

Credence ID LLC

# TEST REPORT

**SCOPE OF WORK**

FCC Testing – CT3-CID-16-4G-011

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# FCC

# RF Test Report

*For*

**Credence ID LLC**

**Product Name: Rugged Handheld Device**

**Model Number: CT3-CID-16-4G-011**

**FCC ID: 2AMBZ-CT3-16-4G-011**

**Report No: 230315012SZN-005**

Tested and Prepared by:

Approved by:

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*Date: 13 July 2023*

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## 1. Summary of Test Result

Applicant:	Credence ID LLC
Address:	2335 Broadway, Suite 100, Oakland, California, 94612, United States
Product name:	Rugged Handheld Device
Model Number:	CT3-CID-16-4G-011
FCC ID:	2AMBZ-CT3-16-4G-011
Report number:	230315012SZN-005
Date of Test	15 March 2023 to 15 May 2023

The above equipment was tested by Intertek Testing Services Shenzhen Ltd. Longhua Branch. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI 63.26:2015 and KDB 971168 D01. This device is in compliance with FCC rules as following:

47 CFR FCC Part 02:2021  
47 CFR FCC Part 22:2021  
47 CFR FCC Part 24:2021  
47 CFR FCC Part 27:2021  
47 CFR FCC Part 90:2021

The test results of this report relate only to the tested sample identified in this report.

## 1.1 Band 2 PCS Band (1850-1910MHz paired with 1930-1990MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232	EIRP $\leq 2$ W	Appendix A	Pass
Peak-Average Ratio	§2.1046, §24.232	Limit $\leq 13$ dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §24.238	$\leq -13$ dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §24.238	$\leq -13$ dBm/1 MHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §24.238	$\leq -13$ dBm/1 MHz.	Appendix G	Pass
Frequency Stability	§2.1055, §24.235	$\leq \pm 2.5$ ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

## 1.2 Band 4 AWS Band (1710-1755MHz paired with 2110-2155MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)	EIRP $\leq 1$ W	Appendix A	Pass
Peak-Average Ratio	§2.1046, §27.50(d)	Limit $\leq 13$ dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(h)	$\leq -13$ dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	$\leq -13$ dBm/1 MHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	$\leq -13$ dBm/1 MHz.	Appendix G	Pass
Frequency Stability	§2.1055, §27.54	$\leq \pm 2.5$ ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

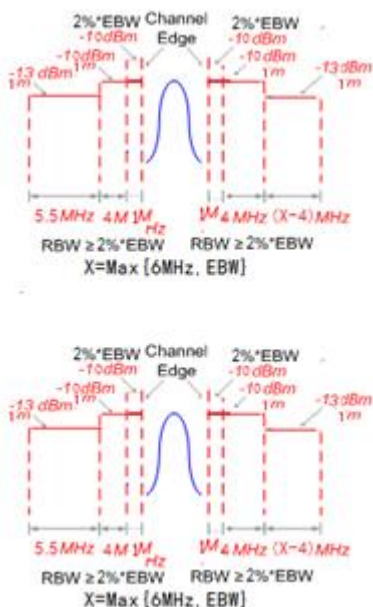
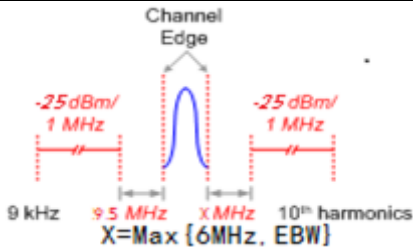
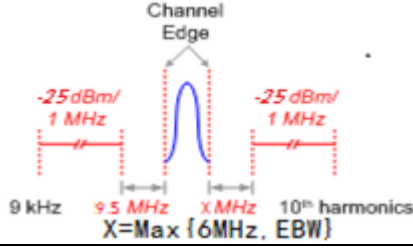
### 1.3 Band 5 Cellular Band (824-849MHz paired with 869-894MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	<del>§</del> 2.1046, <del>§</del> 22.913	FCC: ERP $\leq$ 7 W.	Appendix A	Pass
Peak-Average Ratio	--	--	Appendix B	Pass
Modulation Characteristics	<del>§</del> 2.1047	Digital modulation	Appendix C	Pass
Bandwidth	<del>§</del> 2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	<del>§</del> 2.1051, <del>§</del> 22.917	$\leq$ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	<del>§</del> 2.1051, <del>§</del> 22.917	FCC: $\leq$ -13 dBm/100 kHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	<del>§</del> 2.1053, <del>§</del> 22.917	FCC: $\leq$ -13 dBm/100 kHz.	Appendix G	Pass
Frequency Stability	<del>§</del> 2.1055, <del>§</del> 22.355	$\leq \pm 2.5$ ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

### 1.4 Band12 (699-716MHz paired with 729-746 MHz)

Test Item	FCC Rule No	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§27.50(c)	FCC: ERP $\leq$ 3 W.	Appendix A	Pass
Peak-Average Ratio	--	--	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1047	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1049,	$\leq$ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	FCC: $\leq$ -13 dBm/100 kHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1051, §27.53(g)	FCC: $\leq$ -13 dBm/100 kHz.	Appendix G	Pass
Frequency Stability	§2.1053, §27.53(g)	$\leq \pm 2.5$ ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

# 1.5 Band 7 BRS&EBS Band (2500-2570 MHz paired with 2620-2655 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP ≤ 2W	Appendix A	Pass
Peak-Average Ratio	§27.50(a)	Limit ≤ 13 dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(m4)	<p>FCC/IC:</p> 	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)		Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)		Appendix G	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass

Note1: For the verdict, the "N/A" denotes "not applicable", the "NIT" denotes "not tested".

## 1.6 Band13 (777-787MHz paired with 746-756 MHz)

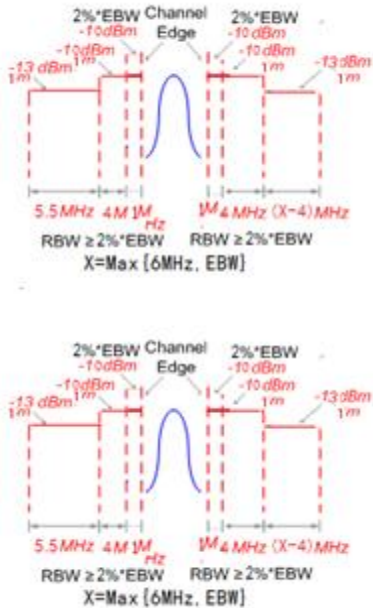
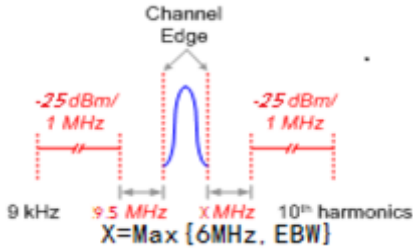
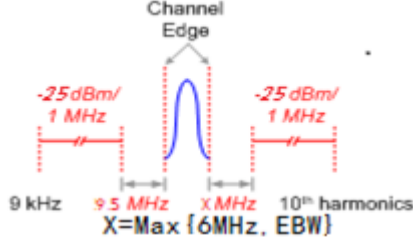
Test Item	FCC Rule No	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§27.50(c)	FCC: ERP ≤ 3 W.	Appendix A	Pass
Peak-Average Ratio	--	--	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1047	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1049,	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz.	Appendix G	Pass
Frequency Stability	§2.1053, §27.53(g)	≤ ±2.5ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

## 1.7 Band17 (704-716MHz paired with 734-746 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§27.50(c).	FCC: ERP ≤ 3 W.	Appendix A	Pass
Peak-Average Ratio	--	--	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1047	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1049,	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz.	Appendix G	Pass
Frequency Stability	§2.1053, §27.53(g)	≤ ±2.5ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				



# 1.8 Band38 (2570-2620 MHz paired with 2570-2620 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	$EIRP \leq 2W$	Appendix A	Pass
Peak-Average Ratio	§27.50(a)	Limit $\leq 13$ dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(m4)	FCC/IC: 	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)		Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)		Appendix G	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass

Note1: For the verdict, the "N/A" denotes "not applicable", the "NIT" denotes "not tested".

# 1.9 Band41 (2555-2655 MHz paired with 2555-2655 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	$EIRP \leq 2W$	Appendix A	Pass
Peak-Average Ratio	§27.50(a)	Limit $\leq 13$ dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(m4)	<p>FCC/IC:</p> <p>2%*EBW Channel Edge 2%*EBW -10 dBm -10 dBm -13 dBm/1m -13 dBm/1m 5.5 MHz 4 MHz 5.5 MHz RBW <math>\geq 2\% \cdot EBW</math> RBW <math>\geq 2\% \cdot EBW</math> <math>X = \text{Max} \{6\text{MHz}, EBW\}</math></p>	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)	<p>Channel Edge -25 dBm/1 MHz -25 dBm/1 MHz 9 kHz 9.5 MHz X MHz 10<sup>th</sup> harmonics <math>X = \text{Max} \{6\text{MHz}, EBW\}</math></p>	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(m)	<p>Channel Edge -25 dBm/1 MHz -25 dBm/1 MHz 9 kHz 9.5 MHz X MHz 10<sup>th</sup> harmonics <math>X = \text{Max} \{6\text{MHz}, EBW\}</math></p>	Appendix G	Pass
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Appendix H	Pass

Note1: For the verdict, the "N/A" denotes "not applicable", the "NIT" denotes "not tested".

## 1.10 Band14 (788-798MHz paired with 758-768MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Transmitter Conducted Power Output	§2.1046, §290.542	ERP ≤ 3 W	Appendix A	Pass
Peak-Average Ratio	--	Limit≤13 dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Emission Mask	§2.1051, §90.691	For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50+10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §90.691	< 43 + 10Log10(P[Watts]) for all out-of band emissions	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §90.691	< 43 + 10Log10(P[Watts]) for all out-of band emissions	Appendix G	Pass
Frequency Stability	§2.1055, §90.213	< ±2.5ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

## 1.11 Band 66 AWS Band (1710-1780MHz paired with 2110-2180MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)	EIRP ≤ 1 W	Appendix A	Pass
Peak-Average Ratio	§2.1046, §27.50(d)	Limit≤13 dB	Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Appendix C	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Appendix D	Pass
Band Edges Compliance	§2.1051, §27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	≤ -13 dBm/1 MHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.	Appendix F	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.	Appendix G	Pass
Frequency Stability	§2.1055, §27.54	≤ ±2.5 ppm.	Appendix H	Pass
Note1: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".				

## 2. General Description

### 2.1 Product Description

CT3-CID-16-4G-011 is subscriber equipment in the UMTS/LTE system. The UMTS frequency band is band 2/5, but only band 2/5 test data included in this report. The LTE frequency band is Band 2/4/5/7/12/13/14/17/38/41/66, but only Band 2/4/5/7/12/13/14/17/38/41/66 test data included in this report. The Mobile Phone implements such functions as RF signal receiving/transmitting, LTE/UMTS protocol processing, voice, video MMS service, GPS, Bluetooth and Wi-Fi etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and USIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices. The EUT is powered by AC 120V/60Hz. For more detailed features description, please refer to the user's manual.

### 2.2 Test Facility

Company Name:	Intertek Testing Service Shenzhen Ltd. Longhua Branch
Address:	101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen, P.R. China.
FCC Registration Number:	CN1188

### 2.3 Test Environment Condition

Ambient Temperature:	19.5 to 25 °C
Ambient Relative Humidity:	40 to 55 %
Atmospheric Pressure:	Not applicable

### 2.4 Sub-Assembly

Description	Manufacturer	Description
Power Adapter	(Provided by Applicant)	MODEL: HJ-FC001K7-UK INPUT: 100-240V~50/60Hz 0.6A OUTPUT: 5.0V=3.0A OR 9.0V=2.0A OR 12.0V=1.5A 18W
USB cable	(Provided by applicant)	Shielded, Length: 100cm

## 2.5 Technical Specification

Characteristics	Description	
Radio System Type	UMTS/LTE	
Supported Frequency Range	WCDMA850	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	WCDMA1900	Transmission (TX): 1850 to 1910 MHz
		Receiving (RX): 1930 to 1990 MHz
	LTE BAND2	Transmission (TX): 1850 to 1910 MHz
		Receiving (RX): 1930 to 1990 MHz
	LTE BAND4	Transmission (TX): 1710 to 1755 MHz
		Receiving (RX): 2110 to 2155 MHz
	LTE BAND5	Transmission (TX): 824 to 849 MHz
		Receiving (RX): 869 to 894 MHz
	LTE BAND7	Transmission (TX): 2500 to 2570 MHz
		Receiving (RX): 2620 to 2655 MHz
	LTE BAND12	Transmission (TX): 699 to 716 MHz
		Receiving (RX): 729 to 746 MHz
	LTE BAND13	Transmission (TX): 777 to 787 MHz
		Receiving (RX): 746 to 756 MHz
	LTE BAND14	Transmission (TX): 788 to 798 MHz
		Receiving (RX): 758 to 768 MHz
TX and RX Antenna Ports	TX & RX port:	1
	TX-only port:	0
	RX-only port:	1
Target TX Output Power	UMTS850: 25dBm UMTS1900: 25dBm LTE BAND2: 25dBm LTE BAND4: 25dBm LTE BAND5: 25dBm LTE BAND7: 25dBm LTE BAND12: 25dBm LTE BAND13: 25dBm LTE BAND14: 25dBm LTE BAND17: 25dBm LTE BAND38: 25dBm LTE BAND41: 25dBm LTE BAND66: 25dBm	
Antenna Gain:	UMTS850: -1.95dBi UMTS1900: 0.39dBi LTE BAND2: 0.39dBi LTE BAND4: -1.86dBi LTE BAND5: -1.95dBi LTE BAND7: 0.26dBi LTE BAND12: -3.16dBi LTE BAND13: -3.09dBi LTE BAND14: -3.26dBi LTE BAND17: -3.16dBi LTE BAND38: 0.68dBi LTE BAND41: 0.68dBi	

Characteristics	Description	
	LTE BAND66: -1.54dBi	
Supported Channel Bandwidth	UMTS system:	5 MHz
	LTE band 2	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE band 4	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE band 5	1.4 MHz, 3 MHz, 5 MHz, 10 MHz
	LTE band 7	5MHz, 10MHz, 15MHz, 20MHz
	LTE band 12	1.4 MHz, 3 MHz, 5 MHz, 10 MHz
	LTE band 13	5 MHz, 10 MHz
	LTE band 14	5 MHz, 10 MHz
	LTE band 17	5 MHz, 10 MHz
	LTE band 38	5MHz, 10MHz, 15MHz, 20MHz
	LTE band 41	5MHz, 10MHz, 15MHz, 20MHz
	LTE band 66	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
Designation of Emissions  (Note: the necessary bandwidth of which is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration.)	UMTS1900:	4M20F9W
	UMTS850:	4M20F9W
	LTE BAND2:	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation) 13M48G7D (15 MHz QPSK modulation), 13M48W7D (15 MHz 16QAM modulation) 18M04G7D (20 MHz QPSK modulation), 18M04W7D (20 MHz 16QAM modulation)
	LTE BAND4:	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation) 13M48G7D (15 MHz QPSK modulation), 13M48W7D (15 MHz 16QAM modulation) 18M04G7D (20 MHz QPSK modulation), 18M04W7D (20 MHz 16QAM modulation)
	LTE BAND5:	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation)
	LTE BAND7:	4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation) 13M48G7D (15 MHz QPSK modulation), 13M48W7D (15 MHz 16QAM modulation) 18M04G7D (20 MHz QPSK modulation), 18M04W7D (20 MHz 16QAM modulation)
	LTE BAND12:	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation)

Characteristics	Description
	2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation)
LTE BAND13:	4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation)
LTE BAND14:	4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation)
LTE BAND17:	4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation)
LTE BAND38:	4M51G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation) 13M48G7D (15 MHz QPSK modulation), 13M48W7D (15 MHz 16QAM modulation) 18M04G7D (20 MHz QPSK modulation), 18M04W7D (20 MHz 16QAM modulation)
LTE BAND41:	4M52G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation) 13M53G7D (15 MHz QPSK modulation), 13M48W7D (15 MHz 16QAM modulation) 18M04G7D (20 MHz QPSK modulation), 18M04W7D (20 MHz 16QAM modulation)
LTE BAND66:	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M51G7D (5 MHz QPSK modulation), 4M52W7D (5 MHz 16QAM modulation) 8M99G7D (10 MHz QPSK modulation), 8M99W7D (10 MHz 16QAM modulation) 13M48G7D (15 MHz QPSK modulation), 13M48W7D (15 MHz 16QAM modulation) 18M04G7D (20 MHz QPSK modulation), 18M04W7D (20 MHz 16QAM modulation)



### 3. General Test Conditions/Configuration

#### 3.1 Test Modes

Test Mode	Test Modes Description
UMTS/TM1	WCDMA system, QPSK modulation
UMTS/TM2	HSDPA system, QPSK modulation
UMTS/TM3	HSUPA system, QPSK modulation
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation

#### 3.2 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	Ambient	
Temperature	TN	Ambient
Voltage	VL	3.6V
	VN	3.8V
	VH	4.35V

NOTE: VL= lower extreme test voltage, VN= nominal voltage, VH= upper extreme test voltage  
TN= normal temperature

#### 3.3 Test Frequency

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA850	TX	Channel 4132	Channel 4182	Channel 4233
		826.4MHz	836.4MHz	846.6MHz
WCDMA1900	TX	Channel 9262	Channel 9400	Channel 9538
		1852.4MHz	1880.0MHz	1907.6MHz

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 2	TX(1.4M)	Channel 18607	Channel 18900	Channel 19193
		1850.7 MHz	1880 MHz	1909.3 MHz
	TX(3M)	Channel 18615	Channel 18900	Channel 19185
		1851.5 MHz	1880 MHz	1908.5 MHz
	TX(5M)	Channel 18625	Channel 18900	Channel 19175
		1852.5 MHz	1880 MHz	1907.5 MHz
	TX(10M)	Channel 18650	Channel 18900	Channel 19150
		1855 MHz	1880 MHz	1905 MHz
	TX(15M)	Channel 18675	Channel 18900	Channel 19125
		1857.5 MHz	1880 MHz	1902.5 MHz
	TX(20M)	Channel 18700	Channel 18900	Channel 19100
		1860 MHz	1880 MHz	1900 MHz



Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 4	TX(1.4M)	Channel 19957	Channel 20175	Channel 20393
		1710.7 MHz	1732.5 MHz	1754.3 MHz
	TX(3M)	Channel 19965	Channel 20175	Channel 20385
		1711.5 MHz	1732.5 MHz	1753.5 MHz
	TX(5M)	Channel 19975	Channel 20175	Channel 20375
		1712.5 MHz	1732.5 MHz	1752.5 MHz
	TX(10M)	Channel 20000	Channel 20175	Channel 20350
		1715 MHz	1732.5 MHz	1750 MHz
	TX(15M)	Channel 20025	Channel 20175	Channel 20325
		1717.5 MHz	1732.5 MHz	1747.5 MHz
	TX(20M)	Channel 20050	Channel 20175	Channel 20300
		1720 MHz	1732.5 MHz	1745 MHz
LTE Band 5	TX(1.4M)	Channel 20407	Channel 20525	Channel 20643
		824.7 MHz	836.5 MHz	848.3 MHz
	TX(3M)	Channel 20415	Channel 20525	Channel 20635
		825.5 MHz	836.5 MHz	847.5 MHz
	TX(5M)	Channel 20425	Channel 20525	Channel 20625
		826.5 MHz	836.5 MHz	846.5 MHz
	TX(10M)	Channel 20450	Channel 20525	Channel 20600
		829 MHz	836.5 MHz	844 MHz
LTE Band 7	TX (5M)	Channel 20775	Channel 21100	Channel 21425
		2502.5 MHz	2535 MHz	2567.5 MHz
	TX (10M)	Channel 20800	Channel 21100	Channel 21400
		2505 MHz	2535 MHz	2565 MHz
	TX (15M)	Channel 20825	Channel 21100	Channel 21375
		2507.5 MHz	2535 MHz	2562.5 MHz
	TX (20M)	Channel 20850	Channel 21100	Channel 21350
		2510 MHz	2535 MHz	2560 MHz
LTE Band 12	TX(1.4M)	Channel 23017	Channel 23095	Channel 23173
		699.7 MHz	707.5 MHz	715.3 MHz
	TX(3M)	Channel 23025	Channel 23095	Channel 23165
		700.5 MHz	707.5 MHz	714.5 MHz
	TX(5M)	Channel 23035	Channel 23095	Channel 23155
		701.5 MHz	707.5 MHz	713.5 MHz
	TX(10M)	Channel 23060	Channel 23095	Channel 23130
		704 MHz	707.5 MHz	711 MHz
LTE Band 13	TX (5M)	Channel 23205	Channel 23230	Channel 23255
		779.5	782	784.5
	TX (10M)	/	Channel 23230	/
		/	782	/
LTE Band 14	TX (5M)	Channel 23305	Channel 23330	Channel 23355
		770.5	793.0	795.5
	TX (10M)	/	Channel 23330	/
		/	793.0	/

Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 17	TX (5M)	Channel 23755	Channel 23790	Channel 23825
		706.5 MHz	710 MHz	713.5 MHz
	TX (10M)	Channel 23780	Channel 23790	Channel 23800
		709 MHz	710 MHz	711 MHz
LTE Band 38	TX/RX (5M)	Channel 37775	Channel 38000	Channel 38225
		2572.5 MHz	2595 MHz	2617.5 MHz
	TX/RX (10M)	Channel 37800	Channel 38000	Channel 38200
		2575 MHz	2595 MHz	2615 MHz
	TX/RX (15M)	Channel 37825	Channel 38000	Channel 38175
		2577.5 MHz	2595 MHz	2612.5 MHz
	TX/RX (20M)	Channel 37850	Channel 38000	Channel 38150
		2580 MHz	2595 MHz	2610 MHz
LTE Band 41	TX/RX (5M)	Channel 40265	Channel 40690	Channel 41215
		2557.5 MHz	2593 MHz	2652.5 MHz
	TX/RX (10M)	Channel 40290	Channel 40690	Channel 41190
		2560 MHz	2593 MHz	2650 MHz
	TX/RX (15M)	Channel 40315	Channel 40690	Channel 41165
		2562.5 MHz	2593 MHz	2647.5 MHz
	TX/RX (20M)	Channel 40340	Channel 40690	Channel 41140
		2565 MHz	2593 MHz	2645 MHz
LTE Band 66	TX(1.4M)	Channel 131979	Channel 132322	Channel 132665
		1710.7 MHz	1745.0 MHz	1779.3 MHz
	TX(3M)	Channel 131987	Channel 132322	Channel 132657
		1711.5 MHz	1745.0 MHz	1778.5 MHz
	TX(5M)	Channel 131997	Channel 132322	Channel 132647
		1712.5 MHz	1745.0 MHz	1777.5 MHz
	TX(10M)	Channel 132022	Channel 132322	Channel 132622
		1715 MHz	1745.0 MHz	1775.0 MHz
	TX(15M)	Channel 132047	Channel 132322	Channel 132597
		1717.5 MHz	1745.0 MHz	1772.5 MHz
	TX(20M)	Channel 132072	Channel 132322	Channel 132572
		1720 MHz	1745.0 MHz	1770.0 MHz

## 4. DESCRIPTION OF TESTS

### 4.1 Radiated Power and Radiated Spurious Emissions

Radiated spurious emissions are investigated indoors in a semi-anechoic chamber to determine the frequencies producing the worst case emissions. Final measurements for radiated power and radiated spurious emissions are performed on the 3 meter OATS per the guidelines of ANSI/TIA-603-C-2004. The equipment under test was transmitting while connected to its integral antenna and is placed on a wooden turntable 80cm above the ground plane and 3 meters from the receive antenna. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. The receive antenna height is adjusted between 1 and 4 meter height, the turntable is rotated through 360 degrees, and the EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer. Emissions are also investigated with the receive antenna horizontally and vertically polarized.

A portable or small unlicensed wireless device shall be placed on a non-metallic test fixture or other non-metallic support during testing. The supporting fixture shall permit orientation of the EUT in each of three orthogonal (x, y, z) axis positions such that emissions from the EUT are maximized. Measure the EUT maximum RF power and record the result.

A half-wave dipole is then substituted in place of the EUT. For emissions above 3GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer level previously recorded from the spurious emission from the EUT.

The power of the emission is calculated using the following formula:

$$P_d [\text{dBm}] = P_g [\text{dBm}] - \text{cable loss} [\text{dB}] + \text{antenna gain} [\text{dBd/dBi}]$$

Where,  $P_d$  is the dipole equivalent power,  $P_g$  is the generator output into the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to  $P_g [\text{dBm}] - \text{cable loss} [\text{dB}]$ .

The calculated  $P_d$  levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of  $43 + 10\log_{10}(\text{Power} [\text{Watts}])$ .

#### Test Procedures Used

KDB 971168 v02r02-Section 5.2.1 / KDB 971168 v02R02-Section 5.8

ANSI/TIA-603-C-2004-Section 2.2.17 / ANSI/TIA-603-C-2004-Section 2.2.12

Note: Reference test setup 3

## **4.2 Peak-Average Ratio**

A peak to average ratio measurement is performed at the conducted port of the EUT. For WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. The traces are generated with the spectrum analyzer set to zero span mode.

### **Test Procedures Used**

KDB 971168 v02r02-Section 5.7.1

### **Test Settings**

1. The signal analyzer's CCDF measurement profile enabled
2. Frequency= carrier center frequency
3. Measurement BW > EBW of signal
4. for continuous transmissions, set to 1ms
5. Record the maximum PAPR level associated with a probability of 0.1%. Note: Reference test setup 1

### 4.3 Occupied Bandwidth

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

#### Test Procedures Used

KDB 971168 v02r02-Section 4.2

#### Test Settings

1. SET RBW=1-5% of OBW
2. SET VBW  $\geq 3 \times$  RBW
3. Detector: Peak
4. Trace mode= max hold.
5. Sweep= auto couple
6. Steps 1-5 were repeated after it is stable

Note: Reference test setup 1.

### 4.4 Band Edge Compliance

the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission power must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log_{10} P$  dB.

#### Test Procedures Used

KDB 971168 v02r02-Section 6.0

#### Test Settings

1. SET RBW  $\geq 1\%$  of Emission BW.
2. SET VBW about three times of RBW
3. Detector: RMS
4. Trace mode= max hold.
5. Span= 2MHz

Note: Reference test setup 1.

## **4.5 Spurious and Harmonic Emissions at Antenna Terminal**

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least

$43 + 10 \log(P)$  dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

### **Test Procedures Used**

KDB 971168 v02r02-Section 6.0

### **Test Settings**

1. 9kHz~150kHz, RBW = 1KHz, VBW  $\geq 3 \times$  RBW,  
150kHz~30MHz, RBW = 10KHz, VBW  $\geq 3 \times$  RBW,  
30MHz~1GHz, RBW = 100 kHz, VBW = 300 kHz.  
Above 1GHz, RBW = 1 MHz, VBW = 3 MHz.
2. Detector: Peak
3. Trace mode= max hold.

Note: Reference test setup 1.

## 4.6 Frequency Stability / Temperature Variation

Frequency stability testing is performed in accordance with the guidelines of ANSI/TIA-603-C-2004. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -10°C to +60°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within  $\pm 0.00025\%$  ( $\pm 2.5$  ppm ) of the center frequency.

### Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -10°C to +60°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

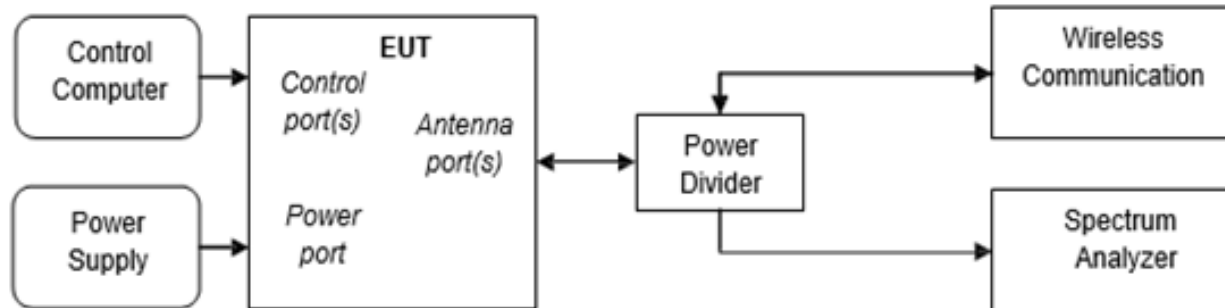
### Test Procedures Used

ANSI/TIA-603-C-2004

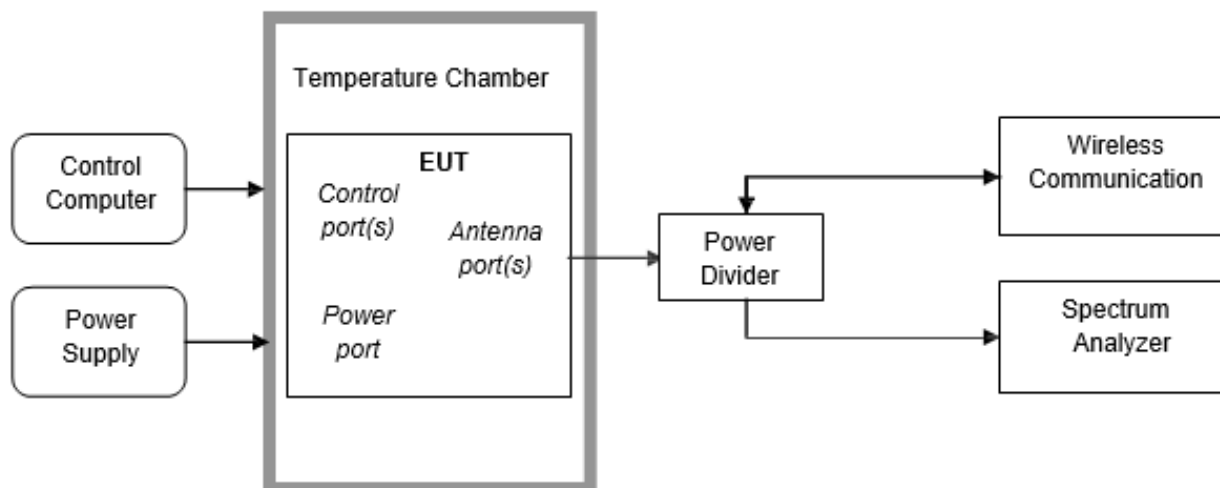
Note: Reference test setup 2.

## 5. Test Setups

### 5.1 Test Setup 1



### 5.2 Test Setup 2

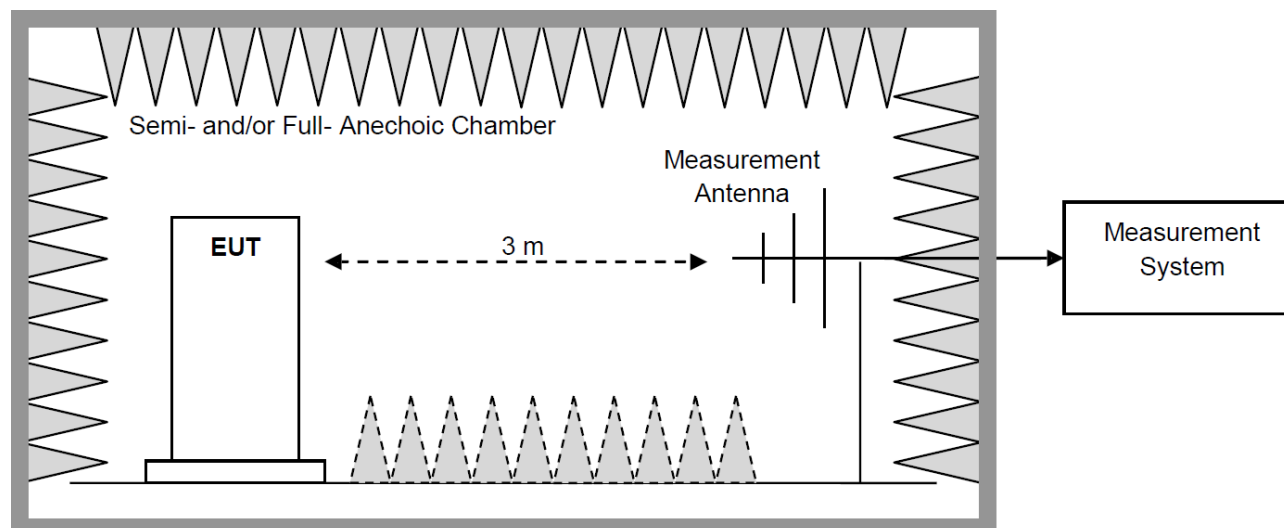




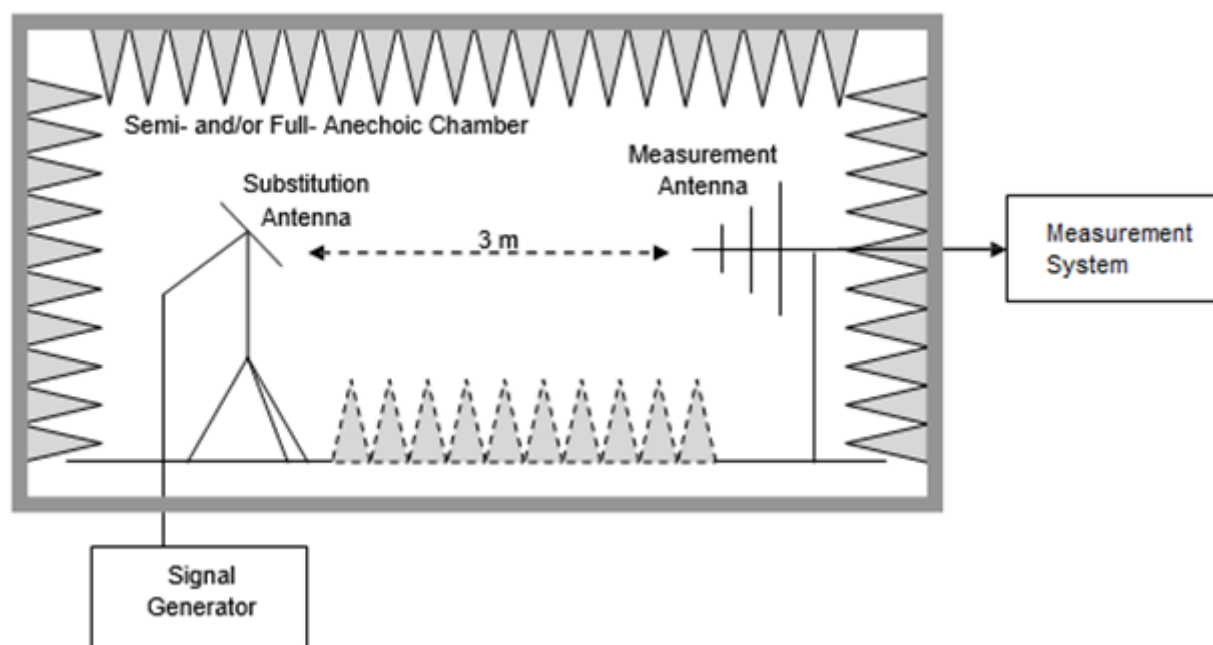
## 5.3 Test Setup 3

NOTE: Effective radiated power (ERP) and Equivalent Isotropic Radiated Power (EIRP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

### 5.3.1 Step 1: Pre-test



### 5.3.2 Step 2: Substitution method to verify the maximum ERP/EIRP



## 5.4 Test Conditions

Test Case		Test Conditions	
Transmit Output Power Data	Average Power, Total	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2
	Average Power, Spectral Density (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2
Peak-to-Average Ratio (if required)		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2
Modulation Characteristics		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	M (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2
Bandwidth	Occupied Bandwidth	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2
	Emission Bandwidth (if required)	Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2
Band Edges Compliance		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2
Spurious Emission at Antenna Terminals		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
		Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2

Test Case	Test Conditions	
Field Strength of Spurious Radiation	Test Env.	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 3
	Test Mode	UMTS/TM1/TM2/TM3, LTE/TM1, LTE/TM2 NOTE: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected.
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Frequency Stability	Test Env.	(1) -10 °C to +60 °C with step 10 °C at Rated Voltage; (2) VL, VN and VH of Rated Voltage at Ambient Climate.
	Test Setup	Test Setup 2
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
	Test Mode	UMTS/TM1, LTE/TM1, LTE/TM2

## 6. Main Test Instruments

Main Test Equipment					
Equip No.	Equipment Name	Manufacturer	Model	Cal Date	Cal- Due
SZ006-27	DC Power Supply	Keysight	E3648A	2022-12-20	2023-12-20
SZ065-08	Wideband Radio Communication Tester	R & S	CMW 500	2022-07-04	2023-07-04
SZ065-07	Wideband Radio Communication Tester	R & S	CMW 500	2023-02-27	2024-02-27
SZ056-06	Signal Analyzer	R&S	FSV 40	2022-12-19	2023-12-19
SZ062-10	RF Cable	Bedeia	RG 58	2023-02-01	2023-08-01
SZ056-08	Signal Analyzer	R&S	FSV 40	2022-12-19	2023-12-19
SZ185-03	EMI Receiver	R&S	ESR7	2023-02-27	2024-02-27
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	2021-05-18	2023-05-18
SZ061-12	BiConiLog Antenna	ETS	3142E	2021-08-04	2024-08-04
SZ061-09	Double-Ridged Waveguide Horn Antenna	ETS	3115	2022-10-14	2025-10-14
SZ181-08	Microwave System Amplifier	Agilent	83017A	2022-08-05	2023-08-05
SZ188-05	Anechoic Chamber	ETS	FACT 3-2.0	2021-05-25	2024-05-25
SZ062-23	RF Cable	RADIAL	SF104PE	2022-10-17	2023-10-17
SZ062-35	RF Cable	Rebes	A50-3.5M3.5M-8M	2022-10-17	2023-10-17
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	2023-02-27	2024-02-27

Software Information			
Test Item	Software Name	Manufacturer	Version
RSE	EMC32	R&S	V8.40.0
Conducted RF	JS1120 RF Test System	Shenzhen JS tonscond co., Ltd	2.6.9.0518

## 7. Measurement Uncertainty

For a 95% confidence level ( $k = 2$ ), the measurement expanded uncertainties for defined systems, in accordance with

the recommendations of ISO 17025 as following:

Test Item		Extended Uncertainty
Transmit Output Power Data	Power [dBm]	U = 0.42 dB
Bandwidth	Magnitude [%]	U = 0.2%
Band Edge Compliance	Disturbance Power [dBm]	U = 1.24 dB
Spurious Emissions, Conducted	Disturbance Power [dBm]	U = 1.62 dB
Field Strength of Spurious Radiation	ERP [dBm]	For 3 m Chamber: U = 4.9 dB (30 MHz to 26.5GHz)
Frequency Stability	Frequency Accuracy [ppm]	U = 0.017 ppm

## 8. Appendixes

Appendix No.	Description
230315012SZN-005_Appendix A	Appendix for WCDMA
230315012SZN-005_Appendix B	Appendix for LTE

\*\*\*\*\* End of Report \*\*\*\*\*