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-R2V1
Issue Date	February 22, 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 24E (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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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	January 19, 2021
Rev.1	Update information in Page 6 ~7. Update data in Page 12 and 14.	February 22, 2021
Note: This revised report (Report No. R2012A0839-R2V1) supersedes and replaces the previously issued report (Report No. R2012A0839-R2). Please discard or destroy the previously issued report and dispose of it accordingly.		

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: December 7, 2020 ~ January 14, 2021			
Date of Sample Received: December 4, 2020			
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.			

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
Post code:	201201
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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, 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		Band	Frequency(MHz)	Antenna Gain(dBi)
		NB-IOT Band 2/ LTE Band 2	1860	1.25
			1880	1.33
			1900	1.59
		NB-IOT Band 25/ LTE Band 25	1860	1.25
			1880	1.33
			1900	1.59
Test Mode(s)		NB-IOT Band 2/25; LTE Band 2/25;		
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.I.R.P		NB-IOT Band 2:	22.63dBm	
		NB-IOT Band 25:	22.31dBm	
		LTE Band 2:	22.81dBm	

	LTE Band 25:	22.56dBm	
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 2	1850 ~ 1910	1930 ~ 1990
	NB-IOT Band 25	1850 ~ 1915	1930 ~ 1995
	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.			

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 (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 to be reported as the worst case configuration below for NB-IOT Band 2/25.

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 Isotropic Radiated Power	O	O	O	O	O	O	O	O
Occupied Bandwidth	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	-
Conducted Spurious Emissions	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.

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	-
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	-
Frequency Stability	O	O	O	O	O	O	O	O	O	O	O	-	O	-
Conducted Spurious Emissions	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.													

5. Test Case Results

5.1. RF Power Output and Effective Isotropic Radiated Power

Ambient condition

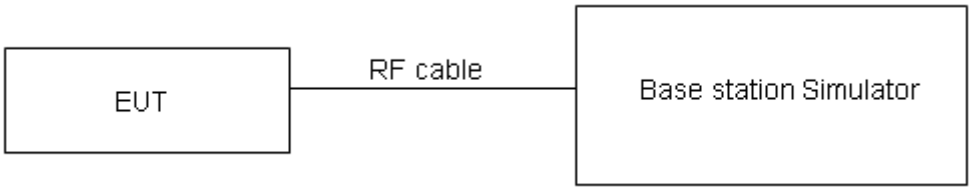
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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.

Test Results

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Maximum Output Power (dBm) for low/middle/high channel			EIRP (dBm)		
				18602 /1850.2MHz	18900 /1880.0MHz	19198 /1909.8MHz	18602 /1850.2MHz	18900 /1880.0MHz	19198 /1909.8MHz
NB-IOT Band 2	BPSK	3.75	1@0	21.01	20.75	20.91	22.26	22.13	22.50
			1@47	20.92	20.71	20.84	22.17	22.09	22.43
		15	1@0	20.92	20.85	21.01	22.17	22.23	22.60
			1@11	20.91	20.83	21.03	22.16	22.21	22.62
	QPSK	3.75	1@0	21.03	20.73	20.88	22.28	22.11	22.47
			1@47	20.95	20.78	20.96	22.20	22.16	22.55
		15	1@0	20.98	20.88	21.00	22.23	22.26	22.59
			1@11	20.84	20.85	21.04	22.09	22.23	22.63
		15	12@0	18.87	18.66	18.79	20.12	20.04	20.38

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Maximum Output Power (dBm) for low/middle/high channel			EIRP (dBm)		
				26042 /1850.2MHz	26365 /1882.5MHz	26688 /1914.8MHz	26042 /1850.2MHz	26365 /1882.5MHz	26688 /1914.8MHz
NB-IOT Band 25	BPSK	3.75	1@0	20.77	20.62	20.66	22.02	22.00	22.25
			1@47	20.76	20.56	20.65	22.01	21.94	22.24
		15	1@0	20.84	20.55	20.70	22.09	21.93	22.29
			1@11	20.74	20.50	20.63	21.99	21.88	22.22
	QPSK	3.75	1@0	20.84	20.58	20.72	22.09	21.96	22.31
			1@47	20.82	20.66	20.60	22.07	22.04	22.19
		15	1@0	20.77	20.57	20.59	22.02	21.95	22.18
			1@11	20.79	20.58	20.66	22.04	21.96	22.25
		15	12@0	18.85	18.74	18.59	20.10	20.12	20.18

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	20.64	19.96	21.89	21.21
		0	6#0	18.57	18.66	19.82	19.91
	18900/1880	0	1#0	21.02	19.30	22.40	20.68
		0	6#0	18.31	18.70	19.69	20.08
	19193/1909.3	0	1#5	21.22	19.70	22.81	21.29
		0	6#0	18.63	19.06	20.22	20.65
3MHz	18615/1851.5	0	1#0	20.80	19.40	22.05	20.65
		0	6#0	18.45	18.72	19.70	19.97
	18900/1880	0	1#0	20.67	19.20	22.05	20.58
		0	6#0	18.30	18.53	19.68	19.91
	19185/1908.5	1	1#5	20.87	19.45	22.46	21.04
		0	6#0	18.74	18.92	20.33	20.51
5MHz	18625/1852.5	3	1#0	20.69	20.24	21.94	21.49
		0	6#0	19.53	19.66	20.78	20.91
	18900/1880	0	1#0	20.51	20.77	21.89	22.15
		0	6#0	19.29	19.44	20.67	20.82
	19175/1907.5	0	1#5	20.71	20.31	22.30	21.90
		0	6#0	19.70	19.74	21.29	21.33
10MHz	18650/1855	3	1#0	20.68	20.29	21.93	21.54
		0	4#0	20.70	20.83	21.95	22.08
	18900/1880	0	1#0	20.57	20.21	21.95	21.59
		0	4#0	20.47	20.69	21.85	22.07
	19150/1905	4	1#5	20.71	20.41	22.30	22.00
		7	4#2	20.74	21.05	22.33	22.64
15MHz	18675/1857.5	3	1#0	20.68	20.35	21.93	21.60
		0	6#0	20.56	20.62	21.81	21.87
	18900/1880	0	1#0	20.55	20.35	21.93	21.73
		0	6#0	20.51	20.56	21.89	21.94
	19125/1902.5	8	1#5	20.72	20.44	22.31	22.03
		11	6#0	20.73	20.76	22.32	22.35
20MHz	18700/1860	3	1#0	20.74	20.31	21.99	21.56
		0	6#0	20.62	20.64	21.87	21.89
	18900/1880	0	1#0	20.59	20.35	21.97	21.73
		0	6#0	20.51	20.56	21.89	21.94
	19100/1900	12	1#5	20.70	20.42	22.29	22.01
		15	6#0	20.71	20.77	22.30	22.36

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	20.68	19.92	21.93	21.17
		0	6#0	18.66	18.49	19.91	19.74
	26365/1882.5	0	1#0	20.95	19.30	22.33	20.68
		0	6#0	18.35	18.75	19.73	20.13
	26683/1914.3	0	1#5	20.95	19.48	22.54	21.07
		0	6#0	18.63	19.11	20.22	20.70
3MHz	26055/1851.5	0	1#0	20.90	19.59	22.15	20.84
		0	6#0	18.69	18.92	19.94	20.17
	26365/1882.5	0	1#0	20.74	19.35	22.12	20.73
		0	6#0	18.47	18.67	19.85	20.05
	26675/1913.5	1	1#5	20.88	19.51	22.47	21.10
		0	6#0	18.75	18.97	20.34	20.56
5MHz	26065/1852.5	3	1#0	20.77	20.44	22.02	21.69
		0	6#0	19.68	19.71	20.93	20.96
	26365/1882.5	0	1#0	20.53	20.25	21.91	21.63
		0	6#0	19.40	19.50	20.78	20.88
	26665/1912.5	0	1#5	20.64	20.25	22.23	21.84
		0	6#0	19.72	19.75	21.31	21.34
10MHz	26090/1855	3	1#0	20.69	20.31	21.94	21.56
		0	4#0	20.66	20.96	21.91	22.21
	26365/1882.5	0	1#0	20.56	20.19	21.94	21.57
		0	4#0	20.55	20.76	21.93	22.14
	26640/1910	4	1#5	20.60	20.35	22.19	21.94
		7	4#2	20.65	20.97	22.24	22.56
15MHz	26115/1857.5	3	1#0	20.71	20.44	21.96	21.69
		0	6#0	20.58	20.66	21.83	21.91
	26365/1882.5	0	1#0	20.53	20.90	21.91	22.28
		0	6#0	20.49	20.58	21.87	21.96
	26615/1907.5	8	1#5	20.66	20.28	22.25	21.87
		11	6#0	20.67	20.68	22.26	22.27
20MHz	26140/1860	3	1#0	20.66	20.44	21.91	21.69
		0	6#0	20.64	20.68	21.89	21.93
	26365/1882.5	0	1#0	20.62	20.43	22.00	21.81
		0	6#0	20.45	20.48	21.83	21.86
	26590/1905	12	1#5	20.51	20.32	22.10	21.91
		15	6#0	20.58	20.65	22.17	22.24

5.2. Occupied Bandwidth

Ambient condition

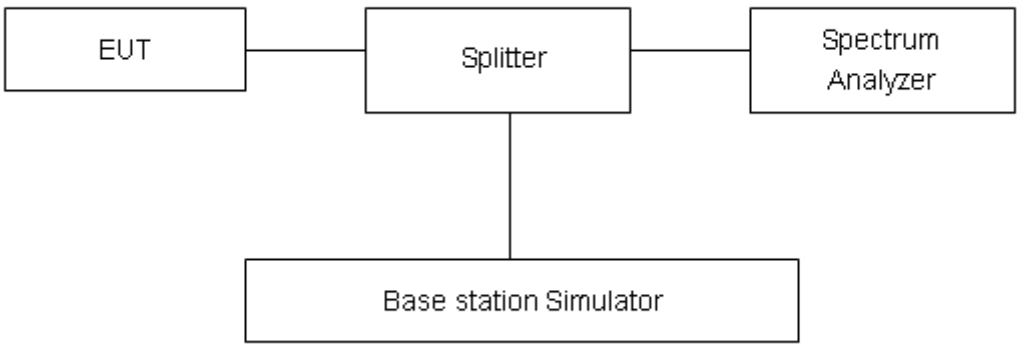
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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.
RBW is set to 2kHz, VBW is set to 6.2kHz for NB-IOT Band 2/25(1@0),
RBW is set to 3.9kHz, VBW is set to 12kHz for NB-IOT Band 2/25(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= 624Hz.

Test Result

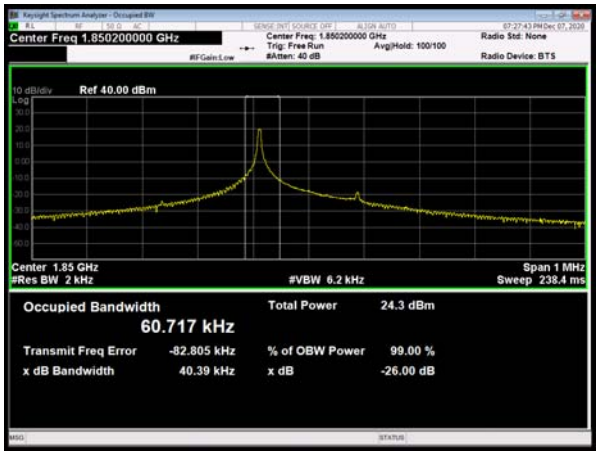
Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/ middle /high channel					
				18602/1850.2MHz		18900/1880.0MHz		19198/1909.8MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 2	BPSK	3.75	1@0	60.72	40.39	59.91	41.33	61.08	41.56
	QPSK	3.75	1@0	68.43	39.64	69.24	41.68	69.12	43.01
	BPSK	15	1@0	122.59	115.60	119.48	106.40	118.07	100.60
	QPSK	15	1@0	120.67	129.60	124.46	130.90	115.24	103.10
	QPSK	15	12@0	187.91	252.60	186.61	248.80	186.22	249.70

Mode	Modulation	Sub-carrier spacing (KHz)	Ntones	Bandwidth(KHz) for low/ middle /high channel					
				26042/1850.2MHz		26365/1882.5MHz		26688/1914.8MHz	
				99% Power	-26dBc	99% Power	-26dBc	99% Power	-26dBc
NB-IOT Band 25	BPSK	3.75	1@0	60.83	40.64	61.85	41.45	62.24	41.34
	QPSK	3.75	1@0	67.73	39.37	69.33	42.73	70.02	39.57
	BPSK	15	1@0	137.83	116.20	118.79	101.00	122.02	102.00
	QPSK	15	1@0	122.10	117.10	119.36	116.10	115.84	103.90
	QPSK	15	12@0	186.07	240.10	184.54	241.40	186.15	239.20

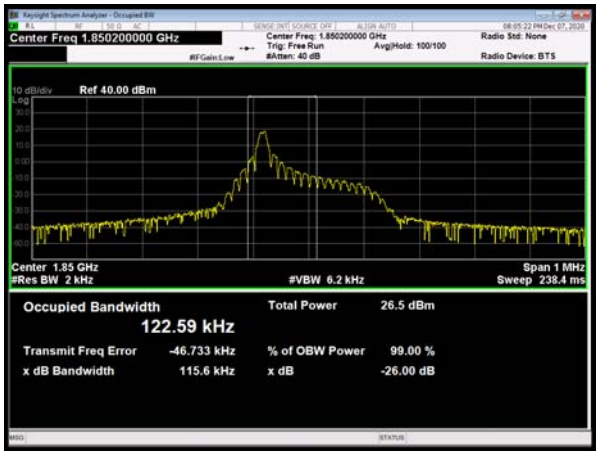
Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
LTE Band 2	1.4MHz	QPSK	18900/1880	1.0996	1.359
		16QAM	18900/1880	0.9336	1.196
	3MHz	QPSK	18900/1880	1.1043	1.368
		16QAM	18900/1880	0.9528	1.157
	5MHz	QPSK	18900/1880	1.1074	1.328
		16QAM	18900/1880	0.9494	1.269
	10MHz	QPSK	18900/1880	1.1155	1.304
		16QAM	18900/1880	0.9544	1.217
	15MHz	QPSK	18900/1880	1.1202	1.350
		16QAM	18900/1880	0.9418	1.166
	20MHz	QPSK	18900/1880	1.1363	1.347
		16QAM	18900/1880	0.9543	1.172

Mode	Bandwidth	Modulation	Channel/ Frequency(MHz)	Bandwidth(MHz)	
				99% Power	-26dBc
LTE Band 25	1.4MHz	QPSK	26365/1882.5	1.1052	1.310
		16QAM	26365/1882.5	0.9362	1.212
	3MHz	QPSK	26365/1882.5	1.1046	1.402
		16QAM	26365/1882.5	0.9459	1.156
	5MHz	QPSK	26365/1882.5	1.1086	1.342
		16QAM	26365/1882.5	0.9506	1.228
	10MHz	QPSK	26365/1882.5	1.1163	1.319
		16QAM	26365/1882.5	0.9533	1.224
	15MHz	QPSK	26365/1882.5	1.1216	1.321
		16QAM	26365/1882.5	0.9612	1.148
	20MHz	QPSK	26365/1882.5	1.1135	1.332
		16QAM	26365/1882.5	0.9589	1.216

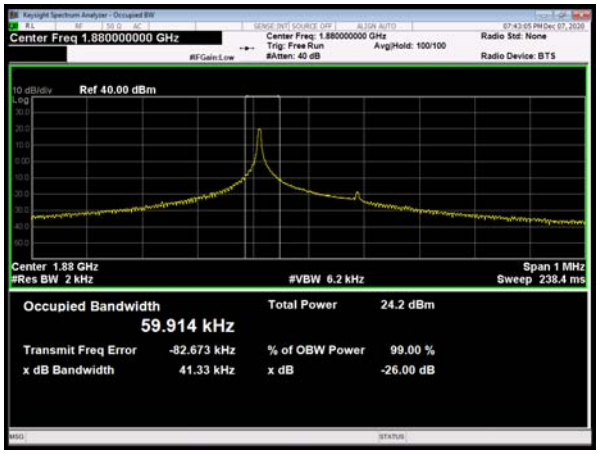
NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 2 BPSK 15kHz 1@0 CH-Low

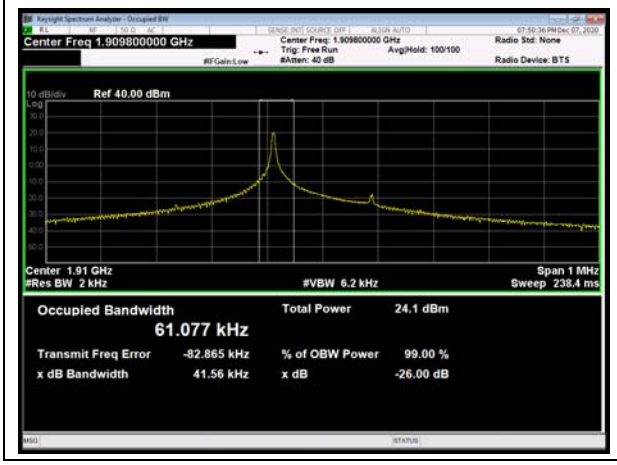


NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-Middle

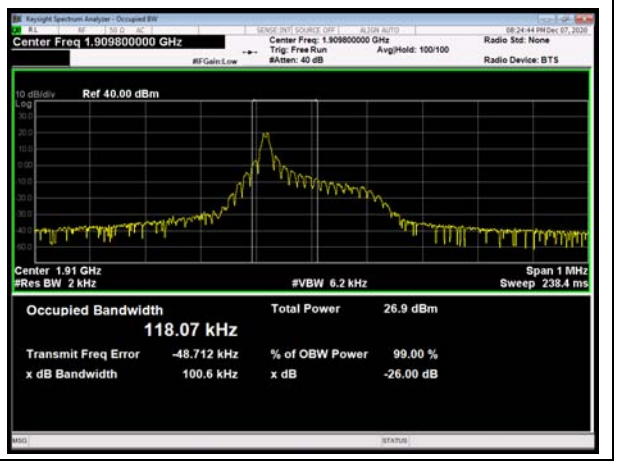


NB-IOT Band 2 BPSK 15kHz 1@0 CH-Middle

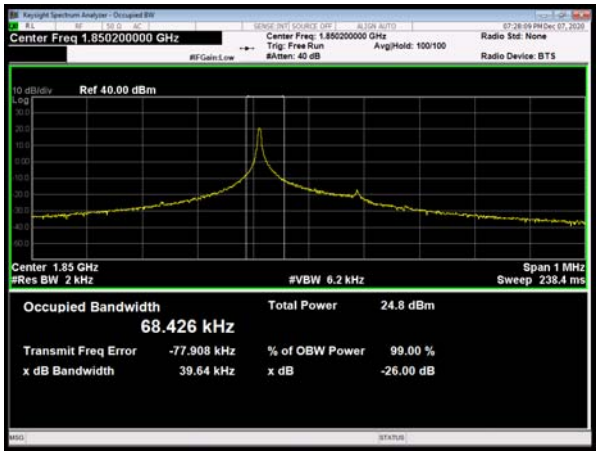
NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-High



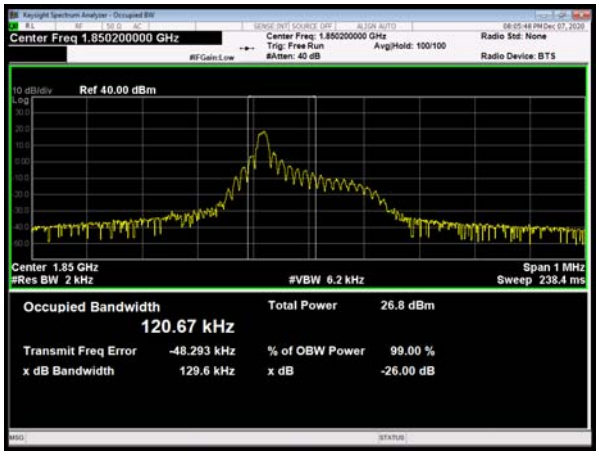
NB-IOT Band 2 BPSK 15kHz 1@0 CH-High



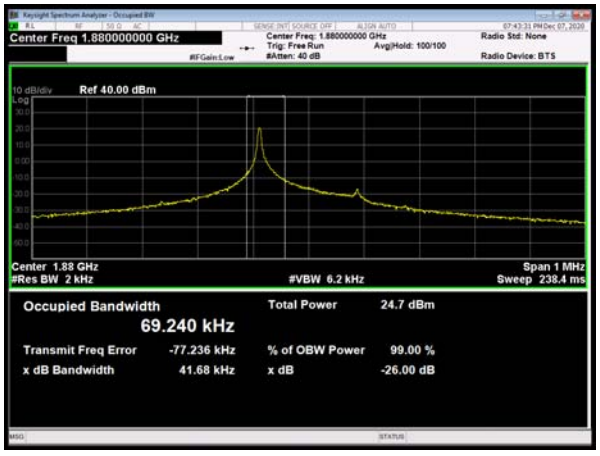
NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-Low



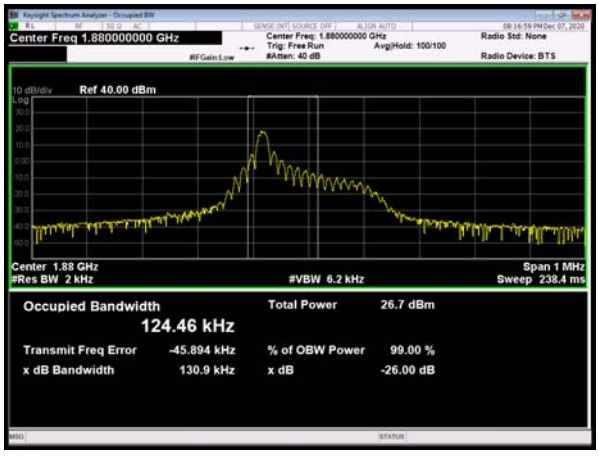
NB-IOT Band 2 QPSK 15kHz 1@0 CH-Low



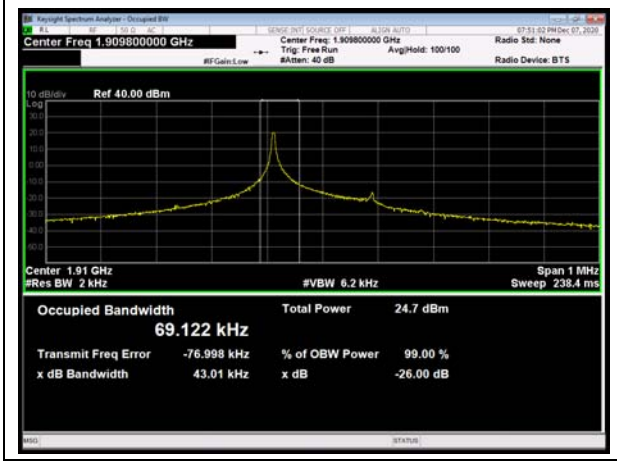
NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-Middle



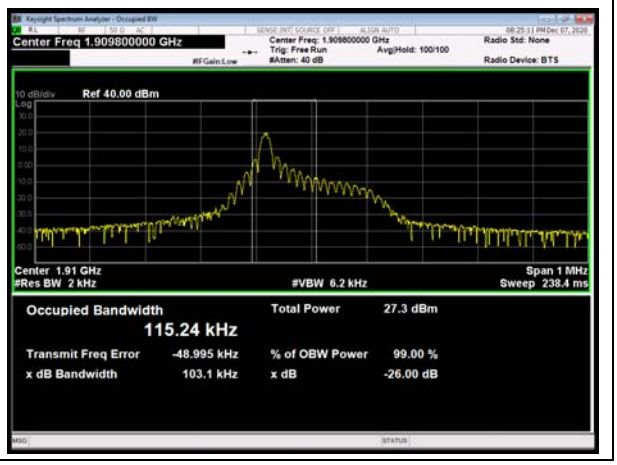
NB-IOT Band 2 QPSK 15kHz 1@0 CH-Middle



NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-High

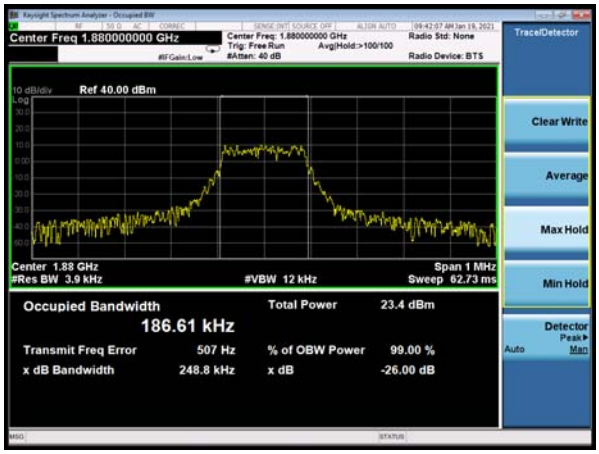


NB-IOT Band 2 QPSK 15kHz 1@0 CH-High

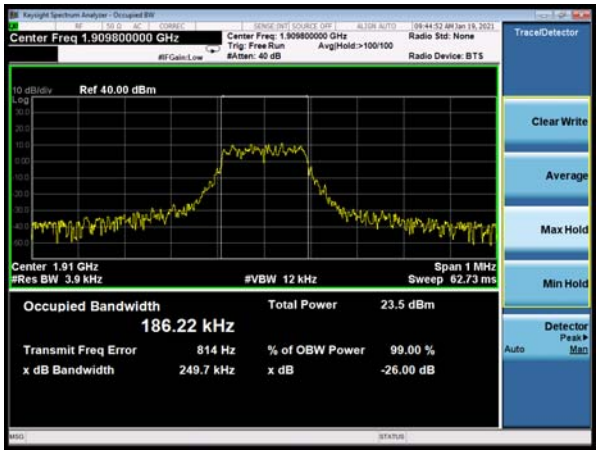


NB-IOT Band 2 QPSK 15kHz 12@0 CH-Low

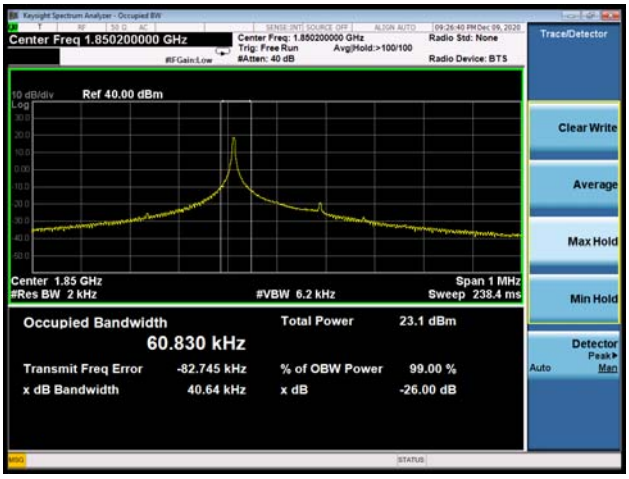
NB-IOT Band 2 QPSK 15kHz 12@0 CH-Middle



NB-IOT Band 2 QPSK 15kHz 12@0 CH-High

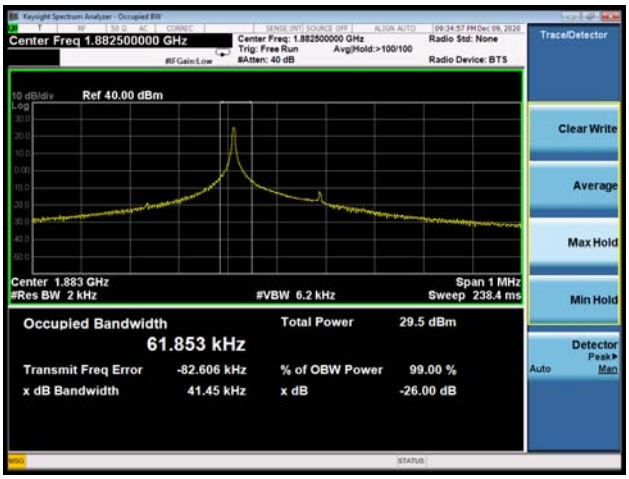


NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Low

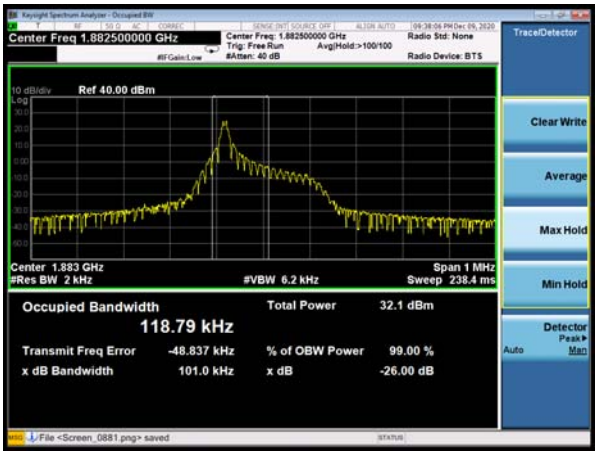


NB-IOT Band 25 BPSK 15kHz 1@0 CH-Low

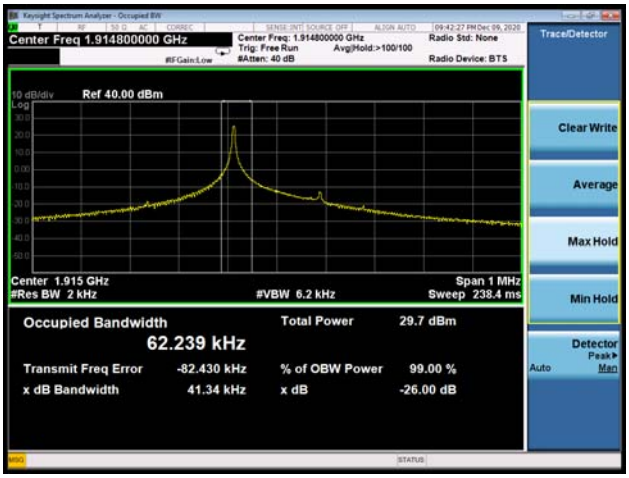
NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Middle



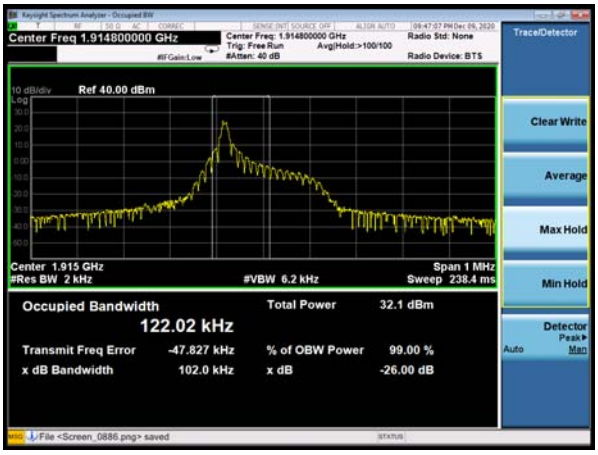
NB-IOT Band 25 BPSK 15kHz 1@0 CH-Middle



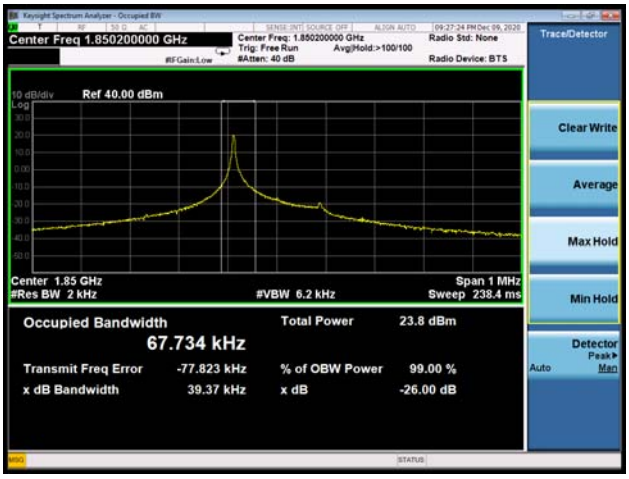
NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-High



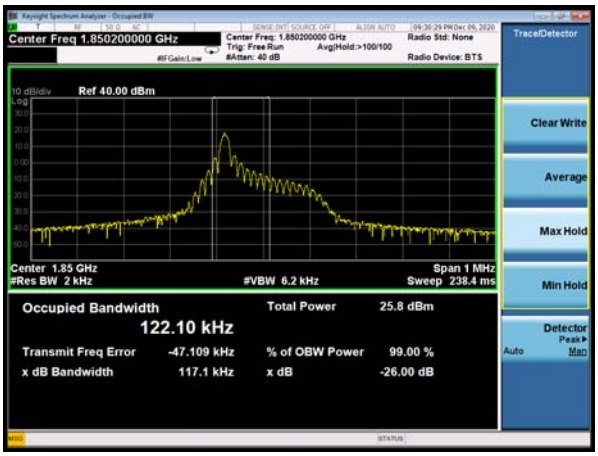
NB-IOT Band 25 BPSK 15kHz 1@0 CH-High



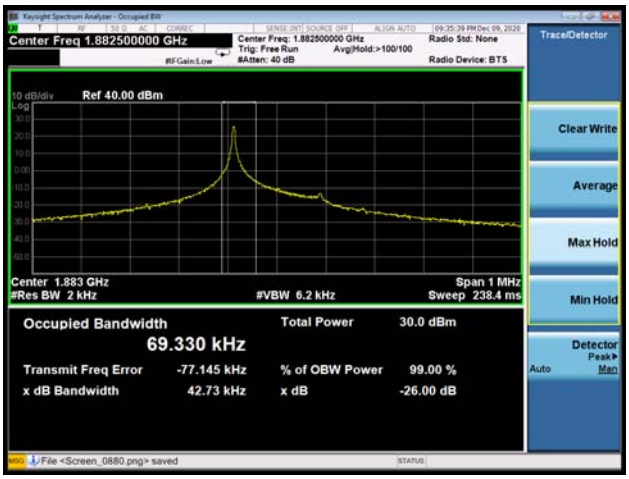
NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 25 QPSK 15kHz 1@0 CH-Low

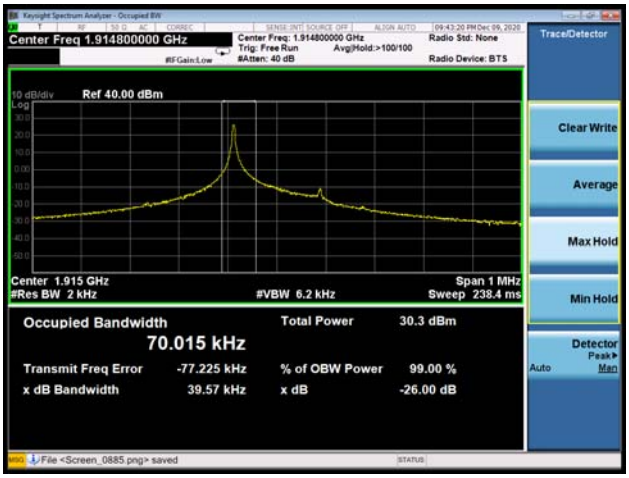


NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-Middle

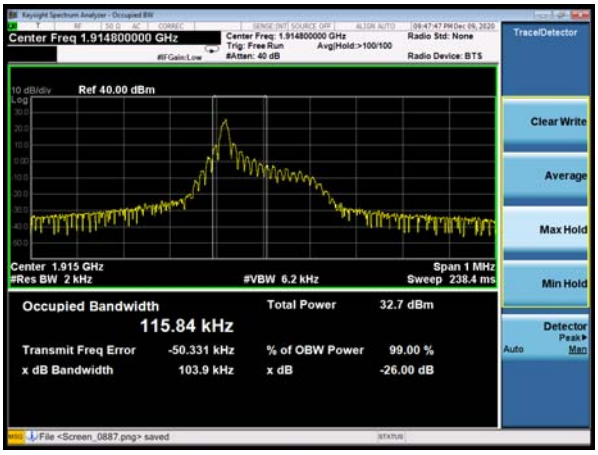


NB-IOT Band 25 QPSK 15kHz 1@0 CH-Middle

NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-High



NB-IOT Band 25 QPSK 15kHz 1@0 CH-High



NB-IOT Band 25 QPSK 15kHz 12@0 CH-Low

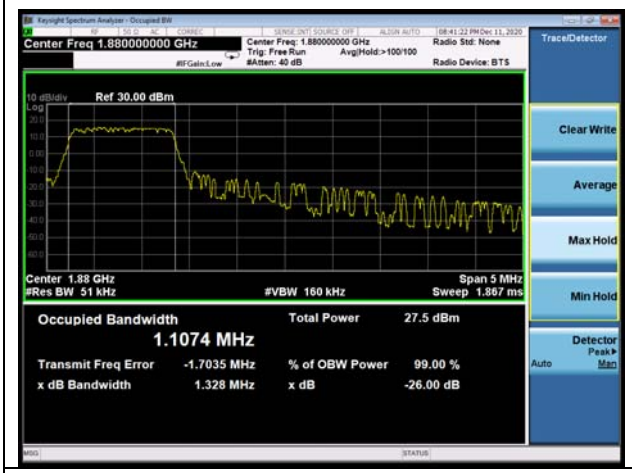
NB-IOT Band 25 QPSK 15kHz 12@0 CH-Middle

NB-IOT Band 25 QPSK 15kHz 12@0 CH-High

LTE Band 2 1.4MHz QPSK CH-Middle

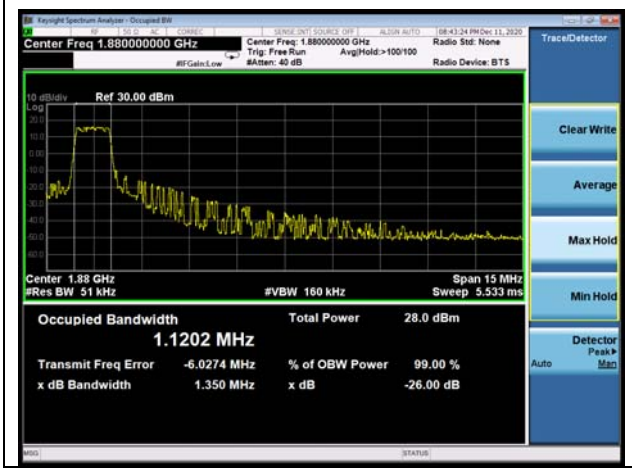
LTE Band 2 3MHz QPSK CH-Middle

LTE Band 2 5MHz QPSK CH-Middle



LTE Band 2 10MHz QPSK CH-Middle

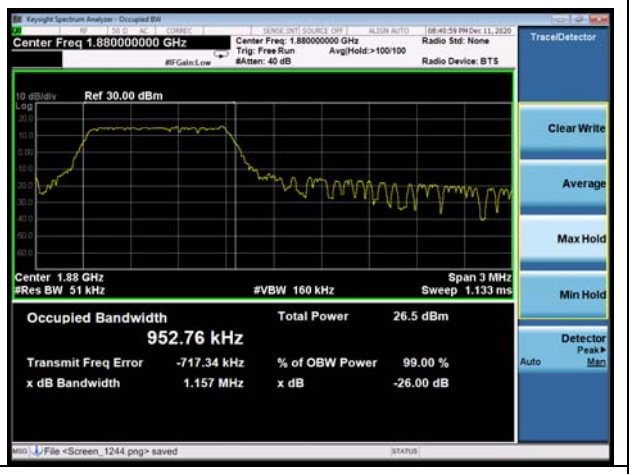
LTE Band 2 15MHz QPSK CH-Middle



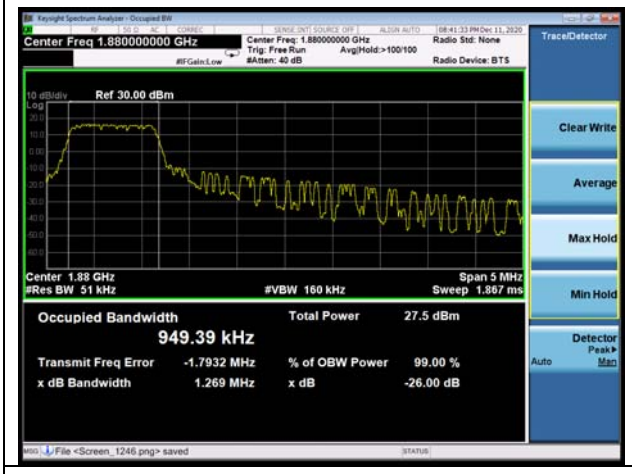
LTE Band 2 20MHz QPSK CH-Middle

LTE Band 2 1.4MHz 16QAM CH-Middle

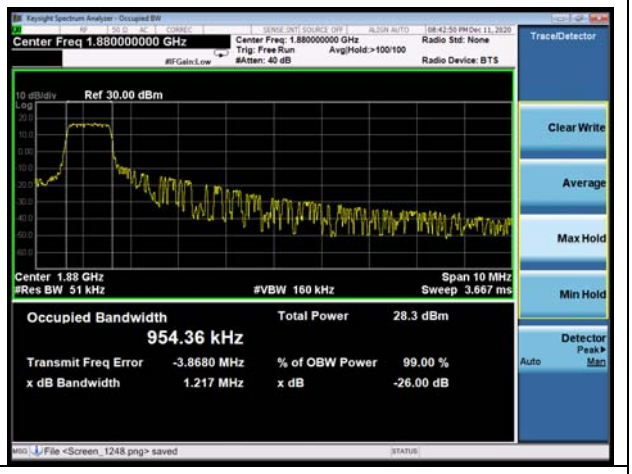
LTE Band 2 3MHz 16QAM CH-Middle



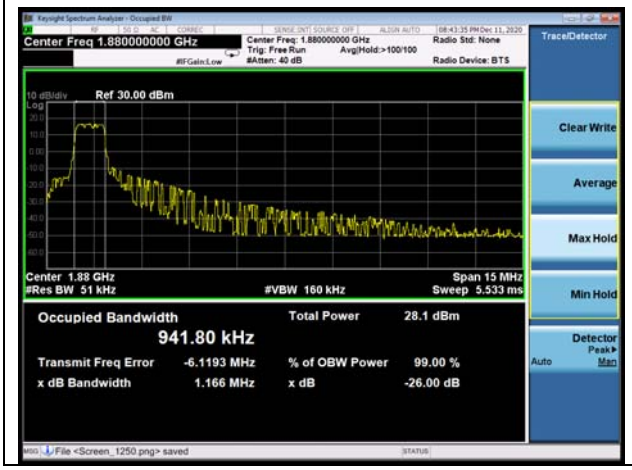
LTE Band 2 5MHz 16QAM CH-Middle



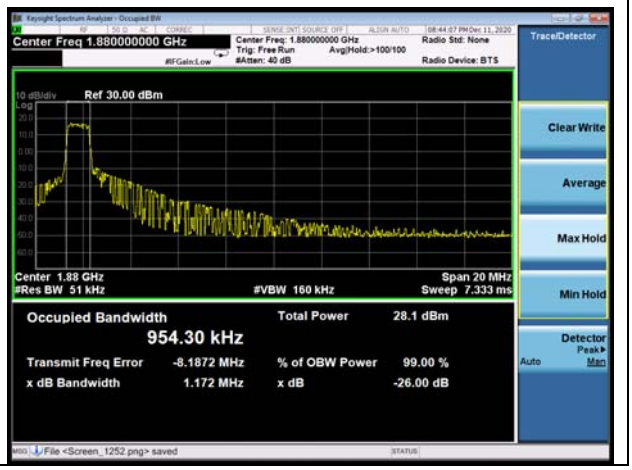
LTE Band 2 10MHz 16QAM CH-Middle



LTE Band 2 15MHz 16QAM CH-Middle



LTE Band 2 20MHz 16QAM CH-Middle



LTE Band 25 1.4MHz QPSK CH-Middle

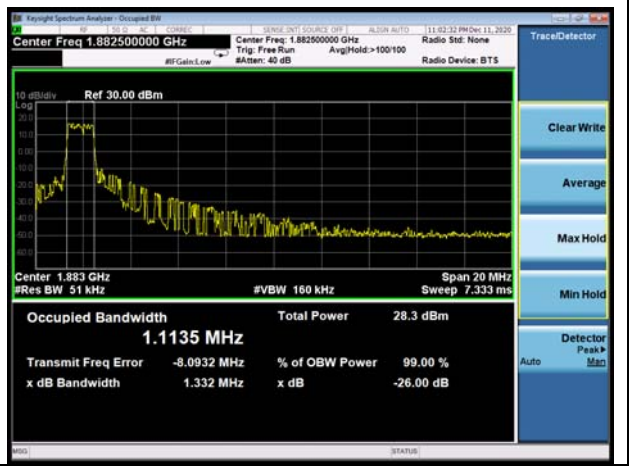
LTE Band 25 3MHz QPSK CH-Middle

LTE Band 25 5MHz QPSK CH-Middle

LTE Band 25 10MHz QPSK CH-Middle

LTE Band 25 15MHz QPSK CH-Middle

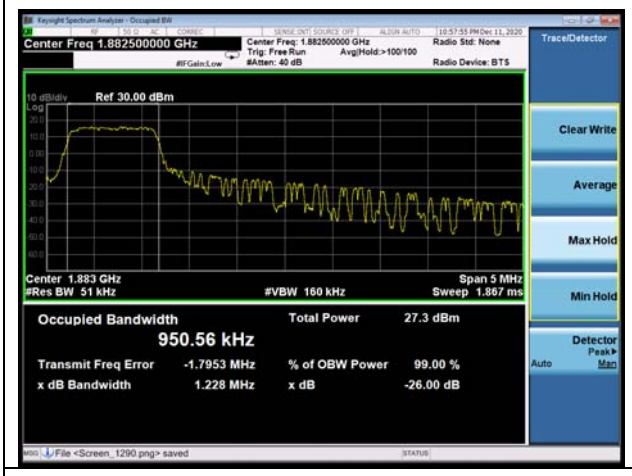
LTE Band 25 20MHz QPSK CH-Middle



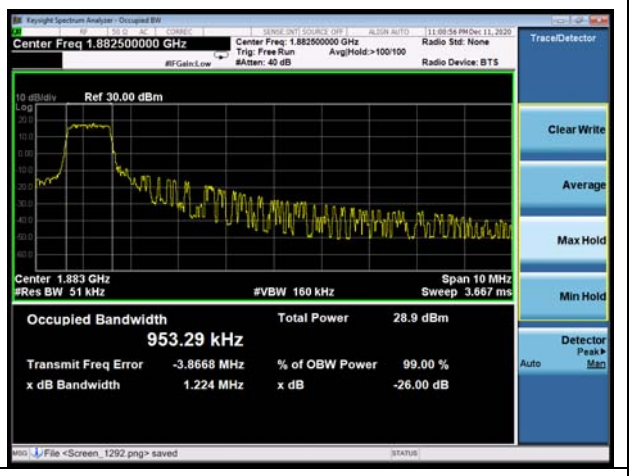
LTE Band 25 1.4MHz 16QAM CH-Middle

LTE Band 25 3MHz 16QAM CH-Middle

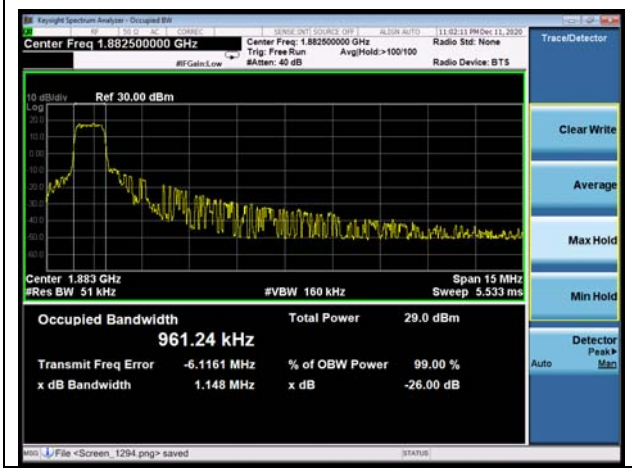
LTE Band 25 5MHz 16QAM CH-Middle



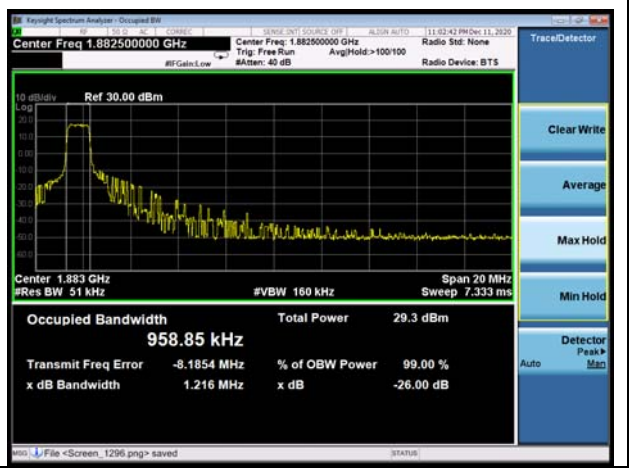
LTE Band 25 10MHz 16QAM CH-Middle



LTE Band 25 15MHz 16QAM CH-Middle



LTE Band 25 20MHz 16QAM CH-Middle



5.3. Band Edge Compliance

Ambient condition

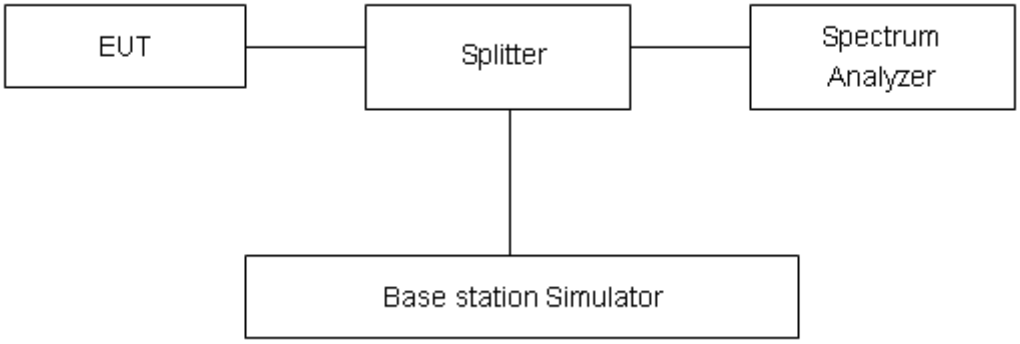
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

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,
RBW is set to ≥1%EBW, VBW is set to 3x RBW for NB-IOT 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.”

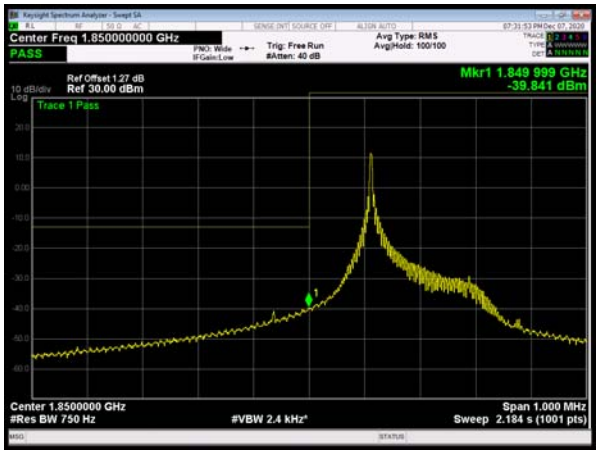
Limit	-13 dBm

Measurement Uncertainty

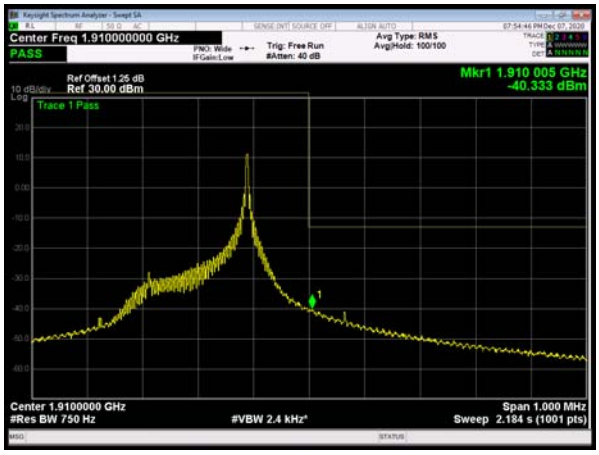
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor k = 1.96, U=0.684dB.

Test Result:

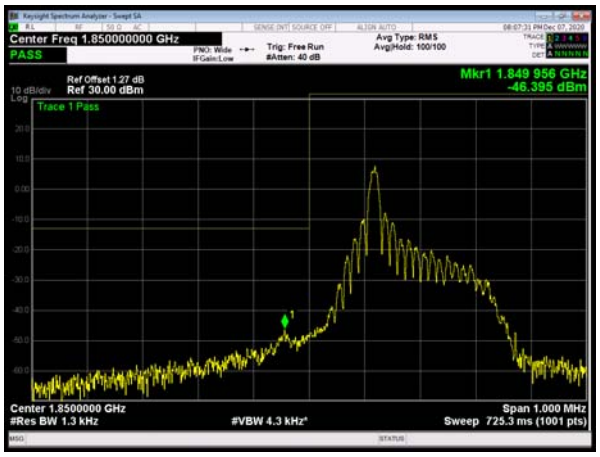
NB-IOT Band 2 BPSK 3.75kHz 1@0 CH-Low



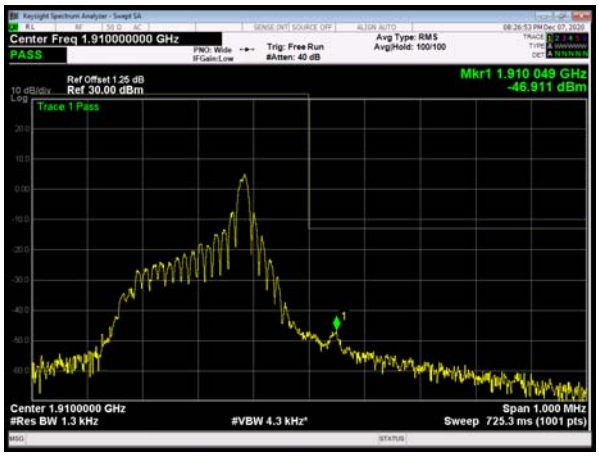
NB-IOT Band 2 BPSK 3.75kHz 1@47 CH-High



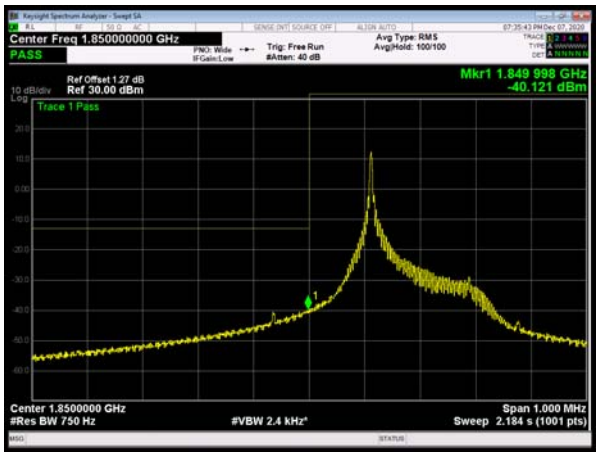
NB-IOT Band 2 BPSK 15kHz 1@0 CH-Low



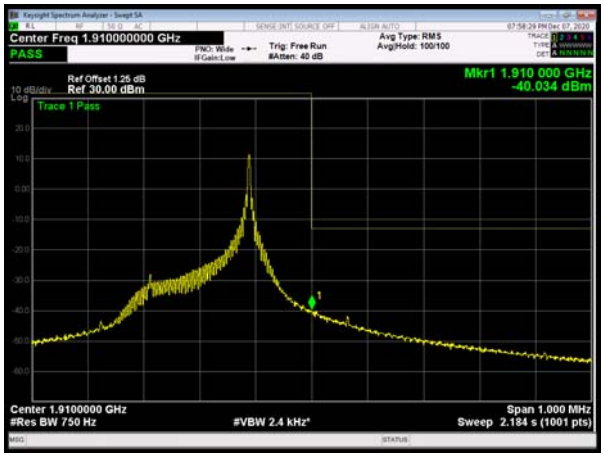
NB-IOT Band 2 BPSK 15kHz 1@11 CH-High



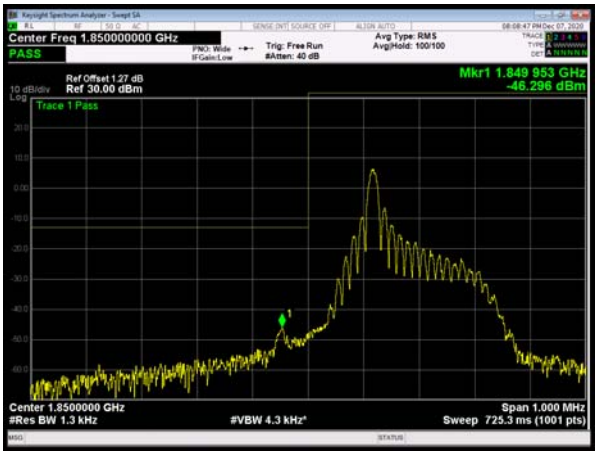
NB-IOT Band 2 QPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 2 QPSK 3.75kHz 1@47 CH-High

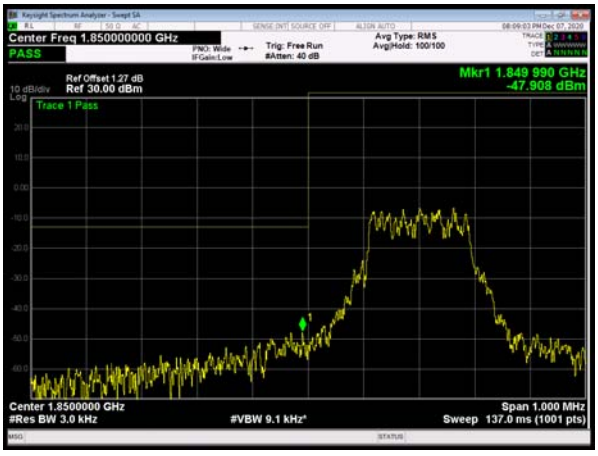


NB-IOT Band 2 QPSK 15kHz 1@0 CH-Low

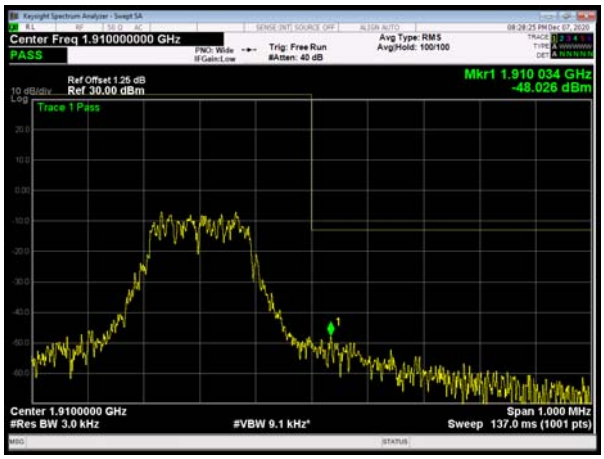


NB-IOT Band 2 QPSK 15kHz 1@11 CH-High

NB-IOT Band 2 QPSK 15kHz 12@0 CH-Low

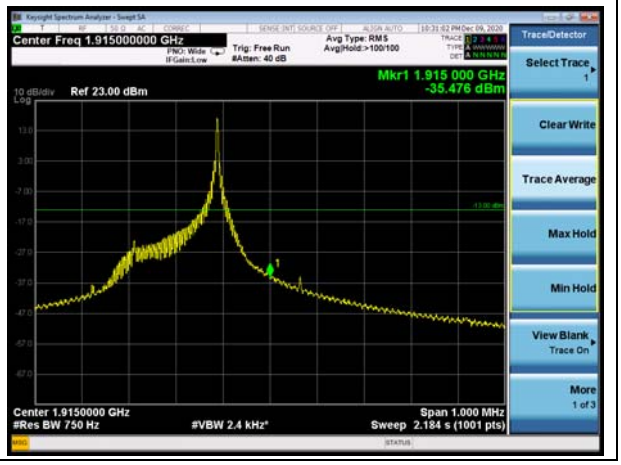


NB-IOT Band 2 QPSK 15kHz 12@0 CH-High

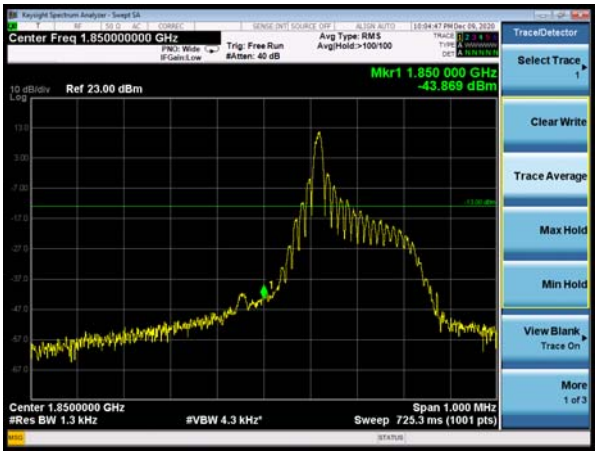


NB-IOT Band 25 BPSK 3.75kHz 1@0 CH-Low

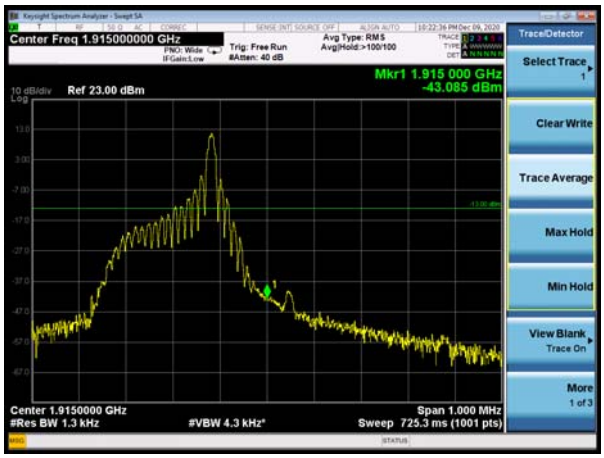
NB-IOT Band 25 BPSK 3.75kHz 1@47 CH-High



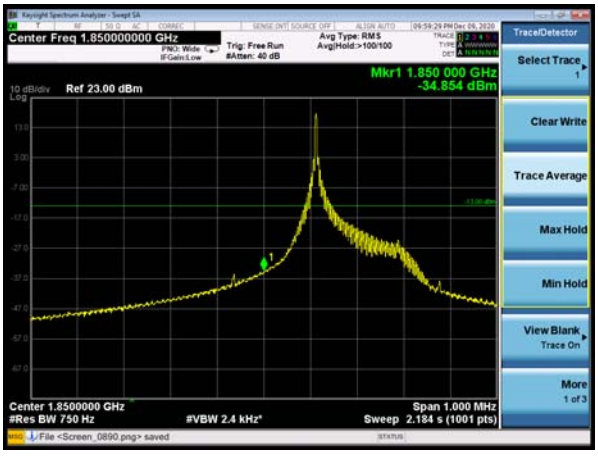
NB-IOT Band 25 BPSK 15kHz 1@0 CH-Low



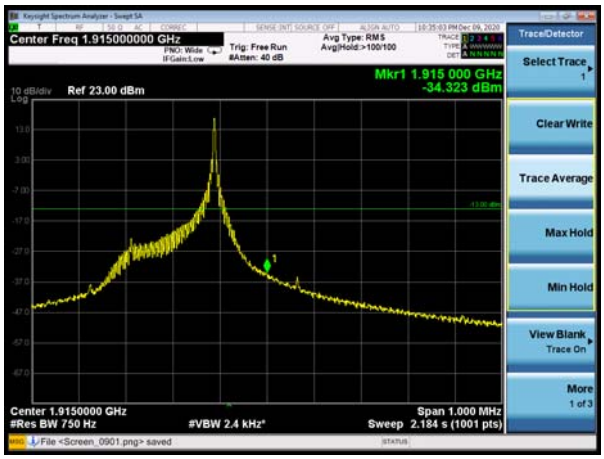
NB-IOT Band 25 BPSK 15kHz 1@11 CH-High



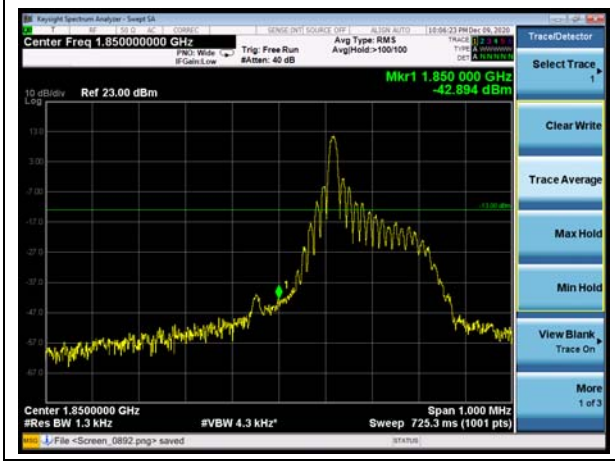
NB-IOT Band 25 QPSK 3.75kHz 1@0 CH-Low



NB-IOT Band 25 QPSK 3.75kHz 1@47 CH-High



NB-IOT Band 25 QPSK 15kHz 1@0 CH-Low

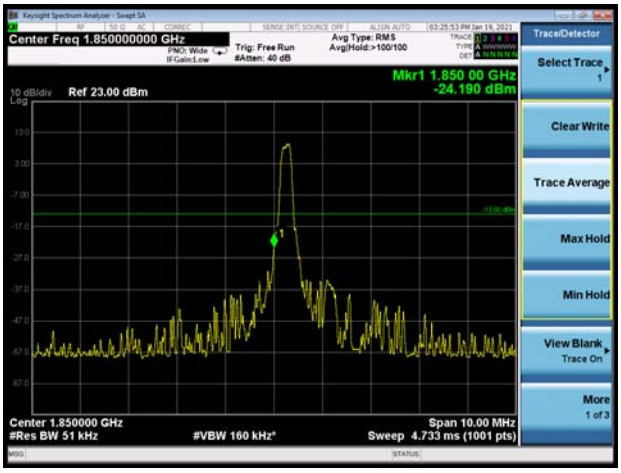


NB-IOT Band 25 QPSK 15kHz 1@11 CH-High

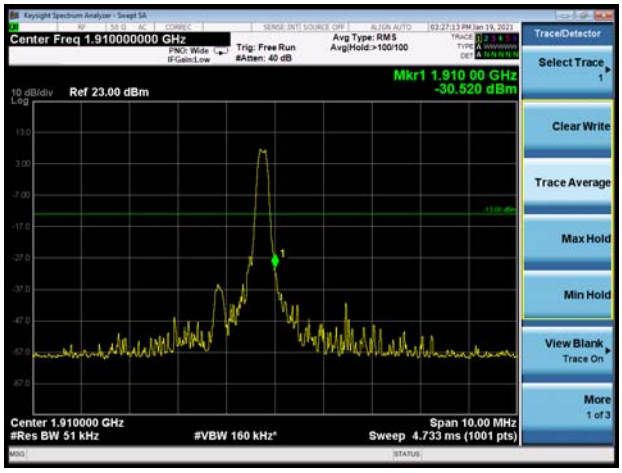
NB-IOT Band 25 QPSK 15kHz 12@0 CH-Low

NB-IOT Band 25 QPSK 15kHz 12@0 CH-High

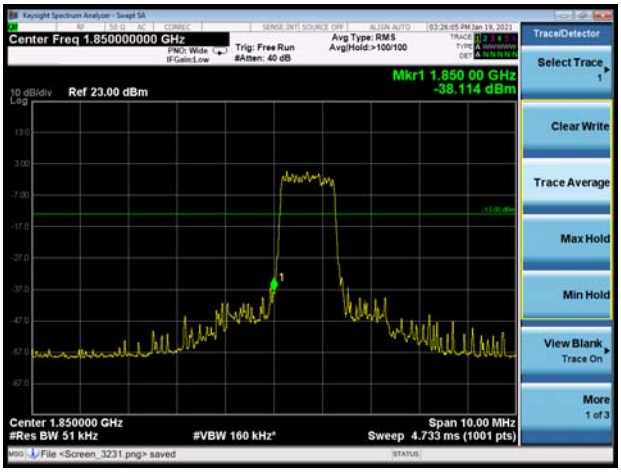
LTE Band 2 1.4MHz QPSK 1RB CH-Low



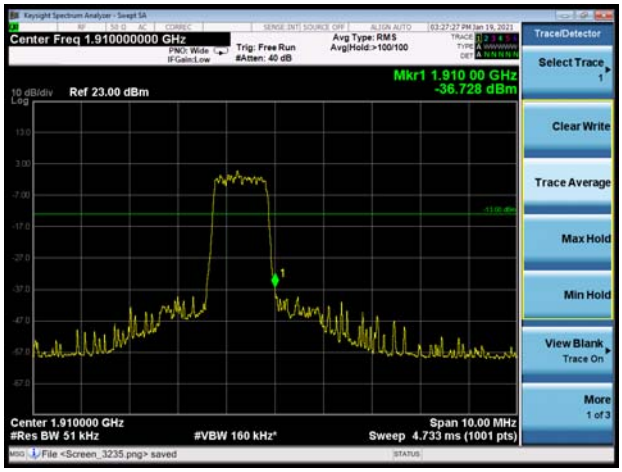
LTE Band 2 1.4MHz QPSK 1RB CH-High



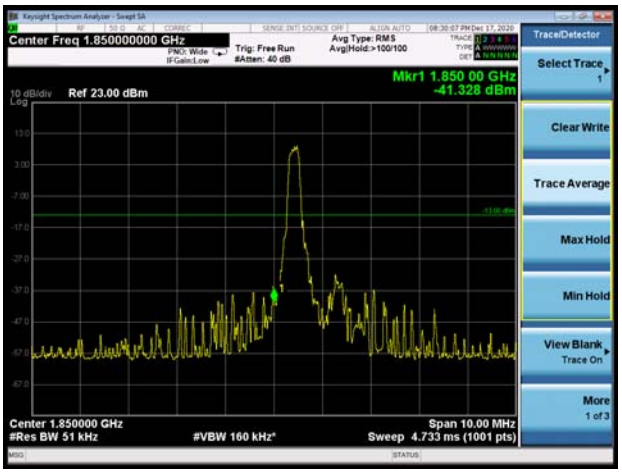
LTE Band 2 1.4MHz QPSK 100%RB CH-Low



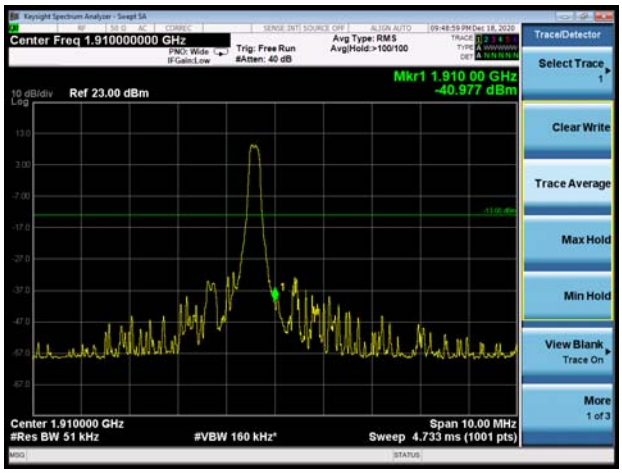
LTE Band 2 1.4MHz QPSK 100%RB CH-High



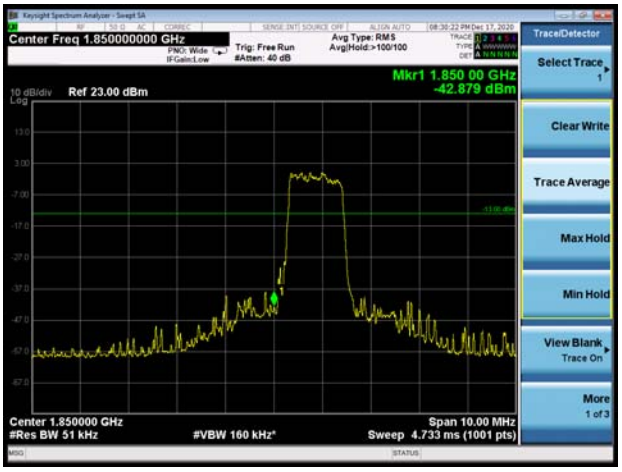
LTE Band 2 3MHz QPSK 1RB CH-Low



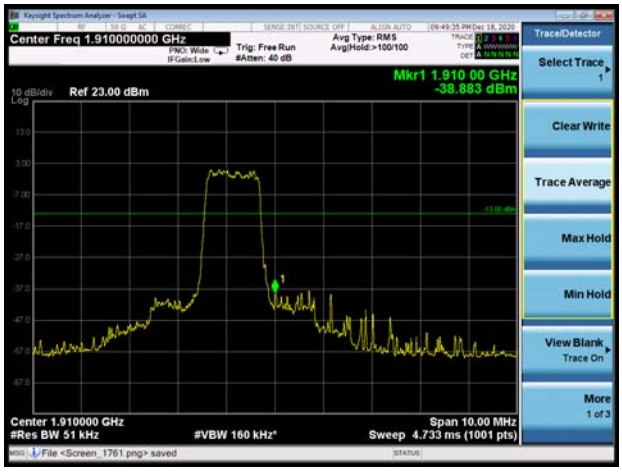
LTE Band 2 3MHz QPSK 1RB CH-High



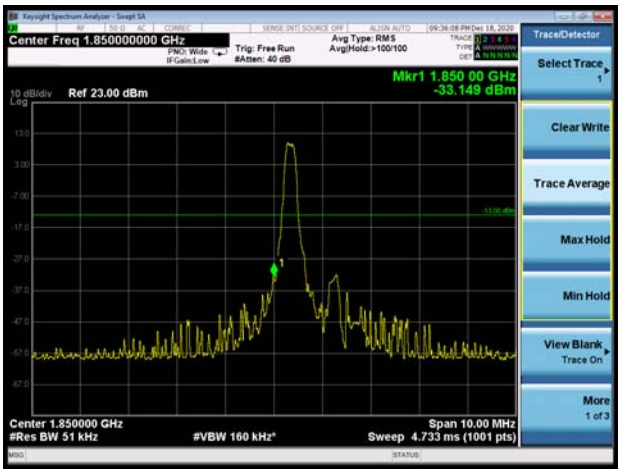
LTE Band 2 3MHz QPSK 100%RB CH-Low



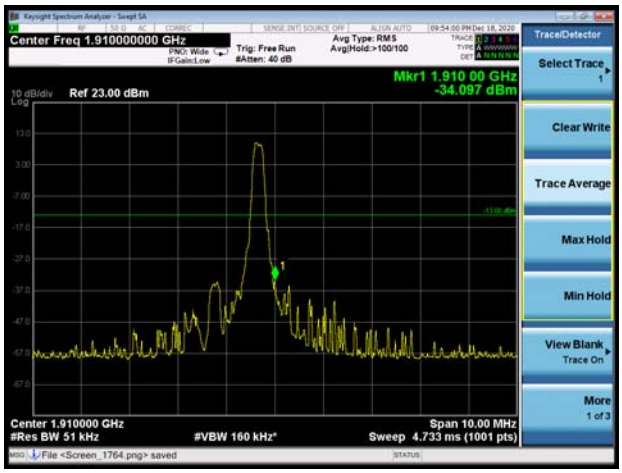
LTE Band 2 3MHz QPSK 100%RB CH-High



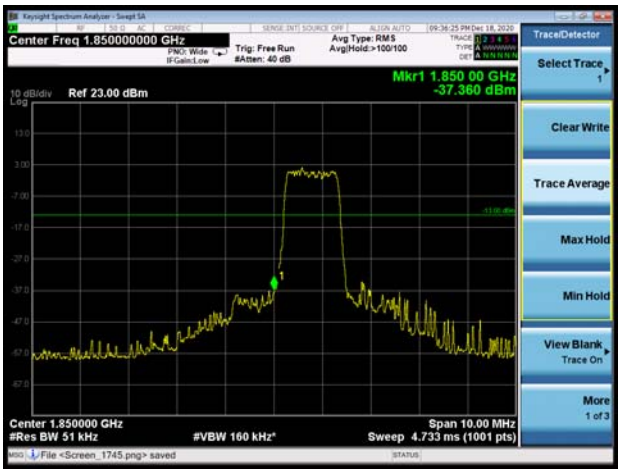
LTE Band 2 5MHz QPSK 1RB CH-Low



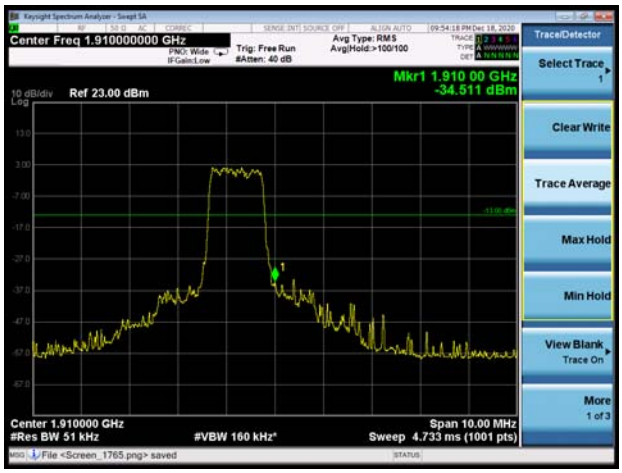
LTE Band 2 5MHz QPSK 1RB CH-High



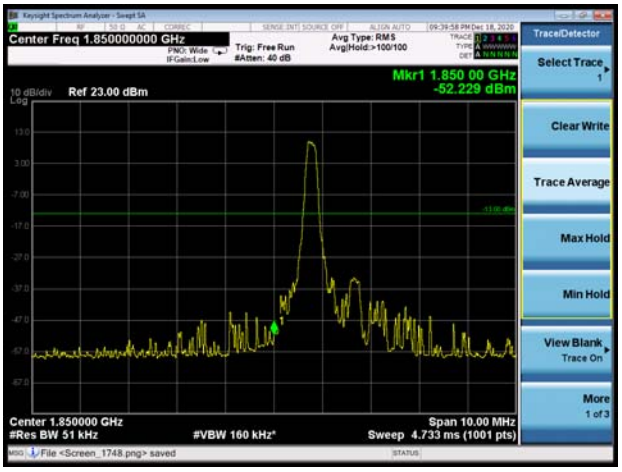
LTE Band 2 5MHz QPSK 100%RB CH-Low



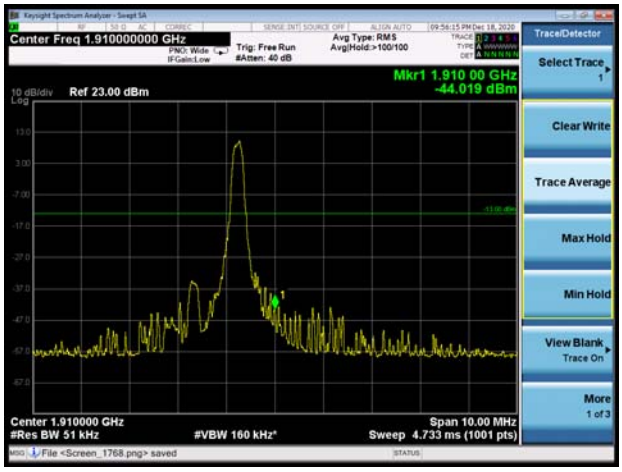
LTE Band 2 5MHz QPSK 100%RB CH-High



LTE Band 2 10MHz QPSK 1RB CH-Low

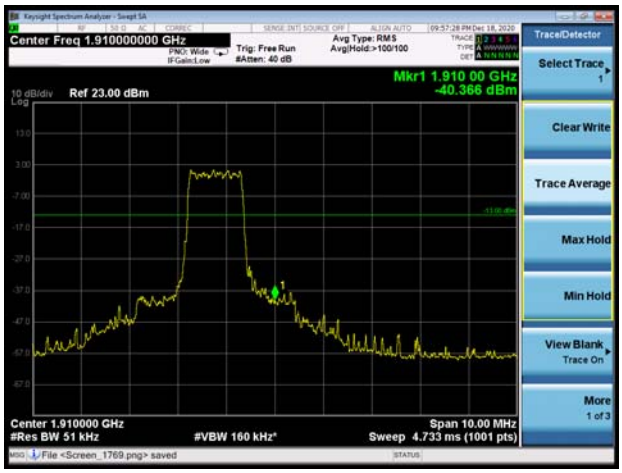


LTE Band 2 10MHz QPSK 1RB CH-High

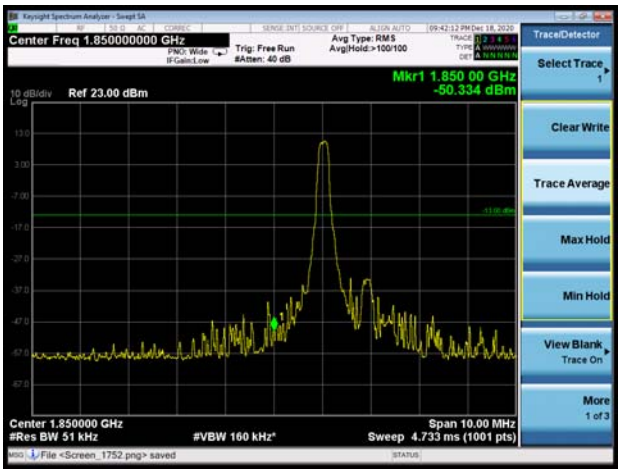


LTE Band 2 10MHz QPSK 100%RB CH-Low

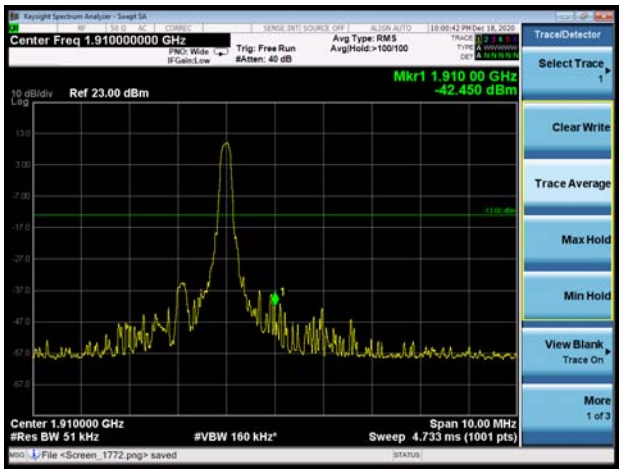
LTE Band 2 10MHz QPSK 100%RB CH-High



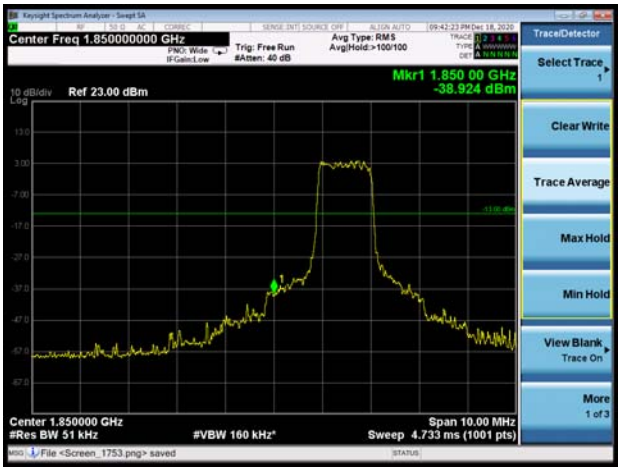
LTE Band 2 15MHz QPSK 1RB CH-Low



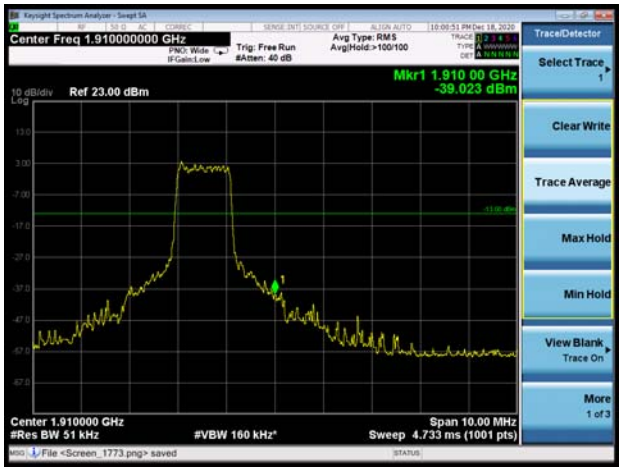
LTE Band 2 15MHz QPSK 1RB CH-High



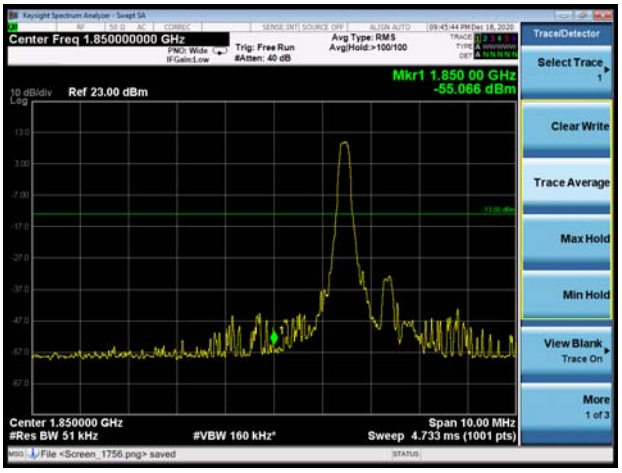
LTE Band 2 15MHz QPSK 100%RB CH-Low



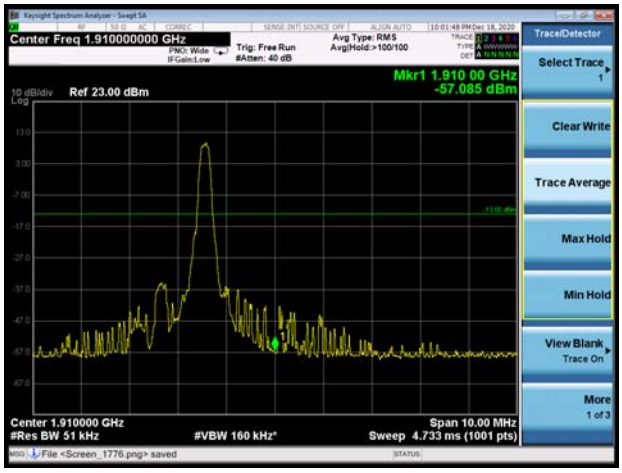
LTE Band 2 15MHz QPSK 100%RB CH-High



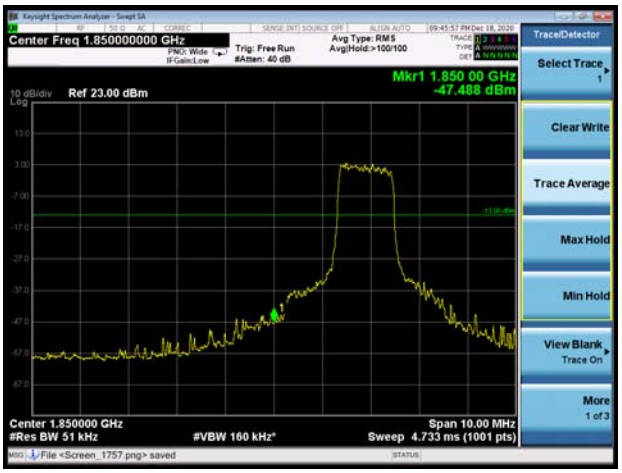
LTE Band 2 20MHz QPSK 1RB CH-Low



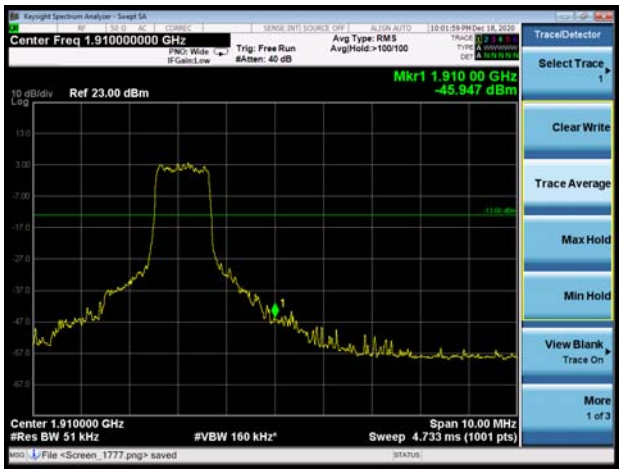
LTE Band 2 20MHz QPSK 1RB CH-High



LTE Band 2 20MHz QPSK 100%RB CH-Low

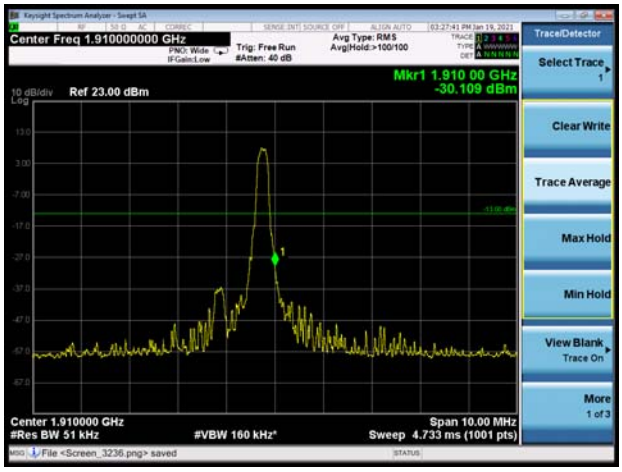


LTE Band 2 20MHz QPSK 100%RB CH-High

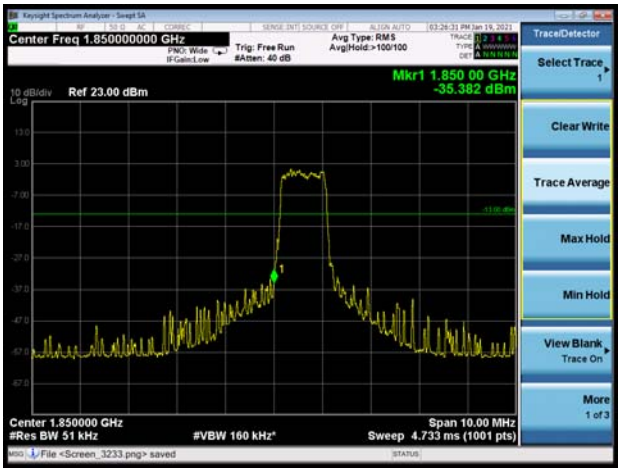


LTE Band 2 1.4MHz 16QAM 1RB CH-Low

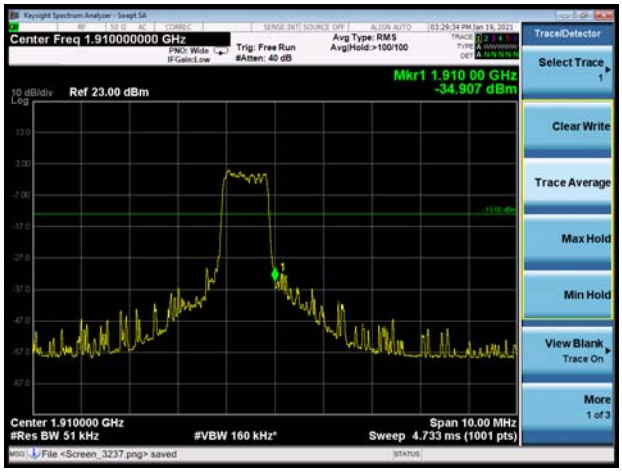
LTE Band 2 1.4MHz 16QAM 1RB CH-High



LTE Band 2 1.4MHz 16QAM 100%RB CH-Low

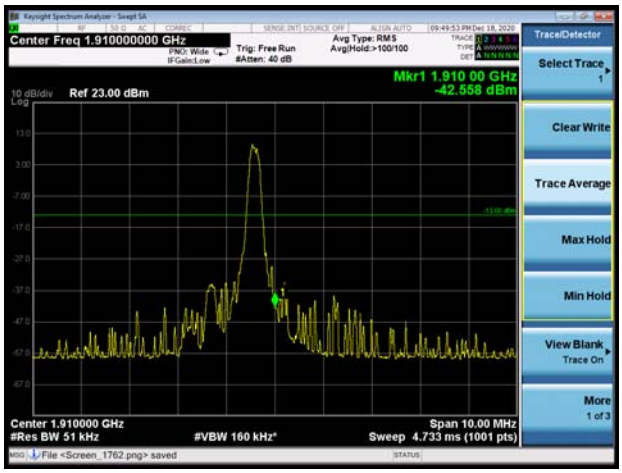


LTE Band 2 1.4MHz 16QAM 100%RB CH-High

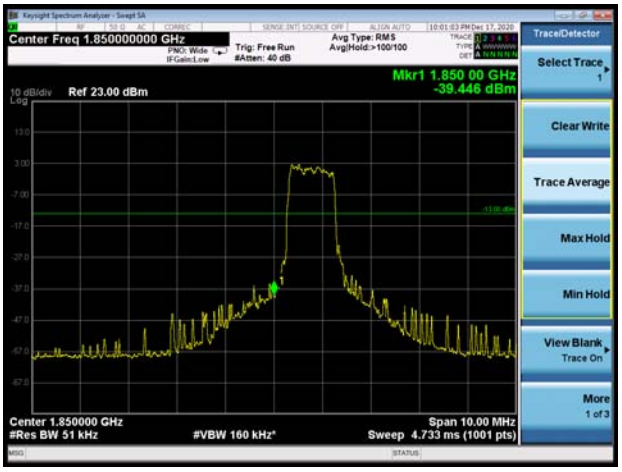


LTE Band 2 3MHz 16QAM 1RB CH-Low

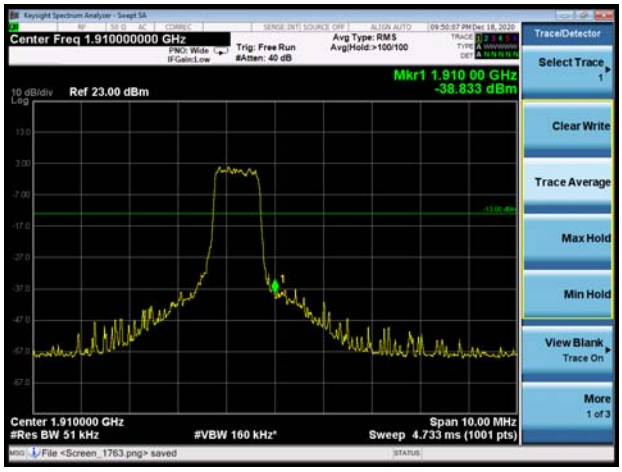
LTE Band 2 3MHz 16QAM 1RB CH-High



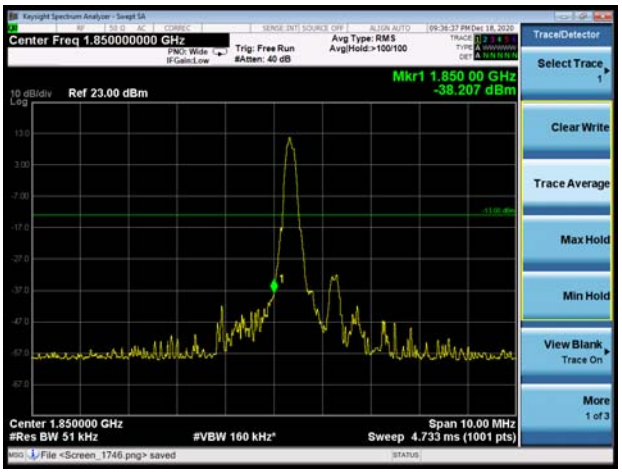
LTE Band 2 3MHz 16QAM 100%RB CH-Low



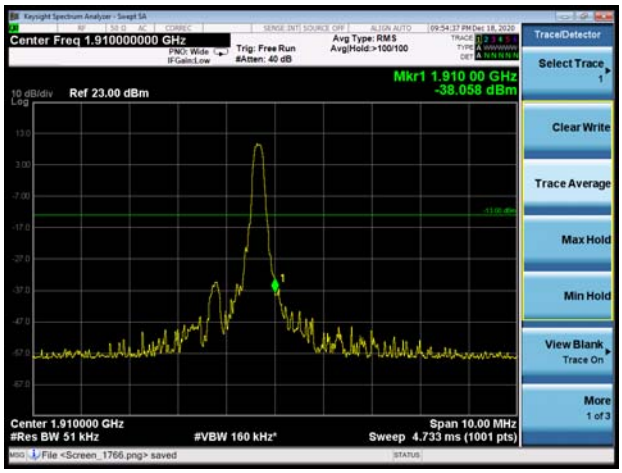
LTE Band 2 3MHz 16QAM 100%RB CH-High



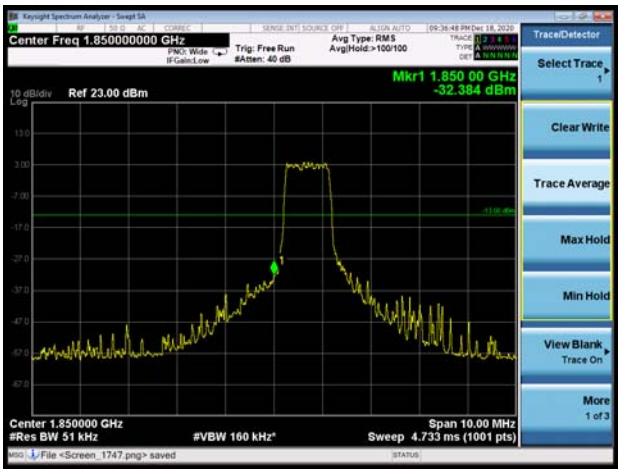
LTE Band 2 5MHz 16QAM 1RB CH-Low



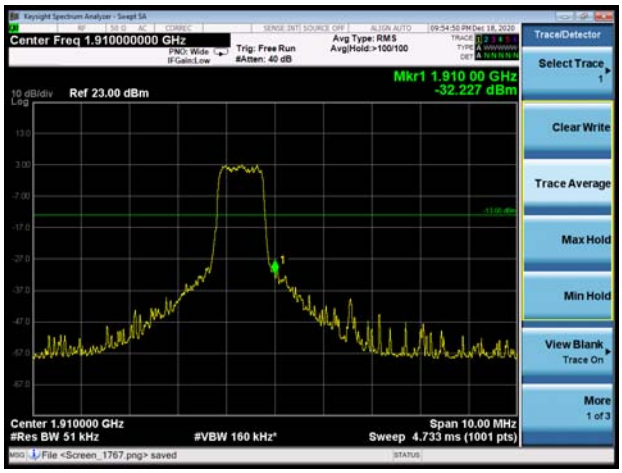
LTE Band 2 5MHz 16QAM 1RB CH-High



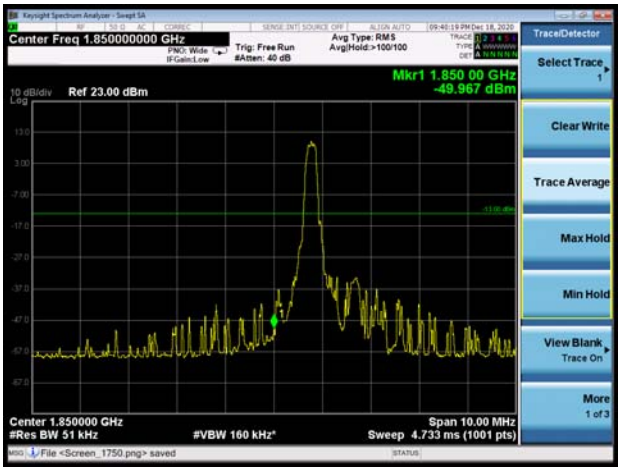
LTE Band 2 5MHz 16QAM 100%RB CH-Low



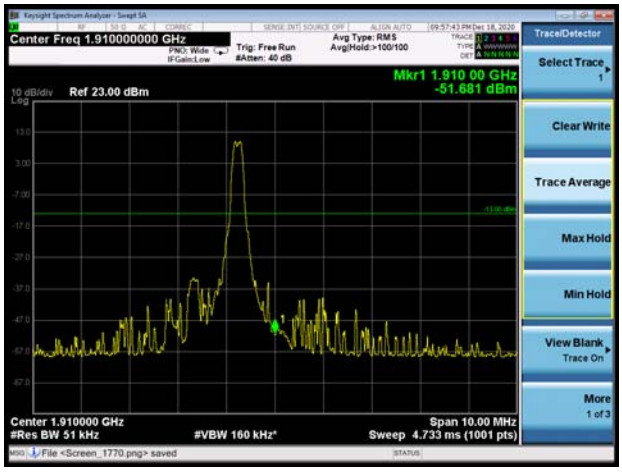
LTE Band 2 5MHz 16QAM 100%RB CH-High



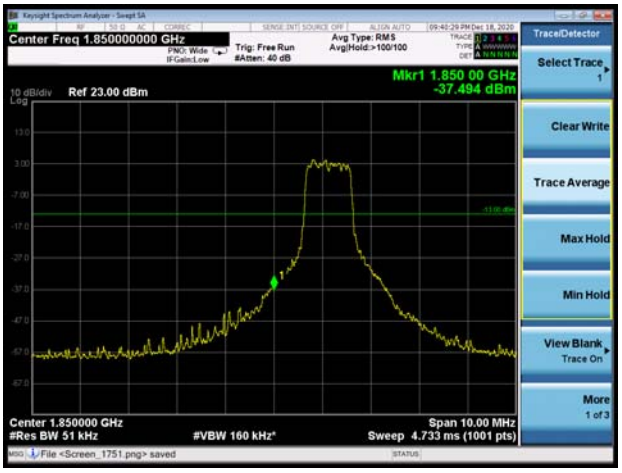
LTE Band 2 10MHz 16QAM 1RB CH-Low



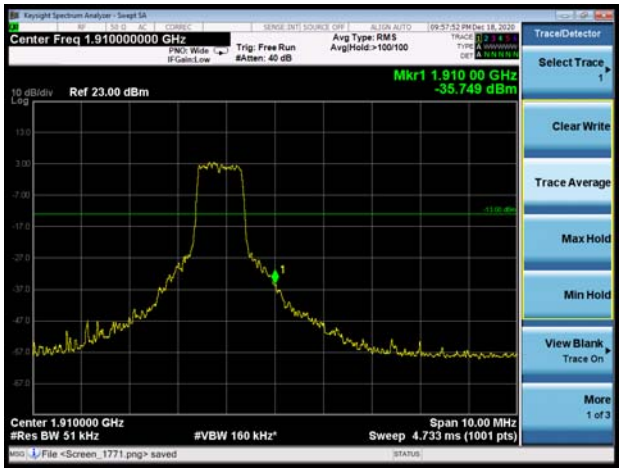
LTE Band 2 10MHz 16QAM 1RB CH-High



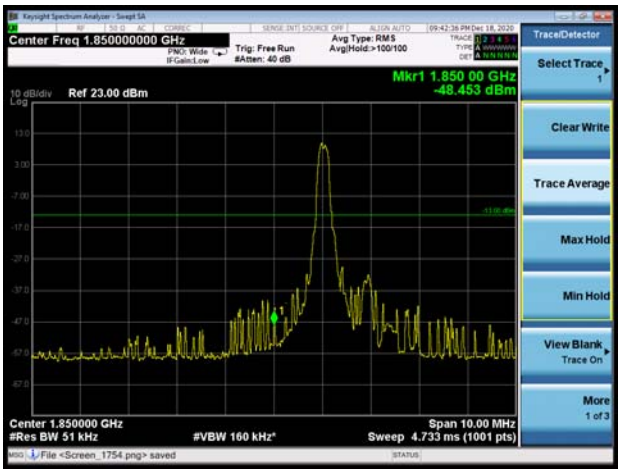
LTE Band 2 10MHz 16QAM 100%RB CH-Low



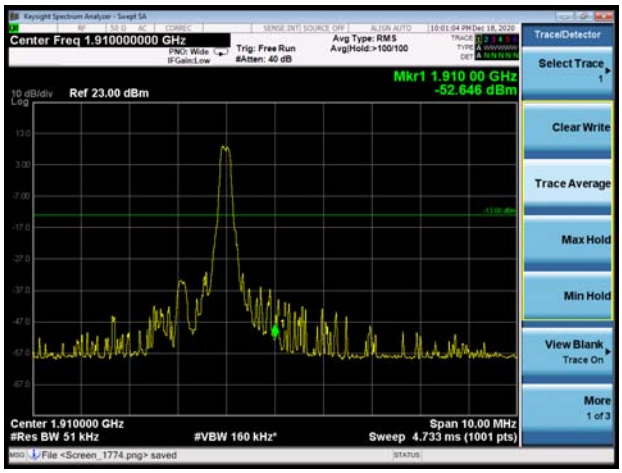
LTE Band 2 10MHz 16QAM 100%RB CH-High



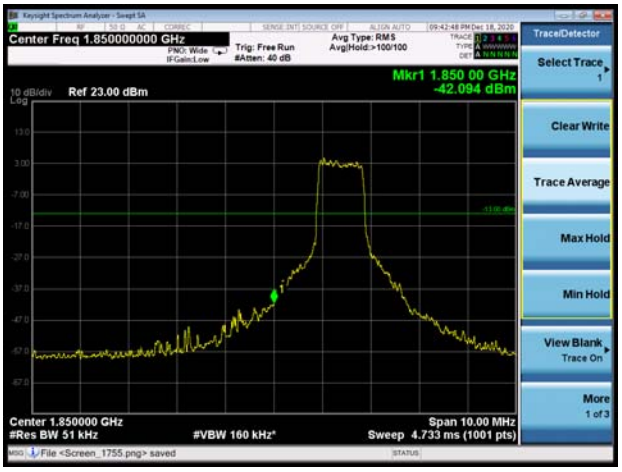
LTE Band 2 15MHz 16QAM 1RB CH-Low



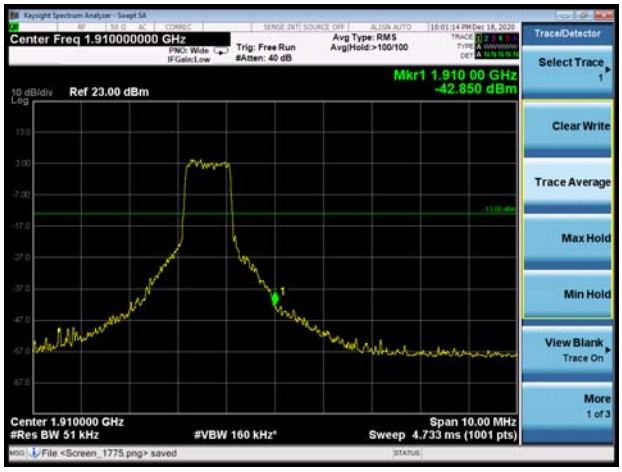
LTE Band 2 15MHz 16QAM 1RB CH-High



LTE Band 2 15MHz 16QAM 100%RB CH-Low

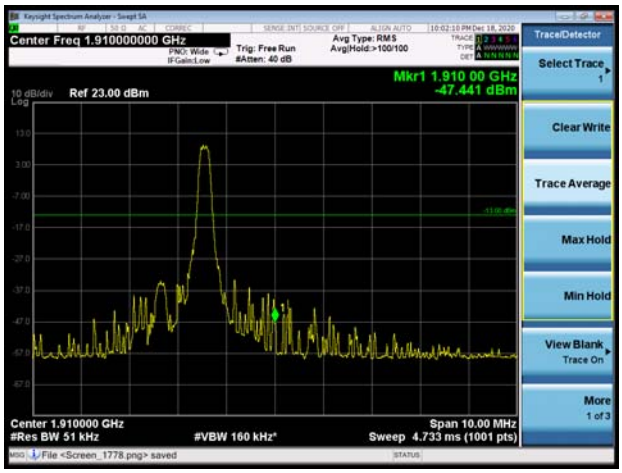


LTE Band 2 15MHz 16QAM 100%RB CH-High

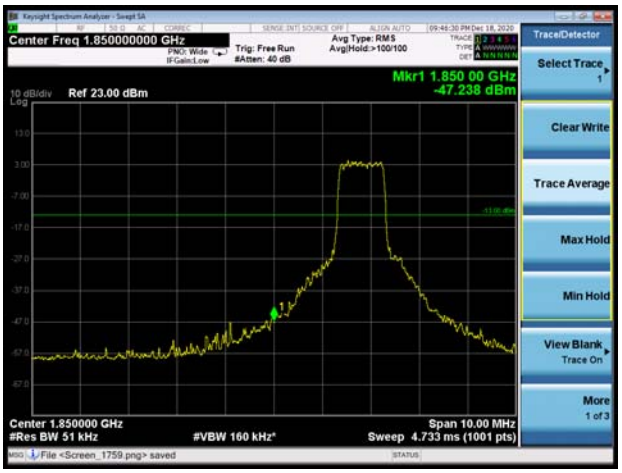


LTE Band 2 20MHz 16QAM 1RB CH-Low

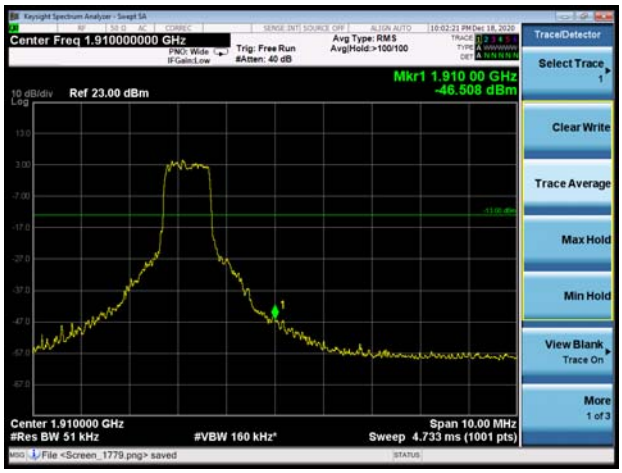
LTE Band 2 20MHz 16QAM 1RB CH-High



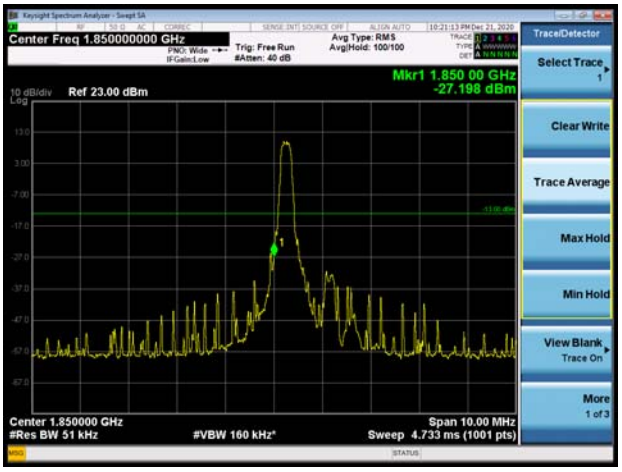
LTE Band 2 20MHz 16QAM 100%RB CH-Low



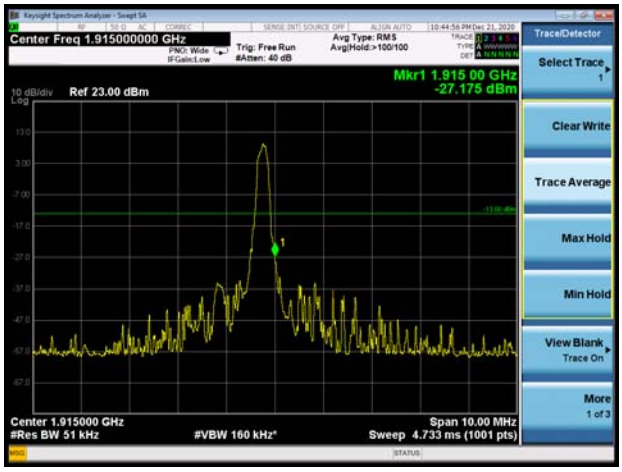
LTE Band 2 20MHz 16QAM 100%RB CH-High



LTE Band 25 1.4MHz QPSK 1RB CH-Low

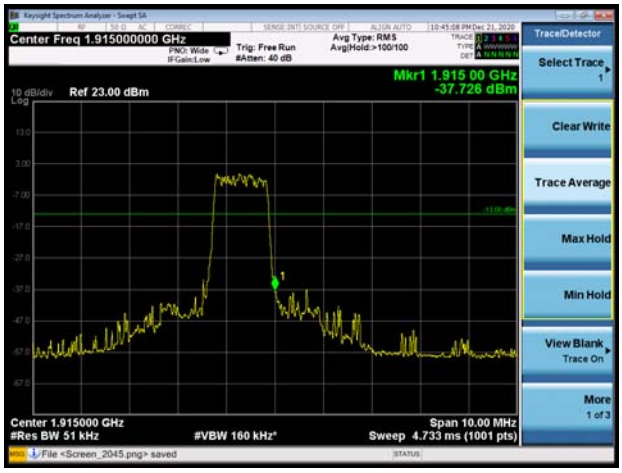


LTE Band 25 1.4MHz QPSK 1RB CH-High

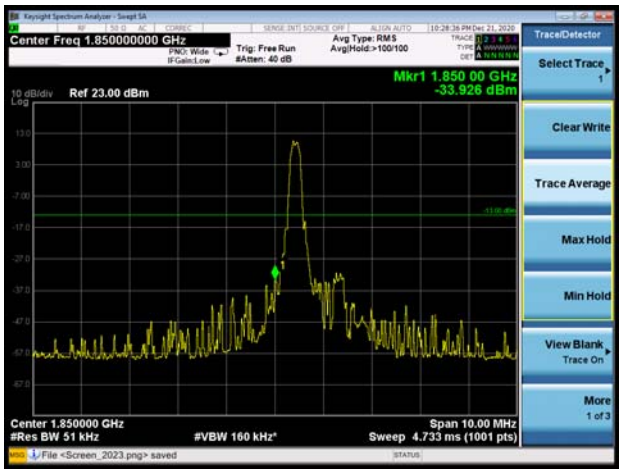


LTE Band 25 1.4MHz QPSK 100%RB CH-Low

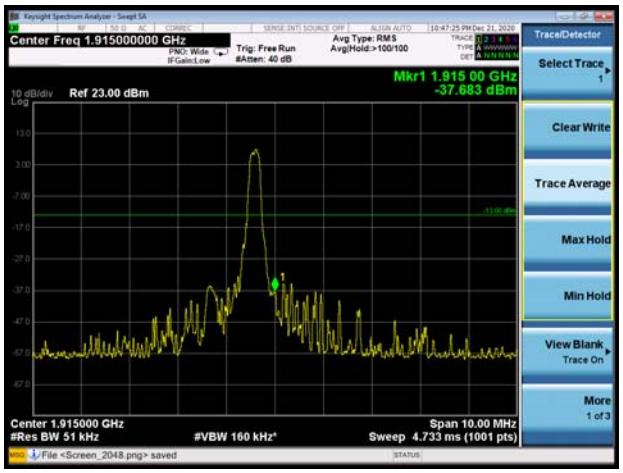
LTE Band 25 1.4MHz QPSK 100%RB CH-High



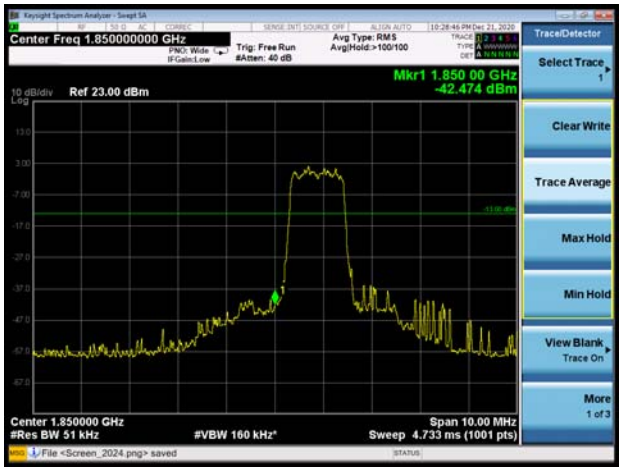
LTE Band 25 3MHz QPSK 1RB CH-Low



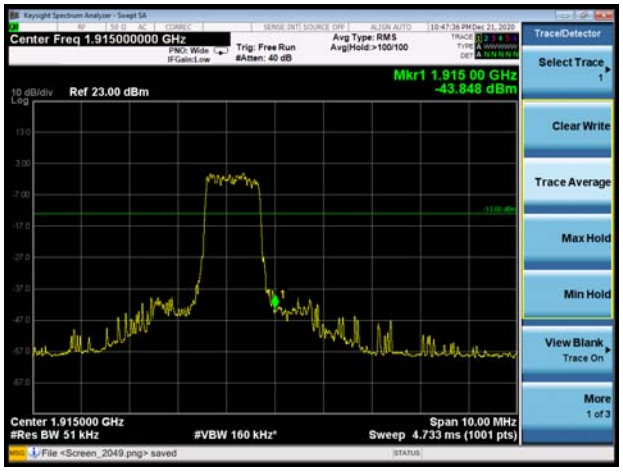
LTE Band 25 3MHz QPSK 1RB CH-High



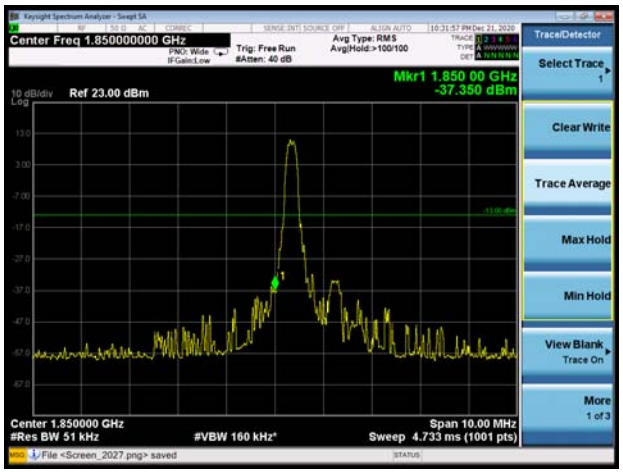
LTE Band 25 3MHz QPSK 100%RB CH-Low



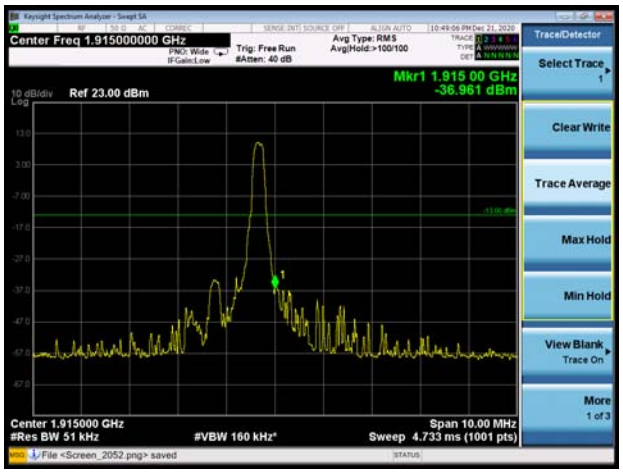
LTE Band 25 3MHz QPSK 100%RB CH-High



LTE Band 25 5MHz QPSK 1RB CH-Low



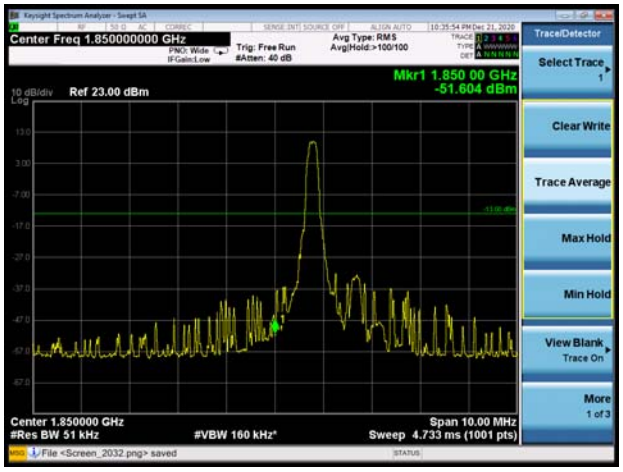
LTE Band 25 5MHz QPSK 1RB CH-High



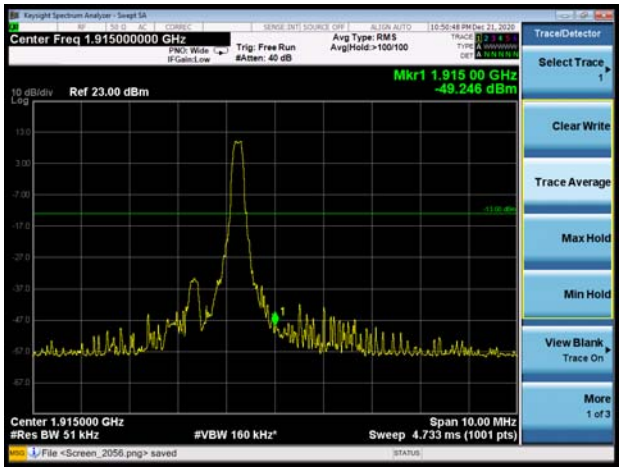
LTE Band 25 5MHz QPSK 100%RB CH-Low

LTE Band 25 5MHz QPSK 100%RB CH-High

LTE Band 25 10MHz QPSK 1RB CH-Low

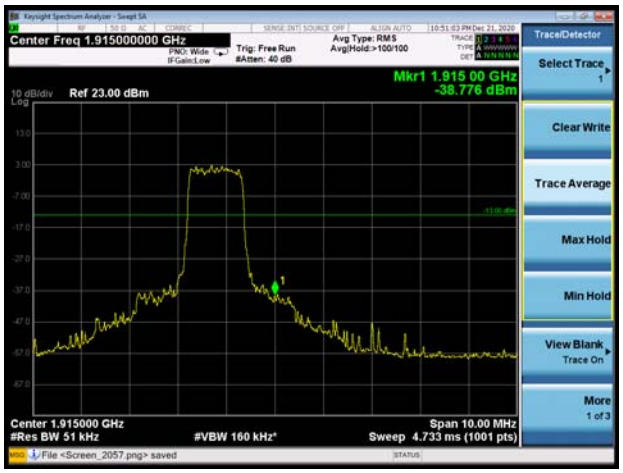


LTE Band 25 10MHz QPSK 1RB CH-High

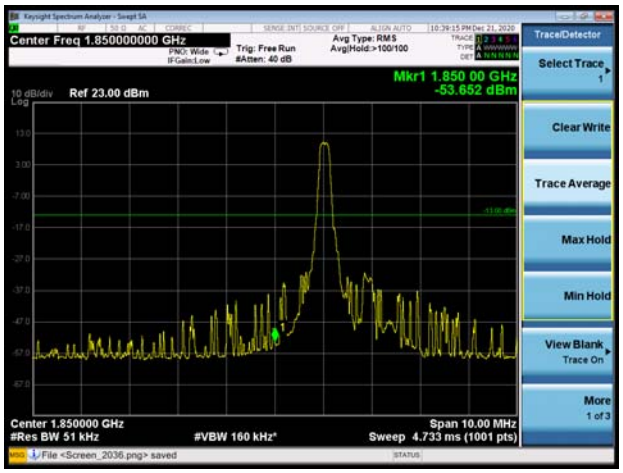


LTE Band 25 10MHz QPSK 100%RB CH-Low

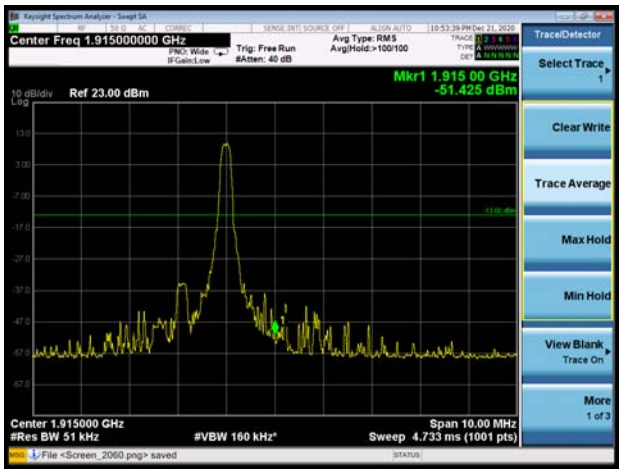
LTE Band 25 10MHz QPSK 100%RB CH-High



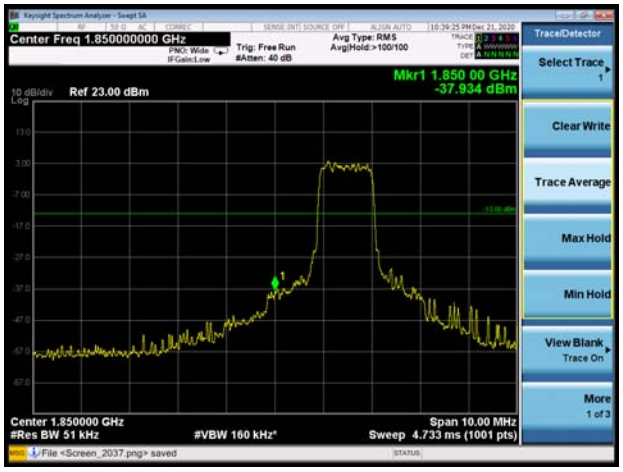
LTE Band 25 15MHz QPSK 1RB CH-Low



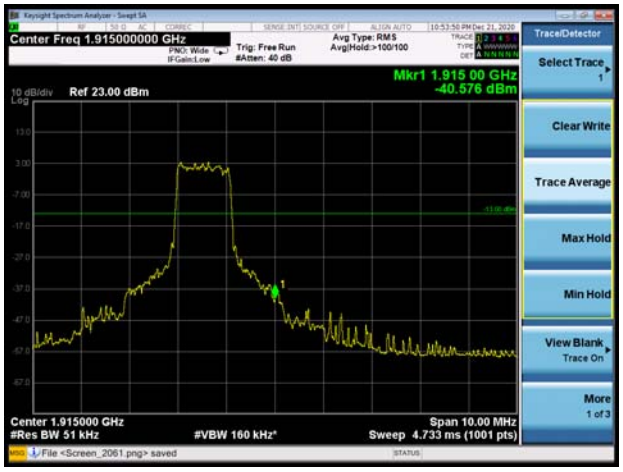
LTE Band 25 15MHz QPSK 1RB CH-High



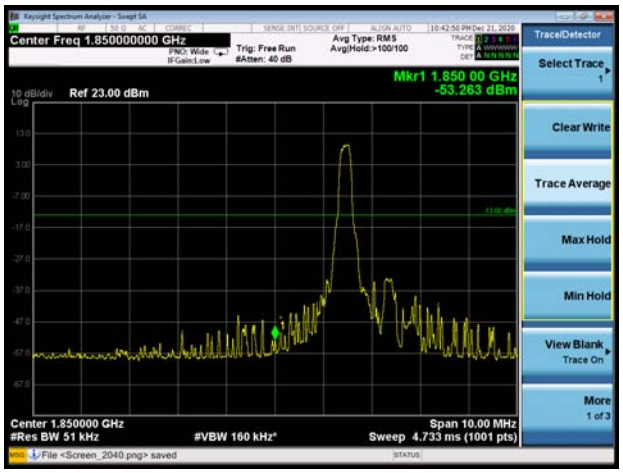
LTE Band 25 15MHz QPSK 100%RB CH-Low



LTE Band 25 15MHz QPSK 100%RB CH-High



LTE Band 25 20MHz QPSK 1RB CH-Low



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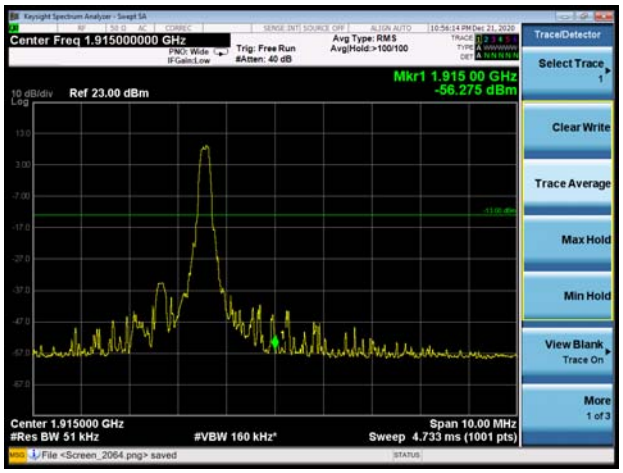

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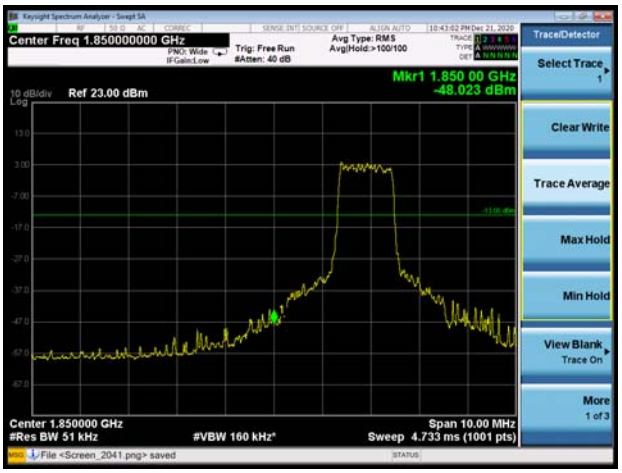

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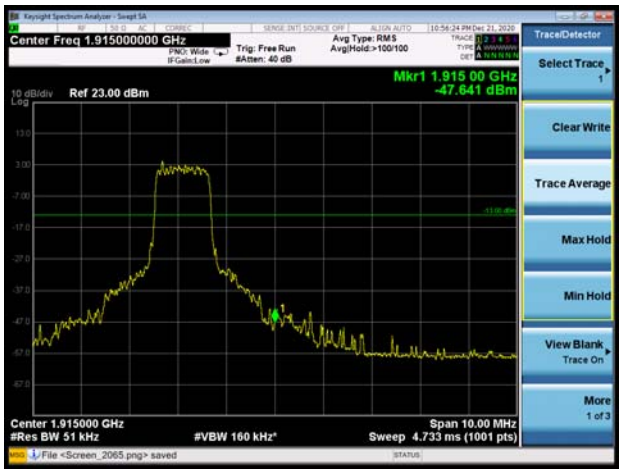
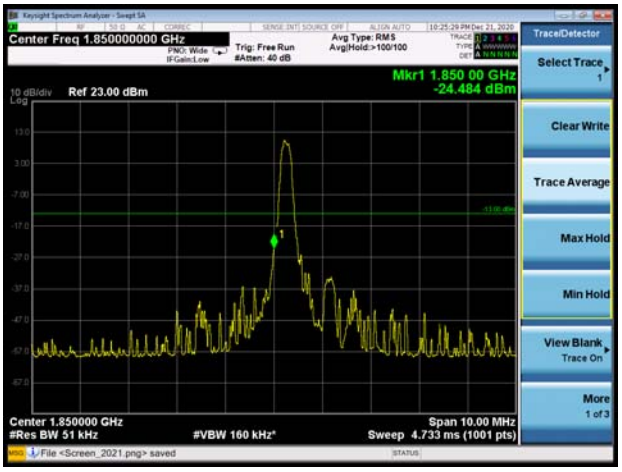
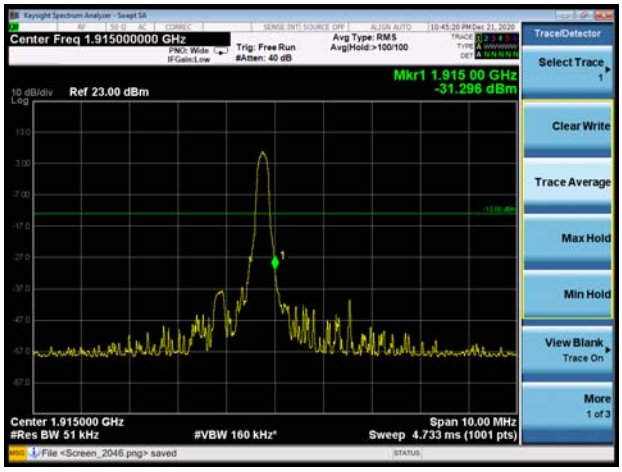


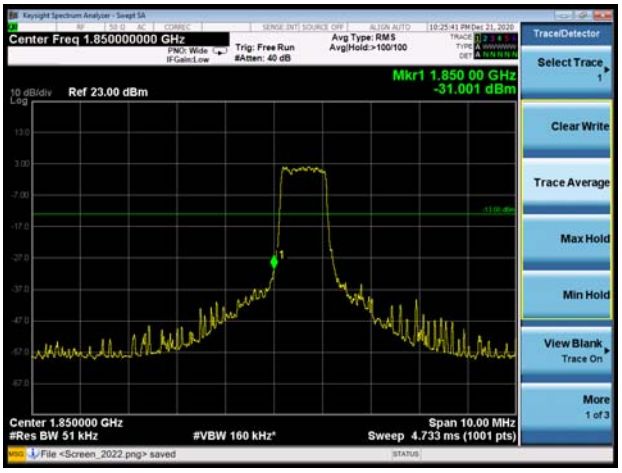
LTE Band 25 1.4MHz 16QAM 1RB CH-Low



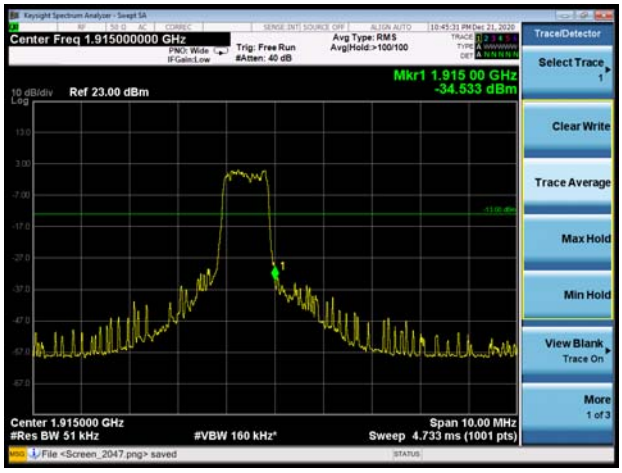
LTE Band 25 1.4MHz 16QAM 1RB CH-High



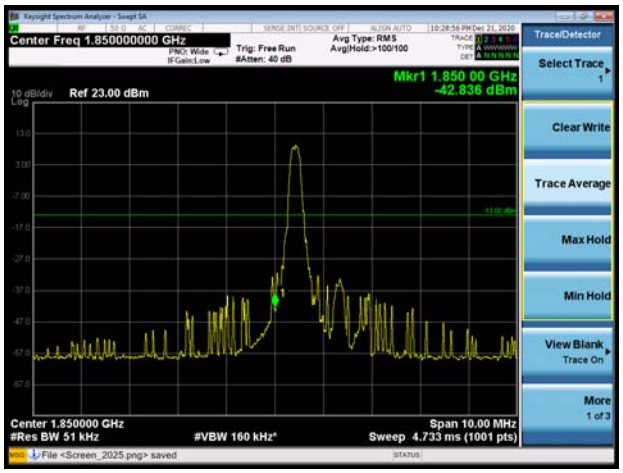
LTE Band 25 1.4MHz 16QAM 100%RB CH-Low



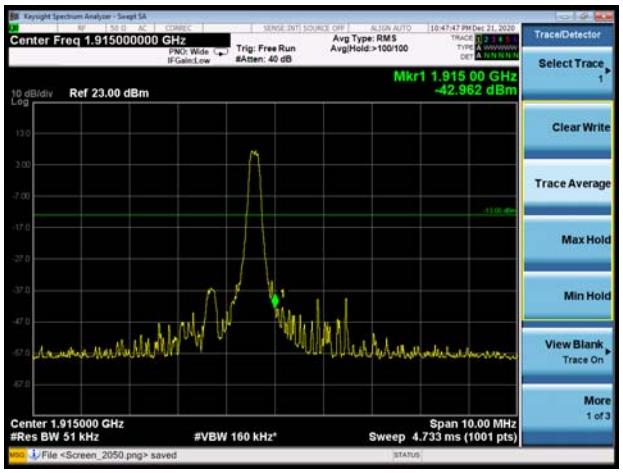
LTE Band 25 1.4MHz 16QAM 100%RB CH-High



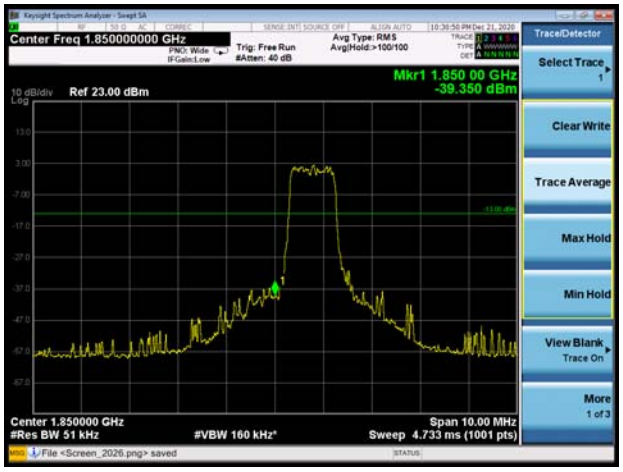
LTE Band 25 3MHz 16QAM 1RB CH-Low



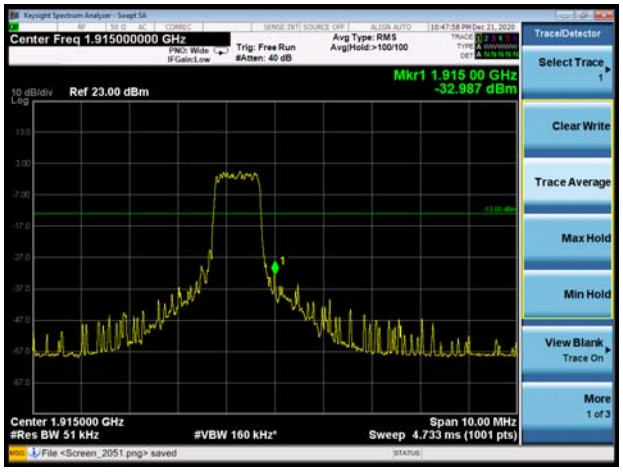
LTE Band 25 3MHz 16QAM 1RB CH-High



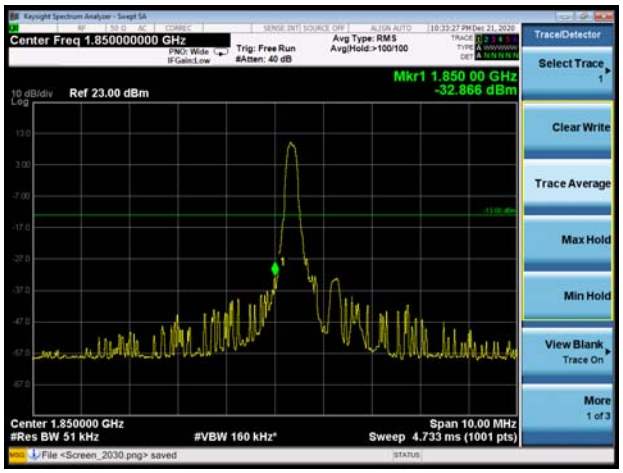
LTE Band 25 3MHz 16QAM 100%RB CH-Low



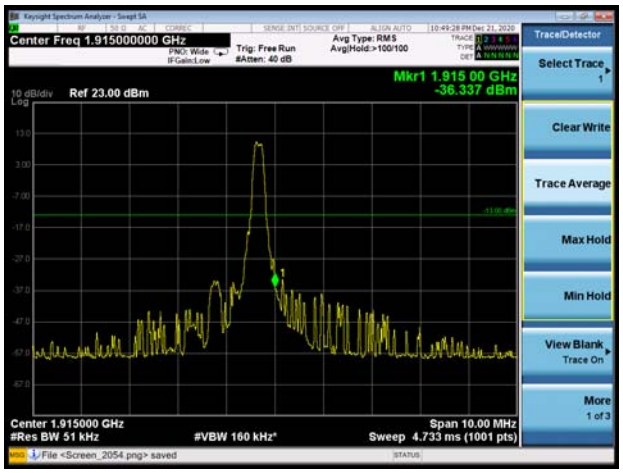
LTE Band 25 3MHz 16QAM 100%RB CH-High



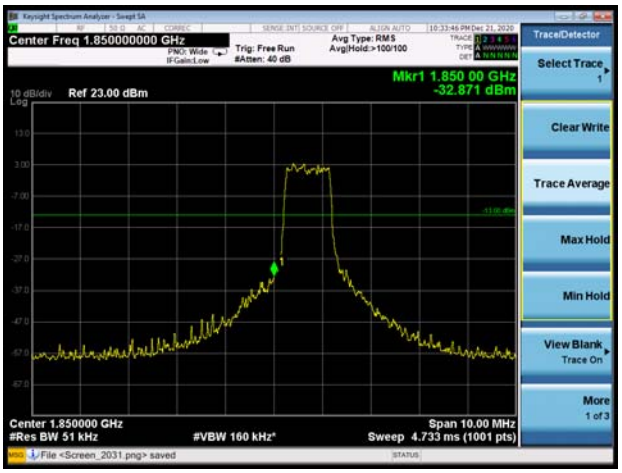
LTE Band 25 5MHz 16QAM 1RB CH-Low



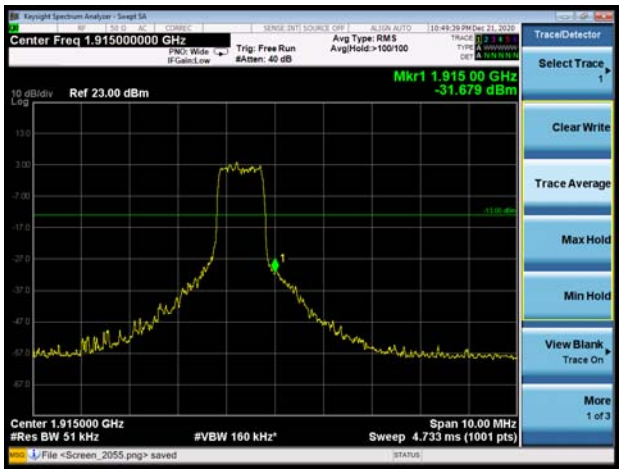
LTE Band 25 5MHz 16QAM 1RB CH-High



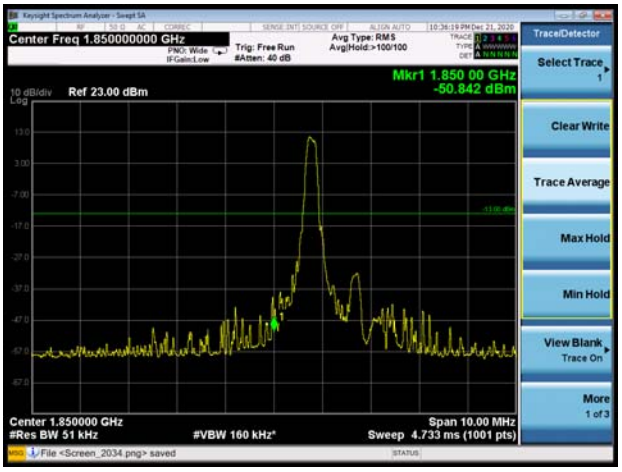
LTE Band 25 5MHz 16QAM 100%RB CH-Low



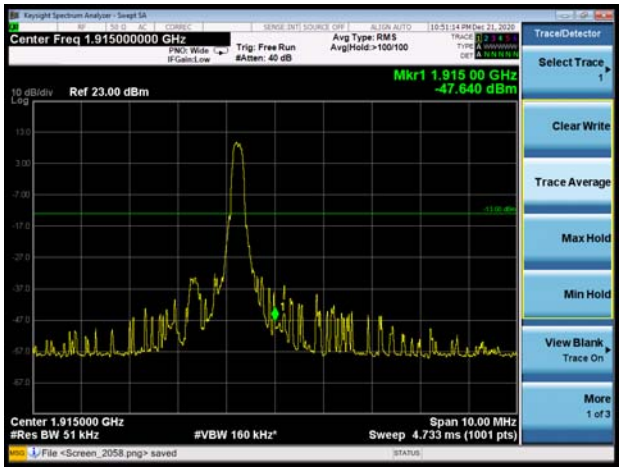
LTE Band 25 5MHz 16QAM 100%RB CH-High



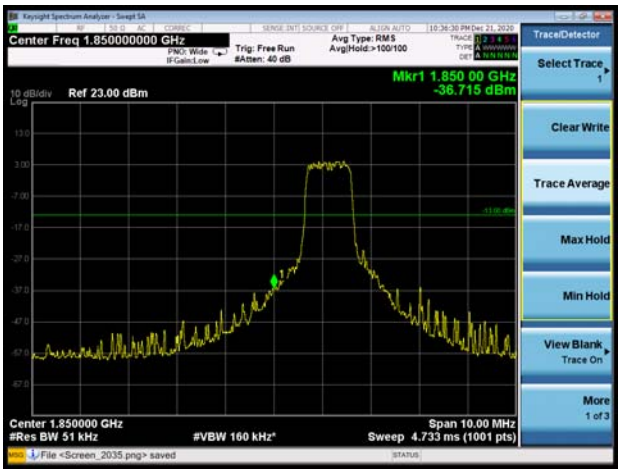
LTE Band 25 10MHz 16QAM 1RB CH-Low



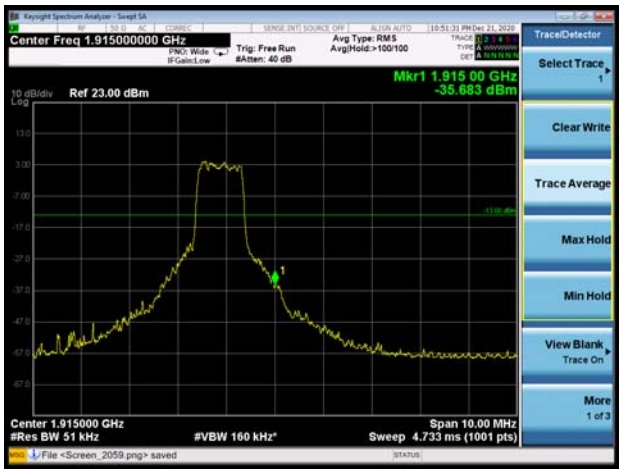
LTE Band 25 10MHz 16QAM 1RB CH-High



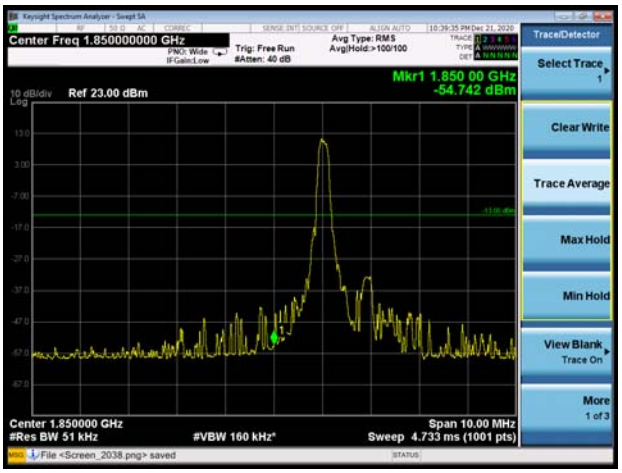
LTE Band 25 10MHz 16QAM 100%RB CH-Low



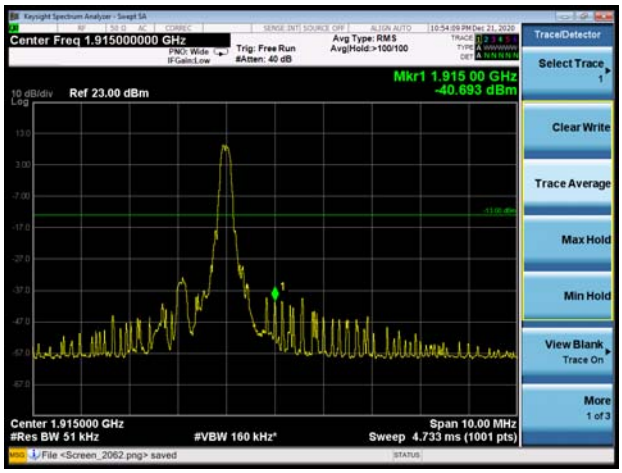
LTE Band 25 10MHz 16QAM 100%RB CH-High



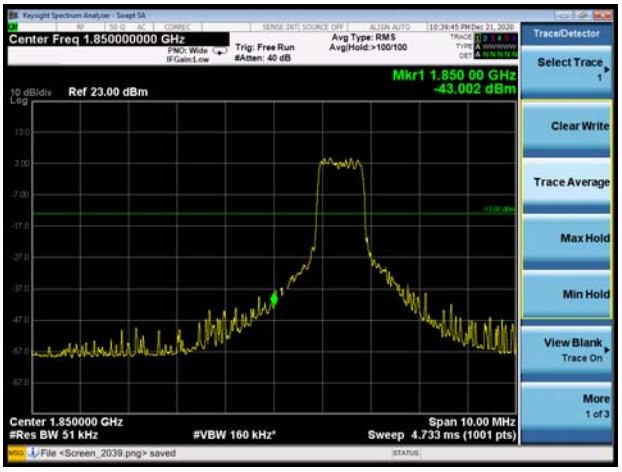
LTE Band 25 15MHz 16QAM 1RB CH-Low



LTE Band 25 15MHz 16QAM 1RB CH-High

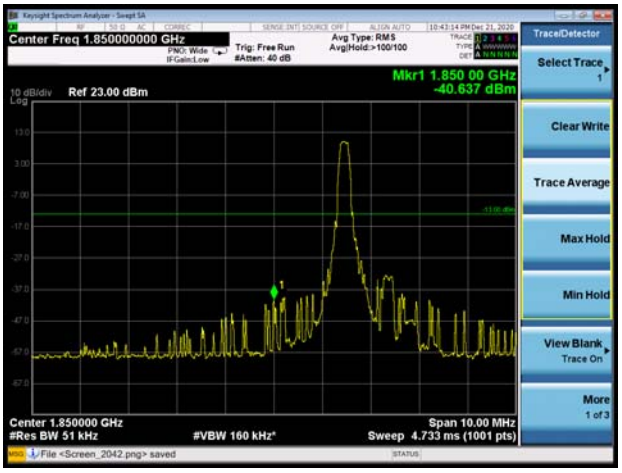


LTE Band 25 15MHz 16QAM 100%RB CH-Low

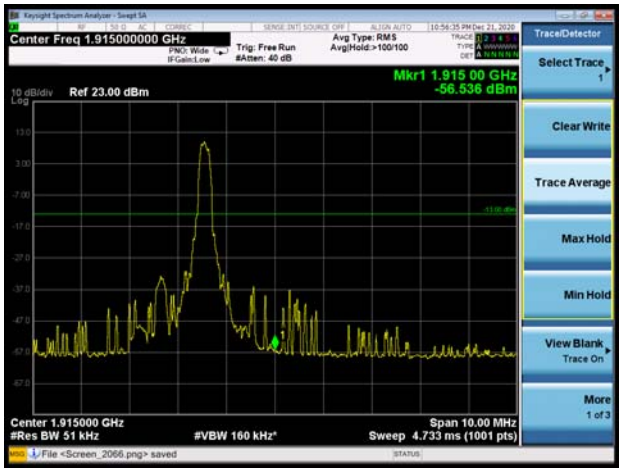


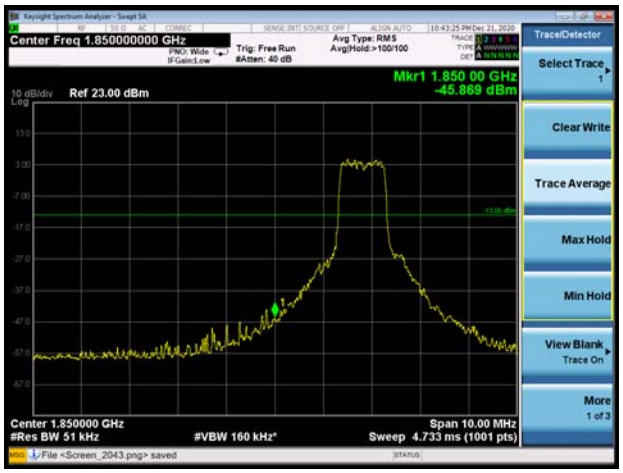
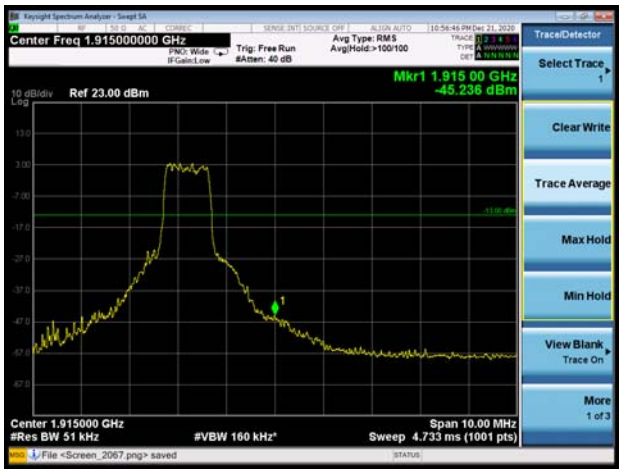
LTE Band 25 15MHz 16QAM 100%RB CH-High

LTE Band 25 20MHz 16QAM 1RB CH-Low



LTE Band 25 20MHz 16QAM 1RB CH-High



LTE Band 25 20MHz 16QAM 100%RB CH-Low	LTE Band 25 20MHz 16QAM 100%RB CH-High
	

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

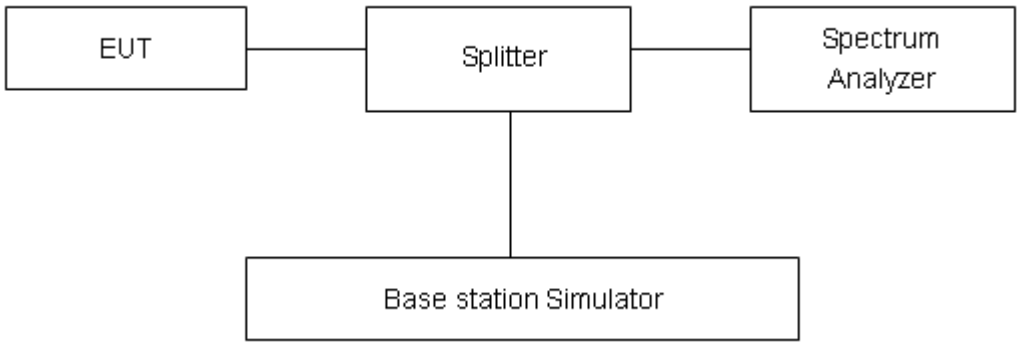
Ambient condition

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

Methods of Measurement

Measure the total peak power and record as PPk. And measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (*e.g.*, dBm). Determine the PAPR from:
PAPR (dB) = PPk (dBm) - PAvg (dBm).

Test Setup



Limits

In measuring transmissions in this band using an average power technique, the peakto-average ratio (PAR) of the transmission may not exceed 13 dB in 24.232(d).

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 2	BPSK	3.75	18900/1880.0	23.22	18.44	4.78	≤13	PASS
	QPSK	3.75	18900/1880.0	22.57	18.45	4.12	≤13	PASS
	BPSK	15	18900/1880.0	22.71	15.50	7.21	≤13	PASS
	QPSK	15	18900/1880.0	22.33	15.49	6.84	≤13	PASS

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 25	BPSK	3.75	26365/1882.5	28.59	23.82	4.77	≤13	PASS
	QPSK	3.75	26365/1882.5	28.11	20.94	7.17	≤13	PASS
	BPSK	15	26365/1882.5	27.97	23.81	4.16	≤13	PASS
	QPSK	15	26365/1882.5	27.77	20.91	6.86	≤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 2	1.4MHz	QPSK	18900/1880	22.76	12.93	9.83	≤13	PASS
		16QAM	18900/1880	23.40	12.57	10.83	≤13	PASS
	3MHz	QPSK	18900/1880	22.60	12.42	10.18	≤13	PASS
		16QAM	18900/1880	23.49	12.96	10.53	≤13	PASS
	5MHz	QPSK	18900/1880	23.53	13.89	9.64	≤13	PASS
		16QAM	18900/1880	24.20	14.06	10.14	≤13	PASS
	10MHz	QPSK	18900/1880	23.33	13.71	9.62	≤13	PASS
		16QAM	18900/1880	24.56	14.94	9.62	≤13	PASS
	15MHz	QPSK	18900/1880	24.27	15.08	9.19	≤13	PASS
		16QAM	18900/1880	24.76	15.48	9.28	≤13	PASS
	20MHz	QPSK	18900/1880	24.31	15.21	9.10	≤13	PASS
		16QAM	18900/1880	24.82	15.43	9.39	≤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 25	1.4MHz	QPSK	26365/1882.5	23.27	13.42	9.85	≤13	PASS
		16QAM	26365/1882.5	23.89	13.58	10.31	≤13	PASS
	3MHz	QPSK	26365/1882.5	23.09	13.10	9.99	≤13	PASS
		16QAM	26365/1882.5	23.73	13.29	10.44	≤13	PASS
	5MHz	QPSK	26365/1882.5	23.93	14.28	9.65	≤13	PASS
		16QAM	26365/1882.5	24.54	14.72	9.82	≤13	PASS
	10MHz	QPSK	26365/1882.5	23.88	14.59	9.29	≤13	PASS
		16QAM	26365/1882.5	24.91	15.37	9.54	≤13	PASS
	15MHz	QPSK	26365/1882.5	24.48	15.57	8.91	≤13	PASS
		16QAM	26365/1882.5	24.96	16.04	8.92	≤13	PASS
	20MHz	QPSK	26365/1882.5	24.52	15.76	8.76	≤13	PASS
		16QAM	26365/1882.5	24.93	15.66	9.27	≤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.

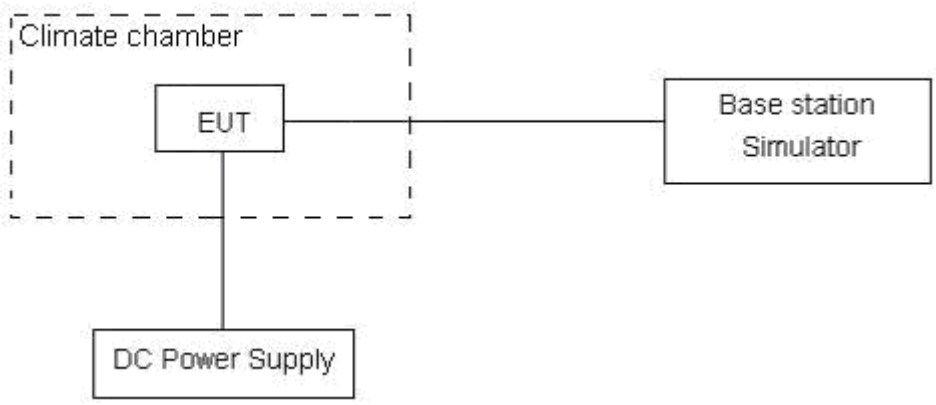
Frequency Stability (Voltage Variation)

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

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

Measurement Uncertainty

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

Test Result

NB-IOT Band 2						
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	15.50	17.21	0.00824	0.00916	PASS
Extreme（50℃）		13.60	11.10	0.00723	0.00590	PASS
Extreme（40℃）		12.40	17.93	0.00660	0.00954	PASS
Extreme（30℃）		6.92	5.44	0.00368	0.00289	PASS
Extreme（20℃）		6.87	4.34	0.00366	0.00231	PASS
Extreme（10℃）		7.60	17.92	0.00404	0.00953	PASS
Extreme（0℃）		2.58	13.41	0.00137	0.00713	PASS
Extreme（-10℃）		16.29	5.91	0.00867	0.00315	PASS
Extreme（-20℃）		7.80	9.96	0.00415	0.00530	PASS
Extreme（-30℃）		17.25	14.88	0.00918	0.00792	PASS
25℃	LV	17.24	15.02	0.00917	0.00799	PASS
	HV	3.16	15.41	0.00168	0.00820	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	1.18	12.11	0.00063	0.00644	PASS
Extreme（50℃）		10.81	2.48	0.00575	0.00132	PASS
Extreme（40℃）		10.23	6.12	0.00544	0.00326	PASS
Extreme（30℃）		14.76	1.50	0.00785	0.00080	PASS
Extreme（20℃）		7.03	9.89	0.00374	0.00526	PASS
Extreme（10℃）		7.44	6.37	0.00396	0.00339	PASS
Extreme（0℃）		14.27	16.53	0.00759	0.00879	PASS
Extreme（-10℃）		1.35	14.40	0.00072	0.00766	PASS
Extreme（-20℃）		9.64	10.83	0.00513	0.00576	PASS
Extreme（-30℃）		13.04	4.00	0.00694	0.00213	PASS
25℃	LV	4.07	6.95	0.00217	0.00370	PASS
	HV	16.99	17.24	0.00904	0.00917	PASS

NB-IOT Band 25						
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	1.08	17.60	0.00058	0.00936	PASS
Extreme（50℃）		17.94	12.13	0.00954	0.00645	PASS
Extreme（40℃）		17.47	6.62	0.00929	0.00352	PASS
Extreme（30℃）		11.62	17.83	0.00618	0.00948	PASS
Extreme（20℃）		14.30	6.62	0.00761	0.00352	PASS
Extreme（10℃）		16.90	14.59	0.00899	0.00776	PASS
Extreme（0℃）		3.89	4.32	0.00207	0.00230	PASS
Extreme（-10℃）		16.06	6.57	0.00854	0.00350	PASS
Extreme（-20℃）		16.38	12.81	0.00871	0.00681	PASS
Extreme（-30℃）		4.45	13.22	0.00237	0.00703	PASS
25℃	LV	5.70	14.48	0.00303	0.00770	PASS
	HV	6.39	8.36	0.00340	0.00445	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	13.20	9.17	0.00702	0.00488	PASS
Extreme（50℃）		1.51	8.23	0.00080	0.00438	PASS
Extreme（40℃）		3.82	4.52	0.00203	0.00241	PASS
Extreme（30℃）		12.68	13.50	0.00675	0.00718	PASS
Extreme（20℃）		4.22	6.78	0.00225	0.00360	PASS
Extreme（10℃）		1.38	15.61	0.00073	0.00831	PASS
Extreme（0℃）		14.04	15.25	0.00747	0.00811	PASS
Extreme（-10℃）		5.54	12.76	0.00295	0.00679	PASS
Extreme（-20℃）		15.80	4.78	0.00840	0.00254	PASS
Extreme（-30℃）		11.99	8.45	0.00638	0.00449	PASS
25℃	LV	6.96	2.99	0.00370	0.00159	PASS
	HV	15.78	13.89	0.00839	0.00739	PASS

LTE Band 2						
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	2.62	17.65	0.00139	0.00939	PASS
Extreme（50℃）		12.35	17.27	0.00657	0.00919	PASS
Extreme（40℃）		4.44	2.37	0.00236	0.00126	PASS
Extreme（30℃）		6.41	12.29	0.00341	0.00654	PASS
Extreme（20℃）		13.00	9.46	0.00692	0.00503	PASS
Extreme（10℃）		8.72	17.35	0.00464	0.00923	PASS
Extreme（0℃）		6.60	15.18	0.00351	0.00807	PASS
Extreme（-10℃）		2.35	16.00	0.00125	0.00851	PASS
Extreme（-20℃）		9.96	15.31	0.00530	0.00814	PASS
Extreme（-30℃）		11.11	8.35	0.00591	0.00444	PASS
25℃	LV	5.49	11.89	0.00292	0.00632	PASS
	HV	7.66	4.83	0.00407	0.00257	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	6.60	3.32	0.00351	0.00177	PASS
Extreme（50℃）		15.50	9.12	0.00824	0.00485	PASS
Extreme（40℃）		14.14	13.42	0.00752	0.00714	PASS
Extreme（30℃）		16.29	8.68	0.00866	0.00462	PASS
Extreme（20℃）		11.48	15.70	0.00611	0.00835	PASS
Extreme（10℃）		8.49	14.19	0.00452	0.00755	PASS
Extreme（0℃）		1.72	15.22	0.00091	0.00810	PASS
Extreme（-10℃）		12.31	6.63	0.00655	0.00352	PASS
Extreme（-20℃）		13.64	16.77	0.00726	0.00892	PASS
Extreme（-30℃）		15.20	15.90	0.00808	0.00846	PASS
25℃	LV	15.25	17.64	0.00811	0.00938	PASS
	HV	13.55	11.39	0.00721	0.00606	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	11.16	16.00	0.00593	0.00851	PASS
Extreme（50℃）		8.49	15.60	0.00451	0.00830	PASS
Extreme（40℃）		15.26	7.38	0.00812	0.00393	PASS
Extreme（30℃）		8.05	9.28	0.00428	0.00494	PASS

Extreme（20℃）		12.75	6.22	0.00678	0.00331	PASS
Extreme（10℃）		7.00	1.83	0.00372	0.00097	PASS
Extreme（0℃）		15.95	10.26	0.00848	0.00546	PASS
Extreme（-10℃）		4.14	10.32	0.00220	0.00549	PASS
Extreme（-20℃）		11.37	15.75	0.00605	0.00838	PASS
Extreme（-30℃）		16.45	9.97	0.00875	0.00530	PASS
25℃	LV	6.01	14.74	0.00320	0.00784	PASS
	HV	17.38	9.71	0.00924	0.00516	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	8.11	13.95	0.00431	0.00742	PASS
Extreme（50℃）		4.29	9.67	0.00228	0.00514	PASS
Extreme（40℃）		9.62	7.62	0.00512	0.00405	PASS
Extreme（30℃）		8.33	6.59	0.00443	0.00350	PASS
Extreme（20℃）		1.57	17.43	0.00083	0.00927	PASS
Extreme（10℃）		12.24	8.95	0.00651	0.00476	PASS
Extreme（0℃）		8.38	8.18	0.00446	0.00435	PASS
Extreme（-10℃）		1.10	16.18	0.00058	0.00860	PASS
Extreme（-20℃）		6.20	15.46	0.00330	0.00823	PASS
Extreme（-30℃）		4.87	13.04	0.00259	0.00693	PASS
25℃	LV	13.18	4.61	0.00701	0.00245	PASS
	HV	13.39	12.22	0.00712	0.00650	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	16.66	8.25	0.00886	0.00439	PASS
Extreme（50℃）		9.46	2.81	0.00503	0.00150	PASS
Extreme（40℃）		9.61	7.41	0.00511	0.00394	PASS
Extreme（30℃）		16.89	7.95	0.00898	0.00423	PASS
Extreme（20℃）		11.92	13.09	0.00634	0.00696	PASS
Extreme（10℃）		8.18	2.46	0.00435	0.00131	PASS
Extreme（0℃）		11.78	9.66	0.00627	0.00514	PASS
Extreme（-10℃）		4.64	10.52	0.00247	0.00560	PASS
Extreme（-20℃）		1.05	17.87	0.00056	0.00950	PASS
Extreme（-30℃）		13.28	14.40	0.00706	0.00766	PASS
25℃	LV	8.20	5.35	0.00436	0.00285	PASS
	HV	12.08	2.55	0.00642	0.00135	PASS
Condition		Freq.Error	Freq.Error	Frequency	Frequency	Verdict

		(Hz)	(Hz)	Stability （ppm）	Stability （ppm）	
BANDWIDTH	20MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal（25℃）	Normal	6.56	3.13	0.00349	0.00167	PASS
Extreme（50℃）		5.68	5.56	0.00302	0.00296	PASS
Extreme（40℃）		1.76	16.80	0.00093	0.00894	PASS
Extreme（30℃）		7.07	13.13	0.00376	0.00698	PASS
Extreme（20℃）		12.80	2.36	0.00681	0.00126	PASS
Extreme（10℃）		4.40	10.40	0.00234	0.00553	PASS
Extreme（0℃）		13.72	12.26	0.00730	0.00652	PASS
Extreme（-10℃）		11.17	8.28	0.00594	0.00441	PASS
Extreme（-20℃）		5.33	14.80	0.00284	0.00787	PASS
Extreme（-30℃）		16.83	1.53	0.00895	0.00081	PASS
25℃	LV	8.35	1.94	0.00444	0.00103	PASS
	HV	9.34	10.84	0.00497	0.00577	PASS

LTE Band 25						
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	5.66	17.33	0.00301	0.00922	PASS
Extreme（50℃）		17.59	5.25	0.00936	0.00279	PASS
Extreme（40℃）		9.41	14.14	0.00501	0.00752	PASS
Extreme（30℃）		2.73	17.33	0.00145	0.00922	PASS
Extreme（20℃）		15.46	5.62	0.00822	0.00299	PASS
Extreme（10℃）		7.70	4.83	0.00410	0.00257	PASS
Extreme（0℃）		14.58	11.46	0.00776	0.00610	PASS
Extreme（-10℃）		16.38	3.01	0.00871	0.00160	PASS
Extreme（-20℃）		1.30	5.35	0.00069	0.00285	PASS
Extreme（-30℃）		2.69	3.10	0.00143	0.00165	PASS
25℃	LV	16.77	11.98	0.00892	0.00637	PASS
	HV	14.32	14.97	0.00762	0.00796	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	4.54	5.66	0.00241	0.00301	PASS
Extreme（50℃）		7.75	3.88	0.00412	0.00206	PASS
Extreme（40℃）		10.38	3.87	0.00552	0.00206	PASS
Extreme（30℃）		2.93	12.26	0.00156	0.00652	PASS

Extreme（20℃）		16.83	13.02	0.00895	0.00692	PASS
Extreme（10℃）		4.56	8.73	0.00242	0.00464	PASS
Extreme（0℃）		12.28	11.35	0.00653	0.00604	PASS
Extreme（-10℃）		7.72	10.17	0.00410	0.00541	PASS
Extreme（-20℃）		5.99	12.97	0.00318	0.00690	PASS
Extreme（-30℃）		8.72	3.88	0.00464	0.00206	PASS
25℃	LV	11.48	2.85	0.00611	0.00151	PASS
	HV	2.09	7.95	0.00111	0.00423	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	5.69	15.68	0.00302	0.00834	PASS
Extreme（50℃）		6.01	7.08	0.00320	0.00377	PASS
Extreme（40℃）		16.40	9.85	0.00872	0.00524	PASS
Extreme（30℃）		12.32	6.37	0.00655	0.00339	PASS
Extreme（20℃）		6.53	7.65	0.00347	0.00407	PASS
Extreme（10℃）		16.89	4.73	0.00898	0.00251	PASS
Extreme（0℃）		10.20	10.61	0.00543	0.00564	PASS
Extreme（-10℃）		10.08	6.96	0.00536	0.00370	PASS
Extreme（-20℃）		3.57	10.60	0.00190	0.00564	PASS
Extreme（-30℃）		5.02	17.11	0.00267	0.00910	PASS
25℃	LV	2.60	1.31	0.00138	0.00069	PASS
	HV	15.83	3.78	0.00842	0.00201	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	13.69	10.21	0.00728	0.00543	PASS
Extreme（50℃）		9.88	17.52	0.00526	0.00932	PASS
Extreme（40℃）		10.25	6.03	0.00545	0.00321	PASS
Extreme（30℃）		9.86	14.91	0.00525	0.00793	PASS
Extreme（20℃）		16.79	14.20	0.00893	0.00755	PASS
Extreme（10℃）		9.93	11.61	0.00528	0.00618	PASS
Extreme（0℃）		5.32	1.65	0.00283	0.00088	PASS
Extreme（-10℃）		9.05	4.74	0.00481	0.00252	PASS
Extreme（-20℃）		10.64	7.20	0.00566	0.00383	PASS
Extreme（-30℃）		16.12	10.58	0.00857	0.00563	PASS
25℃	LV	5.32	13.21	0.00283	0.00702	PASS
	HV	7.56	5.80	0.00402	0.00308	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability	Frequency Stability	Verdict

BANDWIDTH	15MHz			（ppm）	（ppm）	
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal（25℃）	Normal	7.88	13.40	0.00419	0.00713	PASS
Extreme（50℃）		10.73	5.45	0.00571	0.00290	PASS
Extreme（40℃）		13.03	16.55	0.00693	0.00880	PASS
Extreme（30℃）		16.08	5.67	0.00855	0.00302	PASS
Extreme（20℃）		8.58	3.21	0.00457	0.00171	PASS
Extreme（10℃）		7.77	12.89	0.00413	0.00686	PASS
Extreme（0℃）		2.92	5.47	0.00155	0.00291	PASS
Extreme（-10℃）		8.04	10.00	0.00428	0.00532	PASS
Extreme（-20℃）		1.56	6.47	0.00083	0.00344	PASS
Extreme（-30℃）		2.52	9.99	0.00134	0.00531	PASS
25℃	LV	1.73	10.35	0.00092	0.00550	PASS
	HV	16.05	7.64	0.00854	0.00406	PASS
Condition		Freq.Error (Hz)	Freq.Error (Hz)	Frequency Stability （ppm）	Frequency Stability （ppm）	Verdict
BANDWIDTH	20MHz					
Temperature	Voltage	16QAM	QPSK	16QAM	QPSK	
Normal（25℃）	Normal	7.91	11.33	0.00421	0.00602	PASS
Extreme（50℃）		10.12	17.58	0.00538	0.00935	PASS
Extreme（40℃）		5.09	4.62	0.00271	0.00246	PASS
Extreme（30℃）		2.10	2.50	0.00112	0.00133	PASS
Extreme（20℃）		13.30	15.70	0.00707	0.00835	PASS
Extreme（10℃）		17.91	8.26	0.00952	0.00440	PASS
Extreme（0℃）		15.09	3.06	0.00803	0.00163	PASS
Extreme（-10℃）		12.65	17.37	0.00673	0.00924	PASS
Extreme（-20℃）		14.96	16.46	0.00796	0.00875	PASS
Extreme（-30℃）		6.99	12.38	0.00372	0.00658	PASS
25℃	LV	4.23	14.01	0.00225	0.00745	PASS
	HV	6.39	4.06	0.00340	0.00216	PASS