



Certificate No.: 3745.01



FCC TEST REPORT

Report Number : **709502310219-00D** Date of Issue: March 07, 2024

Model : SC162-WCD3

Product Type : Smart Battery Doorbell

Applicant : Zhejiang Lingzhu Technology Co., Ltd

Address : Room 302, No 1 Building Huace Center, Xihu District, Hangzhou
City, Zhejiang Province, China

Manufacturer : Zhejiang Lingzhu Technology Co., Ltd

Address : Room 302, No 1 Building Huace Center, Xihu District, Hangzhou
City, Zhejiang Province, China

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

Total pages including Appendices : 24



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1 Table of Contents

1	Table of Contents	2
2	Report Modification Record	3
3	Details about the Test Laboratory	3
4	Description of the Equipment Under Test.....	4
5	Summary of Test Standards	6
6	Summary of Test Results.....	7
7	General Remarks.....	8
8	Systems test configuration.....	9
9	Test Setups.....	10
10	Test Methodology	12
10.1	Conducted Emission	12
10.2	Radiated Emission.....	17
10.3	Bandwidth Measurement.....	21
10.4	Deactivation Time.....	22
11	Test Equipment List.....	23
12	System Measurement Uncertainty	24



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
-00D	First Issue	03/07/2024

3 Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
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P.R. China

Telephone: +86 21 6141 0123

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FCC Registration No.: 820234

FCC Designation Number: CN1183

ISED CAB identifier: CN0101

IC Registration No.: 31668



4 Description of the Equipment Under Test

Product: Smart Battery Doorbell
 Model no.: SC162-WCD3
 FCC ID: 2BEWXSC162
 Options and accessories: NA
 Rating: 5V DC by lithium-ion battery, AC 8-24V or 5V Input (type C)

RF Transmission Frequency: 802.11b/g/n-HT20: 2412~2462 MHz (Wi-Fi)
 802.11n-HT40: 2422~2452 MHz (Wi-Fi)
 2402~2480 MHz (BLE5.0)
 433.92MHz (SRD)

No. of Operated Channel:

802.11b/g/n(HT20)					802.11n(HT40)		
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
1	2412	7	2442	3	2422	8	2447MHz
2	2417	8	2447	4	2427	9	2452MHz
3	2422	9	2452	5	2432		
4	2427	10	2457	6	2437		
5	2432	11	2462	7	2442		
6	2437						

Bluetooth Low Energy							
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480



Modulation: Direct Sequence Spread Spectrum (DSSS) for 802.11b
Orthogonal Frequency Division Multiplexing (OFDM) for
802.11g/n;
2.4GHz BLE: GFSK (1Mbps and 2Mbps)
433.92MHz: ASK

Hardware Version: V1.0.2

Software Version: V2

Antenna Type: FPC Antenna for 2.4GHz
Spring antenna for 433.92MHz

Antenna Gain: 0.45dBi for 2.4GHz; -2.01dBi for 433.92MHz

Description of the EUT: The EUT was a Smart Battery Doorbell which has Wi-Fi and BLE function, it also can transmit at 433.92MHz. We tested it and listed the worst data in this report. This report is only for 433.92MHz.

Test sample no.: SHA-781837-2 (RF Radiated and Conducted)



5 Summary of Test Standards

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

All the test methods were according to ANSI C63.10-2013.

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	11-15	Shield room	Pass
§15.205, §15.209, 15.35 (c)§15.231(b)	Radiated Emission, 30MHz to 4.5GHz	16-19	3m chamber	Pass
§15.231(c)	Bandwidth Measurement	20	Shield room	Pass
§15.231(a)(1)	Deactivation Time	21	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 FPC antenna, gain is 0.45dBi for 2.4GHz and spring antenna, gain is -2.01dBi for 433.92MHz. 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: 2BEWXSC162, complies with Section 15.207, 15.205, 15.209, 15.231 of the FCC Part 15, Subpart C Rules.

This report in only for 433.92MHz.

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: January 5, 2024

Testing Start Date: January 8, 2024

Testing End Date: March 5, 2024

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

Reviewed by:

Prepared by:

Tested by:



Hui TONG
EMC Section Manager

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EMC Project Engineer

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EMC Test Engineer

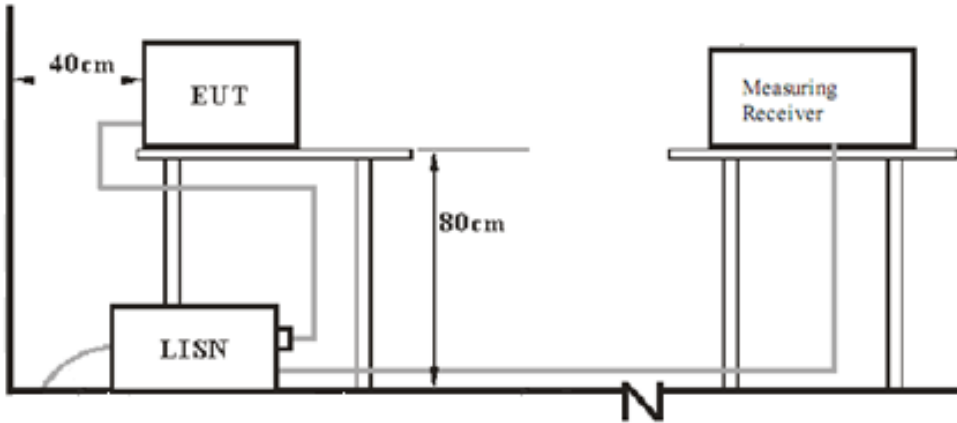
8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
AC/DC adapter	MLF	MLF-A260502000UU	--
AC/AC adapter	Mu Tang	MT48-0025	--

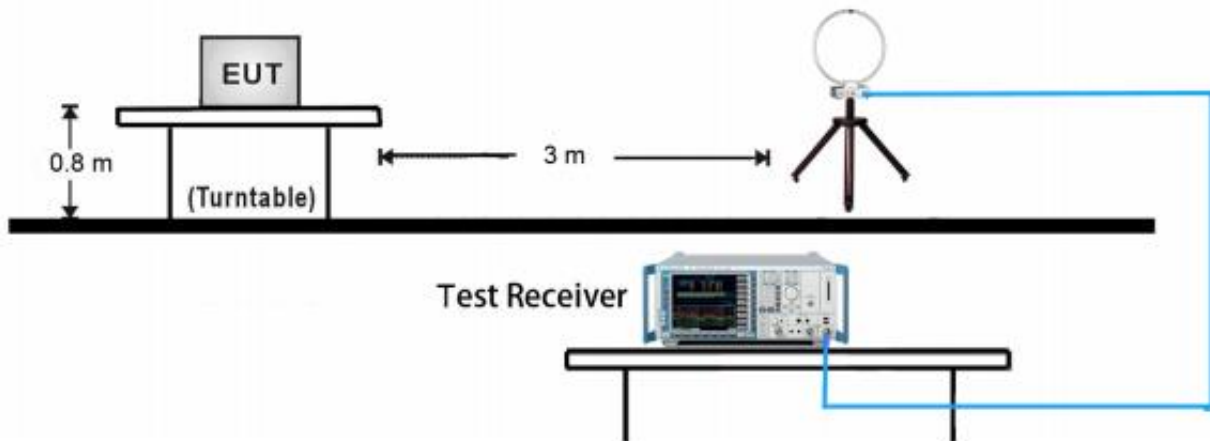
9 Test Setups

8.1 AC Power Line Conducted Emission test setups

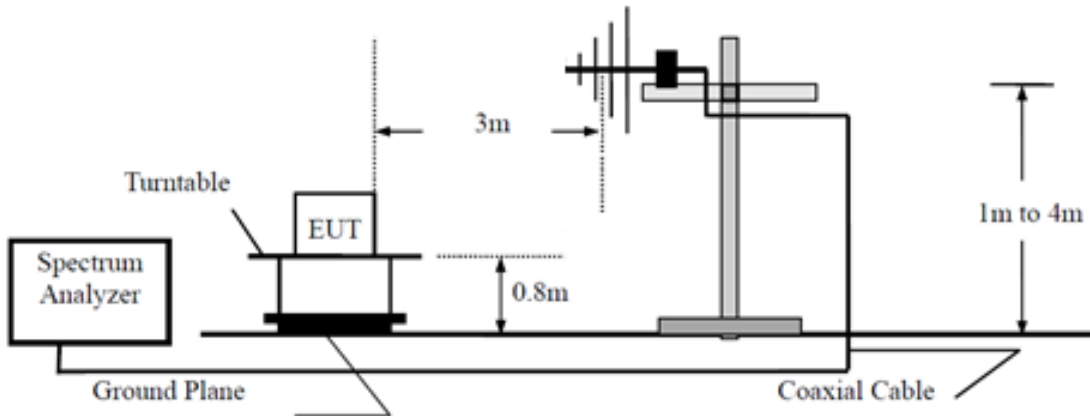


8.2 Radiated test setups

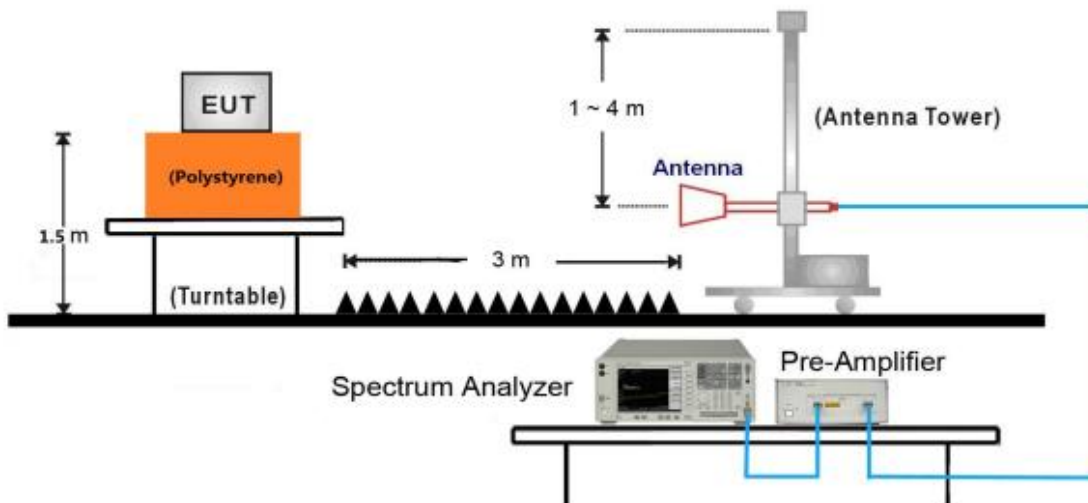
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test- Setup



1GHz ~ 18GHz Test Setup:



10 Test Methodology

10.1 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

Decreasing linearly with logarithm of the frequency

Conducted Emission

150k-30MHz Conducted Emission Test

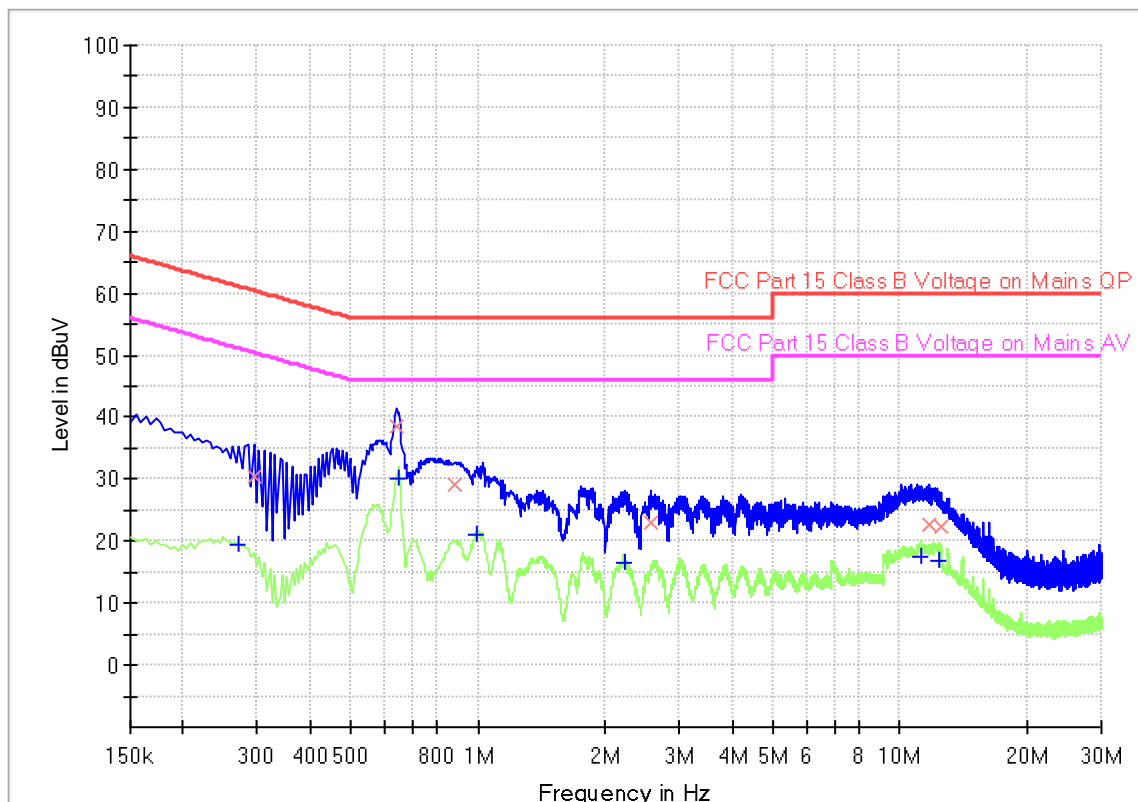
EUT Information

EUT Name: Doorbell Camera
 Model: SC162-WCD3
 Client: Zhejiang Lingzhu Technology Co., Ltd
 Op Cond: Power on with adaptor, 433.92MHz transmitted, AC 120V/60Hz, T21.5, H55.6%, P102.8kPa
 Operator: Huali CHENG
 Standard: FCC Part 15.207(a)
 Comment: Phase L
 Sample No.: SHA-781837-1

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)
0.271500	---	19.29	51.07	31.78	1000.0	9.000	L1	19.5
0.294000	30.46	---	60.41	29.95	1000.0	9.000	L1	19.5
0.640500	38.67	---	56.00	17.33	1000.0	9.000	L1	19.5
0.649500	---	30.19	46.00	15.81	1000.0	9.000	L1	19.5
0.883500	29.25	---	56.00	26.75	1000.0	9.000	L1	19.5
0.996000	---	21.15	46.00	24.85	1000.0	9.000	L1	19.5
2.220000	---	16.64	46.00	29.36	1000.0	9.000	L1	19.5
2.566500	22.93	---	56.00	33.07	1000.0	9.000	L1	19.5
11.220000	---	17.47	50.00	32.53	1000.0	9.000	L1	19.9
11.724000	22.69	---	60.00	37.31	1000.0	9.000	L1	19.9
12.412500	---	16.87	50.00	33.13	1000.0	9.000	L1	19.9
12.462000	22.29	---	60.00	37.71	1000.0	9.000	L1	19.9

150k-30MHz Conducted Emission Test

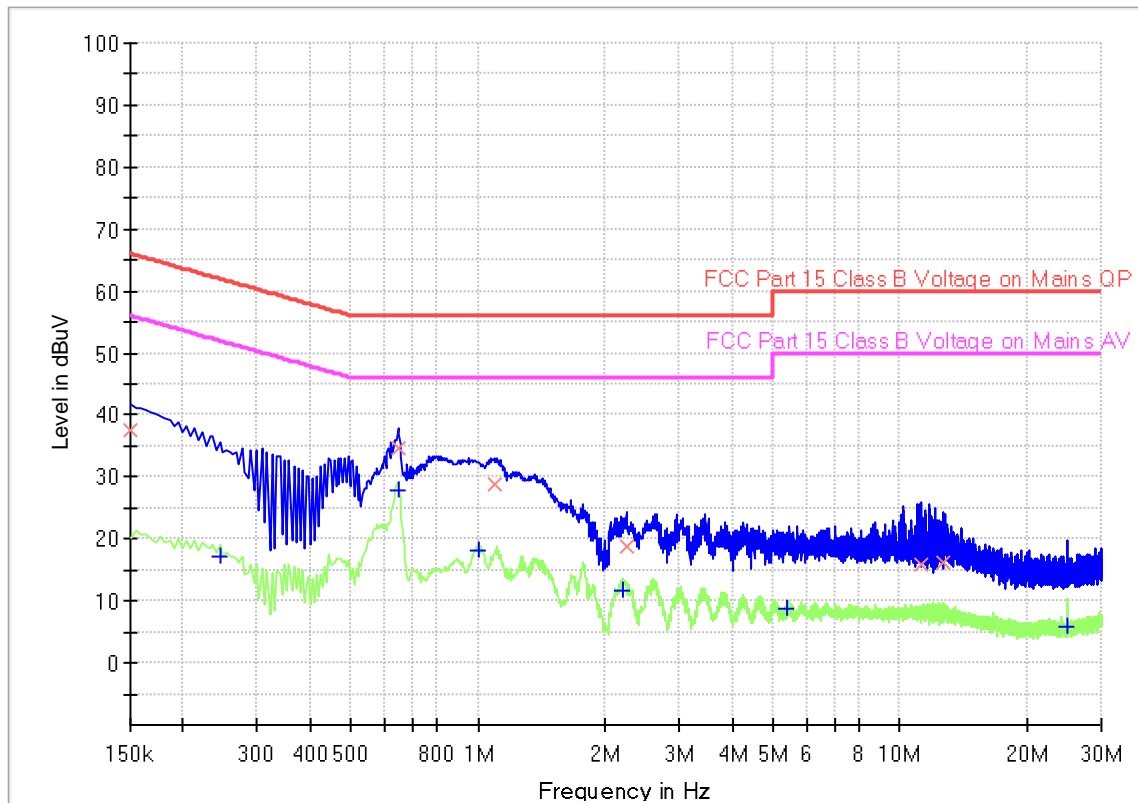
EUT Information

EUT Name: Doorbell Camera
 Model: SC162-WCD3
 Client: Zhejiang Lingzhu Technology Co., Ltd
 Op Cond: Power on with adaptor, 433.92MHz transmitted, AC 120V/60Hz, T21.5, H55.6%, P102.8kPa
 Operator: Huali CHENG
 Standard: FCC Part 15.207(a)
 Comment: Phase N
 Sample No.: SHA-781837-1

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)
0.150000	37.44	---	66.00	28.56	1000.0	9.000	N	19.4
0.244500	---	17.20	51.94	34.74	1000.0	9.000	N	19.4
0.645000	---	27.87	46.00	18.13	1000.0	9.000	N	19.4
0.645000	34.79	---	56.00	21.21	1000.0	9.000	N	19.4
1.000500	---	18.07	46.00	27.93	1000.0	9.000	N	19.5
1.090500	28.87	---	56.00	27.13	1000.0	9.000	N	19.5
2.206500	---	11.74	46.00	34.26	1000.0	9.000	N	19.5
2.242500	18.67	---	56.00	37.33	1000.0	9.000	N	19.5
5.424000	---	8.61	50.00	41.39	1000.0	9.000	N	19.6
11.229000	15.76	---	60.00	44.24	1000.0	9.000	N	19.7
12.642000	16.32	---	60.00	43.68	1000.0	9.000	N	19.8
24.999000	---	5.91	50.00	44.09	1000.0	9.000	N	20.6

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
 Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

Note 2: This test mode (USB input 5V) is worse than AC power on mode, therefore no data about AC power on mode appeared in the report.

10.2 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 Above 1GHz
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW \geq 3RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.
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, VBW \geq 3RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (duty cycle \geq 98%) for peak detection at frequency above 1GHz
4. If the emission is pulsed (duty cycle $<$ 98%), modify the unit for continuous operation: use the settings shown above, then correct the reading by subtracting the peak to average duty cycle correction factor $20\log(\text{duty cycle})$, derived from the appropriate duty cycle calculation.

Limit

According to §15.231 (b), 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 3,370 *	125 to 3750 *
174-260	3,750	375
260-470 √	3,750 to 12, 500*	375 to 1,250*
Above 470	12,500	1,250

Limits for 15.209 Radiated emission limits; general requirements

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

Frequency	Limit at 3m (dBuV/m)
0.009 MHz – 0.490 MHz	128.5 to 93.8 ¹
0.490 MHz – 1.705 MHz	73.8 to 63 ¹
1.705 MHz – 30 MHz	69.5 ¹
30 MHz – 88 MHz	40.0 ¹
88 MHz – 216 MHz	43.5 ¹
216 MHz – 960 MHz	46.0 ¹
Above 960 MHz	54.0 ¹
Above 1000 MHz	54.0 ²
Above 1000 MHz	74.0 ³

¹Limit is with detector with bandwidths as defined in CISPR-16-1-1 except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz where an Average detector is used.

²Limit is with 1 MHz measurement bandwidth and using an Average detector

³Limit is with 1 MHz measurement bandwidth and using a Peak detector

Spurious radiated emissions for transmitter

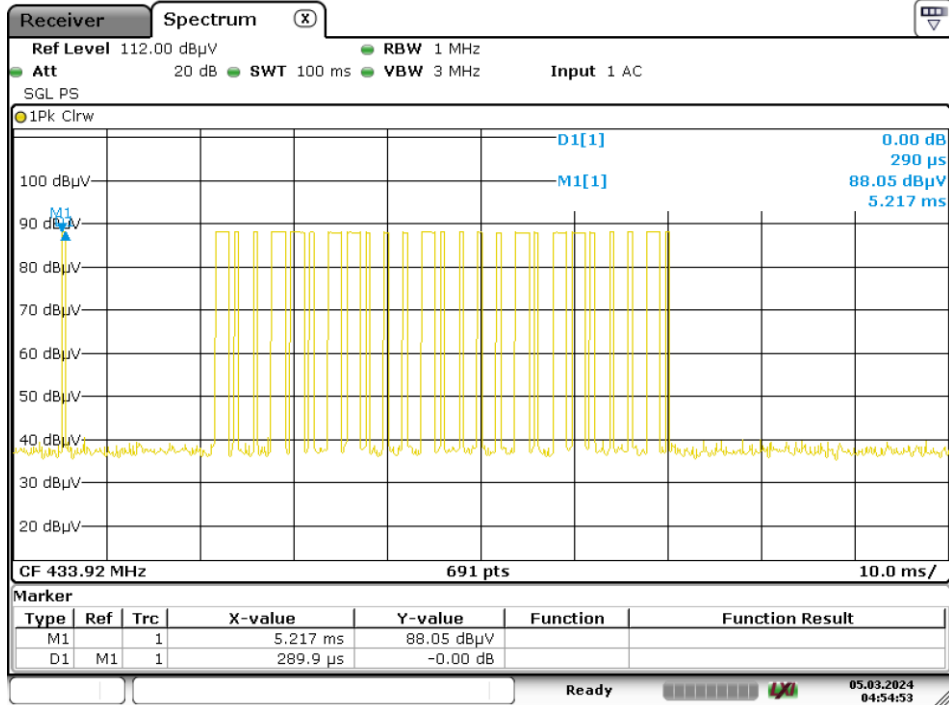
Radiated Emission								
Value	Emissions	E-Field	PK	Average	AV	Limit		Emission Type
	Frequency	Polarity	Emission	Factor	Emission		Margin	
	MHz		dB μ V/m	dB	dB μ V/m	dB μ V/m	dB	
Below 1GHz								
PK	433.91	H	89.51	0.00	/	100.80	11.29	Fundamental
AV	433.91	H	89.51	-14.36	75.15	80.80	5.65	Fundamental
PK	433.91	V	90.45	0.00	/	100.80	10.35	Fundamental
AV	433.91	V	90.45	-14.36	76.09	80.80	4.71	Fundamental
PK	867.84	H	39.12	0.00	/	80.80	41.68	Spurious
AV	867.84	H	39.12	-14.36	24.76	60.80	36.04	Spurious
PK	867.78	V	38.22	0.00	/	80.80	42.58	Spurious
AV	867.78	V	38.22	-14.36	23.86	60.80	36.94	Spurious
Above 1GHz								
PK	1301.81	H	40.50	0.00	/	74.00	33.50	Restricted band
AV	1301.81	H	40.50	-14.36	26.14	54.00	27.86	Restricted band
PK	3037.58	H	52.67	0.00	/	80.80	28.13	Spurious
AV	3037.58	H	52.67	-14.36	38.31	60.80	22.49	Spurious
PK	1301.93	V	45.04	0.00	/	74.00	28.96	Restricted band
AV	1301.93	V	45.04	-14.36	30.68	54.00	23.32	Restricted band
PK	3037.70	V	47.61	0.00	/	80.80	33.19	Spurious
AV	3037.70	V	47.61	-14.36	33.25	60.80	27.55	Spurious

Remark:

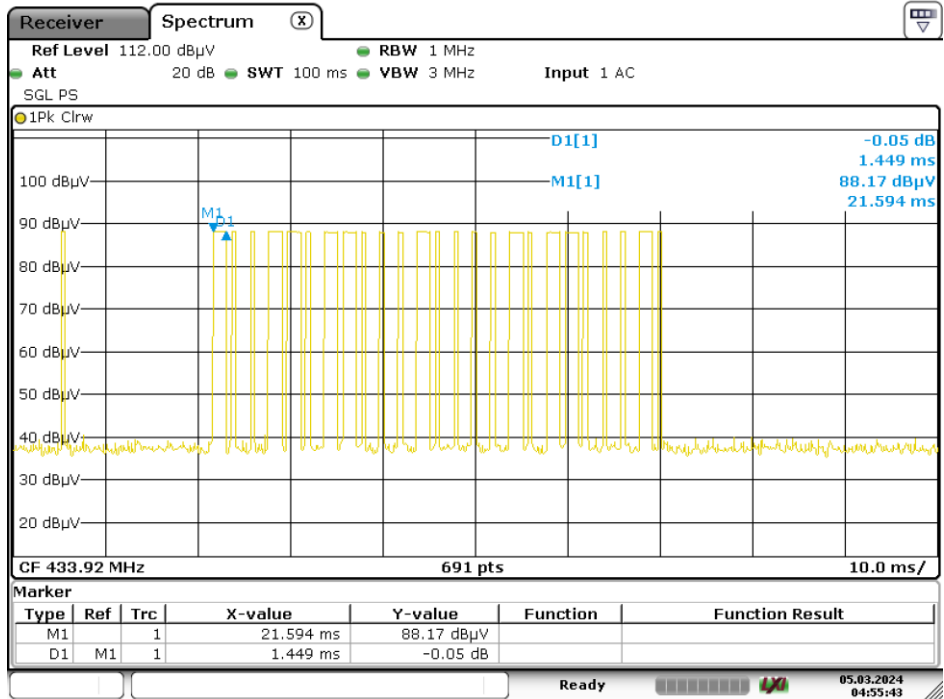
- Corrected Amplitude = Read level + Corrector factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss - Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
- Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz)
- Corrected Reading = Original Receiver Reading + Correct Factor
- Only the worst data listed in this report, Other frequency was 20dB below the limit
- Pre-scan all test modes (different power on modes) and only the worst case listed as above.
- AV Emission Level= PK Emission Level+20log(dutycycle),
Duty Cycle = (0.29*16+1.449*10)ms/100ms =19.13%,
Duty Cycle Factor =20log (Duty Cycle) =-14.36



Duty Cycle



Date: 5.MAR.2024 04:54:53



Date: 5.MAR.2024 04:55:43

10.3 Bandwidth Measurement

Test Method

1. Set to the maximum power setting and enable the EUT transmit continuously.
2. Use the following test receiver settings:
Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel
RBW =1% to 5% of the 20dB bandwidth of the emission being measured, VBW≥RBW,
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.
4. Repeat above procedures until all frequencies measured were complete.

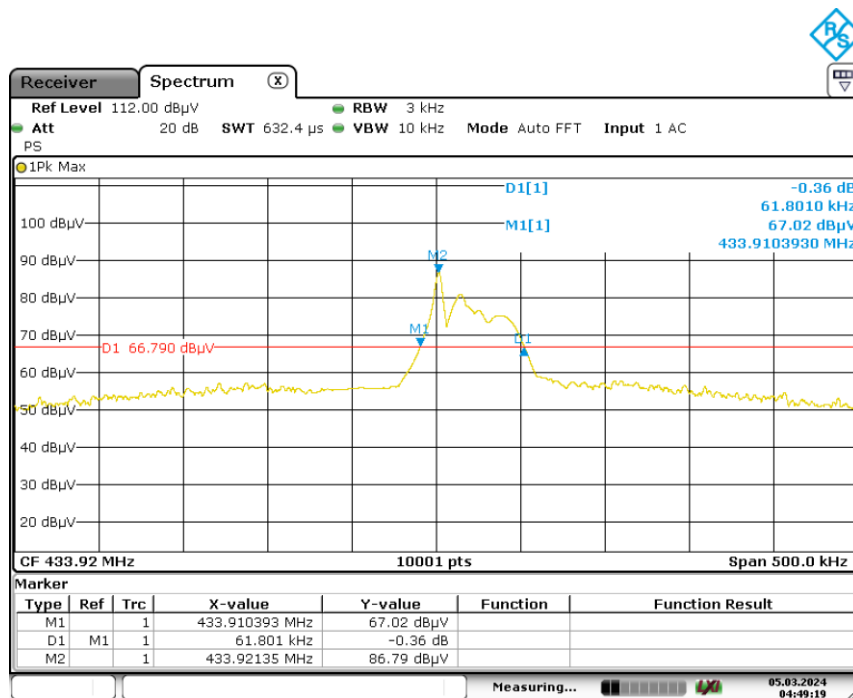
Limit

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% * 433.91 MHz = 1084 kHz

Test Result

Channel	20dB Bandwidth (KHz)	Limit (KHz)
1	61.801	1084



Date: 5.MAR.2024 04:49:19



10.4 Deactivation Time

Test Method

1. Set to the maximum power setting and enable the EUT 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), the transmitter shall be complied the following requirements:

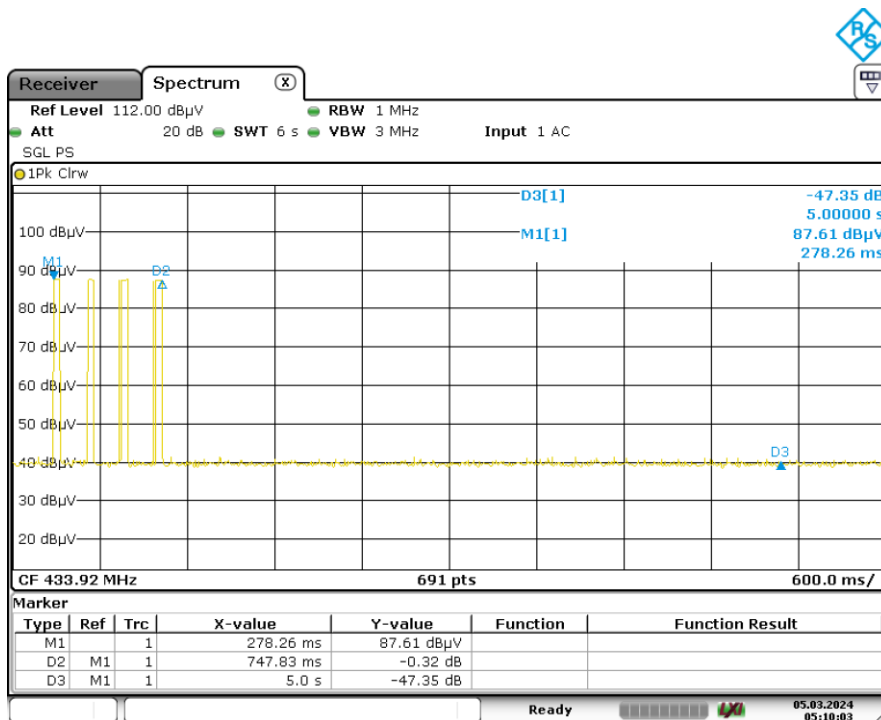
(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

Test Result

Channel	Frequency	Deactivation Time	Result
1	433.92MHz	747.83ms	Pass



Date: 5.MAR.2024 05:10:03

11 Test Equipment List

List of Test Instruments

RF Test

Description	Manufacturer	Model no.	Serial no.	Calibration Date	Calibration Due
Signal and spectrum analyzer	R&S	FSV40	S1503003-YQ-EMC	2023-8-01	2024-7-31

Conducted Emission

Description	Model no.	Manufacturer	Equipment ID.	Calibration Date	Calibration Due
EMI test receiver	ESR3	R&S	S1503001-YQ-EMC	2023-8-01	2024-7-31
2-Line V-network	ENV216	R & S	S1503103-YQ-EMC	2023-8-01	2024-7-31

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	2023-8-01	2024-7-31
<input checked="" type="checkbox"/>	Trilog super broadband test antenna	SCHWARZBE CK	VULB9168	S1808296-YQ-EMC	2021-9-23	2024-9-22
<input checked="" type="checkbox"/>	Double-ridged waveguide horn antenna	HF907	R&S	S1503009-YQ-EMC	2021-4-13	2024-4-12
<input checked="" type="checkbox"/>	Signal conditioning unit	SCU-18D	R&S	S1503012-YQ-EMC	2023-8-01	2024-7-31
<input checked="" type="checkbox"/>	Signal and spectrum analyzer	FSV40	R&S	S1503003-YQ-EMC	2023-8-01	2024-7-31
<input checked="" type="checkbox"/>	Loop antenna	HFH2-Z2	R&S	S1503013-YQ-EMC	2023-6-15	2024-6-14

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	9kHz to 30MHz, 3.16dB (AMN)
Radiated Disturbance	9kHz to 30MHz, 3.52dB
	30MHz to 1GHz, 5.03dB (Horizontal) 5.12dB (Vertical)
	1GHz to 18GHz, 5.49dB
	18GHz to 40GHz, 5.63dB

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.

-----End of Test Report-----