement procedures are according to ANSI C63.4: 2014 and ANSI C63.10: 2013.
2. The EUT is a Class B device when in non-transmitting state and meets the 47 CFR FCC Part15B Class B requirements.
3. The Equipment Under Test (EUT) is a DC operated device and contains no provision for public utility connections.
4. 125kHz is not a designated emission band in US.
5. This product contains FCC certified (FCC ID: 2AHDRSTR1) Part 15 Low Power Transmitter (Below 1705 kHz) Safety Switch from Sick AG.
6. Sick Product Center Asia Pte. Ltd. declares that Flexlock System comprises of a
  - i. Locking device (Sensor)
    - a. FXL1-SPLMSA00 (Tested)
    - b. FXL1-SPBUSA00 (Declared)
    - c. FXL1-SPBMSA00 (Declared)
    - d. FXL1-SPLUAA00 (Declared)
    - e. FXL1-SPLMAA00 (Declared)
    - f. FXL1-SPBUSA00 (Declared)
  - ii. Actuator unit
    - a. FXL1-AF1 (Tested)
    - b. FXL1-AR1(Declared)

The locking device and actuator unit are similar in terms of components, circuitry/design, PCB layout and mechanical structure. The differences between the variant models are mainly in terms of firmware, solenoid technology and release functionality as per stated in Sick Product Center Asia Pte Ltd's document 9314632.





## 1.4 Product Information

### 1.4.1 Technical Description

Description	:	The Equipment Under Test(s) (EUT(s)) is a <b>FLEXLOCK SYSTEM</b> . <b>The EUT</b> comprises of the following units. The RFID is used for detection and sensing. i. Locking device (Sensor) & Actuator unit.
Microprocessor	:	STM32F303RE
Operating Frequency	:	125kHz (RFID)
Clock / Oscillator Frequency	:	16MHz (Crystal for MCU)
Modulation	:	Amplitude Modulation
Antenna Gain	:	Not Applicable
Port / Connectors	:	M12 8Pin
Rated Power	:	DC Supply Voltage Nominal 24Vdc Maximum 28.8Vdc Minimum 19.2Vdc
Accessories	:	Nil

### 1.4.2 Test Configuration and Modes of Operation

Mode(s)	Description
Maximum RF power transmission	The EUT was exercised to transmit continuously at 125kHz.





**1.5 Deviations from the Standard**

Nil.

**1.6 EUT Modification Record**

No modifications were made.

**1.7 Test Location(s)**

TÜV SÜD PSB Pte Ltd  
Electrical & Electronics Centre (EEC), Product Services,  
15 International Business Park  
TÜV SÜD @ IBP  
Singapore 609937





### 1.8 Test Facilities Registrations

Requirements	Registration Numbers
FCC	994109 (Test Firm Registration Number) SG0002 (Designation Number)
ISED	SGAP01 (CAB Identifier) 2932N-1 (10m Semi-Anechoic Chamber)
VCCI	R-13324 (10m ANC), G-10203 (10mANC) C-14933 (C.E @ CEIBP) T-12403 (Telecom Ports @ CEIBP)
BSMI	SL2-IS-E-6001R [ <i>CNS-13803 (ISM Equipment)</i> ] SL2-IN-E-6001R [ <i>CNS-13438 (IT Equipment)</i> ] SL2-R1/R2-E-6001R [ <i>CNS-13439 (Broadcast Receivers)</i> ] SL2-A1-E-6001R [ <i>CNS-13783-1 (Household Appliances)</i> ] SL2-L1-E-6001R [ <i>CNS-14115 (Lighting Equipment)</i> ]
SABS	SABS/A-LAB/0030/2018





### 1.9 Supporting Equipment

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Xantrex DC Power Supply	M/N: XHR 150-4 S/N: 33778 FCC ID: DoC	1.2m unshielded (2 lines) DC cable.





## 2 Test Details

### 2.1 Radiated Emissions (Spurious Emissions Inclusive Restricted Bands Requirement)

#### 2.1.1 Test Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m)
0.009 - 0.490 *	20 log [2400 / F (kHz)] @ 300m
0.490 - 1.705	20 log [24000 / F (kHz)] @ 30m
1.705 - 30.0	30.0 @ 30m
30 – 88	40.0 @ 3m
88 – 216	43.5 @ 3m
216 – 960	46.0 @ 3m
Above 960 *	54.0 @ 3m

\* For frequency bands 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

#### Restricted Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6
13.36 - 13.41			



## 2.1.2 Test Setup

- 2.1.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
- 2.1.2.2 The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
- 2.1.2.3 The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

## 2.1.3 Test Method

- 2.1.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.
- 2.1.3.2 A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
- 2.1.3.3 The test was carried out at the selected frequency points obtained from the pre-scan. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
  - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
  - b. The EUT was then rotated to the direction that gave the maximum emission.
  - c. Finally, the antenna height was adjusted to the height that gave the maximum emission
- 2.1.3.4 A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point in range of 9kHz – 90kHz, 110kHz – 490kHz and above 1GHz, both Peak and Average measurements were carried out.
- 2.1.3.5 The measurements were repeated for the next frequency point, until all selected frequency points were measured.
- 2.1.3.6 The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10<sup>th</sup> harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

### Sample Calculation Example

At 300 MHz

Q-P limit = 46.0 dB $\mu$ V/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB  
Q-P reading obtained directly from EMI Receiver = 40.0 dB $\mu$ V/m  
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 46.0 - 40.0 = 6.0

i.e. 6.0 dB below Q-P limit



### 2.2.5 Test Results

Test Input Power	24Vdc	Temperature	21 °C
Test Distance	10m (< 30MHz) 3m (≥ 30MHz – 1GHz)	Relative Humidity	52%
Mode	Transmit	Atmospheric Pressure	1015mbar
		Tested By	Li Chelmin
		Test Date	08 Mar 2021

Spurious Emissions ranging from 9kHz – 30MHz (for 9kHz – 90kHz, 110kHz – 490kHz) \*See Note 4

Freq (GHz)	Peak Value (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	AV Value (dBμV/m)	AV Limit (dBμV/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
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Spurious Emissions ranging from 9kHz – 30MHz \*See Note 5

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Limit (dBμV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)
2.2780	16.8	30.0	13.2	120	347
3.9170	17.4	30.0	12.6	120	279
4.6700	17.6	30.0	12.4	120	345
9.3760	17.5	30.0	12.5	120	113
13.1100	17.1	30.0	12.9	120	280
29.2060	18.4	30.0	11.6	120	226

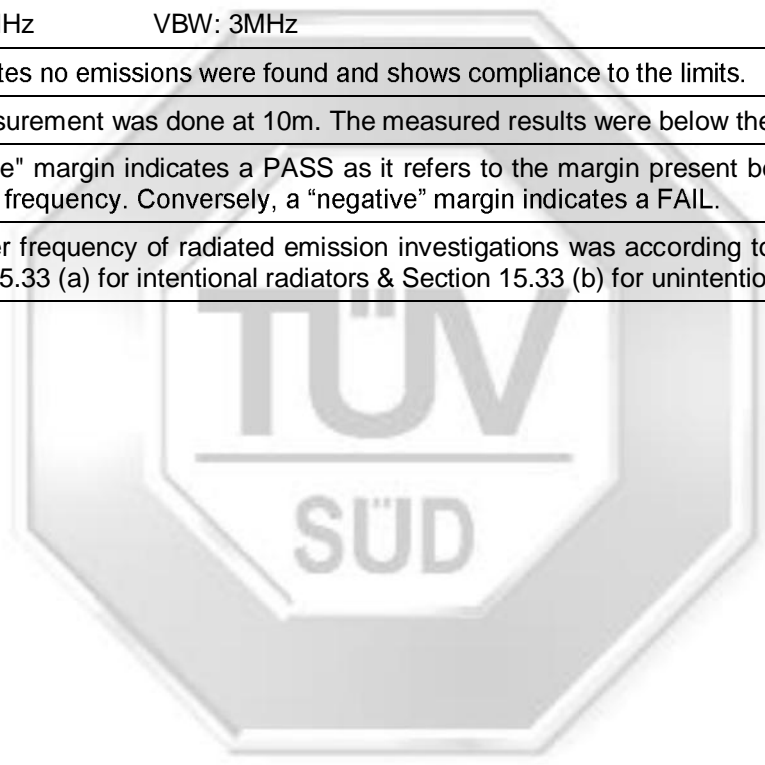
Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Limit (dBμV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
47.6350	37.0	40.0	3.0	100	223	V
55.9630	38.4	40.0	1.6	100	320	V
71.2790	38.8	40.0	1.2	100	258	V
94.6950	30.5	43.5	13.0	100	320	V
117.0980	32.5	43.5	11.0	300	238	V
177.7440	27.0	43.5	16.5	100	268	H



Notes

1.	All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: <u>9kHz – 150kHz</u> RBW: 200Hz                      VBW: 1kHz <u>150kHz – 30MHz</u> RBW: 9kHz                          VBW: 30kHz <u>30MHz - 1GHz</u> RBW: 120kHz                      VBW: 1MHz <u>&gt;1GHz</u> RBW: 1MHz                          VBW: 3MHz
4.	"--" indicates no emissions were found and shows compliance to the limits.
5.	The measurement was done at 10m. The measured results were below the limit line at 30m.
6.	A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
7.	The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33 (a) for intentional radiators & Section 15.33 (b) for unintentional radiators.





## 4 Test Equipment

Instrument	Model	S/No	Cal Due Date
<i>Radiated Emissions (Spurious Emissions Inclusive Restricted Bands Requirement)</i>			
R&S EMI Test Receiver (9kHz - 26.5GHz)	ESR26	101714	23 Apr 2021
Schwarzbeck Active Loop Antenna	1519B	00196	10 Nov 2021
TDK Log Periodic Antenna (30MHz – 3GHz)	HLP-3003C	130237	29 Apr 2021
Sonoma Preamplifier (1MHz – 1GHz)	310	254719	05 Jan 2022







## 5 Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2.

Test Name	Measurement Uncertainty
Conducted Emissions at Mains Terminals	9kHz to 30MHz, $\pm 1.4$ dB
Radiated Emissions	9kHz to 30MHz @ 10m, $\pm 2.2$ dB 30MHz to 1GHz @ 10m, $\pm 3.6$ dB 30MHz to 1GHz @ 3m, $\pm 5.2$ dB >1GHz to 40GHz @ 3m, $\pm 5.1$ dB





## 6 Annex A – FCC Label and Position

Labelling requirements per Section 2.925 & 15.19

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase or in the product user manual.

FCC AND IC RADIO APPROVAL

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**1 FCC and IC radio approval**

- FCC ID: 2AHDRFXL1
- IC: 21147FXL1

The device fulfills the EMC requirements for use in the USA and Canada, in accordance with the following extracts from the relevant approvals:

**FCC § 15.19**

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

**FCC §15.21 (warning statement)**

[Any] changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**IC**

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- This device may not cause interference; and
- This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- l'appareil ne doit pas produire de brouillage;
- l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

**Sample Label in product user manual**



**Please note that this Report is issued under the following terms :**

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Effective 26 January 2021

