



## FCC TEST REPORT

**Application No:** ZR/2021/30014  
**Applicant:** vivo Mobile Communication Co., Ltd.  
**Address of Applicant:** No.168 Jinghai East Rd., Chang'an, Dongguan, Guangdong, China  
**Manufacturer:** vivo Mobile Communication Co., Ltd.  
**Address of Manufacturer:** No.168 Jinghai East Rd., Chang'an, Dongguan, Guangdong, China  
**EUT Description:** Mobile Phone  
**Model No.:** V2050  
**Trade Mark:** vivo  
**FCC ID:** 2AUCY-V2066  
**Standards:** 47 CFR Part 2  
 47 CFR Part 22  
 47 CFR Part 27  
**Date of Receipt:** 2021/3/29  
**Date of Test:** 2021/3/29 to 2021/5/16  
**Date of Issue:** 2021/5/17

<b>Test Result:</b>	<b>PASS *</b>
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\* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Derek Yang  
Wireless Laboratory Manager



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# 1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2021/5/17		Original

Authorized for issue by:			
Prepared By		 _____ (Dee Zheng) / Engineer	
Checked By		 _____ (David Chen) / Reviewer	



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## 2 Test Summary

### 2.1 NR Band N7/ N41 (ENDC DC\_5A\_N41A)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict	Test Lab*
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)	EIRP ≤ 2W	Section 1 of Appendix B	Pass	A
Peak-Average Ratio	§27.50(a)	≤13 dB	Section 2 of Appendix B	Pass	A
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	Pass	A
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Section 4 of Appendix B	Pass	A
Band Edges Compliance	§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.	Section 5 of Appendix B	Pass	A
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)		Section 6 of Appendix B	Pass	A
Field Strength of Spurious Radiation	§2.1053, §27.53(m)		Section 7 of Appendix B	Pass	B
Frequency Stability	§2.1055, §27.54	Within authorized bands of operation/frequency block.	Section 8 of Appendix B	Pass	A

Remark: For the verdict, the "N/A" denotes "not applicable", the "N/T" denotes "not tested".



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### 3 General Information

#### 3.1 Client Information

Applicant:	vivo Mobile Communication Co., Ltd.
Address of Applicant:	No.168 Jinghai East Rd., Chang'an, Dongguan, Guangdong, China
Manufacturer:	vivo Mobile Communication Co., Ltd.
Address of Manufacturer:	No.168 Jinghai East Rd., Chang'an, Dongguan, Guangdong, China

#### 3.2 Test Location

##### Lab A:

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Test engineer:	Dee Zheng, Swing Hu, Habit Zeng

##### Lab B:

Company:	SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.
Address:	1/F, Unit D, Building 1, Kanghong Orange Technology Park, No.137, Keyuan 3rd Road, Fengdong New City, Xi'an, Shaanxi China
Post code:	710086
Test engineer:	Leah Chen, Ken Liu, Andy Yao



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### 3.3 Test Facility

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

**Lab A:**

**• A2LA (Certificate No. 3816.01)**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

**• VCCI**

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

**• FCC –Designation Number: CN1178**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

**• Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

**Lab B:**

**• A2LA (Certificate No. 4854.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

**• FCC –Designation Number: CN1271**



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### 3.4 General Description of EUT

EUT Description::	Mobile Phone
Model No.:	V2050
Trade Mark:	vivo
Hardware Version:	MP_0.1
Software Version:	PD2083CF_EX_A_3.6.2
Sample Type:	<input checked="" type="checkbox"/> Portable Device, <input type="checkbox"/> Module
Antenna Type:	<input type="checkbox"/> External, <input checked="" type="checkbox"/> Integrated
Antenna Gain:	N7: -3.5dBi (Ant0); N41: -3.5dBi (Ant0);

### 3.5 Test Mode

Test Mode	Test Modes Description
NR/TM1	NR system, DFT-s-Pi/2-BPSK modulation
NR/TM2	NR system, DFT-s-QPSK modulation
NR/TM3	NR system, DFT-s-16QAM modulation
NR/TM4	NR system, DFT-s-64QAM modulation
NR/TM5	NR system, DFT-s-256QAM modulation
NR/TM6	NR system, CP-QPSK modulation
NR/TM7	NR system, CP-16QAM modulation
NR/TM8	NR system, CP-64QAM modulation
NR/TM9	NR system, CP-256QAM modulation

Remark: The test mode(s) are selected according to relevant radio technology specifications.

### 3.6 Test Environment

Environment Parameter	Selected Values During Tests	
Relative Humidity	49%	
Atmospheric Pressure:	102.46 KPa	
Temperature	NT	25 °C
Voltage:	LV	3.6V
	NV	3.89V
	HV	4.5V

Remark: LV= lower extreme test voltage; NV= nominal voltage  
HV= upper extreme test voltage; NT= normal temperature



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### 3.7 Technical Specification

Characteristics	Description		
Radio System Type	<input checked="" type="checkbox"/> SA <input checked="" type="checkbox"/> NSA		
Supported Frequency Range	Band	TX	RX
	NR Band N7	2500 to 2570 MHz	2620 to 2690 MHz
	NR Band N41	2496 to 2690 MHz	2496 to 2690 MHz
	NR Band N7	SCK 15k: <input checked="" type="checkbox"/> 5 MHz; <input checked="" type="checkbox"/> 10 MHz; <input checked="" type="checkbox"/> 15 MHz; <input checked="" type="checkbox"/> 20 MHz; <input checked="" type="checkbox"/> 25 MHz; <input checked="" type="checkbox"/> 30 MHz; <input checked="" type="checkbox"/> 40 MHz; <input checked="" type="checkbox"/> 50 MHz	
	NR Band N41	SCK 30k: <input checked="" type="checkbox"/> 10 MHz; <input checked="" type="checkbox"/> 15 MHz; <input checked="" type="checkbox"/> 20 MHz; <input checked="" type="checkbox"/> 30 MHz; <input checked="" type="checkbox"/> 40 MHz; <input checked="" type="checkbox"/> 50 MHz; <input checked="" type="checkbox"/> 60 MHz; <input checked="" type="checkbox"/> 80 MHz; <input checked="" type="checkbox"/> 90 MHz; <input checked="" type="checkbox"/> 100 MHz	
	NR Band N7	SCK 15k: 4M49G7D;4M47W7D; 8M91G7D;8M95W7D; 14M1G7D;14M0W7D; 17M8G7D;17M8W7D; 23M8G7D;23M7W7D; 28M6G7D;28M5W7D; 38M6G7D;38M6W7D; 48M3G7D;48M1W7D;	
	NR Band N41	SCK 30k: 8M58G7D;8M57W7D; 12M9G7D;12M8W7D; 17M8G7D;17M8W7D; 27M8G7D;27M8W7D; 37M6G7D;37M7W7D; 47M2G7D;47M4W7D; 57M5G7D;57M6W7D; 77M0G7D;77M0W7D; 87M3G7D;87M6W7D; 96M5G7D;95M7W7D;	



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### 3.8 Test Frequencies

#### 3.8.1 Reference test frequencies for LTE operating band 5

E-UTRA Band	Transmitter / Receiver	Channel Bandwidth	Frequencies under Test		
			Lowest range (L)	Middle range (M)	Highest range (H)
Band 5	Transmitter	Lowest: 1.4 MHz	Channel 20407 824.7 MHz	Channel 20525 836.5 MHz	Channel 20643 848.3 MHz
		3 MHz	Channel 20415 825.5 MHz	Channel 20525 836.5 MHz	Channel 20635 847.5 MHz
		5 MHz	Channel 20425 826.5 MHz	Channel 20525 836.5 MHz	Channel 20625 846.5 MHz
		Highest: 10 MHz	Channel 20450 829 MHz	Channel 20525 836.5 MHz	Channel 20600 844 MHz
	Receiver	Lowest: 1.4 MHz	Channel 2407 869.7 MHz	Channel 2525 881.5 MHz	Channel 2643 893.3 MHz
		3 MHz	Channel 2415 870.5 MHz	Channel 2525 881.5 MHz	Channel 2635 892.5 MHz
		5 MHz	Channel 2425 871.5 MHz	Channel 2525 881.5 MHz	Channel 2625 891.5 MHz
		Highest: 10 MHz	Channel 2450 874 MHz	Channel 2525 881.5 MHz	Channel 2600 889 MHz



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**3.8.2 Reference test frequencies for NR operating band n7**

**3.8.2.1 Test frequencies for NR operating band n7 and SCS 15 kHz**

Band width [MHz]	carrier Bandwidth [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	absolute Frequency Point A [ARFCN]	offsetTo Carrier [PRBs]	SS block SCS [kHz]	GSCN	absolute Frequency SSB [ARFCN]
5	25	Downlink	Low	2622.5	524500	2620.25	524050	0	15	6554	524410
			Mid	2655	531000	2634.39	526878	102		6636	530910
			High	2687.5	537500	2594.53	518906	504		6718	537410
		Uplink	Low	2502.5	500500	2500.25	500050	0	-	-	-
			Mid	2535	507000	2442.03	488406	504		-	-
			High	2567.5	513500	2564.17	512834	6		-	-
10	52	Downlink	Low	2625	525000	2620.32	524064	0	15	6555	524430
			Mid	2655	531000	2631.96	526392	102		6630	530430
			High	2685	537000	2589.6	517920	504		6705	536430
		Uplink	Low	2505	501000	2500.32	500064	0	-	-	-
			Mid	2535	507000	2439.6	487920	504		-	-
			High	2565	513000	2559.24	511848	6		-	-
15	79	Downlink	Low	2627.5	525500	2620.39	524078	0	15	6556	524450
			Mid	2655	531000	2629.53	525906	102		6624	529950
			High	2682.5	536500	2584.67	516934	504		6692	535450
		Uplink	Low	2507.5	501500	2500.39	500078	0	-	-	-
			Mid	2535	507000	2437.17	487434	504		-	-
			High	2562.5	512500	2554.31	510862	6		-	-
20	106	Downlink	Low	2630	526000	2620.46	524092	0	15	6557	524650
			Mid	2655	531000	2627.1	525420	102		6618	529470
			High	2680	536000	2579.74	515948	504		6682	534530
		Uplink	Low	2510	502000	2500.46	500092	0	-	-	-
			Mid	2535	507000	2434.74	486948	504		-	-
			High	2560	512000	2549.38	509876	6		-	-
25	133	Downlink	Low	2632.5	526500	2620.25	524050	0	15	6554	524410
			Mid	2655	531000	2634.39	526878	102		6636	530910
			High	2677.5	535500	2594.53	518906	504		6718	537410
		Uplink	Low	2512.5	502500	2500.25	500050	0	-	-	-
			Mid	2535	507000	2442.03	488406	504		-	-
			High	2557.5	511500	2564.17	512834	6		-	-
30	160	Downlink	Low	2635	527000	2620.32	524064	0	15	6555	524430
			Mid	2655	531000	2631.96	526392	102		6630	530430
			High	2675	535000	2589.6	517920	504		6705	536430
		Uplink	Low	2515	503000	2500.32	500064	0	-	-	-
			Mid	2535	507000	2439.6	487920	504		-	-
			High	2555	511000	2559.24	511848	6		-	-



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Band width [MHz]	carrier Bandwidth [PRBs]	Range		Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	absolute Frequency PointA [ARFCN]	offsetTo Carrier [PRBs]	SS block SCS [kHz]	GSCN	absolute FrequencySSB [ARFCN]
40	216	Downlink	Low	2640	528000	2620.39	524078	0	15	6556	524450
			Mid	2655	531000	2629.53	525906	102		6624	529950
			High	2670	534000	2584.67	516934	504		6692	535450
		Uplink	Low	2520	504000	2500.39	500078	0	-	-	-
			Mid	2535	507000	2437.17	487434	504		-	-
			High	2550	510000	2554.31	510862	6		-	-
50	270	Downlink	Low	2645	529000	2620.46	524092	0	15	6557	524650
			Mid	2655	531000	2627.1	525420	102		6618	529470
			High	2665	533000	2579.74	515948	504		6682	534530
		Uplink	Low	2525	505000	2500.46	500092	0	-	-	-
			Mid	2535	507000	2434.74	486948	504		-	-
			High	2545	509000	2549.38	509876	6		-	-



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**3.8.3 Reference test frequencies for NR operating band n41**

**3.8.3.1 Test frequencies for NR operating band n41 and SCS 30 kHz**

Band width [MHz]	carrier Bandwidth [PRBs]	Range	Carrier centre [MHz]	Carrier centre [ARFCN]	point A [MHz]	absolute Frequency Point A [ARFCN]	offset To Carrier [PRBs]	SS block SCS [kHz]	GSCN	absolute Frequency SSB [ARFCN]	
10	24	Downlink & Uplink	Low	2501.01	500202	2496.69	499338	0	30	6252	500190
			Mid	2592.99	518598	2551.95	510390	102		6483	518670
			High	2685	537000	2499.24	499848	504		6711	536910
15	38	Downlink & Uplink	Low	2503.5	500700	2496.66	499332	0	30	6252	500190
			Mid	2592.99	518598	2549.43	509886	102		6474	517950
			High	2682.48	536496	2494.2	498840	504		6699	535950
20	51	Downlink & Uplink	Low	2506.02	501204	2496.84	499368	0	30	6252	500190
			Mid	2592.99	518598	2547.09	509418	102		6471	517710
			High	2679.99	535998	2489.37	497874	504		6687	534990
30	78	Downlink & Uplink	Low	2511	502200	2496.96	499392	0	30	6252	500190
			Mid	2592.99	518598	2542.23	508446	102		6456	516510
			High	2674.98	534996	2479.5	495900	504		6663	533070
40	106	Downlink & Uplink	Low	2516.01	503202	2496.93	499386	0	30	6252	500190
			Mid	2592.99	518598	2537.19	507438	102		6444	515550
			High	2670	534000	2469.48	493896	504		6636	530910
50	133	Downlink & Uplink	Low	2521.02	504204	2497.08	499416	0	30	6252	500190
			Mid	2592.99	518598	2532.33	506466	102		6432	514590
			High	2664.99	532998	2459.61	491922	504		6612	528990
60	162	Downlink & Uplink	Low	2526	505200	2496.84	499368	0	30	6252	500190
			Mid	2592.99	518598	2527.11	505422	102		6420	513630
			High	2659.98	531996	2449.38	489876	504		6588	527070
80	217	Downlink & Uplink	Low	2536.02	507204	2496.96	499392	0	30	6252	500190
			Mid	2592.99	518598	2517.21	503442	102		6396	511710
			High	2649.99	529998	2429.49	485898	504		6537	522990
90	245	Downlink & Uplink	Low	2541	508200	2496.9	499380	0	30	6252	500190
			Mid	2592.99	518598	2512.17	502434	102		6381	510510
			High	2644.98	528996	2419.44	483888	504		6513	521070
100	273	Downlink & Uplink	Low	2546.01	509202	2496.87	499374	0	30	6252	500190
			Mid	2592.99	518598	2507.13	501426	102		6369	509550
			High	2640	528000	2409.42	481884	504		6486	518910



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## 4 Description of Tests

### 4.1 Conducted Output Power

Measurement Procedure: FCC KDB 971168 D01 V03r01

The transmitter output was connected to a calibrated coaxial cable, attenuator and power meter, 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 power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. The tests were performed at three frequencies (low channel, middle channel and high channel) and on the highest power levels, which can be setup on the transmitters.

**Remark: Reference test setup 1**

### 4.2 Effective (Isotropic) Radiated Power of Transmitter

Measurement Procedure: FCC KDB 971168 D01 V03r01 ; C63.26 (2015)

Calculate power in dBm by the following formula:

ERP (dBm) = Conducted Power (dBm) + antenna gain (dBd)

EIRP(dBm) = Conducted Power (dBm) + antenna gain (dBi)

EIRP=ERP+2.15dB

### 4.3 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**



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**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  $\geq$  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

**4.4 Band Edge at Antenna Terminals**

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

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 two 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.

**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  $\geq$  1% of the emission bandwidth
4. VBW  $\geq$  3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq$  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

**4.5 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



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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  $10 \times$  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

## 4.6 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

## 4.7 Field Strength of Spurious Radiation

Measurement Procedure: FCC KDB 971168 D01 V03r01





**Below 1GHz test procedure as below:**

- 1). The EUT was powered ON and placed on a 80cm 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) 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:

$$\text{ERP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBd)}$$

Where:

Pd is the dipole equivalent power, Pg 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 Pg [dBm] – cable loss [dB]. The calculated Pd levels are then compared to the absolute spurious emission limit of -13dBm which is equivalent to the required minimum attenuation of 43 + 10log10(Power [Watts]).

**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:

$$\text{EIRP(dBm)} = \text{Pg(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dBi)}$$

$$\text{EIRP} = \text{ERP} + 2.15\text{dB}$$

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**

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Pre-amplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Pre-amplifier Factor

- 2) Scan from 9kHz to 40GHz, The disturbance between 9kHz to 30MHz and 18GHz to 40GHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics



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had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .

3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

4) All modes have been tested, but only the worst case data displayed in this report.

## 4.8 Frequency Stability / Temperature Variation

Measurement Procedure:

Frequency stability testing is performed in accordance with the guidelines of FCC KDB 971168 D01 V03r01; ANSI/C63.26 (2015)

. 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  $\pm 0.00025\%$  ( $\pm 2.5$  ppm ) of the center frequency.

**Time Period and Procedure:**

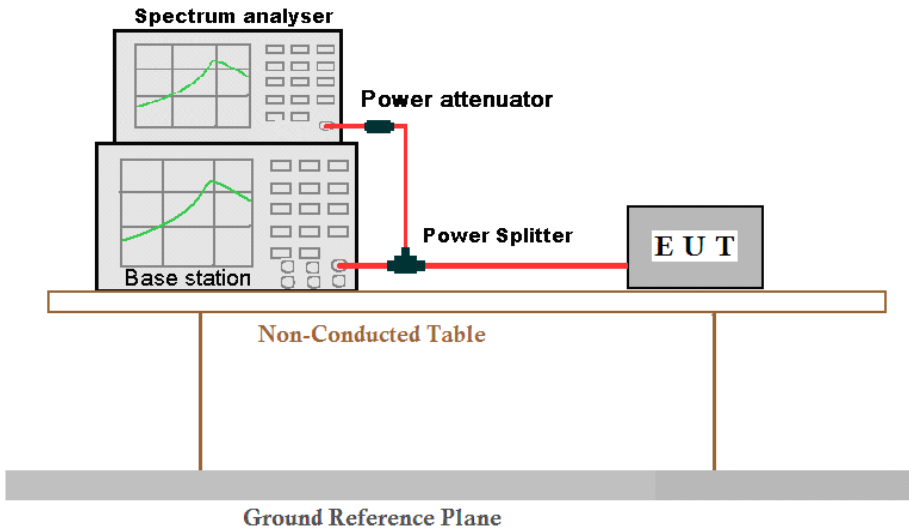
1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -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 4**



## 4.9 Test Setups

### 4.9.1 Test Setup 1



### 4.9.2 Test Setup 2

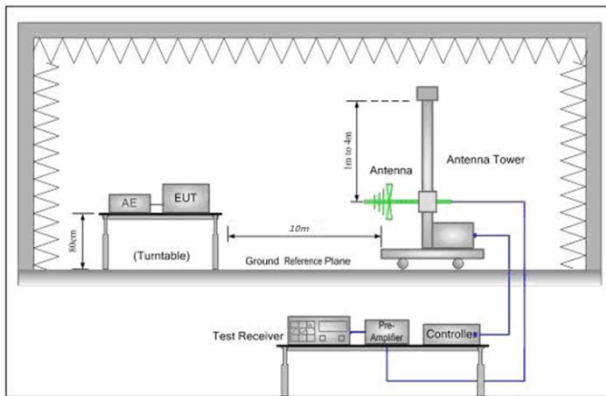


Figure 1. 30MHz to 1GHz

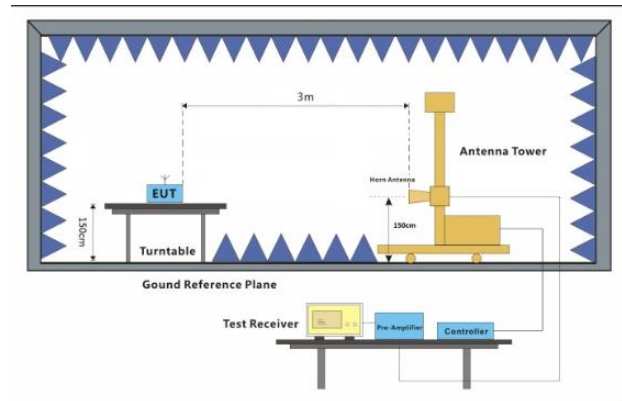


Figure 2. above 1GHz

### 4.9.3 Test Setup 3

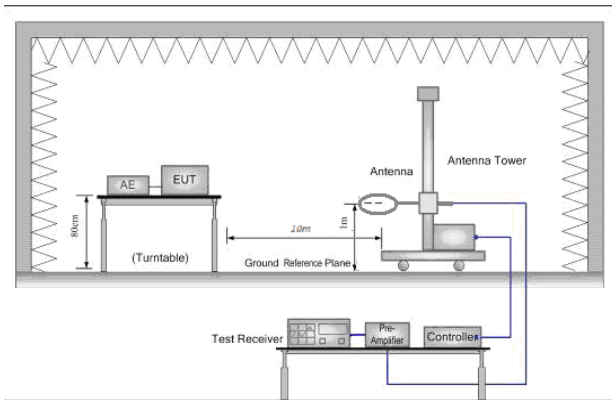


Figure 1. Below 30MHz

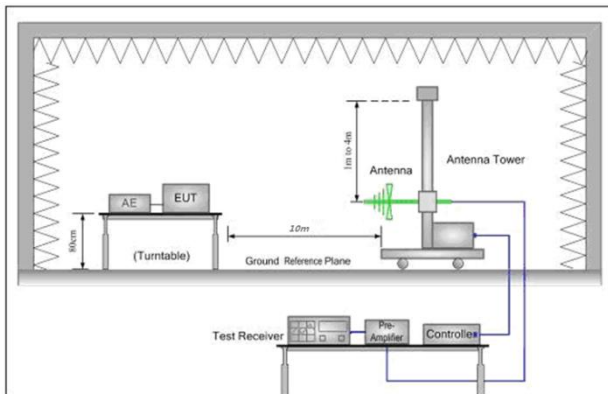


Figure 2. 30MHz to 1GHz

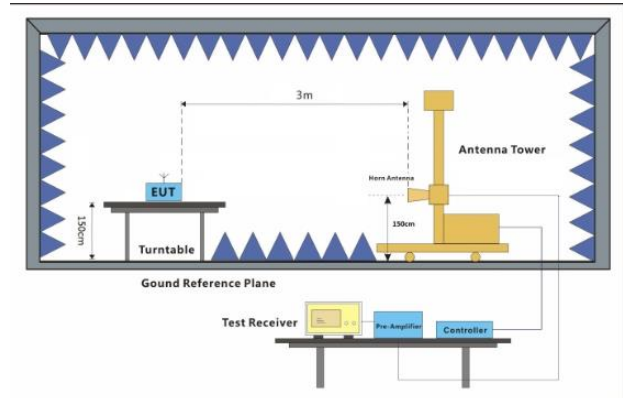
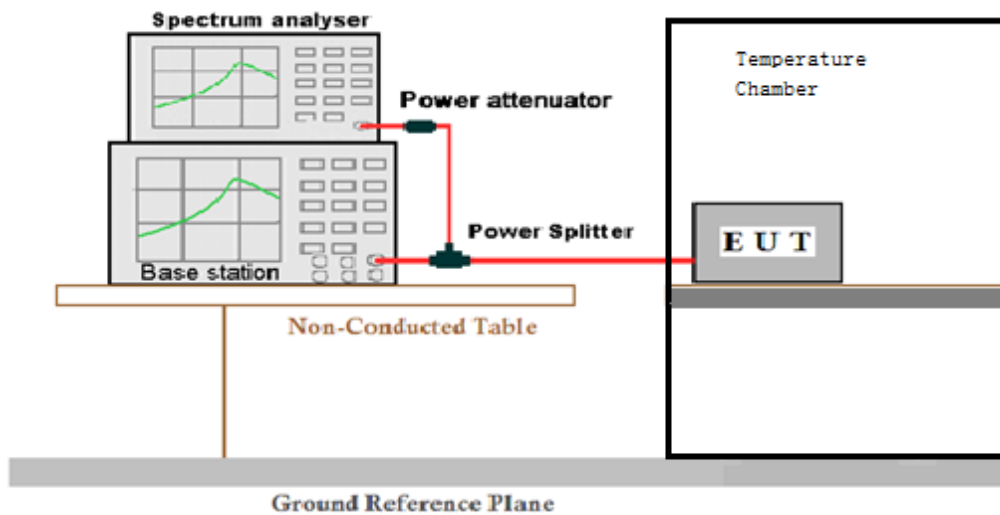


Figure 3. above 1GHz

### 4.9.4 Test Setup 4



### 4.10 Test Conditions

Test Case		Test Conditions	
Transmit Output Power Data	Average Power, Total	Test Environment	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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8;NR/TM9
	Average Power, Spectral Density (if required)	Test Environment	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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8;NR/TM9
Peak-to-Average Ratio (if required)	Test Environment	Ambient Climate & Rated Voltage	
	Test Setup	Test Setup 1	
	RF Channels (TX)	M (M= middle channel )	
	Test Mode	NR/TM1;NR/TM6	
Modulation Characteristics	Test Environment	Ambient Climate & Rated Voltage	
	Test Setup	Test Setup 1	
	RF Channels (TX)	M (M= middle channel )	
	Test Mode	NR/TM1;NR/TM6	
Bandwidth	Occupied Bandwidth	Test Environment	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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8;NR/TM9
	Emission Bandwidth (if required)	Test Environment	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	NR/TM1;NR/TM2;NR/TM3;NR/TM4;NR/TM5;NR/TM6; NR/TM7;NR/TM8;NR/TM9
Band Edges Compliance	Test Environment	Ambient Climate & Rated Voltage	
	Test Setup	Test Setup 1	
	RF Channels (TX)	L, H (L= low channel, H= high channel )	
	Test Mode	NR/TM1;NR/TM6	
Spurious Emission at	Test Environment	Ambient Climate & Rated Voltage	



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Antenna Terminals	Test Setup	Test Setup 1
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel )
	Test Mode	NR/TM1
Field Strength of Spurious Radiation	Test Environment	Ambient Climate & Rated Voltage
	Test Setup	Test Setup 2
	Test Mode	NR/TM1 Remark: 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 Environment	(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 4
	RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel )
	Test Mode	NR/TM1;NR/TM6



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## 5 Main Test Instruments

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date	Cal. Due date
				(yyyy-mm-dd)	(yyyy-mm-dd)
Dual Output Mobile Communication DC Source	Agilent Technologies Inc	66311B	W009-09	2020/10/22	2021/10/21
Signal Analyzer	Rohde & Schwarz	FSV	W005-02	2020/4/16	2021/4/15
				2021/4/14	2022/4/13
Signal Analyzer	KEYSIGHT	N9020A	MY48011756	2020/4/16	2021/4/15
				2021/4/14	2022/4/13
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Humidity/ Temperature Indicator	Shanghai Meteorological Industry Factory	HTC-1	W006-17	2020/10/22	2021/10/21
Temperature Chamber	GIANT FORCE	ICT-150-40-CP-AR	W027-03	2020/10/22	2021/10/21
UXM 5G Wireless Test Platform	KEYSIGHT	E7515B	MY59321333	2020/12/3	2021/12/3



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RSE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2021-04-01	2022-03-31
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2021-04-01	2022-03-31
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna (15GHz~40GHz)	Schwarzbeck	BBHA 9170	XAW01-09-03	2019-10-13	2021-10-12
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP00903040	XAW01-41-01	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2020-10-27	2021-10-26
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2020-10-26	2021-10-25
5G UXM	Keysight	E7515B	XAW01-04-01	2020-09-11	2021-09-10
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2020-11-06	2021-11-05
Measurement Software	Tonscend	TS+ RSE V3.0.0.2	XAW02-05-01	NCR	NCR



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## 6 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	Data
Transmit Output Power Data	Power [dBm]	$U = \pm 0.37$ dB
Bandwidth	Magnitude [%]	$U = \pm 0.2\%$
Band Edge Compliance	Disturbance Power [dBm]	$U = \pm 2.0$ dB
Spurious Emissions, Conducted	Disturbance Power [dBm]	$U = \pm 2.0$ dB
Field Strength of Spurious Radiation	ERP[dBm]/EIRP [dBm]	For 3 m Chamber: $U = \pm 4.5$ dB (30 MHz to 1GHz) $U = \pm 3.3$ dB (above 1 GHz) For 10 m Chamber: $U = \pm 4.5$ dB (30 MHz to 1GHz) $U = \pm 3.2$ dB (above 1 GHz)
Frequency Stability	Frequency Accuracy [ppm]	$U = \pm 0.24$ ppm



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## 7 Appendixes

Appendix A	Set-Up Photos
Appendix B.17	N7
Appendix B.18	N41

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The End



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