



# FCC RF Test Report

**APPLICANT** : Quectel Wireless Solutions Co., Ltd.  
**EQUIPMENT** : 5G Sub-6 GHz LGA Module  
**BRAND NAME** : Quectel  
**MODEL NAME** : RG500L-LA  
**FCC ID** : XMR2023RG500LLA  
**STANDARD** : 47 CFR Part 2, 22(H)  
**CLASSIFICATION** : PCS Licensed Transmitter (PCB)  
**TEST DATE(S)** : Jun. 08, 2023 ~ Jun. 27, 2023

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26-2015 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia



**Sporton International Inc. (Kunshan)**

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300  
People's Republic of China**



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### REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG2D0201-01B	Rev. 01	Initial issue of report	Jul. 10, 2023



### SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.2	§2.1046	Conducted Output Power	-	Report Only	-
	§22.913(a)(5)	Effective Radiated Power (Band 5)	ERP < 7 Watt	PASS	-
3.5	N/A	Peak-to-Average Ratio	<13 dB	PASS	-
3.6	§2.1049	Occupied Bandwidth	-	Report Only	-
3.7	§2.1051 §22.917(a)	Conducted Band Edge Measurement (Band 5)	< 43+10log <sub>10</sub> (P[Watts])	PASS	-
3.8	§2.1051 §22.917(a)	Conducted Spurious Emission (Band 5)	< 43+10log <sub>10</sub> (P[Watts])	PASS	-
3.9	§2.1055 §22.355	Frequency Stability Temperature & Voltage	< 2.5 ppm	PASS	-
0	§2.1053 §22.917(a)	Radiated Spurious Emission (Band 5)	< 43+10log <sub>10</sub> (P[Watts])	PASS	Under limit 46.29 dB at 2496.00 MHz

**Conformity Assessment Condition:**

- The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
- The measurement uncertainty please refer to each test result in the section "Measurement Uncertainty"

**Disclaimer:**

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.



# 1 General Description

## 1.1 Applicant

**Quectel Wireless Solutions Co., Ltd.**

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

## 1.2 Manufacturer

**Quectel Wireless Solutions Co., Ltd.**

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

## 1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	5G Sub-6 GHz LGA Module
Brand Name	Quectel
Model Name	RG500L-LA
FCC ID	XMR2023RG500LLA
IMEI Code	Conducted: 863221060013834 Radiation: 863221060013578
HW Version	R1.0
SW Version	RG500LLA00AAR01A05E8_OCPU
EUT Stage	Identical Prototype

## 1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	LTE Band 5 : 824 MHz ~ 849 MHz
Rx Frequency	LTE Band 5 : 869 MHz ~ 894 MHz
Bandwidth	LTE Band 5 : 1.4MHz / 3MHz / 5MHz / 10MHz
Maximum Output Power to Antenna	LTE Band 5 : 23.01 dBm
Antenna Gain	LTE Band 5 : -10.68 dBi
Type of Modulation	QPSK / 16QAM / 64QAM / 256QAM

## 1.5 Modification of EUT

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



### 1.6 Maximum Conducted Power and Emission Designator

LTE Band 5		QPSK		16QAM/64QAM/256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum Conducted power (W)	Emission Designator (99%OBW)	Maximum Conducted power (W)	Emission Designator (99%OBW)
1.4	824.7 ~ 848.3	0.1866	1M09G7D	0.1581	1M09W7D
3	825.5 ~ 847.5	0.1832	2M70G7D	0.1596	2M72W7D
5	826.5 ~ 846.5	0.1866	4M50G7D	0.1574	4M50W7D
10	829.0 ~ 844.0	0.2000	8M99G7D	0.1600	9M01W7D

Note: All modulations have been tested, and only the worst test results of PSK & QAM are shown in the report.

### 1.7 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH04-KS TH01-KS	CN1257	314309

### 1.8 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24al



## 1.9 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)
- ♦ 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

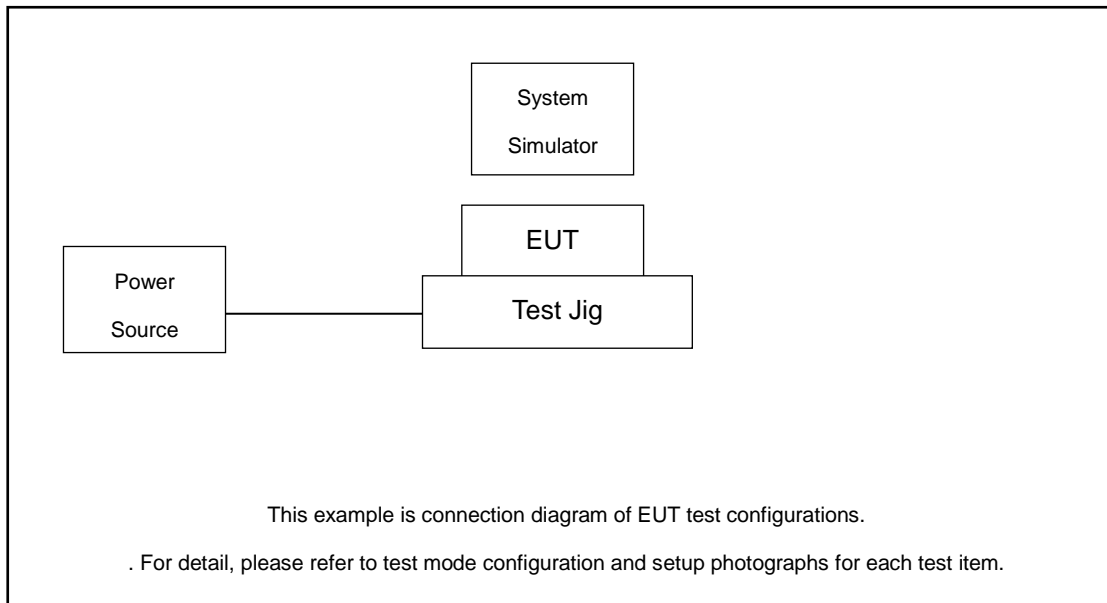
Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas License Digital Systems v03r01 with maximum output power.

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission. (Y-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	5	v	v	v	v	-	-	v	v	v	v	v		v	v	v	v	
Peak-to-Average Ratio	5				v	-	-	v	v	v	v			v		v		
26dB and 99% Bandwidth	5	v	v	v	v	-	-	v	v					v		v		
Conducted Band Edge	5	v	v	v	v	-	-	v	v	v	v	v		v	v		v	
Conducted Spurious Emission	5	v	v	v	v	-	-	v					v			v	v	v
Frequency Stability	5				v	-	-	v						v		v		
E.R.P	5	v	v	v	v	-	-	v	v	v	v	v		v	v	v	v	
Radiated Spurious Emission	5	Worst Case														v		
Note	1. The mark "v " means that this configuration is chosen for testing 2. The mark "- " means that this bandwidth is not supported. 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.																	



## 2.2 Connection Diagram of Test System



## 2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	Power Supply	GWINSTEK	PSS-2002	N/A	N/A	Unshielded, 1.8 m
2.	Base Station	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
3.	Test Jig	Quectel	N/A	N/A	N/A	N/A
4.	Adapter	N/A	N/A	N/A	N/A	N/A

## 2.4 Measurement Results Explanation Example

### For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss.

$$\text{Offset} = \text{RF cable loss.}$$

Following shows an offset computation example with cable loss 4.8 dB.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 4.8 \text{ (dB)} \end{aligned}$$



## 2.5 Frequency List of Low/Middle/High Channels

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

### 3 Conducted Test Items

#### 3.1 Measuring Instruments

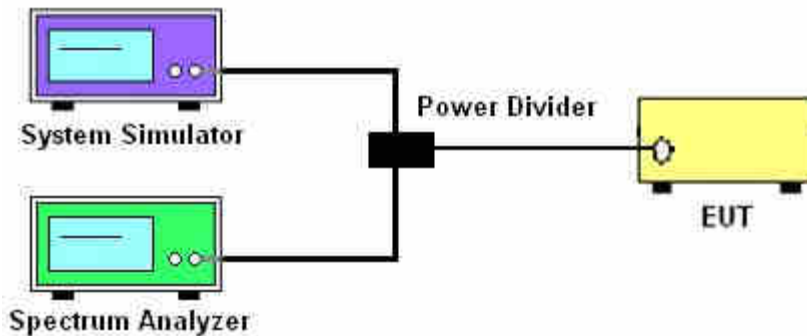
See list of measuring instruments of this test report.

#### 3.2 Test Setup

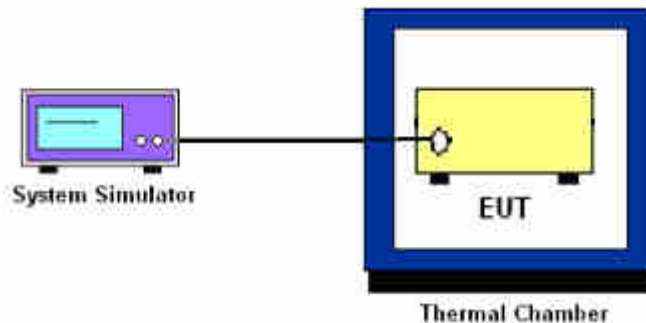
##### 3.2.1 Conducted Output Power



##### 3.2.2 Peak-to-Average Ratio, Occupied Bandwidth ,Conducted Band-Edge and Conducted Spurious Emission



##### 3.2.3 Frequency Stability



### 3.3 Test Result of Conducted Test

Please refer to Appendix A.



### 3.4 Conducted Output Power and ERP

#### 3.4.1 Description of the Conducted Output Power Measurement and ERP 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.

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

#### 3.4.2 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.



## **3.5 Peak-to-Average Ratio**

### **3.5.1 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.

### **3.5.2 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.



### 3.6 Occupied Bandwidth

#### 3.6.1 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.

#### 3.6.2 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.



### 3.7 Conducted Band Edge

#### 3.7.1 Description of Conducted Band Edge Measurement

22.917(a)

For operations in the 824 – 849 MHz band, the FCC limit is  $43 + 10\log_{10}(P[\text{Watts}])$  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.

#### 3.7.2 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  $\geq$  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  $43 + 10\log(P)$ dB below the transmitter power P(Watts)  
 $= P(W) - [43 + 10\log(P)]$  (dB)  
 $= [30 + 10\log(P)]$  (dBm) -  $[43 + 10\log(P)]$  (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.



### 3.8 Conducted Spurious Emission

#### 3.8.1 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 10<sup>th</sup> harmonic.

#### 3.8.2 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  $43 + 10\log(P)$ dB below the transmitter power P(Watts)  
=  $P(W) - [43 + 10\log(P)]$  (dB)  
=  $[30 + 10\log(P)]$  (dBm) -  $[43 + 10\log(P)]$  (dB)  
= -13dBm.





## 3.9 Frequency Stability

### 3.9.1 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  $\pm 0.00025\%$  ( $\pm 2.5\text{ppm}$ ) of the center frequency.

### 3.9.2 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  $-30^{\circ}\text{C}$  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  $10^{\circ}\text{C}$  step up to  $50^{\circ}\text{C}$ . 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.

### 3.9.3 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  $20\pm 5^{\circ}\text{C}$  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.

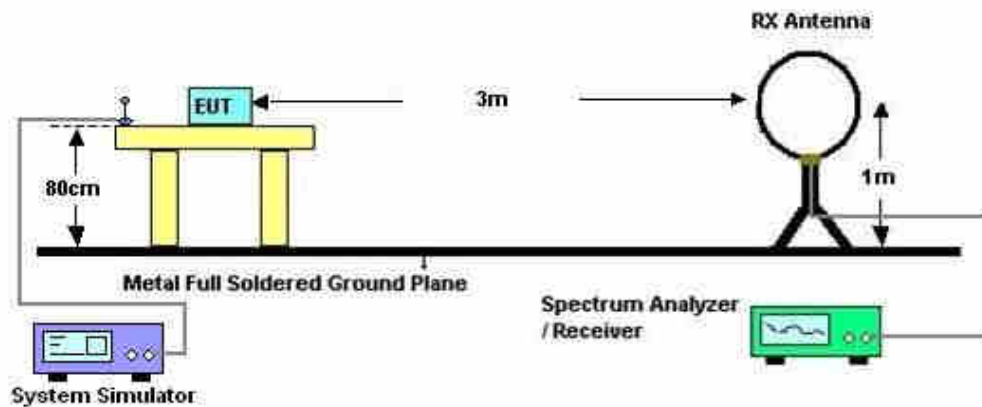
## 4 Radiated Test Items

### 4.1 Measuring Instruments

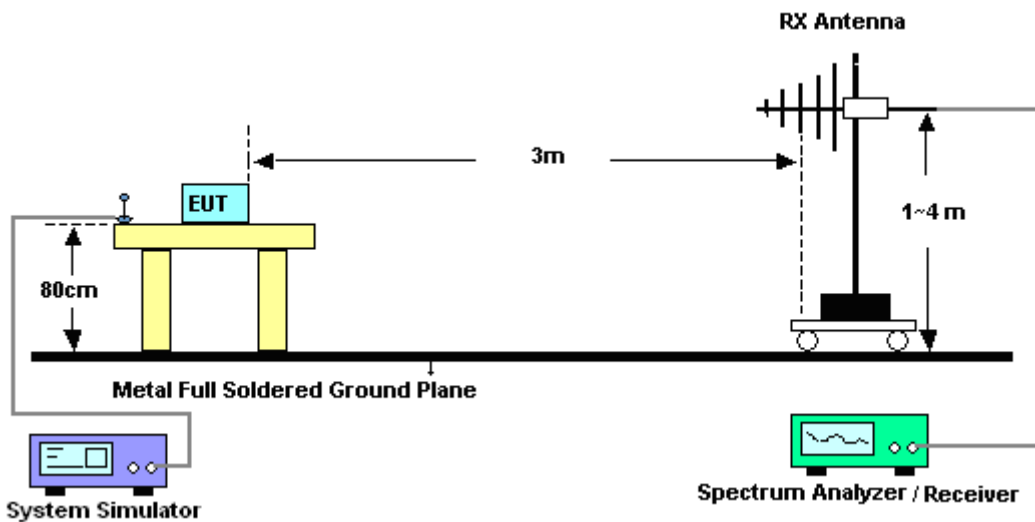
See list of measuring instruments of this test report.

### 4.2 Test Setup

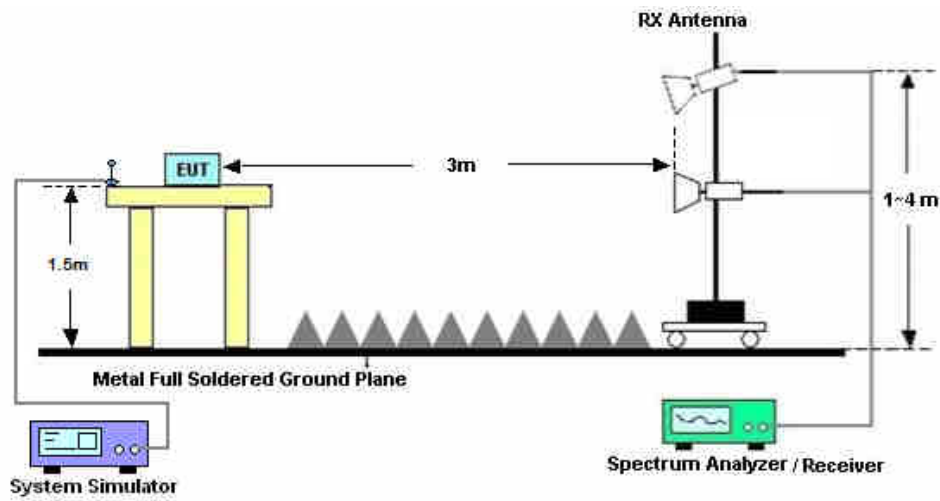
#### 4.2.1 For radiated test below 30MHz



#### 4.2.2 For radiated test from 30MHz to 1GHz



#### 4.2.3 For radiated test above 1GHz



#### 4.3 Test Result of Radiated Test

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

Please refer to Appendix B.



## 4.4 Radiated Spurious Emission

### 4.4.1 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.

### 4.4.2 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  $43 + 10\log(P)$ dB below the transmitter power P(Watts)  
=  $P(W) - [43 + 10\log(P)] (dB)$   
=  $[30 + 10\log(P)] (dBm) - [43 + 10\log(P)] (dB)$   
= -13dBm.



## 5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 12, 2022	Jun. 14, 2023~ Jun. 27, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Power divider	STI	STI08-0055	-	0.5~40GHz	NCR	Jun. 14, 2023~ Jun. 27, 2023	NCR	Conducted (TH01-KS)
Temperature & humidity chamber	Hongzhan	LP-150U	H2014011440	-40~+150°C 20%~95%RH	Jul. 15, 2022	Jun. 14, 2023~ Jun. 27, 2023	Jul. 14, 2023	Conducted (TH01-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY57471079	10Hz-44G,MAX 30dB	Oct. 12, 2022	Jun. 08, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Jun. 08, 2023	Oct. 15, 2023	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	May 23, 2023	Jun. 08, 2023	May 22, 2024	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1284	1GHz~18GHz	Oct. 16, 2022	Jun. 08, 2023	Oct. 15, 2023	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 08, 2023	Jun. 08, 2023	Jan. 07, 2024	Radiation (03CH04-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	May 23, 2023	Jun. 08, 2023	May 22, 2024	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40G GA	060728	18~40GHz	Jan. 05, 2023	Jun. 08, 2023	Jan. 04, 2024	Radiation (03CH04-KS)
high gain Amplifier	EM	EM01G18G A	060840	1Ghz-18Ghz	Oct. 12, 2022	Jun. 08, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
Amplifier	Agilent	8449B	3008A02370	1Ghz-18Ghz	Oct. 12, 2022	Jun. 08, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jun. 08, 2023	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jun. 08, 2023	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jun. 08, 2023	NCR	Radiation (03CH04-KS)

NCR: No Calibration Required



## 6 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26-2015. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

### Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.46 dB
Conducted Emissions	±2.26 dB
Occupied Channel Bandwidth	±0.1 %

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.82 dB
---------------------------------------------------------------------	---------

### Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.56 dB
---------------------------------------------------------------------	---------

### Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.54 dB
---------------------------------------------------------------------	---------



### Appendix A. Test Results of Conducted Test

Test Engineer :	Simle Wang	Temperature :	22~23°C
		Relative Humidity :	40~42%

### Conducted Output Power(Average power) and ERP

#### LTE Band 5:

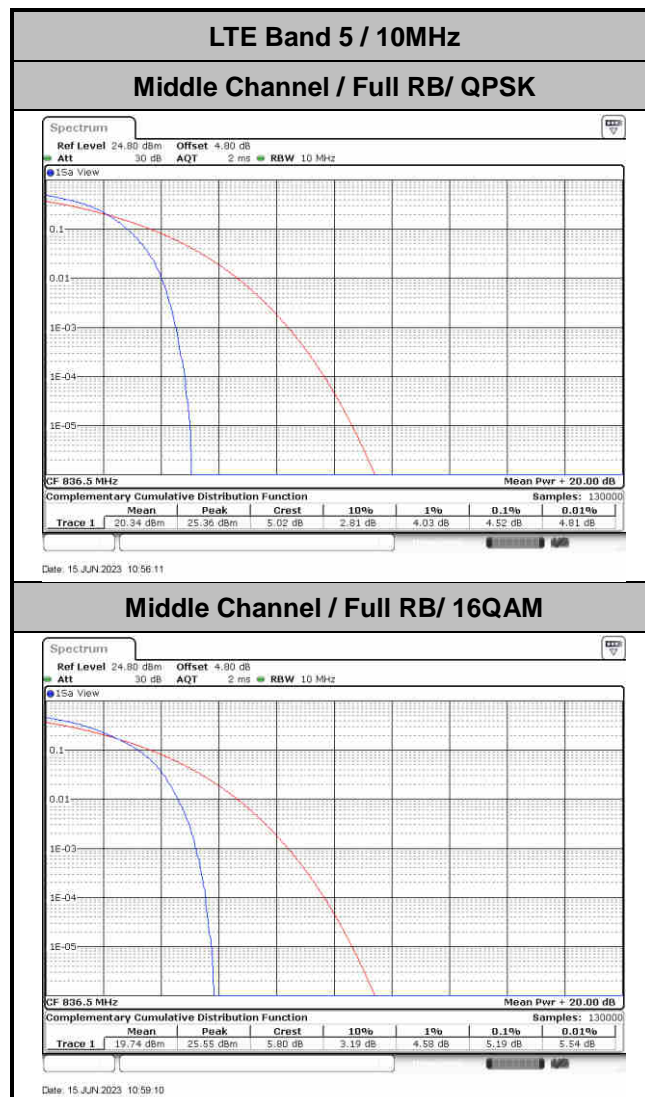
BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	ERP		
Channel				20450	20525	20600	ERP		
Frequency (MHz)				829	836.5	844	L	M	H
10	QPSK	1	0	22.69	22.83	22.81	0.0097	0.0100	0.0100
10	QPSK	1	49	22.76	23.01	22.71	0.0098	0.0104	0.0097
10	QPSK	50	0	21.90	22.12	21.92	0.0081	0.0085	0.0081
10	16QAM	1	0	22.04	21.99	21.93	0.0083	0.0082	0.0081
10	64QAM	1	0	20.87	20.79	20.74	0.0064	0.0063	0.0062
10	256QAM	1	0	17.84	18.12	17.85	0.0032	0.0034	0.0032
Channel				20425	20525	20625	ERP		
Frequency (MHz)				826.5	836.5	846.5	L	M	H
5	QPSK	1	0	22.67	22.71	22.69	0.0096	0.0097	0.0097
5	16QAM	1	0	21.94	21.97	21.94	0.0081	0.0082	0.0081
Channel				20415	20525	20635	ERP		
Frequency (MHz)				825.5	836.5	847.5	L	M	H
3	QPSK	1	0	22.59	22.63	22.61	0.0095	0.0095	0.0095
3	16QAM	1	0	21.94	22.03	21.92	0.0081	0.0083	0.0081
Channel				20407	20525	20643	ERP		
Frequency (MHz)				824.7	836.5	848.3	L	M	H
1.4	QPSK	1	0	22.61	22.71	22.70	0.0095	0.0097	0.0097
1.4	16QAM	1	0	21.86	21.99	21.92	0.0080	0.0082	0.0081



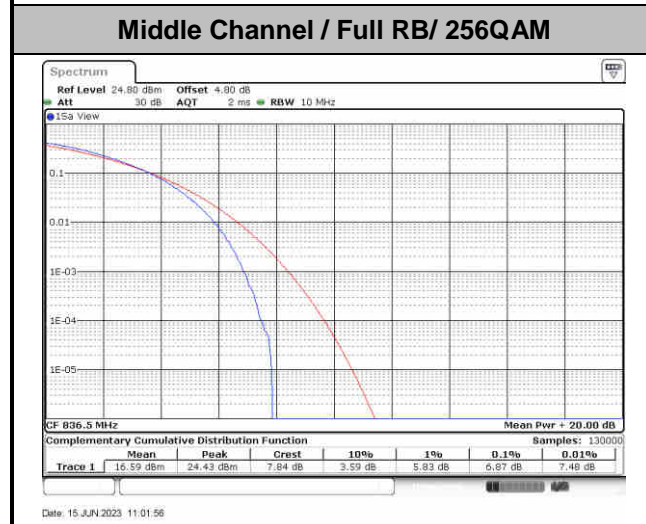
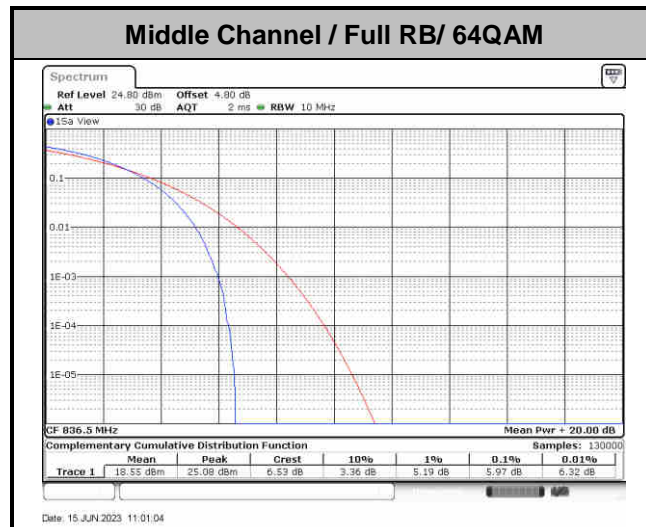
# LTE Band 5

## Peak-to-Average Ratio

Mode	LTE Band 5 / 10MHz				
Mod.	QPSK	16QAM	64QAM	256QAM	Limit: 13dB
RB Size	Full RB	Full RB	Full RB	Full RB	Result
Middle CH	4.52	5.19	5.97	6.87	PASS



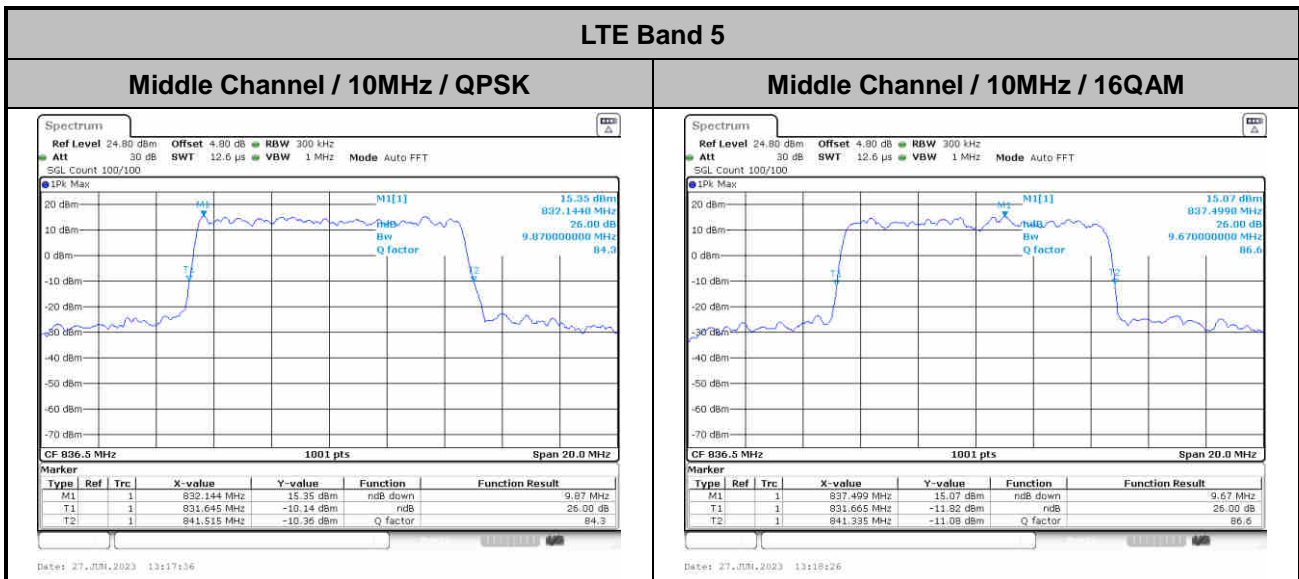






**26dB Bandwidth**

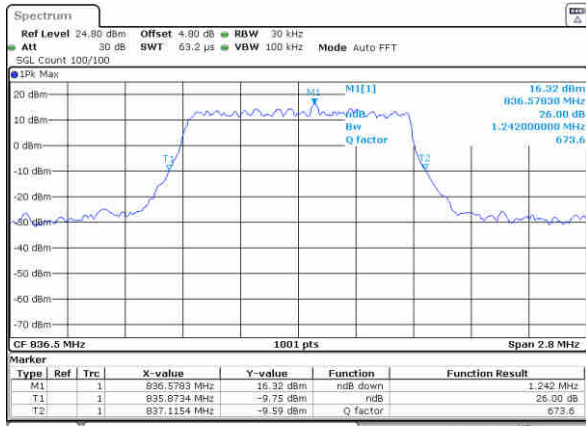
Mode	LTE Band 5 : 26dB BW(MHz)	
BW	1.4MHz	
Mod.	QPSK	16QAM
Middle CH	1.24	1.29
BW	3MHz	
Mod.	QPSK	16QAM
Middle CH	2.99	2.95
BW	5MHz	
Mod.	QPSK	16QAM
Middle CH	4.84	4.86
BW	10MHz	
Mod.	QPSK	16QAM
Middle CH	9.87	9.67





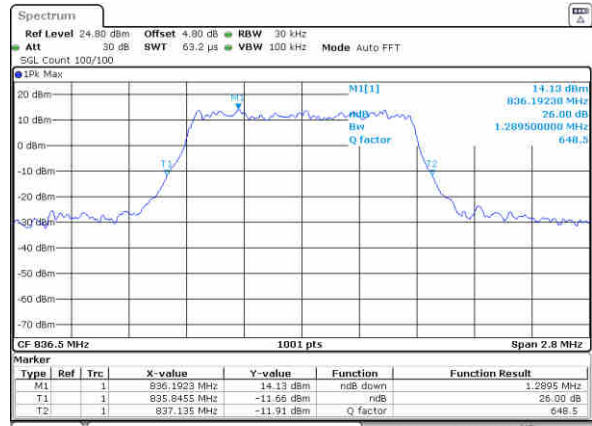
LTE Band 5

Middle Channel / 1.4MHz / QPSK



Date: 27-Jul-2023 12:03:56

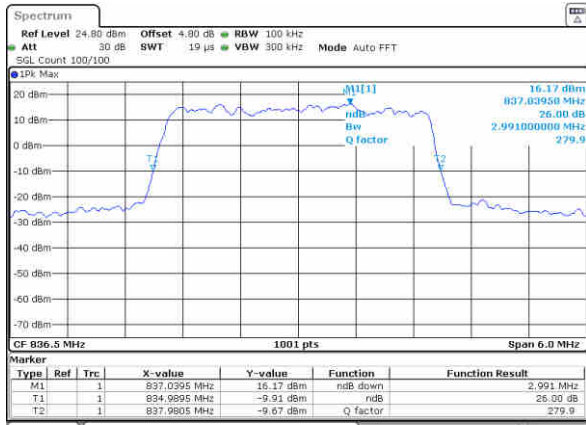
Middle Channel / 1.4MHz / 16QAM



Date: 27-Jul-2023 12:09:16

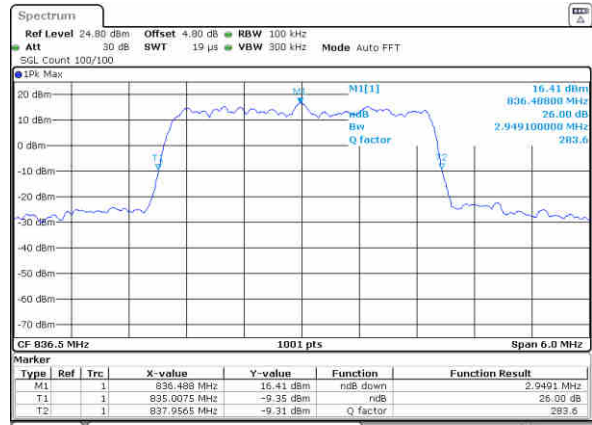
LTE Band 5

Middle Channel / 3MHz / QPSK



Date: 27-Jul-2023 13:07:21

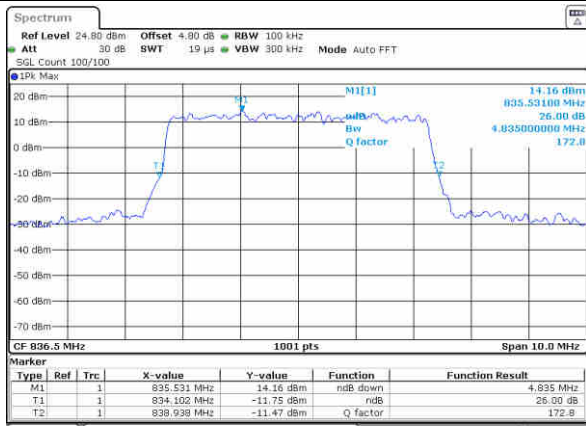
Middle Channel / 3MHz / 16QAM



Date: 27-Jul-2023 13:08:23

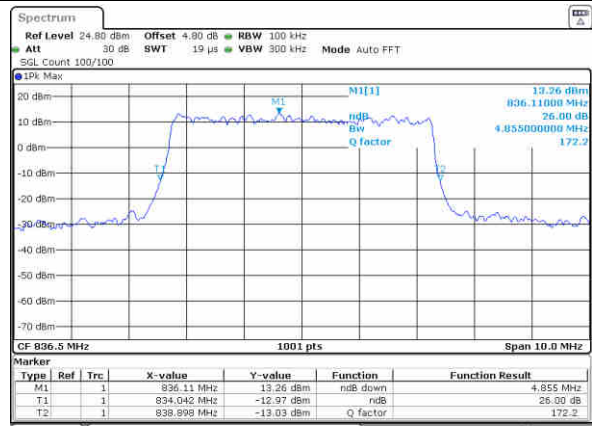
LTE Band 5

Middle Channel / 5MHz / QPSK



Date: 27-Jul-2023 13:15:14

Middle Channel / 5MHz / 16QAM

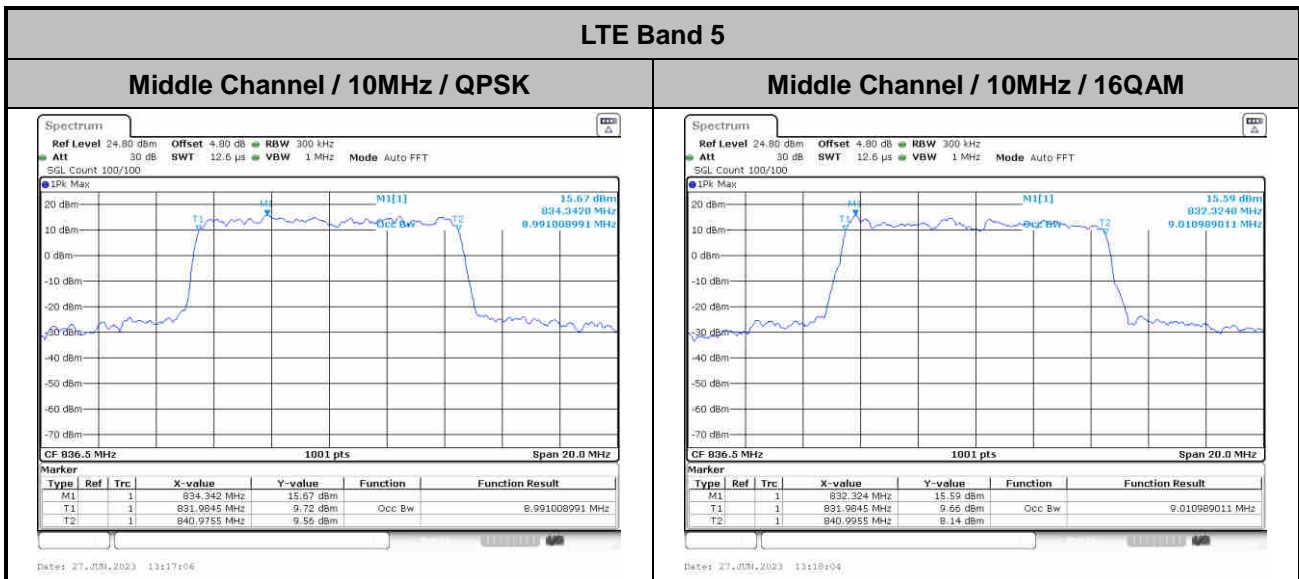


Date: 27-Jul-2023 13:16:14



## Occupied Bandwidth

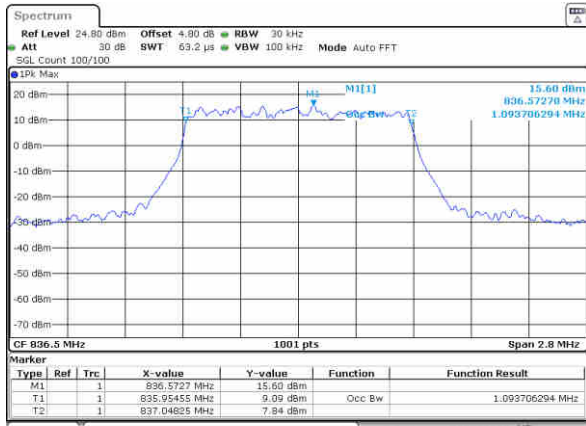
Mode	LTE Band 5 : 99%OBW(MHz)	
BW	1.4MHz	
Mod.	QPSK	16QAM
Middle CH	1.09	1.09
BW	3MHz	
Mod.	QPSK	16QAM
Middle CH	2.70	2.72
BW	5MHz	
Mod.	QPSK	16QAM
Middle CH	4.50	4.50
BW	10MHz	
Mod.	QPSK	16QAM
Middle CH	8.99	9.01





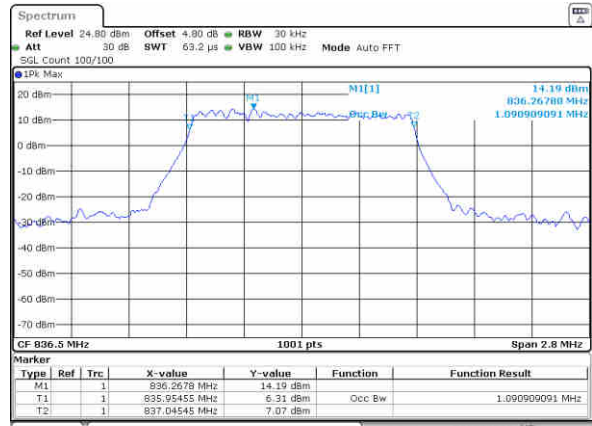
LTE Band 5

Middle Channel / 1.4MHz / QPSK



Date: 27-Jun-2023 12:03:35

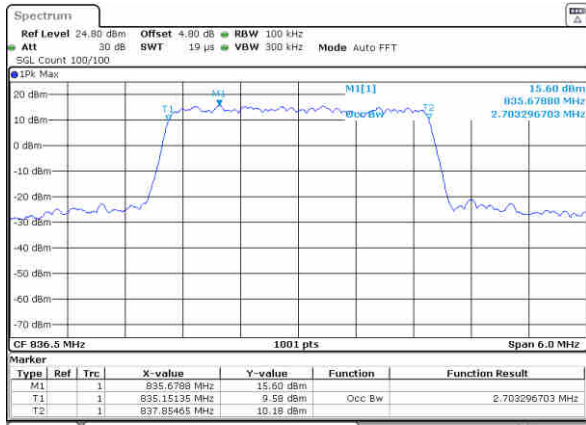
Middle Channel / 1.4MHz / 16QAM



Date: 27-Jun-2023 12:05:14

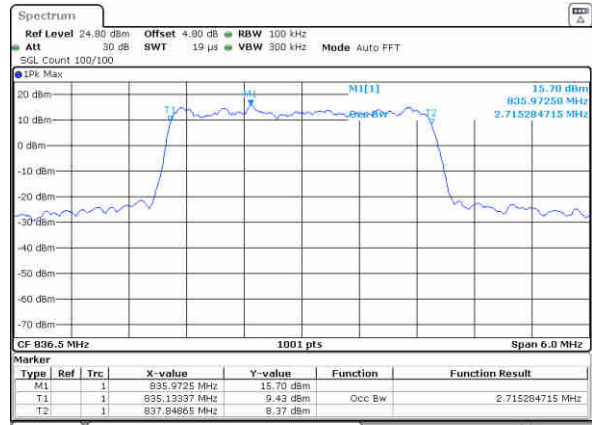
LTE Band 5

Middle Channel / 3MHz / QPSK



Date: 27-Jun-2023 13:04:56

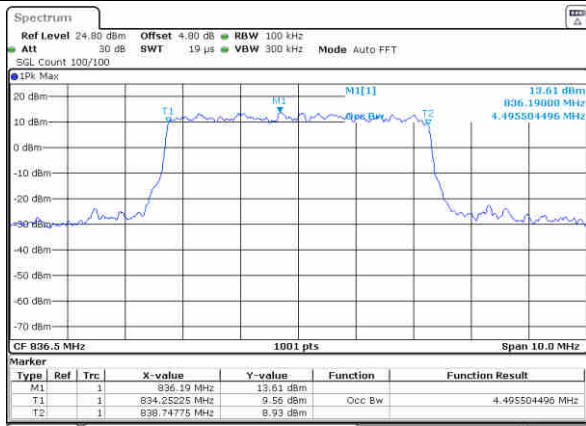
Middle Channel / 3MHz / 16QAM



Date: 27-Jun-2023 13:07:59

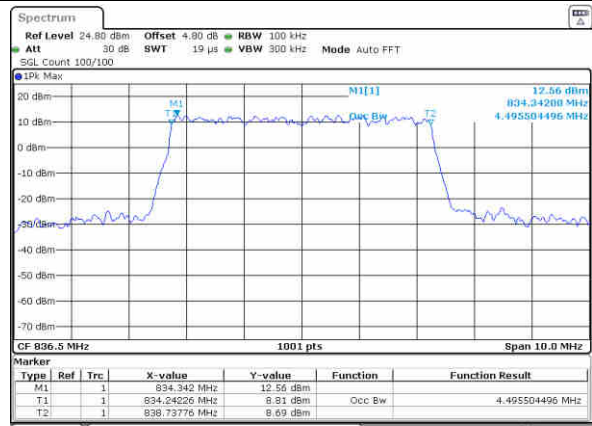
LTE Band 5

Middle Channel / 5MHz / QPSK



Date: 27-Jun-2023 13:09:07

Middle Channel / 5MHz / 16QAM

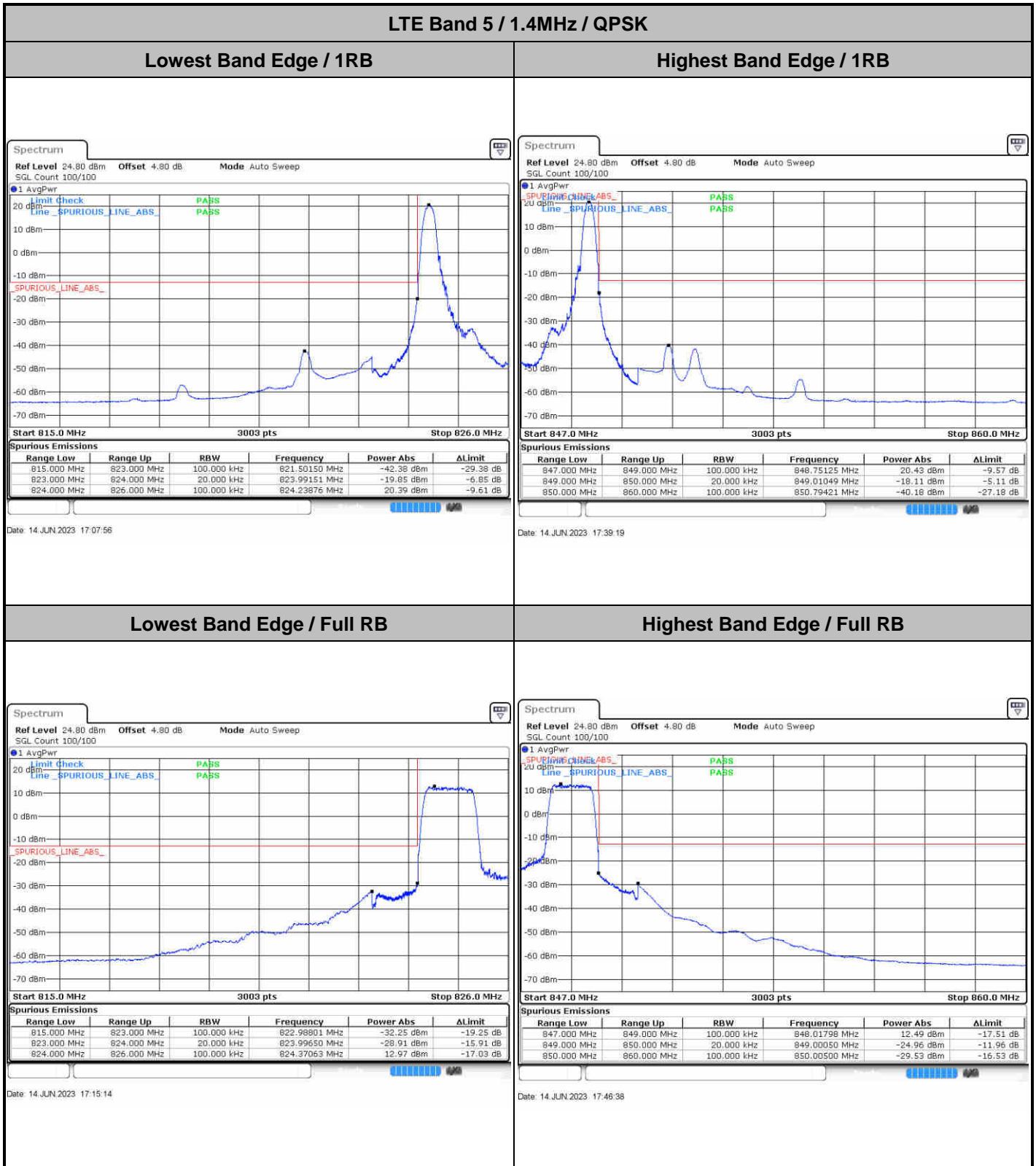


Date: 27-Jun-2023 13:10:44





# Conducted Band Edge





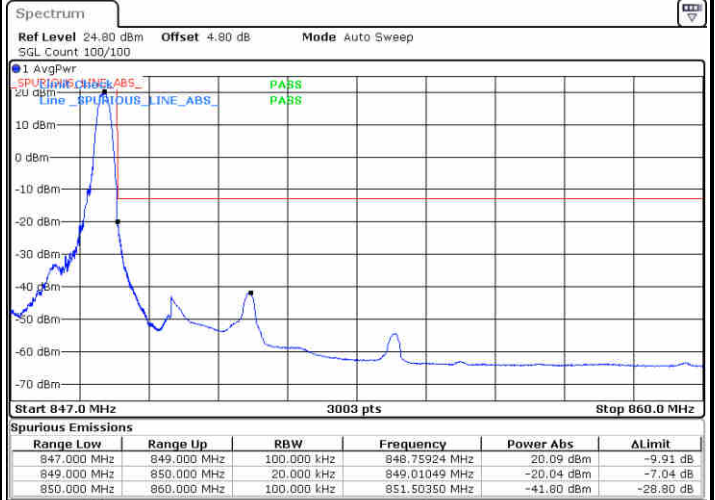
LTE Band 5 / 1.4MHz / 16QAM

Lowest Band Edge / 1 RB



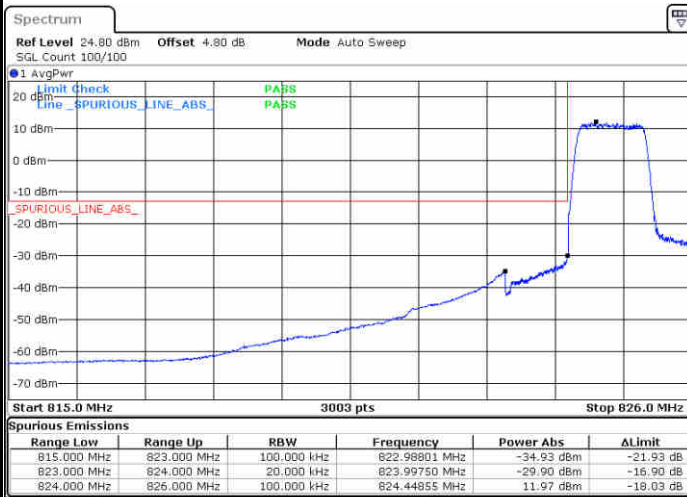
Date: 14 JUN 2023 17:09:45

Highest Band Edge / 1 RB



Date: 14 JUN 2023 17:41:09

Lowest Band Edge / Full RB



Date: 14 JUN 2023 17:17:04

Highest Band Edge / Full RB

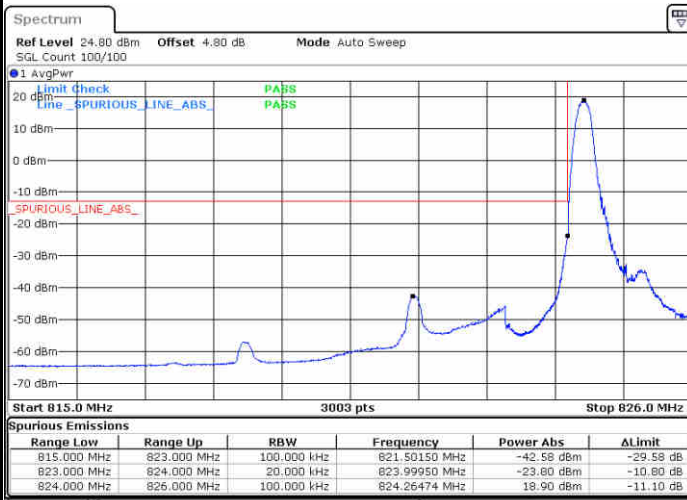


Date: 14 JUN 2023 17:48:27



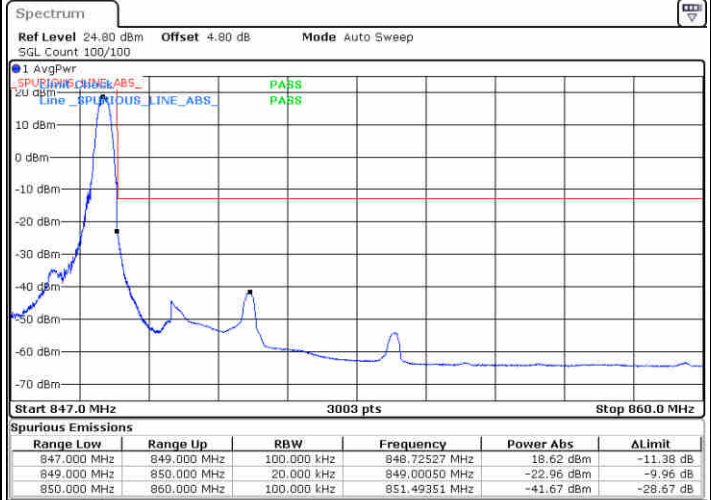
LTE Band 5 / 1.4MHz / 64QAM

Lowest Band Edge / 1 RB



Date: 14 JUN 2023 17:11:35

Highest Band Edge / 1 RB



Date: 14 JUN 2023 17:42:59

Lowest Band Edge / Full RB



Date: 14 JUN 2023 17:18:53

Highest Band Edge / Full RB



Date: 14 JUN 2023 17:50:17

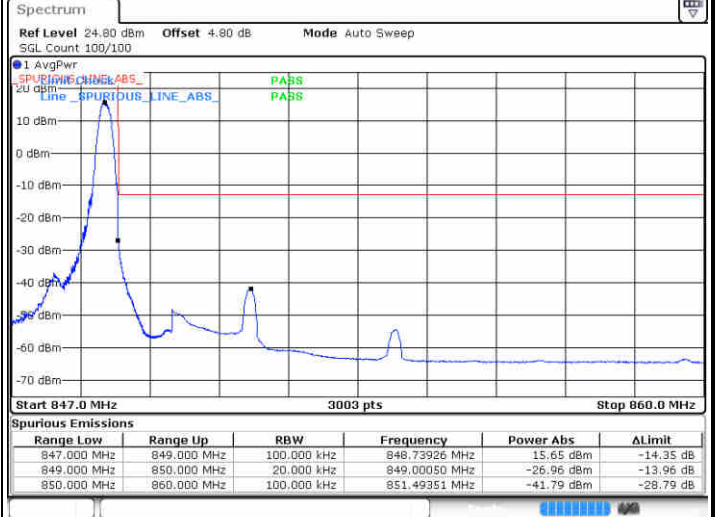
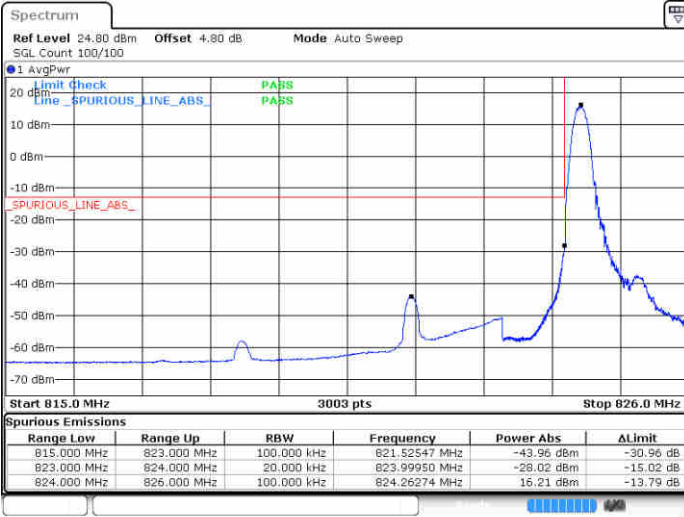




LTE Band 5 / 1.4MHz / 256QAM

Lowest Band Edge / 1 RB

Highest Band Edge / 1 RB

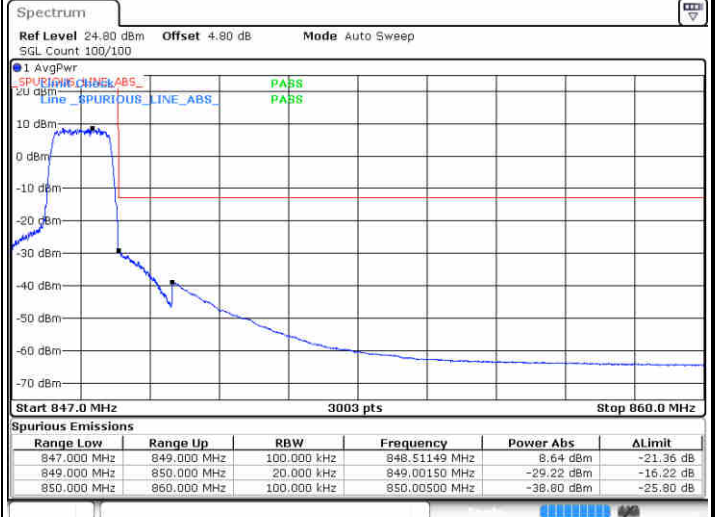
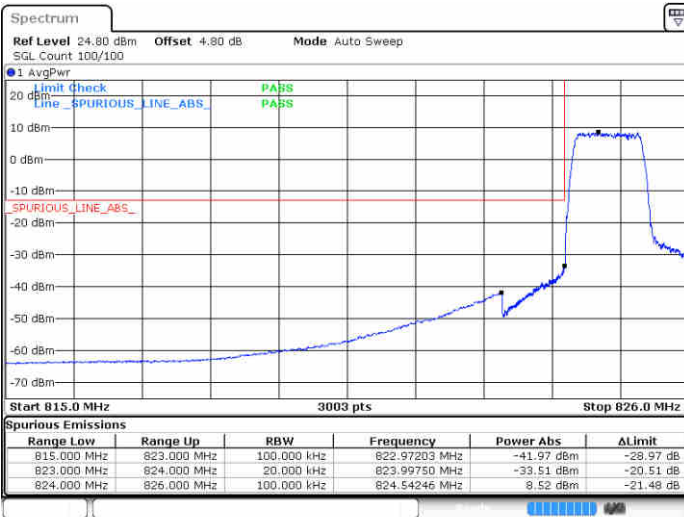


Date: 14 JUN 2023 17:13:24

Date: 14 JUN 2023 17:44:48

Lowest Band Edge / Full RB

Highest Band Edge / Full RB



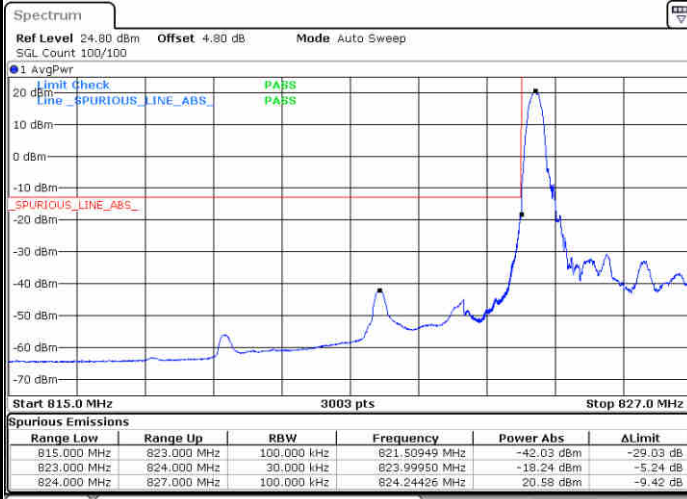
Date: 14 JUN 2023 17:20:43

Date: 14 JUN 2023 17:52:06



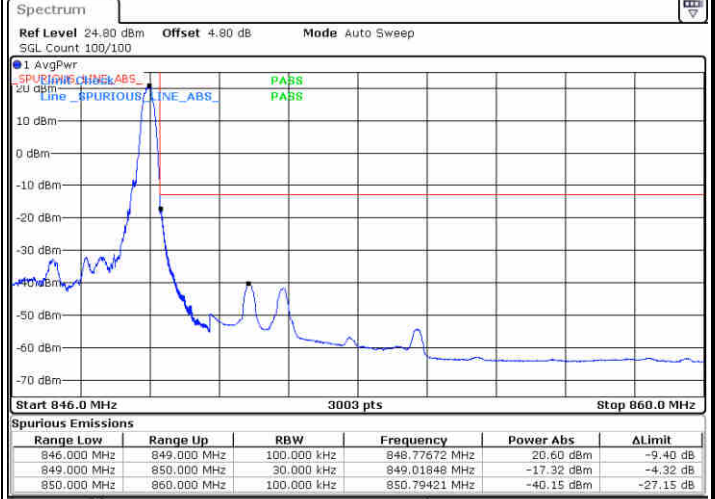
LTE Band 5 / 3MHz / QPSK

Lowest Band Edge / 1RB



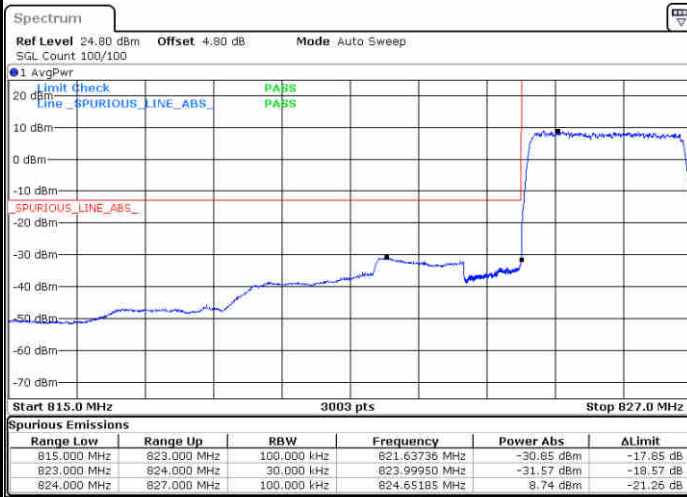
Date: 14 JUN 2023 17:58:56

Highest Band Edge / 1 RB



Date: 14 JUN 2023 18:21:48

Lowest Band Edge / Full RB



Date: 14 JUN 2023 18:06:14

Highest Band Edge / Full RB

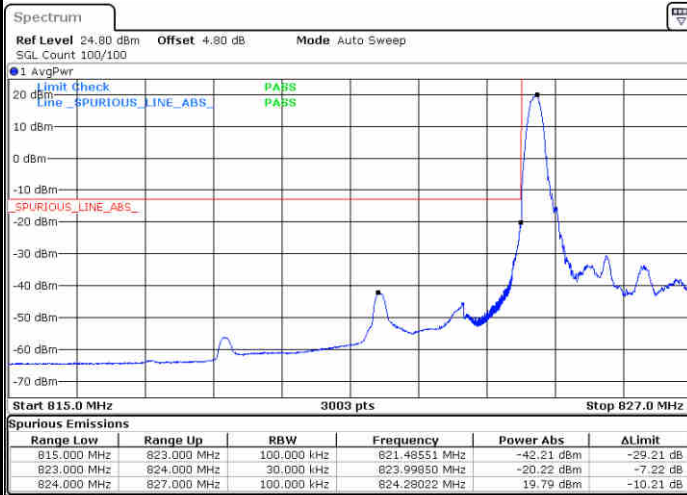


Date: 14 JUN 2023 18:29:06



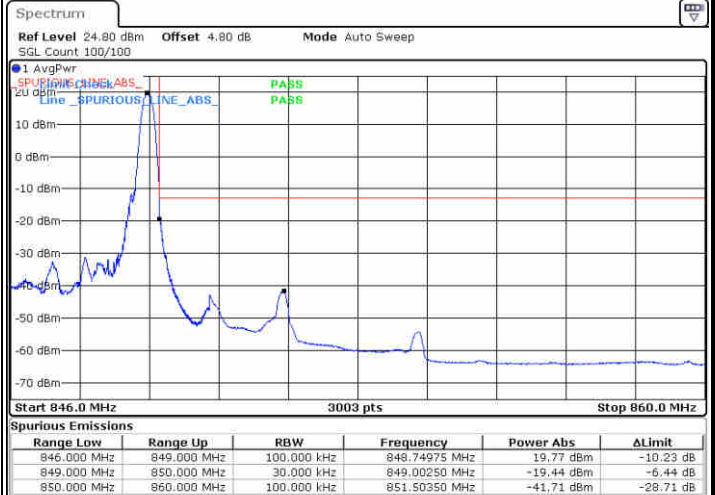
LTE Band 5 / 3MHz / 16QAM

Lowest Band Edge / 1 RB



Date: 14 JUN 2023 18:00:45

Highest Band Edge / 1 RB



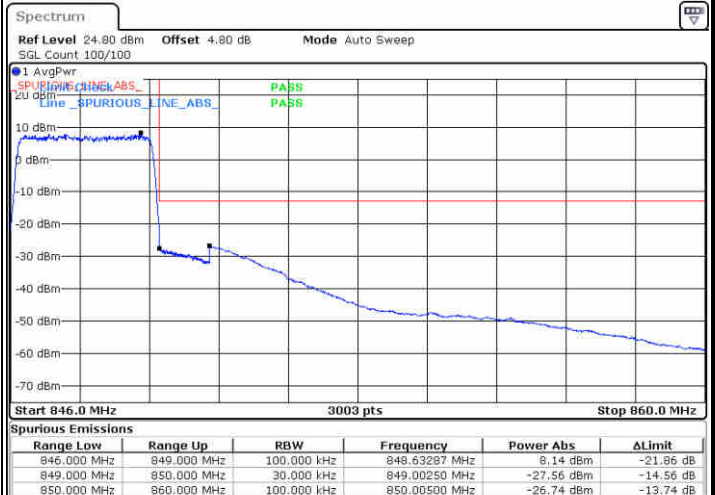
Date: 14 JUN 2023 18:23:37

Lowest Band Edge / Full RB



Date: 14 JUN 2023 18:08:03

Highest Band Edge / Full RB



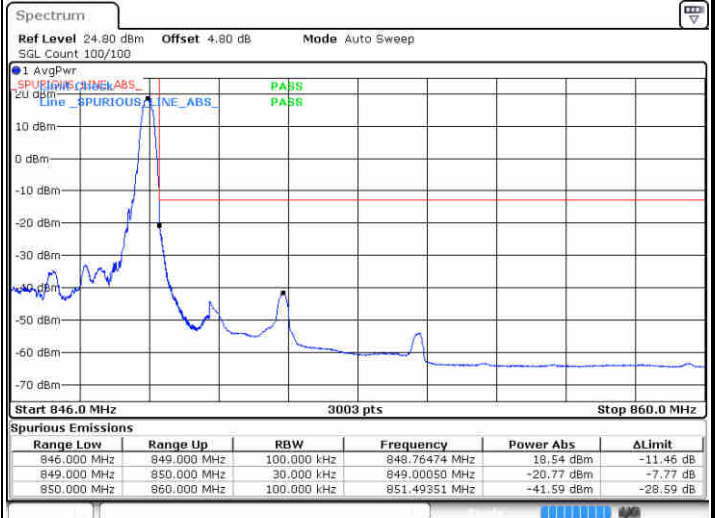
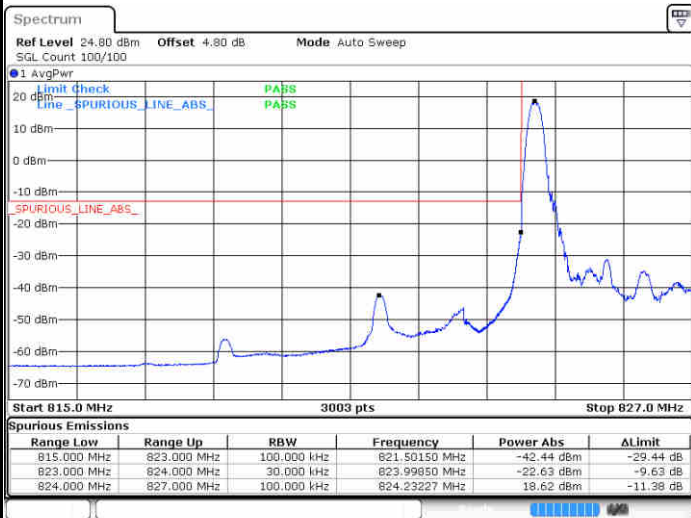
Date: 14 JUN 2023 18:30:56



LTE Band 5 / 3MHz / 64QAM

Lowest Band Edge / 1 RB

Highest Band Edge / 1 RB

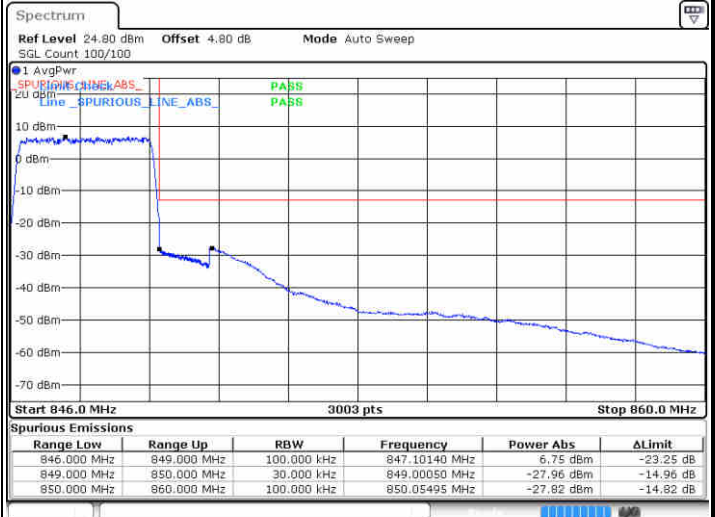
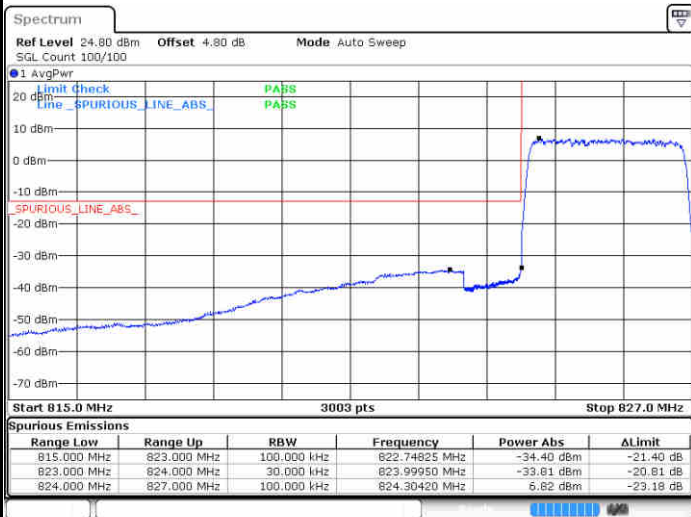


Date: 14 JUN 2023 18:02:35

Date: 14 JUN 2023 18:25:27

Lowest Band Edge / Full RB

Highest Band Edge / Full RB



Date: 14 JUN 2023 18:09:53

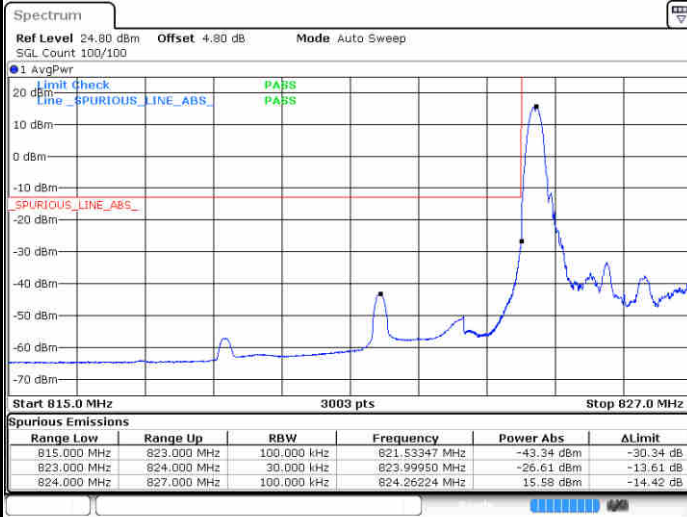
Date: 14 JUN 2023 18:32:45





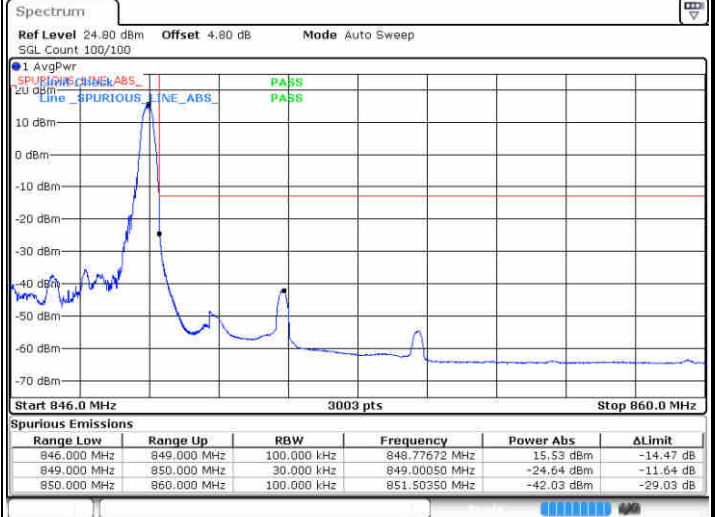
LTE Band 5 / 3MHz / 256QAM

Lowest Band Edge / 1 RB



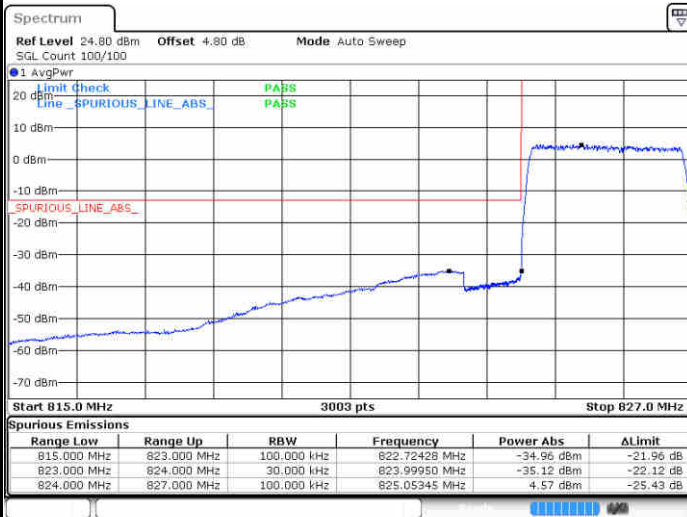
Date: 14 JUN 2023 18:04:24

Highest Band Edge / 1 RB



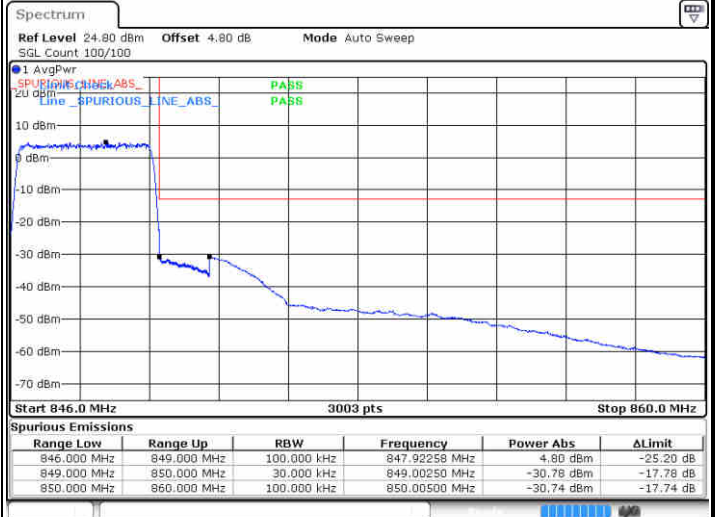
Date: 14 JUN 2023 18:27:17

Lowest Band Edge / Full RB



Date: 14 JUN 2023 18:11:42

Highest Band Edge / Full RB

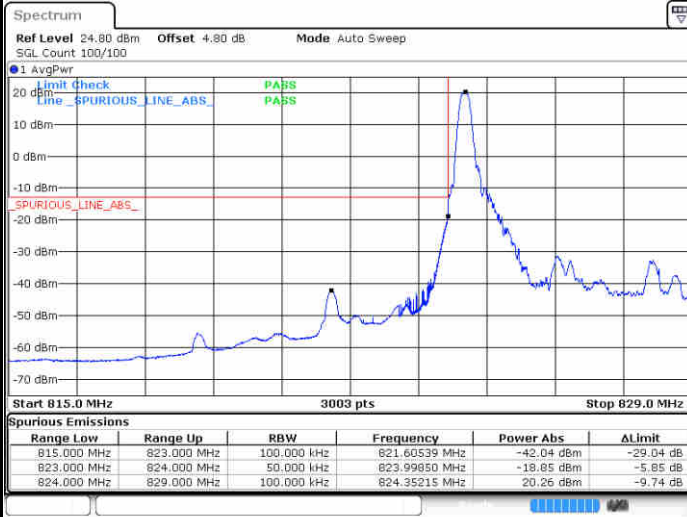


Date: 14 JUN 2023 18:34:35



LTE Band 5 / 5MHz / QPSK

Lowest Band Edge / 1 RB



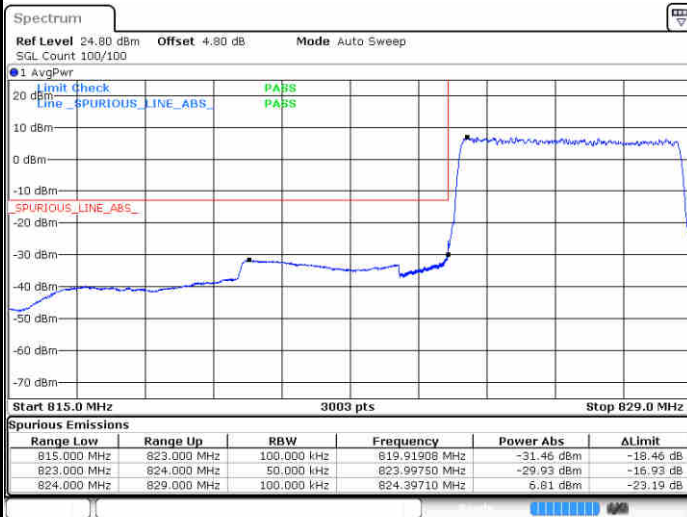
Date: 14 JUN 2023 18:38:03

Highest Band Edge / 1 RB



Date: 15 JUN 2023 08:52:16

Lowest Band Edge / Full RB



Date: 14 JUN 2023 18:45:22

Highest Band Edge / Full RB

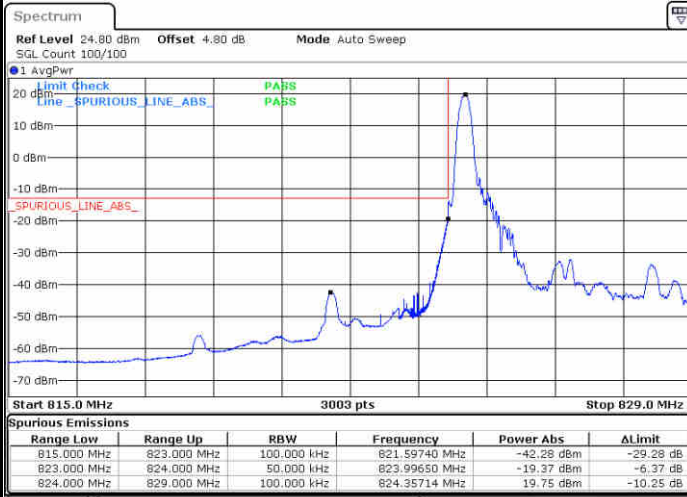


Date: 15 JUN 2023 09:04:00



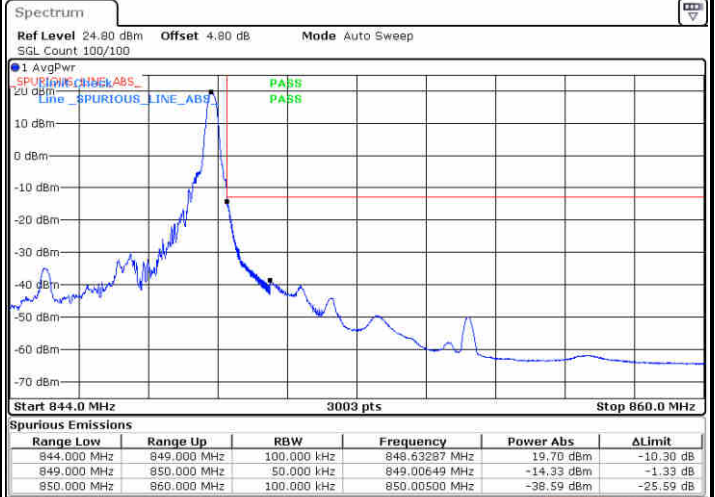
LTE Band 5 / 5MHz / 16QAM

Lowest Band Edge / 1RB



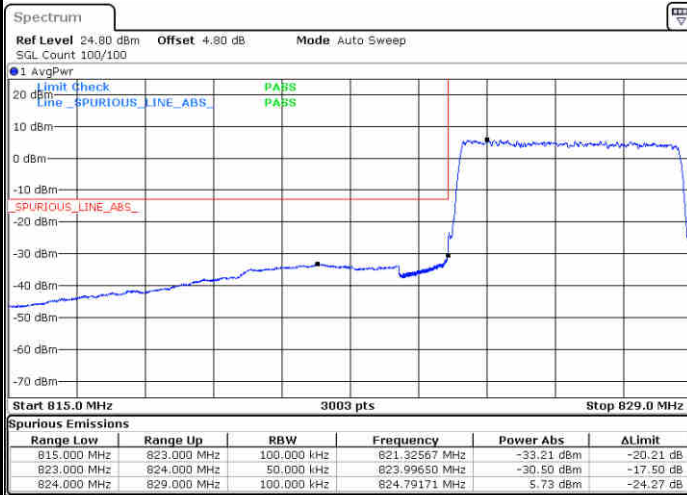
Date: 14 JUN 2023 18:39:53

Highest Band Edge / 1 RB



Date: 15 JUN 2023 08:54:05

Lowest Band Edge / Full RB



Date: 14 JUN 2023 18:47:11

Highest Band Edge / Full RB

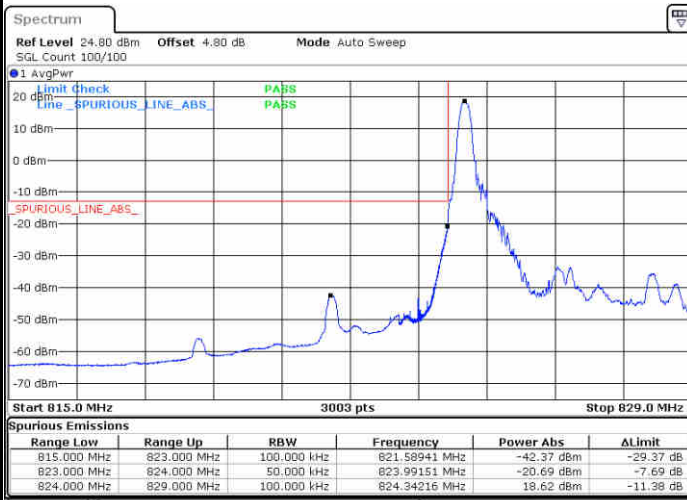


Date: 15 JUN 2023 09:05:49



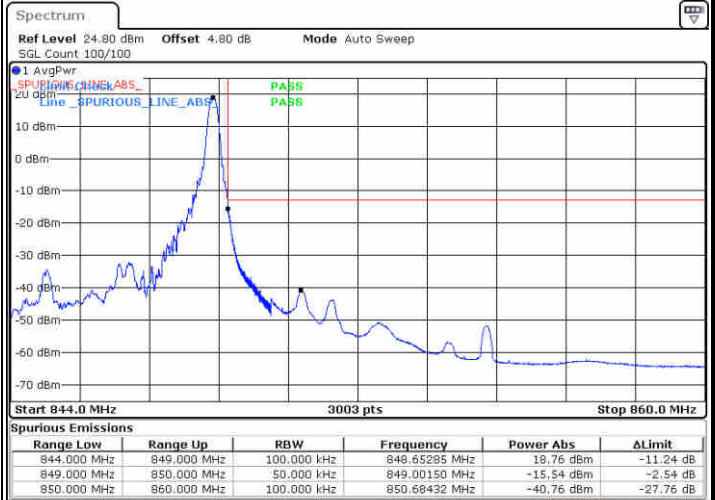
LTE Band 5 / 5MHz / 64QAM

Lowest Band Edge / 1RB



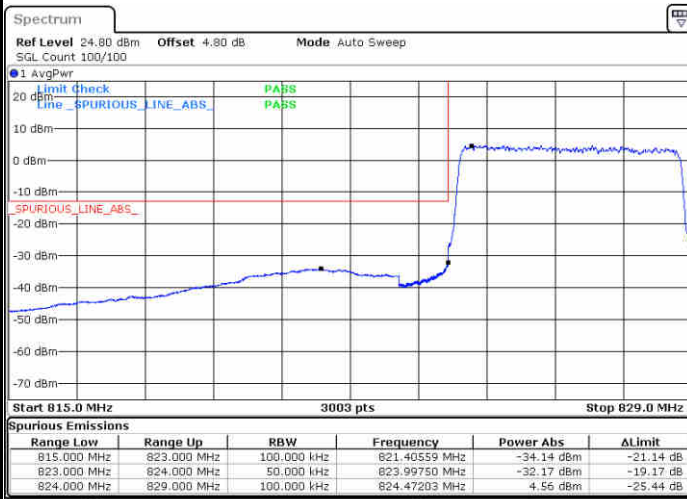
Date: 14 JUN 2023 18:41:42

Highest Band Edge / 1 RB



Date: 15 JUN 2023 08:55:55

Lowest Band Edge / Full RB



Date: 14 JUN 2023 18:49:00

Highest Band Edge / Full RB



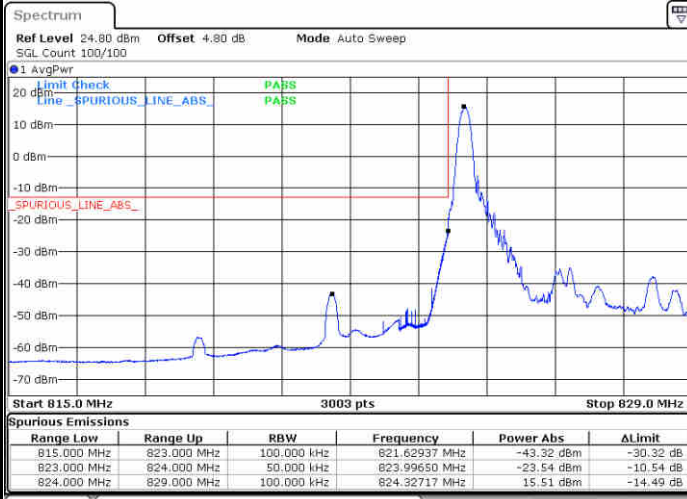
Date: 15 JUN 2023 09:07:38





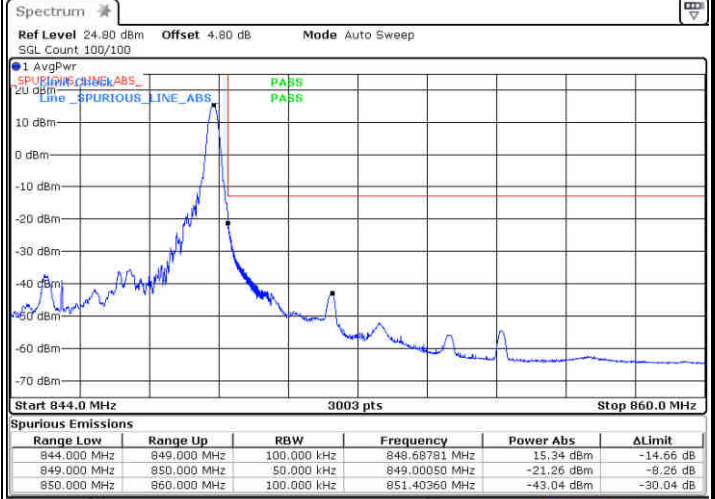
LTE Band 5 / 5MHz / 256QAM

Lowest Band Edge / 1RB



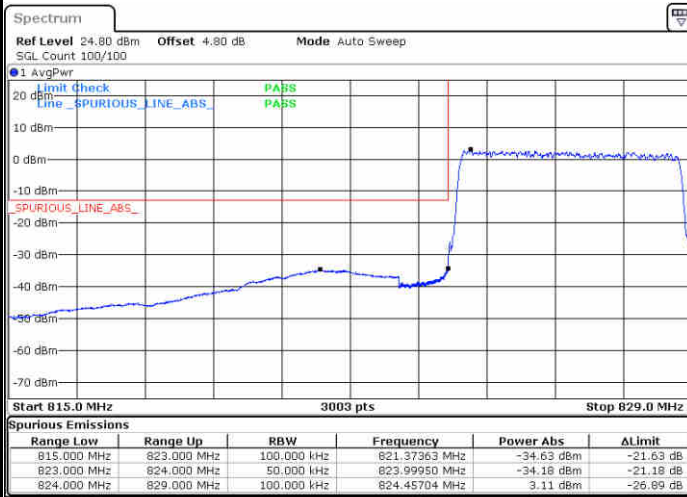
Date: 14 JUN 2023 18:43:32

Highest Band Edge / 1 RB



Date: 15 JUN 2023 10:51:45

Lowest Band Edge / Full RB



Date: 14 JUN 2023 18:50:50

Highest Band Edge / Full RB

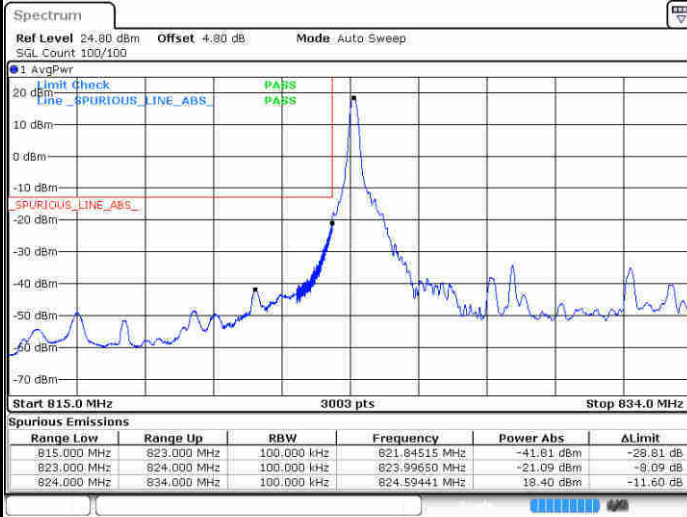


Date: 15 JUN 2023 09:09:28



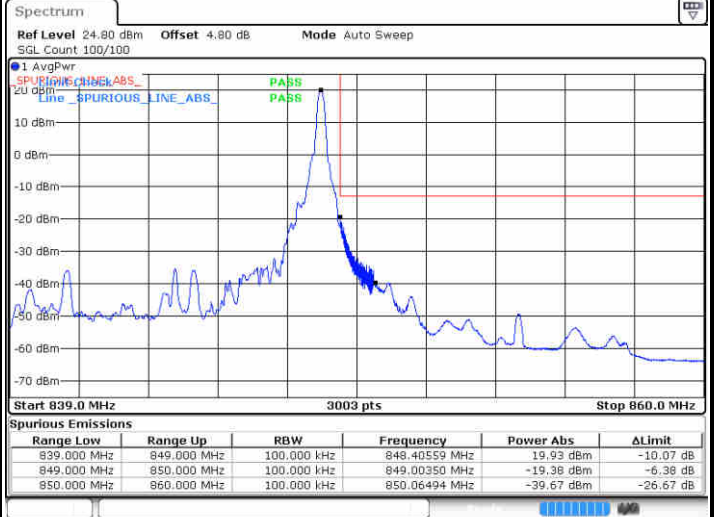
LTE Band 5 / 10MHz / QPSK

Lowest Band Edge / 1 RB



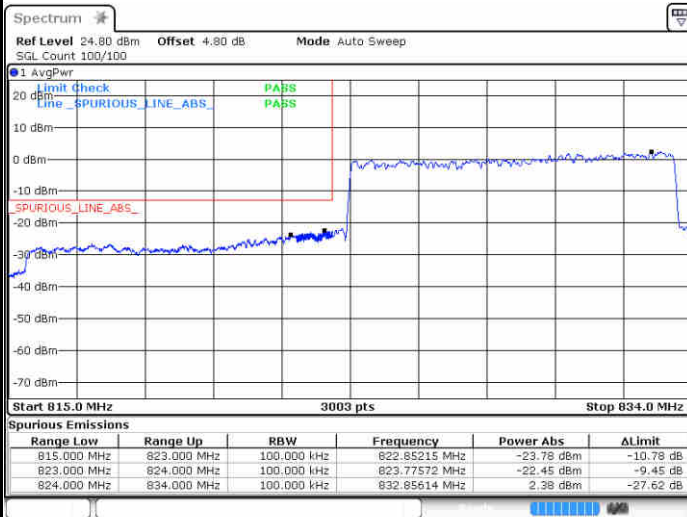
Date: 15 JUN 2023 09:15:23

Highest Band Edge / 1 RB



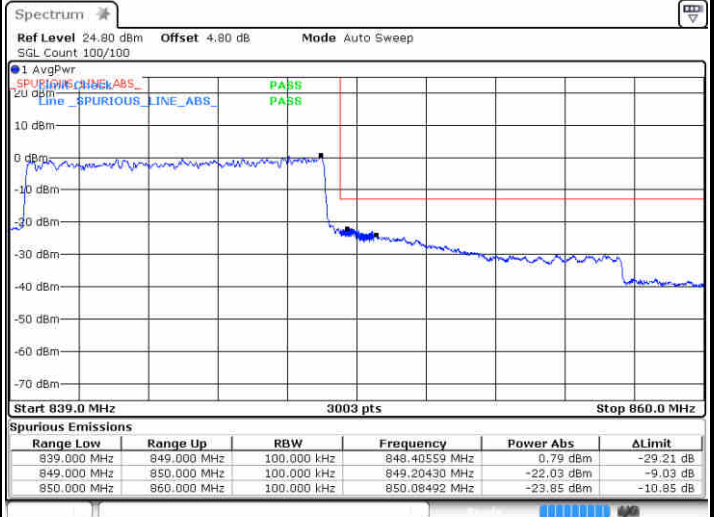
Date: 15 JUN 2023 10:03:11

Lowest Band Edge / Full RB



Date: 15 JUN 2023 09:47:41

Highest Band Edge / Full RB

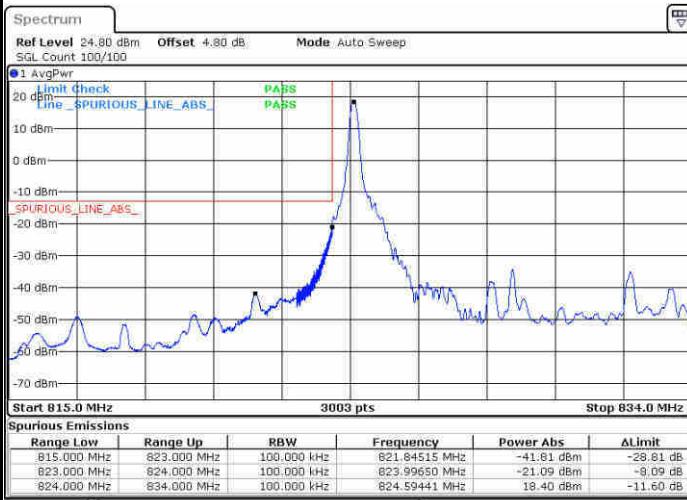


Date: 15 JUN 2023 10:09:39



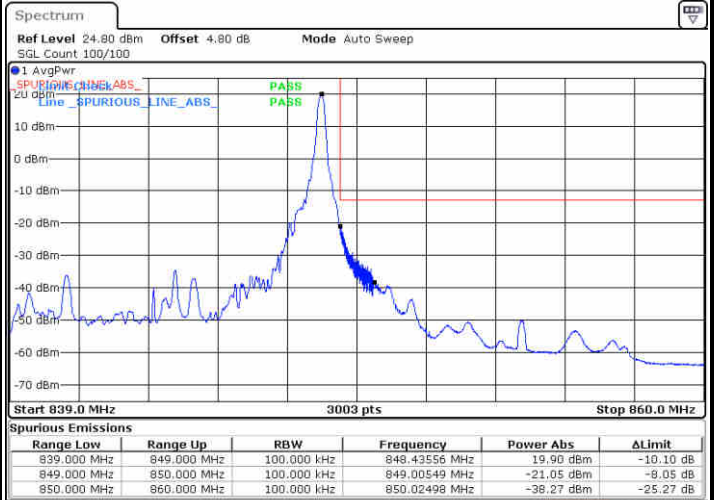
LTE Band 5 / 10MHz / 16QAM

Lowest Band Edge / 1 RB



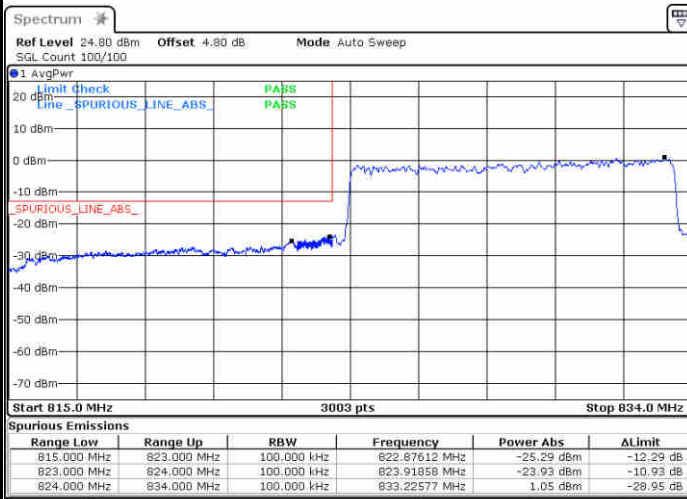
Date: 15 JUN 2023 09:15:23

Highest Band Edge / 1 RB



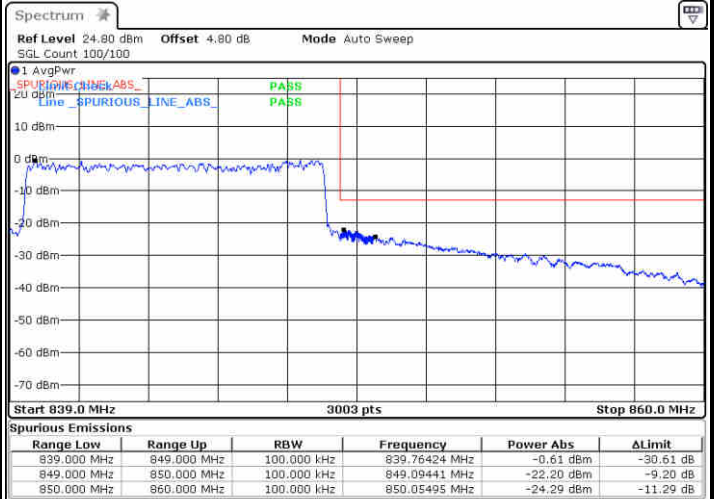
Date: 15 JUN 2023 10:04:02

Lowest Band Edge / Full RB



Date: 15 JUN 2023 09:49:42

Highest Band Edge / Full RB

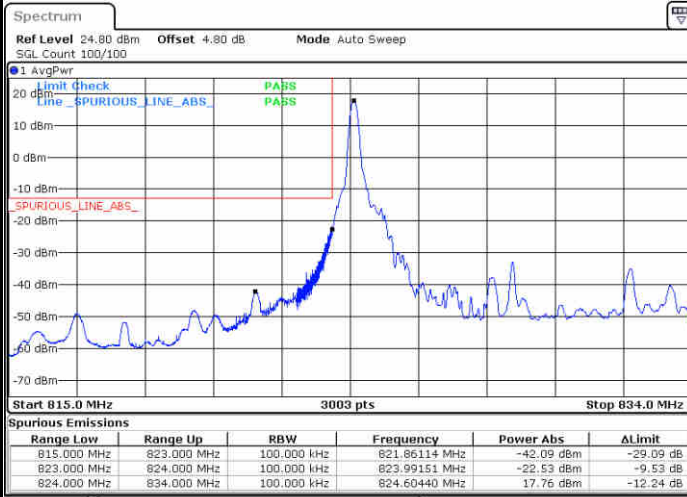


Date: 15 JUN 2023 10:12:23



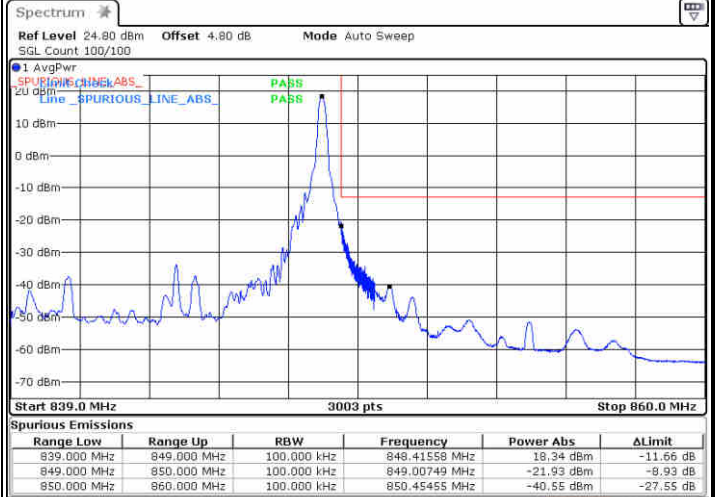
LTE Band 5 / 10MHz / 64QAM

Lowest Band Edge / 1 RB



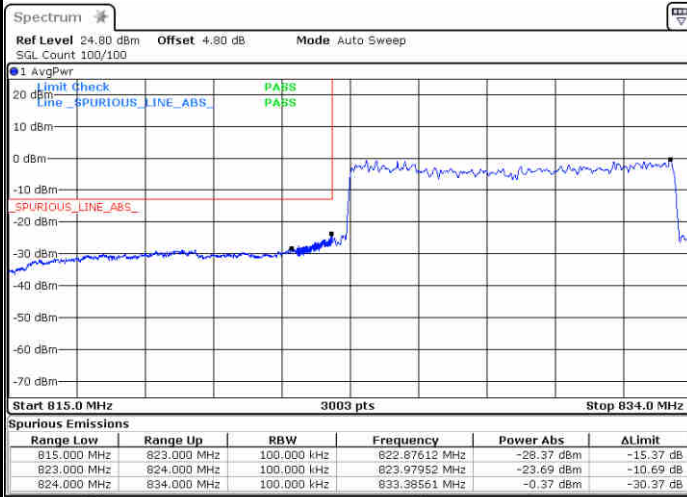
Date: 15 JUN 2023 09:17:13

Highest Band Edge / 1 RB



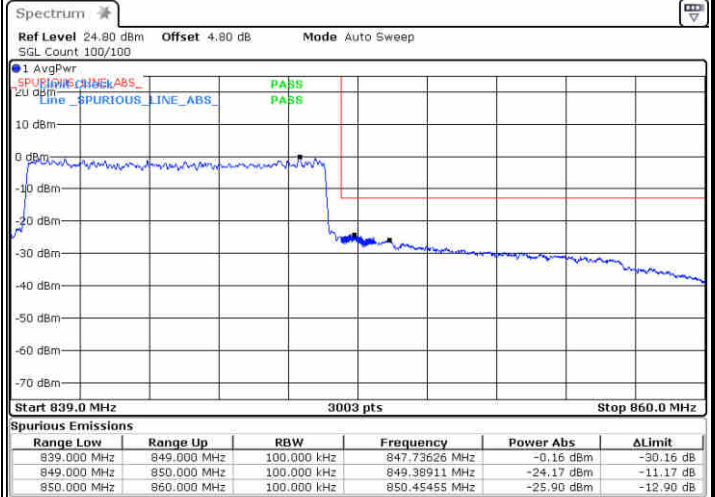
Date: 15 JUN 2023 10:06:33

Lowest Band Edge / Full RB



Date: 15 JUN 2023 09:51:36

Highest Band Edge / Full RB



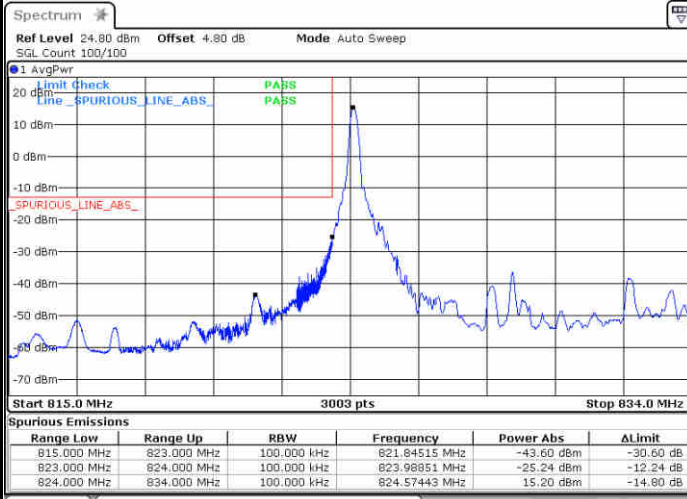
Date: 15 JUN 2023 10:14:25





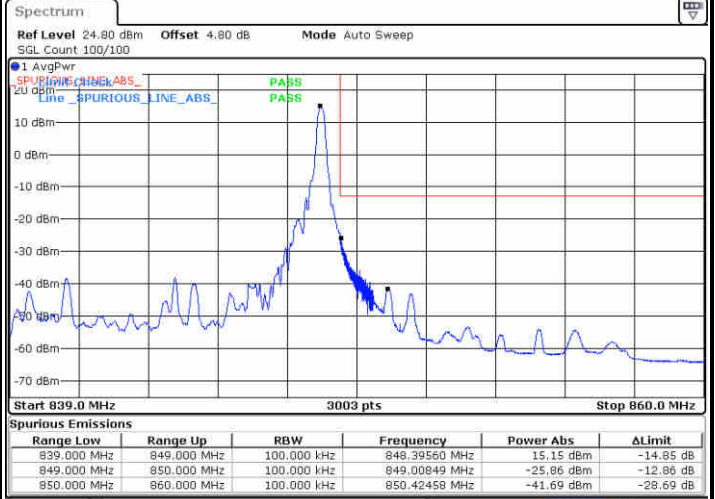
LTE Band 5 / 10MHz / 256QAM

Lowest Band Edge / 1 RB



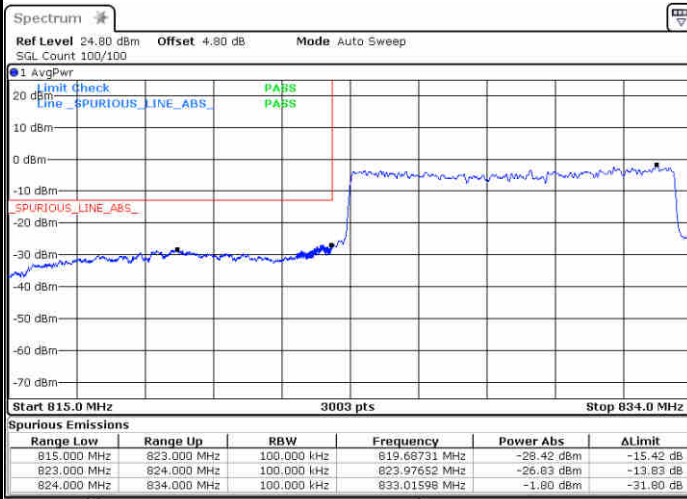
Date: 15 JUN 2023 10:47:56

Highest Band Edge / 1 RB



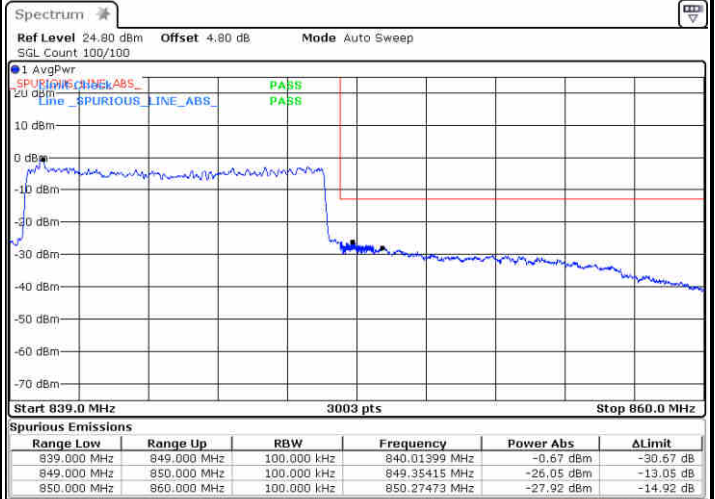
Date: 15 JUN 2023 10:07:52

Lowest Band Edge / Full RB



Date: 15 JUN 2023 10:49:09

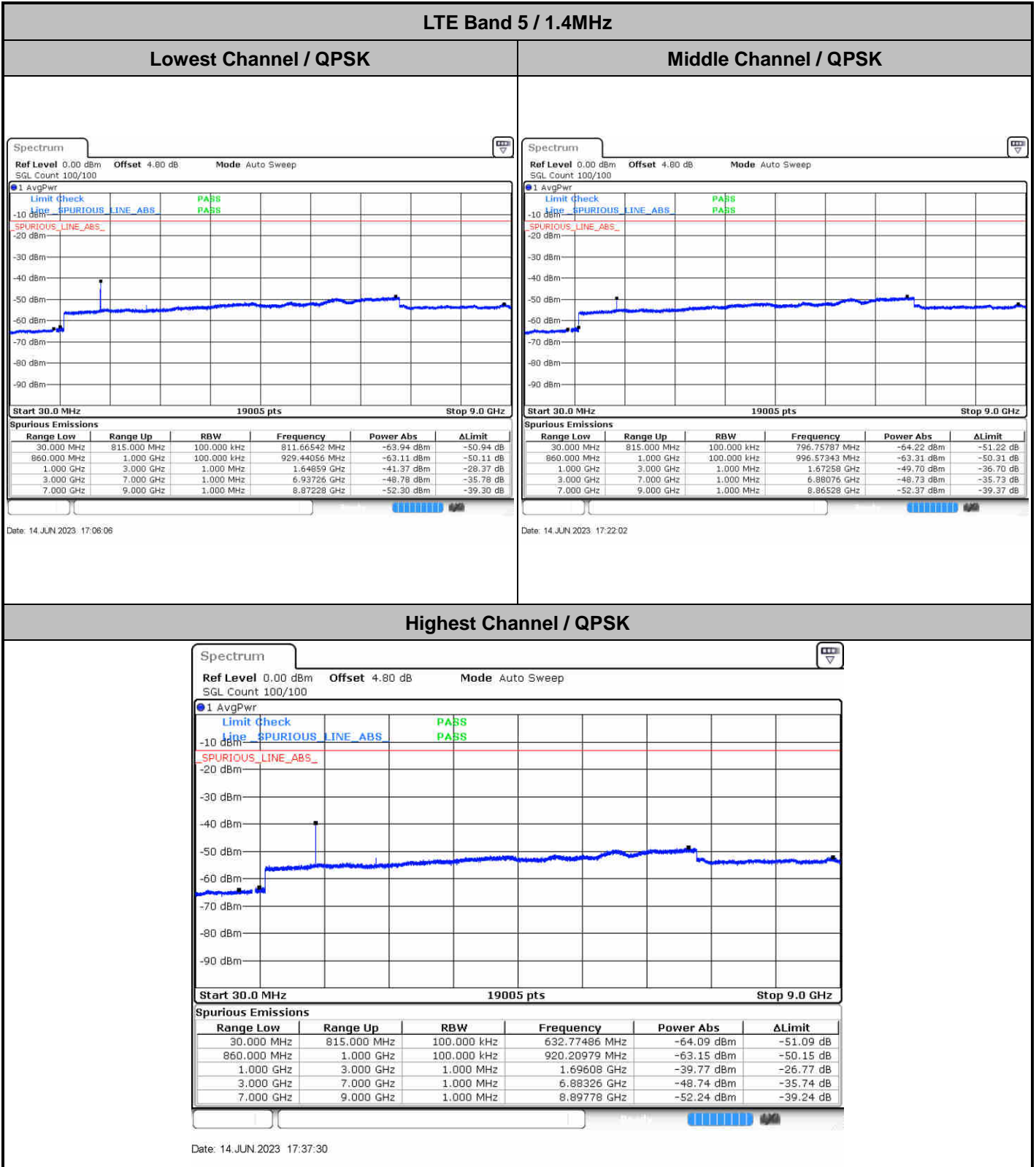
Highest Band Edge / Full RB



Date: 15 JUN 2023 10:19:40



# Conducted Spurious Emission

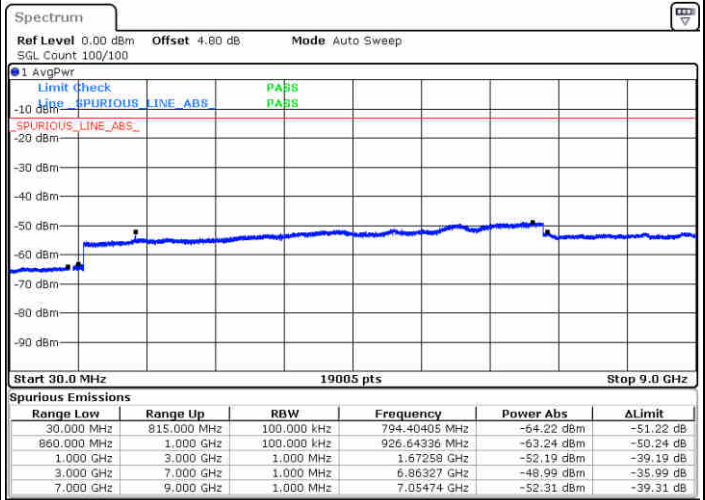
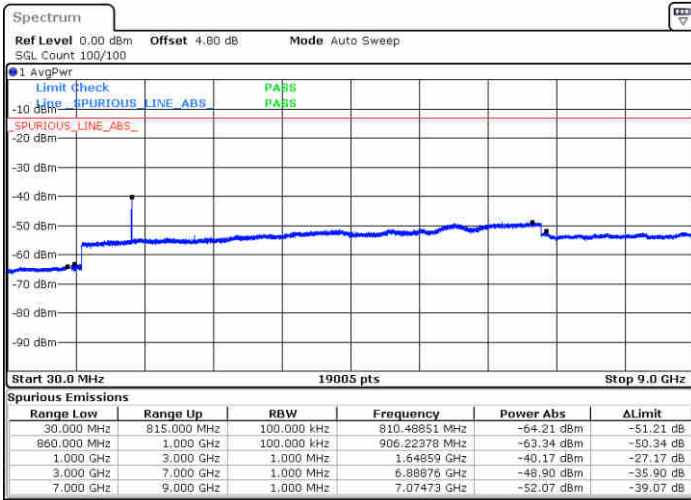




LTE Band 5 / 3MHz

Lowest Channel / QPSK

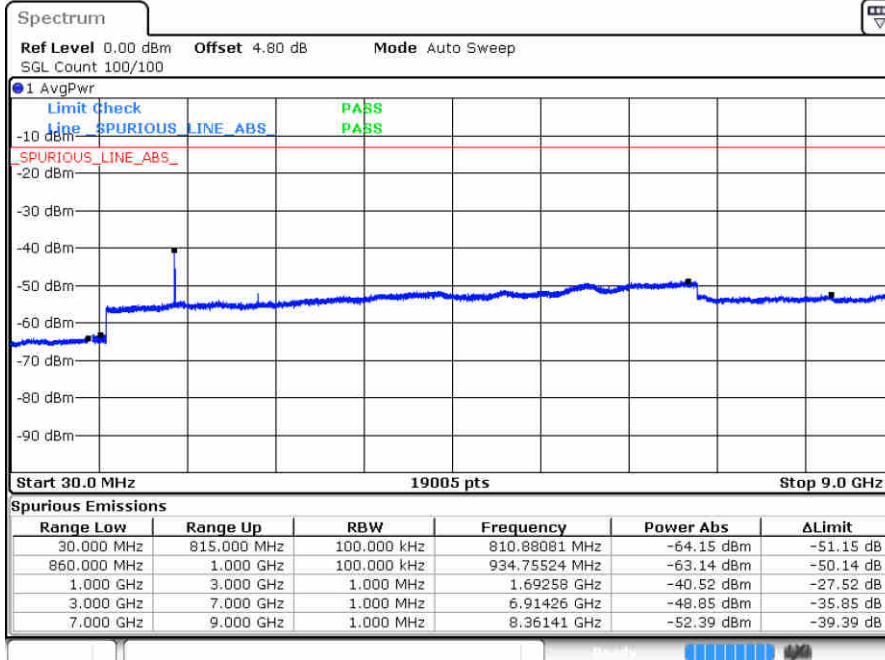
Middle Channel / QPSK



Date: 14 JUN 2023 17:57:06

Date: 14 JUN 2023 18:13:02

Highest Channel / QPSK



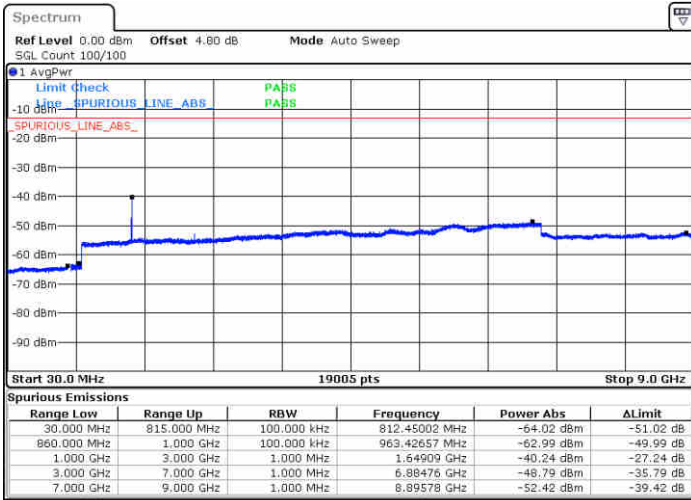
Date: 14 JUN 2023 18:19:58



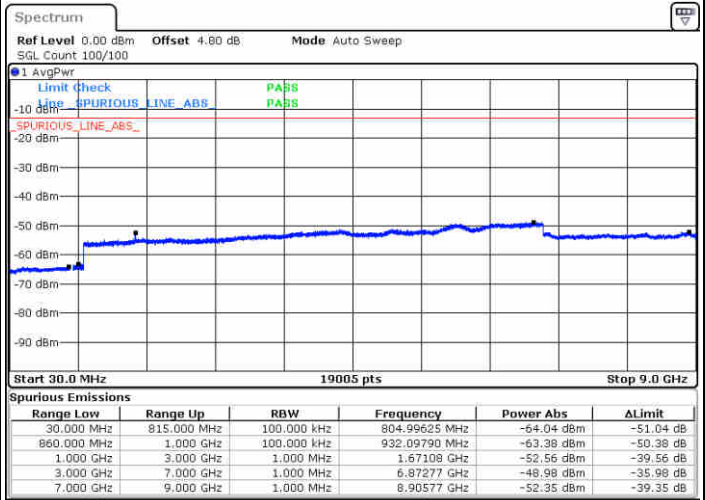
LTE Band 5 / 5MHz

Lowest Channel / QPSK

Middle Channel / QPSK

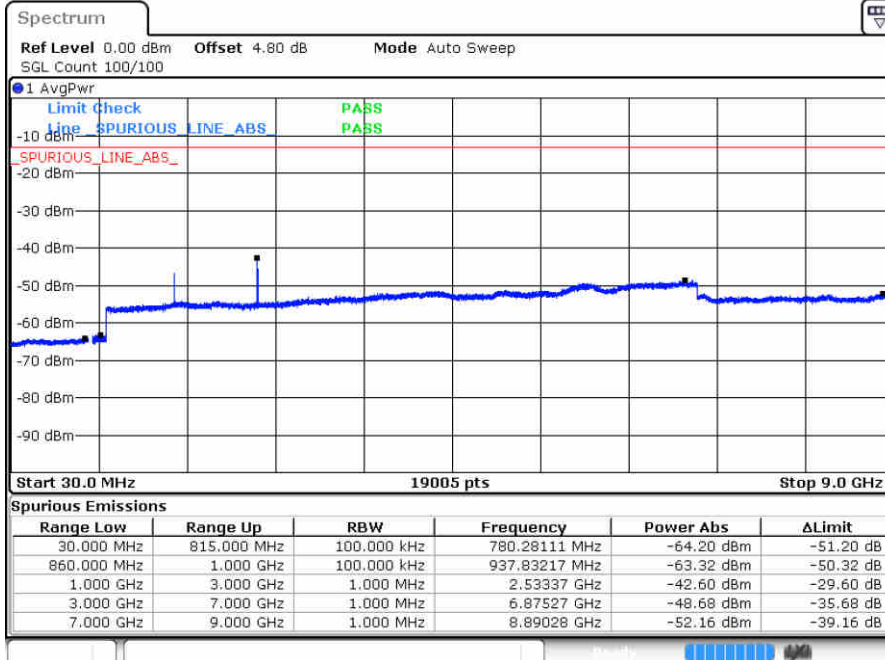


Date: 14 JUN 2023 18:38:14



Date: 14 JUN 2023 18:52:09

Highest Channel / QPSK



Date: 15 JUN 2023 08:49:32

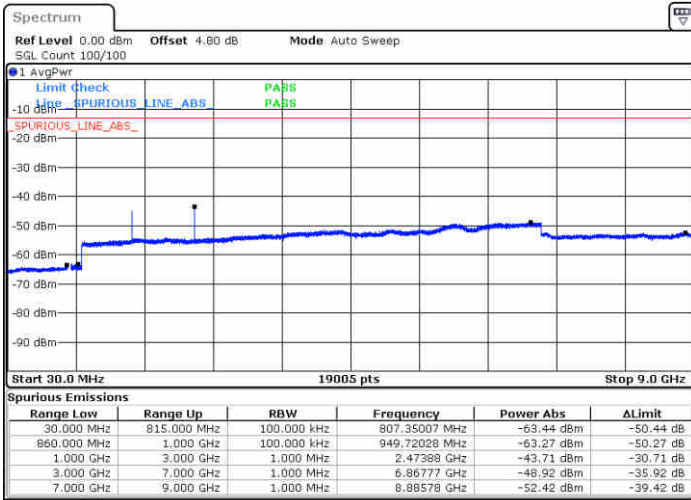




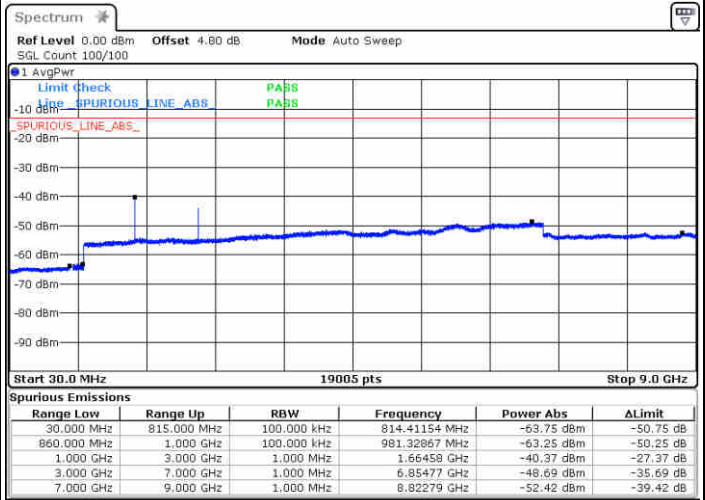
LTE Band 5 / 10MHz

Lowest Channel / QPSK

Middle Channel / QPSK

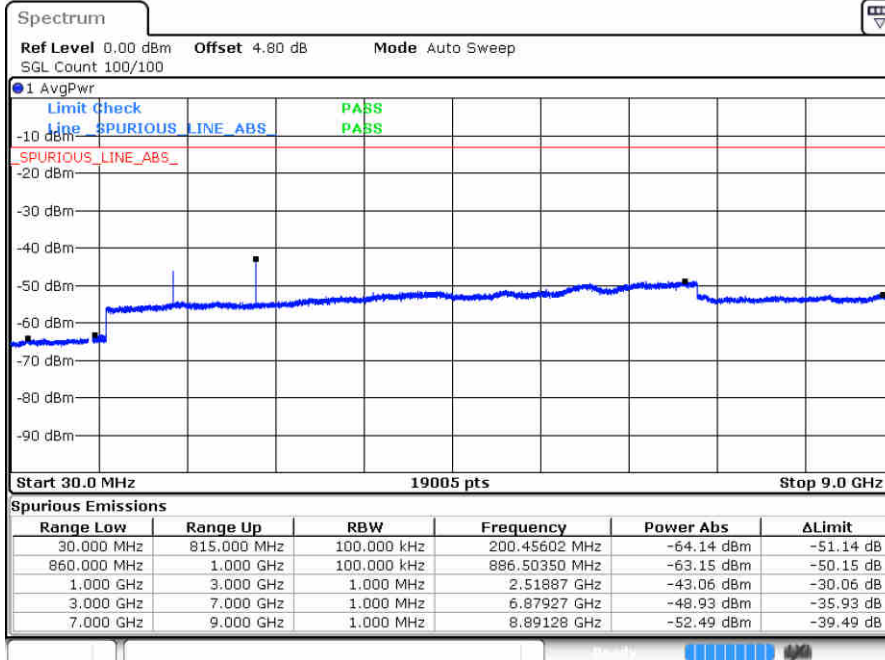


Date: 15 JUN 2023 09:11:45



Date: 15 JUN 2023 09:53:31

Highest Channel / QPSK



Date: 15 JUN 2023 10:21:53



Frequency Stability

Test Conditions		LTE Band 5 (QPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	2.5ppm
		Deviation (ppm)	Result
50	Normal Voltage	0.0025	PASS
40	Normal Voltage	0.0016	
30	Normal Voltage	0.0002	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0011	
0	Normal Voltage	0.0002	
-10	Normal Voltage	0.0015	
-20	Normal Voltage	0.0028	
-30	Normal Voltage	0.0004	
20	Maximum Voltage	0.0016	
20	Normal Voltage	0.0000	
20	End Point	0.0009	

Note: Normal Voltage =3.8 V. ; End Point (BEP) =3.3 V. ; Maximum Voltage =4.3 V.



## Appendix B. Test Results of Radiated Test

### Radiated Spurious Emission

LTE Band 5 / 10MHz / QPSK								
Channel	Frequency ( MHz )	ERP ( dBm )	Limit ( dBm )	Over Limit ( dB )	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1664	-65.21	-13	-52.21	-72.18	1.58	10.70	H
	2496	-60.96	-13	-47.96	-69.21	2.102	12.50	H
	3328	-61.04	-13	-48.04	-69.93	2.856	13.90	H
	1664	-64.36	-13	-51.36	-71.33	1.58	10.70	V
	2496	-59.29	-13	-46.29	-67.54	2.10	12.50	V
	3328	-61.37	-13	-48.37	-70.26	2.86	13.90	V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.