Test Report No.:
FCC2021-0028-RF2

RF Test Report

EUT	:	**Smart Button**
MODEL	:	**WS101-915M**
BRAND NAME	:	**Milesight**
APPLICANT	:	**Xiamen Milesight IoT Co., Ltd.**
Classification Of Test	:	**N/A**

CVC Testing Technology Co., Ltd.

Applicant	**Name : Xiamen Milesight IoT Co., Ltd.** **Address : 4/F,NO. 63-2 Wanghai Road, 2nd Software Park,Xiamen ,China**
Manufacturer	**Name : Xiamen Milesight IoT Co., Ltd.** **Address : 4/F,NO. 63-2 Wanghai Road, 2nd Software Park,Xiamen ,China**
Equipment Under Test	**Name : Smart Button** **Model/Type: WS101-915M** **Trade mark : Milesight** **SerialNO.:N/A** **Sampe NO.:6-1**

Date of Receipt.	**2021.09.08**	Date of Testing	**2021.09.08～2021.11.04**

Test Specification	**Test Result**
FCC Part 15, Subpart C, Section 15.225	PASS

Evaluation of Test Result	The equipment under test was found to comply with the requirements of the standards applied. **Issue Date: 2021.11.05**

Tested by:	Reviewed by:	Approved by:
Xu ZhenFei	**Liu YongHai**	**Chen HuaWen**
Name Signature	Name Signature	Name Signature

Other Aspects: NONE.

Abbreviations:OK, Pass= passed Fail = failed N/A= not applicable EUT= equipment, sample(s) under tested

TABLE OF CONTENTS

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
FCC2021-0028-RF2	Original release	2021.11.05

1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C Section 15.225			
FCC STANDARD SECTION	**TEST TYPE AND LIMIT**	**RESULT**	**REMARK**
15.207	AC Power Line Conducted Emission	N/A	Power form battery.
15.225 (a)&(b)&(c)	The field strength of Fundamental Emission	PASS	Meet the requirement of limit.
15.225 (d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit.
15.225 (e)	Frequency tolerance	PASS	Meet the requirement of limit.
15.215 (c)	20dB Bandwidth	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

1.1 LIST OF TEST AND MEASUREMENT INSTRUMENTS

Refer to Appendix A.

1.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

No.	ITEM	FREQUENCY	UNCERTAINTY
1	Conducted Emissions	9kHz~30MHz	±2.66dB
2	Radiated Spurious Emissions	9KHz ~ 30MHz	±0.769dB
		30MHz ~ 1GMHz	±0.877dB
		1GHz ~ 18GHz	±0.777dB
		18GHz ~ 40GHz	±1.315dB

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

1.3 TEST LOCATION

The tests and measurements refer to this report were performed by EMC testing Lab. of CVC Testing Technology Co., Ltd

Address: No.3,TiantaiyiRoad,KaitaiAvenue,ScienceCity,Guangzhou,China
Post Code：510663 Tel：020-32293888
FAX：020-32293889 E-mail：office@cvc.org.cn
Test Firm Registration Number: 937273
CN Number：26239 Wireless Test Site Registration Number：CN0103

2 GENERAL INFORMATION

2.1 GENERAL PRODUCT INFORMATION

PRODUCT	Smart Button
BRAND	Milesight
MODEL	WS101-915M
ADDITIONAL MODEL	N/A
FCC ID	2AYHY-WS101
POWER SUPPLY	DC 3.6V(ER14335*1*3.6V) From Battey
MODULATION TYPE	ASK
OPERATING FREQUENCY	13.56MHz
NUMBER OF CHANNEL	1
ANTENNA TYPE	Loop antenna
I/O PORTS	Refer to user's manual
CABLE SUPPLIED	N/A

Remark:

1. For more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. EUT photo refer to the report (Report NO.: FCC2021-0028-E).

2.2 OTHER INFORMATION

The EUT only have one channel.

CHANNEL	FREQUENCY (MHz)
1	13.56

2.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports
The worst case was found when positioned on X axis for radiated emission. Following channel(s) was (were) selected for the final test as listed below:

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE	FT	PLC	BW	
A	√	√	-	√	DC 3.6V from Battery with NFC

Where **RE:** Radiated Emission **FT:** Frequency tolerance
PLC: Power Line Conducted Emission **BW:** 20dB Bandwidth

RADIATED EMISSION TEST:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	TESTED CHANNEL	TESTED FREQUENCY (MHZ)	MODULATION TYPE	AXIS
A	1	13.56	ASK	X

FREQUENCY TOLERANCE:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	TESTED CHANNEL	TESTED FREQUENCY (MHZ)	MODULATION TYPE	AXIS
A	1	13.56	ASK	X

20dB BANDWIDTH:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture), and packet types.

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	TESTED CHANNEL	TESTED FREQUENCY (MHZ)	MODULATION TYPE	AXIS
A	1	13.56	ASK	X

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	TEST VOLTAGE (SYSTEM)	TESTED BY
RE	23deg. C, 53%RH	DC 3.6V from Battery	Li JiaLing
FT	25deg. C, 50%RH	DC 3.6V from Battery	Li JiaLing
PLC	-	-	-
BW	25deg. C, 50%RH	DC 3.6V from Battery	Li JiaLing

2.4 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product, according to the specifications of the manufacturers. It must comply with the requirements of the following standards:

FCC PART 15, Subpart C. Section 15.225
ANSI C63.10-2020

All test items have been performed and recorded as per the above standards

2.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Support Equipment					
NO	Description	Brand	Model No.	Serial Number	Supplied by
1	Mobile Phone	iQOO	Z1	8608920450777798	Lab

Support Cable							
NO	Description	Quantity (Number)	Length (m)	Detachable (Yes/ No)	Shielded (Yes/ No)	Cores (Number)	Supplied by
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3 TEST TYPES AND RESULTS

3.1 RADIATED EMISSIONS

3.1.1 Limits

(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.

FREQUENCIES (MHz)	FIELD STRENGTH (Microvolts/Meter)	MEASUREMENT DISTANCE (Meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3
NOTE: 1. The lower limit shall apply at the transition frequencies. NOTE: 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).		

3.1.2 Measurement procedure

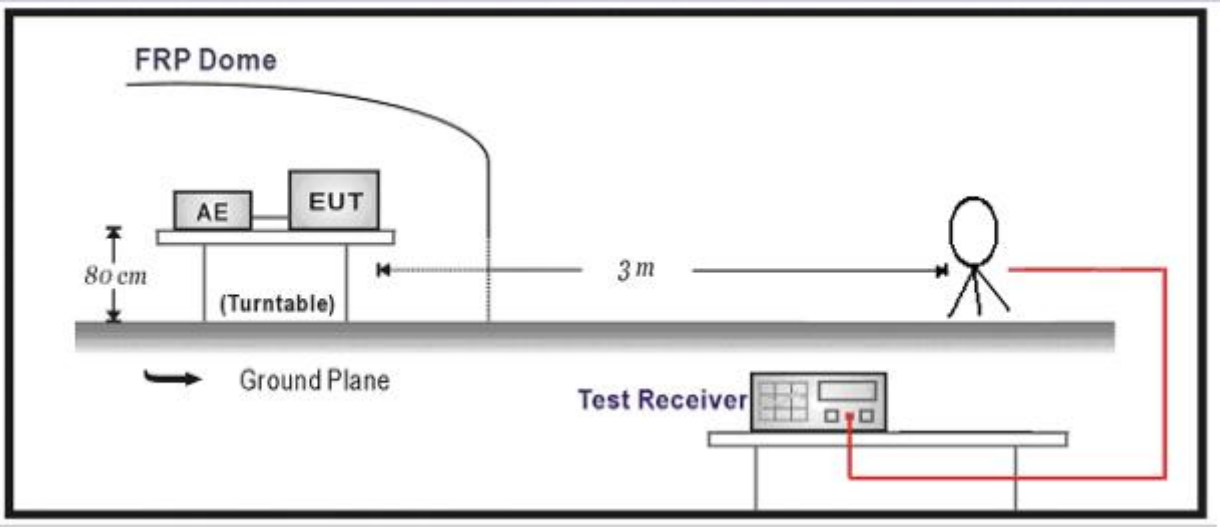
a. The EUT was placed on the top of a rotating table 1.5 meters(above 1GHz) and 0.8 meters(below 1GHz) above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. For below 1GHz was used bilog antenna, and above 1GHz was used horn antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. For below 30MHz, a loop antenna with its vertical plane is place 3m from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. And the centre of the loop shall be 1m above the ground.
g. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using fresh batteries. The turntable was rotated to maximize the emission level.

NOTE:

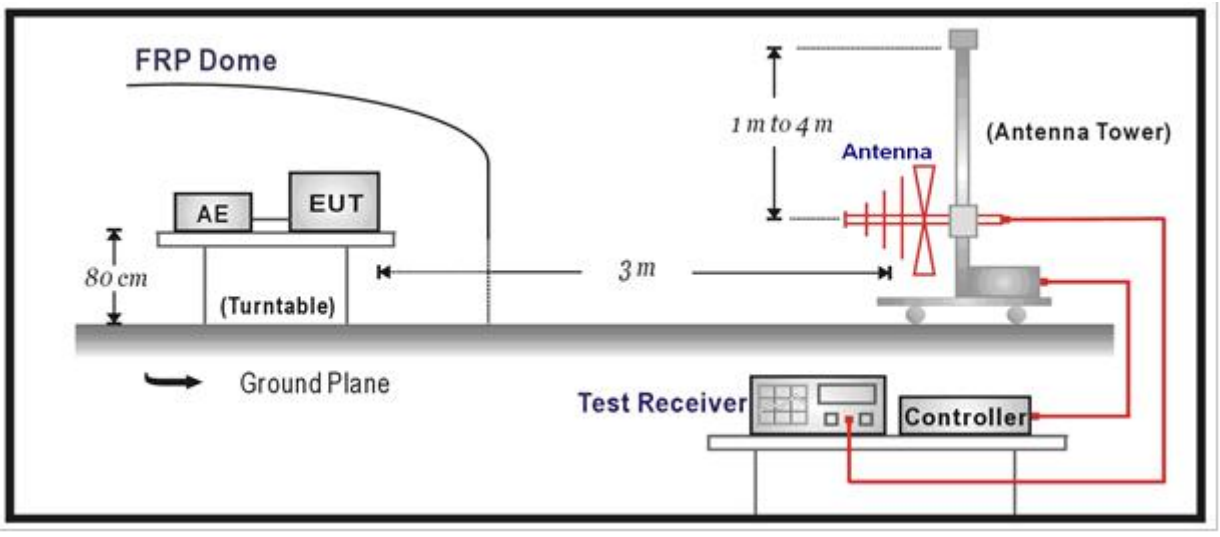
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ⩾ 1/T (Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.
5. The testing of the EUT was performed on all 3 orthogonal axes; the worst-case test configuration was reported on the file test setup photo.

3.1.3 Test setup

Below 30MHz Test Setup:



Below 1GHz Test Setup:

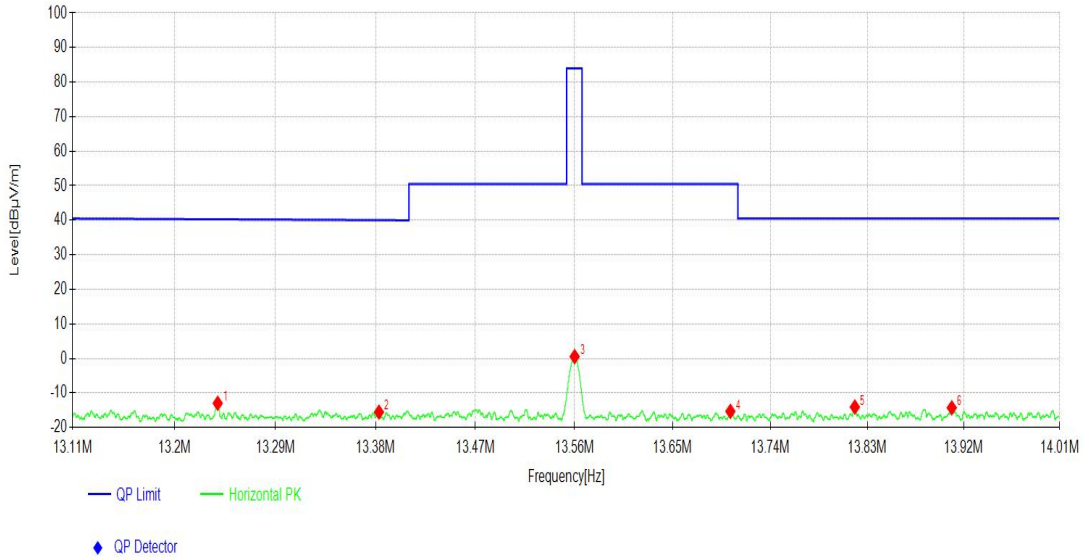


3.1.4 Test results

Result of The field strength of Fundamental Emission

Worst Test Mode	NFC	Channel	13.56M
Frequency Range	13.11MHz ~ 14.01MHz	Detector Function	Quasi-Peak (QP)

Horizontal

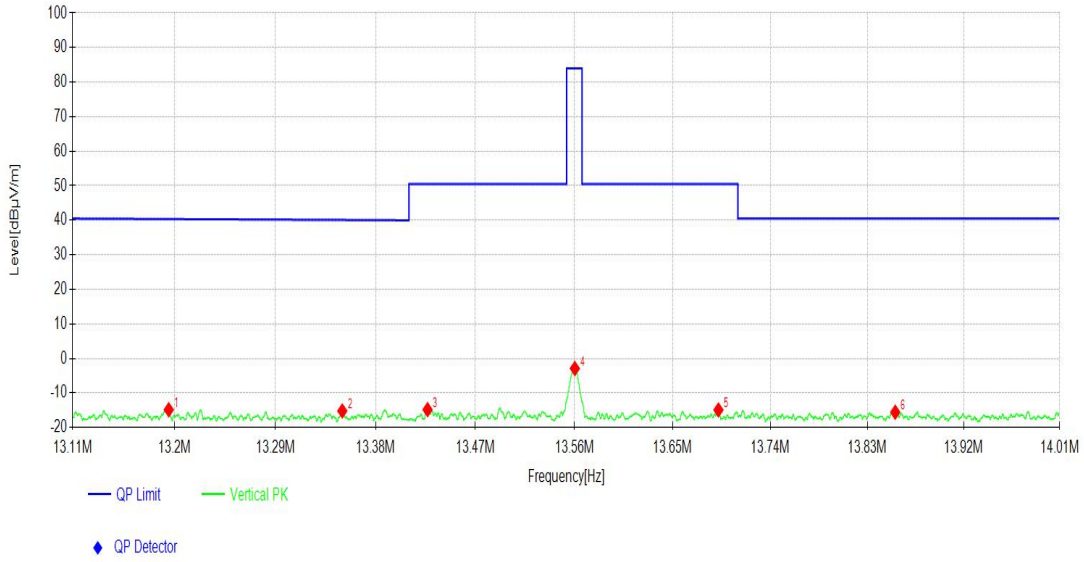


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	13.2386	6.97	-12.98	-19.95	40.29	53.27	100	306
2	13.3830	4.39	-15.54	-19.93	40.05	55.59	100	28
3	13.5603	20.43	0.53	-19.90	84.00	83.47	100	34
4	13.7031	4.55	-15.32	-19.87	50.50	65.82	100	46
5	13.8183	5.77	-14.08	-19.85	40.50	54.58	100	293
6	13.9087	5.55	-14.29	-19.84	40.50	54.79	100	183

Remark: 1. Distance extrapolation factor = 40log(specific distance/test distance)
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m)=Antenna Factor (dB/m) + Cable Factor (dB).+ Distance extrapolation factor
4. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]
5. Emission level (dBuV/m) = 20 log Emission level (uV/m).

Worst Test Mode	NFC	Channel	13.56M
Frequency Range	13.11MHz ~ 14.01MHz	Detector Function	Quasi-Peak (QP)

Vertical



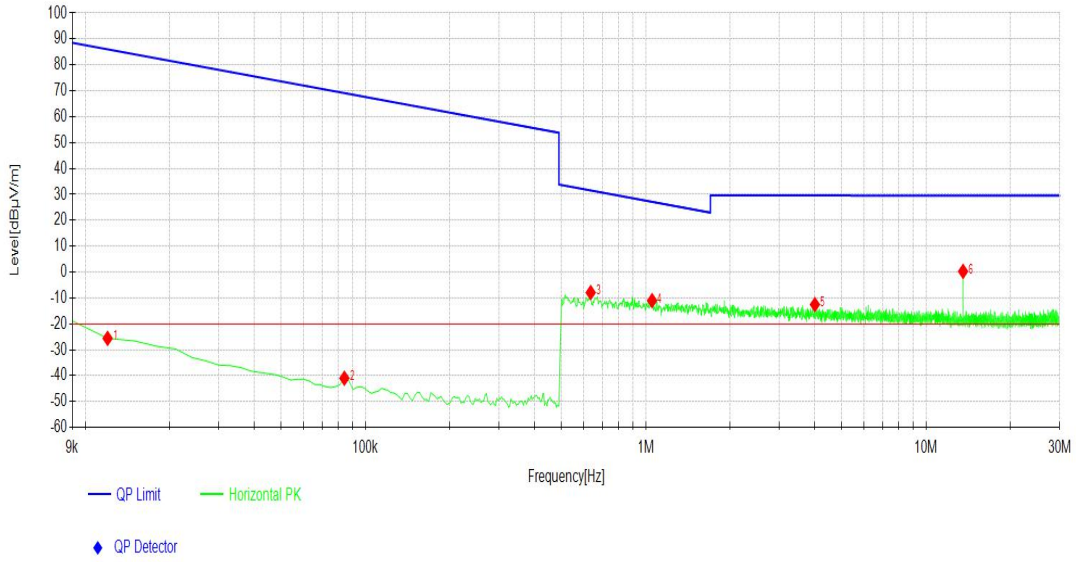
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	13.1951	5.10	-14.86	-19.96	40.36	55.22	100	160
2	13.3500	4.72	-15.21	-19.93	40.10	55.31	100	146
3	13.4268	5.11	-14.81	-19.92	50.50	65.31	100	316
4	13.5605	16.98	-2.92	-19.90	84.00	86.92	100	134
5	13.6921	4.96	-14.91	-19.87	50.50	65.41	100	341
6	13.8559	4.28	-15.57	-19.85	40.50	56.07	100	358

Remark: 1. Distance extrapolation factor = 40log(specific distance/test distance)
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB). + Distance extrapolation factor
4. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]
5. Emission level (dBuV/m) = 20 log Emission level (uV/m).

Result of Radiated Emissions(9kHz~30MHz)

Worst Test Mode	NFC	Channel	13.56M
Frequency Range	9kHz ~ 30MHz	Detector Function	Quasi-Peak (QP)

Horizontal

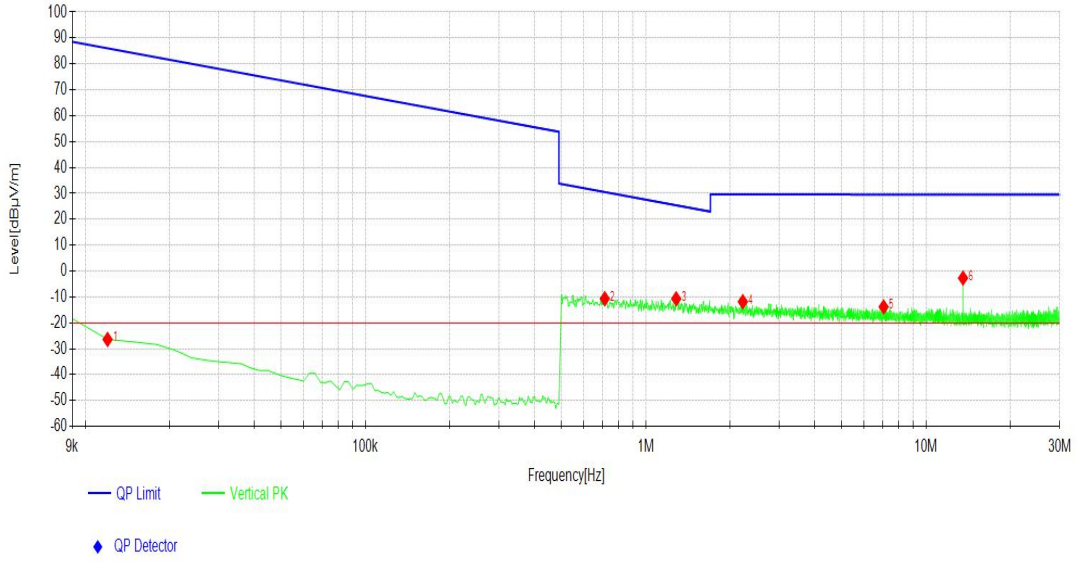


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	0.0120	33.87	-25.58	-59.45	86.02	111.60	100	360
2	0.0840	18.43	-40.98	-59.41	69.12	110.10	100	48
3	0.6359	10.97	-7.90	-18.87	31.53	39.43	100	3
4	1.0528	8.20	-11.00	-19.20	27.14	38.14	100	2
5	4.0132	6.57	-12.53	-19.10	29.56	42.09	100	115
6	13.5603	20.18	0.28	-19.90	29.55	29.27	100	30

Remark: 1. Distance extrapolation factor = 40log(specific distance/test distance)
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) + Cable Factor (dB). + Distance extrapolation factor
4. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]
5. Emission level (dBuV/m) = 20 log Emission level (uV/m).

Worst Test Mode	NFC	Channel	13.56M
Frequency Range	9kHz ~ 30MHz	Detector Function	Quasi-Peak (QP)

Vertical



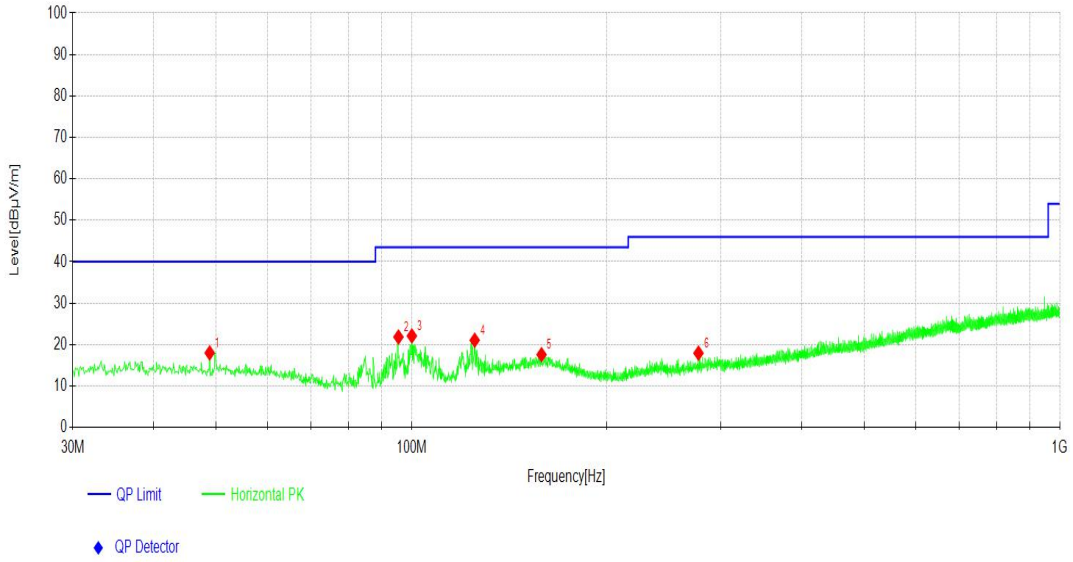
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	0.0120	33.08	-26.37	-59.45	86.02	112.39	100	0
2	0.7139	8.29	-10.65	-18.94	30.52	41.17	100	194
3	1.2837	8.50	-10.68	-19.18	25.42	36.10	100	99
4	2.2196	7.26	-11.82	-19.08	29.57	41.39	100	157
5	7.0606	5.57	-13.81	-19.38	29.56	43.37	100	325
6	13.5603	17.20	-2.70	-19.90	29.55	32.25	100	262

Remark: 1. Distance extrapolation factor = 40log(specific distance/test distance)
2. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
3. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) + Cable Factor (dB). + Distance extrapolation factor
4. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]
5. Emission level (dBuV/m) = 20 log Emission level (uV/m).

Result of Radiated Emissions(30MHz~1GHz)

Worst Test Mode	NFC	Channel	13.56M
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Horizontal

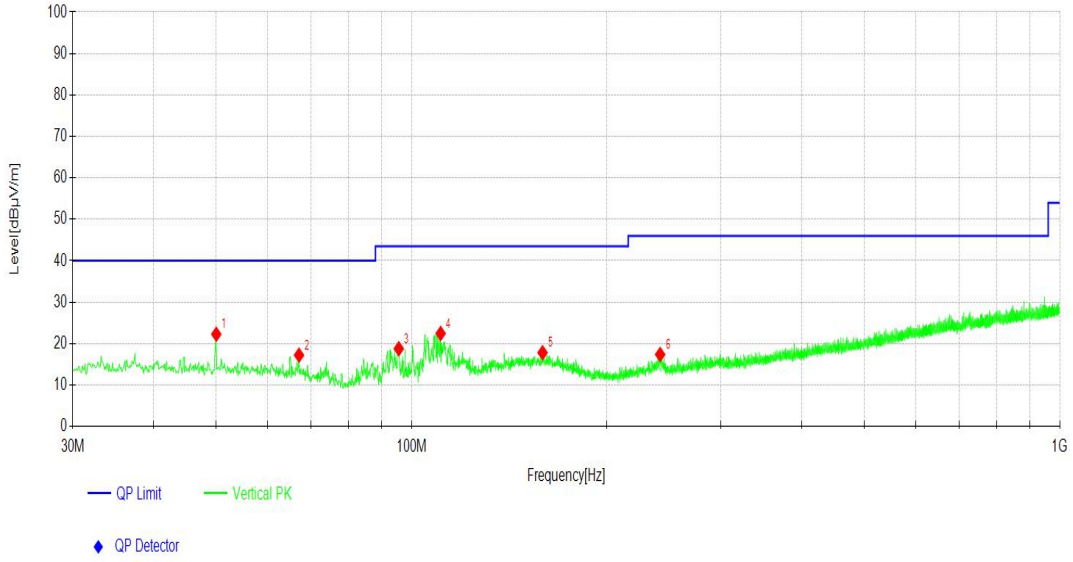


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	48.8199	3.69	18.00	14.31	40.00	22.00	200	129
2	95.4815	10.88	21.84	10.96	43.50	21.66	300	354
3	100.1380	10.80	22.11	11.31	43.50	21.39	300	226
4	125.1665	7.85	21.06	13.21	43.50	22.44	200	162
5	158.7319	1.71	17.57	15.86	43.50	25.93	100	295
6	277.1807	3.75	17.95	14.20	46.00	28.05	200	274

Remark: 1. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
2. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]
4. Emission level (dBuV/m) = 20 log Emission level (uV/m).

Worst Test Mode	NFC	Channel	13.56M
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Vertical



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]
1	49.9840	8.00	22.27	14.27	40.00	17.73	100	349
2	67.0577	4.81	17.21	12.40	40.00	22.79	300	338
3	95.5786	7.81	18.78	10.97	43.50	24.72	300	247
4	110.9061	10.52	22.45	11.93	43.50	21.05	300	128
5	159.3139	1.93	17.81	15.88	43.50	25.69	300	96
6	241.8692	4.03	17.39	13.36	46.00	28.61	300	0

Remark: 1. Level (dBuV/m) = Reading (dBuV/m) + Factor (dB).
2. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. Margin(dB) = Limit[dBµV/m] - Level [dBµV/m]
4. Emission level (dBuV/m) = 20 log Emission level (uV/m).

3.2 FREQUENCY TOLERANCE

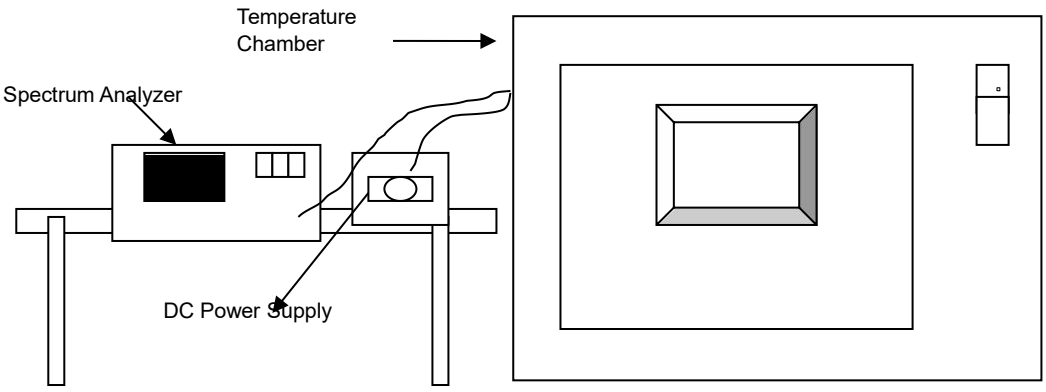
3.2.1 LIMIT OF FREQUENCY TOLERANCE

The frequency tolerance of the carrier signal shall be maintained within ±0.01% (100ppm) 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. For battery operated equipment, the equipment tests shall be performed using a new battery.

3.2.2 TEST PROCEDURES

Refer to ANSI C63.10-2013

3.2.3 TEST SETUP



3.2.4 TEST RESULTS

FREQUEMCY STABILITY VERSUS TEMP.									
TEMP. (℃)	POWER SUPPLY (V)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
50	3.6	13.560617	45.50	13.560619	45.65	13.560613	45.21	13.560614	45.28
40	3.6	13.560613	45.21	13.560614	45.28	13.560618	45.58	13.560616	45.43
30	3.6	13.560615	45.35	13.560617	45.50	13.560610	44.99	13.560613	45.21
20	3.6	13.560619	45.65	13.560623	45.94	13.560615	45.35	13.560616	45.43
10	3.6	13.560621	45.80	13.560623	45.94	13.560618	45.58	13.560619	45.65
0	3.6	13.560619	45.65	13.560615	45.35	13.560617	45.50	13.560613	45.21
-10	3.6	13.560616	45.43	13.560614	45.28	13.560612	45.13	13.560618	45.58
-20	3.6	13.560613	45.21	13.560618	45.58	13.560609	44.91	13.560609	44.91
20	3.24	13.560613	45.21	13.560616	45.43	13.560614	45.28	13.560609	44.91
	3.96	13.560622	45.87	13.560618	45.58	13.560608	44.84	13.560619	45.65

3.3 20dB BANDWIDTH

3.3.1 LIMITS OF 20dB BANDWIDTH

The 20dB bandwidth shall be specified in operating frequency band. (13.11MHz – 14.01MHz)

3.3.2 TEST PROCEDURE

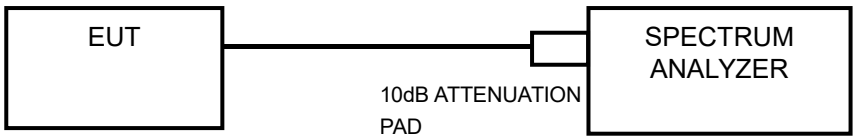
a. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

b. The resolution bandwidth of 1kHz and the video bandwidth of 3kHz were used.

c. Measured spectrum width with power higher than 20dB below carrier.

Note: Because the measured singal is CW or CW-like adjust the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately the RBW

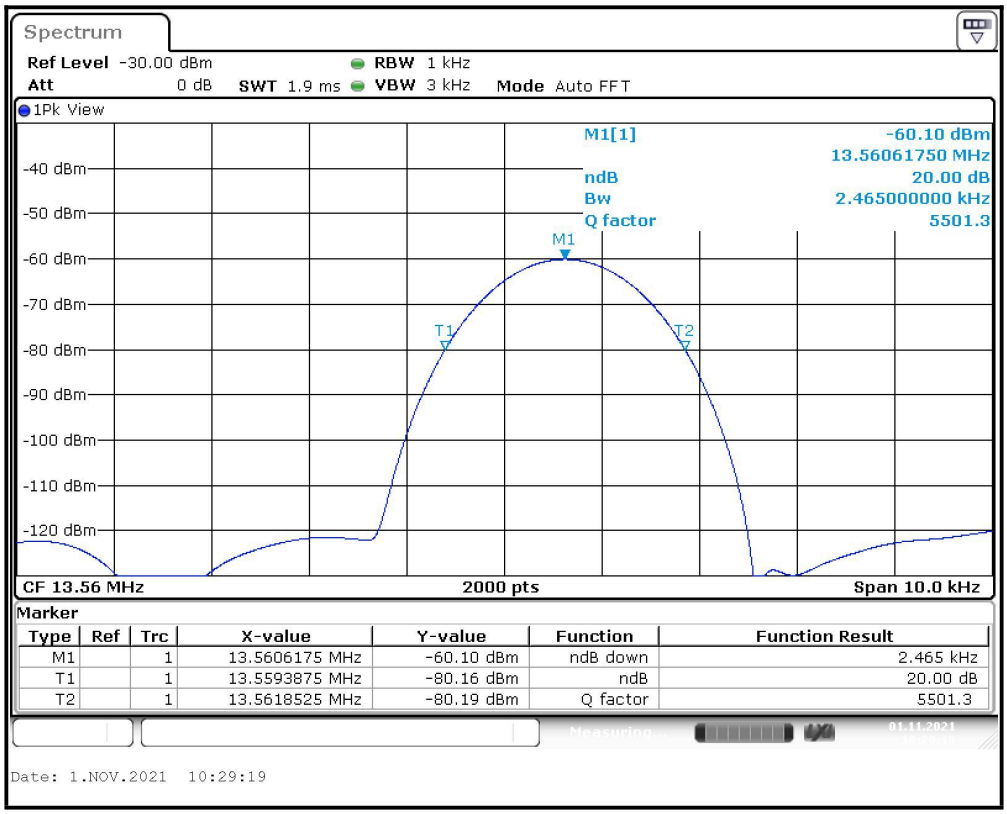
3.3.3 TEST SETUP



3.3.4 TEST RESULTS

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (KHz)
1	13.56	2.465

Lower & Upper Test Frequency Point (MHz)	Test Frequency (MHz)	P/F
Lower	13.5593	PASS
Upper	13.5618	PASS



4 PHOTOGRAPHS OF TEST SETUP

Please refer to the attached file (Test Photos).

5 PHOTOGRAPHS OF THE EUT

Please refer to the attached file (External Photos report and Internal Photos).

Appendix A

Antenna Port Conducted Test				
Equipment	Model No.	Serial Number	Manufacturer	Cal. Due
Communication Shielded Room 2	4m*3m*3m	CRTDSWKSR44301	CRT	2023/04/25
Spectrum Analyzer	FSV40	101580	R&S	2022/06/30
Comprehensive Test Instrument	CMW270	100304	R&S	2021/12/08
Analog Signal Generator	SMB100A	181858	R&S	2022/06/30
Vector Signal Generator	SGT100A	111661	R&S	2022/06/30
RF Radio Frequency Switch	JS0806-2	19H9080187	Tonscend	2022/06/30
Programmable DC Power Supply	E3644A	MY58036222	KEYSIGHT	2022/04/22

Radiated Emission Test - 3M Chamber				
Equipment	Model No.	Serial Number	Manufacturer	Cal. Due
3m Semi-Anechoic Chamber	FACT-4	ST08035	ETS	2024/12/12
Spectrum Analyzer	N9010B	MY57470323	KEYSIGHT	2022/03/05
EMI Test Receiver	N9038A-508	MY532290079	Agilent	2022/03/05
Broadband Antenna	VULB 9163	9163-530	SCHWARZBECK	2022/06/26
Waveguide Horn Antenna	HF906	360306/008	R&S	2022/03/05
Waveguide Horn Antenna	BBHA9170	00949	SCHWARZBECK	2022/03/05
Preamplifier	BBV 9721	9721-050	SCHWARZBECK	2022/06/30
5G Bandstop Filters	WRCJV12-4900-5100-5900-6100-50EE	1	WI	2021/12/16
Comprehensive tester	CMW500	159000	R&S	2022/01/04

Important

(1) The test report is valid with the official seal of the laboratory and the signatures of Test engineer, Author and Reviewer simultaneously.

(2) The test report is invalid if altered.

(3) Any photocopies or part photocopies in the test report are forbidden without the written permission from the laboratory.

(4) Objections to the test report must be submitted to the laboratory within 15 days.

(5) Generally, commission test is responsible for the tested samples only.

Address of the laboratory:

CVC Testing Technology Co., Ltd.

Address: No.3,TiantaiyiRoad,KaitaiAvenue,ScienceCity,Guangzhou,China

Post Code：510663 Tel：020-32293888

FAX：020-32293889 E-mail：office@cvc.org.cn