

**FCC - TEST REPORT**

Report Number : **709502407378-00A** Date of Issue: January 15, 2025

Model : R2130-DC, R2135-DCM, R2120-DC, R2125-DCM

Product Type : Tubular Motor

Applicant : Louver-Lite Limited

Address : Ashton Road, Hyde, Cheshire, SK14 4BG, United Kingdom

Production Facility : ZHEJIANG JIECANG LINEAR MOTION TECHNOLOGY CO., LTD

Address : HIGH TECH PARK, QIXING STREET, XINCHANG COUNTY,
312500 ZheJiang Province, PEOPLE'S REPUBLIC OF CHINA

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including
Appendices : 25

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1 Table of Contents

1	Table of Contents	2
2	Report Modification Record.....	3
3	Details about the Test Laboratory & Report Modification Record.....	3
4	Description of the Equipment Under Test.....	4
5	Summary of Test Standards	5
6	Summary of Test Results	6
7	General Remarks	7
8	Test Setups.....	8
9	Test Methodology.....	10
9.1	Conducted Emission	10
9.2	Radiated Emission.....	15
9.3	Bandwidth Measurement	19
9.4	Deactivation Time	20
10	Systems test configuration	21
11	Test Equipment List.....	22
12	System Measurement Uncertainty	23
13	Photographs of Test Set-ups	24
14	Photographs of EUT	25



2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
709502407378-00A	First Issue	01/15/2025

3 Details about the Test Laboratory & Report Modification Record

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
No.16 Lane, 1951 Du Hui Road,
Shanghai 201108,
P.R. China

Telephone: +86 21 6141 0123

Fax: +86 21 6140 8600

FCC Registration No.: 820234

FCC Designation Number: CN1183



4 Description of the Equipment Under Test

Product:	Tubular Motor
Model no./HVIN:	R2130-DC, R2135-DCM, R2120-DC, R2125-DCM
FCC ID:	2BK6HR2130-DC
Options and accessories:	AC adaptor: KA12C-0502000US (The AC/DC adapter provided by lab, not included the EUR)
Rating:	DC 5V (by USB Type-C port) DC 12V (build-in 3 rechargeable lithium batteries)
RF Transmission Frequency:	433.92 MHz
No. of Operated Channel:	1
Modulation:	FSK
Antenna Type:	Ceramic Antenna
Description of the EUT:	The Equipment Under Test (EUT) is a Tubular Motor with SRD function. We tested it and listed the worst data in this report.
Test sample no.:	SHA-849298-1

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment, antenna gain or any information supplied.



5 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2023 Edition	RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to ANSI C63.10-2020.

6 Summary of Test Results

Technical Requirements				
FCC Part 15 Subpart C				
Test Condition		Pages	Test Site	Test Result
§15.207	Conducted emission AC power port	10-14	Shield room	Pass
§15.205, §15.209, 15.35 (c)§15.231(b),	The Field strength of Emissions	15-18	3m chamber	Pass
§15.231(c)	20dB Bandwidth Measurement	19	Shield room	Pass
§15.231(a)(1)	Deactivation Time	20	Shield room	Pass
§15.203	Antenna requirement	--	See Note 2	Pass

Note 1: N/A=Not Applicable. Conducted emission is not apply for battery operated device.

Note 2: The EUT uses a Ceramic Antenna. In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.



7 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID:2BK6HR2130-DC complies with Section 15.207, 15.205, 15.209, 15.231 of the FCC Part 15, Subpart C Rules.

According to client's declaration, for models R2130-DC, R2135-DCM, R2120-DC and R2125-DCM, there is no difference between the electrical schematic diagram and PCB Layout except for the different model name, so model R2135-DCM was chosen to perform all the tests, the other models R2130-DC, R2120-DC and R2125-DCM are deemed to fulfill all the requirement without further testing.

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: September 28, 2024

Testing Start Date: September 29, 2024

Testing End Date: October 22, 2024

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

Reviewed by:

Prepared by:

Tested by:

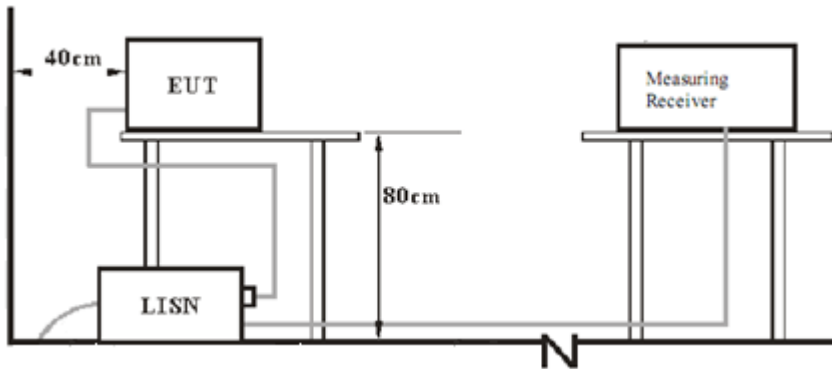
Hui TONG
EMC Section Manager

Yongqing ZHENG
EMC Project Engineer

Tianji XU
EMC Test Engineer

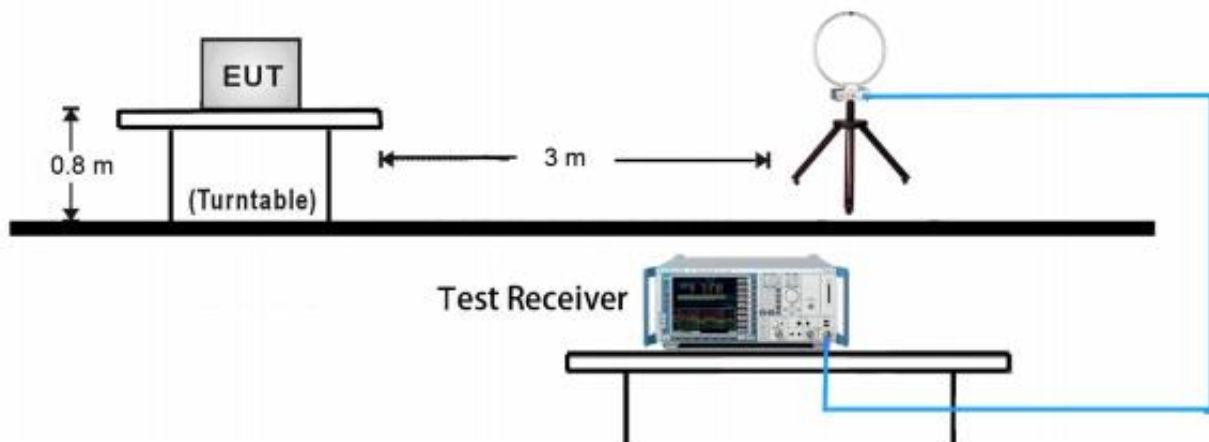
8 Test Setups

8.1 AC Power Line Conducted Emission test setups

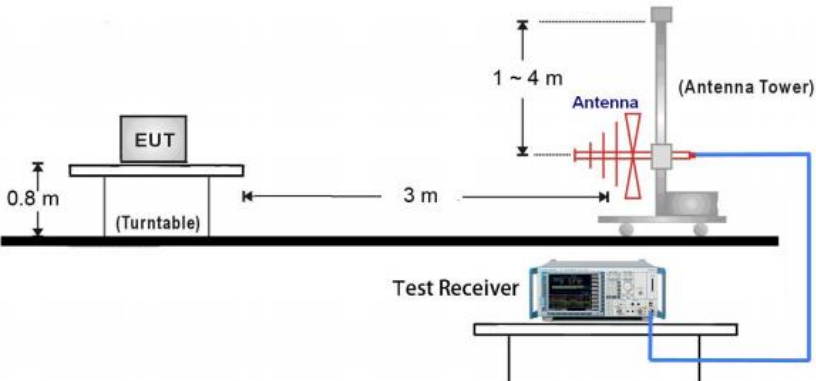


8.2 Radiated test setups

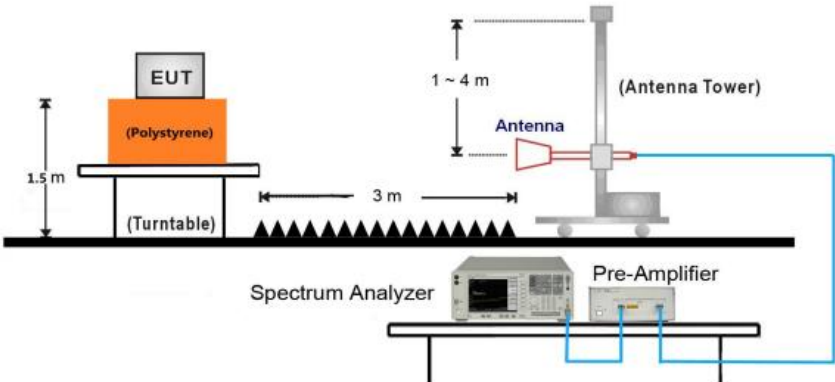
9kHz ~ 30MHz Test Setup:



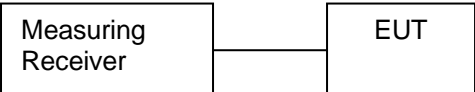
30MHz ~ 1GHz Test Setup:



Above 1GHz Test Setup:



8.3 Conducted RF test setups



9 Test Methodology

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

According to §15.207, conducted emissions limit as below:

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

*Decreasing linearly with logarithm of the frequency.

Conducted Emission Test 0.15MHz – 30MHz

150k-30MHz Conducted Emission Test

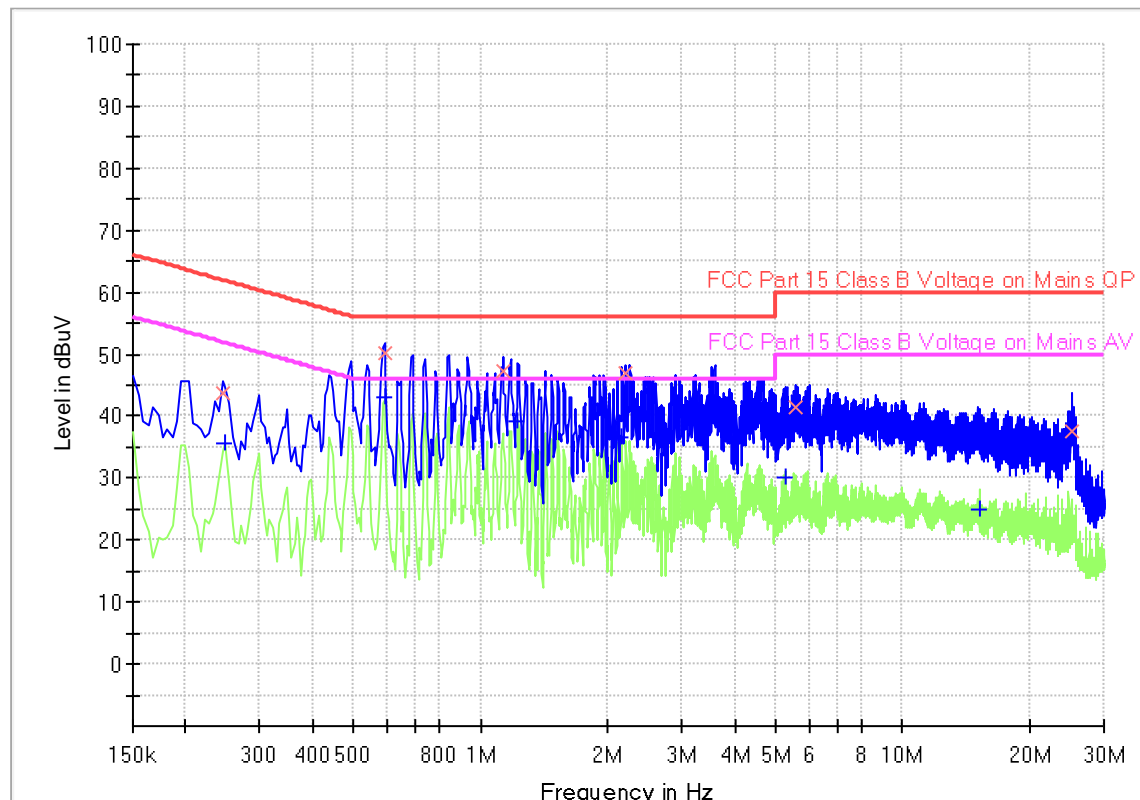
EUT Information

EUT Name: Tubular Motor
 Model: R2135-DCM
 Client: Zhejiang Jiechang Linear Motion Technology Co.,Ltd.
 Op Cond: Power on, Continuous Transmitting
 Operator: Tianji XU
 Test Spec: FCC Part 15.231
 Comment: L
 Sample No: SHA-851865-1

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN
 Receiver: [ESR 3]
 Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB





Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.244500	43.78	---	61.94	18.16	1000.0	9.000	L1	19.4
0.249000	---	35.74	51.79	16.05	1000.0	9.000	L1	19.4
0.591000	---	42.96	46.00	3.04	1000.0	9.000	L1	19.4
0.591000	50.11	---	56.00	5.89	1000.0	9.000	L1	19.4
1.131000	47.24	---	56.00	8.76	1000.0	9.000	L1	19.5
1.225500	---	39.21	46.00	6.79	1000.0	9.000	L1	19.5
2.161500	---	36.56	46.00	9.44	1000.0	9.000	L1	19.5
2.211000	46.88	---	56.00	9.12	1000.0	9.000	L1	19.5
5.302500	---	30.05	50.00	19.95	1000.0	9.000	L1	19.6
5.595000	41.60	---	60.00	18.40	1000.0	9.000	L1	19.6
15.247500	---	25.03	50.00	24.97	1000.0	9.000	L1	20.1
25.309500	37.69	---	60.00	22.31	1000.0	9.000	L1	21.0

150k-30MHz Conducted Emission Test

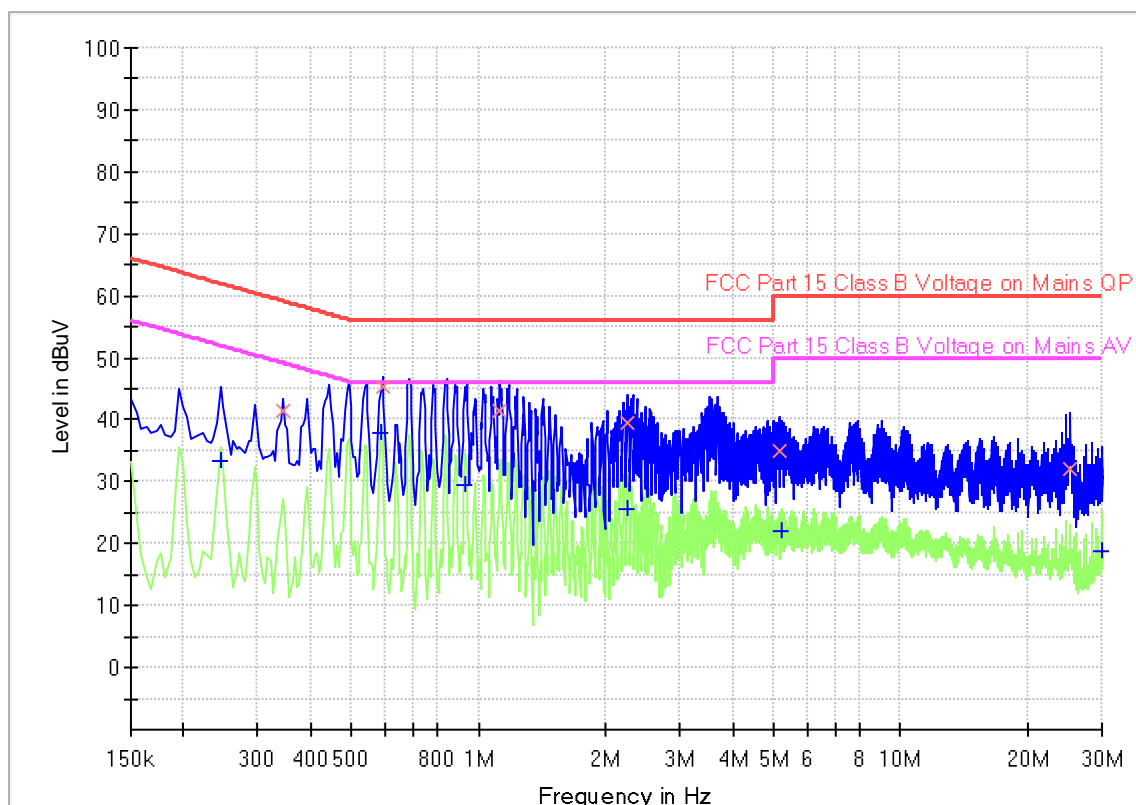
EUT Information

EUT Name: Tubular Motor
 Model: R2135-DCM
 Client: Zhejiang Jiechang Linear Motion Technology Co.,Ltd.
 Op Cond: Power on, Continuous Transmitting
 Operator: Tianji XU
 Test Spec: FCC Part 15.231
 Comment: Vertical
 Sample No: SHA-851865-1

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN
 Receiver: [ESR 3]
 Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB





Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.244500	---	33.45	51.94	18.49	1000.0	9.000	N	19.4
0.343500	41.34	---	59.12	17.78	1000.0	9.000	N	19.5
0.586500	---	37.95	46.00	8.05	1000.0	9.000	N	19.4
0.591000	45.23	---	56.00	10.77	1000.0	9.000	N	19.4
0.928500	---	29.35	46.00	16.65	1000.0	9.000	N	19.5
1.122000	41.44	---	56.00	14.56	1000.0	9.000	N	19.5
2.251500	---	25.70	46.00	20.30	1000.0	9.000	N	19.5
2.260500	39.44	---	56.00	16.56	1000.0	9.000	N	19.5
5.181000	34.89	---	60.00	25.11	1000.0	9.000	N	19.6
5.230500	---	22.08	50.00	27.92	1000.0	9.000	N	19.6
25.233000	32.00	---	60.00	28.00	1000.0	9.000	N	20.6
29.931000	---	18.90	50.00	31.10	1000.0	9.000	N	20.7

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:
 - 9kHz -150kHz
RBW = 200Hz, VBW = 1kHz for peak measurement, Sweep = auto,
Detector function = peak, Trace = max hold.
 - 150kHz - 30MHz
RBW = 10 kHz, VBW = 30 kHz for peak measurement, Sweep = auto,
Detector function = peak, Trace = max hold.
 - 30MHz - 1GHz
RBW = 100 kHz, VBW = 300 kHz for peak measurement, Sweep = auto,
Detector function = peak, Trace = max hold.
 - For Above 1GHz
RBW = 1MHz, VBW \geq 3RBW for peak measurement, Sweep = auto, Detector function = peak,
Trace = max hold.

FCC Limit: In addition to the provisions of § 15.205, the 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 3,750 *	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 interpolation with frequency		

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

(b) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in § 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of § 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(c) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.

Limits for 15.209 Radiated emission limits

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note 1: Limit 3m(dBµV/m)=Limit 300m(dBµV/m)+40Log(300m/3m) (Below 30MHz)

Note 2: Limit 3m(dBµV/m)=Limit 30m(dBµV/m)+40Log(30m/3m) (Below 30MHz)

Note 3: dBµV/m = 20log(µV/m), dBµA/m = 20log(µA/m)



Field strength of Emissions

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.

Antenna polarization	Frequency (MHz)	Duty Cycle Factor(dB)	Corrected Reading (dBuV/m)	Emission Type	Limit (dBuV/m)	Margin	Detector
H	433.956	0	73.71	Fundamental	100.80	27.09	PK
H	433.956	-20.25	53.46	Fundamental	80.80	27.34	AV
H	*1301.765	0	41.45	Harmonics	74.00	32.55	PK
H	*1301.765	-20.25	21.20	Harmonics	54.00	32.80	AV
H	2169.656	0	44.58	Harmonics	80.80	36.22	PK
H	2169.656	-20.25	24.33	Harmonics	60.80	36.47	AV
H	2603.765	0	42.61	Harmonics	80.80	38.19	PK
H	2603.765	-20.25	22.36	Harmonics	60.80	38.44	AV
H	*4339.218	0	48.62	Harmonics	74.00	25.38	PK
H	*4339.218	-20.25	28.37	Harmonics	54.00	25.63	AV
V	433.956	0	64.83	Fundamental	100.80	35.97	PK
V	433.956	-20.25	44.58	Fundamental	80.80	36.22	AV
V	867.837	0	39.17	Harmonics	80.80	41.63	PK
V	867.837	-20.25	18.92	Harmonics	60.80	41.88	AV
V	2169.875	0	51.26	Harmonics	80.80	29.54	PK
V	2169.875	-20.25	31.01	Harmonics	60.80	29.79	AV
V	2603.546	0	52.05	Harmonics	80.80	28.75	PK
V	2603.546	-20.25	31.80	Harmonics	60.80	29.00	AV
V	3037.765	0	44.09	Harmonics	80.80	36.71	PK
V	3037.765	-20.25	23.84	Harmonics	60.80	36.96	AV
V	*4339.656	0	47.36	Harmonics	74.00	26.64	PK
V	*4339.656	-20.25	27.11	Harmonics	54.00	26.89	AV

Remark:

1: AV Emission Level= PK Emission Level+20log (duty cycle)

2: Other than listed in the table are attenuated more than 20dB below the permissible limit of the field strength, therefore no data appear in the report.

3: "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.

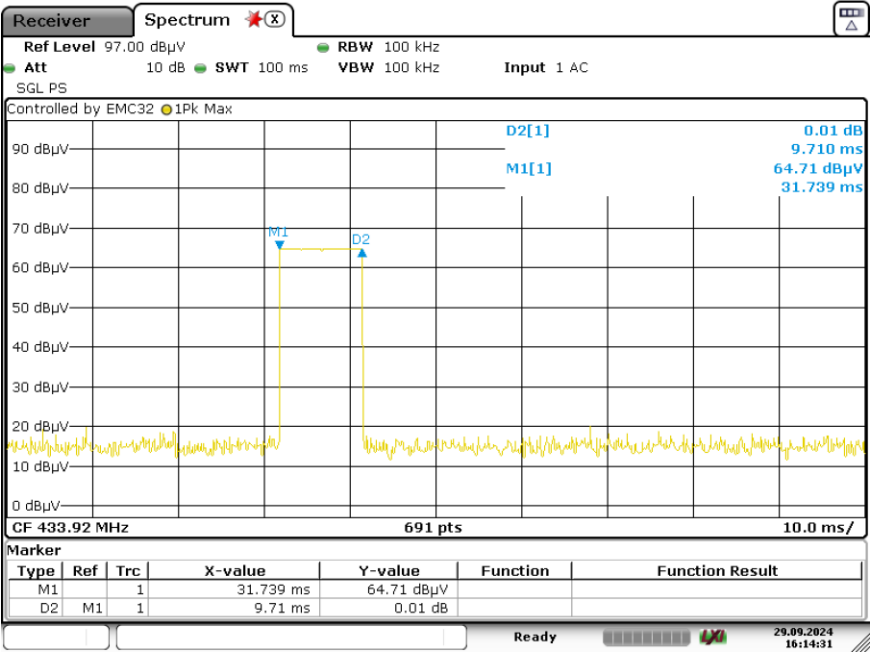
4: Corrected Amplitude = Read level + Corrector factor

Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain

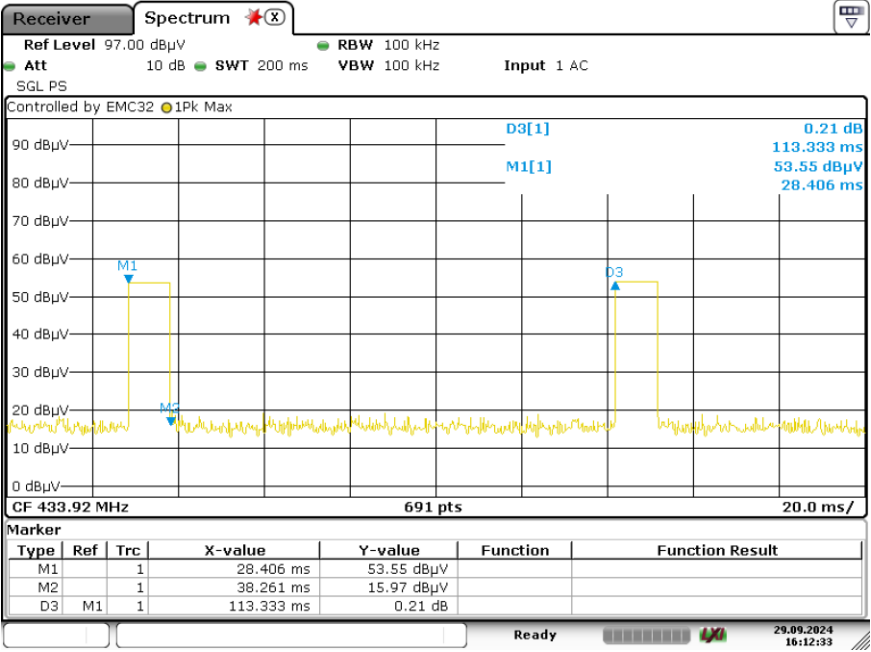
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss



Duty Cycle = 9.71ms/100 ms =9.71%.
Duty Cycle Factor =20log (Duty Cycle) =-20.25.



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9.3 Bandwidth Measurement

Test Method

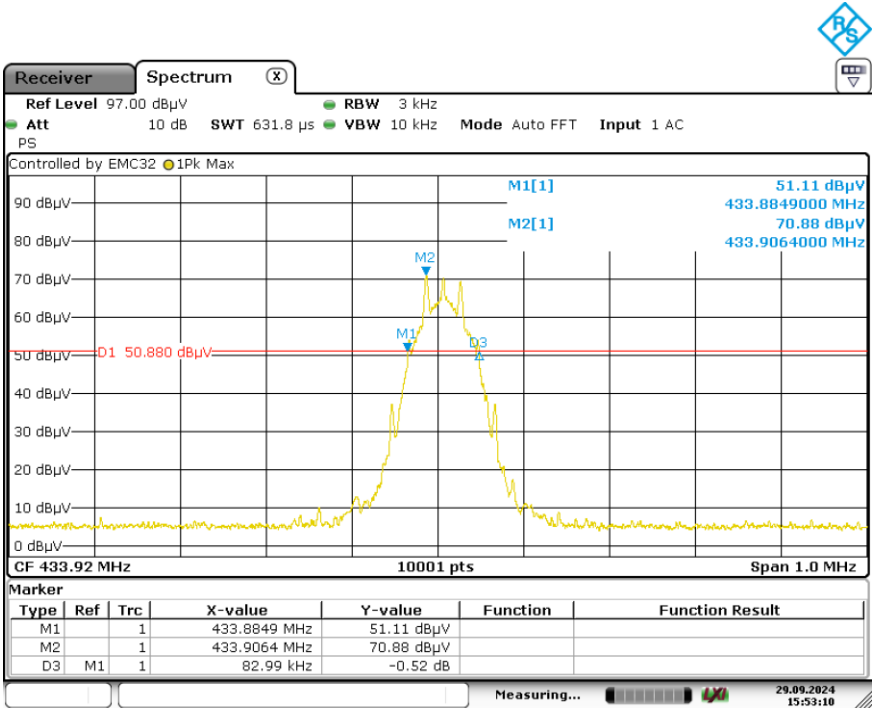
- 1. The EUT was placed on 0.8m height table, the RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously.
Use the following test receiver settings:
RBW = 1% to 5% of the OBW, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth. Record the results.

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 = 1084.8 kHz

Test Result

Channel	20dB Bandwidth (KHz)	Limit (KHz)	Result
1	82.99	≤1084.8	Pass



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9.4 Deactivation Time

Test Method

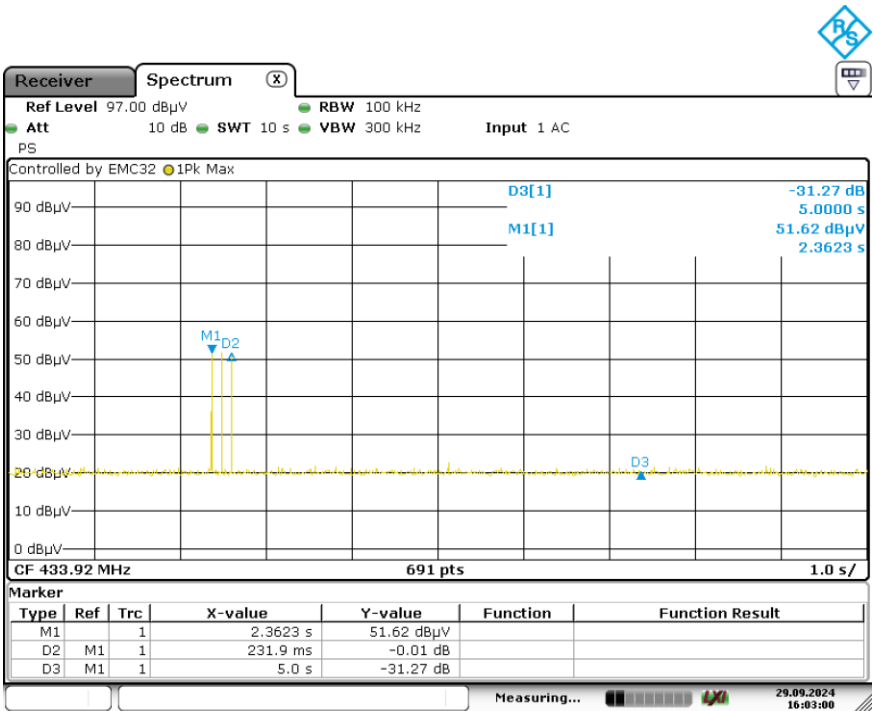
- 1. The EUT was placed on 0.8m height table, the RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT in transmitting mode.
- 3. Set center frequency of spectrum analyzer=operating frequency.
- 4. Set the spectrum analyzer as $RBW \geq OBW$, $VBW \geq RBW$, Span=0Hz, detector=peak.
- 5. Repeat above procedures until all frequency measured was complete.

Limit

According to FCC Part 15.231 (a), the transmitter shall be complied the following requirements:
(√) (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Result

Channel	Frequency	Deactivation Time	Limit	Result
1	433.92MHz	231.9ms	≤5s	Pass



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10 Systems test configuration

Auxiliary Equipment Used during Test:

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



11 Test Equipment List

List of Test Instruments

Test Site1

RF Conductive Test

Description	Manufacturer	Model no.	Serial no.	Calibration Date	Calibration Due
Signal and spectrum analyzer	R&S	FSV40	S1503003-YQ-EMC	2024-8-01	2025-7-31

Conducted Emission

Description	Model no.	Manufacturer	Equipment ID.	Calibration Date	Calibration Due
EMI test receiver	ESR3	R&S	S1503001-YQ-EMC	2024-8-01	2025-7-31
2-Line V-network	ENV216	R & S	S1503103-YQ-EMC	2024-8-01	2025-7-31

Radiated Emission Test

USED	Equipment Name	Model	Manufacturer	Equipment ID.	Calibration Date	Calibration Due
<input checked="" type="checkbox"/>	EMI test receiver	ESR3	R&S	S1503109-YQ-EMC	2024-8-01	2025-7-31
<input checked="" type="checkbox"/>	Trilog super broadband test antenna	SCHWARZBECK	VULB9168	S1808296-YQ-EMC	2024-8-30	2025-8-29
<input checked="" type="checkbox"/>	Double-ridged waveguide horn antenna	HF907	R&S	S1503009-YQ-EMC	2024-4-14	2025-4-13
<input checked="" type="checkbox"/>	Pre-amplifier	HPAP-9K0130	Shenzhen HzEMC	S2110423b-YQ-EMC	2024-8-01	2025-7-31
<input checked="" type="checkbox"/>	Signal and spectrum analyzer	FSV40	R&S	S1503003-YQ-EMC	2024-8-01	2025-7-31
<input checked="" type="checkbox"/>	Loop antenna	HFH2-Z2	R&S	S1503013-YQ-EMC	2024-6-26	2025-6-25

Measurement Software Information

Test Item	Software	Manufacturer	Version
RE	EMC 32	Rohde & Schwarz	V10.50.40
CE	EMC 32	Rohde & Schwarz	V9.15.03



12 System Measurement Uncertainty

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

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, 3.16dB
Radiated Disturbance	9kHz to 30MHz, 3.52dB 30MHz to 1GHz, 5.03dB (Horizontal) 5.11dB (Vertical) 1GHz to 18GHz, 5.15dB (Horizontal) 5.12dB (Vertical)

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2023, clause 4.3.3.



13 Photographs of Test Set-ups

Refer to the < Test Setup photos >.



14 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

THE END