

FCC/ISED - TEST REPORT

Report Number : **68.910.22.0038.01** Date of Issue: **2022-09-05**

Model No./HVIN : **MT01-1320-069001-A, MT01-1320-069002-A,
MT01-1320-069003-A**

Product Type/PMN : **Li-ion 0.5 ARC Motor**

Applicant : **Rollease Acmeda Inc**

Address : **750 East Main Street, 7th Floor, Stamford CT 06902, USA**

Production Facility : **Ningbo Dooya Mechanic & Electronic Technology Co., Ltd.**

Address : **No.168 Shengguang Road, Luotuo, Zhenhai, 315202 Ningbo,
Zhejiang province, PEOPLE'S REPUBLIC OF CHINA**

Test Result : **Positive** **Negative**

Total pages including Appendices : **19**

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Guankou Erlu, Nantou, Nanshan District,
Shenzhen, 518052 China

FCC Designation Number: CN5009

FCC Registration No.: 514049

IC Registration Number: 10320A

Telephone: 86 755 8828 6998
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3 Description of the Equipment Under Test

Product Type/PMN:	Li-ion 0.5 ARC Motor
Model No./HVIN	MT01-1320-069001-A, MT01-1320-069002-A, MT01-1320-069003-A
FCC ID:	2AGGZ003B9ACA46
IC:	21769-003B9ACA46
Rating:	5V $\overline{=}$; 0.73A, 6W
Battery Info:	Rechargeable Li-ion Battery: DCA101-04-02A Rated voltage 7.2V $\overline{=}$ Nominal Capacity: 2.6Ah
RF Transmission Frequency:	433.92MHz
Modulation:	FSK
Antenna Type:	Line Antenna
Antenna Gain:	-1.5dBi
Description of the EUT:	The Equipment Under Test (EUT) is a Li-ion 0.5 ARC Motor supports 433.92MHz wireless function.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5, Amendment 2, February 2021	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 10, December 2019	RSS-210 — Licence-Exempt Radio Apparatus: Category I Equipment

All the test methods were according to ANSI C63.10.

5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subpart C, RSS-210 Issue 10					
Test Condition			Pages	Test Site	Test Result
§15.207	RSS-GEN A8.8	Conducted emission AC power port	10	Site 1	Pass
§15.205, §15.209, 15.35 (c) §15.231 (b)	RSS-210 A.1.2	Radiated Emission, 30MHz to 4.5GHz	13	Site 1	Pass
§15.231(c)	RSS-210 A.1.3	Bandwidth Measurement	18	Site 1	Pass
§15.231 (a) (2)	RSS-210 A.1.1(b)	Deactivation Time	19	Site 1	Pass
§15.203	RSS-Gen 6.8	Antenna requirement	--	See Note 2	Pass

Note 1: N/A=Not Applicable.

Note 2: The EUT uses a line antenna, which gain is -1.5dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

All models are identical, only the model number is different. Therefore, the EMC full tests were applied on MT01-1320-069001-A, other models are deemed to fulfill relevant EMC requirement without further testing.

This submittal(s) (test report) is intended for FCC ID: 2AGGZ003B9ACA46 complies with Section 15.207, 15.209, 15.231 of the FCC Part 15.

This submittal(s) (test report) is intended for IC: 21769-003B9ACA46 complies with RSS-Gen Issue 5 and RSS-210 issue 10.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: 2022-06-06

Testing Start Date: 2022-06-18

Testing End Date: 2022-06-21

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Reviewed by:



Jessie He
EMC Project Manager

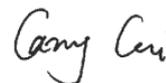


Prepared by:



Myron Yu
EMC Project Engineer

Tested by:



Carry Cai
EMC Test Engineer

7 Systems test configuration

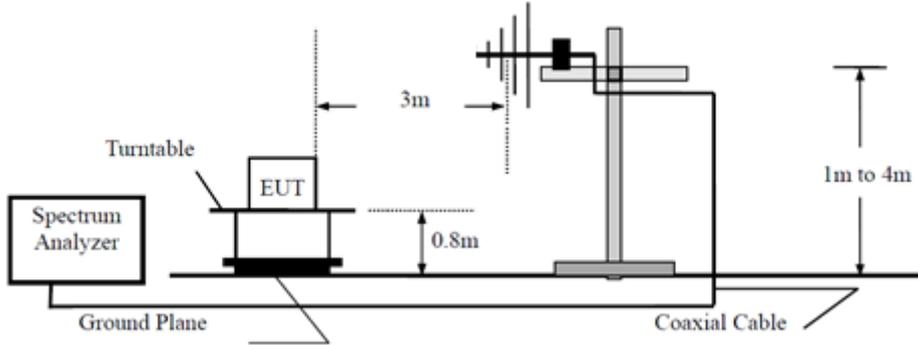
Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Adapter	APPLE	A1357	--

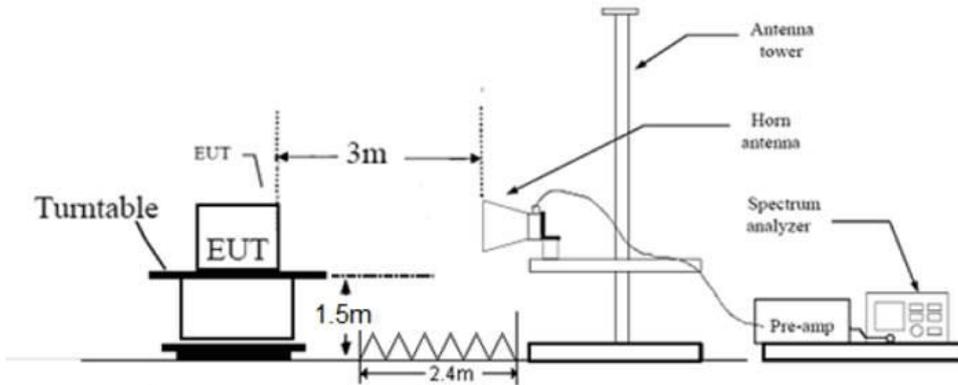
8 Test Setups

7.1 Radiated test setups

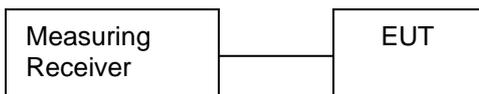
Below 1GHz



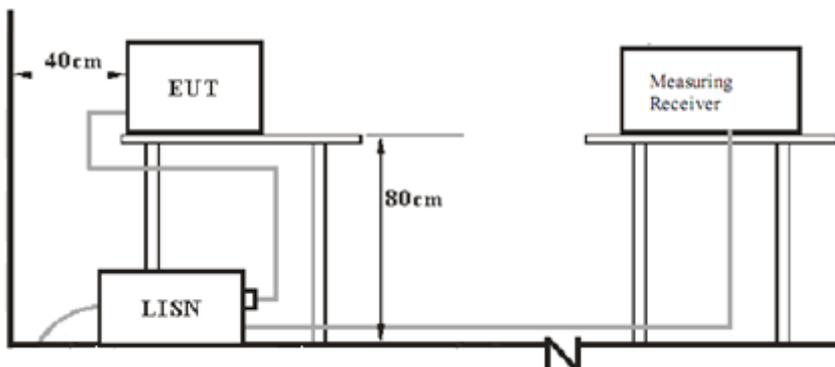
Above 1GHz



7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



9 Test Methodology

9.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

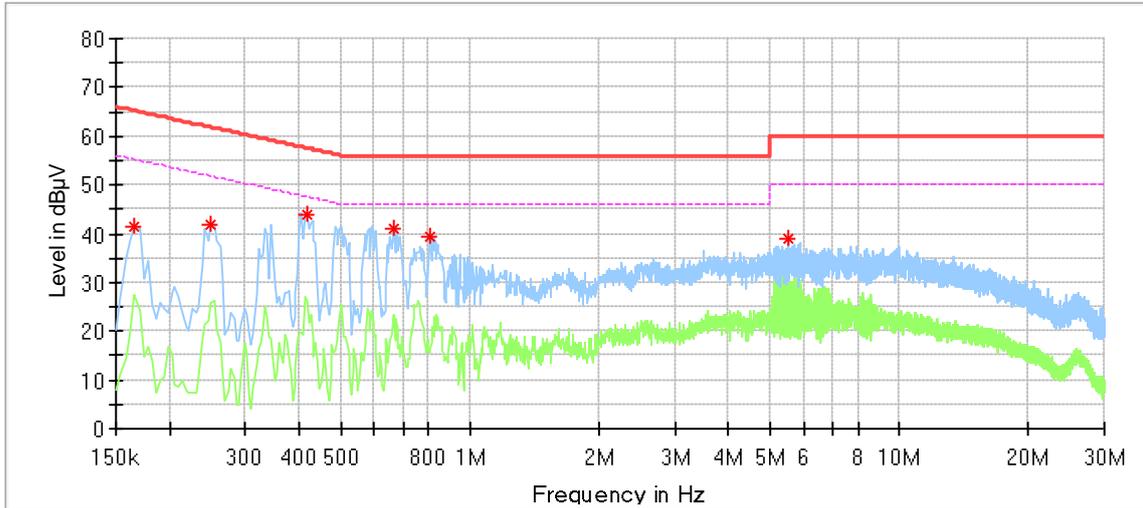
Limit

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

Conducted Emission

Product Type : Li-ion 0.5 ARC Motor
 M/N : MT01-1320-069001-A
 Operating Condition : Charging + transmitting
 Test Specification : Line
 Comment : 120VAC, 60Hz (External adapter)



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.166000	41.61	---	65.16	23.55	L1	9.25
0.250000	41.73	---	61.76	20.03	L1	9.23
0.418000	44.05	---	57.49	13.44	L1	9.21
0.662000	41.14	---	56.00	14.86	L1	9.20
0.806000	39.49	---	56.00	16.51	L1	9.20
5.510000	38.80	---	60.00	21.20	L1	9.32

Remark:

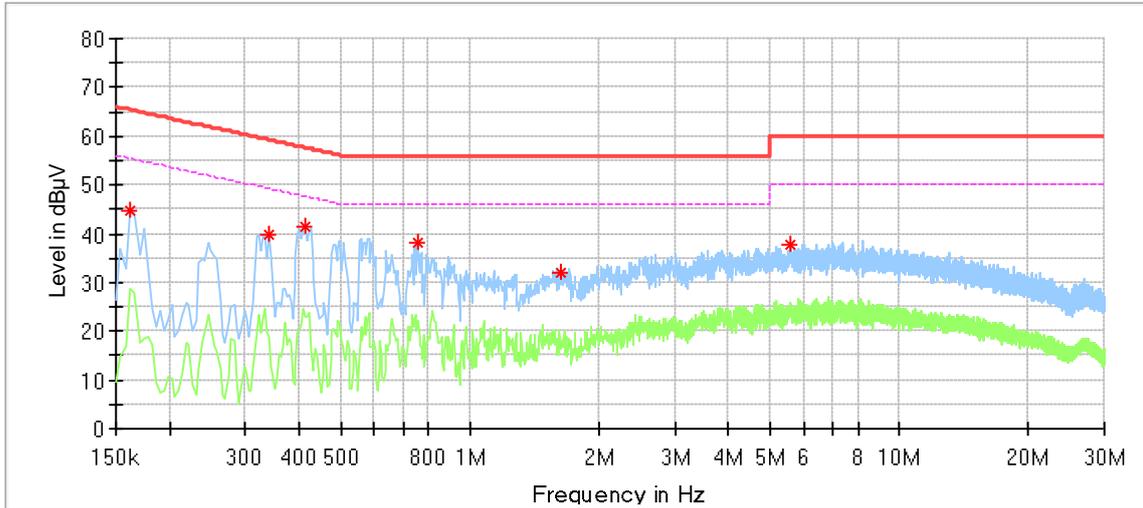
Level=Reading Level + Correction Factor

Correction Factor=Cable Loss + LISN Factor

(The Reading Level is recorded by software which is not shown in the sheet)

Conducted Emission

Product Type : Li-ion 0.5 ARC Motor
M/N : MT01-1320-069001-A
Operating Condition : Charging + transmitting
Test Specification : Neutral
Comment : 120VAC, 60Hz (External adapter)



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.162000	44.71	---	65.36	20.65	N	9.41
0.342000	39.98	---	59.16	19.18	N	9.39
0.414000	41.35	---	57.57	16.22	N	9.38
0.754000	38.05	---	56.00	17.95	N	9.39
1.626000	31.92	---	56.00	24.08	N	9.41
5.578000	37.67	---	60.00	22.33	N	9.52

Remark:

Level=Reading Level + Correction Factor

Correction Factor=Cable Loss + LISN Factor

(The Reading Level is recorded by software which is not shown in the sheet)

9.2 Radiated Emission

Test Method

- 1: The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna 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.
- 4: 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.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 100 kHz to 120kHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
 RBW = 1MHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

- a) RBW = 1MHz.
- b) VBW \ [3 × RBW].
- c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
- e) Sweep time = auto.
- f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
- g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.
 - 2) If linear voltage averaging mode was used in the preceding step e), then the correction

factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

According to §15.231 (b), the and RSS-210 A.1.2 field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field Strength of Fundamental (Microvolts /meter)	Field Strength of spurious emissions ((Microvolts /meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	1, 250 to 3,370 *	125 to 375 *
174-260	3,750	375
260-470	3,750 to 12, 500*	375 to 1,250*
Above 470	12,500	1,250

*Linear interpolations

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

Spurious radiated emissions for transmitter

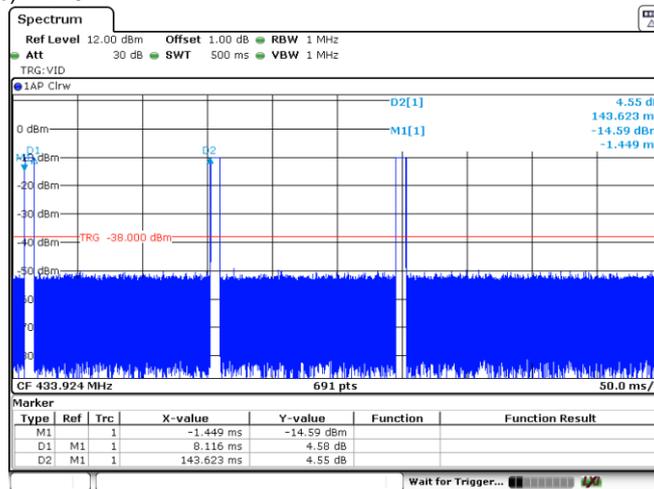
According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Radiated Emission									
Value	Emissions Frequency MHz	E-Field Polarity	PK Emission dBµV/m	Corr.	Average Factor dB	AV Emission dBµV/m	Limit dBµV/m	Margin	Emission Type
Below 1GHz									
PK	433.897	H	83.80	24.24	/	/	100.83	17.03	Fundamental
AV	433.897	H	83.80	/	-21.81	61.99	80.83	18.84	Fundamental
PK	433.897	V	72.18	24.24	/	/	100.83	28.65	Fundamental
AV	433.897	V	72.18	/	-21.81	50.37	80.83	30.46	Fundamental
PK	208.911	H	27.94	18.24	/	/	80.83	52.89	Spurious
AV	208.911	H	27.94	/	-21.81	6.13	60.83	54.70	Spurious
PK	196.948	V	21.39	18.98	/	/	80.83	59.44	Spurious
AV	196.948	V	21.39	/	-21.81	-0.42	60.83	61.25	Spurious
Above 1GHz									
PK	2787.000	H	44.99	-1.23	/	/	74	29.01	Spurious
AV	2787.000	H	44.99	/	-21.81	23.18	54	30.82	Spurious
PK	4841.000	H	49.74	4.52	/	/	74	24.26	Spurious
AV	4841.000	H	49.74	/	-21.81	27.93	54	26.07	Spurious
PK	10575.000	H	45.1	12.15	/	/	74	28.90	Spurious
AV	10575.000	H	45.1	/	-21.81	23.29	54	30.71	Spurious
PK	1293.000	V	37.76	-7.73	/	/	74	36.24	Spurious
AV	1293.000	V	37.76	/	-21.81	15.95	54	38.05	Spurious
PK	4733.000	V	49.36	4.34	/	/	74	24.64	Spurious
AV	4733.000	V	49.36	/	-21.81	27.55	54	26.45	Spurious
PK	12337.500	V	47.07	15	/	/	74	26.93	Spurious
AV	12337.500	V	47.07	/	-21.81	25.26	54	28.74	Spurious

Remark:

- 1: AV Emission Level= PK Emission Level+20log(duty cycle)
- 2: Data of measurement within this frequency range shown "f" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- 3: "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- 4: Level= Reading Level + Correction Factor
Correction Factor = Antenna Factor + Cable Loss- Amplifier Gain
(The Reading Level is recorded by software which is not shown in the sheet)

Duty Cycle =8.116(ms)/100(ms) =8.116%
Duty Cycle Factor =20log (Duty Cycle) =-21.81



Date: 21 JUN 2022 14:47:22

9.3 Bandwidth Measurement

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. 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.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Limit

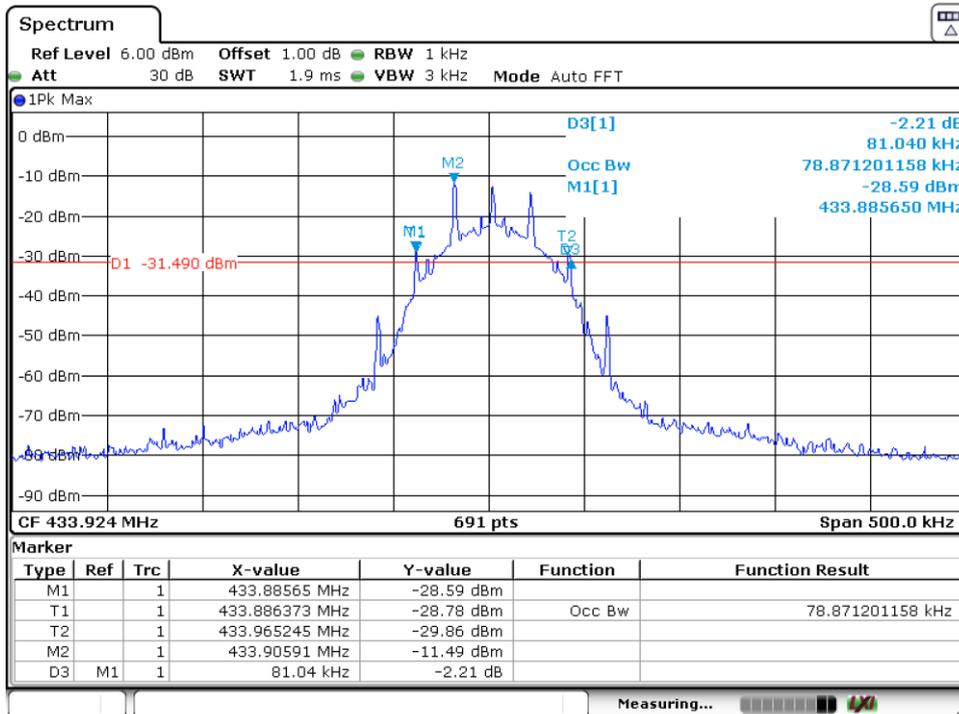
The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated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

The limit for the EUT = 0.25% * 433.92 MHz = 1085 kHz

Test Result

Channel	20dB Bandwidth (kHz)	Limit (kHz)
1	81.04kHz	1085kHz

Channel	99% Bandwidth (kHz)	Limit (kHz)
1	78.87kHz	No limit



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9.4 Deactivation Time

Test Method

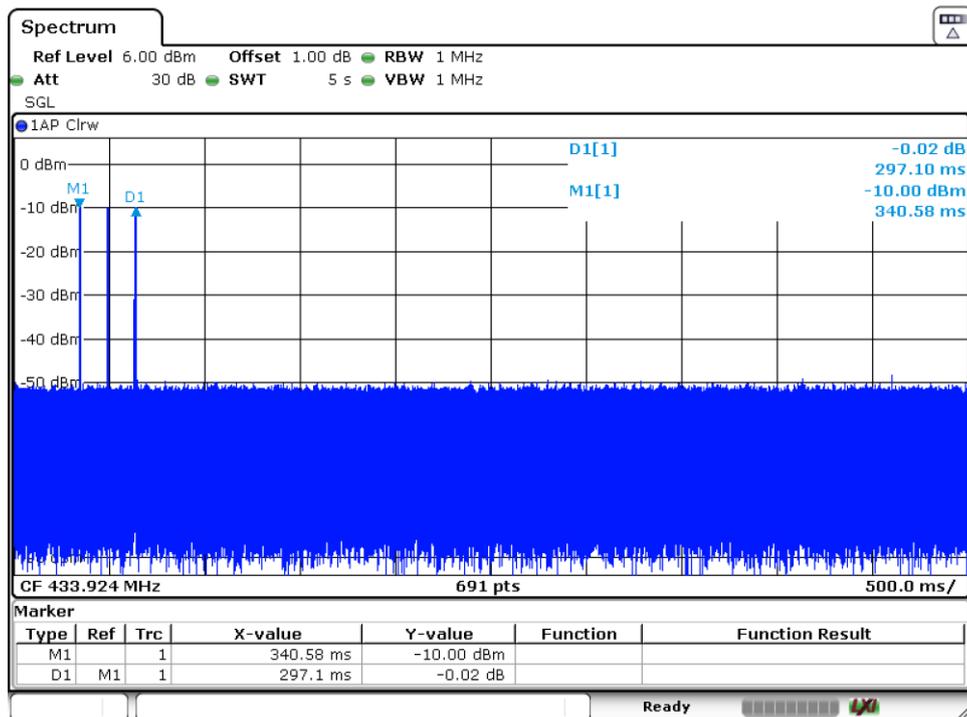
1. Place the EUT in the chamber and set it in transmitting mode.
2. Set center frequency of spectrum analyzer=operating frequency.
3. Set the spectrum analyzer as RBW=120 kHz, VBW=1MHz, Span=0Hz.
4. Repeat above procedures until all frequency measured was complete.

Limit

According to FCC Part 15.231 (a)(2) and RSS-210 A.1.1(b), the transmitter shall be complied the following requirements:
 A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Test Result

Channel	Frequency	Deactivation Time	Result
1	433.92MHz	297.1ms	Pass



Date: 21.JUN.2022 14:45:41

10 Test Equipment List

Conducted Emission Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-19-002	102590	1	2023-5-27
LISN	Rohde & Schwarz	ENV216	68-4-87-19-001	102472	1	2023-5-27
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2023-5-27
Test software	Rohde & Schwarz	EMC32	68-4-90-19-005-A01	Version10.35.02	N/A	N/A
Shielding Room	TDK	CSR #2	68-4-90-19-005	----	3	2022-11-07

Radiated Emission Test 1#

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 7	68-4-74-19-001	102176	1	2023-5-27
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-002	707	1	2022-7-23
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2023-5-28
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-001	15542	1	2023-5-27
3m Semi-anechoic chamber	TDK	SAC-3 #1	68-4-90-14-001	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-14-001-A10	Version 10.35.02	N/A	N/A

Radiated Emission Test 2#

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2023-5-28
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2023-5-9
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2023-5-28
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2023-5-28
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2022-7-21
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2022-7-27
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2023-5-27
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version 10.35.02	N/A	N/A

RF Conducted Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2023-5-27

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission (0.15MHz-30MHz)	3.31dB
Uncertainty for Radiated Emission in 3m chamber (68-4-90-14-001)30MHz-1000MHz	Horizontal: 4.68dB; Vertical: 4.65dB;
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 1000MHz-18000MHz	Horizontal: 4.76dB; Vertical: 4.75dB;
Uncertainty for Radiated Emission 18000MHz-40000MHz	Horizontal: 4.51dB; Vertical: 4.50dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.27dB Frequency test involved: 0.6×10^{-7} or 1%

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.

---THE END OF REPORT---