



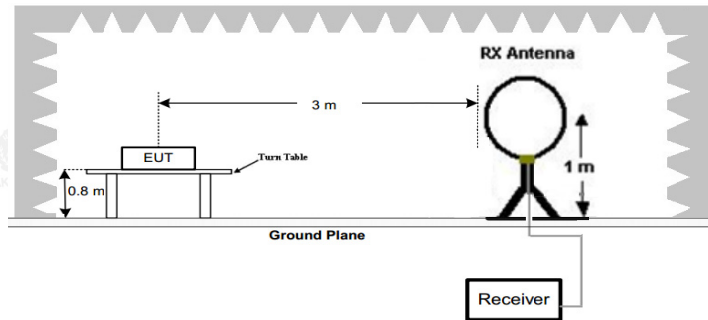
4.5. Spurious Emission

4.5.1. Test Specification

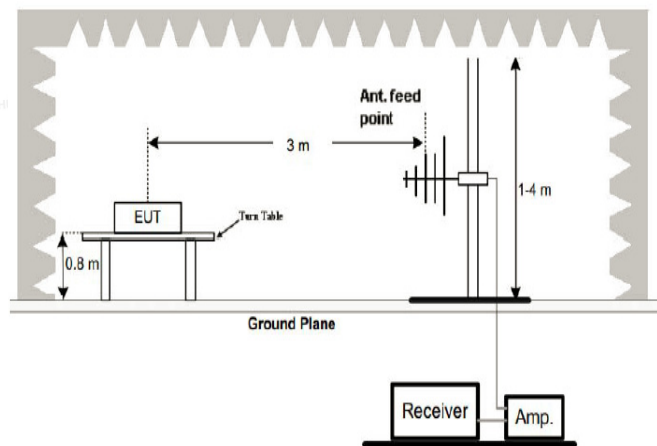
Test Requirement:	FCC CFR47 Part 15 Section 15.407				
Test Method:	KDB 789033 D02 v02r01				
Frequency Range:	9kHz to 40GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Operation mode:	Transmitting mode with modulation				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Peak	1MHz	10Hz	Average Value
Limit:	(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz. (i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. The limit of frequency below 1GHz and which fall in restricted bands should comply 15.209.				

Test setup:

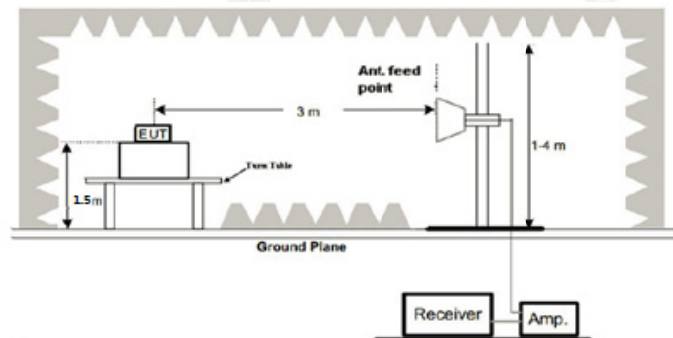
For radiated emissions below 30MHz



30MHz to 1GHz



Above 1GHz



Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height 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. 4. 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 was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Results:	PASS

4.5.2. Test Instruments

Radiated Emission Test Site (966)

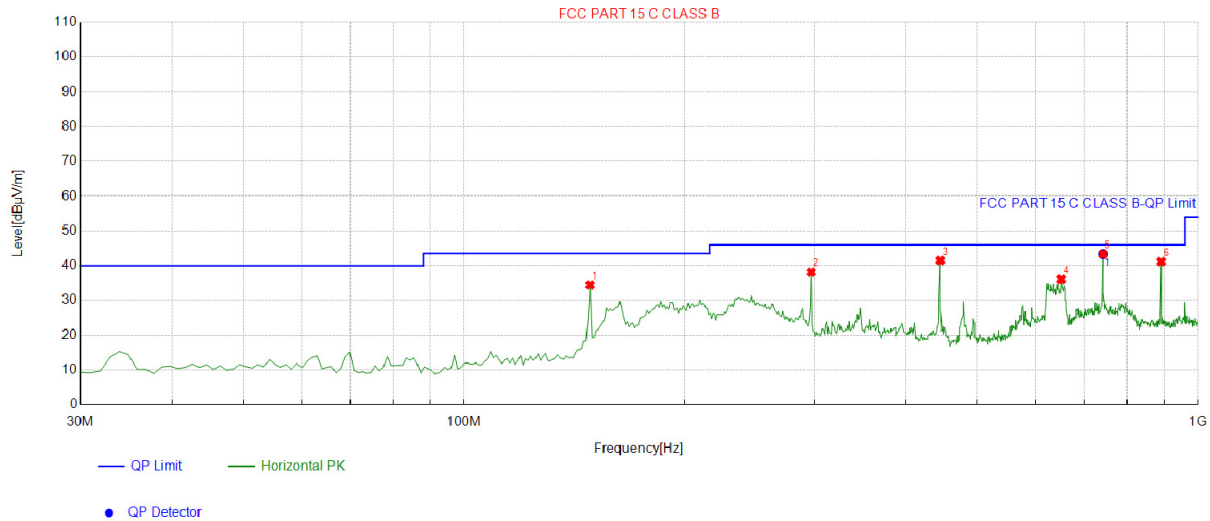
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-025	Feb. 19, 2025	Feb. 18, 2026
Spectrum analyzer	Agilent	N9020A	HKE-117	Feb. 19, 2025	Feb. 18, 2026
Spectrum analyzer	R&S	FSV3044	HKE-126	Feb. 19, 2025	Feb. 18, 2026
Preamplifier	EMCI	EMC051845S	HKE-006	Feb. 19, 2025	Feb. 18, 2026
Preamplifier	Schwarzbeck	BBV 9743	HKE-016	Feb. 19, 2025	Feb. 18, 2026
Preamplifier	A.H. Systems	SAS-574	HKE-182	Feb. 19, 2025	Feb. 18, 2026
6dB Attenuator	Pasternack	6db	HKE-184	Feb. 19, 2025	Feb. 18, 2026
EMI Test Receiver	Rohde & Schwarz	ESR-7	HKE-010	Feb. 19, 2025	Feb. 18, 2026
Broadband Antenna	Schwarzbeck	VULB9168	HKE-167	Feb. 21, 2024	Feb. 20, 2026
Loop Antenna	COM-POWER	AL-130R	HKE-014	Feb. 21, 2024	Feb. 20, 2026
Horn Antenna	Schwarzbeck	9120D	HKE-013	Feb. 21, 2024	Feb. 20, 2026
EMI Test Software	Tonscend	JS32-RE 5.0.0	HKE-082	N/A	N/A
RSE Test Software	Tonscend	JS36-RSE 5.0.0	HKE-184	N/A	N/A

4.5.3. Test Data

Below 1GHz Test Results

All modes have been tested, only the worst mode of GFSK Low channel TX is reflected.

Antenna polarity: Horizontal

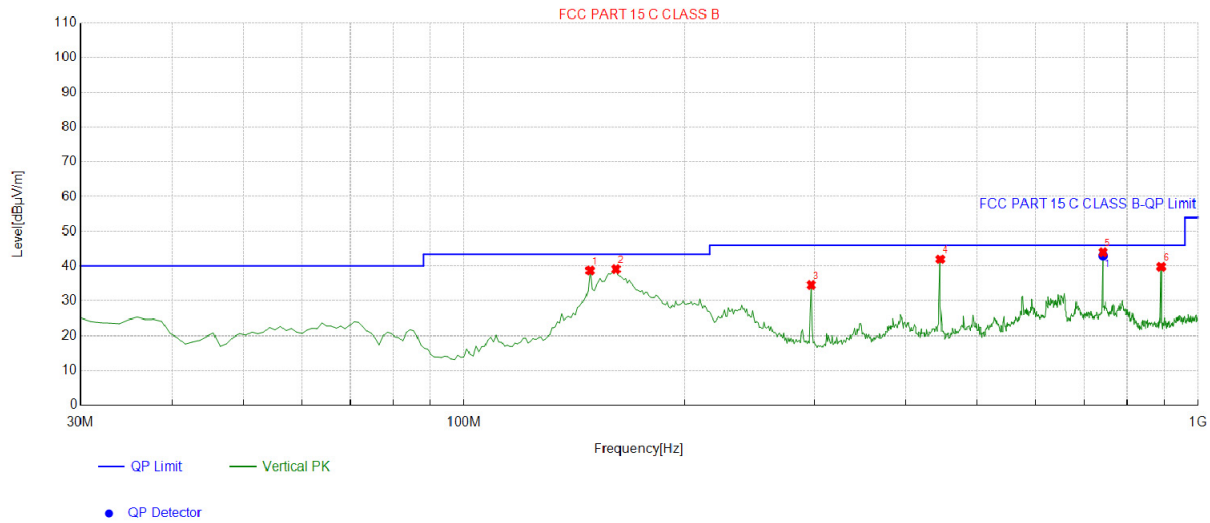


Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	148.4585	-18.14	52.61	34.47	43.50	9.03	100	112	Horizontal
2	297.0170	-11.84	49.95	38.11	46.00	7.89	100	176	Horizontal
3	445.5756	-8.66	50.15	41.49	46.00	4.51	100	126	Horizontal
4	651.4214	-5.07	41.15	36.08	46.00	9.92	100	317	Horizontal
5	742.6927	-3.41	46.73	43.32	46.00	2.68	100	98	Horizontal
6	891.2513	-1.49	42.66	41.17	46.00	4.83	100	87	Horizontal

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBμV/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	742.693	-3.41	46.74	43.33	46.00	2.67	100	98	Horizontal

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	148.4585	-18.14	56.88	38.74	43.50	4.76	100	162	Vertical
2	161.0811	-17.67	56.81	39.14	43.50	4.36	100	133	Vertical
3	297.0170	-11.84	46.43	34.59	46.00	11.41	100	229	Vertical
4	445.5756	-8.66	50.66	42.00	46.00	4.00	100	211	Vertical
5	742.6927	-3.41	47.39	43.98	46.00	2.02	100	144	Vertical
6	891.2513	-1.49	41.31	39.82	46.00	6.18	100	229	Vertical

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Reading [dBμV/m]	QP Value [dBμV/m]	QP Limit [dBμV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	742.693	-3.41	46.47	43.06	46.00	2.94	100	144	Vertical

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Harmonics and Spurious Emissions

Frequency Range (9kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
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Note: 1. Emission Level = Reading + Cable loss - Antenna factor - Amp factor.

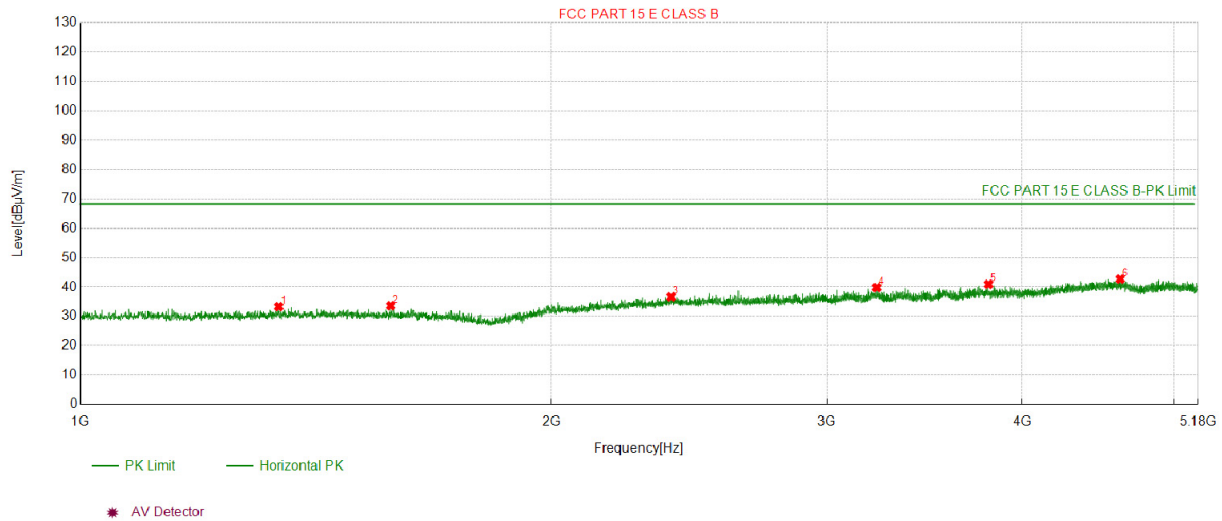
2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement.

Above 1GHz Test Results

All the test modes completed for test. Only the worst result was reported as below:

For 1GHz to 5.18GHz

Antenna polarity: Horizontal

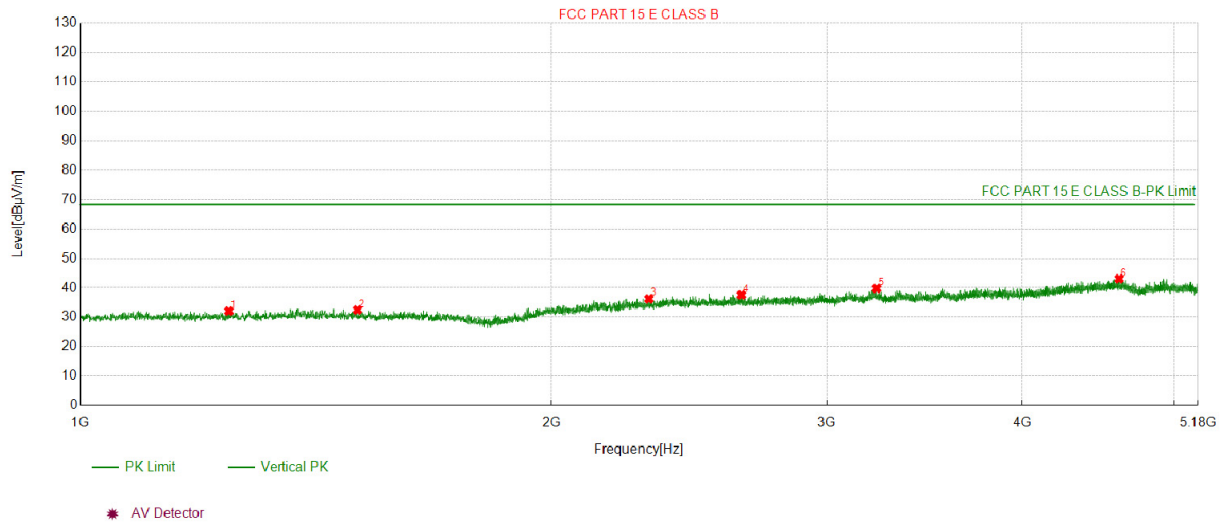


Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1339.031	53.88	33.29	-20.59	68.20	34.91	150	100	Horizontal
2	1578.569	53.81	33.61	-20.20	68.20	34.59	150	230	Horizontal
3	2385.390	52.87	36.63	-16.24	68.20	31.57	150	230	Horizontal
4	3228.998	54.34	39.82	-14.52	68.20	28.38	150	110	Horizontal
5	3805.896	53.02	40.91	-12.11	68.20	27.29	150	360	Horizontal
6	4620.242	52.25	42.71	-9.54	68.20	25.49	150	180	Horizontal

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



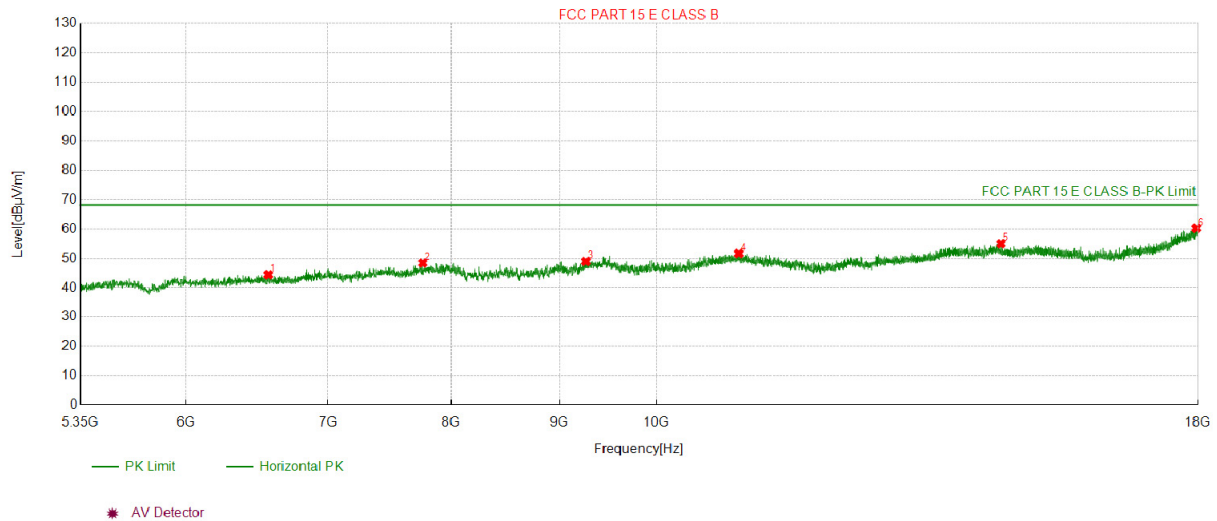
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1244.136	53.06	32.09	-20.97	68.20	36.11	150	0	Vertical
2	1503.322	52.93	32.49	-20.44	68.20	35.71	150	200	Vertical
3	2308.888	52.91	36.24	-16.67	68.20	31.96	150	150	Vertical
4	2645.830	53.64	37.58	-16.06	68.20	30.62	150	40	Vertical
5	3228.162	54.29	39.77	-14.52	68.20	28.43	150	180	Vertical
6	4612.717	52.61	43.08	-9.53	68.20	25.12	150	250	Vertical

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

All the test modes completed for test. Only the worst result was reported as below:

For 5.35GHz to 18GHz

Antenna polarity: Horizontal

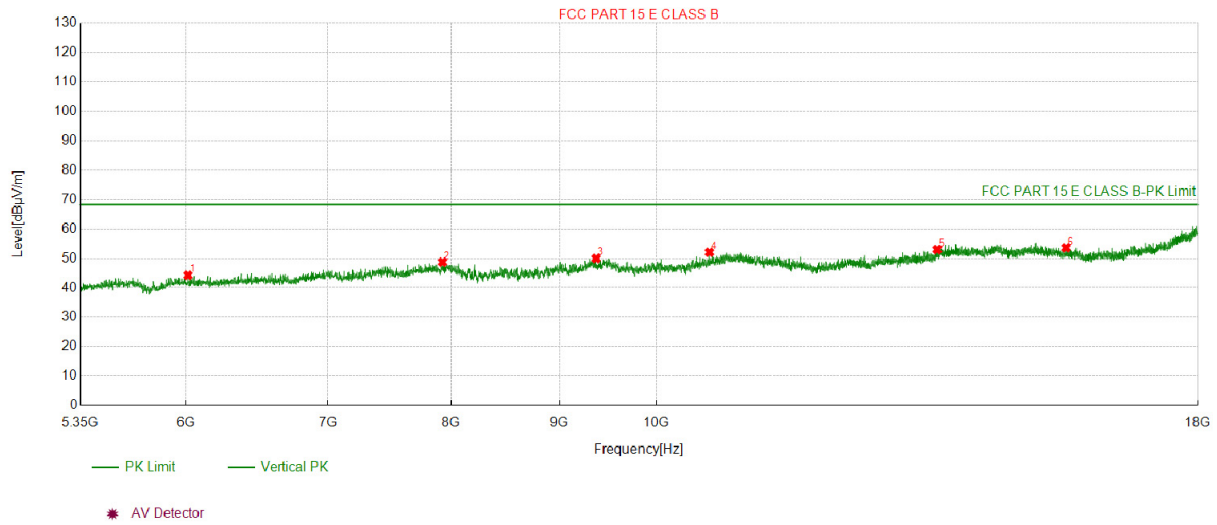


Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	6560.726	51.15	44.44	-6.71	68.20	23.76	150	320	Horizontal
2	7757.535	51.29	48.38	-2.91	68.20	19.82	150	360	Horizontal
3	9261.771	50.56	48.93	-1.63	68.20	19.27	150	350	Horizontal
4	10934.26	50.05	51.65	1.60	68.20	16.55	150	270	Horizontal
5	14534.81	48.44	54.95	6.51	68.20	13.25	150	170	Horizontal
6	17968.37	45.71	60.21	14.50	68.20	7.99	150	80	Horizontal

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



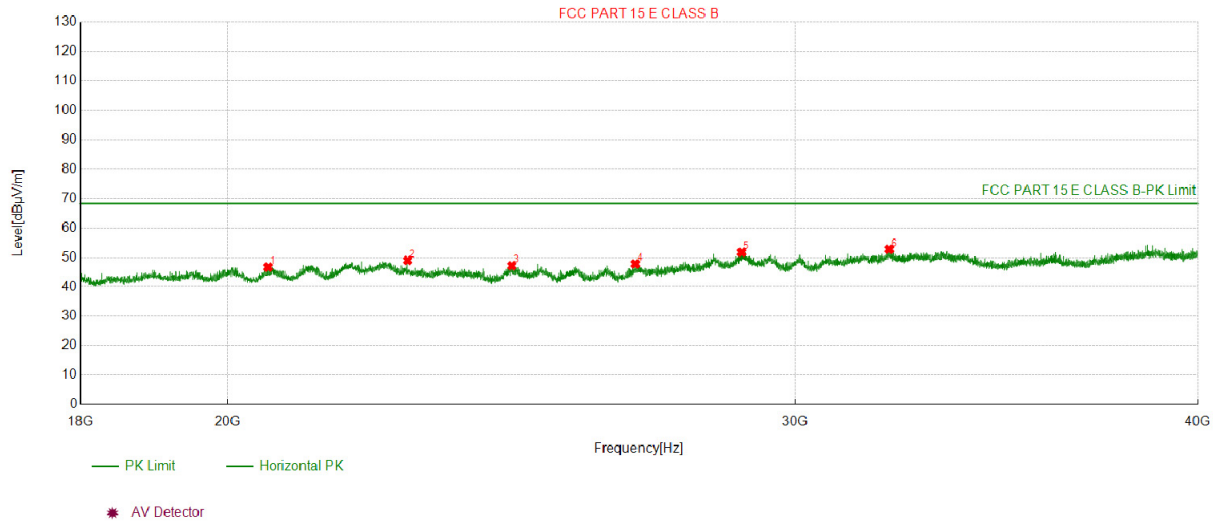
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	6011.661	52.00	44.26	-7.74	68.20	23.94	150	20	Vertical
2	7925.797	51.45	48.73	-2.72	68.20	19.47	150	190	Vertical
3	9365.511	51.17	49.96	-1.21	68.20	18.24	150	200	Vertical
4	10591.41	51.56	52.05	0.49	68.20	16.15	150	140	Vertical
5	13563.20	48.72	52.99	4.27	68.20	15.21	150	80	Vertical
6	15598.78	48.27	53.60	5.33	68.20	14.60	150	60	Vertical

Remark: Factor = Cable loss + Antenna factor + Attenuator – Pre-amplifier; Level = Reading + Factor; Margin = Limit – Level

All the test modes completed for test. Only the worst result was reported as below:

For 18GHz to 40GHz

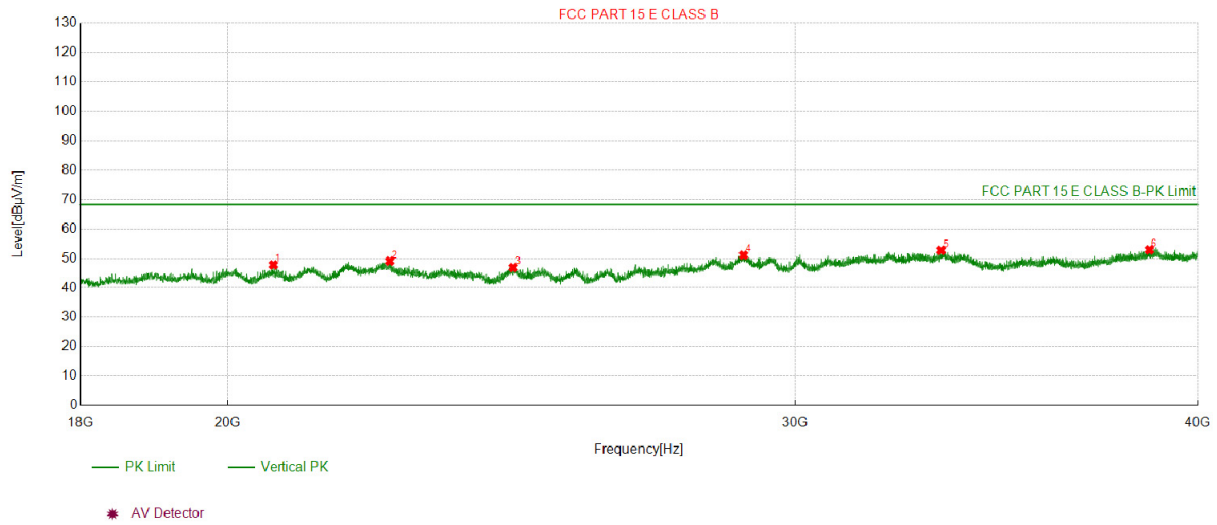
Antenna polarity: Horizontal



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	20583.05	40.77	46.67	5.90	68.20	21.53	150	230	Horizontal
2	22739.27	43.42	48.96	5.54	68.20	19.24	150	290	Horizontal
3	24499.44	41.42	47.14	5.72	68.20	21.06	150	120	Horizontal
4	26759.07	40.46	47.77	7.31	68.20	20.43	150	120	Horizontal
5	28871.28	42.75	51.71	8.96	68.20	16.49	150	180	Horizontal
6	32083.60	42.90	52.75	9.85	68.20	15.45	150	300	Horizontal

Remark: Factor = Cable loss + Antenna factor + Attenuator – Pre-amplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical

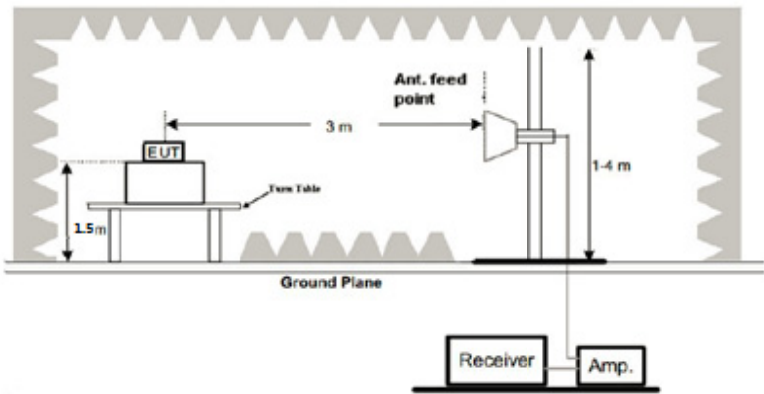


Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	20660.06	41.97	47.78	5.81	68.20	20.42	150	190	Vertical
2	22451.04	43.42	49.08	5.66	68.20	19.12	150	240	Vertical
3	24521.45	41.10	46.86	5.76	68.20	21.34	150	100	Vertical
4	28908.69	42.12	51.10	8.98	68.20	17.10	150	30	Vertical
5	33293.72	41.79	52.73	10.94	68.20	15.47	150	320	Vertical
6	38635.86	42.11	52.89	10.78	68.20	15.31	150	270	Vertical

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

4.6. Band Edge

4.6.1. Test Specification

Test Requirement:	FCC CFR47 Part 15E Section 15.407
Test Method:	ANSI C63.10 2020
Limit:	For band I&II&III: $E[dB\mu V/m] = EIRP[dBm] + 95.2 = 68.2 \text{ dB}\mu V/m$, for $EIRP(dBm) = -27dBm$ For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. For band IV(5715-5725MHz&5850-5860MHz): $E[dB\mu V/m] = EIRP[dBm] + 95.2 = 78.2 \text{ dB}\mu V/m$, for $EIRP(dBm) = -27dBm$; For band IV(other un-restricted band): $E[dB\mu V/m] = EIRP[dBm] + 95.2 = 68.2 \text{ dB}\mu V/m$, for $EIRP(dBm) = -27dBm$
Test Setup:	
Test Mode:	Transmitting mode with modulation

Test Procedure:	1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height 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. 4. 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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi peak or average method as specified and then reported in a data sheet.
Test Result:	PASS



HUAKE TESTING

4.6.2. Test Instruments

Radiated Emission Test Site (966)

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-025	Feb. 19, 2025	Feb. 18, 2026
Spectrum analyzer	Agilent	N9020A	HKE-117	Feb. 19, 2025	Feb. 18, 2026
Spectrum analyzer	R&S	FSV3044	HKE-126	Feb. 19, 2025	Feb. 18, 2026
Preamplifier	EMCI	EMC051845S	HKE-006	Feb. 19, 2025	Feb. 18, 2026
Preamplifier	Schwarzbeck	BBV 9743	HKE-016	Feb. 19, 2025	Feb. 18, 2026
Preamplifier	A.H. Systems	SAS-574	HKE-182	Feb. 19, 2025	Feb. 18, 2026
6dB Attenuator	Pasternack	6db	HKE-184	Feb. 19, 2025	Feb. 18, 2026
EMI Test Receiver	Rohde & Schwarz	ESR-7	HKE-010	Feb. 19, 2025	Feb. 18, 2026
Broadband Antenna	Schwarzbeck	VULB9168	HKE-167	Feb. 21, 2024	Feb. 20, 2026
Loop Antenna	COM-POWER	AL-130R	HKE-014	Feb. 21, 2024	Feb. 20, 2026
Horn Antenna	Schwarzbeck	9120D	HKE-013	Feb. 21, 2024	Feb. 20, 2026
EMI Test Software	Tonscend	JS32-RE 5.0.0	HKE-082	N/A	N/A
RSE Test Software	Tonscend	JS36-RSE 5.0.0	HKE-184	N/A	N/A

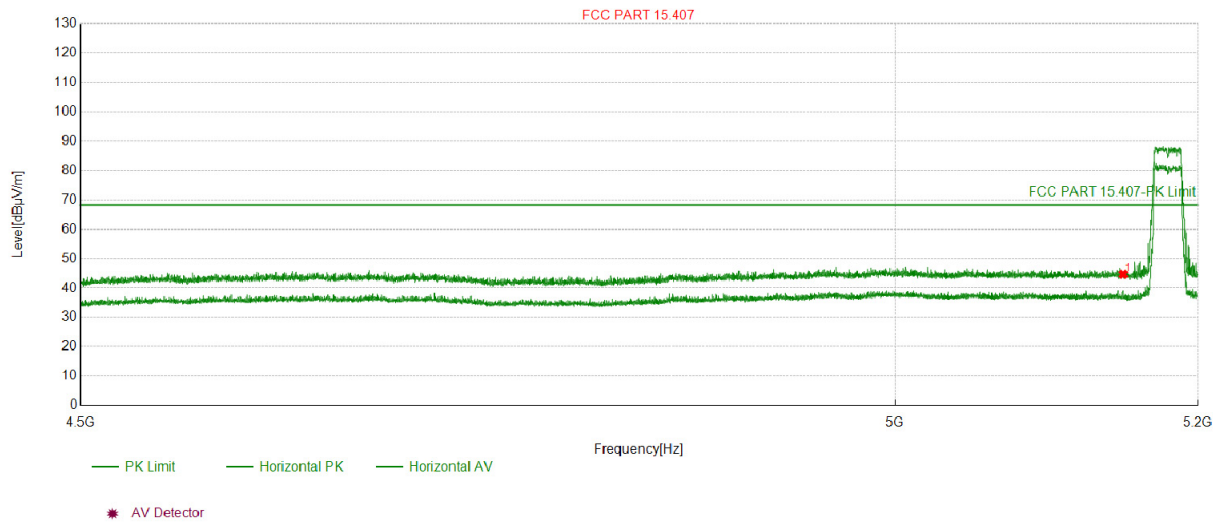
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

4.6.3. Test Data

All the test modes completed for test. Only the worst result was reported as below:

802.11n(HT20)-5180

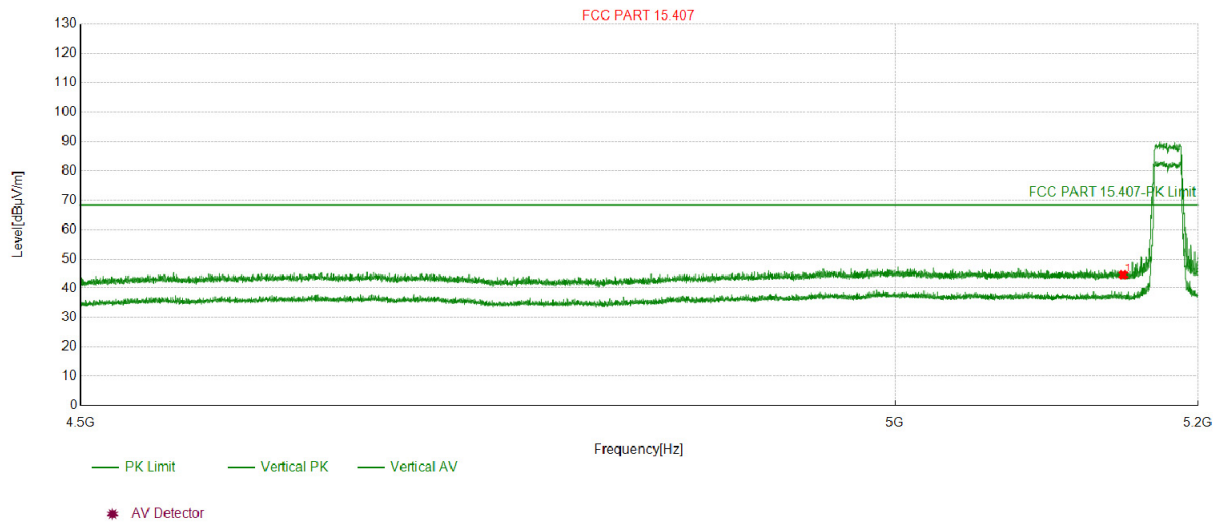
Antenna polarity: Horizontal



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5150.000	49.42	44.64	-4.78	68.20	23.56	150	12	Horizontal

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

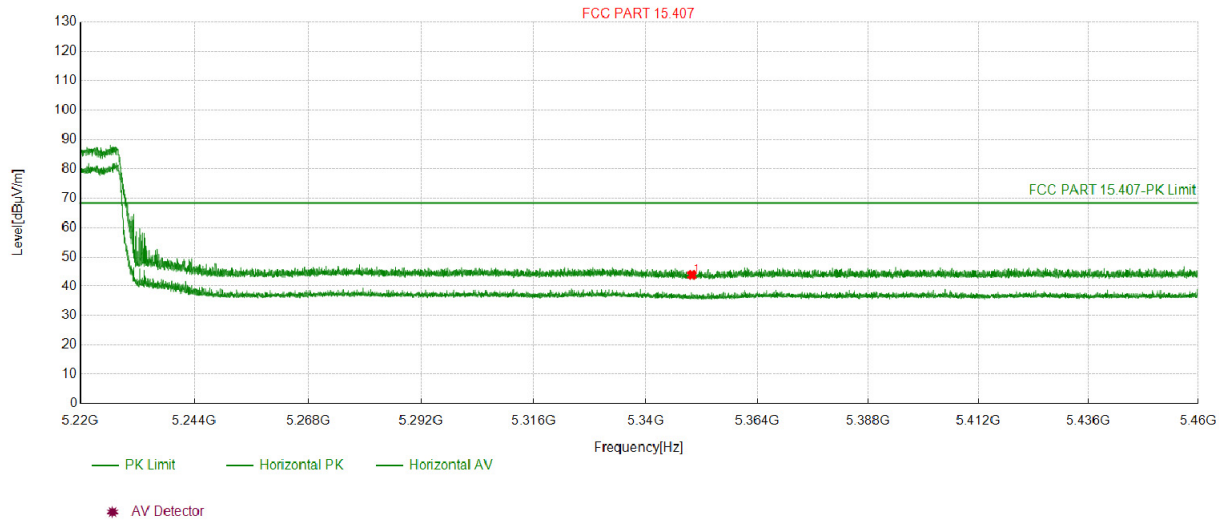
Antenna polarity: Vertical



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5150.000	49.36	44.58	-4.78	68.20	23.62	150	276	Vertical

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

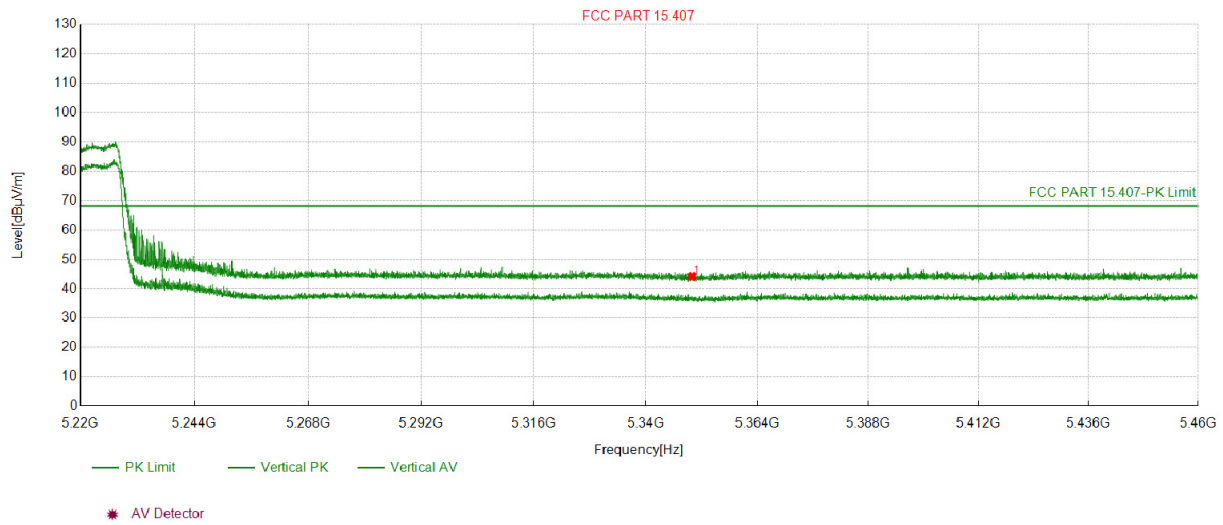
802.11n(HT20)-5240
Antenna polarity: Horizontal



Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5350.000	49.29	43.85	-5.44	68.20	24.35	150	314	Horizontal

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5350.000	49.66	44.22	-5.44	68.20	23.98	150	87	Vertical

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level



4.7. Frequency Stability Measurement

4.7.1. Test Specification

Test Requirement:	FCC Part15 Section 15.407(g)
Test Method:	ANSI C63.10: 2020
Limit:	The frequency tolerance shall be maintained within the band of operation frequency over a temperature variation of 0 degrees to 35 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.
Test Setup:	<pre>graph LR; SA[Spectrum Analyzer] --- EUT[EUT]; EUT --- P[AC/DC Power supply]; subgraph TC [Temperature Chamber]; EUT; end</pre>
Test Procedure:	- The EUT was placed inside the environmental test chamber and powered by nominal AC/DC voltage. - Turn the EUT on and couple its output to a spectrum analyzer. - Turn the EUT off and set the chamber to the highest temperature specified. - Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. - Repeat step 2 and 3 with the temperature chamber set to the lowest temperature. - The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
Test Result:	PASS
Remark:	N/A

4.7.2. Test Instruments

RF Test Room					
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum analyzer	Agilent	N9020A	HKE-025	Feb. 19, 2025	Feb. 18, 2026
Spectrum analyzer	Agilent	N9020A	HKE-117	Feb. 19, 2025	Feb. 18, 2026
Power meter	Agilent	E4419B	HKE-085	Feb. 19, 2025	Feb. 18, 2026
Power Sensor	Agilent	E9300A	HKE-086	Feb. 19, 2025	Feb. 18, 2026
RF cable	Times	1-40G	HKE-034	Feb. 19, 2025	Feb. 18, 2026
RF automatic control unit	Tonscend	JS0806-2	HKE-060	Feb. 19, 2025	Feb. 18, 2026
RF Test Software	Tonscend	JS1120-3 Version 3.5.39	HKE-083	N/A	N/A

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

4.7.3. Test Result

Mode	Voltage (V)	FHL (5180MHz)	Deviation (KHz)	FHH (5240MHz)	Deviation (KHz)
5.2G Band	4.25V	5179.961	-39	5240.051	51
	5.0V	5179.977	-23	5239.971	-29
	5.75V	5179.983	-17	5239.962	-38

Mode	Temperature (°C)	FHL (5180MHz)	Deviation (KHz)	FHH (5240MHz)	Deviation (KHz)
5.2G Band	-30	5180.005	5	5240.007	7
	-20	5179.994	-6	5240.009	9
	-10	5179.966	-34	5240.031	31
	0	5179.973	-27	5240.023	23
	10	5180.021	21	5239.987	-13
	20	5180.023	23	5239.994	-6
	30	5180.014	14	5240.052	52
	40	5179.989	-11	5239.979	-21
	50	5180.024	24	5240.084	84

4.8. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

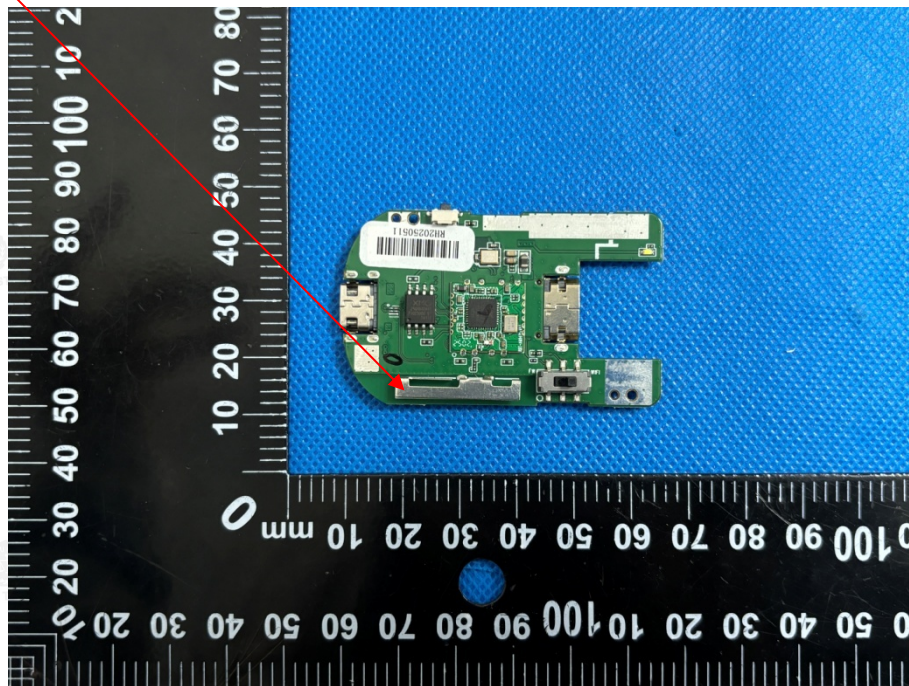
Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

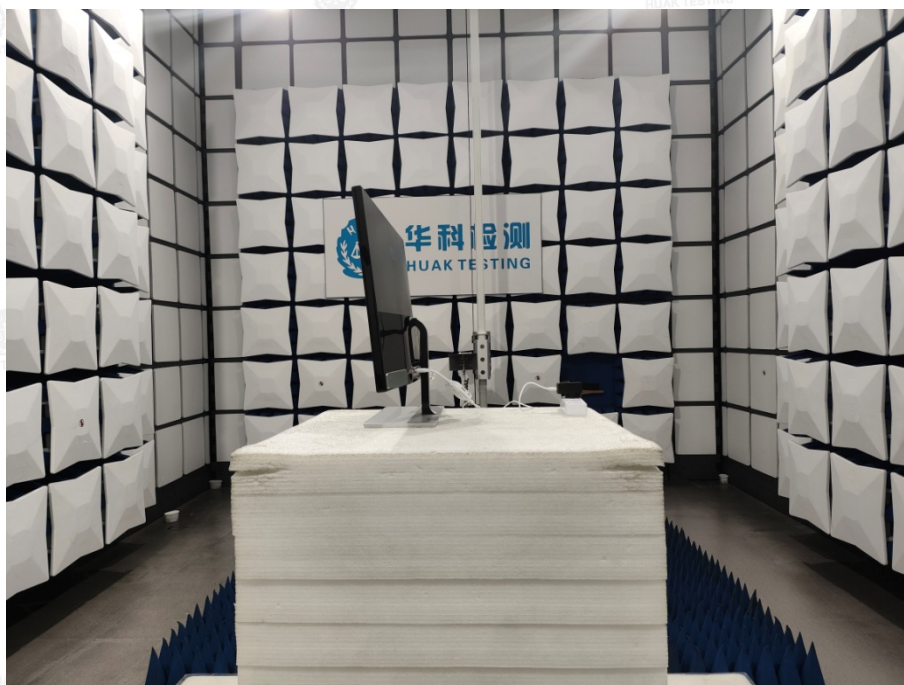
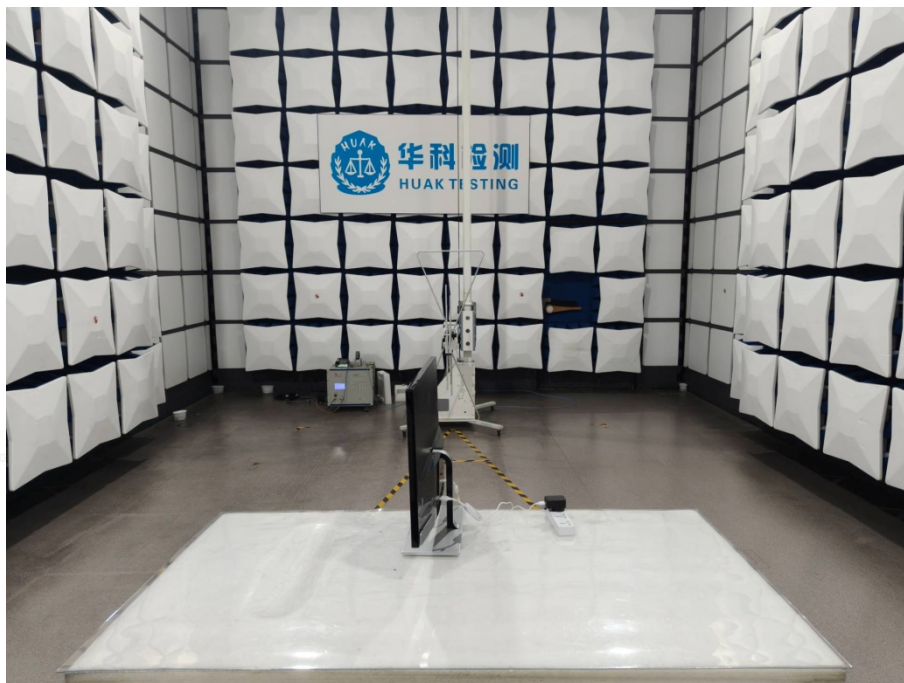
The antenna used in this product is an Iron Sheet Antenna, need professional installation, not easy to remove. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 1.93dBi.

WIFI Antenna



5. Test Setup Photos of the EUT

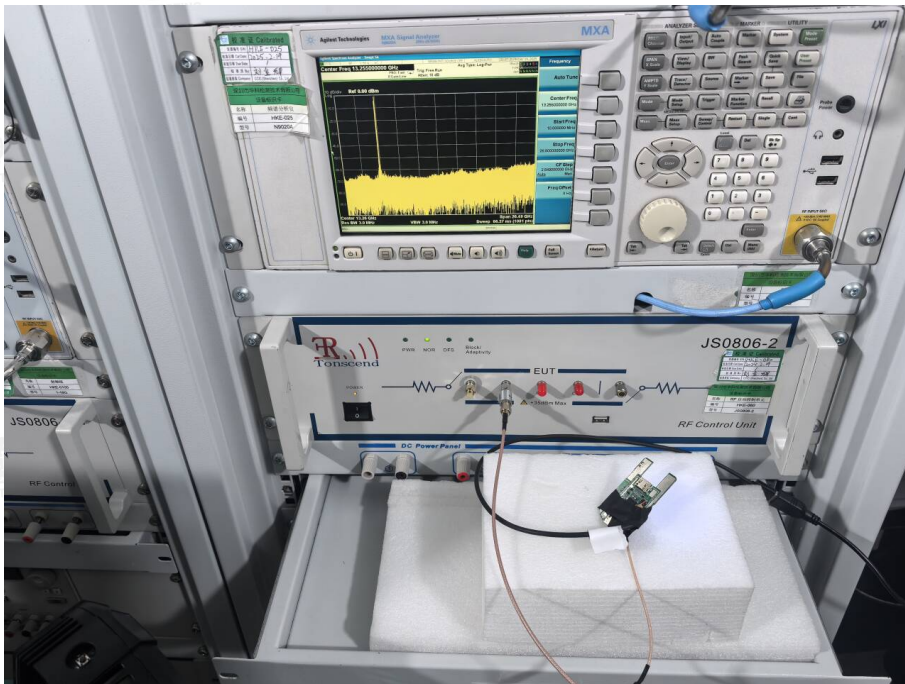
Radiated Emission



AC Conducted Emission



RF Conducted Emission



6. Photos of the EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos

-----End of test report-----