

TEST REPORT

of

Australian/New Zealand Standard AS/NZS 4268:2017

Product : Bluetooth 5.0 Module

Brand: Fanstel

Model: BC840 , BC840M , BC840E

Model Difference: Please see page 5 model summaries table

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; IC: IC4067B-4;

*Address:

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Report No.: ISL-18LR474ANZ

Issue Date : 2019/01/23

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.

This report MUST not be used to claim product endorsement by TAF, NVLAP or any agency of the Government.

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VERIFICATION OF COMPLIANCE

Applicant: Fanstel Corporation, Taipei
Product Description: Bluetooth 5.0 Module
Brand Name: Fanstel
Model No.: BC840 , BC840M , BC840E
Model Difference: Please see page 5 model summaries table
Date of test: 2018/12/26 ~ 2019/01/22
Date of EUT Received: 2018/12/26

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: Barry Lee **Date:** 2019/01/23

Barry Lee / Senior Engineer

Prepared By: Gigi yeh **Date:** 2019/01/23

Gigi Yeh / Senior Engineer

Approved By: DinoChen **Date:** 2019/01/23

Dino Chen / Senior Engineer

Version

Version No.	Date	Description
00	2019/01/23	Initial creation of document

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1 Description of Equipment Under Test (EUT)

General:

Product Name:	Bluetooth 5.0 Module
Brand Name:	Fanstel
Model Name:	BC840 , BC840M , BC840E
Model Difference:	Please see page 5 model summaries table
Type of Equipment:	Stand-alone equipment
Temperature Range:	-40°C to + 85°C
Simultaneous transmissions:	No
Geo-location capability:	No
Power Supply	5Vdc

Model Summaries

module	BC840	BC840M	BC840E
SoC	nRF52840-CKAA	nRF52840-CKAA	nRF52840-CKAA
Size, mm	7.0x9.0x1.5	7.0 (10 antenna area)x12.0x1.5	7.0x12.0x1.5
BT Antenna	PCB trace	PCB trace	u.FL
BT range, 1 Mbps, LMPI	10 meters, est.	150 meters.est	
BT range, 1Mbps, 1.52m			
BT range, 125 Kbps, LMPI.		400 meters, est.	
BT range, 125 kbps, 1.52m			
Availability	Sample	Sample	Sample

Bluetooth:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V5.0
Channel number:	40 channels, 2MHz step
Modulation type:	Wide band Modulation, GFSK
Transmit Power: (EIRP)	8.14dBm
Occupied Channel Bandwidth:	Within 2400-2483.5MHz
Duty Cycle:	N/A
Adaptive/ Non-Adaptive:	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
Antenna Beamforming:	No
Antenna Designation:	BC840: PCB Antennas:-9.47 dBi BC840M: PCB Antennas:-3.58 dBi BM832E : PCB Antenna: 0.54dBi (Max)

The EUT is compliance with Bluetooth BLE Standard.

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 : + 15°C to 35 °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 +55 degree and at a lower value of -10 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

EN 300 440-1V1.6.1 – 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 (Fixed channel)

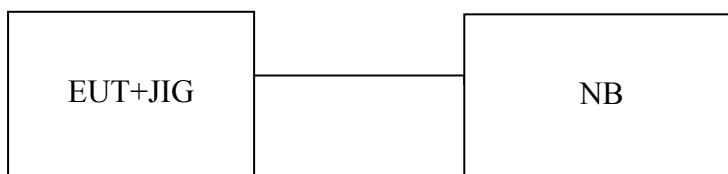


Table 5-1 Equipment Used in Tested System

Item	Equipment	Mrf/Brand	Model name	Series No	Data Cable	Power Cable
1	JIG	NA	NA	NA	Non-Shielded	Non-Shielded
2	NB	Lenovo	220i	NA	Non-Shielded	Non-Shielded

6 Maximum EIRP Measurement

6.1. Limit:

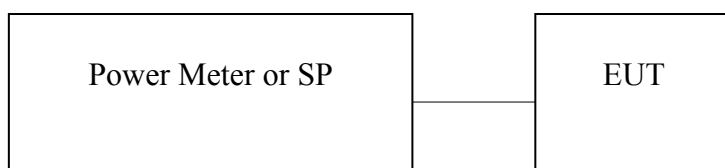
4W(36dBm) for Row 59

According to AS/NZS 4268:2017, Table 1, row 59: Digital modulation 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	10/28/2018	10/27/2019
Power Sensor 05	Anritsu	MA2411B	34NKF50	10/28/2018	10/27/2019
Power Sensor 06	DARE	RPR3006W	13I00030SNO3 3	01/11/2019	01/10/2020
Power Sensor 07	DARE	RPR3006W	13I00030SNO3 4	01/11/2019	01/10/2020
Temperature Chamber	KSON	THS-B4H100	2287	12/02/2018	12/01/2019
DC Power supply	ABM	8185D	N/A	01/10/2019	01/09/2020
AC Power supply	EXTECH	CFC105W	NA	12/25/2018	12/24/2019
Attenuator	Woken	Watt-65m3502	11051601	NA	NA
Splitter	MCLI	PS4-199	12465	12/26/2017	12/25/2019
Spectrum analyzer	keysight	N9010A	MY56070257	10/15/2018	10/14/2019
Spectrum analyzer	R&S	FSP40	100116	01/10/2019	01/09/2020
Test Software	DARE	Radimation Ver:2013.1.23	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:

Example Calculation:

Pburst values (A) = Reading + Cable Loss

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

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2019/01/18

Test Mode: BT LE

Pburst values (value "A" in dBm)

antenna assembly gain "G" in dBi

0.54 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	P 7.64 dBm	P 7.84 dBm	P 8.14 dBm
	A 7.10 dBm	A 7.30 dBm	A 7.60 dBm
	Reading -13.90 dBm	Reading -13.70 dBm	Reading -13.40 dBm
Temp 25 °C	P 7.54 dBm	P 7.74 dBm	P 8.04 dBm
	A 7.00 dBm	A 7.20 dBm	A 7.50 dBm
	Reading -14.00 dBm	Reading -13.80 dBm	Reading -13.50 dBm
Temp 85 °C	P 7.44 dBm	P 7.64 dBm	P 7.94 dBm
	A 6.90 dBm	A 7.10 dBm	A 7.40 dBm
	Reading -14.10 dBm	Reading -13.90 dBm	Reading -13.60 dBm
Limit(P)	20dBm		
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

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: 2019/01/18

Test Mode: Bluetooth BLE mode, TX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	96.93	-63.82	-0.23	-64.05	-54.00	-10.05	VERTICAL
2	256.01	-65.97	4.80	-61.17	-36.00	-25.17	VERTICAL
3	432.55	-73.78	8.08	-65.70	-36.00	-29.70	VERTICAL
4	576.11	-76.18	9.57	-66.61	-54.00	-12.61	VERTICAL
5	640.13	-76.16	11.71	-64.45	-54.00	-10.45	VERTICAL
6	896.21	-77.08	16.64	-60.44	-36.00	-24.44	VERTICAL
7	3205.00	-57.01	8.15	-48.86	-30.00	-18.86	VERTICAL
8	4804.00	-65.94	15.71	-50.23	-30.00	-20.23	VERTICAL
1	96.93	-62.60	0.53	-62.07	-54.00	-8.07	HORIZONTAL
2	220.12	-71.91	2.68	-69.23	-54.00	-15.23	HORIZONTAL
3	322.94	-74.38	4.41	-69.97	-36.00	-33.97	HORIZONTAL
4	536.34	-81.29	9.61	-71.68	-54.00	-17.68	HORIZONTAL
5	726.46	-82.46	13.47	-68.99	-54.00	-14.99	HORIZONTAL
6	896.21	-81.39	15.68	-65.71	-36.00	-29.71	HORIZONTAL
7	1840.00	-59.46	4.07	-55.39	-30.00	-25.39	HORIZONTAL
8	4804.00	-67.02	15.63	-51.39	-30.00	-21.39	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. The result basic equation calculation is as follows:
4. $ERP/EIRP \text{ (dBm)} = SG \text{ Setting (dBm)} + \text{Antenna Gain (dB/dBi)} - \text{Cable loss (dB)}$
5. Measurement Range upto 40GHz.

Ambient temperature: 25 °C **Relative humidity:** 60 % **Test Date:** 2019/01/18

Test Mode: Bluetooth BLE mode, TX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	96.93	-65.01	-0.23	-65.24	-54.00	-11.24	VERTICAL
2	191.99	-68.87	2.23	-66.64	-54.00	-12.64	VERTICAL
3	256.01	-66.87	4.80	-62.07	-36.00	-26.07	VERTICAL
4	432.55	-73.39	8.08	-65.31	-36.00	-29.31	VERTICAL
5	576.11	-76.20	9.57	-66.63	-54.00	-12.63	VERTICAL
6	896.21	-77.49	16.64	-60.85	-36.00	-24.85	VERTICAL
7	3310.00	-56.97	8.58	-48.39	-30.00	-18.39	VERTICAL
8	4960.00	-66.18	16.40	-49.78	-30.00	-19.78	VERTICAL
1	96.93	-65.01	-0.23	-65.24	-54.00	-11.24	HORIZONTAL
2	191.99	-68.87	2.23	-66.64	-54.00	-12.64	HORIZONTAL
3	256.01	-66.87	4.80	-62.07	-36.00	-26.07	HORIZONTAL
4	432.55	-73.39	8.08	-65.31	-36.00	-29.31	HORIZONTAL
5	576.11	-76.20	9.57	-66.63	-54.00	-12.63	HORIZONTAL
6	896.21	-77.49	16.64	-60.85	-36.00	-24.85	HORIZONTAL
7	3527.00	-60.20	9.65	-50.55	-30.00	-20.55	HORIZONTAL
8	4960.00	-66.67	16.15	-50.52	-30.00	-20.52	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. The result basic equation calculation is as follows:
4. $ERP/EIRP \text{ (dBm)} = SG \text{ Setting (dBm)} + \text{Antenna Gain (dB/dBi)} - \text{Cable loss (dB)}$
5. Measurement Range upto 40GHz.

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: 2019/01/18

	Channel	Measured Frequency (MHz)	Limit (MHz)
Bluetooth LE	Lower Frequency	2401.4280	≥ 2400.00
	Upper Frequency	2480.5120	≤ 2483.50

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: Bluetooth LE mode

Ambient temperature: 25 °C **Relative humidity:** 60 % **Test Date:** 2019/01/18

Model: BM832

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	2402.0018	2480.0011
	V _{max}	5.50	V	2402.0016	2480.0012
Temp 25 °C	V _{nom}	5.00	V	2402.0014	2480.0012
Temp 85 °C	V _{min}	4.50	V	2402.0016	2480.0011
	V _{max}	5.50	V	2402.0014	2480.0013
Measured frequencies (lowest and highest)				f _L = 2402.0014 MHz	f _H = 2480.0013 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 2.0 nW ERP (-57 dBm).
1GHz to 40 GHz 20nW 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: 2019/01/18

Test Mode: Bluetooth LE mode, RX CH Low

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	96.93	-63.72	-0.23	-63.95	-57.00	-6.95	VERTICAL
2	256.01	-64.47	4.80	-59.67	-57.00	-2.67	VERTICAL
3	431.58	-74.84	8.02	-66.82	-57.00	-9.82	VERTICAL
4	576.11	-77.32	9.57	-67.75	-57.00	-10.75	VERTICAL
5	832.19	-73.90	14.36	-59.54	-57.00	-2.54	VERTICAL
6	896.21	-77.14	16.64	-60.50	-57.00	-3.50	VERTICAL
7	2743.00	-71.19	6.55	-64.64	-47.00	-17.64	VERTICAL
8	4766.00	-77.30	15.54	-61.76	-47.00	-14.76	VERTICAL
1	96.93	-62.10	0.53	-61.57	-57.00	-4.57	HORIZONTAL
2	224.00	-71.06	2.95	-68.11	-57.00	-11.11	HORIZONTAL
3	320.03	-74.46	4.32	-70.14	-57.00	-13.14	HORIZONTAL
4	486.87	-80.65	8.40	-72.25	-57.00	-15.25	HORIZONTAL
5	733.25	-81.34	13.71	-67.63	-57.00	-10.63	HORIZONTAL
6	896.21	-81.23	15.68	-65.55	-57.00	-8.55	HORIZONTAL
7	2449.00	-70.28	6.09	-64.19	-47.00	-17.19	HORIZONTAL
8	4766.00	-76.91	15.51	-61.40	-47.00	-14.40	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. The result basic equation calculation is as follows:
4. $ERP/EIRP (dBm) = SG \text{ Setting}(dBm) + \text{Antenna Gain} (dB/dBi) - \text{Cable loss} (dB)$
5. Measurement Range upto 40GHz.

Ambient temperature: 25°C

Relative humidity: 60%

Test Date: 2019/01/18

Test Mode: Bluetooth LE mode, RX CH High

No	Freq MHz	Reading dBm	Aux dB	Level dBm	Limit dBm	Margin dB	Pol V/H
1	96.93	-63.55	-0.23	-63.78	-57.00	-6.78	VERTICAL
2	256.01	-65.97	4.80	-61.17	-57.00	-4.17	VERTICAL
3	431.58	-74.53	8.02	-66.51	-57.00	-9.51	VERTICAL
4	576.11	-74.98	9.57	-65.41	-57.00	-8.41	VERTICAL
5	832.19	-74.33	14.36	-59.97	-57.00	-2.97	VERTICAL
6	896.21	-78.20	16.64	-61.56	-57.00	-4.56	VERTICAL
7	2386.00	-71.42	5.56	-65.86	-47.00	-18.86	VERTICAL
8	4990.00	-78.44	16.53	-61.91	-47.00	-14.91	VERTICAL
1	96.93	-62.02	0.53	-61.49	-57.00	-4.49	HORIZONTAL
2	219.15	-71.30	2.62	-68.68	-57.00	-11.68	HORIZONTAL
3	323.91	-75.23	4.44	-70.79	-57.00	-13.79	HORIZONTAL
4	692.51	-81.80	12.40	-69.40	-57.00	-12.40	HORIZONTAL
5	837.04	-81.13	14.76	-66.37	-57.00	-9.37	HORIZONTAL
6	896.21	-80.81	15.68	-65.13	-57.00	-8.13	HORIZONTAL
7	2043.00	-71.09	4.92	-66.17	-47.00	-19.17	HORIZONTAL
8	4920.00	-77.11	16.02	-61.09	-47.00	-14.09	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. The result basic equation calculation is as follows:
4. $ERP/EIRP (dBm) = SG \text{ Setting}(dBm) + \text{Antenna Gain} (dB/dBi) - \text{Cable loss} (dB)$
5. Measurement Range upto 40GHz.

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:

LE mode

Frequency	Power Density	Maximum Limit
MHz	Level (dBm)/3kHz	(dBm)
Low	1.38	13.97
Mid	1.91	13.97
High	2.44	13.97

Appendix 1

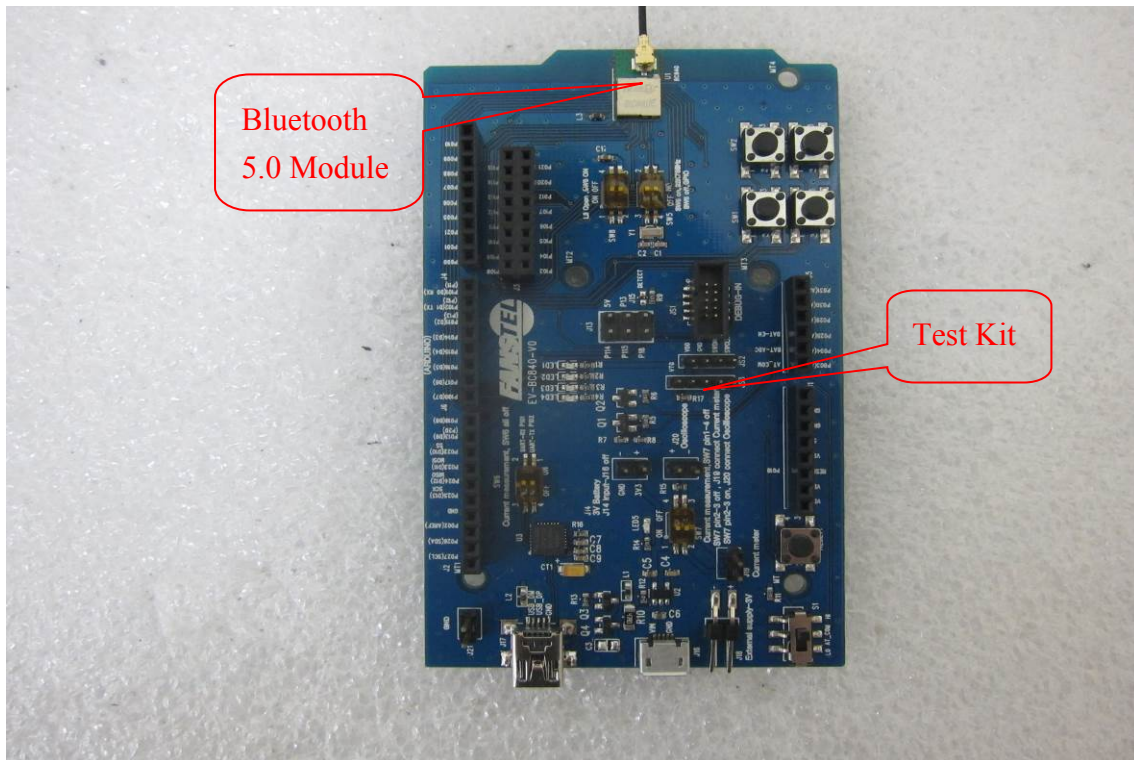
Photographs of Test Setup



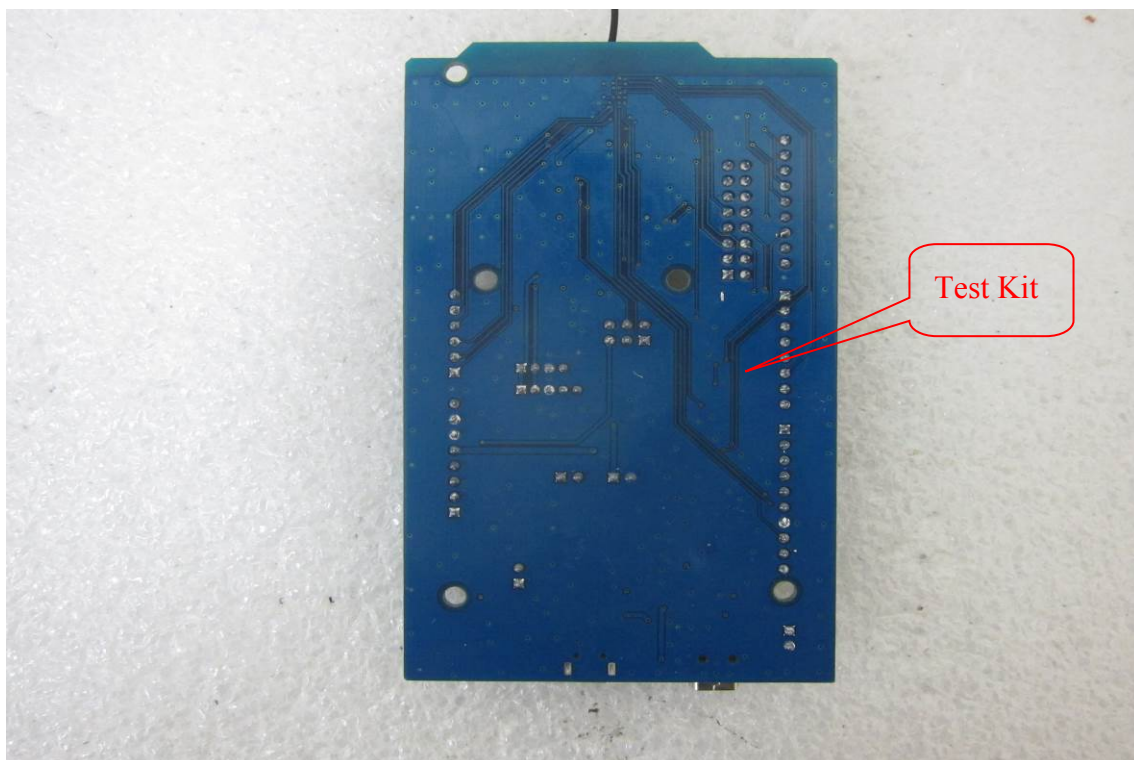
Appendix 2

Photographs of EUT

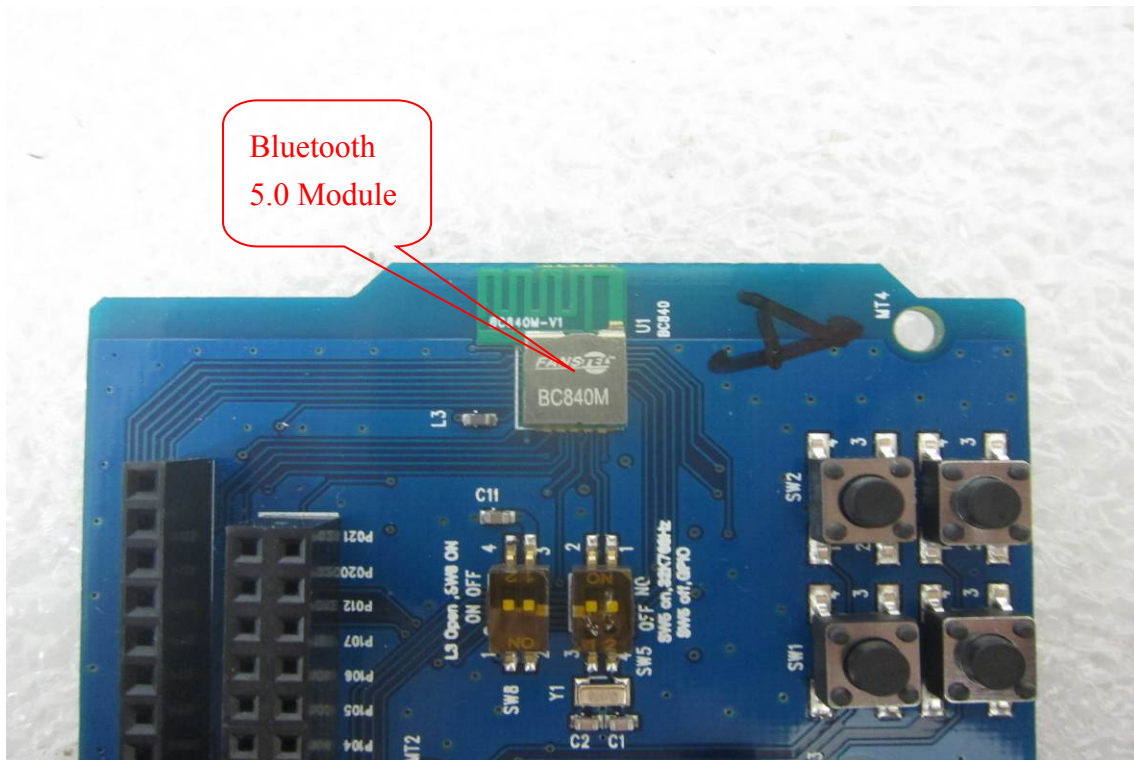
EUT 1



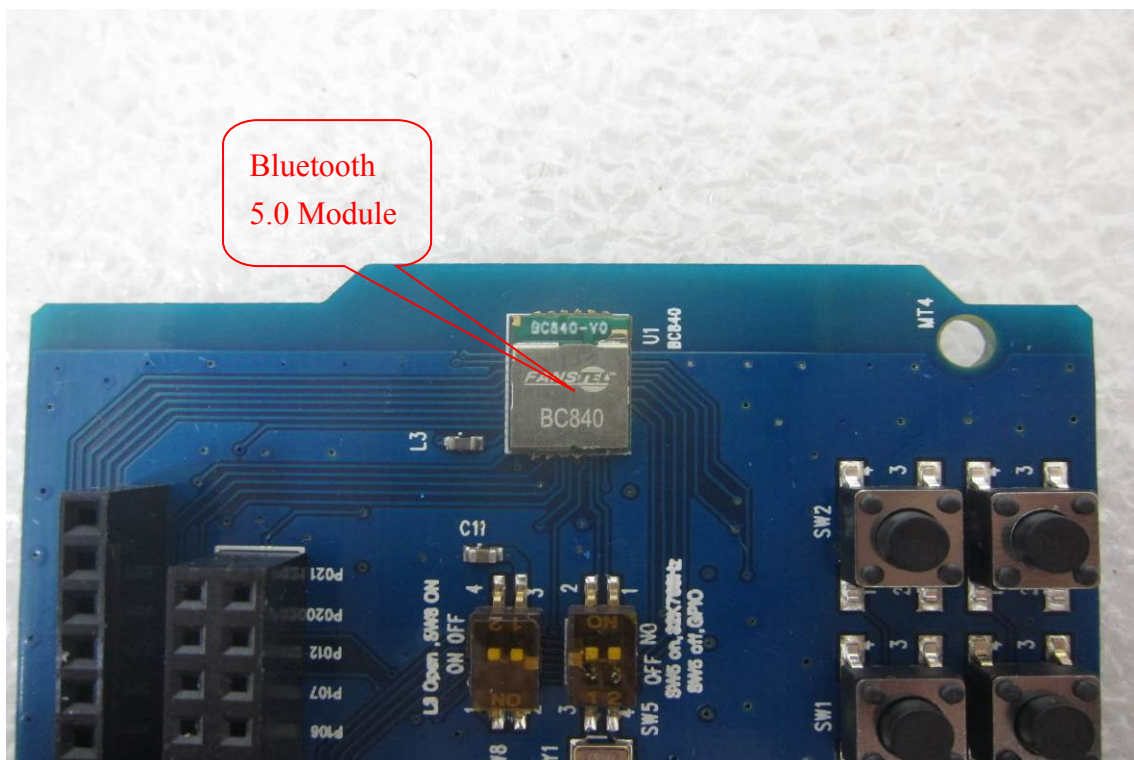
EUT 2



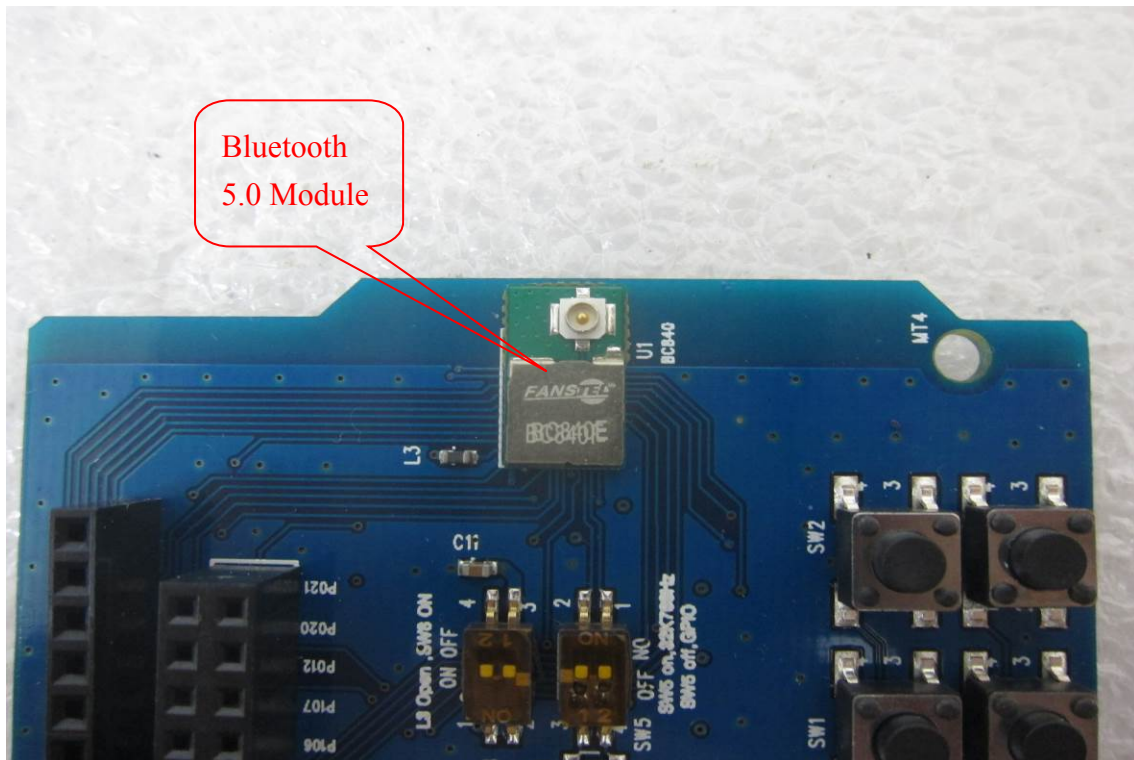
EUT 3 BC840M



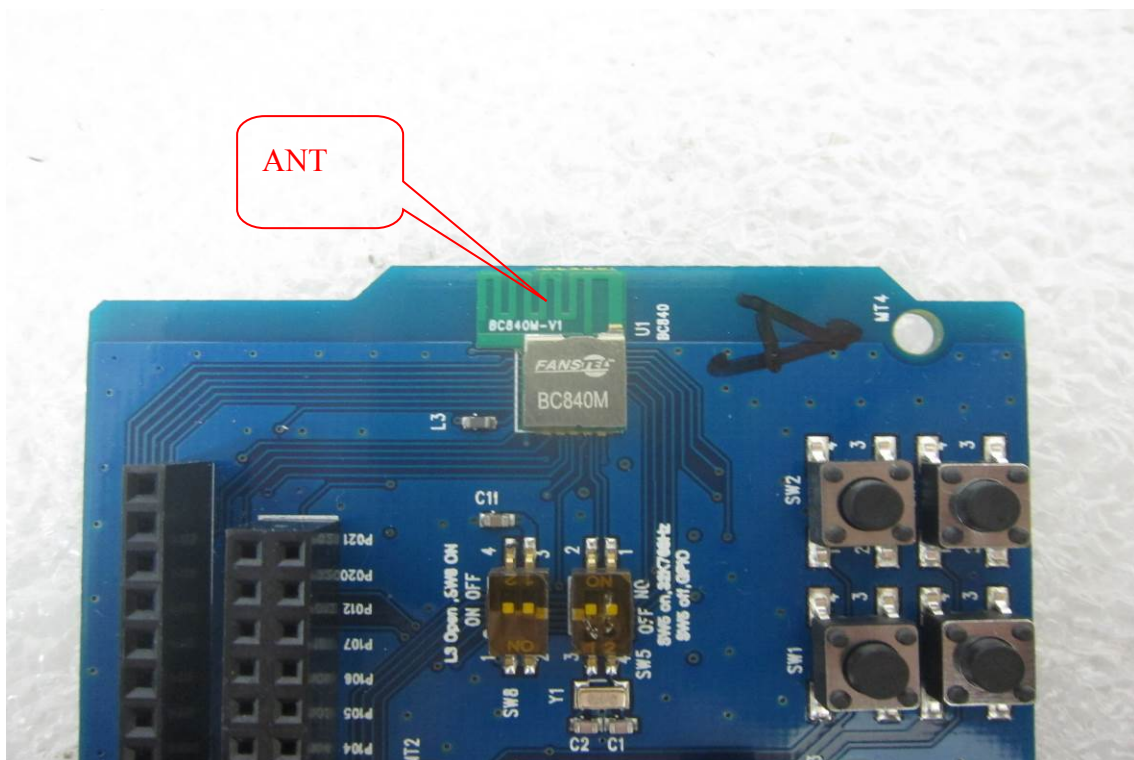
EUT 4 BC840



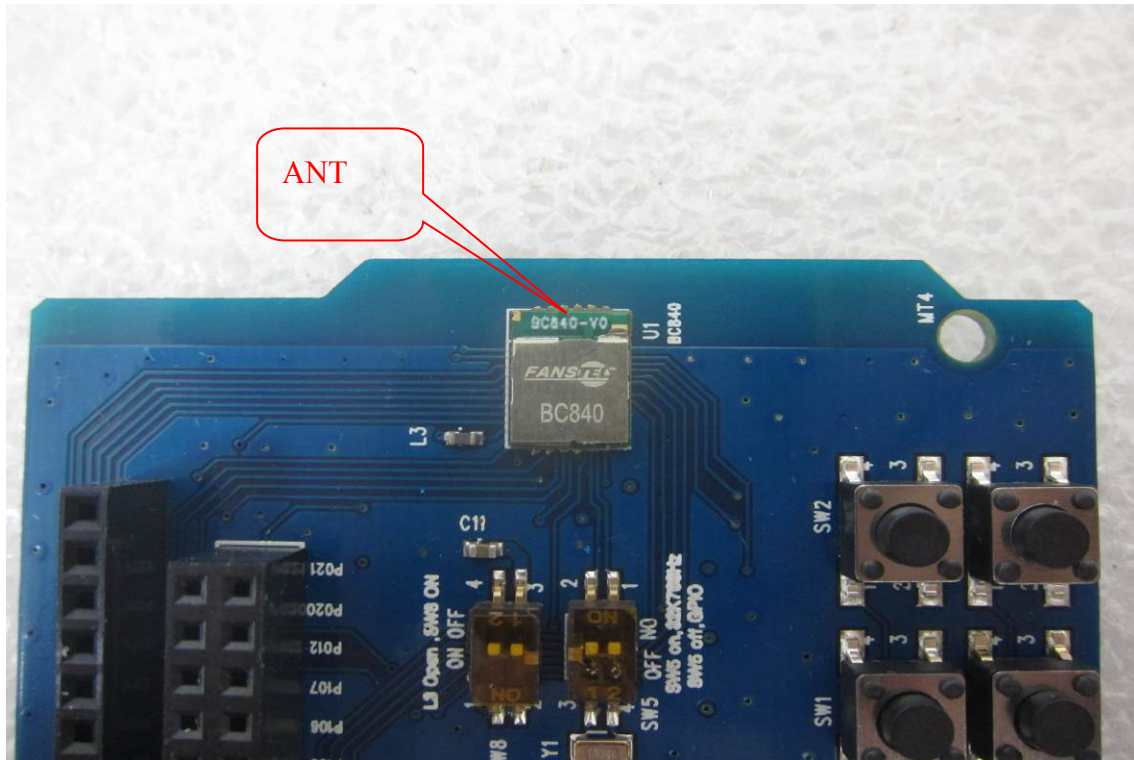
EUT 5 BC840E



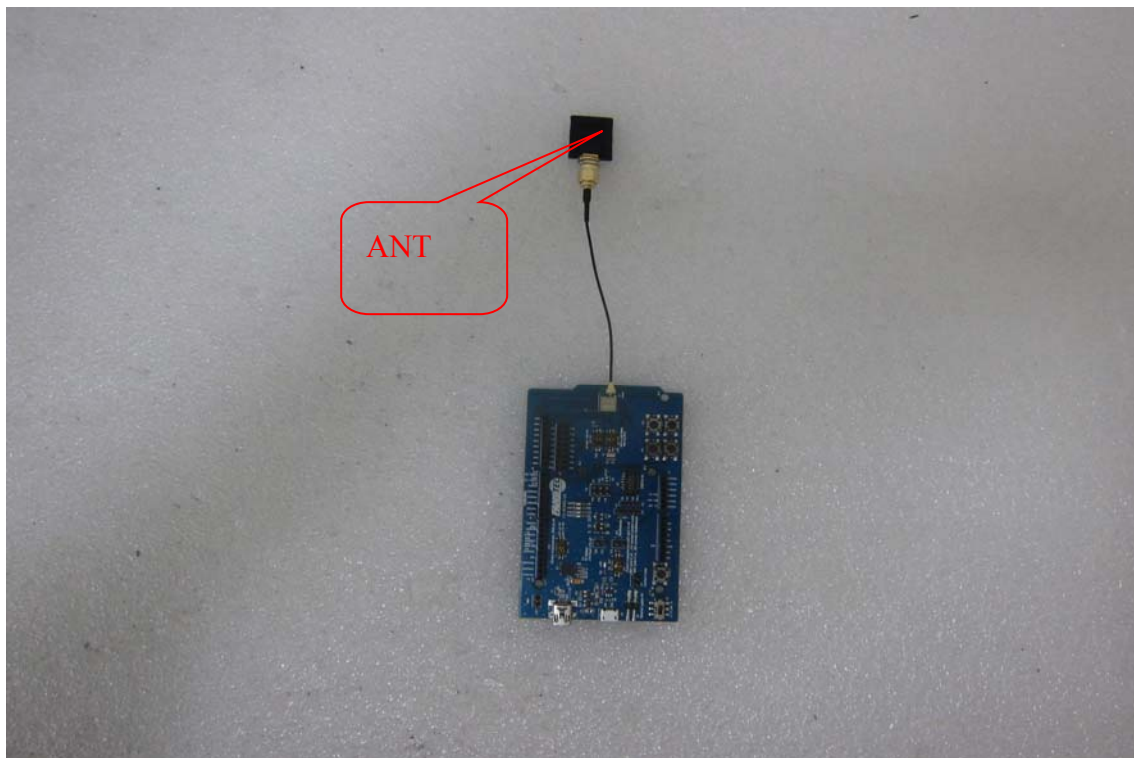
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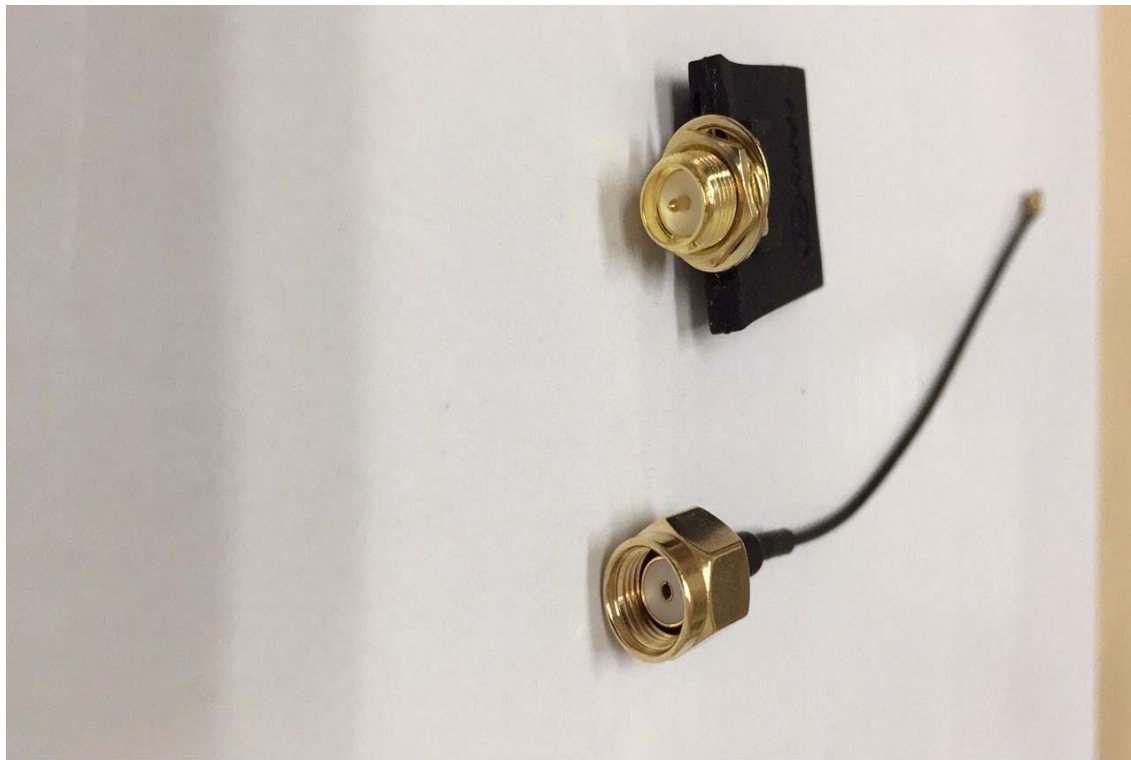
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EUT 8 BC840E



EUT 9 BM832E



~ End of Report ~