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

FCC LTE TEST REPORT

PRODUCT	4G Smart Phone
BRAND	MobiWire,MobiWire,Vodafone,Orange
MODEL	H5028,Smart Green,Vodafone Lite,Orange Neva sparkle
APPLICANT	MobiWire SAS
FCC ID	QPN-H5028
ISSUE DATE	November 11, 2022
STANDARD(S)	FCC Part 2, FCC Part 22, FCC Part 24, FCC Part 27

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

CONTENTS

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	2020-10-01
2	FCC Part 22	PUBLIC MOBILE SERVICES	2020-10-01
3	FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2020-10-01
4	FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	2020-10-01

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

1.3 Summary of Test Results

LTE Band 7

Items	Test Name	Clause in FCC rules	Verdict
1	Output Power	27.50(d)(4)	Pass
2	Emission Limit	27.53(h), 2.1051	Pass
3	Frequency Stability	27.54, 2.1055	Pass
4	Occupied Bandwidth	2.1049(h)(i)	Pass
5	Emission Bandwidth	27.53(h)	Pass
6	Band Edge Compliance	27.53(h)	Pass
7	Conducted Spurious Emission	27.53(h), 2.1057	Pass
8	Peak to Average Power Ratio	27.50(a)	Pass
Note: The H5028,Smart Green,Vodafone Lite,Orange Neva sparkle, manufactured by MobiWire SAS is a new			

Items	Test Name	Clause in FCC rules	Verdict
product for testing 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 5.3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 6 of this test report.			

1.4 Data Provided by Applicant

No.	Item(s)	Data
1	LTE band 7	-1.5dBi

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.	958356
FCC Designation No.	CN1177

2.2 Laboratory Environmental Requirements

Temperature	15℃~35℃
Relative Humidity	25%RH~75%RH
Atmospheric Pressure	101kPa

2.3 Project Information

Project Manager	Xu Yuting
Test Date	September 20, 2022 to November 11, 2022

3. General Information of The Customer

3.1 Applicant

Company	MobiWire SAS
Address	107 Boulevard de la Mission Marchand, 92400 Courbevoie, France.
Telephone	+33625028368

3.2 Manufacturer

Company	MobiWire SAS
Address	107 Boulevard de la Mission Marchand, 92400 Courbevoie, France.

4. General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product	4G Smart Phone
Model	H5028,Smart Green,Vodafone Lite,Orange Neva sparkle
Date of Receipt	S02aa :September 22, 2022 S06aa: September 22, 2022
EUT ID*	S02aa/S06aa
SN/IMEI	S02aa : 352243540001872 352243540001880 S06aa: 352243540002615 352243540002623
Supported Radio Technology and Bands	GSM850/GSM900/DCS1800/PCS1900 WCDMA Band I/II/V/VIII LTE Band 1/3/7/20/28 BT 5.0 BLE/BR/EDR WLAN 802.11b/g/n WLAN 802.11a/n GPS GLONASS Gallileo FM
Hardware Version	V01A
Software Version	Mobiwire_H5028_V01
FCC ID	QPN-H5028
NOTE: EUT ID is the internal identification code of the laboratory.	

4.2 Description for Auxiliary Equipment (AE)

AE ID*	Description	Model	SN/Remark
AE1	RF Cable	N/A	N/A
NOTE: AE ID is the internal identification code of the laboratory.			

4.3 Additional Information

Type of modulation	QPSK/16QAM

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℃	55℃
Working Voltage of EUT	Normal	Minimum	Maximum
	3.8V	3.6V	4.2V

5.2 Test Equipments Utilized

Radiated emission test system

No.	Name	Model	S/N	Manufacturer	Cal. Date	Cal. Interval
1	Universal Radio Communication Tester	CMU200	123123	R&S	May 10,2021	1.5 Years
2	Universal Radio Communication Tester	CMW500	104178	R&S	May 10, 2021	1.5 Years
3	EMI Test Receiver	ESU40	100307	R&S	February 23, 2022	1 Year
4	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	March 11, 2022	1 Year
5	Double- ridged Waveguide Antenna	ETS-3117	00135890	ETS	March 9, 2022	2 Years
6	2-Line V-Network	ENV216	101380	R&S	February 21, 2022	1 Year
7	EMI Test Software	EMC32 V9.15.00	N/A	R&S	N/A	N/A

Anechoic chamber

Fully anechoic chamber by ETS.

Conducted Test System

No.	Name	Model	S/N	Manufacturer	Cal. Date	Cal. Interval
1	Universal Radio Communication Tester	CMW500	148874	R&S	August. 23,2022	1 Year
2	Vector Signal Analyzer	FSQ26	101091	R&S	August. 23,2022	1 Year

3	Programmable power supply	Keithley 2303	4039070	Keithley	July 12,2022	1 Year
4	Eagle Test Software	Eagle V3.3 FCC BT/WIFI	N/A	ECIT	N/A	N/A
5	Temperature Chamber	B-TF-107C	BTF107C-201804107	BoYi	June 30,2022	1Year

5.3 Measurement Uncertainty

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Peak Output Power-Conducted	2412MHz-2462MHz	95%	0.544dB
Peak Power Spectral Density	2412MHz-2462MHz	95%	0.502dB
Occupied 6dB Bandwidth	2412MHz-2462MHz	95%	69.26kHz
Band Edges-Conducted	2412MHz-2462MHz	95%	0.544dB
Conducted Emission	30MHz-2GHz	95%	0.90dB
Conducted Emission	2GHz-3.6GHz	95%	0.88dB
Conducted Emission	3.6GHz-8GHz	95%	0.96dB
Conducted Emission	8GHz-20GHz	95%	0.94dB
Conducted Emission	20GHz-22GHz	95%	0.88dB
Conducted Emission	22GHz-26GHz	95%	0.86dB
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	5.66dB
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	4.98dB
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	5.06dB
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	5.20dB
AC Power line Conducted Emission	0.15MHz-30MHz	95%	3.66 dB

6. Test Results

6.1 Output Power

6.1.1 Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation. In all cases, output power is within the specified limits.

CMW500 setting:

1: CMW500 is connected to the DUT

2: Set RX Expected PEP to 30 dBm

6.1.2 Conducted

6.1.2.1Method of Measurements

The EUT was set up for the max output power with pseudo random data modulation.
These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each bandwidth.

6.1.2.2 Measurement result

LTE band 7

LTE			LTE B7			
Modulation	RB	RB Offset	Tune up	5MHz		
				20775/2502.5	21100/2535	21425/2567.5
QPSK	1	Low	22.80	21.64	21.59	21.60
		Middle		21.80	21.95	21.82
		High		21.60	21.58	21.61
	50%	Low	21.80	20.68	20.70	20.77
		Middle		20.78	20.82	20.87
		High		20.74	20.69	20.71
	100%	/	21.80	20.77	20.80	20.74
16QAM	1	Low	21.80	20.99	20.89	20.73
		Middle		21.24	21.17	20.98
		High		21.00	20.93	20.72
	50%	Low	20.80	19.80	19.75	19.86
		Middle		19.89	19.82	19.92
		High		19.86	19.69	19.84
	100%	/	20.80	19.76	19.74	19.74
Modulation	RB	RB Offset	Tune up	10MHz		
				20800/2505	21100/2535	21400/2565
QPSK	1	Low	22.80	21.74	21.68	21.68
		Middle		21.86	21.92	21.80
		High		21.73	21.72	21.73
	50%	Low	21.80	20.74	20.76	20.89
		Middle		20.75	20.85	20.83
		High		20.81	20.86	20.76
	100%	/	21.80	20.79	20.83	20.88
16QAM	1	Low	21.80	20.91	20.90	20.95

		Middle		21.02	21.14	21.15
		High		20.95	20.93	20.95
	50%	Low	20.80	19.79	19.87	19.88
		Middle		19.84	19.87	19.90
		High		19.85	19.91	19.85
	100%	/	20.80	19.87	19.75	19.86
Modulation	**RB**	**RB Offset**	**Tune up**	**15MHz**		
				20825/2507.5	**21100/2535**	**21375/2562.5**
QPSK	1	Low	22.80	21.68	21.67	21.61
		Middle		21.81	21.76	21.77
		High		21.69	21.63	21.69
	50%	Low	21.80	20.73	20.73	20.87
		Middle		20.78	20.76	20.88
		High		20.83	20.82	20.78
	100%	/	21.80	20.84	20.78	20.83
16QAM	1	Low	21.80	20.94	20.95	20.85
		Middle		21.13	21.01	21.01
		High		20.99	20.87	20.91
	50%	Low	20.80	19.87	19.75	19.77
		Middle		19.81	19.82	19.87
		High		19.89	19.83	19.86
	100%	/	20.80	19.80	19.76	19.79
Modulation	**RB**	**RB Offset**	**Tune up**	**20MHz**		
				20850/2510	**21100/2535**	**21350/2560**
QPSK	1	Low	22.80	21.51	21.46	21.42
		Middle		21.95	21.89	21.83
		High		21.59	21.53	21.59
	50%	Low	21.80	20.79	20.82	20.86
		Middle		20.80	20.83	20.83
		High		20.82	20.84	20.85
	100%	/	21.80	20.80	20.78	20.83
16QAM	1	Low	21.80	20.63	20.93	20.85
		Middle		21.12	21.25	21.05
		High		20.90	20.98	20.81
	50%	Low	20.80	19.77	19.76	19.85
		Middle		19.79	19.86	19.91
		High		19.83	19.78	19.83
	100%	/	20.80	19.73	19.80	19.78

6.1.3 Radiated

6.1.3.1 Description

This is the test for the maximum radiated power from the EUT.

Rule Part 24.232(b) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous

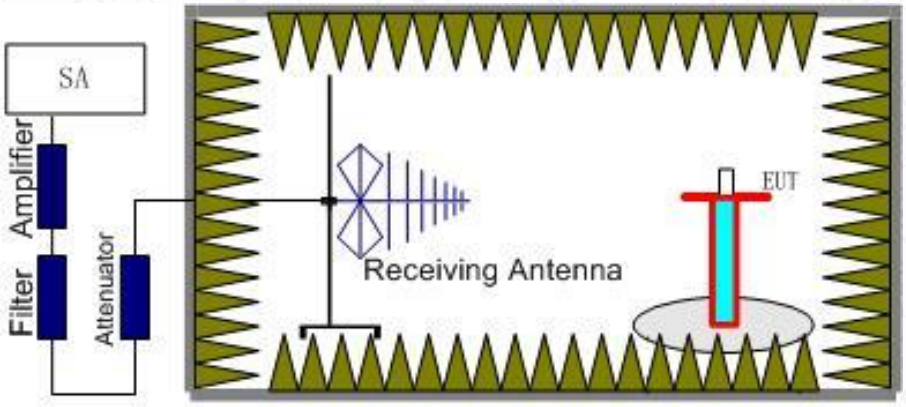
transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

Rule Part 27.50(d) specifies “Fixed, mobile, and portable (handheld) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP”.

Rule Part 27.50(h)(2) specifies “Mobile stations are limited to 2.0 watts EIRP.”.

Rule Part 27.50(c) specifies “Portable stations (hand-held de-vices) are limited to 3 watts ERP.”

6.1.3.2 Method of Measurement

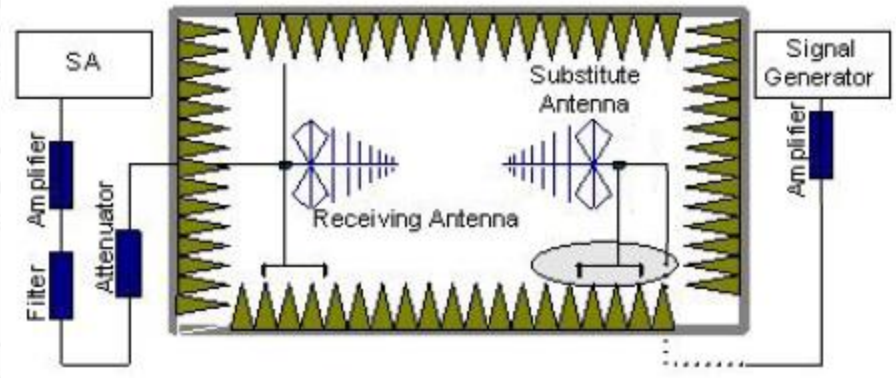


The measurements procedures in TIA-603E-2016 are used.

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 transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.

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).

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



In the chamber, a 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. Adjust the level of the signal generator output until the value of the receiver reaches 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.

An amplifier should be connected to the Signal Source output port. And the cable should be connected between the amplifier and the substitution antenna.

The cable loss (Pcl), the substitution antenna Gain (Ga) and the amplifier Gain (PAg) should be recorded after test.

The measurement results are obtained as described below:

Power (EIRP) = PMea + PAg - Pcl + Ga

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

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

6.1.3.3 Measurement result

LTE Band 7- EIRP 27.50(h)(2)

Limits: ≤33 dBm (2W)

LTE Band 7_5MHz_QPSK

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2502.5	20.30	33.00	H
2535	20.45	33.00	H
2567.5	20.32	33.00	H

LTE Band 7_10MHz_QPSK

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2505	20.36	33.00	H
2535	20.42	33.00	H
2565	20.30	33.00	H

LTE Band 7_15MHz_QPSK

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2507.5	20.31	33.00	H
2535	20.26	33.00	H
2562.5	20.27	33.00	H

LTE Band 7_20MHz_QPSK

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2510	20.45	33.00	H
2535	20.39	33.00	H
2560	20.33	33.00	H

LTE Band 7_5MHz_16QAM

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2502.5	19.74	33.00	H
2535	19.67	33.00	H
2567.5	19.48	33.00	H

LTE Band 7_10MHz_16QAM

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2505	19.52	33.00	H
2535	19.64	33.00	H
2565	19.65	33.00	H

LTE Band 7_15MHz_16QAM

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2507.5	19.63	33.00	H
2535	19.51	33.00	H
2562.5	19.51	33.00	H

LTE Band 7_20MHz_16QAM

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2510	19.62	33.00	H
2535	19.75	33.00	H
2560	19.55	33.00	H

ANALYZER SETTINGS:

RBW = VBW = 8MHz for occupied bandwdiths equal to or less than 5MHz.

RBW = VBW = 20MHz for occupied bandwidths equal to or greater than 10MHz.

6.2 Emission Limt

Reference

CFR 2.1051,22.917.

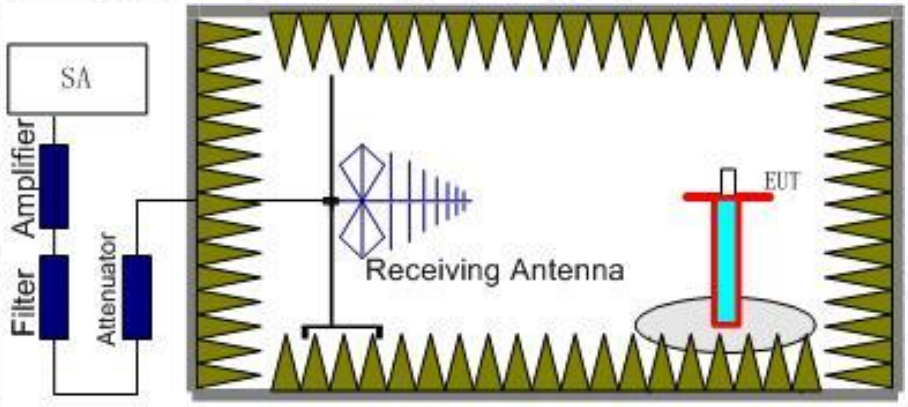
6.2.1 Measurement Method

The measurements procedures in TIA-603E-2016 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 27.53(g), Part 27.53(h), Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 7.

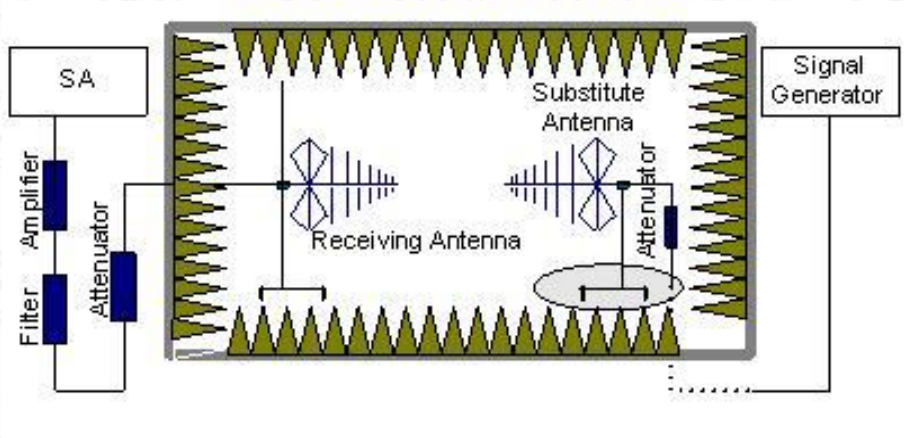
The procedure of radiated spurious emissions is as follows:

Below 1 GHz, EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. Above 1 GHz, EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna.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 10th harmonic were measured with peak detector.



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).

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. Adjust the level of the signal generator output until the value of the receiver reaches 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.

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

An amplifier should be connected in for the test.

The Path loss (Ppl) is the summation of the cable loss and the gain of the amplifier.

The measurement results are obtained as described below:

Power (EIRP) =PMea- Ppl + Ga

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

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

6.2.2 Measurement Limit

Part 27.53(g),27.53(h), 27.53(m) state that on any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log (P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

According to KDB 971168 6, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

Part 27.53(m) states that 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. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all

frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

6.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 5.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 LTE Bands 5. 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. The evaluated frequency range is from 30MHz to 26GHz.

BAND	Channel		Result
7	L	20775	Pass
	M	21100	Pass
	H	21425	Pass

RSE-LTE7-S06aa-H

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit （dBm）	Polarization
5085.2	-49.15	7.9	9.6	-47.45	-13	H
6596.8	-48.31	9.1	10.6	-46.81	-13	V
8429.6	-50.51	10.2	12.6	-48.11	-13	V
10188.4	-45.65	11.3	12.5	-44.45	-13	V
12863.8	-40.53	13.0	12.3	-41.23	-13	H
15240.2	-35.74	14.5	12.3	-37.94	-13	H

RSE-LTE7-S06aa-L

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit （dBm）	Polarization
5180.0	-47.55	8.0	9.4	-46.15	-13	V
6473.2	-49.41	8.9	10.6	-47.71	-13	H
8658.0	-49.62	10.3	12.7	-47.22	-13	V
10547.2	-45.49	11.6	12.3	-44.79	-13	H
12191.8	-41.19	12.6	12.3	-41.49	-13	V
13775.5	-39.77	13.8	12.3	-41.27	-13	V

RSE-LTE7-S06aa-M

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit （dBm）	Polarization
5312.8	-49.34	8.0	9.4	-47.94	-13	V
6848.8	-50.34	9.2	10.9	-48.64	-13	H
8676.0	-49.26	10.4	12.7	-46.96	-13	H
10659.6	-44.76	11.7	12.3	-44.16	-13	V
12466.5	-42.58	12.7	12.3	-42.98	-13	H
14843.0	-37.86	14.3	12.3	-39.86	-13	V

6.3 Frqency Stability

Reference

CFR Part 2.1055,22.235.

6.3.1 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 -10℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE band 7. 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 -10℃ to +50℃. Allow at least 1.5 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 1.5 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 ℃ decrements from +50℃ to -10℃. 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.

6.3.2Measurement Limit

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.6VDC and 4.35VDC, with a nominal voltage of 3.8VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. For the purposes of measuring frequency stability these voltage limits are to be used.

6.3.3 Measurement results

LTE Band 7, 5MHz bandwidth (worst case of all bandwidths)

Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.6	-15.163	17.481	0.006	0.007
3.8	-12.774	17.238	0.005	0.007
4.2	11.888	-15.407	0.005	0.006

Frequency Error vs Temperature

Temperature (℃)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50	-13.032	-15.306	0.005	0.006
40	-18.01	-17.896	0.007	0.007
30	-9.027	-16.05	0.004	0.006
20	-18.854	-12.46	0.008	0.005
10	-6.952	-16.565	0.003	0.007
0	-11.044	19.841	0.004	0.008
-10	-17.996	-9.942	0.007	0.004
-20	-14.849	-11.916	0.006	0.005
-30	-11.859	-12.875	0.005	0.005

6.4 Occupied Bandwidth

Reference

CFR Part 2.1049(h) (i)

6.4.1 Occupied Bandwidth Results

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 the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

The measurement method is from KDB 971168 4:

a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).

b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.

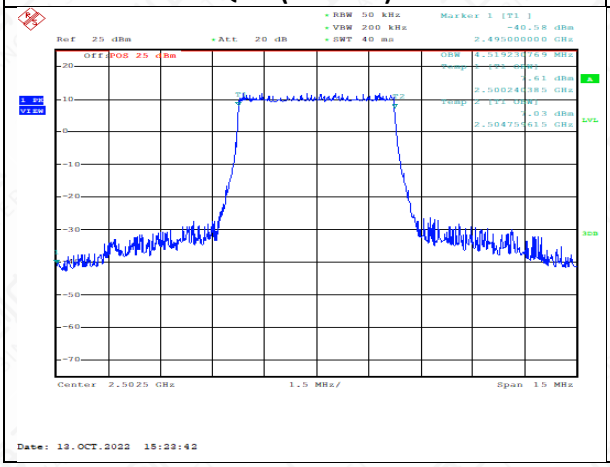
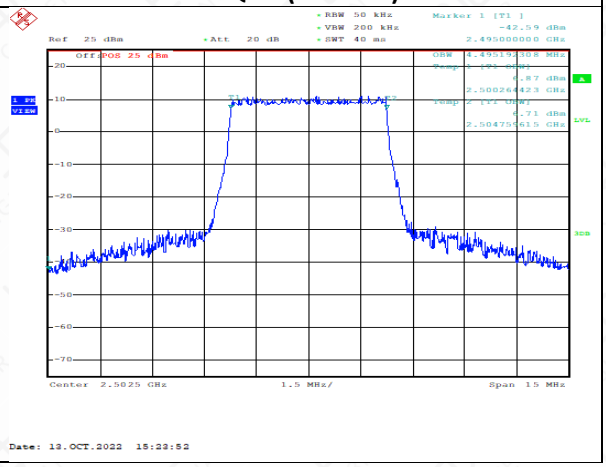
c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least 10log (OBW / RBW) below the reference level.

d) Set the detection mode to peak, and the trace mode to max hold.

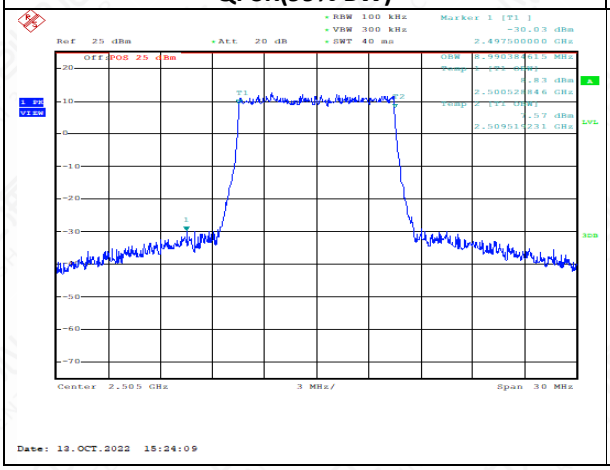
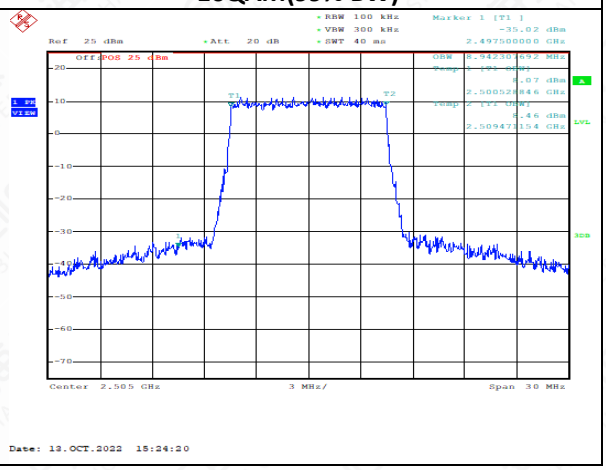
e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

Occupied Bandwidth Measurement Results:

LTE band 7,5MHz (99%)low

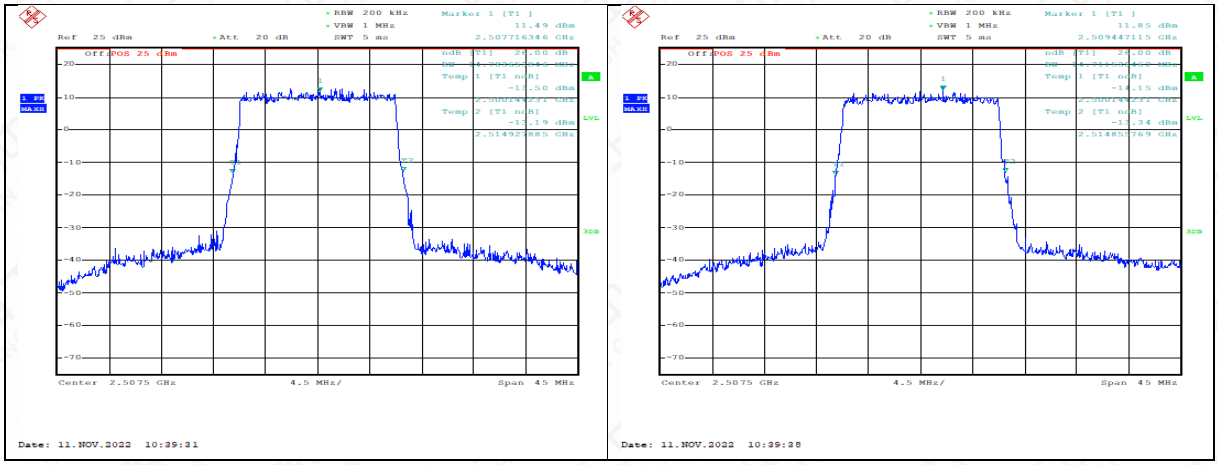
Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2502.5	4.52	4.50
QPSK(99% BW)	16QAM(99% BW)	
		

LTE band 7, 10MHz (99%) low

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2505	8.99	8.94
QPSK(99% BW)	16QAM(99% BW)	
		

LTE band 7,15MHz (99%)low

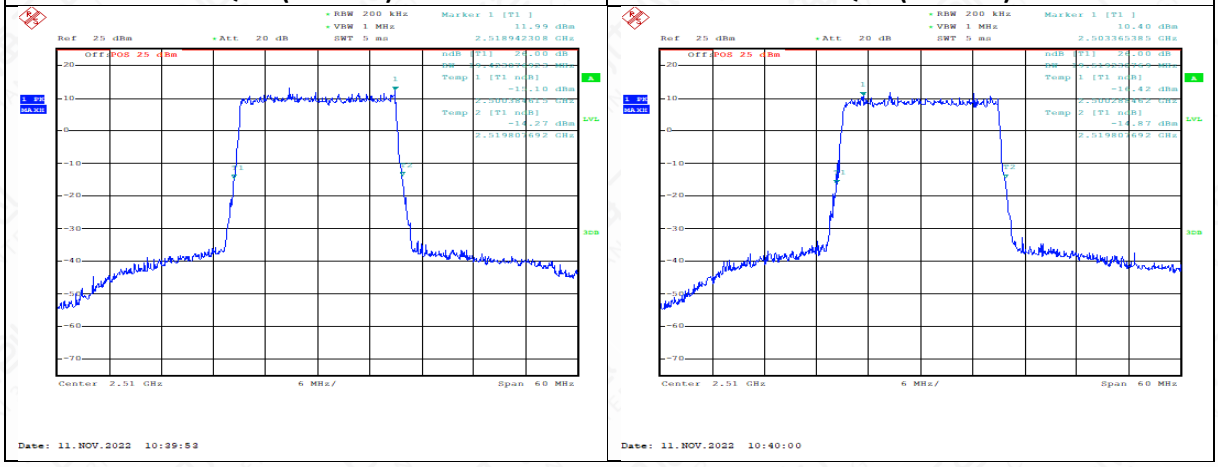
Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2507.5	14.78	14.71
QPSK(99% BW)	16QAM(99% BW)	



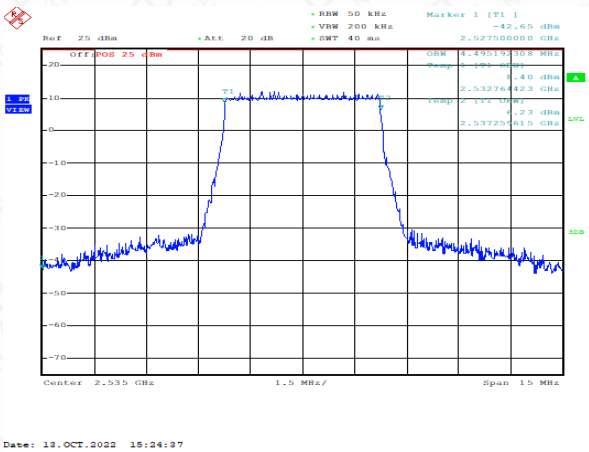
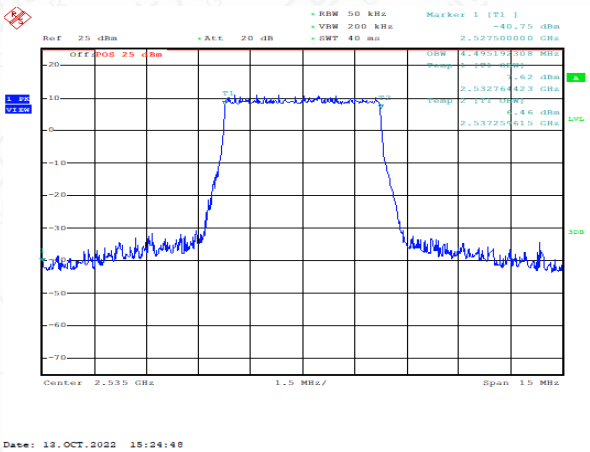
LTE band 7,20MHz (99%)low

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2510	19.42	19.52

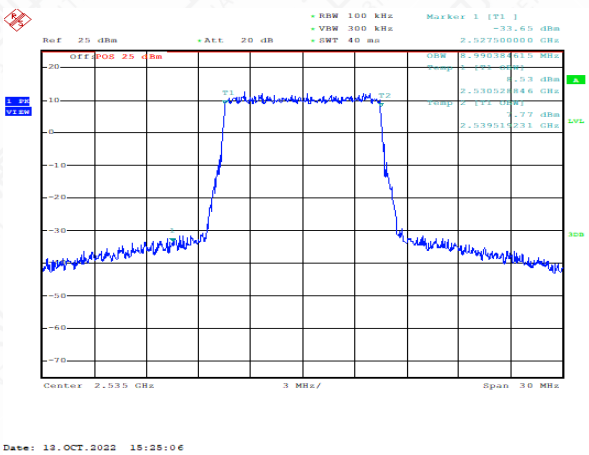
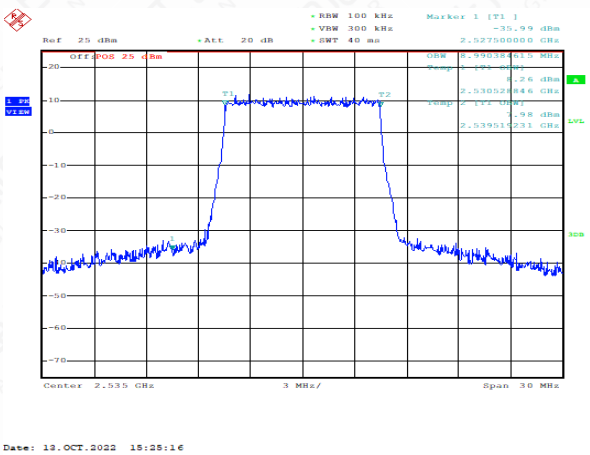
QPSK(99% BW)	16QAM(99% BW)



LTE band 7, 5MHz (99%)mid

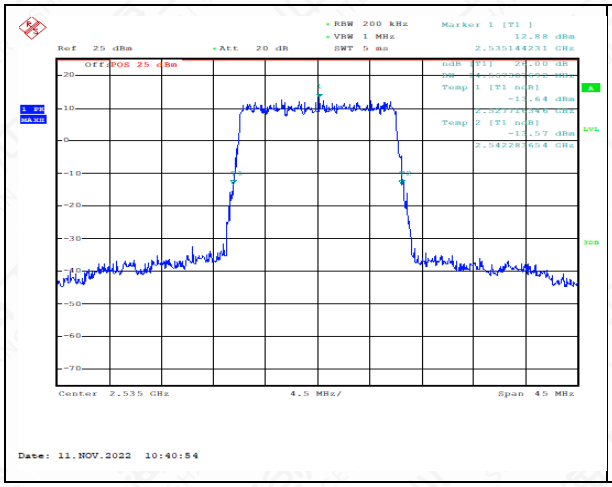
Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2535	4.5	4.5
QPSK(99% BW)	16QAM(99% BW)	
		

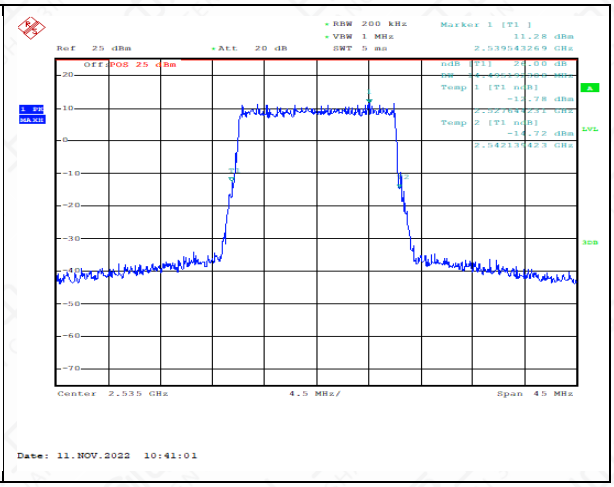
LTE band 7, 10MHz (99%)mid

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2535	8.99	8.94
QPSK(99% BW)	16QAM(99% BW)	
		

LTE band 7, 15MHz (99%)mid

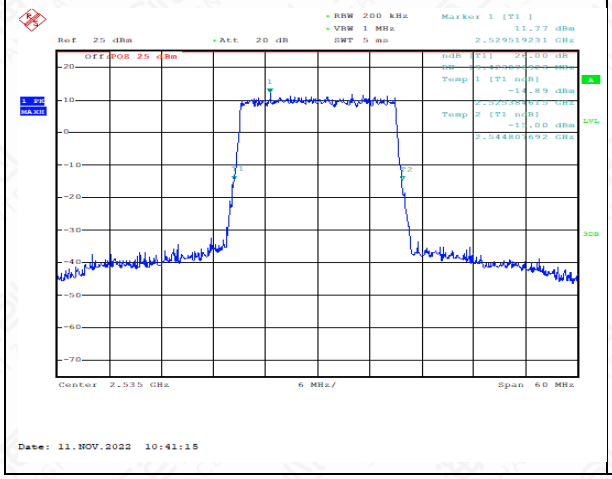
Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2535	14.57	14.50
QPSK(99% BW)	16QAM(99% BW)	

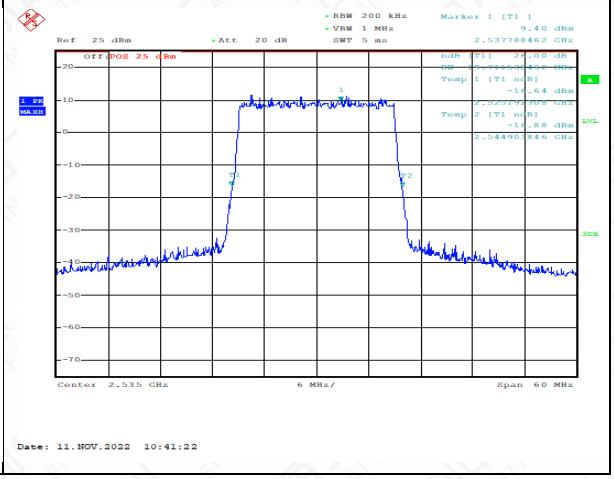




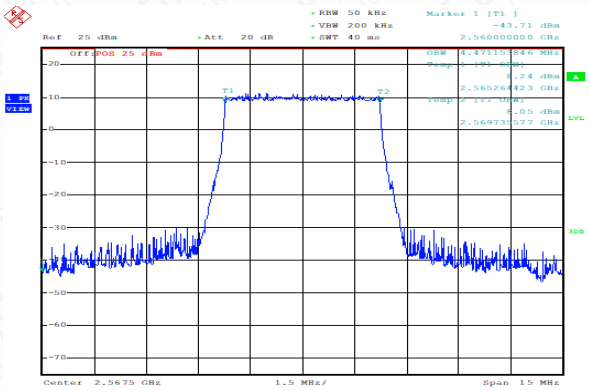
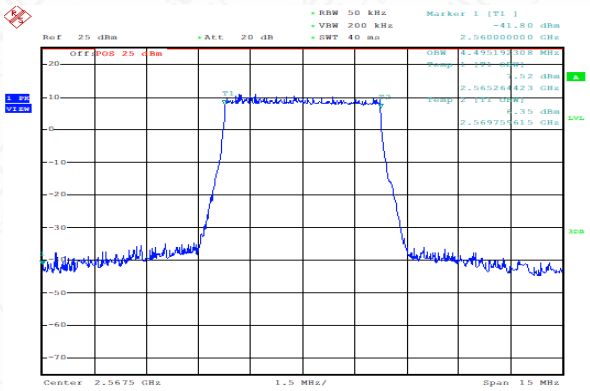
LTE band 7, 20MHz (99%)mid

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2535	19.42	19.52
QPSK(99% BW)	16QAM(99% BW)	

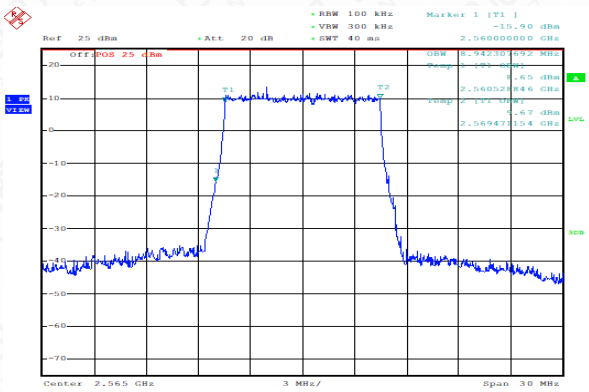
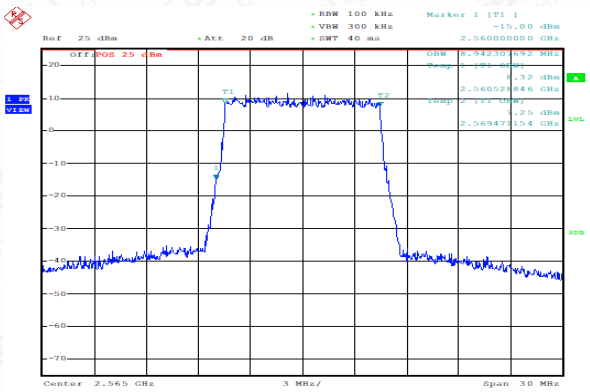




LTE band 7, 5MHz (99%)high

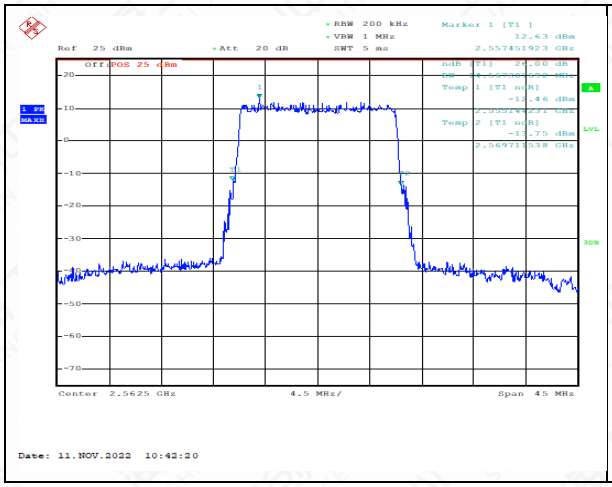
Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2567.5	4.47	4.50
QPSK(99% BW)	16QAM(99% BW)	
		

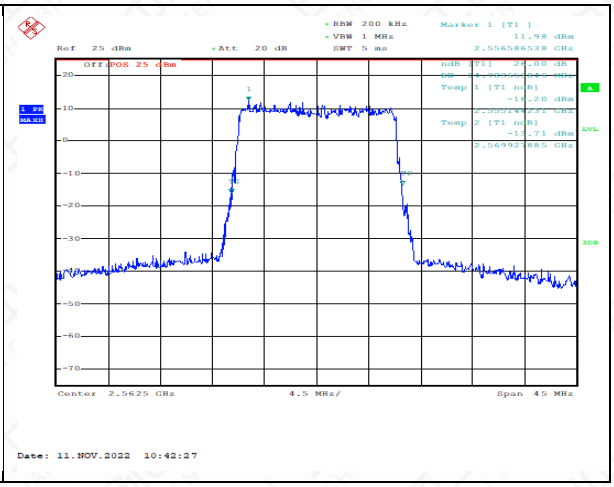
LTE band 7, 10MHz (99%)high

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2565	8.94	8.94
QPSK(99% BW)	16QAM(99% BW)	
		

LTE band 7, 15MHz (99%)high

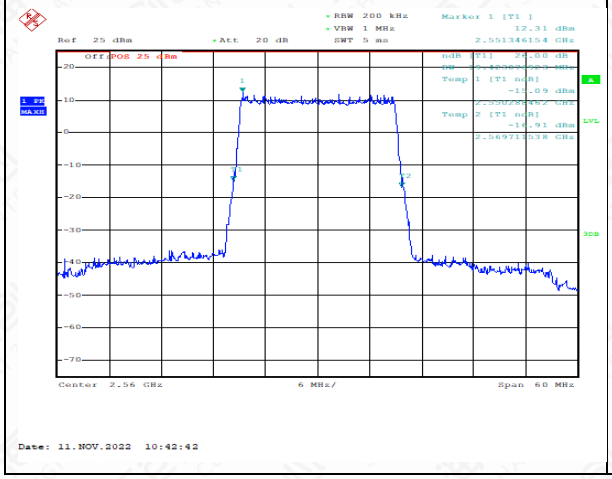
Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2562.5	14.57	14.78
QPSK(99% BW)	16QAM(99% BW)	

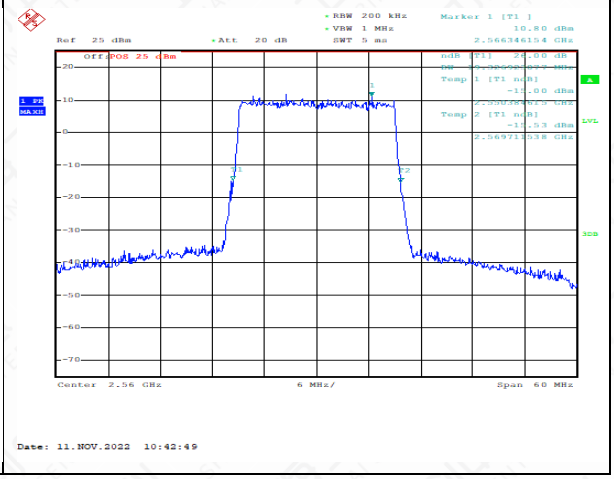




LTE band 7, 20MHz (99%)high

Frequency(MHz)	Occupied Bandwidth (99%)(MHz)	
	QPSK	16QAM
2560	19.42	19.33
QPSK(99% BW)	16QAM(99% BW)	





6.5 Emission Bandwidth

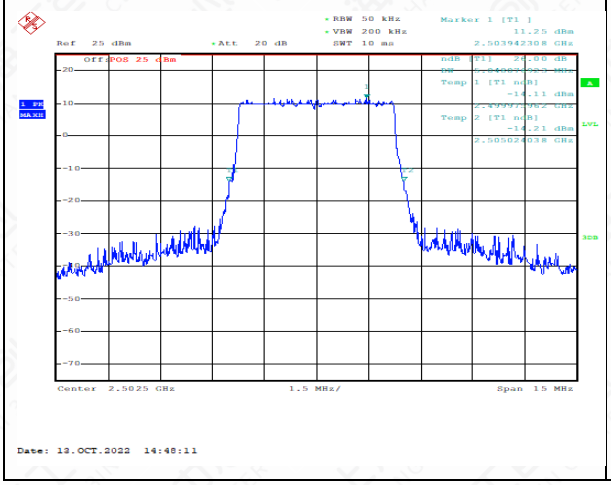
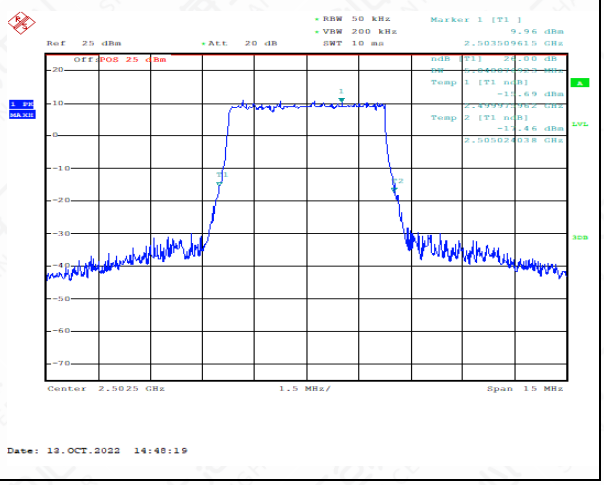
Reference

CFR Part 22.917(b).

6.5.1Emission Bandwidth Results

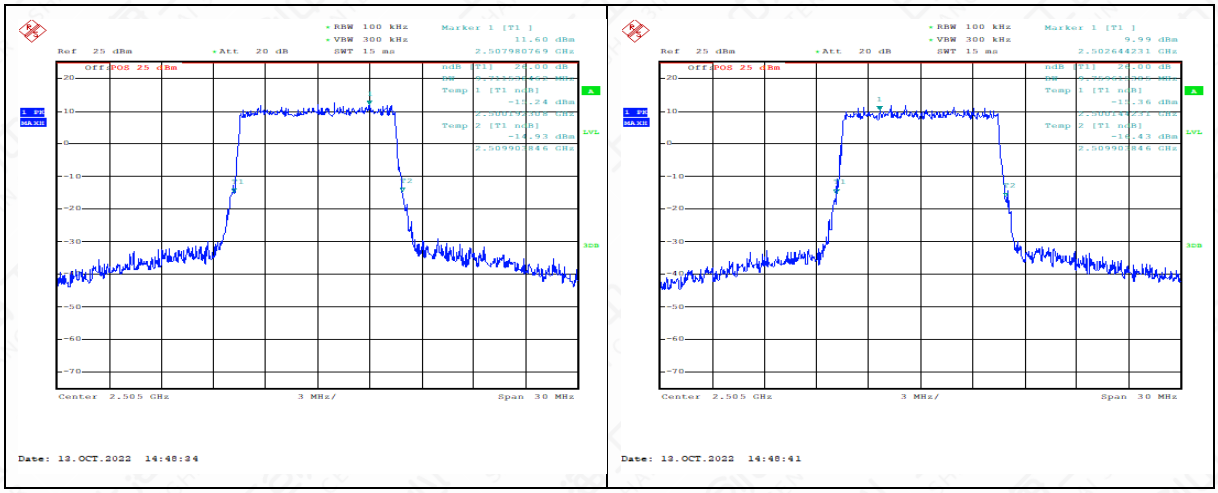
The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the followinag pages.

LTE band 7,5MHz (-26dBc) ,low

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
2502.5	QPSK	16QAM
	5.05	5.05
QPSK (-26dBc)	16QAM (-26dBc)	
		

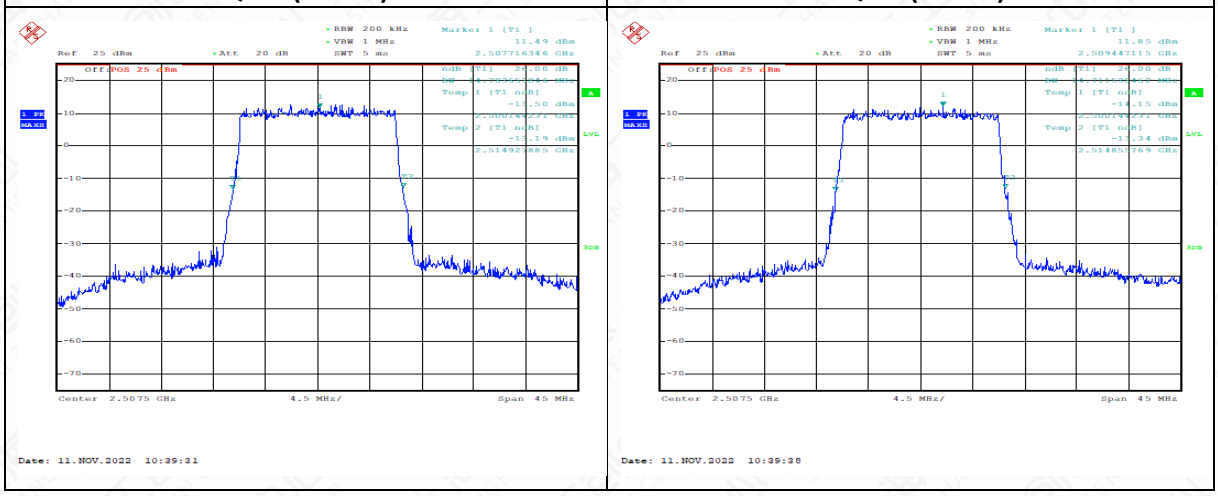
LTE band 7, 10MHz (-26dBc) ,low

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
2505	QPSK	16QAM
	9.71	9.76
QPSK (-26dBc)	16QAM (-26dBc)	



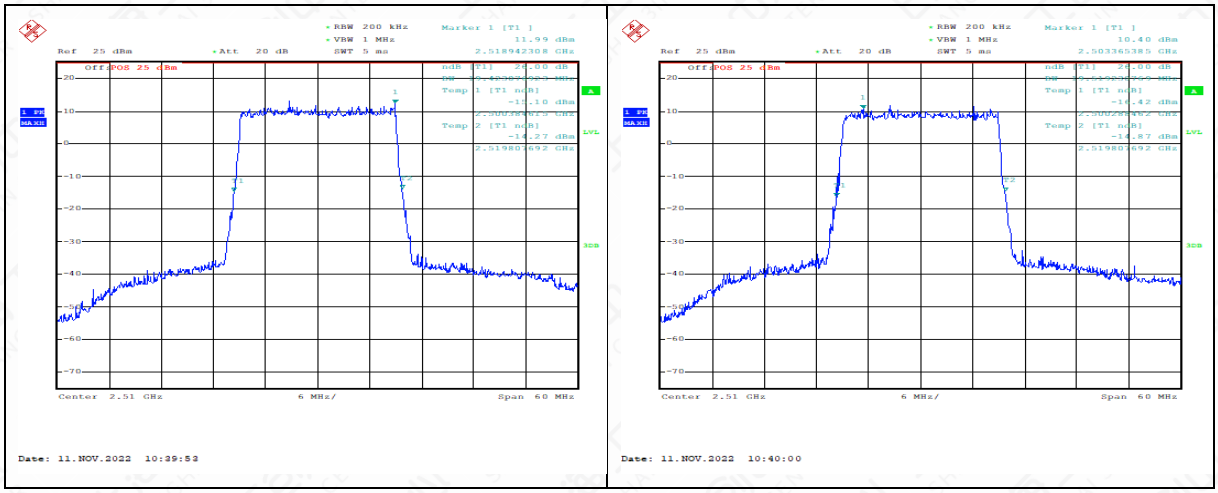
LTE band 7, 15MHz (-26dBc) ,low

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2507.5	14.78	14.71
QPSK (-26dBc)	16QAM (-26dBc)	

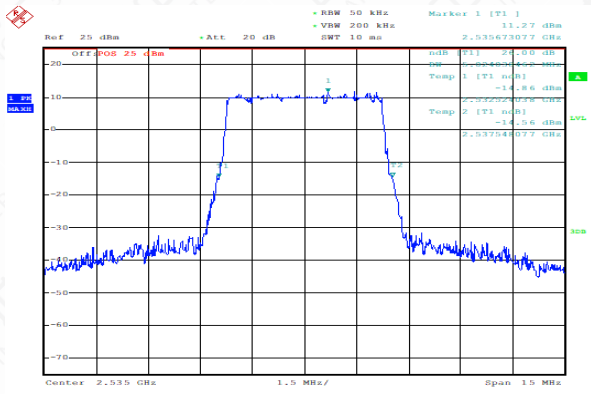
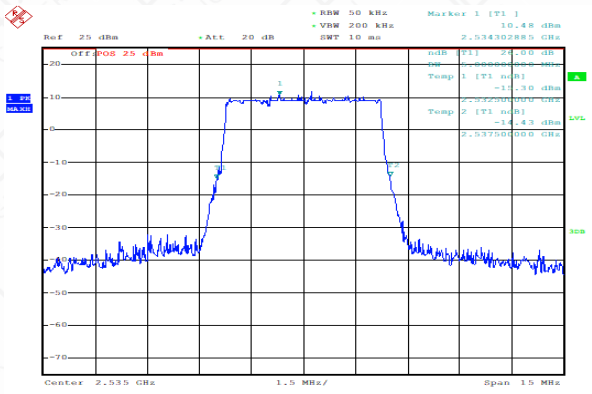


LTE band 7, 20MHz (-26dBc) ,low

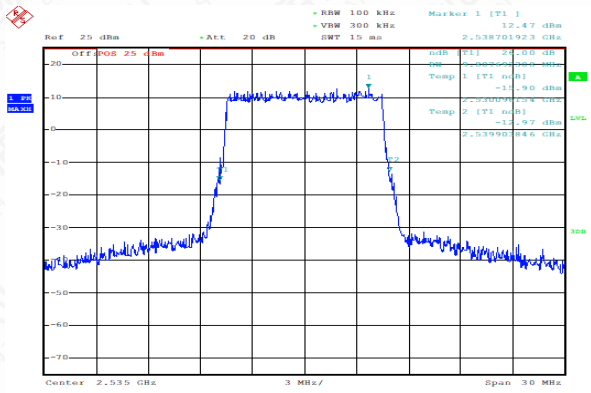
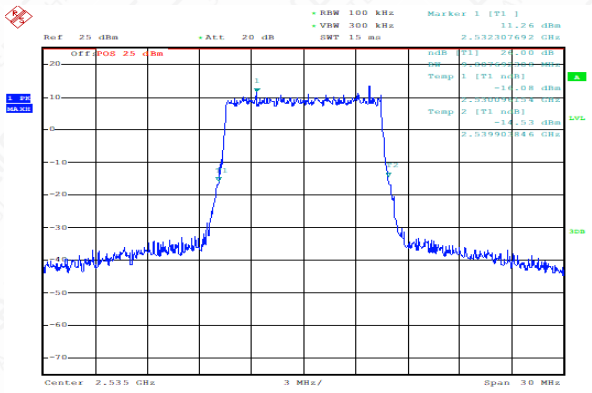
Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2510	19.42	19.52
QPSK (-26dBc)	16QAM (-26dBc)	


RBW 200 kHz
VBW 1 MHz
SWT 5 ms
Marker 1 [T1]
11.99 dBm
2.51894230 8 GHz
Ref 25 dBm
Att 20 dB
OffsPOS 25 dBm
Temp 1 [T1 ncB]
-17.10 dBm
Temp 2 [T1 ncB]
-14.27 dBm
2.51980 692 GHz
Center 2.51 GHz
6 MHz/
Span 60 MHz
Date: 11.NOV.2022 10:39:53
RBW 200 kHz
VBW 1 MHz
SWT 5 ms
Marker 1 [T1]
10.40 dBm
2.503365385 GHz
Ref 25 dBm
Att 20 dB
OffsPOS 25 dBm
Temp 1 [T1 ncB]
-16.42 dBm
Temp 2 [T1 ncB]
-14.87 dBm
2.51980 692 GHz
Center 2.51 GHz
6 MHz/
Span 60 MHz
Date: 11.NOV.2022 10:40:00

LTE band 7, 5MHz (-26dBc)mid

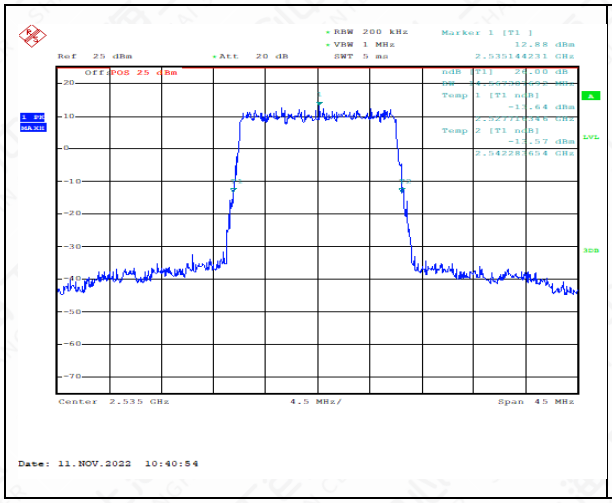
Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2535	5.00	5.00
QPSK (-26dBc)	16QAM (-26dBc)	
		

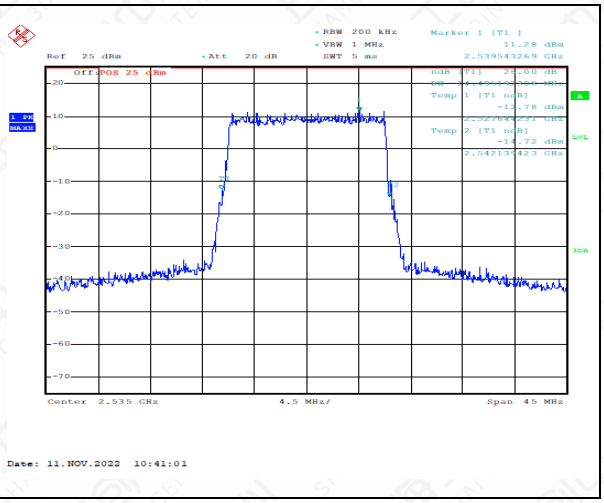
LTE band 7, 10MHz (-26dBc)mid

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2535	9.81	9.81
QPSK (-26dBc)	16QAM (-26dBc)	
		

LTE band 7, 15MHz (-26dBc)mid

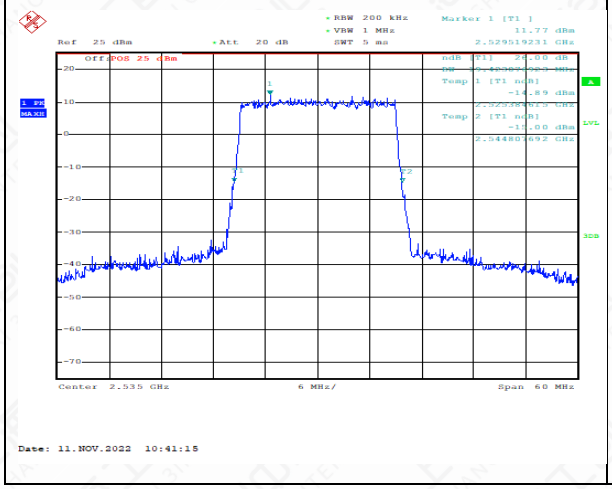
Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2535	14.57	14.50
QPSK (-26dBc)	16QAM (-26dBc)	

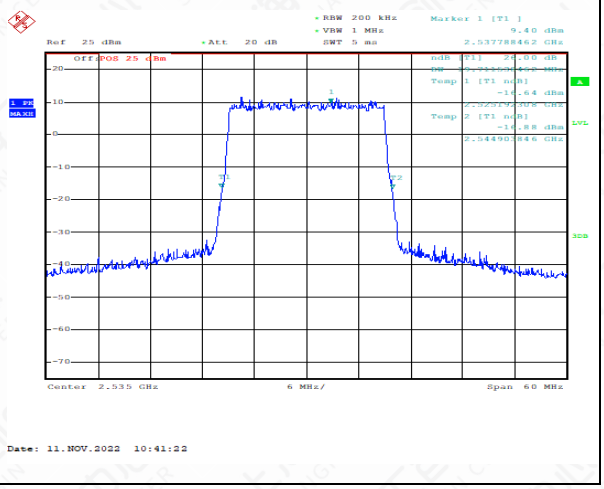




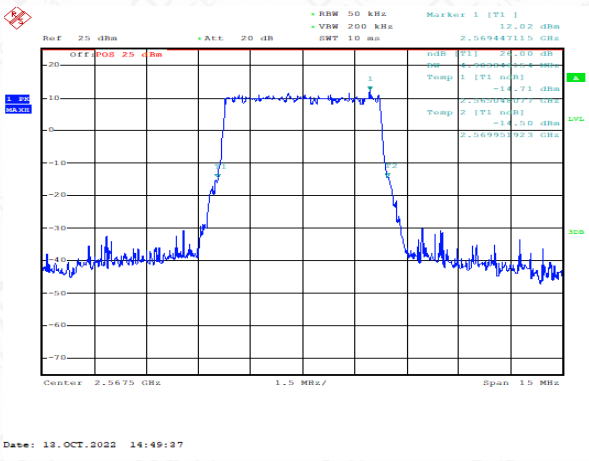
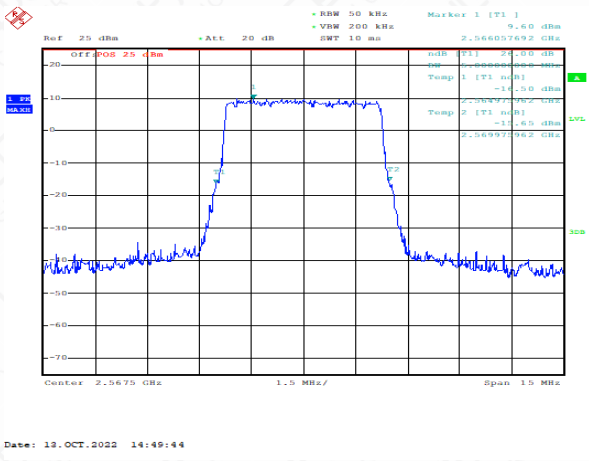
LTE band 7, 20MHz (-26dBc)mid

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2535	19.42	19.52
QPSK (-26dBc)	16QAM (-26dBc)	

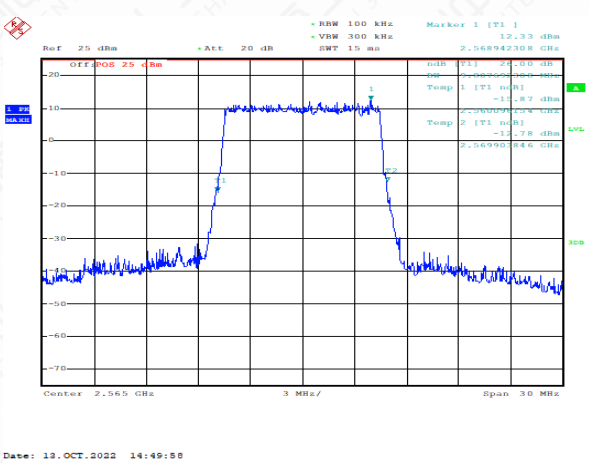
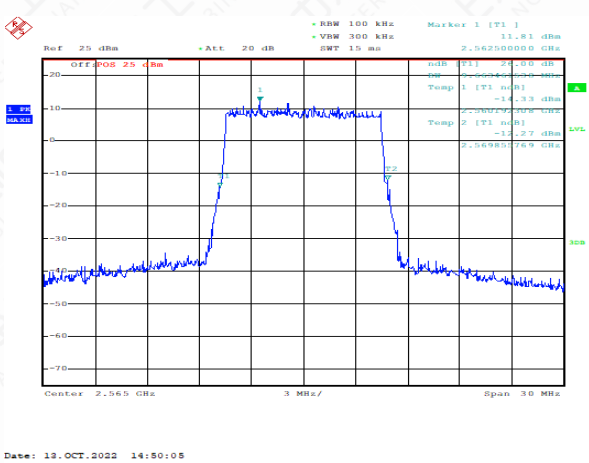




LTE band 7, 5MHz (-26dBc)high

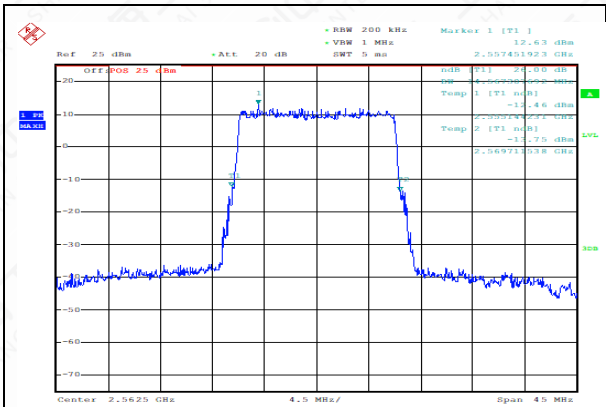
Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2567.5	4.90	5.00
QPSK (-26dBc)	16QAM (-26dBc)	
		

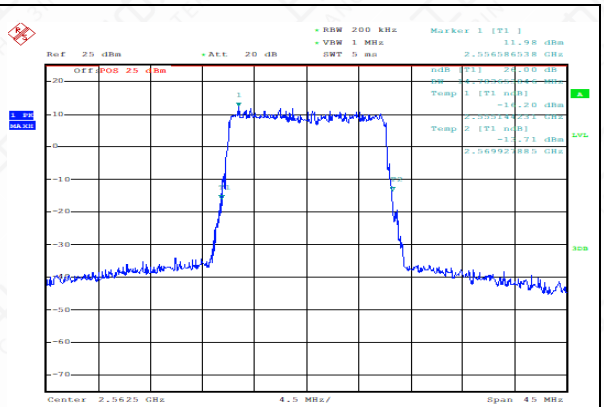
LTE band 7, 10MHz (-26dBc)high

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2565	9.81	9.66
QPSK (-26dBc)	16QAM (-26dBc)	
		

LTE band 7, 15MHz (-26dBc)high

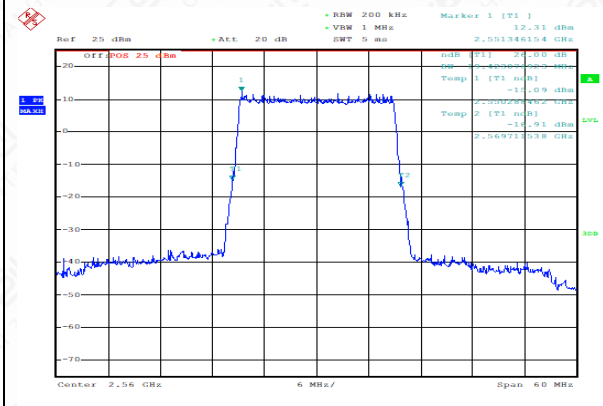
Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2562.5	14.57	14.78
QPSK (-26dBc)	16QAM (-26dBc)	

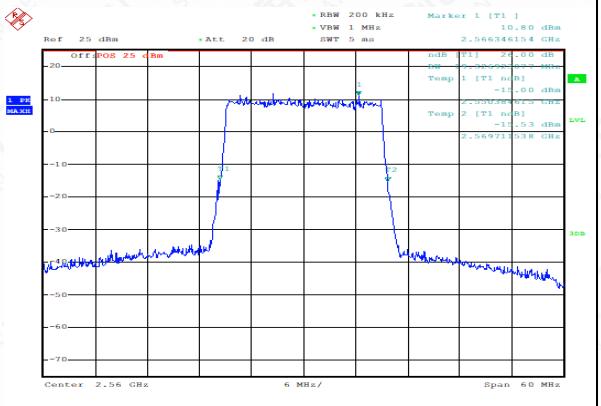




LTE band 7, 20MHz (-26dBc)high

Frequency(MHz)	Occupied Bandwidth (-26dBc)(MHz)	
	QPSK	16QAM
2560	19.42	19.33
QPSK (-26dBc)	16QAM (-26dBc)	





6.6 Band Edge Compliance

Reference

CFR Part 22.917(b)

6.6.1 Measurement limit

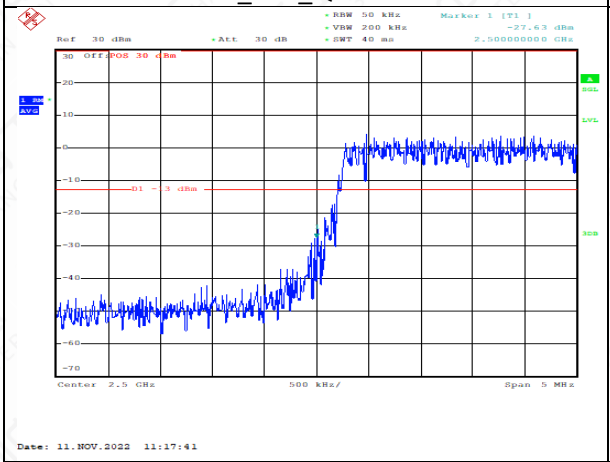
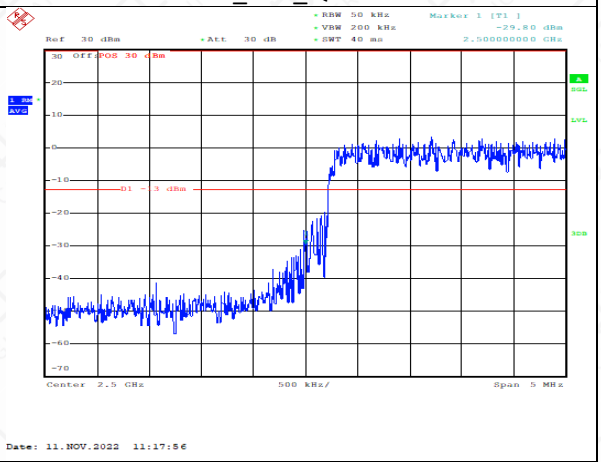
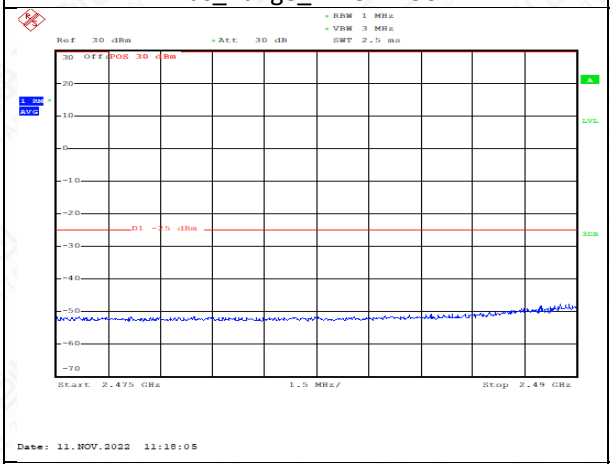
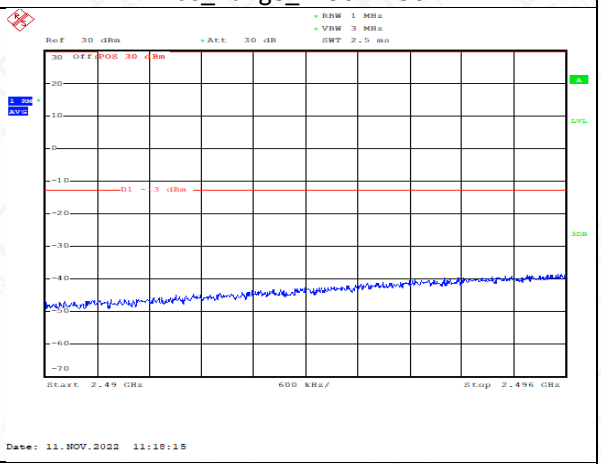
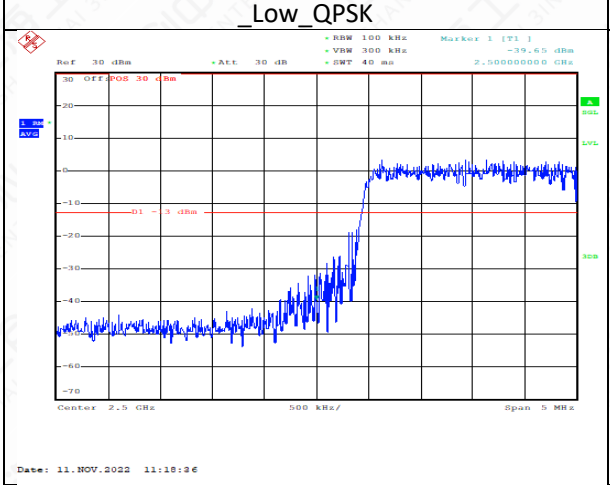
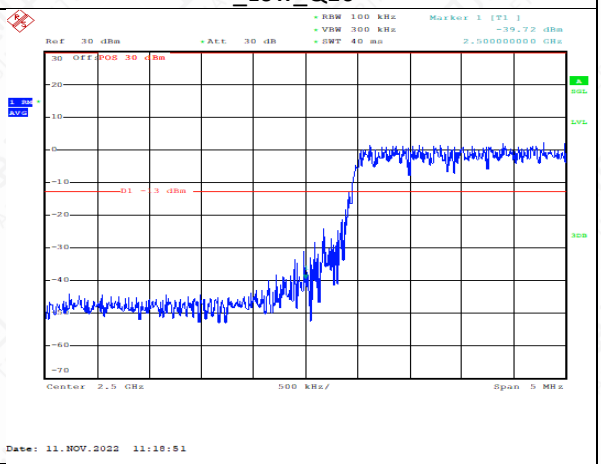
Part 27.53(g),27.53(h), 27.53(m) state that on any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log (P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dm.

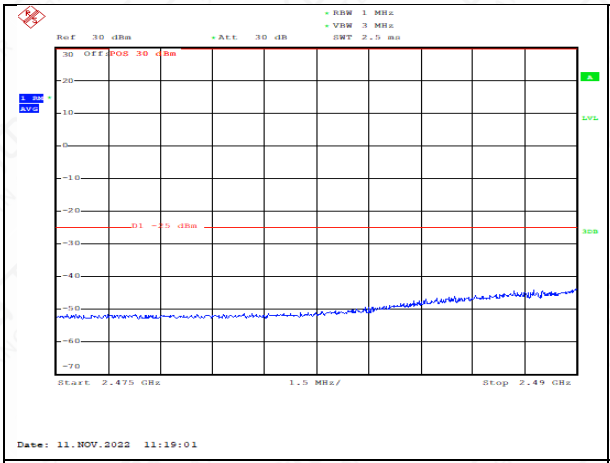
According to KDB 971168 6, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

Part 27.53(m) states that 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. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

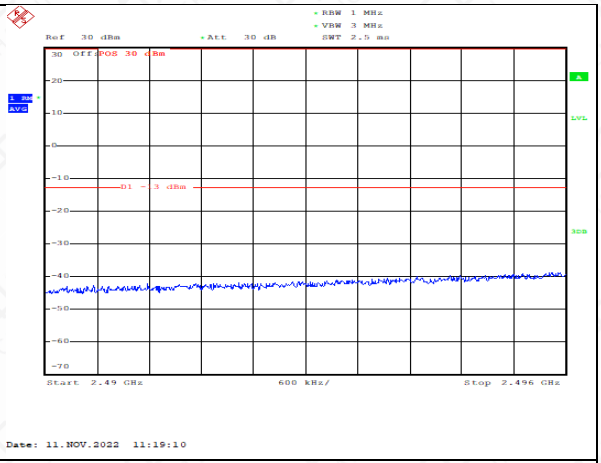
6.6.2 Measurement result

LTE band 7

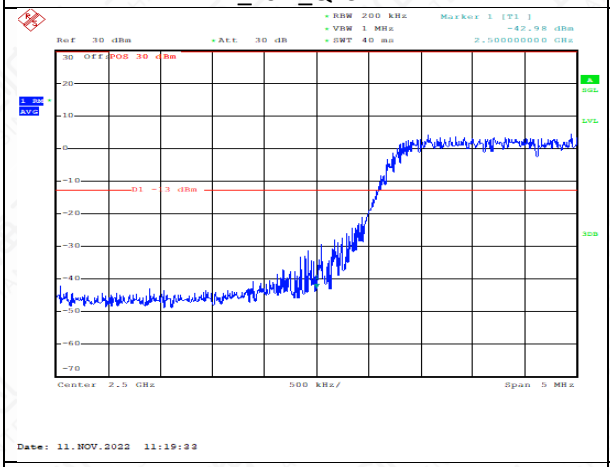
LowRange_ FDD07_5MHz_2502.5_fullRB _Low_QPSK	LowRange_ FDD07_5MHz_2502.5_fullRB _Low_Q16
	
FDD07_5MHz_2502.5_QPSK_fullRB_ExtraBa nds_Range_2475~2490	FDD07_5MHz_2502.5_QPSK_fullRB_ExtraBa nds_Range_2490~2496
	
LowRange_ FDD07_10MHz_2505_fullRB _Low_QPSK	LowRange_ FDD07_10MHz_2505_fullRB _Low_Q16
	
FDD07_10MHz_2505_QPSK_fullRB_ExtraBan ds_Range_2475~2490	FDD07_10MHz_2505_QPSK_fullRB_ExtraBan ds_Range_2490~2496



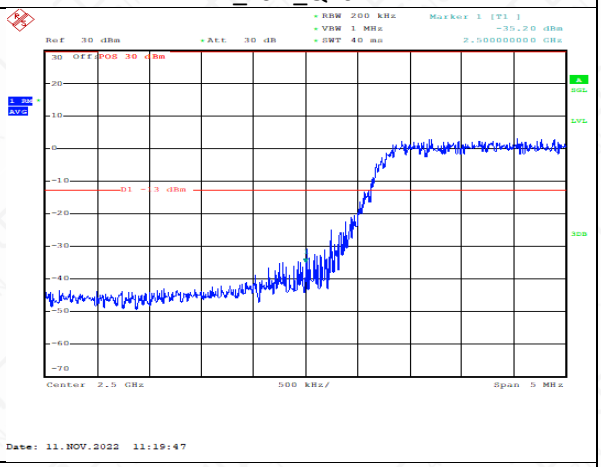
LowRange_ FDD07_15MHz_2507.5_fullRB_Low_QPSK



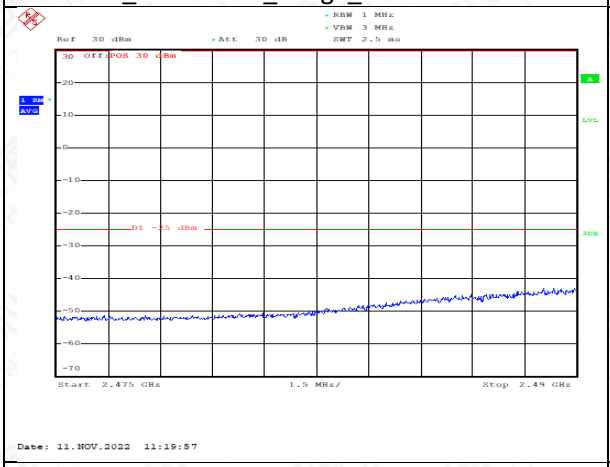
LowRange_ FDD07_15MHz_2507.5_fullRB_Low_Q16



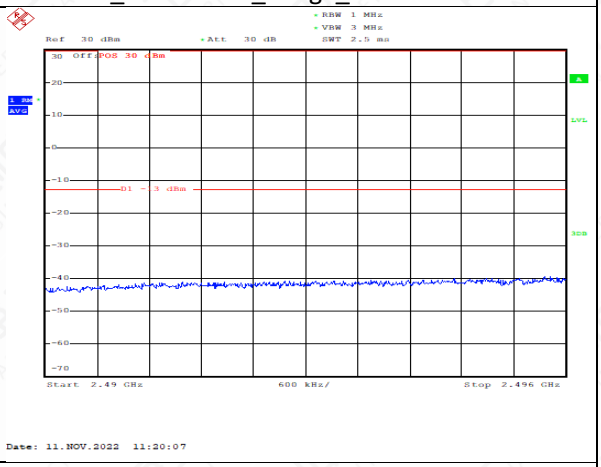
FDD07_15MHz_2507.5_QPSK_fullRB_ExtraBands_Range_2475~2490



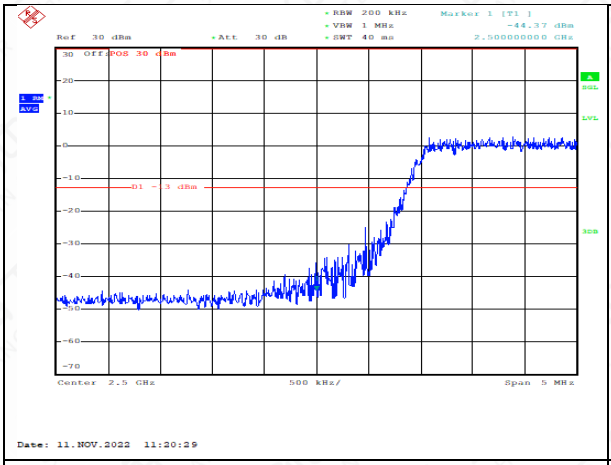
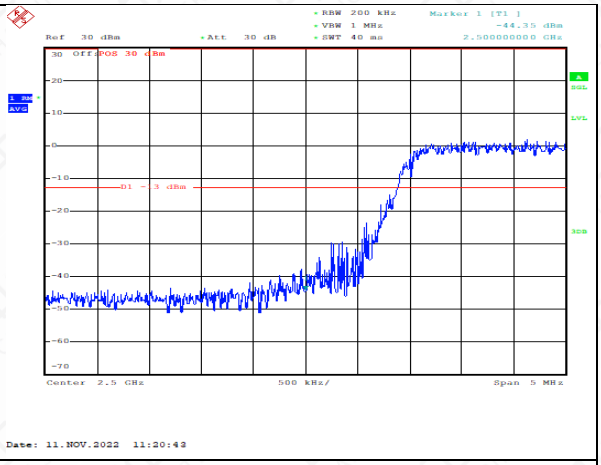
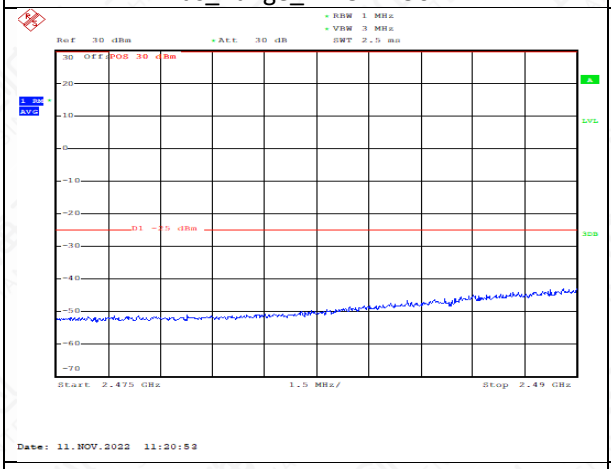
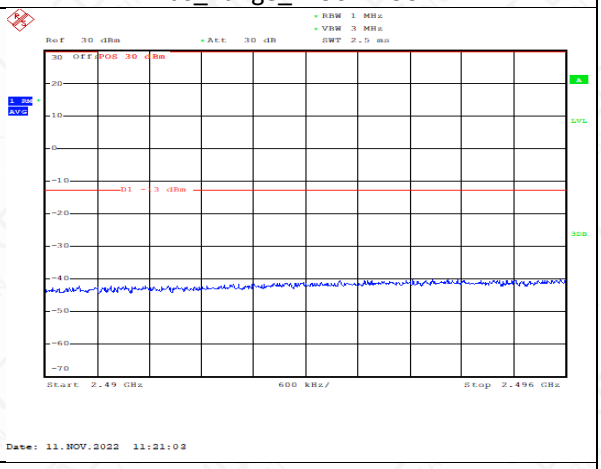
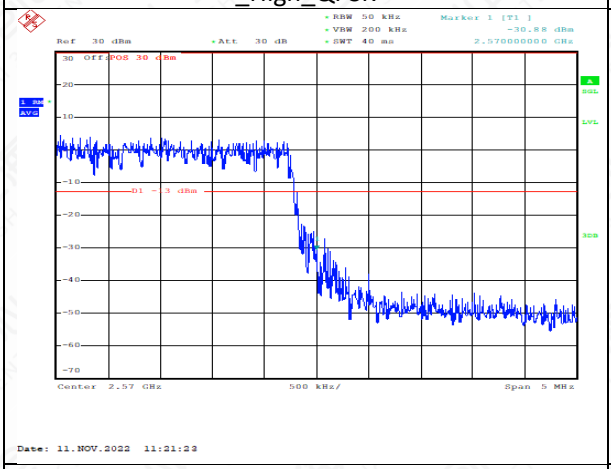
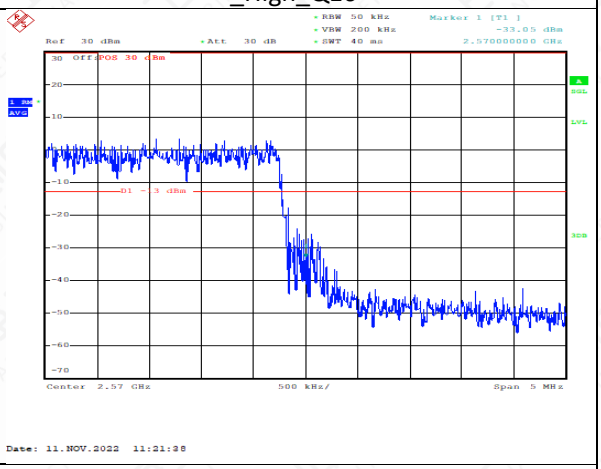
FDD07_15MHz_2507.5_QPSK_fullRB_ExtraBands_Range_2490~2496

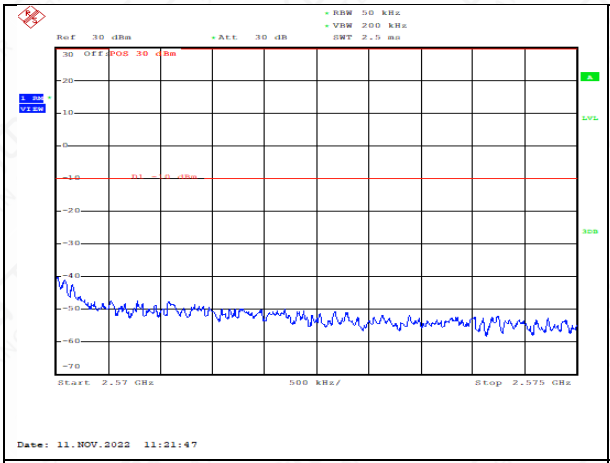


LowRange_ FDD07_20MHz_2510_fullRB_Low_QPSK

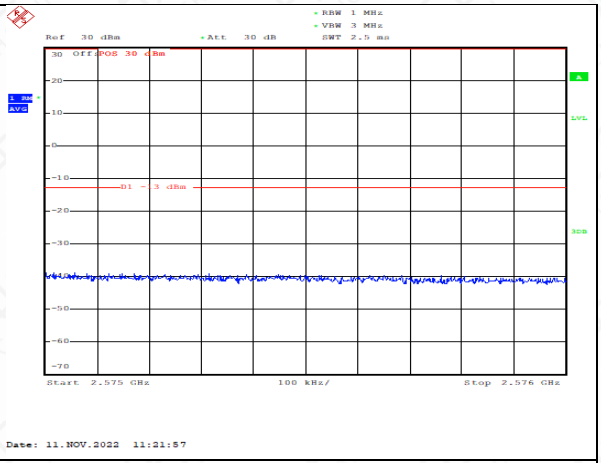


LowRange_ FDD07_20MHz_2510_fullRB_Low_Q16

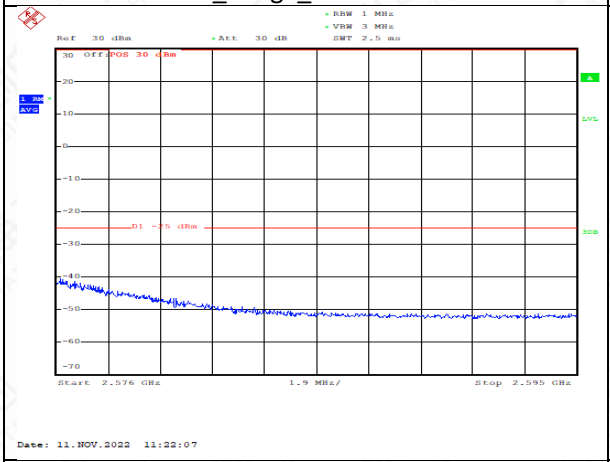
	
FDD07_20MHz_2510_QPSK_fullRB_ExtraBands_Range_2475~2490	FDD07_20MHz_2510_QPSK_fullRB_ExtraBands_Range_2490~2496
	
HighRange_ FDD07_5MHz_2567.5_fullRB_High_QPSK	HighRange_ FDD07_5MHz_2567.5_fullRB_High_Q16
	
FDD07_5MHz_2567.5_QPSK_fullRB_ExtraBands_Range_2570~2575	FDD07_5MHz_2567.5_QPSK_fullRB_ExtraBands_Range_2575~2576



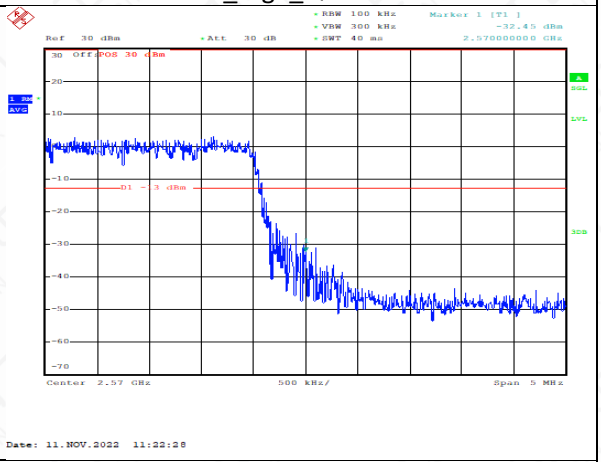
FDD07_5MHz_2567.5_QPSK_fullRB_ExtraBands_Range_2576~2595



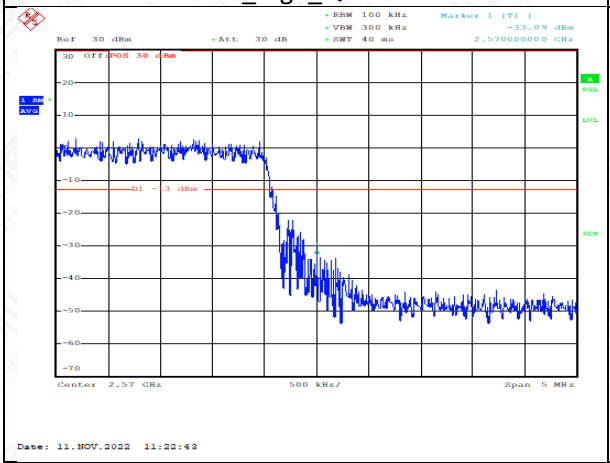
HighRange_ FDD07_10MHz_2565_fullRB_High_QPSK



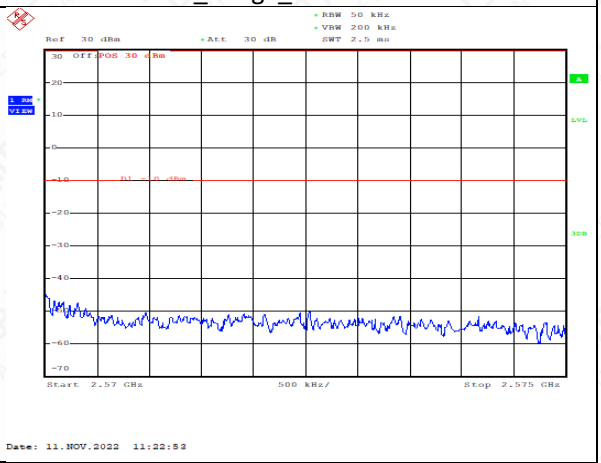
HighRange_ FDD07_10MHz_2565_fullRB_High_Q16



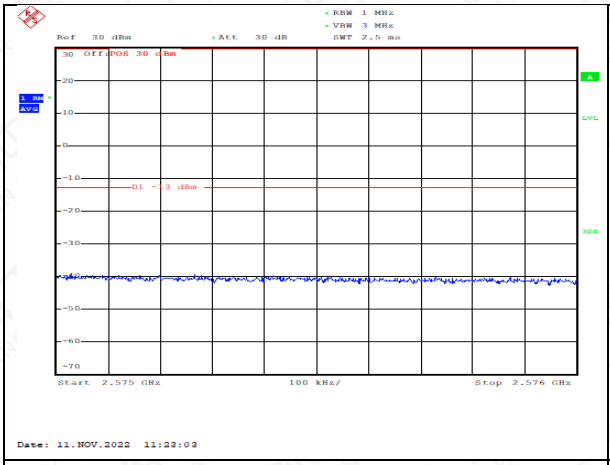
FDD07_10MHz_2565_QPSK_fullRB_ExtraBands_Range_2570~2575



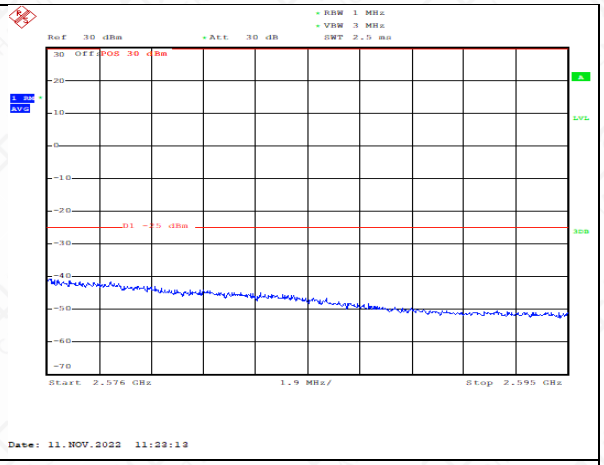
FDD07_10MHz_2565_QPSK_fullRB_ExtraBands_Range_2575~2576



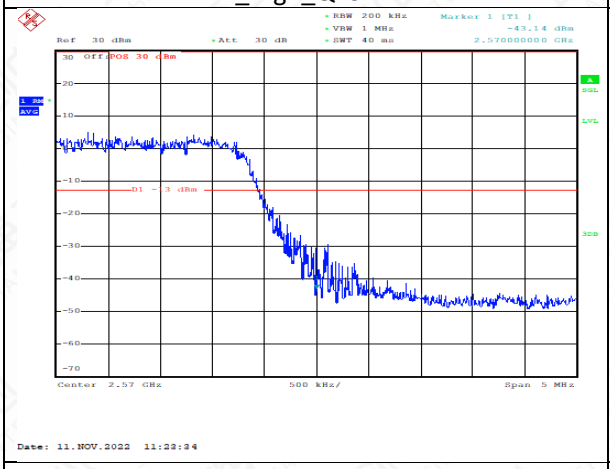
FDD07_10MHz_2565_QPSK_fullRB_ExtraBands_Range_2576~2595



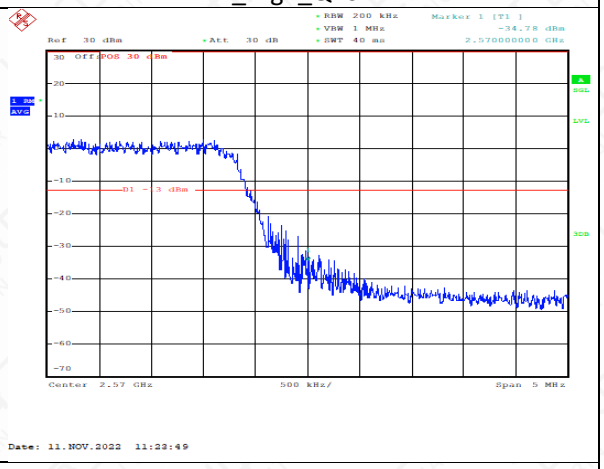
HighRange_ FDD07_15MHz_2562.5_fullRB_High_QPSK



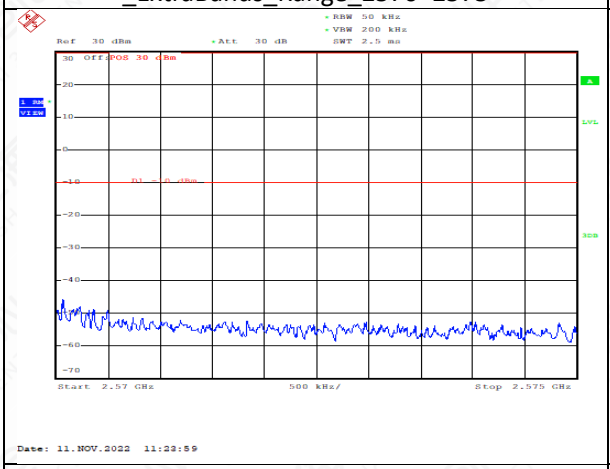
HighRange_ FDD07_15MHz_2562.5_fullRB_High_Q16



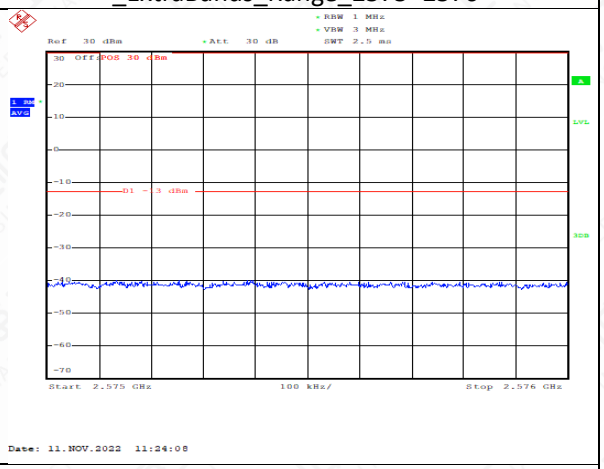
FDD07_15MHz_2562.5_QPSK_fullRB_ExtraBands_Range_2570~2575



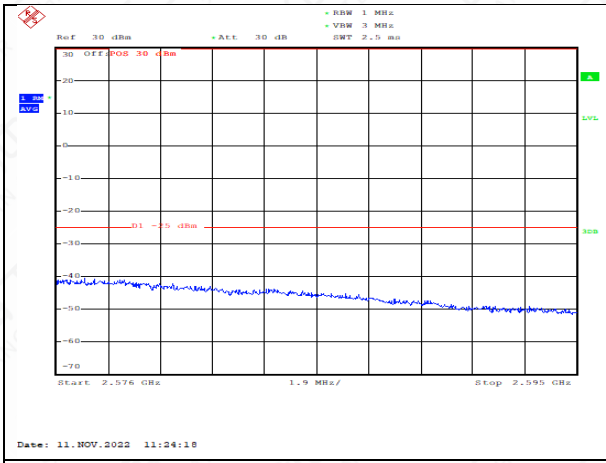
FDD07_15MHz_2562.5_QPSK_fullRB_ExtraBands_Range_2575~2576



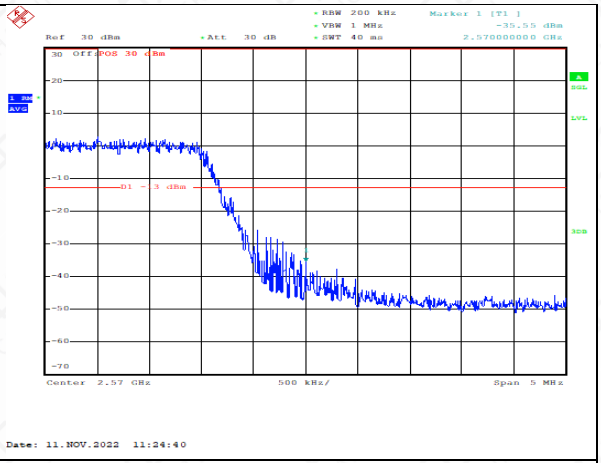
FDD07_15MHz_2562.5_QPSK_fullRB_ExtraBands_Range_2576~2595



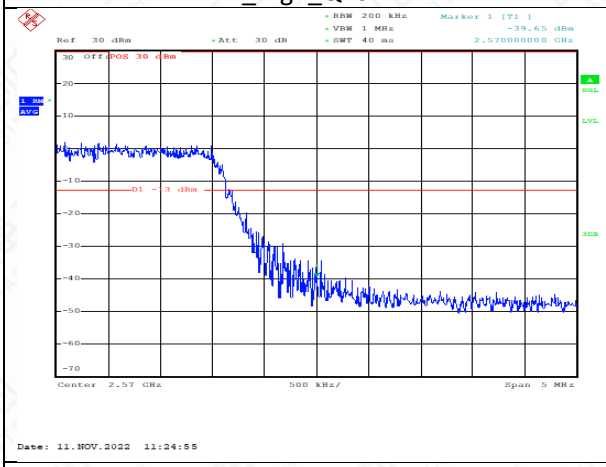
HighRange_ FDD07_20MHz_2560_fullRB_High_QPSK



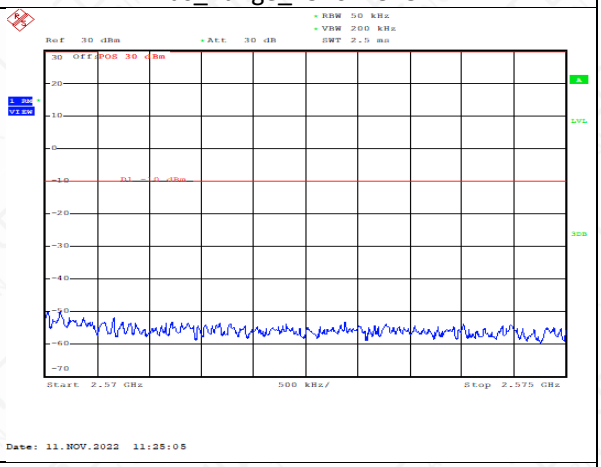
HighRange_ FDD07_20MHz_2560_fullRB_High_Q16



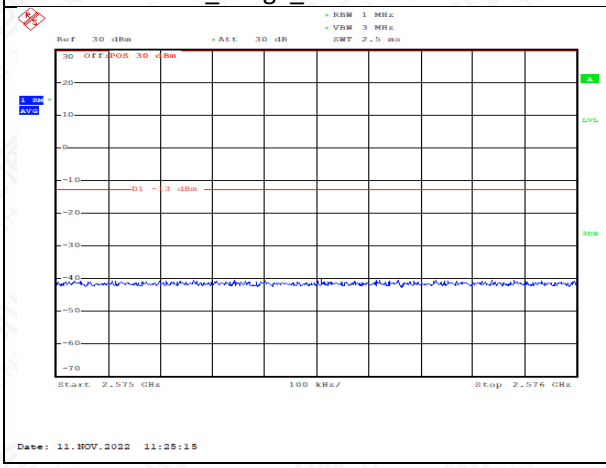
FDD07_20MHz_2560_QPSK_fullRB_ExtraBands_Range_2570~2575

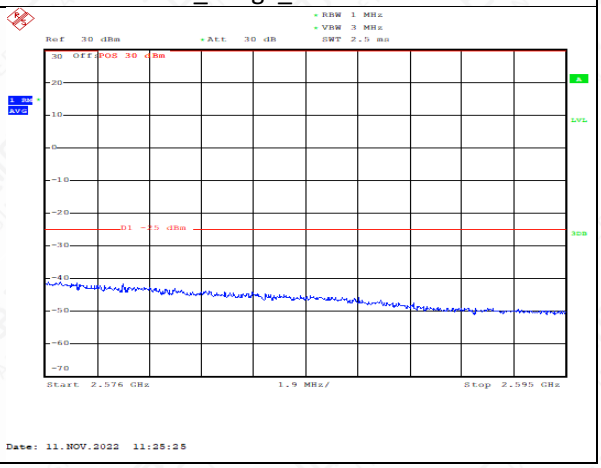


FDD07_20MHz_2560_QPSK_fullRB_ExtraBands_Range_2575~2576



FDD07_20MHz_2560_QPSK_fullRB_ExtraBands_Range_2576~2595





6.7 Conducted Spurious Emission

6.7.1 Measurement Method

The following steps outline the procedure used to measure the conducted emissions from the EUT.

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 mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.

Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

The number of sweep points of spectrum analyzer is set to 30001 which is greater than span/RBW.

6.7.2 Measurement Limit

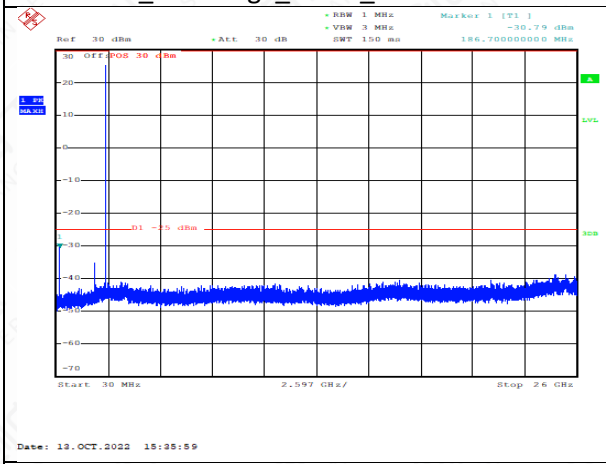
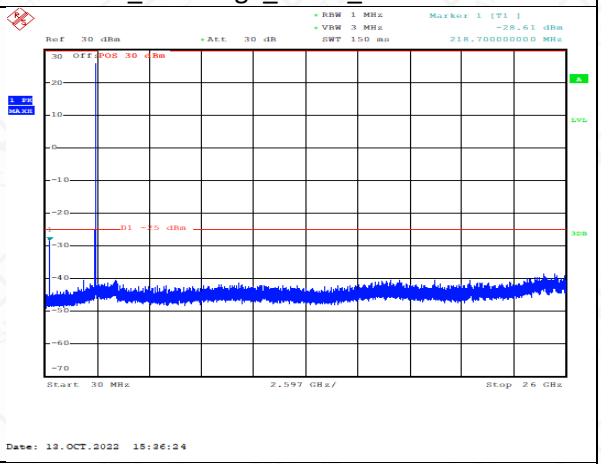
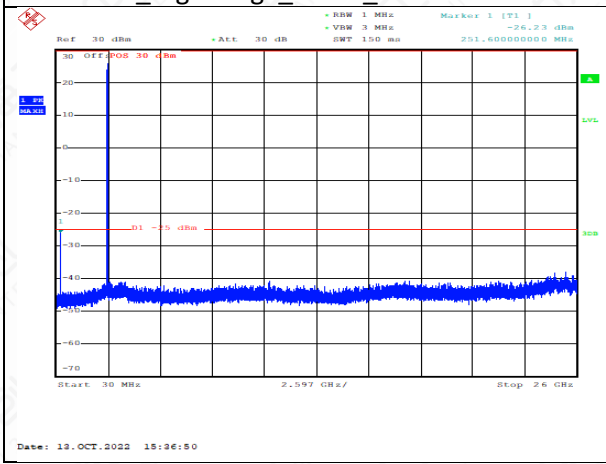
Part 27.53(g),27.53(h), 27.53(m) specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

Part 27.53(m)(4) specifies 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. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

6.7.3 Measurement result

Only worst case result is given below

Spurious emission limit –13dBm.(30MHz – 26GHz)	
FDD07_LowRange_5MHz_30MHz~26GHz	FDD07_MidRange_5MHz_30MHz~26GHz
	
FDD07_HighRange_5MHz_30MHz~26GHz	/
	/

Annex A: Revised History

Version	Revised Content
V00	Initial
V01	1.Add the test lab's registered MRA test site number 2.Added 10MHZ, 20MHZ related test case results

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 12th day of April 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2023

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

END OF REPORT