

10.10.2. Test configuration

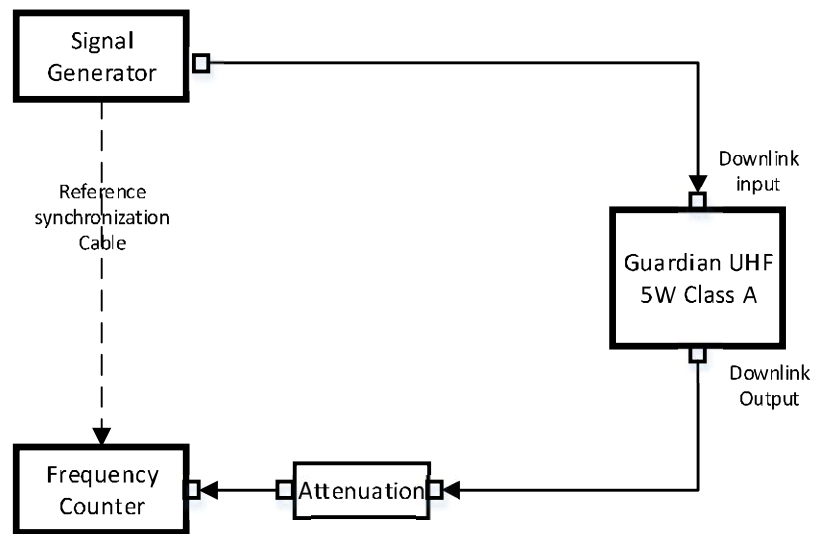


Figure 10.10-1 Downlink test connection diagram

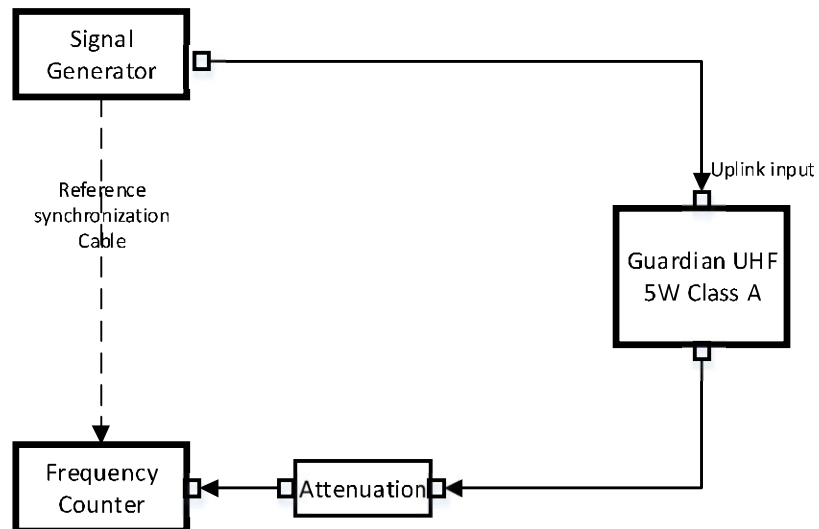


Figure 10.10-2 Uplink test connection diagram

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10.10.3. Test procedures

10.10.3.1. FCC PART 2 1055(a) (1)

§2.1055 Measurements required: Frequency stability.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(2) From -20° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBs), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to $+50^{\circ}$ centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

10.10.3.2. ANSI C63.26-2015 clause 5.6.3

5.6.3 Procedure for frequency stability testing

Frequency stability is a measure of the frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at $+20^{\circ}\text{C}$ and rated supply voltage.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency determining circuit element shall be made subsequent to this initial set-up. Frequency stability is tested:

- a) At 10°C intervals of temperatures between -30°C and $+50^{\circ}\text{C}$ at the manufacturer's rated supply voltage, and
- b) At $+20^{\circ}\text{C}$ temperature and $\pm 15\%$ supply voltage variations. If a product is specified to operate over a range of input voltage then the -15% variation is applied to the lowermost voltage and the $+15\%$ is applied to the uppermost voltage.

During the test all necessary settings, adjustments and control of the EUT have to be performed without disturbing the test environment, i.e., without opening the environmental chamber. The frequency stabilities can be maintained to a lesser temperature range provided that the transmitter is automatically inhibited from operating outside the lesser temperature range. For handheld equipment that is only capable of operating from internal batteries and the supply voltage cannot be varied, the frequency stability tests shall be performed at the nominal battery voltage and the battery end point voltage specified by the manufacturer. An external supply voltage can be used and set at the internal battery nominal voltage, and again at the battery operating end point voltage which shall be specified by the equipment manufacturer.

If an unmodulated carrier is not available, the mean frequency of a modulated carrier can be obtained by using a frequency counter with gating time set to an appropriately large multiple of bit periods (gating time depending on the required accuracy). Full details on the choice of values shall be included in the test report.

NOTE 1: Input power supply range limits by manufacturer's declare: DC input power: DC $+24\text{V}$;

NOTE 2: Operating Temperature limits by manufacturer's declare: -20°C to $+55^{\circ}\text{C}$.

10.10.4. Test results

Test Date (yy-mm-dd): 2024-02-18

Normal condition: Temp: 22.5°C, Humid:52%, Atmospheric Pressure:101kpa

Extreme test conditions:

Temp range: -20°C~+50°C

Test Date: 2024-02-18

Supply Voltage: DC +24V

10.10.4.1. Downlink transmit mode

Temperature (°C)	Voltage	Input carrier Frequency (MHz)	Output carrier Frequency error(Hz)	Limit (ppm)	Frequency stability (ppm)	Result
-20	DC +20.4V(24*85%)	479.0	0.4	±0.5	0.0008	PASS
	DC +24V	479.0	-0.3	±0.5	-0.0006	PASS
	DC +27.6V(24*115%)	479.0	-0.5	±0.5	-0.0010	PASS
-10	DC +20.4V(24*85%)	479.0	-0.3	±0.5	-0.0006	PASS
	DC +24V	479.0	-1.1	±0.5	-0.0023	PASS
	DC +27.6V(24*115%)	479.0	-0.5	±0.5	-0.0010	PASS
0	DC +20.4V(24*85%)	479.0	0.9	±0.5	0.0019	PASS
	DC +24V	479.0	0.8	±0.5	0.0017	PASS
	DC +27.6V(24*115%)	479.0	-0.2	±0.5	-0.0004	PASS
10	DC +20.4V(24*85%)	479.0	-0.3	±0.5	-0.0006	PASS
	DC +24V	479.0	-1.2	±0.5	-0.0025	PASS
	DC +27.6V(24*115%)	479.0	1.1	±0.5	0.0023	PASS
20	DC +20.4V(24*85%)	479.0	0.8	±0.5	0.0017	PASS
	DC +24V	479.0	0.9	±0.5	0.0019	PASS
	DC +27.6V(24*115%)	479.0	0.7	±0.5	0.0015	PASS
30	DC +20.4V(24*85%)	479.0	1.1	±0.5	0.0023	PASS
	DC +24V	479.0	0.4	±0.5	0.0008	PASS
	DC +27.6V(24*115%)	479.0	-0.4	±0.5	-0.0008	PASS
40	DC +20.4V(24*85%)	479.0	0.5	±0.5	0.0010	PASS
	DC +24V	479.0	-0.8	±0.5	-0.0017	PASS
	DC +27.6V(24*115%)	479.0	-1.0	±0.5	-0.0021	PASS
50	DC +20.4V(24*85%)	479.0	0.5	±0.5	0.0010	PASS
	DC +24V	479.0	-1.0	±0.5	-0.0021	PASS
	DC +27.6V(24*115%)	479.0	0.3	±0.5	0.0006	PASS

NOTE: The test result is accurate to 4 decimal places.

10.11. Radiated spurious emissions

Test requirement:	KDB 935210 D05 clause 4.9 FCC PART 2.1053 FCC PART 90.219 (c)(3)
Test Method:	KDB 935210 D05 clause 4.9 ANSI C63.26-2015/5.5 ANSI/TIA 603-E-2016 ANSI/TIA-102.CAAA-E-2016

10.11.1. Requirements

10.11.1.1. KDB 935210 D05 clause 4.9

The EUT shall comply with sections 4.9 of KDB 935210 D05.

4.9 Spurious emissions radiated measurements

This measurement is intended to produce test data necessary to demonstrate compliance to the radiated spurious emission requirements specified in Section 2.1053 of the FCC rules. This test is intended to capture any emissions that radiate directly from the case, cabinet, control circuits, etc., instead of via the antenna output port, and thus would not be captured in conducted spurious emission measurements. See KDB Publication 971168 [R8] for measurement procedure guidance.

10.11.1.2. FCC PART 2.1053

§2.1053 Measurements required: Field strength of spurious radiation.

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required, with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from halfwave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

[39 FR 5919, Feb. 15, 1974. Redesignated and amended at 63 FR 36599, July 7, 1998]

According to FCC PART 2.1053 requirement, this test was performed to measure radiated spurious emissions from the EUT. The test is intended to capture any emissions that radiate directly from the case, cabinet, control

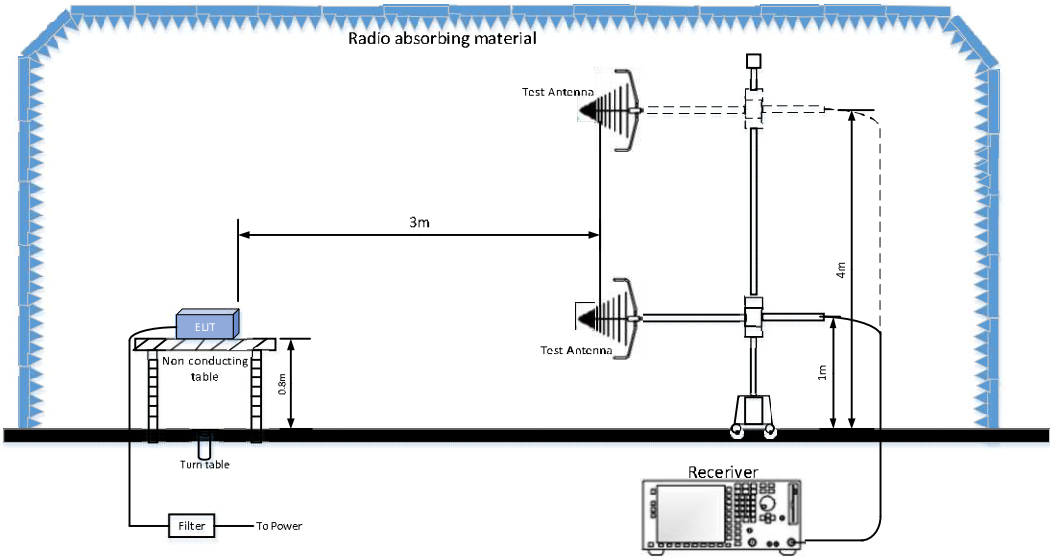
circuits, etc., instead of via the antenna output port, and thus would not be captured in conducted spurious emission measurements.

Spurious emissions of zone enhancers shall be suppressed as much as possible, Any emissions must be attenuated below the power (P) of the highest emissions contained within the authorized, by at least: $43+10*\log_{10} P$ or 70dB, whichever is less stringent, where P is the total RF output power of the test tones in Watts. Since $43+10*\log_{10} P$ is less stringent than 70dB, that limit was used.

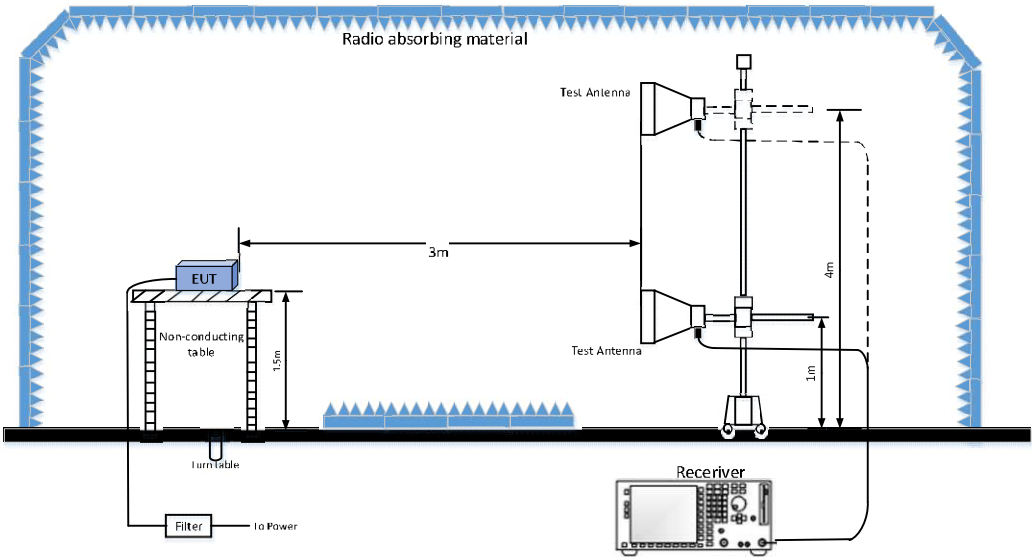
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10.11.2. Test configuration

10.11.2.1. Below 1GHz



10.11.2.2. Above 1GHz



———— The following blanks ————

10.11.3. Test procedures

According to the test method of ANSIC63.26-2015/5.5.2.3.1 Test arrangements for tabletop EUTs:

10.11.3.1. Below 1GHz

For radiated emissions measurements performed at frequencies less than or equal to 1GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80 cm above the reference ground plane. Radiated measurements shall be made with the measurement antenna positioned in both horizontal and vertical polarization. The measurement antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level (i.e., field strength or received power). When orienting the measurement antenna in vertical polarization, the minimum height of the lowest element of the antenna shall clear the site reference ground plane by at least 25 cm.

Figure 8.8.2-1 of ANSIC63.26-2015 shows a typical EUT configuration with a wireless device placed on a tabletop on an appropriate radiated test site. The measurement antenna shall be placed at the specified distance from the closest point of the EUT. Tabletop devices shall be placed on a RF transparent platform with nominal top surface dimensions of 1m by 1.5m. Any necessary support equipment shall be placed far enough away from the EUT, such that changes in relative position of the EUT and support equipment do not influence the measured values. If the EUT requires a connection to a server or computer, via control/data cable(s), to exercise the product, then the controlling server or computer may be placed outside of the test area.

10.11.3.2. Above 1GHz

For radiated measurements performed at frequencies above 1GHz, the EUT shall be placed on an RF transparent table or support at a nominal height of 1.5m above the ground plane. Radiated measurements shall be made with the measurement antenna positioned in both horizontal and vertical polarization. The height scan of the measurement antenna shall be varied from 1m to 4m in a search for the relative positioning that produces the maximum radiated signal level (i.e., field strength or received power). When using the direct field strength method and the EUT is manipulated through three different orientations, then the scan height range of the measurement antenna is limited to 2.5m, or 0.5m above the top of EUT, whichever is higher.

Radiated unwanted emissions measurements shall be made over the frequency range specified in 5.1 of ANSIC 63.26-2015, dependent upon the relevant operational frequency band, these radiated measurements shall be made around the EUT (or alternatively, with the EUT rotated on a turntable), while varying the measurement antenna height and examining both horizontal and vertical polarization of the measurement antenna, as described above. Ordinarily, this will require the use of a turntable and an antenna positioned.

The EUT shall be set up in its typical configuration and arrangement and operated in its various modes of operation. Unless the EUT uses an integral antenna, the EUT shall be terminated with a non-radiating transmitter load. In cases where the EUT uses an adjustable antenna, the antenna shall be adjusted through typical positions and lengths to maximize emissions levels, EUTs with integral antennas shall be evaluated in their normal orientation. Where EUTs are designed to be installed in one of two distinct orientations, they shall be tested in both of their possible orientations. EUTs that can be operated in one of multiple orientations (e.g., handheld, portable, or modular devices) shall be tested in a minimum of three orientations. When large antennas or antennas not structurally supported by the EUT are utilized, a RF transparent supporting structure shall be used to facilitate the compliance testing. In all cases, the EUT, including the transmit antenna, shall be orientated such that the measurement of the emissions is maximized.

10.11.3.3.Final radiated emissions testing produce

- (1) Connect the device as illustrated;
- (2) Place the EUT in the center of the turntable. The EUT shall be configured to transmit into the standard non-radiating load (for measuring radiated spurious emissions), connected with cables of minimal length unless specified otherwise. If the EUT uses an adjustable antenna, the antenna shall be positioned to the length that produces the worst case emission at the fundamental operating frequency.
- (3) Adjust the spectrum analyzer for the following setting;
RBW=100 kHz for spurious emission below 1 GHz, and 1MHz for spurious emission above 1GHz;
VBW=300k for spurious emission below 1GHz, and 3MHz for spurious emission above 1GHz;
- (4) Sweep speed slow enough to maintain measurement calibration;
- (5) Detector Mode= Positive Peak;
- (6) Place the transmitter to be tested on the turntable in the standard test site, or FCC listed site compliant with ANSI C63.4-2001 clause 5.4. The transmitter is transmitting into a non-radiating load that is placed on the turntable, the RF cable to this load should be of minimum length. For transmitters with integral antennas, the tests are to be run with the unit operating into the integral antenna.
- (7) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the device. Measurements shall be made from the lowest radio frequency generated in the device to the tenth harmonic of the carrier, except for the region close to the carrier equal to $\pm$ the test bandwidth.
- (8) Key the transmitter with normal modulation base the standard.
- (9) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
- (10) Repeat step (9) for each spurious frequency with the test antenna polarized vertically.
- (11) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{cable loss}(\text{dB}) + \text{antenna gain}(\text{dB})$$

Where: Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.

During the test, when the EUT is in downlink working state, the test radiated emissions is the worst, so the data is recorded.

NOTE 1: It is permissible to use other antennas provided they can be referenced to a dipole.

NOTE 2: Effective radiated power(e.r.p) refers to the radiation of a half wave tuned dipole instead of and isotropic antenna. There is a constant difference of 2.15 dB between e.i.r.p and

$$e.r.p.(\text{dBm}) = e.i.r.p(\text{dB}) - 2.15$$

NOTE 3: The test frequency is set as the center frequency of the frequency band.

NOTE 4: When testing the uplink and downlink transmission spurious, it was found that the downlink transmission spurious was the worst, so the worst test data is recorded in this report.

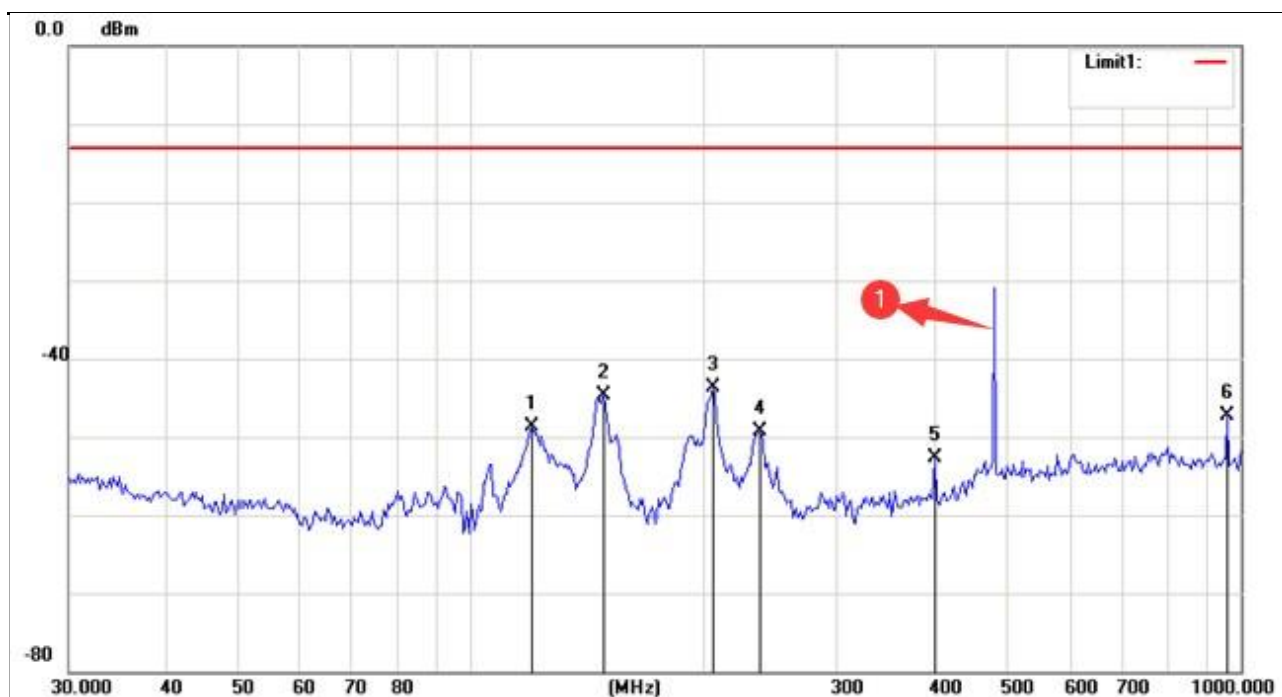
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10.11.4. Test results

10.11.4.1. Below 1GHz

10.11.4.1.1. Polarization type: Horizontal

Test Result:	PASS	Polarization:	Horizontal
Standard:	FCC PART 90	Power Source:	DC+24V
Test item:	Radiation spurious emissions	Date:	2024-02-21
Temp.(°C)/Hum.(%RH):	22.3°C/55%RH	Time:	8:30:07
EUT:	Public safety signal booster	Test mode:	TX mode
Model:	Guardian UHF 5W Class A	Distance:	3m
Note:	/		



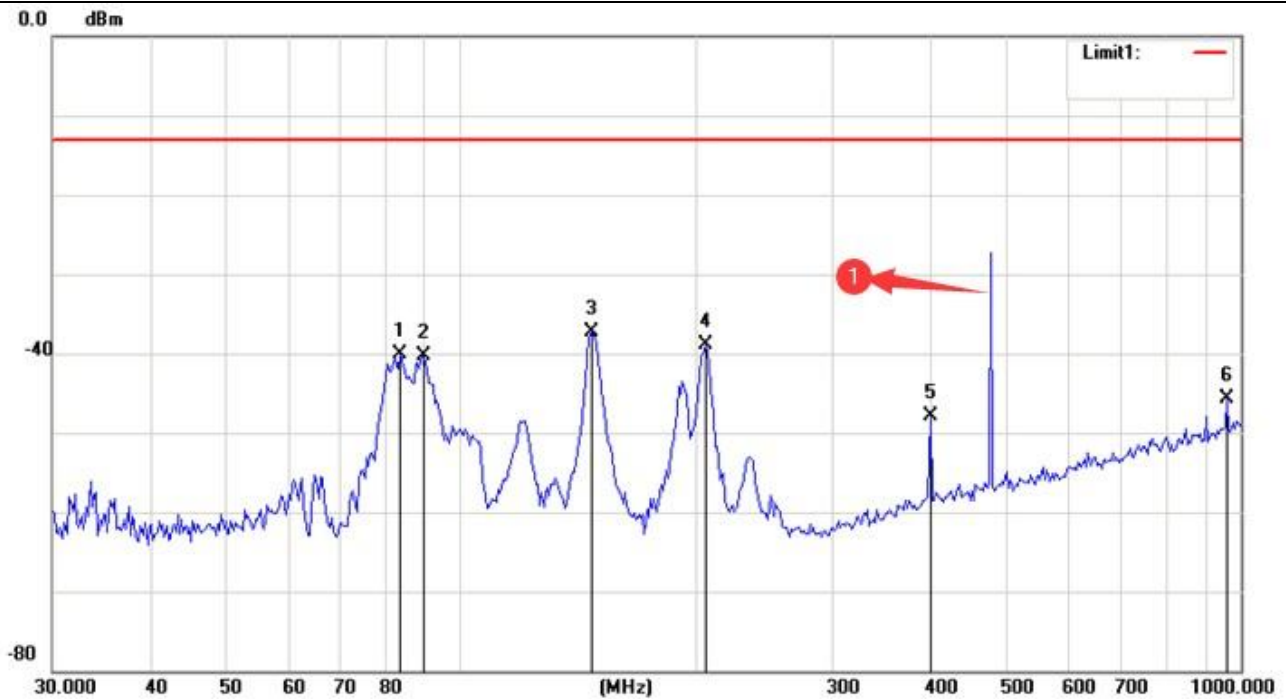
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBm)	Factor(dB)	(dBm)	(dBm)	(dB)	
1	120.2064	-61.33	12.59	-48.74	-13.00	-35.74	peak
2	148.8214	-59.67	14.89	-44.78	-13.00	-31.78	peak
3	206.1656	-55.47	11.73	-43.74	-13.00	-30.74	peak
4	237.2624	-62.28	13.02	-49.26	-13.00	-36.26	peak
5	400.1259	-70.51	17.87	-52.64	-13.00	-39.64	peak
6	961.4270	-73.42	26.10	-47.32	-13.00	-34.32	peak

Note: 1. In the above figure, ① its frequency is 479MHz.

2. When the read value of the test frequency does not exceed the peak limit, peak is used instead of RMS value.

10.11.4.1.2. Polarization type: Vertical

Test Result:	PASS	Polarization:	Vertical
Standard:	FCC PART 90	Power Source:	DC+24V
Test item:	Radiation spurious emissions	Date:	2024-02-21
Temp.(°C)/Hum.(%RH):	22.3°C/55%RH	Time:	8:33:04
EUT:	Public safety signal booster	Test mode:	TX mode
Model:	Guardian UHF 5W Class A	Distance:	3m
Note:	/		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBm)	Factor(dB)	(dBm)	(dBm)	(dB)	
1	83.8947	-49.87	9.71	-40.16	-13.00	-27.16	peak
2	89.7472	-48.66	8.41	-40.25	-13.00	-27.25	pcak
3	147.1586	-52.00	14.71	-37.29	-13.00	-24.29	peak
4	206.1656	-49.87	10.96	-38.91	-13.00	-25.91	peak
5	400.1259	-66.24	18.27	-47.97	-13.00	-34.97	peak
6	961.4270	-72.22	26.60	-45.62	-13.00	-32.62	pcak

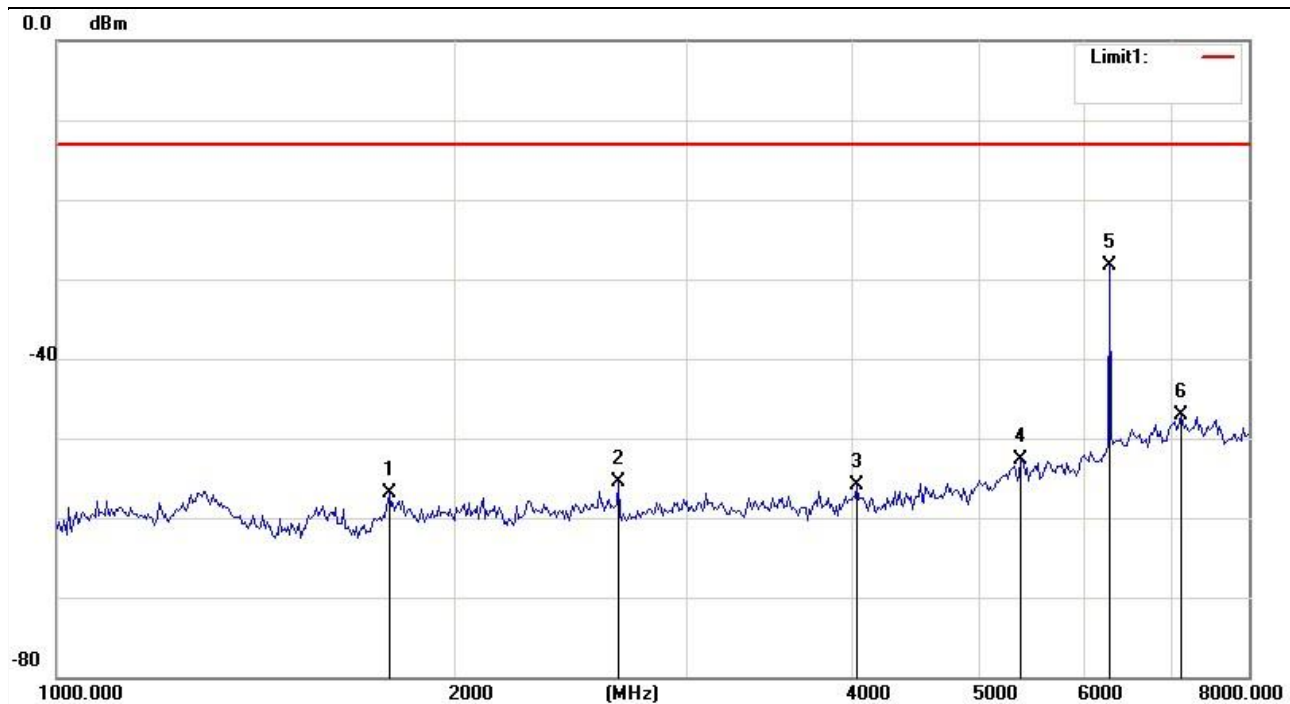
Note: 1. In the above figure, ① its frequency is 479MHz.

2. When the read value of the test frequency does not exceed the peak limit, peak is used instead of RMS value.

10.11.4.2.Above 1GHz

10.11.4.2.1. Polarization type: Horizontal

Test Result:	PASS	Polarization:	Horizontal
Standard:	FCC PART 90	Power Source:	DC+24V
Test item:	Radiation spurious cmissions	Date:	2024-02-21
Temp.(°C)/Hum.(%RH):	22.3°C/55%RH	Time:	9:02:49
EUT:	Public safety signal booster	Test mode:	TX mode
Model:	Guardian UIIF 5W Class A	Distance:	3m
Note:	/		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBm)	Factor(dB)	(dBm)	(dBm)	(dB)	
1	1785.760	-64.41	7.44	-56.97	-13.00	-43.97	peak
2	2663.755	-63.54	8.12	-55.42	-13.00	-42.42	pcak
3	4040.190	-67.57	11.73	-55.84	-13.00	-42.84	peak
4	5381.038	-66.96	14.22	-52.74	-13.00	-39.74	peak
5	6272.491	-47.15	18.92	-28.23	-13.00	-15.23	peak
6	7119.277	-69.28	22.12	-47.16	-13.00	-34.16	pcak

Note: When the read value of the test frequency does not exceed the peak limit, peak is used instead of RMS value.

10.11.4.2.2. Polarization type: Vertical

Test Result:	PASS	Polarization:	Vertical
Standard:	FCC PART 90	Power Source:	DC+24V
Test item:	Radiation spurious emissions	Date:	2024-02-21
Temp.(°C)/Hum.(%RH):	22.3°C/55%RH	Time:	8:59:08
EUT:	Public safety signal booster	Test mode:	TX mode
Model:	Guardian UHF 5W Class A	Distance:	3m
Note:	/		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBm)	Factor(dB)	(dBm)	(dBm)	(dB)	
1	1648.500	-61.57	4.51	-57.06	-13.00	-44.06	peak
2	2102.514	-61.46	6.95	-54.51	-13.00	-41.51	peak
3	2663.755	-59.01	7.41	-51.60	-13.00	-38.60	peak
4	5399.000	-62.46	15.96	-46.50	-13.00	-33.50	peak
5	6272.491	-48.76	17.53	-31.23	-13.00	-18.23	peak
6	7095.592	-68.52	21.86	-46.66	-13.00	-33.66	peak

Note: When the read value of the test frequency does not exceed the peak limit, peak is used instead of RMS value.