

TEST REPORT

of

Australian/New Zealand Standard AS/NZS 4268:2017

Product : Bluetooth 5.1 Module

Brand: Fanstel

Model: BC40C; BC40M; BC40P

Model Difference: Antenna difference

Applicant: Fanstel Corporation, Taipei

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Test Performed by:



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Report No.: ISL-21LR190ANZ

Issue Date : 2021/07/15

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.

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VERIFICATION OF COMPLIANCE

Applicant: Fanstel Corporation, Taipei
Product Description: Bluetooth 5.1 Module
Brand Name: Fanstel
Model No.: BC40C; BC40M; BC40P
Model Difference: Antenna difference
Date of test: 2021/06/28 ~ 2021/07/14
Date of EUT Received: 2021/06/28

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

2021/07/15

Weitin Chen / Senior Engineer

Prepared By:

Gigi yeh

Date:

2021/07/15

Gigi Yeh / Senior Engineer

Approved By:

Jerry Liu

Date:

2021/07/15

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Version

Version No.	Date	Description
00	2021/07/15	Initial creation of document

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1 Description of Equipment Under Test (EUT)

General:

Product Name:	Bluetooth 5.1 Module
Brand Name:	Fanstel
Model Name:	BC40C; BC40M; BC40P
Model Difference:	Antenna difference
Type of Equipment:	Stand-alone equipment
Temperature Range:	-40°C to +105°C
Simultaneous transmissions:	Yes
Geo-location capability:	No
Power Supply	5Vdc from USB (JIG)

Model Summaries:

module	BC40C	BC40M	BC40P
SoC	nRF5340 CLAA	nRF5340 CLAA	nRF5340 CLAA
Size	8.4x11.5x1.5 mm	8.4(10.1)x12.7x1.5mm	8.4x9x1.5mm
32 MHz and 32.768 kHz crystals	Integrated	Integrated	Integrated
DC converter inductors, VDD, VDDH	Integrated	Integrated	Integrated
BT Antenna	Chip	PCB trace	Pads for external
Max TX			
Operating temp.	-40°C to +105°C	-40°C to +105°C	-40°C to +105°C
Availability	Sample 05/2021	Sample 05/2021	Sample 06/2021

Bluetooth Version	BT 5.1
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	Wide band Modulation
Transmit Power (EIRP):	2.73 dBi
Dwell Time	N/A
Operating Mode	Point-to-Point
Adaptive/ Non-Adaptive	Non-Adaptive
LBT (Listen Before Talk)	Yes
	<input checked="" type="checkbox"/> Adaptive Frequency Hopping using LBT based DAA <input type="checkbox"/> Adaptive Frequency Hopping using other forms of DAA (non-LBT based) <input type="checkbox"/> Short Control Signaling Transmissions
Occupied Channel Bandwidth	Within 2400-2483.5MHz
Duty Cycle	N/A
Antenna Beam forming	No
Antenna Designation:	BC40C: Chip Antenna, 1dBi BC40M: PCB trace Antenna, 1.53dBi BC40P: Pads for external Antenna, 0.54dBi

This test report applies for Bluetooth BLE.

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 Bluetooth BLE 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

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.

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

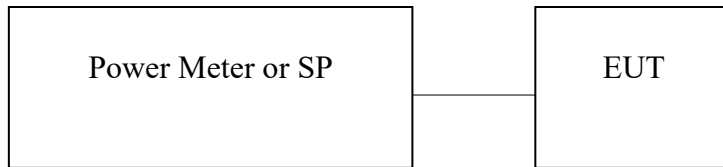
According to AS/NZS 4268:2017, Table 1, row 59: Digital modulation transmitters

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	09/25/2020	09/25/2021
Conducted	Power Sensor	Anritsu	MA2411B	34NKF50	09/25/2020	09/25/2021
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	09/23/2020	09/23/2021
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	11/29/2020	11/29/2021
Conducted	Wideband Radio Communication Tester	R&S	CMW500	1201.002K50108793-JG	10/28/2020	10/28/2021
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	07/19/2020	07/19/2021
Conducted (TS8997)	Signal Generator	R&S	SMB100B	101085	10/28/2020	10/28/2021
Conducted (TS8997)	Vector Signal Generator	R&S	SMBV100A	263246	10/28/2020	10/28/2021
Conducted (TS8997)	Signal analyzer 40GHz	R&S	FSV40	101884	10/20/2020	10/20/2021
Conducted (TS8997)	OSP150 extension unit CAM-BUS	R&S	OSP150	101107	04/06/2021	04/06/2022
Conducted (TS8997)	Test Software	R&S	EMC32 Ver:11.10.00	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:

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BC40C (Chip Ant.)

Mode	Frequency (MHz)	Temp.	Output Power e.i.r.p. (dBm)	Limit (dBm)	Results
BLE	2402	Normal	1.70	20	Pass
		Low	2.20	20	Pass
		High	1.10	20	Pass
	2442	Normal	1.50	20	Pass
		Low	2.00	20	Pass
		High	0.90	20	Pass
	2480	Normal	1.20	20	Pass
		Low	1.70	20	Pass
		High	0.40	20	Pass

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BC40M (PCB trace Ant.)

Mode	Frequency (MHz)	Temp.	Output Power e.i.r.p. (dBm)	Limit (dBm)	Results
BLE	2402	Normal	2.23	20	Pass
		Low	2.73	20	Pass
		High	1.63	20	Pass
	2442	Normal	2.03	20	Pass
		Low	2.53	20	Pass
		High	1.43	20	Pass
	2480	Normal	1.73	20	Pass
		Low	2.23	20	Pass
		High	0.93	20	Pass

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BC40P (Pads for external Ant.)

Mode	Frequency (MHz)	Temp.	Output Power e.i.r.p. (dBm)	Limit (dBm)	Results
BLE	2402	Normal	1.24	20	Pass
		Low	1.74	20	Pass
		High	0.64	20	Pass
	2442	Normal	1.04	20	Pass
		Low	1.54	20	Pass
		High	0.44	20	Pass
	2480	Normal	0.74	20	Pass
		Low	1.24	20	Pass
		High	-0.06	20	Pass

7 Transmitter Spurious Emissions Measurement

7.1. Limit:

According to AS/NZS 4268:2017, Section 6.2.2

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)

Model: BC40C (Chip Ant.)

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-59.70	0.49	-59.21	-54.00	-5.21	VERTICAL
2	208.48	-68.55	2.19	-66.36	-54.00	-12.36	VERTICAL
3	504.33	-76.90	8.95	-67.95	-54.00	-13.95	VERTICAL
4	591.63	-76.34	9.94	-66.40	-54.00	-12.40	VERTICAL
5	618.79	-80.69	10.89	-69.80	-54.00	-15.80	VERTICAL
6	665.35	-74.67	12.65	-62.02	-54.00	-8.02	VERTICAL
7	4804.00	-76.02	15.71	-60.31	-30.00	-30.31	VERTICAL
8	7055.00	-75.18	22.06	-53.12	-30.00	-23.12	VERTICAL
1	106.63	-64.16	1.11	-63.05	-54.00	-9.05	HORIZONTAL
2	203.63	-61.49	1.50	-59.99	-54.00	-5.99	HORIZONTAL
3	519.85	-79.61	9.08	-70.53	-54.00	-16.53	HORIZONTAL
4	579.99	-78.09	10.77	-67.32	-54.00	-13.32	HORIZONTAL
5	627.52	-78.23	11.47	-66.76	-54.00	-12.76	HORIZONTAL
6	670.20	-78.82	12.01	-66.81	-54.00	-12.81	HORIZONTAL
7	4804.00	-73.96	15.63	-58.33	-30.00	-28.33	HORIZONTAL
8	6698.00	-72.16	23.74	-48.42	-30.00	-18.42	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 26GHz.

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-64.17	1.11	-63.06	-54.00	-9.06	VERTICAL
2	203.63	-61.57	1.50	-60.07	-54.00	-6.07	VERTICAL
3	519.85	-79.25	9.08	-70.17	-54.00	-16.17	VERTICAL
4	579.99	-78.76	10.77	-67.99	-54.00	-13.99	VERTICAL
5	627.52	-78.74	11.47	-67.27	-54.00	-13.27	VERTICAL
6	670.20	-78.79	12.01	-66.78	-54.00	-12.78	VERTICAL
7	4960.00	-74.78	16.40	-58.38	-30.00	-28.38	VERTICAL
8	7111.00	-75.11	22.20	-52.91	-30.00	-22.91	VERTICAL
1	106.63	-64.48	1.11	-63.37	-54.00	-9.37	HORIZONTAL
2	203.63	-61.36	1.50	-59.86	-54.00	-5.86	HORIZONTAL
3	519.85	-79.28	9.08	-70.20	-54.00	-16.20	HORIZONTAL
4	579.99	-78.75	10.77	-67.98	-54.00	-13.98	HORIZONTAL
5	627.52	-78.65	11.47	-67.18	-54.00	-13.18	HORIZONTAL
6	670.20	-78.43	12.01	-66.42	-54.00	-12.42	HORIZONTAL
7	4960.00	-74.42	16.15	-58.27	-30.00	-28.27	HORIZONTAL
8	6908.00	-74.20	23.62	-50.58	-30.00	-20.58	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 26GHz.

Model: BC40M (PCB trace Ant.)

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-59.86	0.49	-59.37	-54.00	-5.37	VERTICAL
2	208.48	-69.86	2.19	-67.67	-54.00	-13.67	VERTICAL
3	487.84	-77.86	8.97	-68.89	-54.00	-14.89	VERTICAL
4	533.43	-79.03	8.92	-70.11	-54.00	-16.11	VERTICAL
5	591.63	-72.61	9.94	-62.67	-54.00	-8.67	VERTICAL
6	665.35	-73.19	12.65	-60.54	-54.00	-6.54	VERTICAL
7	4804.00	-74.01	15.71	-58.30	-30.00	-28.30	VERTICAL
8	6873.00	-73.63	21.33	-52.30	-30.00	-22.30	VERTICAL
1	106.63	-65.44	1.11	-64.33	-54.00	-10.33	HORIZONTAL
2	204.60	-60.07	1.57	-58.50	-54.00	-4.50	HORIZONTAL
3	504.33	-77.89	8.57	-69.32	-54.00	-15.32	HORIZONTAL
4	551.86	-79.48	10.09	-69.39	-54.00	-15.39	HORIZONTAL
5	585.81	-77.12	10.90	-66.22	-54.00	-12.22	HORIZONTAL
6	634.31	-78.78	11.52	-67.26	-54.00	-13.26	HORIZONTAL
7	4804.00	-74.39	15.63	-58.76	-30.00	-28.76	HORIZONTAL
8	6614.00	-74.00	23.79	-50.21	-30.00	-20.21	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 26GHz.

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-60.21	0.49	-59.72	-54.00	-5.72	VERTICAL
2	202.66	-67.15	1.77	-65.38	-54.00	-11.38	VERTICAL
3	498.51	-77.21	8.95	-68.26	-54.00	-14.26	VERTICAL
4	592.60	-76.21	9.96	-66.25	-54.00	-12.25	VERTICAL
5	623.64	-77.73	11.08	-66.65	-54.00	-12.65	VERTICAL
6	668.26	-74.01	12.75	-61.26	-54.00	-7.26	VERTICAL
7	4960.00	-74.07	16.40	-57.67	-30.00	-27.67	VERTICAL
8	7020.00	-74.55	21.96	-52.59	-30.00	-22.59	VERTICAL
1	106.63	-64.29	1.11	-63.18	-54.00	-9.18	HORIZONTAL
2	203.63	-62.28	1.50	-60.78	-54.00	-6.78	HORIZONTAL
3	504.33	-77.54	8.57	-68.97	-54.00	-14.97	HORIZONTAL
4	534.40	-78.80	9.55	-69.25	-54.00	-15.25	HORIZONTAL
5	556.71	-77.89	10.21	-67.68	-54.00	-13.68	HORIZONTAL
6	583.87	-77.52	10.86	-66.66	-54.00	-12.66	HORIZONTAL
7	4960.00	-74.69	16.15	-58.54	-30.00	-28.54	HORIZONTAL
8	6691.00	-73.96	23.75	-50.21	-30.00	-20.21	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 26GHz.

Model: BC40P (Pads for external Ant.)

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-59.55	0.49	-59.06	-54.00	-5.06	VERTICAL
2	202.66	-67.93	1.77	-66.16	-54.00	-12.16	VERTICAL
3	504.33	-77.24	8.95	-68.29	-54.00	-14.29	VERTICAL
4	570.29	-80.97	9.42	-71.55	-54.00	-17.55	VERTICAL
5	626.55	-80.01	11.19	-68.82	-54.00	-14.82	VERTICAL
6	668.26	-74.13	12.75	-61.38	-54.00	-7.38	VERTICAL
7	4804.00	-75.28	15.71	-59.57	-30.00	-29.57	VERTICAL
8	6950.00	-74.46	21.68	-52.78	-30.00	-22.78	VERTICAL
1	106.63	-63.70	1.11	-62.59	-54.00	-8.59	HORIZONTAL
2	204.60	-59.40	1.57	-57.83	-54.00	-3.83	HORIZONTAL
3	491.72	-78.50	8.41	-70.09	-54.00	-16.09	HORIZONTAL
4	581.93	-78.19	10.81	-67.38	-54.00	-13.38	HORIZONTAL
5	639.16	-80.22	11.56	-68.66	-54.00	-14.66	HORIZONTAL
6	681.84	-77.53	12.22	-65.31	-54.00	-11.31	HORIZONTAL
7	4804.00	-73.93	15.63	-58.30	-30.00	-28.30	HORIZONTAL
8	6775.00	-73.26	23.70	-49.56	-30.00	-19.56	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 26GHz.

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-60.55	0.49	-60.06	-54.00	-6.06	VERTICAL
2	199.75	-69.90	1.59	-68.31	-54.00	-14.31	VERTICAL
3	504.33	-75.87	8.95	-66.92	-54.00	-12.92	VERTICAL
4	515.97	-74.95	8.94	-66.01	-54.00	-12.01	VERTICAL
5	591.63	-76.89	9.94	-66.95	-54.00	-12.95	VERTICAL
6	665.35	-72.74	12.65	-60.09	-54.00	-6.09	VERTICAL
7	4960.00	-74.71	16.40	-58.31	-30.00	-28.31	VERTICAL
8	6936.00	-73.71	21.62	-52.09	-30.00	-22.09	VERTICAL
1	106.63	-64.88	1.11	-63.77	-54.00	-9.77	HORIZONTAL
2	202.66	-60.08	1.43	-58.65	-54.00	-4.65	HORIZONTAL
3	524.70	-78.22	9.24	-68.98	-54.00	-14.98	HORIZONTAL
4	560.59	-79.29	10.30	-68.99	-54.00	-14.99	HORIZONTAL
5	585.81	-76.65	10.90	-65.75	-54.00	-11.75	HORIZONTAL
6	614.91	-79.91	11.36	-68.55	-54.00	-14.55	HORIZONTAL
7	4960.00	-74.17	16.15	-58.02	-30.00	-28.02	HORIZONTAL
8	6572.00	-73.89	23.82	-50.07	-30.00	-20.07	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 26GHz.

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: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Channel	Measured Frequency (MHz)	Limit (MHz)
Upper Frequency	2401.5067	>2400
Lower Frequency	2480.5988	<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:

Model: BC40C (Chip Ant.)

Test Results: BT BLE mode

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

antenna assembly gain "G" in dBi

1.00 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	2402.0412	2480.0425
	V _{max}	5.50	V	2403.0412	2481.0425
Temp 25 °C	V _{nom}	5.00	V	2404.0410	2482.0424
Temp 80 °C	V _{min}	4.50	V	2405.0410	2483.0426
	V _{max}	5.50	V	2406.0410	2484.0426
Measured frequencies (lowest and highest)				f _L = 2402.0412 MHz	f _H = 2484.0426 MHz
Limit				2400.0000 MHz	2483.5000 MHz
Measurement Uncertainty				+/- 120kHz	

Model: BC40M (PCB trace Ant.)

Test Results: BT BLE mode

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

antenna assembly gain "G" in dBi

1.53 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	2402.0412	2480.0425
	V _{max}	5.50	V	2403.0412	2481.0425
Temp 25 °C	V _{nom}	5.00	V	2404.0410	2482.0424
Temp 80 °C	V _{min}	4.50	V	2405.0410	2483.0426
	V _{max}	5.50	V	2406.0410	2484.0426
Measured frequencies (lowest and highest)				f _L = 2402.0412 MHz	f _H = 2484.0426 MHz
Limit				2400.0000 MHz	2483.5000 MHz
Measurement Uncertainty				+/- 120kHz	

Model: BC40P (Pads for external Ant.)

Test Results: BT BLE mode

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

antenna assembly gain "G" in dBi

0.54 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	2402.0412	2480.0425
	V _{max}	5.50	V	2403.0412	2481.0425
Temp 25 °C	V _{nom}	5.00	V	2404.0410	2482.0424
Temp 80 °C	V _{min}	4.50	V	2405.0410	2483.0426
	V _{max}	5.50	V	2406.0410	2484.0426
Measured frequencies (lowest and highest)				f _L = 2402.0412 MHz	f _H = 2484.0426 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:

Model: BC40C (Chip Ant.)

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	107.22	-60.68	0.49	-60.19	-57.00	-3.19	VERTICAL
2	161.32	-70.26	5.07	-65.19	-57.00	-8.19	VERTICAL
3	209.32	-68.42	2.19	-66.23	-57.00	-9.23	VERTICAL
4	297.37	-68.07	4.30	-63.77	-57.00	-6.77	VERTICAL
5	444.27	-76.76	8.73	-68.03	-57.00	-11.03	VERTICAL
6	668.77	-74.71	12.75	-61.96	-57.00	-4.96	VERTICAL
7	3646.00	-72.59	10.26	-62.33	-47.00	-15.33	VERTICAL
8	5886.00	-74.58	18.45	-56.13	-47.00	-9.13	VERTICAL
1	106.64	-64.71	1.11	-63.60	-57.00	-6.60	HORIZONTAL
2	162.89	-68.93	3.59	-65.34	-57.00	-8.34	HORIZONTAL
3	216.99	-62.06	2.41	-59.65	-57.00	-2.65	HORIZONTAL
4	320.47	-70.71	4.32	-66.39	-57.00	-9.39	HORIZONTAL
5	592.76	-76.42	11.06	-65.36	-57.00	-8.36	HORIZONTAL
6	683.17	-74.61	12.23	-62.38	-57.00	-5.38	HORIZONTAL
7	3772.00	-71.83	11.27	-60.56	-47.00	-13.56	HORIZONTAL
8	6236.00	-74.26	21.39	-52.87	-47.00	-5.87	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 26GHz.

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	107.35	-60.94	0.49	-60.45	-57.00	-3.45	VERTICAL
2	163.05	-70.99	4.87	-66.12	-57.00	-9.12	VERTICAL
3	295.97	-68.53	4.31	-64.22	-57.00	-7.22	VERTICAL
4	456.66	-78.16	9.04	-69.12	-57.00	-12.12	VERTICAL
5	665.74	-74.73	12.65	-62.08	-57.00	-5.08	VERTICAL
6	740.71	-79.07	13.74	-65.33	-57.00	-8.33	VERTICAL
7	3842.00	-71.71	11.46	-60.25	-47.00	-13.25	VERTICAL
8	6670.00	-73.59	20.37	-53.22	-47.00	-6.22	VERTICAL
1	107.19	-64.21	1.11	-63.10	-57.00	-6.10	HORIZONTAL
2	161.36	-70.18	3.73	-66.45	-57.00	-9.45	HORIZONTAL
3	216.70	-62.18	2.41	-59.77	-57.00	-2.77	HORIZONTAL
4	320.33	-72.22	4.32	-67.90	-57.00	-10.90	HORIZONTAL
5	445.51	-74.23	8.21	-66.02	-57.00	-9.02	HORIZONTAL
6	705.00	-77.14	12.68	-64.46	-57.00	-7.46	HORIZONTAL
7	3303.00	-71.92	8.68	-63.24	-47.00	-16.24	HORIZONTAL
8	6404.00	-74.76	22.98	-51.78	-47.00	-4.78	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 26GHz.

Model: BC40M (PCB trace Ant.)

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-59.88	0.49	-59.39	-57.00	-2.39	VERTICAL
2	164.83	-71.28	4.68	-66.60	-57.00	-9.60	VERTICAL
3	203.63	-68.42	1.84	-66.58	-57.00	-9.58	VERTICAL
4	296.75	-71.00	4.30	-66.70	-57.00	-9.70	VERTICAL
5	449.04	-77.46	9.00	-68.46	-57.00	-11.46	VERTICAL
6	665.35	-74.74	12.65	-62.09	-57.00	-5.09	VERTICAL
7	2862.00	-70.21	6.89	-63.32	-47.00	-16.32	VERTICAL
8	5914.00	-74.58	18.50	-56.08	-47.00	-9.08	VERTICAL
1	106.63	-64.59	1.11	-63.48	-57.00	-6.48	HORIZONTAL
2	160.95	-71.14	3.73	-67.41	-57.00	-10.41	HORIZONTAL
3	224.00	-63.65	2.95	-60.70	-57.00	-3.70	HORIZONTAL
4	295.78	-70.13	3.75	-66.38	-57.00	-9.38	HORIZONTAL
5	444.19	-75.79	8.19	-67.60	-57.00	-10.60	HORIZONTAL
6	687.66	-76.08	12.32	-63.76	-57.00	-6.76	HORIZONTAL
7	3415.00	-72.69	9.14	-63.55	-47.00	-16.55	HORIZONTAL
8	6474.00	-75.74	23.62	-52.12	-47.00	-5.12	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 26GHz.

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.63	-60.10	0.49	-59.61	-57.00	-2.61	VERTICAL
2	208.48	-70.27	2.19	-68.08	-57.00	-11.08	VERTICAL
3	295.78	-69.20	4.31	-64.89	-57.00	-7.89	VERTICAL
4	455.83	-77.57	9.04	-68.53	-57.00	-11.53	VERTICAL
5	593.57	-77.14	9.99	-67.15	-57.00	-10.15	VERTICAL
6	668.26	-75.72	12.75	-62.97	-57.00	-5.97	VERTICAL
7	2939.00	-71.30	7.10	-64.20	-47.00	-17.20	VERTICAL
8	5508.00	-74.02	17.83	-56.19	-47.00	-9.19	VERTICAL
1	90.14	-59.70	0.70	-59.00	-57.00	-2.00	HORIZONTAL
2	224.00	-63.67	2.95	-60.72	-57.00	-3.72	HORIZONTAL
3	320.03	-71.42	4.32	-67.10	-57.00	-10.10	HORIZONTAL
4	444.19	-75.47	8.19	-67.28	-57.00	-10.28	HORIZONTAL
5	591.63	-77.80	11.04	-66.76	-57.00	-9.76	HORIZONTAL
6	738.10	-78.92	13.87	-65.05	-57.00	-8.05	HORIZONTAL
7	3149.00	-70.42	8.03	-62.39	-47.00	-15.39	HORIZONTAL
8	6257.00	-74.70	21.59	-53.11	-47.00	-6.11	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 26GHz.

Model: BC40P (Pads for external Ant.)

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	107.47	-59.63	0.49	-59.14	-57.00	-2.14	VERTICAL
2	224.82	-64.32	3.25	-61.07	-57.00	-4.07	VERTICAL
3	320.51	-69.25	4.78	-64.47	-57.00	-7.47	VERTICAL
4	446.13	-75.42	8.78	-66.64	-57.00	-9.64	VERTICAL
5	533.92	-75.31	8.92	-66.39	-57.00	-9.39	VERTICAL
6	665.68	-75.35	12.65	-62.70	-57.00	-5.70	VERTICAL
7	3751.00	-70.41	10.91	-59.50	-47.00	-12.50	VERTICAL
8	5942.00	-73.32	18.54	-54.78	-47.00	-7.78	VERTICAL
1	106.72	-63.68	1.11	-62.57	-57.00	-5.57	HORIZONTAL
2	160.99	-70.04	3.73	-66.31	-57.00	-9.31	HORIZONTAL
3	320.24	-69.99	4.32	-65.67	-57.00	-8.67	HORIZONTAL
4	441.29	-75.55	8.08	-67.47	-57.00	-10.47	HORIZONTAL
5	557.44	-78.12	10.21	-67.91	-57.00	-10.91	HORIZONTAL
6	689.37	-76.99	12.34	-64.65	-57.00	-7.65	HORIZONTAL
7	3541.00	-72.92	9.75	-63.17	-47.00	-16.17	HORIZONTAL
8	6173.00	-74.33	20.79	-53.54	-47.00	-6.54	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 26GHz.

Ambient temperature: 20°C

Relative humidity: 66%

Test Date: 2021/07/02

Test Mode: BLE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	106.78	-60.61	0.49	-60.12	-57.00	-3.12	VERTICAL
2	161.81	-67.73	5.07	-62.66	-57.00	-5.66	VERTICAL
3	204.05	-69.47	1.84	-67.63	-57.00	-10.63	VERTICAL
4	295.83	-71.03	4.31	-66.72	-57.00	-9.72	VERTICAL
5	445.55	-76.92	8.78	-68.14	-57.00	-11.14	VERTICAL
6	594.66	-76.42	10.01	-66.41	-57.00	-9.41	VERTICAL
7	3625.00	-71.88	10.13	-61.75	-47.00	-14.75	VERTICAL
8	7167.00	-75.30	22.35	-52.95	-47.00	-5.95	VERTICAL
1	106.68	-64.70	1.11	-63.59	-57.00	-6.59	HORIZONTAL
2	161.67	-68.96	3.73	-65.23	-57.00	-8.23	HORIZONTAL
3	224.03	-63.25	2.95	-60.30	-57.00	-3.30	HORIZONTAL
4	295.89	-68.88	3.75	-65.13	-57.00	-8.13	HORIZONTAL
5	444.88	-74.67	8.19	-66.48	-57.00	-9.48	HORIZONTAL
6	580.39	-77.64	10.77	-66.87	-57.00	-9.87	HORIZONTAL
7	3590.00	-72.96	10.08	-62.88	-47.00	-15.88	HORIZONTAL
8	6467.00	-74.83	23.56	-51.27	-47.00	-4.27	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 26GHz.

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 6.2.

11.3. Test Setup:

Refer to section 6.3.

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:

Test Mode: BC40C (Chip Ant.)

Channel	Power Density Reading (dBm)	Antenna Gian (dBi)	Power Density EIRP	Maximum Limit (dBm)
Low	-10.55	1.00	-9.55	13.97
Mid	-10.21	1.00	-9.21	13.97
High	-9.79	1.00	-8.79	13.97

Test Mode: BC40M (PCB trace Ant.)

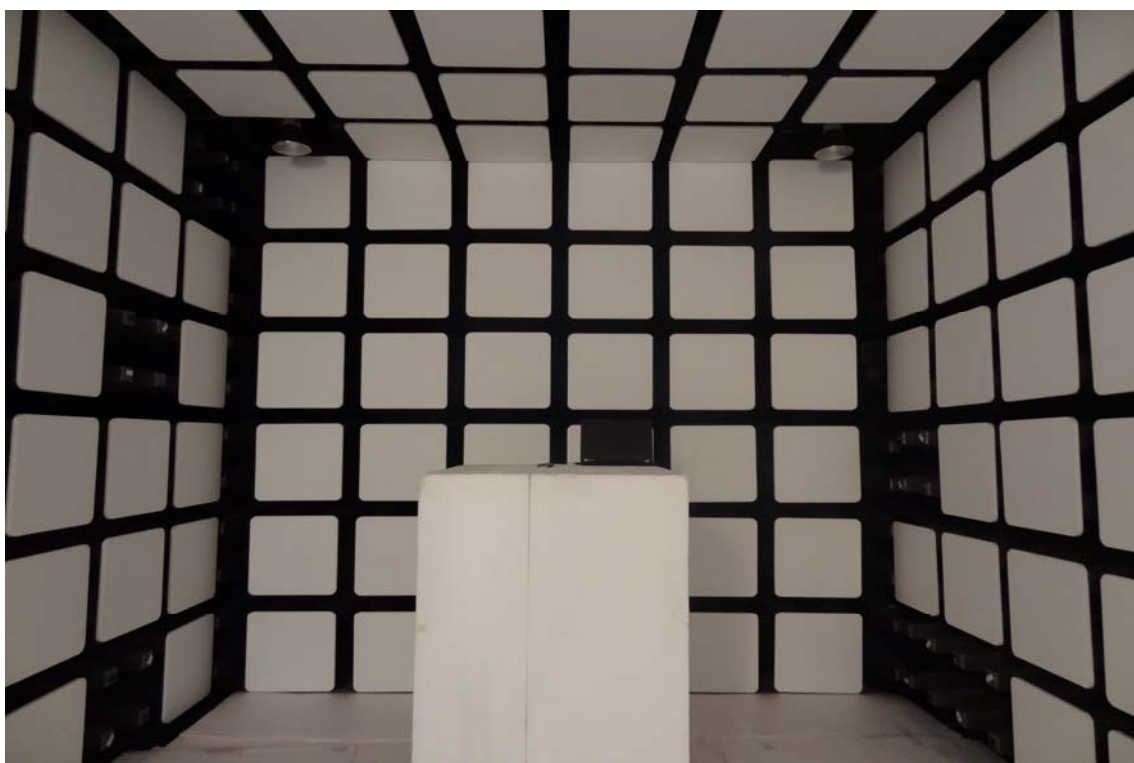
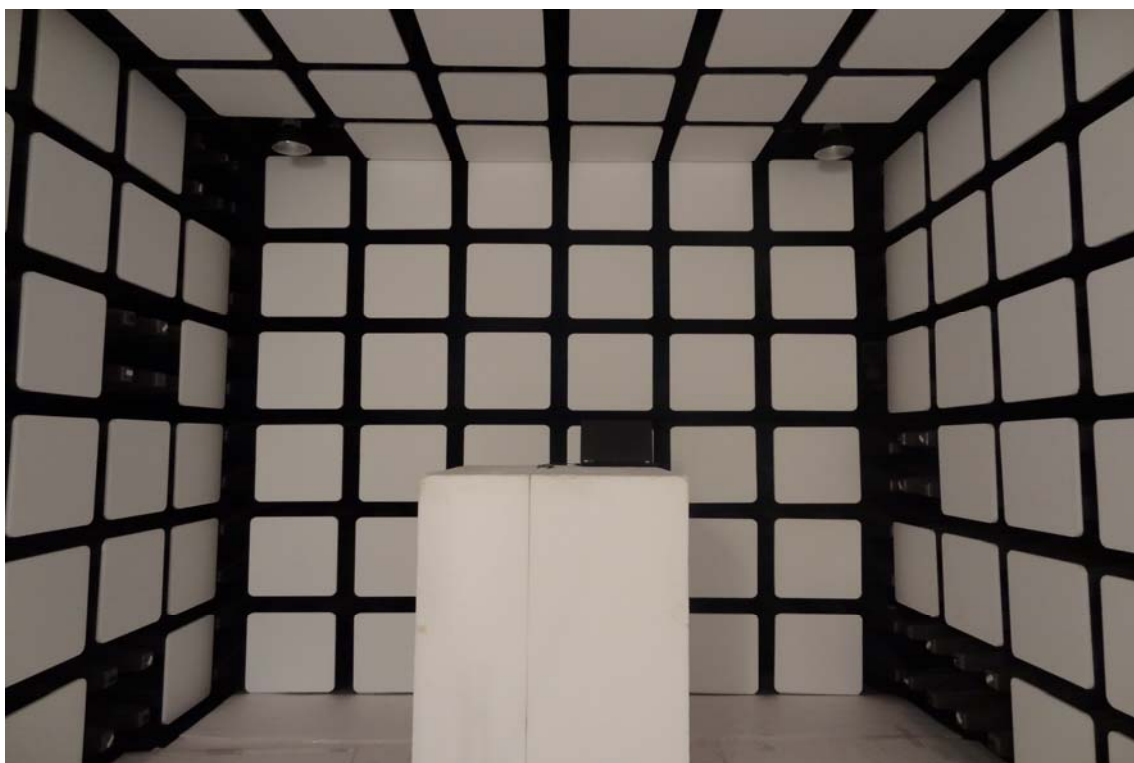
Channel	Power Density Reading (dBm)	Antenna Gian (dBi)	Power Density EIRP	Maximum Limit (dBm)
Low	-10.55	1.53	-9.02	13.97
Mid	-10.21	1.53	-8.68	13.97
High	-9.79	1.53	-8.26	13.97

Test Mode: BC40P (Pads for external Ant.)

Channel	Power Density Reading (dBm)	Antenna Gian (dBi)	Power Density EIRP	Maximum Limit (dBm)
Low	-10.55	0.54	-10.01	13.97
Mid	-10.21	0.54	-9.67	13.97
High	-9.79	0.54	-9.25	13.97

Appendix 1

Photographs of Test Setup



Appendix 2

Photographs of EUT

Please refer to the file ISL-21LR190P