



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd
FCC ID XMR202012BG95MF
Product LTE Cat M1 & Cat NB2 & WIFI Module
Brand Quectel
Model BG95-MF
Report No. R2012A0839-R1
Issue Date January 19, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2019)/ FCC CFR 47 Part 22H (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Radiated Power	2.1046 22.913(a)(5)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	2.1051 / 22.917(a)	PASS
4	Peak-to-Average Power Ratio	22.913(d)/ KDB 971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 22.355	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 / 22.917(a)	PASS
7	Radiates Spurious Emission	2.1053 / 22.917 (a)	PASS
Date of Testing: December 7, 2020 ~ January 14, 2021			
Date of Sample Received: December 4, 2020			
Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			



1. Test Laboratory

1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City: Shanghai
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E-mail: xukai@ta-shanghai.com

2. General Description of Equipment under Test

2.3. Applicant and Manufacturer Information

Applicant	Quectel Wireless Solutions Co., Ltd
Applicant address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233
Manufacturer	Quectel Wireless Solutions Co., Ltd
Manufacturer address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China 200233

2.4. General Information

EUT Description		
Model	BG95-MF	
IMEI	860612040005002	
Hardware Version	R1.1	
Software Version	BG95MFLAR02A01	
Power Supply	External power supply	
Antenna Type	The EUT don't have standard Antenna, The Antenna used for testing in this report is the after-market accessory (Dipole Antenna)	
Antenna Gain	Frequency(MHz)	Antenna Gain(dBi)
	820	2.53
	840	1.89
	850	2.29
Test Mode(s)	NB-IOT Band 5; LTE Band 5/26;	
LTE	Test Modulation	QPSK 16QAM;
	Category	M1
NB-IOT	Test Modulation	BPSK, QPSK
	Category	NB2
	Deployment	stand-alone
	Sub-carrier spacing	3.75KHz, 15KHz
	Ntones	single-tone, multi-tone
Maximum E.R.P.	NB-IOT Band 5:	21.41dBm
	LTE Band 5:	22.06dBm
	LTE Band 26:	21.87dBm
Rated Power Supply Voltage	3.8V	
Extreme Voltage	Minimum: 3.23V Maximum: 4.37V	
Extreme Temperature	Lowest: -30°C Highest: +50°C	



Operating Voltage	Minimum: 3.3V Maximum: 4.3V		
Operating Temperature	Lowest: -35°C Highest: +75°C		
Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	NB-IOT Band 5	824 ~ 849	869 ~ 894
	LTE Band 5	824 ~ 849	869 ~ 894
	LTE Band 26	824 ~ 849	869 ~ 894
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.			



3. Applied Standards

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

Test standards:

FCC CFR 47 Part 22H (2019)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2019)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4. Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT stand-up position (Z axis), lie-down position (X, Y axis). Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (X axis, horizontal polarization) and the worst case was recorded.

All modes as Subcarrier Spacing, modulations, Channel were investigated.

Subsequently, only the worst case emissions are reported.

The following testing in NB-IOT is set based on the maximum RF Output Power.

Test modes are chosen as the worst case configuration below for NB-IOT Band 5.

Test items	Deployment mode	Subcarrier Spacing (kHz)		Modulation		Test Channel		
	Stand-alone	3.75	15	BPSK	QPSK	L	M	H
RF power output and Effective Radiated power	O	O	O	O	O	O	O	O
Occupied Bandwidth	O	O	O	O	O	O	O	O
Band Edge Compliance	O	O	O	O	O	O	-	O
Peak-to-Average Power Ratio	O	O	O	O	O	-	O	-
Frequency Stability	O	O	O	O	O	-	O	-
Spurious Emissions at Antenna Terminals	O	-	O	-	O	O	O	O
Radiates Spurious Emission	O	O	-	-	O	O	O	O
Note: 1. The mark "O" means that this configuration is chosen for testing. 2. The mark "-" means that this configuration is not testing.								



The following testing in LTE is set based on the maximum RF Output Power.

Test modes are chosen as the worst case configuration below for LTE Band 5/26

Test items	Modes	Bandwidth (MHz)					Modulation		RB			Test Channel		
		1.4	3	5	10	15	QPSK	16QAM	1	50%	100%	L	M	H
RF power output and Effective Radiated power	LTE 5	O	O	O	O	-	O	O	O	O	O	O	O	O
	LTE 26	O	O	O	O	O	O	O	O	O	O	O	O	O
Occupied Bandwidth	LTE 5	O	O	O	O	-	O	O	-	-	O	-	O	-
	LTE 26	O	O	O	O	O	O	O	-	-	O	-	O	-
Band Edge Compliance	LTE 5	O	O	O	O	-	O	O	O	-	O	O	-	O
	LTE 26	O	O	O	O	O	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	LTE 5	O	O	O	O	-	O	O	-	-	O	-	O	-
	LTE 26	O	O	O	O	O	O	O	-	-	O	-	O	-
Frequency Stability	LTE 5	O	O	O	O	-	O	O	O	O	O	-	O	-
	LTE 26	O	O	O	O	O	O	O	O	O	O	-	O	-
Spurious Emissions at Antenna Terminals	LTE 5	O	O	O	O	-	O	-	O	-	-	O	O	O
	LTE 26	O	O	O	O	O	O	-	O	-	-	O	O	O
Radiates Spurious Emission	LTE 5	O	-	O	O	-	O	-	O	-	-	-	O	-
	LTE 26	O	-	O	-	O	O	-	O	-	-	-	O	-
Note	1. The mark "O" means that this configuration is chosen for testing. 2. The mark "-" means that this configuration is not testing.													

5. Test Case Results

5.1. RF Power Output and Effective Radiated Power

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the Base Station Simulator with a known loss. The EUT is controlled by the Base Station Simulator test set to ensure max power transmission with proper modulation.

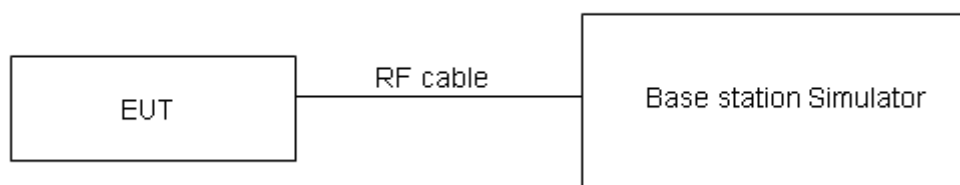
ERP can then be calculated as follows:

$EIRP \text{ (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBi)}$

where:dBd refers to gain relative to an ideal dipole.

$EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15 \text{ (dB)}$.

Test Setup



Limits

No specific RF power output requirements in part 2.1046.

Rule Part 22.913(a)(5) specifies that "Mobile/portable stations are limited to 7 watts ERP".

Limit	$\leq 7 \text{ W}$ (38.45 dBm)
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.4 \text{ dB}$ for RF power output, $k = 2$, $U = 1.19 \text{ dB}$ for ERP.



Test Results

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Maximum Output Power(dBm) for low/middle/high channel			ERP (dBm)		
				20402 /824.2MHz	20525 /836.5MHz	20648 /848.8MHz	20402 /824.2MHz	20525 /836.5MHz	20648 /848.8MHz
NB-IOT Band 5	BPSK	3.75	1@0	21.03	20.74	20.82	21.41	20.48	20.96
			1@47	20.96	20.66	20.78	21.34	20.40	20.92
		15	1@0	21.00	20.93	20.85	21.38	20.67	20.99
			1@11	20.95	20.86	20.85	21.33	20.60	20.99
	QPSK	3.75	1@0	21.02	20.83	20.80	21.40	20.57	20.94
			1@47	20.97	20.68	20.75	21.35	20.42	20.89
		15	1@0	21.03	20.84	20.82	21.41	20.58	20.96
			1@11	20.90	20.88	20.78	21.28	20.62	20.92
		15	12@0	19.09	18.94	18.83	19.47	18.68	18.97

LTE Band 5	Channel/ Frequency(MHz)	Index	RB# RBstart	Maximum Output Power (dBm)		ERP (dBm)	
				QPSK	16QAM	QPSK	16QAM
1.4MHz	20407/824.7	0	1#0	21.68	20.26	22.06	20.64
		0	6#0	19.00	19.28	19.38	19.66
	20525/836.5	0	1#0	21.82	19.95	21.56	19.69
		0	6#0	19.11	19.80	18.85	19.54
	20643/848.3	0	1#5	21.56	19.84	21.70	19.98
		0	6#0	18.96	19.68	19.10	19.82
3MHz	20415/825.5	0	1#0	21.55	20.16	21.53	20.14
		0	6#0	19.14	19.38	19.12	19.36
	20525/836.5	0	1#0	21.58	20.17	21.32	19.91
		0	6#0	19.13	19.51	18.87	19.25
	20635/847.5	1	1#5	21.30	19.86	21.44	20.00
		0	6#0	18.99	19.39	19.13	19.53
5MHz	20425/826.5	3	1#0	21.41	21.07	21.39	21.05
		0	6#0	20.28	20.55	20.26	20.53
	20525/836.5	0	1#0	21.28	21.70	21.02	21.44
		0	6#0	20.33	20.50	20.07	20.24
	20625/846.5	0	1#5	21.14	20.63	21.28	20.77
		0	6#0	20.18	20.32	20.32	20.46
10MHz	20450/829	3	1#0	21.41	21.01	21.39	20.99
		0	4#0	20.31	21.52	20.29	21.50
	20525/836.5	0	1#0	21.54	21.01	21.28	20.75
		0	4#0	21.52	21.92	21.26	21.66
	20600/844	4	1#5	21.12	20.65	20.86	20.39
		7	4#2	21.32	21.72	21.06	21.46

LTE Band 26	Channel/ Frequency(MHz)	Index	RB# RBstart	Maximum Output Power (dBm)		ERP (dBm)	
				QPSK	16QAM	QPSK	16QAM
1.4MHz	26797/824.7	0	1#0	21.06	20.67	21.44	21.05
		0	6#0	19.06	19.03	19.44	19.41
	26915/836.5	0	1#0	21.40	19.58	21.14	19.32
		0	6#0	18.82	19.62	18.56	19.36
	27033/848.3	0	1#5	21.12	19.38	21.26	19.52
		0	6#0	18.68	19.48	18.82	19.62
3MHz	26805/825.5	0	1#0	21.38	19.92	21.36	19.90
		0	6#0	19.05	19.38	19.03	19.36
	26915/836.5	0	1#0	21.21	19.77	20.95	19.51
		0	6#0	18.82	19.19	18.56	18.93
	27025/847.5	1	1#5	20.91	19.40	21.05	19.54
		0	6#0	18.70	19.10	18.84	19.24
5MHz	26815/826.5	3	1#0	21.16	20.80	21.14	20.78
		0	6#0	20.06	20.32	20.04	20.30
	26915/836.5	0	1#0	20.95	21.38	20.69	21.12
		0	6#0	19.86	20.06	19.60	19.80
	27015/846.5	0	1#5	20.70	20.23	20.84	20.37
		0	6#0	19.74	19.94	19.88	20.08
10MHz	26840/829	3	1#0	21.20	20.78	21.18	20.76
		0	4#0	21.30	21.89	21.28	21.87
	26915/836.5	0	1#0	21.04	20.75	20.78	20.49
		0	4#0	21.19	21.77	20.93	21.51
	26990/844	4	1#5	20.72	20.37	20.46	20.11
		7	4#2	20.96	21.58	20.70	21.32
15MHz	26865/831.5	3	1#0	21.15	20.88	21.13	20.86
		0	6#0	21.17	21.34	21.15	21.32
	26915/836.5	0	1#0	21.09	20.83	20.83	20.57
		0	6#0	21.13	21.28	20.87	21.02
	26965/841.5	8	1#5	21.10	20.80	20.84	20.54
		11	6#0	20.89	20.32	20.63	20.06

5.2. Occupied Bandwidth

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.

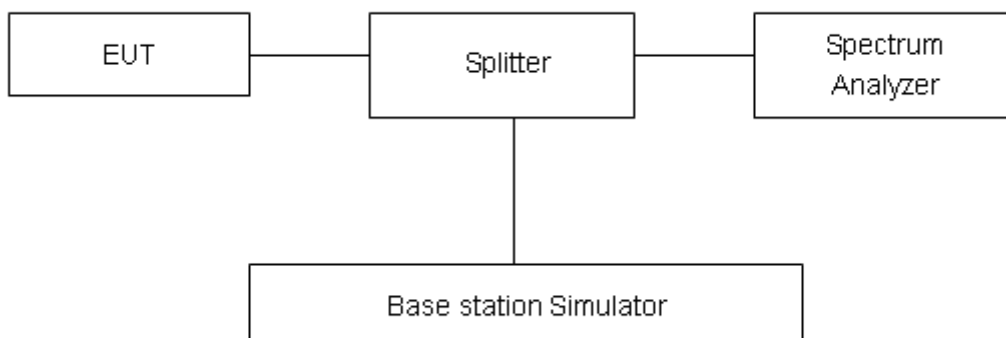
RBW is set to 51kHz, VBW is set to 160kHz for LTE Band 5/26,

RBW is set to 2kHz, VBW is set to 6.2kHz for NB-IOT Band 5(1@0),

RBW is set to 3.9kHz, VBW is set to 12kHz for NB-IOT Band 5(12@0).

99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

No specific occupied bandwidth requirements in part 2.1049.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 624\text{Hz}$.

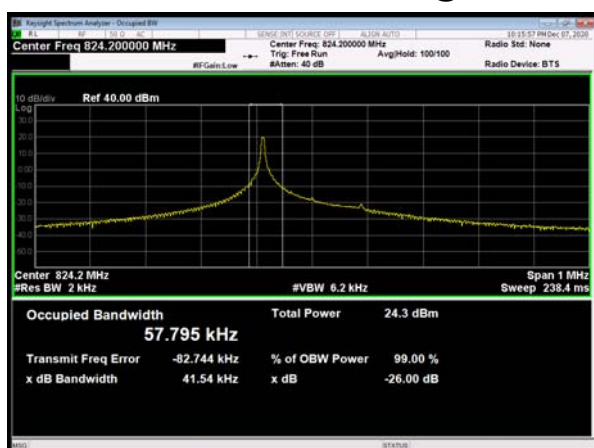
Test Result

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/ middle /high channel					
				20402/824.2MHz		20525/836.5MHz		20648/848.8MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 5	BPSK	3.75	1@0	57.80	41.54	57.61	40.94	57.91	41.40
	QPSK	3.75	1@0	66.13	42.95	65.75	39.23	67.70	40.57
	BPSK	15	1@0	125.31	105.10	127.51	103.80	122.07	102.50
	QPSK	15	1@0	120.11	116.70	125.22	116.10	114.17	116.70
	QPSK	15	12@0	185.73	243.50	185.91	244.00	184.11	239.50

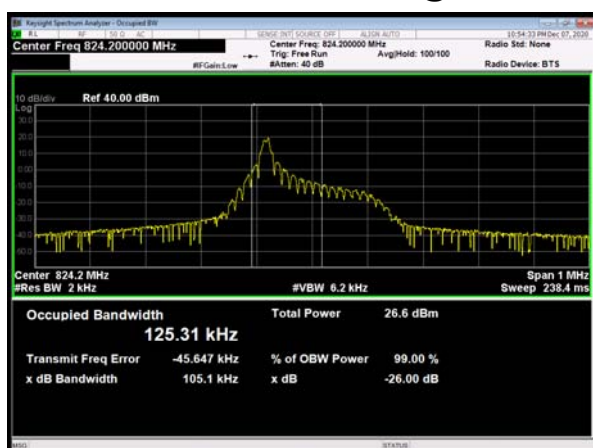
Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
LTE Band 5	1.4MHz	QPSK	20525/836.5	1.1027	1.332
		16QAM	20525/836.5	0.9401	1.160
	3MHz	QPSK	20525/836.5	1.1049	1.312
		16QAM	20525/836.5	0.9459	1.162
	5MHz	QPSK	20525/836.5	1.1076	1.301
		16QAM	20525/836.5	0.9493	1.213
	10MHz	QPSK	20525/836.5	1.1200	1.345
		16QAM	20525/836.5	0.9636	1.229

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
LTE Band 26	1.4MHz	QPSK	26915/836.5	1.1029	1.311
		16QAM	26915/836.5	0.9417	1.146
	3MHz	QPSK	26915/836.5	1.1003	1.398
		16QAM	26915/836.5	0.9474	1.157
	5MHz	QPSK	26915/836.5	1.1109	1.322
		16QAM	26915/836.5	0.9485	1.197
	10MHz	QPSK	26915/836.5	1.1170	1.335
		16QAM	26915/836.5	0.9606	1.166
	15MHz	QPSK	26915/836.5	1.1133	1.326
		16QAM	26915/836.5	0.9541	1.160

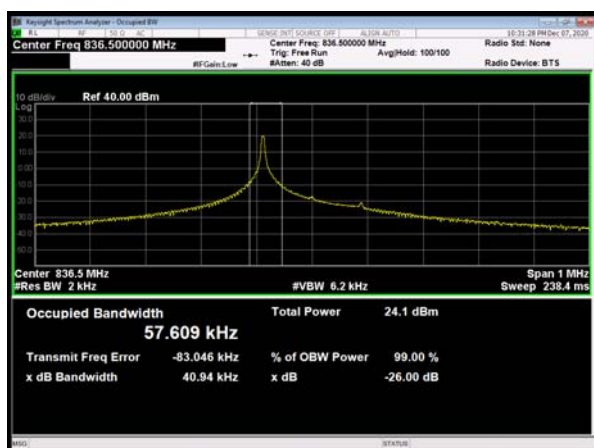
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 5 BPSK 15kHz 1@0 CH-Low



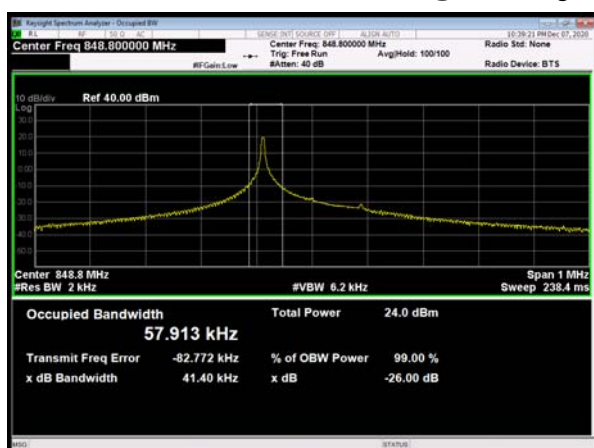
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-Middle



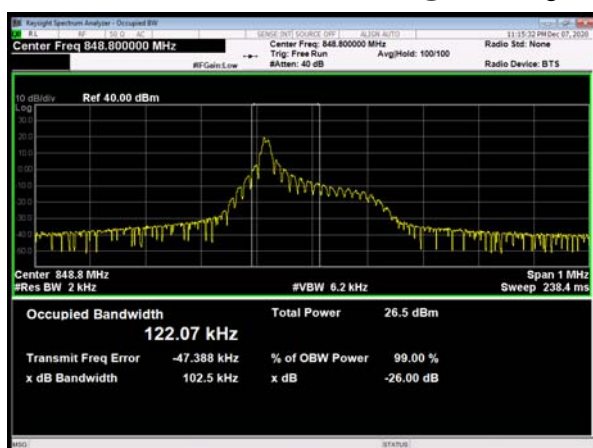
NB-IOT Band 5 BPSK 15kHz 1@0 CH-Middle



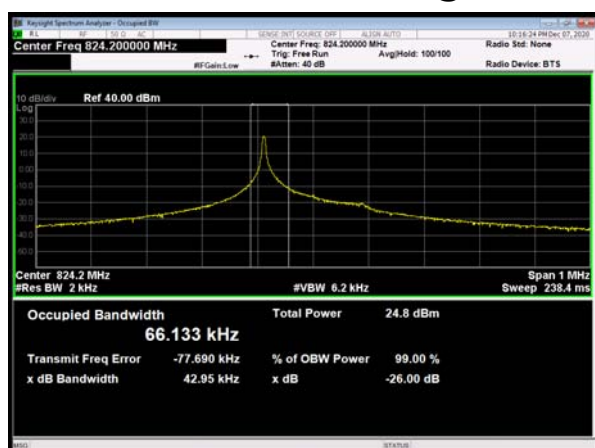
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-High



NB-IOT Band 5 BPSK 15kHz 1@0 CH-High



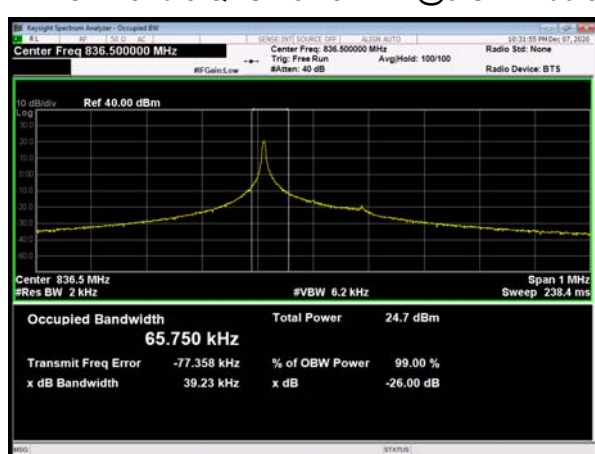
NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-Low



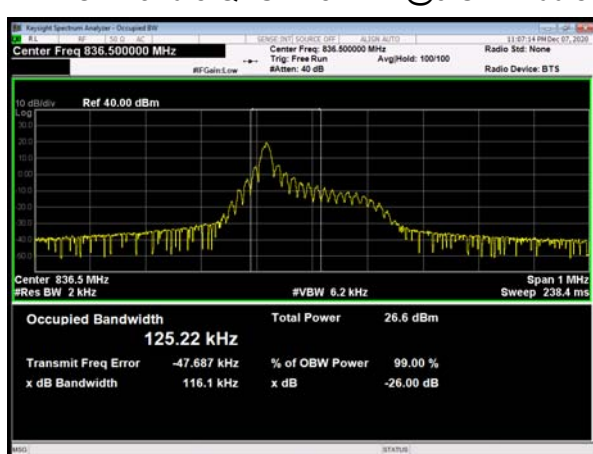
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Low



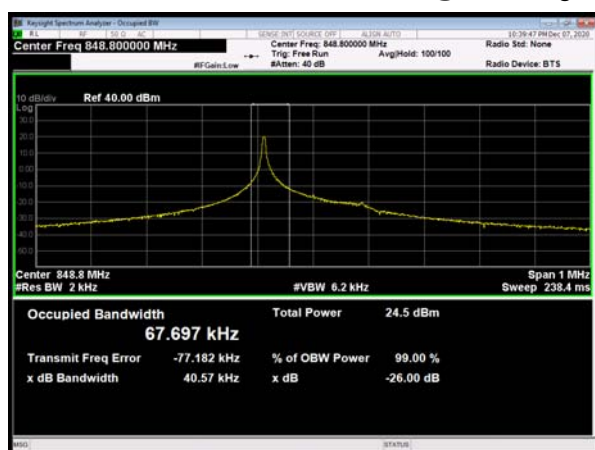
NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-Middle



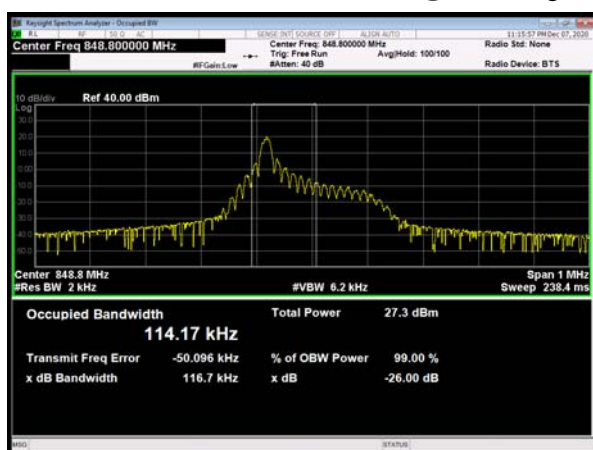
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Middle



NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-High



NB-IOT Band 5 QPSK 15kHz 1@0 CH-High



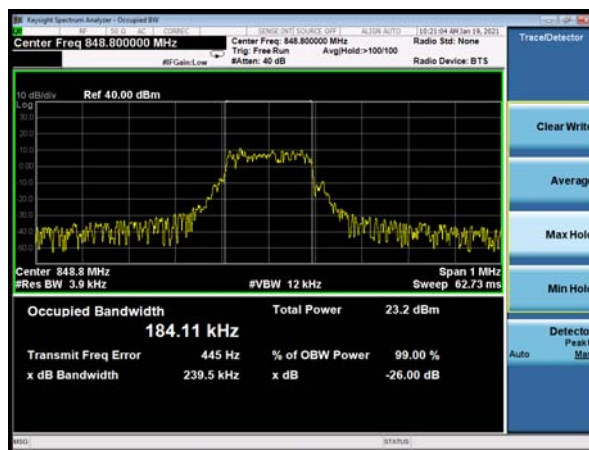
NB-IOT Band 5 QPSK 15kHz 12@0 CH-Low



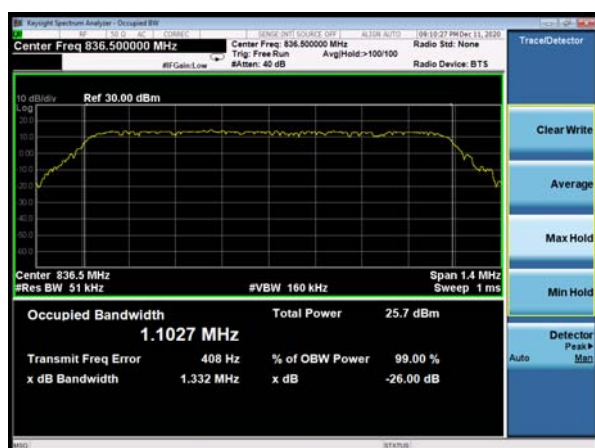
NB-IOT Band 5 QPSK 15kHz 12@0 CH-Middle



NB-IOT Band 5 QPSK 15kHz 12@0 CH-High



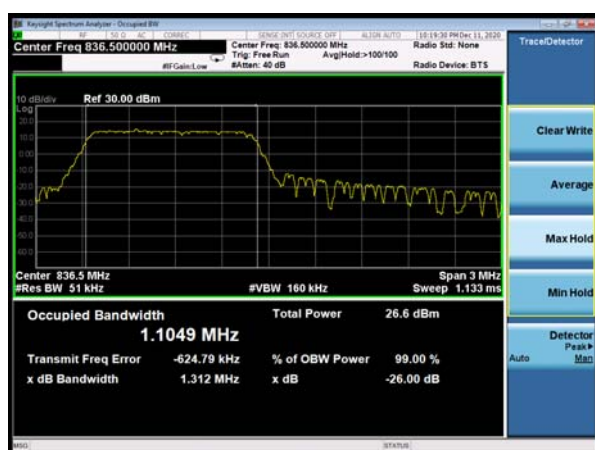
LTE Band 5 QPSK 1.4MHz CH-Middle



LTE Band 5 16QAM 1.4MHz CH-Middle



LTE Band 5 QPSK 3MHz CH-Middle



LTE Band 5 16QAM 3MHz CH-Middle



LTE Band 5 QPSK 5MHz CH-Middle



LTE Band 5 16QAM 5MHz CH-Middle



LTE Band 5 QPSK 10MHz CH-Middle



LTE Band 5 16QAM 10MHz CH-Middle



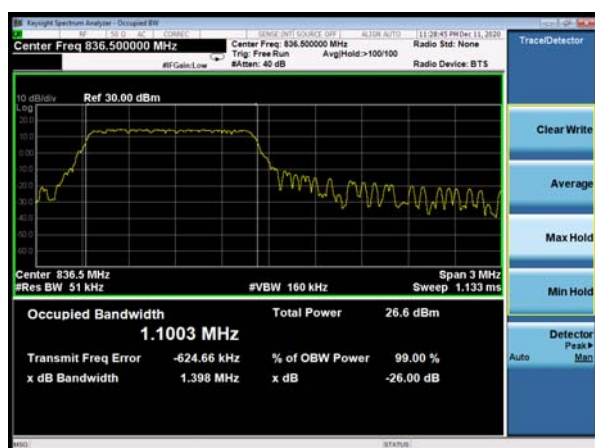
LTE Band 26 QPSK 1.4MHz CH-Middle



LTE Band 26 16QAM 1.4MHz CH-Middle



LTE Band 26 QPSK 3MHz CH-Middle



LTE Band 26 16QAM 3MHz CH-Middle



LTE Band 26 QPSK 5MHz CH-Middle



LTE Band 26 16QAM 5MHz CH-Middle



LTE Band 26 QPSK 10MHz CH-Middle



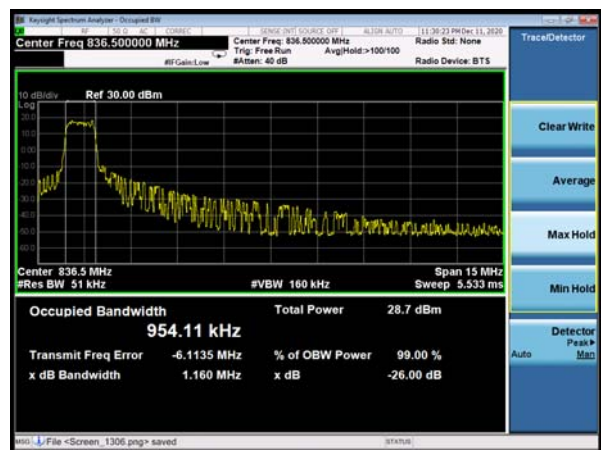
LTE Band 26 16QAM 10MHz CH-Middle



LTE Band 26 QPSK 15MHz CH-Middle



LTE Band 26 16QAM 15MHz CH-Middle



5.3. Band Edge Compliance

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

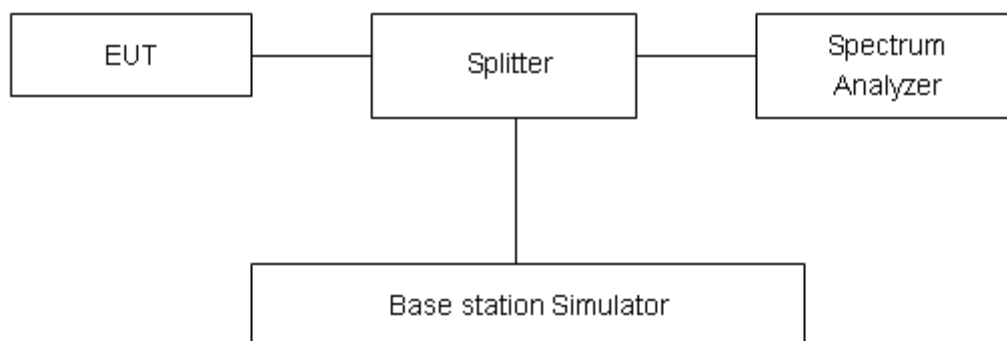
The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured. The average detector is used.

RBW is set to 51kHz, VBW is set to 160kHz for LTE Band 5/26,

RBW is set to $\geq 1\%$ EBW, VBW is set to 3x RBW for NB-IOT Band 5 .

Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 22.917(a) specifies that “The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.”

Limit	-13 dBm
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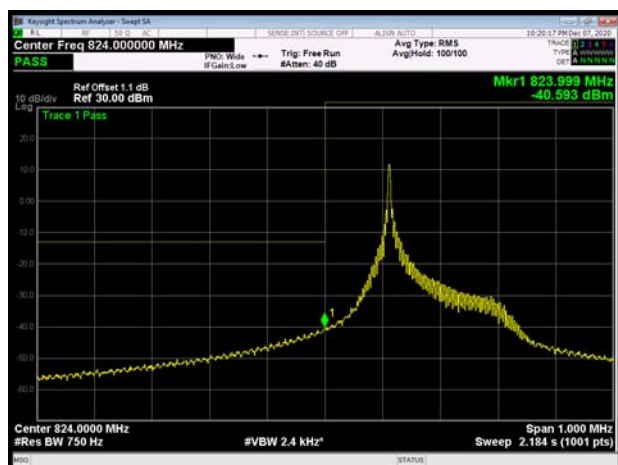
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U=0.684$ dB.

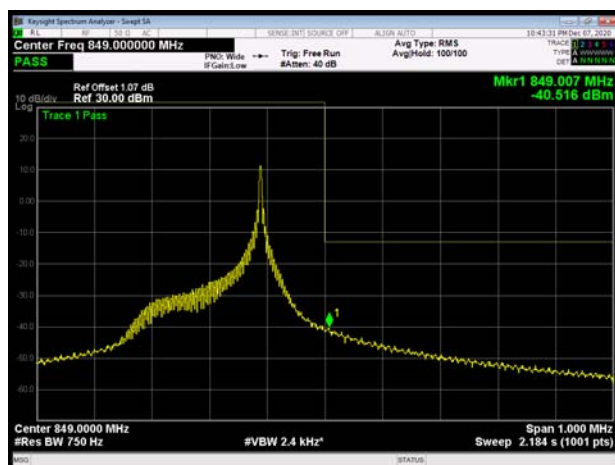


Test Result:

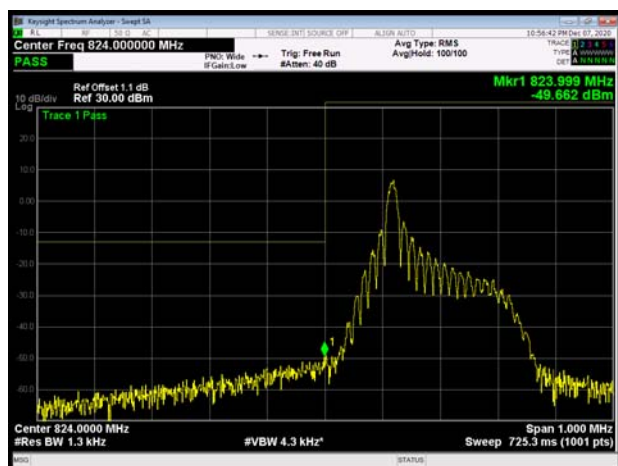
NB-IOT Band 5 BPSK 3.75kHz 1@0 CH-Low



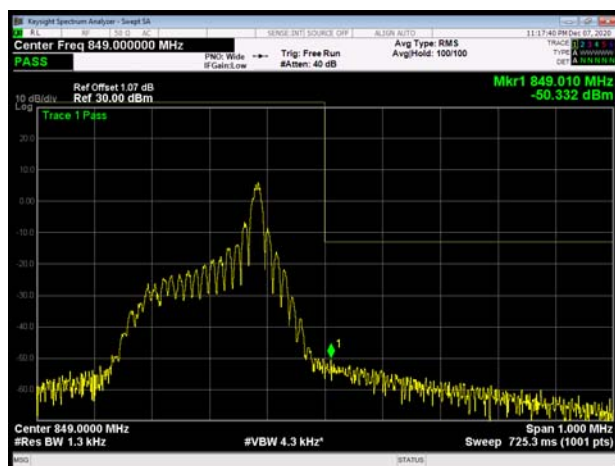
NB-IOT Band 5 BPSK 3.75kHz 1@47 CH-High



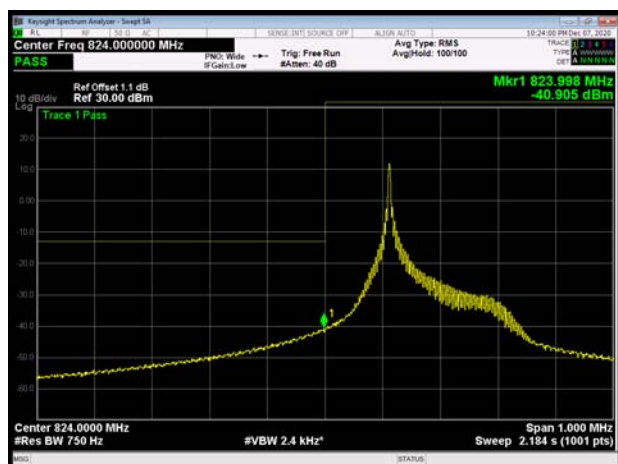
NB-IOT Band 5 BPSK 15kHz 1@0 CH-Low



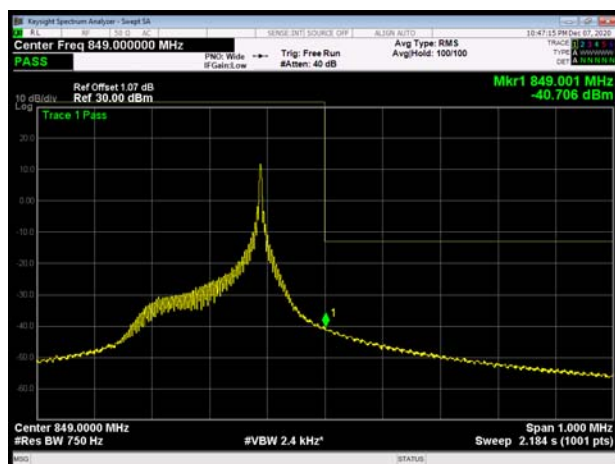
NB-IOT Band 5 BPSK 15kHz 1@11 CH-High



NB-IOT Band 5 QPSK 3.75kHz 1@0 CH-Low

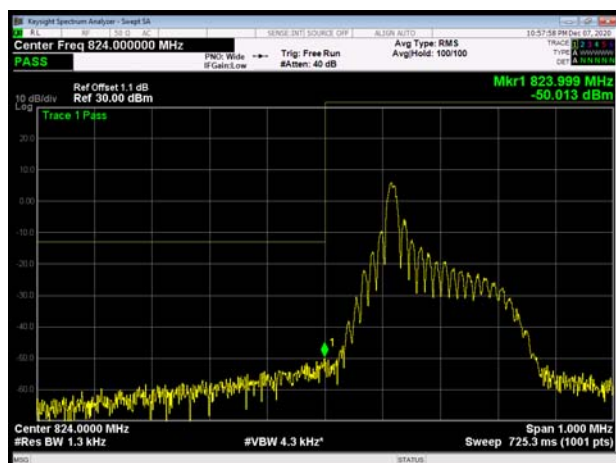


NB-IOT Band 5 QPSK 3.75kHz 1@47 CH-High

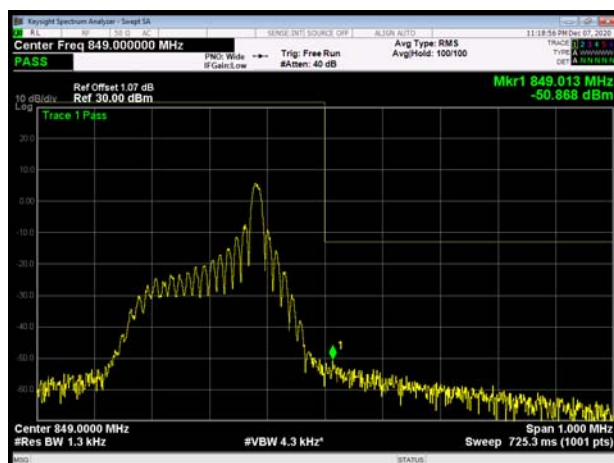




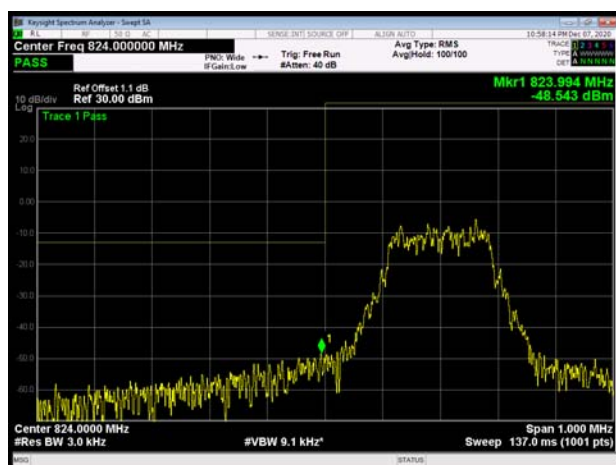
NB-IOT Band 5 QPSK 15kHz 1@0 CH-Low



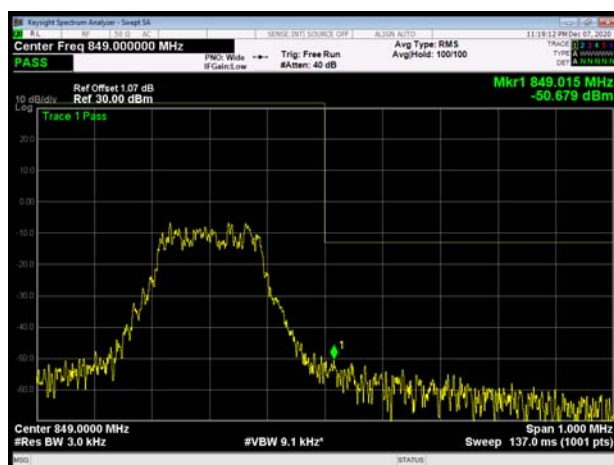
NB-IOT Band 5 QPSK 15kHz 1@11 CH-High



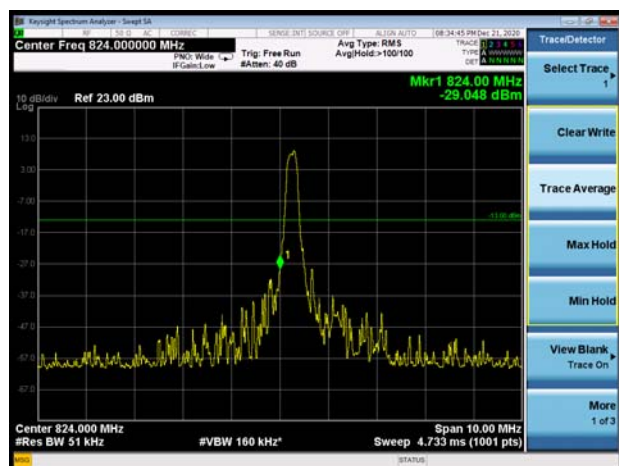
NB-IOT Band 5 QPSK 15kHz 12@0 CH-Low



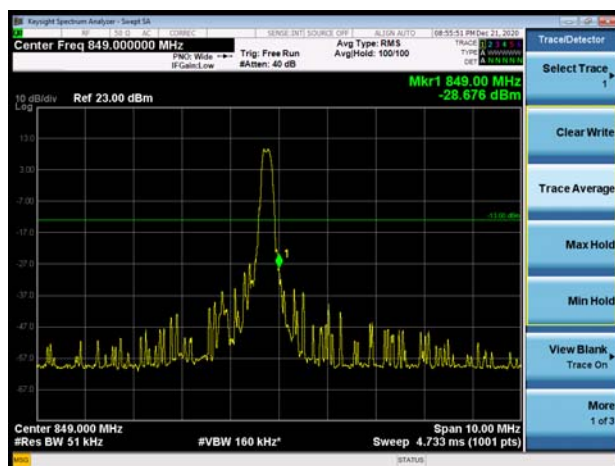
NB-IOT Band 5 QPSK 15kHz 12@0 CH-High



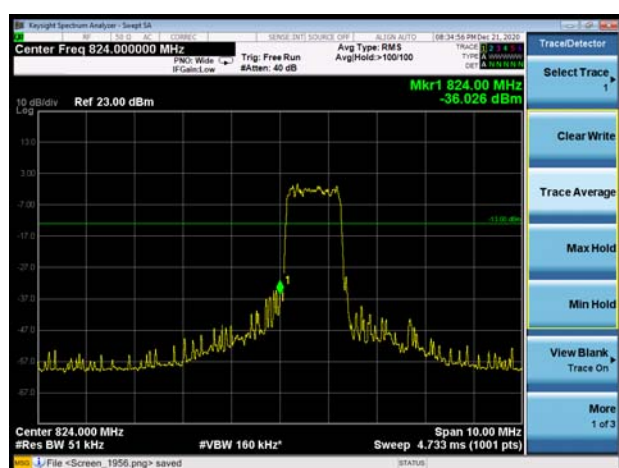
LTE Band 5 QPSK 1.4MHz CH-Low 1RB



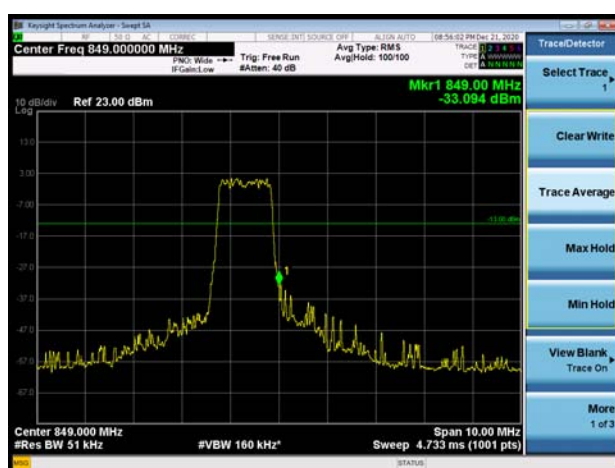
LTE Band 5 QPSK 1.4MHz CH-High 1RB



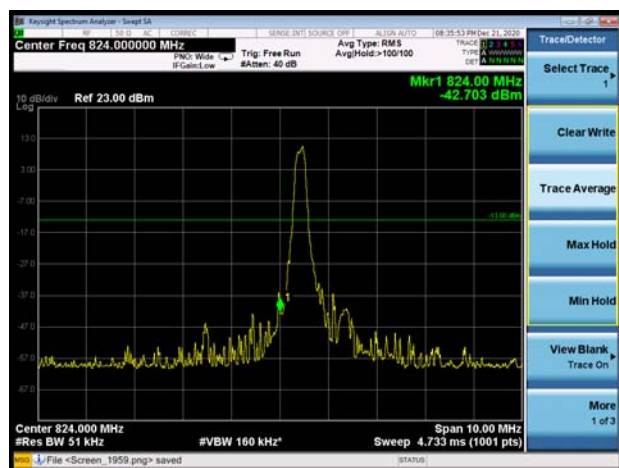
LTE Band 5 QPSK 1.4MHz CH-Low 100%RB



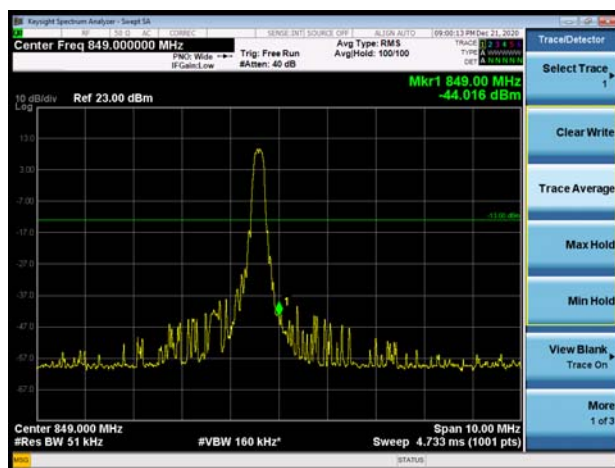
LTE Band 5 QPSK 1.4MHz CH-High 100%RB



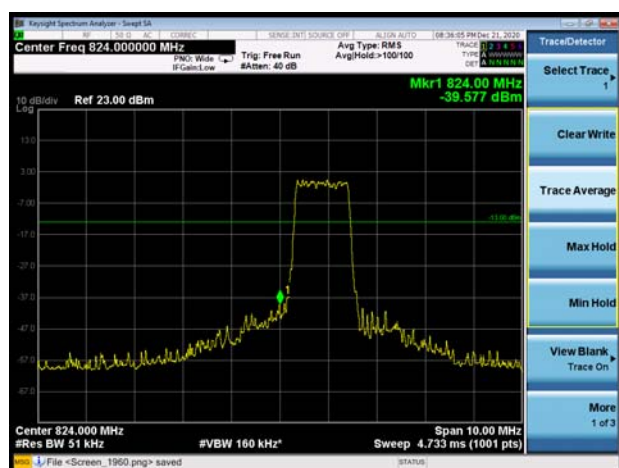
LTE Band 5 QPSK 3MHz CH-Low 1RB



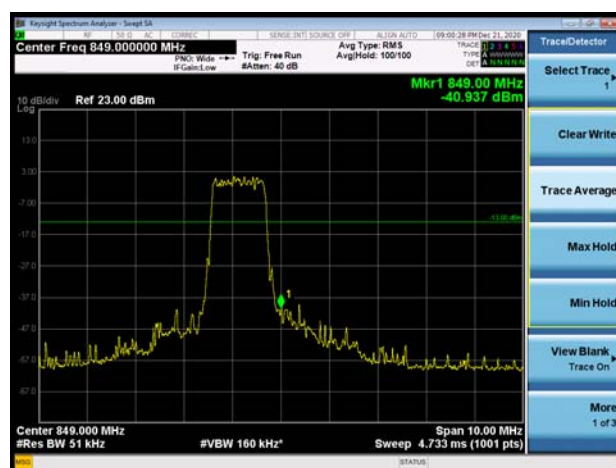
LTE Band 5 QPSK 3MHz CH-High 1RB



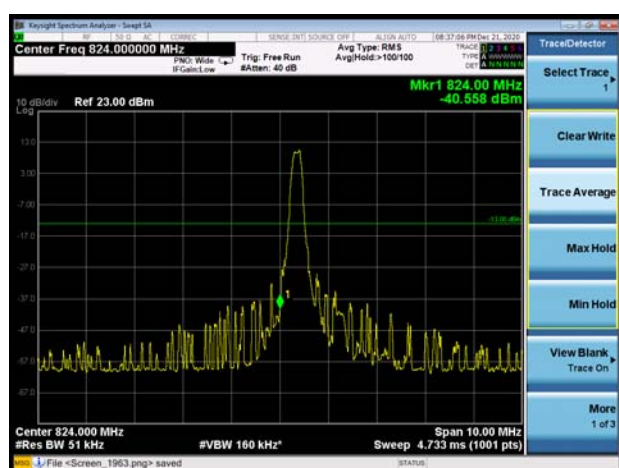
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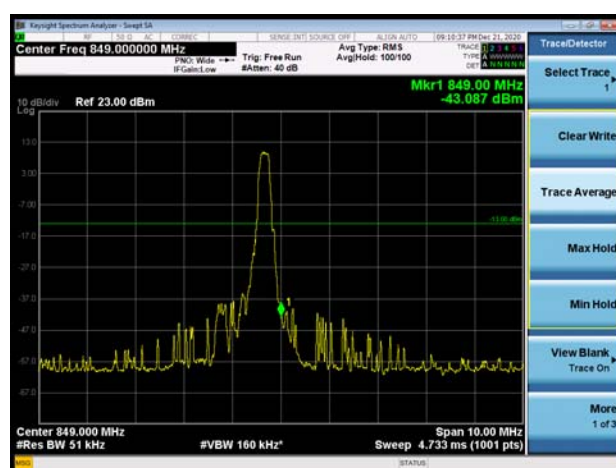
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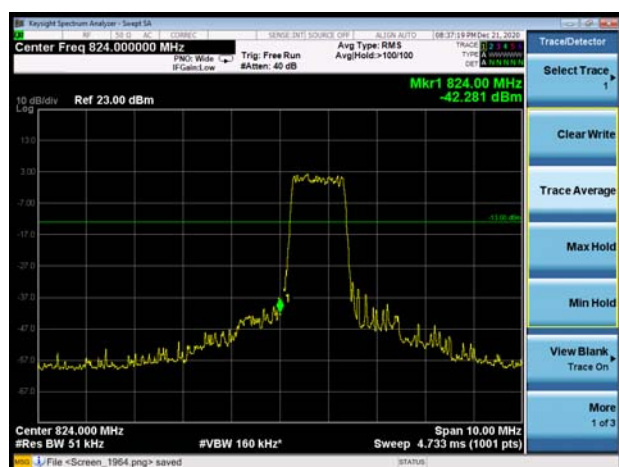
LTE Band 5 QPSK 5MHz CH-Low 1RB



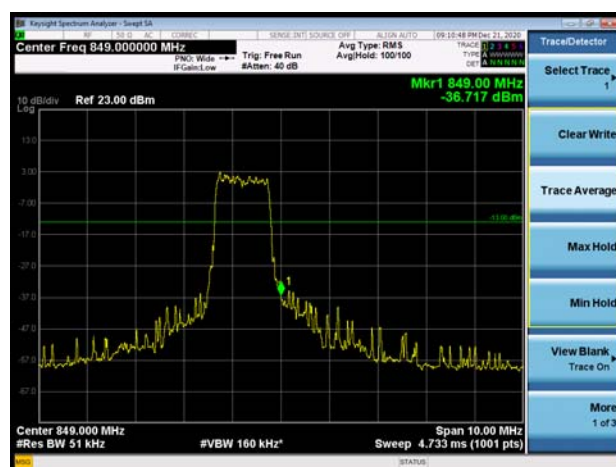
LTE Band 5 QPSK 5MHz CH-High 1RB



LTE Band 5 QPSK 5MHz CH-Low 100%RB

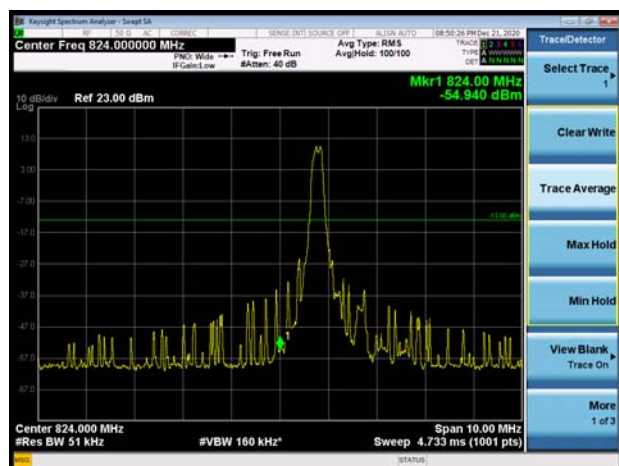


LTE Band 5 QPSK 5MHz CH-High 100%RB

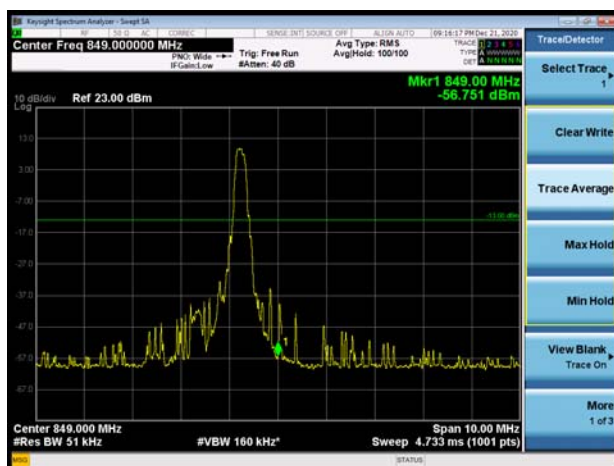




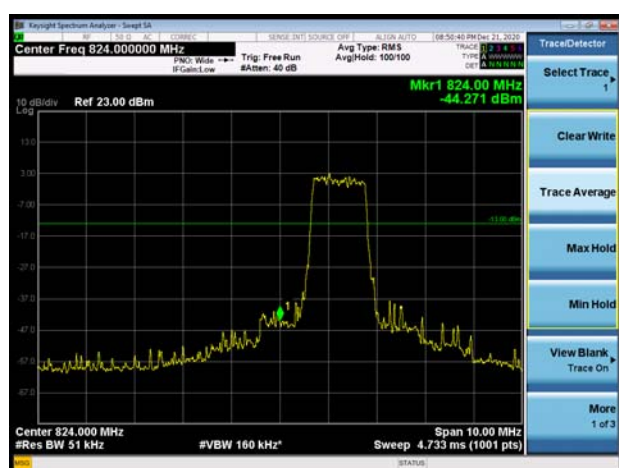
LTE Band 5 QPSK 10MHz CH-Low 1RB



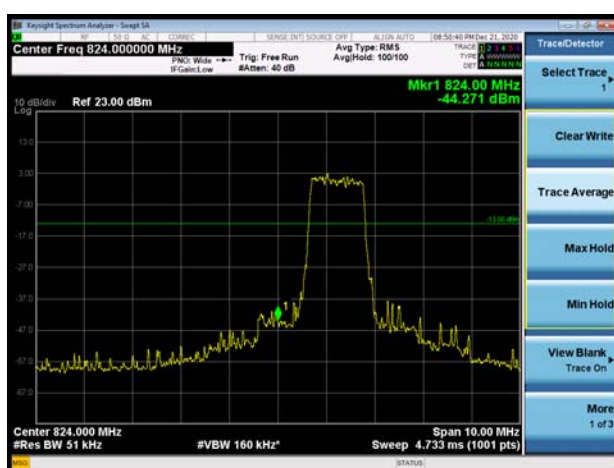
LTE Band 5 QPSK 10MHz CH-High 1RB



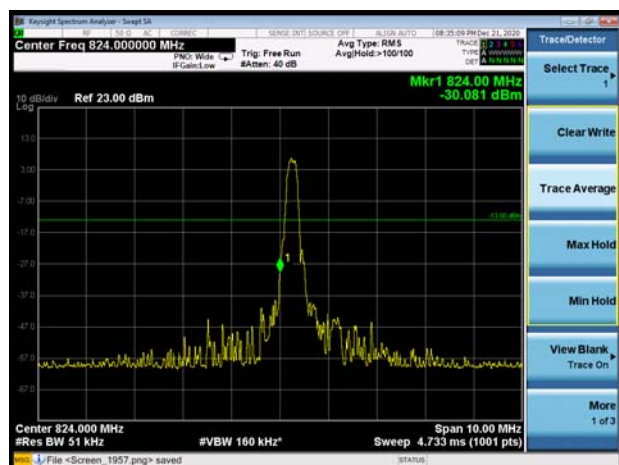
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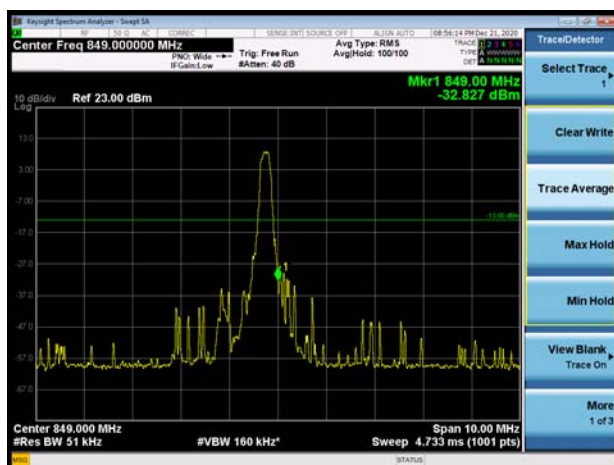
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LTE Band 5 16QAM 1.4MHz CH-Low 1RB

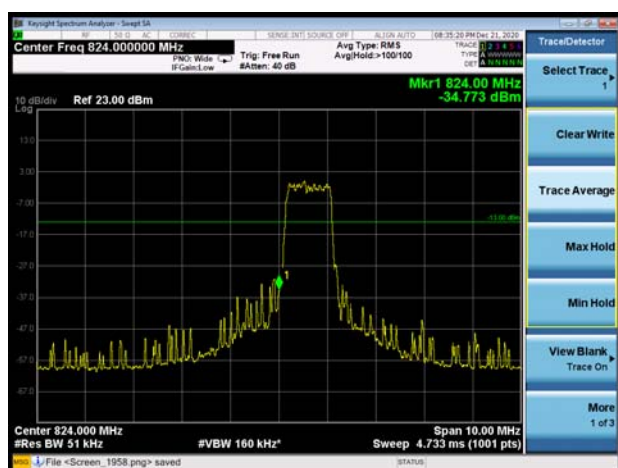


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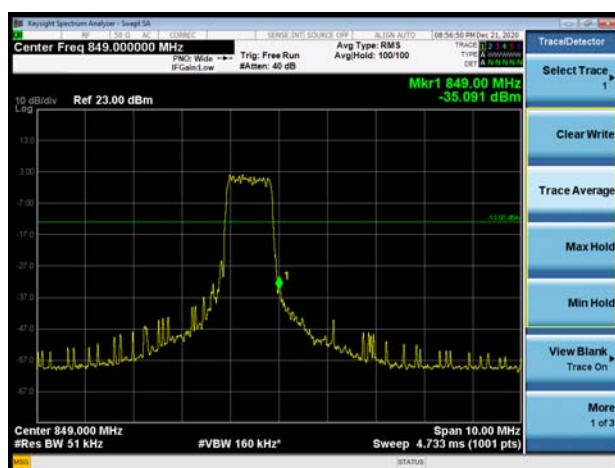




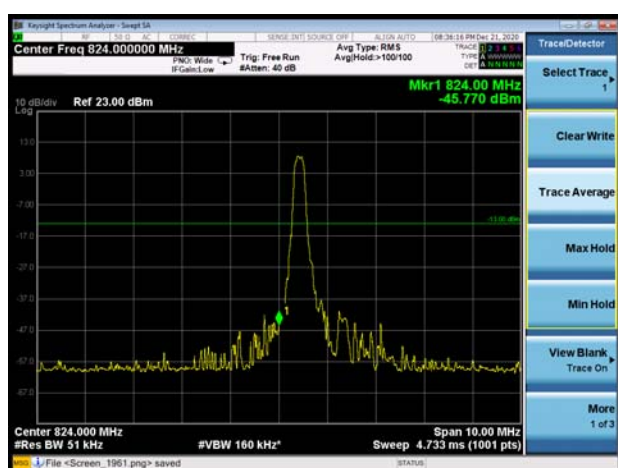
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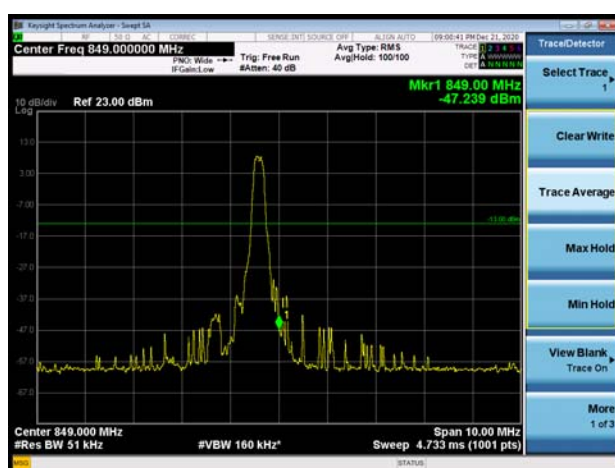
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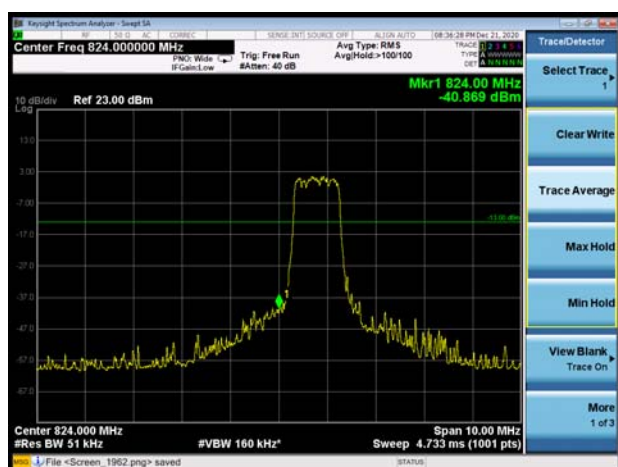
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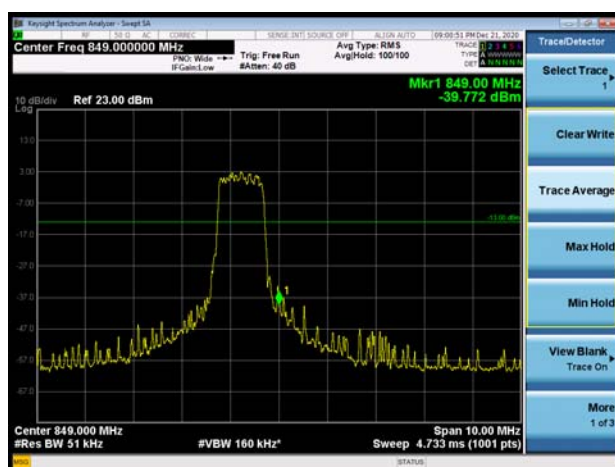
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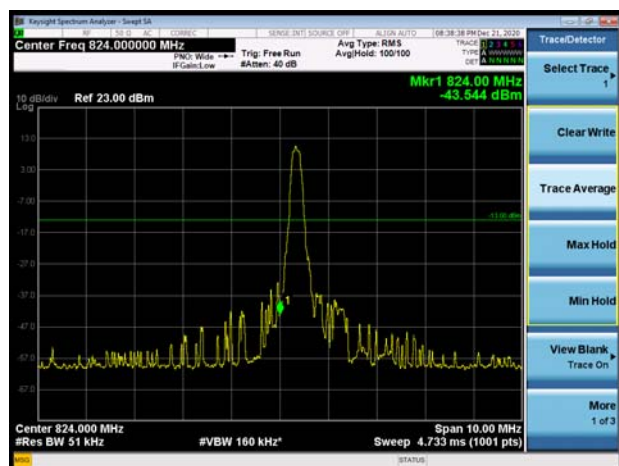
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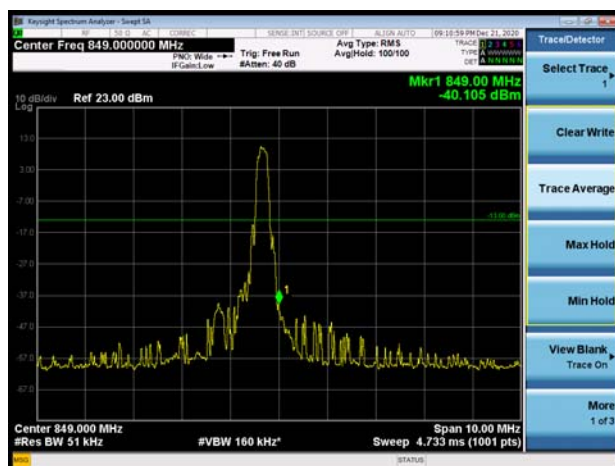
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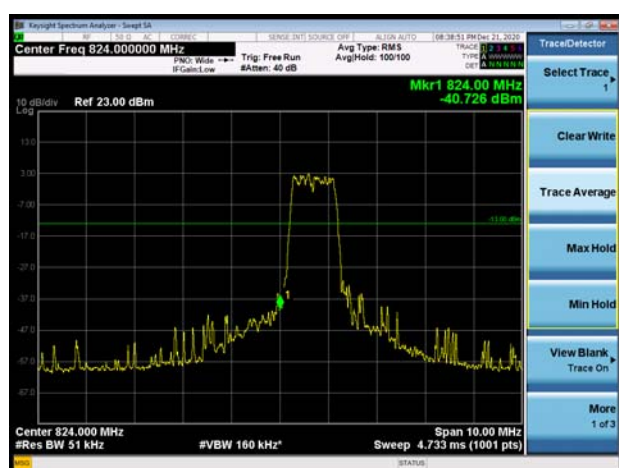
LTE Band 5 16QAM 5MHz CH-Low 1RB



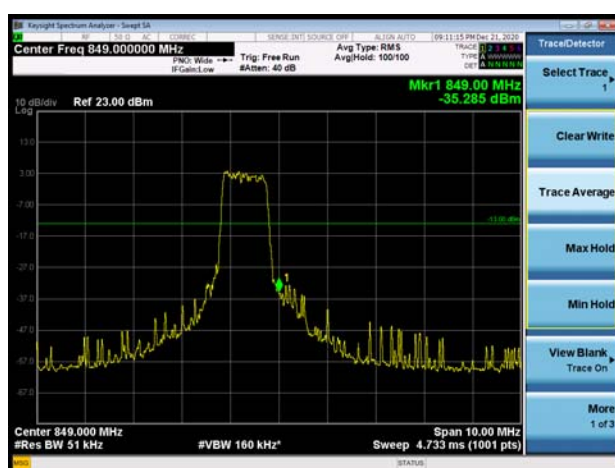
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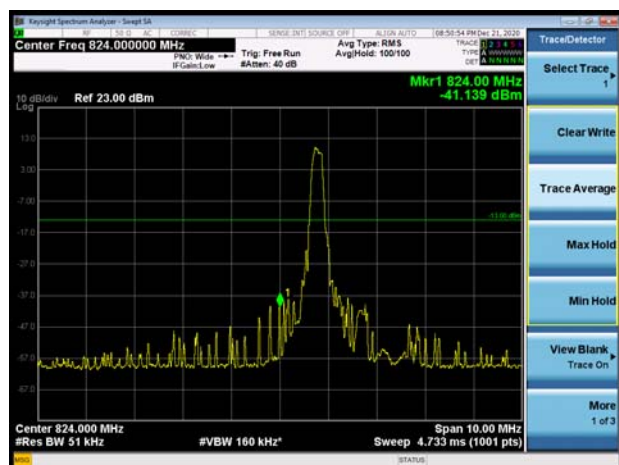
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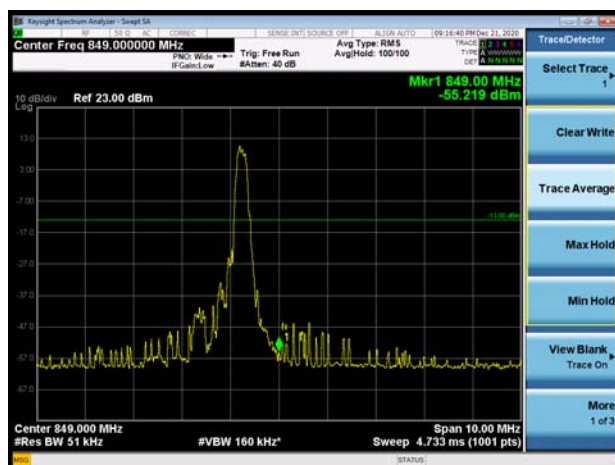
LTE Band 5 16QAM 5MHz CH-High 100%RB



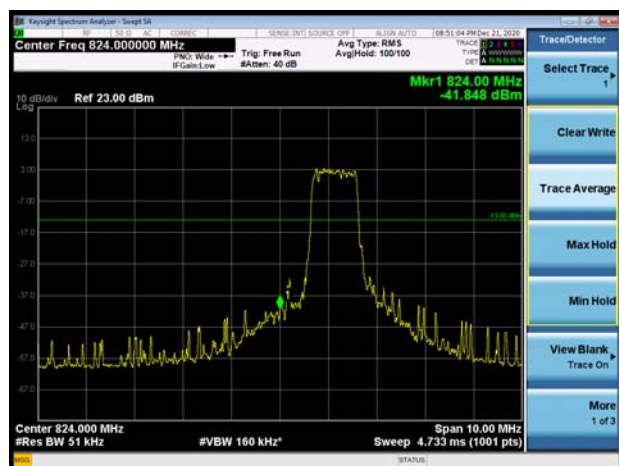
LTE Band 5 16QAM 10MHz CH-Low 1RB



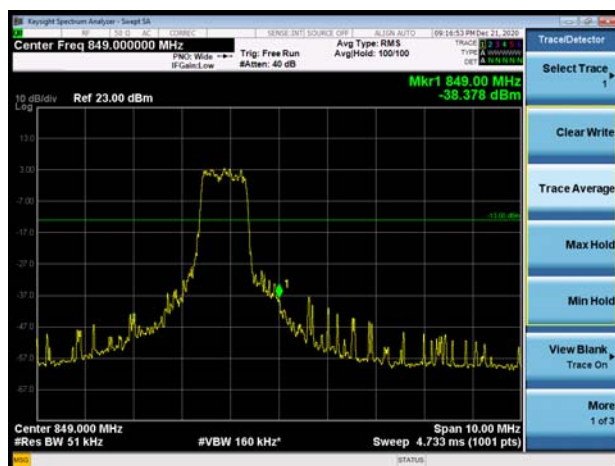
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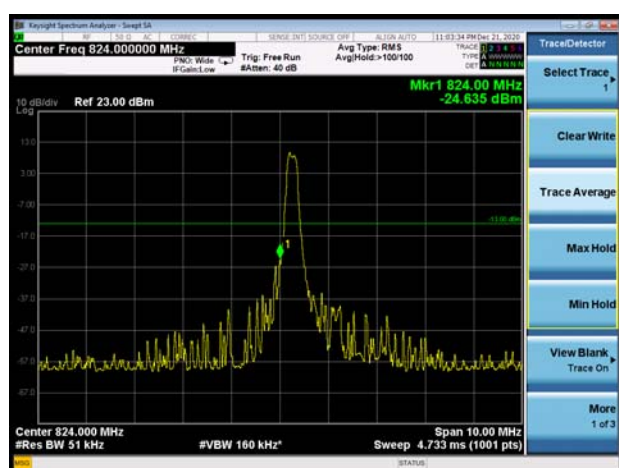
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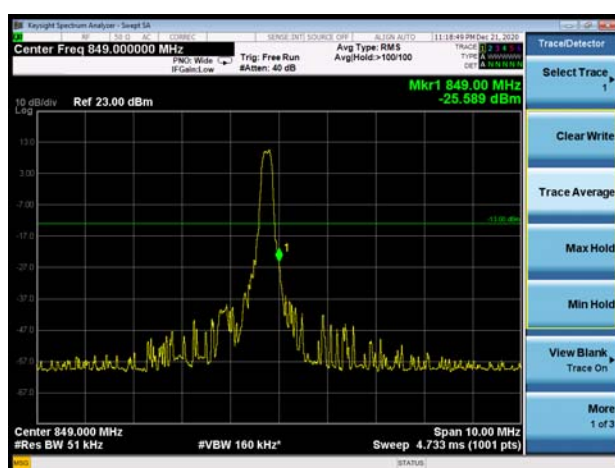
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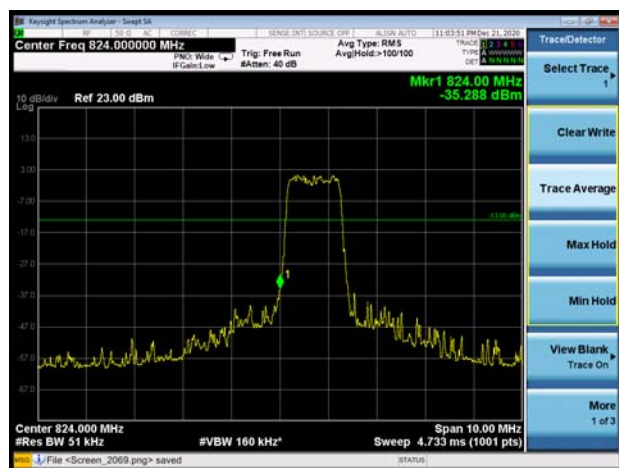
LTE Band 26 QPSK 1.4MHz CH-Low 1RB



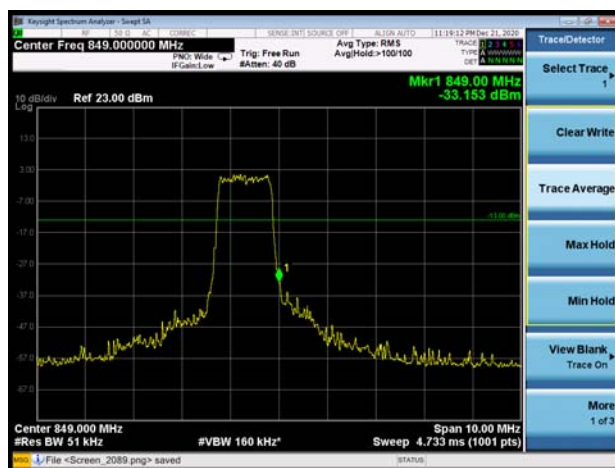
LTE Band 26 QPSK 1.4MHz CH-High 1RB



LTE Band 26 QPSK 1.4MHz CH-Low 100%RB

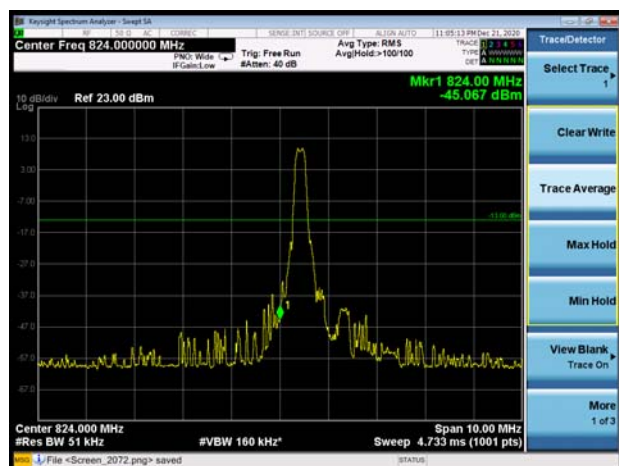


LTE Band 26 QPSK 1.4MHz CH-High 100%RB

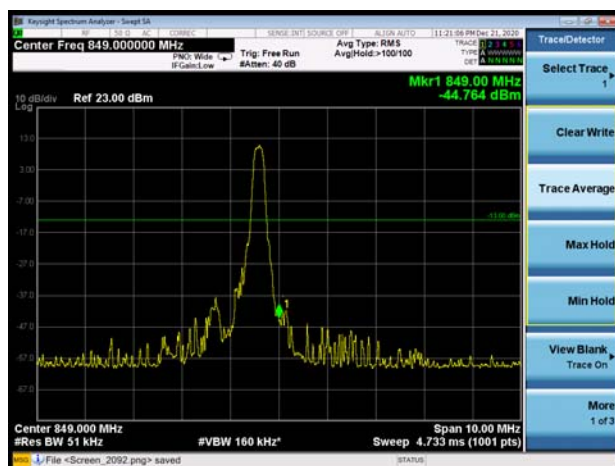




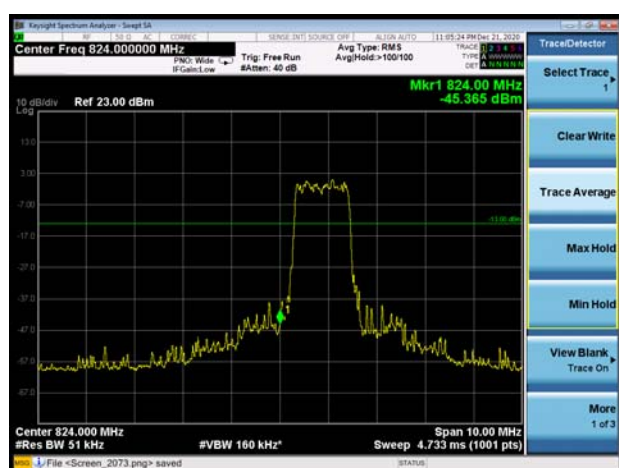
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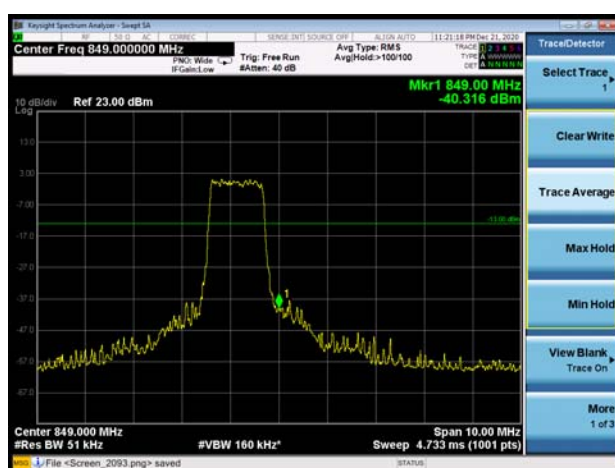
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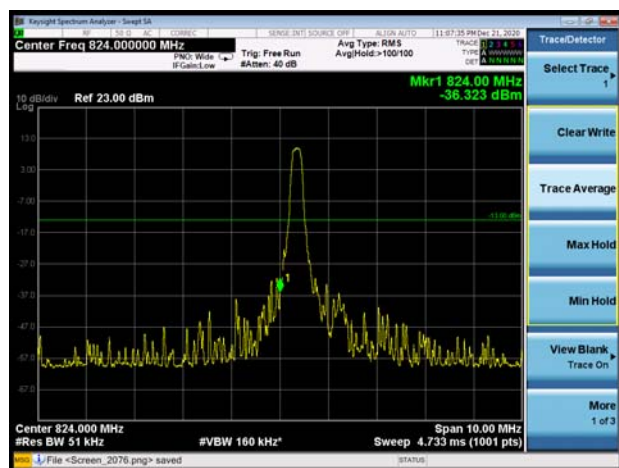
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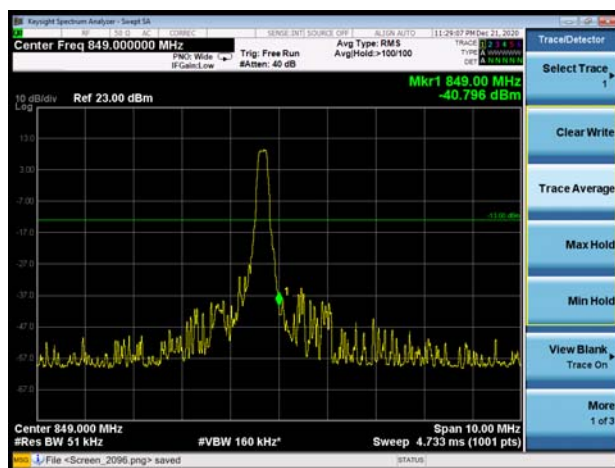
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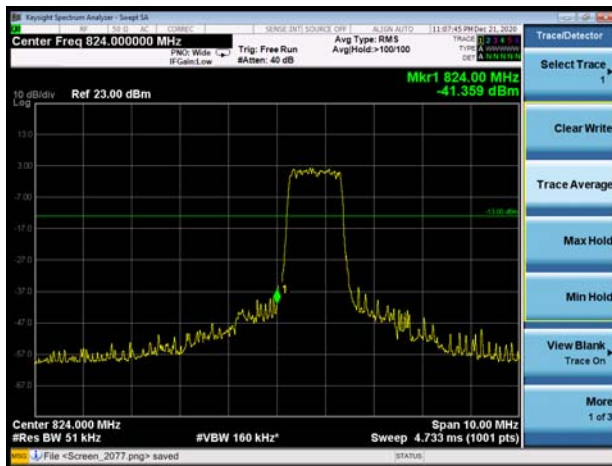
LTE Band 26 QPSK 5MHz CH-Low 1RB



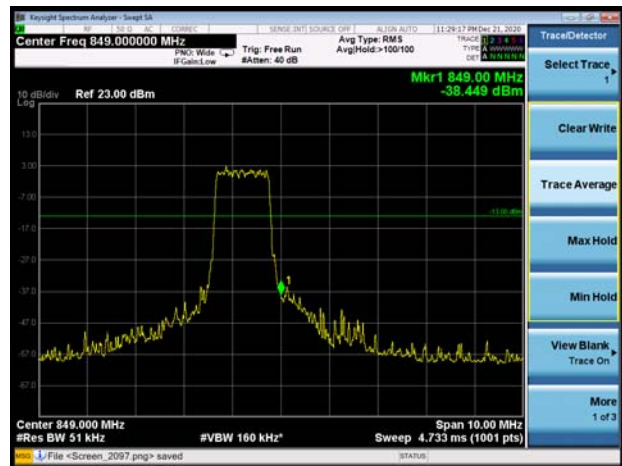
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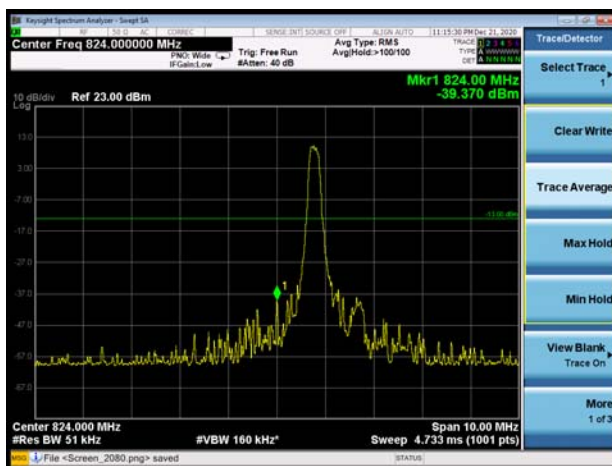
LTE Band 26 QPSK 5MHz CH-Low 100%RB



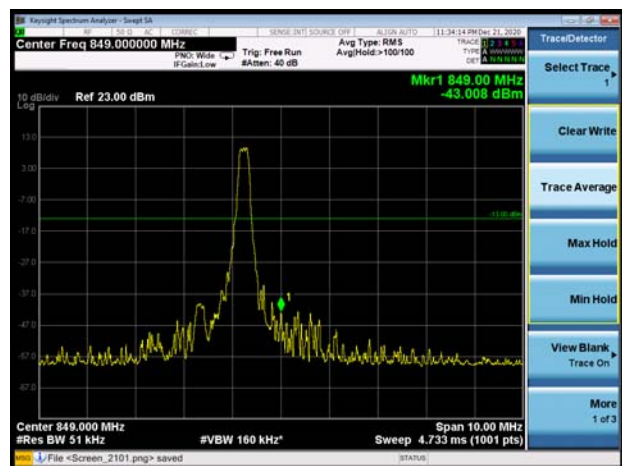
LTE Band 26 QPSK 5MHz CH-High 100%RB



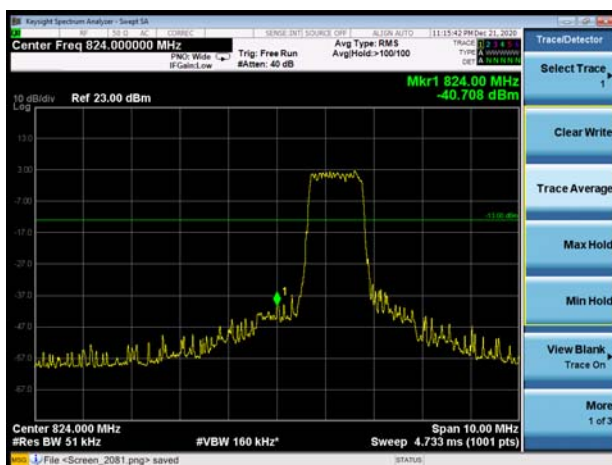
LTE Band 26 QPSK 10MHz CH-Low 1RB



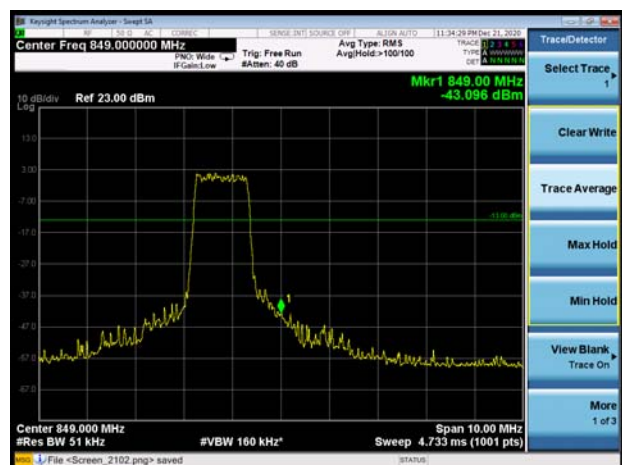
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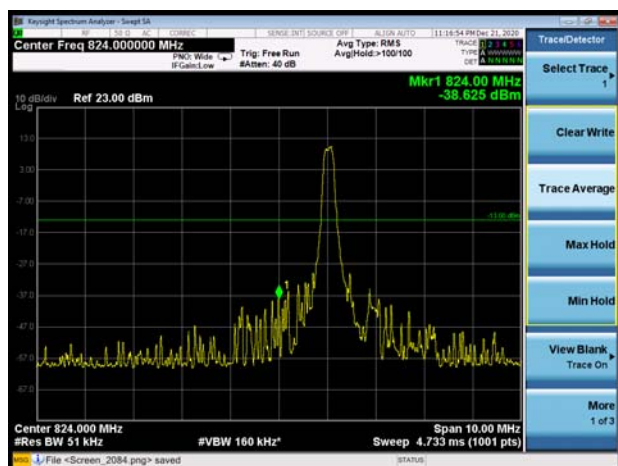
LTE Band 26 QPSK 10MHz CH-Low 100%RB



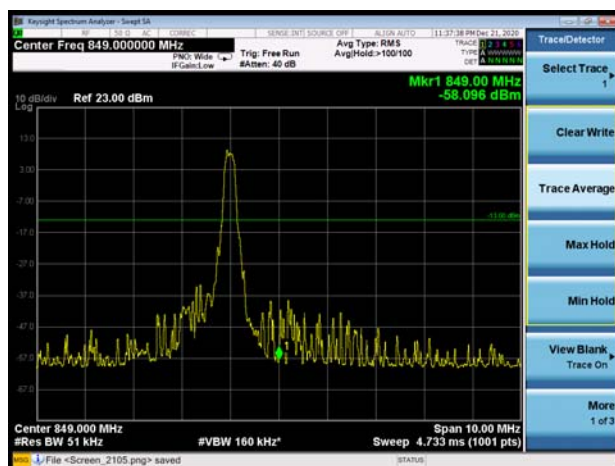
LTE Band 26 QPSK 10MHz CH-High 100%RB



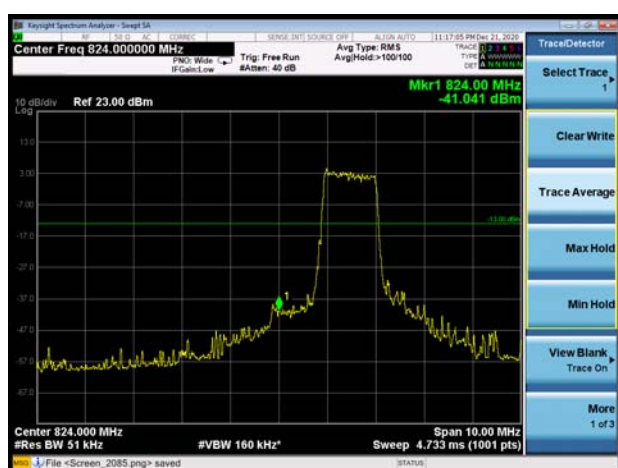
LTE Band 26 QPSK 15MHz CH-Low 1RB



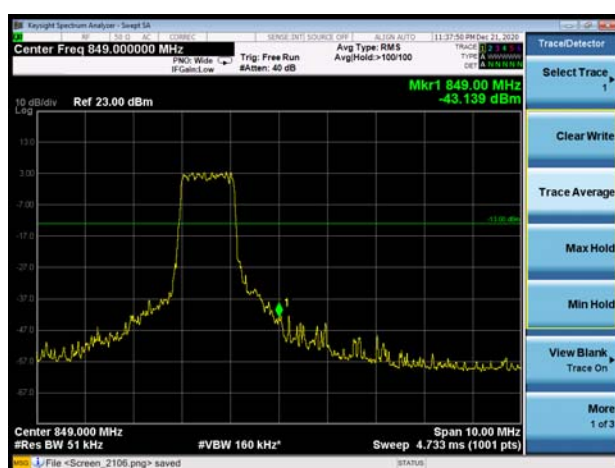
LTE Band 26 QPSK 15MHz CH-High 1RB



LTE Band 26 QPSK 15MHz CH-Low 100%RB



LTE Band 26 QPSK 15MHz CH-High 100%RB



LTE Band 26 16QAM 1.4MHz CH-Low 1RB

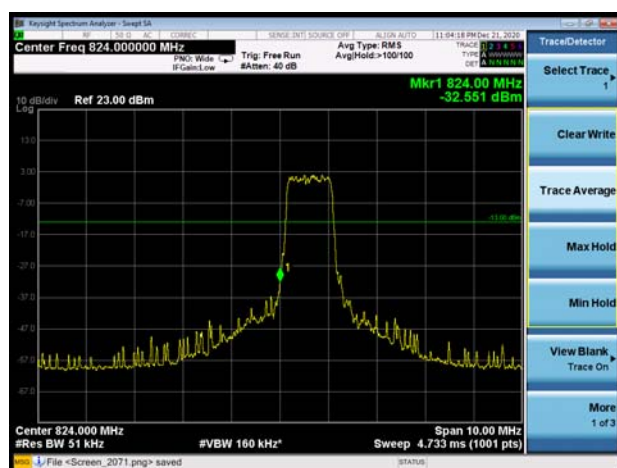


LTE Band 26 16QAM 1.4MHz CH-High 1RB

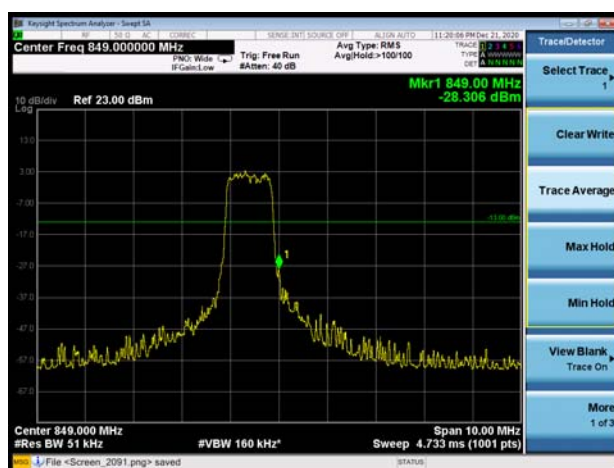




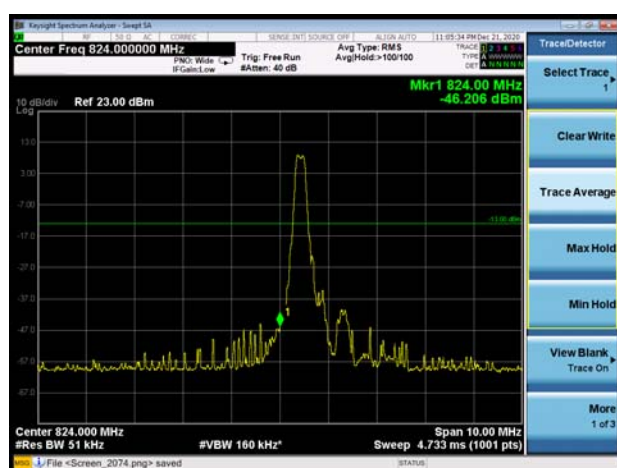
LTE Band 26 16QAM 1.4MHz CH-Low 100%RB



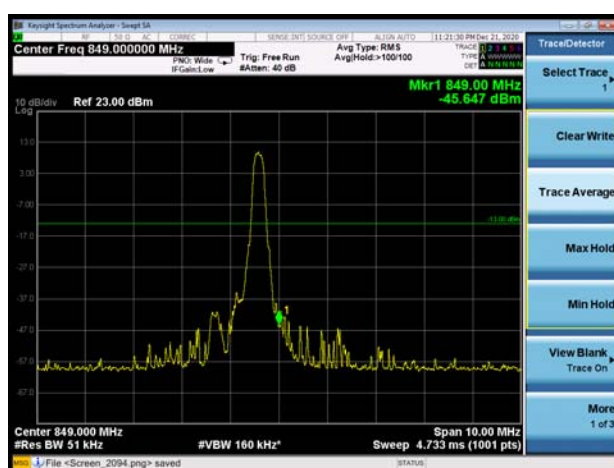
LTE Band 26 16QAM 1.4MHz CH-High 100%RB



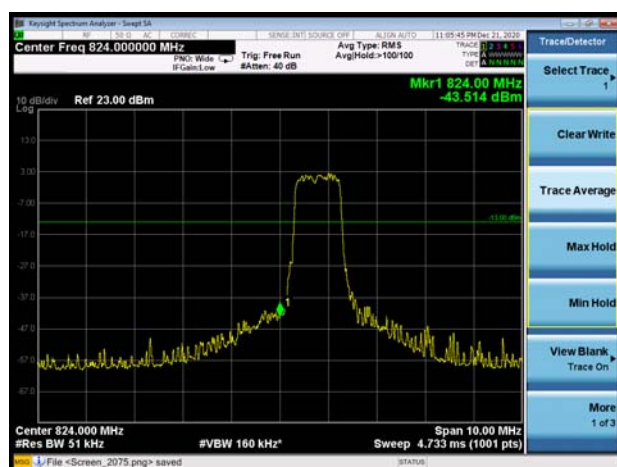
LTE Band 26 16QAM 3MHz CH-Low 1RB



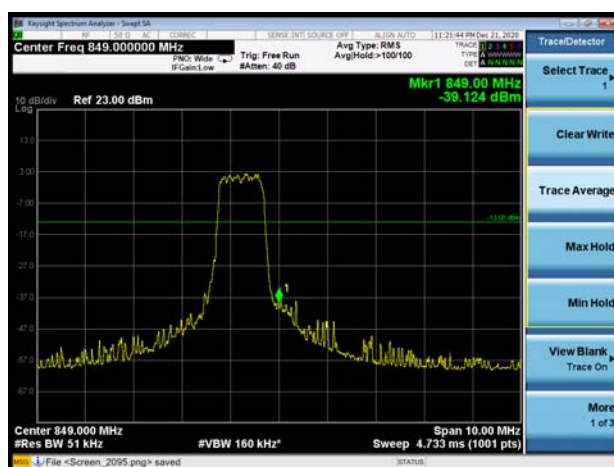
LTE Band 26 16QAM 3MHz CH-High 1RB



LTE Band 26 16QAM 3MHz CH-Low 100%RB

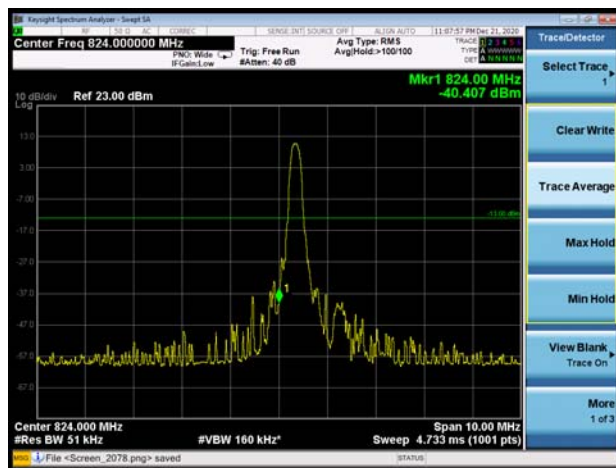


LTE Band 26 16QAM 3MHz CH-High 100%RB

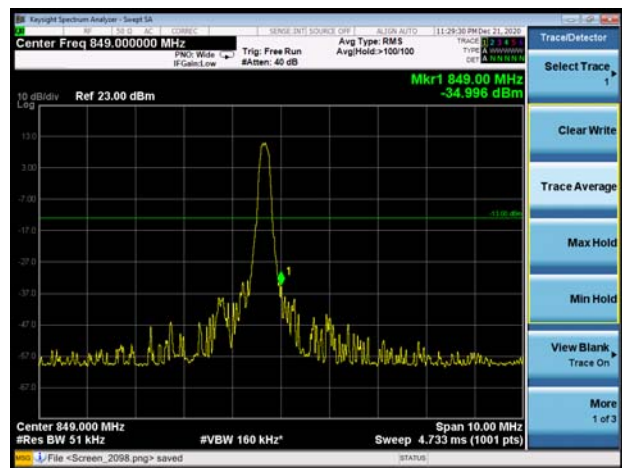




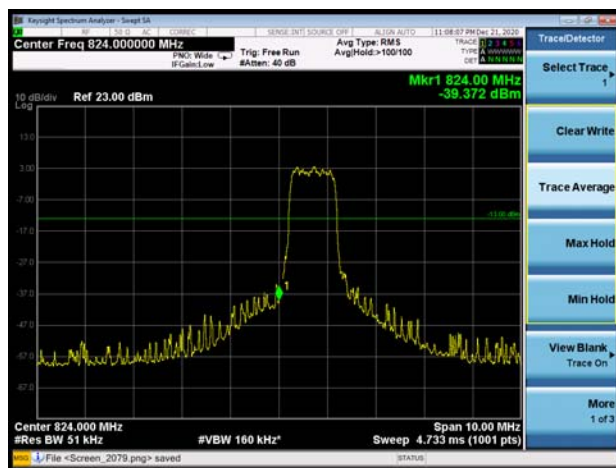
LTE Band 26 16QAM 5MHz CH-Low 1RB



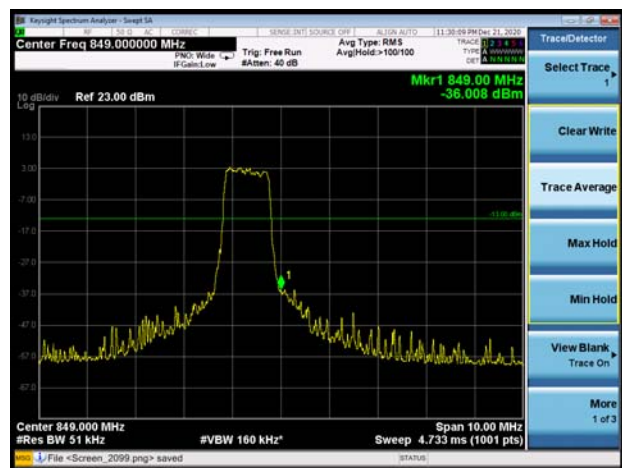
LTE Band 26 16QAM 5MHz CH-High 1RB



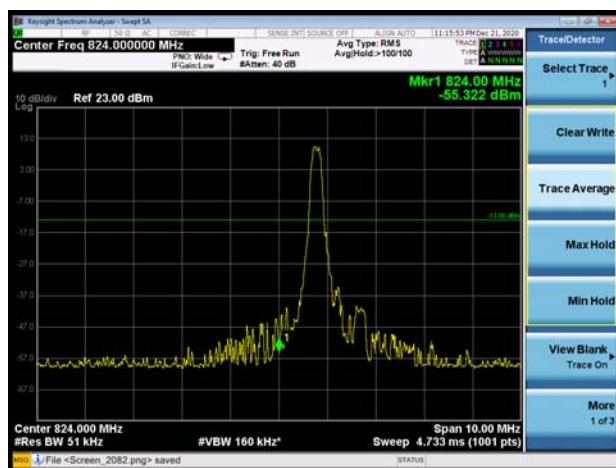
LTE Band 26 16QAM 5MHz CH-Low 100%RB



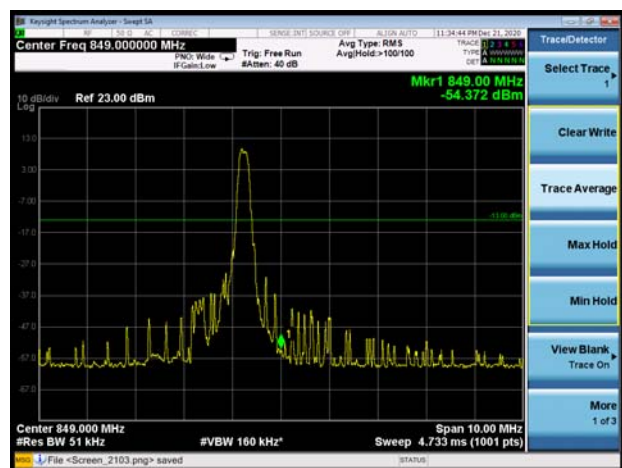
LTE Band 26 16QAM 5MHz CH-High 100%RB



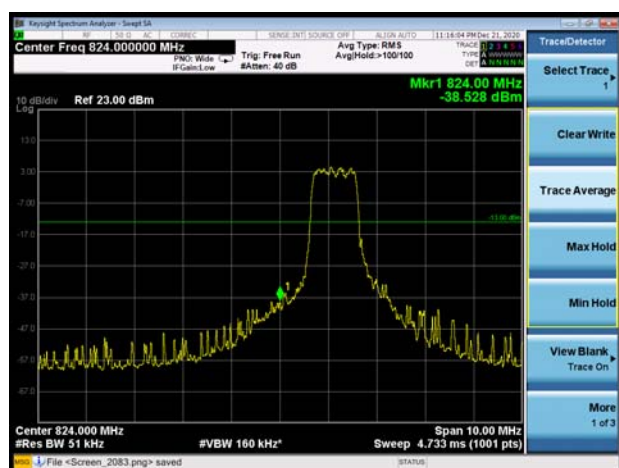
LTE Band 26 16QAM 10MHz CH-Low 1RB



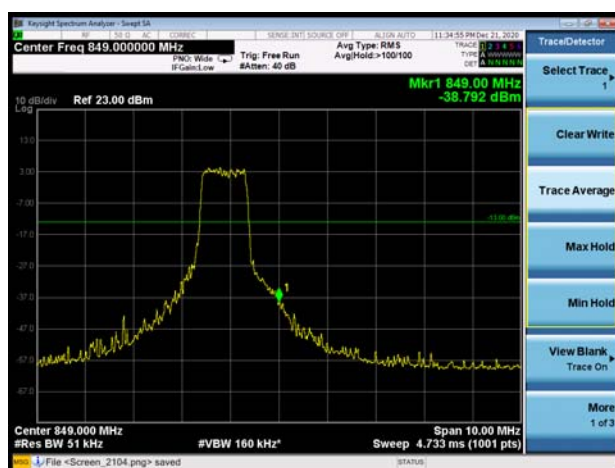
LTE Band 26 16QAM 10MHz CH-High 1RB



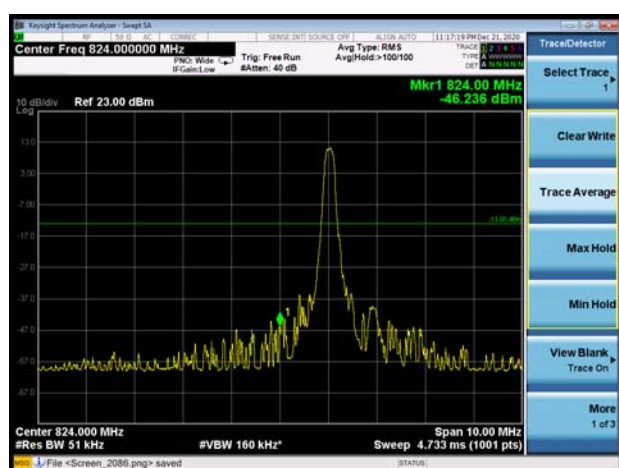
LTE Band 26 16QAM 10MHz CH-Low 100%RB



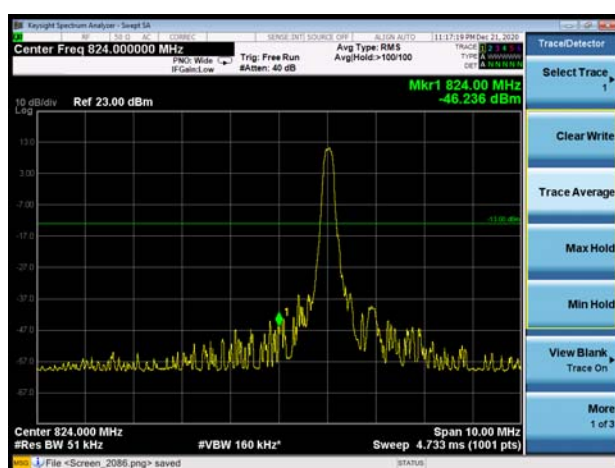
LTE Band 26 16QAM 10MHz CH-High 100%RB



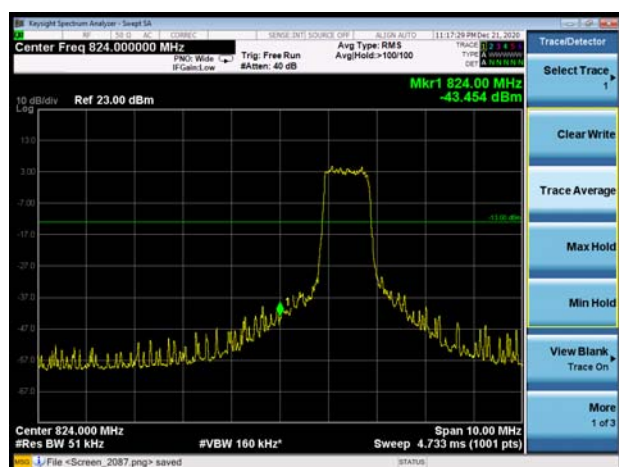
LTE Band 26 16QAM 15MHz CH-Low 1RB



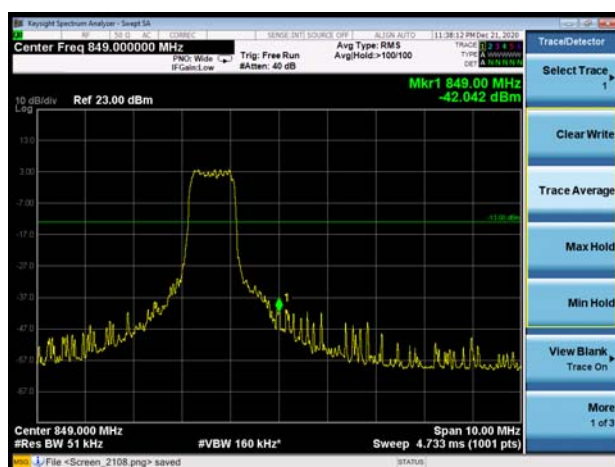
LTE Band 26 16QAM 15MHz CH-High 1RB



LTE Band 26 16QAM 15MHz CH-Low 100%RB



LTE Band 26 16QAM 15MHz CH-High 100%RB



5.4. Peak-to-Average Power Ratio (PAPR)

Ambient condition

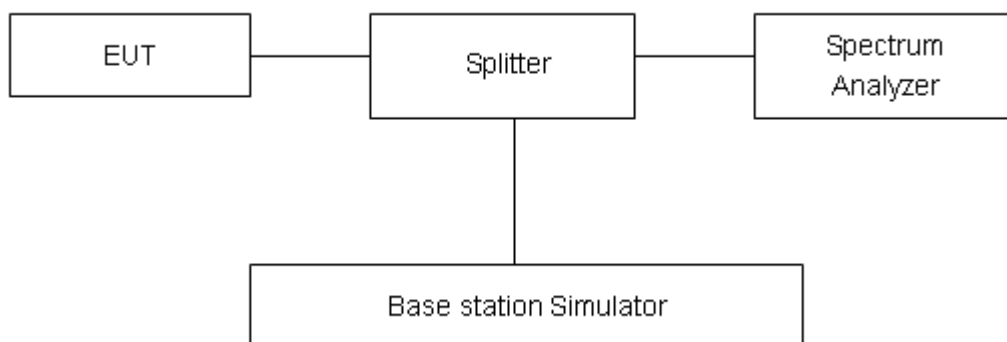
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

Measure the total peak power and record as P_{Pk} . And measure the total average power and record as P_{Avg} . Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

$$PAPR (dB) = P_{Pk} (dBm) - P_{Avg} (dBm).$$

Test Setup



Limits

According to the Sec. 22.913(d), The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.4$ dB.

Test Results

Mode	Modulation	Sub-carrier spacing (kHz)	Channel/ Frequency(MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak(dBm)	Avg(dBm)	PAPR(dB)		
NB-IOT Band 5	BPSK	3.75	20525/836.5	23.05	18.33	4.72	≤13	PASS
	QPSK	3.75	20525/836.5	22.52	18.37	4.15	≤13	PASS
	BPSK	15	20525/836.5	22.74	15.51	7.23	≤13	PASS
	QPSK	15	20525/836.5	22.34	15.46	6.88	≤13	PASS

Mode	Bandwidth	Modulation	Channel/ Frequency (MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak (dBm)	Avg (dBm)	PAPR (dB)		
LTE Band 5	1.4MHz	QPSK	20525/836.5	23.03	11.43	11.60	≤13	PASS
		16QAM	20525/836.5	24.51	12.46	12.05	≤13	PASS
	3MHz	QPSK	20525/836.5	23.09	13.08	10.01	≤13	PASS
		16QAM	20525/836.5	23.98	13.34	10.64	≤13	PASS
	5MHz	QPSK	20525/836.5	24.11	14.29	9.82	≤13	PASS
		16QAM	20525/836.5	24.73	14.42	10.31	≤13	PASS
	10MHz	QPSK	20525/836.5	24.15	14.47	9.68	≤13	PASS
		16QAM	20525/836.5	25.60	15.69	9.91	≤13	PASS

Mode	Bandwidth	Modulation	Channel/ Frequency (MHz)	Peak-to-Average Power Ratio (PAPR)			Limit (dB)	Conclusion
				Peak (dBm)	Avg (dBm)	PAPR (dB)		
LTE Band 26	1.4MHz	QPSK	26915/836.5	23.34	11.91	11.43	≤13	PASS
		16QAM	26915/836.5	24.77	12.70	12.07	≤13	PASS
	3MHz	QPSK	26915/836.5	23.39	13.46	9.93	≤13	PASS
		16QAM	26915/836.5	24.18	13.36	10.82	≤13	PASS
	5MHz	QPSK	26915/836.5	24.45	14.68	9.77	≤13	PASS
		16QAM	26915/836.5	25.07	14.75	10.32	≤13	PASS
	10MHz	QPSK	26915/836.5	24.31	14.36	9.95	≤13	PASS
		16QAM	26915/836.5	25.61	15.66	9.95	≤13	PASS
	15MHz	QPSK	26915/836.5	25.05	15.55	9.50	≤13	PASS
		16QAM	26915/836.5	25.53	15.50	10.03	≤13	PASS

5.5. Frequency Stability

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -30°C to +50°C in 10°C step size,

(1) With all power removed, the temperature was decreased to 0°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

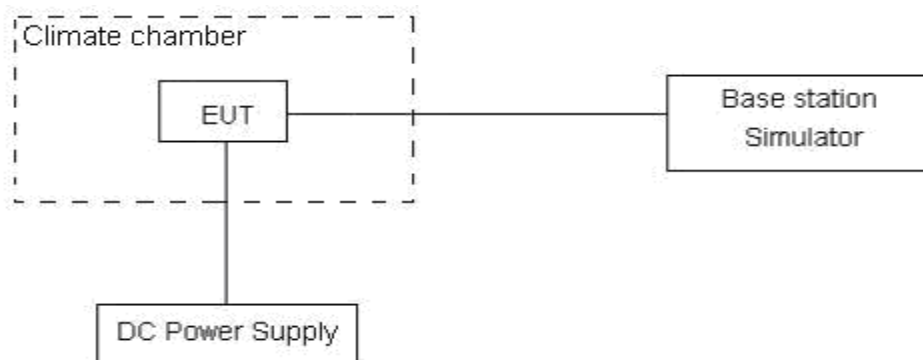
(3) Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements. Frequency Stability (Voltage Variation)

The frequency stability shall be measured with variation of primary supply voltage as follows:

Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 3.23V and 4.37 V, with a nominal voltage of 3.8V.

Test setup



Limits

According to the Sec. 22.355, the frequency stability of the carrier shall be accurate to within 2.5 ppm of the received frequency for mobile stations.

Limits	≤ 2.5 ppm
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 3$, $U = 0.01\text{ppm}$.

Test Result

NB-IOT Band 5						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
Sub-carrier spacing	3.75kHz					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal (25℃)	Normal	13.29	12.16	0.00707	0.00647	PASS
Extreme (50℃)		10.85	12.59	0.00577	0.00669	PASS
Extreme (40℃)		13.12	5.00	0.00698	0.00266	PASS
Extreme (30℃)		5.15	11.70	0.00274	0.00623	PASS
Extreme (20℃)		7.36	12.93	0.00392	0.00688	PASS
Extreme (10℃)		17.62	12.02	0.00937	0.00640	PASS
Extreme (0℃)		13.37	12.40	0.00711	0.00660	PASS
Extreme (-10℃)		4.27	16.16	0.00227	0.00860	PASS
Extreme (-20℃)		1.73	5.16	0.00092	0.00275	PASS
Extreme (-30℃)		6.59	5.75	0.00351	0.00306	PASS
25℃	LV	14.78	3.60	0.00786	0.00191	PASS
	HV	5.72	9.15	0.00304	0.00487	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
Sub-carrier spacing	15kHz					
Temperature	Voltage	BPSK	QPSK	BPSK	QPSK	
Normal (25℃)	Normal	3.14	2.49	0.00167	0.00132	PASS
Extreme (50℃)		2.50	1.44	0.00133	0.00077	PASS
Extreme (40℃)		16.30	3.24	0.00867	0.00172	PASS
Extreme (30℃)		4.41	12.54	0.00235	0.00667	PASS
Extreme (20℃)		8.05	6.82	0.00428	0.00363	PASS
Extreme (10℃)		15.55	4.62	0.00827	0.00246	PASS
Extreme (0℃)		2.28	6.68	0.00121	0.00356	PASS
Extreme (-10℃)		2.81	16.13	0.00149	0.00858	PASS
Extreme (-20℃)		16.69	16.82	0.00888	0.00895	PASS
Extreme (-30℃)		7.46	5.67	0.00397	0.00302	PASS
25℃	LV	8.22	15.25	0.00437	0.00811	PASS
	HV	6.44	2.78	0.00342	0.00148	PASS



LTE Band 5						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	1.4MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	1.48	16.17	0.00079	0.00860	PASS
Extreme (50℃)		10.84	9.30	0.00577	0.00495	PASS
Extreme (40℃)		5.91	12.31	0.00315	0.00655	PASS
Extreme (30℃)		8.54	10.28	0.00454	0.00547	PASS
Extreme (20℃)		2.62	16.26	0.00139	0.00865	PASS
Extreme (10℃)		1.18	9.43	0.00063	0.00501	PASS
Extreme (0℃)		16.21	3.15	0.00862	0.00168	PASS
Extreme (-10℃)		13.69	4.47	0.00728	0.00238	PASS
Extreme (-20℃)		1.52	4.54	0.00081	0.00242	PASS
Extreme (-30℃)		4.01	5.54	0.00213	0.00295	PASS
25℃	LV	3.78	12.14	0.00201	0.00646	PASS
	HV	16.58	11.87	0.00882	0.00632	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	3MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	8.18	11.06	0.00435	0.00588	PASS
Extreme (50℃)		4.28	10.69	0.00228	0.00568	PASS
Extreme (40℃)		1.12	17.78	0.00059	0.00946	PASS
Extreme (30℃)		17.90	12.87	0.00952	0.00684	PASS
Extreme (20℃)		4.27	15.16	0.00227	0.00806	PASS
Extreme (10℃)		4.65	7.22	0.00247	0.00384	PASS
Extreme (0℃)		8.79	4.79	0.00468	0.00255	PASS
Extreme (-10℃)		5.60	15.55	0.00298	0.00827	PASS
Extreme (-20℃)		10.67	3.06	0.00567	0.00163	PASS
Extreme (-30℃)		12.57	8.45	0.00669	0.00449	PASS
25℃	LV	4.18	1.82	0.00222	0.00097	PASS
	HV	17.99	12.90	0.00957	0.00686	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	5MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	7.64	10.00	0.00406	0.00532	PASS
Extreme (50℃)		14.45	7.44	0.00769	0.00396	PASS
Extreme (40℃)		13.72	12.18	0.00730	0.00648	PASS
Extreme (30℃)		15.90	6.07	0.00846	0.00323	PASS



Extreme (20℃)		6.74	4.95	0.00359	0.00263	PASS
Extreme (10℃)		8.48	7.87	0.00451	0.00419	PASS
Extreme (0℃)		2.64	12.26	0.00141	0.00652	PASS
Extreme (-10℃)		9.90	11.32	0.00526	0.00602	PASS
Extreme (-20℃)		9.42	6.55	0.00501	0.00349	PASS
Extreme (-30℃)		17.93	1.93	0.00954	0.00103	PASS
25℃	LV	1.68	5.90	0.00089	0.00314	PASS
	HV	4.86	9.84	0.00258	0.00524	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	10MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	5.32	2.94	0.00283	0.00156	PASS
Extreme (50℃)		7.56	5.81	0.00402	0.00309	PASS
Extreme (40℃)		11.19	1.04	0.00595	0.00055	PASS
Extreme (30℃)		2.97	6.91	0.00158	0.00367	PASS
Extreme (20℃)		17.49	9.05	0.00930	0.00481	PASS
Extreme (10℃)		1.04	4.32	0.00055	0.00230	PASS
Extreme (0℃)		16.82	1.96	0.00895	0.00104	PASS
Extreme (-10℃)		15.64	6.71	0.00832	0.00357	PASS
Extreme (-20℃)		13.77	7.74	0.00732	0.00412	PASS
Extreme (-30℃)		1.43	16.94	0.00076	0.00901	PASS
25℃	LV	9.47	14.40	0.00504	0.00766	PASS
	HV	16.84	9.96	0.00896	0.00530	PASS

LTE Band 26						
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	1.4MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	10.08	1.01	0.00536	0.00054	PASS
Extreme (50℃)		6.46	6.65	0.00343	0.00354	PASS
Extreme (40℃)		1.72	7.47	0.00091	0.00397	PASS
Extreme (30℃)		17.29	14.85	0.00920	0.00790	PASS
Extreme (20℃)		8.36	3.78	0.00445	0.00201	PASS
Extreme (10℃)		12.05	3.96	0.00641	0.00211	PASS
Extreme (0℃)		8.08	15.89	0.00430	0.00845	PASS
Extreme (-10℃)		7.72	12.07	0.00410	0.00642	PASS
Extreme (-20℃)		2.04	10.23	0.00109	0.00544	PASS
Extreme (-30℃)		11.22	3.67	0.00597	0.00195	PASS
25℃	LV	1.52	8.47	0.00081	0.00450	PASS



	HV	6.95	11.11	0.00370	0.00591	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	3MHz					
Temperature	Voltage					
Normal (25℃)	Normal	17.87	4.66	0.00951	0.00248	PASS
Extreme (50℃)		4.83	2.80	0.00257	0.00149	PASS
Extreme (40℃)		11.97	14.29	0.00637	0.00760	PASS
Extreme (30℃)		12.10	12.17	0.00643	0.00647	PASS
Extreme (20℃)		15.70	16.57	0.00835	0.00882	PASS
Extreme (10℃)		14.38	7.31	0.00765	0.00389	PASS
Extreme (0℃)		8.23	6.84	0.00438	0.00364	PASS
Extreme (-10℃)		8.84	8.03	0.00470	0.00427	PASS
Extreme (-20℃)		8.52	1.88	0.00453	0.00100	PASS
Extreme (-30℃)		12.46	6.83	0.00663	0.00363	PASS
25℃	LV	8.21	3.21	0.00437	0.00171	PASS
	HV	10.05	13.08	0.00534	0.00696	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	5MHz					
Temperature	Voltage					
Normal (25℃)	Normal	13.07	5.80	0.00695	0.00308	PASS
Extreme (50℃)		8.58	9.59	0.00457	0.00510	PASS
Extreme (40℃)		7.60	6.39	0.00404	0.00340	PASS
Extreme (30℃)		13.17	13.56	0.00701	0.00721	PASS
Extreme (20℃)		11.45	3.42	0.00609	0.00182	PASS
Extreme (10℃)		12.27	12.52	0.00653	0.00666	PASS
Extreme (0℃)		16.59	1.18	0.00883	0.00063	PASS
Extreme (-10℃)		14.63	3.68	0.00778	0.00196	PASS
Extreme (-20℃)		4.48	15.89	0.00238	0.00845	PASS
Extreme (-30℃)		6.08	7.64	0.00323	0.00406	PASS
25℃	LV	8.29	13.72	0.00441	0.00730	PASS
	HV	4.97	2.41	0.00264	0.00128	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	10MHz					
Temperature	Voltage					
Normal (25℃)	Normal	8.78	1.21	0.00467	0.00064	PASS
Extreme (50℃)		5.02	3.24	0.00267	0.00172	PASS
Extreme (40℃)		5.78	3.91	0.00308	0.00208	PASS
Extreme (30℃)		5.49	2.03	0.00292	0.00108	PASS
Extreme (20℃)		1.17	4.18	0.00062	0.00222	PASS



Extreme (10℃)		16.00	3.49	0.00851	0.00186	PASS
Extreme (0℃)		4.95	15.03	0.00264	0.00799	PASS
Extreme (-10℃)		7.81	7.42	0.00415	0.00395	PASS
Extreme (-20℃)		17.45	2.47	0.00928	0.00131	PASS
Extreme (-30℃)		17.37	6.76	0.00924	0.00360	PASS
25℃	LV	15.70	7.39	0.00835	0.00393	PASS
	HV	6.70	10.40	0.00356	0.00553	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability (ppm)	Frequency Stability (ppm)	Verdict
BANDWIDTH	15MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal (25℃)	Normal	9.48	8.62	0.00504	0.00459	PASS
Extreme (50℃)		4.61	6.82	0.00245	0.00363	PASS
Extreme (40℃)		12.50	4.99	0.00665	0.00265	PASS
Extreme (30℃)		9.51	3.15	0.00506	0.00168	PASS
Extreme (20℃)		3.37	7.56	0.00179	0.00402	PASS
Extreme (10℃)		11.82	17.07	0.00629	0.00908	PASS
Extreme (0℃)		7.66	11.49	0.00407	0.00611	PASS
Extreme (-10℃)		1.73	14.83	0.00092	0.00789	PASS
Extreme (-20℃)		15.54	9.94	0.00827	0.00529	PASS
Extreme (-30℃)		5.93	15.29	0.00315	0.00813	PASS
25℃	LV	10.80	16.47	0.00575	0.00876	PASS
	HV	5.04	2.51	0.00268	0.00133	PASS

5.6. Spurious Emissions at Antenna Terminals

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 9kHz to the 10th harmonic of the carrier.

The peak detector is used.

RBW is set to 1 kHz (0.009MHz~ 0.15 MHz),

RBW is set to 10 kHz (0.15 MHz~ 30 MHz),

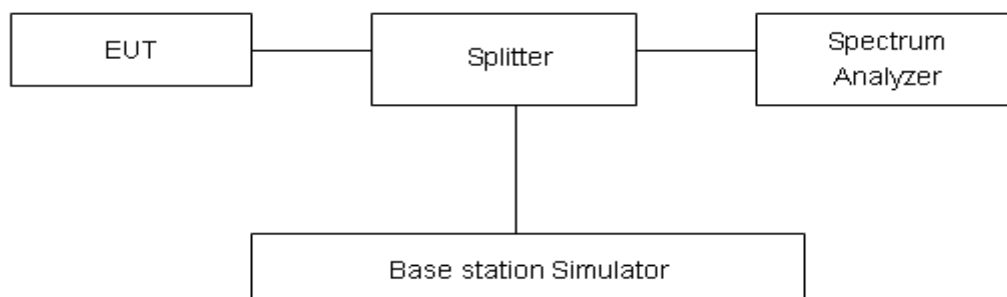
RBW is set to 100 kHz (30MHz~1000 MHz),

RBW is set to 1000 kHz (above 1000MHz),

, Sweep is set to ATUO.

The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup



Limits

Rule Part 22.917(a) specifies that “The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.”

Limit	-13 dBm
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

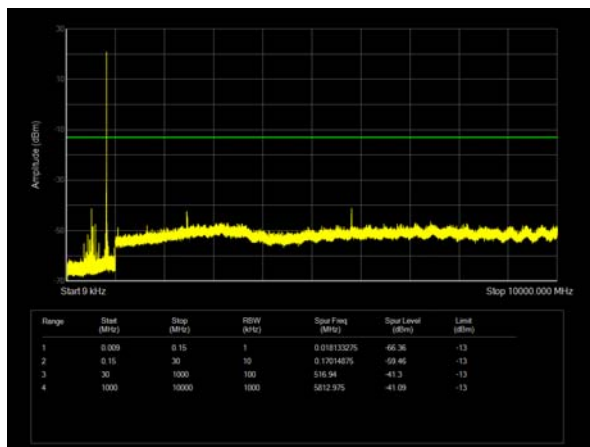
Frequency	Uncertainty
9kHz-1GHz	0.684 dB
1GHz-18GHz	1.407 dB

Test Result

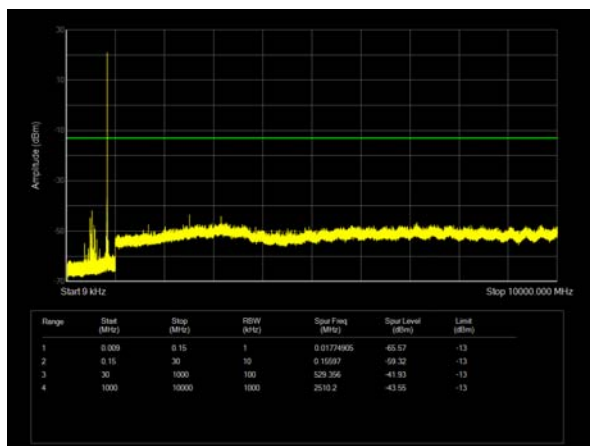
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions more than 20 dB below the limit are not reported.

The signal beyond the limit is carrier.

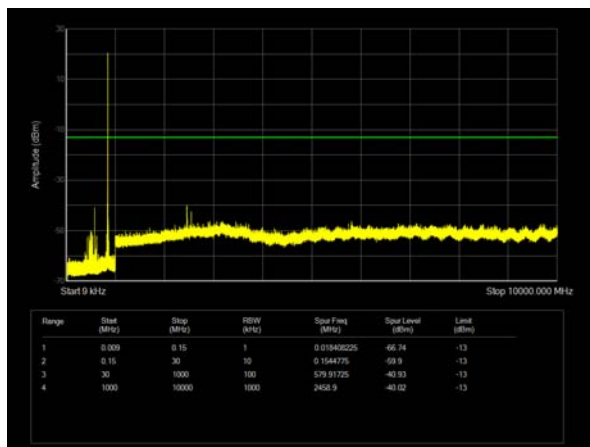
NB-IOT Band 5 CH-Low 9kHz~10GHz



NB-IOT Band 5 CH-Middle 9kHz~10GHz



NB-IOT Band 5 CH-High 9kHz~10GHz





LTE Band 5 1.4MHz CH-Low 9kHz~10GHz



LTE Band 5 3MHz CH-Low 9kHz~10GHz



LTE Band 5 1.4MHz CH-Middle 9kHz~10GHz



LTE Band 5 3MHz CH-Middle 9kHz~10GHz



LTE Band 5 1.4MHz CH-High 9kHz~10GHz



LTE Band 5 3MHz CH-High 9kHz~10GHz



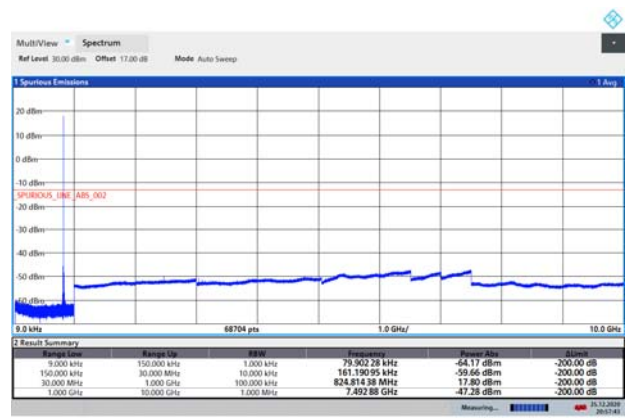


LTE Band 5 5MHz CH-Low 9kHz~10GHz



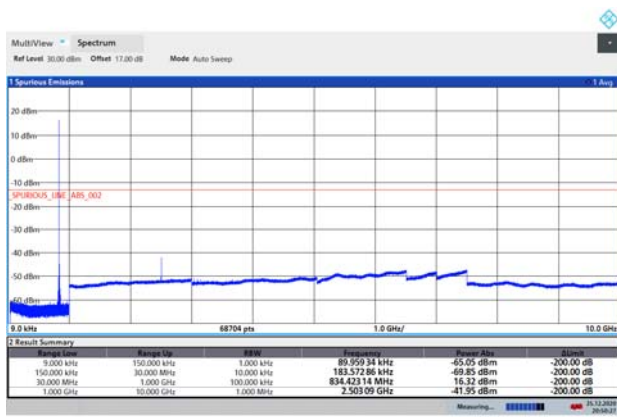
20:48:32 25.12.2020

LTE Band 5 10MHz CH-Low 9kHz~10GHz



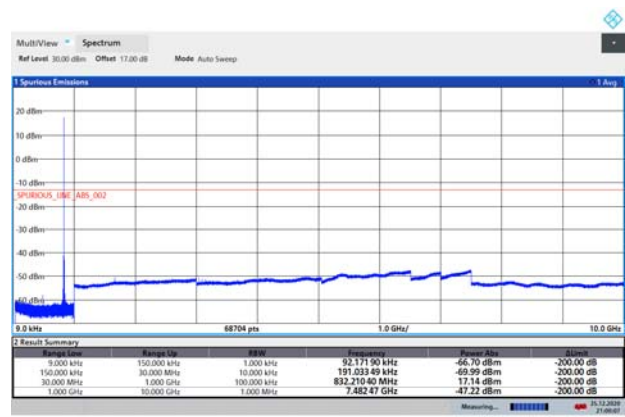
20:57:43 25.12.2020

LTE Band 5 5MHz CH-Middle 9kHz~10GHz



20:50:28 25.12.2020

LTE Band 5 10MHz CH-Middle 9kHz~10GHz



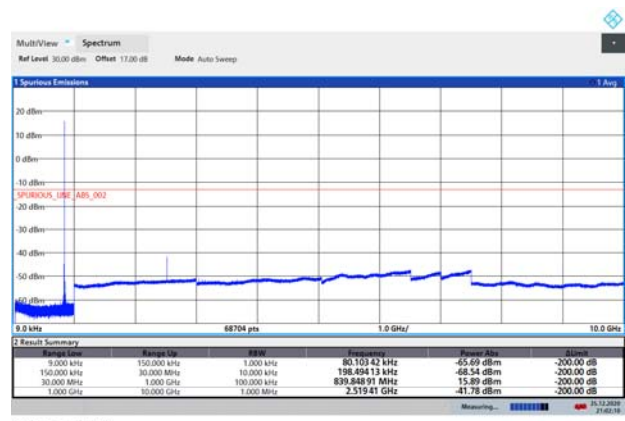
21:00:07 25.12.2020

LTE Band 5 5MHz CH-High 9kHz~10GHz



20:54:34 25.12.2020

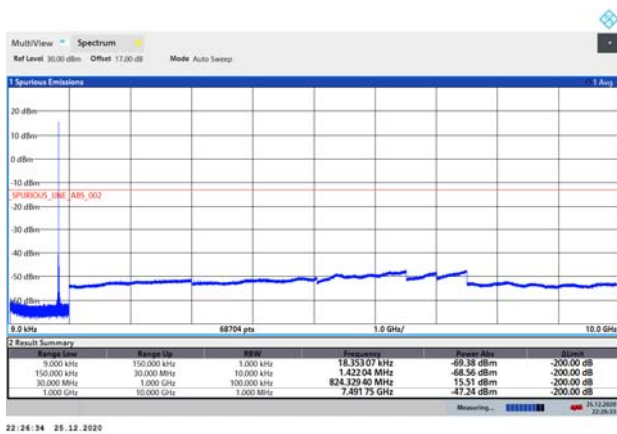
LTE Band 5 10MHz CH-High 9kHz~10GHz



21:02:10 25.12.2020



LTE Band 26 1.4MHz CH-Low 9kHz~10GHz



LTE Band 26 3MHz CH-Low 9kHz~10GHz



LTE Band 26 1.4MHz CH-Middle 9kHz~10GHz



LTE Band 26 3MHz CH-Middle 9kHz~10GHz



LTE Band 26 1.4MHz CH-High 9kHz~10GHz



LTE Band 26 3MHz CH-High 9kHz~10GHz





LTE Band 26 5MHz CH-Low 9kHz~10GHz



LTE Band 26 10MHz CH-Low 9kHz~10GHz



LTE Band 26 5MHz CH-Middle 9kHz~10GHz



LTE Band 26 10MHz CH-Middle 9kHz~10GHz



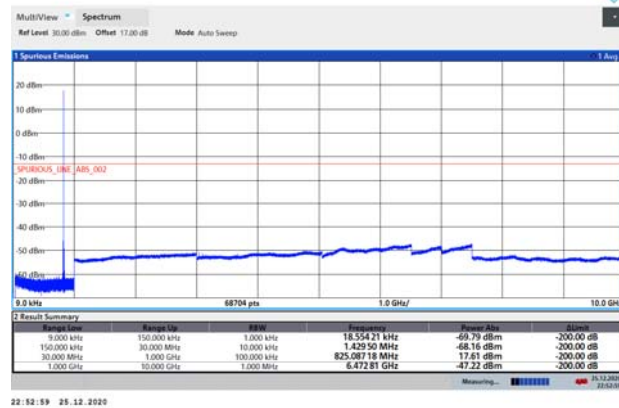
LTE Band 26 5MHz CH-High 9kHz~10GHz



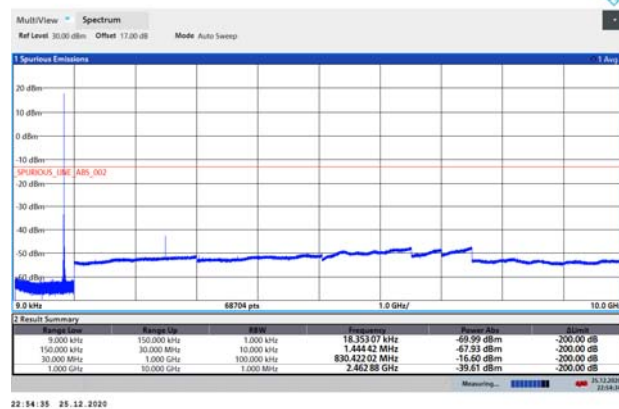
LTE Band 26 10MHz CH-High 9kHz~10GHz



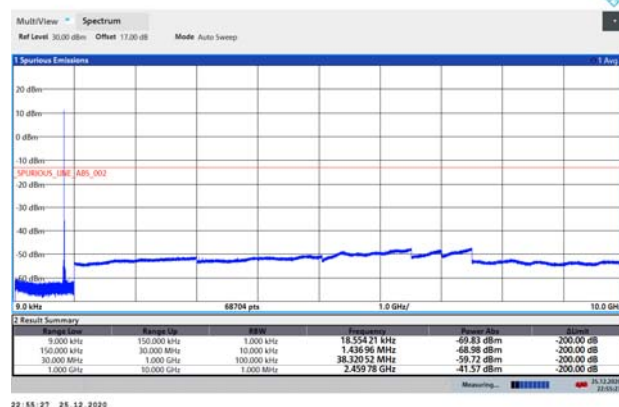
LTE Band 26 15MHz CH-Low 9kHz~10GHz



LTE Band 26 15MHz CH-Middle 9kHz~10GHz



LTE Band 26 15MHz CH-High 9kHz~10GHz



5.7. Radiates Spurious Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

1. The testing follows FCC KDB 971168 v03r01 Section 5.8 and ANSI C63.26 (2015).
2. Below 1GHz: The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H). Above 1GHz: (Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).
3. A loop antenna, A log-periodic antenna or horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
4. The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum RBW=200Hz,VBW=600Hz for 9kHz-150kHz , RBW=10kHz, VBW=30kHz 150kHz-30MHz , RBW=100kHz,VBW=300kHz for 30MHz to 1GHz and RBW=1MHz, VBW=3MHz for above 1GHz, And the maximum value of the receiver should be recorded as (Pr).
5. The EUT shall be replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power (PMea) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded (Pr). The power of signal source (PMea) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
6. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss (Pcl) ,the Substitution Antenna Gain (Ga) and the Amplifier Gain (PAG) should be recorded after test.
7. The measurement results are obtained as described below:

$$\text{Power(EIRP)} = \text{PMea} - \text{PAG} - \text{Pcl} + \text{Ga}$$
The measurement results are amend as described below:

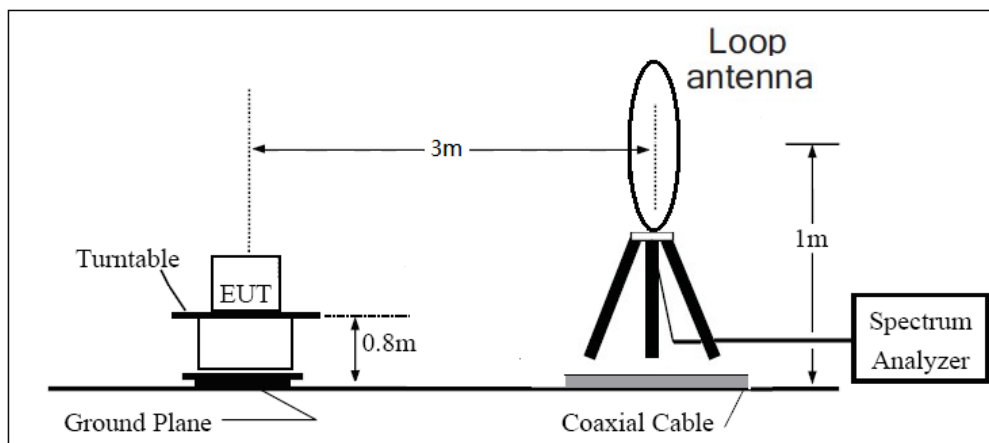
$$\text{Power(EIRP)} = \text{PMea} - \text{Pcl} + \text{Ga}$$
8. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi)

and known input power. ERP can be calculated from EIRP by subtracting the gain of the dipole, $ERP = EIRP - 2.15\text{dBi}$.

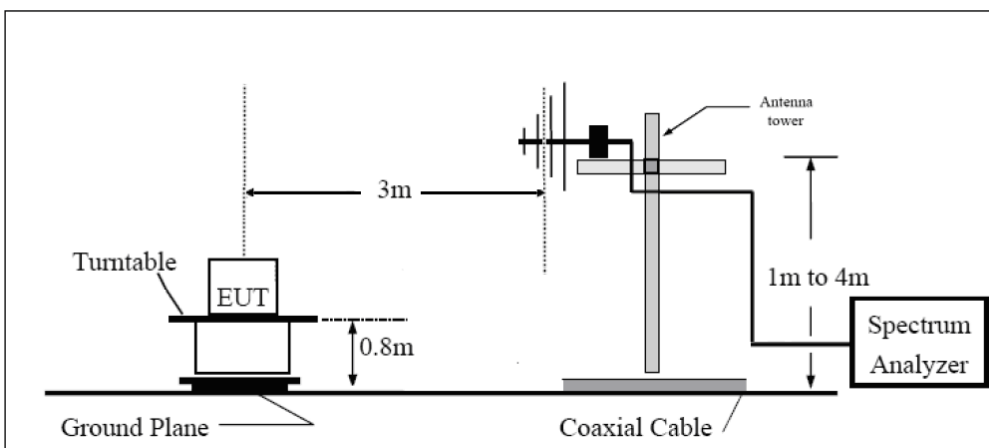
The modulation mode and RB allocation refer to section 5.1, using the maximum output power configuration.

Test setup

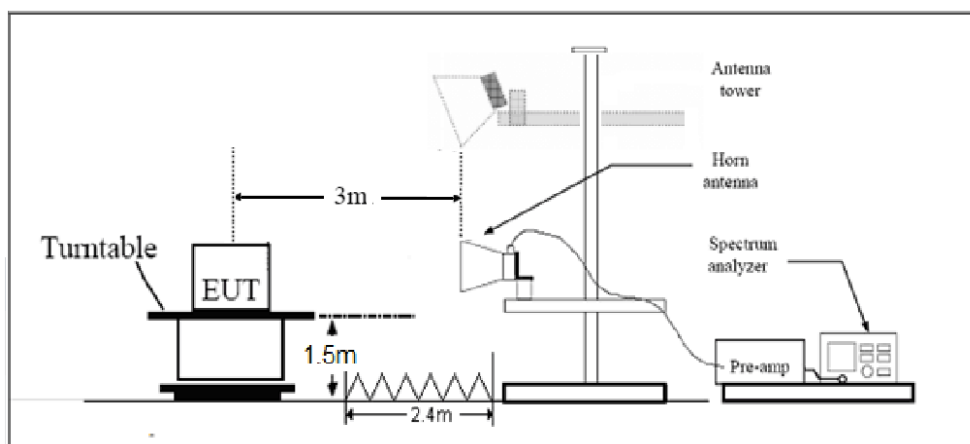
9KHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



Note: Area side: 2.4mX3.6m

Limits

Rule Part 22.917(a) specifies that “The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$ dB.”

Limit	-13 dBm
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 3.55$ dB.

Test Result

Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the emissions below the noise floor will not be recorded in the report.

NB-IOT Band 5 15kHz CH-Low

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1648.20	-64.53	2.00	10.15	Horizontal	-58.53	-13.00	45.53	315
3	2472.30	-65.49	2.51	11.35	Horizontal	-58.80	-13.00	45.80	0
4	3296.40	-45.72	4.20	10.85	Horizontal	-41.22	-13.00	28.22	0
5	4120.50	-31.46	5.20	11.35	Horizontal	-27.46	-13.00	14.46	0
6	4944.60	-40.28	5.50	11.95	Horizontal	-35.98	-13.00	22.98	315
7	5768.70	-39.29	5.70	13.55	Horizontal	-33.59	-13.00	20.59	90
8	6592.80	-56.06	6.30	13.75	Horizontal	-50.76	-13.00	37.76	225
9	7416.90	-53.41	6.80	13.85	Horizontal	-48.51	-13.00	35.51	180
10	8241.00	-54.90	6.90	14.25	Horizontal	-49.70	-13.00	36.70	0
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									

NB-IOT Band 5 15kHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1668.20	-63.80	2.00	10.75	Horizontal	-57.20	-13.00	44.20	180
3	2502.30	-65.61	2.51	11.05	Horizontal	-59.22	-13.00	46.22	45
4	3345.75	-42.72	4.20	11.15	Horizontal	-37.92	-13.00	24.92	45
5	4170.50	-25.26	5.20	11.15	Horizontal	-21.46	-13.00	8.46	90
6	5004.60	-36.87	5.50	11.95	Horizontal	-32.57	-13.00	19.57	180
7	5838.70	-34.10	5.70	13.55	Horizontal	-28.40	-13.00	15.40	0
8	6672.80	-55.21	6.30	13.75	Horizontal	-49.91	-13.00	36.91	315
9	7506.90	-52.24	6.80	13.85	Horizontal	-47.34	-13.00	34.34	270
10	8341.00	-54.57	6.90	14.25	Horizontal	-49.37	-13.00	36.37	45
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									



NB-IOT Band 5 15kHz CH-High

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1697.80	-61.25	2.00	10.15	Horizontal	-55.25	-13.00	42.25	315
3	2546.70	-65.00	2.51	11.05	Horizontal	-58.61	-13.00	45.61	225
4	3395.60	-40.23	4.20	11.15	Horizontal	-35.43	-13.00	22.43	315
5	4244.50	-25.23	5.20	11.15	Horizontal	-21.43	-13.00	8.43	315
6	5093.40	-35.53	5.50	11.95	Horizontal	-31.23	-13.00	18.23	225
7	5942.30	-36.19	5.70	13.55	Horizontal	-30.49	-13.00	17.49	180
8	6791.20	-57.06	6.30	13.75	Horizontal	-51.76	-13.00	38.76	45
9	7640.10	-54.86	6.80	13.85	Horizontal	-49.96	-13.00	36.96	270
10	8489.00	-53.76	6.90	14.25	Horizontal	-48.56	-13.00	35.56	0

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.

LTE Band 5 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.00	-58.28	2.00	10.75	Horizontal	-51.68	-13.00	38.68	180
3	2509.50	-49.84	2.51	11.05	Horizontal	-43.45	-13.00	30.45	225
4	3346.00	-63.49	4.20	11.15	Horizontal	-58.69	-13.00	45.69	0
5	4182.50	-56.63	5.20	11.15	Horizontal	-52.83	-13.00	39.83	135
6	5019.00	-56.63	5.50	11.95	Horizontal	-52.33	-13.00	39.33	180
7	5855.50	-59.63	5.70	13.55	Horizontal	-53.93	-13.00	40.93	270
8	6692.00	-57.95	6.30	13.75	Horizontal	-52.65	-13.00	39.65	135
9	7528.50	-53.94	6.80	13.85	Horizontal	-49.04	-13.00	36.04	45
10	8365.00	-54.22	6.90	14.25	Horizontal	-49.02	-13.00	36.02	90

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.



LTE Band 5 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.00	-59.99	2.00	10.75	Horizontal	-53.39	-13.00	40.39	315
3	2509.50	-52.36	2.51	11.05	Horizontal	-45.97	-13.00	32.97	45
4	3337.50	-63.18	4.20	11.15	Horizontal	-58.38	-13.00	45.38	90
5	4171.88	-57.52	5.20	11.15	Horizontal	-53.72	-13.00	40.72	135
6	5006.25	-56.26	5.50	11.95	Horizontal	-51.96	-13.00	38.96	180
7	5840.63	-58.14	5.70	13.55	Horizontal	-52.44	-13.00	39.44	225
8	6675.00	-58.24	6.30	13.75	Horizontal	-52.94	-13.00	39.94	315
9	7509.38	-53.56	6.80	13.85	Horizontal	-48.66	-13.00	35.66	45
10	8343.75	-54.48	6.90	14.25	Horizontal	-49.28	-13.00	36.28	270

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.

LTE Band 5 10MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.00	-60.07	2.00	10.75	Horizontal	-53.47	-13.00	40.47	45
3	2509.50	-47.66	2.51	11.05	Horizontal	-41.27	-13.00	28.27	90
4	3346.00	-63.12	4.20	11.15	Horizontal	-58.32	-13.00	45.32	225
5	4182.50	-57.58	5.20	11.15	Horizontal	-53.78	-13.00	40.78	180
6	5019.00	-56.09	5.50	11.95	Horizontal	-51.79	-13.00	38.79	45
7	5855.50	-58.68	5.70	13.55	Horizontal	-52.98	-13.00	39.98	90
8	6692.00	-58.30	6.30	13.75	Horizontal	-53.00	-13.00	40.00	0
9	7528.50	-53.98	6.80	13.85	Horizontal	-49.08	-13.00	36.08	135
10	8365.00	-54.21	6.90	14.25	Horizontal	-49.01	-13.00	36.01	315

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.



LTE Band 26 1.4MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.00	-56.20	2.00	10.75	Horizontal	-49.60	-13.00	36.60	45
3	2509.50	-55.48	2.51	11.05	Horizontal	-49.09	-13.00	36.09	315
4	3346.00	-62.34	4.20	11.15	Horizontal	-57.54	-13.00	44.54	270
5	4182.50	-56.25	5.20	11.15	Horizontal	-52.45	-13.00	39.45	135
6	5019.00	-55.38	5.50	11.95	Horizontal	-51.08	-13.00	38.08	225
7	5855.50	-57.40	5.70	13.55	Horizontal	-51.70	-13.00	38.70	90
8	6692.00	-58.84	6.30	13.75	Horizontal	-53.54	-13.00	40.54	315
9	7528.50	-53.54	6.80	13.85	Horizontal	-48.64	-13.00	35.64	180
10	8365.00	-54.51	6.90	14.25	Horizontal	-49.31	-13.00	36.31	45

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.

LTE Band 26 5MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.00	-57.01	2.00	10.75	Horizontal	-50.41	-13.00	37.41	180
3	2509.50	-55.56	2.51	11.05	Horizontal	-49.17	-13.00	36.17	225
4	3337.13	-62.93	4.20	11.15	Horizontal	-58.13	-13.00	45.13	270
5	4150.00	-57.95	5.20	11.15	Horizontal	-54.15	-13.00	41.15	180
6	4980.00	-56.84	5.50	11.95	Horizontal	-52.54	-13.00	39.54	90
7	5810.00	-58.23	5.70	13.55	Horizontal	-52.53	-13.00	39.53	315
8	6640.00	-57.36	6.30	13.75	Horizontal	-52.06	-13.00	39.06	225
9	7470.00	-53.43	6.80	13.85	Horizontal	-48.53	-13.00	35.53	45
10	8300.00	-54.73	6.90	14.25	Horizontal	-49.53	-13.00	36.53	180

Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor.

2.The worst emission was found in the antenna is Horizontal position.



LTE Band 26 15MHz CH-Middle

Harmonic	Frequency (MHz)	SG (dBm)	Cable Loss (dB)	Gain (dBi)	Antenna Polarization	ERP Level (dBm)	Limit (dBm)	Margin (dB)	Azimuth (deg)
2	1673.00	-57.05	2.00	10.75	Horizontal	-50.45	-13.00	37.45	135
3	2509.50	-55.82	2.51	11.05	Horizontal	-49.43	-13.00	36.43	0
4	3320.00	-63.85	4.20	11.15	Horizontal	-59.05	-13.00	46.05	180
5	4130.00	-59.11	5.20	11.15	Horizontal	-55.31	-13.00	42.31	315
6	4950.00	-56.66	5.50	11.95	Horizontal	-52.36	-13.00	39.36	45
7	5785.00	-57.97	5.70	13.55	Horizontal	-52.27	-13.00	39.27	135
8	6612.00	-58.37	6.30	13.75	Horizontal	-53.07	-13.00	40.07	225
9	7438.00	-53.63	6.80	13.85	Horizontal	-48.73	-13.00	35.73	270
10	8265.00	-54.19	6.90	14.25	Horizontal	-48.99	-13.00	35.99	180
Note: 1.The other Spurious RF Radiated emissions level is no more than noise floor. 2.The worst emission was found in the antenna is Horizontal position.									



6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Date
Base Station Simulator	R&S	CMW500	113824	2020-05-18	2021-05-17
Power Splitter	Hua Xiang	SHX-GF2-2-13	10120101	/	/
Spectrum Analyzer	Key sight	N9010A	MY50210259	2020-05-18	2021-05-17
Universal Radio Communication Tester	Key sight	E5515C	MY48367192	2020-05-27	2021-05-26
Signal Analyzer	R&S	FSV30	100815	2019-12-15	2020-12-14
				2020-12-13	2021-12-12
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2020-04-02	2023-04-01
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	391	2019-12-16	2021-12-15
Horn Antenna	R&S	HF907	102723	2018-08-11	2021-08-10
Horn Antenna	ETS-Lindgren	3160-09	00102643	2018-06-20	2021-06-19
Signal generator	R&S	SMB 100A	102594	2020-05-18	2021-05-17
Climatic Chamber	ESPEC	SU-242	93000506	2017-12-17	2020-12-16
				2020-12-13	2021-12-12
Preamplifier	R&S	SCU18	102327	2020-05-18	2021-05-17
MOB COMMS DC SUPPLY	Keysight	66319D	MY43004105	2020-05-18	2021-05-17
RF Cable	Agilent	SMA 15cm	0001	2020-06-12	2020-12-11
				2020-12-10	2021-06-09
Software	R&S	EMC32	9.26.0	/	/
Wireless Test Set	StarPoint	SP8315	SP8315-1202	2020-05-18	2021-05-17
Wireless Test Set	StarPoint	SP8315	SP8315-1203	2020-05-18	2021-05-17

*****END OF REPORT *****



ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.



ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.