TEST REPORT

Product Name:	REMOTE CONTROL
FCC ID:	2AYGSSFRC
Trademark:	N/A
Model Number:	SFRC
Prepared For:	EISGmbH
Address:	Am Lenkwerk 3, 33609 Bielefeld Germany
Manufacturer:	DONGGUAN LI YA ELECTRONIC CO.,LTD
Address:	No. 65, Maxin Road, Yuanjiangyuan Industrial Area, Changping Town, DongguanCity, Guangdong, China
Prepared By:	Shenzhen CTB Testing Technology Co., Ltd.
Address:	Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China
Sample Received Date:	Oct. 31, 2020
Sample tested Date:	Oct. 31, 2020 - Nov. 02, 2020
Issue Date:	Nov. 03, 2020
Report No.:	CTB201104005RFX
Test Standards	FCC Part15.231 ANSI C63.10:2013
Test Results	PASS
Remark:	This is 433MHz radio test report.

Compiled by:	Reviewed by:	Approved by:
Arron Liu	Bin Mei	Rita Xiao / Director

The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.

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(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB201104005RFX	Nov. 03, 2020	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(b)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15 Subpart C Section 15.231 (a)	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=±54.3Hz
Conducted output power Above 1G	U=±1.0dB
Conducted output power below 1G	U=±0.9dB
Power Spectral Density , Conduction	U=±1.0dB
Conduction spurious emissions	U=±2.8dB
Out of band emission	U=±54Hz
3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
humidity uncertainty	U=±5.3%
Temperature uncertainty	U=±0.59℃
Supply voltages	U=±3%
Time	U=±5%

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s): SFRC

Model Description: N/A

Hardware Version: V1.0

Software Version: V1.0

Operation Frequency: 433MHz

Type of Modulation: ASK

Antenna installation: Internal antenna

Antenna Gain: 0dBi

Ratings: DC 3.0V from battery

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(DC):	3.0
Normal Temperature(℃)	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

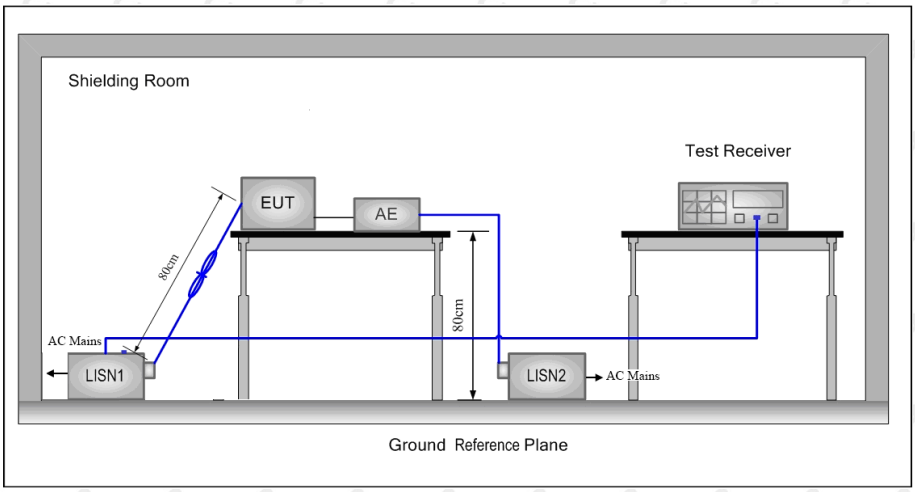
Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	Oct. 17, 2020	Oct. 16, 2021
2	Power Sensor	Agilent	U2021XA	MY56120032	Nov. 02, 2020	Nov. 01, 2021
3	Power Sensor	Agilent	U2021XA	MY56120034	Nov. 02, 2020	Nov. 01, 2021
4	Communication test set	R&S	CMW500	118735	Nov. 02, 2020	Nov. 01, 2021
5	Spectrum Analyzer	R&S	FSP40	100550	Nov. 02, 2020	Nov. 01, 2021
6	Signal Generator	Agilent	N5181A	MY49060920	Nov. 03, 2020	Nov. 02, 2021
7	Signal Generator	Agilent	N5182A	MY47420195	Nov. 03, 2020	Nov. 02, 2021
8	Communication test set	R&S	CMU200	119978	Nov. 02, 2020	Nov. 01, 2021
9	band rejection filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	Nov. 02, 2020	Nov. 01, 2021
10	band rejection filter	Shenxiang	MSF5150-5850MS-1155	20181015001	Nov. 02, 2020	Nov. 01, 2021
11	band rejection filter	Xingbo	XBLBQ-DZA120	190821-1-1	Nov. 02, 2020	Nov. 01, 2021
12	BT&WI-FI Automatic test software	Micowave	MTS8310	Ver. 2.0.0.0	\	\
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	Nov. 02, 2020	Nov. 01, 2021
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	Nov. 02, 2020	Nov. 01, 2021
15	234G Automatic test software	Micowave	MTS8200	Ver. 2.0.0.0	\	\
16	966 chamber	C.R.T.	966 Room	966	Nov. 10, 2020	Nov. 09, 2021

17	Receiver	R&S	ESPI	100362	Nov. 02, 2020	Nov. 01, 2021
18	Amplifier	HP	8447E	2945A02747	Nov. 03, 2020	Nov. 02, 2021
19	Amplifier	Agilent	8449B	3008A01838	Nov. 03, 2020	Nov. 02, 2021
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	869	Nov. 02, 2020	Nov. 01, 2021
21	Horn Antenna	Schwarzbeck	BBHA9120D	1911	Nov. 02, 2020	Nov. 01, 2021
22	Software	Fala	EZ-EMC	FA-03A2 RE	\	\
23	3-Loop Antenna	Daze	ZN30401	17014	Nov. 02, 2020	Nov. 01, 2021
24	loop antenna	ZHINAN	ZN30900A	/	Nov. 02, 2020	Nov. 01, 2021
25	Horn antenna	A/H/System	SAS-574	588	Nov. 02, 2020	Nov. 01, 2021
26	Amplifier	AEROFLEX	/	S/N/ 097	Nov. 02, 2020	Nov. 01, 2021

Conducted emissions Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
AMN	ROHDE&SCHWARZ	ESH3-Z5	831551852	Nov. 02, 2020	Nov. 01, 2021
Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	Nov. 02, 2020	Nov. 01, 2021
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCS30	834115/006	Nov. 02, 2020	Nov. 01, 2021
Coaxial cable	ZDECL	Z302S	18091904	Nov. 02, 2020	Nov. 01, 2021
ISN	TESEQ	NTFM8158	NTFM8158 #183	Nov. 02, 2020	Nov. 01, 2021
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	10428	Nov. 02, 2020	Nov. 01, 2021
Software	Fala	EZ-EMC	EMC-CON 3A1.1	\	\

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	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 50Ω/50μH + 5Ω 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

N/A

NOTE: This EUT is powered by the battery only, this test item is not applicable.

7. RADIATED EMISSION

7.1 Block Diagram Of Test Setup

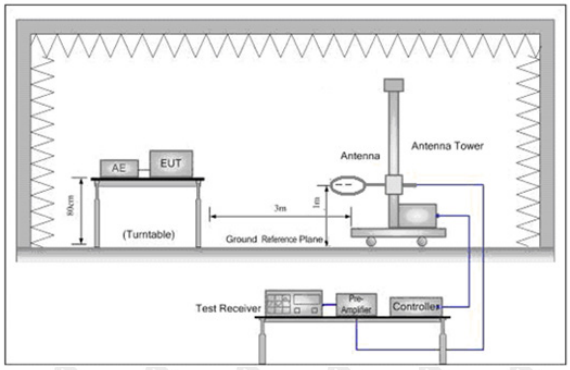


Figure 1. Below 30MHz

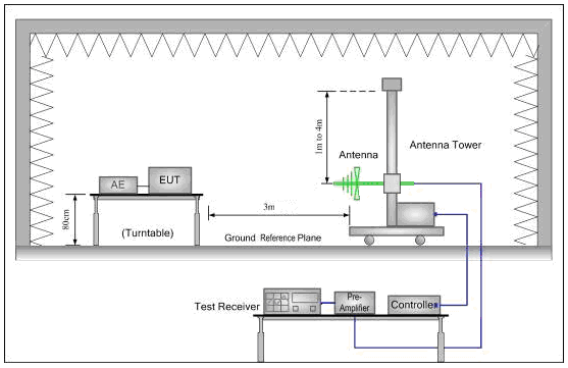


Figure 2. 30MHz to 1GHz

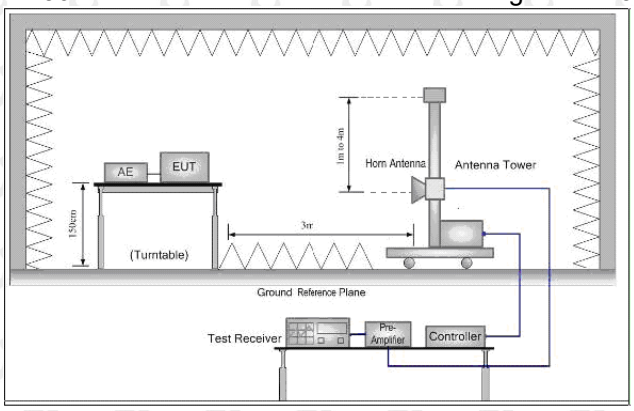


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	20log 2400/F (kHz) + 80	-	3
0.490MHz-1.705MHz	20log 24000/F (kHz) + 40	-	3
1.705MHz-30MHz	20log 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	2280	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

** 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, μV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, μV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

Frequency	Limit (dBμV/m @3m)	Remark
433MHz	80.8	Average Value
	100.8	Peak Value

7.3 Test procedure

Below 1GHz test procedure as below:

a.The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. 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.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.

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 (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.

e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f.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:

g.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).

h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel

j.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

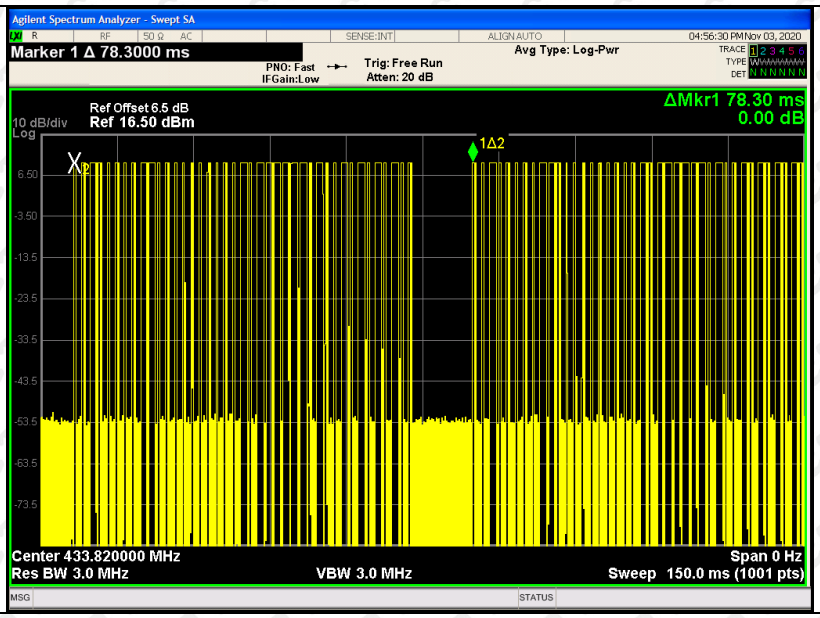
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

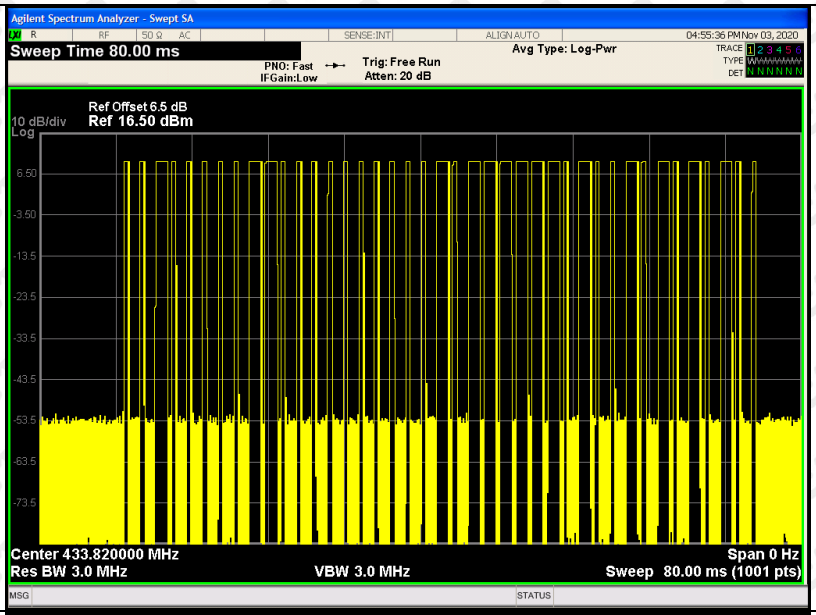
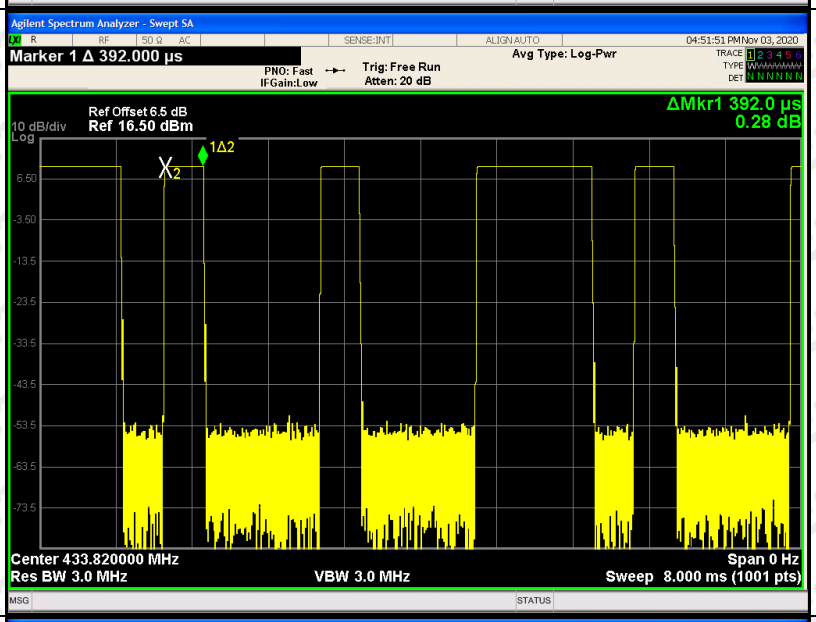
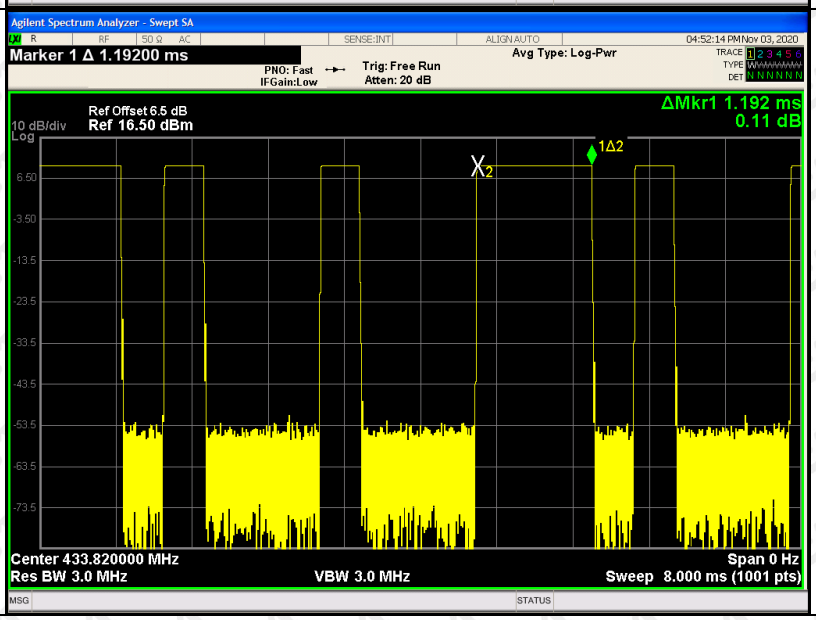
7.4 Test Result

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.

Cycle



Pulse			
On-time1			
On-time2			

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 = 0.392×26+1.192×15=28.072(ms); T period =78.30(ms)
	PDCF = 20 log(28.072/78.30)= -8.91dB

7.4.2 Radiated Spurious Emission

Frequency Range (9 kHz-30MHz)

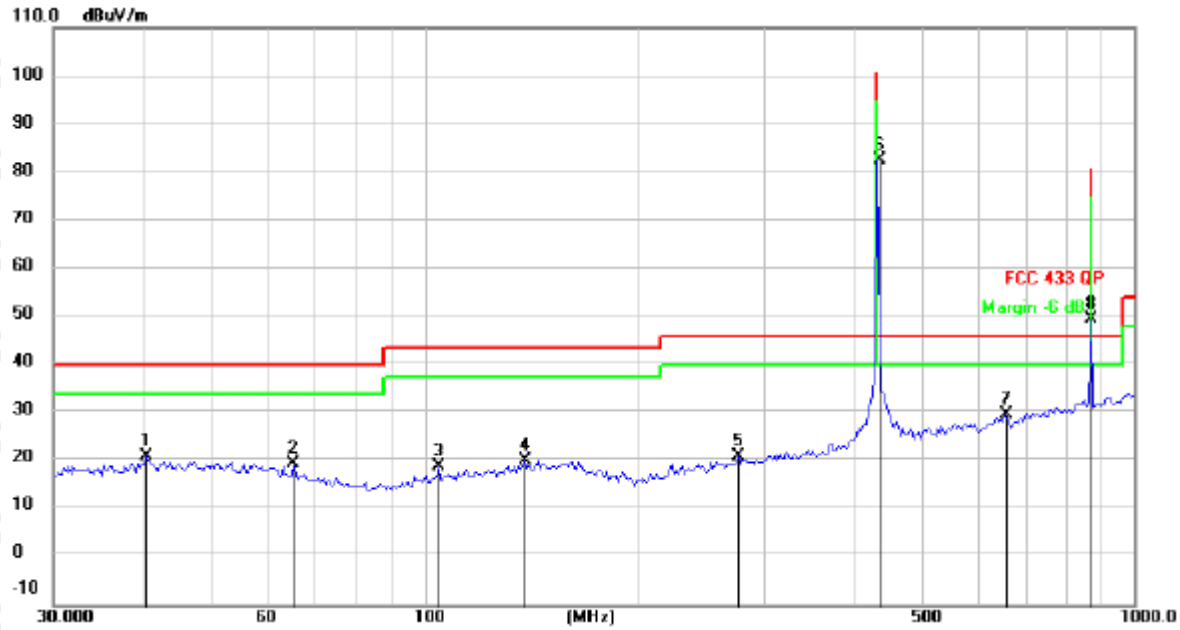
Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

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

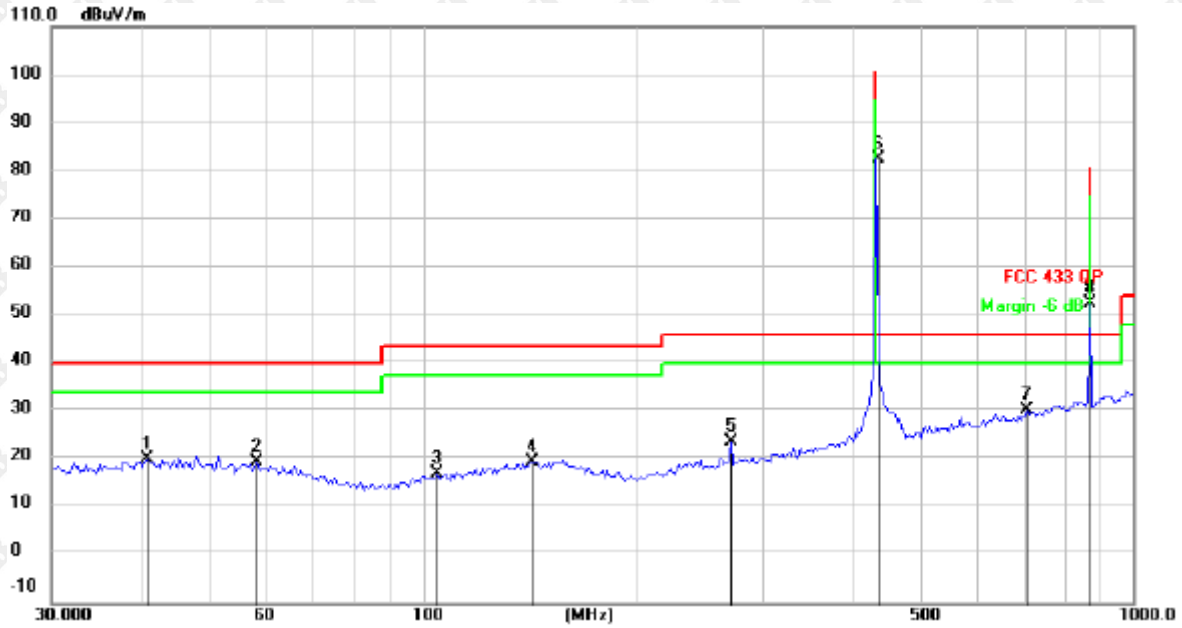
About 30MHz-1GHz Test Results:

Antenna polarity: H



Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
40.3721	25.65	-5.6	20.05	40	-19.95	QP
65.3475	24.86	-6.18	18.68	40	-21.32	QP
104.0788	27.44	-8.88	18.56	43.5	-24.94	QP
139.5084	26.64	-7.72	18.92	43.5	-24.58	QP
279.3618	26.73	-6.7	20.03	46	-25.97	QP
434.0687	86.29	-4.73	81.56	100.8	-19.24	QP
658.8191	32.71	-4.41	28.30	46	-17.70	QP
869.1369	57.93	-8.61	49.32	80.8	-31.48	QP

Antenna polarity: V



Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
41.0184	26.36	-7.39	18.97	40	-21.03	QP
60.7765	24.44	-6.39	18.05	40	-21.95	QP
104.2848	26.11	-9.53	16.58	43.5	-26.92	QP
142.6078	27.06	-9.51	17.55	43.5	-25.95	QP
273.5638	28.90	-6.34	22.56	46	-23.44	QP
434.0674	84.70	-3.3	81.40	100.8	-19.40	QP
709.1832	32.11	-2.34	29.77	46	-16.23	QP
869.1315	57.81	-5.52	52.29	80.8	-28.51	QP

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

For average Emission

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	AverageLevel dBuV/m	Limit AV	Margin	Polarization
433.82	81.56	-8.91	72.65	80.8	-8.15	Horizontal
867.64	49.32	-8.91	40.41	60.8	-20.39	Horizontal
433.82	81.4	-8.91	72.49	80.8	-8.31	Vertical
867.64	52.29	-8.91	43.38	60.8	-17.42	Vertical

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

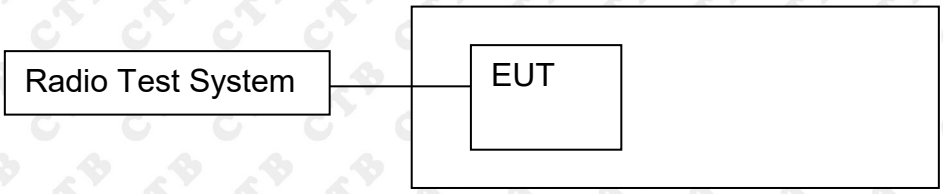
Above 1GHz Test Results

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	Average Level dBuV/m	Limit		Margin dB		Polarization
				PK	AV	PK	AV	
1301.71	50.14	-8.91	41.23	80.8	60.8	-30.66	-19.57	Vertical
1735.26	47.59	-8.91	38.68	80.8	60.8	-33.21	-22.12	Vertical
2603.56	43.23	-8.91	34.32	80.8	60.8	-37.57	-26.48	Vertical
3037.43	42.19	-8.91	33.28	80.8	60.8	-38.61	-27.52	Vertical
3471.35	40.91	-8.91	32.00	80.8	60.8	-39.89	-28.80	Vertical
3905.24	40.70	-8.91	31.79	80.8	60.8	-40.10	-29.01	Vertical
1301.71	49.67	-8.91	40.76	80.8	60.8	-31.13	-20.04	Horizontal
1735.26	46.51	-8.91	37.60	80.8	60.8	-34.29	-23.20	Horizontal
2603.56	44.70	-8.91	35.79	80.8	60.8	-36.10	-25.01	Horizontal
3037.43	41.44	-8.91	32.53	80.8	60.8	-39.36	-28.27	Horizontal
3471.35	41.78	-8.91	32.87	80.8	60.8	-39.02	-27.93	Horizontal
3905.24	41.29	-8.91	32.38	80.8	60.8	-39.51	-28.42	Horizontal

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

8. DWELL TIME

8.1 Block Diagram Of Test Setup



8.2 Limit

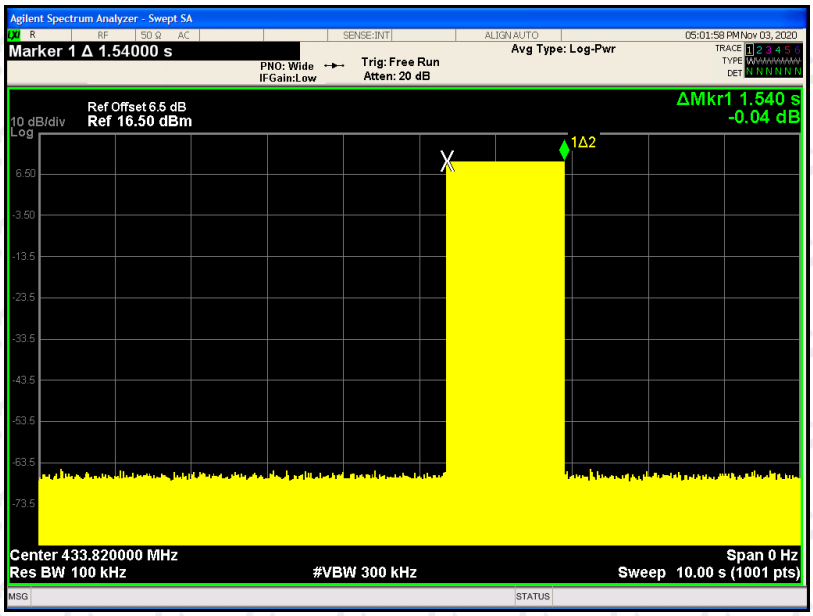
According to FCC 15.231(a) requirement:
A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

8.3 Test procedure

a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
e) Repeat above procedures until all measured frequencies were complete.

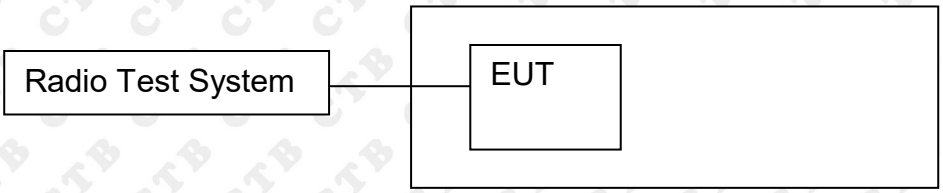
8.4 Test Result

Transmitting time(S)	Limit (S)	Results
1.540	≤5	Pass



9. OCCUPIED BANDWIDTH

9.1 Block Diagram Of Test Setup



9.2 Limit

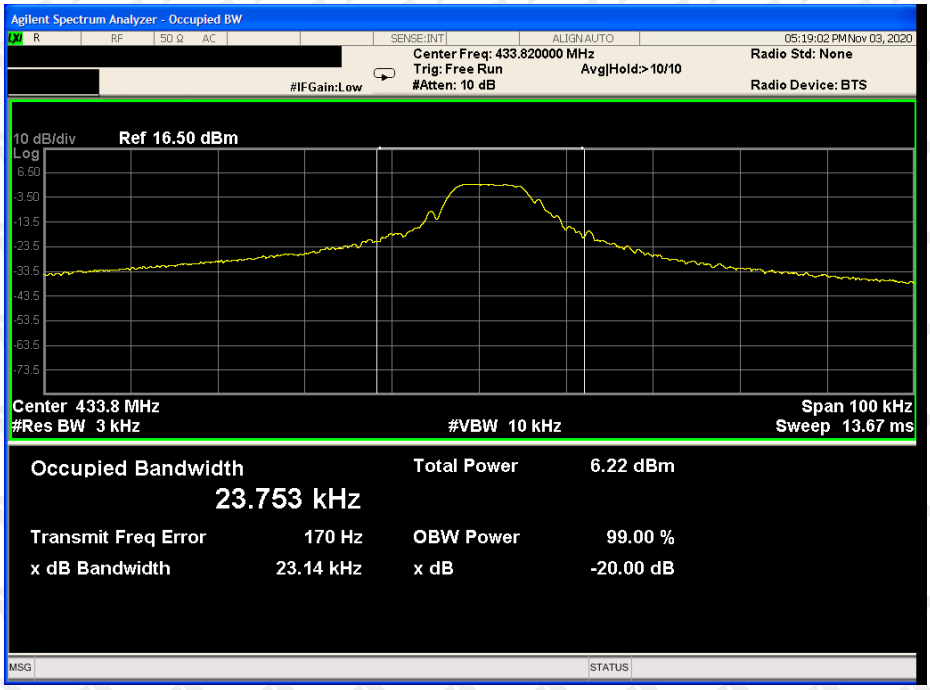
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.
B.W (20dBc) Limit = 0.25% * f(MHz) = 0.25% * 433.82MHz = 1.0846MHz

9.3 Test procedure

1. Set RBW = 10 kHz.
2. Set the video bandwidth (VBW) ≥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
23.14	1.0846	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 PCB Antenna and no consideration of replacement. The best case gain of the antenna is 0dBi.

11. EUT PHOTOGRAPHS

EUT Photo 1

12. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

Below 1GHz

Above 1GHz

※※※※※ END OF REPORT ※※※※※