

TEST REPORT

FCC ID..... :	2AOKUNOTE13	
Test Report No..... :	TCT240318E069	
Date of issue..... :	Apr. 28, 2024	
Testing laboratory	SHENZHEN TONGCE TESTING LAB	
Testing location/ address:	2101 & 2201, Zhenchang Factory, Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China	
Applicant's name..... :	SHENZHEN TUGAO INTELLIGENT CO., LTD	
Address..... :	8th Floor, Bldg A, Jinggang Science&Technology Park, Fuyong, Bao'an District, Shenzhen, China	
Manufacturer's name ... :	SHENZHEN TUGAO INTELLIGENT CO., LTD	
Address..... :	8th Floor, Bldg A, Jinggang Science&Technology Park, Fuyong, Bao'an District, Shenzhen, China	
Standard(s)	FCC CFR Title 47 Part 2 FCC CFR Title 47 Part22 FCC CFR Title 47 Part24 FCC CFR Title 47 Part27	
Product Name..... :	Smartphone	
Trade Mark	HOTWAV	
Model/Type reference..... :	Note 13, Note, Note 11, Note 11 Pro, Note 15, Note 15 Pro, Note 16, Note 16 Pro, Note 17, Note 17 Pro, Note 18, Note 18 Pro, Note 19, Note 19 Pro, Note 20, Note 20 Pro, Note 21, Note 21 Pro	
Rating(s)..... :	Refer to EUT description of page 3	
Date of receipt of test item	Mar. 18, 2024	
Date (s) of performance of test..... :	Mar. 18, 2024 ~ Apr. 28, 2024	
Tested by (+signature) ... :	Aaron MO	
Check by (+signature).... :	Beryl ZHAO	
Approved by (+signature):	Tomsin	

General disclaimer:

This report shall not be reproduced except in full, without the written approval of SHENZHEN TONGCE TESTING LAB. This document may be altered or revised by SHENZHEN TONGCE TESTING LAB personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

TABLE OF CONTENTS

1. General Product Information	3
1.1. EUT description	3
1.2. Model(s) list.....	4
1.3. Emission Designator	4
1.4. Test Frequency	6
2. Test Result Summary	8
3. General Information.....	9
3.1. Test environment and mode.....	9
3.2. Description of Support Units.....	11
3.3. Configuration of Tested System	11
3.4. Measurement Results Explanation Example.....	11
4. Facilities and Accreditations	12
4.1. Facilities	12
4.2. Location	12
4.3. Measurement Uncertainty.....	12
5. Test Results and Measurement Data	13
5.1. Effective Radiated Power and Effective Isotropic Radiated Power Measurement	13
5.2. Peak to Average Ratio.....	15
5.3. 99% Occupied Bandwidth and 26dB Bandwidth Measurement	16
5.4. Band Edge and Conducted Spurious Emission Measurement	17
5.5. Field Strength of Spurious Radiation Measurement	19
5.6. Frequency Stability Measurement	31

Appendix B: Photographs of Test Setup

Appendix C: Photographs of EUT

**Test Data: Refer to Appendix For LTE Band 5, Appendix For LTE Band 7,
Appendix For LTE Band 41 and Appendix For LTE Band 66**

1. General Product Information

1.1. EUT description

Product Name.....:	Smartphone
Model/Type reference.....:	Note 13
Sample Number.....:	TCT240318E060-0101
Tx Frequency.....:	LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 41: 2535 MHz ~ 2655 MHz LTE Band 66: 1710 MHz ~ 1780 MHz
Rx Frequency	LTE Band 5: 869 MHz ~ 894 MHz LTE Band 7: 2620 MHz ~ 2690 MHz LTE Band 41: 2535 MHz ~ 2655 MHz LTE Band 66: 2110 MHz ~ 2180 MHz
Bandwidth.....:	LTE Band 5: 1.4MHz /3MHz /5MHz /10MHz LTE Band 7: 5MHz /10MHz/15MHz /20MHz LTE Band 41: 5MHz /10MHz /15MHz /20MHz LTE Band 66: 1.4MHz /3MHz /5MHz /10MHz /15MHz /20MHz
Maximum Output Power to Antenna.....:	LTE Band 5: 16.72dBm LTE Band 7: 19.24dBm LTE Band 41: 19.95dBm LTE Band 66: 19.94dBm
99% Occupied Bandwidth.....:	LTE Band 5: 9M03G7D LTE Band 7: 18M1W7D LTE Band 41: 18M1G7D LTE Band 66: 18M1W7D
Type of Modulation.....:	QPSK/16QAM
Antenna Type.....:	Internal Antenna
Antenna Gain.....:	LTE Band 5: -3.86dBi LTE Band 7: -3.24dBi LTE Band 41: -2.96dBi LTE Band 66: -3.03dBi
Rating(s).....:	Adapter Information: Model: HJ-0502000W2-US Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 5.0V, 2.0A, 10.0W Rechargeable Li-ion Battery DC 3.87V

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2. Model(s) list

No.	Model No.	Tested with
1	Note 13	☒
Other models	Note, Note 11, Note 11 Pro, Note 15, Note 15 Pro, Note 16, Note 16 Pro, Note 17, Note 17 Pro, Note 18, Note 18 Pro, Note 19, Note 19 Pro, Note 20, Note 20 Pro, Note 21, Note 21 Pro	☐

Note: Note 13 is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names. So the test data of Note 13 can represent the remaining models.

1.3. Emission Designator

LTE Band 5	QPSK		16QAM	
BW(MHz)	Emission Designator (99%OBW)	Maximum ERP(W)	Emission Designator (99%OBW)	Maximum ERP(W)
1.4	1M09G7D	0.047	1M09W7D	0.035
3	2M74G7D	0.045	2M75W7D	0.041
5	4M50G7D	0.047	4M50W7D	0.039
10	9M03G7D	0.045	9M00W7D	0.040

LTE Band 7	QPSK		16QAM	
BW(MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	4M50G7D	0.084	4M52W7D	0.070
10	9M03G7D	0.082	8M97W7D	0.072
15	13M5G7D	0.079	13M5W7D	0.073
20	18M0G7D	0.079	18M1W7D	0.075

LTE Band 41	QPSK		16QAM	
BW(MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	4M50G7D	0.091	4M52W7D	0.063
10	9M00G7D	0.093	9M00W7D	0.063
15	13M5G7D	0.099	13M5W7D	0.065
20	18M1G7D	0.098	18M0W7D	0.066

LTE Band 66	QPSK		16QAM	
BW(MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
1.4	1M10G7D	0.089	1M10W7D	0.069
3	2M74G7D	0.085	2M74W7D	0.074
5	4M50G7D	0.090	4M50W7D	0.076
10	9M03G7D	0.084	8M97W7D	0.075
15	13M5G7D	0.086	13M5W7D	0.075
20	18M0G7D	0.090	18M1W7D	0.075

1.4. Test Frequency

LTE Band 5(1.4MHz)		LTE Band 5(3MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
20407	824.7	20415	825.5
20525	836.5	20525	836.5
20643	848.3	20635	847.5
LTE Band 5(5MHz)		LTE Band 5(10MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
20425	826.5	20450	829
20525	836.5	20525	836.5
20625	846.5	20600	844

LTE Band 7(5MHz)		LTE Band 7(10MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
20775	2502.5	20800	2505.0
21100	2535	21100	2535
21425	2567.5	21400	2565.0
LTE Band 7(15MHz)		LTE Band 7(20MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
20825	2507.5	20850	2510.0
21100	2535	21100	2535
21375	2562.5	21350	2560.0

LTE Band 41(5MHz)		LTE Band 41(10MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
40065	2537.5	40090	2540
40640	2595	40640	2595
41215	2652.5	41190	2650
LTE Band 41(15MHz)		LTE Band 41(20MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
40115	2542.5	40140	2545
40640	2595	40640	2595
41165	2647.5	41140	2645

LTE Band 66(1.4MHz)		LTE Band 66(3MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
131979	1710.7	131987	1711.5
132322	1745	132322	1745
132665	1779.3	132657	1778.5
LTE Band 66(5MHz)		LTE Band 66(10MHz)	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
131997	1712.5	132022	1715
132322	1745	132322	1745
132647	1777.5	132622	1775
LTE Band 66(15MHz)		LTE Band 66(20MHz)	
132047	1717.5	132072	1720
132322	1745	132322	1745
132597	1772.5	132572	1770

2. Test Result Summary

Requirement	CFR 47 Section	Result
Conducted Output Power	§2.1046; §22.913; §24.232(c); §27.50(d); §27.50(c); §27.50(b)	PASS
Peak-to-Average Ratio	§2.1046; §24.232(d) §27.50(d); §27.50(c); §27.50(b)	PASS
Effective Radiated Power	§2.1046; §22.913; §24.232(c); §27.50(d); §27.50(c); §27.50(b)	PASS
Equivalent Isotropic Radiated Power	§2.1046; §22.913; §24.232(c); §27.50(d); §27.50(c); §27.50(b)	PASS
Occupied Bandwidth	§2.1049; §24.238(b); §27.53	PASS
Band Edge	§2.1051; §22.917(a); §27.53(h); §27.53(c); §27.53(g); §24.238(a)	PASS
Conducted Spurious Emission	§2.1051; §22.917(a); §27.53(h); §27.53(g); §27.53(c); §24.238(a)	PASS
Field Strength of Spurious Radiation	§2.1053; §22.917(a); §27.53(g); §27.53(c); §27.53(h); §24.238(a)	PASS
Frequency Stability for Temperature & Voltage	§2.1055; §22.355; §27.54; §24.235	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.
5. The EUT has two appearance types, only the camera position is different, and both have been tested, only camera position 1 has the worst test data.

3. General Information

3.1. Test environment and mode

Operating Environment:

Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar

Keep the EUT in communication with CMW500 and select channel with modulation
All modes and data rates and positions were investigated.
Test modes are chosen to be reported as the worst case configuration below:

Test Mode		
Band	Radiated TCs	Conducted TCs
LTE Band 5	QPSK Link (1.4MHz / 3MHz / 5MHz / 10MHz)	16QAM Link (1.4MHz / 3MHz / 5MHz / 10MHz)
LTE Band 7	QPSK Link (5MHz / 10MHz / 15MHz / 20MHz)	16QAM Link (5MHz / 10MHz / 15MHz / 20MHz)
LTE Band 41	QPSK Link (5MHz / 10MHz / 15MHz / 20MHz)	16QAM Link (5MHz / 10MHz / 15MHz / 20MHz)
LTE Band 66	QPSK Link (1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz)	16QAM Link (1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz)

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas License Digital Systems v03 with maximum output power. Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission. The sample was placed 0.8m/1.5m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarization. The emissions worst-case are shown in Test Results of the following pages.

Test Items	Band	Bandwidth (MHz)						Modulation		RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	1	Half	Full	L	M	H
	5	v	v	v	v	-	-	v	v	v	v	v	v	v	v
	7	-	-	v	v	v	v	v	v	v	v	v	v	v	v
	41	-	-	v	v	v	v	v	v	v	v	v	v	v	v
	66	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Peak-to-Average Ratio	5	v	v	v	v	-	-	v	v	v	v	v	v	v	v
	7	-	-	v	v	v	v	v	v	v	v	v	v	v	v
	41	-	-	v	v	v	v	v	v	v	v	v	v	v	v
	66	v	v	v	v	v	v	v	v	v	v	v	v	v	v
26dB and 99% Bandwidth	5	v	v	v	v	-	-	v	v	v	v	v	v	v	v
	7	-	-	v	v	v	v	v	v	v	v	v	v	v	v
	41	-	-	v	v	v	v	v	v	-	-	v	v	v	v
	66	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Conducted Band Edge	5	v	v	v	v	-	-	v	v	v	v	v	v	-	v
	7	-	-	v	v	v	v	v	v	v	v	v	v	-	v
	41	-	-	v	v	v	v	v	v	v	-	v	v	-	v
	66	v	v	v	v	v	v	v	v	v	v	v	v	-	v
Conducted Spurious Emission	5	v	v	v	v	-	-	v	v	v	-	-	v	v	v
	7	-	-	v	v	v	v	v	v	v	-	-	v	v	v
	41	-	-	v	v	v	v	v	v	v	-	-	v	v	v
	66	v	v	v	v	v	v	v	v	v	-	-	v	v	v
Frequency Stability	5	v	-	-	-	-	-	v	v	v	-	-	v	v	v
	7	-	-	v	-	-	-	v	v	v	-	-	v	v	v
	41	-	-	v	-	-	-	v	v	v	-	-	v	v	v
	66	v	-	-	-	-	-	v	v	v	-	-	v	v	v
E.R.P./ E.I.R.P.	5	v	v	v	v	-	-	v	v	v	v	v	v	v	v
	7	-	-	v	v	v	v	v	v	v	v	v	v	v	v
	41	-	-	v	v	v	v	v	v	v	v	v	v	v	v
	66	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Radiated Spurious Emission	5	-	-	-	v	-	-	v	v	v	-	-	v	v	v
	7	-	-	v	-	-	-	v	v	v	-	-	v	v	v
	41	-	-	-	-	-	v	v	v	v	-	-	v	v	v
	66	-	-	-	-	-	v	v	v	v	-	-	v	v	v
Note	1. The mark "v" means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported.														

3.2. Description of Support Units

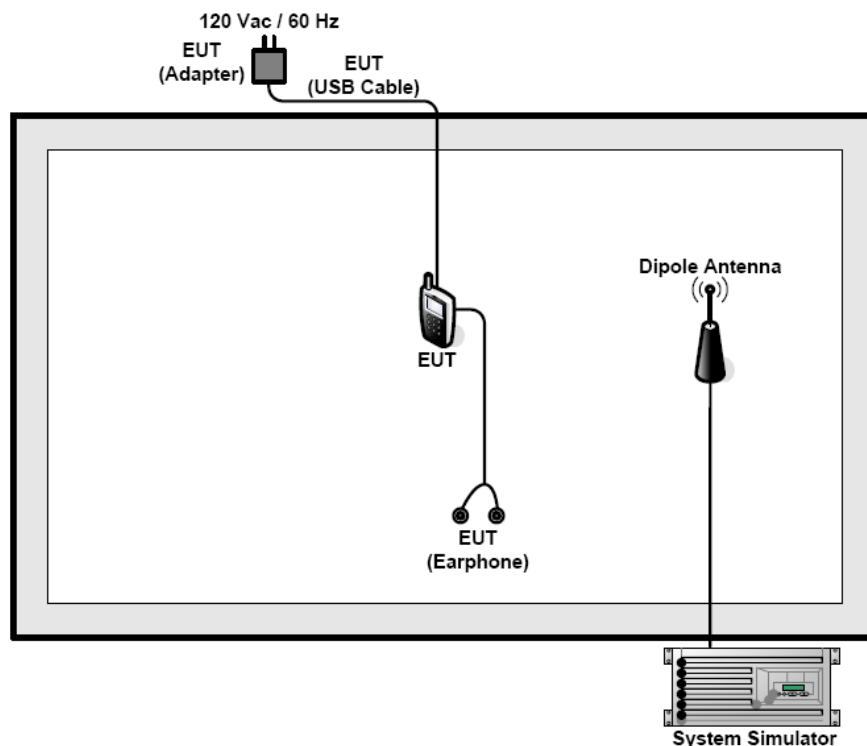
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3.3. Configuration of Tested System



3.4. Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level. The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

$$\text{Offset} = \text{RF cable loss} + \text{attenuator factor}.$$

4. Facilities and Accreditations

4.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 645098

SHENZHEN TONGCE TESTING LAB

Designation Number: CN1205

The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

SHENZHEN TONGCE TESTING LAB

CAB identifier: CN0031

The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

SHENZHEN TONGCE TESTING LAB

Address: 2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China

TEL: +86-755-27673339

4.3. Measurement Uncertainty

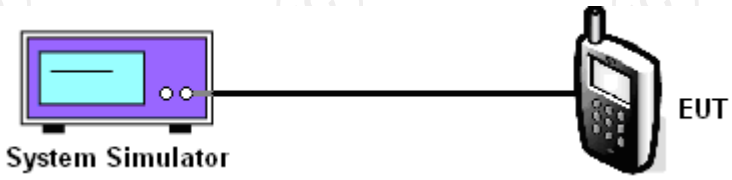
The reported uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB
5	All emissions, radiated(1 GHz - 18 GHz)	± 4.22 dB
6	All emissions, radiated(18 GHz- 40 GHz)	± 4.36 dB

5. Test Results and Measurement Data

5.1. Effective Radiated Power and Effective Isotropic Radiated Power Measurement

5.1.1. Test Specification

Test Requirement:	Refer to section 2
Test Method:	FCC part 2.1046
Limit:	LTE Band 5: 7W LTE Band 7: 2W LTE Band 41: 2W LTE Band 66: 1W
Test Setup:	 The diagram illustrates the test setup. On the left is a 'System Simulator' represented by a computer monitor with a blue screen. A black cable connects the simulator to an 'EUT' (Equipment Under Test), which is depicted as a mobile phone on the right.
Test Procedure:	1. The transmitter output port was connected to the system simulator. 2. Set EUT at maximum power through system simulator. 3. Select lowest, middle, highest channels for each band and different modulation. 4. Measure and record the power level from the system simulator. 5. Calculate the ERP and EIRP The relevant equation for determining the ERP or EIRP from the conducted RF output power measured using the guidance provided above is: $\text{ERP or EIRP} = P_{\text{Meas}} + G_T - L_C$ where: ERP or EIRP = effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, typically dBW or dBm); P_{Meas} = measured transmitter output power or PSD, in dBm or dBW; G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP); L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB. <i>Note: For personal/portable radios utilizing an integral antenna, the factor L_C is typically negligible. However, in a</i>

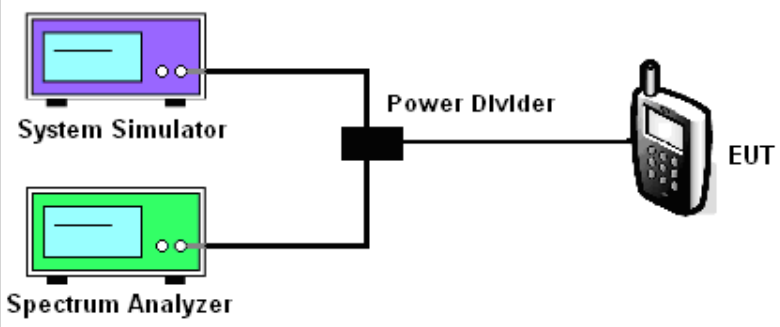
	<i>fixed station transmit system that utilizes a long cable run between the transmitter and the transmitting antenna, this factor can be significant.</i>
Test Result:	PASS

5.1.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Wideband Radio Communication Tester	R&S	CMW500	114220	Jan. 31, 2025
Combiner Box	Ascentest	AT890-RFB	/	/

5.2. Peak to Average Ratio

5.2.1. Test Specification

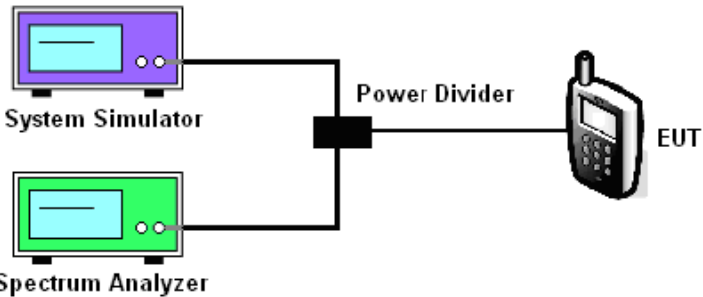
Test Requirement:	Refer to section 2
Test Method:	FCC KDB 971168 D01v03
Limit:	The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.
Test Setup:	 The diagram illustrates the test setup. A System Simulator (represented by a purple monitor icon) and a Spectrum Analyzer (represented by a green monitor icon) are connected to a central Power Divider (represented by a black square icon). The Power Divider is then connected to the EUT (Equipment Under Test, represented by a mobile phone icon).
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 5.7.1. 2. The EUT was connected to spectrum analyzer and system simulator via a power divider. 3. Set EUT to transmit at maximum output power. 4. Set the CCDF (Complementary Cumulative Distribution Function) option of the spectrum analyzer. Record the maximum PAPR level associated with a probability of 0.1%.
Test Result:	PASS

5.2.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Wideband Radio Communication Tester	R&S	CMW500	114220	Jan. 31, 2025
Spectrum Analyzer	R&S	FSV40-N	102188	Jan. 31, 2025
Combiner Box	Ascentest	AT890-RFB	/	/

5.3. 99% Occupied Bandwidth and 26dB Bandwidth Measurement

5.3.1. Test Specification

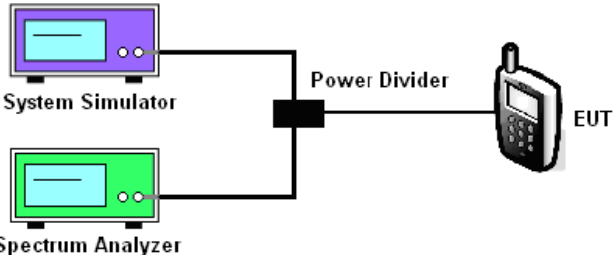
Test Requirement:	Refer to section 2
Test Method:	FCC part 2.1049
Limit:	N/A
Test Setup:	 The diagram shows a System Simulator (purple box) and a Spectrum Analyzer (green box) connected to a Power Divider (black box). The Power Divider is connected to the EUT (Equipment Under Test, a mobile phone). The System Simulator and Spectrum Analyzer are connected to the Power Divider via cables.
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 4.2. 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider. 3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 4. The 99% occupied bandwidth were measured, set RBW= 1% of OBW, VBW= 3*RBW, sample detector, trace maximum hold. 5. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW= 3*RBW, peak detector, trace maximum hold.
Test Result:	PASS

5.3.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Wideband Radio Communication Tester	R&S	CMW500	114220	Jan. 31, 2025
Spectrum Analyzer	R&S	FSV40-N	102188	Jan. 31, 2025
Combiner Box	Ascentest	AT890-RFB	/	/

5.4. Band Edge and Conducted Spurious Emission Measurement

5.4.1. Test Specification

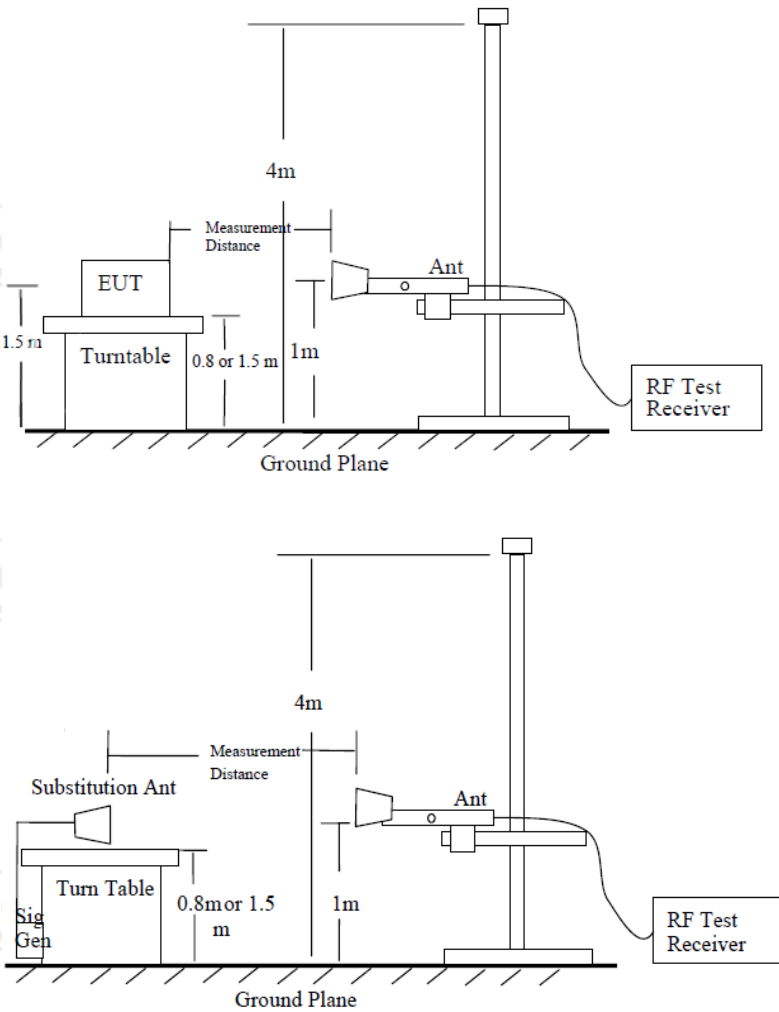
Test Requirement:	Refer to section 2
Test Method:	FCC part2.1051
Limit:	-13dbm Band 13: -13dBm/-35dbm/-40dbm Band 41: -10dBm/-13dbm/-25dbm
Test Setup:	 The diagram shows a System Simulator (top) and a Spectrum Analyzer (bottom) connected to a central Power Divider. The Power Divider is then connected to the EUT (Equipment Under Test), represented by a mobile phone icon.
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 6.0. 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider. 3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement. 4. The band edges of low and high channels for the highest RF powers were measured. 5. The conducted spurious emission for the whole frequency range was taken. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band. 7. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power $P(\text{Watts}) = P(\text{W}) - [43 + 10\log(P)] (\text{dB}) = [30 + 10\log(P)] (\text{dBm}) - [43 + 10\log(P)] (\text{dB}) = -13\text{dBm}$. For Band 17, the limit line is derived from $55 + 10\log(P)$ dB below the transmitter power
Test Result:	PASS

5.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Wideband Radio Communication Tester	R&S	CMW500	114220	Jan. 31, 2025
Spectrum Analyzer	R&S	FSV40-N	102188	Jan. 31, 2025
Combiner Box	Ascentest	AT890-RFB	/	/

5.5. Field Strength of Spurious Radiation Measurement

5.5.1. Test Specification

Test Requirement:	Refer to section 2
Test Method:	FCC part 2.1053
Limit:	30MHz~20GHz -13dBm
Test setup:	
Test Procedure:	1. The testing follows FCC KDB 971168 D01v03 Section 5.8 and ANSI / TIA-603-D-2010 Section 2.2.12. 2. The EUT was placed on a rotatable wooden table 0.8 meters above the ground. 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower. 4. The table was rotated 360 degrees to determine the position of the highest spurious emission. 5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical

	polarizations. 6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission. 7. A horn antenna was substituted in place of the EUT and was driven by a signal generator. 8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission. 9. Taking the record of output power at antenna port. 10. Repeat step 7 to step 8 for another polarization. 11. $EIRP\ (dBm) = S.G.\ Power - Tx\ Cable\ Loss + Tx\ Antenna\ Gain$ 12. $ERP\ (dBm) = EIRP - 2.15$ 13. The RF fundamental frequency should be excluded against the limit line in the operating frequency band. 14. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts) $= P(W) - [43 + 10\log(P)]\ (dB)$ $= [30 + 10\log(P)]\ (dBm) - [43 + 10\log(P)]\ (dB)$ $= -13dBm.$
Test results:	PASS
Remark:	All modulations have been tested, but only the worst modulation show in this test item.

5.5.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Universal Radio Communication Tester	R&S	CMU200	110188	Jun. 28, 2024
Spectrum Analyzer	R&S	FSQ40	200061	Jun. 29, 2024
Signal Generator	HP	83623B	3614A00396	Feb. 24, 2025
Broadband Antenna	Schwarzbeck	VULB9163	340	Jul. 01, 2024
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Jul. 01, 2024
Broadband Antenna	Schwarzbeck	VULB9163	412	Jul. 01, 2024
Horn Antenna	Schwarzbeck	BBHA 9120D	1201	Jul. 01, 2024
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Feb. 02, 2025
Coaxial cable	SKET	RC-18G-N-M	/	Jan. 31, 2025
Coaxial cable	SKET	RC_40G-K-M	/	Jan. 31, 2025
Antenna Mast	Keleto	RE-AM	/	/
EMI Test Software	Shurple Technology	EZ-EMC	/	/

5.5.3. Test Data

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note: 1. Emission Level=Reading+ Cable loss+Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

Band	Band 5(QPSK, 10MHz)	Test channel:	Lowest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1658.00	Vertical	-61.25	23.15	-38.10	-13.00	PASS
2487.00	V	-65.86	23.24	-42.62		
3316.00	V	-79.74	23.35	-56.39		
1658.00	Horizontal	-60.21	23.15	-37.06		
2487.00	H	-61.04	23.24	-37.80		
3316.00	H	-78.36	23.35	-55.01		

Band	Band 5(QPSK, 10MHz)	Test channel:	Middle
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1673.00	Vertical	-59.32	23.17	-36.15	-13.00	PASS
2509.50	V	-71.21	23.26	-47.95		
3346.00	V	-78.19	23.38	-54.81		
1673.00	Horizontal	-58.30	23.17	-35.13		
2509.50	H	-64.97	23.26	-41.71		
3346.00	H	-78.42	23.38	-55.04		

Band	Band 5(QPSK, 10MHz)	Test channel:	Highest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1688.00	Vertical	-63.02	23.19	-39.83	-13.00	PASS
2532.00	V	-72.49	23.28	-49.21		
3376.00	V	-83.73	23.40	-60.33		
1688.00	Horizontal	-57.42	23.19	-34.23		
2532.00	H	-67.20	23.28	-43.92		
3376.00	H	-83.44	23.40	-60.04		

Band	Band 5(16QAM, 10MHz)	Test channel:	Lowest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1658.00	Vertical	-59.92	23.15	-36.77	-13.00	PASS
2487.00	V	-64.48	23.24	-41.24		
3316.00	V	-79.55	23.35	-56.20		
1658.00	Horizontal	-58.72	23.15	-35.57		
2487.00	H	-65.12	23.24	-41.88		
3316.00	H	-78.49	23.35	-55.14		

Band	Band 5(16QAM, 10MHz)	Test channel:	Middle
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1673.00	Vertical	-59.82	23.17	-36.65	-13.00	PASS
2509.50	V	-71.52	23.26	-48.26		
3346.00	V	-78.17	23.38	-54.79		
1673.00	Horizontal	-56.06	23.17	-32.89		
2509.50	H	-66.89	23.26	-43.63		
3346.00	H	-78.13	23.38	-54.75		

Band	Band 5(16QAM, 10MHz)	Test channel:	Highest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
1688.00	Vertical	-62.64	23.19	-39.45	-13.00	PASS
2532.00	V	-71.22	23.28	-47.94		
3376.00	V	-79.73	23.40	-56.33		
1688.00	Horizontal	-58.95	23.19	-35.76		
2532.00	H	-67.43	23.28	-44.15		
3376.00	H	-82.05	23.40	-58.65		

Band	Band 7(QPSK, 20MHz)	Test channel:	Lowest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5020.00	Vertical	-61.89	23.11	-38.78	-25.00	PASS
7530.00	V	-65.14	23.25	-41.89		
10040.00	V	-80.77	23.38	-57.39		
5020.00	Horizontal	-59.28	23.11	-36.17		
7530.00	H	-62.06	23.25	-38.81		
10040.00	H	-77.91	23.38	-54.53		

Band	Band 7(QPSK, 20MHz)	Test channel:	Middle
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5070.00	Vertical	-58.69	23.14	-35.55	-25.00	PASS
7605.00	V	-71.11	23.23	-47.88		
10140.00	V	-79.58	23.34	-56.24		
5070.00	Horizontal	-57.46	23.14	-34.32		
7605.00	H	-64.56	23.23	-41.33		
10140.00	H	-78.03	23.34	-54.69		

Band	Band 7(QPSK, 20MHz)	Test channel:	Highest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5120.00	Vertical	-61.29	23.17	-38.12	-25.00	PASS
7680.00	V	-71.14	23.25	-47.89		
10240.00	V	-84.70	23.40	-61.30		
5120.00	Horizontal	-58.96	23.17	-35.79		
7680.00	H	-67.47	23.25	-44.22		
10240.00	H	-81.11	23.40	-57.71		

Band	Band 7(16QAM, 20MHz)	Test channel:	Lowest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5020.00	Vertical	-59.73	23.11	-36.62	-25.00	PASS
7530.00	V	-63.03	23.25	-39.78		
10040.00	V	-81.27	23.38	-57.89		
5020.00	Horizontal	-60.09	23.11	-36.98		
7530.00	H	-64.75	23.25	-41.50		
10040.00	H	-78.08	23.38	-54.70		

Band	Band 7(16QAM, 20MHz)	Test channel:	Middle
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5070.00	Vertical	-59.03	23.14	-35.89	-25.00	PASS
7605.00	V	-70.54	23.23	-47.31		
10140.00	V	-80.04	23.34	-56.70		
5070.00	Horizontal	-57.93	23.14	-34.79		
7605.00	H	-65.45	23.23	-42.22		
10140.00	H	-79.38	23.34	-56.04		

Band	Band 7(16QAM, 20MHz)	Test channel:	Highest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5120.00	Vertical	-62.07	23.17	-38.90	-25.00	PASS
7680.00	V	-70.93	23.25	-47.68		
10240.00	V	-79.04	23.40	-55.64		
5120.00	Horizontal	-57.32	23.17	-34.15		
7680.00	H	-67.19	23.25	-43.94		
10240.00	H	-80.28	23.40	-56.88		

Band	Band 41(QPSK, 20MHz)	Test channel:	Lowest
Test mode:		Temperature:	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5012.00	Vertical	-61.33	22.16	-39.17	-25.00	PASS
7518.00	V	-67.18	22.99	-44.19		
10024.00	V	-81.40	23.04	-58.36		
5012.00	Horizontal	-61.81	22.16	-39.65		
7518.00	H	-63.72	22.99	-40.73		
10024.00	H	-79.95	23.04	-56.91		

Band	Band 41(QPSK, 20MHz)	Test channel:	Middle
Test mode:		Temperature:	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5186.00	Vertical	-62.10	22.76	-39.34	-25.00	PASS
7779.00	V	-71.08	23.07	-48.01		
10372.00	V	-81.40	23.11	-58.29		
5186.00	Horizontal	-58.02	22.76	-35.26		
7779.00	H	-64.71	23.07	-41.64		
10372.00	H	-79.12	23.11	-56.01		

Band	Band 41(QPSK, 20MHz)	Test channel:	Highest
Test mode:		Temperature:	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5360.00	Vertical	-63.98	22.42	-41.56	-25.00	PASS
8040.00	V	-73.06	22.33	-50.73		
10720.00	V	-84.44	23.00	-61.44		
5360.00	Horizontal	-58.13	22.42	-35.71		
8040.00	H	-66.08	22.33	-43.75		
10720.00	H	-83.45	23.00	-60.45		

Band	Band 41(16QAM, 20MHz)	Test channel:	Lowest
Test mode:		Temperature:	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5012.00	Vertical	-61.00	22.16	-38.84	-25.00	PASS
7518.00	V	-64.17	22.99	-41.18		
10024.00	V	-82.36	23.04	-59.32		
5012.00	Horizontal	-59.76	22.16	-37.60		
7518.00	H	-65.84	22.99	-42.85		
10024.00	H	-79.19	23.04	-56.15		

Band	Band 41(16QAM, 20MHz)	Test channel:	Middle
Test mode:		Temperature:	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5186.00	Vertical	-60.33	22.76	-37.57	-25.00	PASS
7779.00	V	-71.42	23.07	-48.35		
10372.00	V	-79.09	23.11	-55.98		
5186.00	Horizontal	-59.37	22.76	-36.61		
7779.00	H	-66.50	23.07	-43.43		
10372.00	H	-79.64	23.11	-56.53		

Band	Band 41(16QAM, 20MHz)	Test channel:	Highest
Test mode:		Temperature:	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
5360.00	Vertical	-62.02	22.42	-39.60	-25.00	PASS
8040.00	V	-71.47	22.33	-49.14		
10720.00	V	-80.26	23.00	-57.26		
5360.00	Horizontal	-59.57	22.42	-37.15		
8040.00	H	-67.11	22.33	-44.78		
10720.00	H	-82.03	23.00	-59.03		

Band	Band 66(QPSK, 20MHz)	Test channel:	Lowest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3440.00	Vertical	-61.02	23.40	-37.62	-13.00	PASS
5160.00	V	-65.16	23.69	-41.47		
6880.00	V	-81.46	23.75	-57.71		
3440.00	Horizontal	-61.14	23.40	-37.74		
5160.00	H	-64.37	23.69	-40.68		
6880.00	H	-67.16	23.75	-43.41		

Band	Band 66(QPSK, 20MHz)	Test channel:	Middle
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3490.00	Vertical	-58.00	23.42	-34.58	-13.00	PASS
5235.00	V	-70.02	23.73	-46.29		
6980.00	V	-79.13	23.79	-55.34		
3490.00	Horizontal	-56.45	23.42	-33.03		
5235.00	H	-65.77	23.73	-42.04		
6980.00	H	-78.98	23.79	-55.19		

Band	Band 66(QPSK, 20MHz)	Test channel:	Highest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3540.00	Vertical	-61.12	23.46	-37.66	-13.00	PASS
5310.00	V	-71.97	23.77	-48.20		
7080.00	V	-83.30	23.81	-59.49		
3540.00	Horizontal	-56.16	23.46	-32.70		
5310.00	H	-66.05	23.77	-42.28		
7080.00	H	-82.27	23.81	-58.46		

Band	Band 66(16QAM, 20MHz)	Test channel:	Lowest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3440.00	Vertical	-60.14	23.40	-36.74	-13.00	PASS
5160.00	V	-64.69	23.69	-41.00		
6880.00	V	-80.01	23.75	-56.26		
3440.00	Horizontal	-57.33	23.40	-33.93		
5160.00	H	-64.91	23.69	-41.22		
6880.00	H	-77.21	23.75	-53.46		

Band	Band 66(16QAM, 20MHz)	Test channel:	Middle
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3490.00	Vertical	-59.01	23.42	-35.59	-13.00	PASS
5235.00	V	-71.23	23.73	-47.50		
6980.00	V	-79.41	23.79	-55.62		
3490.00	Horizontal	-57.25	23.42	-33.83		
5235.00	H	-64.74	23.73	-41.01		
6980.00	H	-78.76	23.79	-54.97		

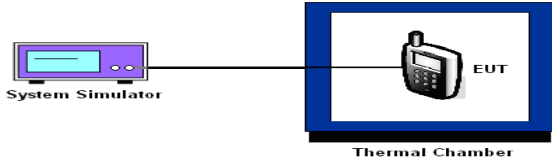
Band	Band 66(16QAM, 20MHz)	Test channel:	Highest
Test mode:		Temperature :	25°C
		Relative Humidity:	56%

Note: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

Frequency (MHz)	Spurious Emission				Limit (dBm)	Result
	Polarization	Level (dBm)	Correction Factor (dB)	Spurious emissions (dBm)		
3540.00	Vertical	-61.07	23.46	-37.61	-13.00	PASS
5310.00	V	-70.29	23.77	-46.52		
7080.00	V	-78.98	23.81	-55.17		
3540.00	Horizontal	-56.24	23.46	-32.78		
5310.00	H	-66.58	23.77	-42.81		
7080.00	H	-80.13	23.81	-56.32		

5.6. Frequency Stability Measurement

5.6.1. Test Specification

Test Requirement:	FCC part 27.54, FCC part 22.355, 24.235
Test Method:	FCC Part 2.1055
Limit:	±2.5 ppm
Test Setup:	 The diagram illustrates the test setup. On the left, a 'System Simulator' is connected by a cable to a 'Thermal Chamber'. Inside the thermal chamber, the 'EUT' (Equipment Under Test) is positioned.
Test Procedure:	Test Procedures for Temperature Variation 1. The testing follows FCC KDB 971168 D01v03 Section 9.0. 2. The EUT was set up in the thermal chamber and connected with the system simulator. 3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute. 4. With power OFF, the temperature was raised in 10°C steps up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute. Test Procedures for Voltage Variation 1. The testing follows FCC KDB 971168 D01v03 Section 9.0. 2. The EUT was placed in a temperature chamber at 25±5° C and connected with the system simulator. 3. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT. 4. The variation in frequency was measured for the worst case. 5. The worst case(worst bandwidth) for frequency stability reported in the Test Data. The worst bandwidth is as follow: 1.4M is for LTE Band 5, 5M is for LTE Band 7, 5M is for LTE Band 41, 1.4M is for LTE Band 66
Test Result:	PASS

5.6.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Wideband Radio Communication Tester	R&S	CMW500	114220	Jan.31, 2025
Programable tempratuce and humidity chamber	JQ	JQ-2000	/	Jun. 28, 2024
DC power supply	Kingrang	KR3005K	/	Jun. 28, 2024
Combiner Box	AT890-RFB	Ascentest	/	/

Appendix B: Photographs of Test Setup

Refer to the test report No. TCT240318E068

Appendix C: Photographs of EUT

Refer to the test report No. TCT240318E060

Test Data for Appendix Refer to Appendix For LTE Band 5, Appendix For LTE Band 7, Appendix For LTE Band 41 and Appendix For LTE Band 66

*******END OF REPORT*******