TEST REPORT

Dt&C Co., Ltd.
42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042
Tel : 031-321-2664, Fax : 031-321-1664

1. Report No : DRTFCC2407-0082

2. Customer

- Name (FCC) : BLUEBIRD INC.
- Address (FCC) : 3F, 115, Irwon-ro, Gangnam-gu, Seoul South Korea

3. Use of Report : FCC Certification

4. Product Name / Model Name : Enterprise Full Touch Handheld Computer / S50
FCC ID : SS4S50F1

5. FCC Regulation(s): Part 96
Test Method Used : KDB971168 D01v03, ANSI/TIA-603-E-2016, ANSI C63.26-2015

6. Date of Test : 2024.05.16 ~ 2024.07.24

7. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

8. Testing Environment : See appended test report.

9. Test Result : Refer to the attached Test Result

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test report is not related to KOLAS accreditation.

Affirmation	Tested by Name : SeokHo Han	Technical Manager Name : JaeJin Lee

2024 . 07 . 24 .

Dt&C Co., Ltd.

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2407-0082	Jul. 24, 2024	Initial issue	SeokHo Han	JaeJin Lee

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1. GENERAL INFORMATION

FCC Classification	Citizens Band End User Devices (CBE)
FCC ID	SS4S50F1
Product Name	Enterprise Full Touch Handheld Computer
Model Name(s)	S50, S70
FVIN(Firmware Version Identification Number)	R1.00
EUT Serial Number	Conducted: S50A5LAWBA320, S50A5LAWBA326 Radiated: S50A5LAWBA321
Supplying power	DC 3.85 V
Modulation type	QPSK, 16QAM, 64QAM, 256QAM
Channel Bandwidth(MHz)	LTE Band 48: 20, 15, 10, 5
Antenna Type	LDS Antenna
Antenna Gain (dBi)	LTE Band 48 (Antenna 4): 0.43

LTE Frequency Band	Channel Bandwidth (MHz)	Modulation	TX Frequency (MHz)	Emission Designator	Conducted Output Power		EIRP	
					Max power (dBm/10MHz)	Max power (W/10MHz)	Max power (dBm/10MHz)	Max power (W/10MHz)
LTE Band 48	20	QPSK	3 560 ~ 3 690	17M9G7D	21.85	0.153	22.28	0.169
LTE Band 48	20	16QAM	3 560 ~ 3 690	17M8W7D	20.85	0.122	21.28	0.134
LTE Band 48	20	64QAM	3 560 ~ 3 690	17M9W7D	19.68	0.093	20.11	0.103
LTE Band 48	20	256QAM	3 560 ~ 3 690	17M9W7D	17.05	0.051	17.48	0.056
LTE Band 48	15	QPSK	3 557.5 ~ 3 692.5	13M4G7D	21.97	0.157	22.40	0.174
LTE Band 48	15	16QAM	3 557.5 ~ 3 692.5	13M4W7D	21.16	0.131	21.59	0.144
LTE Band 48	15	64QAM	3 557.5 ~ 3 692.5	13M4W7D	20.12	0.103	20.55	0.114
LTE Band 48	15	256QAM	3 557.5 ~ 3 692.5	13M4W7D	17.39	0.055	17.82	0.061
LTE Band 48	10	QPSK	3 555 ~ 3 695	8M93G7D	22.26	0.168	22.69	0.186
LTE Band 48	10	16QAM	3 555 ~ 3 695	8M96W7D	21.15	0.130	21.58	0.144
LTE Band 48	10	64QAM	3 555 ~ 3 695	8M95W7D	20.27	0.106	20.70	0.117
LTE Band 48	10	256QAM	3 555 ~ 3 695	8M96W7D	17.39	0.055	17.82	0.061
LTE Band 48	5	QPSK	3 552.5 ~ 3 697.5	4M46G7D	21.94	0.156	22.37	0.173
LTE Band 48	5	16QAM	3 552.5 ~ 3 697.5	4M48W7D	21.52	0.142	21.95	0.157
LTE Band 48	5	64QAM	3 552.5 ~ 3 697.5	4M49W7D	19.94	0.099	20.37	0.109
LTE Band 48	5	256QAM	3 552.5 ~ 3 697.5	4M49W7D	17.13	0.052	17.56	0.057

2. INTRODUCTION

2.1. EUT DESCRIPTION

The Equipment Under Test (EUT) supports 850/1900 GSM, 850/1700/1900 WCDMA, Multi-band LTE/5GNR, 2.4/5/6GHz WLAN, Bluetooth(BDR, EDR, BLE) and NFC.

2.2. TESTING ENVIRONMENT

Ambient Condition	
▪ Temperature	+23 ℃ ~ +24 ℃
▪ Relative Humidity	45 % ~ 50 %

2.3. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

2.4. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C 63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Radiated Disturbance (Below 1 GHz)	5.0 dB (The confidence level is about 95 %, k = 2)
Radiated Disturbance (1 GHz ~ 18 GHz)	4.8 dB (The confidence level is about 95 %, k = 2)
Radiated Disturbance (Above 18 GHz)	5.0 dB (The confidence level is about 95 %, k = 2)

2.5. TEST FACILITY

Dt&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.
The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.

- FCC & IC MRA Designation No. : KR0034

- ISED#: 5740A

www.dtnc.net

Telephone	:	+ 82-31-321-2664
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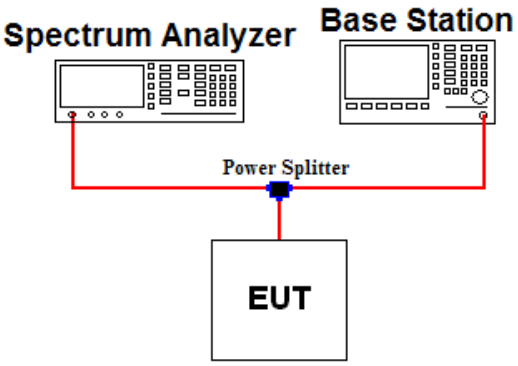
3. DESCRIPTION OF TESTS

3.1. MAXIMUM OUTPUT POWER

Conducted Output Power

Test Set-up



Test Procedure

- **KDB971168 D01v03 - Section 5.4**
- **ANSI C63.26-2015 – Section 5.2.4.5, 5.2.4.4.2**

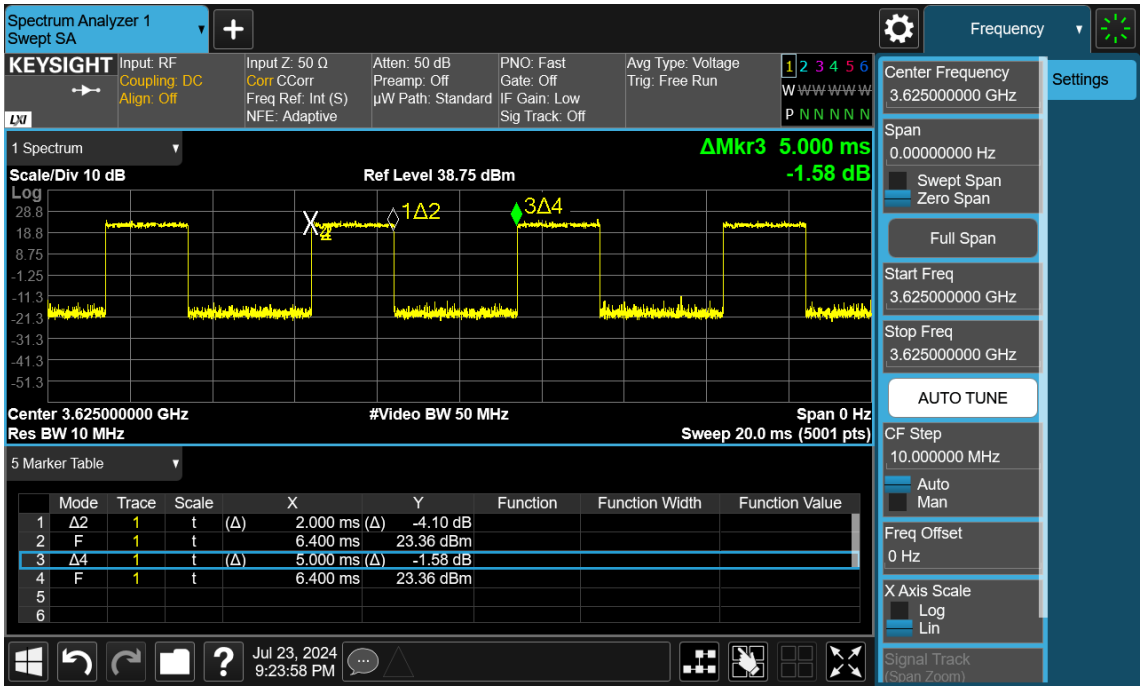
Test setting

1. Set span to 2 x to 3 x the OBW.
2. Set RBW = 10 MHz
3. Set VBW ≥ 3 x RBW.
4. Set number of points in sweep ≥ 2 × span / RBW.
5. Sweep time:
   1) Set = auto-couple, or
   2) Set ≥ [10 × (number of points in sweep) × (transmission symbol period)] for single sweep (automation-compatible) measurement.
6. Detector = power averaging (rms).
7. Set sweep trigger to “free run”
8. Trace average at least 100 traces in power averaging (rms) mode if sweep is set to auto-couple. To accurately determine the average power over the on and off time of the transmitter, it can be necessary to increase the number of traces to be averaged above 100, or if using a manually configured sweep time, increase the sweep time.
9. By using the marker function to identify the maximum PSD instead of summing the power across the OBW.
10. Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission. For example, add [10 log (1/0.25)] = 6 dB if the duty cycle is a constant 25 %.

Note 1: Please refer to next page for duty cycle.

EUT duty cycle

LTE Band	T_{on}(ms)	T_{on+off} (ms)	Duty cycle = T_{on} / (T_{on+off})	10 log (1/duty cycle)
LTE Band 48	2.000	5.000	0.40	**3.98 dB**



20 MHz / QPSK / FULL RB Size

- ERP & EIRP (Effective Radiated Power & Equivalent Isotropic Radiated Power)

Test Procedure

- **KDB971168 D01v03 - Section 5.6**
- **ANSI C63.26-2015 – Section 5.2.5.5**

Determining ERP and EIRP from conducted RF output power measurement results

ERP or EIRP = $P_{Meas} + G_T - L_C$

where:

ERP or EIRP = effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, typically dBW or dBm);

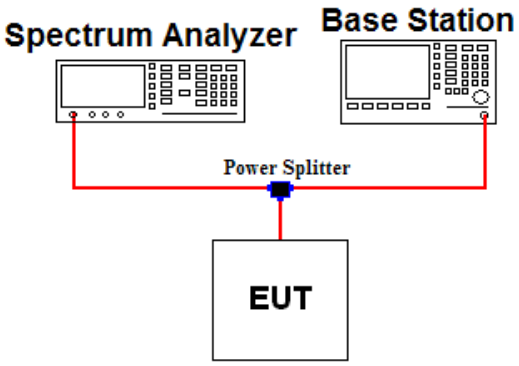
P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;

G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

3.2. PEAK TO AVERAGE RATIO

Test set-up



Test Procedure

- **KDB971168 D01v03 - Section 5.7.2**
- **ANSI C63.26-2015 – Section 5.2.3.4**

A peak to average ratio measurement is performed at the conducted port of the EUT.
The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The present of time the signal spends at or above the level defines the probability for that particular power level.

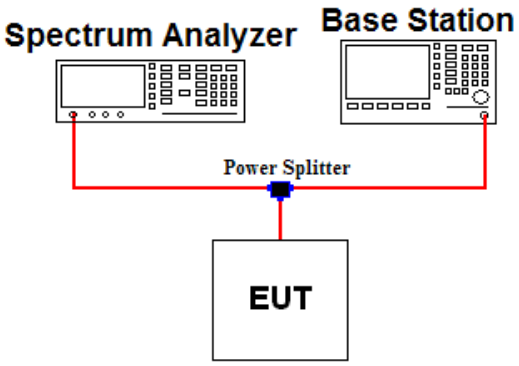
Test setting

The spectrum Analyzer`s CCDF measurement function is enabled.

1. Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth.
2. Set the number of counts to a value that stabilizes the measured CCDF curve.
3. Set the measurement interval as follows:
   1) For continuous transmissions, set to the greater of [10 × (number of points in sweep) × (transmission symbol period)] or 1 ms.
   2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
   3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
4. Record the maximum PAPR level associated with a probability of 0.1 %.
5. The peak power level is calculated form the sum of the PAPR value from step d) to the measured average power.

3.3. OCCUPIED BANDWIDTH

Test set-up



Test Procedure

- **KDB971168 D01v03 - Section 4.3**
- **ANSI C63.26-2015 – Section 5.4.4**

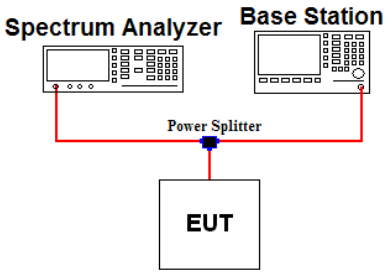
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power of a given emission.

Test setting

1. The signal analyzer`s automatic bandwidth measurement capability was used to perform the 99 % occupied bandwidth and the 26 dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 % ~ 5 % of the expected OBW & VBW ≥ 3 X RBW
3. Detector = Peak
4. Trance mode = Max hold
5. Sweep = Auto couple
6. The trace was allowed to stabilize
7. If necessary, step 2 ~ 6 were repeated after changing the RBW such that it would be within 1 % ~ 5 % of the 99 % occupied bandwidth observed in step 6.

3.4. BAND EDGE EMISSIONS AT ANTENNA TERMINAL

Test set-up



Test Procedure

- **KDB971168 D01v03 - Section 6**
- **ANSI C63.26-2015 – Section 5.7**

All out of band emissions are measured by means of a calibrated spectrum analyzer. The EUT was setup to maximum output power at its lowest and highest channel with all bandwidths, modulations and RB configurations.

Test setting

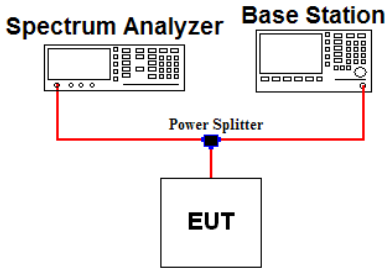
1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW ≥ 1 % of the emission bandwidth or Specified bandwidth
4. VBW ≥ 3 X RBW
5. Detector = RMS & Trace mode = Average
6. Sweep time = Auto couple or 1 s for band edge
7. Number of sweep point ≥ 2 X span / RBW
8. The trace was allowed to stabilize

Note 1: For TDD signal, the trace mode was set to average and trigger was set to free run.
And added 10 log (1/duty cycle) to the measured level. (Path loss was applied to the spectrum correction factor function, and 10 log (1/duty cycle) was applied to the spectrum offset function during measurement. Please refer to the section 3.1 for duty cycle.

Part 96.41(e)
(1) 3.5 GHz Emissions and Interference Limits
(i) Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by the SAS to CBSDs, the conducted power of any CBSD emission outside the fundamental emission bandwidth as specified in paragraph (e)(3) of this section (whether the emission is inside or outside of the authorized band) shall not exceed −13 dBm/MHz within 0–10 megahertz above the upper SAS-assigned channel edge and within 0–10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any CBSD emission shall not exceed −25 dBm/MHz. The upper and lower SAS assigned channel edges are the upper and lower limits of any channel assigned to a CBSD by an SAS, or in the case of multiple contiguous channels, the upper and lower limits of the combined contiguous channels.
(ii) Except as otherwise specified in paragraph (e)(2) of this section, for channel and frequency assignments made by a CBSD to End User Devices, the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed −13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed −25 dBm/MHz. Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB.
(2) *Additional protection levels.* Notwithstanding paragraph (e)(1) of this section, for CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

3.5. SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL

Test set-up



Test Procedure

- **KDB971168 D01v03 - Section 6**
- **ANSI C63.26-2015 – Section 5.7**

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The EUT was setup to maximum output power at its low, middle, high channel with all bandwidths, modulations and RB configurations. The spectrum is scanned from 9 kHz up to a frequency including its 10^{th} harmonic.

The conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

Test setting

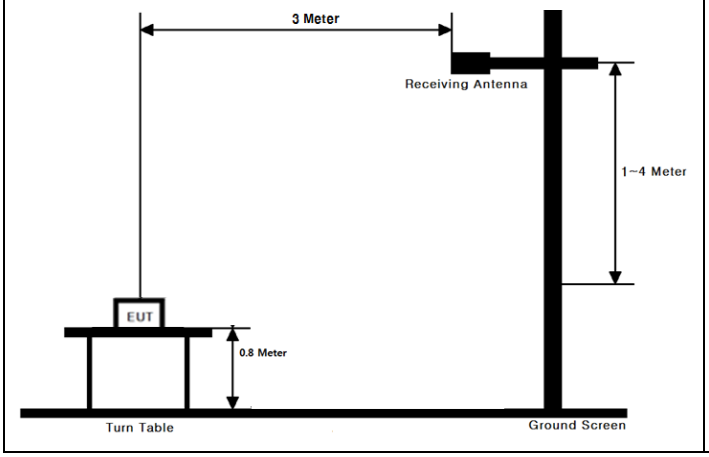
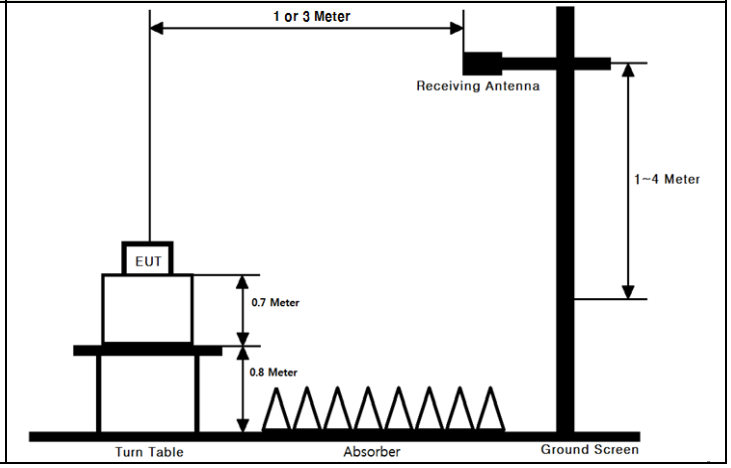
1. RBW = 1 MHz & VBW ≥ 3 X RBW (Refer to Note 2)
2. Detector = RMS & Trace mode = Average
3. Sweep time = Auto couple or 1 s
4. Number of sweep point ≥ 2 X span / RBW
5. The trace was allowed to stabilize

Note 1: For TDD signal, the trace mode was set to average and trigger was set to free run.
And added 10 log (1/duty cycle) to the measured level. (Path loss was applied to the spectrum correction factor function, and 10 log (1/duty cycle) was applied to the spectrum offset function during measurement. Please refer to the section 3.1 for duty cycle.

Note 2: Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and 1 MHz or greater for frequencies greater than 1GHz.

3.6. UNDESIRABLE EMISSIONS

Test Set-up

Below 1GHz	Above 1GHz
	

These measurements were performed at 3 test site. The equipment under test is placed on a non-conductive table 0.8 or 1.5 meters above a turntable which is flush with the ground plane and 3 meters from the receive antenna. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.

Test Procedure

- **KDB971168 D01v03 - Section 6**
- **ANSI C63.26-2015 – Section 5.5**
- **ANSI/TIA-603-E-2016 - Section 2.2.12**

Test setting

1. RBW = 100 kHz for below 1 GHz and 1 MHz for above 1 GHz / VBW ≥ 3 X RBW
2. Detector = RMS & Trace mode = power averaging (rms)
3. Sweep time = Auto couple
4. Number of sweep point ≥ 2 X span / RBW
5. The trace was allowed to stabilize

Note: If duty cycle < 98%, add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission. Please refer to the section 3.1 for duty cycle.

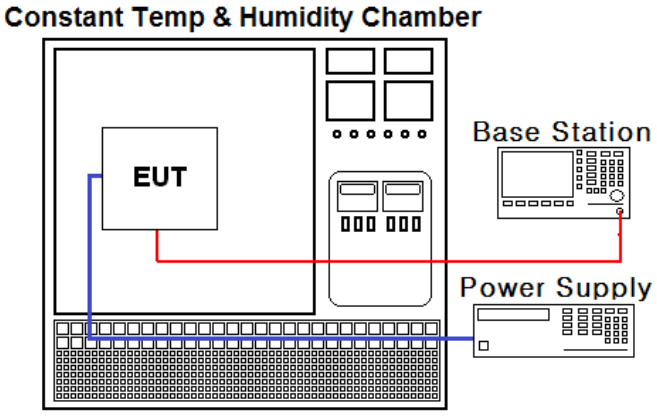
The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer.

For radiated power measurements below 1 GHz, a half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading.

For radiated power measurements above 1 GHz, a Horn antenna was substituted in place of the EUT. This Horn antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same spectrum analyzer reading. The difference between the gain of the horn and an isotropic antenna are taken into consideration. This measurement was performed with the EUT oriented in 3 orthogonal axis.

3.7. FREQUENCY STABILITY

Test Set-up



Test Procedure

- **KDB971168 D01v03 - Section 9**
- **ANSI/TIA-603-E-2016**

The frequency stability of the transmitter is measured by:

a.) **Temperature:**
The temperature is varied from -30 °C to +50 °C using an environmental chamber.

b.) **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.

Specification:
Part 2.1055: The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature.
   (20 °C to provide a reference)
2. The equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10 °C intervals ranging from -30 °C to +50 °C.
   A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

4. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal. Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	23/12/15	24/12/15	MY50110097
Spectrum Analyzer	KEYSIGHT	N9030B	23/12/15	24/12/15	MY55480168
DC power supply	H.P	66332A	23/12/15	24/12/15	US37471368
Multimeter	FLUKE	17B+	23/12/15	24/12/15	36390701WS
Power Splitter	Anritsu	K241B	23/06/23 24/06/04	24/06/23 25/06/04	020611
Temp & Humi	SJ Science	SJ-TH-S50	23/06/22 24/06/11	24/06/22 25/06/11	SJ-TH-S50-130930
Radio Communication Analyzer	Anritsu	MT8821C	23/12/15	24/12/15	6262062793
Thermohygrometer	BODYCOM	BJ5478	23/12/15	24/12/15	120612-1
Thermohygrometer	BODYCOM	BJ5478	23/12/15	24/12/15	120612-2
Signal Generator	Rohde Schwarz	SMBV100A	23/12/15	24/12/15	255571
Signal Generator	ANRITSU	MG3695C	23/12/15	24/12/15	173501
Loop Antenna	ETS-Lindgren	6502	23/11/09	24/11/09	00060496
BILOG ANTENNA	Schwarzbeck	VULB9160	23/12/15	24/12/15	3362
Dipole Antenna	Schwarzbeck	UHA9105	22/12/16	24/12/16	2262
HORN ANT	ETS	3117	23/12/15	24/12/15	00140394
HORN ANT	A.H.Systems	SAS-574	23/06/23 24/06/11	24/06/23 25/06/11	155
PreAmplifier	H.P	8447D	23/12/15	24/12/15	2944A07774
PreAmplifier	Agilent	8449B	23/12/15	24/12/15	3008A02108
PreAmplifier	tsj	MLA-1840-J02-45	23/06/23 24/06/03	24/06/23 25/06/03	16966-10728
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	23/12/15	24/12/15	7
High Pass Filter	Wainwright Instruments	WHKX6-6320-8000-26500-40CC	23/12/15	24/12/15	2
High-pass filter	Wainwright	WHNX5.0/26.5G-6SS	23/06/23 24/06/04	24/06/23 25/06/04	8
Cable	HUBER+SUHNER	SUCOFLEX100	24/01/03	25/01/03	M-1
Cable	HUBER+SUHNER	SUCOFLEX100	24/01/03	25/01/03	M-2
Cable	Junkosha	MWX241/B	24/01/03	25/01/03	M-3
Cable	Junkosha	MWX221	24/01/03	25/01/03	M-4
Cable	Junkosha	MWX221	24/01/03	25/01/03	M-5
Cable	JUNFLON	J12J101757-00	24/01/03	25/01/03	M-7
Cable	HUBER+SUHNER	SUCOFLEX104	24/01/03	25/01/03	M-8
Cable	HUBER+SUHNER	SUCOFLEX106	24/01/03	25/01/03	M-9
Cable	Junkosha	MWX315	24/01/03	25/01/03	M-10
Cable	Junkosha	MWX241	24/01/03	25/01/03	mmW-1
Cable	Junkosha	MWX241	24/01/03	25/01/03	mmW-4
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0185

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.
Note2: The cable is not a regular calibration item, so it has been calibrated by Dt&C itself.

5. SUMMARY OF TEST RESULTS

FCC Part Section(s)	Test Description	Test Limit	Status Note 1
2.1046	Conducted Output Power	N/A	C Note2
96.41(b)	Maximum EIRP	< 23 dBm / 10MHz (End user device)	C
2.1049	Occupied Bandwidth	N/A	C
96.41(g)	Peak to Average Ratio	< 13 dB	C
2.1051 96.41(e)	Band Edge / Conducted Spurious Emissions	Refer to the Section 3.4	C
2.1055	Frequency Stability	Within the authorized frequency band	C
2.1053 96.41	Undesirable Emissions	< -40 dBm / MHz	C Note3

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable
Note 2: Refer to SAR Test Report for total conducted output power.
Note 3: This test item was performed in three orthogonal EUT positions and the worst case data was reported.

6. SAMPLE CALCULATION

A. Emission Designator

LTE Band 48(QPSK)

Emission Designator = **17M9G7D**
OBW = 17.890 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data Transmission

LTE Band 48(16QAM)

Emission Designator = **17M8W7D**
OBW = 17.808 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data Transmission

LTE Band 48(64QAM)

Emission Designator = **17M9W7D**
OBW = 17.861 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data Transmission

LTE Band 48(256QAM)

Emission Designator = **17M9W7D**
OBW = 17.853 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data Transmission

B. For substitution method

Unwanted emissions

1) The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1 GHz respectively above ground.
2) The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
3) Vary the measurement antenna height through 1 m to 4 m and the rotate EUT through 360° in order to determine the maximum emission level.
4) Record the measured emission level and frequency using the available test method.
If required by the test method, add 10 log(1/duty cycle) to measured emission level.
5) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
6) Vary the measurement antenna height between 1 m to 4 m to maximize the received (measured) signal amplitude. And adjust the signal generator output power level until the amplitude detected by the measurement instrument equals the previously measured emission level.
7) The conducted power at the terminal of the substitute antenna is measured.
8) Record the level at substituted antenna terminal.
9) The result is calculated as below;

Result: EIRP(dBm) = Level at Substitute antenna terminal + Substitute Antenna Gain (dBi)
Result: ERP(dBm) = Level at Substitute antenna terminal + Substitute Antenna Gain (dBd)
Where, TX Antenna Gain (dBd) = TX Antenna Gain (dBi) - 2.15 dB

7. TEST DATA

7.1. OCCUPIED BANDWIDTH

- Plots of the EUT's Occupied Bandwidth are shown in Clause 8.1

7.2. PEAKTOAVERAGERATIO

- Plots of the EUT's Peak- to- Average Ratio are shown in Clause 8.2

7.3. BAND EDEG EMISSIONS (Conducted)

- Plots of the EUT's Band Edge Emissions are shown in Clause 8.3

7.4. SPURIOUS AND HARMONICS EMISSIONS (Conducted)

- Plots of the EUT's Spurious Emissions are shown in Clause 8.4

7.5. MAXIMUM OUTPUT POWER

- Test Notes

1) EIRP = Conducted Output Power(dBm) + Antenna gain(dBi)
   ERP = EIRP – 2.15(dB)
2) All bandwidths, RB configurations, and modulations were investigated. And the worst case test results are reported.

7.5.1. LTE Band 48

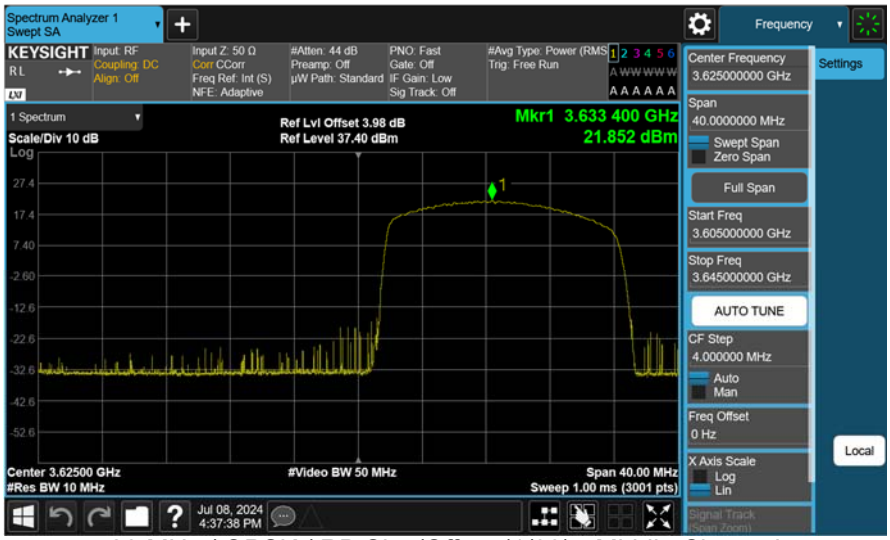
Channel Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size/ Offset	Conducted Output Power (dBm/10MHz)	Antenna Gain(dBi)	EIRP (dBm/10MHz)
20	3 560	QPSK	1/0	**19.46**	**0.43**	**19.89**
		16QAM	1/99	19.34	0.43	19.77
		64QAM	1/0	18.05	0.43	18.48
		256QAM	1/0	15.94	0.43	16.37
	3 625	QPSK	1/99	**21.85**	**0.43**	**22.28**
		16QAM	1/50	20.85	0.43	21.28
		64QAM	1/50	19.68	0.43	20.11
		256QAM	1/99	17.05	0.43	17.48
	3 690	QPSK	1/50	**20.64**	**0.43**	**21.07**
		16QAM	1/0	19.66	0.43	20.09
		64QAM	1/99	18.57	0.43	19.00
		256QAM	1/50	17.02	0.43	17.45
15	3 557.5	QPSK	1/36	**19.94**	**0.43**	**20.37**
		16QAM	1/0	19.71	0.43	20.14
		64QAM	1/36	17.97	0.43	18.40
		256QAM	1/0	16.06	0.43	16.49
	3 625	QPSK	1/36	**21.97**	**0.43**	**22.40**
		16QAM	1/74	21.16	0.43	21.59
		64QAM	1/36	20.12	0.43	20.55
		256QAM	1/74	17.39	0.43	17.82
	3 692.5	QPSK	1/36	**21.08**	**0.43**	**21.51**
		16QAM	1/74	20.38	0.43	20.81
		64QAM	1/36	19.34	0.43	19.77
		256QAM	1/36	17.01	0.43	17.44

Channel Bandwidth (MHz)	Frequency (MHz)	Modulation	RB Size/ Offset	Conducted Output Power (dBm/10MHz)	Antenna Gain(dBi)	EIRP (dBm/10MHz)
10	3 555	QPSK	1/25	**20.41**	**0.43**	**20.84**
		16QAM	1/0	19.71	0.43	20.14
		64QAM	1/25	18.27	0.43	18.70
		256QAM	1/0	15.63	0.43	16.06
	3 625	QPSK	1/0	**22.26**	**0.43**	**22.69**
		16QAM	1/25	21.15	0.43	21.58
		64QAM	1/49	20.27	0.43	20.70
		256QAM	1/25	17.39	0.43	17.82
	3 695	QPSK	1/25	**21.37**	**0.43**	**21.80**
		16QAM	1/49	20.62	0.43	21.05
		64QAM	1/49	19.33	0.43	19.76
		256QAM	1/25	17.15	0.43	17.58
5	3 552.5	QPSK	1/12	**20.57**	**0.43**	**21.00**
		16QAM	1/12	20.15	0.43	20.58
		64QAM	1/0	18.62	0.43	19.05
		256QAM	1/24	15.39	0.43	15.82
	3 625	QPSK	1/0	**21.94**	**0.43**	**22.37**
		16QAM	1/12	21.52	0.43	21.95
		64QAM	1/0	19.94	0.43	20.37
		256QAM	1/12	17.01	0.43	17.44
	3 697.5	QPSK	1/24	**21.39**	**0.43**	**21.82**
		16QAM	1/24	20.60	0.43	21.03
		64QAM	1/12	19.33	0.43	19.76
		256QAM	1/0	17.13	0.43	17.56

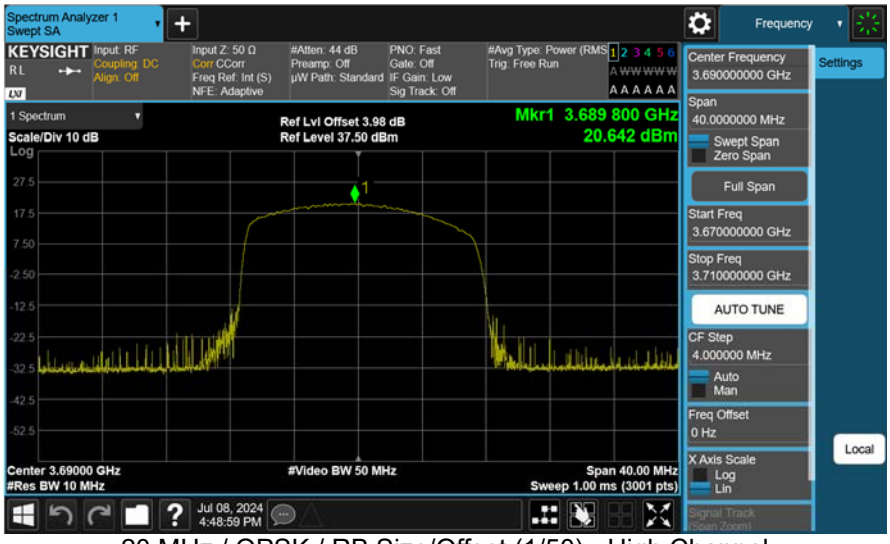
Note: Please refer to next page for worst-case plots.

(Path loss was applied to the spectrum correction factor function, and 10 log (1/duty cycle) was applied to the spectrum offset function during measurement.

20 MHz / QPSK / RB Size/Offset (1/0) - Low Channel

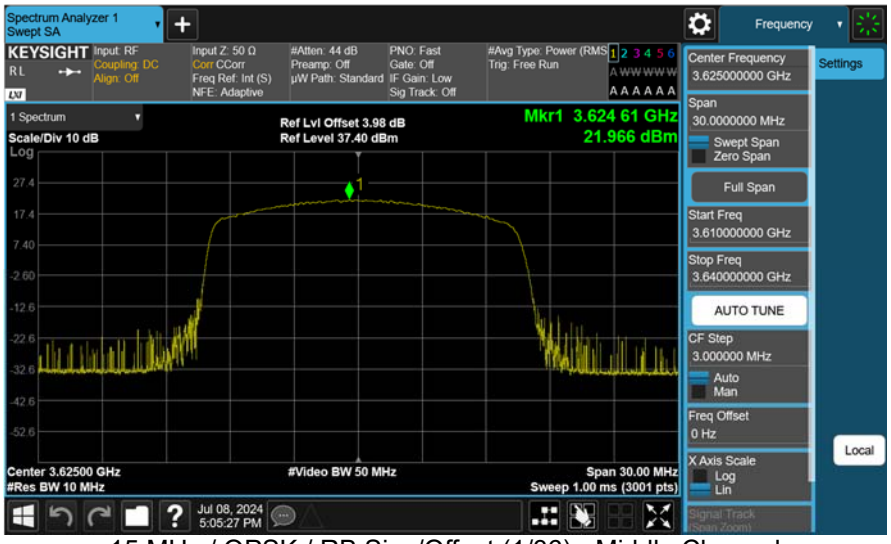


20 MHz / QPSK / RB Size/Offset (1/99) - Middle Channel



20 MHz / QPSK / RB Size/Offset (1/50) - High Channel

15 MHz / QPSK / RB Size/Offset (1/36) - Low Channel



15 MHz / QPSK / RB Size/Offset (1/36) - Middle Channel

15 MHz / QPSK / RB Size/Offset (1/36) - High Channel

10 MHz / QPSK / RB Size/Offset (1/25) - Low Channel

10 MHz / QPSK / RB Size/Offset (1/0) - Middle Channel

10 MHz / QPSK / RB Size/Offset (1/25) - High Channel

5 MHz / QPSK / RB Size/Offset (1/12) - Low Channel

5 MHz / QPSK / RB Size/Offset (1/0) - Middle Channel

5 MHz / QPSK / RB Size/Offset (1/24) - High Channel

7.6. UNDESIRABLE EMISSIONS (Radiated)

- Test Notes

1) Limit = -40 dBm/MHz
2) Result(dBm) = Level at Substitute antenna terminal(dBm) + Substitute Antenna Gain (dBi)
3) The frequency spectrum is examined from 9 kHz to the 10th harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.

7.6.1. LTE Band 48

Channel Bandwidth (MHz)	Frequency (MHz)	Modulation	RB size/ offset	Freq.(MHz)	Ant Pol (H/V)	Level at Antenna Terminal(dBm)	Substitute Antenna Gain(dBi)	Result (dBm)	Limit (dBm)	Margin (dB)
20	3 560	QPSK	1/50	7 120.27	H	-55.28	11.71	-43.57	-40.00	3.57
				10 679.96	H	-62.47	13.04	-49.43	-40.00	9.43
				14 240.84	H	-60.99	14.15	-46.84	-40.00	6.84
	3 625	QPSK	1/50	7 250.09	H	-67.90	11.85	-46.01	-40.00	6.01
				10 875.63	H	-77.86	13.06	-50.20	-40.00	10.20
				14 500.13	H	-77.29	13.94	-46.84	-40.00	6.84
	3 690	QPSK	1/50	7 380.20	H	-67.07	12.01	-45.15	-40.00	5.15
				11 069.39	H	-77.56	13.12	-50.22	-40.00	10.22
				14 759.41	H	-76.42	13.92	-50.70	-40.00	10.70

7.7. FREQUENCY STABILITY

- Test Notes

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

7.7.1. LTE Band 48

OPERATING FREQUENCY : 3 625 MHz
REFERENCE VOLTAGE : 3.85 V DC
LIMIT(FCC) : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	FREQ (Hz)	Deviation	
				(%)	(ppm)
100 %	3.85	+20(Ref)	3,624,999,990	-0.000 000 3	-0.003
100 %		-30	3,624,999,990	-0.000 000 3	-0.003
100 %		-20	3,624,999,992	-0.000 000 2	-0.002
100 %		-10	3,624,999,993	-0.000 000 2	-0.002
100 %		0	3,624,999,991	-0.000 000 2	-0.002
100 %		+10	3,624,999,989	-0.000 000 3	-0.003
100 %		+20	3,624,999,990	-0.000 000 3	-0.003
100 %		+30	3,624,999,993	-0.000 000 2	-0.002
100 %		+40	3,624,999,992	-0.000 000 2	-0.002
100 %		+50	3,624,999,989	-0.000 000 3	-0.003
115 %	4.43	+20	3,624,999,991	-0.000 000 2	-0.002
BATT.ENDPOINT	3.15	+20	3,624,999,990	-0.000 000 3	-0.003

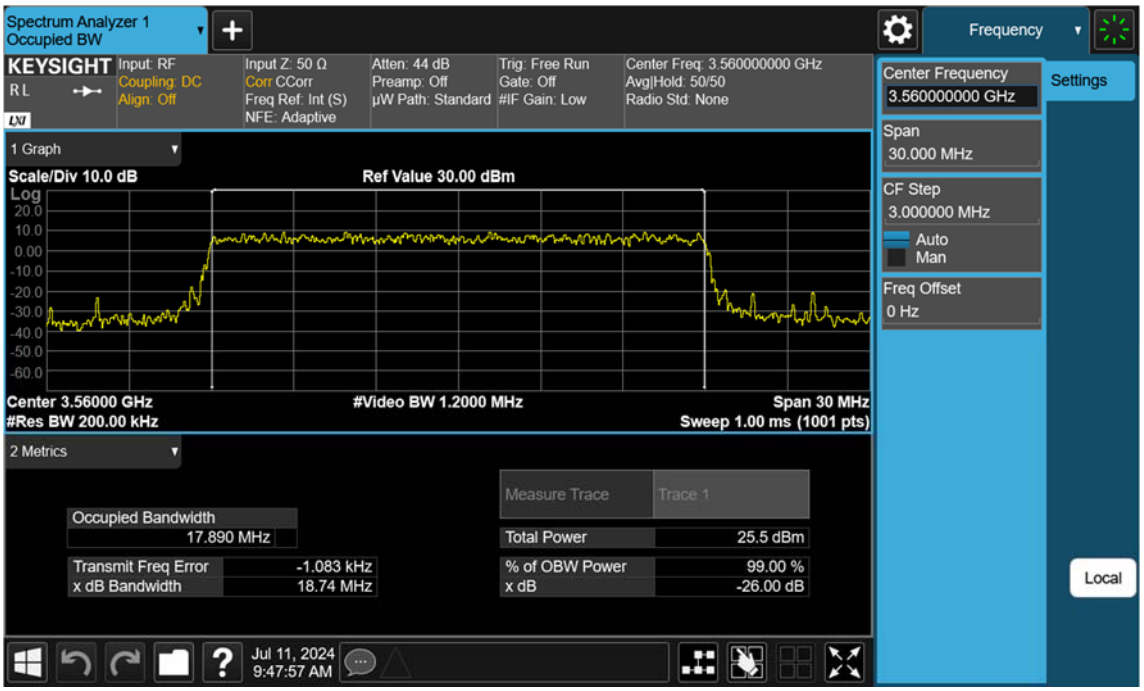
8. TEST PLOTS

- Test Notes:

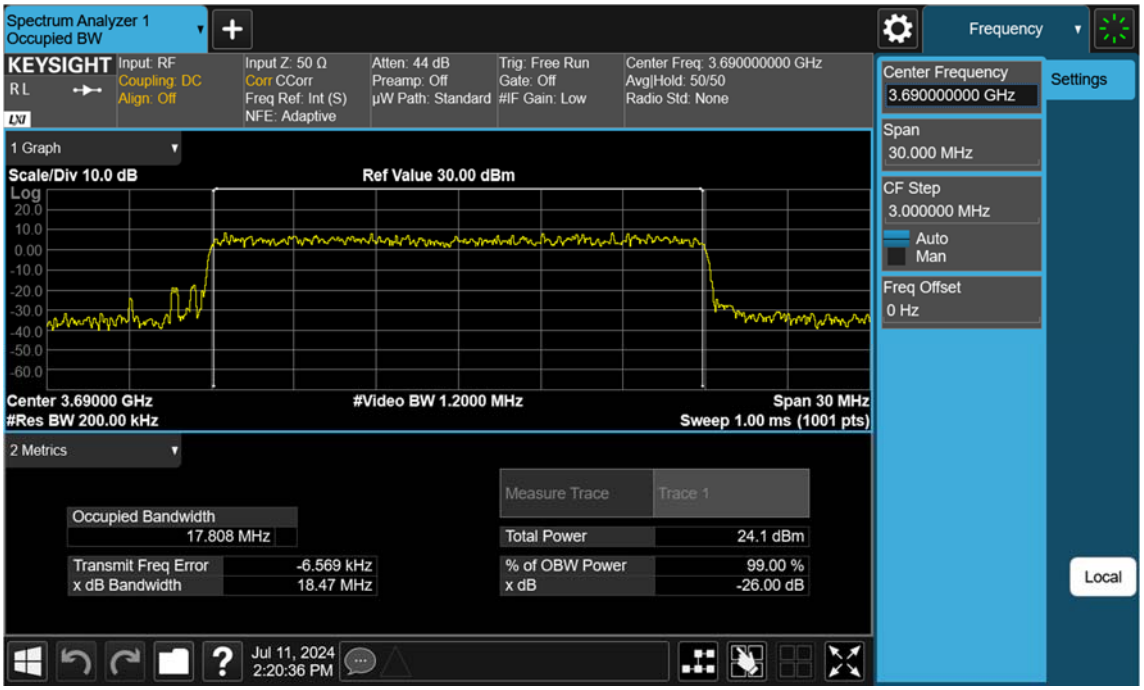
All bandwidths, RB configurations, and modulations were investigated.
The worst case test results are reported.

8.1. OCCUPIED BANDWIDTH

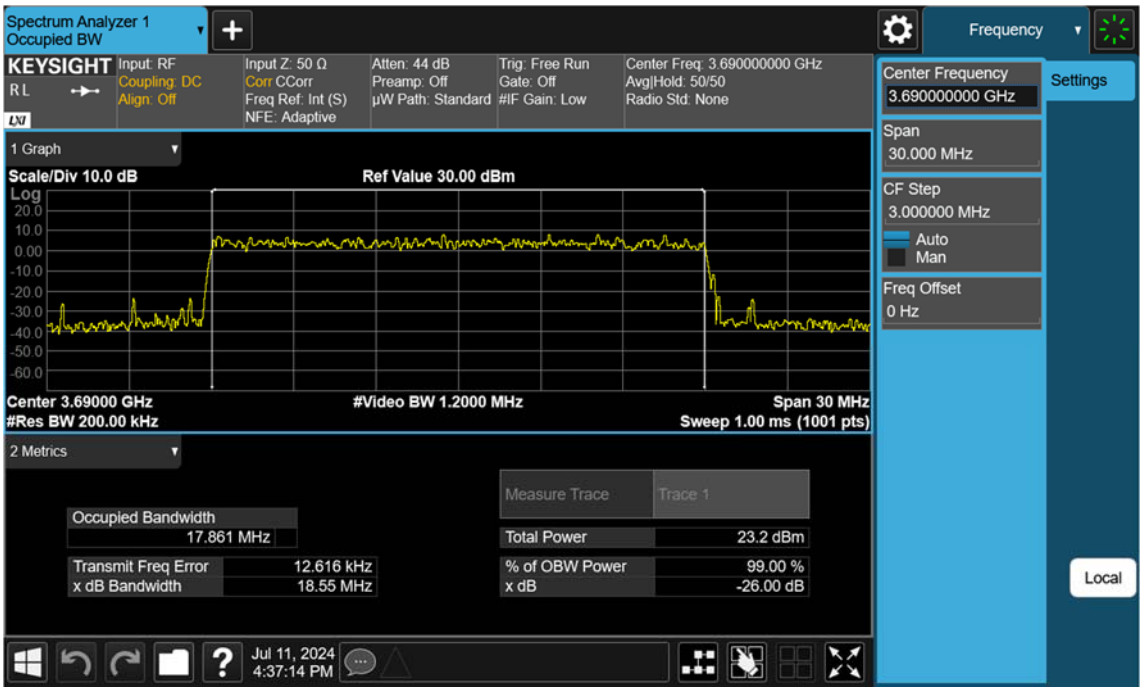
8.1.1. LTE Band 48



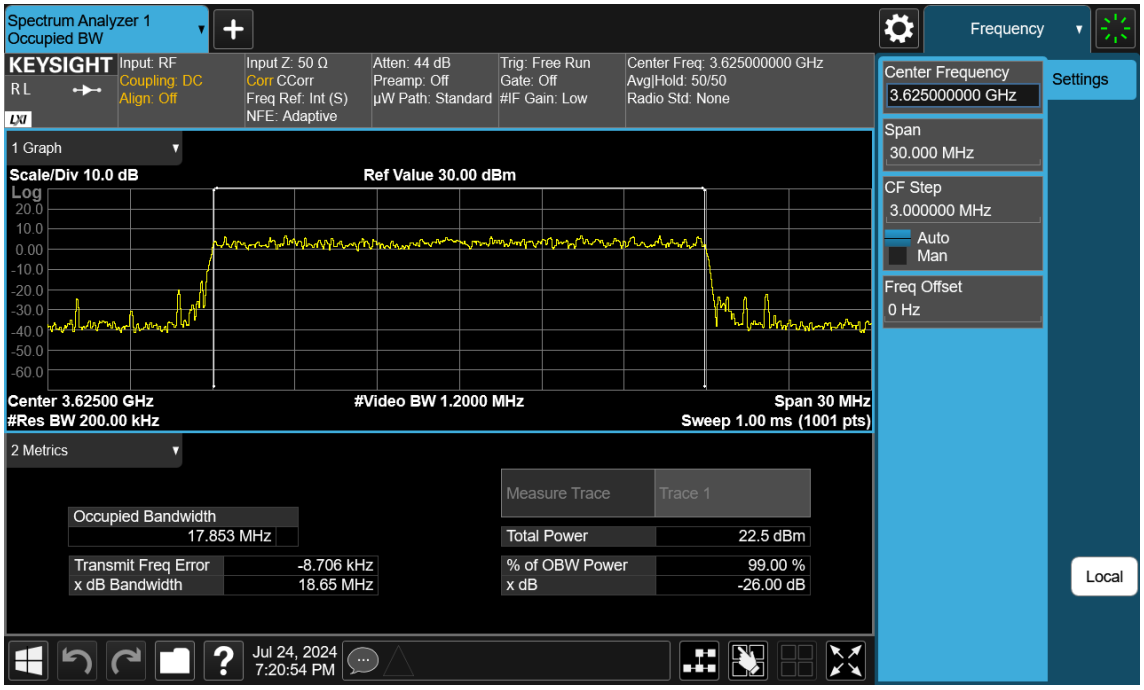
20 MHz / QPSK / FULL RB Size



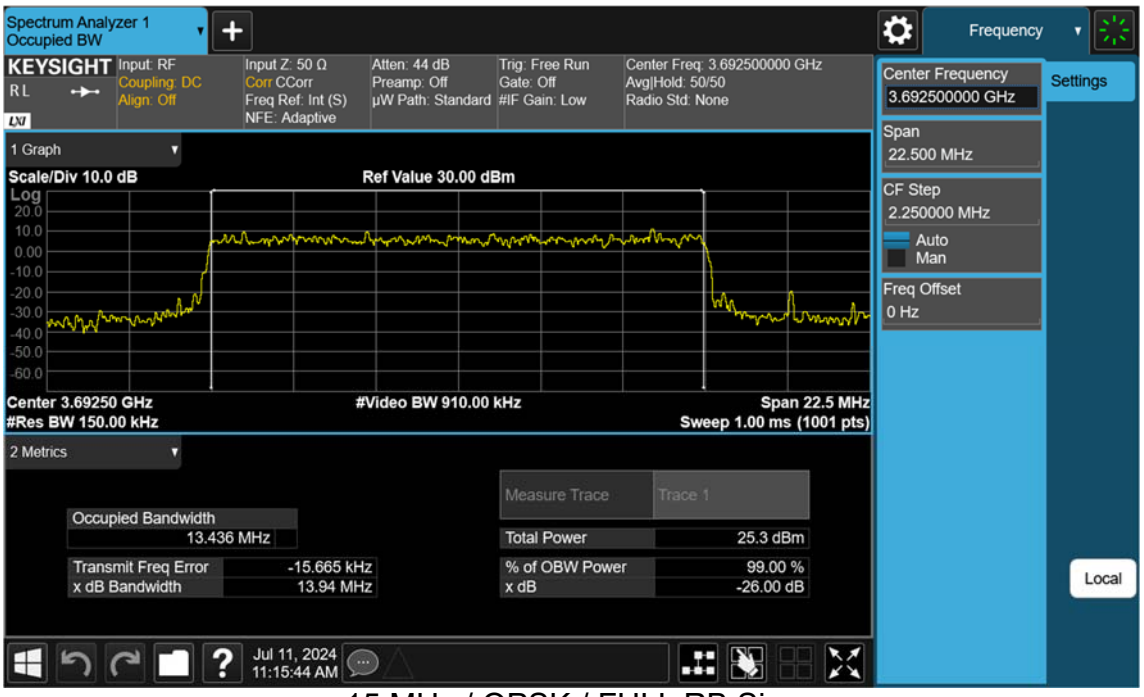
20 MHz / 16QAM / FULL RB Size



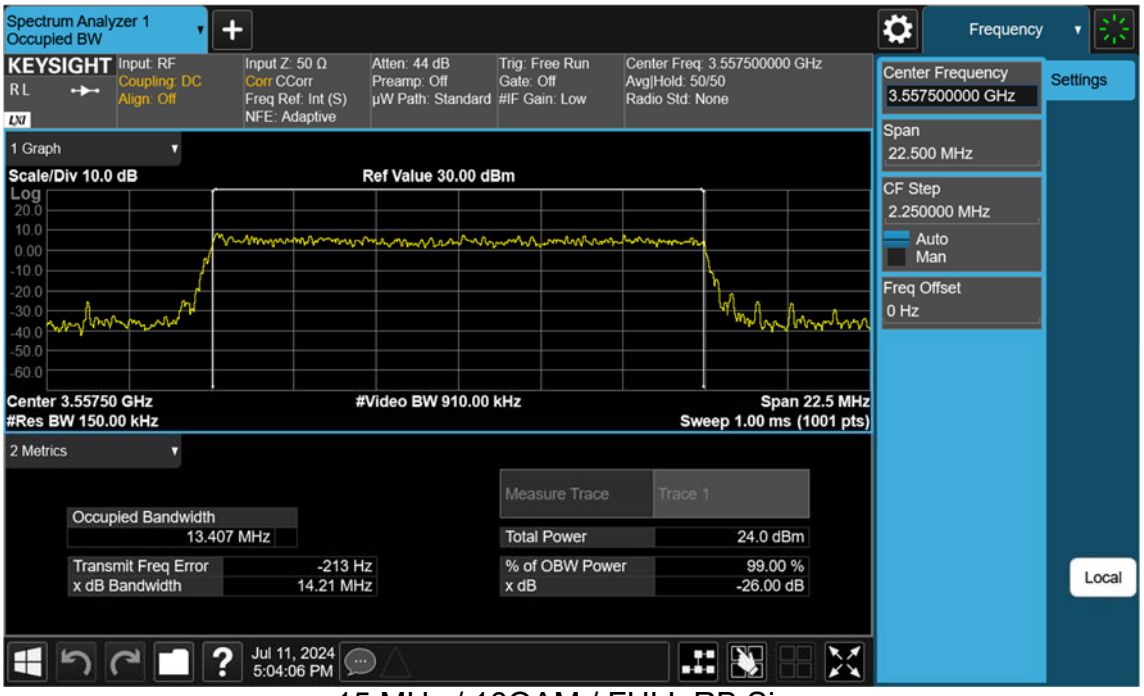
20 MHz / 64QAM / FULL RB Size



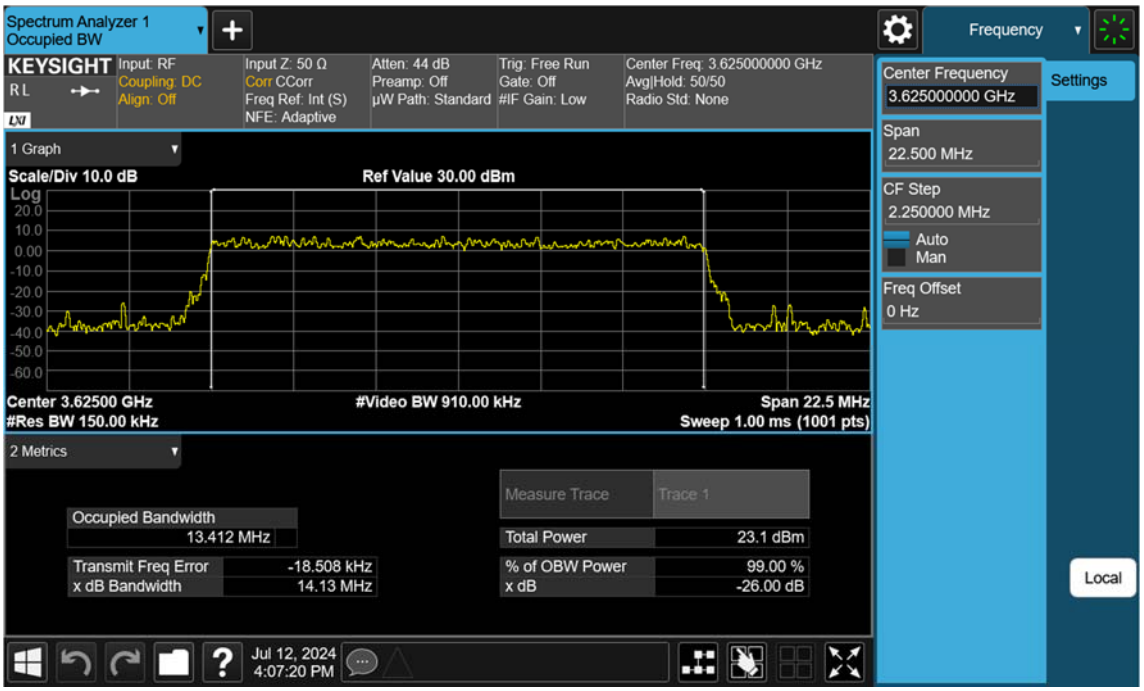
20 MHz / 256QAM / FULL RB Size



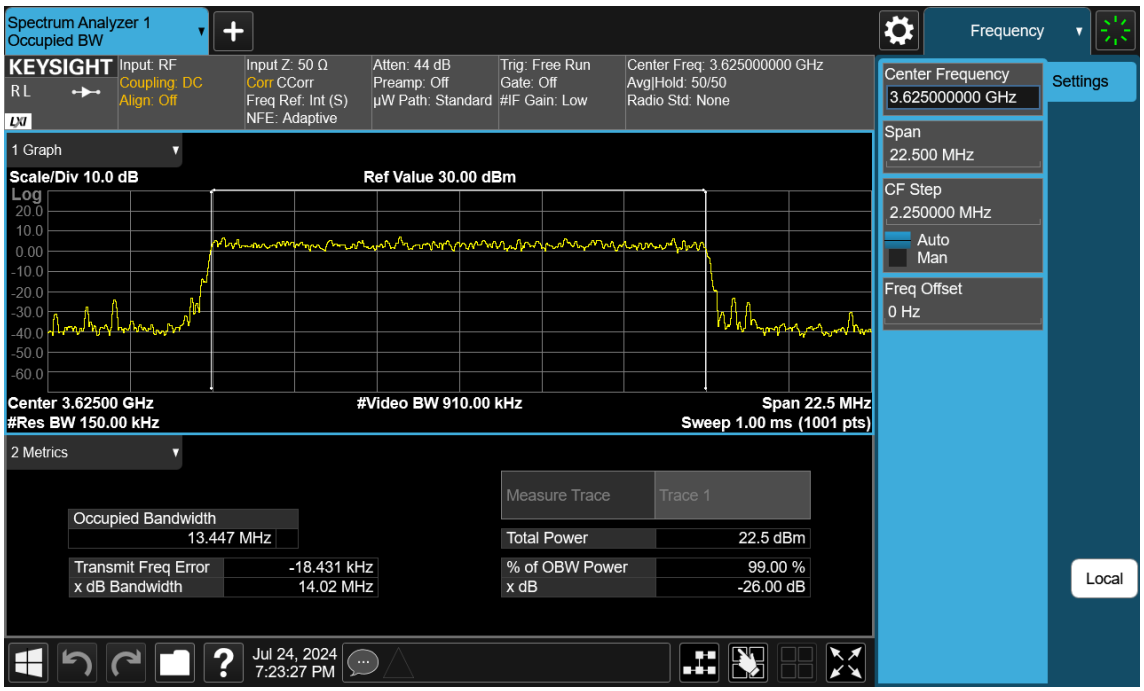
15 MHz / QPSK / FULL RB Size



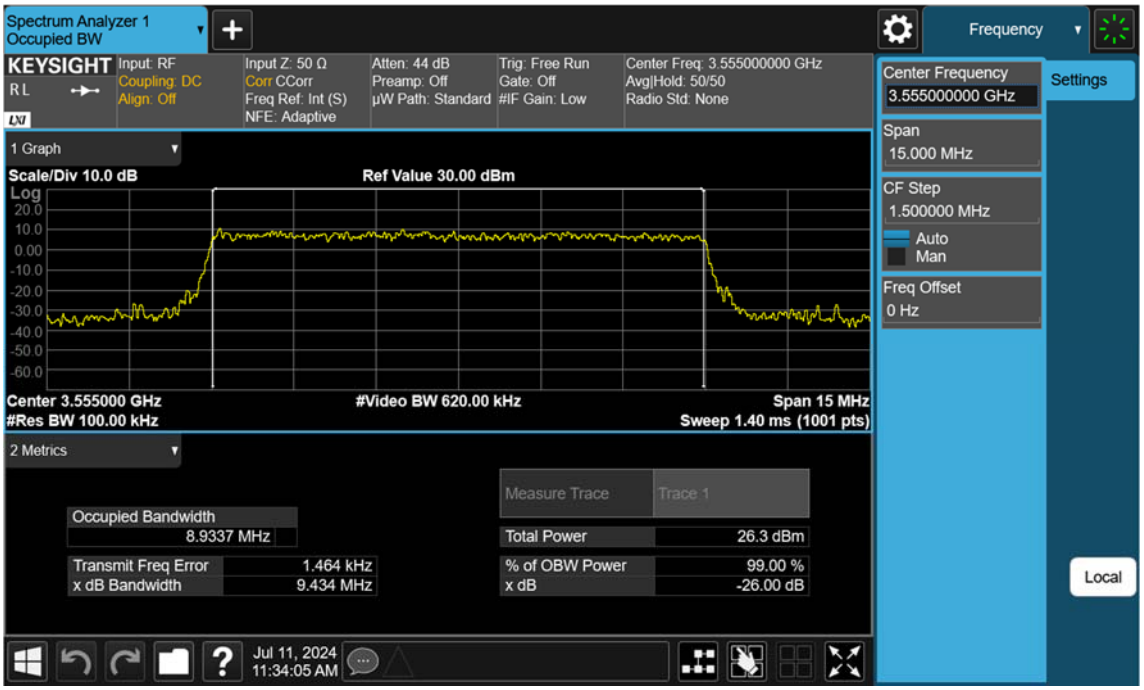
15 MHz / 16QAM / FULL RB Size



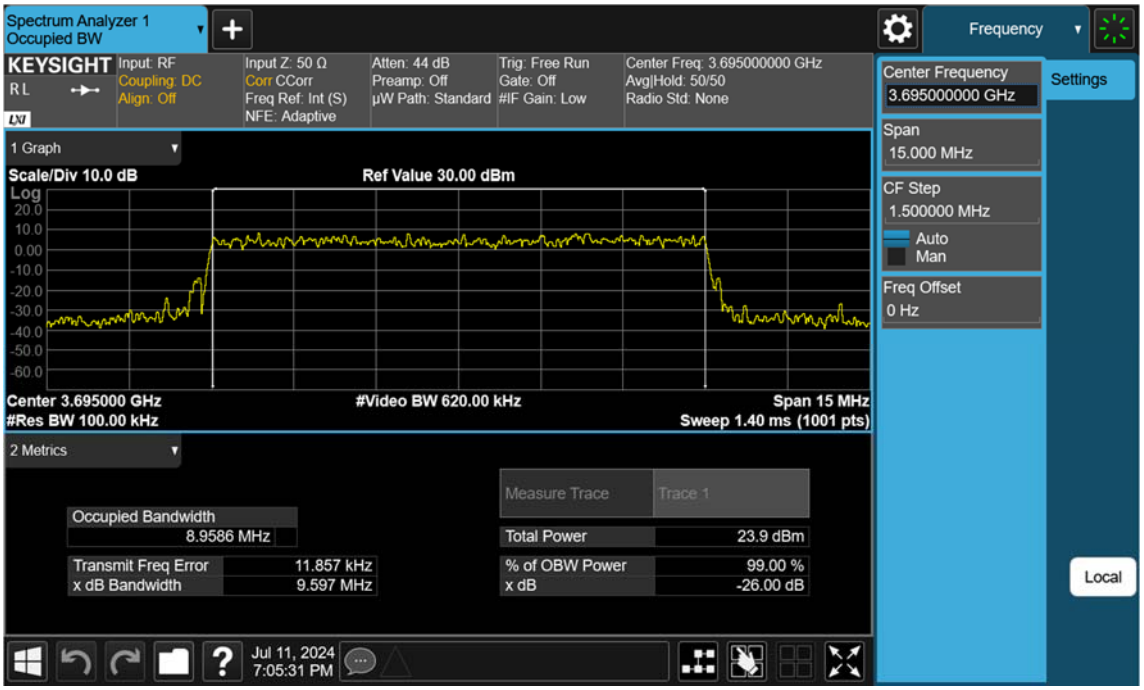
15 MHz / 64QAM / FULL RB Size



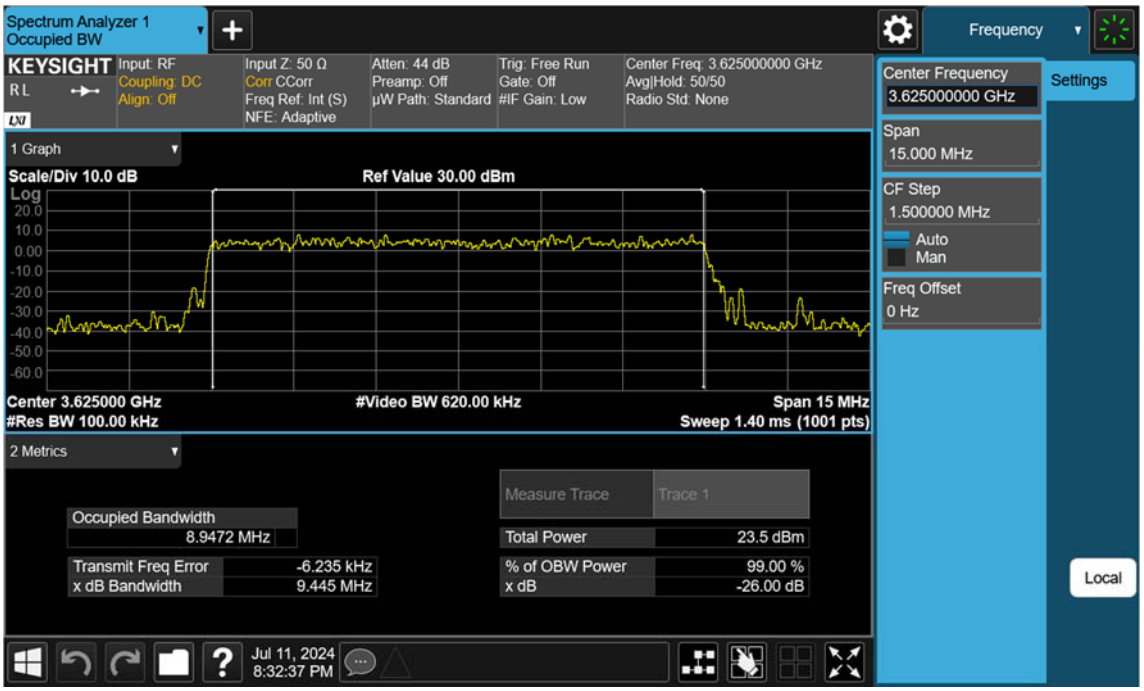
15 MHz / 256QAM / FULL RB Size



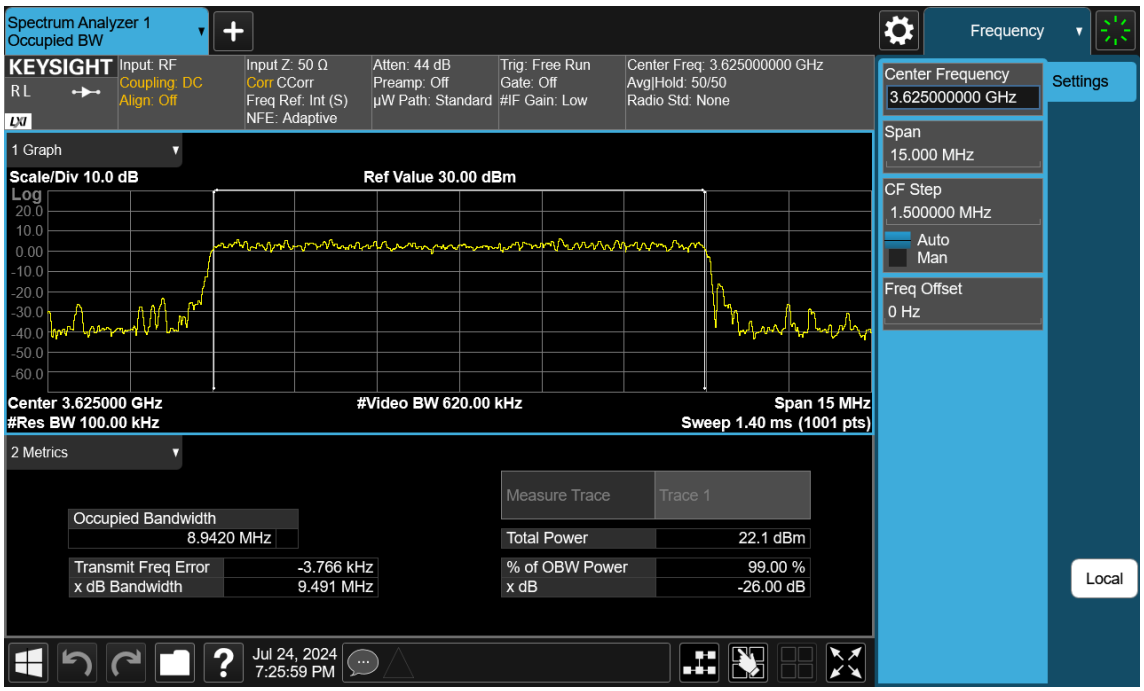
10 MHz / QPSK / FULL RB Size



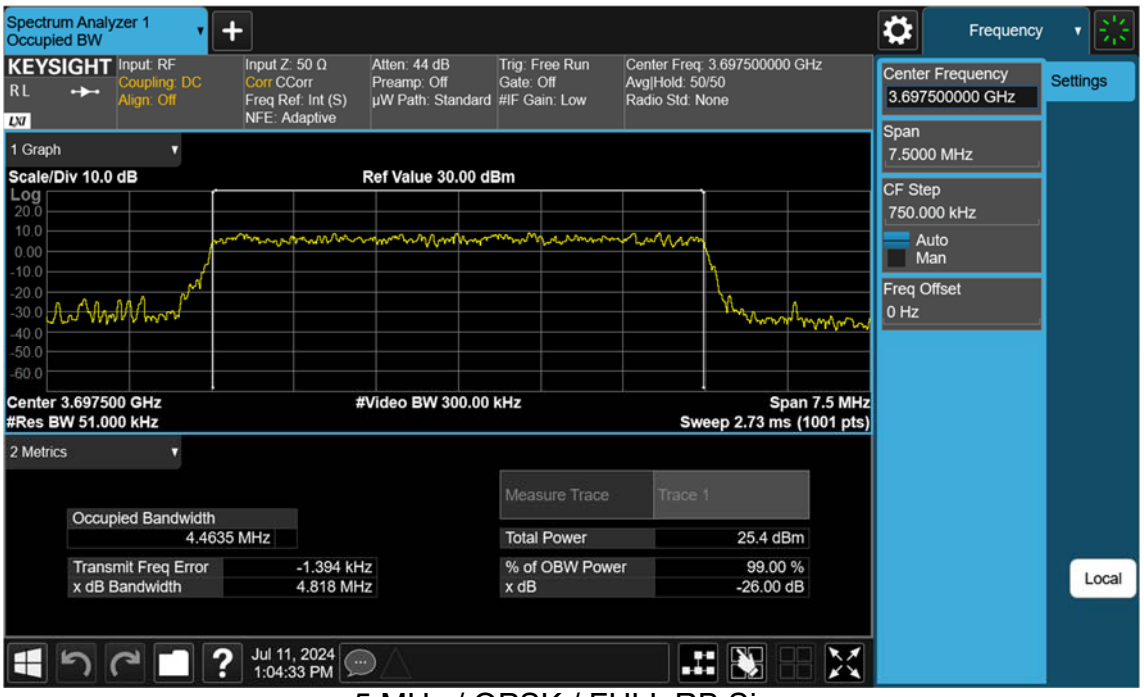
10 MHz / 16QAM / FULL RB Size



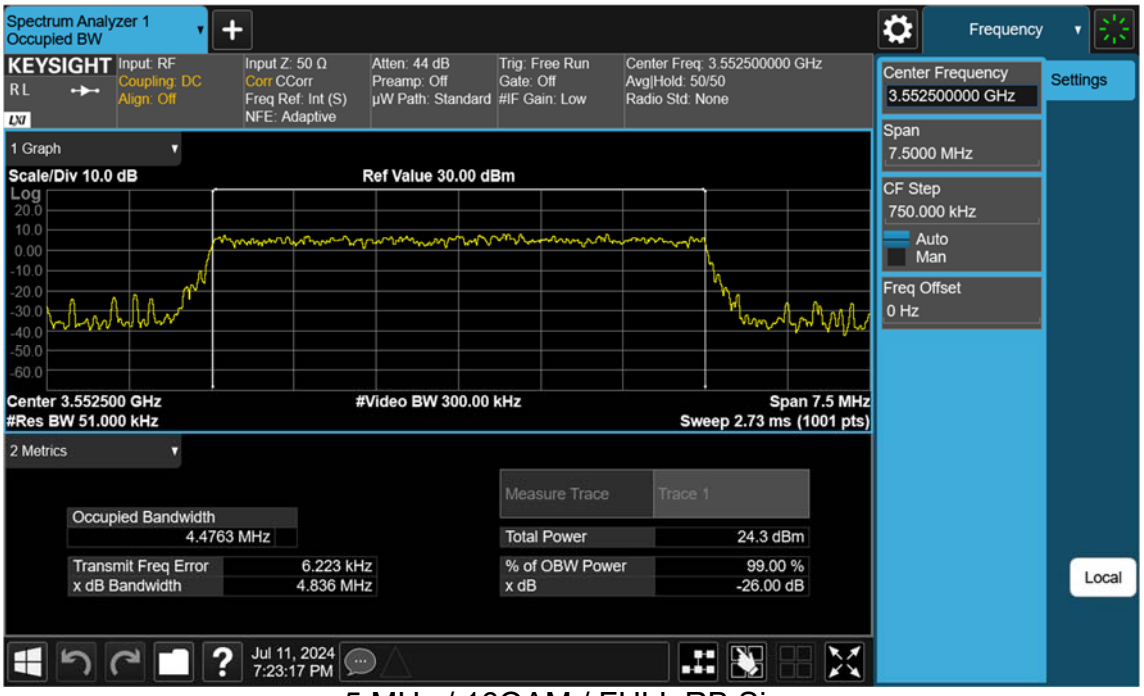
20 MHz / 64QAM / FULL RB Size



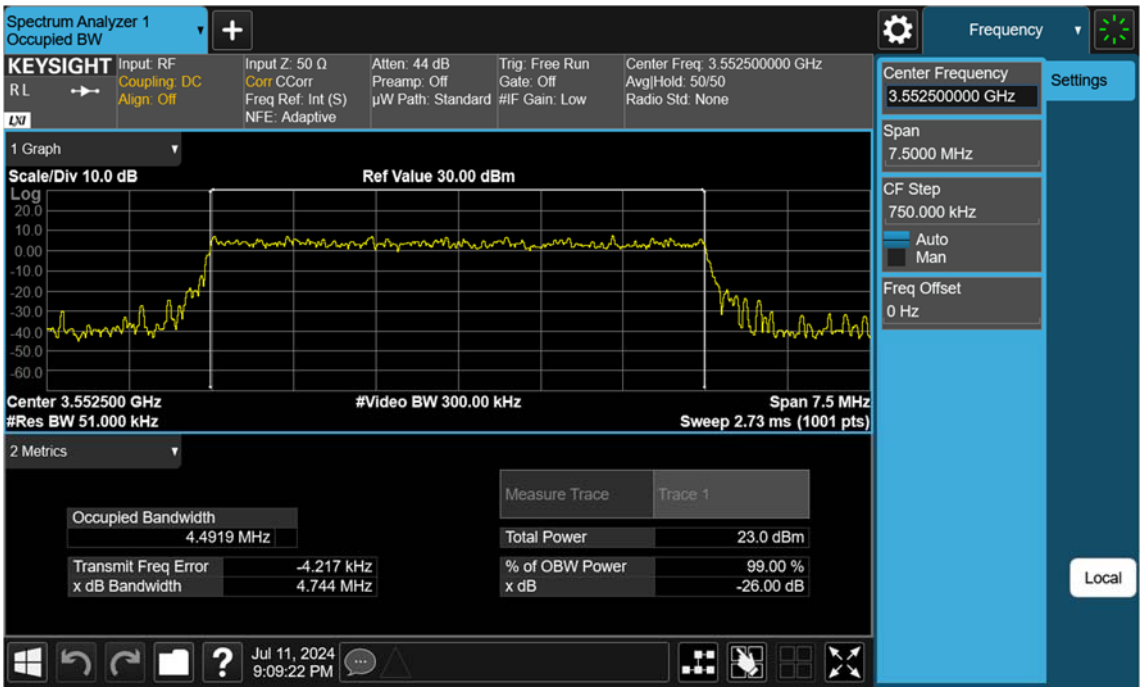
20 MHz / 256QAM / FULL RB Size



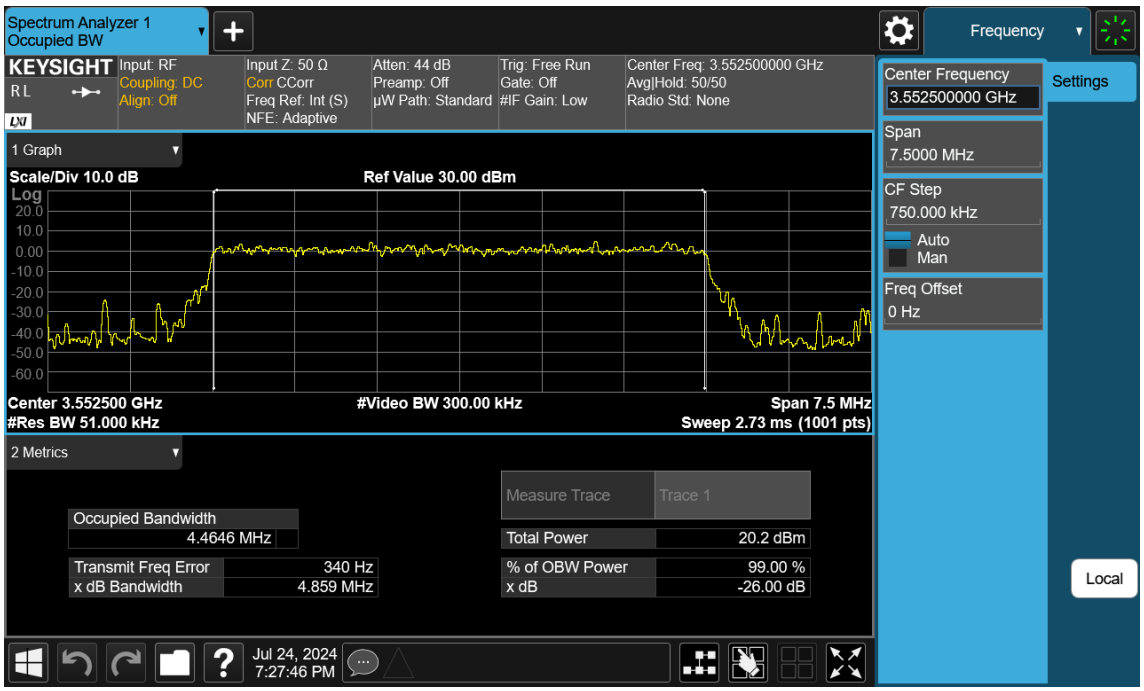
5 MHz / QPSK / FULL RB Size



5 MHz / 16QAM / FULL RB Size



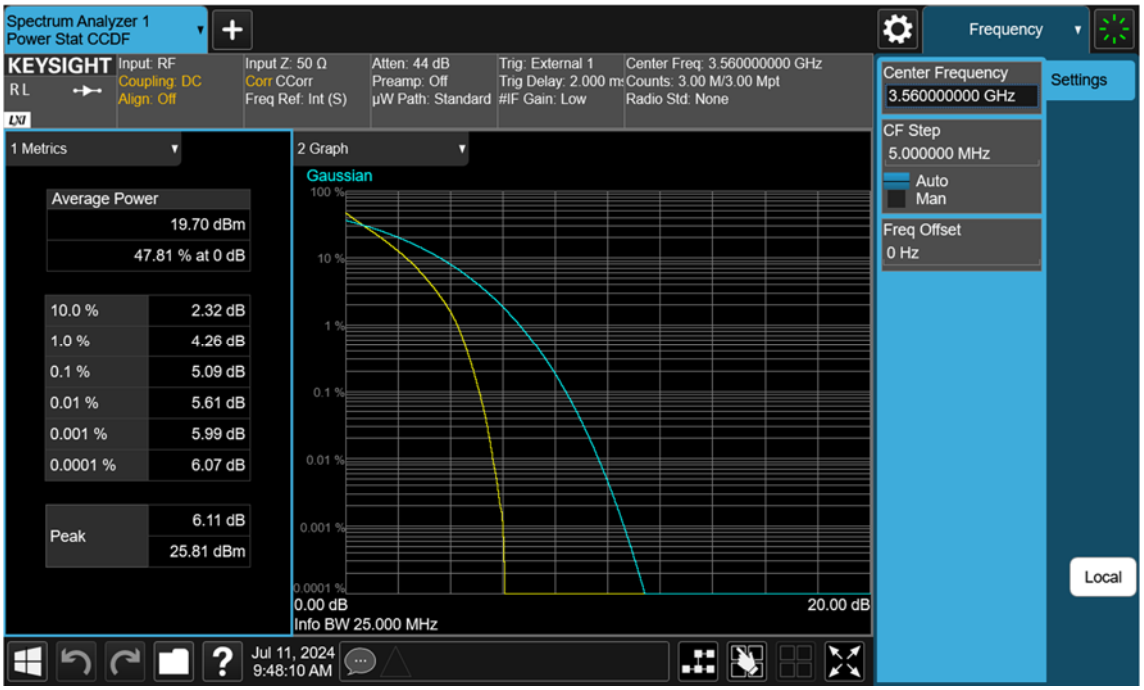
5 MHz / 64QAM / FULL RB Size



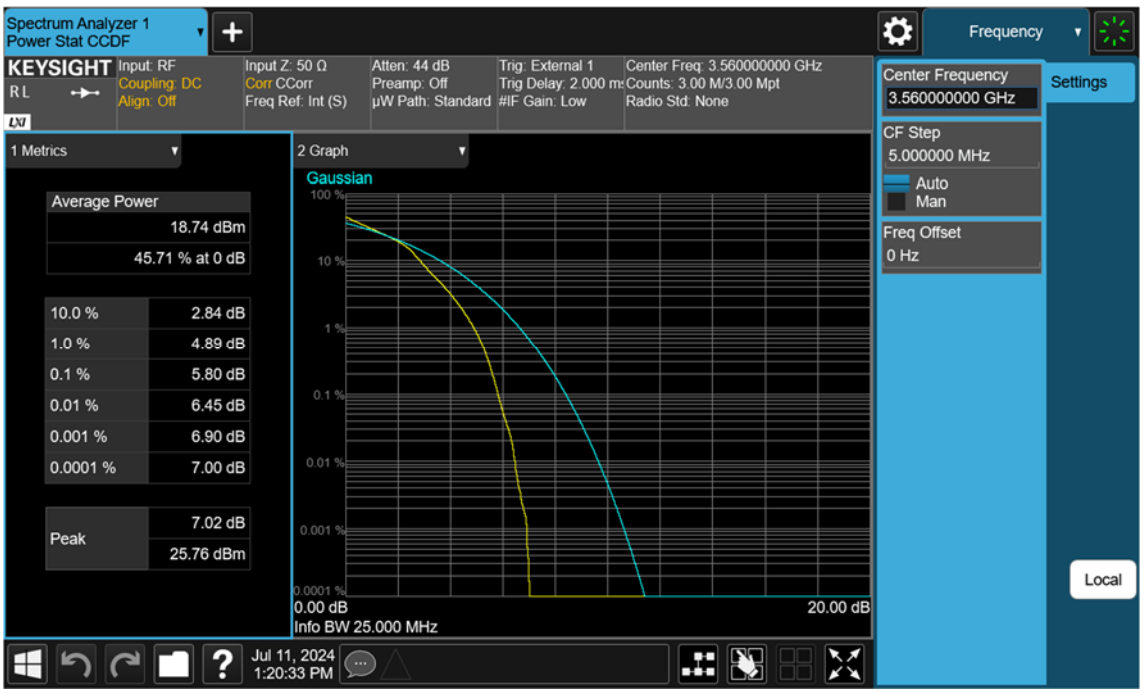
5MHz / 256QAM / FULL RB Size

8.2. PEAK TO AVERAGE RATIO

8.2.1. LTE Band 48

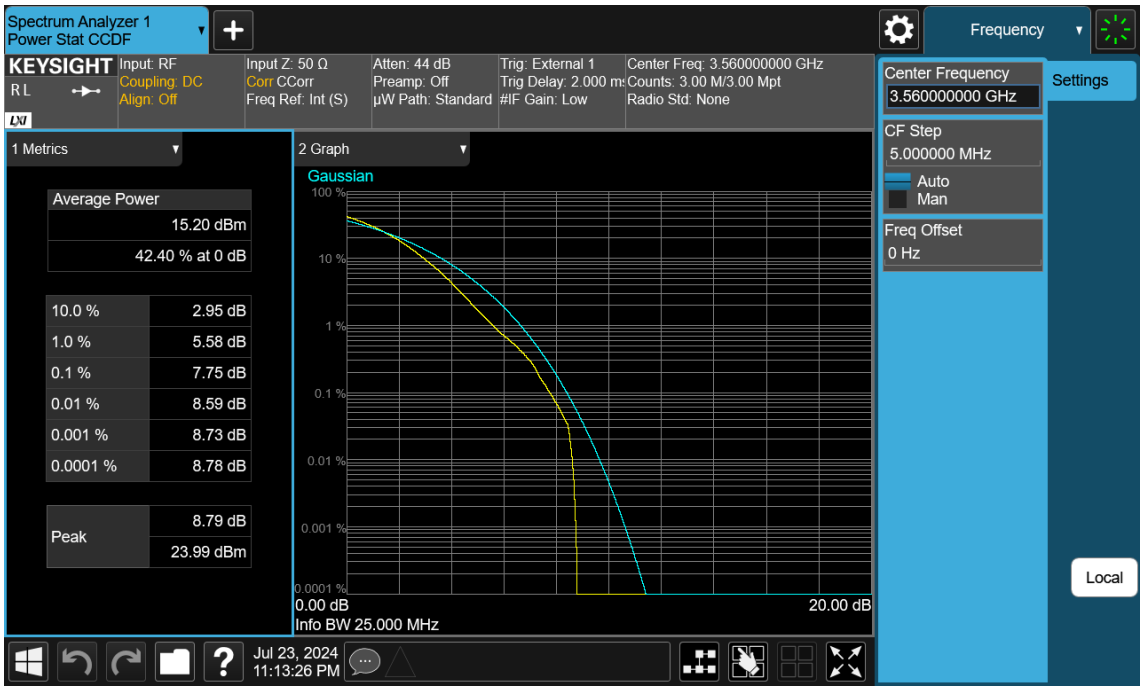


20 MHz / QPSK / FULL RB Size

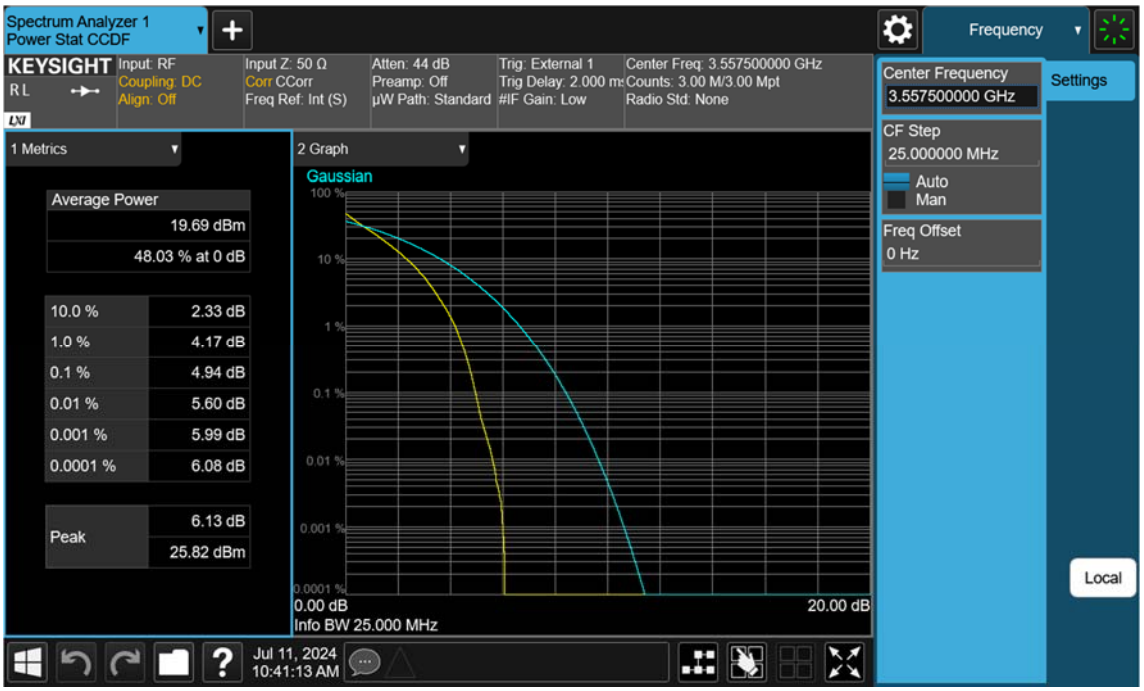


20 MHz / 16QAM / FULL RB Size

20 MHz / 64QAM / FULL RB Size



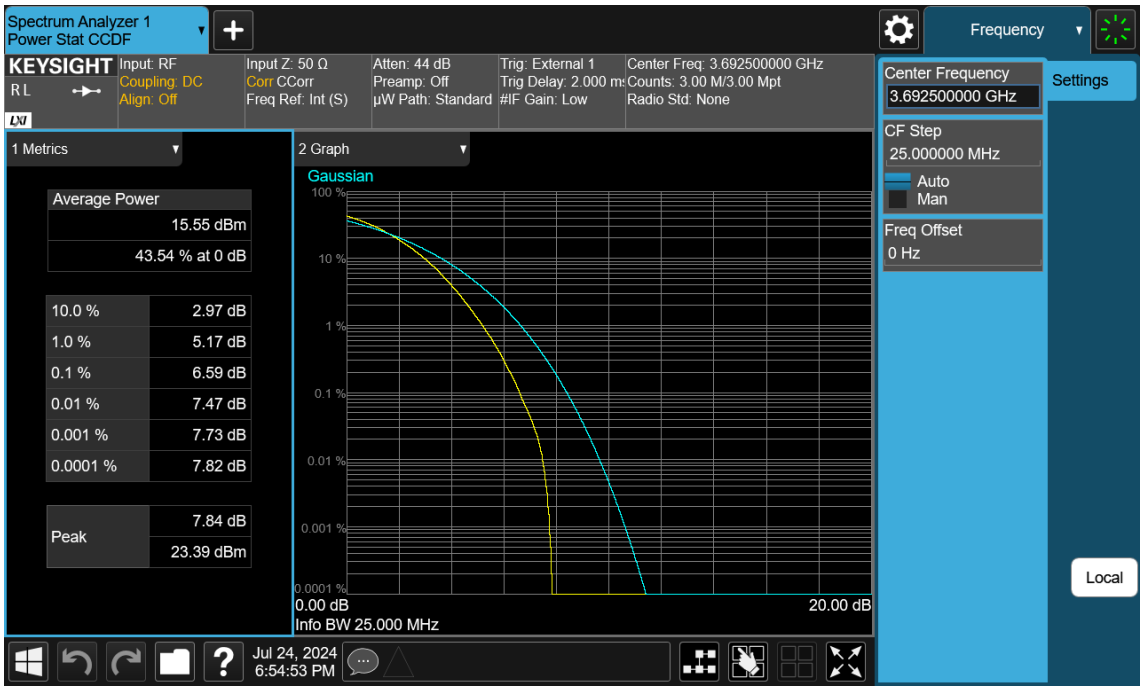
20 MHz / 256QAM / FULL RB Size



15 MHz / QPSK / FULL RB Size

15 MHz / 16QAM / FULL RB Size

15 MHz / 64QAM / FULL RB Size



15 MHz / 256QAM / FULL RB Size

10 MHz / QPSK / FULL RB Size

10 MHz / 16QAM / FULL RB Size