



R&TTE RF Test Report



Applicant :	Mobility Sound Technology Ltd.
Address of Applicant :	5F, No. 100, Jian 1 st Road, ZhongHe Dist., New Taipei City #235, Taiwan
Trade name :	Mobility Sound
Equipment Under Test :	Bluetooth Speaker Microphone
Model Number :	BTH-500
Series :	N/A

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12 Photographs of the EUT

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Verification

Applicant :	Mobility Sound Technology Ltd.
Address of Applicant :	5F, No. 100, Jian 1 st Road, ZhongHe Dist., New Taipei City #235, Taiwan
Manufacturer :	Mobility Sound Technology Ltd.
Address of Manufacturer :	5F, No. 100, Jian 1 st Road, ZhongHe Dist., New Taipei City #235, Taiwan
Trade Name :	Mobility Sound
Equipment Under Test :	Bluetooth Speaker Microphone
Model Number :	BTH-500
Serial Number :	N/A
Product Series :	N/A
Working Frequency :	2402~2480
RF Output Power (e.i.r.p.) :	2.53 dBm
Type of Modulation :	FHSS
Sample Received Date :	28-Apr-2017
Test Standard :	EN 300 328 V1.9.1 (2015-02)

Deviations from standard test methods & any other specifications : NONE

Remark:

This report details the results of the test carried out on one sample. This report shows the EUT is technically compliant with the EN 300 328 V1.9.1 (2015-02) official requirements. This report applies to the above sample only and shall not be reproduced in part without written approval of Matrix Test Laboratory.

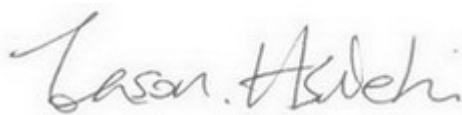
Documented by:



2017-05-10

Kay Wang/ ADM. Dept Staff

Tested by:



2017-05-05

Eason Hsieh / ENG. Dept. Staff

Approved by:



Date: 2017-05-12

Peter Chin / Section Manager

List of Measurements

Applicable Standards		
Sub Clause	Parameter to be measured	Result
4.3.1.1	RF output power	Compliance
4.3.1.2	Duty Cycle, Tx-sequence, Tx-gap	N/A
4.3.1.3	Dwell time, Minimum Frequency Occupation and Hopping Sequence	Compliance
4.3.1.4	Hopping Frequency Separation	Compliance
4.3.1.5	Medium Utilisation (MU) factor	N/A
4.3.1.6	Adaptivity (Adaptive Frequency Hopping)	N/A
4.3.1.7	Occupied Channel Bandwidth	Compliance
4.3.1.8	Transmitter unwanted emissions in the out-of-band domain	Compliance
4.3.1.9	Transmitter unwanted emissions in the spurious domain	Compliance
4.3.1.10	Receiver spurious emissions	Compliance
4.3.1.11	Receiver Blocking	N/A

Note:

- These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm EIRP or for equipment when operating in a mode where the RF Output power is less than 10 dBm EIRP.
- The clause numbers are referenced to EN 300 328 V1.9.1 (2015-02)

Measurement Uncertainty

The following relevant measurement uncertainties have been estimated and determined following the ETSI Technical Report, ETR 028:

Parameter	Uncertainty
Radio Frequency	$\pm 8 \times 10^{-6}$
Total RF power, conducted	+ 0.28dB/ - 0.30dB
RF power density, conducted	+1.5dB/ -1.4dB
Spurious emissions, conducted	+1.2dB/ -1.1dB
All emissions, radiated	± 3.84 dB
Temperature	± 0.5 oC
Humidity	$\pm 2\%$
DC and low frequency voltages	$\pm 1\%$

This reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of $k = 2$, providing a level of confidence of approximately 95%.

1 General Description

1.1 Information of Applicant

Name : Mobility Sound Technology Ltd.
Address : 5F, No. 100, Jian 1st Road, ZhongHe Dist., New Taipei City #235, Taiwan

1.2 Information of Manufacturer

Name : Mobility Sound Technology Ltd.
Address : 5F, No. 100, Jian 1st Road, ZhongHe Dist., New Taipei City #235, Taiwan

1.3 Description of Equipment Under Test (EUT)

Equipment Under Test	:	Bluetooth Speaker Microphone
Model Number of EUT	:	BTH-500
Product Series	:	N/A
Power Supply	:	USB DC 5 V
Frequency Range	:	2402~2480 MHz
RF output power (e.i.r.p.)	:	2.53 dBm
Number of Channels	:	79 Channels
Antenna Specification	:	Chip Antenna/ Gain: 1.3 dBi
Temperature Range	:	-20°C ~ +50°C
Specification	:	Dimensions : 55 mm (L) X 85 mm (W) X 40 mm (H) Weight : 130g Intended Function : The EUT is a Bluetooth Speaker Microphone. Product Variance : N/A.

1.4 Test Instruments

Instrument Name	Manufacture Mode	Model Number	Serial Number	Last Cal. Date	Next Cal. Date
RF Amplifier	Schaffner	CPA9231A	0405	01-JUN-2016	31-MAY-2017
EMI Receiver	R&S	ESCI	100931	25-JUL-2016	24-JUL-2017
Spectrum Analyzer	R&S	FSV	101629	27-JAN-2017	26-JAN-2018
Preamplifier	HD	HD17187	004	01-JUN-2016	31-MAY-2017
Bilog Antenna	TESEQ	CBL6111D	38521	04-JUN-2016	03-JUN-2017
Double-Ridged Waveguide Horn	EMCO	3115	9912-5992	01-JUN-2016	31-MAY-2017
Temp. & Humidity Chamber	MALLIER	MCT-2X-M	13490413-001	15-DEC-2016	14-DEC-2017
Horn Antenna (18-40GHz)	Com-Power	AH-840	101042	02-JUN-2016	01-JUN-2017
Microwave Preamplifier	Com-Power	PAM-840	461269	04-JUN-2016	03-JUN-2017
L.I.S.N.	Mess Tec	NNB-2/16Z	03/1006	22-FEB-2017	22-FEB-2018
L.I.S.N.	EMCIS	3810/2NM	9702-1820	16-JUL-2016	16-JUL-2017
WIDEBAND RADIO COMMUNICATION TESTER	ROHDE&SCHWARZ	CMW-500	141958	05-NOV-2016	05-NOV-2017

1.5 Test Methodology

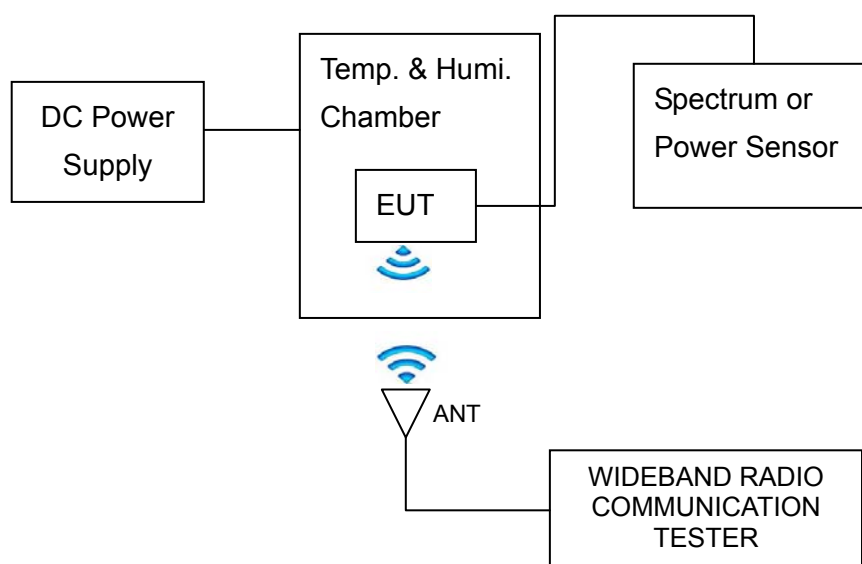
All Tests were performed according to the procedures specified in EN 300 328 V1.9.1 (2015-02).

1.6 Auxiliary Equipments

Provided by Matrix Test Lab.

N/A

1.7 Block Diagram



Note: The EUT has been tested as an independent unit.

1.8 Description of Test Mode

The EUT had been tested under the operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2402
Middle	2441
High	2480

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

1.9 Identifying the Final Test Mode (Worst Case)

Applicability	Test Item	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
☒	ROP	0 to 78	0, 39, 78	FHSS	GFSK	DH1
☐	DC/TS/TG	0 to 78	Hopping mode	FHSS	GFSK	DH1
☒	DT/MFO/HS	0 to 78	Hopping mode	FHSS	8-DPSK	DH1/3/5
☒	HFS	0 to 78	Hopping mode	FHSS	8-DPSK	DH1
☐	MU	0 to 78	Hopping mode	FHSS	GFSK	DH1
☒	OCB	0 to 78	0, 39, 78	FHSS	GFSK 8-DPSK	DH1 DH5
☒	EOB	0 to 78	Hopping mode	FHSS	GFSK	DH1
☒	SE<1G	0 to 78	Hopping mode	FHSS	GFSK	DH1
☒	SE≥1G	0 to 78	Hopping mode	FHSS	GFSK	DH1

Note:

ROP	RF Output Power	OCB	Occupied Channel Bandwidth
DC/TS/TG	Duty Cycle/ Tx-Sequence/ Tx-gap		
DT/MFO/HS	Dwell time/ Minimum Frequency Occupation/ Hopping Sequence	EOB	Transmitter unwanted emissions in the out-of-band domain
HFS	Hopping Frequency Separation	SE<1G	Spurious Emissions below 1GHz
MU	Medium Utilisation	SE≥1G	Spurious Emissions above 1GHz

1.10 Condition of Power Supply

Power Condition	Voltage (V)
V nor	5
V min	4.5
V max	5.5

1.11 EUT Configuration

1. Setup the EUT as shown in Sec.1.7 Block Diagram.
2. Turn on the power of all equipments.
3. Activate the selected Final Test Mode.

2 RF OUTPUT POWER

2.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

2.2 Test Limit

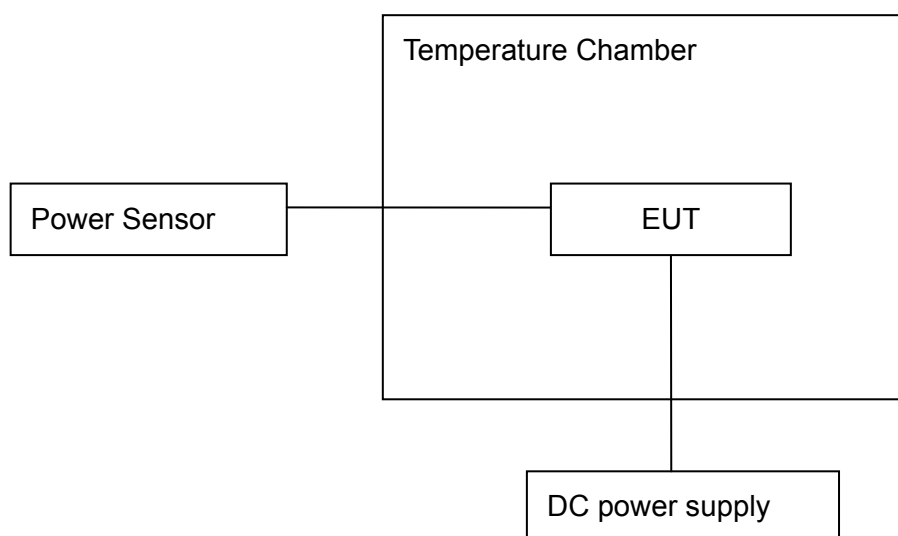
Condition	Frequency Band	Limit (e.i.r.p)
Under all test conditions	2400-2483.5	20 dBm

2.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.2.2.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

2.4 Test Setup



2.5 Test Setup

The measurements for RF output power was performed at both normal environmental conditions and at the extremes of the operating temperature and voltage range. Controlling software has been activated to set the EUT on hopping channel and maximum power level.

2.6 Test Result

Compliance

The final test data are shown on the following page(s).

Test Conditions (1Mbps)		EIRP Power (dBm)		
		Low	Mid	High
		EIRP	EIRP	EIRP
$T_{nom}(25)^{\circ}C$	$V_{nom}(5Vdc)$	0.17	0.72	1.52
$T_{min}(-20)^{\circ}C$	$V_{min}(4.5Vdc)$	0.18	0.72	1.52
	$V_{max}(5.5Vdc)$	0.18	0.72	1.53
$T_{max}(+50)^{\circ}C$	$V_{min}(4.5Vdc)$	0.16	0.72	1.52
	$V_{max}(5.5Vdc)$	0.18	0.71	1.51
Limit		20dBm		
Measurement uncertainty (dB)		+ 0.28/ -0.30		

Test Conditions (2Mbps)		EIRP Power (dBm)		
		Low	Mid	High
		EIRP	EIRP	EIRP
$T_{nom}(25)^{\circ}C$	$V_{nom}(5Vdc)$	1.17	1.67	2.17
$T_{min}(-20)^{\circ}C$	$V_{min}(4.5Vdc)$	1.18	1.68	2.18
	$V_{max}(5.5Vdc)$	1.19	1.68	2.18
$T_{max}(+50)^{\circ}C$	$V_{min}(4.5Vdc)$	1.17	1.67	2.17
	$V_{max}(5.5Vdc)$	1.18	1.67	2.17
Limit		20dBm		
Measurement uncertainty (dB)		+ 0.28/ -0.30		

Test Conditions (3Mbps)		EIRP Power (dBm)		
		Low	Mid	High
		EIRP	EIRP	EIRP
$T_{nom}(25)^{\circ}C$	$V_{nom}(5Vdc)$	1.43	1.63	2.52
$T_{min}(-20)^{\circ}C$	$V_{min}(4.5Vdc)$	1.43	1.63	2.52
	$V_{max}(5.5Vdc)$	1.44	1.63	2.53
$T_{max}(+50)^{\circ}C$	$V_{min}(4.5Vdc)$	1.43	1.62	2.52
	$V_{max}(5.5Vdc)$	1.43	1.62	2.52
Limit		20dBm		
Measurement uncertainty (dB)		+ 0.28/ -0.30		

3 Duty Cycle, Tx-Sequence, Tx-Gap (Not Apply)

3.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

3.2 Test Limit

Condition	Limit
For non-adaptive FHSS equipment	Maximum Tx-sequence time shall be 5 ms while the minimum Tx-gap time shall be 5 ms.
	Duty cycle shall be equal or less than the maximum value declared by the supplier.
For non-adaptive using wide band modulations other than FHSS.	Maximum Tx-Sequence Time = Minimum Tx-gap Time = M (where M is in the range of 3.5 ms to 10 ms.)
	Duty cycle shall be equal or less than the maximum value declared by the supplier.

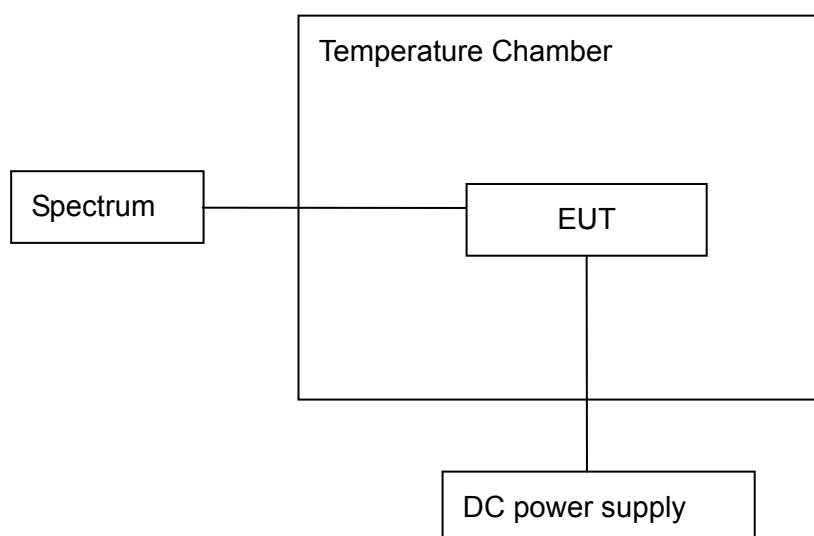
3.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.2.2.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

3.4 Test Setup

The test setup has been constructed as the normal test conditions. The measurement was performed during normal operation (hopping). In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software has been activated to set the EUT on specific status.



3.5 Test Result

N/A

Not applicable for this kind of EUT.

4 DWELL TIME, MINIMUM FREQUENCY OCCUPATION AND HOPPING SEQUENCE

4.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

4.2 Test Limit

Dwell Time	
Condition	Limit
Non-adaptive frequency hopping systems	≤ 15 ms
Adaptive frequency hopping systems	≤ 400 ms

Minimum Frequency Occupation Time	
Condition	Limit
Non-adaptive frequency hopping systems	Equal to one dwell time within a period not exceeding four times the product of the dwell time per hop and the number of hopping frequencies in use
Adaptive frequency hopping systems	

Hopping Sequence(s)	
Condition	Limit
Non-adaptive frequency hopping systems	≥ 15 hopping frequencies or 15/ Minimum Hopping Frequency Separation in MHz, whichever is the greater.
Adaptive frequency hopping systems	Operating frequency band ≥ 58.45 MHz (Operating over a minimum of 70% of the operating in the band 2.4 GHz to 2.4835 GHz)
	≥ 15 hopping frequencies or 15/ Minimum Hopping Frequency Separation in MHz, whichever is the greater.

4.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.4.2.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

4.4 Test Setup

The measurements were only performed at normal test conditions. The equipment was configured to operated at its maximum Dwell Time and maximum Duty Cycle. The measurement was performed on a minimum of 2 hopping frequencies chosen arbitrary from the actual hopping sequence. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software has been activated to set the EUT on specific status.

4.5 Test Result

Compliance

The following table only shows the data of the worst case, 3Mbps.

Dwell Time (3Mbps)									
DH packet	Number of Hopping Channel	Number of transmission in a period (channel number*0.015 sec)				Length of transmission time (ms)	Result (ms)	Limit (ms)	Pass/ Fail
		Period (sec)	Sweep Time (sec)	Times in a sweep	Times in a period				
DH1	79	1.185	5	51	12.087	0.4404	5.323	≤ 15	Pass
DH3	79	1.185	5	25	5.925	1.7017	10.083	≤ 15	Pass
DH5	79	1.185	5	17	4.029	2.9429	11.857	≤ 15	Pass
Dwell Time (sec) = 79 (Total Channel) * 0.4 (sec) * NP * Pulse Time (sec)									

Minimum Frequency Occupation Time (3Mbps)						
DH packet	Number of Hopping Channel	Number of transmission in a period of 4*Dwell Time*number of hopping channel	Length of transmission time (ms)	Result (ms)	Minimum Limit (ms)	Pass/ Fail
DH1	79	2	0.4404	0.8808	0.4404	Pass
DH3	79	3	1.7017	5.1051	1.7017	Pass
DH5	79	3	2.9429	8.8287	2.9429	Pass

Hopping Sequence(s)			
Mode	Amount of Hopping frequency	Limit	Pass/ Fail
8-DPSK	79	≥15 hopping frequencies	Pass

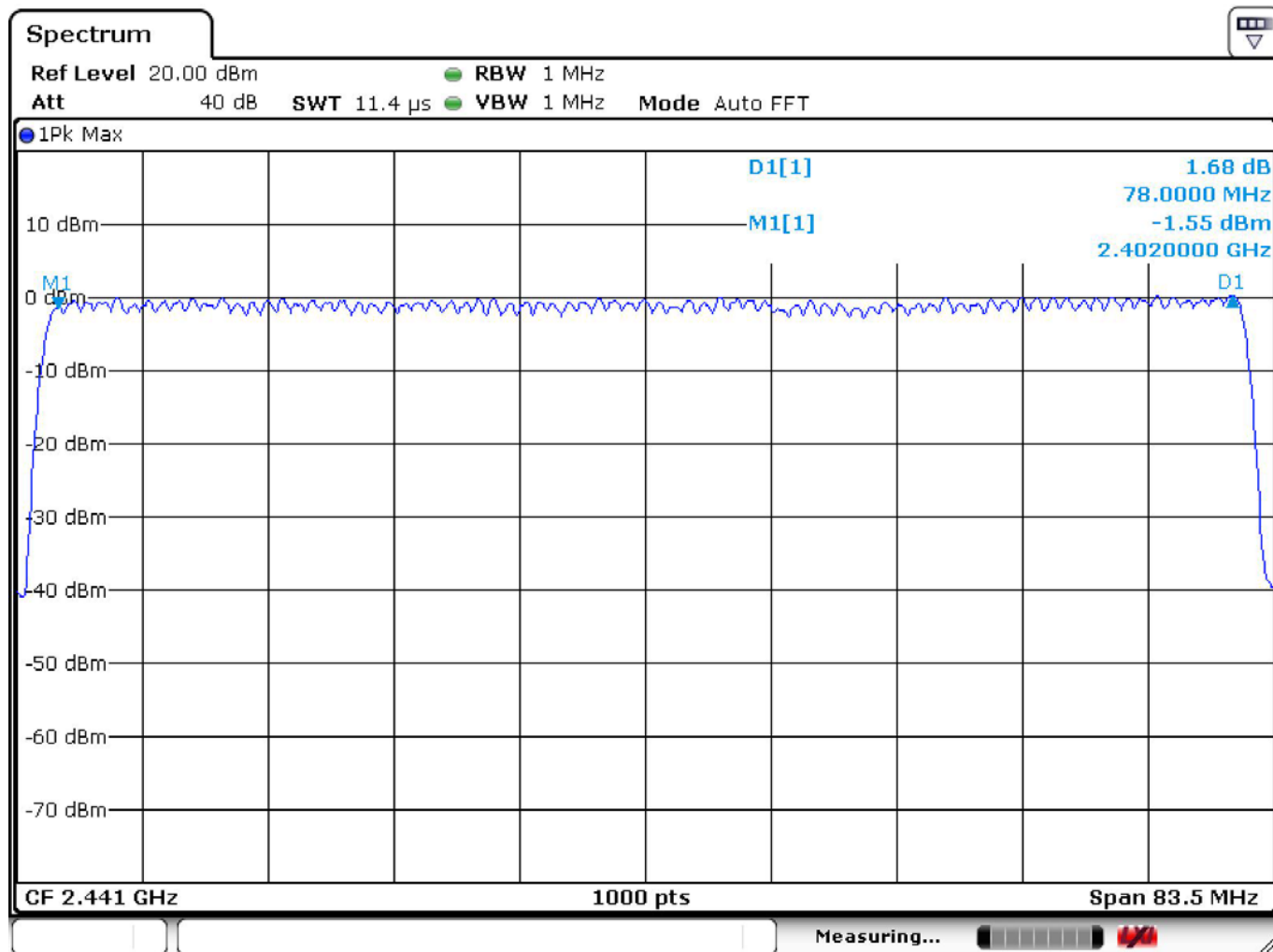
Temperature : 26.3°C

Humidity : 47%

Test Date : 05-May-2017

Tested by : Eason Hsieh

Test Mode : BT EDR(3Mbps) DH5



5 OCCUPIED CHANNEL BANDWIDTH

5.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

5.2 Test Limit

Condition		Limit
All types of equipment		Shall fall completely within the band 2400 to 2483.5 MHz
Additional requirement	For non-adaptive using wide band modulations other than FHSS system and e.i.r.p > 10 dBm.	Less than 20 MHz
	For non-adaptive Frequency Hopping system and e.i.r.p > 10 dBm	Less than 5 MHz

5.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.8.2.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

5.4 Test Setup

The measurements were only performed at normal test conditions. The measurement shall be performed only on the highest frequency within the stated frequency range. Using software to force the EUT to hop or transmit on a single Hopping Frequency. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software has been activated to set the EUT on specific status.

5.5 Test Result

Compliance

The following table only shows the data of the worst case, 3Mbps.

Temperature : 26.3°C

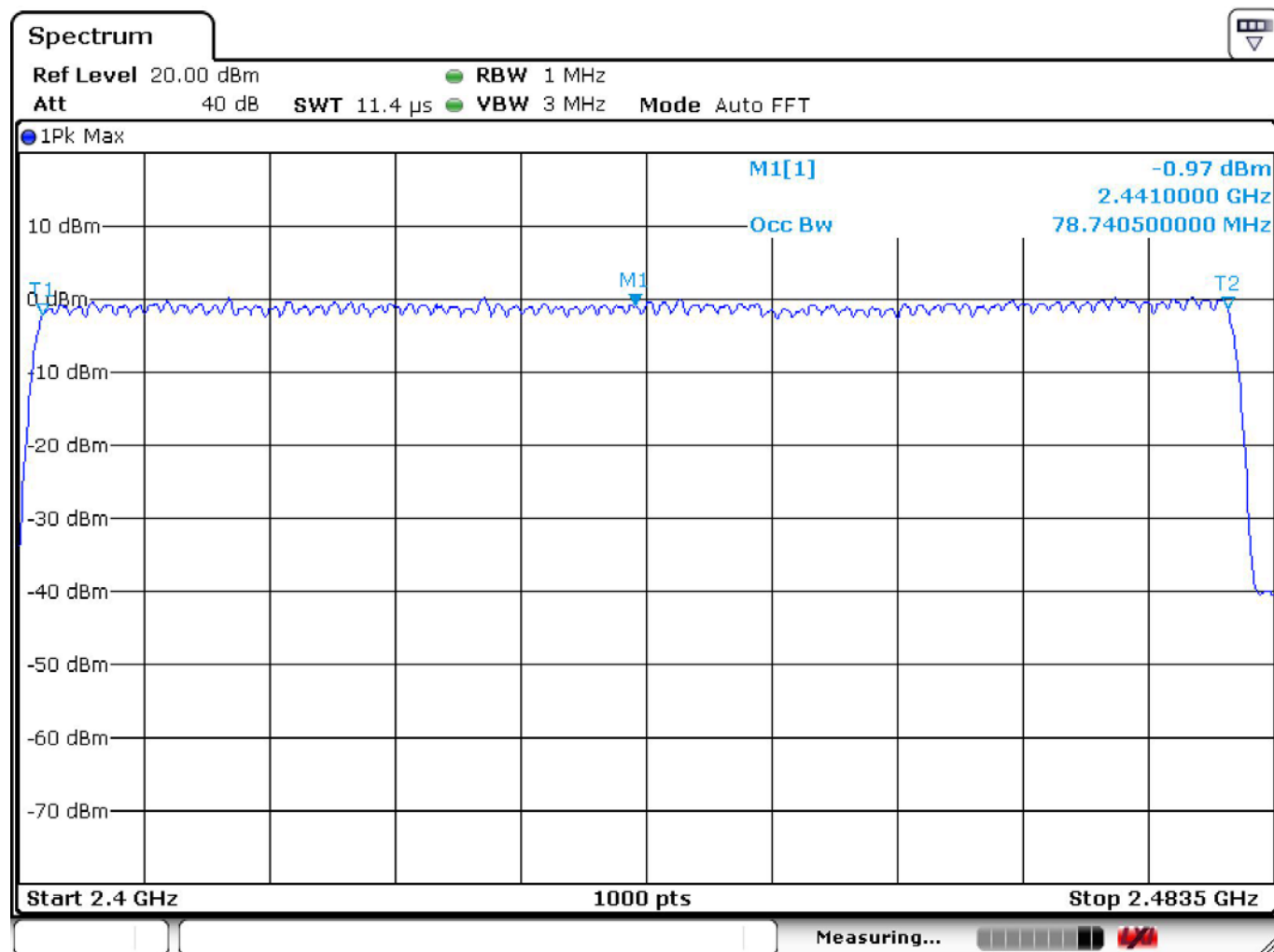
Humidity : 47%

Test Date : 05-May-2017

Tested by : Eason Hsieh

Test Mode : BT (3 Mbps) DH5

Channel : 00



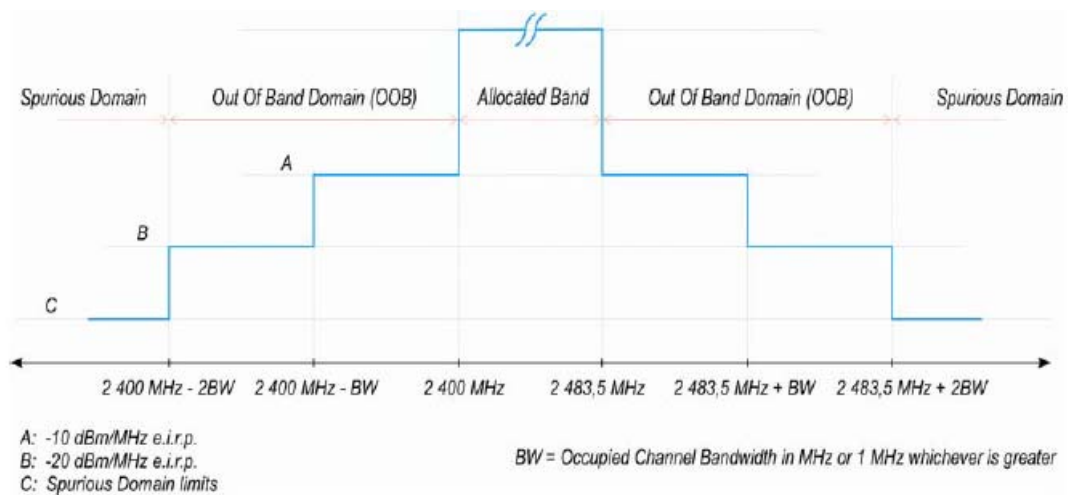
6 TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

6.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

6.2 Test Limit

Condition	Limit
Under all test conditions	The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in below figure.



6.3 Test Setup

The measurements were performed at normal environmental conditions and shall be repeated at the extremes of the operating temperature and voltage range. The equipment was configured to operated under its worst case situation with respect to output power. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. The power source of the EUT has to be connected with the power supply for voltage change. The frequency has to be recored for the right and left end above threshold of highest and lowest channel respectively.

6.4 Test Result

Compliance

Test Conditions		Frequency Range (MHz)	Frequency (MHz)	Transmitter unwanted emission EIRP (dBm/MHz)	Limit (dBm/MHz)
V _{nom} (3)Vdc	T _{nom} (25)°C	2372.52 to 2386.26	2398.444	-58.59	-20
		2386.26 to 2400	2399.835	-58.67	-10
		2483.5 to 2497.22	2484.198	-59.19	-10
		2497.22 to 2510.94	2484.587	-58.51	-20
	T _{min} (-20)°C	2372.52 to 2386.26	2398.766	-59.28	-20
		2386.26 to 2400	2399.576	-58.16	-10
		2483.5 to 2497.22	2483.67	-56.72	-10
		2497.22 to 2510.94	2484.63	-57.26	-20
	T _{max} (50)°C	2372.52 to 2386.26	2398.434	-56.75	-20
		2386.26 to 2400	2399.952	-56.51	-10
		2483.5 to 2497.22	2484.396	-57.98	-10
		2497.22 to 2510.94	2484.894	-57.16	-20

7 HOPPING FREQUENCY SEPARATION

7.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

7.2 Test Limits

Condition	Limit
Non-adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be equal to Occupied Channel Bandwidth of a single hop, with a minimum separation of 100 kHz.
Adaptive frequency hopping systems	The minimum Hopping Frequency Separation shall be 100 kHz.

7.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.5.2

Measurement	
☒ Conducted measurement	☐ Radiated measurement

7.4 Test Setup

The measurements were performed at normal test conditions. The measurement was performed on 2 adjacent hopping frequencies. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software has been activated to set the EUT on specific status.

7.5 Test Result

Compliance

Channel Number	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz) ^{Note1}	Pass/ Fail
00	2402	1	1	Pass
39	2441	1	1	Pass
78	2480	1	1	Pass

Note1: The manufacturer declares that the Occupied Channel Bandwidth is 1MHz.

8 MEDIUM UTILISATION (MU) FACTOR (NOT APPLY)

8.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

8.2 Test Limit

Condition	Limit
For non-adaptive Frequency Hopping equipment	$\leq 10\%$

8.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.2.2.

8.4 Test Setup

The measurements were performed at normal test conditions. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software has been activated to set the EUT on specific status.

8.5 Test Result

N/A

9 TRANSMITTER SPURIOUS EMISSIONS

9.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

9.2 Test Limit

Frequency Range	Maximum Power Limit (e.r.p. (≤ 1 GHz) e.i.r.p. (>1 GHz))	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87.5 MHz	-36 dBm	100 kHz
87.5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

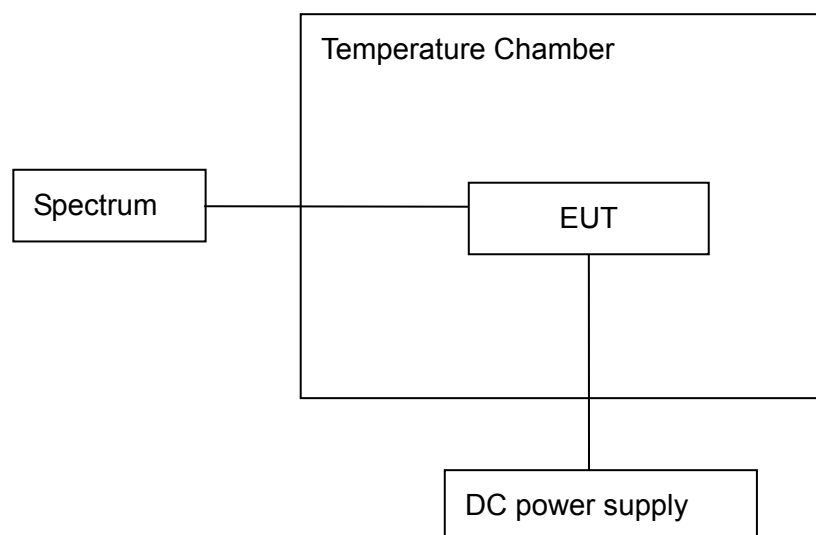
9.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.10.2.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

9.4 Test Setup

The measurements were performed at normal test conditions. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software has been activated to set the EUT on specific status.



9.5 Test Result

Compliance

The final test data are shown on the following page(s).

Test Conditions		Frequency (MHz)	Transmitter unwanted emission in spurious domain (dBm)	Limit (dBm)
30 to 1000 MHz	$T_{nom}(25)^{\circ}C$ $V_{nom}(5)V_{dc}$	681.782	-62.24	☐ -54 ☒ -36
1 to 12.75 GHz	$T_{nom}(25)^{\circ}C$ $V_{nom}(5)V_{dc}$	6132.434	-62.29	-30

10 RECEIVER SPURIOUS EMISSIONS

10.1 Test Instruments

Refer to Sec. 1.4 Test Instruments.

10.2 Test Limit

Frequency Range	Maximum Power Limit (e.r.p. (≤ 1 GHz) e.i.r.p. (>1 GHz))
30 MHz ~ 1 GHz	-57 dBm
1 GHz ~ 12.75 GHz	-47 dBm

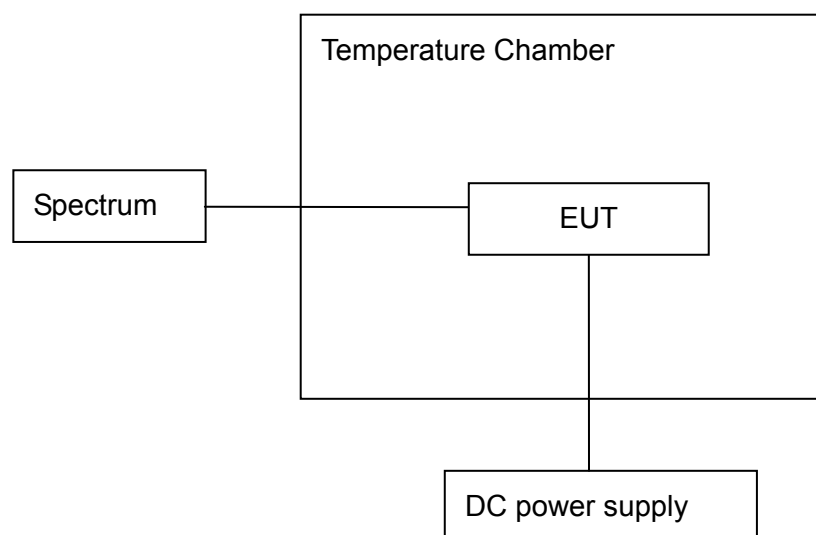
10.3 Test Procedures

Please refer to ETSI EN 300 328 (V1.8.1) clause 5.3.11.2.

Measurement	
☒ Conducted measurement	☐ Radiated measurement

10.4 Test Setup

The measurements were performed at normal test conditions. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator. Controlling software has been activated to set the EUT on specific status.



10.5 Test Result

Compliance

The final test data are shown on the following page(s).

Test Conditions			Frequency (MHz)	Transmitter unwanted emission in spurious domain (dBm)	Limit (dBm)
30 to 1000 MHz	$T_{nom}(25)^{\circ}C$	CH 00, 2402	55.063	-64.24	-57
	$V_{nom}(5)Vdc$	CH 78, 2480	667.491	-63.05	-57
1 to 12.75 GHz	$T_{nom}(25)^{\circ}C$	CH 00, 2402	3301.542	-62.32	-47
	$V_{nom}(5)Vdc$	CH 78, 2480	8817.657	-64.72	-47

11 Photographs of Test

11.1 Temperature chamber



Front View

12 Photographs of the EUT



Front View of the EUT



Rear View of the EUT



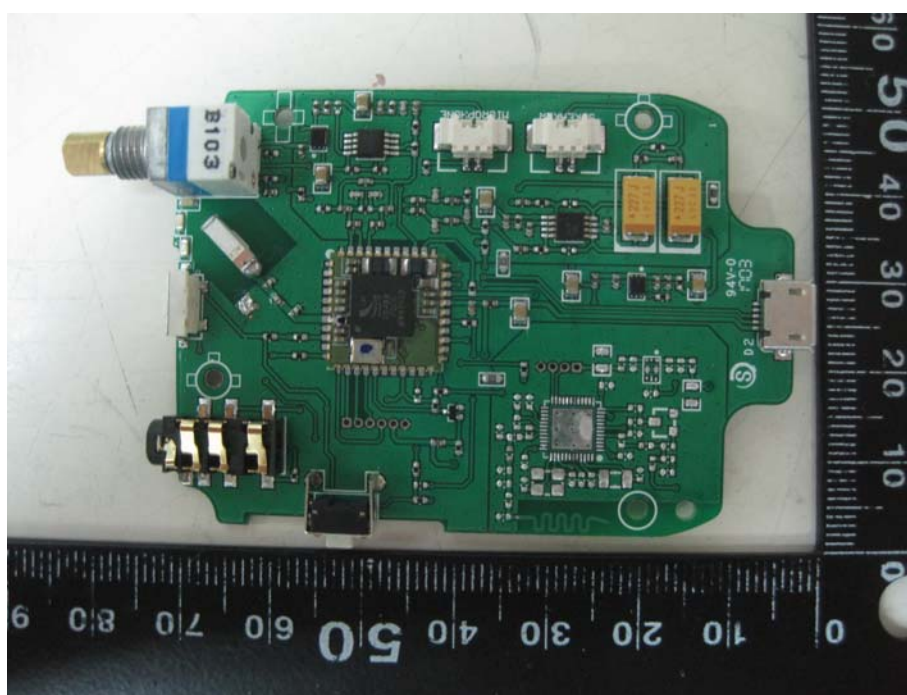
Side View of the EUT



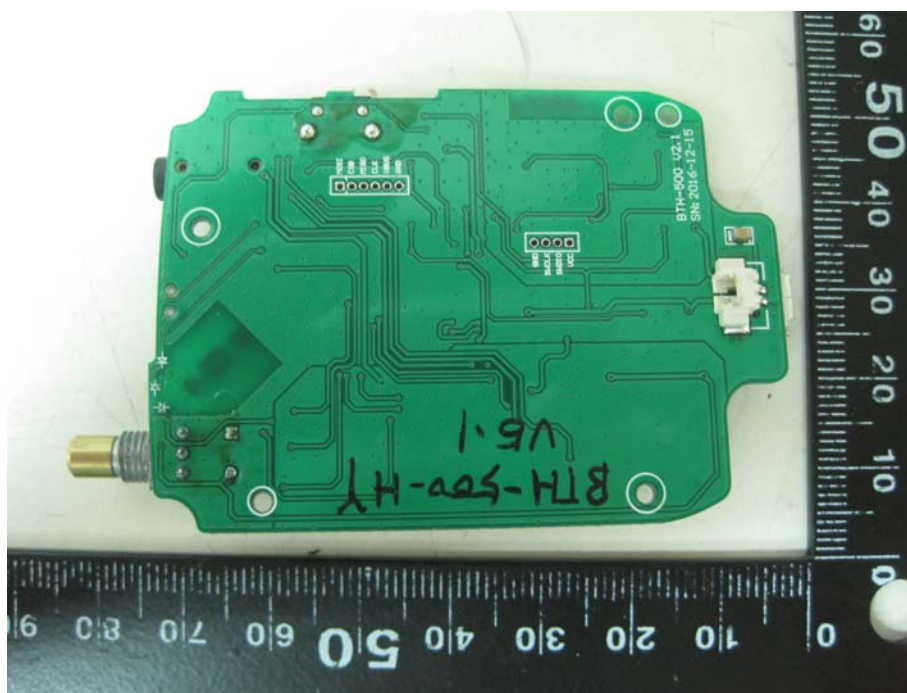
Side View of the EUT



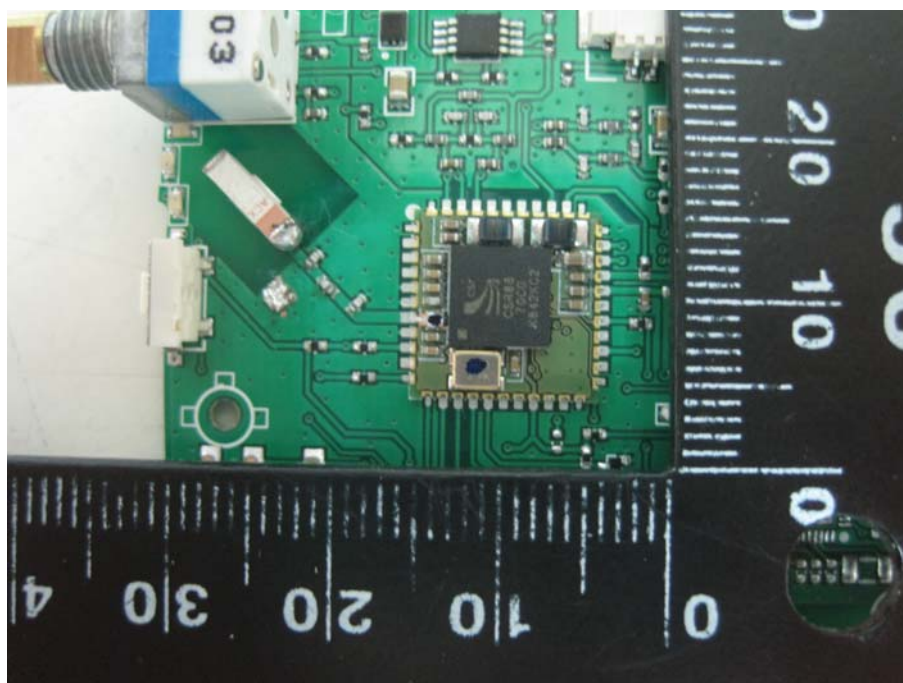
Inside View of the PCB



Front View of the PCB



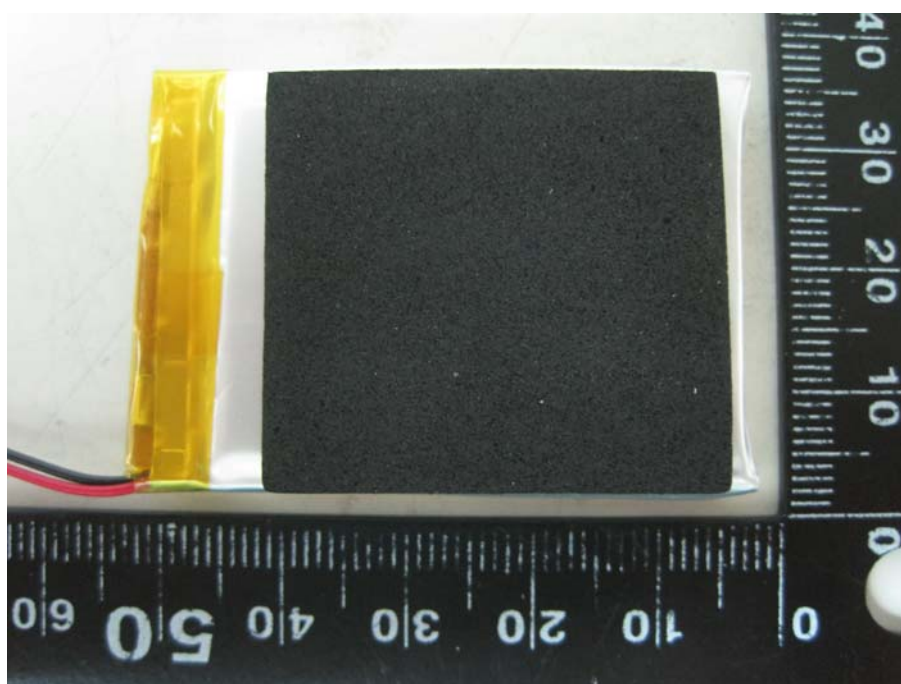
Rear View of the PCB



View of the Bluetooth module



Front View of the Battery



Rear View of the Battery



USB Cable



View of the Speaker