FCC Test Report

Report No.:	RFCEPG-WTW-P22030025
FCC ID:	VECDF8
Test Model:	DF800-0
Received Date:	2022/1/7
Test Date:	2022/1/7 ~ 2022/3/30
Issued Date:	2022/4/25
Applicant:	ST Electronics (Satcom & Sensor Systems) Pte Ltd
Address:	1 Ang Mo Kio Electronics Park Road #06-02 ST Engineering Hub, Singapore 567710
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

Testing Laboratory
2022

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Release Control Record

Issue No.	Description	Date Issued
RFCEPG-WTW-P22030025	Original release.	2022/4/25

1 Certificate of Conformity

Product:	Long Range K-band Microwave Sensor
Brand:	AgilSense
Test Model:	DF800-0
Sample Status:	Engineering sample
Applicant:	ST Electronics (Satcom & Sensor Systems) Pte Ltd
Test Date:	2022/1/7 ~ 2022/3/30
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.245) 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:** 2022/4/25

Claire Kuan / Specialist

Approved by : _____ , **Date:** 2022/4/25

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.245)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -28.68 dB at 16.46875 MHz.
15.245	Radiated Emission Test	Pass	Meet the requirement of limit Minimum passing margin is -10.4 dB at 915.29 MHz.
15.215 (c)	20dB Bandwidth	Pass	Meet the requirement.
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	150kHz ~ 30MHz	1.9 dB
Radiated Emissions	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.5 dB
	1GHz ~ 18GHz	5.1 dB
	18GHz ~ 40GHz	5.3 dB
	40GHz ~ 100GHz	5.4 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Long Range K-band Microwave Sensor
Brand	AgilSense
Test Model	DF800-0
Status of EUT	Engineering sample
Power Supply Rating	5 Vdc
Modulation Type	CW
Operating Frequency	24.1254 GHz
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. The antenna information is listed as below.

Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
18	24.075 – 24.175	Microstrip Patch Antenna	None

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 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

1 channel is provided for test:

Channel	Frequency (GHz)
1	24.1254

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

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane (below 1GHz)** and **Z-plane (above 1GHz)**.

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	CW

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	CW

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	CW

20dB Bandwidth Measurement:

☒ 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	CW

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE≥1G	23~25deg. C, 62~65%RH	120Vac, 60Hz	Carter Lin
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Carter Lin
PLC	25deg. C, 75%RH	120Vac, 60Hz	Carter Lin
BW	25deg. C, 60%RH	120Vac, 60Hz	Leon Dai

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
1.	DC Power Supply	GOOD WILL INSTRUMENT CO. LTD	GPC-3030D	E847076	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m)

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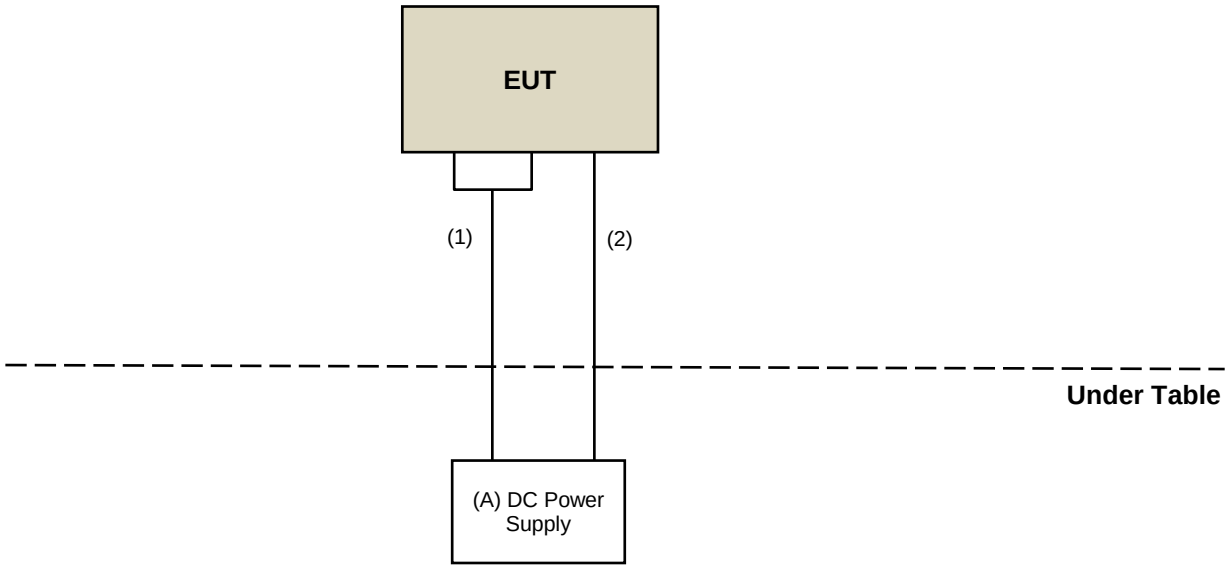
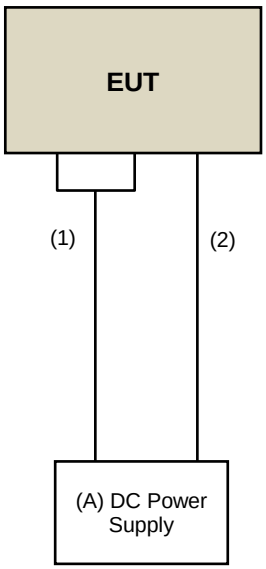
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC Cable	1	1.8	No	0	Provided by Lab
2	DC Cable	1	1.8	No	0	Provided by Lab

3.3.1 Configuration of System under Test

For Radiated Emission test:



For AC Power Conducted 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 (15.245)
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 (MHz)	Field Strength of Fundamental (millivolts/meter)	Field strength of harmonics (millivolts/meter)
902-928	500	1.6
2435-2465	500	1.6
5785-5815	500	1.6
10500-10550	2500	25.0
24075-24175	2500	25.0

Regardless of the limits shown in the above table, harmonic emissions in the restricted bands below 17.7 GHz, as specified in § 15.205, shall not exceed the field strength limits shown in § 15.209. Harmonic emissions in the restricted bands at and above 17.7 GHz shall not exceed the following field strength limits:

(i) For the second and third harmonics of field disturbance sensors operating in the 24075-24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors, 25.0 mV/m.

(ii) For all other field disturbance sensors, 7.5 mV/m.

(iii) Field disturbance sensors designed to be used in motor vehicles or aircraft must include features to prevent continuous operation unless their emissions in the restricted bands, other than the second and third harmonics from devices operating in the 24075-24175 MHz band, fully comply with the limits given in § 15.209. Continuous operation of field disturbance sensors designed to be used in farm equipment, vehicles such as fork lifts that are intended primarily for use indoors or for very specialized operations, or railroad locomotives, railroad cars and other equipment which travels on fixed tracks is permitted. A field disturbance sensor will be considered not to be operating in a continuous mode if its operation is limited to specific activities of limited duration (e.g., putting a vehicle into reverse gear, activating a turn signal, etc.).

(2) Field strength limits are specified at a distance of 3 meters.

(3) 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 in § 15.209, whichever is the lesser attenuation.

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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

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 Radiated Emission test: (Below 40GHz)

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver Agilent	N9038A	MY51210202	2021/11/19	2022/11/18
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA
Pre_Amplifier EMCI	EMC001340	980142	2021/5/24	2022/5/23
Loop Antenna TESEQ	HLA 6121	45745	2021/7/21	2022/7/20
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 EMCI	EMC330N	980701	2022/3/8	2023/3/7
Trilog Broadband Antenna Schwarzbeck	VULB 9168	9168-406	2021/10/27	2022/10/26
RF Coaxial Cable COMMATE/PEWC	8D	966-4-1	2022/3/8	2023/3/7
RF Coaxial Cable COMMATE/PEWC	8D	966-4-2	2022/3/8	2023/3/7
RF Coaxial Cable COMMATE/PEWC	8D	966-4-3	2022/3/8	2023/3/7
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-03	2022/1/10	2023/1/9
Horn Antenna Schwarzbeck	BBHA 9120D	9120D-783	2021/11/14	2022/11/13
Pre_Amplifier EMCI	EMC 12630 SE	980638	2021/4/7	2022/4/6
RF Cable-Frequency Range : 1-26.5GHz EMCI	EMC104-SM-SM-1200	160922	2021/12/24	2022/12/23
RF Coaxial Cable EMCI	EMC104-SM-SM-2000	180502	2021/4/26	2022/4/25
RF Coaxial Cable EMCI	EMC104-SM-SM-6000	210704	2021/11/9	2022/11/8
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: 2022/3/25

For Radiated Emission test: (Above 40GHz)

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer Keysight	N9042B+V3050A	US60360159	2021/6/11	2022/6/10
*OXE89 Horn Antenna (33~55GHz) QuinStar	QWH-QPRR00	QWH-QPRR00-1	2021/6/11	2022/6/10
*Conical Horn Antenna (50~75GHz) Keysight	WR15CH-Conical	RCHO15RL-1	2021/6/11	2022/6/10
*Conical Horn Antenna (75~110GHz) Keysight	WR10CH-Conical	RCHO10RL-1	2021/6/11	2022/6/10
N9029AV15-DC9 - 50-110 GHz VDI Standard Downconverter with 9VDC supply Keysight	V3050A	US60360159	CoC	CoC
Millimeter-Wave Signal Generator Frequency Extension Module (50~75 GHz) Keysight	E8257DV15	SGX648	CoC	CoC
Millimeter-Wave Signal Generator Frequency Extension Module (75~110 GHz) Keysight	E8257DV10	SGX647	CoC	CoC
PSG analog signal generator Keysight	E8257D	MY53401987	2021/6/18	2022/6/17
*Power Meter VDI	PM5B	571V	2021/6/11	2022/6/10
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA

Note: 1. The test was performed in 966 Chamber No. 6.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Certificate of Conformance (CoC) which is issued by manufacturer states that the product meets the specification.
3. Tested Date: 2022/1/7

For other test items:

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer R&S	FSV40	100964	2021/5/31	2022/5/30
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2021/4/13	2022/4/12
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: 2022/3/30

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 ~ 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 is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz 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

External harmonic mixers are utilized.

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:

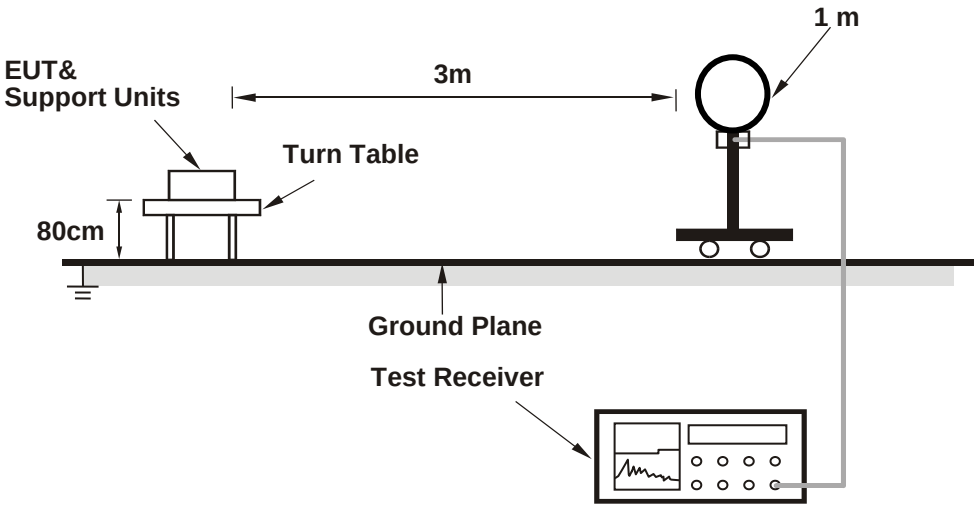
1. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection (PK).
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Average detection (AV).

4.1.4 Deviation from Test Standard

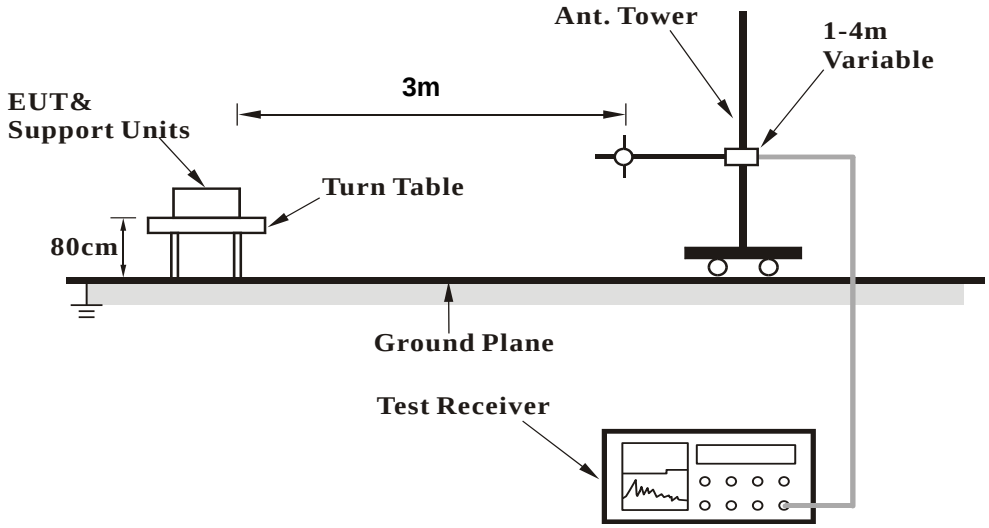
No deviation.

4.1.5 Test Setup

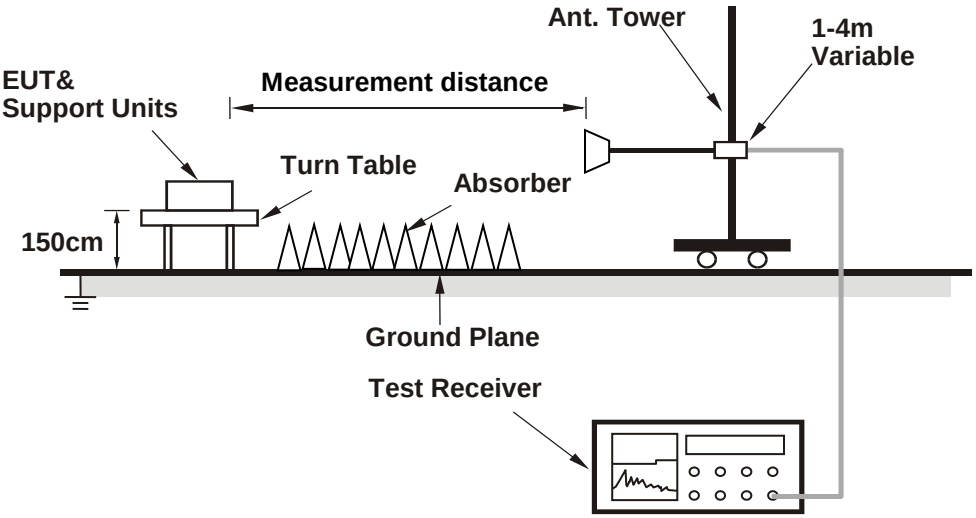
For Radiated emission below 30MHz



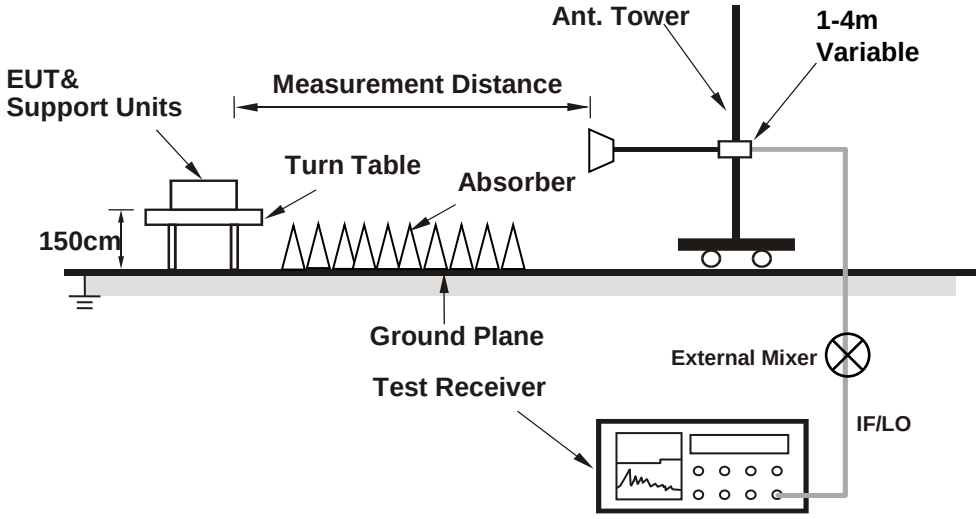
For Radiated emission 30MHz to 1GHz



For Radiated emission 1GHz ~ 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

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

For 1~18 GHz Data:

RF Mode	TX	Channel	CH 1：24.1254 GHz
Frequency Range	1GHz ~ 18GHz	Detector Function	Peak (PK) Average (AV)

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	1500.00	32.2 PK	74.0	-41.8	1.50 H	120	39.7	-7.5
2	1500.00	23.5 AV	54.0	-30.5	1.50 H	120	31.0	-7.5
3	5000.00	36.7 PK	74.0	-37.3	1.50 H	300	36.1	0.6
4	5000.00	28.9 AV	54.0	-25.1	1.50 H	300	28.3	0.6
5	#10000.00	45.8 PK	74.0	-28.2	1.50 H	210	36.4	9.4
6	#10000.00	35.4 AV	54.0	-18.6	1.50 H	210	26.0	9.4
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	1500.00	32.3 PK	74.0	-41.7	1.50 V	100	39.8	-7.5
2	1500.00	23.3 AV	54.0	-30.7	1.50 V	100	30.8	-7.5
3	5000.00	36.9 PK	74.0	-37.1	1.00 V	350	36.3	0.6
4	5000.00	28.7 AV	54.0	-25.3	1.00 V	350	28.1	0.6
5	#10000.00	46.0 PK	74.0	-28.0	1.50 V	200	36.6	9.4
6	#10000.00	35.7 AV	54.0	-18.3	1.50 V	200	26.3	9.4

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.
5. " # ": The radiated frequency is out of the restricted band.

For 18~40 GHz Data:

RF Mode	TX	Channel	CH 1：24.1254 GHz
Frequency Range	18GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

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	24075.00	46.6 PK	74.0	-27.4	1.08 H	116	48.8	-2.2
2	24075.00	39.7 AV	54.0	-14.3	1.08 H	116	41.9	-2.2
3	*24125.40	91.3 PK	147.9	-56.6	1.08 H	116	93.4	-2.1
4	*24125.40	91.1 AV	127.9	-36.8	1.08 H	116	93.2	-2.1
5	24175.00	48.3 PK	74.0	-25.7	1.08 H	116	50.3	-2.0
6	24175.00	40.1 AV	54.0	-13.9	1.08 H	116	42.1	-2.0
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	24075.00	46.5 PK	74.0	-27.5	1.90 V	186	48.7	-2.2
2	24075.00	39.8 AV	54.0	-14.2	1.90 V	186	42.0	-2.2
3	*24125.40	107.5 PK	147.9	-40.4	1.90 V	186	109.6	-2.1
4	*24125.40	107.1 AV	127.9	-20.8	1.90 V	186	109.2	-2.1
5	24175.00	48.5 PK	74.0	-25.5	1.90 V	186	50.5	-2.0
6	24175.00	40.6 AV	54.0	-13.4	1.90 V	186	42.6	-2.0

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.

Above 40GHz Data:

RF Mode	TX	Channel	CH 1：24.1254 GHz
Frequency Range	40GHz ~ 100GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity : Horizontal								
No.	Frequency (GHz)	Factor (dB/m)	Reading (dBuV)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Pass/Fail
1	48.25	20.09	34.47	54.56	97.5	-42.942	Peak	Pass
2	48.25	20.09	17.34	37.43	77.5	-40.072	Average	Pass
3	72.38	1.50	52.81	54.31	97.5	-43.192	Peak	Pass
4	72.38	1.50	35.50	37.00	77.5	-40.502	Average	Pass
5	98.72	19.59	20.95	40.54	74	-33.462	Peak	Pass
6	98.72	19.59	3.22	22.81	54	-31.192	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	48.25	20.09	34.71	54.80	97.5	-42.702	Peak	Pass
2	48.25	20.09	16.94	37.03	77.5	-40.472	Average	Pass
3	72.38	1.50	52.39	53.89	97.5	-43.612	Peak	Pass
4	72.38	1.50	34.53	36.03	77.5	-41.472	Average	Pass
5	98.52	19.59	20.55	40.14	74	-33.862	Peak	Pass
6	98.52	19.59	3.53	23.12	54	-30.882	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 + VDI loss+ Cable loss = 45.96-50.34+12.53+2.89=11.04+(-9.54)=1.5
where:
Measurements made at 1 meter distance.
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 63.10 section 9.1 as:
R far field = (2 * D^2) /λ
D is the Largest Antenna Dimension of measurement antenna, including the reflector
λ is the wavelength

Frequency (GHz)	D (m)	Lambda (m)	R (Far Field) (m)
40	0.03	0.0075	0.240
50	0.03	0.0060	0.300
Frequency (GHz)	D (m)	Lambda (m)	R (Far Field) (m)
50	0.025	0.0060	0.208
75	0.025	0.0040	0.313
Frequency (GHz)	D (m)	Lambda (m)	R (Far Field) (m)
75	0.018	0.0040	0.162
100	0.018	0.0030	0.216

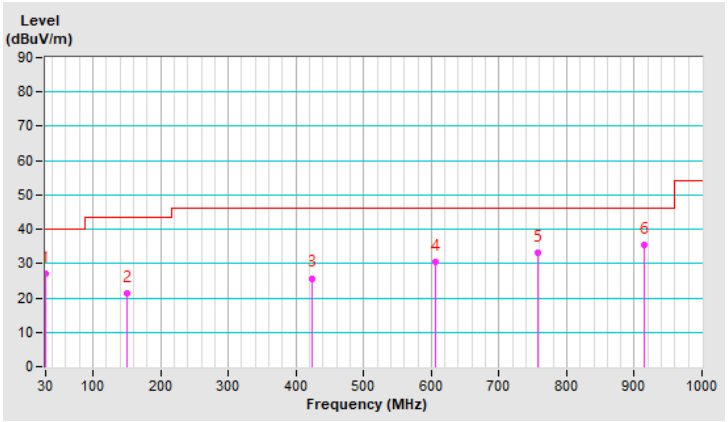
Below 1GHz Data:

RF Mode	TX	Channel	CH 1：24.1254 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

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	30.95	27.1 QP	40.0	-12.9	1.50 H	360	40.7	-13.6
2	149.70	21.5 QP	43.5	-22.0	1.50 H	360	33.1	-11.6
3	422.97	25.7 QP	46.0	-20.3	1.50 H	168	32.3	-6.6
4	606.96	30.4 QP	46.0	-15.6	1.50 H	73	32.2	-1.8
5	758.15	33.0 QP	46.0	-13.0	2.00 H	207	32.0	1.0
6	**915.29**	**35.6 QP**	**46.0**	**-10.4**	**1.00 H**	**50**	**31.7**	**3.9**

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 of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

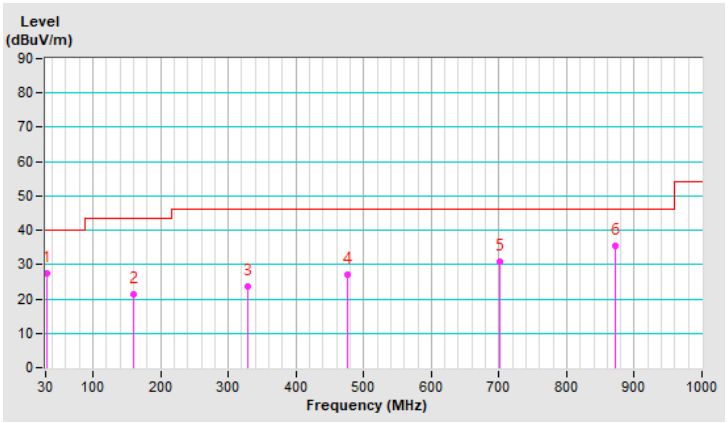


RF Mode	TX	Channel	CH 1：24.1254 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

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	31.41	27.3 QP	40.0	-12.7	1.00 V	335	40.8	-13.5
2	159.42	21.2 QP	43.5	-22.3	2.50 V	49	32.8	-11.6
3	329.08	23.7 QP	46.0	-22.3	1.00 V	349	33.2	-9.5
4	476.01	27.2 QP	46.0	-18.8	1.50 V	50	32.4	-5.2
5	701.80	31.0 QP	46.0	-15.0	1.50 V	339	31.3	-0.3
6	**871.04**	**35.6 QP**	**46.0**	**-10.4**	**2.50 V**	**76**	**32.4**	**3.2**

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 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: 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	2021/9/25	2022/9/24
Fixed attenuator STI	STI02-2200-10	005	2021/8/27	2022/8/26
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: 2022/3/25

4.2.3 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.

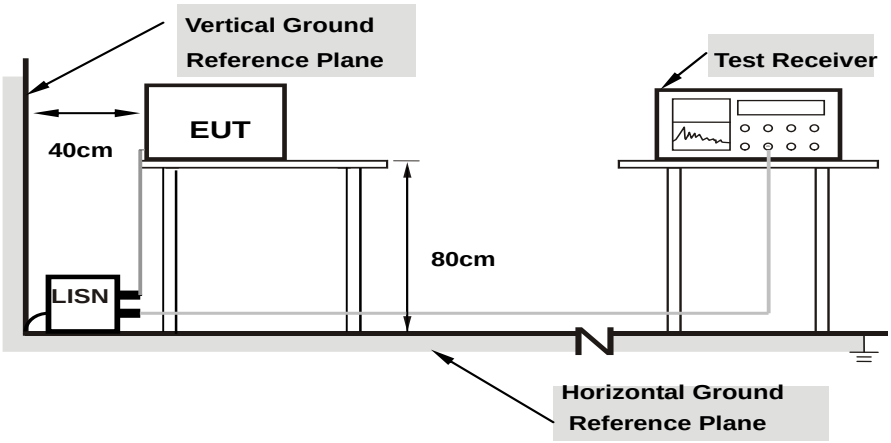
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

Note: 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.

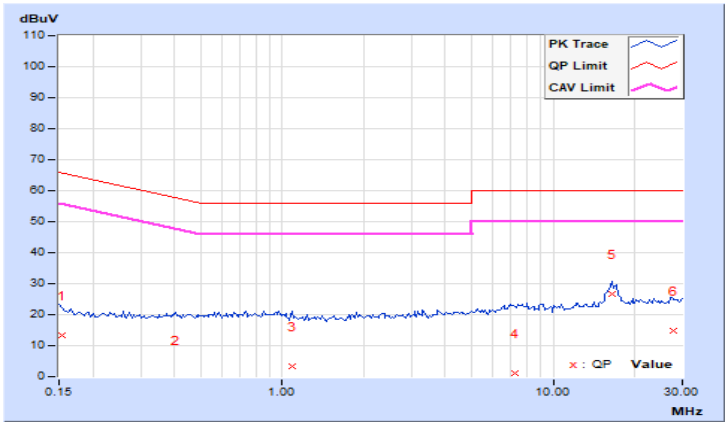
4.2.7 Test Results

RF Mode	TX	Channel	CH 1：24.1254 GHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.15391	10.05	3.16	-8.77	13.21	1.28	65.79	55.79	-52.58	-54.51
2	0.40391	10.07	-11.29	-14.27	-1.22	-4.20	57.77	47.77	-58.99	-51.97
3	1.08984	10.11	-6.85	-12.67	3.26	-2.56	56.00	46.00	-52.74	-48.56
4	7.18750	10.45	-9.18	-12.80	1.27	-2.35	60.00	50.00	-58.73	-52.35
5	16.44922	11.01	15.63	9.81	26.64	20.82	60.00	50.00	-33.36	-29.18
6	27.67578	11.34	3.49	-0.76	14.83	10.58	60.00	50.00	-45.17	-39.42

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

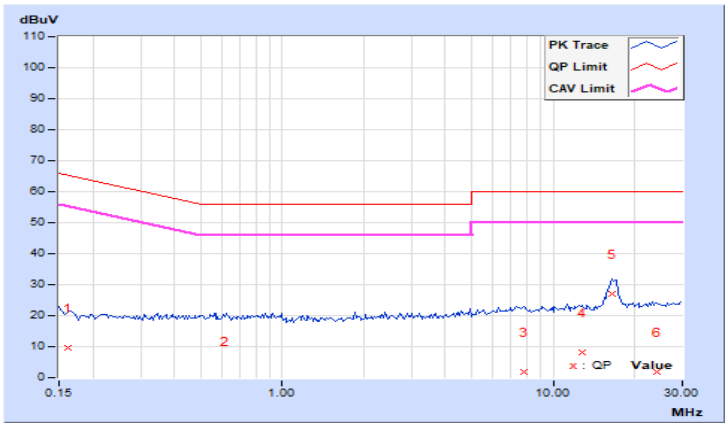


RF Mode	TX	Channel	CH 1：24.1254 GHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.16172	10.02	-0.24	-9.82	9.78	0.20	65.38	55.38	-55.60	-55.18
2	0.61484	10.05	-11.15	-14.27	-1.10	-4.22	56.00	46.00	-57.10	-50.22
3	7.85156	10.39	-8.71	-12.51	1.68	-2.12	60.00	50.00	-58.32	-52.12
4	12.77734	10.62	-2.50	-7.94	8.12	2.68	60.00	50.00	-51.88	-47.32
5	**16.46875**	**10.79**	**16.23**	**10.53**	**27.02**	**21.32**	**60.00**	**50.00**	**-32.98**	**-28.68**
6	24.18359	10.97	-9.08	-12.72	1.89	-1.75	60.00	50.00	-58.11	-51.75

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

According to 15.215(c), the requirement is to ensure the 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.3.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.3 Test Procedures

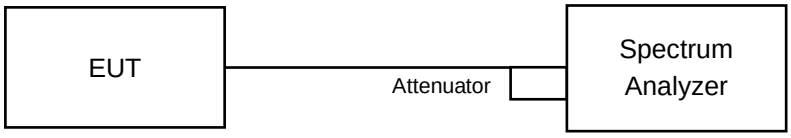
The bandwidth of the fundamental frequency was measured by spectrum analyzer with 300 Hz RBW and 1 kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span from band edge. The bandedge was measured and recorded.

4.3.4 Deviation from Test Standard

No deviation

4.3.5 Test Setup

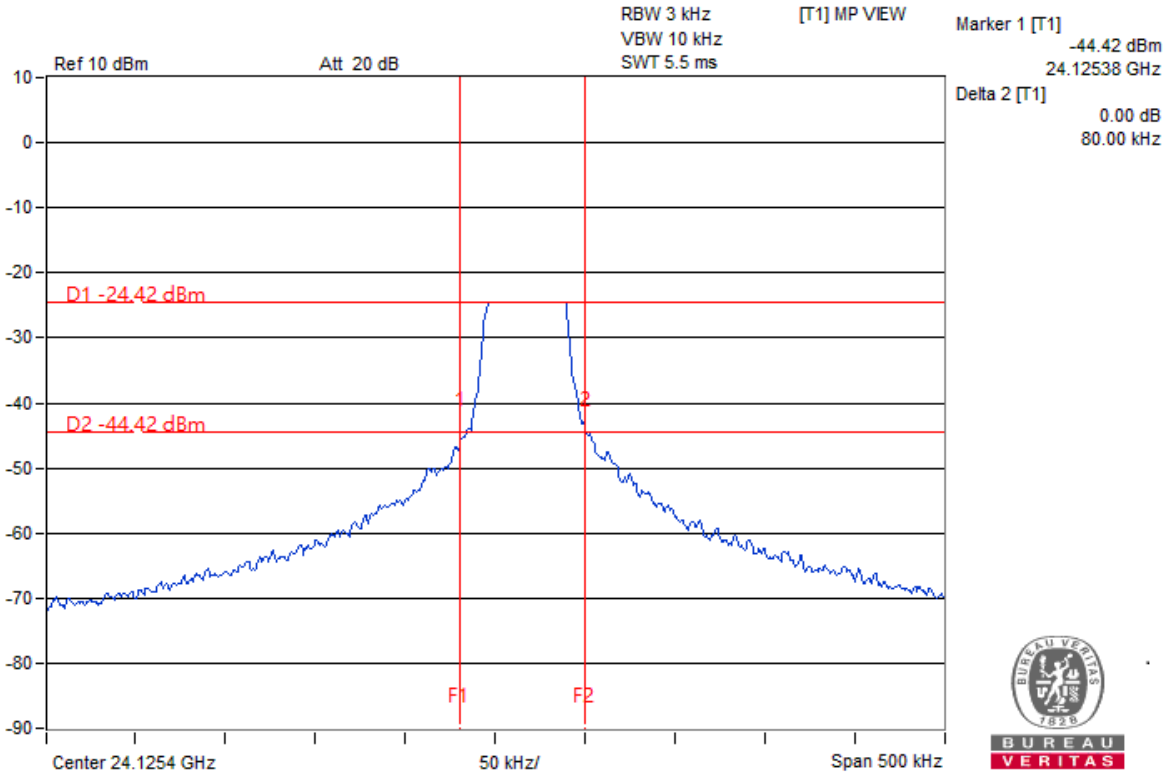


4.3.6 EUT Operating Conditions

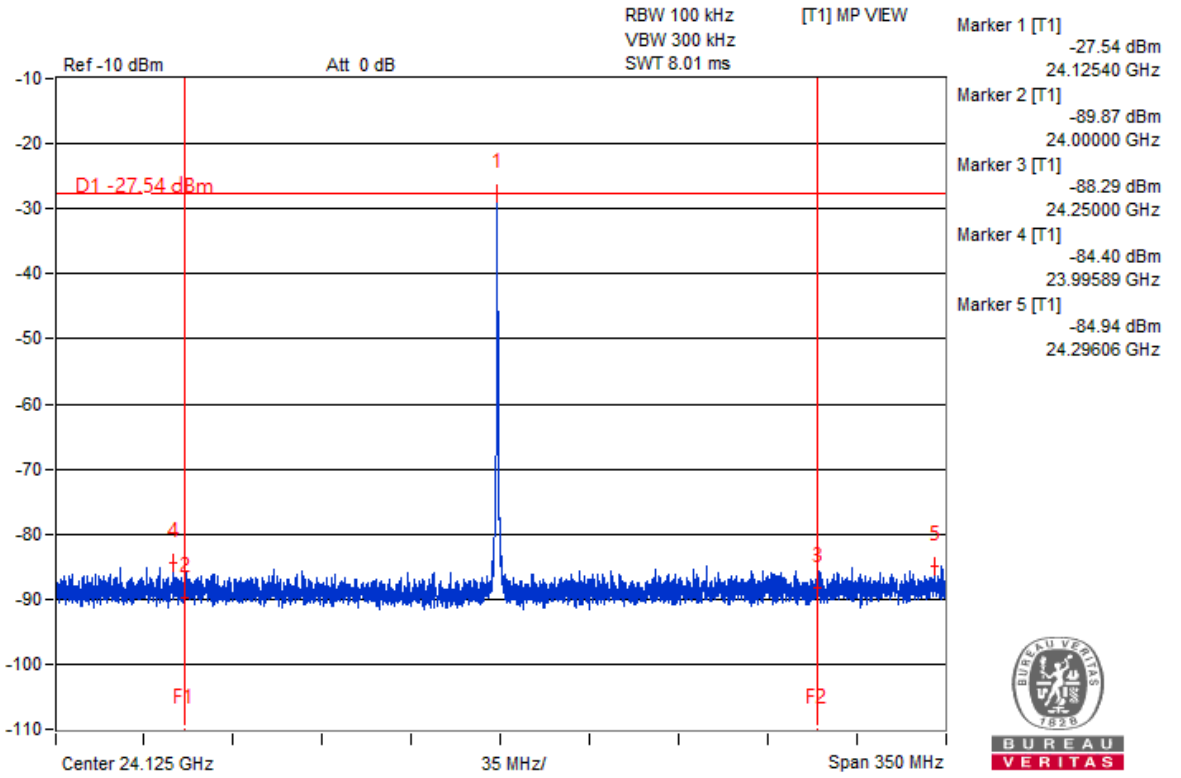
The software provided by client to enable the EUT under transmission condition continuously.

4.3.7 Test Results

For 20dB Bandwidth



For Bandedge



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.

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

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