

FCC Test Report

Applicant : SHENZHEN NEO ELECTRONICS CO.,LTD

Address : East6/F Building 2,Laobing industry,Baoan
District Shenzhen, 518000, China

Product Name : Water Sensor

Report Date : Apr. 21, 2023

Shenzhen Anbotek Compliance Laboratory Limited



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TEST REPORT

Applicant : SHENZHEN NEO ELECTRONICS CO.,LTD
Manufacturer : SHENZHEN NEO ELECTRONICS CO.,LTD
Product Name : Water Sensor
Model No. : NAS-WS09Z8U
Trade Mark : NEO
Rating(s) : Input: 3V $\equiv$ with "CR123A"*1 battery

Test Standard(s) : FCC Part15 Subpart C, Paragraph 15.249

Test Method(s) : ANSI C63.10: 2020

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Receipt

Dec. 12, 2022

Date of Test

Dec. 12, 2022 ~ Jan. 13, 2023

Prepared by

Nian Xiu Chen

(Nianxiu Chen)

Approved & Authorized Signer

Kingkong Jin

(Kingkong Jin)



Revision History

Report Version	Description	Issued Date
R00	Original Issue.	Apr. 21, 2023



1. General Information

1.1. Client Information

Applicant	:	SHENZHEN NEO ELECTRONICS CO.,LTD
Address	:	East6/F Building 2,Laobing industry,Baoan District Shenzhen, 518000, China
Manufacturer	:	SHENZHEN NEO ELECTRONICS CO.,LTD
Address	:	East6/F Building 2,Laobing industry,Baoan District Shenzhen, 518000, China
Factory	:	SHENZHEN NEO ELECTRONICS CO.,LTD
Address	:	East6/F Building 2,Laobing industry,Baoan District Shenzhen, 518000, China

1.2. Description of Device (EUT)

Product Name	:	Water Sensor
Model No.	:	NAS-WS09Z8U
Trade Mark	:	NEO
Test Power Supply	:	DC 3V battery
Test Sample No.	:	1-2-1(Normal Sample), 1-2-2(Engineering Sample)
Adapter	:	N/A

RF Specification

Operation Frequency	:	908.4MHz, 916MHz
Number of Channel	:	2 Channels
Modulation Type	:	ASK
Antenna Type	:	PCB Antenna
Antenna Gain(Peak)	:	1.9 dBi (Provided by customer)

Remark: 1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.



1.3. Auxiliary Equipment Used During Test

Description	Rating(s)
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1.4. Description of Test Configuration

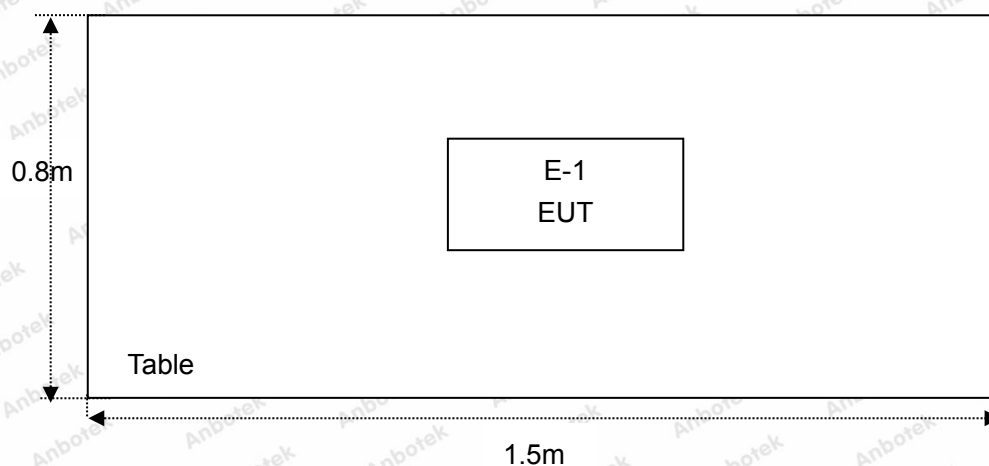
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	908.4	02	916				

Note:

1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

1.5. Description of Test Setup

RE



1.6. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Oct. 23, 2022	1 Year
2.	Three Phase V-type Artificial Power Network	CYBERTEK	EM5040DT	E215040DT001	Jul. 05, 2022	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Oct. 13, 2022	1 Year
4.	EMI Test Receiver	Rohde & Schwarz	ESR26	101481	Oct. 23, 2022	1 Year
5.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Oct. 22, 2022	1 Year
6.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Oct. 13, 2022	1 Year
7.	EMI Preamplifier	SKET Electronic	LNPA-0118G-45	SKET-PA-002	Oct. 13, 2022	1 Year
8.	Double Ridged Horn Antenna	SCHWARZBECK	BBHA 9120D	02555	Oct. 16, 2022	3 Year
9.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Oct. 23, 2022	1 Year
10.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Oct. 23, 2022	1 Year
11.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Oct. 23, 2022	1 Year
12.	Pre-amplifier	SONOMA	310N	186860	Oct. 23, 2022	1 Year
13.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
14.	MXA Spectrum Analysis	KEYSIGHT	N9020A	MY53280032	Oct. 13, 2022	1 Year
15.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Oct. 13, 2022	1 Year
16.	Signal Generator	Agilent	E4421B	MY41000743	Oct. 13, 2022	1 Year
17.	DC Power Supply	IVYTECH	IV3605	1804D360510	Oct. 22, 2022	1 Year
18.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Oct. 19, 2022	1 Year



1.7. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.8. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111.

ISED-Registration No.: 8058A

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A.

Test Location

Shenzhen Anbotek Compliance Laboratory Limited.

1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102



2. Summary of Test Results

Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.205/15.209/15.249	Radiated Emission	PASS
15.249(d)	Band Edge	PASS
15.215(c)	20dB Bandwidth	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

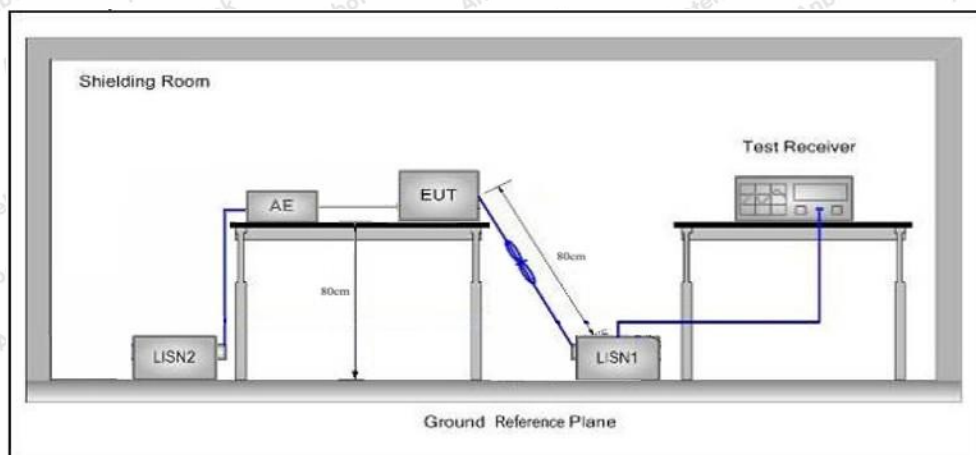


3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50
Remark: (1) *Decreasing linearly with logarithm of the frequency. (2) The lower limit shall apply at the transition frequency.			

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2020 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

Not applicable. The EUT is powered by DC 3V battery inside, so there is no need to conduct this test.



4. Radiated Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209 and 15.205				
	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
Test Limit	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz~1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz~30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1) The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Test Standard	FCC Part15 C Section 15.249					
	Frequency (MHz)	Field Strength of fundamental (millivolts /meter)	Field Strength of Harmonics (microvolts/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
Test Limit	902~928	50	-	94.0	QP	3
	902~928	-	500	74.0	Peak	3
	902~928	-	500	54.0	Average	3
	2400~2483.5	50	-	114.0	Peak	3
	2400~2483.5	50	-	94.0	Average	3
	2400~2483.5	-	500	74.0	Peak	3
	2400~2483.5	-	500	54.0	Average	3

Remark:

(1) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.



4.2. Test Setup

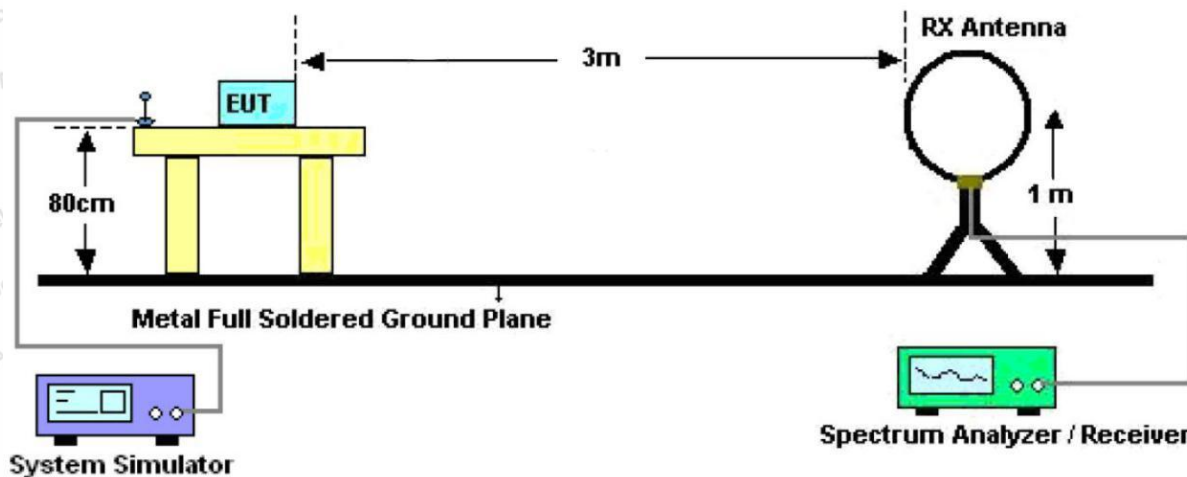


Figure 1. Below 30MHz

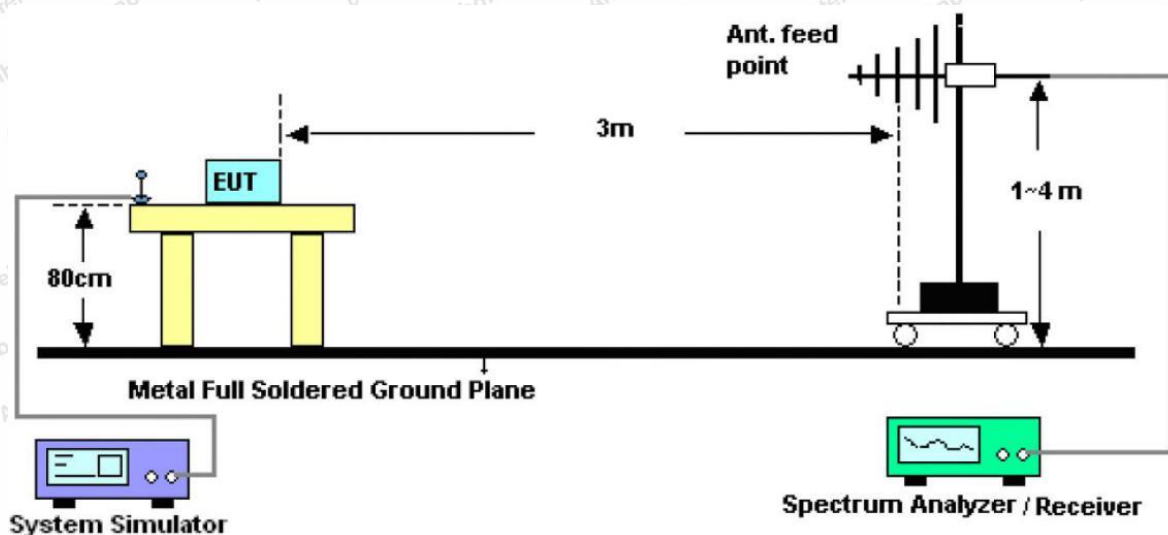


Figure 2. 30MHz to 1GHz



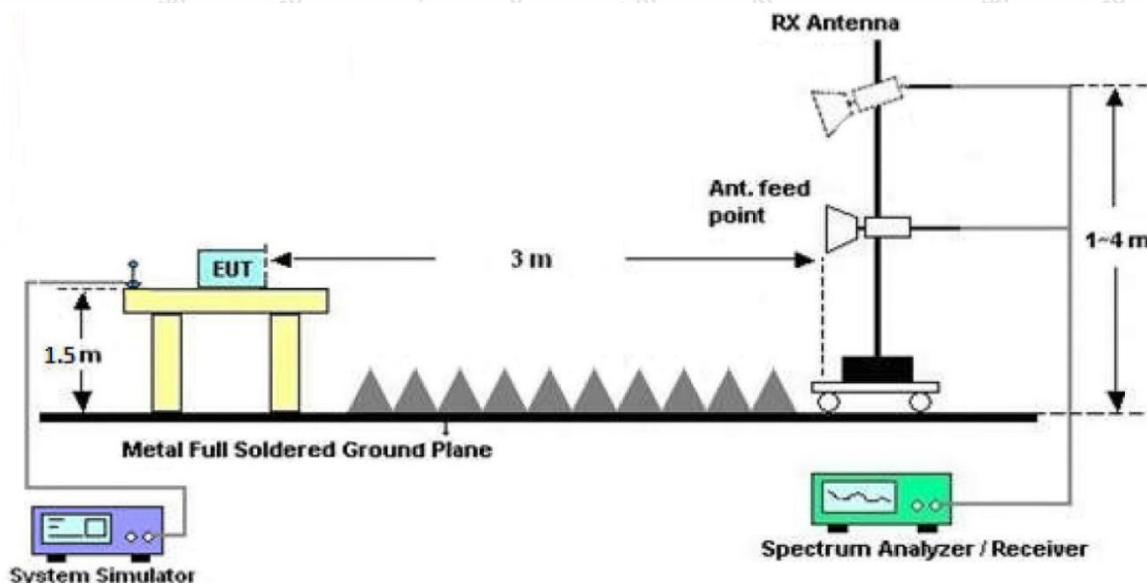


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:

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.

For 9kHz to 150kHz, Set the spectrum analyzer as:

RBW = 200Hz, VBW = 1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.



For 150kHz to 30MHz, Set the spectrum analyzer as:

RBW = 9KHz, VBW = 30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:

RBW = 100kHz, VBW = 300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz, Set the spectrum analyzer as:

RBW = 1MHz, VBW = 1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

RBW = 1MHz, VBW = 10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

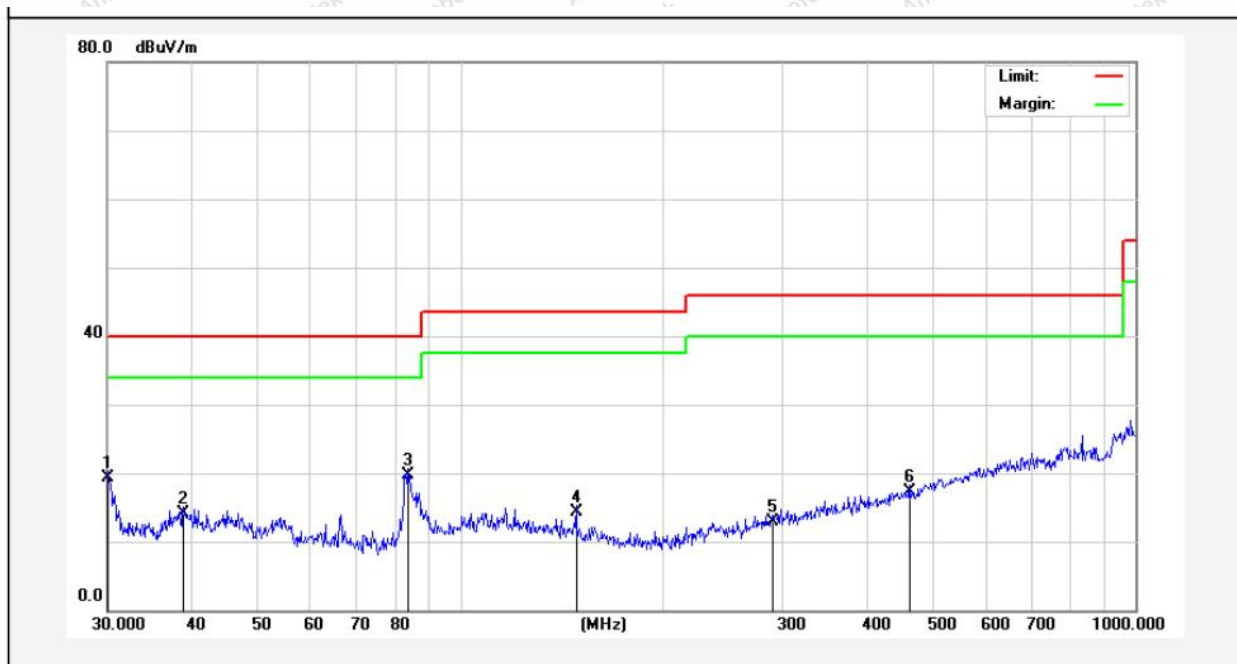
The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan all the modes, only the worst case is recorded in the report.



Test Results (30~1000MHz)

Test Mode: CH 01
Power Source: DC 3V battery
Polarization: Horizontal
Temp.(°C)/Hum.(%RH): 23.5°C/50%RH

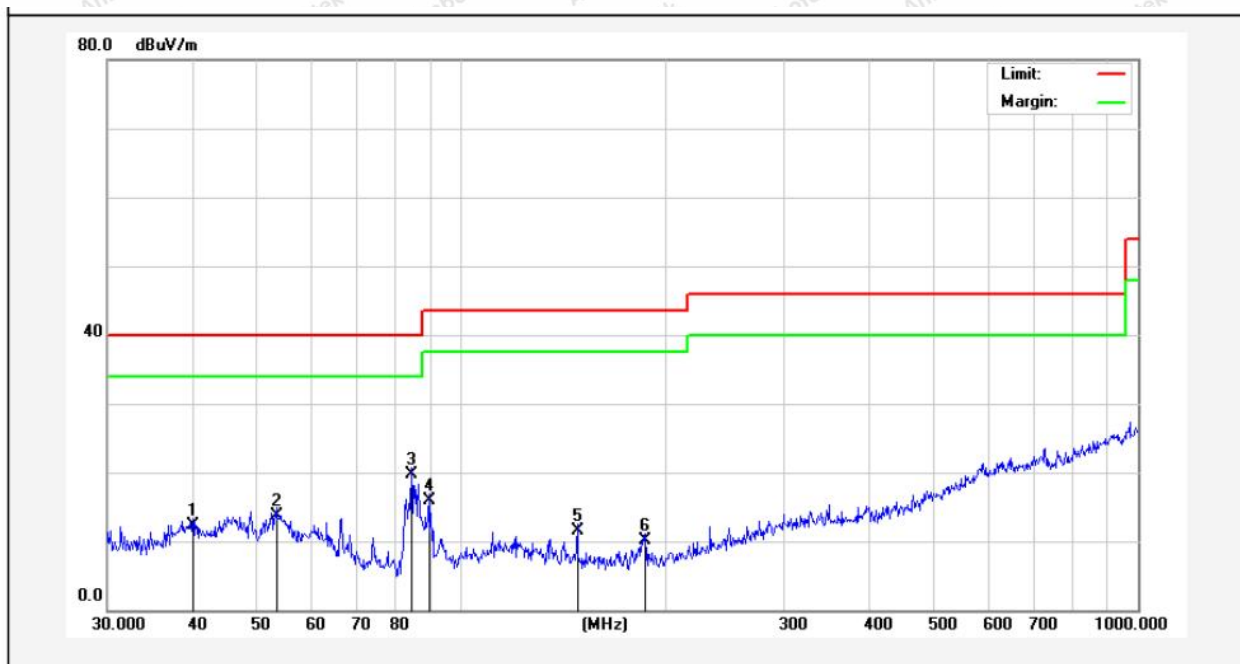


No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	30.0000	39.62	-20.26	19.36	40.00	-20.64	QP			
2	38.8878	30.70	-16.56	14.14	40.00	-25.86	QP			
3	83.5222	42.06	-22.36	19.70	40.00	-20.30	QP			
4	148.4410	37.21	-22.88	14.33	43.50	-29.17	QP			
5	290.0172	30.91	-18.02	12.89	46.00	-33.11	QP			
6	462.3455	32.41	-15.05	17.36	46.00	-28.64	QP			



Test Results (30~1000MHz)

Test Mode: CH01
Power Source: DC 3V battery
Polarization: Vertical
Temp.(°C)/Hum.(%RH): 23.5°C/50%RH



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	40.1347	26.83	-14.57	12.26	40.00	-27.74	QP			
2	53.3179	30.80	-17.00	13.80	40.00	-26.20	QP			
3	84.4054	38.32	-18.64	19.68	40.00	-20.32	QP			
4	89.5899	33.62	-17.65	15.97	43.50	-27.53	QP			
5	148.4410	33.52	-22.10	11.42	43.50	-32.08	QP			
6	187.0958	30.39	-20.27	10.12	43.50	-33.38	QP			



Test Results (1GHz-25GHz)

Test channel: Lowest

Peak value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
1816.80	28.27	15.27	43.54	74.00	-30.46	Vertical
2725.20	26.82	18.09	44.91	74.00	-29.09	Vertical
3633.60	27.62	23.76	51.38	74.00	-22.62	Vertical
4542.00	*			74.00		Vertical
5450.40	*			74.00		Vertical
1816.80	24.81	15.27	40.08	74.00	-33.92	Horizontal
2725.20	25.89	18.09	43.98	74.00	-30.02	Horizontal
3633.60	31.63	23.76	55.39	74.00	-18.61	Horizontal
4542.00	*			74.00		Horizontal
5450.40	*			74.00		Horizontal

Average value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
1816.80	14.46	15.27	29.73	54.00	-24.27	Vertical
2725.20	16.36	18.09	34.45	54.00	-19.55	Vertical
3633.60	21.71	23.76	45.47	54.00	-8.53	Vertical
4542.00	*			54.00		Vertical
5450.40	*			54.00		Vertical
1816.80	17.51	15.27	32.78	54.00	-21.22	Horizontal
2725.20	18.21	18.09	36.30	54.00	-17.70	Horizontal
3633.60	17.31	23.76	41.07	54.00	-12.93	Horizontal
4542.00	*			54.00		Horizontal
5450.40	*			54.00		Horizontal

Remark:

1.Result =Reading + Factor

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.



Test Results (1GHz-25GHz)

Test channel: Highest

Peak value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
1832.00	29.73	15.27	45.00	74.00	-29.00	Vertical
2748.00	32.14	18.09	50.23	74.00	-23.77	Vertical
3664.00	31.17	23.76	54.93	74.00	-19.07	Vertical
4580.00	*			74.00		Vertical
5496.00	*			74.00		Vertical
1832.00	23.39	15.27	38.66	74.00	-35.34	Horizontal
2748.00	29.09	18.09	47.18	74.00	-26.82	Horizontal
3664.00	30.19	23.76	53.95	74.00	-20.05	Horizontal
4580.00	*			74.00		Horizontal
5496.00	*			74.00		Horizontal

Average value:

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
1832.00	17.37	15.27	32.64	54.00	-21.36	1840.80
2748.00	14.19	18.09	32.28	54.00	-21.72	2761.20
3664.00	15.67	23.76	39.43	54.00	-14.57	3681.60
4580.00	*			54.00		4602.00
5496.00	*			54.00		5522.40
1832.00	15.89	15.27	31.16	54.00	-22.84	1840.80
2748.00	14.11	18.09	32.20	54.00	-21.80	2761.20
3664.00	16.55	23.76	40.31	54.00	-13.69	3681.60
4580.00	*			54.00		4602.00
5496.00	*			54.00		5522.40

Remark:

1.Result =Reading + Factor

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.



Test Results (Fundamental):

Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	polarization
908.40	90.98	-6.04	84.94	94.00	-9.06	Vertical
908.40	88.98	-6.04	82.94	94.00	-11.06	Horizontal
916.00	90.72	-6.04	84.68	94.00	-9.32	Vertical
916.00	88.78	-6.04	82.74	94.00	-11.26	Horizontal

Remark:

1.Result =Reading + Factor

Test Results (Band Edge):

Frequency (MHz)	Read Level (dBuV/m)	Antenna Factor (dB)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Det.
902.0000	43.85	22.45	4.48	31.33	39.45	46.00	-6.55	H	QP
928.0000	40.44	22.59	4.54	31.35	36.22	46.00	-9.78	H	QP
902.0000	43.63	22.45	4.48	31.33	39.23	46.00	-6.77	V	QP
928.0000	41.11	22.59	4.54	31.35	36.89	46.00	-9.11	V	QP

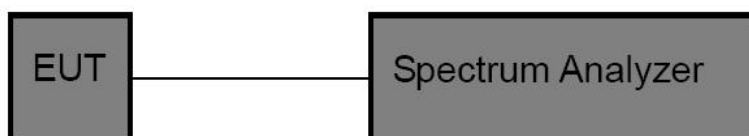


5. 20dB Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.215(c)
Test Limit	N/A

5.2. Test Setup



5.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
RBW = 30kHz, VBW $\geq$ 3*RBW =100kHz,
Detector= Average
Trace mode= Max hold.
Sweep- auto couple.
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

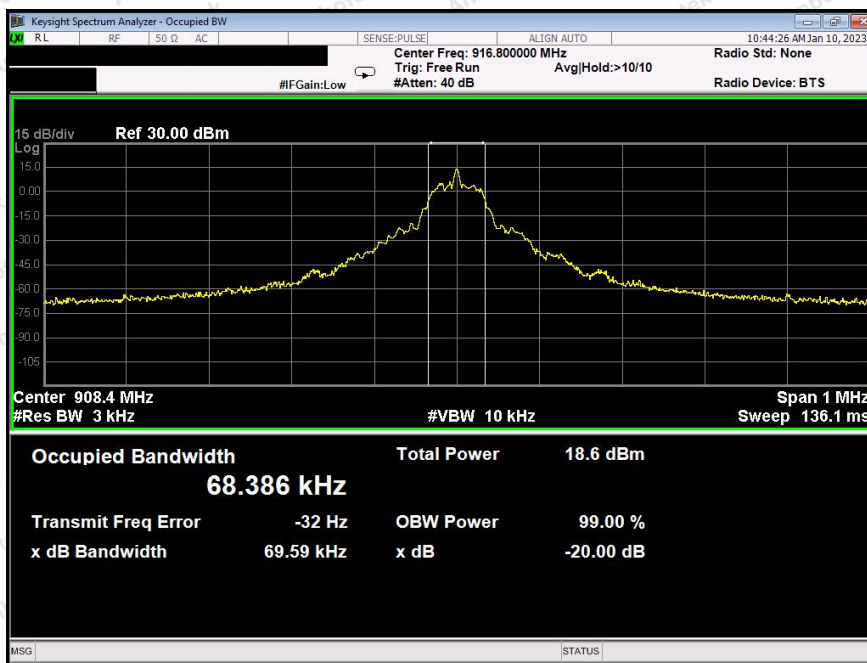
5.4. Test Data

Test Item	: 20dB Bandwidth	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 3V battery	Temperature	: 22.4℃
Test Result	: PASS	Humidity	: 55%RH

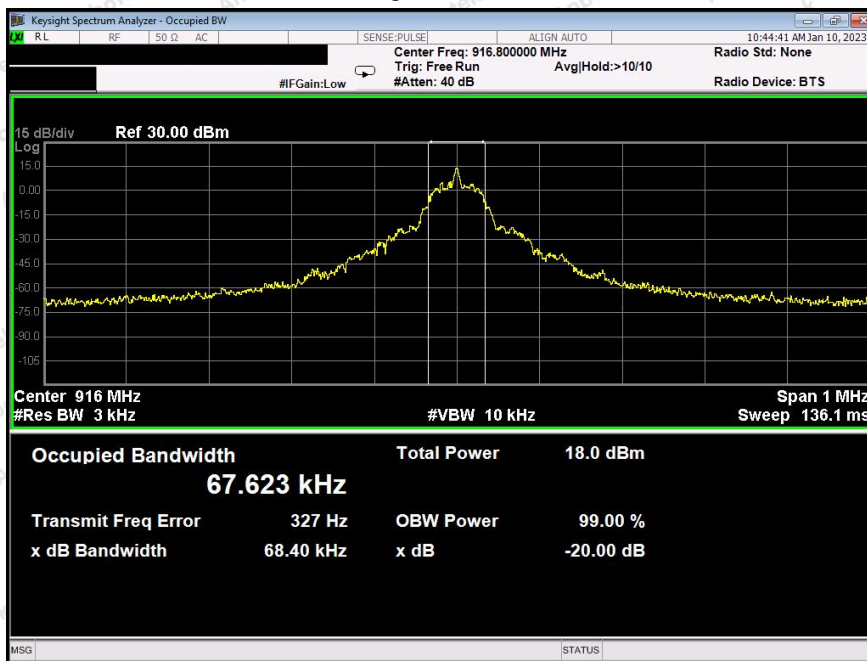
Channel	Bandwidth (kHz)	Result
Low	69.59	PASS
High	68.40	PASS



Low Channel



High Channel



6. Antenna Requirement

6.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 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.

6.2. Antenna Connected Construction

The antenna is a PCB Antenna which permanently attached, and the best case gain of the antenna is 1.9 dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Please refer to separated files Appendix I -- Test Setup Photograph

APPENDIX II -- EXTERNAL PHOTOGRAPH

Please refer to separated files Appendix II -- External Photograph

APPENDIX III -- INTERNAL PHOTOGRAPH

Please refer to separated files Appendix III -- Internal Photograph

----- End of Report -----

