

TEST REPORT

Product Name: Wireless Dog Fence
FCC ID: 2AX2Y-C100
Trademark: N/A
Model Number: C-100, AS-7
Prepared For: SunSun Electronic Technology Inc.
Address: 1942 Broadway Street STE 314C Boulder, Colorado 80302 United States
Manufacturer: SunSun Electronic Technology Inc.
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Prepared By: Shenzhen CTB Testing Technology Co., Ltd.
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Sample Received Date: Mar. 10, 2022
Sample tested Date: Mar. 10, 2022 to Apr. 15, 2022
Issue Date: Apr. 15, 2022
Report No.: CTB220402013RFX
Test Standards: FCC Part15.231 (e)
ANSI C63.10:2013
Test Results: PASS
Remark: This is 433MHz radio test report.

Compiled by:

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Approved by:

Bin Mei / Director

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TABLE OF CONTENT

Test Report Declaration	Page
1. VERSION	3
2. TEST SUMMARY	4
3. MEASUREMENT UNCERTAINTY	5
4. PRODUCT INFORMATION AND TEST SETUP	6
4.1 Product Information	6
4.2 Test Setup Configuration	6
4.3 Support Equipment	6
4.4 Test Mode	7
4.5 Test Environment	7
5. TEST FACILITY AND TEST INSTRUMENT USED	8
5.1 Test Facility	8
5.2 Test Instrument Used	8
6. AC POWER LINE CONDUCTED EMISSION	10
6.1 Block Diagram Of Test Setup	10
6.2 Limit	10
6.3 Test procedure	10
6.4 Test Result	11
7. RADIATED EMISSION	13
7.1 Block Diagram Of Test Setup	13
7.2 Limit	13
7.3 Test procedure	14
7.4 Test Result	15
8. DWELL TIME	21
8.1 Block Diagram Of Test Setup	21
8.2 Limit	21
8.3 Test procedure	21
8.4 Test Result	22
9. OCCUPIED BANDWIDTH	23
9.1 Block Diagram Of Test Setup	23
9.2 Limit	23
9.3 Test procedure	23
9.4 Test Result	24
10. ANTENNA REQUIREMENT	25
11. EUT PHOTOGRAPHS	26
12. EUT TEST SETUP PHOTOGRAPHS	27

(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB220402013RFX	Apr. 01, 2022	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	N/A
Radiated Emission	47 CFR Part 15 Subpart C Section 15.209; 15.231(e)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15 Subpart C Section 15.231 (e)	ANSI C63.10-2013	PASS
Occupied Bandwidth	47 CFR Part 15 Subpart C Section 15.231(c)	ANSI C63.10-2013	PASS
Antenna requirement	47 CFR Part 15 Subpart C Section 15.203	ANSI C63.10-2013	PASS

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Item	Uncertainty
Occupancy bandwidth	$U=\pm 54.3\text{Hz}$
Conducted output power Above 1G	$U=\pm 1.0\text{dB}$
Conducted output power below 1G	$U=\pm 0.9\text{dB}$
Power Spectral Density , Conduction	$U=\pm 1.0\text{dB}$
Conduction spurious emissions	$U=\pm 2.8\text{dB}$
Out of band emission	$U=\pm 54\text{Hz}$
3m camber Radiated spurious emission(30MHz-1GHz)	$U=\pm 4.3\text{dB}$
3m chamber Radiated spurious emission(1GHz-18GHz)	$U=\pm 4.5\text{dB}$
humidity uncertainty	$U=\pm 5.3\%$
Temperature uncertainty	$U=\pm 0.59^{\circ}\text{C}$
Supply voltages	$U=\pm 3\%$
Time	$U=\pm 5\%$

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	C-100, AS-7
Model Description:	All the model are the same circuit and RF module, only for model name. Test sample model: C-100
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	433.93MHz
Type of Modulation:	ASK
Antenna installation:	External antenna
Antenna Gain:	1dBi
Ratings:	AC120V/60Hz

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

No.	Device Type	Brand	Model	Series No.	Data Cable	Power Cord
1.	---	---	---	---	---	--

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode
Keep the EUT in transmitting mode with modulation.

4.5 Test Environment

Humidity(%):	55
Atmospheric Pressure(kPa):	101.1
Normal Voltage(AC):	120
Normal Temperature(°C)	25

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

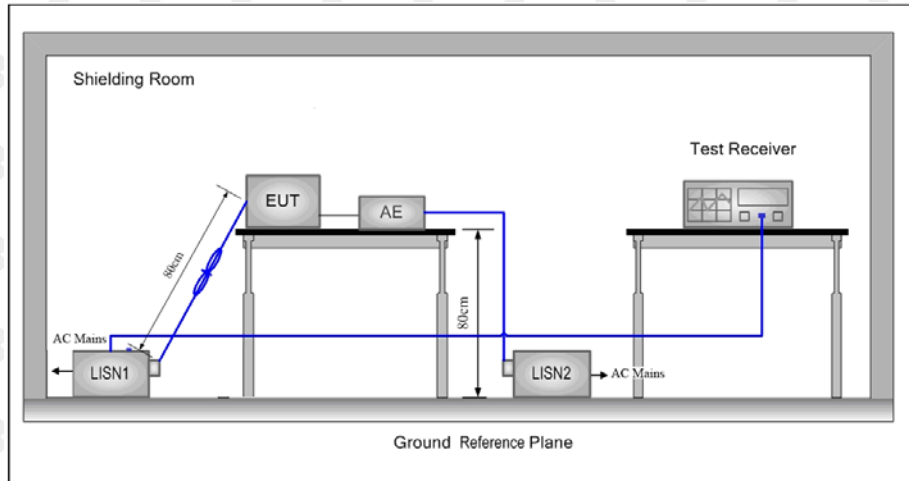
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated date	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	2021.09.27	2022.08.05
2	Power Sensor	Agilent	U2021XA	MY56120032	2021.09.27	2022.08.05
3	Power Sensor	Agilent	U2021XA	MY56120034	2021.09.27	2022.08.05
4	Communication test set	R&S	CMW500	108058	2021.09.27	2022.08.05
5	Spectrum Analyzer	R&S	FSP40	100550	2021.09.27	2022.08.05
6	Signal Generator	Agilent	N5181A	MY49060920	2021.09.27	2022.08.16
7	Signal Generator	Agilent	N5182A	MY47420195	2021.09.27	2022.08.05
8	Communication test set	Agilent	E5515C	MY50102567	2021.09.27	2022.08.16
9	band rejection filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	2021.09.27	2022.08.05
10	band rejection filter	Shenxiang	MSF5150-5850 MS-1155	20181015001	2021.09.27	2022.08.05
11	band rejection filter	Xingbo	XBLBQ-DZA120	190821-1-1	2021.09.27	2022.08.05
12	BT&WI-FI Automatic test software	Microwave	MTS8310	Ver. 2.0.0.0	2021.09.27	2022.08.05
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	2021.09.27	2022.08.05
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	2021.09.27	2022.08.05
15	234G Automatic test software	Microwave	MTS8200	Ver. 2.0.0.0	2021.09.27	2022.08.05
16	966 chamber	C.R.T.	966 Room	966	2021.09.27	2024.08.11
17	Receiver	R&S	ESPI	100362	2021.09.27	2022.08.05
18	Amplifier	HP	8447E	2945A02747	2021.09.27	2022.08.05
19	Amplifier	Agilent	8449B	3008A01838	2021.09.27	2022.08.05

20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	869	2021.09.27	2022.08.07
21	Horn Antenna	Schwarzbeck	BBHA9120D	1911	2021.09.27	2022.08.08
22	Software	Fala	EZ-EMC	FA-03A2 RE	2021.09.27	2022.08.05
23	3-Loop Antenna	Daze	ZN30401	17014	2021.09.27	2022.08.05
24	loop antenna	ZHINAN	ZN30900A	/	2021.09.27	2022.08.05
25	Horn antenna	A/H/System	SAS-574	588	2021.09.27	2022.08.05
26	Amplifier	AEROFLEX	/	S/N/ 097	2021.09.27	2022.08.05

Radiated emission						
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated date	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120D	1911	2021.09.27	2022.08.05
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	869	2021.09.27	2022.08.05
3	Amplifier	Agilent	8449B	3008A01838	2021.09.27	2022.08.05
4	Amplifier	HP	8447E	2945A02747	2021.09.27	2022.08.05
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESPI7	100362	2021.09.27	2022.08.05
6	Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2021.09.27	2022.08.05
7	Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2021.09.27	2022.08.05
8	Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2021.09.27	2022.08.05
9	Coaxial cable	ETS	RFC-NNS-100-NMS-30 0 NI	/	2021.09.27	2022.08.05
10	Communication test set	Agilent	E5515C	MY50102567	2021.09.27	2022.08.05
11	Communication test set	R&S	CMW500	108058	2021.09.27	2022.08.05
12	EZ-EMC	Frad	EMC-con3A1.1	/	/	/

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreasing linearly with the logarithm of the frequency

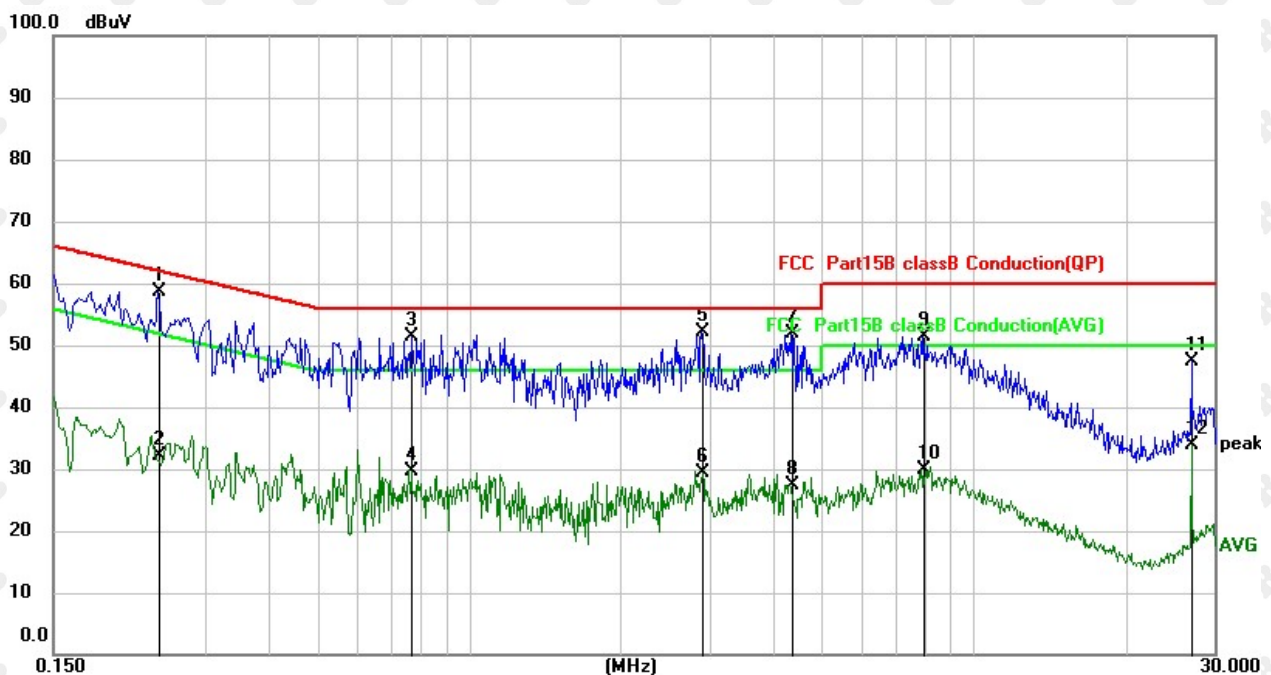
6.3 Test procedure

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed

0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

6.4 Test Result

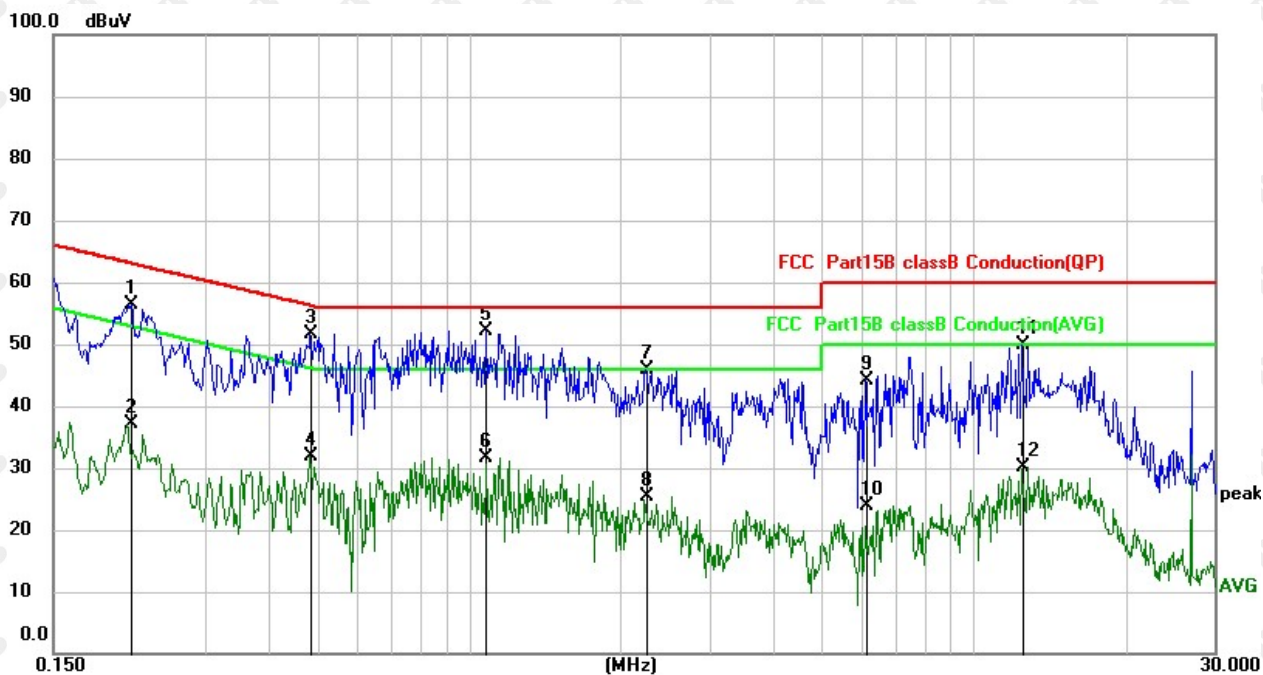


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector
1	*	0.2419	47.98	10.67	58.65	62.03	-3.38	QP
2		0.2419	21.47	10.67	32.14	52.03	-19.89	AVG
3		0.7700	40.71	10.57	51.28	56.00	-4.72	QP
4		0.7700	19.12	10.57	29.69	46.00	-16.31	AVG
5		2.8980	41.43	10.63	52.06	56.00	-3.94	QP
6		2.8980	18.72	10.63	29.35	46.00	-16.65	AVG
7		4.3459	41.30	10.65	51.95	56.00	-4.05	QP
8		4.3459	16.61	10.65	27.26	46.00	-18.74	AVG
9		7.9618	40.66	10.75	51.41	60.00	-8.59	QP
10		7.9618	19.08	10.75	29.83	50.00	-20.17	AVG
11		27.1219	36.36	11.02	47.38	60.00	-12.62	QP
12		27.1219	22.80	11.02	33.82	50.00	-16.18	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

N:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2139	45.77	10.68	56.45	63.05	-6.60	QP
2		0.2139	26.36	10.68	37.04	53.05	-16.01	AVG
3		0.4859	41.22	10.53	51.75	56.24	-4.49	QP
4		0.4859	21.25	10.53	31.78	46.24	-14.46	AVG
5	*	1.0780	41.42	10.62	52.04	56.00	-3.96	QP
6		1.0780	21.00	10.62	31.62	46.00	-14.38	AVG
7		2.2419	35.21	10.63	45.84	56.00	-10.16	QP
8		2.2419	14.73	10.63	25.36	46.00	-20.64	AVG
9		6.0938	33.56	10.69	44.25	60.00	-15.75	QP
10		6.0938	13.27	10.69	23.96	50.00	-26.04	AVG
11		12.4900	38.95	10.86	49.81	60.00	-10.19	QP
12		12.4900	19.20	10.86	30.06	50.00	-19.94	AVG

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

7. RADIATED EMISSION

7.1 Block Diagram Of Test Setup

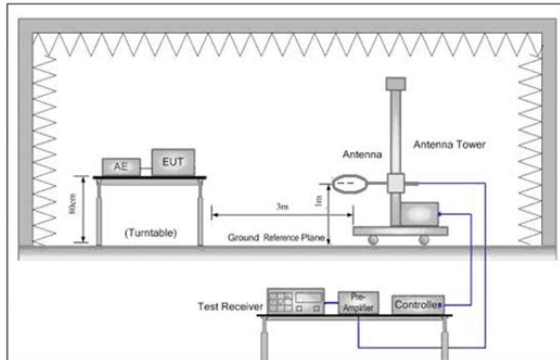


Figure 1. Below 30MHz

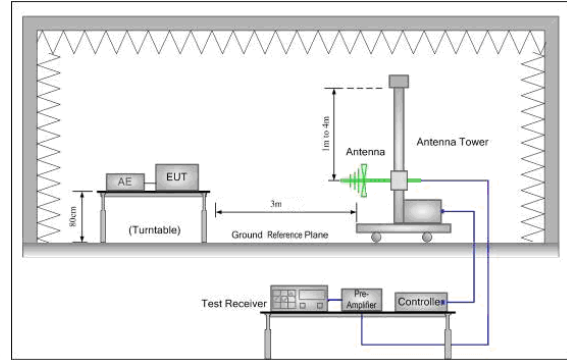


Figure 2. 30MHz to 1GHz

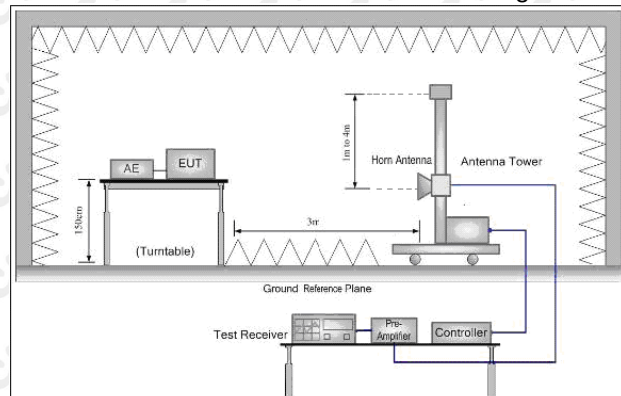


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	$20\log 2400/F \text{ (kHz)} + 80$	-	3
0.490MHz-1.705MHz	$20\log 24000/F \text{ (kHz)} + 40$	-	3
1.705MHz-30MHz	$20\log 30 + 40$	-	3
30MHz-88MHz	40.0	Quasi-peak	3
88MHz-216MHz	43.5	Quasi-peak	3
216MHz-960MHz	46.0	Quasi-peak	3
960MHz-1GHz	54.0	Quasi-peak	3
Above 1GHz	54.0	Average	3

Note: 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.

Field Strength of Fundamental Limit:

Fundamental and harmonics emission limits Frequency(MHz)	Field strength of Fundamental((microvolts/meter)	Field strength of spurious emissions(microvolts/meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1500**	50 to 150**
174-260	1500	150
260-470	1500 to 5000**	150 to 500**
Above 470	5000	500

** linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $22.72727(F)+500$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $16.66667(F) +1500$ The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

Frequency	Limit (dB $\mu\text{V/m}$ @3m)	Remark
433.92MHz	72.87	Average Value
	92.87	Peak Value

7.3 Test procedure**Below 1GHz test procedure as below:**

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna 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.
- 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

- Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
- Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- Repeat above procedures until all frequencies measured was complete.

Receiver set:

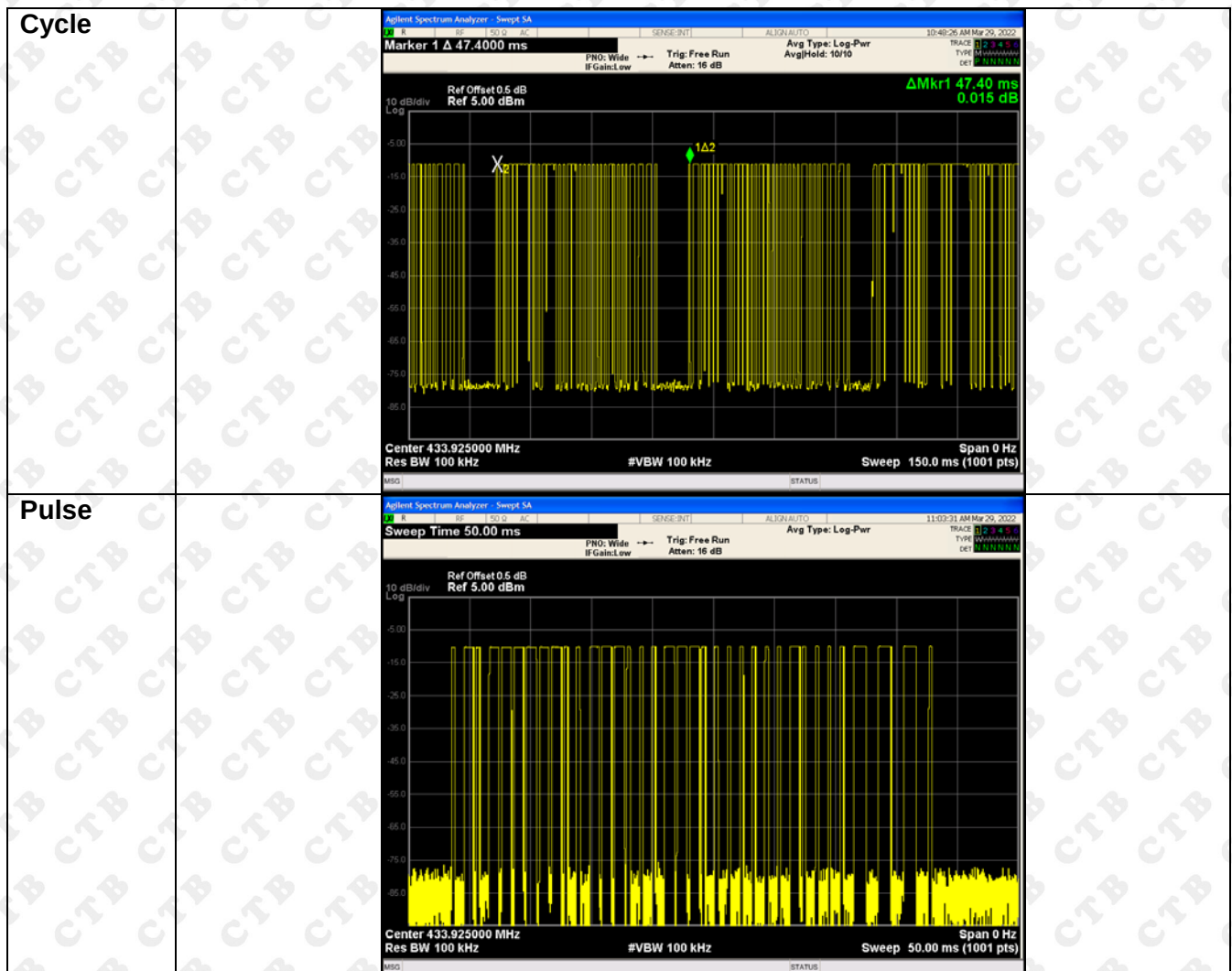
Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak

Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

7.4 Test Result

7.4.1 Calculation of average factor

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector. The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.




Average factor:

Calculate Formula:

Average value=Peak value + PDCF

PDCF=20 log(Duty cycle)

Duty cycle = T on time / T period

Calculated average factor:

Ton time = 0.24×19+0.768×3=6.864(ms) T period=47.40(ms)

PDCF = 20 log(6.864/47.40)=-16.78dB

7.4.2 Radiated Spurious Emission

Frequency Range (9 kHz-30MHz)

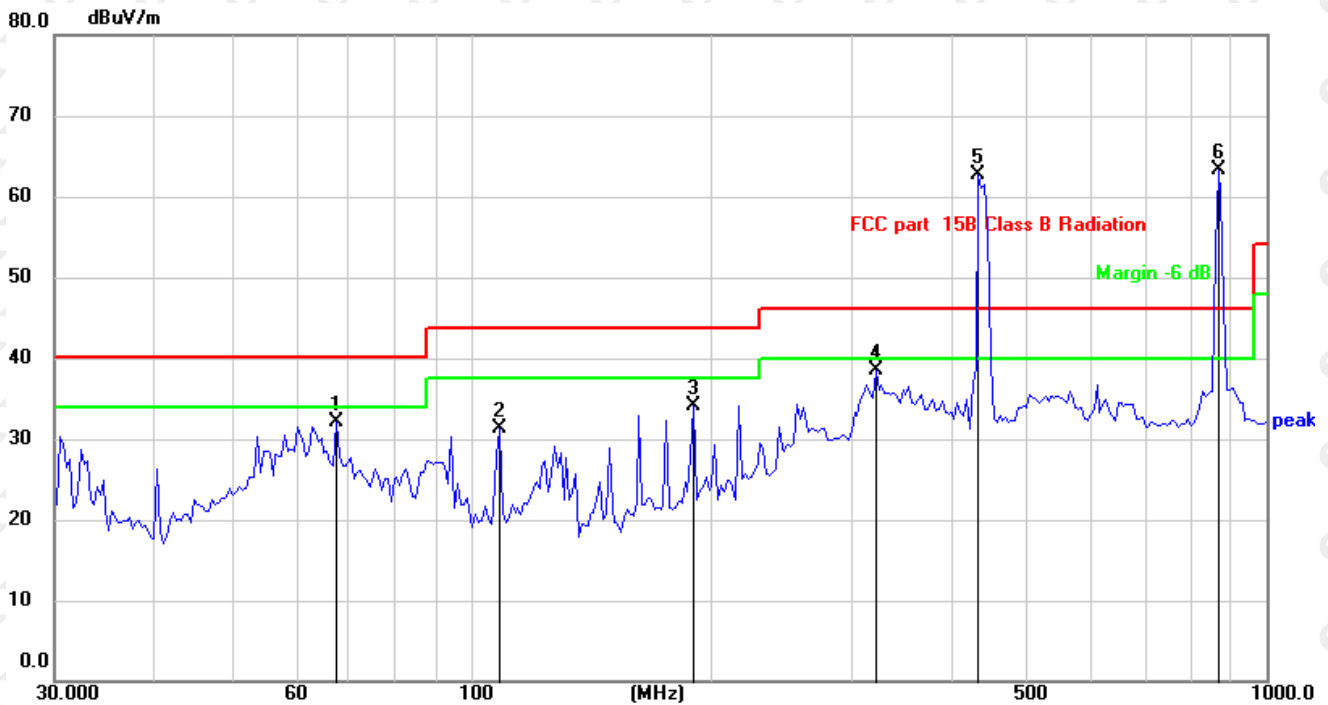
Frequency (MHz)	Level@3m (dB μ V/m)	Limit@3m (dB μ V/m)
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--	--	--
--	--	--
--	--	--

Note: 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

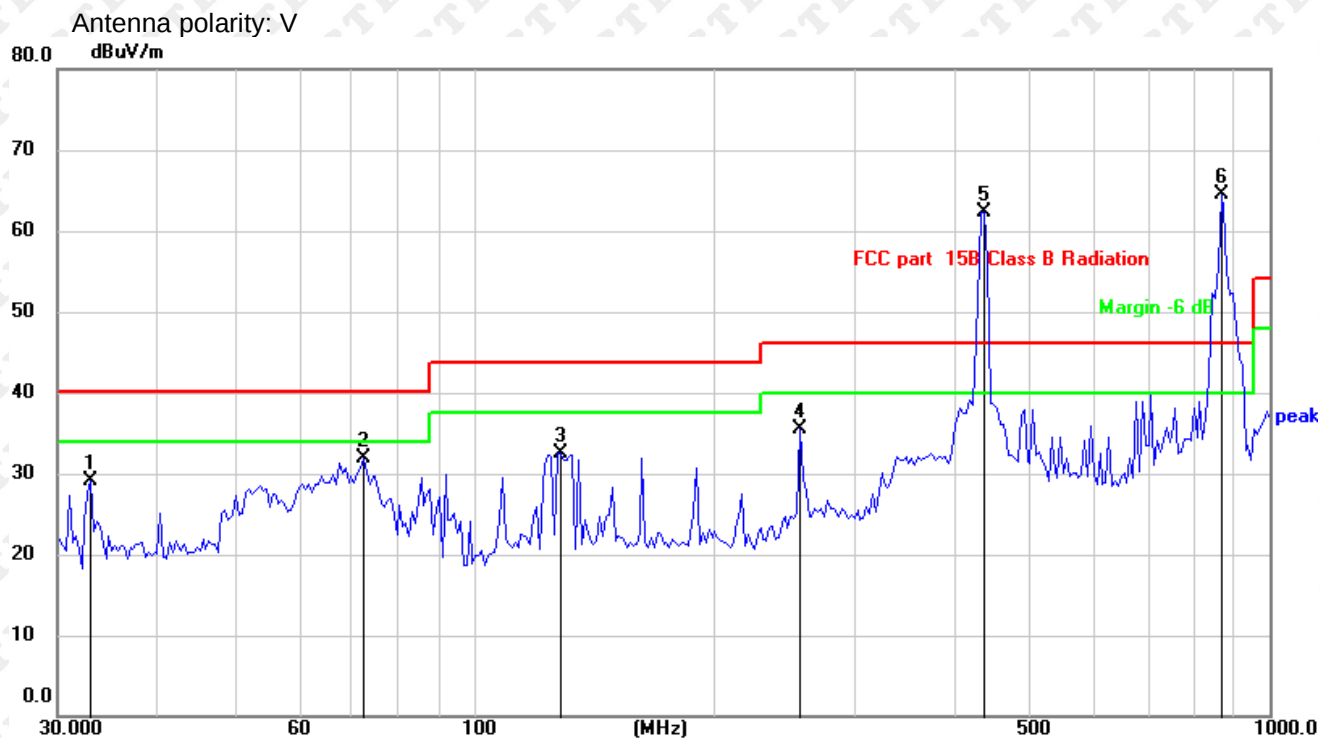
2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

About 30MHz-1GHz Test Results:

Antenna polarity: H



Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
67.7938	39.62	-7.54	32.08	40	-7.92	QP
108.8375	39.40	-8.07	31.33	43.5	-8.67	QP
190.7390	42.15	-8.09	34.06	43.5	-9.44	QP
322.7538	42.98	-4.41	38.57	46	-7.43	QP
434.0687	63.59	-0.85	62.74	92.87	-30.13	Peak
869.1369	57.16	6.15	63.31	72.87	-9.56	Peak



Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
33.0369	35.99	-6.90	29.09	40	-10.91	QP
72.7189	40.28	-8.43	31.85	40	-8.15	QP
128.5629	38.74	-6.26	32.48	43.5	-11.02	QP
256.9712	41.20	-5.63	35.57	46	-10.43	QP
434.0687	63.04	-0.76	62.28	92.87	-30.59	Peak
869.1369	58.36	6.15	64.51	72.87	-8.36	Peak

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Limit – Level

For average Emission

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit AV	Margin	Polarization
433.93	62.74	-16.78	45.96	72.87	-26.91	Horizontal
867.85	63.31	-16.78	46.53	52.87	-6.34	Horizontal
433.93	62.28	-16.78	45.50	72.87	-27.37	Vertical
867.85	64.51	-16.78	47.73	52.87	-5.14	Vertical

Notes: Average emission Level = Peak Level + Duty cycle factor

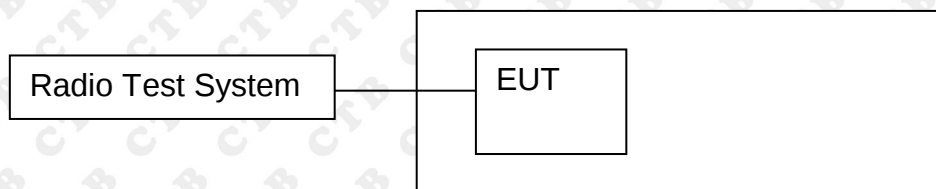
Above 1GHz Test Results

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit		Margin dB		Polarization
				PK	AV	PK	AV	
1301.71	51.55	-16.78	34.77	72.87	52.87	-21.32	-18.1	Vertical
1735.26	47.18	-16.78	30.40	72.87	52.87	-25.69	-22.47	Vertical
2603.56	42.56	-16.78	25.78	72.87	52.87	-30.31	-27.09	Vertical
3037.43	41.94	-16.78	25.16	72.87	52.87	-30.93	-27.71	Vertical
3471.35	40.56	-16.78	23.78	72.87	52.87	-32.31	-29.09	Vertical
3905.24	41.41	-16.78	24.63	72.87	52.87	-31.46	-28.24	Vertical
1301.71	49.11	-16.78	32.33	72.87	52.87	-23.76	-20.54	Horizontal
1735.26	47.24	-16.78	30.46	72.87	52.87	-25.63	-22.41	Horizontal
2603.56	44.46	-16.78	27.68	72.87	52.87	-28.41	-25.19	Horizontal
3037.43	39.74	-16.78	22.96	72.87	52.87	-33.13	-29.91	Horizontal
3471.35	41.27	-16.78	24.49	72.87	52.87	-31.6	-28.38	Horizontal
3905.24	40.10	-16.78	23.32	72.87	52.87	-32.77	-29.55	Horizontal

Notes: Average emission Level = Peak Level + Duty cycle factor

8. DWELL TIME

8.1 Block Diagram Of Test Setup



8.2 Limit

According to FCC 15.231(e):

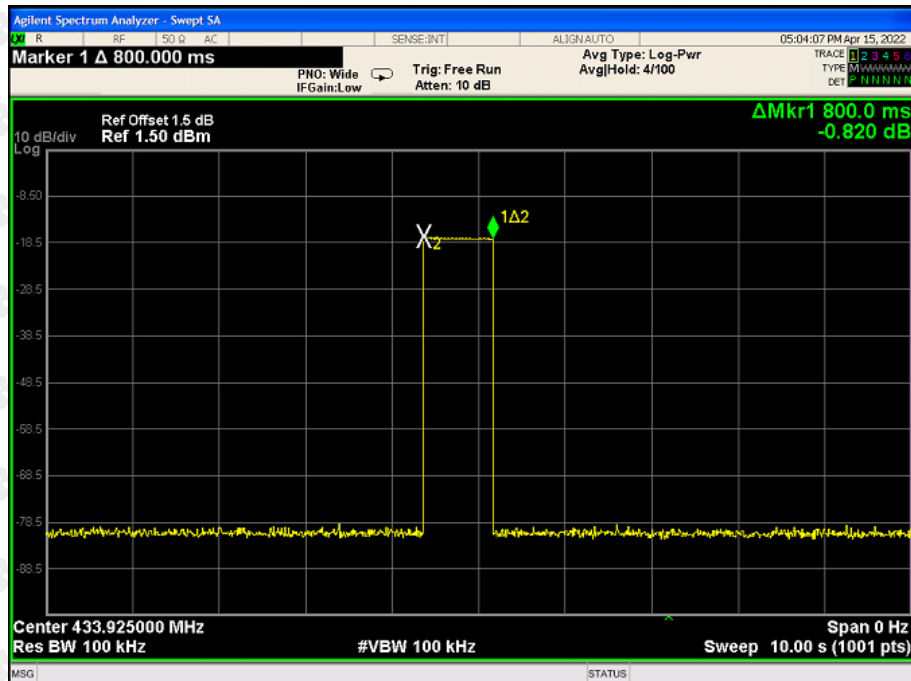
In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

8.3 Test procedure

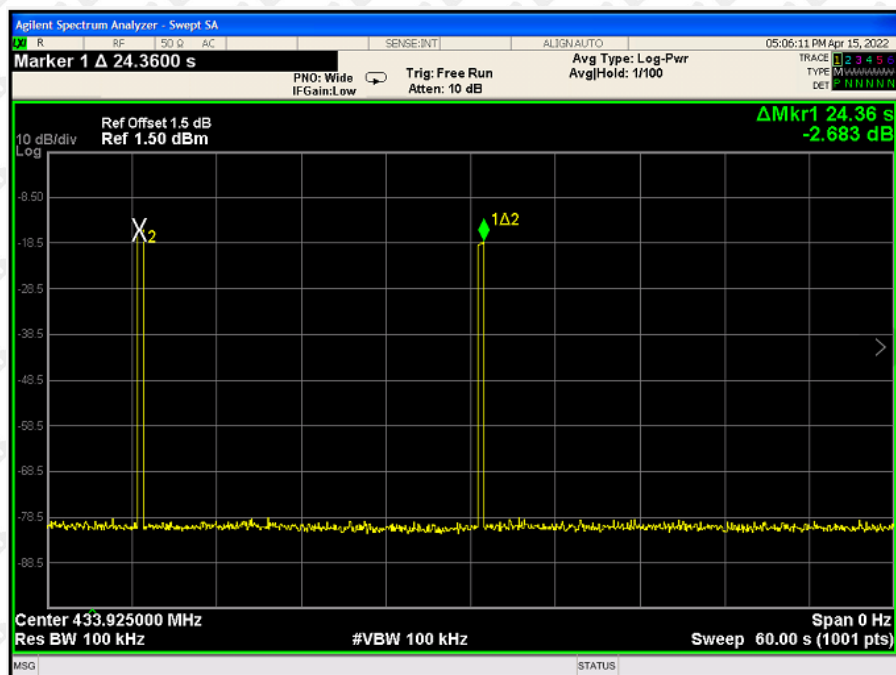
With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the transmission duration was measured and recorded.

8.4 Test Result

Duration (ms)	Limit (S)	Results
0.800	<1	Pass

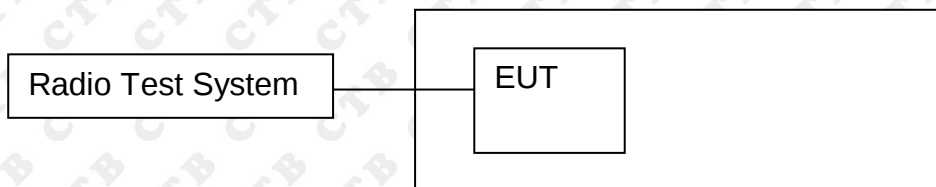


the silent period between transmissions (s)	Limit (S)	Results
24.36	> 10S	Pass



9. OCCUPIED BANDWIDTH

9.1 Block Diagram Of Test Setup



9.2 Limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

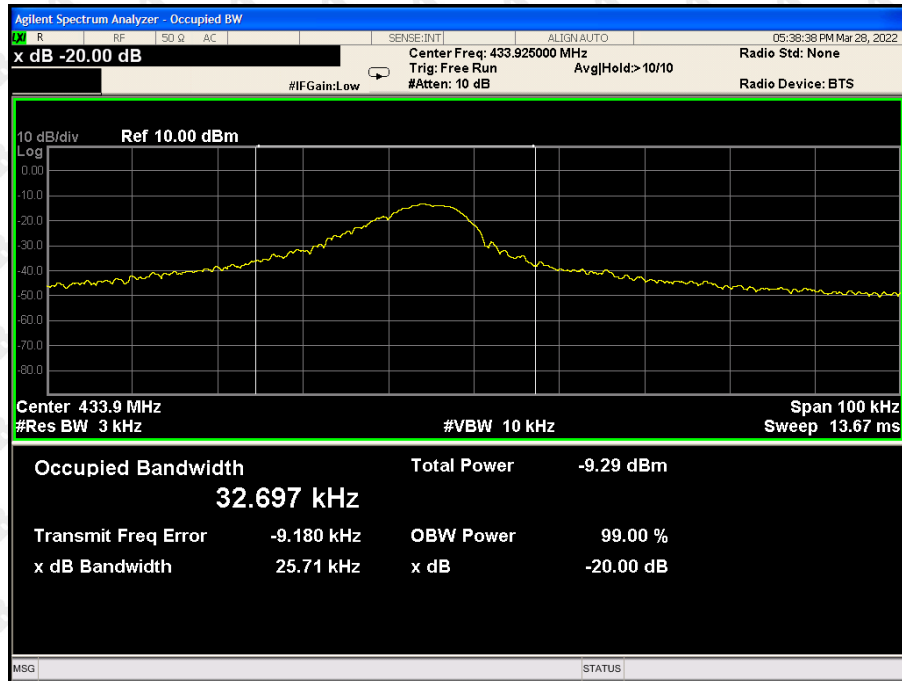
B.W (20dBc) Limit = $0.25\% * f(\text{MHz}) = 0.25\% * 433.92\text{MHz} = 1.0848\text{MHz}$

9.3 Test procedure

1. Set RBW = 3 kHz.
2. Set the video bandwidth (VBW) $\geq$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

9.4 Test Result

20dB bandwidth (kHz)	Limit (MHz)	Results
25.71	1.0848	Pass



10. 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.

EUT Antenna:

The antenna is External antenna and no consideration of replacement. The best case gain of the antenna is 0dBi.

11. EUT PHOTOGRAPHS

External Photos

EUT Photo 1



EUT Photo 2



12. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

Below 1GHz



Above 1GHz



Conducted Emission



***** END OF REPORT *****