

FCC Test Report

Report No.: RFBAOZ-WTW-P22040585-3

FCC ID: 2AUIUWYZECOP

Test Model: WYZECOP

Received Date: 2022/4/19

Test Date: 2022/5/20 ~ 2022/9/20

Issued Date: 2022/12/26

Applicant: Wyze Labs, Inc

Address: 5808 Lake Washington Blvd NE, Ste 300 Kirkland WA United States Of America

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RFBAOZ-WTW-P22040585-3	Original release.	2022/12/26

1 Certificate of Conformity

Product: Wyze Battery Cam Pro

Brand: WYZE

Test Model: WYZECOP

Sample Status: Engineering sample

Applicant: Wyze Labs, Inc

Test Date: 2022/5/20 ~ 2022/9/20

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.249)
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, 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 :  , **Date:** 2022/12/26
Claire Kuan / Specialist

Approved by :  , **Date:** 2022/12/26
May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.249)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -11.54 dB at 12.13672 MHz.
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	Pass	Meet the requirement of limit. Minimum passing margin is -3.4 dB at 24250.00 MHz.
15.215 (c)	20dB Bandwidth	Pass	Meet the requirement of limit
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note:

Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	1.9 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.1 dB
	30 MHz ~ 1 GHz	5.4 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	5.0 dB
	18 GHz ~ 40 GHz	5.3 dB
	40 GHz ~ 100 GHz	5.4 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wyze Battery Cam Pro
Brand	WYZE
Test Model	WYZECOP
Status of EUT	Engineering sample
Power Supply Rating	5Vdc from host equipment or 3.7Vdc from battery
Modulation Type	FMCW
Operating Frequency	24.00~24.25 GHz
Number of Channel	1
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Refer to Note
Cable Supplied	Refer to Note

Note:

1. The EUT has below radios, as following table:

Radio 1	Radio 2
WLAN (2.4GHz / 5GHz / Bluetooth)	24GHz

2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN 2.4GHz	24GHz
2	WLAN 5GHz	24GHz
3	Bluetooth	24GHz

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

3. The following antennas were provided to the EUT.

Antenna No.	Antenna Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable length (cm)
1	2.43	2.4~2.4835GHz	Dipole	ipex(MHF)	4
	3.48	5.15~5.85GHz			
2	2	24~24.25GHz	Array	none	-

4. Only radiated measurements are used to show compliance with FCC limits for fundamental and spurious emissions.

5. The EUT uses following accessories.

Battery		
Brand	Model	Specification
WYZE	WBAT1	Power Rating : 3.7V, 6200mAh, 22.94Wh
USB Cable		
Brand	Model	Specification
NETWORK GIANT LIMITED	A210017	Signal Line : 0.6m, Shielded

6. The EUT was pre-tested under the following modes:

Pre-Scan:	- For AC Power Conducted Emissions items: Laptop/ AC Adapter. Pre-scan these modes and find the worst case as a representative test condition. - For Unwanted Emissions Below 1GHz items: Battery/ AC Adapter. Only these modes as a representative test condition.
Worst Case:	- For AC Power Conducted Emissions items the Laptop mode is the worst case of power supply. - For Unwanted Emissions Below 1GHz items the AC Adapter mode is the worst case of power supply. - 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).

7. 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.
8. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

Only the worst-case frequency is reported within the supported frequency range.

Frequency (GHz)
24.148

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	BW	
-	√	√	√	√	-

Where **RE≥1G**: Radiated Emission above 1GHz & Bandedge Measurement **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **BW**: 20dB Bandwidth Measurement

Radiated Emission Test (Above 1GHz):

- ☒ 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.

TESTED CHANNEL	MODULATION TYPE
1	FMCW

Radiated Emission Test (Below 1GHz):

- ☒ 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.

TESTED CHANNEL	MODULATION TYPE
1	FMCW

Power Line Conducted Emission Test:

- ☒ 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.

TESTED CHANNEL	MODULATION TYPE
1	FMCW

20dB Bandwidth Measurement:

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ 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.

TESTED CHANNEL	MODULATION TYPE
1	FMCW

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE$\geq$1G	25deg. C, 65%RH 23deg. C, 62%RH	120Vac, 60Hz (System)	Carter Lin
RE<1G	20deg. C, 70%RH	120Vac, 60Hz (System)	Ryan Du
PLC	21deg. C, 62%RH	120Vac, 60Hz (System)	Sampson Chen
BW	25deg. C, 60%RH	3.7 Vdc	Chilin Lee

3.3 Description of Support Units

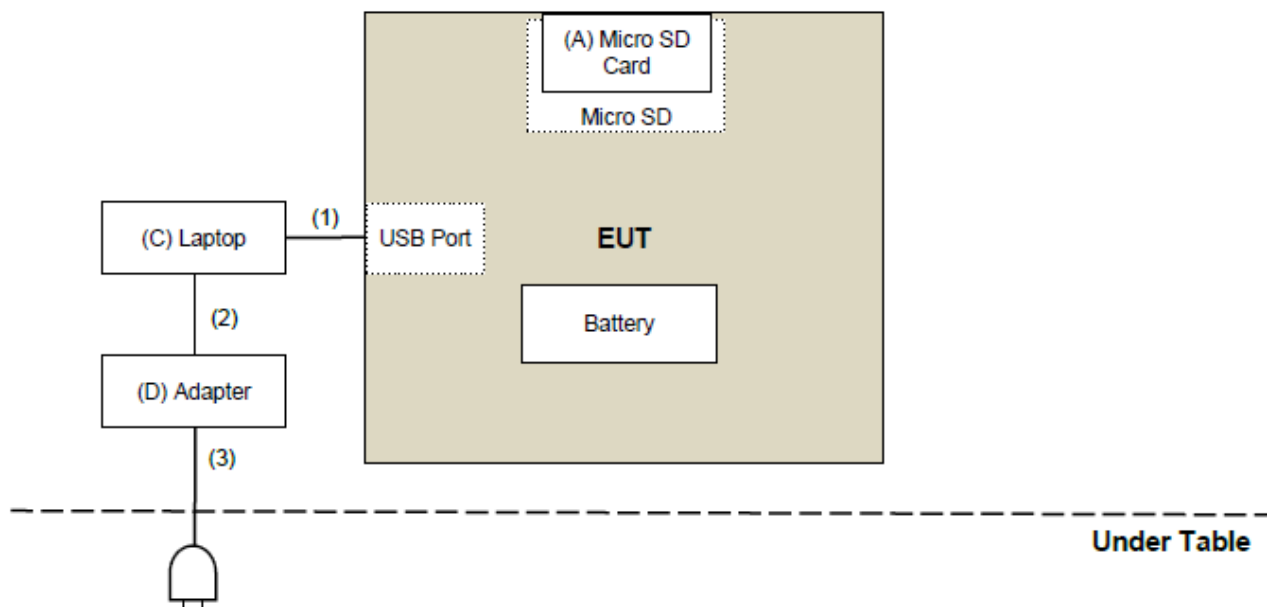
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Micro SD Card	ADATA	N/A	N/A	N/A	Provided by Lab
B	USB Adapter	ASUS	EXA1205UA	N/A	N/A	Provided by Lab
C	Laptop	Lenovo	20U5S01X00 L14	PF-1ANPYA	N/A	Provided by Lab
D	Adapter	Lenovo	ADLX45YLC3D	N/A	N/A	Provided by Lab

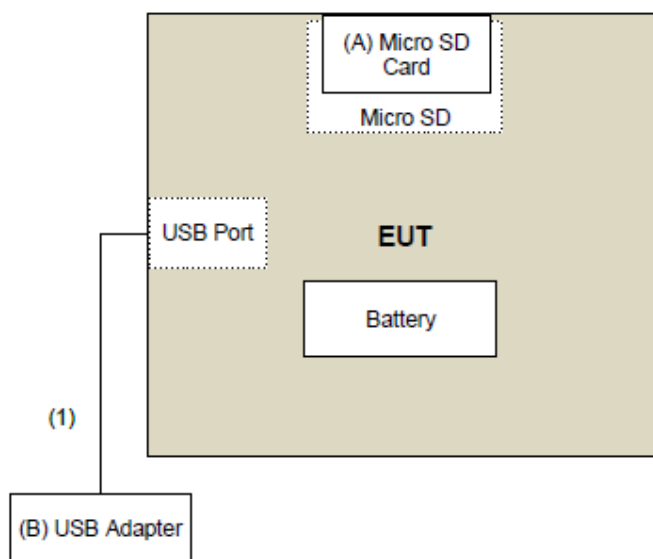
ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	USB Cable	1	0.6	Yes	0	Supplied by applicant
2	DC Cable	1	1.8	No	0	Provided by Lab
3	AC Cable	1	1	No	0	Provided by Lab

3.3.1 Configuration of System under Test

For AC Power Conducted Emission test



For Radiated Emission test



3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.249)

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	$2400/F(\text{kHz})$	300
0.490 ~ 1.705	$24000/F(\text{kHz})$	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

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 1000MHz, 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 20dB under any condition of modulation.

4.1.2 Test Instruments

For below 1GHz test:

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer KEYSIGHT	N9030B	MY57142938	2022/4/26	2023/4/25
Test Receiver KEYSIGHT	N9038A	MY59050100	2022/6/20	2023/6/19
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	NA	NA
Pre_Amplifier Agilent	8447D	2944A10636	2022/3/19	2023/3/18
LOOP ANTENNA Electro-Metrics	EM-6879	264	2022/3/18	2023/3/17
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2022/1/6	2023/1/5
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-002	2022/1/6	2023/1/5
Pre_Amplifier Mini-Circuits	ZFL-1000VH2	QA0838008	2021/10/19	2022/10/18
Trilog Broadband Antenna Schwarzbeck	VULB 9168	9168-361	2021/10/26	2022/10/25
RF Coaxial Cable COMMATE/PEWC	8D	966-4-1	2022/3/8	2023/3/7
RF Coaxial Cable COMMATE/PEWC	8D	966-3-2	2022/2/26	2023/2/25
RF Coaxial Cable COMMATE/PEWC	8D	966-3-3	2022/2/26	2023/2/25
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	2021/9/23	2022/9/22

- Note: 1. The test was performed in 966 Chamber No. 3.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: 2022/9/19

For above 1GHz~40GHz test:

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
MXE EMI Receiver(20 Hz to 44 GHz) Keysight	N9038A	MY54450088	2021/7/6	2022/7/5
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Horn Antenna Schwarzbeck	BBHA9120-D	9120D-406	2021/11/14	2022/11/13
Pre_Amplifier EMCI	EMC12630SE	980384	2022/1/10	2023/1/9
RF Coaxial Cable EMCI	EMC104-SM-SM-1500	180504	2022/4/25	2023/4/24
RF Coaxial Cable EMCI	EMC104-SM-SM-2000	180601	2021/6/8	2022/6/7
RF Cable EMCI	EMC104-SM-SM-6000	210201	2022/5/10	2023/5/9
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	NA	NA
Spectrum Analyzer Keysight	N9030A	MY54490679	2021/7/9	2022/7/8
Pre_Amplifier EMCI	EMC184045SE	980387	2022/1/10	2023/1/9
Horn Antenna Schwarzbeck	BBHA 9170	9170-739	2021/11/14	2022/11/13
RF Cable-Frequency range: 1-40GHz EMCI	EMC102-KM-KM-1200	160924	2022/1/10	2023/1/9
RF Coaxial Cable EMCI	EMC-KM-KM-4000	200214	2022/3/8	2023/3/7

- Note: 1. The test was performed in 966 Chamber No. 3.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: 2022/5/20 ~ 2022/5/25

For above 40GHz test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Keysight	N9030A	MY55330160	Feb. 14, 2022	Feb. 13, 2023
Spectrum Analyzer Keysight	N9042B+V3050A	US60360159	Jan. 12, 2022	Jan. 11, 2023
PSG analog signal generator (from 250 kHz to 50 GHz) Keysight	E8257D	MY53401987	June 21, 2022	June 20, 2023
Antenna_Horn oxe89 QUINSTAR	QWH-QPRR00	QWH-QPRR00-2	Feb. 11, 2021	Feb. 10, 2023
Antenna_Horn Conical Keysight	WR15CH-Conical	RCHO15RL-2	Feb. 11, 2021	Feb. 10, 2023
Antenna_Horn Conical Keysight	WR10CH-Conical	RCHO10RL-2	Feb. 11, 2021	Feb. 10, 2023
Antenna_Horn Conical Keysight	WR6.5CH-Conical	RCHO6RL-2	Feb. 11, 2021	Feb. 10, 2023
Antenna_Horn Conical Keysight	WR5.1CH-Conical	RCHO5RL-2	Feb. 11, 2021	Feb. 10, 2023
Antenna_Horn Conical Keysight	WR3.4DH-Diagonal	WR3.4DHR4 5-12	Feb. 11, 2021	Feb. 10, 2023
Power Sensor Keysight	U8489A	US60490117	Feb. 11, 2021	Feb. 10, 2023
Extension Module_up converter VDI	E8257DV10	SGX647	Feb. 11, 2021	Feb. 10, 2023
Extension Module_up converter VDI	E8257DV06	SGX645	Feb. 11, 2021	Feb. 10, 2023
Extension Module_up converter VDI	E8257DV03	SGX643	Feb. 11, 2021	Feb. 10, 2023
Extension Module_down converter VDI	N9029AV06	SAX723	Feb. 11, 2021	Feb. 10, 2023
Extension Module_down converter VDI	N9029AV05	SAX722	Feb. 11, 2021	Feb. 10, 2023
Extension Module_down converter VDI	N9029AV03	SAX721	Feb. 11, 2021	Feb. 10, 2023
Power Meter VDI	PM5B	571V	Feb. 11, 2021	Feb. 10, 2023
Extension Module_up converter VDI	E8257DV15	SGX648	Feb. 11, 2021	Feb. 10, 2023
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 6
4. Tested Date: 2022/5/26

4.1.3 Test Procedures

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. Parallel, perpendicular, and ground-parallel orientations 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 30MHz to 40GHz

- 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 3 MHz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 40GHz

- a. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meters chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The distance at which limits are typically specified is 3 meter; however, closer measurement distances may be utilized.
- c. Begin handheld measurements with the test antenna (horn) at a distance of 1 meter from the EUT, in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 meter from the EUT.
- d. Repeat (b) with the horn in a vertically polarized position.
- e. If the emission cannot be detected at 1 meter, reduce the RBW in order to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.
- f. Note the maximum level indicated on the Spectrum Analyzer.
- g. Based on the distance at which the measurement was made and the calculated distance to the edge of the far field, determine the appropriate distance attenuation factor. Apply this factor to the calculated field strength in order to determine the equivalent field strength at the distance at which the regulatory limit is specified. Compare to the appropriate limits
- h. Repeat (a) - (f) for every emission that must be measured, up through the required frequency range of investigation

Note:

1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak and Average detection at frequency above 40GHz.
2. Shorter measurement distances may be used to improve the measurement system's noise floor. As ANSI C63.10 section 9.4 description is based on the measurement in distance of 3 meters, the data obtained at 1-meter distance was extrapolate results to the 3-m distance:

Test value at 3-meter distance (dBuV)

= Test value at 1 meter distance (dBuV) + 20log(1/3)(dB)

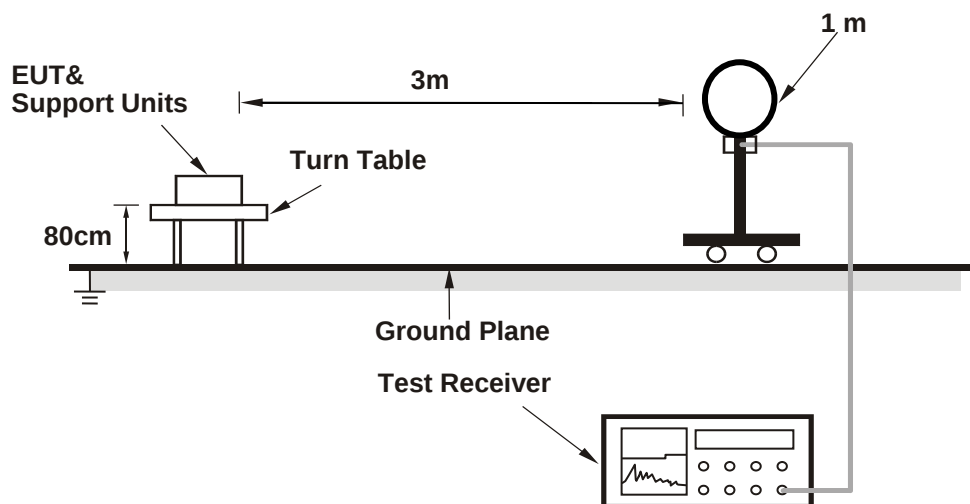
= Test value at 1 meter distance (dBuV) - 9.5(dB).

4.1.4 Deviation from Test Standard

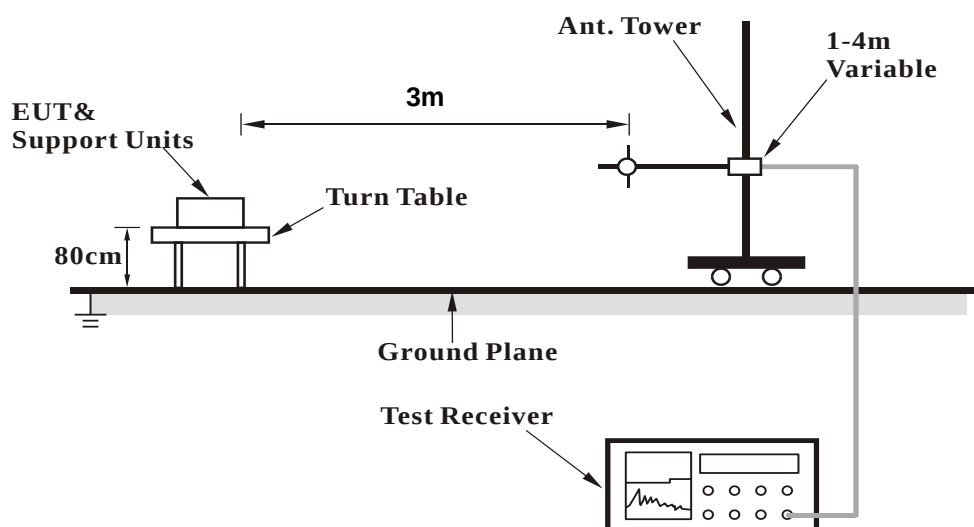
No deviation.

4.1.5 Test Setup

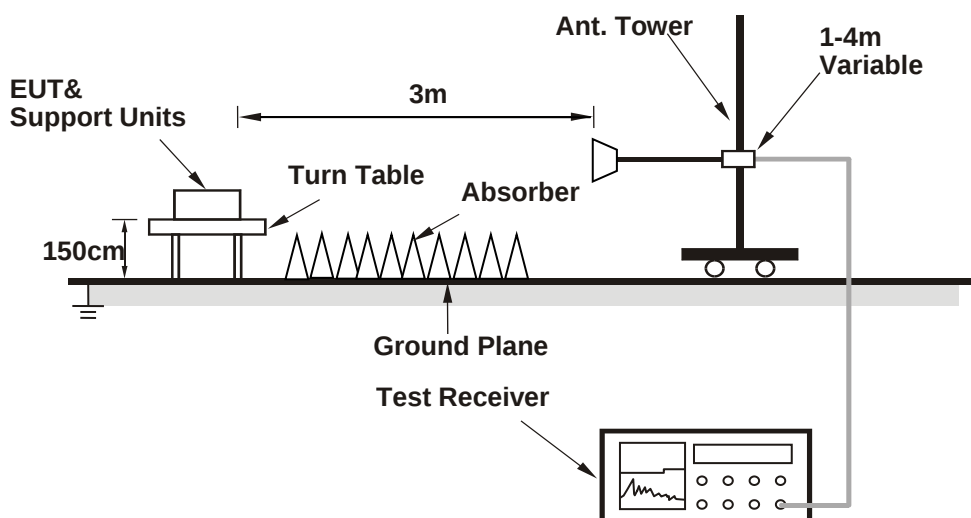
For Radiated emission below 30MHz



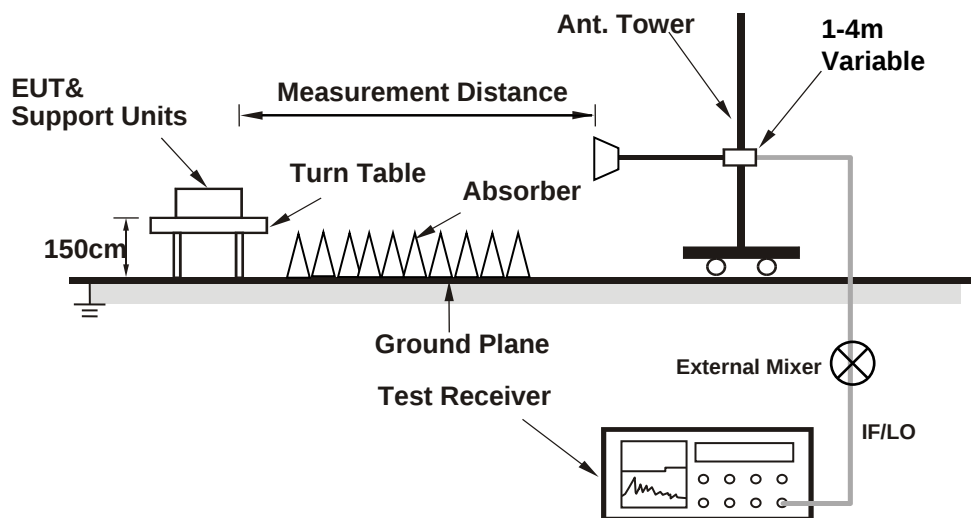
For Radiated emission 30MHz to 1GHz



For Radiated emission 1GHz to 50GHz



For Radiated emission above 50GHz



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

4.1.6 EUT Operating Conditions

- Placed the EUT on the testing table.
- Controlling software (Teratorm-4.77) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

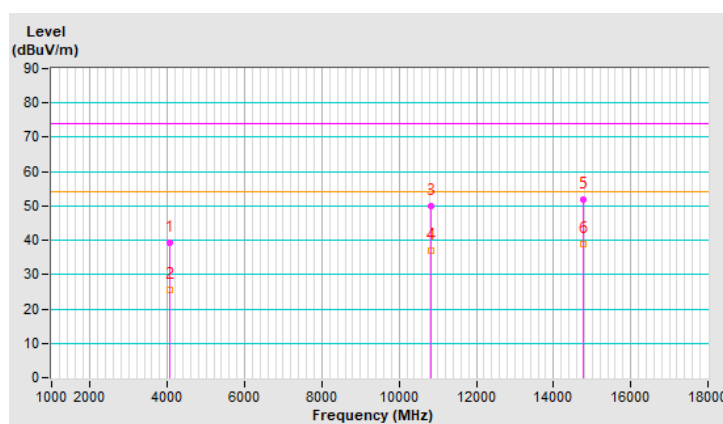
For 1~18GHz

RF Mode	TX	Frequency	24.148 GHz
Frequency Range	1 GHz ~ 18 GHz	Detector Function & Bandwidth	Peak (PK) Average (AV)
Environmental Conditions	25°C, 65% RH	Tested By	Nelson Teng

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4072.32	39.2 PK	74.0	-34.8	1.50 H	249	37.0	2.2
2	4072.32	25.6 AV	54.0	-28.4	1.50 H	249	23.4	2.2
3	10810.70	50.1 PK	74.0	-23.9	2.00 H	60	35.4	14.7
4	10810.70	37.1 AV	54.0	-16.9	2.00 H	60	22.4	14.7
5	14781.90	51.7 PK	74.0	-22.3	3.50 H	305	34.3	17.4
6	14781.90	38.9 AV	54.0	-15.1	3.50 H	305	21.5	17.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.

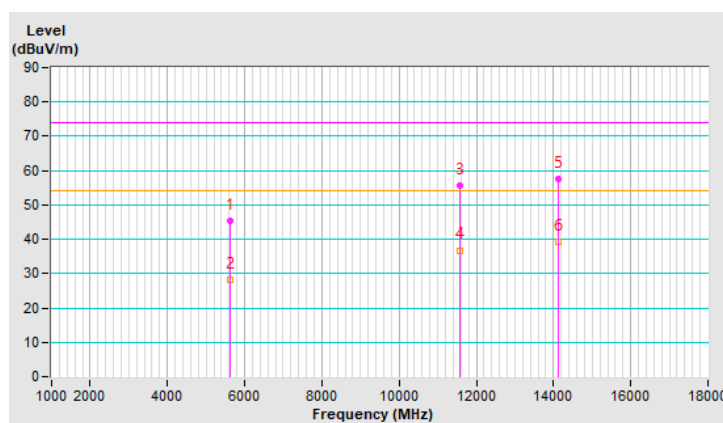


RF Mode	TX	Frequency	24.148 GHz
Frequency Range	1 GHz ~ 18 GHz	Detector Function & Bandwidth	Peak (PK) Average (AV)
Environmental Conditions	25°C, 65% RH	Tested By	Nelson Teng

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	5623.60	45.4 PK	74.0	-28.6	1.50 V	95	40.5	4.9
2	5623.60	28.2 AV	54.0	-25.8	1.50 V	95	23.3	4.9
3	11590.00	55.7 PK	74.0	-18.3	2.00 V	188	40.6	15.1
4	11590.00	36.8 AV	54.0	-17.2	2.00 V	188	21.7	15.1
5	14138.20	57.6 PK	74.0	-16.4	1.00 V	34	39.7	17.9
6	14138.20	39.4 AV	54.0	-14.6	1.00 V	34	21.5	17.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.



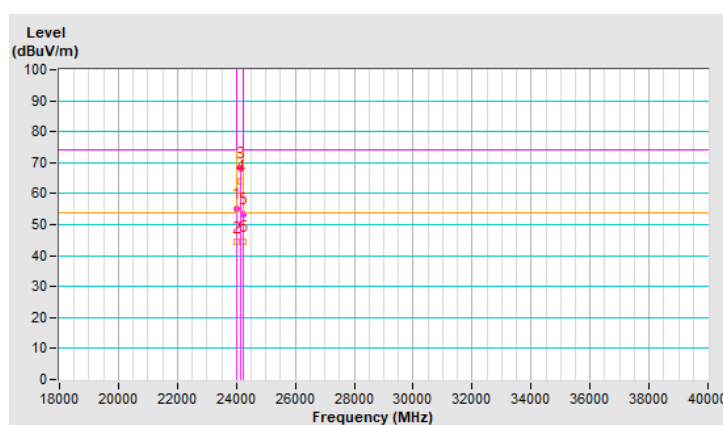
For 18~40GHz

RF Mode	TX	Frequency	24.148 GHz
Frequency Range	18 GHz ~ 40 GHz	Detector Function & Bandwidth	Peak (PK) Average (AV)
Environmental Conditions	25°C, 75% RH	Tested By	Nelson Teng

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	24000.00	55.2 PK	74.0	-18.8	1.64 H	0	57.9	-2.7
2	24000.00	44.3 AV	54.0	-9.7	1.64 H	0	47.0	-2.7
3	*24148.00	68.4 PK	127.9	-59.5	1.64 H	0	70.9	-2.5
4	*24148.00	64.1 AV	107.9	-43.8	1.64 H	0	66.6	-2.5
5	24250.00	53.6 PK	74.0	-20.4	1.64 H	0	55.9	-2.3
6	24250.00	44.6 AV	54.0	-9.4	1.64 H	0	46.9	-2.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

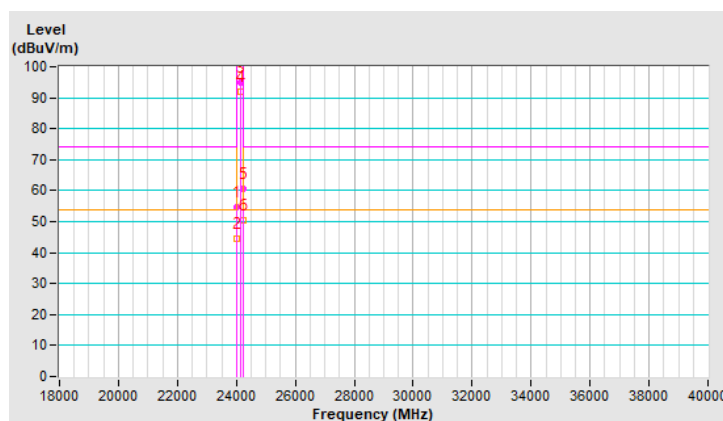


RF Mode	TX	Frequency	24.148 GHz
Frequency Range	18 GHz ~ 40 GHz	Detector Function & Bandwidth	Peak (PK) Average (AV)
Environmental Conditions	25°C, 75% RH	Tested By	Nelson Teng

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	24000.00	54.6 PK	74.0	-19.4	1.64 V	0	57.3	-2.7
2	24000.00	44.5 AV	54.0	-9.5	1.64 V	0	47.2	-2.7
3	*24148.00	95.0 PK	127.9	-32.9	1.64 V	0	97.5	-2.5
4	*24148.00	91.9 AV	107.9	-16.0	1.64 V	0	94.4	-2.5
5	24250.00	60.8 PK	74.0	-13.2	1.64 V	0	63.1	-2.3
6	24250.00	50.6 AV	54.0	-3.4	1.64 V	0	52.9	-2.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.



For 40~100GHz

RF Mode	TX	Frequency	24.148 GHz
Frequency Range	40 GHz ~ 100 GHz	Detector Function & Bandwidth	Peak (PK) Average (AV)
Environmental Conditions	25°C, 75% RH	Tested By	Carter Lin

Antenna Polarity : Horizontal								
No.	Frequency (GHz)	Factor (dB/m)	Reading (dBuV)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Pass/Fail
1	48.30	20.94	33.89	54.83	87.9	-33.072	Peak	Pass
2	48.30	20.94	16.31	37.25	67.9	-30.652	Average	Pass
3	72.44	-0.44	55.05	54.61	87.9	-33.292	Peak	Pass
4	72.44	-0.44	37.12	36.68	67.9	-31.222	Average	Pass
5	98.32	22.47	18.04	40.51	74	-33.492	Peak	Pass
6	98.32	22.47	0.35	22.82	54	-31.182	Average	Pass
Antenna Polarity : Vertical								
No.	Frequency (GHz)	Factor (dB/m)	Reading (dBuV)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Pass/Fail
1	48.30	20.94	33.62	54.56	87.9	-33.342	Peak	Pass
2	48.30	20.94	15.91	36.85	67.9	-31.052	Average	Pass
3	72.44	-0.44	54.59	54.15	87.9	-33.752	Peak	Pass
4	72.44	-0.44	36.67	36.23	67.9	-31.672	Average	Pass
5	98.37	22.47	17.28	39.75	74	-34.252	Peak	Pass
6	98.37	22.47	0.43	22.90	54	-31.102	Average	Pass

REMARKS:

1. The measured power level is converted to E_{Meas} using the equation:

Emission = Factor + Reading

Factor = ANT Gain to AF - AMP Gain + Cable loss = 38.90-13.53+5.11=30.48+(-9.54)=20.94

Factor = ANT Gain to AF - AMP Gain + VDI loss + Cable loss = 42.24-47.62+10.59+3.89=9.1+(-9.54)=-0.44

Factor = ANT Gain to AF - AMP Gain + VDI loss + Cable loss = 49.23-18.24+11.57+3.43=45.99+(-23.52)=22.47
where:

Measurements made at 1 m

2. Shorter measurement distances may be used to improve the measurement system's noise floor.

As ANSI C63.10 section 9.4 description is based on the measurement in distance of 3 meters,

the data obtained at 1-meter distance was extrapolate results to the 3-m distance:

Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB)

= Test value at 1 meter distance (dBuV) -9.5(dB).

*Measurements made at 1 meter distance. Test value converted to account for 3-meter measurement distance.

3. The far-field boundary is given in ANSI C63.10 section 9.1 as:

$R \text{ far field} = (2 * D^2) / \lambda$

D is the Largest Antenna Dimension of measurement antenna, including the reflector

λ is the wavelength

Frequency (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
40	0.03	0.0075	0.240
50	0.03	0.0060	0.300

Frequency (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
50	0.025	0.0060	0.208
75	0.025	0.0040	0.313

Frequency (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
75	0.018	0.0040	0.162
100	0.018	0.0030	0.216

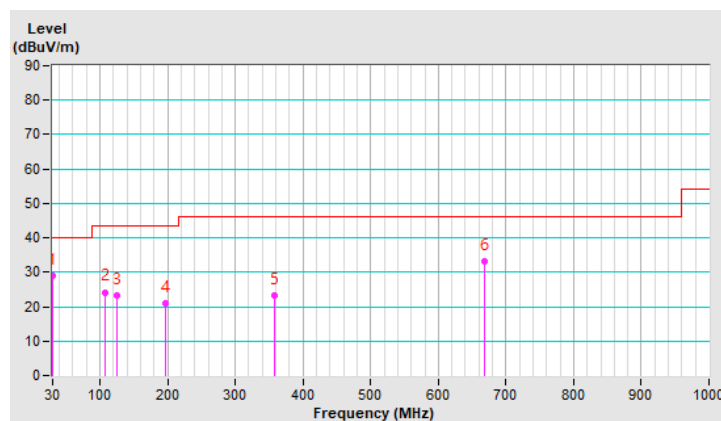
Below 1GHz Data:

RF Mode	TX	Frequency	24.148 GHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	Quasi-Peak (QP)
Environmental Conditions	20°C, 70% RH	Tested By	Ryan Du

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.73	28.9 QP	40.0	-11.1	1.00 H	19	38.3	-9.4
2	108.02	24.2 QP	43.5	-19.3	1.00 H	53	35.4	-11.2
3	124.49	23.2 QP	43.5	-20.3	1.50 H	43	32.9	-9.7
4	196.03	20.8 QP	43.5	-22.7	1.00 H	75	32.0	-11.2
5	358.01	23.1 QP	46.0	-22.9	1.00 H	63	29.4	-6.3
6	667.55	33.3 QP	46.0	-12.7	2.50 H	148	33.1	0.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

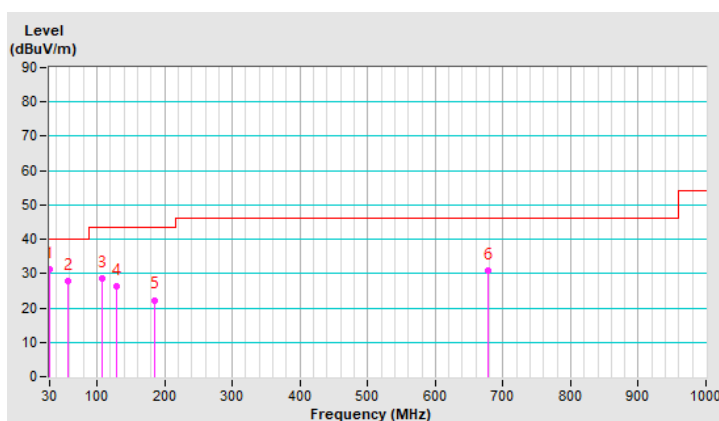


RF Mode	TX	Frequency	24.148 GHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	Quasi-Peak (QP)
Environmental Conditions	20°C, 70% RH	Tested By	Ryan Du

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.69	31.2 QP	40.0	-8.8	1.00 V	262	40.6	-9.4
2	57.08	27.8 QP	40.0	-12.2	1.50 V	56	36.5	-8.7
3	108.08	28.6 QP	43.5	-14.9	1.50 V	35	39.8	-11.2
4	129.29	26.3 QP	43.5	-17.2	1.50 V	43	35.6	-9.3
5	186.02	22.3 QP	43.5	-21.2	1.50 V	28	32.7	-10.4
6	677.52	30.9 QP	46.0	-15.1	1.50 V	66	30.5	0.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 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.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
TEST RECEIVER R&S	ESCS 30	847124/029	2021/10/13	2022/10/12
LISN R&S	ESH3-Z5	848773/004	2021/10/29	2022/10/28
50 ohms Terminator NA	50	3	2021/10/27	2022/10/26
RF Coaxial Cable JYEBO	5D-FB	COCCAB-001	2022/8/24	2023/8/23
Fixed attenuator STI	STI02-2200-10	005	2022/8/24	2023/8/23
Software BVADT	BVADT_Cond_V7.3.7.4	NA	NA	NA

Note: 1. The test was performed in Conduction 1.

2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

3. Tested Date: 2022/9/20

4.2.3 Test Procedures

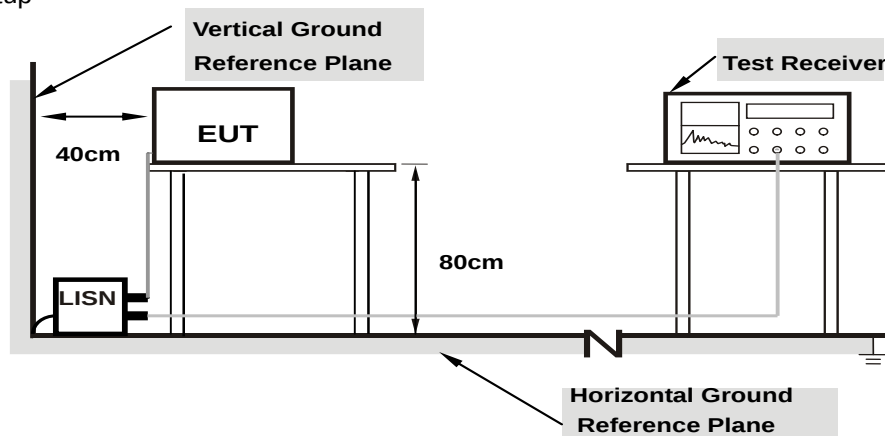
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

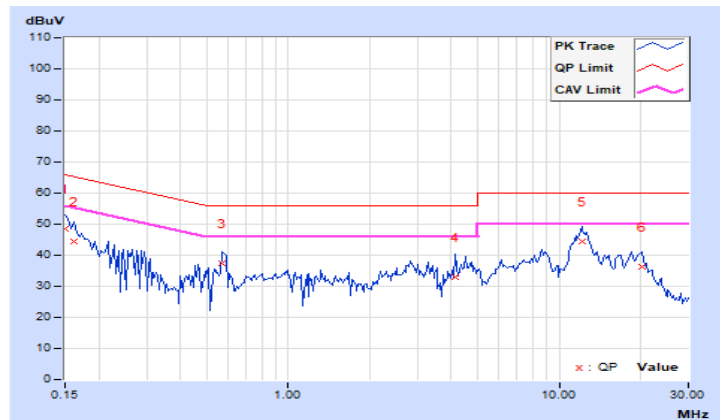
4.2.7 Test Results

RF Mode	TX	Frequency	24.148 GHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Environmental Conditions	25°C, 75% RH	Tested By	Ryan Du

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.95	38.63	24.38	48.58	34.33	66.00	56.00	-17.42	-21.67
2	0.16172	9.95	34.40	20.55	44.35	30.50	65.38	55.38	-21.03	-24.88
3	0.56797	9.97	27.49	18.13	37.46	28.10	56.00	46.00	-18.54	-17.90
4	4.12891	10.21	22.85	15.70	33.06	25.91	56.00	46.00	-22.94	-20.09
5	12.13672	10.74	33.78	27.72	44.52	38.46	60.00	50.00	-15.48	-11.54
6	20.22656	11.20	24.95	20.47	36.15	31.67	60.00	50.00	-23.85	-18.33

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

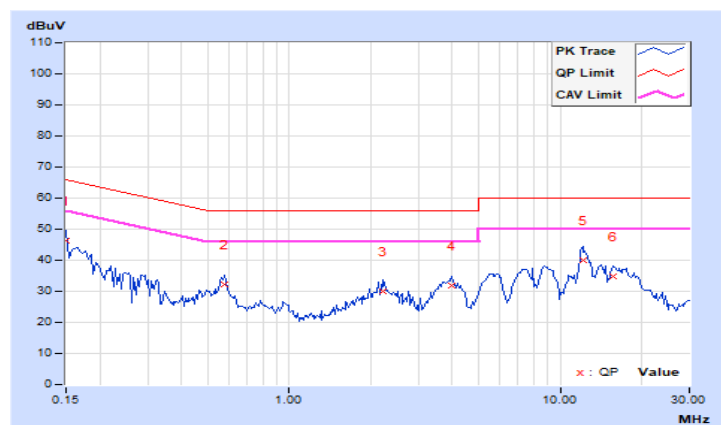


RF Mode	TX	Frequency	24.148 GHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Environmental Conditions	25°C, 75% RH	Tested By	Ryan Du

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.95	36.25	20.38	46.20	30.33	66.00	56.00	-19.80	-25.67
2	0.57969	9.97	22.27	17.07	32.24	27.04	56.00	46.00	-23.76	-18.96
3	2.20703	10.07	19.81	12.96	29.88	23.03	56.00	46.00	-26.12	-22.97
4	4.00000	10.18	21.69	15.19	31.87	25.37	56.00	46.00	-24.13	-20.63
5	12.17188	10.63	29.47	23.00	40.10	33.63	60.00	50.00	-19.90	-16.37
6	15.72656	10.79	24.00	20.06	34.79	30.85	60.00	50.00	-25.21	-19.15

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



4.3 20dB Bandwidth Measurement

4.3.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

4.3.2 Test Instruments

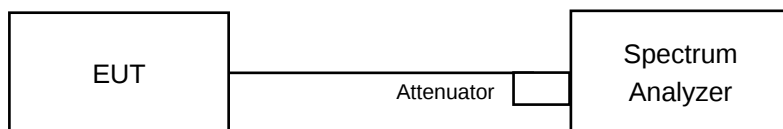
Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer R&S	FSV40	101516	2022/3/7	2023/3/6
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2022/4/5	2023/4/4
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

- Note: 1. The test was performed in Oven room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: 2022/5/26

4.3.3 Test Procedure

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3 MHz RBW and 10 MHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.3.4 Test Setup



4.3.5 Deviation from Test Standard

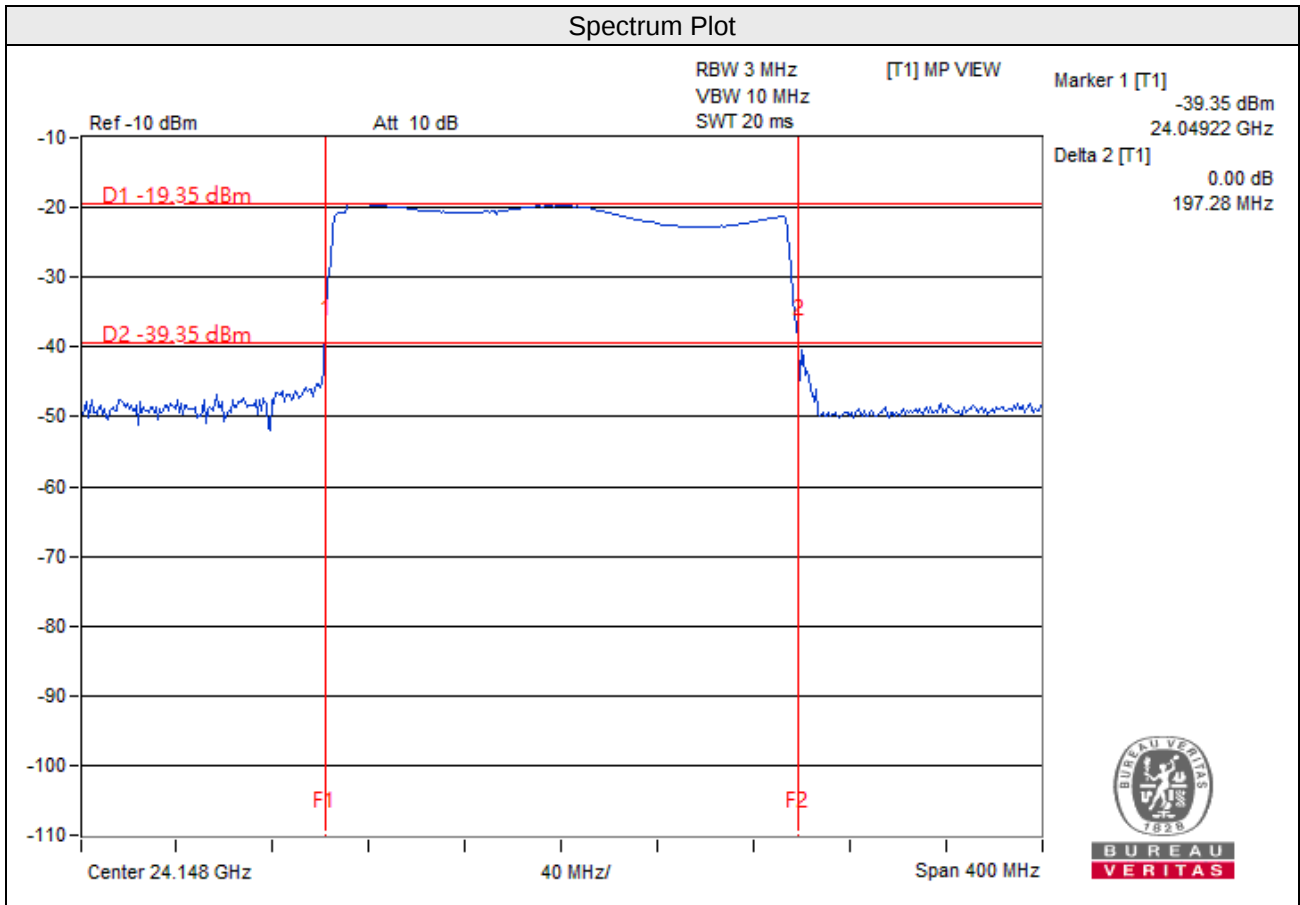
No deviation.

4.3.6 EUT Operating Condition

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

4.3.7 Test Results

Frequency (GHz)	20dB Bandwidth (MHz)
24.148	197.28
FL (GHz)	FH (GHz)
24.04922	24.2465



5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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