

TEST REPORT

of

Australian/New Zealand Standard

AS/NZS 4268:2017

Product : **Lora module**
Brand: **Fanstel**
Model(s): **LR62E**
Model Difference: **N/A**
Applicant: **Fanstel Corporation, Taipei**
Address: **10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd., Hsi-Chih,
New Taipei City 221 Taiwan**

Test Performed by:



International Standards Laboratory Corp. LT Lab.

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Taiwan

Report No.: **ISL-20LR171A4268**
Issue Date : **2022/01/05**



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein. The uncertainty of the measurement does not include in consideration of the test result unless the customer required the determination of uncertainty via the agreement, regulation or standard document specification. This test report shall not be reproduced except in full, without the written approval of International Standards Laboratory Corp.

VERIFICATION OF COMPLIANCE

Applicant: Fanstel Corporation, Taipei
Equipment Under Test: Lora module
Brand Name: Fanstel
Model Number: LR62E
Model Different: N/A
Date of Test: 2021/11/24 ~ 2021/12/06
Date of EUT Received: 2021/11/24

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
AS/NZS 4268:2017 Row 58	Complied

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory Corp.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:

Weitin Chen

Date:

2022/01/05

Weitin Chen / Senior Engineer

Prepared By:

Elisa Chen

Date:

2022/01/05

Elisa Chen / Senior Engineer

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Date:

2022/01/05

Jerry Liu / Assistant Manager

Version

Version No.	Date	Description
00	2022/01/05	Initial creation of document

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1 Description of Equipment under Test (EUT)

General Information	
Product Name:	Lora module
Brand Name:	Fanstel
Model Name:	LR62E
Model Difference:	N/A
Temperature Range	-40°C to +105°C
Power Supply:	5Vdc from USB (JIG)
LoRa Information	
Frequency Range:	915.5MHz – 927.5MHz
Transmit Power (EIRP):	12.29 dBm
Channel number:	13 channels
Antenna Designation:	Dipole Antenna : 1.39dBi (Max)

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

2 Description of Test Modes

The EUT has been tested under Operating condition. To control the EUT for staying in continuous transmitting and receiving mode is programmed.

LoRa: Lowest (915.5MHz), Mid (921.5MHz) and Highest (927.5MHz) with 1 Mbps

Normal test conditions:

Temperature : -40°C to 105°C

Relative humidity: 20 % to 75 %

Normal Voltage: 5Vdc

Extreme Temperatures

For test at extreme temperatures, measurements shall be in accordance with the procedures specified in section 5.3 of AS/NZS 4268 at upper value of +105 degree and at a lower value of -40 degree.

Extreme Test Source Voltages

Low voltage is 4.5Vdc and 5.5Vdc for high voltage nominal voltage 5Vdc

3 General Description of Applied Standards`

The EUT According to the Specifications, it must comply with the requirements of the following standards:

AS/NZS 4268:2017, – Radio equipment and systems – Short range devices – Limits and methods of measurement.

Row 58: Digital modulation transmitters

ETSI EN 300 220-1 V3.1.1 – Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 1: Technical characteristics and methods of measurement

4 Test Facility

International Standards Laboratory Corp.

<LT Lab.>

No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan

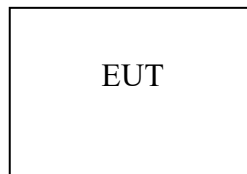
A fully anechoic chamber was used for the radiated spurious emissions test.

TAF Accreditation Lab. Lab number: 0997

5 Test Setup

5.1 EUT Configuration

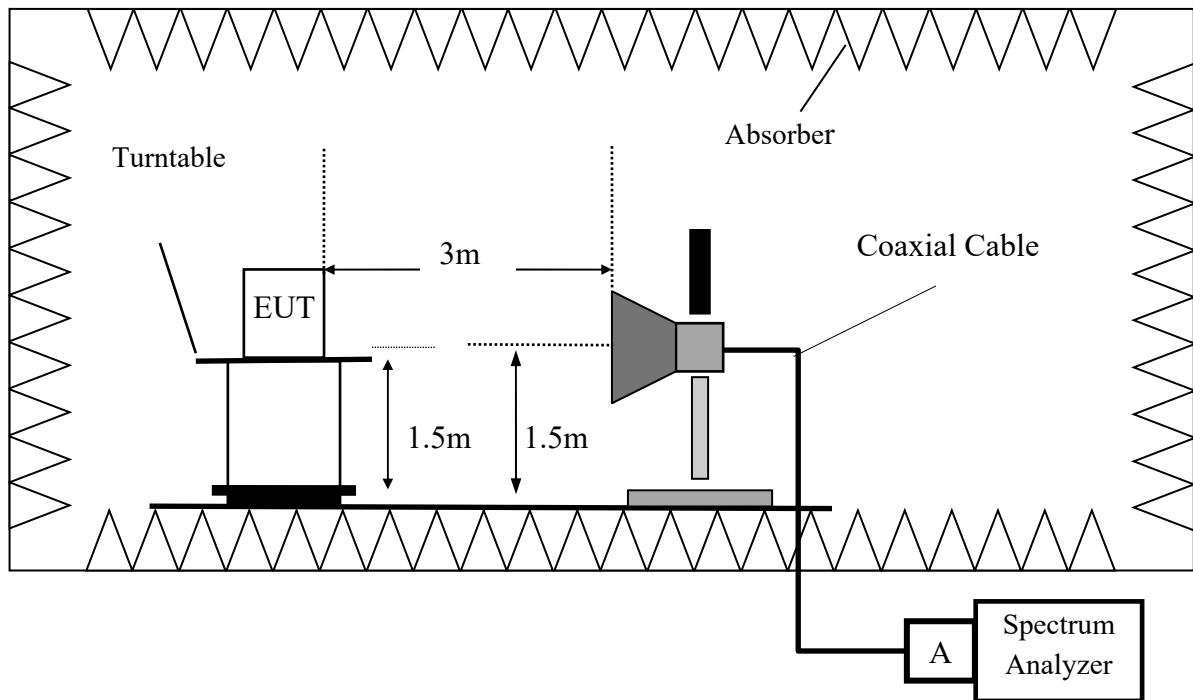
Configuration of Tested System



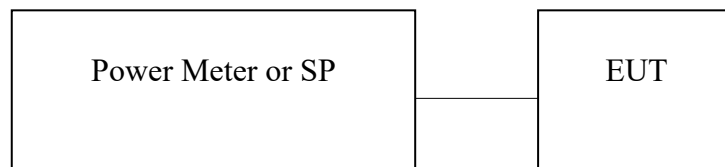
Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
	N/A					

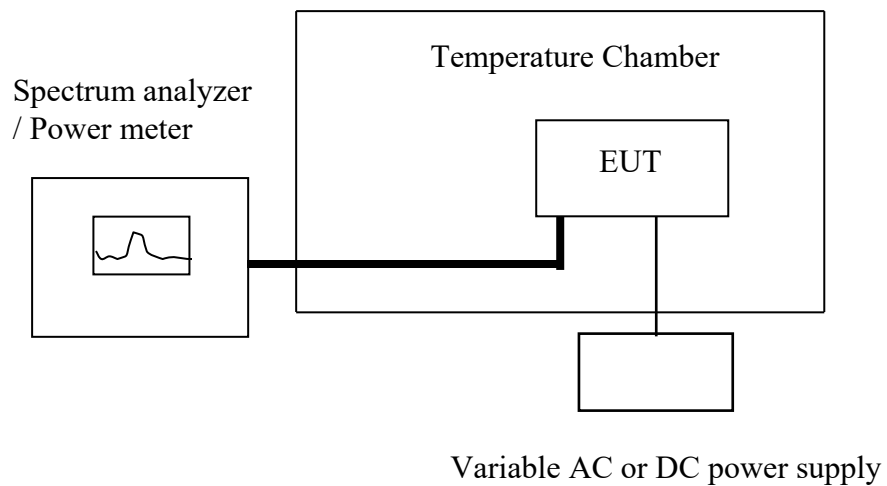
5.2 Test Setup for ERP/EIRP Measurement



5.3 Test Setup for Conducted Measurement



5.4 Test Setup for Extreme test



6 Measurement Results

6.1 Summary of Measurement

Clause of Ref. Std.	Test Items	Verdict
6.3	Maximum EIRP	Pass
6.4	Transmitter Spurious Emissions	Pass
6.5	Emission Bandwidth	Pass
6.6	Operating Frequencies	Pass
7.2	Receiver Spurious Emissions	Pass
Table 1 Note 2	Radiated Peak Spectral Density	Pass

6.2 Maximum EIRP

6.2.1 Limit

AS/NZS 4268 Clause 6.3 & Table 1 row 58 requirement:

The maximum EIRP shall not exceed 1W (30 dBm).

6.2.2 Test Procedure

According to Clause 5.2 of ETSI EN 300 220-1.

6.2.3 Test Result

Mode	Frequency (MHz)	Temp.	Output Power (dBm)	Antenna Gain(dBi)	Output Power e.i.r.p. (dBm)	Limit (dBm)	Results
LORA	915.5	Normal	10.8	1.39	12.19	30	Pass
		Low	10.8	1.39	12.19	30	Pass
		High	10.9	1.39	12.29	30	Pass
	921.5	Normal	10.7	1.39	12.09	30	Pass
		Low	10.6	1.39	11.99	30	Pass
		High	10.6	1.39	11.99	30	Pass
	927.5	Normal	10.5	1.39	11.89	30	Pass
		Low	10.5	1.39	11.89	30	Pass
		High	10.5	1.39	11.89	30	Pass

6.3 Transmitter Spurious Emissions

6.3.1 Limit

According to ETSI EN 300 220-1 requirement:

Transmitter limits for spurious emissions

Frequency	47 MHz to 74 MHz 87.5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Tx mode	-54dBm	-36dBm	-30dBm

6.3.2 Test Procedure:

According to Clause 5.9.3 of ETSI EN 300 220-1.

6.3.3 Test Result:

Test Mode: TX CH Low

Ambient temperature: 21°C

Relative humidity: 64%

Test Date: 2021/12/03

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	109.54	-80.68	0.94	-79.74	-54.00	-25.74	VERTICAL
2	189.08	-80.04	2.47	-77.57	-54.00	-23.57	VERTICAL
3	504.33	-80.53	8.95	-71.58	-54.00	-17.58	VERTICAL
4	564.47	-80.13	9.28	-70.85	-54.00	-16.85	VERTICAL
5	651.77	-79.41	12.15	-67.26	-54.00	-13.26	VERTICAL
6	746.83	-80.07	13.72	-66.35	-54.00	-12.35	VERTICAL
7	1833.00	-44.89	3.78	-41.11	-30.00	-11.11	VERTICAL
8	2750.00	-39.43	6.57	-32.86	-30.00	-2.86	VERTICAL
1	96.93	-81.17	0.53	-80.64	-54.00	-26.64	HORIZONTAL
2	217.21	-81.48	2.48	-79.00	-54.00	-25.00	HORIZONTAL
3	549.92	-80.74	10.04	-70.70	-54.00	-16.70	HORIZONTAL
4	651.77	-80.05	11.68	-68.37	-54.00	-14.37	HORIZONTAL
5	714.82	-80.96	13.06	-67.90	-54.00	-13.90	HORIZONTAL
6	758.47	-80.26	14.26	-66.00	-54.00	-12.00	HORIZONTAL
7	1833.00	-54.71	4.03	-50.68	-30.00	-20.68	HORIZONTAL
8	2743.00	-40.05	6.81	-33.24	-30.00	-3.24	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Test Mode: TX CH High

Ambient temperature: 21°C

Relative humidity: 64%

Test Date: 2021/12/03

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	105.66	-80.27	0.33	-79.94	-54.00	-25.94	VERTICAL
2	213.33	-80.56	2.53	-78.03	-54.00	-24.03	VERTICAL
3	511.12	-80.76	8.94	-71.82	-54.00	-17.82	VERTICAL
4	588.72	-79.95	9.87	-70.08	-54.00	-16.08	VERTICAL
5	676.99	-79.99	13.07	-66.92	-54.00	-12.92	VERTICAL
6	738.10	-80.36	13.75	-66.61	-54.00	-12.61	VERTICAL
7	1854.00	-46.15	3.89	-42.26	-30.00	-12.26	VERTICAL
8	2785.00	-40.69	6.67	-34.02	-30.00	-4.02	VERTICAL
1	113.42	-79.43	1.73	-77.70	-54.00	-23.70	HORIZONTAL
2	211.39	-80.38	2.07	-78.31	-54.00	-24.31	HORIZONTAL
3	523.73	-80.08	9.21	-70.87	-54.00	-16.87	HORIZONTAL
4	626.55	-79.45	11.46	-67.99	-54.00	-13.99	HORIZONTAL
5	703.18	-80.18	12.64	-67.54	-54.00	-13.54	HORIZONTAL
6	758.47	-79.29	14.26	-65.03	-54.00	-11.03	HORIZONTAL
7	1854.00	-54.73	4.13	-50.60	-30.00	-20.60	HORIZONTAL
8	2785.00	-45.36	6.90	-38.46	-30.00	-8.46	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

6.4 Emission Bandwidth

6.4.1 Limit

AS/NZS 4268 Clause 6.5 requirement:

The upper and lower frequency limits of 99% emission power bandwidth shall at all times remain within the operating frequency limits.

Some transmitter categories require a specific limit for emission bandwidth. In such cases, the emission bandwidth shall be established by testing in accordance with the relevant specified Standard.

6.4.2 Test Procedure:

According to Clause 5.6 of ETSI EN 300 220-1.

6.4.3 Test Result:

PASS.

Frequency (MHz)	99% Bandwidth (kHz)
915.5	330.73
927.5	330.75

6.5 Operating Frequencies

6.5.1 Limit

According to AS/NZS 4268 Table 1 Row 58:

Operating frequency range shall be within 915MHz to 928MHz.

6.5.2 Test Procedure:

According to Clause 6.5 of AS/NZS 4268 requirement:

The upper and lower frequency limits of 99% emission power bandwidth shall at all times remain within the operating frequency limits.

6.5.3 Test Result:

PASS.

Mode	Frequency (MHz)	99% Bandwidth (kHz)	F _L at 99% BW (MHz)	F _H at 99% BW (MHz)	Limit (MHz)
LORA	915.5	330.73	915.33	---	F _L > 915
	927.5	330.75	---	927.67	F _H < 928

6.6 Receiver Spurious Emissions

6.6.1 Limit

According to ETSI EN 300 220-1 requirement:

Receiver limits for spurious emissions

Frequency	Frequencies below 1 000 MHz	Frequencies above 1 000 MHz
Rx mode	-57dBm	-47dBm

6.6.2 Test Procedure:

According to Clause 5.9.3 of ETSI EN 300 220-1.

6.6.3 Test Result:

Test Mode: RX CH Low

Ambient temperature: 21°C

Relative humidity: 64%

Test Date: 2021/12/03

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	150.28	-81.08	6.17	-74.91	-57.00	-17.91	VERTICAL
2	252.13	-81.21	4.85	-76.36	-57.00	-19.36	VERTICAL
3	431.58	-81.10	8.02	-73.08	-57.00	-16.08	VERTICAL
4	530.52	-79.10	8.93	-70.17	-57.00	-13.17	VERTICAL
5	619.76	-80.26	10.93	-69.33	-57.00	-12.33	VERTICAL
6	740.04	-79.37	13.74	-65.63	-57.00	-8.63	VERTICAL
7	2351.00	-70.18	5.49	-64.69	-47.00	-17.69	VERTICAL
8	3583.00	-71.35	9.87	-61.48	-47.00	-14.48	VERTICAL
1	140.58	-82.18	3.89	-78.29	-57.00	-21.29	HORIZONTAL
2	390.84	-82.76	6.58	-76.18	-57.00	-19.18	HORIZONTAL
3	479.11	-82.09	8.39	-73.70	-57.00	-16.70	HORIZONTAL
4	580.96	-80.83	10.79	-70.04	-57.00	-13.04	HORIZONTAL
5	701.24	-81.74	12.57	-69.17	-57.00	-12.17	HORIZONTAL
6	788.54	-81.18	14.19	-66.99	-57.00	-9.99	HORIZONTAL
7	2806.00	-70.03	6.95	-63.08	-47.00	-16.08	HORIZONTAL
8	4269.00	-72.26	13.73	-58.53	-47.00	-11.53	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz -1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

Test Mode: RX CH High

Ambient temperature: 21°C

Relative humidity: 64%

Test Date: 2021/12/03

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	146.40	-80.79	5.79	-75.00	-57.00	-18.00	VERTICAL
2	327.79	-81.12	4.97	-76.15	-57.00	-19.15	VERTICAL
3	431.58	-80.72	8.02	-72.70	-57.00	-15.70	VERTICAL
4	526.64	-80.78	8.93	-71.85	-57.00	-14.85	VERTICAL
5	697.36	-80.04	13.79	-66.25	-57.00	-9.25	VERTICAL
6	878.75	-81.69	15.98	-65.71	-57.00	-8.71	VERTICAL
7	3023.00	-71.74	7.36	-64.38	-47.00	-17.38	VERTICAL
8	4745.00	-73.61	15.45	-58.16	-47.00	-11.16	VERTICAL
1	148.34	-81.28	4.43	-76.85	-57.00	-19.85	HORIZONTAL
2	291.90	-81.55	3.82	-77.73	-57.00	-20.73	HORIZONTAL
3	515.97	-81.07	8.95	-72.12	-57.00	-15.12	HORIZONTAL
4	671.17	-81.29	12.03	-69.26	-57.00	-12.26	HORIZONTAL
5	751.68	-80.28	14.28	-66.00	-57.00	-9.00	HORIZONTAL
6	806.00	-81.34	14.26	-67.08	-57.00	-10.08	HORIZONTAL
7	2785.00	-71.88	6.90	-64.98	-47.00	-17.98	HORIZONTAL
8	4759.00	-73.67	15.48	-58.19	-47.00	-11.19	HORIZONTAL

Measurement uncertainty	30MHz - 80MHz: 5.04dB
	80MHz - 1000MHz: 3.76dB
	1GHz - 26GHz: 4.45dB

Remark:

1. The emission behaviors belong to narrowband spurious emission.
2. Remark " --- " means that the emission level is too low to be measured
3. Aux: Field strength to EIRP correction factor
4. Level (dBm) = Reading (dBm) + Aux (dB)
5. Measurement Range upto 12.75GHz.

6.7 Radiated Peak Power Spectral Density

6.7.1 Limit

According to AS/NZS 4268 Table 1 Note 2 requirement:

The radiated peak power spectral density in any 3 kHz is limited to 25 mW per 3 kHz.

6.7.2 Test Procedure

- (1) Set analyzer center frequency to operating channel center frequency.
- (2) Set the span to 1.5 times the occupied bandwidth.
- (3) Set the RBW to 3 kHz.
- (4) Set the VBW to 10 kHz.
- (5) Detector = peak.
- (6) Sweep time = auto couple.
- (7) Trace mode = max hold.
- (8) Use the peak marker function to determine the maximum amplitude level(D).
- (9) Calculated from the above measured value(D) and the applicable antenna assembly gain in dB.

6.7.3 Test Result

Mode	Frequency (MHz)	PSD (dBm/3kHz)	Antenna Gain(dBi)	PSD e.i.r.p. (dBm/3kHz)	Limit (dBm/3kHz)	Results
LORA	915.5	10.56	1.39	11.95	14	Pass
	921.5	10.50	1.39	11.89	14	Pass
	927.5	11.31	1.39	12.70	14	Pass

7 Appendix

7.1 Appendix A: Measurement Uncertainty

Measurement Uncertainty (K=2)

Description Of Test	Uncertainty
Conducted Emission (AC power line)	2.586 dB
Field Strength of Spurious Radiation	<=30MHz: 2.96dB 30-1GHz: 4.22 dB 1-40 GHz: 4.08 dB
Conducted Power	2.412 GHz: 1.30 dB 5.805 GHz: 1.55 dB
Power Density	2.412 GHz: 1.30 dB 5.805 GHz: 1.67 dB
Frequency	0.0032%

7.2 Appendix B: Equipment List

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 16	Spectrum Analyzer (26.5GHz)	Agilent	N9010A	MY52100117	09/01/2021	09/01/2022
Chamber 16	Dipole antenna	Schwarzbeck	VHAP,30-300	919	05/13/2021	05/13/2022
Chamber 16	Dipole antenna	Schwarzbeck	UHAP,300-1000	1195	05/13/2021	05/13/2022
Chamber 16	Loop Antenna	EM	EM-6879	271	09/29/2021	09/29/2022
Chamber 16	Bilog Antenna	Schwarzbeck	VULB9168 w 5dB Att.	9168-495	11/11/2021	11/11/2022
Chamber 16	Horn antenna (1GHz - 18GHz)	EM	EM-AH-10180	2011071401	11/25/2021	11/25/2022
Chamber 16	Horn antenna (18GHz - 26GHz)	Com-power	AH-826	081001	11/23/2021	11/23/2022
Chamber 16	Horn antenna (26GHz - 40GHz)	Com-power	AH-640	100A	03/11/2021	03/11/2022
Chamber 16	Preamplifier (9kHz - 1.3GHz)	HP	8447F	3113A04621	06/22/2021	06/22/2022
Chamber 16	Preamplifier (1GHz - 26GHz)	EM	EM01M26G	060559	05/20/2021	05/20/2022
Chamber 16	Preamplifier (26GHz - 40GHz)	MITEQ	JS4-26004000-27-5A	818471	05/07/2021	05/07/2022
Chamber 16	Cable (100kHz-1GHz)	HUBER SUHNER	Sucoflex 104A	1166 cable 001	12/25/2020	12/25/2021
Chamber 16	Cable (9kHz-18GHz)	Huber Suhner & Scube	Sucoflex 104A & CA3601-3601-L & CA3601-3601-L	50927/4A & 1166-1G-26G-01 & 1166-1G-26G-02	12/25/2020	12/25/2021
Chamber 16	Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	11/17/2021	11/17/2022
Chamber 16	Signal Generator	Anritsu	MG3692A	20311	01/03/2021	01/03/2022
Chamber 16	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conducted	Power Meter	Anritsu	ML2495A	1116010	09/30/2021	09/30/2022
Conducted	Power Sensor	Anritsu	MA2411B	34NKF50	09/30/2021	09/30/2022
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO33	01/04/2021	01/04/2022
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO34	01/04/2021	01/04/2022
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO35	06/23/2021	06/23/2022
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO36	06/23/2021	06/23/2022
Conducted	Temperature Chamber	KSON	THS-B4H100	2287	04/26/2021	04/26/2022
Conducted	DC Power supply	ABM	8185D	N/A	01/05/2021	01/05/2022
Conducted	AC Power supply	EXTECH	CFC105W	NA	N/A	N/A
Conducted	Spectrum analyzer	Keysight	N9010A	MY56070257	09/28/2021	09/28/2022
Conducted	Test Software	DARE	Radiation Ver:2013.1.23	NA	NA	NA
Conducted	Test Software	R&S	CMUGO Ver:2.0.0	N/A	N/A	N/A
Conducted	Universal Digital Radio Communication Tester	R&S	CMU200	111968	11/18/2021	11/18/2022
Conducted	Wideband Radio Communication Tester	R&S	CMW500	1201.002K50108793-JG	10/26/2021	10/26/2022
Conducted	BT Simulator	Agilent	N4010A	MY48100200	NA	NA
Conducted	GPS Simulator	Welnavigate	GS-50	701523	NA	NA
Conducted (TS8997)	Wideband Radio Communication Tester	R&S	CMW500	168811	09/09/2021	09/09/2022
Conducted (TS8997)	Signal Generator	R&S	SMB100B	101085	09/09/2021	09/09/2022
Conducted (TS8997)	Vector Signal Generator	R&S	SMBV100A	263246	09/09/2021	09/09/2022
Conducted (TS8997)	Signal analyzer 40GHz	R&S	FSV40	101884	09/07/2021	09/07/2022
Conducted (TS8997)	OSP150 extension unit CAM-BUS	R&S	OSP150	101107	09/10/2021	09/10/2022
Conducted (TS8997)	Test Software	R&S	EMC32	NA	NA	NA

7.3 Appendix C: Photographs of Setup



7.4 Appendix D: Photographs of EUT

Please refer to the File of ISL-20LR171P

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