FCC Part 15, Subpart C
Test Report

FCC ID:	2A3G8-R24A
Applicant:	Chengdu SongYuan Technology Co., Ltd.
Address:	No. 1, 8th Floor, Unit 1, Building 6, No. 399, Fucheng Avenue, High-tech Zone, Chengdu
Manufacturer:	Chengdu SongYuan Technology Co., Ltd.
Address:	No. 1, 8th Floor, Unit 1, Building 6, No. 399, Fucheng Avenue, High-tech Zone, Chengdu
Product:	24G Millimeter wave radar module
Brand:	MicRadar
Test Model(s):	R24A
Series Model(s):	N/A
Test Date:	Oct. 25, 2021~Nov. 23, 2021
Issued Date:	Nov. 24, 2021
Issued By:	Hwa-Hsing (Dongguan) Testing Co., Ltd.
Address:	No.101, Bld N1, Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China
Test Firm Registration No.:	915896
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.249) ANSI C63.10:2013 ANSI C63.4: 2014 & ANSI C63.4a: 2017

The above equipment has been tested by **Hwa-Hsing (Dongguan) Testing Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Candy Zhang/ Report Engineer

Reviewed by : Tank tan/ Project Engineer

Approved by : Harry Li/ Technical Director

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
211018DC01-RF-US-01	Original Release	Nov. 24, 2021

1 Summary of Test Results

47 CFR FCC Part 15, Subpart C ANSI C63.10:2013 ANSI C63.4: 2014 & ANSI C63.4a: 2017			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit.
15.215(c)	Bandwidth Measurement	Pass	Meet the requirement of limit.
15.209	Radiated Emissions	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.
--	Frequency Stability	Pass	No antenna connector is used.

Note 1: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (sDoC). The test report has been issued separately.

1.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUTas specified in CISPR 16-4-2:
The listed uncertainties are the worst-case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.66 dB
Radiated Emissions up to 1 GHz	9KHz ~ 30MHz	2.16 dB
	30MHz ~ 1000MHz	3.47 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	4.84 dB
	18GHz ~ 40GHz	4.67 dB

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

1.2 Modification Record

There were no modifications required for compliance.

2 General Information

2.1 General Description of EUT

Product	24G Millimeter wave radar module
Brand	MicRadar
Test Model(s)	R24A
Series Model(s)	N/A
FCC ID:	2A3G8-R24A
Status of EUT	Modular
Power Supply Rating	DC5V
Modulation Type	Sweep
Operating Frequency	24.00GHz~24.25GHz
Output Power（AVG）	101.84dBuV @ 1m
Antenna Type	PCB Antenna
Antenna Gain	0dBi
Antenna Connector	N/A
Accessory Device	N/A
Cable Supplied	N/A

Note:

1. Please refer to the EUT photo document (Reference No.: 211018DC01-1) for detailed product photo.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
3. The EUT is a Doppler radar module that uses 24 GHz ISM band with Continuous Wave signals for motion detection.

2.2 Description of Test Modes

2.2.1 Test Mode Applicability

Channel	Freq. (GHz)
1	24.0 GHz-24.25 GHz

EUT Configure	Applicable test items	X-Axis	Y-Axis	Z-Axis	Voltage Supply
Conducted	AC Power Conducted Emission	N/A	N/A	N/A	DC power supply
Radiated	Radiated Emissions	√	√	√	
Antenna Port	Bandwidth Measurement	N/A	N/A	N/A	
Antenna Port	Frequency Stability	N/A	N/A	N/A	

1. *: The EUT had been pre-tested on the positioned of each 3 Axis. The worst case was found when positioned on **X-plane**.
2. "N/A" means no effect.

Test Condition:

Applicable test items	Environmental Conditions	Tested by
AC Power Conducted Emission	25deg. C, 65%RH	Benson Pan
Radiated Emissions	25deg. C, 65%RH	Tank Tan
Bandwidth Measurement	25deg. C, 65%RH	Benson Pan

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Radiated Emission Test (Above 1 GHz):

EUT Configure Mode	Available Channel	Tested Channel	Modulation
-	1	1	Sweep

Radiated Emission Test (Below 1 GHz):

EUT Configure Mode	Available Channel	Tested Channel	Modulation
-	1	1	Sweep

Power Line Conducted Emission Test:

EUT Configure Mode	Available Channel	Tested Channel	Modulation
-	1	1	Sweep

Antenna Port Conducted Measurement:

EUT Configure Mode	Available Channel	Tested Channel	Modulation
-	1	1	Sweep

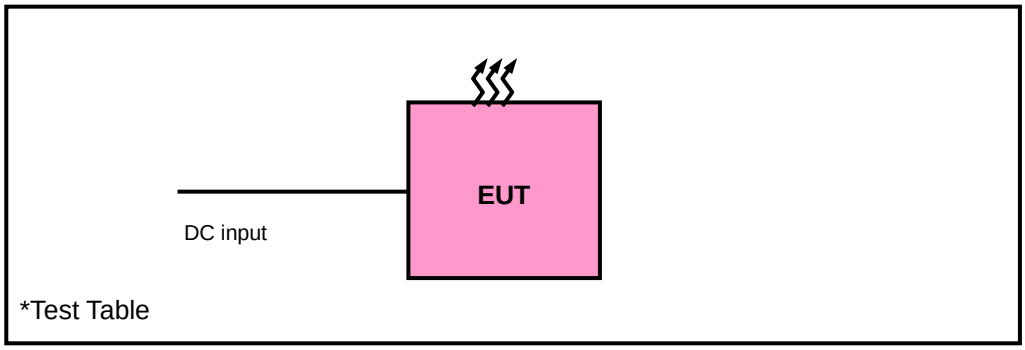
2.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
1	N/A	N/A	N/A	N/A	N/A	N/A

No.	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Line	1	1.5	No	0	N/A

2.3.1 Configuration of System under Test



3 Test Typesand Results

3.1 Radiated Emission and Bandedge Measurement

3.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits below:

Frequencies (MHz)	Field Strength (microvolts/meter)	
	Fundamental emissions	Harmonic emissions
24000~24250	250	2.5

Emissions radiated outside ofthe specified frequéncy bands, except for harmonic emissions, shall be attenuated at least 50 dB below the level of the fundamental emissions or to the general field strength limits, whichever is less stringent.

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (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
* DTS emissions in non-restricted frequency bands Subclause 11.11 of ANSI C63.10 is applicable. * DTS emissions in restricted frequency bands Subclause 11.12 of ANSI C63.10 is applicable		

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

For unintentional radiators:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705~108	1000
108~500	2000
500~1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz whichever is lower.

3.1.2 Test Instruments

Radiated emission below 30MHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI 7	100962	2022/01/05
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2022/04/14
Test software	FARAD	FARAD	EZ_EMCV1.1.4.2	N/A
Loop Antenna	EMCI	HLA 6121	45745	2022/04/13
Preamplifier	EMCI	EMC001340	980201	2022/09/12
Antenna Tower	MF	MFA-440H	NA	NA
Turn Table	MF	MFT-201SS	NA	NA
Antenna Tower&Turn Table Controller	MF	MF-7802	NA	NA

Frequency Range below 1GHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI 7	100962	2022/01/05
Broadband antenna	Schwarzbeck	VULB 9168	00937	2022/04/15
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2022/04/14
Signal Amplifier	Com-power	PAM-103	18020051	2022/03/14
Attenuator	Rohde&Schwarz	TS2GA-6dB	18101101	N/A
Test software	FARAD	FARAD	EZ_EMCV1.1.4.2	N/A

Frequency Range 1-18GHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2022/04/14
Horn Antenna	Schwarzbeck	BBHA 9170	01959	2022/04/15
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	00025	2022/03/14
Spectrum	Keysight	N9020A	MY51240612	2022/09/12
Antenna Tower	MF	MFA-440H	NA	NA
Turn Table	MF	MFT-201SS	NA	NA
Antenna Tower&Turn Table Controller	MF	MF-7802	NA	NA

Frequency Range 18-40GHz:

Equipment	Manufacturer	Model No.	Serial No.	Next Cal.
3m Semi-anechoic Chamber	MAORUI	9m*6m*6m	NSEMC003	2022/04/14
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2022/03/14
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170242	2022/04/15
Pre-Amplifier	EMCI	EMC 184045	980102	2022/03/14
Antenna Tower	MF	MFA-440H	NA	NA
Turn Table	MF	MFT-201SS	NA	NA
Antenna Tower&Turn Table Controller	MF	MF-7802	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months (The Antenna and Chamber was 24 mounths) and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in 966.

3.1.3 Test Procedures

a. Peak emission levels are measured by setting the instrument as follow:

1) RBW & VBW setting as a function of frequency:

Frequency	RBW	VBW
9kHz~150kHz	200Hz	600Hz
0.15MHz~30MHz	9kHz	30kHz
30MHz~1000MHz	120kHz	300kHz
>1000MHz	1MHz	3MHz

2) Detector = peak.
3) Sweep time = auto.
4) Trace mode = max hold.
5) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be lengthened for low-duty-cycle applications.)

Note: If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement

b. Average emission levels are measured by setting the instrument as follow:

- **Trace averaging with continuous EUT transmission at full power**

If the EUT can be configured or modified to transmit continuously (D ≥ 98%). then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

1) RBW=1 MHz (unless otherwise specified).
2) VBW ≥ 3 *RBW.
3) Detector =RMS
4) Sweep time = auto.
5) Perform a trace average of at least 100 traces.

- **Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction**

If continuous transmission of the EUT (D ≥ 98%) cannot be achieved and the duty cycle is constant (duty cycle variations are less than ±2%). then the following procedure shall be used

1) The EUT shall be configured to operate at the maximum achievable duty cycle.
2) Measure the duty cycle D of the transmitter output signal as described in 11.6.
3) RBW=1 MHz (unless otherwise specified).
4) VBW ≥ 3 *RBW.
5) Detector =RMS
6) Sweep time = auto.
7) Perform a trace average of at least 100 traces.

A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

*If power averaging (rms) mode was used in step 5). then the applicable correction factor is [10 10g (1/ D)], where D is the duty cycle.

**If linear voltage averaging mode was used in step f). then the applicable correction factor is [20 10g (1/D)], where D is the duty cycle.

***If a specific emission is demonstrated to be continuous (D > 98%) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that

- **Reduced VBW Averaqing across ON and OFF times of the EUT transmissions with max hold**

If continuous transmission of the EUT (D > 98%) cannot be achieved and the duty cycle is not constant (duty cycle variations exceed ±2%), then the following procedure shall be used:

1) RBW = 1 MHz.
2) VBW ≥ 1/T.
3) Detector =peak
4) Sweep time = auto.
5) Trace mode = max hold.
6) Allow max hold to run for at least [50 x (1/ D)] traces

c. The EUT was placed on the top of a rotating table 0.8 meters (below 1GHz) / 1.5 meters (1-18GHz) / 1.5 meters (18-40GHz) above the reference ground. The table was rotated 360 degrees to determine the position of the highest radiation.
d. The EUT was set 3 meters away from the interference-receiving antenna (Below 1GHz) & (Above 1-18GHz), which was mounted on the top of a variable-height antenna tower. The EUT was set 1meters away from the interference-receiving antenna (18-40GHz).
e. 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.
f. 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.
g. 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.

The test-receiver system was set to peak and average detected 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.

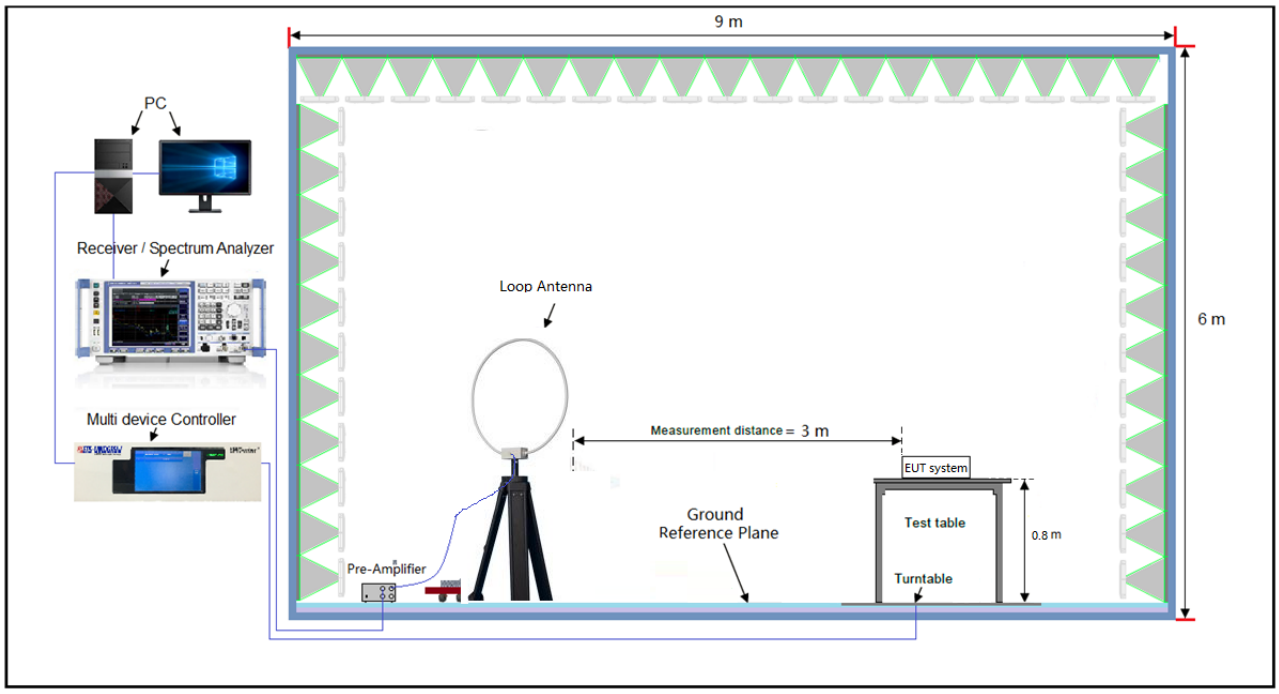
Note:
1. Test procedures for measuring FHSS device: The use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the unwanted emission limit is subject to an average field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period. Subclause 7.5 of ANSI C63.10 provides additional measurement guidance applicable to determination of the DCCF.
2. All modes of operation were investigated and the worst-case emissions are reported.

3.1.4 Deviation from Test Standard

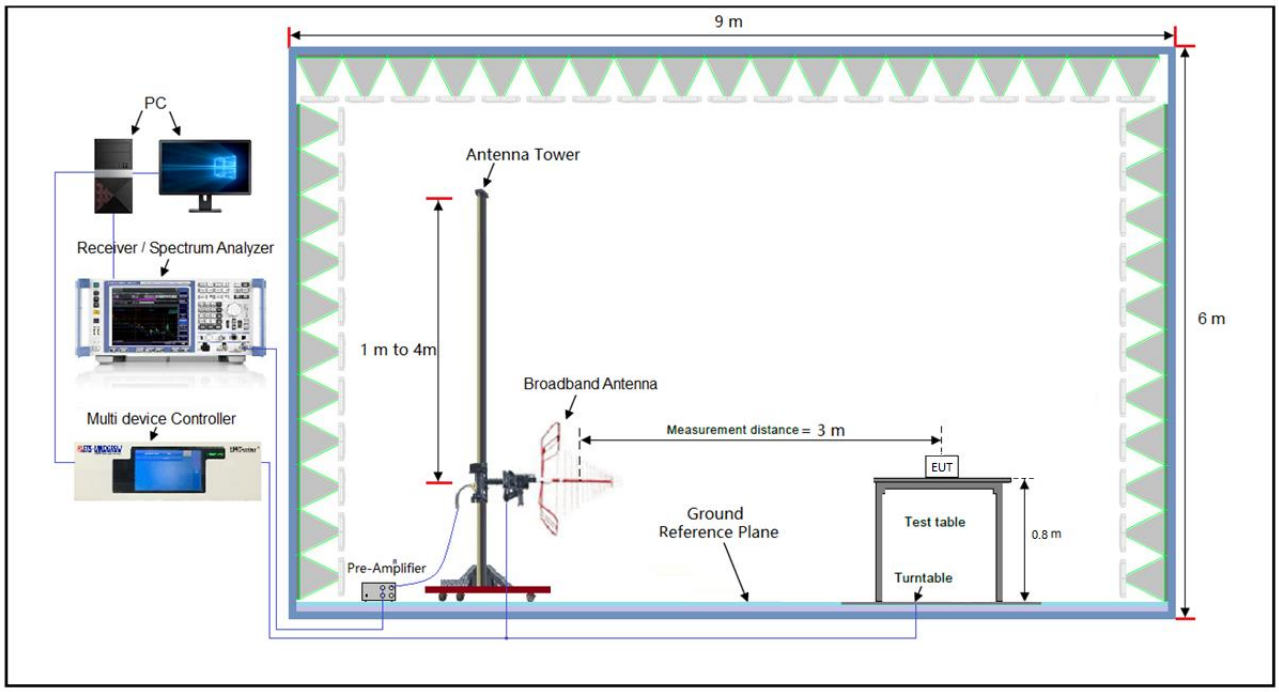
No deviation.

3.1.5 Test Setup

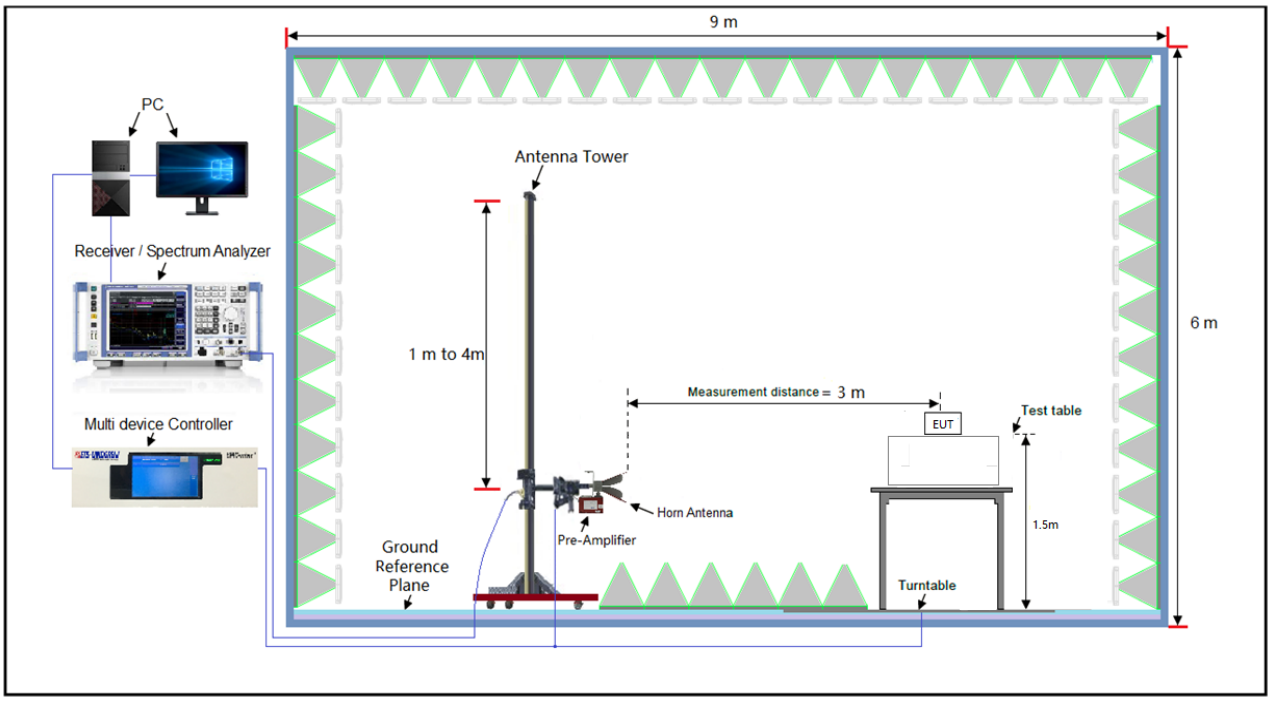
Radiated emission below 30MHz:



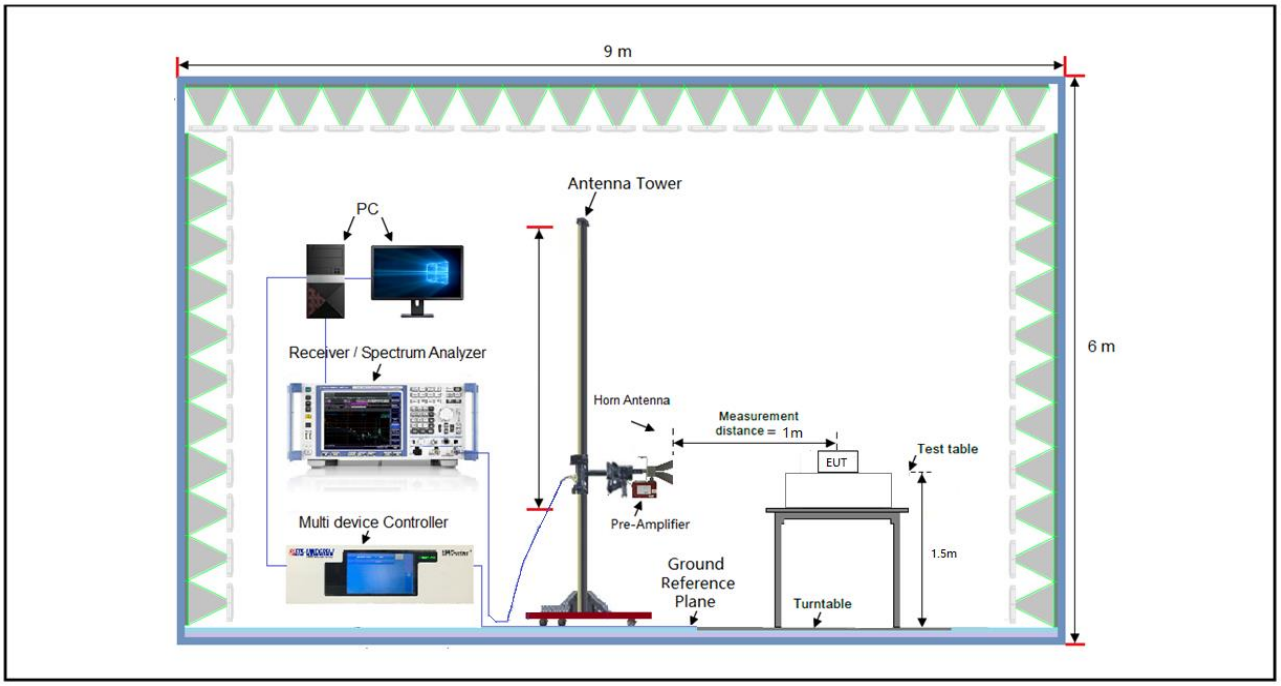
Frequency Range below 1GHz:



Frequency Range above 1GHz:



Frequency Range 18-40GHz:



*For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.1.6 EUT Operating Conditions

Set the EUT under transmission condition continuously at specific channel frequency.

3.1.7 Test Results

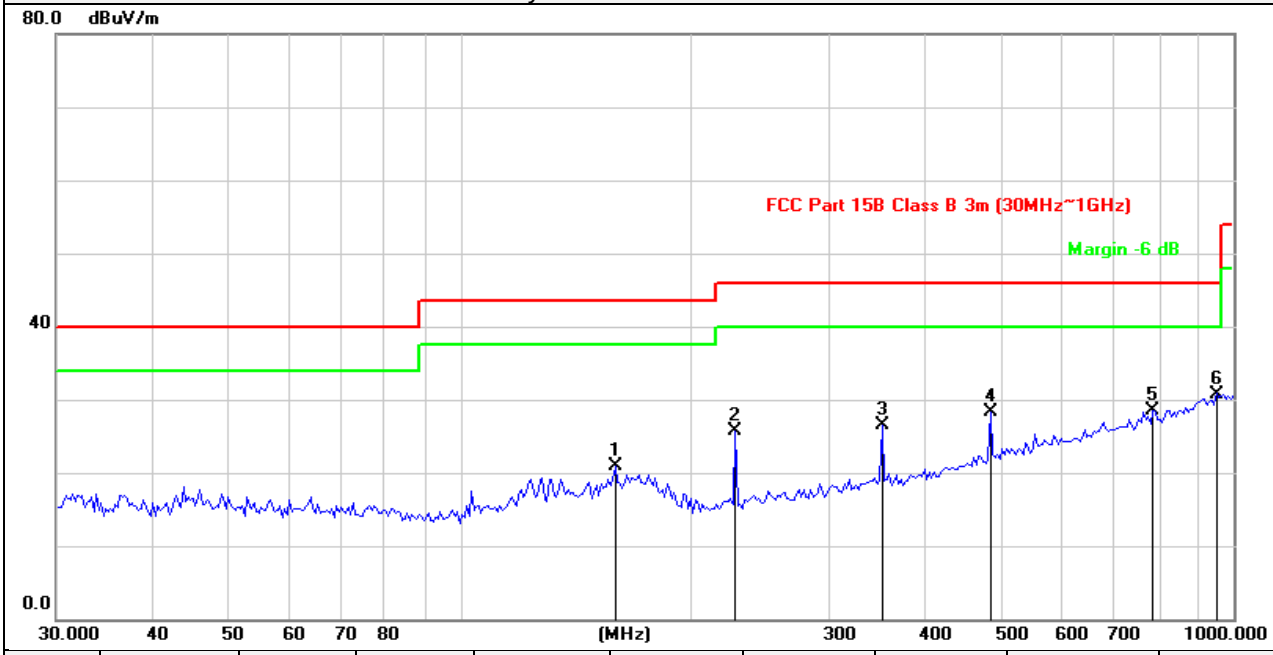
9 kHz ~ 30 MHz Data:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1GHz Worst-Case Data:

Frequency Range	30MHz ~ 1GHz	Detector Function	Peak (PK) Quasi-peak (QP)

Antenna Polarity & Test Distance: Horizontal at 3 m



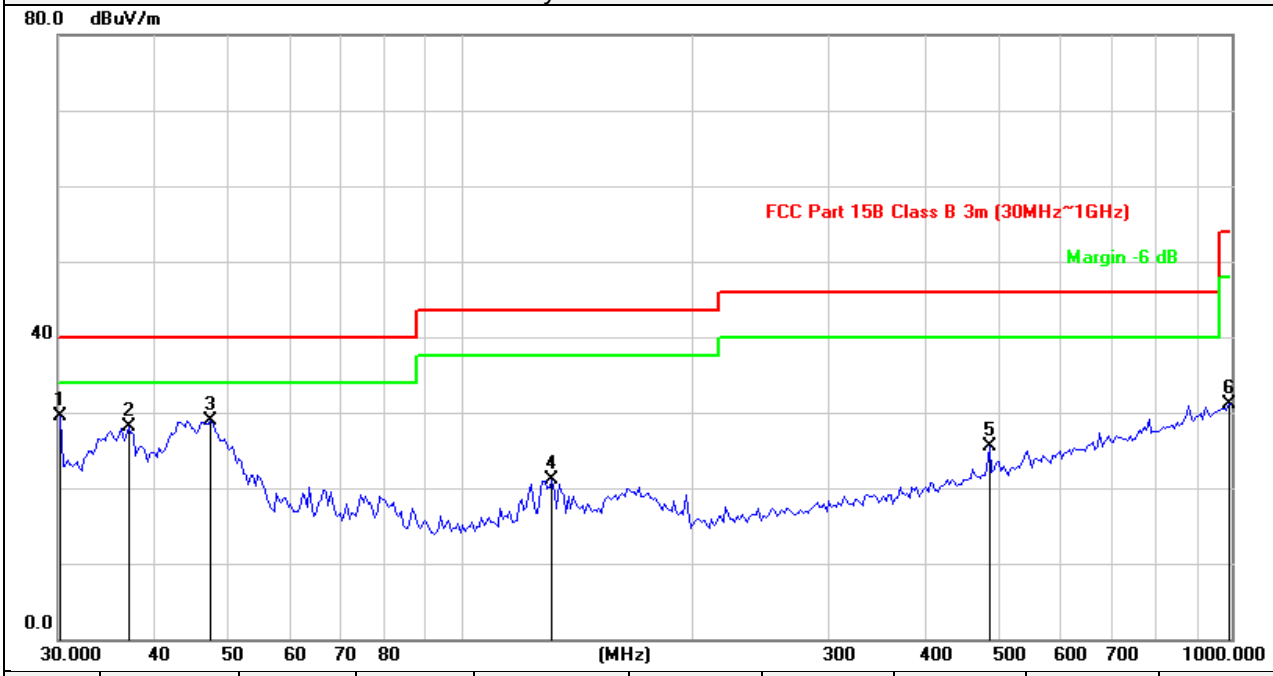
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detecter	Antenna Height (cm)	Table Angle (Degree)
1	158.6399	34.20	-13.22	20.98	43.50	-22.52	peak	200	206
2	227.0164	41.60	-15.93	25.67	46.00	-20.33	peak	200	130
3	350.9722	39.26	-12.73	26.53	46.00	-19.47	peak	300	158
4	484.9068	37.67	-9.41	28.26	46.00	-17.74	peak	200	241
5	787.4749	31.81	-3.39	28.42	46.00	-17.58	peak	300	28
6	952.0001	31.05	-0.25	30.80	46.00	-15.20	peak	200	325

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Frequency Range	30MHz ~ 1GHz	Detector Function	Peak (PK) Quasi-peak (QP)

Antenna Polarity & Test Distance: Vertical at 3 m



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detecter	Antenna Height (cm)	Table Angle (Degree)
1	30.2116	46.23	-16.82	29.41	40.00	-10.59	peak	100	211
2	37.0405	44.79	-16.75	28.04	40.00	-11.96	peak	100	286
3	47.3688	45.66	-16.79	28.87	40.00	-11.13	peak	100	224
4	131.2235	36.70	-15.61	21.09	43.50	-22.41	peak	200	139
5	484.9068	34.98	-9.41	25.57	46.00	-20.43	peak	200	150
6	992.9975	30.78	0.27	31.05	54.00	-22.95	peak	100	193

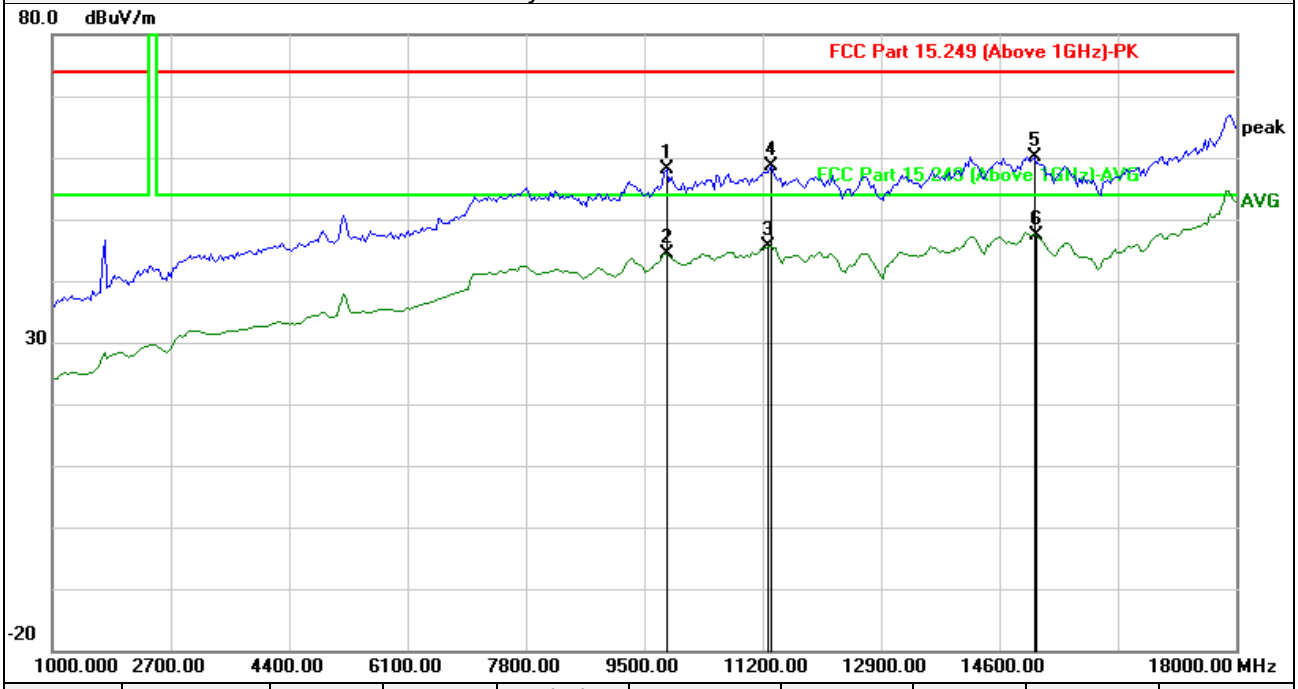
Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Above 1GHz Data:

Frequency Range	1GHz ~ 18GHz	Detector Function	Peak (PK) Average (AVG)

Antenna Polarity & Test Distance: Horizontal at 3 m



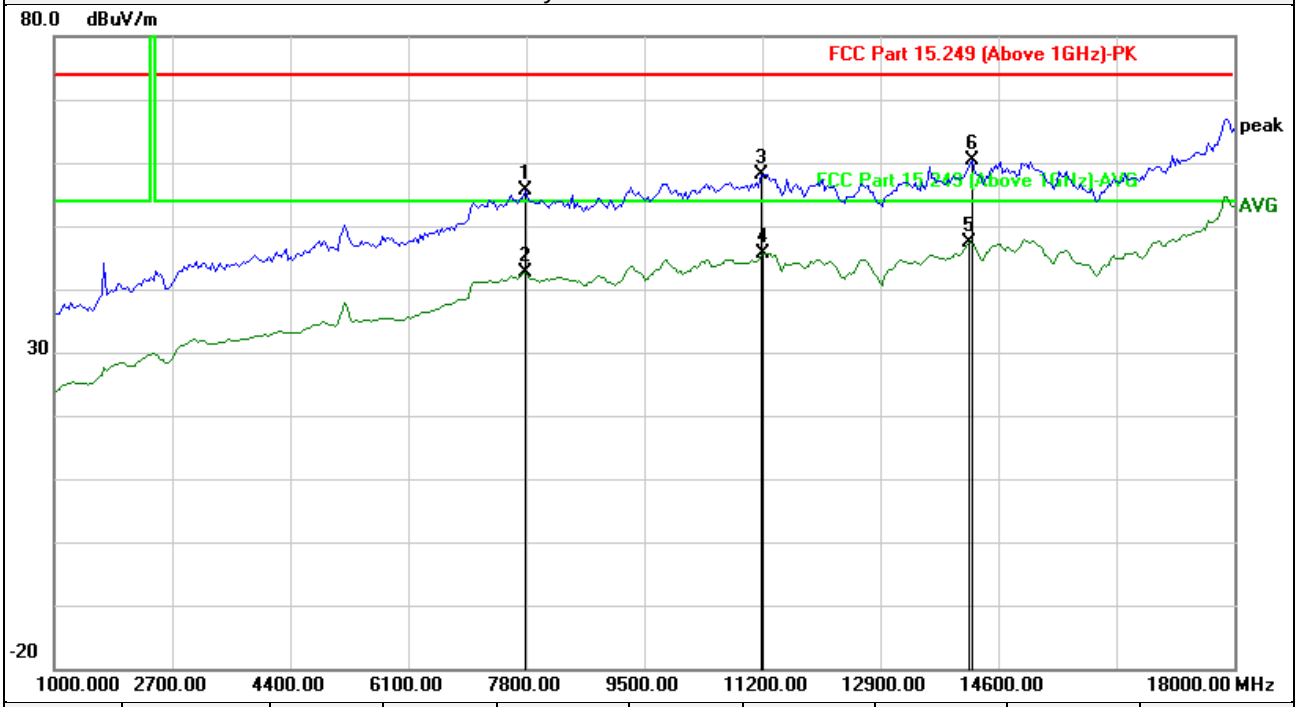
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detecter	Antenna Height (cm)	Table Angle (Degree)
1	9823.647	44.69	13.34	58.03	74.00	-15.97	peak	100	178
2	9823.647	31.15	13.34	44.49	54.00	-9.51	AVG	100	178
3	11288.577	30.22	15.42	45.64	54.00	-8.36	AVG	200	88
4	11322.645	43.19	15.41	58.60	74.00	-15.40	peak	200	88
5	15104.208	40.38	19.81	60.19	74.00	-13.81	peak	200	136
6	15138.276	27.69	19.69	47.38	54.00	-6.62	AVG	200	136

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Frequency Range	1GHz ~ 18GHz	Detector Function	Peak (PK) Average (AVG)

Antenna Polarity & Test Distance: Vertical at 3 m



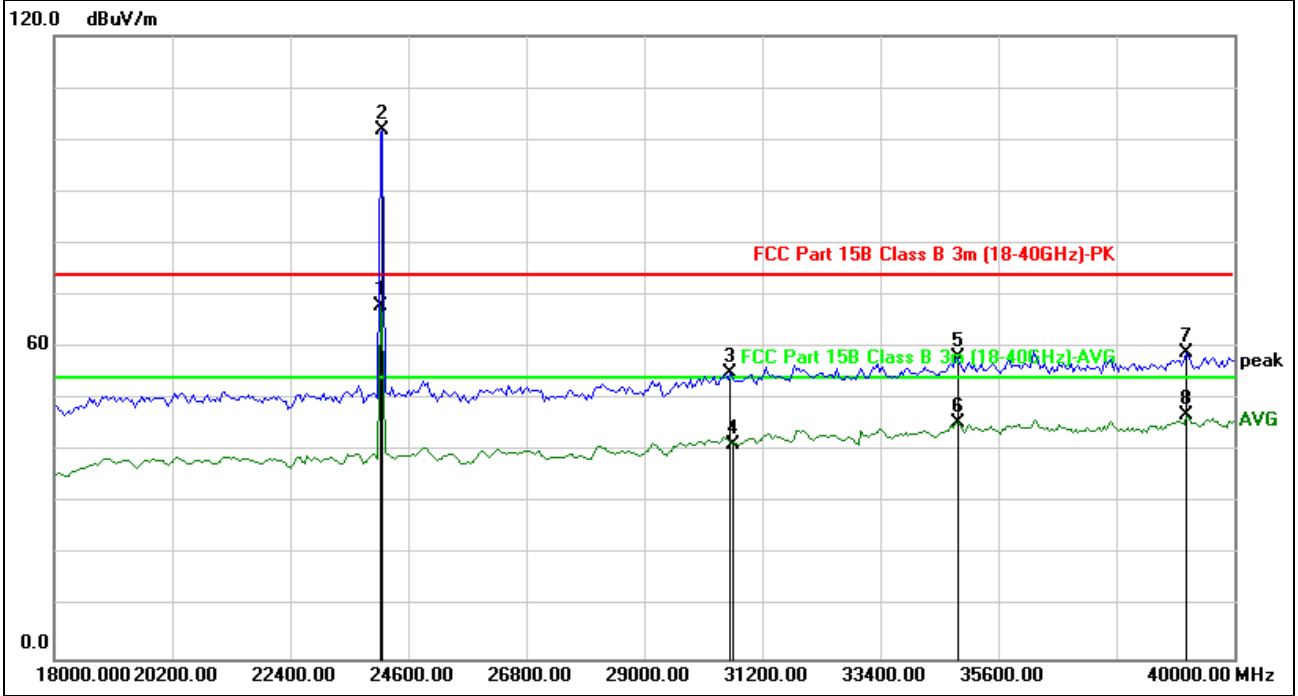
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detecter	Antenna Height (cm)	Table Angle (Degree)
1	7779.559	45.20	10.40	55.60	74.00	-18.40	peak	200	169
2	7779.559	32.14	10.40	42.54	54.00	-11.46	AVG	200	169
3	11186.373	42.74	15.46	58.20	74.00	-15.80	peak	300	258
4	11220.441	30.13	15.46	45.59	54.00	-8.41	AVG	300	258
5	14184.369	28.09	19.21	47.30	54.00	-6.70	AVG	100	13
6	14218.437	41.14	19.25	60.39	74.00	-13.61	peak	100	13

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Frequency Range	18GHz ~ 40GHz	Detector Function	Peak (PK) Average (AVG)

Antenna Polarity & Test Distance: Horizontal at 1 m



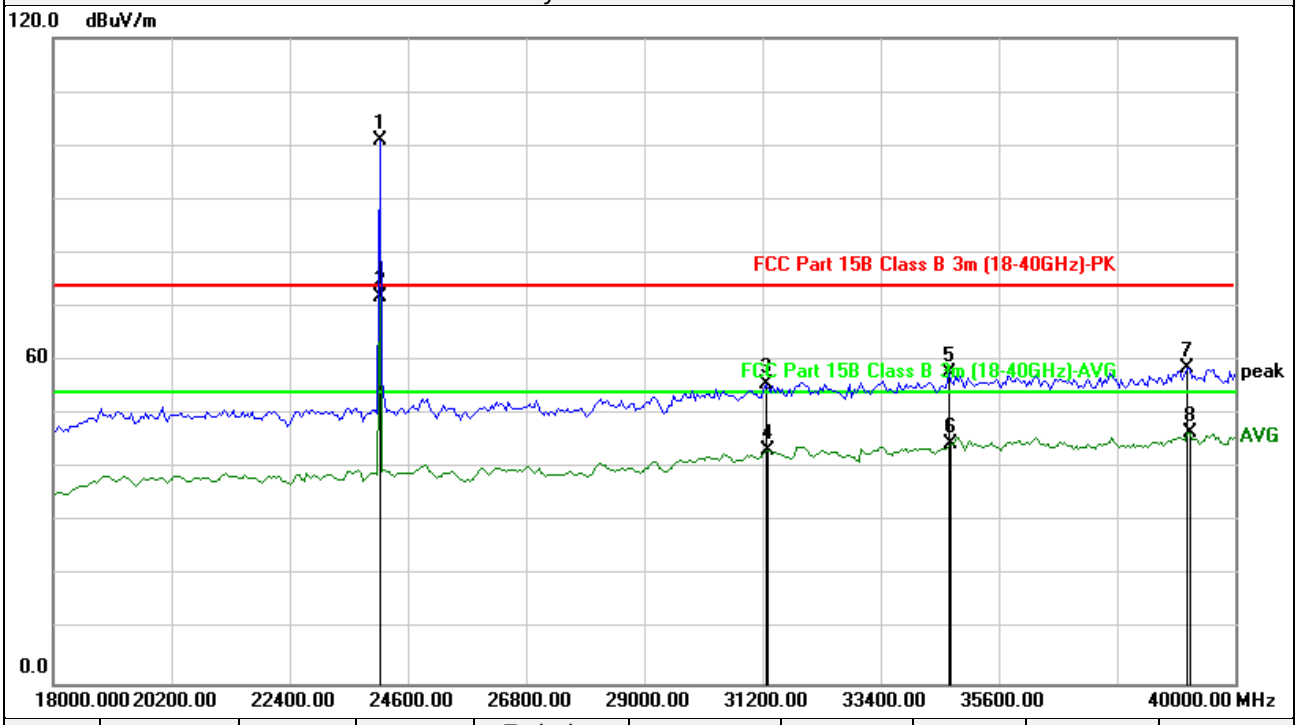
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detecter	Antenna Height (cm)	Table Angle (Degree)
1#	24128.256	102.66	-0.82	101.84	117.54	-15.70	peak	150	121
2#	24084.168	68.88	-0.83	68.05	97.54	-29.49	AVG	150	121
3	30609.218	55.72	-0.53	55.19	83.54	-28.35	peak	100	214
4	30653.306	41.82	-0.52	41.30	63.54	-22.24	AVG	100	214
5	34841.683	56.70	1.49	58.19	83.54	-25.35	peak	100	268
6	34841.683	44.09	1.49	45.58	63.54	-17.96	AVG	100	268
7	39118.236	54.93	3.89	58.82	83.54	-24.72	peak	100	123
8	39118.236	42.98	3.89	46.87	63.54	-16.67	AVG	100	123

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

Frequency Range	18GHz ~ 40GHz	Detector Function	Peak (PK) Average (AVG)

Antenna Polarity & Test Distance: Vertical at 1 m



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detecter	Antenna Height (cm)	Table Angle (Degree)
1#	24084.168	101.76	-0.83	100.93	117.54	-16.61	peak	100	195
2#	24084.168	72.73	-0.83	71.90	97.54	-25.64	AVG	100	195
3	31270.541	55.88	-0.17	55.71	83.54	-27.83	peak	100	177
4	31314.629	43.56	-0.14	43.42	63.54	-20.12	AVG	100	177
5	34665.331	56.46	1.33	57.79	83.54	-25.75	peak	100	255
6	34709.419	43.28	1.38	44.66	63.54	-18.88	AVG	100	255
7	39118.236	54.87	3.89	58.76	83.54	-24.78	peak	100	236
8	39162.325	42.65	3.88	46.53	63.54	-17.01	AVG	100	236

Remarks:

1. Emission Level = Read Level + Factor (Antenna Factor + Cable Loss - Preamp Factor)
2. Margin value = Emission level – Limit value

3.2 Conducted Emission Measurement

3.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

3.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Due Date of Calibration
EMI Test Receiver Rohde&Schwarz	ESCI3	101418	2022/09/12
Artificial Mains Network Rohde&Schwarz	ENV216	3560.6550.15	2022/09/12
Test software FARAD	EZ_EMC V1.1.4.2	N/A	N/A
Hygrothermograph Yuhuaze	HTC-1	NA	2022/09/12
Digital Multimeter FLUKE	15B+	43512617WS	2022/09/12

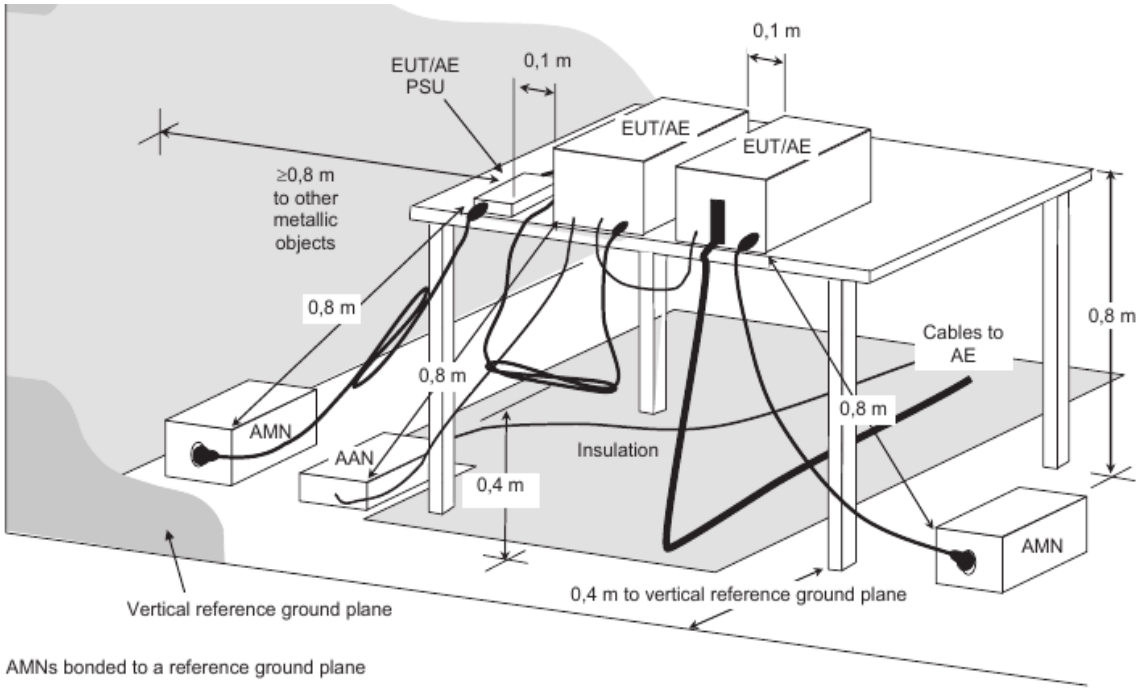
Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Shielded Room 1.

3.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit – 20dB) was not recorded.

Note: All modes of operation were investigated and the worst-case emissions are reported.

3.2.4 Test Setup



AMNs bonded to a reference ground plane

For the actual test configuration, please refer to the attached file (Test Setup Photo).

3.2.5 EUT Operating Condition

Set the EUT under transmission condition continuously at specific channel frequency.

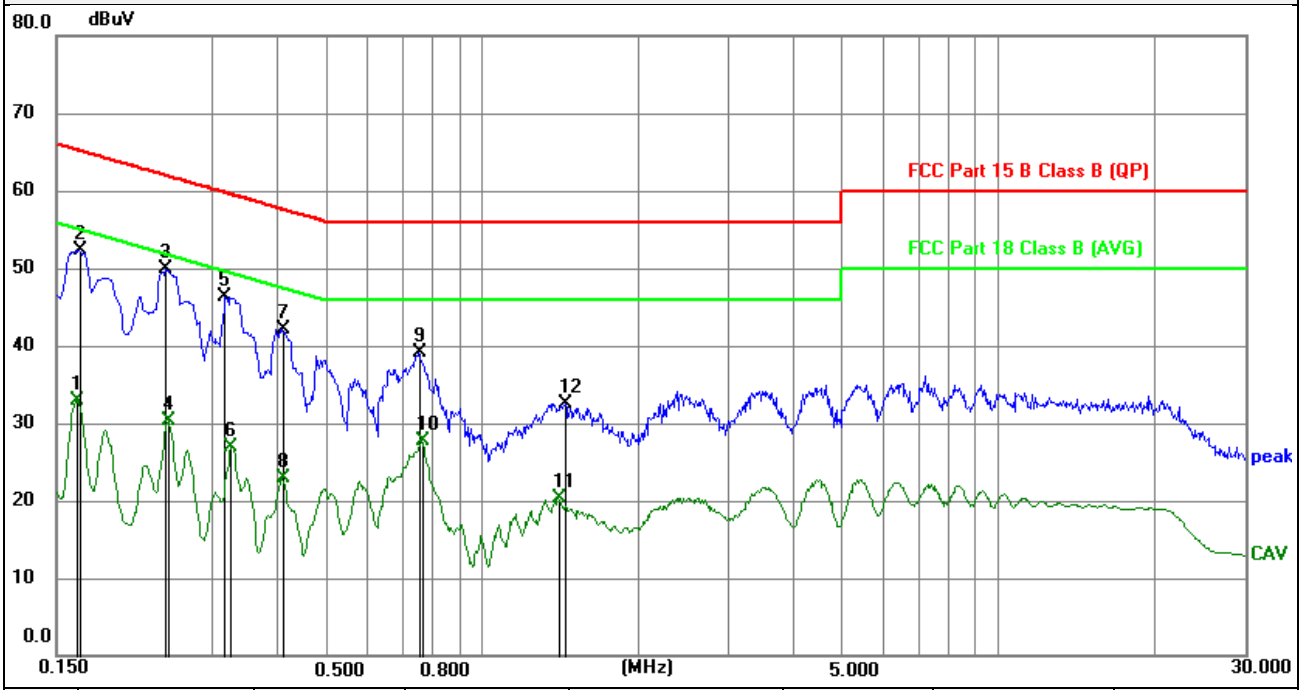
3.2.6 Deviation from Test Standard

No deviation.

3.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution andwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase of Power: Line (L)



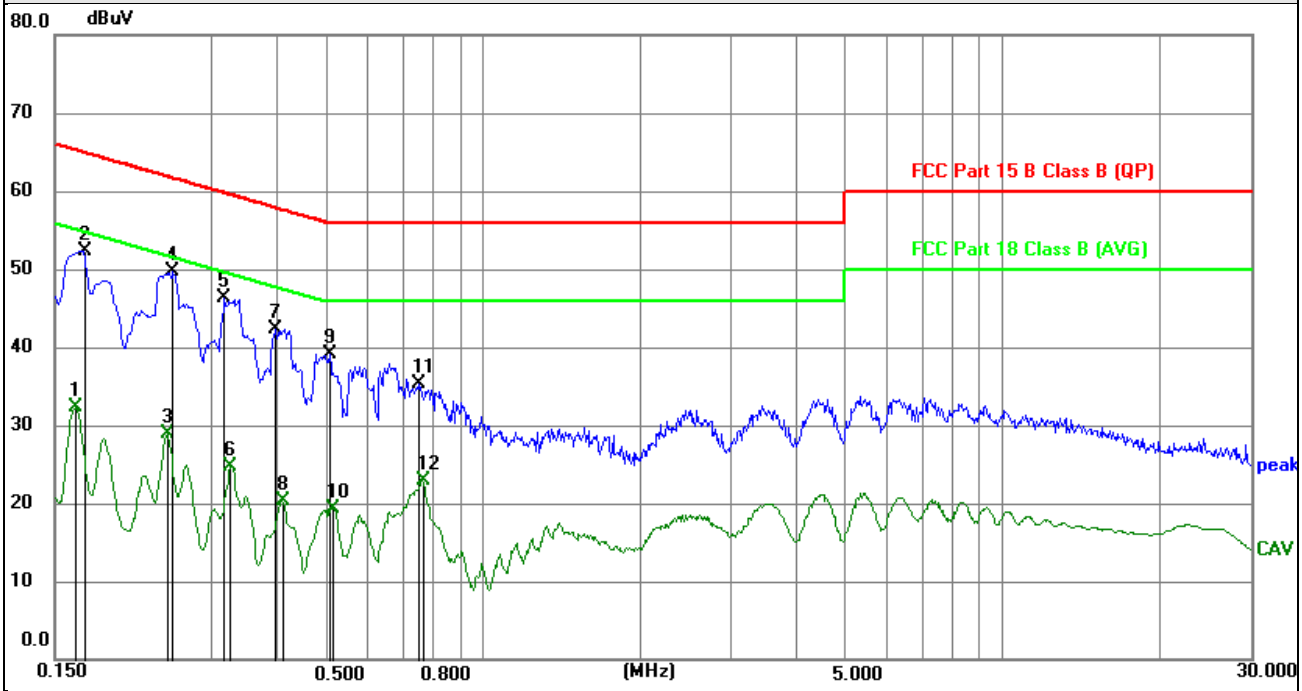
No.	Frequency	Reading	Correcttion Factor	Emission Level	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	Detecter
1	0.1635	23.12	9.82	32.94	55.28	-22.34	AVG
2	0.1658	42.40	9.81	52.21	65.17	-12.96	peak
3	0.2445	40.03	9.79	49.82	61.94	-12.12	peak
4	0.2468	20.56	9.79	30.35	51.86	-21.51	AVG
5	0.3187	36.52	9.80	46.32	59.74	-13.42	peak
6	0.3277	17.05	9.80	26.85	49.51	-22.66	AVG
7	0.4110	32.31	9.80	42.11	57.63	-15.52	peak
8	0.4110	13.07	9.80	22.87	47.63	-24.76	AVG
9	0.7575	29.27	9.89	39.16	56.00	-16.84	peak
10	0.7665	17.81	9.88	27.69	46.00	-18.31	AVG
11	1.4078	10.49	9.85	20.34	46.00	-25.66	AVG
12	1.4505	22.71	9.85	32.56	56.00	-23.44	peak

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution andwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase of Power: Neutral (N)



No.	Frequency	Reading	Correct Factor	Emission Level	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	Detecter
1	0.1635	22.52	9.78	32.30	55.28	-22.98	AVG
2	0.1703	42.60	9.77	52.37	64.95	-12.58	peak
3	0.2468	19.06	9.76	28.82	51.86	-23.04	AVG
4	0.2535	39.85	9.76	49.61	61.64	-12.03	peak
5	0.3187	36.55	9.75	46.30	59.74	-13.44	peak
6	0.3277	14.94	9.75	24.69	49.51	-24.82	AVG
7	0.3975	32.62	9.72	42.34	57.91	-15.57	peak
8	0.4110	10.64	9.72	20.36	47.63	-27.27	AVG
9	0.5100	29.31	9.76	39.07	56.00	-16.93	peak
10	0.5167	9.54	9.76	19.30	46.00	-26.70	AVG
11	0.7530	25.56	9.77	35.33	56.00	-20.67	peak
12	0.7665	13.12	9.76	22.88	46.00	-23.12	AVG

Remarks:

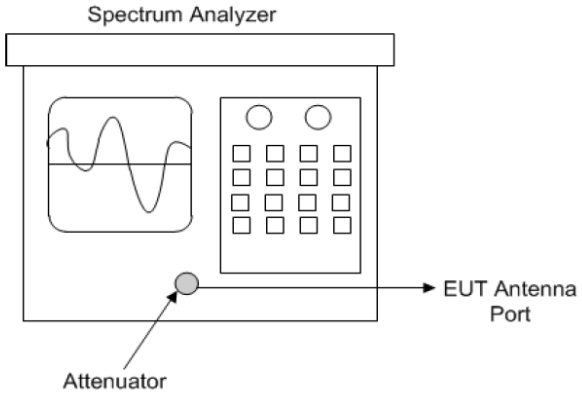
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

3.3 Bandwidth Measurement

3.3.1 Limit

The intentional radiator shall be operated in the frequency bands 902 MHz - 928 MHz; 2400 MHz2483.5 MHz; 5725 MHz-5875 MHz or 24.0 GHz -24.25 GHz.

3.3.2 Test Setup



3.3.3 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Due Date of Calibration
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2022/09/12
Hygrothermograph	Yuhuaze	HTC-1	NA	2022/09/12

Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA.
2. The test was performed in Chamber 1.

3.3.4 Test Procedure

The test was perforrnhed according to ANSI C63.10, clauses 6.9
The minimum of 20dB Bandwidth Measurement is within 24.0 GHz -24.25 GHz.
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5%of the total mean power of a given emission.

3.3.5 Deviation from Test Standard

No deviation.

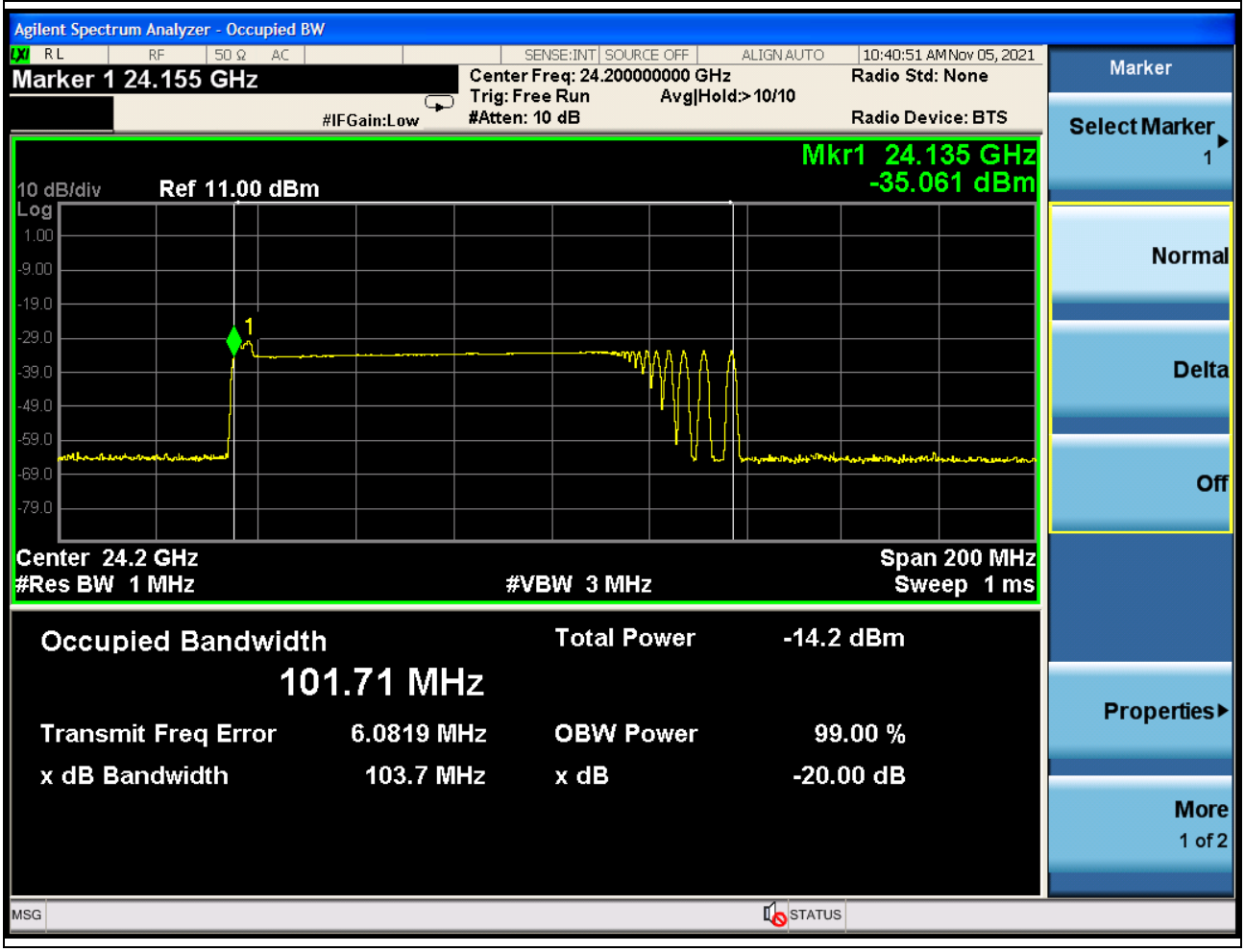
3.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

3.3.7 Test Results

Channel	Frequency (GHz)	99% Bandwidth (MHz)	Lowest Frequency (GHz)	Highest Frequency (GHz)
1	24.0 ~ 24.25	101.71	24.1350	24.236

Channel	Frequency (GHz)	20dB Bandwidth (MHz)	Lowest Frequency (GHz)	Highest Frequency (GHz)
1	24.0 ~ 24.25	103.70	--	--

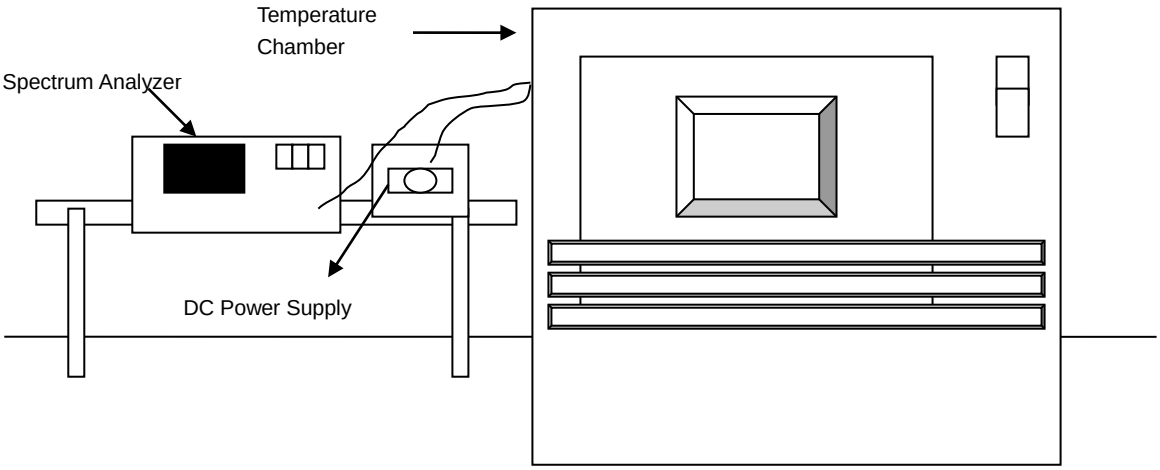


3.4 Frequency Stability

3.4.1 Limits of Frequency Stability Measurement

The frequency of the carrier signal shall be maintained within 24.0 ~ 24.25GHz band of operation

3.4.2 Test Setup



3.4.3 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Due Date of Calibration
Spectrum Analyzer	Rohde&Schwarz	FSV-40N	101783	2022/09/12
Oven	Taike	TW0010B	23210340	2022/09/12
Hygrothermograph	Yuhuaze	HTC-1	NA	2022/09/12

3.4.4 Test Procedure

The frequency łolerance of the carrier signal is measured over a temperature variation of-20 ℃C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rates supply voltage at a temperature of 20 °C. Temperature and voltage range may vary if the manufacturer states another temperature or voltage rangeIf the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matçhing network equal to the impedance specified or employed for the antenna is used as well as a DC blbck and appropriate (50 2) attenuators. In case where the EUT does not provide an antenna connector or a test fixture is usedFor battery operated equipment, the test is performed using a new battery. Alternatively, an external supply voltage cah be used and is at least set to:

- The maximumn battery voltage as delivered by a new battery or 115 % of the battery nominal volt age:
- The battery npminal voltage
- 85 % of the battery nominal voltage
- The battery operating end point voltage which shall be specified by the equipment manufacturer.The EUT is operating providing an unmodulated carrier for frequency error tests. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to shape of the spectrum of the EUT. The frequency counter mode of the spectrum analyzer is sed to maximize the accuracy of the measured frequency toleranceIf an unmodulated carrier is not available a significant and stable point of the spectrum is selected and the span is reduced to a value that delivers an accuracy which shall be better than 1 % of the maximum frequency tolerance allowed for the carrier signal. This method may be performed as long as the margin to the frequency tolerance is larger than the uncertainty of the measured frequency tolerance.

3.4.5 Deviation from Test Standard

No deviation.

3.4.6 EUT Operating Condition

Set the EUT transmit at un-modulation mode to test frequency stability.

3.4.7 Test Results

Frequemcy Stability Versus Temp.					
Operating Frequency: 24.0 ~ 24.25GHz					
Temp. (℃)	Power Supply (Vdc)	0minute	2minute	5minute	10minute
		Measured Frequency (GHz)	Measured Frequency (GHz)	Measured Frequency (GHz)	Measured Frequency (GHz)
50	5	24.142~24.226	24.142~24.226	24.142~24.226	24.142~24.226
40	5	24.137~24.229	24.137~24.229	24.137~24.229	24.137~24.229
30	5	24.133~24.234	24.133~24.234	24.133~24.234	24.133~24.234
20	5	24.134~24.235	24.134~24.235	24.134~24.235	24.134~24.235
10	5	24.132~24.237	24.132~24.237	24.132~24.237	24.132~24.237
0	5	24.132~24.236	24.132~24.236	24.132~24.235	24.132~24.235
-10	5	24.131~24.235	24.134~24.235	24.134~24.235	24.134~24.235
-20	5	24.131~24.236	24.134~24.235	24.134~24.235	24.134~24.235
-30	5	24.124~24.237	24.134~24.236	24.134~24.236	24.134~24.236

Frequemcy Stability Versus Temp.				
Operating Frequency: 24.0 ~ 24.25GHz				
Temp. (20℃)				
Power Supply (Vdc)	0minute	2minute	5minute	10minute
	Measured Frequency (GHz)	Measured Frequency (GHz)	Measured Frequency (GHz)	Measured Frequency (GHz)
4.25	24.115~24.236	24.115~24.236	24.115~24.236	24.115~24.236
5	24.115~24.236	24.115~24.236	24.115~24.236	24.115~24.236
5.75	24.115~24.236	24.115~24.236	24.115~24.236	24.115~24.236

4 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Hwa-Hsing (Dongguan) Co., Ltd., A global provider of TESTING and CERTIFICATION services for consumer products, electronic products and wireless information technology products. Adhering to the core values “HONEST and TRUSTWORTHY, OBJECTIVE and IMPARTIALITY, RIGOROUS and AFFICIENT”, commitment to provide professional, perfect and efficient comprehensive ONE-STOP solution of TESTING and CERTIFICATION services for Manufacturers, Buyers, Traders, Brands, Retailers. Assist client to better manage risk, protect their brands, reduce costs and cut time to over 150 markets in global. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lab Address: No.101, Bld N1, Yuyuan 2Rd, Yuyuan Industrial Park, HuangJiang Town, Dongguan, China
Contact Tel: 0769-83078199
Email: Customerservice.dg@hwa-hsing.com
Web Site: www.hwa-hsing.com

The address and road map of all our labs can be found in our web site also.

--- END ---