



Shenzhen CTL Testing Technology Co., Ltd.  
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# TEST REPORT

## FOR FCC PART 15 SUBPART C 15.249

Report Reference No. .... : CTL2011231101-WF

Compiled by: Happy Guo  
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Ray Feng

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Ivan Xie

Product Name ..... : Distance Monitor Device

Model/Type reference ..... : BC3-109

List Model(s)..... : N/A

Trade Mark..... : Bubble

FCC ID..... : 2AOZK-BC3-109

Applicant's name ..... : Comet Innovation Limited

Address of applicant ..... : Unit 1204, Winful Centre, 30 Shing Yip Street, Kwun Tong,  
Kowloon, Hong Kong

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 15.249: Operation within the bands 920-928 MHz,  
2400-2483.5 MHz, 5725-5850 MHz and 24.0 - 24.25 GHz.

TRF Originator ..... : Shenzhen CTL Testing Technology Co., Ltd.

Master TRF ..... : Dated 2011-01

Date of receipt of test item ..... : Nov. 25, 2020

Date of sampling..... : Nov. 25, 2020

Date of Test Date..... : Nov. 25, 2020–Dec. 03, 2020

Data of Issue..... : Dec. 03, 2020

Result..... : Pass

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# TEST REPORT

<b>Test Report No. :</b>	<b>CTL2011231101-WF</b>	Dec. 03, 2020
		Date of issue

Equipment under Test : Distance Monitor Device

Sample No. CTL201123110-1-S001

Model /Type : BC3-109

Listed Models : N/A

**Applicant** : **Comet Innovation Limited**

Address : Unit 1204, Winful Centre, 30 Shing Yip Street, Kwun Tong, Kowloon, Hong Kong

**Manufacturer** : **Comet Innovation Limited**

Address : Unit 1204, Winful Centre, 30 Shing Yip Street, Kwun Tong, Kowloon, Hong Kong

<b>Test result</b>	<b>Pass *</b>
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\* In the configuration tested, the EUT complied with the standards specified page 5.

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

This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.

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**Table of Contents****Page**

<b>1. SUMMARY .....</b>	<b>5</b>
1.1. TEST STANDARDS .....	5
1.2. TEST DESCRIPTION .....	5
1.3. TEST FACILITY .....	6
1.4. STATEMENT OF THE MEASUREMENT UNCERTAINTY .....	6
<b>2. GENERAL INFORMATION .....</b>	<b>7</b>
2.1. ENVIRONMENTAL CONDITIONS .....	7
2.2. GENERAL DESCRIPTION OF EUT .....	7
2.3. DESCRIPTION OF TEST MODES AND TEST FREQUENCY .....	7
2.4. EQUIPMENTS USED DURING THE TEST .....	8
2.5. RELATED SUBMITTAL(S) / GRANT(S) .....	8
2.6. MODIFICATIONS .....	8
<b>3. TEST CONDITIONS AND RESULTS .....</b>	<b>9</b>
3.1. CONDUCTED EMISSIONS TEST .....	9
3.2. RADIATED EMISSIONS AND BAND EDGE .....	10
3.3. OCCUPIED BANDWIDTH MEASUREMENT .....	14
3.4. ANTENNA REQUIREMENT .....	15
<b>4. TEST SETUP PHOTOS OF THE EUT .....</b>	<b>16</b>
<b>5. EXTERNAL AND INTERNAL PHOTOS OF THE EUT .....</b>	<b>17</b>

## 1. SUMMARY

### 1.1. TEST STANDARDS

The tests were performed according to following standards:

[FCC Rules Part 15.249](#): Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz.

[ANSI C63.10:2013](#) : American National Standard for Testing Unlicensed Wireless Devices

### 1.2. Test Description

FCC PART 15.249		
FCC Part 15.249(a)	Field Strength of Fundamental	PASS
FCC Part 15.209	Spurious Emission	PASS
FCC Part 15.209	Band edge	PASS
FCC Part 15.215(c)	20dB bandwidth	PASS
FCC Part 15.207	Conducted Emission	N/A
FCC Part 15.203	Antenna Requirement	PASS

### 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.: 9518B**

##### **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.: 9518B on Jan. 22, 2019.

### 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	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	Above 1GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	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:	Distance Monitor Device
Model/Type reference:	BC3-109
Power supply:	DC3.7V from battery
Hardware version:	V3.0
Software version:	V1.0
<b>2.4GHz Wireless</b>	
Modulation:	GFSK
Operation frequency:	2452MHz
Channel number:	1
Channel separation:	1MHz
Antenna type:	PCB Antenna
Antenna gain:	0.07dBi

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

### 2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 71 channels provided to the EUT and Channel 01 were selected for testing.

#### Operation Frequency List :

Channel	Frequency (MHz)
<b>01</b>	<b>2452</b>

Note: The line display in grey is the channel selected to perform test.

## 2.4. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ESH2-Z5	860014/010	2020/05/15	2021/05/14
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2020/04/08	2021/04/07
EMI Test Receiver	R&S	ESCI	1166.5950.03	2020/05/18	2021/05/17
Spectrum Analyzer	Agilent	E4407B	MY41440676	2020/05/14	2021/05/13
Spectrum Analyzer	Agilent	N9020A	US46220290	2020/05/14	2021/05/13
Spectrum Analyzer	Keysight	N9020A	MY53420874	2020/05/14	2021/05/13
Controller	EM Electronics	EM 1000	060859	2020/05/20	2021/05/19
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2020/05/20	2021/05/19
Active Loop Antenna	Da Ze	ZN30900A	/	2020/05/20	2021/05/19
Amplifier	Agilent	8449B	3008A02306	2020/05/15	2021/05/14
Amplifier	Agilent	8447D	2944A10176	2020/05/15	2021/05/14
Temperature/Humidity Meter	Gangxing	CTH-608	02	2020/05/16	2021/05/15
Power Sensor	Agilent	U2021XA	MY55130004	2020/05/14	2021/05/13
Power Sensor	Agilent	U2021XA	MY55130006	2020/05/14	2021/05/13
Spectrum Analyzer	RS	FSP	1164.4391.38	2020/05/15	2021/05/14
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

## 2.5. Related Submittal(s) / Grant(s)

This submittal(s) (test report) is intended to comply with Section 15.249 of the FCC Part 15, Subpart C Rules.

## 2.6. Modifications

No modifications were implemented to meet testing criteria.

### 3. TEST CONDITIONS AND RESULTS

#### 3.1. Conducted Emissions Test

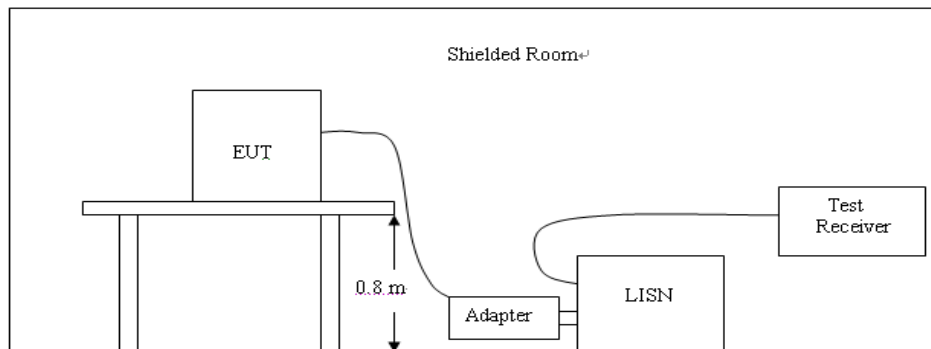
##### LIMIT

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 C63.10:2013.
2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
4. If a EUT received DC power from the USB Port of Notebook PC, the PC's 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

Not applicable to this device.

### 3.2. Radiated Emissions and Band Edge

#### Limit

According 15.249, the field strength of emissions from intentional radiators operated within 2400MHz-2483.5 MHz shall not exceed 94dB $\mu$ V/m (50mV/m):

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

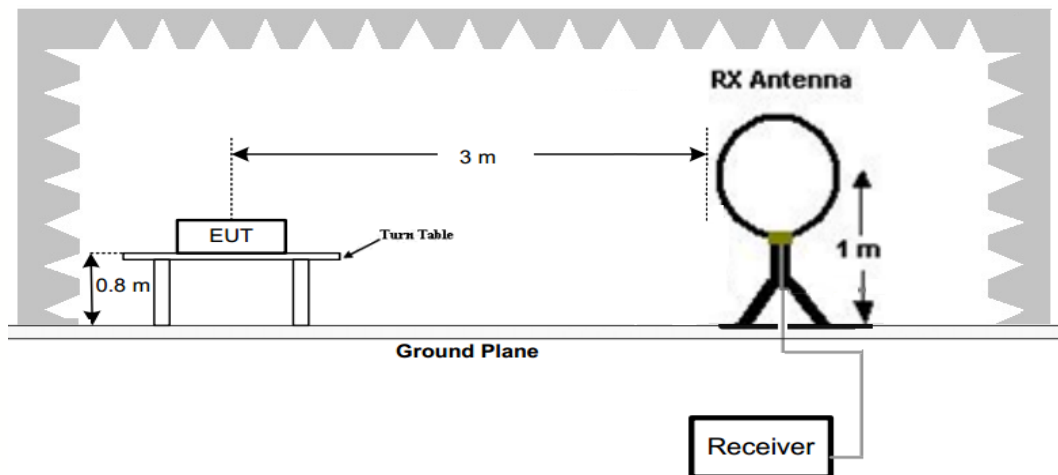
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

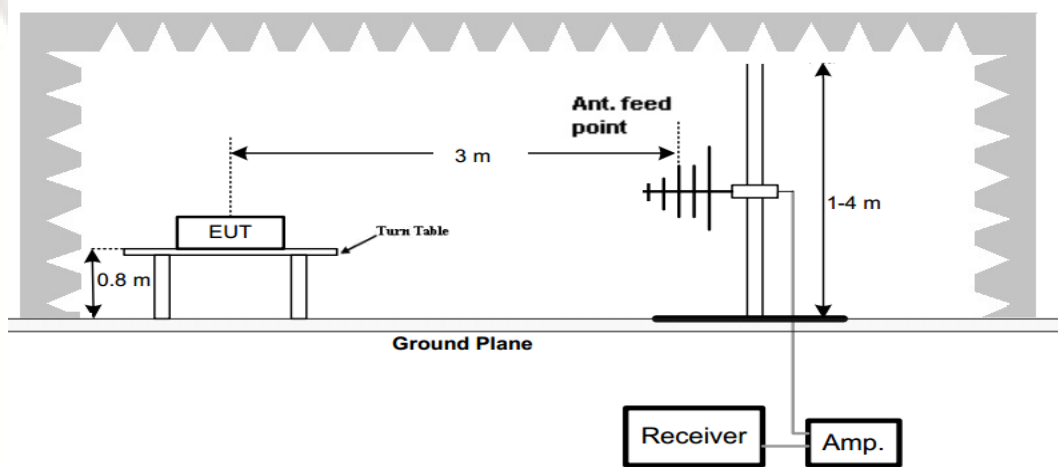
Frequency (MHz)	Distance (Meters)	Radiated (dB $\mu$ V/m)	Radiated ( $\mu$ V/m)
0.009-0.49	3	$20\log(2400/F(\text{KHz}))+40\log(300/3)$	$2400/F(\text{KHz})$
0.49-1.705	3	$20\log(24000/F(\text{KHz}))+40\log(30/3)$	$24000/F(\text{KHz})$
1.705-30	3	$20\log(30)+40\log(30/3)$	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

#### TEST CONFIGURATION

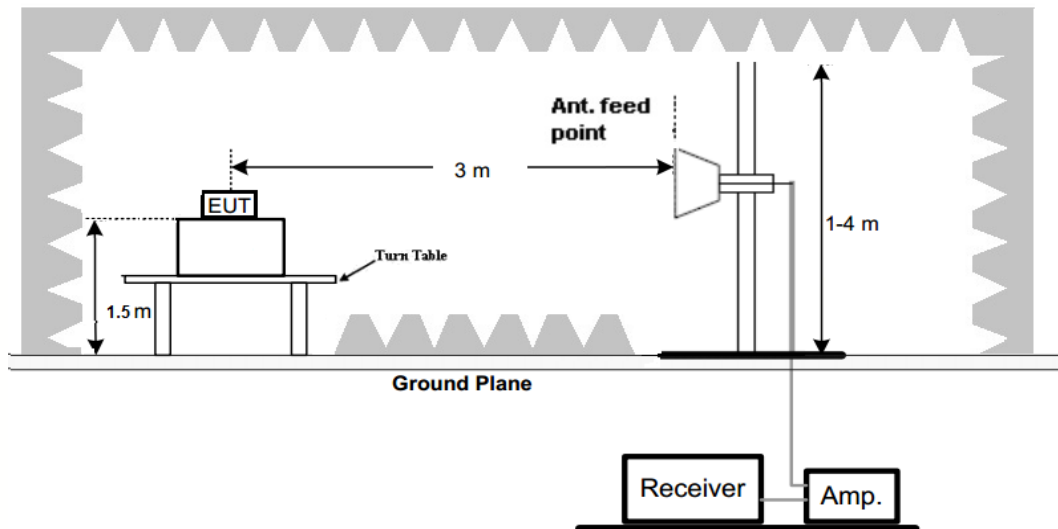
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



## (C) Radiated Emission Test Set-Up, Frequency above 1000MHz

**Test Procedure**

- Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
- 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
- And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- Repeat above procedures until all frequency measurements have been completed.
- Radiated emission test frequency band from 9KHz to 25GHz.
- The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Antenna	1

- Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz, Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz, Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz, Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

**TEST RESULTS****Remark:**

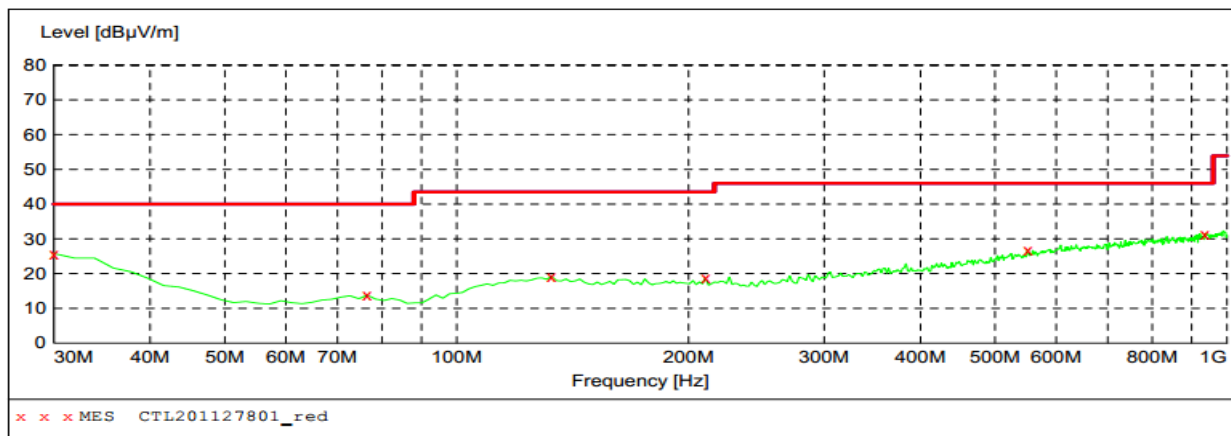
- We measured Radiated Emission at GFSK mode from 9 KHz to 25GHz and recorded worst case.
- For below 1GHz testing recorded worst at GFSK low channel.
- Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.

## For 30MHz-1GHz

## Horizontal

**SWEEP TABLE: "test (30M-1G)"**

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency				
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	100 kHz	JB1

**MEASUREMENT RESULT: "CTL201127801\_red"**

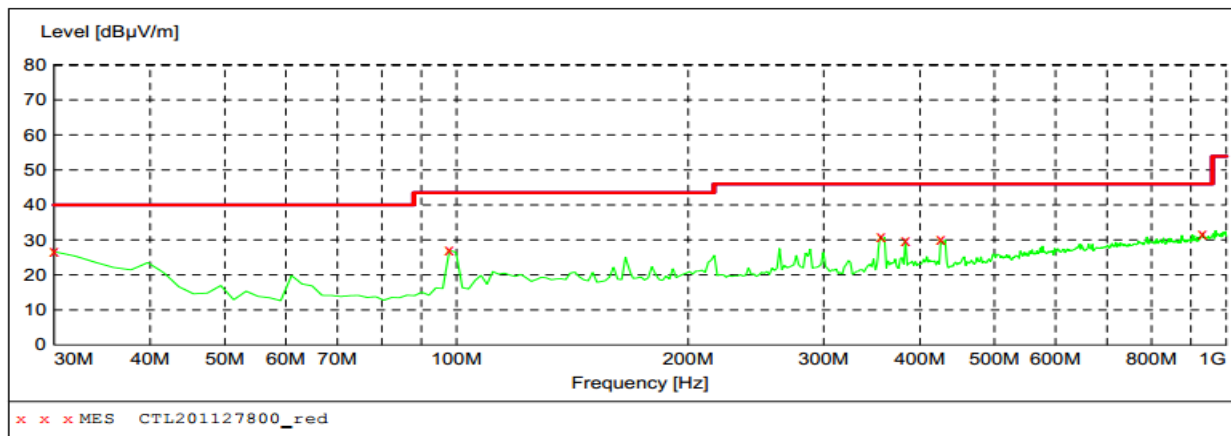
27/11/2020 15:39

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	25.80	22.2	40.0	14.2	---	0.0	0.00	HORIZONTAL
76.560000	13.80	9.0	40.0	26.2	---	0.0	0.00	HORIZONTAL
132.820000	19.20	15.2	43.5	24.3	---	0.0	0.00	HORIZONTAL
210.420000	18.70	14.5	43.5	24.8	---	0.0	0.00	HORIZONTAL
551.860000	26.80	21.9	46.0	19.2	---	0.0	0.00	HORIZONTAL
935.980000	31.50	27.0	46.0	14.5	---	0.0	0.00	HORIZONTAL

## Vertical

**SWEEP TABLE: "test (30M-1G)"**

Short Description:		Field Strength			
Start	Stop	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency				
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	100 kHz	JB1

**MEASUREMENT RESULT: "CTL201127800\_red"**

27/11/2020 15:38

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
30.000000	26.60	22.2	40.0	13.4	---	0.0	0.00	VERTICAL
97.900000	27.00	10.8	43.5	16.5	---	0.0	0.00	VERTICAL
355.920000	30.80	17.4	46.0	15.2	---	0.0	0.00	VERTICAL
383.080000	30.00	17.9	46.0	16.0	---	0.0	0.00	VERTICAL
425.760000	30.10	18.9	46.0	15.9	---	0.0	0.00	VERTICAL
932.100000	31.80	26.9	46.0	14.2	---	0.0	0.00	VERTICAL

**For 1GHz to 25GHz****GFSK Mode (above 1GHz)**

Frequency(MHz):				2452		Polarity:			HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2452.00	96.67	PK	114	17.33	63.26	28.79	4.62	0.00	33.41
1	2452.00	87.36	AV	94	6.64	53.95	28.79	4.62	0.00	33.41
2	2390.00	47.77	PK	74	26.23	14.45	28.72	4.60	0.00	33.32
2	2390.00	--	AV	54	--	--	--	--	--	--
3	2400.00	51.34	PK	74	3.58	17.95	28.78	4.61	0.00	33.39
3	2400.00	--	AV	54	--	--	--	--	--	--
4	4904.00	49.72	PK	74	24.28	45.19	33.50	6.92	35.89	4.53
4	4904.00	--	AV	54	--	--	33.50	6.92	35.89	--
5	5011.00	45.36	PK	74	28.64	34.38	34.02	7.04	34.23	10.98
5	5011.00	--	AV	54	--	--	--	--	--	--
6	7215.00	46.12	PK	74	3.58	34.96	36.99	9.19	35.02	11.16
6	7215.00	--	AV	54	--	--	--	--	--	--

Frequency(MHz):				2452		Polarity:			VERTICAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2452.00	97.62	PK	114	16.38	64.12	28.79	4.62	0.00	33.50
1	2452.00	88.42	AV	94	5.58	54.92	28.79	4.62	0.00	33.50
2	2390.00	46.34	PK	74	27.66	8.40	28.72	4.60	0.00	37.94
2	2390.00	--	AV	54	--	--	--	--	--	--
3	2400.00	50.85	PK	74	3.58	10.30	28.78	4.61	0.00	40.55
3	2400.00	--	AV	54	--	--	--	--	--	--
4	4904.00	52.61	PK	74	21.39	46.23	33.50	6.92	35.89	6.38
4	4904.00	--	AV	54	--	--	33.50	6.92	35.89	--
5	6934.00	46.42	PK	74	27.58	34.78	36.16	9.00	35.05	11.64
5	6934.00	--	AV	54	--	--	--	--	--	--
6	7215.00	46.12	PK	74	3.58	34.96	36.99	9.19	35.02	11.16
6	7215.00	--	AV	54	--	--	--	--	--	--

**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)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.
6. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.
7. For fundamental frequency, RBW 3MHz VBW 3MHz Peak detector is for PK Value ; RMS detector is for AV value.

### 3.3. Occupied Bandwidth Measurement

#### Limit

N/A

#### Test Configuration



#### Test Procedure

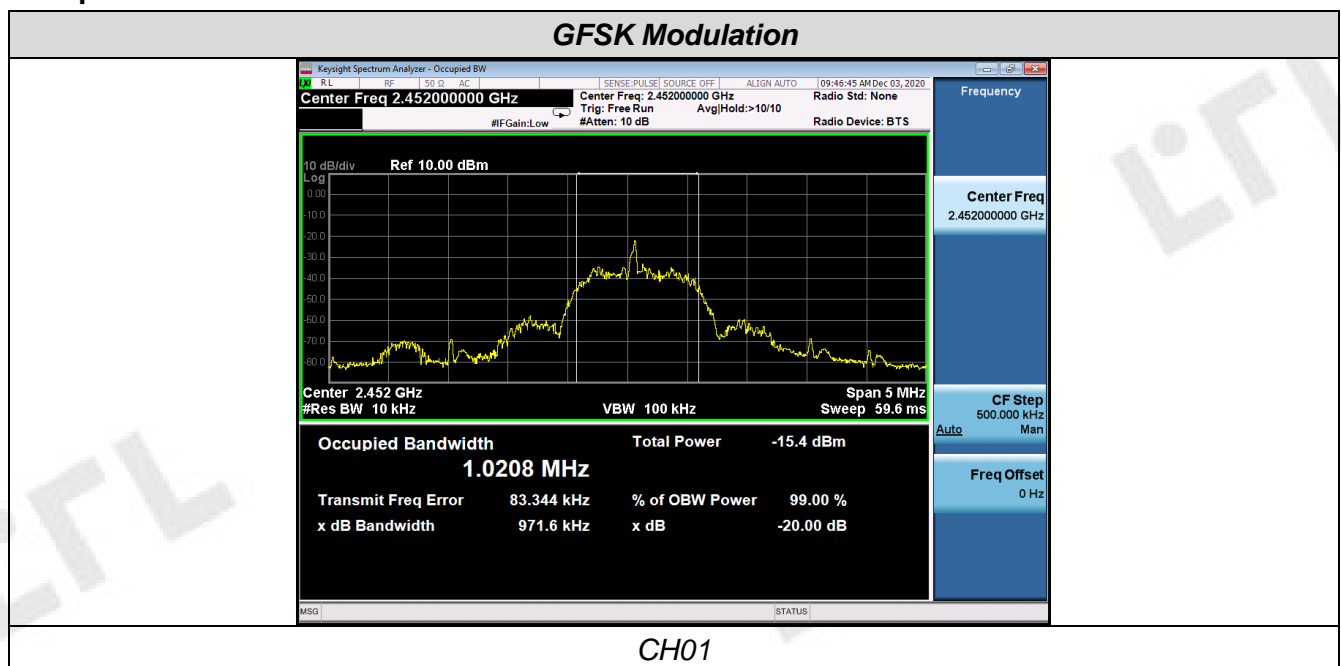
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100 KHz VBW.

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

#### Test Results

Modulation	Channel	99% OBW (MHz)	20dB bandwidth (MHz)	Result
GFSK	CH01	1..0208	0.9716	Pass

Test plot as follows:



### 3.4. Antenna Requirement

#### **Standard Applicable**

For intentional device, according to FCC 47 CFR 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.

#### **Refer to statement below for compliance.**

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

#### **Antenna Connected Construction**

The antenna used in this product is a PCB Antenna, The directional gains of antenna used for transmitting is 0.07dBi.

#### 4. Test Setup Photos of the EUT

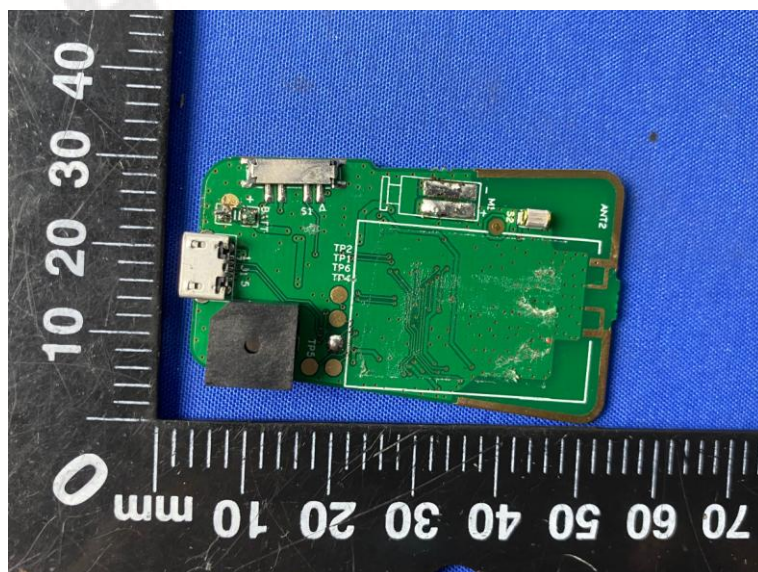
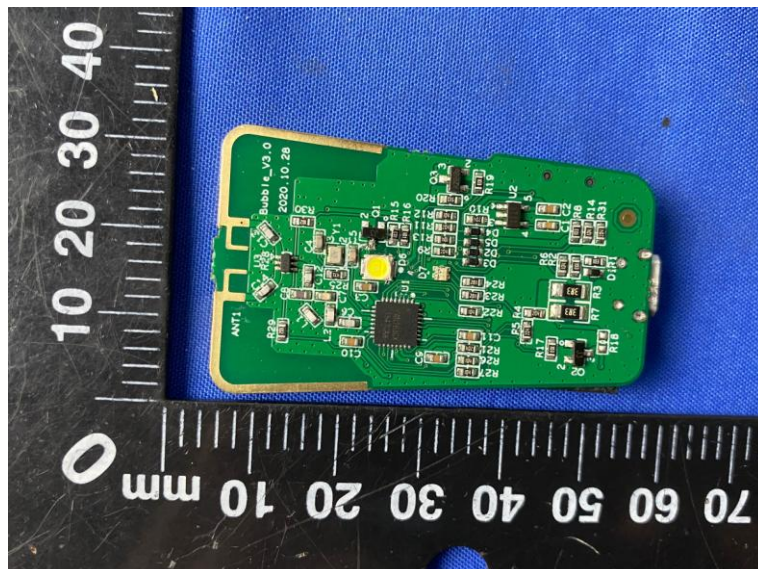
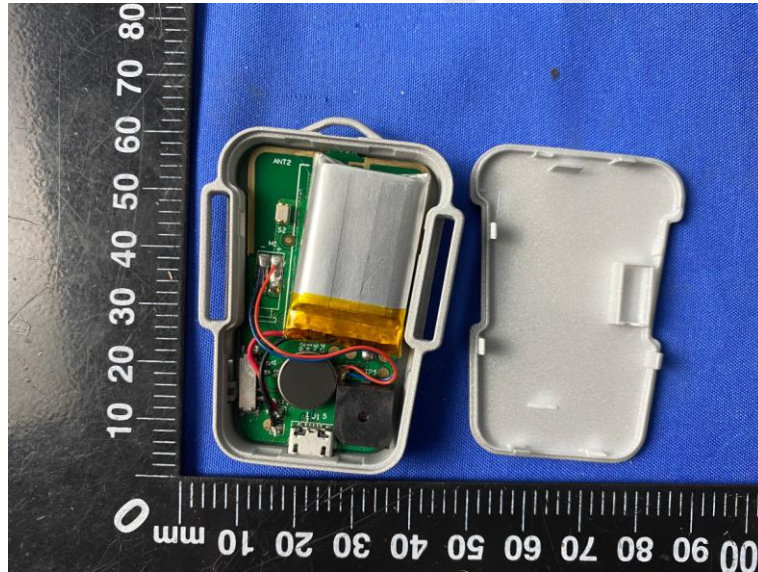


## 5. External and Internal Photos of the EUT

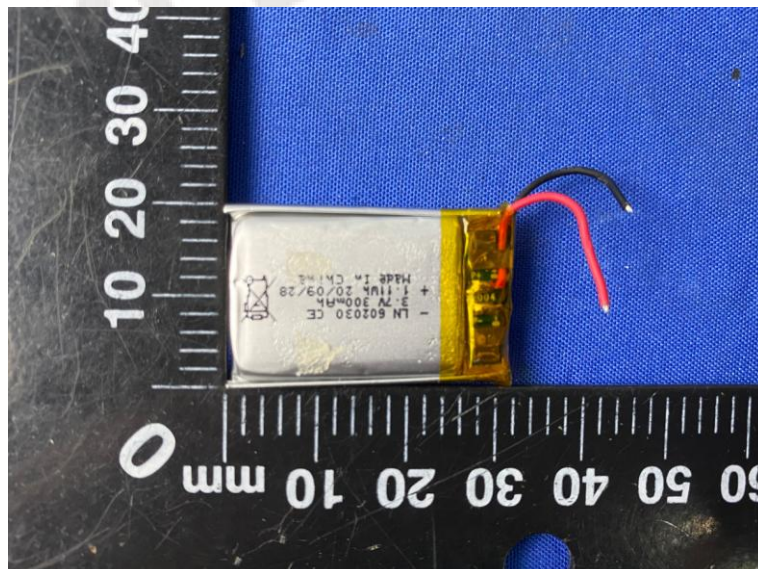
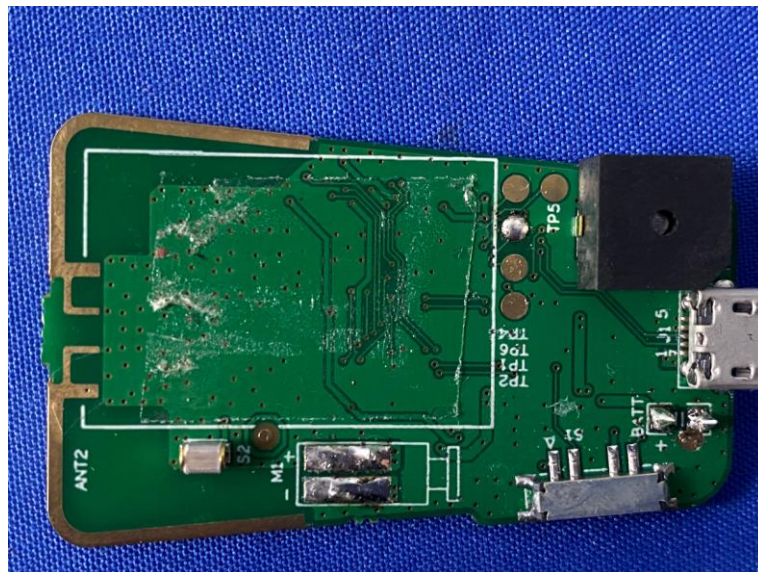
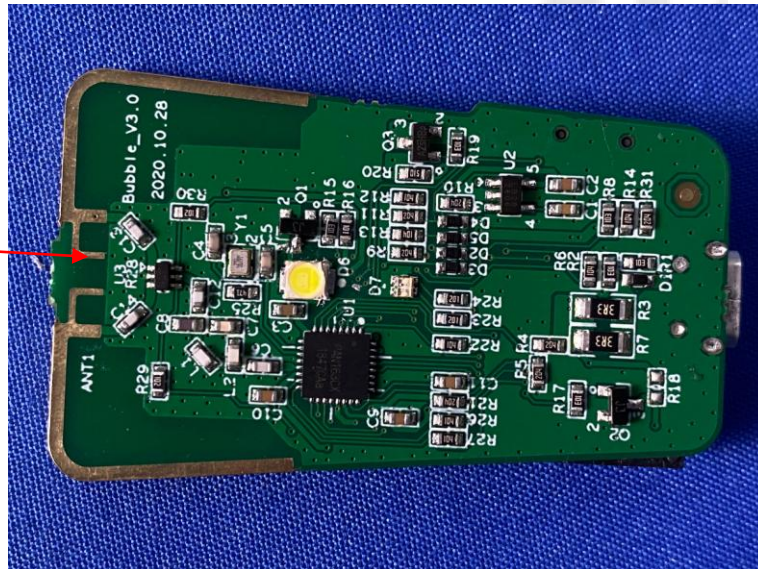
### External Photos of EUT





Internal Photos of EUT

Antenna



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