

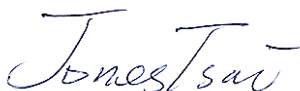
# FCC RADIO TEST REPORT

**FCC ID** : J9CQGM8180X  
**Equipment** : Module  
**Model Name** : QGM8180X  
**Applicant** : Qualcomm Inc  
5775 Morehouse Dr.San Diego, CA 92121-1714 (USA)  
**Manufacturer** : Universal Scientific Industrial (Shanghai) Co., Ltd.  
No. 1558, Zhang Dong Road, Zhangjiang Hi-Tech Park,  
Shanghai, P.R. China 201203  
**Standard** : FCC 47 CFR Part 2, Part 27(D)

The product was received on Feb. 01, 2019 and testing was started from Feb. 27, 2019 and completed on Mar. 08, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Jones Tsai

**SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory**  
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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## History of this test report

Report No.	Version	Description	Issued Date
FG920117C	01	Initial issue of report	Jun. 11, 2019
FG920117C	02	1. Revise the test completed date on the cover page. 2. Revise the calibration date and due date of the instrument Programmable Power Supply on page 21.	Jul. 15, 2019

## Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power and Effective Isotropic Radiated Power	Reporting only	-
3.3	-	Peak-to-Average Ratio	Reporting only	-
3.4	§27.50 (a)(3)	EIRP Power Density	Pass	-
3.5	§2.1049	Occupied Bandwidth	Reporting only	-
3.6	§2.1051 §27.53 (a)(4)	Conducted Band Edge Measurement	Pass	-
3.7	§2.1051 §27.53 (a)(4)	Conducted Spurious Emission	Pass	-
3.8	§2.1055 §27.54	Frequency Stability Temperature & Voltage	Pass	-
4.2	§2.1053 §27.53 (a)(4)	Radiated Spurious Emission	Pass	Under limit 17.56 dB at 4614.000 MHz

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

**Reviewed by: Wii Chang**

**Report Producer: Maggie Chiang**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

WCDMA/LTE and GNSS

Product Specification subjective to this standard	
Antenna Type	WWAN: Dipole Antenna GPS/Glonass/BDS/Galileo/SBAS: Dipole Antenna

## 1.2 Modification of EUT

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

## 1.3 Testing Site

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	<b>Sporton Site No.</b> TH05-HY
Test Engineer	Chester Chen
Temperature	22~24°C
Relative Humidity	54~59%

**Note:** The test site complies with ANSI C63.4 2014 requirement.

Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	<b>Sporton Site No.</b> 03CH12-HY
Test Engineer	Jack Cheng, Lance Chiang, and Chuan Chul
Temperature	23~24°C
Relative Humidity	63~66%

**Note:** The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No. TW1190 and TW0007



## **1.4 Applied Standards**

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

- ♦ ANSI C63.26-2015
- ♦ 47 CFR Part 2, Part 27(D)
- ♦ ANSI / TIA-603-E
- ♦ FCC KDB 971168 Power Meas License Digital Systems D01 v03r01
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01

**Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

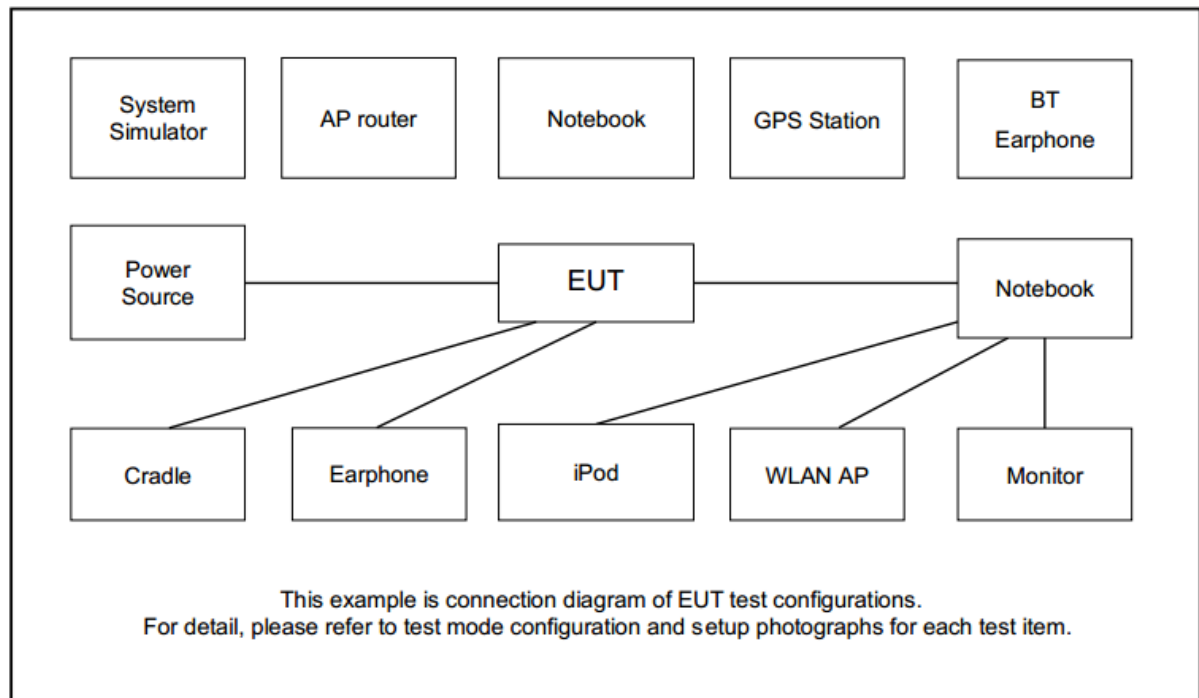
## 2 Test Configuration of Equipment Under Test

### 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.

Test Items	Band	Bandwidth (MHz)						Modulation			RB #			Test Channel		
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	1	Half	Full	L	M	H
Max. Output Power	30	-	-	v	v	-	-	v	v	v	v	v	v	v	v	v
Peak-to-Average Ratio	30	-	-		v	-	-	v	v	v	v		v	v	v	v
E.I.R.P PSD	30	-	-	v	v	-	-	v	v	v	v			v	v	v
26dB and 99% Bandwidth	30	-	-	v	v	-	-	v	v	v			v	v	v	v
Conducted Band Edge	30	-	-	v	v	-	-	v	v	v	v		v	v		v
Conducted Spurious Emission	30	-	-	v	v	-	-	v	v	v	v			v	v	v
Frequency Stability	30	-	-		v	-	-	v	v	v			v		v	
Radiated Spurious Emission	30	Worst Case												v	v	v
Remark	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.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m

## 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 and attenuator factor 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 and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$





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

LTE Band 30 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	27710	-
	Frequency	-	2310	-
5	Channel	27685	27710	27735
	Frequency	2307.5	2310	2312.5

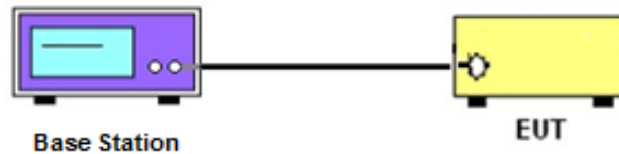
### 3 Conducted Test Items

#### 3.1 Measuring Instruments

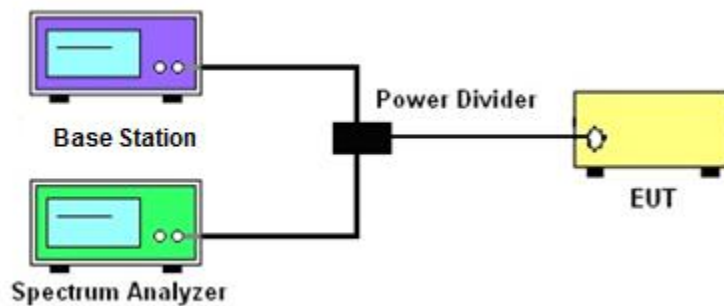
See list of measuring instruments of this test report.

##### 3.1.1 Test Setup

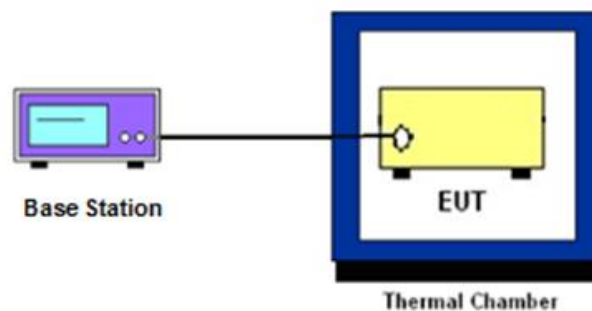
##### 3.1.2 Conducted Output Power



##### 3.1.3 Peak-to-Average Ratio, Occupied Bandwidth, 26dB Bandwidth ,Band-Edge and Conducted Spurious Emission



##### 3.1.4 Frequency Stability



##### 3.1.5 Test Result of Conducted Test

Please refer to Appendix A.

## 3.2 Conducted Output Power Measurement and EIRP Measurement

### 3.2.1 Description of the Conducted Output Power Measurement and EIRP Measurement

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

The EIRP of mobile transmitters must not exceed 0.25 Watts for LTE Band 30.

According to KDB 412172 D01 Power Approach,

$EIRP = P_T + G_T - L_C$ , 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

### 3.2.2 Test Procedures

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

### **3.3 Peak-to-Average Ratio**

#### **3.3.1 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.

#### **3.3.2 Test Procedures**

The testing follows ANSI C63.26-2015 Section 5.2.6

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

## 3.4 EIRP Power Density

### 3.4.1 Description of EIRP Power Density

For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, *except that* for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth. For mobile and portable stations using time division duplexing (TDD) technology, the duty cycle must not exceed 38 percent in the 2305-2315 MHz and 2350-2360 MHz bands. Mobile and portable stations using FDD technology are restricted to transmitting in the 2305-2315 MHz band. Power averaging shall not include intervals in which the transmitter is off.

### 3.4.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.2.4.5

1. Set instrument center frequency to OBW center frequency.
2. Set span to at least 1.5 times the OBW.
3. Set the RBW to the specified reference bandwidth (5MHz).
4. Set VBW  $\geq 3 \times$  RBW.
5. Detector = RMS (power averaging).
6. Ensure that the number of measurement points in the sweep  $\geq 2 \times$  span/RBW.
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).
10. Determine the EIRP by adding the effective antenna gain to the adjusted power level.

## 3.5 Occupied Bandwidth

### 3.5.1 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.

### 3.5.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.4.3 (26dB) and Section 5.4.4 (99OB)

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. 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.
3. 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.
4. Set the detection mode to peak, and the trace mode to max hold.
5. 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)
6. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
7. 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.
8. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

## 3.6 Conducted Band Edge

### 3.6.1 Description of Conducted Band Edge Measurement

27.53 (a)(4)

For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360 MHz bands:

- (i) By a factor of not less than:  $43 + 10 \log (P)$  dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than  $55 + 10 \log (P)$  dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than  $61 + 10 \log (P)$  dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than  $67 + 10 \log (P)$  dB on all frequencies between 2328 and 2337 MHz.
- (ii) By a factor of not less than  $43 + 10 \log (P)$  dB on all frequencies between 2300 and 2305 MHz,  $55 + 10 \log (P)$  dB on all frequencies between 2296 and 2300 MHz,  $61 + 10 \log (P)$  dB on all frequencies between 2292 and 2296 MHz,  $67 + 10 \log (P)$  dB on all frequencies between 2288 and 2292 MHz, and  $70 + 10 \log (P)$  dB below 2288 MHz.
- (iii) By a factor of not less than  $43 + 10 \log (P)$  dB on all frequencies between 2360 and 2365 MHz, and not less than  $70 + 10 \log (P)$  dB above 2365 MHz.

### 3.6.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.7.

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

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

## 3.7 Conducted Spurious Emission

### 3.7.1 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  $70 + 10 \log (P)$  dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 9 kHz up to a frequency including its 10<sup>th</sup> harmonic.

### 3.7.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.7.

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. 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.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
6. Set spectrum analyzer with RMS detector.
7. Taking the record of maximum spurious emission.
8. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
9. The limit line is derived from  $70 + 10\log(P)$ dB below the transmitter power P(Watts)



## **3.8 Frequency Stability**

### **3.8.1 Description of Frequency Stability Measurement**

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

### **3.8.2 Test Procedures for Temperature Variation**

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

1. The EUT was set up in the thermal chamber and connected with the system simulator.
2. 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.
3. 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.

### **3.8.3 Test Procedures for Voltage Variation**

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

1. The EUT was placed in a temperature chamber at 20±5° C and connected with the system simulator.
2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

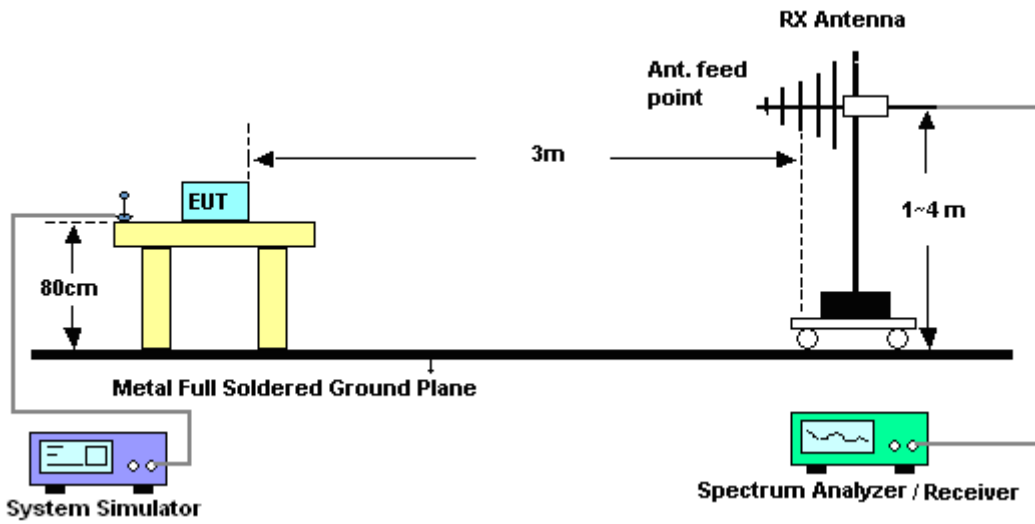
## 4 Radiated Test Items

### 4.1 Measuring Instruments

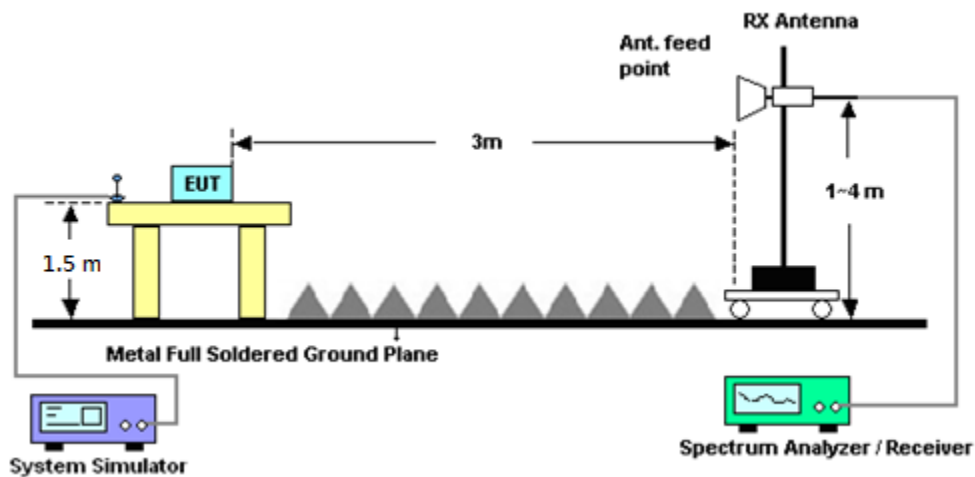
See list of measuring instruments of this test report.

#### 4.1.1 Test Setup

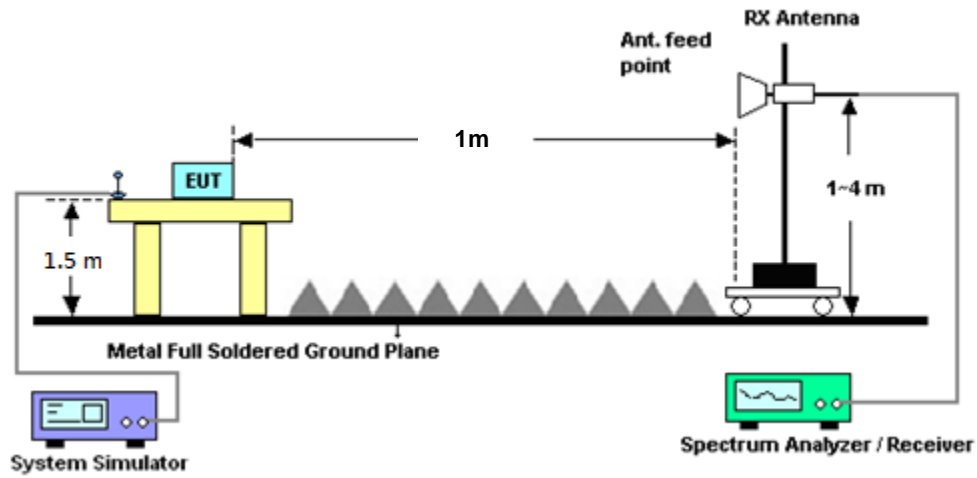
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



#### 4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

## 4.2 Radiated Spurious Emission Measurement

### 4.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. 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  $70 + 10 \log(P)$  dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

### 4.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI / TIA-603-E Section 2.2.12.

1. 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.
2. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
5. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.

$$\text{EIRP (dBm)} = \text{S.G. Power} - \text{Tx Cable Loss} + \text{Tx Antenna Gain}$$

$$\text{ERP (dBm)} = \text{EIRP} - 2.15$$

4. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from  $70 + 10\log(P)$ dB below the transmitter power P(Watts)

$$= P(W) - [70 + 10\log(P)] \text{ (dB)}$$

$$= [30 + 10\log(P)] \text{ (dBm)} - [70 + 10\log(P)] \text{ (dB)}$$

$$= -40\text{dBm}.$$



## 5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
LTE Base Station	Anritsu	MT8820C	6201341951	GSM/GPRS /WCDMA/LTE	Mar. 21, 2018	Feb. 27, 2019	Mar. 20, 2020	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 13, 2018	Feb. 27, 2019	Nov. 12, 2019	Conducted (TH05-HY)
Temperature Chamber	ESPEC	SH-641	92013720	-30℃~70℃	Aug. 29, 2018	Feb. 27, 2019	Aug. 28, 2019	Conducted (TH05-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL890001	1V~20V 0.5A~5A	Oct. 08, 2018	Feb. 27, 2019	Oct. 07, 2019	Conducted (TH05-HY)
Coupler	Warison	1-18GHz 20dB 25WSMA Directional Coupler	#B	1G~18GHz	Jan. 14, 2019	Feb. 27, 2019	Jan. 13, 2020	Conducted (TH05-HY)
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz~30 MHz	Mar. 29, 2018	Mar. 01, 2019~Mar. 08, 2019	Mar. 28, 2019	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D&00800 N1D01N-06	37059&01	30MHz~1GHz	Oct. 13, 2018	Mar. 01, 2019~Mar. 08, 2019	Oct. 12, 2019	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1328	1GHz ~ 18GHz	Oct. 19, 2018	Mar. 01, 2019~Mar. 08, 2019	Oct. 18, 2019	Radiation (03CH12-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170576	18GHz ~ 40GHz	May 08, 2018	Mar. 01, 2019~Mar. 08, 2019	May 07, 2019	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103	161075	10MHz~1GHz	Mar. 26, 2018	Mar. 01, 2019~Mar. 08, 2019	Mar. 25, 2019	Radiation (03CH12-HY)
Preamplifier	Jet-Power	JPA0118-55-3 03K	171000180005 4002	1GHz~18GHz	Apr. 17, 2018	Mar. 01, 2019~Mar. 08, 2019	Apr. 16, 2019	Radiation (03CH12-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz ~ 40GHz	Dec. 06, 2018	Mar. 01, 2019~Mar. 08, 2019	Dec. 05, 2019	Radiation (03CH12-HY)
EMI Test Receiver	Rohde & Schwarz	ESU26	100390	20Hz~26.5GHz	Dec. 26, 2018	Mar. 01, 2019~Mar. 08, 2019	Dec. 25, 2019	Radiation (03CH12-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	May 21, 2018	Mar. 01, 2019~Mar. 08, 2019	May 20, 2019	Radiation (03CH12-HY)
Filter	Wainwright	WLJ4-1000-15 30-6000-40ST	SN3	1.53 GHz Lowpass	Mar. 21, 2018	Mar. 01, 2019~Mar. 08, 2019	Mar. 20, 2019	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-1080 -1200-1500-60 SS	SN2	1.2G High Pass	Sep. 16, 2018	Mar. 01, 2019~Mar. 08, 2019	Sep. 15, 2019	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-2700 -3000-18000-6 0ST	SN2	3GHz High Pass	Mar. 21, 2018	Mar. 01, 2019~Mar. 08, 2019	Mar. 20, 2019	Radiation (03CH12-HY)
Filter	Woken	WHKX8-5272. 5-6750-18000-40ST	SN2	6.75G Highpass	Mar. 21, 2018	Mar. 01, 2019~Mar. 08, 2019	Mar. 20, 2019	Radiation (03CH12-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30M-18G	Mar. 14, 2018	Mar. 01, 2019~ Mar. 08, 2019	Mar. 13, 2019	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Oct. 16, 2018	Mar. 01, 2019~ Mar. 08, 2019	Oct. 15, 2019	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30M~40GHz	Oct. 16, 2018	Mar. 01, 2019~ Mar. 08, 2019	Oct. 15, 2019	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Mar. 01, 2019~ Mar. 08, 2019	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Mar. 01, 2019~ Mar. 08, 2019	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Mar. 01, 2019~ Mar. 08, 2019	N/A	Radiation (03CH12-HY)

## 6 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.36
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### Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.70
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### Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ )	3.98
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## Appendix A. Test Results of Conducted Test

### Conducted Output Power(Average power)

LTE Band 30 Maximum Average Power [dBm]						
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest
10	1	0	QPSK	-	23.04	-
10	1	25			23.12	
10	1	49			23.17	
10	25	0			22.20	
10	25	12			22.22	
10	25	25			22.21	
10	50	0			22.23	
10	1	0	16-QAM		22.24	
10	1	25			22.33	
10	1	49			22.43	
10	25	0			21.18	
10	25	12			21.23	
10	25	25			21.20	
10	50	0			21.22	
10	1	0	64-QAM		21.31	
10	1	25			21.38	
10	1	49			21.44	
10	25	0			20.21	
10	25	12			20.24	
10	25	25			20.22	
10	50	0			20.24	
5	1	0	QPSK	23.02	23.05	23.03
5	1	12		23.09	23.15	23.09
5	1	24		23.16	23.14	23.12
5	12	0		22.12	22.17	22.19
5	12	7		22.19	22.22	22.25
5	12	13		22.19	22.22	22.24
5	25	0		22.18	22.18	22.25
5	1	0	16-QAM	22.31	22.35	22.36
5	1	12		22.37	22.41	22.39
5	1	24		22.42	22.46	22.37
5	12	0		21.13	21.18	21.20
5	12	7		21.24	21.23	21.27
5	12	13		21.21	21.24	21.25
5	25	0		21.18	21.17	21.27
5	1	0	64-QAM	21.24	21.36	21.33
5	1	12		21.38	21.46	21.42
5	1	24		21.45	21.43	21.38
5	12	0		20.18	20.23	20.26
5	12	7		20.26	20.31	20.31
5	12	13		20.24	20.29	20.29
5	25	0		20.21	20.20	20.30



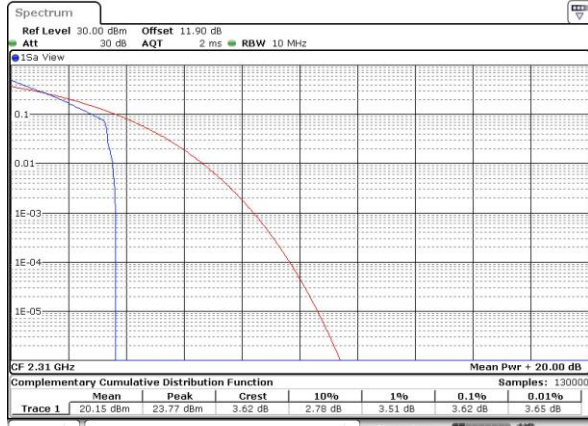
## LTE Band 30

### Peak-to-Average Ratio

Mode	LTE Band 30 / 10MHz				
Mod.	QPSK		16QAM		Limit: 13dB
RB Size	1RB	Full RB	1RB	Full RB	Result
Lowest CH	-	-	-	-	PASS
Middle CH	3.62	4.38	4.49	5.48	
Highest CH	-	-	-	-	
Mode	LTE Band 30 / 10MHz				
Mod.	64QAM				Limit: 13dB
RB Size	1RB	Full RB			Result
Lowest CH	-	-	-	-	PASS
Middle CH	5.48	6.26	-	-	
Highest CH	-	-	-	-	

## LTE Band 30 / 10MHz / QPSK

### Middle Channel / 1RB



Date: 27 FEB 2019 11:23:03

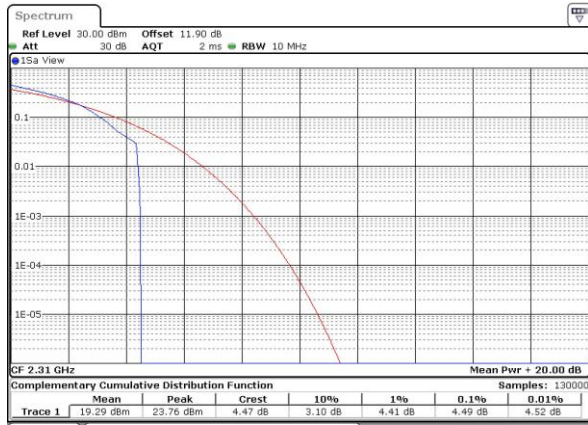
### Middle Channel / Full RB



Date: 27 FEB 2019 11:23:15

## LTE Band 30 / 10MHz / 16QAM

### Middle Channel / 1RB



Date: 27 FEB 2019 11:22:38

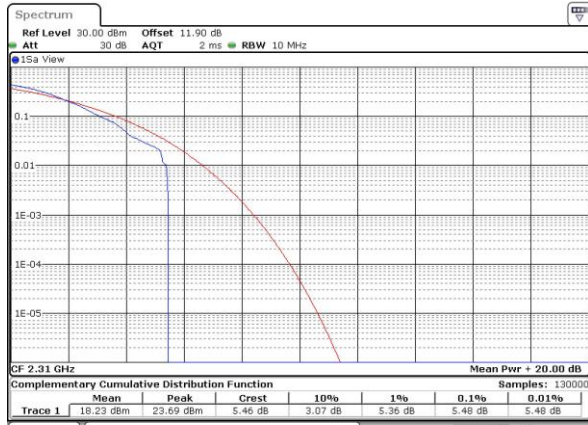
### Middle Channel / Full RB



Date: 27 FEB 2019 11:22:49

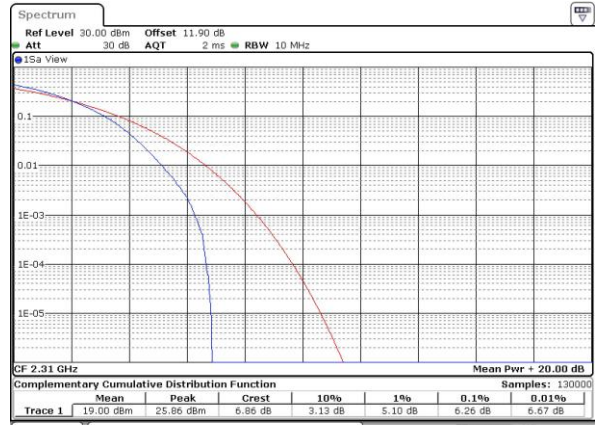
## LTE Band 30 / 10MHz / 64QAM

### Middle Channel / 1RB



Date: 27 FEB 2019 11:22:15

### Middle Channel / Full RB



Date: 27 FEB 2019 11:22:28

**EIRP Power Density**

Mode	LTE Band 30 : Conducted Power Density (dBm/5MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	-	-	-	23.32	22.83	-	-	-	-	-	-
Middle CH	-	-	-	-	23.57	23.17	23.01	22.45	-	-	-	-
Highest CH	-	-	-	-	23.35	22.57	-	-	-	-	-	-
Mode	LTE Band 30 : Conducted Power Density (dBm/5MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM		64QAM		64QAM		64QAM		64QAM		64QAM	
Lowest CH	-	-	-	-	22.27	-	-	-	-	-	-	-
Middle CH	-	-	-	-	22.40	-	21.32	-	-	-	-	-
Highest CH	-	-	-	-	21.85	-	-	-	-	-	-	-

Mode	LTE Band 30 : EIRP Power Density (dBm/5MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	-	-	-	23.32	22.83	-	-	-	-	-	-
Middle CH	-	-	-	-	23.57	23.17	23.01	22.45	-	-	-	-
Highest CH	-	-	-	-	23.35	22.57	-	-	-	-	-	-
Mode	LTE Band 30 : EIRP Power Density (dBm/5MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM		64QAM		64QAM		64QAM		64QAM		64QAM	
Lowest CH	-	-	-	-	22.27	-	-	-	-	-	-	-
Middle CH	-	-	-	-	22.40	-	21.32	-	-	-	-	-
Highest CH	-	-	-	-	21.85	-	-	-	-	-	-	-
Antenna Gain	0 dBi											
Limit	250mW / 5MHz = 24dBm / 5MHz											
Result	Pass											



## LTE Band 30 / 5MHz

## Lowest Channel / 5MHz / 1RB0 / QPSK



Date: 28 FEB 2019 12:00:02

## Lowest Channel / 5MHz / 1RB0 / 16QAM



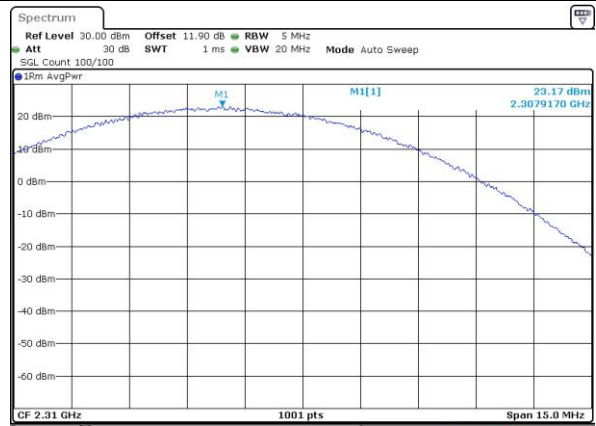
Date: 28 FEB 2019 13:46:36

## Middle Channel / 5MHz / 1RB0 / QPSK



Date: 28 FEB 2019 13:45:10

## Middle Channel / 5MHz / 1RB0 / 16QAM



Date: 28 FEB 2019 13:44:16

## Highest Channel / 5MHz / 1RB0 / QPSK



Date: 28 FEB 2019 12:01:03

## Highest Channel / 5MHz / 1RB0 / 16QAM



Date: 28 FEB 2019 12:01:31



LTE Band 30 / 5MHz

Lowest Channel / 5MHz / 1RB0 / 64QAM



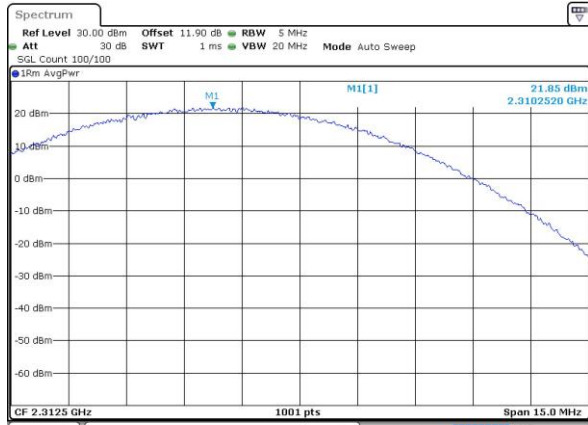
Date: 28 FEB 2019 13:47:05

Middle Channel / 5MHz / 1RB0 / 64QAM



Date: 28 FEB 2019 13:47:23

Highest Channel / 5MHz / 1RB0 / 64QAM

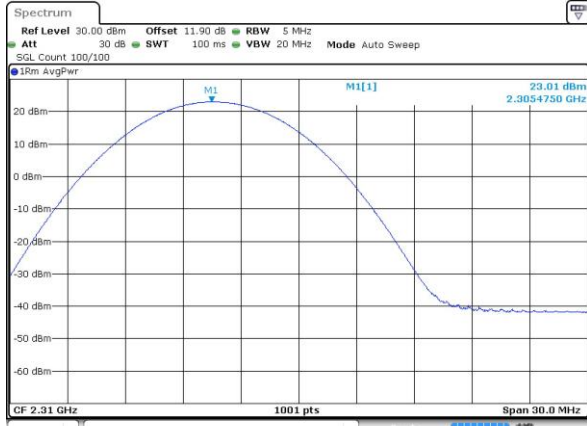


Date: 28 FEB 2019 13:47:49



LTE Band 30 / 10MHz

Lowest Channel / 10MHz / 1RB0 / QPSK



Date: 28 FEB 2019 14:03:38

Lowest Channel / 10MHz / 1RB0 / 16QAM



Date: 28 FEB 2019 13:49:20

Lowest Channel / 10MHz / 1RB0 / 64QAM



Date: 28 FEB 2019 13:49:34

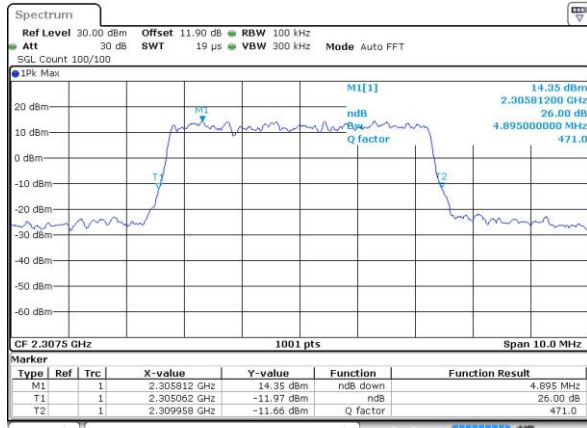
**26dB Bandwidth**

Mode	LTE Band 30 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	-	-	-	4.90	4.92	-	-	-	-	-	-
Middle CH	-	-	-	-	4.92	4.91	9.85	9.87	-	-	-	-
Highest CH	-	-	-	-	4.72	4.85	-	-	-	-	-	-
Mode	LTE Band 30 : 26dB BW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM		64QAM		64QAM		64QAM		64QAM		64QAM	
Lowest CH	-	-	-	-	4.84	-	-	-	-	-	-	-
Middle CH	-	-	-	-	4.80	-	9.77	-	-	-	-	-
Highest CH	-	-	-	-	4.83	-	-	-	-	-	-	-



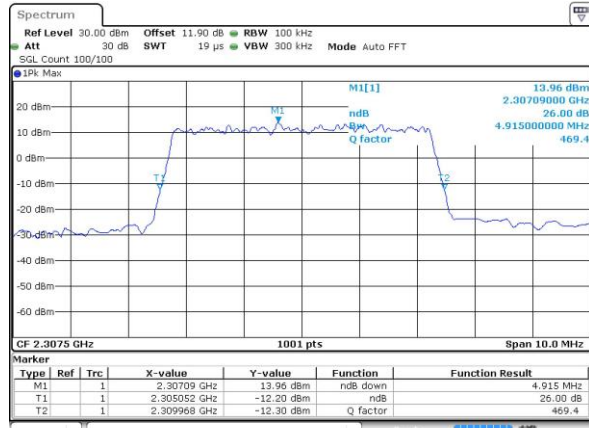
## LTE Band 30

## Lowest Channel / 5MHz / QPSK



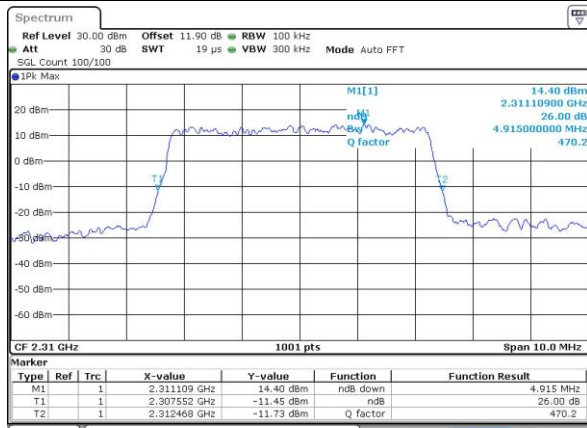
Date: 27 FEB 2019 11:00:49

## Lowest Channel / 5MHz / 16QAM



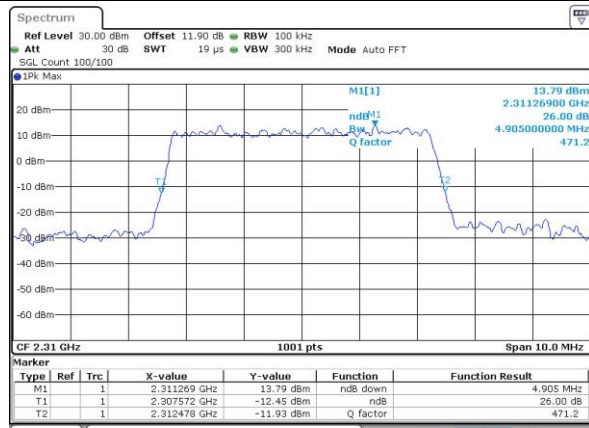
Date: 27 FEB 2019 11:01:01

## Middle Channel / 5MHz / QPSK



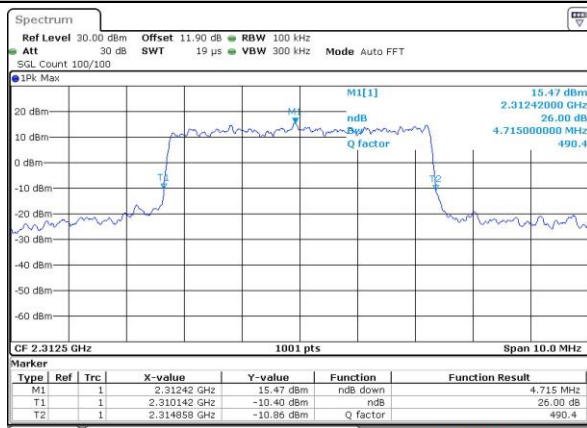
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## Middle Channel / 5MHz / 16QAM



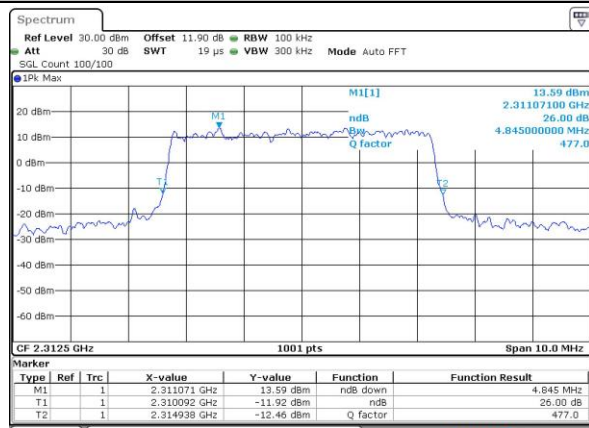
Date: 27 FEB 2019 11:01:46

## Highest Channel / 5MHz / QPSK



Date: 27 FEB 2019 11:02:21

## Highest Channel / 5MHz / 16QAM



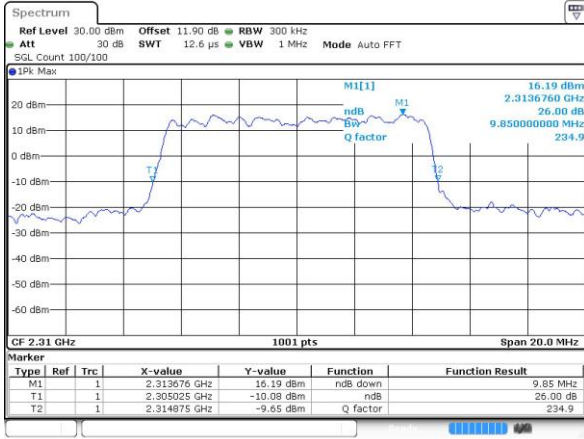
Date: 27 FEB 2019 11:02:32





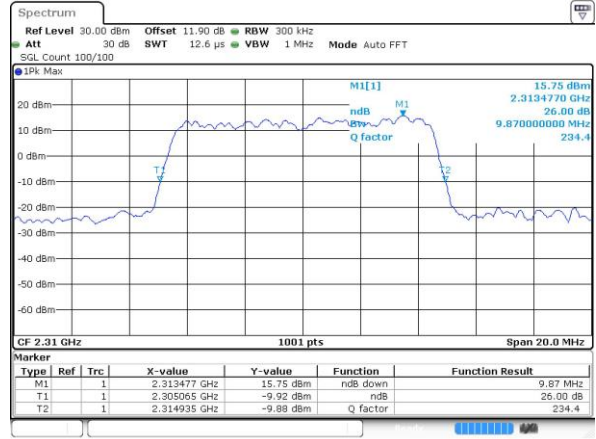
## LTE Band 30

## Middle Channel / 10MHz / QPSK



Date: 27.FEB.2019 11:03:06

## Middle Channel / 10MHz / 16QAM

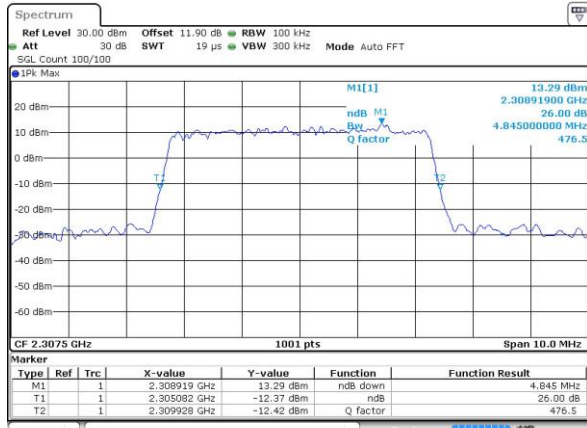


Date: 27.FEB.2019 11:03:18



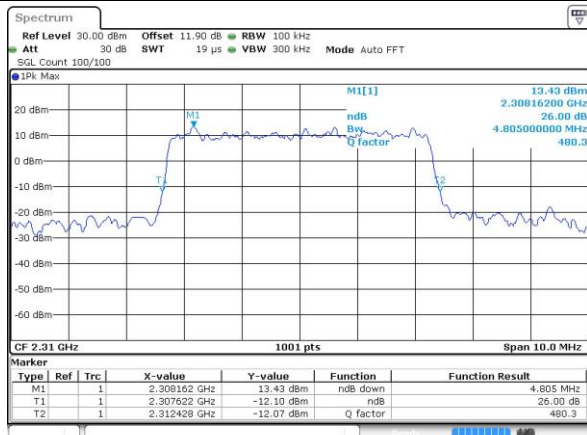
## LTE Band 30

## Lowest Channel / 5MHz / 64QAM



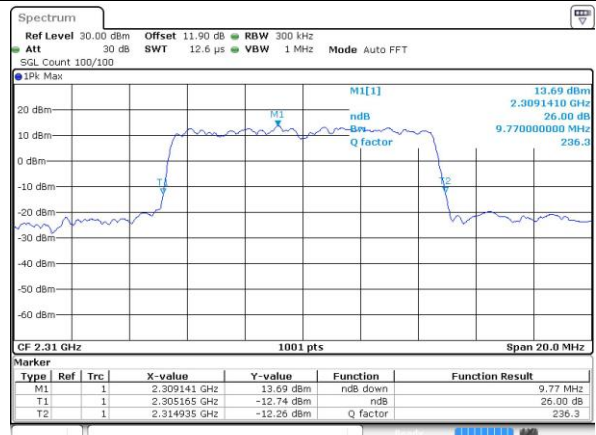
Date: 27 FEB 2019 11:03:40

## Middle Channel / 5MHz / 64QAM



Date: 27 FEB 2019 11:04:03

## Middle Channel / 10MHz / 64QAM



Date: 27 FEB 2019 11:04:49

## Highest Channel / 5MHz / 64QAM



Date: 27 FEB 2019 11:04:26

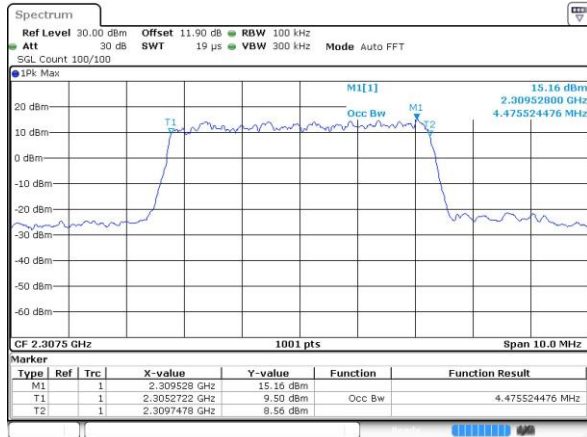
**Occupied Bandwidth**

Mode	LTE Band 30 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	-	-	-	-	4.48	4.49	-	-	-	-	-	-
Middle CH	-	-	-	-	4.50	4.48	9.07	8.97	-	-	-	-
Highest CH	-	-	-	-	4.51	4.51	-	-	-	-	-	-
Mode	LTE Band 26 : 99%OBW(MHz)											
BW	1.4MHz		3MHz		5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM		64QAM		64QAM		64QAM		64QAM		64QAM	
Lowest CH	-	-	-	-	4.50	-	-	-	-	-	-	-
Middle CH	-	-	-	-	4.48	-	9.01	-	-	-	-	-
Highest CH	-	-	-	-	4.48	-	-	-	-	-	-	-



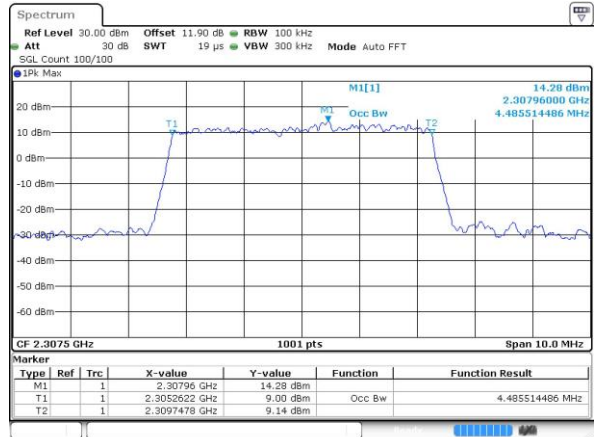
## LTE Band 30

## Lowest Channel / 5MHz / QPSK



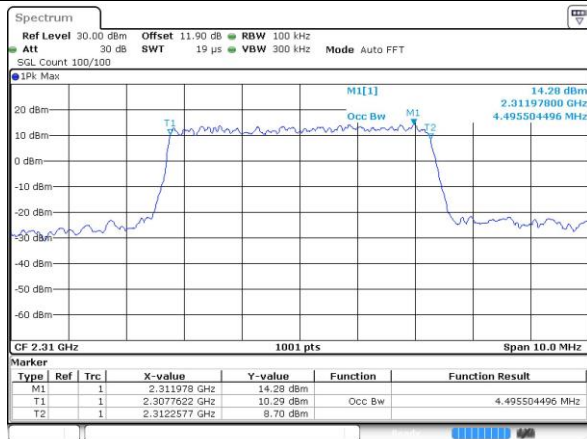
Date: 27 FEB 2019 11:00:26

## Lowest Channel / 5MHz / 16QAM



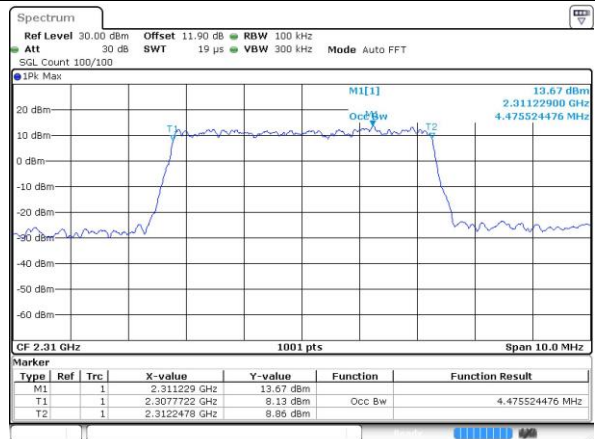
Date: 27 FEB 2019 11:00:38

## Middle Channel / 5MHz / QPSK



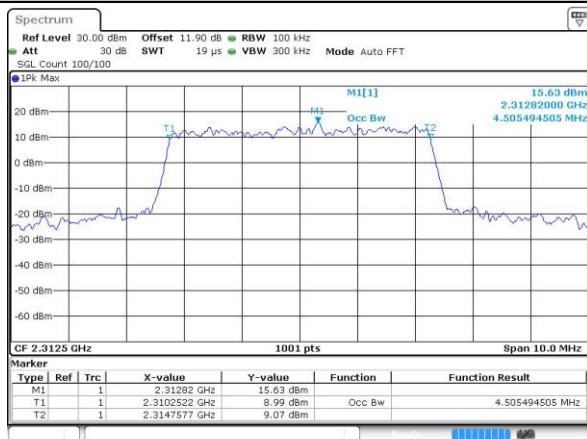
Date: 27 FEB 2019 11:01:12

## Middle Channel / 5MHz / 16QAM



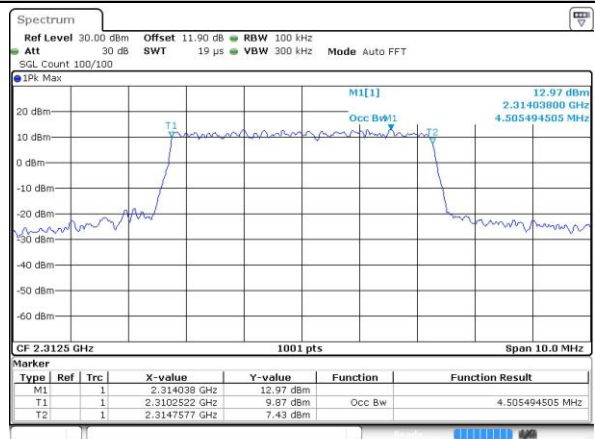
Date: 27 FEB 2019 11:01:24

## Highest Channel / 5MHz / QPSK



Date: 27 FEB 2019 11:01:58

## Highest Channel / 5MHz / 16QAM

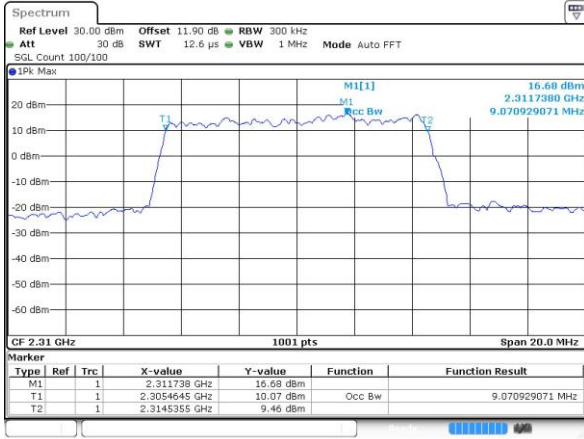


Date: 27 FEB 2019 11:02:09

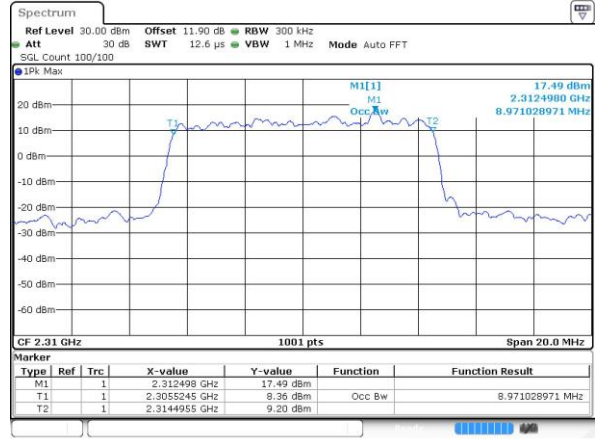


## LTE Band 30

## Middle Channel / 10MHz / QPSK



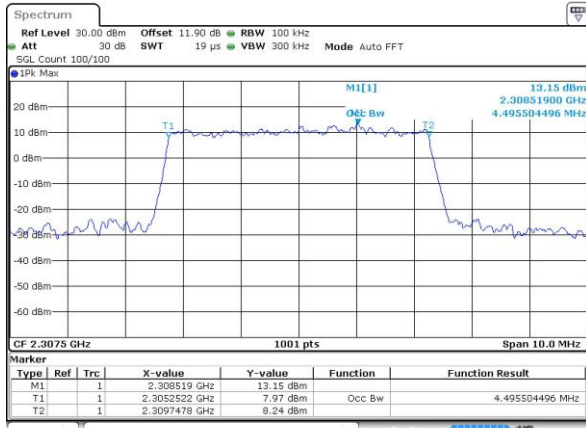
## Middle Channel / 10MHz / 16QAM





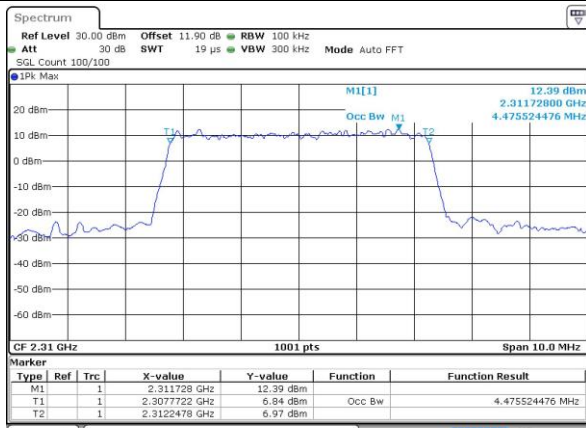
## LTE Band 30

## Lowest Channel / 5MHz / 64QAM



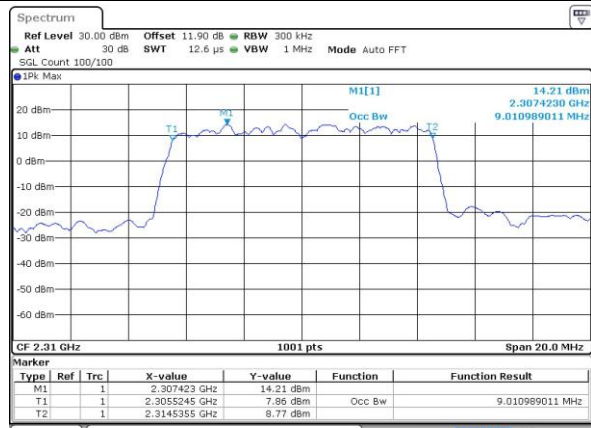
Date: 27 FEB 2019 11:03:29

## Middle Channel / 5MHz / 64QAM



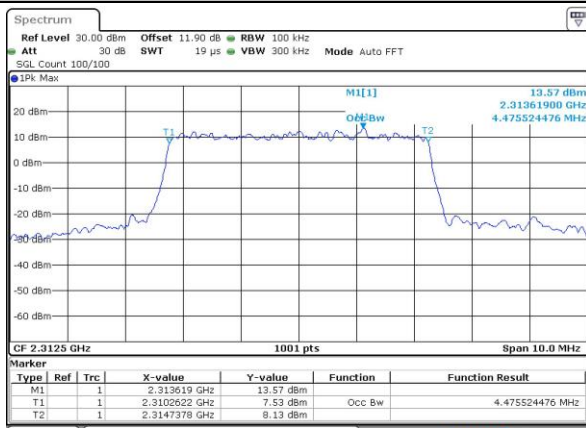
Date: 27 FEB 2019 11:03:52

## Middle Channel / 10MHz / 64QAM

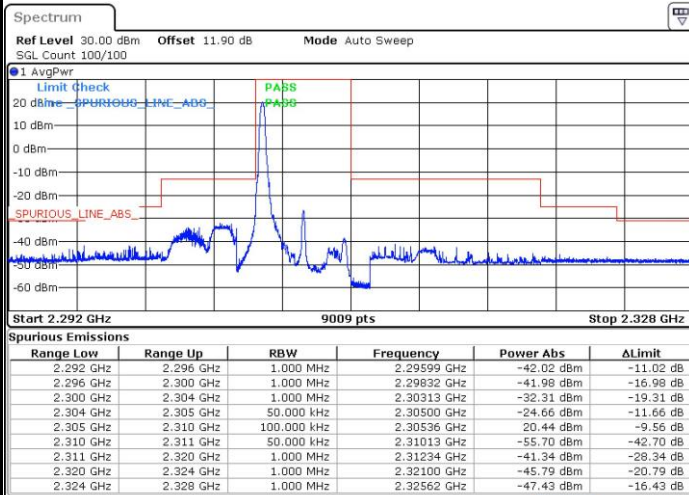


Date: 27 FEB 2019 11:04:37

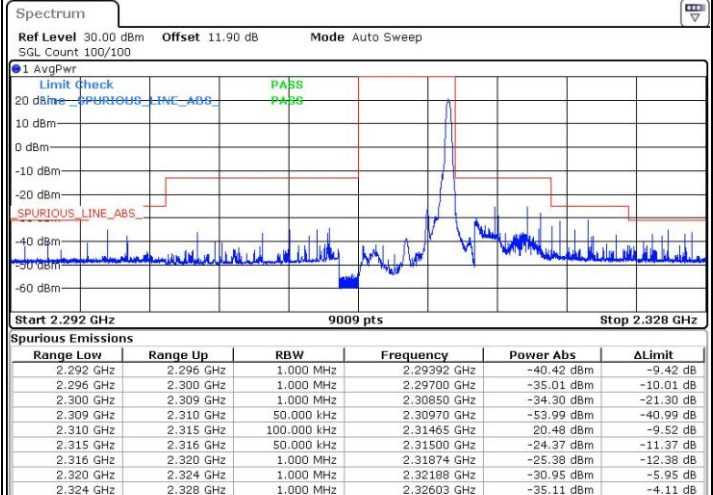
## Highest Channel / 5MHz / 64QAM



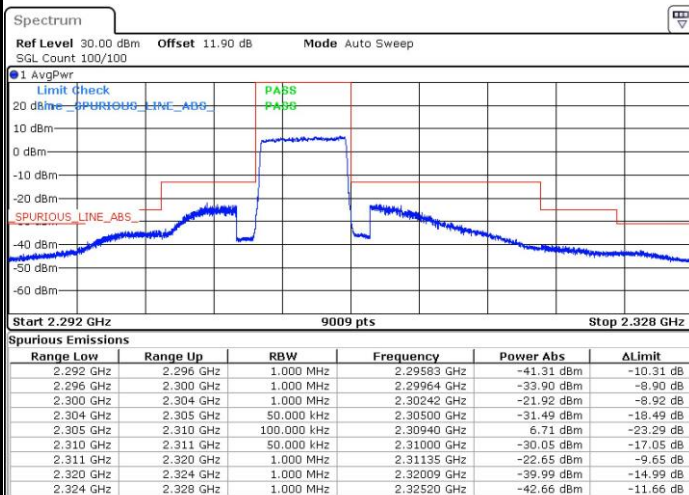
Date: 27 FEB 2019 11:04:15

**Conducted Band Edge****LTE Band 30 / 5MHz / QPSK****Lowest Band Edge / 1 RB**

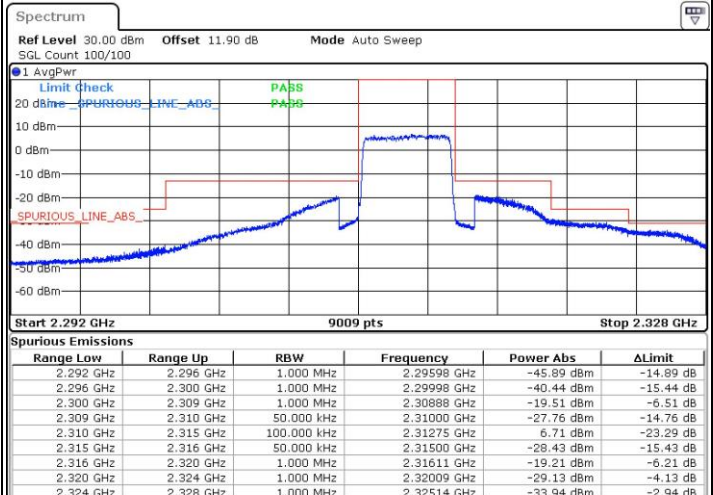
Date: 27.FEB.2019 11:25:10

**Highest Band Edge / 1 RB**

Date: 27.FEB.2019 11:32:16

**Lowest Band Edge / Full RB**

Date: 27.FEB.2019 11:28:43

**Highest Band Edge / Full RB**

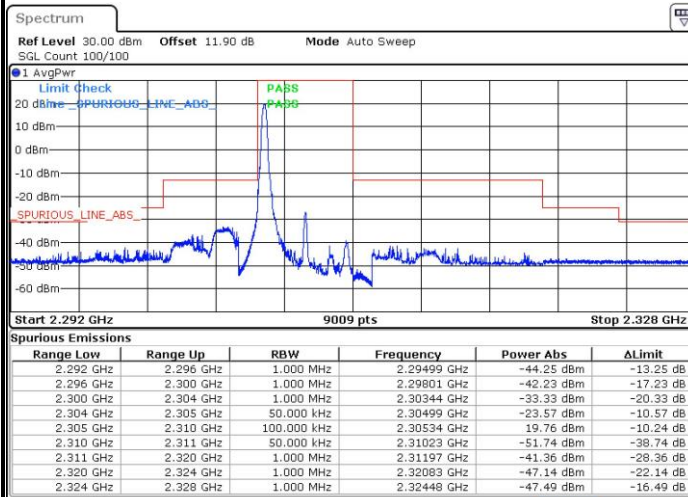
Date: 27.FEB.2019 11:35:49





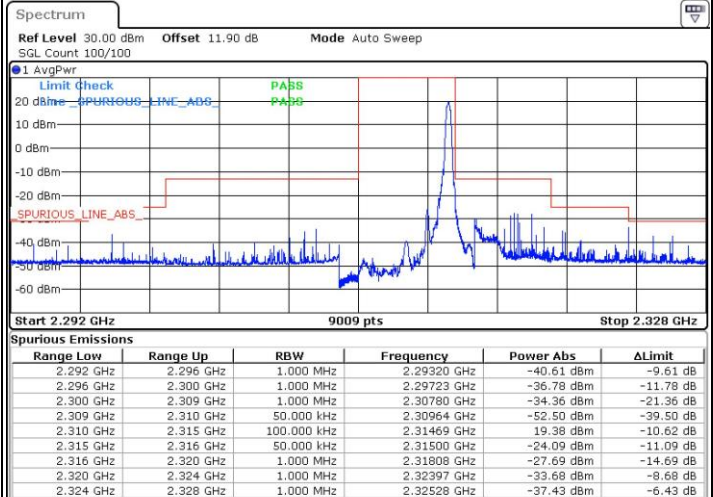
## LTE Band 30 / 5MHz / 16QAM

## Lowest Band Edge / 1RB



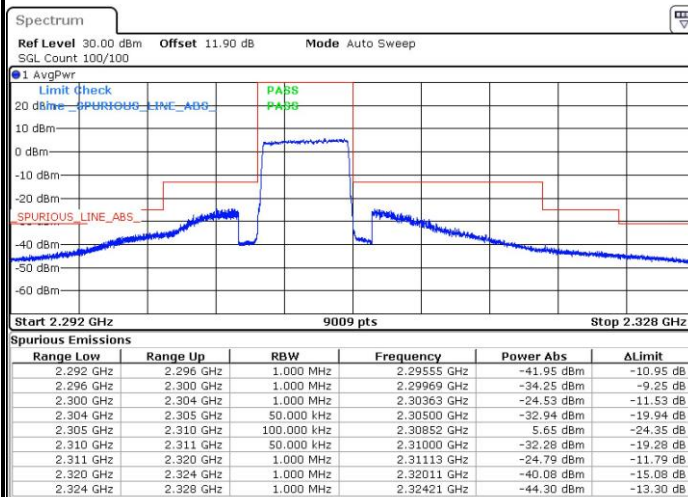
Date: 27.FEB.2019 11:26:21

## Highest Band Edge / 1 RB



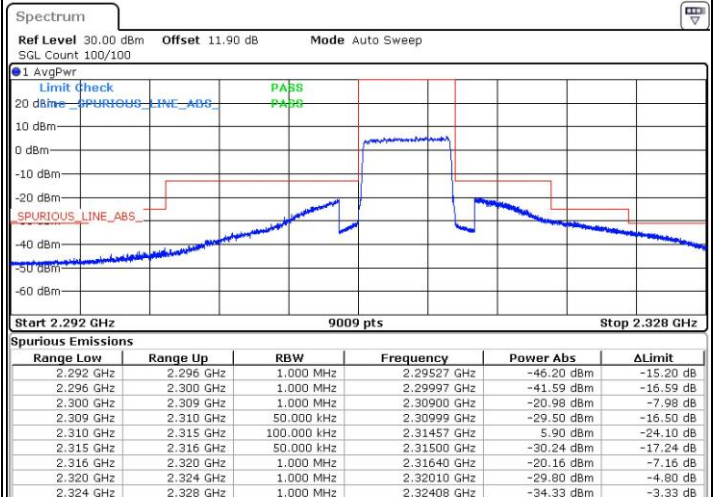
Date: 27.FEB.2019 11:33:27

## Lowest Band Edge / Full RB



Date: 27.FEB.2019 11:29:54

## Highest Band Edge / Full RB



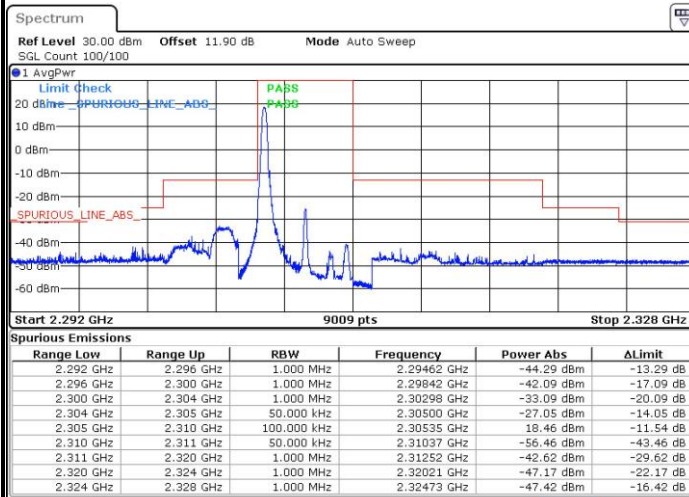
Date: 27.FEB.2019 11:37:01





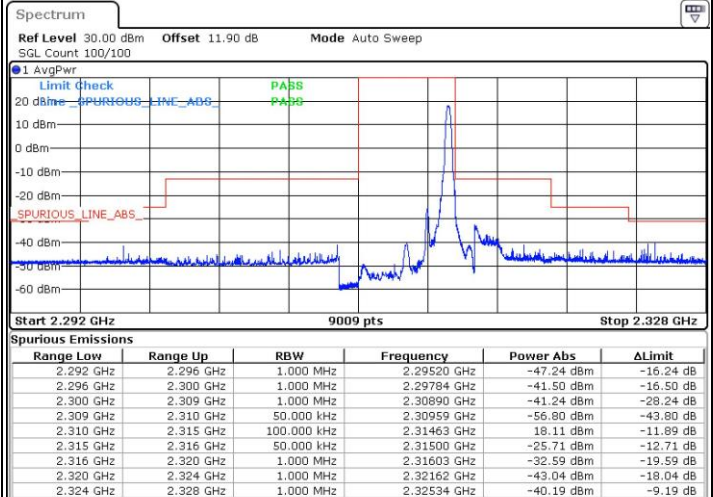
## LTE Band 30 / 5MHz / 64QAM

## Lowest Band Edge / 1RB



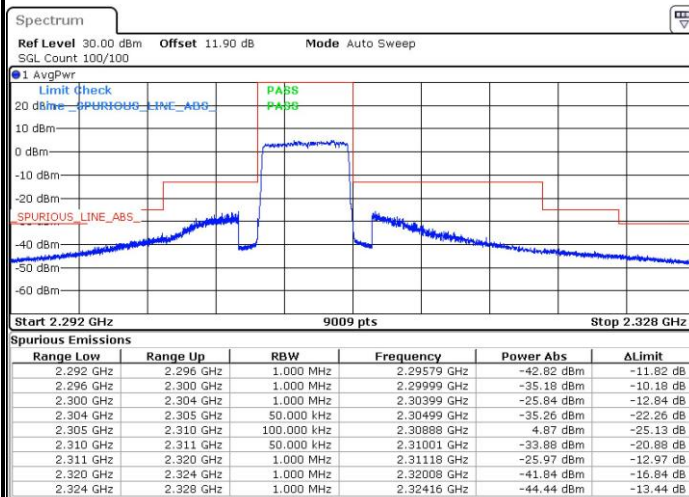
Date: 27.FEB.2019 11:27:32

## Highest Band Edge / 1 RB



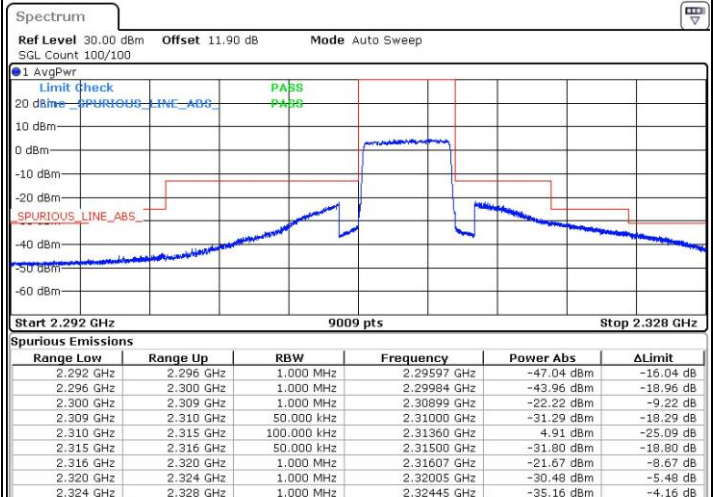
Date: 27.FEB.2019 11:34:38

## Lowest Band Edge / Full RB



Date: 27.FEB.2019 11:31:05

## Highest Band Edge / Full RB

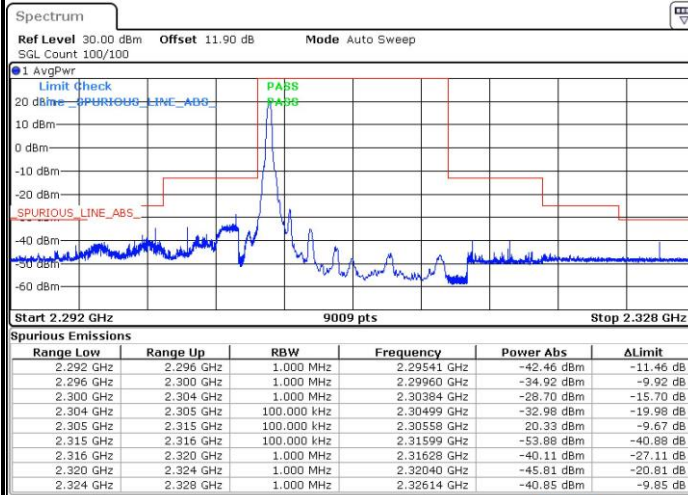


Date: 27.FEB.2019 11:38:12



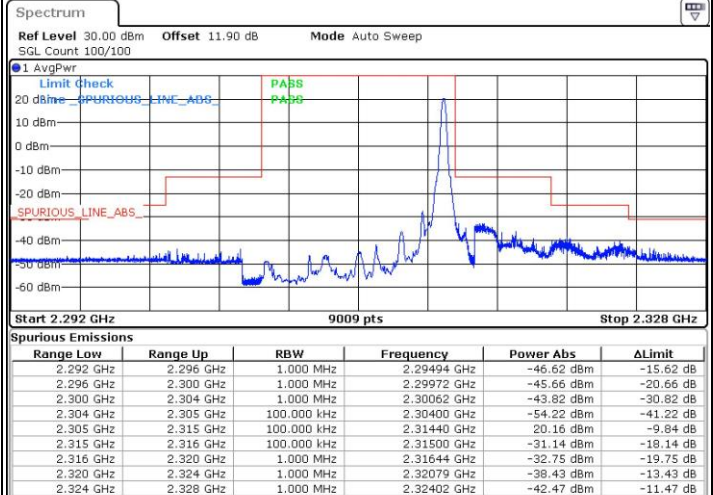
## LTE Band 30 / 10MHz / QPSK

## Lowest Band Edge / 1 RB



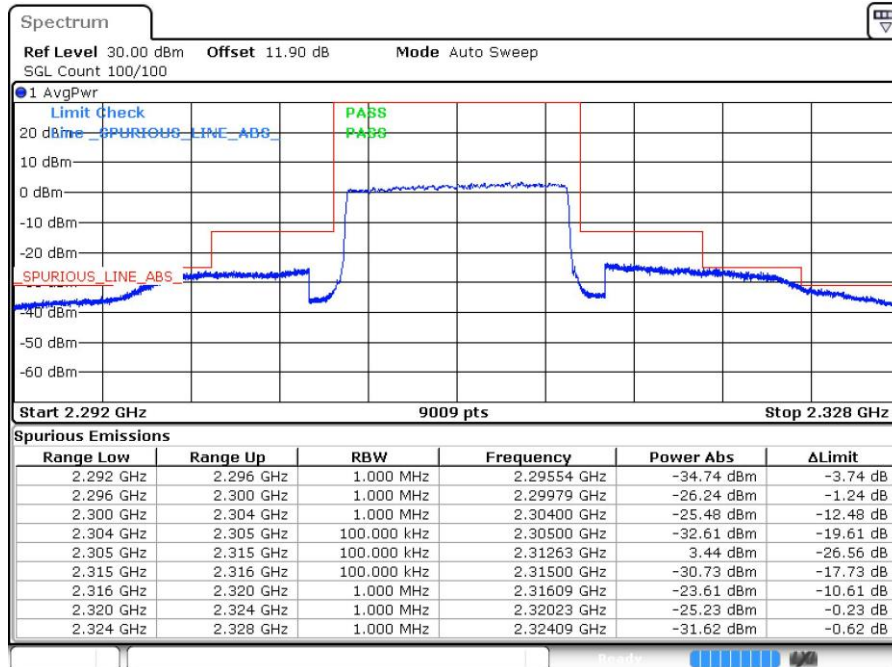
Date: 27.FEB.2019 11:39:23

## Highest Band Edge / 1 RB



Date: 27.FEB.2019 11:42:56

## Band Edge / Full RB

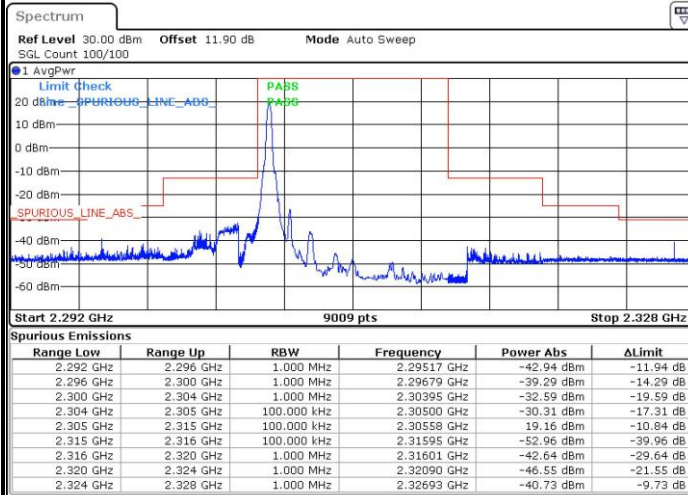


Date: 28.FEB.2019 11:58:46



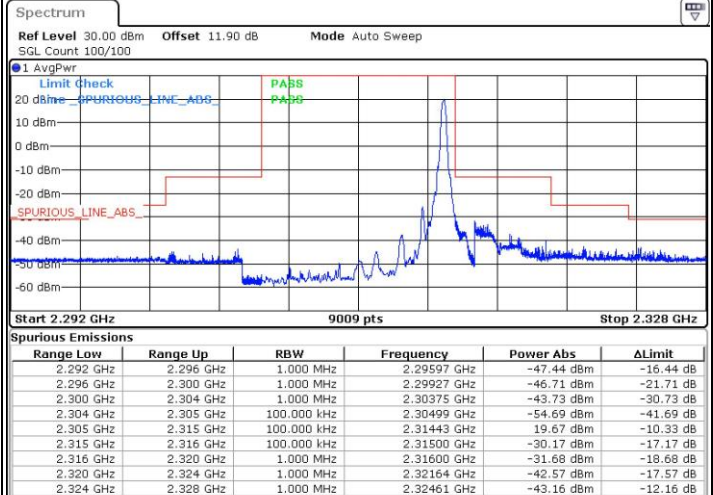
## LTE Band 30 / 10MHz / 16QAM

## Lowest Band Edge / 1 RB



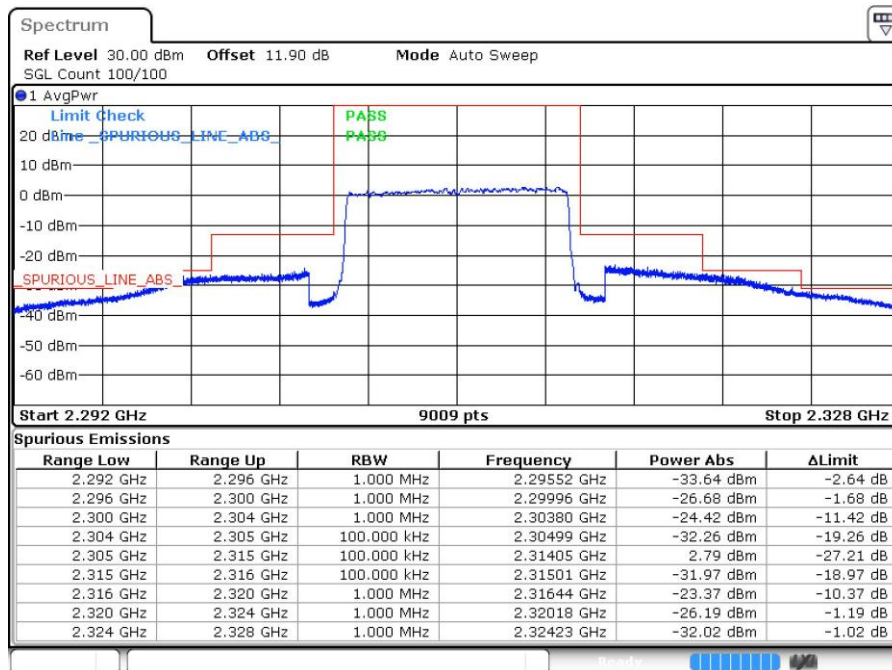
Date: 27.FEB.2019 11:40:34

## Highest Band Edge / 1 RB



Date: 27.FEB.2019 11:44:07

## Band Edge / Full RB



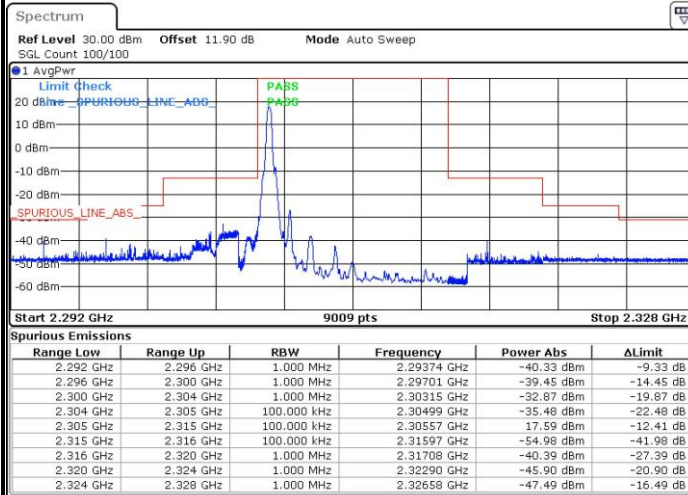
Date: 27.FEB.2019 11:47:40



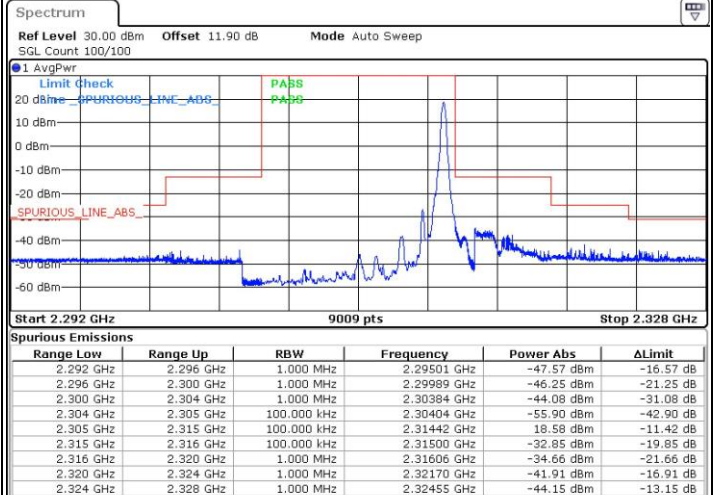


## LTE Band 30 / 10MHz / 64QAM

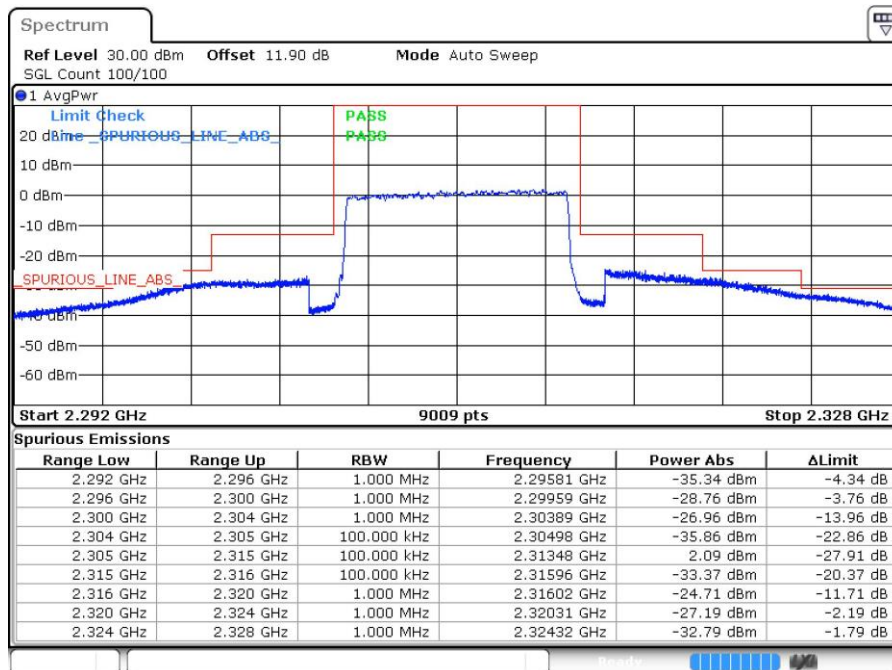
## Lowest Band Edge / 1 RB



## Highest Band Edge / 1 RB



## Band Edge / Full RB

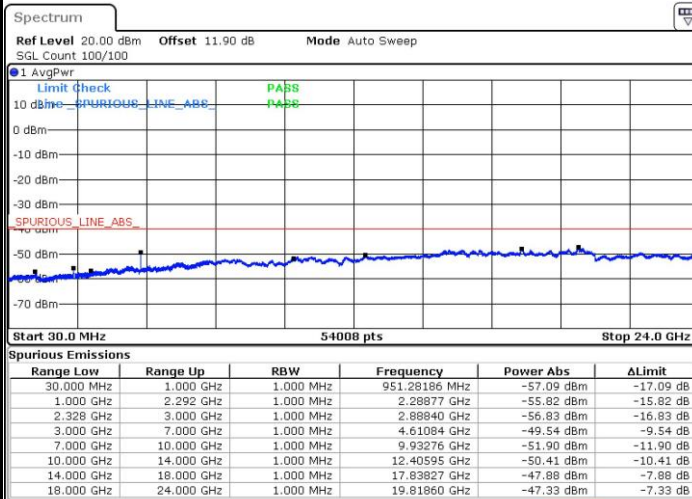




# Conducted Spurious Emission

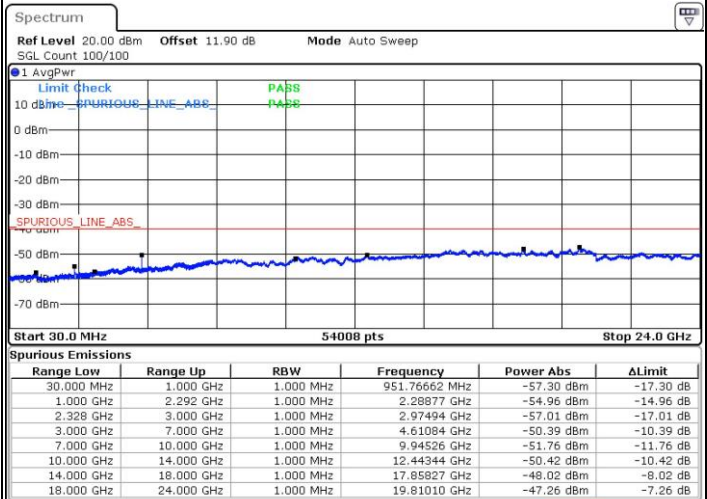
## LTE Band 30 / 5MHz

### Lowest Channel / QPSK



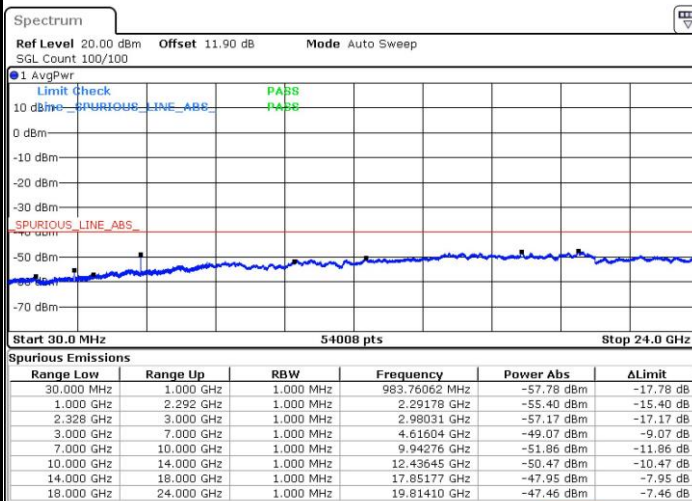
Date: 27.FEB.2019 11:50:32

### Lowest Channel / 16QAM



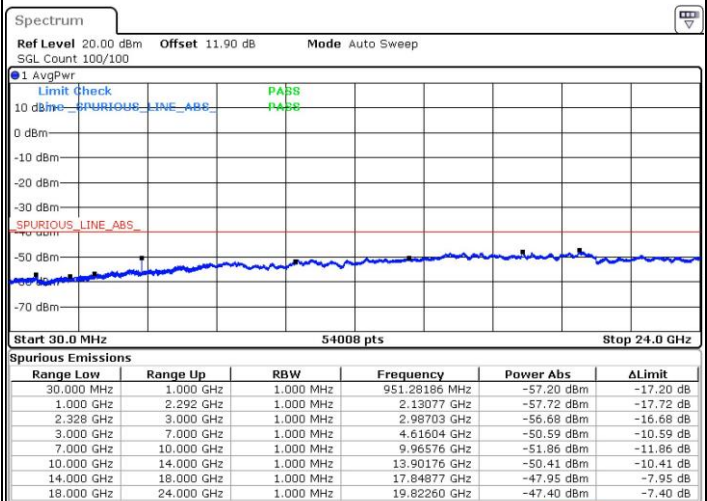
Date: 27.FEB.2019 11:51:22

### Middle Channel / QPSK



Date: 27.FEB.2019 11:52:13

### Middle Channel / 16QAM

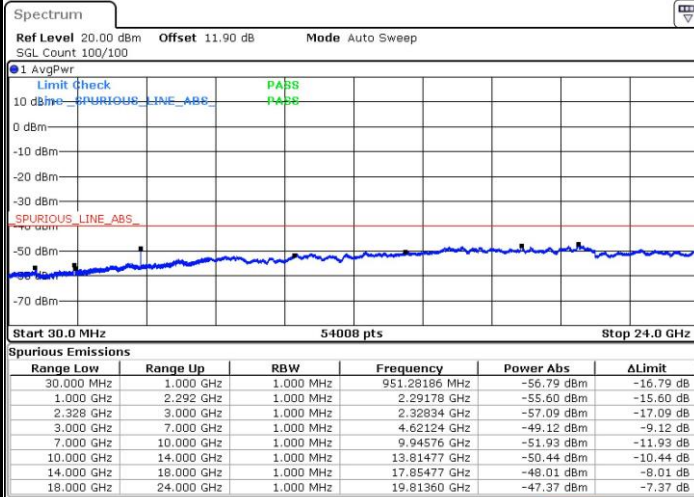


Date: 27.FEB.2019 11:53:03



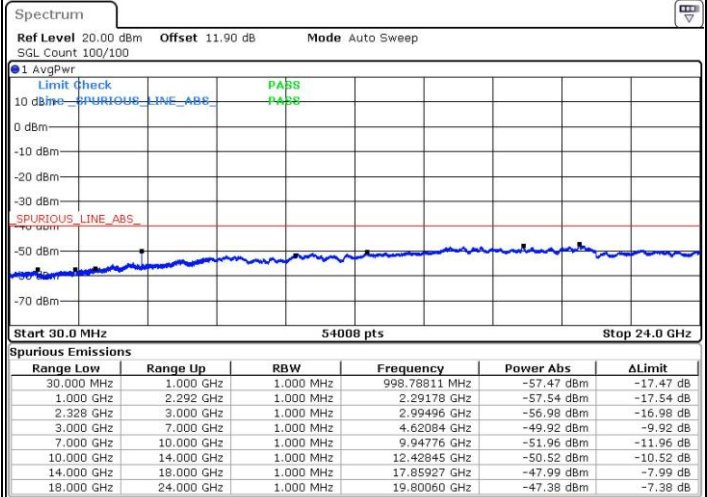
## LTE Band 30 / 5MHz

## Highest Channel / QPSK



Date: 27.FEB.2019 11:53:54

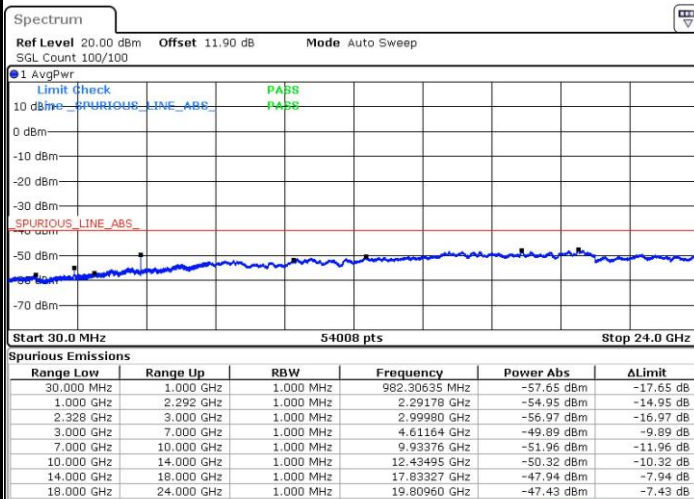
## Highest Channel / 16QAM



Date: 27.FEB.2019 11:54:44

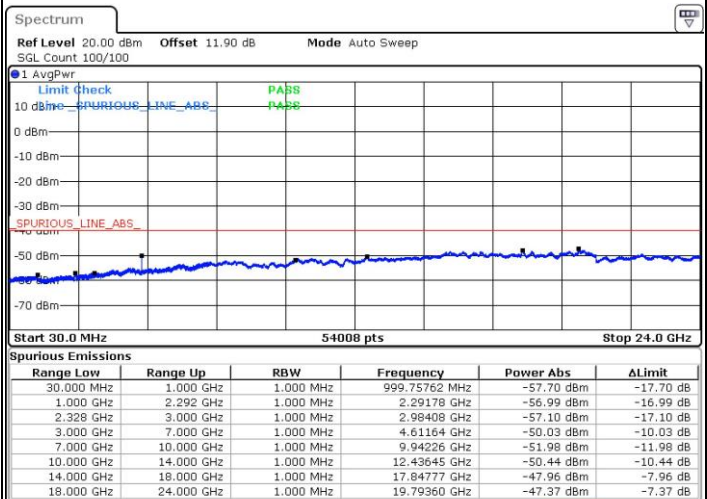
## LTE Band 30 / 10MHz

## Middle Channel / QPSK



Date: 27.FEB.2019 11:58:57

## Middle Channel / 16QAM

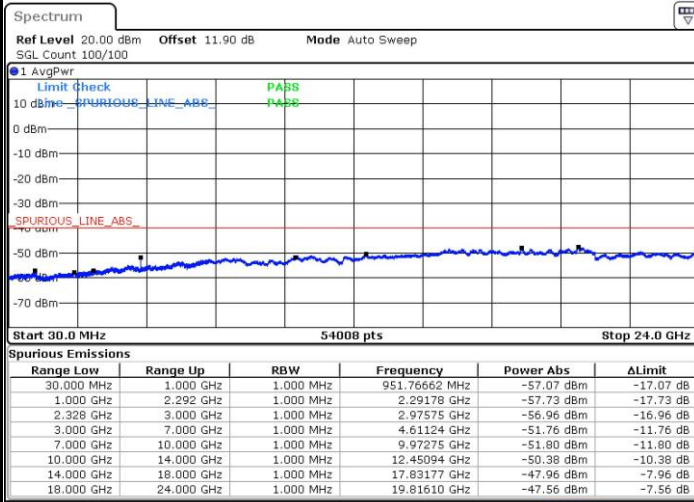


Date: 27.FEB.2019 11:59:48



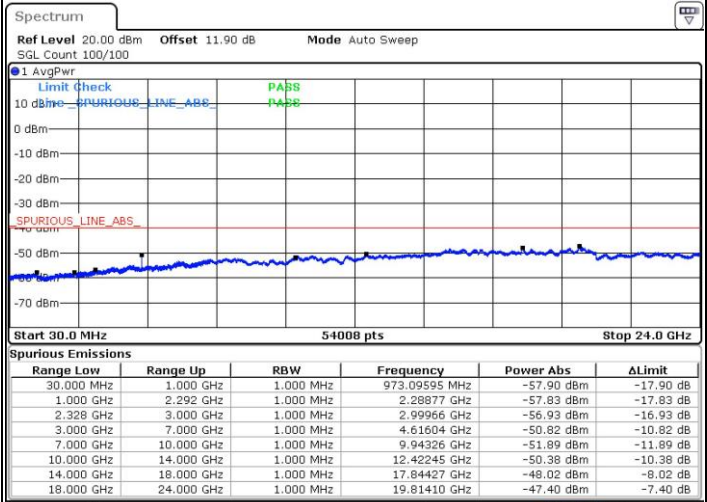
## LTE Band 30 / 5MHz

## Lowest Channel / 64QAM



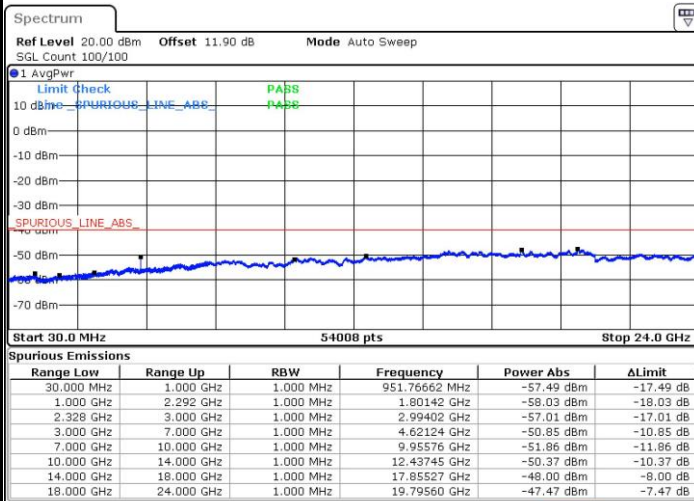
Date: 27.FEB.2019 11:55:35

## Middle Channel / 64QAM



Date: 27.FEB.2019 11:56:26

## Highest Channel / 64QAM

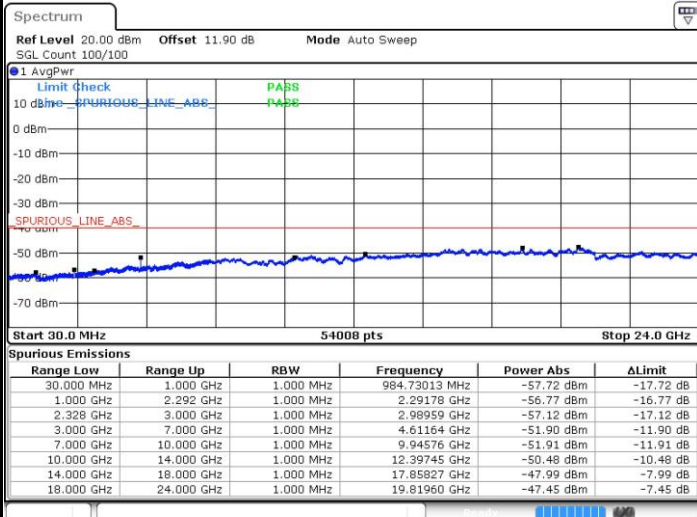


Date: 27.FEB.2019 11:57:16



## LTE Band 30 / 10MHz

## Middle Channel / 64QAM



Date: 27.FEB.2019 11:58:07



## Frequency Stability

Test Conditions		LTE Band 30 (QPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	0.0002	PASS
40	Normal Voltage	0.0055	
30	Normal Voltage	0.0004	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0005	
0	Normal Voltage	0.0055	
-10	Normal Voltage	0.0002	
-20	Normal Voltage	0.0064	
-30	Normal Voltage	0.0062	
20	Maximum Voltage	0.0004	
20	Normal Voltage	0.0000	
20	Battery End Point	0.0058	

**Note:**

1. Normal Voltage =3.8 V. ; Battery End Point (BEP) =3.6 V. ; Maximum Voltage =4.2 V..
2. Note: The frequency fundamental emissions stay within the authorized frequency block.



## Appendix B. Test Results of EIRP and Radiated Test

### EIRP

#### <Reporting Only>

LTE Band 30 / 5MHz (Average) (GT - LC = 0 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	1	24	23.16	0.2070	23.16	0.2070
Middle		1	24	23.14	0.2061	23.14	0.2061
Highest		1	24	23.12	0.2051	23.12	0.2051
Lowest	16QAM	1	24	22.42	0.1746	22.42	0.1746
Middle		1	24	22.46	0.1762	22.46	0.1762
Highest		1	24	22.37	0.1726	22.37	0.1726
Lowest	64QAM	1	12	21.38	0.1374	21.38	0.1374
Middle		1	12	21.46	0.1400	21.46	0.1400
Highest		1	12	21.42	0.1387	21.42	0.1387
Limit	EIRP < 0.25W			Result		PASS	

LTE Band 30 / 10MHz (Average) (GT - LC = 0 dB)							
Channel	Mode	RB		Conducted		EIRP	
		Size	Offset	Power (dBm)	Power (Watts)	EIRP(dBm)	EIRP(W)
Lowest	QPSK	-	-	-	-	-	-
Middle		1	49	23.17	0.2075	23.17	0.2075
Highest		-	-	-	-	-	-
Lowest	16QAM	-	-	-	-	-	-
Middle		1	49	22.43	0.1750	22.43	0.1750
Highest		-	-	-	-	-	-
Lowest	64QAM	-	-	-	-	-	-
Middle		1	49	21.44	0.1393	21.44	0.1393
Highest		-	-	-	-	-	-
Limit	EIRP < 0.25W			Result		PASS	

**Radiated Spurious Emission****LTE Band 30**

LTE Band 30 / 5MHz / QPSK									
Channel	Frequency ( MHz )	EIRP ( dBm )	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4614	-59.79	-40	-19.79	-57.21	-71.01	1.46	12.68	H
	6924	-61.56	-40	-21.56	-64.49	-71.84	1.73	12.01	H
	9234	-59.79	-40	-19.79	-64.96	-69.40	2.16	11.77	H
									H
	4614	-57.56	-40	-17.56	-54.21	-68.78	1.46	12.68	V
	6924	-62.20	-40	-22.20	-64.68	-72.48	1.73	12.01	V
	9234	-58.98	-40	-18.98	-65.16	-68.59	2.16	11.77	V
									V
Middle	4620	-60.06	-40	-20.06	-57.48	-71.28	1.46	12.68	H
	6924	-61.86	-40	-21.86	-64.79	-72.14	1.73	12.01	H
	9234	-60.49	-40	-20.49	-65.66	-70.10	2.16	11.77	H
									H
	4620	-58.30	-40	-18.30	-54.95	-69.52	1.46	12.68	V
	6924	-62.10	-40	-22.10	-64.58	-72.38	1.73	12.01	V
	9234	-58.80	-40	-18.80	-64.98	-68.41	2.16	11.77	V
									V
Highest	4620	-59.68	-40	-19.68	-57.1	-70.90	1.46	12.68	H
	6930	-60.92	-40	-20.92	-63.94	-71.19	1.73	12.00	H
	9243	-60.06	-40	-20.06	-65.21	-69.65	2.16	11.76	H
									H
	4620	-58.38	-40	-18.38	-55.03	-69.60	1.46	12.68	V
	6930	-62.05	-40	-22.05	-64.61	-72.32	1.73	12.00	V
	9243	-58.67	-40	-18.67	-64.86	-68.26	2.16	11.76	V
									V

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



LTE Band 30 / 10MHz / QPSK									
Channel	Frequency ( MHz )	ERP ( dBm )	Limit ( dBm )	Over Limit ( dB )	SPA Reading (dBm)	S.G. Power ( dBm )	TX Cable loss ( dB )	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	4614	-58.52	-40	-18.52	-55.94	-69.74	1.46	12.68	H
	6918	-60.55	-40	-20.55	-63.48	-70.83	1.73	12.01	H
	9225	-59.68	-40	-19.68	-64.87	-69.30	2.16	11.78	H
									H
									H
									H
									H
	4614	-57.96	-40	-17.96	-54.61	-69.18	1.46	12.68	V
	6918	-61.73	-40	-21.73	-64.21	-72.01	1.73	12.01	V
	9225	-59.21	-40	-19.21	-65.41	-68.83	2.16	11.78	V
									V
									V
									V
									V

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