

**FCC/ISED – TEST REPORT**Report Number : **709502301261-00A** Date of Issue: January 25, 2024Model : RE500Product Type : Smart ControllerApplicant : Qingdao RONCO Mechanic Electronic Technology Co., Ltd.Address : No.43 Yanqing Rd, Huanxiu Sub-District, Jimo District Qingdao, Shandong, ChinaProduction Facility : Qingdao RONCO Mechanic Electronic Technology Co., Ltd.Address : No.43 Yanqing Rd, Huanxiu Sub-District, Jimo District Qingdao, Shandong, ChinaTest Result : ☒ **Positive** ☐ **Negative**Total pages including
Appendices : 26

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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. Shanghai Branch
No.16 Lane, 1951 Du Hui Road,
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P.R. China

FCC Registration Number: 820234
Designation Number: CN1183
IC Company Number: 31668
CAB identifier: CN0101
Telephone: +86 21 6141 0123
Fax: +86 21 6140 8600

3 Description of the Equipment Under Test

Product:	Smart Controller
Model no./HVIN:	RE500
FCC ID:	2A3UM-RE500
IC:	30162-RE500
Rating:	DC 5V/1A by USB charge input
RF Transmission Frequency:	433.92MHz
Modulation:	OOK
Antenna Type:	Spring antenna
Antenna Gain:	2.0 dBi max (Declared by manufacturer)
Description of the EUT:	The Equipment Under Test (EUT) is a transmitter operated at 433.92MHz.
Test sample no.:	SHA-714353-2
Contains Wi-Fi & BT Transmitter module:	FCC ID: 2ANDL-CBU approve date: 2020.12.31 IC: 23243-CBU approve date: 2021-08-06

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.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 Amendment 2 February 2021	General Requirements for the Certification of Radio Apparatus
RSS-210 Issue 10 December 2019	RSS-210 — Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

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

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	10-14	Shield room	Pass
§15.205, §15.209, 15.35 (c)§15.231(b), RSS-210 A.1.2	Radiated Emission, 30MHz to 4.5GHz	15-19	3m chamber	Pass
§15.231(c), RSS-210 A.1.3	Bandwidth Measurement & 99% Occupied Bandwidth	20-21	Shield room	Pass
§15.231(a)(1), RSS-210 A.1.1(b)	Deactivation Time	22	Shield room	Pass
§15.203, RSS-Gen 6.8	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 an PCB Antenna, which gain is 2.0dBi. In accordance to §15.203 and RSS-Gen 6.8, It is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2A3UM-RE500, IC: 30162-RE500 complies with Section 15.205, 15.209, 15.231 of the FCC Part 15, Subpart C Rules, 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: March 13, 2023

Testing Start Date: March 14, 2023


Testing End Date: January 16, 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



Huali CHENG
EMC Test Engineer

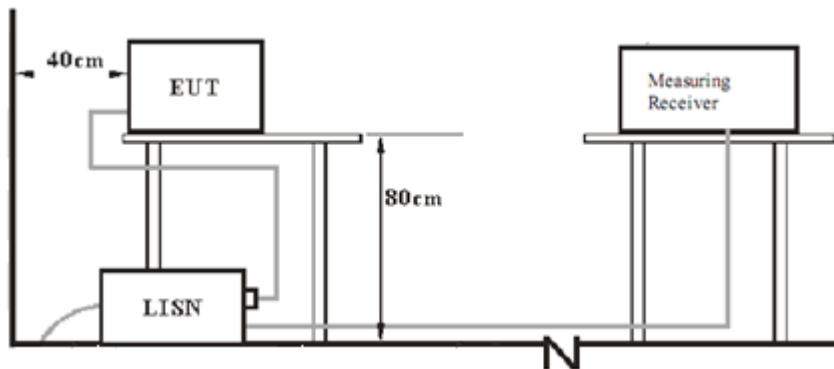
7 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
AC Adapter	MLF	MLF-A260502000UU	--

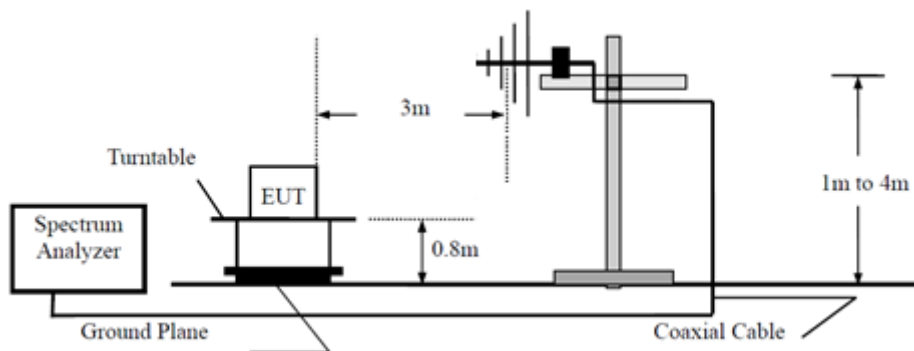
8 Test Setups

8.1 AC Power Line Conducted Emission test setups

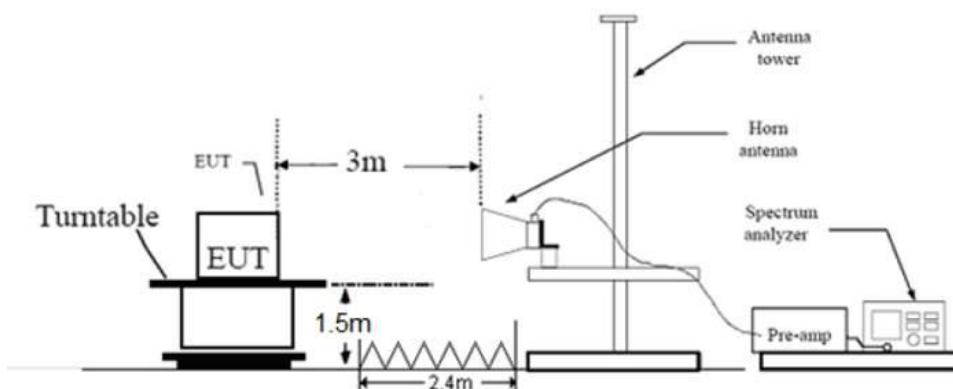


8.2 Radiated Emission test setups

Below 1GHz



Above 1GHz



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

According to §15.207 and RSS-GEN A8.8

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

150k-30MHz Conducted Emission Test

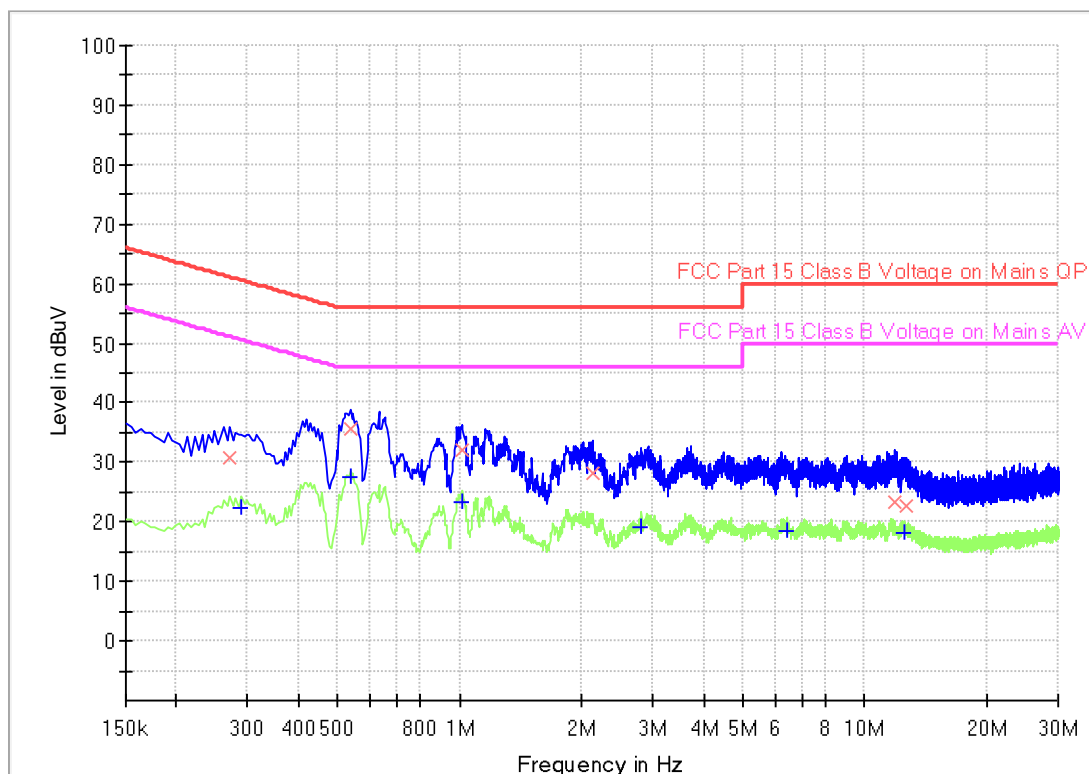
EUT Information

EUT Name: Smart Controller
 Model: RE500
 Client: Qingdao RONCO Mechanic Electronic Technology Co., Ltd.
 Op Cond: Power on, Tx on, DC 5V by USB charger, T20.3, H42.7%, P102.1kPa
 Operator: Huali CHENG
 Test Spec: FCC Part 15.207(a), RSS-Gen
 Comment: Phase L
 Sample No: SHA-714353-2

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	20 dB





Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.271500	30.84	---	61.07	30.23	1000.0	9.000	L1	19.6
0.289500	---	22.47	50.54	28.07	1000.0	9.000	L1	19.6
0.537000	---	27.48	46.00	18.52	1000.0	9.000	L1	19.6
0.537000	35.50	---	56.00	20.50	1000.0	9.000	L1	19.6
1.014000	31.95	---	56.00	24.05	1000.0	9.000	L1	19.6
1.018500	---	23.20	46.00	22.80	1000.0	9.000	L1	19.6
2.125500	28.14	---	56.00	27.86	1000.0	9.000	L1	19.6
2.814000	---	19.09	46.00	26.91	1000.0	9.000	L1	19.6
6.436500	---	18.35	50.00	31.65	1000.0	9.000	L1	19.6
11.841000	23.23	---	60.00	36.77	1000.0	9.000	L1	19.8
12.547500	---	18.13	50.00	31.87	1000.0	9.000	L1	19.8
12.700500	22.64	---	60.00	37.36	1000.0	9.000	L1	19.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

150k-30MHz Conducted Emission Test

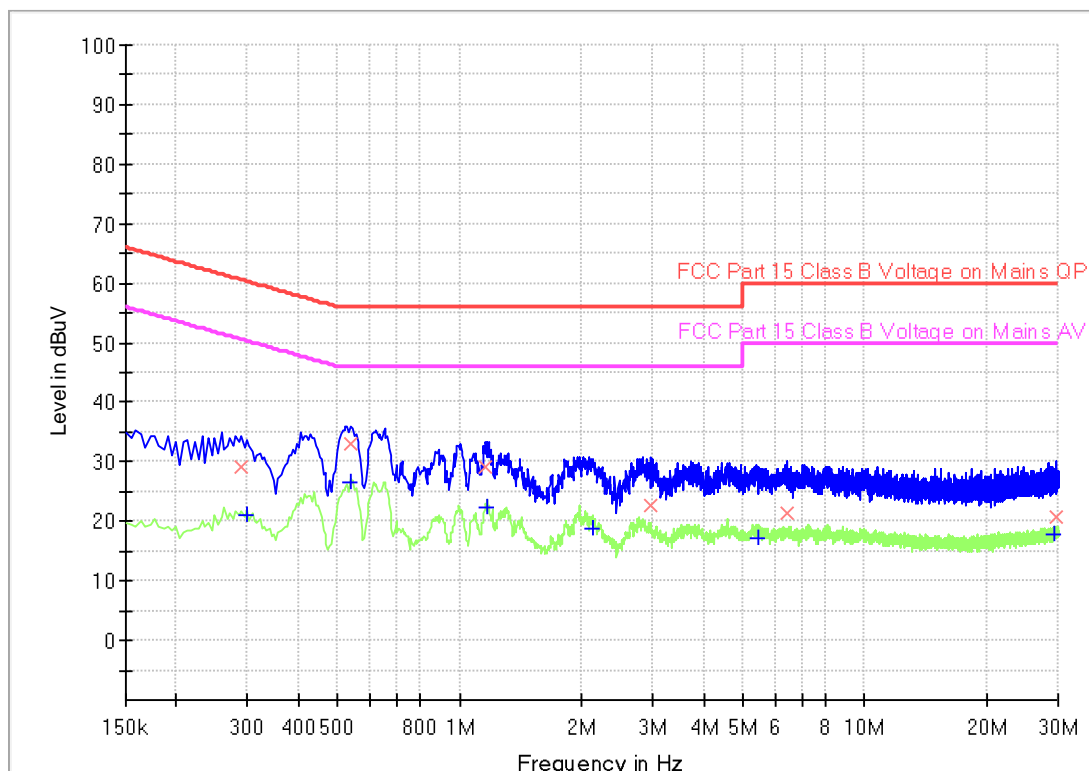
EUT Information

EUT Name: Smart Controller
 Model: RE500
 Client: Qingdao RONCO Mechanic Electronic Technology Co., Ltd.
 Op Cond: Power on, Tx on, DC 5V by USB charger, T20.3, H42.7%, P102.1kPa
 Operator: Huali CHENG
 Test Spec: FCC Part 15.207(a), RSS-Gen
 Comment: Phase N
 Sample No: SHA-714353-2

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	20 dB





Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.289500	29.03	---	60.54	31.51	1000.0	9.000	N	19.6
0.298500	---	20.95	50.28	29.33	1000.0	9.000	N	19.6
0.537000	---	26.66	46.00	19.34	1000.0	9.000	N	19.6
0.537000	33.06	---	56.00	22.94	1000.0	9.000	N	19.6
1.162500	29.22	---	56.00	26.78	1000.0	9.000	N	19.6
1.171500	---	22.36	46.00	23.64	1000.0	9.000	N	19.6
2.125500	---	18.94	46.00	27.06	1000.0	9.000	N	19.6
2.976000	22.69	---	56.00	33.31	1000.0	9.000	N	19.6
5.464500	---	17.24	50.00	32.76	1000.0	9.000	N	19.7
6.432000	21.49	---	60.00	38.51	1000.0	9.000	N	19.7
29.206500	---	17.92	50.00	32.08	1000.0	9.000	N	20.2
29.796000	20.89	---	60.00	39.11	1000.0	9.000	N	20.2

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

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 meters chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
4. 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.
5. 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.
6. Use the following spectrum analyzer settings According to C63.10:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.
 For average measurement:
 VBW = 10 Hz, when duty cycle is no less than 98 percent.
 VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
7. Repeat above procedures until all frequencies measured were complete.

Limit

According to §15.231 (b) and RSS-210 A.1.2 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 375 *
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

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.

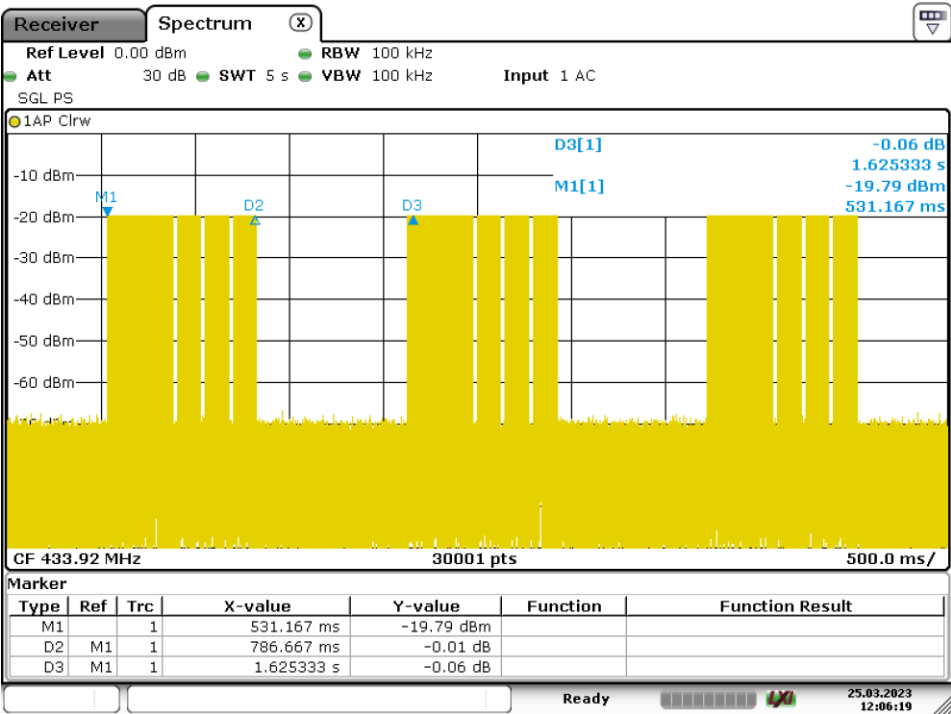
Antenna polarization	Frequency (MHz)	Duty Cycle Factor(dB)	Corrected Reading (dBuV/m)	Emission Type	Limit (dBuV/m)	Margin	Detector
H	433.92	N/A	79.22	Fundamental	100.80	21.58	PK
H	433.92	-6.28	72.94	AV	80.80	7.86	AV
V	433.92	N/A	76.11	Fundamental	100.80	24.69	PK
V	433.92	-6.28	69.83	AV	80.80	10.97	AV
H	867.837	N/A	41.53	Harmonics	80.80	39.27	PK
V	867.837	N/A	43.29	Harmonics	80.80	37.51	PK
H	2603.5	N/A	46.32	Harmonics	80.80	34.48	PK
V	2169.4	N/A	36.75	Harmonics	80.80	44.05	PK
H	3037.7	N/A	43.51	Harmonics	80.80	37.29	PK
V	2603.7	N/A	42.67	Harmonics	80.80	38.13	PK
H	3471.8	N/A	44.04	Harmonics	80.80	36.76	PK
V	3037.3	N/A	42.33	Harmonics	80.80	38.47	PK
H	4096.6	N/A	42.41	Harmonics	80.80	38.39	PK
V	3471.4	N/A	43.55	Harmonics	80.80	37.25	PK

Remark:

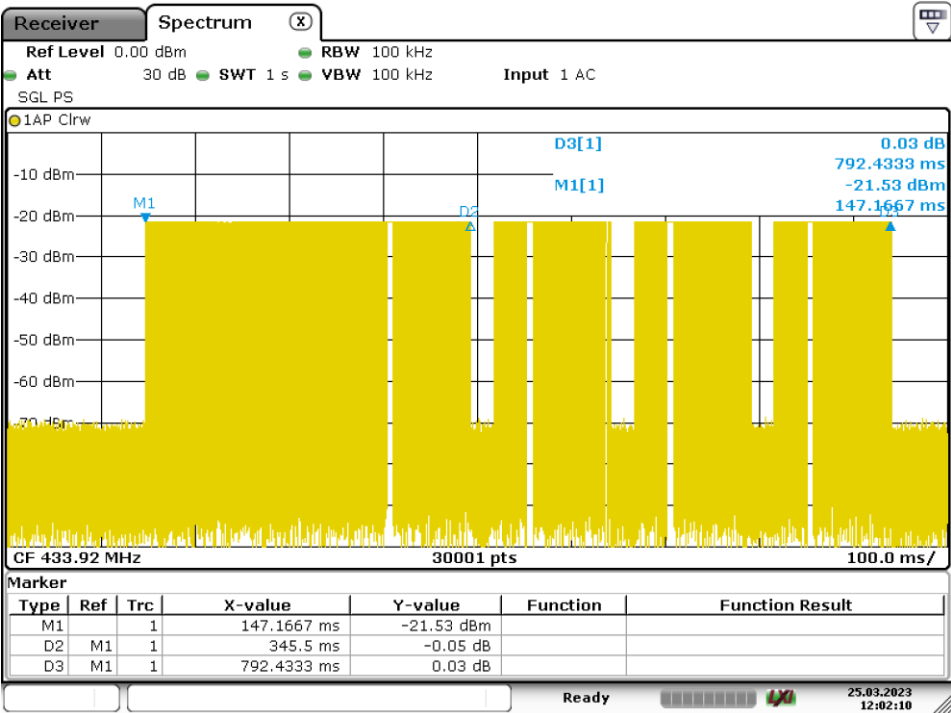
- 1: AV Emission Level= PK Emission Level+20log (duty cycle)
- 2: If PK reading is less than AV limit, the AV test can be elided.
- 3: Other than listed in the table are attenuated more than 20dB below the permissible limit of the field strength, therefore no data appear in the report.
- 4: “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- 5: Corrected Amplitude = Read level + Corrector factor
 Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
 Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
- 6: Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz)
- 7: Corrected Reading = Original Receiver Reading + Correct Factor
8. Only the worst data listed in this report



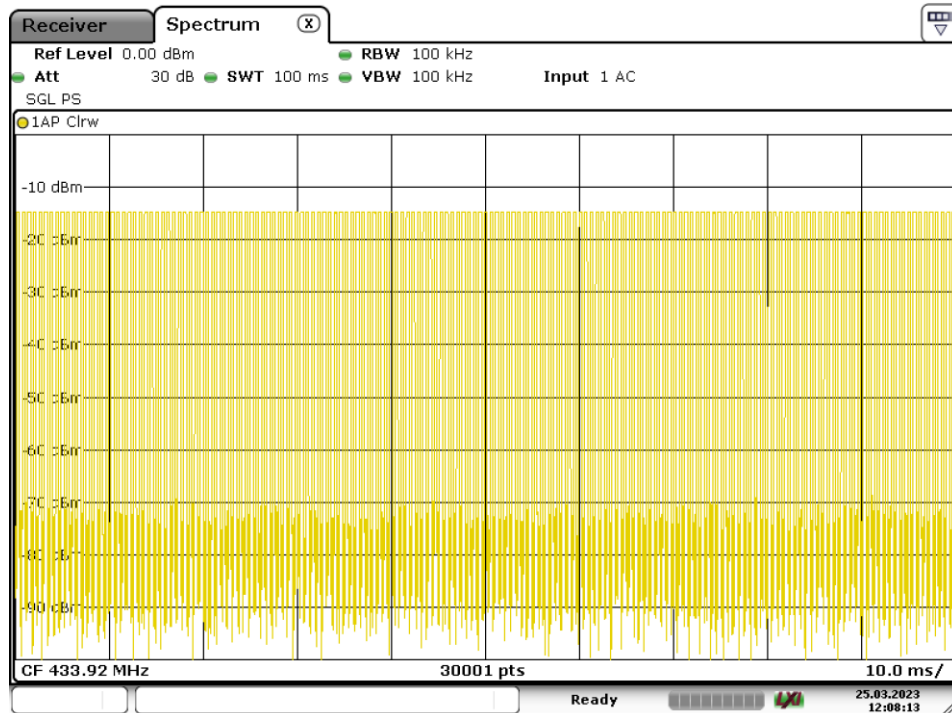
Duty Cycle = 285.333(us)*170/100 (ms) = 48.51%
Duty Cycle Factor = 20*log (Duty Cycle) = -6.28



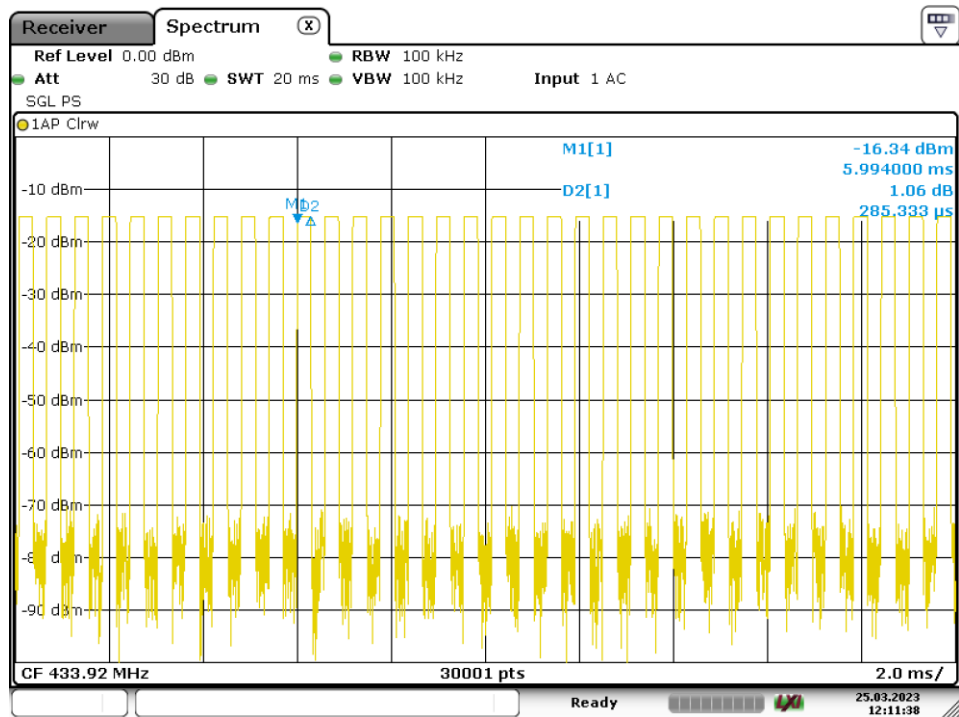
Date: 25.MAR.2023 12:06:18



Date: 25.MAR.2023 12:02:10



Date: 25.MAR.2023 12:08:13



Date: 25.MAR.2023 12:11:38

9.3 Bandwidth Measurement & 99% Occupied Bandwidth

Test Method

1. 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.
3. 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
4. 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.
5. Repeat above procedures until all frequencies measured were complete.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was set from 1% to 5% of the estimated 99% bandwidth. The occupied 99% bandwidth was measured by using the occupied bandwidth function of the spectrum analyzer set to 99% with a peak detector.

Limit

According to §15.231(c) and RSS-210 A.1.3:

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

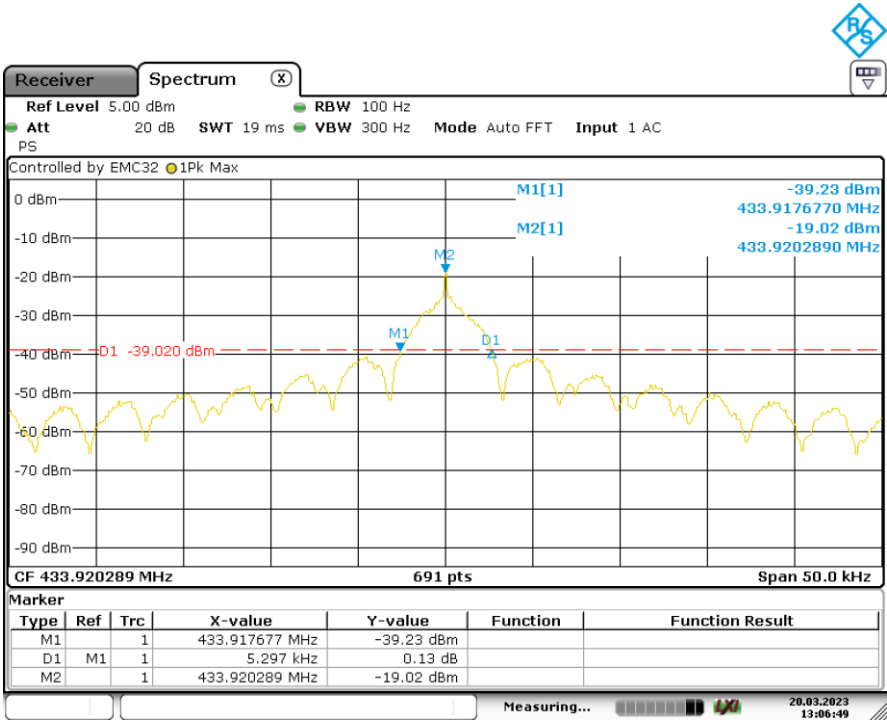
Test Result

Channel	20dB Bandwidth (KHz)	Limit (KHz)
1	5.3	1085

Channel	99% bandwidth (KHz)	Limit (KHz)
1	24.7	N/A

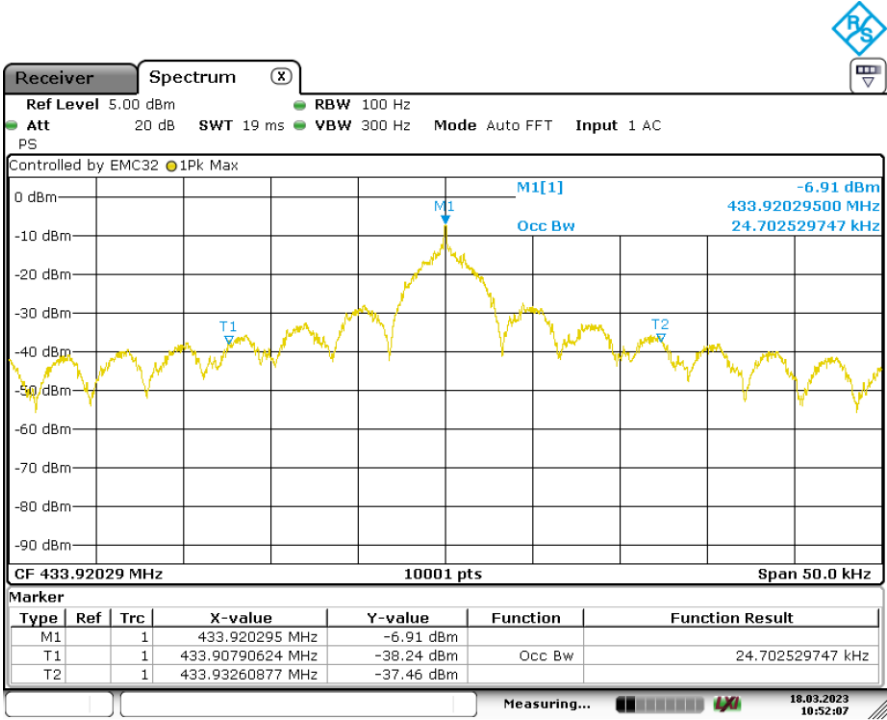


20dB bandwidth test result



Date: 20.MAR.2023 13:06:50

99% bandwidth test result



Date: 18.MAR.2023 10:52:07

9.4 Deactivation Time

Test Method

1. 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=120 KHz, VBW=1MHz, Span=0Hz.
5. Repeat above procedures until all frequency measured was complete.

Limit

According to FCC Part 15.231 (a) and RSS-210 A.1.1(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	811.6ms	Pass



10 Test Equipment List

List of Test Instruments

Conducted Emission Test

Description	Manufacturer	Model no.	Serial no.	Calibration Date	Calibration Due
EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2023-8-1	2024-7-31
LISN	Rohde & Schwarz	ENV216	101924	2023-8-1	2024-7-31

RF conducted test

Description	Manufacturer	Model no.	Serial no.	Calibration Date	Calibration Due
Signal and spectrum analyzer	R&S	FSV40	S1503003-YQ-EMC	2022-8-01	2023-7-31
Signal and spectrum analyzer	R&S	FSV40	S1503003-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	2022-8-01	2023-7-31
<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	SCHWARZBECK	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	2022-8-01	2023-7-31
<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	2022-8-01	2023-7-31
<input checked="" type="checkbox"/>	Signal and spectrum analyzer	FSV40	R&S	S1503003-YQ-EMC	2023-8-01	2024-7-31

Measurement Software Information

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

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 Name	Measurement 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
RF Conducted Measurement	Power related: 1.16dB Frequency related: 6.00×10^{-8}

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.



12 Photographs of Test Set-ups

Refer to the < Test Setup photos >.



13 Photographs of EUT

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

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