



RF Test Report

For

Applicant Name: Micron Electronics LLC.
Address: 1001 Yamato Road Suite 400 Boca Raton, Florida 33431 United States
EUT Name: WB100
Brand Name: /
Model Number: WB100

Issued By

Company Name: BTF Testing Lab (Shenzhen) Co., Ltd.
Address: F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China

Report Number: BTF230815R00201
Test Standards: 47 CFR Part 15.247

Test Conclusion: Pass
FCC ID: ZKQ-WB100
Test Date: 2023-06-30 to 2023-07-14
Date of Issue: 2023-07-30

Prepared By:

Elma. Yang

Date:

elma.yang / Project Engineer
2023-07-30

Approved By:

Ryan.CJ

Date:

Ryan.CJ / EMC Manager
2023-07-30



Note: All the test results in this report only related to the testing samples. Which can be duplicated completely for the legal use with approval of applicant; it shall not be reproduced except in full without the written approval of BTF Testing Lab (Shenzhen) Co., Ltd., All the objections should be raised within thirty days from the date of issue. To validate the report, you can contact us.

Revision History		
Version	Issue Date	Revisions Content
R_V0	2023-07-30	Original
Note:	Once the revision has been made, then previous versions reports are invalid.	

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1 Test Summary

Test Item	Section in CFR 47	Result
RF Output Power	Part 2.1046	Pass
Peak-To-Average Ratio	Part 22.913(d) Part 24.232 (d) Part 27.50(d)(5)	Pass
Modulation Characteristics	Part 2.1047	N/A
99% & -26 dB Occupied Bandwidth	Part 2.1049	Pass
Spurious Emissions at Antenna Terminal	Part 2.1051 Part 22.917 Part 24.238 Part 27.53(g) Part 27.53(h)	Pass
Field Strength of Spurious Radiation	Part 2.1053 Part 22.917 Part 24.238 Part 27.53(g) Part 27.53(h)	Pass
ERP,EIRP	Part 22.913(a) Part 24.232(c) Part 27.50(c) Part 27.50(d)	Pass
Out of band emission, Band Edge	Part 2.1051 Part 22.917 Part 24.238 Part 27.53(g) Part 27.53(h)	Pass
Frequency stability vs. temperature	Part 2.1055(a)(1)(b) Part 22.355 Part 24.235 Part 27.54	Pass
Frequency stability vs. voltage	Part 2.1055(d)(1)(2) Part 22.355 Part 24.235 Part 27.54	Pass

Note: 1. Pass: The EUT complies with the essential requirements in the standard.

2. The conclusion of this test report is judged by actual test data without considering measurement uncertainty.

2 General Information

2.1 General Description of EUT

Description of Device (EUT)

EUT Name : WB100
Model No. : WB100
DIFF. : /
Power supply : DV 3.8V by battery or DC 5V by USB

Support Bands : LTE Band 2/4/5/12/66

Channel Bandwidth : LTE Band 2: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 4: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz
LTE Band 5: 1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 12: 1.4MHz, 3MHz, 5MHz, 10MHz
LTE Band 66: 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz, 20MHz

TX Frequency : LTE Band 2: 1850 ~ 1910 MHz
LTE Band 4: 1710 ~ 1755 MHz
LTE Band 5: 824 ~ 849 MHz
LTE Band 12: 699MHz ~ 716MHz
LTE Band 66: 1710MHz ~ 1780MHz

Modulation type : QPSK, 16QAM

Antenna Type : Internal antenna, Antenna information is provided by applicant.
LTE Band 2: Maximum Gain is 0.37 dBi.
LTE Band 4: Maximum Gain is 0.35 dBi
LTE Band 5: Maximum Gain is -0.13 dBi
LTE Band 12: Maximum Gain is -0.12 dBi.
LTE Band 66: Maximum Gain is 0.36 dBi

Software version : WB01_V

Hardware version : WB01v01.01b05.00

Remark 1: The worst-case simultaneous transmission configuration was evaluated with no non-compliance found. Results in this report are only for 4G function, and there is no other transmitter involved.

2.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with Section Part 22 subpart H and Part 24 subpart E of the FCC CFR 47 Rules.

2.3 Test Facility

Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Description:	All measurement facilities used to collect the measurement data are located at F101,201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
FCC Registration Number:	518915
Designation Number:	CN1330
Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.

2.4 Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or SDoC
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2.5 Test Conditions

Items	Required	Actual
Temperature range:	15-35°C	24°C
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

2.6 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2 and TR100 028-1/-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Measurement	Value
RF output power, conducted	0.63 dB
Conducted spurious emissions	0.94 dB
Radiated emissions (< 1 GHz)	4.12 dB
Radiated emissions (> 1 GHz)	4.16 dB
Occupied Channel Bandwidth	69 KHz
Frequency Stability	0.4 KHz
Temperature	0.82 °C
Humidity	4.1 %

3 Test Instruments list

Conducted Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022.11.24	2023.11.23	☑
WIDEBAND RADIO COMMUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022.11.24	2023.11.23	☑
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022.11.24	2023.11.23	☑
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022.11.24	2023.11.23	☑
RF Sensor Unit	Techy	TR1029-2	/	2022.11.24	2023.11.23	☑
RF Control Unit	Techy	TR1029-1	/	2022.11.24	2023.11.23	☑
RFTest software	/	V1.00	/	/	/	☑

Radiated Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022.11.24	2023.11.23	☑
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022.11.24	2023.11.23	☑
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021.11.28	2023.11.27	☑
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021.11.28	2023.11.27	☑
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/	☑
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF1-SMASMAM-10m	21101566	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF1-SMASMAM-1m	21101568	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022.11.24	2023.11.23	☑
RE Cable	REBES Talent	UF1-SMASMAM-10m	21101566	2022.11.24	2023.11.23	☑

Preamplifier	SCHWARZBECK	BBV9744	00246	2022.11.24	2023.11.23	☒
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2022.5.22	2024.5.21	☒
Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023.3.24	2024.3.23	☒
Broadband Preamplifier	Schwarzbeck	BBV9718D	00008	2023.3.24	2024.3.23	☒
Preamplifier	SCHWARZBECK	BBV9744	00246	2022.11.24	2023.11.23	☒

4 System test configuration

4.1 Test mode

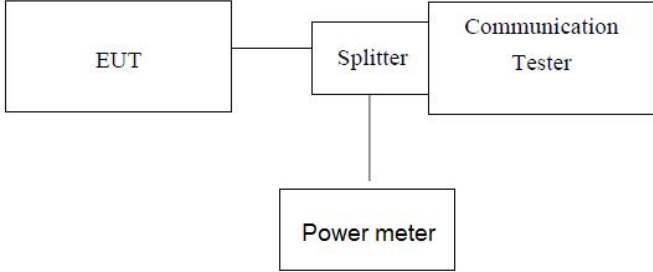
During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

Test modes		
Band	Radiated	Conducted
LTE Band 2	■ QPSK link, 16QAM link	■ QPSK link, 16QAM link
LTE Band 4	■ QPSK link, 16QAM link	■ QPSK link, 16QAM link
LTE Band 5	■ QPSK link, 16QAM link	■ QPSK link, 16QAM link
LTE Band 12	■ QPSK link, 16QAM link	■ QPSK link, 16QAM link
LTE Band 66	■ QPSK link, 16QAM link	■ QPSK link, 16QAM link

Note: Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas License Digital Systems v03r1 with maximum output power.

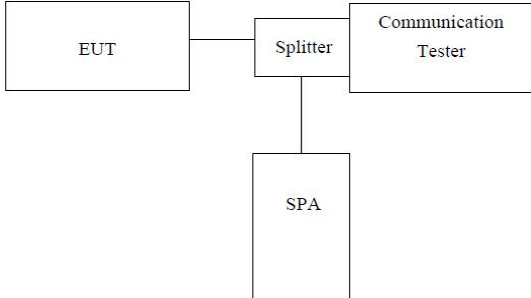
Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

4.2 Conducted Output Power

Test Requirement:	Part 2.1046
Test Method:	ANSI C63.26:2015
Limit:	N/A
Test setup:	 <p><i>Note: Measurement setup for testing on Antenna connector</i></p>
Test Procedure:	<ol style="list-style-type: none"> 1. The transmitter output port was connected to base station. 2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement. 3. Set EUT at maximum power through base station. 4. Select lowest, middle, and highest channels for each band and different modulation. 5. Measure the maximum burst average power.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

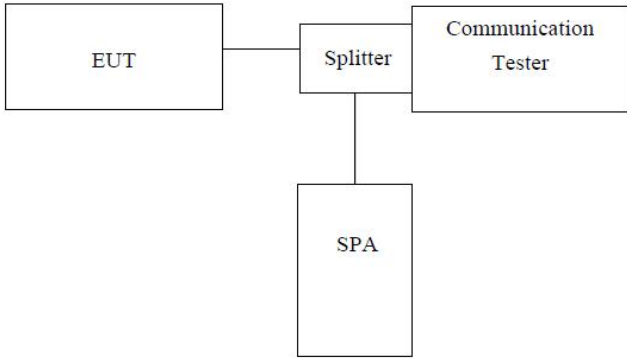
Note: Please refer to Appendix A of the Appendix Test Data.

4.3 Peak-to-Average Ratio

Test Requirement:	Part 22.913(d), FCC part24.232(d) and FCC part27.50(d)(5)
Test Method:	ANSI C63.26:2015
Test Limit:	Used complementary cumulative distribution function (CCDF) of analyzer to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time
Test setup:	 <p><i>Note: Measurement setup for testing on Antenna connector</i></p>
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.7 2. The EUT was connected to spectrum and system simulator via a power divider 3. Using the CCDF measurement of spectrum analyzer; 4. Set RBW\geqOBW or specified reference bandwidth; 5. Set the number of counts to a value that stabilizes the measured CCDF curve; 6. Set the measurement interval as 1ms 7. Record the maximum PAPR level associated with a probability of 0.1%.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Note: Please refer to Appendix A of the Appendix Test Data.

4.4 Occupied Bandwidth

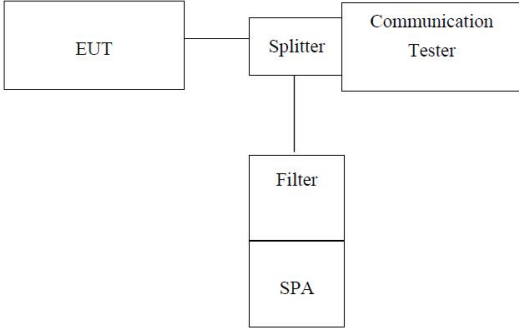
Test Requirement:	2.1049
Test Method:	ANSI C63.26:2015
Test Limit:	N/A
Test setup:	 <p><i>Note: Measurement setup for testing on Antenna connector</i></p>
Test Procedure:	<ol style="list-style-type: none"> 1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer, set center frequency to channel center frequency. 2. RBW was set to about 1%-5% of emission OBW, VBW\geq 3 X RBW. 3. Set spectrum analyzer detection mode to peak, and the trace mode to max hold. 4. Use the 99% OBW function, The 99% power OBW can be found on the plot, determine the "-26dB amplitude" as equal to reference value -26dB.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Note: Please refer to Appendix A of the Appendix Test Data.

4.5 Modulation Characteristic

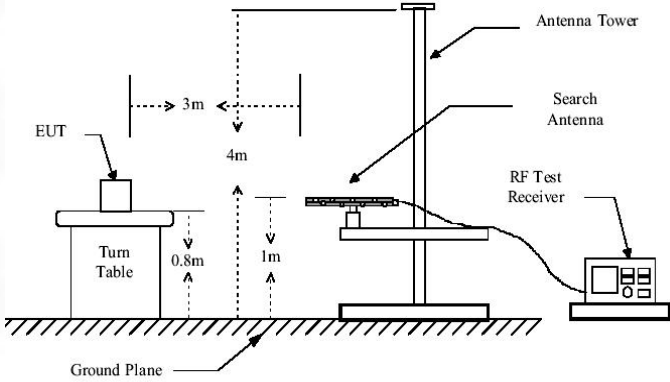
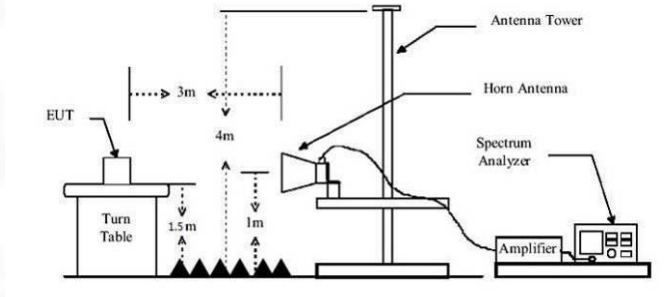
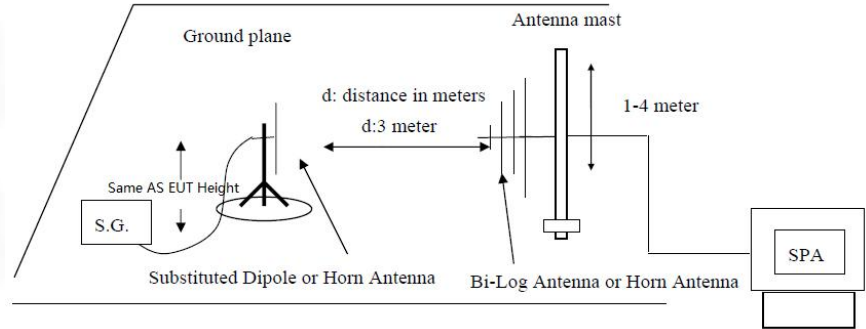
According to FCC § 2.1047(d), Part 24E & Part 27 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

4.6 Out of band emission at antenna terminals

Test Requirement:	Part 2.1051 Part 22.917 Part 24.238 Part 27.53(g) Part 27.53(h)
Test Method:	ANSI C63.26:2015
Limit:	$\leq -13\text{dBm}$ (LTE Band 5) $\leq -13\text{dBm}$ (LTE Band 2) $\leq -13\text{dBm}$ (LTE Band 12) $\leq -13\text{dBm}$ (LTE Band 4) $\leq -13\text{dBm}$ (LTE Band 66)
Test setup:	 <p><i>Note: Measurement setup for testing on Antenna connector</i></p>
Test Procedure:	<ol style="list-style-type: none"> 1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. 2 The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic. 3 For the out of band: Set the RBW=1MHz, VBW = 3MHz, Start=30MHz, Stop= 10th harmonic. 4 Band Edge Requirements: In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

Note: Please refer to Appendix A of the Appendix Test Data.

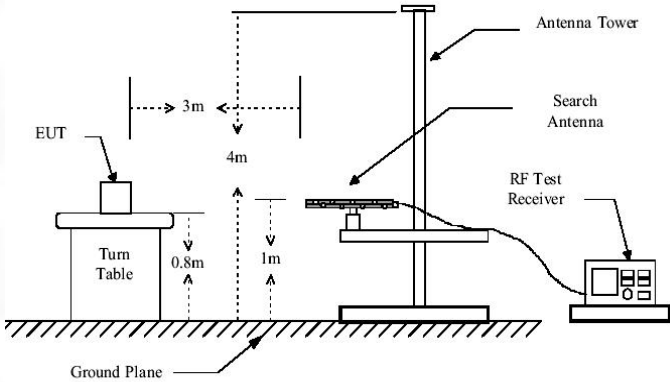
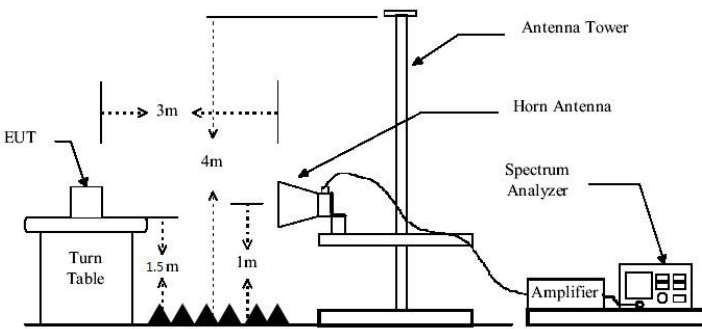
4.7 ERP, EIRP Measurement

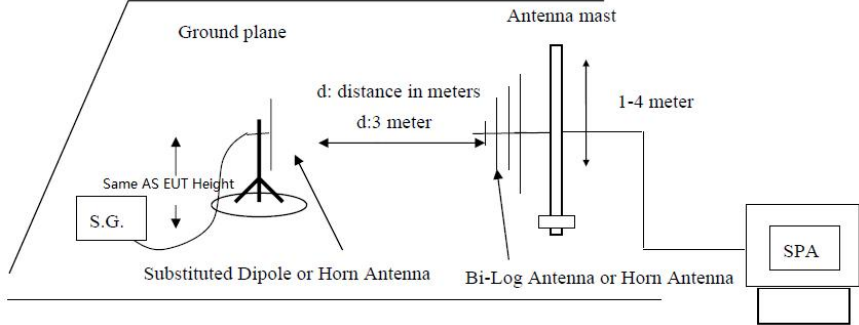
Test Requirement:	Part 22.913(a), Part 24.232(c), Part 27.50(c), Part 27.50(d)
Test Method:	ANSI C63.26:2015
Limit:	$ERP \leq 7W(38.45dBm)$ (LTE Band 5) $EIRP \leq 2W(33.00dBm)$ (LTE Band 2) $ERP \leq 3W(34.77dBm)$ (LTE Band 12) $EIRP \leq 1W(30.00dBm)$ (LTE Band 4) $EIRP \leq 1W(30.00dBm)$ (LTE Band 66)
Test setup:	<p>Below 1GHz</p>  <p>Above 1GHz</p>  <p>Substituted method:</p> 

Test Procedure:	<ol style="list-style-type: none">1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.2. During the measurement, the EUT was communication with the station. The highest emission was recorded with the rotation of the turntable and the lowering of the test antenna from 4m to 1m. The reading was recorded and the field strength (E in dBuV/m) was calculated.3. ERP were measured using a substitution method. The EUT was replaced by dipole antenna connected, the S.G. output was recorded and ERP was calculated asfollows: $\text{ERP} = \text{S.G. output (dBm)} + \text{Antenna Gain (dBd)} - \text{Cable Loss (dB)}$4. EIRP were measured using a substitution method. The EUT was replaced by or horn antenna connected, the S.G. output was recorded and EIRP was calculated as follows: $\text{EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain (dBi)} - \text{Cable Loss (dB)}$
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass
Remark:	H,E1,E2 mean for EUT polarization of X, Y, Z

Note: Please refer to Appendix A of the Appendix Test Data.

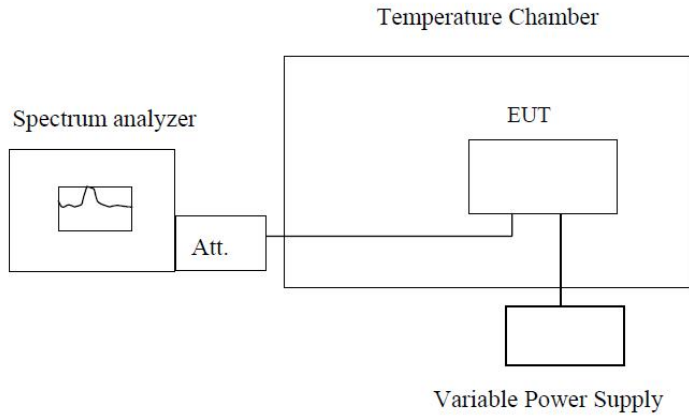
4.8 Field strength of spurious radiation measurement

Test Requirement:	Part 2.1053 Part 22.917 Part 24.238 Part 27.53(g) Part 27.53(h)
Test Method:	ANSI C63.26:2015
Limit:	$\leq -13\text{dBm}$ (LTE Band 5) $\leq -13\text{dBm}$ (LTE Band 2) $\leq -13\text{dBm}$ (LTE Band 12) $\leq -13\text{dBm}$ (LTE Band 4) $\leq -13\text{dBm}$ (LTE Band 66)
Test setup:	<p>Below 1GHz</p>  <p>Above 1GHz</p>  <p>Substituted method:</p>

	 <p>The diagram illustrates the test setup. A ground plane is shown at the bottom. An antenna mast is positioned on the right, with a height of 1-4 meters. A substituted dipole or horn antenna is positioned on the left, at the same height as the EUT. The distance d between the antenna and the EUT is 3 meters. A spectrum analyzer (SPA) is connected to the antenna mast. The EUT is labeled 'S.G.' and 'Same AS EUT Height'.</p>
Test Procedure:	<ol style="list-style-type: none"> 1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer. 2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations. 3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method. 4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency. $\text{ERP / EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain(dB/dBi)} - \text{Cable Loss (dB)}$
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass

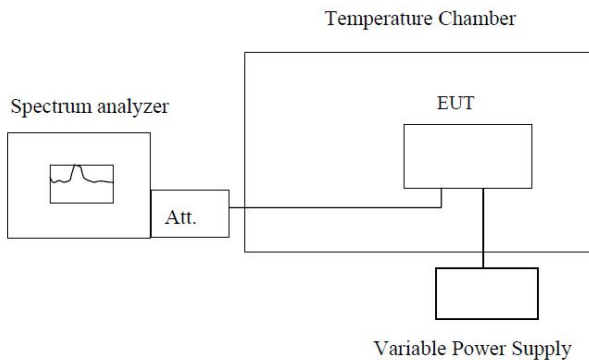
Note: Please refer to Appendix A of the Appendix Test Data.

4.9 Frequency stability V.S. Temperature measurement

Test Requirement:	Part 2.1055(a)(1),(b) Part 22.355 Part 24.235 Part 27.54
Test Method:	ANSI C63.26:2015
Limit:	$\pm 2.5\text{ppm}$ (Part 22) Within the authorized bands of operation(Part 24, Part 27)
Test setup:	 <p>Note : Measurement setup for testing on Antenna connector</p>
Test procedure:	<ol style="list-style-type: none"> 1. The equipment under test was connected to an external DC power supply and input rated voltage. 2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. 3. The EUT was placed inside the temperature chamber. 4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency. 5. Turn EUT off and set the chamber temperature to -20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. 6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass
Remark:	If all frequencies stability are comply with the lower limit, then all results can be considered qualified

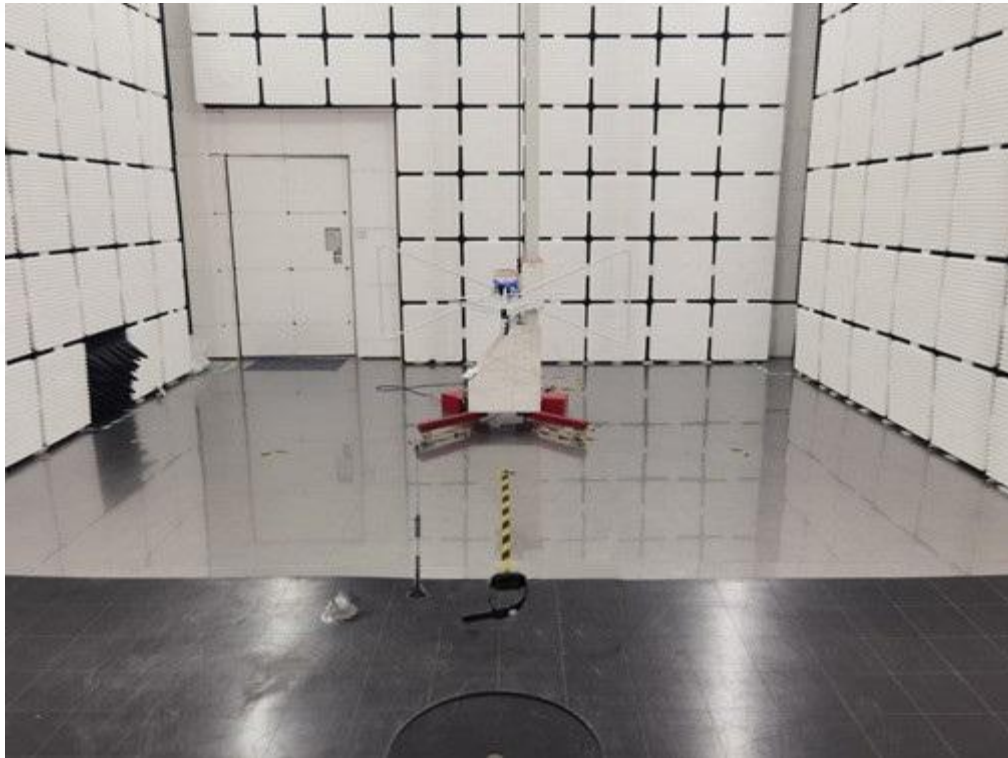
Note: Please refer to Appendix A of the Appendix Test Data.

4.10 Frequency stability V.S. Voltage measurement

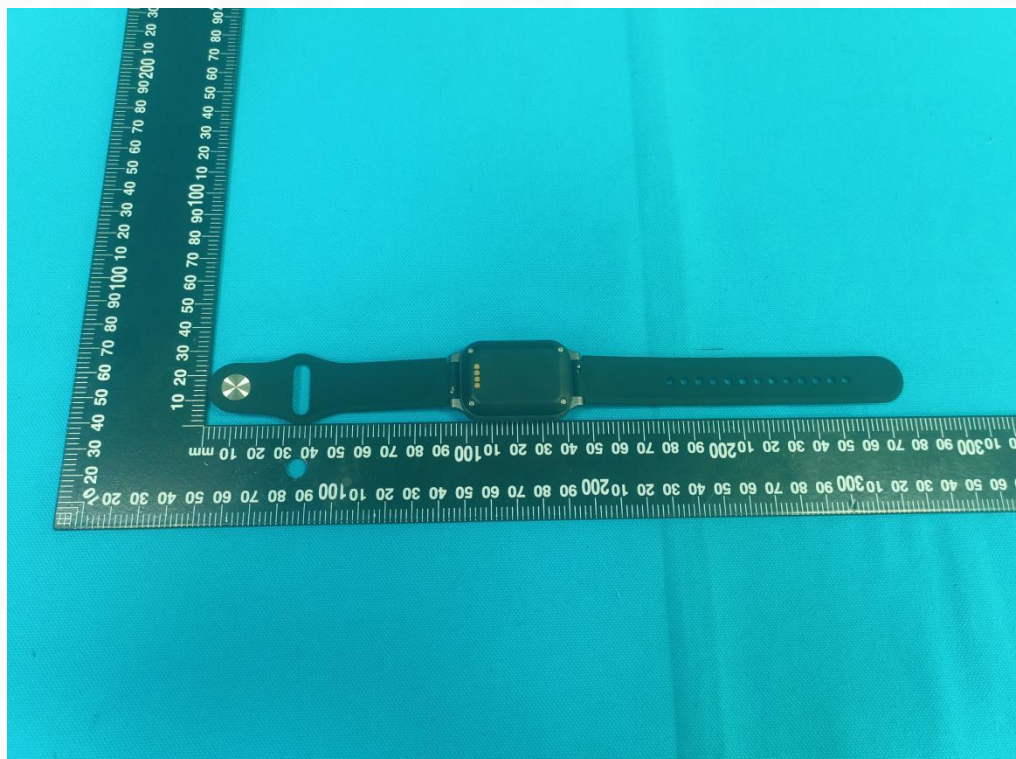
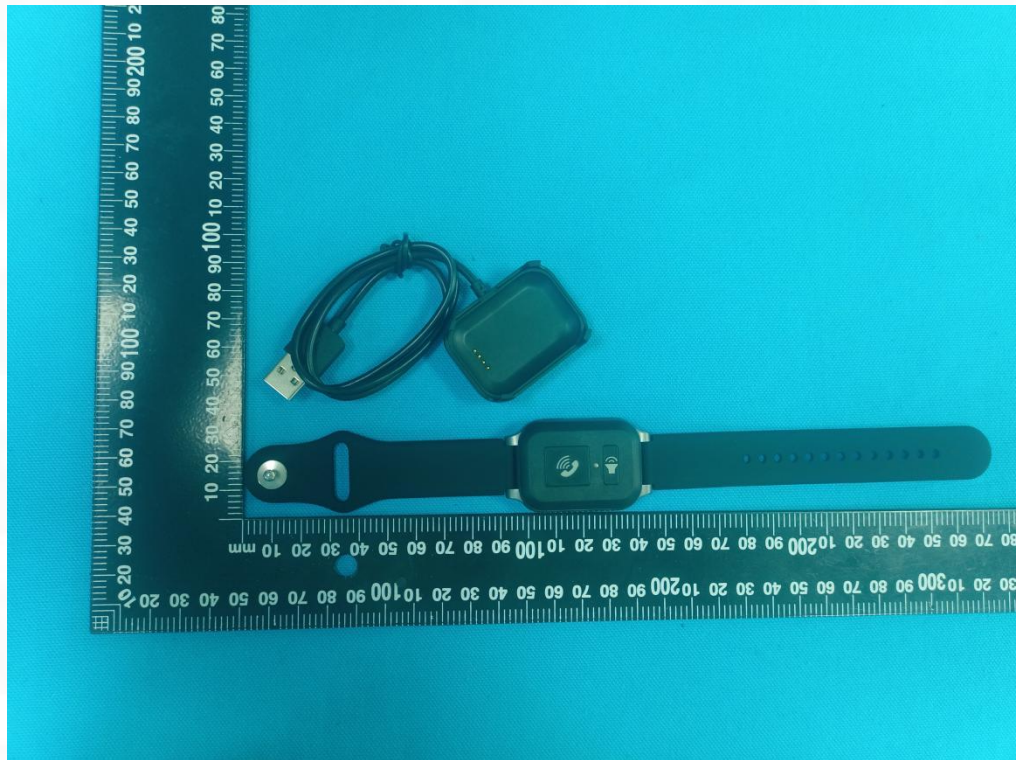
Test Requirement:	Part 2.1055(d)(1)(2) Part 22.355 Part 24.235 Part 27.54
Test Method:	ANSI C63.26:2015
Limit:	$\pm 2.5\text{ppm}$ (part 22) Within the authorized bands of operation(Part 24, Part 27)
Test setup:	 <p>Note : Measurement setup for testing on Antenna connector</p>
Test procedure:	<ol style="list-style-type: none"> 1. Set chamber temperature to 20°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. 2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. 3. Reduce the input voltage to specified extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.
Test Instruments:	Refer to section 3 for details
Test mode:	Refer to section 4.1 for details
Test results:	Pass
Remark:	<ol style="list-style-type: none"> 1. Manufacturer specified the battery operating end point voltage is 3.4VDC, max voltage is 4.35VDC. 2. If all frequencies stability are comply with the lower limit, then all results can be considered qualified

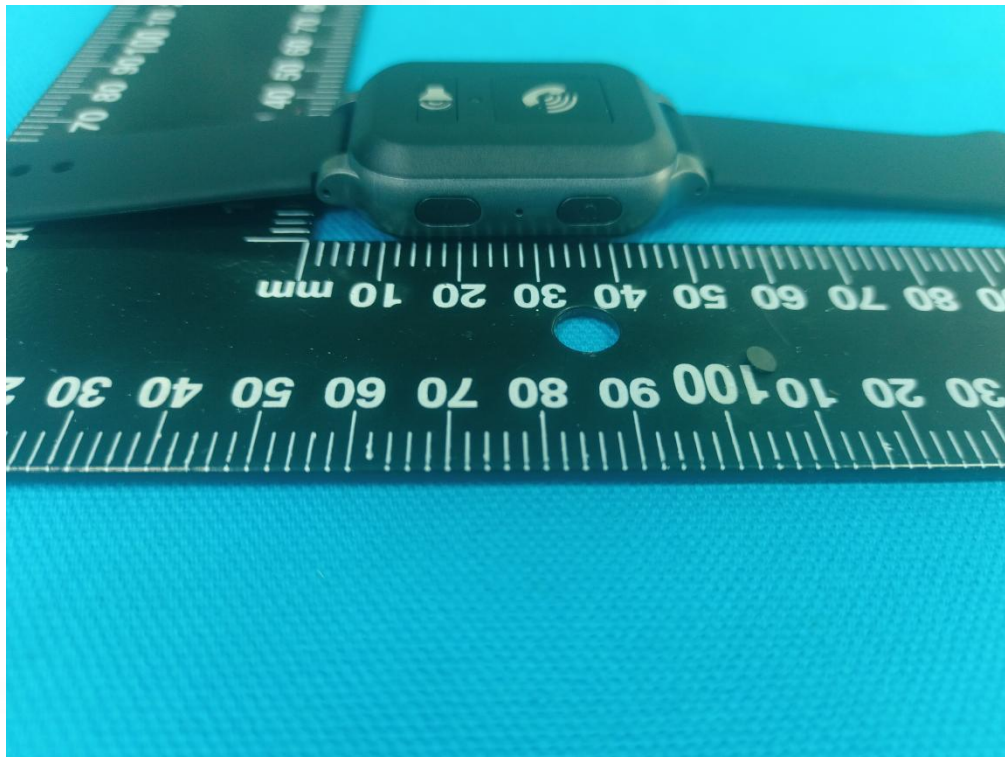
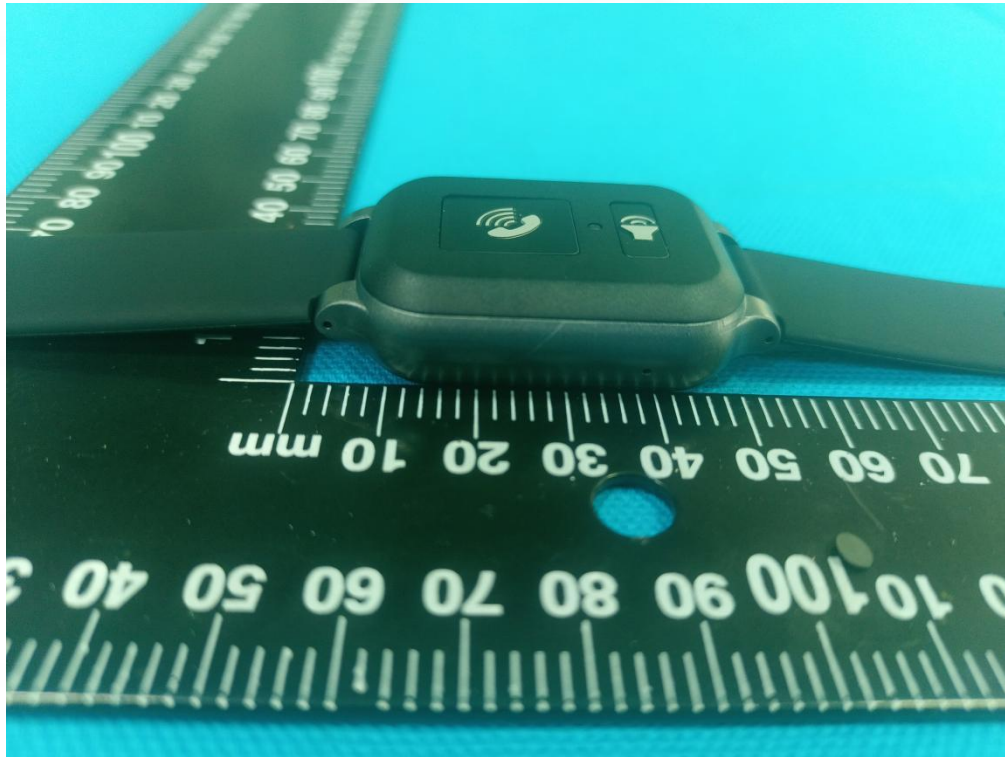
Note: Please refer to Appendix A of the Appendix Test Data.

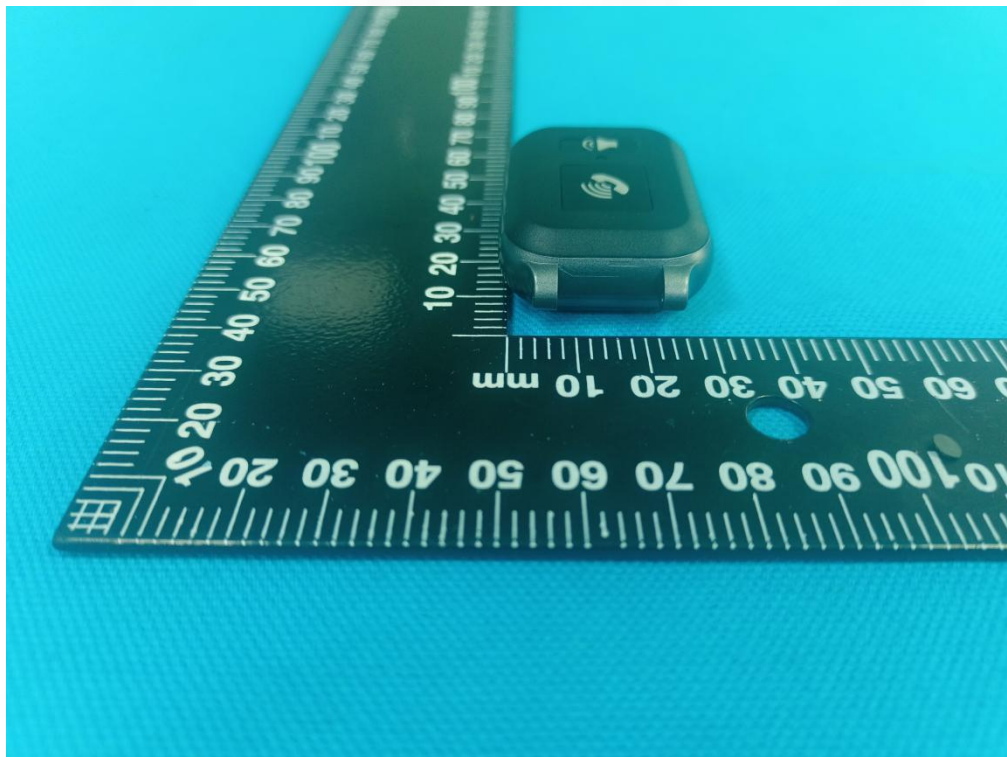
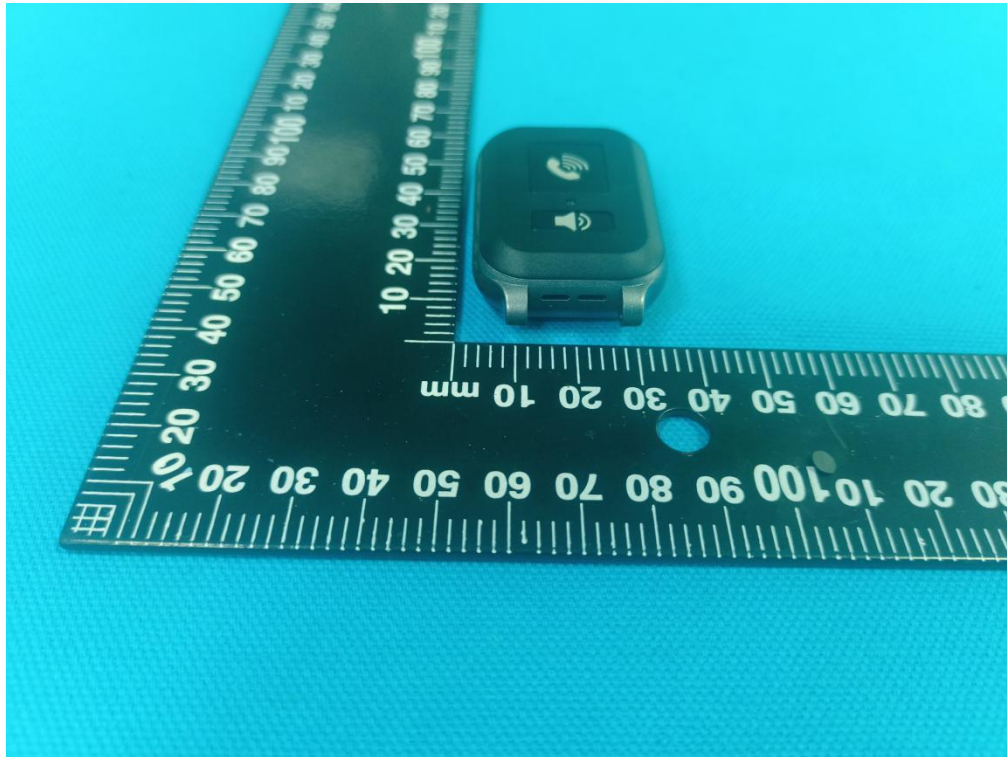
4.11 Test Setup Photo

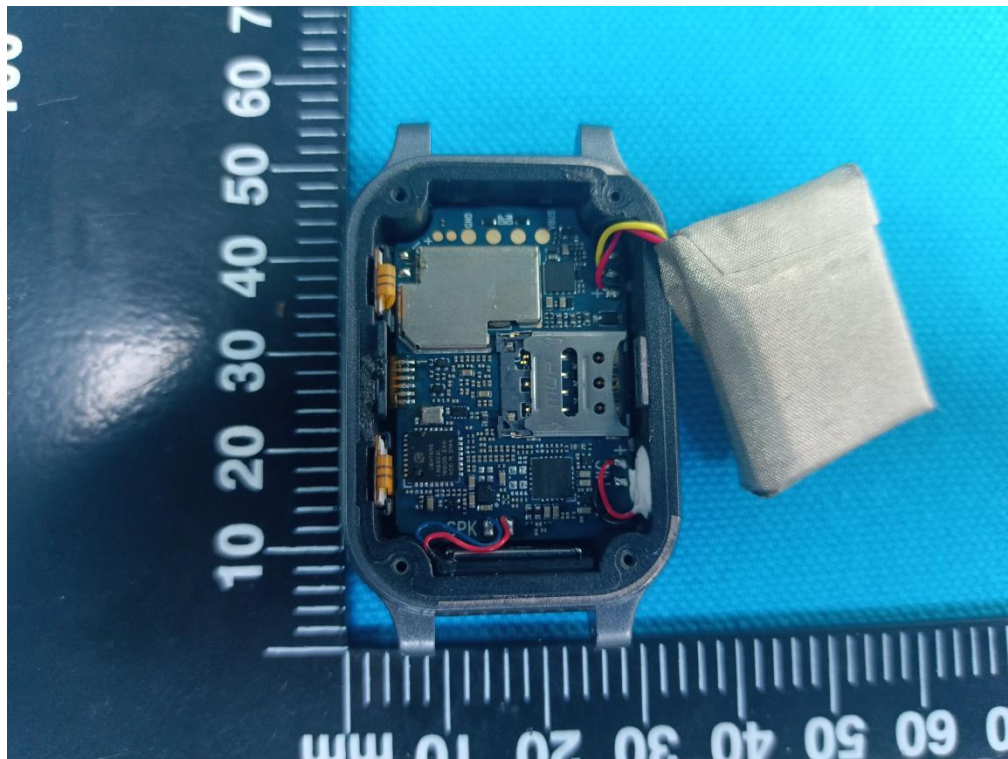
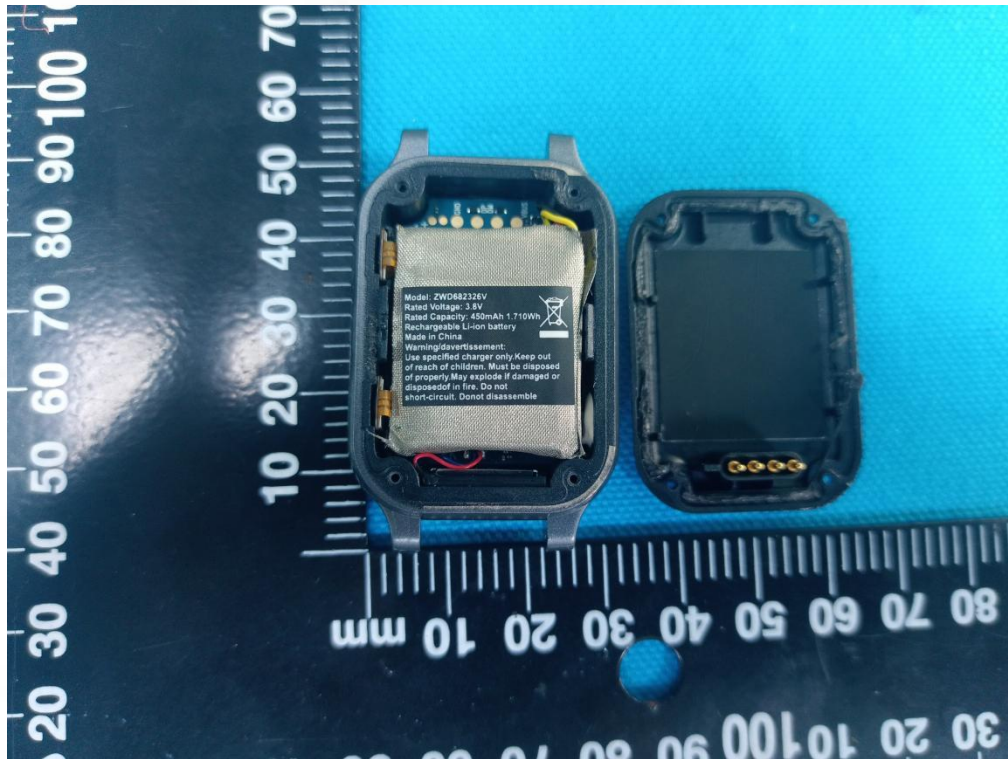


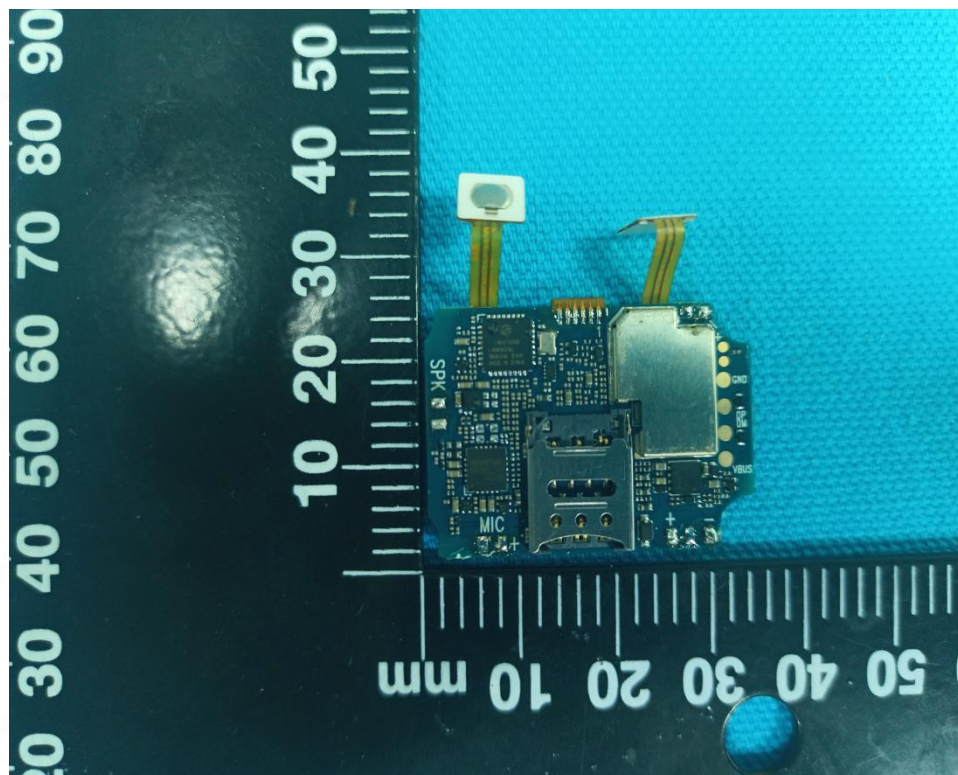
4.12 EUT Photos

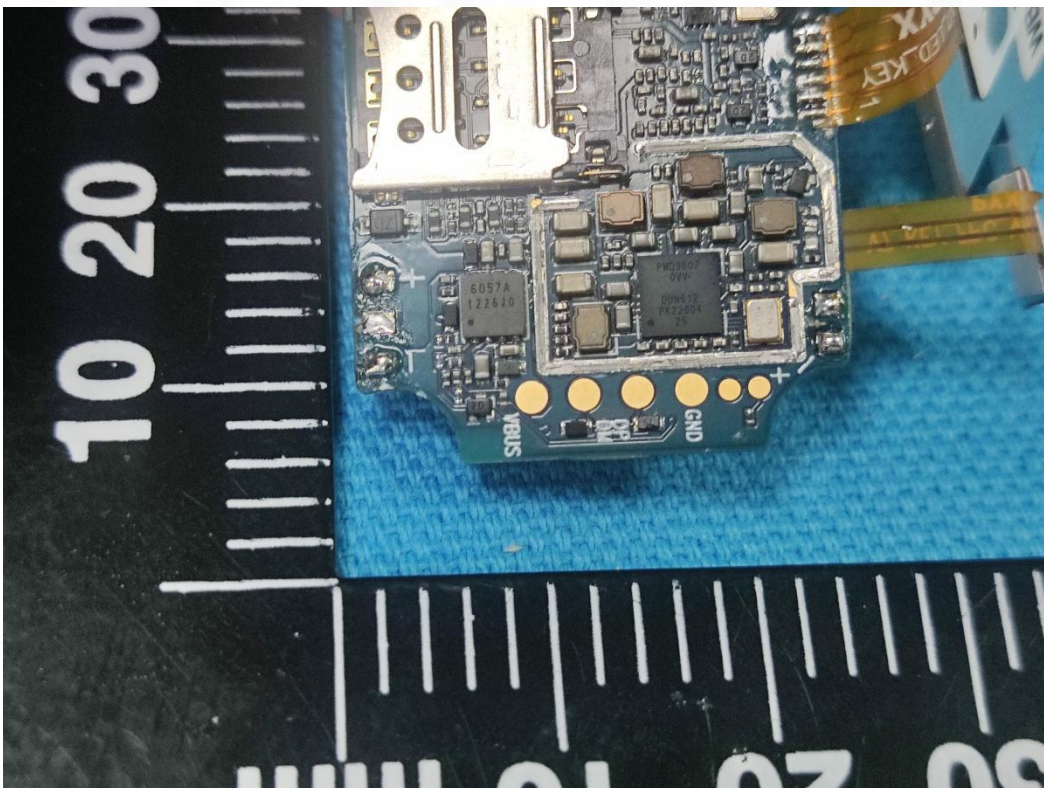
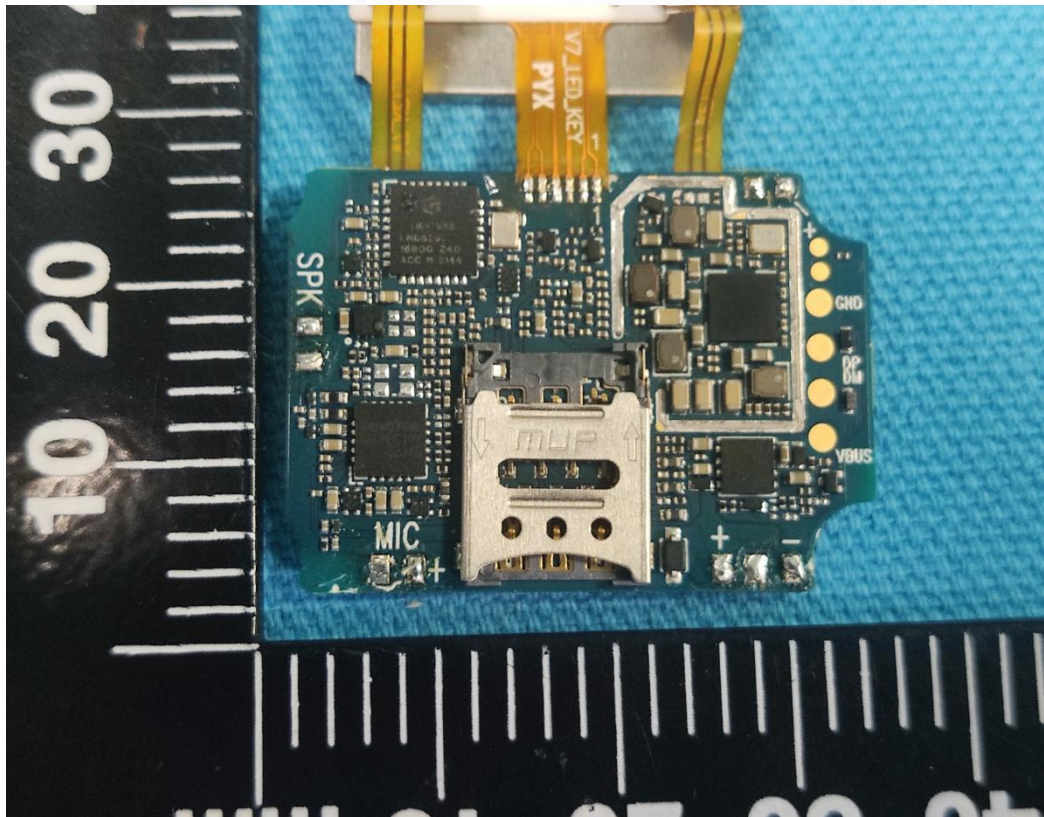


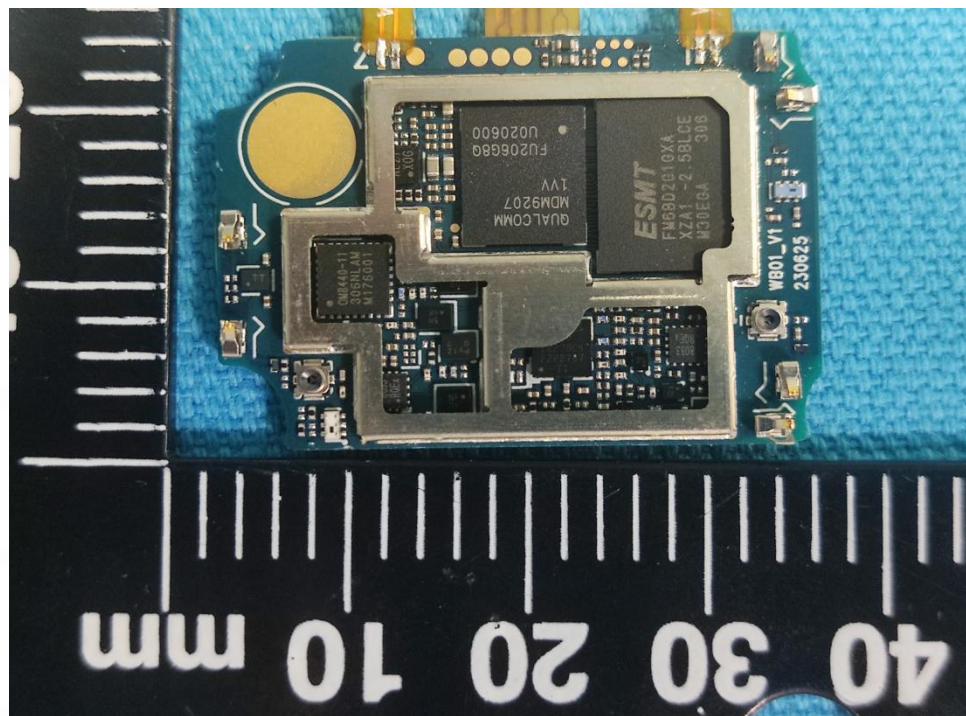
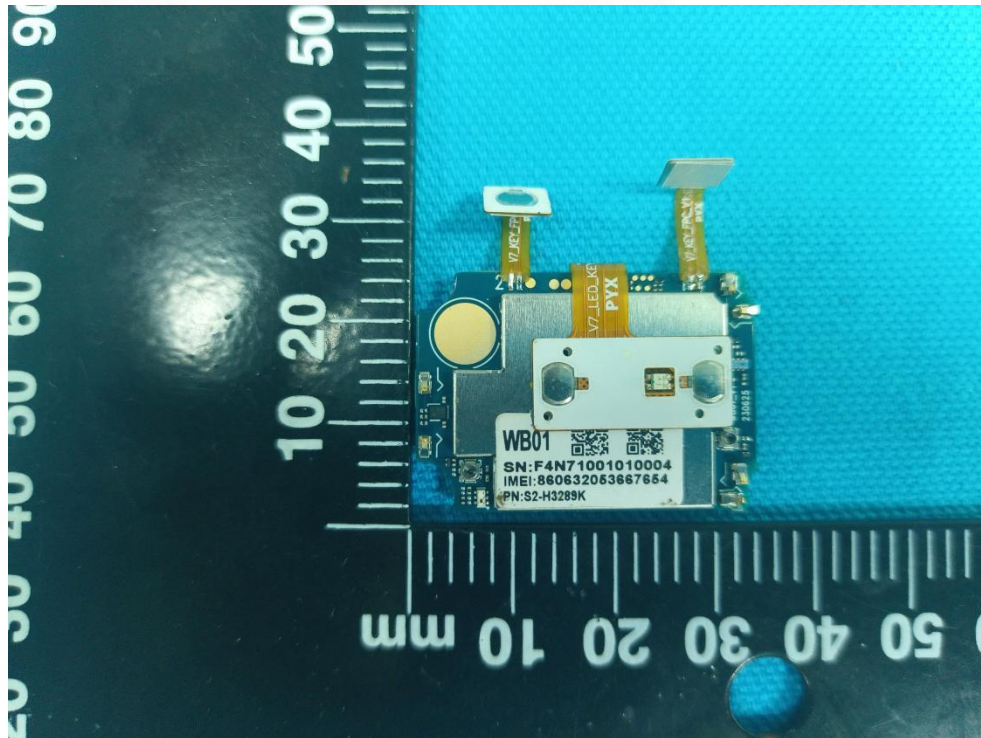


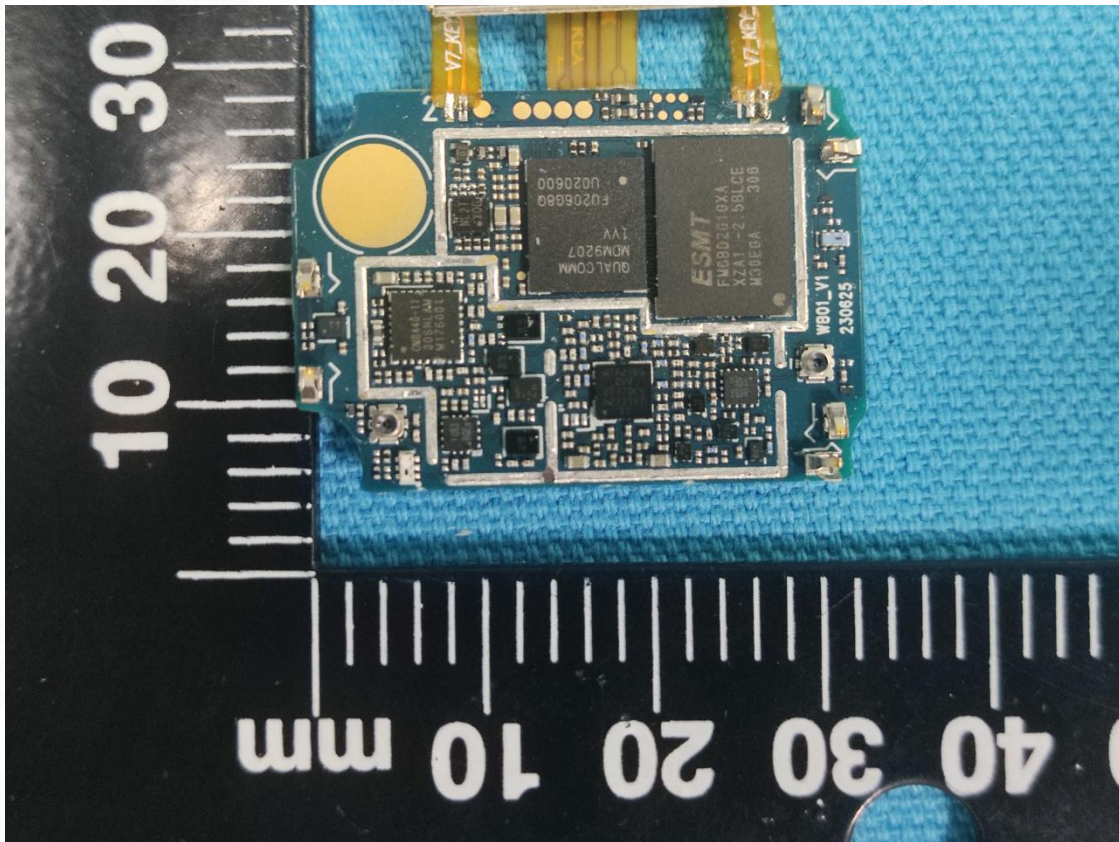














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