

TEST REPORT

Test Report Number: N2110R-0129

Project Number: A2020-10478

Applicant: Honggi

Address of Applicant: 14, Naeto-ro 11-gil, Jecheon-si, Chungcheongbuk-do, Korea

Manufacturer and Country Honggi

Address of Manufacturer/Factory: 14, Naeto-ro 11-gil, Jecheon-si, Chungcheongbuk-do, Korea

Equipment Under Test (EUT)

Product Name: RF Remote Control Switch

Model No.: HK-A326

■ FCC ID : 2A2L6-HK-A326

Applicable standards: FCC CFR Title 47 Part 15 Subpart C (15.231)
ANSI C63.10-2013

Date of Test: Jun. 02, 2021 to Jun. 22, 2021

Date of report issued: Oct, 06, 2021

Test Result: Compliance *

Prepared By:



Date:

Oct, 06, 2021

Project Engineer

Check By:



Date:

Oct, 06, 2021

Reviewer

Laboratory Manager

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REPORT REVISION HISTORY

Date	Revision	Page No
Oct, 06, 2021	Originally Issued	-

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1. General Information

1.1 General Description of EUT

Product Name	RF Remote Control Switch
Model No.	HK-A326
Hardware Version	Ver. 1.0
Software Version	N/A
Operation Frequency	315 MHz
Number of Channel	1
Antenna Specification	PCB pattern Antenna
Power supply	3 V

Note : N/A : Operated manually.

1.2 Test Condition

	Normal voltage
DC Power	3 V

1.3 Test Performed

RRA Designation No.: KR0157

KOLAS Accreditation No. : KT511

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SITE MAP

1st laboratory



2nd laboratory


* The test was performed at 2nd laboratory.

1.4 Test Instruments list

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Due date (mm-dd-yy)
1	Signal Analyzer	ROHDE & SCHWARZ	FSV40	100994	03-11-22
2	DC Power Supply	Hewlett Packard	6674A	3501A00827	11-02-21
3	Tri-Log Antenna	ROHDE & SCHWARZ	VULB9168	9168-721	03-24-22
4	LOOP ANTENNA	ROHDE & SCHWARZ	FMZB1519	1519-051	03-27-22
5	EMI Test Receiver	ROHDE & SCHWARZ	ESR7	102035	11-02-21
6	Horn Antenna	Schwarzbeck	BBHA 9120D	1244	03-16-22
7	Attenuator	AEROFLEX	40AH2W-10	203129	03-12-22
8	Amplifier	TESTEK	TK-PA18H	160006-L	03-13-22
9	Amplifier	TESTEK	TK-PA6S	120018	11-02-21



1.5 Summary of tests

FCC Part	Parameter	Test Result
15.203	Antenna Requirement	-
15.231 (c)	20dB occupied Bandwidth	Pass
15.231 (e)	Duration time	Pass
15.231 (e)	Field strength of the Fundamental signal	Pass
15.231(e)/ 15.209	Spurious Emission	Pass
15.207	Conducted Emission	N/A

N/A¹⁾ The EUT is powered by battery.

1.6 Measurement uncertainty

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR100028-1 [2] and shall correspond to an expansion factor (coverage factor) $k=1.96$ or $k=2$ (which provide confidence levels of respectively 95% and 95.5% in the case where the distributions characterizing the actual measurement uncertainties are normal.

Parameter	Uncertainty
Transmitter output power (Conducted)	± 1.4 dB
AC Conducted emission	± 2.0 dB
Radiated spurious emission (Below 1 GHz)	± 4.8 dB
Radiated spurious emission (Above 1 GHz)	± 5.0 dB

2. Test results

2.1 Antenna Requirement

2.1.1 Requirement

15.203 requirement

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, 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.

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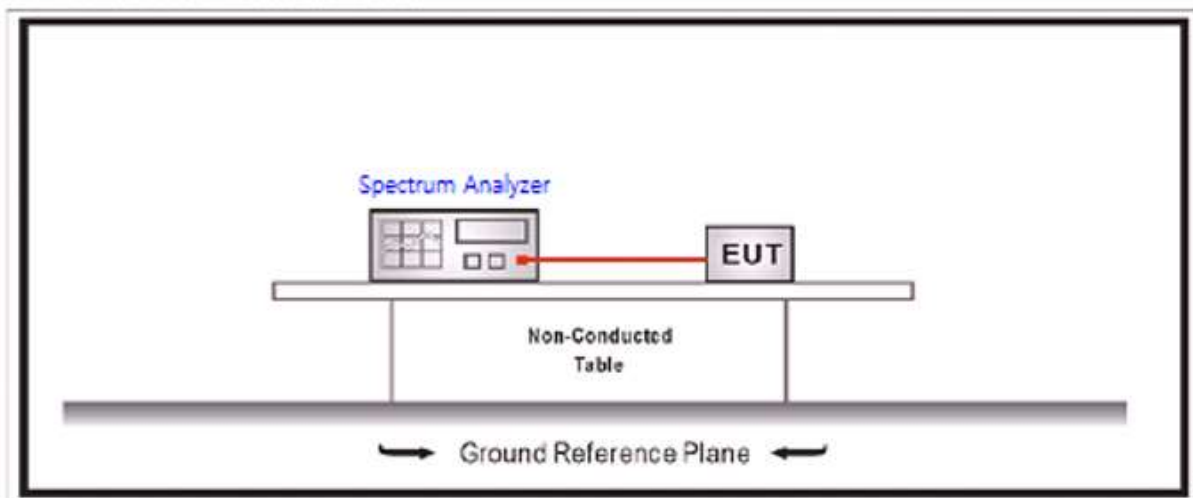
2.2 20 dB Occupied Bandwidth

2.2.1 Limit

The bandwidth of the emission shall be no wider than 0.25% of the centre 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 centre frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

2.2.2 Test Configuration

RF Conducted Measurement:



2.2.3 Test Procedure

1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.
2. Set the EUT to proper test channel.
3. Max hold the radiated emissions, mark the peak power frequency point and the -20dB upper and lower frequency points.
4. Read 20dB bandwidth.

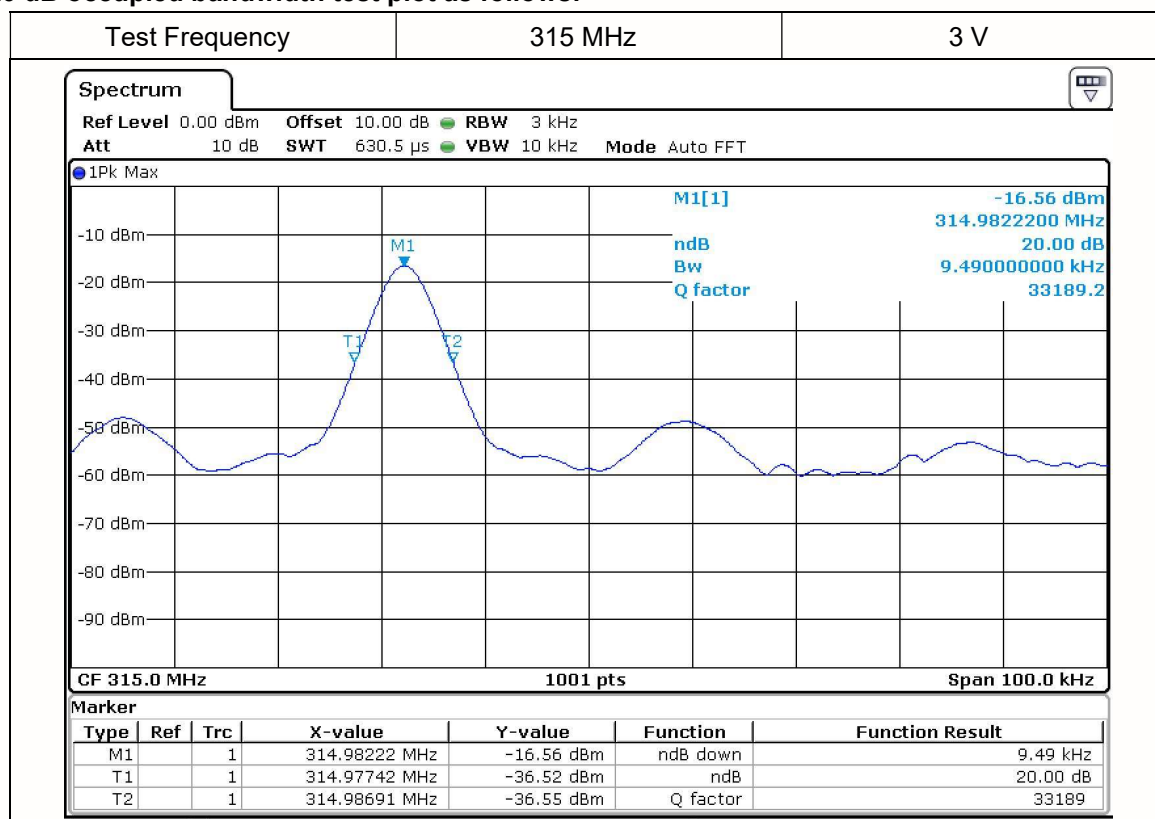
2.2.4 Test Result

Measurement Data

Test Frequency (MHz)	20 dB occupied bandwidth (MHz)	Limit (MHz)
315	0.00949	≤0.7875
Test Result	Pass	

Note: Limit cal. = Fundamental frequency x 0.25%
= 315 MHz x 0.25% = 0.7875 MHz

20 dB occupied bandwidth test plot as follows:



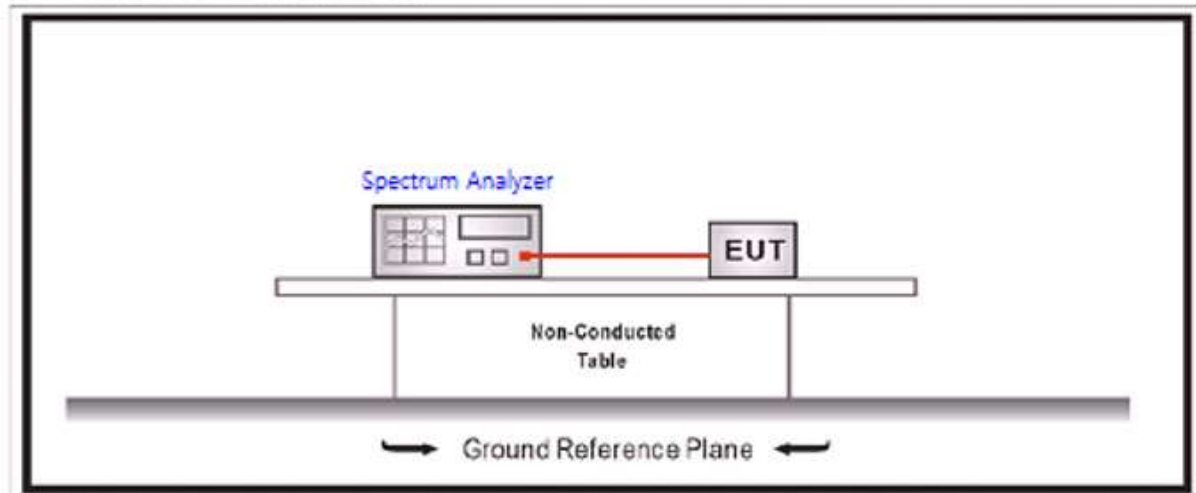
2.3 Duration Time

2.3.1 Limit

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

2.3.2 Test Configuration

RF Conducted Measurement:



2.3.3 Test Procedure

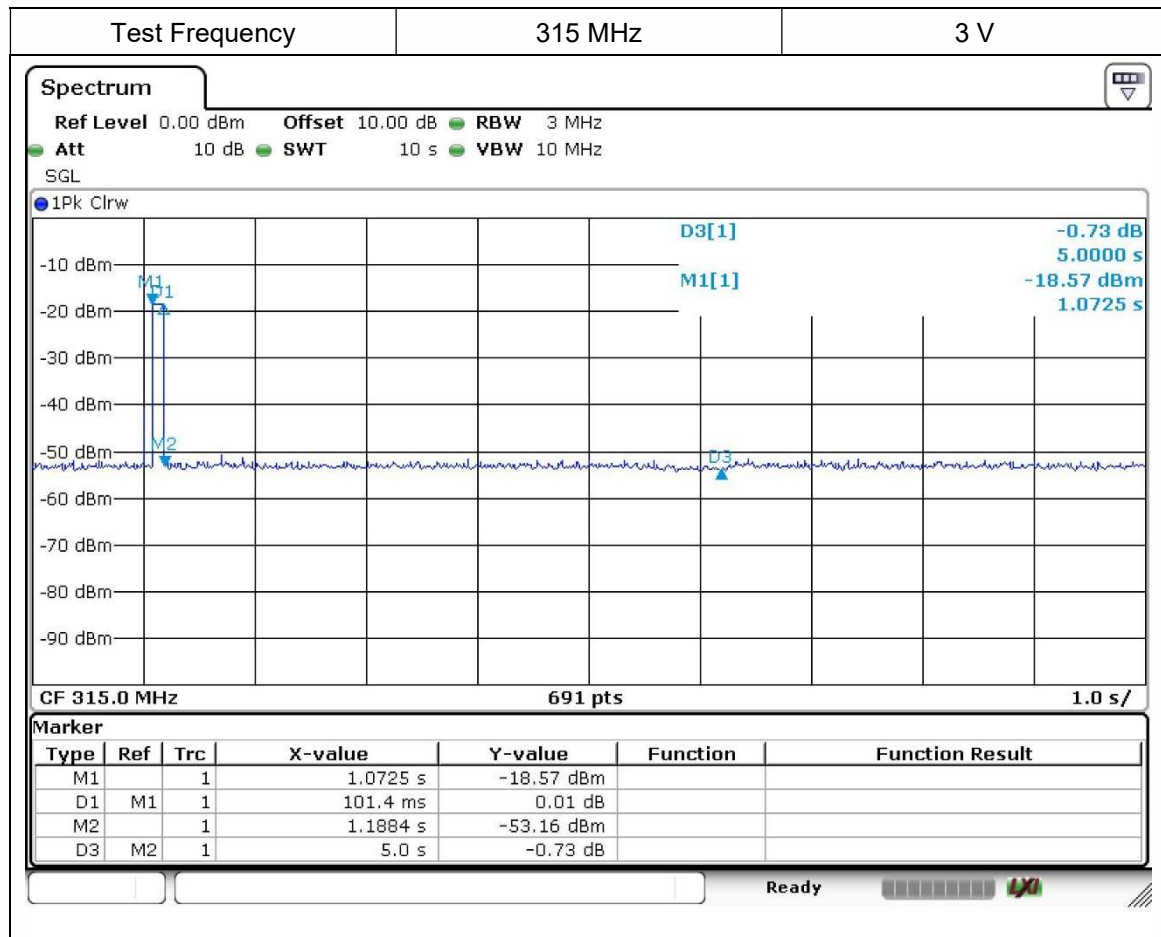
1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT.
2. Set the EUT to proper test channel.
3. Single scan the transmission and read the transmission time.

2.3.4 Test Result

Test Frequency (MHz)	Duration of each TX (second)	Limit (Second)
315	0.1014	<5
Test Result	Pass	

Note 1: The transmitter was automatically activated.

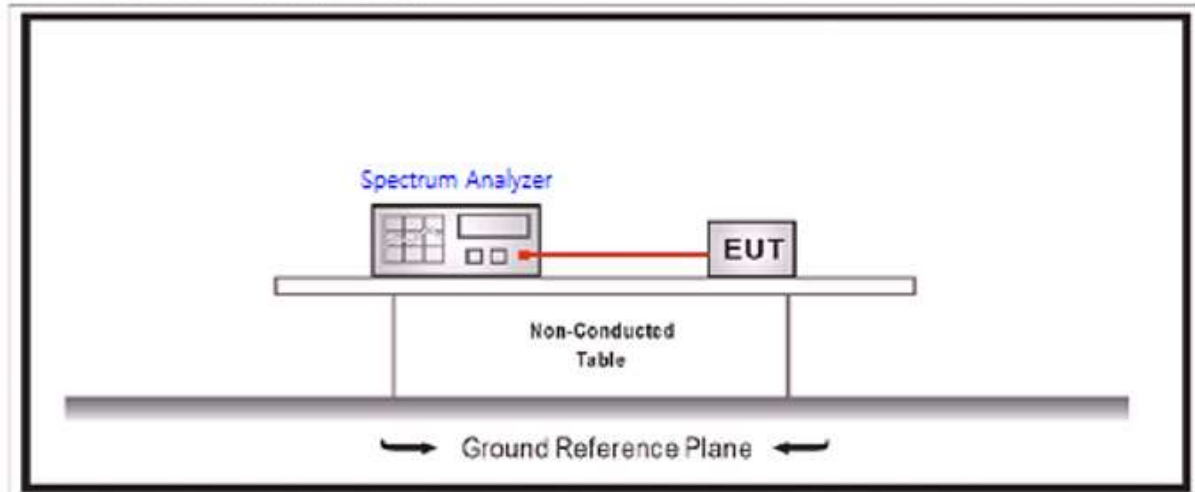
Duration time test plot as follows:



2.4 Duty Cycle

2.4.1 Test configuration

RF Conducted Measurement:



2.4.3 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 centre frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW=100 kHz, VBW= 100 kHz, Span=0 Hz, Adjust Sweep = 100 ms to obtain the "worst-case" pulse on time.
5. Repeat above procedures until all frequency measured was complete.

2.4.4 Test Result

Calculate Formula: Duty cycle factor = (Number of short pulses) * (On time a single short pulse) +

(Number of long pulses) * (On time a single long pulse) / Pulse train length (or 100 ms)

$$20 \cdot \log(Ton/Tp) = 20 \cdot \log(19.91/60.652) = -9.675 \text{ dB}$$

One Period	Short Pulse Width (ms)	Number of Short pulse	Long Pulse width (ms)	Number of Long pulse	Duty cycle in a pulse train length (or 100ms)	20log Duty Cycle
60.652	0.2609	11	1.2174	14	45.957	-9.675

Duty cycle test plot as follows:



2.5 Radiated Spurious Emission

2.5.1 Test Procedure

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1 GHz; 1.5 m above the ground plane for measurement above 1 GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 Ghz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and add duty cycle factor for average measurements. Please refer to test report section 7.2 for duty cycle factor information. Note: The pre-scan measurements above 1 Ghz the VBW is set to 30 kHz.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

2D antenna use – For below 30 MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

2.5.2 Limit

In addition to the provisions of 15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250

Note 1: Linear interpolations.

For 130-174 MHz: FS (microvolts/m) = (56.82 x F) - 6,136

For 260-470 MHz: FS (microvolts/m) = (41.67 x F) - 7,083

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below;

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
10.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

Note1: Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

Note2: Above 38.6

15.205 (b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

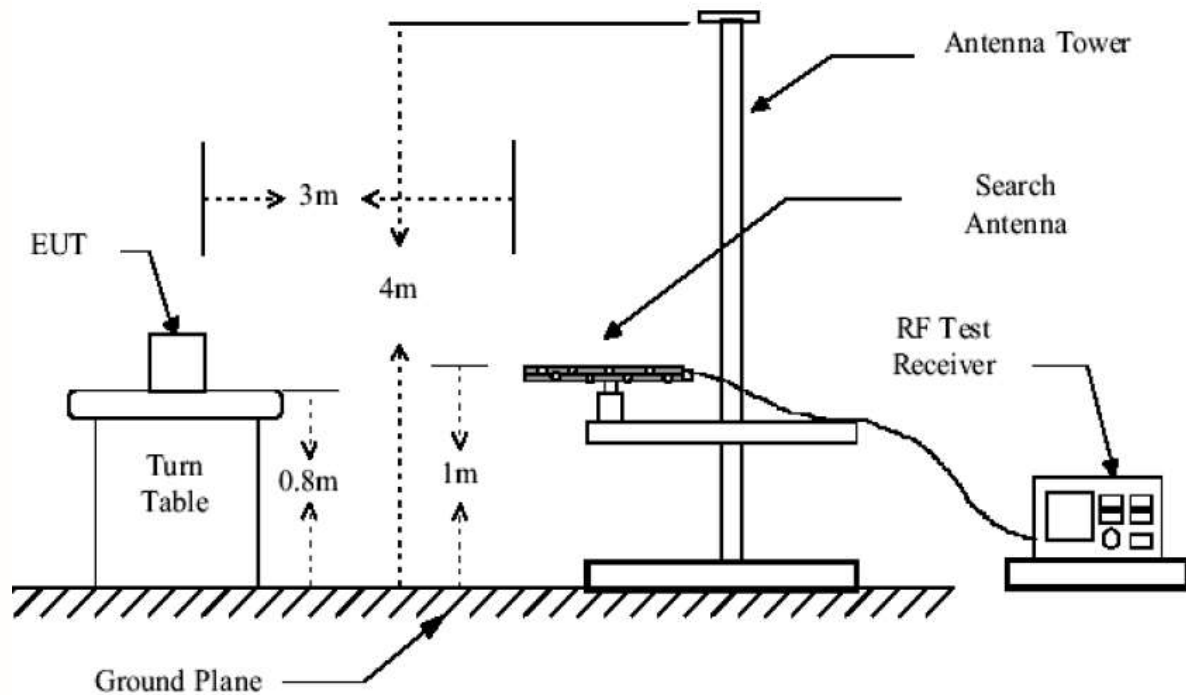
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

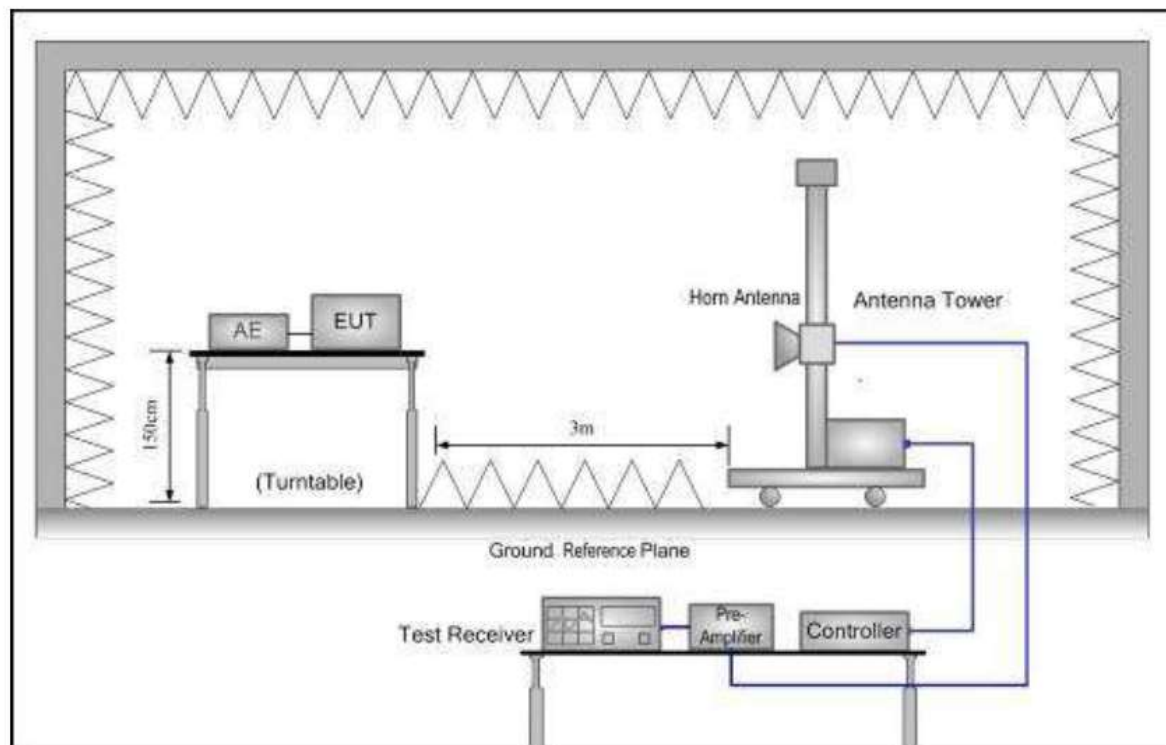
15.209 (b) In the emission table above, the tighter limit applies at the band edges.

2.5.3 Test configuration

Below 1 GHz



Above 1 GHz



Fundamental harmonics and TX spurious emission (30-1000 MHz) test plot as follows:

30-1_X

2021-06-02

Test Report

Common Information

Test Description:

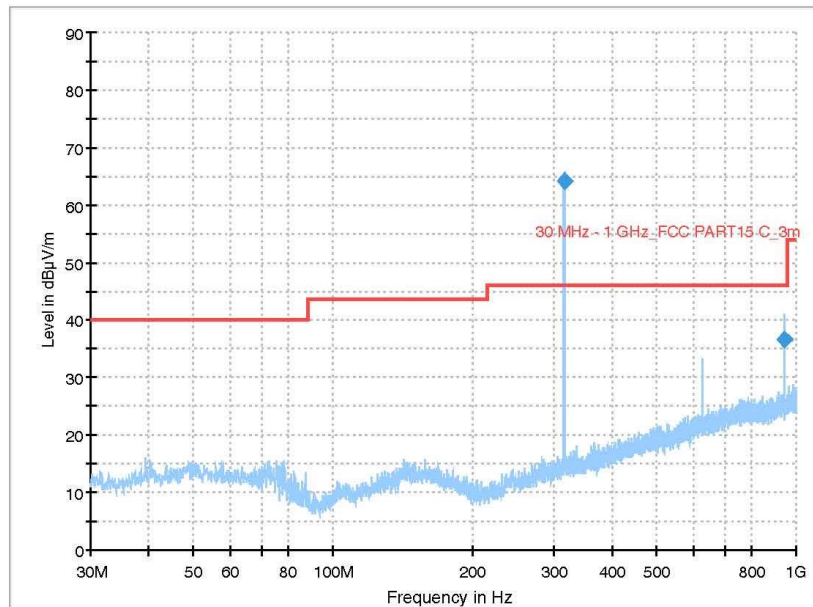
Test Mode:

Test Standard:

Environment Conditions:

Operator Name:

Comment:



Peak Value					
Frequency (MHz)	Reading (dBuV/m)	DCCF (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
945.00	36.61	-	36.61	75.62	9.41
Average Value					
945.00	36.61	-9.68	26.94	55.62	28.69

Note1: The test performed worst axis (X axis)

Note2: Total = Reading + Correction Factor

(Correction Factor = Antenna gain + Cable loss + Amp. gain)

Note3: Average value = Peak value + Duty Cycle Factor

Harmonics and TX spurious emission above 1 GHz test plot as follows:

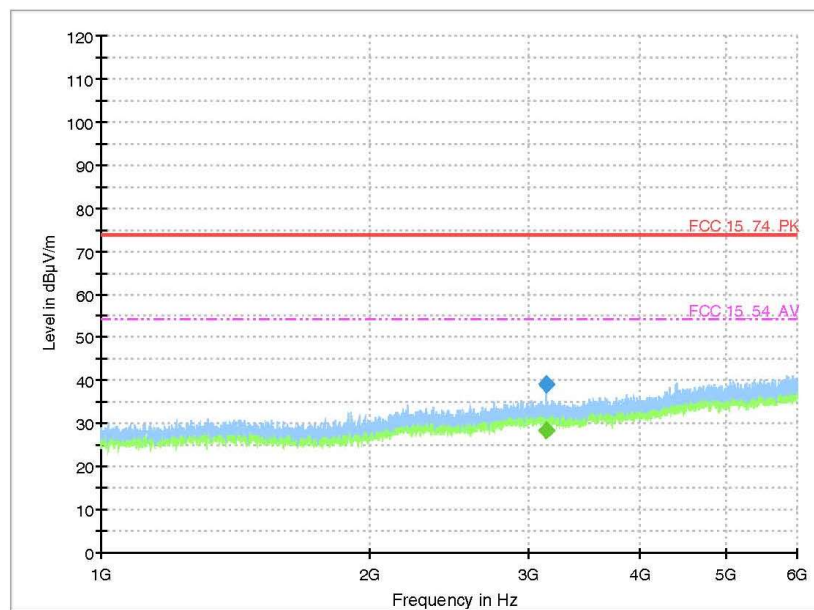
1-6 GHz_X

2021-06-02

Test Report

Common Information

Test Description:
Test Mode:
Test Standard:
Environment Conditions:
Operator Name:
Comment:



Peak Value					
Frequency (MHz)	Reading (dBuV/m)	DCCF (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
3150.50	38.98	-	38.98	74	35.02
Average Value					
5150.00	28.35	-	28.35	54	25.65

Note: The test performed worst axis (X axis)

Below 30 MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

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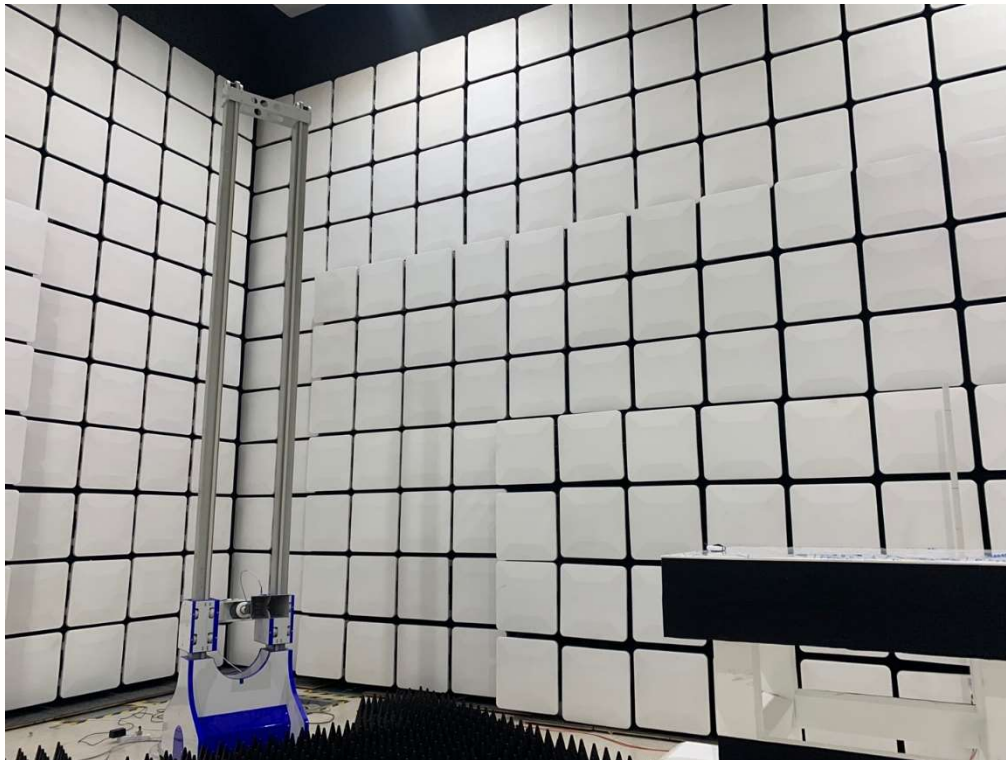
3. Test setup photo



9 kHz to 30 MHz



30 MHz to 1 GHz



1 GHz to 6 GHz

4. External photo



Front

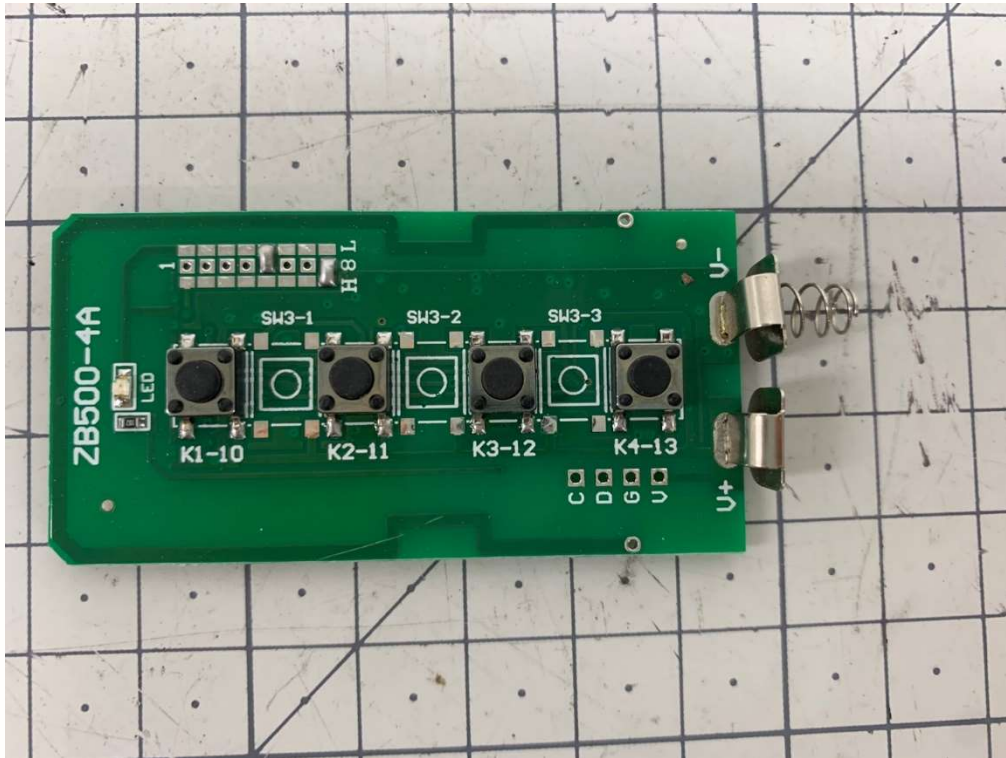


Rear

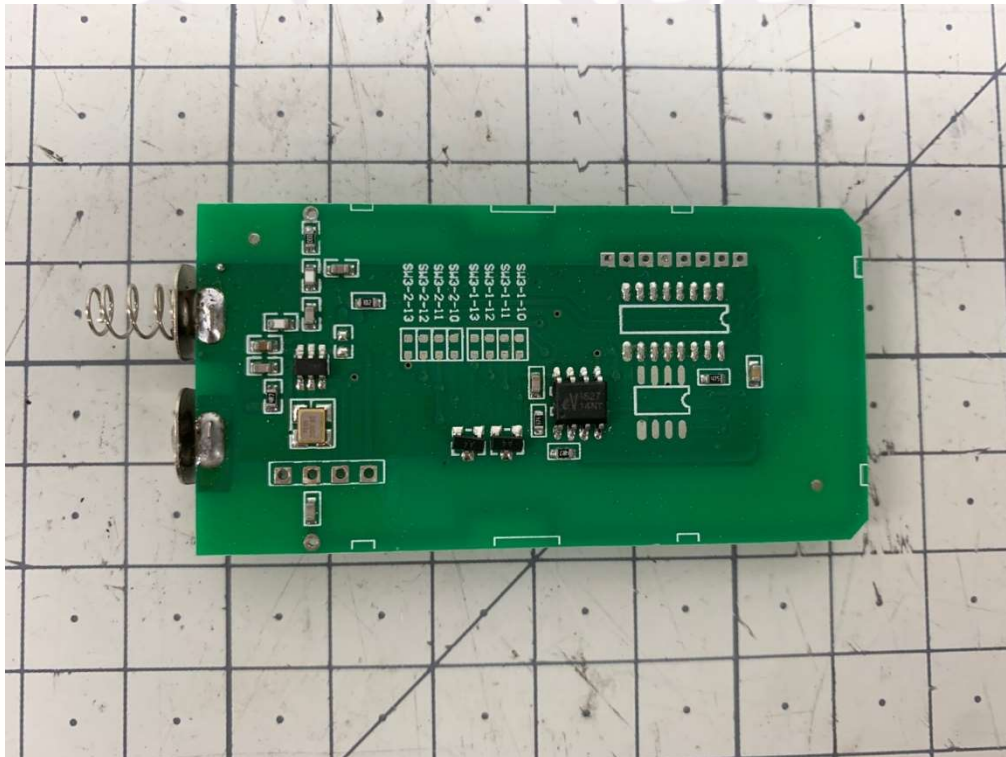
**Left****Right**

**Top****Bottom**

5. Internal photo



Front



Real