

TEST REPORT

of

Australian/New Zealand Standard AS/NZS 4268:2017

Product : Bluetooth 5.1 Module

Brand: Fanstel

Model: BM833AF, BM833A

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.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997

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Report No.: ISL-19LR246ANZ

Issue Date : 2019/10/29

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 5.1 Module
Brand Name: Fanstel
Model No.: BM833AF, BM833A
Model Difference: Antenna. Please see page 5 for detail
Date of test: 2019/10/12 ~2019/10/25
Date of EUT Received: 2019/10/09

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:

2019/10/29

Weitin Chen / Senior Engineer

Prepared By:

Elisa Chen

Date:

2019/10/29

Elisa Chen / Senior Engineer

Approved By:

Jerry Liu

Date:

2019/10/29

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Version

Version No.	Date	Description
00	2019/10/29	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:	BM833AF, BM833A
Model Difference:	Antenna. Please see table below for detail.
Type of Equipment:	Stand-alone equipment
Temperature Range:	-40°C to +85°C
Simultaneous transmissions:	Yes
Geo-location capability:	No
Power Supply	5Vdc by USB port

Model Summaries

module	BM833A	BM833AF
Flash/RAM	192KB/24KB	192KB/24KB
Size	10.2x15x1.9mm	10.2 (15 antenna area) x 20.6 x1.9mm.
GPIO	32	32
Antenna	PCB Trace	PCB trace
Antenna Gain	0.01dBi	-0.88dBi
BT range, low interference	680 meters at 125Kbps, est.	1400 meters at 125 Kbps, est.

BT version	BT 5.1
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	Wide band Modulation
Transmit Power: (EIRP)	4.31 dBm
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:	BM833A: PCB Antenna, 0.01dBi BM833AF: PCB Antenna, -0.88dBi

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 +85 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

5 Support Equipment

Fig. 5-1 Configuration of Tested System

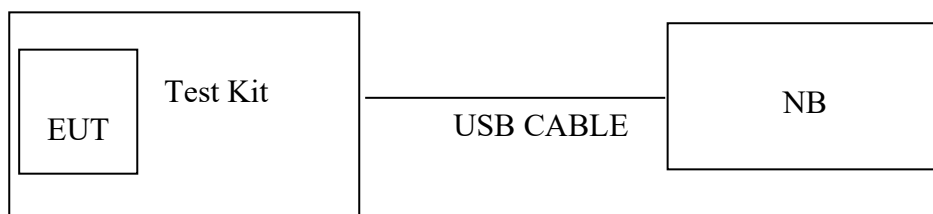


Table 5-1 Equipment Used in Tested System

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

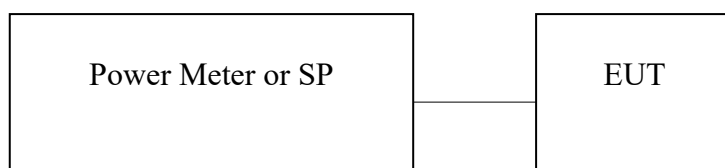
According to AS/NZS 4268:2017, Table 1, row 59: Digital modulation transmitters

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

6.2. Measurement Equipment Used:

Conducted Emission Test Site					
Equipment Type	Manufacturer	Model Number	Serial Number	Last Cal.	Cal. Due.
Power Meter 05	Anritsu	ML2495A	1116010	10/04/2019	10/03/2020
Power Sensor 05	Anritsu	MA2411B	34NKF50	10/04/2019	10/03/2020
Power Sensor 06	DARE	RPR3006W	13I00030SNO3 3	01/11/2019	01/10/2020
Power Sensor 08	DARE	RPR3006W	14I00889SNO3 5	06/27/2019	06/26/2020
Power Sensor 09	DARE	RPR3006W	14I00889SNO3 6	06/27/2019	06/26/2020
Temperature Chamber	KSON	THS-B4H100	2287	02/19/2019	02/18/2020
DC Power supply	ABM	8185D	N/A	01/10/2019	01/09/2020
AC Power supply	EXTECH	CFC105W	NA	N/A	N/A
Attenuator	Woken	Watt-65m3502	11051601	NA	NA
Splitter	MCLI	PS4-199	12465	12/26/2017	12/25/2019

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:

Example Calculation:

Pburst values (A) = Reading + Cable Loss

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

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2019/10/15

Test Mode: BT BLE

Pburst values (value "A" in dBm)

antenna assembly gain "G" in dBi

0.01 dBi

beamforming gain "Y" in dB

0.00 dB

Cable Loss=

21.00 dB

TEST CONDITIONS		TRANSMITTER POWER (dBm)					
		Lowest Frequency		Middle Frequency		Highest Frequency	
Temp -40 °C	Vmin 4.5 V	P 4.64 dBm	P 4.24 dBm	P 4.14 dBm			
		A 4.30 dBm	A 3.90 dBm	A 3.80 dBm			
		Reading -16.70 dBm	Reading -17.10 dBm	Reading -17.20 dBm			
	Vmax 5.5 V	P 4.64 dBm	P 4.24 dBm	P 4.14 dBm			
		A 4.30 dBm	A 3.90 dBm	A 3.80 dBm			
		Reading -16.70 dBm	Reading -17.10 dBm	Reading -17.20 dBm			
Temp 25 °C	Vnom 5 V	P 3.44 dBm	P 3.14 dBm	P 3.04 dBm			
		A 3.10 dBm	A 2.80 dBm	A 2.70 dBm			
		Reading -17.90 dBm	Reading -18.20 dBm	Reading -18.30 dBm			
Temp 80 °C	Vmin 4.5 V	P 3.44 dBm	P 3.14 dBm	P 3.04 dBm			
		A 3.10 dBm	A 2.80 dBm	A 2.70 dBm			
		Reading -17.90 dBm	Reading -18.20 dBm	Reading -18.30 dBm			
	Vmax 5.5 V	P 3.44 dBm	P 3.14 dBm	P 3.04 dBm			
		A 3.10 dBm	A 2.80 dBm	A 2.70 dBm			
		Reading -17.90 dBm	Reading -18.20 dBm	Reading -18.30 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)

Ambient temperature: 25 °C Relative humidity: 60 % Test Date: 2019/10/17

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	-67.69	0.49	-67.20	-40.00	-27.20	VERTICAL
2	237.58	-79.30	4.12	-75.18	-40.00	-35.18	VERTICAL
3	420.91	-79.57	7.40	-72.17	-40.00	-32.17	VERTICAL
4	585.81	-81.26	9.80	-71.46	-40.00	-31.46	VERTICAL
5	705.12	-81.22	13.86	-67.36	-40.00	-27.36	VERTICAL
6	841.89	-81.29	14.63	-66.66	-40.00	-26.66	VERTICAL
7	3219.00	-57.71	8.21	-49.50	-40.00	-9.50	VERTICAL
8	4804.00	-73.66	15.71	-57.95	-40.00	-17.95	VERTICAL
1	96.93	-64.52	0.53	-63.99	-40.00	-23.99	HORIZONTAL
2	257.95	-78.58	4.45	-74.13	-40.00	-34.13	HORIZONTAL
3	434.49	-79.65	7.91	-71.74	-40.00	-31.74	HORIZONTAL
4	640.13	-80.52	11.57	-68.95	-40.00	-28.95	HORIZONTAL
5	752.65	-79.79	14.27	-65.52	-40.00	-25.52	HORIZONTAL
6	874.87	-80.95	15.36	-65.59	-40.00	-25.59	HORIZONTAL
7	3219.00	-61.98	8.33	-53.65	-40.00	-13.65	HORIZONTAL
8	4804.00	-73.10	15.63	-57.47	-40.00	-17.47	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: 2019/10/17

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	-64.93	0.49	-64.44	-40.00	-24.44	VERTICAL
2	529.55	-79.80	8.93	-70.87	-40.00	-30.87	VERTICAL
3	614.91	-80.52	10.73	-69.79	-40.00	-29.79	VERTICAL
4	689.60	-81.82	13.52	-68.30	-40.00	-28.30	VERTICAL
5	749.74	-80.65	13.71	-66.94	-40.00	-26.94	VERTICAL
6	872.93	-80.92	15.75	-65.17	-40.00	-25.17	VERTICAL
7	3499.00	-66.12	9.33	-56.79	-40.00	-16.79	VERTICAL
8	4960.00	-73.66	16.40	-57.26	-40.00	-17.26	VERTICAL
1	96.93	-64.70	0.53	-64.17	-40.00	-24.17	HORIZONTAL
2	527.61	-80.12	9.33	-70.79	-40.00	-30.79	HORIZONTAL
3	612.00	-80.75	11.33	-69.42	-40.00	-29.42	HORIZONTAL
4	662.44	-79.58	11.88	-67.70	-40.00	-27.70	HORIZONTAL
5	762.35	-80.94	14.25	-66.69	-40.00	-26.69	HORIZONTAL
6	842.86	-80.88	14.86	-66.02	-40.00	-26.02	HORIZONTAL
7	3499.00	-69.56	9.47	-60.09	-40.00	-20.09	HORIZONTAL
8	4960.00	-74.01	16.15	-57.86	-40.00	-17.86	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: 2019/10/17

	Channel	Measured Frequency (MHz)	Limit (MHz)
BLE	Upper Frequency	2401.1587	>2400
	Lower Frequency	2480.995	<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:

Test Results: BT BLE mode

Ambient temperature: 25 °C

Relative humidity: 60%

Test Date: 2019/10/17

antenna assembly gain "G" in dBi

0.01 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	2480.0013
	V _{max}	5.50	V	2402.0015	2480.0014
Temp 25 °C	V _{nom}	5.00	V	2402.0017	2480.0015
Temp 80 °C	V _{min}	4.50	V	2402.0016	2480.0014
	V _{max}	5.50	V	2402.0015	2480.0013
Measured frequencies (lowest and highest)				f _L = 2402.0014 MHz	f _H = 2480.0015 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:

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2019/10/17

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	-64.43	0.49	-63.94	-54.82	-9.12	VERTICAL
2	149.31	-78.13	6.12	-72.01	-54.82	-17.19	VERTICAL
3	262.80	-78.30	4.71	-73.59	-54.82	-18.77	VERTICAL
4	487.84	-79.61	8.97	-70.64	-54.82	-15.82	VERTICAL
5	642.07	-79.11	11.78	-67.33	-54.82	-12.51	VERTICAL
6	720.64	-80.21	13.81	-66.40	-54.82	-11.58	VERTICAL
7	1497.00	-54.58	1.84	-52.74	-44.84	-7.90	VERTICAL
8	5991.00	-69.82	18.62	-51.20	-44.84	-6.36	VERTICAL
1	106.63	-65.30	1.11	-64.19	-54.82	-9.37	HORIZONTAL
2	168.71	-78.55	3.19	-75.36	-54.82	-20.54	HORIZONTAL
3	253.10	-79.12	4.55	-74.57	-54.82	-19.75	HORIZONTAL
4	426.73	-79.32	7.68	-71.64	-54.82	-16.82	HORIZONTAL
5	713.85	-81.22	13.03	-68.19	-54.82	-13.37	HORIZONTAL
6	874.87	-79.98	15.36	-64.62	-54.82	-9.80	HORIZONTAL
7	1497.00	-59.12	2.31	-56.81	-44.84	-11.97	HORIZONTAL
8	5998.00	-72.22	19.09	-53.13	-44.84	-8.29	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: 2019/10/17

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	-68.03	0.49	-67.54	-54.82	-12.72	VERTICAL
2	153.19	-78.36	5.86	-72.50	-54.82	-17.68	VERTICAL
3	295.78	-79.27	4.31	-74.96	-54.82	-20.14	VERTICAL
4	462.62	-79.04	9.02	-70.02	-54.82	-15.20	VERTICAL
5	613.94	-81.57	10.70	-70.87	-54.82	-16.05	VERTICAL
6	718.70	-80.89	13.82	-67.07	-54.82	-12.25	VERTICAL
7	3114.00	-70.77	7.76	-63.01	-44.84	-18.17	VERTICAL
8	5795.00	-71.47	18.31	-53.16	-44.84	-8.32	VERTICAL
1	106.63	-65.28	1.11	-64.17	-54.82	-9.35	HORIZONTAL
2	261.83	-77.73	4.37	-73.36	-54.82	-18.54	HORIZONTAL
3	418.97	-79.68	7.45	-72.23	-54.82	-17.41	HORIZONTAL
4	487.84	-79.46	8.40	-71.06	-54.82	-16.24	HORIZONTAL
5	600.36	-80.30	11.23	-69.07	-54.82	-14.25	HORIZONTAL
6	763.32	-81.27	14.25	-67.02	-54.82	-12.20	HORIZONTAL
7	1497.00	-54.01	2.31	-51.70	-44.84	-6.86	HORIZONTAL
8	5998.00	-70.76	19.09	-51.67	-44.84	-6.83	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.

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.

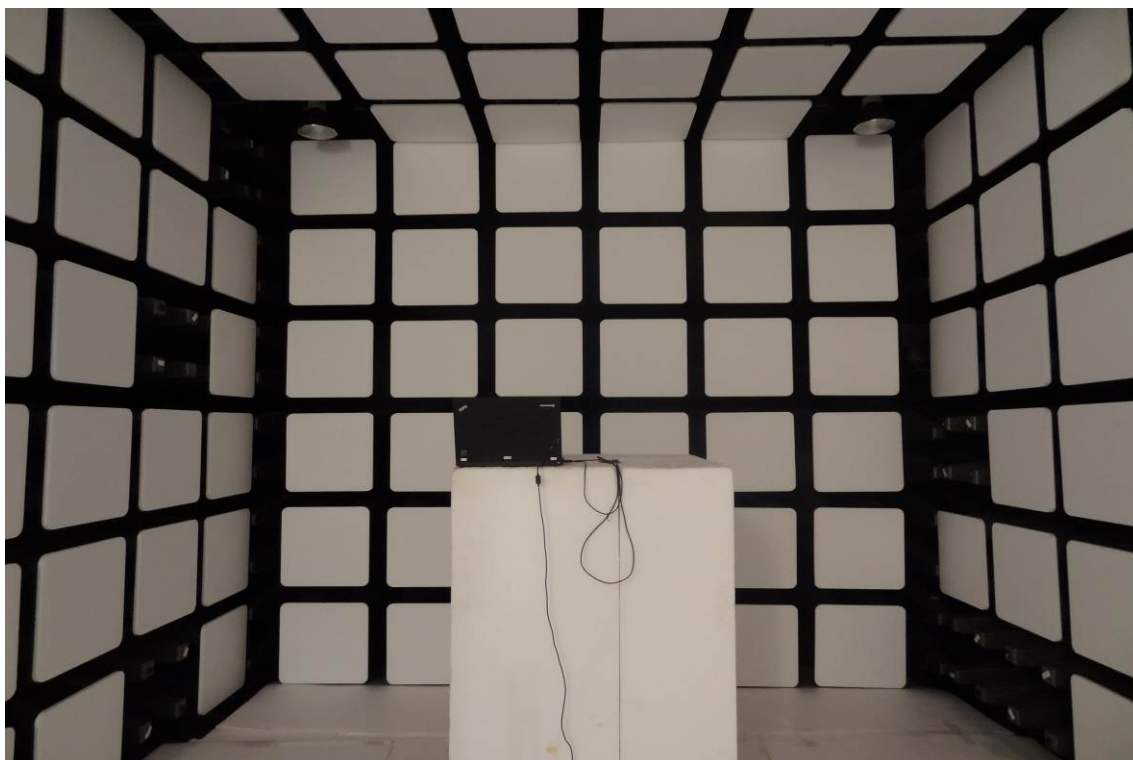
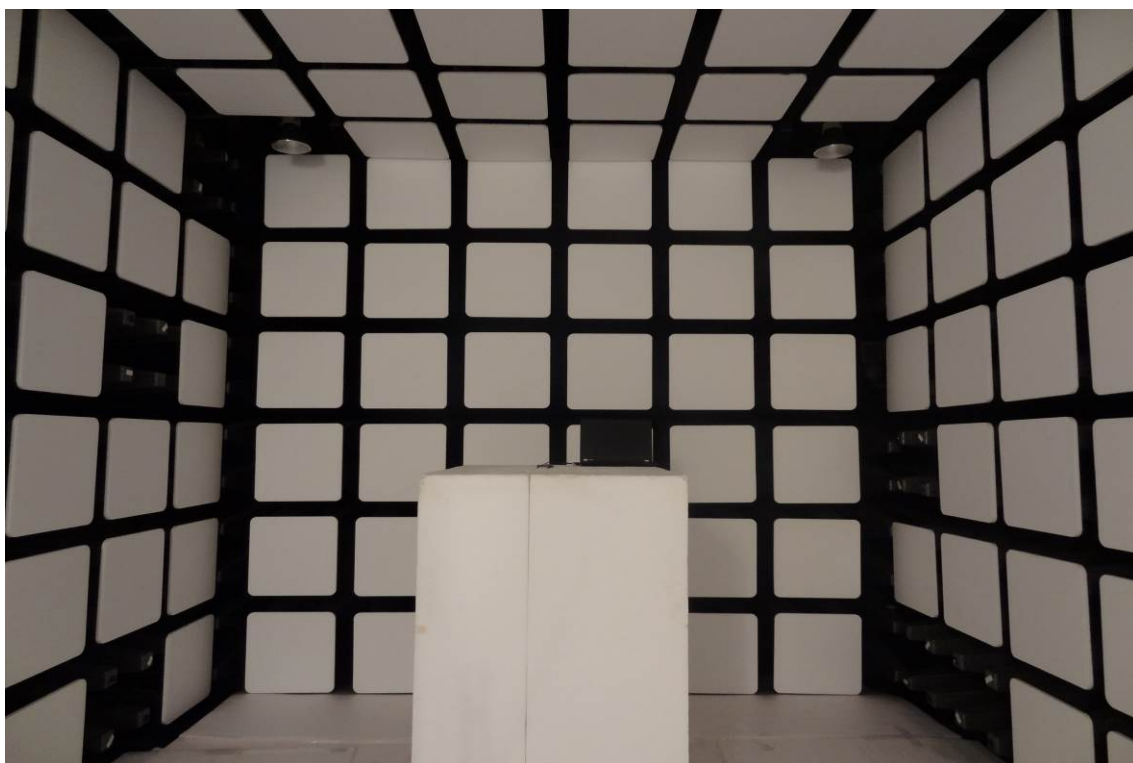
11.5. Measurement Result:

BT LE

Channel	Power Density Reading (dBm)	Antenna Gain (dBi)	EIRP	Maximum Limit (dBm)
Low	-9.62	0.01	-9.61	13.97
Mid	-7.92	0.01	-7.91	13.97
High	-8.53	0.01	-8.52	13.97

Appendix 1

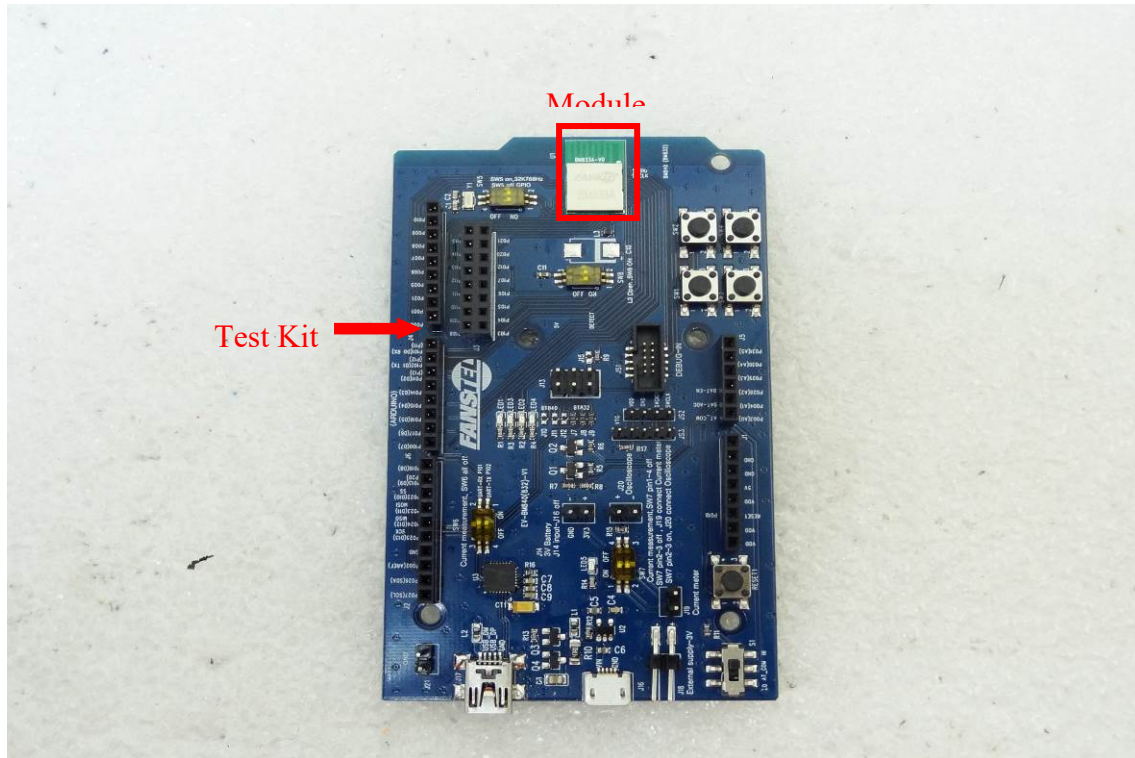
Photographs of Test Setup



Appendix 2

Photographs of EUT

EUT 1



EUT 2 BM833A



EUT 3 BM833AF



EUT 4 BM833A



EUT 5 BM833AF



~ End of Report ~