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NINGBO LINSHENG ELECTRIC CO.,LTD.

RF TEST REPORT

Report Type:
FCC Part 15.231 & ISED RSS-210 RF report

Model:
LTR05

REPORT NUMBER:
191102415SHA-001

ISSUE DATE:
Jan 16, 2020

DOCUMENT CONTROL NUMBER:
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TEST REPORT

Report no.: 191102415SHA-001

Applicant: NINGBO LINSHENG ELECTRIC CO.,LTD.
XIAODONG INDUSTRIAL ZONE, YUYAO CITY, ZHEJIANG, CHINA

Manufacturer: Same as applicant

Manufacturing site: Same as applicant

FCC ID: 2AL5O-LTR05

SUMMARY:

The equipment complies with the requirements according to the following standard(s) or Specification:
47CFR Part 15 (2019): Radio Frequency Devices (Subpart C) **ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices **RSS-210 Issue 9 (August 2016):** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment **RSS-Gen Issue 5 (April 2018):** General Requirements for Compliance of Radio Apparatus

PREPARED BY:	**REVIEWED BY:**
Project Engineer Stephanie Zhang	Reviewer Daniel Zhao

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Revision History

Report No.	Version	Description	Issued Date
191102415SHA-001	Rev. 01	Initial issue of report	Jan 16, 2020

Measurement result summary

TEST ITEM	FCC REFERANCE	IC REFERANCE	RESULT
Fundamental & spurious emission &Restrict band radiated emission	15.231(b) 15.209(a) 15.205	RSS-210 A.1.2 RSS-Gen Issue 5 Clause 8.9&8.10	Pass
Power line conducted emission	15.207	RSS-Gen Issue 5 Clause 8.8	Pass
Emission bandwidth	15.231(c)	RSS-210 Issue 9 A1.3 RSS-GEN Issue 5 6.7	Pass
Transmission Time	15.231(a)(1)	RSS-210 Issue 9 A1.1(a)	Pass
Antenna requirement	15.203	-	Pass

Notes: 1: NA =Not Applicable

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name:	Wireless Remote Control
Type/Model:	LTR05
Description of EUT:	The EUT is Wireless Remote Control which supports SRD function. It works at 433.92MHz Frequency, there is only one model, we test it and list the worst results in this report. The Elecrical Light Sensor Timer LTU08C-F and the Remote Control Power Switch LTU09-F share this remote control.
Rating:	3VDC
Category of EUT:	Class B
EUT type:	☒ Table top ☐ Floor standing
Software Version:	/
Hardware Version:	/
Sample received date:	2019.11.27
Date of test:	2019.11.27~2020.01.10

1.2 Technical Specification

Operation Frequency:	433.92MHz
Type of Modulation:	ASK
Product Type:	☐ Mobile ☒ Portable ☐ Fix Location
Channel Number:	1

1.3 Description of Test Facility

Name:	Intertek Testing Services Shanghai
Address:	Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone:	86 21 61278200
Telefax:	86 21 54262353

The test facility is recognized, certified, or accredited by these organizations:	CNAS Accreditation Lab Registration No. CNAS L0139
	FCC Accredited Lab Designation Number: CN1175
	IC Registration Lab Registration code No.: 2042B-1
	VCCI Registration Lab Registration No.: R-4243, G-845, C-4723, T-2252
	NVLAP Accreditation Lab NVLAP LAB CODE: 200849-0
	A2LA Accreditation Lab Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Standards or specification

47CFR Part 15 (2019)
ANSI C63.10 (2013)
RSS-210 Issue 9 (August 2016)
RSS-Gen Issue 5 (April 2018)

2.2 Mode of operation during the test

While testing transmitting mode of EUT, the continuously transmission was applied.

The EUT is a handheld device, so three axes (X, Y, Z) were observed while the test receiver worked as "max hold" continuously and the highest reading among the whole test procedure was recorded. Compare with the test results that **X axis** with **ON button** is the worst case.

2.3 Test software list

Test Items	Software	Manufacturer	Version
Conducted emission	ESxS-K1	R&S	V2.1.0
Radiated emission	ES-K1	R&S	V1.71

2.4 Test peripherals list

Item No.	Name	Band and Model	Description
-	-	-	-

2.5 Test environment condition:

Test items	Temperature	Humidity
Fundamental & spurious emission & Restrict band radiated emission	20°C	51% RH
Power line conducted emission	20°C	52% RH
Emission bandwidth & Transmission Time	20°C	52% RH

2.6 Instrument list

Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	Test Receiver	R&S	ESIB 26	EC 3045	2020-09-16
☑	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2020-09-24
☑	Horn antenna	R&S	HF 906	EC 3049	2020-09-22
☐	Horn antenna	ETS	3117	EC 4792-1	2020-08-23
☐	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2020-07-09
☑	Pre-amplifier	R&S	Pre-amp 18	EC5881	2020-06-19
☑	Semi-anechoic chamber	Albatross project	-	EC 3048	2020-09-08
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2020-09-10
☐	Power sensor	Agilent	U2021XA	EC 5338-1	2020-09-10
☐	Vector Signal Generator	Agilent	N5182B	EC 5175	2020-09-10
☐	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2020-09-10
☑	Test Receiver	R&S	ESCI 7	EC 4501	2020-09-16
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☑	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3323	2020-06-14
☑	Pressure meter	YM3	Shanghai Mengde	EC 3320	2020-06-28

2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Test item	Measurement uncertainty
Maximum peak output power	± 0.74dB
Radiated Emissions in restricted frequency bands below 1GHz	± 4.90dB
Radiated Emissions in restricted frequency bands above 1GHz	± 5.02dB
Emission outside the frequency band	± 2.89dB
Power line conducted emission	± 3.19dB

3 Fundamental & Spurious Emission & Restrict band radiated emission

Test result: **Pass**

3.1 Limit

3.1.1 The emission shall test through the 10th harmonic or to 40GHz, whichever is lower. It must comply with the limits below:

	Fundamental Frequency (MHz)	Fundamental limit (uV/m)	Spurious limit (uV/m)
☐	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

The formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(Frequency) - 6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(Frequency) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

For that the EUT use fundamental frequency of 433.92MHz, after calculation, the limit is:

Fundamental limit = 41.6667 * 433.92 - 7083.3333 = 10996.68 uV/m = 80.80dBuV/m
Spurious limit = 81 – 20 = 60.80dBuV/m

//

3.1.2 The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

3.2 Measurement Procedure

For Radiated emission below 30MHz:

a) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c) Both X and Y axes of the antenna are set to make the measurement.
d) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz:

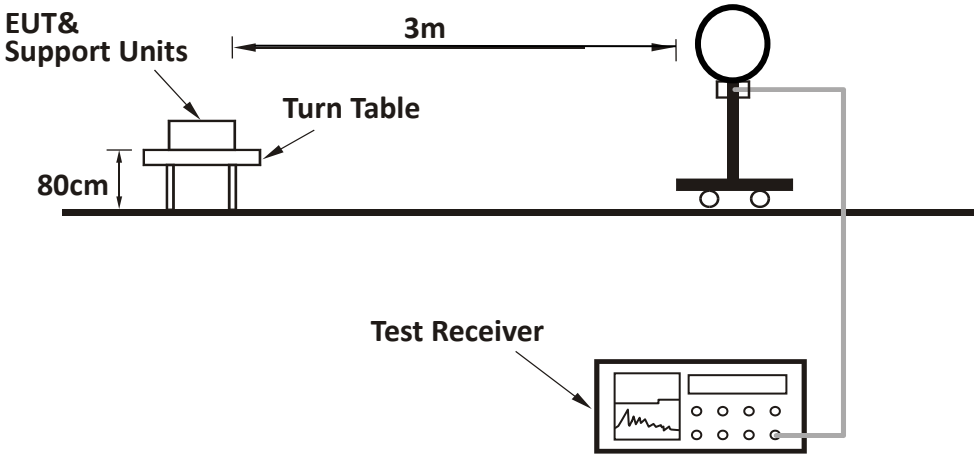
a) The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c) 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.
d) 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.
e) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
f) The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

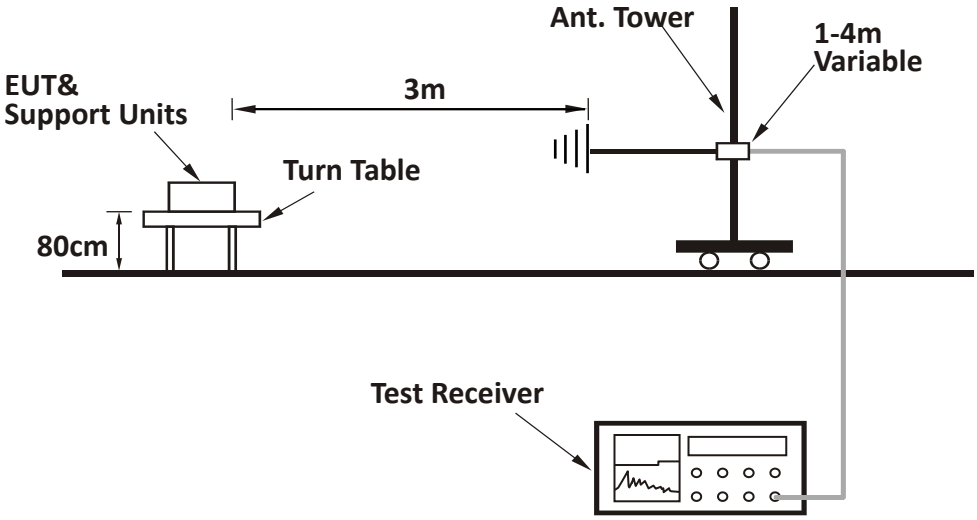
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 3 x RBW (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported

3.3 Test Configuration

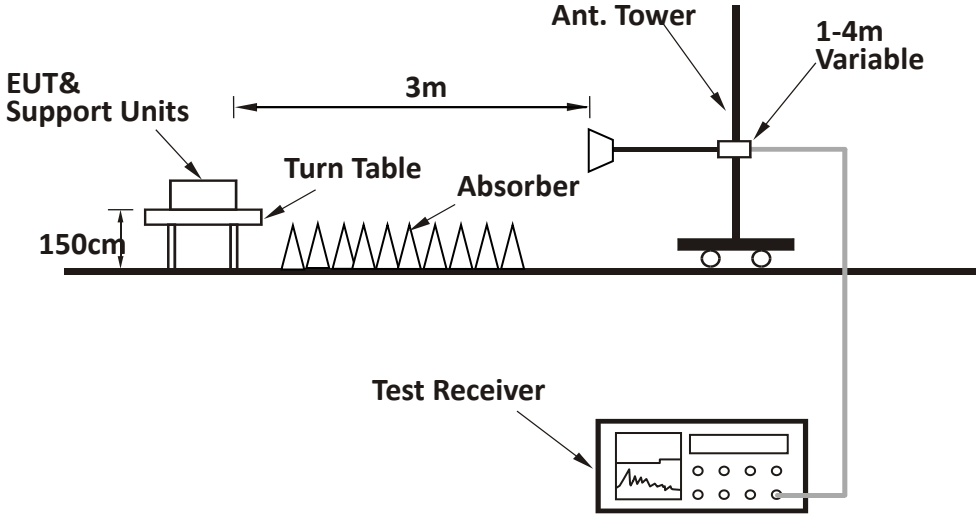
For Radiated emission below 30MHz:



For Radiated emission 30MHz to 1GHz:



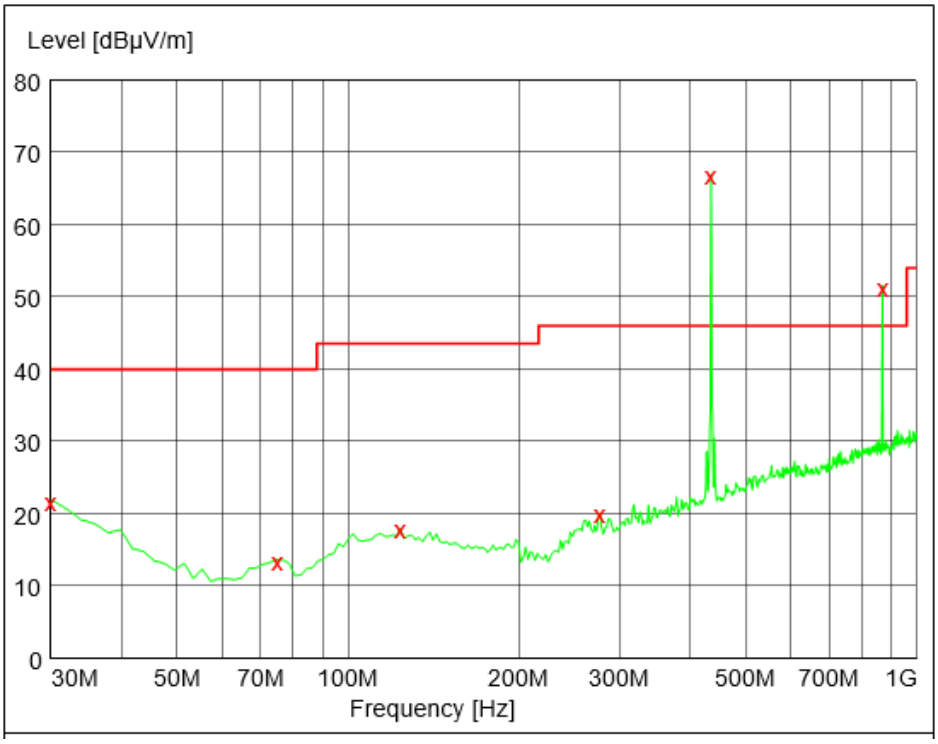
For Radiated emission above 1GHz:

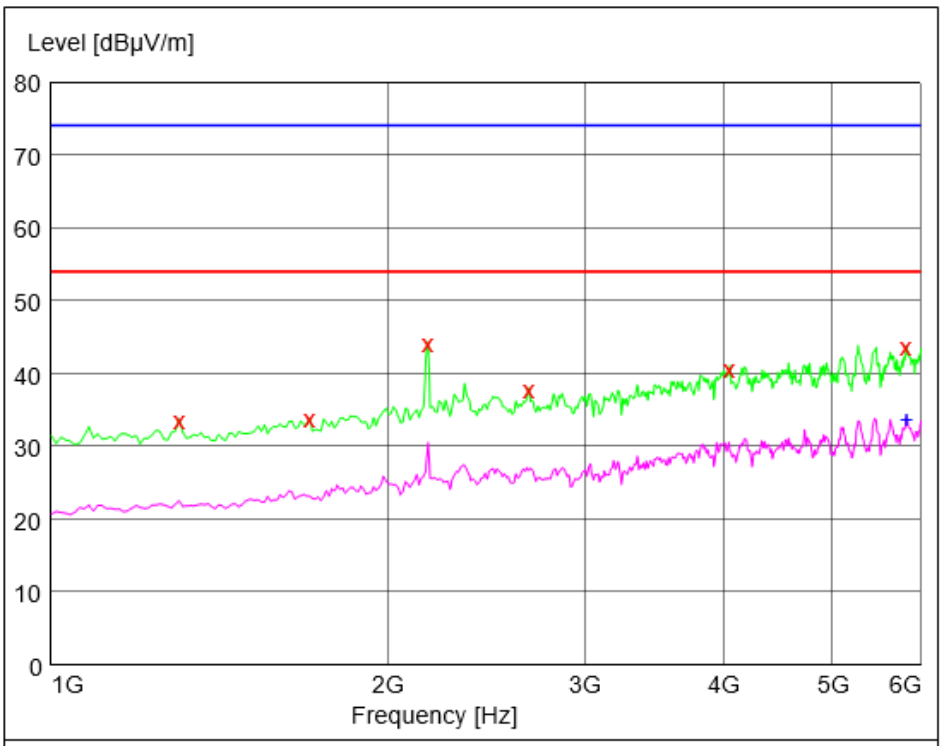


3.4 Test Results of Radiated Emissions

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

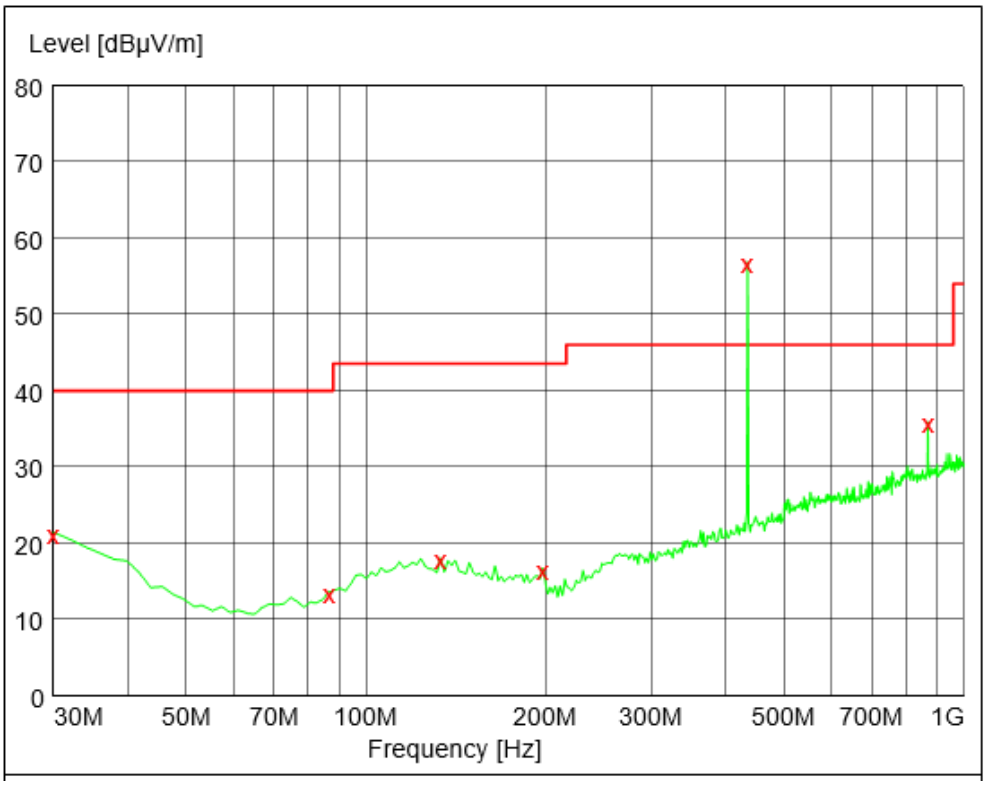
Horizontal

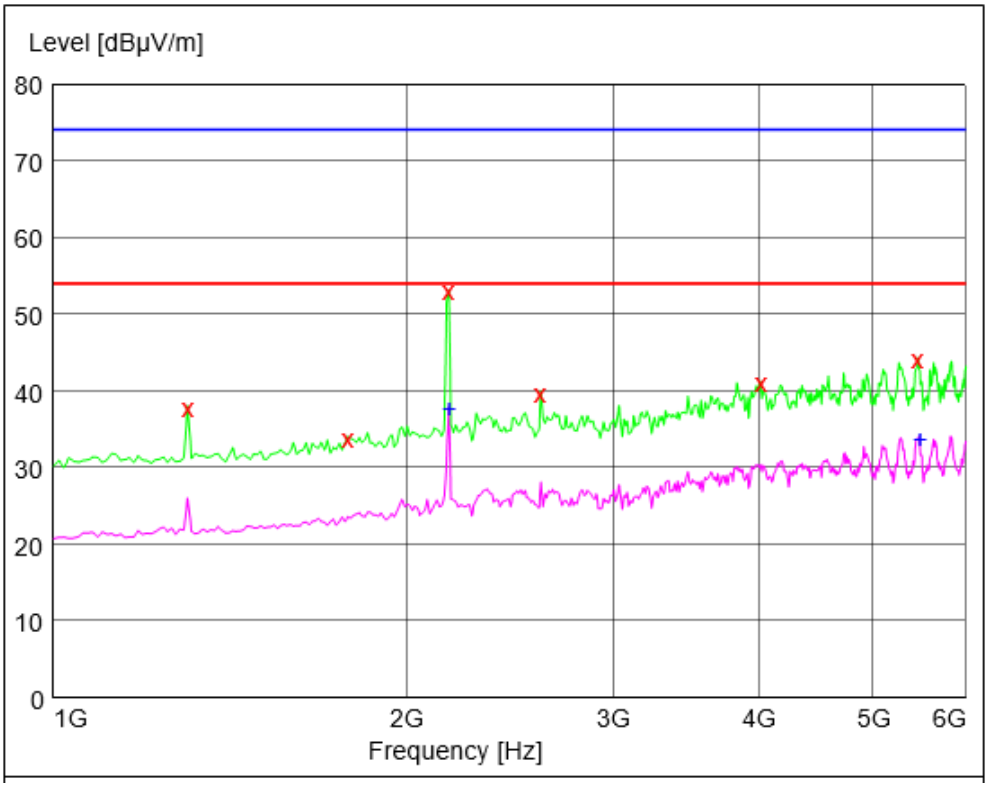




TEST REPORT

Vertical





Test data:

Polarization	Frequency (MHz)	Corrected Reading (dBμV/m)	Correct Factor (dB/m)	Limits (dBμV/m)	Margin (dB)	Detector
H	30.000	21.90	18.80	40.00	18.10	PK
	74.709	13.70	7.60	40.00	26.30	PK
	123.307	18.00	13.20	43.50	25.50	PK
	406.500	22.80	14.80	46.00	23.20	PK
	434.329	66.90	18.40	100.80	33.90	PK
	869.760	51.60	23.50	80.80	29.20	PK
	1300.601	33.80	-10.60	74.00	40.20	PK
	1701.403	33.90	-8.50	74.00	40.10	PK
	2172.345	44.40	-5.60	80.80	36.40	PK
	2673.347	38.10	-4.00	80.80	42.70	PK
	4046.092	40.90	0.90	74.00	33.10	PK
	5819.639	43.80	5.10	80.80	37.00	PK
V	30.000	21.40	18.80	40.00	18.60	PK
	86.373	13.60	9.30	40.00	26.40	PK
	133.026	18.00	12.80	43.50	25.50	PK
	410.000	21.70	11.00	46.00	24.30	PK
	434.329	56.90	18.40	100.80	43.90	PK
	869.760	35.90	23.50	80.80	44.90	PK
	1300.601	38.00	-10.60	74.00	36.00	PK
	1781.563	34.00	-8.00	80.80	46.80	PK
	2172.345	53.20	-5.60	80.80	27.60	PK
	2603.206	40.00	-4.00	80.80	40.80	PK
	4006.012	41.30	0.80	74.00	32.70	PK
	5458.918	44.30	4.70	74.00	29.70	PK

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (- Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.

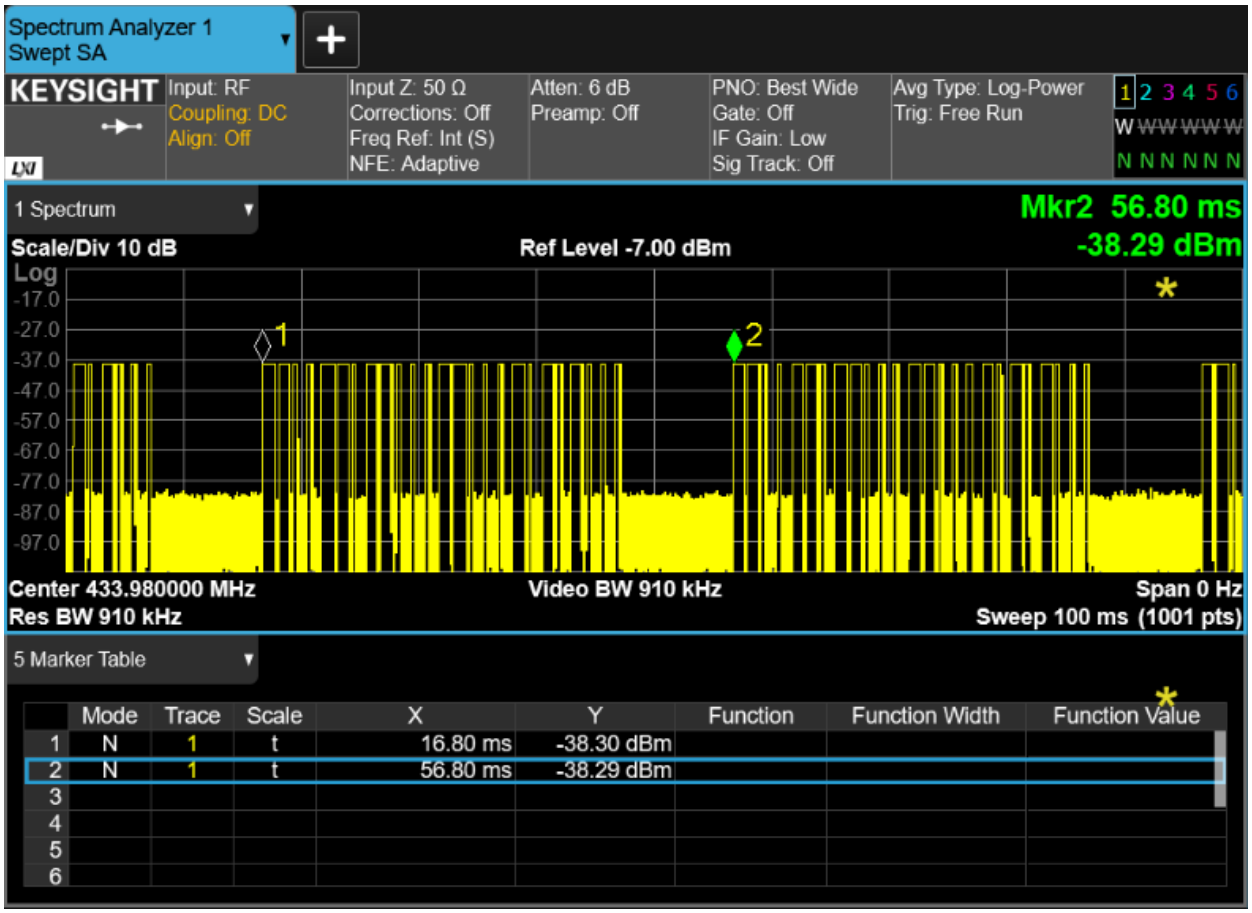
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;
Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

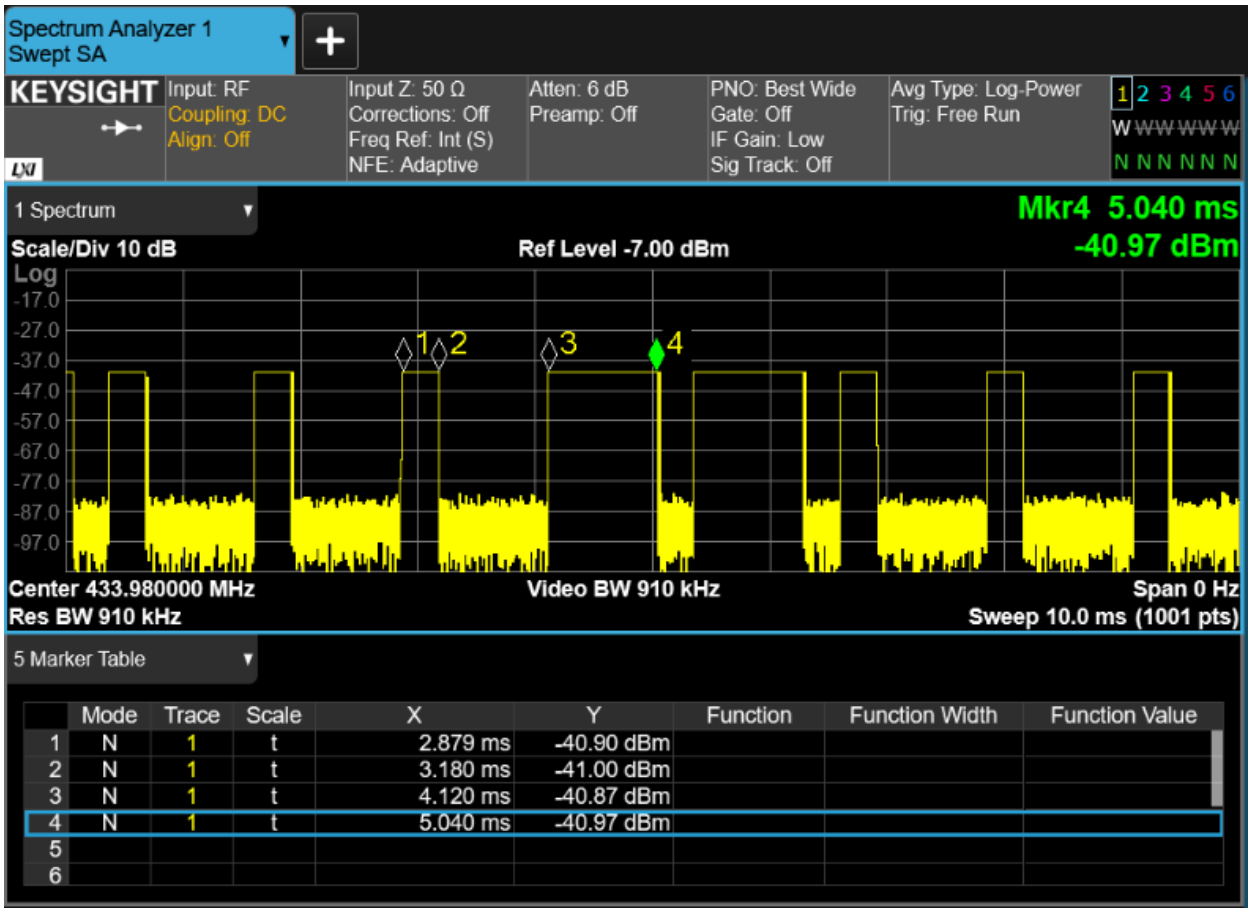
Duty Cycle:

The test data with maximum duty cycle was listed below.

The worst Duty cycle= (0.92*11+0.301*14) / 40 = 14.334/40=0.358



TEST REPORT



	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	t	2.879 ms	-40.90 dBm			
2	N	1	t	3.180 ms	-41.00 dBm			
3	N	1	t	4.120 ms	-40.87 dBm			
4	N	1	t	5.040 ms	-40.97 dBm			
5								
6								

Calculating the AV value according to the duty cycle

Antenna	Frequency (MHz)	PK Reading (dBuV/m)	Correct Factor (dB)	AV Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
H	**434.329**	66.90	-8.92	57.98	80.80	22.82
H	869.760	51.60		42.68	60.80	18.12
H	1701.403	33.90		24.98	54.00	29.02
H	2172.345	44.40		35.48	60.80	25.32
V	**434.329**	56.90		47.98	80.80	32.82
V	869.760	35.90		26.98	60.80	33.82
V	1781.563	34.00		25.08	60.80	35.72
V	2172.345	53.20		44.28	60.80	16.52

Remark:
1. Correct Factor = 20lg (duty cycle) = 20lg (0.358) = -8.92;
2. AV Reading = PK Reading + Correct Factor;
3. Margin = limit - AV Reading.

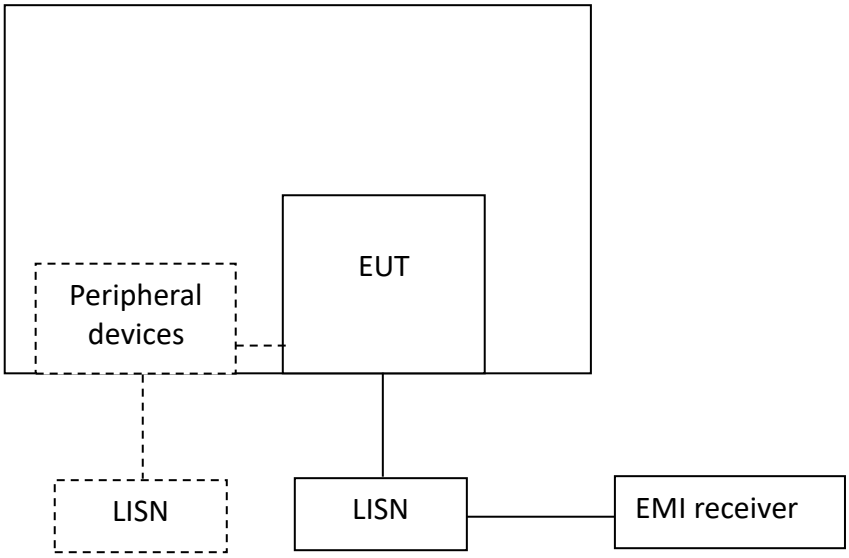
4 Power line conducted emission

Test result: **NA**

4.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

4.2 Test Configuration



4.3 Measurement Procedure

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

4.4 Test Results of Power line conducted emission

Test Curve:

Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(μV)	Limit dB(μV)	Margin (dB)	level dB(μV)	limit dB(μV)	Margin (dB)
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

5 Emission Bandwidth

Test result: **Pass**

5.1 Limit

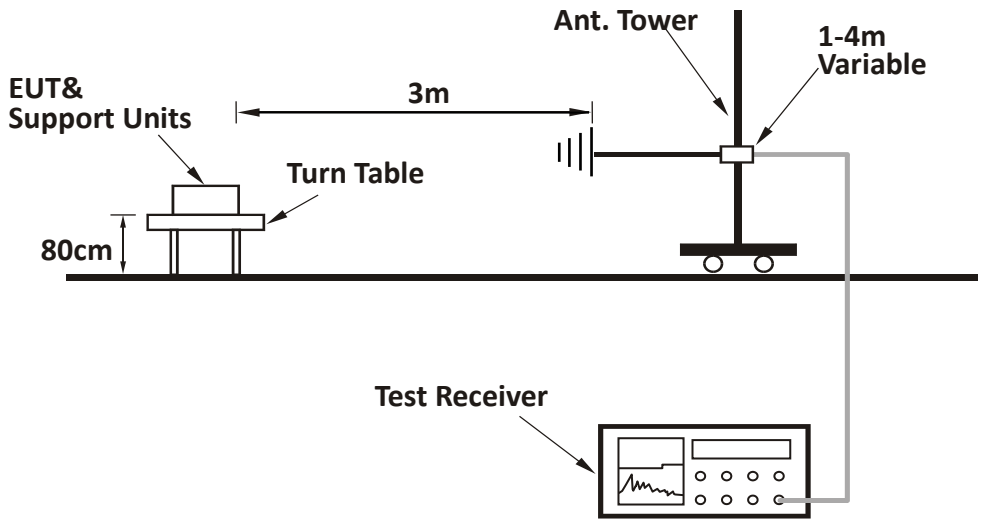
The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the center frequency.

The limit for the EUT = 0.25% * 433.92 MHz = 1085 kHz

5.2 Measurement Procedure

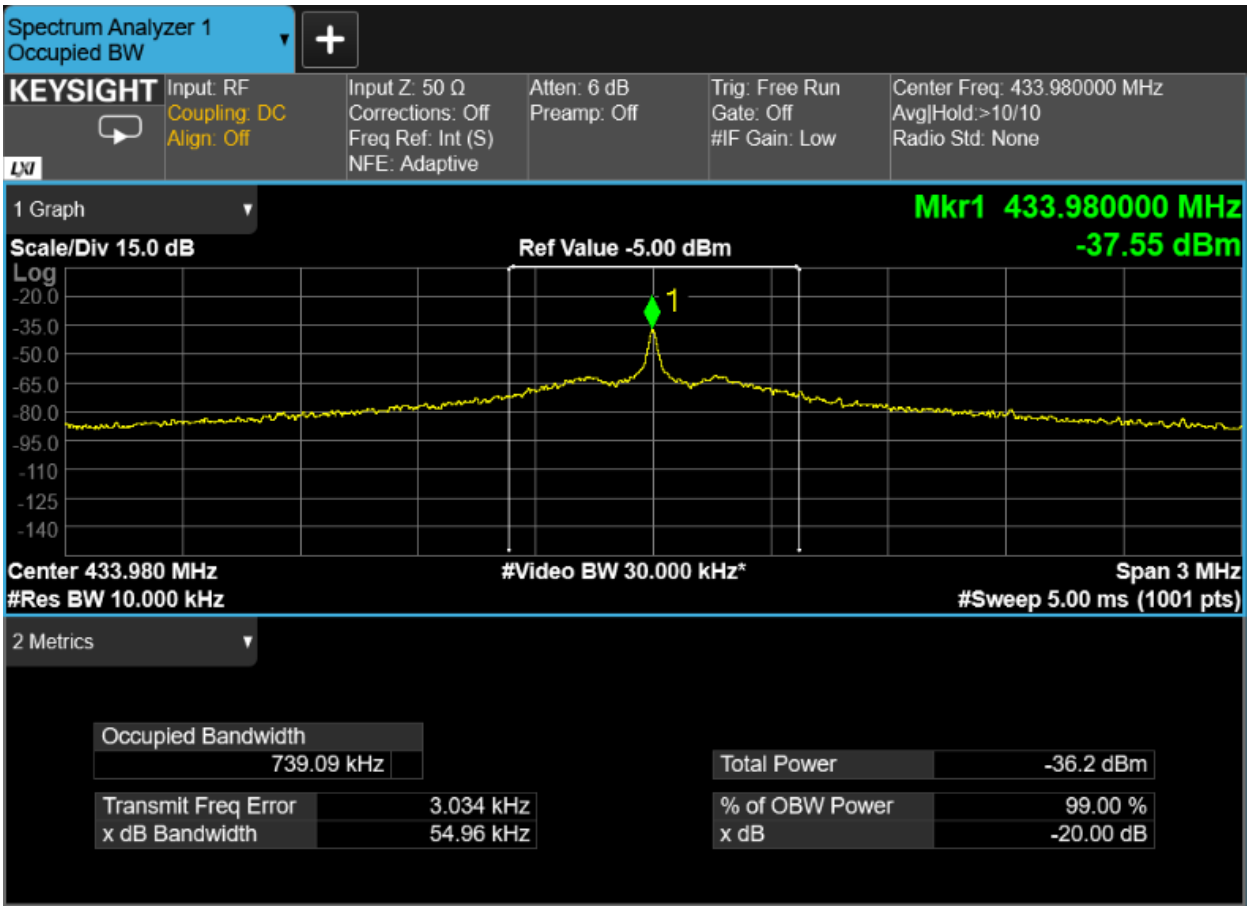
The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.
The central frequency of test receiver was set near the operating frequency of EUT.
The test was conducted using the Spectrum Analyzer with the resolutions bandwidth set at 10kHz, the video bandwidth set at 30kHz.

5.3 Test Configuration



5.4 The results

Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
433.98	54.96	739.09
Limit	1085	1085
Result	**Complied**	**Complied**



6 Deactivating time

Test result: **Pass**

6.1 Test limit

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

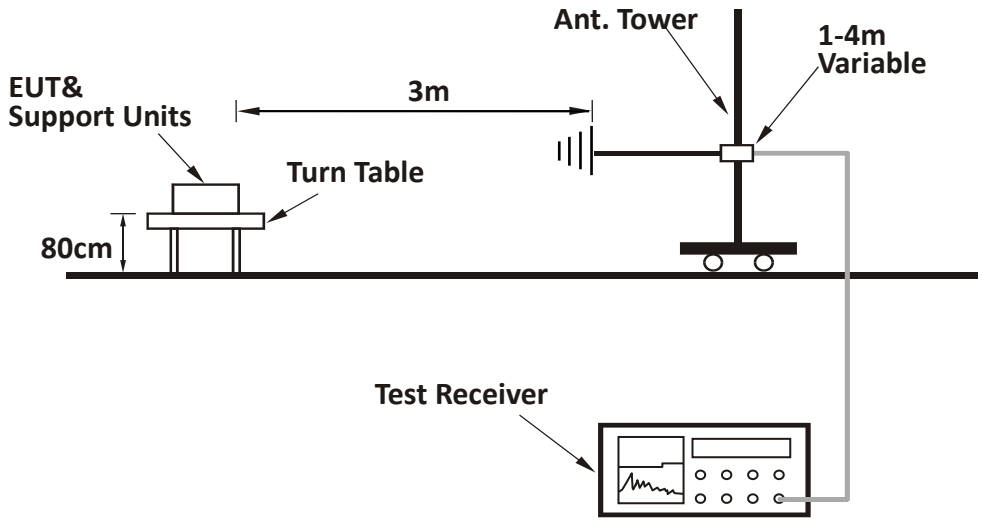
☐ (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

☐ (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.

☐ (4) 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.

☐ (5) Transmission of set-up information for security systems may exceed the transmission duration limits in (1) and (2) above, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

6.2 Test Configuration

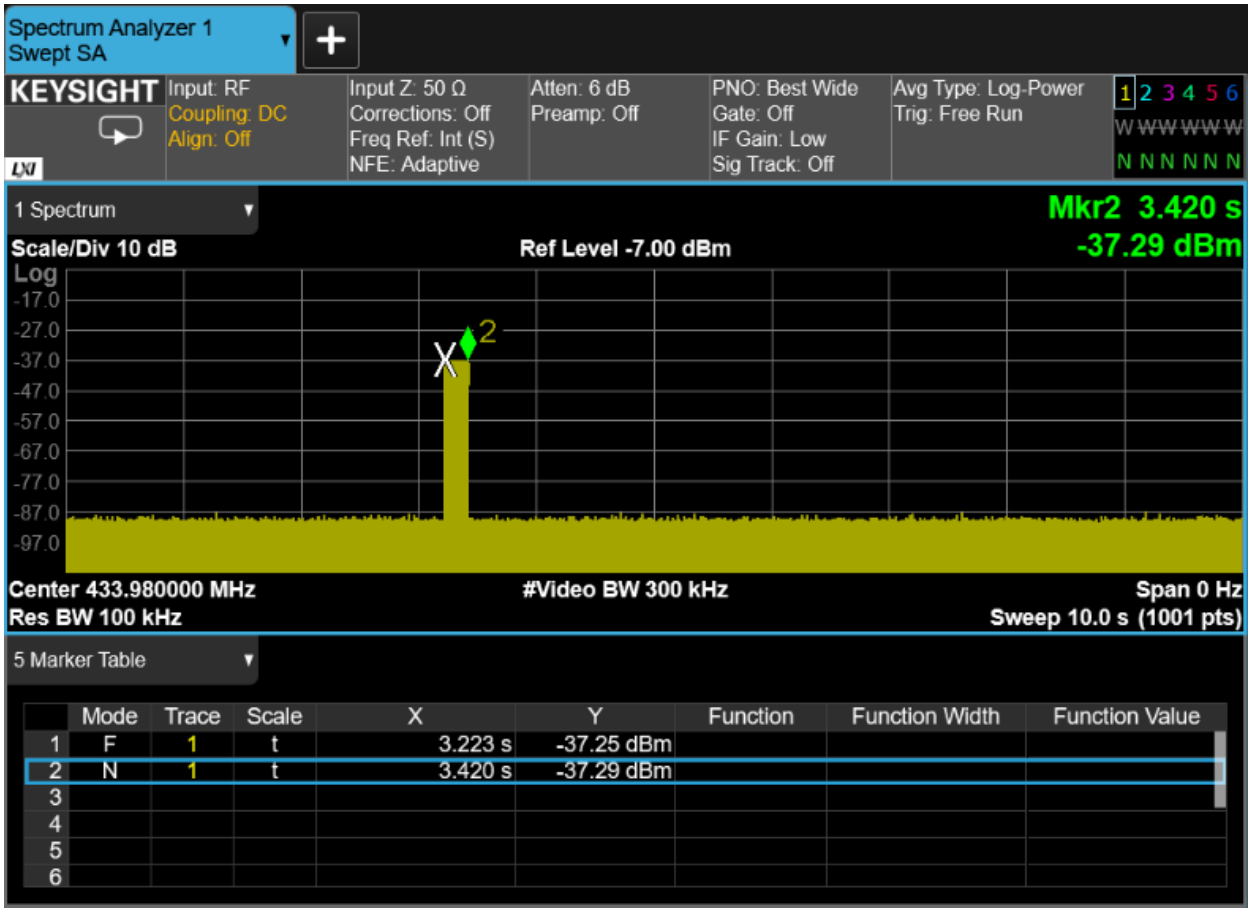


6.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber.
The central frequency of test receiver was set as the operating frequency of EUT and the Span was set as 0.
The EUT was switched once. The test receiver recorded the whole time from the triggered moment to the time of stopping radiating. For manual switching, to avoid uncertainty, the operating above would be repeated five times and the worst data is recorded.

6.4 Test protocol

Whole time from the triggered moment to the time of stopping radiating: 0.197s.
As a result, the EUT complies with the limit of 5s' deactivating time.



7 Antenna requirement

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 shall be considered sufficient to comply with the provisions of this section.

Result:
EUT uses permanently attached antenna to the intentional radiator, so it can comply with the provisions of this section.

********** END **********