

FCC LTE REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Date of Issue:
June 15, 2021

Address:
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Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Location:
HCT CO., LTD.,
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Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-2105-FC019-R1

FCC ID: A3LSMG990U

APPLICANT: SAMSUNG Electronics Co., Ltd.

Model(s): SM-G990U
 Additional Model(s): SM-G990U1/DS, SM-G990U1
 EUT Type: Mobile Phone
 FCC Classification: PCS Licensed Transmitter Held to Ear (PCE)
 FCC Rule Part(s): §27, §2

Mode (MHz)	Tx Frequency (MHz)	Emission Designator	Modulation	EIRP	
				Max. Power (W)	Max. Power (dBm)
LTE – Band 7 (5)	2502.5 – 2567.5	4M51G7D	QPSK	0.134	21.28
		4M50W7D	16QAM	0.117	20.68
		4M50W7D	64QAM	0.089	19.48
		4M51W7D	256QAM	0.044	16.40
LTE – Band 7 (10)	2505.0 – 2565.0	8M96G7D	QPSK	0.138	21.41
		9M00W7D	16QAM	0.118	20.73
		8M98W7D	64QAM	0.090	19.55
		8M99W7D	256QAM	0.043	16.37
LTE – Band 7 (15)	2507.5 – 2562.5	13M5G7D	QPSK	0.141	21.49
		13M5W7D	16QAM	0.117	20.67
		13M5W7D	64QAM	0.094	19.75
		13M4W7D	256QAM	0.045	16.57
LTE – Band 7 (20)	2510.0 – 2560.0	17M9G7D	QPSK	0.139	21.43
		17M9W7D	16QAM	0.115	20.59
		17M9W7D	64QAM	0.092	19.62
		17M9W7D	256QAM	0.044	16.42

The measurements shown in this report were made in accordance with the procedures specified in CFR47 section §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S. C.853(a)

Report No.: HCT-RF-2105-FC019-R1

REVIEWED BY



Report prepared by : Jae Mun Do
Engineer of Telecommunication Testing Center

Report approved by : Jong Seok Lee
Manager of Telecommunication Testing Center

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *.

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2105-FC019	May 26, 2021	- First Approval Report
HCT-RF-2105-FC019-R1	June 15, 2021	- Revised the Additional model(s). (SM-G990U1 added)

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

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MEASUREMENT REPORT

1. GENERAL INFORMATION

Applicant Name:	SAMSUNG Electronics Co., Ltd.
Address:	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
FCC ID:	A3LSMG990U
Application Type:	Certification
FCC Classification:	PCS Licensed Transmitter Held to Ear (PCE)
FCC Rule Part(s):	§27, §2
EUT Type:	Mobile Phone
Model(s):	SM-G990U
Additional Model(s):	SM-G990U1/DS, SM-G990U1
Tx Frequency:	2502.5 – 2567.5 : 5 MHz 2505.0 – 2565.0 : 10 MHz 2507.5 – 2562.5 : 15 MHz 2510.0 – 2560.0 : 20 MHz
Date(s) of Tests:	April 19, 2021 ~ May 18, 2021
Serial number:	Radiated: R3CR315S6MD Conducted: R3CR3117FBH

2. INTRODUCTION

2.1. DESCRIPTION OF EUT

The EUT was a Mobile Phone with GSM/GPRS/EGPRS/UMTS, CDMA(BC0, 1, 10) and LTE, Sub6.

It also supports IEEE 802.11 a/b/g/n/ac/ax (HT20/40/80), Bluetooth, BT LE, NFC, WPT, mmWave(n260/261).

2.2. 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.

2.3. TEST FACILITY

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the **74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.**

3. DESCRIPTION OF TESTS

3.1 TEST PROCEDURE

Test Description	Test Procedure Used
Occupied Bandwidth	- KDB 971168 D01 v03r01 – Section 4.3 - ANSI C63.26-2015 – Section 5.4.4
Band Edge	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Spurious and Harmonic Emissions at Antenna Terminal	- KDB 971168 D01 v03r01 – Section 6.0 - ANSI C63.26-2015 – Section 5.7
Conducted Output Power	- N/A (See SAR Report)
Peak- to- Average Ratio	- KDB 971168 D01 v03r01 – Section 5.7 - ANSI C63.26-2015 – Section 5.2.3.4 - ANSI C63.26-2015 – Section 5.2.6(only GSM)
Frequency stability	- ANSI C63.26-2015 – Section 5.6
Effective Radiated Power/ Effective Isotropic Radiated Power	- KDB 971168 D01 v03r01 – Section 5.2 & 5.8 - ANSI/TIA-603-E-2016 – Section 2.2.17
Radiated Spurious and Harmonic Emissions	- KDB 971168 D01 v03r01 – Section 6.2 - ANSI/TIA-603-E-2016 – Section 2.2.12

3.2 RADIATED POWER

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-E-2016 Clause 2.2.17.

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW \geq 3 x RBW
4. Span = 1.5 times the OBW
5. No. of sweep points $>$ 2 x span / RBW
6. Detector = RMS
7. Trigger is set to "free run" for signals with continuous operation with the sweep times set to "auto".
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Note

1. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission.
2. A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

$$P_{d(dBm)} = P_{g(dBm)} - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.

3. The maximum value is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration
4. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
5. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

3.3 RADIATED SPURIOUS EMISSIONS

Test Overview

Radiated tests are performed in the Fully-anechoic chamber.

Radiated Spurious Emission Measurements at 3 meters by Substitution Method according to ANSI/TIA-603-E-2016.

Test Settings

1. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz
2. VBW $\geq 3 \times$ RBW
3. Span = 1.5 times the OBW
4. No. of sweep points $> 2 \times$ span / RBW
5. Detector = Peak
6. Trace mode = Max Hold
7. The trace was allowed to stabilize
8. Test channel : Low/ Middle/ High
9. Frequency range : We are performed all frequency to 10th harmonics from 9 kHz.

Test Note

1. Measurements value show only up to 3 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
2. The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data
3. For spurious emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The spurious emissions is calculated by the following formula;

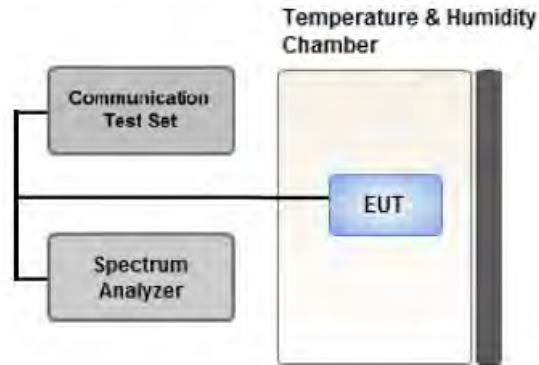
$$\text{Result}_{(\text{dBm})} = P_{g(\text{dBm})} - \text{cable loss}_{(\text{dB})} + \text{antenna gain}_{(\text{dBi})}$$

Where: P_g is the generator output power into the substitution antenna.

If the fundamental frequency is below 1GHz, RF output power has been converted to EIRP.

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

3.4 PEAK- TO- AVERAGE RATIO



Test setup

① CCDF Procedure for PAPR

Test Settings

1. Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
2. Set the number of counts to a value that stabilizes the measured CCDF curve;
3. Set the measurement interval as follows:
 - .- for continuous transmissions, set to 1 ms,
 - .- or 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 and set the measurement interval to a time that is less than or equal to the burst duration.
4. Record the maximum PAPR level associated with a probability of 0.1%.

② Alternate Procedure for PAPR

Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as P_{Pk} .

Use one of the applicable procedures presented 5.2(ANSI C63.26-2015) to measure the total average power and record as P_{Avg} . Determine the P.A.R. from:

$$P.A.R_{(dB)} = P_{Pk (dBm)} - P_{Avg (dBm)} \quad (P_{Avg} = \text{Average Power} + \text{Duty cycle Factor})$$

Test Settings(Peak Power)

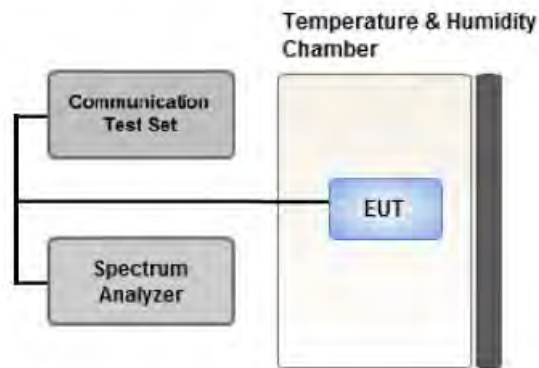
The measurement instrument must have a RBW that is greater than or equal to the OBW of the signal to be measured and a VBW $\geq 3 \times$ RBW.

1. Set the RBW \geq OBW.
2. Set VBW $\geq 3 \times$ RBW.
3. Set span $\geq 2 \times$ OBW.
4. Sweep time $\geq 10 \times$ (number of points in sweep) \times (transmission symbol period).
5. Detector = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the peak amplitude level.

Test Settings(Average Power)

1. Set span to $2 \times$ to $3 \times$ the OBW.
2. Set RBW \geq OBW.
3. Set VBW $\geq 3 \times$ RBW.
4. Set number of measurement points in sweep $\geq 2 \times$ span / RBW.
5. Sweep time:
Set $\geq [10 \times (\text{number of points in sweep}) \times (\text{transmission period})]$ for single sweep (automation-compatible) measurement. The transmission period is the (on + off) time.
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 period 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. Use the peak marker function to determine the maximum amplitude level.
10. Add $[10 \log (1/\text{duty cycle})]$ to the measured maximum 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%.

3.5 OCCUPIED BANDWIDTH.



Test setup

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

The EUT makes a call to the communication simulator.

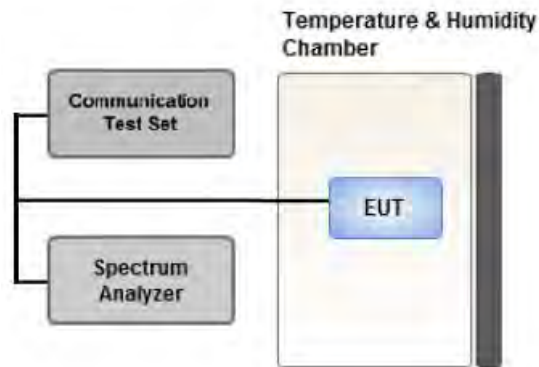
The conducted occupied bandwidth used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency. Use OBW measurement function of Spectrum analyzer to measure 99 % occupied bandwidth

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW \geq 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7

3.6 SPURIOUS AND HARMONIC EMISSIONS AT ANTENNA TERMINAL



Test setup

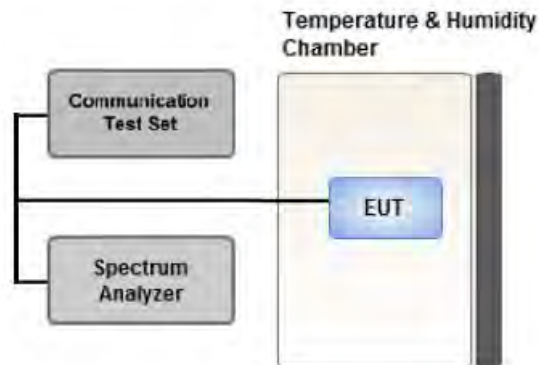
Test Overview

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

1. RBW = 1 MHz
2. VBW \geq 3 MHz
3. Detector = RMS
4. Trace Mode = Average
5. Sweep time = auto
6. Number of points in sweep \geq 2 * Span / RBW

3.7 BAND EDGE



Test setup

Test Overview

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Settings

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
4. VBW > 3 x RBW
5. Detector = RMS
6. Number of sweep points $\geq 2 \times \text{Span}/\text{RBW}$
7. Trace mode = trace average
8. Sweep time = auto couple
9. The trace was allowed to stabilize

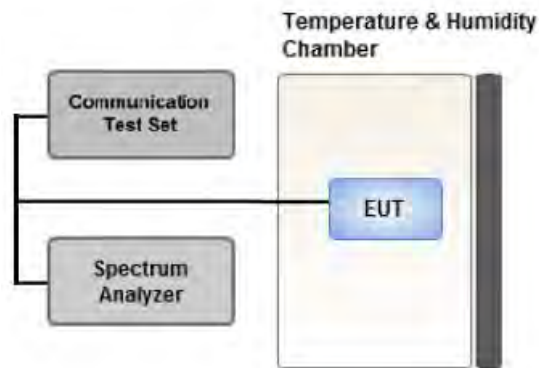
Test Notes

According to FCC 22.917, 24.238, 27.53 specified that power of any emission outside of The authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

All measurements were done at 2 channels(low and high operational frequency range.)

The band edge measurement used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

3.8 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE



Test setup

Test Overview

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015.

The frequency stability of the transmitter is measured by:

1. Temperature:

The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

2. Primary Supply Voltage:

- Unless otherwise specified, vary primary supply voltage from 85% to 115% of the nominal value for other than hand carried battery equipment.
- For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.

Test Settings

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 fifteen minutes 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.

3.9 WORST CASE(RADIATED TEST)

- The EUT was tested in three orthogonal planes(X, Y, Z) and in all possible test configurations and positioning.
- All modes of operation were investigated and the worst case configuration results are reported.
- The worst case is reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the test data.
- SM-G990U & additional models were tested and the worst case results are reported.
(Worst case : SM-G990U)

[Worst case]

Test Description	Modulation	RB size	RB offset	Axis
Effective Isotropic Radiated Power	QPSK, 16QAM, 64QAM, 256QAM	1	0	X
Radiated Spurious and Harmonic Emissions	QPSK	1	0	Z

3.10 WORST CASE(CONDUCTED TEST)

[Worst case]

Test Description	Modulation	Bandwidth (MHz)	Frequency	RB size	RB offset
Occupied Bandwidth	QPSK, 16QAM, 64QAM, 256QAM	5, 10, 15, 20	Mid	Full RB	0
Peak-To-Average Ratio	QPSK, 16QAM, 64QAM, 256QAM	5, 10, 15, 20	Mid	Full RB	0
Band Edge	QPSK	5	Low	1	0
			High	1	24
		10	Low	1	0
			High	1	49
		15	Low	1	0
			High	1	74
		20	Low	1	0
			High	1	99
5, 10, 15, 20	Low, High	Full RB	0		
Spurious and Harmonic Emissions at Antenna Terminal	QPSK	5, 10, 15, 20	Low, Mid, High	1	0

- All modes of operation were investigated and the worst case configuration results are reported.

- SM-G990U & additional models were tested and the worst case results are reported.

(Worst case : SM-G990U)

4. LIST OF TEST EQUIPMENT

Manufacture	Model/ Equipment	Serial Number	Calibration Date	Calibrati on Interval	Calibration Due
T&M SYSTEM	FBSR-02B(WHK1.2/15G-10EF)/H.P.F	-	03/02/2021	Annual	03/02/2022
T&M SYSTEM	FBSR-02B(WHK3.3/18G-10EF)/H.P.F	-	03/02/2021	Annual	03/02/2022
Hewlett Packard	11667B / Power Splitter(DC~26.5 GHz)	11275	04/07/2021	Annual	04/07/2022
Hewlett Packard	E3632A/DC Power Supply	MY40004427	09/16/2020	Annual	09/16/2021
Schwarzbeck	UHAP/ Dipole Antenna	557	04/05/2021	Biennial	04/05/2023
Schwarzbeck	UHAP/ Dipole Antenna	558	04/05/2021	Biennial	04/05/2023
ESPEC	SU-642 / Chamber	93008124	03/15/2021	Annual	03/15/2022
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	147	08/29/2019	Biennial	08/29/2021
Schwarzbeck	BBHA 9120D/ Horn Antenna(1~18GHz)	9120D-1298	09/25/2019	Biennial	09/25/2021
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170342	10/13/2020	Biennial	10/13/2022
Schwarzbeck	BBHA 9170/ Horn Antenna(15~40GHz)	BBHA9170124	02/11/2020	Biennial	02/11/2022
Agilent	N9020A/Signal Analyzer(10Hz~26.5GHz)	MY50200093	11/17/2020	Annual	11/17/2021
Hewlett Packard	8493C/ATTENUATOR(20dB)	17280	06/04/2020	Annual	06/04/2021
REOHDE & SCHWARZ	FSV40/Spectrum Analyzer(10Hz~40GHz)	100931	10/14/2020	Annual	10/14/2021
Agilent	8960 (E5515C)/ Base Station	MY48360800	08/26/2020	Annual	08/26/2021
Schwarzbeck	FMZB1513/ Loop Antenna(9kHz~30MHz)	1513-333	03/19/2020	Biennial	03/19/2022
Schwarzbeck	VULB9160/ Bilog Antenna	3150	03/03/2021	Biennial	03/03/2023
Schwarzbeck	VULB9168/ Hybrid Antenna	760	02/22/2021	Biennial	02/22/2023
Anritsu Corp.	MT8821C/Wideband Radio Communication Tester	6262116770	07/22/2020	Annual	07/22/2021
Anritsu Corp.	MT8820C/Wideband Radio Communication Tester	6201026545	01/07/2021	Annual	01/07/2022
REOHDE & SCHWARZ	SMB100A/ SIGNAL GENERATOR (100kHz~40GHz)	177633	07/13/2020	Annual	07/13/2021
KEYSIGHT	N9030B / Signal Analyzer(5Hz~40.0GHz)	MY55480167	06/04/2020	Annual	06/04/2021
HCT CO., LTD.,	FCC LTE Mobile Conducted RF Automation Test Software	-	-	-	-

Note:

1. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.
2. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (\pm dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

6. SUMMARY OF TEST RESULTS

6.1 Test Condition : Conducted Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Occupied Bandwidth	§2.1049	N/A	PASS
Band Edge / Spurious and Harmonic Emissions at Antenna Terminal.	§2.1051, §27.53(m)(4)	<ul style="list-style-type: none"> ■ $< 40 + 10\log_{10} (P[\text{Watts}])$ at Channel edges ■ $< 43 + 10\log_{10} (P[\text{Watts}])$ between 5 and X MHz from Channel edges ■ $< 55 + 10\log_{10} (P[\text{Watts}])$ beyond X MHz beyond from Channel edges ■ $< 43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz 	PASS
Conducted Output Power	§2.1046	N/A	<u>See Note1</u>
Frequency stability / variation of ambient temperature	§2.1055, §27.54	Emission must remain in band	PASS

Note:

1. See SAR Report

6.2 Test Condition : Radiated Test

Test Description	FCC Part Section(s)	Test Limit	Test Result
Equivalent Isotropic Radiated Power	§27.50(h)(2)	< 2 Watts max. EIRP	PASS
Radiated Spurious and Harmonic Emissions	§2.1053, §27.53(m)(4)	$< 43 + 10\log_{10} (P[\text{Watts}])$ for all out-of band emissions	PASS

7. SAMPLE CALCULATION

7.1 ERP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBd)	C.L	Pol.	ERP	
channel	Freq.(MHz)						W	dBm
128	824.20	-21.37	38.40	-10.61	0.95	H	0.483	26.84

ERP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter’s level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter’s level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of effective radiated power.

7.2 EIRP Sample Calculation

Ch./ Freq.		Measured Level(dBm)	Substitute Level(dBm)	Ant. Gain (dBi)	C.L	Pol.	EIRP	
channel	Freq.(MHz)						W	dBm
20175	1,732.50	-15.75	18.45	9.90	1.76	H	0.456	26.59

EIRP = Substitute LEVEL(dBm) + Ant. Gain – CL(Cable Loss)

- 1) The EUT mounted on a non-conductive turntable is 2.5 meter above test site ground level.
- 2) During the test , the turn table is rotated until the maximum signal is found.
- 3) Record the field strength meter’s level.
- 4) Replace the EUT with dipole/Horn antenna that is connected to a calibrated signal generator.
- 5) Increase the signal generator output till the field strength meter’s level is equal to the item (3).
- 6) The signal generator output level with Ant. Gain and cable loss are the rating of equivalent isotropic radiated power.

7.3. Emission Designator

GSM Emission Designator

Emission Designator = 249KGXW

GSM BW = 249 kHz

G = Phase Modulation

X = Cases not otherwise covered

W = Combination (Audio/Data)

EDGE Emission Designator

Emission Designator = 249KG7W

GSM BW = 249 kHz

G = Phase Modulation

7 = Quantized/Digital Info

W = Combination (Audio/Data)

WCDMA Emission Designator

Emission Designator = 4M17F9W

WCDMA BW = 4.17 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

QPSK Modulation

Emission Designator = 4M48G7D

LTE BW = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

QAM Modulation

Emission Designator = 4M48W7D

LTE BW = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission; telemetry; telecommand

8. TEST DATA

8.1 EQUIVALENT ISOTROPIC RADIATED POWER

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2502.5	LTE B7/ 5 MHz	QPSK	-24.11	13.07	10.70	2.49	H	< 2.00	0.134	21.28
		16-QAM	-24.77	12.41	10.70	2.49	H		0.115	20.62
		64-QAM	-25.94	11.24	10.70	2.49	H		0.088	19.45
		256-QAM	-28.99	8.19	10.70	2.49	H		0.044	16.40
2535.0		QPSK	-24.36	12.95	10.83	2.51	H		0.134	21.28
		16-QAM	-24.96	12.35	10.83	2.51	H		0.117	20.68
		64-QAM	-26.16	11.15	10.83	2.51	H		0.089	19.48
		256-QAM	-29.24	8.07	10.83	2.51	H		0.044	16.40
2567.5		QPSK	-24.83	12.37	10.95	2.52	H		0.120	20.80
		16-QAM	-25.47	11.73	10.95	2.52	H		0.104	20.16
		64-QAM	-26.60	10.60	10.95	2.52	H		0.080	19.03
		256-QAM	-29.65	7.55	10.95	2.52	H		0.040	15.98

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit	EIRP	
								W	W	dBm
2505.0	LTE B7/ 10 MHz	QPSK	-24.06	13.18	10.73	2.50	H	< 2.00	0.138	21.41
		16-QAM	-24.85	12.39	10.73	2.50	H		0.115	20.62
		64-QAM	-25.99	11.25	10.73	2.50	H		0.089	19.48
		256-QAM	-29.13	8.11	10.73	2.50	H		0.043	16.34
2535.0		QPSK	-24.24	13.07	10.83	2.51	H		0.138	21.40
		16-QAM	-24.91	12.40	10.83	2.51	H		0.118	20.73
		64-QAM	-26.09	11.22	10.83	2.51	H		0.090	19.55
		256-QAM	-29.27	8.04	10.83	2.51	H		0.043	16.37
2565.0		QPSK	-24.59	12.62	10.94	2.52	H		0.127	21.04
		16-QAM	-25.30	11.91	10.94	2.52	H		0.108	20.33
		64-QAM	-26.48	10.73	10.94	2.52	H		0.082	19.15
		256-QAM	-29.64	7.57	10.94	2.52	H		0.040	15.99

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit		EIRP	
								W	W	dBm	dBm
2507.5	LTE B7/ 15 MHz	QPSK	-24.11	13.20	10.75	2.50	H	< 2.00	0.140	21.45	
		16-QAM	-25.10	12.21	10.75	2.50	H		0.111	20.46	
		64-QAM	-26.02	11.29	10.75	2.50	H		0.090	19.54	
		256-QAM	-29.20	8.11	10.75	2.50	H		0.043	16.36	
2535.0		QPSK	-24.15	13.16	10.83	2.51	H		0.141	21.49	
		16-QAM	-24.97	12.34	10.83	2.51	H		0.117	20.67	
		64-QAM	-25.89	11.42	10.83	2.51	H		0.094	19.75	
		256-QAM	-29.07	8.24	10.83	2.51	H		0.045	16.57	
2562.5		QPSK	-24.57	12.64	10.93	2.52	H		0.127	21.05	
		16-QAM	-25.33	11.88	10.93	2.52	H		0.107	20.29	
		64-QAM	-26.30	10.91	10.93	2.52	H		0.086	19.32	
		256-QAM	-29.42	7.79	10.93	2.52	H		0.042	16.20	

Freq (MHz)	Bandwidth	Modulation	Measured Level (dBm)	Substitute Level (dBm)	Ant. Gain(dBi)	C.L	Pol	Limit		EIRP	
								W	W	dBm	dBm
2510.0	LTE B7/ 20 MHz	QPSK	-24.22	13.09	10.75	2.50	H	< 2.00	0.136	21.34	
		16-QAM	-25.00	12.31	10.75	2.50	H		0.114	20.56	
		64-QAM	-26.00	11.31	10.75	2.50	H		0.090	19.56	
		256-QAM	-29.33	7.98	10.75	2.50	H		0.042	16.23	
2535.0		QPSK	-24.21	13.10	10.83	2.51	H		0.139	21.43	
		16-QAM	-25.05	12.26	10.83	2.51	H		0.114	20.59	
		64-QAM	-26.02	11.29	10.83	2.51	H		0.092	19.62	
		256-QAM	-29.22	8.09	10.83	2.51	H		0.044	16.42	
2560.0		QPSK	-24.41	12.80	10.93	2.52	H		0.132	21.21	
		16-QAM	-25.10	12.11	10.93	2.52	H		0.113	20.52	
		64-QAM	-26.16	11.05	10.93	2.52	H		0.088	19.46	
		256-QAM	-29.28	7.93	10.93	2.52	H		0.043	16.34	

8.2 RADIATED SPURIOUS EMISSIONS

- ▣ OPERATING FREQUENCY : 2502.5 MHz
- ▣ MEASURED OUTPUT POWER: 21.28 dBm = 0.134 W
- ▣ MODE: LTE B7
- ▣ MODULATION SIGNAL: 5 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 46.28 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20775 (2502.5)	5 005.00	-46.12	12.68	-55.38	3.60	H	-46.30	67.58
	7 507.50	-52.65	11.25	-53.79	4.48	H	-47.02	68.29
	10 010.00	-50.42	10.98	-47.44	5.27	V	-41.73	63.01
	12 512.50	-56.01	13.90	-52.72	6.02	H	-44.84	66.12
	15 015.00	-49.60	12.98	-39.53	6.67	H	-33.22	54.49
21100 (2535.0)	5 070.00	-46.89	12.40	-55.49	3.65	V	-46.74	68.02
	7 605.00	-53.04	11.53	-54.57	4.49	H	-47.52	68.80
	10 140.00	-49.66	11.18	-46.03	5.29	H	-40.14	61.41
	12 675.00	-55.27	13.55	-49.98	6.03	H	-42.46	63.74
	15 210.00	-48.38	14.08	-39.77	6.73	V	-32.42	53.70
21425 (2567.5)	5 135.00	-48.52	12.43	-57.11	3.67	H	-48.35	69.62
	7 702.50	-49.23	11.70	-50.73	4.51	V	-43.54	64.82
	10 270.00	-47.87	10.90	-43.43	5.40	H	-37.93	59.20
	12 837.50	-53.01	13.40	-46.45	6.15	H	-39.20	60.48
	15 405.00	-48.61	15.33	-40.17	6.74	V	-31.58	52.86

- ▣ OPERATING FREQUENCY : 2505.0 MHz
- ▣ MEASURED OUTPUT POWER: 21.41 dBm = 0.138 W
- ▣ MODE: LTE B7
- ▣ MODULATION SIGNAL: 10 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 46.41 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20800 (2505.0)	5 010.00	-45.90	12.65	-55.11	3.59	V	-46.05	67.46
	7 515.00	-54.12	11.28	-55.27	4.46	V	-48.45	69.86
	10 020.00	-50.00	11.05	-46.39	5.27	V	-40.61	62.02
	12 525.00	-56.12	13.90	-52.48	5.94	V	-44.52	65.93
	15 030.00	-51.94	13.00	-41.68	6.66	V	-35.34	56.75
21100 (2535.0)	5 070.00	-48.28	12.40	-56.88	3.65	H	-48.13	69.55
	7 605.00	-54.14	11.53	-55.67	4.49	V	-48.62	70.04
	10 140.00	-49.11	11.18	-45.48	5.29	V	-39.59	61.00
	12 675.00	-56.24	13.55	-50.95	6.03	V	-43.43	64.84
	15 210.00	-49.80	14.08	-41.19	6.73	V	-33.84	55.25
21400 (2565.0)	5 130.00	-48.28	12.40	-56.64	3.67	V	-47.91	69.33
	7 695.00	-53.37	11.70	-54.76	4.51	V	-47.57	68.98
	10 260.00	-49.22	10.95	-44.48	5.40	V	-38.93	60.34
	12 825.00	-54.49	13.40	-48.37	6.12	H	-41.09	62.50
	15 390.00	-48.99	15.23	-40.84	6.79	V	-32.40	53.81

- ▣ OPERATING FREQUENCY : 2535.0 MHz
- ▣ MEASURED OUTPUT POWER: 21.49 dBm = 0.141 W
- ▣ MODE: LTE B7
- ▣ MODULATION SIGNAL: 15 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 46.49 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20825 (2507.5)	5 015.00	-47.75	12.63	-57.00	3.60	H	-47.97	69.45
	7 522.50	-54.67	11.30	-56.01	4.46	H	-49.17	70.65
	10 030.00	-49.71	11.05	-45.79	5.29	V	-40.03	61.51
	15 045.00	-52.77	13.08	-42.64	6.68	V	-36.23	57.72
21100 (2535.0)	5 070.00	-47.73	12.40	-56.33	3.65	V	-47.58	69.07
	7 605.00	-52.10	11.53	-53.63	4.49	V	-46.58	68.07
	10 140.00	-48.50	11.18	-44.87	5.29	V	-38.98	60.46
	12 675.00	-55.85	13.55	-50.56	6.03	H	-43.04	64.53
	15 210.00	-48.96	14.08	-40.35	6.73	V	-33.00	54.49
21375 (2562.5)	5 125.00	-48.45	12.40	-56.44	3.67	H	-47.71	69.20
	7 687.50	-53.48	11.70	-54.75	4.51	H	-47.56	69.05
	10 250.00	-48.79	11.00	-43.78	5.39	V	-38.17	59.65
	12 812.50	-54.49	13.40	-48.61	6.05	H	-41.26	62.74
	15 375.00	-49.40	15.15	-41.35	6.79	V	-32.98	54.47

- ▣ OPERATING FREQUENCY : 2535.0 MHz
- ▣ MEASURED OUTPUT POWER: 21.43 dBm = 0.139 W
- ▣ MODE: LTE B7
- ▣ MODULATION SIGNAL: 20 MHz QPSK
- ▣ DISTANCE: 1 meters
- ▣ LIMIT: $55 + 10 \log_{10}(W) =$ 46.43 dBc

Ch	Freq (MHz)	Measured Level (dBm)	Ant. Gain (dBi)	Substitute Level (dBm)	C.L	Pol	Result (dBm)	dBc
20850 (2510.0)	5 020.00	-45.93	12.60	-55.21	3.60	H	-46.21	67.64
	7 530.00	-45.81	11.30	-46.82	4.45	H	-39.97	61.40
	10 040.00	-50.64	11.13	-46.68	5.32	V	-40.87	62.30
	12 550.00	-56.93	13.90	-52.71	5.98	V	-44.79	66.22
	15 060.00	-53.23	13.18	-43.37	6.69	H	-36.88	58.31
21100 (2535.0)	5 070.00	-47.21	12.40	-55.81	3.65	V	-47.06	68.49
	7 605.00	-53.64	11.53	-55.17	4.49	V	-48.12	69.55
	10 140.00	-48.36	11.18	-44.73	5.29	V	-38.84	60.26
	15 210.00	-50.97	14.08	-42.36	6.73	V	-35.01	56.44
21350 (2560.0)	5 120.00	-48.25	12.40	-55.87	3.67	V	-47.14	68.57
	7 680.00	-52.90	11.70	-53.73	4.50	V	-46.53	67.95
	10 240.00	-49.54	11.00	-44.71	5.37	V	-39.08	60.51
	12 800.00	-55.26	13.40	-49.34	6.03	H	-41.97	63.39
	15 360.00	-49.93	15.08	-41.82	6.75	V	-33.49	54.92

8.3 PEAK-TO-AVERAGE RATIO

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (dB)
7	5 MHz	2535.0	QPSK	25	0	5.44
			16-QAM	25	0	6.24
			64-QAM	25	0	6.87
			256-QAM	25	0	6.78
	10 MHz		QPSK	50	0	5.46
			16-QAM	50	0	6.26
			64-QAM	50	0	6.84
			256-QAM	50	0	6.75
	15 MHz		QPSK	75	0	5.48
			16-QAM	75	0	6.26
			64-QAM	75	0	6.75
			256-QAM	75	0	6.76
	20 MHz		QPSK	100	0	5.47
			16-QAM	100	0	6.25
			64-QAM	100	0	6.77
			256-QAM	100	0	6.82

Note:

1. Plots of the EUT's Peak- to- Average Ratio are shown Page 86 ~ 101.

8.4 OCCUPIED BANDWIDTH

Band	Band Width	Frequency (MHz)	Modulation	Resource Block Size	Resource Block Offset	Data (MHz)
7	5 MHz	2535.0	QPSK	25	0	4.5134
			16-QAM	25		4.5015
			64-QAM	25		4.4966
			256-QAM	25		4.5056
	10 MHz		QPSK	50		8.9631
			16-QAM	50		8.9993
			64-QAM	50		8.9808
			256-QAM	50		8.9931
	15 MHz		QPSK	75		13.492
			16-QAM	75		13.458
			64-QAM	75		13.470
			256-QAM	75		13.418
	20 MHz		QPSK	100		17.938
			16-QAM	100		17.907
			64-QAM	100		17.915
			256-QAM	100		17.904

Note:

1. Plots of the EUT's Occupied Bandwidth are shown Page 70 ~ 85.

8.5 CONDUCTED SPURIOUS EMISSIONS

Band	Band Width (MHz)	Frequency (MHz)	Frequency of Maximum Harmonic (GHz)	Factor (dB)	Measurement Maximum Data (dBm)	Result (dBm)	Limit (dBm)
7	5	2502.5	25.8040	30.131	-76.335	-46.204	-25.00
		2535.0	26.1347	30.131	-76.668	-46.537	
		2567.5	26.1470	30.131	-76.432	-46.301	
	10	2505.0	26.1020	30.131	-76.645	-46.514	
		2535.0	26.1513	30.131	-76.290	-46.159	
		2565.0	26.1674	30.131	-76.164	-46.033	
	15	2507.5	26.1440	30.131	-75.911	-45.780	
		2535.0	26.2027	30.131	-76.361	-46.230	
		2562.5	26.2125	30.131	-76.622	-46.491	
	20	2510.0	26.1496	30.131	-76.687	-46.556	
		2535.0	26.1139	30.131	-76.618	-46.487	
		2560.0	26.1109	30.131	-76.517	-46.386	

Note:

1. Plots of the EUT's Conducted Spurious Emissions are shown Page 102 ~125.
2. Conducted Spurious Emissions was Tested QPSK Modulation, Resource Block Size 1 and Resource Block Offset 0
3. Result (dBm) = Measurement Maximum Data (dBm) + Factor (dB)
4. Factor(dB) = Cable Loss + Attenuator + Power Splitter

Frequency Range (GHz)	Factor [dB]
0.03 – 1	25.270
1 – 5	27.976
5 – 10	28.591
10 – 15	29.116
15 – 20	29.489
Above 20	30.131

8.6 CHANNEL EDGE

Band Width (Modulation)	Frequency (MHz)	RB Size / Offset	C.E ~ (C.E ± 1MHz)		2 496 MHz ~ 2 499 MHz	(C.E + 1 MHz) ~ (C.E + 5 MHz)	2 490.5 MHz ~ 2 496 MHz	(C.E + 5 MHz) ~ (C.E + X MHz)	Below 2 490.5 MHz	Above (C.E + X MHz)
			Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
5MHz	2502.5	25 / 0	-26.49	-26.34	-21.20	-23.56	-32.24	-32.84	-40.01	-32.90
10MHz	2505.0	50 / 0	-30.30	-31.63	-26.71	-29.03	-30.79	-31.86	-38.78	-33.49
15MHz	2507.5	75 / 0	-26.42	-26.41	-22.38	-22.01	-25.09	-25.95	-33.66	-32.84
20MHz	2510.0	100 / 0	-26.71	-25.63	-24.22	-22.55	-26.45	-25.33	-31.59	-34.24
Limit			-10.0		-10.0		-13.0		-25.0	

Band Width (Modulation)	Frequency (MHz)	RB Size / Offset	C.E ~ (C.E ± 1MHz)		(C.E ± 1 MHz) ~ (C.E ± 5 MHz)	
			Lower	Upper	Lower	Upper
5MHz (QPSK)	2535.0	25 / 0	-23.69	-24.35	-17.50	-18.45
	2567.5	25 / 0	-23.01	-23.42	-16.79	-17.22
10MHz (QPSK)	2535.0	50 / 0	-27.65	-28.68	-23.24	-24.40
	2565.0	50 / 0	-27.66	-28.15	-23.86	-23.18
15MHz (QPSK)	2535.0	75 / 0	-25.01	-25.97	-20.72	-21.56
	2562.5	75 / 0	-25.93	-24.94	-22.33	-20.22
20MHz (QPSK)	2535.0	100 / 0	-25.16	-26.08	-22.02	-22.82
	2560.0	100 / 0	-25.91	-24.47	-22.95	-20.95
Limit			-10.0		-10.0	

Band Width (Modulation)	Frequency (MHz)	Resource Block Size	(C.E ± 5 MHz) ~ (C.E ± X MHz)		Above (C.E ± X MHz)	
			Lower	Upper	Lower	Upper
5MHz (QPSK)	2535.0	25 / 0	-32.61	-32.59	-33.60	-33.29
	2567.5	25 / 0	-28.20	-28.14	-29.87	-29.92
10MHz (QPSK)	2535.0	50 / 0	-28.78	-28.73	-35.54	-35.55
	2565.0	50 / 0	-28.97	-28.11	-34.41	-35.42
15MHz (QPSK)	2535.0	75 / 0	-24.76	-24.85	-37.86	-37.84
	2562.5	75 / 0	-25.53	-23.58	-35.86	-36.71
20MHz (QPSK)	2535.0	100 / 0	-25.13	-25.09	-38.95	-38.12
	2560.0	100 / 0	-25.36	-24.10	-37.89	-40.54
Limit			-13.0		-25.0	

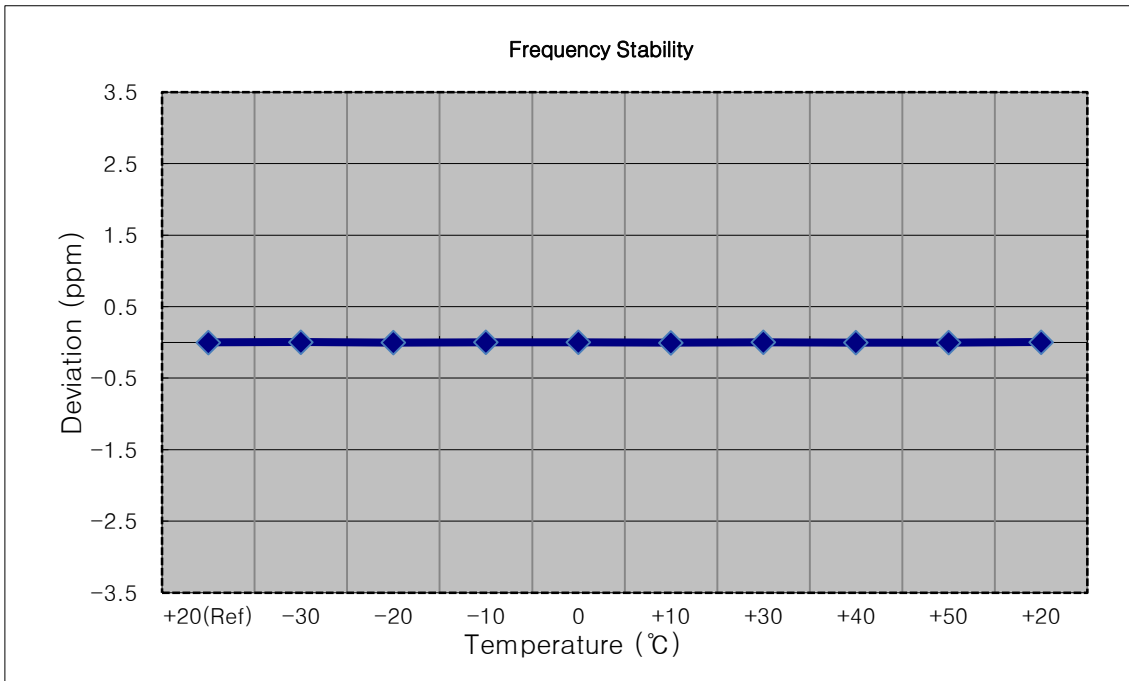
Note:

1. C.E = Channel Edge
2. X = X is the greater of 6MHz or the actual emission bandwidth.
3. X = 6MHz(5MHz Bandwidth), 10MHz(10MHz Bandwidth), 15MHz(15MHz Bandwidth), 20MHz(20MHz Bandwidth)
4. Plots of the EUT's Channel Edge are shown Page 46 ~ 69.

8.7 FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

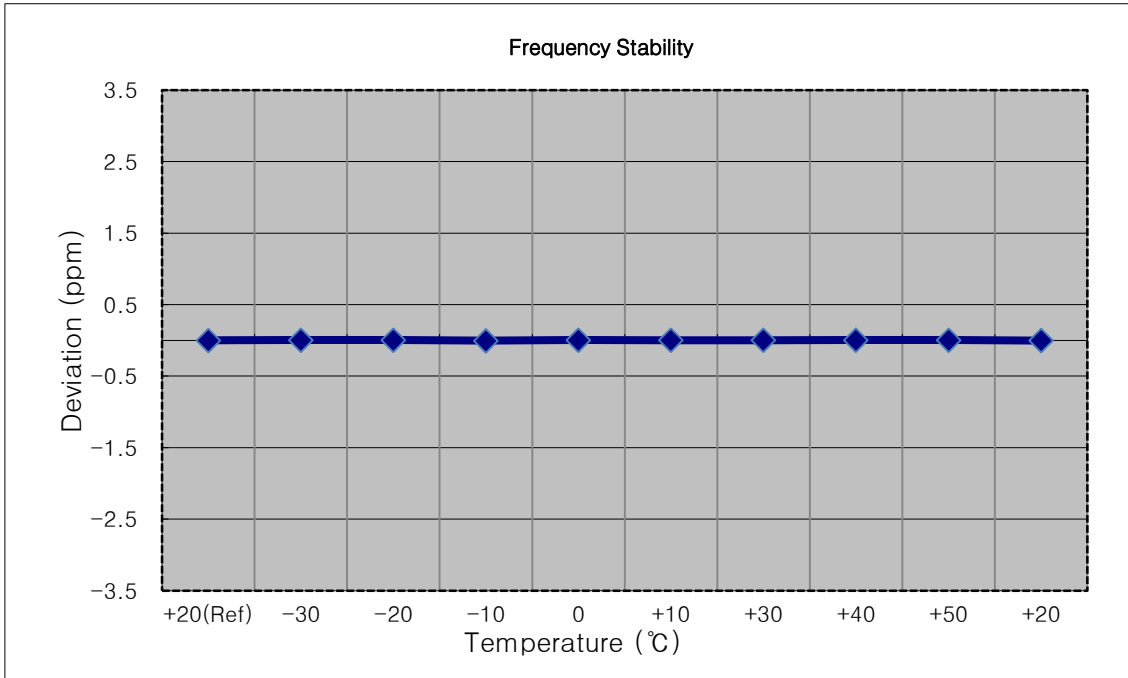
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,502,500,000 Hz
- ▣ CHANNEL: 20775 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2502 500 008	0.0	0.000 000	0.000
100%		-30	2502 500 017	8.4	0.000 000	0.003
100%		-20	2502 500 002	-5.9	0.000 000	-0.002
100%		-10	2502 500 013	4.2	0.000 000	0.002
100%		0	2502 500 012	4.1	0.000 000	0.002
100%		+10	2502 499 999	-9.8	0.000 000	-0.004
100%		+30	2502 500 014	5.7	0.000 000	0.002
100%		+40	2502 500 002	-6.8	0.000 000	-0.003
100%		+50	2502 500 000	-8.4	0.000 000	-0.003
Batt. Endpoint		3.650	+20	2502 500 021	12.6	0.000 001



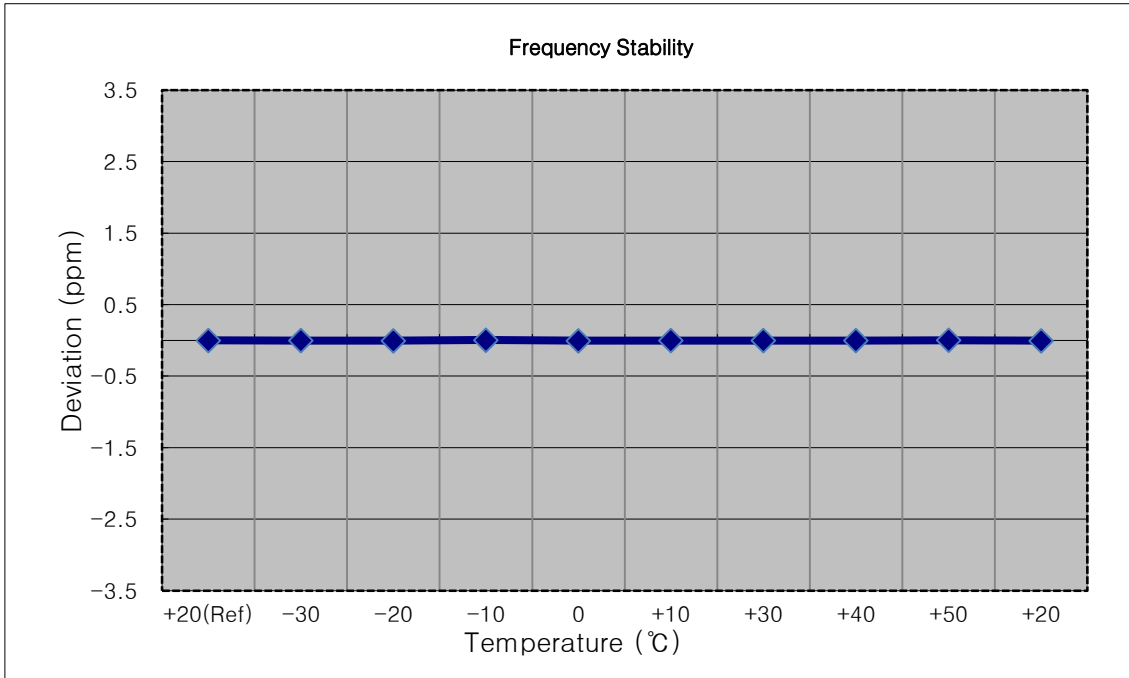
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,505,000,000 Hz
- ▣ CHANNEL: 20800 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2504 999 993	0.0	0.000 000	0.000
100%		-30	2505 000 005	12.2	0.000 000	0.005
100%		-20	2505 000 004	10.9	0.000 000	0.004
100%		-10	2504 999 984	-8.8	0.000 000	-0.004
100%		0	2505 000 007	13.7	0.000 001	0.005
100%		+10	2505 000 001	8.2	0.000 000	0.003
100%		+30	2504 999 999	5.6	0.000 000	0.002
100%		+40	2505 000 005	11.5	0.000 000	0.005
100%		+50	2505 000 002	8.7	0.000 000	0.003
Batt. Endpoint	3.650	+20	2504 999 989	-3.9	0.000 000	-0.002



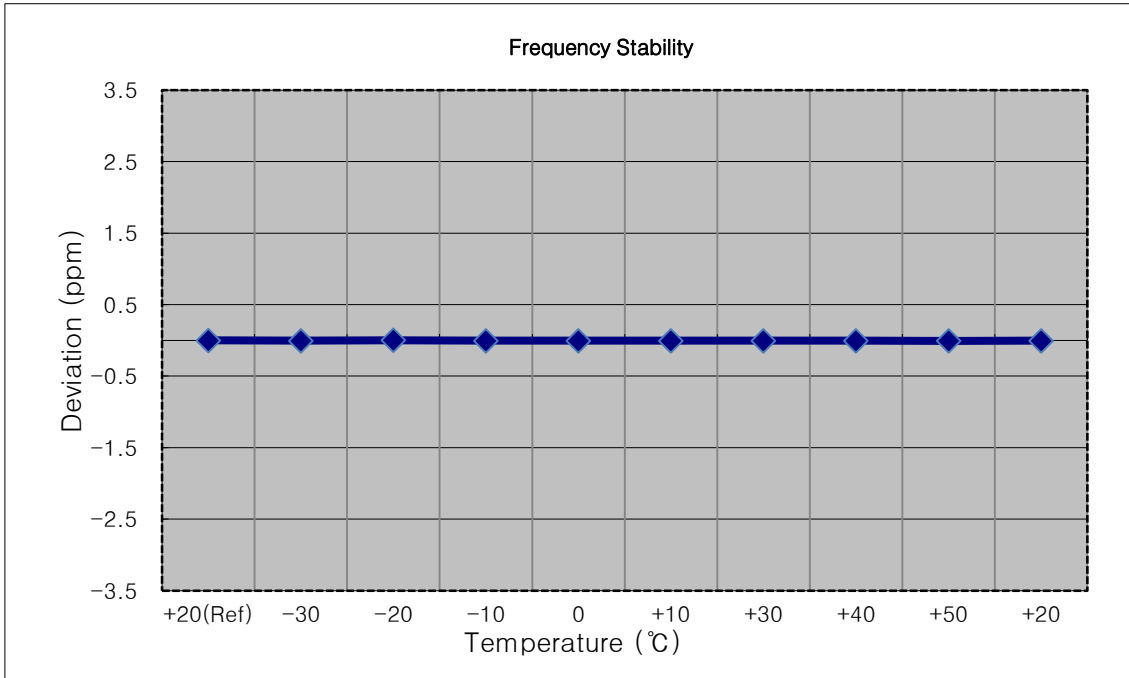
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,507,500,000 Hz
- ▣ CHANNEL: 20825 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2507 499 992	0.0	0.000 000	0.000
100%		-30	2507 499 984	-7.6	0.000 000	-0.003
100%		-20	2507 499 983	-9.3	0.000 000	-0.004
100%		-10	2507 500 002	9.7	0.000 000	0.004
100%		0	2507 499 981	-11.0	0.000 000	-0.004
100%		+10	2507 499 985	-7.2	0.000 000	-0.003
100%		+30	2507 499 985	-7.4	0.000 000	-0.003
100%		+40	2507 499 987	-4.8	0.000 000	-0.002
100%		+50	2507 499 998	6.3	0.000 000	0.003
Batt. Endpoint	3.650	+20	2507 499 981	-11.4	0.000 000	-0.005



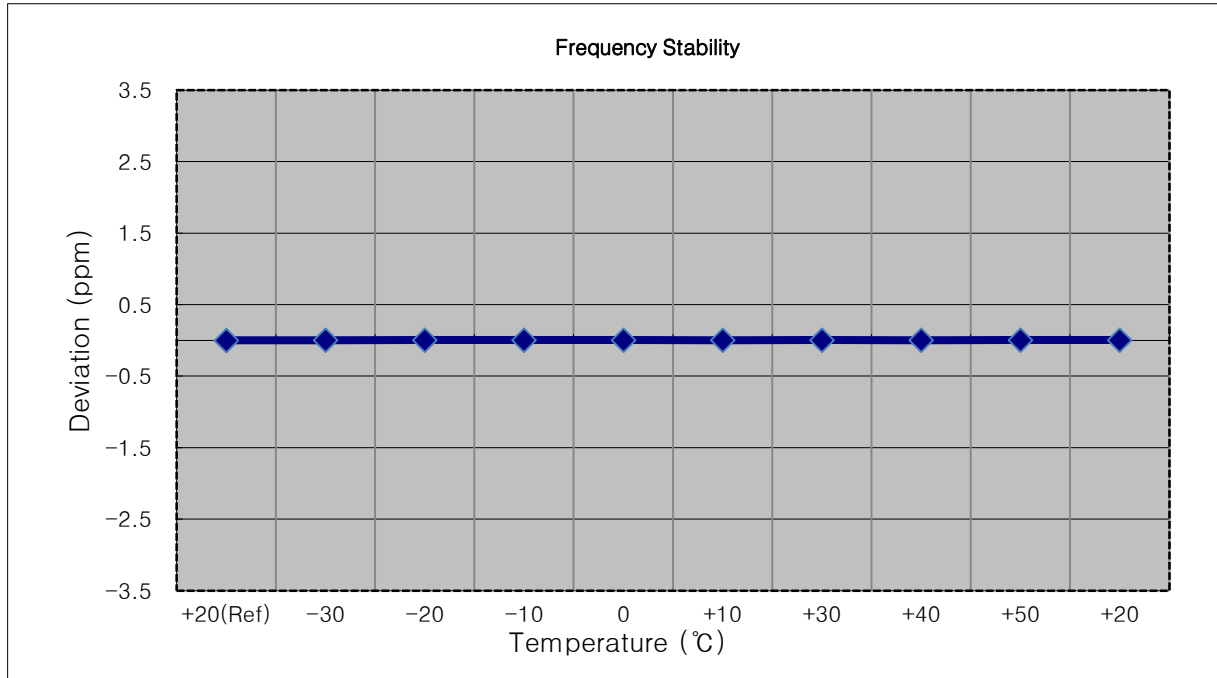
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,510,000,000 Hz
- ▣ CHANNEL: 20850 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2509 999 986	0.0	0.000 000	0.000
100%		-30	2509 999 973	-12.6	-0.000 001	-0.005
100%		-20	2509 999 991	5.1	0.000 000	0.002
100%		-10	2509 999 975	-10.9	0.000 000	-0.004
100%		0	2509 999 974	-11.3	0.000 000	-0.005
100%		+10	2509 999 972	-13.4	-0.000 001	-0.005
100%		+30	2509 999 974	-11.6	0.000 000	-0.005
100%		+40	2509 999 972	-13.8	-0.000 001	-0.005
100%		+50	2509 999 970	-15.9	-0.000 001	-0.006
Batt. Endpoint	3.650	+20	2509 999 972	-13.9	-0.000 001	-0.006



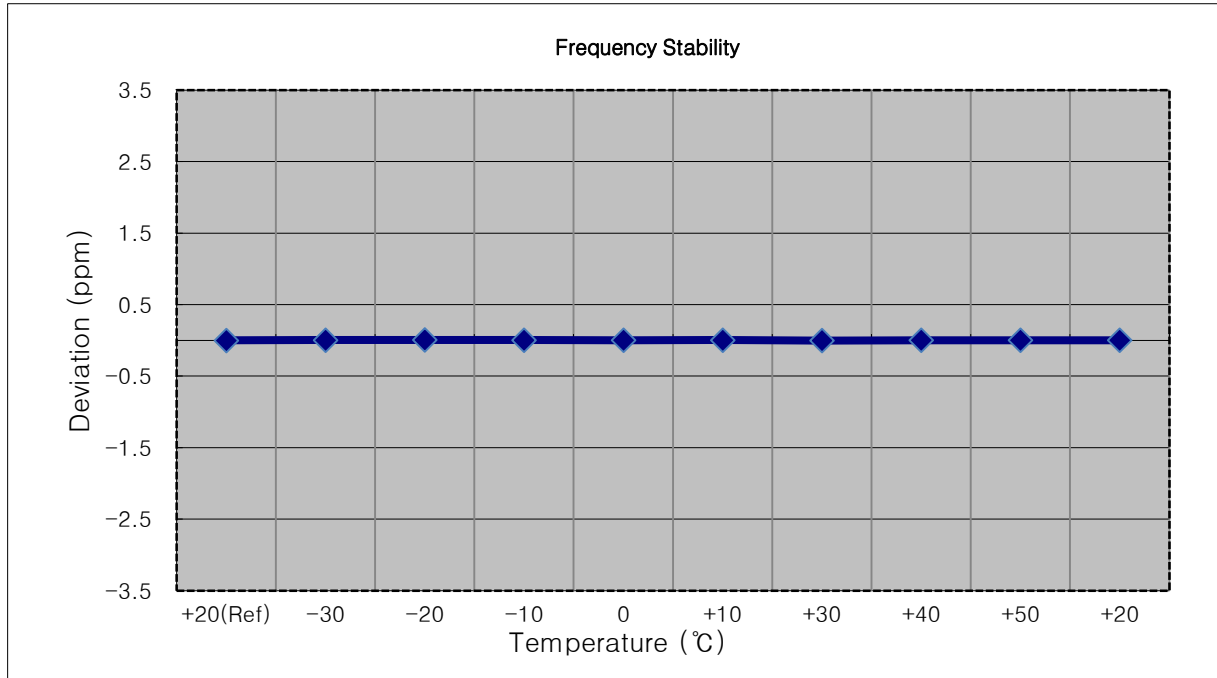
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,535,000,000 Hz
- ▣ CHANNEL: 21100 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2535 000 007	0.0	0.000 000	0.000
100%		-30	2535 000 012	5.2	0.000 000	0.002
100%		-20	2535 000 017	9.5	0.000 000	0.004
100%		-10	2535 000 019	11.9	0.000 000	0.005
100%		0	2535 000 016	8.7	0.000 000	0.003
100%		+10	2535 000 013	6.2	0.000 000	0.002
100%		+30	2535 000 018	10.4	0.000 000	0.004
100%		+40	2535 000 011	3.4	0.000 000	0.001
100%		+50	2535 000 018	10.9	0.000 000	0.004
Batt. Endpoint	3.650	+20	2535 000 019	11.8	0.000 000	0.005



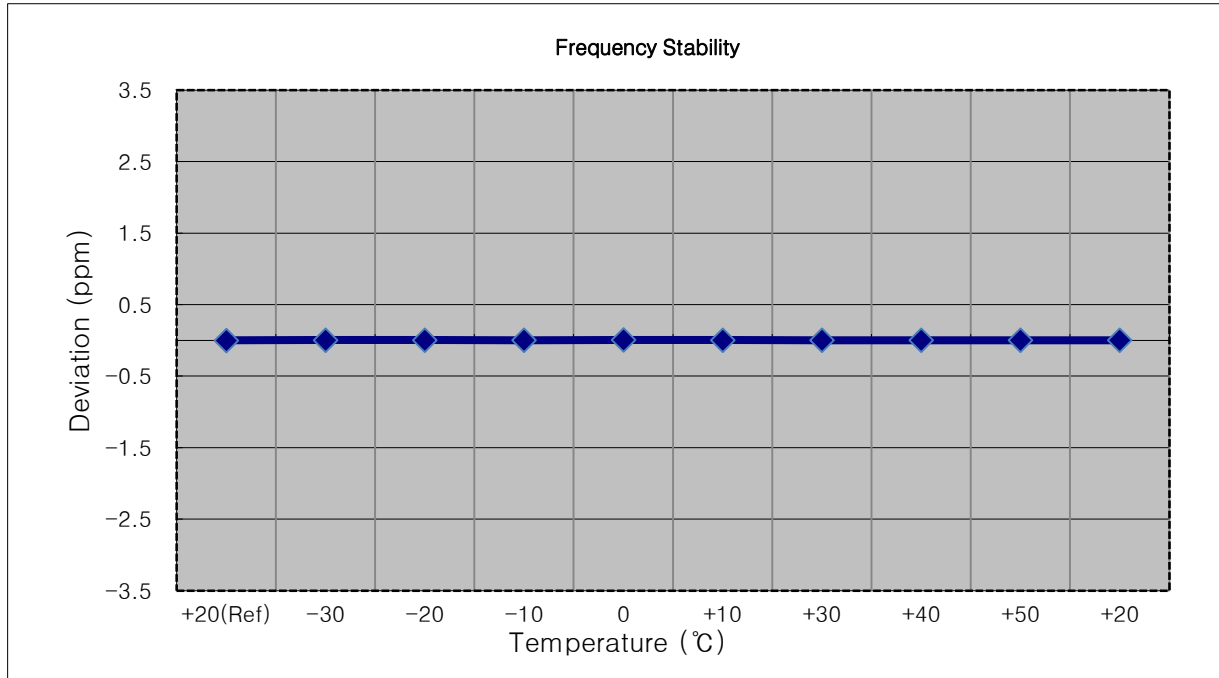
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,535,000,000 Hz
- ▣ CHANNEL: 21100 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2534 999 996	0.0	0.000 000	0.000
100%		-30	2535 000 006	10.5	0.000 000	0.004
100%		-20	2535 000 010	14.6	0.000 001	0.006
100%		-10	2535 000 007	11.0	0.000 000	0.004
100%		0	2535 000 003	7.6	0.000 000	0.003
100%		+10	2535 000 010	13.9	0.000 001	0.005
100%		+30	2534 999 988	-7.2	0.000 000	-0.003
100%		+40	2535 000 001	5.1	0.000 000	0.002
100%		+50	2535 000 004	8.0	0.000 000	0.003
Batt. Endpoint	3.650	+20	2535 000 004	8.4	0.000 000	0.003



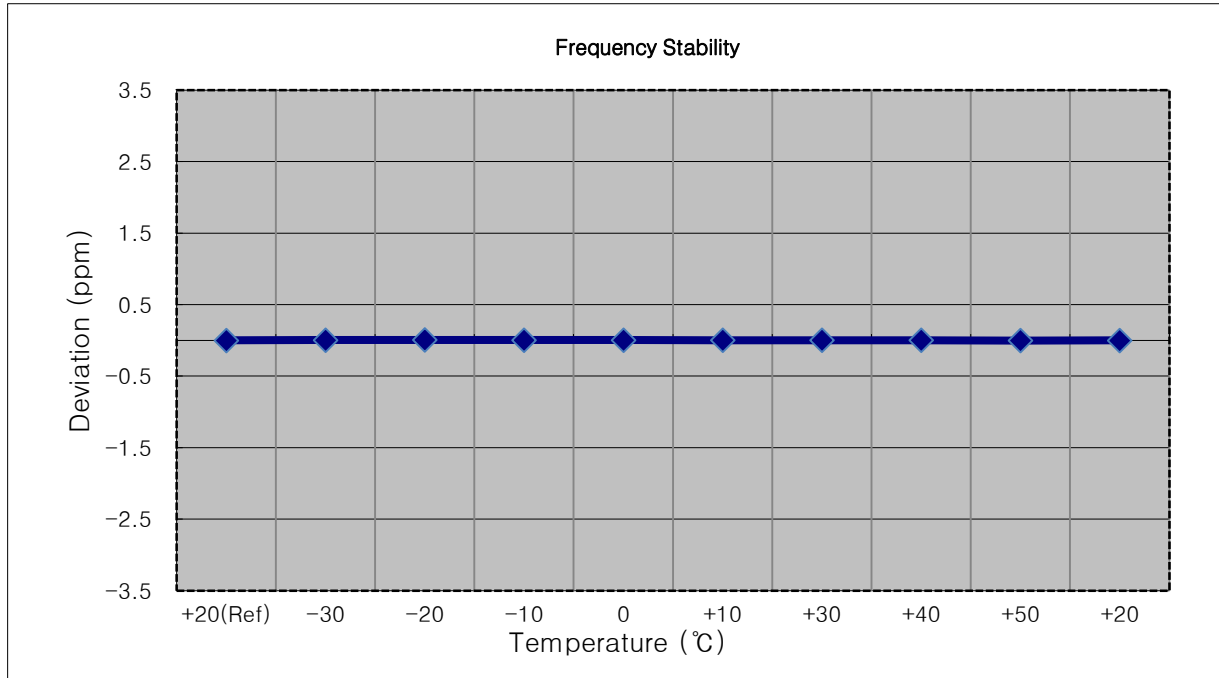
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,535,000,000 Hz
- ▣ CHANNEL: 21100 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2534 999 993	0.0	0.000 000	0.000
100%		-30	2535 000 004	10.8	0.000 000	0.004
100%		-20	2535 000 003	10.0	0.000 000	0.004
100%		-10	2534 999 999	5.9	0.000 000	0.002
100%		0	2535 000 009	16.5	0.000 001	0.007
100%		+10	2535 000 003	10.3	0.000 000	0.004
100%		+30	2534 999 999	6.2	0.000 000	0.002
100%		+40	2535 000 000	7.1	0.000 000	0.003
100%		+50	2535 000 000	7.2	0.000 000	0.003
Batt. Endpoint	3.650	+20	2535 000 000	7.4	0.000 000	0.003



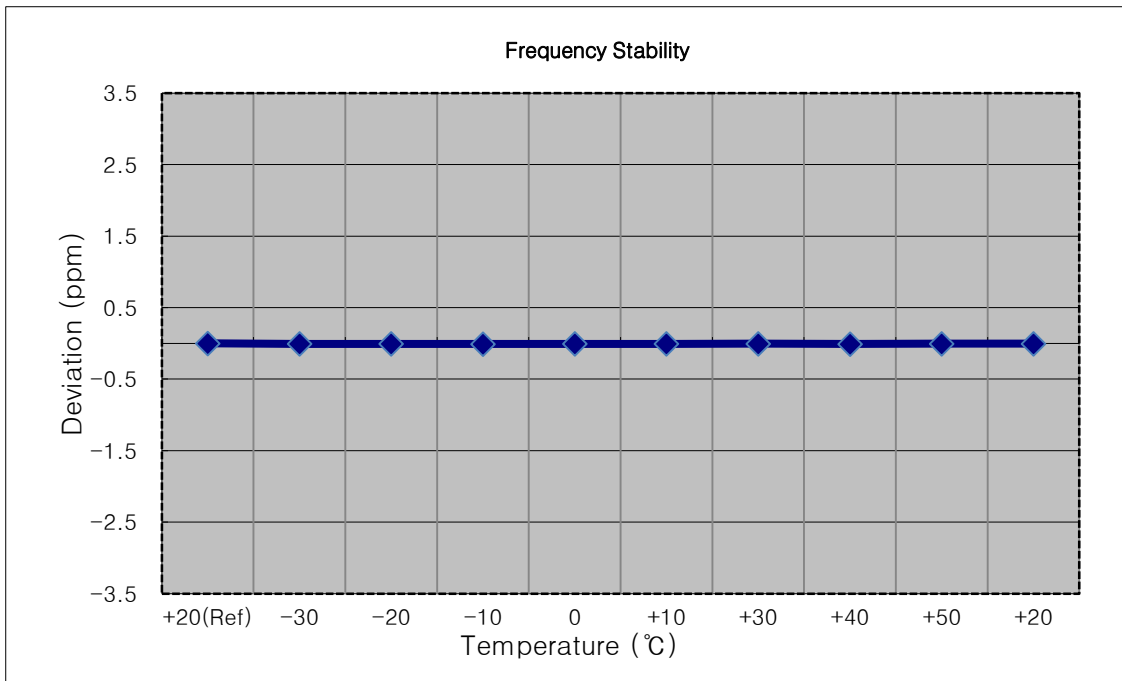
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,535,000,000 Hz
- ▣ CHANNEL: 21100 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2535 000 008	0.0	0.000 000	0.000
100%		-30	2535 000 020	12.0	0.000 000	0.005
100%		-20	2535 000 025	16.9	0.000 001	0.007
100%		-10	2535 000 019	11.4	0.000 000	0.004
100%		0	2535 000 019	11.2	0.000 000	0.004
100%		+10	2535 000 016	8.4	0.000 000	0.003
100%		+30	2535 000 014	6.1	0.000 000	0.002
100%		+40	2535 000 012	3.8	0.000 000	0.001
100%		+50	2535 000 004	-4.2	0.000 000	-0.002
Batt. Endpoint	3.650	+20	2535 000 005	-2.4	0.000 000	-0.001



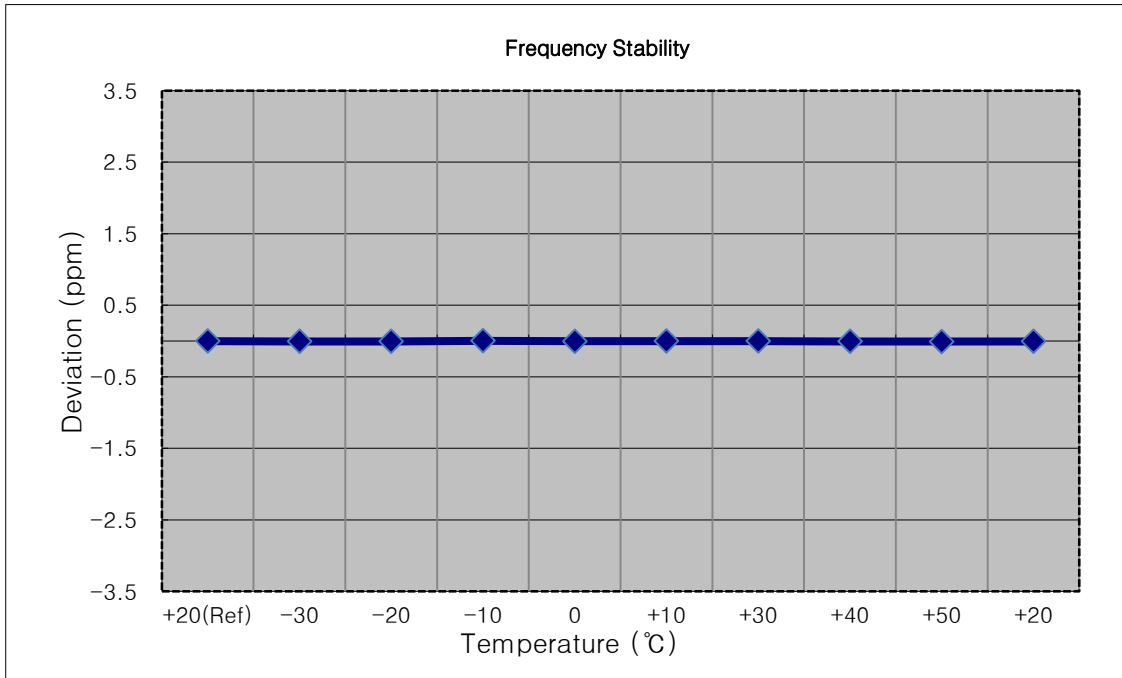
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,567,500,000 Hz
- ▣ CHANNEL: 21425 (5 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2567 499 980	0.0	0.000 000	0.000
100%		-30	2567 499 962	-18.7	-0.000 001	-0.007
100%		-20	2567 499 961	-19.7	-0.000 001	-0.008
100%		-10	2567 499 960	-20.3	-0.000 001	-0.008
100%		0	2567 499 964	-16.7	-0.000 001	-0.007
100%		+10	2567 499 965	-15.3	-0.000 001	-0.006
100%		+30	2567 499 967	-13.0	-0.000 001	-0.005
100%		+40	2567 499 955	-25.3	-0.000 001	-0.010
100%		+50	2567 499 968	-12.2	0.000 000	-0.005
Batt. Endpoint	3.650	+20	2567 499 966	-13.8	-0.000 001	-0.005



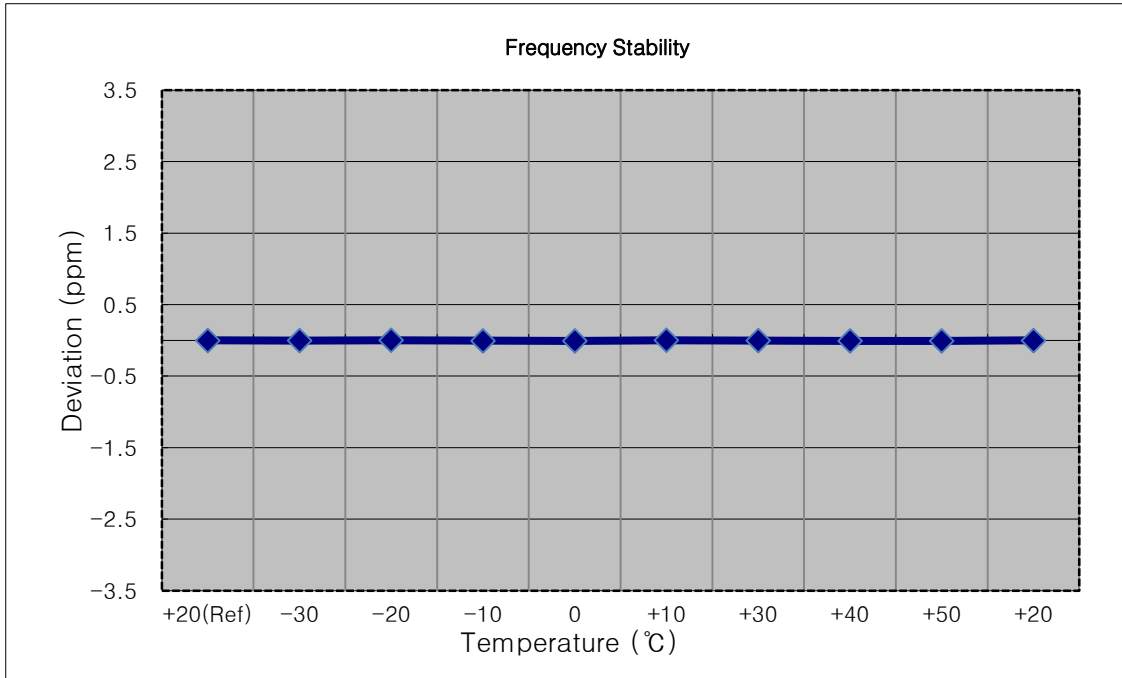
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,565,000,000 Hz
- ▣ CHANNEL: 21400 (10 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2564 999 995	0.0	0.000 000	0.000
100%		-30	2564 999 982	-13.0	-0.000 001	-0.005
100%		-20	2564 999 982	-12.3	0.000 000	-0.005
100%		-10	2565 000 002	7.4	0.000 000	0.003
100%		0	2564 999 988	-7.0	0.000 000	-0.003
100%		+10	2564 999 991	-3.8	0.000 000	-0.001
100%		+30	2564 999 991	-4.1	0.000 000	-0.002
100%		+40	2564 999 979	-15.9	-0.000 001	-0.006
100%		+50	2564 999 978	-17.1	-0.000 001	-0.007
Batt. Endpoint	3.650	+20	2564 999 983	-11.8	0.000 000	-0.005



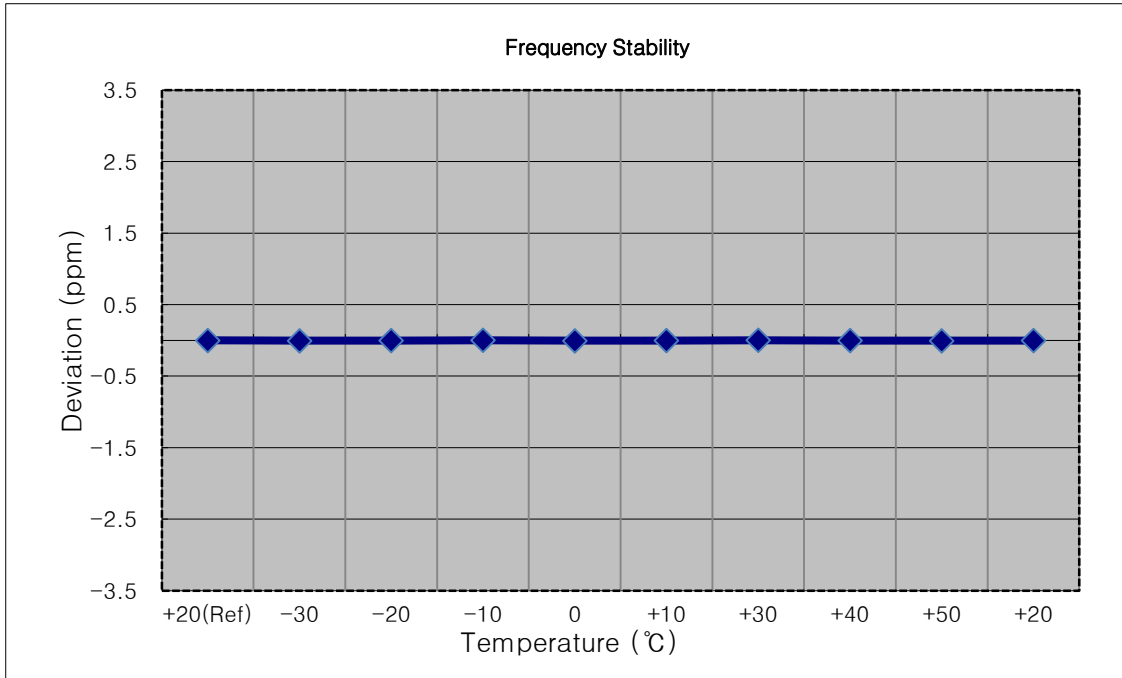
- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,562,500,000 Hz
- ▣ CHANNEL: 21375 (15 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2562 499 988	0.0	0.000 000	0.000
100%		-30	2562 499 982	-6.3	0.000 000	-0.002
100%		-20	2562 499 993	5.2	0.000 000	0.002
100%		-10	2562 499 975	-13.4	-0.000 001	-0.005
100%		0	2562 499 973	-15.6	-0.000 001	-0.006
100%		+10	2562 499 993	5.3	0.000 000	0.002
100%		+30	2562 499 982	-5.9	0.000 000	-0.002
100%		+40	2562 499 973	-14.9	-0.000 001	-0.006
100%		+50	2562 499 971	-17.0	-0.000 001	-0.007
Batt. Endpoint	3.650	+20	2562 499 985	-2.9	0.000 000	-0.001



- ▣ MODE: LTE 7
- ▣ OPERATING FREQUENCY: 2,560,000,000 Hz
- ▣ CHANNEL: 21350 (20 MHz)
- ▣ REFERENCE VOLTAGE: 3.88 VDC
- ▣ DEVIATION LIMIT: Emission must remain in band

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	ppm
100%	3.880	+20(Ref)	2560 000 004	0.0	0.000 000	0.000
100%		-30	2559 999 994	-9.7	0.000 000	-0.004
100%		-20	2559 999 997	-6.1	0.000 000	-0.002
100%		-10	2560 000 009	5.6	0.000 000	0.002
100%		0	2559 999 991	-12.2	0.000 000	-0.005
100%		+10	2559 999 999	-4.8	0.000 000	-0.002
100%		+30	2560 000 008	4.4	0.000 000	0.002
100%		+40	2559 999 996	-7.4	0.000 000	-0.003
100%		+50	2559 999 993	-10.8	0.000 000	-0.004
Batt. Endpoint	3.650	+20	2559 999 999	-4.4	0.000 000	-0.002

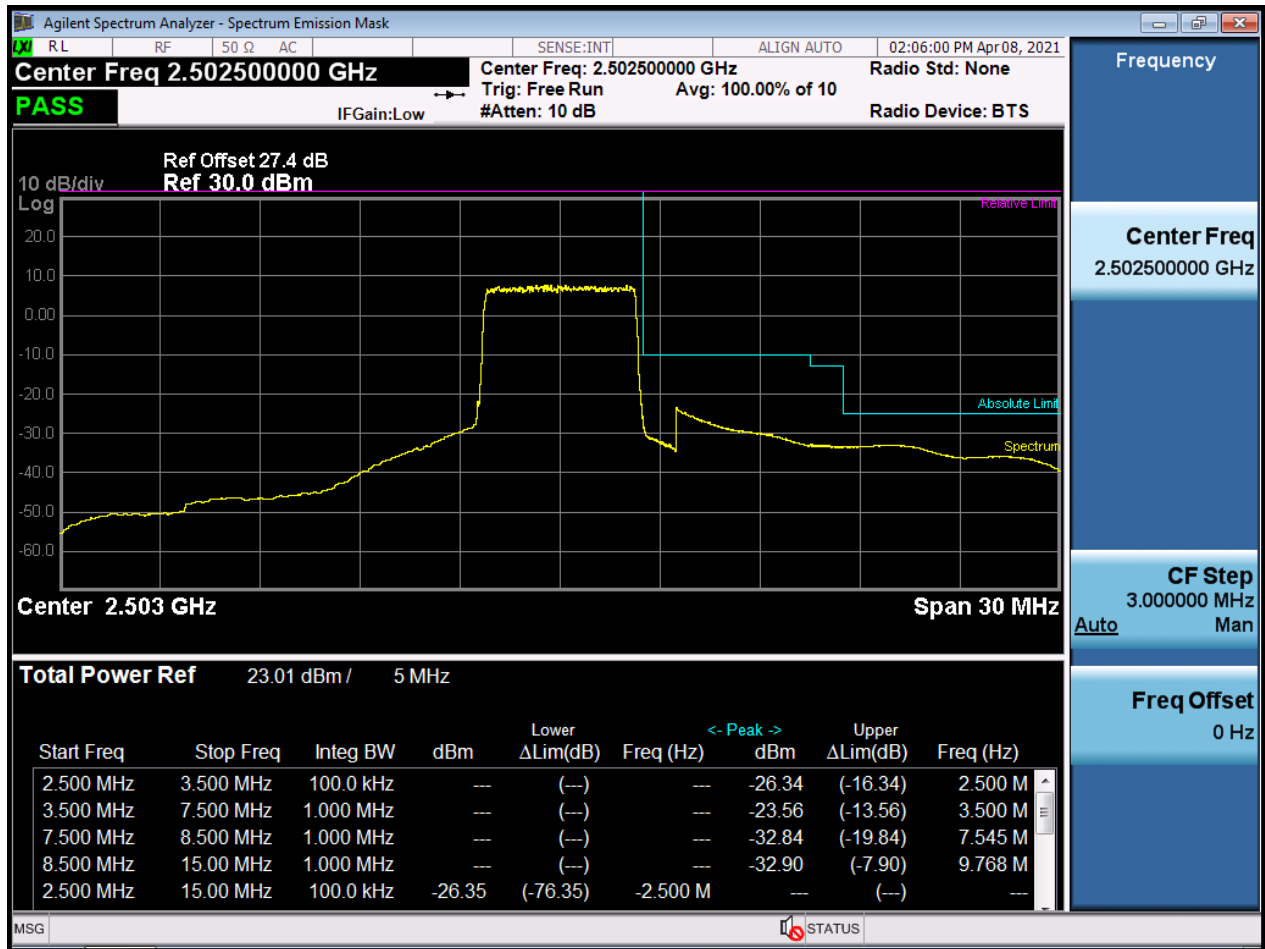


9. TEST PLOTS

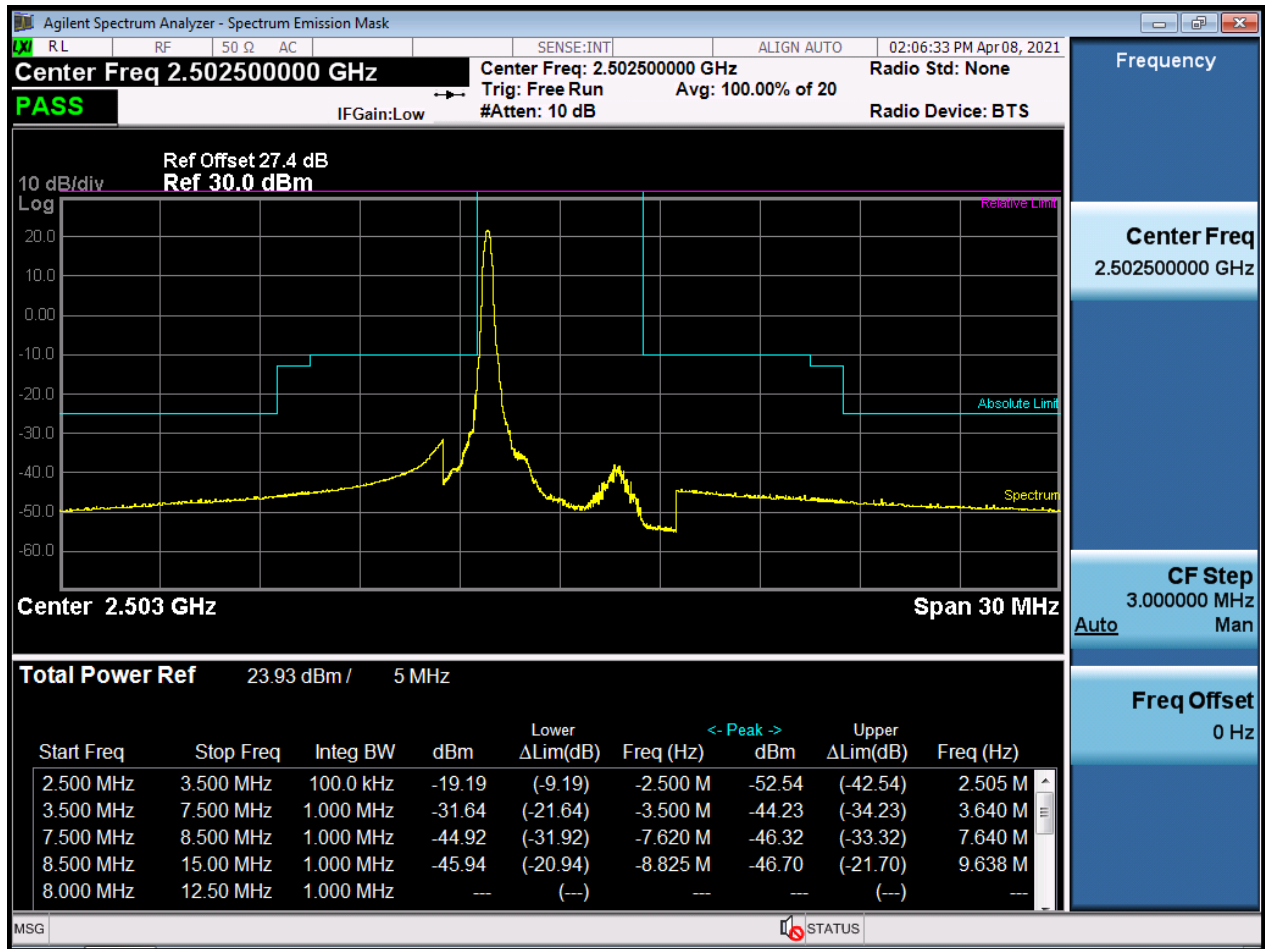
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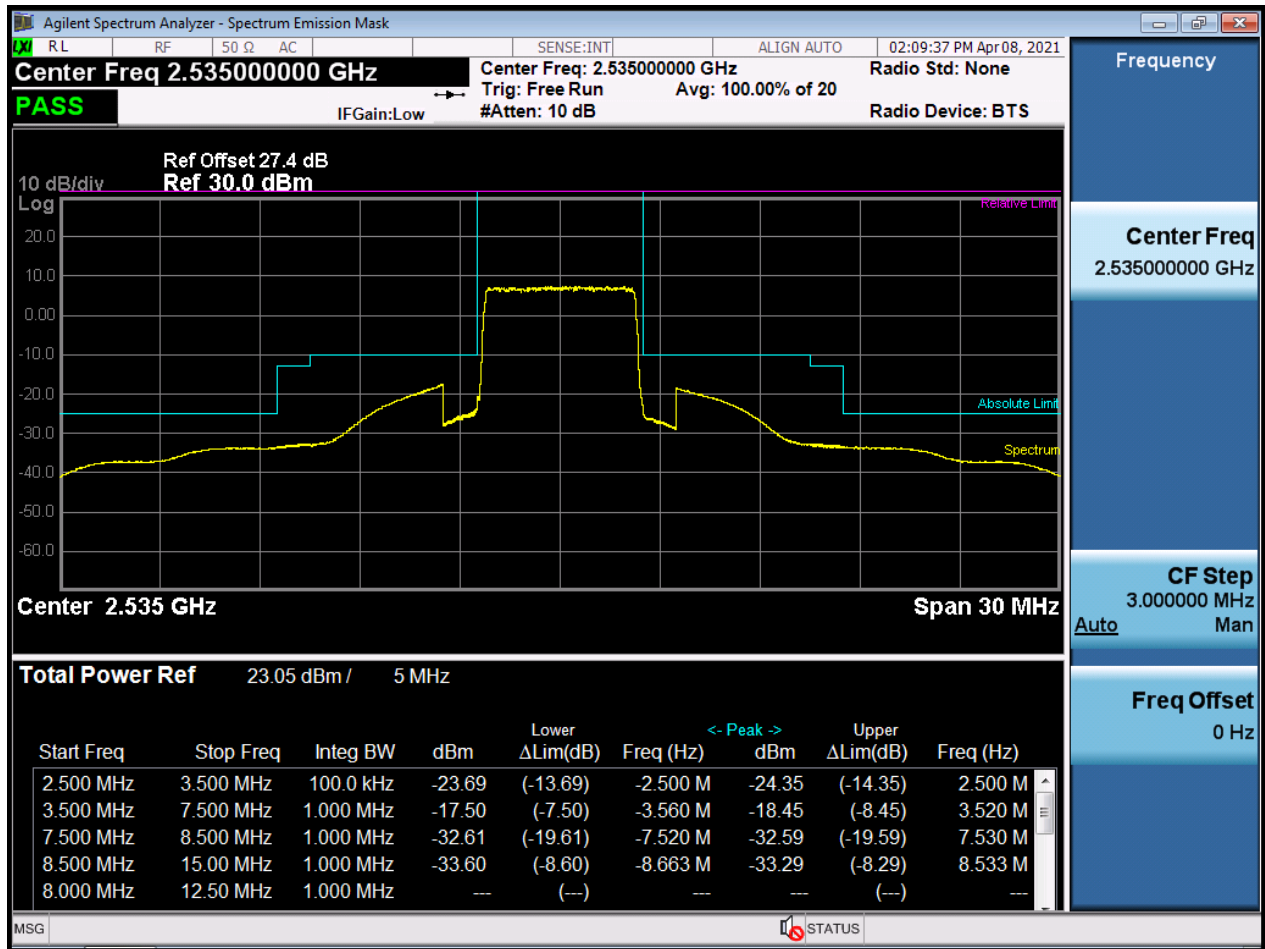
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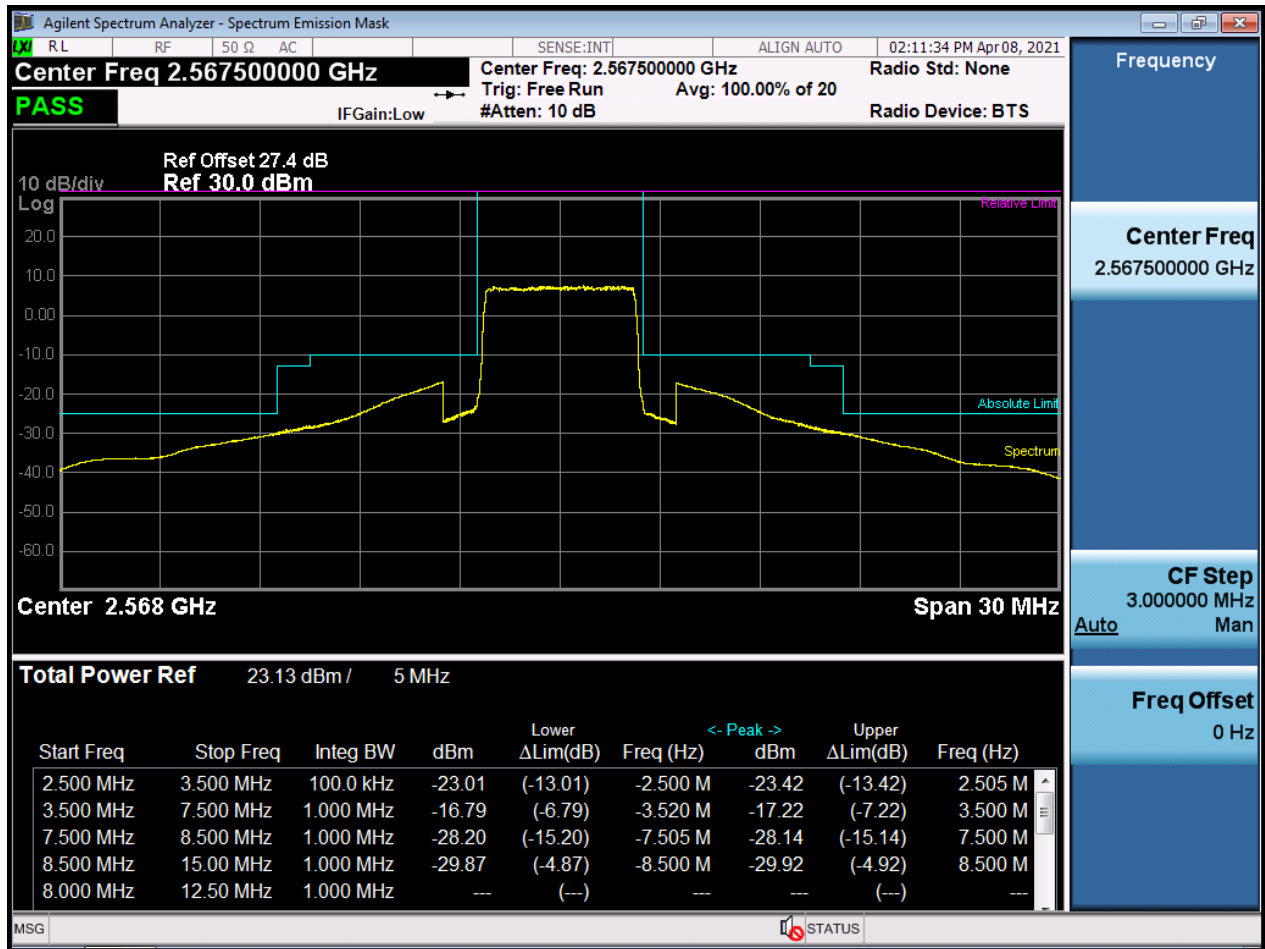
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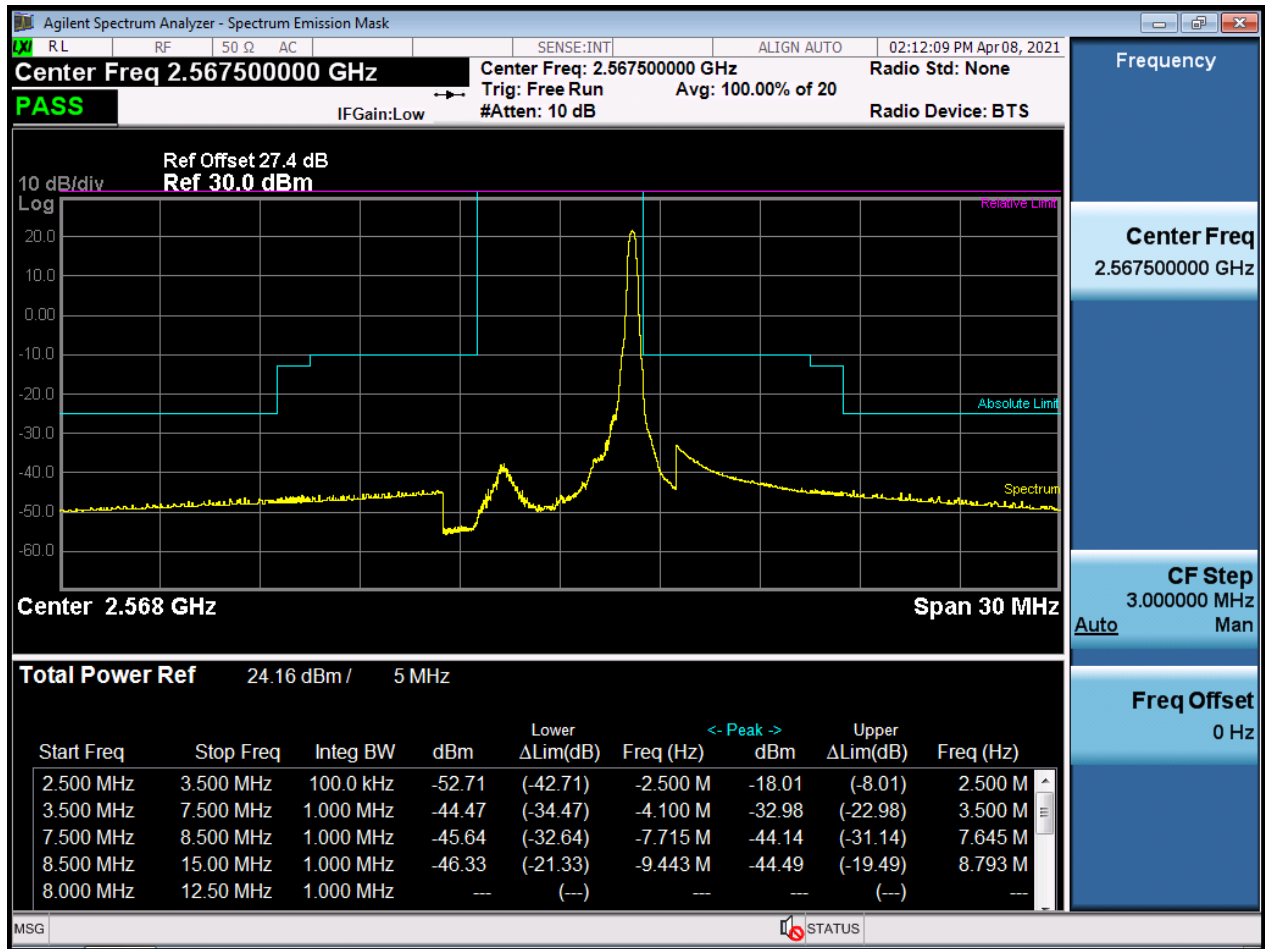
LTE7_5M_BandEdge_Mid_2535MHz_QPSK_FullIRB



LTE7_5M_BandEdge_High_2567.5MHz_QPSK_FullIRB



LTE7_5M_BandEdge_High_2567.5MHz_QPSK_1RB



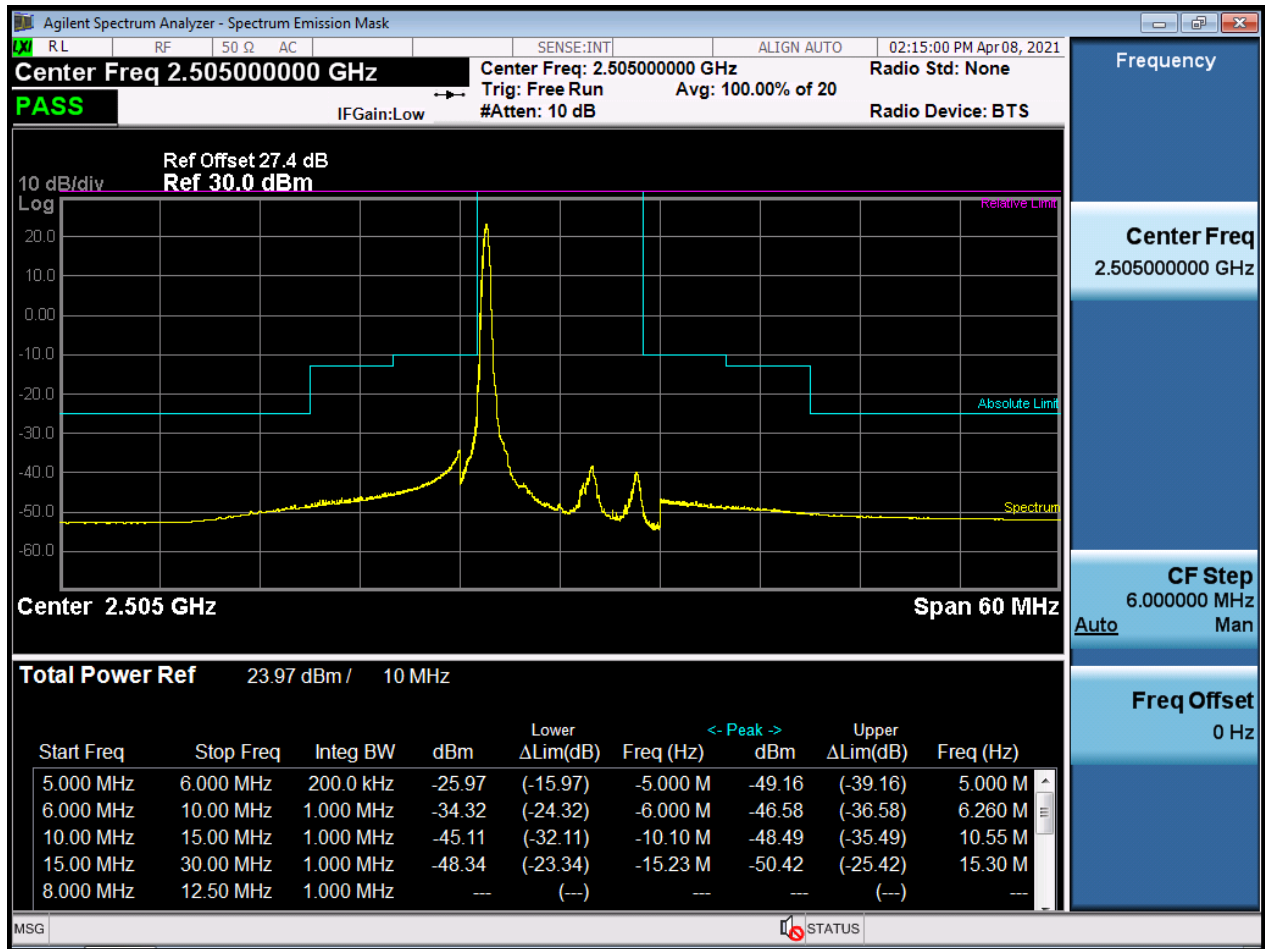
LTE7_10M_BandEdge_Lower_Low_2505MHz_QPSK_FullRB



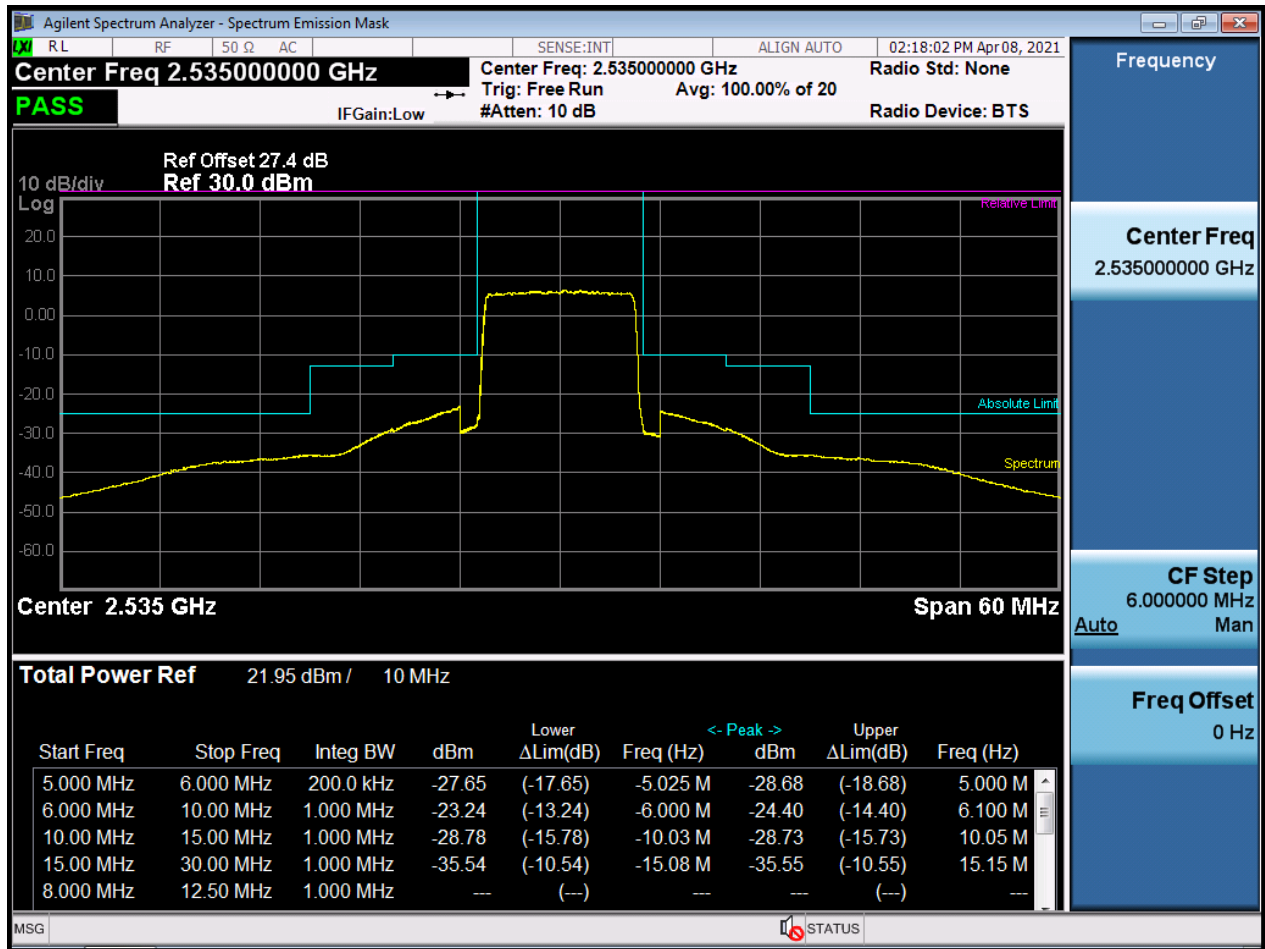
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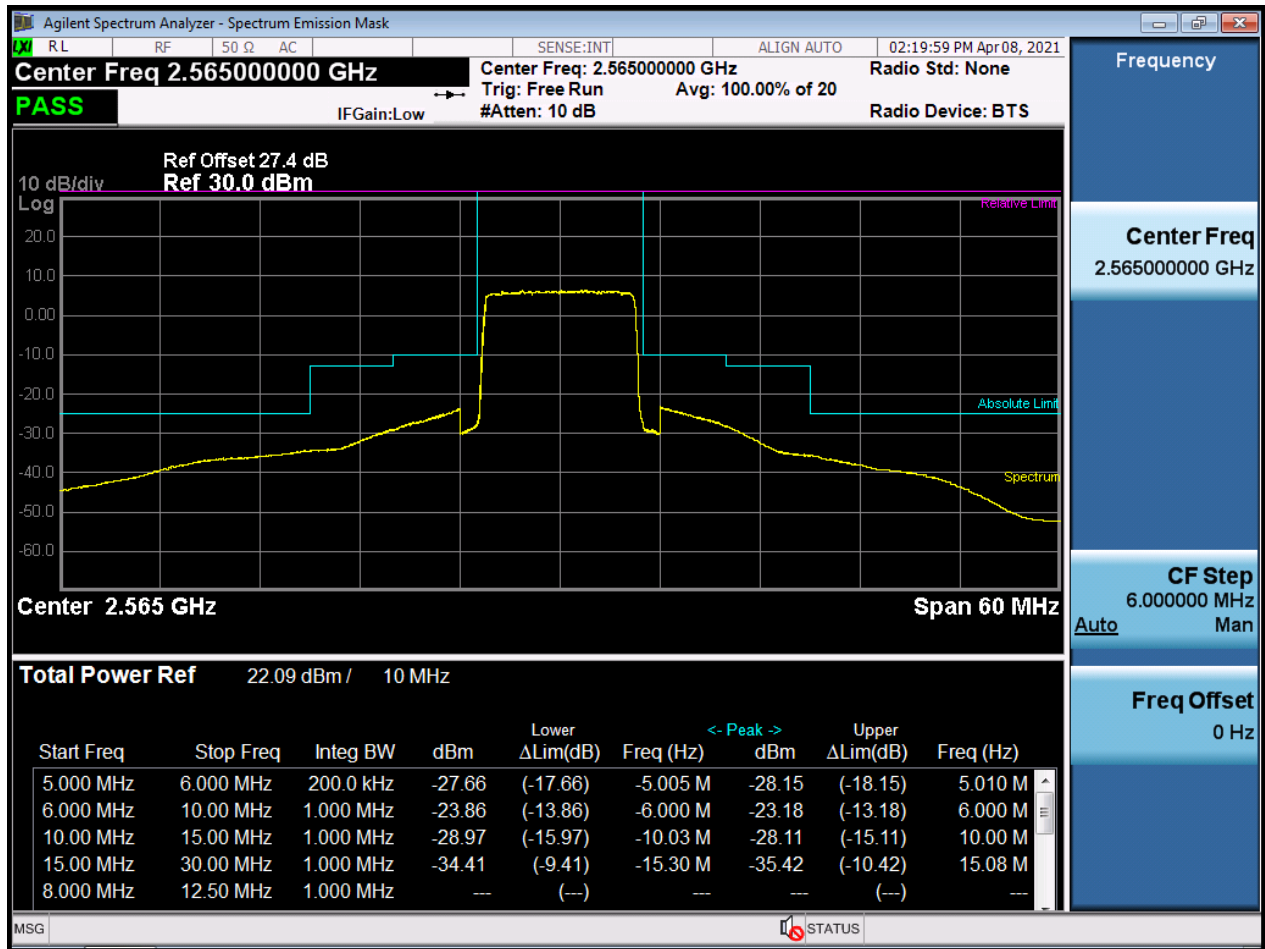
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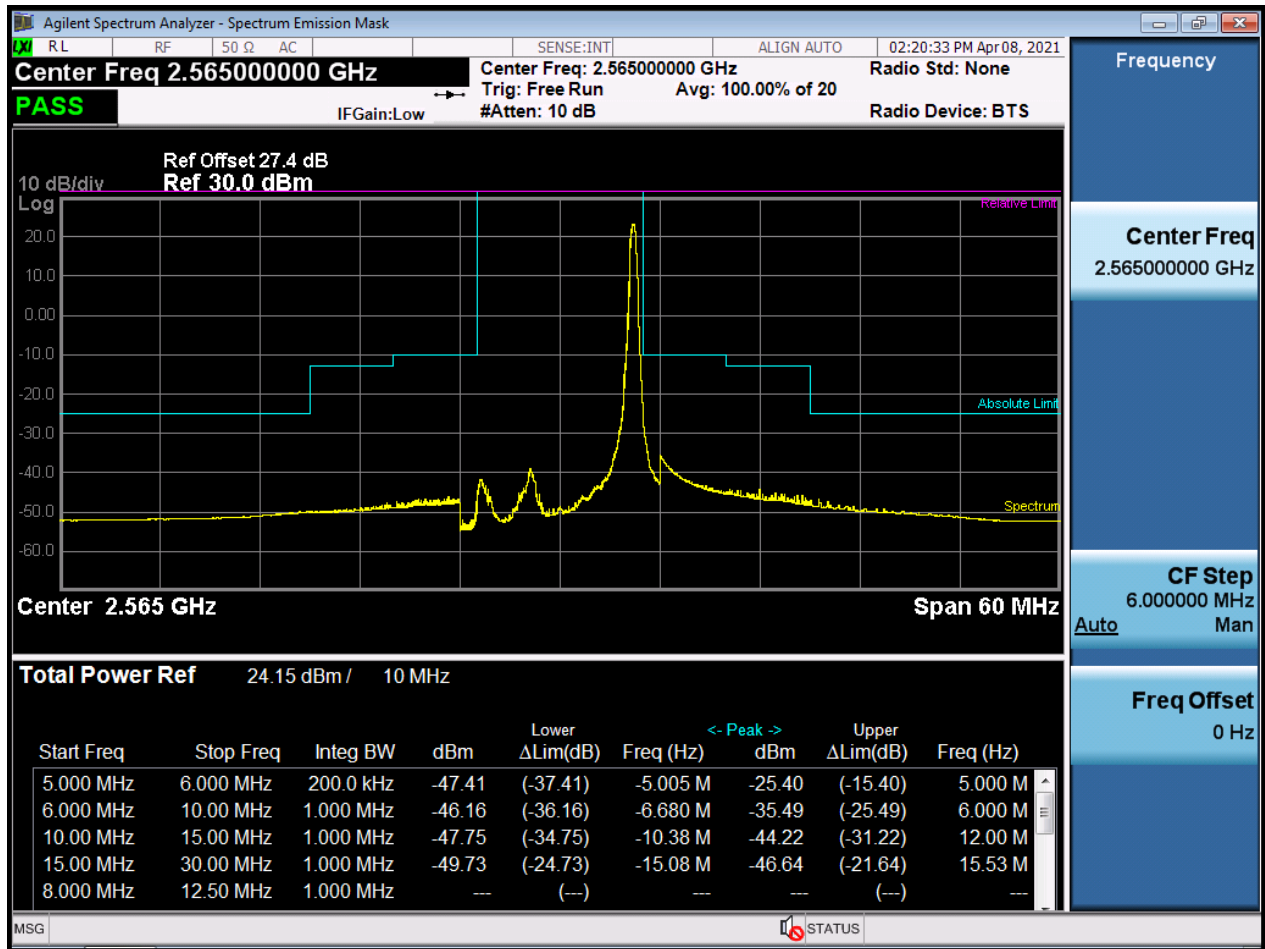
LTE7_10M_BandEdge_Mid_2535MHz_QPSK_FullIRB



LTE7_10M_BandEdge_High_2565MHz_QPSK_FullIRB



LTE7_10M_BandEdge_High_2565MHz_QPSK_1RB



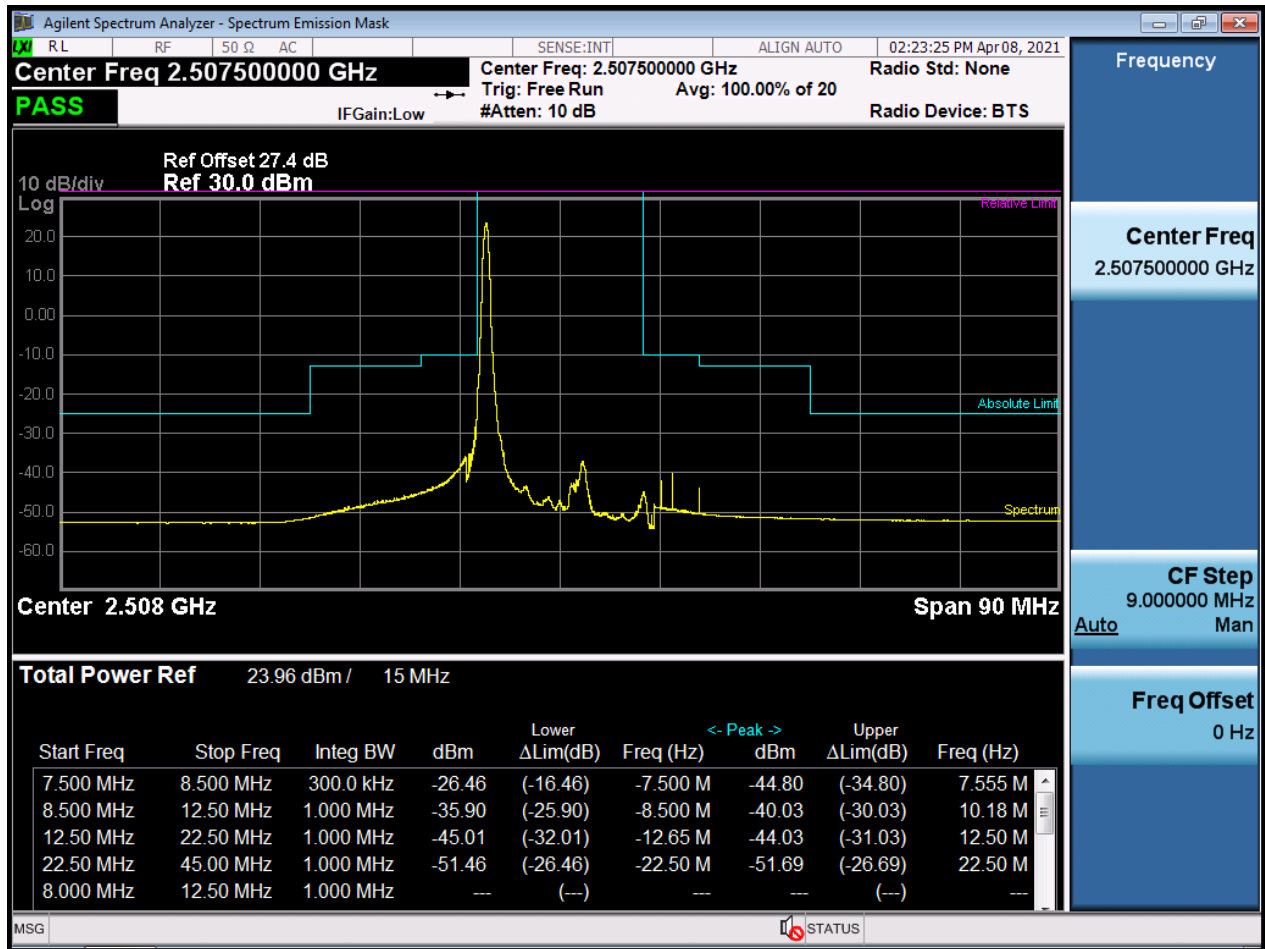
LTE7_15M_BandEdge_Lower_Low_2507.5MHz_QPSK_FullIRB



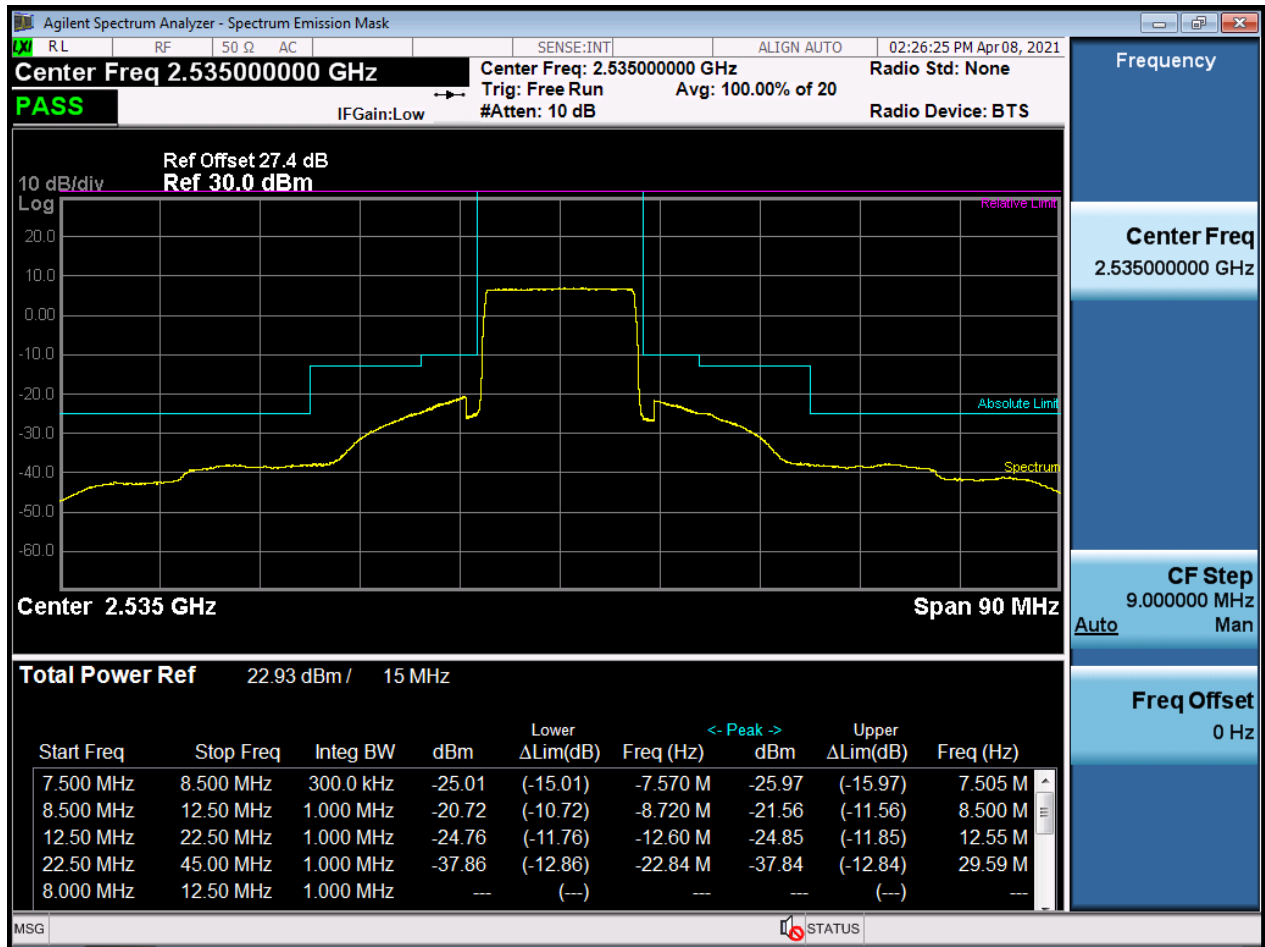
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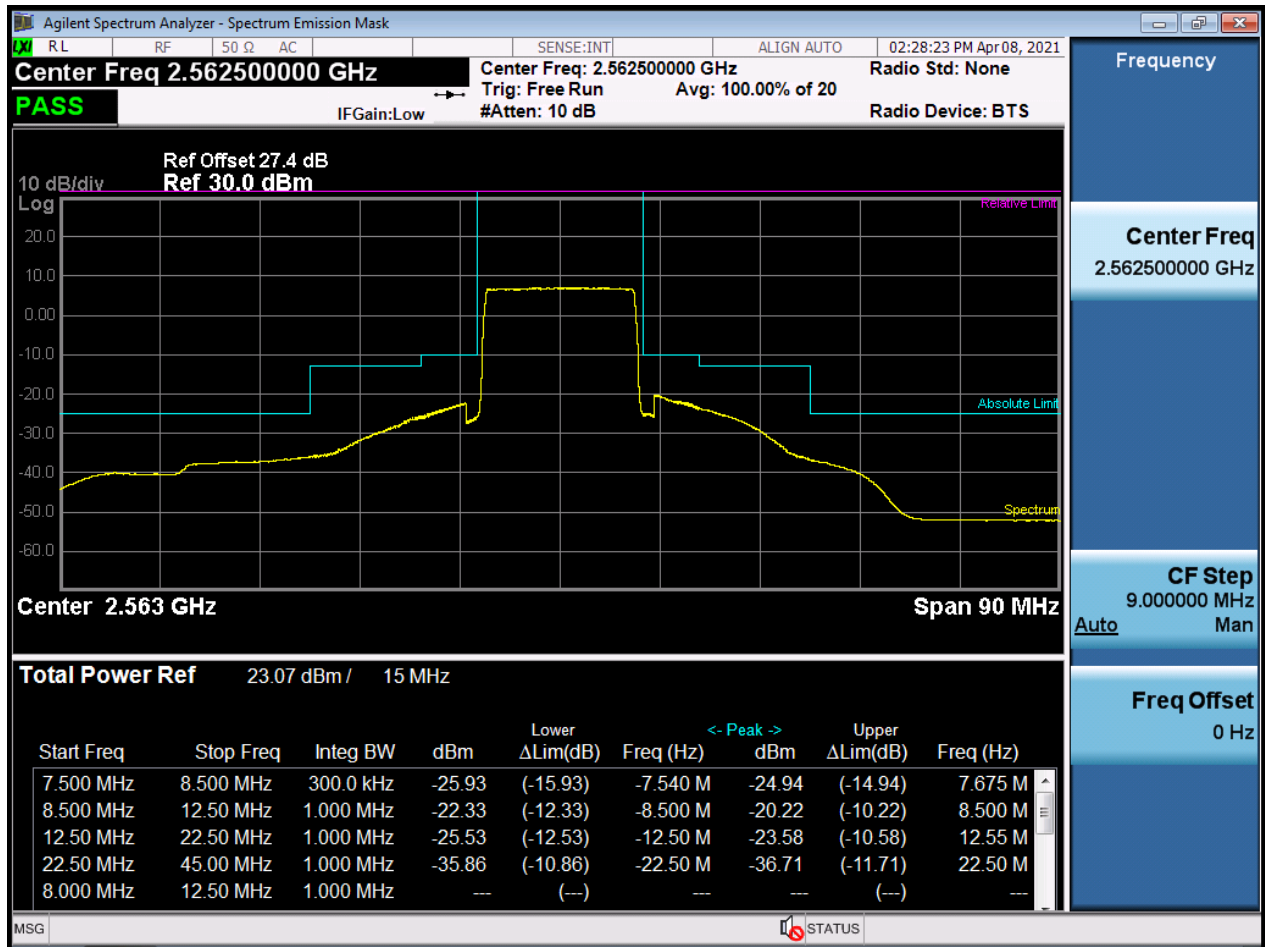
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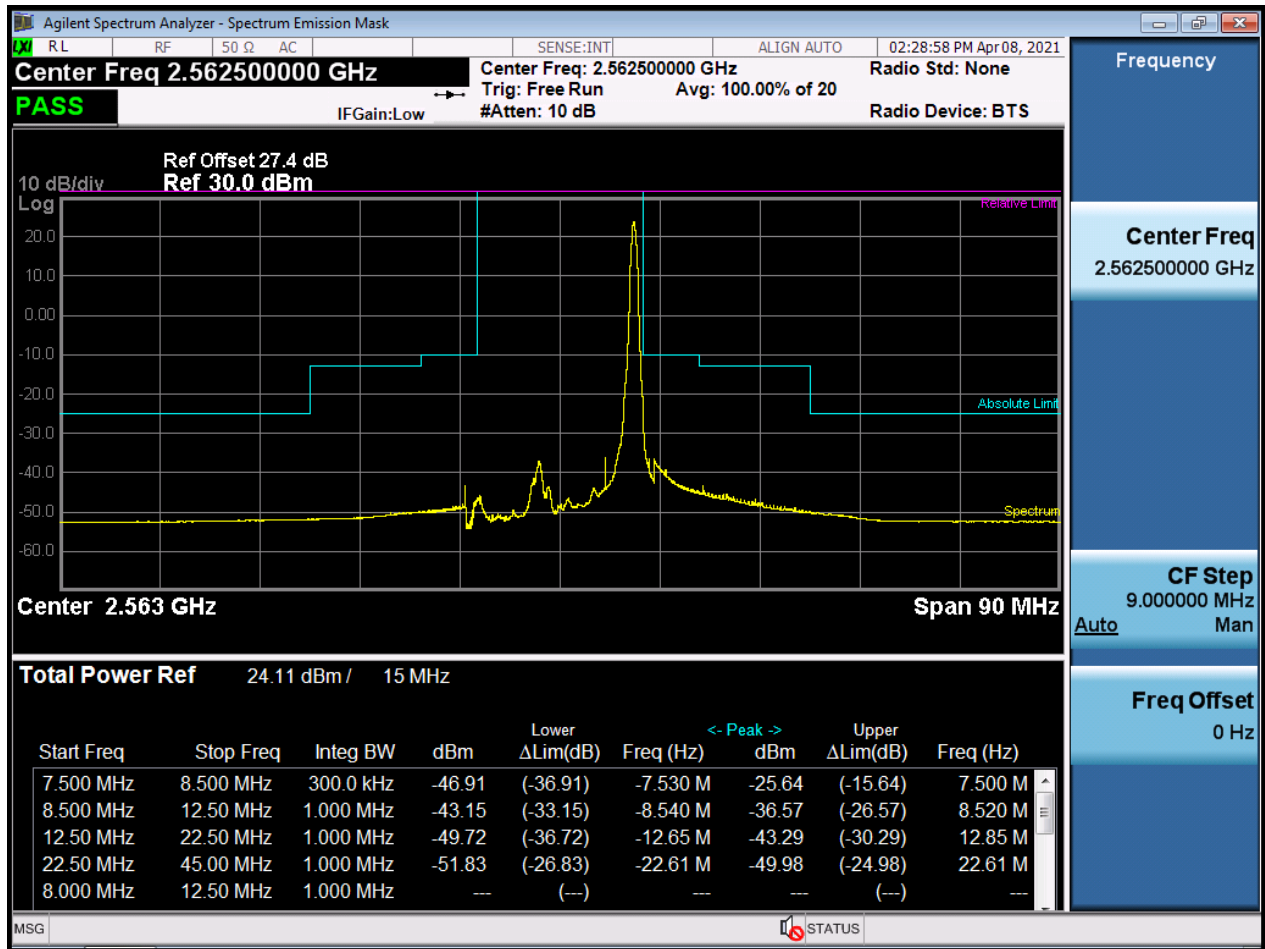
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LTE7_15M_BandEdge_High_2562.5MHz_QPSK_FullIRB



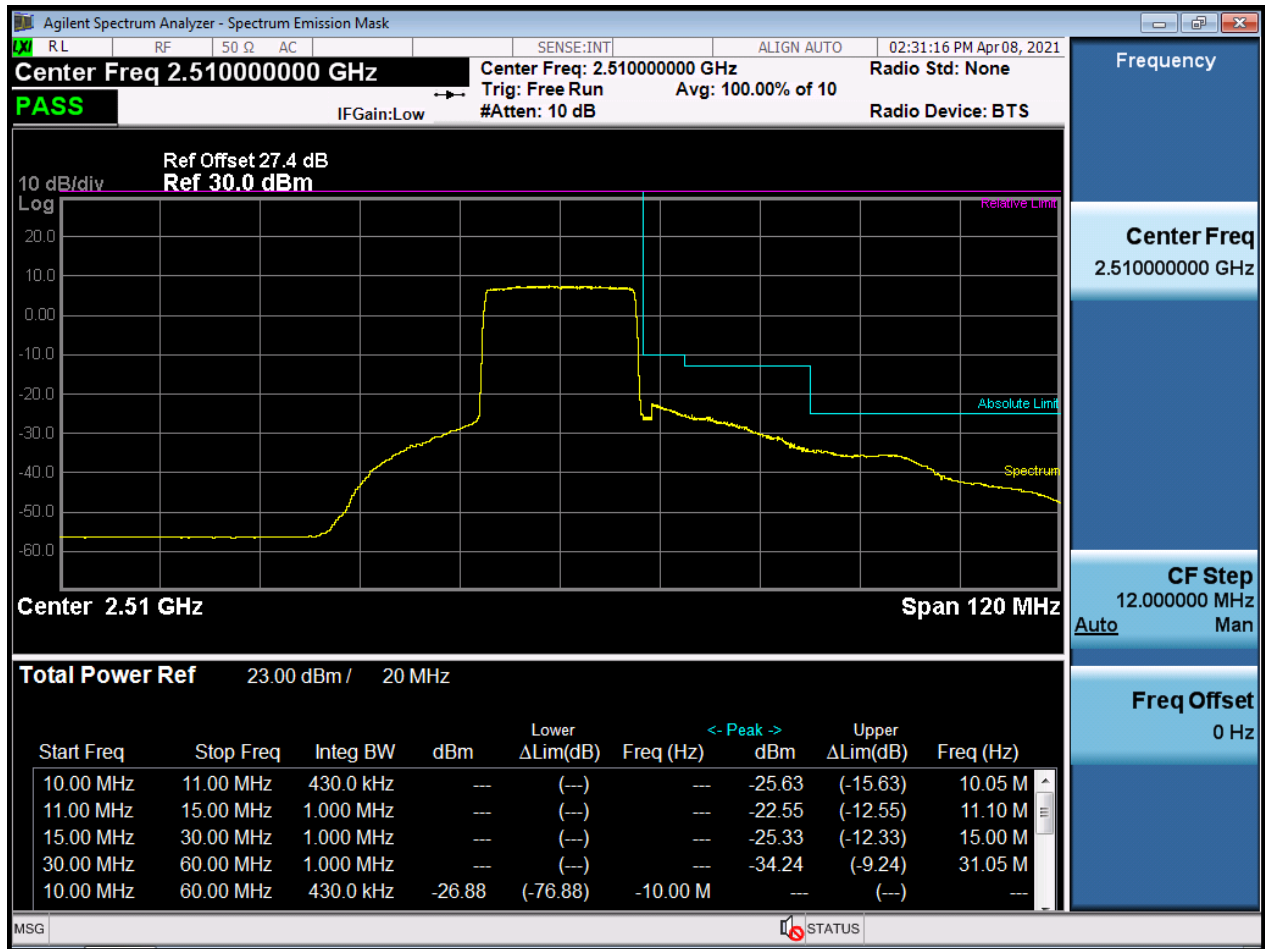
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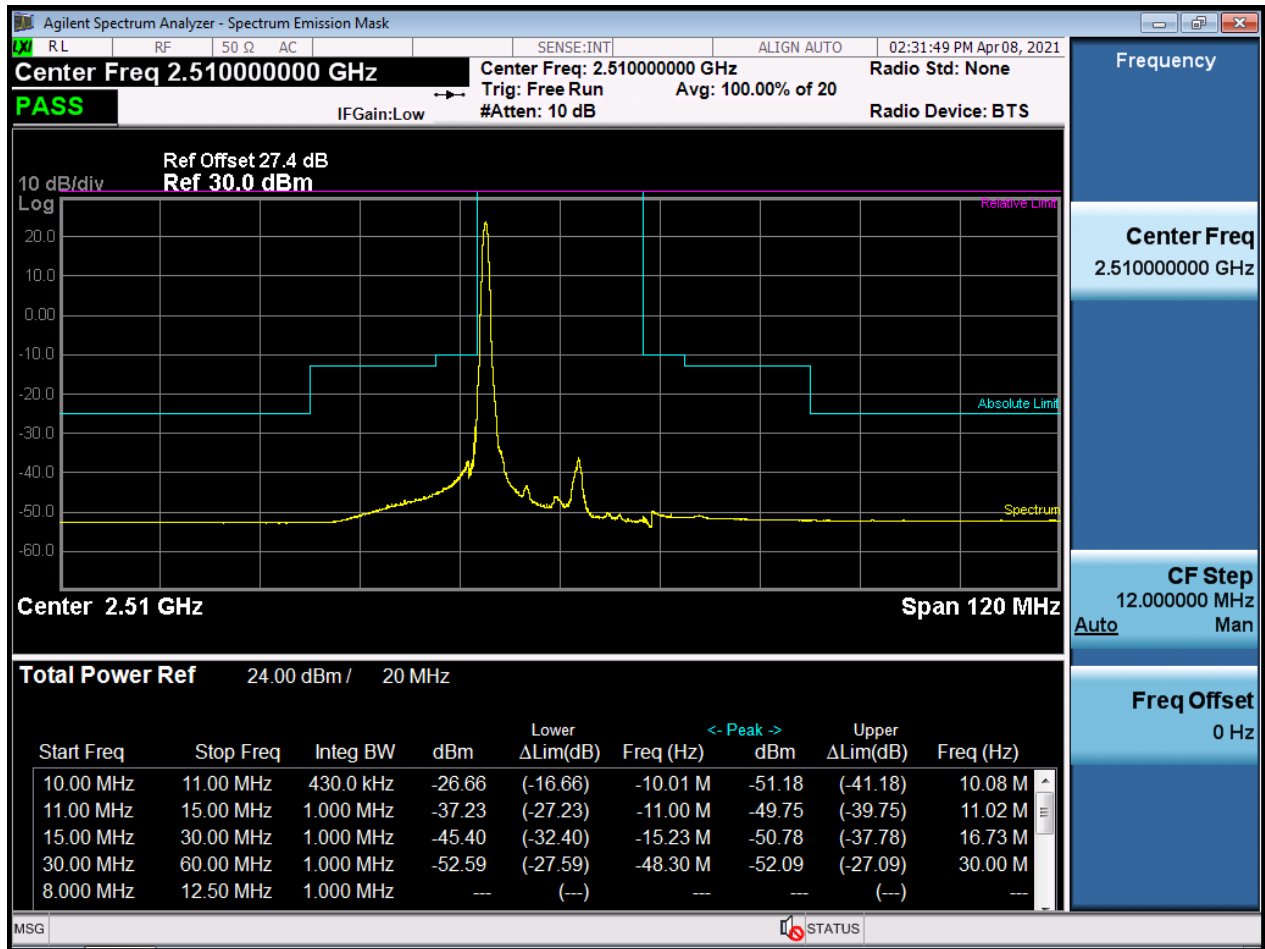
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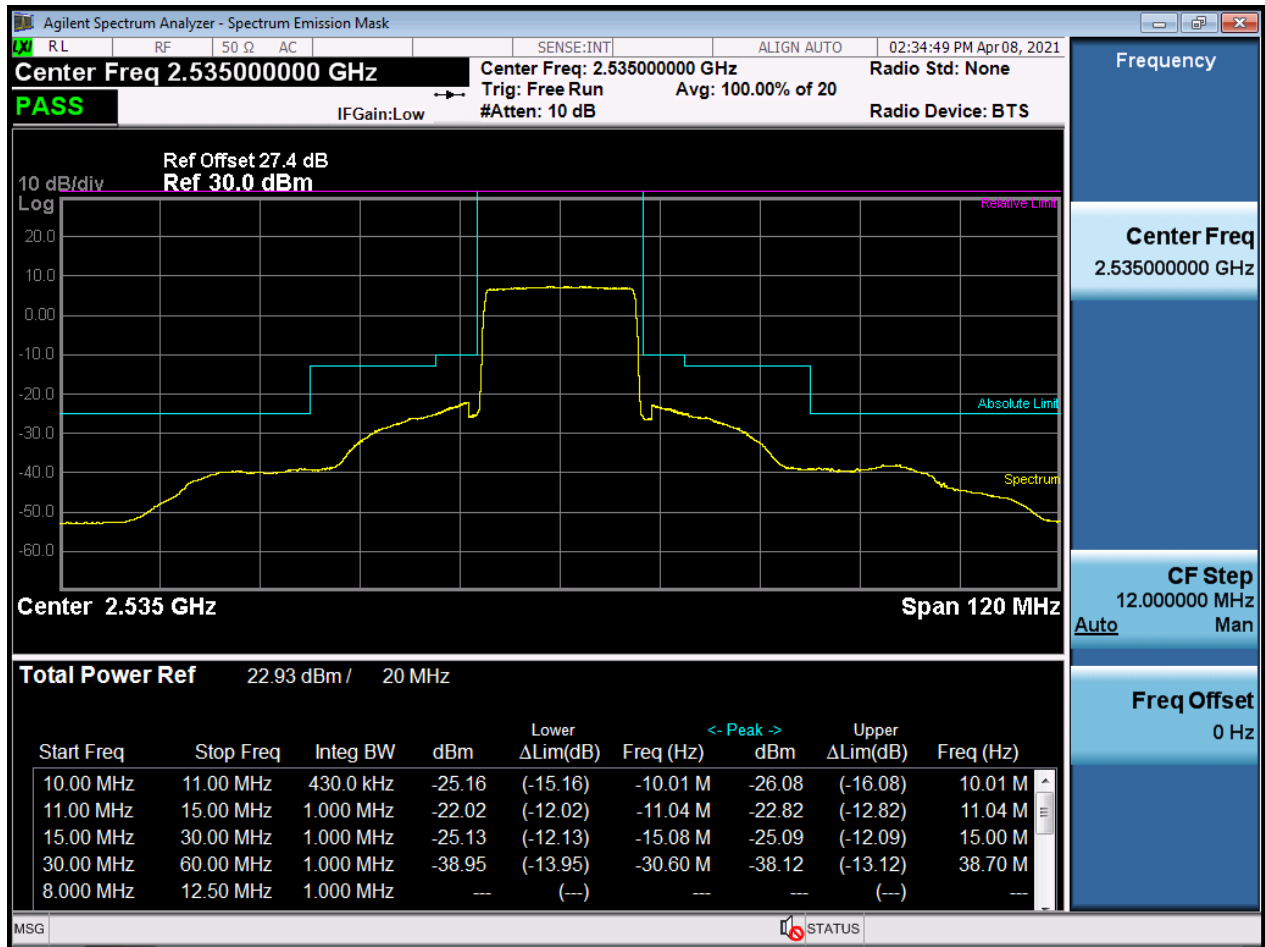
LTE7_20M_BandEdge_Upper_Low_2510MHz_QPSK_FullRB



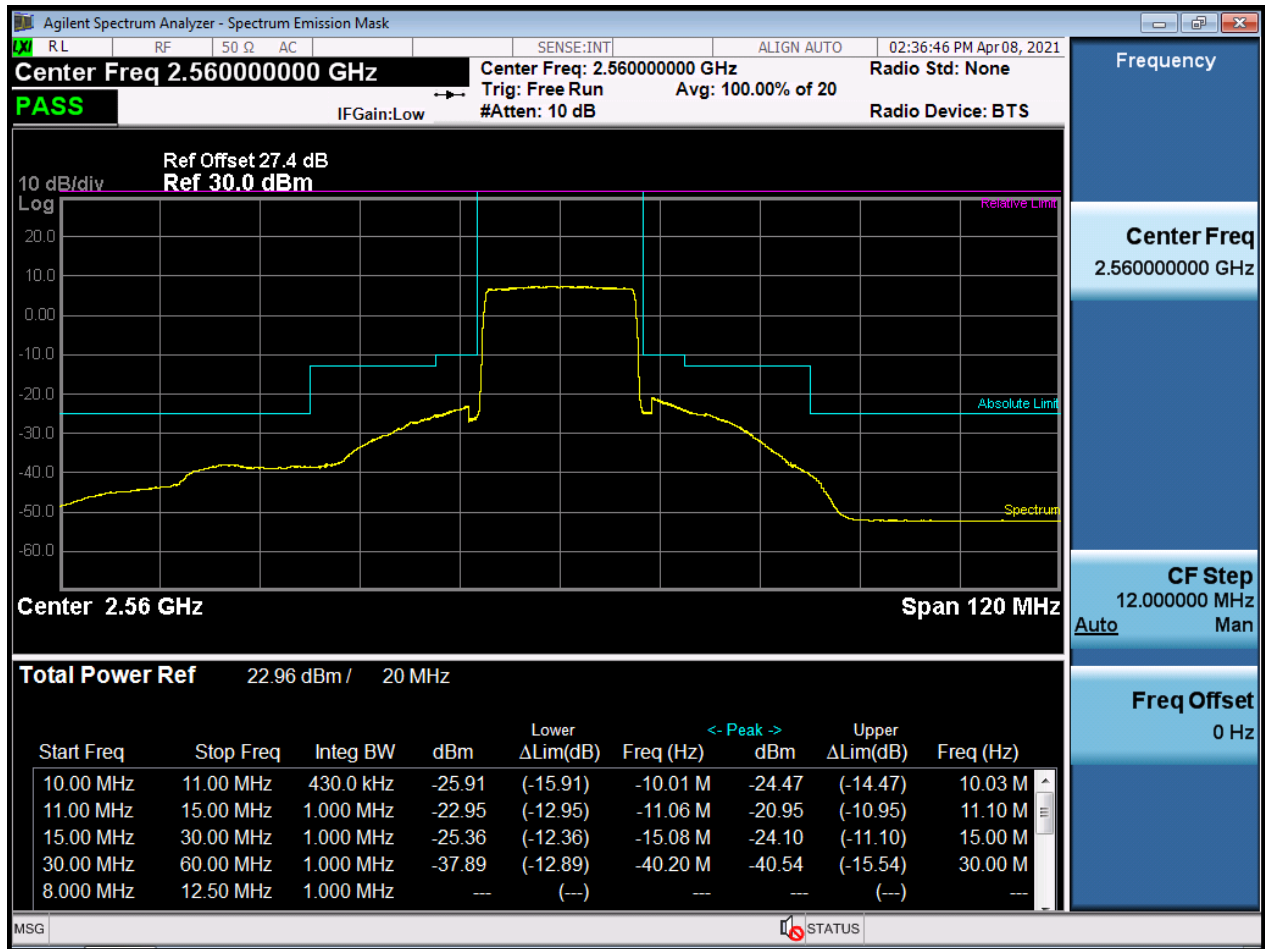
LTE7_20M_BandEdge_Low_2510MHz_QPSK_1RB



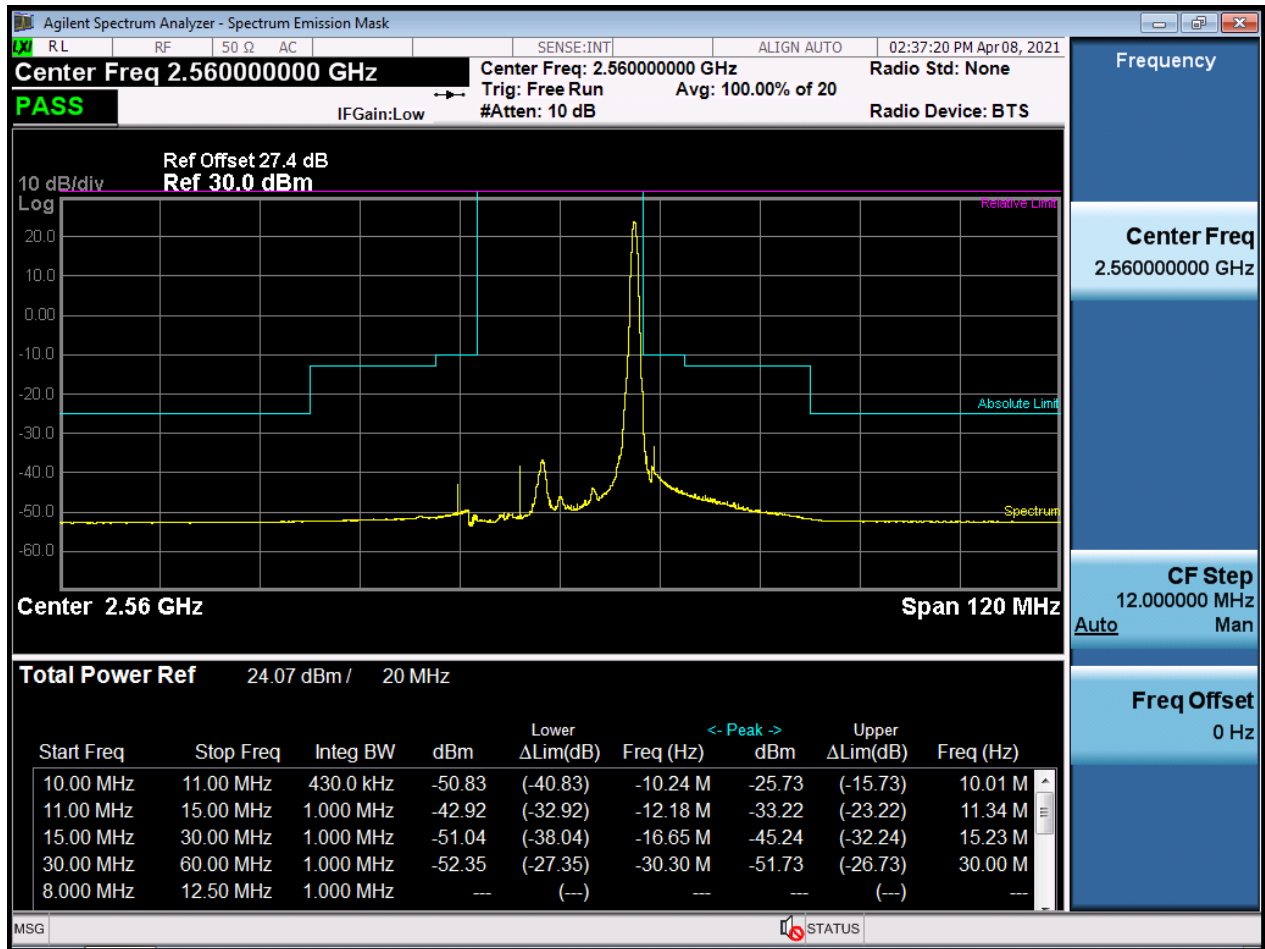
LTE7_20M_BandEdge_Mid_2535MHz_QPSK_FullRB



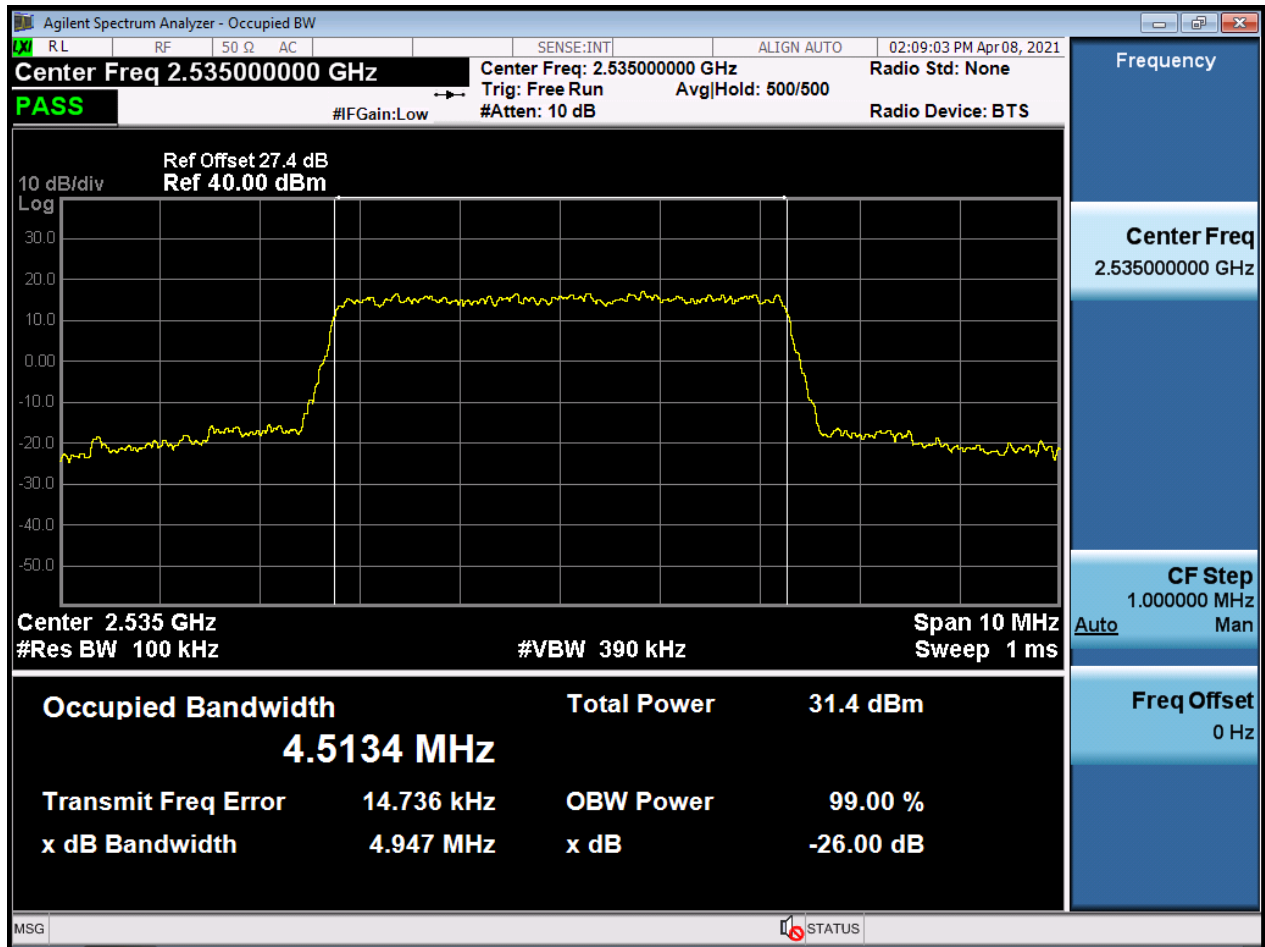
LTE7_20M_BandEdge_High_2560MHz_QPSK_FullIRB



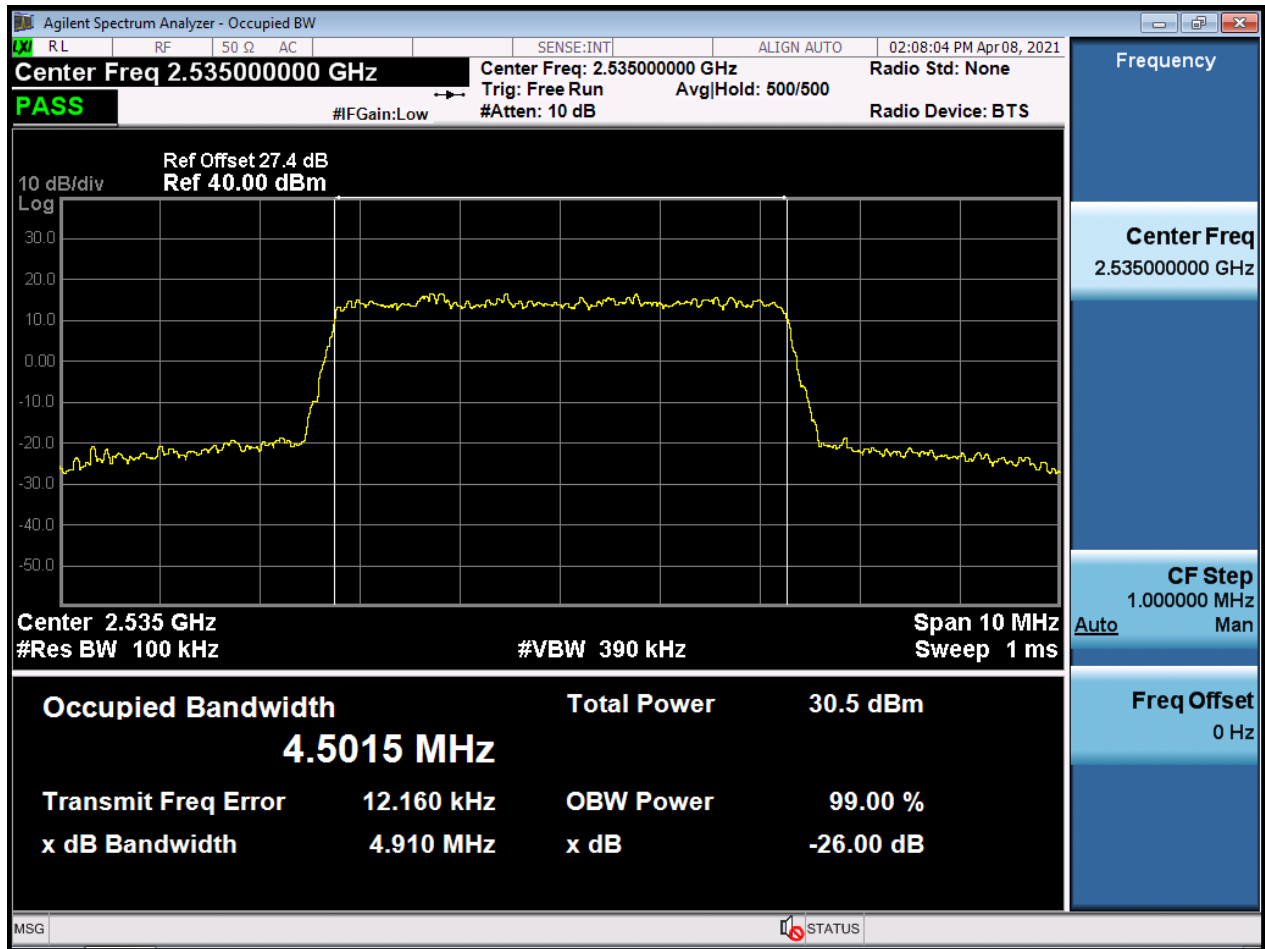
LTE7_20M_BandEdge_High_2560MHz_QPSK_1RB



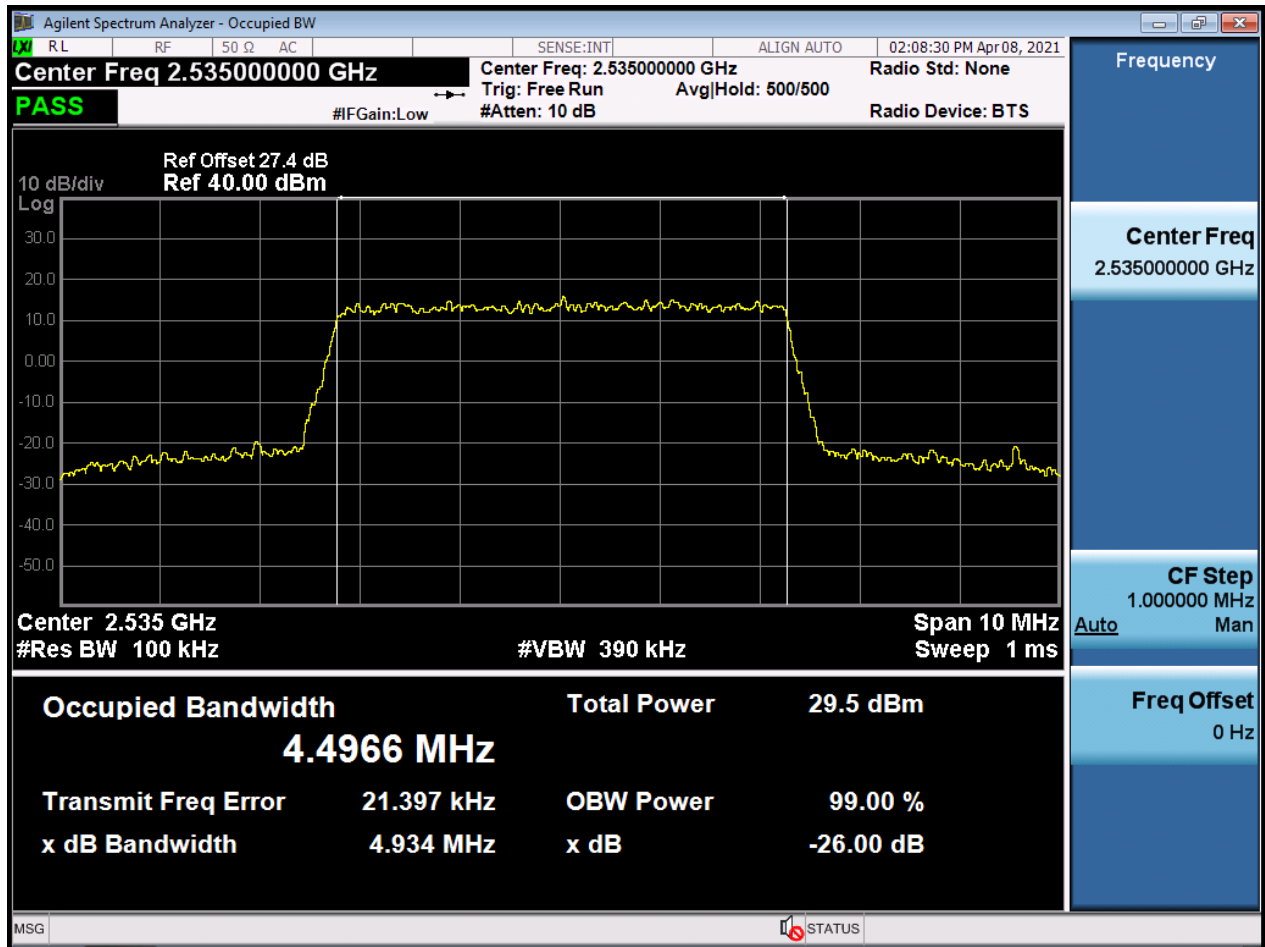
LTE7_5M_OBW_Mid Channel_QPSK_FullIRB



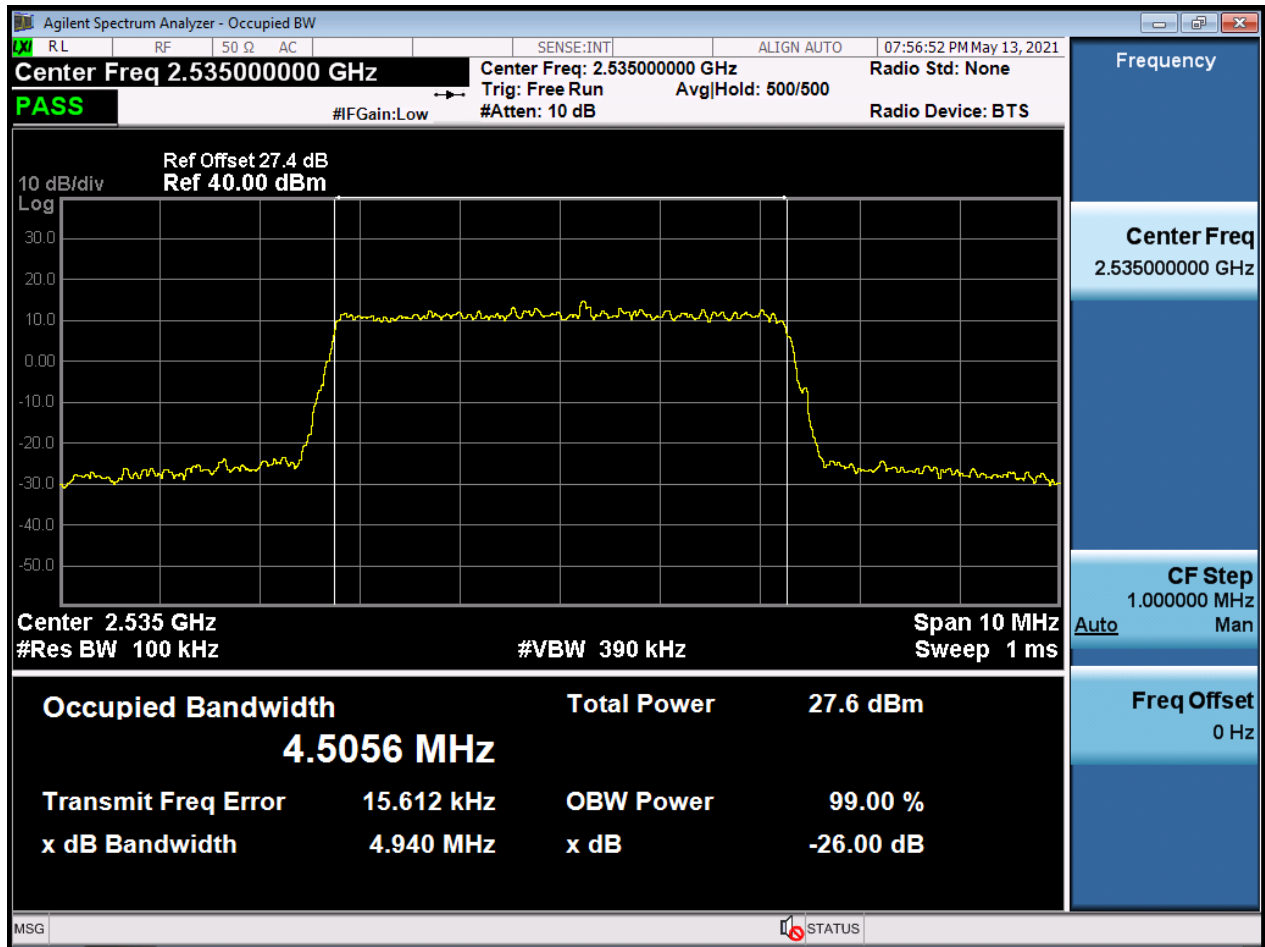
LTE7_5M_OBW_Mid Channel_16QAM_FullRB



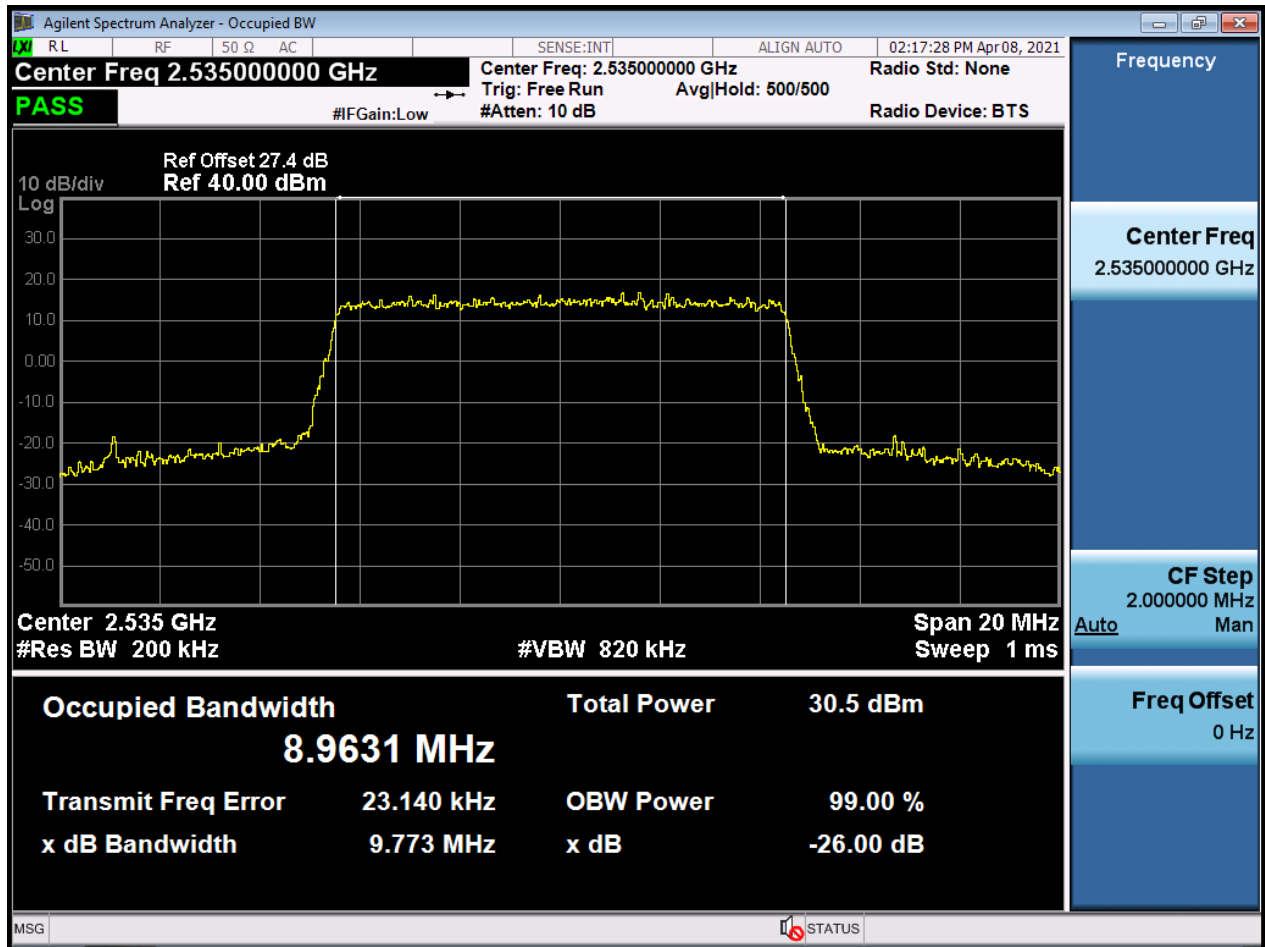
LTE7_5M_OBW_Mid Channel_64QAM_FullRB



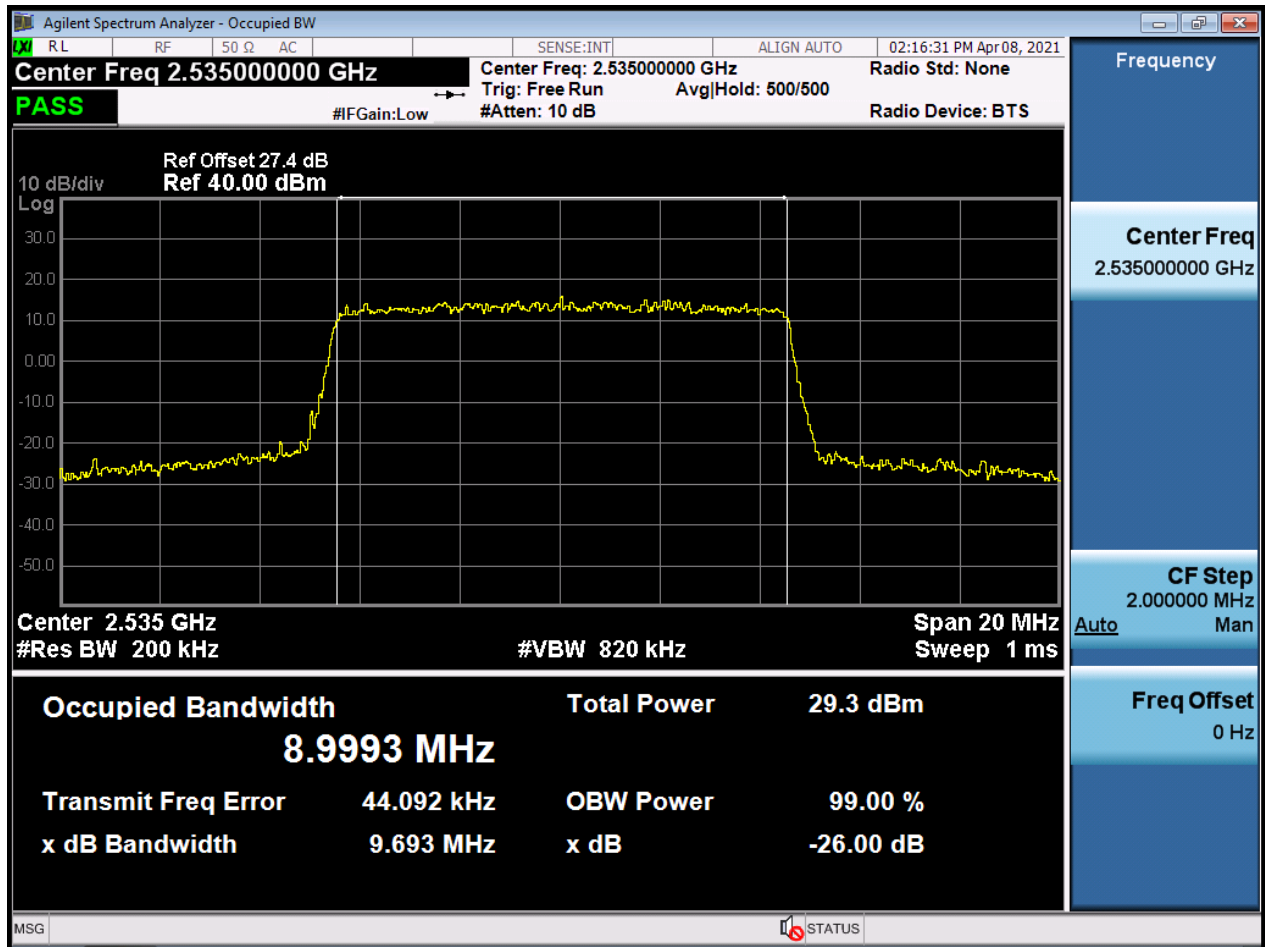
LTE7_5M_OBW_Mid Channel_256QAM_FullRB



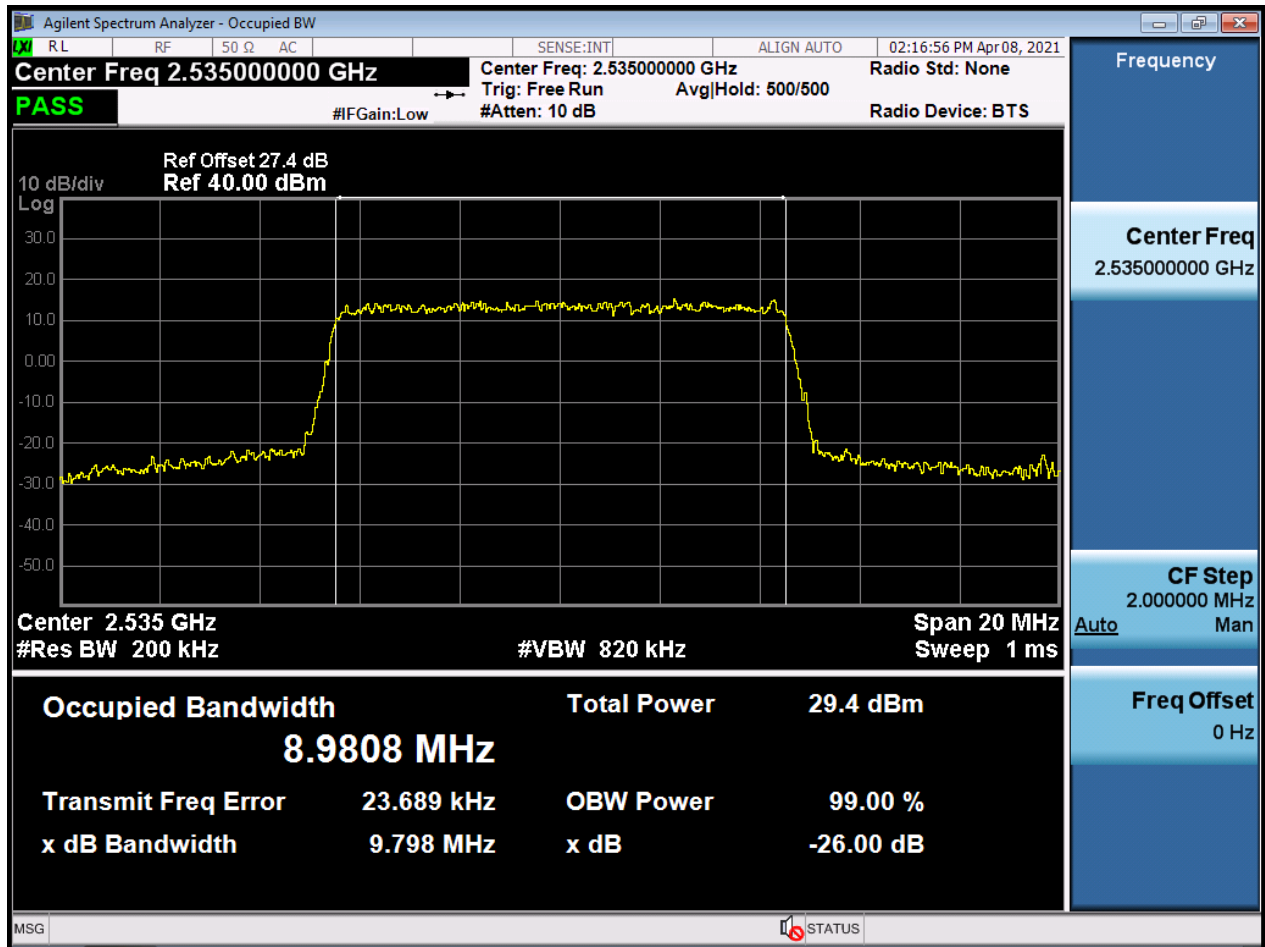
LTE7_10M_OBW_Mid Channel_QPSK_FullRB



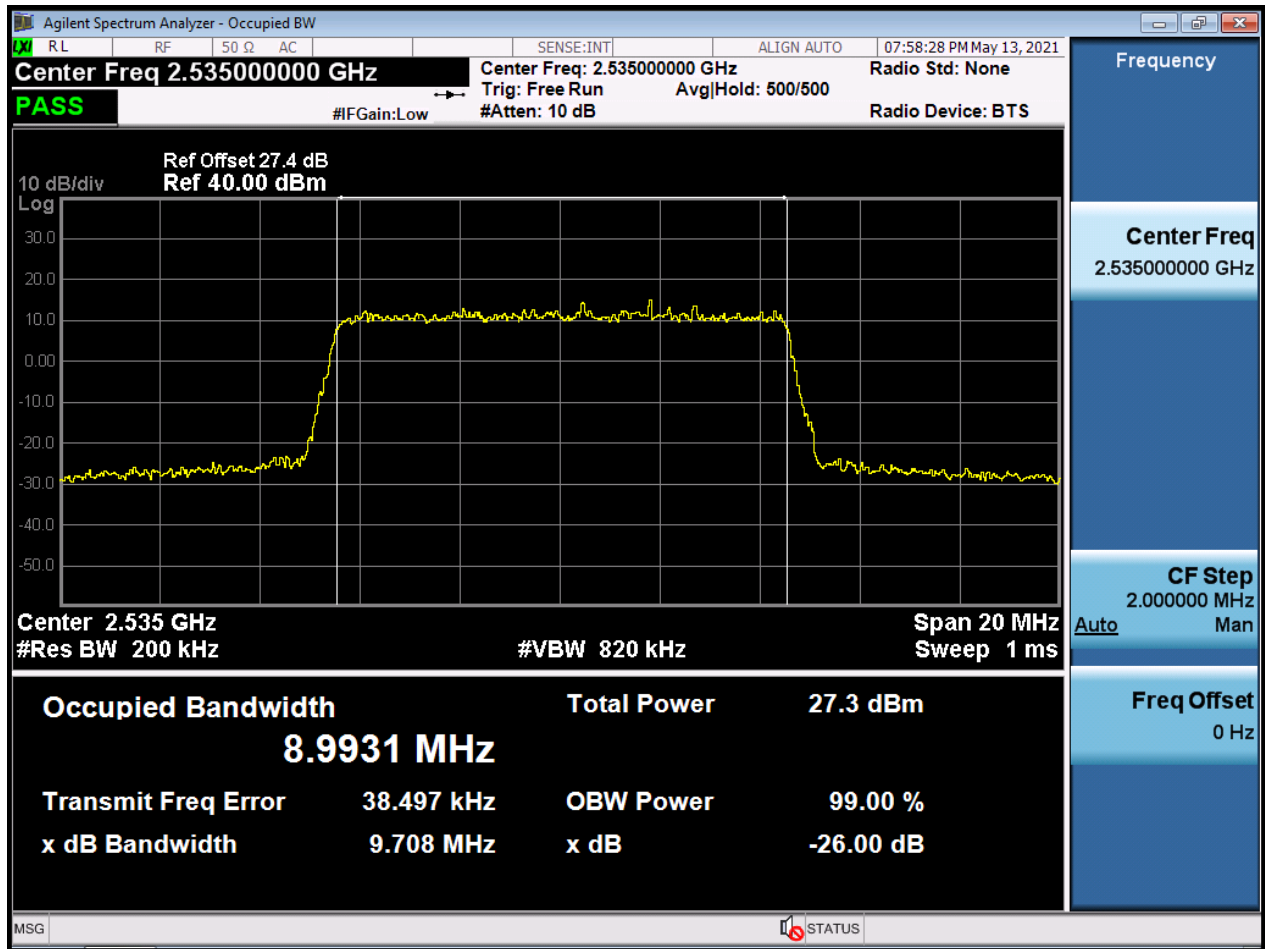
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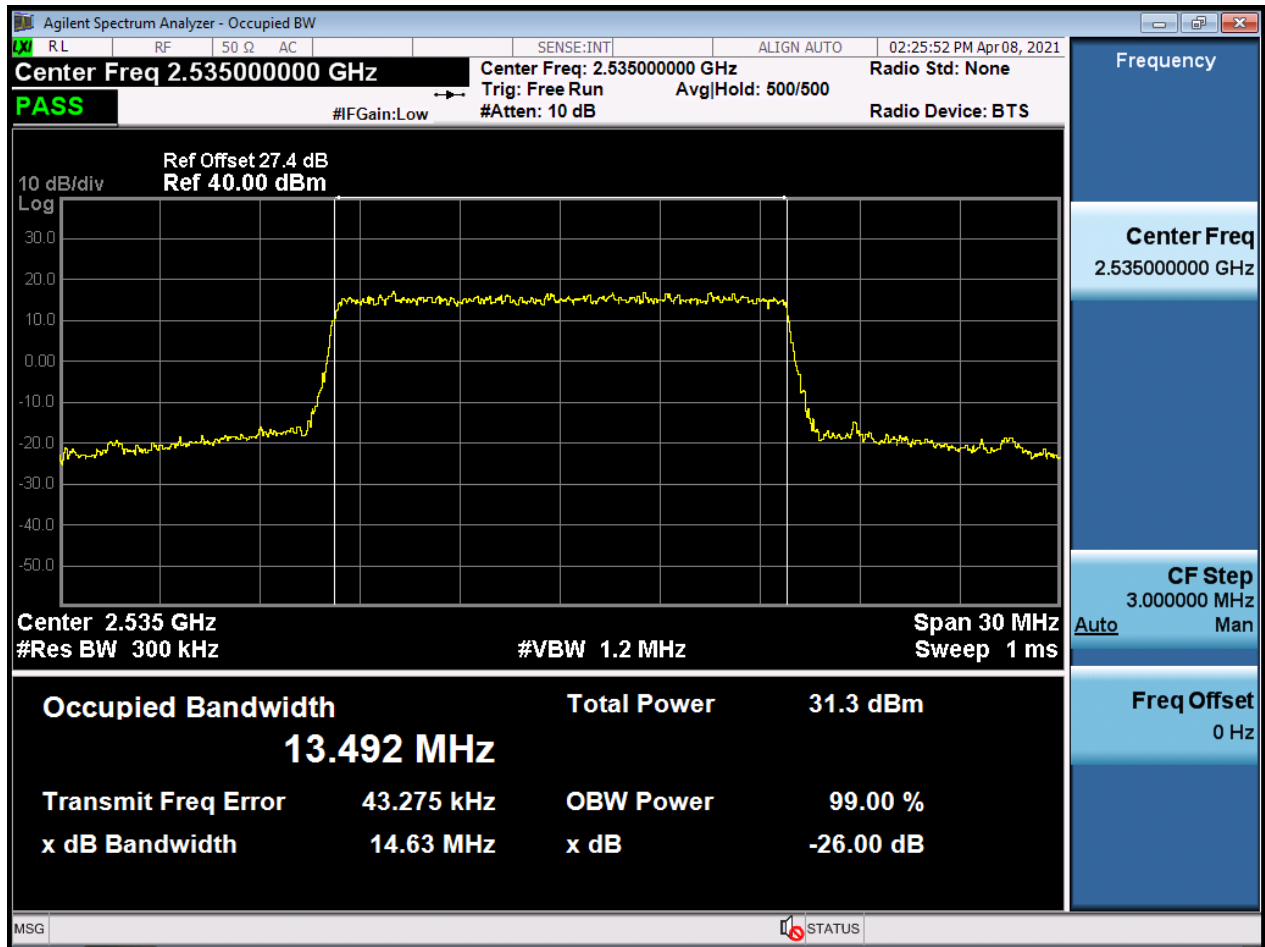
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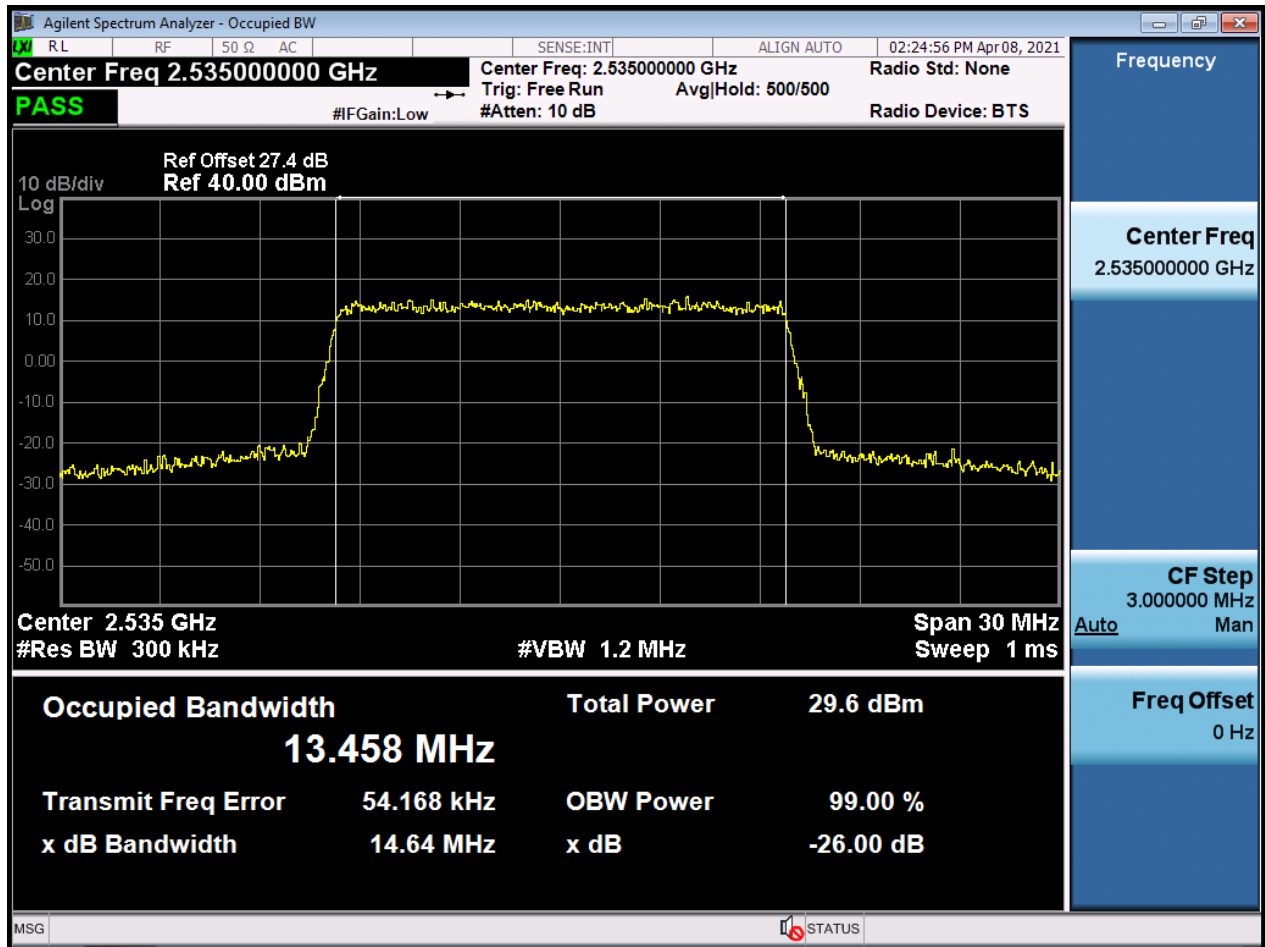
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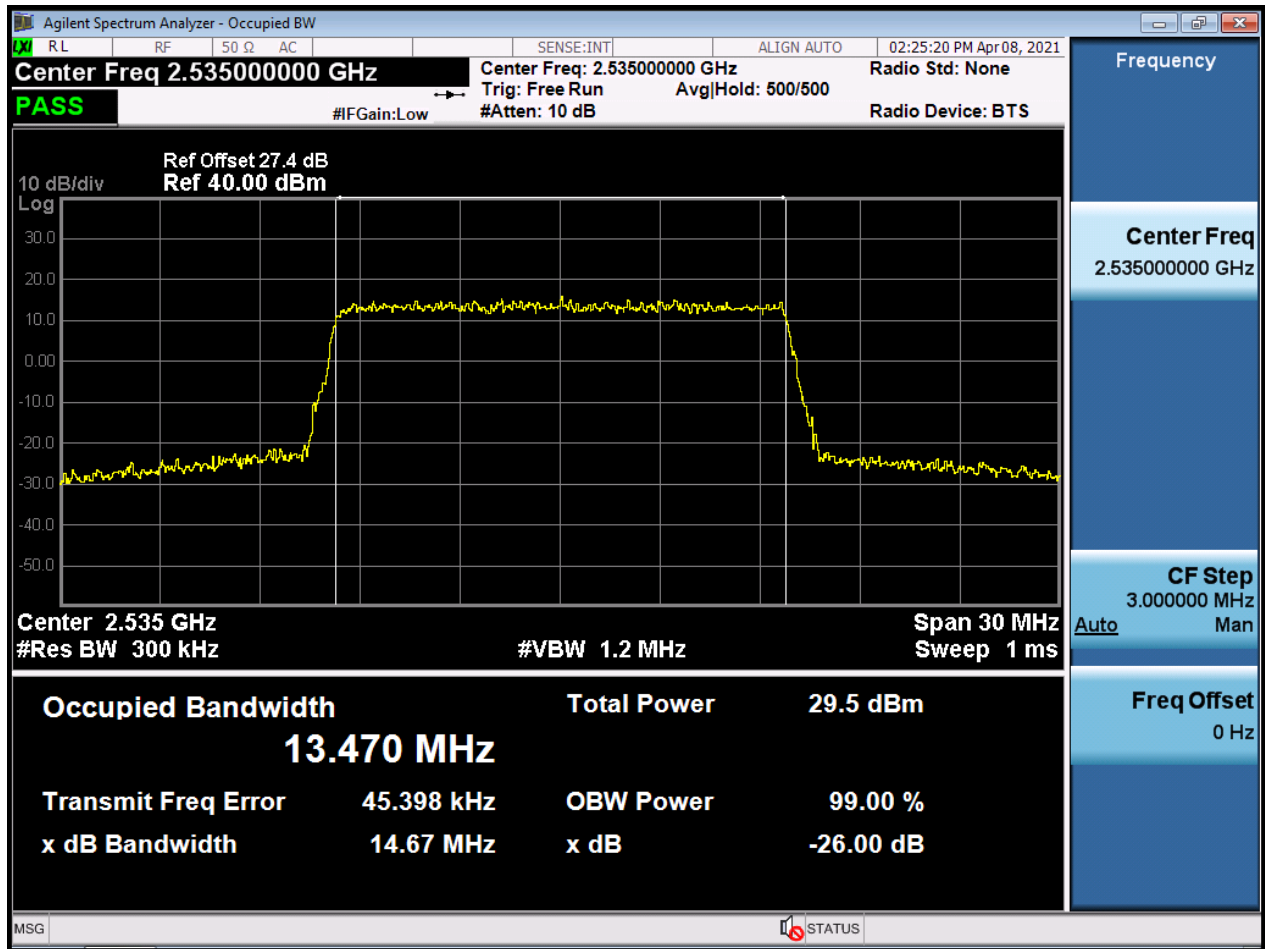
LTE7_15M_OBW_Mid Channel_QPSK_FullRB



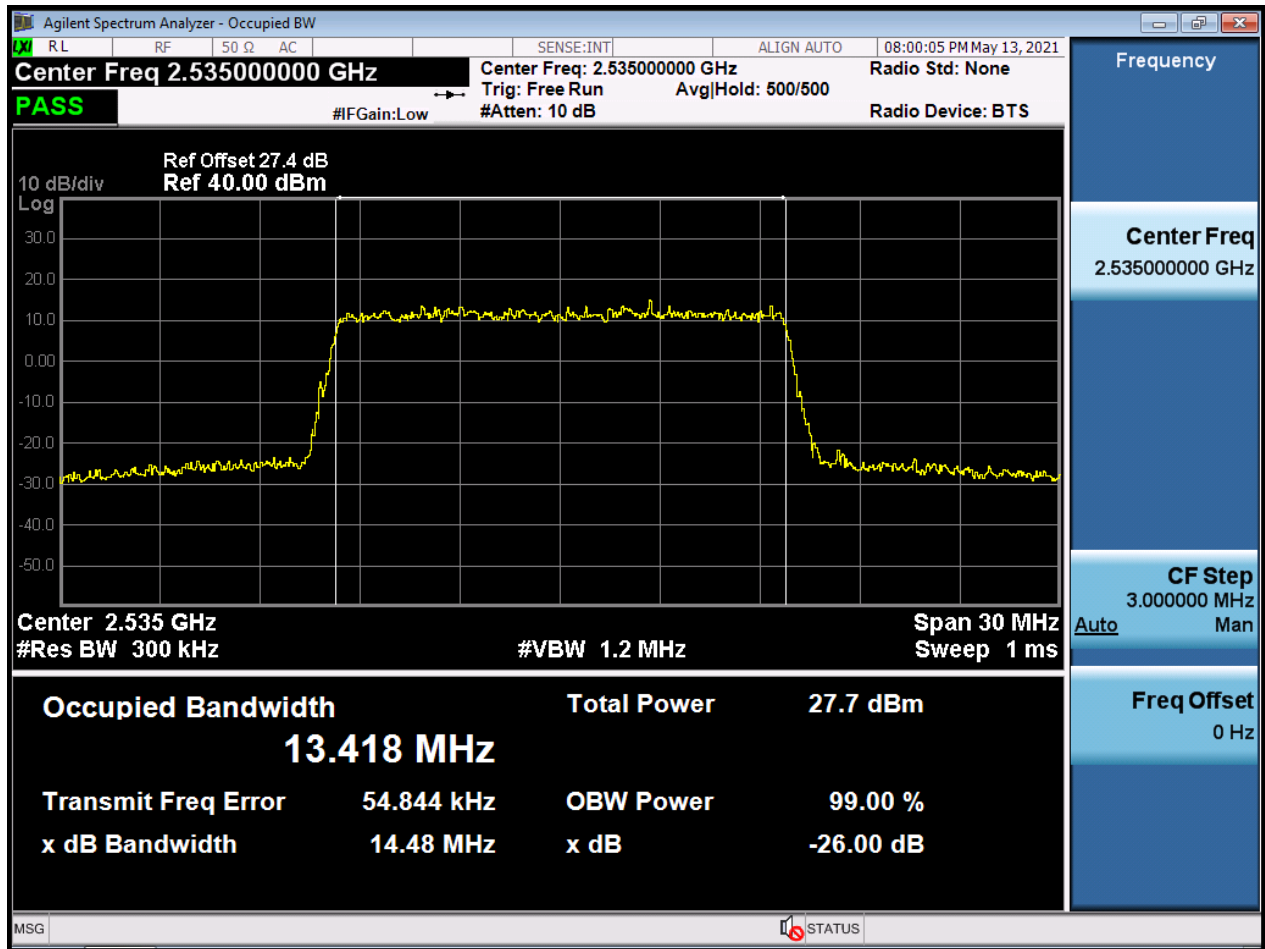
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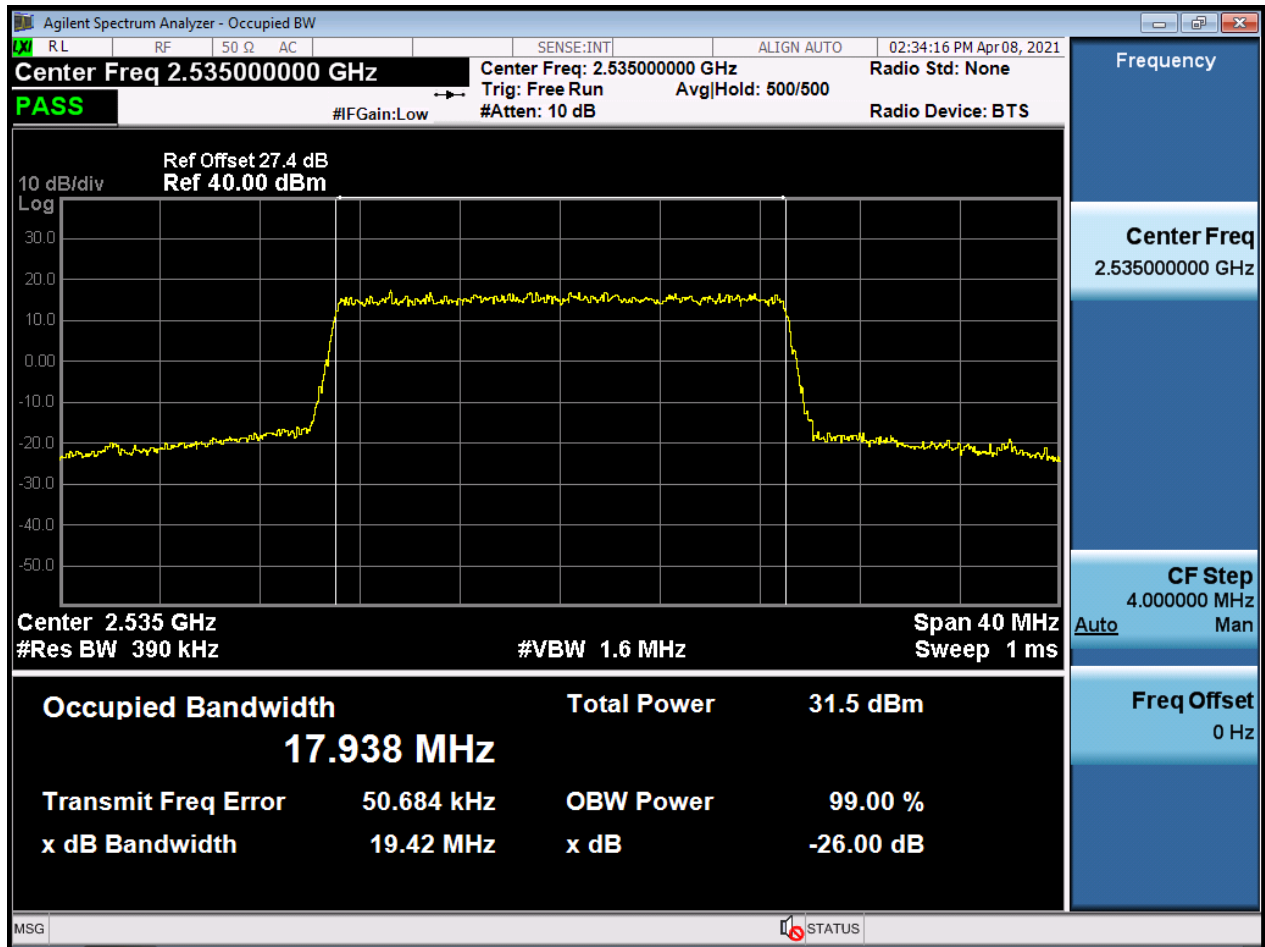
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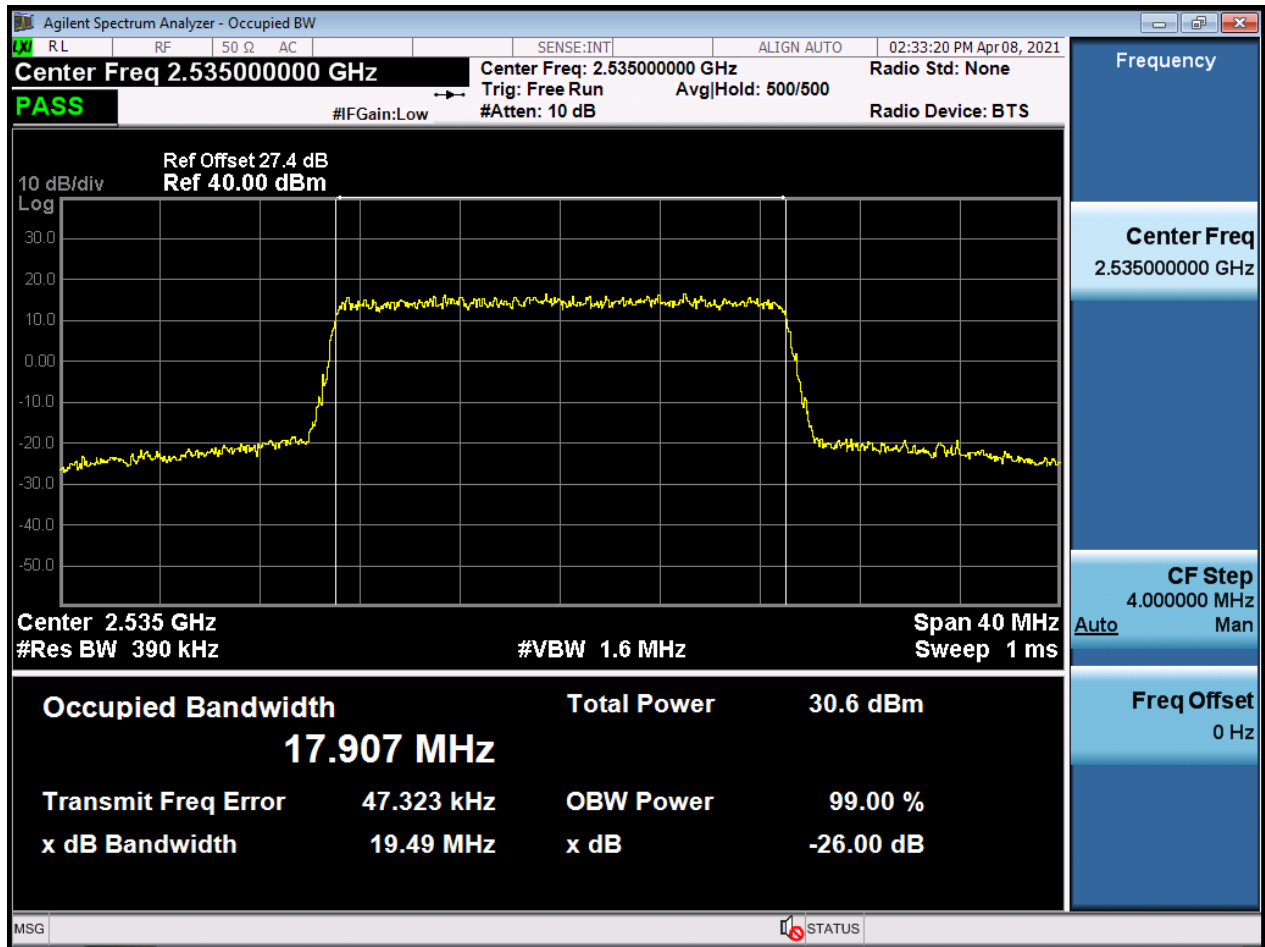
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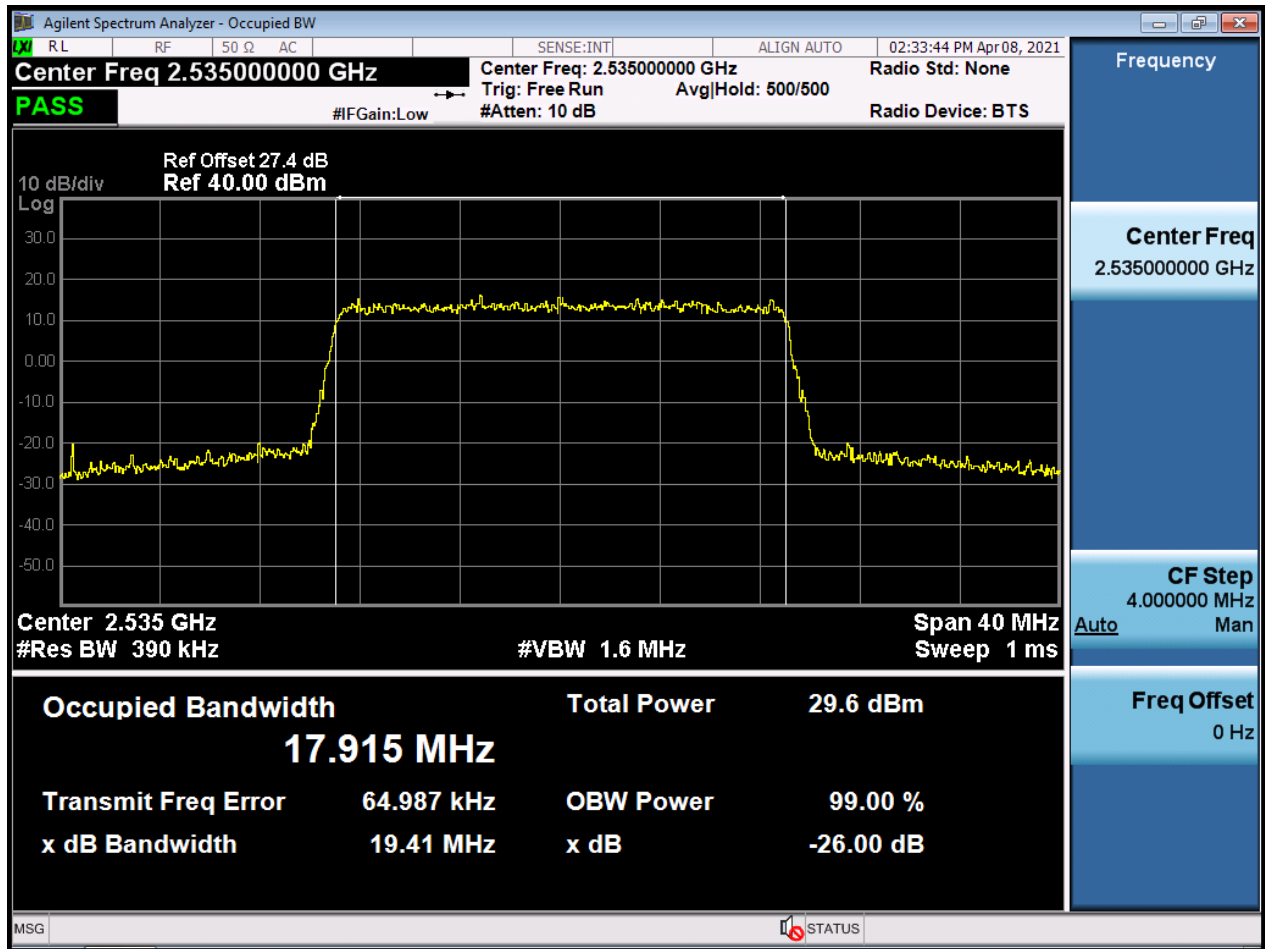
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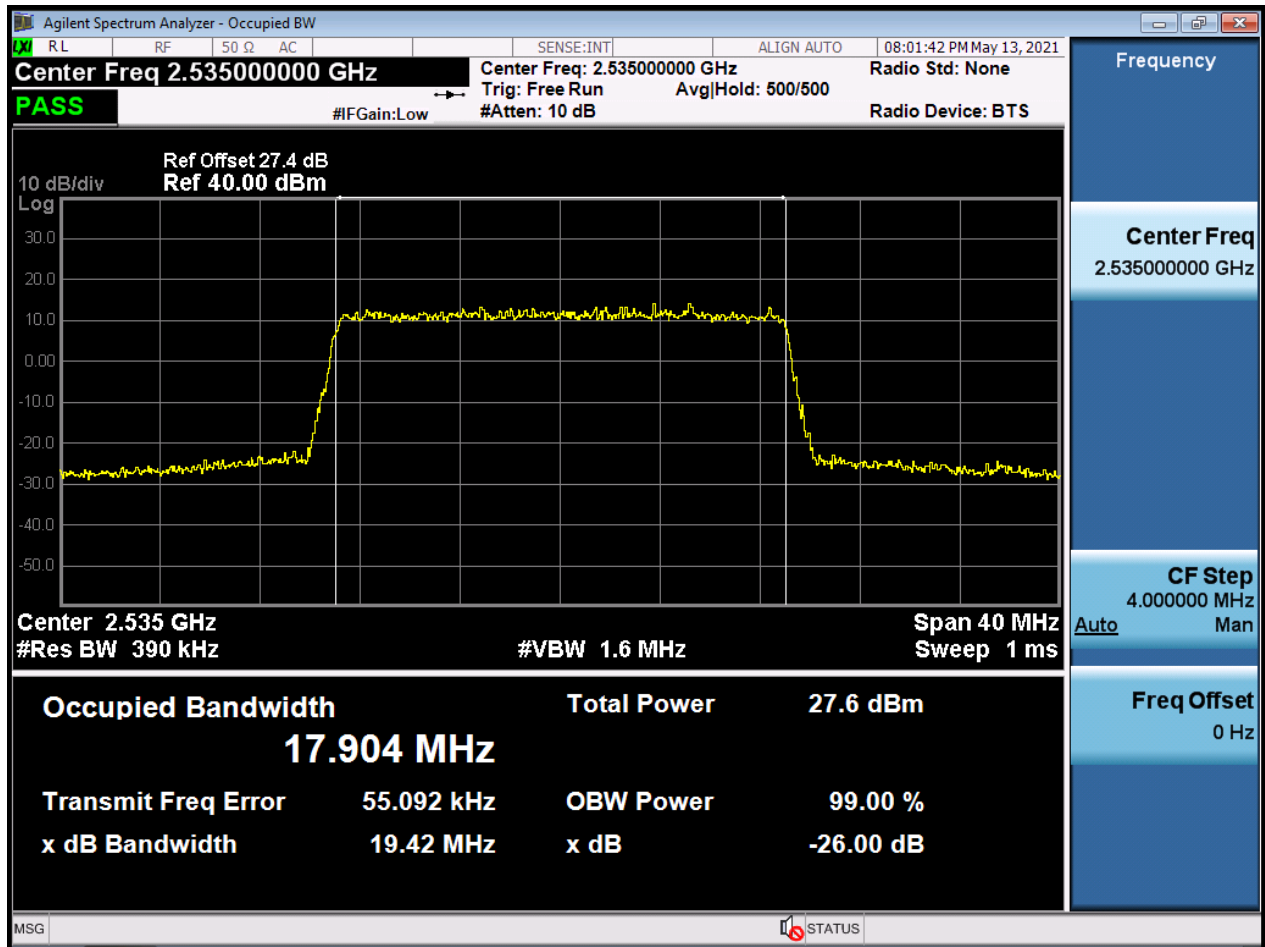
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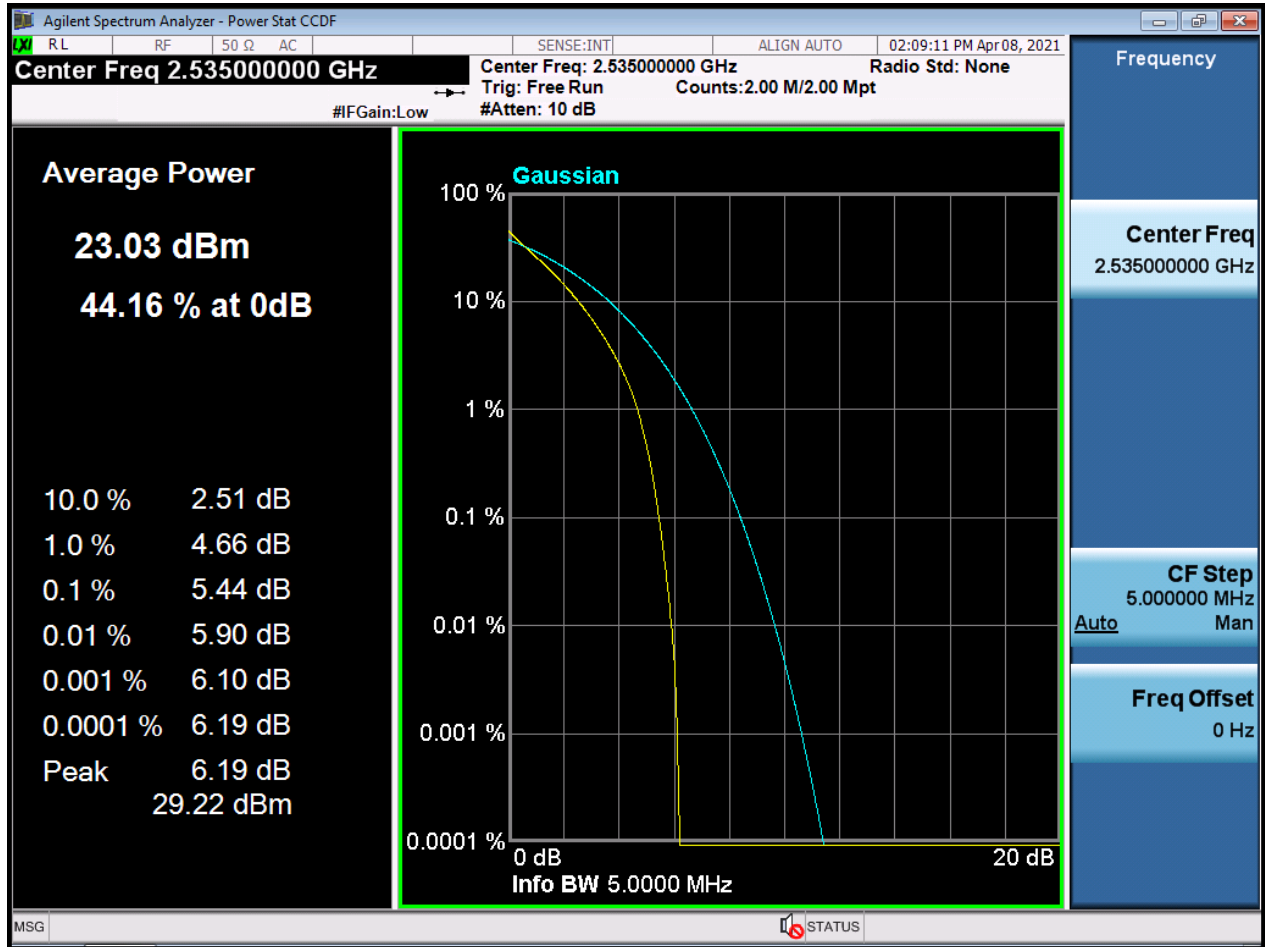
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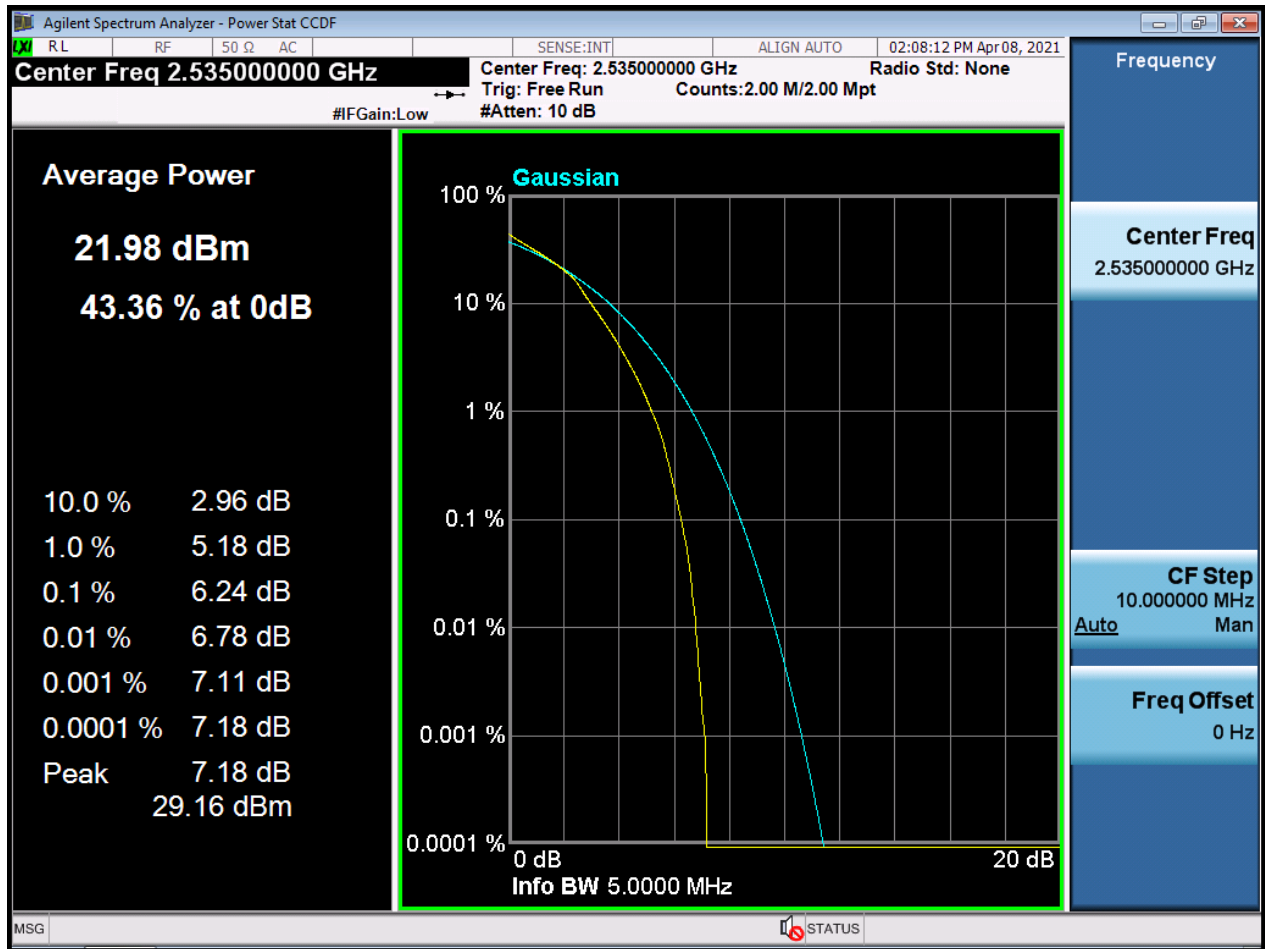
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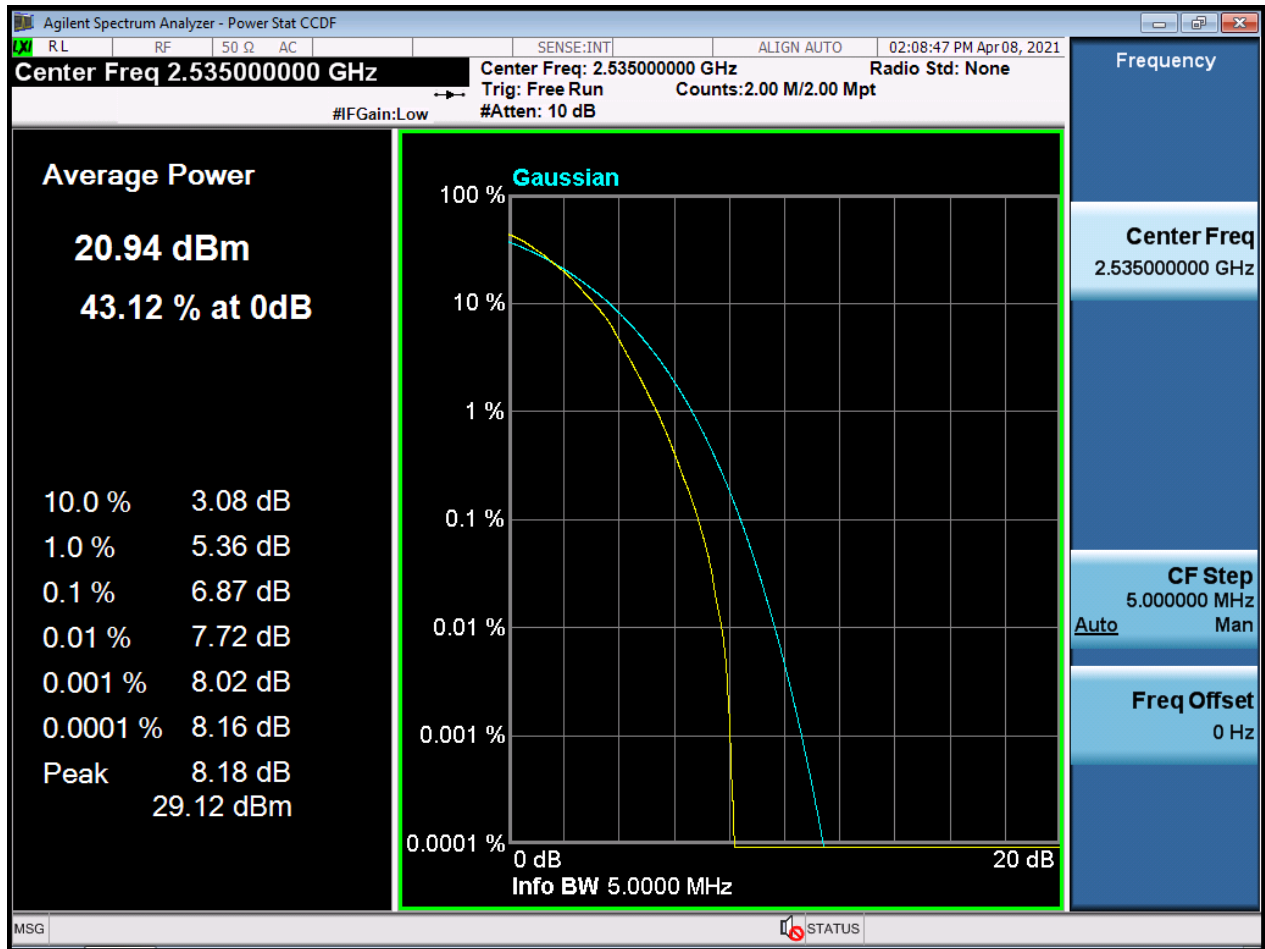
LTE7_5M_PAR_Mid Channel_QPSK_FullIRB



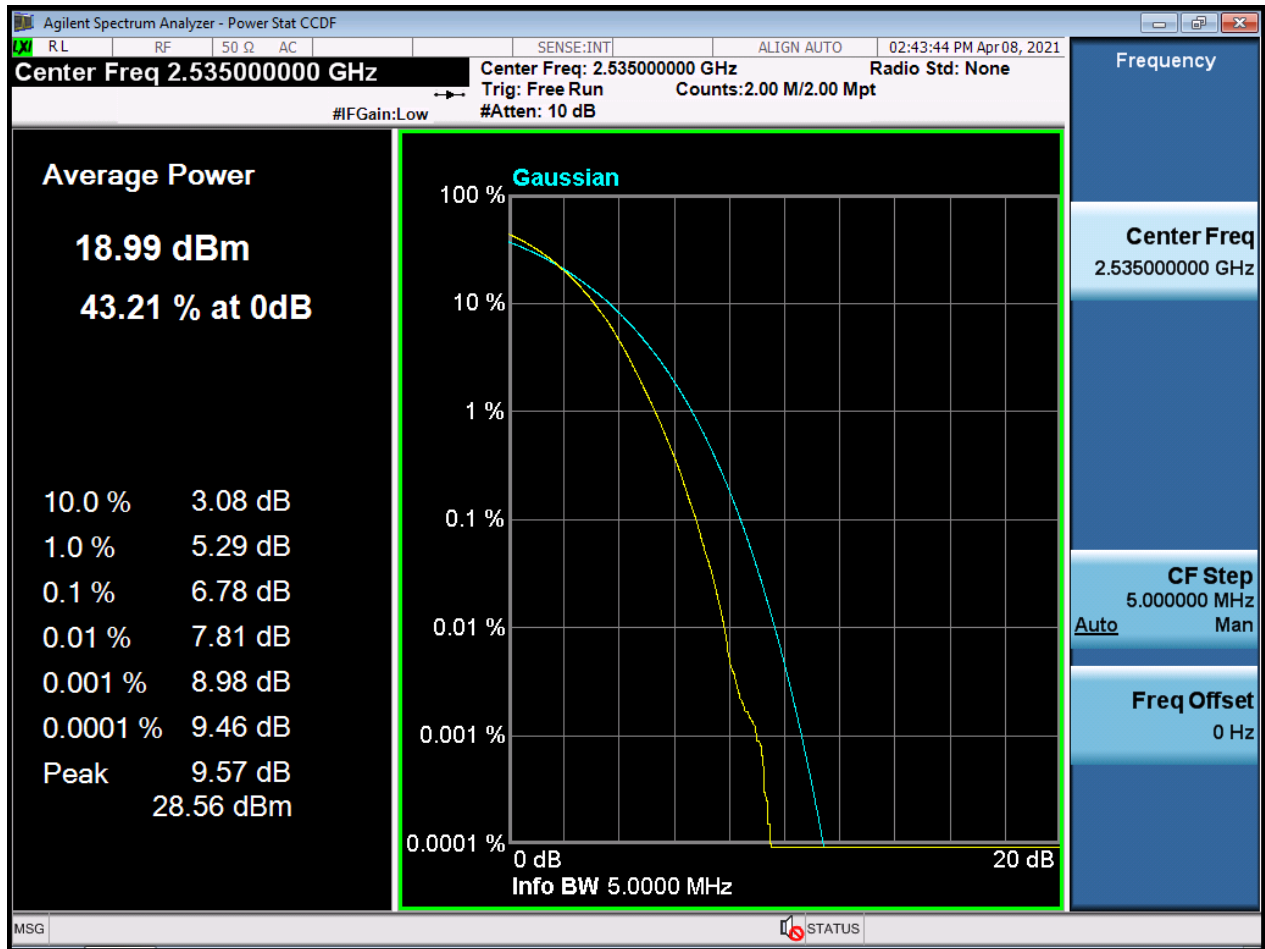
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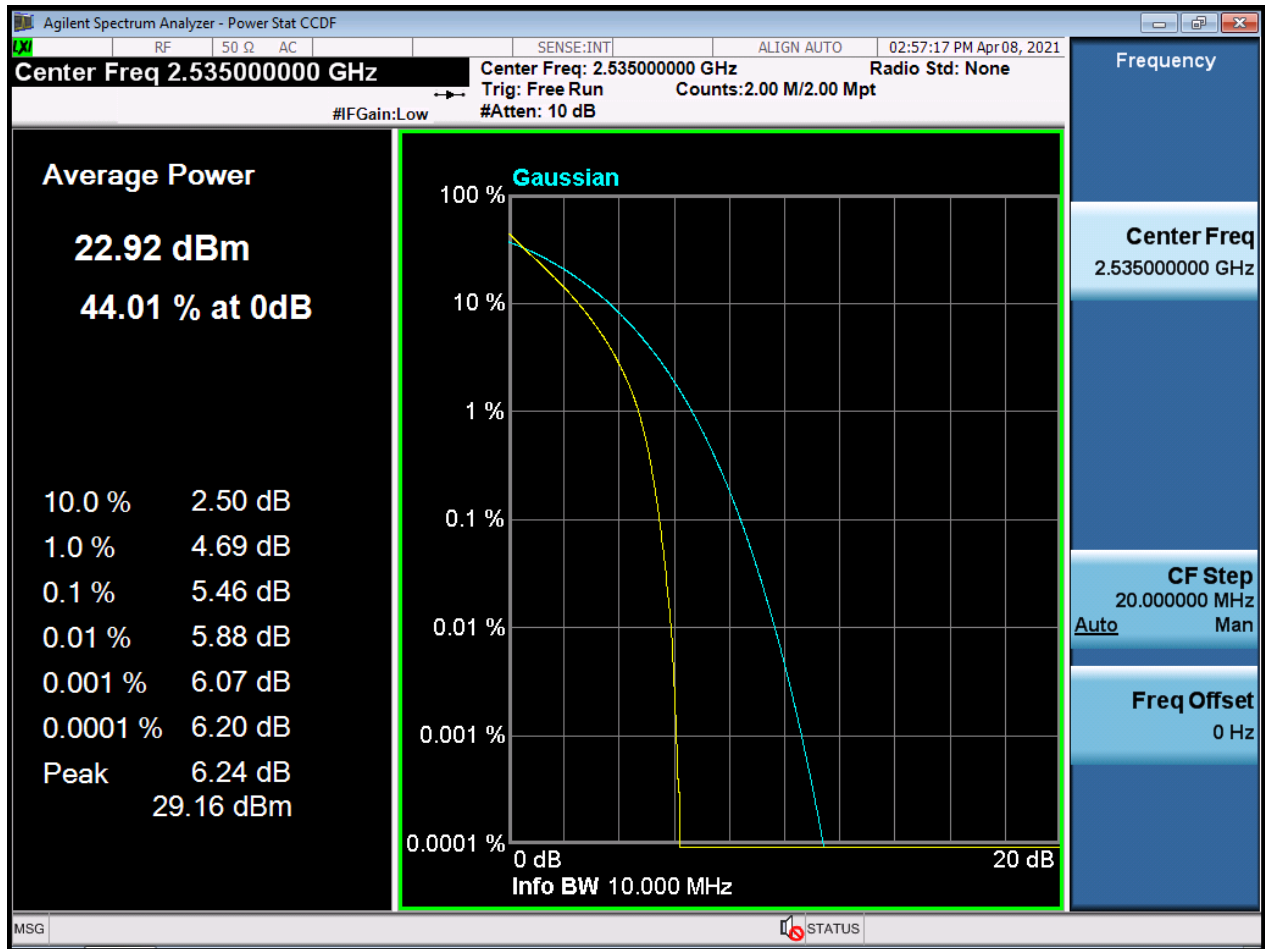
LTE7_5M_PAR_Mid Channel_64QAM_FullIRB



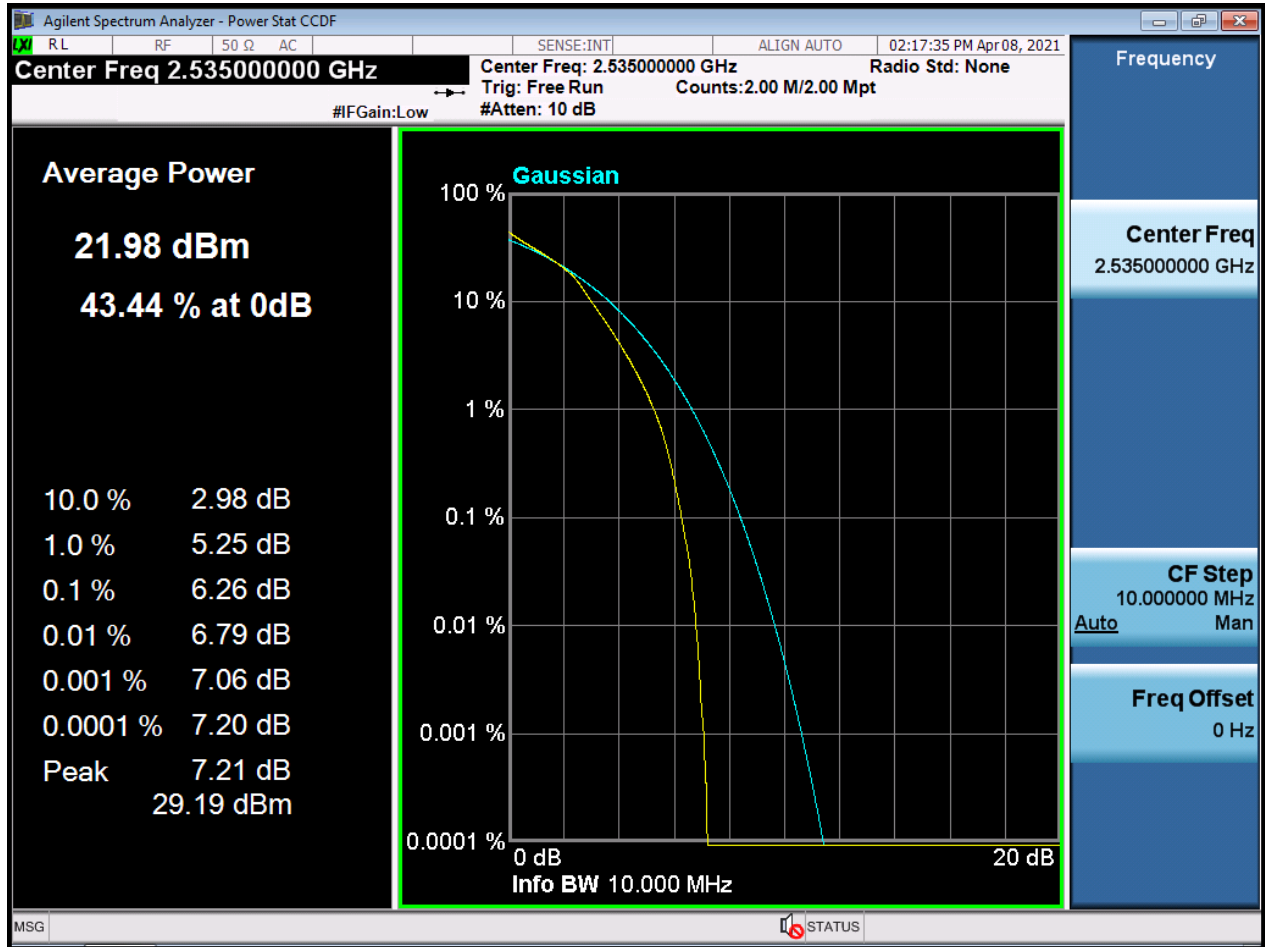
LTE7_5M_PAR_Mid Channel_256QAM_FullIRB



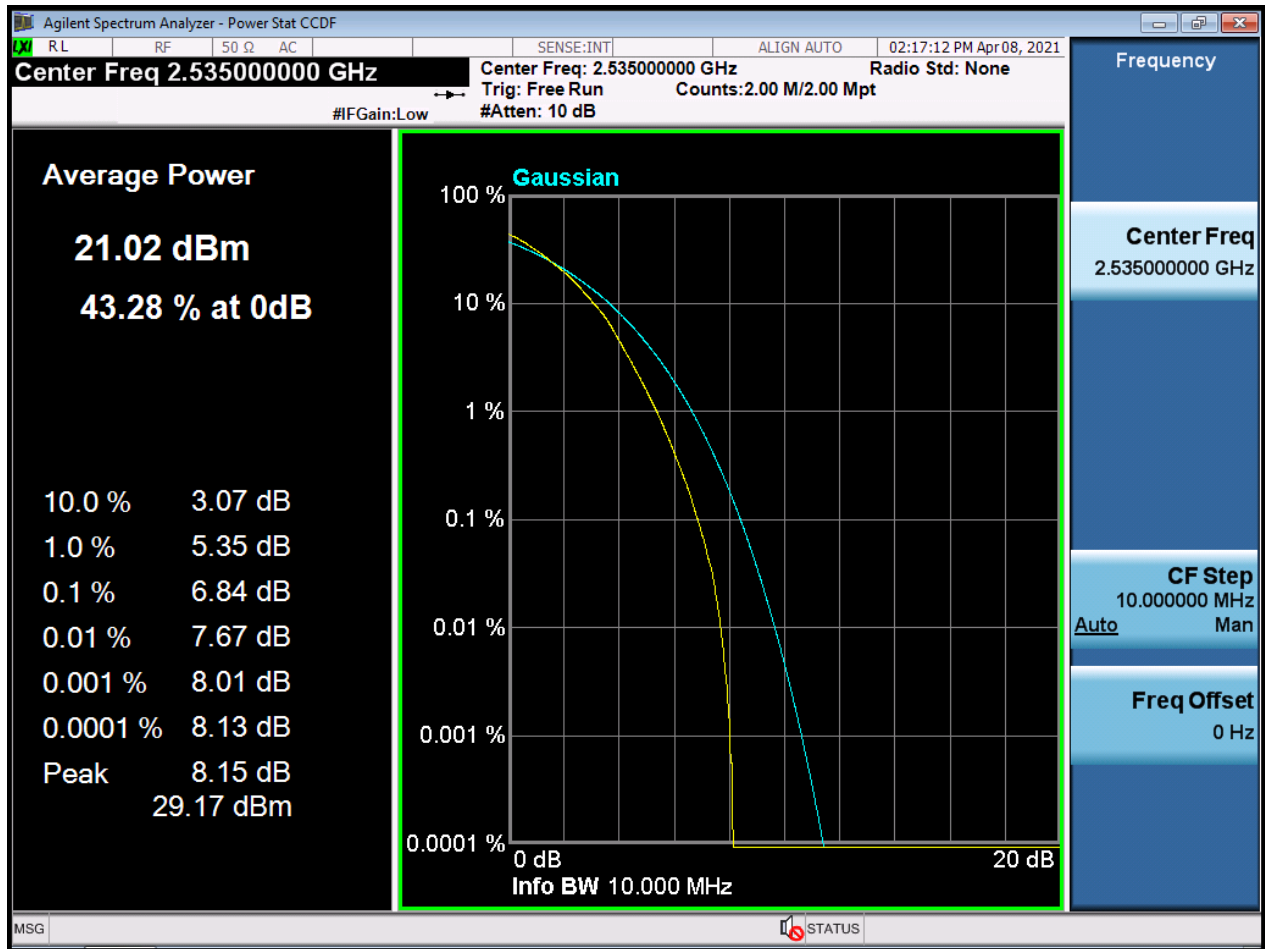
LTE7_10M_PAR_Mid Channel_QPSK_FullIRB



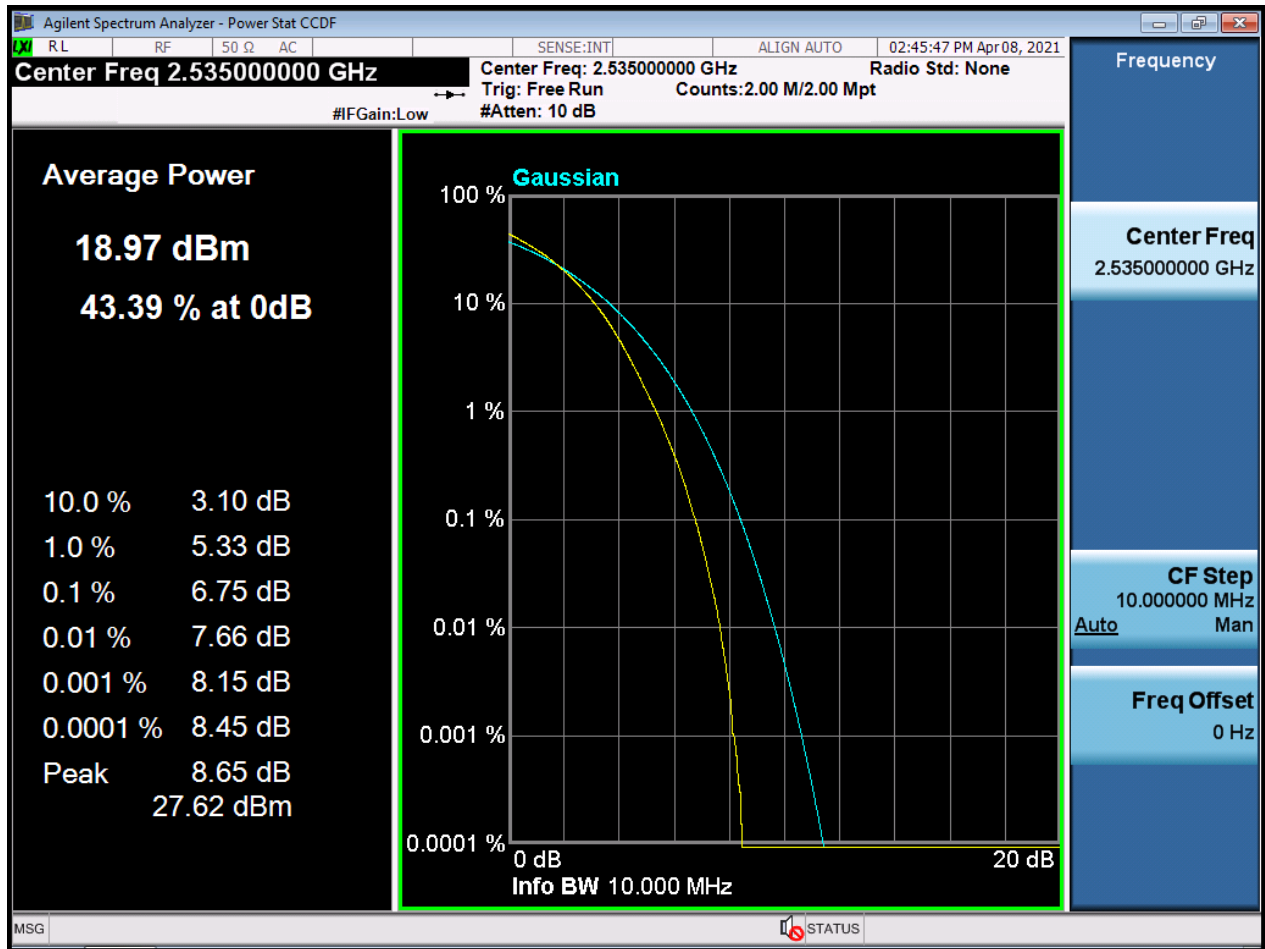
LTE7_10M_PAR_Mid Channel_16QAM_FullIRB



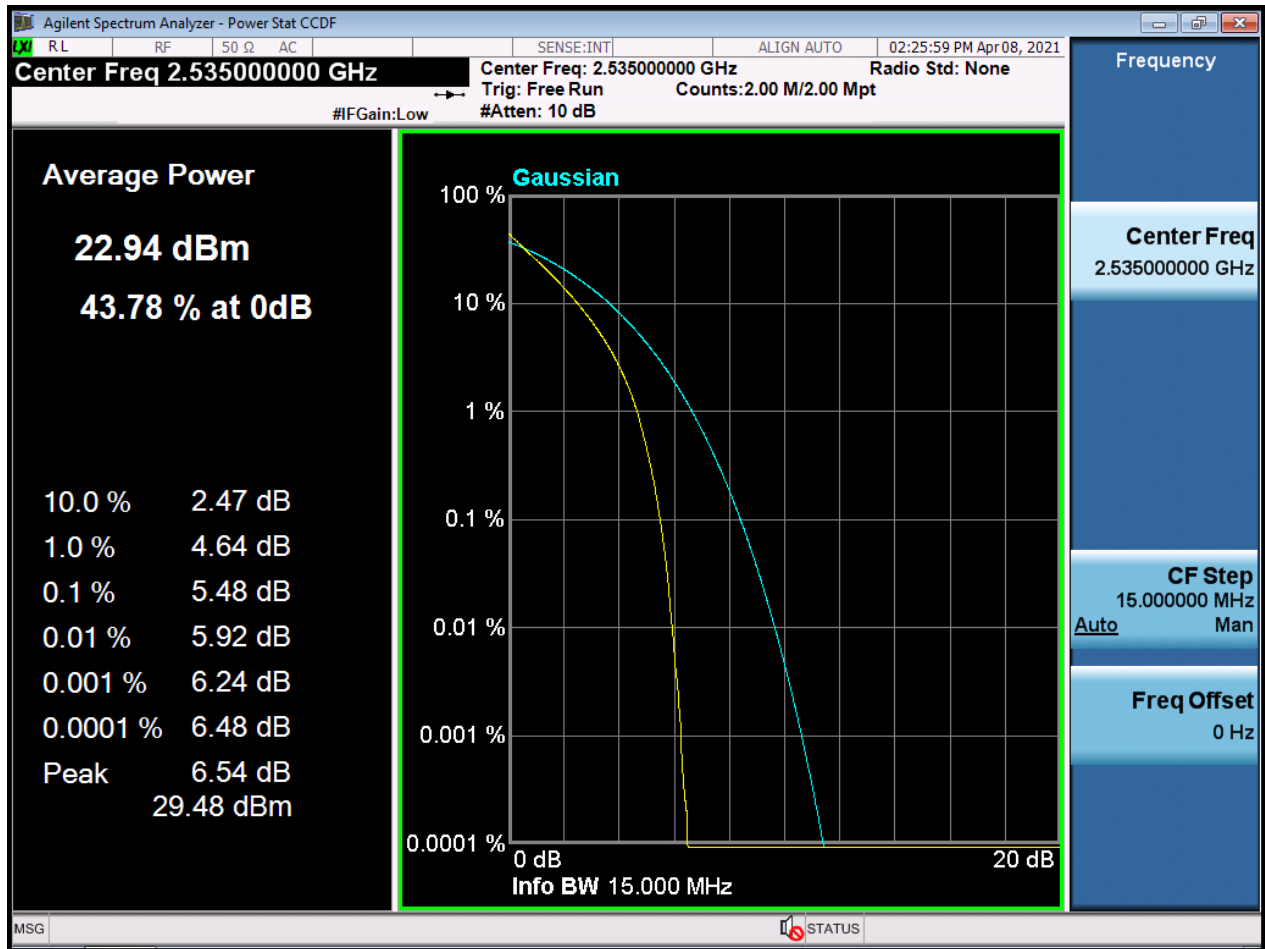
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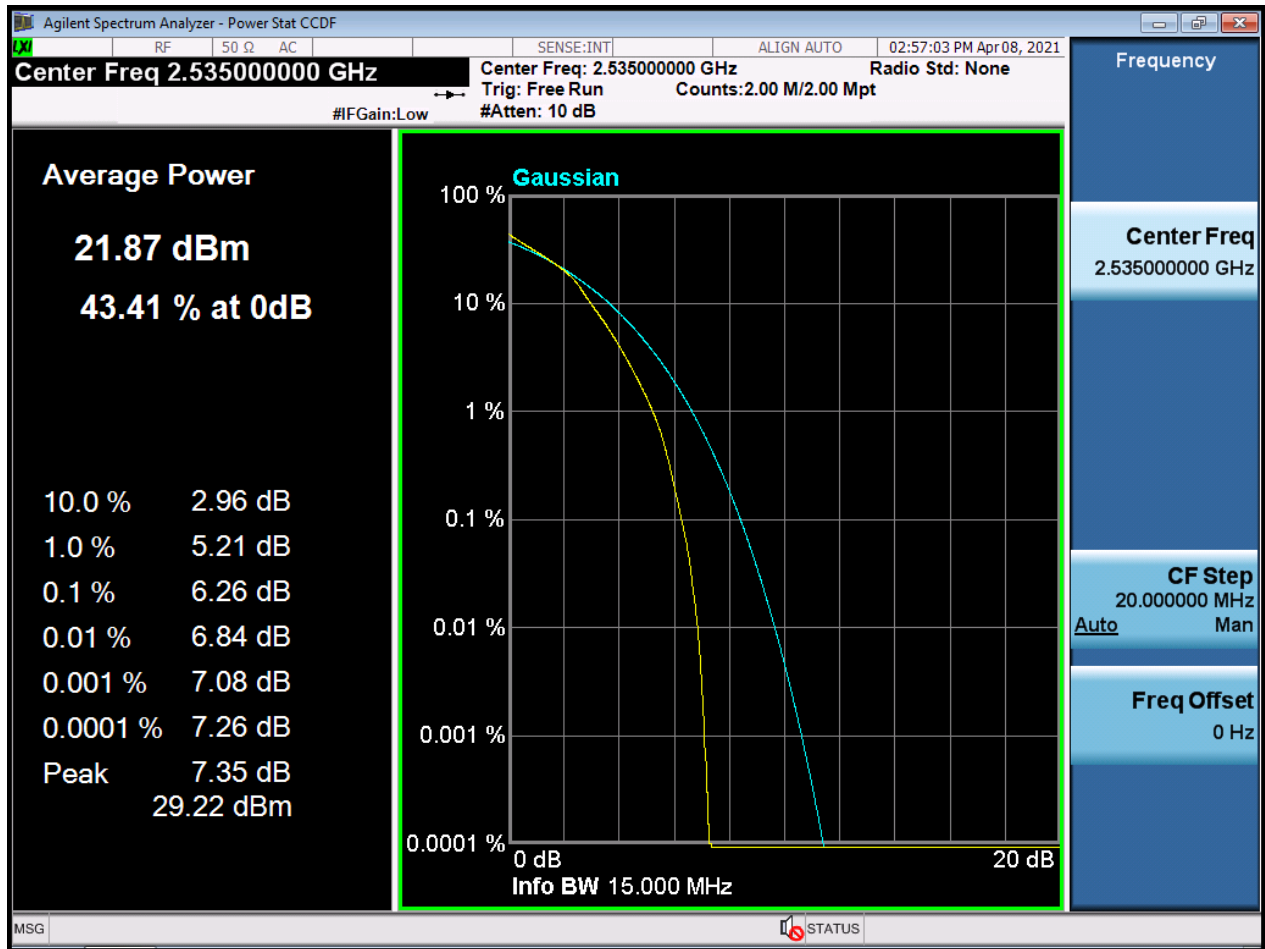
LTE7_10M_PAR_Mid Channel_256QAM_FullIRB



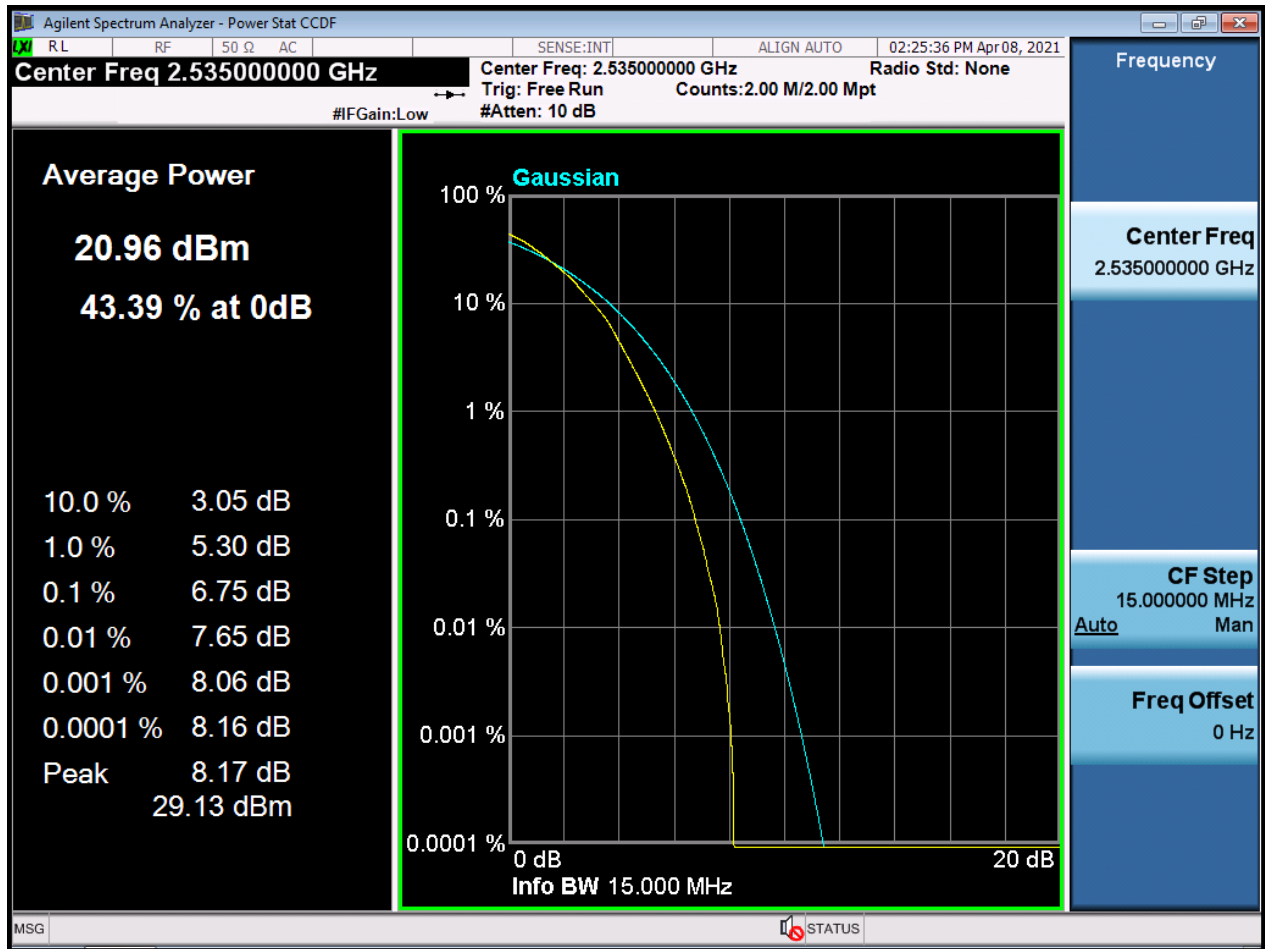
LTE7_15M_PAR_Mid Channel_QPSK_FullIRB



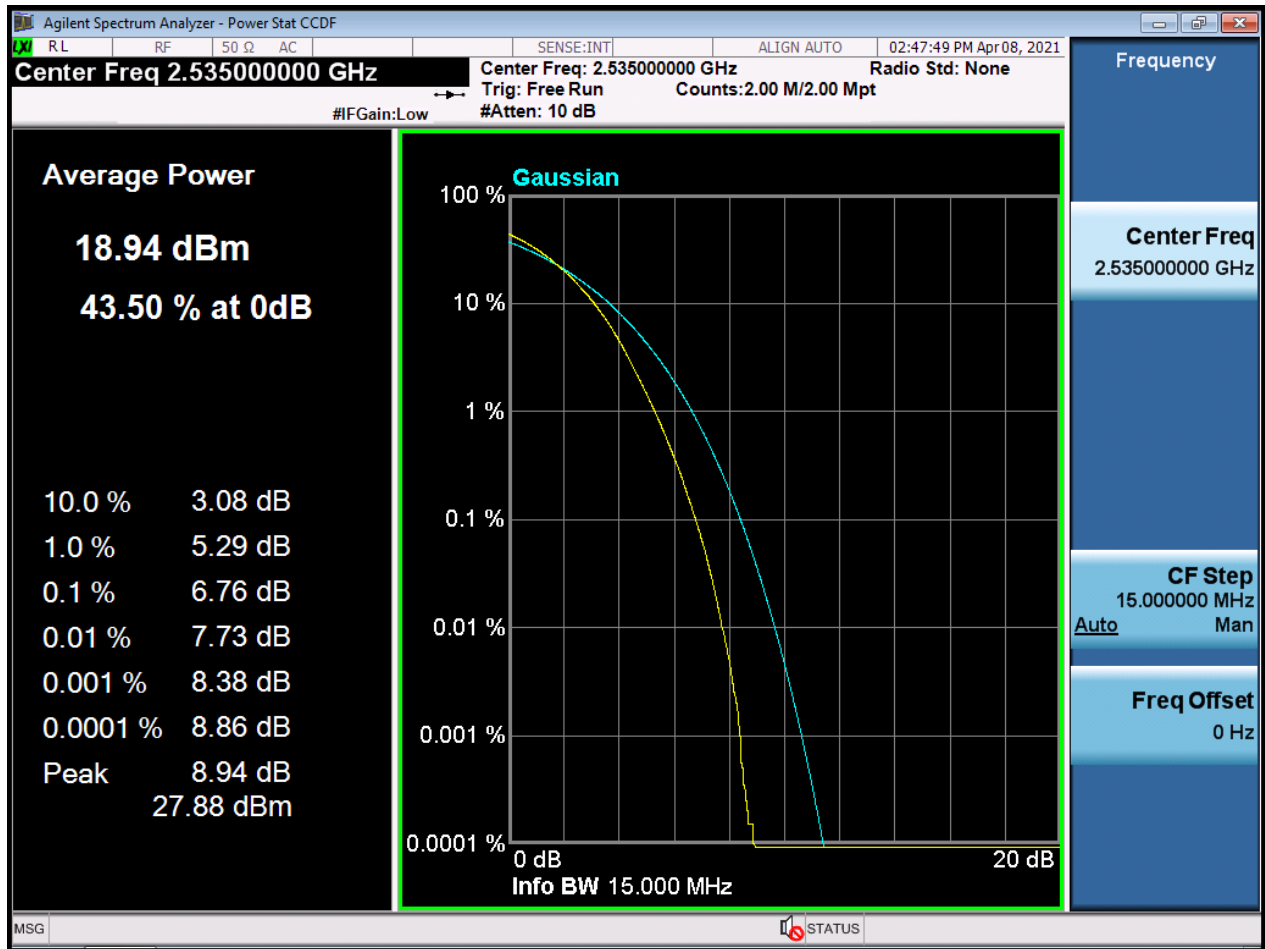
LTE7_15M_PAR_Mid Channel_16QAM_FullRB



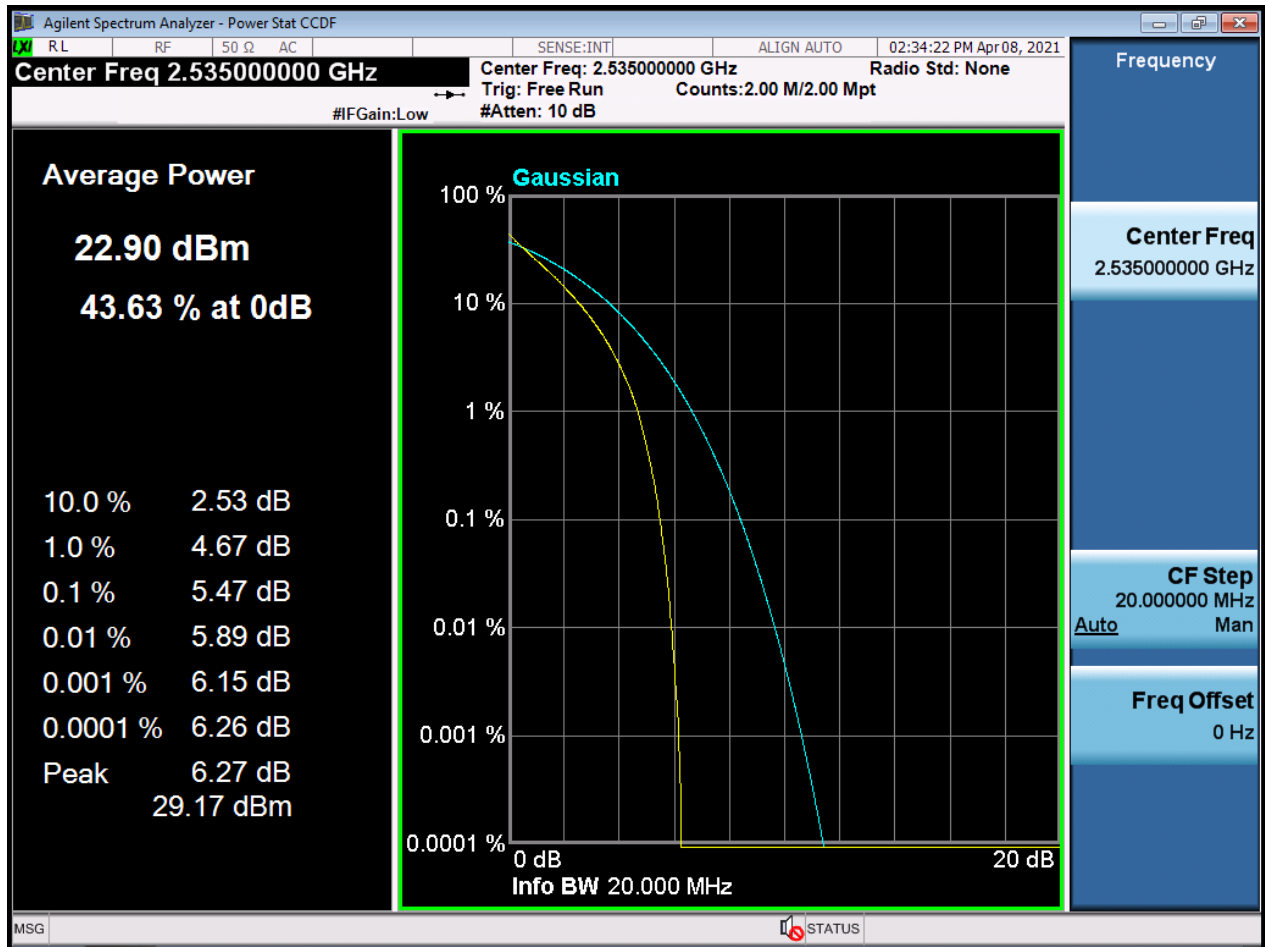
LTE7_15M_PAR_Mid Channel_64QAM_FullIRB



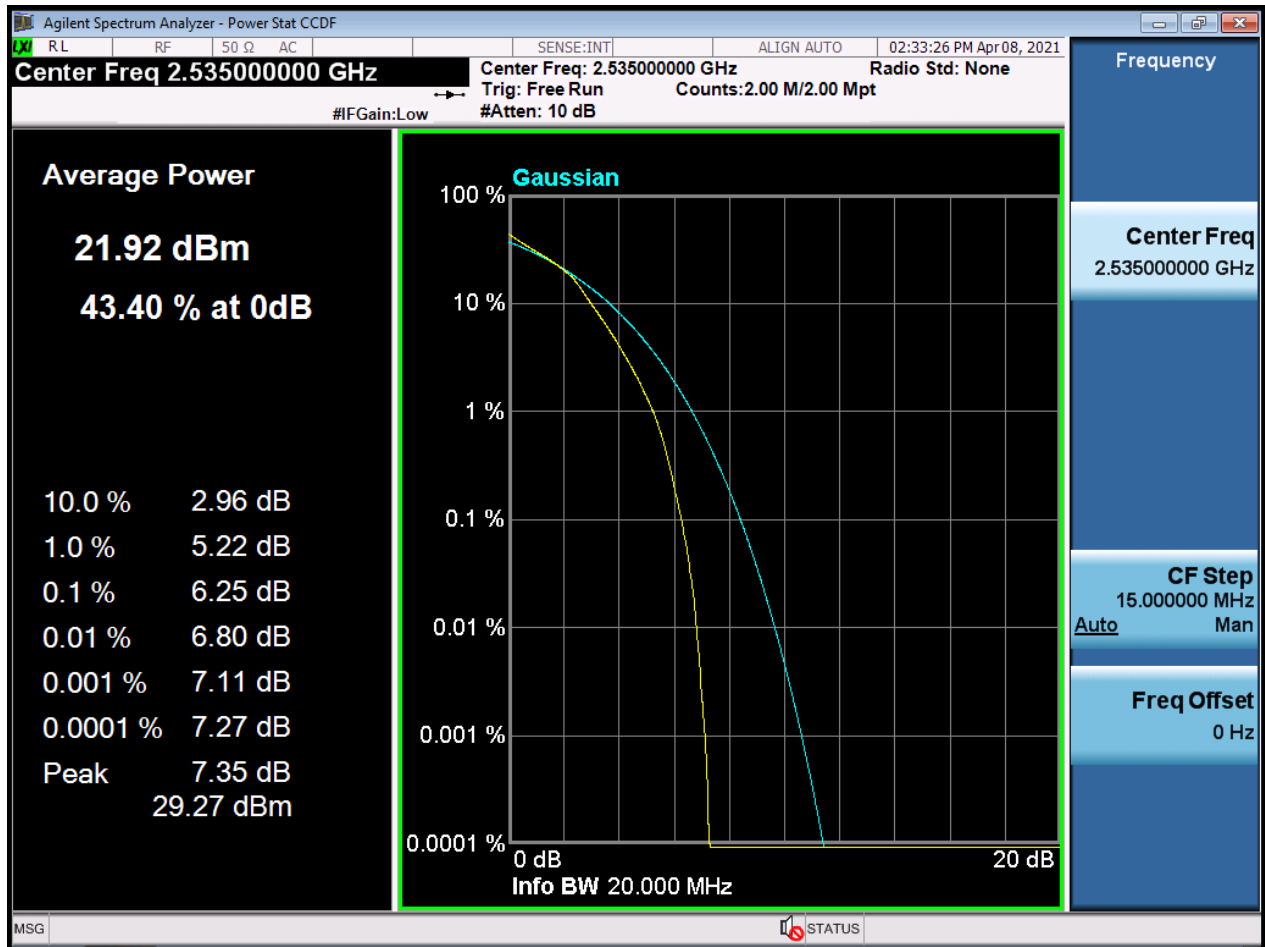
LTE7_15M_PAR_Mid Channel_256QAM_FullRB



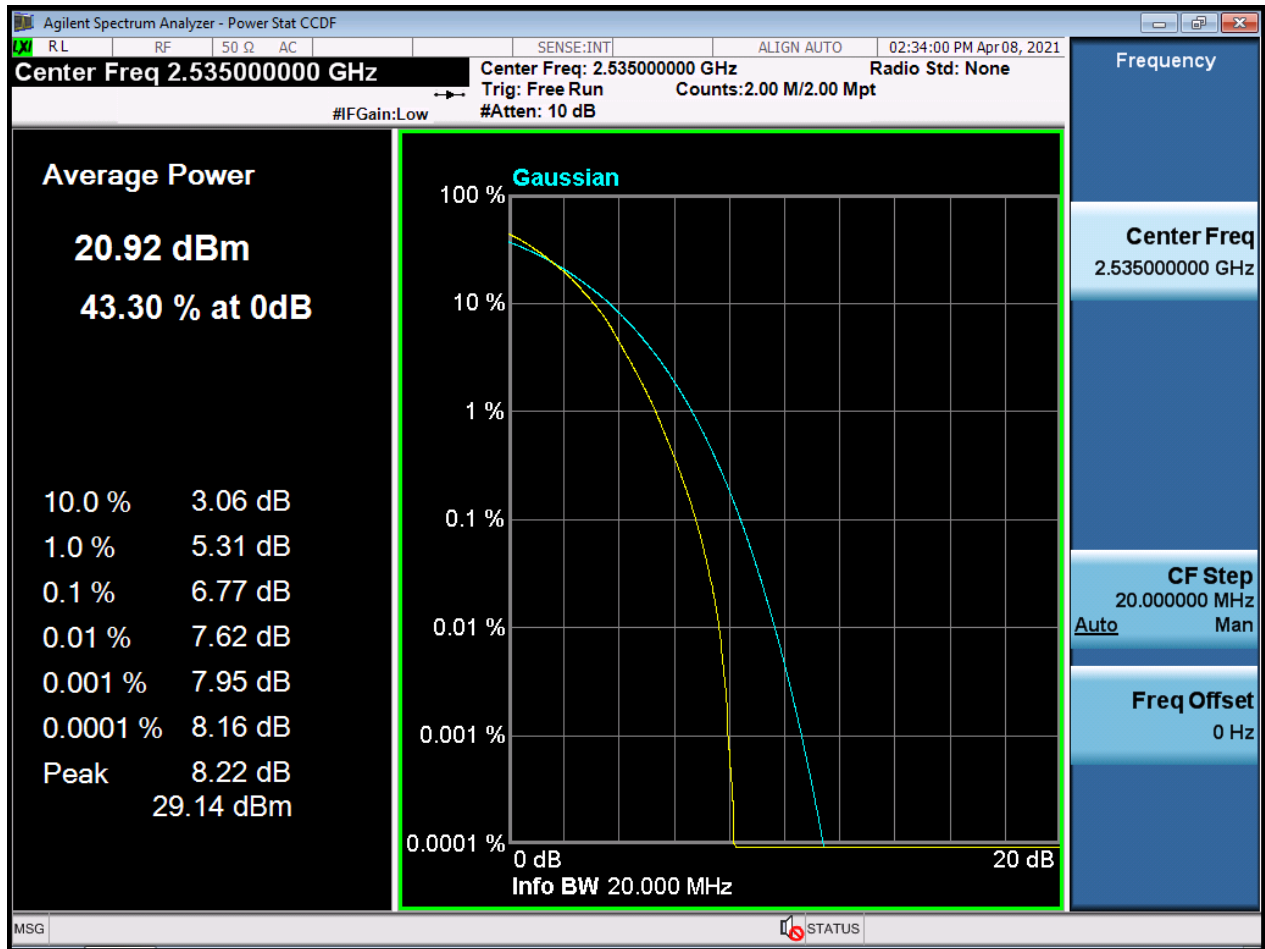
LTE7_20M_PAR_Mid Channel_QPSK_FullIRB



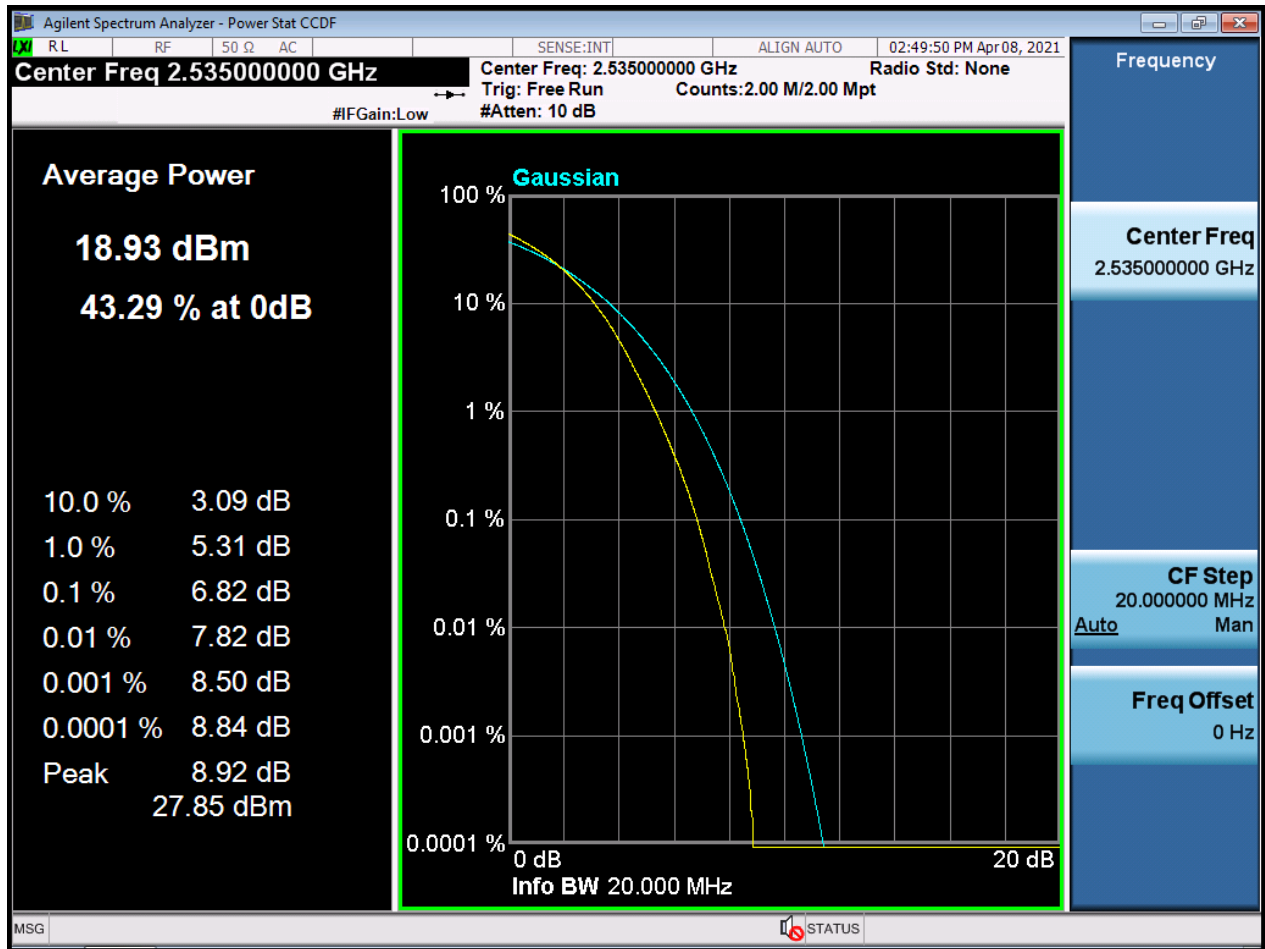
LTE7_20M_PAR_Mid Channel_16QAM_FullIRB



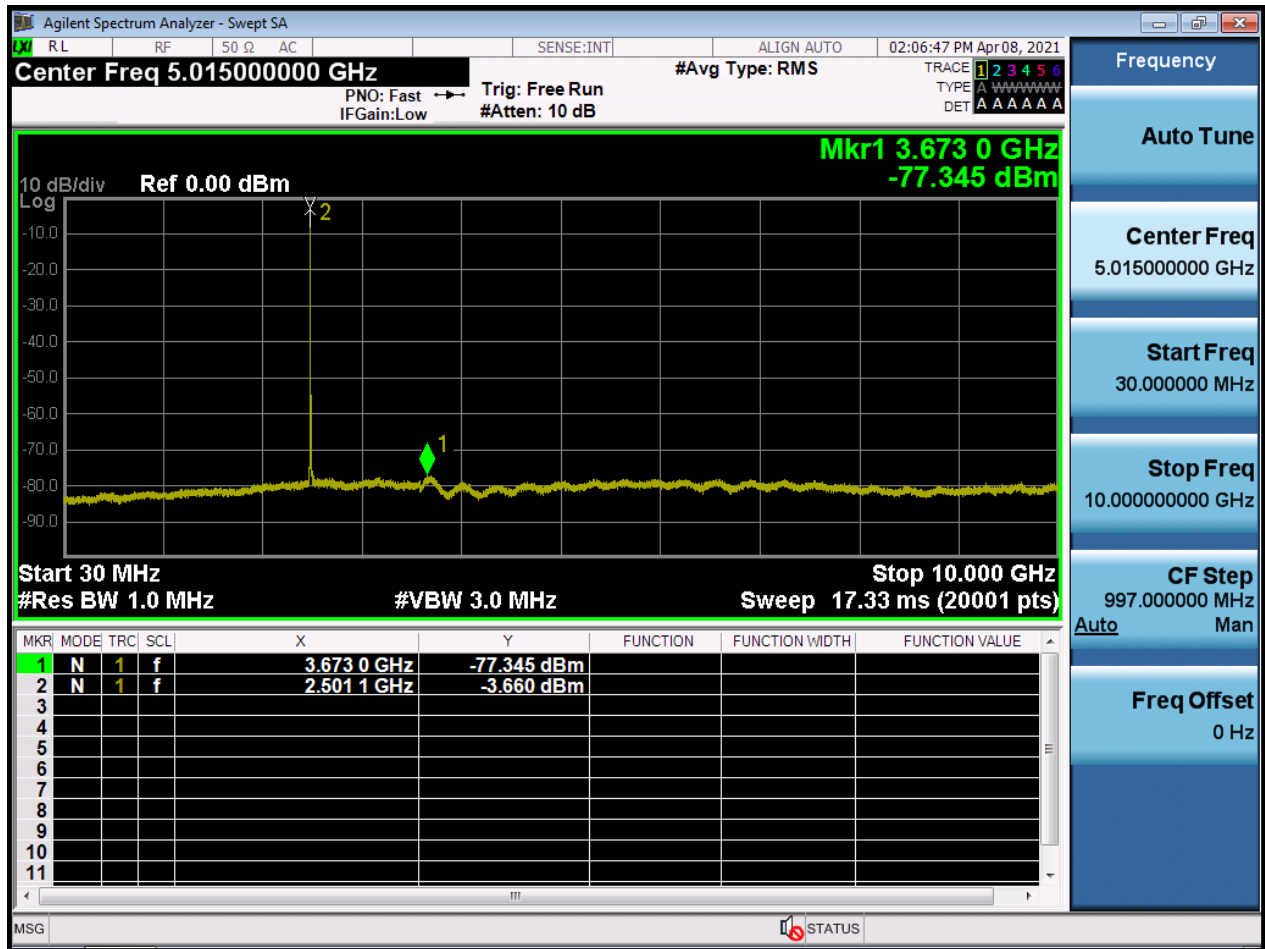
LTE7_20M_PAR_Mid Channel_64QAM_FullIRB



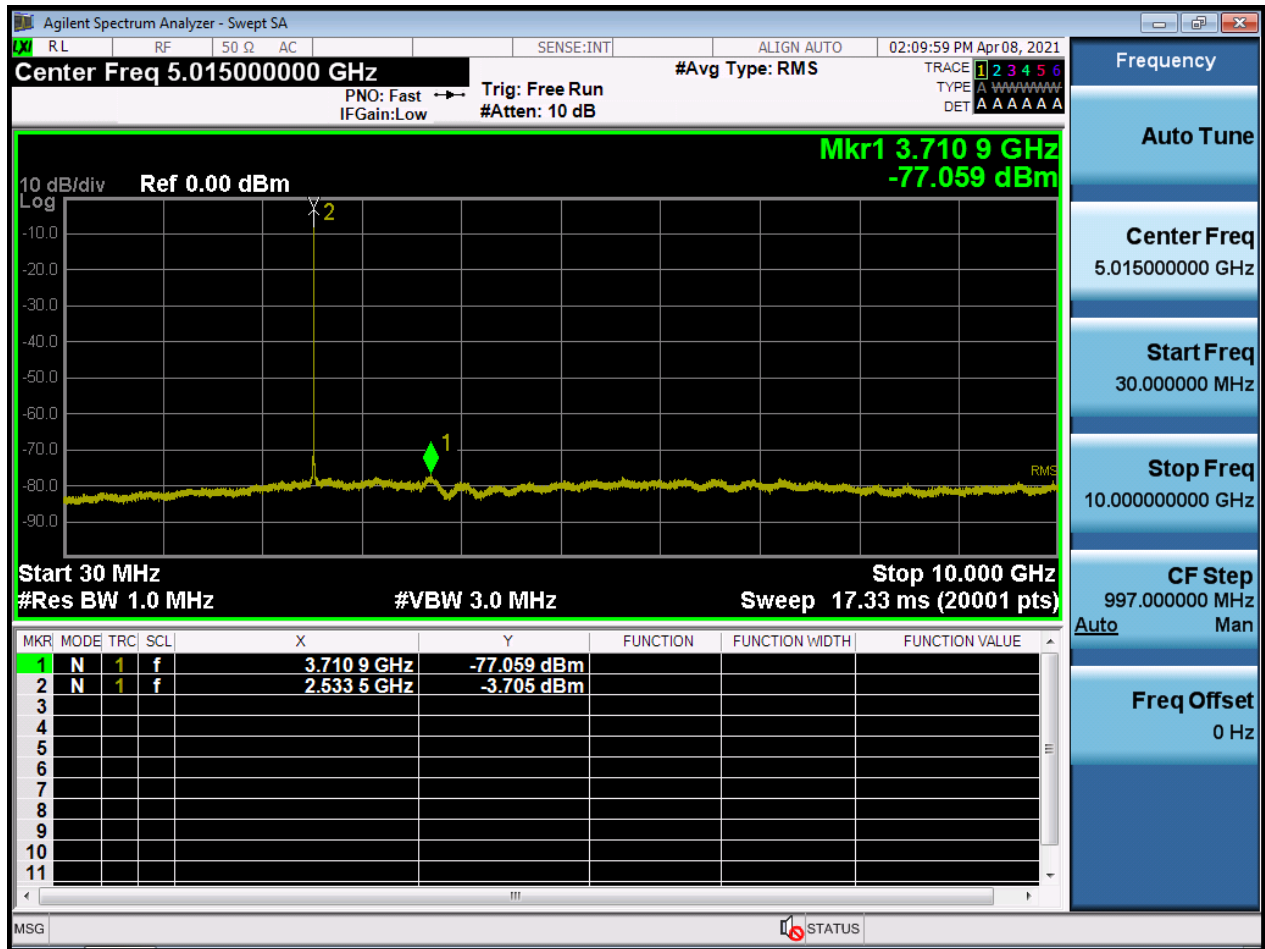
LTE7_20M_PAR_Mid Channel_256QAM_FullIRB



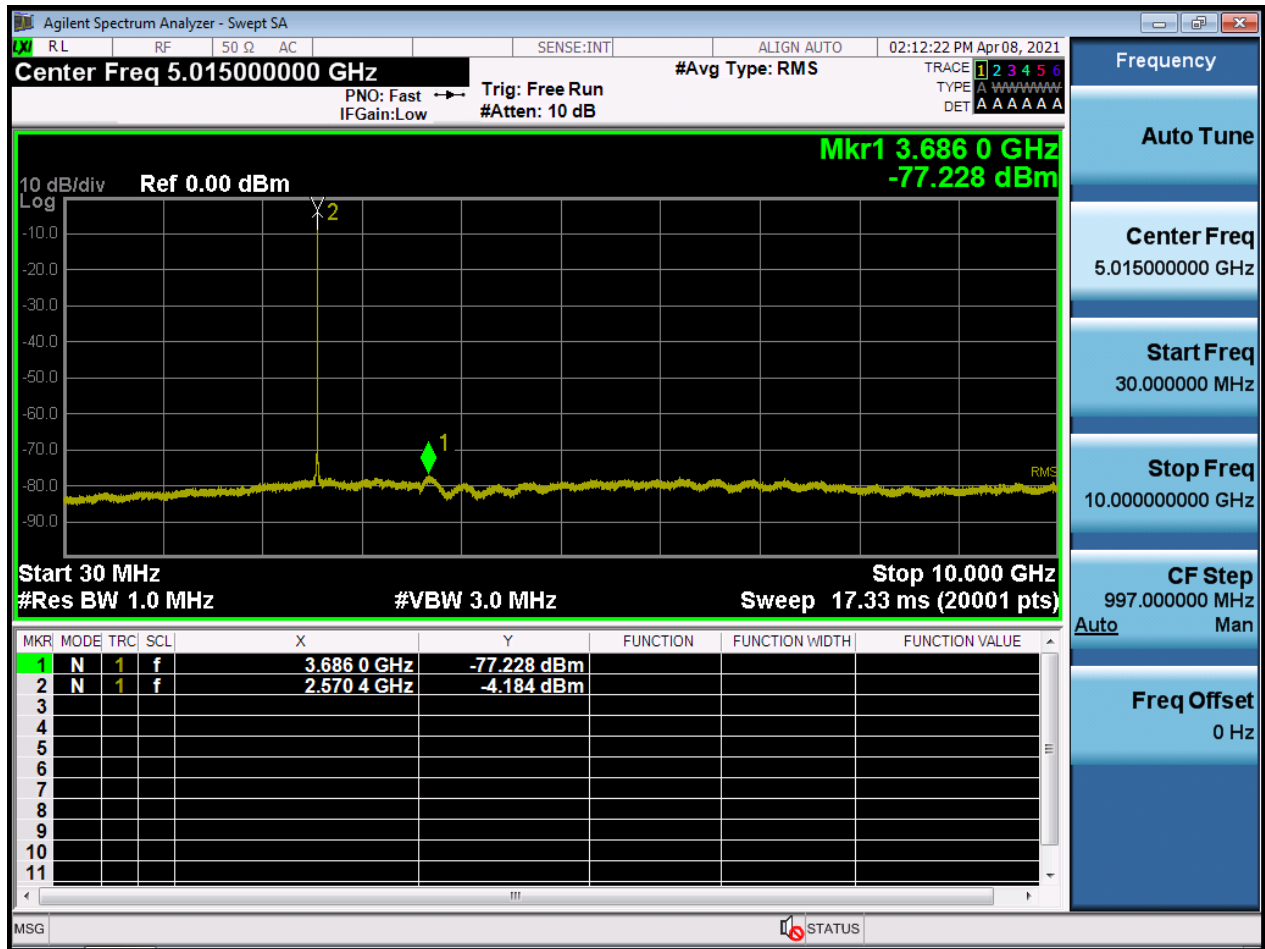
LTE7_5M_CSE(30M-10G)_Lowest Channel



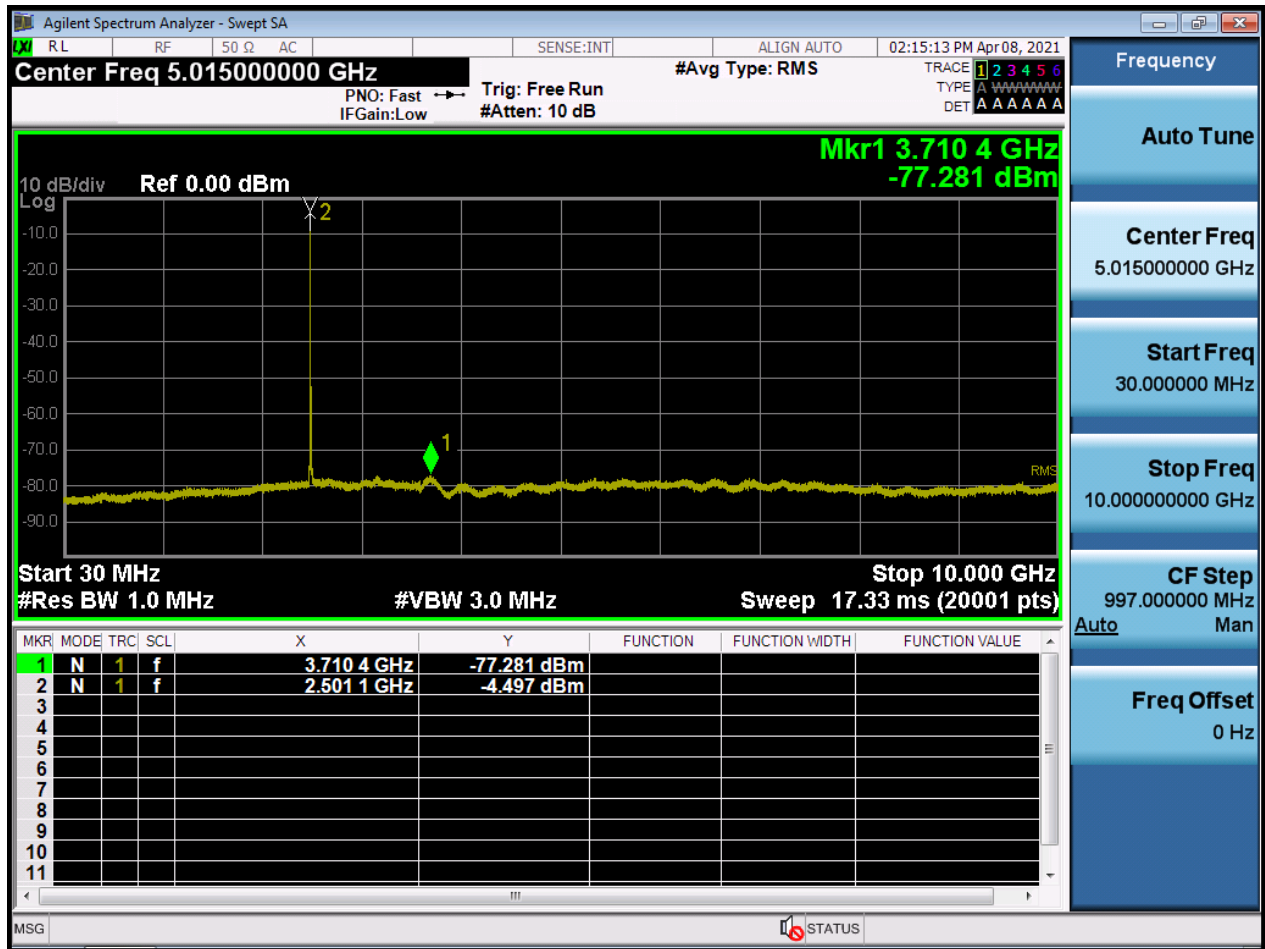
LTE7_5M_CSE(30M-10G)_Mid Channel



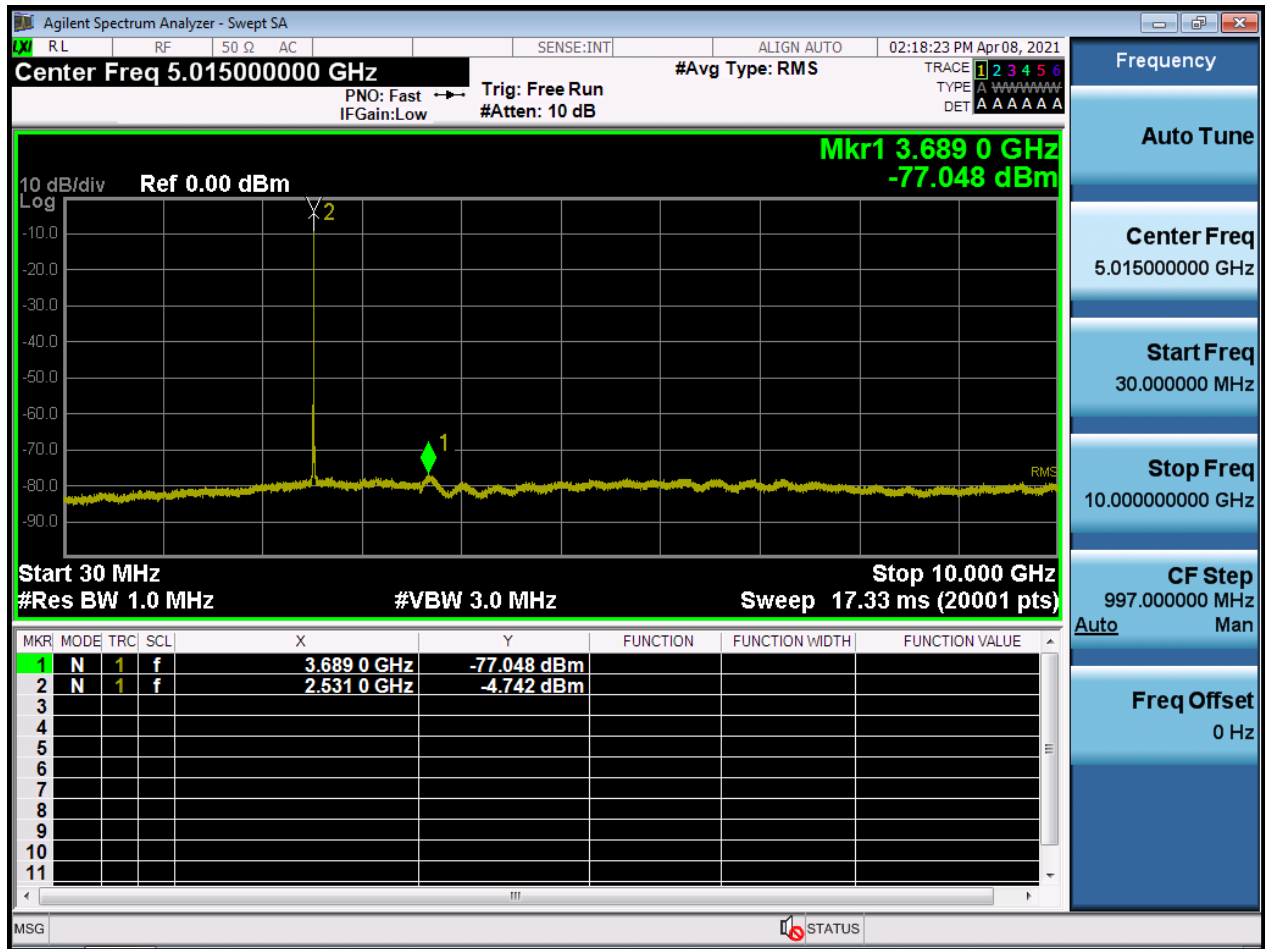
LTE7_5M_CSE(30M-10G)_Highest Channel



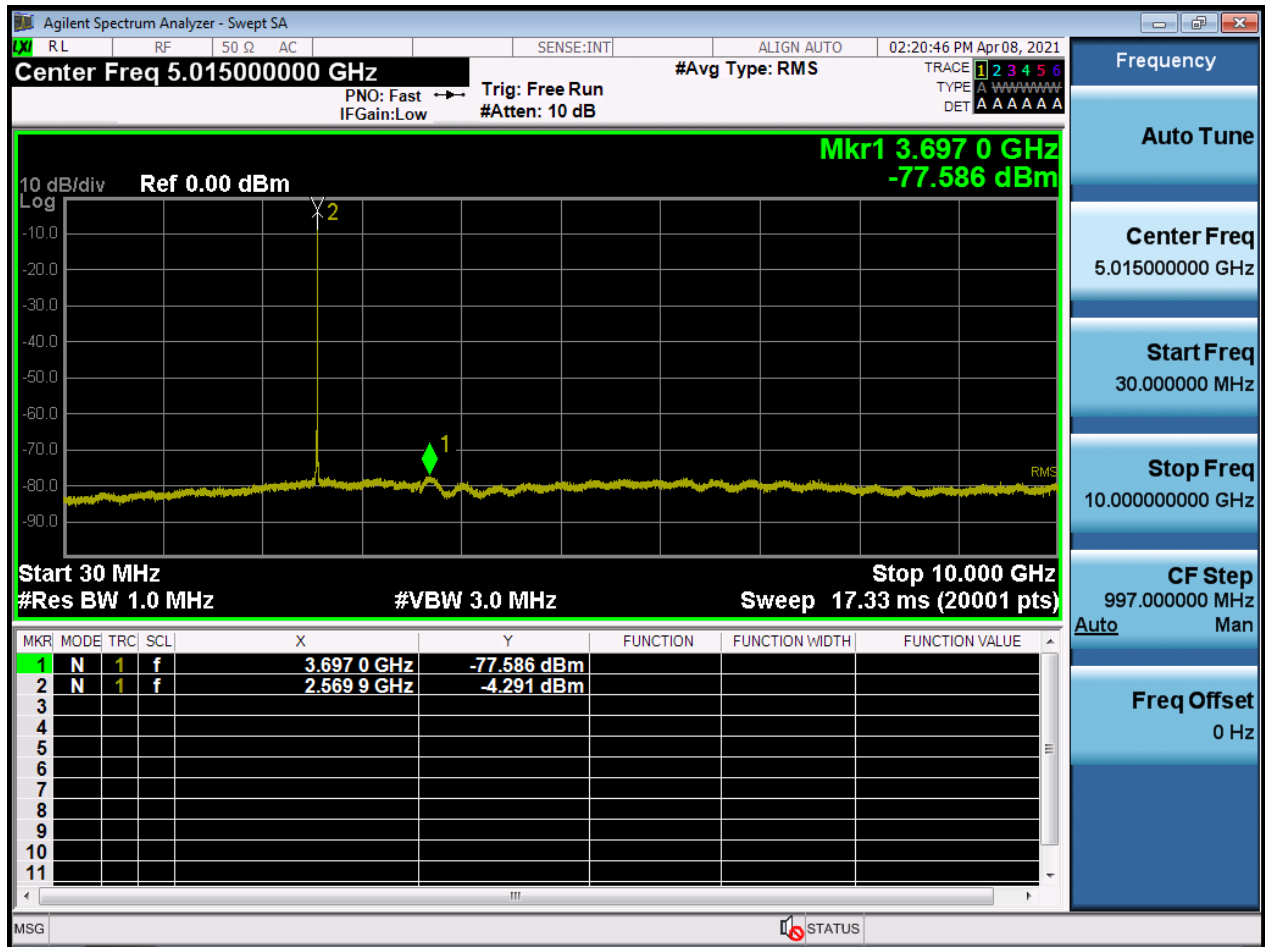
LTE7_10M_CSE(30M-10G)_Lowest Channel



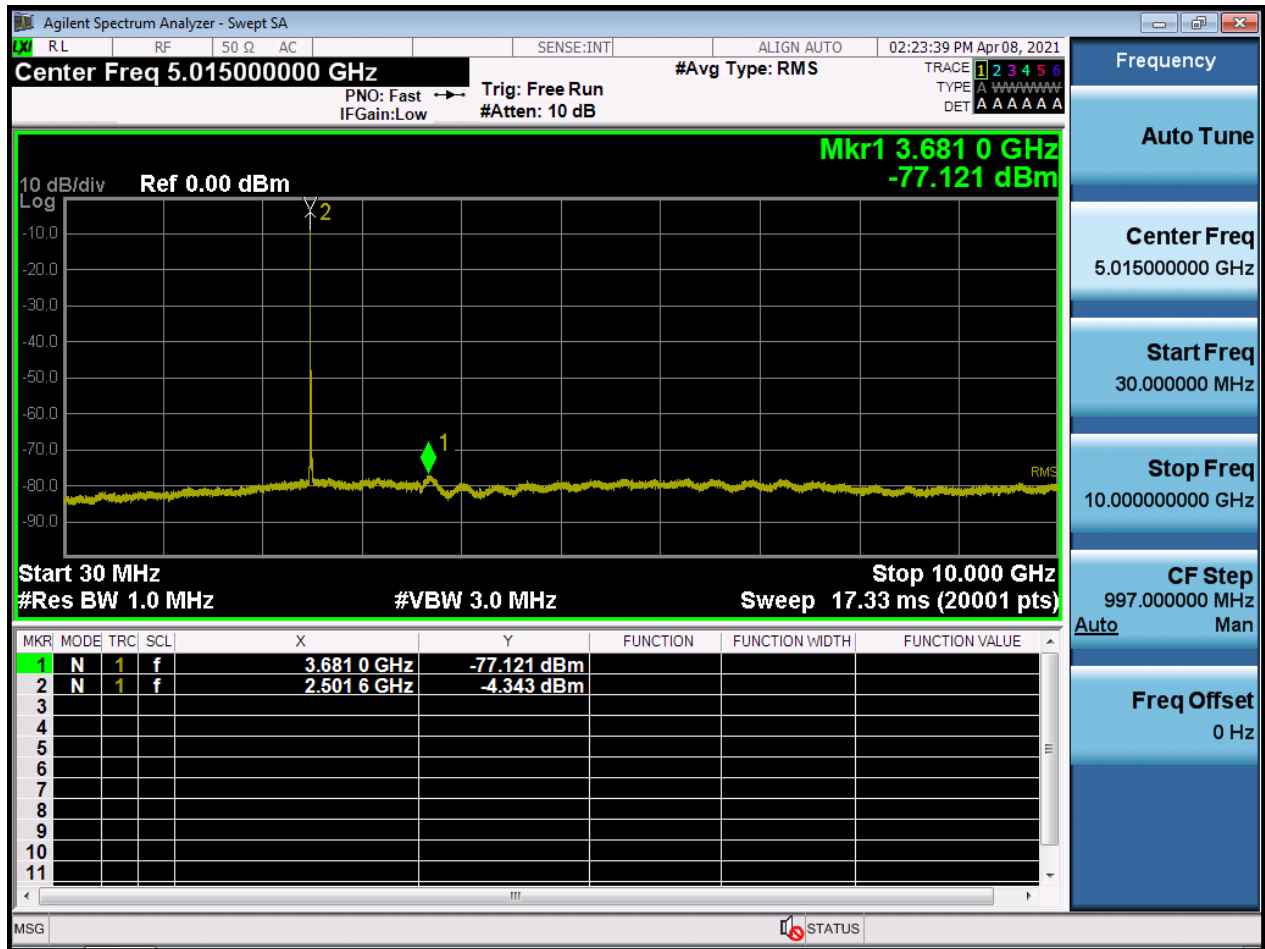
LTE7_10M_CSE(30M-10G)_Mid Channel



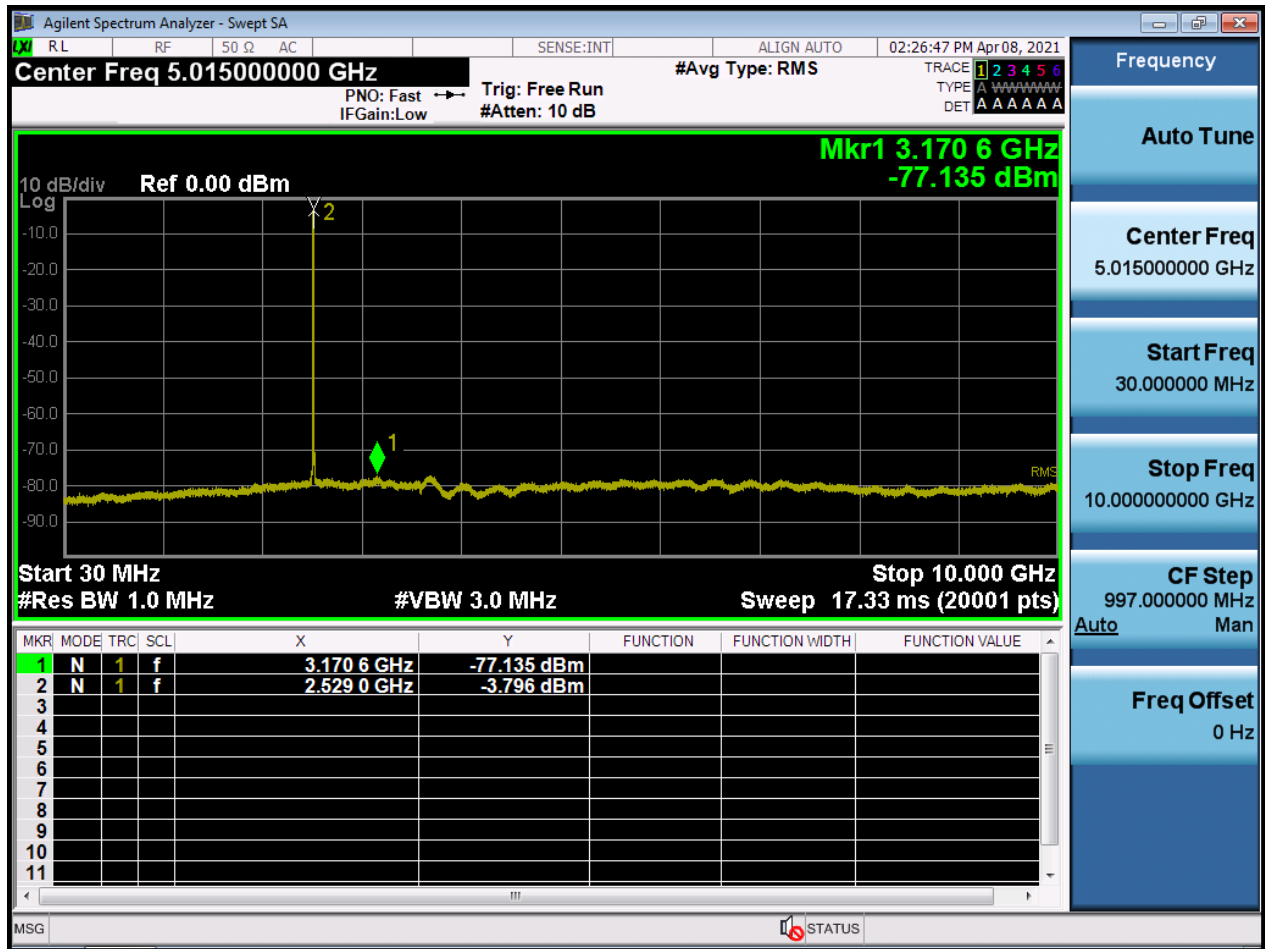
LTE7_10M_CSE(30M-10G)_Highest Channel



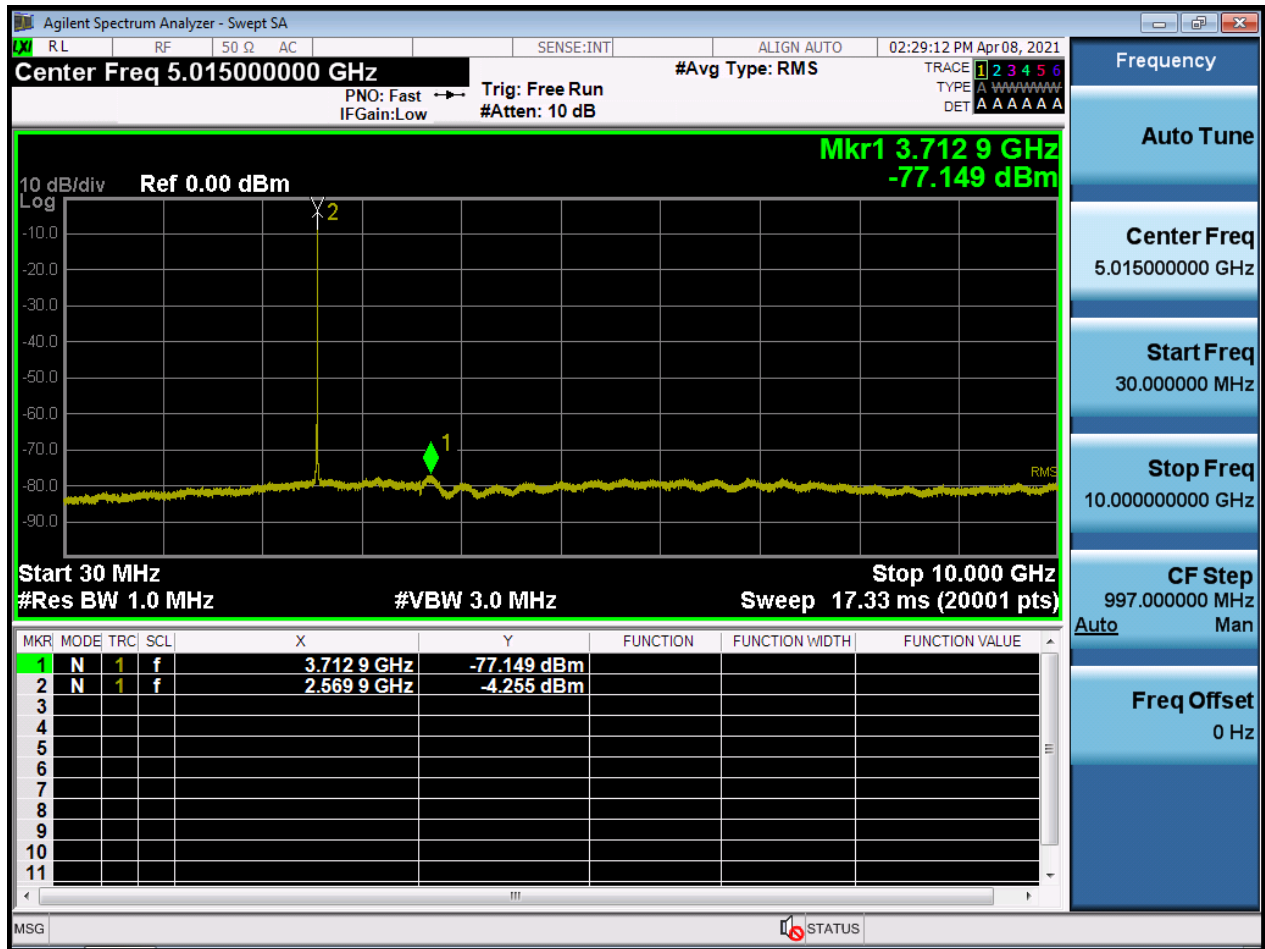
LTE7_15M_CSE(30M-10G)_Lowest Channel



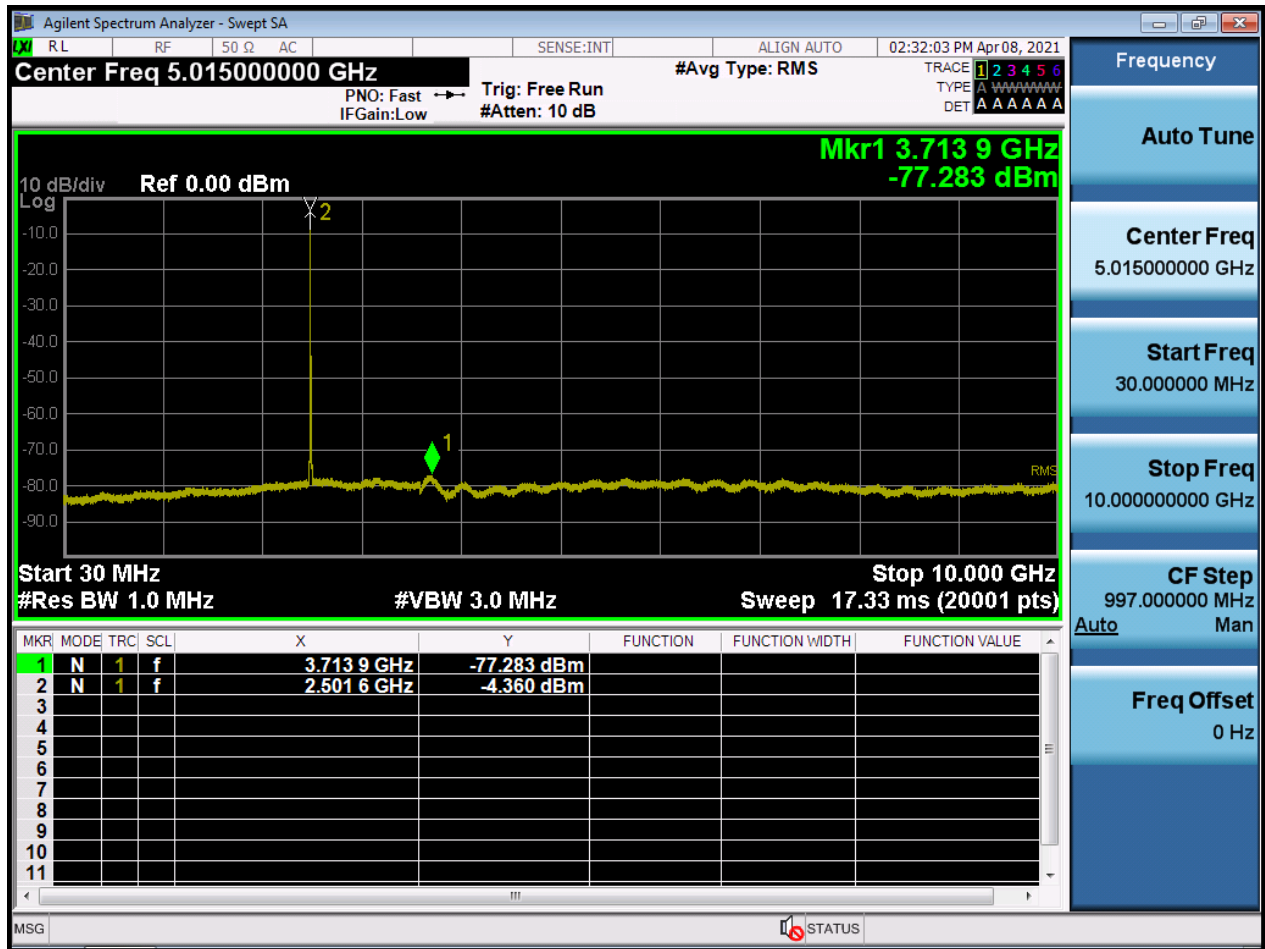
LTE7_15M_CSE(30M-10G)_Mid Channel



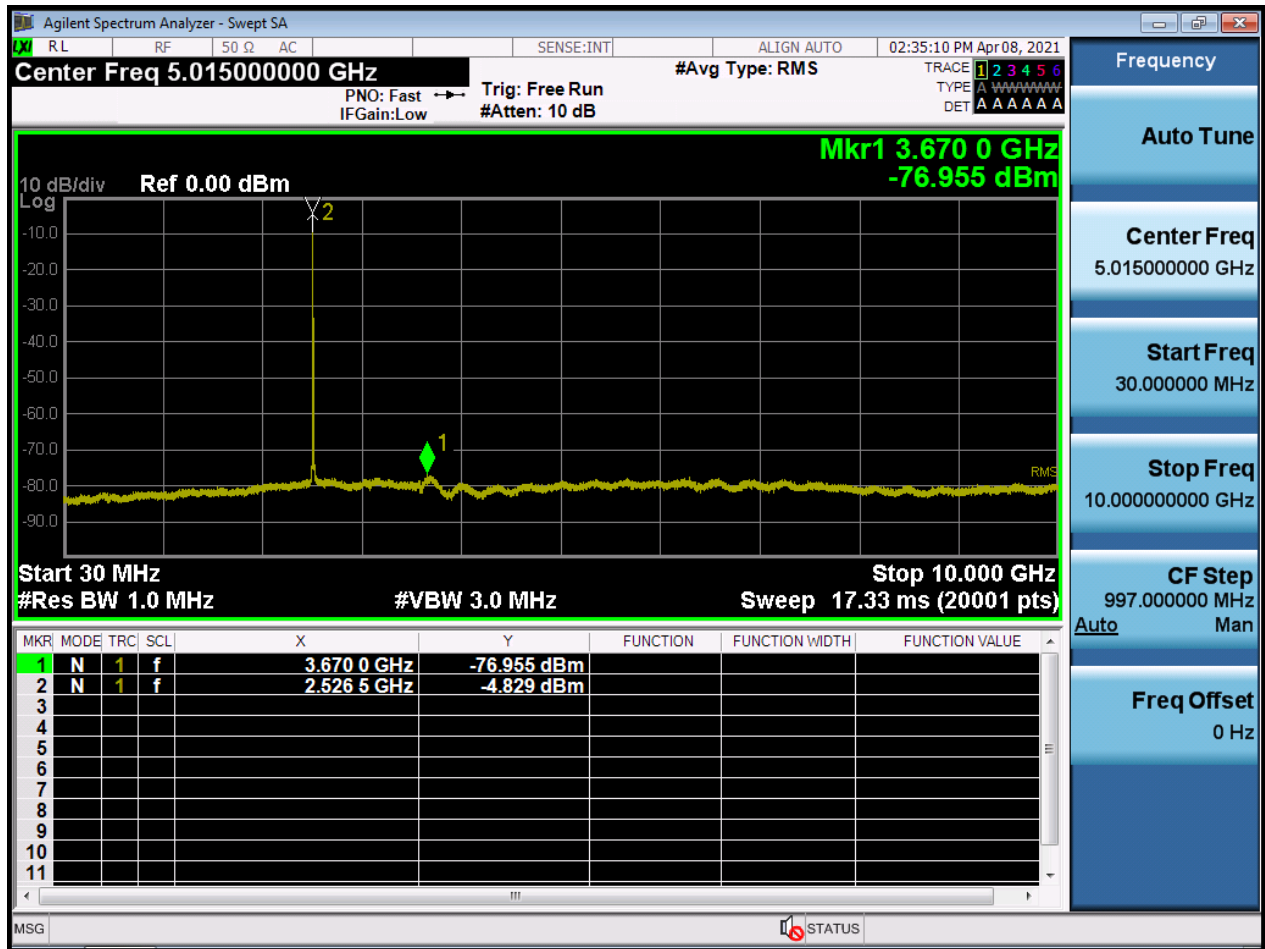
LTE7_15M_CSE(30M-10G)_Highest Channel



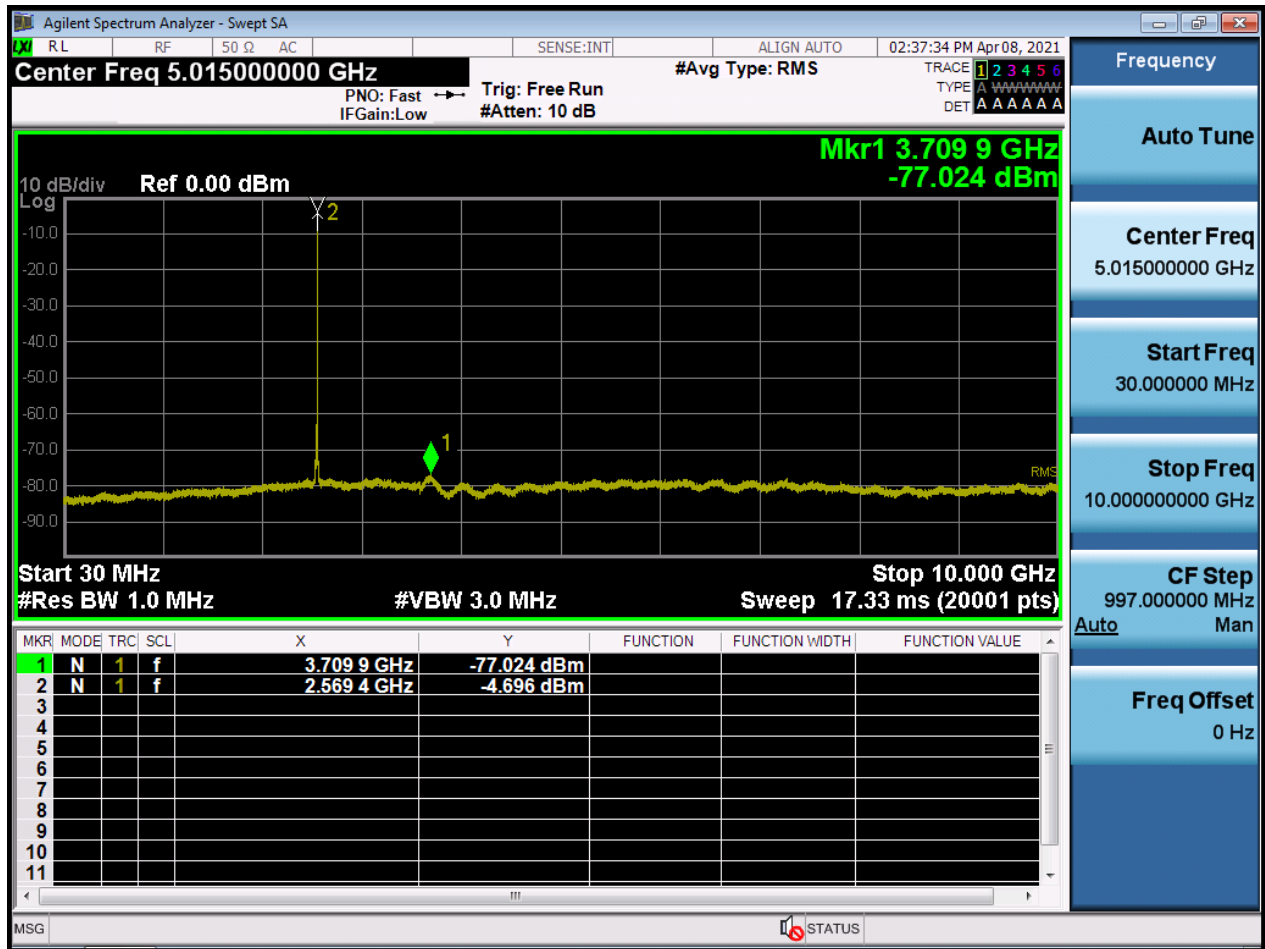
LTE7_20M_CSE(30M-10G)_Lowest Channel



LTE7_20M_CSE(30M-10G)_Mid Channel



LTE7_20M_CSE(30M-10G)_Highest Channel



LTE7_5M_CSE(10G-26.5G)_Lowest Channel



LTE7_5M_CSE(10G-26.5G)_Mid Channel



LTE7_5M_CSE(10G-26.5G)_Highest Channel



LTE7_10M_CSE(10G-26.5G)_Lowest Channel



LTE7_10M_CSE(10G-26.5G)_Mid Channel



LTE7_10M_CSE(10G-26.5G)_Highest Channel



LTE7_15M_CSE(10G-26.5G)_Lowest Channel



LTE7_15M_CSE(10G-26.5G)_Mid Channel



LTE7_15M_CSE(10G-26.5G)_Highest Channel



LTE7_20M_CSE(10G-26.5G)_Lowest Channel



LTE7_20M_CSE(10G-26.5G)_Mid Channel



LTE7_20M_CSE(10G-26.5G)_Highest Channel



10. APPENDIX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-2105-FC019-P