Industrial Internet Innovation Center (Shanghai) Co.,Ltd.

RF TEST REPORT

PRODUCT	Smart POS system
BRAND	SUNMI
MODEL	T6F10
APPLICANT	Shanghai Sunmi Technology Co.,Ltd.
FCC ID	2AH25T6F10
ISSUE DATE	January 26, 2024
STANDARD(S)	FCC Part 2, FCC Part 22H, FCC Part 24E,FCC Part27

Prepared by: ***Rui Wu*** **Reviewed by:** ***Fan Yang*** **Approved by:** ***Min Zhang***

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1. Summary of Test Report

1.1 Test Standard (s)

No.	Test Standard	Title	Version
1	FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	--
2	FCC Part 22H	CELLULAR RADIOTELEPHONE SERVICE	--
3	FCC Part 24E	BROADBAND PCS	--
4	FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	--
Note: FCC Part 2 have not been accredited by A2LA.			

1.2 Reference Documents

No.	Test Standard	Title	Version
1	ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
2	ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio	2015
3	KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01
Note: KDB 971168 D01 have not been accredited by A2LA.			

1.3 Summary of Test Results

WCDMA II

Test Name	Clause in FCC rules	Verdict
Output Power/EIRP	2.1046,24.232(c)	Pass
Peak-to-Average Ratio	24.232(d)	Pass
99%Occupied Bandwidth	2.1049	Pass
26dB Emission Bandwidth	2.1049	Pass
Band Edge at antenna terminals	2.1051/24.238(a)	Pass
Frequency stability	24.235	Pass
Conducted Spurious mission	2.1051/24.238(a)	Pass
Emission Limit	2.1053/24.238(a)	Pass

WCDMA IV

Test Name	Clause in FCC rules	Verdict
Output Power	2.1046/27.50(d)(4)	Pass
Peak-to-Average Ratio	27.50(d)(5)	Pass
99%Occupied Bandwidth	2.1049	Pass
26dB Emission Bandwidth	2.1049	Pass
Band Edge Compliance	2.1051/27.53(h)	Pass
Frequency Stability	27.54	Pass
Conducted Spurious Emission	2.1051/27.53(h)	Pass
Emission Limit	2.1053/27.53(h)	Pass

WCDMA V

Test Name	Clause in FCC rules	Verdict
Output Power/ERP	2.1046/22.913(a)	Pass
Peak-to-Average Ratio	N/A	Pass
99%Occupied Bandwidth	2.1049	Pass
26dB Emission Bandwidth	2.1049	Pass
Band Edge at antenna terminals	2.1051/22.917(a)	Pass
Frequency stability	22.355	Pass
Conducted Spurious mission	2.1051/22.917(a)	Pass
Emission Limit	2.1053/22.917(a)	Pass

Note:

The T6F10, manufactured by Shanghai Sunmi Technology Co.,Ltd is a new product for testing.

There are two configurations S15aa&S14aa (Mainly Supply) and S21aa&S24aa (Secondary Supply) in this project. We mainly tested the S15aa&S14aa (Mainly Supply), and the S21aa&S24aa (Secondary Supply) tested the worst mode RSE of the mainly supply, and recorded the test results of the worst mode respectively in the report.

The description of the differences between S15aa&S14aa (Mainly Supply) and S21aa&S24aa (Secondary Supply) are as follows:

Model / Difference	T6F10 (High Configuration) S15aa&S14aa (Mainly Supply)	T6F10 (Basic Configuration) S21aa&S24aa (Secondary Supply)
Scanner	Yes	No
LCD (Just different manufacturers)	SHENZHEN DJN PHOTOELECTRIC TECHNOLOGY CO., LTD	CPT Technology (Group) Co.,Ltd
DDR	It's just that the manufacturer and memory are different	
EMMC	It's just that the manufacturer and memory are different	

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 1.3.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 4 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 1 of this test report.

1.4 Data Provided by Applicant

No.	Item(s)	Data
1	WCDMA Band 2	0.46dBi
2	WCDMA Band 4	-0.42dBi
3	WCDMA Band 5	-1.63dBi
Note: The data of antenna gain is provided by the Antenna specification may affect the validity of the test results in this report, and the impact and consequences of this shall be undertaken by the customer.		

2. General Information of The Laboratory

2.1 Testing Laboratory

Lab Name	Industrial Internet Innovation Center (Shanghai) Co.,Ltd.
Address	Building 4，No. 766，Jingang Road，Pudong，Shanghai，China
Telephone	021-68866880
FCC Registration No.	708870
FCC Designation No.	CN1364

2.2 Laboratory Environmental Requirements

Temperature	15℃~35℃
Relative Humidity	25%RH~75%RH
Atmospheric Pressure	86kPa~106kPa

2.3 Project Information

Project Manager	Gao Hongning
Test Date	December 05, 2023 to January 25, 2024

3. General Information of The Customer

3.1 Applicant

Company	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, No.388,Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18826519551

3.2 Manufacturer

Company	Shanghai Sunmi Technology Co.,Ltd.
Address	Room 505, No.388,Song Hu Road, Yang Pu District, Shanghai, China
Telephone	18826519551

4. General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product	Smart POS system
Model	T6F10
Date of Receipt	S14aa/S15aa/S21aa: December 05, 2023 S24aa:December 11, 2023
EUT ID*	S14aa/S15aa/S21aa/S24aa
SN/IMEI	S14aa:P305D3BP10020 S15aa: P305D3BP10023 S21aa: P302D3BF10251 S24aa :P305D3BP10042
Supported Radio Technology and Bands	GSM850/GSM900/DCS1800/PCS1900 WCDMA Band I/II/IV/V/VI/VIII/XIX LTE Band 1/2/3/4/5/7/8/18/19/20/26/28/34/38/39/40/41 BT 5.0 BLE/BR/EDR WLAN 802.11b/g/n WLAN 802.11a/n/ac GPS/GLONASS/BDS/Galileo NFC
Hardware Version	V1.0(LA+EU)
Software Version	V3.0.0
FCC ID	2AH25T6F10
Power Rating	DC 7.7V form battery, DC 5V form adapter
NOTE1: EUT ID is the internal identification code of the laboratory. NOTE2: Samples in the test report are provided by the customer. The test results are only applicable to the samples received by the laboratory.	

4.2 Description for Auxiliary Equipment (AE)

AE ID*	Description	Model	SN/Remark
AE1	RF Cable	N/A	N/A
CD01	Adapter	TPA-141A050200UU01	N/A
CH02	Adapter	UC13US	N/A
CI02	Adapter	TPA-23A050200UU01	N/A
UA09	USB Cable	N/A	N/A
BA12	Battery	HPPA	ICON ENERGY SYSTEM (SHENZHEN) CO., LTD.
BB07	Battery	HPPA	Guangdong Highpower New Energy TechnologyCo., Ltd.

NOTE1: AE ID is the internal identification code of the laboratory. NOTE2: By verifying that BA12+CI02 is the worst battery and adapter combination, this battery and adapter are used in all tests.

4.3 Additional Information

Modulation:

Type of modulation	QPSK/16QAM

Band Frequency Range:

Band	**Frequency Range(MHz)**
Band II	1850 -1910
Band IV	1710 -1755
Band V	824 – 849

Band List:

Band	**Low Channel**	**Low Freq. (MHz)**	**Mid Channel**	**Mid Freq. (MHz)**	**High Channel**	**High Freq. (MHz)**
Band II	9262	1852.4	9400	1880	9538	1907.6
Band IV	1312	1712.4	1413	1732.6	1513	1752.6
Band V	4132	826.4	4183	836.6	4233	846.6

5. Test Configuration Information

5.1 Laboratory Environmental Conditions

5.1.1 Permanent Facilities

Relative Humidity	Min. = 45%, Max. = 55 %		
Atmospheric Pressure	101kPa		
Temperature	Normal	Minimum	Maximum
	25℃	-10℃	50℃
Working Voltage of EUT	Normal	Minimum	Maximum
	7.7V	6.0V	8.8 V

5.2 Test Equipments Utilized

Conduction test system

No.	Name	Model	S/N	SW Version	HW Version	Manufacturer	Cal. Date	Cal. Interval
1	Software	Eagle V3.3	N/A	V3.3	N/A	3IN	N/A	N/A
2	Frequency spectrum analyzer	FSQ	101091	V4.75	V11.00	R&S	2023-07-26	1 Year
3	Wideband Radio Communication Tester	CMW 500	148874	V3.5.136	N/A	R&S	2023-07-27	1 Year
4	Temperature Chamber	B-TF-107C	201804107	N/A	N/A	BoYi	2023-06-28	1 Year
5	Programmable power supply	Keithley 2303	4039070	N/A	N/A	Keithley	2023-06-23	1 Year
6	RF Test Automation Box	RF 2021B	2001	V3.3	N/A	RANATEC	N/A	N/A

Radiated emission test system

No.	Name	Model	S/N	SW Version	HW Version	Manufacturer	Cal. Date	Cal. Interval
1	Universal Radio Communication Tester	CMU200	123126	V5.2.1	B12	R&S	2023-10-16	1 Year
2	Universal Radio Communication Tester	CMW500	104178	V3.7.20	1206.0600.00	R&S	2023-10-16	1 Year

3	EMI Test Receiver	ESU40	100307	V5.1-24-3	01	R&S	2022-12-19	1 Year
4	TRILOG Broadband Antenna	VULB9163	01345	N/A	N/A	Schwarzbeck	2023-03-23	1 Year
5	Double- ridged Waveguide Antenna	ETS-3117	00135890	N/A	N/A	ETS	2022-03-09	2 Years
6	EMI Test Software	EMC32 V10.35.02	N/A	N/A	N/A	R&S	N/A	N/A
7	Preamplifier	SCU08F1	8320024	N/A	N/A	R&S	2023-10-16	1 year
8	Preamplifier	SCU18	10155	N/A	N/A	R&S	2023-10-16	1 year
9	Antenna	SWB-VUBA 9117	9117-266	N/A	N/A	Schwarzbeck	2023-9-8	1 year
10	Antenna	BBHA9120 D	02112	N/A	N/A	Schwarzbeck	2023-7-28	1 year
11	Signal Generator	SMF100A	102314	3.20.390.24	05.10	R&S	2023-10-16	1 year

5.3 Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in 3IN documents. The detailed measurement uncertainty is defined in 3IN documents.

Measurement Uncertainty of Radiation test

Frequency Range	Uncertainty(dB)
30MHz ≤ f ≤ 1GHz	±5.10
1GHz ≤ f ≤ 18GHz	±5.66
18GHz ≤ f ≤ 40GHz	±5.22

Measurement Uncertainty of Conduction test

No	Item	Extended uncertainty（k=2）	
1	Frequency Tolerance	23Hz	
2	RF Output Power	0.7dB	
3	conducted spurious	9kHz～3.6GHz	1.5dB
		3.6GHz～8.4GHz	2.8dB
		8.4GHz～12.75GHz	3.4dB
4	EVM	2.1%	
6	Occupied Bandwidth	Bandwidth 1.4MHz	0.03MHz
		Bandwidth 3MHz	0.03MHz
		Bandwidth 5MHz	0.03MHz
		Bandwidth 10MHz	0.05MHz
		Bandwidth 15MHz	0.06MHz
		Bandwidth 20MHz	0.08MHz
7	Emission intermodulation	Adjacent channel	1.4dB
		Alternate channel	1.4dB
8	Range of frequency	0.08MHz	

6. Test Results

6.1 Output Power

6.1.1 Measurement Limit

FCC §22.913(a) Mobile stations are limited to 7watts.
FCC §24.232(c) Mobile and portable stations are limited to 2 watts.
FCC §27.50d(4) Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

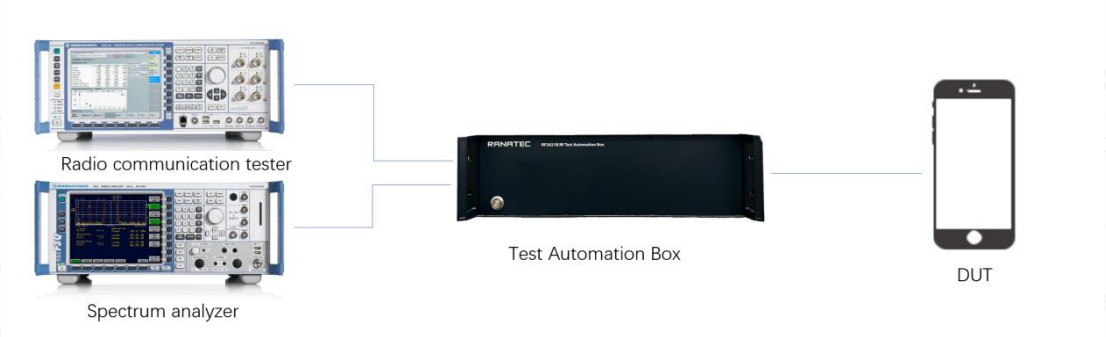
6.1.2 Method of Measurements

Method of measurements please refer to KDB971168 D01 v03 clause 5.
The EUT was set up for the max output power with pseudo random data modulation.
The power was measured with Rhode & Schwarz base station CMW500.
These measurements were done at 3 frequencies.(bottom, middle and top of operational frequency range).
1. The transmitter output port was connected to base station.
2. Set the EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record maximum average power for other modulation signal.
5. During the process of testing, the EUT was controlled Rhode & Schwarz Digital Radio.
6. Communication tester to ensure max power transmission and proper modulation.
7. This result contains output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.
EIRP= Conducted power+Gain, ERP = EIRP -2.15dBi.

6.1.3 Test procedures

The transmitter output power was connected to calibrated attenuator, the other end of which was connected to signal analyzer. Transmitter output power was read off the power in dBm. The power outputs at the transmitter antenna port was determined by adding the value of attenuator to the base station reading.

6.1.4 Test Setup



6.1.5 Output Powe results

Mode	Test Mode	Tune up	Channel/Frequency(MHz)		
			9262/1852.4	9400/1880	9538/1907.6
WCDMA II	RMC	23.50	23.05	23.08	23.06
Mode	Test Mode	Tune up	Channel/Frequency(MHz)		
			1312/1712.4	1413/1732.6	1513/1752.6
WCDMA IV	RMC	23.50	23.11	23.13	23.06
Mode	Test Mode	Tune up	Channel/Frequency(MHz)		
			4132/826.4	4183/836.6	4233/846.6
WCDMA V	RMC	24.50	23.76	23.78	23.73

6.1.6 EIRP/ERP results

WCDMA Band 2

Frequency (MHz)	EIRP (dBm)
1852.4	23.51
1880.0	23.54
1907.6	23.52

WCDMA Band 4

Frequency(MHz)	EIRP(dBm)
1712.4	22.69
1732.6	22.71
1752.6	22.64

WCDMA Band 5

Frequency(MHz)	EIRP(dBm)	ERP(dBm)
826.4	22.13	19.98
836.6	22.15	20.00
846.6	22.10	19.95

6.2 Peak-to-Average Power Ratio

6.2.1 Measurement Limit

CFR Part 22.913(d)/24.232(d)/27.50:The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB

6.2.2 Method of Measurement

The EUT was connected to the spectrum analyzer and system simulator via a power divider.
Select the spectrum analyzer CCDF function.
Set RBW ≥ signal's occupied bandwidth.
Set the number of counts to a value that stabilizes the measured CCDF cure;
Sweep time ≥ 1s.
Record the maximum PAPR level associated with a probability of 0.1%.

6.2.3 Test Setup

6.2.4 Measurement results

Band	Channel	PAPR	Limit
WCDMA II	Low	2.82	N/A
WCDMA II	Mid	3.08	N/A
WCDMA II	High	3.04	N/A
Band	**Channel**	**PAPR**	**Limit**
WCDMA IV	Low	2.82	13
WCDMA IV	Mid	2.69	13
WCDMA IV	High	2.98	13
Band	**Channel**	**PAPR**	**Limit**
WCDMA V	Low	3.01	13
WCDMA V	Mid	3.01	13
WCDMA V	High	3.01	13

6.3 99% Occupied Bandwidth

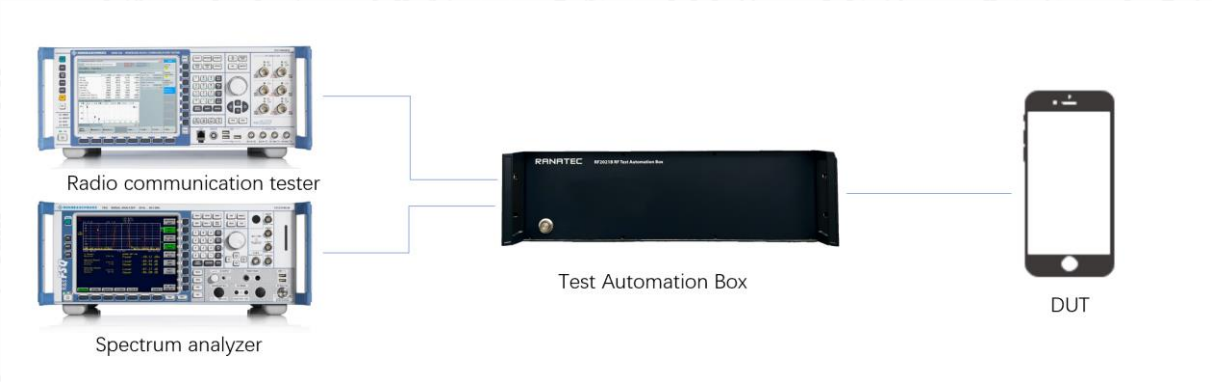
6.3.1 Summary

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of WCDMA BAND II , WCDMA BAND IV and WCDMA BAND V.

6.3.2 Method of Measurement

The EUT output RF connector was connected with a short cable to the signal analyzer.
RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
99% bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.

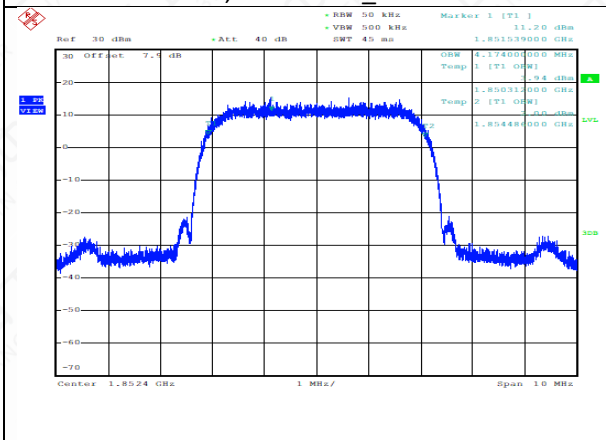
6.3.3 Test Setup



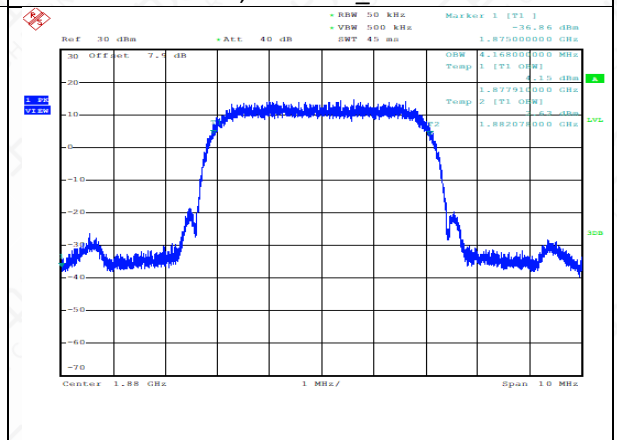
6.3.4 Measurement results

Band	Channel	99%Occupied Width(kHz)
OB2	9262	4174.00 kHz
OB2	9400	4168.00 kHz
OB2	9538	4171.00 kHz
Band	**Channel**	**99%Occupied Width(kHz)**
OB4	1312	4177.00 kHz
OB4	1413	4182.00 kHz
OB4	1513	4172.00 kHz
Band	**Channel**	**99%Occupied Width(kHz)**
OB5	4132	4174.00 kHz
OB5	4183	4167.00 kHz
OB5	4233	4152.00 kHz

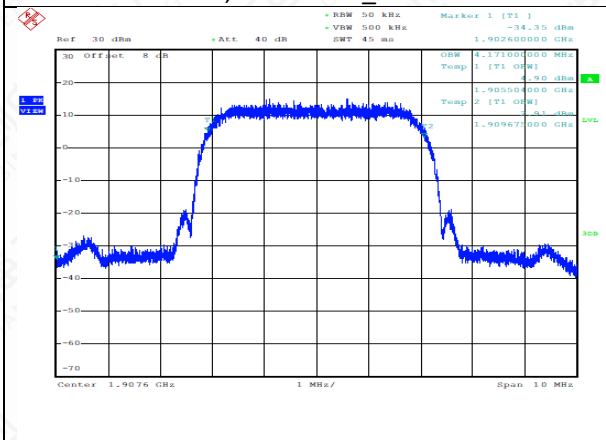
OB2,1852.4MHz_OBW



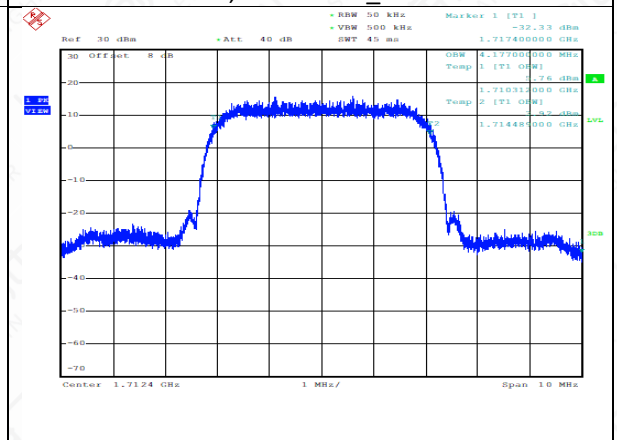
OB2,1880MHz_OBW



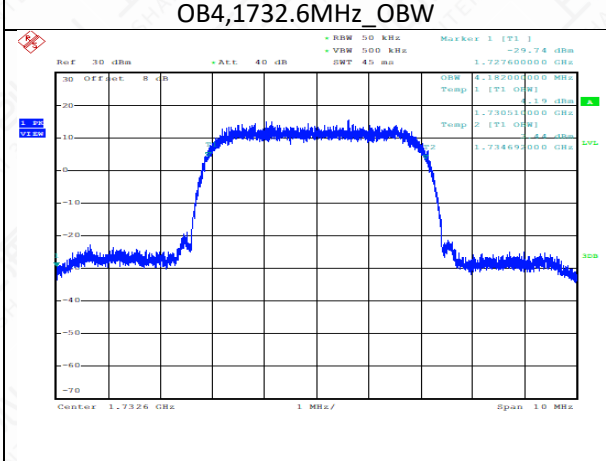
OB2,1907.6MHz_OBW



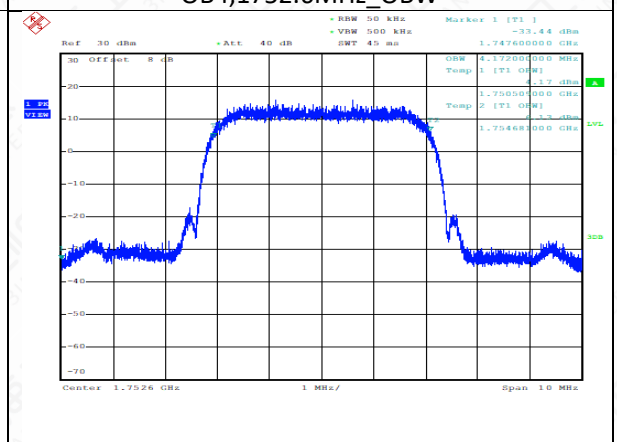
OB4,1712.4MHz_OBW



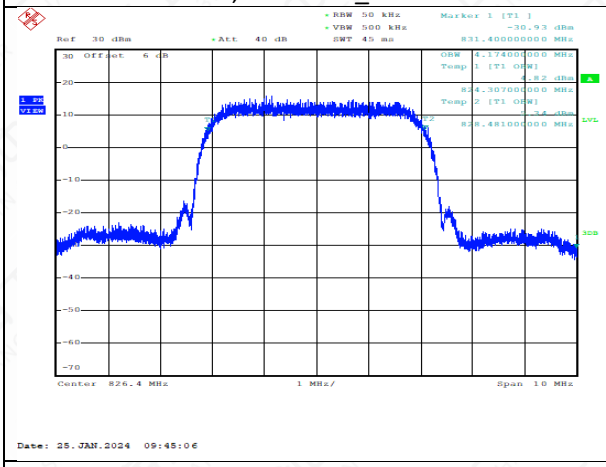
OB4,1732.6MHz_OBW



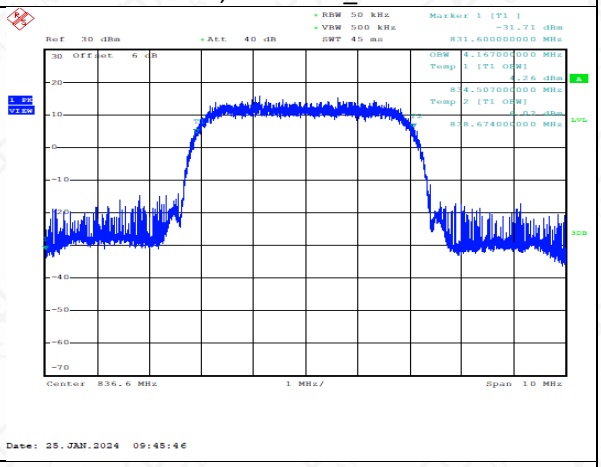
OB4,1752.6MHz_OBW



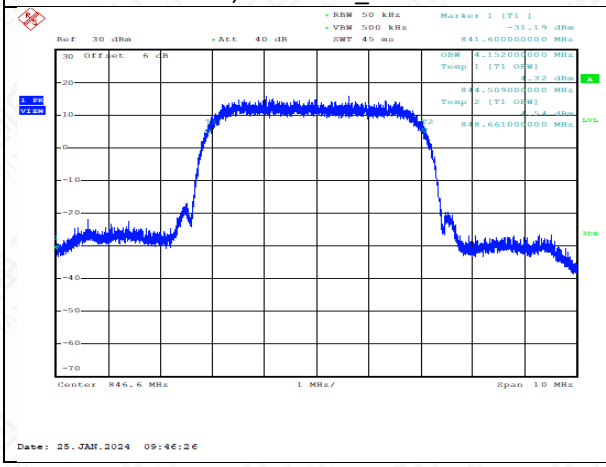
OB5,826.4MHz_OBW



OB5,836.6MHz_OBW



OB5,846.6MHz_OBW



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6.4 26dB Emission Bandwidth

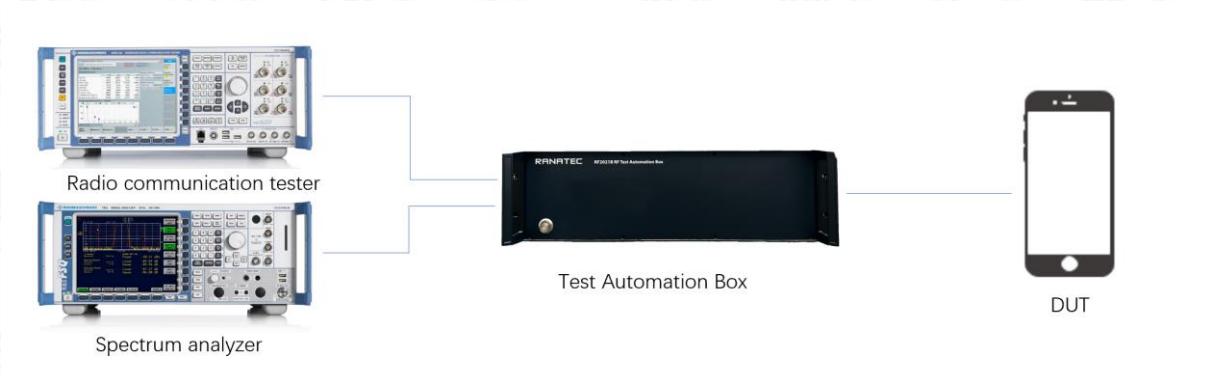
6.4.1 Summary

Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of WCDMA BANDII, WCDMA BANDIV, WCDMA BANDV.

6.4.2 Method of Measurement

The EUT output RF connector was connected with a short cable to the signal analyzer.
RBW was set to about 1% of emission BW, VBW >= 3 times RBW,.
26dB bandwidth were measured, the occupied bandwidth is delta frequency between the two points where the display line intersects the signal trace.
For WCDMA: signal analyzer setting as: RBW=50KHz; VBW=200KHz; Span=10MHz.

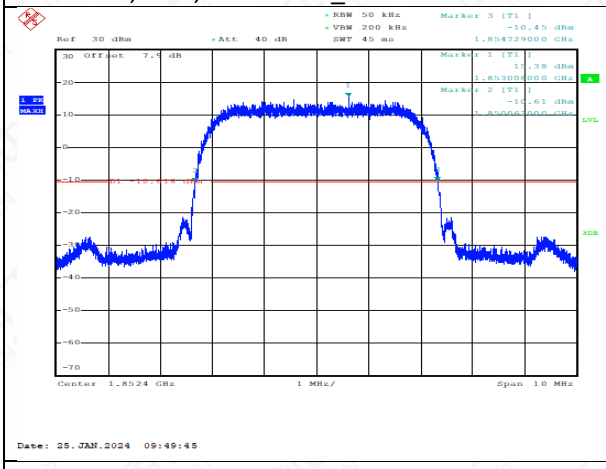
6.4.3 Test Setup



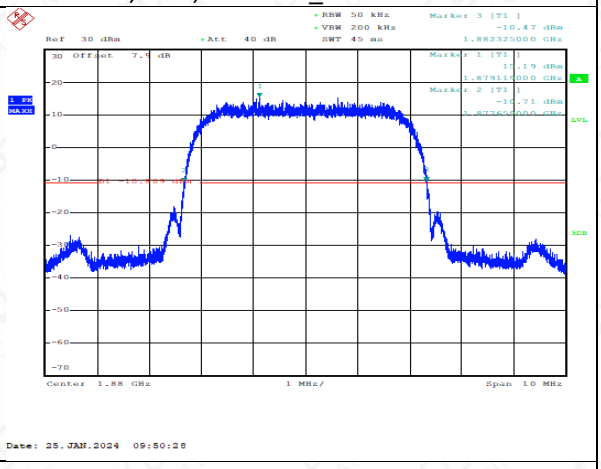
6.4.4 Measurement results

Band	Channel	26dBDown OccupiedWidth(kHz)
WCDMA II	9262	4666.00 kHz
WCDMA II	9400	4666.00 kHz
WCDMA II	9538	4663.00 kHz
Band	**Channel**	**26dBDown OccupiedWidth(kHz)**
WCDMA IV	1312	4658.00 kHz
WCDMA IV	1413	4678.00 kHz
WCDMA IV	1513	4670.00 kHz
Band	**Channel**	**26dBDown OccupiedWidth(kHz)**
WCDMA V	4132	4650.00 kHz
WCDMA V	4183	4840.00 kHz
WCDMA V	4233	4665.00 kHz

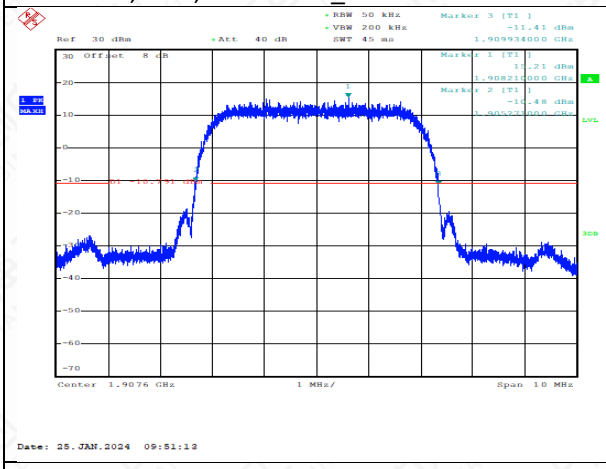
OB2,9262,1852.4MHz_26dBDownOBW



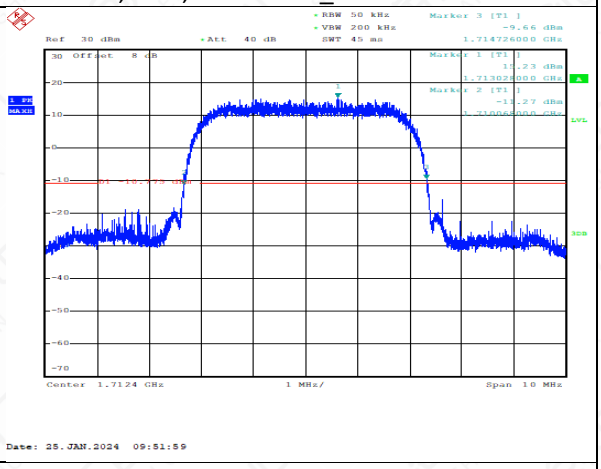
OB2,9400,1880MHz_26dBDownOBW



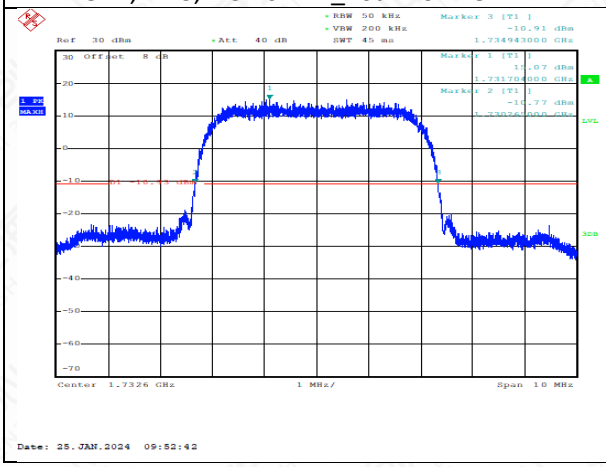
OB2,9538,1907.6MHz_26dBDownOBW



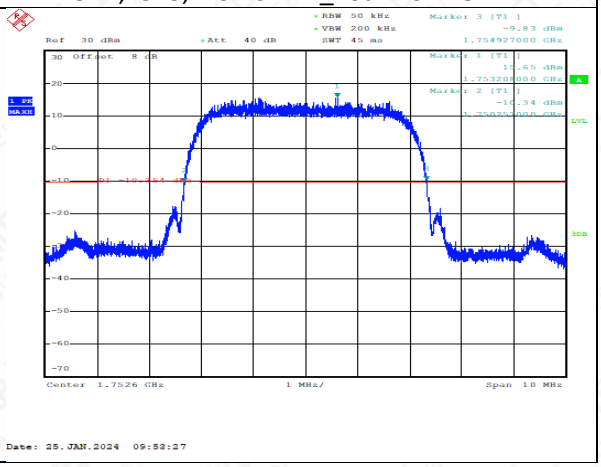
OB4,1312,1712.4MHz_26dBDownOBW



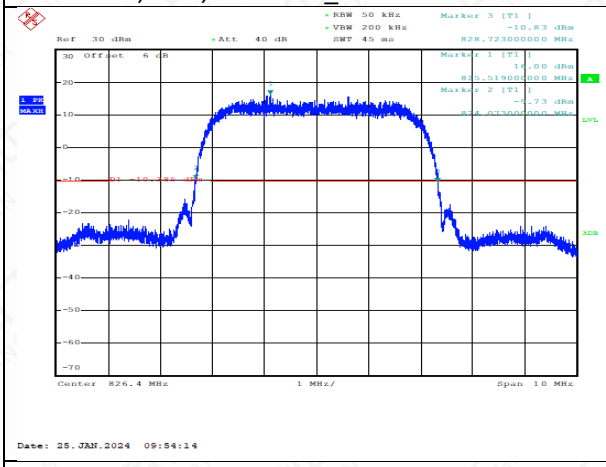
OB4,1413,1732.6MHz_26dBDownOBW



OB4,1513,1752.6MHz_26dBDownOBW



OB5,4132,826.4MHz_26dBDownOBW



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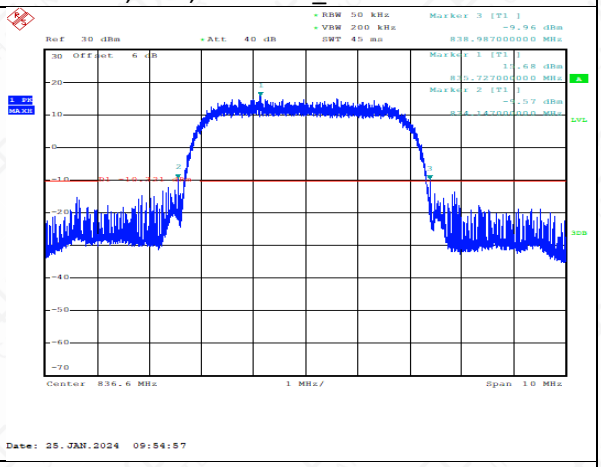
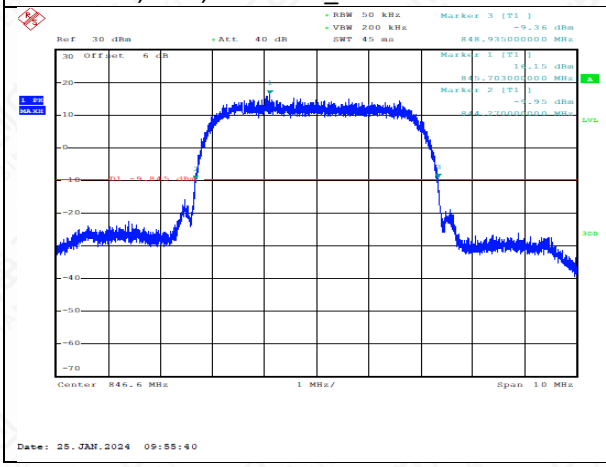


OB5,4233,846.6MHz_26dBDownOBW



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6.5 Band Edge at antenna terminals

6.5.1 Measurement Limit

FCC §22.917(a):The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.
(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
FCC §24.238(a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
FCC §27.53(h):
AWS emission limits —
(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.
(2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180–2200 MHz band are subject to the out-of-band emission requirements set forth in § 27.1134 for the protection of federal government operations operating in the 2200–2290 MHz band.
(ii) For operations in the 2000–2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.
(iii) For operations in the 1915–1920 MHz band, the power of any emission between 1930–1995 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.
(iv) For operations in the 1995–2000 MHz band, the power of any emission between 2005–2020 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.

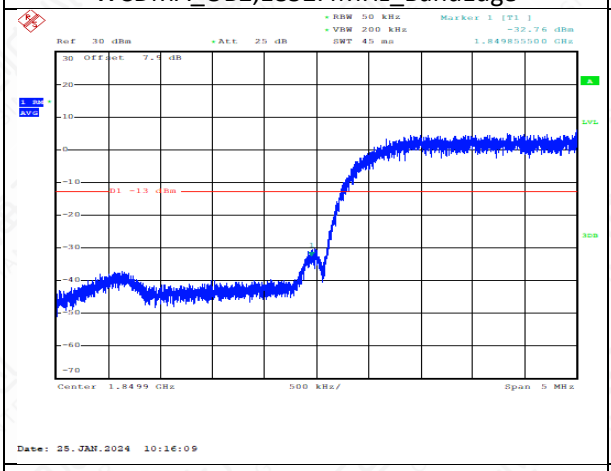
6.5.2 Method of Measurement

The RF output of the transceiver was connected to a signal analyzer through appropriate attenuation.
In the 1MHz 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 RF fundamental frequency should be excluded against the limit line in the operating frequency band
The limit line is derived from 43+10log(P) Db below the transmitter power P(Watts)
=P(W)-[43+10log(P)](dB)
=[30+10log(P)](dBm)-[43+10log(P)](dB)
=-13dBm

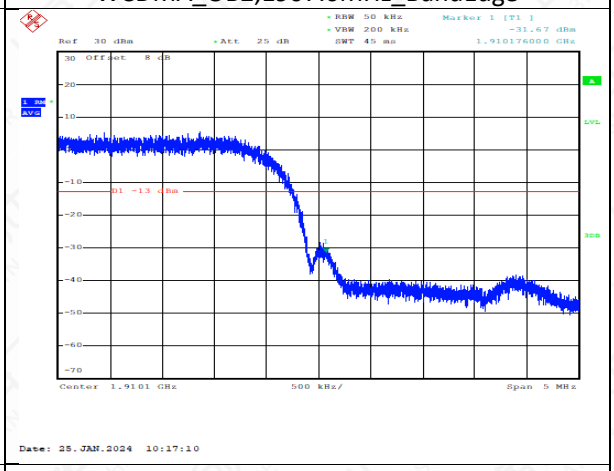
6.5.3 Test Setup

6.5.4 Measurement Result

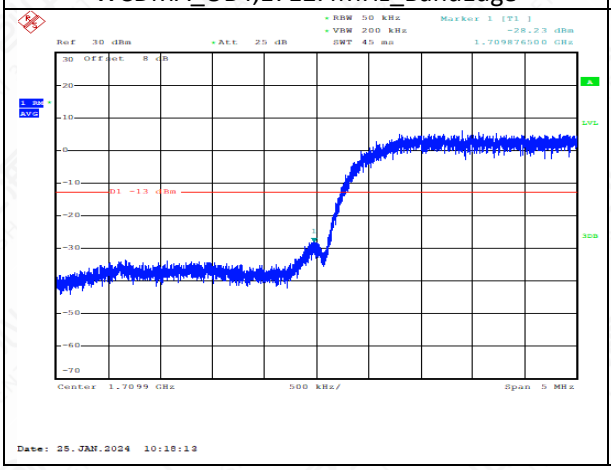
WCDMA_OB2,1852.4MHz_BandEdge



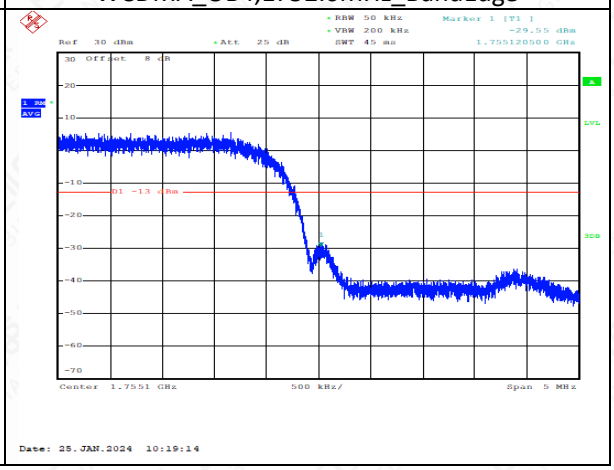
WCDMA_OB2,1907.6MHz_BandEdge



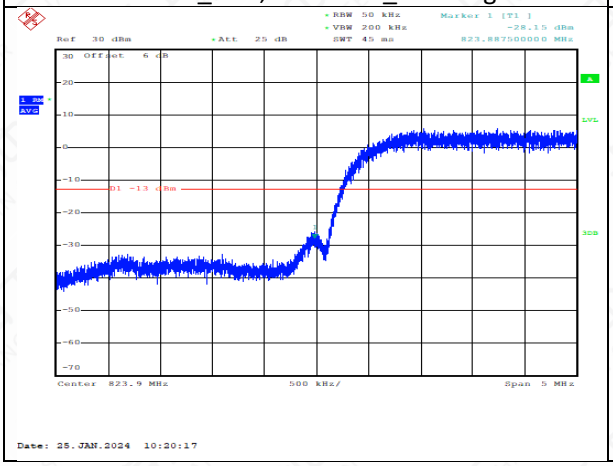
WCDMA_OB4,1712.4MHz_BandEdge



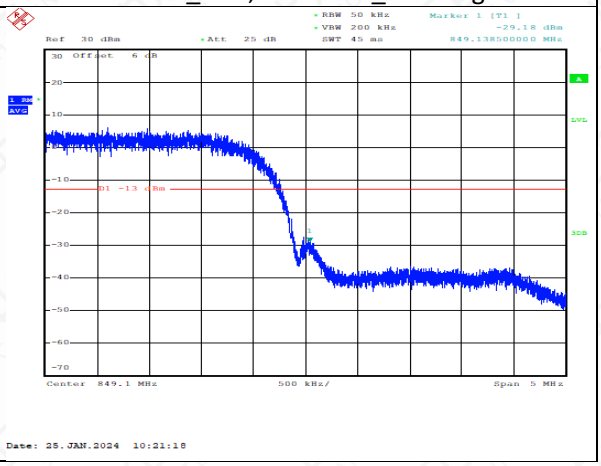
WCDMA_OB4,1752.6MHz_BandEdge



WCDMA_OB5,826.4MHz_BandEdge



WCDMA_OB5,846.6MHz_BandEdge



6.6 Frequency Stability

6.6.1 Measurement Limit

FCC §2.1055 The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
(2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.
FCC §24.235 Frequency stability.The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
FCC §22.355 Frequency tolerance.Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C–1 of this section.
FCC §27.54 The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

6.6.2 Method of Measurement

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on mid channel of WCDMA BANDII, WCDMA BANDIV and WCDMA BANDV, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 C increments from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

6.6.3 Test Setup

6.6.4 Test results

Band	Channel	Temperature	Voltage	Frequency Error(Hz)	Frequency Error(ppm)	Result
OB2	9400	Normal	Low	-18.64	0.01	Pass
OB2	9400	Normal	Normal	-15.786	0.008	Pass
OB2	9400	Normal	High	-18.933	0.01	Pass
OB2	9400	50	Normal	-13.998	0.007	Pass
OB2	9400	40	Normal	-19.19	0.01	Pass
OB2	9400	30	Normal	-15.943	0.008	Pass
OB2	9400	20	Normal	-13.332	0.007	Pass
OB2	9400	10	Normal	-17.552	0.009	Pass
OB2	9400	0	Normal	-17.781	0.009	Pass
OB2	9400	-10	Normal	-10.071	0.005	Pass
OB2	9400	-20	Normal	-12.259	0.007	Pass
OB2	9400	-30	Normal	-12.209	0.006	Pass
Band	**Channel**	**Temperature**	**Voltage**	**Frequency Error(Hz)**	**Frequency Error(ppm)**	**Result**
OB4	1413	Normal	Low	-12.453	0.007	Pass
OB4	1413	Normal	Normal	-12.925	0.007	Pass
OB4	1413	Normal	High	-11.709	0.007	Pass
OB4	1413	50	Normal	-7.181	0.004	Pass
OB4	1413	40	Normal	-14.763	0.009	Pass
OB4	1413	30	Normal	-7.41	0.004	Pass
OB4	1413	20	Normal	-15.185	0.009	Pass

OB4	1413	10	Normal	-10.371	0.006	Pass
OB4	1413	0	Normal	-15.149	0.009	Pass
OB4	1413	-10	Normal	-5.794	0.003	Pass
OB4	1413	-20	Normal	-8.533	0.005	Pass
OB4	1413	-30	Normal	-9.148	0.005	Pass
Band	**Channel**	**Temperature**	**Voltage**	**Frequency Error(Hz)**	**Frequency Error(ppm)**	**Result**
OB5	4183	Normal	Low	-8.225	0.01	Pass
OB5	4183	Normal	Normal	-4.621	0.006	Pass
OB5	4183	Normal	High	-5.865	0.007	Pass
OB5	4183	50	Normal	-9.112	0.011	Pass
OB5	4183	40	Normal	-9.205	0.011	Pass
OB5	4183	30	Normal	-6.18	0.007	Pass
OB5	4183	20	Normal	-10.979	0.013	Pass
OB5	4183	10	Normal	-8.19	0.01	Pass
OB5	4183	0	Normal	-4.563	0.005	Pass
OB5	4183	-10	Normal	-5.279	0.006	Pass
OB5	4183	-20	Normal	-9.663	0.012	Pass
OB5	4183	-30	Normal	-6.266	0.007	Pass

6.7 Conducted Spurious Emission

6.7.1 Measurement Limit

FCC §22.917(a):The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.
(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
FCC §24.238(a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
FCC §27.53(h):
AWS emission limits —
(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.
(2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:
(i) Operations in the 2180–2200 MHz band are subject to the out-of-band emission requirements set forth in § 27.1134 for the protection of federal government operations operating in the 2200–2290 MHz band.
(ii) For operations in the 2000–2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.
(iii) For operations in the 1915–1920 MHz band, the power of any emission between 1930–1995 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.
(iv) For operations in the 1995–2000 MHz band, the power of any emission between 2005–2020 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.

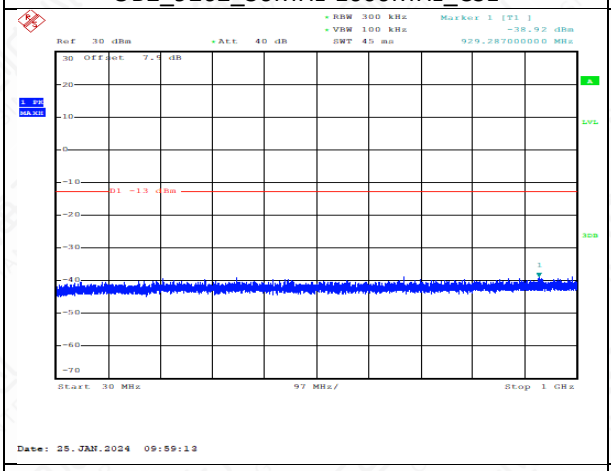
6.7.2 Method of Measurement

The following steps outline the procedure used to measure the conducted emissions from the EUT.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of WCDMA Band II and WCDMA BANDIV, these equate to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For WCDMA Band V, data taken from 30 MHz to 10GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:
The trace mode is set to MaxHold to get the highest signal at each frequency; Wait 25 seconds; Get the result.
4. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

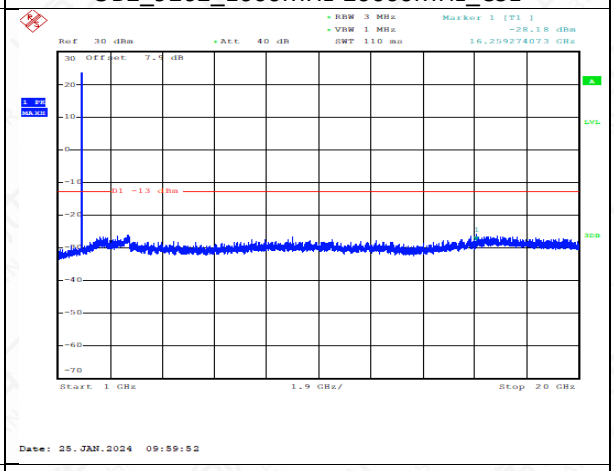
6.7.3 Test Setup

6.7.4 Measurement Limit

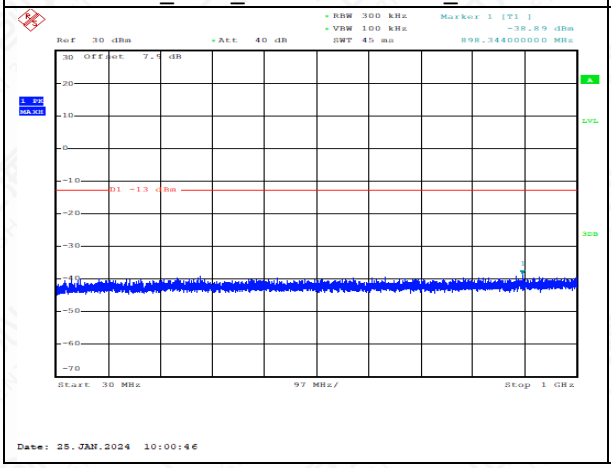
OB2_9262_30MHz-1000MHz_CSE



OB2_9262_1000MHz-20000MHz_CSE



OB2_9400_30MHz-1000MHz_CSE



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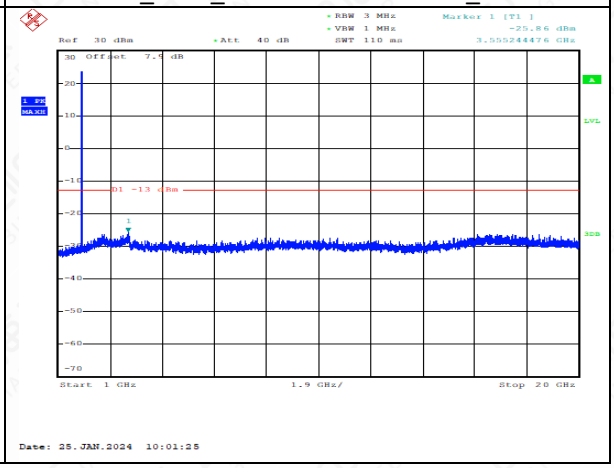
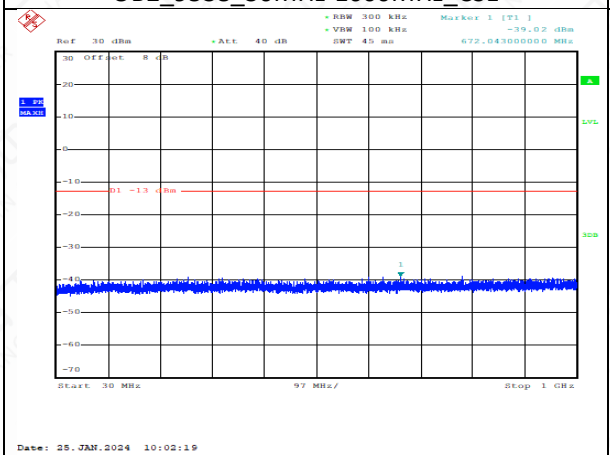
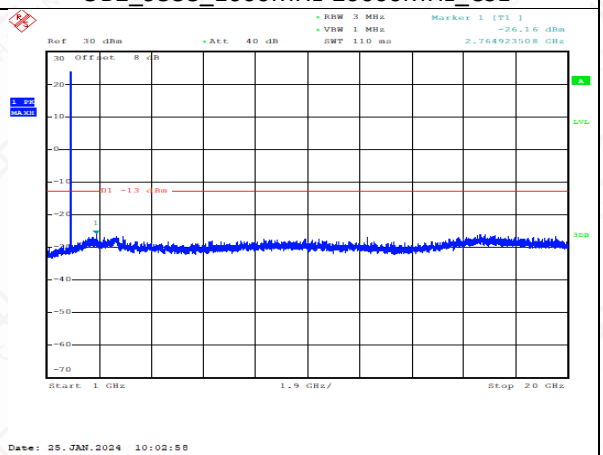


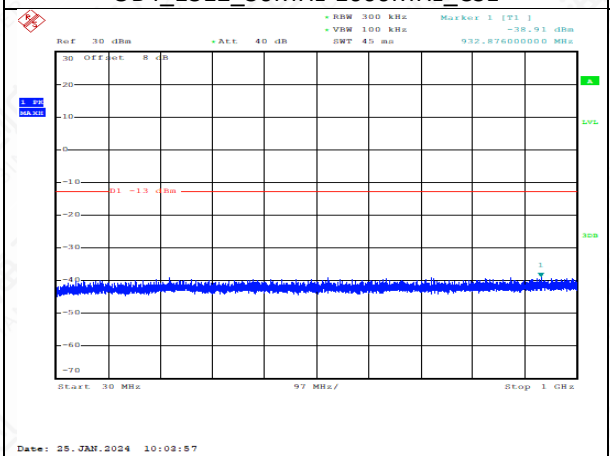
OB2_9538_30MHz-1000MHz_CSE



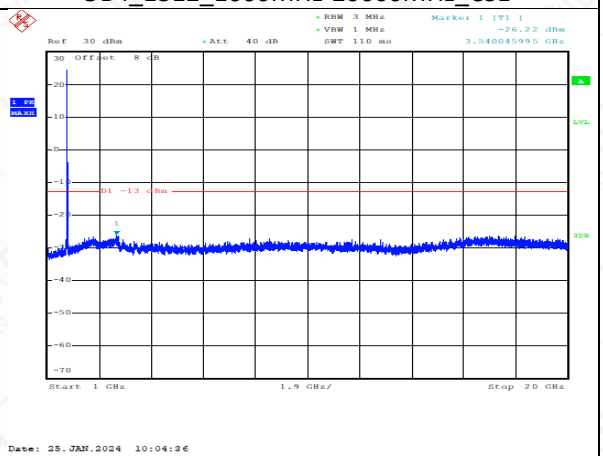
OB2_9538_1000MHz-20000MHz_CSE



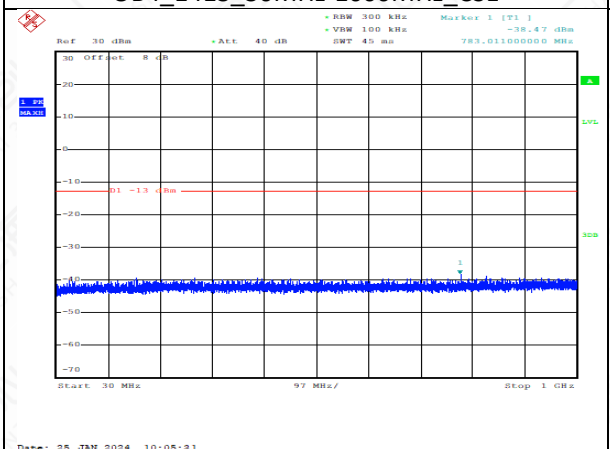
OB4_1312_30MHz-1000MHz_CSE



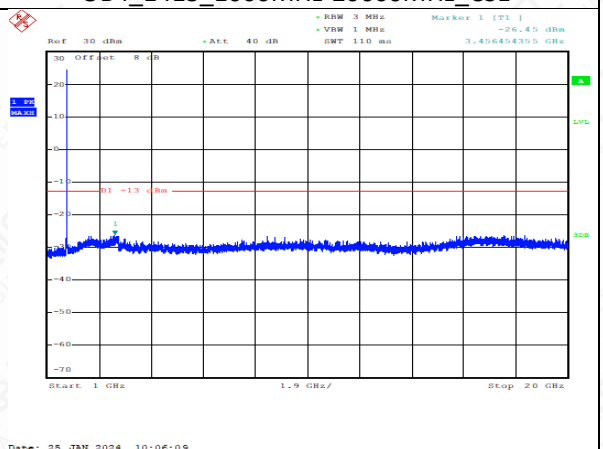
OB4_1312_1000MHz-20000MHz_CSE



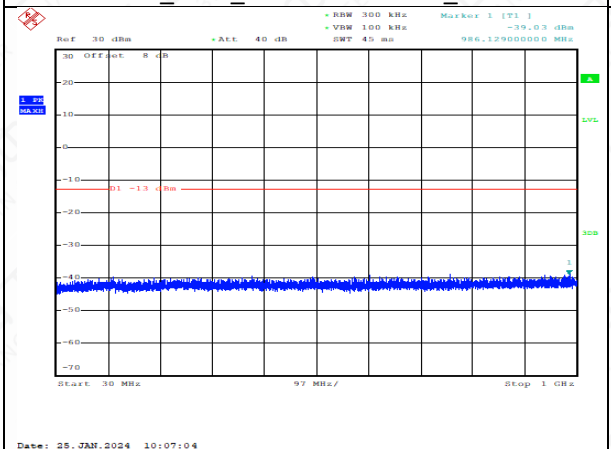
OB4_1413_30MHz-1000MHz_CSE



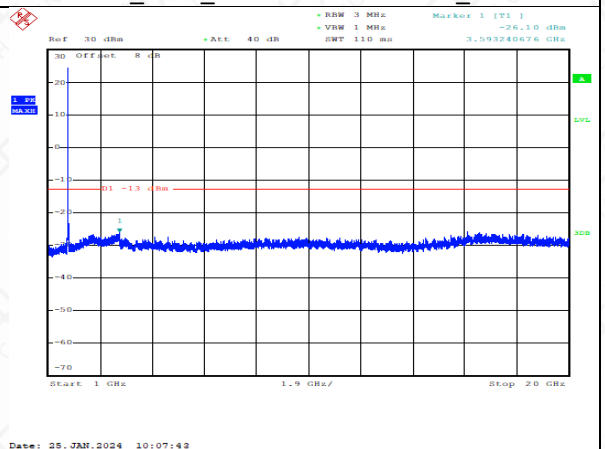
OB4_1413_1000MHz-20000MHz_CSE



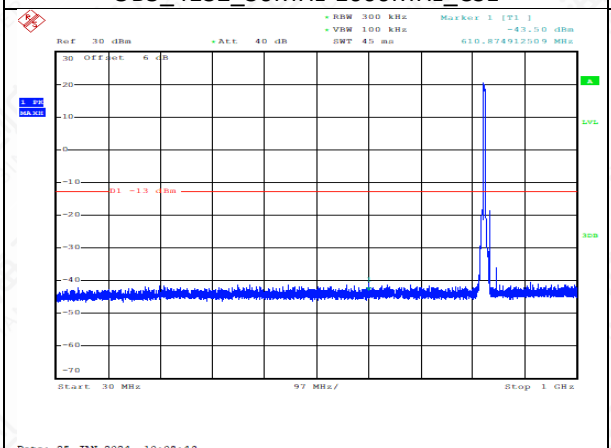
OB4_1513_30MHz-1000MHz_CSE



OB4_1513_1000MHz-20000MHz_CSE



OB5_4132_30MHz-1000MHz_CSE



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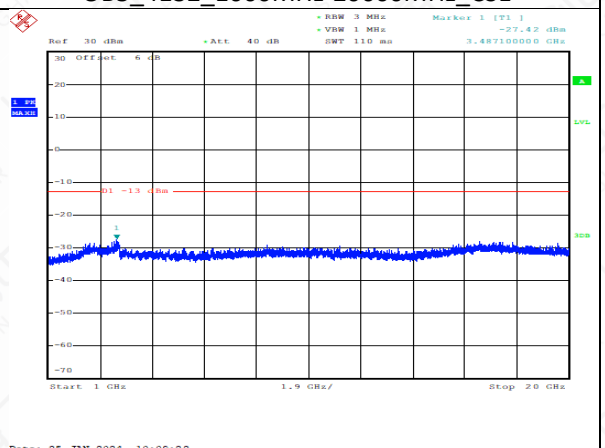
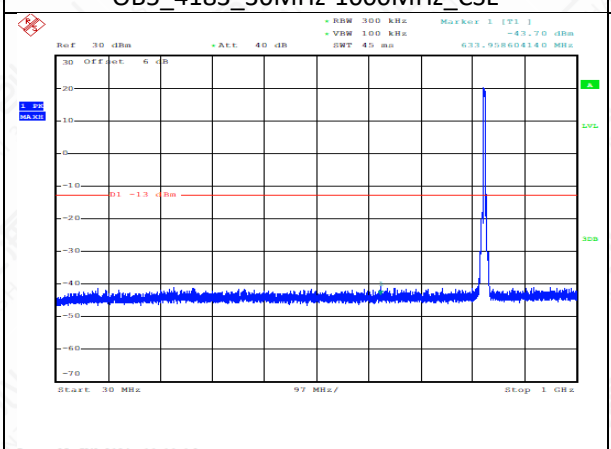


OB5_4183_30MHz-1000MHz_CSE



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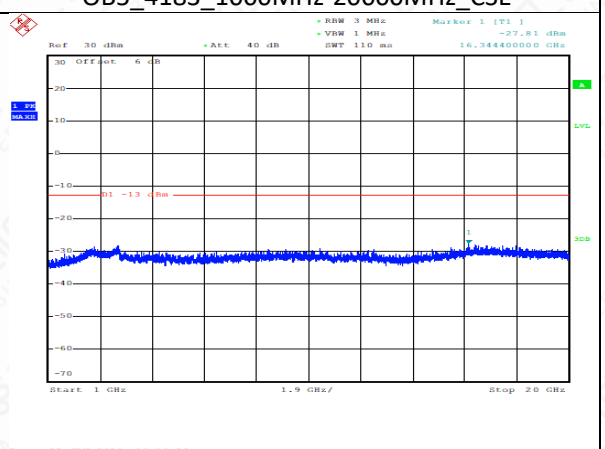
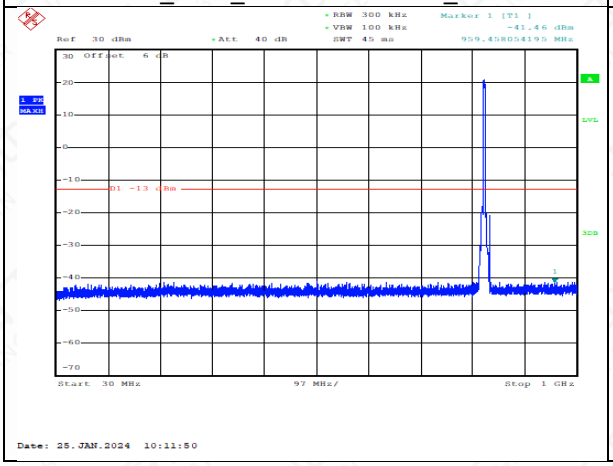
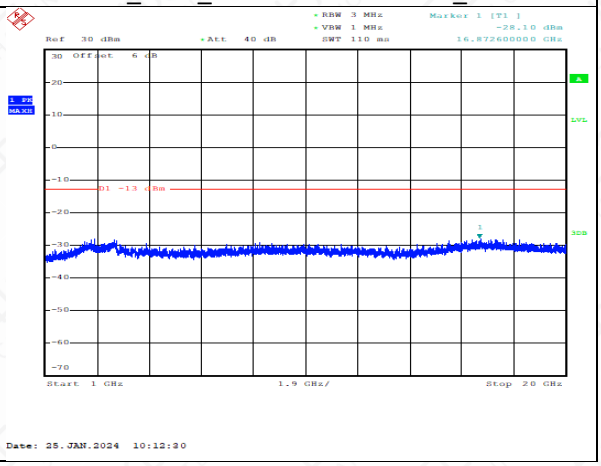


OB5_4233_30MHz-1000MHz_CSE



OB5_4233_1000MHz-20000MHz_CSE



6.8 Emission Limit

6.8.1 Measurement Limit

After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB. Limit -13 dBm

FCC §22.917(a):The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

FCC §24.238(a): Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

FCC §27.53(h):

AWS emission limits —

(1) General protection levels. Except as otherwise specified below, for operations in the 1695–1710 MHz, 1710–1755 MHz, 1755–1780 MHz, 1915–1920 MHz, 1995–2000 MHz, 2000–2020 MHz, 2110–2155 MHz, 2155–2180 MHz, and 2180–2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(2) Additional protection levels. Notwithstanding the foregoing paragraph (h)(1) of this section:

(i) Operations in the 2180–2200 MHz band are subject to the out-of-band emission requirements set forth in § 27.1134 for the protection of federal government operations operating in the 2200–2290 MHz band.

(ii) For operations in the 2000–2020 MHz band, the power of any emissions below 2000 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.

(iii) For operations in the 1915–1920 MHz band, the power of any emission between 1930–1995 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.

(iv) For operations in the 1995–2000 MHz band, the power of any emission between 2005–2020 MHz shall be attenuated below the transmitter power (P) in watts by at least 70 + 10 log10(P) dB.

6.8.2 Method of Measurement

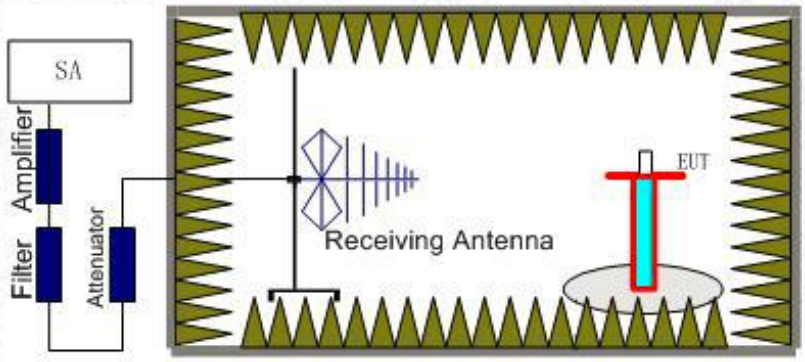
The measurements procedures in TIA-603E-2016 are used.

The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment. The resolution bandwidth is set as outlined in Part 24.238 and Part 24.917.

The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of WCDMA Band V.

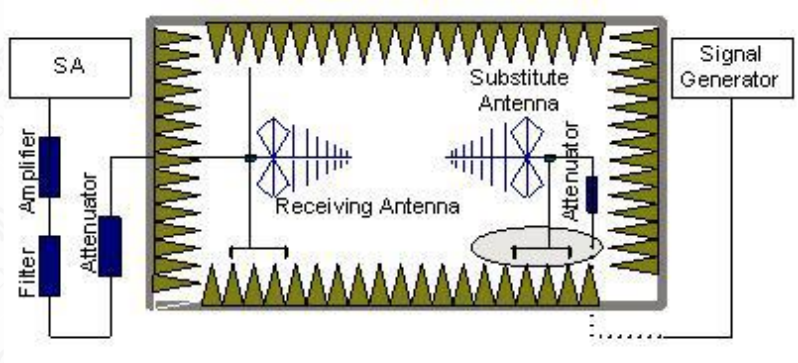
The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10thharmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).

3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss (Pcl) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain (Ga) should be recorded after test.

A amplifier should be connected in for the test.

The Path loss (Pcl) is the summation of the cable loss .

The test results are obtained as described below:

Power(EIRP)=PMea- Pcl+ Ga

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.

6. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi

6.8.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the WCDMA Band V (826.4MHz, 836.6MHz and 846.6MHz) . It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the WCDMA Band V into any of the other blocks. The equipment must still,

however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

Frequency	Channel	Frequency Range	Result
WCDMA Band II	Low	30MHz~20GHz	Pass
	Middle	30MHz~20GHz	Pass
	High	30MHz~20GHz	Pass
WCDMA Band IV	Low	30MHz~20GHz	Pass
	Middle	30MHz~20GHz	Pass
	High	30MHz~20GHz	Pass
WCDMA Band V	Low	30MHz~20GHz	Pass
	Middle	30MHz~20GHz	Pass
	High	30MHz~20GHz	Pass

Mainly Supply

RSE-W2-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3703.6	-55.99	6.6	7.9	-54.69	-13	41.69	H
5554.0	-60.77	8.2	9.8	-59.17	-13	46.17	H
7410.4	-55.04	9.7	11.6	-53.14	-13	40.14	H
9352.4	-57.42	10.7	12.7	-55.42	-13	42.42	H
11148.8	-54.99	12.1	12.3	-54.79	-13	41.79	V
13304.4	-52.53	13.6	12.3	-53.83	-13	40.83	V

RSE-W2- M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3761.6	-56.16	6.6	7.9	-54.86	-13	41.86	H
5643.6	-61	8.3	10.2	-59.1	-13	46.10	H
7524.0	-54.79	9.7	11.6	-52.89	-13	39.89	H
9548.8	-58.53	10.7	12.7	-56.53	-13	43.53	H
11275.1	-54.46	12.1	12.3	-54.26	-13	41.26	H
13590.0	-53.65	13.8	12.3	-55.15	-13	42.15	H

RSE-W2- H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3816.4	-48.2	6.7	7.9	-47	-13	34.00	H
5726.8	-55.55	8.5	10.2	-53.85	-13	40.85	H
7627.6	-52.24	9.7	11.8	-50.14	-13	37.14	H
9972.4	-54.99	11.2	12.5	-53.69	-13	40.69	H
11981.0	-53.37	12.6	12.3	-53.67	-13	40.67	H
14370.2	-52.22	13.9	12.3	-53.82	-13	40.82	V

RSE-W4- L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3422.8	-49.93	6.3	7.8	-48.43	-13	35.43	H
5233.6	-59.65	8.0	9.4	-58.25	-13	45.25	H
6846.0	-60.35	9.2	10.9	-58.65	-13	45.65	H
8556.4	-51.57	10.3	12.6	-49.27	-13	36.27	H
10322.8	-57.26	11.5	12.3	-56.46	-13	43.46	H
12749.3	-53.63	12.7	12.3	-54.03	-13	41.03	V

RSE-W4- M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3463.6	-53.93	6.4	7.8	-52.53	-13	39.53	V
6934.4	-58.43	9.3	11.1	-56.63	-13	43.63	H
8664.4	-47.48	10.3	12.7	-45.08	-13	32.08	H
10332.0	-56.79	11.5	12.3	-55.99	-13	42.99	V
11612.2	-53.89	12.2	12.3	-53.79	-13	40.79	V
13330.6	-53.81	13.6	12.3	-55.11	-13	42.11	H

RSE-W4- H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3503.6	-56.04	6.4	7.8	-54.64	-13	41.64	V
5165.6	-60.11	7.9	9.4	-58.61	-13	45.61	H
7007.2	-55.51	9.3	11.1	-53.71	-13	40.71	H
8762.0	-46.71	10.4	12.7	-44.41	-13	31.41	H

10529.2	-56.5	11.6	12.3	-55.8	-13	42.80	V
12409.8	-54.9	12.5	12.3	-55.1	-13	42.10	H

RSE-W5-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
1651.1	-58.45	4.5	4.7	-58.25	-13	45.25	H
2479.2	-55.36	5.4	5.6	-55.16	-13	42.16	H
3308.8	-64.14	6.2	6.9	-63.44	-13	50.44	H
4173.6	-62.86	7.0	8.9	-60.96	-13	47.96	H
5014.8	-62.69	7.8	9.6	-60.89	-13	47.89	H
5892.4	-60.93	8.5	10.2	-59.23	-13	46.23	H

RSE-W5- M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
1671.8	-59.57	4.5	4.7	-59.37	-13	46.37	H
2506.9	-53.76	5.4	5.6	-53.56	-13	40.56	V
3349.2	-64.39	6.2	6.9	-63.69	-13	50.69	H
4244.4	-61.71	7.1	8.9	-59.91	-13	46.91	H
5080.4	-60.92	7.9	9.6	-59.22	-13	46.22	V
6076.8	-59.49	8.7	10.2	-57.99	-13	44.99	V

RSE-W5- H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
1695.0	-59.02	4.5	4.7	-58.82	-13	45.82	H
2537.3	-51.29	5.4	5.6	-51.09	-13	38.09	V
3382.0	-64.83	6.3	7.8	-63.33	-13	50.33	V
4175.2	-63.12	7.0	8.9	-61.22	-13	48.22	H
5004.4	-61.65	7.8	9.6	-59.85	-13	46.85	H
5760.8	-61.76	8.5	10.2	-60.06	-13	47.06	V

Secondary Supply

RSE-W4- L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3426.4	-48.59	6.4	7.8	-47.19	-13	34.19	H

6845.2	-50.94	9.2	10.9	-49.24	-13	36.24	V
8556.4	-52.79	10.3	12.6	-50.49	-13	37.49	V
11658.7	-54.58	12.4	12.3	-54.68	-13	41.68	V
13696.0	-52.75	13.9	12.3	-54.35	-13	41.35	V
17029.8	-45.81	16.0	12.3	-49.51	-13	36.51	H

RSE-W4- M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3463.2	-50.99	6.4	7.8	-49.59	-13	36.59	H
6930.0	-53.15	9.3	11.1	-51.35	-13	38.35	V
8670.0	-54.95	10.3	12.7	-52.55	-13	39.55	V
11554.8	-54.66	12.2	12.3	-54.56	-13	41.56	V
14299.8	-53.51	13.6	12.3	-54.81	-13	41.81	V
16818.8	-45.93	15.8	12.3	-49.43	-13	36.43	H

RSE-W4- H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	test result (dBm)	Limit （dBm）	Margin(dBm)	Polarization
3506.8	-51.51	6.4	7.8	-50.11	-13	37.11	H
7015.2	-49.87	9.3	11.1	-48.07	-13	35.07	V
8767.2	-53.79	10.4	12.7	-51.49	-13	38.49	V
11711.9	-54.3	12.4	12.3	-54.4	-13	41.40	H
14016.3	-52.37	13.7	12.3	-53.77	-13	40.77	V
16899.6	-45.43	16.3	12.3	-49.43	-13	36.43	V

Note:

Only data in worst mode is provided.

Annex A: Revised History

Version	Revised Content
V00	Initial
V01	Modify some data and statements

Annex B: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

INDUSTRIAL INTERNET INNOVATION CENTER (SHANGHAI) CO., LTD.

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 20th day of September 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2025

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

END OF REPORT