Testing Laboratory
3787

RADIO TEST REPORT

FCC ID	:	RCC-RAR820000
Equipment	:	77G Millimeter Wave Radar
Brand Name	:	RoyalTek
Model Name	:	RAR-8200
Applicant	:	RoyalTek Company Ltd. 8th Floor, No. 40 Wenhwa 2nd Rd., Guishan Dist., Tao Yuan City, 333010, Taiwan
Manufacturer	:	RoyalTek Company Ltd. 8th Floor, No. 40 Wenhwa 2nd Rd., Guishan Dist., Tao Yuan City, 333010, Taiwan
Standard	:	47 CFR FCC Part 95M

The product was received on Nov. 05, 2024, and testing was started from Nov. 29, 2024 and completed on Dec. 11, 2024. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory
No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FR4N0405	01	Initial issue of report	Dec. 23, 2024
FR4N0405	02	Revising Internal Photos of the Photographs of EUT	Dec. 26, 2024
FR4N0405	03	Revising the value to 104.77 from 104.7 in section 3.2.3 and 3.3.3.	Dec. 26, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	95.303	Occupied Bandwidth	PASS	-
3.2	95.3367	Radiated E.I.R.P Power	PASS	-
3.3	95.3379	Transmitter Radiated Unwanted Emissions	PASS	-
3.4	95.3379	Frequency Stability	PASS	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen
Report Producer: Cathy Chiu

1 General Description

1.1 Information

1.1.1 RF General Information

For Radio 1:

RF General Information			
Frequency Range (GHz)	**Operating Frequency Range (GHz)**	**Test Frequency (GHz)**	**Modulation**
76-81	76.021-76.993	76.507	FMCW

For Radio 2:

RF General Information			
Frequency Range (GHz)	**Operating Frequency Range (GHz)**	**Test Frequency (GHz)**	**Modulation**
76-81	76.021-76.634	76.329	FMCW

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	TX/RX Function
1	RoyalTek	TI-AWR1642 Ant	Patch Array	N/A	13.0381	2TX/4RX
2	RoyalTek	TI-AWR1642 LCP Ant	Patch Array	N/A	11.5981	
3	RoyalTek	TI-AWR11843 Ant	Patch Array	N/A	12.9995	3TX/4RX

Note: The above information was declared by manufacturer.

1.1.3 EUT Operational Condition

EUT Power Type	From DC power supply by vehicle battery (9-36Vdc)			
Supply Voltage	☐	AC	State AC voltage	-
Supply Voltage	☒	DC	State DC voltage	12

1.1.4 Test Signal Duty Cycle

For Radio 1:

Test Signal Duty Cycle
☒ Continuous transmission – 14.5%
☐ Transmissions occur regularly in time - …%

For Radio 2:

Test Signal Duty Cycle
☒ Continuous transmission – 32.7%
☐ Transmissions occur regularly in time - …%

1.1.5 Table for EUT Information

Radio	Operating Frequency (GHz)	Bandwidth (MHz)	Antenna	TX/RX Function
1	76.021~76.993	972	1, 2	2TX/4RX
2	76.021~76.634	613	3	3TX/4RX

Note 1: The EUT has two radios.

Note 2: The above information was declared by manufacturer.

1.2 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 95M
- ANSI C63.10 - Testing Unlicensed Wireless Devices
- KDB653005 D01 76-81 GHz Radars v01r02

The following reference test guidance is not within the scope of accreditation of TAF.

- FCC KDB 414788 D01 v01r01

1.3 Testing Location Information

Testing Location Information	
Test Lab.：Sporton International Inc. Hsinchu Laboratory	
Hsinchu (TAF: 3787)	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) TEL: 886-3-656-9065 FAX: 886-3-656-9085 Test site Designation No. TW3787 with FCC. Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

Test Condition	Test Site No.	Test Engineer	Test Environment (°C / %)	Test Date
Radiated (Frequency Stability)	TH03-CB	Jay Lo	20.5-21.6 / 52-59	Dec. 11, 2024
Radiated (Others)	03CH06-CB	Mark Hsu	22.5-22.9 / 58-60	Nov. 29, 2024~ Dec. 11, 2024

1.4 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Test Items	Uncertainty	Remark
Radiated Emission (9kHz ~ 30MHz)	4.1 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	4.2 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	4.2 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	4.0 dB	Confidence levels of 95%
Radiated Emission (40GHz ~ 60GHz)	3.0 dB	Confidence levels of 95%
Radiated Emission (60GHz ~ 90GHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (90GHz ~ 200GHz)	2.5 dB	Confidence levels of 95%
Radiated Emission (200GHz ~ 280GHz)	5.0 dB	Confidence levels of 95%
Temperature	1.2°C	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Channel Frequencies Configuration

Radio	Radio 1	Radio 2
Test Software Version	Default	Default
Test Frequencies (GHz)	76.507	76.329
Software Setting	Default	Default

2.2 Conformance Tests and Related Test Frequencies

Test Item	Test Frequencies (GHz)
Occupied Bandwidth	76.507, 76.329
Radiated E.I.R.P Power	76.507, 76.329
Transmitter Spurious Emissions (below 1 GHz)	76.507, 76.329
Transmitter Spurious Emissions (1 GHz-40 GHz)	76.507, 76.329
Transmitter Spurious Emissions (above 40 GHz)	76.507, 76.329
Frequency Stability	76.507, 76.329

2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	Occupied Bandwidth Radiated E.I.R.P Power Frequency Stability Transmitter Radiated Unwanted Emissions above 40GHz
Test Condition	Radiated measurement
Operating Mode	CTX
After evaluating, EUT in Y axis was the worst case, so the measurement will follow this same test configuration.	
1	EUT in Y axis_radio 1
2	EUT in Y axis_radio 2

The Worst Case Mode for Following Conformance Tests	
Tests Item	Transmitter Radiated Unwanted Emissions below 40GHz
Test Condition	Radiated measurement
Operating Mode	CTX
After evaluating, EUT in Y axis was the worst case, so the measurement will follow this same test configuration.	
1	EUT in Y axis_radio 1 + radio 2 + vehical battery (12Vdc)

2.4 EUT Operation during Test

The EUT was programmed to be in continuously transmitting/receiving mode.

2.5 Accessories

Accessories
ECU*1
ECU to radar cable*1, non-shielded, 3.7m
ECU to single cable*1, non-shielded, 5m
Indicator*1, non-shielded, 1m

2.6 Support Equipment

Support Equipment				
No.	**Equipment**	**Brand Name**	**Model Name**	**FCC ID**
A	Battery	YUASA	38B19L-MF	N/A

2.7 Far Field Boundary Calculations

The far-field boundary is given as:

far field = (2 * L^2) /λ

where:

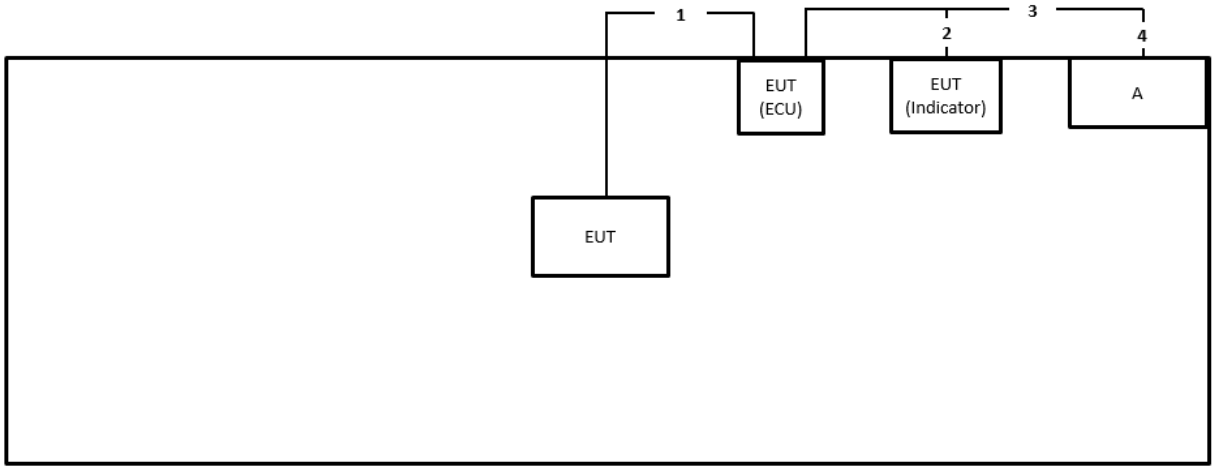
L = Largest Antenna Dimension, including the reflector, in meters

λ= wavelength in meters

Far Field (m)				
Frequency (GHz)	**L (m)**	**Lambda (m)**	**d(Far Field) (m)**	**d(Far Field) (cm)**
76.507	0.008	0.0039212	0.033	3.26
76.329	0.01	0.0039304	0.051	5.09

2.8 Test Setup Diagram

Test Setup Diagram - Radiated Test



Item	Connection	Shielded	Length
1	ECU to radar cable	No	3.7m
2	Indicator cable	No	1m
3	ECU to signal cable	No	5m
4	Crocodile clip cable	No	1m

3 Transmitter Test Result

3.1 Occupied Bandwidth

3.1.1 Occupied Bandwidth (OBW) Limit

Occupied Bandwidth (EBW) Limit
Information only

3.1.2 Measuring Instruments

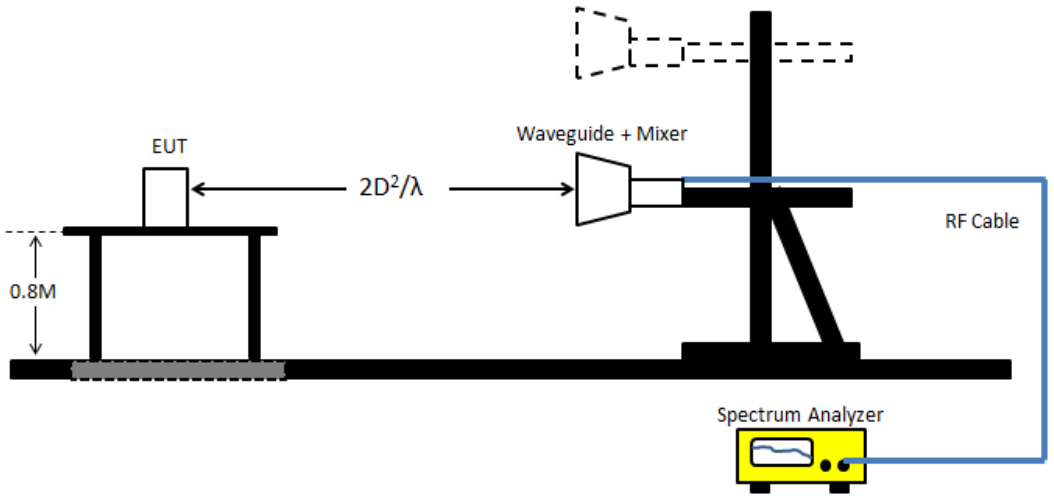
Refer a test equipment and calibration data table in this test report.

3.1.3 Test Procedures

Test Method	
☒	For the Occupied bandwidth shall be measured using one of the options below:
☒	Refer as ANSI C63.10, clause 7.8.7 for EBW measurement.
☐	Refer as ANSI C63.10, clause 6.9.2 for occupied bandwidth testing.
☒	Refer as ANSI C63.10, clause 9 for radiated measurement.
☒	Radiated test was conducted at far-field distance. the distance from the radiating element of the EUT to the edge of the far field may be calculated from [$r \geq 2D^2/\lambda$] r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation [300/f (MHz)], in m

3.1.4 Test Setup

Occupied Bandwidth

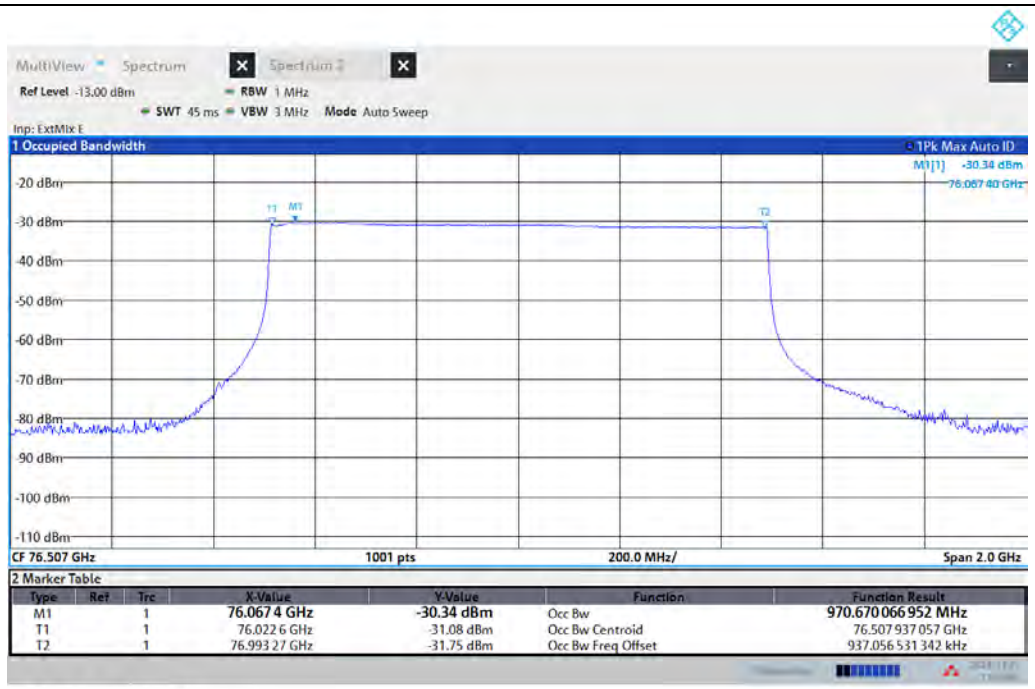


3.1.5 Test Result of Occupied Bandwidth

Test Results		
Test Freq. (GHz)	**99% Occupied Bandwidth (MHz)**	**Limit (MHz)**
76.507	970.670	N/A
76.329	608.882	N/A

Occupied Bandwidth Plots

Test Frequency: 76.507 GHz



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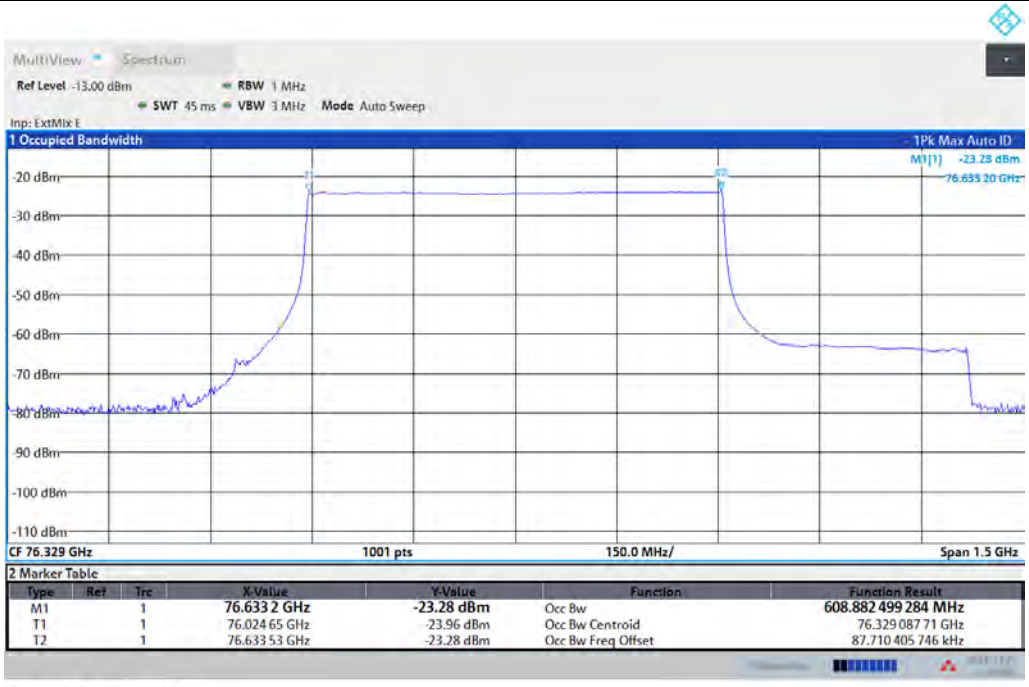
Test Frequency: 76.329 GHz



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3.2 Radiated E.I.R.P Power

3.2.1 Radiated E.I.R.P Power Limit

Radiated E.I.R.P Power	
☒	76-81 GHz Band:
	☒ Peak: EIRP 55 dBm [279uW/cm^2 at 3m] Average: EIRP 50 dBm [88uW/cm^2 at 3m]

3.2.2 Measuring Instruments

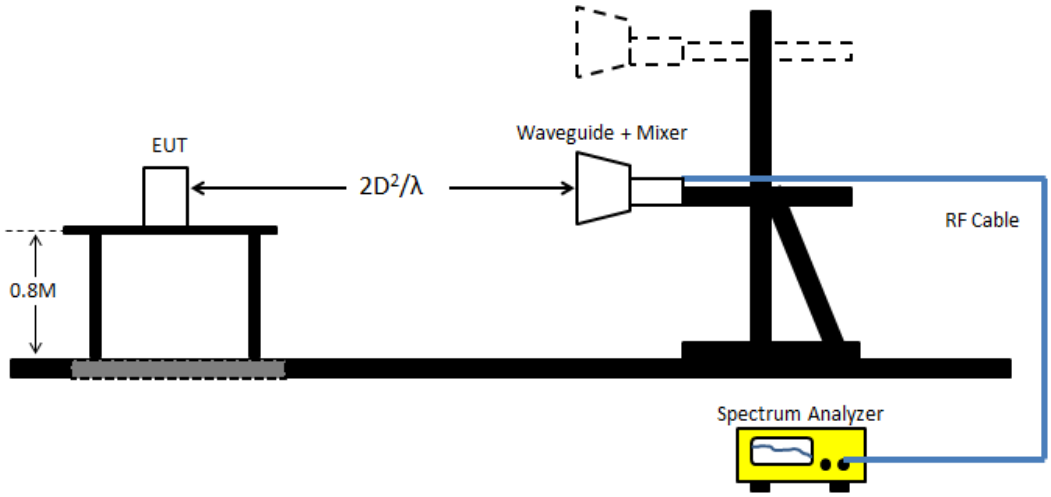
Refer a test equipment and calibration data table in this test report.

3.2.3 Test Procedures

Test Method	
☒	For the Occupied bandwidth shall be measured using one of the options below:
☒	Refer as ANSI C63.10, clause 9 for radiated measurement.
	☒ Radiated test was conducted at far-field distance. the distance from the radiating element of the EUT to the edge of the far field may be calculated from [$r \geq 2D^2/\lambda$] r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation [300/f (MHz)], in m
	☒ The measured power level is converted to EIRP using the Friis equation: E Meas = 126.8 - 20log(λ) + P – G where E is the field strength of the emission at the measurement distance, in dBμV/m P is the power measured at the output of the test antenna, in dBm λ is the wavelength of the emission under investigation [300/fMHz], in m G is the gain of the test antenna, in dBi EIRP = E Meas + 20 log(d Meas) – 104.77 where EIRP : is the equivalent isotropically radiated power, in dBm. E Meas : is the field strength of the emission at the measurement distance, in dBμV/m. d Meas : is the measurement distance, in m.

3.2.4 Test Setup

Radiated E.I.R.P Power



3.2.5 Measurement Results Calculation

The measured Level is calculated using:
EIRP = Read Level - Rx Gain +20*LOG(4*3.14159* Distance / (300/(Test Freq.*1000))).

3.2.6 Test Result of Radiated E.I.R.P Power

Freq. (GHz)	Rx Gain (dBi)	P-Peak (dBm)	P-Average (dBm)	E-Meas-Peak (dBuV/m)	E-Meas-Average (dBuV/m)	Distance (m)	EIRP-Peak (dBm)	EIRP-Average (dBm)
76.507	23.9	-0.33	-29.37	150.70	121.66	0.50	39.88	10.84
76.329	23.9	3.25	-22.1	154.26	128.91	0.50	43.44	18.09
EIRP Limit							**55**	**50**

3.3 Transmitter Radiated Unwanted Emissions

3.3.1 Transmitter Radiated Unwanted Emissions Limit

Transmitter Radiated Unwanted Emissions Limit (Below 40 GHz)			
Frequency Range (MHz)	**Field Strength (uV/m)**	**Field Strength (dBuV/m)**	**Measure Distance (m)**
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960 - 40000	500	54	3

Frequency Range (GHz)	EIRP (dBm)	Power Density (pW/cm^2 @ 3m)
40 - 200	-23.97	3.5452
200 - 231	-24.75	2.9600

3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.3.3 Test Procedures

Test Method – General Information			
☒	For the transmitter unwanted emissions shall be measured using following options below:		
	☒	Refer as ANSI C63.10, clause 6.3 for unwanted emissions into non-restricted bands.	
	☒	For unwanted emissions below 40GHz bands.	
		☒	Radiated emissions below 40 GHz shall not exceed the general limits in LP0002 Section 2.8
		☒	Refer as ANSI C63.10, clause 4.1.4.2.3 (Video Averaging) average measurements using spectrum reduced video bandwidth (VBW≥10Hz) - [duty cycle ≥ 98 or external power trigger].
		☐	Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
		☐	Refer as ANSI C63.10, clause 4.1.4.2.2 measurement procedure peak limit.

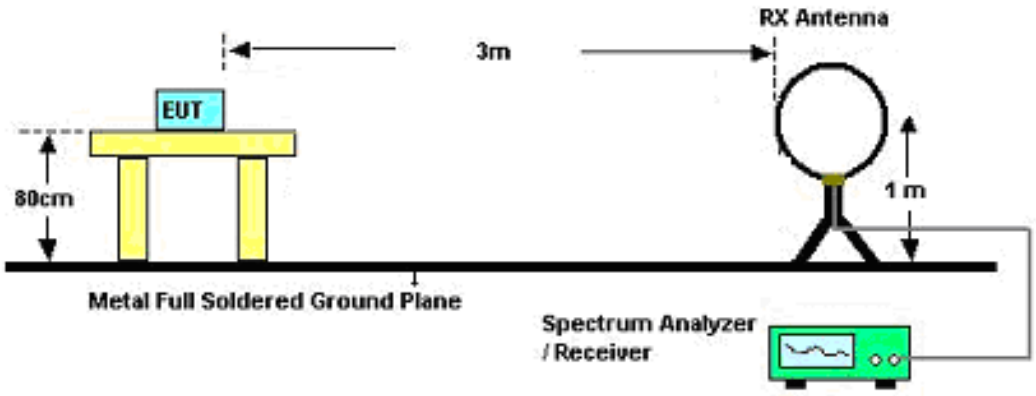
Test Method		
☒	For radiated measurement below 40GHz.	
	☒	Refer as ANSI C63.10, clause 6.3 through 6.6 for radiated emissions from below 40 GHz.
☒	For radiated measurement above 40GHz. Refer as ANSI C63.10, clause 9.12 for radiated measurement.	
	☒	Radiated test was conducted at far-field distance. the distance from the radiating element of the

Test Method		
		EUT to the edge of the far field may be calculated from [$r \geq 2D^2/\lambda$] r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation [300/f (MHz)], in m
	☒	The measured power level is converted to EIRP using the Friis equation: E Meas = 126.8 - 20log(λ) + P – G where E is the field strength of the emission at the measurement distance, in dBμV/m P is the power measured at the output of the test antenna, in dBm λ is the wavelength of the emission under investigation [300/fMHz], in m G is the gain of the test antenna, in dBi EIRP = E Meas + 20 log(d Meas) – 104.77 where EIRP : is the equivalent isotropically radiated power, in dBm. E Meas : is the field strength of the emission at the measurement distance, in dBμV/m. d Meas : is the measurement distance, in m. Equations to calculate power density Calculate the power density at the distance specified by the limit from the EIRP in watts using Equation: $PD = \frac{EIRP_{Linear}}{4\pi d^2}$ where PD is the power density at the distance specified by the limit, in W/m2 EIRPLinear is the equivalent isotropically radiated power, in watts d is the distance at which the power density limit is specified, in m.

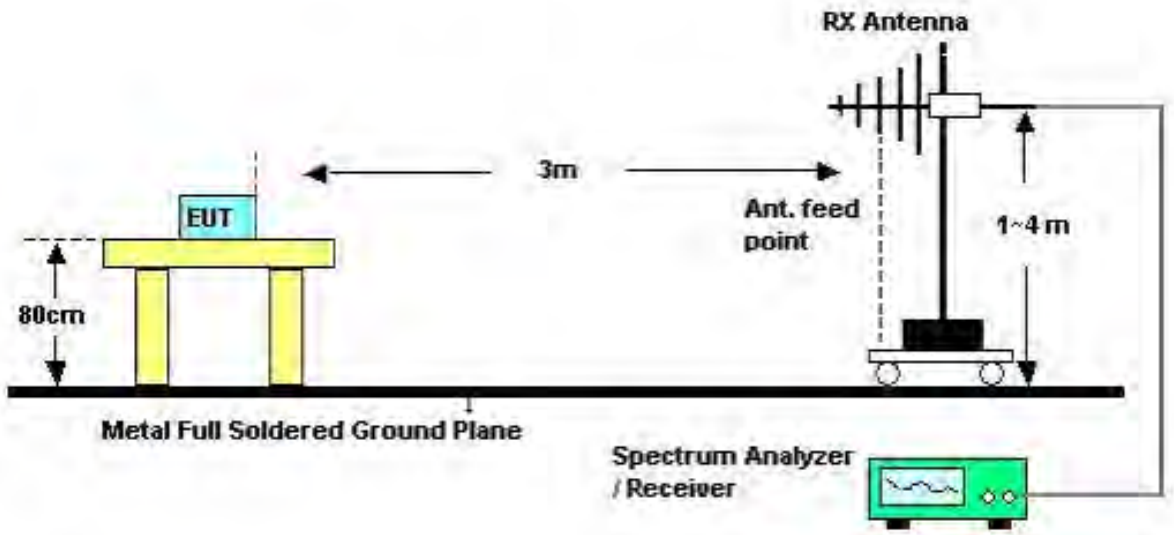
3.3.4 Test Setup

Transmitter Radiated Unwanted Emissions

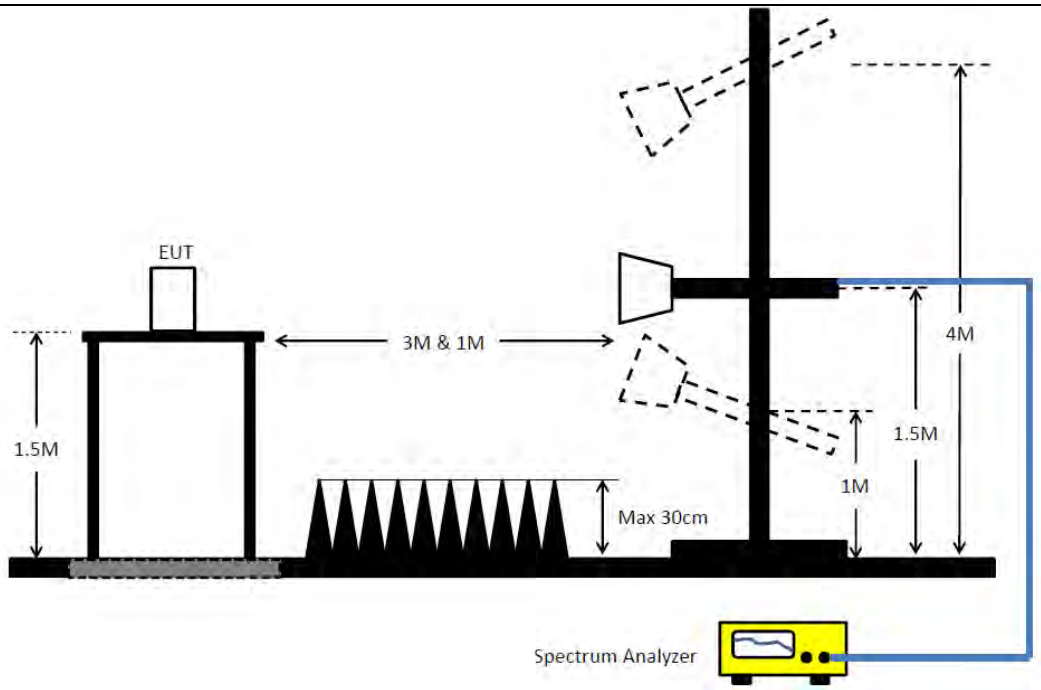
9kHz ~30MHz



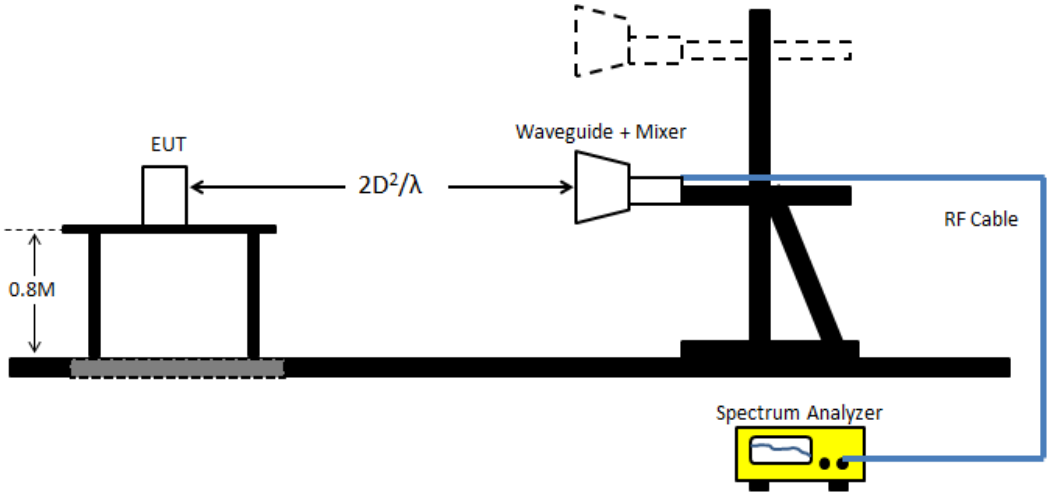
30MHz~1GHz



1GHz ~40GHz



Above 40GHz



3.3.5 Measurement Results Calculation

The measured Level is calculated using:
For below 40GHz
Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA)(if applicable) = Level.
For above 40GHz
EIRP = Read Level - Rx Gain +20*LOG(4*3.14159* Distance / (300/(Test Freq.*1000))).
Power Density = ((10^(EIRP/10)/1000)/(4*3.14159*(Specification Distance *100)^2))*1000000000000.

3.3.6 Test Result of Transmitter Radiated Unwanted Emissions (Below 30MHz)

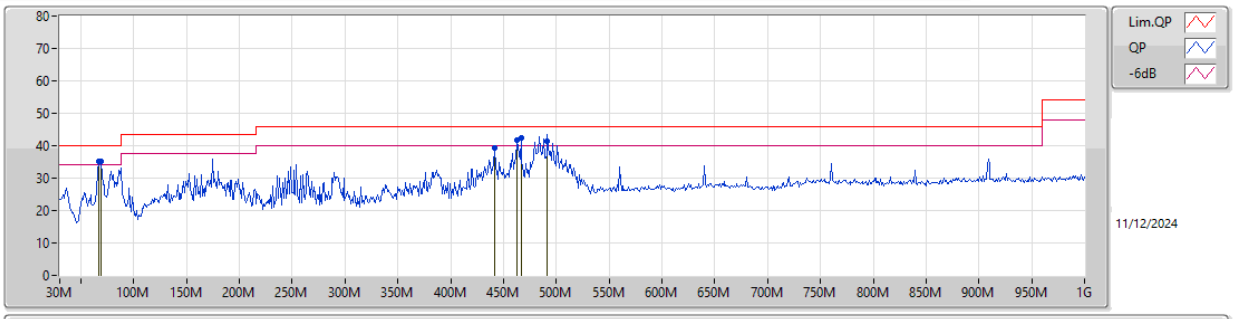
There is a comparison data of both open-field test site and alternative test site - semi-Anechoic chamber according to KDB414788 Radiated Test Site, and the result came out very similar.
All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.
The radiated emissions were investigated from 9 kHz or the lowest frequency generated within the device, up to the 10 harmonic or 40 GHz, whichever is appropriate.

3.3.7 Test Result of Transmitter Radiated Unwanted Emissions (30MHz ~ 1GHz)

Test Range	30 MHz – 1000 MHz

Horizontal

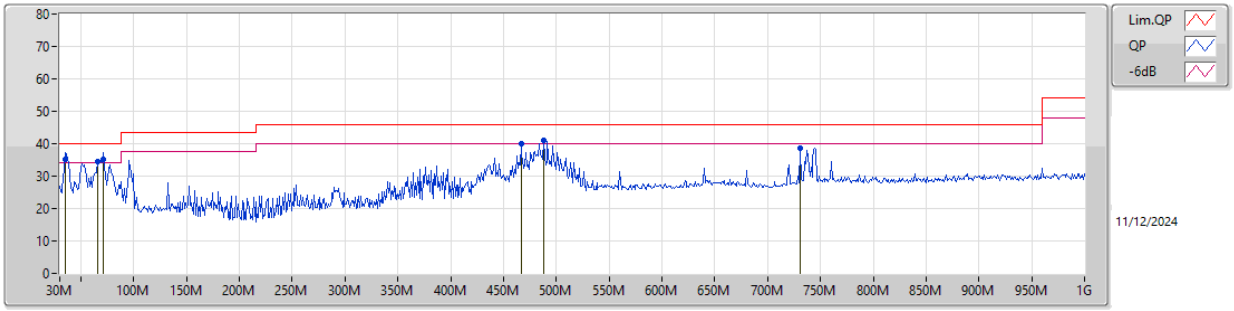
Mode 1



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV)	(dB/m)	(dB)	(dB)
QP	491.72M	41.46	46.00	-4.54	-6.45	3	Horizontal	126	2.00	-	47.91	23.17	2.20	31.82
PK	466.5M	42.57	46.00	-3.43	-6.89	3	Horizontal	165	2.00	"Worst"	49.46	22.91	2.13	31.93
PK	462.62M	41.68	46.00	-4.32	-7.04	3	Horizontal	165	2.00	-	48.72	22.79	2.12	31.95
PK	66.86M	35.34	40.00	-4.66	-19.57	3	Horizontal	219	1.00	-	54.91	12.08	0.80	32.45
PK	68.8M	35.08	40.00	-4.92	-19.43	3	Horizontal	360	1.00	-	54.51	12.18	0.85	32.46
PK	441.28M	39.27	46.00	-6.73	-7.48	3	Horizontal	244	2.00	-	46.75	22.46	2.06	32.00

Vertical

Mode 1



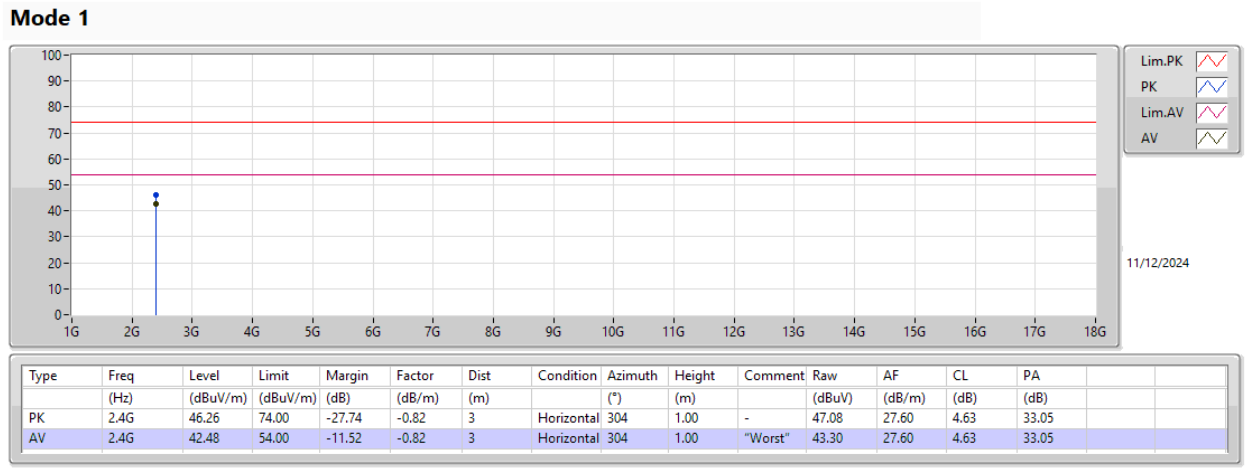
Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV)	(dB/m)	(dB)	(dB)
QP	34.85M	35.19	40.00	-4.81	-9.99	3	Vertical	2	1.00	"Worst"	45.18	21.73	0.57	32.29
QP	70.74M	35.09	40.00	-4.91	-19.45	3	Vertical	360	2.00	-	54.54	12.14	0.88	32.47
PK	487.84M	41.01	46.00	-4.99	-6.45	3	Vertical	174	2.00	-	47.46	23.20	2.19	31.84
PK	65.89M	34.51	40.00	-5.49	-19.60	3	Vertical	172	1.25	-	54.11	12.08	0.77	32.45
PK	466.5M	40.01	46.00	-5.99	-6.89	3	Vertical	181	1.50	-	46.90	22.91	2.13	31.93
PK	730.34M	38.59	46.00	-7.41	-3.43	3	Vertical	0	1.00	-	42.02	25.43	2.69	31.55

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)

3.3.8 Test Result of Transmitter Radiated Unwanted Emissions (1GHz – 40GHz)

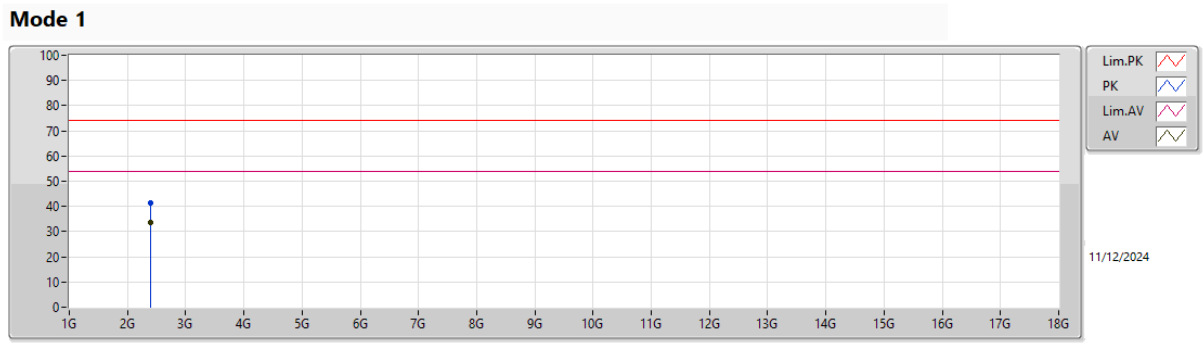
Test Range	1GHz – 18GHz

Horizontal



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV)	(dB/m)	(dB)	(dB)
PK	2.4G	46.26	74.00	-27.74	-0.82	3	Horizontal	304	1.00	-	47.08	27.60	4.63	33.05
AV	2.4G	42.48	54.00	-11.52	-0.82	3	Horizontal	304	1.00	"Worst"	43.30	27.60	4.63	33.05

Vertical

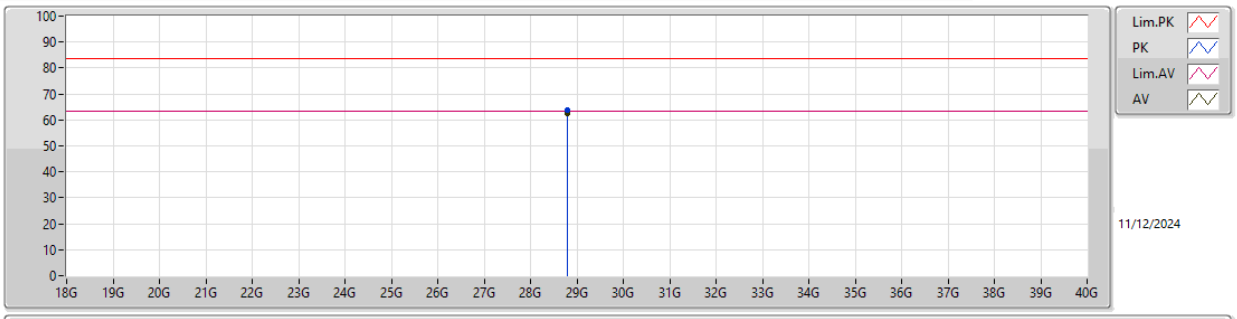


Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV)	(dB/m)	(dB)	(dB)
PK	2.40017G	41.55	74.00	-32.45	-0.82	3	Vertical	53	1.35	-	42.37	27.60	4.63	33.05
AV	2.40002G	33.64	54.00	-20.36	-0.82	3	Vertical	53	1.35	"Worst"	34.46	27.60	4.63	33.05

Test Range	18GHz – 40GHz

Horizontal

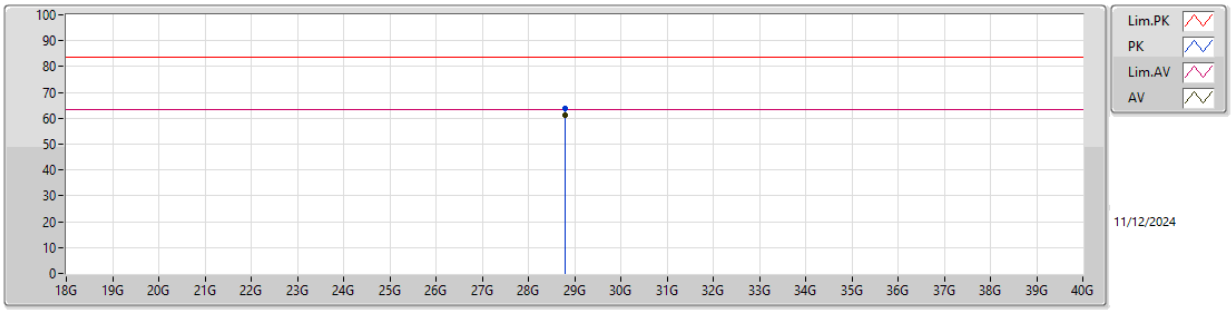
Mode 1



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV)	(dB/m)	(dB)	(dB)
PK	28.80001G	64.00	83.54	-19.54	11.72	1	Horizontal	329	1.50	-	52.28	40.20	19.20	47.68
AV	28.80012G	62.32	63.54	-1.22	11.72	1	Horizontal	329	1.50	"Worst"	50.60	40.20	19.20	47.68

Vertical

Mode 1



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB/m)	(m)		(°)	(m)		(dBuV)	(dB/m)	(dB)	(dB)
PK	28.79999G	63.78	83.54	-19.76	11.72	1	Vertical	334	1.75	-	52.06	40.20	19.20	47.68
AV	28.80005G	61.31	63.54	-2.23	11.72	1	Vertical	334	1.75	"Worst"	49.59	40.20	19.20	47.68

Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

3.3.9 Test Result of Transmitter Radiated Unwanted Emissions (40GHz – 200GHz)

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm^2)	Test Result
76.507	23.9	0.50	83.270	-64.9	-23.97	3	3.5452	PASS
76.329	23.9	0.50	83.270	-64.9	-23.97	3	3.5452	PASS
Limit							**600**	-

3.3.10 Test Result of Transmitter Radiated Unwanted Emissions (200GHz – 231GHz)

Test Freq. (GHz)	Rx Gain (dBi)	Distance (m)	Read Worse Frequency (GHz)	Read Level (dBm)	EIRP (dBm)	Specification Distance (m)	Power Density (pW/cm^2)	Test Result
76.507	23.9	0.50	204.086	-73.47	-24.75	3	2.9600	PASS
76.329	23.9	0.50	204.086	-73.47	-24.75	3	2.9600	PASS
Limit							**1000**	-

3.4 Frequency Stability

3.4.1 Frequency Stability Limit

Frequency Stability Limit
Fundamental emissions must be contained within the frequency bands specified in this 76-81GHz band during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage.

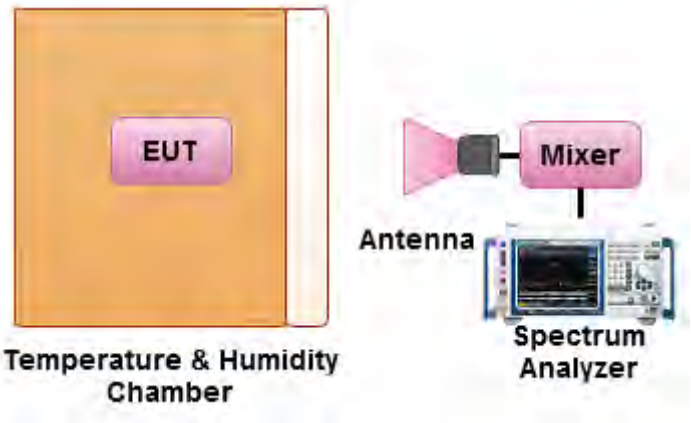
3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method	
☒	For the frequency stability shall be measured using one of the options below:
	☒ Refer as ANSI C63.10, clause 9.14 for frequency stability measurement.
☒	Refer as ANSI C63.10, clause 9 for radiated measurement.
	☒ Radiated test was conducted at far-field distance. the distance from the radiating element of the EUT to the edge of the far field may be calculated from [$r \geq 2D^2/\lambda$] r is the distance from the radiating element of the EUT to the edge of the far field, in m D is the largest dimension of both the radiating element and the test antenna (horn), in m λ is the wavelength of the emission under investigation [300/f (MHz)], in m
	☒ The mixer may be placed outside the chamber in front of the temperature chamber door, and the chamber door opened for each reading.

3.4.4 Test Setup

Frequency Stability


3.4.5 Test Result of Frequency Stability

For Radio 1:

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76510.518	1741	**within band**
-30	76510.332	1555	**within band**
-20	76509.435	658	**within band**
-10	76509.382	605	**within band**
0	76509.323	546	**within band**
10	76508.992	215	**within band**
20	76508.777	Reference	**within band**
30	76507.676	-1101	**within band**
40	76507.415	-1362	**within band**
50	76506.636	-2141	**within band**
60	76506.635	-2142	**within band**
70	76506.132	-2645	**within band**
80	76506.067	-2710	**within band**
85	76506.033	-2744	**within band**
Test Voltage: (Vdc)	**Measured Frequency (MHz)**	**Delta Frequency (kHz)**	**Limit (±kHz)**
10.2	76509.382	605	**within band**
12	76508.777	Reference	**within band**
13.8	76507.415	-1362	**within band**

For Radio 2:

Test Temperature: (°C)	Measured Frequency (MHz)	Delta Frequency (kHz)	Limit (±kHz)
-40	76333.726	2887	**within band**
-30	76333.544	2705	**within band**
-20	76332.91	2071	**within band**
-10	76333.205	2366	**within band**
0	76332.479	1640	**within band**
10	76331.933	1094	**within band**
20	76330.839	Reference	**within band**
30	76330.715	-124	**within band**
40	76330.441	-398	**within band**
50	76330.325	-514	**within band**
60	76329.758	-1081	**within band**
70	76329.757	-1082	**within band**
80	76329.755	-1084	**within band**
85	76328.683	-2156	**within band**
Test Voltage: (Vdc)	**Measured Frequency (MHz)**	**Delta Frequency (kHz)**	**Limit (±kHz)**
10.2	76331.933	1094	**within band**
12	76330.839	Reference	**within band**
13.8	76330.715	-124	**within band**

4 Test Equipment and Calibration Data

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Loop Antenna	Teseq	HLA 6121	65417	9kHz - 30 MHz	Oct. 16, 2024	Oct. 15, 2025	Radiation (03CH06-CB)
3m Semi Anechoic Chamber NSA	TDK	SAC-3M	03CH06-CB	30 MHz ~ 1 GHz	Aug. 02, 2024	Aug. 01, 2025	Radiation (03CH06-CB)
3m Semi Anechoic Chamber VSWR	TDK	SAC-3M	03CH06-CB	1GHz ~18GHz 3m	Oct. 08, 2024	Oct. 07, 2025	Radiation (03CH06-CB)
Bilog Antenna with 6 dB attenuator	TESEQ & EMCI	CBL6112D & N-6-06	37878 & AT-N0606	20MHz ~ 2GHz	Jul. 29, 2024	Jul. 28, 2025	Radiation (03CH06-CB)
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA 9120D-1292	1GHz~18GHz	Jul. 29, 2024	Jul. 28, 2025	Radiation (03CH06-CB)
Pre-Amplifier	Agilent	310N	187290	0.1MHz ~ 1GHz	Nov. 02, 2024	Nov. 01, 2025	Radiation (03CH06-CB)
Pre-Amplifier	EMCI	EMC12630SE	980383	1GHz ~ 18GHz	Jul. 31, 2024	Jul. 30, 2025	Radiation (03CH06-CB)
Signal analyzer	R&S	FSV3044	101667	9kHz~44GHz	Aug. 20, 2024	Aug. 19, 2025	Radiation (03CH06-CB)
EMI Test Receiver	R&S	ESR7	102172	9kHz ~ 7GHz	Oct. 21, 2024	Oct. 20, 2025	Radiation (03CH06-CB)
RF Cable-low	Woken	RG402	Low Cable-05+68	30MHz~1GHz	Oct. 24, 2024	Oct. 23, 2025	Radiation (03CH06-CB)
RF Cable-high	Woken	RG402	High Cable-05+68	1GHz~18GHz	Oct. 01, 2024	Sep. 30, 2025	Radiation (03CH06-CB)
Mixer	OML	M19HWA	U91113-1	40 GHz ~ 60 GHz	Apr. 23, 2024	Apr. 22, 2025	Radiation (03CH06-CB)
*Harmonic Mixer	R&S	FS-Z90	102135	60GHz~90GHz	Sep. 13, 2024	Sep. 12, 2026	Radiation (03CH06-CB)
*Harmonic Mixer	R&S	FS-Z140	101160	90GHz~140GHz	Feb. 22, 2023	Feb. 21, 2025	Radiation (03CH06-CB)
*Harmonic Mixer	R&S	FS-Z220	101065	140GHz~ 220GHz	Feb. 22, 2023	Feb. 21, 2025	Radiation (03CH06-CB)
*Harmonic Mixer	R&S	FS-Z325	101026	220GHz~ 325GHz	Feb. 22, 2023	Feb. 21, 2025	Radiation (03CH06-CB)
Standard Horn Antenna	Custom Microwave	M19RH	U91113-A	40 ~ 60 GHz	N.C.R.	N.C.R.	Radiation (03CH06-CB)
Standard Horn Antenna	Custom Microwave	M12RH	E91113-A	60 ~ 90 GHz	N.C.R.	N.C.R.	Radiation (03CH06-CB)
Standard Horn Antenna	Custom Microwave	M08RH	F91113-A	90 ~ 140 GHz	N.C.R.	N.C.R.	Radiation (03CH06-CB)
Standard Horn Antenna	Custom Microwave	M05RH	G91113-A	140 ~ 220 GHz	N.C.R.	N.C.R.	Radiation (03CH06-CB)
Standard Horn Antenna	Custom Microwave	M03RH	120320-A	220 ~ 325 GHz	N.C.R.	N.C.R.	Radiation (03CH06-CB)

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
Test Software	SPORTON	SENSE-EMI	V5.11.8	30MHz-40GHz	N.C.R.	N.C.R.	Radiation (03CH06-CB)
Spectrum analyzer	R&S	FSV40	101028	9kHz~40GHz	Dec. 22, 2023	Dec. 21, 2024	Radiation (TH03-CB)
Temp. and Humidity Chamber	Gaint Force	GTH-408-40-CP-AR	MAA1410-011	-40~100 degree	Aug. 30, 2024	Aug. 29, 2025	Radiation (TH03-CB)
RF Cable	Woken	RG402	High Cable-11	30MHz –18 GHz	Oct. 01, 2024	Sep. 30, 2025	Radiation (TH03-CB)
RF Cable	Woken	RG402	High Cable-12	30MHz –18 GHz	Oct. 01, 2024	Sep. 30, 2025	Radiation (TH03-CB)
RF Cable	Woken	RG402	High Cable-13	30MHz –18 GHz	Oct. 01, 2024	Sep. 30, 2025	Radiation (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-14	1 GHz –18 GHz	Oct. 01, 2024	Sep. 30, 2025	Radiation (TH03-CB)
RF Cable-high	Woken	RG402	High Cable-15	1 GHz –18 GHz	Oct. 01, 2024	Sep. 30, 2025	Radiation (TH03-CB)

Note: Calibration Interval of instruments listed above is one year.
N.C.R. means Non-Calibration required.