

TEST REPORT

of

Australian/New Zealand Standard AS/NZS 4268:2017

Product : Bluetooth 5.3, 802.15.4 module

Brand: Fanstel

Model: BT40N; BT40NE

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.>

*Site Registration No.

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Report No.: ISL-23LR0019ANZ

Issue Date : 2023/04/11

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.

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VERIFICATION OF COMPLIANCE

Applicant: Fanstel Corporation, Taipei
Product Description: Bluetooth 5.3, 802.15.4 module
Brand Name: Fanstel
Model No.: BT40N; BT40NE
Model Difference: Antenna. Please see page 5 for detail
Date of test: 2023/02/02 ~ 2023/04/11
Date of EUT Received: 2023/02/02

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:* 2023/04/11

Weitin Chen / Senior Engineer

Prepared By: Gigi yeh *Date:* 2023/04/11

Gigi Yeh / Senior Engineer

Approved By: Jerry Liu *Date:* 2023/04/11

Jerry Liu / Technical Manager

Version

Version No.	Date	Description
00	2023/04/11	Initial creation of document

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1 Description of Equipment Under Test (EUT)

General Information	
Product Name:	Bluetooth 5.3, 802.15.4 module
Brand Name:	Fanstel
Model Name:	BT40N; BT40NE
Model Difference:	N/A
Temperature Range	-40°C to +105°C
Power Supply:	5VDC
BLE Information	
Frequency Range:	2402 – 2480MHz
Max Output Power:	9.98dBm
Channel number:	40 channels
Modulation type:	GFSK
IEEE 802.15.4 (Thread, Zigbee) Information	
Frequency Range:	2405 – 2475MHz
Max Output Power:	9.88dBm
Channel number:	15 channels
Modulation type:	GFSK

	Antenna Type	Brand	Model	Peak Gain	Frequency Range	Connector Type
1	Dipole	Fanstel	ANT0	0dBi	2400-2485 MHz	MMCX
2	PCB	Fanstel	F type	-0.33dBi	2400-2485 MHz	MURATA
3	PCB	Fanstel	F type	0.88dBi	2400-2485 MHz	MMCX

Model Summaries

module	BT40N	BT40NE
SoC	nRF5340	nRF5340
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.	-40°C to +105°C	-40°C to +105°C
Evaluation board	EV-BT40NE	EV-BT40NE

Zigbee channels

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

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 V1.6.1 – Part 1: 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

NEMKO Laboratory Authorization No.: ELA 113B

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

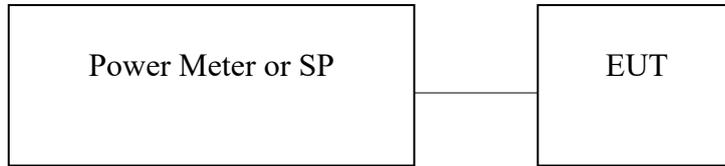
According to AS/NZS 4268:2017, Table 1, row 59: Digital modulation transmitters

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	06/29/2022	06/29/2023
Conducted	Power Sensor	DARE	RPR3006W	14I00889SNO36	06/29/2022	06/29/2023
Conducted	Temperature Chamber	KSON	THS-B4H100	2287	05/20/2022	05/20/2023
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	1201.002K50108793-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 V1.6.1, clause 7.1.

Refer to ETSI EN 300 328 V2.1.1,

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: 2023/04/10

Test Mode: BLE

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=

2.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)					
		Lowest Frequency		Middle Frequency		Highest Frequency	
Temp -40 °C	Vmin 4.5 V	P	9.10 dBm	P	7.20 dBm	P	7.40 dBm
		A	9.10 dBm	A	7.20 dBm	A	7.40 dBm
		Reading	7.10 dBm	Reading	5.20 dBm	Reading	5.40 dBm
	Vmax 5.5 V	P	9.10 dBm	P	7.20 dBm	P	7.40 dBm
		A	9.10 dBm	A	7.20 dBm	A	7.40 dBm
		Reading	7.10 dBm	Reading	5.20 dBm	Reading	5.40 dBm
Temp 25 °C	Vnom 5 V	P	7.20 dBm	P	5.30 dBm	P	5.50 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 dBm
Temp 105 °C	Vmin 4.5 V	P	7.20 dBm	P	5.30 dBm	P	5.50 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 dBm
	Vmax 5.5 V	P	7.20 dBm	P	5.30 dBm	P	5.50 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 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: 2023/04/10

Test Mode: BLE

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=

2.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)					
		Lowest Frequency		Middle Frequency		Highest Frequency	
Temp -40 °C	Vmin 4.5 V	P	9.98 dBm	P	8.08 dBm	P	8.28 dBm
		A	9.10 dBm	A	7.20 dBm	A	7.40 dBm
		Reading	7.10 dBm	Reading	5.20 dBm	Reading	5.40 dBm
	Vmax 5.5 V	P	9.98 dBm	P	8.08 dBm	P	8.28 dBm
		A	9.10 dBm	A	7.20 dBm	A	7.40 dBm
		Reading	7.10 dBm	Reading	5.20 dBm	Reading	5.40 dBm
Temp 25 °C	Vnom 5 V	P	8.08 dBm	P	6.18 dBm	P	6.38 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 dBm
Temp 105 °C	Vmin 4.5 V	P	8.08 dBm	P	6.18 dBm	P	6.38 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 dBm
	Vmax 5.5 V	P	8.08 dBm	P	6.18 dBm	P	6.38 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 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: 2023/04/10

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=

2.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)					
		Lowest Frequency		Middle Frequency		Highest Frequency	
Temp -40 °C	Vmin 4.5 V	P	9.10 dBm	P	7.20 dBm	P	7.40 dBm
		A	9.10 dBm	A	7.20 dBm	A	7.40 dBm
		Reading	7.10 dBm	Reading	5.20 dBm	Reading	5.40 dBm
	Vmax 5.5 V	P	9.10 dBm	P	7.20 dBm	P	7.40 dBm
		A	9.10 dBm	A	7.20 dBm	A	7.40 dBm
		Reading	7.10 dBm	Reading	5.20 dBm	Reading	5.40 dBm
Temp 25 °C	Vnom 5 V	P	7.20 dBm	P	5.30 dBm	P	5.50 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 dBm
Temp 105 °C	Vmin 4.5 V	P	7.20 dBm	P	5.30 dBm	P	5.50 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 dBm
	Vmax 5.5 V	P	7.20 dBm	P	5.30 dBm	P	5.50 dBm
		A	7.20 dBm	A	5.30 dBm	A	5.50 dBm
		Reading	5.20 dBm	Reading	3.30 dBm	Reading	3.50 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: 2023/04/10

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=

2.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)					
		Lowest Frequency		Middle Frequency		Highest Frequency	
Temp -40 °C	Vmin 4.5 V	P	9.88 dBm	P	8.28 dBm	P	8.38 dBm
		A	9.00 dBm	A	7.40 dBm	A	7.50 dBm
		Reading	7.00 dBm	Reading	5.40 dBm	Reading	5.50 dBm
	Vmax 5.5 V	P	9.88 dBm	P	8.28 dBm	P	8.38 dBm
		A	9.00 dBm	A	7.40 dBm	A	7.50 dBm
		Reading	7.00 dBm	Reading	5.40 dBm	Reading	5.50 dBm
Temp 25 °C	Vnom 5 V	P	7.98 dBm	P	6.38 dBm	P	6.48 dBm
		A	7.10 dBm	A	5.50 dBm	A	5.60 dBm
		Reading	5.10 dBm	Reading	3.50 dBm	Reading	3.60 dBm
Temp 105 °C	Vmin 4.5 V	P	7.98 dBm	P	6.38 dBm	P	6.48 dBm
		A	7.10 dBm	A	5.50 dBm	A	5.60 dBm
		Reading	5.10 dBm	Reading	3.50 dBm	Reading	3.60 dBm
	Vmax 5.5 V	P	7.98 dBm	P	6.38 dBm	P	6.48 dBm
		A	7.10 dBm	A	5.50 dBm	A	5.60 dBm
		Reading	5.10 dBm	Reading	3.50 dBm	Reading	3.60 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 V1.6.1, 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: 2023/04/10

Test Mode: BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.69	-51.07	1.00	-50.07	-36.00	-14.07	VERTICAL
2	192.39	-62.21	2.23	-59.98	-54.00	-5.98	VERTICAL
3	506.62	-72.44	8.95	-63.49	-54.00	-9.49	VERTICAL
4	616.75	-73.56	10.73	-62.83	-54.00	-8.83	VERTICAL
5	745.02	-76.70	13.73	-62.97	-36.00	-26.97	VERTICAL
6	815.04	-74.12	13.83	-60.29	-36.00	-24.29	VERTICAL
7	1,554.50	-62.40	2.18	-60.22	-30.00	-30.22	VERTICAL
8	4,804.00	-71.90	15.71	-56.19	-30.00	-26.19	VERTICAL
1	85.43	-51.53	0.37	-51.16	-36.00	-15.16	HORIZONTAL
2	193.80	-56.26	1.70	-54.56	-54.00	-0.56	HORIZONTAL
3	597.63	-73.23	11.10	-62.13	-54.00	-8.13	HORIZONTAL
4	666.97	-74.28	11.93	-62.35	-54.00	-8.35	HORIZONTAL
5	742.00	-75.38	13.94	-61.44	-36.00	-25.44	HORIZONTAL
6	815.67	-75.56	14.39	-61.17	-36.00	-25.17	HORIZONTAL
7	1,443.22	-62.07	2.16	-59.91	-30.00	-29.91	HORIZONTAL
8	4,804.00	-72.55	15.63	-56.92	-30.00	-26.92	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: 2023/04/10

Test Mode: BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.78	-47.12	1.00	-46.12	-36.00	-10.12	VERTICAL
2	193.85	-60.95	2.23	-58.72	-54.00	-4.72	VERTICAL
3	482.01	-70.51	8.99	-61.52	-54.00	-7.52	VERTICAL
4	594.00	-70.71	9.94	-60.77	-54.00	-6.77	VERTICAL
5	742.44	-76.46	13.74	-62.72	-36.00	-26.72	VERTICAL
6	816.00	-73.81	13.83	-59.98	-36.00	-23.98	VERTICAL
7	1,995.38	-60.28	4.60	-55.68	-30.00	-25.68	VERTICAL
8	4,960.00	-71.73	16.40	-55.33	-30.00	-25.33	VERTICAL
1	85.71	-49.09	0.37	-48.72	-36.00	-12.72	HORIZONTAL
2	193.88	-56.35	1.70	-54.65	-54.00	-0.65	HORIZONTAL
3	596.08	-76.55	11.10	-65.45	-54.00	-11.45	HORIZONTAL
4	666.92	-76.83	11.93	-64.90	-54.00	-10.90	HORIZONTAL
5	744.53	-77.26	14.04	-63.22	-36.00	-27.22	HORIZONTAL
6	818.00	-74.74	14.44	-60.30	-36.00	-24.30	HORIZONTAL
7	1,995.02	-61.19	4.75	-56.44	-30.00	-26.44	HORIZONTAL
8	4,960.00	-71.02	16.15	-54.87	-30.00	-24.87	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.

PIFA Ant.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/04/10

Test Mode: BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	85.62	-50.90	1.00	-49.90	-36.00	-13.90	VERTICAL
2	193.04	-61.58	2.23	-59.35	-54.00	-5.35	VERTICAL
3	507.26	-71.46	8.95	-62.51	-54.00	-8.51	VERTICAL
4	616.71	-73.72	10.73	-62.99	-54.00	-8.99	VERTICAL
5	745.16	-75.58	13.73	-61.85	-36.00	-25.85	VERTICAL
6	816.66	-73.53	13.83	-59.70	-36.00	-23.70	VERTICAL
7	1,553.80	-62.41	2.18	-60.23	-30.00	-30.23	VERTICAL
8	4,804.00	-70.68	15.71	-54.97	-30.00	-24.97	VERTICAL
1	86.66	-51.21	0.37	-50.84	-36.00	-14.84	HORIZONTAL
2	194.19	-56.00	1.70	-54.30	-54.00	-0.30	HORIZONTAL
3	598.07	-73.64	11.10	-62.54	-54.00	-8.54	HORIZONTAL
4	667.81	-73.61	11.93	-61.68	-54.00	-7.68	HORIZONTAL
5	742.46	-75.46	13.94	-61.52	-36.00	-25.52	HORIZONTAL
6	816.50	-75.85	14.39	-61.46	-36.00	-25.46	HORIZONTAL
7	1,442.37	-61.61	2.16	-59.45	-30.00	-29.45	HORIZONTAL
8	4,804.00	-72.39	15.63	-56.76	-30.00	-26.76	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: 2023/04/10

Test Mode: BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	86.61	-46.42	1.00	-45.42	-36.00	-9.42	VERTICAL
2	194.37	-61.27	2.23	-59.04	-54.00	-5.04	VERTICAL
3	482.98	-70.78	8.99	-61.79	-54.00	-7.79	VERTICAL
4	594.47	-71.03	9.94	-61.09	-54.00	-7.09	VERTICAL
5	743.97	-76.59	13.74	-62.85	-36.00	-26.85	VERTICAL
6	817.23	-73.84	13.83	-60.01	-36.00	-24.01	VERTICAL
7	1,996.24	-61.89	4.60	-57.29	-30.00	-27.29	VERTICAL
8	4,960.00	-71.79	16.40	-55.39	-30.00	-25.39	VERTICAL
1	86.66	-48.59	0.37	-48.22	-36.00	-12.22	HORIZONTAL
2	193.78	-56.64	1.70	-54.94	-54.00	-0.94	HORIZONTAL
3	596.79	-75.60	11.10	-64.50	-54.00	-10.50	HORIZONTAL
4	668.21	-76.20	11.93	-64.27	-54.00	-10.27	HORIZONTAL
5	745.20	-77.88	14.04	-63.84	-36.00	-27.84	HORIZONTAL
6	819.03	-74.79	14.44	-60.35	-36.00	-24.35	HORIZONTAL
7	1,995.71	-61.09	4.75	-56.34	-30.00	-26.34	HORIZONTAL
8	4,960.00	-71.07	16.15	-54.92	-30.00	-24.92	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: 2023/04/10

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	86.36	-50.79	1.00	-49.79	-36.00	-13.79	VERTICAL
2	193.86	-60.87	2.23	-58.64	-54.00	-4.64	VERTICAL
3	507.60	-70.71	8.95	-61.76	-54.00	-7.76	VERTICAL
4	617.65	-72.73	10.73	-62.00	-54.00	-8.00	VERTICAL
5	745.44	-75.29	13.73	-61.56	-36.00	-25.56	VERTICAL
6	817.40	-73.02	13.83	-59.19	-36.00	-23.19	VERTICAL
7	1,553.80	-62.31	2.18	-60.13	-30.00	-30.13	VERTICAL
8	4,810.00	-70.22	15.71	-54.51	-30.00	-24.51	VERTICAL
1	86.71	-50.42	0.37	-50.05	-36.00	-14.05	HORIZONTAL
2	194.36	-56.93	1.70	-55.23	-54.00	-1.23	HORIZONTAL
3	598.77	-72.98	11.10	-61.88	-54.00	-7.88	HORIZONTAL
4	668.80	-73.21	11.93	-61.28	-54.00	-7.28	HORIZONTAL
5	742.72	-74.60	13.94	-60.66	-36.00	-24.66	HORIZONTAL
6	816.50	-75.53	14.39	-61.14	-36.00	-25.14	HORIZONTAL
7	1,443.18	-61.30	2.16	-59.14	-30.00	-29.14	HORIZONTAL
8	4,810.00	-71.61	15.63	-55.98	-30.00	-25.98	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.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/04/10

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	87.49	-45.61	1.00	-44.61	-36.00	-8.61	VERTICAL
2	195.23	-60.45	2.23	-58.22	-54.00	-4.22	VERTICAL
3	483.46	-70.35	8.99	-61.36	-54.00	-7.36	VERTICAL
4	595.10	-70.28	9.94	-60.34	-54.00	-6.34	VERTICAL
5	744.08	-75.82	13.74	-62.08	-36.00	-26.08	VERTICAL
6	817.56	-73.78	13.83	-59.95	-36.00	-23.95	VERTICAL
7	1,997.14	-61.01	4.60	-56.41	-30.00	-26.41	VERTICAL
8	4,950.00	-70.90	16.40	-54.50	-30.00	-24.50	VERTICAL
1	87.15	-47.99	0.37	-47.62	-36.00	-11.62	HORIZONTAL
2	194.26	-56.19	1.70	-54.49	-54.00	-0.49	HORIZONTAL
3	596.89	-74.62	11.10	-63.52	-54.00	-9.52	HORIZONTAL
4	669.12	-75.89	11.93	-63.96	-54.00	-9.96	HORIZONTAL
5	745.67	-77.74	14.04	-63.70	-36.00	-27.70	HORIZONTAL
6	819.88	-74.06	14.44	-59.62	-36.00	-23.62	HORIZONTAL
7	1,996.46	-60.32	4.75	-55.57	-30.00	-25.57	HORIZONTAL
8	4,950.00	-70.50	16.15	-54.35	-30.00	-24.35	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.

PIFA Ant.

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2023/04/10

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	86.05	-50.69	1.00	-49.69	-36.00	-13.69	VERTICAL
2	193.20	-61.32	2.23	-59.09	-54.00	-5.09	VERTICAL
3	508.21	-70.99	8.95	-62.04	-54.00	-8.04	VERTICAL
4	617.30	-73.53	10.73	-62.80	-54.00	-8.80	VERTICAL
5	745.41	-75.52	13.73	-61.79	-36.00	-25.79	VERTICAL
6	817.13	-72.72	13.83	-58.89	-36.00	-22.89	VERTICAL
7	1,554.41	-62.15	2.18	-59.97	-30.00	-29.97	VERTICAL
8	4,810.00	-69.98	15.71	-54.27	-30.00	-24.27	VERTICAL
1	86.93	-50.37	0.37	-50.00	-36.00	-14.00	HORIZONTAL
2	195.05	-55.88	1.70	-54.18	-54.00	-0.18	HORIZONTAL
3	598.94	-73.10	11.10	-62.00	-54.00	-8.00	HORIZONTAL
4	668.78	-73.07	11.93	-61.14	-54.00	-7.14	HORIZONTAL
5	742.75	-74.97	13.94	-61.03	-36.00	-25.03	HORIZONTAL
6	816.85	-75.14	14.39	-60.75	-36.00	-24.75	HORIZONTAL
7	1,442.49	-61.38	2.16	-59.22	-30.00	-29.22	HORIZONTAL
8	4,810.00	-71.55	15.63	-55.92	-30.00	-25.92	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: 2023/04/10

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	87.45	-46.42	1.00	-45.42	-36.00	-9.42	VERTICAL
2	195.34	-60.89	2.23	-58.66	-54.00	-4.66	VERTICAL
3	483.52	-69.79	8.99	-60.80	-54.00	-6.80	VERTICAL
4	594.68	-70.35	9.94	-60.41	-54.00	-6.41	VERTICAL
5	744.20	-75.91	13.74	-62.17	-36.00	-26.17	VERTICAL
6	818.18	-73.21	13.83	-59.38	-36.00	-23.38	VERTICAL
7	1,997.01	-61.40	4.60	-56.80	-30.00	-26.80	VERTICAL
8	4,950.00	-70.80	16.40	-54.40	-30.00	-24.40	VERTICAL
1	87.04	-48.27	0.37	-47.90	-36.00	-11.90	HORIZONTAL
2	194.48	-56.13	1.70	-54.43	-54.00	-0.43	HORIZONTAL
3	596.94	-75.33	11.10	-64.23	-54.00	-10.23	HORIZONTAL
4	668.70	-75.94	11.93	-64.01	-54.00	-10.01	HORIZONTAL
5	745.22	-77.80	14.04	-63.76	-36.00	-27.76	HORIZONTAL
6	819.80	-74.57	14.44	-60.13	-36.00	-24.13	HORIZONTAL
7	1,996.33	-60.18	4.75	-55.43	-30.00	-25.43	HORIZONTAL
8	4,950.00	-70.30	16.15	-54.15	-30.00	-24.15	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.

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: 2023/04/10

Dipole Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
BLE	Upper Frequency	2401.2868	>2400
	Lower Frequency	2480.2981	<2483.5

PIFA Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
BLE	Upper Frequency	2401.2868	>2400
	Lower Frequency	2480.2981	<2483.5

Dipole Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
EEE 802.15.4 (Thread, Zigbee)	Upper Frequency	2404.4361	>2400
	Lower Frequency	2475.7601	<2483.5

PIFA Ant.

	Channel	Measured Frequency (MHz)	Limit (MHz)
EEE 802.15.4 (Thread, Zigbee)	Upper Frequency	2404.4361	>2400
	Lower Frequency	2475.7601	<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 V1.6.1, clause 7.2.2 and 7.2.3.

Refer to ETSI EN 300 328 V2.1.1, clause 4.3.2.7

9.5. Measurement Result:

Dipole Antenna

Test Results: BLE mode

Ambient temperature: 25 °C

Relative humidity: 60%

Test Date: 2023/04/10

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	2402.0014	2480.0015
	V _{max}	5.50	V	2402.0014	2480.0014
Temp 25 °C	V _{nom}	5.00	V	2402.0013	2480.0015
Temp 105 °C	V _{min}	4.50	V	2402.0013	2480.0014
	V _{max}	5.50	V	2402.0014	2480.0014
Measured frequencies (lowest and highest)				f _L = 2402.0013 MHz	f _H = 2480.0015 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: 2023/04/10

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	2402.0014	2480.0015
	V _{max}	5.50	V	2402.0014	2480.0014
Temp 25 °C	V _{nom}	5.00	V	2402.0013	2480.0015
Temp 105 °C	V _{min}	4.50	V	2402.0013	2480.0014
	V _{max}	5.50	V	2402.0014	2480.0014
Measured frequencies (lowest and highest)				f _L = 2402.0013 MHz	f _H = 2480.0015 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: 2023/04/10

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	2405.0014	2475.0015
	V _{max}	5.50	V	2405.0014	2475.0014
Temp 25 °C	V _{nom}	5.00	V	2405.0013	2475.0015
Temp 105 °C	V _{min}	4.50	V	2405.0013	2475.0014
	V _{max}	5.50	V	2405.0014	2475.0014
Measured frequencies (lowest and highest)				f _L = 2405.0013 MHz	f _H = 2475.0015 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: 2023/04/10

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	2405.0014	2475.0015
	V _{max}	5.50	V	2405.0014	2475.0014
Temp 25 °C	V _{nom}	5.00	V	2405.0013	2475.0015
Temp 105 °C	V _{min}	4.50	V	2405.0013	2475.0014
	V _{max}	5.50	V	2405.0014	2475.0014
Measured frequencies (lowest and highest)				f _L = 2405.0013 MHz	f _H = 2475.0015 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 V1.6.1, clause 8.4.

10.5. Measurement Result:

Dipole Ant.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/04/10

Test Mode: BLE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	37.19	-63.88	6.41	-57.47	-57.00	-0.47	VERTICAL
2	85.58	-59.55	1.00	-58.55	-57.00	-1.55	VERTICAL
3	339.12	-62.61	5.18	-57.43	-57.00	-0.43	VERTICAL
4	604.84	-73.18	10.19	-62.99	-57.00	-5.99	VERTICAL
5	744.31	-78.17	13.73	-64.44	-57.00	-7.44	VERTICAL
6	819.92	-76.04	13.92	-62.12	-57.00	-5.12	VERTICAL
7	1,996.58	-62.65	4.60	-58.05	-47.00	-11.05	VERTICAL
8	5,404.88	-71.14	17.59	-53.55	-47.00	-6.55	VERTICAL
1	34.21	-67.71	9.65	-58.06	-57.00	-1.06	HORIZONTAL
2	110.18	-58.32	1.29	-57.03	-57.00	-0.03	HORIZONTAL
3	219.15	-59.72	2.41	-57.31	-57.00	-0.31	HORIZONTAL
4	337.45	-61.85	4.81	-57.04	-57.00	-0.04	HORIZONTAL
5	596.22	-76.46	11.08	-65.38	-57.00	-8.38	HORIZONTAL
6	742.25	-76.82	13.94	-62.88	-57.00	-5.88	HORIZONTAL
7	1,484.02	-64.34	2.28	-62.06	-47.00	-15.06	HORIZONTAL
8	5,264.66	-70.98	16.82	-54.16	-47.00	-7.16	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: 2023/04/10

Test Mode: BLE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	86.23	-58.44	1.00	-57.44	-57.00	-0.44	VERTICAL
2	217.43	-60.26	2.73	-57.53	-57.00	-0.53	VERTICAL
3	338.79	-64.00	5.18	-58.82	-57.00	-1.82	VERTICAL
4	742.57	-76.18	13.74	-62.44	-57.00	-5.44	VERTICAL
5	818.57	-74.31	13.92	-60.39	-57.00	-3.39	VERTICAL
6	949.00	-74.92	17.65	-57.27	-57.00	-0.27	VERTICAL
7	1,973.85	-65.19	4.50	-60.69	-47.00	-13.69	VERTICAL
8	4,942.23	-71.15	16.32	-54.83	-47.00	-7.83	VERTICAL
1	193.66	-59.31	1.70	-57.61	-57.00	-0.61	HORIZONTAL
2	247.13	-62.10	4.38	-57.72	-57.00	-0.72	HORIZONTAL
3	521.57	-71.84	9.08	-62.76	-57.00	-5.76	HORIZONTAL
4	667.65	-76.72	11.93	-64.79	-57.00	-7.79	HORIZONTAL
5	745.39	-76.37	14.04	-62.33	-57.00	-5.33	HORIZONTAL
6	818.39	-76.33	14.44	-61.89	-57.00	-4.89	HORIZONTAL
7	4,606.07	-70.69	14.95	-55.74	-47.00	-8.74	HORIZONTAL
8	6,532.32	-71.93	23.84	-48.09	-47.00	-1.09	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.

PIFA Ant.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/04/10

Test Mode: BLE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	38.13	-64.04	6.41	-57.63	-57.00	-0.63	VERTICAL
2	86.79	-59.30	1.00	-58.30	-57.00	-1.30	VERTICAL
3	340.96	-62.78	5.18	-57.60	-57.00	-0.60	VERTICAL
4	604.47	-71.60	10.19	-61.41	-57.00	-4.41	VERTICAL
5	746.28	-77.64	13.73	-63.91	-57.00	-6.91	VERTICAL
6	821.11	-74.13	13.92	-60.21	-57.00	-3.21	VERTICAL
7	1,996.09	-64.16	4.60	-59.56	-47.00	-12.56	VERTICAL
8	5,404.83	-71.67	17.59	-54.08	-47.00	-7.08	VERTICAL
1	35.36	-67.07	9.65	-57.42	-57.00	-0.42	HORIZONTAL
2	111.20	-58.82	1.29	-57.53	-57.00	-0.53	HORIZONTAL
3	219.50	-60.51	2.41	-58.10	-57.00	-1.10	HORIZONTAL
4	337.66	-62.33	4.81	-57.52	-57.00	-0.52	HORIZONTAL
5	597.55	-74.25	11.08	-63.17	-57.00	-6.17	HORIZONTAL
6	743.25	-75.15	13.94	-61.21	-57.00	-4.21	HORIZONTAL
7	1,484.83	-65.49	2.28	-63.21	-47.00	-16.21	HORIZONTAL
8	5,264.50	-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: 2023/04/10

Test Mode: BLE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	87.04	-58.95	1.00	-57.95	-57.00	-0.95	VERTICAL
2	218.77	-60.56	2.73	-57.83	-57.00	-0.83	VERTICAL
3	340.76	-62.50	5.18	-57.32	-57.00	-0.32	VERTICAL
4	743.74	-76.03	13.74	-62.29	-57.00	-5.29	VERTICAL
5	820.53	-73.76	13.92	-59.84	-57.00	-2.84	VERTICAL
6	950.15	-75.16	17.65	-57.51	-57.00	-0.51	VERTICAL
7	1,974.29	-65.34	4.50	-60.84	-47.00	-13.84	VERTICAL
8	4,942.49	-70.65	16.32	-54.33	-47.00	-7.33	VERTICAL
1	194.61	-59.57	1.70	-57.87	-57.00	-0.87	HORIZONTAL
2	249.17	-62.04	4.38	-57.66	-57.00	-0.66	HORIZONTAL
3	522.81	-71.49	9.08	-62.41	-57.00	-5.41	HORIZONTAL
4	668.30	-75.40	11.93	-63.47	-57.00	-6.47	HORIZONTAL
5	746.01	-75.64	14.04	-61.60	-57.00	-4.60	HORIZONTAL
6	819.84	-73.86	14.44	-59.42	-57.00	-2.42	HORIZONTAL
7	4,605.25	-70.27	14.95	-55.32	-47.00	-8.32	HORIZONTAL
8	6,530.97	-72.35	23.84	-48.51	-47.00	-1.51	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: 2023/04/10

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	38.25	-63.57	6.41	-57.16	-57.00	-0.16	VERTICAL
2	87.66	-58.77	1.00	-57.77	-57.00	-0.77	VERTICAL
3	340.97	-63.21	5.18	-58.03	-57.00	-1.07	VERTICAL
4	604.79	-71.40	10.19	-61.21	-57.00	-4.21	VERTICAL
5	747.06	-77.53	13.73	-63.80	-57.00	-6.80	VERTICAL
6	821.66	-73.41	13.92	-59.49	-57.00	-2.49	VERTICAL
7	1,996.31	-63.79	4.60	-59.19	-47.00	-12.19	VERTICAL
8	5,405.73	-71.31	17.59	-53.72	-47.00	-6.72	VERTICAL
1	35.85	-67.85	9.65	-58.20	-57.00	-1.20	HORIZONTAL
2	111.20	-58.55	1.29	-57.26	-57.00	-0.26	HORIZONTAL
3	219.73	-59.75	2.41	-57.34	-57.00	-0.34	HORIZONTAL
4	337.90	-62.26	4.81	-57.45	-57.00	-0.45	HORIZONTAL
5	598.23	-74.22	11.08	-63.14	-57.00	-6.14	HORIZONTAL
6	743.74	-74.16	13.94	-60.22	-57.00	-3.22	HORIZONTAL
7	1,485.78	-65.25	2.28	-62.97	-47.00	-15.97	HORIZONTAL
8	5,265.22	-72.37	16.82	-55.55	-47.00	-8.55	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: 2023/04/10
 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	87.10	-58.82	1.00	-57.82	-57.00	-0.82	VERTICAL
2	219.60	-51.09	2.73	-58.36	-57.00	-1.36	VERTICAL
3	341.61	-62.83	5.18	-57.65	-57.00	-0.65	VERTICAL
4	744.20	-75.17	13.74	-61.43	-57.00	-4.43	VERTICAL
5	820.79	-73.35	13.92	-59.43	-57.00	-2.43	VERTICAL
6	950.35	-75.18	17.65	-57.53	-57.00	-0.53	VERTICAL
7	1,974.41	-64.71	4.50	-60.21	-47.00	-13.21	VERTICAL
8	4,942.98	-70.06	16.32	-53.74	-47.00	-6.74	VERTICAL
1	195.51	-59.96	1.70	-57.26	-57.00	-0.26	HORIZONTAL
2	249.17	-62.03	4.38	-57.65	-57.00	-0.65	HORIZONTAL
3	523.00	-70.99	9.08	-61.91	-57.00	-4.91	HORIZONTAL
4	668.53	-75.12	11.93	-63.19	-57.00	-6.19	HORIZONTAL
5	746.40	-75.61	14.04	-61.57	-57.00	-4.57	HORIZONTAL
6	820.19	-73.53	14.44	-59.09	-57.00	-2.09	HORIZONTAL
7	4,605.56	-69.97	14.95	-55.02	-47.00	-8.02	HORIZONTAL
8	6,531.96	-71.65	23.84	-47.81	-47.00	-0.81	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.

PIFA Ant.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2023/04/10

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	38.59	-64.40	6.41	-57.99	-57.00	-0.99	VERTICAL
2	86.99	-59.02	1.00	-58.02	-57.00	-1.02	VERTICAL
3	341.18	-63.05	5.18	-57.87	-57.00	-0.87	VERTICAL
4	604.63	-71.51	10.19	-61.32	-57.00	-4.32	VERTICAL
5	746.78	-76.84	13.73	-63.11	-57.00	-6.11	VERTICAL
6	821.50	-73.72	13.92	-59.80	-57.00	-2.80	VERTICAL
7	1,996.93	-63.92	4.60	-59.32	-47.00	-12.32	VERTICAL
8	5,404.89	-70.90	17.59	-53.31	-47.00	-6.31	VERTICAL
1	35.88	-66.96	9.65	-57.31	-57.00	-0.31	HORIZONTAL
2	111.43	-59.12	1.29	-57.83	-57.00	-0.83	HORIZONTAL
3	219.51	-60.23	2.41	-57.82	-57.00	-0.82	HORIZONTAL
4	337.70	-62.61	4.81	-57.80	-57.00	-0.80	HORIZONTAL
5	598.53	-73.76	11.08	-62.68	-57.00	-5.68	HORIZONTAL
6	744.19	-74.29	13.94	-60.35	-57.00	-3.35	HORIZONTAL
7	1,485.59	-65.01	2.28	-62.73	-47.00	-15.73	HORIZONTAL
8	5,265.00	-71.47	16.82	-54.65	-47.00	-7.65	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: 2023/04/10
 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	87.80	-58.60	1.00	-57.60	-57.00	-0.60	VERTICAL
2	219.58	-60.32	2.73	-57.59	-57.00	-0.59	VERTICAL
3	340.80	-62.79	5.18	-57.61	-57.00	-0.61	VERTICAL
4	744.07	-75.06	13.74	-61.32	-57.00	-4.32	VERTICAL
5	821.16	-72.93	13.92	-59.01	-57.00	-2.01	VERTICAL
6	950.61	-75.18	17.65	-57.53	-57.00	-0.53	VERTICAL
7	1,974.50	-64.57	4.50	-60.07	-47.00	-13.07	VERTICAL
8	4,943.37	-70.02	16.32	-53.70	-47.00	-6.70	VERTICAL
1	195.02	-59.41	1.70	-57.71	-57.00	-0.71	HORIZONTAL
2	249.49	-61.78	4.38	-57.40	-57.00	-0.40	HORIZONTAL
3	523.03	-70.99	9.08	-61.91	-57.00	-4.91	HORIZONTAL
4	668.92	-74.80	11.93	-62.87	-57.00	-5.87	HORIZONTAL
5	746.81	-74.65	14.04	-60.61	-57.00	-3.61	HORIZONTAL
6	819.84	-73.66	14.44	-59.22	-57.00	-2.22	HORIZONTAL
7	4,605.81	-69.35	14.95	-54.40	-47.00	-7.40	HORIZONTAL
8	6,531.26	-72.01	23.84	-48.17	-47.00	-1.17	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	5.52	13.97
Mid	5.56	13.97
High	4.73	13.97

PCB Antenna

BLE

Channel	Power Density Reading (dBm)	Maximum Limit (dBm)
Low	0.40	13.97
Mid	0.44	13.97
High	-0.39	13.97

Dipole Antenna

IEEE 802.15.4 (Thread, Zigbee)

Channel	Power Density Reading (dBm)	Maximum Limit (dBm)
Low	6.50	13.97
Mid	6.08	13.97
High	6.30	13.97

PCB Antenna

IEEE 802.15.4 (Thread, Zigbee)

Channel	Power Density Reading (dBm)	Maximum Limit (dBm)
Low	1.38	13.97
Mid	0.96	13.97
High	1.18	13.97

Appendix 1

Photographs of Test Setup

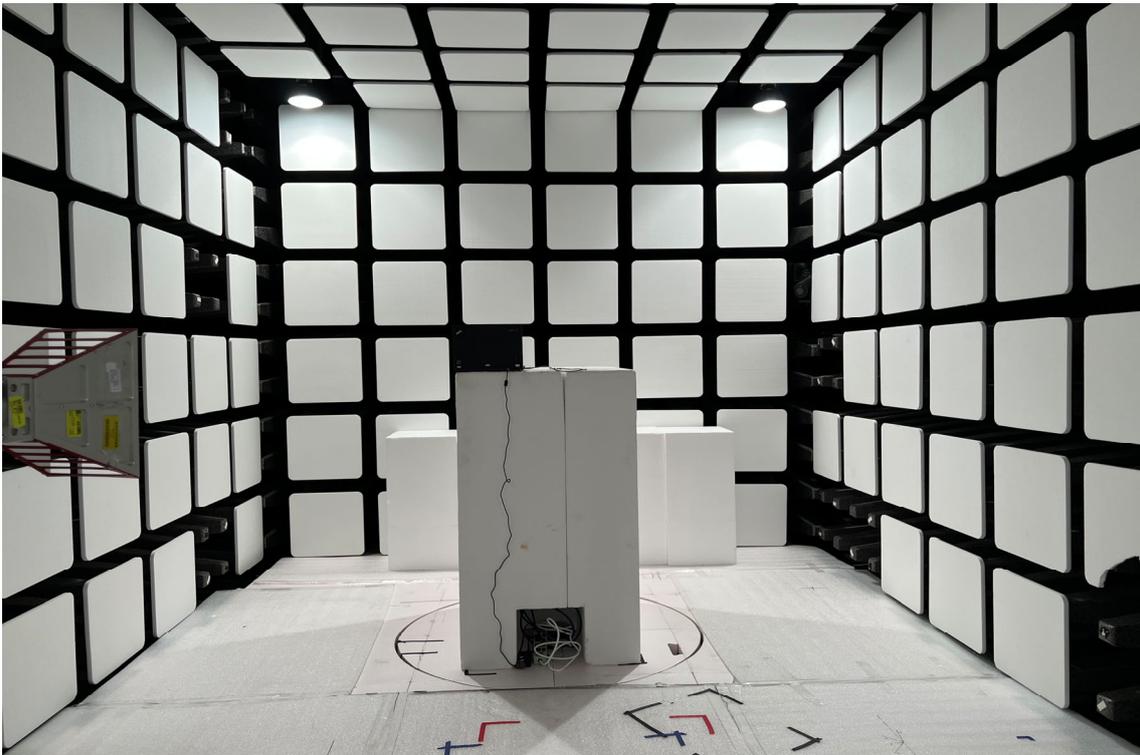
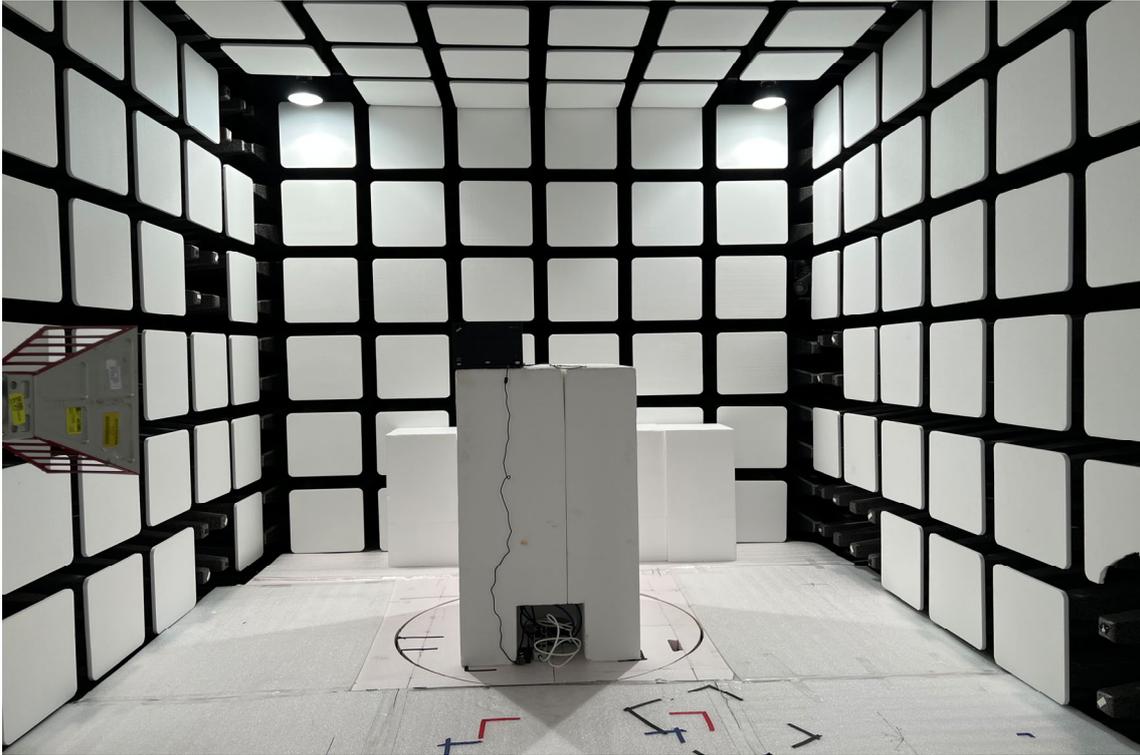
Dipole Antenna

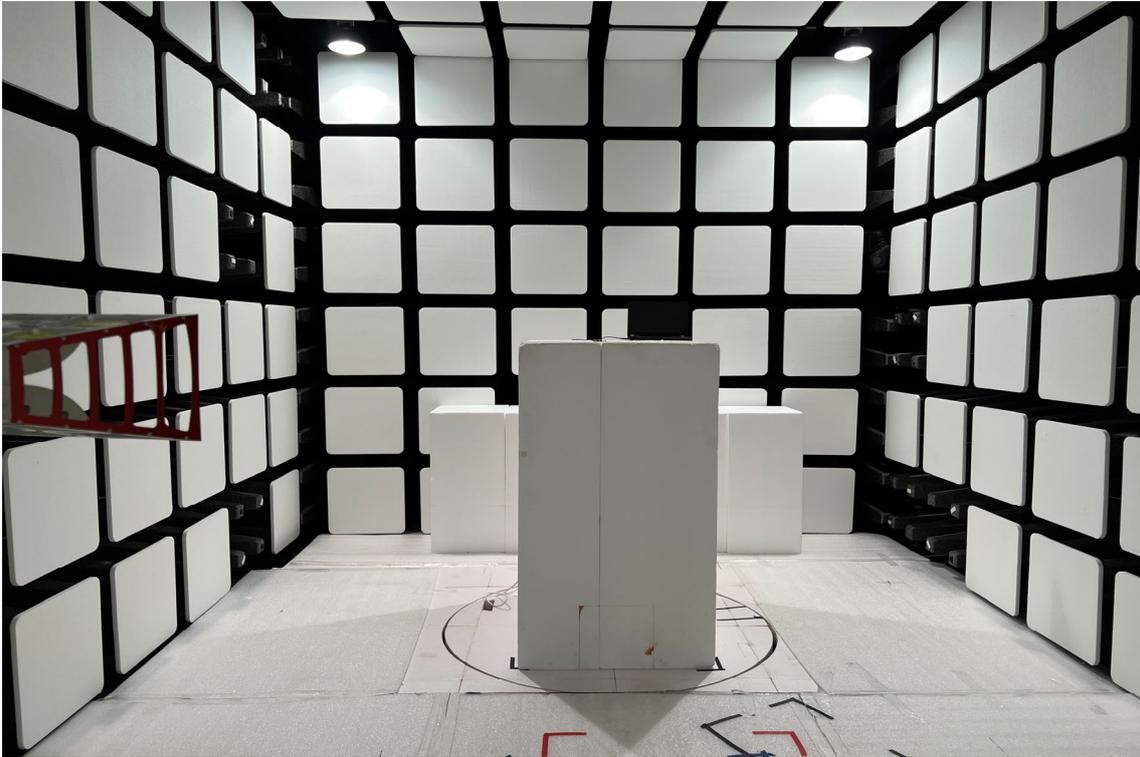




PIFA Antenna







Appendix 2

Photographs of EUT

Please refer to the file ISL-23LR0019P