

TEST REPORT

of

Australian/New Zealand Standard AS/NZS 4268:2017

Product : Bluetooth 5.3 module

Brand: Fanstel

Model: BT840N; BT840NE

Model Difference: Antenna. Please see page 5 for detail

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.

TEL: +886-3-263-8888 FAX: +886-3-263-8899

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

Report No.: **ISL-23LR0074ANZ**
Issue Date :**2023/09/11**

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
Product Description: Bluetooth 5.3 module
Brand Name: Fanstel
Model No.: BT840N; BT840NE
Model Difference: Antenna. Please see page 5 for detail
Date of test: 2023/05/30 ~ 2023/09/11
Date of EUT Received: 2023/05/30

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
AS/NZS 4268:2017, Row 59 Row 21	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:

2023/09/11

Weitin Chen / Senior Engineer

Prepared By:

Gigi yeh

Date:

2023/09/11

Gigi Yeh / Senior Engineer

Approved By:

Jerry Liu

Date:

2023/09/11

Jerry Liu / Manager

Version

Version No.	Date	Description
00	2023/09/11	Initial creation of document

Table of Contents

1	Description of Equipment Under Test (EUT)	5
2	Description of Test Modes and Test Condition	7
3	General Description of Apply Standards	8
4	Test Facility.....	8
5	Support Equipment.....	9
6	Maximum EIRP Measurement	10
7	Transmitter Spurious Emissions Measurement.....	16
8	Emission Bandwidth Measurement.....	25
9	Operating Frequencies Measurement	27
10	Receiver Emissions Measurement	32
11	Radiated Peak Power Spectral Density Measurement	41
	Photographs of Test Setup	43
	Photographs of EUT	50

1 Description of Equipment Under Test (EUT)

General Information	
Product Name:	Bluetooth 5.3 module
Brand Name:	Fanstel
Model Name:	BT840N; BT840NE
Model Difference:	Antenna difference
Temperature Range	-40°C to +105°C
Power Supply:	5Vdc
BLE Information	
Frequency Range:	2402 – 2480MHz
Max Output Power:	8.04dBm
Channel number:	40 channels
Modulation type:	GFSK
IEEE 802.15.4 (Thread, Zigbee) Information	
Frequency Range:	2405 – 2480MHz
Max Output Power:	9.57dBm
Channel number:	16 channels
Modulation type:	FSK

	Antenna Type	Brand	Model	Peak Gain	Frequency Range	Connector Type
1	Dipole	Fanstel	ANT000	0dBi	2400-2485 MHz	MMCX
2	PCB	Fanstel	F type	0.88dBi	2400-2485 MHz	MMCX

Model Summaries

module	BT840N	BT840NE
SoC	nRF52840	nRF52840
Size, mm	15x29.9x2.0	15x29.9x2.0
32M,32.768kHz crystals	Integrated	Integrated
DCDC inductors,VDD,VDDH	Integrated	Integrated
BT Antenna	PA+PCB	PA+PCB+u.FL
Operating temp.	-40oC to +85oC	-40oC to +85oC
Evaluation board	EV-BT840NE	EV-BT840NE

IEEE 802.15.4 (Thread, Zigbee) channels

Center Frequency (MHz)	
2405MHz	2445MHz
2410MHz	2450MHz
2415MHz	2455MHz
2420MHz	2460MHz
2425MHz	2465MHz
2430MHz	2470MHz
2435MHz	2475MHz
2440MHz	2480MHz

Test Plan

Applicable standard	AS/NZS 4268:2017		
Test Configuration	Config 1	Config 2	Config 3
Operation mode	BT link(BT840N) Antenna:F Type	BT link(BT840NE)	Zigbee link(BT840N) Antenna:F Type

This test report applies for Bluetooth BLE and IEEE 802.15.4 (Thread, Zigbee).

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 and Test Condition

The EUT has been tested under Operating and standby condition. And used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lower, mid and higher of IEEE 802.15.4 (Thread, Zigbee) modes were chosen for testing.

Normal test conditions:

Temperature : -20°C to 55°C

Relative humidity: 20 % to 75 %

5Vdc Voltage

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 Apply 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 59: Digital modulation transmitters

Row 21: All transmitters

EN 300 440: Technical characteristics and test method.

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 Support Equipment

Fig. 5-1 Configuration of Tested System



Table 5-1 Equipment Used in Tested System

Item	Equipment	Mrf/Brand	Model name	Series No	Data Cable	Power Cable
1	Notebook	Lenovo	X220i	N/A	N/A	Non-shielded
2	Test Kit	N/A	N/A	N/A	N/A	N/A

6 Maximum EIRP Measurement

6.1. Limit:

4W(36dBm) for Row 59

10W(20dBm) for Row 21

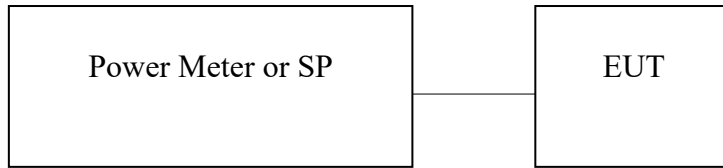
According to AS/NZS 4268:2017, Table 1, row 59: Digital modulation transmitters

According to AS/NZS 4268:2017, Table 1, row 21: All transmitters

6.2. Measurement Equipment Used:

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conducted	Power Meter	Anritsu	ML2495A	1116010	09/29/2022	09/29/2023
Conducted	Power Sensor	Anritsu	MA2411B	34NKF50	09/29/2022	09/29/2023
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO33	01/06/2023	01/06/2024
Conducted	Power Sensor	DARE	RPR3006W	13I00030SNO34	01/06/2023	01/06/2024
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO35	06/21/2023	06/21/2024
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO36	06/21/2023	06/21/2024
Conducted	Temperature Chamber	KSON	THS-B4H100	2287	05/20/2023	05/20/2024
Conducted	DC Power supply	ABM	8185D	N/A	01/04/2023	01/04/2024
Conducted	AC Power supply	EXTECH	CFC105W	NA	N/A	N/A
Conducted	Spectrum analyzer	Keysight	N9010A	MY56070257	09/28/2022	09/28/2023
Conducted	Test Software	DARE	Radiation Ver:2013.1.23	NA	NA	NA
Conducted	Universal Radio Comm. Tester	R&S	CMU200	111968	11/19/2022	11/19/2023
Conducted	Wideband Radio Comm. Tester	R&S	CMW500	1201.002K50108 793-JG	10/31/2022	10/31/2023
Conducted	BT Simulator	Agilent	N4010A	MY48100200	NA	NA
Conducted	Signal Generator	Agilent	E4438C	MY49071550	12/28/2022	12/28/2023
Conducted	Signal Generator	Keysight	N5182B	MY53052399	12/28/2022	12/28/2023
Conducted	Spectrum analyzer	Keysight	N9010A	MY56070257	09/28/2022	09/28/2023
Conducted (TS8997)	Wideband Radio Comm. Tester	R&S	CMW500	168811	09/22/2022	09/22/2023
Conducted (TS8997)	UP/DOWN converter	R&S	CMW-Z800A	100566	12/22/2022	12/22/2023
Conducted (TS8997)	Signal Generator	R&S	SMB100A	183701	01/18/2023	01/18/2024
Conducted (TS8997)	Vector Signal Generator	R&S	SMM100A	101908	11/23/2022	11/23/2023
Conducted (TS8997)	Signal analyzer 40GHz	R&S	FSV40	101884	09/22/2022	09/22/2023
Conducted (TS8997)	OSP150 extension unit CAM-BUS	R&S	OSP150	101107	09/21/2022	09/21/2023
Conducted (TS8997)	Test Software	R&S	EMC32 Ver:11.50.00	NA	NA	NA

6.3. Test Setup:



6.4. Test Procedure:

Refer to ETSI EN 300 440-1, clause 7.1.

Refer to ETSI EN 300 328

See Sub-Clause 5.3.2.1 of ETSI EN 300 328 for the test conditions

See Sub-Clause 5.3.2.2.1.1 of ETSI EN 300 328 for conducted method.

6.5. Measurement Result: Refer to next page for the details.

6.5.1. Test Results:

Dipole Antenna

Example Calculation:

Pburst values (A) = Reading + Cable Loss

RF output power (P) = A+G+Y

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: BT LE

Pburst values (value "A" in dBm)

antenna assembly gain "G" in dBi

0.00 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		Lowest Frequency	Middle Frequency	Highest Frequency
Temp -45 °C	Vmin 4.5 V	P 7.16 dBm	P 5.24 dBm	P 2.23 dBm
		A 7.16 dBm	A 5.24 dBm	A 2.23 dBm
		Reading 6.16 dBm	Reading 4.24 dBm	Reading 1.23 dBm
	Vmax 5.5 V	P 7.16 dBm	P 5.24 dBm	P 2.23 dBm
Temp 25 °C	Vnom 5 V	A 7.16 dBm	A 5.24 dBm	A 2.23 dBm
		Reading 6.16 dBm	Reading 4.24 dBm	Reading 1.23 dBm
		P 6.66 dBm	P 4.74 dBm	P 1.73 dBm
		A 6.66 dBm	A 4.74 dBm	A 1.73 dBm
Temp 105 °C	Vmin 4.5 V	Reading 5.66 dBm	Reading 3.74 dBm	Reading 0.73 dBm
		P 6.66 dBm	P 4.74 dBm	P 1.73 dBm
		A 6.66 dBm	A 4.74 dBm	A 1.73 dBm
	Vmax 5.5 V	Reading 5.66 dBm	Reading 3.74 dBm	Reading 0.73 dBm
Limit(P)		36dBm		
Measurement uncertainty		+ 0.28dB / - 0.30dB		

PCB Antenna

Example Calculation:

Pburst values (A) = Reading + Cable Loss

RF output power (P) = A+G+Y

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: BT LE

Pburst values (value "A" in dBm)

antenna assembly gain "G" in dBi

0.88 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		Lowest Frequency	Middle Frequency	Highest Frequency
Temp -45 °C	Vmin 4.5 V	P 8.04 dBm	P 6.12 dBm	P 3.11 dBm
		A 7.16 dBm	A 5.24 dBm	A 2.23 dBm
		Reading 6.16 dBm	Reading 4.24 dBm	Reading 1.23 dBm
	Vmax 5.5 V	P 8.04 dBm	P 6.12 dBm	P 3.11 dBm
Temp 25 °C	Vnom 5 V	A 7.16 dBm	A 5.24 dBm	A 2.23 dBm
		Reading 6.16 dBm	Reading 4.24 dBm	Reading 1.23 dBm
		P 7.54 dBm	P 5.62 dBm	P 2.61 dBm
		A 6.66 dBm	A 4.74 dBm	A 1.73 dBm
Temp 105 °C	Vmin 4.5 V	Reading 5.66 dBm	Reading 3.74 dBm	Reading 0.73 dBm
		P 7.54 dBm	P 5.62 dBm	P 2.61 dBm
		A 6.66 dBm	A 4.74 dBm	A 1.73 dBm
	Vmax 5.5 V	Reading 5.66 dBm	Reading 3.74 dBm	Reading 0.73 dBm
Limit(P)		36dBm		
Measurement uncertainty		+ 0.28dB / - 0.30dB		

Dipole Antenna

Example Calculation:

Pburst values (A) = Reading + Cable Loss

RF output power (P) = A+G+Y

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee)

Pburst values (value "A" in dBm)

antenna assembly gain "G" in dBi

0.00 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		Lowest Frequency	Middle Frequency	Highest Frequency
Temp -45 °C	Vmin 4.5 V	P 7.69 dBm	P 6.41 dBm	P 5.18 dBm
		A 7.69 dBm	A 6.41 dBm	A 5.18 dBm
		Reading 7.689 dBm	Reading 6.408 dBm	Reading 5.178 dBm
	Vmax 5.5 V	P 7.69 dBm	P 6.41 dBm	P 5.18 dBm
Temp 25 °C	Vnom 5 V	A 7.69 dBm	A 6.41 dBm	A 5.18 dBm
		Reading 7.689 dBm	Reading 6.408 dBm	Reading 5.178 dBm
		P 7.19 dBm	P 5.91 dBm	P 4.68 dBm
		A 7.19 dBm	A 5.91 dBm	A 4.68 dBm
Temp 105 °C	Vmin 4.5 V	Reading 7.189 dBm	Reading 5.908 dBm	Reading 4.678 dBm
		P 7.19 dBm	P 5.91 dBm	P 4.68 dBm
		A 7.19 dBm	A 5.91 dBm	A 4.68 dBm
	Vmax 5.5 V	P 7.19 dBm	P 5.91 dBm	P 4.68 dBm
Limit(P)		36dBm		
Measurement uncertainty		+ 0.28dB / - 0.30dB		

PCB Antenna

Example Calculation:

Pburst values (A) = Reading + Cable Loss

RF output power (P) = A+G+Y

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee)

Pburst values (value "A" in dBm)

antenna assembly gain "G" in dBi

0.88 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		Lowest Frequency	Middle Frequency	Highest Frequency
Temp -45 °C	Vmin 4.5 V	P 9.57 dBm	P 8.29 dBm	P 7.06 dBm
		A 8.69 dBm	A 7.41 dBm	A 6.18 dBm
		Reading 7.689 dBm	Reading 6.408 dBm	Reading 5.178 dBm
	Vmax 5.5 V	P 9.57 dBm	P 8.29 dBm	P 7.06 dBm
Temp 25 °C	Vnom 5 V	A 8.69 dBm	A 7.41 dBm	A 6.18 dBm
		Reading 7.689 dBm	Reading 6.408 dBm	Reading 5.178 dBm
		P 9.07 dBm	P 7.79 dBm	P 6.56 dBm
		A 8.19 dBm	A 6.91 dBm	A 5.68 dBm
Temp 105 °C	Vmin 4.5 V	Reading 7.189 dBm	Reading 5.908 dBm	Reading 4.678 dBm
		P 9.07 dBm	P 7.79 dBm	P 6.56 dBm
		A 8.19 dBm	A 6.91 dBm	A 5.68 dBm
	Vmax 5.5 V	Reading 7.189 dBm	Reading 5.908 dBm	Reading 4.678 dBm
Limit(P)		36dBm		
Measurement uncertainty		+ 0.28dB / - 0.30dB		

7 Transmitter Spurious Emissions Measurement

7.1. Limit:

According to AS/NZS 4268:2017, Table 1, row 59: Digital modulation transmitters

According to AS/NZS 4268:2017, Table 1, row 21: All transmitters

7.2. Measurement Equipment Used:

Refer to section 6.2 of present report.

7.3. Test Setup:

Refer to section 6.3 of present report.

7.4. Test Procedure:

Refer to ETSI EN 300 440-1, clause 7.3.

7.5. Measurement Result:

Refer to next page for the details.

7.5.1. Test Results: (Radiated)

Dipole Ant.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/09/05

Test Mode: BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.73	-50.99	1.00	-49.99	-36.00	-13.99	VERTICAL
2	192.74	-61.96	2.23	-59.73	-54.00	-5.73	VERTICAL
3	506.92	-72.00	8.95	-63.05	-54.00	-9.05	VERTICAL
4	617.37	-73.48	10.73	-62.75	-54.00	-8.75	VERTICAL
5	745.20	-76.53	13.73	-62.80	-36.00	-26.80	VERTICAL
6	815.65	-73.91	13.83	-60.08	-36.00	-24.08	VERTICAL
7	4804.00	-69.68	17.44	-52.24	-30.00	-22.24	VERTICAL
8	6488.00	-69.36	20.84	-48.52	-30.00	-18.52	VERTICAL
1	85.86	-51.19	0.37	-50.82	-36.00	-14.82	HORIZONTAL
2	194.78	-56.64	1.70	-54.94	-54.00	-0.94	HORIZONTAL
3	598.86	-73.53	11.10	-62.43	-54.00	-8.43	HORIZONTAL
4	668.11	-73.57	11.93	-61.64	-54.00	-7.64	HORIZONTAL
5	743.52	-73.88	13.94	-59.94	-36.00	-23.94	HORIZONTAL
6	817.01	-75.70	14.39	-61.31	-36.00	-25.31	HORIZONTAL
7	4804.00	-70.09	17.44	-52.65	-30.00	-22.65	HORIZONTAL
8	6341.00	-69.22	20.56	-48.66	-30.00	-18.66	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.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/09/05

Test Mode: BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	86.62	-46.48	1.00	-45.48	-36.00	-9.48	VERTICAL
2	194.60	-60.04	2.23	-57.81	-54.00	-3.81	VERTICAL
3	482.78	-70.46	8.99	-61.47	-54.00	-7.47	VERTICAL
4	594.67	-70.57	9.94	-60.63	-54.00	-6.63	VERTICAL
5	743.25	-76.23	13.74	-62.49	-36.00	-26.49	VERTICAL
6	816.98	-73.47	13.83	-59.64	-36.00	-23.64	VERTICAL
7	4960.00	-70.97	17.87	-53.10	-30.00	-23.10	VERTICAL
8	6327.00	-69.01	20.54	-48.47	-30.00	-18.47	VERTICAL
1	85.96	-48.49	0.37	-48.12	-36.00	-12.12	HORIZONTAL
2	194.57	-56.59	1.70	-54.89	-54.00	-0.89	HORIZONTAL
3	596.56	-76.11	11.10	-65.01	-54.00	-11.01	HORIZONTAL
4	667.57	-76.02	11.93	-64.09	-54.00	-10.09	HORIZONTAL
5	744.64	-76.69	14.04	-62.65	-36.00	-26.65	HORIZONTAL
6	818.64	-74.31	14.44	-59.87	-36.00	-23.87	HORIZONTAL
7	4960.00	-70.31	17.87	-52.44	-30.00	-22.44	HORIZONTAL
8	6453.00	-69.75	20.77	-48.98	-30.00	-18.98	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.

PCB Ant.

Ambient temperature: 25 °C **Relative humidity:** 60 % **Test Date:** 2023/09/05

Test Mode: BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.97	-50.79	1.00	-49.79	-36.00	-13.79	VERTICAL
2	193.48	-61.44	2.23	-59.21	-54.00	-5.21	VERTICAL
3	507.43	-70.49	8.95	-61.54	-54.00	-7.54	VERTICAL
4	617.10	-72.81	10.73	-62.08	-54.00	-8.08	VERTICAL
5	745.26	-74.61	13.73	-60.88	-36.00	-24.88	VERTICAL
6	817.42	-73.18	13.83	-59.35	-36.00	-23.35	VERTICAL
7	4804.00	-70.63	17.44	-53.19	-30.00	-23.19	VERTICAL
8	6488.00	-69.36	20.84	-48.52	-30.00	-18.52	VERTICAL
1	87.23	-51.10	0.37	-50.73	-36.00	-14.73	HORIZONTAL
2	194.44	-55.76	1.70	-54.06	-54.00	-0.06	HORIZONTAL
3	598.98	-72.93	11.10	-61.83	-54.00	-7.83	HORIZONTAL
4	668.15	-73.08	11.93	-61.15	-54.00	-7.15	HORIZONTAL
5	742.46	-75.34	13.94	-61.40	-36.00	-25.40	HORIZONTAL
6	816.73	-75.62	14.39	-61.23	-36.00	-25.23	HORIZONTAL
7	4804.00	-70.80	17.44	-53.36	-30.00	-23.36	HORIZONTAL
8	6341.00	-69.22	20.56	-48.66	-30.00	-18.66	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.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/09/05

Test Mode: BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	87.11	-45.56	1.00	-44.56	-36.00	-8.56	VERTICAL
2	194.75	-60.77	2.23	-58.54	-54.00	-4.54	VERTICAL
3	483.78	-70.37	8.99	-61.38	-54.00	-7.38	VERTICAL
4	594.86	-70.14	9.94	-60.20	-54.00	-6.20	VERTICAL
5	744.45	-76.55	13.74	-62.81	-36.00	-26.81	VERTICAL
6	818.17	-73.74	13.83	-59.91	-36.00	-23.91	VERTICAL
7	4884.00	-69.62	17.66	-51.96	-30.00	-21.96	VERTICAL
8	6327.00	-69.01	20.54	-48.47	-30.00	-18.47	VERTICAL
1	86.66	-47.82	0.37	-47.45	-36.00	-11.45	HORIZONTAL
2	194.94	-55.92	1.70	-54.22	-54.00	-0.22	HORIZONTAL
3	597.70	-75.03	11.10	-63.93	-54.00	-9.93	HORIZONTAL
4	669.00	-75.59	11.93	-63.66	-54.00	-9.66	HORIZONTAL
5	745.81	-77.49	14.04	-63.45	-36.00	-27.45	HORIZONTAL
6	819.54	-73.86	14.44	-59.42	-36.00	-23.42	HORIZONTAL
7	4884.00	-70.63	17.66	-52.97	-30.00	-22.97	HORIZONTAL
8	6453.00	-69.75	20.77	-48.98	-30.00	-18.98	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.

Dipole Ant.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.73	-50.99	1.00	-49.99	-36.00	-13.99	VERTICAL
2	192.74	-61.96	2.23	-59.73	-54.00	-5.73	VERTICAL
3	506.92	-72.00	8.95	-63.05	-54.00	-9.05	VERTICAL
4	617.37	-73.48	10.73	-62.75	-54.00	-8.75	VERTICAL
5	745.20	-76.53	13.73	-62.80	-36.00	-26.80	VERTICAL
6	815.65	-73.91	13.83	-60.08	-36.00	-24.08	VERTICAL
7	4,810.00	-70.36	17.44	-52.92	-30.00	-22.92	VERTICAL
8	6,488.30	-70.26	20.84	-49.42	-30.00	-19.42	VERTICAL
1	85.86	-51.19	0.37	-50.82	-36.00	-14.82	HORIZONTAL
2	194.78	-56.64	1.70	-54.94	-54.00	-0.94	HORIZONTAL
3	598.86	-73.53	11.10	-62.43	-54.00	-8.43	HORIZONTAL
4	668.11	-73.57	11.93	-61.64	-54.00	-7.64	HORIZONTAL
5	743.52	-73.88	13.94	-59.94	-36.00	-23.94	HORIZONTAL
6	817.01	-75.70	14.39	-61.31	-36.00	-25.31	HORIZONTAL
7	4,810.00	-70.24	17.44	-52.80	-30.00	-22.80	HORIZONTAL
8	6,341.82	-69.35	20.56	-48.79	-30.00	-18.79	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.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	86.62	-46.48	1.00	-45.48	-36.00	-9.48	VERTICAL
2	194.60	-60.04	2.23	-57.81	-54.00	-3.81	VERTICAL
3	482.78	-70.46	8.99	-61.47	-54.00	-7.47	VERTICAL
4	594.67	-70.57	9.94	-60.63	-54.00	-6.63	VERTICAL
5	743.25	-76.23	13.74	-62.49	-36.00	-26.49	VERTICAL
6	816.98	-73.47	13.83	-59.64	-36.00	-23.64	VERTICAL
7	4,960.00	-71.08	17.87	-53.21	-30.00	-23.21	VERTICAL
8	6,327.64	-69.10	20.54	-48.56	-30.00	-18.56	VERTICAL
1	85.96	-48.49	0.37	-48.12	-36.00	-12.12	HORIZONTAL
2	194.57	-56.59	1.70	-54.89	-54.00	-0.89	HORIZONTAL
3	596.56	-76.11	11.10	-65.01	-54.00	-11.01	HORIZONTAL
4	667.57	-76.02	11.93	-64.09	-54.00	-10.09	HORIZONTAL
5	744.64	-76.69	14.04	-62.65	-36.00	-26.65	HORIZONTAL
6	818.64	-74.31	14.44	-59.87	-36.00	-23.87	HORIZONTAL
7	4,960.00	-70.71	17.87	-52.84	-30.00	-22.84	HORIZONTAL
8	6,453.07	-69.85	20.77	-49.08	-30.00	-19.08	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.

PCB Ant.

Ambient temperature: 25 °C **Relative humidity:** 60 % **Test Date:** 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	86.43	-51.30	1.00	-50.30	-36.00	-14.30	VERTICAL
2	193.62	-61.85	2.23	-59.62	-54.00	-5.62	VERTICAL
3	508.26	-71.36	8.95	-62.41	-54.00	-8.41	VERTICAL
4	617.40	-73.32	10.73	-62.59	-54.00	-8.59	VERTICAL
5	746.12	-73.94	13.73	-60.21	-36.00	-24.21	VERTICAL
6	817.83	-73.97	13.83	-60.14	-36.00	-24.14	VERTICAL
7	4,810.00	-71.42	17.44	-53.98	-30.00	-23.98	VERTICAL
8	6,488.43	-70.28	20.84	-49.44	-30.00	-19.44	VERTICAL
1	87.28	-51.94	0.37	-51.57	-36.00	-15.57	HORIZONTAL
2	194.77	-56.07	1.70	-54.37	-54.00	-0.37	HORIZONTAL
3	599.46	-73.00	11.10	-61.90	-54.00	-7.90	HORIZONTAL
4	668.91	-73.14	11.93	-61.21	-54.00	-7.21	HORIZONTAL
5	742.83	-74.62	13.94	-60.68	-36.00	-24.68	HORIZONTAL
6	817.36	-76.21	14.39	-61.82	-36.00	-25.82	HORIZONTAL
7	4,810.00	-71.51	17.44	-54.07	-30.00	-24.07	HORIZONTAL
8	6,341.28	-70.21	20.56	-49.65	-30.00	-19.65	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.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	87.66	-45.88	1.00	-44.88	-36.00	-8.88	VERTICAL
2	195.55	-61.39	2.23	-59.16	-54.00	-5.16	VERTICAL
3	484.35	-71.19	8.99	-62.20	-54.00	-8.20	VERTICAL
4	595.35	-70.71	9.94	-60.77	-54.00	-6.77	VERTICAL
5	744.89	-75.60	13.74	-61.86	-36.00	-25.86	VERTICAL
6	818.80	-73.80	13.83	-59.97	-36.00	-23.97	VERTICAL
7	4,960.00	-71.17	17.87	-53.30	-30.00	-23.30	VERTICAL
8	6,327.24	-69.42	20.54	-48.88	-30.00	-18.88	VERTICAL
1	87.08	-47.90	0.37	-47.53	-36.00	-11.53	HORIZONTAL
2	195.49	-56.72	1.70	-55.02	-54.00	-1.02	HORIZONTAL
3	598.12	-75.15	11.10	-64.05	-54.00	-10.05	HORIZONTAL
4	669.15	-76.36	11.93	-64.43	-54.00	-10.43	HORIZONTAL
5	745.95	-77.19	14.04	-63.15	-36.00	-27.15	HORIZONTAL
6	820.28	-74.53	14.44	-60.09	-36.00	-24.09	HORIZONTAL
7	4,960.00	-70.49	17.87	-52.62	-30.00	-22.62	HORIZONTAL
8	6,453.59	-70.49	20.77	-49.72	-30.00	-19.72	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.

8 Emission Bandwidth Measurement

8.1. Limit:

99% power emission bandwidth shall within 2400MHz and 2483.5MHz.
According to AS/NZS 4268:2017, section 6.5.

8.2. Measurement Equipment Used:

Refer to section 6.2 of present report.

8.3. Test Setup:

Refer to section 6.3 of present report.

8.4. Test Procedure:

Refer to section 6.5 of AS/NZS 4268 for the details.

8.5. Measurement Result:

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/09/05

Dipole Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
BLE	Upper Frequency	2401.4724	>2400
	Lower Frequency	2480.5550	<2483.5

PCB Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
BLE	Upper Frequency	2401.4724	>2400
	Lower Frequency	2480.5550	<2483.5

Dipole Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
EEE 802.15.4 (Thread, Zigbee)	Upper Frequency	2403.9500	>2400
	Lower Frequency	2481.0550	<2483.5

PCB Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
EEE 802.15.4 (Thread, Zigbee)	Upper Frequency	2403.9500	>2400
	Lower Frequency	2481.0550	<2483.5

9 Operating Frequencies Measurement

9.1. Limit:

2400MHz and 2483.5MHz.

According to AS/NZS 4268:2017 section 6.6.

9.2. Measurement Equipment Used:

Refer to section 6.2 of present report.

9.3. Test Setup:

Refer to section 6.3 of present report.

9.4. Test Procedure:

Refer to ETSI EN 300 440-1, clause 7.2.2 and 7.2.3.

Refer to ETSI EN 300 328

9.5. Measurement Result:

Dipole Antenna

Test Results: BLE mode

Ambient temperature: 25 °C

Relative humidity: 60%

Test Date: 2023/09/05

antenna assembly gain "G" in dBi

0.00 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS				FREQUENCY (MHz)	
				Lowest	Highest
Temp -40 °C	V _{min}	4.50	V	2402.0076	2480.0080
	V _{max}	5.50	V	2402.0076	2480.0080
Temp 25 °C	V _{nom}	5.00	V	2402.0076	2480.0080
Temp 105 °C	V _{min}	4.50	V	2402.0076	2480.0080
	V _{max}	5.50	V	2402.0076	2480.0080
Measured frequencies (lowest and highest)				f _L = 2402.0076 MHz	f _H = 2480.0080 MHz
Limit				2400.0000 MHz	2483.5000 MHz
Measurement Uncertainty				+/- 120kHz	

PCB Antenna

Test Results: BLE mode

Ambient temperature: 25 °C

Relative humidity: 60%

Test Date: 2023/09/05

antenna assembly gain "G" in dBi

0.88 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS				FREQUENCY (MHz)	
				Lowest	Highest
Temp -40 °C	V _{min}	4.50	V	2402.0076	2480.0080
	V _{max}	5.50	V	2402.0076	2480.0080
Temp 25 °C	V _{nom}	5.00	V	2402.0076	2480.0080
Temp 105 °C	V _{min}	4.50	V	2402.0076	2480.0080
	V _{max}	5.50	V	2402.0076	2480.0080
Measured frequencies (lowest and highest)				f _L = 2402.0076 MHz	f _H = 2480.0080 MHz
Limit				2400.0000 MHz	2483.5000 MHz
Measurement Uncertainty				+/- 120kHz	

Dipole Antenna

Test Results: IEEE 802.15.4 (Thread, Zigbee) mode

Ambient temperature: 25 °C

Relative humidity: 60%

Test Date: 2023/09/05

antenna assembly gain "G" in dBi

0.00 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS				FREQUENCY (MHz)	
				Lowest	Highest
Temp -45 °C	V _{min}	4.50	V	2405.0093	2480.0096
	V _{max}	5.50	V	2405.0094	2480.0096
Temp 25 °C	V _{nom}	5.00	V	2405.0094	2480.0098
Temp 105 °C	V _{min}	4.50	V	2405.0093	2480.0097
	V _{max}	5.50	V	2405.0094	2480.0098
Measured frequencies (lowest and highest)				f _L = 2405.0093 MHz	f _H = 2480.0098 MHz
Limit				2400.0000 MHz	2483.5000 MHz
Measurement Uncertainty				+/- 120kHz	

PCB Antenna

Test Results: IEEE 802.15.4 (Thread, Zigbee) mode

Ambient temperature: 25 °C

Relative humidity: 60%

Test Date: 2023/09/05

antenna assembly gain "G" in dBi

0.88 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

1.00 dB

TEST CONDITIONS				FREQUENCY (MHz)	
				Lowest	Highest
Temp -45 °C	V _{min}	4.50	V	2405.0093	2480.0096
	V _{max}	5.50	V	2405.0094	2480.0096
Temp 25 °C	V _{nom}	5.00	V	2405.0094	2480.0098
Temp 105 °C	V _{min}	4.50	V	2405.0093	2480.0097
	V _{max}	5.50	V	2405.0094	2480.0098
Measured frequencies (lowest and highest)				f _L = 2405.0093 MHz	f _H = 2480.0098 MHz
Limit				2400.0000 MHz	2483.5000 MHz
Measurement Uncertainty				+/- 120kHz	

10 Receiver Emissions Measurement

10.1. Limit:

According to section 7.2 of AS/NZS 4268:2017
25MHz to 1 GHz 2 nW ERP (-57 dBm).
1GHz to 40 GHz 20 nW ERP (-47 dBm).

10.2. Measurement Equipment Used:

Refer to section 6.2 of present report.

10.3. Test Setup:

Refer to section 6.3 of present report.

10.4. Test Procedure:

Refer to ETSI EN 300 440-1, clause 8.4.

10.5. Measurement Result:

Dipole Ant.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: BLE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	38.19	-64.69	6.41	-58.28	-57.00	-1.28	VERTICAL
2	86.85	-58.89	1.00	-57.89	-57.00	-0.89	VERTICAL
3	340.97	-62.46	5.18	-57.28	-57.00	-0.28	VERTICAL
4	605.14	-72.40	10.19	-62.21	-57.00	-5.21	VERTICAL
5	746.09	-77.48	13.73	-63.75	-57.00	-6.75	VERTICAL
6	821.27	-75.59	13.92	-61.67	-57.00	-4.67	VERTICAL
7	1,997.44	-61.86	4.60	-57.26	-47.00	-10.26	VERTICAL
8	5,405.62	-70.65	17.59	-53.06	-47.00	-6.06	VERTICAL
1	35.17	-67.91	9.65	-58.26	-57.00	-1.26	HORIZONTAL
2	111.93	-59.12	1.29	-57.83	-57.00	-0.83	HORIZONTAL
3	221.49	-59.59	2.41	-57.18	-57.00	-0.18	HORIZONTAL
4	339.17	-62.39	4.81	-57.58	-57.00	-0.58	HORIZONTAL
5	596.95	-75.55	11.08	-64.47	-57.00	-7.47	HORIZONTAL
6	743.93	-76.18	13.94	-62.24	-57.00	-5.24	HORIZONTAL
7	1,484.04	-63.51	2.28	-61.23	-47.00	-14.23	HORIZONTAL
8	5,264.94	-70.67	16.82	-53.85	-47.00	-6.85	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.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: BLE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	87.85	-58.40	1.00	-57.40	-57.00	-0.40	VERTICAL
2	218.04	-60.58	2.73	-57.85	-57.00	-0.85	VERTICAL
3	340.22	-64.00	5.18	-58.82	-57.00	-1.82	VERTICAL
4	743.02	-76.87	13.74	-63.13	-57.00	-6.13	VERTICAL
5	819.63	-73.32	13.92	-59.40	-57.00	-2.40	VERTICAL
6	951.29	-75.29	17.65	-57.64	-57.00	-0.64	VERTICAL
7	1,974.52	-64.34	4.50	-59.84	-47.00	-12.84	VERTICAL
8	4,942.65	-70.24	16.32	-53.92	-47.00	-6.92	VERTICAL
1	194.13	-58.77	1.70	-57.07	-57.00	-0.07	HORIZONTAL
2	247.74	-61.68	4.38	-57.30	-57.00	-0.30	HORIZONTAL
3	522.51	-71.16	9.08	-62.08	-57.00	-5.08	HORIZONTAL
4	669.06	-77.30	11.93	-65.37	-57.00	-8.37	HORIZONTAL
5	746.72	-75.28	14.04	-61.24	-57.00	-4.24	HORIZONTAL
6	820.01	-76.46	14.44	-62.02	-57.00	-5.02	HORIZONTAL
7	4,606.73	-70.64	14.95	-55.69	-47.00	-8.69	HORIZONTAL
8	6,532.52	-71.19	23.84	-47.35	-47.00	-0.35	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.

PCB Ant.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: BLE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	38.15	-65.10	6.41	-59.69	-57.00	-1.69	VERTICAL
2	87.11	-58.93	1.00	-57.93	-57.00	-0.93	VERTICAL
3	341.71	-63.36	5.18	-58.18	-57.00	-1.18	VERTICAL
4	604.73	-70.65	10.19	-60.46	-57.00	-3.46	VERTICAL
5	747.03	-77.41	13.73	-63.68	-57.00	-6.68	VERTICAL
6	821.32	-73.65	13.92	-59.73	-57.00	-2.73	VERTICAL
7	1,996.30	-63.95	4.60	-59.35	-47.00	-12.35	VERTICAL
8	5,405.15	-71.64	17.59	-54.05	-47.00	-7.05	VERTICAL
1	39.40	-67.62	9.65	-57.97	-57.00	-0.97	HORIZONTAL
2	114.28	-59.30	1.29	-58.01	-57.00	-1.01	HORIZONTAL
3	221.75	-60.50	2.41	-58.09	-57.00	-1.09	HORIZONTAL
4	339.71	-63.46	4.81	-58.65	-57.00	-1.65	HORIZONTAL
5	744.79	-76.32	14.04	-62.28	-36.00	-26.28	HORIZONTAL
6	819.50	-75.19	14.44	-60.75	-36.00	-24.75	HORIZONTAL
7	1,485.66	-64.66	2.28	-62.38	-47.00	-15.38	HORIZONTAL
8	5,264.50	-71.65	16.82	-54.83	-47.00	-7.83	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.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: BLE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	89.12	-58.83	1.00	-57.83	-57.00	-0.83	VERTICAL
2	220.97	-59.95	2.73	-57.22	-57.00	-0.22	VERTICAL
3	341.52	-62.40	5.18	-57.22	-57.00	-0.22	VERTICAL
4	743.94	-75.99	13.74	-62.25	-57.00	-5.25	VERTICAL
5	820.72	-73.01	13.92	-59.09	-57.00	-2.09	VERTICAL
6	950.74	-75.52	17.65	-57.87	-57.00	-0.87	VERTICAL
7	1,975.10	-64.79	4.50	-60.29	-47.00	-13.29	VERTICAL
8	4,942.54	-70.64	16.32	-54.32	-47.00	-7.32	VERTICAL
1	197.53	-59.17	1.70	-57.47	-57.00	-0.47	HORIZONTAL
2	251.77	-61.74	4.38	-57.36	-57.00	-0.36	HORIZONTAL
3	523.45	-70.90	9.08	-61.82	-57.00	-4.82	HORIZONTAL
4	668.78	-74.42	11.93	-62.49	-57.00	-5.49	HORIZONTAL
5	746.17	-74.78	14.04	-60.74	-57.00	-3.74	HORIZONTAL
6	820.00	-73.38	14.44	-58.94	-57.00	-1.94	HORIZONTAL
7	4,605.57	-69.40	14.95	-54.45	-47.00	-7.45	HORIZONTAL
8	6,531.18	-71.72	23.84	-47.88	-47.00	-0.88	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.

Dipole Ant.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	39.15	-64.60	6.41	-58.19	-57.00	-1.19	VERTICAL
2	87.26	-59.12	1.00	-58.12	-57.00	-1.12	VERTICAL
3	341.34	-63.42	5.18	-58.24	-57.00	-1.24	VERTICAL
4	605.45	-73.09	10.19	-62.90	-57.00	-5.90	VERTICAL
5	746.74	-76.66	13.73	-62.93	-57.00	-5.93	VERTICAL
6	821.49	-75.71	13.92	-61.79	-57.00	-4.79	VERTICAL
7	1,997.79	-62.78	4.60	-58.18	-47.00	-11.18	VERTICAL
8	5,405.97	-70.79	17.59	-53.20	-47.00	-6.20	VERTICAL
1	35.80	-67.57	9.65	-57.92	-57.00	-0.92	HORIZONTAL
2	112.72	-59.63	1.29	-58.34	-57.00	-1.34	HORIZONTAL
3	221.70	-60.12	2.41	-57.71	-57.00	-0.71	HORIZONTAL
4	339.78	-62.92	4.81	-58.11	-57.00	-1.11	HORIZONTAL
5	597.33	-75.30	11.08	-64.22	-57.00	-7.22	HORIZONTAL
6	744.08	-76.22	13.94	-62.28	-57.00	-5.28	HORIZONTAL
7	1,484.93	-63.74	2.28	-61.46	-47.00	-14.46	HORIZONTAL
8	5,264.96	-70.97	16.82	-54.15	-47.00	-7.15	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.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	88.27	-58.62	1.00	-57.62	-57.00	-0.62	VERTICAL
2	218.19	-61.54	2.73	-58.81	-57.00	-1.81	VERTICAL
3	341.02	-64.23	5.18	-59.05	-57.00	-2.05	VERTICAL
4	743.50	-77.32	13.74	-63.58	-57.00	-6.58	VERTICAL
5	820.22	-73.31	13.92	-59.39	-57.00	-2.39	VERTICAL
6	951.97	-75.76	17.65	-58.11	-57.00	-1.11	VERTICAL
7	1,975.07	-64.50	4.50	-60.00	-47.00	-13.00	VERTICAL
8	4,943.61	-70.62	16.32	-54.30	-47.00	-7.30	VERTICAL
1	195.03	-58.96	1.70	-57.26	-57.00	-0.26	HORIZONTAL
2	247.87	-62.54	4.38	-58.16	-57.00	-1.16	HORIZONTAL
3	522.61	-72.07	9.08	-62.99	-57.00	-5.99	HORIZONTAL
4	669.88	-78.28	11.93	-66.35	-57.00	-9.35	HORIZONTAL
5	746.97	-74.66	14.04	-60.62	-57.00	-3.62	HORIZONTAL
6	820.23	-77.24	14.44	-62.80	-57.00	-5.80	HORIZONTAL
7	4,607.47	-70.72	14.95	-55.77	-47.00	-8.77	HORIZONTAL
8	6,533.16	-71.38	23.84	-47.54	-47.00	-0.54	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.

PCB Ant.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	38.22	-65.17	6.41	-58.76	-57.00	-1.76	VERTICAL
2	87.90	-58.93	1.00	-57.93	-57.00	-0.93	VERTICAL
3	342.31	-64.04	5.18	-58.86	-57.00	-1.86	VERTICAL
4	605.28	-71.03	10.19	-60.84	-57.00	-3.84	VERTICAL
5	747.26	-76.42	13.73	-62.69	-57.00	-5.69	VERTICAL
6	821.46	-73.86	13.92	-59.94	-57.00	-2.94	VERTICAL
7	1,996.34	-64.04	4.60	-59.44	-47.00	-12.44	VERTICAL
8	5,406.12	-71.66	17.59	-54.07	-47.00	-7.07	VERTICAL
1	39.91	-68.09	9.65	-58.44	-57.00	-1.44	HORIZONTAL
2	115.19	-59.79	1.29	-58.50	-57.00	-1.50	HORIZONTAL
3	222.53	-61.07	2.41	-58.66	-57.00	-1.66	HORIZONTAL
4	340.31	-64.13	4.81	-59.32	-57.00	-2.32	HORIZONTAL
5	745.47	-75.89	14.04	-61.85	-36.00	-25.85	HORIZONTAL
6	819.91	-75.93	14.44	-61.49	-36.00	-25.49	HORIZONTAL
7	1,486.09	-65.06	2.28	-62.78	-47.00	-15.78	HORIZONTAL
8	5,264.76	-72.44	16.82	-55.62	-47.00	-8.62	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.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/09/05

Test Mode: IEEE 802.15.4 (Thread, Zigbee) mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	89.32	-59.53	1.00	-58.53	-57.00	-1.53	VERTICAL
2	221.55	-60.42	2.73	-57.69	-57.00	-0.69	VERTICAL
3	342.18	-62.85	5.18	-57.67	-57.00	-0.67	VERTICAL
4	744.71	-76.66	13.74	-62.92	-57.00	-5.92	VERTICAL
5	820.95	-72.35	13.92	-58.43	-57.00	-1.43	VERTICAL
6	951.56	-75.93	17.65	-58.28	-57.00	-1.28	VERTICAL
7	1,975.54	-65.57	4.50	-61.07	-47.00	-14.07	VERTICAL
8	4,943.28	-71.33	16.32	-55.01	-47.00	-8.01	VERTICAL
1	197.74	-59.21	1.70	-57.51	-57.00	-0.51	HORIZONTAL
2	252.66	-61.79	4.38	-57.41	-57.00	-0.41	HORIZONTAL
3	523.49	-70.96	9.08	-61.88	-57.00	-4.88	HORIZONTAL
4	669.13	-74.44	11.93	-62.51	-57.00	-5.51	HORIZONTAL
5	746.68	-74.30	14.04	-60.26	-57.00	-3.26	HORIZONTAL
6	820.48	-73.87	14.44	-59.43	-57.00	-2.43	HORIZONTAL
7	4,605.58	-69.69	14.95	-54.74	-47.00	-7.74	HORIZONTAL
8	6,531.93	-71.87	23.84	-48.03	-47.00	-1.03	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.

11 Radiated Peak Power Spectral Density Measurement

11.1. Limit:

According to AS/NZS 4268:2017, Table 1, Note 2.

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

11.2. Measurement Equipment Used:

Refer to section 11.2.

11.3. Test Setup:

Refer to section 11.3.

11.4. Test Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 1.5MHz, Sweep=100s, Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

11.5. Measurement Result:

Dipole Antenna

BLE

Channel	Power Density Reading (dBm)	Maximum Limit (dBm)
Low	6.78	13.97
Mid	4.79	13.97
High	1.91	13.97

PCB Antenna

BLE

Channel	Power Density Reading (dBm)	Maximum Limit (dBm)
Low	6.78	13.97
Mid	4.79	13.97
High	1.91	13.97

Dipole Antenna

IEEE 802.15.4 (Thread, Zigbee)

Channel	Power Density Reading (dBm)	Maximum Limit (dBm)
Low	5.141	13.97
Mid	4.260	13.97
High	3.522	13.97

PCB Antenna

IEEE 802.15.4 (Thread, Zigbee)

Channel	Power Density Reading (dBm)	Maximum Limit (dBm)
Low	5.141	13.97
Mid	4.260	13.97
High	3.522	13.97

Appendix 1

Photographs of Test Setup

Dipole Antenna

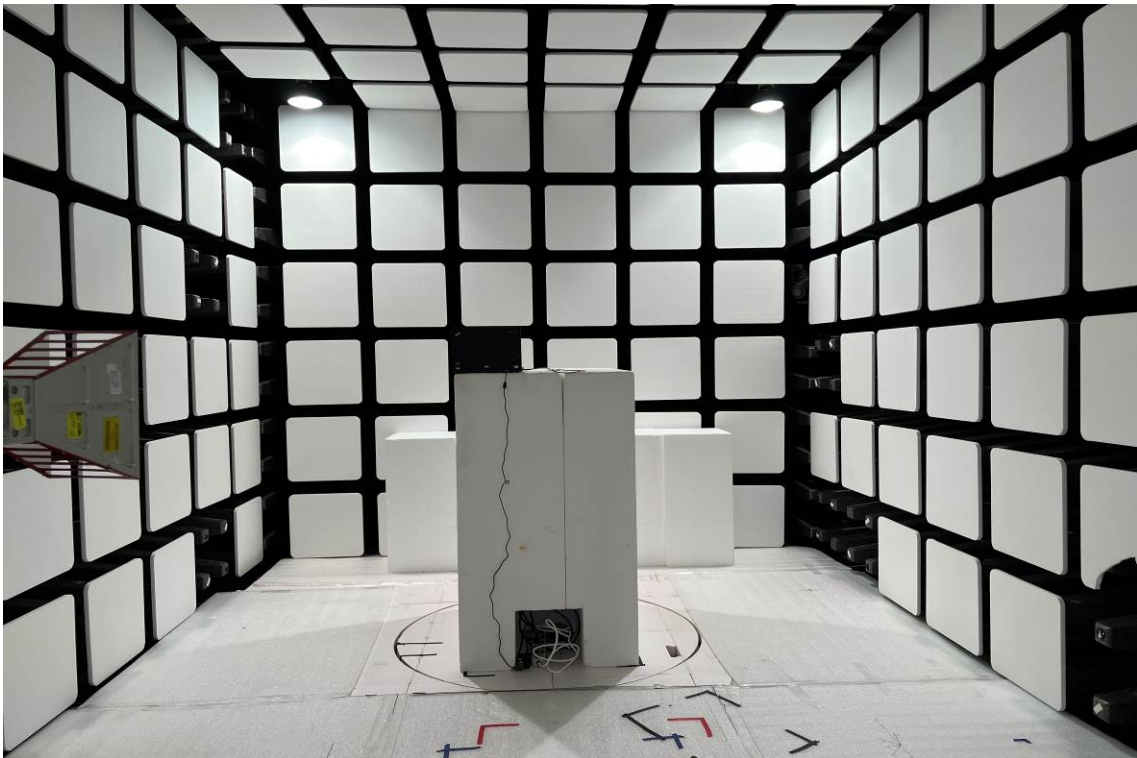
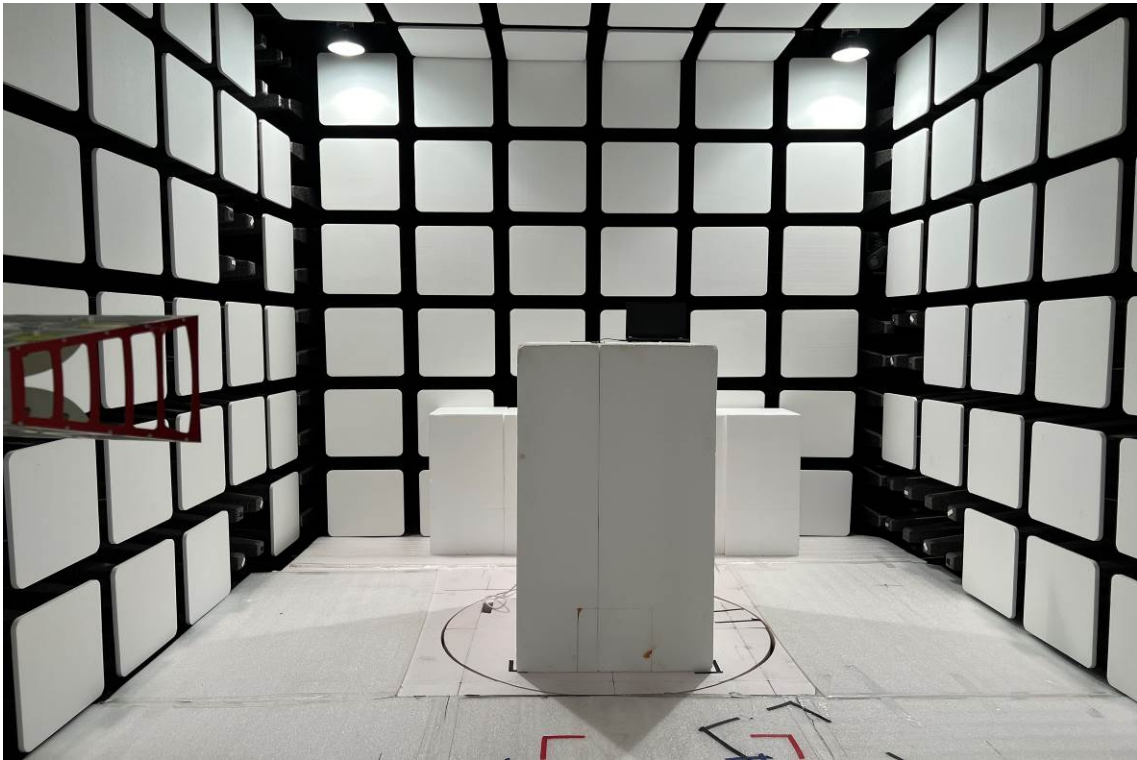






PCB Antenna







Appendix 2

Photographs of EUT

Please refer to the file ISL-23LR0074P