

MEASUREMENT REPORT

Part 22 & Part 27

Applicant Name:

Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:

07/09/2021 - 08/20/2021

Test Site/Location:

PCTEST KOREA Lab. Yongin-si, Gyeonggi-do, Korea

Test Report Serial No.:

8K21070502R3.A3L

FCC ID:

A3LRF4442D-13A

APPLICANT:

Samsung Electronics Co., Ltd.

Application Type:

Certification

Model/HVIN:

RF4442d-13A

EUT Type:

RRU (RF4442d)

FCC Rule Part(s):

22 & 27

FCC Classification:

TNB Licensed Transmitter

Test Procedure(s):

ANSI C63.26-2015, KDB 971168 D01 v03r01, KDB 662911 D01 v02r01

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Prepared by



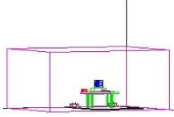
Reviewed by

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 1 of 225

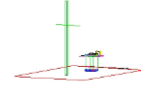
TABLE OF CONTENTS

1.0	INTRODUCTION	4
1.1	Scope	4
1.2	PCTEST KOREA Test Location	4
1.3	Test Facility / Accreditations.....	4
2.0	PRODUCT INFORMATION.....	5
2.1	Equipment Description	5
2.2	Test Configuration	6
2.3	EMI Suppression Device(s)/Modifications	8
3.0	DESCRIPTION OF TESTS	9
3.1	Measurement Procedure.....	9
3.2	Measurement Software	9
4.0	MEASUREMENT UNCERTAINTY	10
5.0	TEST EQUIPMENT CALIBRATION DATA	11
6.0	SAMPLE CALCULATIONS	12
7.0	TEST RESULTS.....	13
7.1	Summary.....	13
7.2	Occupied Bandwidth	14
7.3	Conducted Average Output Power.....	44
7.4	Peak To Average Power Ratio (PAPR)	92
7.5	Band Edge Emissions at Antenna Terminal	104
7.6	Spurious and Harmonic Emissions at Antenna Terminal	127
7.7	Radiated spurious emission	206
7.8	Frequency Stability.....	222
8.0	CONCLUSION.....	225

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 2 of 225



MEASUREMENT REPORT



Mode	Band	FCC Rule Part	Tx Frequency (MHz)	Total Power		Emission Designator	Modulation
				MaxPower (W)	MaxPower (dBm)		
LTE_B5_5M_1C	5	22	869 – 894	42.56	46.29	4M48G7D	QPSK
				42.07	46.24	4M48W7D	16QAM
				42.46	46.28	4M49W7D	64QAM
				41.98	46.23	4M49W7D	256QAM
LTE_B5_10M_1C	5	22	869 – 894	40.64	46.09	8M98G7D	QPSK
				42.17	46.25	9M00W7D	16QAM
				40.64	46.09	8M99W7D	64QAM
				40.83	46.11	8M98W7D	256QAM
LTE_B5_5M+5M_2C	5	22	869 – 894	40.83	46.11	9M43G7D	QPSK
				40.64	46.09	9M44W7D	16QAM
				41.02	46.13	9M44W7D	64QAM
				40.36	46.06	9M45W7D	256QAM
LTE_B5_10M+10M_2C	5	22	869 – 894	40.46	46.07	18M9G7D	QPSK
				40.46	46.07	18M9W7D	16QAM
				40.64	46.09	18M9W7D	64QAM
				40.64	46.09	18M9W7D	256QAM
LTE_B5_10M+10M+5M_3C	5	22	869 – 894	40.74	46.10	24M1G7D	QPSK
				41.11	46.14	24M2W7D	16QAM
				41.02	46.13	24M1W7D	64QAM
				40.46	46.07	24M1W7D	256QAM
DSS_B5_10M	5	27	869 – 894	41.11	46.14	9M29G7D	QPSK
				40.93	46.12	9M23W7D	16QAM
				40.64	46.09	9M28W7D	64QAM
				40.83	46.11	9M27W7D	256QAM
LTE_B13_5M_1C	13	27	746 – 756	41.50	46.18	4M48G7D	QPSK
				41.78	46.21	4M48W7D	16QAM
				42.07	46.24	4M49W7D	64QAM
				41.69	46.20	4M49W7D	256QAM
LTE_B13_10M_1C	13	27	746 – 756	41.11	46.14	8M97G7D	QPSK
				41.98	46.23	8M97W7D	16QAM
				41.02	46.13	8M98W7D	64QAM
				42.27	46.26	8M98W7D	256QAM
LTE_B13_5M+5M_2C	13	27	746 – 756	41.69	46.20	9M43G7D	QPSK
				41.98	46.23	9M44W7D	16QAM
				41.11	46.14	9M43W7D	64QAM
				41.69	46.20	9M44W7D	256QAM

EUT Overview

Notes:

Total Power shown in the table above are the full conducted average output power that will appear on the Grant of Authorization.

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 3 of 225

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST KOREA Test Location

These measurement tests were conducted at the PCTEST KOREA CO., LTD. facility located at (#1407) 13, Heungdeok 1-ro, Giheung-gu, Yongin-si, Gyeonggi-do 16954, Korea.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST KOREA Lab located in Yongin-si, Gyeonggi, Korea.

- PCTEST KOREA is an ISO 17025:2005 accredited test facility under the National Institute of Standards and Technology (NIST) with Certificate number 600143-0 for Specific Absorption Rate (SAR), where applicable, and Electromagnetic Compatibility (EMC) testing for IC and Innovation, Science, and Economic Development Canada rules.
- PCTEST KOREA facility is accredited, designated and recognized in accordance with the provision of Radio Wave Act and International Standard ISO/IEC 17025:2017 under the National Radio Research Agency.
 - Designation Number / CABID: KR0169
 - Test Firm Registration Number of FCC: 417945
 - Test Firm Registration Number of IC: 26168

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 4 of 225

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung RRU (RF4442d) FCC ID: A3LRF4442D-13A**. The test data contained in this report pertains only to the emissions due to the EUT's licensed transmitters that operate under the provisions of Part 22 and 27.

This device supports the following conditional features:

EUT Type:	RRU (RF4442d)		
Model Name:	RF4442d-13A		
Test Device Serial No.:	SN-F0684		
Device Capabilities:	LTE, DSS, NB-IoT Guard Band/In-Band		
Operating Band/Frequency Range:	Band	Tx (Downlink)	Rx (Uplink)
	B13:	746 MHz to 756 MHz	777 MHz to 787 MHz
	B5:	869 MHz to 894 MHz	824 MHz to 849 MHz
Supported Number of Carriers:	LTE Band 13 : Max. 3 carriers for LTE LTE Band 13 : Max. 1 carrier for DSS LTE Band 5 : Max. 2 carrier for LTE LTE Band 5 : Max. 2 carriers for NB-IoT GuardBand LTE Band 5 : Max. 2 carriers for NB-IoT InBand		
Supported Modulation:	LTE: QPSK(E-TM 1.1), 16QAM(E-TM 3.2), 64QAM(E-TM 3.1), 256QAM(E-TM 3.1a) DSS: QPSK(E-TM 1.1&NR-FR1-TM1.1), 16QAM(E-TM 3.2&NR-FR1-TM3.2), 64QAM(E-TM 3.1&NR-FR1-TM3.1), 256QAM(E-TM 3.1a&NR-FR1-TM3.1a) NB-IoT: QPSK(N-TM)		
Maximum Output Power	10W/Path in band 5 10W/Path in band 13		
Supported Channel Bandwidth:	5MHz, and 10MHz for LTE and 10MHz for DSS in band 13 5MHz, and 10MHz for LTE and 200kHz for NB-IoT in band 5		
Number of Antenna ports	4		
Supported Configurations:	Single carrier, Multi-carrier, Multi band operation		
Input Voltage:	-48 VDC		
Antenna:	Antenna is not provided by manufacture		

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 5 of 225

2.2 Test Configuration

The setup is as follows:

- The EUT ("RRU (RF4442d)") and a Data Unit (DU) are each powered by -48V DC power supply.
- The DU is connected to a test laptop via an ethernet cable acting as backhaul.
- DU connects to the EUT through a fiber optic cable.
- An RF cable connects the signal analyzer and the EUT Ports for respective measurement.

The EUT was tested per the guidance of ANSI C63.26-2015, KDB 971168 D01 v03r01 and KDB 662911 D01 v02r01. See Section 7.0 of this test report for a description of the radiated and antenna port conducted emissions tests.

The following information is about configurations of carrier frequency and output power per port declared by the manufacturer.

* Abbreviations:

- B13: Band 13
- B5: Band 5
- 1C: 1 carrier
- 2C: 2 carrier
- 3C: 3 carrier
- GB: NB-IoT Guard Band operation
- IB: NB-IoT In-Band operation
- L: LTE
- D: DSS

Configuration	No. of Carriers	Carrier Bandwidth (MHz)	Carrier Frequency Configuration (MHz)			Rated Power (per a path)
			Lowest	Middle	Highest	
LTE_B13_5M	1	5	748.5	751.0	753.5	10W (40dBm)
LTE_B13_10M	1	10	751.0			10W (40dBm)
LTE_B13_5M+5M	2	5+5	748.5 + 753.5			10W (40dBm)
LTE_B13_10M+NB-Iot(GB)+ NB-Iot(GB)	3	0.2+5+0.2	746.4(GB) + 751.0(L) + 755.6(GB)			10W (40dBm)
LTE_B13_5M+NB-Iot(IB)	1	5	746.7(IB) + 748.5(L)	750.1(IB) + 751.0(L)	753.5(L) + 755.3(IB)	10W (40dBm)
LTE_B13_10M+NB-Iot(IB)+NB-Iot(IB)	1	5	747.3(IB) + 751.0(L) + 754.7(IB)			10W (40dBm)
LTE_B13_10M+NB-Iot(IB)+ NB-Iot(GB)	2	0.2+5	746.4(GB) + 751.0(L) + 754.7(IB)			10W (40dBm)
LTE_B13_10M+NB-Iot(GB)+ NB-Iot(IB)	2	5+0.2	747.3(IB) + 751.0(L) + 755.6(GB)			10W (40dBm)

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)	Page 6 of 225	

Configuration	No. of Carriers	Carrier Bandwidth (MHz)	Carrier Frequency Configuration (MHz)			Rated Power (per a path)
			Lowest	Middle	Highest	
LTE_B5_5M	1	5	871.5	881.5	891.5	10W (40dBm)
LTE_B5_10M	1	10	874.0	881.5	889.0	10W (40dBm)
LTE_B5_5M+5M	2	5+5	871.5 + 876.5	879.0 + 884.0	886.5 + 891.5	10W (40dBm)
LTE_B5_5M+5M _Non-conti	2	5+5	871.5 + 891.5			10W (40dBm)
LTE_B5_10M+10M	2	10+10	874.0 + 884.0	876.5 + 886.5	879.0 + 889.0	10W (40dBm)
LTE_B5_10M+10M _Non-conti	2	10+10	874.0 + 889.0			10W (40dBm)
LTE_B5_5M+10M+10M	3	5+10+10	871.5 + 879.0 + 889.0			10W (40dBm)
DSS_B5(LTE9:NR1)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5(LTE8:NR2)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5(LTE7:NR3)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5(LTE6:NR4)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5(LTE5:NR5)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5(LTE4:NR6)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5(LTE3:NR7)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5(LTE2:NR8)	1	10	874.0	881.5	889.0	10W (40dBm)
DSS_B5_10M+5M	2	5+10	874.0(D) + 881.5(L)	879.0(D) + 886.5(L)	881.5(L) + 889.0(D)	10W (40dBm)
DSS_B5_10M+5M _Non-conti	2	5+10	871.5(D) + 889.0(L)			10W (40dBm)
DSS_B5_10M+10M	2	10+10	874.0(D) + 884.0(L)	876.5(D) + 886.5(L)	879.0(L) + 889.0(D)	10W (40dBm)
DSS_B5_10M+10M _Non-conti	2	10+10	874.0(D) + 889.0(L)			10W (40dBm)
DSS_B5_10M+10M+5M	3	5+10+10	871.5(L) + 879.0(L) + 889.0(D)			10W (40dBm)

FCC ID: A3LRF4442D-13A	 MEASUREMENT REPORT (CERTIFICATION) 		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)	Page 7 of 225

Configuration	No. of Carriers	Carrier Bandwidth (MHz)	Carrier Frequency Configuration		Rated Power (per a path)
			B13 (MHz)	B5 (MHz)	
Multi Band_ B13_5M_1C+ B5_5M_1C	2	5+5	748.5	871.5	10W (40dBm)
			751.0	881.5	
			753.5	891.5	
Multi Band_ B13_5M+5M_2C+ B5_5M+10M+10M_3C	5	10 & 15	748.5+753.5	871.5+879.0+889.0	10W (40dBm)
Multi Band_ + B5_10M(DSS)_1C+B13_5M_1C	3	0.2+10 & 10	748.5	889.0	10W (40dBm)
			753.5	874.0	
Multi Band_ B5_10M(DSS)_1C + B13_10M+NB-lot(GB)+NB-lot(IB)_3C	3	10+0.2 & 10	751.0+764.4+754.7	874.0	10W (40dBm)
			751.0+764.4+754.7	889.0	
Multi Band_ B5_5M+10M(DSS)_2C+B13_10M+NB-lot(GB)+NB-lot(IB)_3C	3	10+0.2 & 10+5	751.0+764.4+754.7	874.0+881.5	10W (40dBm)
			751.0+764.4+754.7	889.0+881.5	

2.3 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 8 of 225

3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled “American National Standard for Compliance Testing of Transmitter Used in Licensed Radio Service” (ANSI C63.26-2015) and the guidance provided in KDB 971168 D01 v03r01, and KDB 662911 D01 v02r01 were used in the measurement of the EUT.

Occupied Bandwidth:

KDB 971168 D01 v03r01 – Section 4.3
 ANSI C63.26-2015 – Section 5.4.4

Conducted Power Measurement

KDB 971168 D01 v03r01 – Section 5
 KDB 662911 D01 v02r01 – Section E)1) In-Band Power Measurements
 ANSI C63.26-2015 – Section 5.2.4.4.1
 ANSI C63.26-2015 – Section 5.2.4.5

Peak-to-Average Power Ratio:

KDB 971168 D01 v03r01 – Section 5.7
 ANSI C63.26-2015 – Section 5.2.3.4

Band Edge Emissions at Antenna Terminal

KDB 971168 D01 v03r01 – Section 6
 KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
 a) Absolute Emission Limits
 iii) Measure and add $10 \log(N_{ANT})$ dB
 ANSI C63.26-2015 – Section 5.7

Spurious and Harmonic Emissions at Antenna Terminal

KDB 971168 D01 v03r01 – Section 6
 KDB 662911 D01 v02r01 – Section E)3) Out-of-Band and Spurious Emission Measurements
 a) Absolute Emission Limits
 iii) Measure and add $10 \log(N_{ANT})$ dB
 ANSI C63.26-2015 – Section 5.7

Radiated unwanted emission

KDB 971168 D01 v03r01 – Section 7
 ANSI C63.26-2015 – Section 5.8

Frequency Stability / Temperature Variation

KDB 971168 D01 v03r01 – Section 9
 ANSI C63.26-2015 – Section 5.6

3.2 Measurement Software

Test item	Name	Version
Conducted Measurement	Node B automation	1.0

FCC ID: A3LRF4442D-13A	 PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 9 of 225

4.0 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 uncertainty shown below 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.

Contribution	Expanded Uncertainty ($\pm$ dB)
Conducted Bench Top Measurements	1.20
Radiated Disturbance (<1GHz)	3.01
Radiated Disturbance (>1GHz)	5.56
Radiated Disturbance (>18GHz)	3.16

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 10 of 225

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST). Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacture	Model	Description	Cal Date	Cal interval	Cal Due	Serial Number
KEYSIGHT	N9030B	PXA Signal Analyzer	05/11/2021	Annual	05/10/2022	MY57142018
KEYSIGHT	N9020B	MXA Signal Analyzer	11/13/2020	Annual	11/12/2021	MY55470135
KEYSIGHT	N9030B	PXA Signal Analyzer	07/06/2021	Annual	07/05/2022	MY57143276
Rohde & Schwarz	FSW43	Signal and Spectrum Analyzer	02/22/2021	Annual	02/21/2022	101955
SUKSAN TECHNOLOGY	SE-CT-10	Temperature Chamber	09/17/2020	Annual	09/16/2021	191021
Rohde & Schwarz	TS-SFUNIT-Rx	Shielded Filter Unit	02/19/2021	Annual	02/18/2022	102131
Schwarzbeck	VULB9162	Broadband TRILOG Antenna	07/13/2021	Biennial	07/12/2023	9162-217
Sunol sciences	DRH-118	Horn Antenna	01/12/2021	Biennial	01/11/2023	A060215
Reachline	250W18N-40FF	High Power Attenuator	03/17/2021	Annual	03/16/2022	PK0288
Reachline	250W18N-40FF	High Power Attenuator	03/17/2021	Annual	03/16/2022	PK0289
Reachline	250W18N-40FF	High Power Attenuator	03/17/2021	Annual	03/16/2022	PK0290
Reachline	250W18N-40FF	High Power Attenuator	03/17/2021	Annual	03/16/2022	PK0293
KIKISUI	PWR1201ML	DC POWER SUPPLY	05/25/2021	Annual	05/24/2022	ZL000972

Table 5-1. Test Equipment

Notes:

1. For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.
2. Equipment with a calibration date of "N/A" shown in this list was not used to make direct calibrated measurements.
3. All testing was performed before the calibration due date.

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 11 of 225

6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 4M48G7D

Occupied Bandwidth = 4.48 MHz

G = Phase Modulation

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 4M48W7D

Occupied Bandwidth = 4.48 MHz

W = Amplitude/Angle Modulated

7 = Quantized/Digital Info

D = Data transmission, telemetry, telecommand

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 12 of 225

7.0 TEST RESULTS

7.1 Summary

Company Name: SAMSUNG Electronics Co., Ltd.
 FCC ID: A3LRF4442D-13A
 FCC Classification: Licensed Non-Broadcast Station Transmitter
 Mode(s): LTE & DSS & NB-IoT Guard Band/In-Band

FCC Part Section(s)	Test Description	Test Condition	Test Result	Reference
§2.1049	Occupied Bandwidth	CONDUCTED	PASS	Section 7.2
§2.1046	Conducted Average Output Power		PASS	Section 7.3
§22.913 §27.50(b)	Peak-to-average power ratio		PASS	Section 7.4
§2.1051 §22.917 §27.53(c), (f)	Band Edge Emissions at Antenna Terminal		PASS	Section 7.5
§2.1053 §22.917 §27.53(c), (f)	Spurious and Harmonic Emissions at Antenna Terminal		PASS	Section 7.6
§2.1055 §27.54	Frequency Stability		PASS	Section 7.8
§2.1053 §22.917 §27.53(c)	Radiated unwanted emission	Radiated	PASS	Section 7.7

Table 7-1. Summary of Test Results

Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The correction table was used to account for the losses of the cables and attenuators used to test the EUT at all frequencies of interest.
- 3) The analyzer plots were all taken with a correction table loaded into the analyzer.
- 4) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.
- 5) This unit was tested while powered by a -48V DC power source.

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 13 of 225

7.2 Occupied Bandwidth

\$2.1049

Test Overview

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 radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

KDB 971168 D01 v0301 - Section 4.3
ANSI C63.26 - Section 5.4.4

Test Setting

The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The spectrum analyzer setting were as follows:

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied 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 $\geq 3 \times$ 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

Test Setup

The EUT and measurement equipment were set up as shown in the diagram below.

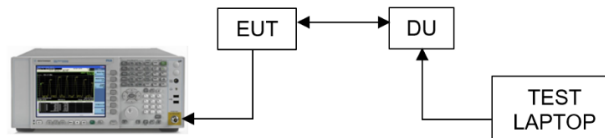


Figure 7-1. Test Instrument & Measurement Setup

Limit

The occupied bandwidth shall not exceed the equipment's channel bandwidth, which is declared by the manufacturer.

Test Notes

1. The highest values are highlighted in the following tables. The plots are presented only for the highlighted values.

FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 14 of 225

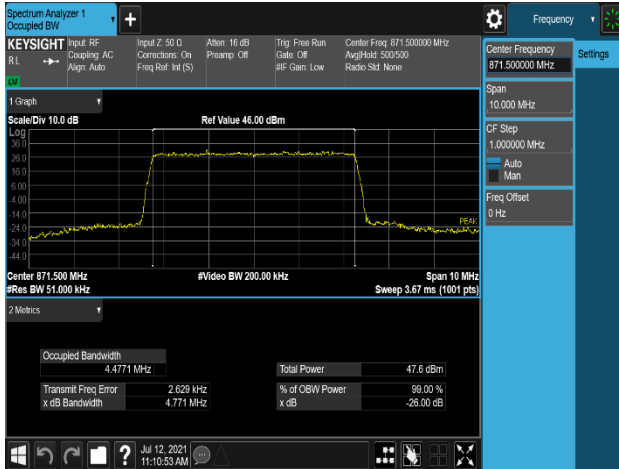
Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	4.48	4.47	4.48	4.48
	1	4.48	4.47	4.49	4.48
	2	4.47	4.47	4.49	4.49
	3	4.47	4.47	4.48	4.48
Middle	0	4.48	4.48	4.49	4.48
	1	4.48	4.47	4.49	4.48
	2	4.48	4.47	4.49	4.48
	3	4.48	4.48	4.49	4.49
High	0	4.47	4.48	4.49	4.48
	1	4.48	4.48	4.48	4.48
	2	4.48	4.47	4.48	4.48
	3	4.48	4.47	4.48	4.48

Table 7-2. Occupied Bandwidth Summary Data (LTE_B5_5M_1C)

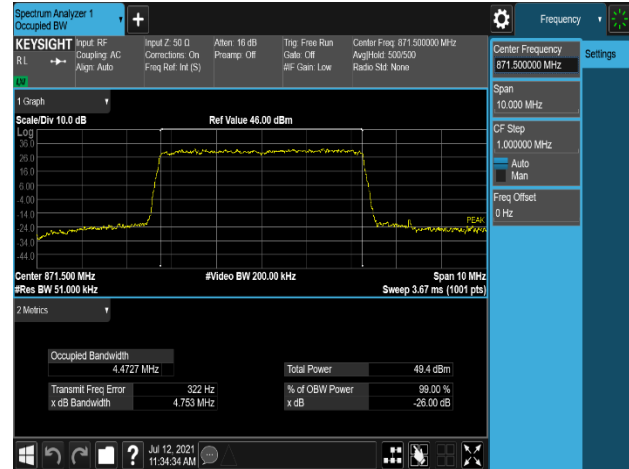
Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	8.96	8.97	8.97	8.98
	1	8.98	8.96	8.97	8.96
	2	8.96	8.96	8.96	8.95
	3	8.95	8.97	8.96	8.95
Middle	0	8.96	9.00	8.99	8.98
	1	8.97	8.99	8.98	8.98
	2	8.97	8.98	8.99	8.96
	3	8.96	8.96	8.99	8.96
High	0	8.96	8.98	8.98	8.96
	1	8.96	8.96	8.97	8.96
	2	8.97	8.96	8.97	8.96
	3	8.96	8.96	8.98	8.97

Table 7-3. Occupied Bandwidth Summary Data (LTE_B5_10M_1C)

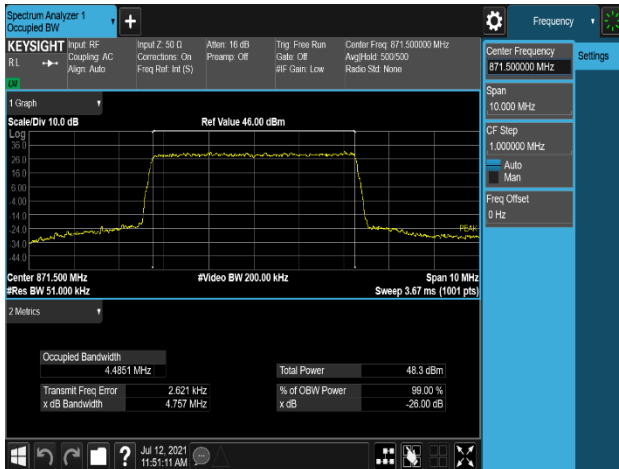
FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 15 of 225



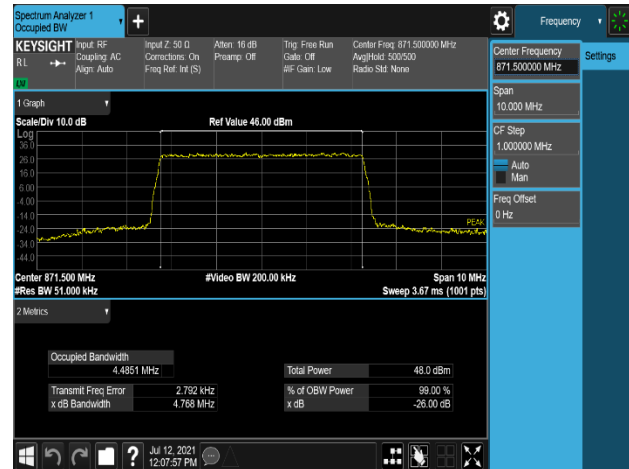
Plot 7-1. Occupied Bandwidth Plot
(LTE_B5_5M_1C_QPSK - Low Channel, Port 0)



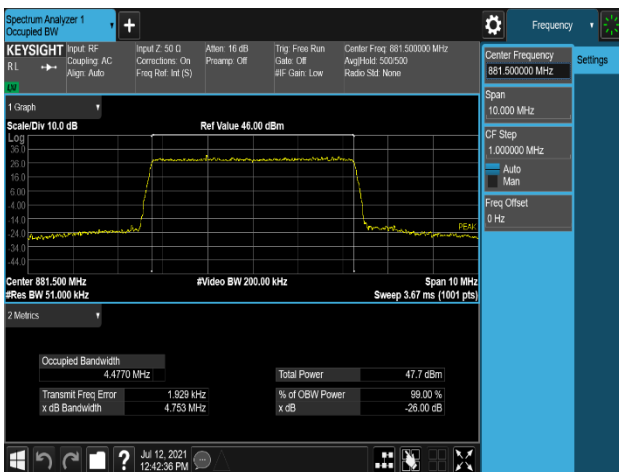
Plot 7-2. Occupied Bandwidth Plot
(LTE_B5_5M_1C_16QAM - Low Channel, Port 0)



Plot 7-3. Occupied Bandwidth Plot
(LTE_B5_5M_1C_64QAM - Low Channel, Port 1)



Plot 7-4. Occupied Bandwidth Plot
(LTE_B5_5M_1C_256QAM - Low Channel, Port 2)

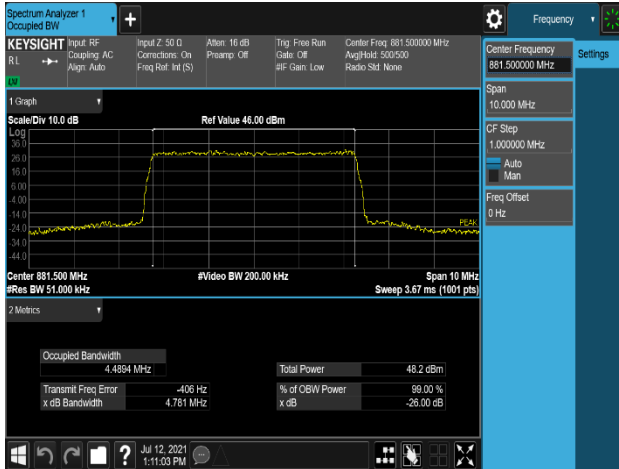


Plot 7-5. Occupied Bandwidth Plot
(LTE_B5_5M_1C_QPSK - Mid Channel, Port 0)

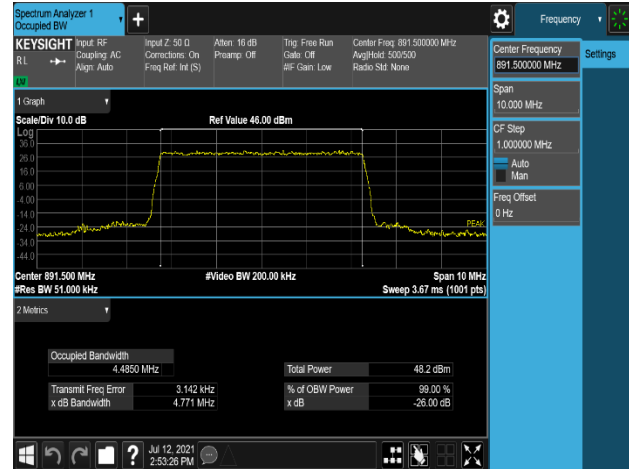


Plot 7-6. Occupied Bandwidth Plot
(LTE_B5_5M_1C_16QAM - Mid Channel, Port 0)

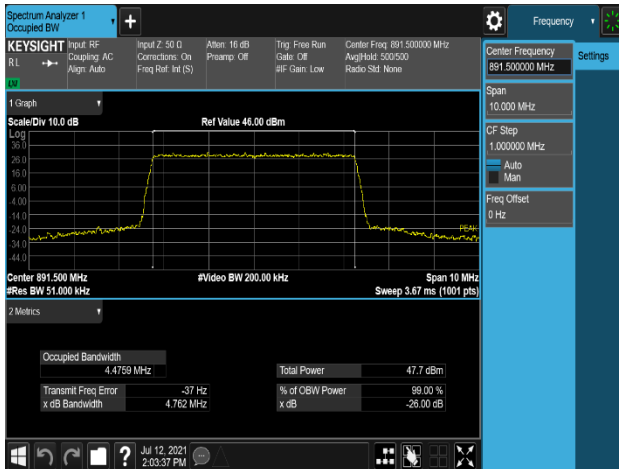
FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 16 of 225



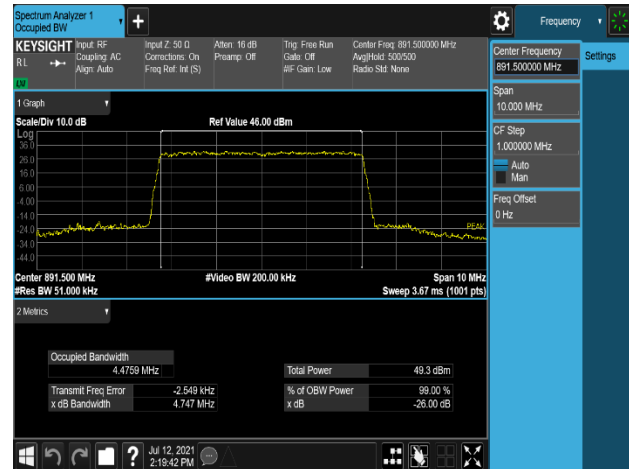
Plot 7-7. Occupied Bandwidth Plot
(LTE_B5_5M_1C_64QAM - Mid Channel, Port 0)



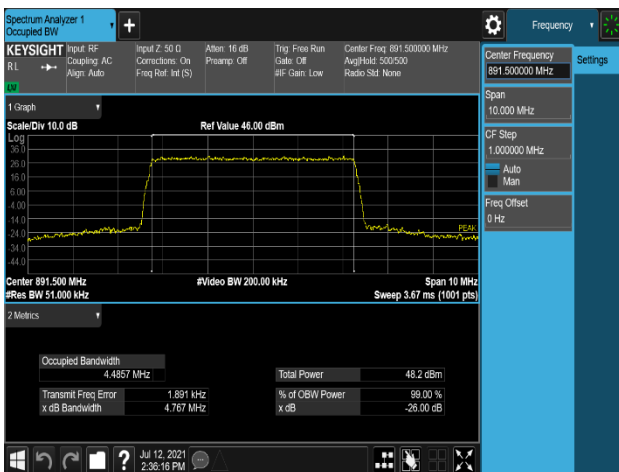
Plot 7-8. Occupied Bandwidth Plot
(LTE_B5_5M_1C_256QAM - Mid Channel, Port 3)



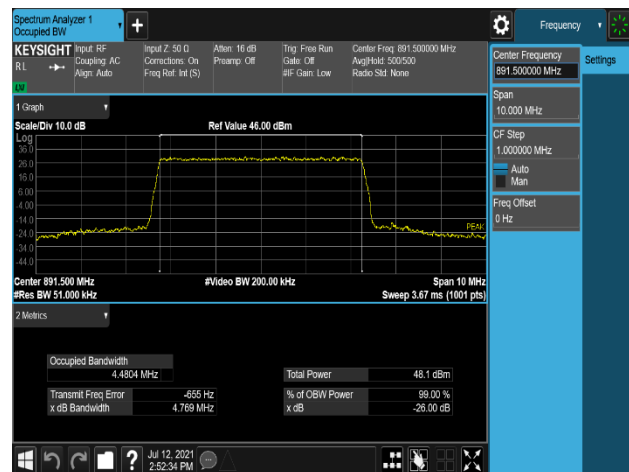
Plot 7-9. Occupied Bandwidth Plot
(LTE_B5_5M_1C_QPSK - High Channel, Port 1)



Plot 7-10. Occupied Bandwidth Plot
(LTE_B5_5M_1C_16QAM - High Channel, Port 0)

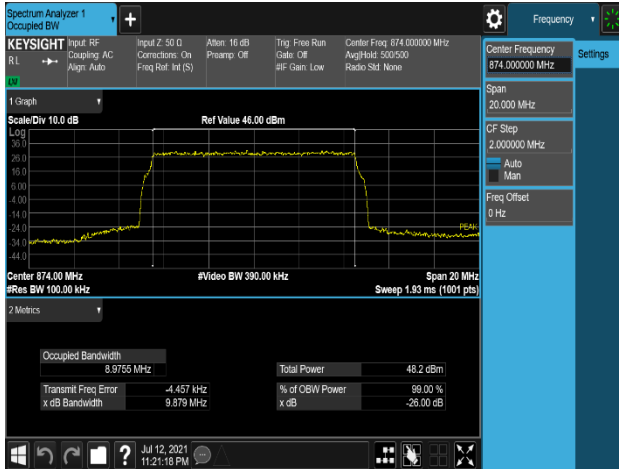


Plot 7-11. Occupied Bandwidth Plot
(LTE_B5_5M_1C_64QAM - High Channel, Port 0)

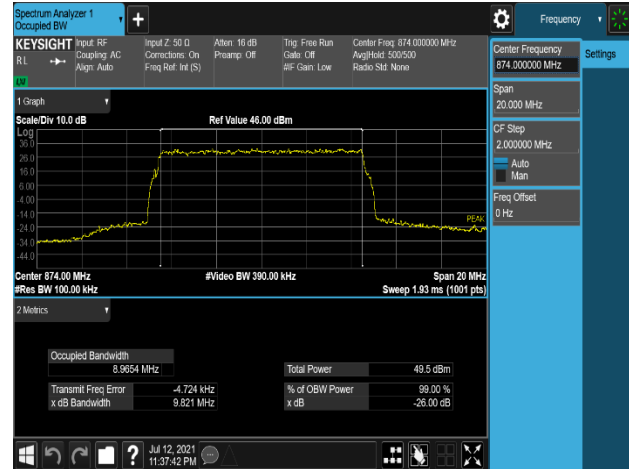


Plot 7-12. Occupied Bandwidth Plot
(LTE_B5_5M_1C_256QAM - High Channel, Port 0)

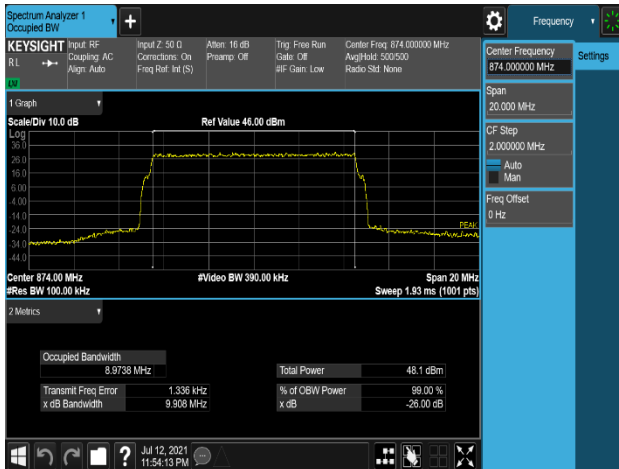
FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 17 of 225



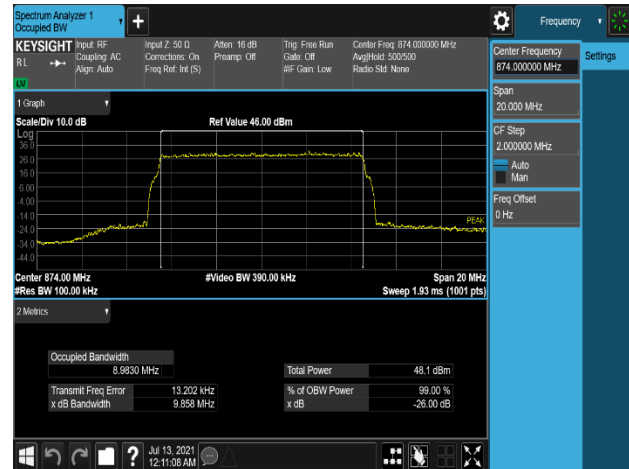
Plot 7-13. Occupied Bandwidth Plot (LTE_B5_10M_1C_QPSK - Low Channel, Port 1)



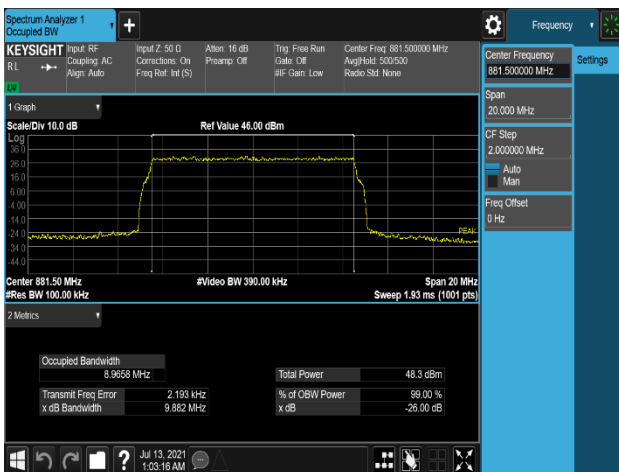
Plot 7-14. Occupied Bandwidth Plot (LTE_B5_10M_1C_16QAM - Low Channel, Port 0)



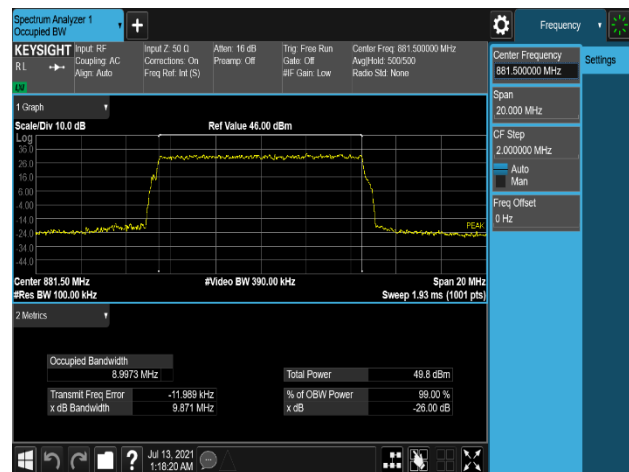
Plot 7-15. Occupied Bandwidth Plot (LTE_B5_10M_1C_64QAM - Low Channel, Port 0)



Plot 7-16. Occupied Bandwidth Plot (LTE_B5_10M_1C_256QAM - Low Channel, Port 0)

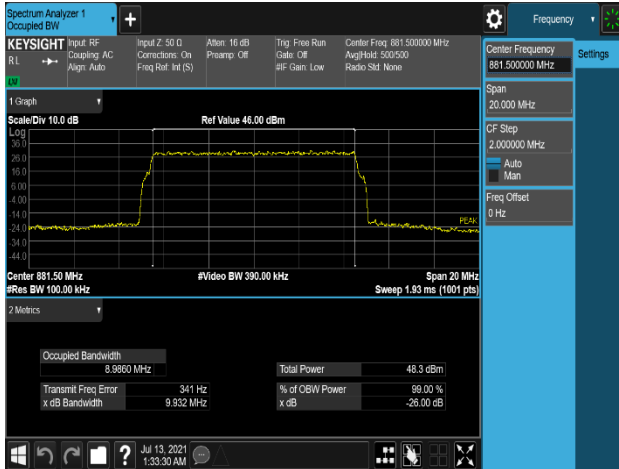


Plot 7-17. Occupied Bandwidth Plot (LTE_B5_10M_1C_QPSK - Mid Channel, Port 1)

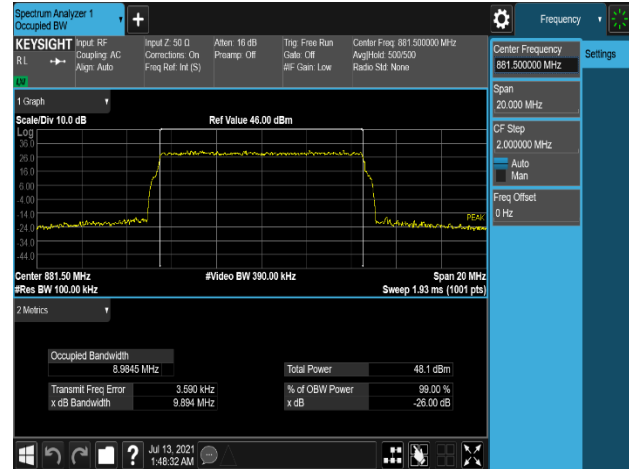


Plot 7-18. Occupied Bandwidth Plot (LTE_B5_10M_1C_16QAM - Mid Channel, Port 0)

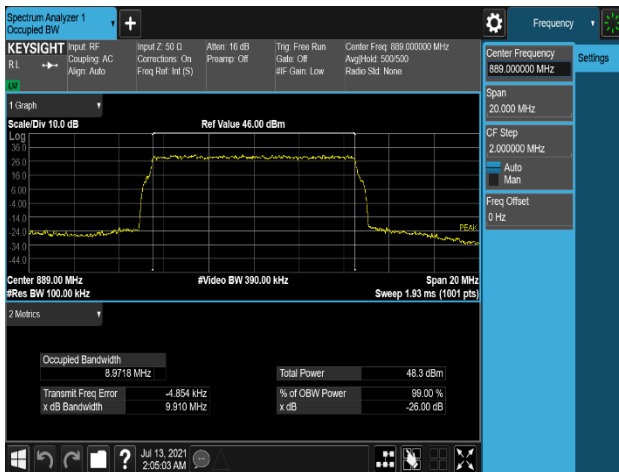
FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 18 of 225



Plot 7-19. Occupied Bandwidth Plot
(LTE_B5_10M_1C_64QAM - Mid Channel, Port 0)



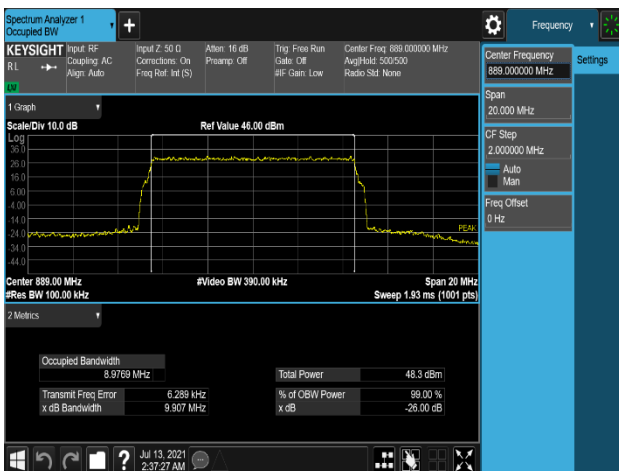
Plot 7-20. Occupied Bandwidth Plot
(LTE_B5_10M_1C_256QAM - Mid Channel, Port 0)



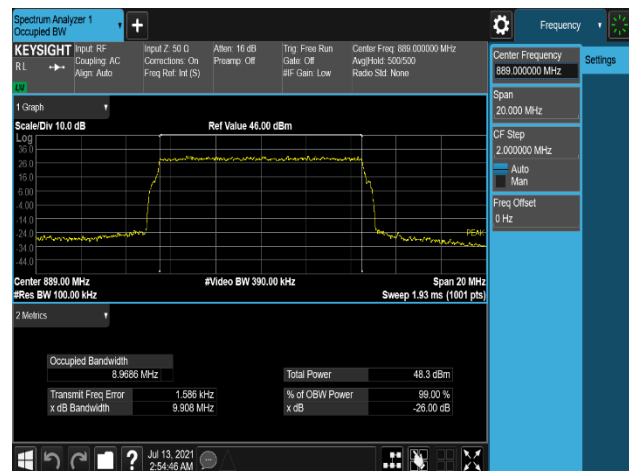
Plot 7-21. Occupied Bandwidth Plot
(LTE_B5_10M_1C_QPSK - High Channel, Port 2)



Plot 7-22. Occupied Bandwidth Plot
(LTE_B5_10M_1C_16QAM - High Channel, Port 0)



Plot 7-23. Occupied Bandwidth Plot
(LTE_B5_10M_1C_64QAM - High Channel, Port 0)



Plot 7-24. Occupied Bandwidth Plot
(LTE_B5_10M_1C_256QAM - High Channel, Port 3)

FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 19 of 225

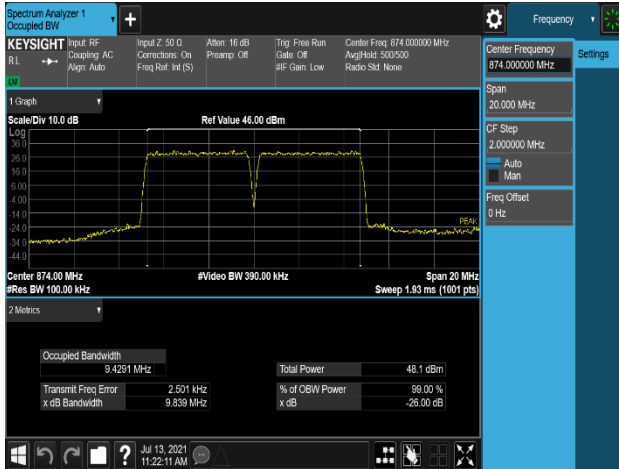
Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	9.42	9.44	9.42	9.44
	1	9.41	9.43	9.43	9.43
	2	9.43	9.44	9.42	9.44
	3	9.43	9.43	9.42	9.43
Middle	0	9.43	9.44	9.43	9.44
	1	9.43	9.42	9.43	9.43
	2	9.43	9.43	9.44	9.45
	3	9.43	9.43	9.43	9.44
High	0	9.43	9.41	9.42	9.44
	1	9.42	9.42	9.41	9.43
	2	9.43	9.43	9.43	9.44
	3	9.42	9.42	9.42	9.44

Table 7-4. Occupied Bandwidth Summary Data (LTE_B5_5M+5M_2C)

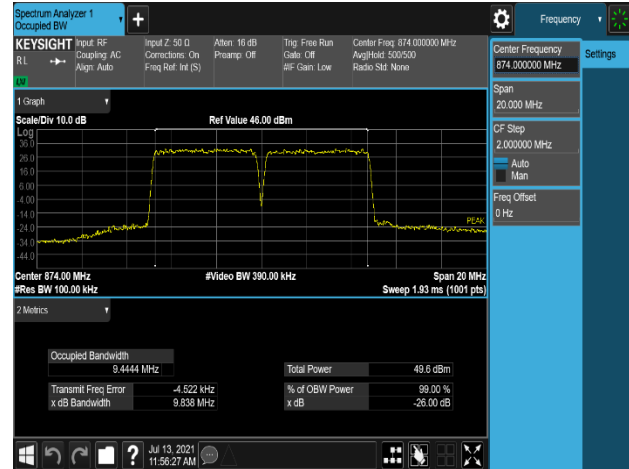
Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	18.90	18.88	18.93	18.91
	1	18.87	18.90	18.89	18.91
	2	18.88	18.88	18.86	18.91
	3	18.86	18.89	18.90	18.88
Middle	0	18.87	18.91	18.90	18.92
	1	18.87	18.92	18.87	18.88
	2	18.89	18.93	18.89	18.88
	3	18.88	18.91	18.91	18.89
High	0	18.85	18.92	18.91	18.89
	1	18.86	18.92	18.88	18.89
	2	18.89	18.89	18.91	18.92
	3	18.88	18.93	18.88	18.90

Table 7-5. Occupied Bandwidth Summary Data (LTE_B5_10M+10M_2C)

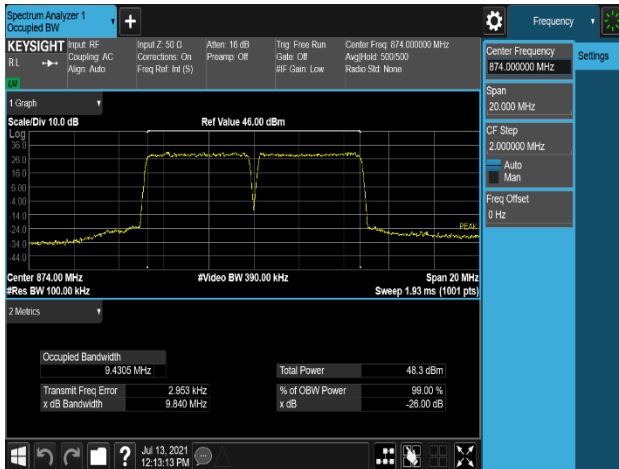
FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 20 of 225



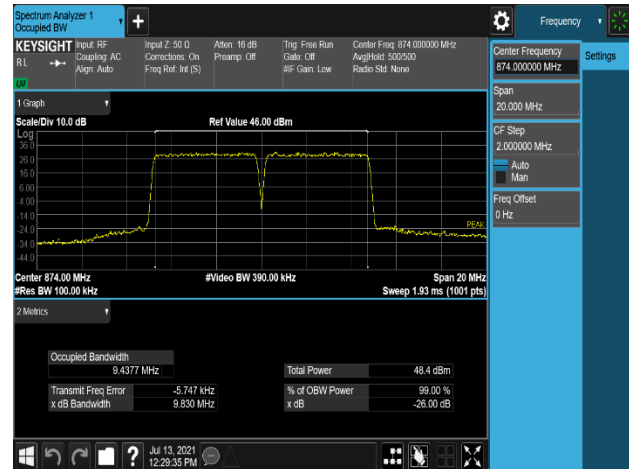
Plot 7-25. Occupied Bandwidth Plot
(LTE_B5_5M+5M_2C_QPSK - Low Channel, Port 2)



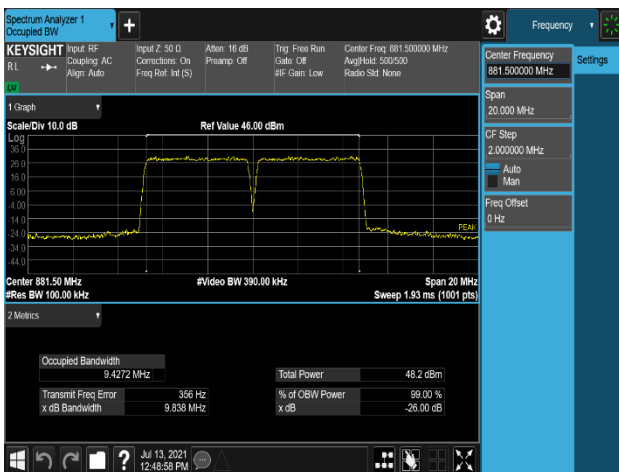
Plot 7-26. Occupied Bandwidth Plot
(LTE_B5_5M+5M_2C_16QAM - Low Channel, Port 0)



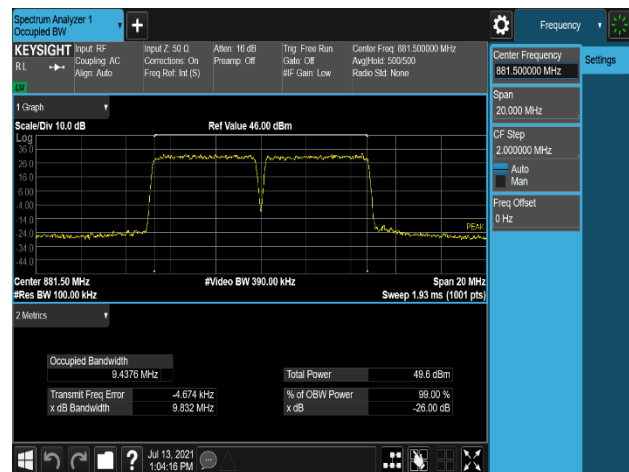
Plot 7-27. Occupied Bandwidth Plot
(LTE_B5_5M+5M_2C_64QAM - Low Channel, Port 1)



Plot 7-28. Occupied Bandwidth Plot
(LTE_B5_5M+5M_2C_256QAM - Low Channel, Port 0)

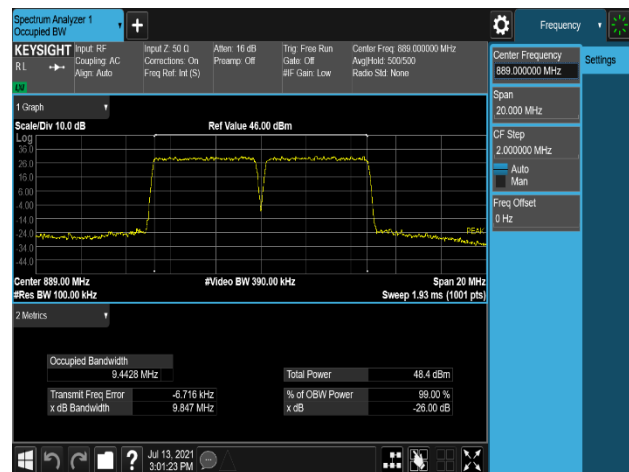
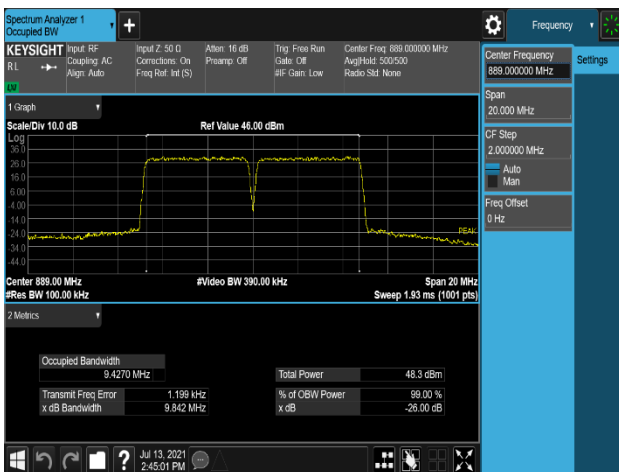
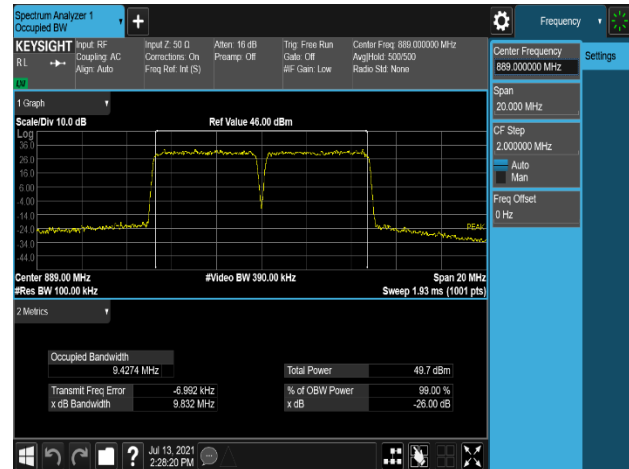
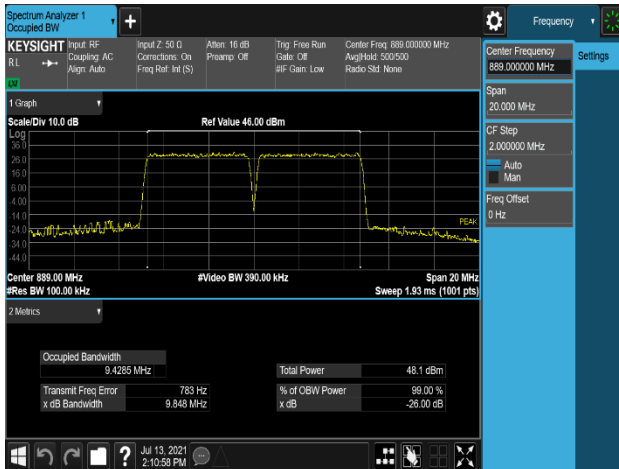
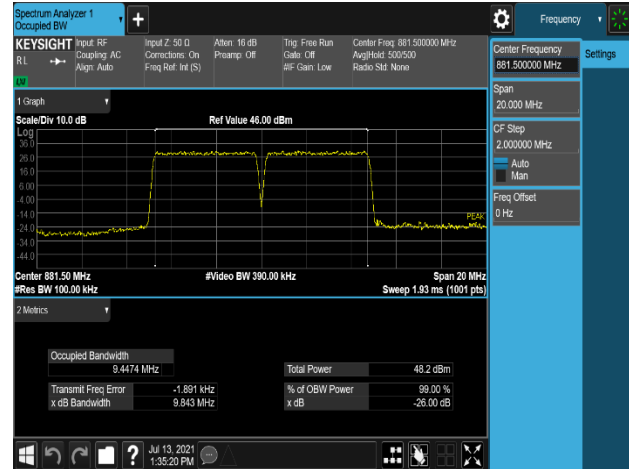
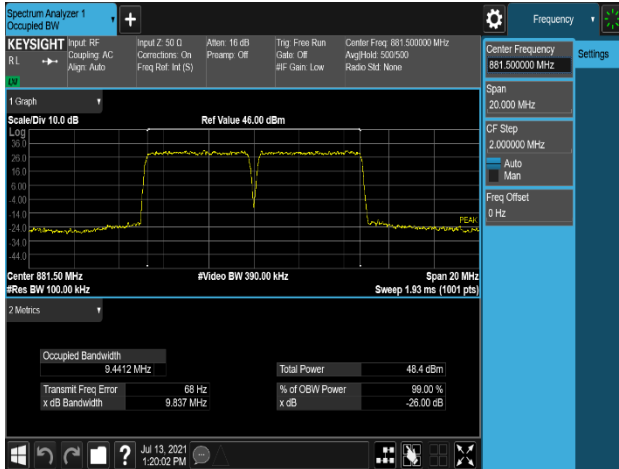


Plot 7-29. Occupied Bandwidth Plot
(LTE_B5_5M+5M_2C_QPSK - Mid Channel, Port 0)

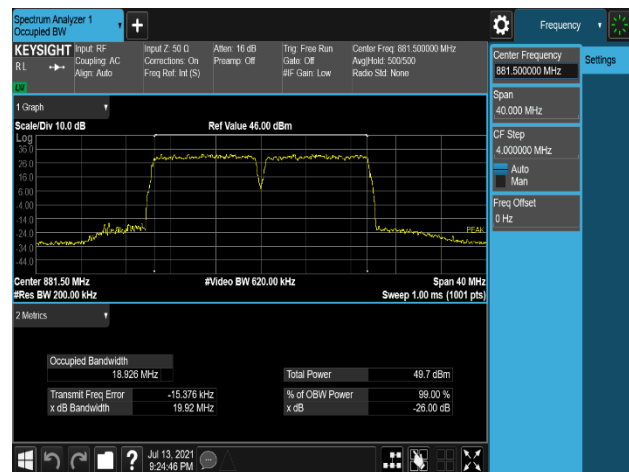
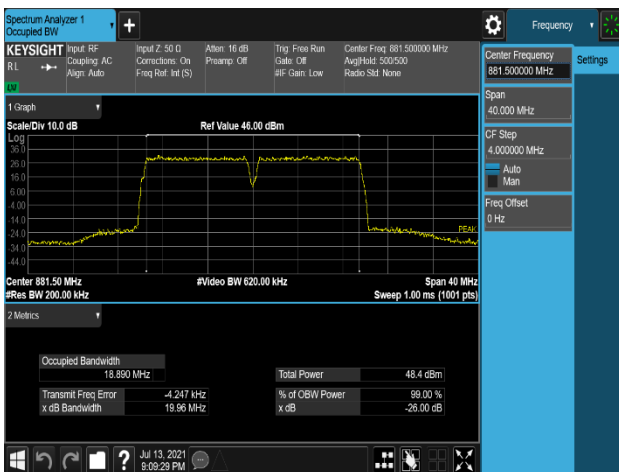
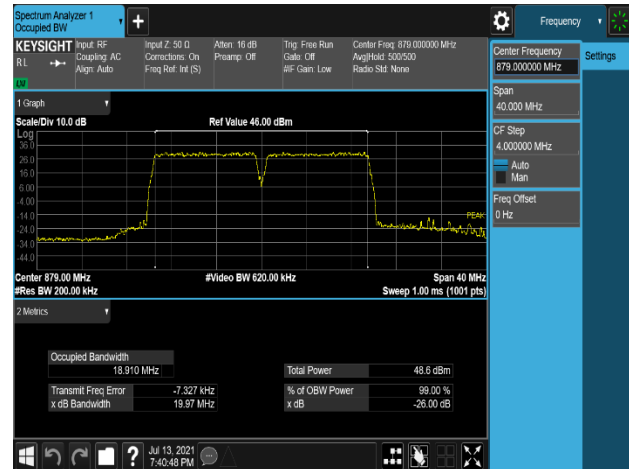
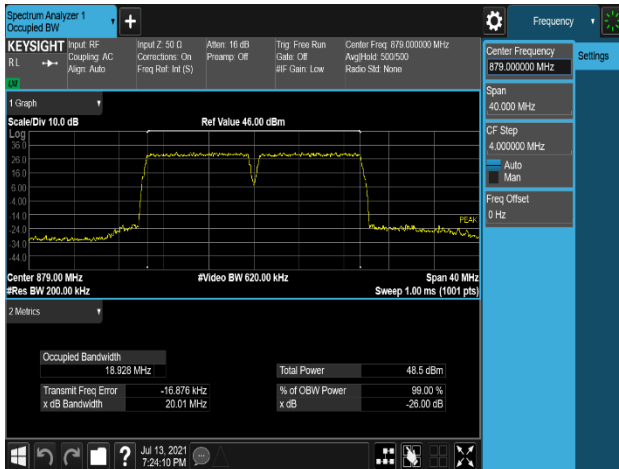
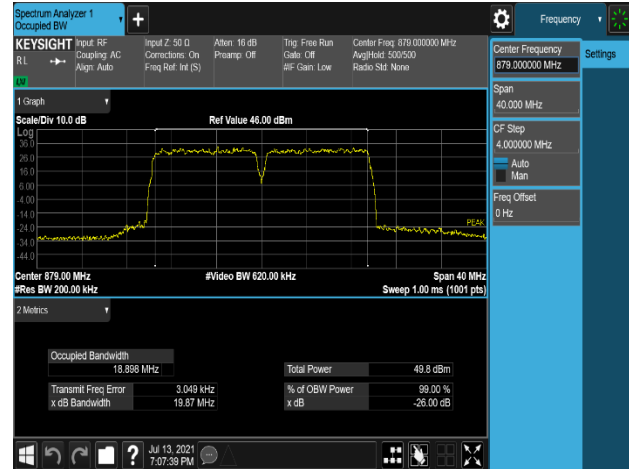
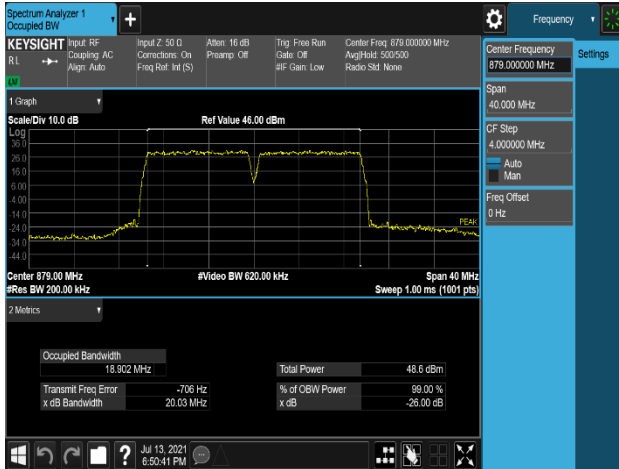


Plot 7-30. Occupied Bandwidth Plot
(LTE_B5_5M+5M_2C_16QAM - Mid Channel, Port 0)

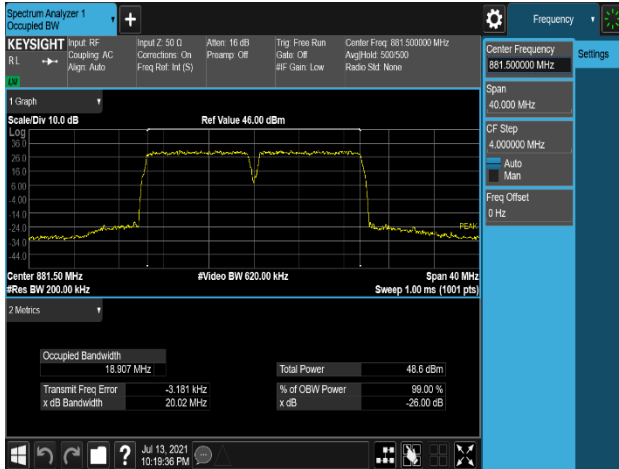
FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 21 of 225



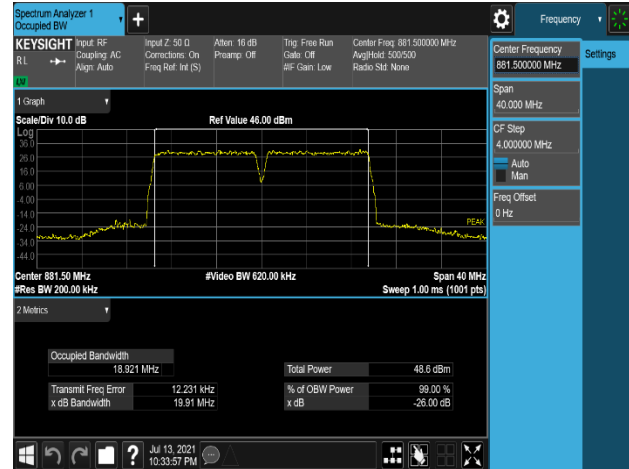
FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 22 of 225



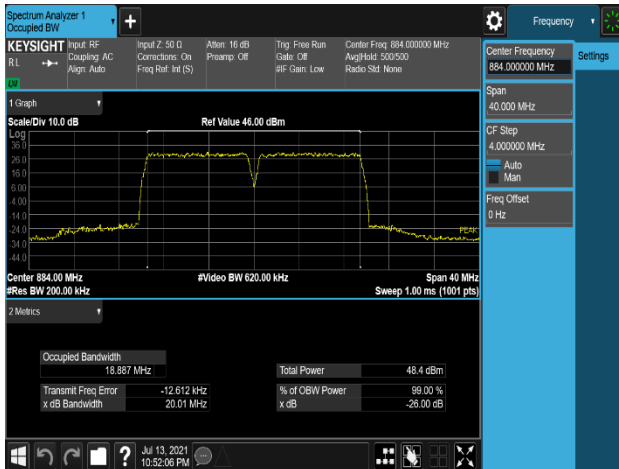
FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 23 of 225



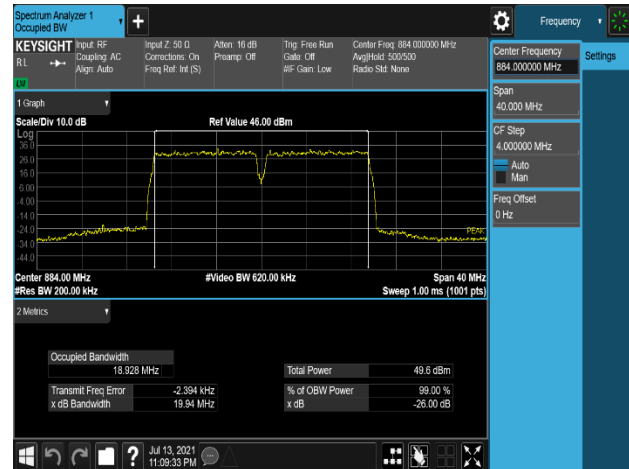
Plot 7-43. Occupied Bandwidth Plot
(LTE_B5_10M+10M_2C_64QAM - Mid Channel, Port 3)



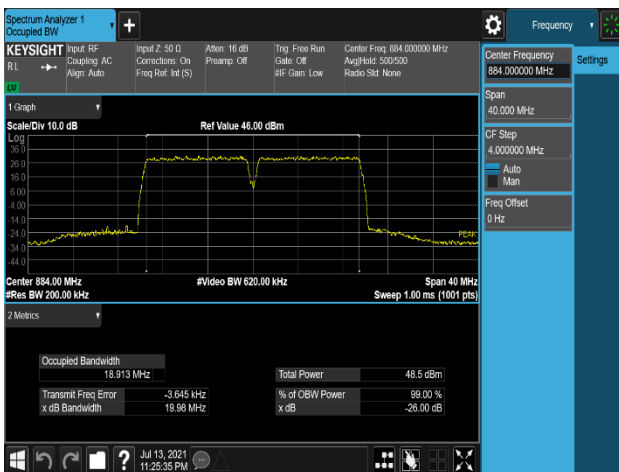
Plot 7-44. Occupied Bandwidth Plot
(LTE_B5_10M+10M_2C_256QAM - Mid Channel, Port 0)



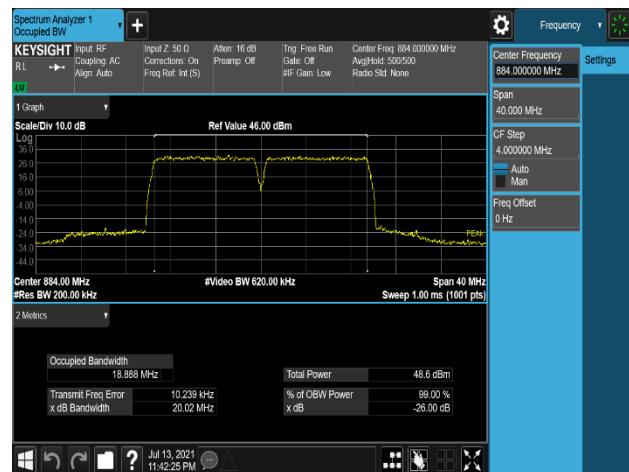
Plot 7-45. Occupied Bandwidth Plot
(LTE_B5_10M+10M_2C_QPSK - High Channel, Port 2)



Plot 7-46. Occupied Bandwidth Plot
(LTE_B5_10M+10M_2C_16QAM - High Channel, Port 3)



Plot 7-47. Occupied Bandwidth Plot
(LTE_B5_10M+10M_2C_64QAM - High Channel, Port 0)

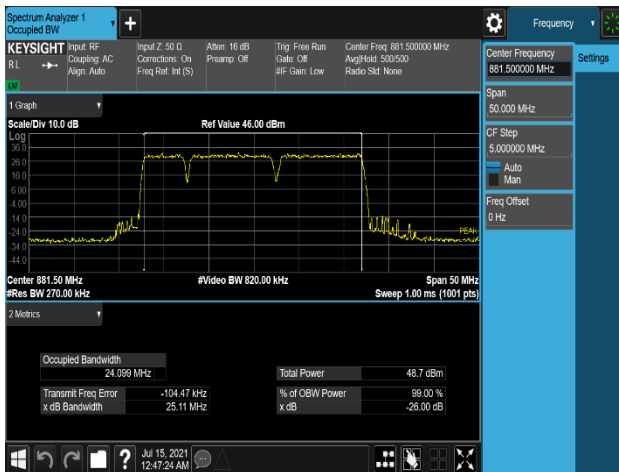


Plot 7-48. Occupied Bandwidth Plot
(LTE_B5_10M+10M_2C_256QAM - High Channel, Port 2)

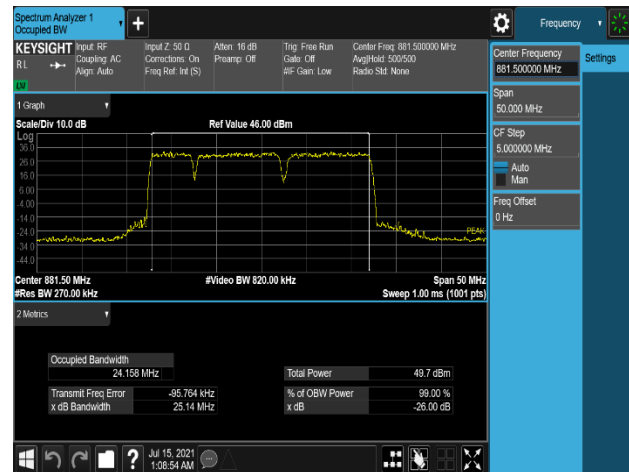
FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 24 of 225

Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Middle	0	24.09	24.13	24.11	24.08
	1	24.10	24.11	24.08	24.08
	2	24.10	24.16	24.05	24.12
	3	24.09	24.10	24.11	24.08

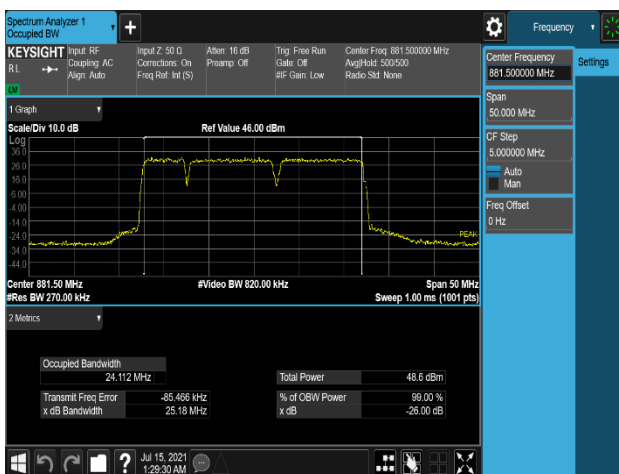
Table 7-6. Occupied Bandwidth Summary Data (LTE_B5_5M+10M+10M_3C)



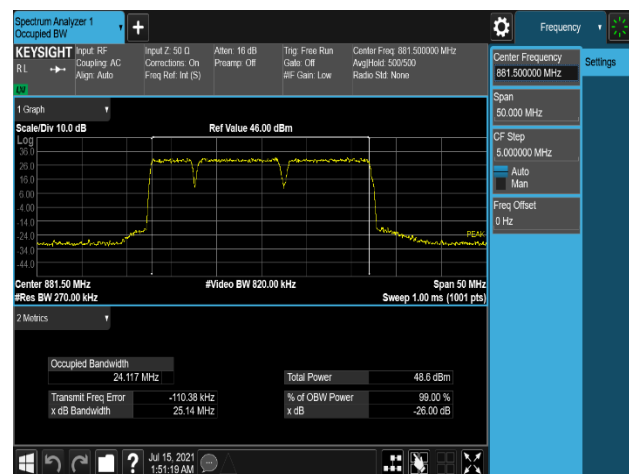
Plot 7-49. Occupied Bandwidth Plot
(LTE_B5_5M+10M+10M_3C_QPSK - Low Channel, Port 1)



Plot 7-50. Occupied Bandwidth Plot
(LTE_B5_5M+10M+10M_3C_16QAM - Low Channel, Port 2)



Plot 7-51. Occupied Bandwidth Plot
(LTE_B5_5M+10M+10M_3C_64QAM - Low Channel, Port 0)



Plot 7-52. Occupied Bandwidth Plot
(LTE_B5_5M+10M+10M_3C_256QAM - Low Channel, Port 2)

FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 25 of 225

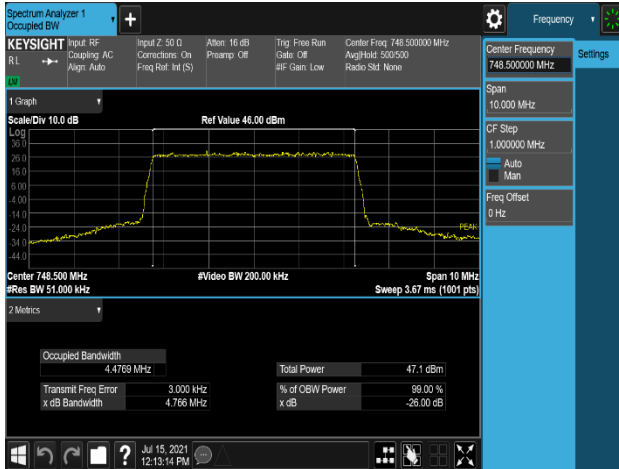
Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Low	0	4.48	4.47	4.49	4.48
	1	4.47	4.47	4.49	4.48
	2	4.48	4.47	4.49	4.48
	3	4.48	4.47	4.48	4.48
Middle	0	4.48	4.46	4.48	4.48
	1	4.48	4.47	4.49	4.49
	2	4.48	4.48	4.48	4.48
	3	4.48	4.48	4.48	4.49
High	0	4.48	4.47	4.48	4.48
	1	4.48	4.48	4.49	4.48
	2	4.47	4.47	4.49	4.48
	3	4.47	4.48	4.48	4.48

Table 7-7. Occupied Bandwidth Summary Data (LTE_B13_5M_1C)

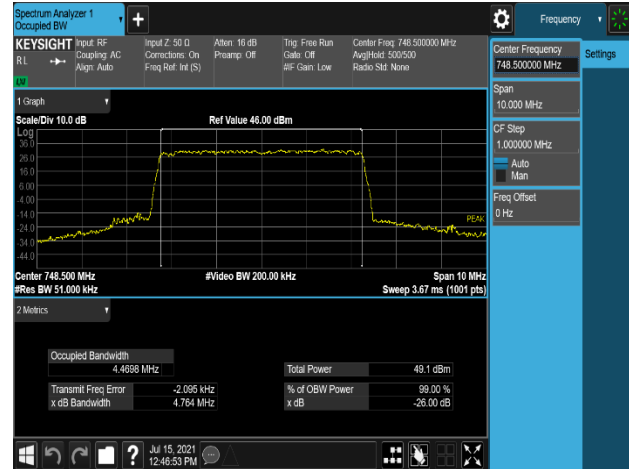
Channel	Port	OBW (MHz)			
		QPSK	16QAM	64QAM	256QAM
Middle	0	8.96	8.96	8.98	8.98
	1	8.97	8.97	8.98	8.98
	2	8.97	8.97	8.98	8.96
	3	8.97	8.96	8.97	8.96

Table 7-8. Occupied Bandwidth Summary Data (LTE_B13_10M_1C)

FCC ID: A3LRF4442D-13A		MEASUREMENT REPORT (CERTIFICATION)		Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 26 of 225



Plot 7-53. Occupied Bandwidth Plot
(LTE_B13_5M_1C_QPSK - Low Channel, Port 0)



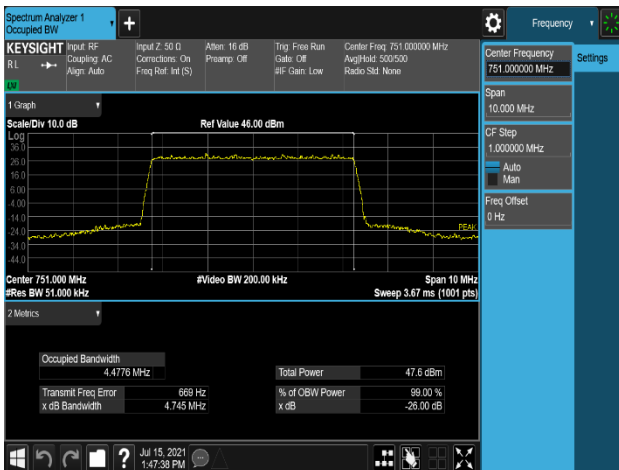
Plot 7-54. Occupied Bandwidth Plot
(LTE_B13_5M_1C_16QAM - Low Channel, Port 0)



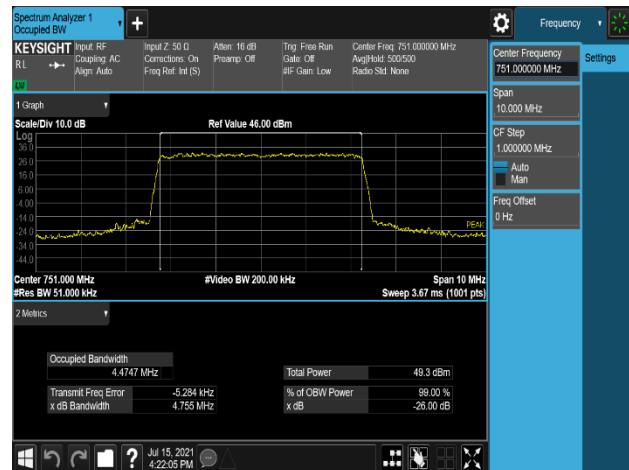
Plot 7-55. Occupied Bandwidth Plot
(LTE_B13_5M_1C_64QAM - Low Channel, Port 0)



Plot 7-56. Occupied Bandwidth Plot
(LTE_B13_5M_1C_256QAM - Low Channel, Port 0)

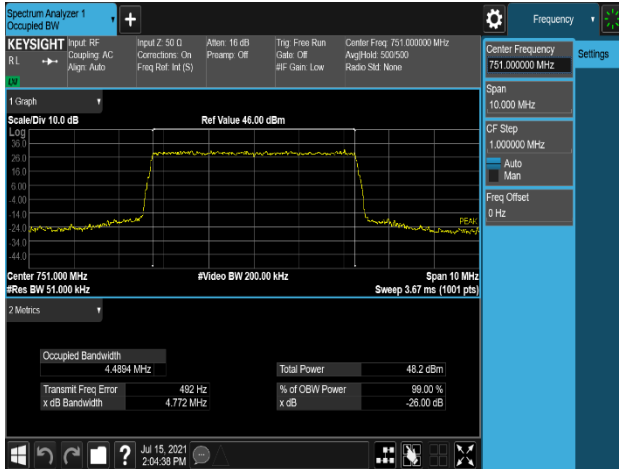


Plot 7-57. Occupied Bandwidth Plot
(LTE_B13_5M_1C_QPSK - Mid Channel, Port 0)

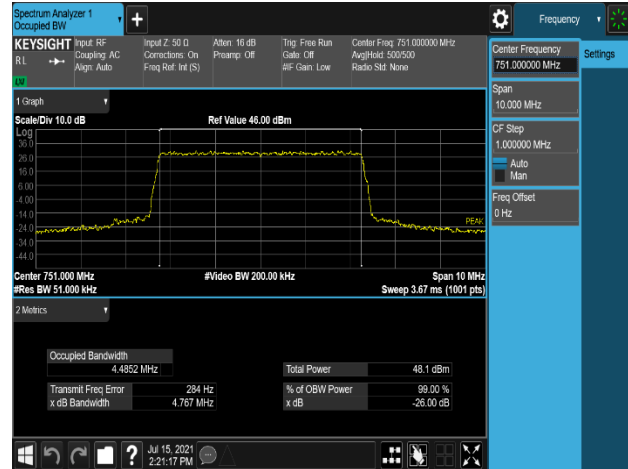


Plot 7-58. Occupied Bandwidth Plot
(LTE_B13_5M_1C_16QAM - Mid Channel, Port 2)

FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 27 of 225



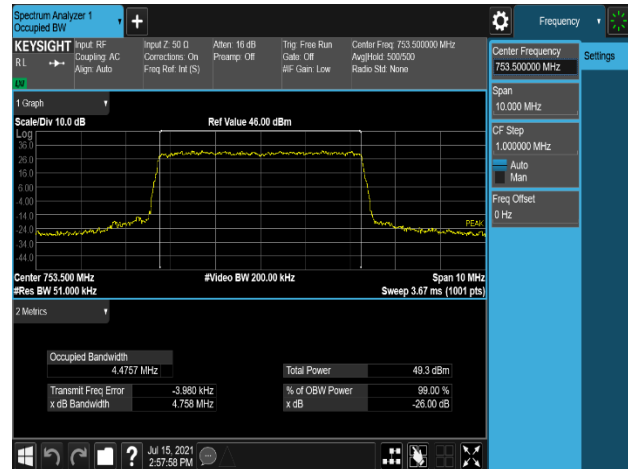
Plot 7-59. Occupied Bandwidth Plot
(LTE_B13_5M_1C_64QAM - Mid Channel, Port 1)



Plot 7-60. Occupied Bandwidth Plot
(LTE_B13_5M_1C_256QAM - Mid Channel, Port 1)



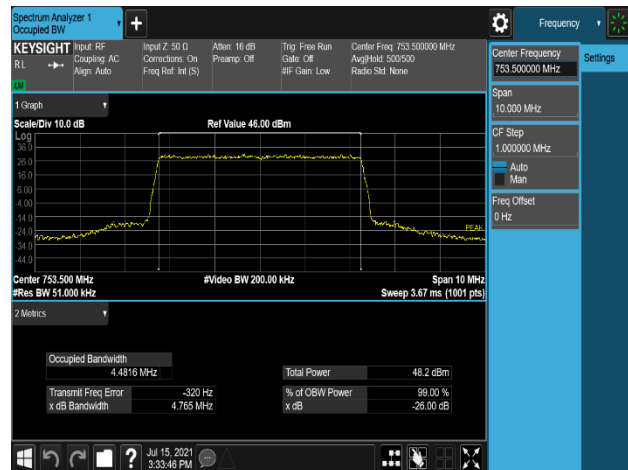
Plot 7-61. Occupied Bandwidth Plot
(LTE_B13_5M_1C_QPSK - High Channel, Port 0)



Plot 7-62. Occupied Bandwidth Plot
(LTE_B13_5M_1C_16QAM - High Channel, Port 1)



Plot 7-63. Occupied Bandwidth Plot
(LTE_B13_5M_1C_64QAM - High Channel, Port 1)

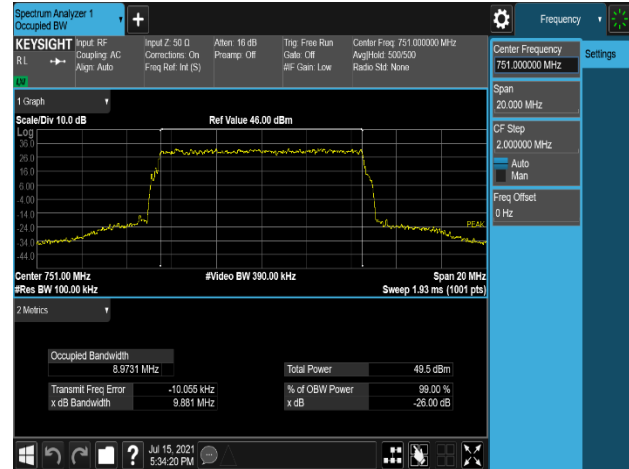


Plot 7-64. Occupied Bandwidth Plot
(LTE_B13_5M_1C_256QAM - High Channel, Port 0)

FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 28 of 225



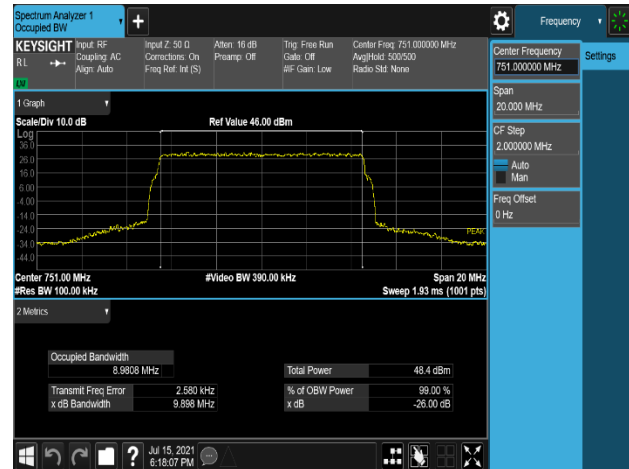
Plot 7-65. Occupied Bandwidth Plot
(LTE_B13_10M_1C_QPSK - Port 1)



Plot 7-66. Occupied Bandwidth Plot
(LTE_B13_10M_1C_16QAM - Port 1)



Plot 7-67. Occupied Bandwidth Plot
(LTE_B13_10M_1C_64QAM - Port 0)



Plot 7-68. Occupied Bandwidth Plot
(LTE_B13_10M_1C_256QAM - Port 0)

FCC ID: A3LRF4442D-13A	PCTEST ENGINEERING LABORATORY, INC.	MEASUREMENT REPORT (CERTIFICATION)	SAMSUNG	Approved by: Technical Manager
Test Report S/N: 8K21070502R3.A3L	Test Dates: 07/09/2021 - 08/26/2021	EUT Type: RRU (RF4442d)		Page 29 of 225