

# Report on the EMC Testing of:

## RFID PROXIMITY SWITCH – safeIDS

### Model(s):

1. SE1-ST1A20 (Sensor)
2. SE1-SS1A20 (Sensor)
3. SE1-AM02 (Actuator)

In accordance with  
FCC 47 CFR Part 15B

Prepared for:  
SICK AG  
Erwin-Sick-Str. 1  
79183 Waldkirch  
Germany



PSB Singapore

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## COMMERCIAL-IN-CONFIDENCE

Document Number: 7191331641-EEC24/01 | Issue: 01  
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
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Prepared By	Quek Keng Huat	24 Apr 2024	

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

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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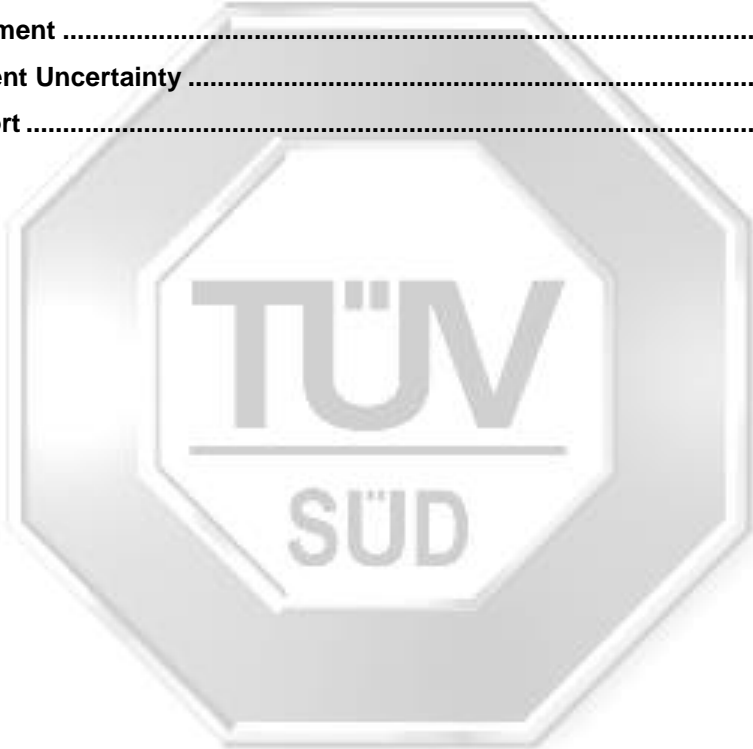
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# 1 Report Summary

## 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	24 Apr 2024





## 1.2 Introduction

Applicant	:	SICK AG Erwin-Sick-Str. 1 79183 Waldkirch Germany
Manufacturer	:	Sick Product Center Asia Pte. Ltd. 1 North Coast Avenue #08-01 Singapore 737663
Factory	:	SICK Sdn. Bhd. No. 16, Jalan Indah Gemilang 5 Taman Perindustrian Gemilang 81800, Ulu Tiram, Johor, Malaysia
Model Number(s)	:	1. SE1-ST1A20 - Sensors 2. SE1-SS1A20 – Sensors 3. SE1-AM02 - Actuators
Serial Number(s)	:	1. 23320012 (Part Number 1132196) - Sensors 2. 23330027 (Part Number 1132197) – Sensors 3. 23340004 (Part Number 1132272) - Actuators
Number of Samples Tested	:	2
Test Sample(s) Condition	:	Good
Quotation Reference	:	5824642 & 5993428
Test Specification/Issue/Date	:	FCC 47 CFR 15B
Test Sample(s) Received Date	:	29 Sep 2023
Start of Test	:	29 Sep 2023
Finish of Test	:	03 Oct 2023

### 1.3 Brief Summary of Results

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

Specification Clause	Test Description	Result	Comments/Base Standard
<b>FCC 47 CFR 15B</b>			
15.107	Conducted Emissions at Mains Terminals (Class B)	Pass	ANSI C63.4: 2014
15.109	Radiated Emissions (Class A / B)	Pass	ANSI C63.4: 2014

### Notes

- The software library stacks firmware used in the product during testing is R01.06.00. Sick Product Center Asia Pte. Ltd. has since updated their firmware to R01.06.00 → R01.07.00. Sick Product Center Asia Pte. Ltd. declares that the firmware update will not impact the RF performance and Sick Product Center Asia Pte. Ltd. had performed detailed analysis of the impact of this firmware update to the testing results. Please refer to Sick Product Center Asia Pte. Ltd. for more information.
- The difference between variant SE1-SS1A20 and SE1-ST1A20 is the number of inductor coils (antenna) and capacitors used for impedance matching due to different sensing direction. Please refer to the following illustrations for more details.
- Sick Product Center Asia Pte. Ltd. declares that safeIDS System comprises of a Device (Sensor) & Actuator.

Device (Sensor)  
a. SE1-ST1A20 (Tested)  
b. SE1-SS1A20 (Tested)

Actuator  
a. SE1-AM01 (Declared)  
b. SE1-AM02 (Tested)  
c. SE1-AM03 to SE1-AM16 Declared)



## Notes (Continued)

	 <b>SISTRAID</b> IP-0204-PD20-801	 SE1 Variant 1 and 2 comparisons E372141 Rev. 01 (2023-11-29)
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Variant No	safelDS Description	Product iden. Number P/N	TYPE of Device	Sensing Direction	Antenna placement at PCB	Hardware (RFID chipset, MCU, power supply, digital circuits)	Firmware
1	Front/TOP sensing via IO-Link Safety – refer to Figure 1 (a) to (c)	1132196	SE1-ST1A20	TOP (Figure 1b)	Two ferrite inductor coils	IDENTICAL	IDENTICAL
2	SIDE sensing via IO-Link Safety – refer to Figure 1 (d) to (f)	1132197	SE1-SS1A20	SIDE (Figure 1e)	One ferrite inductor coil		



#### Notes (Continued)

4. Sick Product Center Asia Pte. Ltd. declares that the actuators have identical electrical characteristics, material and physical dimensions.

SE1 Actuator			
no.	Type of Device	Identification Number (1 mio#)	ShortID (Variants)
1	SE1-AM01	1132271	01
2	SE1-AM02	1132272	02
3	SE1-AM03	1132273	03
4	SE1-AM04	1132274	04
5	SE1-AM05	1132275	05
6	SE1-AM06	1132276	06
7	SE1-AM07	1132277	07
8	SE1-AM08	1132278	08
9	SE1-AM09	1132279	09
10	SE1-AM10	1132280	10
11	SE1-AM11	1132281	11
12	SE1-AM12	1132282	12
13	SE1-AM13	1132283	13
14	SE1-AM14	1132284	14
15	SE1-AM15	1132285	15
16	SE1-AM16	1132286	16

The only difference between each actuator is the digital data programmed in ShortID. Sick Product Center Asia Pte. Ltd. declares that the difference in ShortID value will not cause any interference to RF/electromagnetic or EMC. SE1-AM02 was selected as a representative model for the family.

5. This report 7191331641-EEC24/01 | Issue: 01 was reproduced from TÜV SÜD PSB issued test report 7191315763-EEC23/01 | Issue: 01 dated 17 Oct 2023 to amend Applicant to SICK AG.

## 1.4 Product Information

### 1.4.1 Technical Description

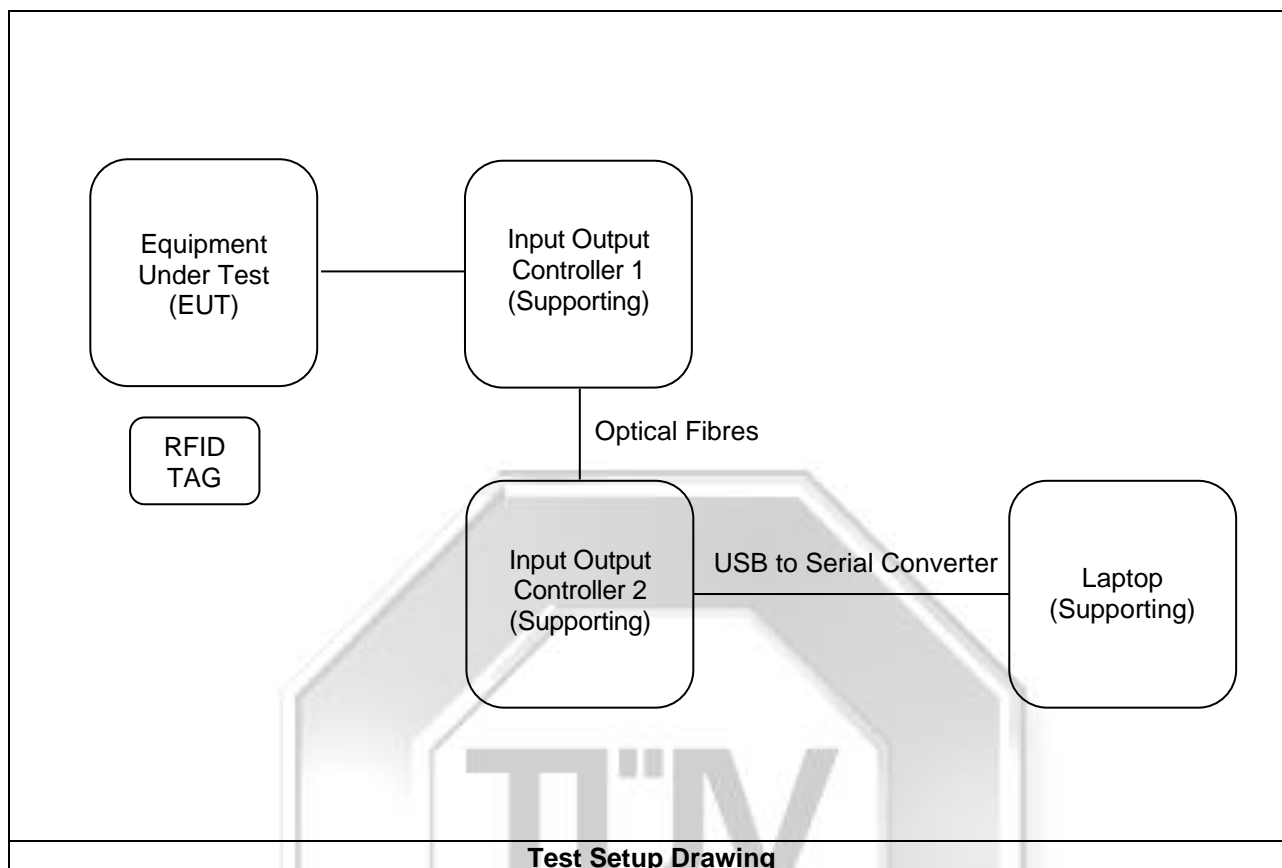
Description	:	The Equipment Under Test(s) (EUT(s)) is a <b>RFID PROXIMITY SWITCH</b> .
Microprocessor	:	STMicroelectronics STM32F303VEH6
Operating Frequency	:	125KHz (RFID)
Clock / Oscillator Frequency	:	16MHz (crystal for MCU)
Modulation	:	Amplitude Modulation (AM)
Antenna Gain	:	Not Applicable
Port / Connectors	:	M12 A-coded 4-pin Male connector
Rated Power	:	DC Supply Voltage Nominal 24Vdc Maximum 30Vdc Minimum 18Vdc
Accessories	:	Nil

### 1.4.2 Test Configuration and Modes of Operation

Mode(s)	Description
RFID Polling Mode	The EUT was transmitting and receiving continuously at 125kHz.



### 1.4.3 Test Setup Drawings



### 1.4.4 Performance Criteria and Monitoring Methods

Not Applicable.

### 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) R-20151 (3m RF Chamber - Lab 7), G-20149 (3m RF Chamber - Lab 7) C-14933 (C.E @ CEIBP) T-12403 (Telecom Ports @ CEIBP)
BSMI	SL2-IS-E-6001R [CNS-13803 (ISM Equipment)] SL2-IN-E-6001R [CNS-13438, CNS-15936 (IT Equipment)] SL2-R1/R2-E-6001R [CNS-13439, CNS-15936 (Broadcast Receivers)] SL2-A1-E-6001R [CNS-13783-1 (Household Appliances)] SL2-L1-E-6001R [CNS-14115 (Lighting Equipment)]
SABS	SABS/A-LAB/0030/2018
ASCA	TL-86

## 1.9 Supporting Equipment

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Dell Latitude 7280 Laptop	M/N: P28S001 S/N: JQPRBH2 FCC ID: DoC	
Dell AC Adapter	M/N: LA130PM121 S/N: CN-0VJCH5-72438-4AS-2F47-A01 FCC ID: DoC	1.80m unshielded power cable
PowerPax AC Adapter	M/N: SW4309B S/N: AM-77717 FCC ID: DoC	1.50m unshielded power cable
PowerPax AC Adapter	M/N: SW4309B S/N: AM-77718 FCC ID: DoC	1.50m unshielded power cable
TEConcept GmbH	M/N: IO-Link Master 03 S/N: EMVT006A FCC ID: DoC	
TEConcept GmbH	M/N: IO-Link Master 03 S/N: EMVT006B FCC ID: DoC	
LINDY Electronics Limited Serial USB to Serial Converter	M/N: Nil S/N: Nil FCC ID: DoC	1.50m unshielded signal cable

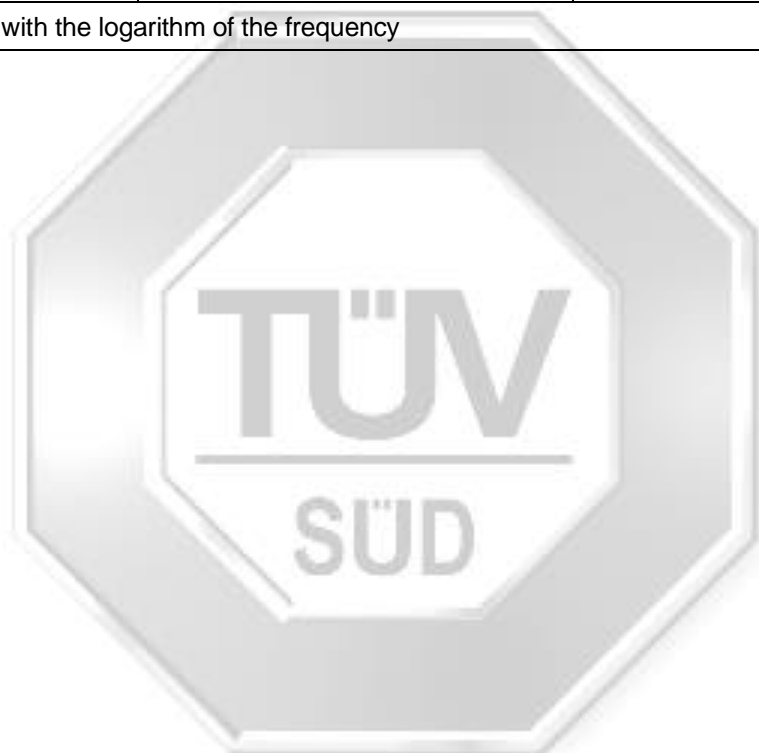
## 2 Test Details

### 2.1 Conducted Emissions at Mains Terminals

#### 2.1.1 Test Limits

##### AC Mains Port (Class B)

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak (Q-P)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50
* Decreasing linearly with the logarithm of the frequency		



## 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 power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
- 2.1.2.3 The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
- 2.1.2.4 All other supporting equipment were powered separately from another LISN.

## 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 scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
- 2.1.3.3 High peaks, relative to the limit line, were then selected.
- 2.1.3.4 The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.
- 2.1.3.5 The measurements were then repeated for the LIVE line.

## Sample Calculation Example

At 20 MHz

Q-P limit (Class B) = 60.0 dBμV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBμV  
(Calibrated for system losses)

Therefore, Q-P margin = 60.0 - 40.0 = 20.0

i.e. 20.0 dB below Q-P limit

#### 2.1.4 Test Results

The detailed of the test results are shown below.

Operating Mode	Polling Mode	Temperature	24°C
Test Input Power	120V 60Hz	Relative Humidity	60%
Line Under Test	AC Mains	Atmospheric Pressure	1030mbar
Class	B	Tested By	Kelvin Cheng
Model	SE1-SS1A20	Test Date	29 Sep 2023

Frequency (MHz)	Q-P Value (dBμV)	Q-P Limit (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Limit (dBμV)	AV Margin (dB)	Line
0.1682	45.1	65.0	19.9	28.0	55.0	27.0	Live
0.3444	38.1	59.1	21.0	32.6	49.1	16.5	Live
3.3093	36.0	56.0	20.0	28.7	46.0	17.3	Neutral
3.9579	36.6	56.0	19.4	28.9	46.0	17.1	Neutral
4.3766	35.7	56.0	20.3	27.1	46.0	18.9	Neutral
4.8380	35.3	56.0	20.7	26.9	46.0	19.1	Neutral

Operating Mode	Polling Mode	Temperature	24°C
Test Input Power	120V 60Hz	Relative Humidity	60%
Line Under Test	AC Mains	Atmospheric Pressure	1030mbar
Class	B	Tested By	Kelvin Cheng
Model	SE1-ST1A20	Test Date	29 Sep 2023

Frequency (MHz)	Q-P Value (dBμV)	Q-P Limit (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Limit (dBμV)	AV Margin (dB)	Line
0.1691	46.0	65.0	19.0	29.8	55.0	25.2	Live
0.3440	38.3	59.1	20.8	32.6	49.1	16.5	Live
2.9888	35.1	56.0	20.9	27.9	46.0	18.1	Neutral
3.5700	36.8	56.0	19.2	29.2	46.0	16.8	Neutral
3.9509	36.4	56.0	19.6	28.7	46.0	17.3	Neutral
4.3395	35.7	56.0	20.3	27.2	46.0	18.8	Neutral



#### Notes

1.	All possible modes of operation were investigated from 150kHz to 30MHz. 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>150kHz - 30MHz</u> RBW: 9kHz      VBW: 30kHz





## 2.2 Radiated Emissions

### 2.2.1 Test Limits

#### Class B

Frequency Range (MHz)	Quasi-Peak Limits (dB $\mu$ V/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*

\* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.





## 2.2.2 Test Setup

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

## 2.2.3 Test Method

- 2.2.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.
- 2.2.3.2 A pre-scan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the pre-scan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
- 2.2.3.3 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.
- 2.2.3.4 A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
- 2.2.3.5 The measurements were repeated for the next frequency point, until all selected frequency points were measured.

## Sample Calculation Example

At 300 MHz

Q-P limit (Class B) = 37.0 dB $\mu$ V/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 31.0 dB $\mu$ V/m

(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 37.0 - 31.0 = 6.0

i.e. 6.0 dB below Q-P limit

## 2.2.4 Test Results

The detailed of the test results are shown below.

Operating Mode	Polling Mode	Temperature	24°C
Test Input Power	120V 60Hz	Relative Humidity	60%
Test Distance	3m (30MHz – 1GHz)	Atmospheric Pressure	1030mbar
Class	B	Tested By	Derrick Ng
Model	SE1-SS1A20	Test Date	03 Oct 2023

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Limit (dBμV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarization (H/V)
47.6150	30.1	40.0	9.9	100	227	V
88.0190	23.0	43.5	20.5	133	140	V
90.1790	15.8	43.5	27.7	160	101	H
168.0800	23.8	43.5	19.7	107	88	V
354.9790	22.7	46.0	23.3	120	123	V
532.3350	23.6	46.0	22.4	100	149	V

Operating Mode	Polling Mode	Temperature	24°C
Test Input Power	120V 60Hz	Relative Humidity	60%
Test Distance	3m (30MHz – 1GHz)	Atmospheric Pressure	1030mbar
Class	B	Tested By	Derrick Ng
Model	SE1-ST1A20	Test Date	03 Oct 2023

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Limit (dBμV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Polarization (H/V)
47.9850	21.4	40.0	18.6	101	226	V
87.7910	23.0	40.0	17.0	140	111	V
87.9910	17.0	40.0	23.0	159	171	H
168.1940	22.8	43.5	20.7	105	356	V
362.8120	22.4	46.0	23.6	101	128	V
711.8260	20.8	46.0	25.2	137	199	V

#### Notes

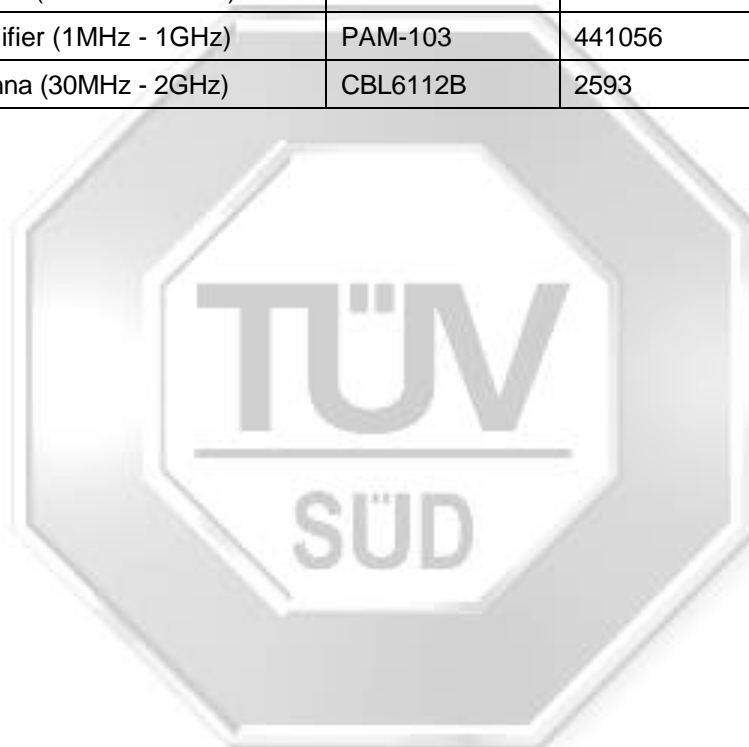
1.	All possible modes of operation were investigated. Only the worst-case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: <u>30MHz - 1GHz</u> RBW: 120kHz          VBW: 1MHz <u>1GHz – 40GHz</u> RBW: 1MHz          VBW: 3MHz
4.	The highest frequency of internal sources of the EUT is less than 108MHz, as such the measurement was made up to 1GHz.





### 3 Test Equipment

Instrument	Model	S/No	Cal Due Date
Conducted Emissions at Mains Terminals			
R&S EMI Test Receiver (9kHz - 3GHz)	ESPI3	100349	09 May 2024
AFJ LISN	AFJ LT32C/10	32031929295	13 Apr 2024
Schaffner LISN	NNB42	04/10055	08 Aug 2024
EMCO LISN (supporting)	3825/2	9309-2127	08 Aug 2024
Radiated Emissions			
R&S EMI Test Receiver (9kHz - 26.5GHz)	ESR26	101714	14 Sep 2024
Com-Power Preamplifier (1MHz - 1GHz)	PAM-103	441056	11 Sep 2024
Schaffner Bilog Antenna (30MHz - 2GHz)	CBL6112B	2593	11 Dec 2023





4 Measurement Uncertainty

All measured results are traceable to the SI units. The uncertainty of the measurement is at a confidence level of approximately 95%, with a coverage factor of 2.

Test Name	Measurement Uncertainty
Conducted Emissions at Mains Terminals	1.1dB (9kHz to 30MHz)
Radiated Emissions	<u>10m Anechoic Chamber (Lab 4)</u> 2.2dB (9kHz to 30MHz @ 10m) 3.1dB (30MHz to 1GHz @ 10m) 3.7dB (30MHz to 1GHz @ 3m) 4.7dB (>1GHz to 40GHz @ 3m)  <u>3m RF Chamber (Lab7)</u> 3.6dB (30MHz to 1GHz @ 3m) 4.7dB (>1GHz to 40GHz @ 3m)





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Effective 27 March 2024

