FCC Test Report

Report No.:	RFBWHO-WTW-P24040364
FCC ID:	2AY6FSTKT60
Test Model:	T60
Received Date:	2024/2/28
Test Date:	2024/2/28 ~ 2024/5/17
Issued Date:	2024/6/14
Applicant:	STREAMTECK SCIENTIFIC INC.
Address:	No. 174, Huamei St., West Dist., Taichung City 403024, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	(1) No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan (2) No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
FCC Registration / Designation Number:	(1) 788550 / TW0003 (2) 281270 / TW0032

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Release Control Record

Issue No.	Description	Date Issued
RFBWHO-WTW-P24040364	Original Release	2024/6/14

1 Certificate of Conformity

Product:	SmartCaring
Brand:	STREAMTECK
Test Model:	T60
Sample Status:	Engineering Sample
Applicant:	STREAMTECK SCIENTIFIC INC.
Test Date:	2024/2/28 ~ 2024/5/17
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.255)

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 RF characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** 2024/6/14

Polly Chien / Specialist

Approved by : _____ , **Date:** 2024/6/14

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.255)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -6.75 dB at 0.36600 MHz.
15.255(e)	6dB Bandwidth	-	Reference only.
-	Occupied Bandwidth	Pass	Meet the requirement of limit
15.255(c)(2)(iii)(A)	Output Power	Pass	Meet the requirement of limit.
15.255(d) 15.205 15.209	Spurious Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -4.0 dB at 719.67 MHz.
15.255(f)	Frequency Stability	Pass	Meet the requirement of limit.

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	2.88 dB
Radiated Emissions	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 dB
	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB
	40GHz ~ 66GHz	4.59 dB
	66GHz ~ 100GHz	5.37 dB
	Above 100GHz	5.40 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	SmartCaring
Brand	STREAMTECK
Test Model	T60
Sample Status	Engineering Sample
Power Supply Method	5Vdc from adapter
Modulation Type	FMCW
Operating Frequency	60~64GHz
Output Power (EIRP)	13.90dBm (PK)

Note:

1. The EUT contains certified WLAN/Bluetooth modular which FCC ID: COF-AS01.
2. The EUT uses following accessories.

Adapter		
Brand	Model	Specification
ADAPTER TECH.	ATM012T-W050U	AC Input : 100-240V, 50-60Hz, 0.32-0.19A DC Output : 5V, 2.0A, 10.0W DC Output Cable (unshielded, 1.5m)

3. Simultaneously transmission condition.

Condition	Technology		
1	WLAN (2.4 GHz)	Bluetooth	mmWave (60GHz)
2	WLAN (5 GHz)	Bluetooth	mmWave (60GHz)
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.			

4. The antenna information is listed as below.

Antenna type	Frequency Range (GHz)	Antenna Net Gain (dBi)	Connector Type
PCB	60~64	15.8	N/A

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

5. 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.

3.2 Description of Test Modes

Operating Frequency is provided for EUT.

Operating Frequency (GHz)
60~64

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To							Description
	PLC	BW	OBW	OP	FS	RE < 1G	RE ≥ 1G	
-	√	√	√	√	√	√	√	-

Where PLC: Power Line Conducted Emission
BW: 6dB Bandwidth
OBW: Occupied bandwidth
OP: Output Power
FS: Frequency Stability
RE < 1G: Radiated Emission below 1GHz
RE ≥ 1G: Radiated Emission above 1GHz

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.

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.

Available Channel	Tested Channel	Modulation Type
1	1	FMCW

6dB Bandwidth 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.

Available Channel	Tested Channel	Modulation Type
1	1	FMCW

Occupied Bandwidth 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.

Available Channel	Tested Channel	Modulation Type
1	1	FMCW

Output Power 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.

Available Channel	Tested Channel	Modulation Type
1	1	FMCW

Frequency Stability Test:

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Type
1	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.

Available Channel	Tested Channel	Modulation Type
1	1	FMCW

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.

Available Channel	Tested Channel	Modulation Type
1	1	FMCW

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
PLC	25 deg. C, 75 %RH	120Vac, 60Hz	Karl Li
BW	25 deg. C, 66 %RH	120Vac, 60Hz	Wade Huang
OBW	25 deg. C, 66 %RH	120Vac, 60Hz	Wade Huang
OP	25 deg. C, 66 %RH	120Vac, 60Hz	Wade Huang
FS	25 deg. C, 66 %RH	120Vac, 60Hz	Wade Huang
RE<1G	23 deg. C, 67 %RH	120Vac, 60Hz	Wade Huang
RE≥1G	22 deg. C, 67 %RH	120Vac, 60Hz	Wade Huang

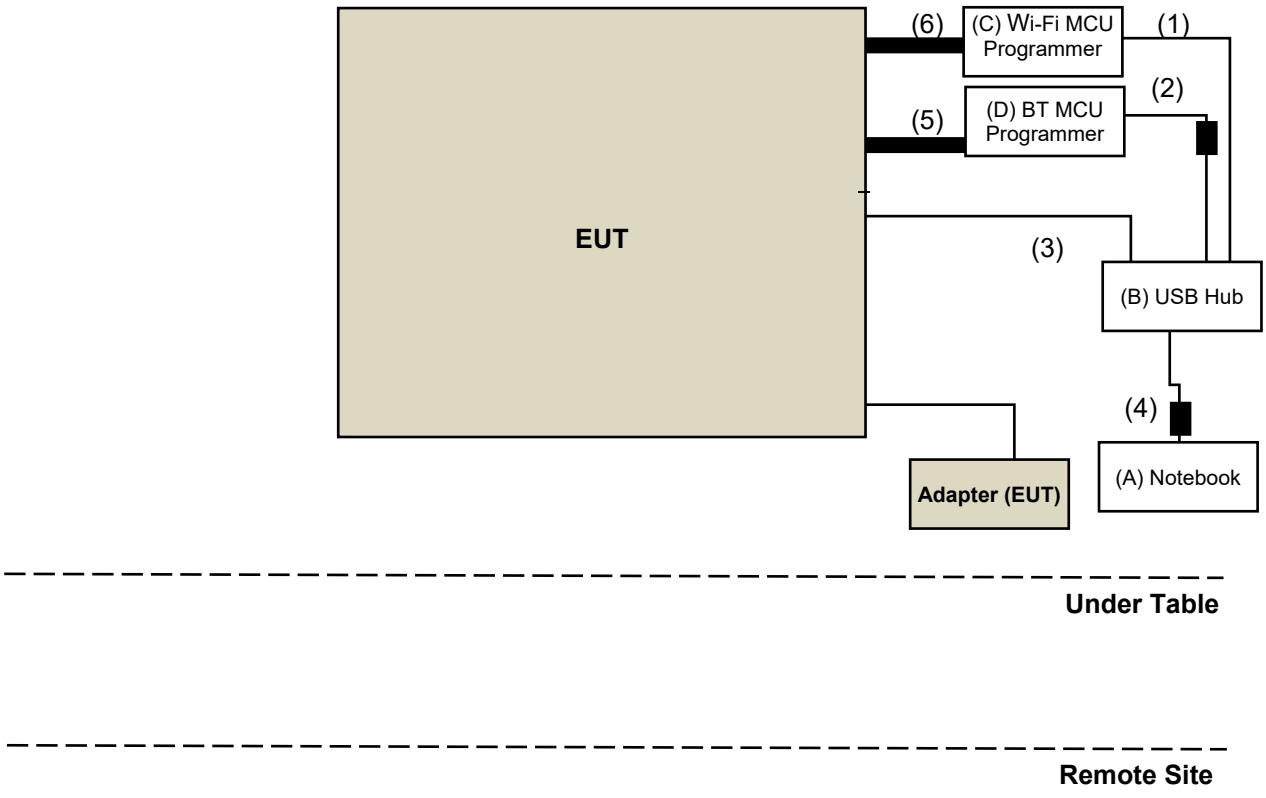
3.3 Description of Support Units

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.	Notebook	DELL	P24G	N/A	N/A	Supplied by applicant
B.	USB Hub (4-Port USB 2.0 Hub)	D-Link	DUB-H4	N/A	N/A	Supplied by applicant
C.	Wi-Fi MCU Programmer	Streamteck	STK-AZ-WIFI-PG01	N/A	N/A	Supplied by applicant
D.	BT MCU Programmer	Streamteck	STK-MCU-ISP01	N/A	N/A	Supplied by applicant

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB micro cable	1	3	No	0	Provided by Lab
2.	USB mini cable	1	1.5	No	1	Provided by Lab
3.	USB cable	1	1.2	No	0	Supplied by applicant
4.	USB Hub cable	1	0.5	Yes	1	Supplied by applicant
5.	14-Pin Shielded Ribbon Cable	1	0.1	Yes	0	Supplied by applicant
6.	3-Pin Shielded Ribbon Cable	1	0.05	Yes	0	Supplied by applicant

3.3.1 Configuration of System under 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 (15.255)

ANSI C63.10-2020/Cor.1-2023

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

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

Spurious Emission	
Frequency Range	Limitation
Radiated emissions below 40GHz	Part 15.209
Between 40GHz and 200GHz	90pW/cm^2 (at 3 meter)
Note: The levels of the spurious emissions shall not exceed the level of the fundamental emission.	

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. As shown in 15.35(b), 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. Section 15.205 restricted bands of operation shall compliance with the limits in Section 15.209.

4.1.2 Test Instruments

For Below 40GHz and Frequency Stability

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	ESR3	102579	Jul. 04, 2023	Jul. 03, 2024
Spectrum Analyzer KEYSIGHT	N9020B	MY60110462	Apr. 22, 2024	Apr. 21, 2025
BILOG Antenna SCHWARZBECK	VULB9168	9168-995	Oct. 16, 2023	Oct. 15, 2024
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-404	Nov. 12, 2023	Nov. 11, 2024
HORN Antenna SCHWARZBECK	BBHA 9170	995	Nov. 12, 2023	Nov. 11, 2024
Loop Antenna EMCI	EM-6879	269	Sep. 23, 2023	Sep. 22, 2024
Preamplifier EMCI	EMC330N	980783	Jan. 15, 2024	Jan. 14, 2025
Preamplifier EMCI	EMC118A45SE	980810	Dec. 28, 2023	Dec. 27, 2024
Preamplifier EMCI	EMC184045SE	980787	Jan. 15, 2024	Jan. 14, 2025
RF signal cable EMCI	EMC104-SM-SM-(9000+2000+1000)	201230+ 201242+ 210101	Jan. 15, 2024	Jan. 14, 2025
RF signal cable EMCI	EMCCFD400-NM-NM-(9000+300+500)	201252+ 201250+ 201245	Jan. 15, 2024	Jan. 14, 2025
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201261+201258+ 201249	Jan. 15, 2024	Jan. 14, 2025
Software BV CPS	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Turn Table Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208675	NA	NA
Antenna Tower KaiTuo	NA	NA	NA	NA
Antenna Tower Controller KaiTuo	KT-2000	NA	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Temperature & Humidity Chamber Terchy	MHU-225AU	920842	Jun. 17, 2023	Jun. 16, 2024
Digital Storage Oscilloscope Keysight	DSO-X 6004A	MY55190202	Jun. 20, 2023	Jun. 19, 2024

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 test was performed in WM Chamber 7.
3. Test date: May 17, 2024

For Above 40GHz:

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer Keysight	N9042B	US60360159	Apr. 16, 2024	Apr. 15, 2025
*OXE89 Horn Antenna (33~55GHz) QuinStar	QWH-QPRR00	QWH-QPRR00-1	Apr. 09, 2024	Apr. 08, 2025
*Conical Horn Antenna (50~75GHz) Keysight	WR15CH-Conical	RCHO15RL-1	Apr. 09, 2024	Apr. 08, 2025
*Conical Horn Antenna (75~110GHz) Keysight	WR10CH-Conical	RCHO10RL-1	Apr. 09, 2024	Apr. 08, 2025
*Conical Horn Antenna (110~170GHz) Keysight	WR6.5CH-Conical	RCHO6RL-1	Apr. 09, 2024	Apr. 08, 2025
*Conical Horn Antenna (140~220GHz) Keysight	WR5.1CH-Conical	RCHO5RL-1	Apr. 09, 2024	Apr. 08, 2025
Extension Module_down converter (50-75GHz) 9VDC supply Keysight	N9029AV15	SAX 381	Apr. 16, 2024	Apr. 15, 2025
Extension Module_down converter (75-110GHz) 9VDC supply Keysight	N9029AV10	SAX 378	Apr. 16, 2024	Apr. 15, 2025
Extension Module_down converter (110-170GHz) 9VDC supply Keysight	N9029AV06	SAX723	Apr. 16, 2024	Apr. 15, 2025
Extension Module_down converter (140-220GHz) 9VDC supply Keysight	N9029AV05	SAX722	Apr. 16, 2024	Apr. 15, 2025
PSG analog signal generator Keysight	E8257D	MY60020399	Jan. 16, 2024	Jan. 15, 2025
*Power Meter VDI (110-325GHz)	PM5B	571V	Apr. 16, 2024	Apr. 15, 2025
*Power Meter Keysight (50-110GHz)	U8489A	US59290810	Mar. 08, 2024	Mar. 07, 2025
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 test was performed in WM Chamber 7.
3. Test date: May 14, 2024

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

For Radiated emission above 40GHz

a. Connect the test antenna covering the appropriate frequency range to a spectrum analyzer via an external mixer to the spectrum analyzer.

b. Set spectrum analyzer RBW = 1 MHz, VBW = 3 MHz, average detector.

c. Calculate the distance to the far field boundary and determine the maximum measurement distance.

d. Perform an exploratory search for emissions and determine the approximate direction at which each observed emission emanates from the EUT.

e. Exploratory measurements be made at a closer distance than the validated maximum measurement distance.

f. Perform a final measurement; begin with the test antenna at the approximate position where the maximum level occurred during the exploratory scan.

g. Slowly scan the test antenna around this position, slowly vary the test antenna polarization by rotating through at least 0° to 180°, and slowly vary the orientation of the test antenna to find the final position, polarization, and orientation at which the maximum level of the emission is observed.

h. Record the measured reading with the test antenna fixed at this maximized position, polarization, and orientation. Record the measurement distance.

i. Calculate the maximum field strength of the emission at the measurement distance and the adjusted/corrected power at the output of the test antenna.

j. Calculate the EIRP from the measured field strength and then convert to the linear.

k. Calculate the power density at the distance specified by the limit from the field strength at the distance specified by the limit.

l. Repeat the preceding sequence for every emission observed in the frequency band under investigation.

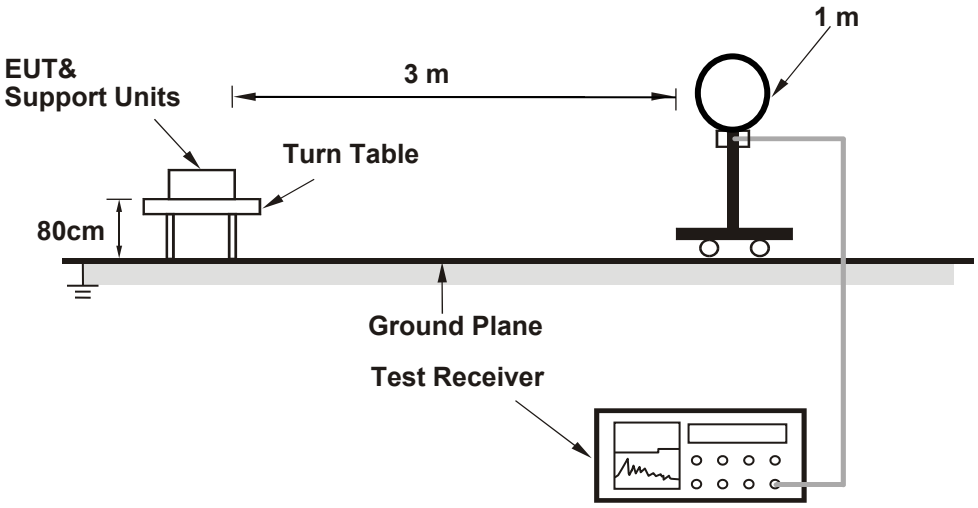
Note: For FMCW emissions, the procedures in ANSI C63.10-2020 Section 4.1.5.2.8 and Annex L were followed. The appropriate analyzer sweep time was used for peak / average detection as per the guidance in these sections.

4.1.4 Deviation from Test Standard

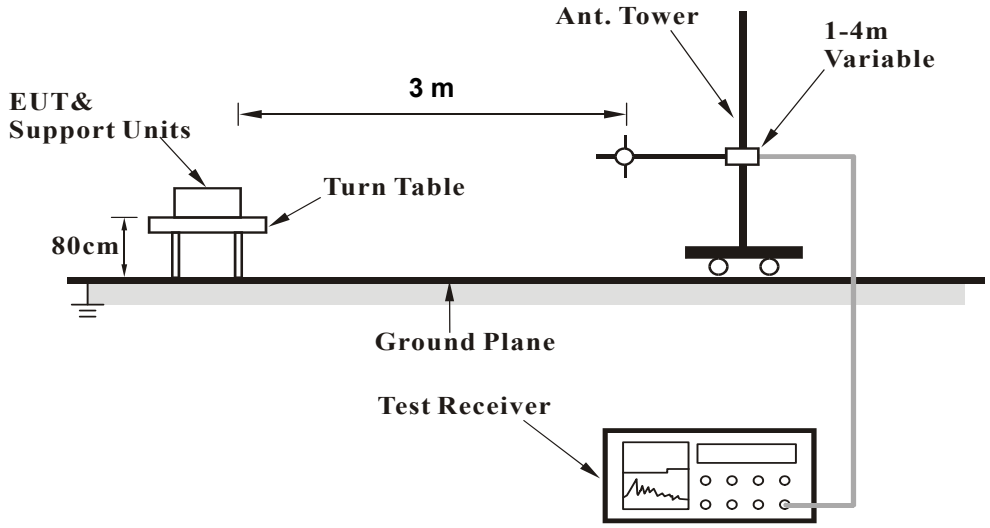
No deviation.

4.1.5 Test Setup

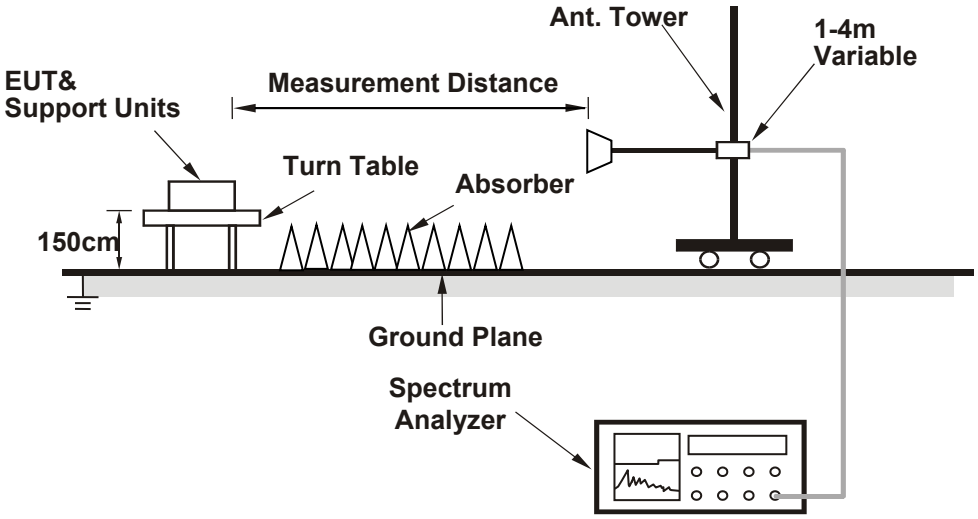
For Radiated emission below 30MHz



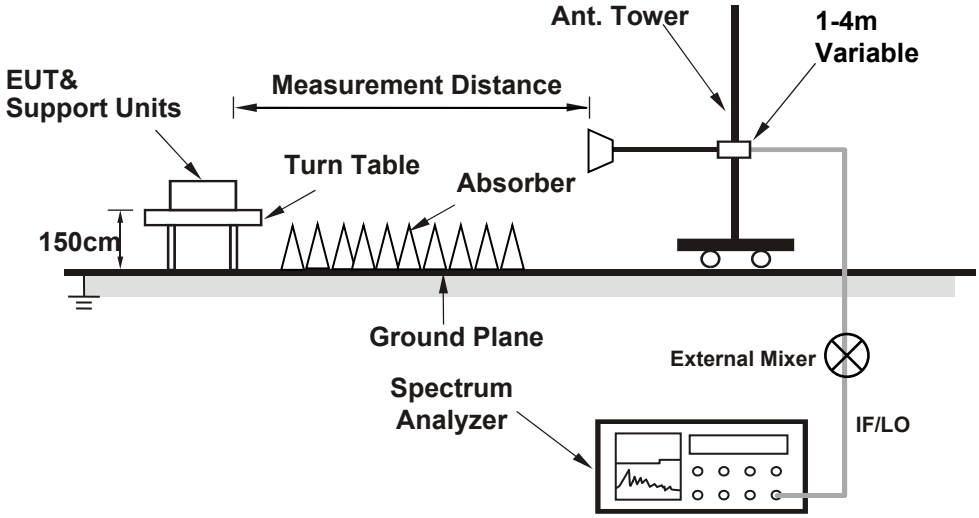
For Radiated emission 30MHz to 1GHz



For Radiated emission 1GHz to 40GHz



For Radiated emission above 40GHz



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

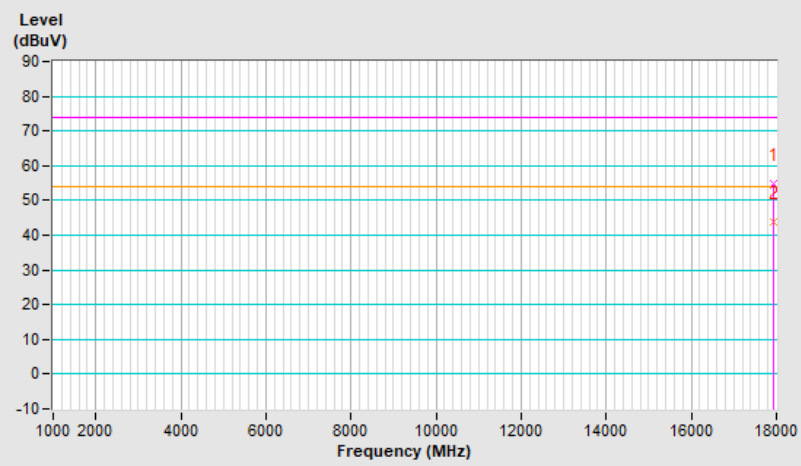
Above 1GHz Data:

Channel	CH 1 : 61.96 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	17924.0	55.0 PK	74.0	-19.0	1.34 H	211	55.0	0.0
2	17924.0	43.9 AV	54.0	-10.1	1.34 H	211	43.9	0.0

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.

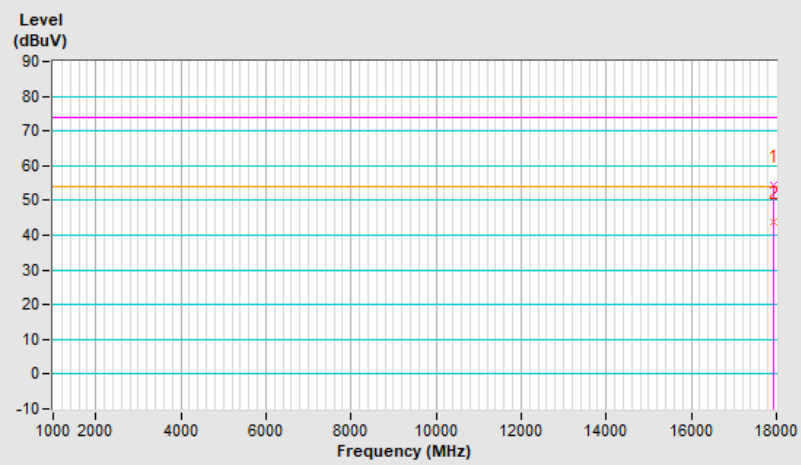


Channel	CH 1 : 61.96 GHz		
Frequency Range	1GHz ~ 18GHz	Detector Function	Peak (PK) Average (AV)

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	17924.0	54.6 PK	74.0	-19.4	1.63 V	55	54.6	0.0
2	17924.0	43.7 AV	54.0	-10.3	1.63 V	55	43.7	0.0

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.

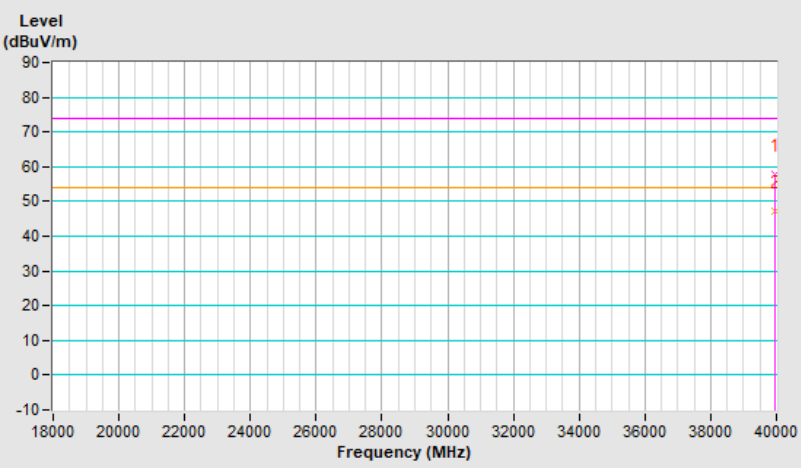


Channel	CH 1 : 61.96 GHz		
Frequency Range	18GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

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	39969.0	58.0 PK	74.0	-16.0	1.59 H	119	57.6	0.4
2	39969.0	47.2 AV	54.0	-6.8	1.59 H	119	46.8	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.

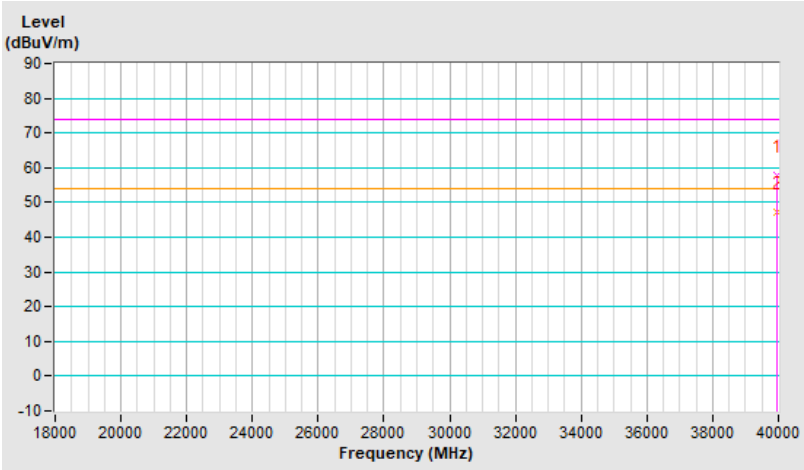


Channel	CH 1 : 61.96 GHz		
Frequency Range	18GHz ~ 40GHz	Detector Function	Peak (PK) Average (AV)

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	39969.0	57.7 PK	74.0	-16.3	1.71 V	23	57.3	0.4
2	39969.0	47.0 AV	54.0	-7.0	1.71 V	23	46.6	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.



For above 40 GHz

Channel	CH 1 : 61.96 GHz		
Frequency Range	40GHz ~ 200GHz	Detector Function	Average (AV)

Antenna Polarity: Horizontal									
No.	Frequency (GHz)	Power (dBm)	Gain of test Antenna (dBi)	EMeas (dBμV/m)	EIRP Level (dBm)	Power Density (pW/cm^2)	Power Density Limit (pW/cm^2)	Margin (pW/cm^2)	PASS/ FAIL
1	49.82	-72.09	22.50	76.62	-28.20	1.34	90.00	-88.66	PASS
2	52.51	-88.47	21.50	61.69	-43.13	0.04	90.00	-89.96	PASS
3	72.00	-90.24	21.50	62.66	-42.16	0.05	90.00	-89.95	PASS
4	86.40	-93.37	21.60	61.02	-43.80	0.04	90.00	-89.96	PASS
5	110.94	-105.81	22.00	50.35	-54.47	0.00	90.00	-90.00	PASS
6	170.02	-89.56	21.30	71.01	-33.81	0.37	90.00	-89.63	PASS
Antenna Polarity : Vertical									
No.	Frequency (GHz)	Power (dBm)	Gain of test Antenna (dBi)	EMeas (dBμV/m)	EIRP Level (dBm)	Power Density (pW/cm^2)	Power Density Limit (pW/cm^2)	Margin (pW/cm^2)	PASS/ FAIL
1	49.83	-72.16	22.50	76.55	-28.27	1.32	90.00	-88.68	PASS
2	50.99	-90.32	21.50	59.59	-45.23	0.03	90.00	-89.97	PASS
3	64.08	-90.85	21.50	61.04	-43.78	0.04	90.00	-89.96	PASS
4	86.40	-87.84	21.60	66.55	-38.27	0.13	90.00	-89.87	PASS
5	115.20	-100.06	22.00	56.43	-48.39	0.01	90.00	-89.99	PASS
6	170.05	-89.59	21.30	70.98	-33.84	0.37	90.00	-89.64	PASS

Remarks:

Follow ANSI 63.10-2020 section 9.2.2 Equations to calculate EIRP

EIRP Level (dBm/MHz) = $21.98-20\log(\lambda)+20*\log(d_{Meas})+P-G$

E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m

d_{Meas} is the measurement distance, in m

Measurements made at 1 meter distance.

2. Power density formula as follows

Follow ANSI 63.10-2020 section 9.2.3 Equations to calculate power density

$PD=EIRP_{Linear}/4\pi d^2$

PD is is the power density at the distance specified by the limit, in W/m^2

$EIRP_{Linear}$ is the equivalent isotropically radiated power, in watts

d is the 3m distance.

3. The far-field boundary is given in ANSI 63.10 as:

R far field = (2 * L^2) /λ

L 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
110	0.018	0.0027	0.238

Frequency (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
110	0.012	0.0027	0.106
170	0.012	0.0018	0.163

Frequency (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
170	0.008	0.0018	0.073
260	0.008	0.0012	0.111

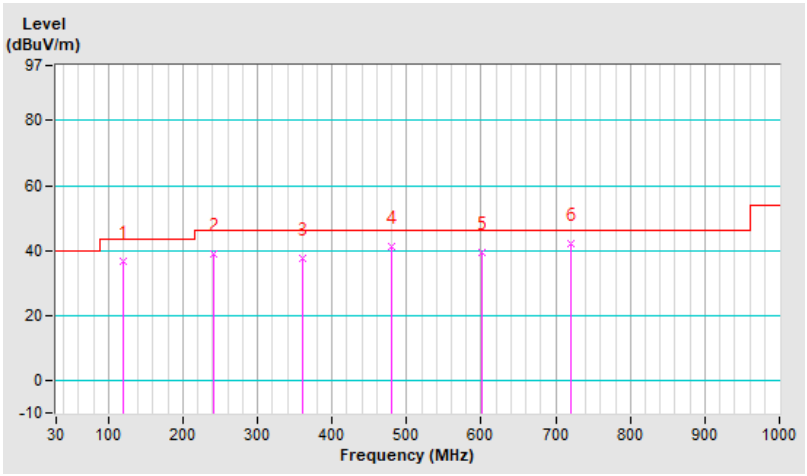
Below 1GHz Data:

Channel	CH 1 : 61.96 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	120.21	36.6 QP	43.5	-6.9	1.01 H	18	51.7	-15.1
2	240.49	39.1 QP	46.0	-6.9	1.51 H	206	53.7	-14.6
3	359.80	37.5 QP	46.0	-8.5	2.00 H	122	48.6	-11.1
4	480.08	41.4 QP	46.0	-4.6	1.01 H	32	49.4	-8.0
5	600.36	39.5 QP	46.0	-6.5	1.51 H	66	44.9	-5.4
6	**719.67**	**42.0 QP**	**46.0**	**-4.0**	**1.01 H**	**253**	**45.4**	**-3.4**

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 30MHz~1000MHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

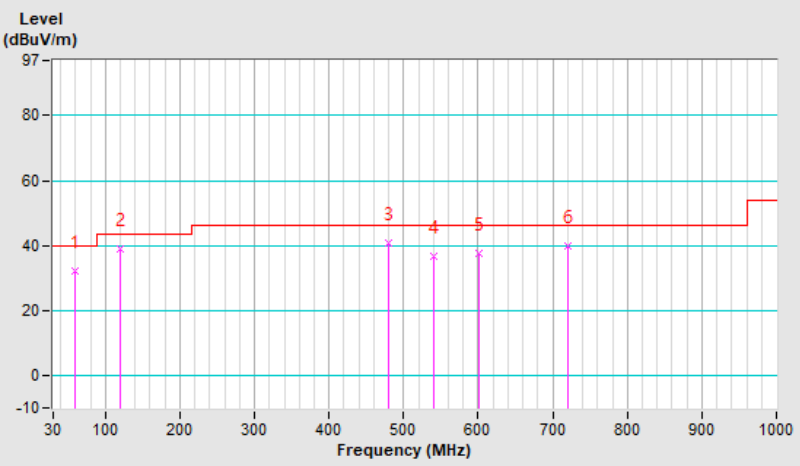


Channel	CH 1 : 61.96 GHz		
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

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	60.07	32.2 QP	40.0	-7.8	1.00 V	290	45.6	-13.4
2	120.21	39.0 QP	43.5	-4.5	1.00 V	207	54.1	-15.1
3	480.08	40.6 QP	46.0	-5.4	1.00 V	139	48.6	-8.0
4	540.22	36.8 QP	46.0	-9.2	2.00 V	161	43.6	-6.8
5	600.36	37.4 QP	46.0	-8.6	1.50 V	171	42.8	-5.4
6	719.67	39.7 QP	46.0	-6.3	1.00 V	74	43.1	-3.4

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 30MHz~1000MHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this 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
50 ohm terminal resistance HUBER+SUHNER	E1-011315	13	Nov. 22, 2023	Nov. 21, 2024
50 ohm terminal resistance	E1-011279	04	Nov. 22, 2023	Nov. 21, 2024
	E1-011280	05	Nov. 22, 2023	Nov. 21, 2024
DC-LISN Schwarzbeck	NNBM 8126G	8126G-069	Nov. 07, 2023	Nov. 06, 2024
EMI Test Receiver R&S	ESCI	100613	Dec. 04, 2023	Dec. 03, 2024
Fixed Attenuator Mini-Circuits	HAT-10+	PAD-COND1-01	Jan. 06, 2024	Jan. 05, 2025
LISN R&S	ENV216	101826	Mar. 25, 2024	Mar. 24, 2025
	ESH3-Z5	100311	Sep. 06, 2023	Sep. 05, 2024
RF Coaxial Cable Woken	5D-FB	Cable-cond1-01	Jan. 06, 2024	Jan. 05, 2025
Software BVADT	BVADT_Cond_ V7.3.7.4	N/A	N/A	N/A
V-LISN Schwarzbeck	NNBL 8226-2	8226-142	Aug. 31, 2023	Aug. 30, 2024

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 test was performed in HwaYa Shielded Room 1 (Conduction 1).
3. The VCCI Site Registration No. is C-12040.
4. Test date: May 14, 2024

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.

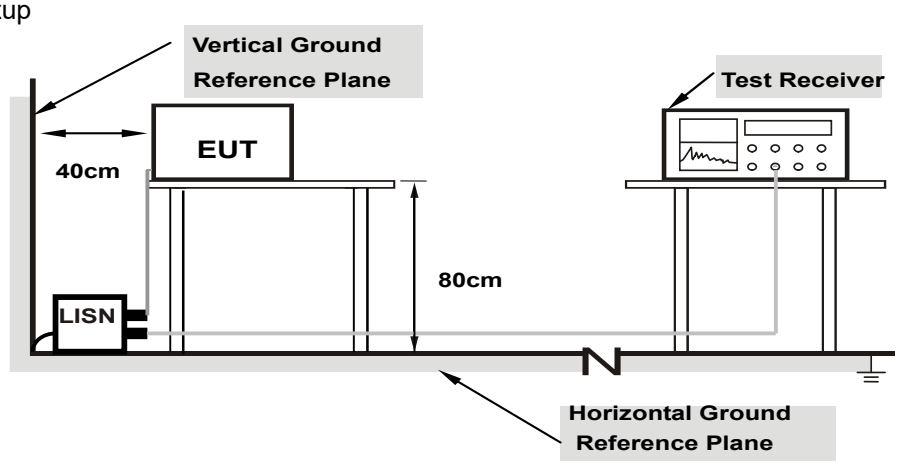
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

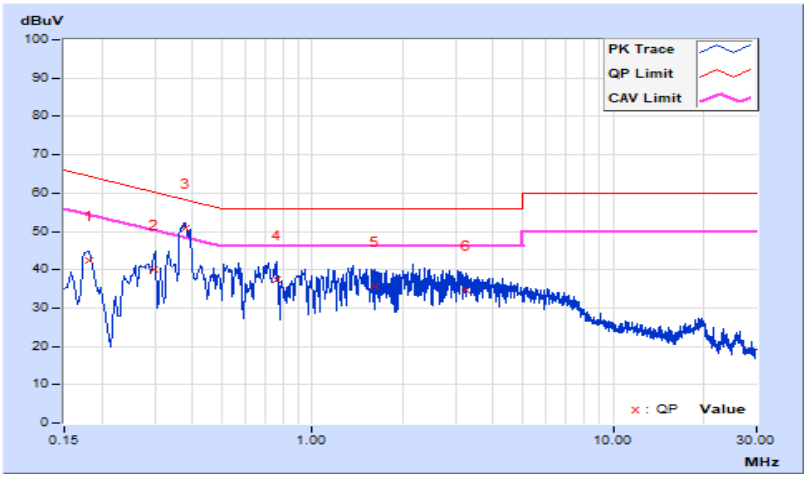
4.2.7 Test Results

Channel	CH 1 : 61.96 GHz		
Frequency Range	150kHz ~ 30MHz	Detector Function & 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	0.18037	9.72	32.83	24.17	42.55	33.89	64.47	54.47	-21.92	-20.58
2	0.29835	9.77	30.33	20.61	40.10	30.38	60.29	50.29	-20.19	-19.91
3	0.37718	9.82	41.07	31.09	50.89	40.91	58.34	48.34	-7.45	-7.43
4	0.75800	9.86	27.66	17.66	37.52	27.52	56.00	46.00	-18.48	-18.48
5	1.62200	9.93	25.60	16.65	35.53	26.58	56.00	46.00	-20.47	-19.42
6	3.23400	10.00	24.62	16.94	34.62	26.94	56.00	46.00	-21.38	-19.06

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

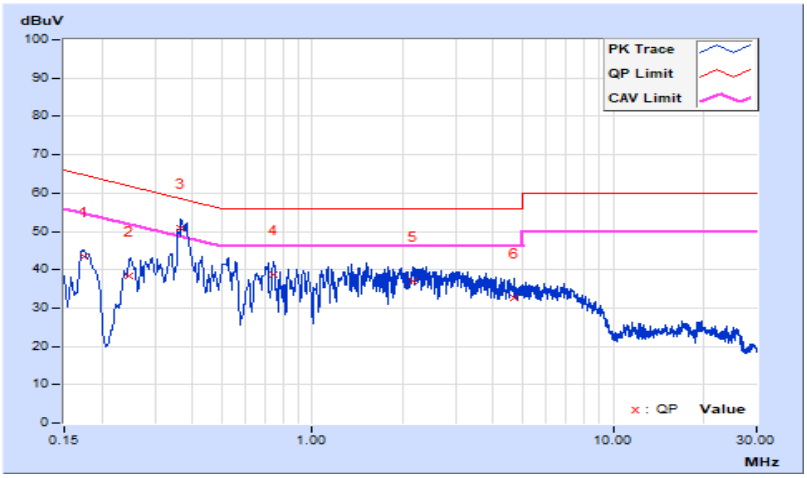


Channel	CH 1 : 61.96 GHz		
Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.17384	9.70	33.73	23.33	43.43	33.03	64.77	54.77	-21.34	-21.74
2	0.24615	9.75	28.54	19.63	38.29	29.38	61.89	51.89	-23.60	-22.51
3	**0.36600**	**9.84**	**41.06**	**32.00**	**50.90**	**41.84**	**58.59**	**48.59**	**-7.69**	**-6.75**
4	0.74200	9.90	28.94	18.90	38.84	28.80	56.00	46.00	-17.16	-17.20
5	2.16600	9.98	26.90	18.80	36.88	28.78	56.00	46.00	-19.12	-17.22
6	4.71000	10.06	22.76	16.27	32.82	26.33	56.00	46.00	-23.18	-19.67

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

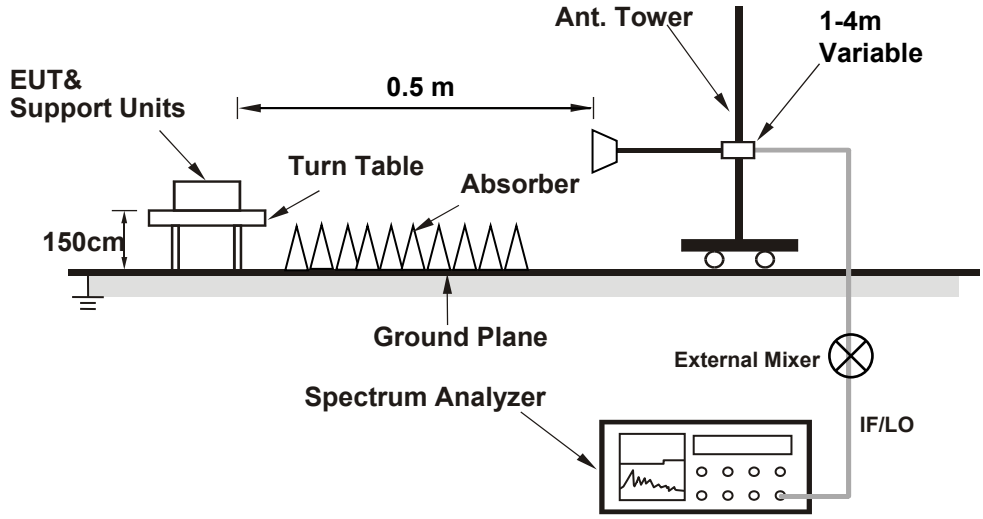


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

None: For reporting purposes only.

4.3.2 Test Setup



4.3.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 14, 2023	Dec. 13, 2024
Spectrum Analyzer (50~110GHz) Keysight	N9030A	MY55330160	Jan. 31, 2024	Jan. 30, 2025
Conical Horn Antenna (50~75GHz) Keysight	WR15CH-Conical	RCH015RL-2	Apr. 25, 2023	Apr. 24, 2024
AC Power Supply Extech	CFW-105	E000603	NA	NA
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	Dec. 19, 2023	Dec. 18, 2024

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. Tested date: Feb. 28, 2024

4.3.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100kHz

b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.

c. Trace mode = max hold.

d. Sweep = auto couple.

e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

Same as 4.1.6.

4.3.7 Test Result

Channel	Frequency (GHz)	6dB Bandwidth (GHz)
1	61.96	2.965

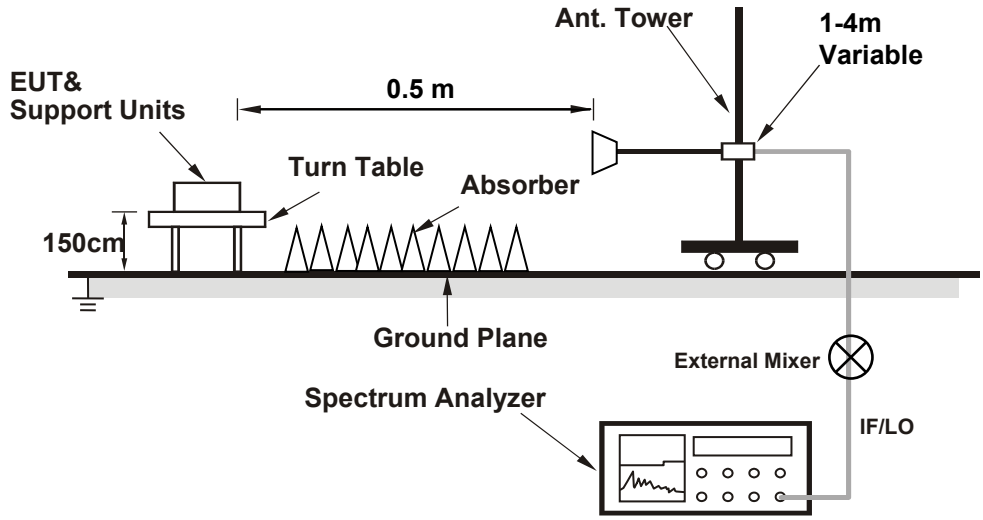
Spectrum Plot of Worst Value

4.4 Occupied Bandwidth Measurement

4.4.1 Limits of Occupied Bandwidth Measurement

None: For reporting purposes only.

4.4.2 Test Setup



4.4.3 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 14, 2023	Dec. 13, 2024
Spectrum Analyzer (50~110GHz) Keysight	N9030A	MY55330160	Jan. 31, 2024	Jan. 30, 2025
Conical Horn Antenna (50~75GHz) Keysight	WR15CH-Conical	RCH015RL-2	Apr. 25, 2023	Apr. 24, 2024
AC Power Supply Extech	CFW-105	E000603	NA	NA
Temperature & Humidity Chamber TERCHY	HRM-120RF	931022	Dec. 19, 2023	Dec. 18, 2024

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. Tested date: Mar. 13, 2024

4.4.4 Test Procedure

1. Set Span=1.5 times the OBW
2. Set RBW = 1~5% of the OBW, or minimum of 1MHz if the this is not possible due to a large OBW.
3. Set the VBW approximately 3 x RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. The EUT shall be transmitting at its maximum data rate, Allow the trace to stabilize.

4.4.5 Deviation from Test Standard

No deviation.

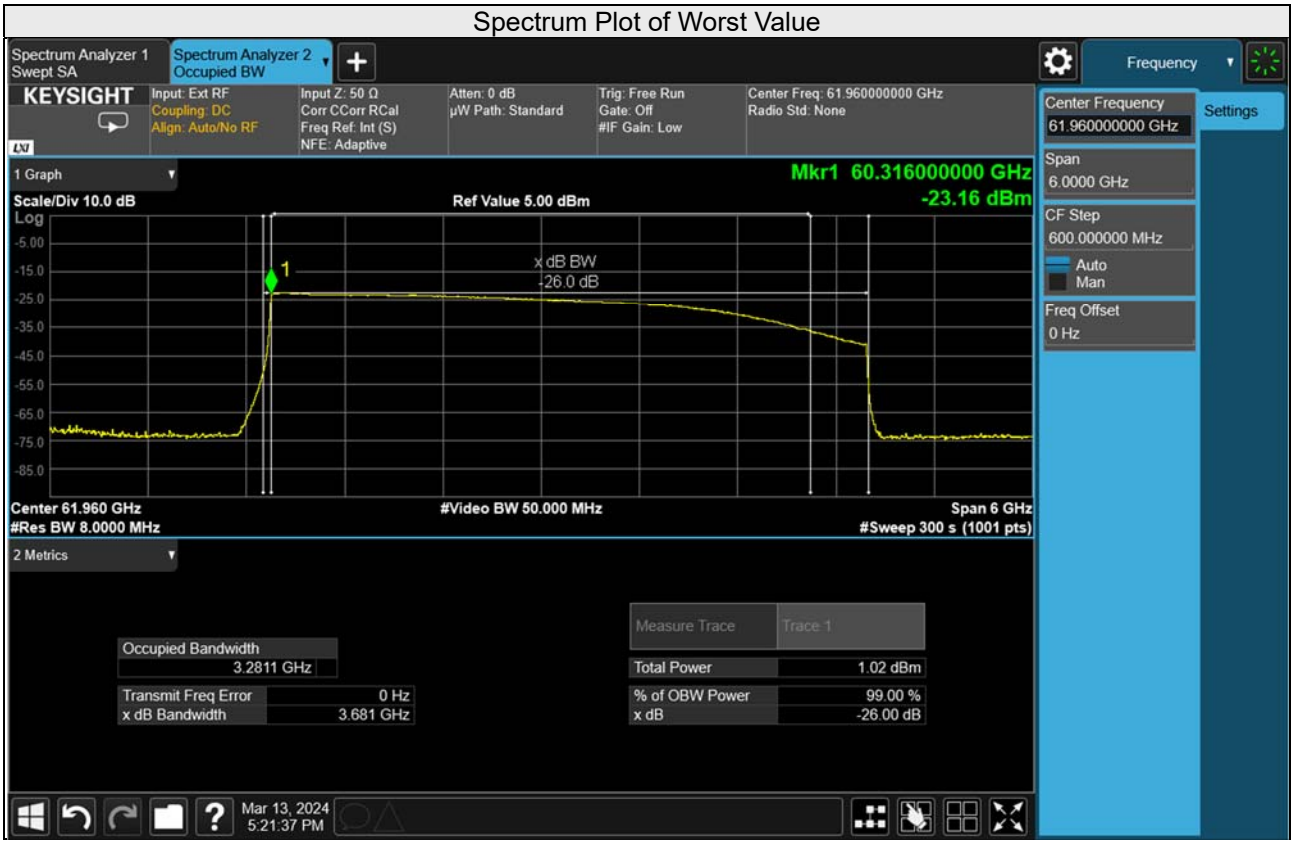
4.4.6 EUT Operating Conditions

Same as 4.1.6.

4.4.7 Test Result

Channel	Frequency (GHz)	Occupied Bandwidth (GHz)	Pass/Fail
1	61.96	3.2811	Pass

Spectrum Plot of Worst Value

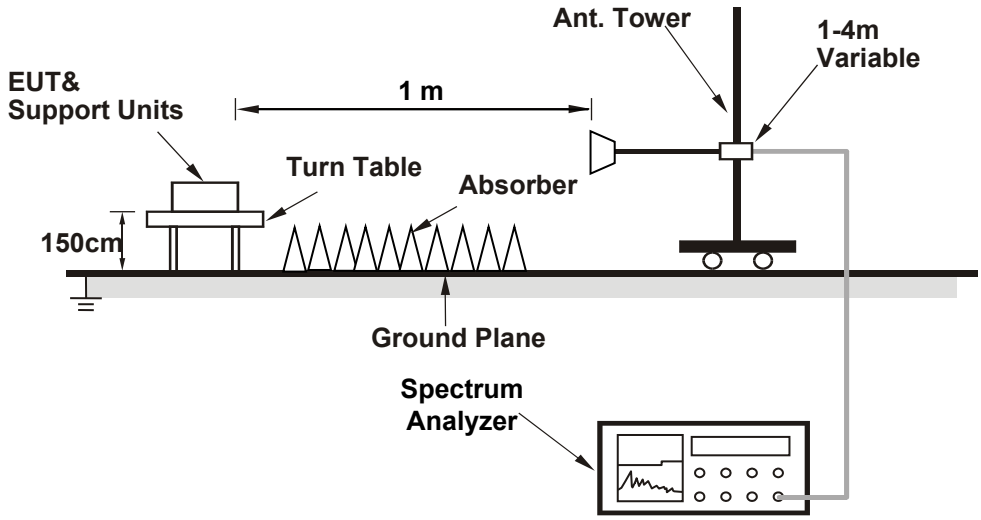


4.5 Output Power Measurement

4.5.1 Limits of Output Power Measurement

15.255(c)(2)(iii)(A)
Any terrestrial radar operating within the 57.0-64.0 GHz band segment can be certified under §15.255(c)(2)(iii)(A), with a peak EIRP limit of 14 dBm and a corresponding off-time requirement of 25.5 milliseconds within any 33.0-millisecond interval.

4.5.2 Test Setup



4.5.3 Test Instruments

Same as Item 4.1.2.

4.5.4 Test Procedures

Method of measurement: Refer as ANSI C63.10-2020 clause 9.8 and Annex L

4.5.5 Deviation from Test Standard

No deviation.

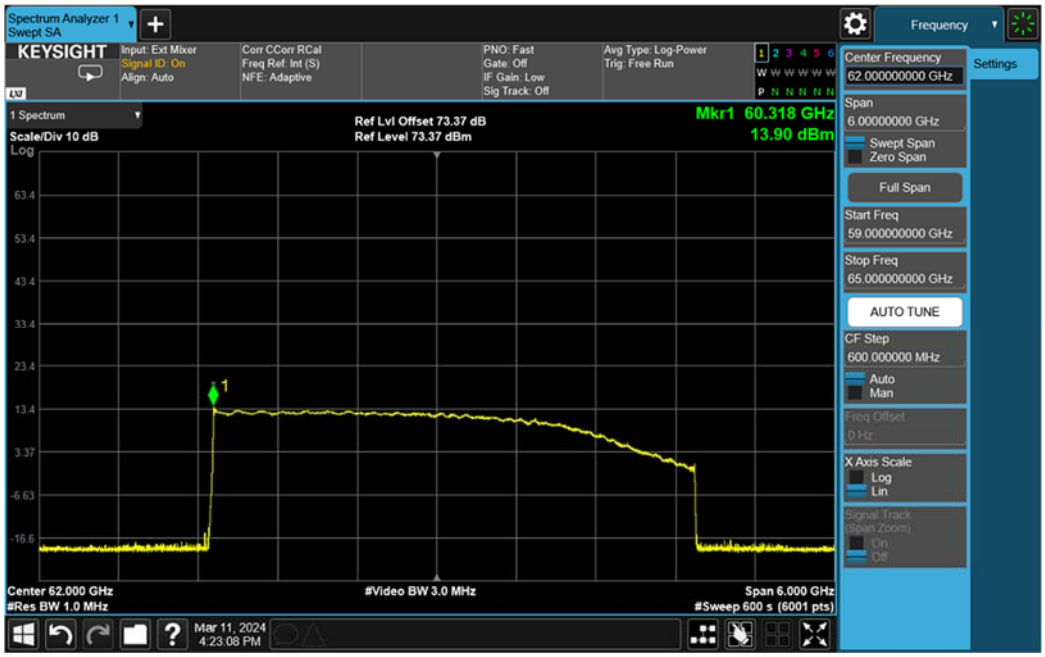
4.5.6 EUT Operating Conditions

Same as 4.1.6.

4.5.7 Test Results

For Output Power (EIRP)

Max Peak EIRP(dBm)	Peak EIRP Limit(dBm)	Result
13.9	14	Pass



Spectrum analyzer

Frequency (GHz)	Ant Gain(dBi)	IF Cable loss	d (m)	Desensitization Factor (dB)	Free space loss (dB)	Ref Lvl Offset (dB)
61.96	21.5	11.59	1	14.99	68.29	73.37

Note1: Ref Lvl Offset =Free Space loss-Ant. Gain+ Cable Loss+ Desensitization Factor
Note2: The Mixer conversion loss has been offset in mixer mode of spectrum analyzer.
Note3: The Free-space propagation path loss is determined from Equation(G.9) of Annex G in ANSI C63.10
=20log(F) + 20log (d) - 27.5

The FMCW Desensitization factor

Start Frequency (GHz)	Stop Frequency (GHz)	FMCW Chirp Width (MHz)	FMCW Chirp Time (us)	FMCW Chirp Rate (Hz/s)	RBW (MHz)	Normalized Sweep Rate (lin)	Desensitization factor (lin)	Desensitization factor (dB)
60	64	4000	56	7.14E+13	1	71.45	0.18	-14.99

Note: The derivation of the FMCW Desensitization Factor is givin in ANSI C63.10-2020/Cor.1-2023 Annex L.1.

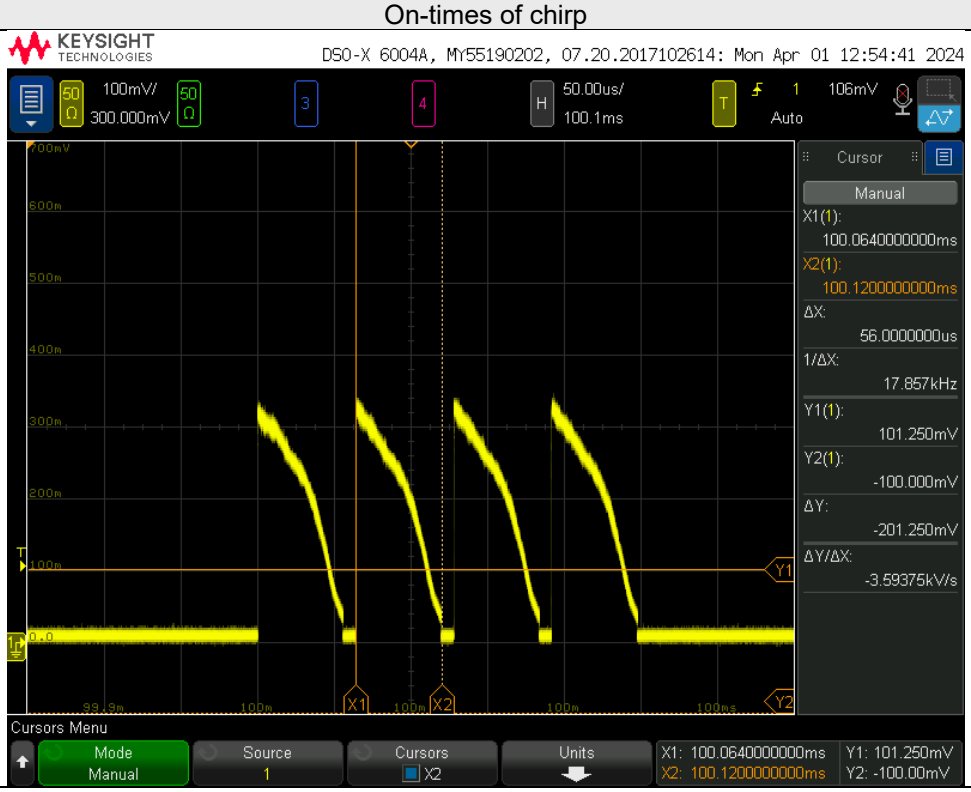
$$\alpha = \frac{1}{\left(1+\left[\left(\frac{2\times\ln(2)}{\pi}\right)^2\times\left(\frac{BW_{Chirp}}{T_{Chirp}\times RBW^2}\right)^2\right]\right)^{0.25}}$$

α is the reduztion in amplitude
BW_{Chirp} is the FMCW Chrip Bandwidth
T_{Chirp} is the FMCW Chrip Time
B is the 3dB IF Bandwidth=RBW

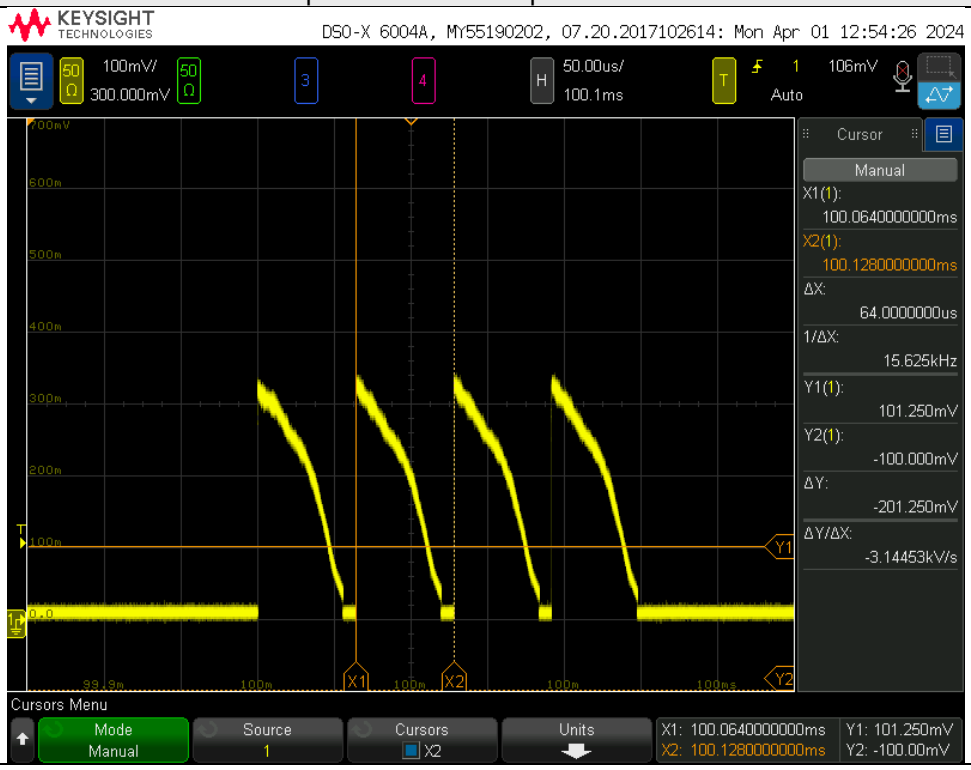
For continuous transmitter time

Tx On Duration(ms)	Tx Off Duration(ms)	Period (ms)	Tx Off Limit (ms)	Result
0.247	32.753	33	25.5	PASS

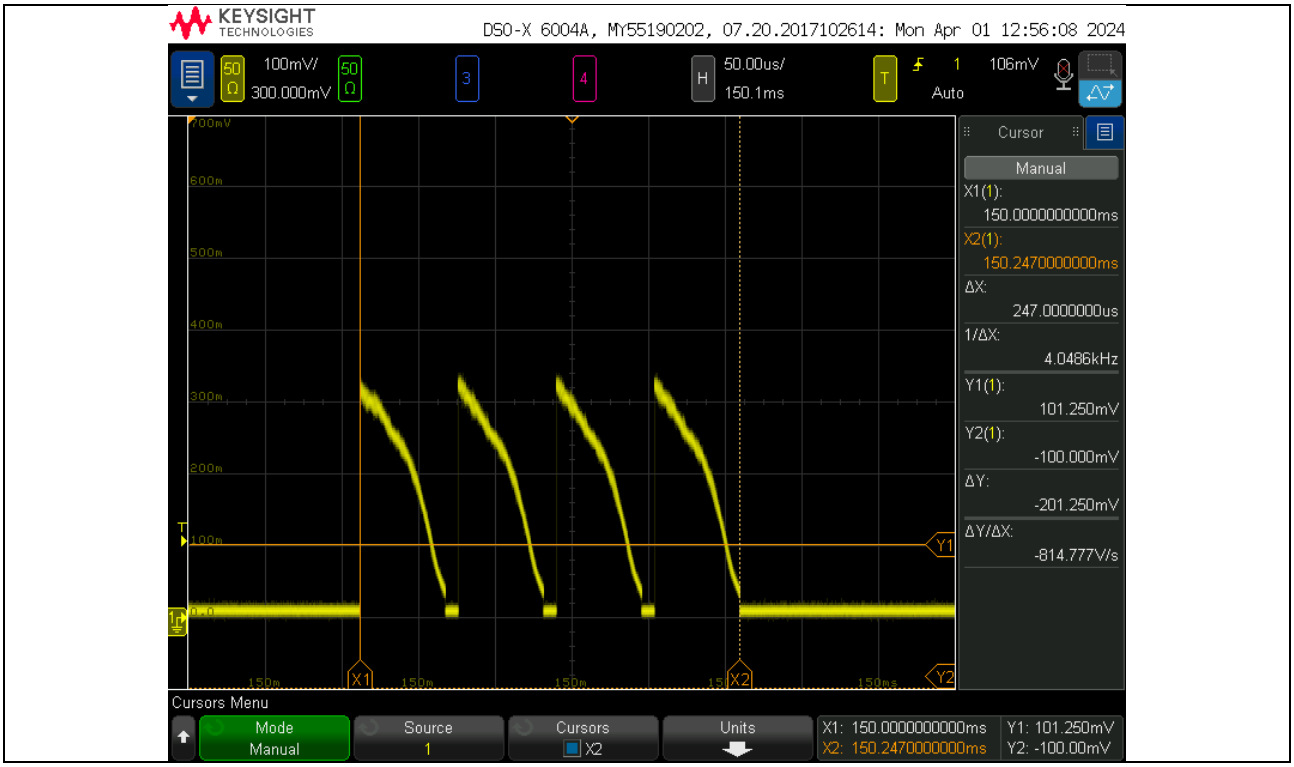
On-times of chirp



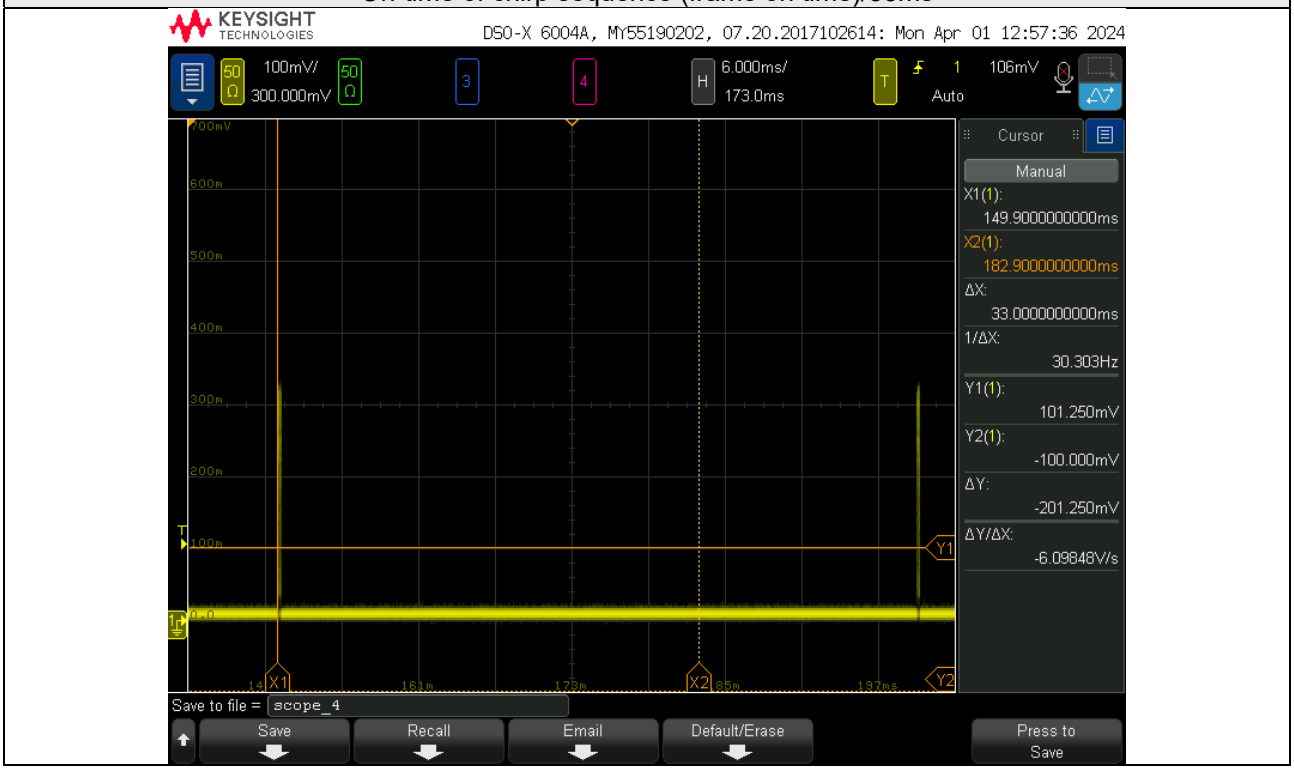
Repetition time of chirps within burst



On-time of chirp sequence (frame on time)



On-time of chirp sequence (frame on time)/33ms

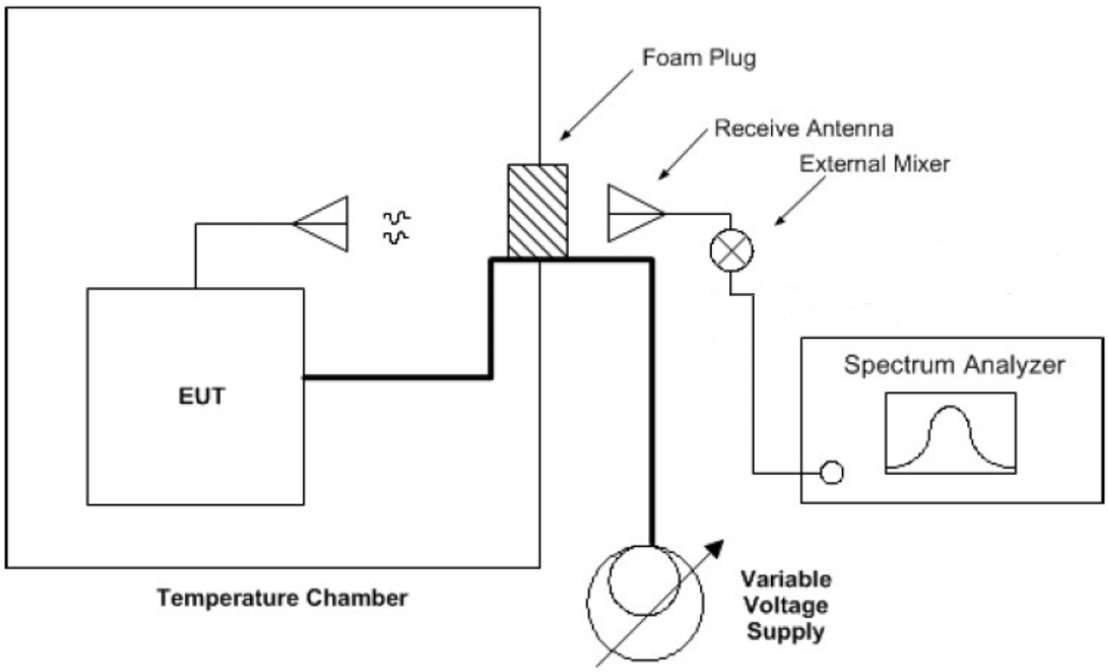


4.6 Frequency Stability Measurement

4.6.1 Limits of Frequency Stability Measurement

15.255(f) Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation.

4.6.2 Test Setup



4.6.3 Test Instruments

Same as Item 4.4.3.

4.6.4 Test Procedure

a. Arrange EUT and test equipment as above setup configuration.
b. With the EUT at ambient temperature and voltage source set to the EUT nominal operating voltage (100%), record the spectrum mask of the EUT emission on the spectrum analyzer.
c. Vary EUT power supply between 85% and 115% of nominal, and record the frequency excursion of the EUT emission mask.
d. Set the power supply to 100% nominal setting, and raise EUT operating temperature to 50 °C. Record the frequency excursion of the EUT emission mask.
e. Repeat step d) at each 10 °C increment down to −20 °C

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as 4.1.6.

4.6.7 Test Results

Frequency Stability Versus Temperature													
Operating Frequency: 61960 MHz													
Temp. (℃)	Power Supply (Vac)	0 Minute			2 Minutes			5 Minutes			10 Minutes		
		Measured Frequency (MHz)		Test Result	Measured Frequency (MHz)		Test Result	Measured Frequency (MHz)		Test Result	Measured Frequency (MHz)		Test Result
		FL	FH		FL	FH		FL	FH		FL	FH	
50	120	60.30026	63.62016	Pass	60.30025	63.62015	Pass	60.30028	63.62018	Pass	60.30026	63.62016	Pass
40	120	60.30010	63.62000	Pass	60.30005	63.61995	Pass	60.30011	63.62001	Pass	60.30011	63.62001	Pass
30	120	60.30017	63.62007	Pass	60.30020	63.62010	Pass	60.30017	63.62007	Pass	60.30018	63.62008	Pass
20	120	60.30030	63.62020	Pass	60.30033	63.62023	Pass	60.30031	63.62021	Pass	60.30031	63.62021	Pass
10	120	60.29989	63.61979	Pass	60.29988	63.61978	Pass	60.29988	63.61978	Pass	60.29984	63.61974	Pass
0	120	60.29980	63.61970	Pass	60.29982	63.61972	Pass	60.29979	63.61969	Pass	60.29980	63.61970	Pass
-10	120	60.30004	63.61994	Pass	60.30004	63.61994	Pass	60.30000	63.61990	Pass	60.30002	63.61992	Pass
-20	120	60.30004	63.61994	Pass	60.30005	63.61995	Pass	60.30005	63.61995	Pass	60.30002	63.61992	Pass

Frequency Stability Versus Voltage													
Operating Frequency: 61960 MHz													
Temp. (℃)	Power Supply (Vac)	0 Minute			2 Minutes			5 Minutes			10 Minutes		
		Measured Frequency (MHz)		Test Result	Measured Frequency (MHz)		Test Result	Measured Frequency (MHz)		Test Result	Measured Frequency (MHz)		Test Result
		FL	FH		FL	FH		FL	FH		FL	FH	
20	138	60.30036	63.62026	Pass	60.30032	63.62022	Pass	60.30035	63.62025	Pass	60.30034	63.62024	Pass
	120	60.30030	63.62020	Pass	60.30033	63.62023	Pass	60.30031	63.62021	Pass	60.30031	63.62021	Pass
	102	60.30025	63.62015	Pass	60.30027	63.62017	Pass	60.30027	63.62017	Pass	60.30026	63.62016	Pass

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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