FCC Test Report

Report No.: AGC09637191201FE03

FCC ID	:	2AKJ2PM-0002
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Soccer sensor
BRAND NAME	:	Playermaker
MODEL NAME	:	PM-0002
APPLICANT	:	Motionize Israel LTD.
DATE OF ISSUE	:	Jan. 03, 2020
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15 Rules
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 03, 2020	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	Motionize Israel LTD.
Address	Sderot Yehudit 35Tel Aviv-YafoIsrael
Manufacturer	Motionize Israel LTD.
Address	Sderot Yehudit 35Tel Aviv-YafoIsrael
Factory	Nistec
Address	Tuval 5 Ta'asiya St 1, Ma'alot-Tarshiha
Product Designation	Soccer sensor
Brand Name	Playermaker
Test Model	PM-0002
Date of test	Dec. 12, 2019 to Jan. 03, 2020
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:
The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.249.

Prepared By	Nini Guo (Project Engineer)	Jan. 03, 2020
Reviewed By	Max Zhang (Reviewer)	Jan. 03, 2020
Approved By	Forrest Lei (Authorized Officer)	Jan. 03, 2020

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480GHz
Bluetooth Version	V4.0
Maximum field strength	89.70dBuV/m(Peak)@3m
Modulation	GFSK
Number of channels	40
Antenna Gain	-1.9dBi
Antenna Designation	Chip Antenna (Met 15.203 Antenna requirement)
Hardware Version	1.0.5
Software Version	6.12.3
Power Supply	DC 3.8V by battery

2.2. TABLE OF CARRIER FREQUENCY

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	0	2402MHZ
	1	2404MHZ
	:	:
	38	2478 MHZ
	39	2480 MHZ

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %

4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK

Note:
1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

5.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Soccer sensor	PM-0002	2AKJ2PM-0002	EUT

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.249&15.209	Radiated Emission	Compliant
§15.249	Band Edges	Compliant
§15.215	20dB bandwidth	Compliant
§15.207	Conducted Emission	N/A

Note: The EUT can not use the BT function with charging.

6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun. 12, 2019	Jun. 11, 2020
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 12, 2019	Dec. 11, 2020
2.4GHz Fliter	EM Electronics	2400-2500MHz	N/A	Feb. 27, 2019	Feb. 26, 2020
Attenuator	ZHINAN	E-002	N/A	Sep. 09, 2019	Sep. 08, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 09, 2019	Sep. 08, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 14, 2018	Jun. 13, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 26, 2018	May. 25, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 16, 2020
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 09, 2018	Jan. 08, 2020
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

7. RADIATED EMISSION

7.1TEST LIMIT

Standard FCC15.249

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
900-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

Standard FCC 15.209

Frequency (MHz)	Distance Meters	Field Strengths Limit	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	---
1.705 ~ 30	30	30	---
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	Other:74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remark: (1) Emission level dBμV = 20 log Emission level μV/m

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

7.2. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use minimum resolution bandwidth of 1 MHz. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

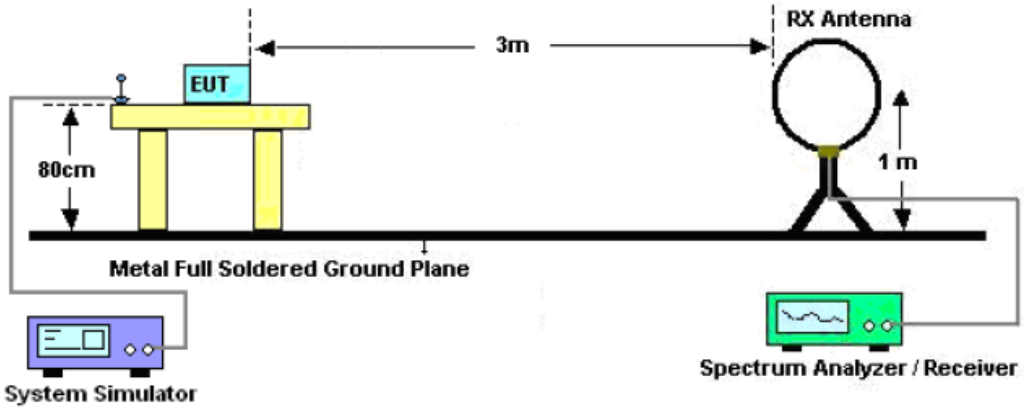
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1.5MHz/ VBW 8MHz for Peak, 1.5MHz/10Hz for Average

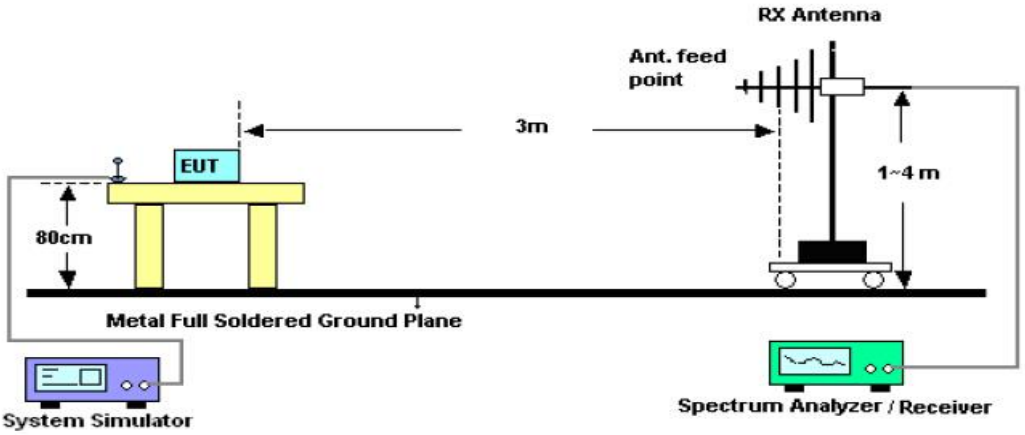
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

7.3. TEST SETUP

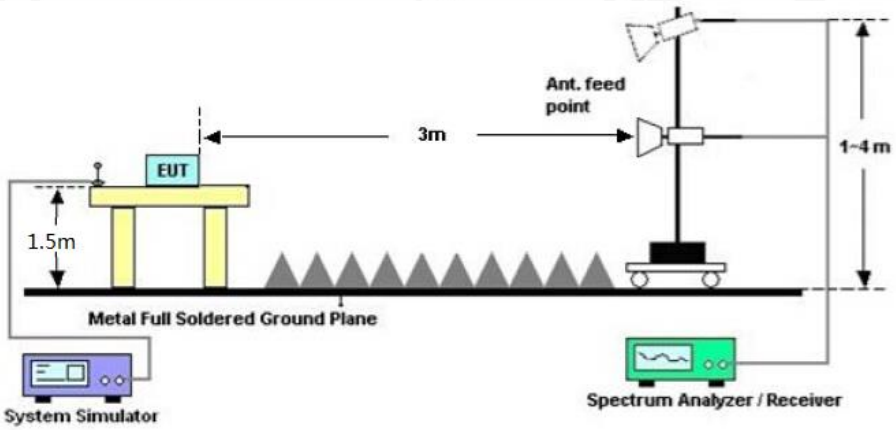
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



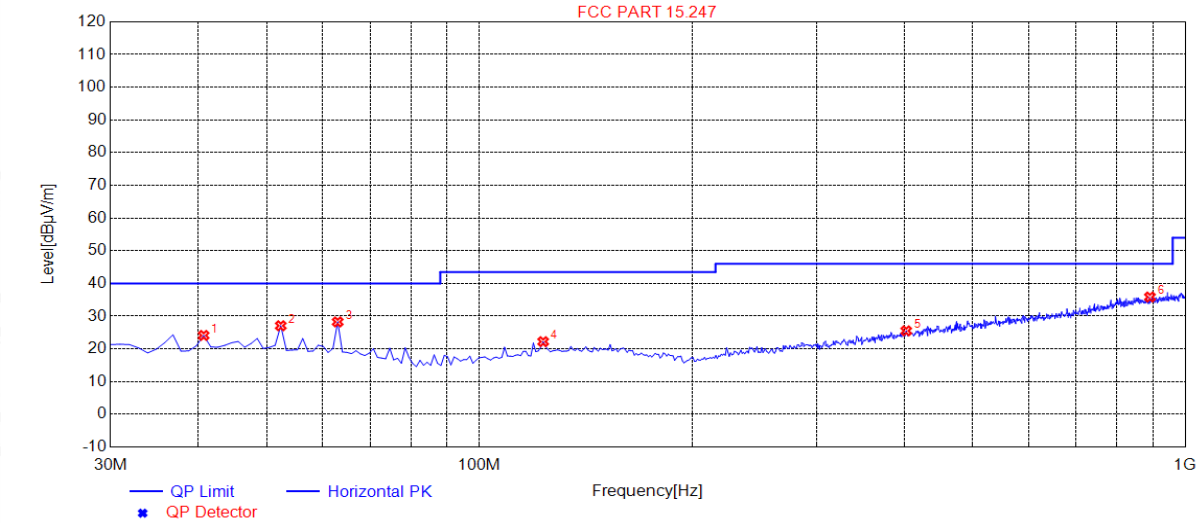
7.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

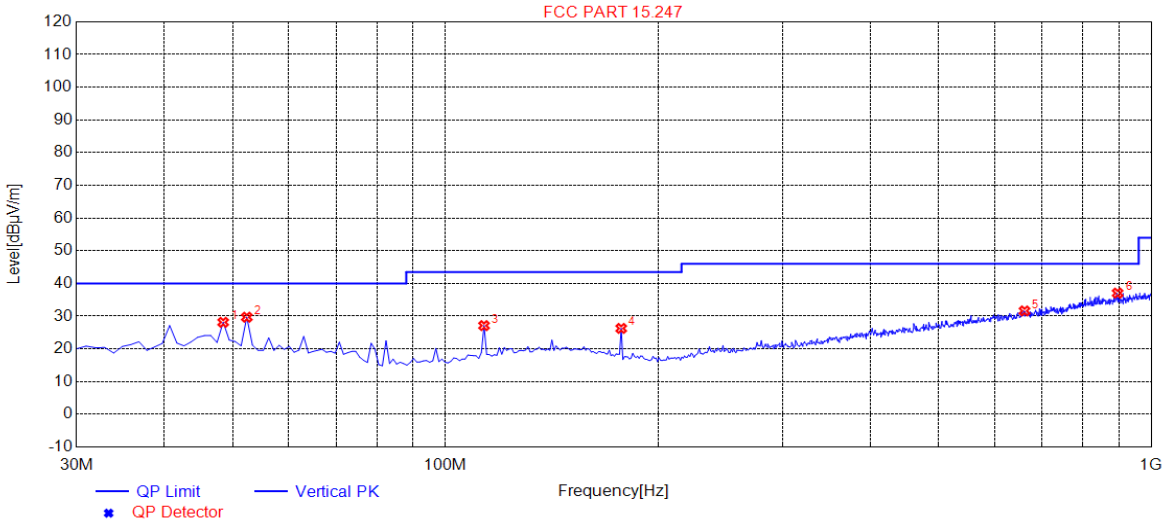
RADIATED EMISSION 30MHz- 1GHZ

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 1	Polarization：	Horizontal



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6700	24.12	14.91	40.00	15.88	150	55	Horizontal
2	52.3100	27.08	14.49	40.00	12.92	150	98	Horizontal
3	62.9800	28.26	13.42	40.00	11.74	150	150	Horizontal
4	123.1200	22.22	13.68	43.50	21.28	150	55	Horizontal
5	402.4800	25.52	19.87	46.00	20.48	150	298	Horizontal
6	891.3600	35.87	30.00	46.00	10.13	150	75	Horizontal

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 1	Polarization：	Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	48.4300	28.14	14.71	40.00	11.86	150	163	Vertical
2	52.3100	29.69	14.49	40.00	10.31	150	258	Vertical
3	113.4200	27.12	12.79	43.50	16.38	150	358	Vertical
4	177.4400	26.27	13.24	43.50	17.23	150	357	Vertical
5	661.4700	31.61	25.32	46.00	14.39	150	323	Vertical
6	896.2100	37.06	30.09	46.00	8.94	150	228	Vertical

RESULT: PASS

Note:

Factor=Antenna Factor + Cable loss, Margin=Result-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

The mode 1 is the worst case, and only the data of the worst case recorded in this test report.

FIELD STRENGTH OF FUNDAMENTAL

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Modulation ：	GFSK	Polarization：	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2402.031	96.35	-9.53	86.82	114.00	-27.18	peak
2402.031	93.16	-9.53	83.63	94.00	-10.37	AVG
2440.031	95.37	-9.47	85.9	114.00	-28.10	peak
2440.031	91.24	-9.47	81.77	94.00	-12.23	AVG
2480.031	98.57	-9.32	89.25	114.00	-24.75	peak
2480.031	97.49	-9.32	88.17	94.00	-5.83	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Modulation ：	GFSK	Polarization：	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
2402.031	94.23	-9.53	84.7	114	-29.3	peak
2402.031	91.48	-9.53	81.95	94	-12.05	AVG
2440.031	94.77	-9.47	85.3	114	-28.7	peak
2440.031	90.48	-9.47	81.01	94	-12.99	AVG
2480.031	99.02	-9.32	89.7	114	-24.3	peak
2480.031	97.52	-9.32	88.2	94	-5.8	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RADIATED EMISSION ABOVE 1GHZ

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 1	Polarization：	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.011	46.51	0.08	46.59	74	-27.41	peak
4804.011	41.03	0.08	41.11	54	-12.89	AVG
7206.022	42.37	2.21	44.58	74	-29.42	peak
7206.022	37.65	2.21	39.86	54	-14.14	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 1	Polarization：	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.011	44.87	0.08	44.95	74	-29.05	peak
4804.011	41.23	0.08	41.31	54	-12.69	AVG
7206.022	42.57	2.21	44.78	74	-29.22	peak
7206.022	37.86	2.21	40.07	54	-13.93	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 2	Polarization：	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.005	45.89	0.14	46.03	74	-27.97	peak
4880.005	41.49	0.14	41.63	54	-12.37	AVG
7320.140	42.81	2.36	45.17	74	-28.83	peak
7320.140	36.73	2.36	39.09	54	-14.91	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 2	Polarization：	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.050	44.72	0.14	44.86	74	-29.14	peak
4880.050	39.58	0.14	39.72	54	-14.28	AVG
7320.080	42.64	2.36	45	74	-29	peak
7320.080	37.14	2.36	39.5	54	-14.5	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 3	Polarization：	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.012	46.35	0.22	46.57	74	-27.43	peak
4960.012	41.36	0.22	41.58	54	-12.42	AVG
7440.027	42.87	2.64	45.51	74	-28.49	peak
7440.027	38.22	2.64	40.86	54	-13.14	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 3	Polarization：	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.013	45.23	0.22	45.45	74	-28.55	peak
4960.013	41.62	0.22	41.84	54	-12.16	AVG
7440.027	41.94	2.64	44.58	74	-29.42	peak
7440.027	37.06	2.64	39.7	54	-14.3	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Note: Other emissions from 8G to 25 GHz are considered as ambient noise. No recording in the test report.
Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.
The “Factor” value can be calculated automatically by software of measurement system.
The GFSK modulation was the worst case and only the data of worst recorded in this report

8. BAND EDGE EMISSION

8.1TEST LIMIT

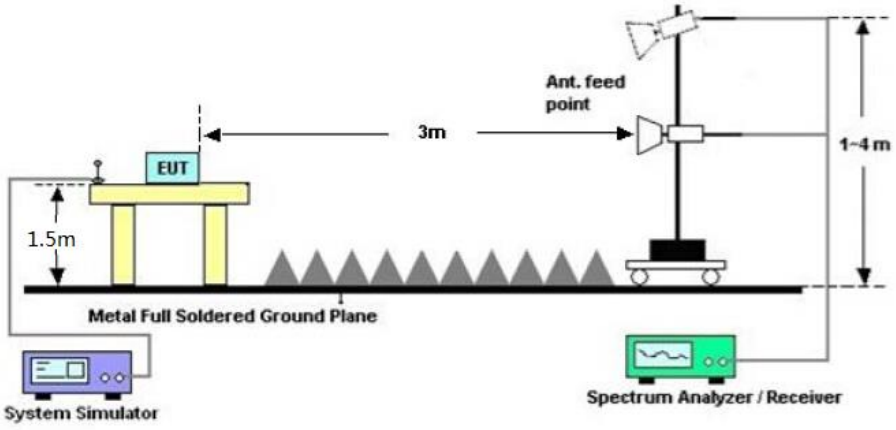
Frequency Band	Limit of the Field Strength (dBμV/m)	
	Peak	Average
f≤2390MHz	74	54
f≥2483.5MHz	74	54

8.2. MEASUREMENT PROCEDURE

1. The EUT operates at transmitting mode. The operate channel is tested to verify the largest transmission and spurious emissions power at the continuous transmission mode.
2. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission: (a) PEAK: RBW=1MHz, VBW=3MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz ; VBW=1/on time(1KHz) / Sweep=AUTO
3. Other procedures refer to clause 7.2.

8.3 TEST SETUP

RADIATED EMISSION TEST SETUP



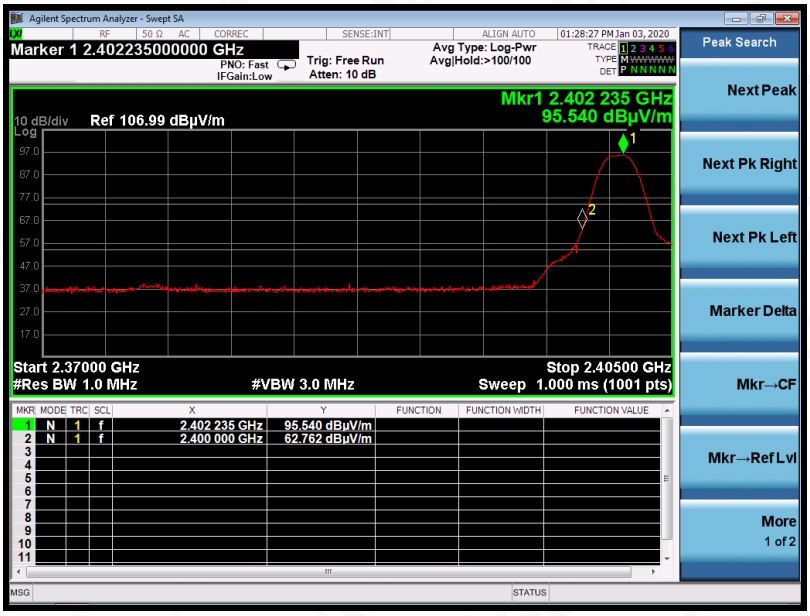
8.4 TEST RESULT

Note:

1. Factor=Antenna Factor + Cable loss - Amplifier gain. Field Strength=Factor + Reading level
2. The factor had been edited in the “Input Correction” of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(μV) to represent the Amplitude. Use the F dB(μV/m) to represent the Field Strength. So A=F.

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 1	Polarization：	Horizontal

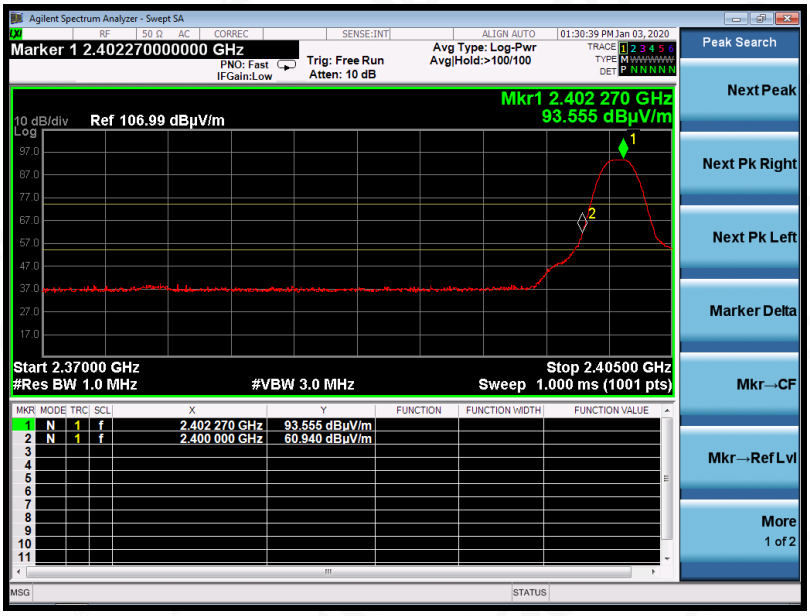
Peak Value



Average Value

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 1	Polarization：	Vertical

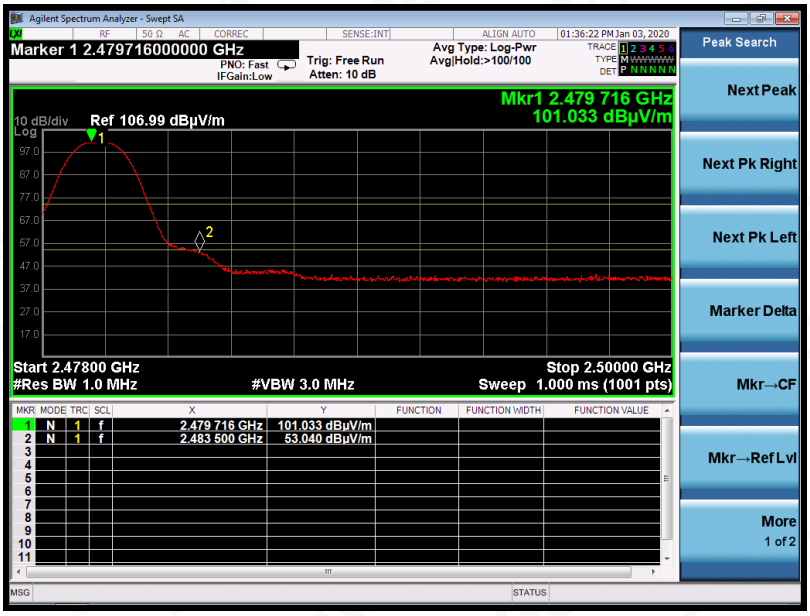
Peak Value



Average Value

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 3	Polarization :	Horizontal

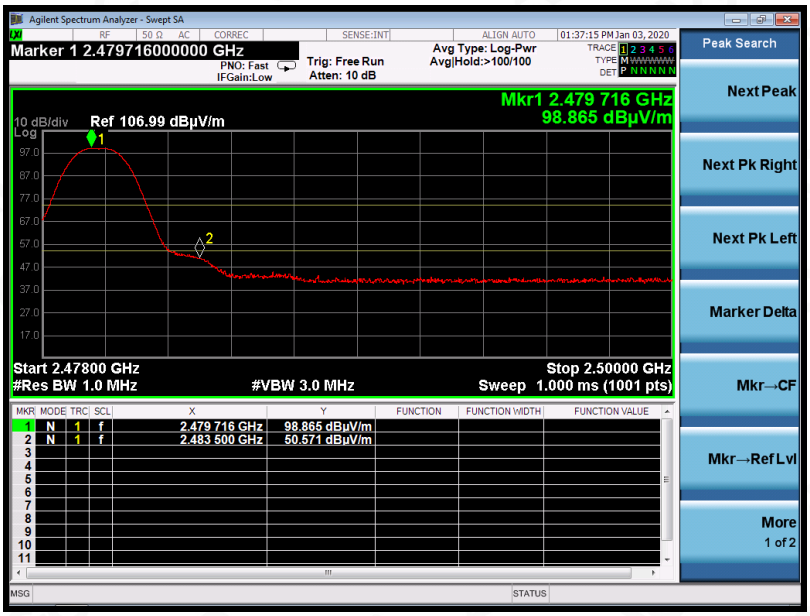
Peak Value



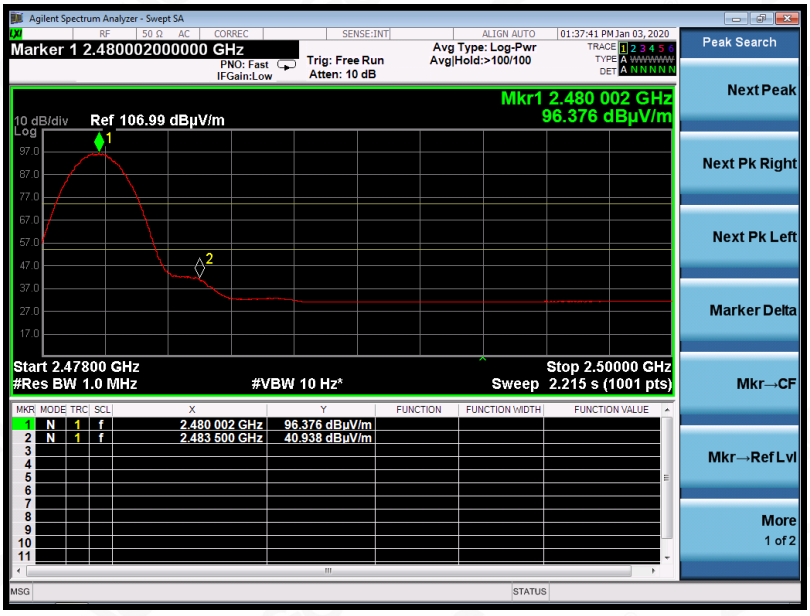
Average Value

EUT：	Soccer sensor	Model Name. ：	PM-0002
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC3.8V
Test Mode ：	Mode 3	Polarization：	Vertical

Peak Value



Average Value

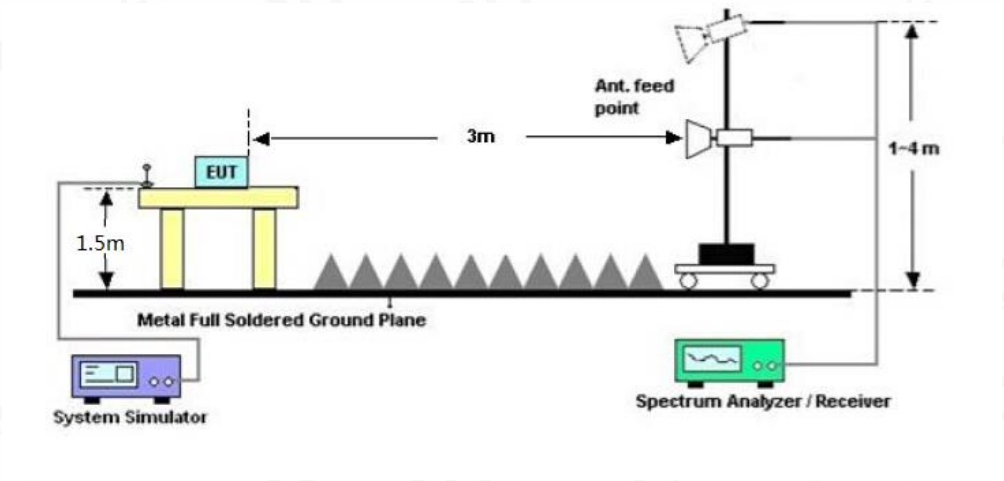


9. 20DB BANDWIDTH

9.1. MEASUREMENT PROCEDURE

1. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
2. Set SPA Centre Frequency = Operation Frequency, RBW= 30 KHz, VBW⩾3×RBW.
3. Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



9.3. MEASUREMENT RESULTS

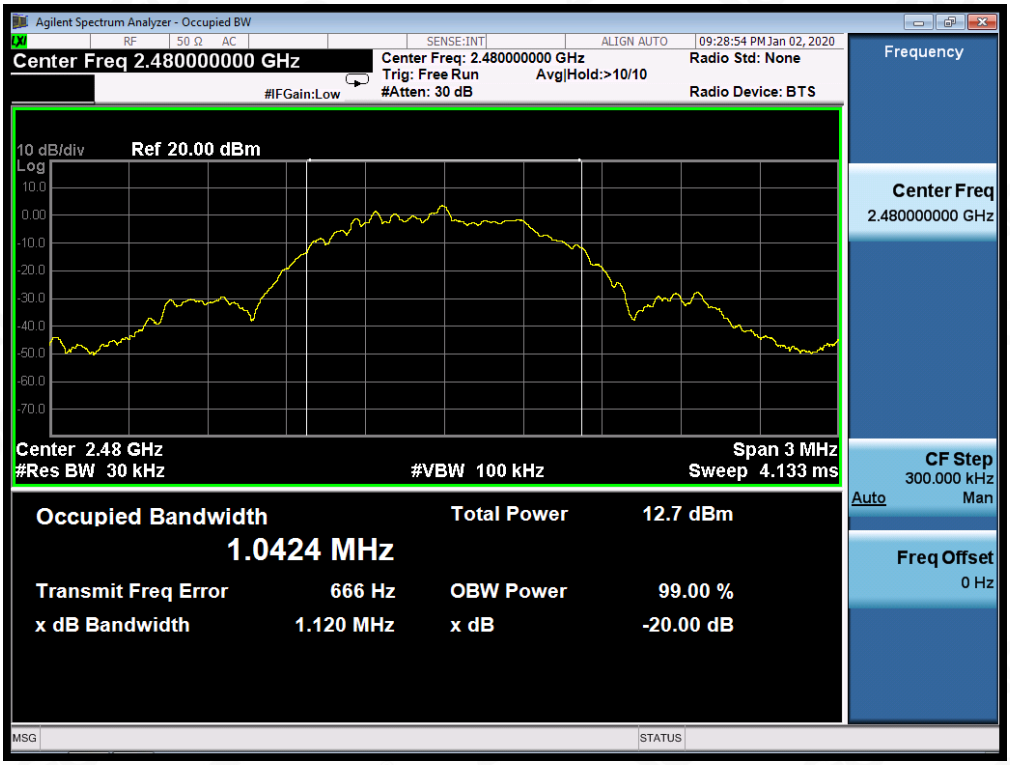
TEST ITEM	20DB BANDWIDTH
TEST MODULATION	GFSK

Test Data (MHz)		Criteria
Low Channel	1.122	PASS
Middle Channel	1.120	PASS
High Channel	1.120	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

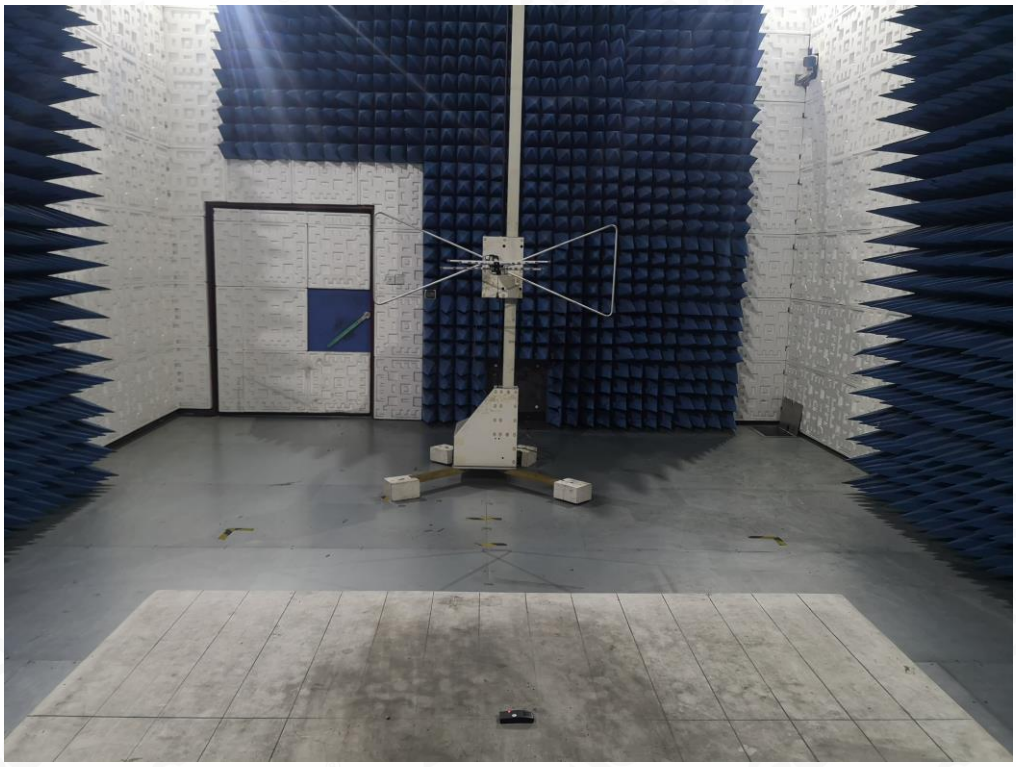
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



APPENDIX A: PHOTOGRAPHS OF TEST SETUP

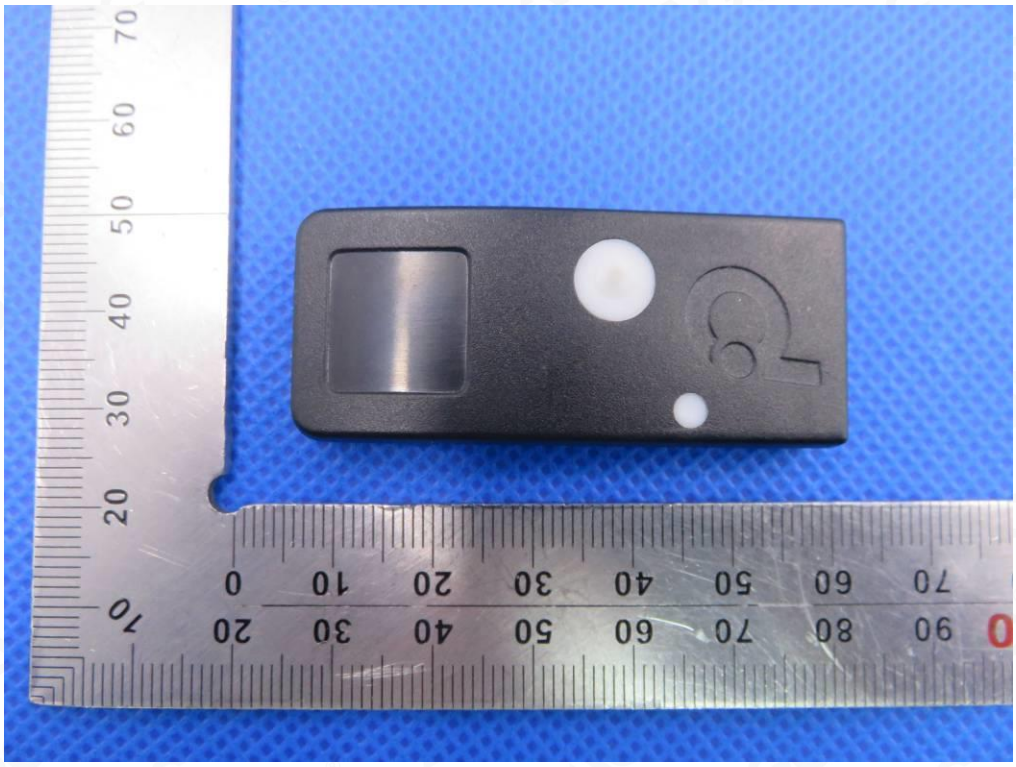
FCC RADIATED EMISSION TEST SETUP BELOW 1GHZ



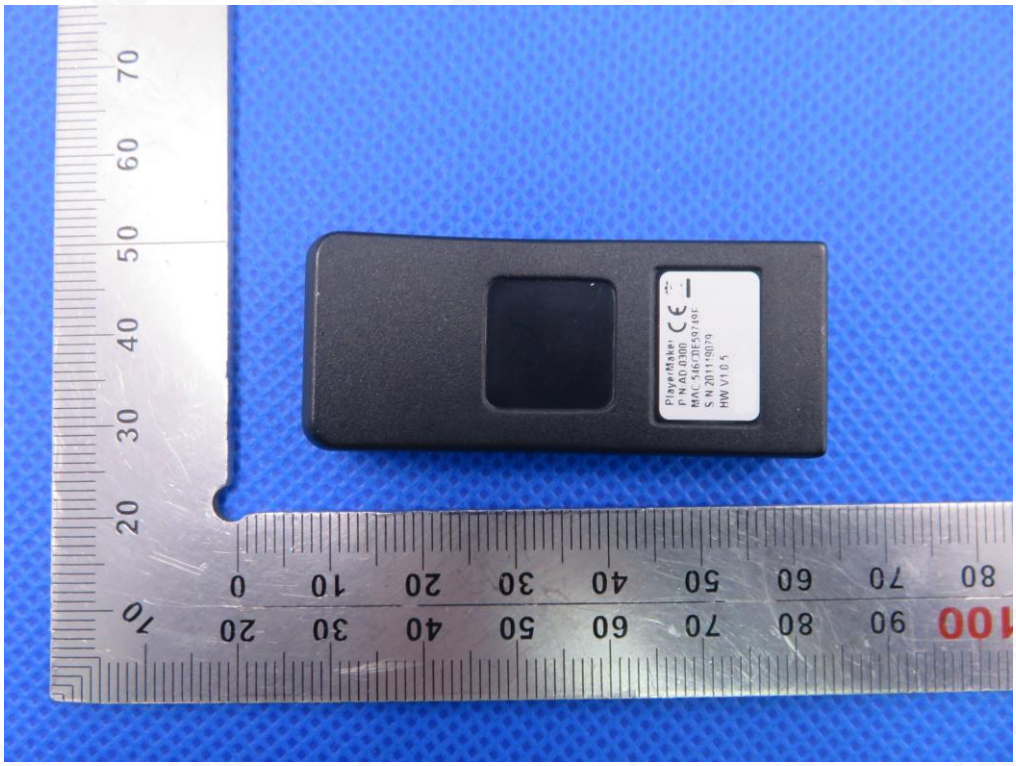
FCC RADIATED EMISSION TEST SETUP ABOVE 1GHZ

APPENDIX B: PHOTOGRAPHS OF THE EUT

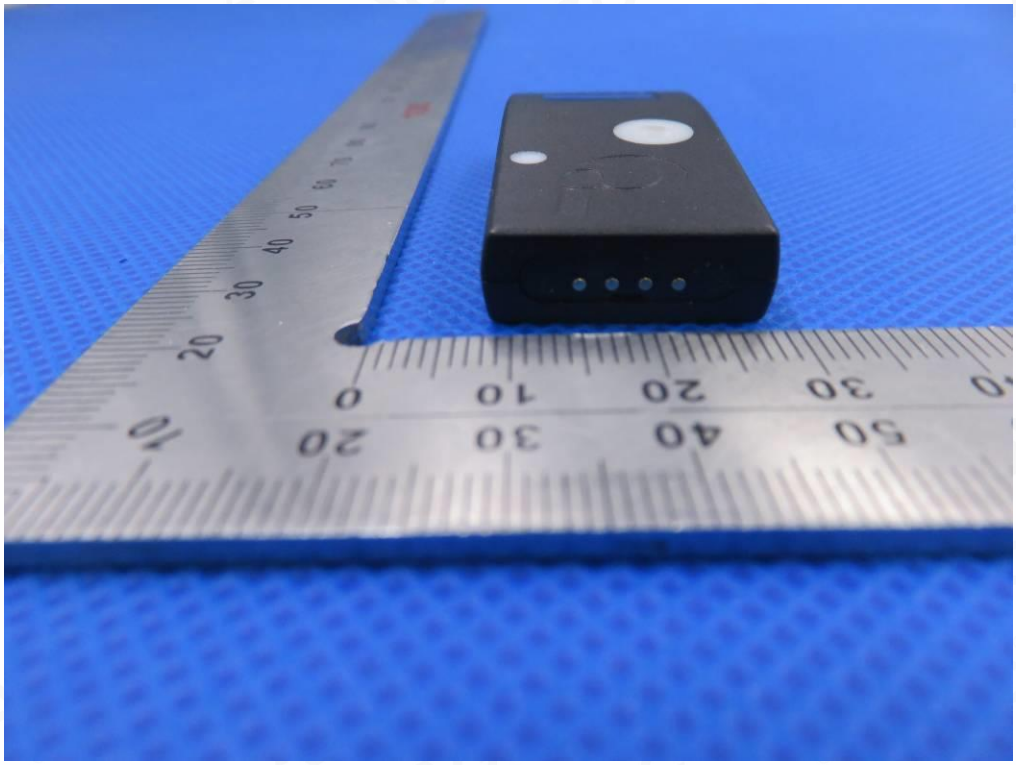
TOP VIEW OF EUT



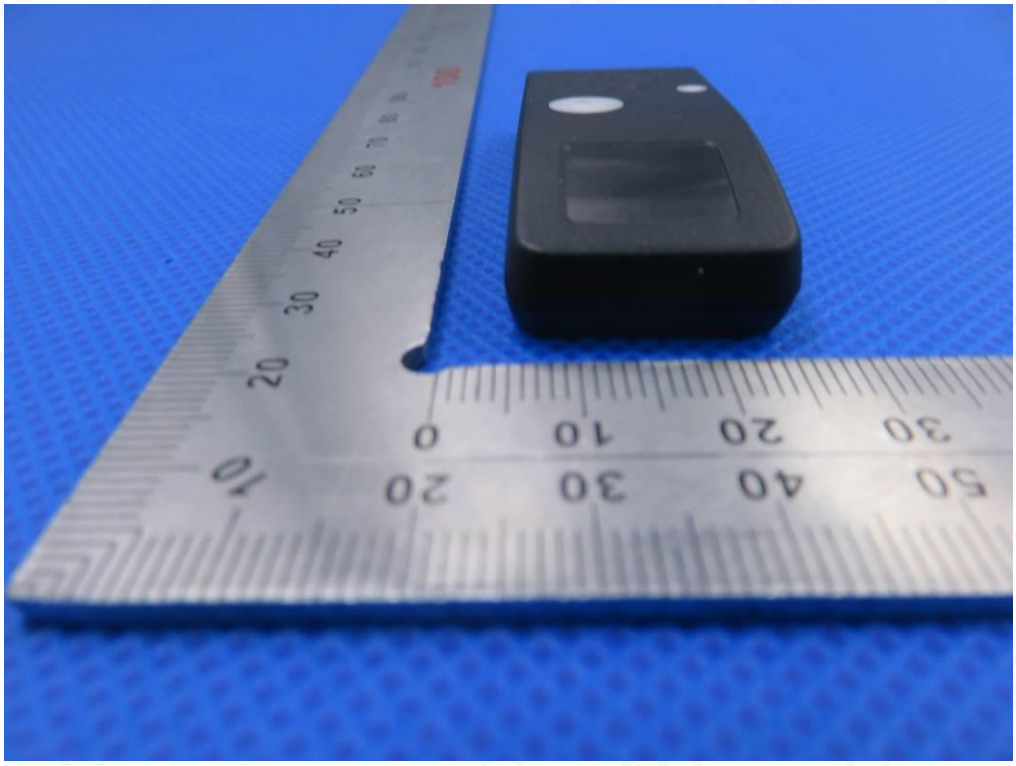
BOTTOM VIEW OF EUT



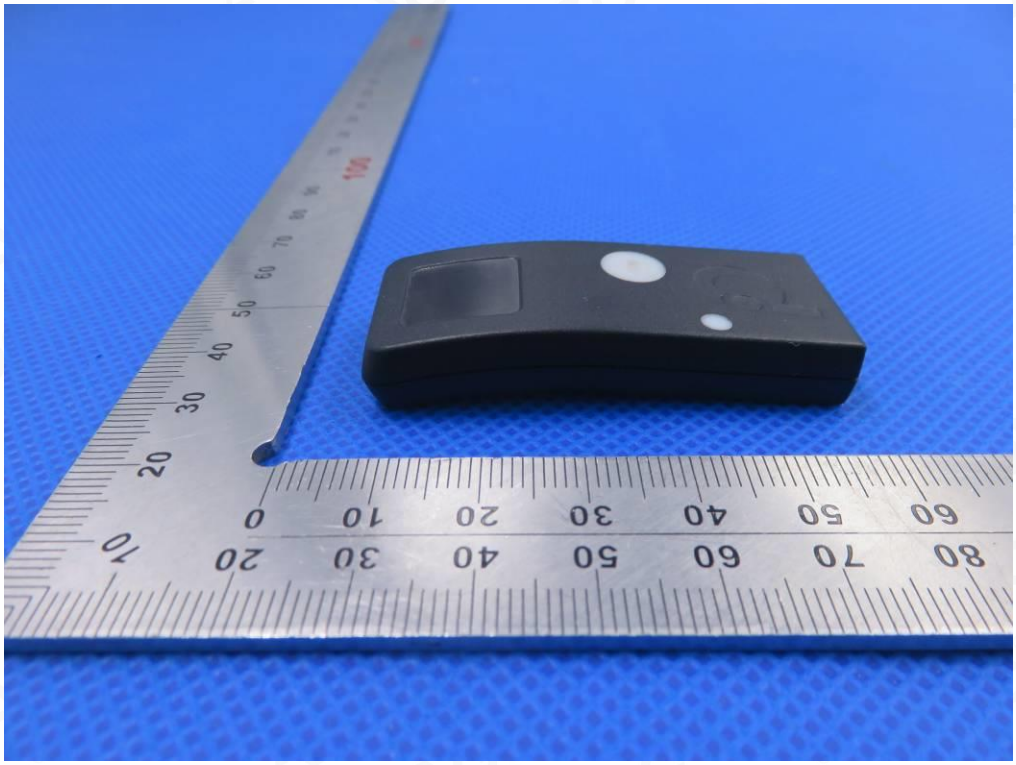
FRONT VIEW OF EUT



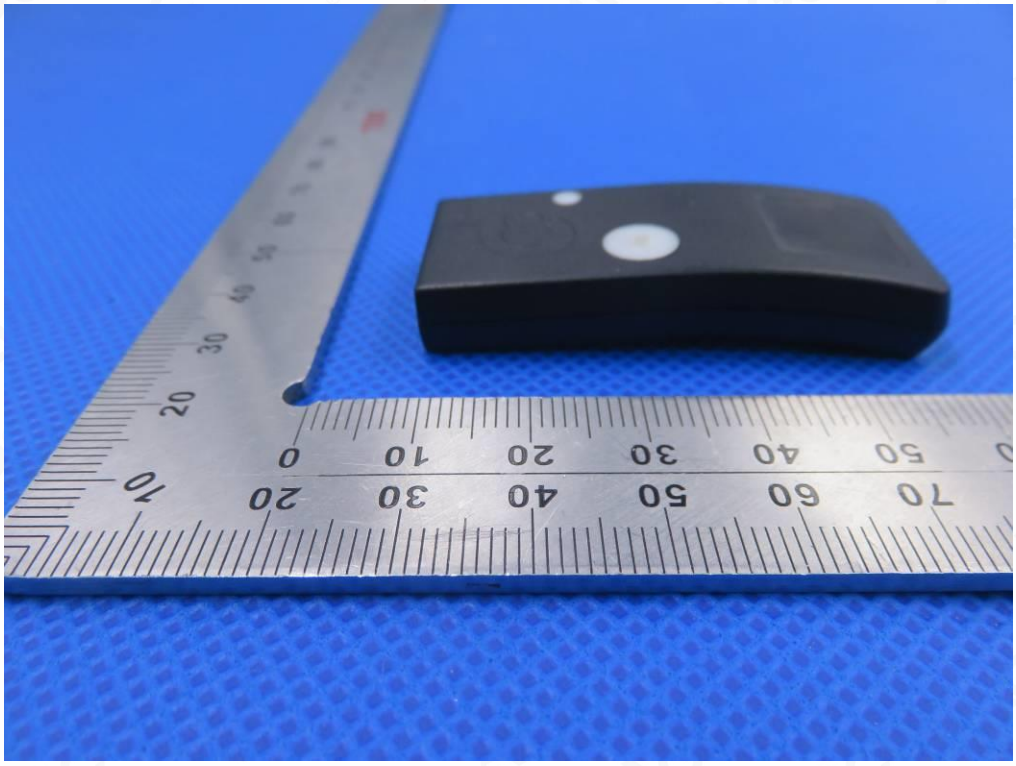
BACK VIEW OF EUT



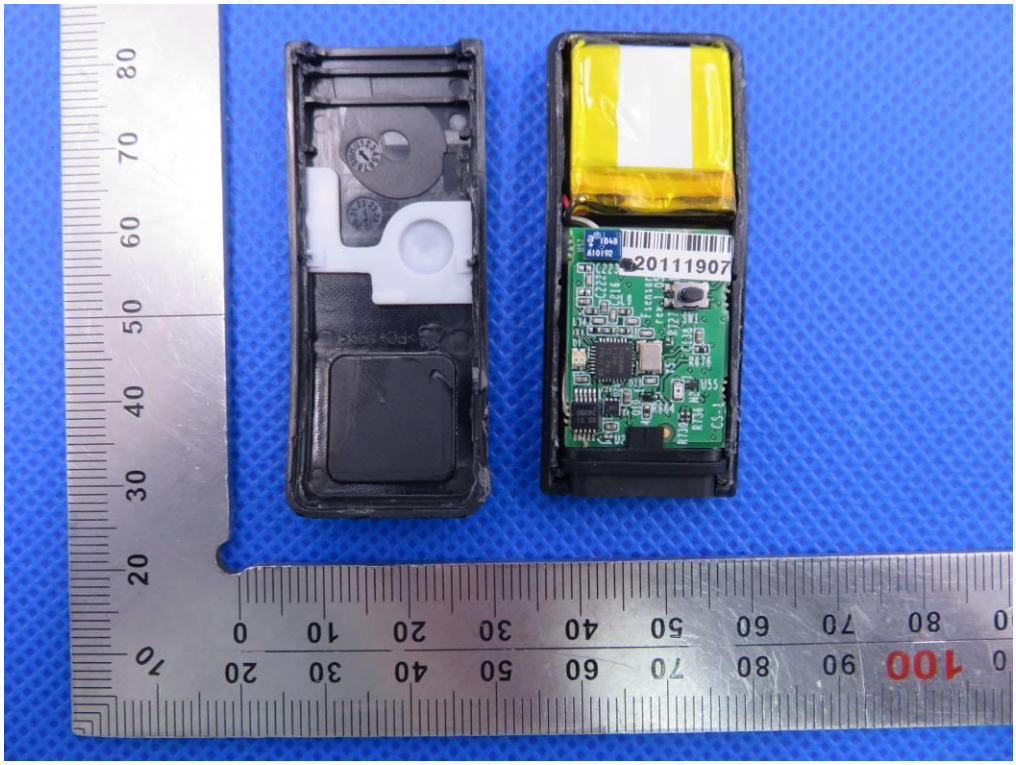
LEFT VIEW OF EUT



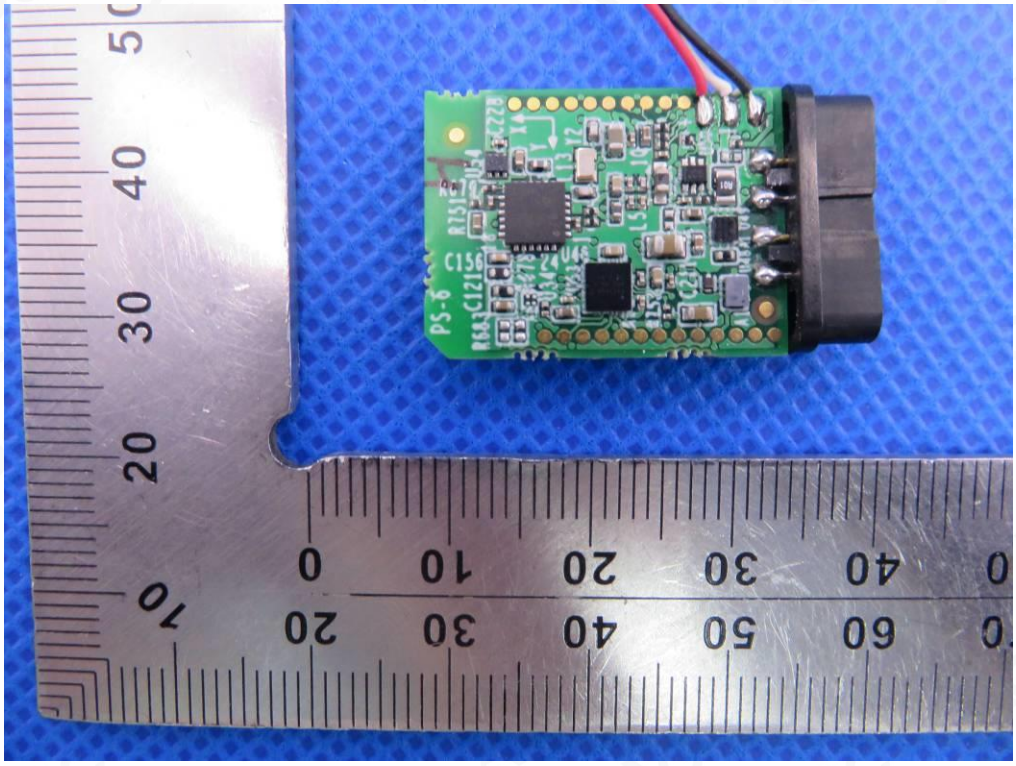
RIGHT VIEW OF EUT



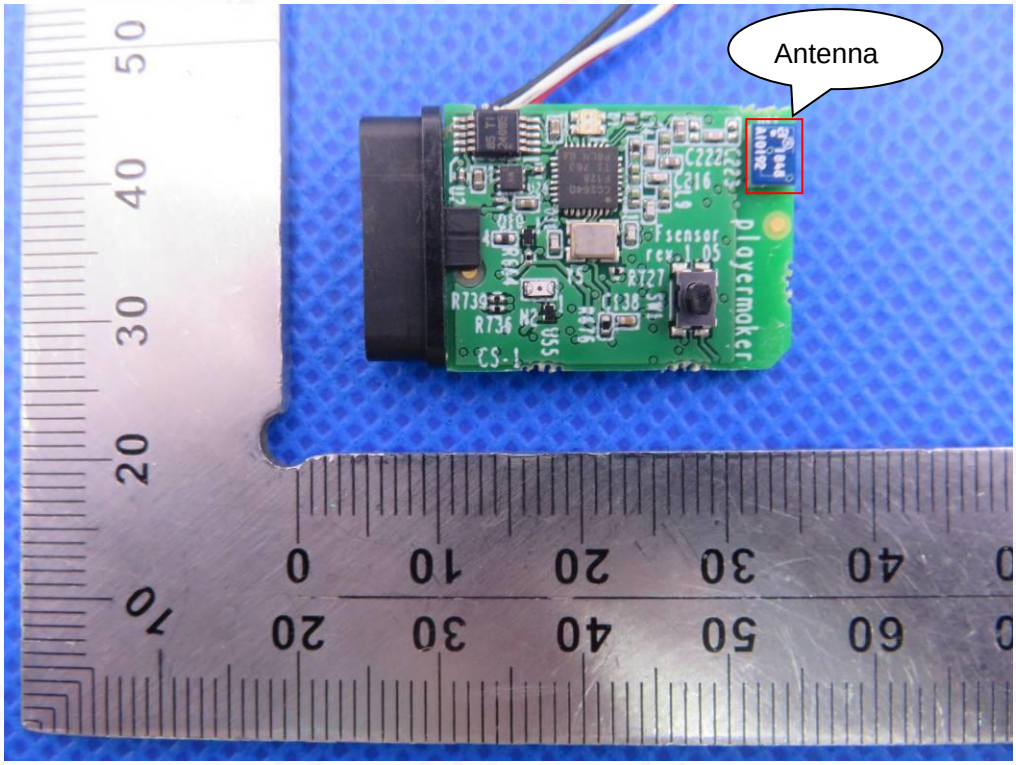
OPEN VIEW OF EUT



INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



----END OF REPORT----