TEST REPORT

Report No.: SHATBL2306006W04

Applicant	:	Shanghai AllyNav Technology Co.,Ltd.
Product Name	:	GNSS Receiver
Brand Name	:	N/A
Model Name	:	R61
FCC ID	:	2AT4H-R61
Test Standard	:	47 CFR Part 2, 27(M), 27(H), 27(F)
Date of Test	:	2023.06.13-2023.08.14

Report Prepared by : Chris Xu

(Chris Xu)

Report Approved by : Ghost Li.

(Ghost Li)

Authorized Signatory : Terry Yang

(Terry Yang)

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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised by
00	2023.08.15	Initial Release	Ghost Li

DECLARATION OF REPORT

1. The device has been tested by ATBL, and the test results show that the equipment under test (EUT) is in compliance with the requirements of FCC. And it is applicable only to the tested sample identified in the report.

2. This report shall not be reproduced except in full, without the written approval of ATBL, this document only be altered or revised by ATBL, personal only, and shall be noted in the revision of the document.

3. The general information of EUT in this report is provided by the customer or manufacture, ATBL is only responsible for the test data but not for the information provided by the customer or manufacture.

4. The results in this report is only apply to the sample as tested under conditions. The customer or manufacturer is responsible for ensuring that the additional production units of this model have the same electrical and mechanical components.

SUMMARY OF TEST RESULT

Report Section	Standard Section	Test Item	Limit	Judgment	Remark
3.1	§2.1046	Conducted Output Power	-	Report Only	--
	§27.50(b)(10) §27.50(c)(10)	Effective Radiated Power (Band 12) (Band 13) (Band 17)	ERP < 3 Watt	PASS	--
	§27.50(h)(2)	Equivalent Isotropic Radiated Power (Band 7) (Band 38) (Band 41)	EIRP < 2Watt		--
3.2	N/A	Peak-to-Average Ratio	<13 dB	PASS	--
3.3	§2.1049	Occupied Bandwidth	-	Report Only	--
3.4	§2.1051 §27.53(c)(2)(4) §27.53(g)	Conducted Band Edge Measurement (Band 12) (Band 13) (Band 17)	< 43+10log10(P[Watts])	PASS	--
	§27.53(m)(4)	Conducted Band Edge Measurement (Band 7) (Band 38) (Band 41)	§27.53(m)(4)		
3.5	§2.1051 §27.53(c)(2) §27.53(g)	Conducted Spurious Emission (Band 12) (Band 13) (Band 17)	< 43+10log10(P[Watts])	PASS	--
	§2.1051 §27.53(m)(4)	Conducted Spurious Emission (Band 7) (Band 38) (Band 41)	< 55+10log10(P[Watts])		
3.6	§2.1055 §27.54	Frequency Stability Temperature & Voltage	Within Authorized Band	PASS	--
3.7	§2.1053 §27.53(c)(2) §27.53(f) §27.53(g)	Radiated Spurious Emission (Band 12) (Band 13) (Band 17)	< 43+10log10(P[Watts])	PASS	--
	§2.1053 §27.53(m)(4)	Radiated Spurious Emission (Band 7) (Band 38) (Band 41)	< 55+10log10(P[Watts])		

1. GENERAL DESCRIPTION

1.1. Applicant

Name : Shanghai AllyNav Technology Co.,Ltd.

Address : Room 201, Buliding 1,No 215, Gaoguang RD, Qingpu District,Shanghai, China

1.2. Manufacturer

Name : Shanghai AllyNav Technology Co.,Ltd.

Address : Room 201, Buliding 1,No 215, Gaoguang RD, Qingpu District,Shanghai, China

1.3. Factory

Name : Shanghai AllyNav Technology Co.,Ltd.

Address : Room 201, Buliding 1,No 215, Gaoguang RD, Qingpu District,Shanghai, China

1.4. General Information of EUT

General Information	
Equipment Name	GNSS Receiver
Brand Name	N/A
Model Name	R61
Series Model	N/A
Model Difference	N/A
SN or IMEI Code	202306100007004
Adapter	Model: OUSM-1500300 Brand: N/A Input: AC 100-240V,50/60Hz Output: DC15V 3A
Battery	Model: N/A Brand: N/A Rated Voltage: N/A Charge Limit Voltage: N/A Capacity: N/A
Hardware Version	R61 V5 20221121
Software Version	LIANSHI R61 V2.4.4EF
Antenna Type	external antenna
Connecting I/O Port(s)	Refer to the remark below.

Remark:

The above information of EUT was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.5. Equipment Specification

Standards-related Product Specification		
Frequency		
Band	**Tx Frequency Range**	**Rx Frequency Range**
☑ Band 7	2500 MHz ~ 2570 MHz	2620 MHz ~ 2690 MHz
☑ Band 12	699 MHz ~ 716 MHz	729 MHz ~ 746 MHz
☑ Band 13	777 MHz ~ 787 MHz	746 MHz ~ 756 MHz
☑ Band 38	2570 MHz ~ 2620 MHz	2570 MHz ~ 2620 MHz
☑ Band 41	2496 MHz ~ 2690 MHz	2496 MHz ~ 2690 MHz
Bandwidth		
Band	**Bandwidth**	
☑ Band 7	5MHz / 10MHz / 15MHz / 20MHz	
☑ Band 12	1.4MHz / 3MHz / 5MHz / 10MHz	
☑ Band 13	5MHz / 10MHz	
☑ Band 38	5MHz / 10MHz / 15MHz / 20MHz	
☑ Band 41	5MHz / 10MHz / 15MHz / 20MHz	
Antenna Gain		
Band	**Antenna Gain**	
☑ Band 7	4.00dBi	
☑ Band 12	2.60dBi	
☑ Band 13	2.60dBi	
☑ Band 38	3.00dBi	
☑ Band 41	4.00dBi	
Maximum Output Power to Antenna		
Band	**Maximum Output Power**	
☑ Band 7	21.57dBm	
☑ Band 12	22.17dBm	
☑ Band 13	21.88dBm	
☑ Band 38	22.62dBm	
☑ Band 41	21.63dBm	
Type of Modulation		
☑ QPSK ☑ 16QAM ☐ 64QAM ☐ 256QAM		

Note:

The maximum ERP/EIRP is calculated from max output power and max antenna gain, so only the maximum ERP/EIRP is shown in the report.

1.6. Modification of EUT

No modifications are made to the EUT during all test items.

1.7. Laboratory Information

Company Name	:	SHENZHEN HAIYUAN STANDARD TECHNICAL CO.,LTD
Address	:	No.110,111,112,113,115,116,Block B,Jinyuan business Building, No.302, Xixiang Avenue, Laodong Community, Xixiang Street, Bao'an District, Shenzhen P.R.C.

1.8. Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

47 CFR Part 2, 27(M), 27(H), 27(F)

ANSI C63.26-2015

FCC KDB 971168 D01 Power Meas License Digital Systems v03r01

FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.

2. TEST CONFIGURATION OF EQUIPMENT UNDER TEST

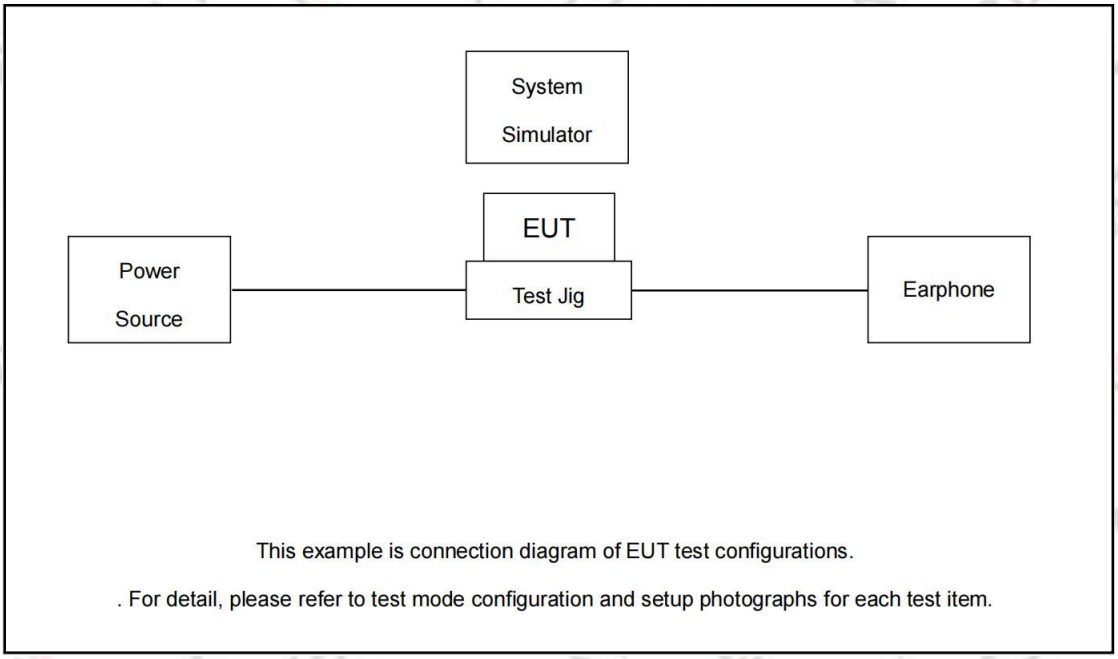
2.1. Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas License Digital Systems v03r01 with maximum output power.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission. (X-Plane)

Test Items	Band	Bandwidth (MHz)						Modulation				RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	256QAM	1	Half	Full	L	M	H
Max. Output Power	7	√	√	√	√	√	√	√	√			√		√	√	√	√
	12	√	√	√	√	√	√	√	√			√		√	√	√	√
	13	√	√	√	√			√	√			√		√	√	√	√
	38	√	√	√	√	√		√	√			√		√	√	√	√
	41	√	√	√	√	√	√	√	√			√		√	√	√	√
Peak-to-Average Ratio	7						√	√	√					√		√	
	12/17						√	√	√					√		√	
	13				√			√	√					√		√	
	38						√	√	√					√		√	
	41																
26dB and 99% Bandwidth	7	√	√	√	√	√	√	√	√					√		√	
	12/17	√	√	√	√	√	√	√	√					√		√	
	13	√	√	√	√	√		√	√					√		√	
	38																
	41			√	√	√	√	√	√					√		√	
Conducted Band Edge	7	√	√	√	√	√	√	√	√			√		√	√		√
	12/17	√	√	√	√	√	√	√	√			√		√	√		√
	13	√	√	√	√	√		√	√			√		√	√		√
	38																
	41			√	√	√	√	√	√			√		√	√		√
Conducted Spurious Emission	7	√	√	√	√	√	√	√				√			√	√	√
	12/17	√	√	√	√	√	√	√				√			√	√	√
	13	√	√	√	√	√		√				√			√	√	√
	38																
	41			√	√	√	√	√				√			√	√	√
Frequency Stability	7				√			√						√		√	
	12/17				√			√						√		√	
	13				√			√						√		√	
	38																
	41				√			√						√		√	
E.R.P / E.I.R.P	7	√	√	√	√	√	√	√	√			√		√	√	√	√
	12	√	√	√	√	√	√	√	√			√		√	√	√	√
	13	√	√	√	√			√	√			√		√	√	√	√
	17	√	√	√	√	√	√	√	√			√		√	√	√	√
	38	√	√	√	√	√		√	√			√		√	√	√	√
	41	√	√	√	√	√	√	√	√			√		√	√	√	√
Radiated Spurious Emission	7	Worst Case													√	√	√
	12/17	Worst Case													√	√	√
	13	Worst Case													√	√	√
	38	Worst Case															
	41	Worst Case													√	√	√
Note	1. The mark "√" means that this configuration is chosen for testing 2. When a cell is empty, it means it is not supported or does not require testing. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 4. The UE category is 1, so bandwidth greater than 5M does not support 16QAM.																

2.2. Connection Diagram of Test System



2.3. Support Unit used in test configuration and system

NO.	Unit	Brand	Model	Description
1	Adapter	N/A	OUSM-1500300	N/A
2	SIM Card	N/A	N/A	N/A
3	RF Cable	N/A	100CM	N/A

2.4. Frequency List of Low/Middle/High Channels

LTE Band 7 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	20850	21100	21350
	Frequency	2510	2535	2560
15	Channel	20825	21100	21375
	Frequency	2507.5	2535	2562.5
10	Channel	20800	21100	21400
	Frequency	2505	2535	2565
5	Channel	20775	21100	21425
	Frequency	2502.5	2535	2567.5

LTE Band 12 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	23060	23095	23130
	Frequency	704	707.5	711
5	Channel	23035	23095	23155
	Frequency	701.5	707.5	713.5
3	Channel	23025	23095	23165
	Frequency	700.5	707.5	714.5
1.4	Channel	23017	23095	23173
	Frequency	699.7	707.5	715.3

LTE Band 13 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	23230	-
	Frequency	-	782	-
5	Channel	23205	23230	23255
	Frequency	779.5	782	784.5

LTE Band 38 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	37850	38000	38150
	Frequency	2580	2595	2610
15	Channel	37825	38000	38175
	Frequency	2577.5	2595	2612.5
10	Channel	37800	38000	38200
	Frequency	2575	2595	2615
5	Channel	37775	38000	38225
	Frequency	2572.5	2595	2617.5

LTE Band 41 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	39750	40620	41490
	Frequency	2506	2593	2680
15	Channel	39725	40620	41515
	Frequency	2503.5	2593	2682.5
10	Channel	39700	40620	41540
	Frequency	2501	2593	2685
5	Channel	39675	40620	41565
	Frequency	2498.5	2593	2687.5

2.5. Equipment List

2.5.1. For Conducted Test

Equipment Name	Manufacturer	Model	Serial No.	Equipment No.	Calibration Until
Meideshi multifunctional electronic thermometer and hygrometer	Meideshi	JR900	/	JLE042	2024.05.02
RF Control Unit	dsusoft	JS0806-2	21G8060449	JLE053	2024.05.02
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	1201.0002K50-116064-Dt	JLE054	2024.05.02
power supply unit	dsusoft	JS0806-4ADC	N/A	JLE055	2024.05.02
RF Control Unit	dsusoft	JS0806-1	21G8060451	JLE058	2024.05.02
Signal Generator	Anritsu	MG3694C	#213104	JLE059	2024.05.02
Vector Signal Generator	Anritsu	MG3710E	6272323212	JLE060	2024.05.02
Signal Analyzer	Anritsu	MS2850A	6272347524	JLE061	2024.05.02
Radio Communication Analyzer	Anritsu	MT8821C	6272278400	JLE063	2024.05.02
Radio Communication Test Station	Anritsu	MT8000A	6272337398	JLE064	2024.05.02
RF Control Unit	dsusoft	JS0806-1	22E8060579	JLE065	2024.05.02
UPV·Audio Analyzer·DC…250kHz	Rohde & Schwarz	1146.2003K02	101433	JLE066	2024.05.02
SFE·Broadcast Tester	Rohde & Schwarz	2112.4300K02	100106	JLE067	2024.05.02
VXG Signal Generator	Keysight	N5182B	MY59100855	JLE068	2024.05.02
MXA Signal Analyzer	Keysight	N9010A	MY51440158	JLE076	2024.05.02

2.5.2. For Radiated Spurious Emission

Equipment Name	Manufacturer	Model	Serial No.	Equipment No.	Calibration Until
Meideshi multifunctional electronic thermometer and hygrometer	Meideshi	JR900	/	JLE017	2024/5/2
Low frequency amplifier		LNA 0920N	2014	JLE023	2024/5/2
High frequency amplifier	Schwarzbeck	BBV 9718	284	JLE024	2024/5/2
Broadband preamplifier	Schwarzbeck	BBV9721	9721-019	JLE025	2024/5/2
RF cable(966 chamber)9kHz-1GHz	/	/	/	JLE026	2024/5/2
RF cable(966 chamber)1GHz-18GHz	/	/	/	JLE027	2024/5/2
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1273	JLE028	2024/4/22
Horn Antenna	SCHWARZBECK	BBHA 9170	9170#685	JLE029	2024/4/22
Loop Antenna	SCHWARZBECK	FMZB1519B	00029	JLE030	2024/4/22
MXA Signal Analyzer	Keysight	N9021B	MY60080169	JLE050	2024/4/22
VXG Signal Generator	Keysight	M9384B	MY61270787	JLE051	2024/4/22
EXG Analog Signal Generator	Keysight	N5173B	MY59101282	JLE052	2024/4/22

2.6. Measurement Uncertainty

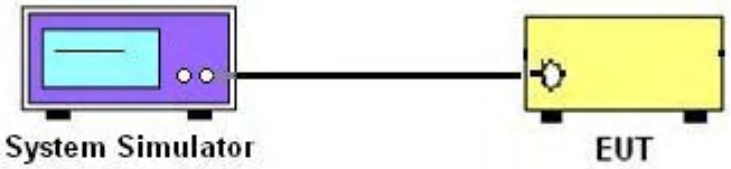
The reported uncertainty of measurement y±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.958dB
2	Conducted spurious emissions	±2.988dB
3	All emissions, radiated 30MHz-1GHz	±2.50dB
4	All emissions, radiated 1GHz-18GHz	±3.51dB
5	Occupied bandwidth	±23.20Hz
6	Power spectral density	±0.886dB

3. TEST RESULT

3.1. Conducted Output Power and ERP/EIRP

3.1.1. Test Setup



3.1.2. Description of the Conducted Output Power Measurement and ERP/EIRP Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The ERP of mobile transmitters must not exceed 3 Watts for LTE Band 12, Band 13 and Band 17.

The EIRP of mobile transmitters must not exceed 2 Watts for Band 7and Band 38 and Band 41.

According to KDB 412172 D01 Power Approach, EIRP = $P_T + G_T - L_C$, ERP = EIRP -2.15, where P_T = transmitter output power in dBm, G_T = gain of the transmitting antenna in dBi, L_C= signal attenuation in the connecting cable between the transmitter and antenna in dB.

3.1.3. Test Procedures

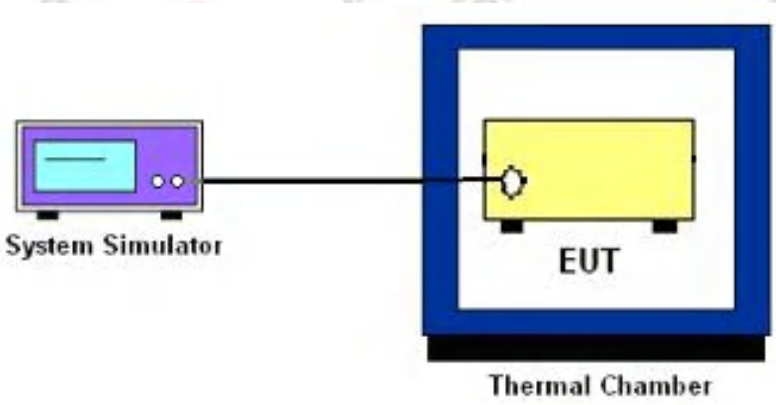
1. The testing follows ANSI C63.26 Section 5.2.
2. The transmitter output port was connected to the system simulator.
3. Set EUT at maximum power through the system simulator.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure and record the power level from the system simulator.

3.1.4. Test Result of Conducted Output Power and ERP/EIRP

Please refer to the Appendix A.

3.2. Frequency Stability

3.2.1. Test Setup



3.2.2. Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

3.2.3. Test Procedures for Temperature Variation

1. The testing follows ANSI C63.26 section 5.6.4.
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. With power OFF, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

3.2.4. Test Procedures for Voltage Variation

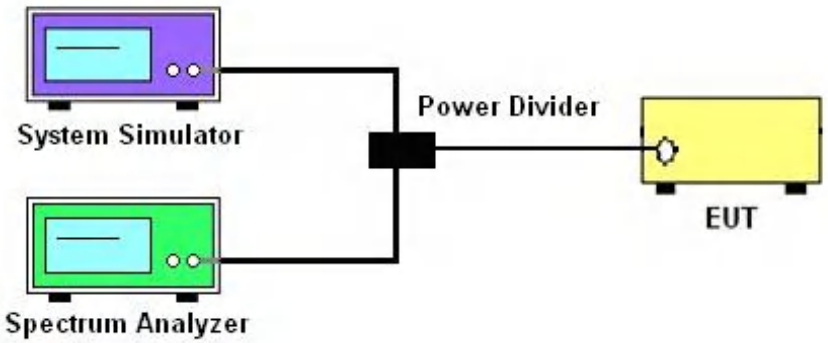
1. The testing follows ANSI C63.26 section 5.6.5
2. The EUT was placed in a temperature chamber at 20±5°C and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
4. For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.
5. The variation in frequency was measured for the worst case.

3.2.5. Test Result of Frequency Stability

Please refer to the Appendix A.

3.3. Peak-to-Average Ratio

3.3.1. Test Setup



3.3.2. Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

3.3.3. Test Procedures

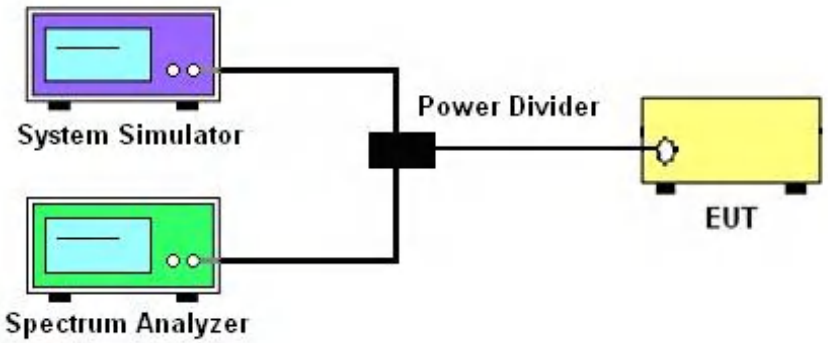
1. The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5. Record the deviation as Peak to Average Ratio.

3.3.4. Test Result of Peak-to-Average Ratio

Please refer to the Appendix A.

3.4. Occupied Bandwidth

3.4.1. Test Setup



3.4.2. Description of Occupied Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

3.4.3. Test Procedures

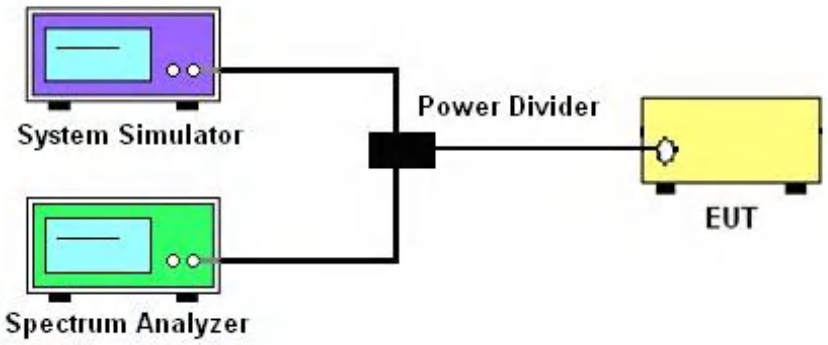
1. The testing follows ANSI C63.26 Section 5.4.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
4. The nominal resolution bandwidth (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.
5. Set the detection mode to peak, and the trace mode to max hold.
6. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.(this is the reference value)
7. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
8. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “–X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
9. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

3.4.4. Test Result of Occupied Bandwidth

Please refer to the Appendix A.

3.5. Conducted Band Edge

3.5.1. Test Setup



3.5.2. Description of Conducted Band Edge Measurement

27.53 (c):

For operations in the 776-788 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 100 kHz bandwidth. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed. In addition, the power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least 65 + 10 log10 p(watts), dB, for mobile and portable equipment.

27.53 (g):

For operations in the 600MHz band and 698-746 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 100 kHz bandwidth. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

27.53(m)(4):

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.

3.5.3. Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured.
4. Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
5. Beyond the 1 MHz band from the band edge, RBW=1MHz was used .
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. Checked that all the results comply with the emission limit line.

   Example:

   The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

   = P(W) - [43 + 10log(P)] (dB)

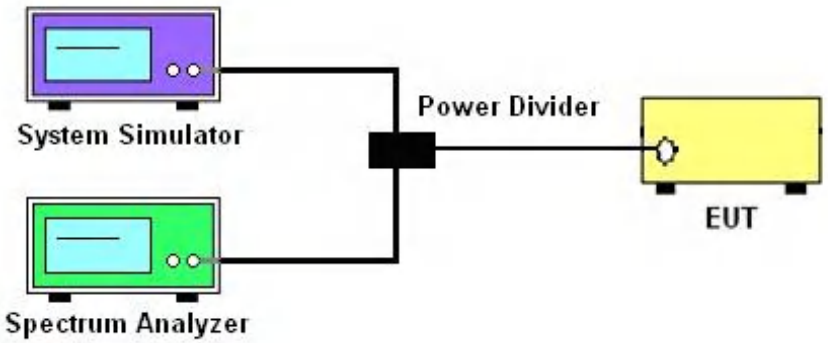
   = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB) = -13dBm
9. When using the integration method, the starting frequency of the integration shall be centered at one-half of the RBW away from the band edge.

3.5.4. Test Result of Conducted Band Edge

Please refer to the Appendix A.

3.6. Conducted Spurious Emission

3.6.1. Test Setup



3.6.2. Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

For Band 7,38,41:

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 55 + 10 log (P) dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

3.6.3. Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
7. Set spectrum analyzer with RMS detector.
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band
10. 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.
11. For Band 7, 38, 41:

The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)
= P(W)- [55+ 10log(P)] (dB) = [30+ 10log(P)] (dBm) - [55+ 10log(P)] (dB) = -25dBm.

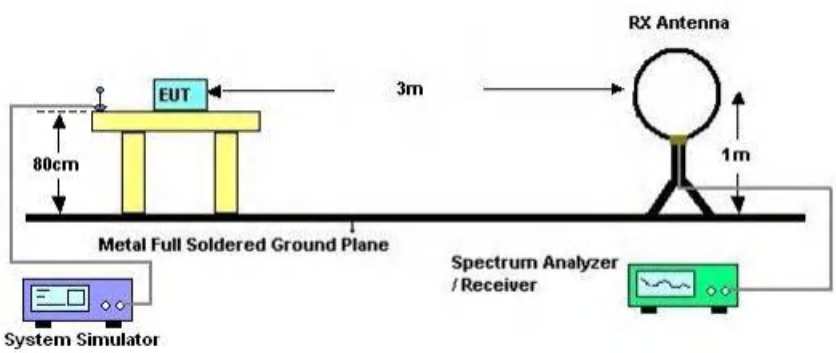
3.6.4. Test Result of Conducted Spurious Emission

Please refer to the Appendix A.

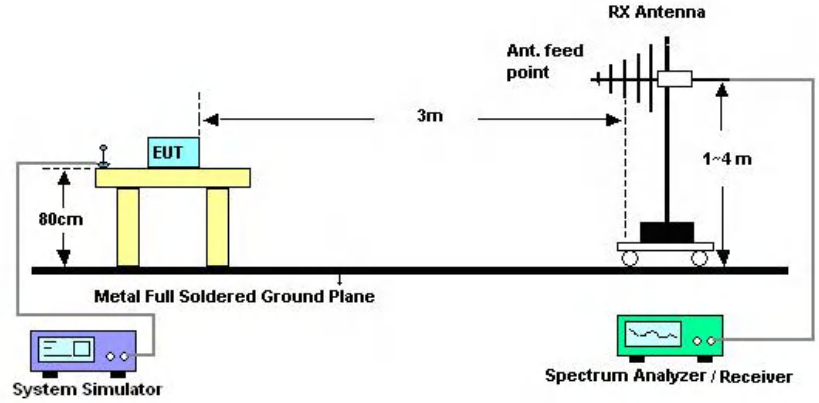
3.7. Radiated Spurious Emission

3.7.1. Test Setup

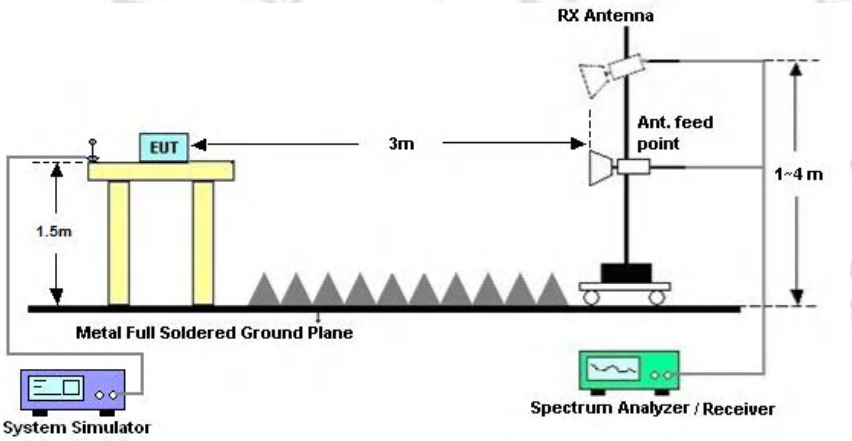
3.7.1.1. For radiated test below 30MHz



3.7.1.2. For radiated test from 30MHz to 1GHz



3.7.1.3. For radiated test above 1GHz



3.7.2. Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI C63.26.

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

For Band 7, 38, 41:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 55 + 10 log (P) dB.

For LTE Band 13:

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559- 1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.7.3. Test Procedures

1. The testing follows ANSI C63.26 Section 5.5
2. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
6. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
7. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
8. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
9. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
10. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
11. ERP (dBm) = EIRP - 2.15
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.7.4. Test Result of Radiated Spurious Emission

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

The frequency which above 30 MHz, please refer to the Appendix B.

4. TEST SETUP PHOTOGRAPHS

Please refer to the Appendix C.

※※※※※END OF THE REPORT※※※※※

Appendix A _ Conducted Test Data

LTE Band 7

01 Conducted output power

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Power (dBm)	Gain (dBm)	ERP (dBm)	ERP Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)	Verdict
Band7	5	20775	1	#0	QAM16	19.71	4	21.56	37	23.71	37	PASS
Band7	5	21100	1	#0	QAM16	19.27	4	21.12	37	23.27	37	PASS
Band7	5	21425	1	#0	QAM16	19.50	4	21.35	37	23.50	37	PASS
Band7	5	20775	1	#0	QPSK	20.74	4	22.59	37	24.74	37	PASS
Band7	5	21100	1	#0	QPSK	20.70	4	22.55	37	24.70	37	PASS
Band7	5	21425	1	#0	QPSK	20.93	4	22.78	37	24.93	37	PASS
Band7	10	20800	1	#0	QPSK	20.76	4	22.61	37	24.76	37	PASS
Band7	10	21100	1	#0	QPSK	20.68	4	22.53	37	24.68	37	PASS
Band7	10	21400	1	#0	QPSK	21.57	4	23.42	37	25.57	37	PASS
Band7	15	20825	1	#0	QPSK	20.91	4	22.76	37	24.91	37	PASS
Band7	15	21100	1	#0	QPSK	20.81	4	22.66	37	24.81	37	PASS
Band7	15	21375	1	#0	QPSK	20.97	4	22.82	37	24.97	37	PASS
Band7	20	20850	1	#0	QPSK	20.52	4	22.37	37	24.52	37	PASS
Band7	20	21100	1	#0	QPSK	20.67	4	22.52	37	24.67	37	PASS
Band7	20	21350	1	#0	QPSK	21.04	4	22.89	37	25.04	37	PASS

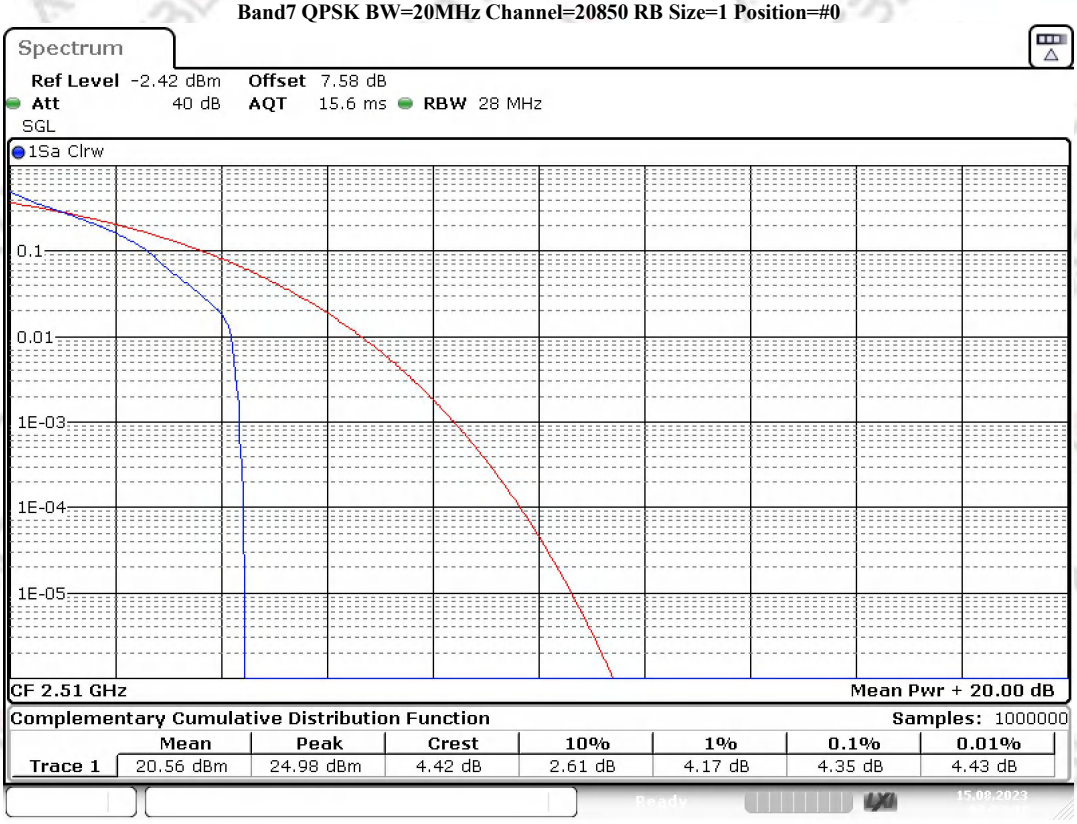
02 Frequency stability

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Result(Hz)	Result (ppm)	Low Limit (ppm)	high Limit (ppm)	Verdict
Band7	5	20775	25	#0	QAM16	3.11	0.001	-2.5	2.5	PASS
Band7	5	21100	25	#0	QAM16	-1.49	-0.001	-2.5	2.5	PASS
Band7	5	21425	25	#0	QAM16	1.38	0.001	-2.5	2.5	PASS
Band7	5	20775	25	#0	QPSK	1.82	0.001	-2.5	2.5	PASS
Band7	5	21100	25	#0	QPSK	-1.50	-0.001	-2.5	2.5	PASS
Band7	5	21425	25	#0	QPSK	1.48	0.001	-2.5	2.5	PASS
Band7	10	20800	50	#0	QPSK	-4.14	-0.002	-2.5	2.5	PASS
Band7	10	21100	50	#0	QPSK	-1.58	-0.001	-2.5	2.5	PASS
Band7	10	21400	50	#0	QPSK	-3.00	-0.001	-2.5	2.5	PASS
Band7	15	20825	75	#0	QPSK	0.61	0.000	-2.5	2.5	PASS
Band7	15	21100	75	#0	QPSK	-2.03	-0.001	-2.5	2.5	PASS
Band7	15	21375	75	#0	QPSK	3.06	0.001	-2.5	2.5	PASS
Band7	20	20850	100	#0	QPSK	1.18	0.000	-2.5	2.5	PASS
Band7	20	21100	100	#0	QPSK	-1.43	-0.001	-2.5	2.5	PASS
Band7	20	21350	100	#0	QPSK	1.17	0.000	-2.5	2.5	PASS

03 Peak-to-Average Ratio

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Result (dB)	high Limit (dB)	Verdict
Band7	20	20850	1	#0	QPSK	4.35	13	PASS
Band7	20	20850	100	#0	QPSK	4.99	13	PASS
Band7	20	21100	1	#0	QPSK	4.46	13	PASS
Band7	20	21100	100	#0	QPSK	4.41	13	PASS
Band7	20	21350	1	#0	QPSK	4.00	13	PASS
Band7	20	21350	100	#0	QPSK	4.55	13	PASS

Band7 QPSK BW=20MHz Channel=20850 RB Size=1 Position=#0



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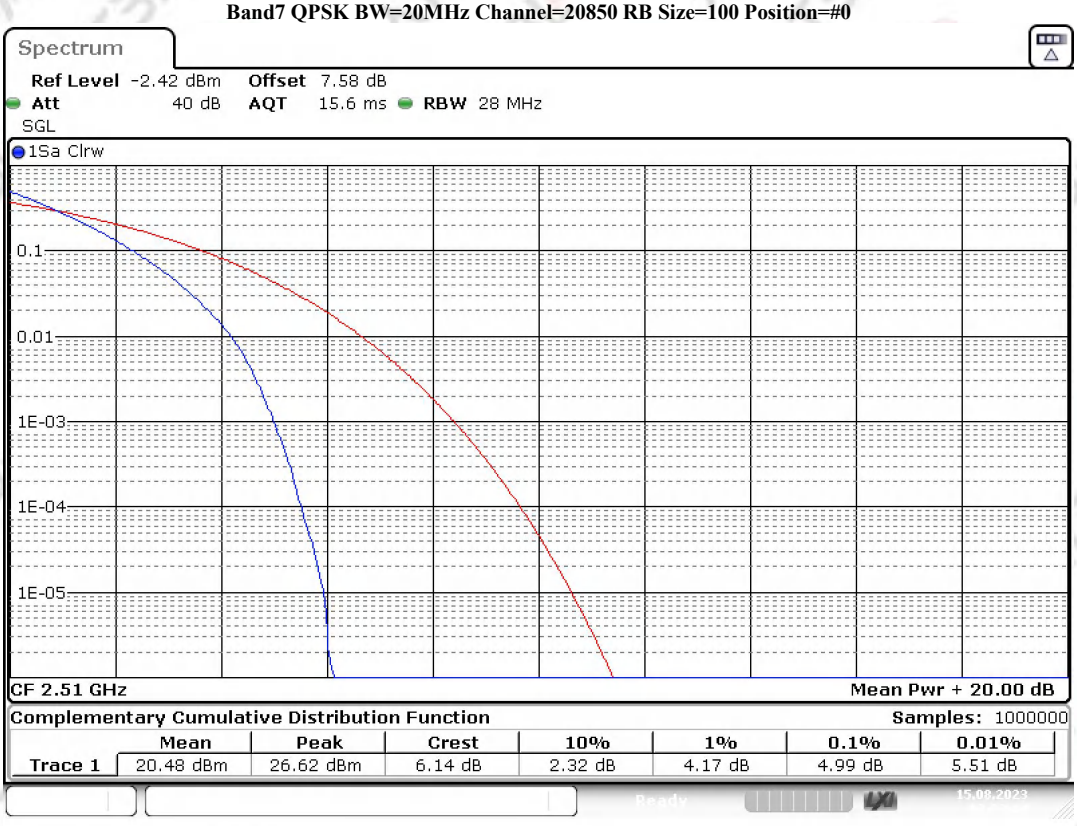
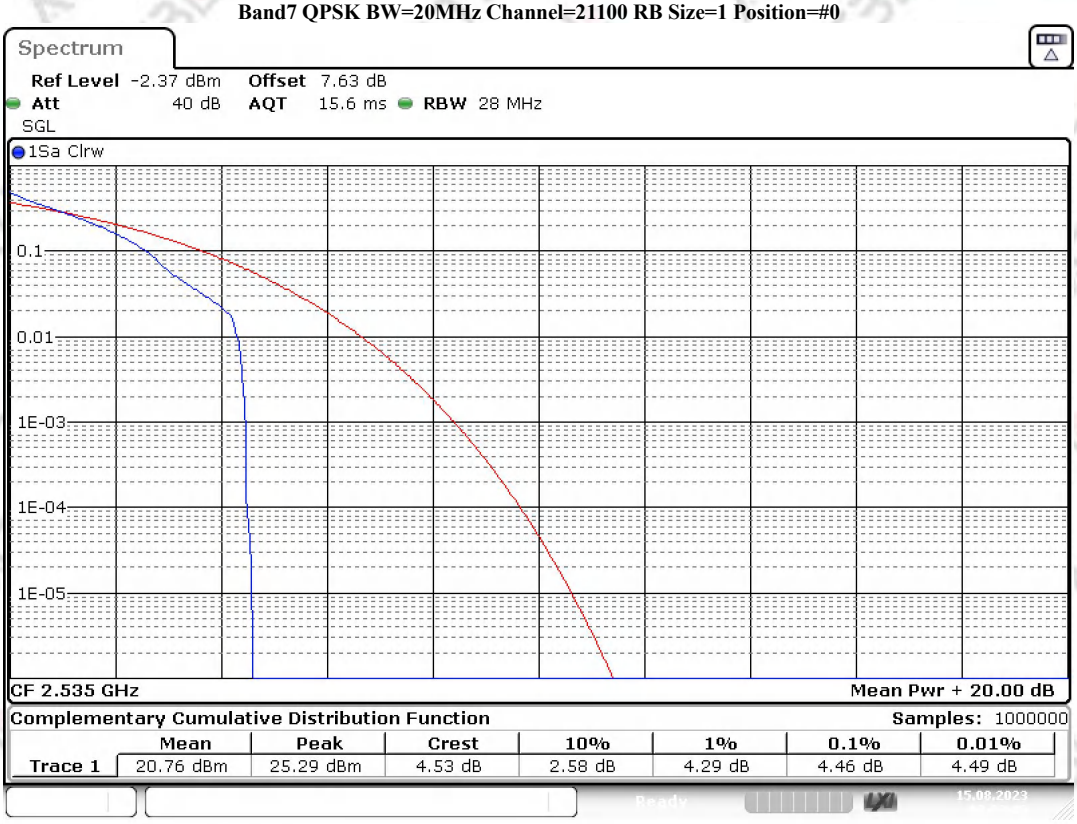
Band7 QPSK BW=20MHz Channel=20850 RB Size=100 Position=#0



Date: 15.AUG.2023 02:59:44

Band7 QPSK BW=20MHz Channel=21100 RB Size=1 Position=#0



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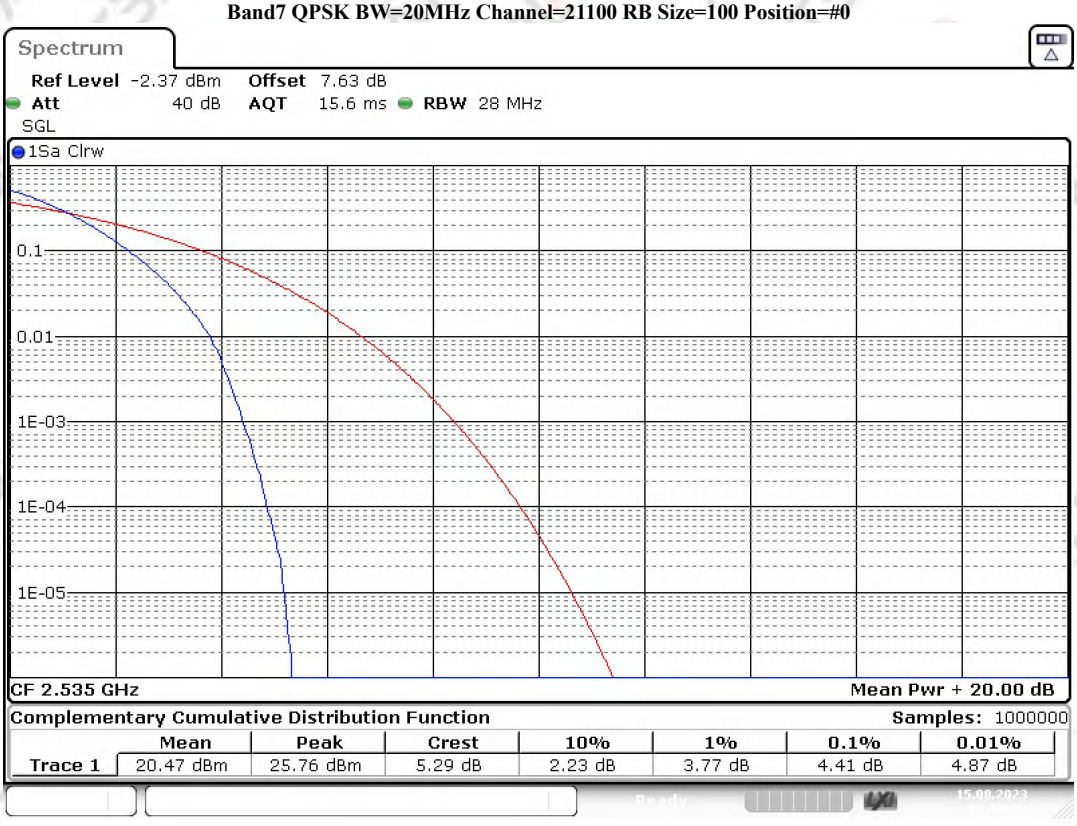
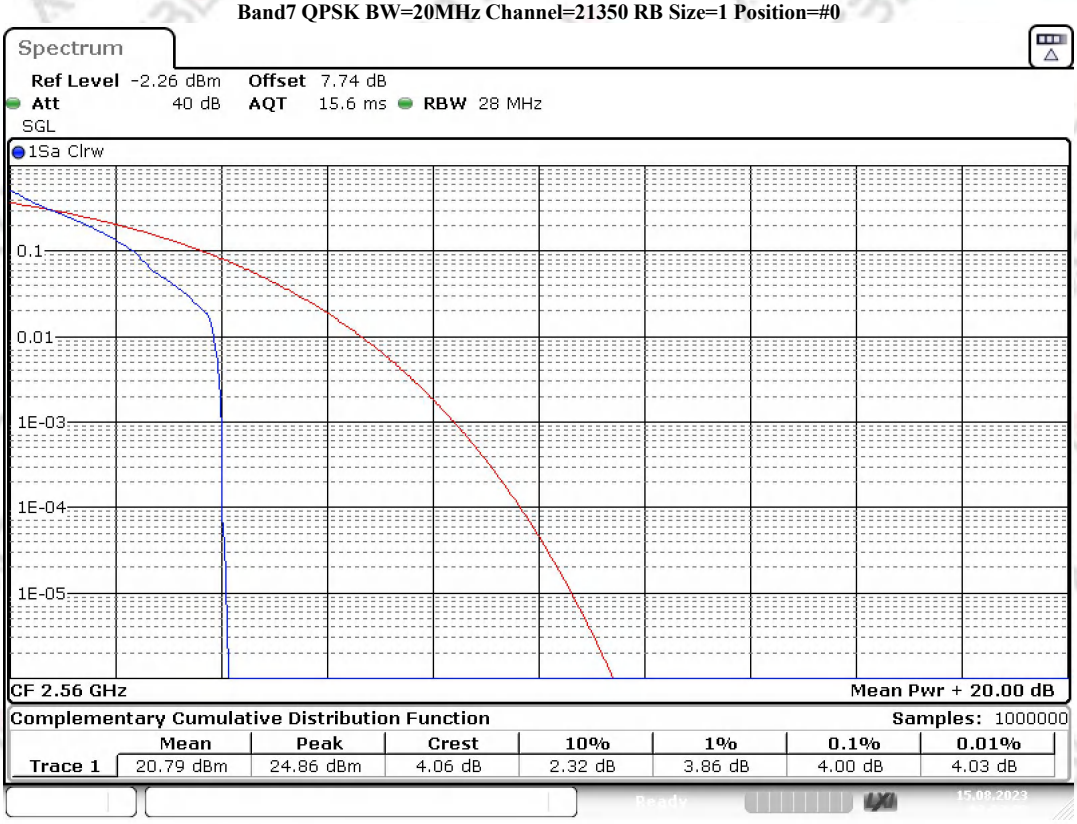
Band7 QPSK BW=20MHz Channel=21100 RB Size=100 Position=#0



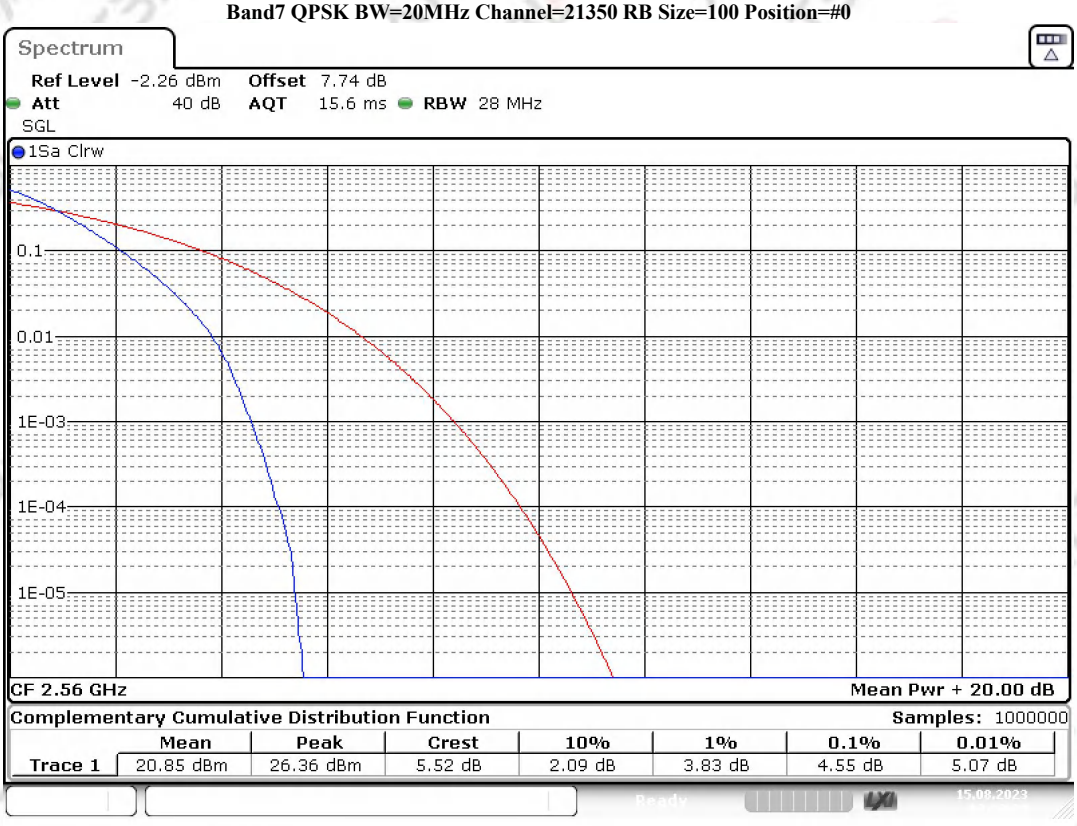
Date: 15.AUG.2023 02:59:52

Band7 QPSK BW=20MHz Channel=21350 RB Size=1 Position=#0



Date: 15.AUG.2023 02:59:57

Band7 QPSK BW=20MHz Channel=21350 RB Size=100 Position=#0



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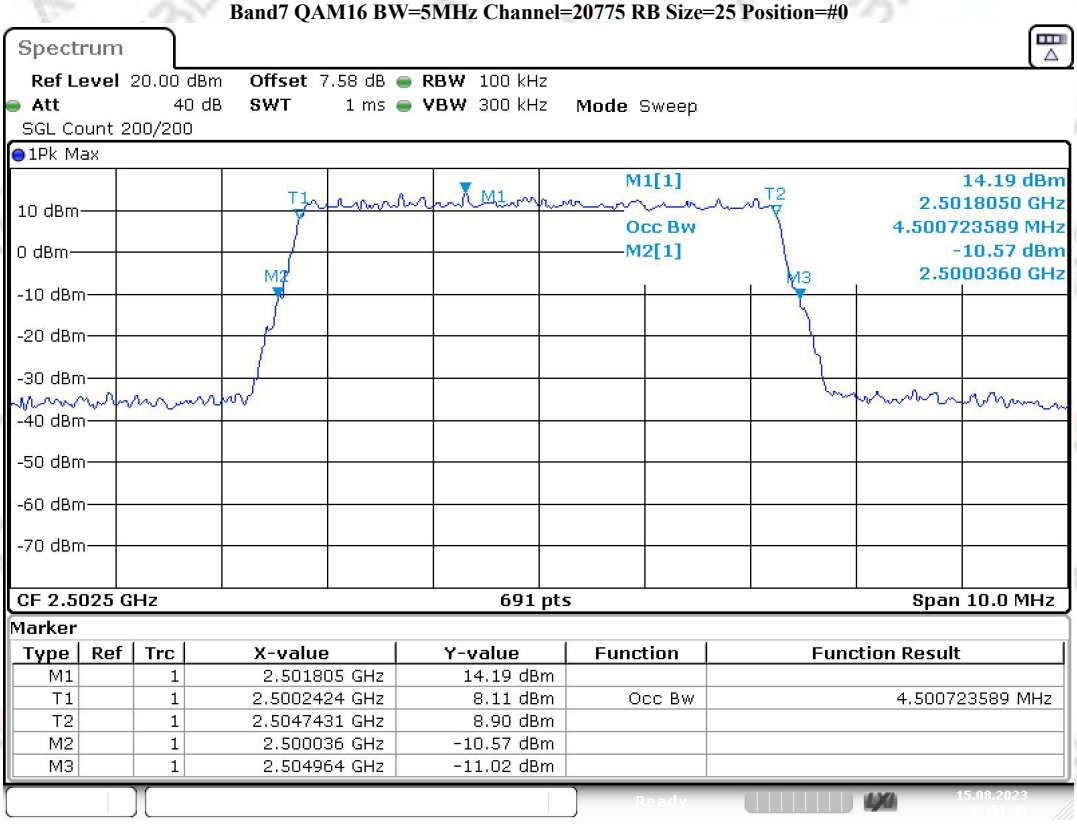
04 Occupied bandwidth

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	99% OBW (MHz)	-26dB EBW (MHz)	Verdict
Band7	5	20775	25	#0	QAM16	4.501	4.928	PASS
Band7	5	21100	25	#0	QAM16	4.515	5.000	PASS
Band7	5	21425	25	#0	QAM16	4.515	4.942	PASS
Band7	10	20800	50	#0	QPSK	8.973	9.739	PASS
Band7	10	21100	50	#0	QPSK	8.973	9.710	PASS
Band7	10	21400	50	#0	QPSK	8.973	9.768	PASS
Band7	15	20825	75	#0	QPSK	13.459	14.609	PASS
Band7	15	21100	75	#0	QPSK	13.415	14.522	PASS
Band7	15	21375	75	#0	QPSK	13.415	14.435	PASS
Band7	20	20850	100	#0	QPSK	18.003	19.478	PASS
Band7	20	21100	100	#0	QPSK	17.945	19.420	PASS
Band7	20	21350	100	#0	QPSK	18.003	19.536	PASS
Band7	5	20775	25	#0	QPSK	4.501	4.942	PASS
Band7	5	21100	25	#0	QPSK	4.515	4.986	PASS
Band7	5	21425	25	#0	QPSK	4.486	4.971	PASS

Band7 QAM16 BW=5MHz Channel=20775 RB Size=25 Position=#0



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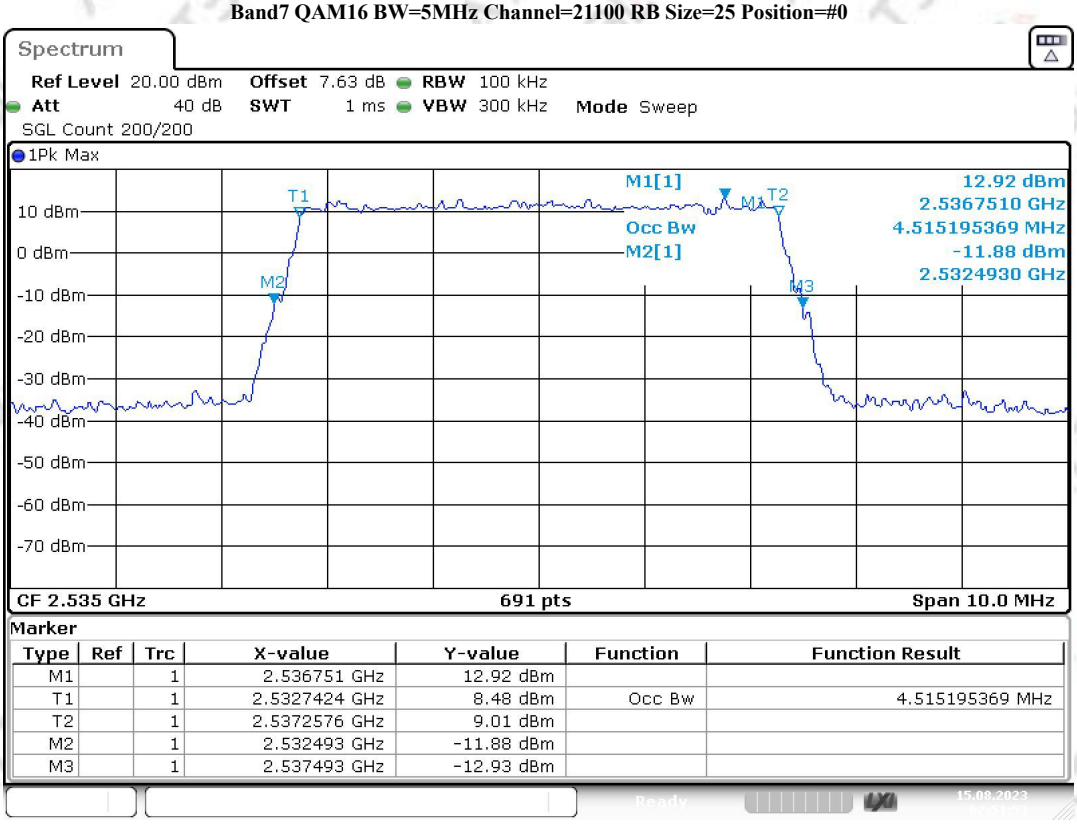
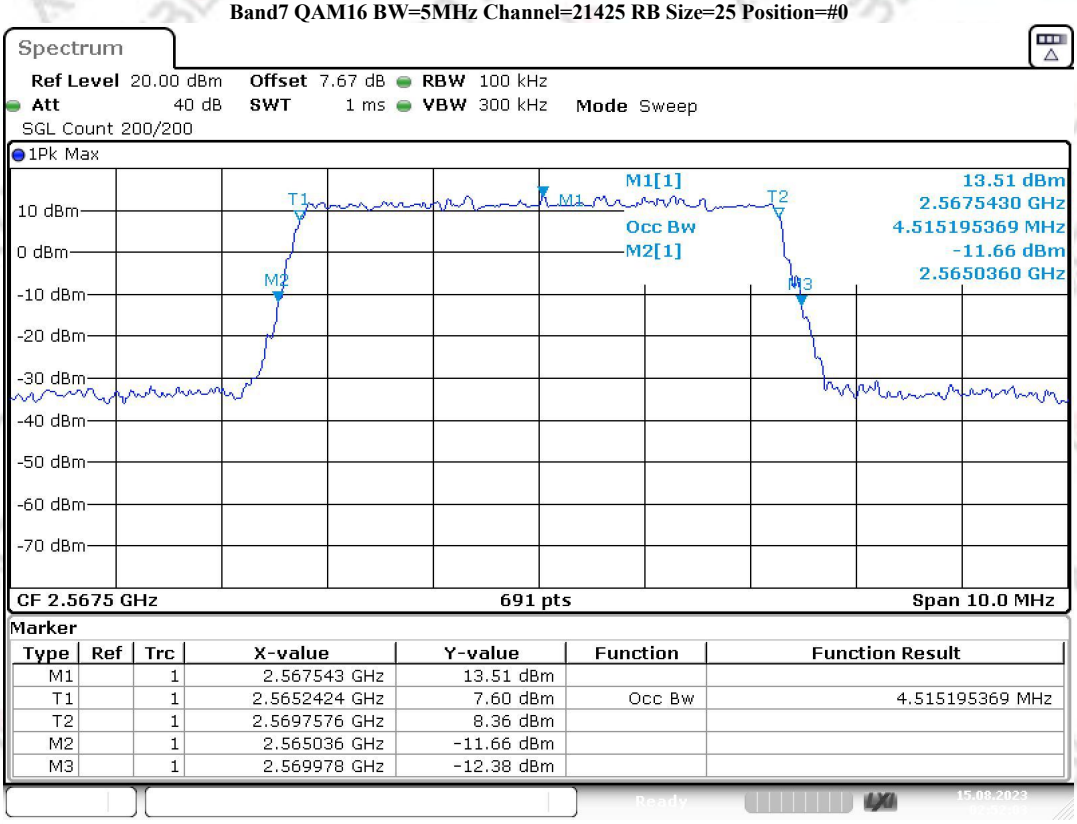
Band7 QAM16 BW=5MHz Channel=21100 RB Size=25 Position=#0



Date: 15.AUG.2023 02:51:53

Band7 QAM16 BW=5MHz Channel=21425 RB Size=25 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.567543 GHz	13.51 dBm		
T1		1	2.5652424 GHz	7.60 dBm	Occ Bw	4.515195369 MHz
T2		1	2.5697576 GHz	8.36 dBm		
M2		1	2.565036 GHz	-11.66 dBm		
M3		1	2.569978 GHz	-12.38 dBm		

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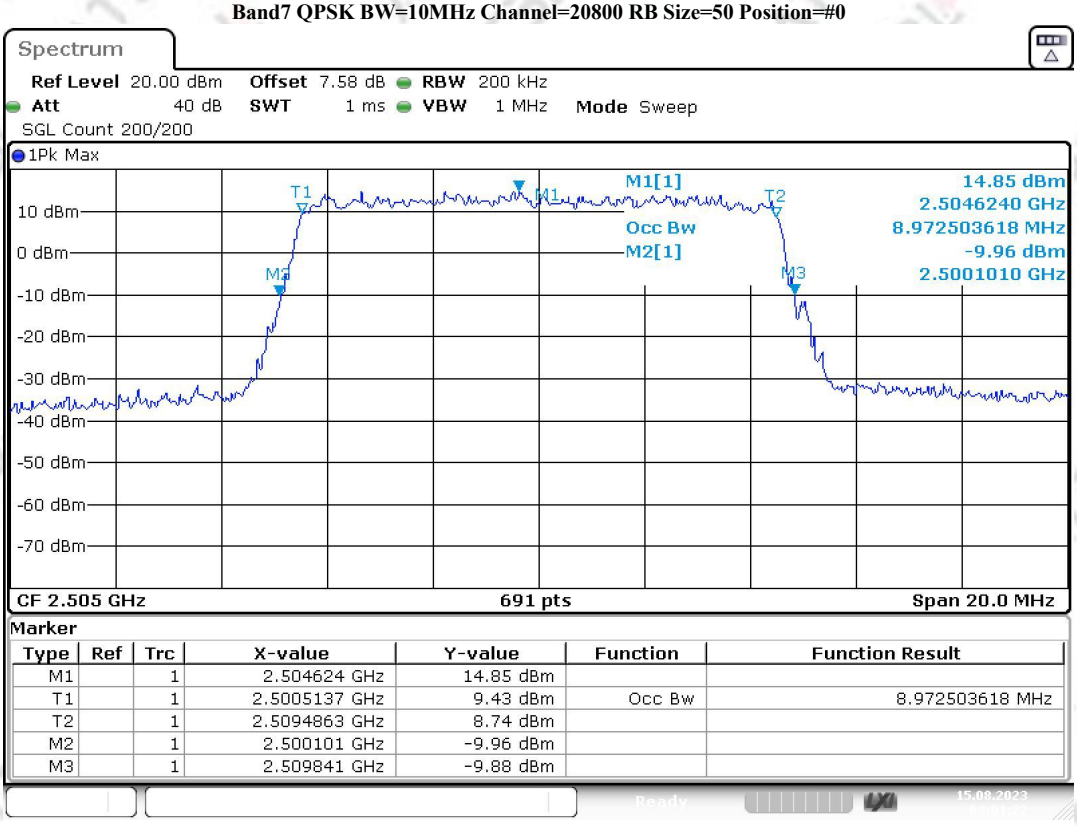
Band7 QPSK BW=10MHz Channel=20800 RB Size=50 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.504624 GHz	14.85 dBm		
T1		1	2.5005137 GHz	9.43 dBm	Occ Bw	8.972503618 MHz
T2		1	2.5094863 GHz	8.74 dBm		
M2		1	2.500101 GHz	-9.96 dBm		
M3		1	2.509841 GHz	-9.88 dBm		

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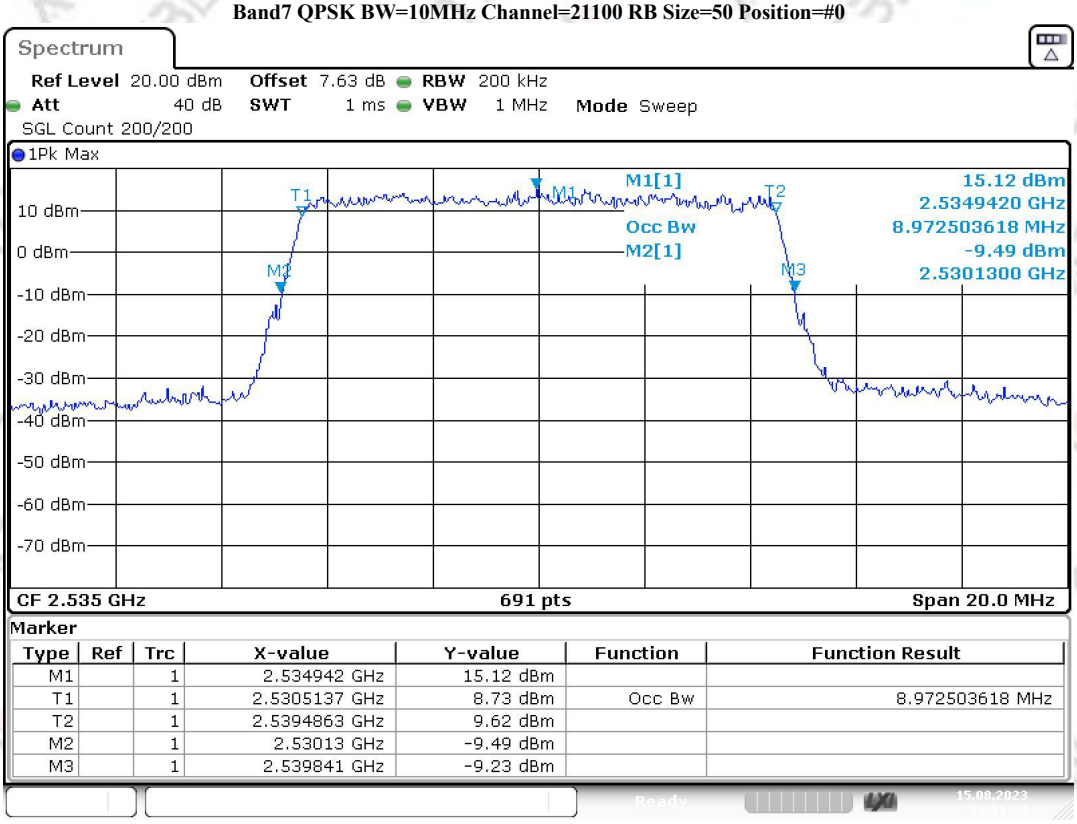
Band7 QPSK BW=10MHz Channel=21100 RB Size=50 Position=#0

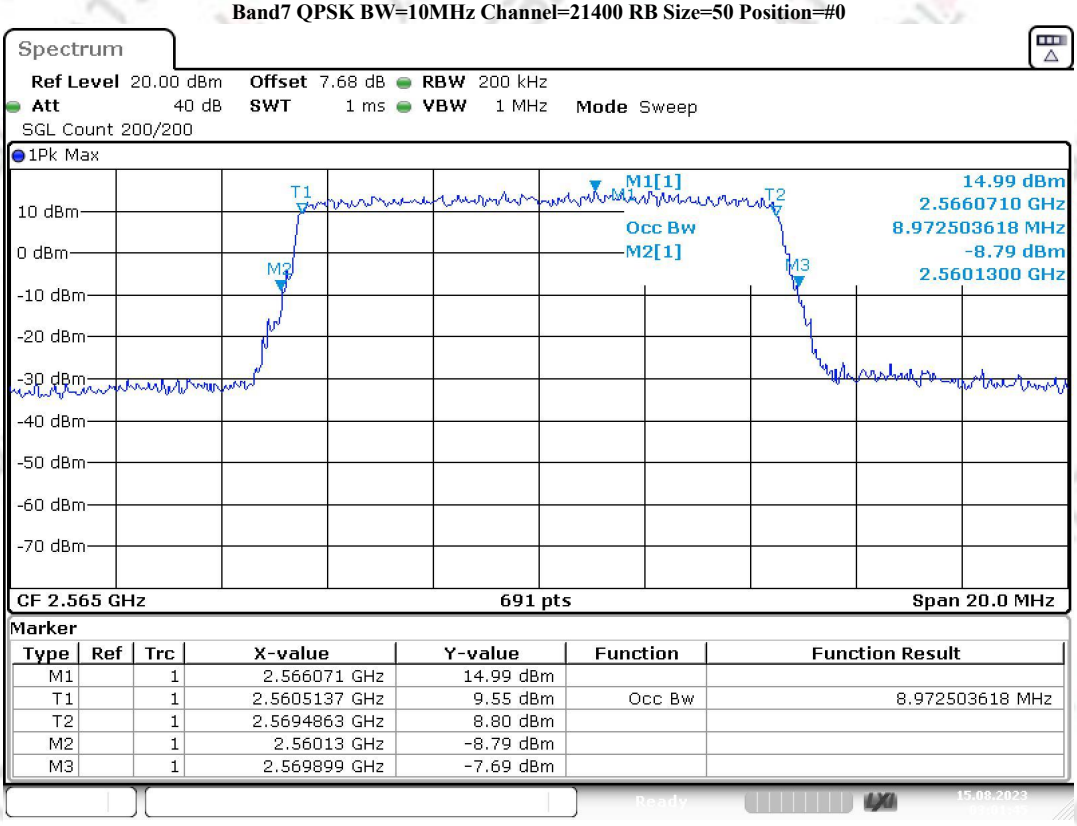


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.534942 GHz	15.12 dBm		
T1		1	2.5305137 GHz	8.73 dBm	Occ Bw	8.972503618 MHz
T2		1	2.5394863 GHz	9.62 dBm		
M2		1	2.53013 GHz	-9.49 dBm		
M3		1	2.539841 GHz	-9.23 dBm		

Date: 15.AUG.2023 03:01:33

Band7 QPSK BW=10MHz Channel=21400 RB Size=50 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.566071 GHz	14.99 dBm		
T1		1	2.5605137 GHz	9.55 dBm	Occ Bw	8.972503618 MHz
T2		1	2.5694863 GHz	8.80 dBm		
M2		1	2.56013 GHz	-8.79 dBm		
M3		1	2.569899 GHz	-7.69 dBm		

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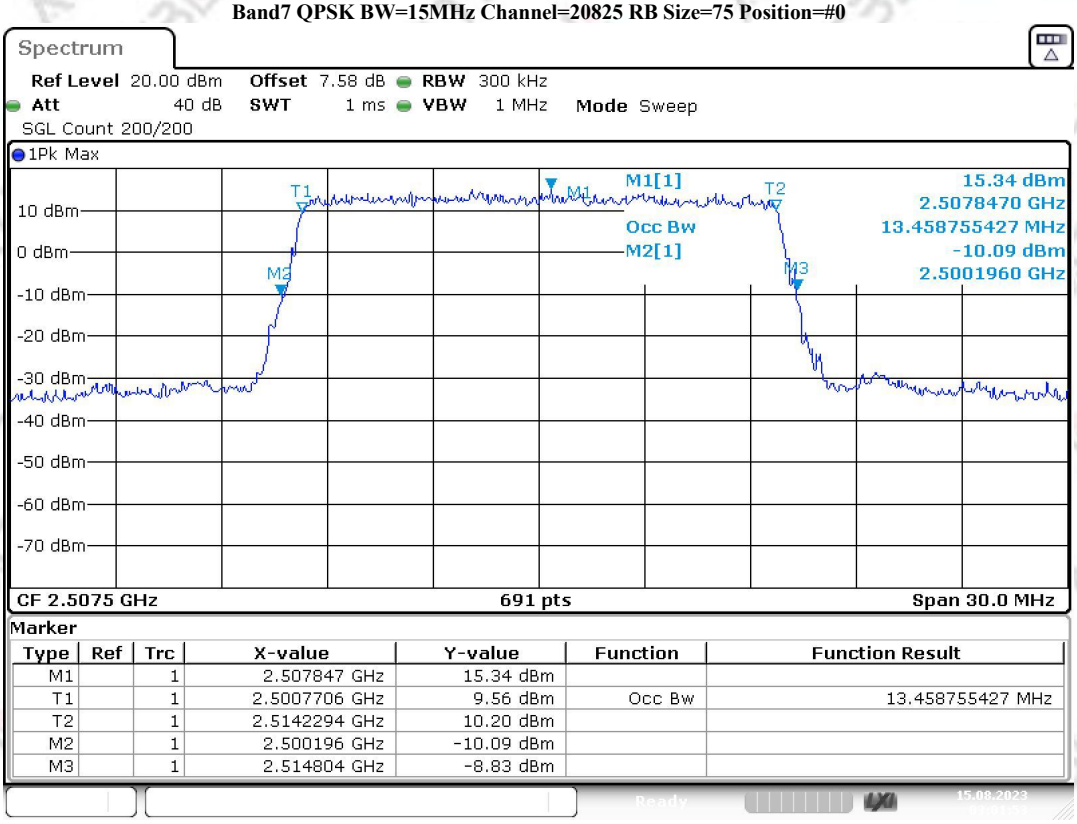
Band7 QPSK BW=15MHz Channel=20825 RB Size=75 Position=#0

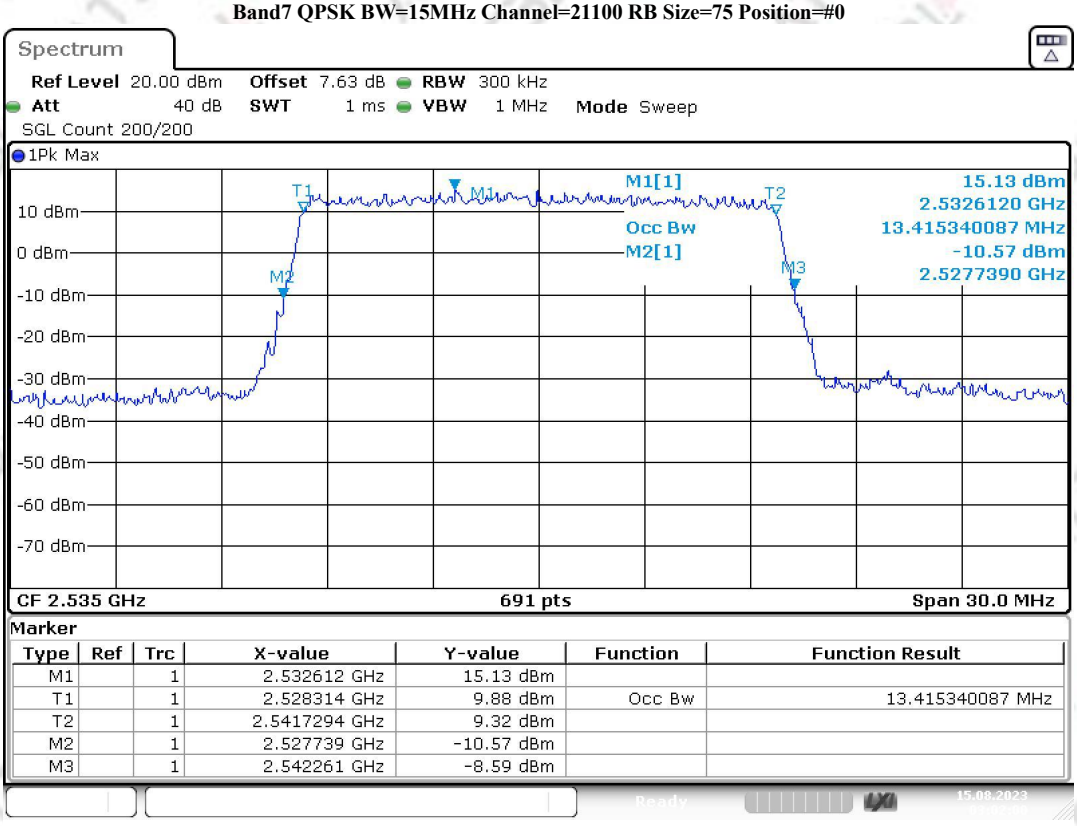


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.507847 GHz	15.34 dBm		
T1		1	2.5007706 GHz	9.56 dBm	Occ Bw	13.458755427 MHz
T2		1	2.5142294 GHz	10.20 dBm		
M2		1	2.500196 GHz	-10.09 dBm		
M3		1	2.514804 GHz	-8.83 dBm		

Date: 15.AUG.2023 03:01:53

Band7 QPSK BW=15MHz Channel=21100 RB Size=75 Position=#0

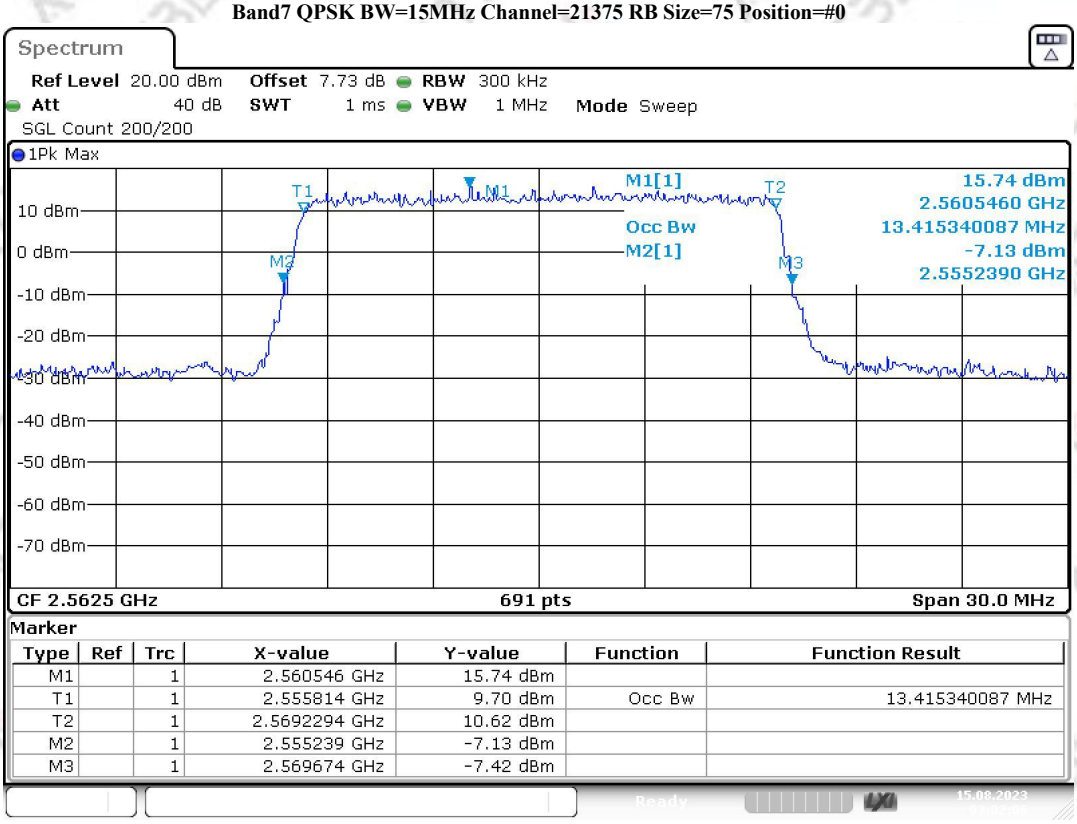


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.532612 GHz	15.13 dBm		
T1		1	2.528314 GHz	9.88 dBm	Occ Bw	13.415340087 MHz
T2		1	2.5417294 GHz	9.32 dBm		
M2		1	2.527739 GHz	-10.57 dBm		
M3		1	2.542261 GHz	-8.59 dBm		

Date: 15.AUG.2023 03:02:00

Band7 QPSK BW=15MHz Channel=21375 RB Size=75 Position=#0

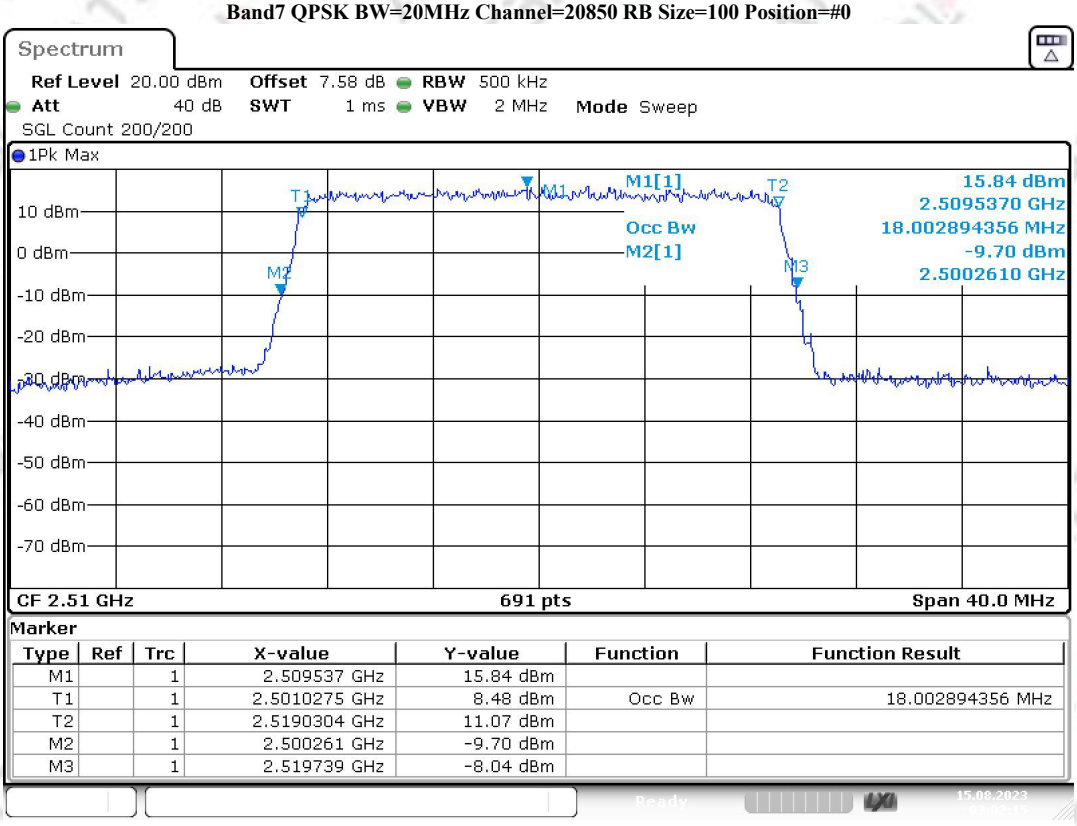


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.560546 GHz	15.74 dBm		
T1		1	2.555814 GHz	9.70 dBm	Occ Bw	13.415340087 MHz
T2		1	2.5692294 GHz	10.62 dBm		
M2		1	2.555239 GHz	-7.13 dBm		
M3		1	2.569674 GHz	-7.42 dBm		

Date: 15.AUG.2023 03:02:07

Band7 QPSK BW=20MHz Channel=20850 RB Size=100 Position=#0

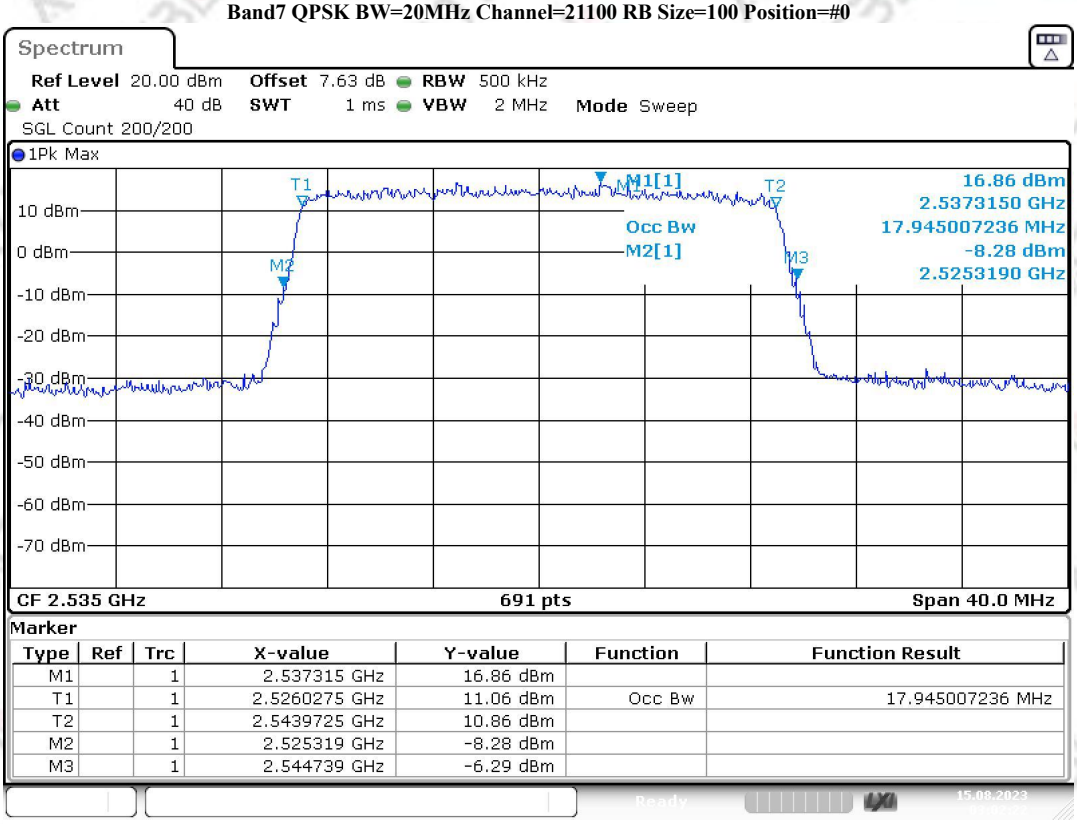


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.509537 GHz	15.84 dBm		
T1		1	2.5010275 GHz	8.48 dBm	Occ Bw	18.002894356 MHz
T2		1	2.5190304 GHz	11.07 dBm		
M2		1	2.500261 GHz	-9.70 dBm		
M3		1	2.519739 GHz	-8.04 dBm		

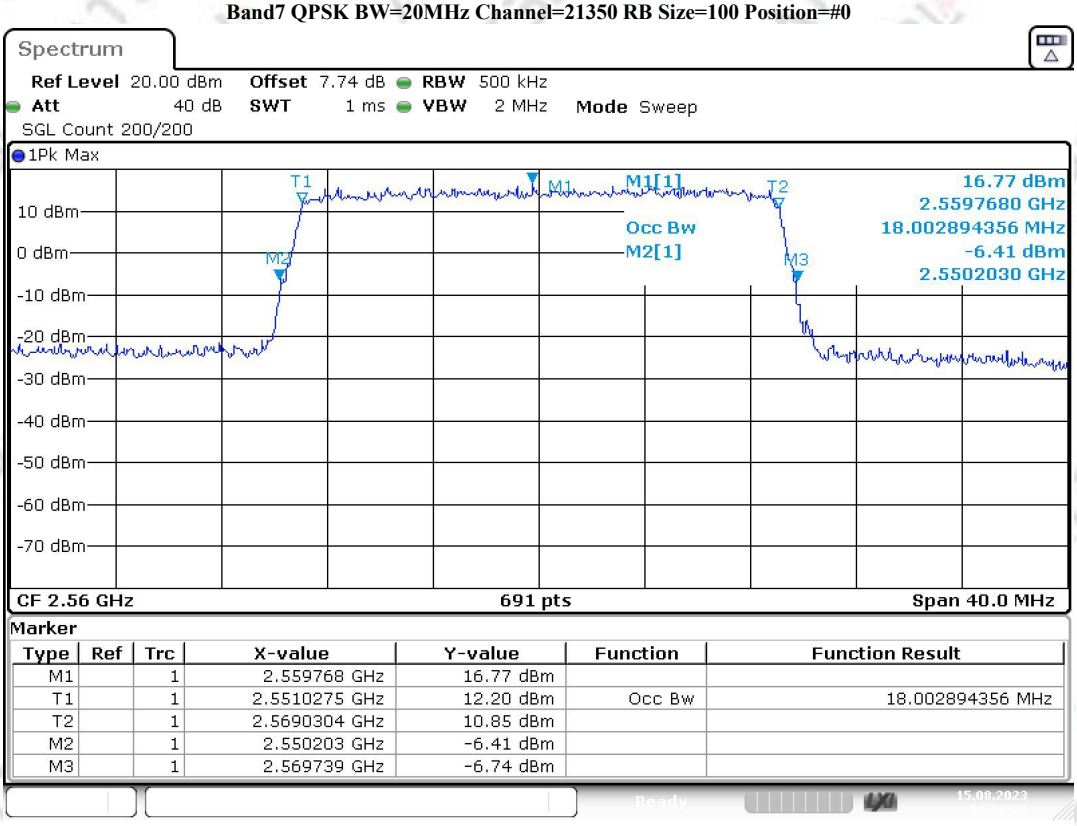
Date: 15.AUG.2023 03:02:15

Band7 QPSK BW=20MHz Channel=21100 RB Size=100 Position=#0



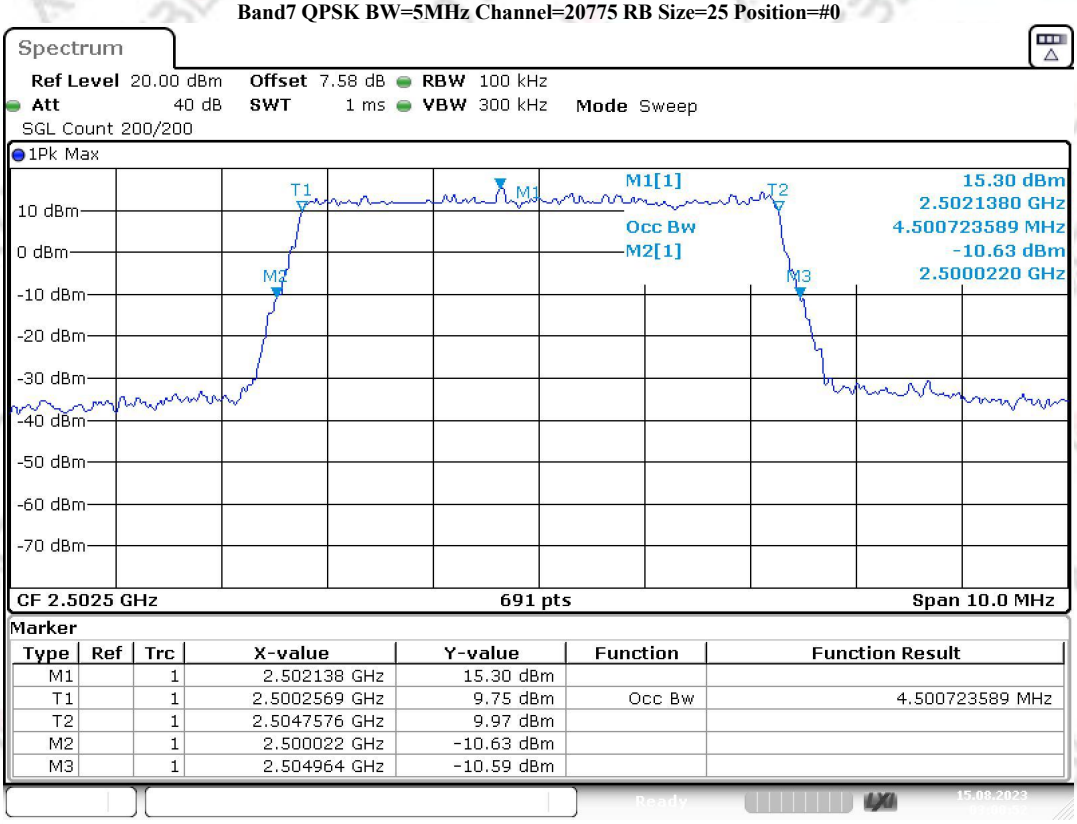
Date: 15.AUG.2023 03:02:22

Band7 QPSK BW=20MHz Channel=21350 RB Size=100 Position=#0



Date: 15.AUG.2023 03:02:28

Band7 QPSK BW=5MHz Channel=20775 RB Size=25 Position=#0

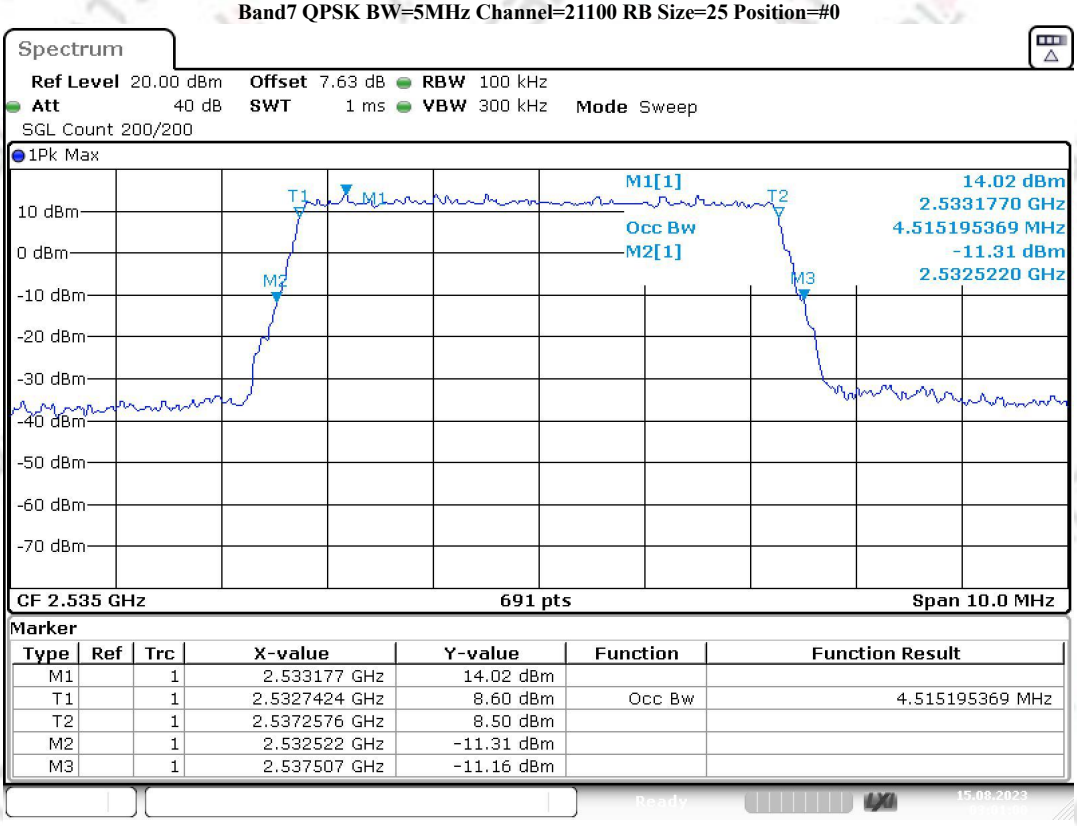


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.502138 GHz	15.30 dBm		
T1		1	2.5002569 GHz	9.75 dBm	Occ Bw	4.500723589 MHz
T2		1	2.5047576 GHz	9.97 dBm		
M2		1	2.500022 GHz	-10.63 dBm		
M3		1	2.504964 GHz	-10.59 dBm		

Date: 15.AUG.2023 03:00:51

Band7 QPSK BW=5MHz Channel=21100 RB Size=25 Position=#0

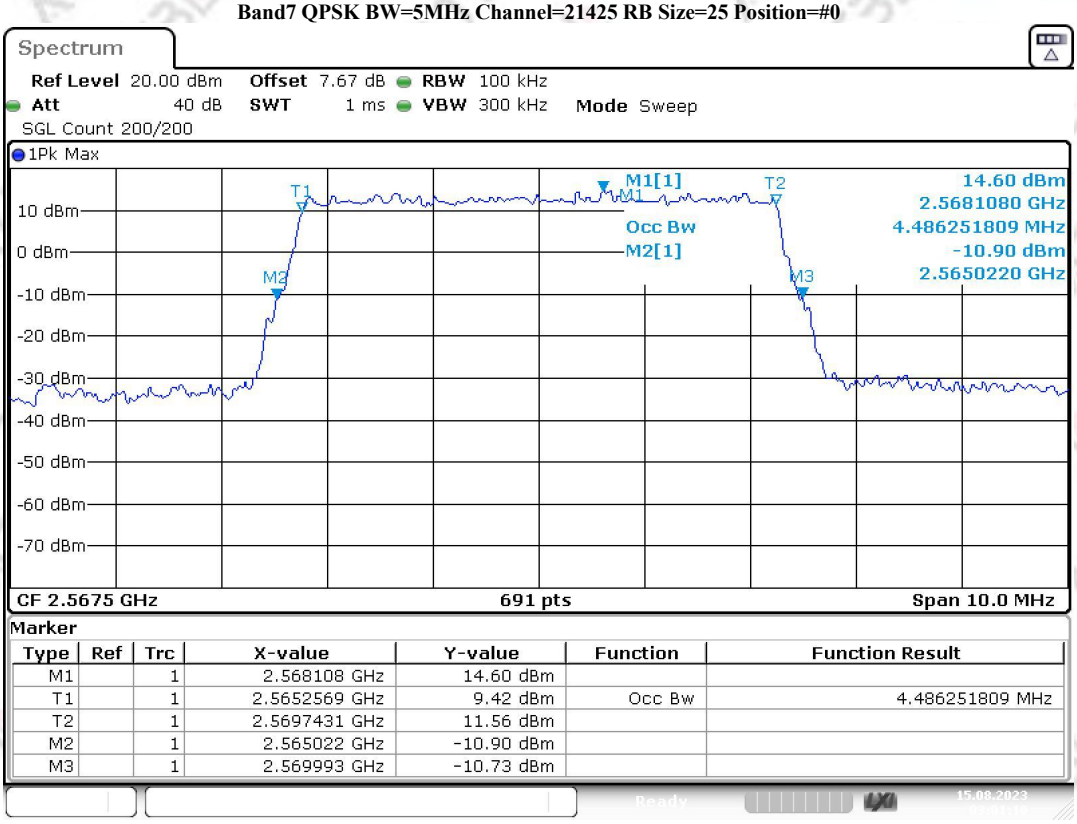


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.533177 GHz	14.02 dBm		
T1		1	2.5327424 GHz	8.60 dBm	Occ Bw	4.515195369 MHz
T2		1	2.5372576 GHz	8.50 dBm		
M2		1	2.532522 GHz	-11.31 dBm		
M3		1	2.537507 GHz	-11.16 dBm		

Date: 15.AUG.2023 03:01:00

Band7 QPSK BW=5MHz Channel=21425 RB Size=25 Position=#0

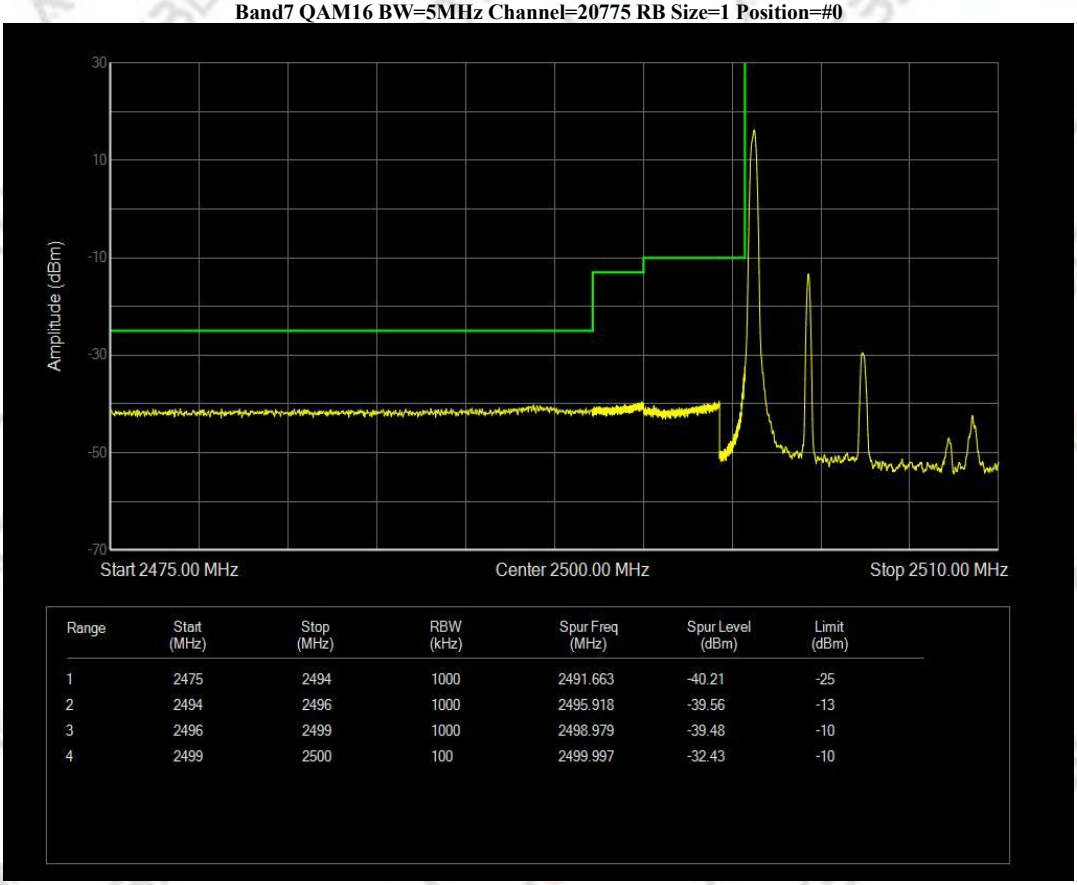


Date: 15.AUG.2023 03:01:10

05 Band edge

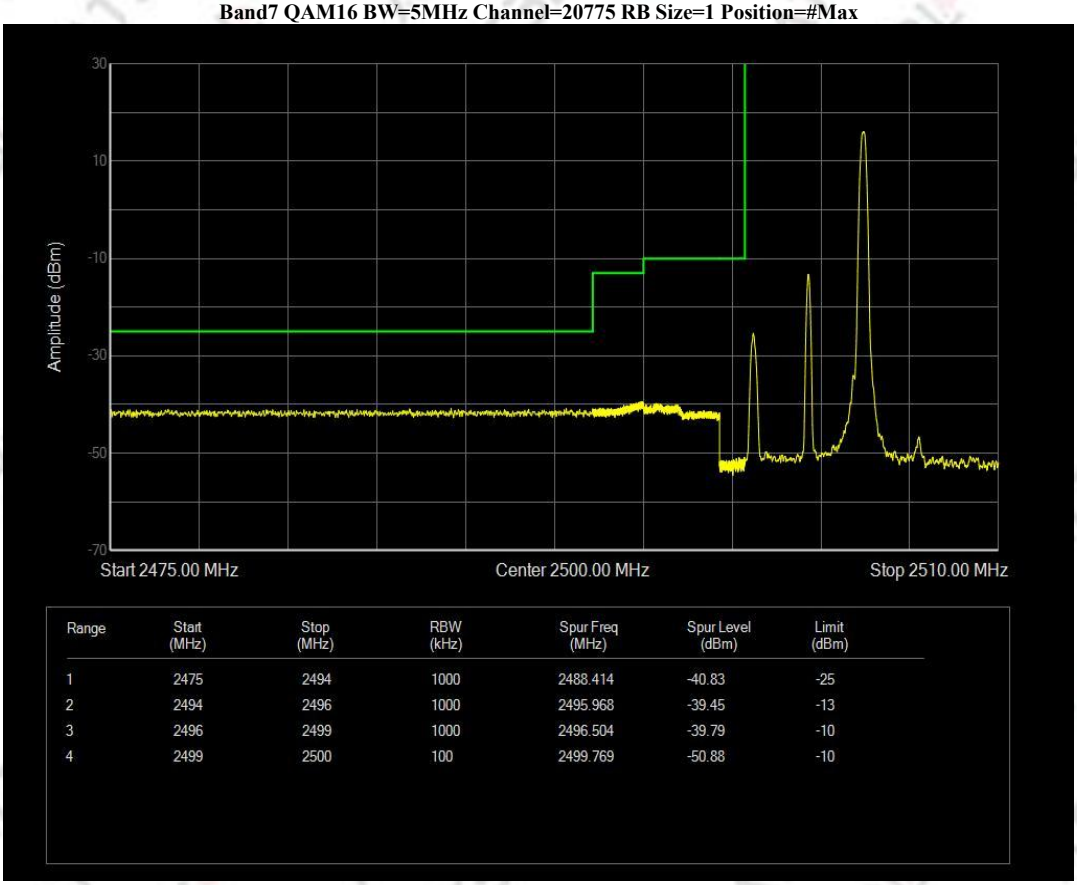
Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)	Verdict
Band7	5	20775	1	#0	QAM16	2491.66	-40.21	-25	PASS
Band7	5	20775	1	#Max	QAM16	2488.41	-40.83	-25	PASS
Band7	5	20775	25	#0	QAM16	2494.00	-39.53	-25	PASS
Band7	5	21425	1	#0	QAM16	2592.28	-40.44	-25	PASS
Band7	5	21425	1	#Max	QAM16	2578.53	-39.22	-25	PASS
Band7	5	21425	25	#0	QAM16	2571.03	-20.56	-10	PASS
Band7	10	20800	1	#0	QPSK	2483.06	-38.10	-25	PASS
Band7	10	20800	1	#Max	QPSK	2484.03	-40.59	-25	PASS
Band7	10	20800	50	#0	QPSK	2489.10	-40.40	-25	PASS
Band7	10	21400	1	#0	QPSK	2580.09	-40.52	-25	PASS
Band7	10	21400	1	#Max	QPSK	2587.31	-39.65	-25	PASS
Band7	10	21400	50	#0	QPSK	2571.08	-20.07	-10	PASS
Band7	15	20825	1	#0	QPSK	2484.77	-40.82	-25	PASS
Band7	15	20825	1	#Max	QPSK	2476.35	-40.70	-25	PASS
Band7	15	20825	75	#0	QPSK	2495.97	-26.45	-13	PASS
Band7	15	21375	1	#0	QPSK	2593.58	-40.52	-25	PASS
Band7	15	21375	1	#Max	QPSK	2590.46	-40.38	-25	PASS
Band7	15	21375	75	#0	QPSK	2572.19	-20.94	-10	PASS
Band7	20	20850	1	#0	QPSK	2479.36	-40.80	-25	PASS
Band7	20	20850	1	#Max	QPSK	2477.46	-41.06	-25	PASS
Band7	20	20850	100	#0	QPSK	2479.45	-40.87	-25	PASS
Band7	20	21350	1	#0	QPSK	2592.84	-40.23	-25	PASS
Band7	20	21350	1	#Max	QPSK	2594.69	-40.18	-25	PASS
Band7	20	21350	100	#0	QPSK	2571.19	-21.27	-10	PASS
Band7	5	20775	1	#0	QPSK	2491.66	-40.58	-25	PASS
Band7	5	20775	1	#Max	QPSK	2475.19	-40.90	-25	PASS
Band7	5	20775	25	#0	QPSK	2493.54	-38.55	-25	PASS
Band7	5	21425	1	#0	QPSK	2584.34	-40.47	-25	PASS
Band7	5	21425	1	#Max	QPSK	2578.20	-38.22	-25	PASS
Band7	5	21425	25	#0	QPSK	2571.05	-18.11	-10	PASS

Band7 QAM16 BW=5MHz Channel=20775 RB Size=1 Position=#0



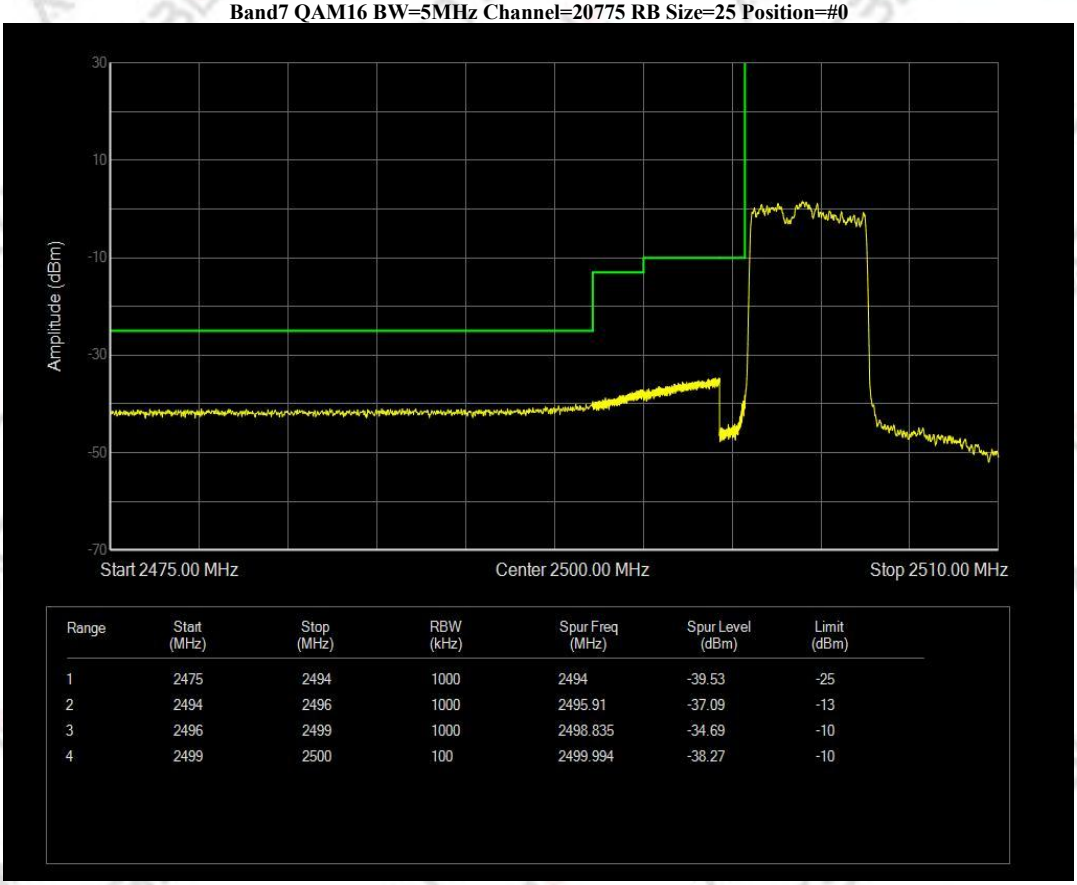
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2475	2494	1000	2491.663	-40.21	-25
2	2494	2496	1000	2495.918	-39.56	-13
3	2496	2499	1000	2498.979	-39.48	-10
4	2499	2500	100	2499.997	-32.43	-10

Band7 QAM16 BW=5MHz Channel=20775 RB Size=1 Position=#Max



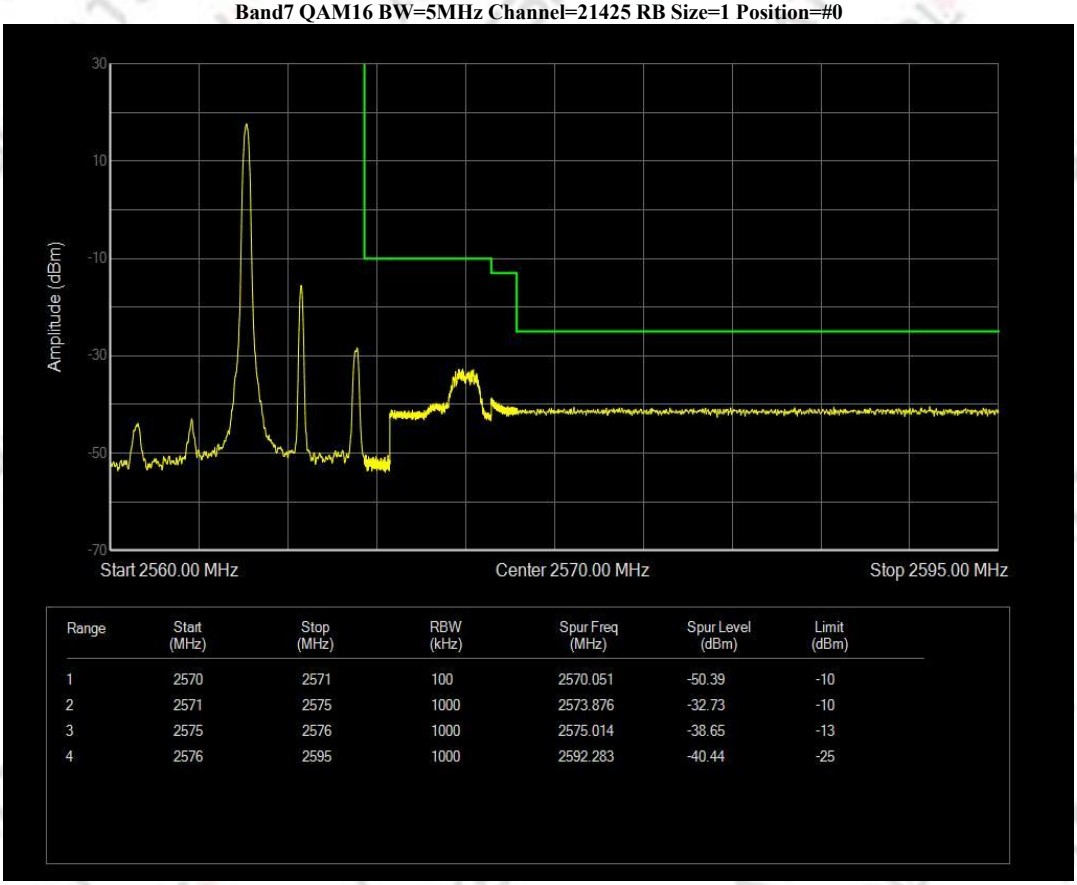
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2475	2494	1000	2488.414	-40.83	-25
2	2494	2496	1000	2495.968	-39.45	-13
3	2496	2499	1000	2496.504	-39.79	-10
4	2499	2500	100	2499.769	-50.88	-10

Band7 QAM16 BW=5MHz Channel=20775 RB Size=25 Position=#0



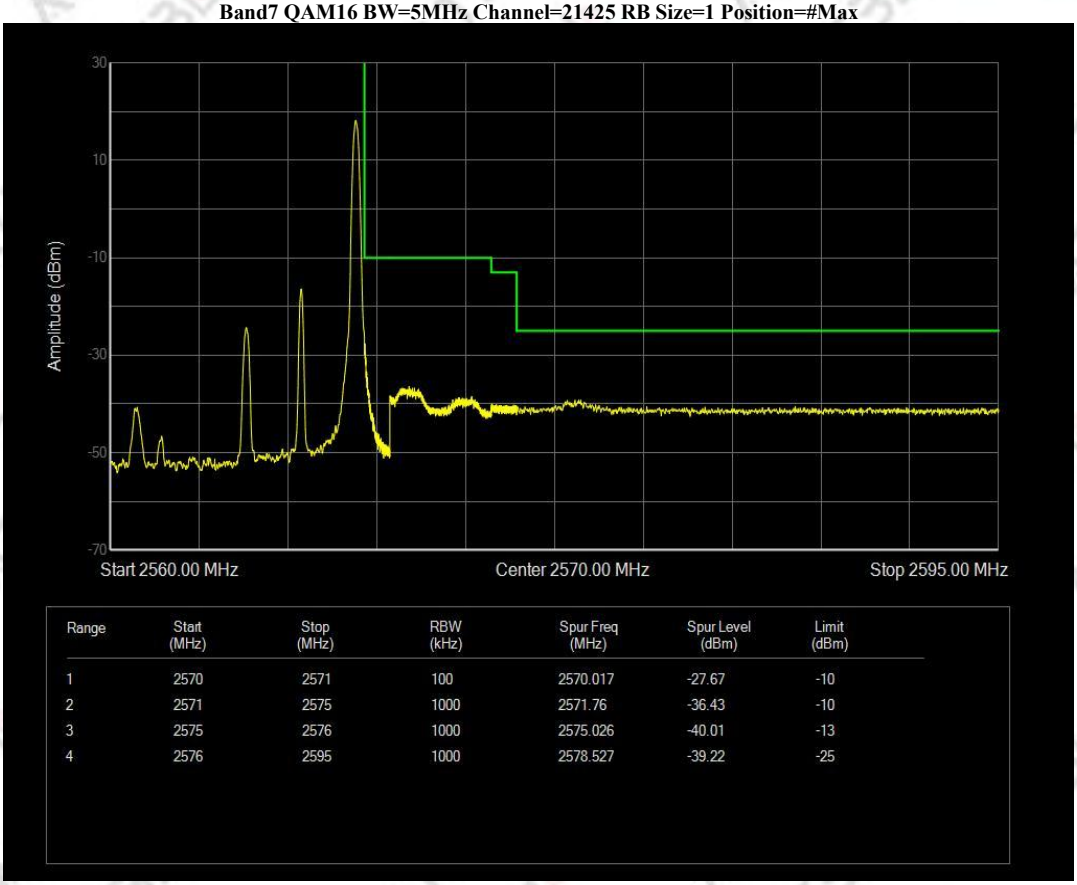
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2475	2494	1000	2494	-39.53	-25
2	2494	2496	1000	2495.91	-37.09	-13
3	2496	2499	1000	2498.835	-34.69	-10
4	2499	2500	100	2499.994	-38.27	-10

Band7 QAM16 BW=5MHz Channel=21425 RB Size=1 Position=#0



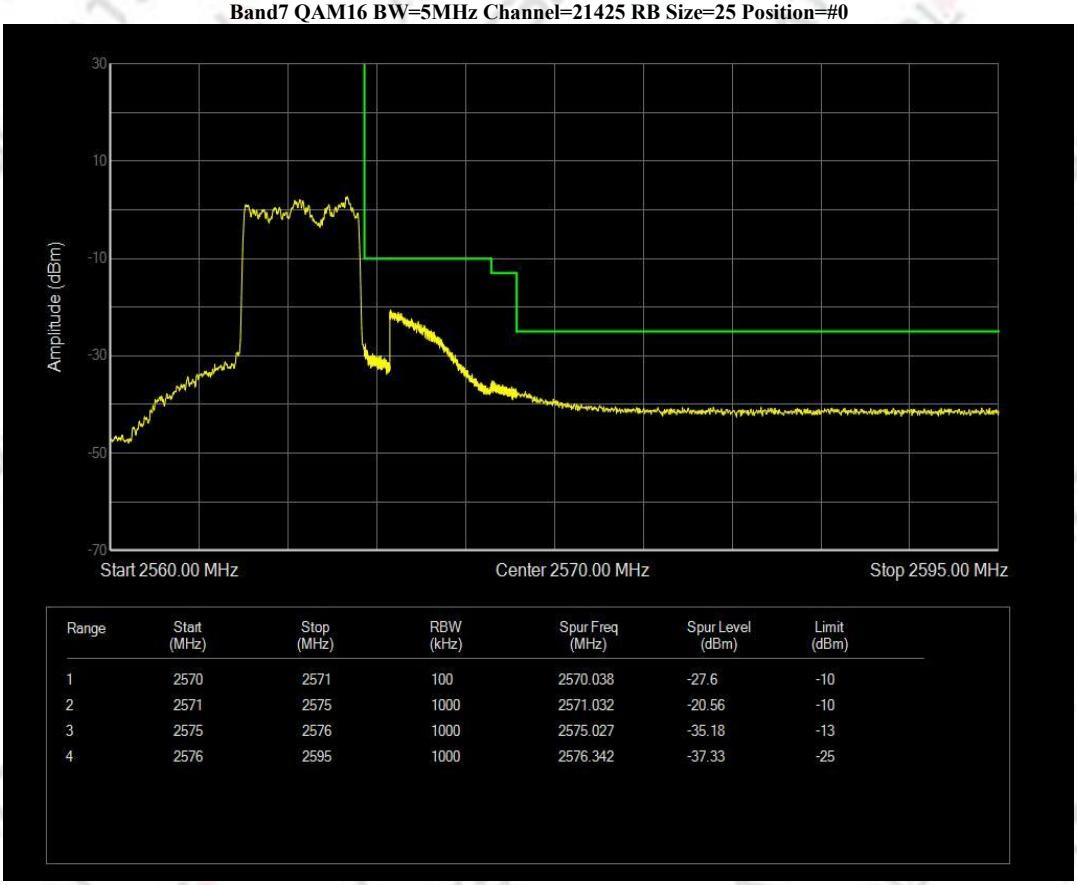
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2570	2571	100	2570.051	-50.39	-10
2	2571	2575	1000	2573.876	-32.73	-10
3	2575	2576	1000	2575.014	-38.65	-13
4	2576	2595	1000	2592.283	-40.44	-25

Band7 QAM16 BW=5MHz Channel=21425 RB Size=1 Position=#Max



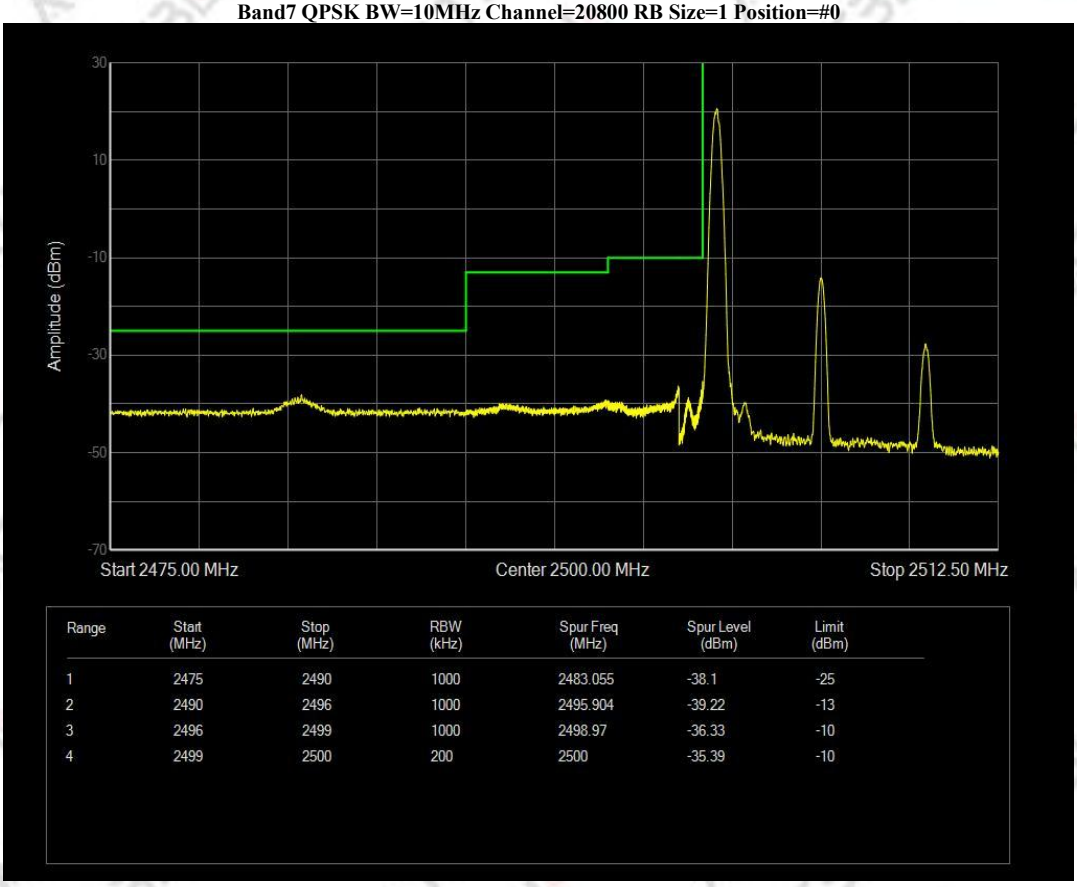
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2570	2571	100	2570.017	-27.67	-10
2	2571	2575	1000	2571.76	-36.43	-10
3	2575	2576	1000	2575.026	-40.01	-13
4	2576	2595	1000	2578.527	-39.22	-25

Band7 QAM16 BW=5MHz Channel=21425 RB Size=25 Position=#0



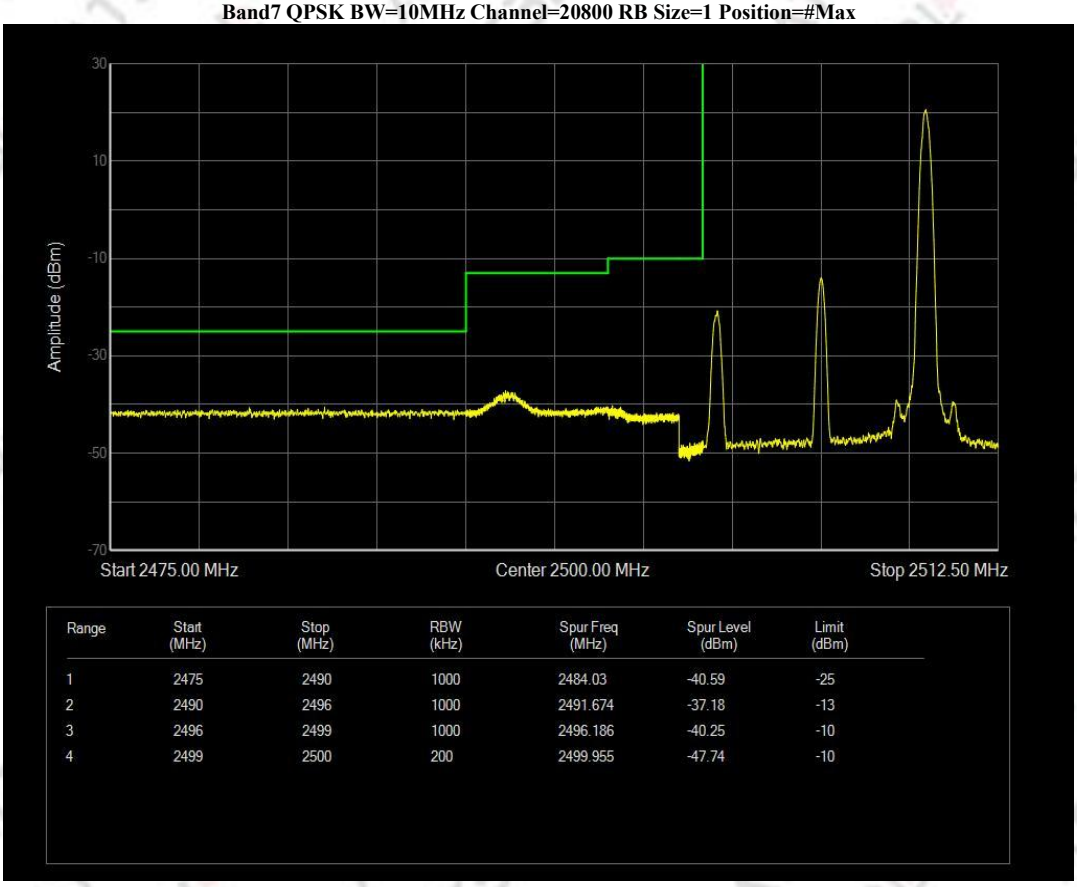
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2570	2571	100	2570.038	-27.6	-10
2	2571	2575	1000	2571.032	-20.56	-10
3	2575	2576	1000	2575.027	-35.18	-13
4	2576	2595	1000	2576.342	-37.33	-25

Band7 QPSK BW=10MHz Channel=20800 RB Size=1 Position=#0



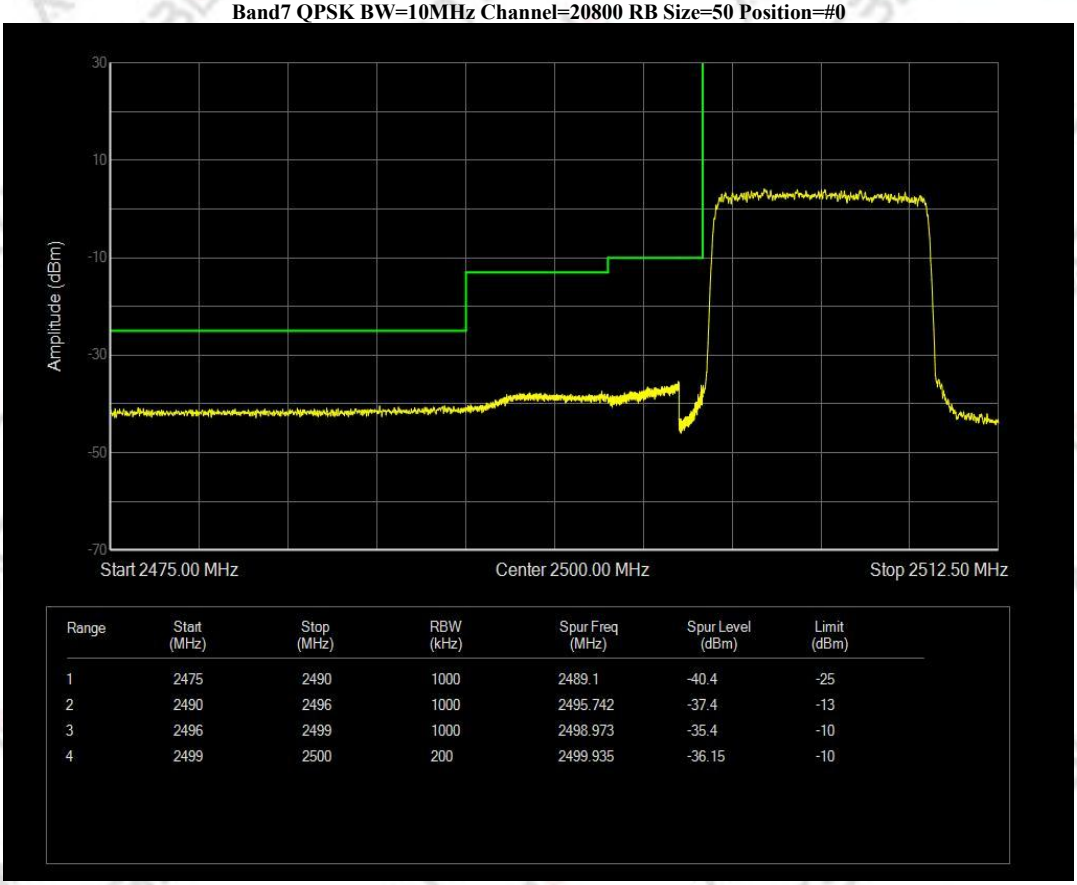
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2475	2490	1000	2483.055	-38.1	-25
2	2490	2496	1000	2495.904	-39.22	-13
3	2496	2499	1000	2498.97	-36.33	-10
4	2499	2500	200	2500	-35.39	-10

Band7 QPSK BW=10MHz Channel=20800 RB Size=1 Position=#Max



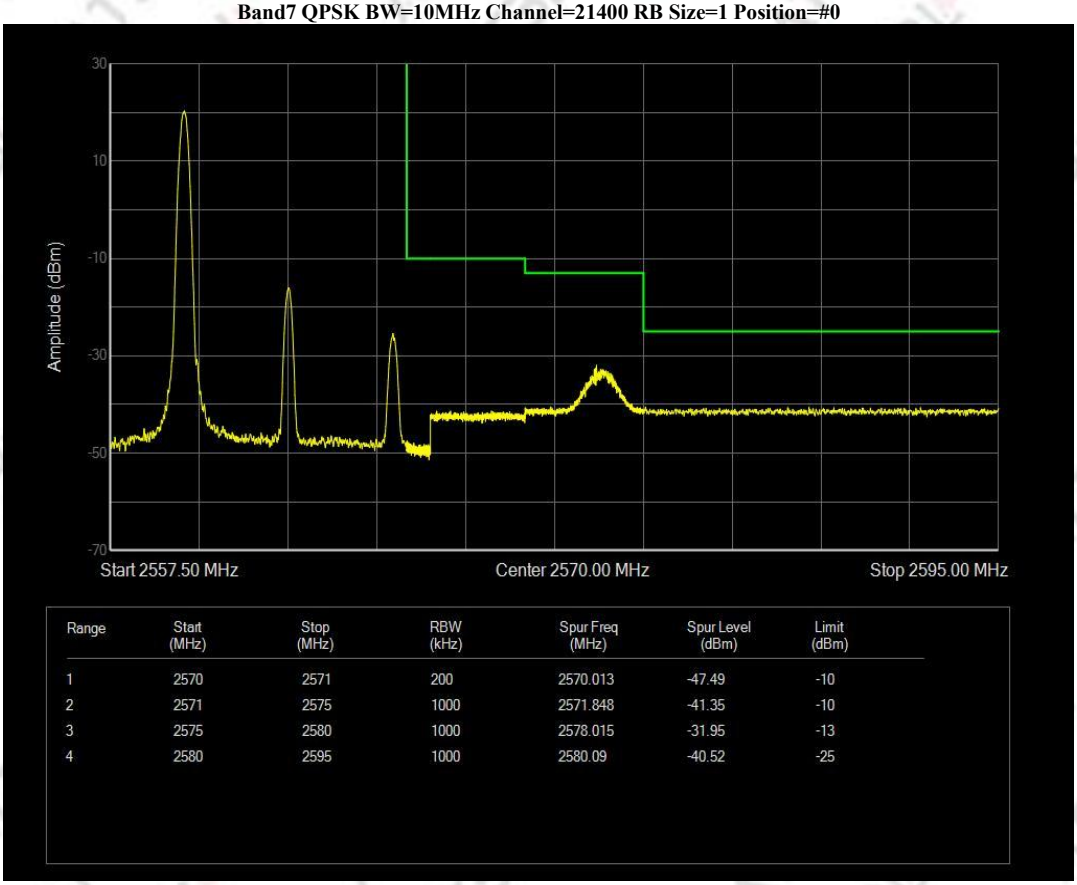
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2475	2490	1000	2484.03	-40.59	-25
2	2490	2496	1000	2491.674	-37.18	-13
3	2496	2499	1000	2496.186	-40.25	-10
4	2499	2500	200	2499.955	-47.74	-10

Band7 QPSK BW=10MHz Channel=20800 RB Size=50 Position=#0



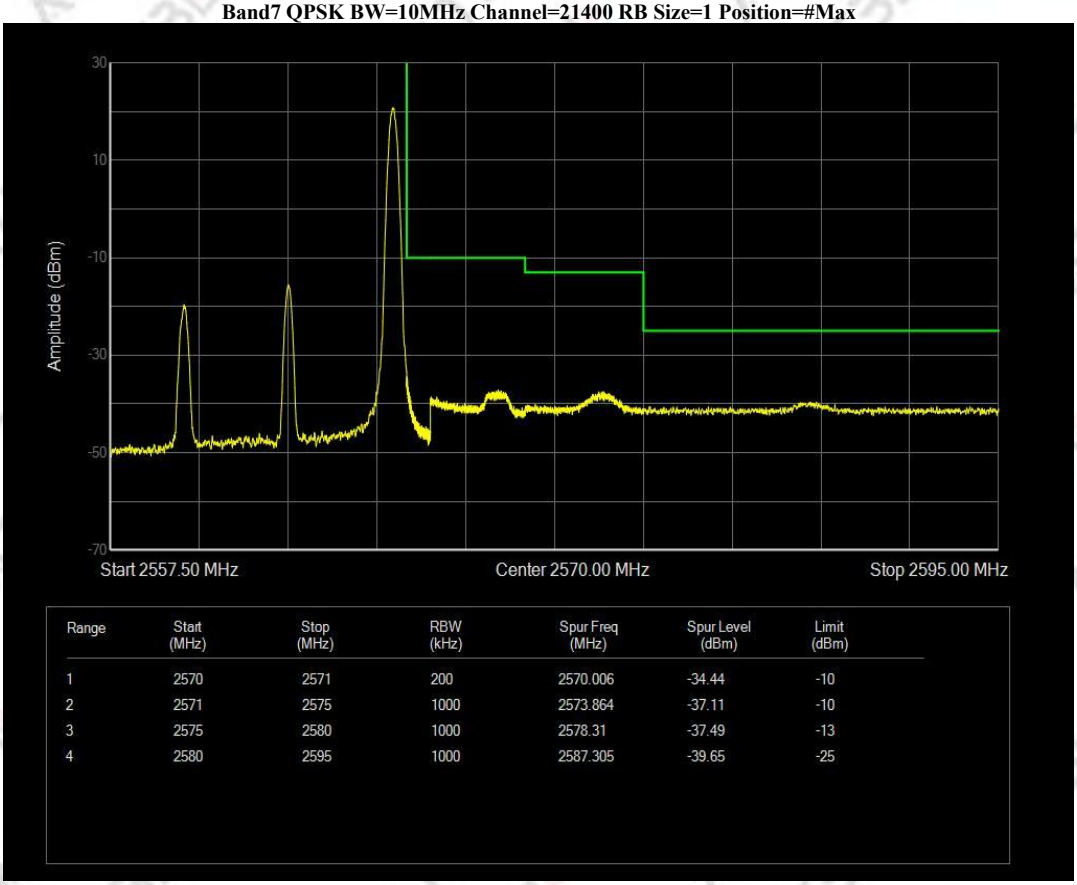
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2475	2490	1000	2489.1	-40.4	-25
2	2490	2496	1000	2495.742	-37.4	-13
3	2496	2499	1000	2498.973	-35.4	-10
4	2499	2500	200	2499.935	-36.15	-10

Band7 QPSK BW=10MHz Channel=21400 RB Size=1 Position=#0



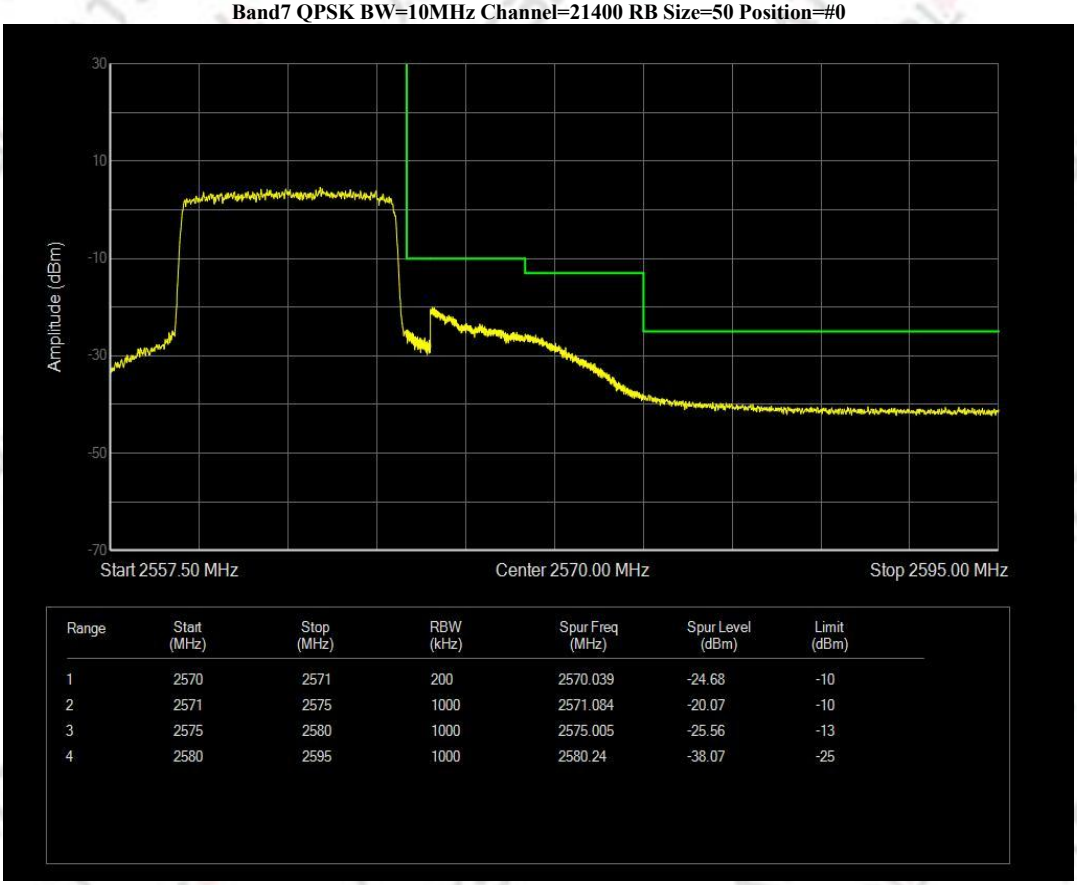
Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2570	2571	200	2570.013	-47.49	-10
2	2571	2575	1000	2571.848	-41.35	-10
3	2575	2580	1000	2578.015	-31.95	-13
4	2580	2595	1000	2580.09	-40.52	-25

Band7 QPSK BW=10MHz Channel=21400 RB Size=1 Position=#Max



Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2570	2571	200	2570.006	-34.44	-10
2	2571	2575	1000	2573.864	-37.11	-10
3	2575	2580	1000	2578.31	-37.49	-13
4	2580	2595	1000	2587.305	-39.65	-25

Band7 QPSK BW=10MHz Channel=21400 RB Size=50 Position=#0



Range	Start (MHz)	Stop (MHz)	RBW (kHz)	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)
1	2570	2571	200	2570.039	-24.68	-10
2	2571	2575	1000	2571.084	-20.07	-10
3	2575	2580	1000	2575.005	-25.56	-13
4	2580	2595	1000	2580.24	-38.07	-25