

**ETSI EN 301 489-1 V2.2.3 (2019-11)
ETSI EN 301 489-17 V3.2.4 (2020-09)**

TEST REPORT

For

Bluetooth Low Energy and 802.15.4 wireless radio module

MODEL NUMBER: HM-MT2401, HM-MT2401B

REPORT NUMBER: E04A24020079E00101

ISSUE DATE: May 06, 2024

Prepared for

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Prepared by

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**Room 101-105, 203-210, Building 1, No.2, Keji 8 Road, Songshan Lake Park,
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**This report is based on a single evaluation of the submitted sample(s) of the above mentioned
Product, it does not imply an assessment of the production of the products.
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Global Testing Technology Co., Ltd.**

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	May 06, 2024	Initial Issue	

Summary of Test Results

Emission			
Standard	Test Item	Limit	Result
ETSI EN 301 489-1 V2.2.3 (2019-11)	Radiated emissions below 1GHz	Clause 7.1	Pass
	Radiated emissions above 1GHz	Clause 7.1	Pass

Immunity (ETSI EN 301 489-1 V2.2.3 (2019-11))				
Basic Standard	Test Item	Test Specification	Criteria	Result
EN 61000-4-3:2006+A1:2008+A2:2010	RF electromagnetic field (80 MHz to 6000MHz)	Clause 9.2.2	A	Pass
EN 61000-4-2:2009	Electrostatic Discharge	Clause 9.3.2	B	Pass

*This test report is only published to and used by the applicant, and it is not for evidence purpose in China.

*The measurement result for the sample received is <Pass> according to <ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-17 V3.2.4 (2020-09)> when <Accuracy Method> decision rule is applied.

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Shenzhen HOPE Microelectronics Co., Ltd
Address: 30th floor of 8th Building, C Zone Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, Guangdong, China

Manufacturer Information

Company Name: Shenzhen HOPE Microelectronics Co., Ltd
Address: 30th floor of 8th Building, C Zone Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, Guangdong, China

EUT Information

Product Description: Bluetooth Low Energy and 802.15.4 wireless radio module
Model: HM-MT2401
Series Model: HM-MT2401B
Brand: HOPERF
Sample Received Date: Mar. 01, 2024
Sample Status: Normal
Sample ID: A24020079 001
Date of Tested: Mar. 01, 2024 to May 06, 2024

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
ETSI EN 301 489-1 V2.2.3 (2019-11)	Pass
ETSI EN 301 489-17 V3.2.4 (2020-09)	Pass

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Checked By:

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Laboratory Leader

Approved By:

Shawn Wen

Shawn Wen

Laboratory Manager

2. TEST METHODOLOGY

All tests were performed in accordance with the standard ETSI EN 301 489-1 V2.2.3 (2019-11), ETSI EN 301 489-17 V3.2.4 (2020-09)

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p>A2LA (Certificate No.: 6947.01) Guangdong Global Testing Technology Co., Ltd. has been assessed and proved to be in compliance with A2LA.</p> <p>FCC (FCC Designation No.: CN1343) Guangdong Global Testing Technology Co., Ltd. has been recognized to perform compliance testing on equipment subject to Supplier's Declaration of Conformity (SDoC) and Certification rules</p> <p>ISED (Company No.: 30714) Guangdong Global Testing Technology Co., Ltd. has been registered and fully described in a report filed with ISED. The Company Number is 30714 and the test lab Conformity Assessment Body Identifier (CABID) is CN0148.</p>
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Note: All tests measurement facilities use to collect the measurement data are located at Room 101-105, 203-210, Building 1, No.2, Keji 8 Road, Songshan Lake Park, Dongguan city, Guangdong, People's Republic of China, 523808

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Measurement Frequency Range	K	U(dB)
Radiated emissions	30 MHz ~ 1 GHz	2	3.79
Radiated emissions	1 GHz ~ 18 GHz	2	5.62
Radiated emissions	18 GHz ~ 40 GHz	2	5.54

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name		Bluetooth Low Energy and 802.15.4 wireless radio module
Model		HM-MT2401
Series Model		HM-MT2401B
Model Difference		HM-MT2401/19.5dBm, HM-MT2401B/10dBm
Hardware Version		V1.0
Software Version		V1.0
Ratings		Input: DC 1.71V-3.8V
Power Supply	AC	N/A
	Battery	N/A

5.2. TEST MODE

Test Mode	Description
M01	Bluetooth Working: Connect to the PC
M02	802.15.4 Working: Connect to the PC

5.3. SUPPORT UNITS FOR SYSTEM TEST

The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	PC	Lenovo	T430	N/A	GTG Support
E-2	Serial Port Tool	N/A	USB TO TTL	N/A	GTG Support

The following cables were used to form a representative test configuration during the tests.

Item	Type of cable	Shielded Type	Ferrite Core	Length
C-1	Dupont cable	Unshielded	without ferrite	0.2 m

6. MEASURING EQUIPMENT AND SOFTWARE USED

Test Equipment of Radiated emissions below 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
Chamber	ETS	9*6*6	Q2146	2022/8/30	2025/8/29
Receiver	R&S	ESC13	101409	2023/9/19	2024/9/18
Loop Antenna	ETS	6502	243668	2022/3/30	2025/3/30
Pre-Amplifier	HzEMC	HPA-9K0130	HYP A21001	2023/9/19	2024/9/18
Biconilog Antenna	Schwarzbeck	VULB 9168	1315	2022/10/10	2025/10/9
Biconilog Antenna	ETS	3142E	243646	2022/3/23	2025/3/22
EZ-EMC	Farad	Ver/FA-03A2 RE+	N/A	N/A	N/A

Test Equipment of Radiated emissions above 1GHz

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
Spectrum Analyzer	R&S	FSV40	101413	2023/9/19	2024/9/18
Pre-Amplifier	HzEMC	HPA-1G1850	HYP A21003	2023/9/19	2024/9/18
Horn antenna	ETS	3117	246069	2022/3/11	2025/3/10
EZ-EMC	Farad	Ver/FA-03A2 RE+	N/A	N/A	N/A

Test Equipment of RF electromagnetic field (80 MHz to 6000MHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
Stacked Log-Per-Broadband Antenna	Schwarzbeck	STLP 9129	170	N/A	N/A
Power amplifier	MiCOTOP	MPA-80-1000-500	MPA220933 6	2023/9/19	2024/9/18
Power amplifier	MiCOTOP	MPA-1000-6000-100	MPA220933 7	2023/9/19	2024/9/18
EPM Series Power Meter	Keysight	N1914A	MY53240003	2023/9/19	2024/9/18
Average Power Sensor	Keysight	E9304A	MY41498925	2023/9/19	2024/9/18
Average Power Sensor	Keysight	E9304A	MY41497454	2023/9/19	2024/9/18
EXG Analog Signal Generator	Keysight	N5171B	MY61252624	2023/9/19	2024/9/18
Field Probe	Narda	EP 601	811ZX11137	2023/9/19	2024/9/18
FASLAB-RS	HzEMC	V2/7/2/3	N/A	N/A	N/A

Test Equipment of Electrostatic Discharge					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
ESD Simulator	TESEQ	NSG437	336	2023/9/19	2024/9/18

7. EMISSION TEST

7.1. RADIATED EMISSIONS BELOW 1GHZ

LIMITS

(a). Limits up to 1 GHz

FREQUENCY (MHz)	Class A		Class B	
	At 10 m	At 3 m	At 10 m	At 3 m
	dB μ V/m	dB μ V/m	dB μ V/m	dB μ V/m
30 – 230	40	50	30	40
230 – 1000	47	57	37	47

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dB μ V/m)=20log Emission level (uV/m).
- (3) If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less.

TEST PROCEDURE

Below 1 GHz and above 30 MHz

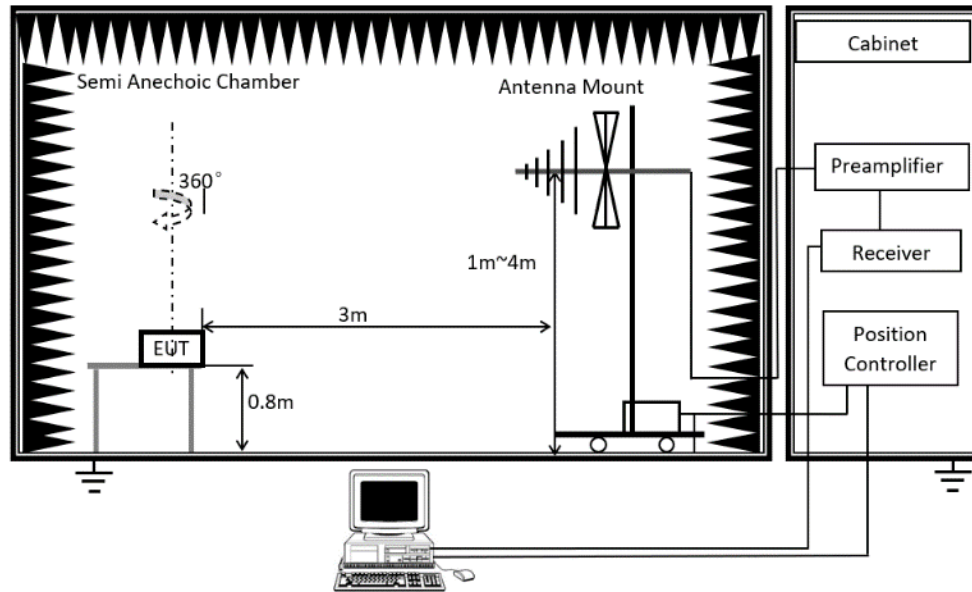
The setting of the spectrum analyzer

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak and QP
Trace	Max hold

1. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp was used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
2. The EUT was placed on a turntable with 80 cm above ground.
3. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
4. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

5. Cables of hand-operated devices, such as keyboards and mice, shall be placed as for normal used.
6. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
7. For measurement below 1 GHz, the initial step in collecting Radiated emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.

TEST SETUP

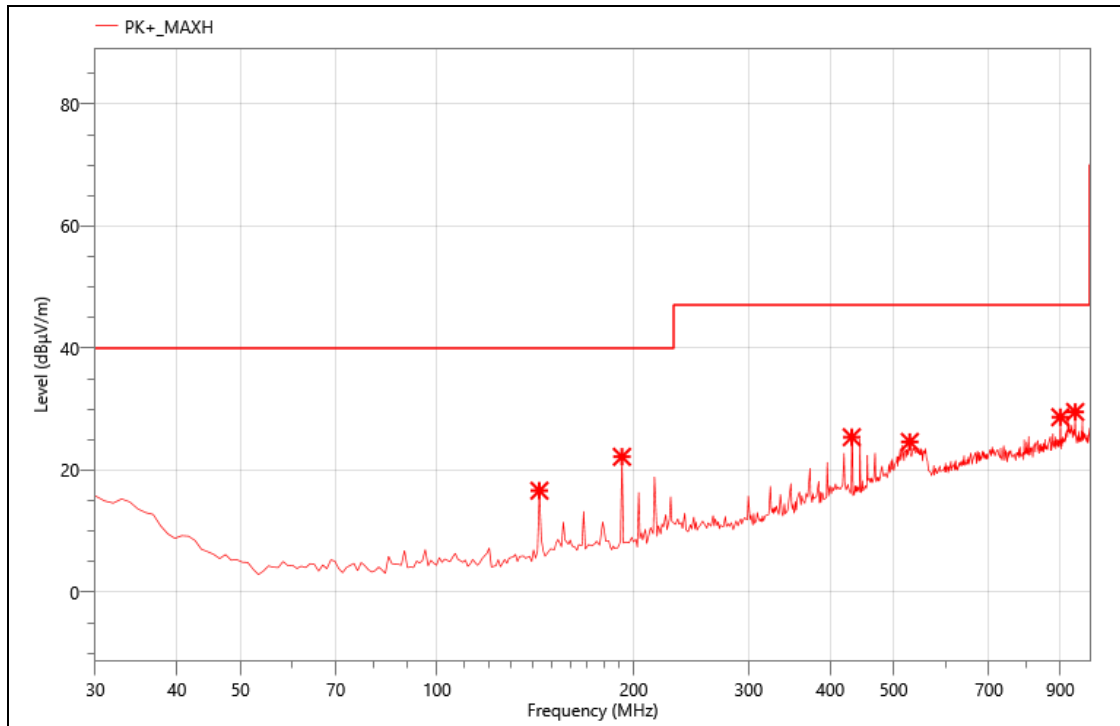


TEST ENVIRONMENT

Temperature	24.3°C	Relative Humidity	54%
Atmosphere Pressure	101kPa		

TEST MODE

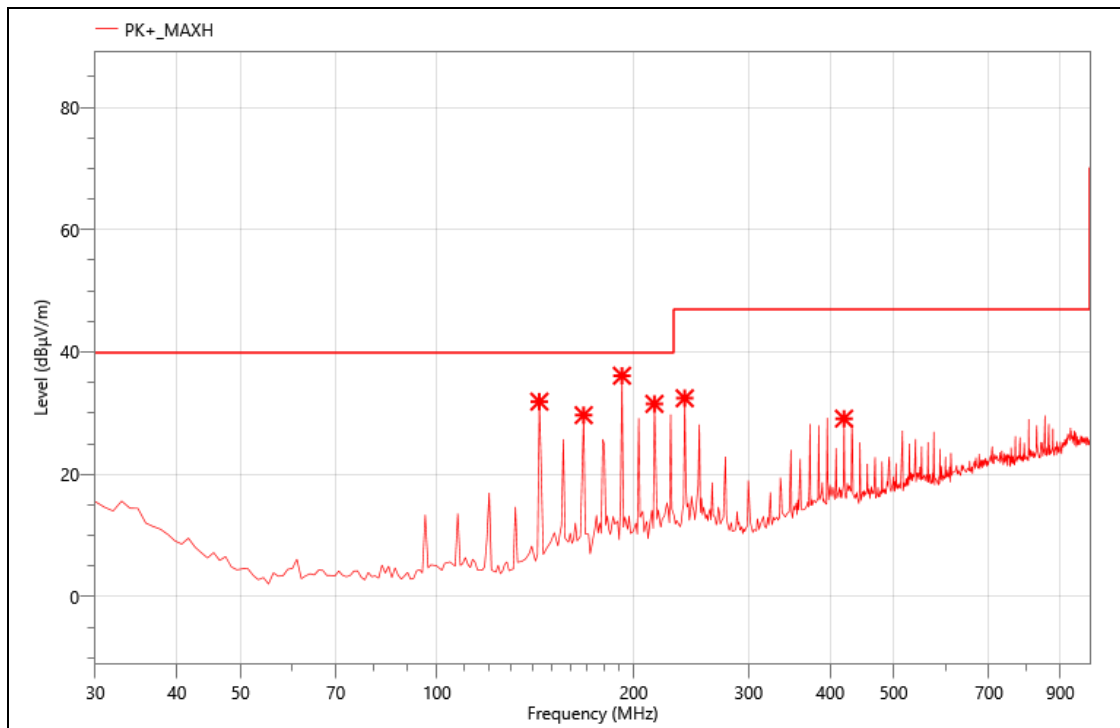
Pre-test Mode:	M01 ~ M02
Final Test Mode:	M01, M02

TEST RESULTS

Antenna: Vertical

Mode: M01

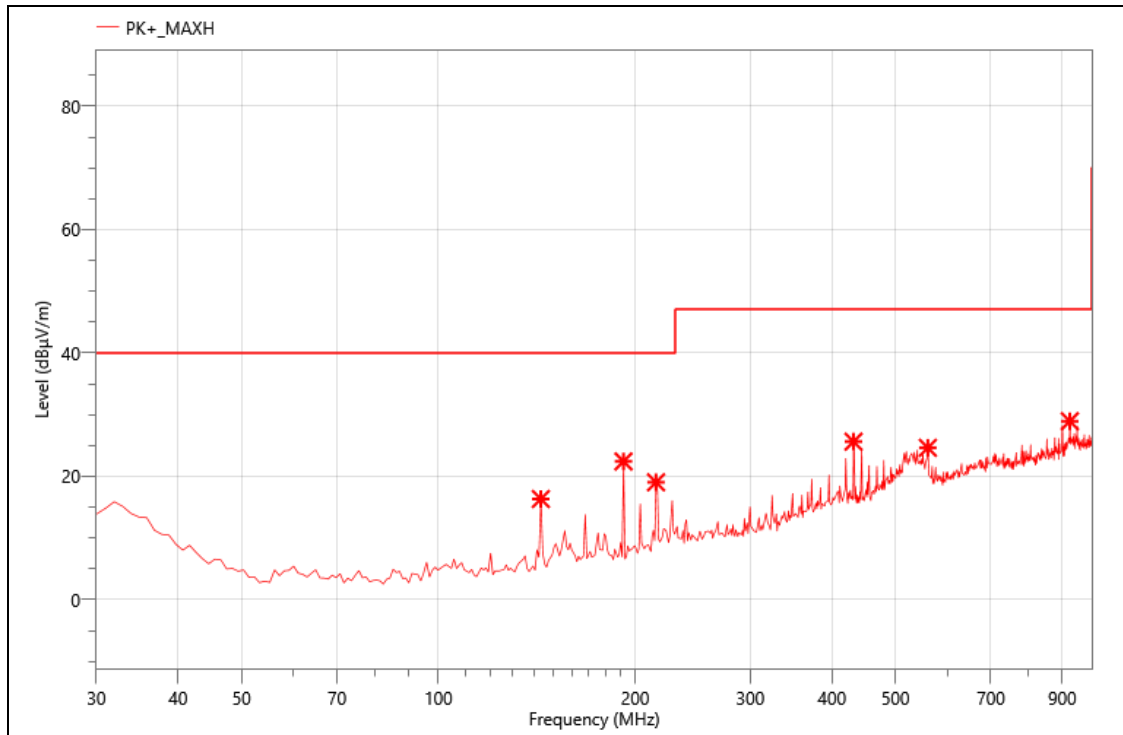
No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	143.490	40.16	-23.52	16.64	40.00	23.36	PK+	V
2	191.990	44.77	-22.57	22.20	40.00	17.80	PK+	V
3	431.580	39.57	-14.16	25.41	47.00	21.59	PK+	V
4	529.550	35.44	-10.79	24.65	47.00	22.35	PK+	V
5	900.090	33.79	-5.1	28.69	47.00	18.31	PK+	V
6	948.590	32.97	-3.42	29.55	47.00	17.45	PK+	V



Antenna: Horizontal

Mode: M01

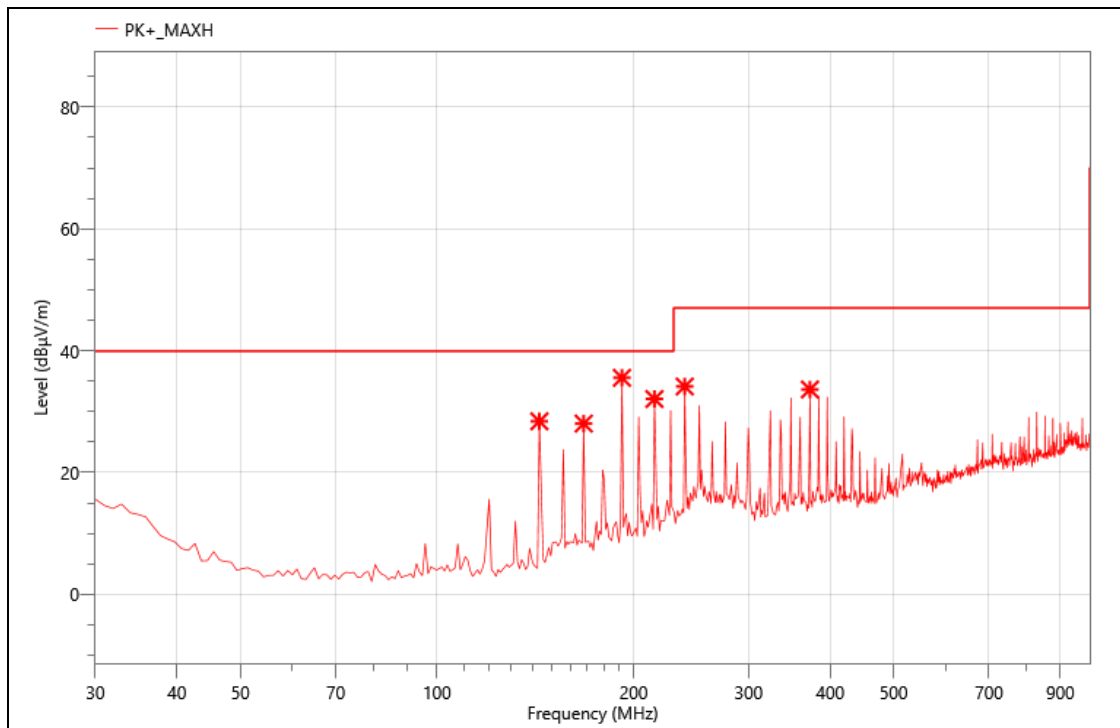
No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	143.490	55.42	-23.52	31.90	40.00	8.10	PK+	H
2	167.740	52.39	-22.7	29.69	40.00	10.31	PK+	H
3	191.990	58.70	-22.57	36.13	40.00	3.87	PK+	H
4	215.270	52.53	-21	31.53	40.00	8.47	PK+	H
5	239.520	52.11	-19.66	32.45	47.00	14.55	PK+	H
6	419.940	43.00	-13.89	29.11	47.00	17.89	PK+	H



Antenna: Vertical

Mode: M02

No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	143.490	39.85	-23.52	16.33	40.00	23.67	PK+	V
2	191.990	44.99	-22.57	22.42	40.00	17.58	PK+	V
3	215.270	40.04	-21	19.04	40.00	20.96	PK+	V
4	431.580	39.79	-14.16	25.63	47.00	21.37	PK+	V
5	560.590	34.99	-10.36	24.63	47.00	22.37	PK+	V
6	924.340	32.21	-3.27	28.94	47.00	18.06	PK+	V



Antenna: Horizontal

Mode: M02

No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	143.490	51.93	-23.52	28.41	40.00	11.59	PK+	H
2	167.740	50.73	-22.7	28.03	40.00	11.97	PK+	H
3	191.990	58.11	-22.57	35.54	40.00	4.46	PK+	H
4	215.270	53.07	-21	32.07	40.00	7.93	PK+	H
5	239.520	53.78	-19.66	34.12	47.00	12.88	PK+	H
6	372.410	48.89	-15.26	33.63	47.00	13.37	PK+	H

Note: 1. Result = Reading +Correct (Amplifier Factor + Cable Loss + Antenna Factor)

2. Margin = Result - Limit

7.2. RADIATED EMISSIONS ABOVE 1GHZ

LIMITS

(a). Limits above 1 GHz

FREQUENCY (MHz)	Class A (at 3 m) dBμV/m		Class B (at 3 m) dBμV/m	
	Peak	Avg	Peak	Avg
1000-3000	76	56	70	50
3000-6000	80	60	74	54

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBμV/m)=20log Emission level (uV/m).
- (3) If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less.

TEST PROCEDURE

Above 1 GHz

The setting of the spectrum analyzer

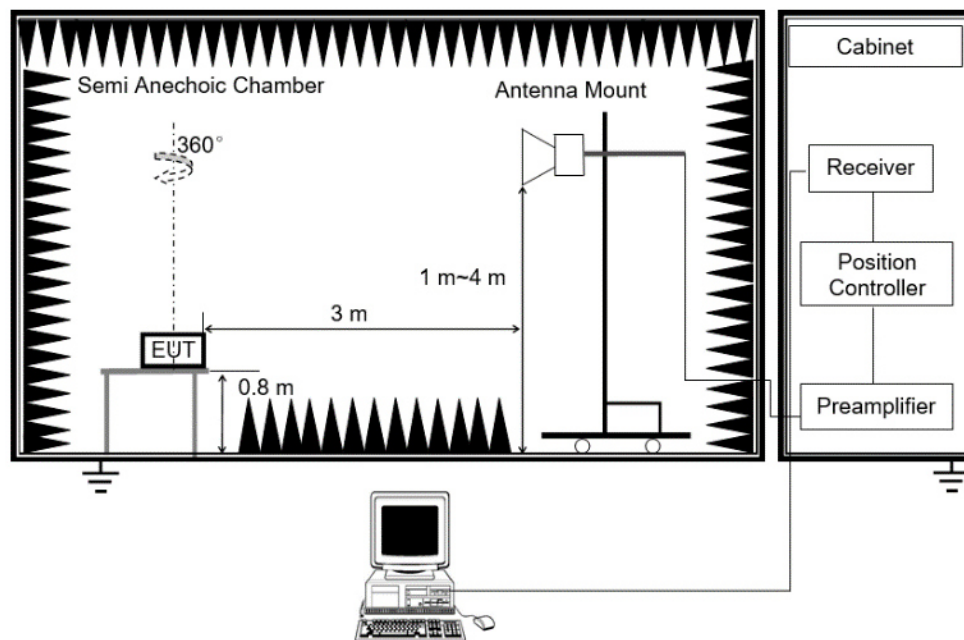
RBW	1 MHz
VBW	3 MHz
Sweep	Auto
Detector	Peak: Peak AVG: RMS
Trace	Max hold

- a. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- b. The EUT was placed on a turntable with 80 cm above ground.
- c. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- d. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance.

The overall length shall not exceed 1 m.

- e. Cables of hand-operated devices, such as keyboards and mice, shall be placed as for normal used.
- f. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- g. For measurement above 1 GHz, the peak emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the peak limit. If peak result complies with average limit, average result is deemed to comply with average limit.
- h. The average emission measurement will be measured by the RMS detector and must comply with the average limit.

TEST SETUP

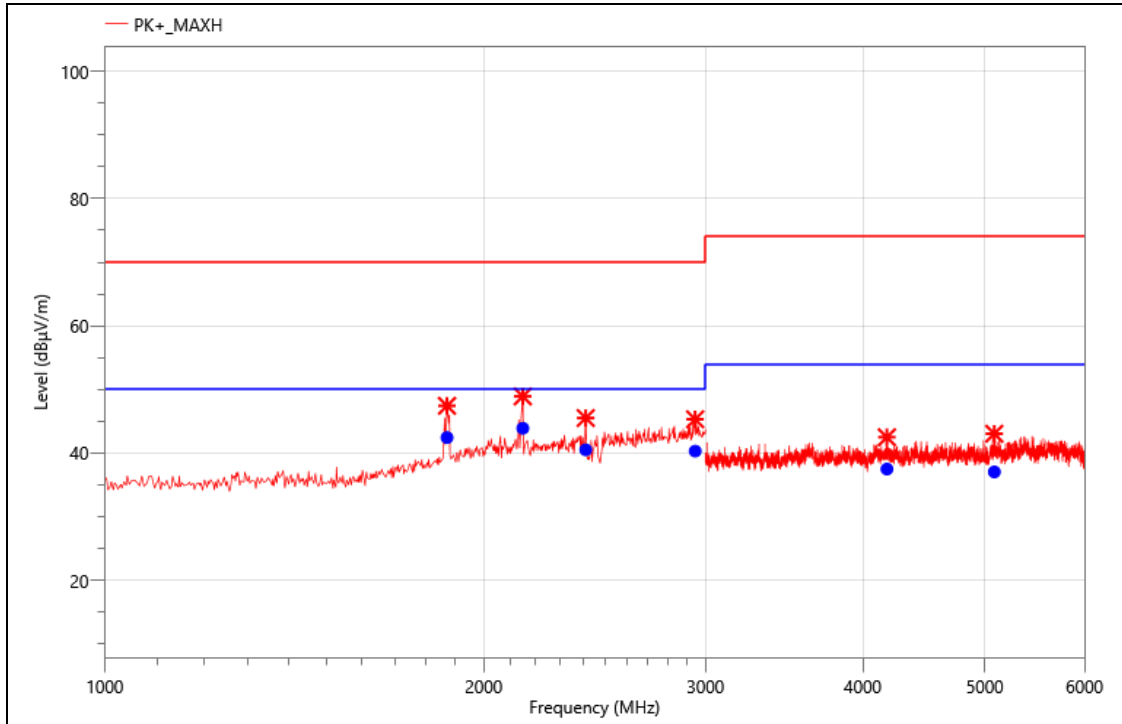


TEST ENVIRONMENT

Temperature	24.3°C	Relative Humidity	54%
Atmosphere Pressure	101kPa		

TEST MODE

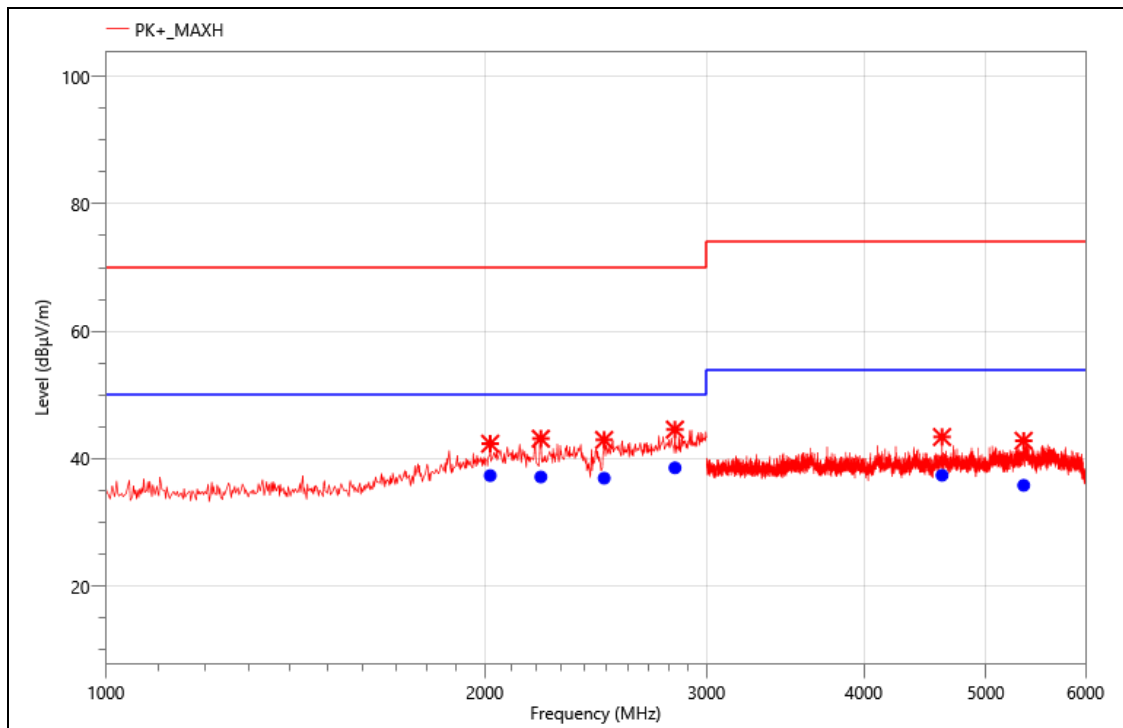
Pre-test Mode:	M01 ~ M02
Final Test Mode:	M01, M02

TEST RESULTS

Antenna: Horizontal

Mode: M01

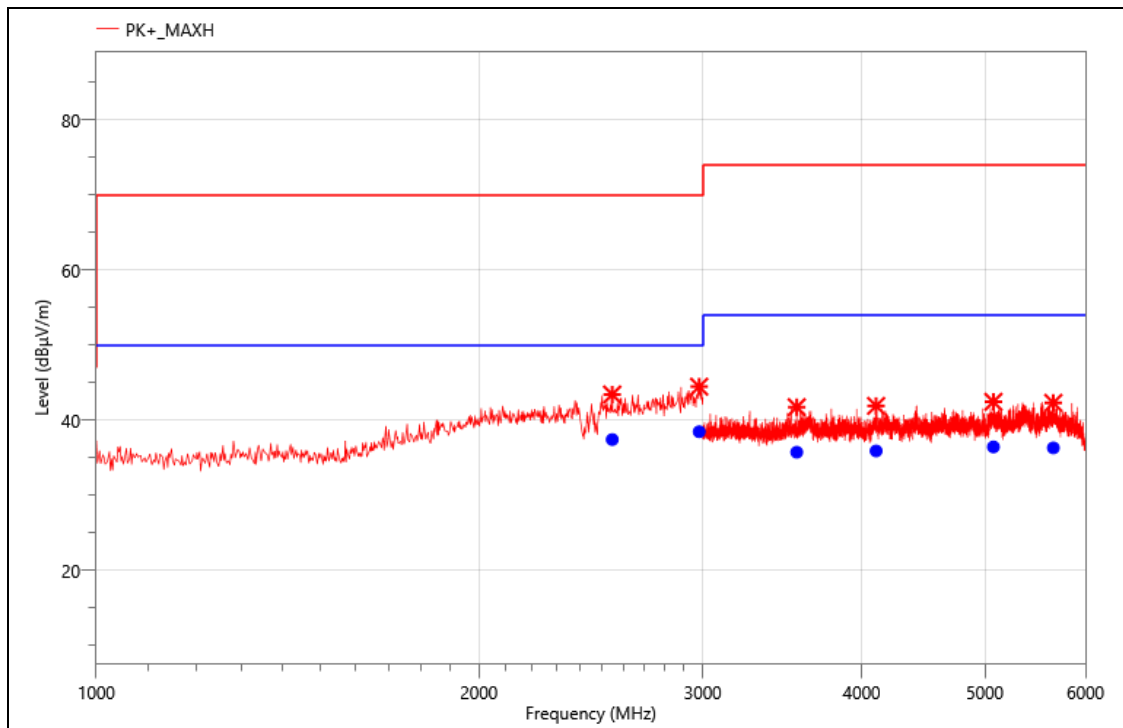
No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	1870.000	57.83	-10.37	47.46	70.00	22.54	PK+	V
2	2148.000	57.98	-9.05	48.93	70.00	21.07	PK+	V
3	2410.000	54.06	-8.52	45.54	70.00	24.46	PK+	V
4	2944.000	52.80	-7.46	45.34	70.00	24.66	PK+	V
5	4180.500	54.87	-12.35	42.52	74.00	31.48	PK+	V
6	5087.700	53.47	-10.4	43.07	74.00	30.93	PK+	V
7	1870.000	52.83	-10.37	42.46	50.00	7.54	AVG	V
8	2148.000	52.98	-9.05	43.93	50.00	6.07	AVG	V
9	2410.000	49.06	-8.52	40.54	50.00	9.46	AVG	V
10	2944.000	47.80	-7.46	40.34	50.00	9.66	AVG	V
11	4180.500	49.87	-12.35	37.52	54.00	16.48	AVG	V
12	5087.700	47.47	-10.4	37.07	54.00	16.93	AVG	V



Antenna: Vertical

Mode: M01

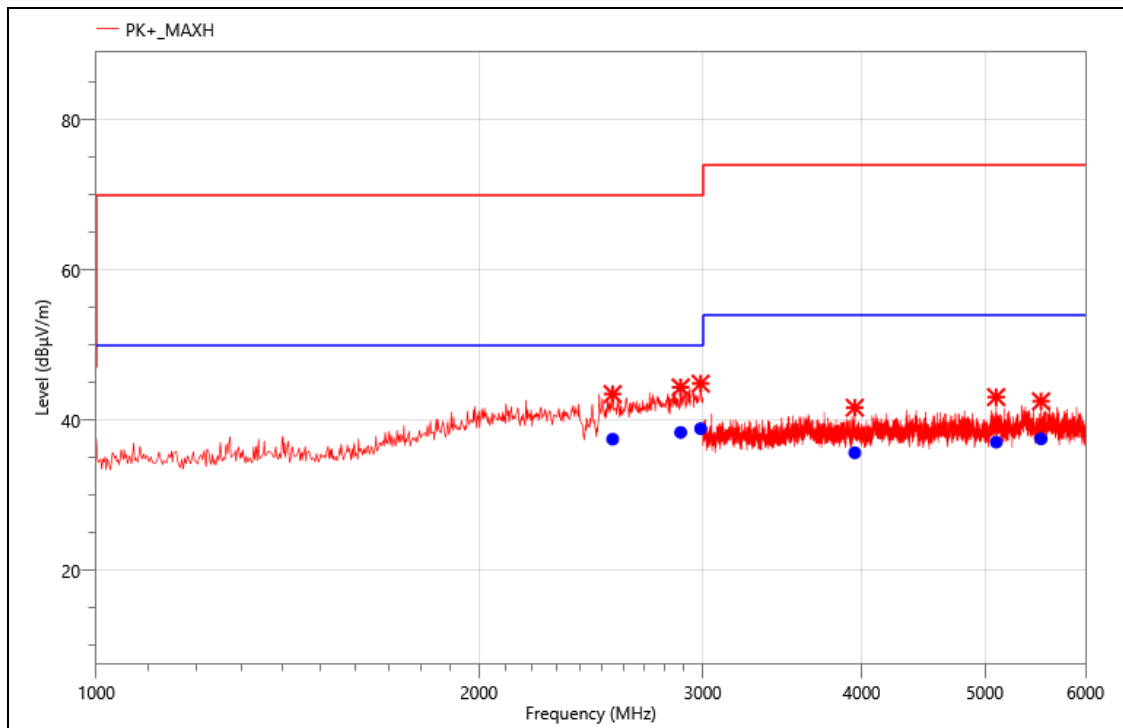
No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	2020.000	51.40	-9.02	42.38	70.00	27.62	PK+	H
2	2216.000	52.40	-9.23	43.17	70.00	26.83	PK+	H
3	2488.000	51.39	-8.42	42.97	70.00	27.03	PK+	H
4	2832.000	52.33	-7.73	44.60	70.00	25.40	PK+	H
5	4615.500	54.98	-11.55	43.43	74.00	30.57	PK+	H
6	5358.600	52.40	-9.55	42.85	74.00	31.15	PK+	H
7	2020.000	46.40	-9.02	37.38	50.00	12.62	AVG	H
8	2216.000	46.40	-9.23	37.17	50.00	12.83	AVG	H
9	2488.000	45.39	-8.42	36.97	50.00	13.03	AVG	H
10	2832.000	46.33	-7.73	38.60	50.00	11.40	AVG	H
11	4615.500	48.98	-11.55	37.43	54.00	16.57	AVG	H
12	5358.600	45.40	-9.55	35.85	54.00	18.15	AVG	H



Antenna: Vertical

Mode: M02

No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	2546.000	51.70	-8.27	43.43	70.00	26.57	PK+	H
2	2980.000	51.46	-6.99	44.47	70.00	25.53	PK+	H
3	3556.200	55.76	-14.02	41.74	74.00	32.26	PK+	H
4	4106.100	54.41	-12.5	41.91	74.00	32.09	PK+	H
5	5078.100	52.86	-10.41	42.45	74.00	31.55	PK+	H
6	5660.400	51.46	-9.14	42.32	74.00	31.68	PK+	H
7	2546.000	45.70	-8.27	37.43	50.00	12.57	AVG	H
8	2980.000	45.46	-6.99	38.47	50.00	11.53	AVG	H
9	3556.200	49.76	-14.02	35.74	54.00	18.26	AVG	H
10	4106.100	48.41	-12.5	35.91	54.00	18.09	AVG	H
11	5078.100	46.86	-10.41	36.45	54.00	17.55	AVG	H
12	5660.400	45.46	-9.14	36.32	54.00	17.68	AVG	H



Antenna: Horizontal

Mode: M02

No.	Freq. (MHz)	Reading (dBμV)	Corr. (dB)	Meas. (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Det.	Pol.
1	2548.000	51.70	-8.22	43.48	70.00	26.52	PK+	V
2	2882.000	52.66	-8.28	44.38	70.00	25.62	PK+	V
3	2988.000	51.85	-6.97	44.88	70.00	25.12	PK+	V
4	3950.400	54.90	-13.23	41.67	74.00	32.33	PK+	V
5	5104.200	53.50	-10.42	43.08	74.00	30.92	PK+	V
6	5536.200	52.06	-9.54	42.52	74.00	31.48	PK+	V
7	2548.000	45.70	-8.22	37.48	50.00	12.52	AVG	V
8	2882.000	46.66	-8.28	38.38	50.00	11.62	AVG	V
9	2988.000	45.85	-6.97	38.88	50.00	11.12	AVG	V
10	3950.400	48.90	-13.23	35.67	54.00	18.33	AVG	V
11	5104.200	47.50	-10.42	37.08	54.00	16.92	AVG	V
12	5536.200	47.06	-9.54	37.52	54.00	16.48	AVG	V

Note: 1. Result = Reading +Correct (Amplifier Factor + Cable Loss + Antenna Factor)

2. Margin = Result - Limit

8. IMMUNITY TEST

8.1. PERFORMANCE CRITERIA

According to **ETSI EN 301 489-17 V3.2.4 (2020-09)** standard, the general performance criteria as following:

Criteria	During Test	After test (i.e. as a result of the application of the test)
A	Shall operate as intended. (See note). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
B	May be loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.
NOTE: Operate as intended during the test allows a level of degradation in accordance with Minimum performance level.		

Minimum performance level

For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.

Performance criteria for Continuous phenomena

The performance criteria A shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur during the test.

Performance criteria for Transient phenomena

The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as a result of the application of the test. **ETSI EN 301 489-17 V3.2.4 (2020-09)**

1.	Performance criteria for continuous phenomena applied to transmitters (CT)
2.	Performance criteria for transient phenomena applied to transmitters (TT)
3.	Performance criteria for continuous phenomena applied to receivers (CR)
4.	Performance criteria for transient phenomena applied to receivers (TR)

According to **ETSI EN 301 489-17 V3.2.4 (2020-09)** standard, the general performance criteria as following:

Criteria	During Test	After test (i.e. as a result of the application of the test)
----------	-------------	---

A	Shall operate as intended. (See note). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
B	May be loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.
NOTE: Operate as intended during the test allows a level of degradation in accordance with Minimum performance level.		

Minimum performance level

For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.

Performance criteria for Continuous phenomena

The performance criteria A shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur during the test.

Performance criteria for Transient phenomena

The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as a result of the application of the test.

8.2. RF ELECTROMAGNETIC FIELD (80 MHZ TO 6000MHZ)

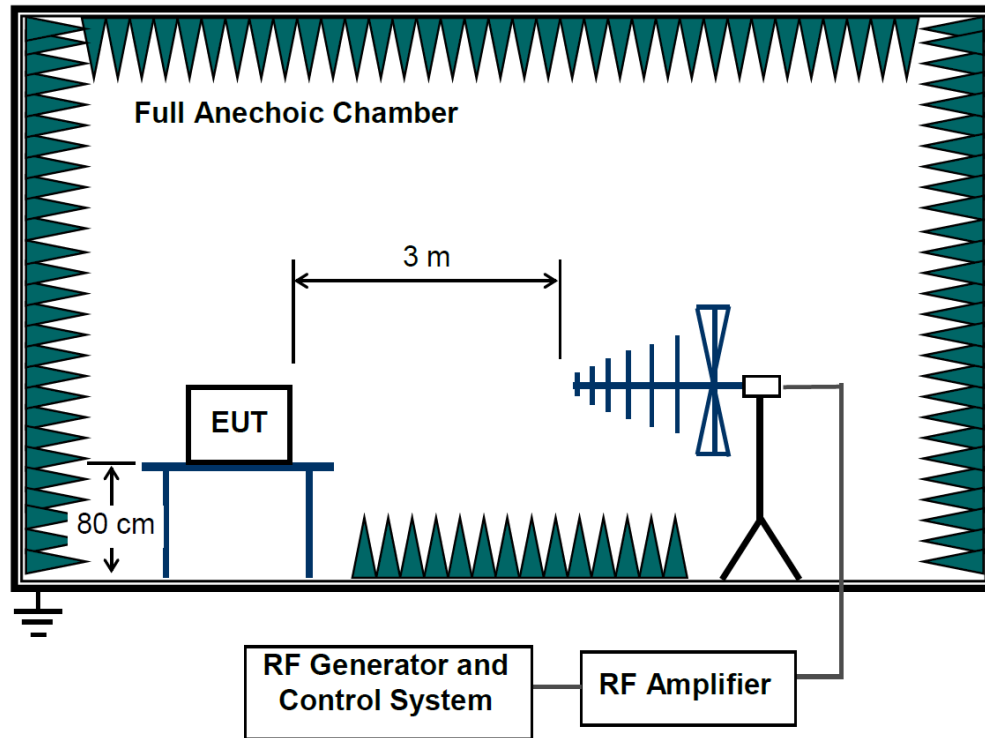
TEST SPECIFICATION

Standard:	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-17 V3.2.4 (2020-09) EN 61000-4-3:2006+A1:2008+A2:2010
Test Level:	3 V/m(measured unmodulated)
Step size	1 % increment
Dwell time:	1 seconds
Antenna Polarisation:	Horizontal and vertical

TEST PROCEDURE

The test procedure was in accordance with IEC 61000-4-3.

- The testing was performed in a fully anechoic chamber. The transmit antenna was located at a distance of 3 meters from the EUT.
- The frequency range is swept from 80 MHz to 6000 MHz with the signal 80 % amplitude modulated with a 1 kHz sine wave. The rate of sweep did not exceed 1.5×10^{-3} decade/s. Where the frequency range is swept incrementally, the step size was 1 % of fundamental.
- The dwell time at each frequency shall be not less than the time necessary for the EUT to be able to respond.
- The field strength level was 3 V/m.
- The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

TEST SETUP**TEST ENVIRONMENT**

Temperature	24.2°C	Relative Humidity	52%
Atmosphere Pressure	101kPa	Test Voltage	

TEST MODE

Test Mode:	M01, M02
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TEST RESULTS

Freq.Range (MHz)	Position (Face)	Polarity (H or V)	Field Strength (V/m) (unmodulated,r.m.s)	Criterion	Observation	Result	Judgment
80-6000	Front	H&V	3 V/m	A	CT,CR	A	Pass
80-6000	Rear	H&V	3 V/m	A	CT,CR	A	Pass
80-6000	Left	H&V	3 V/m	A	CT,CR	A	Pass
80-6000	Right	H&V	3 V/m	A	CT,CR	A	Pass
80-6000	Bottom	H&V	3 V/m	A	CT,CR	A	Pass
80-6000	Top	H&V	3 V/m	A	CT,CR	A	Pass

Observation:

A: No observable change.

Conclusion: The EUT met the requirements of the standard

8.3. ELECTROSTATIC DISCHARGE

TEST SPECIFICATION

Standard:	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-17 V3.2.4 (2020-09) EN 61000-4-2:2009
Discharge Impedance:	330 Ω / 150 pF
Polarity:	Positive & Negative
Number of Discharge:	Minimum 10 times at each test point
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum
Test Level:	Contact discharge: Level 2 (\pm 4 kV); Air discharge: Level 3 (\pm 8 kV)

TEST PROCEDURE

The test generator necessary to perform direct and indirect application of discharges to the EUT in the following manner:

- a. Contact discharge was applied to conductive surfaces and coupling planes of the EUT.

During the test, it was performed with single discharges. For the single discharge time between successive single discharges was at least 1 second.

Vertical Coupling Plane (VCP):

The coupling plane, of dimensions 0.5 m x 0.5 m, is placed parallel to, and positioned at a distance 0.1 m from, the EUT, with the Discharge Electrode touching the coupling plane.

The four faces of the EUT will be performed with electrostatic discharge.

Horizontal Coupling Plane (HCP):

The coupling plane is placed under to the EUT. The generator shall be positioned vertically at a distance of 0.1 m from the EUT, with the Discharge Electrode touching the coupling plane. The four faces of the EUT will be performed with electrostatic discharge.

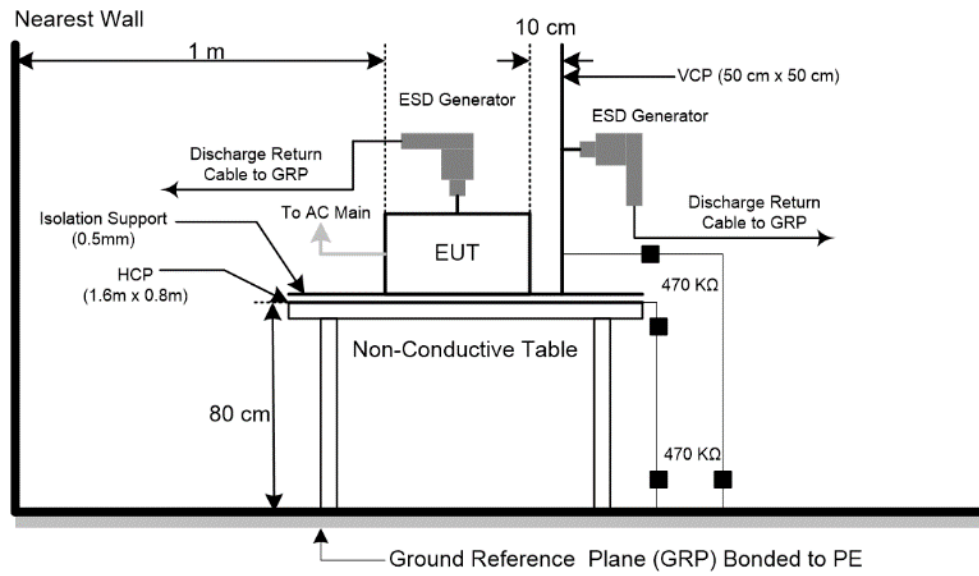
- b. Air discharges at insulation surfaces of the EUT.

It was at least ten single discharges with positive and negative at the same selected point.

- c. The test shall be performed with single discharges. On each pre-selected point at least 10 single discharges (in the most sensitive polarity) shall be applied.

- d. For air discharge testing, the test shall be applied at all test levels 2 kV, 4 kV and 8 kV.

- e. For the actual test configuration, please refer to the related Item: EUT Test Photos.

TEST SETUP**TEST ENVIRONMENT**

Temperature	23.6°C	Relative Humidity	52%
Atmosphere Pressure	101kPa	Test Voltage	

TEST MODE

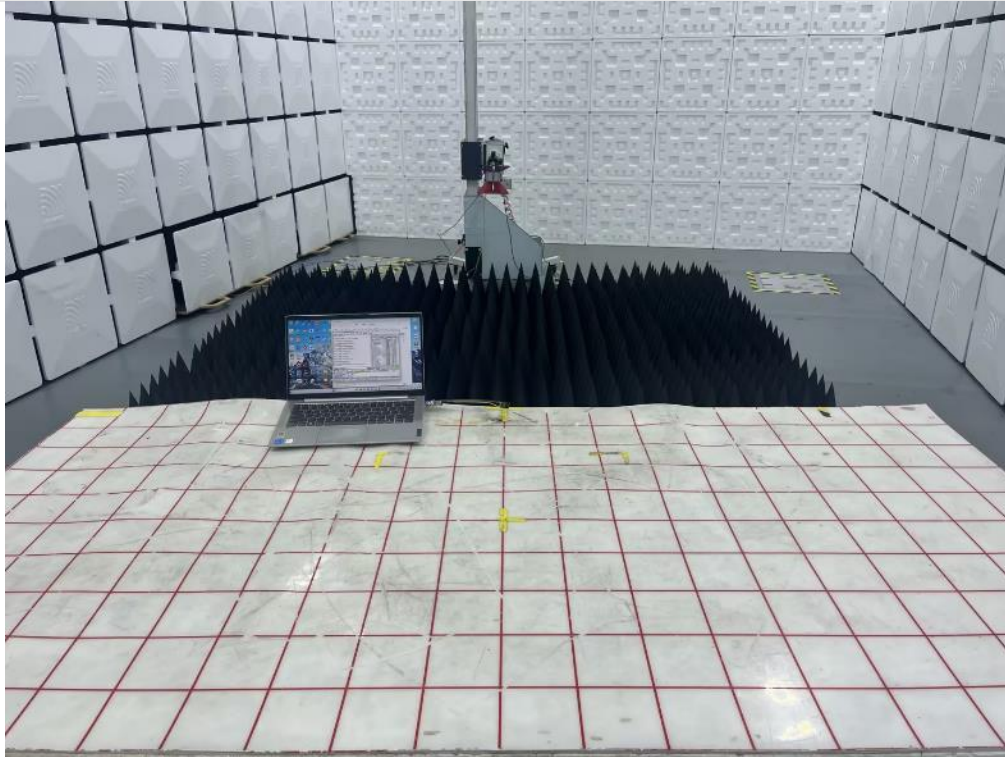
Test Mode:	M01, M02
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TEST RESULTS

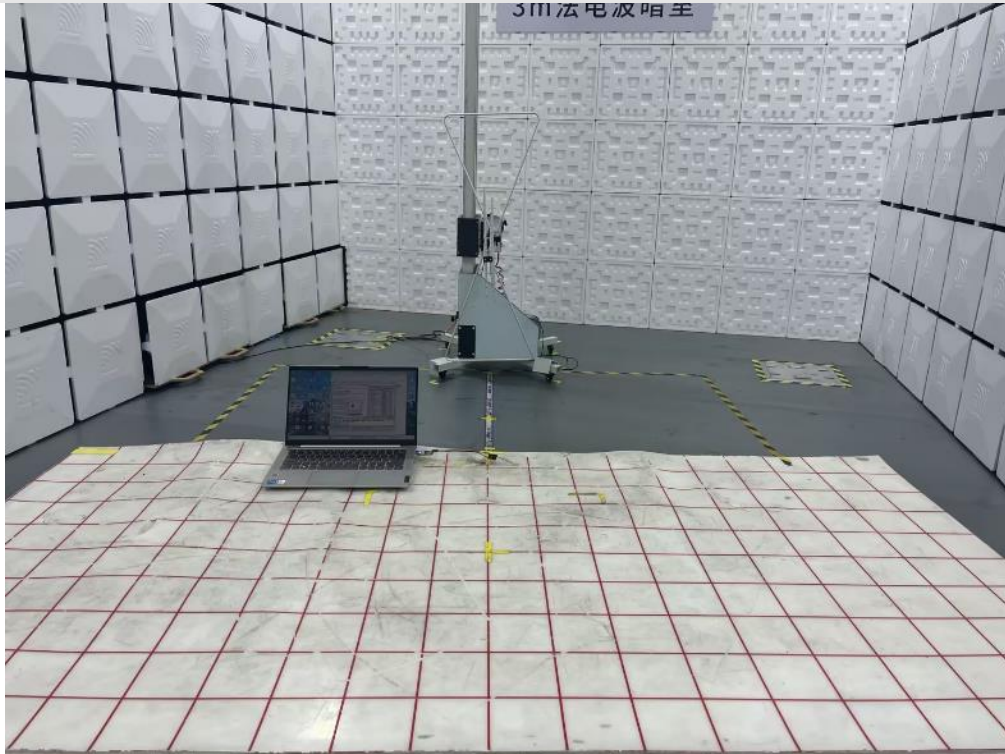
Mode	Level(kV)	Polarity	Test Point	Criteria	Observation	Result	Judgement
Air Discharge	2,4,8	+	All Slot	B	TT,TR	A	Pass
Air Discharge	2,4,8	-	All Slot	B	TT,TR	A	Pass
Contact Discharge	4	+	All Metal	B	TT,TR	A	Pass
Contact Discharge	4	-	All Metal	B	TT,TR	A	Pass
Horizontal Coupling	4	+	Front,rear,left,right	B	TT,TR	A	Pass
Horizontal Coupling	4	-	Front,rear,left,right	B	TT,TR	A	Pass
Vertical Coupling	4	+	Front,rear,left,right	B	TT,TR	A	Pass
Vertical Coupling	4	-	Front,rear,left,right	B	TT,TR	A	Pass
Air Discharge	15	+	All Slot	/	TT,TR	/	/
Air Discharge	15	-	All Slot	/	TT,TR	/	/
Contact Discharge	8	+	All Metal	/	TT,TR	/	/
Contact Discharge	8	-	All Metal	/	TT,TR	/	/
Observation:							
A: No observable change.							
Conclusion: The EUT met the requirements of the standard							

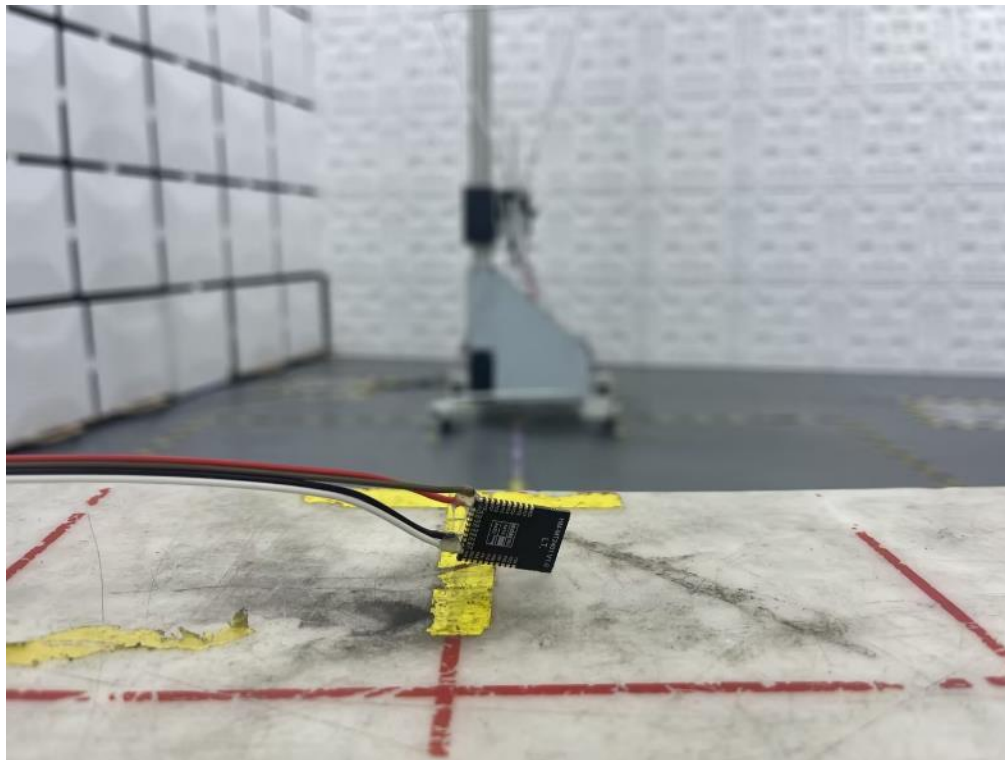
APPENDIX: PHOTOGRAPHS OF TEST CONFIGURATION

Radiated emissions above 1GHz



Radiated emissions below 1GHz

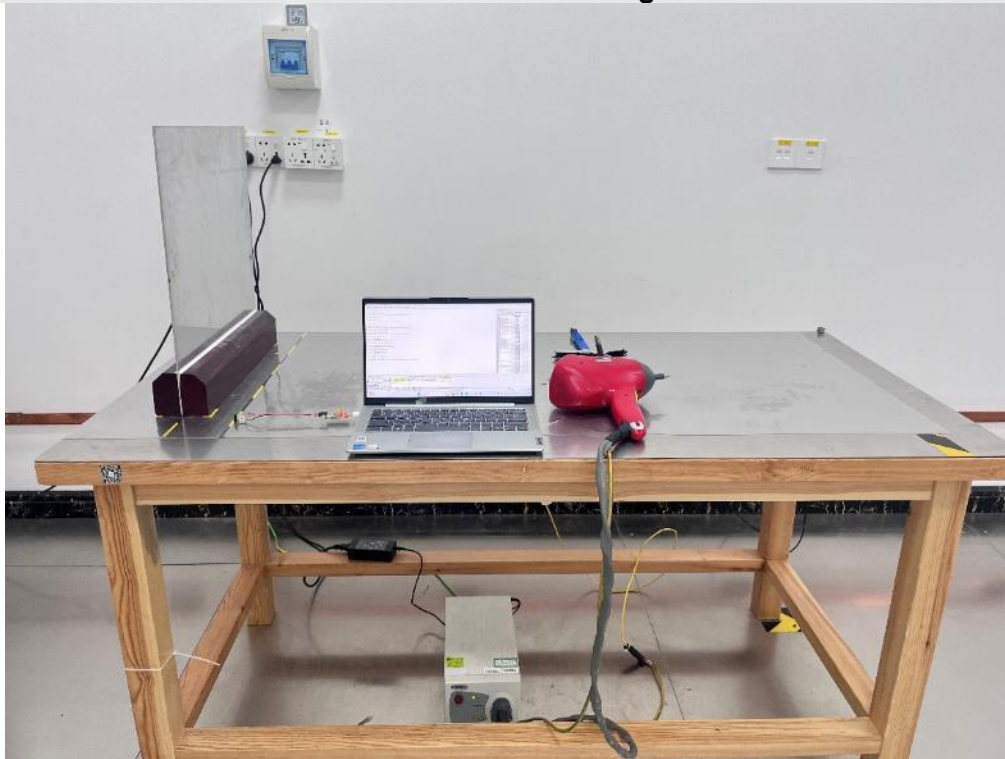




RF electromagnetic field (80 MHz to 6000MHz)

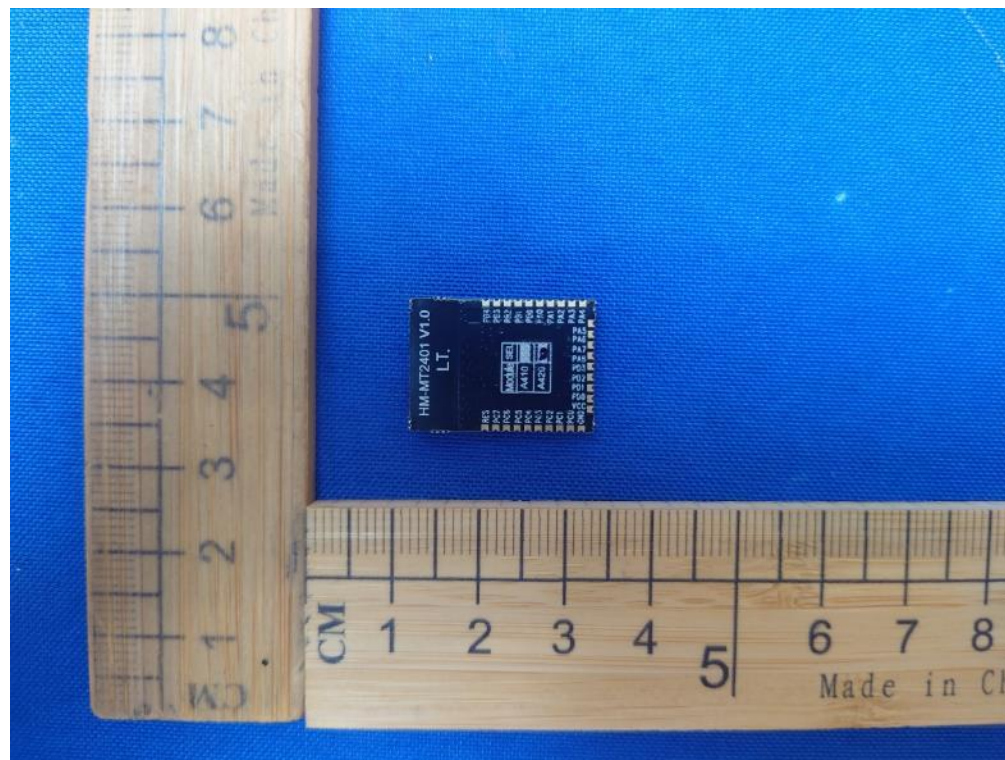
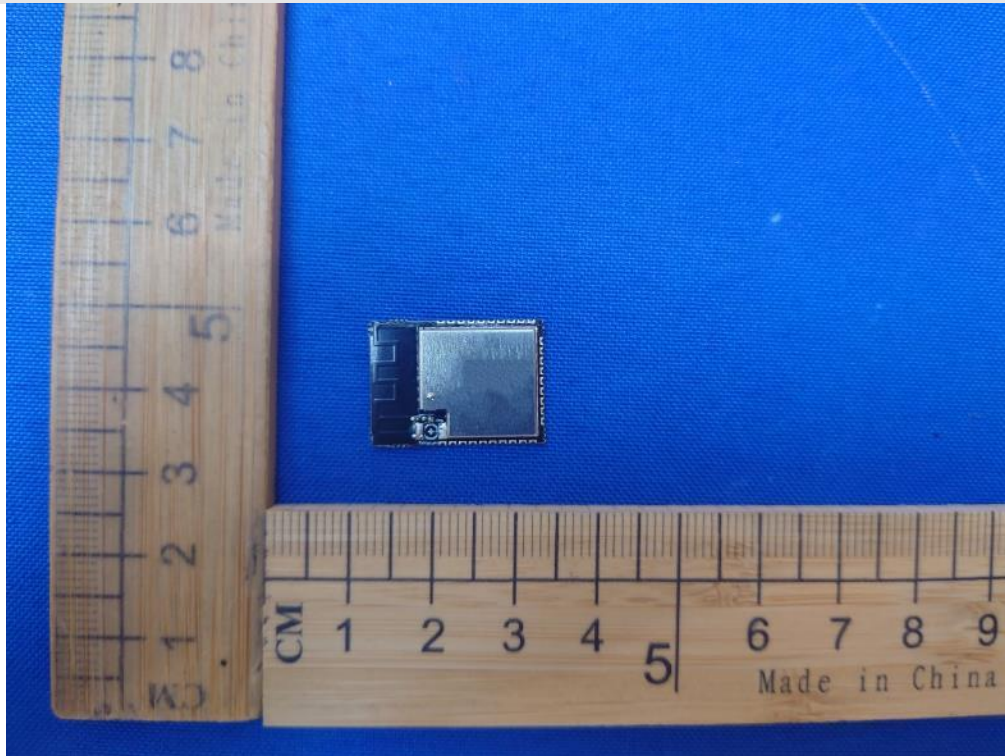


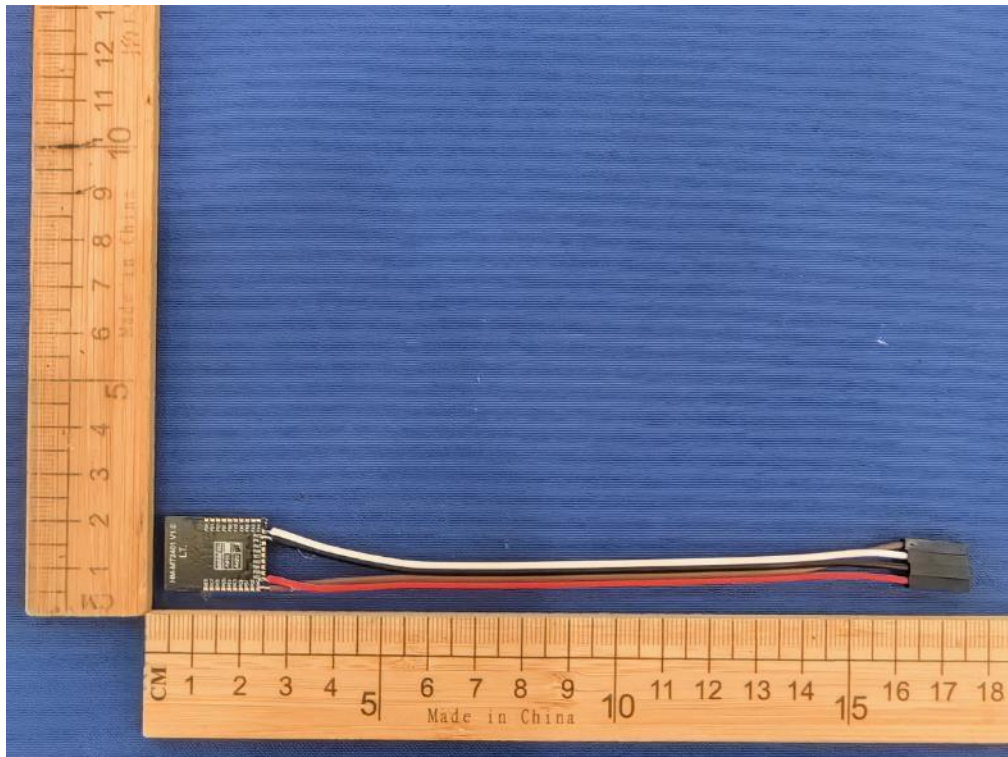
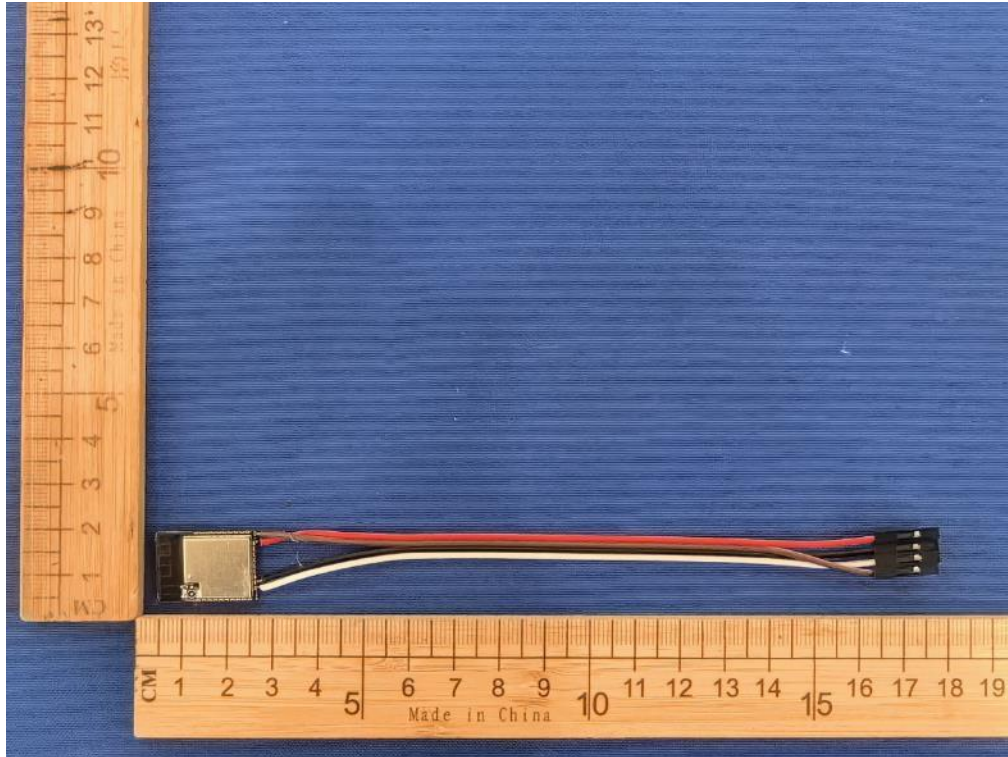
Electrostatic Discharge

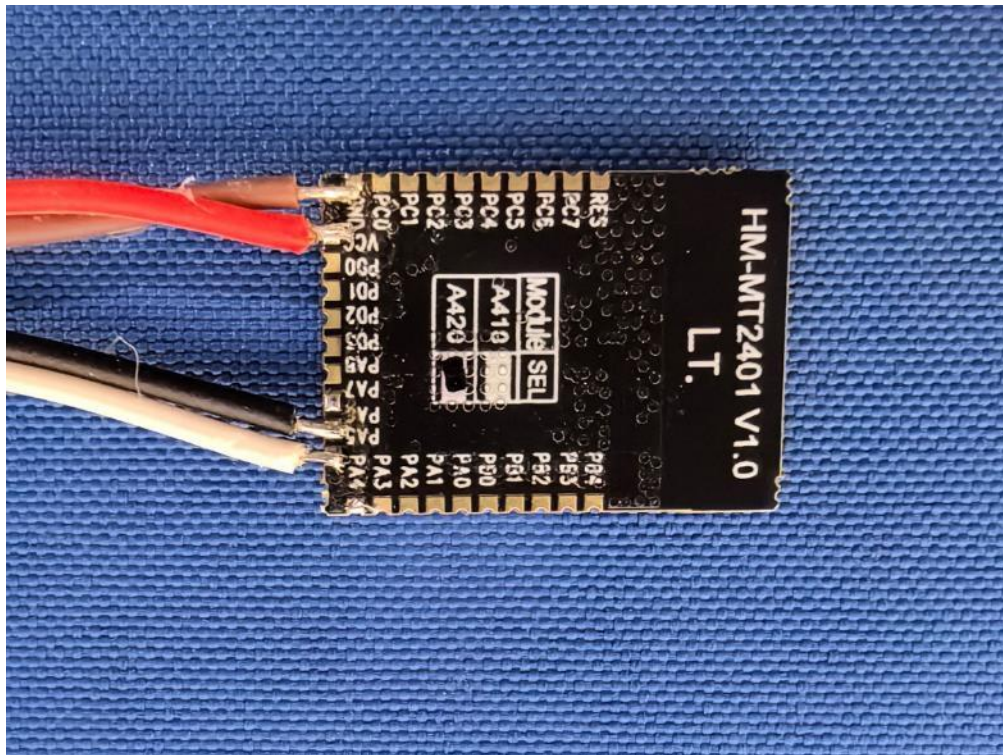
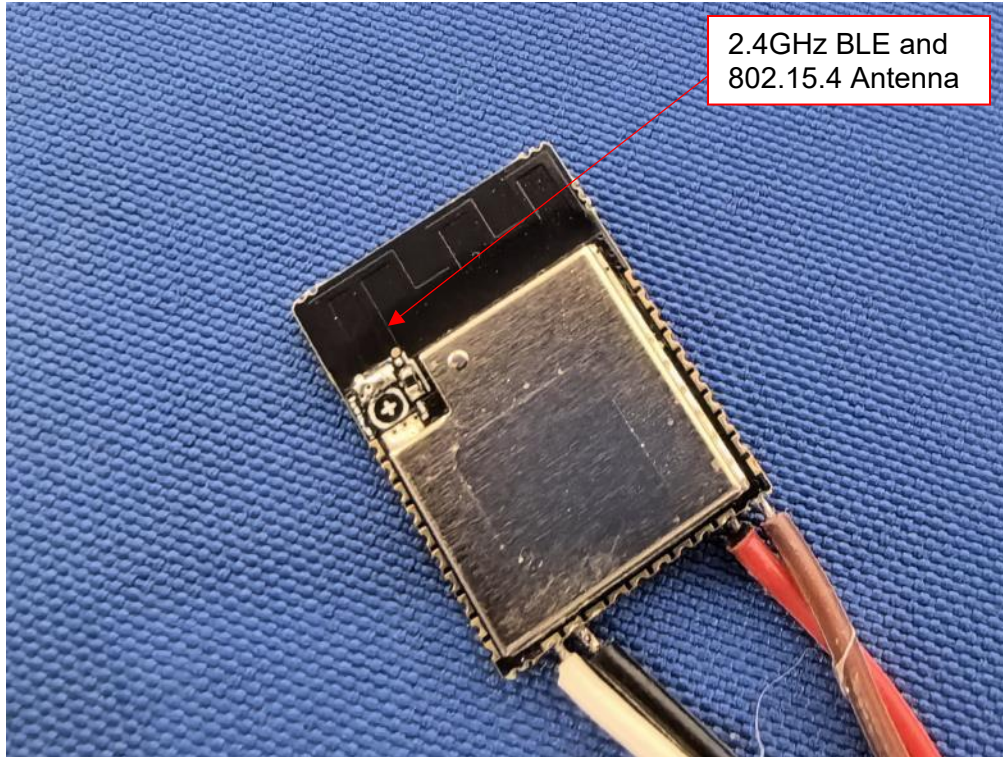


APPENDIX: PHOTOGRAPHS OF THE EUT

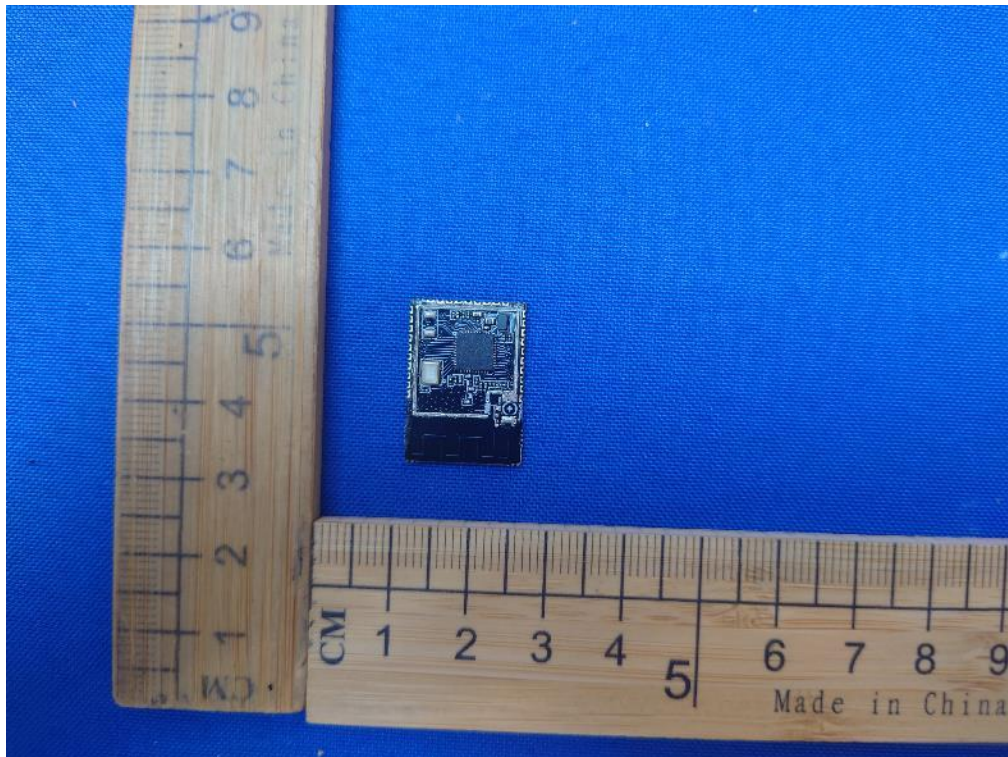
External

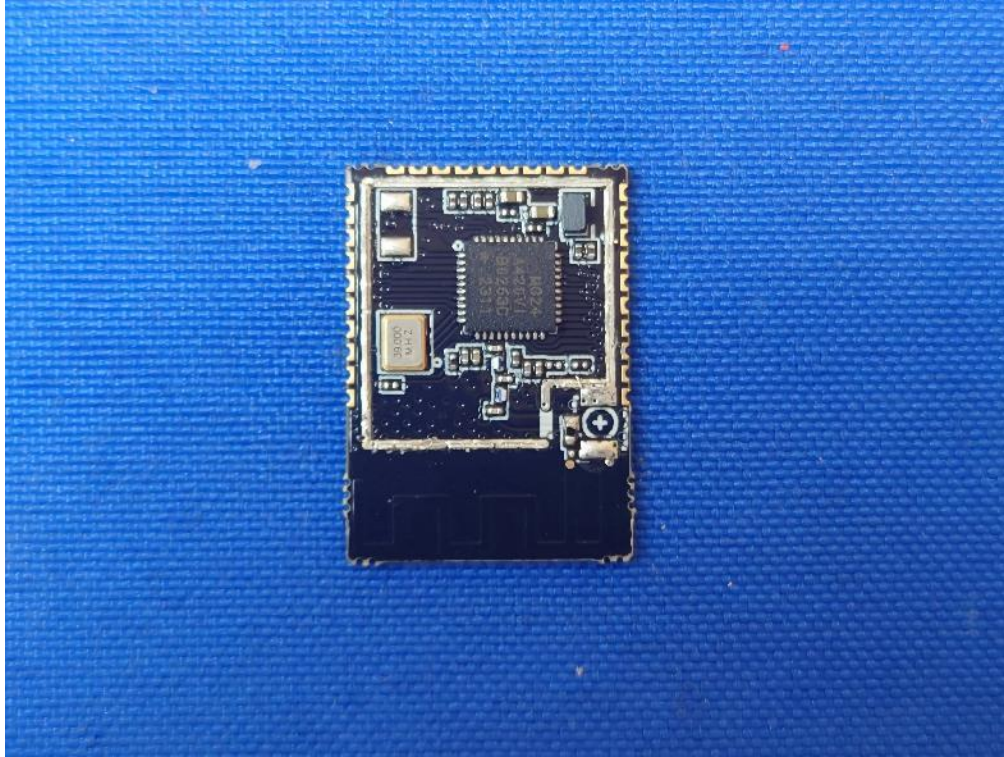






Internal





END OF REPORT