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TEST REPORT

Report No. ..... :	**CHTEW22020052**
Project No.....:	**SHT2202007003EW**
FCC ID ..... :	**2ADHNSM1251SMD**
Applicant's name ..... :	**MATRIX COMSEC PVT. LTD.**
Address.....:	394 - GIDC, MAKARPURA, VADODARA - 390010, GUJARAT, INDIA
Test item description ..... :	**EMPROX READER MODULE**
Trade Mark .....:	MATRIX
Model/Type reference.....:	SM1251SMD
Listed Model(s) .....:	-
Standard ..... :	**FCC CFR Title 47 Part 15 Subpart C Section 15.209**
Date of receipt of test sample.....:	Feb.11, 2022
Date of testing.....:	Feb.11, 2022- Feb.28, 2022
Date of issue.....:	Mar.01, 2022
Result..... .....:	**PASS**

Report Verification:

Compiled by (Position+Printed name+Signature):	File administrator Echo Wei	Echo Wei
Supervised by (Position+Printed name+Signature):	Project Engineer Kiki Kong	Kiki Kong
Approved by (Position+Printed name+Signature):	RF Manager Hans Hu	Hans Hu

Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd.**
Address.....:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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The test report merely correspond to the test sample.

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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.209: Radiated emission limits; general requirements

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

1.2. Report version information

Revision No.	Date of issue	Description
N/A	2022-03-01	Original

2. TEST DESCRIPTION

Report clause	Test Item	Section in CFR 47	Result	Test Engineer
5.1	Antenna requirement	15.203	PASS	-
5.2	AC Power Line Conducted Emissions	15.207	N/A	N/A
5.3	20dB Occupied Bandwidth	2.1049	PASS	Hailey Chen
5.4	Spurious Emissions	15.209	PASS	Dongyang Wu

Noted: The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	MATRIX COMSEC PVT. LTD.
Address:	394 - GIDC, MAKARPURA, VADODARA - 390010, GUJARAT, INDIA
Manufacturer:	MATRIX COMSEC PVT. LTD.
Address:	15 & 19 - GIDC, WAGHODIA, VADODARA - 391760, GUJARAT, INDIA
Factory:	MATRIX COMSEC PVT. LTD.
Address:	15 & 19 - GIDC, WAGHODIA, VADODARA - 391760, GUJARAT, INDIA

3.2. Product Description

Name of EUT:	EMPROX READER MODULE
Trade Mark:	MATRIX
Model No.:	SM1251SMD
Listed Model(s):	-
Power supply:	DC 3.3-5V
Hardware version:	V2R1
Software version:	NA

3.3. Radio Specification Description

Frequency Range:	120-130kHz
Operation frequency:	125kHz
Channel number:	1
Modulation Type:	Manchester
Antenna type:	Coil Antenna

3.4. Testing Laboratory Information

Laboratory Name	Shenzhen Huatongwei International Inspection Co., Ltd.	
Laboratory Location	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China	
Connect information:	Phone: 86-755-26715499 E-mail: cs@szhtw.com.cn http://www.szhtw.com.cn	
Qualifications	Type	Accreditation Number
	FCC	762235

4. TEST CONFIGURATION

4.1. EUT operation mode

TEST MODE

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit.
For AC power line conducted emissions:
The engineering test program was provided and enabled to make EUT continuous transmit.

Operation Method/Procedure	1. Power ON SM1251SMD module by applying 3.3-5V d.c. supply. 2. Use RFID card to verify functionality of the module. 3. Show RFID card to attached antenna. The LED on the module should blink to confirm successful detection of the card.

4.2. Support unit used in test configuration and system

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The following peripheral devices and interface cables were connected during the measurement:

Whether support unit is used?			
✓ No			
Item	Equipement	Trade Name	Model No.
1			
2			

4.3. Testing environmental condition

Type	Requirement	Actual
Temperature:	15~35°C	25°C
Relative Humidity:	25~75%	50%
Air Pressure:	860~1060mbar	1000mbar

4.4. Measurement uncertainty

Test Items	Measurement Uncertainty
AC Power Conducted Emissions	±3.00 dB
Radiated emissions below 1GHz	±4.36 dB
Radiated emissions above 1GHz	±5.10 dB
Occupied Bandwidth	±70Hz for <1GHz ±130Hz for >1GHz

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.5. Equipments Used during the Test

● Conducted Emission							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Shielded Room	Albatross projects	HTWE0114	N/A	N/A	2018/09/28	2023/09/27
●	EMI Test Receiver	R&S	HTWE0111	ESCI	101247	2021/09/14	2022/09/13
●	Artificial Mains	SCHWARZBECK	HTWE0113	NNLK 8121	573	2021/09/17	2022/09/16
●	Pulse Limiter	R&S	HTWE0193	ESH3-Z2	101447	2021/09/16	2022/09/15
●	RF Connection Cable	HUBER+SUHNER	HTWE0113-02	ENVIROFLEX_142	EF-NM-BNCM-2M	2021/09/17	2022/09/16
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-6th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0127	SAC-3m-02	C11121	2018/09/30	2022/09/29
●	EMI Test Receiver	R&S	HTWE0099	ESCI	100900	2021/09/14	2022/09/13
●	Loop Antenna	R&S	HTWE0170	HFH2-Z2	100020	2021/04/06	2024/04/05
●	Ultra-Broadband Antenna	SCHWARZBECK	HTWE0123	VULB9163	538	2021/04/06	2024/04/05
●	Pre-Amplifer	SCHWARZBECK	HTWE0295	BBV 9742	N/A	2021/11/05	2022/11/04
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-01	N/A	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0062-02	SUCOFLEX104	501184/4	2022/02/25	2023/02/24
●	Test Software	R&S	N/A	ES-K1	N/A	N/A	N/A

● Radiated emission-7th test site							
Used	Test Equipment	Manufacturer	Equipment No.	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Semi-Anechoic Chamber	Albatross projects	HTWE0122	SAC-3m-01	C11121	2018/09/27	2022/09/26
●	Spectrum Analyzer	R&S	HTWE0098	FSP40	100597	2021/09/13	2022/09/12
●	Horn Antenna	SCHWARZBECK	HTWE0126	9120D	1011	2020/04/01	2023/03/31
●	Broadband Horn Antenna	SCHWARZBECK	HTWE0103	BBHA9170	BBHA9170472	2020/04/27	2023/04/26
●	Pre-amplifier	CD	HTWE0071	PAP-0102	12004	2021/11/05	2022/11/04
●	Broadband Pre-amplifier	SCHWARZBECK	HTWE0201	BBV 9718	9718-248	2021/03/05	2022/03/04
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-01	6m 18GHz S Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-02	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0119-05	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	RF Connection Cable	HUBER+SUHNER	HTWE0120-04	6m 3GHz RG Serisa	N/A	2022/02/25	2023/02/24
●	Test Software	Audix	N/A	E3	N/A	N/A	N/A

●	RF Conducted Method					
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
●	Signal and spectrum Analyzer	R&S	FSV40	100048	2021/09/13	2022/09/12
●	Spectrum Analyzer	Agilent	N9020A	MY50510187	2021/09/13	2022/09/12
●	Power Meter	Anritsu	ML249A	N/A	2021/09/13	2022/09/12
○	Radio communication tester	R&S	CMW500	137688-Lv	2021/09/13	2022/09/12

5. TEST CONDITIONS AND RESULTS

5.1. Antenna requirement

Requirement

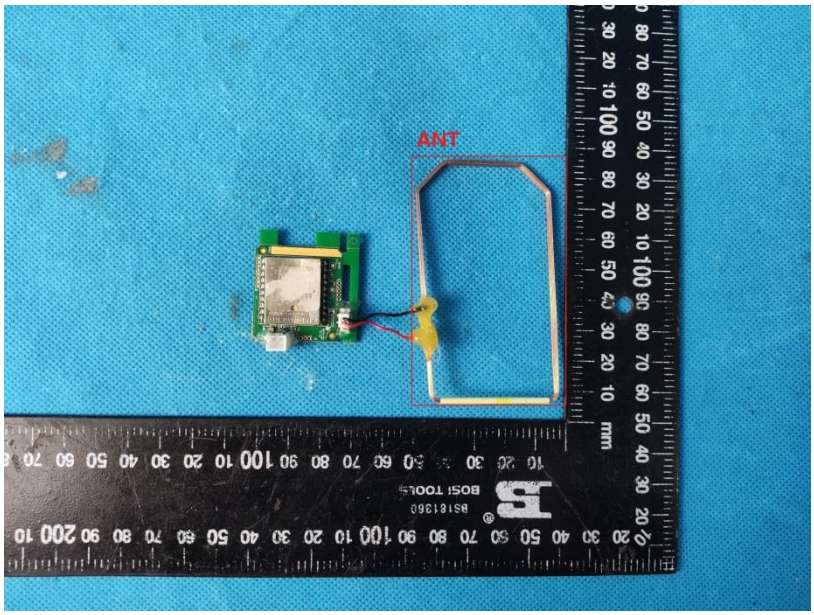
FCC CFR Title 47 Part 15 Subpart C Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

The antenna type is a Coil antenna, please refer to the below antenna photo.



5.2. AC Power Conducted Emissions

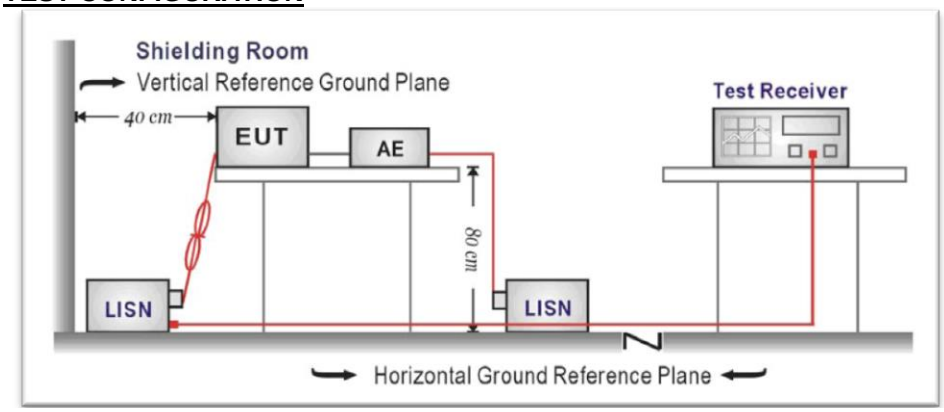
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207:

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10
2. The EUT was placed on a plat form of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50ohm / 50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor,was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST MODE:

Please refer to the clause 4.1

TEST RESULTS

☐ **Passed** ☒ **Not Applicable**

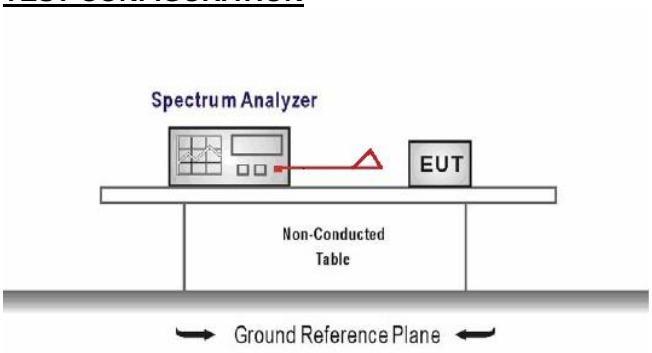
5.3. 20dB Bandwidth

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.215

Intentional radiators must be designed to ensure that the 20dB emission bandwidth in the specific band.

TEST CONFIGURATION



TEST PROCEDURE

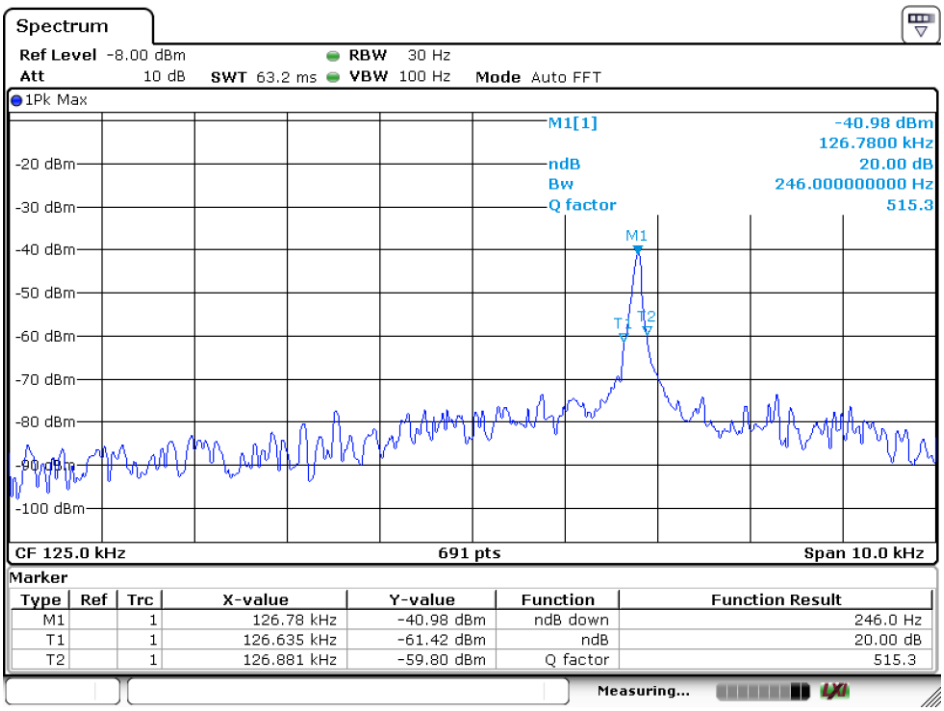
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Please refer to the clause 4.1

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**



Date: 21.FEB.2022 09:58:32

Test Channel	20dB Bandwidth (Hz)	Limit (KHz)	Result
00	246.0	-	Pass

5.4. Radiated Emission

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209
Limit for frequency below 30MHz:

Frequency	Limit (uV/m)	Measurement Distance(m)	Remark
0.009~0.490	2400/F(kHz)	300	Quasi-peak
0.490~1.705	24000/F(kHz)	30	Quasi-peak
1.705~30.0	30	30	Quasi-peak

Note: Limit dBuV/m @3m = Limit dBuV/m @300m + 40*log(300/3)= Limit dBuV/m @300m +80,

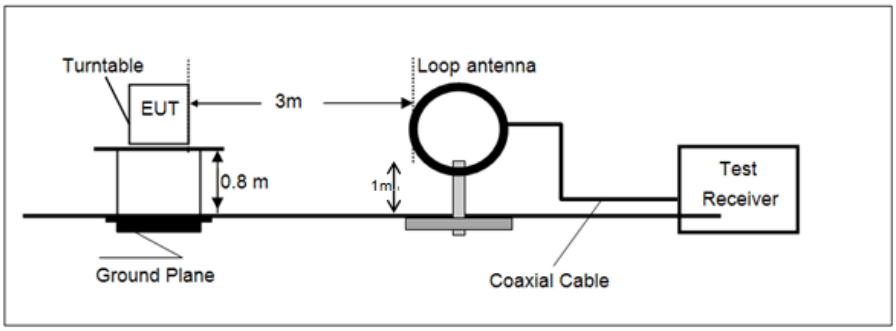
Limit dBuV/m @3m = Limit dBuV/m @30m +40*log(30/3)= Limit dBuV/m @30m + 40.

Limit for frequency above 30MHz:

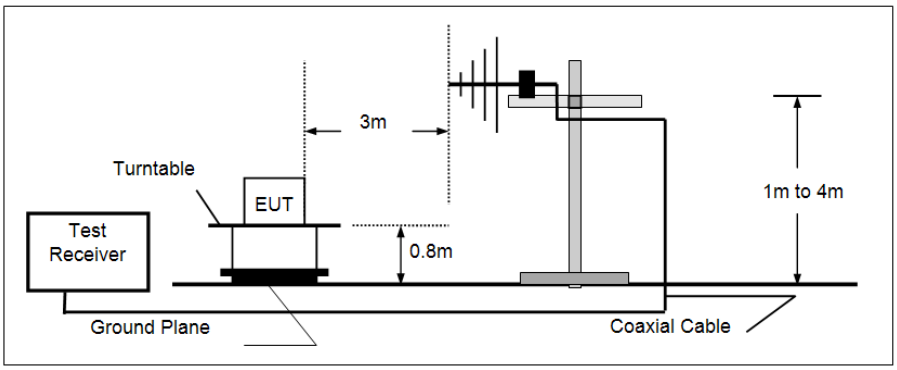
Frequency	Limit (dBuV/m@3m)	Remark
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz-1GHz	54.00	Quasi-peak

TEST CONFIGURATION

- 9 kHz ~ 30 MHz



- 30 MHz ~ 1 GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, 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 to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Below 30MHz:
   RBW=10 kHz, VBW=30 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
   (3) 30MHz to 1 GHz:
   RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
   If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
   (4) From 1 GHz to 10th harmonic:
   RBW=1MHz, VBW=3MHz Peak detector for Peak value.
   RBW=1MHz, VBW=3MHz RMS detector for Average value.

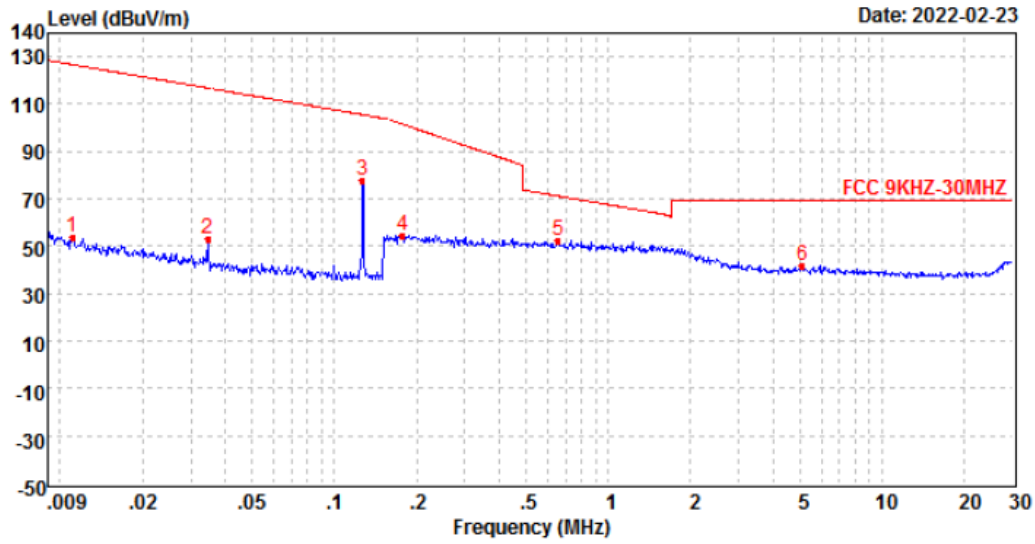
TEST MODE:

Please refer to the clause 4.1

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

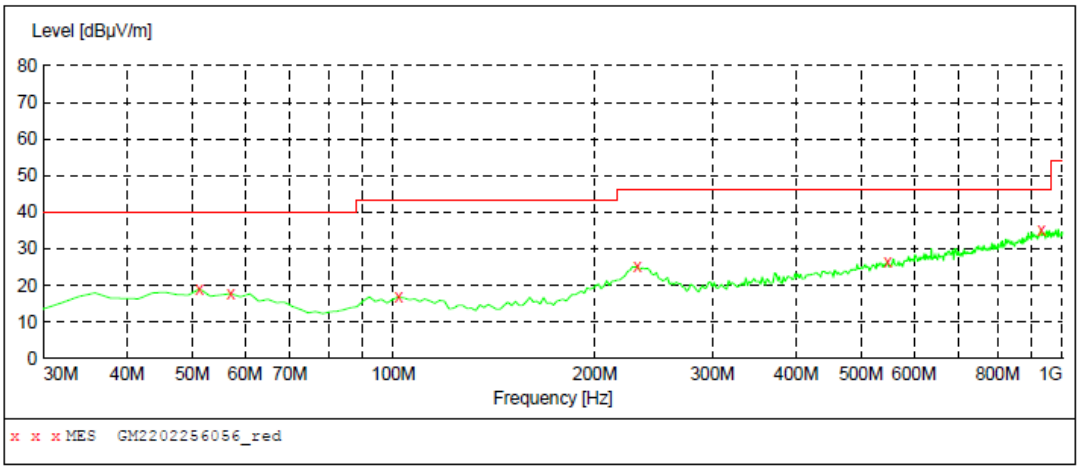
Below 30MHz:



Mark	Frequency MHz	Reading dBuV/m	Antenna dB	Cable dB	Preamp dB	Level dBuV/m	Limit dBuV/m	Over limit	Remark
1	0.01	24.58	22.23	7.21	0.00	54.02	126.71	-72.69	Peak
2	0.03	23.79	22.34	7.21	0.00	53.34	116.82	-63.48	Peak
3	0.13	48.48	22.27	7.21	0.00	77.96	105.53	-27.57	Peak
4	0.18	25.23	22.22	7.21	0.00	54.66	101.66	-47.00	Peak
5	0.66	23.25	22.20	7.20	0.00	52.65	71.24	-18.59	Peak
6	5.11	12.79	22.18	7.16	0.00	42.13	69.54	-27.41	Peak

Above 30MHz:

Polarization:	Vertical

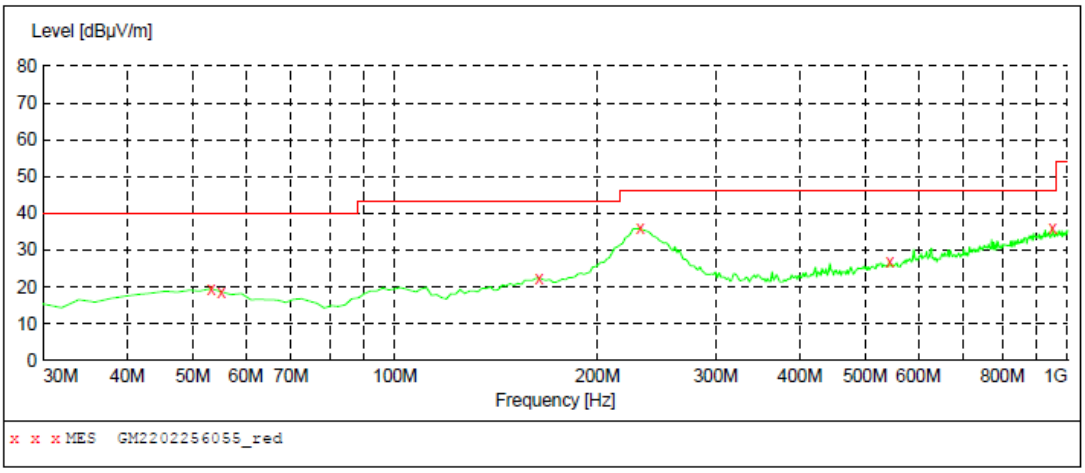


MEASUREMENT RESULT: "GM2202256056_red"

2/25/2022 3:34PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
51.340000	19.10	-9.1	40.0	20.9	QP	100.0	227.00	VERTICAL
57.160000	17.80	-9.5	40.0	22.2	QP	100.0	254.00	VERTICAL
101.780000	16.80	-10.6	43.5	26.7	QP	100.0	118.00	VERTICAL
231.760000	25.20	-9.4	46.0	20.8	QP	100.0	216.00	VERTICAL
547.980000	26.30	-0.8	46.0	19.7	QP	100.0	107.00	VERTICAL
930.160000	35.00	7.2	46.0	11.0	QP	100.0	278.00	VERTICAL

Polarization:	Horizontal



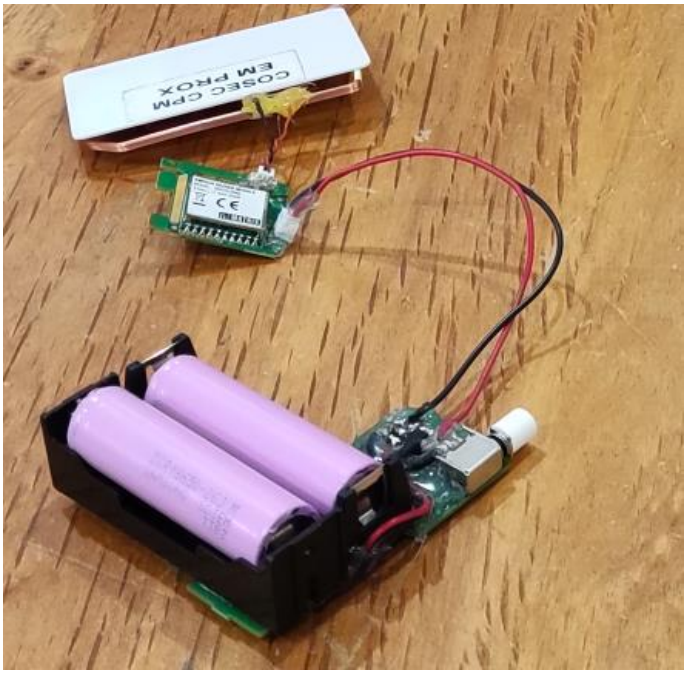
MEASUREMENT RESULT: "GM2202256055_red"

2/25/2022 3:31PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.280000	19.60	-9.1	40.0	20.4	QP	100.0	159.00	HORIZONTAL
55.220000	18.70	-9.2	40.0	21.3	QP	300.0	97.00	HORIZONTAL
163.860000	22.50	-13.2	43.5	21.0	QP	100.0	268.00	HORIZONTAL
231.760000	36.00	-9.4	46.0	10.0	QP	100.0	107.00	HORIZONTAL
544.100000	26.70	-0.9	46.0	19.3	QP	100.0	121.00	HORIZONTAL
949.560000	36.00	7.4	46.0	10.0	QP	300.0	360.00	HORIZONTAL

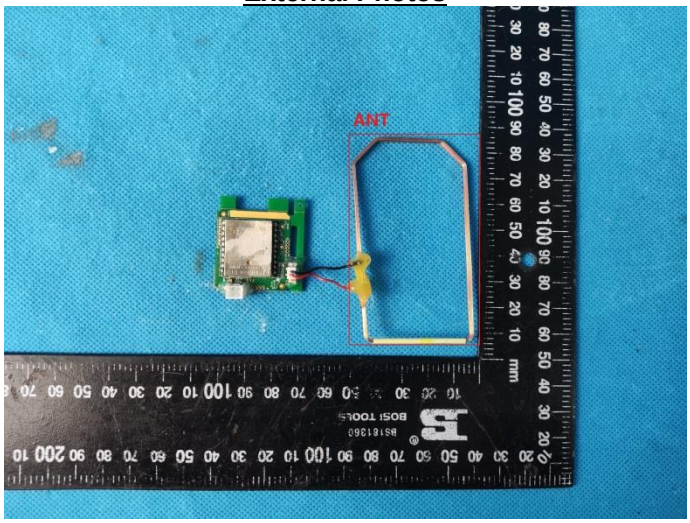
6. TEST SETUP PHOTOS

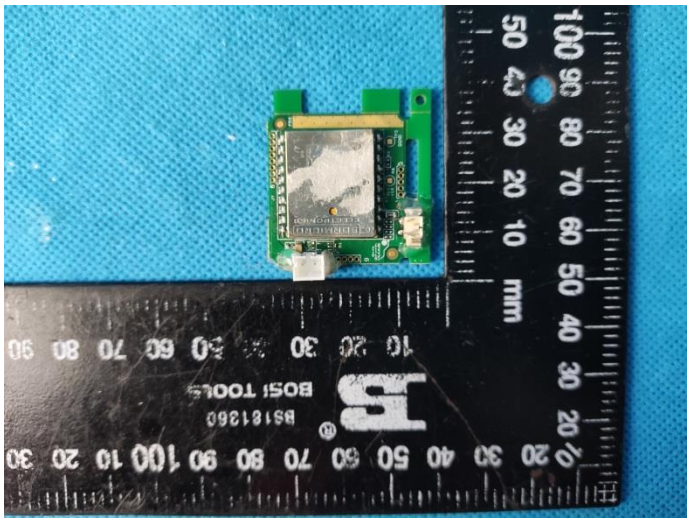
Radiated Emissions

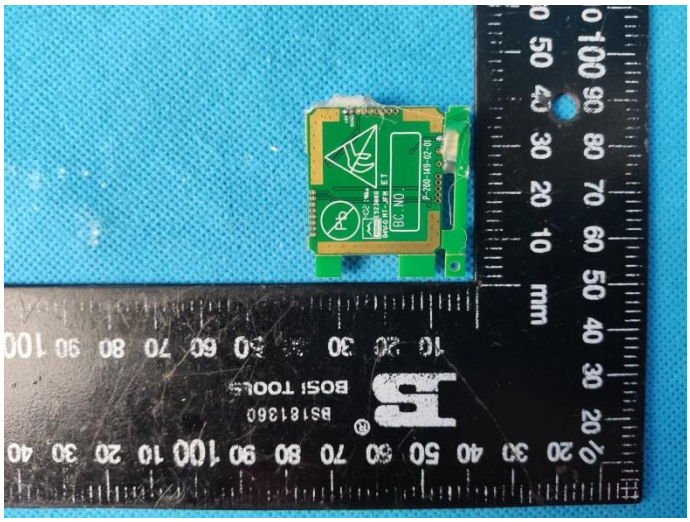

COSEC CPM
EM PROX

7. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

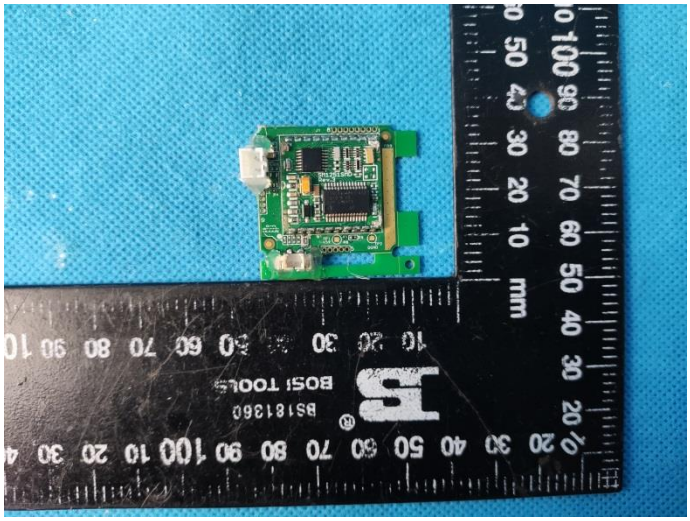
External Photos

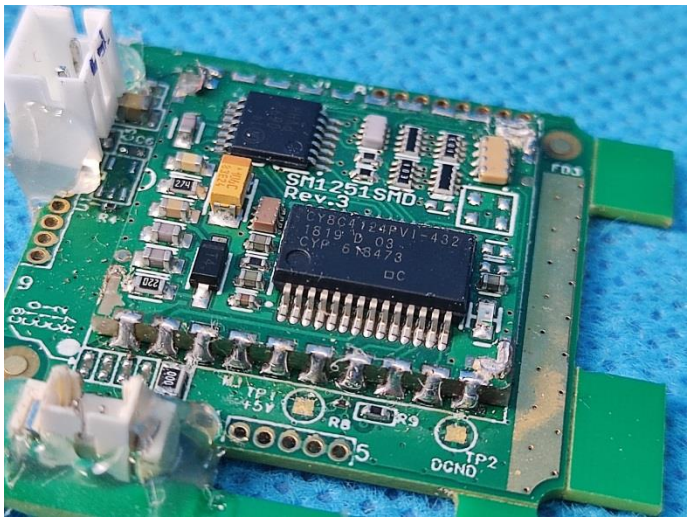






Internal Photos





--------End of Report--------