RF TEST REPORT

Applicant	Quectel Wireless Solutions Co., Ltd.
FCC ID	XMR2021BG770AGL
Product	LTE Module
Brand	Quectel
Model	BG770A-GL
Report No.	R2104A0331-R6
Issue Date	June 22, 2021

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2020)/ FCC CFR 47 Part 24E (2020)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Peng Tao

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Summary of measurement results

No.	Test Case	Clause in FCC rules	Verdict
1	RF Power Output and Effective Isotropic Radiated Power	2.1046 24.232(c)	PASS
2	Occupied Bandwidth	2.1049	PASS
3	Band Edge Compliance	2.1051 /24.238(a)	PASS
4	Peak-to-Average Power Ratio	24.232/KDB 971168 D01(5.7)	PASS
5	Frequency Stability	2.1055 / 24.235	PASS
6	Spurious Emissions at Antenna Terminals	2.1051 / 24.238(a)	PASS
7	Radiates Spurious Emission	2.1053 / 24.238(a)	PASS
Date of Testing: April 21, 2021 ~ May 14, 2021 Date of Sample Received: April 16, 2021			
Note: PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard. 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.			

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1. Test Laboratory

1.1. Notes of the test report

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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
Post code:	201201
Country:	P. R. China
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E-mail:	xukai@ta-shanghai.com

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

2.4. General information

EUT Description			
Model	BG770A-GL		
IMEI	863593050006733		
Hardware Version	R1.1		
Software Version	BG770AGLAAR01A03		
Power Supply	External power supply		
Antenna Type	External Antenna		
Antenna Gain	Mode	Frequency (MHz)	Gain (dBi)
	LTE Band 2/25	1840	1.36
		1860	1.25
		1880	1.38
		1900	1.59
		1920	1.36
Test Mode(s)	LTE Band 2/25;		
Test Modulation	QPSK,16QAM		
LTE Category	M1		
Maximum E.I.R.P	LTE Band 2:	25.37dBm	
	LTE Band 25:	25.34dBm	
Rated Power Supply Voltage	3.3V		
Operating Voltage	Minimum: 3.1V Maximum: 4.2V		
Operating Temperature	Lowest: -35°C Highest: +75°C		
Extreme Temperature	Lowest: -30°C Highest: +50°C		
Frequency Range(s)	Band	Tx (MHz)	Rx (MHz)
	LTE Band 2	1850 ~ 1910	1930 ~ 1990
	LTE Band 25	1850 ~ 1915	1930 ~ 1995
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.			

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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 24E (2020)

ANSI C63.26 (2015)

Reference standard:

FCC CFR47 Part 2 (2020)

KDB 971168 D01 Power Meas License Digital Systems v03r01

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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 (Z axis, horizontal polarization) and the worst case was recorded.

All mode and data rates and positions and RB size and modulations were investigated.
Subsequently, only the worst case emissions are reported.
The following testing in LTE is set based on the maximum RF Output Power.

Test modes are chosen to be reported as the worst case configuration below for LTE Band 2/25:

Test items	Bandwidth (MHz)						Modulation		RB			Test Channel		
	1.4	3	5	10	15	20	QPSK	16QAM	1	50%	100%	L	M	H
RF Power Output and Effective Isotropic Radiated Power	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Occupied Bandwidth	O	O	O	O	O	O	O	O	-	-	O	O	O	O
Band Edge Compliance	O	O	O	O	O	O	O	O	O	-	O	O	-	O
Peak-to-Average Power Ratio	O	O	O	O	O	O	O	O	-	-	O	O	O	O
Frequency Stability	O	O	O	O	O	O	O	O	O	-	-	-	O	-
Spurious Emissions at Antenna Terminals	O	O	O	O	O	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.													

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5. Test Case Results

5.1. RF Power Output and Effective Isotropic Radiated Power

Ambient condition

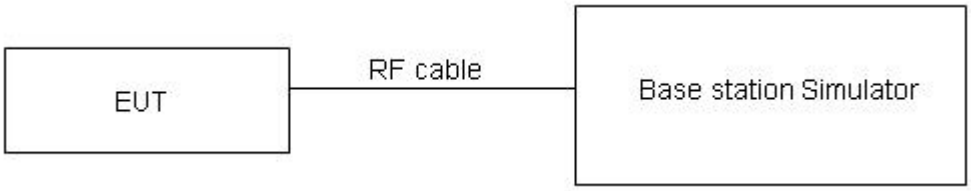
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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 (dBm) = Output Power (dBm) - Losses (dB) + Antenna Gain (dBi)
where:dBd refers to gain relative to an ideal dipole.
EIRP (dBm) = ERP (dBm) + 2.15 (dB.)

Test Setup



Limits

No specific RF power output requirements in part 2.1046.

Rule Part 24.232(c) Mobile and portable stations are limited to 2 watts EIRP.
Rule Part 24.232(e) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

Limit	≤ 2 W (33 dBm)

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 for RF power output, *k* = 2, *U*= 1.19 dB for EIRP.

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Test Results

LTE Band 2	Channel/ Frequency(MHz)	Index	RB# RBstart	Maximum Output Power (dBm)		EIRP (dBm)	
				QPSK	16QAM	QPSK	16QAM
1.4MHz	18607/1850.7	0	1#0	23.68	22.27	24.93	23.52
		0	6#0	22.24	21.68	23.49	22.93
	18900/1880	0	1#0	22.91	23.02	24.29	24.40
		0	6#0	21.81	21.74	23.19	23.12
	19193/1909.3	0	1#5	23.52	22.41	25.11	24.00
		0	6#0	21.93	21.44	23.52	23.03
3MHz	18615/1851.5	0	1#0	23.65	22.77	24.90	24.02
		0	6#0	21.88	21.61	23.13	22.86
	18900/1880	0	1#0	23.65	22.73	25.03	24.11
		0	6#0	21.81	21.60	23.19	22.98
	19185/1908.5	1	1#5	23.58	22.58	25.17	24.17
		0	6#0	21.75	21.47	23.34	23.06
5MHz	18625/1852.5	3	1#0	23.63	23.69	24.88	24.94
		0	6#0	22.94	21.66	24.19	22.91
	18900/1880	0	1#0	23.63	23.70	25.01	25.08
		0	6#0	22.89	21.63	24.27	23.01
	19175/1907.5	0	1#5	23.61	23.54	25.20	25.13
		0	6#0	22.95	21.44	24.54	23.03
10MHz	18650/1855	3	1#0	23.62	23.68	24.87	24.93
		0	4#0	23.44	22.64	24.69	23.89
	18900/1880	0	1#0	23.64	23.71	25.02	25.09
		0	4#0	23.21	22.71	24.59	24.09
	19150/1905	4	1#5	23.64	23.59	25.23	25.18
		7	4#2	23.30	21.66	24.89	23.25
15MHz	18675/1857.5	3	1#0	23.66	23.69	24.91	24.94
		0	6#0	23.45	23.59	24.70	24.84
	18900/1880	0	1#0	23.64	23.68	25.02	25.06
		0	6#0	23.43	23.61	24.81	24.99
	19125/1902.5	8	1#5	23.68	23.63	25.27	25.22
		11	6#0	23.78	23.47	25.37	25.06
20MHz	18700/1860	3	1#0	23.68	23.70	24.93	24.95
		0	6#0	23.50	23.59	24.75	24.84
	18900/1880	0	1#0	23.20	23.03	24.58	24.41
		0	6#0	23.73	23.12	25.11	24.50
	19100/1900	12	1#5	23.62	23.58	25.21	25.17
		15	6#0	23.37	23.54	24.96	25.13

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LTE Band 25	Channel/ Frequency(MHz)	Index	RB# RBstart	Maximum Output Power (dBm)		EIRP (dBm)	
				QPSK	16QAM	QPSK	16QAM
1.4MHz	26047/1850.7	0	1#0	23.50	22.51	24.75	23.76
		0	6#0	22.15	21.63	23.40	22.88
	26365/1882.5	0	1#0	23.55	22.59	24.93	23.97
		0	6#0	22.18	21.63	23.56	23.01
	26683/1914.3	0	1#5	23.58	22.40	24.94	23.76
		0	6#0	21.99	21.48	23.35	22.84
3MHz	26055/1851.5	0	1#0	23.67	22.80	24.92	24.05
		0	6#0	21.88	21.60	23.13	22.85
	26365/1882.5	0	1#0	23.68	22.80	25.06	24.18
		0	6#0	21.92	21.64	23.30	23.02
	26675/1913.5	1	1#5	23.68	22.67	25.04	24.03
		0	6#0	21.83	21.57	23.19	22.93
5MHz	26065/1852.5	3	1#0	23.69	23.73	24.94	24.98
		0	6#0	22.79	21.73	24.04	22.98
	26365/1882.5	0	1#0	23.72	23.76	25.10	25.14
		0	6#0	22.87	22.05	24.25	23.43
	26665/1912.5	0	1#5	23.70	23.62	25.06	24.98
		0	6#0	22.63	21.53	23.99	22.89
10MHz	26090/1855	3	1#0	23.68	23.73	24.93	24.98
		0	4#0	23.34	22.72	24.59	23.97
	26365/1882.5	0	1#0	23.74	23.80	25.12	25.18
		0	4#0	23.30	22.93	24.68	24.31
	26640/1910	4	1#5	23.69	23.64	25.05	25.00
		7	4#2	23.33	21.65	24.69	23.01
15MHz	26115/1857.5	3	1#0	23.74	23.77	24.99	25.02
		0	6#0	23.48	23.68	24.73	24.93
	26365/1882.5	0	1#0	23.75	23.02	25.13	24.40
		0	6#0	23.44	23.76	24.82	25.14
	26615/1907.5	8	1#5	23.71	23.68	25.30	25.27
		11	6#0	23.32	23.51	24.91	25.10
20MHz	26140/1860	3	1#0	23.70	23.75	24.95	25.00
		0	6#0	23.52	23.70	24.77	24.95
	26365/1882.5	0	1#0	23.73	23.78	25.11	25.16
		0	6#0	23.45	23.77	24.83	25.15
	26590/1905	12	1#5	23.65	23.62	25.24	25.21
		15	6#0	23.75	23.48	25.34	25.07

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5.2. Occupied Bandwidth

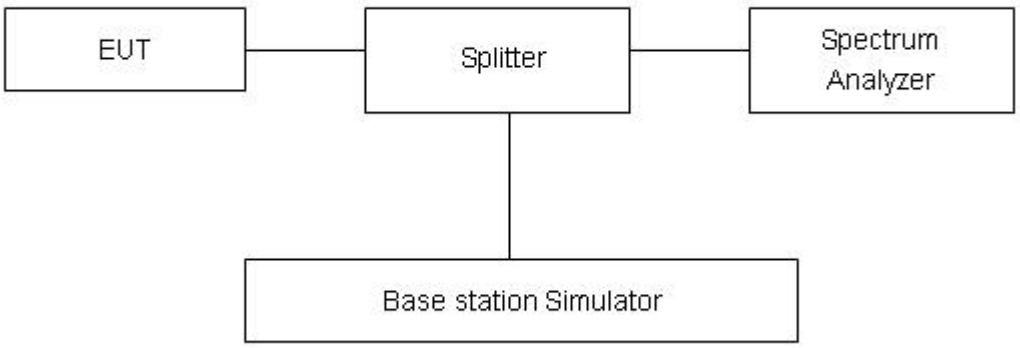
Ambient condition

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 2/25.
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= 624Hz.

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Test Result

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
LTE Band 2	1.4MHz	QPSK	18900/1880	1.1168	1.337
		16QAM	18900/1880	0.9671	1.308
	3MHz	QPSK	18900/1880	1.1163	1.336
		16QAM	18900/1880	0.9605	1.290
	5MHz	QPSK	18900/1880	1.1055	1.332
		16QAM	18900/1880	0.9916	1.315
	10MHz	QPSK	18900/1880	1.1111	1.346
		16QAM	18900/1880	0.9954	1.320
	15MHz	QPSK	18900/1880	1.2540	1.531
		16QAM	18900/1880	1.0057	1.339
	20MHz	QPSK	18900/1880	1.1148	1.351
		16QAM	18900/1880	1.0037	1.334

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
LTE Band 25	1.4MHz	QPSK	26365/1882.5	1.1116	1.325
		16QAM	26365/1882.5	0.9599	1.302
	3MHz	QPSK	26365/1882.5	1.1103	1.320
		16QAM	26365/1882.5	0.9620	1.284
	5MHz	QPSK	26365/1882.5	1.1035	1.343
		16QAM	26365/1882.5	0.9790	1.311
	10MHz	QPSK	26365/1882.5	1.1022	1.346
		16QAM	26365/1882.5	0.9874	1.302
	15MHz	QPSK	26365/1882.5	1.1104	1.342
		16QAM	26365/1882.5	1.0025	1.330
	20MHz	QPSK	26365/1882.5	1.1155	1.350
		16QAM	26365/1882.5	0.9956	1.325

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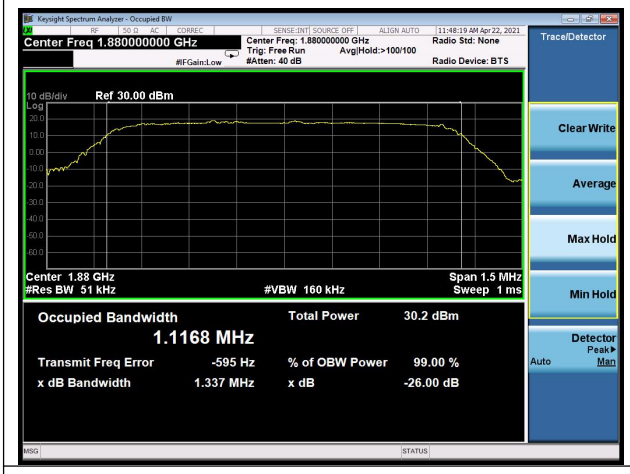
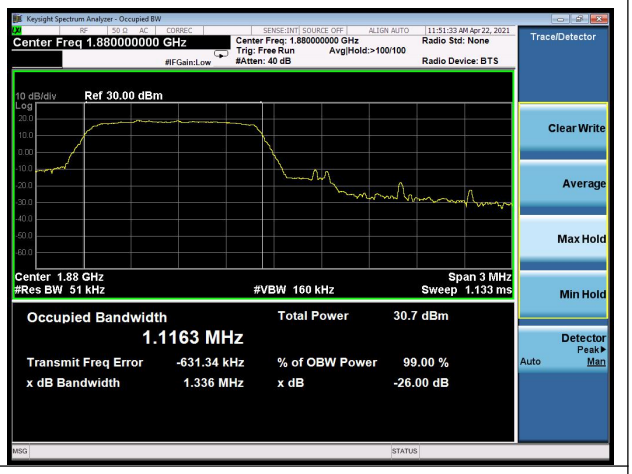
LTE Band 2 1.4MHz QPSK CH-Middle



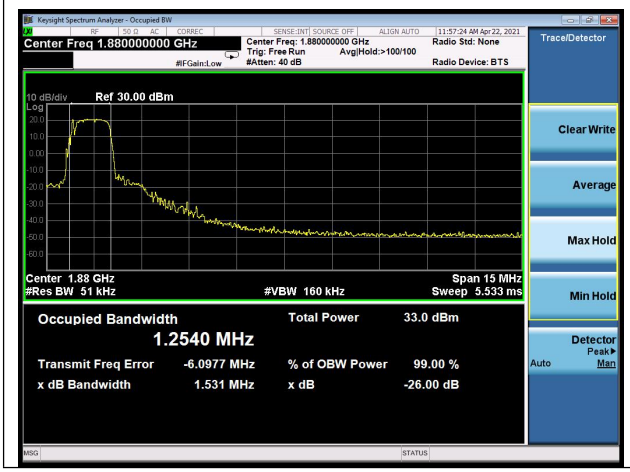
LTE Band 2 3MHz QPSK CH-Middle



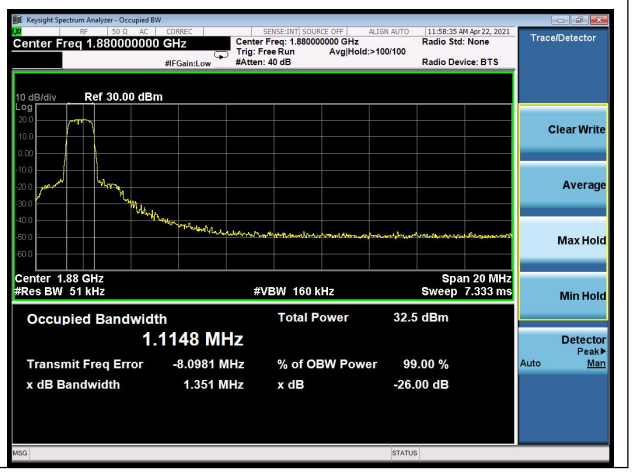
LTE Band 2 5MHz QPSK CH-Middle

LTE Band 2 10MHz QPSK CH-Middle

LTE Band 2 15MHz QPSK CH-Middle



LTE Band 2 20MHz QPSK CH-Middle



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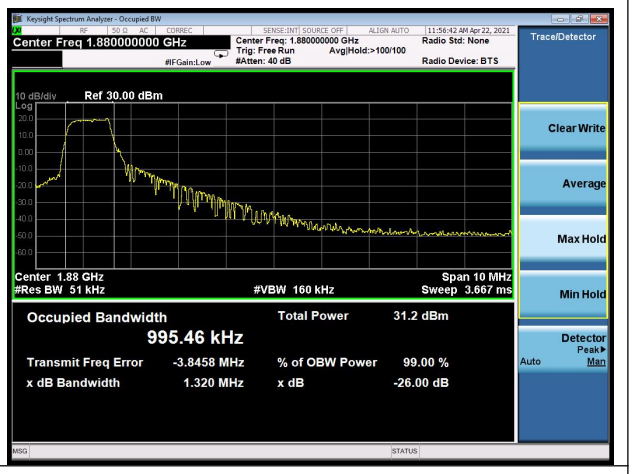
LTE Band 2 1.4MHz 16QAM CH-Middle

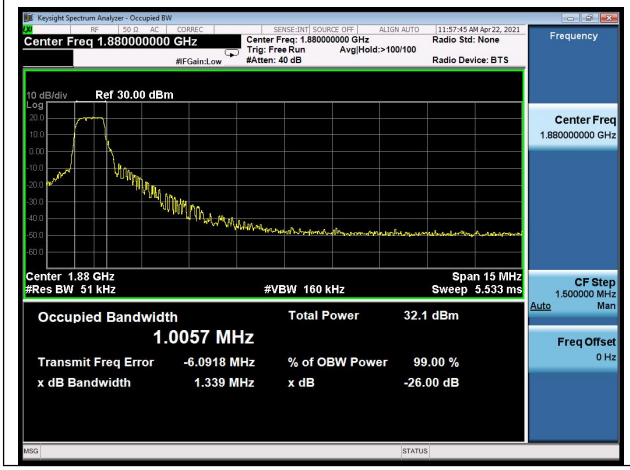
LTE Band 2 3MHz 16QAM CH-Middle

LTE Band 2 5MHz 16QAM CH-Middle

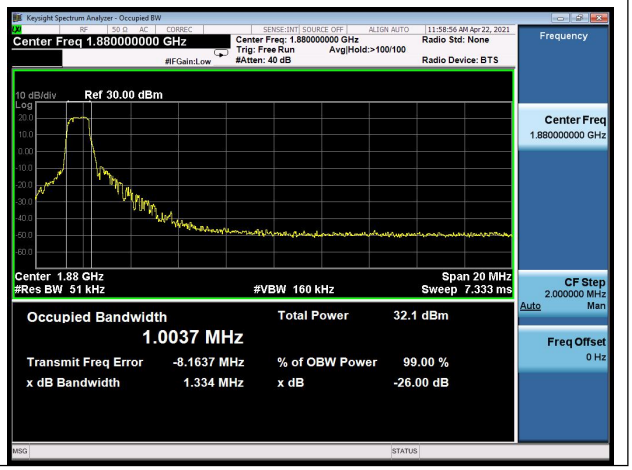
LTE Band 2 10MHz 16QAM CH-Middle



LTE Band 2 15MHz 16QAM CH-Middle



LTE Band 2 20MHz 16QAM CH-Middle



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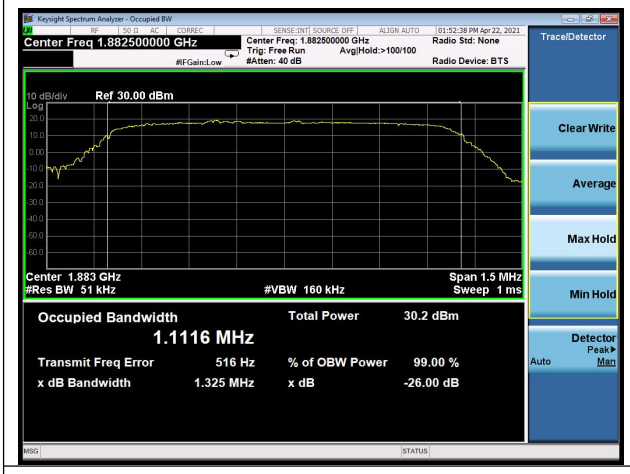
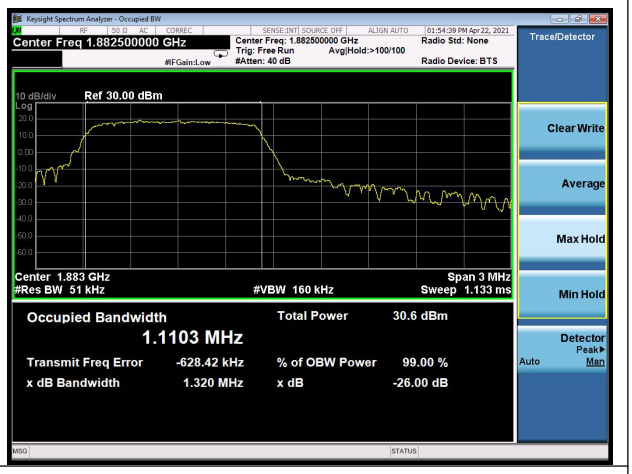
LTE Band 25 1.4MHz QPSK CH-Middle

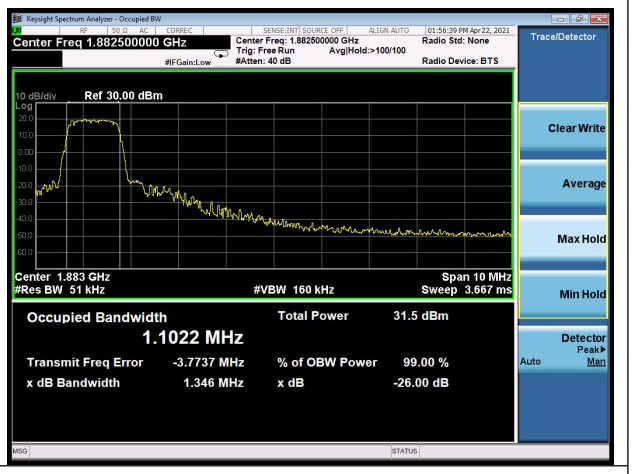


LTE Band 25 3MHz QPSK CH-Middle



LTE Band 25 5MHz QPSK CH-Middle

LTE Band 25 10MHz QPSK CH-Middle



LTE Band 25 15MHz QPSK CH-Middle

LTE Band 25 20MHz QPSK CH-Middle

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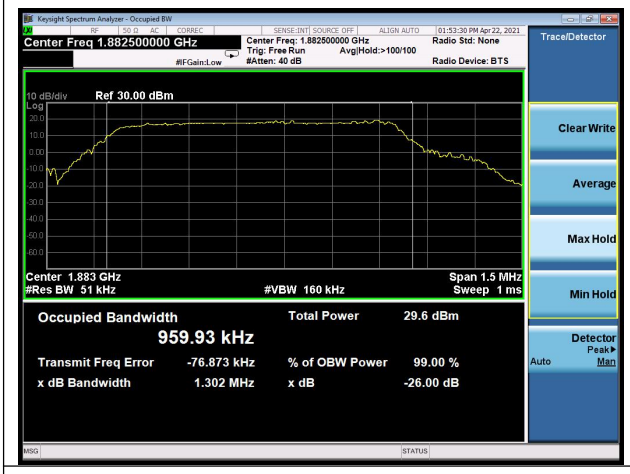
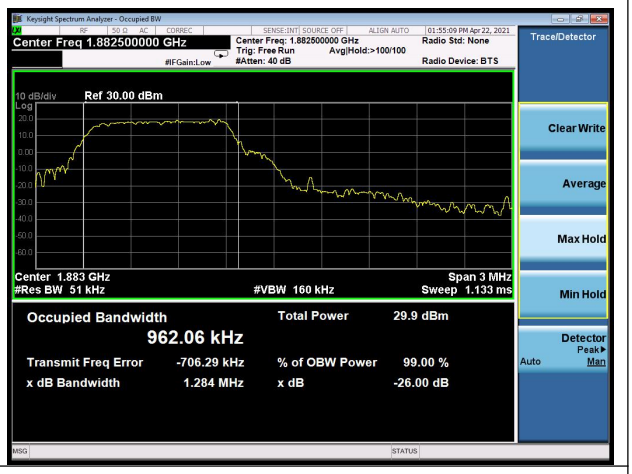
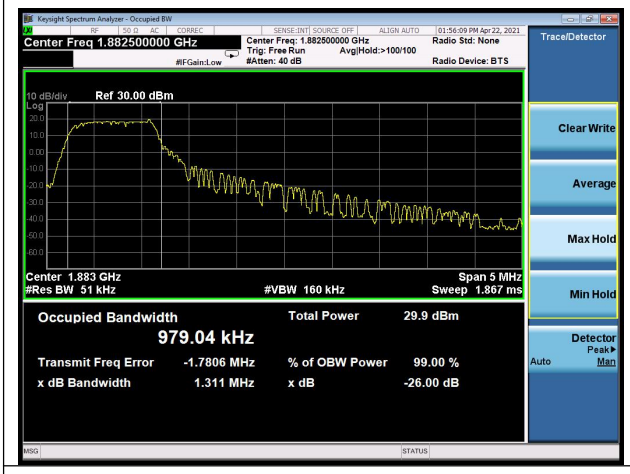
LTE Band 25 1.4MHz 16QAM CH-Middle



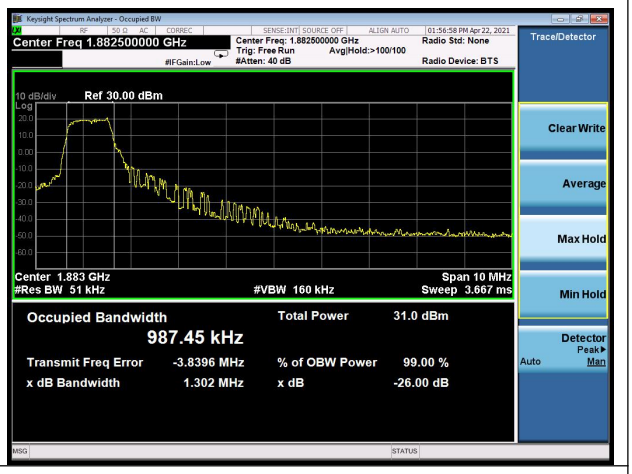
LTE Band 25 3MHz 16QAM CH-Middle



LTE Band 25 5MHz 16QAM CH-Middle

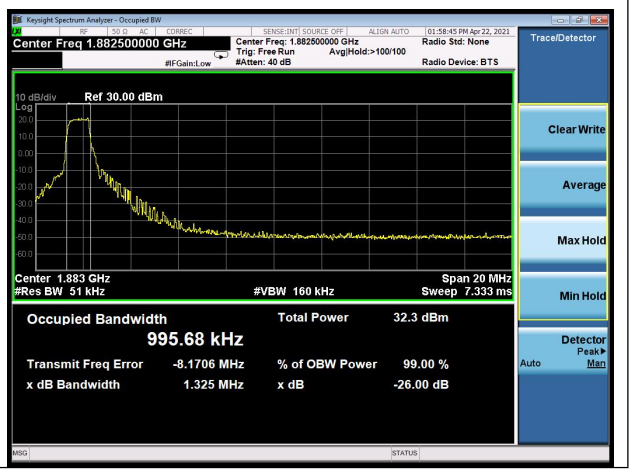


LTE Band 25 10MHz 16QAM CH-Middle



LTE Band 25 15MHz 16QAM CH-Middle

LTE Band 25 20MHz 16QAM CH-Middle



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5.3. Band Edge Compliance

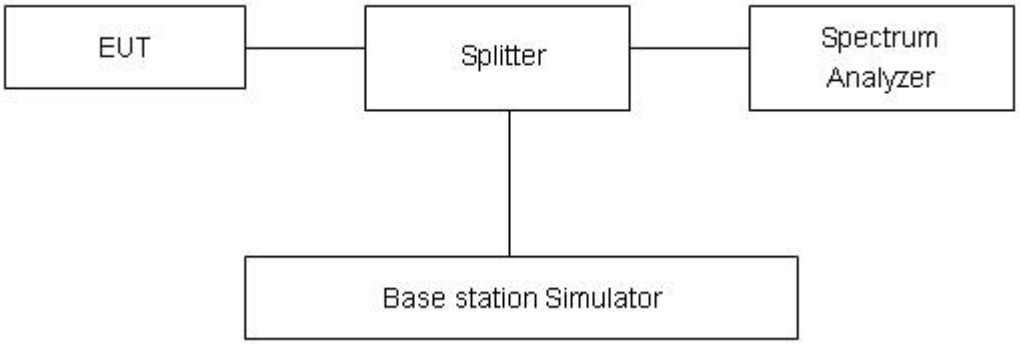
Ambient condition

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 and RBW is set to 51kHz, VBW is set to 160kHz for LTE Band 2/25.
Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 24.238(a) specifies that “on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log10 (P) dB.”

Limit	-13 dBm

Measurement Uncertainty

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

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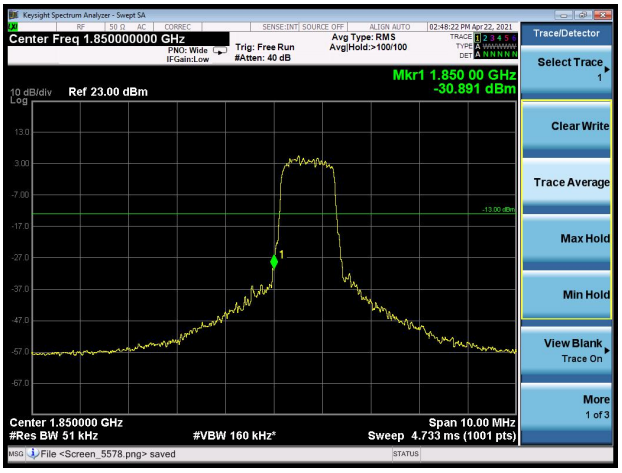
Test Result:

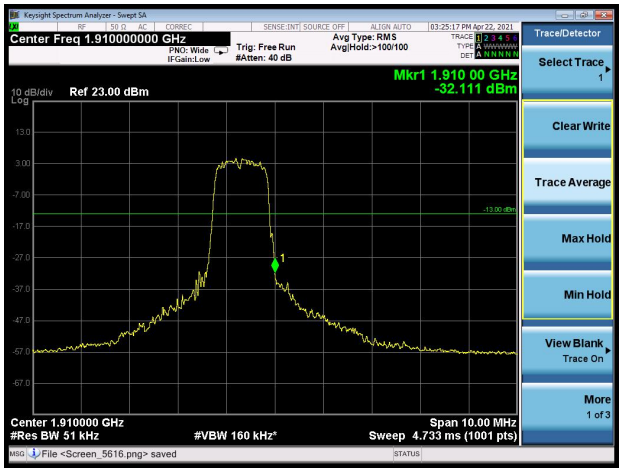
LTE Band 2 1.4MHz QPSK 1RB CH-Low

LTE Band 2 1.4MHz QPSK 1RB CH-High

LTE Band 2 1.4MHz QPSK 100%RB CH-Low

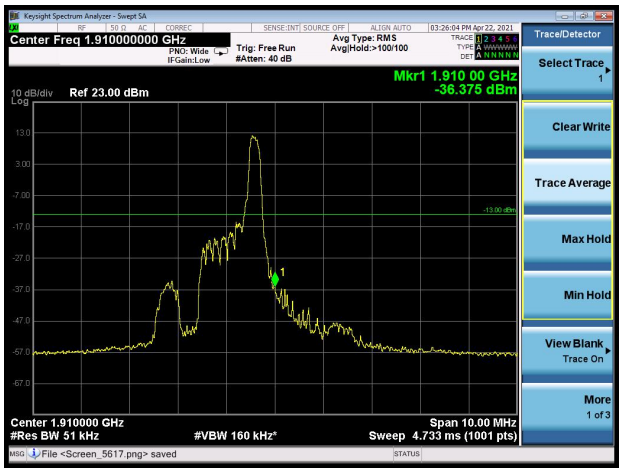


LTE Band 2 1.4MHz QPSK 100%RB CH-High



LTE Band 2 3MHz QPSK 1RB CH-Low

LTE Band 2 3MHz QPSK 1RB CH-High



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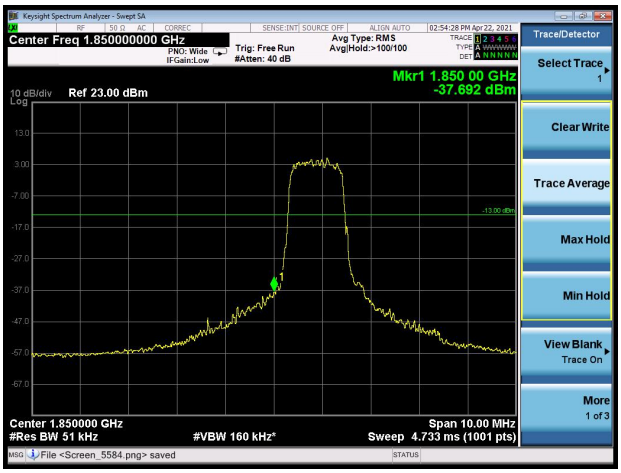
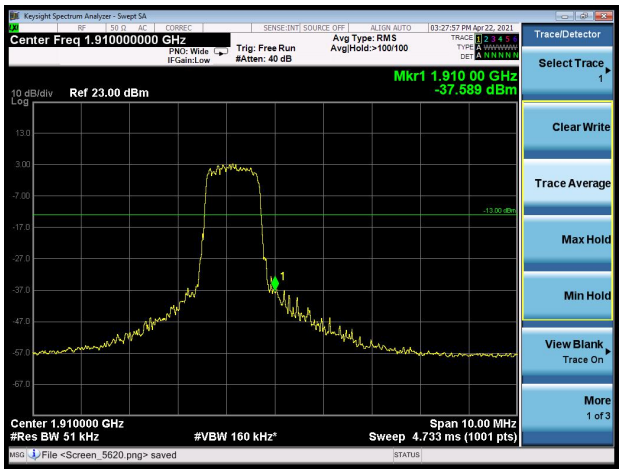
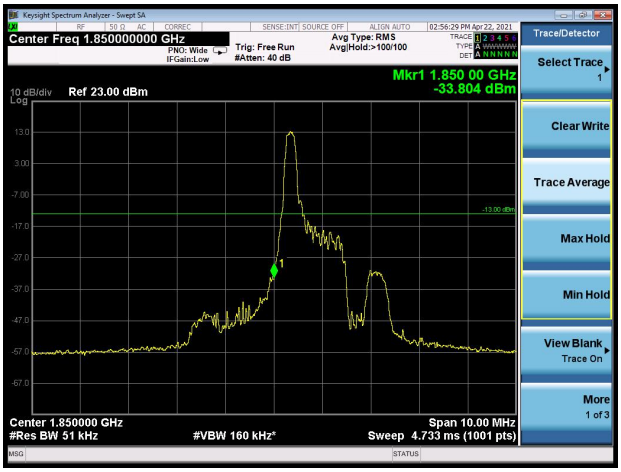
LTE Band 2 3MHz QPSK 100%RB CH-Low



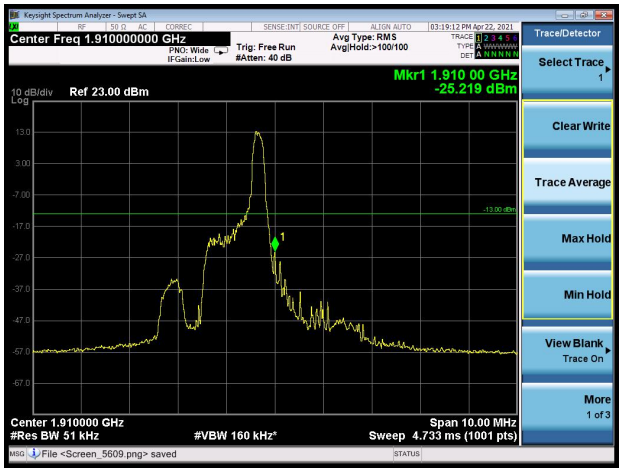
LTE Band 2 3MHz QPSK 100%RB CH-High



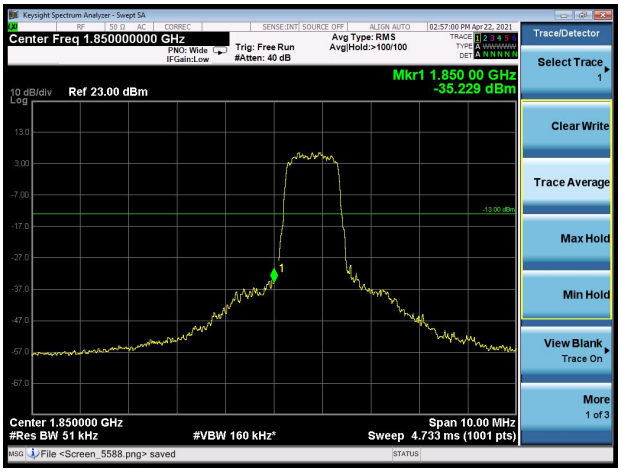
LTE Band 2 5MHz QPSK 1RB CH-Low



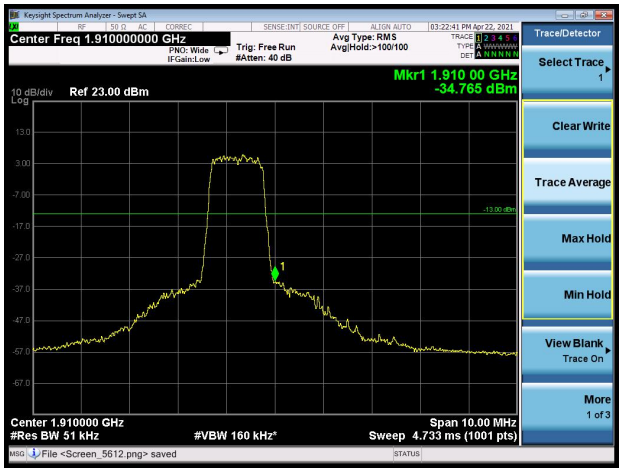
LTE Band 2 5MHz QPSK 1RB CH-High



LTE Band 2 5MHz QPSK 100%RB CH-Low



LTE Band 2 5MHz QPSK 100%RB CH-High



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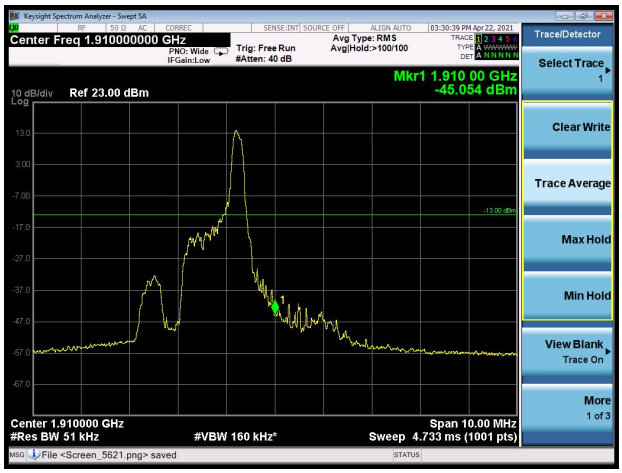
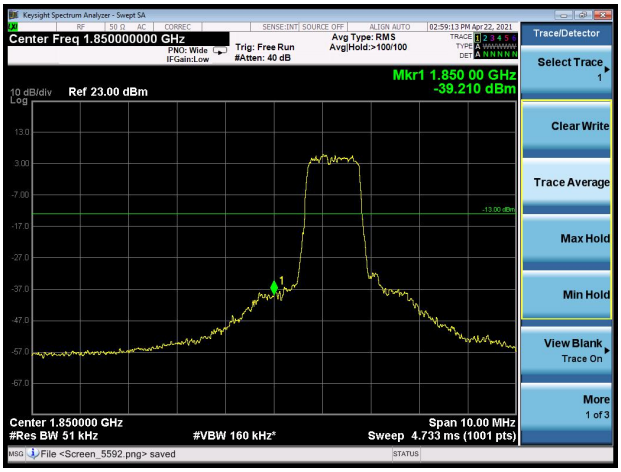
LTE Band 2 10MHz QPSK 1RB CH-Low

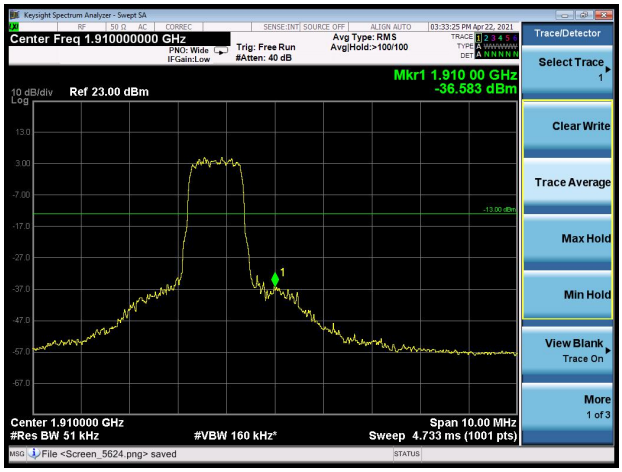
LTE Band 2 10MHz QPSK 1RB CH-High



LTE Band 2 10MHz QPSK 100%RB CH-Low

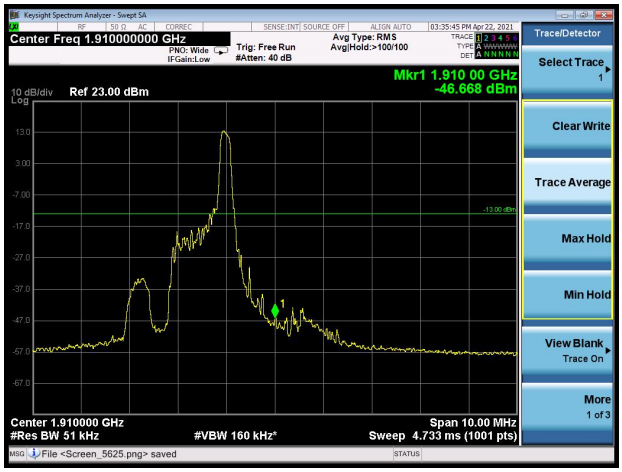


LTE Band 2 10MHz QPSK 100%RB CH-High



LTE Band 2 15MHz QPSK 1RB CH-Low

LTE Band 2 15MHz QPSK 1RB CH-High



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