TEST REPORT

Report No.: SHATBL2306006W03

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, 22(H), 24(E), 27(L), 27(N)
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	--
	§22.913(a)(5)	Effective Radiated Power (Band 5) (Band 26)	ERP < 7 Watt	PASS	
	§24.232(c)	Equivalent Isotropic Radiated Power (Band 2) (Band 25)	EIRP < 2Watt		
	§27.50(b)(10) §27.50(c)(10)	Effective Radiated Power (Band 71)	ERP < 3 Watt		
	§27.50(d)(4)	Equivalent Isotropic Radiated Power (Band 4) (Band 66)	EIRP < 1Watt		
3.2	§24.232(d)	Peak-to-Average Ratio	<13 dB	PASS	--
3.3	§2.1049	Occupied Bandwidth	-	Report Only	--
3.4	§2.1051 §22.917(a) §24.238(a) §27.53(h) §27.53(g)	Conducted Band Edge Measurement (Band 2) (Band 4) (Band 5) (Band 25) (Band 26) (Band 66) (Band 71)	< 43+10log10(P[Watts])	PASS	--
3.5	§2.1051 §22.917(a) §24.238(a) §27.53(h) §27.53(g)	Conducted Spurious Emission (Band 2) (Band 4) (Band 5) (Band 25) (Band 26) (Band 66) (Band 71)	< 43+10log10(P[Watts])	PASS	--
3.6	§2.1055 §22.355	Frequency Stability Temperature & Voltage	< 2.5 ppm for Part 22	PASS	--
	§2.1055 §24.235 §27.54		Within Authorized Band		
3.7	§2.1053 §22.917(a) §24.238(a) §27.53(h) §27.53(g)	Radiated Spurious Emission (Band 2) (Band 4) (Band 5) (Band 25) (Band 26) (Band 66) (Band 71)	< 43+10log10(P[Watts])	PASS	--

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 2	1850 MHz ~ 1910 MHz	1930 MHz ~ 1990 MHz
☑ Band 4	1710 MHz ~ 1755 MHz	2110 MHz ~ 2155 MHz
☑ Band 5	824 MHz ~ 849 MHz	869 MHz ~ 894 MHz
☑ Band 25	1850 MHz ~ 1915 MHz	1930 MHz ~ 1995 MHz
☑ Band 26	824 MHz ~ 849 MHz	869 MHz ~ 894 MHz
☑ Band 66	1710 MHz ~ 1780 MHz	2110 MHz~ 2200 MHz
Bandwidth		
Band	**Bandwidth**	
☑ Band 2	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz	
☑ Band 4	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz	
☑ Band 5	1.4MHz / 3MHz / 5MHz / 10MHz	
☑ Band 25	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz	
☑ Band 26	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz	
☑ Band 66	1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz	
Antenna Gain		
Band	**Antenna Gain**	
☑ Band 2	1.30dBi	
☑ Band 4	3.20dBi	
☑ Band 5	2.60dBi	
☑ Band 25	1.30dBi	
☑ Band 26	2.60dBi	
☑ Band 66	3.20dBi	
Maximum Output Power to Antenna		
Band	**Maximum Output Power**	
☑ Band 2	20.74dBm	
☑ Band 4	22.15dBm	
☑ Band 5	21.60dBm	
☑ Band 25	21.54dBm	
☑ Band 26	21.38dBm	
☑ Band 66	22.21dBm	
Type of Modulation		
☑ QPSK ☑ 16QAM ☐ 64QAM ☐ 256QAM		

Note:

The maximum ERP/EIRP is calculated from max output power and max antenna gain, 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, 22(H), 24(E), 27(L) , 27(N)

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

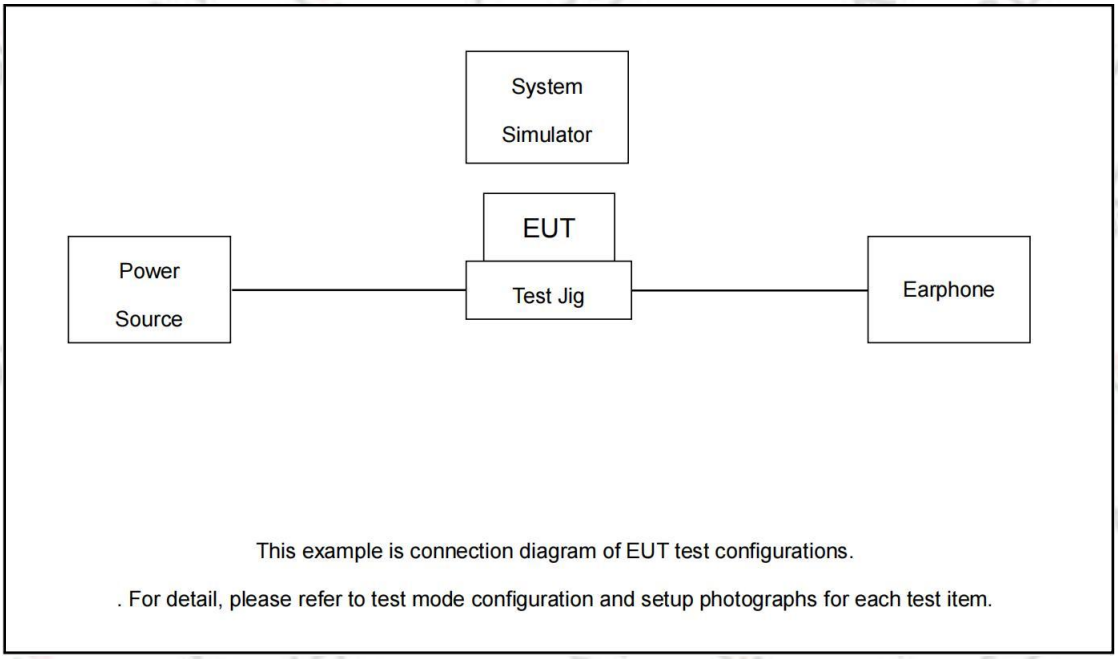
2.1. Test Mode

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	2	√	√	√	√	√	√	√	√			√		√	√	√	√
	4	√	√	√	√	√	√	√	√			√		√	√	√	√
	5	√	√	√	√			√	√			√		√	√	√	√
	25	√	√	√	√	√	√	√	√			√		√	√	√	√
	26	√	√	√	√	√		√	√			√		√	√	√	√
	66	√	√	√	√	√	√	√	√			√		√	√	√	√
Peak-to-Average Ratio	2/25						√	√	√					√		√	
	4/66						√	√	√					√		√	
	5/26				√			√	√					√		√	
26dB and 99% Bandwidth	2/25	√	√	√	√	√	√	√	√					√		√	
	4/66	√	√	√	√	√	√	√	√					√		√	
	5/26	√	√	√	√	√		√	√					√		√	
Conducted Band Edge	2/25	√	√	√	√	√	√	√	√			√		√	√		√
	4/66	√	√	√	√	√	√	√	√			√		√	√		√
	5/26	√	√	√	√	√		√	√			√		√	√		√
Conducted Spurious Emission	2/25	√	√	√	√	√	√	√				√			√	√	√
	4/66	√	√	√	√	√	√	√				√			√	√	√
	5/26	√	√	√	√	√		√				√			√	√	√
Frequency Stability	2/25				√			√						√		√	
	4/66				√			√						√		√	
	5/26				√			√						√		√	
E.R.P / E.I.R.P	2	√	√	√	√	√	√	√	√			√		√	√	√	√
	4	√	√	√	√	√	√	√	√			√		√	√	√	√
	5	√	√	√	√			√	√			√		√	√	√	√
	25	√	√	√	√	√	√	√	√			√		√	√	√	√
	26	√	√	√	√	√		√	√			√		√	√	√	√
	66	√	√	√	√	√	√	√	√			√		√	√	√	√
Radiated Spurious Emission	2/25	Worst Case													√	√	√
	4/66	Worst Case													√	√	√
	5/26	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 2 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	18700	18900	19100
	Frequency	1860	1880	1900
15	Channel	18675	18900	19125
	Frequency	1857.5	1880	1902.5
10	Channel	18650	18900	19150
	Frequency	1855	1880	1905
5	Channel	18625	18900	19175
	Frequency	1852.5	1880	1907.5
3	Channel	18615	18900	19185
	Frequency	1851.5	1880	1908.5
1.4	Channel	18607	18900	19193
	Frequency	1850.7	1880	1909.3

LTE Band 25 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	26140	26340	26590
	Frequency	1860	1880	1905
15	Channel	26115	26340	26615
	Frequency	1857.5	1880	1907.5
10	Channel	26090	26340	26640
	Frequency	1855	1880	1910
5	Channel	26065	26340	26665
	Frequency	1852.5	1880	1912.5
3	Channel	26055	26340	26675
	Frequency	1851.5	1880	1913.5
1.4	Channel	26047	26340	26683
	Frequency	1850.7	1880	1914.3

LTE Band 4 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	20050	20175	20300
	Frequency	1720	1732.5	1745
15	Channel	20025	20175	20325
	Frequency	1717.5	1732.5	1747.5
10	Channel	20000	20175	20350
	Frequency	1715	1732.5	1750
5	Channel	19975	20175	20375
	Frequency	1712.5	1732.5	1752.5
3	Channel	19965	20175	20385
	Frequency	1711.5	1732.5	1753.5
1.4	Channel	19957	20175	20393
	Frequency	1710.7	1732.5	1754.3

LTE Band 66 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
20	Channel	132072	132322	132572
	Frequency	1720	1745	1770
15	Channel	132047	132322	132597
	Frequency	1717.5	1745	1772.5
10	Channel	132022	132322	132622
	Frequency	1715	1745	1775
5	Channel	131997	132322	132647
	Frequency	1712.5	1745	1777.5
3	Channel	131987	132322	132657
	Frequency	1711.5	1745	1778.5
1.4	Channel	131979	132322	132665
	Frequency	1710.7	1745	1779.3

LTE Band 5 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	20450	20525	20600
	Frequency	829	836.5	844
5	Channel	20425	20525	20625
	Frequency	826.5	836.5	846.5
3	Channel	20415	20525	20635
	Frequency	825.5	836.5	847.5
1.4	Channel	20407	20525	20643
	Frequency	824.7	836.5	848.3

LTE Band 26 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
15	Channel	26865	26915	26965
	Frequency	831.5	836.5	841.5
10	Channel	26840	26915	26990
	Frequency	829	836.5	844
5	Channel	26815	26915	27015
	Frequency	826.5	836.5	846.5
3	Channel	26805	26915	27025
	Frequency	825.5	836.5	847.5
1.4	Channel	26797	26915	27033
	Frequency	824.7	836.5	848.3

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

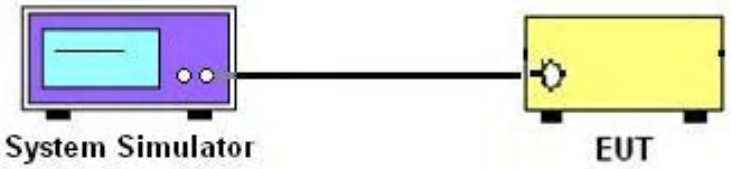
The reported uncertainty of measurement y±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

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 7 Watts for LTE Band 5 and Band 26.

The ERP of mobile transmitters must not exceed 3 Watts for LTE Band 71.

The EIRP of mobile transmitters must not exceed 2 Watts for LTE Band 2 and Band 25

The EIRP of mobile transmitters must not exceed 1 Watts for LTE Band 4 and Band 66.

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

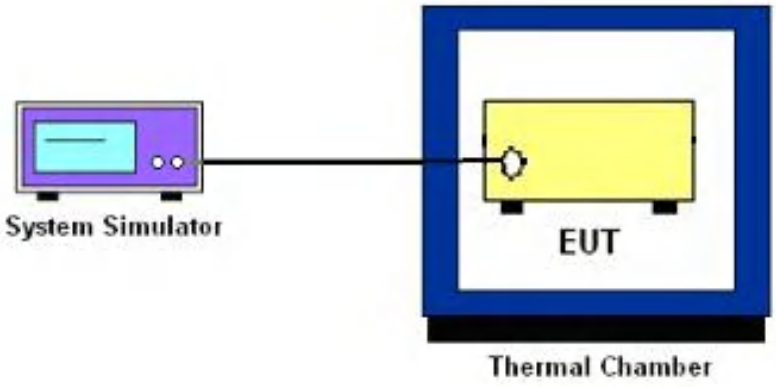
1. The testing follows ANSI C63.26 Section 5.2.
2. The transmitter output port was connected to the system simulator.
3. Set EUT at maximum power through the system simulator.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure and record the power level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

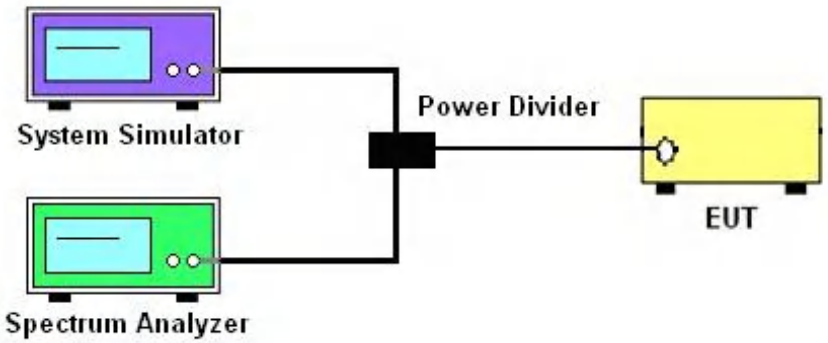
1. The testing follows ANSI C63.26 section 5.6.5
2. The EUT was placed in a temperature chamber at 20±5°C and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
4. For hand carried, 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

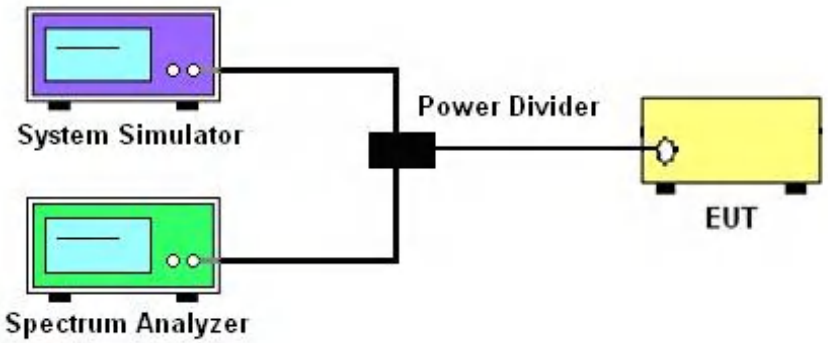
1. The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR 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

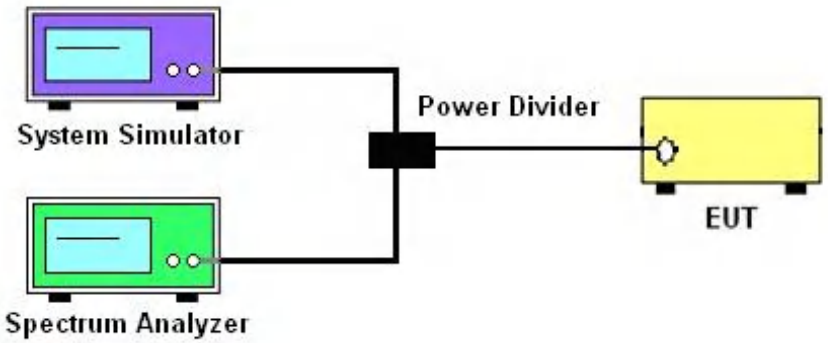
1. The testing follows ANSI C63.26 Section 5.4.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five 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

22.917(a):

For operations in the 824 – 849 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 100kHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

24.238 (a):

For operations in the 1850-1910 and 1930-1990 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 1MHz bandwidth. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

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 (h):

For operations in the 1710 – 1755 MHz and 1710 – 1780 MHz band, the FCC limit is 43 + 10log10(P[Watts]) dB below the transmitter power P(Watts) in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

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 or a narrower RBW was used and the measured power was integrated over the full required measurement bandwidth of 1 MHz.
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)

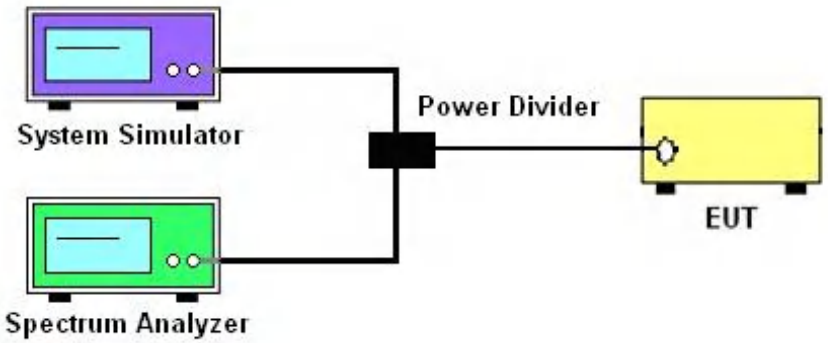
   = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB) = -13dBm
9. When using the integration method, the starting frequency of the integration shall be centered at one-half of the RBW away from the band edge.

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.

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.

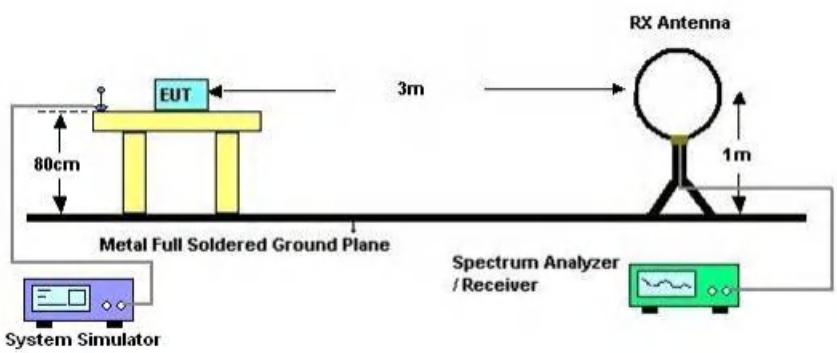
3.6.4. Test Result of Conducted Spurious Emission

Please refer to the Appendix A.

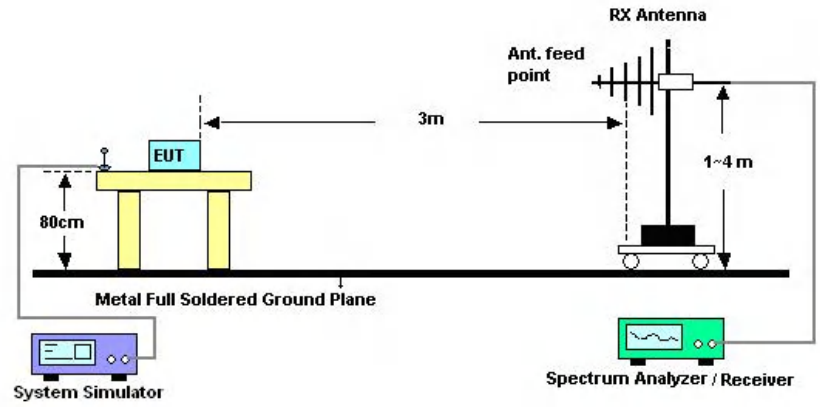
3.7. Radiated Spurious Emission

3.7.1. Test Setup

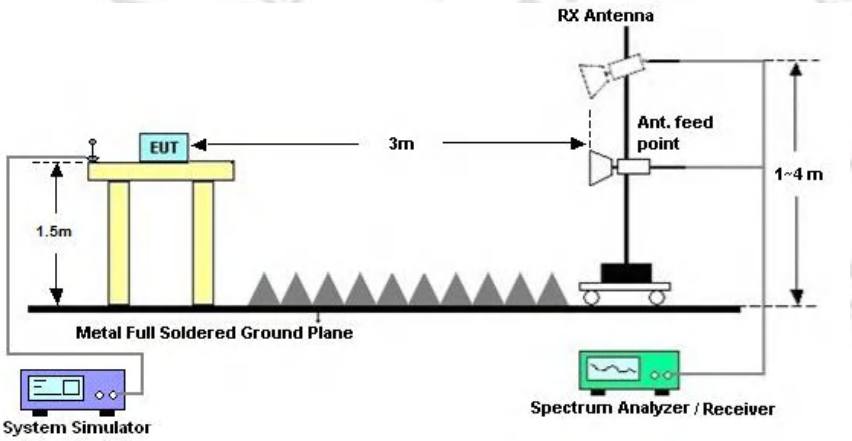
3.7.1.1. For radiated test below 30MHz



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.

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.

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.

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 2

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
Band2	1.4	18607	1	#0	QAM16	20.30	1.3	19.45	37	21.60	37	PASS
Band2	1.4	18900	1	#0	QAM16	19.54	1.3	18.69	37	20.84	37	PASS
Band2	1.4	19193	1	#0	QAM16	20.29	1.3	19.44	37	21.59	37	PASS
Band2	3	18615	1	#0	QAM16	20.70	1.3	19.85	37	22.00	37	PASS
Band2	3	18900	1	#0	QAM16	19.20	1.3	18.35	37	20.50	37	PASS
Band2	3	19185	1	#0	QAM16	20.23	1.3	19.38	37	21.53	37	PASS
Band2	5	18625	1	#0	QAM16	20.05	1.3	19.20	37	21.35	37	PASS
Band2	5	18900	1	#0	QAM16	19.20	1.3	18.35	37	20.50	37	PASS
Band2	5	19175	1	#0	QAM16	20.15	1.3	19.30	37	21.45	37	PASS
Band2	1.4	18607	1	#0	QPSK	21.52	1.3	20.67	37	22.82	37	PASS
Band2	1.4	18900	1	#0	QPSK	21.29	1.3	20.44	37	22.59	37	PASS
Band2	1.4	19193	1	#0	QPSK	21.64	1.3	20.79	37	22.94	37	PASS
Band2	3	18615	1	#0	QPSK	21.56	1.3	20.71	37	22.86	37	PASS
Band2	3	18900	1	#0	QPSK	21.18	1.3	20.33	37	22.48	37	PASS
Band2	3	19185	1	#0	QPSK	21.71	1.3	20.86	37	23.01	37	PASS
Band2	5	18625	1	#0	QPSK	21.22	1.3	20.37	37	22.52	37	PASS
Band2	5	18900	1	#0	QPSK	20.74	1.3	19.89	37	22.04	37	PASS
Band2	5	19175	1	#0	QPSK	21.31	1.3	20.46	37	22.61	37	PASS
Band2	10	18650	1	#0	QPSK	21.54	1.3	20.69	37	22.84	37	PASS
Band2	10	18900	1	#0	QPSK	21.21	1.3	20.36	37	22.51	37	PASS
Band2	10	19150	1	#0	QPSK	21.29	1.3	20.44	37	22.59	37	PASS
Band2	15	18675	1	#0	QPSK	21.38	1.3	20.53	37	22.68	37	PASS
Band2	15	18900	1	#0	QPSK	21.04	1.3	20.19	37	22.34	37	PASS
Band2	15	19125	1	#0	QPSK	21.03	1.3	20.18	37	22.33	37	PASS
Band2	20	18700	1	#0	QPSK	21.19	1.3	20.34	37	22.49	37	PASS
Band2	20	18900	1	#0	QPSK	21.43	1.3	20.58	37	22.73	37	PASS
Band2	20	19100	1	#0	QPSK	21.28	1.3	20.43	37	22.58	37	PASS

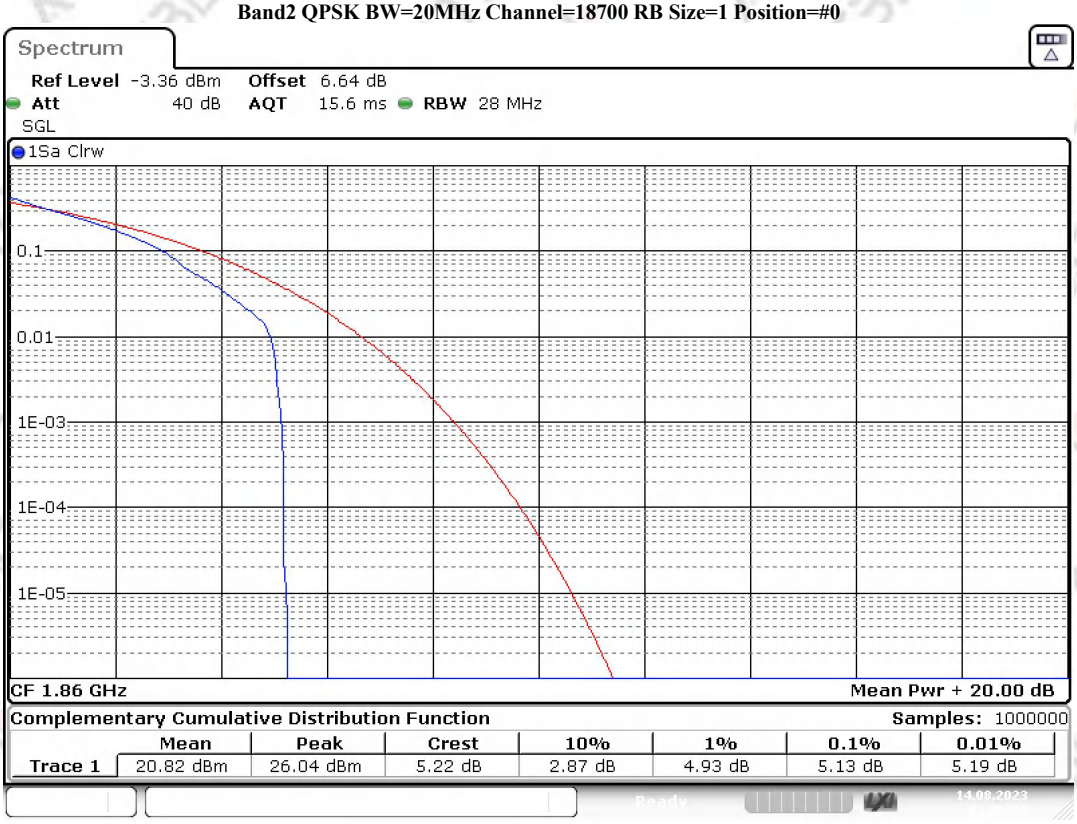
02 Frequency stability

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	Result(Hz)	Result (ppm)	Low Limit (ppm)	high Limit (ppm)	Verdict
Band2	1.4	18607	6	#0	QAM16	-2.43	-0.001	-2.5	2.5	PASS
Band2	1.4	18900	6	#0	QAM16	-1.79	-0.001	-2.5	2.5	PASS
Band2	1.4	19193	6	#0	QAM16	1.01	0.001	-2.5	2.5	PASS
Band2	3	18615	15	#0	QAM16	-2.20	-0.001	-2.5	2.5	PASS
Band2	3	18900	15	#0	QAM16	-2.38	-0.001	-2.5	2.5	PASS
Band2	3	19185	15	#0	QAM16	1.85	0.001	-2.5	2.5	PASS
Band2	5	18625	25	#0	QAM16	-1.50	-0.001	-2.5	2.5	PASS
Band2	5	18900	25	#0	QAM16	-6.18	-0.003	-2.5	2.5	PASS
Band2	5	19175	25	#0	QAM16	1.96	0.001	-2.5	2.5	PASS
Band2	1.4	18607	6	#0	QPSK	-2.30	-0.001	-2.5	2.5	PASS
Band2	1.4	18900	6	#0	QPSK	-3.42	-0.002	-2.5	2.5	PASS
Band2	1.4	19193	6	#0	QPSK	2.50	0.001	-2.5	2.5	PASS
Band2	3	18615	15	#0	QPSK	-2.66	-0.001	-2.5	2.5	PASS
Band2	3	18900	15	#0	QPSK	-2.58	-0.001	-2.5	2.5	PASS
Band2	3	19185	15	#0	QPSK	1.97	0.001	-2.5	2.5	PASS
Band2	5	18625	25	#0	QPSK	-2.40	-0.001	-2.5	2.5	PASS
Band2	5	18900	25	#0	QPSK	-2.04	-0.001	-2.5	2.5	PASS
Band2	5	19175	25	#0	QPSK	0.01	0.000	-2.5	2.5	PASS
Band2	10	18650	50	#0	QPSK	-3.09	-0.002	-2.5	2.5	PASS
Band2	10	18900	50	#0	QPSK	-3.48	-0.002	-2.5	2.5	PASS
Band2	10	19150	50	#0	QPSK	1.67	0.001	-2.5	2.5	PASS
Band2	15	18675	75	#0	QPSK	-3.03	-0.002	-2.5	2.5	PASS
Band2	15	18900	75	#0	QPSK	-2.19	-0.001	-2.5	2.5	PASS
Band2	15	19125	75	#0	QPSK	-3.25	-0.002	-2.5	2.5	PASS
Band2	20	18700	100	#0	QPSK	1.31	0.001	-2.5	2.5	PASS
Band2	20	18900	100	#0	QPSK	-2.59	-0.001	-2.5	2.5	PASS
Band2	20	19100	100	#0	QPSK	-1.66	-0.001	-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
Band2	20	18700	1	#0	QPSK	5.13	13	PASS
Band2	20	18700	100	#0	QPSK	5.07	13	PASS
Band2	20	18900	1	#0	QPSK	5.07	13	PASS
Band2	20	18900	100	#0	QPSK	5.57	13	PASS
Band2	20	19100	1	#0	QPSK	4.81	13	PASS
Band2	20	19100	100	#0	QPSK	5.74	13	PASS

Band2 QPSK BW=20MHz Channel=18700 RB Size=1 Position=#0



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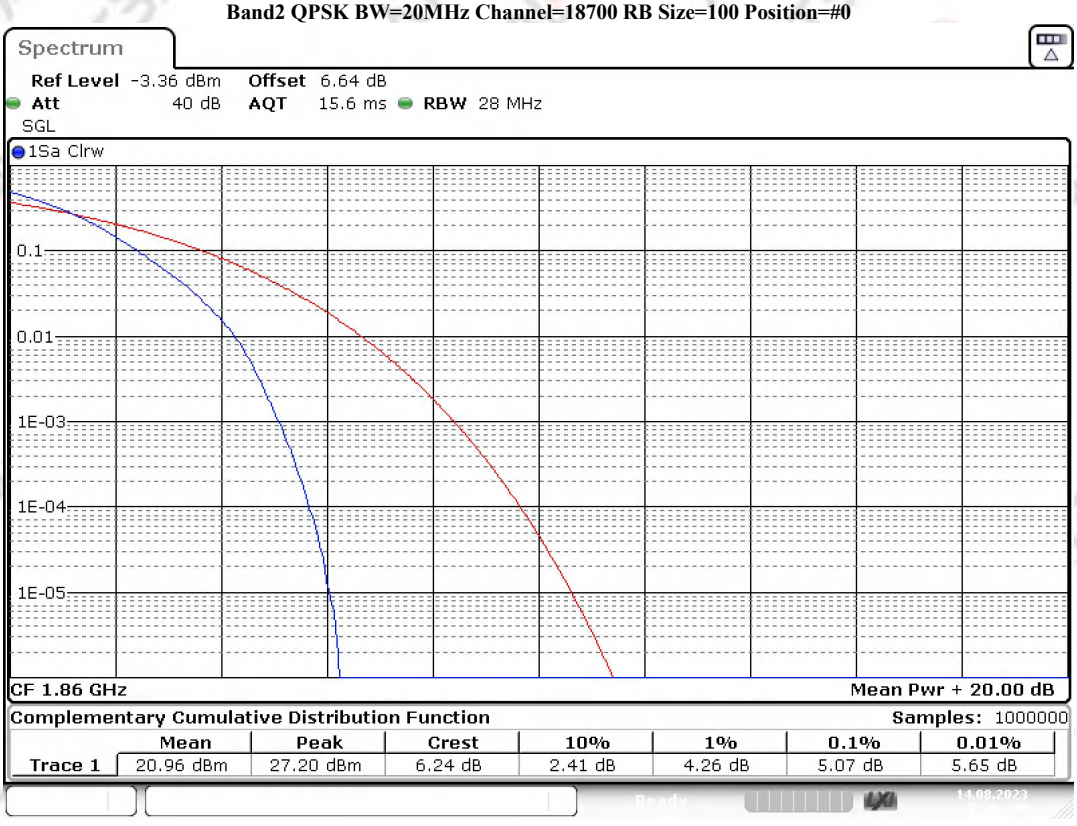
Band2 QPSK BW=20MHz Channel=18700 RB Size=100 Position=#0



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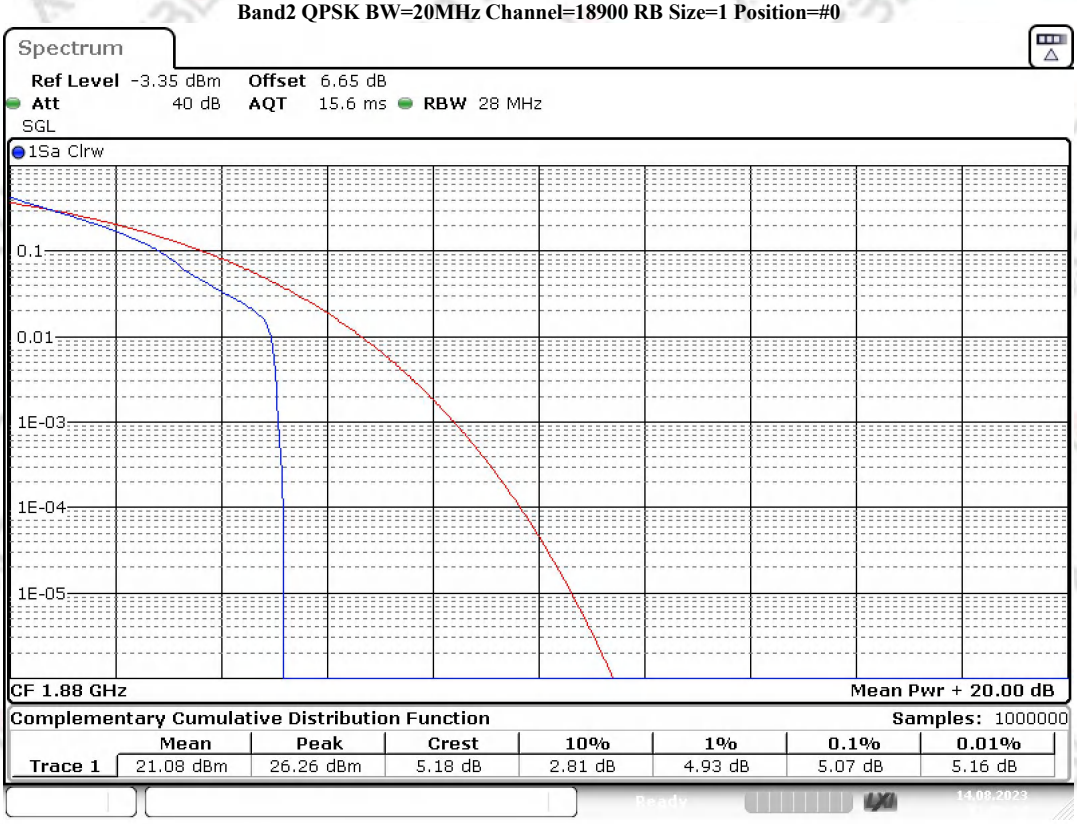
Band2 QPSK BW=20MHz Channel=18900 RB Size=1 Position=#0



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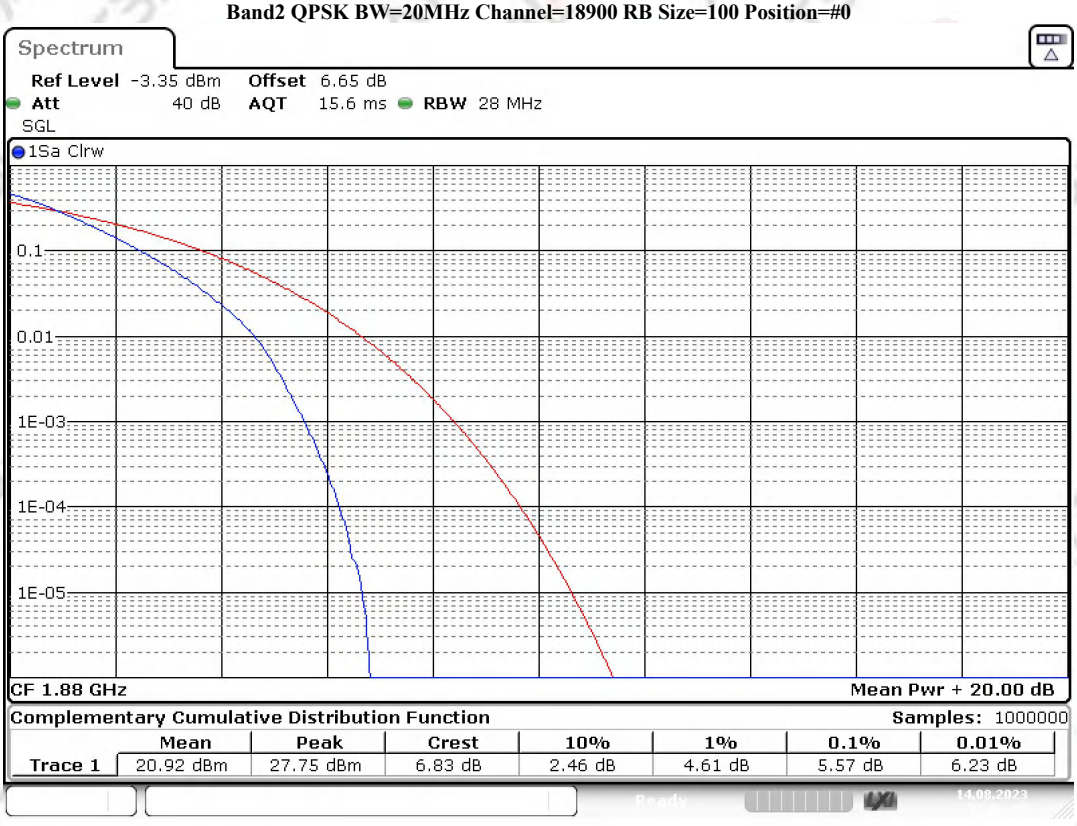
Band2 QPSK BW=20MHz Channel=18900 RB Size=100 Position=#0



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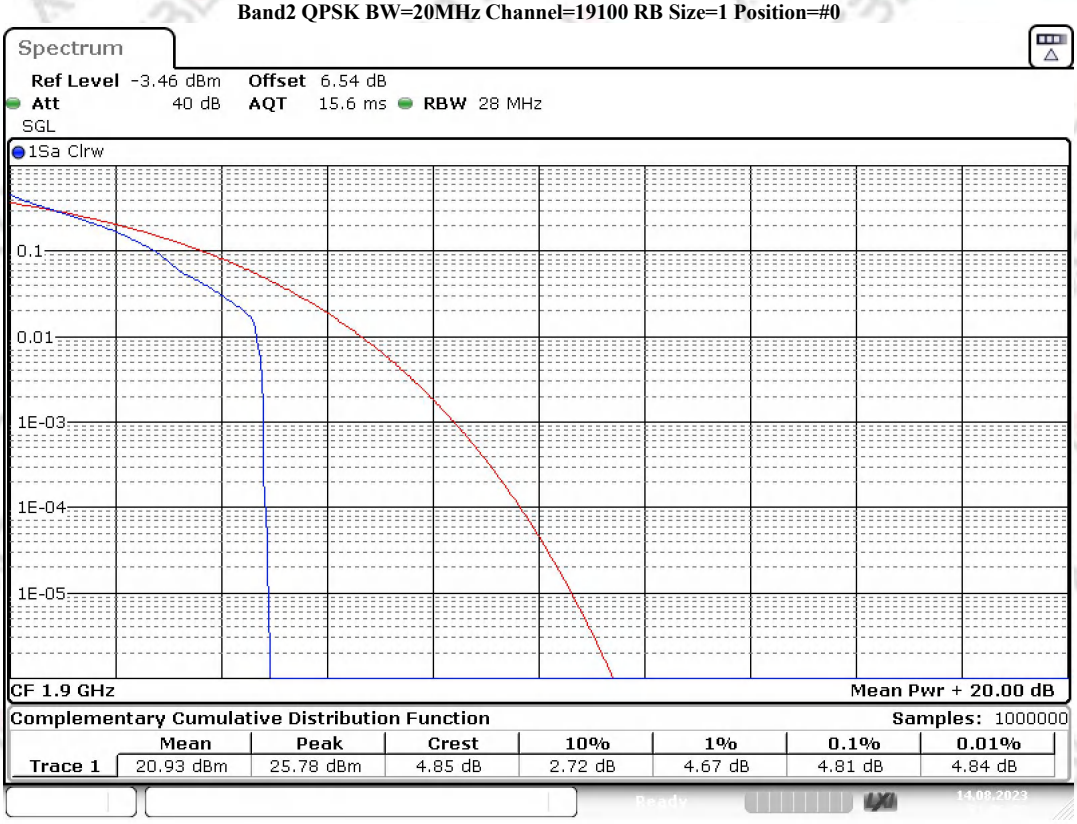
Band2 QPSK BW=20MHz Channel=19100 RB Size=1 Position=#0



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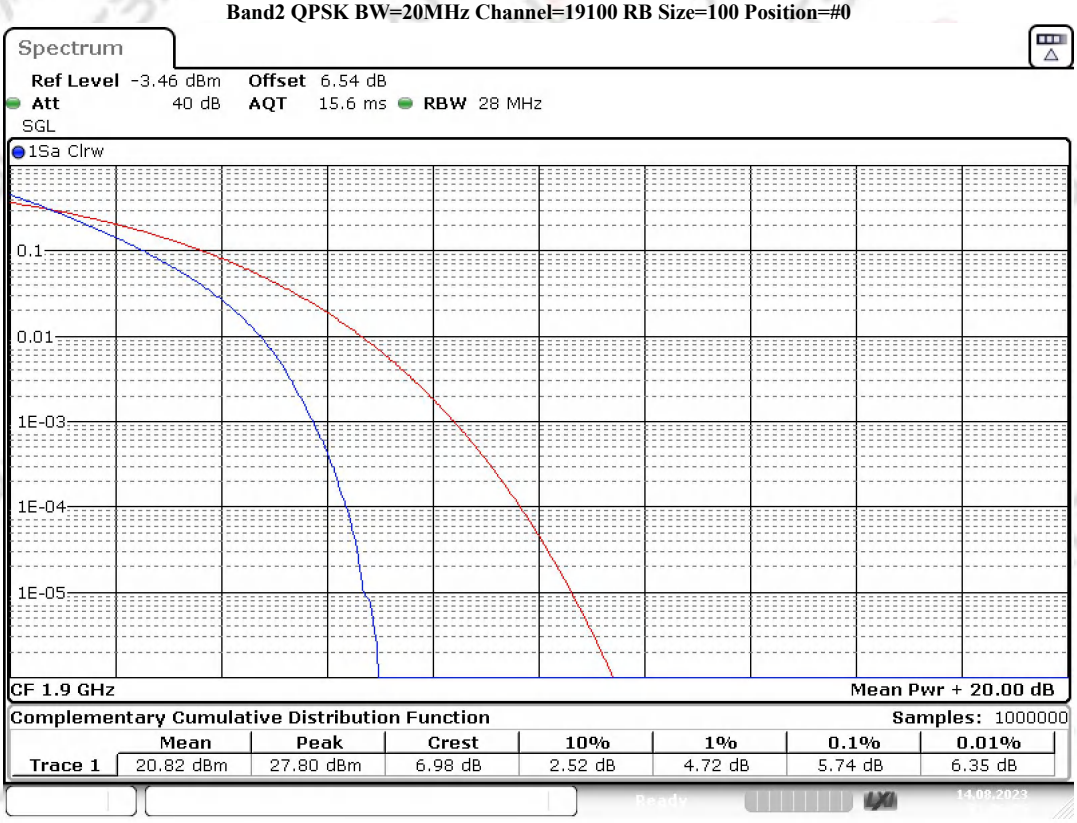
Band2 QPSK BW=20MHz Channel=19100 RB Size=100 Position=#0



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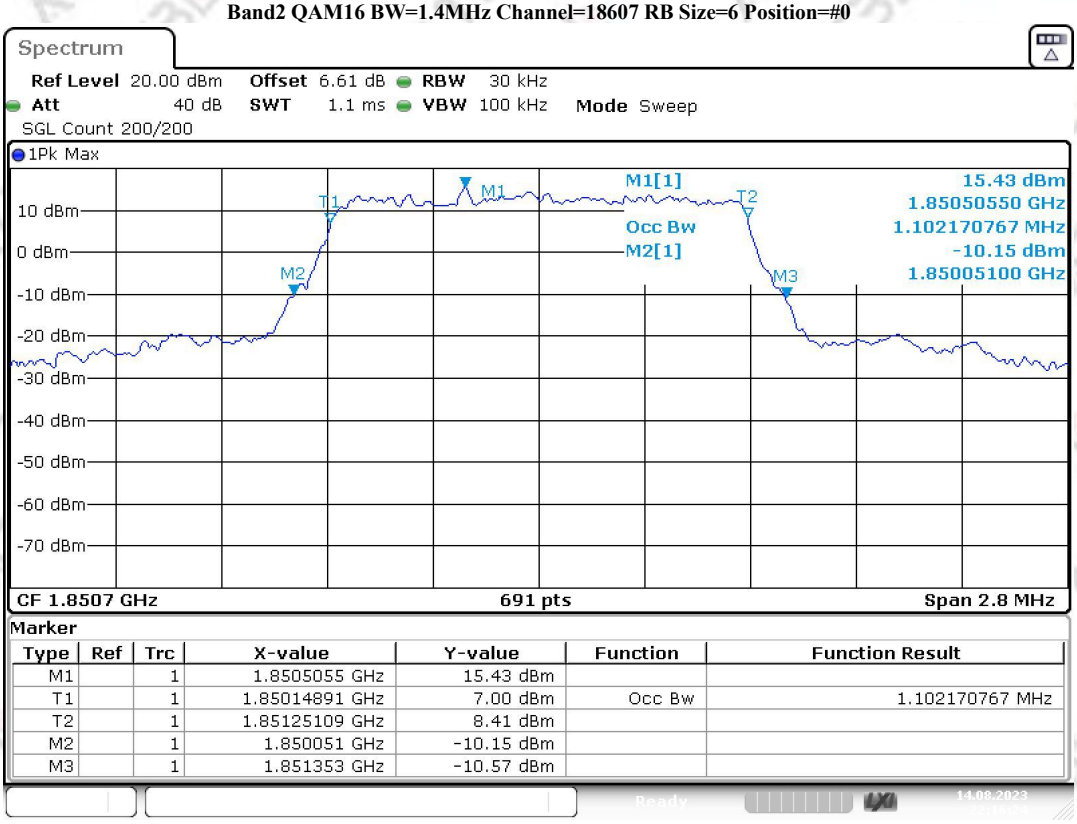
04 Occupied bandwidth

Band	Bandwidth (MHz)	UL Channel	RB Size	RB Position	Modulation	99% OBW (MHz)	-26dB EBW (MHz)	Verdict
Band2	1.4	18607	6	#0	QAM16	1.102	1.303	PASS
Band2	1.4	18900	6	#0	QAM16	1.098	1.315	PASS
Band2	1.4	19193	6	#0	QAM16	1.090	1.270	PASS
Band2	3	18615	15	#0	QAM16	2.726	3.043	PASS
Band2	3	18900	15	#0	QAM16	2.735	3.017	PASS
Band2	3	19185	15	#0	QAM16	2.726	3.061	PASS
Band2	5	18625	25	#0	QAM16	4.515	4.942	PASS
Band2	5	18900	25	#0	QAM16	4.501	4.971	PASS
Band2	5	19175	25	#0	QAM16	4.515	4.986	PASS
Band2	1.4	18607	6	#0	QPSK	1.102	1.266	PASS
Band2	1.4	18900	6	#0	QPSK	1.094	1.303	PASS
Band2	1.4	19193	6	#0	QPSK	1.098	1.286	PASS
Band2	10	18650	50	#0	QPSK	8.944	9.739	PASS
Band2	10	18900	50	#0	QPSK	8.973	9.826	PASS
Band2	10	19150	50	#0	QPSK	9.001	9.768	PASS
Band2	15	18675	75	#0	QPSK	13.372	14.478	PASS
Band2	15	18900	75	#0	QPSK	13.459	14.522	PASS
Band2	15	19125	75	#0	QPSK	13.502	14.522	PASS
Band2	20	18700	100	#0	QPSK	17.887	19.420	PASS
Band2	20	18900	100	#0	QPSK	17.945	19.594	PASS
Band2	20	19100	100	#0	QPSK	18.119	19.594	PASS
Band2	3	18615	15	#0	QPSK	2.744	3.026	PASS
Band2	3	18900	15	#0	QPSK	2.744	3.061	PASS
Band2	3	19185	15	#0	QPSK	2.735	3.017	PASS
Band2	5	18625	25	#0	QPSK	4.515	4.971	PASS
Band2	5	18900	25	#0	QPSK	4.515	4.957	PASS
Band2	5	19175	25	#0	QPSK	4.501	4.884	PASS

Band2 QAM16 BW=1.4MHz Channel=18607 RB Size=6 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.8505055 GHz	15.43 dBm		
T1		1	1.85014891 GHz	7.00 dBm	Occ Bw	1.102170767 MHz
T2		1	1.85125109 GHz	8.41 dBm		
M2		1	1.850051 GHz	-10.15 dBm		
M3		1	1.851353 GHz	-10.57 dBm		

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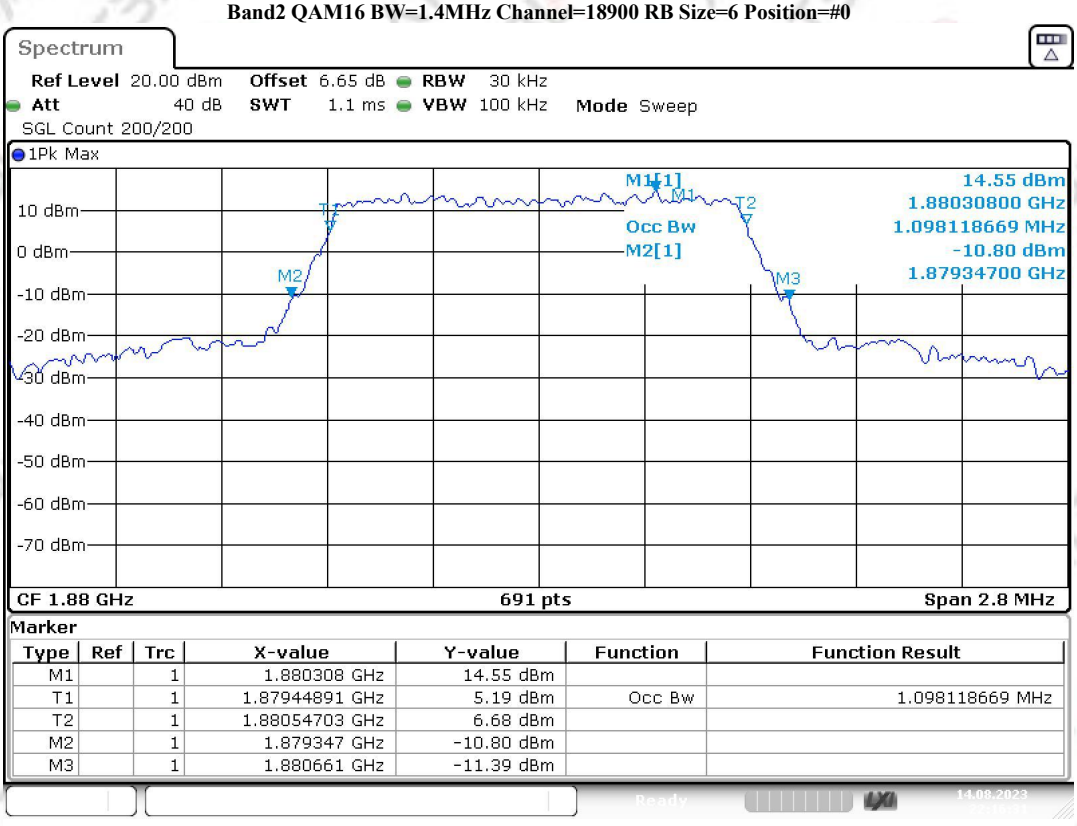
Band2 QAM16 BW=1.4MHz Channel=18900 RB Size=6 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.880308 GHz	14.55 dBm		
T1		1	1.87944891 GHz	5.19 dBm	Occ Bw	1.098118669 MHz
T2		1	1.88054703 GHz	6.68 dBm		
M2		1	1.879347 GHz	-10.80 dBm		
M3		1	1.880661 GHz	-11.39 dBm		

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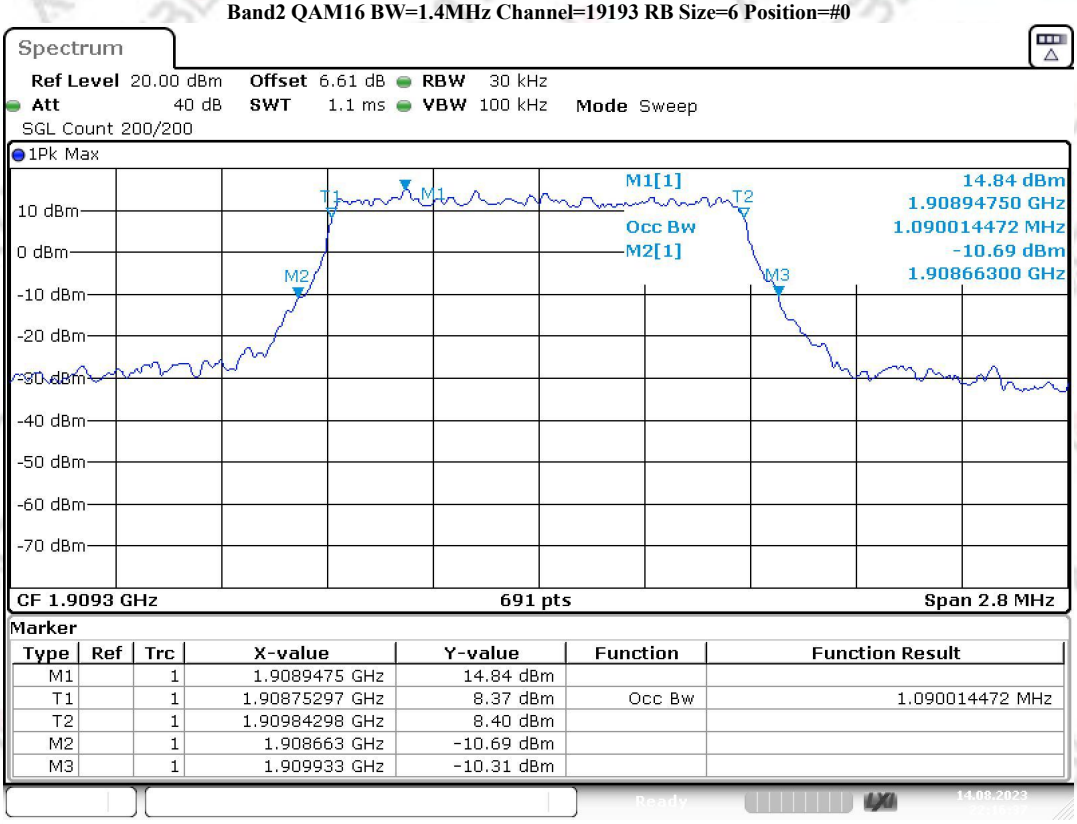
Band2 QAM16 BW=1.4MHz Channel=19193 RB Size=6 Position=#0



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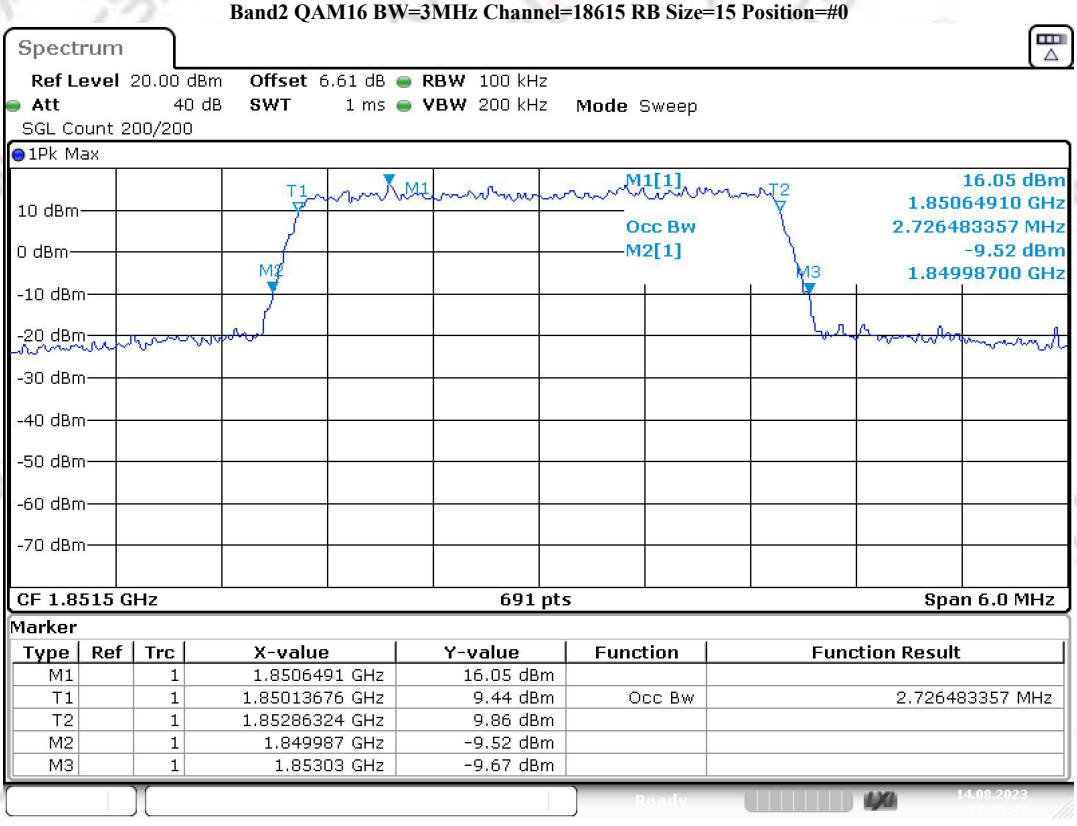
Band2 QAM16 BW=3MHz Channel=18615 RB Size=15 Position=#0



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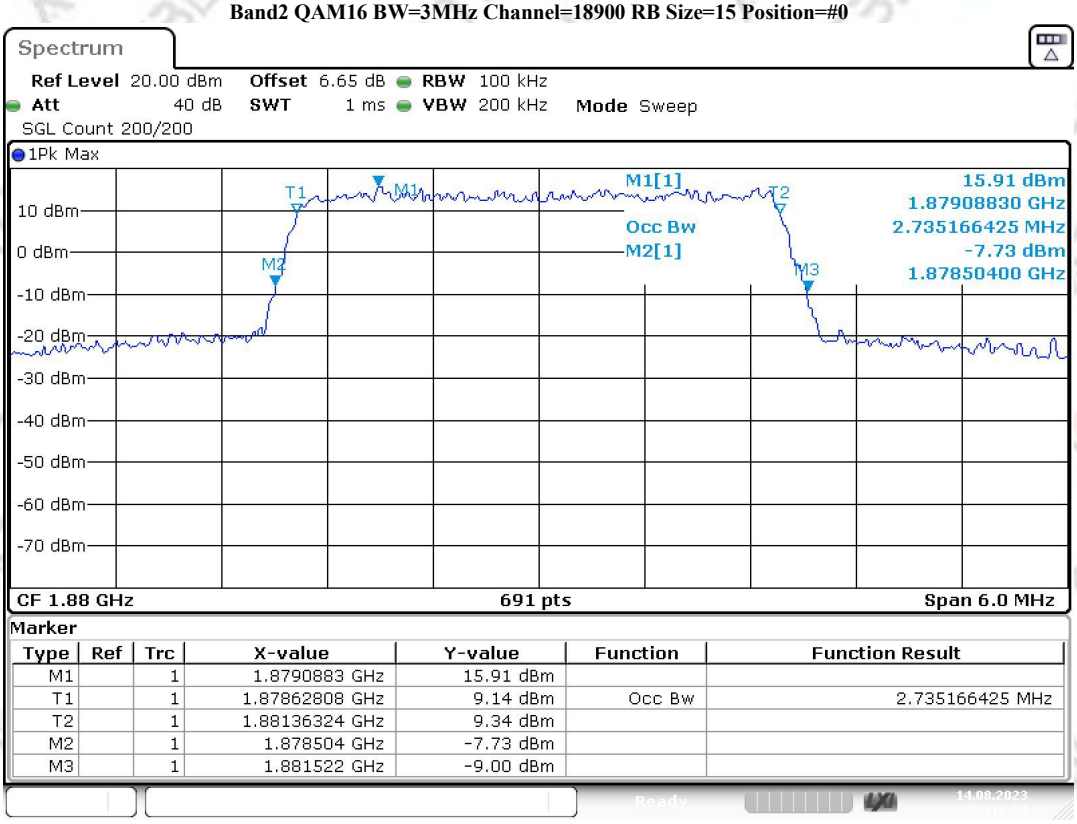
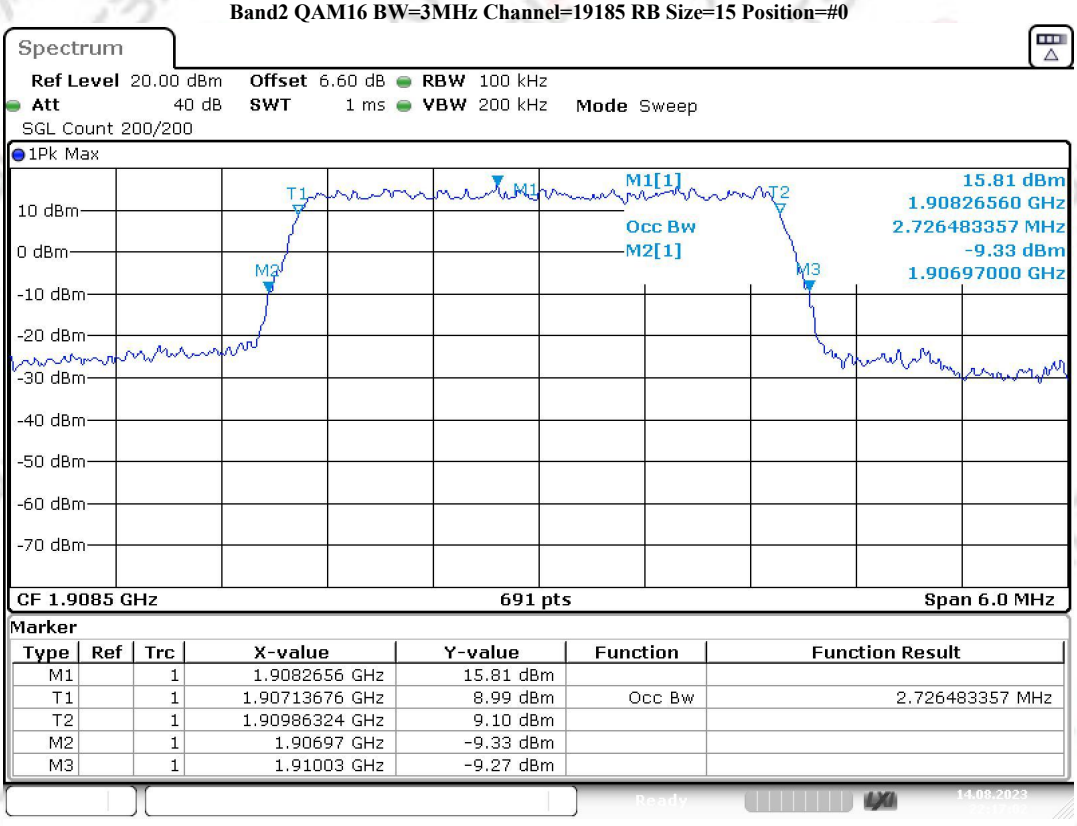
Band2 QAM16 BW=3MHz Channel=18900 RB Size=15 Position=#0



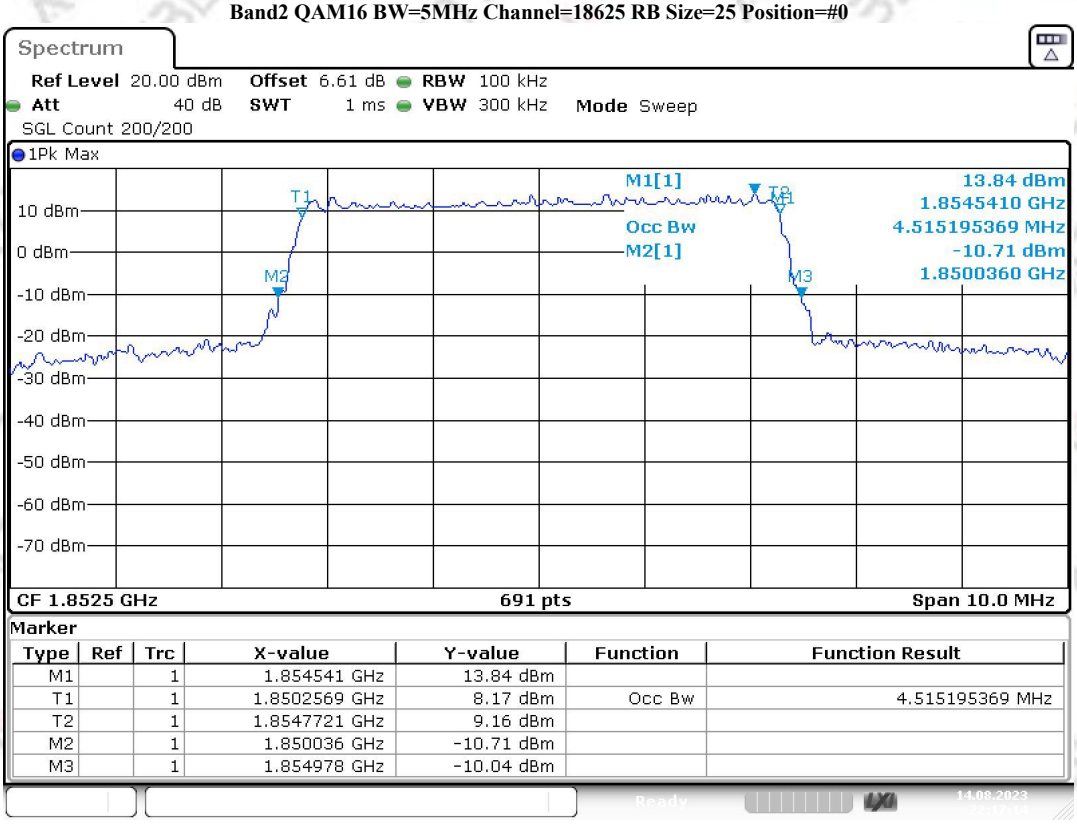
Date: 14.AUG.2023 22:16:54

Band2 QAM16 BW=3MHz Channel=19185 RB Size=15 Position=#0



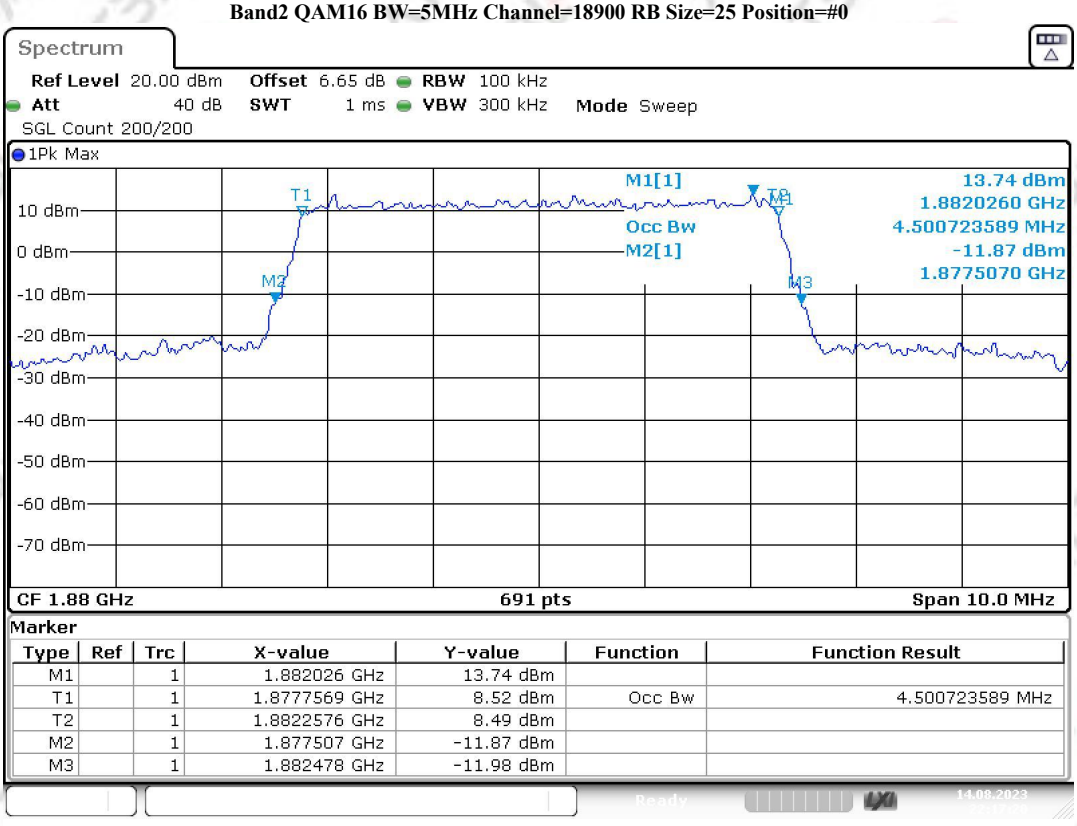
Date: 14.AUG.2023 22:17:02

Band2 QAM16 BW=5MHz Channel=18625 RB Size=25 Position=#0



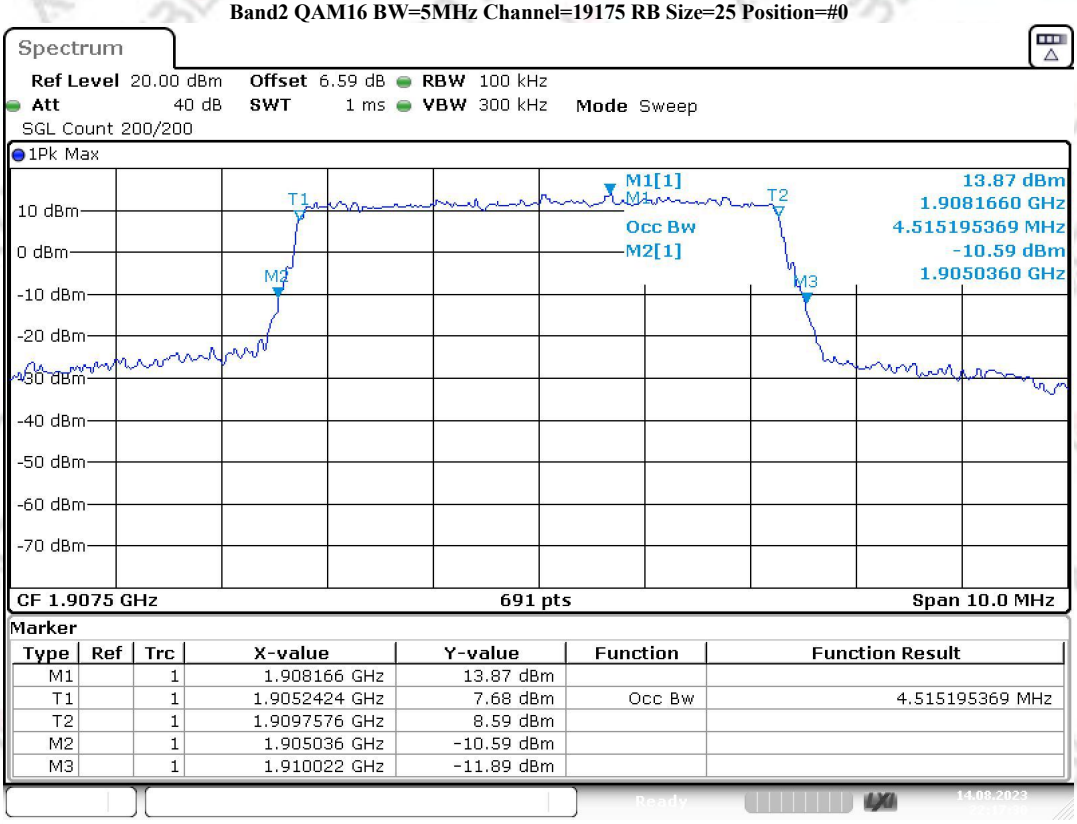
Date: 14.AUG.2023 22:17:14

Band2 QAM16 BW=5MHz Channel=18900 RB Size=25 Position=#0



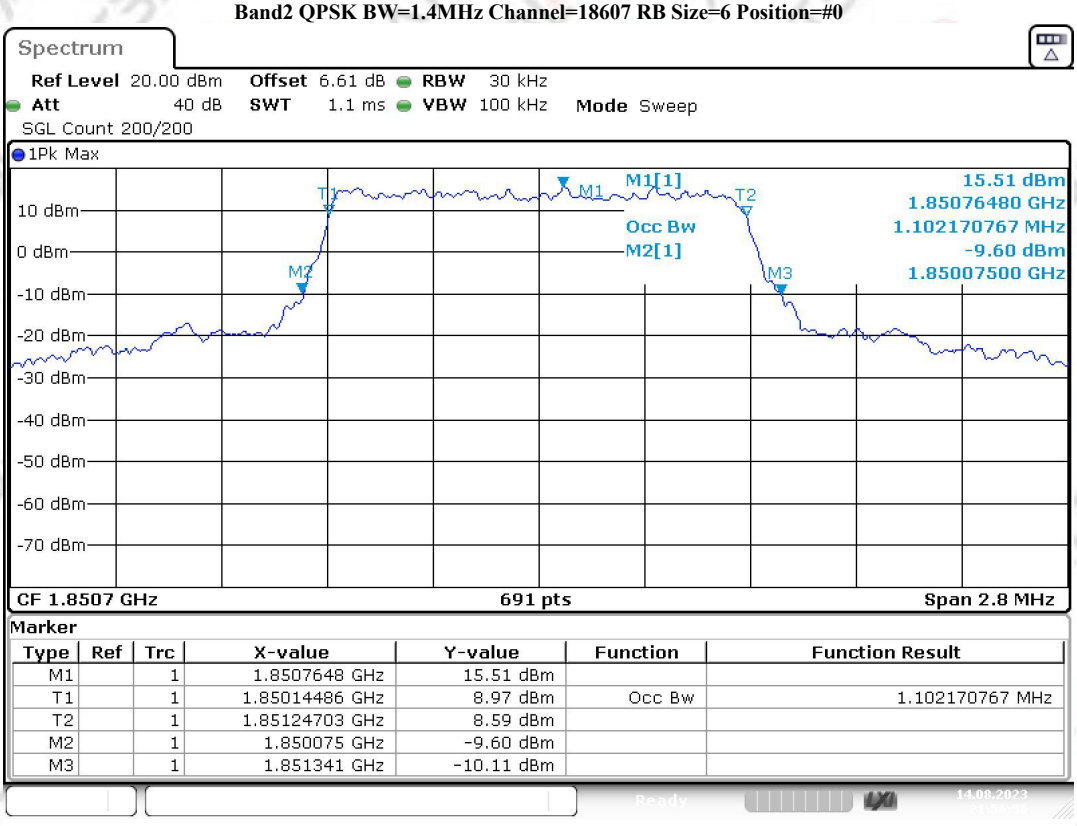
Date: 14.AUG.2023 22:17:20

Band2 QAM16 BW=5MHz Channel=19175 RB Size=25 Position=#0



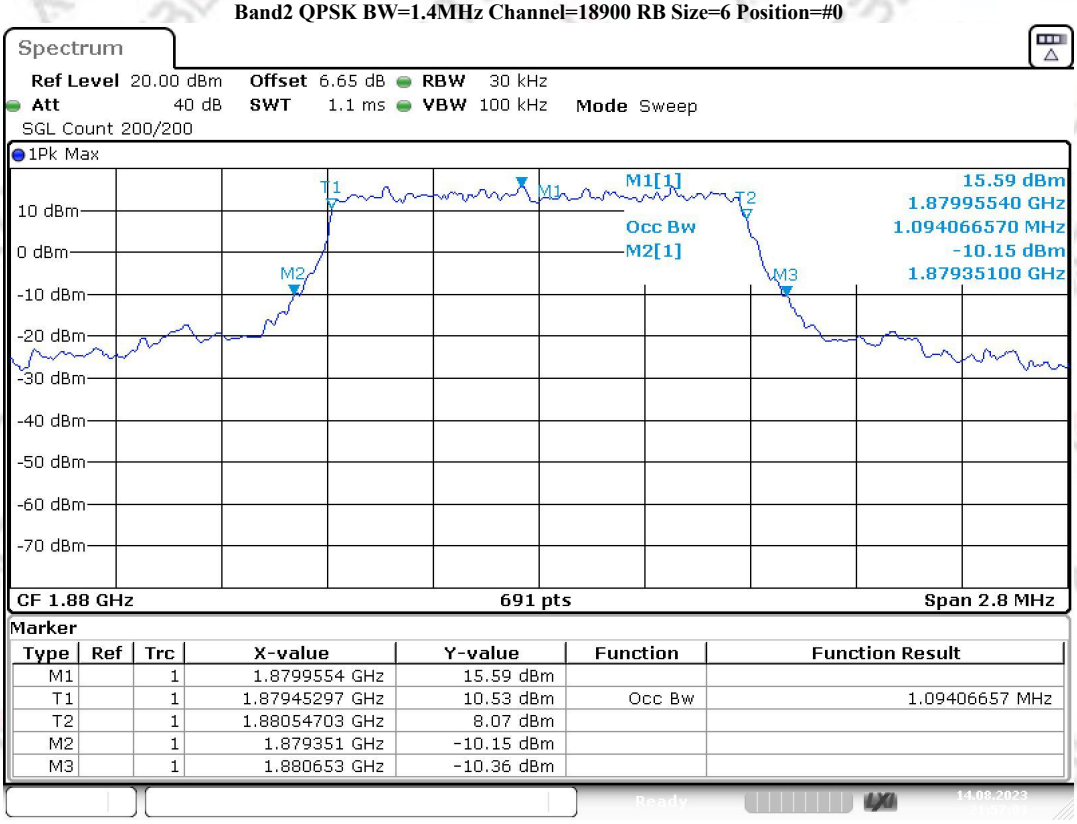
Date: 14.AUG.2023 22:17:30

Band2 QPSK BW=1.4MHz Channel=18607 RB Size=6 Position=#0



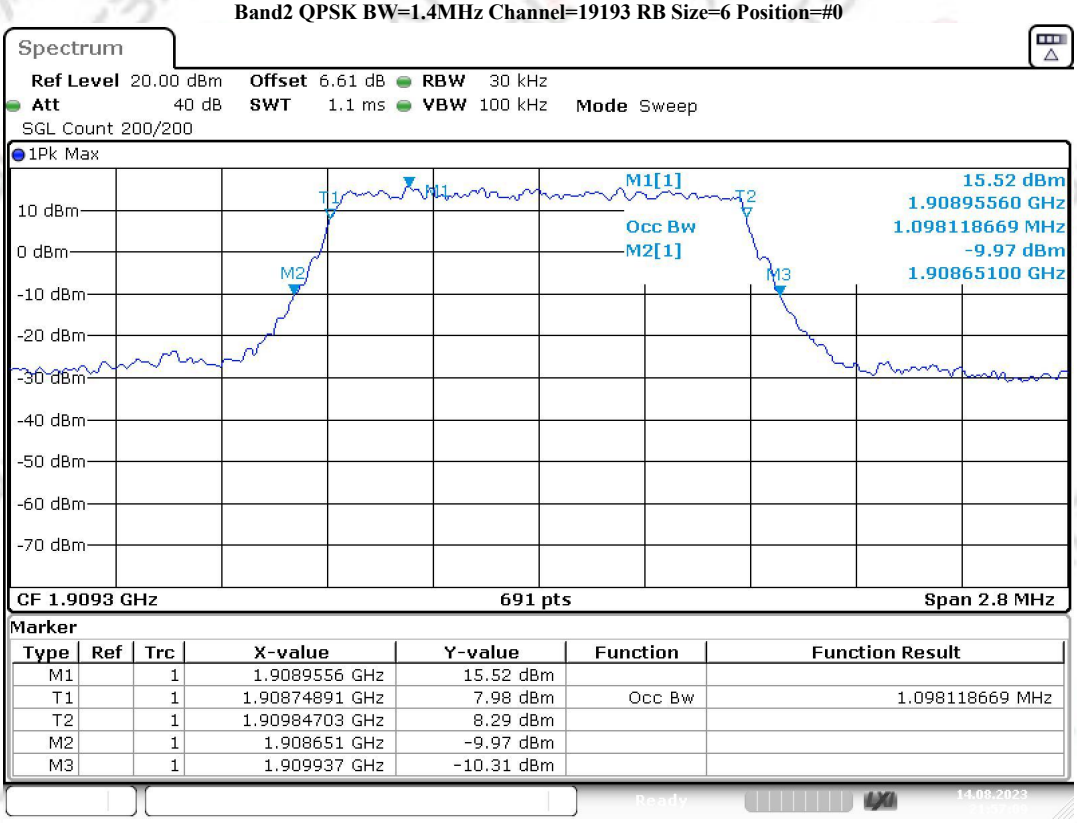
Date: 14.AUG.2023 21:56:55

Band2 QPSK BW=1.4MHz Channel=18900 RB Size=6 Position=#0



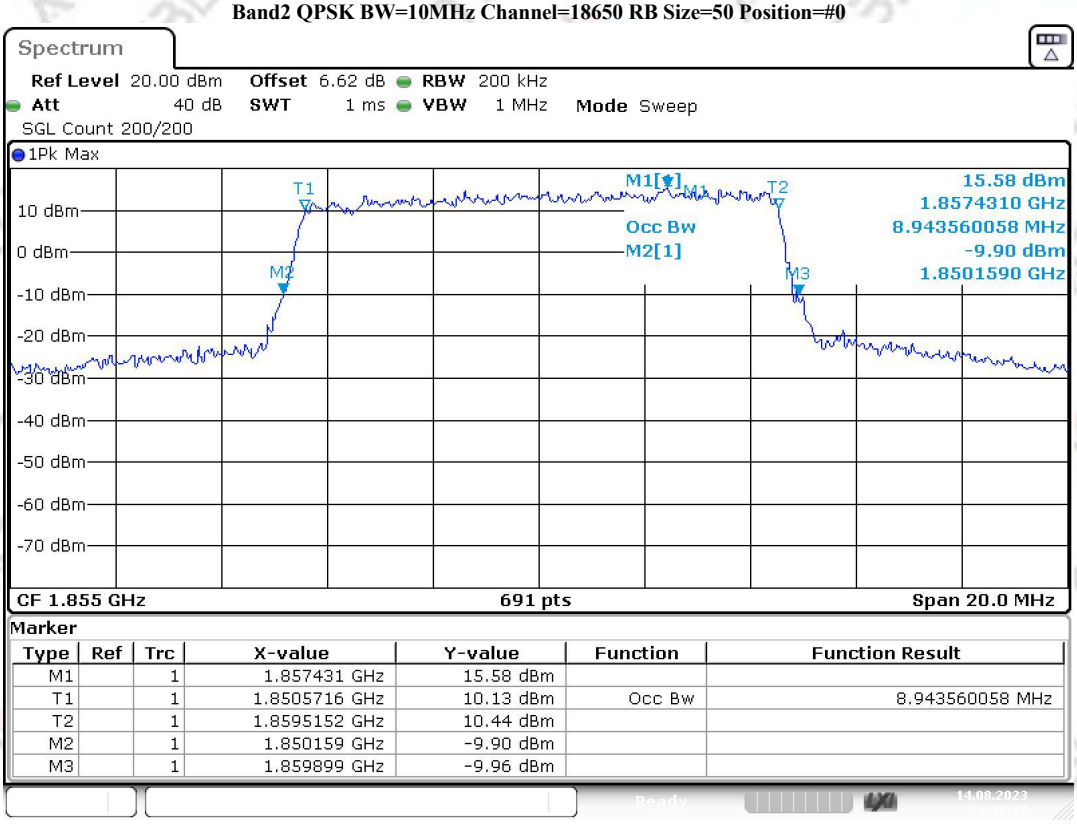
Date: 14.AUG.2023 21:57:02

Band2 QPSK BW=1.4MHz Channel=19193 RB Size=6 Position=#0



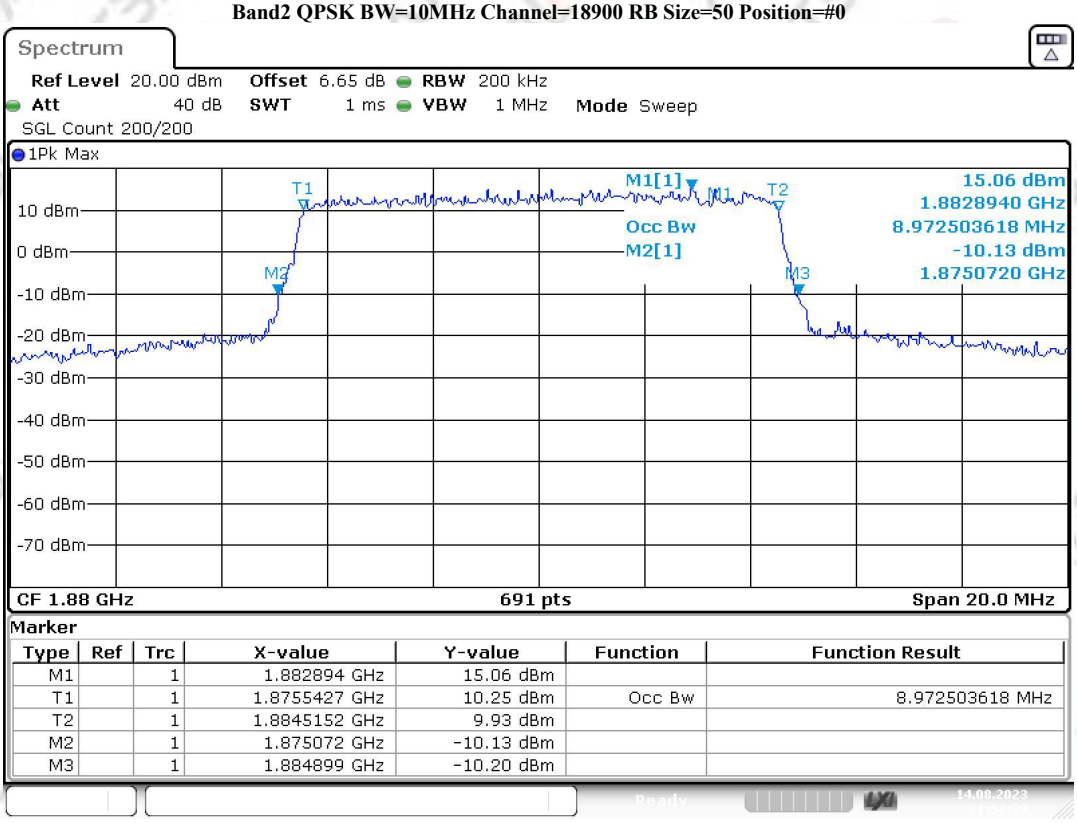
Date: 14.AUG.2023 21:57:09

Band2 QPSK BW=10MHz Channel=18650 RB Size=50 Position=#0



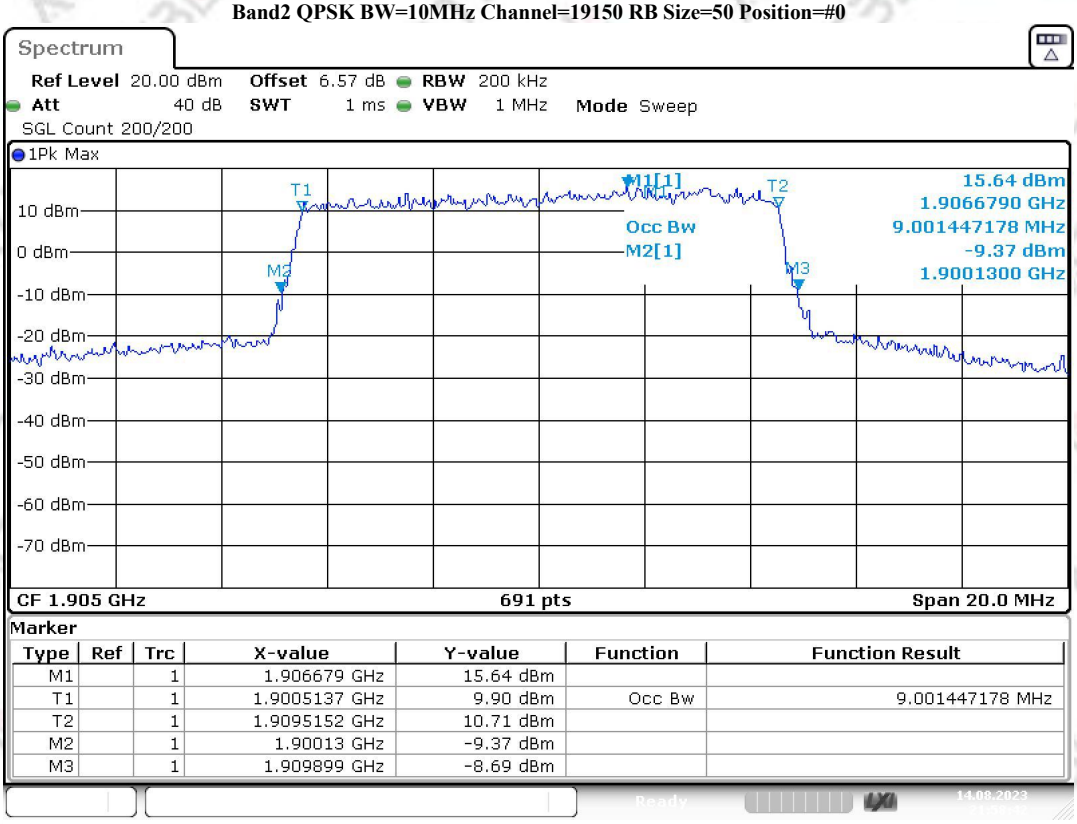
Date: 14.AUG.2023 21:58:17

Band2 QPSK BW=10MHz Channel=18900 RB Size=50 Position=#0



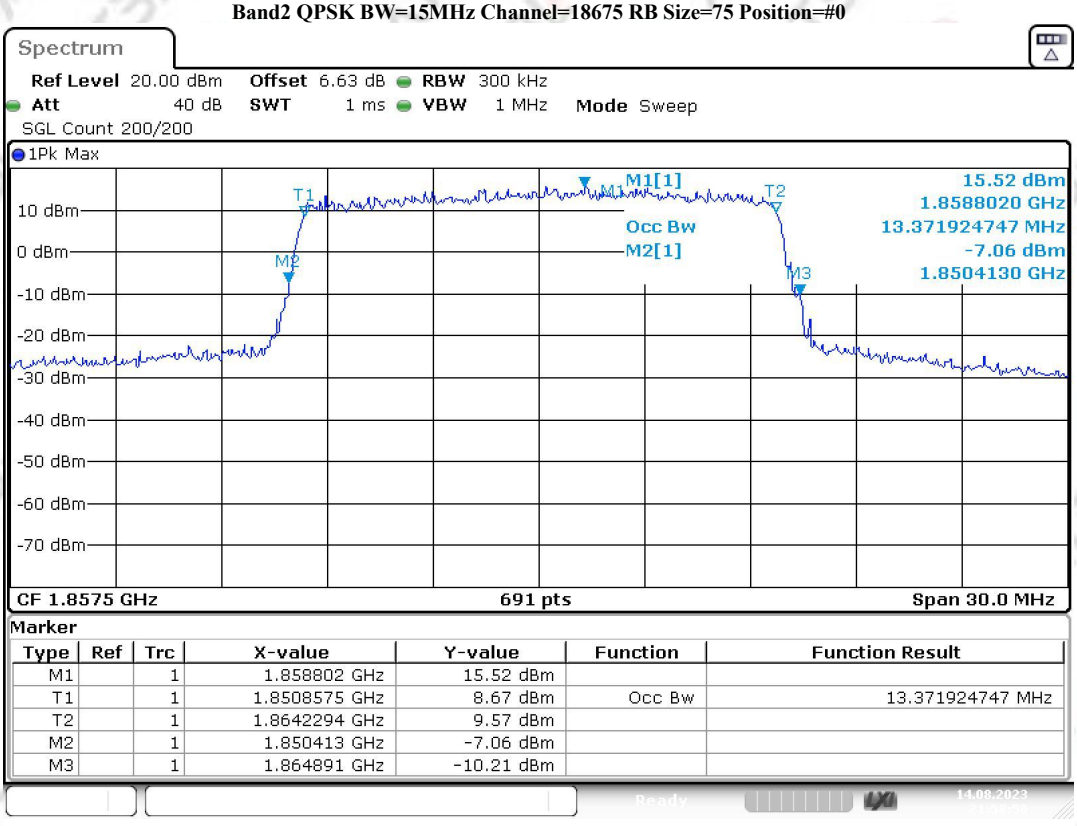
Date: 14.AUG.2023 21:58:29

Band2 QPSK BW=10MHz Channel=19150 RB Size=50 Position=#0



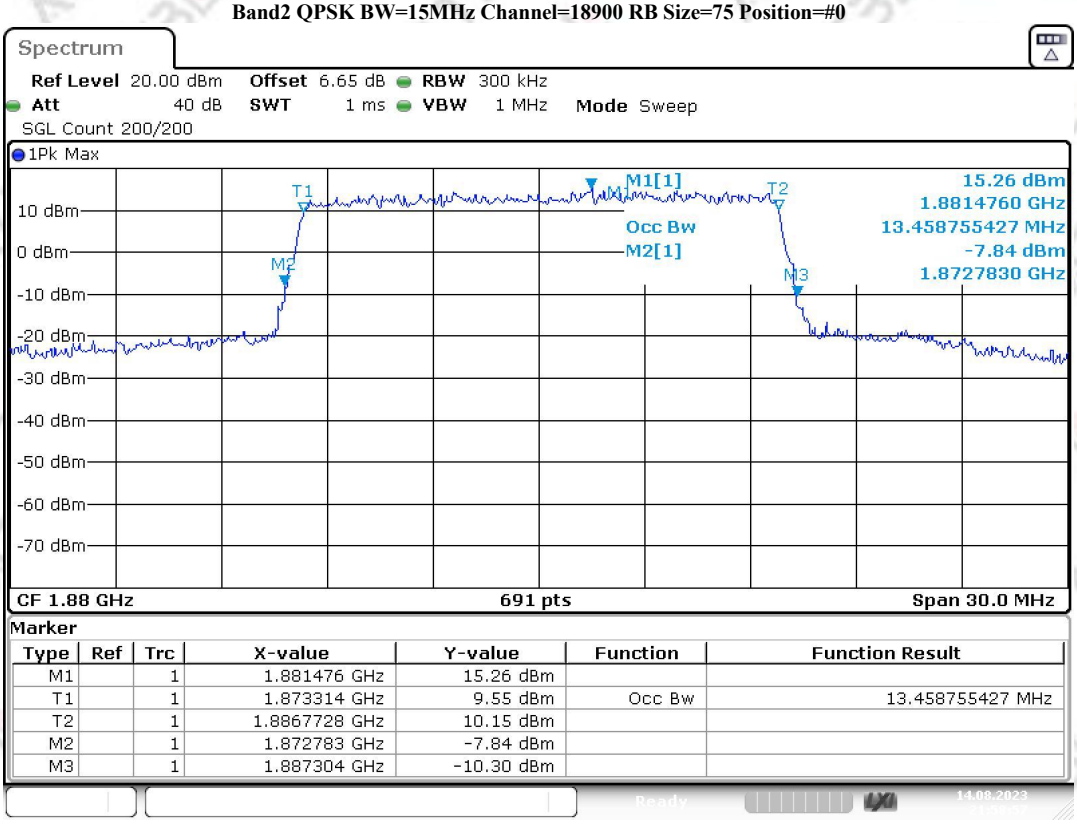
Date: 14.AUG.2023 21:58:42

Band2 QPSK BW=15MHz Channel=18675 RB Size=75 Position=#0



Date: 14.AUG.2023 21:58:51

Band2 QPSK BW=15MHz Channel=18900 RB Size=75 Position=#0

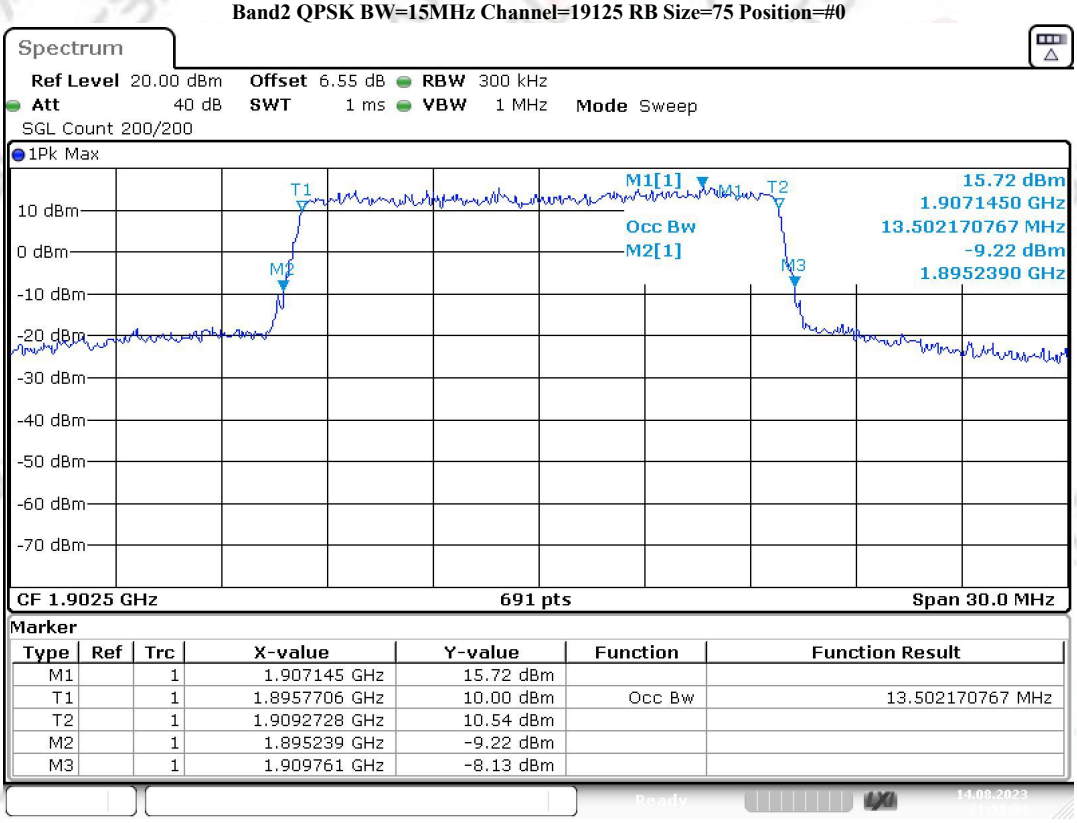


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.881476 GHz	15.26 dBm		
T1		1	1.873314 GHz	9.55 dBm	Occ Bw	13.458755427 MHz
T2		1	1.8867728 GHz	10.15 dBm		
M2		1	1.872783 GHz	-7.84 dBm		
M3		1	1.887304 GHz	-10.30 dBm		

Date: 14.AUG.2023 21:58:57

Band2 QPSK BW=15MHz Channel=19125 RB Size=75 Position=#0

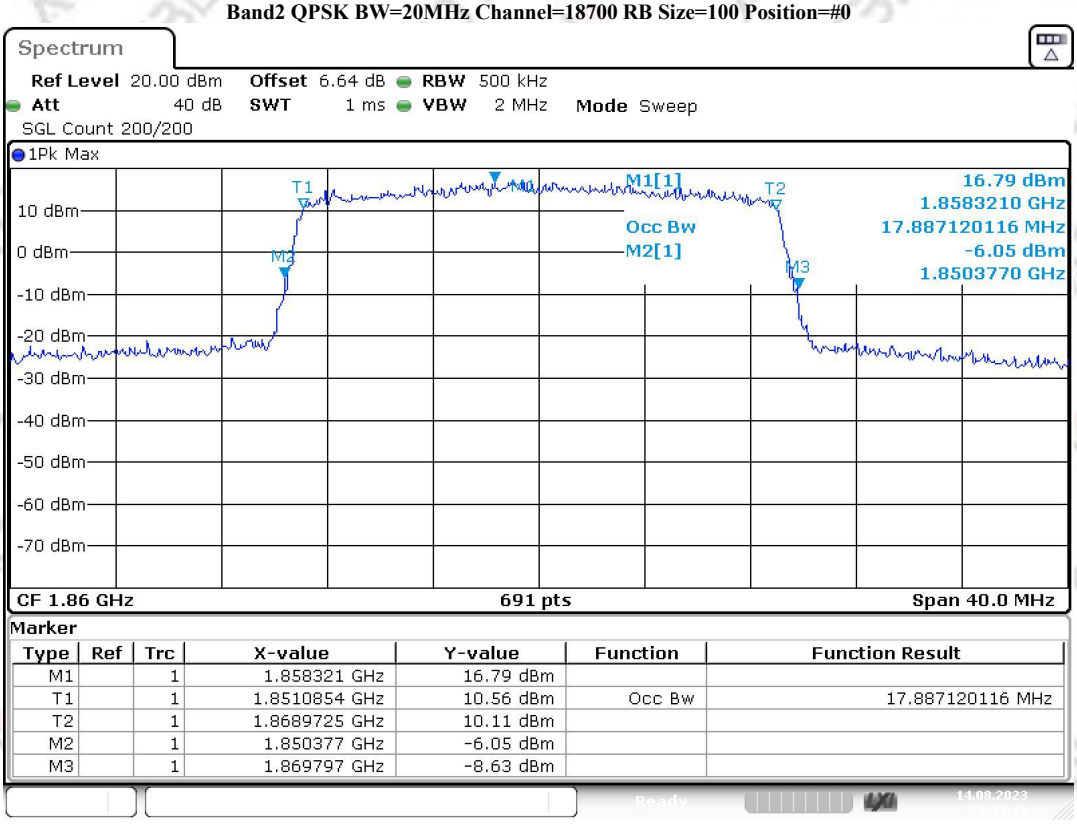


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.907145 GHz	15.72 dBm		
T1		1	1.8957706 GHz	10.00 dBm	Occ Bw	13.502170767 MHz
T2		1	1.9092728 GHz	10.54 dBm		
M2		1	1.895239 GHz	-9.22 dBm		
M3		1	1.909761 GHz	-8.13 dBm		

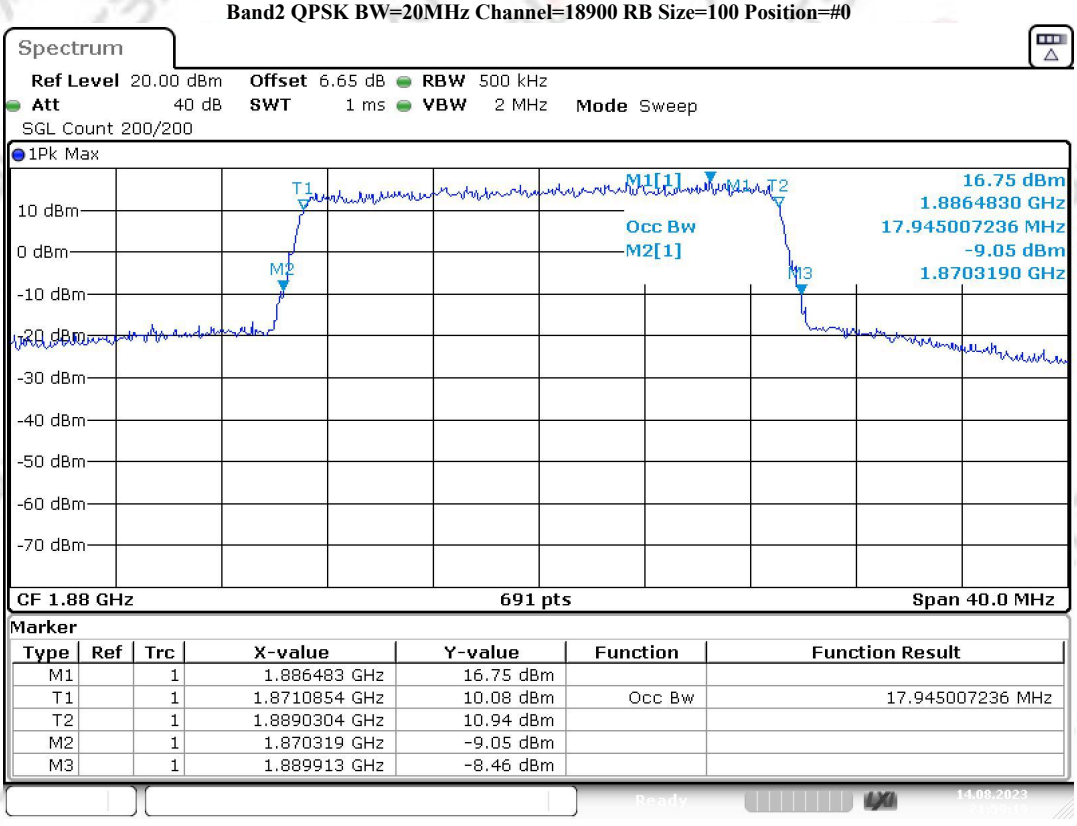
Date: 14.AUG.2023 21:59:04

Band2 QPSK BW=20MHz Channel=18700 RB Size=100 Position=#0



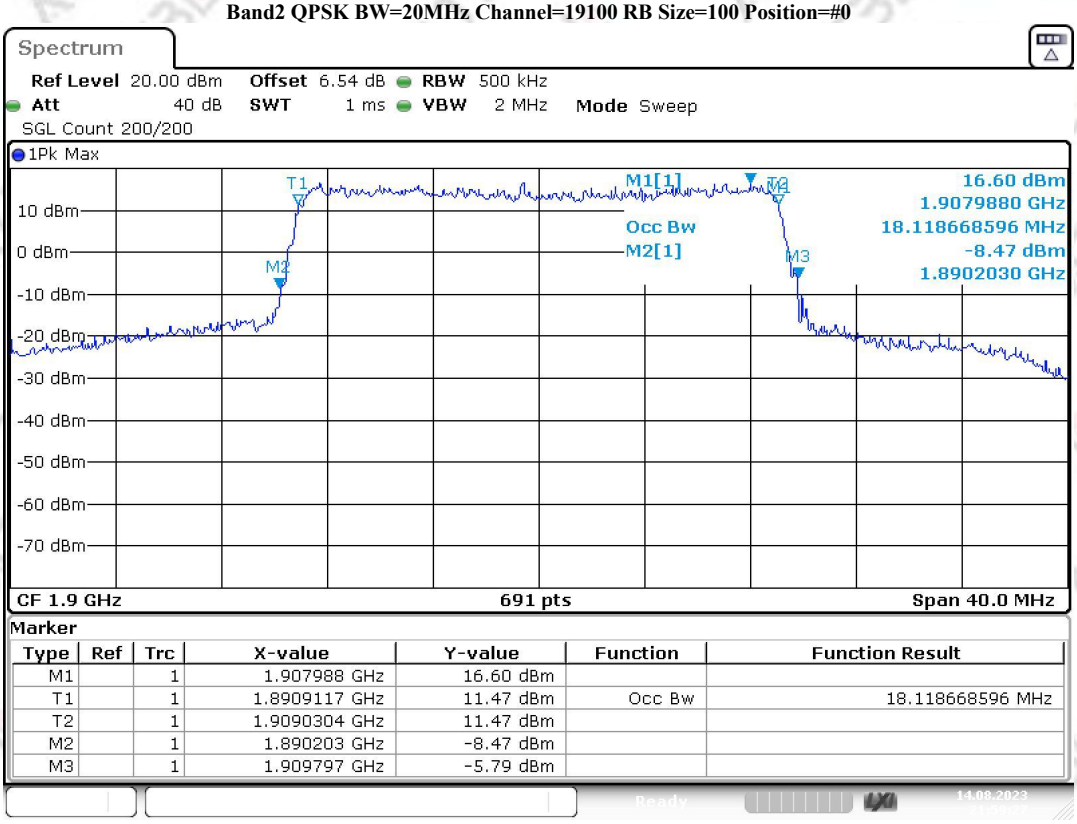
Date: 14.AUG.2023 21:59:13

Band2 QPSK BW=20MHz Channel=18900 RB Size=100 Position=#0



Date: 14.AUG.2023 21:59:20

Band2 QPSK BW=20MHz Channel=19100 RB Size=100 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.907988 GHz	16.60 dBm		
T1		1	1.8909117 GHz	11.47 dBm	Occ Bw	18.118668596 MHz
T2		1	1.9090304 GHz	11.47 dBm		
M2		1	1.890203 GHz	-8.47 dBm		
M3		1	1.909797 GHz	-5.79 dBm		

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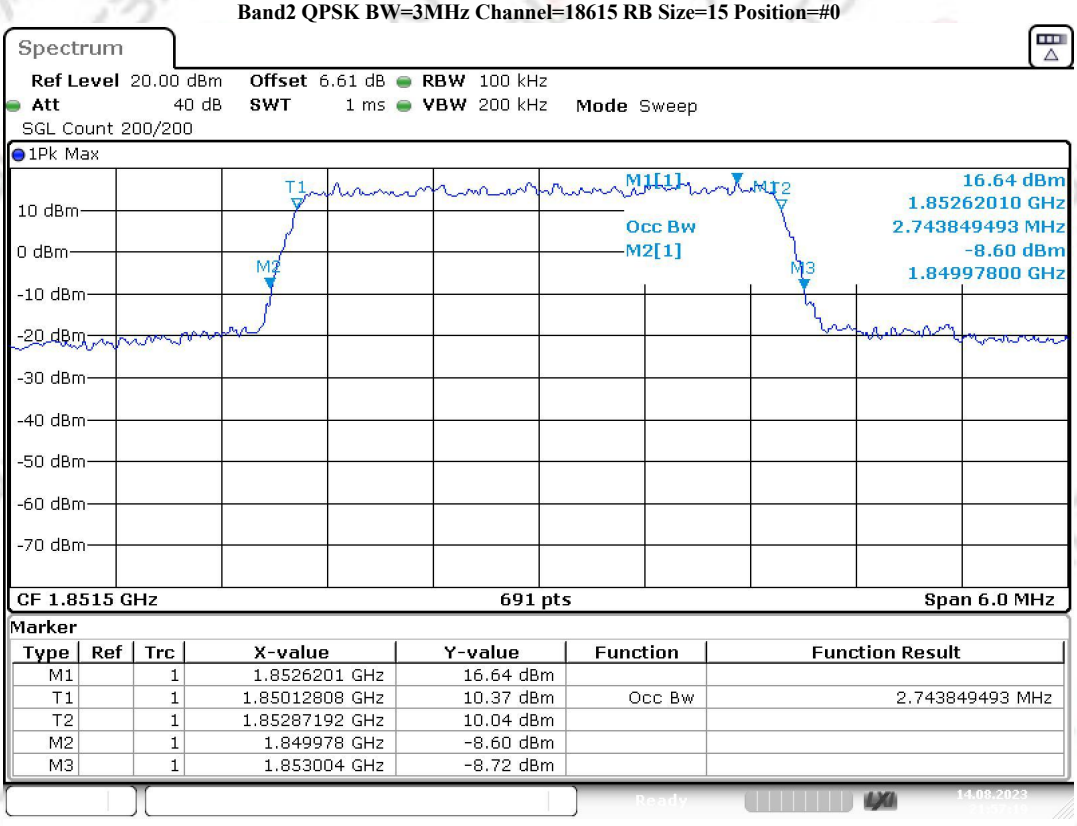
Band2 QPSK BW=3MHz Channel=18615 RB Size=15 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.8526201 GHz	16.64 dBm		
T1		1	1.85012808 GHz	10.37 dBm	Occ Bw	2.743849493 MHz
T2		1	1.85287192 GHz	10.04 dBm		
M2		1	1.849978 GHz	-8.60 dBm		
M3		1	1.853004 GHz	-8.72 dBm		

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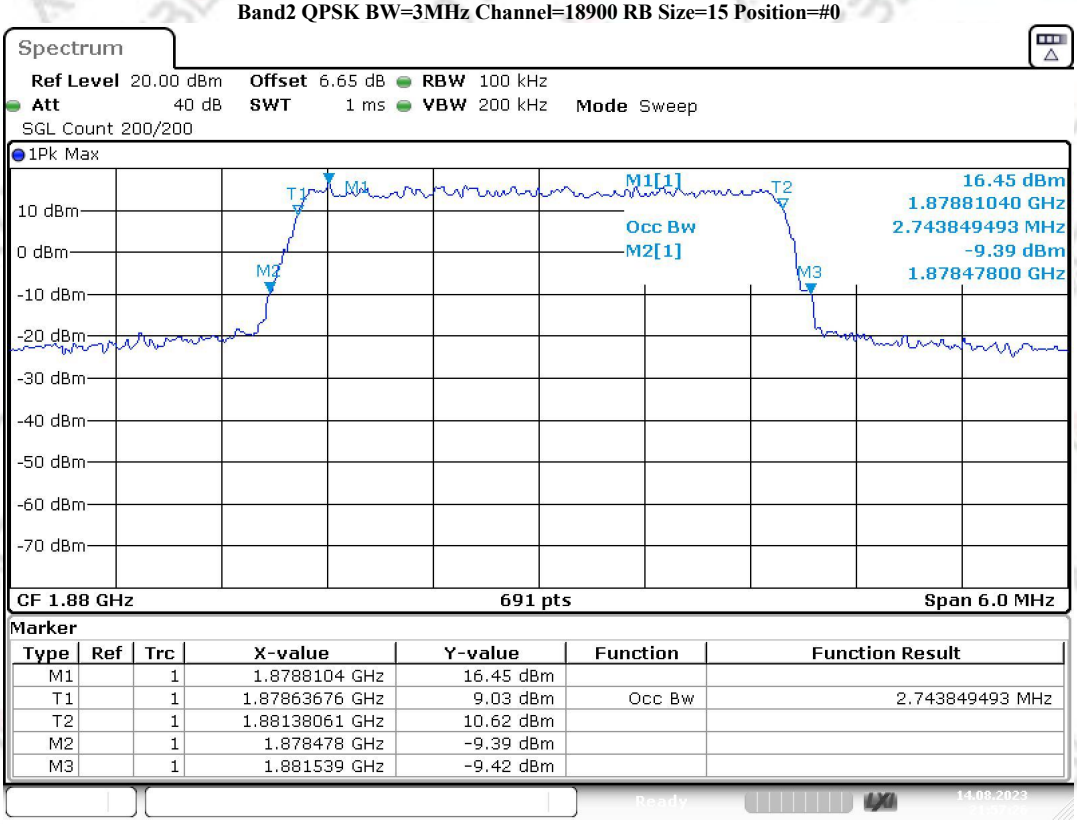
Band2 QPSK BW=3MHz Channel=18900 RB Size=15 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.8788104 GHz	16.45 dBm		
T1		1	1.87863676 GHz	9.03 dBm	Occ Bw	2.743849493 MHz
T2		1	1.88138061 GHz	10.62 dBm		
M2		1	1.878478 GHz	-9.39 dBm		
M3		1	1.881539 GHz	-9.42 dBm		

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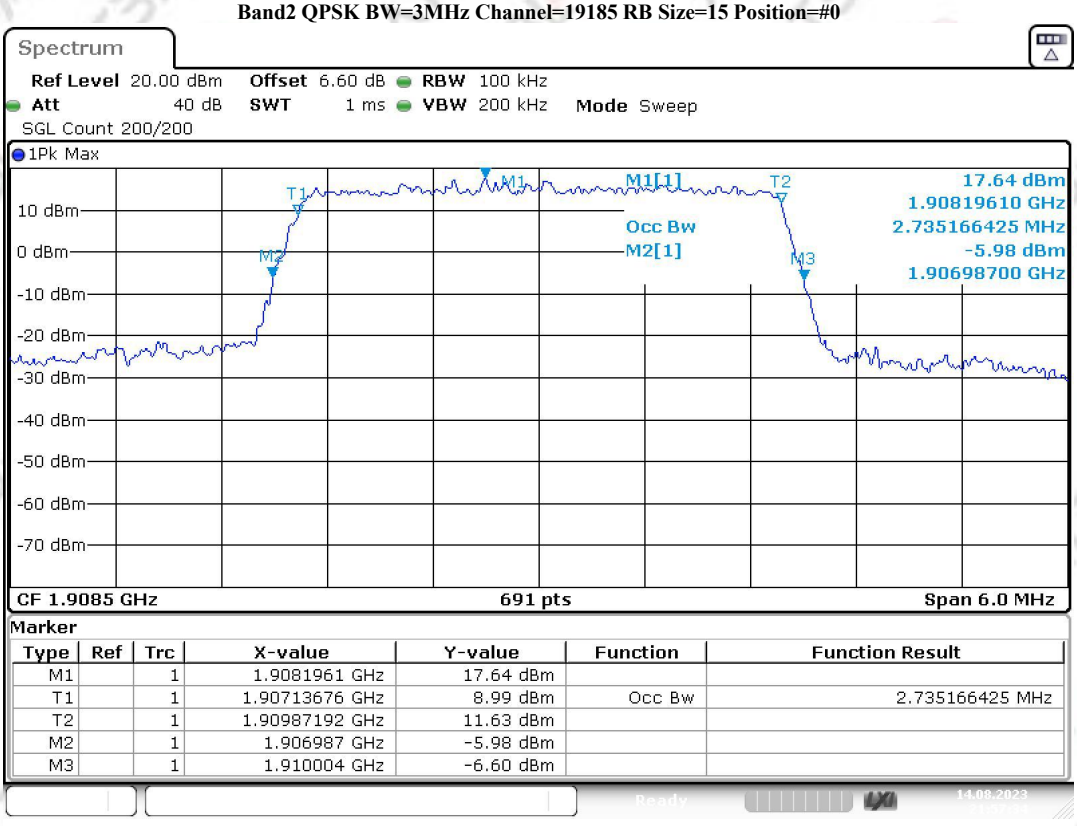
Band2 QPSK BW=3MHz Channel=19185 RB Size=15 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.9081961 GHz	17.64 dBm		
T1		1	1.90713676 GHz	8.99 dBm	Occ Bw	2.735166425 MHz
T2		1	1.90987192 GHz	11.63 dBm		
M2		1	1.906987 GHz	-5.98 dBm		
M3		1	1.910004 GHz	-6.60 dBm		

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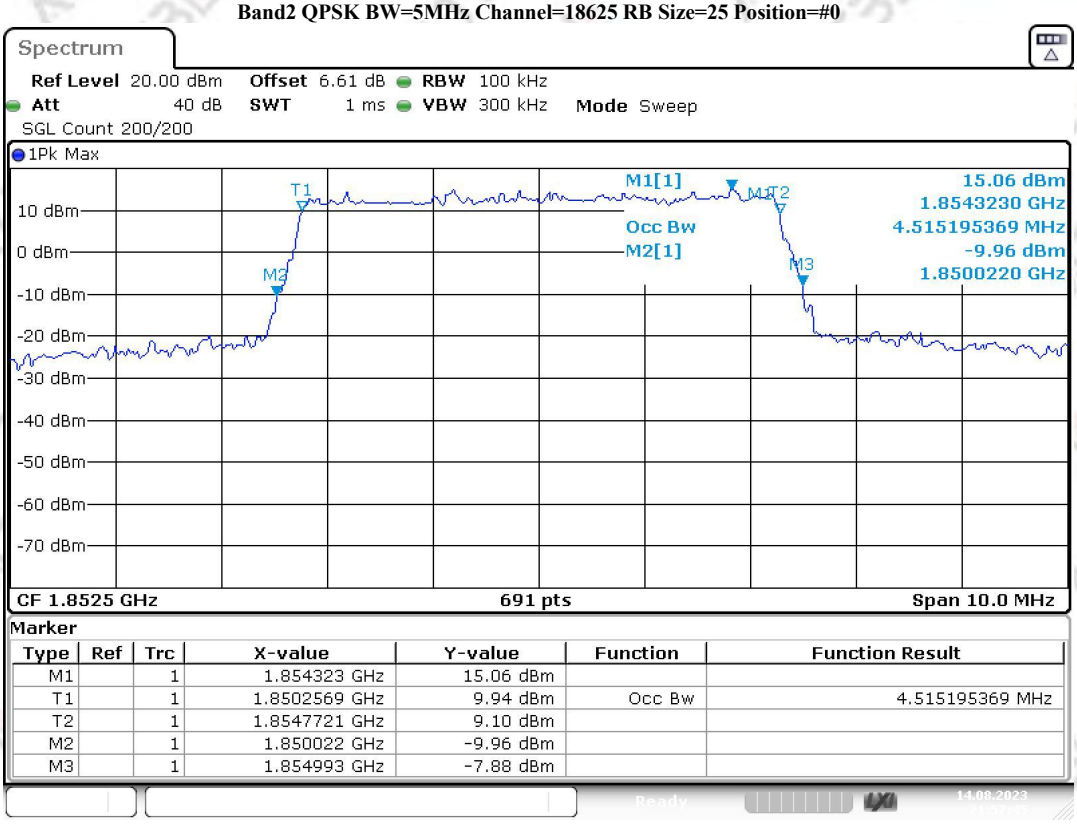
Band2 QPSK BW=5MHz Channel=18625 RB Size=25 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.854323 GHz	15.06 dBm		
T1		1	1.8502569 GHz	9.94 dBm	Occ Bw	4.515195369 MHz
T2		1	1.8547721 GHz	9.10 dBm		
M2		1	1.850022 GHz	-9.96 dBm		
M3		1	1.854993 GHz	-7.88 dBm		

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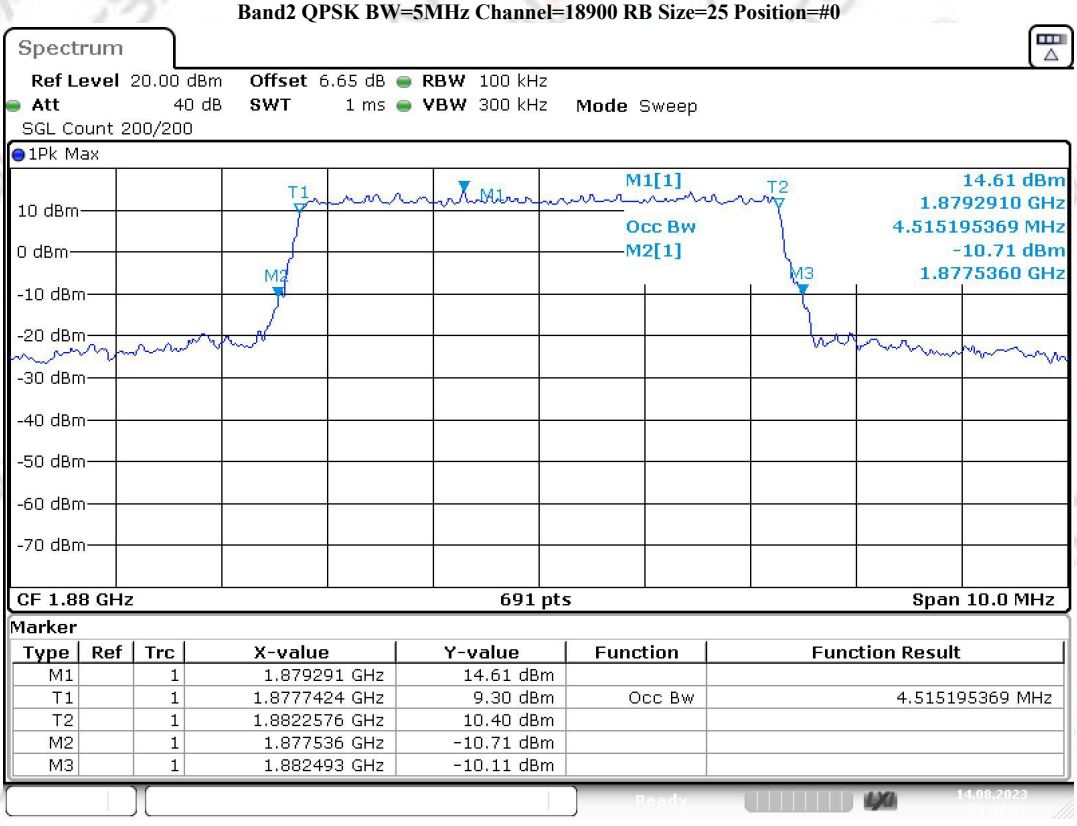
Band2 QPSK BW=5MHz Channel=18900 RB Size=25 Position=#0



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.879291 GHz	14.61 dBm		
T1		1	1.8777424 GHz	9.30 dBm	Occ Bw	4.515195369 MHz
T2		1	1.8822576 GHz	10.40 dBm		
M2		1	1.877536 GHz	-10.71 dBm		
M3		1	1.882493 GHz	-10.11 dBm		

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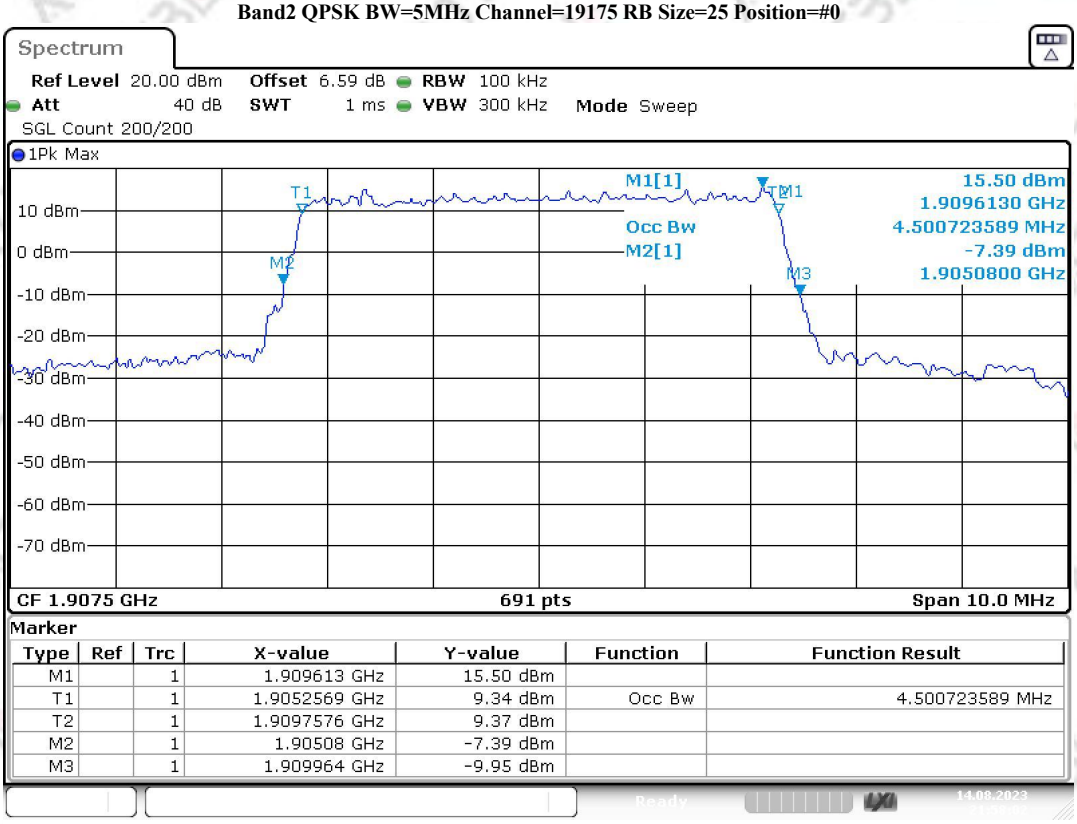
Band2 QPSK BW=5MHz Channel=19175 RB Size=25 Position=#0



Date: 14.AUG.2023 21:58:02