TEST REPORT

KES Co., Ltd.
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Anyang-si, Gyeonggi-do, 14057, Republic of Korea
Tel : +82-31-425-6200, Fax : +82-31-341-3838

■ **FCC/IC TEST REPORT**

1. Client

○ Name : SONGJUNG SMART CO.,LTD
○ Address : 4, Cheoyongsaneop 1-gil, Onsan-eup, Uljin-gun, Ulsan, Republic of Korea

2. Sample Description

○ Product item : Tubular motor
○ Model name : DM20LEU/S
○ Manufacturer etc. : Ningbo Dooya Mechanic & Electronic Technology Co., Ltd

3. Date of test : 2024.04.29 ~ 2024.05.28

p

4. Location of Test : ☑ Permanent Testing Lab ☐ On Site Testing

○ Address : 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea

5. Test method used : Part 15.231 & RSS-210(Issue 11)

6. Test result : PASS

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This laboratory is not accredited for the test results marked*.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : Bong-Seok Kim (Signature) [김봉석]2024/08/16	Technical Manager Name : Yeong-Jun Cho (Signature) [조영준]2024/08/16

2024. 08. 16.

KES Co., Ltd.

Accredited by KOLAS, Republic of KOREA

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
2024.08.14.	KES-RF240247	Initial
2024.08.16	KES-RF240247-R1	Retested for item : 99% Occupied bandwidth

Use of uncertainty of measurement for decisions on conformity (decision rule):

■ No decision rule is specified by the standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty(“simple acceptance” decision rule, previously known as “accuracy method”).

☐ Other (to be specified, for example when required by the standard or client)

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1. General information

Applicant:	SONGJUNG SMART CO.,LTD
Applicant address:	4, Cheoyongsaneop 1-gil, Onsan-eup, Uljin-gun, Ulsan, Republic of Korea
Test site:	KES Co., Ltd.
Test site address:	☐ #3002, #3503, #3701, 40, Simin-daero 365beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do,14057,Republic of Korea ☒ 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, Korea
Test Facility	FCC Accreditation Designation No.: KR0100, Registration No.: 444148 ISED Registration No.: 23298
FCC rule part(s):	15.231
IC rule part(s):	RSS-210 (Issue 11)
FCC ID:	2BGKS-DM20LEUS
IC ID:	32668-DM20LEUS
Test device serial No.:	☒ Production ☐ Pre-production ☐ Engineering

1.1. EUT description

Equipment under test	Tubular motor
Frequency range	433.92 ㎒
Model	DM20LEU/S
Modulation technique	FSK
Number of channels	433.92 ㎒ : 1 ch
Antenna specification	Wire Antenna
Power source	AC 120 V (Adapter Output DC 5 V) / DC 7.2 V (Battery)
H/W Version	A/10
S/W Version	A/10
Serial Number	MA20LEU0001

1.2. Test configuration

The **SONGJUNG SMART CO.,LTD // Tubular motor // DM20LEU/S // FCC ID : 2BGKS-DM20LEUS // IC number : 32668-DM20LEUS** was tested according to the specification of EUT, the EUT must comply with following standards and KDB documents.

FCC Part 15.231
RSS-GEN (Issue 5) & RSS-210 (Issue 11)
KDB 558074 D01 v05 r02
ANSI C63.10-2013

1.3. Information about derivative model

N/A

1.4. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
-	-	-	-	-

1.5. Sample calculation

Where relevant, the following sample calculation is provided
For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor
between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

For Radiation test :
Field strength level (㏈㎶/m) = Measured level (㏈㎶) + Antenna factor (㏈) + Cable loss (㏈) – Amplifier gain (㏈)

1.6. Measurement Uncertainty

Test Item		Uncertainty
Uncertainty for Conduction emission test		2.22 ㏈ (SHIELD ROOM #6)
Uncertainty for Radiation emission test (include Fundamental emission)	Below 1㎓	4.04 ㏈ (SAC #6)
	Above 1㎓	5.32 ㏈ (SAC #5)
Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.		

1.7. Frequency/channel operations

Ch.	Frequency (㎒)
01	433.92

2. Summary of tests

Section in FCC Part 15	Section in RSS-210 & Gen	Parameter	Test results
-	RSS-Gen 6.7	99% Occupied bandwidth	Pass
15.209(a) 15.231(b)	RSS-210 Annex A.1.3 (a), (b)	Radiated emission, Spurious emission and Field Strength of Fundamental	Pass
15.207(a)	RSS-Gen 8.8	AC Conducted emissions	Pass note.1
15.231(a)	RSS-210 Annex A.1.2 (a)	Transmission time	Pass
15.231(c)	RSS-210 Annex A.1.4	Bandwidth of operation frequency	Pass
15.203	-	Antenna Requirement	Pass note.2

Note.
1. This EUT operates on DC battery power only, AC power is for charging only.
2. Please check the antenna spec. for the Antenna Requirement.

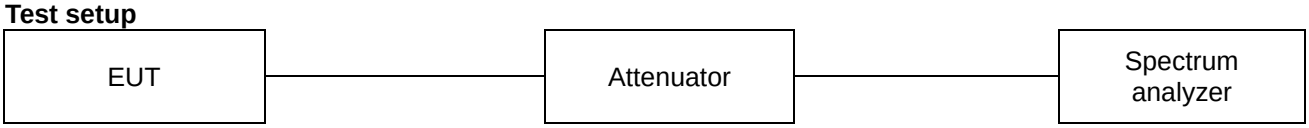
3. Test results

3.1. 99% Occupied Bandwidth

Test procedure

ANSI C63.10-2013 clause 6.9.2 and 6.9.3

Test setup



Test setting

1. Span = The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
2. RBW = The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW
3. VBW = shall be approximately three times the RBW
4. Sweep = auto
5. Detector function = Peak
6. Trace = Max hold

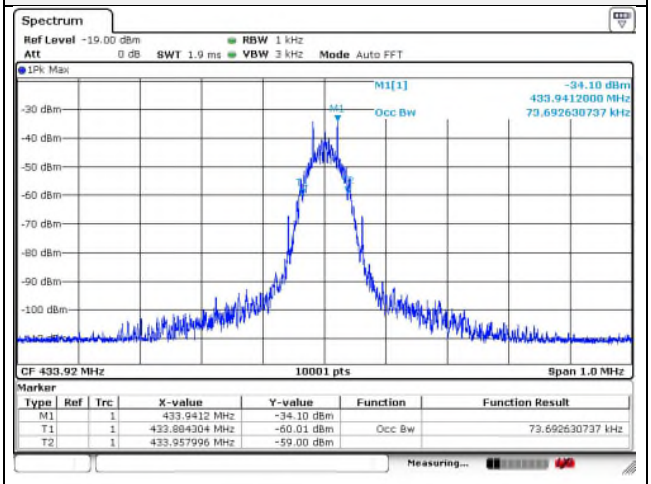
Limit

None; for reporting purpose only.

Test results

Frequency(㎒)	99% occupied bandwidth(㎒)	Limit(㎒)
433.92	0.074	-

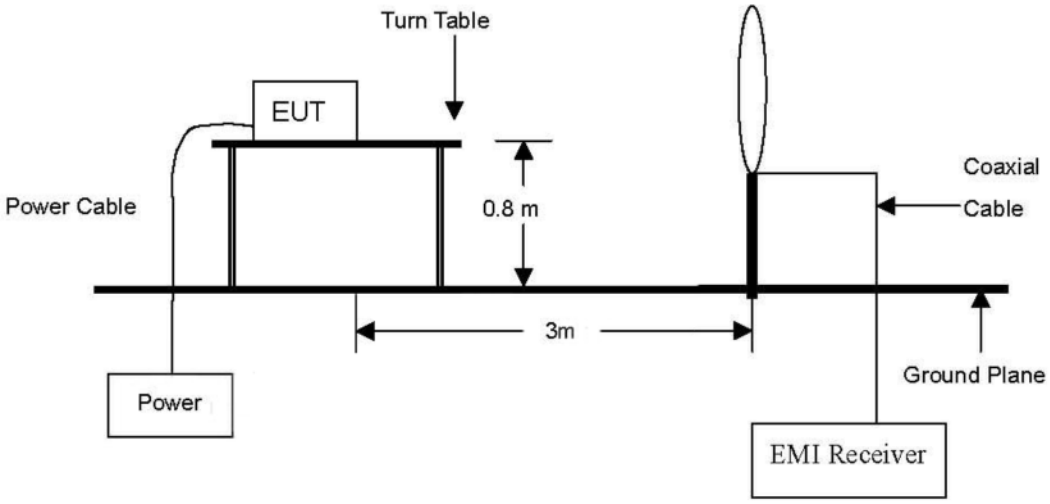
99% occupied bandwidth



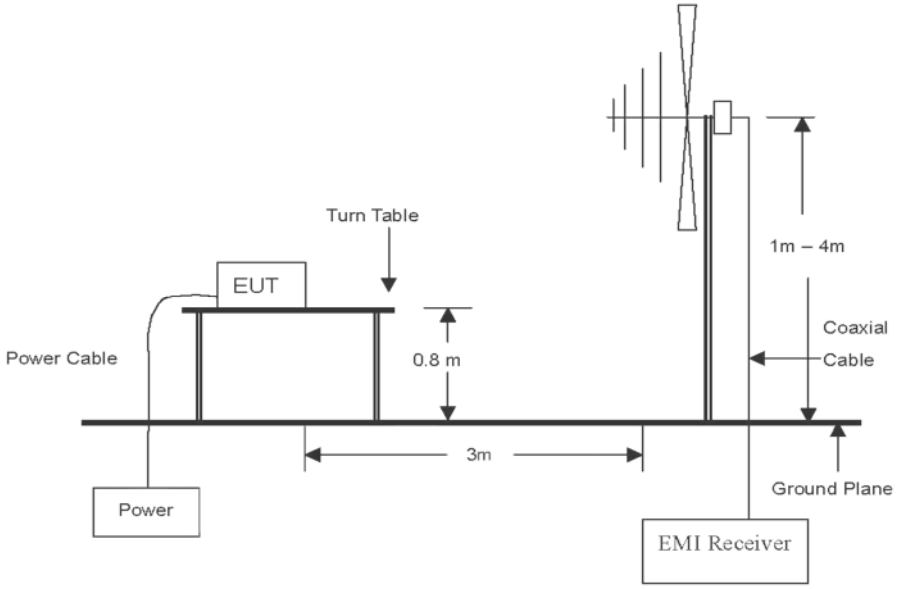
3.2. Radiated emission, Spurious emission and Field Strength of Fundamental

Test setup

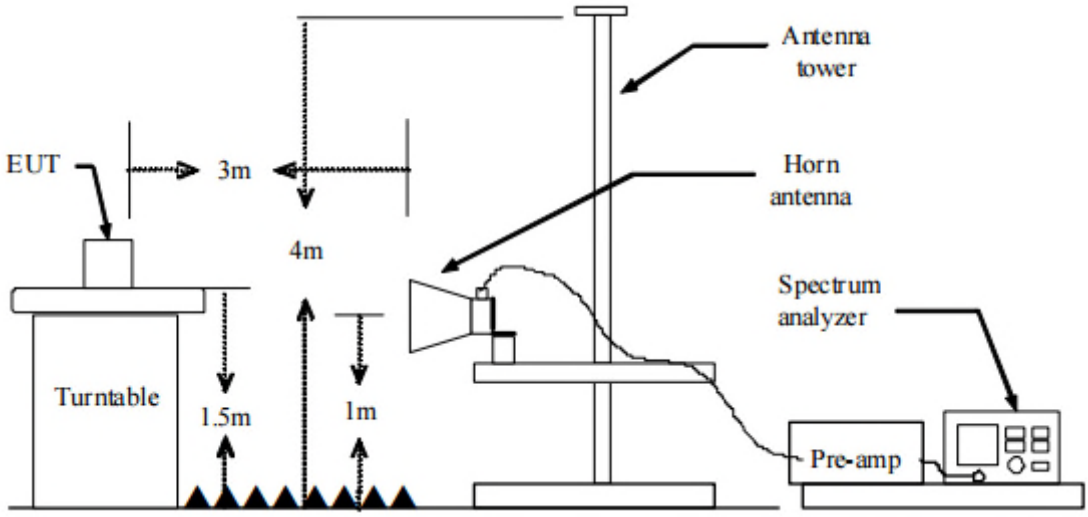
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



Test procedure

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

Test procedure below 30 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel, ground parallel and perpendicular of the antenna are set to make the measurement. It was determined that **parallel** was worst-case orientation; therefore, all final radiated testing was performed with the EUT in **parallel.**
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

Test procedure above 30 ㎒ ~ 1 000 ㎒

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground for 30 ㎒-1 ㎓ and 1.5 meters for above 1 ㎓ at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The antenna is a bi-log antenna, a horn antenna, and its height are 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.
3. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Test procedure above 1 000 ㎒

1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The antenna is a bi-log antenna, a horn antenna, and its height are 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.
3. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5. Spectrum analyzer settings for *f* < 1 ㎓:
   ① Span = wide enough to fully capture the emission being measured
   ② RBW = 100 ㎑
   ③ VBW ≥ RBW
   ④ Detector = quasi peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
6. Spectrum analyzer settings for *f* ≥1 ㎓: Peak
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW ≥ 3 ㎒
   ④ Detector = peak
   ⑤ Sweep time = auto
   ⑥ Trace = max hold
   ⑦ Trace was allowed to stabilize

7. Spectrum analyzer settings for *f* ≥1 ㎓: Average
   ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
   ② RBW = 1 ㎒
   ③ VBW ≥ 3 × RBW
   ④ Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
   ⑤ Averaging type = power(i.e., RMS)
      1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
      2) Some instruments require linear display mode in order to use linear voltage averaging. Log or ㏈ averaging shall not be used.
   ⑥ Sweep = auto
   ⑦ Trace = max hold
   ⑧ Perform a trace average of at least 100 traces.A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
      1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
      2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
      3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

Note.

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/Ds)$
   f ≥30 ㎒, extrapolation factor of 20 ㏈/decade of distance. $F_d = 20\log(D_m/Ds)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
2. Field strength(㏈㎶/m) = Level(㏈㎶) + CF (㏈) + or DCF(㏈)
3. Margin(㏈) = Limit(㏈㎶/m) - Field strength(㏈㎶/m)
4. Emissions below 18 ㎓ were measured at a 3 meter test distance while emissions above 18 ㎓ were measured at a 1 meter test distance with the application of a distance correction factor.
5. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that **X orientation** was worst-case orientation; therefore, all final radiated testing was performed with the EUT in **X orientation.**
6. The worst-case emissions are reported however emissions whose levels were not within 20 ㏈ of respective limits were not reported.
7. According to exploratory test no any obvious emission were detected from 9 ㎑ to 30 ㎒. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

FCC Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 ~ 0.490	300	2 400/F(㎑)
0.490 ~ 1.705	30	24 000/F(㎑)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 ~ 72 ㎒, 76 ~ 88 ㎒, 174 ~ 216 ㎒ or 470 ~ 806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

According to 15.231(b), 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 (㎒)	Field strength of fundamental (microvolts / meter)	Field strength of spurious emission (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 interpolations.

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

(2) 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.

(3) 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.

IC Limit

According to RSS-Gen, Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
0.009 – 0.490 Note 1	6.37/F (F in kHz)	300
0.490 – 1.705	63.7/F (F in kHz)	30
1.705 - 30	0.08	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960*	3	500

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

According to RSS-210 A1.3, The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits in table A1, based on the average value of the measured emissions. The requirements of the "Pulsed operation" section of RSS-Gen apply for averaging pulsed emissions and limiting peak emissions.

Alternatively, compliance with the limits in table A1 may be demonstrated using an Internatio nal Special Committee on Radio Interference (CISPR) quasi-peak detector.

Frequency (㎒)	Distance (Meters)	Radiated (㎶/m)
70-130	3	1 250
130-174	3	1 250 to 3 750
174-260**	3	3 750
260-470**	3	3 750 to 12 500*
Above 470	3	12 500

* Linear interpolation with frequency, f, in MHz:
For 130-174 MHz: Field Strength (µV/m) = (56.82 x f)-6136
For 260-470 MHz: Field Strength (µV/m) = (41.67 x f)-7083

** Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interf erence and degradation of their licence-exempt radio equipment in these frequency bands.

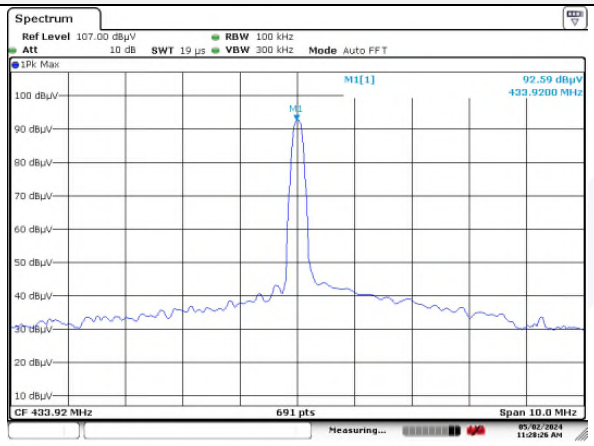
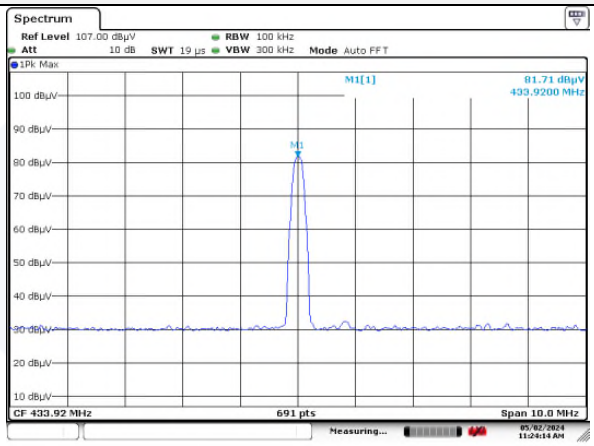
Test results for fundamental

Operating frequency: 433.92 ㎒

Distance of measurement: 3 meter

Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
433.92	92.59	Peak	H	-6.41	-	86.18	100.83	14.65
		Average	H	-6.41	-22.13	64.05	80.83	16.77
433.92	81.71	Peak	V	-6.41	-	75.30	100.83	25.53
		Average	V	-6.41	-22.13	53.17	80.83	27.65

Test Plot

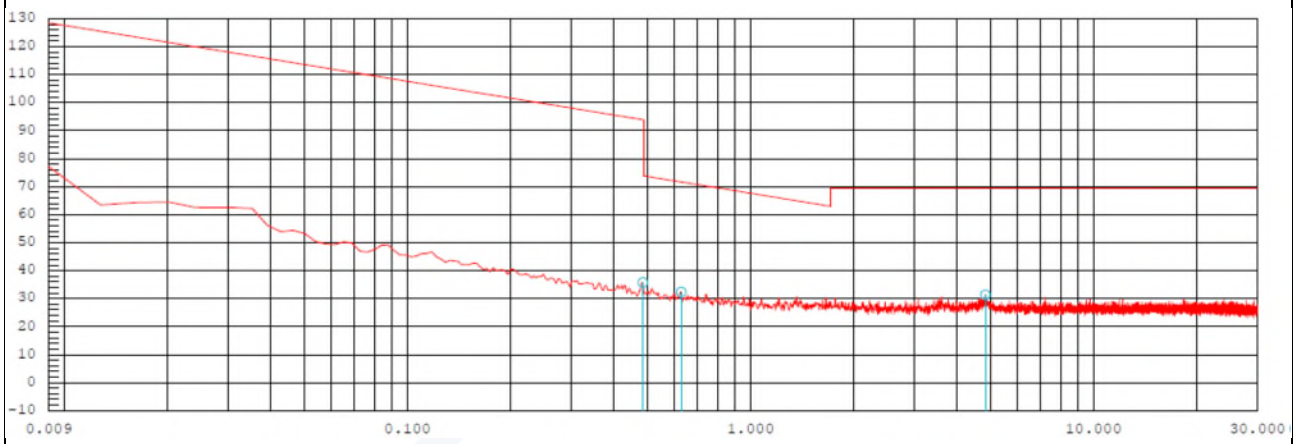
Horizontal // Peak	Vertical // Peak
	

Note.

1. 3m Average Limit(dB㎶/m) = 20log(41.6667 x $F_{(㎒)}$-7083.3333) = 80.83
   3m Peak Limit(dB㎶/m) = Average limit + 20 = 100.83
   Average Field strength = Peak Field strength + Duty Cycle Correction Factor
2. Duty Cycle Correction Factor : 20log(Ton / 100 ms) = 20log(7.826 / 100) = -22.13
   $Tx_{on\ time}$ = 7.826 ms
   Tx_{on+off} ≥ 100 ms (pulse train is 100 ms)
3. Tests were performed only on the worst axis.

Test results (Below 30 ㎒)

Parallel

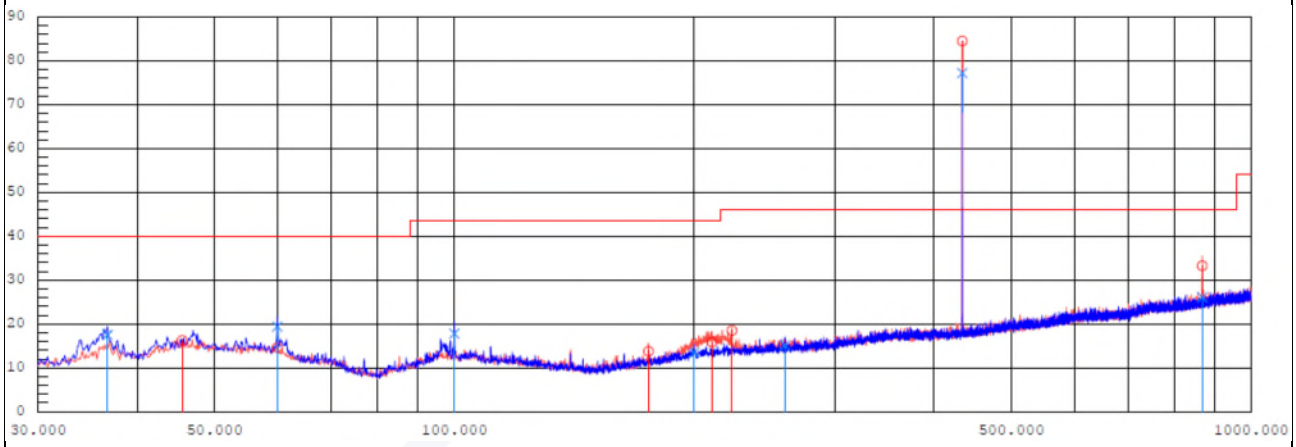


Final Result

No.	Frequency [MHz]	Reading QP [dB(µV)]	c.f [dB(1/m)]	Result QP [dB(µV/m)]	Limit QP [dB(µV/m)]	Margin QP [dB]	Angle [deg]	Remark
1	0.485	17.0	18.7	35.7	93.9	58.2	180.7	
2	0.628	13.7	18.7	32.4	71.7	39.3	0.0	
3	4.841	12.1	19.3	31.4	69.5	38.1	290.4	

Test results (Below 1 000 ㎒)

Horizontal // Vertical



Final Result

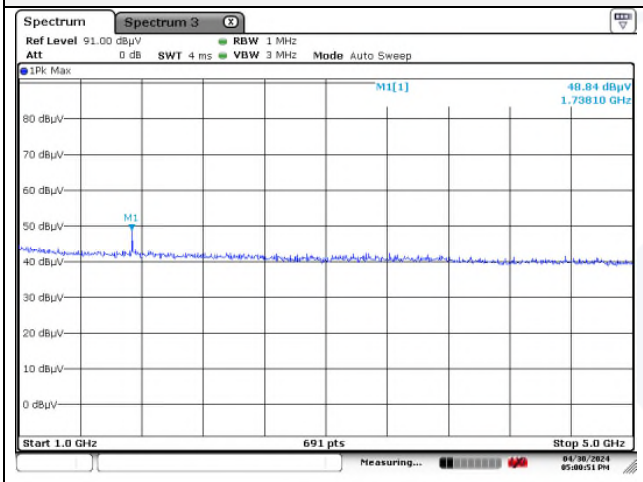
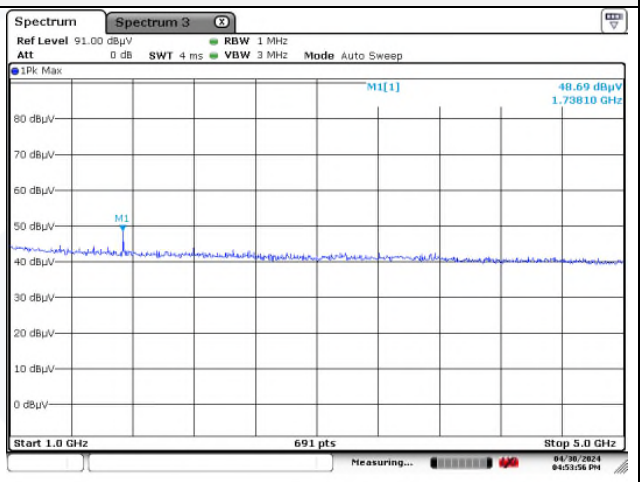
No.	Frequency [MHz]	Pol	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	36.669	V	31.8	-14.3	17.5	40.0	22.5	133.0	269.2	
2	45.520	H	28.9	-12.6	16.3	40.0	23.7	223.0	162.3	
3	59.949	V	32.6	-13.2	19.4	40.0	20.6	187.0	202.3	
4	59.949	H	27.8	-13.2	14.6	40.0	25.4	211.0	293.3	
5	99.961	V	31.6	-13.8	17.8	43.5	25.7	154.0	96.4	
6	175.258	H	28.9	-15.1	13.8	43.5	29.7	236.0	206.5	
7	199.993	V	26.8	-13.3	13.5	43.5	30.0	153.0	22.5	
8	210.420	H	28.9	-13.0	15.9	43.5	27.6	200.0	349.1	
9	223.030	H	31.1	-12.6	18.5	46.0	27.5	236.0	29.4	
10	260.011	V	26.8	-11.7	15.1	46.0	30.9	136.0	198.2	
11	867.959	V	25.9	0.2	26.1	46.0	19.9	100.0	89.6	
12	867.959	H	33.1	0.2	33.3	46.0	12.7	219.0	248.0	

Test results (Above 1 000 ㎒)

Mode:	FSK
Distance of measurement:	3 meter
Channel:	01

- **Spurious**

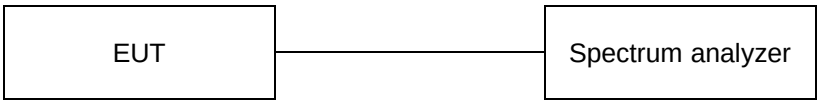
Frequency (㎒)	Level (dB㎶)	Detect mode	Ant. Pol. (H/V)	CF (dB)	DCF (dB)	Field strength (dB㎶/m)	Limit (dB㎶/m)	Margin (dB)
1 738.10	48.84	Peak	H	-4.04	-	44.80	74.00	29.20
1 738.10	48.69	Peak	V	-4.04	-	44.65	74.00	29.35

Horizontal // Peak for 1 ㎓ to 5 ㎓	Vertical // Peak for 1 ㎓ to 5 ㎓
	

Note.
1. Average test would be performed if the peak result were greater than the average limit.

3.3. Bandwidth of operation frequency

Test setup



Test procedure

1. Use the following spectrum analyzer setting
2. RBW = 10 ㎑
3. VBW = 30 ㎑ (≥ RBW)
4. Span = 1 ㎒
5. Detector function = peak
6. Trace = max hold

Limit

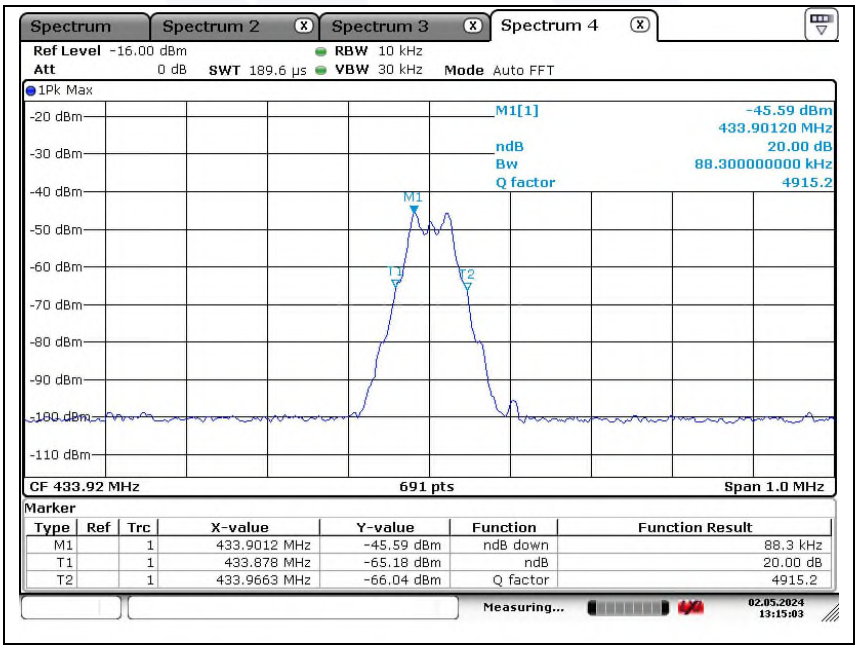
According to 15.231(c), The bandwidth of the emissions shall be no wider than 0.25 % of the center frequency for devices operating above 70 ㎒ and below 900 ㎒. Bandwidth is determined at the points 20 ㏈ down from the modulated carrier.

IC Limit

According to RSS-210 Annex A.1.4, The occupied bandwidth of momentarily operated devices shall be less than or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the occupied bandwidth shall be less than or equal to 0.5% of the centre frequency.

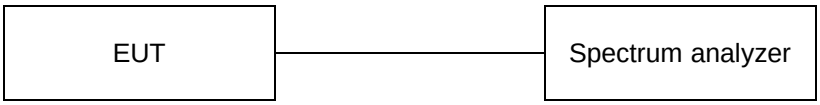
Test results

Frequency(㎒)	Bandwidth(㎑)	Limit (㎑)
433.92	88.30	1 084.80



3.4. Transmission time

Test setup



Test procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW=100 ㎑, VBW=100 ㎑, Span=0 ㎐.

Limit

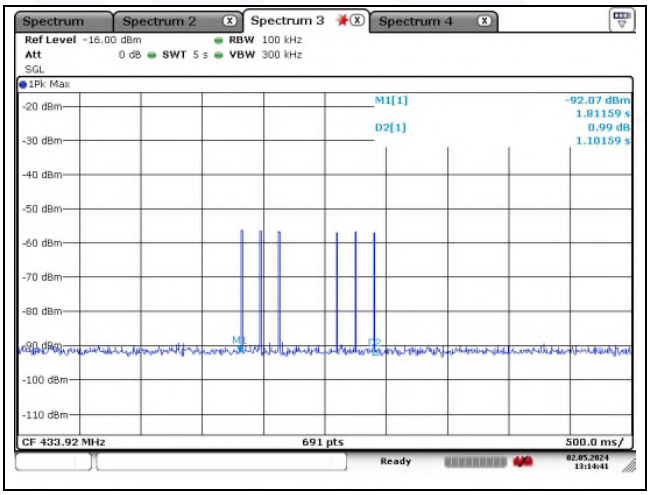
According to 15.231(a), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

IC Limit

According to RSS-210 Annex A.1.2 (a), a manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released.

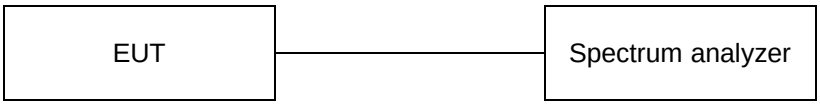
Test results

Frequency(㎒)	Transmission time (s)	Limit (s)
433.92	1.102	Same or less than 5 sec



3.5. Duty cycle correction factor

Test setup



Test procedure

1. The transmitter output is connected to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW=100 ㎑, VBW=100 ㎑, Span=0 ㎐ and Sweep time =100 ㎳.

Limit

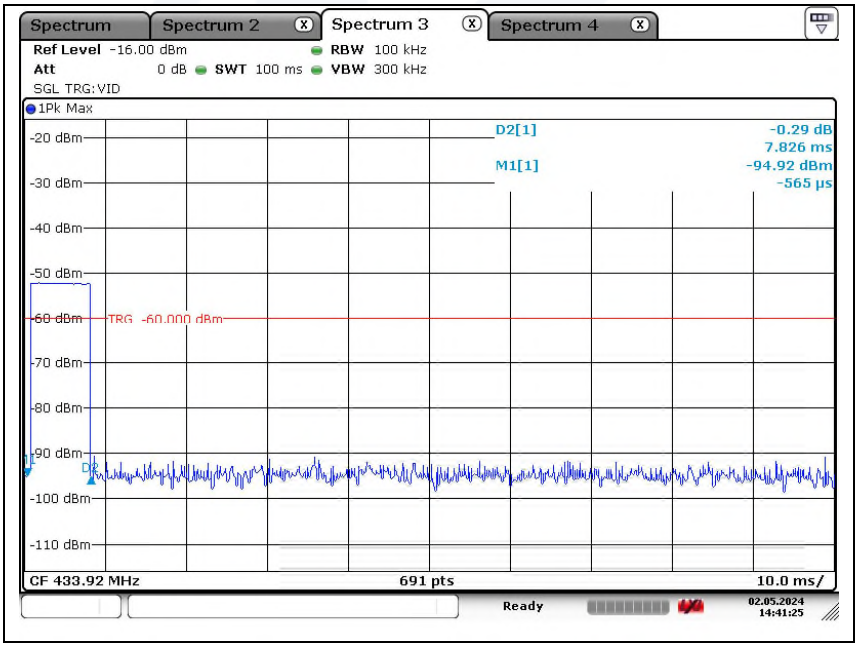
None (No dedicated Limit specified in the Rules)

Test results

Duty Cycle Correction Factor : 20log(Ton / 100 ms) = 20log(7.826 / 100) = -22.13

$Tx_{on\ time}$ = 7.826 ms

Tx_{on+off} ≥ 100 ms (pulse train is 100 ms)



3.6. AC conducted emissions

Limit

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	**Conducted limit (㏈㎶)**	
	Quasi-peak	**Average**
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.00	60	50

*Decreases with the logarithm of the frequency.

IC Limit

Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 H / 50 line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Frequency of Emission (㎒)	**Conducted limit (dB㎶)**	
	Quasi-peak	**Average**
0.15 – 0.5	66 to 56[note1]	56 to 46 [note1]
0.5 – 5.	56	46
5 – 30	60	50

Note 1: The level decreases linearly with the logarithm of the frequency.

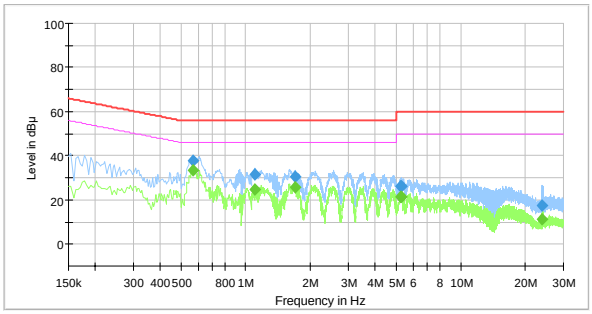
For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:

Perform the AC power-line conducted emissions test with the antenna connected to determine compliance with the limits of table 4 outside the transmitter's fundamental emission band.

Retest with a dummy load instead of the antenna to determine compliance with the limits of table 4 within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network that simulates the antenna in the fundamental frequency band.

Test results

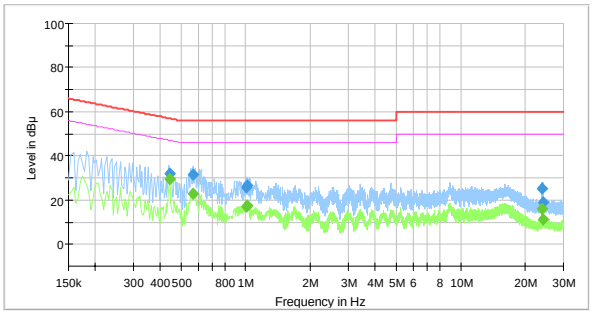
Hot Line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.570000	37.95	---	56.00	18.05	1000.0	9.000	L1	19.5
0.570000	---	33.18	46.00	12.82	1000.0	9.000	L1	19.5
1.106000	31.73	---	56.00	24.27	1000.0	9.000	L1	19.6
1.106000	---	24.54	46.00	21.46	1000.0	9.000	L1	19.6
1.698000	30.33	---	56.00	25.67	1000.0	9.000	L1	19.6
1.698000	---	25.79	46.00	20.21	1000.0	9.000	L1	19.6
5.234000	26.20	---	60.00	33.80	1000.0	9.000	L1	20.0
5.234000	---	21.54	50.00	28.46	1000.0	9.000	L1	20.0
5.294000	26.34	---	60.00	33.66	1000.0	9.000	L1	20.0
5.294000	---	21.20	50.00	28.80	1000.0	9.000	L1	20.0
23.838000	---	11.05	50.00	38.95	1000.0	9.000	L1	21.1
23.838000	17.61	---	60.00	42.39	1000.0	9.000	L1	21.1

Neutral Line



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.442000	---	29.66	47.02	17.36	1000.0	9.000	N	19.5
0.442000	31.87	---	57.02	25.15	1000.0	9.000	N	19.5
0.570000	---	22.57	46.00	23.43	1000.0	9.000	N	19.5
0.570000	31.47	---	56.00	24.53	1000.0	9.000	N	19.5
1.002000	---	16.86	46.00	29.14	1000.0	9.000	N	19.6
1.002000	25.76	---	56.00	30.24	1000.0	9.000	N	19.6
1.018000	---	17.61	46.00	28.39	1000.0	9.000	N	19.6
1.018000	26.65	---	56.00	29.35	1000.0	9.000	N	19.6
23.846000	---	16.11	50.00	33.89	1000.0	9.000	N	21.2
23.846000	24.99	---	60.00	35.01	1000.0	9.000	N	21.2
24.154000	---	11.34	50.00	38.66	1000.0	9.000	N	21.2
24.154000	19.16	---	60.00	40.84	1000.0	9.000	N	21.2

3.7. Antenna Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

Appendix A. Measurement equipment

Equipment	Manufacturer	Model	Serial No.	Calibration interval	Calibration due.
SPECTRUM ANALYZER	R & S	FSV40	101725	1 year	2024.06.15 2025.06.12
SIGNAL GENERATOR	KEYSIGHT	N5182B	MY59100115	1 year	2024.04.19 2025.04.15
DC POWER SUPPLY	AGILENT	6632B	MY43004090	1 year	2025.01.12
AC POWER SOURCE/ ANALYZER	HP	6813A	3729A00754	1 year	2025.01.12
ATTENUATOR	Mini-Circuits	BW-S10-2W263+	2	1 year	2025.01.15
Loop Antenna	Schwarzbeck	FMZB1513	1513-257	2 years	2025.03.22
BILOG ANTENNA	Schwarzbeck	VULB 9163	714	2 years	2026.04.19
Attenuator	HUBER+SHHNER	6806.17.A	NONE	1 year	2025.02.13
Horn Antenna	A.H.	SAS-571	414	1 year	2025.01.16
Amplifier	SONOMA INSTRUMENT	310N	186549	1 year	2025.02.13
PREAMPLIFIER	HP	8449B	3008A00899	1 year	2025.03.05
EMI Test Receiver	R & S	ESU26	100552	1 year	2025.02.13
EMI TEST RECEIVER	R & S	ESR3	101783	1 year	2024.11.08
LISN	R & S	ENV216	101787	1 year	2024.11.08
LISN	R & S	ESH2-Z5	100450	1 year	2024.11.08
PULSE LIMITER	R & S	ESH3-Z2	101915	1 year	2024.11.08

Peripheral devices

Device	Manufacturer	Model No.	Serial No.
-	-	-	-

The end of test report.