Shenzhen CTL Testing Technology Co., Ltd.
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TEST REPORT

FCC PART 15.225

Report Reference No. ..... :	**CTL2106212131-WF**	
Compiled by: (position+printed name+signature)	Happy Guo (File administrators)	Happy Guo
Tested by: (position+printed name+signature)	Gary Gao (Test Engineer)	Gary Gao
Approved by: (position+printed name+signature)	Ivan Xie (Manager)	Ivan Xie

Product Name ..... :	HF RFID NFC Reader
Model/Type reference ..... :	OEM-DES-M890-USB-GS
List Model(s)..... :	OEM-DES-M890-HID-GS, OEM-DES-M890-PCSC-GS, OEM-DES-M890-232-GS, OEM-DES-M890-SA-GS
Trade Mark..... :	N/A
FRN ..... :	0030525836
FCC ID..... :	2A2L74351100442XXX
Applicant's name ..... :	**Georg Schlegel GmbH & Co. KG**
Address of applicant ..... :	Kapellenweg 4, 88525 Dürmentingen, Deutschland, Germany
Test Firm..... :	**Shenzhen CTL Testing Technology Co., Ltd.**
Address of Test Firm ..... :	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification..... :	
Standard ..... :	**FCC Part 15.225:** Operation within the band 13.110–14.010 MHz.
TRF Originator ..... :	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF..... :	Dated 2011-01
Date of receipt of test item ..... :	July 05, 2021
Date of sampling..... :	July 05, 2021
Date of Test Date..... :	July 05, 2021-July 12, 2021
Data of Issue ..... :	July 13, 2021

TEST REPORT

Test Report No. :	CTL2106212131-WF	July 13, 2021 Date of issue

Equipment under Test	:	HF RFID NFC Reader
Sample No	:	CTL210621213-1-S001
Model /Type	:	OEM-DES-M890-USB-GS
Listed Models	:	OEM-DES-M890-HID-GS, OEM-DES-M890-PCSC-GS, OEM-DES-M890-232-GS, OEM-DES-M890-SA-GS
Order Codes		RRJ(XX)_RFID_(CO)(HID)(RS2)(USB)(SKS)(OC)(RS4)(yy) RFID_kkkkkk_yy RRJ(XX)_RFID(_Buuu) 435110044200002, 435110044210002, 435110044220001, 435110044220002, 435110044220003 XX=Color VA, SW, BL, RT, WS, GB, GN kkkkkk = 000000…999999 yy = Version 01…99 Buuu = B001…B999
Applicant	:	**Georg Schlegel GmbH & Co. KG**
Address	:	Kapellenweg 4, 88525 Dürmentingen, Deutschland, Germany
Manufacturer	:	**Georg Schlegel GmbH & Co. KG**
Address	:	Kapellenweg 4, 88525 Dürmentingen, Deutschland, Germany

Test result	Pass *

* In the configuration tested, the EUT complied with the standards specified page 5.

The device (Product Name: HF RFID NFC Reader) Models Name: OEM-DES-M890-USB-GS, OEM-DES-M890-HID-GS, OEM-DES-M890-PCSC-GS,OEM-DES-M890-232-GS, OEM-DES-M890-SA-GS have same electrical, PCB and BOM, only the colour and model's names are different for marketing requirements.

The test results presented in this report relate only to the object tested.

** Modified History **

Revisions	**Description**	**Issued Data**	**Report No.**	**Remark**
Version 1.0	Initial Test Report Release	2021-07-13	CTL2106212131-WF	Tracy Qi

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1. SUMMARY

1.1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.225: Operation within the band 13.110–14.010 MHz

ANSI C63.10:2020 : American National Standard for Testing Unlicensed Wireless Devices

1.2. Test Description

FCC PART 15 .225		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 2.1049	20dB Bandwidth	PASS
FCC Part 15.225(a) (b) (c)	In-band Emissions	PASS
FCC Part 15.225(d)/15.207	Out-of-band Emissions	PASS
FCC Part 15.225(e)	Frequency Stability Tolerance	PASS

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

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China
There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L7497

Shenzhen CTL Testing Technology Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No. 4343.01

Shenzhen CTL Testing Technology Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

IC Registration No.: 9618B

CAB identifier: CN0041

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements with Registration No.: 9618B on Jan. 22, 2019.

FCC-Registration No.: 399832

Designation No.: CN1216

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 399832, December 08, 2017.

1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)

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

2. GENERAL INFORMATION

2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2. General Description of EUT

Product Name:	HF RFID NFC Reader
Model/Type reference:	OEM-DES-M890-USB-GS
Power supply:	DC 3.3V~5.0V
RFID	
Operation frequency:	13.56MHz
Modulation :	ASK
No. of Channel :	1
Antenna type:	PCB Antenna
Antenna gain:	0.0dBi

Note1: For more details, please refer to the user's manual of the EUT.

2.3. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ESH2-Z5	860014/010	2021/05/10	2022/05/09
Double cone logarithmic antenna	Schwarzbeck	VULB 9168	824	2020/04/07	2023/04/06
Horn Antenna	Ocean Microwave	OBH100400	26999002	2020/11/28	2021/11/27
EMI Test Receiver	R&S	ESCI	1166.5950.03	2021/05/10	2022/05/09
Spectrum Analyzer	Agilent	E4407B	MY41440676	2021/05/19	2022/05/18
Spectrum Analyzer	Agilent	N9020A	US46220290	2021/05/19	2022/05/18
Spectrum Analyzer	Keysight	N9020A	MY53420874	2021/05/19	2022/05/18
Controller	EM Electronics	EM 1000	060859	2021/05/19	2022/05/18
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2021/05/10	2022/05/09
Active Loop Antenna	Da Ze	ZN30900A	/	2021/05/13	2022/05/12
Amplifier	Agilent	8449B	3008A02306	2021/05/13	2022/05/12
Amplifier	Agilent	8447D	2944A10176	2021/05/11	2022/05/10
Amplifier	Brief&Smart	LNA-4018	2104197	2021/05/19	2022/05/18
Temperature/Humidity Meter	Gangxing	CTH-608	02	2021/05/19	2022/05/18
Power Sensor	Agilent	U2021XA	MY55130004	2021/05/19	2022/05/18
Power Sensor	Agilent	U2021XA	MY55130006	2021/05/19	2022/05/18
Power Sensor	Agilent	U2021XA	MY54510008	2021/05/19	2022/05/18
Power Sensor	Agilent	U2021XA	MY55060003	2021/05/19	2022/05/18
Spectrum Analyzer	RS	FSP	1164.4391.38	2021/05/19	2022/05/18

Test Software	
Name of Software	Version
TST-PASS	1.0.5
ES-K1(Below 1GHz)	V1.71
e3(Above 1GHz)	6.111221a

The calibration interval was one year

2.4. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2A2L74351100442XXX filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.

2.5. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emissions Test

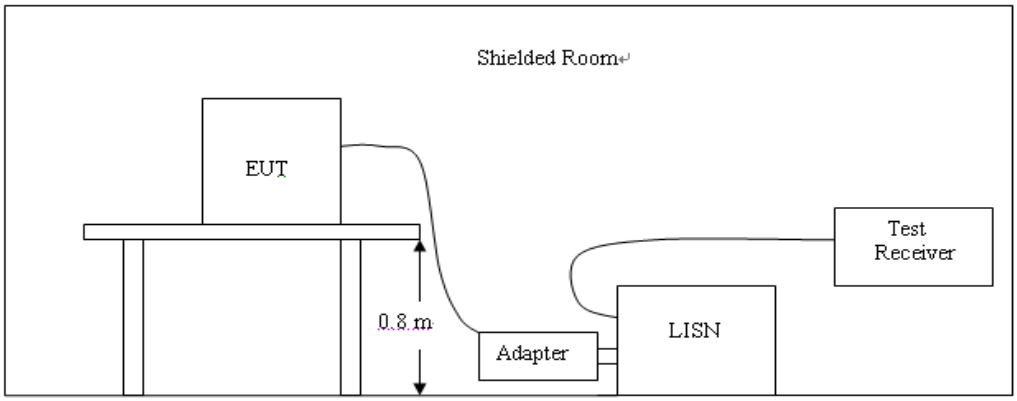
LIMIT

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

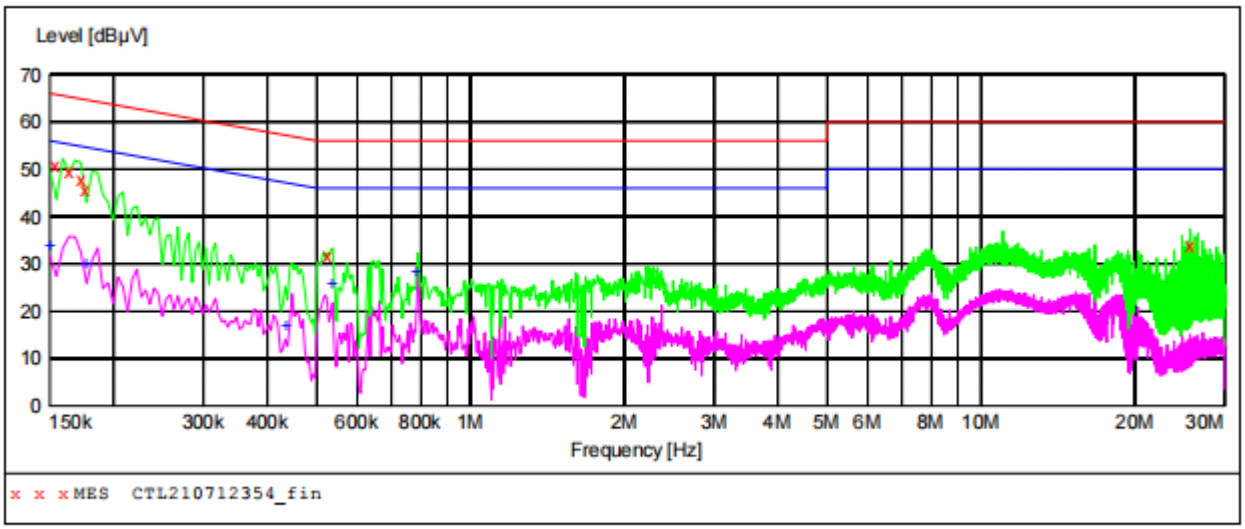


TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10:2020.
2. Support equipment, if needed, was placed as per ANSI C63.10:2020.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2020.
4. The adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST RESULTS

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL210712354_fin"

7/12/2021 9:31AM

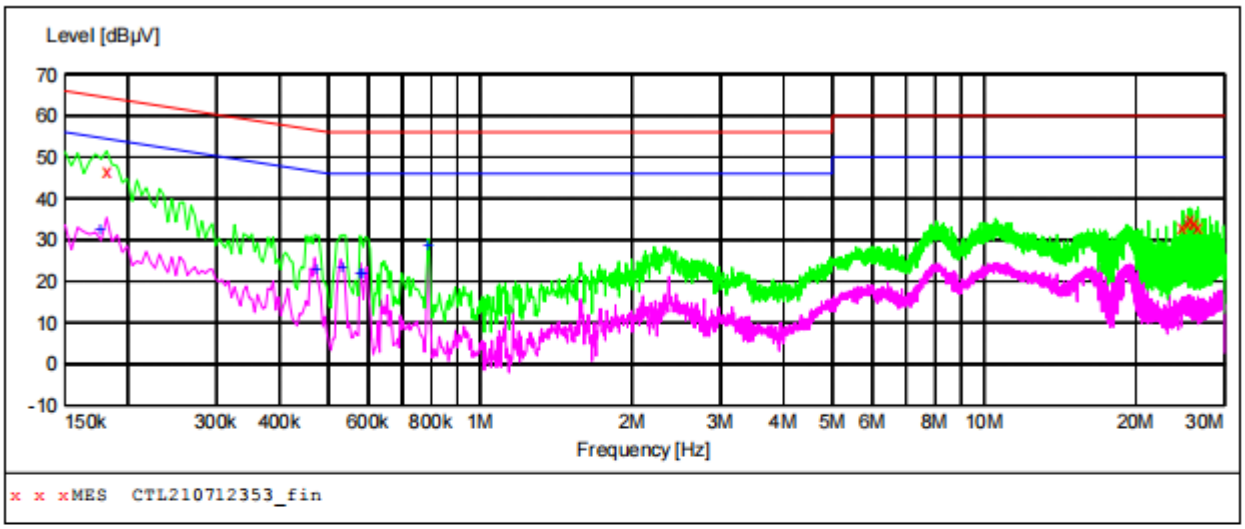
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.154500	50.60	10.0	66	15.2	QP	L1	GND
0.163500	49.40	10.0	65	15.9	QP	L1	GND
0.172500	47.70	10.0	65	17.1	QP	L1	GND
0.177000	45.90	10.0	65	18.7	QP	L1	GND
0.528000	31.70	10.1	56	24.3	QP	L1	GND
25.665000	34.00	11.5	60	26.0	QP	L1	GND

MEASUREMENT RESULT: "CTL210712354_fin2"

7/12/2021 9:31AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	33.80	10.0	56	22.2	AV	L1	GND
0.177000	30.30	10.0	55	24.3	AV	L1	GND
0.438000	17.00	10.0	47	30.1	AV	L1	GND
0.537000	25.90	10.1	46	20.1	AV	L1	GND
0.789000	28.20	10.1	46	17.8	AV	L1	GND

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL210712353_fin"

7/12/2021 9:28AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.181500	46.90	10.0	64	17.5	QP	N	GND
24.769500	33.20	11.5	60	26.8	QP	N	GND
25.363500	33.90	11.5	60	26.1	QP	N	GND
25.665000	35.20	11.5	60	24.8	QP	N	GND
26.263500	34.00	11.6	60	26.0	QP	N	GND
26.565000	33.10	11.6	60	26.9	QP	N	GND

MEASUREMENT RESULT: "CTL210712353_fin2"

7/12/2021 9:28AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.177000	32.40	10.0	55	22.2	AV	N	GND
0.474000	23.00	10.0	46	23.4	AV	N	GND
0.532500	23.70	10.1	46	22.3	AV	N	GND
0.582000	21.90	10.1	46	24.1	AV	N	GND
0.586500	22.10	10.1	46	23.9	AV	N	GND
0.789000	28.70	10.1	46	17.3	AV	N	GND

3.2. Radiated Emissions and Band Edge

Limit

a The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

b Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

c Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

d The field strength of any emissions appearing outside of the 13.110– 14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Frequency (MHz)	Distance (Meters)	Radiated (dBuV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-13.110	3	69.54	30
13.110-13.410	3	80.50	106
13410-13.553	3	90.47	334
13.553-13.567	3	124.00	15848
13.567-13.710	3	90.47	334
13.710-14.010	3	80.50	106
14.010-30.0	3	69.54	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

Test Procedure

1. The EUT was placed on 80cm wooden desk above ground plane which on a turn table.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL – AG

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

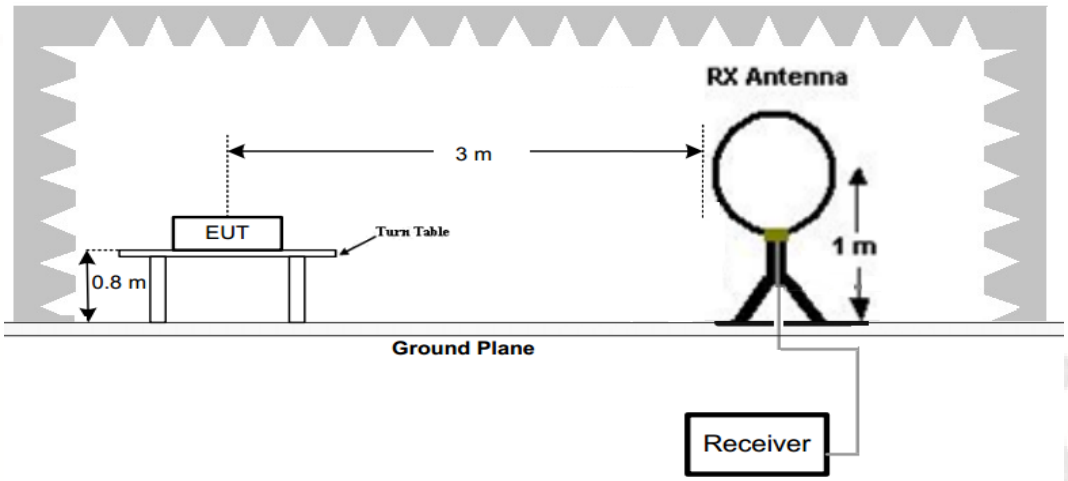
For example

Frequency (MHz)	FS (dBuV/m)	RA (dBuV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
150.00	40	58.1	12.2	1.6	31.90	-18.1

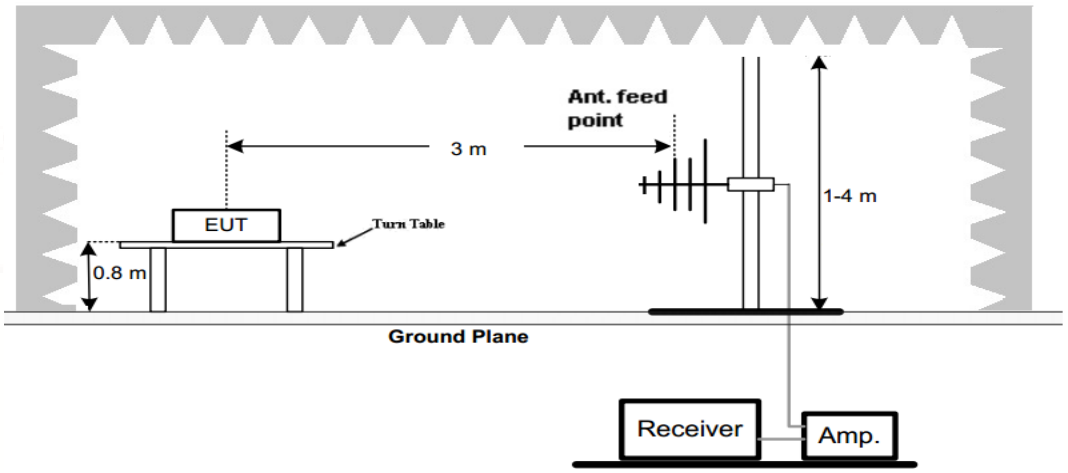
Transd=AF +CL-AG

Test Configuration

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



Test Results

3.2.1 In-band Emissions

Frequency(MHz):			13.56			Polarity:		HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)	Detector	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Correction Factor (dB/m)
1	13.15	43.96	PK	80.50	36.54	39.26	5.26	-0.56	4.70
2	13.55	48.53	PK	90.47	41.94	43.74	5.36	-0.57	4.79
3	13.56	86.43	PK	124.00	37.57	81.55	5.45	-0.57	4.88
4	13.57	49.97	PK	90.47	40.50	44.83	5.49	-0.35	5.14
5	13.75	43.04	PK	80.50	37.46	37.71	5.63	-0.30	5.33

Frequency(MHz):			13.56			Polarity:		VERTICAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)	Detector	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Correction Factor (dB/m)
1	13.15	41.75	PK	80.50	38.75	37.05	5.26	-0.56	4.70
2	13.55	47.52	PK	90.47	42.95	42.73	5.36	-0.57	4.79
3	13.56	89.17	PK	124.00	34.83	84.29	5.45	-0.57	4.88
4	13.57	46.72	PK	90.47	43.75	41.58	5.49	-0.35	5.14
5	13.75	40.66	PK	80.50	39.84	35.33	5.63	-0.30	5.33

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)
3. Margin value = Limit value- Emission level.
4. The other emission levels were very low against the limit.

3.2.2 Out-of-band Emissions

Frequency(MHz):			13.56			Polarity:		HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)	Detector	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Correction Factor (dB/m)
1	27.12	36.86	PK	69.54	32.68	29.36	7.25	0.25	7.50
2	40.68	35.30	PK	40.00	4.70	26.49	8.25	0.56	8.81
3	54.24	30.62	PK	40.00	9.38	21.58	8.30	0.74	9.04
4	67.80	29.25	PK	40.00	10.75	19.72	8.55	0.98	9.53

Frequency(MHz):			13.56			Polarity:		VERTICAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)	Detector	Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Correction Factor (dB/m)
1	27.12	38.77	PK	69.54	30.77	31.27	7.25	0.25	7.50
2	40.68	36.64	PK	40.00	3.36	27.83	8.25	0.56	8.81
3	54.24	31.73	PK	40.00	8.27	22.69	8.30	0.74	9.04
4	67.80	30.08	PK	40.00	9.92	20.55	8.55	0.98	9.53

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)
3. Margin value = Limit value- Emission level.
4. The other emission levels were very low against the limit.

3.3. 20dB Bandwidth

Limit

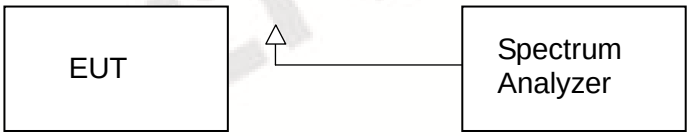
No limit for 20dB bandwidth.

Test Procedure

The 20dB bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Test Configuration



Test Results

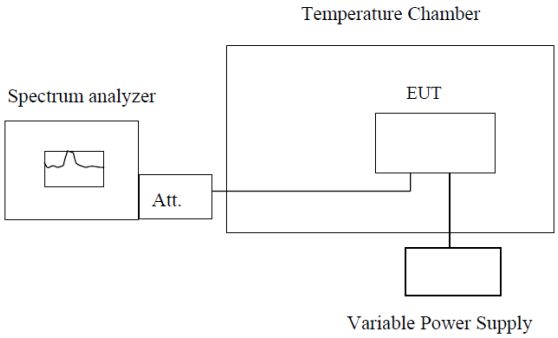
Modulation	Frequency(MHz)	20dB bandwidth (KHz)	Result
ASK	13.56	4.359	Pass

3.4. Frequency Stability Test Data

LIMIT

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

TEST CONFIGURATION



Note : Measurement setup for testing on Antenna connector

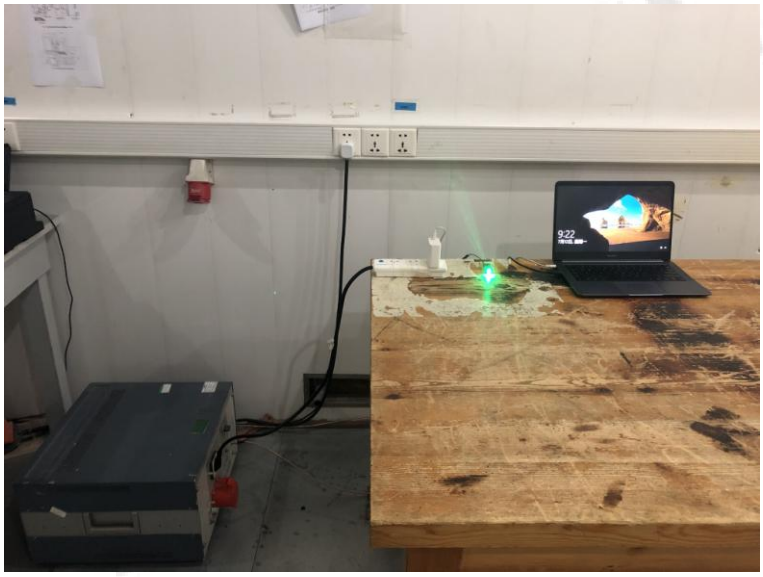
TEST PROCEDURE

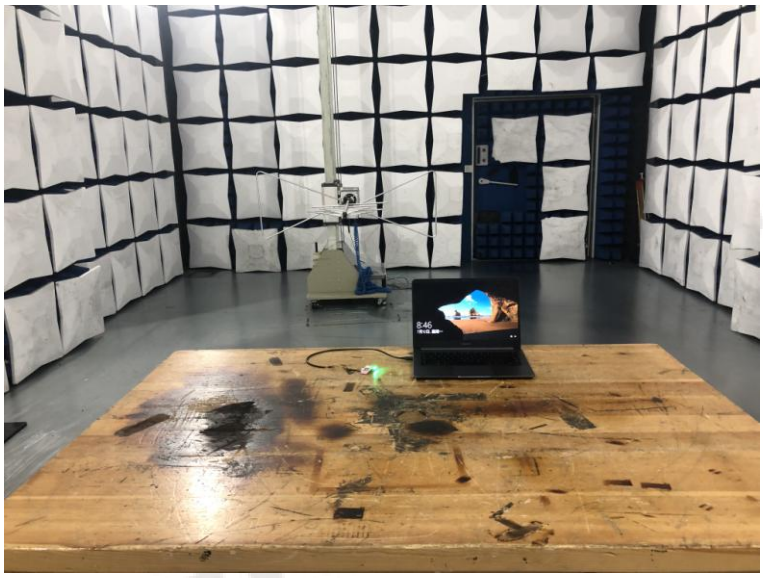
1. The equipment under test was connected to an external DC power supply and input rated voltage.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20℃ operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to –20℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.
7. Reduce the input voltage to specified extreme voltage variation (+/- 15%) or endpoint, record the maximum frequency change.

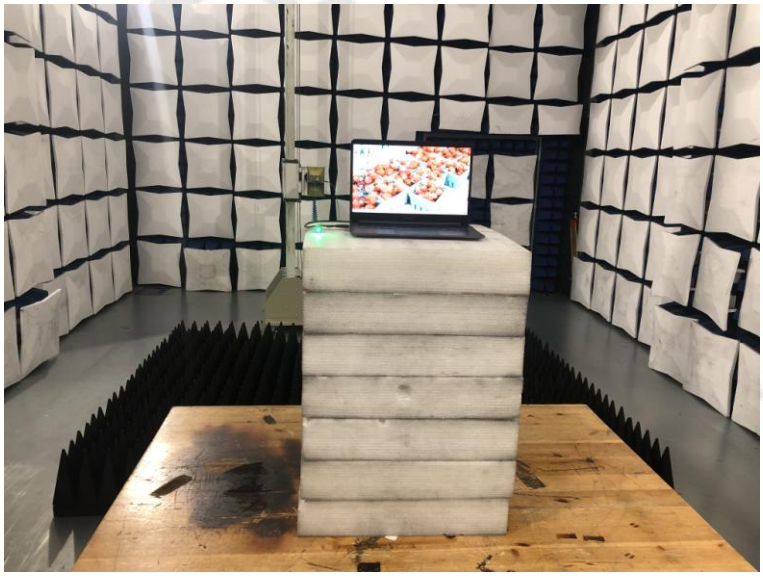
TEST RESULTS

Reference Frequency: 13.56MHz				
Voltage (V)	Temperature (℃)	Frequency (Hz)	Frequency Deviation(Hz)	Deviation (±0.01) %
3.30	+20(Ref)	13560013	13	0.000096
	-20	13560026	26	0.000192
	-10	13560011	11	0.000081
	0	13560021	21	0.000155
	+10	13560016	16	0.000118
	+20	13560012	12	0.000088
	+25	13560017	17	0.000125
	+30	13560024	24	0.000177
	+40	13560035	35	0.000258
	+50	13560015	15	0.000111
3.795	+20	13560025	25	0.000184
2.805	+20	13560023	23	0.000170

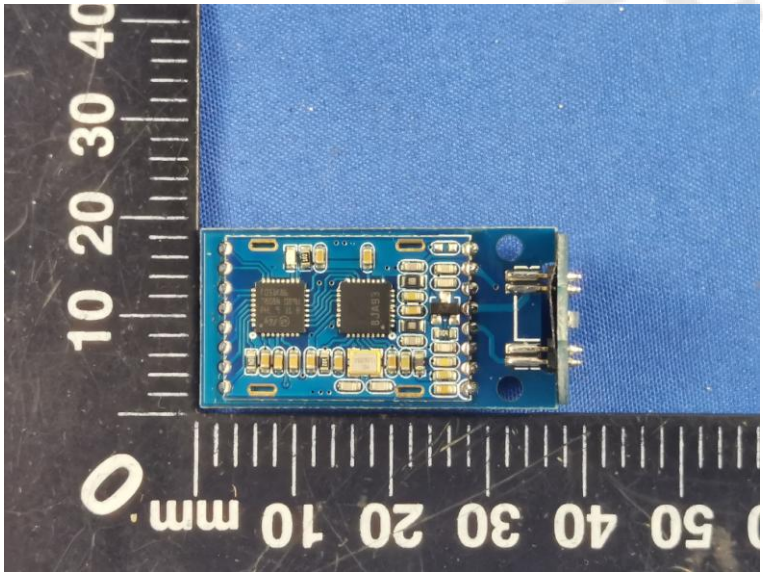
4. Test Setup Photos of the EUT

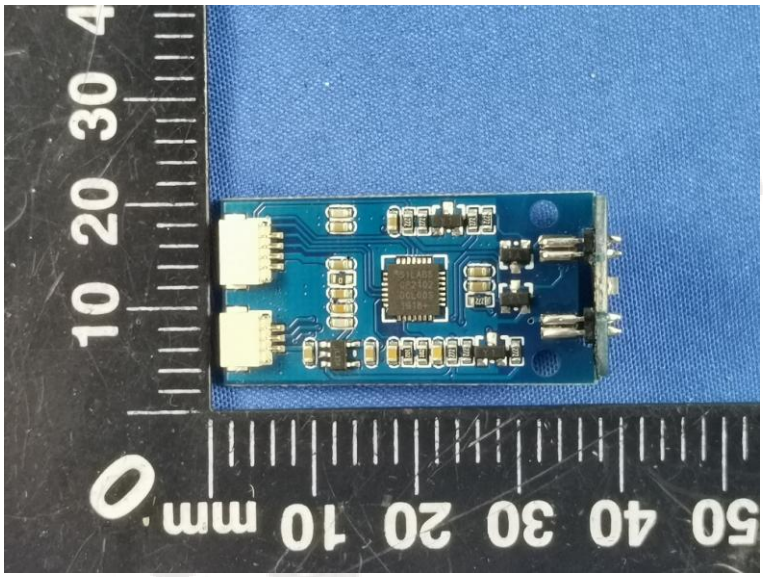


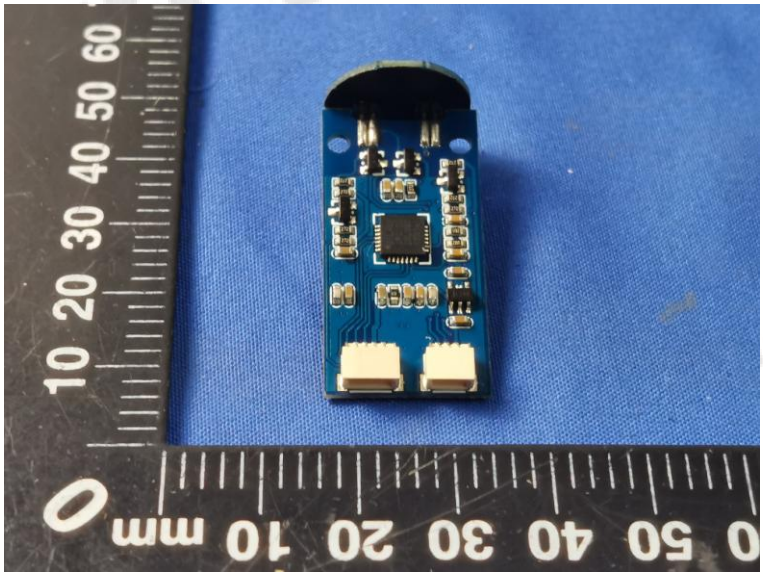


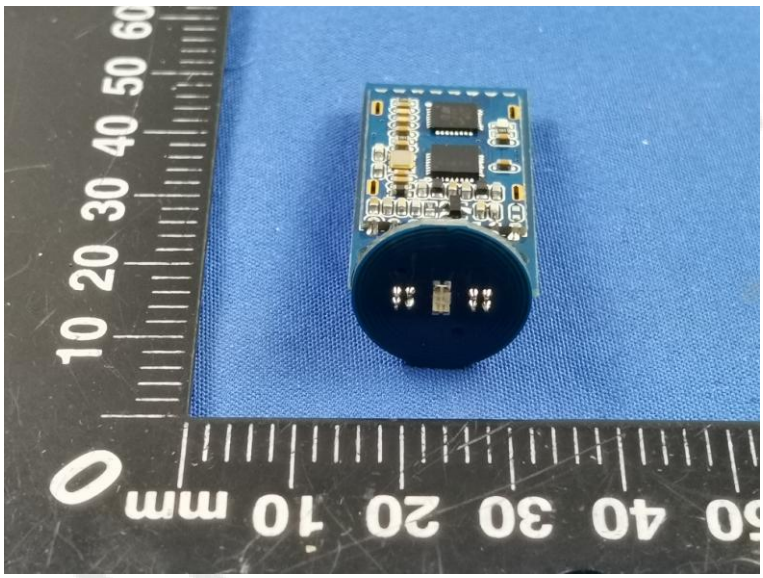


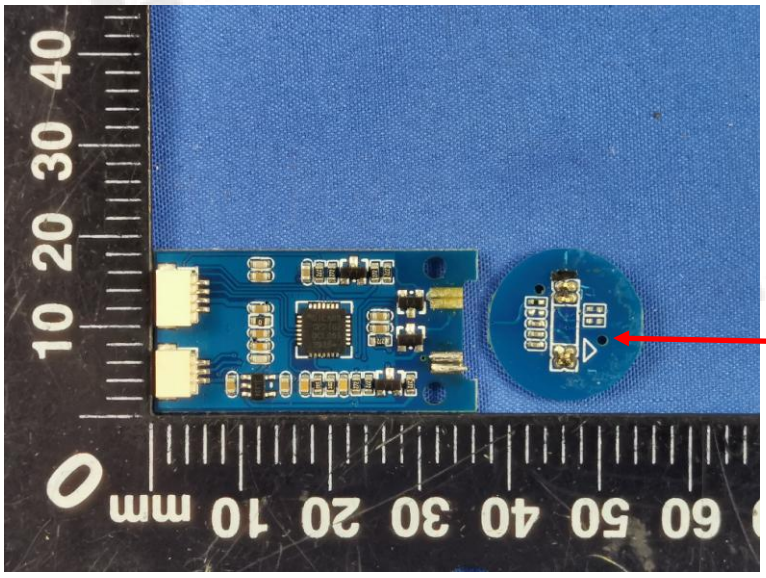
5. External and Internal Photos of the EUT

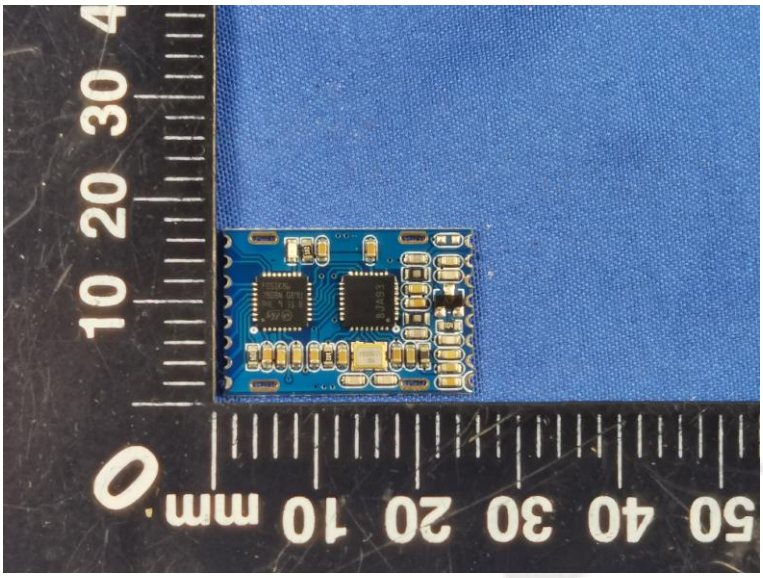


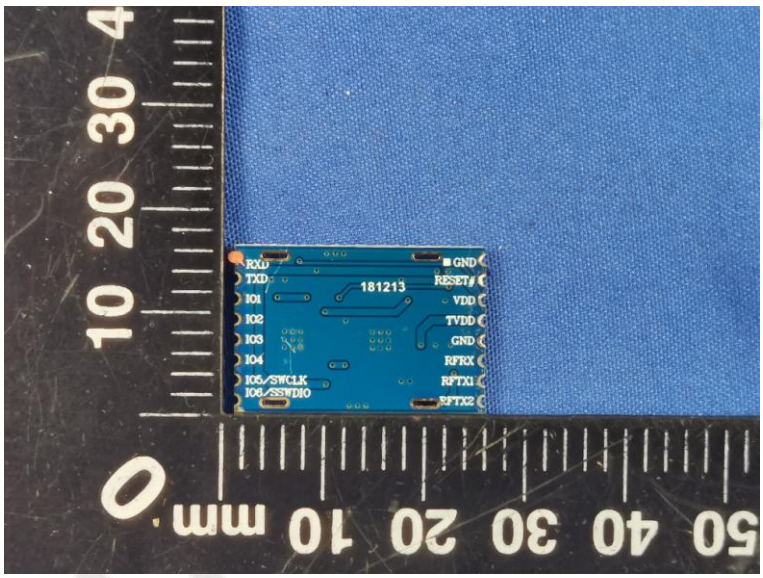


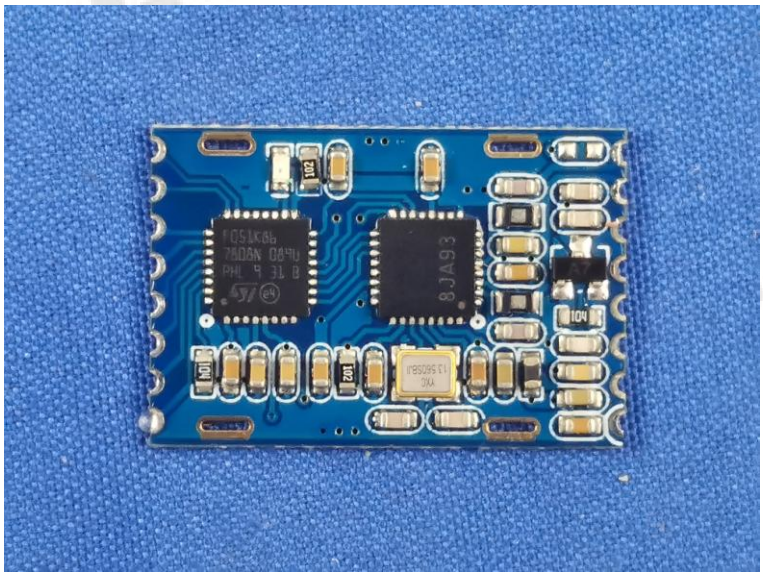


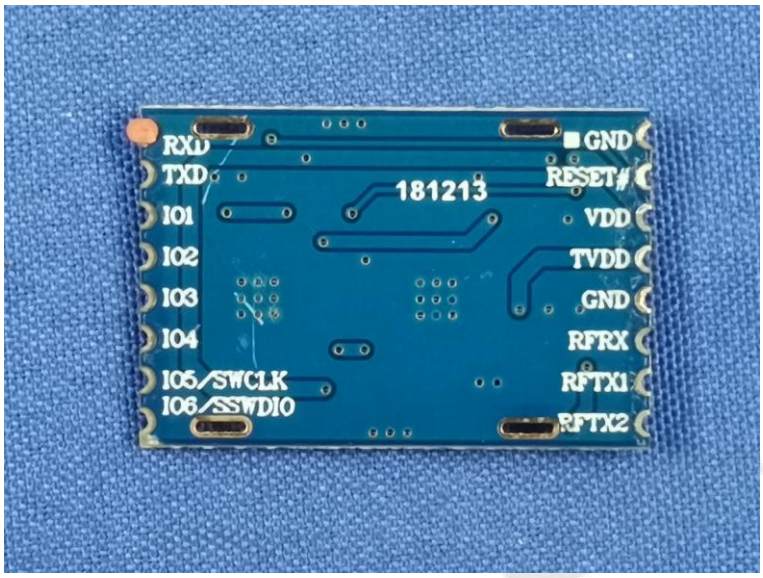



Antenna









********** End of Report **********