Product Name: LTE Module	**Report No: FCC022022-05502RF12(a)**
Product Model: TOBY-L3414	**Security Classification: Open**
Version: V1.0	**Total Page: 34**

Testing Report

Prepared By:	**Checked By:**	**Approved By:**	
Stone Tang	Randy Lv	Daniel Chen	
Stone Tang	Randy LV	Daniel chen	

RF TEST REPORT

FCC ID: 2A3Z6TOBYL3414

According to

47 CFR FCC Part 2

47 CFR FCC Part 24E

47 CFR FCC Part 27C

ANSI C63.26:2015

Equipment	:	LTE Module
Model No.	:	TOBY-L3414
Trademark	:	TASHANG
Product No.	:	20220820018527
Applicant	:	Tashang Semiconductor(Shanghai) Co., Ltd. Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town, Chongming District, Shanghai

- The test result referred exclusively to the presented test model /sample.
- Without written approval of TIRT Inc. the test report shall not reproduced except in full.
- Test Date: 2022.09.06-2022.09.30

Lab: Beijing TIRT Technology Service Co.,Ltd Shenzhen

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REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Oct. 20, 2022
R01	Revised issue	Nov. 03, 2022

1. General Information

1.1 Applicant

Tashang Semiconductor(Shanghai) Co., Ltd.

Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town, Chongming District, Shanghai

1.2 Manufacturer

Tashang Semiconductor(Shanghai) Co., Ltd.

Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town, Chongming District, Shanghai

1.3 Factory

Tashang Semiconductor(Shanghai) Co., Ltd.

Room 818, Building 4, No.89, Sanshahong Road, Chengqiao Town, Chongming District, Shanghai

1.4 Basic Description of Equipment Under Test

Items	Description	
Equipment Name	LTE Module	
Model Number	TOBY-L3414	
Trademark	TASHANG	
Power Supply	3.8VDC	
Operating Temperature	-40~85℃	
EUT Stage	○ Product Unit	●Final-Sample
Radio System Type	LTE	
Operating Band	Band 2, Band 4, Band 7, Band 12, Band13, Band 41, Band66, Band 71	

1.5 Technical Specification

Characteristics	Description	
Radio System Type	LTE	
Supported Frequency Range	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 BAND7	Transmission (TX): 2500 to 2570 MHz
		Receiving (RX): 2620 to 2690 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 BAND41	Transmission (TX): 2535 to 2655 MHz
		Receiving (RX): 2535 to 2655 MHz
	LTE BAND66	Transmission (TX): 1710 to 1780 MHz
		Receiving (RX): 2110 to 2180 MHz
	LTE BAND71	Transmission (TX): 663 to 698 MHz
		Receiving (RX): 617 to 652 MHz
Max. ERP/EIRP	LTE BAND2: 24.76dBm; LTE BAND4: 27.46dBm; LTE BAND7: 26.04dBm; LTE BAND12: 23.43dBm; LTE BAND13: 22.97dBm; LTE BAND41: 25.31dBm; LTE BAND66: 27.27dBm; LTE BAND71: 22.97dBm;	
Antenna Gain:	LTE BAND2: 0.43dBi; LTE BAND4: 3.05dBi; LTE BAND7: 1.48dBi; LTE BAND12: 0.73dBi; LTE BAND13: 0.22dBi; LTE BAND41: 1.58dBi; LTE BAND66: 3.05dBi; LTE BAND71: 0.73dBi;	
Supported Channel Bandwidth	LTE BAND2	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE BAND4	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE BAND7	5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE BAND12	1.4 MHz, 3 MHz, 5 MHz, 10 MHz
	LTE BAND13	5 MHz, 10 MHz
	LTE BAND41	5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE BAND66	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
	LTE BAND71	5 MHz,10 MHz, 15 MHz, 20 MHz

Characteristics	Description	
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.)	LTE BAND2:	1M1G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M52G7D (5 MHz QPSK modulation), 4M51W7D (5 MHz 16QAM modulation) 8M98G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 17M9G7D (20 MHz QPSK modulation), 17M9W7D (20 MHz 16QAM modulation)
	LTE BAND4:	1M1G7D (1.4 MHz QPSK modulation), 1M1W7D (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) 8M97G7D (10 MHz QPSK modulation), 8M98W7D (10 MHz 16QAM modulation) 13M4G7D (15 MHz QPSK modulation), 13M4W7D (15 MHz 16QAM modulation) 17M9G7D (20 MHz QPSK modulation), 17M9W7D (20 MHz 16QAM modulation)
	LTE BAND7:	4M53G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 8M97G7D (10 MHz QPSK modulation), 8M96W7D (10 MHz 16QAM modulation) 13M4G7D (15 MHz QPSK modulation), 13M4W7D (15 MHz 16QAM modulation) 17M9G7D (20 MHz QPSK modulation), 17M9W7D (20 MHz 16QAM modulation)
	LTE BAND12:	1M1G7D (1.4 MHz QPSK modulation), 1M1W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M70W7D (3 MHz 16QAM modulation) 4M50G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 8M96G7D (10 MHz QPSK modulation), 8M98W7D (10 MHz 16QAM modulation)
	LTE BAND13:	4M51G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation)

Characteristics	Description	
		8M94G7D (10 MHz QPSK modulation), 8M95W7D (10 MHz 16QAM modulation)
	LTE BAND41:	4M49G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 9M01G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 17M9G7D (20 MHz QPSK modulation), 17M9W7D (20 MHz 16QAM modulation)
	LTE BAND66:	1M09G7D (1.4 MHz QPSK modulation), 1M09W7D (1.4 MHz 16QAM modulation) 2M70G7D (3 MHz QPSK modulation), 2M69W7D (3 MHz 16QAM modulation) 4M49G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 8M98G7D (10 MHz QPSK modulation), 8M98W7D (10 MHz 16QAM modulation)
	LTE BAND71:	4M49G7D (5 MHz QPSK modulation), 4M50W7D (5 MHz 16QAM modulation) 9M01G7D (10 MHz QPSK modulation), 8M97W7D (10 MHz 16QAM modulation) 13M5G7D (15 MHz QPSK modulation), 13M5W7D (15 MHz 16QAM modulation) 17M9G7D (20 MHz QPSK modulation), 17M9W7D (20 MHz 16QAM modulation)

2. Summary of Test Results

2.1 Application of Standard

47 CFR FCC Part 2
47 CFR FCC Part 24 subpart E
47 CFR FCC Part 27 subpart C
KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI C63.26:2015

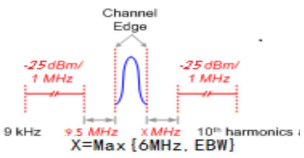
2.2 Band 2

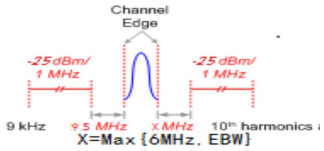
Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	Part 2.1046, 24.232	EIRP ≤ 2 W	Appendix A	Pass
Peak-Average Ratio	Part 2.1046, 24.232	Limit≤13 dB	Appendix A	Pass
Modulation Characteristics	Part 2.1047	Digital modulation	Appendix A	Pass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

2.3 Band 4/66

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	Part 2.1046, 27.50(d)	EIRP ≤ 1 W	Appendix B of Band4, Appendix G of Band66	Pass
Peak-Average Ratio	Part 2.1046, 27.50(d)	Limit≤13 dB	Appendix B of Band4, Appendix G of Band66	Pass
Modulation Characteristics	Part 2.1047	Digital modulation	Appendix B of Band4, Appendix G of Band66	Pass
Bandwidth	Part 2.1049	OBW: No limit. EBW: No limit.	Appendix B of Band4, Appendix G of Band66	Pass
Band Edges Compliance	Part 2.1051, 27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix B of Band4, Appendix G of Band66	Pass
Spurious Emission at Antenna Terminals	Part 2.1051, 27.53(h)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix B of Band4, Appendix G of Band66	Pass
Field Strength of Spurious Radiation	Part 2.1053, 27.53(h)	≤ -13 dBm/1 MHz.	Appendix B of Band4, Appendix G of Band66	Pass
Frequency Stability	Part 2.1055, 27.54	≤ ± 2.5 ppm.	Appendix B of Band4, Appendix G of Band66	Pass
Note1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

2.4 Band 7/41

Test Item	FCC Rule No.	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	Part 2.1046 27.50(h)	EIRP ≤ 2 W	Appendix C of Band7, Appendix F of Band41	Pass
Peak-Average Ratio	Part 27.50(a)	Limit≤13 dB	Appendix C of Band7, Appendix F of Band41	Pass
Modulation Characteristics	Part 2.1047	Digital modulation	Appendix C of Band7, Appendix F of Band41	Pass
Bandwidth	Part 2.1049	OBW: No limit. EBW: No limit.	Appendix C of Band7, Appendix F of Band41	Pass
Band Edges Compliance	Part 2.1051, 27.53(m4)	For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section.	Appendix C of Band7, Appendix F of Band41	Pass
Spurious Emission at Antenna Terminals	Part 2.1051, 27.53(m)		Appendix C of Band7, Appendix F of Band41	Pass

Field Strength of Spurious Radiation	Part 2.1053, 27.53(m)		Appendix C of Band7, Appendix F of Band41	Pass
Frequency Stability	Part 2.1055, 27.54	Within authorized bands of operation/frequency block.	Appendix C of Band7, Appendix F of Band41	Pass
Note1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

2.5 Band 12/71

Test Item	FCC Rule No	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	Part 27.50(c)	FCC: ERP ≤ 3 W.	Appendix D of Band12, Appendix H of Band71	Pass
Peak-Average Ratio	Part 2.1046, Part 27.50(c)	Limit≤13 dB	Appendix D of Band12, Appendix H of Band71	Pass
Modulation Characteristics	Part 2.1047	Digital modulation	Appendix D of Band12, Appendix H of Band71	Pass
Bandwidth	Part 2.1049	OBW: No limit. EBW: No limit.	Appendix D of Band12, Appendix H of Band7	Pass
Band Edges Compliance	Part 2.1051, Part 27.53(g) ,	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix D of Band12, Appendix H of Band71	Pass
Spurious Emission at Antenna Terminals	Part 2.1051, 27.53(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Appendix D of Band12, Appendix H of Band71	Pass
Field Strength of Spurious Radiation	Part 2.1053, 27.53(g)	FCC: ≤ -13 dBm/100 kHz.	Appendix D of Band12, Appendix H of Band71	Pass
Frequency Stability	Part 2.1055 27.54	≤ ±2.5ppm.	Appendix D of Band12, Appendix H of Band71	Pass
Note1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

2.6 Band 13

Test Item	FCC Rule No	Requirements	Test Result	Verdict (Note1)
Effective (Isotropic) Radiated Power Output Data	Part 2.1046, Part 27.50(b)	FCC: ERP ≤ 3 W.	Appendix E	Pass
Peak-Average Ratio	Part 27.50	Limit≤13 dB	Appendix E	Pass
Modulation Characteristics	Part 2.1047	Digital modulation	Appendix E	Pass
Bandwidth	Part 2.1049	OBW: No limit. EBW: No limit.	Appendix E	Pass
Band Edges Compliance	Part 2.1051, Part 27.53(c) ,	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Appendix E	Pass
Spurious Emission at Antenna Terminals	Part 2.1051, Part 27.53(c) Part 27.53(f)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges. On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations. For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.	Appendix E	Pass
Field Strength of Spurious Radiation	Part 2.1053, Part 27.53(c) Part	FCC: ≤ -13 dBm/100 kHz. For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be	Appendix E	Pass

	27.53(f)	limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.		
Frequency Stability	Part 2.1055 27.54	≤ ±2.5ppm.	Appendix E	Pass
Note1: For the verdict, the “N/A” denotes “not applicable”, the “N/T” denotes “not tested”.				

3. General Test Frequency and Configuration

3.1 Test Modes

Test Mode	Test Modes Description
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation

3.2 Test Frequency

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
	RX(1.4M)	Channel 607	Channel 900	Channel 1193
		1930.7 MHz	1960 MHz	1989.3 MHz
	RX(3M)	Channel 615	Channel 900	Channel 1185
		1931.5 MHz	1960 MHz	1988.5 MHz
	RX(5M)	Channel 625	Channel 900	Channel 1175
		1932.5 MHz	1960 MHz	1987.5 MHz
	RX(10M)	Channel 650	Channel 900	Channel 1150
		1935 MHz	1960 MHz	1985 MHz
	RX(15M)	Channel 675	Channel 900	Channel 1125
		1937.5 MHz	1960 MHz	1982.5 MHz
	RX(20M)	Channel 700	Channel 900	Channel 1100
		1940 MHz	1960 MHz	1980 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
	RX(1.4M)	Channel 1975	Channel 2175	Channel 2375
		2112.5 MHz	2132.5MHz	2152.5 MHz
	RX(3M)	Channel 2000	Channel 2175	Channel 2350
		2115 MHz	2132.5MHz	2150 MHz
	RX(5M)	Channel 1975	Channel 2175	Channel 2375
		2112.5 MHz	2132.5MHz	2152.5 MHz
	RX(10M)	Channel 2000	Channel 2175	Channel 2350
		2115 MHz	2132.5MHz	2150 MHz
	RX(15M)	Channel 2025	Channel 2175	Channel 2325
		2117.5 MHz	2132.5MHz	2147.5 MHz
	RX(20M)	Channel 2050	Channel 2175	Channel 2300
		2120 MHz	2132.5MHz	2145 MHz
Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 7	TX(5M)	CH20775	CH21100	CH21425
		2502.5MHz	2535MHz	2567.5MHz
	TX(10M)	CH20800	CH21100	CH21400
		2505MHz	2535MHz	2565MHz
	TX(15M)	CH20825	CH21100	CH21375
		2507.5MHz	2535MHz	2562.5MHz
	TX(20M)	CH20850	CH21100	CH21350
		2510MHz	2535MHz	2560MHz
	RX(5M)	Channel 2775	Channel 3100	Channel 5825
		2622.5 MHz	2655 MHz	2687.5 MHz
	RX (10M)	Channel 2800	Channel 3100	Channel 3400
		2625 MHz	2655 MHz	2685 MHz
	RX(15M)	Channel 2825	Channel 3100	Channel 3375
		2627.5 MHz	2655 MHz	2682.5 MHz
	RX (20M)	Channel 2850	Channel 3100	Channel 3350
		2630 MHz	2655 MHz	2680 MHz
Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
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
	RX(1.4M)	Channel 5017	Channel 5095	Channel 5173
		729.7 MHz	737.5 MHz	745.3 MHz
	RX (3M)	Channel 5025	Channel 5095	Channel 5165
		730.5 MHz	737.5 MHz	744.5 MHz
	RX(5M)	Channel 5035	Channel 5095	Channel 5155
		731.5 MHz	737.5 MHz	743.5 MHz
	RX (10M)	Channel 5060	Channel 5095	Channel 5130
		734 MHz	737.5 MHz	741 MHz
Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 13	TX(5M)	Channel 23025	Channel 23230	Channel 23255
		779.5 MHz	782 MHz	784.5 MHz
	TX(10M)	Channel 23230	Channel 23230	Channel 23230
		782 MHz	782 MHz	782 MHz
	RX(5M)	Channel 5205	Channel 5230	Channel 5255
		748.5 MHz	751 MHz	753.5 MHz
	RX (10M)	Channel 5230	Channel 5230	Channel 5230
		751 MHz	751 MHz	751 MHz
Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 41	TX(5M)	Channel 40065	Channel40640	Channel 41215
		2537.5 MHz	2595 MHz	2652.5 MHz
	TX(10M)	Channel 40090	Channel40640	Channel 41190
		2540 MHz	2595 MHz	2650 MHz
	TX(15M)	Channel 40115	Channel40640	Channel 41165
		2542.5 MHz	2595 MHz	2647.5 MHz
	TX(20M)	Channel 40140	Channel40640	Channel 41140
		2545 MHz	2595 MHz	2645 MHz
	RX(5M)	Channel 40065	Channel40640	Channel 41215
		2537.5 MHz	2595 MHz	2652.5 MHz
	RX (10M)	Channel 40090	Channel40640	Channel 41190
		2540 MHz	2595 MHz	2650 MHz
	RX(15M)	Channel 40115	Channel40640	Channel 41165
		2542.5 MHz	2595 MHz	2647.5 MHz
	RX (20M)	Channel 40140	Channel40640	Channel 41140

		2545 MHz	2595 MHz	2645 MHz
Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 66	TX(1.4M)	Channel 131979	Channel 132322	Channel 132665
		1710.7 MHz	1745 MHz	1779.3 MHz
	TX(3M)	Channel 131987	Channel 132322	Channel 132657
		1711.5 MHz	1745 MHz	1778.5MHz
	TX(5M)	Channel 131997	Channel 132322	Channel 132647
		1712.5 MHz	1745 MHz	1777.5 MHz
	TX(10M)	Channel 132022	Channel 132322	Channel 132622
		1715 MHz	1745 MHz	1775 MHz
	TX(15M)	Channel 132047	Channel 132322	Channel 132597
		1717.5 MHz	1745 MHz	1772.5 MHz
	TX(20M)	Channel 132072	Channel 132322	Channel 132572
		1720 MHz	1745 MHz	1770 MHz
	RX(1.4M)	Channel 66443	Channel 66786	Channel 67329
		2110.7 MHz	2145MHz	2199.3 MHz
	RX(3M)	Channel 66451	Channel 66786	Channel 67321
		2111.5 MHz	2145MHz	2198.5MHz
	RX(5M)	Channel 66461	Channel 66786	Channel 67311
		2112.5 MHz	2145MHz	2197.5 MHz
	RX (10M)	Channel 66486	Channel 66786	Channel 67286
		2115 MHz	2145MHz	2195 MHz
	RX(15M)	Channel 66511	Channel 66786	Channel 67261
		2117.5 MHz	2145MHz	2192.5 MHz
	RX (20M)	Channel 66536	Channel 66786	Channel 67236
		2120 MHz	2145MHz	2190 MHz
Test Mode	TX / RX	RF Channel		
		Low (B)	Middle (M)	High (T)
LTE Band 71	TX(5M)	Channel 133147	Channel 133297	Channel 133447
		665.5 MHz	680.5 MHz	695.5 MHz
	TX(10M)	Channel 133172	Channel 133297	Channel 133422
		668 MHz	680.5 MHz	693 MHz
	TX(15M)	Channel 133197	Channel 133297	Channel 133397
		670.5 MHz	680.5 MHz	690.5 MHz
	TX(20M)	Channel 133222	Channel 133297	Channel 133372
		673 MHz	680.5 MHz	688 MHz
	RX(5M)	Channel 68611	Channel 68761	Channel 68911
		619.5 MHz	634.5 MHz	649.5 MHz
	RX (10M)	Channel 68636	Channel 68761	Channel 68886
		622 MHz	634.5 MHz	647 MHz
	RX(15M)	Channel 68661	Channel 68761	Channel 68861

		624.5 MHz	634.5 MHz	644.5 MHz
	RX (20M)	Channel 68686	Channel 68761	Channel 68836
		627 MHz	634.5 MHz	642 MHz

3.3 Test Environment

Applicable to	Environmental conditions	Input Power	Tested by
Transmitter Conducted Power Output	24.3°C, 56 % RH	120Vac, 60Hz	Stone Tang
Peak-Average Ratio	24.2°C, 55 % RH	120Vac, 60Hz	Stone Tang
Bandwidth	24.5°C, 56 % RH	120Vac, 60Hz	Stone Tang
Emission Mask	24.8°C, 56 % RH	120Vac, 60Hz	Stone Tang
Spurious Emission at Antenna Terminals	24.7°C, 56 % RH	120Vac, 60Hz	Stone Tang
Field Strength of Spurious Radiation	24.0°C, 58 % RH	120Vac, 60Hz	Stone Tang
Frequency Stability	24.2°C, 55 % RH	120Vac, 60Hz	Stone Tang

The applicant declare the operating environment of EUT as below:

Normal conditions: 3.8V DC ,15°C ~35°C

Extreme conditions:3.3V DC~4.2V DC, -40°C ~85°C

VL= lower extreme test voltage, VN= nominal voltage, VH= upper extreme test voltage

TL= lower extreme test temperature, TN= normal temperature, TH= upper extreme test temperature

3.4 Test Instruments

Main Test Equipment					
No.	Equipment Name	Manufacturer	Model	Calibrated date	Calibrated until
1	DC Power Supply	Keysight	E3642A	2021/11/10	2022/11/09
2	Wideband Radio Communication Tester	R & S	CMW 500	2021/11/03	2022/11/02
3	MXA Signal Analyzer	Keysight	N9020B	2021/11/10	2022/11/09
4	Programmable Temperature & Humidity Chamber	ETMOA	NTH1100-30A	2021/11/10	2022/11/09
5	Temperature&Humidity Recorder	Anymetre	JR900	2021/11/10	2022/11/09
6	Integral Antenna	SCHWARZBECK	VULB9163	2021/11/10	2022/11/09
7	Loop Antenna	SCHWARZBECK	FMZB1519B	2021/11/10	2022/11/09
8	Horn Antenna	SCHWARZBECK	BBHA 9170	2021/11/10	2022/11/09
9	Double Ridged Broadband Horn Antenna	SCHWARZBECK	BBHA 9120D	2021/11/10	2022/11/09
10	Spectrum Analyzer	R & S	FSV30	2021/11/10	2022/11/09
11	EMI Receiver	R & S	ESR	2021/11/10	2022/11/09
12	Broadband amplifier	SCHWARZBECK	BBV9718	2021/11/10	2022/11/09
13	Broadband amplifier	SCHWARZBECK	BBV9721	2021/11/10	2022/11/09
14	Anechoic Chamber	ZHONGSHUO	FSAC318	2021/07/17	2024/07/16
15	RF Cable	Top Precision	BLU18A-Sm-2 m	2021/11/10	2022/11/09
16	RF Cable	Top Precision	BLU18A-Sm-2 m	2021/11/10	2022/11/09
17	RF Cable	ZDECL	ZT40-2.92J-6 M	2021/11/10	2022/11/09
18	Band Reject Filter Group	Tonscend	JS0806-F	NA	NA

Software Information			
Test Item	Software Name	Manufacturer	Version
RSE	EZ-EMC	EZ-EMC	TW-03A2
Conducted RF	JS1120 RF Test System	Shenzhen JS tonscend co., Ltd	2.6.9.0826

3.5 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT.
This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Uncertainty	
Parameter	Uncertainty
Occupied Channel Bandwidth	±142.12kHz
RF power conducted	±0.74dB
RF power radiated	±3.25dB
Spurious emissions, conducted	±1.78dB
Spurious emissions, radiated (30MHz～1GHz)	±4.6dB
Spurious emissions, radiated (1GHz ~ 18GHz)	±4.9dB
Conduction Emissions(150kHz~30MHz)	±3.1dB
Humidity	±4.6%
Temperature	±0.7°C
Time	±1.25%

3.6 Test Location

Company:	Beijing TIRT Technology Service Co.,Ltd Shenzhen
Address:	101, 3 # Factory Building, Gongjin Electronics Shatin Community, Kengzi Street, Pingshan District, Shenzhen, China
CNAS Registration Number:	CNAS L14158
A2LA Registration Number:	6049.01
FCC Accredited Lab. Designation Number:	CN1309
FCC Test Firm Registration Number:	825524
Telephone:	+86-0755-27087573

3.7 Deviation from Standards

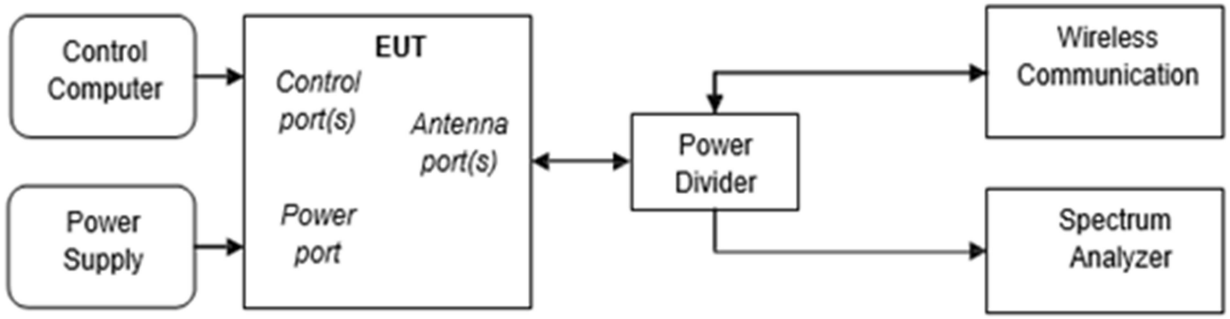
None

3.8 Abnormalities from Standard Conditions

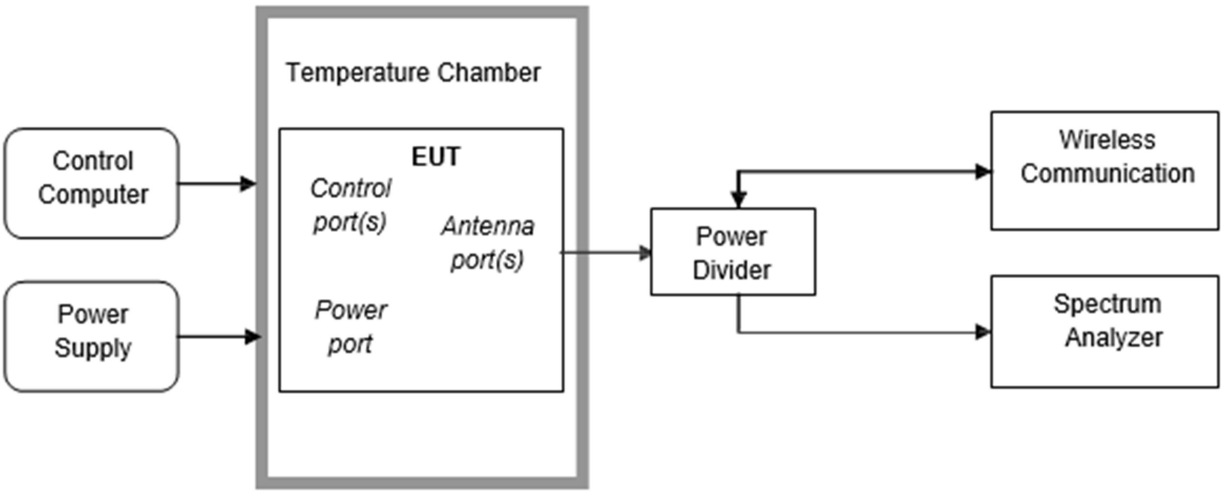
None

4. Test Setup and Conditions

4.1 Test Setup 1



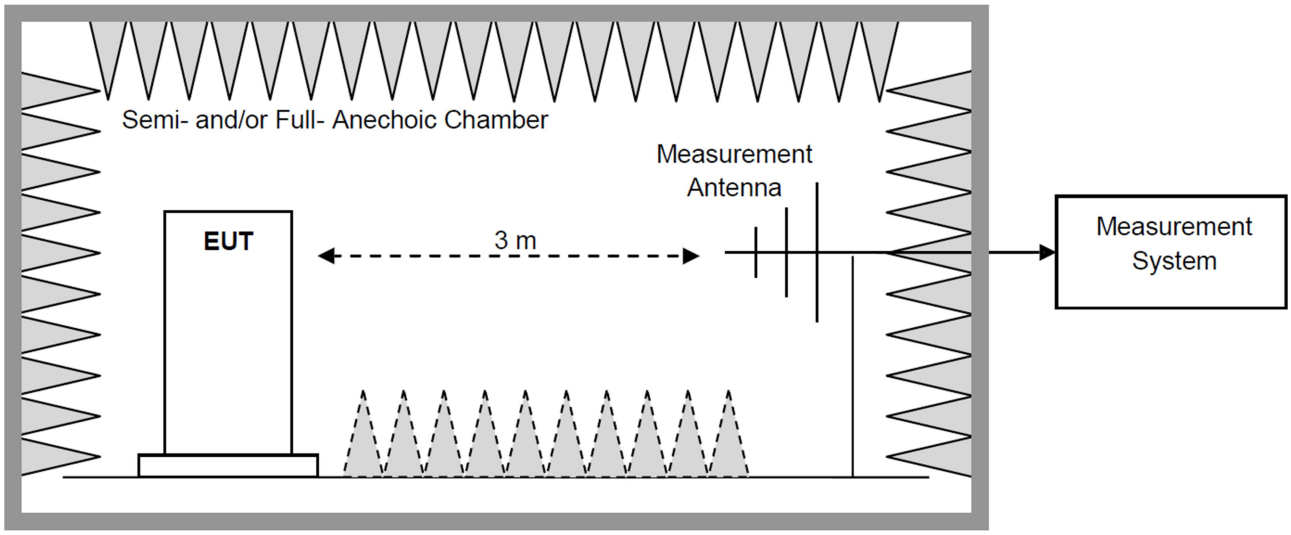
4.2 Test Setup 2



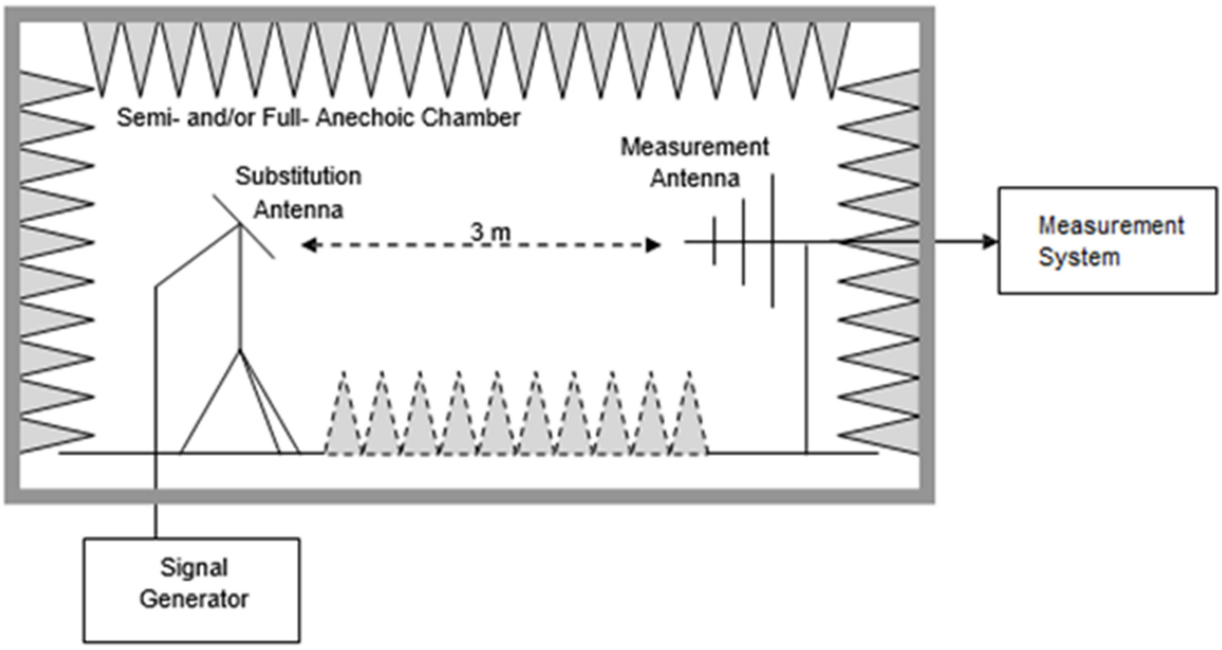
4.3 Test Setup 3

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.

Step 1: Pre-test



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



4.4 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	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	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	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	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	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	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	LTE/TM1,LTE/TM2
Spurious Emission at Antenna Terminals		Test Env.	Ambient Climate & Rated Voltage
		Test Setup	Test Setup 1
		RF Channels	L, M, H

	(TX)	(L= low channel, M= middle channel, H= high channel)
	Test Mode	LTE/TM1,LTE/TM2
Field Strength of Spurious Radiation	Test Env.	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 3
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
	Test Mode	LTE/TM1, LTE/TM2 NOTE: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected.
Frequency Stability	Test Env.	(1) -30 °C to +50 °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	LTE/TM1, LTE/TM2

5. Description of Tests

5.1 Effective (Isotropic) Radiated Power

Measurement Procedure: FCC KDB 971168 D01 V03r01 ; ANSI/ C63.10

Below 1GHz test procedure as below:

1). The EUT was powered ON and placed on a 0.8m high table in the chamber. The antenna of the transmitter was extended to its maximum length.

2). The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.

3). Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.

4). The transmitter was then removed and replaced with another antenna. The center of the antenna was approximately at the same location as the center of the transmitter.

5). A signal at the disturbance was fed to the substitution antenna by means of a non-radiating cable. With both the substitution and the receive antennas horizontally polarized, the receive antenna was raised and lowered to obtain a maximum reading at the test receiver. The level of the signal generator was adjusted until the measured field strength level in step 2) is obtained for this set of conditions.

6). The output power into the substitution antenna was then measured.

7). Steps 5) and 6) were repeated with both antennas polarized.

8). Calculate power in dBm by the following formula:

ERP (dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd)

Where:

Pg is the generator output power into the substitution antenna.

Above 1GHz test procedure as below:

1). Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber

2). Calculate power in dBm by the following formula:

EIRP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBi)

EIRP=ERP+2.15dB

Where:

Pg is the generator output power into the substitution antenna.

3). Test the EUT in the lowest channel, the middle channel the Highest channel

4). The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.

5). Repeat above procedures until all frequencies measured was complete.

Remark: Reference test setup 3

5.2 Peak-Average Ratio

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.7.1
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. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. The traces are generated with the spectrum analyzer set to zero span mode.
Remark: Reference test setup 1

Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power

5.3 Occupied Bandwidth

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 4.2

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 transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel, middle channel and high channel).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.

Remark: Reference test setup 1

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

5.4 Band Edge Compliance

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0
The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel).in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to peak or peak hold power.
Test Procedures Used
Remark: Reference test setup 1

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize

5.5 Spurious and Harmonic Emissions at Antenna Terminal

Measurement Procedure: FCC KDB 971168 D01 V03r01
The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel).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 10th 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.
Remark: Reference test setup 1

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to at least 10 * the fundamental frequency (separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings

5.6 Frequency Stability / Temperature Variation

Measurement Procedure:
Frequency stability testing is performed in accordance with the guidelines of FCC KDB 971168 D01 V03r01; ANSI/ C63.10
. The frequency stability of the transmitter is measured by:
a.) Temperature: The temperature is varied from -30°C to +50°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 ±0.00025% (±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 -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.
Remark: Reference test setup 2

6. Appendixes

Appendix No.	Description
FCC022022-0616RF12-Appendix A	Appendix for LTE B2
FCC022022-0616RF12-Appendix B	Appendix for LTE B4
FCC022022-0616RF12-Appendix C	Appendix for LTE B7
FCC022022-0616RF12-Appendix D	Appendix for LTE B12
FCC022022-0616RF12-Appendix E	Appendix for LTE B13
FCC022022-0616RF12-Appendix F	Appendix for LTE B41
FCC022022-0616RF12-Appendix G	Appendix for LTE B66
FCC022022-0616RF12-Appendix H	Appendix for LTE B71

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