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CHAOZHOU XIN HWELL CERAMIC TECHNOLOGY CO.,LTD

TEST REPORT

SCOPE OF WORK
EMC TESTING–HW01

REPORT NUMBER
240202113GZU-001

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TEST REPORT

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Manufacturing Site	:	Same as applicant
Intertek Report No:		240202113GZU-001
FCC ID:		2BGKV-HWELL

Test standards

FCC PART 15 Subpart C: 2021 section 15.231

Sample Description

Product	:	Remote control
Model No.	:	HW01
Electrical Rating	:	DC4.5V
Serial No.	:	Not Labeled
Date Received	:	02 February 2024
Date Test Conducted	:	29 May 2024-03 June 2024

Prepared and Checked By

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1.0 TEST RESULT SUMMARY

Test Item	Test Requirement	Test Method	Result
Radiated Emission	FCC PART 15 section 15.231(b)	ANSI C 63.10: Clause 6.4, 6.5 and 6.6	PASS
Occupied Bandwidth	FCC PART 15 section 15.231(c)	ANSI C 63.10: Clause 6.9	PASS
Dwell Time	FCC PART 15 section 15.231(a)	FCC PART 15: Section 15.231(a)	PASS
Conducted Emission	FCC PART 15 section 15.207	ANSI C 63.10: Clause 6.2	N/A

Remark:
N/A: not applicable. Refer to the relative section for the details.
EUT: In this whole report EUT means Equipment Under Test.
Tx: In this whole report Tx (or tx) means Transmitter.
Rx: In this whole report Rx (or rx) means Receiver.
RF: In this whole report RF means Radio Frequency.
ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report

TEST REPORT

2.0 General Description

2.1 Product Description

Operating Frequency	315MHz
Type of Modulation:	ASK
Number of Channels	1 Channel
Channel Separation:	N/A
Antenna Type	Integral
Function:	Remote control with 315 MHz as carrier.
Power Supply:	DC 4.5 V

2.2 Related Submittal(s) Grants

This is an application for certification of:
DSC: Part 15 Security/ Remote Control Transmitter

2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans and final tests were performed in the semi-anechoic chamber to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise.

2.4 Test Facility

All tests were performed at:
Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Room102/104, No 203, KeZhu Road, Science City, GETDD Guangzhou, China
Except Conducted Emissions was performed at:
Room101/301/401/102/202/302/402/502/602/702/802, No. 7-2, Caipin Road, Huangpu District, Guangzhou, Guangdong, China

A2LA Certificate Number 0078.10

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Intertek Testing Services Shenzhen Ltd. Guangzhou Branch is accredited by A2LA and Listed in FCC website. FCC accredited test labs may perform both Certification testing under Parts 15 and 18 and Declaration of Conformity testing.

3.0 System Test Configuration

3.1 Justification

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, AC power line was manipulated to produce worst case emissions. It was powered by AC 120V/60Hz supply.
The signal is maximized through rotation. If it's portable product, then place it in the three orthogonal axes to find its maximum emission. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.
For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Frequency range of radiated emission measurements:

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

3.2 EUT Exercising Software

Use remote control button continuous transmission.

3.3 Special Accessories

No special accessories used.

3.4 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	20 dB Bandwidth	2.3%
	6dB Bandwidth	
	99% Bandwidth	
2	Dwell Time	1.2%
3	Radiated Emissions	4.7 dB (25 MHz-1 GHz)
		4.8 dB (1 GHz-18 GHz)
		5.21dB (18GZH-26GHz)
4	Conducted Emissions at Mains Terminals	2.58dB
5	Temperature	0.5 °C
6	Humidity	0.4 %
7	Time	1.2%

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty is calculated in accordance with ETSI TR 100 028-2001.
The measurement uncertainty is given with a confidence of 95%, k=2.

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance – Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value

3.5 Equipment Modification

Any modifications installed previous to testing by CHAOZHOU XIN HWELL CERAMIC TECHNOLOGY CO.,LTD will be incorporated in each production model sold / leased in the United States.

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No modifications were installed by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch.

3.6 Support Equipment List and Description

The client made a continuous transmit sample for test, in actual use the product has duty cycle (detail information can refer to page 14-15).

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4.0 Measurement Results

4.1 Antenna Requirement

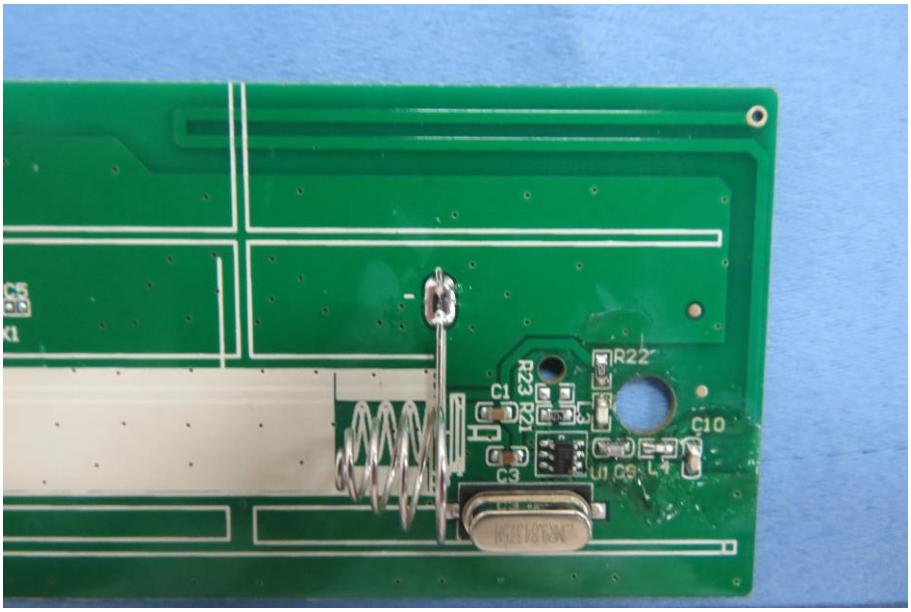
Standard requirement:

15.203 requirement:

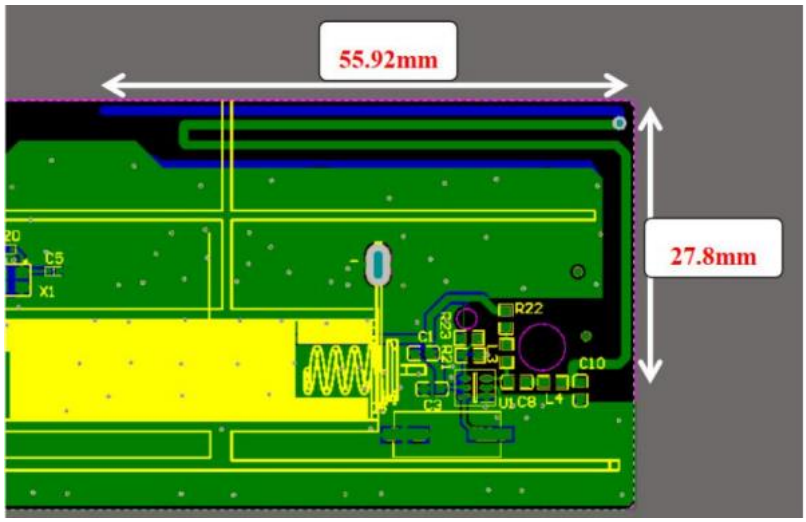
For intentional device. According to 15.203 an intentional radiator shall be designed to Ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT Antenna

The antenna is an integral antenna and no consideration of replacement.



Antenna dimension design



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4.2 Radiated Emissions

Test Requirement:	FCC Part 15 C section 15.231(b)
Test Method:	ANSI C63.10: Clause 6.4, 6.5 and 6.6
Measurement Distance:	3 m (Semi-Anechoic Chamber)
Test Status:	Test the transmitter in continuous transmitting mode.
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Limit:	The field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency MHz	Field Strength of Fundamental (dBµV/m @ 3 m)	Field Strength of Harmonics and Spurious Emissions (dBµV/m @ 3 m)
40.66 to 40.70	67.04	47.04
70 to 130	61.94	41.94
130 to 174	61.94 to 71.48**	41.94 to 51.48**
174 to 260	71.48	51.48
260 to 470	71.48 to 81.94**	51.48 to 61.94**
Above 470	81.94	61.94

** linear interpolations

No fundamental is allowed in the restricted bands.

The fundamental frequency of the EUT is 315MHz

The limit for average field strength for the fundamental emission is 75.6 dBµV/m.

The limit for average field strength for the spurious emission is 55.6 dBuV/m.

Spurious Emissions appear within the restricted bands shall not exceed the limits shown in Section 15.209.

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 limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Field Strength Calculation: The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below:
FS = RA + AF + CF - AG + PD + AV
FS = RA + Correct Factor + AV

FS = Field Strength in dBµV/m

Where:

RA = Receiver Amplitude (including preamplifier) in dBµV
AF = Antenna Factor in dB/m
CF = Cable Attenuation Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in –dB
Correct Factor = AF + CF – AG + PD

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:
FS = RA + AF + CF - AG + PD + AV
Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of dB/m and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m.
RA = 62.0 dBµV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB
Correct Factor = 7.4 + 1.6 – 29.0 + 0 = -20 dB/m
FS = 62 + (-20) + (-10) = 32 dBµV/m

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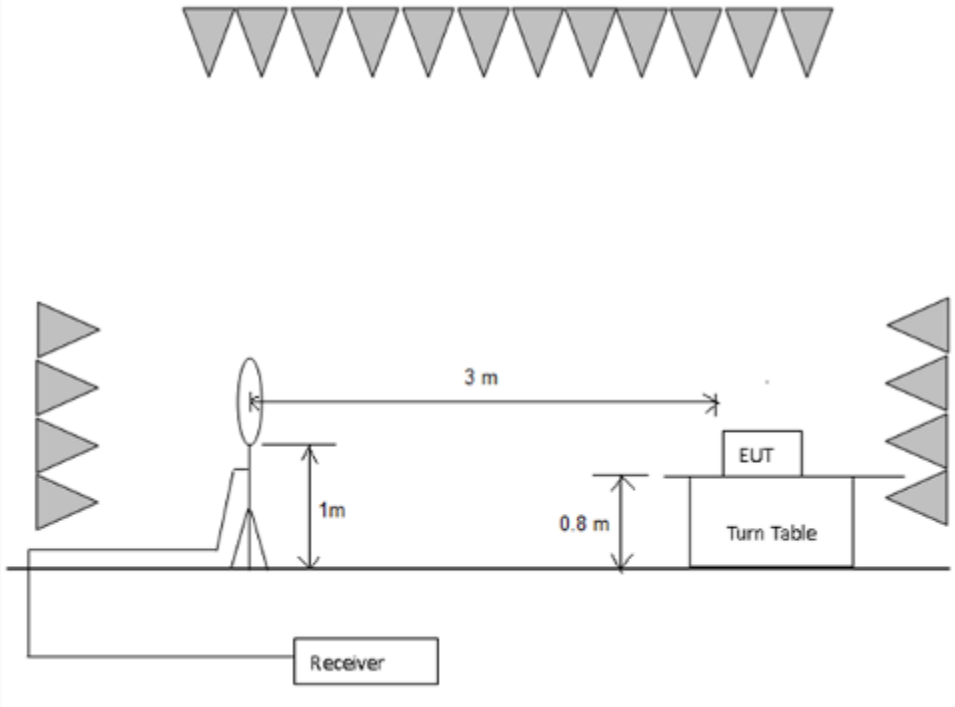
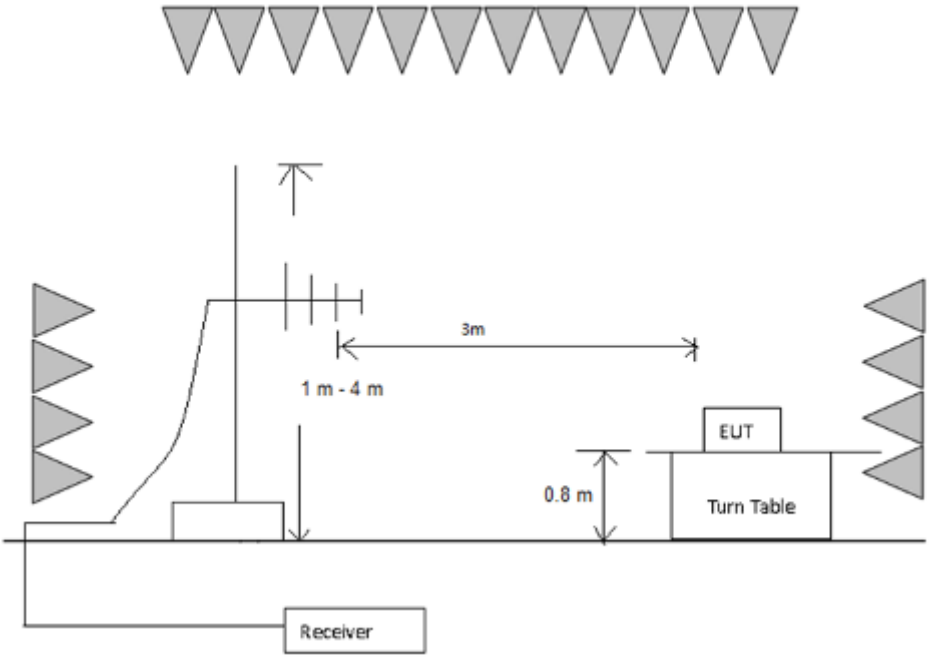
Test Configuration:

1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 40 GHz emissions:

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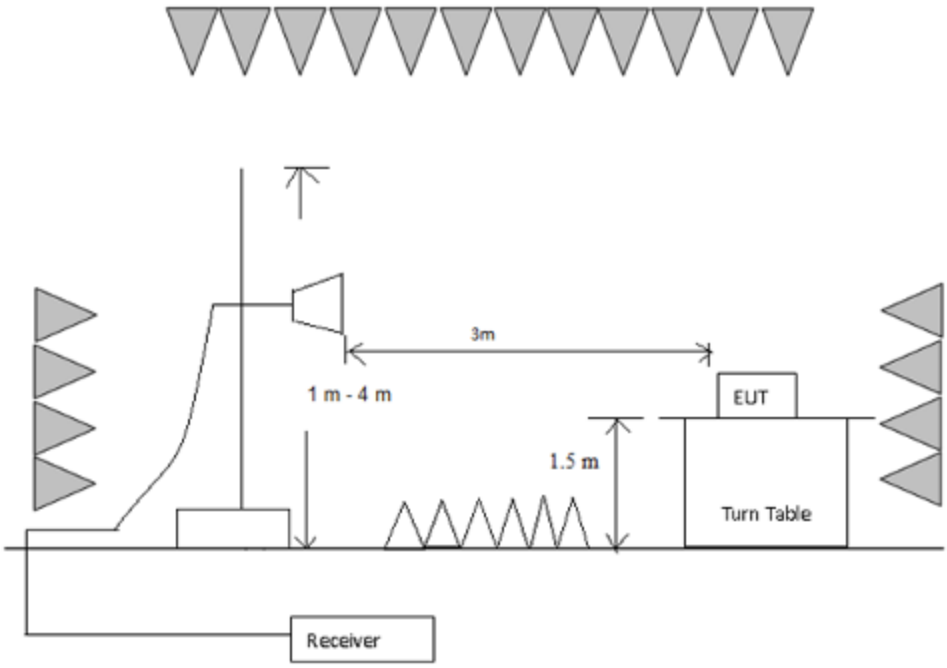

Test Procedure:

1) 9 kHz to 30 MHz emissions:

For testing performed with the loop antenna. The lowest of the loop was positioned 1 m above the ground and positioned with its plane vertical at the special distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.

2) 30 MHz to 1 GHz emissions:

For testing performed with the bi-log type antenna. The measurement is performed with the EUT rotated 360º, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

3) 1 GHz to 40 GHz emissions:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2010 was used to perform radiated emission test above 1 GHz.

For testing performed with the horn antenna. The measurement is performed with the EUT rotated 360º, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

Detector: Resolution bandwidth for Peak and Quasi-Peak value:
200 Hz for 9 kHz to 150 kHz
9 kHz for 150 kHz to 30 MHz
120 kHz for 30 MHz to 1GHz
1 MHz for above 1 GHz,
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For AV value:
Average = Peak value + 20log (Duty cycle)

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The average correction factor is computed by analyzing the on time in one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds, therefore the average value of fundamental frequency is: Average = Peak value + 20log (Duty cycle), where the duty factor is calculated from following formula:

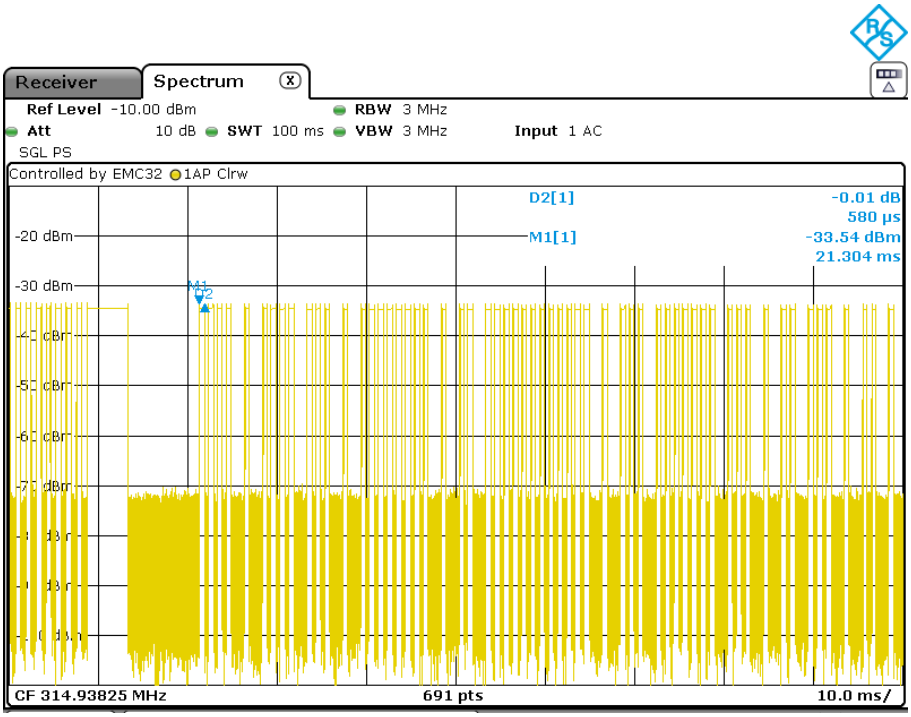
The duration of one cycle =100ms

Effective period of the cycle =(0.58x67+4.638) ms=43.498 ms

DC =43.498/100=0.43498 or 43.498%

Therefore, the averaging factor is found by 20lg0.43498=-7.2

Please refer to below plots for more details.



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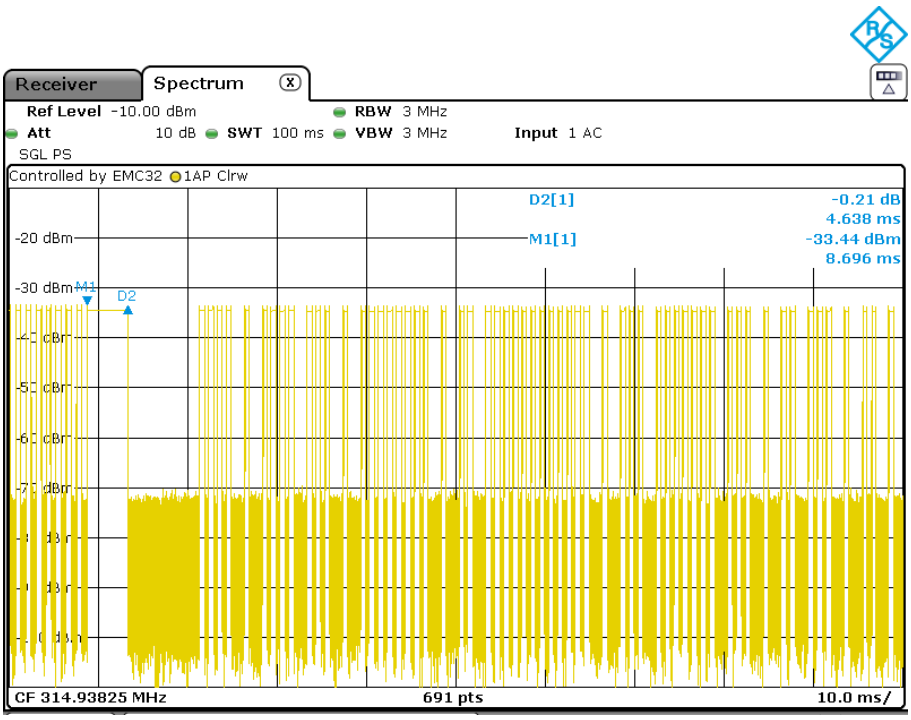

Used Test Equipment List:

3m Semi-Anechoic Chamber, EMI Test Receiver (9 kHz~7 GHz), Signal and Spectrum Analyzer (10 Hz~40 GHz), Loop antenna (9 kHz-30 MHz). TRILOG Super Broadband test Antenna(30 MHz-3 GHz）(RX), Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX) and High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX). Refer to Clause 5 Test Equipment List for details

1) Fundamental emission:

Peak Measurement:

Frequency (MHz)	PK Reading (dBuV)	Correction Factor(dB)	PK value (dBuV/m)	PK limit (dBuV/m)	Antenna polarization
315.0	47.2	21.6	68.8	95.6	V
314.9	55.6	21.6	77.2	95.6	H

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

Average Measurement:

Frequency (MHz)	PK value (dBuV/m)	Average Factor(dB)	AV value (dBuV/m)	AV limit (dBuV/m)	Antenna polarization
315.0	68.8	-7.2	61.6	75.6	V
314.9	77.2	-7.2	70.0	75.6	H

X: EUT as Radiated Emission test setup photograph.
Y: rotate EUT by 90° clockwise.
Z: rotate EUT by 90° vertically.
1. Corr. (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB)
2. Level (dBμV/m) = Corr. (dB/m) + Read Level (dBμV/m)

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3. Margin (dB) = Limit Line (dBµV/m) –Level (dBµV/m)

2) Other emissions:

The receiver was scanned from the lowest frequency generated within the EUT to 5 GHz.

The field strength is calculated by adding the Antenna Factor, Cable Factor & Peramplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor –Peramplifier Factor.

The following test results were performed on the EUT.
If the peak emission level is lower than the average limit, the average emission level does not need to show.

Test the EUT in transmitting mode:

9 kHz~30 MHz Field Strength of Unwanted Emissions. Peak or Quasi-Peak measurement.

The measurements with active loop antenna were greater than 20dB below the limit, so the test data were not recorded in the test report.

30 MHz~5 GHz Field Strength of Unwanted Emissions. Peak or Quasi-Peak measurement:

Peak Measurement:

Frequency (MHz)	PK Reading (dBuV)	Correction Factor(dB)	PK value (dBuV/m)	PK limit (dBuV/m)	Antenna polarization
629.8	26.7	27.9	54.6	75.6	V
944.8	13.1	31.5	44.6	75.6	V
2520.0	64.8	-7.7	57.1	75.6	V
629.8	21.9	27.9	49.8	75.6	H
944.8	20.3	31.5	51.8	75.6	H
2204.4	68.4	-8.8	59.6	74.0	H

Remark: When Peak emission level was below AV limit, the AV emission level did not be recorded.

Average Measurement:

Frequency (MHz)	PK value (dBuV/m)	Average Factor(dB)	AV value (dBuV/m)	AV limit (dBuV/m)	Antenna polarization
629.8	54.6	-7.2	47.4	55.6	V
944.8	44.6	-7.2	37.4	55.6	V
2520.0	57.1	-7.2	49.9	55.6	V
629.8	49.8	-7.2	42.6	55.6	H
944.8	51.8	-7.2	44.6	55.6	H
2204.4	59.6	-7.2	52.4	54.0	H

Remark:
According to 15.35 (b) When average radiated emission measurements are specified in the regulations, including emission measurements below 1000 MHz, there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules, e.g., see Section 15.255.

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4.3 Occupied Bandwidth

Test Requirement:	FCC Part 15 C section 15.231 (c)
Test Method:	ANSI C63.10: Clause 6.9
Test Status:	Test in transmitting mode at lowest and highest channel.
Requirements:	15.231 (c) 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.
Method of measurement:	The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector. Record the 20 dB bandwidth of the carrier.

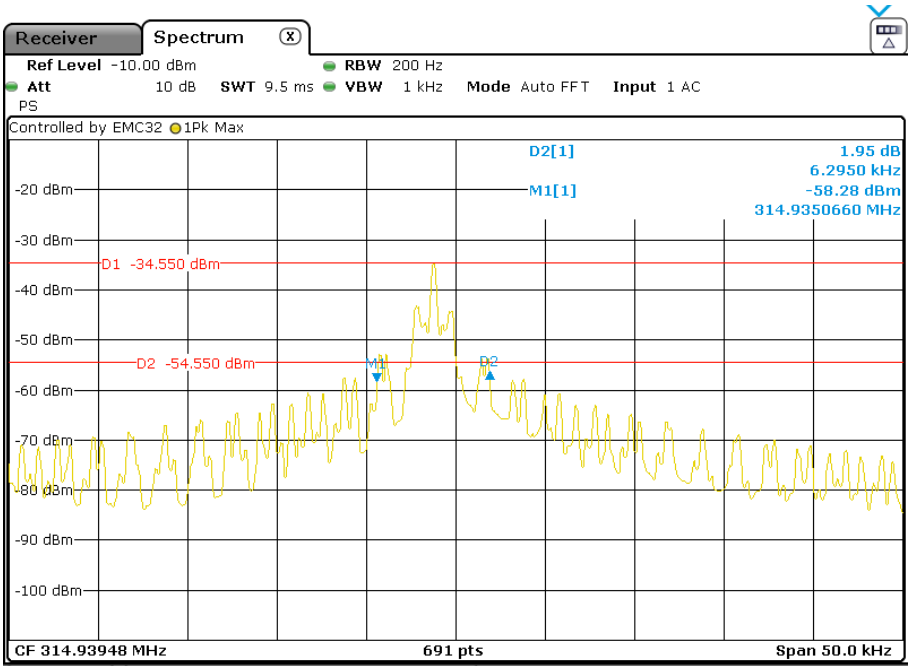
Used Test Equipment List:
Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

Test Result

Test Channel	bandwidth	Limit
314.939 MHz	6.3 kHz	787.3kHz

Remark:
The bandwidth limit is 314.939x 0.0025 = 787.3 kHz.

Test Plot:



4.4 Dwell Time

Test Requirement: FCC Part 15 C section 15.231(a)

Test Method: FCC Part 15 C section 15.231(a)

Test Status: Test in normal operation mode.

Requirements:

1. Regulation 15.231 (a) The provisions of this Section are restricted to periodic operation within the band 40.66 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmissions, such as voice or video, and data transmissions are not permitted. The prohibition against data transmissions does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system.

Result:

The EUT is a remote switch without audio or video transmitted.

The EUT meets the requirements of this section.

2. Regulation 15.231 (a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
Regulation 15.231 (a2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Used Test Equipment List:

Spectrum Analyzer. Refer to Clause 5 Test Equipment List for details.

Result:

Carrier Frequency	Shutdown Time	Limit
314.9MHz	0.334s	≤5s

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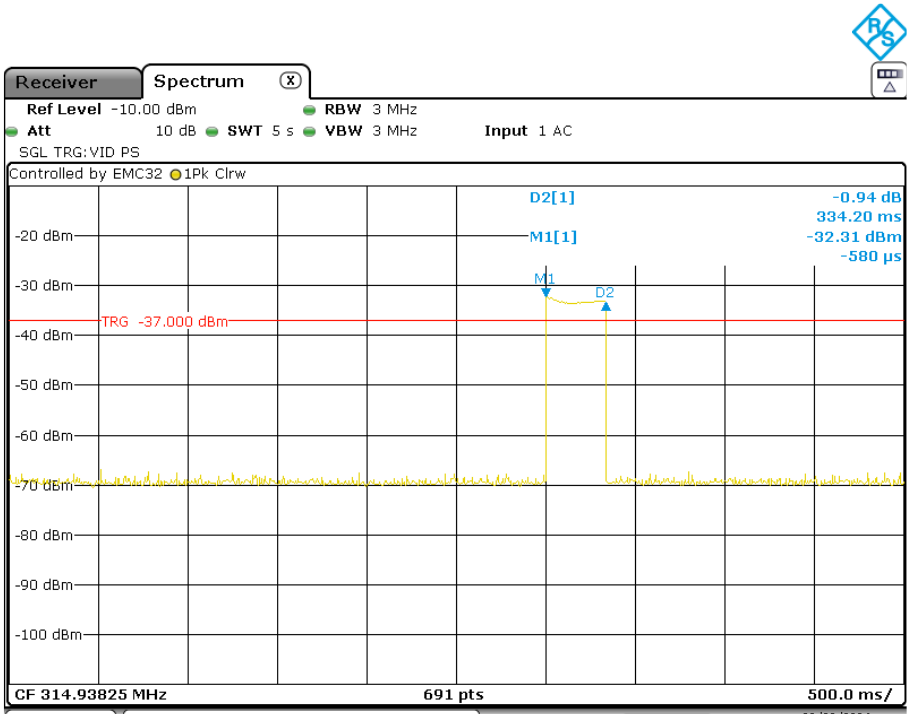
Result Plot:



Result:

The EUT does not have automatic transmission.

4. Regulation15.231 (a3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

Result:

The EUT does not employ periodic transmission.

5. Regulation 15.231 (a4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

Result:

This section is not applicable to the EUT.

4.5 Conducted Emission Test

N/A

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5.0 Test Equipment List

Radiated Emission/Radio					
Equipment No.	Equipment	Model	Manufacturer	Cal. Due date (YYYY-MM-DD)	Calibration Interval
EM030-04	3m Semi-Anechoic Chamber	9×6×6 m^3	ETS• LINDGREN	2025-04-09	1Y
EM031-02	EMI Test Receiver (9 kHz~7 GHz)	R&S ESR7	R&S	2024-11-15	1Y
EM031-03	Signal and Spectrum Analyzer (10 Hz~40 GHz)	R&S FSV40	R&S	2024-11-12	1Y
EM011-04	Loop antenna (9 kHz-30 MHz)	HFH2-Z2	R&S	2024-07-02	1Y
EM033-01	TRILOG Super Broadband test Antenna(30 MHz-3 GHz）(RX)	VULB 9163	SCHWARZBECK	2024-12-05	1Y
EM033-02	Bouble-Ridged Waveguide Horn Antenna (800 MHz-18 GHz)(RX)	R&S HF907	R&S	2024-07-02	1Y
EM033-03	High Frequency Antenna & preamplifier(18 GHz~26.5 GHz) (RX)	R&S SCU-26	R&S	2025-04-22	1Y
EM033-04	High Frequency Antenna & preamplifier (26 GHz-40 GHz)	R&S SCU-40	R&S	2025-04-22	1Y
EM031-02-01	Coaxial cable(9 kHz-1 GHz)	N/A	R&S	2025-04-09	1Y
EM033-02-02	Coaxial cable(1 GHz-18 GHz)	N/A	R&S	2025-04-09	1Y
EM033-04-02	Coaxial cable(18 GHz~40 GHz)	N/A	R&S	2025-04-25	1Y
EM031-01	Signal Generator (9 kHz~6 GHz)	SMB100A	R&S	2025-03-17	1Y
EM040-01	Band Reject/Notch Filter	WRHFV	Wainwright	N/A	1Y
EM040-02	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM040-03	Band Reject/Notch Filter	WRCGV	Wainwright	N/A	1Y
EM022-03	2.45 GHz Filter	BRM50702	Micro-Tronics	2025-05-15	1Y
SA016-29	Climatic Test Chamber	MHU-80L	JIANQIAO	2025-01-03	1Y
EM046-05	Power meter	NPR6A	R&S	2025-04-22	1Y
EM046-06	Power meter	NPR6A	R&S	2025-05-09	1Y
EM045-01-01	EMC32 software (RE/RS)	V10.01.00	R&S	N/A	N/A

**********End of the test report**********