NCT Technology

TEST REPORT

FCC ID: 2BFZL-LS1

Product	:	**Wireless Sensors**
Model Name	:	**LS1, LS2, LS3, LS4, LS5, LS6, LS7, LS8, LM1, LM2, LD1, LD2, MS1, MS2, MS3, LW1, LW2, LC1, LB1, LA1**
Brand	:	**MOCREO/VOBOT**
Report No.	:	**NCT24046172E1-2**

Prepared for

MOCREO PTE. LTD.

10 ANSON ROAD #33-17 INTERNATIONAL PLAZA SINGAPORE (079903)

Prepared by

Shenzhen NCT Testing Technology Co., Ltd.

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TEL: 400-8868-419

1 TEST RESULT CERTIFICATION

Applicant's name	:	MOCREO PTE. LTD.
Address	:	10 ANSON ROAD #33-17 INTERNATIONAL PLAZA SINGAPORE (079903)
Manufacture's name	:	Shenzhen Aozhuo IoT Technology Co., Ltd.
Address	:	Room 301A, Building A, No.8 Heshu Road, Xinxue Community, Bantian Street, Longgang District, Shenzhen
Product name	:	Wireless Sensors
Model name	:	LS1, LS2, LS3, LS4, LS5, LS6, LS7, LS8, LM1, LM2, LD1, LD2, MS1, MS2, MS3, LW1, LW2, LC1, LB1, LA1
Standards	:	FCC CFR47 Part 15 Section 15.249
Test procedure	:	ANSI C63.10:2020
Date of test	:	Nov. 11, 2024 to Nov. 22, 2024
Date of Issue	:	Nov. 22, 2024

This device described above has been tested by NCT, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Test Engineer:

Keven Wu / Engineer

Technical Manager:

Henry Wang / Manager

Contents

Page

1 TEST RESULT CERTIFICATION 2
2 TEST SUMMARY 5
2.1 TEST SITE 6
3 GENERAL INFORMATION 7
3.1 GENERAL DESCRIPTION OF E.U.T. 7
3.2 CHANNEL LIST 8
3.3 TEST SETUP CONFIGURATION 8
3.4 TEST MODE 8
4 EQUIPMENT DURING TEST 9
4.1 EQUIPMENTS LIST 9
4.2 MEASUREMENT UNCERTAINTY 11
4.3 DESCRIPTION OF SUPPORT UNITS 11
5 CONDUCTED EMISSION 12
5.1 E.U.T. OPERATION 12
5.2 EUT SETUP 12
5.3 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 13
5.4 MEASUREMENT PROCEDURE 13
5.5 CONDUCTED EMISSION LIMIT 13
5.6 MEASUREMENT DESCRIPTION 13
5.7 CONDUCTED EMISSION TEST RESULT 13
6 RADIATED SPURIOUS EMISSIONS 14
6.1 EUT OPERATION 14
6.2 TEST SETUP 15
6.3 SPECTRUM ANALYZER SETUP 16
6.4 TEST PROCEDURE 17
6.5 SUMMARY OF TEST RESULTS 19
7 BANDWIDTH MEASUREMENT 25
7.1 TEST PROCEDURE 25
7.2 TEST RESULT 25

8 FREQUENCY TOLERANCE **26**
8.1 ANTENNA REQUIREMENT 26
8.2 TEST PROCEDURE 26
8.3 TEST SETUP 26
8.4 TEST PROCEDURE 26
9 ANTENNA APPLICATION **28**
9.1 ANTENNA REQUIREMENT 28
9.2 RESULT 28
10 TEST SETUP PHOTOS AND EUT PHOTOS **29**

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2 Test Summary

Test Items	Test Requirement	Result
15.207	Conducted Emission	N/A
15.249(c)	Fundamental &Radiated Spurious Emission Measurement	PASS
15.205	Band Edge Emission	PASS
15.215	20dB Bandwidth	PASS
15.203	Antenna Requirement	PASS

Remark:

1. “N/A” denotes test is not applicable in this Test Report.

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2.1 Test Site

Site Description

EMC Lab.	:	Accredited by CNAS, 2022-09-27
		The certificate is valid until 2028.01.07
		The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2017)
		The Certificate Registration Number is L8251
		Designation Number: CN1347
		Test Firm Registration Number: 894804
		Accredited by A2LA, June 14, 2023
		The Certificate Registration Number is 6837.01
		Accredited by Industry Canada, November 09, 2018
		The Conformity Assessment Body Identifier is CN0150
		Company Number: 30806
Name of Firm	:	Shenzhen NCT Testing Technology Co., Ltd.
Site Location	:	A101&2F B2, Fuqiao 6th Area, Xintian Community, Fuhai Street, Baoan District, Shenzhen, People's Republic of China

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Wireless Sensors
Model Name	:	LS1
Sample ID	:	24046172-001#
Sample(s) Status:	:	Engineer sample
Series Model	:	LS2, LS3, LS4, LS5, LS6, LS7, LS8, LM1, LM2, LD1, LD2, MS1, MS2, MS3, LW1, LW2, LC1, LB1, LA1
Model Different.:	:	All the same except the model number.
Operating frequency	:	915MHz
Number of Channels	:	1 channels
Type of Modulation	:	GFSK
Antenna installation	:	Spring Antenna
Antenna Gain	:	3 dBi
Power supply	:	DC 4.5V From 3*AAA Battery
Hardware Version	:	/
Software Version	:	/
Remark：the Antenna gain is provided by customer from Antenna spec. and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.		

3.2 Channel List

The EUT has been tested under its typical operating condition. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.
The EUT has been associated with peripherals pursuant to ANSI C63.10-2020 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).
The details of test channels and bandwidth were for RF conductive measurement.

Channel List:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	**915**				

Note:
Test of channel was included the lowest, middle and highest frequency in highest data rate and to perform the test, then record on this report.

Test Channel：

	Channel	Frequency(MHz)
Channel	01	915

3.3 Test Setup Configuration

Radiated Emission

EUT

3.4 Test Mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.	

4 Equipment During Test

4.1 Equipments List

Conducted emission Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
944 Shielded Room	944 Room	/	EMToni	2022/5/31	2025/5/30
EMI Test Receiver	ESPI	101604	Rohde & Schwarz	2024/6/17	2025/6/16
LISN	ENV 216	102796	Rohde & Schwarz	2024/6/17	2025/6/16
LISN	VN1-13S	004023	CRANAGE	2024/6/17	2025/6/16
Cable	RG223-1500MM	NA	RG	2024/6/17	2025/6/16

Radiated emission & Radio Frequency Test Equipment

Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
966 Shielded Room	966 Room	/	EMToni	2022/5/31	2025/5/30
Spectrum Analyze（10Hz-26.5GHz）	N9020A	MY50510202	Agilent	2024/6/17	2025/6/16
Amplifi（30MHz-1GHz）	BBV 9743 B	00374	SCHNWARZBECK	2024/6/17	2025/6/16
Bilog Antenna（30MHz-1GHz）	VULB9162	00473	SCHNWARZBECK	2023/3/19	2025/3/18
Horn antenna（1GHz-18GHz）	BBHA 9120 D	02622	SCHNWARZBECK	2023/3/19	2025/3/18
Pream plifier（1GHz-18GHz）	BBV 9718D	00042	SCHNWARZBECK	2024/6/17	2025/6/16
Spectrum Analyze（1GHz-40GHz）	FSV 40	100952	Rohde & Schwarz	2024/6/17	2025/6/16
Pream plifier（15GHz-40GHz）	BBV 9718D	0024	SCHNWARZBECK	2024/6/17	2025/6/16
Broadband Antenna（15GHz-40GHz）	SAS-574	588	A.H.System	2023/3/19	2025/3/18
Loop Antenna (9KHz-30MHz)	FMZB1519B	014	SCHNWARZBECK	2024/6/20	2025/6/19
Capacitive voltage probe	CVP 9222 C	00109	SCHNWARZBECK	2024/6/18	2025/6/17

MXG Signal Analyzer	N9020A	MY50510202	Agilent	2024/6/17	2025/6/16
MXG Vector Signal Generator	N5182A	MY50140020	Agilent	2024/6/17	2025/6/16
MXG Analog Signal Generator	N5181A	MY47420919	Agilent	2024/6/17	2025/6/16
Power Sensor	TR1029-2	512364	Techoy	2024/6/17	2025/6/16
RF Swith	TR1029-1	512364	Techoy	2024/6/17	2025/6/16
Cable	DA800-4000MM	NA	DA	2024/6/17	2025/6/16
Cable	DA800-11000MM	NA	DA	2024/6/17	2025/6/16

Peak Output Power Test Equipment

Peak Output Power					
Name	Model No.	Serial No.	Manufacturer	Date of Cal.	Due Date
Power Meter	E4419B	230480	Agilent	2024/6/20	2025/6/19
RF Cable	MWX322	MY50510202	1305G006	2024/6/20	2025/6/19
10dB Attenuator	2AS102-K10S3	N/A	Rosenberger	2024/6/20	2025/6/19

Other

Item	Name	Manufacturer	Model	Software version
1	EMC Conduction Test System	FALA	EZ-EMC	Ver.EMC-CON 3A1.1+
2	EMC radiation test system	FALA	EZ-EMC	Ver.FA-03A2 RE+
3	RF test system	TACHOY	RFTest	V1.0.0
4	RF communication test system	TACHOY	RFTest	V1.0.0

4.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(9KHz~30MHz)	±4.51dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB
Radiated Emission(25GHz~40GHz)	±3.38dB
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	

4.3 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.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Battery	Camelion	LR03 AM4	/	Auxiliary
E-2	Wireless Sensors	/	LS1	N/A	EUT

Note: (1)The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

5 Conducted Emission

Test Requirement	:	FCC CFR 47 Part 15 Section 15.207
Test Method	:	ANSI C63.10:2020
Test Result	:	PASS
Frequency Range	:	150kHz to 30MHz
Class/Severity	:	Class B

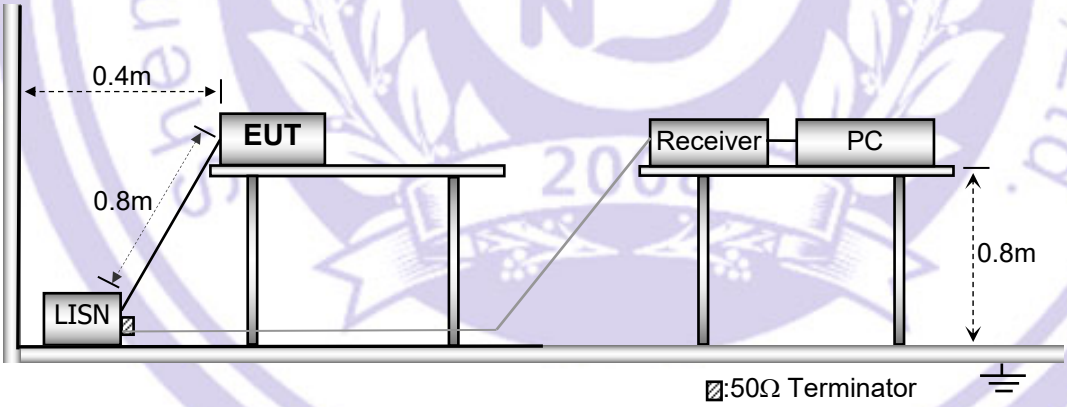
5.1 E.U.T. Operation

Operating Environment :

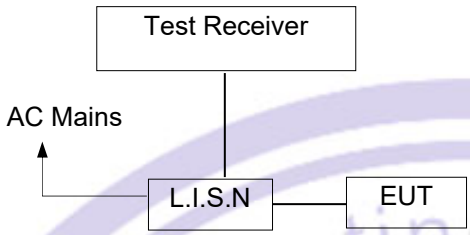
Temperature	:	25.5 °C
Humidity	:	51 % RH
Atmospheric Pressure	:	101.2kPa

5.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2020.



5.3 Test SET-UP (Block Diagram of Configuration)



5.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

5.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies

2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

5.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

5.7 Conducted Emission Test Result

The EUT is powered by a battery, This item is not applicable.

6 Radiated Spurious Emissions

Test Requirement : FCC CFR47 Part 15 Section 15.209
Test Method : ANSI C63.10:2020
Test Result : PASS
Measurement Distance : 3m
Limit : See the follow table

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

15.249(a):Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

6.1 EUT Operation

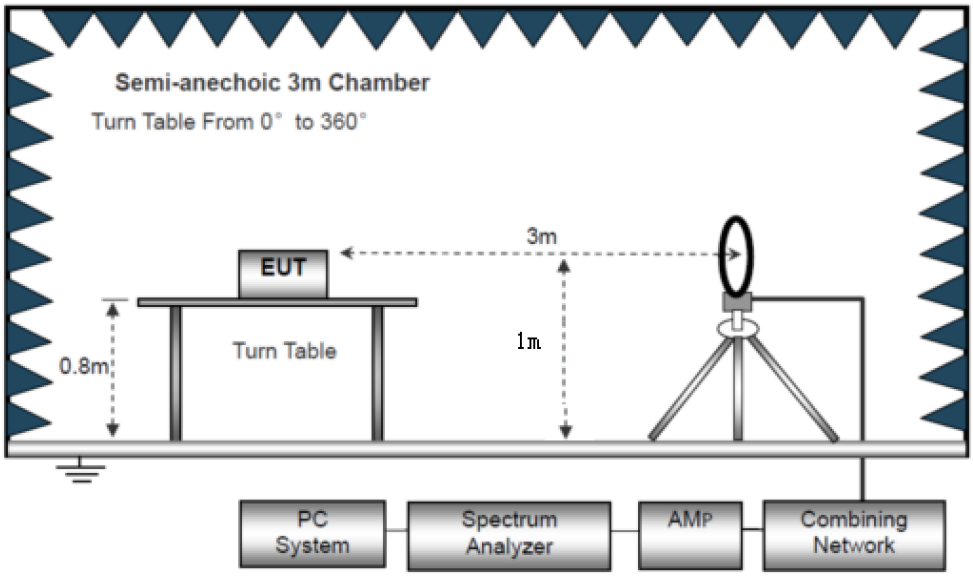
Operating Environment :

Temperature : 23.5 °C
Humidity : 51.1 % RH
Atmospheric Pressure : 101.2kPa

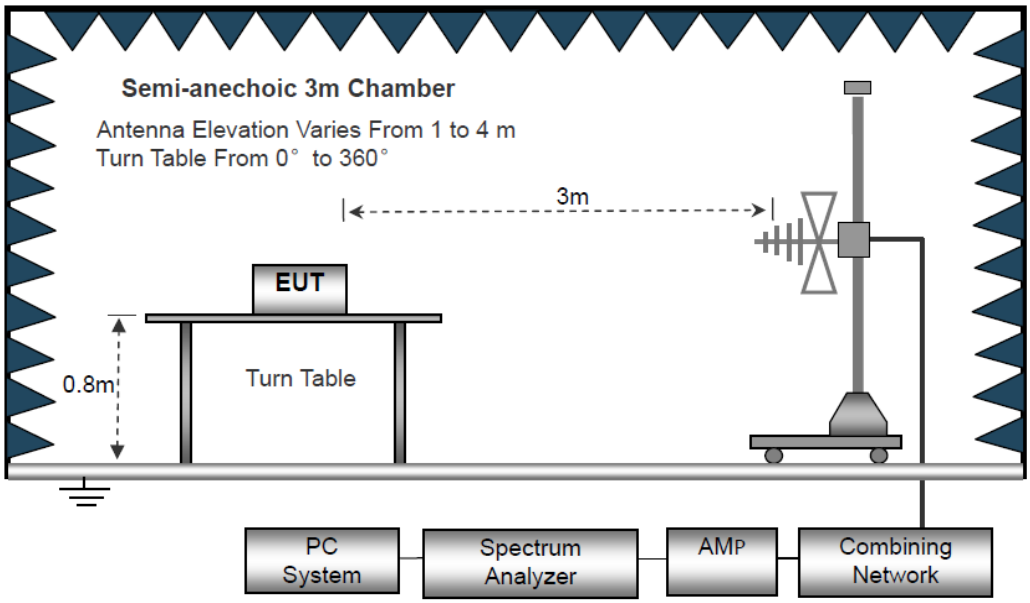
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

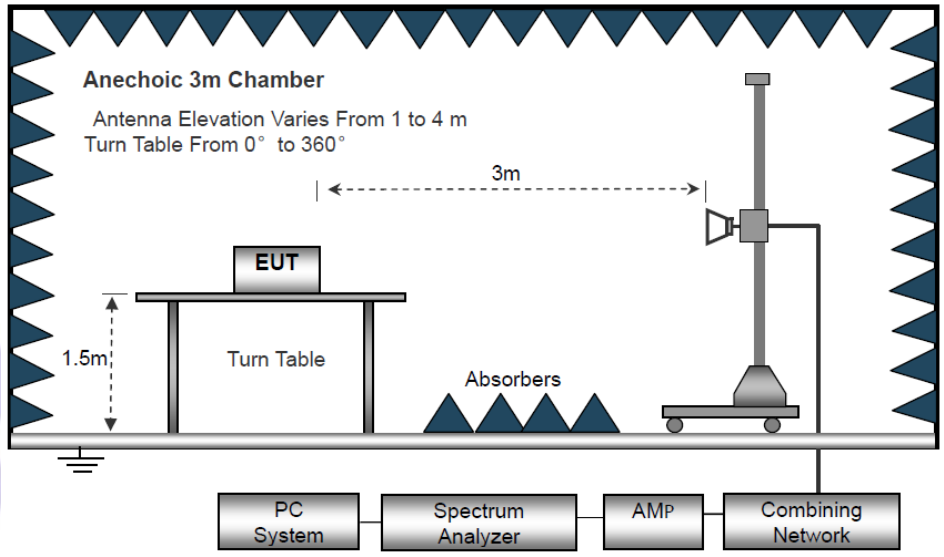
The test setup for emission measurement below 30MHz



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz



6.3 Spectrum Analyzer Setup

	Frequency	Detector	RBW	VBW	Remark
Receiver Setup	Below 30MHz	--	10kHz	10kHz	--
	30MHz ~ 1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value

6.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2020.

2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

5. Set to the maximum power setting and enable the EUT transmit continuously.

6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.

7. Test Procedure of measurement (For Above 1GHz):

1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).

2) Change the antenna polarization and repeat 1) with vertical polarization.

3) Make a hardcopy of the spectrum.

4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.

5) Change the analyser mode to Clear/ Write and found the cone of emission.

6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.

7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.

8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

8. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

For Average Measurement:

VBW=10Hz, when duty cycle is no less than 98 percent.

VBW≥1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

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6.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

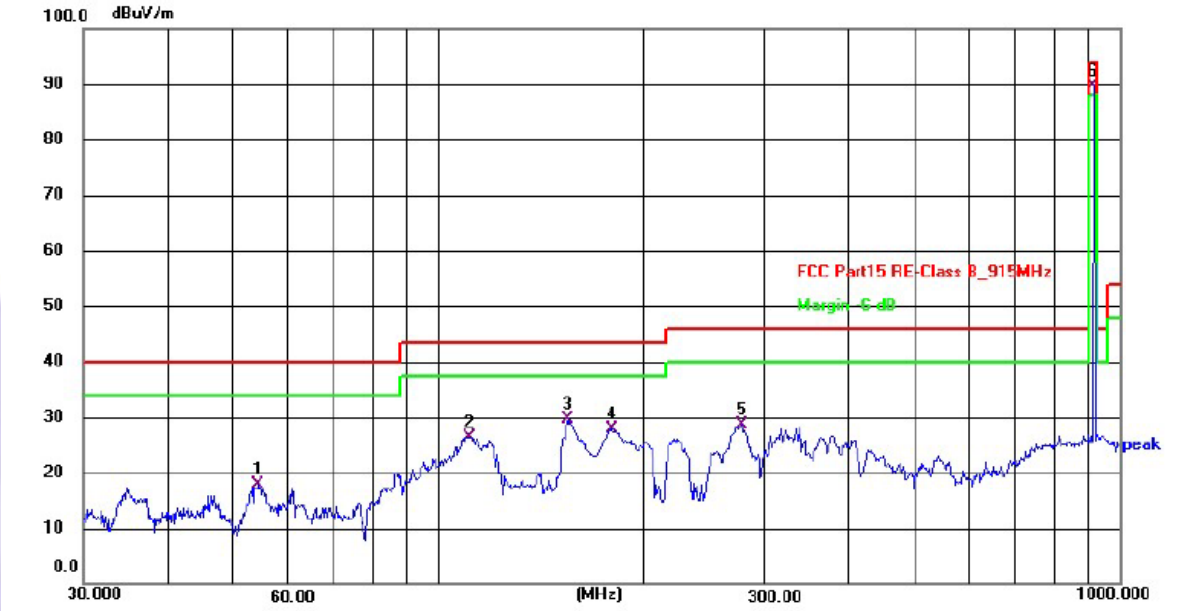
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

Test Frequency: 30MHz ~ 1GHz

Pass.

All the modulation modes were tested the data of the worst mode (Lowest channel) are recorded in the following pages and the others modulation methods do not exceed the limits.

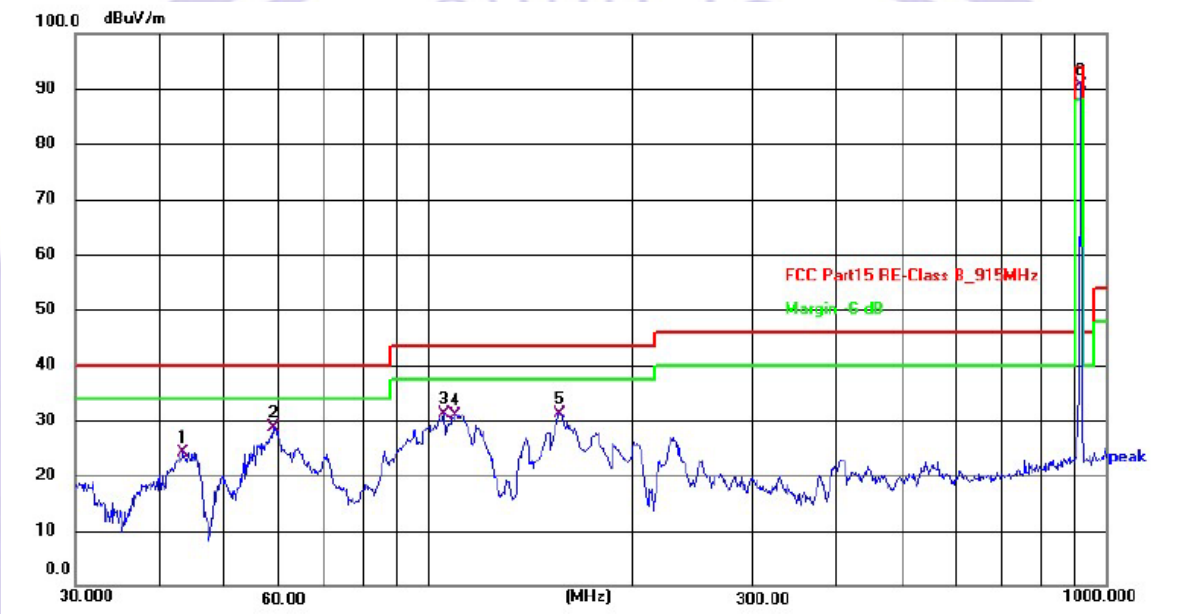
Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 4.5V	Mode:	915MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	54.2610	32.47	-14.55	17.92	40.00	-22.08	QP
2	110.5686	42.27	-15.78	26.49	43.50	-17.01	QP
3	154.8204	48.68	-18.97	29.71	43.50	-13.79	QP
4	179.3863	45.49	-17.55	27.94	43.50	-15.56	QP
5	278.0668	42.60	-14.02	28.58	46.00	-17.42	QP
6	915.0235	92.49	-2.98	89.51	94.00	-4.49	QP

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Vertical
Test Voltage:	DC 4.5V	Mode:	915MHz



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	43.3534	38.76	-14.56	24.20	40.00	-15.80	QP
2	58.8185	43.67	-14.92	28.75	40.00	-11.25	QP
3	105.2716	46.95	-15.77	31.18	43.50	-12.32	QP
4	109.4116	46.69	-15.69	31.00	43.50	-12.50	QP
5	155.9100	50.12	-18.90	31.22	43.50	-12.28	QP
6	915.0325	93.49	-2.98	90.51	94.00	-3.49	QP

Remark:Emission Level=Reading+Cable Loss+ANT Factor-AMP Factor

Test Frequency 1GHz-10GHz:

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
V	1830	48.98	-4.97	44.01	74	-29.99	Pk
V	1830	42.21	-4.97	37.24	54	-16.76	AV
V	2745	50.69	-1.12	49.57	74	-24.43	Pk
V	2745	42.40	-1.12	41.28	54	-12.72	AV
V	3660	49.64	1.32	50.96	74	-23.04	Pk
V	3660	41.73	1.32	43.05	54	-10.95	AV
H	1830	53.25	-4.97	48.28	74	-25.72	Pk
H	1830	40.11	-4.97	35.14	54	-18.86	AV
H	2745	48.76	-1.12	47.64	74	-26.36	Pk
H	2745	39.76	-1.12	38.64	54	-15.36	AV
H	3660	50.81	1.32	52.13	74	-21.87	Pk
H	3660	39.23	1.32	40.55	54	-13.45	AV

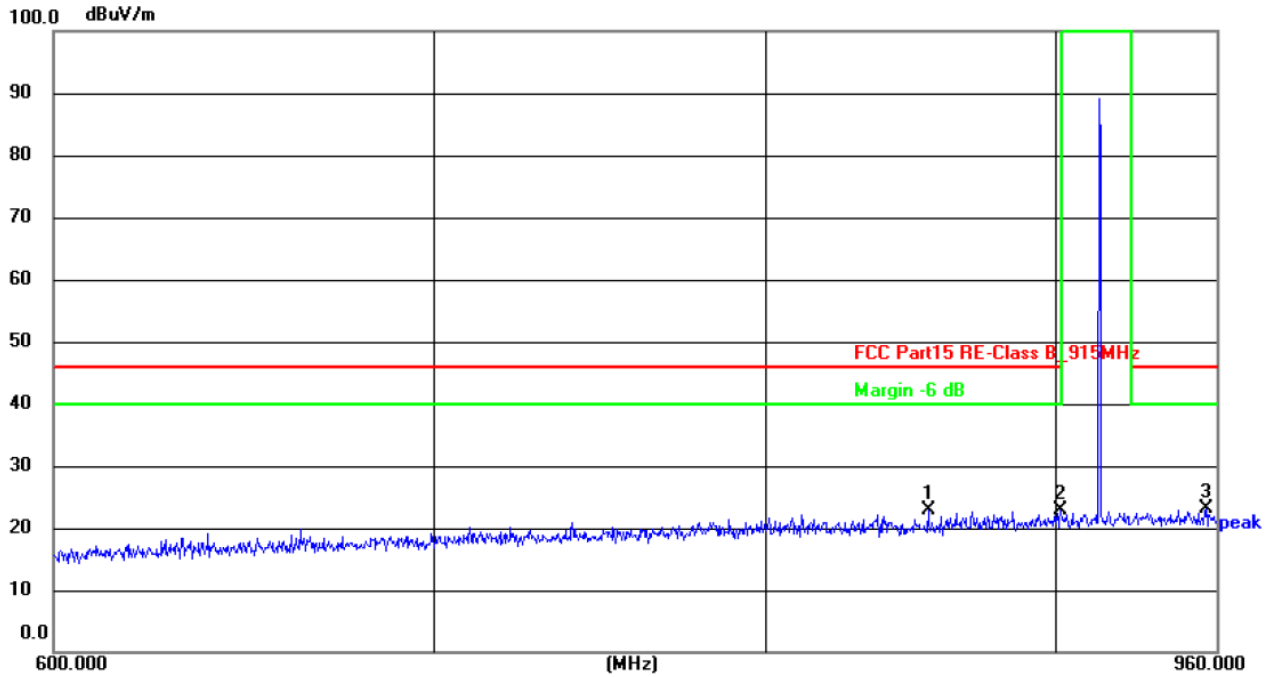
Note: 1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,

Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.

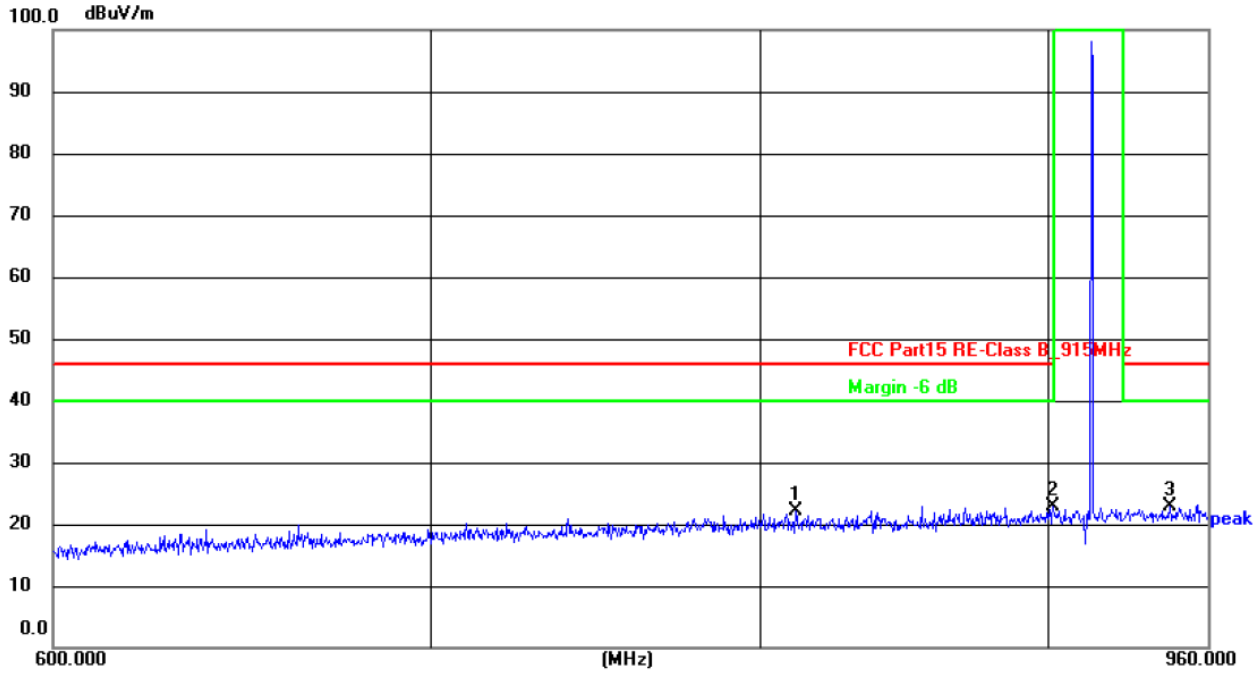
Spurious Emission in Restricted Band 902-928MHz

H



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	854.3768	27.02	-4.09	22.93	46.00	-23.07	peak
2	901.4032	26.06	-3.08	22.98	46.00	-23.02	peak
3	955.9477	25.76	-2.65	23.11	46.00	-22.89	peak

V



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	811.7090	26.40	-4.34	22.06	46.00	-23.94	peak
2	901.4031	26.06	-3.08	22.98	46.00	-23.02	peak
3	945.2250	25.65	-2.79	22.86	46.00	-23.14	peak

7 Bandwidth Measurement

Test Requirement : FCC Part15 (15.249) , Subpart C

Test Method : ANSI C63.10:2020

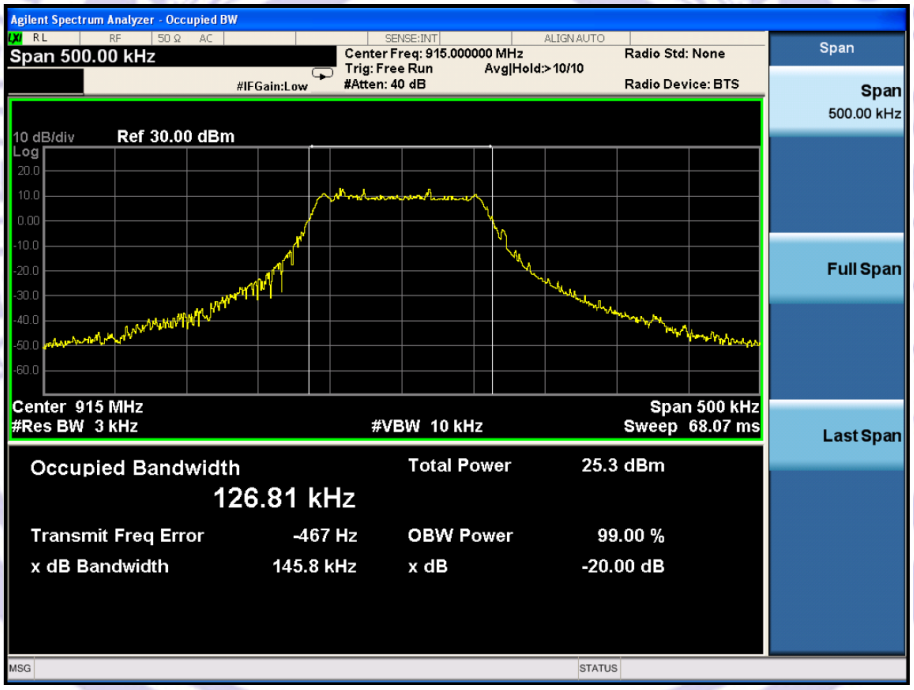
7.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 3kHz, VBW = 10kHz

7.2 Test Result

Modulation:	Frequency (MHz)	20dB Bandwidth (kHz)	Result
GFSK	915	145.8	Pass

915MHz



8 FREQUENCY TOLERANCE

8.1 Antenna Requirement

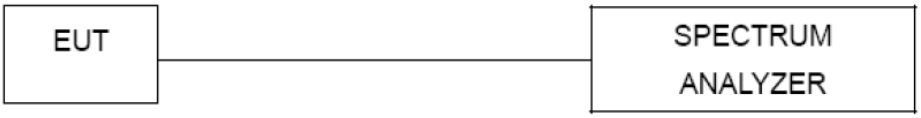
The frequency tolerance of the carrier signal shall be maintained within ±0.001% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

8.2 Test Procedure

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,

b. Spectrum Setting : RBW= 10KHz, VBW≧RBW, Sweep time = Auto.

8.3 TEST SETUP



8.4 Test Procedure

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	DC 4.5V	Mode:	915MHz

Voltage (V)	Frequency(MHz)	Reading(MHz)	Frequency Tolerance(ppm)	LIMIT(ppm)
DC 4.5V	915	915.003	0.00033%	±0.001%
DC 3.8V	915	915.003	0.00033%	±0.001%
DC 5.2V	915	915.004	0.00044%	±0.001%

Temperature (℃)	Frequency(MHz)	Reading(MHz)	Frequency Tolerance(ppm)	LIMIT(ppm)
-20	915	915.003	0.00033%	±0.001%
-10	915	915.003	0.00033%	±0.001%
0	915	915.003	0.00033%	±0.001%
10	915	915.004	0.00044%	±0.001%
20	915	915.003	0.00033%	±0.001%
30	915	915.005	0.00055%	±0.001%
40	915	915.003	0.00033%	±0.001%
50	915	915.003	0.00033%	±0.001%

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9 Antenna Application

9.1 Antenna Requirement

15.203 requirement:

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

15.247(c) (1)(i) requirement:

Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

According to RSS-GEN section 6.8

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

9.2 Result

The antenna is Spring Antenna, the Max gain of the antennas is 3dBi, reference to the attachment for details.

10 Test Setup Photos and EUT Photos

Please see the attachment for details.

******THE END REPORT******