MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313
33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372
3162 BELICK STREET • SANTA CLARA, CA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372
13501 MCCALLEN PASS • AUSTIN, TEXAS 78753 • PHONE (512) 287-2500 • FAX (512) 287-2513

December 15, 2015

CommScope Technologies LLC
250 Apollo Drive
Chelmsford, MA 01824

Dear Kevin Craig,

Enclosed is the EMC Wireless test report for compliance testing of the CommScope Technologies LLC, OneCell Radio Point as tested to the requirements of the FCC Certification rules under Title 47 of the CFR 24 Subpart E for Broadband PCS Devices.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please contact me.

Sincerely yours,
MET LABORATORIES, INC.

Jennifer Warnell
Documentation Department

Reference: (\CommScope Technologies LLC\EMC87739-FCC24)

MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313
33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372
3162 BELICK STREET • SANTA CLARA, CA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372
13501 MCCALLEN PASS • AUSTIN, TEXAS 78753 • PHONE (512) 287-2500 • FAX (512) 287-2513

Electromagnetic Compatibility Criteria
Test Report

for the

CommScope Technologies LLC
Model OneCell Radio Point

Tested under
FCC Certification Rules
Title 47 of the CFR,
Part 24 Subpart E for Broadband PCS Devices

MET Report: EMC87739-FCC24

December 15, 2015

Prepared For:

CommScope Technologies LLC
250 Apollo Drive
Chelmsford, MA 01824

Prepared By:
MET Laboratories, Inc.
914 W. Patapsco Ave
Baltimore, MD 21230

Electromagnetic Compatibility Criteria
Test Report

for the

CommScope Technologies LLC
Model OneCell Radio Point

Tested Under
FCC Certification Rules
Title 47 of the CFR,
Part 22 Subpart H and RSS-132 for Cellular Devices
&
Part 24 Subpart E and RSS-133 for Broadband PCS Devices

Surinder Singh
Project Engineer, Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 24 Subpart E of the FCC Rules under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	December 15, 2015	Initial Issue

Table of Contents

List of Tables

List of Plots

List of Photographs

List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**er**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**er**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the CommScope Technologies LLC OneCell Radio Point, with the requirements of Part 24 Subpart E. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the OneCell Radio Point. CommScope Technologies LLC should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the OneCell Radio Point, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 24 Subpart E, in accordance with CommScope Technologies LLC, purchase order number 60032.

FCC Reference	Description	Compliance
Part 24 Subpart E §2.1046; §24.232	RF Power Output (ERP/EIRP)	Compliant
Part 24 Subpart E §2.1049; §24.238	Occupied Bandwidth	Compliant
Part 24 Subpart E §2.1051; §24.238	Conducted Spurious Emissions at Antenna Terminals	Compliant
Part 24 Subpart E §2.1053; §24.238	Radiated Spurious Emissions from the Cabinet	Compliant
Part 24 Subpart E §2.1055; §24.235	Frequency stability	Compliant with Similarity

Table 1. Executive Summary of EMC ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by CommScope Technologies LLC to perform testing on the OneCell Radio Point, under CommScope Technologies LLC's purchase order number 60032.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the CommScope Technologies LLC, OneCell Radio Point.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	OneCell Radio Point	
Model(s) Covered:	OneCell Radio Point	
Filing Status:	**Class II PC**	
EUT Specifications:	EIRP: 31.5dBm	
	FCC ID: QHYRP-A2014	
	Type of Modulations:	QPSK, 16QAM, 64QAM
	Equipment Code:	TNB
	RF Conducted Power Output	23.5dBm
	EUT Frequency Ranges:	Band 2: 1937.5-1982.5MHz Band 25: 1937.5-1987.5MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Surinder Singh	
Date(s):	December 15, 2015	

B. References

CFR 47, Part 24, Subpart E	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 24: Rules and Regulations for Personal Communications Services
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration Laboratories
EIA/TIA-603-A-2001	Land Mobile FM or PM Communication Equipment Measurement and Performance Standards
KDB 971168	Power Measurement License Digital System

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave, Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The CommScope Technologies LLC OneCell Radio Point, Equipment Under Test (EUT), is an LTE Quad band Radio Access Point. It is used to provide in-build coverage for the LTE cellular users. The unit can be located below the ceiling or in a plenum airspace above a ceiling as it is plenum rated to UL-2043.

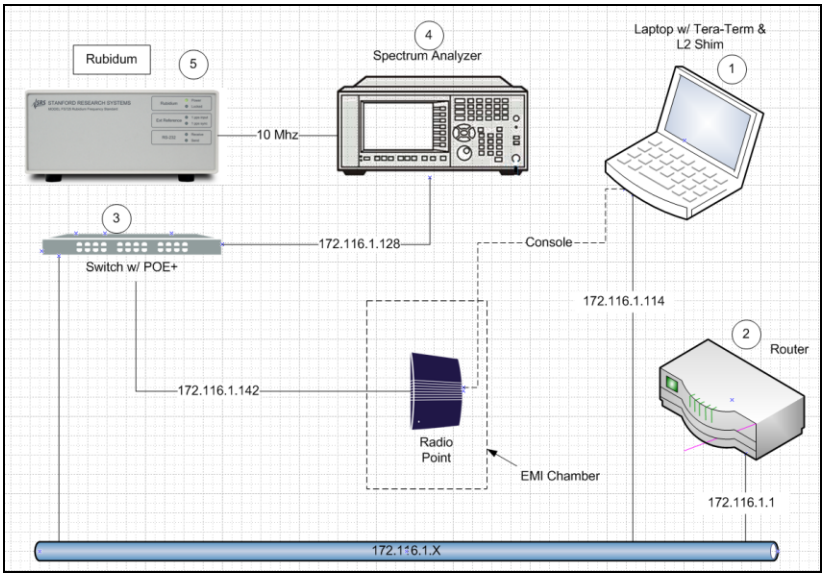


Figure 1. Block Diagram of Test Configuration

E. Equipment Configuration

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Revision
1	OneCell® Radio Point	RP-A2014	800245	--	--

Table 2. Equipment Configuration

F. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
1	Laptop	--	--	--
2	Ethernet Router	Linksys	EA2700	--
3	Ethernet Switch	Linksys	LG308P	--
4	20 Hz – 26.5 GHz Spectrum Analyzer	Keysight	KT-N9020A-256/B25/P26/CG1	--
5	Rubidium	Stanford Research	FS725	--

Table 3. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Point
1	Ethernet/Power	Cat5 cable	1	1	N	Port 1 Ethernet Switch
2	Antenna port J1	Coax	1	2	Y	Spectrum Analyzer
3	Antenna port J2	Coax	1	3	Y	Spectrum Analyzer
4	Console	Signal	1	4	N	--

Table 4. Ports and Cabling Information

H. Mode of Operation

The EUT will be configured to operate in a specific band of interest using Tera Term Scripts and transmit test models supplied by the chip vendor per the 3GPP standard TS 36.141 Release 10.10. The test models will cover all of the test modes, 15 & 20 MHz bandwidth as well as the three modulation types, QPSK, 16QAM & 64 QAM. The EUT transmitter will provide a continuous transmit signal without manual intervention on it has been configured. For conducted testing the EUT will be controlled by a serial interface. For radiated test the EUT will be controlled by the Ethernet. Interface.
The EUT will require a reboot whenever band or bandwidth is changed.

Supported Frequency Bands and Bandwidths						
Frequency Band	Duplex	Uplink RX Frequency (MHz)	Downlink TX Frequency (MHz)	MAX Bandwidth (MHz)	MAX Output Power (dBm)	FCC PART
10	FDD	1710-1770	2110-2170	20	23	27
25	FDD	1850-1915	1930-1995	20	23	24
12	FDD	699-716	729-746	15	23	27
2	FDD	1850-1910	1930-1990	20	23	24
4	FDD	1710-1755	2110-2155	20	23	27

I. Method of Monitoring EUT Operation

The radio transmitter is monitored using a spectrum analyzer. The EUT console will be monitored for error messages via the serial or Ethernet interface.

J. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to CommScope Technologies LLC. upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1046 RF Power Output and PAPR

Test Requirements: **§ 2.1046 Measurements required: RF power output:**

§ 2.1046 (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in § 2.1033(c)(8).The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

§ 22.913 (b) The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

§ 24.232 Power and antenna height limits.

§ 24.232 (b): Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

§ 24.232 (d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

Test Procedures: As required by 47 CFR 2.1046, RF power output measurements were made at the RF output terminals using an attenuator and spectrum analyzer. The spectrum analyzer was set to settings as dictated by the licensed measurement guidance procedures. Measurements were taken at the low, mid and high channels.

Test Results: The EUT complies with the requirements of this section.

Test Engineer(s): Surinder Singh

Test Date(s): 11/24/15

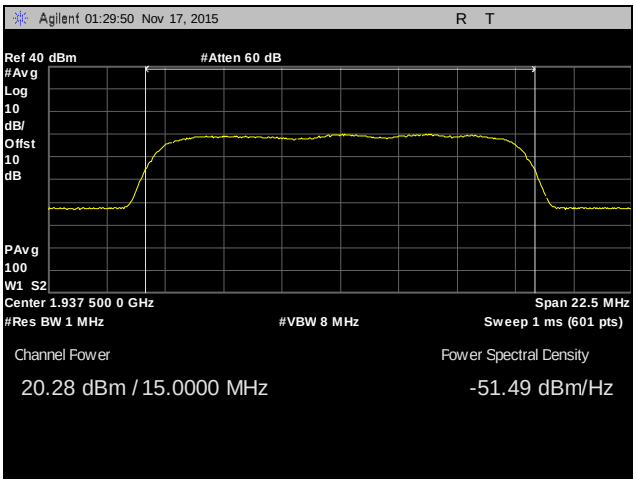
Band	Center Freq.	Band-width	Mod.	Max. RMS Power Port 1 dBm	Max. RMS Power Port 2 dBm	Peak Power Port 1 dBm	Peak Power Port 2 dBm	PAPR Port 1 dB (limit:13dB)	PAPR Port 2 dB (limit:13dB)	Total Max. RMS Output Power	Directional Gain dBi	Limit dBm	EIRP dBm	Margin dB	Result
2	1937.5	15	QPSK	20.46	20.24	23.94	23.42	3.48	3.18	23.4	8	33	31.4	-1.6	Pass
2	1937.5	15	16QAM	20.28	20.33	23.2	23.53	2.92	3.2	23.4	8	33	31.4	-1.6	Pass
2	1937.5	15	64QAM	20.3	20.12	23.27	23.49	2.97	3.37	23.3	8	33	31.3	-1.7	Pass
2	1960	15	QPSK	20.43	20.17	24.25	23.28	3.82	3.11	23.4	8	33	31.4	-1.6	Pass
2	1960	15	16QAM	20.35	20.12	23.68	23.33	3.33	3.21	23.3	8	33	31.3	-1.7	Pass
2	1960	15	64QAM	20.5	20.48	23.49	23.55	2.99	3.07	23.5	8	33	31.5	-1.5	Pass
2	1982.5	15	QPSK	20.4	20.2	23.81	23.49	3.41	3.29	23.4	8	33	31.4	-1.6	Pass
2	1982.5	15	16QAM	20.05	20.16	23.25	23.39	3.2	3.23	23.2	8	33	31.2	-1.8	Pass
2	1982.5	15	64QAM	20.07	20.27	23.26	23.11	3.19	2.84	23.2	8	33	31.2	-1.8	Pass
2	1940	20	QPSK	20.47	20.52	23.96	24.31	3.49	3.79	23.5	8	33	31.5	-1.5	Pass
2	1940	20	16QAM	20.2	20.46	23.45	23.98	3.25	3.52	23.4	8	33	31.4	-1.6	Pass
2	1940	20	64QAM	20.26	20.17	23.65	24.15	3.39	3.98	23.3	8	33	31.3	-1.7	Pass
2	1960	20	QPSK	20.41	20.37	23.83	23.9	3.42	3.53	23.5	8	33	31.5	-1.5	Pass
2	1960	20	16QAM	20.39	20.37	23.59	23.59	3.2	3.22	23.4	8	33	31.4	-1.6	Pass
2	1960	20	64QAM	20.45	20.99	23.46	23.68	3.01	3.19	23.5	8	33	31.5	-1.5	Pass
2	1980	20	QPSK	20.19	20.39	23.33	24.04	3.14	3.65	23.4	8	33	31.4	-1.6	Pass
2	1980	20	16QAM	20.08	20.42	23.73	23.97	3.65	3.55	23.3	8	33	31.3	-1.7	Pass
2	1980	20	64QAM	20.21	20.24	22.79	23.46	2.58	3.22	23.3	8	33	31.3	-1.7	Pass

Table 5. Output Power, EIRP, LTE Band 2

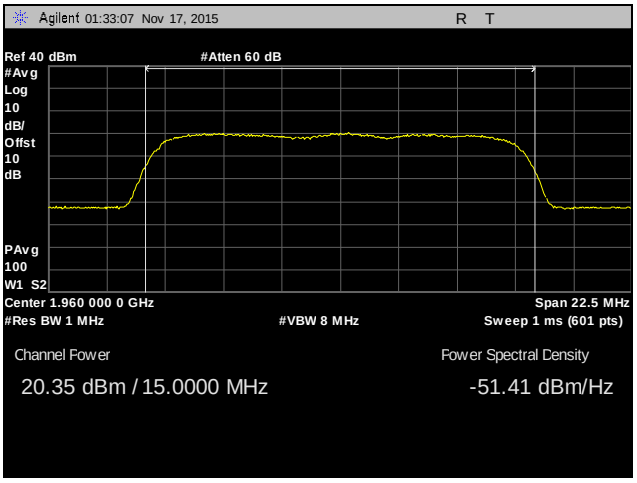
Band	Center Freq.	Band-width	Mod.	Max. RMS Power Port 1 dBm	Max. RMS Power Port 2 dBm	Peak Power Port 1 dBm	Peak Power Port 2 dBm	PAPR Port 1 dB (limit:13dB)	PAPR Port 2 dB (limit:13dB)	Total Max. RMS Output Power	Directional Gain dBi	Limit dBm	EIRP dBm	Margin dB	Result
25	1937.5	15	QPSK	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2
25	1937.5	15	16QAM	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2
25	1937.5	15	64QAM	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2
25	1962.5	15	QPSK	20.2	19.97	23.62	23.29	3.42	3.32	23.1	8	33	31.1	-1.9	Pass
25	1962.5	15	16QAM	20.16	20.02	23.49	23.4	3.33	3.38	23.2	8	33	31.2	-1.8	Pass
25	1962.5	15	64QAM	19.87	20.02	23.95	23.68	4.08	3.66	23	8	33	31	-2	Pass
25	1987.5	15	QPSK	19.76	19.97	23.52	23.38	3.76	3.41	22.9	8	33	30.9	-2.1	Pass
25	1987.5	15	16QAM	19.59	19.89	23.16	23.46	3.57	3.57	22.8	8	33	30.8	-2.2	Pass
25	1987.5	15	64QAM	19.94	20.76	22.57	24.23	2.63	3.47	23.4	8	33	31.4	-1.6	Pass
25	1940	20	QPSK	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2
25	1940	20	16QAM	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2
25	1940	20	64QAM	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2	see band 2
25	1962.5	20	QPSK	20.13	20.68	23.55	24.14	3.42	3.46	23.5	8	33	31.5	-1.5	Pass
25	1962.5	20	16QAM	20.12	20.66	23.64	23.83	3.52	3.17	23.5	8	33	31.5	-1.5	Pass
25	1962.5	20	64QAM	20.24	20.83	23.53	24.07	3.29	3.34	23.5	8	33	31.5	-1.5	Pass
25	1985	20	QPSK	19.72	20.55	23.31	24.05	3.59	3.5	23.2	8	33	31.2	-1.8	Pass
25	1985	20	16QAM	19.71	20.67	23.29	24.29	3.58	3.62	23.3	8	33	31.3	-1.7	Pass
25	1985	20	64QAM	19.61	20.56	23.34	23.92	3.73	3.26	23.2	8	33	31.2	-1.8	Pass

Table 6. Output Power, EIRP, LTE Band 25

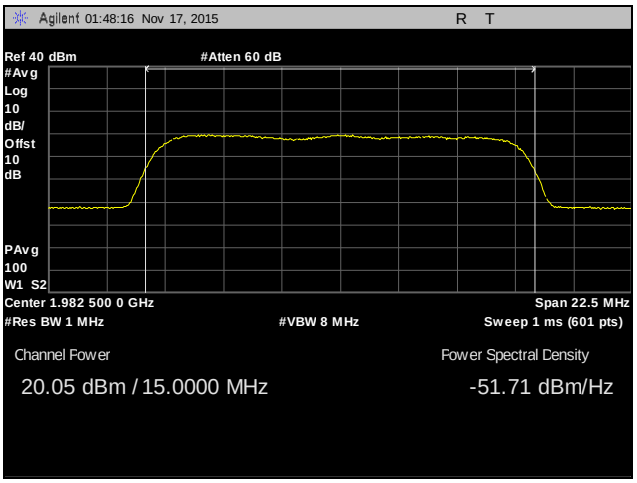
RF Power Output, LTE Band 2, 15 MHz, Average, 16QAM, Port 1



Plot 1. RF Power, LTE Band 2, Low Channel, 16QAM, 15 MHz, Average, Port 1

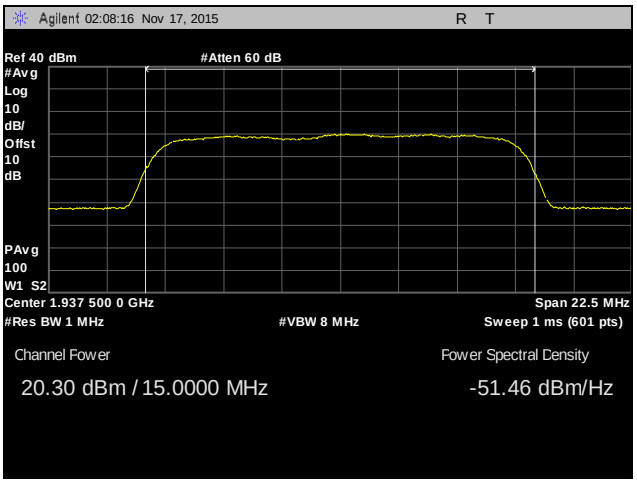


Plot 2. RF Power, LTE Band 2, Mid Channel, 16QAM, 15 MHz, Average, Port 1

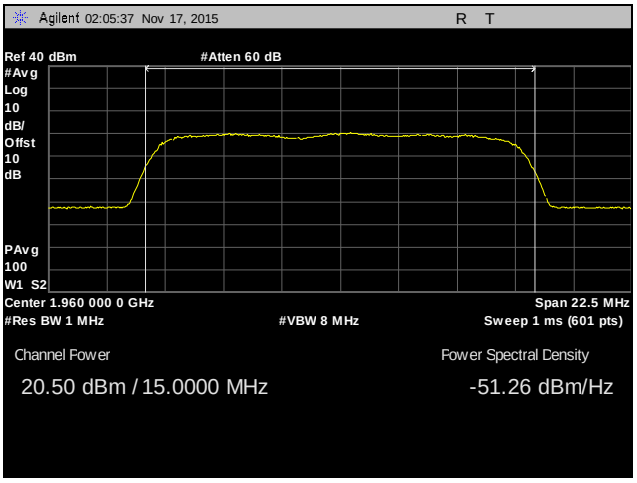


Plot 3. RF Power, LTE Band 2, High Channel, 16QAM, 15 MHz, Average, Port 1

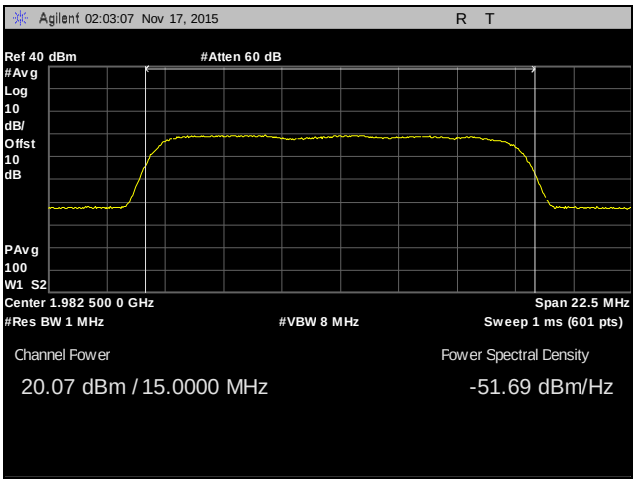
RF Power Output, LTE Band 2, 15 MHz, Average, 64QAM, Port 1



Plot 4. RF Power, LTE Band 2, Low Channel, 64QAM, 15 MHz, Average, Port 1

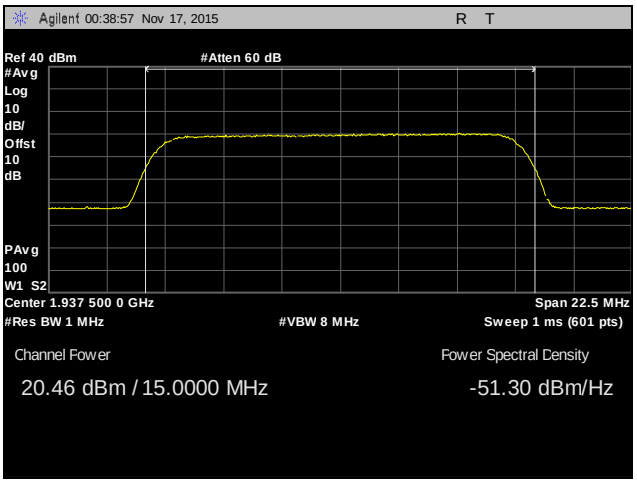


Plot 5. RF Power, LTE Band 2, Mid Channel, 64QAM, 15 MHz, Average, Port 1

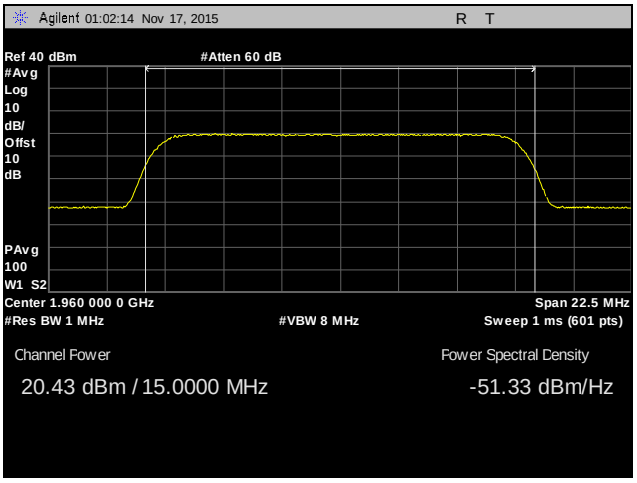


Plot 6. RF Power, LTE Band 2, High Channel, 64QAM, 15 MHz, Average, Port 1

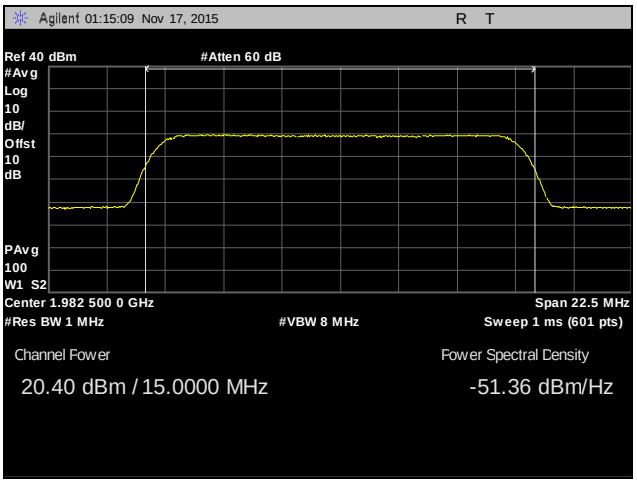
RF Power Output, LTE Band 2, 15 MHz, Average, QPSK, Port 1



Plot 7. RF Power, LTE Band 2, Low Channel, QPSK, 15 MHz, Average, Port 1

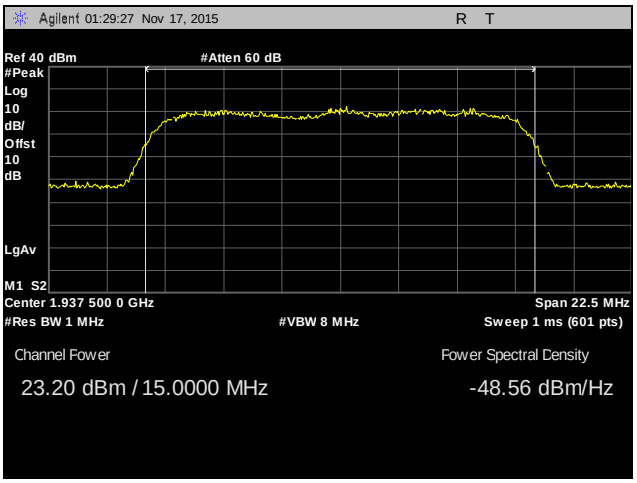


Plot 8. RF Power, LTE Band 2, Mid Channel, QPSK, 15 MHz, Average, Port 1

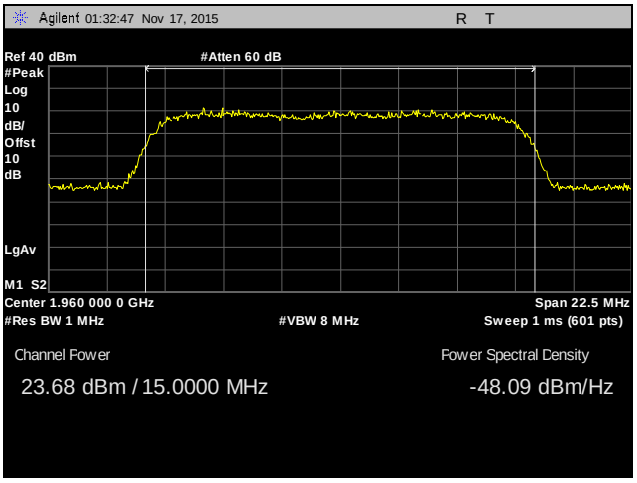


Plot 9. RF Power, LTE Band 2, High Channel, QPSK, 15 MHz, Average, Port 1

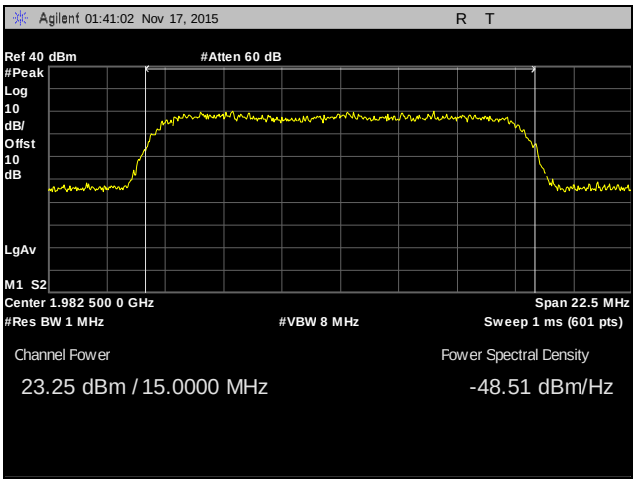
RF Power Output, LTE Band 2, 15 MHz, Peak, 16QAM, Port 1



Plot 10. RF Power, LTE Band 2, Low Channel, 16QAM, 15 MHz, Peak, Port 1

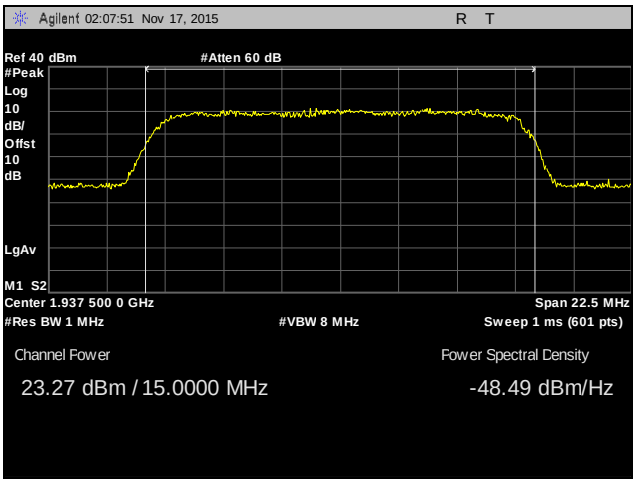


Plot 11. RF Power, LTE Band 2, Mid Channel, 16QAM, 15 MHz, Peak, Port 1

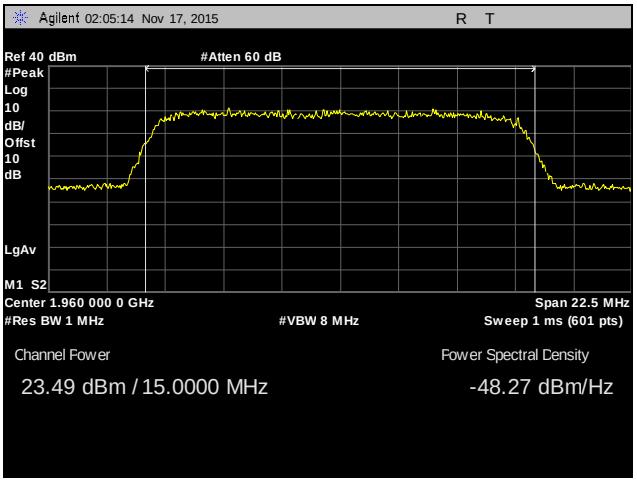


Plot 12. RF Power, LTE Band 2, High Channel, 16QAM, 15 MHz, Peak, Port 1

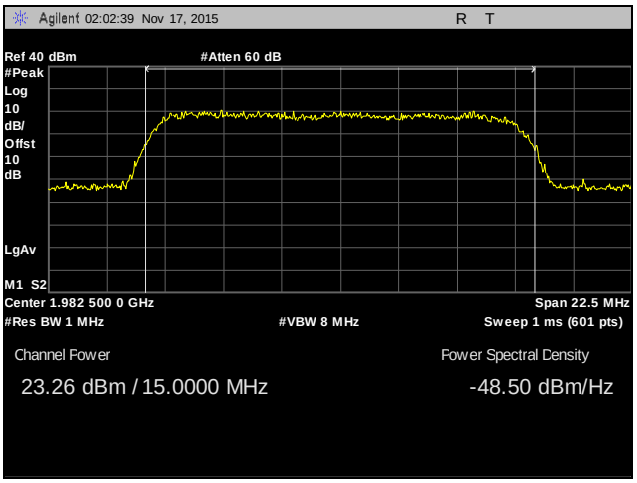
RF Power Output, LTE Band 2, 15 MHz, Peak, 64QAM, Port 1



Plot 13. RF Power, LTE Band 2, Low Channel, 64QAM, 15 MHz, Peak, Port 1

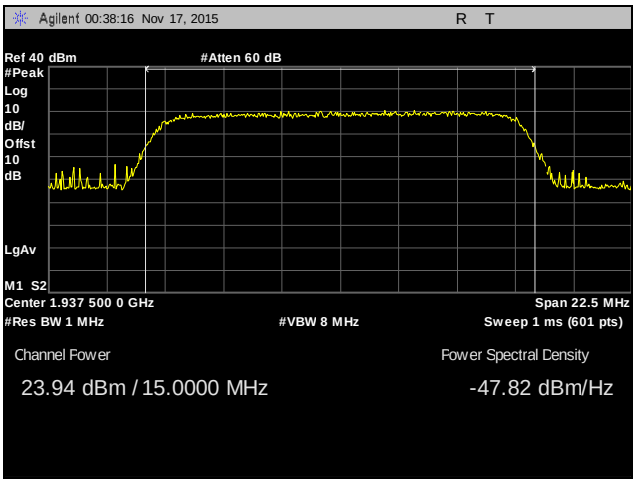


Plot 14. RF Power, LTE Band 2, Mid Channel, 64QAM, 15 MHz, Peak, Port 1

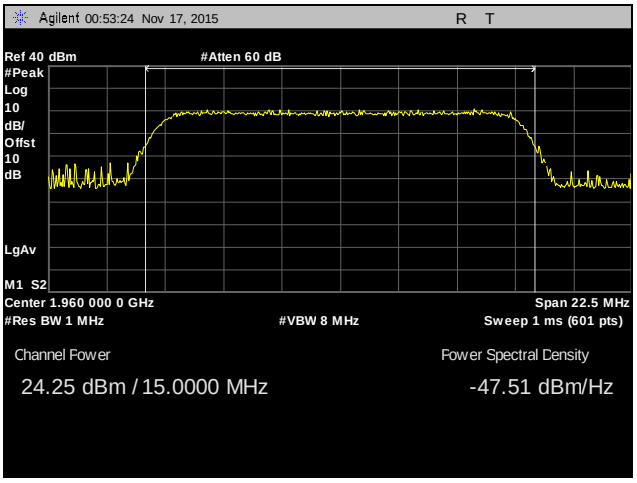


Plot 15. RF Power, LTE Band 2, High Channel, 64QAM, 15 MHz, Peak, Port 1

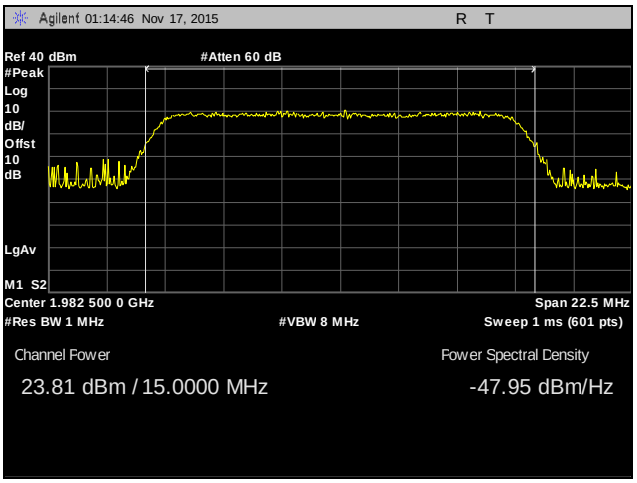
RF Power Output, LTE Band 2, 15 MHz, Peak, QPSK, Port 1



Plot 16. RF Power, LTE Band 2, Low Channel, QPSK, 15 MHz, Peak, Port 1

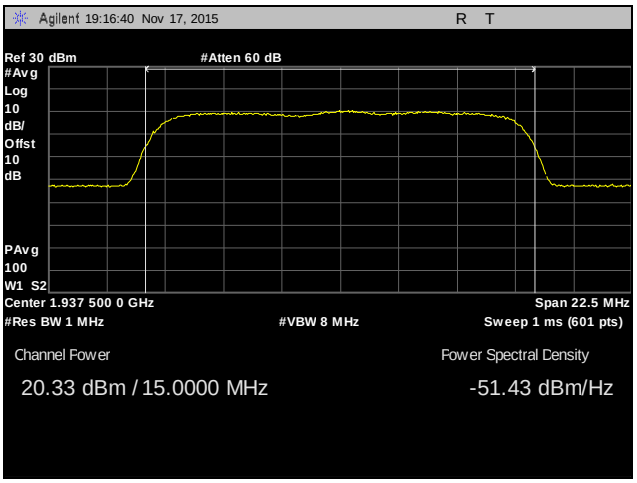


Plot 17. RF Power, LTE Band 2, Mid Channel, QPSK, 15 MHz, Peak, Port 1

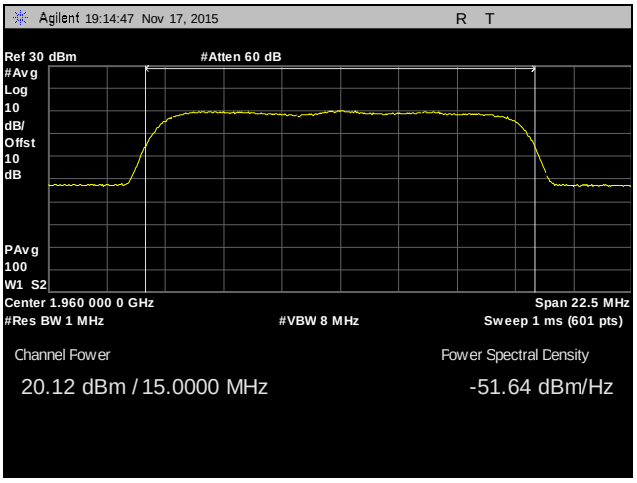


Plot 18. RF Power, LTE Band 2, High Channel, QPSK, 15 MHz, Peak, Port 1

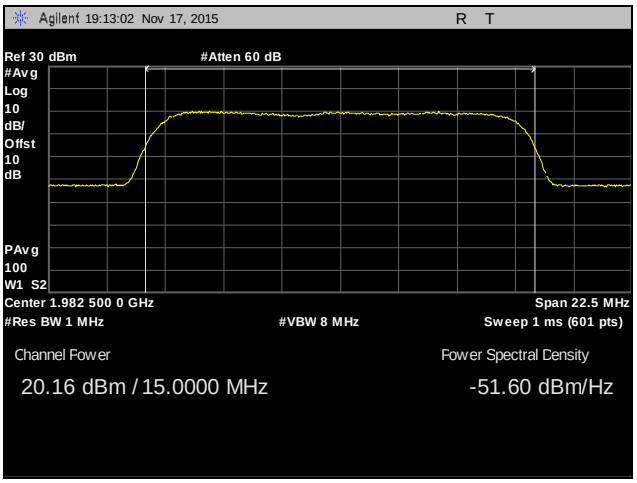
RF Power Output, LTE Band 2, 15 MHz, Average, 16QAM, Port 2



Plot 19. RF Power, LTE Band 2, Low Channel, 16QAM, 15 MHz, Average, Port 2

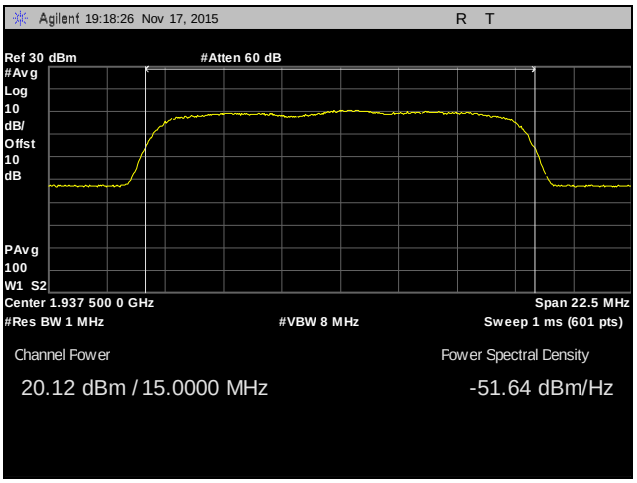


Plot 20. RF Power, LTE Band 2, Mid Channel, 16QAM, 15 MHz, Average, Port 2

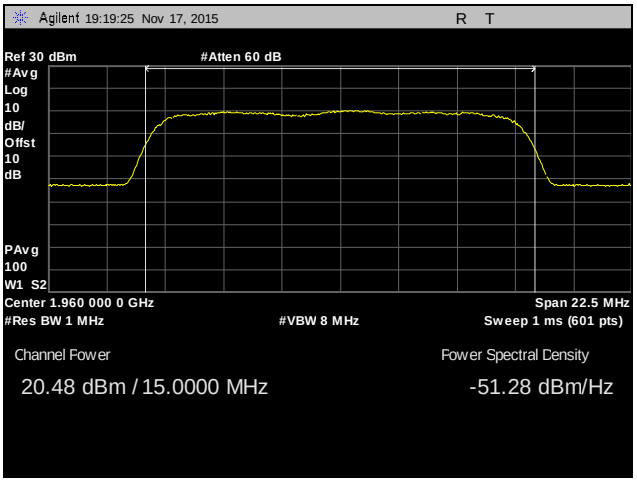


Plot 21. RF Power, LTE Band 2, High Channel, 16QAM, 15 MHz, Average, Port 2

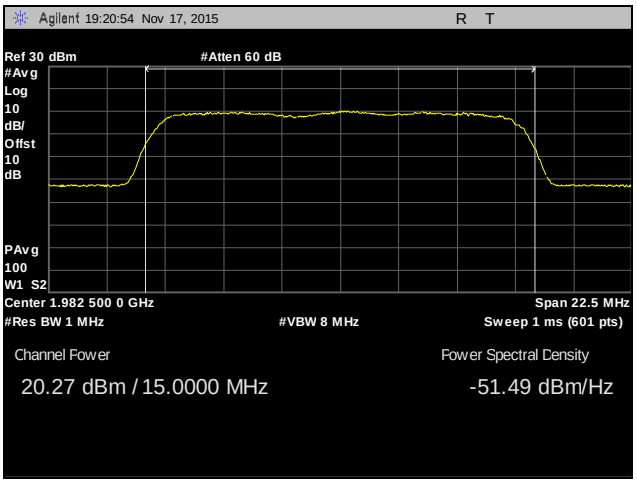
RF Power Output, LTE Band 2, 15 MHz, Average, 64QAM, Port 2



Plot 22. RF Power, LTE Band 2, Low Channel, 64QAM, 15 MHz, Average, Port 2

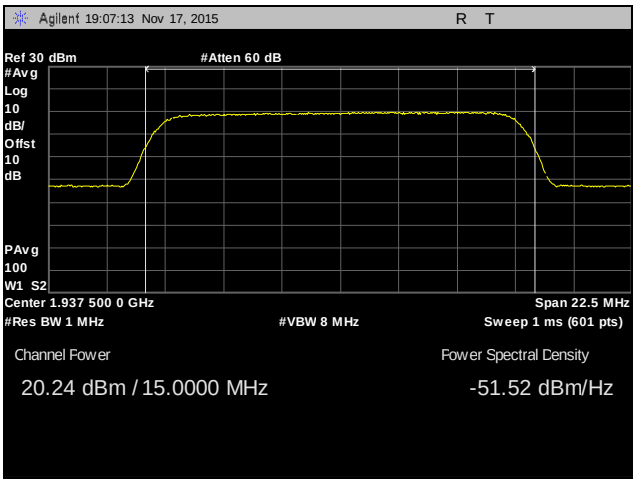


Plot 23. RF Power, LTE Band 2, Mid Channel, 64QAM, 15 MHz, Average, Port 2

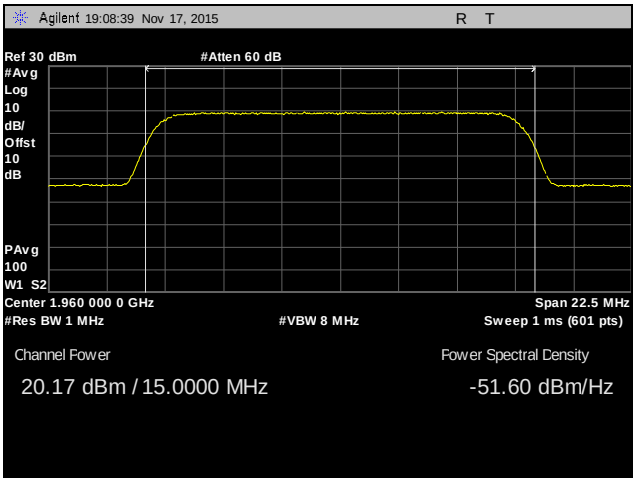


Plot 24. RF Power, LTE Band 2, High Channel, 64QAM, 15 MHz, Average, Port 2

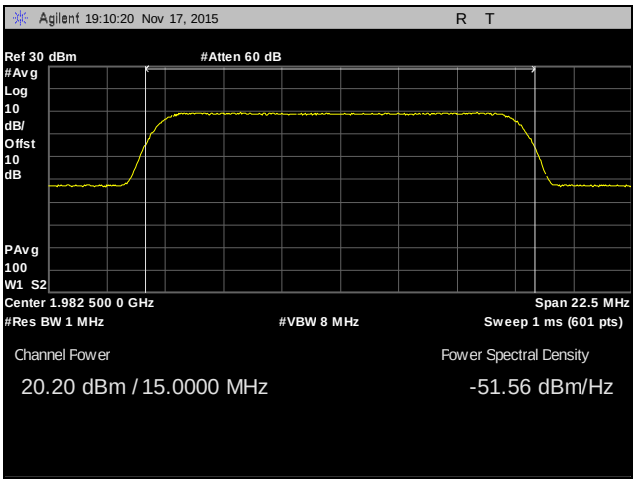
RF Power Output, LTE Band 2, 15 MHz, Average, QPSK, Port 2



Plot 25. RF Power, LTE Band 2, Low Channel, QPSK, 15 MHz, Average, Port 2

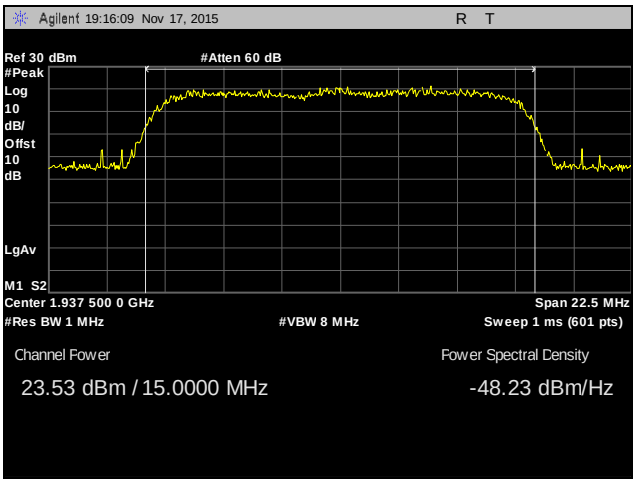


Plot 26. RF Power, LTE Band 2, Mid Channel, QPSK, 15 MHz, Average, Port 2

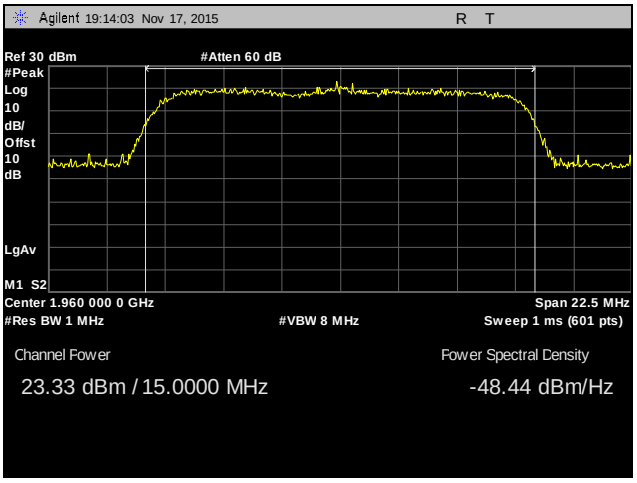


Plot 27. RF Power, LTE Band 2, High Channel, QPSK, 15 MHz, Average, Port 2

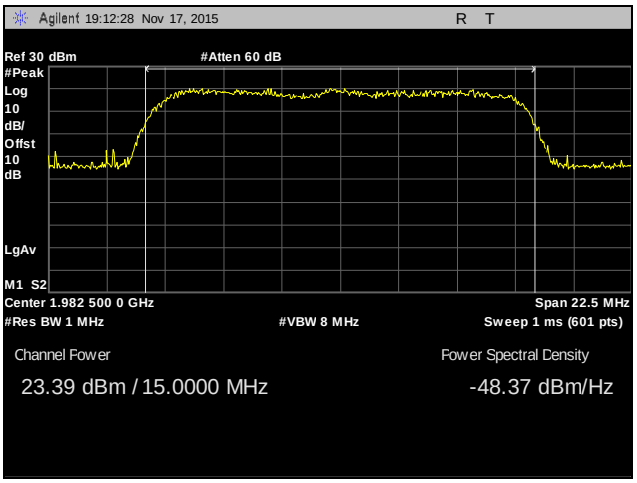
F Power Output, LTE Band 2, 15 MHz, Peak, 16QAM, Port 2



Plot 28. RF Power, LTE Band 2, Low Channel, 16QAM, 15 MHz, Peak, Port 2

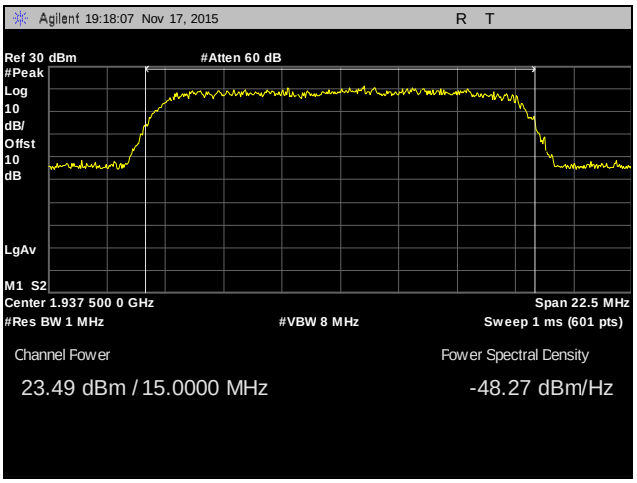


Plot 29. RF Power, LTE Band 2, Mid Channel, 16QAM, 15 MHz, Peak, Port 2

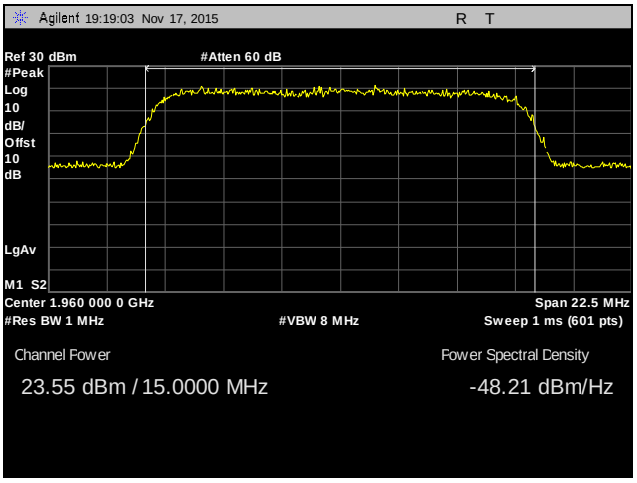


Plot 30. RF Power, LTE Band 2, High Channel, 16QAM, 15 MHz, Peak, Port 2

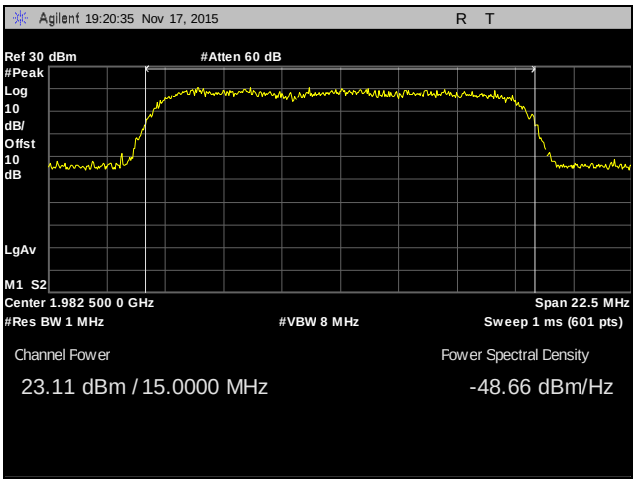
RF Power Output, LTE Band 2, 15 MHz, Peak, 64QAM, Port 2



Plot 31. RF Power, LTE Band 2, Low Channel, 64QAM, 15 MHz, Peak, Port 2

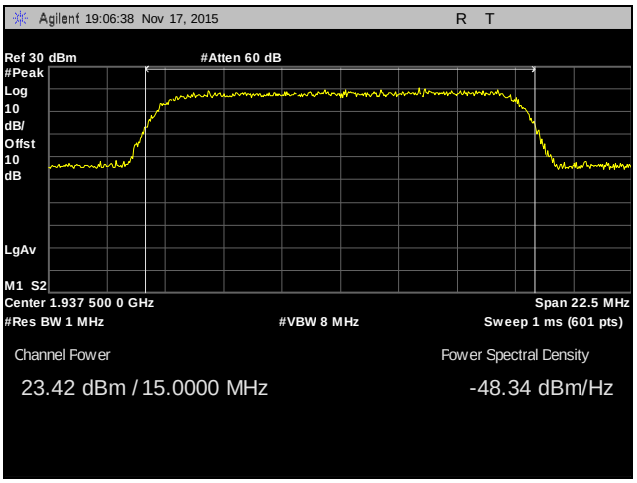


Plot 32. RF Power, LTE Band 2, Mid Channel, 64QAM, 15 MHz, Peak, Port 2

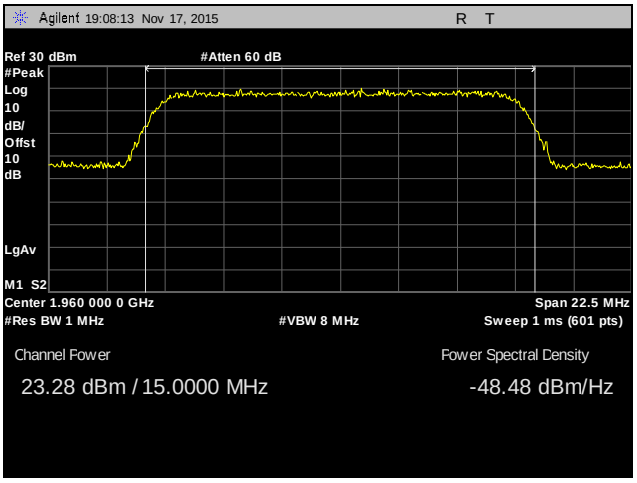


Plot 33. RF Power, LTE Band 2, High Channel, 64QAM, 15 MHz, Peak, Port 2

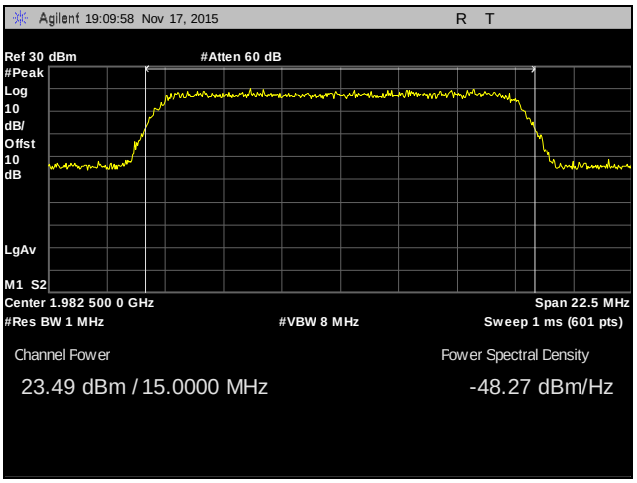
RF Power Output, LTE Band 2, 15 MHz, Peak, QPSK, Port 2



Plot 34. RF Power, LTE Band 2, Low Channel, QPSK, 15 MHz, Peak, Port 2

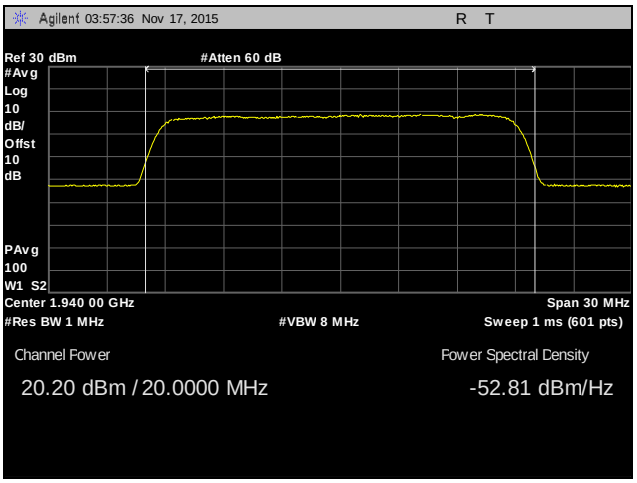


Plot 35. RF Power, LTE Band 2, Mid Channel, QPSK, 15 MHz, Peak, Port 2

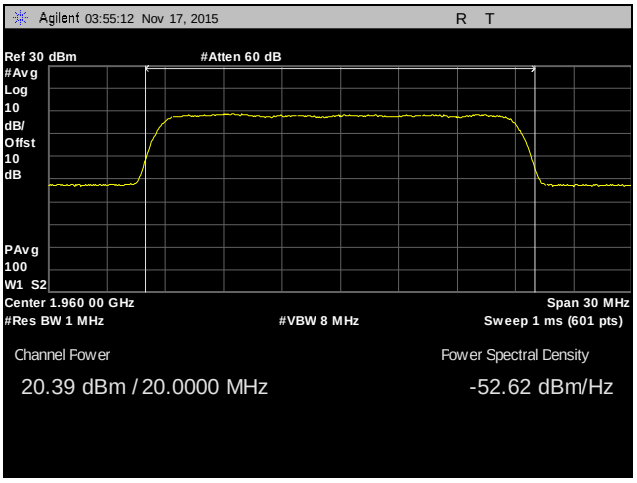


Plot 36. RF Power, LTE Band 2, High Channel, QPSK, 15 MHz, Peak, Port 2

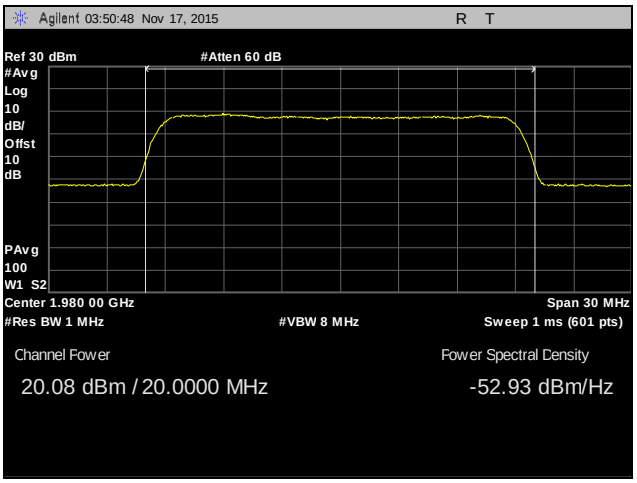
RF Power Output, LTE Band 2, 20 MHz, Average, 16QAM, Port 1



Plot 37. RF Power, LTE Band 2, Low Channel, 16QAM, 20 MHz, Average, Port 1

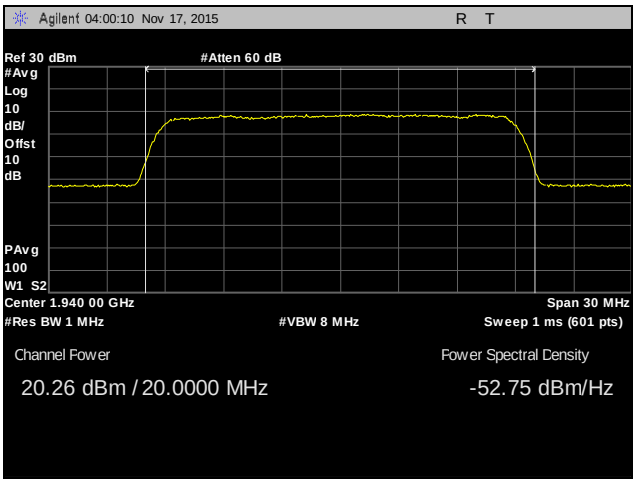


Plot 38. RF Power, LTE Band 2, Mid Channel, 16QAM, 20 MHz, Average, Port 1

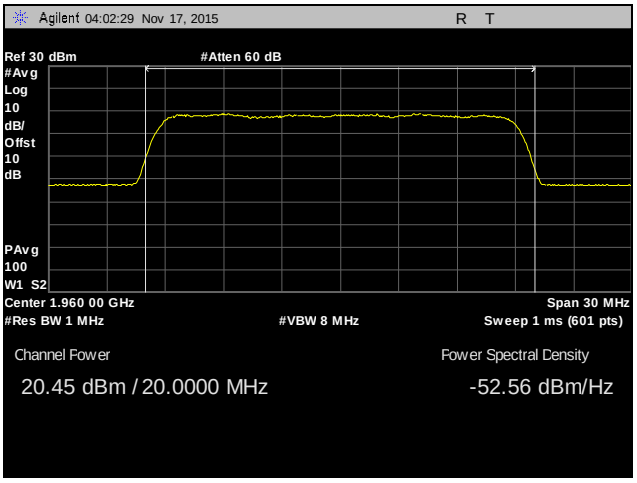


Plot 39. RF Power, LTE Band 2, High Channel, 16QAM, 20 MHz, Average, Port 1

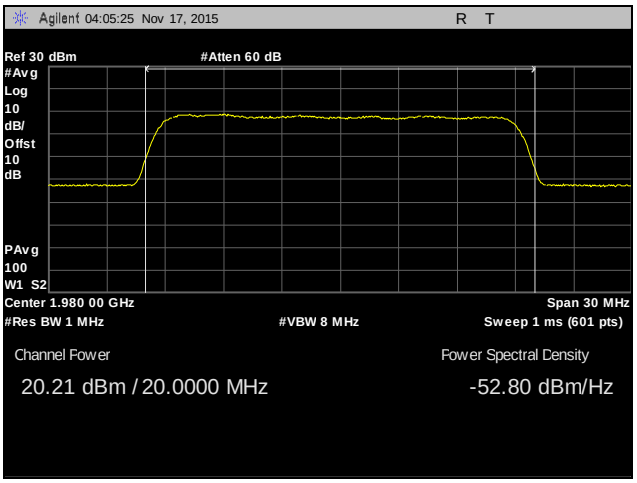
RF Power Output, LTE Band 2, 20 MHz, Average, 64QAM, Port 1



Plot 40. RF Power, LTE Band 2, Low Channel, 64QAM, 20 MHz, Average, Port 1

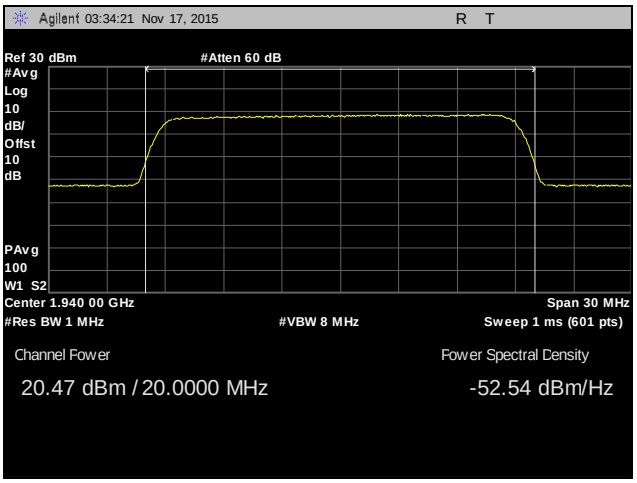


Plot 41. RF Power, LTE Band 2, Mid Channel, 64QAM, 20 MHz, Average, Port 1

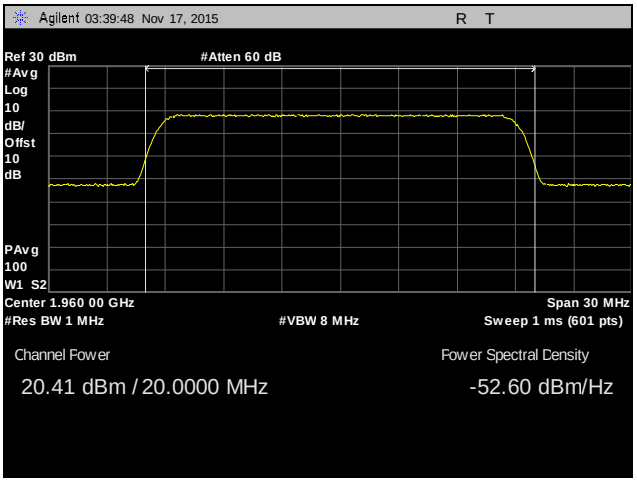


Plot 42. RF Power, LTE Band 2, High Channel, 64QAM, 20 MHz, Average, Port 1

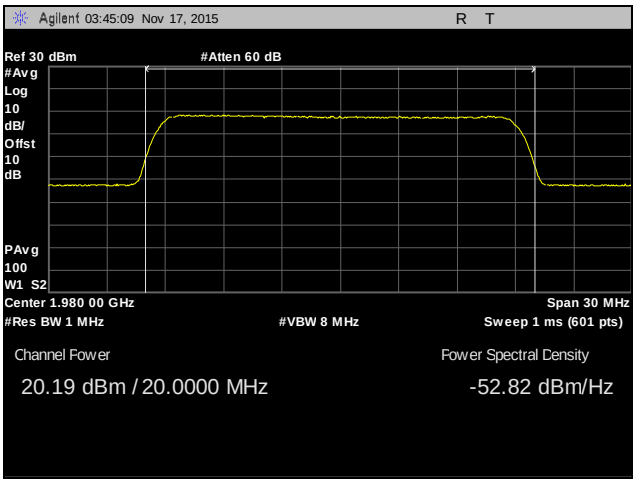
RF Power Output, LTE Band 2, 20 MHz, Average, QPSK, Port 1



Plot 43. RF Power, LTE Band 2, Low Channel, QPSK, 20 MHz, Average, Port 1

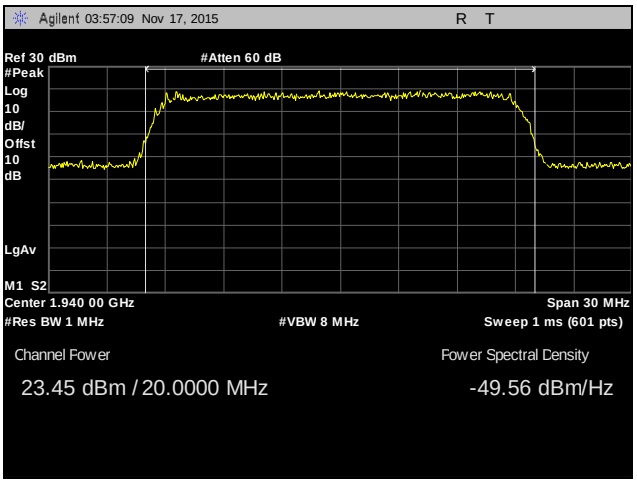


Plot 44. RF Power, LTE Band 2, Mid Channel, QPSK, 20 MHz, Average, Port 1

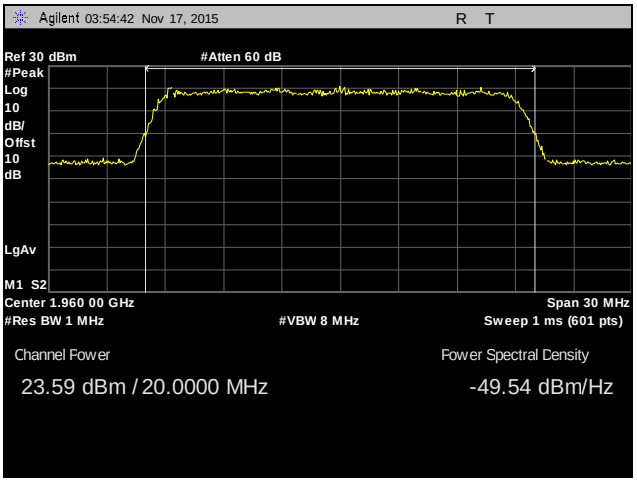


Plot 45. RF Power, LTE Band 2, High Channel, QPSK, 20 MHz, Average, Port 1

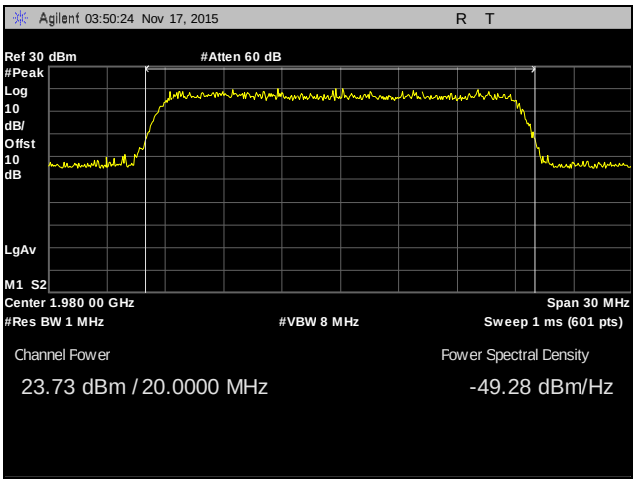
F Power Output, LTE Band 2, 20 MHz, Peak, 16QAM, Port 1



Plot 46. RF Power, LTE Band 2, Low Channel, 16QAM, 20 MHz, Peak, Port 1

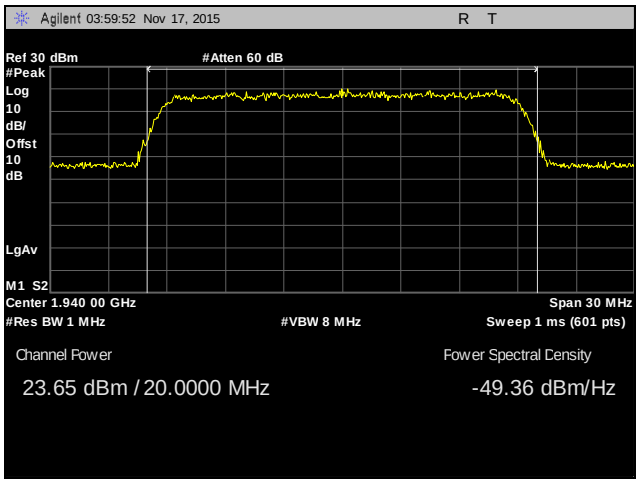


Plot 47. RF Power, LTE Band 2, Mid Channel, 16QAM, 20 MHz, Peak, Port 1

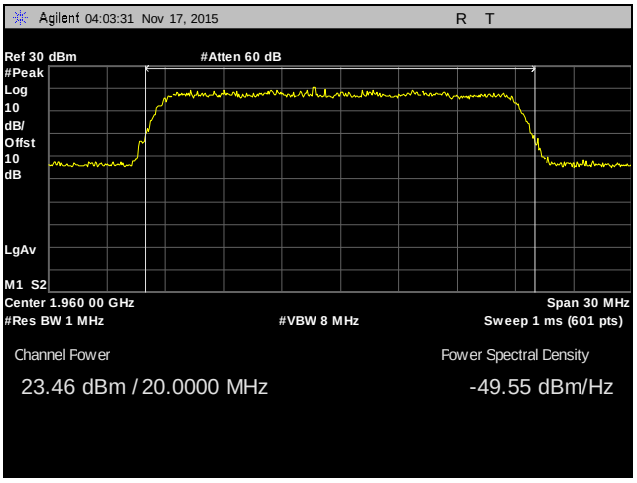


Plot 48. RF Power, LTE Band 2, High Channel, 16QAM, 20 MHz, Peak, Port 1

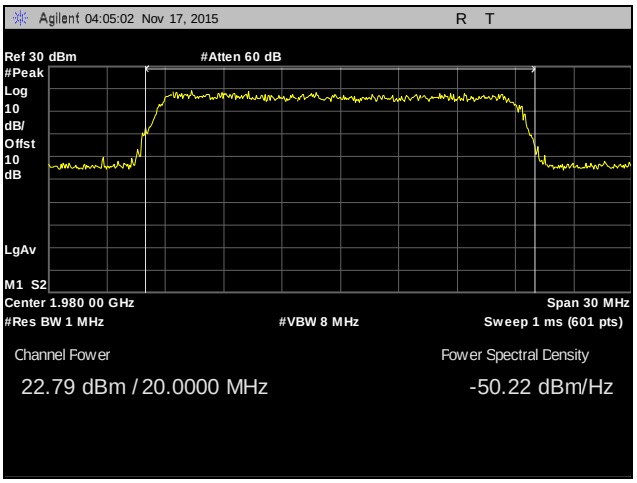
RF Power Output, LTE Band 2, 20 MHz, Peak, 64QAM, Port 1



Plot 49. RF Power, LTE Band 2, Low Channel, 64QAM, 20 MHz, Peak, Port 1

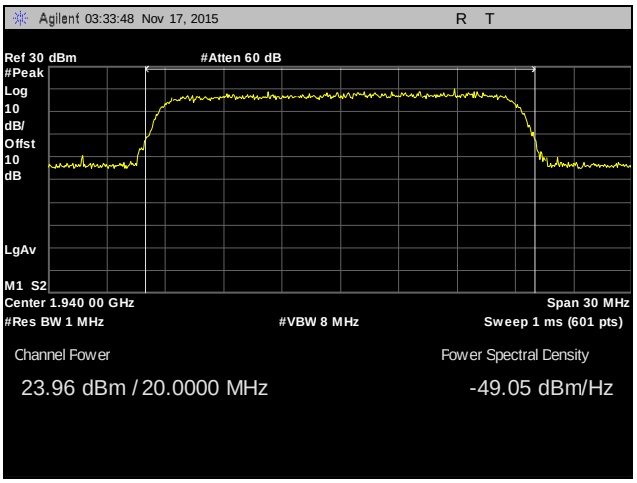


Plot 50. RF Power, LTE Band 2, Mid Channel, 64QAM, 20 MHz, Peak, Port 1

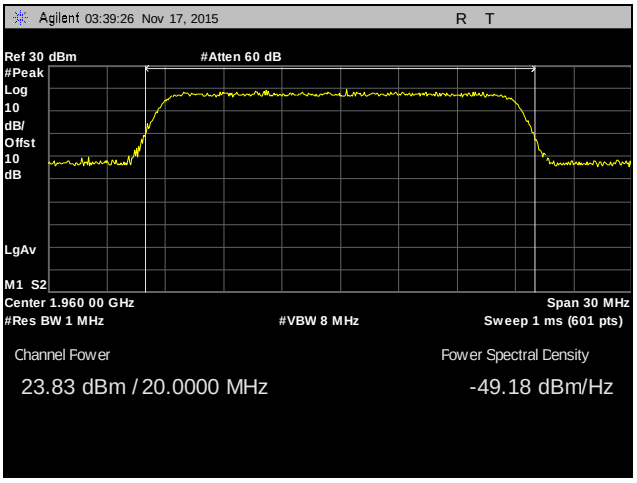


Plot 51. RF Power, LTE Band 2, High Channel, 64QAM, 20 MHz, Peak, Port 1

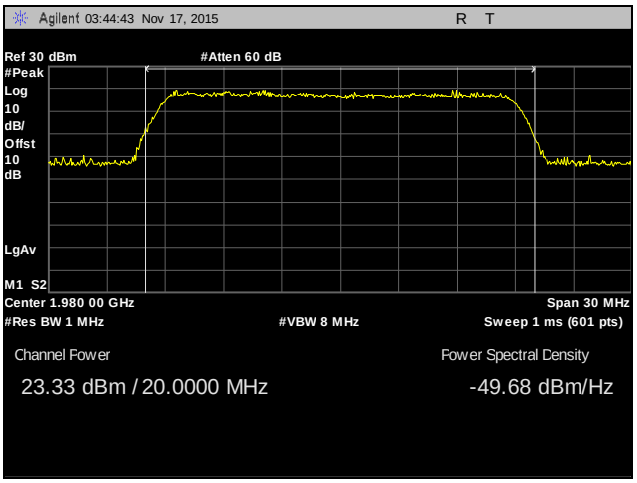
RF Power Output, LTE Band 2, 20 MHz, Peak, QPSK, Port 1



Plot 52. RF Power, LTE Band 2, Low Channel, QPSK, 20 MHz, Peak, Port 1

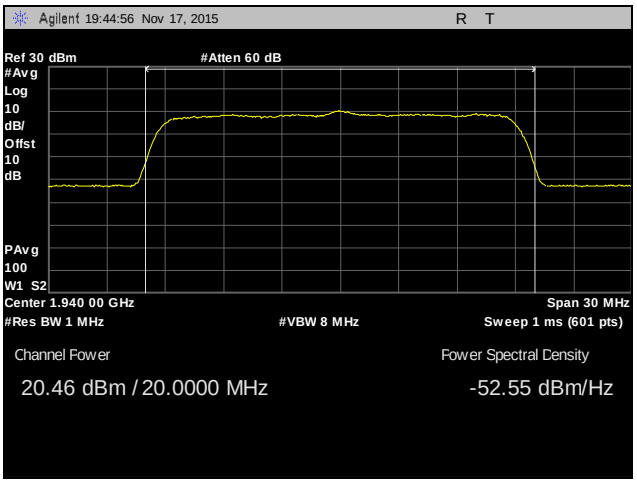


Plot 53. RF Power, LTE Band 2, Mid Channel, QPSK, 20 MHz, Peak, Port 1

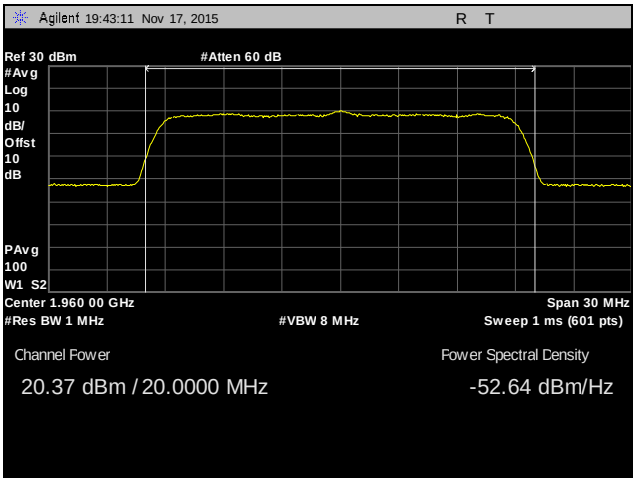


Plot 54. RF Power, LTE Band 2, High Channel, QPSK, 20 MHz, Peak, Port 1

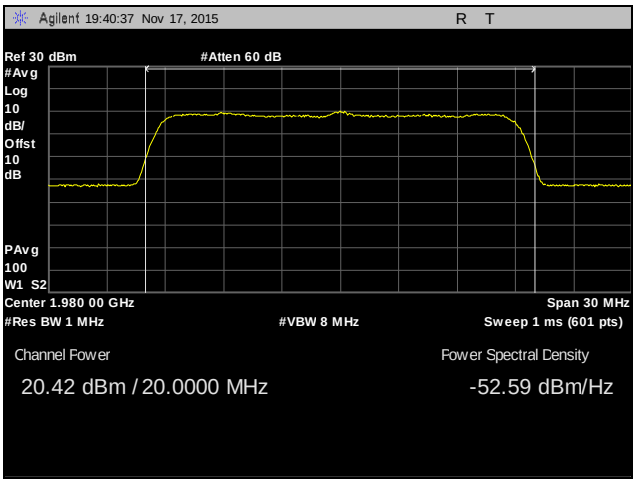
RF Power Output, LTE Band 2, 20 MHz, Average, 16QAM, Port 2



Plot 55. RF Power, LTE Band 2, Low Channel, 16QAM, 20 MHz, Average, Port 2

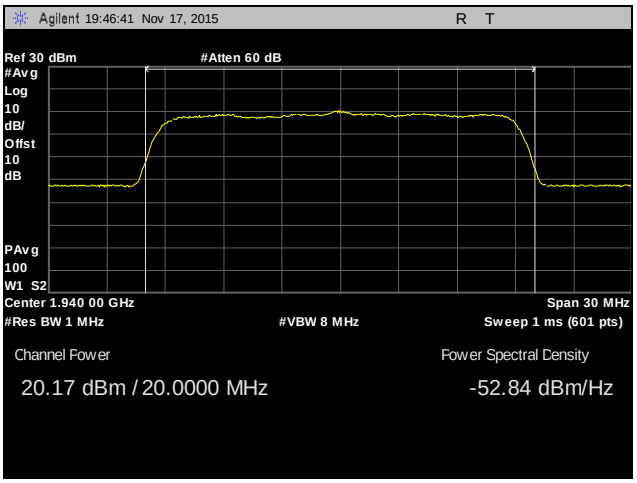


Plot 56. RF Power, LTE Band 2, Mid Channel, 16QAM, 20 MHz, Average, Port 2

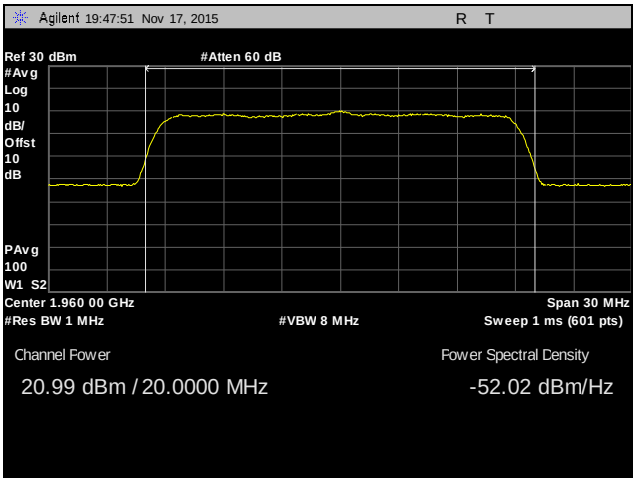


Plot 57. RF Power, LTE Band 2, High Channel, 16QAM, 20 MHz, Average, Port 2

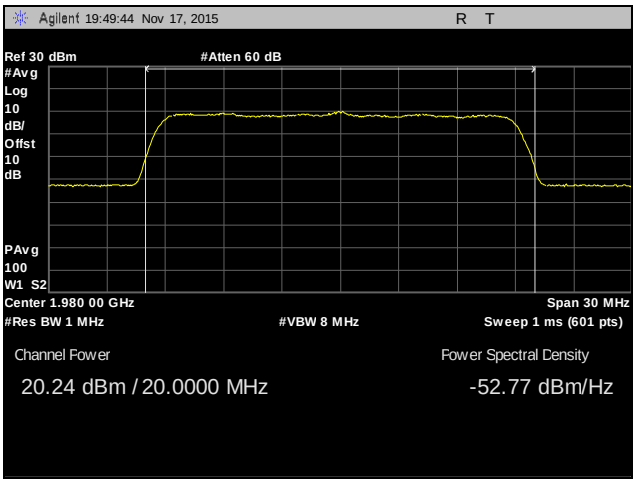
RF Power Output, LTE Band 2, 20 MHz, Average, 64QAM, Port 2



Plot 58. RF Power, LTE Band 2, Low Channel, 64QAM, 20 MHz, Average, Port 2

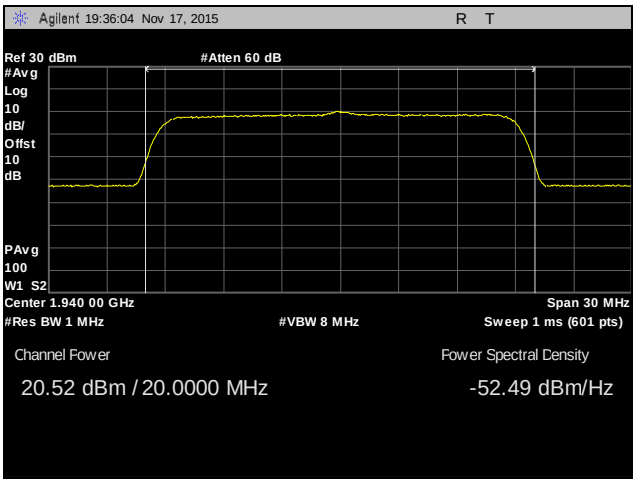


Plot 59. RF Power, LTE Band 2, Mid Channel, 64QAM, 20 MHz, Average, Port 2

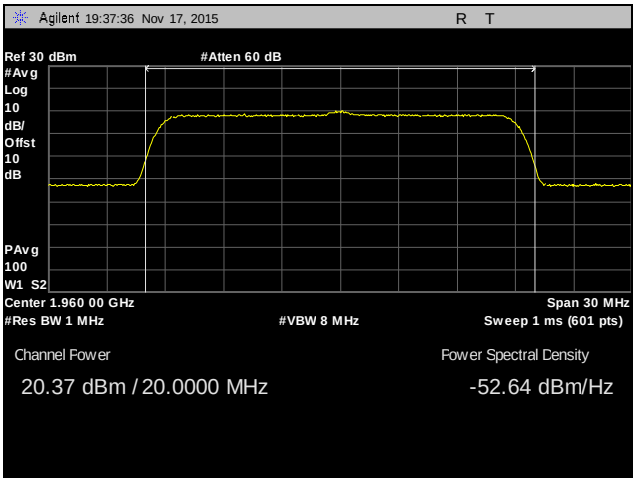


Plot 60. RF Power, LTE Band 2, High Channel, 64QAM, 20 MHz, Average, Port 2

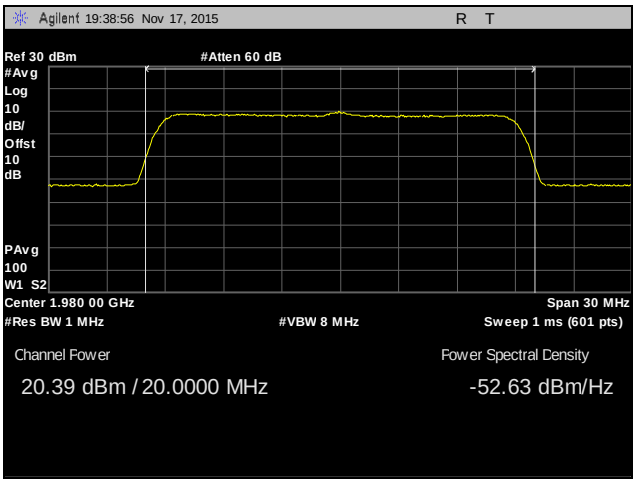
RF Power Output, LTE Band 2, 20 MHz, Average, QPSK, Port 2



Plot 61. RF Power, LTE Band 2, Low Channel, QPSK, 20 MHz, Average, Port 2

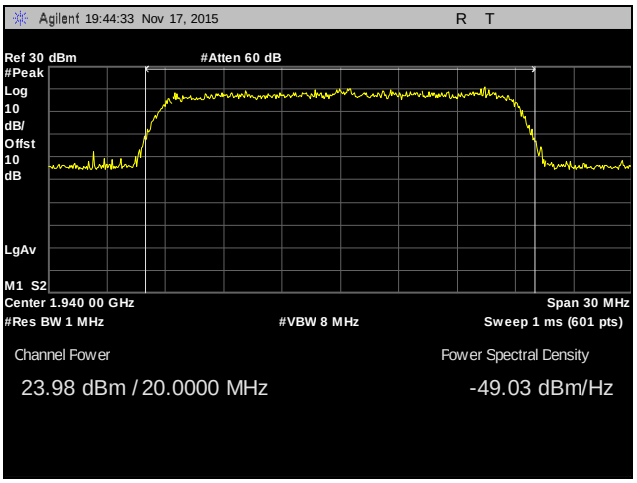


Plot 62. RF Power, LTE Band 2, Mid Channel, QPSK, 20 MHz, Average, Port 2

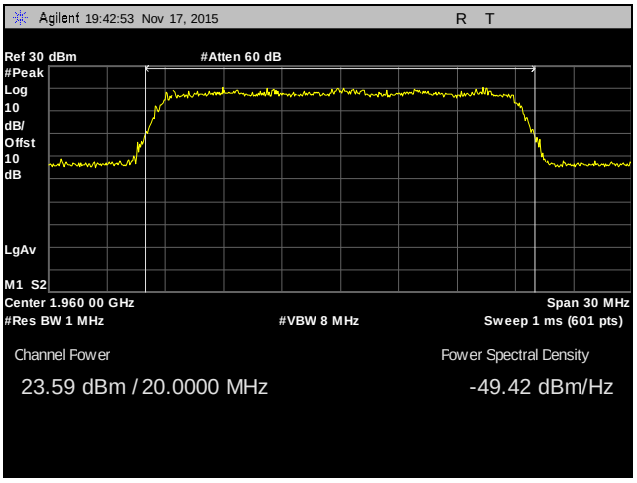


Plot 63. RF Power, LTE Band 2, High Channel, QPSK, 20 MHz, Average, Port 2

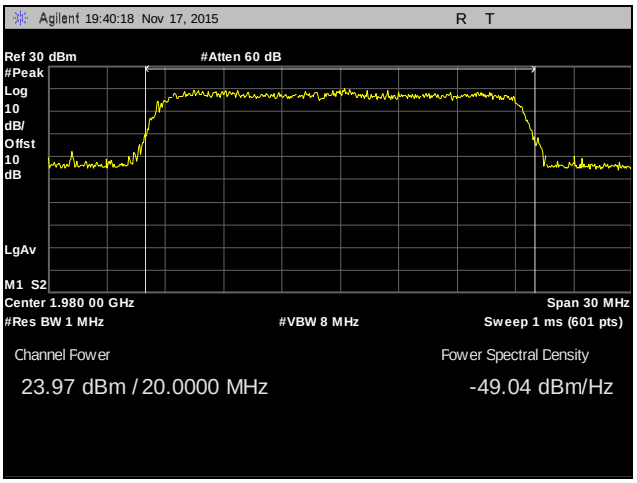
F Power Output, LTE Band 2, 20 MHz, Peak, 16QAM, Port 2



Plot 64. RF Power, LTE Band 2, Low Channel, 16QAM, 20 MHz, Peak, Port 2

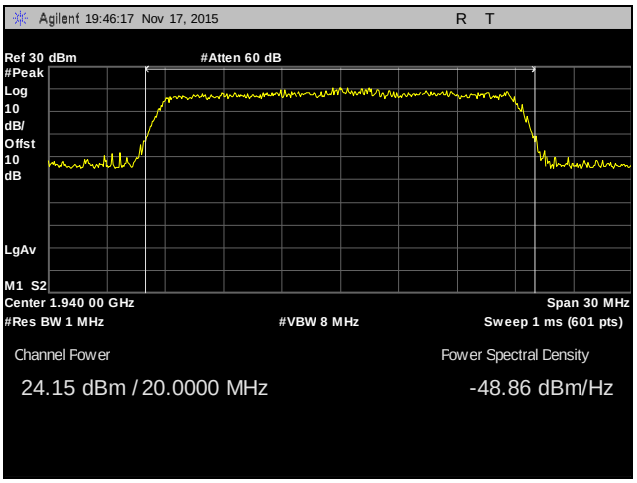


Plot 65. RF Power, LTE Band 2, Mid Channel, 16QAM, 20 MHz, Peak, Port 2

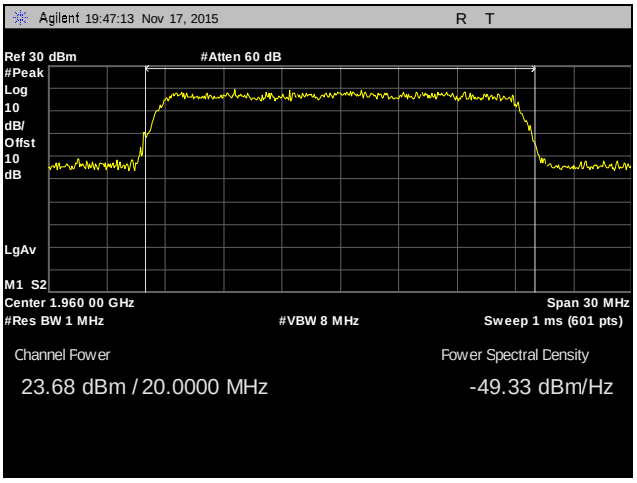


Plot 66. RF Power, LTE Band 2, High Channel, 16QAM, 20 MHz, Peak, Port 2

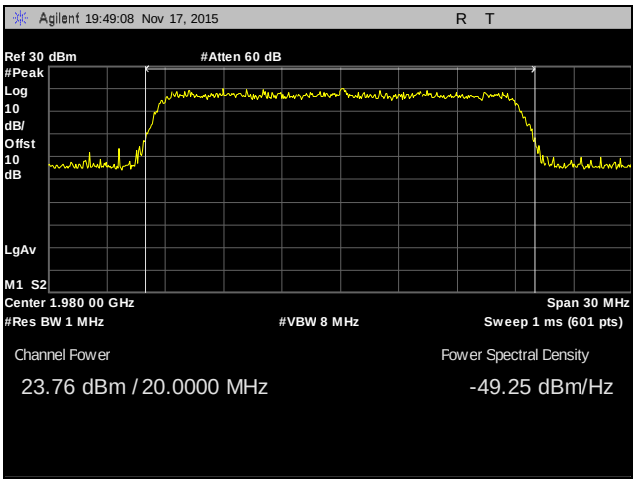
RF Power Output, LTE Band 2, 20 MHz, Peak, 64QAM, Port 2



Plot 67. RF Power, LTE Band 2, Low Channel, 64QAM, 20 MHz, Peak, Port 2

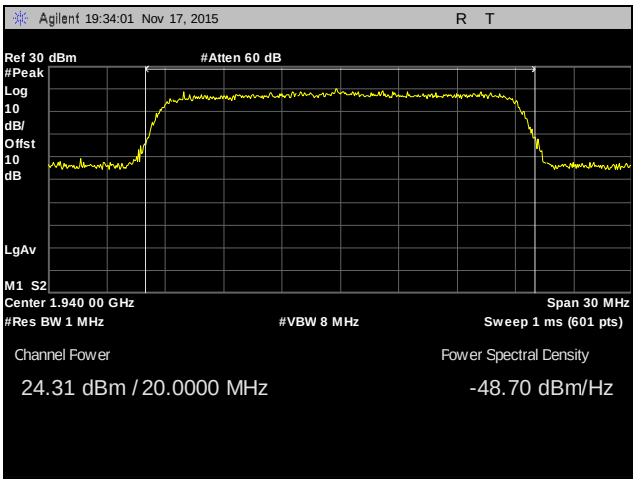


Plot 68. RF Power, LTE Band 2, Mid Channel, 64QAM, 20 MHz, Peak, Port 2

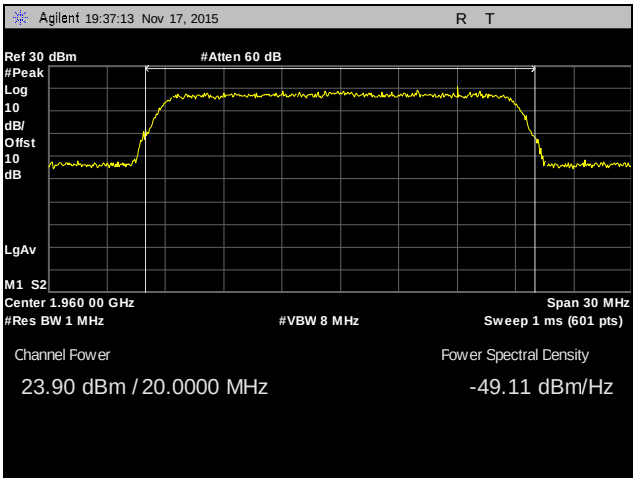


Plot 69. RF Power, LTE Band 2, High Channel, 64QAM, 20 MHz, Peak, Port 2

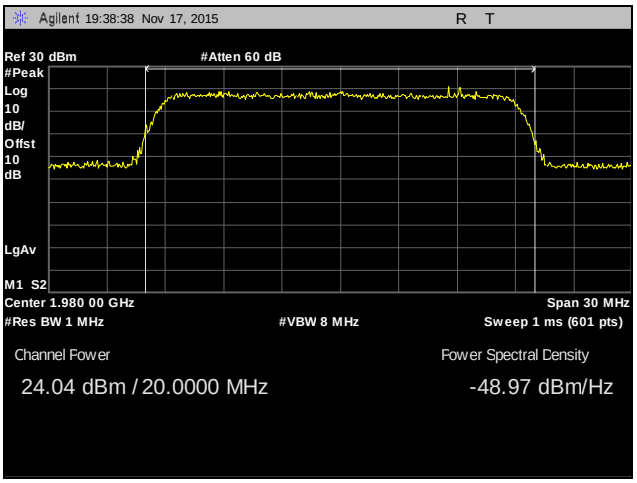
RF Power Output, LTE Band 2, 20 MHz, Peak, QPSK, Port 2



Plot 70. RF Power, LTE Band 2, Low Channel, QPSK, 20 MHz, Peak, Port 2

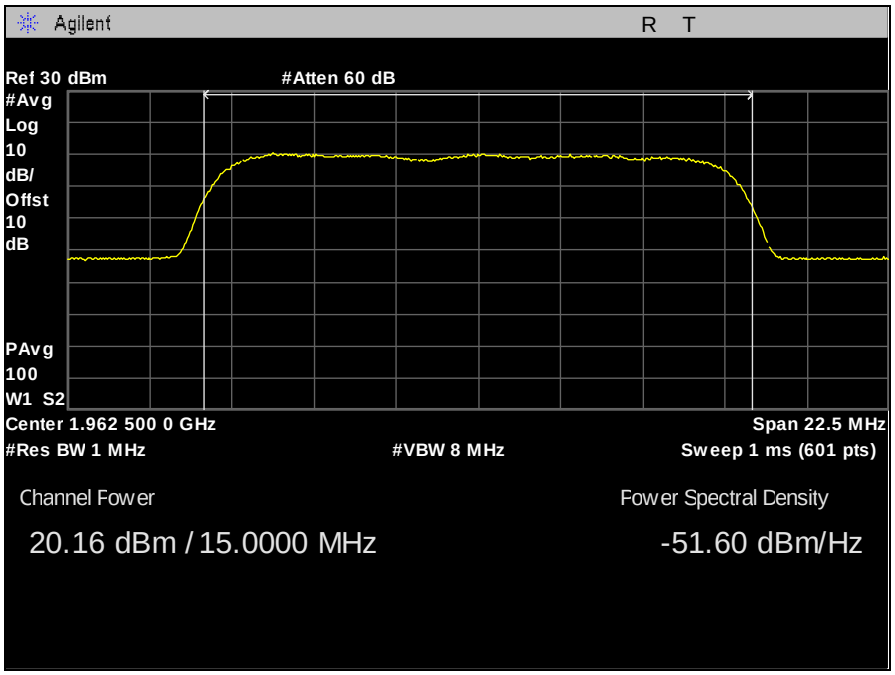


Plot 71. RF Power, LTE Band 2, Mid Channel, QPSK, 20 MHz, Peak, Port 2

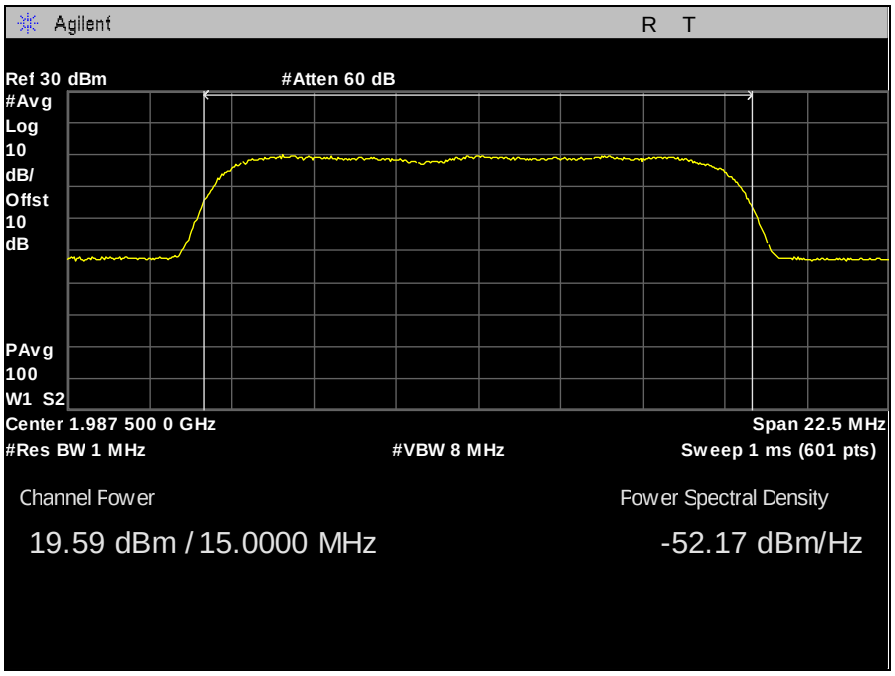


Plot 72. RF Power, LTE Band 2, High Channel, QPSK, 20 MHz, Peak, Port 2

RF Power Output, LTE Band 25, 15 MHz, Average, 16QAM, Port 1

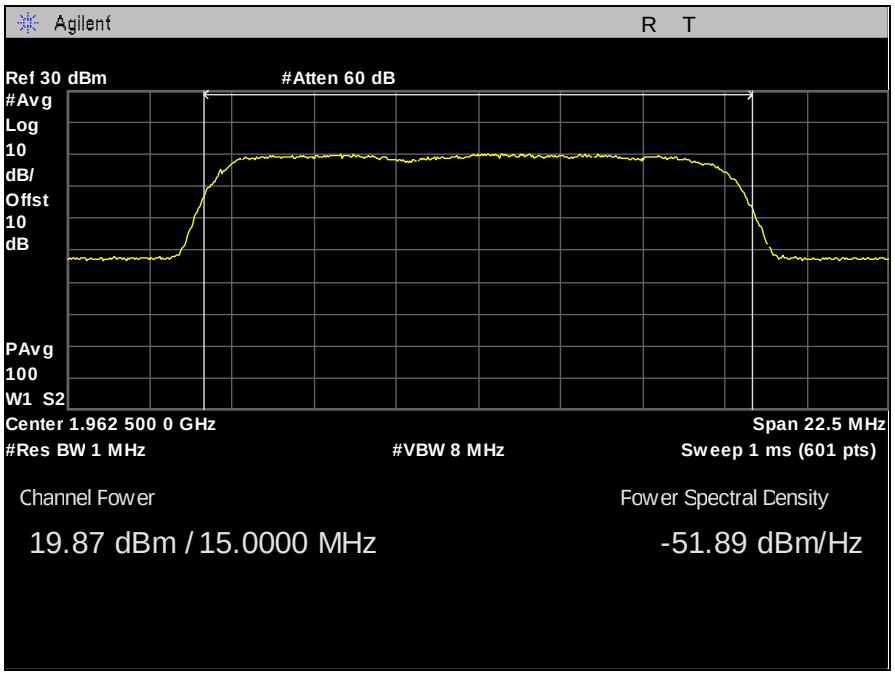


Plot 73. RF Power, LTE Band 25, Mid Channel, 16QAM, 15 MHz, Average, Port 1

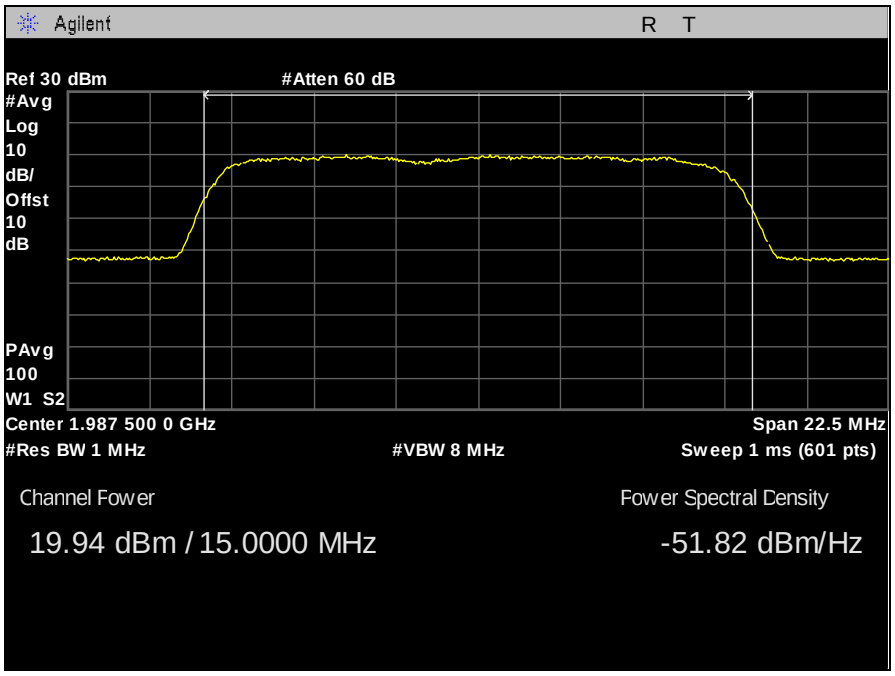


Plot 74. RF Power, LTE Band 25, High Channel, 16QAM, 15 MHz, Average, Port 1

RF Power Output, LTE Band 25, 15 MHz, Average, 64QAM, Port 1

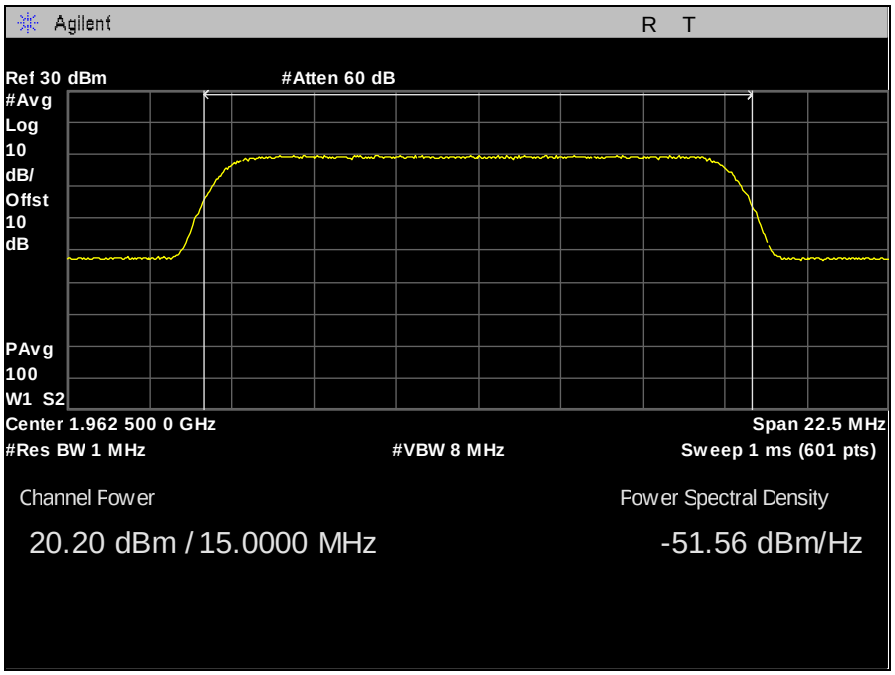


Plot 75. RF Power, LTE Band 25, Mid Channel, 64QAM, 15 MHz, Average, Port 1

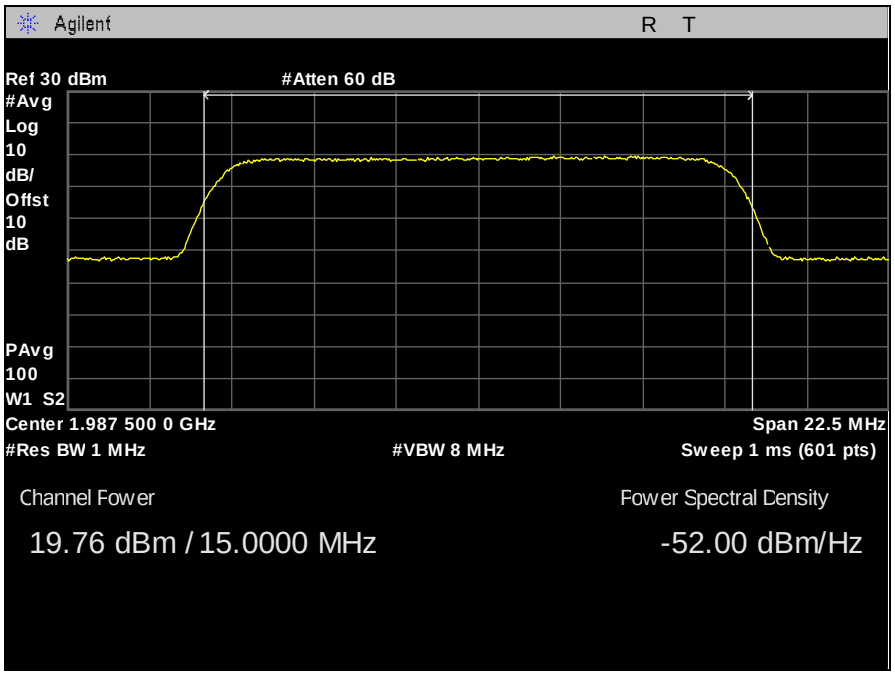


Plot 76. RF Power, LTE Band 25, High Channel, 64QAM, 15 MHz, Average, Port 1

RF Power Output, LTE Band 25, 15 MHz, Average, QPSK, Port 1

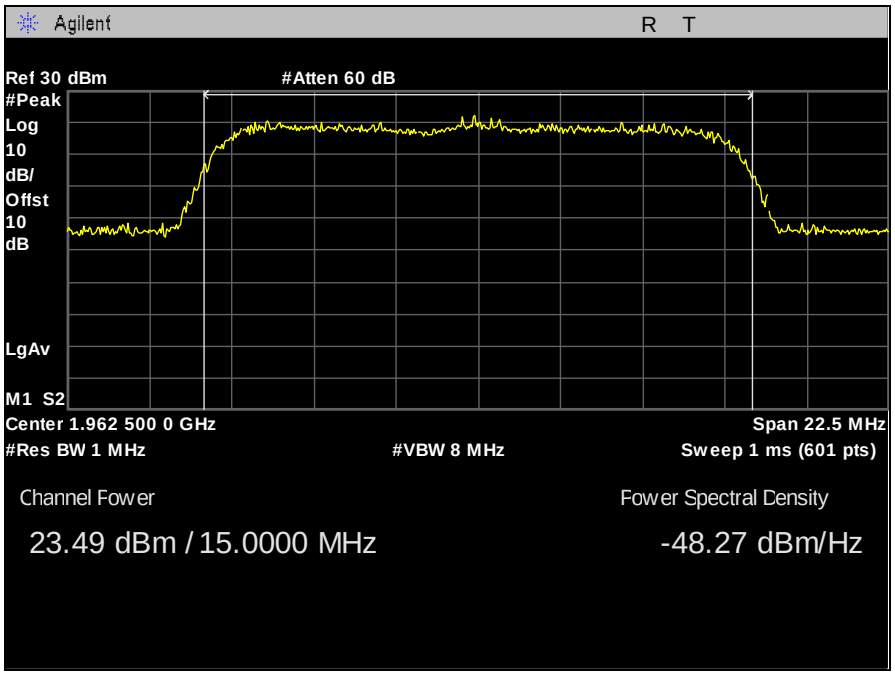


Plot 77. RF Power, LTE Band 25, Mid Channel, QPSK, 15 MHz, Average, Port 1

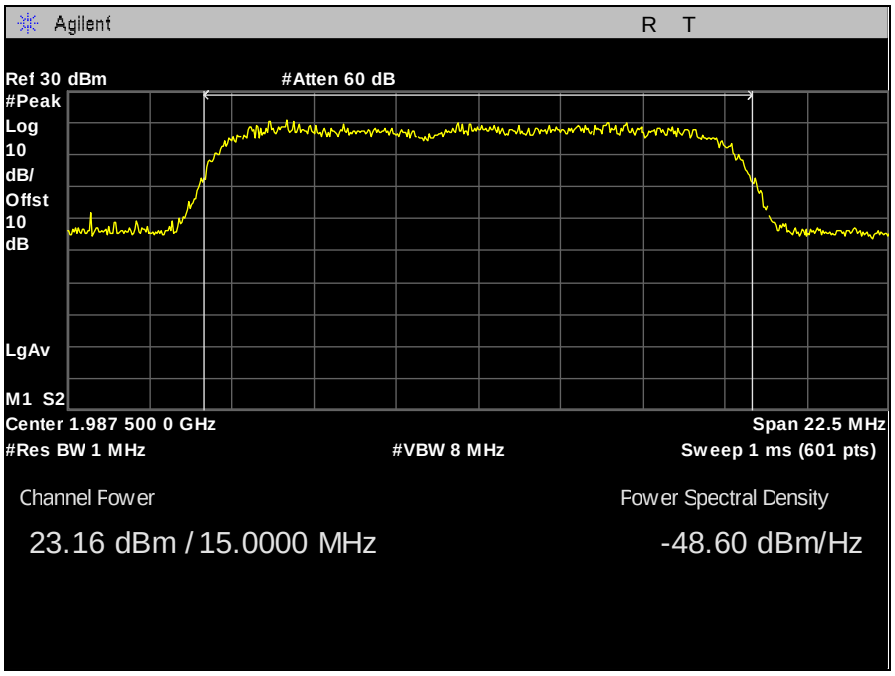


Plot 78. RF Power, LTE Band 25, High Channel, QPSK, 15 MHz, Average, Port 1

RF Power Output, LTE Band 25, 15 MHz, Peak, 16QAM, Port 1

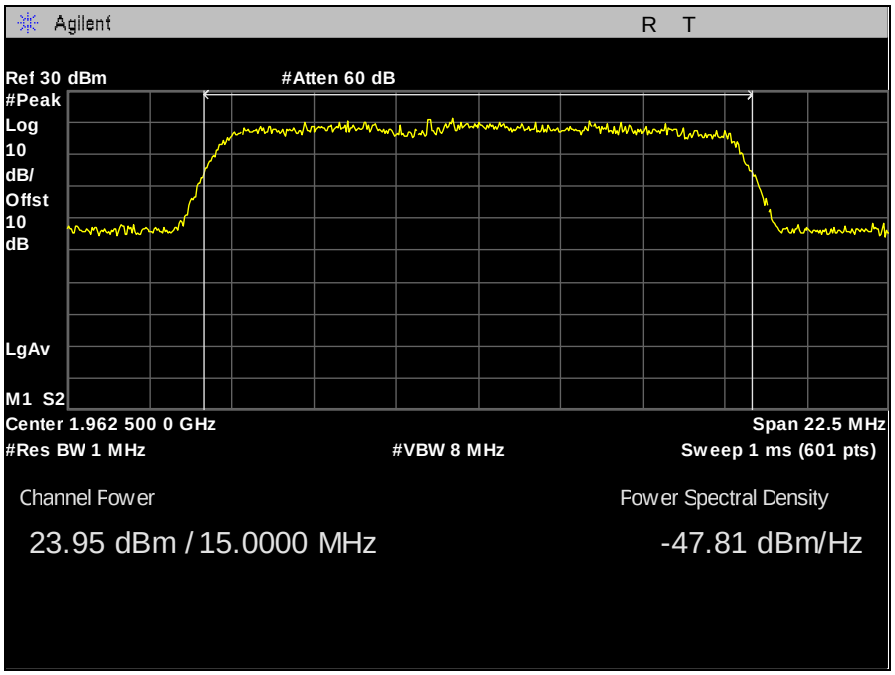


Plot 79. RF Power, LTE Band 25, Mid Channel, 16QAM, 15 MHz, Peak, Port 1

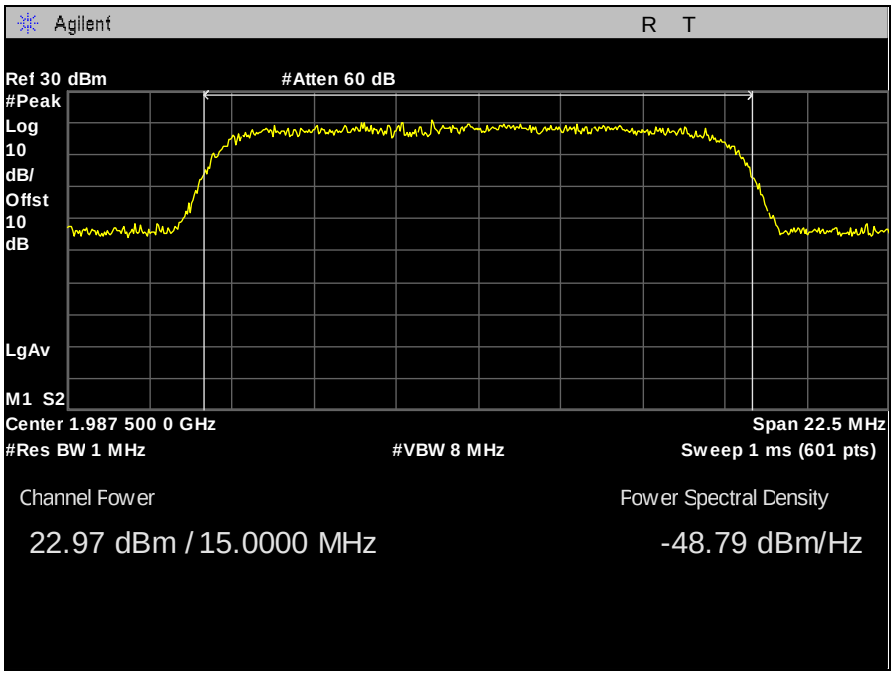


Plot 80. RF Power, LTE Band 25, High Channel, 16QAM, 15 MHz, Peak, Port 1

RF Power Output, LTE Band 25, 15 MHz, Peak, 64QAM, Port 1

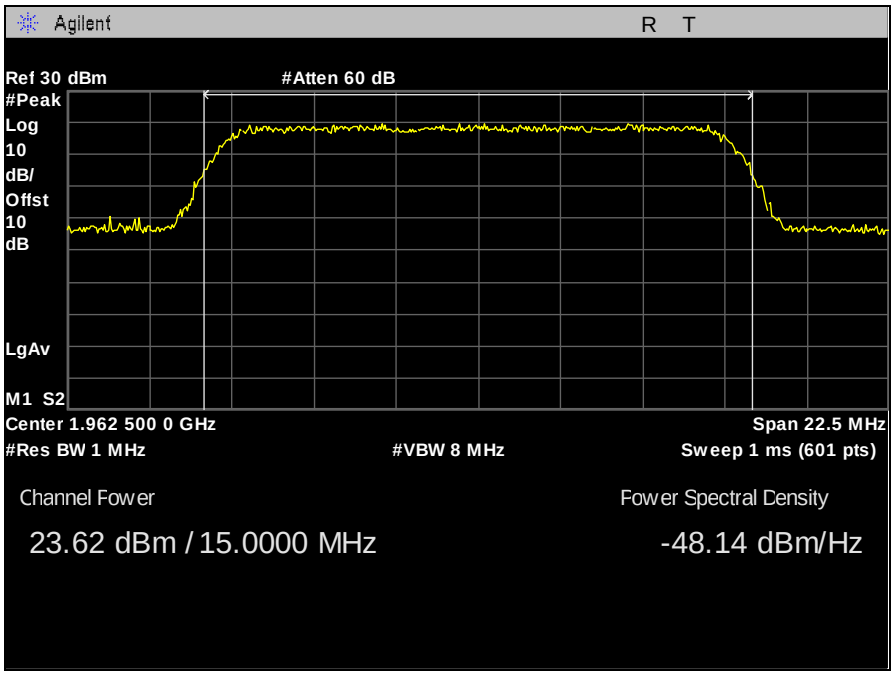


Plot 81. RF Power, LTE Band 25, Mid Channel, 64QAM, 15 MHz, Peak, Port 1

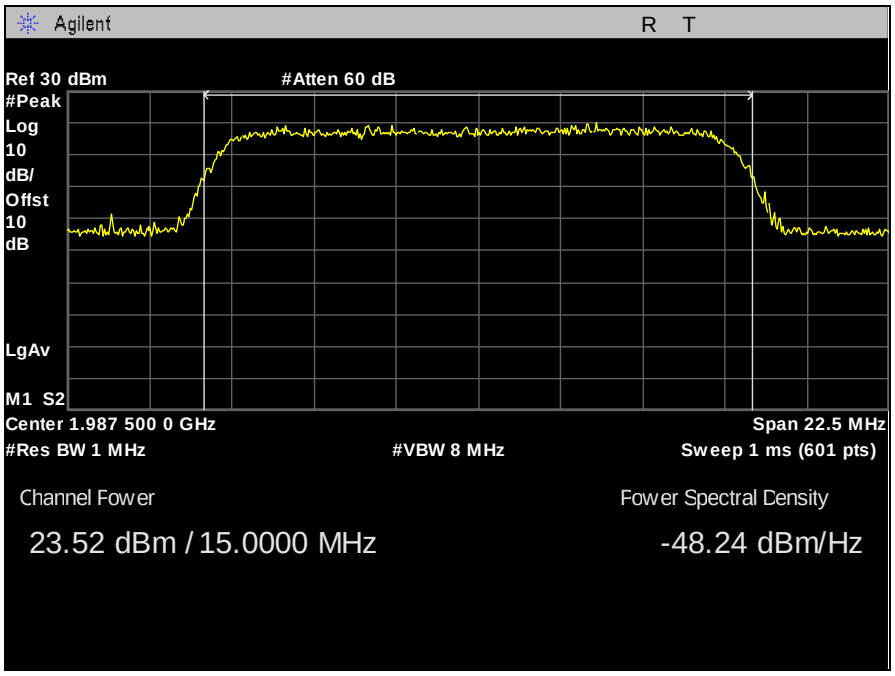


Plot 82. RF Power, LTE Band 25, High Channel, 64QAM, 15 MHz, Peak, Port 1

RF Power Output, LTE Band 25, 15 MHz, Peak, QPSK, Port 1

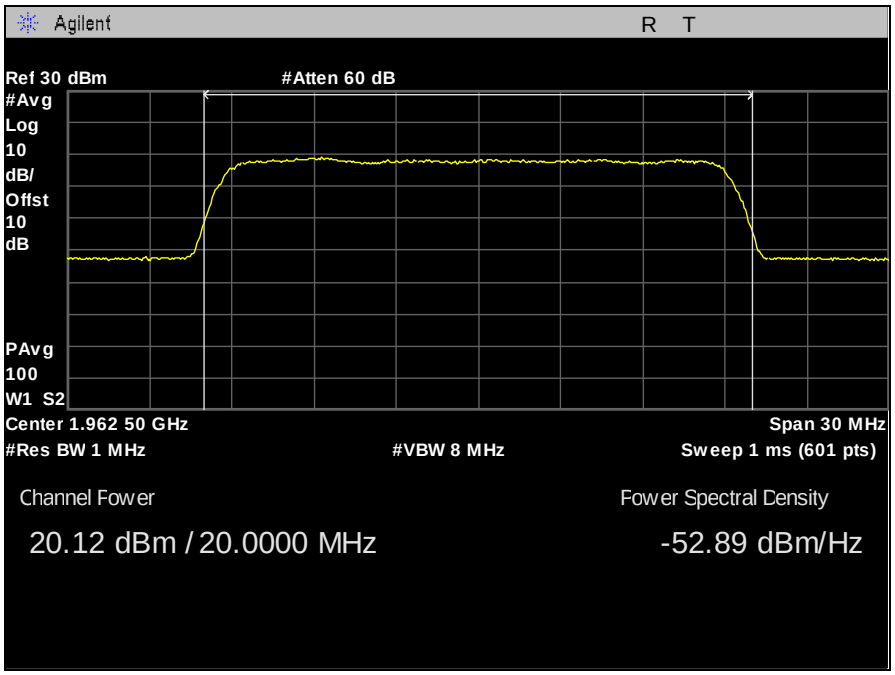


Plot 83. RF Power, LTE Band 25, Mid Channel, QPSK, 15 MHz, Peak, Port 1

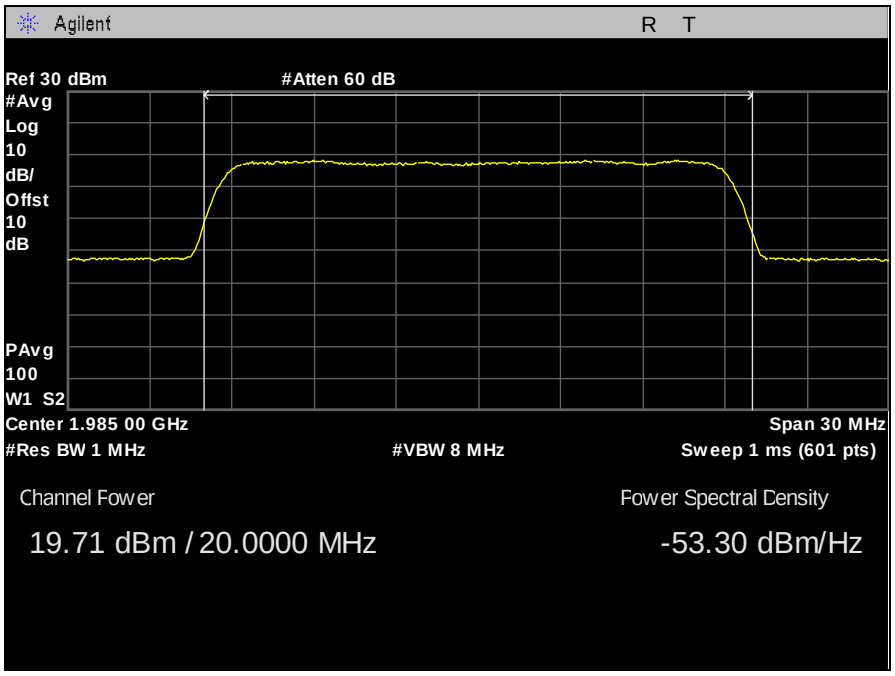


Plot 84. RF Power, LTE Band 25, High Channel, QPSK, 15 MHz, Peak, Port 1

RF Power Output, LTE Band 25, 20 MHz, Average, 16QAM, Port 1

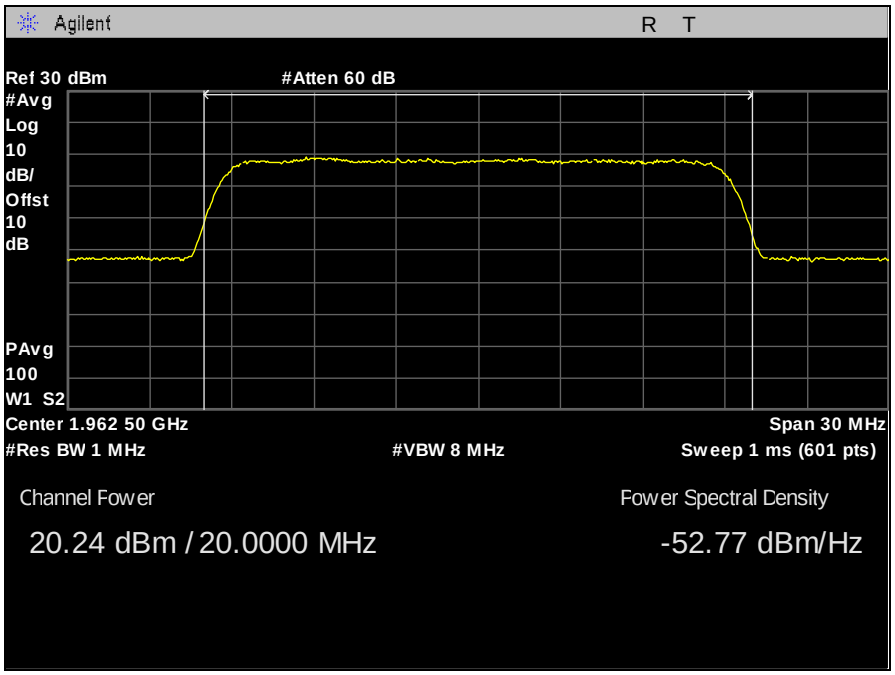


Plot 85. RF Power, LTE Band 25, Mid Channel, 16QAM, 20 MHz, Average, Port 1

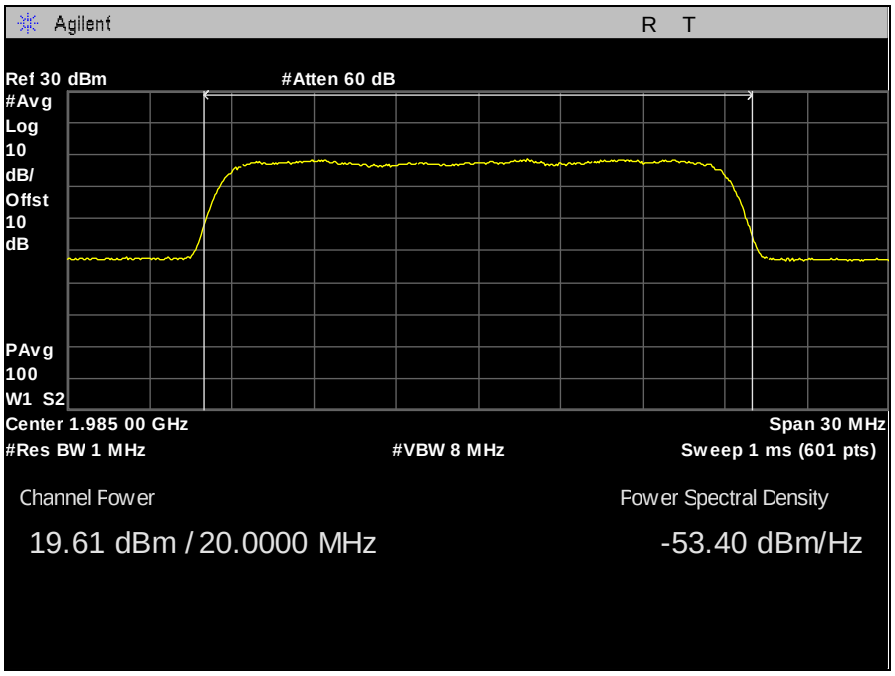


Plot 86. RF Power, LTE Band 25, High Channel, 16QAM, 20 MHz, Average, Port 1

RF Power Output, LTE Band 25, 20 MHz, Average, 64QAM, Port 1

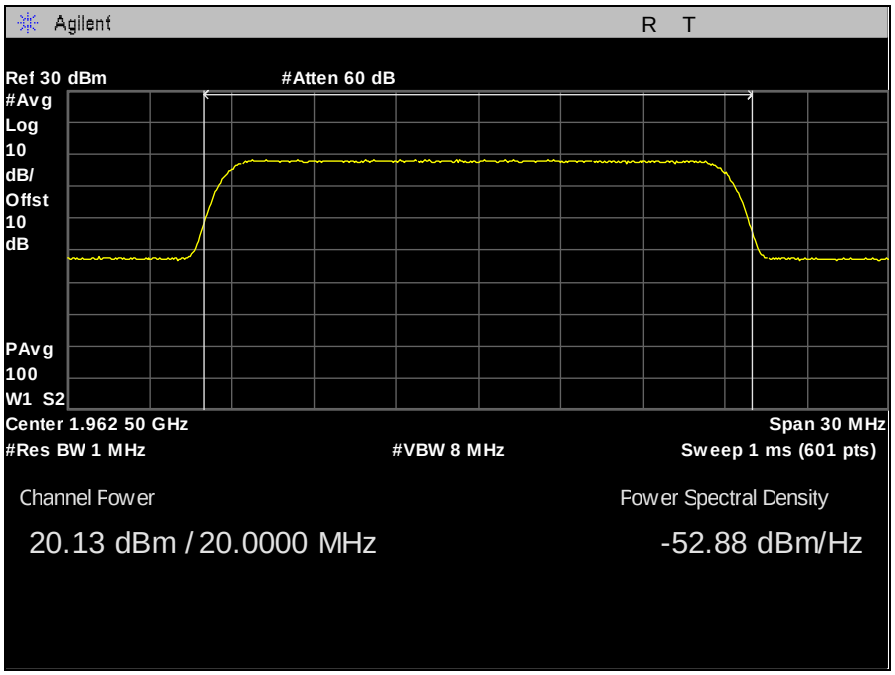


Plot 87. RF Power, LTE Band 25, Mid Channel, 64QAM, 20 MHz, Average, Port 1

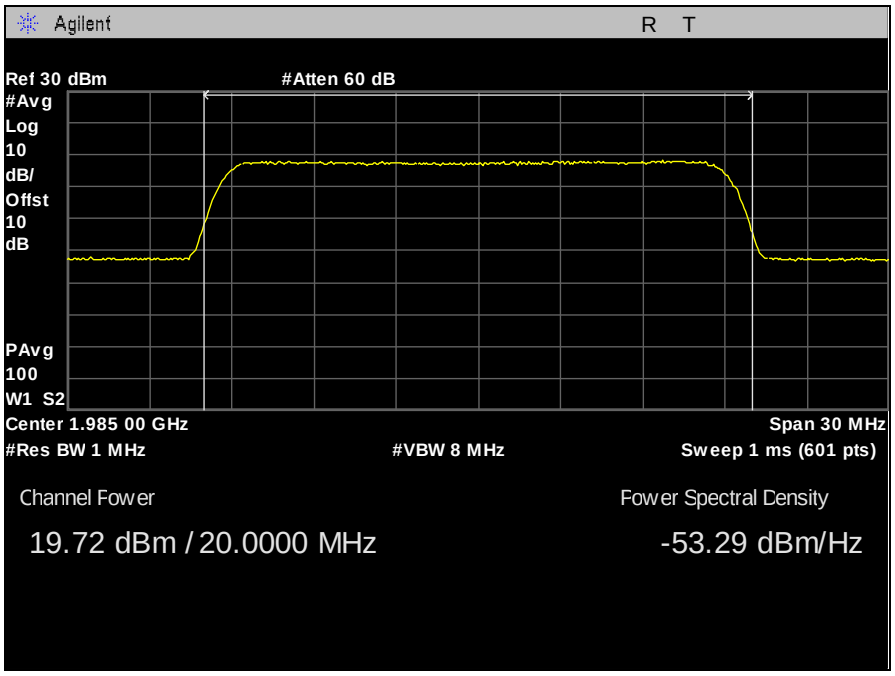


Plot 88. RF Power, LTE Band 25, High Channel, 64QAM, 20 MHz, Average, Port 1

RF Power Output, LTE Band 25, 20 MHz, Average, QPSK, Port 1

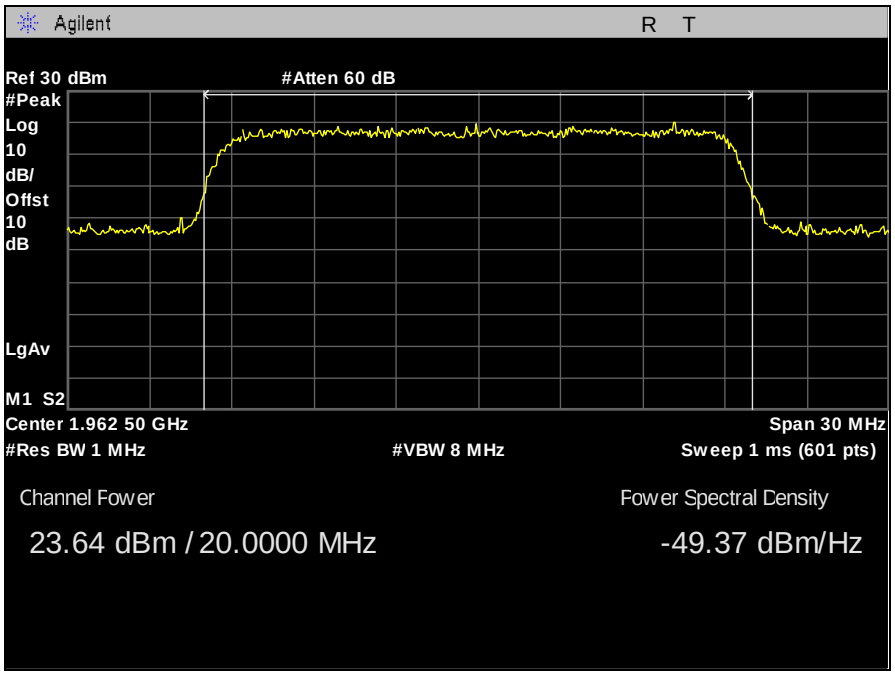


Plot 89. RF Power, LTE Band 25, Mid Channel, QPSK, 20 MHz, Average, Port 1

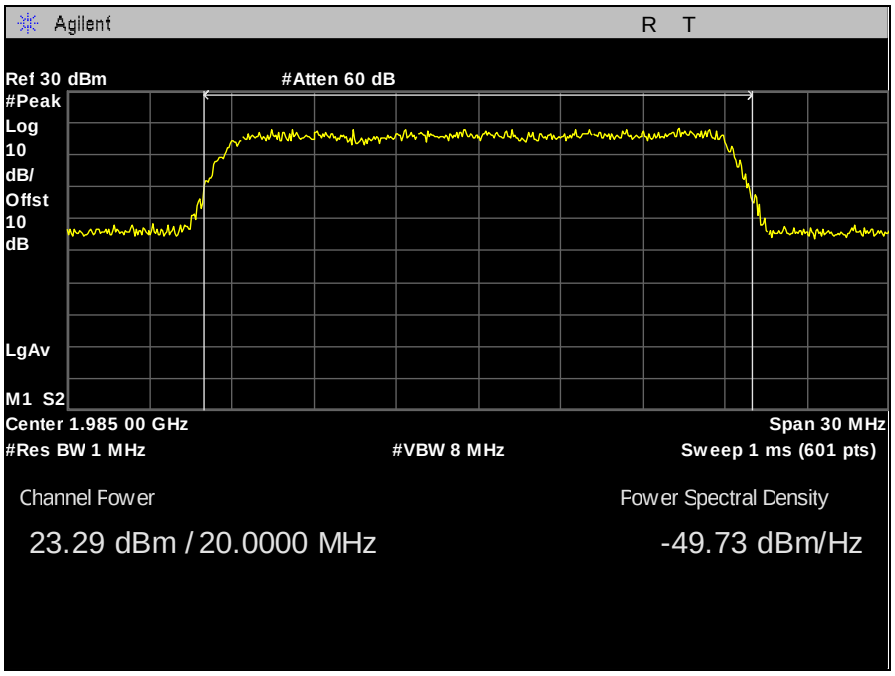


Plot 90. RF Power, LTE Band 25, High Channel, QPSK, 20 MHz, Average, Port 1

RF Power Output, LTE Band 25, 20 MHz, Peak, 16QAM, Port 1

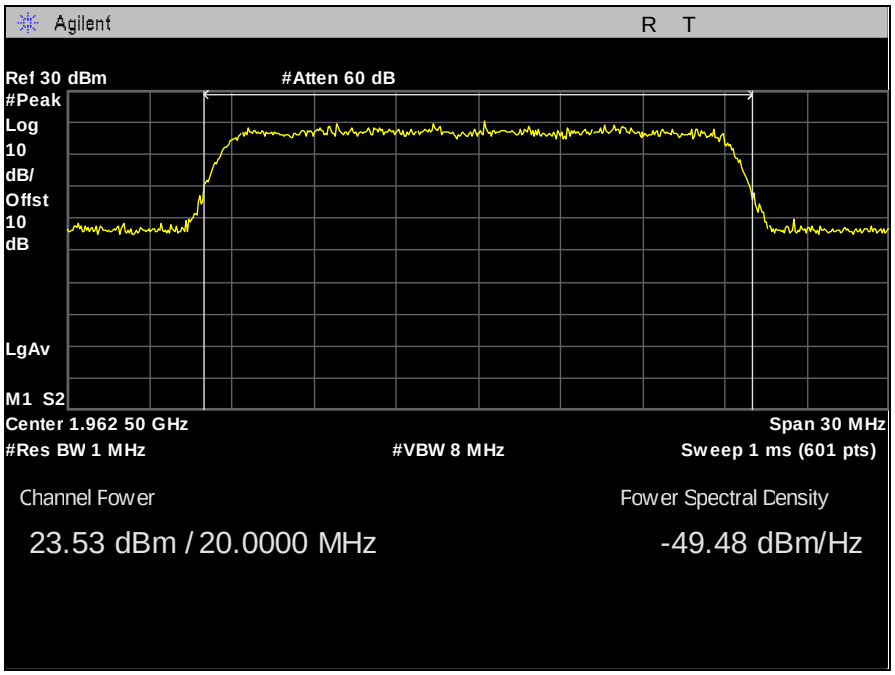


Plot 91. RF Power, LTE Band 25, Mid Channel, 16QAM, 20 MHz, Peak, Port 1

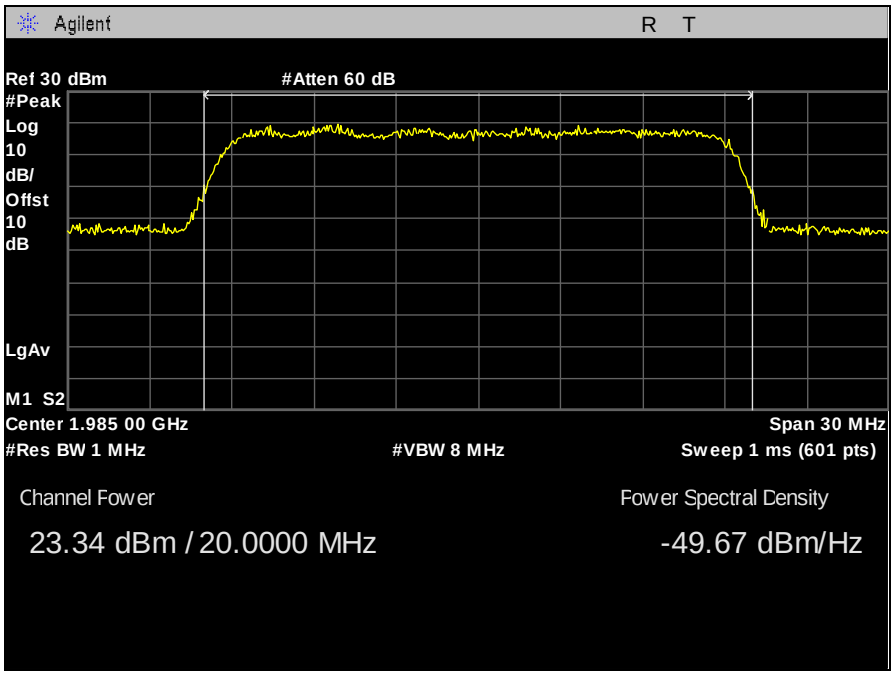


Plot 92. RF Power, LTE Band 25, High Channel, 16QAM, 20 MHz, Peak, Port 1

RF Power Output, LTE Band 25, 20 MHz, Peak, 64QAM, Port 1

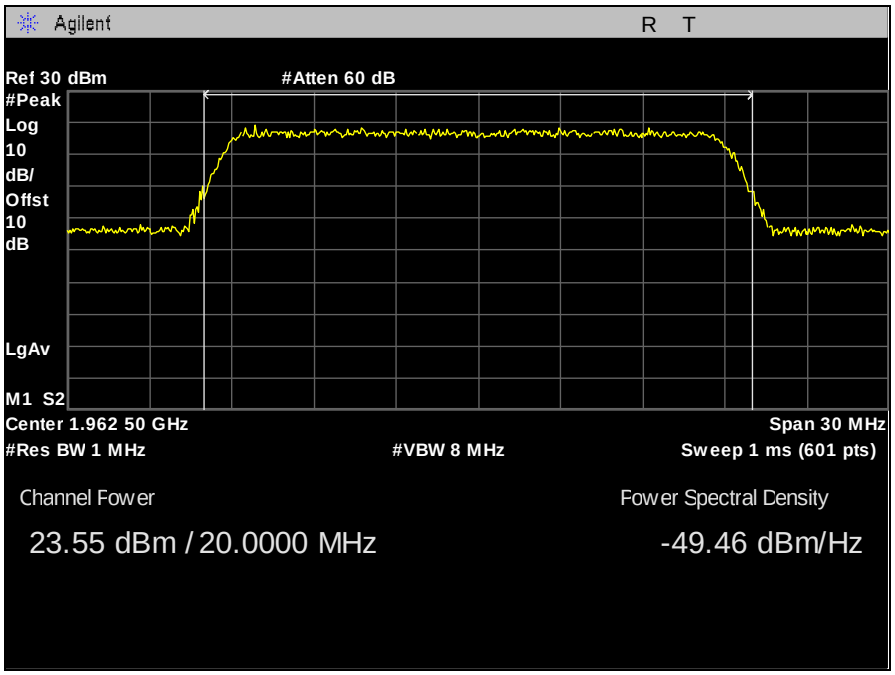


Plot 93. RF Power, LTE Band 25, Mid Channel, 64QAM, 20 MHz, Peak, Port 1

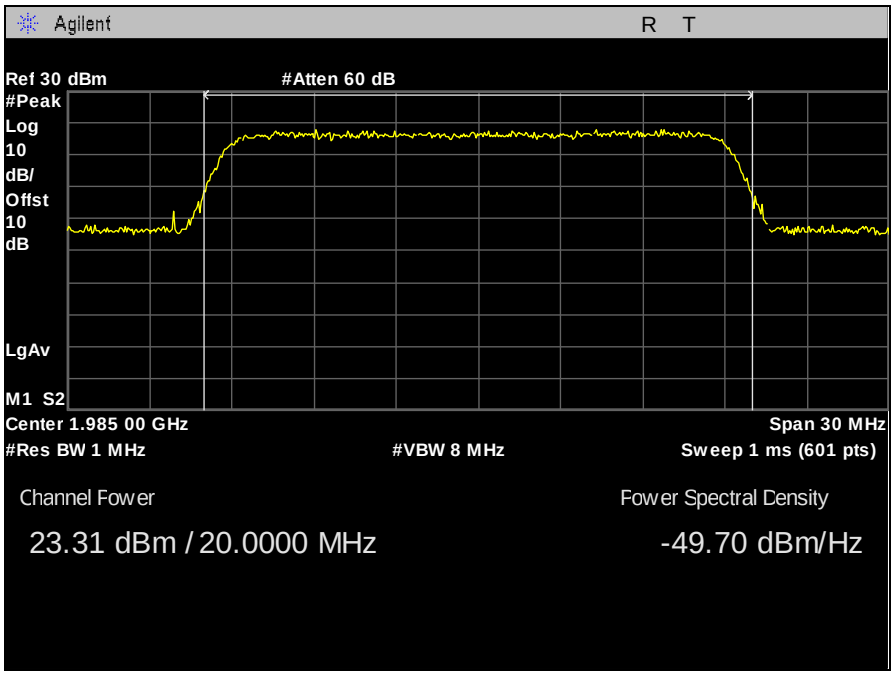


Plot 94. RF Power, LTE Band 25, High Channel, 64QAM, 20 MHz, Peak, Port 1

RF Power Output, LTE Band 25, 20 MHz, Peak, QPSK, Port 1

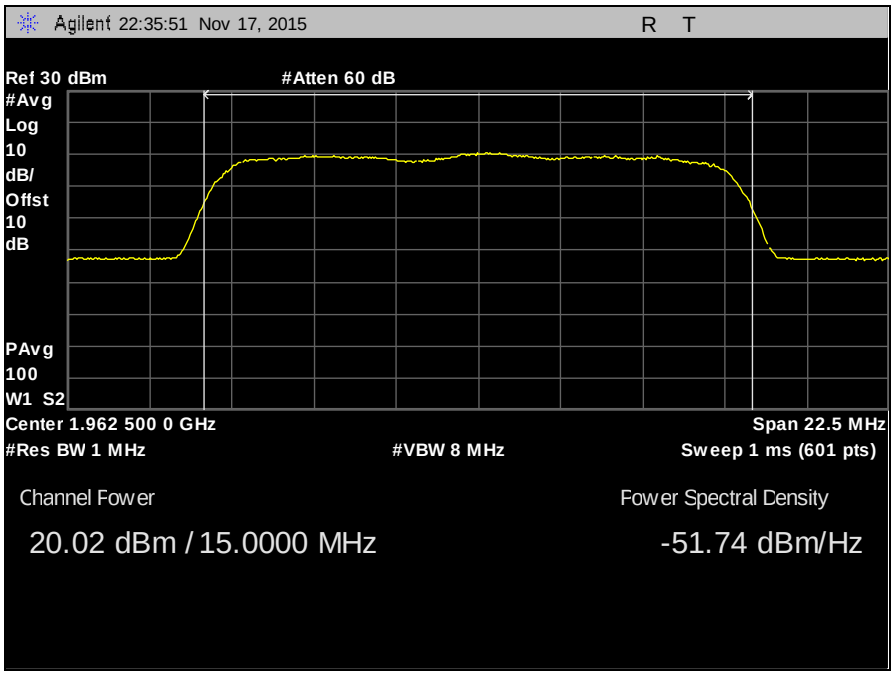


Plot 95. RF Power, LTE Band 25, Mid Channel, QPSK, 20 MHz, Peak, Port 1

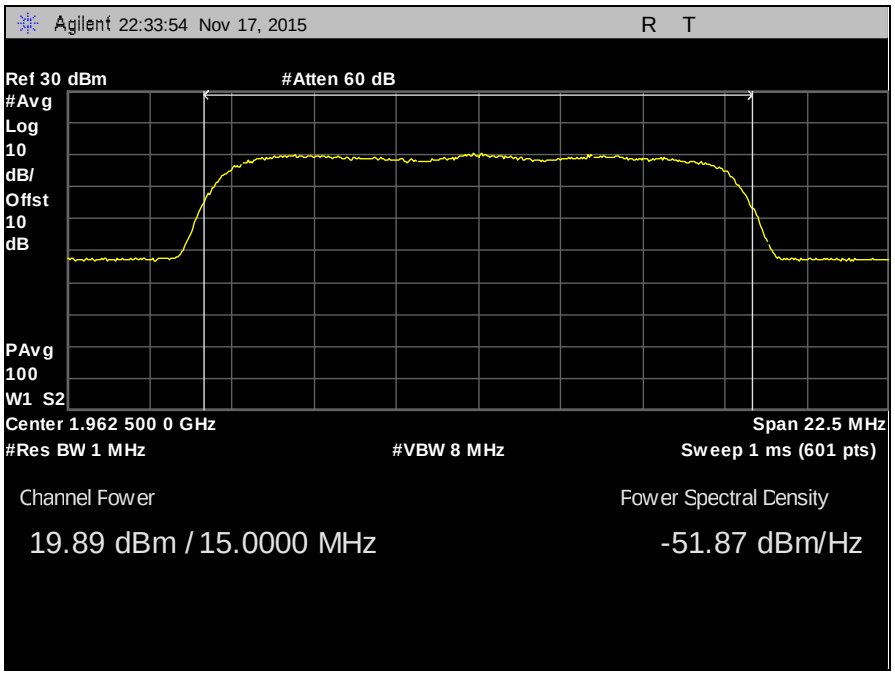


Plot 96. RF Power, LTE Band 25, High Channel, QPSK, 20 MHz, Peak, Port 1

RF Power Output, LTE Band 25, 15 MHz, Average, 16QAM, Port 2

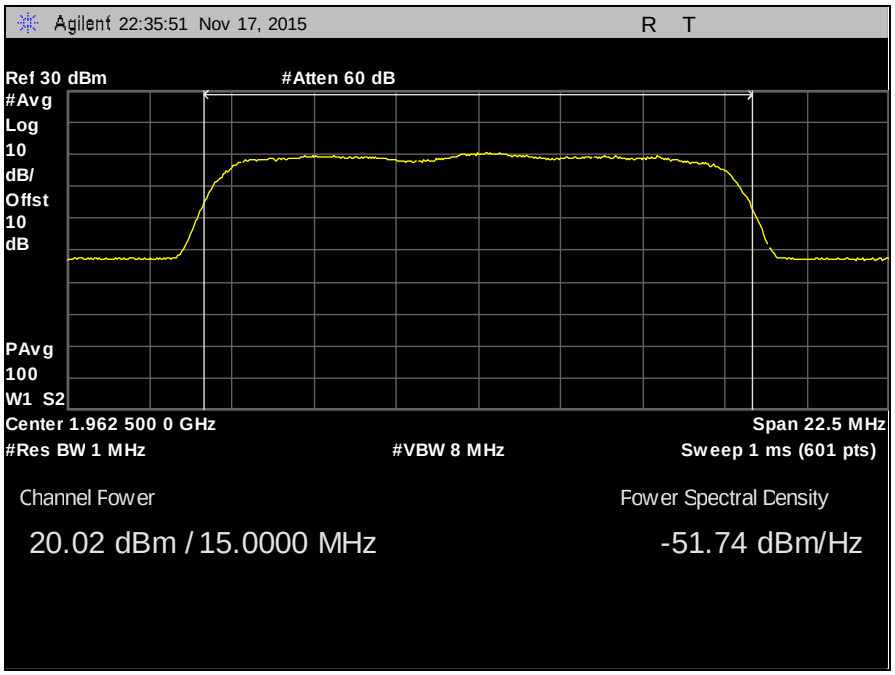


Plot 97. RF Power, LTE Band 25, Mid Channel, 16QAM, 15 MHz, Average, Port 2

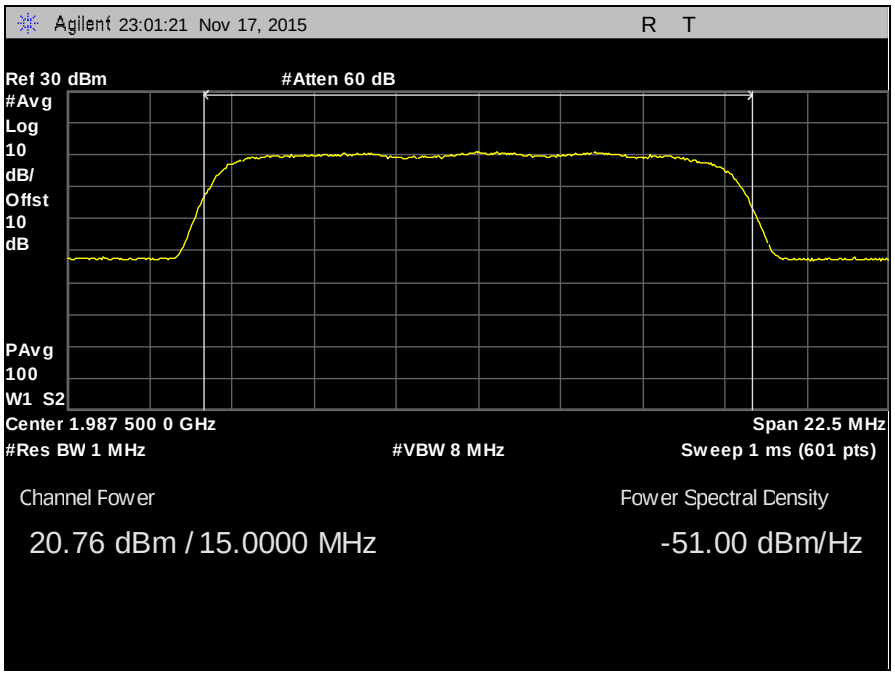


Plot 98. RF Power, LTE Band 25, High Channel, 16QAM, 15 MHz, Average, Port 2

RF Power Output, LTE Band 25, 15 MHz, Average, 64QAM, Port 2

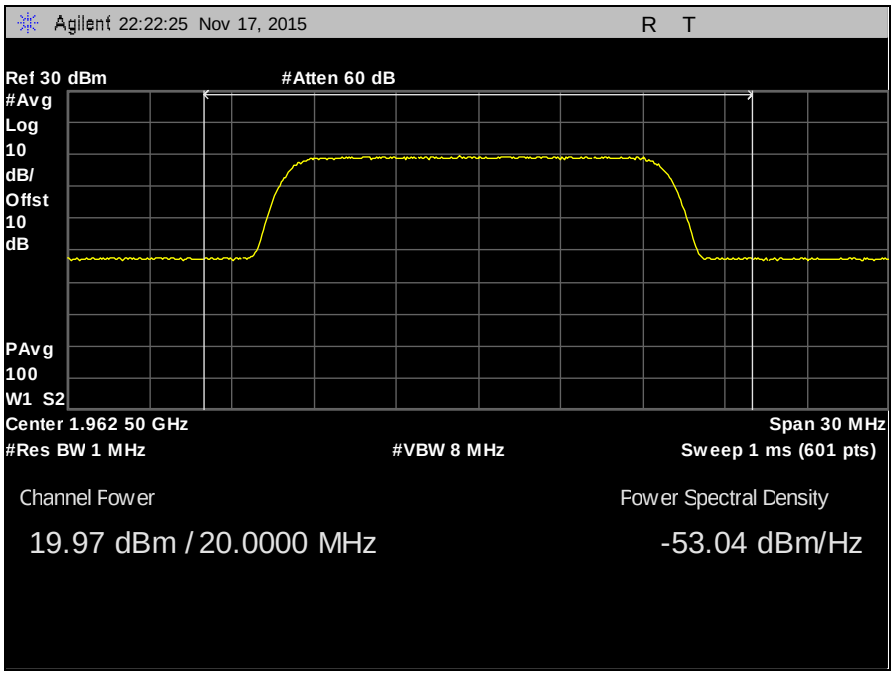


Plot 99. RF Power, LTE Band 25, Mid Channel, 64QAM, 15 MHz, Average, Port 2

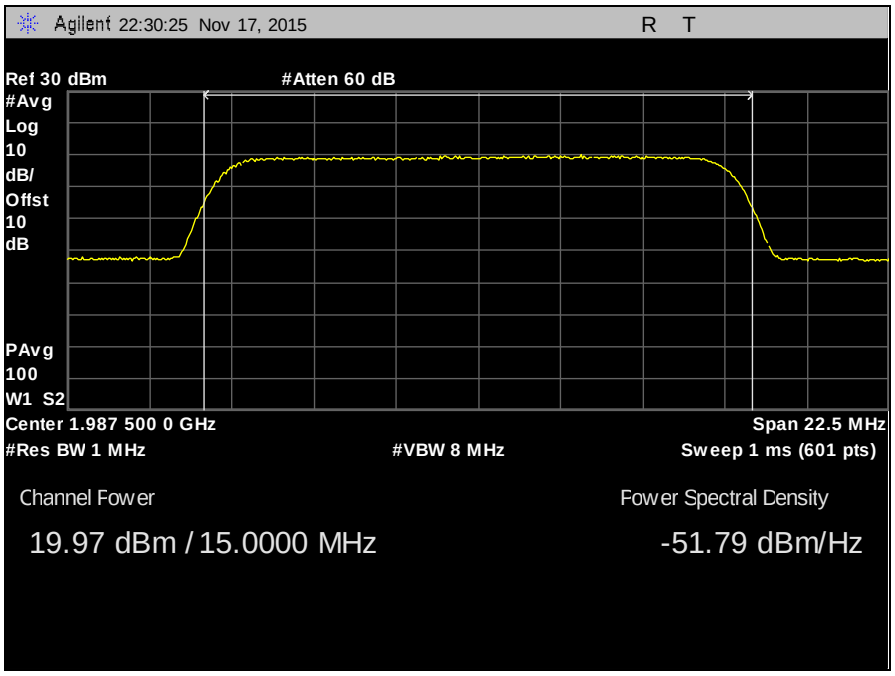


Plot 100. RF Power, LTE Band 25, High Channel, 64QAM, 15 MHz, Average, Port 2

RF Power Output, LTE Band 25, 15 MHz, Average, QPSK, Port 2

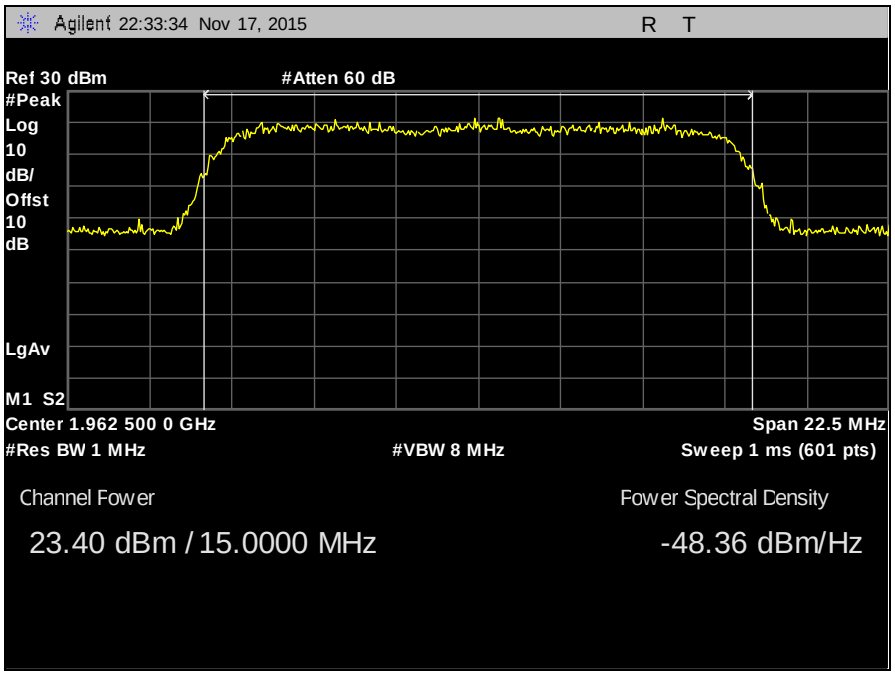


Plot 101. RF Power, LTE Band 25, Mid Channel, QPSK, 15 MHz, Average, Port 2

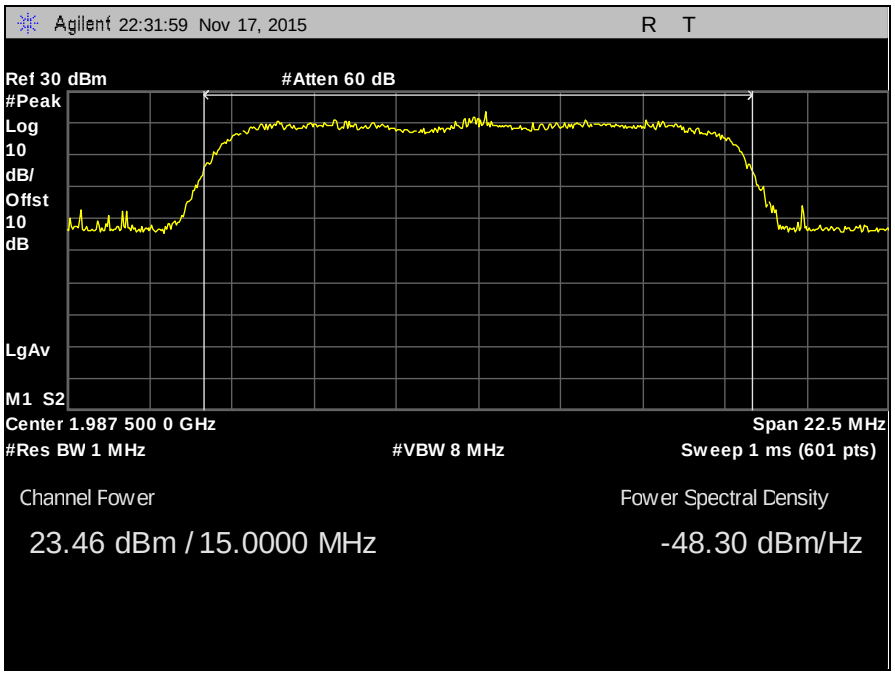


Plot 102. RF Power, LTE Band 25, High Channel, QPSK, 15 MHz, Average, Port 2

RF Power Output, LTE Band 25, 15 MHz, Peak, 16QAM, Port 2

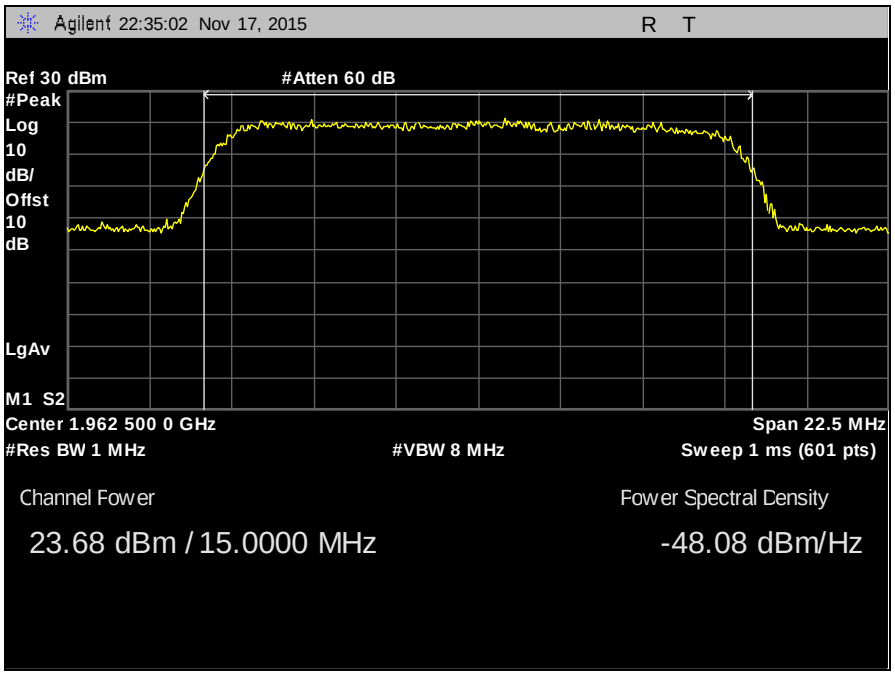


Plot 103. RF Power, LTE Band 25, Mid Channel, 16QAM, 15 MHz, Peak, Port 2

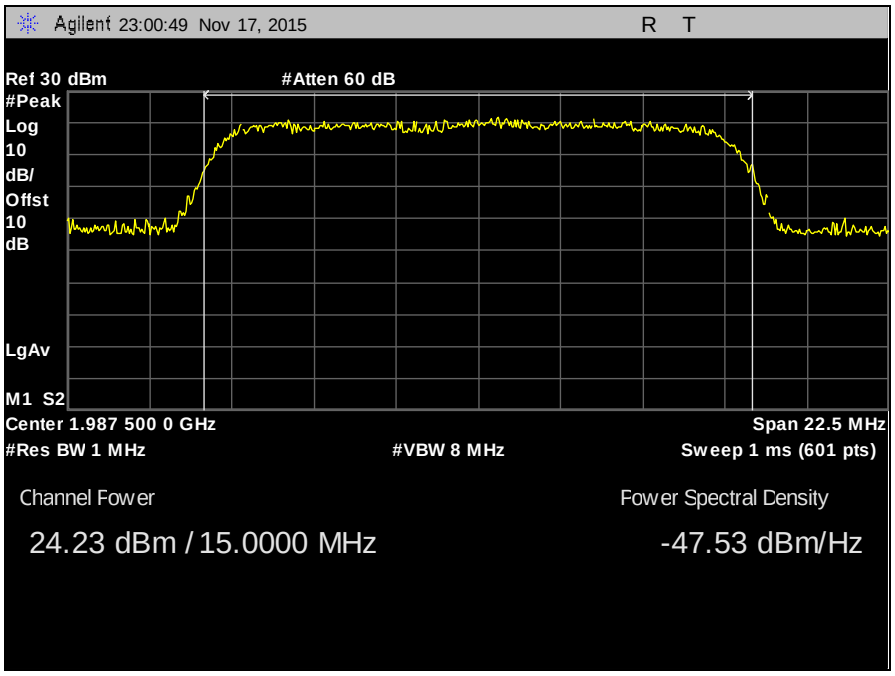


Plot 104. RF Power, LTE Band 25, High Channel, 16QAM, 15 MHz, Peak, Port 2

RF Power Output, LTE Band 25, 15 MHz, Peak, 64QAM, Port 2

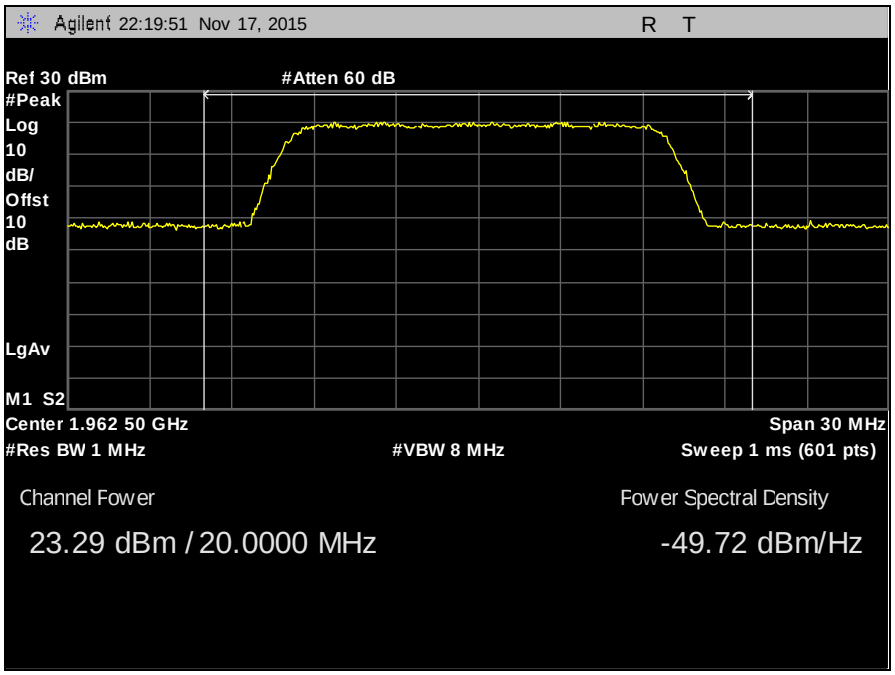


Plot 105. RF Power, LTE Band 25, Mid Channel, 64QAM, 15 MHz, Peak, Port 2

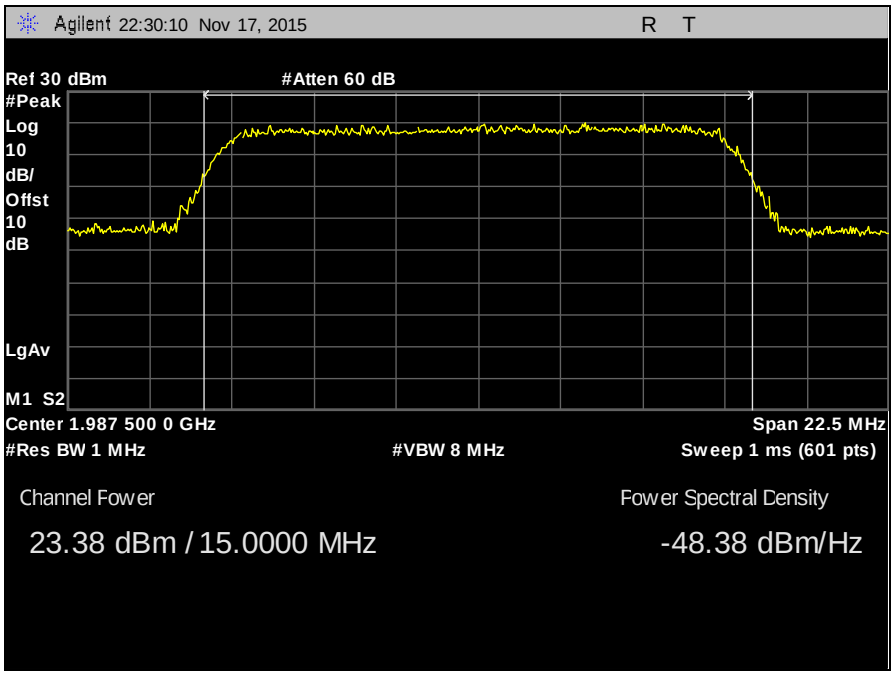


Plot 106. RF Power, LTE Band 25, High Channel, 64QAM, 15 MHz, Peak, Port 2

RF Power Output, LTE Band 25, 15 MHz, Peak, QPSK, Port 2

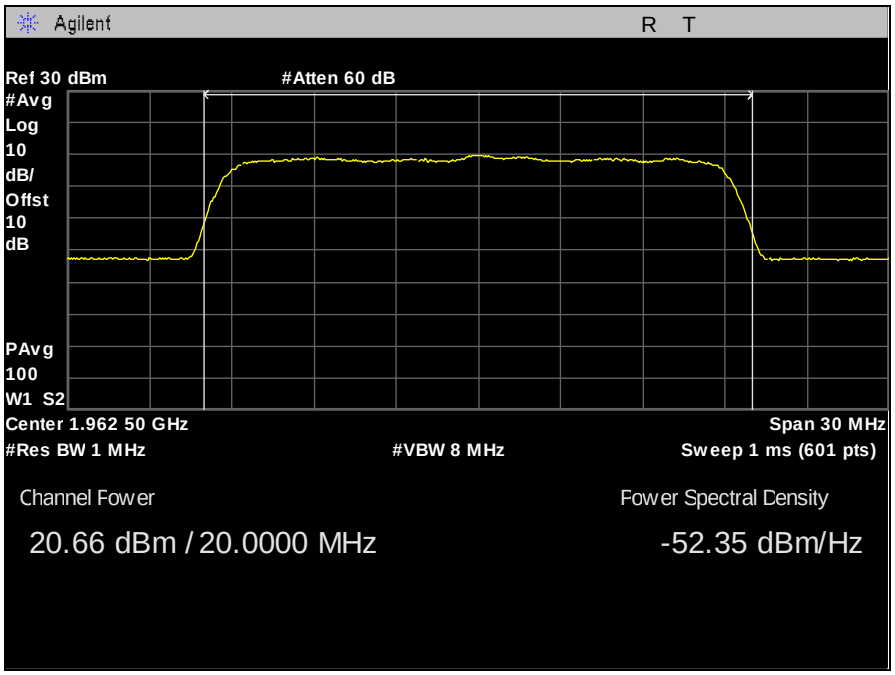


Plot 107. RF Power, LTE Band 25, Mid Channel, QPSK, 15 MHz, Peak, Port 2

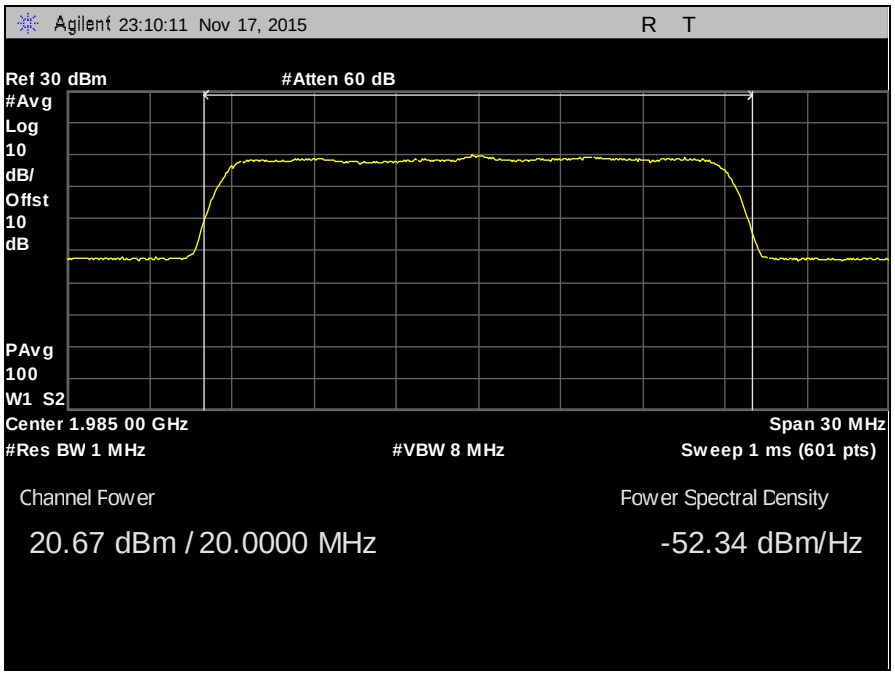


Plot 108. RF Power, LTE Band 25, High Channel, QPSK, 15 MHz, Peak, Port 2

RF Power Output, LTE Band 25, 20 MHz, Average, 16QAM, Port 2

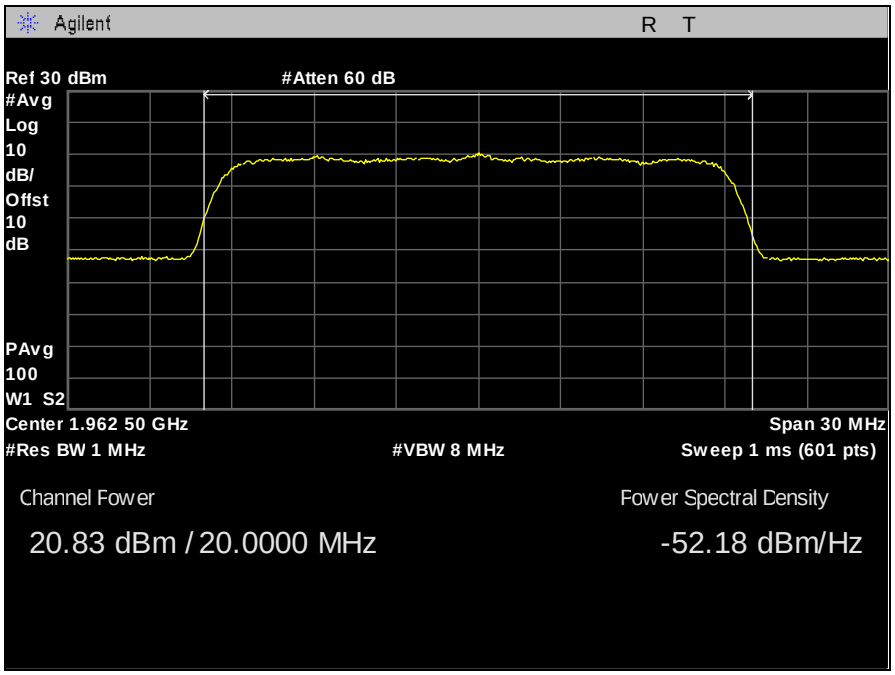


Plot 109. RF Power, LTE Band 25, Mid Channel, 16QAM, 20 MHz, Average, Port 2

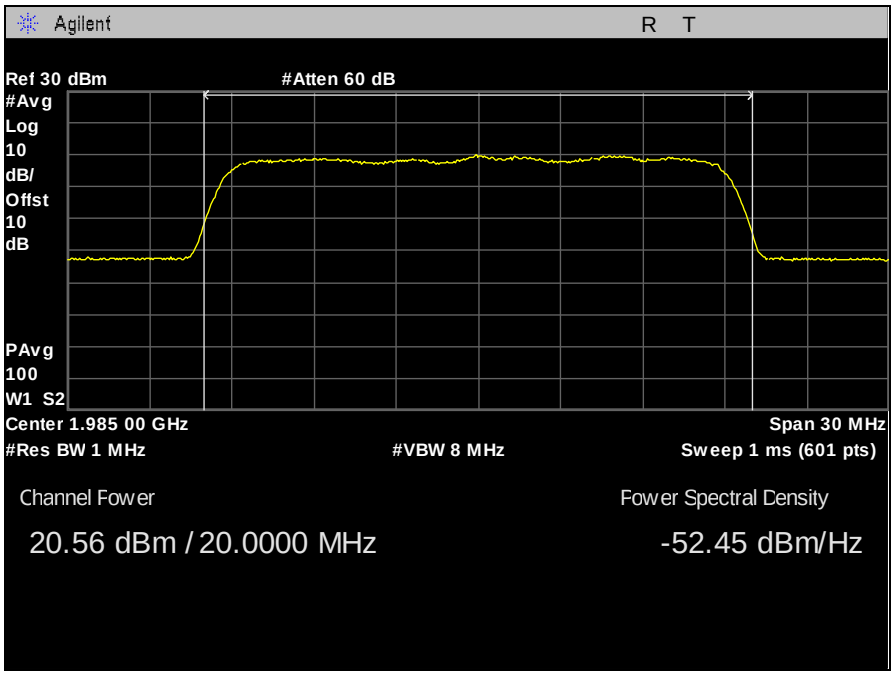


Plot 110. RF Power, LTE Band 25, High Channel, 16QAM, 20 MHz, Average, Port 2

RF Power Output, LTE Band 25, 20 MHz, Average, 64QAM, Port 2

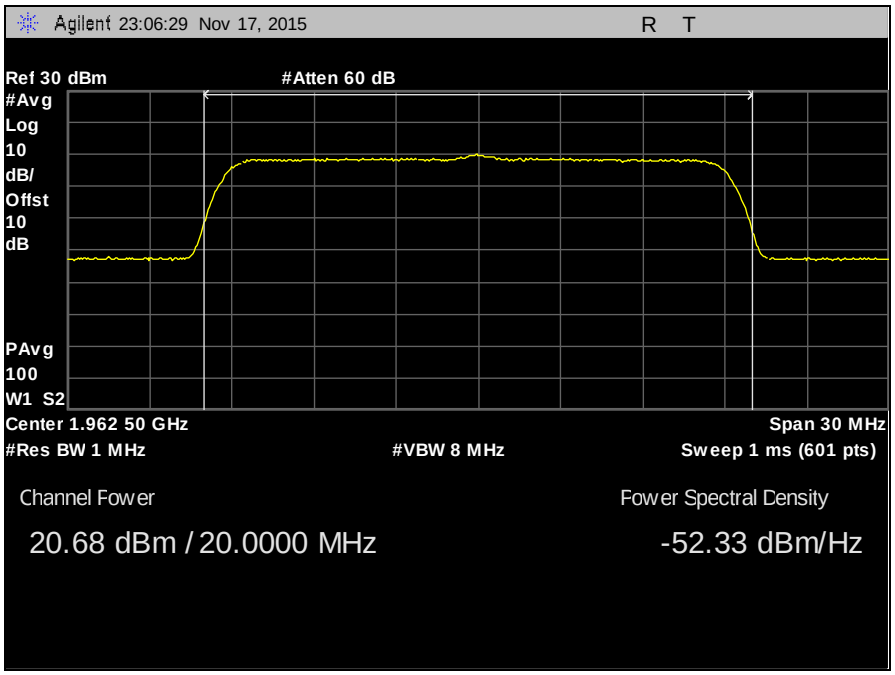


Plot 111. RF Power, LTE Band 25, Mid Channel, 64QAM, 20 MHz, Average, Port 2

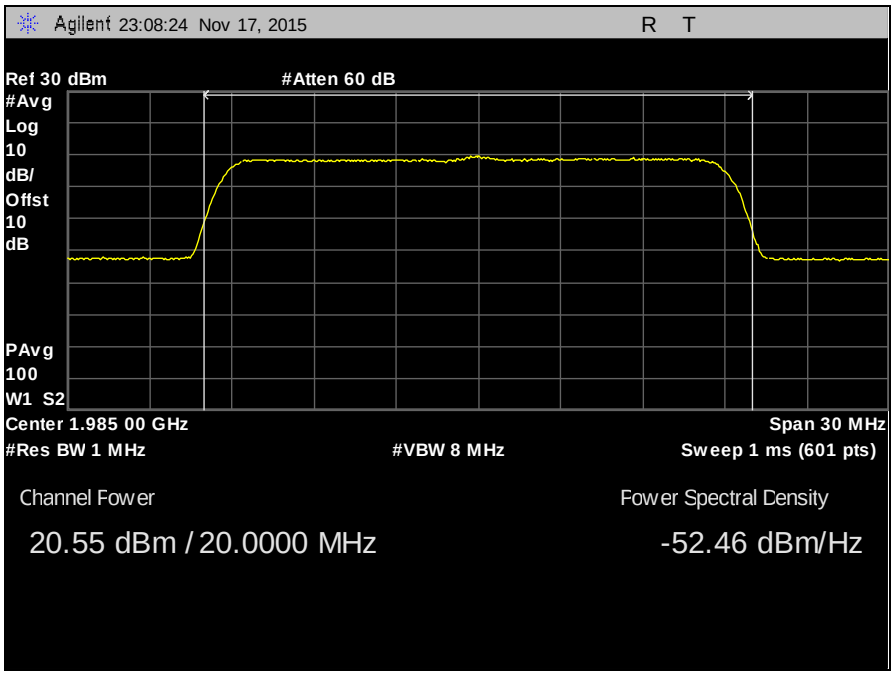


Plot 112. RF Power, LTE Band 25, High Channel, 64QAM, 20 MHz, Average, Port 2

RF Power Output, LTE Band 25, 20 MHz, Average, QPSK, Port 2

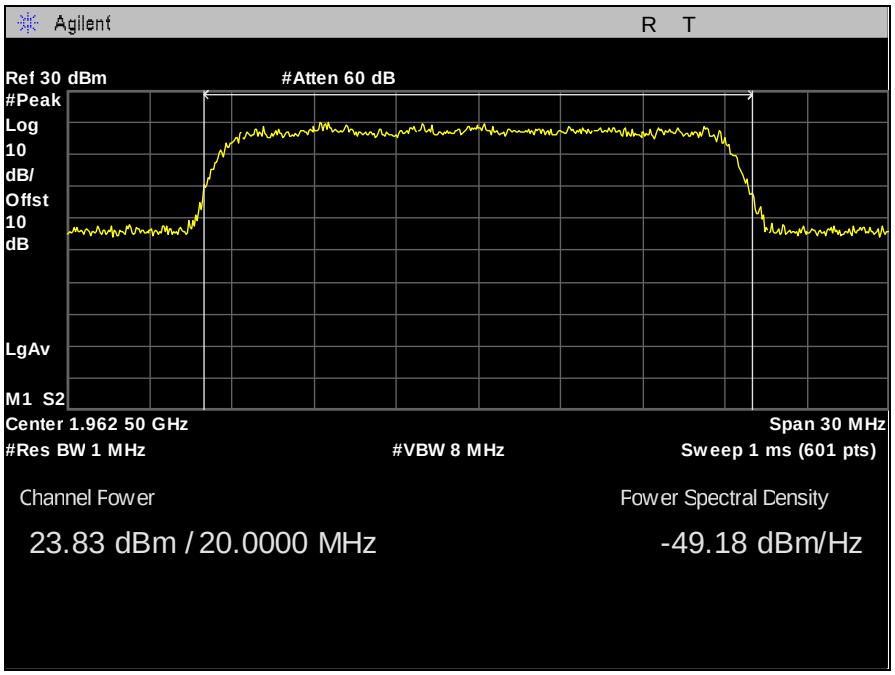


Plot 113. RF Power, LTE Band 25, Mid Channel, QPSK, 20 MHz, Average, Port 2

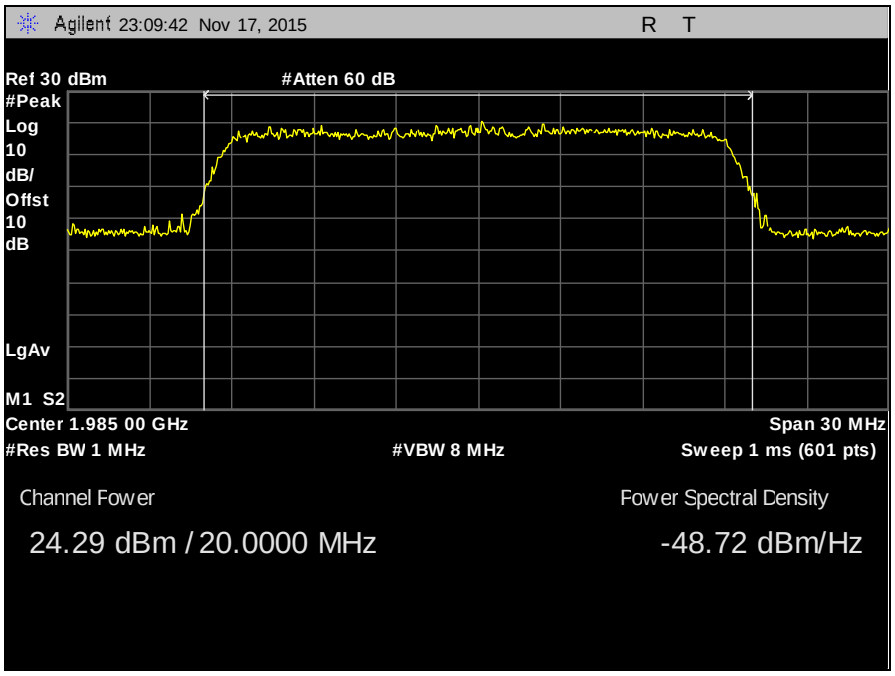


Plot 114. RF Power, LTE Band 25, High Channel, QPSK, 20 MHz, Average, Port 2

RF Power Output, LTE Band 25, 20 MHz, Peak, 16QAM, Port 2

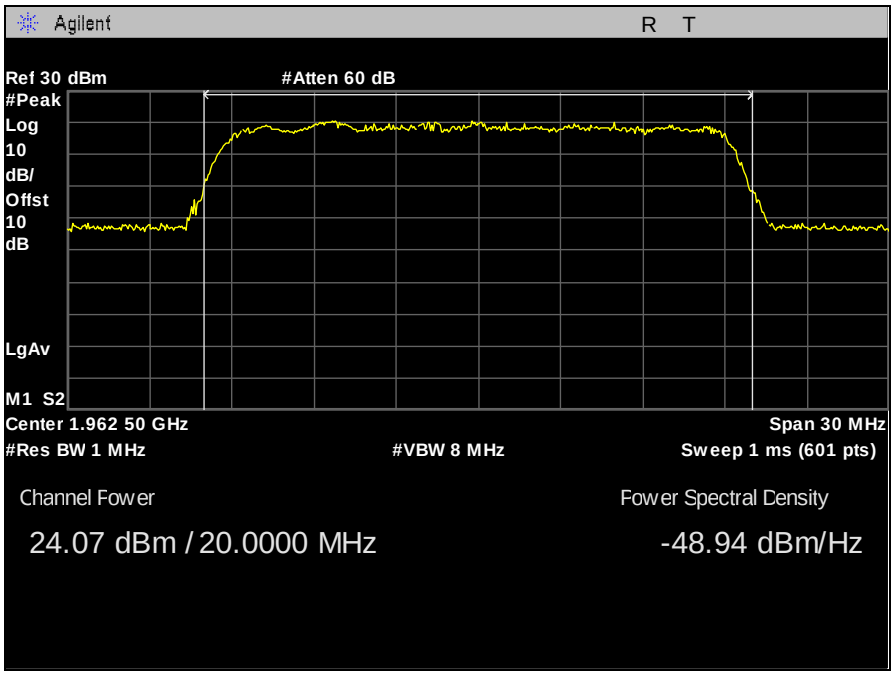


Plot 115. RF Power, LTE Band 25, Mid Channel, 16QAM, 20 MHz, Peak, Port 2

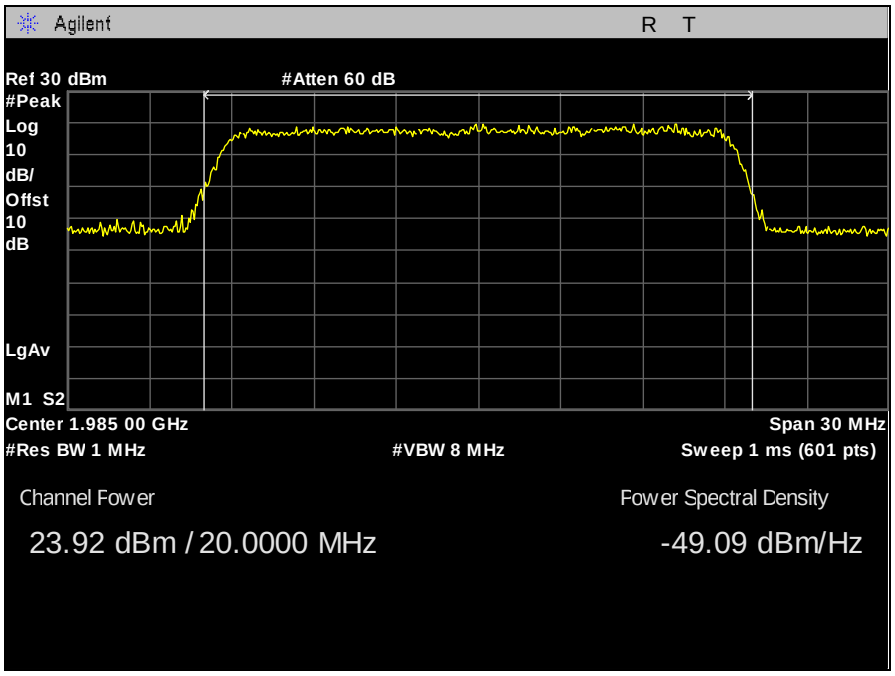


Plot 116. RF Power, LTE Band 25, High Channel, 16QAM, 20 MHz, Peak, Port 2

RF Power Output, LTE Band 25, 20 MHz, Peak, 64QAM, Port 2

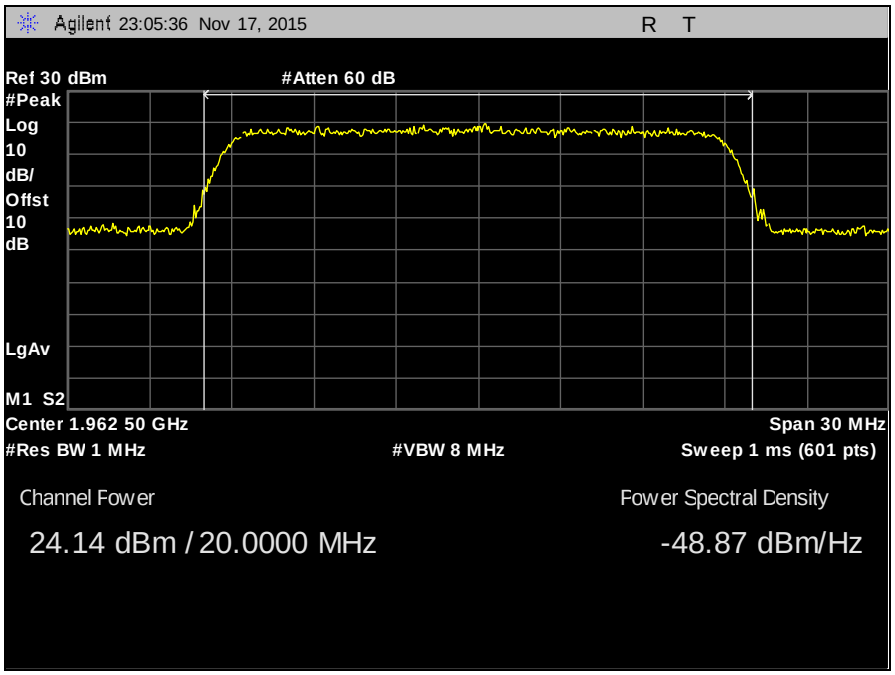


Plot 117. RF Power, LTE Band 25, Mid Channel, 64QAM, 20 MHz, Peak, Port 2

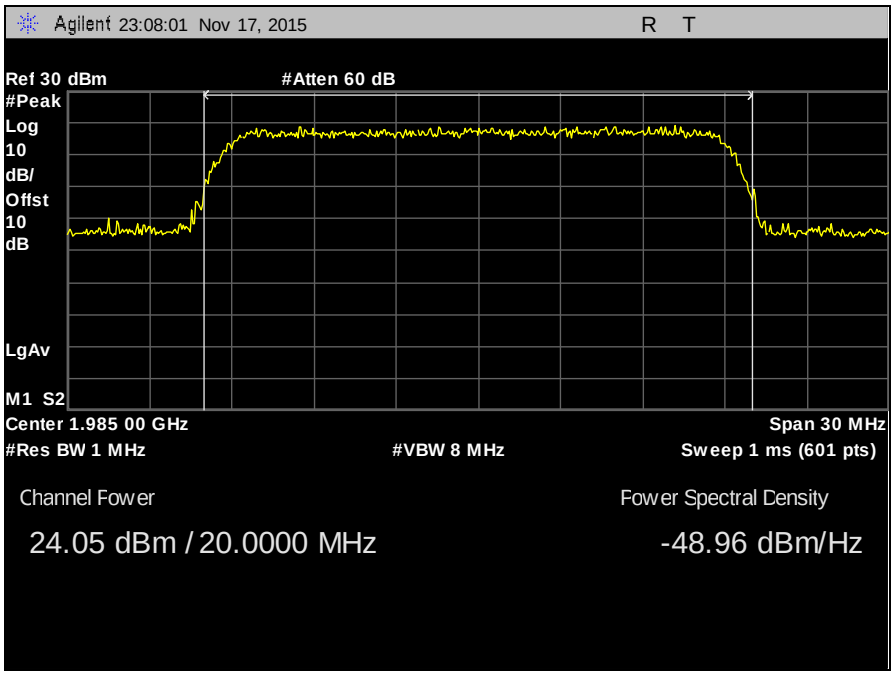


Plot 118. RF Power, LTE Band 25, High Channel, 64QAM, 20 MHz, Peak, Port 2

RF Power Output, LTE Band 25, 20 MHz, Peak, QPSK, Port 2



Plot 119. RF Power, LTE Band 25, Mid Channel, QPSK, 20 MHz, Peak, Port 2



Plot 120. RF Power, LTE Band 25, High Channel, QPSK, 20 MHz, Peak, Port 2

§ 2.1049 Occupied Bandwidth

Test Requirement(s): **§ 2.1049 Measurements required: Occupied bandwidth:** 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 under the specified conditions of § 2.1049 (a) through (i) as applicable.

Test Procedures: As required by 47 CFR 2.1049, *occupied bandwidth measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF frequency channel. The EUT was connected to a Spectrum Analyzer via attenuator. The RBW of the Spectrum Analyzer was set to at least 1% of the channel bandwidth. Measurements were carried out at the low, mid, and high channels of the TX band.

Test Results: Equipment complies with FCC requirements.

Test Engineer(s): Surinder Singh

Test Date(s): 11/17/15

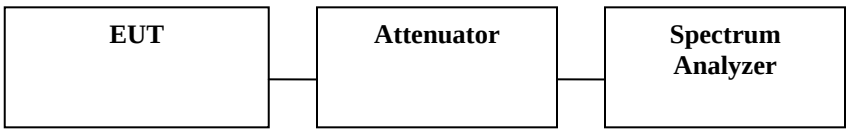


Figure 2. Occupied Bandwidth Test Setup

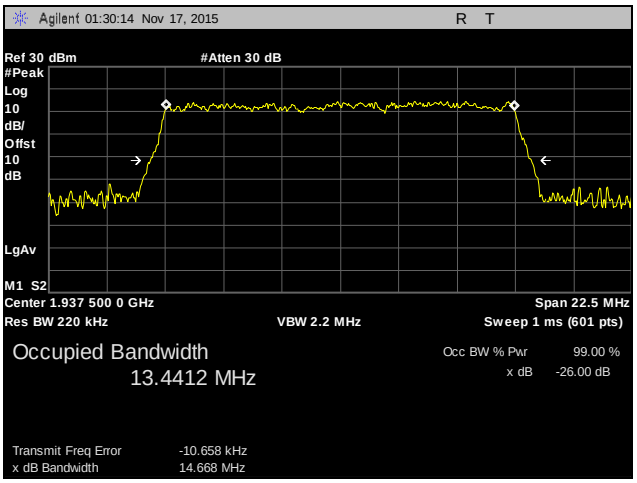
Band	Center Frequency MHz	Bandwidth	Modulation	26 dB OBW
2	1937.5	15	QPSK	14.774
2	1937.5	15	16QAM	14.668
2	1937.5	15	64QAM	14.499
2	1960	15	QPSK	14.707
2	1960	15	16QAM	14.697
2	1960	15	64QAM	14.5
2	1982.5	15	QPSK	14.877
2	1982.5	15	16QAM	14.767
2	1982.5	15	64QAM	14.568
2	1940	20	QPSK	19.464
2	1940	20	16QAM	19.387
2	1940	20	64QAM	19.387
2	1960	20	QPSK	19.645
2	1960	20	16QAM	19.294
2	1960	20	64QAM	19.481
2	1980	20	QPSK	19.752
2	1980	20	16QAM	19.555
2	1980	20	64QAM	19.371

Table 7. Occupied Bandwidth, LTE Band 2

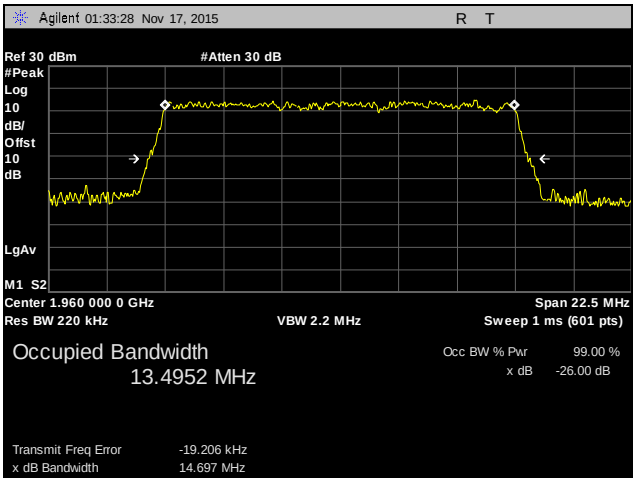
Band	Center Frequency MHz	Bandwidth	Modulation	26 dB OBW
25	1937.5	15	QPSK	See Band 2
25	1937.5	15	16QAM	See Band 2
25	1937.5	15	64QAM	See Band 2
25	1962.5	15	QPSK	14.618
25	1962.5	15	16QAM	14.541
25	1962.5	15	64QAM	14.339
25	1987.5	15	QPSK	14.846
25	1987.5	15	16QAM	14.465
25	1987.5	15	64QAM	14.515
25	1940	20	QPSK	See Band 2
25	1940	20	16QAM	See Band 2
25	1940	20	64QAM	See Band 2
25	1962.5	20	QPSK	19.392
25	1962.5	20	16QAM	19.394
25	1962.5	20	64QAM	19.27
25	1985	20	QPSK	19.503
25	1985	20	16QAM	19.255
25	1985	20	64QAM	19.608

Table 8. Occupied Bandwidth, LTE Band 25

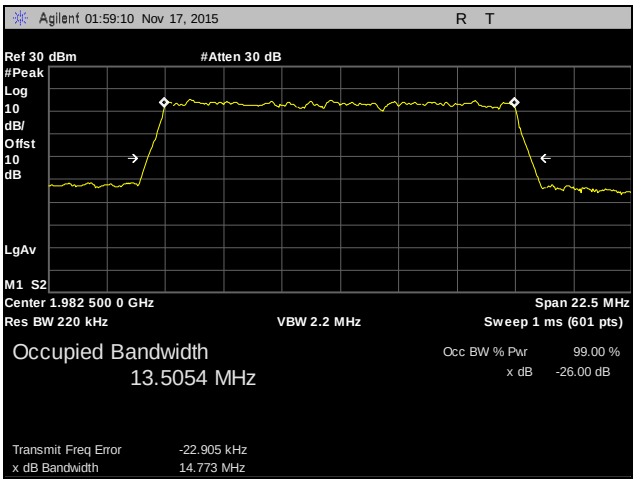
Occupied Bandwidth, LTE Band 2, 15 MHz, 16QAM



Plot 121. Occupied Bandwidth, LTE Band 2, Low Channel, 16QAM, 15 MHz

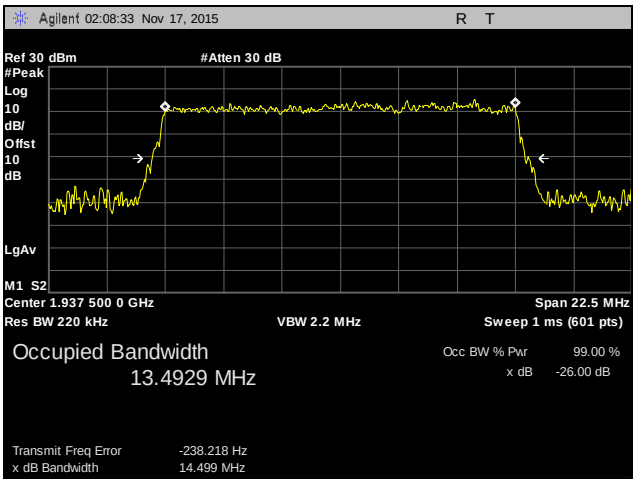


Plot 122. Occupied Bandwidth, LTE Band 2, Mid Channel, 16QAM, 15 MHz

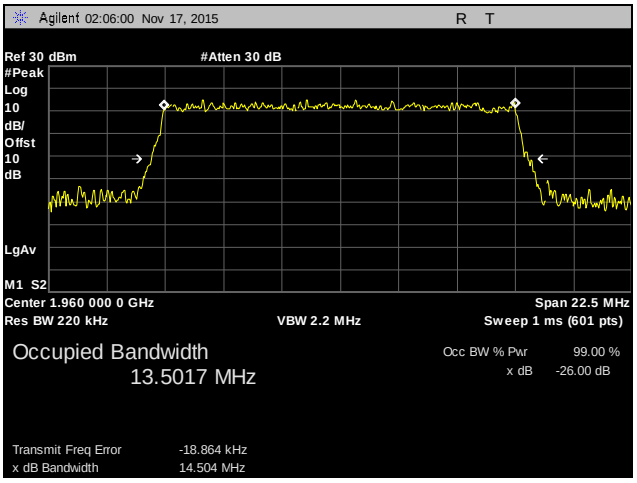


Plot 123. Occupied Bandwidth, LTE Band 2, High Channel, 16QAM, 15 MHz

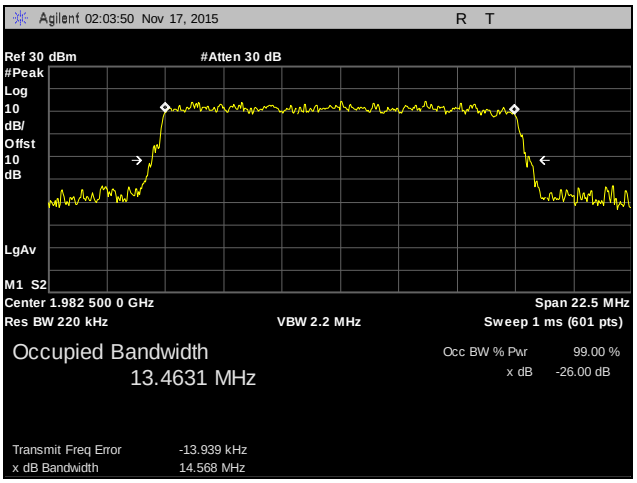
Occupied Bandwidth, LTE Band 2, 15 MHz, 64QAM



Plot 124. Occupied Bandwidth, LTE Band 2, Low Channel, 64QAM, 15 MHz

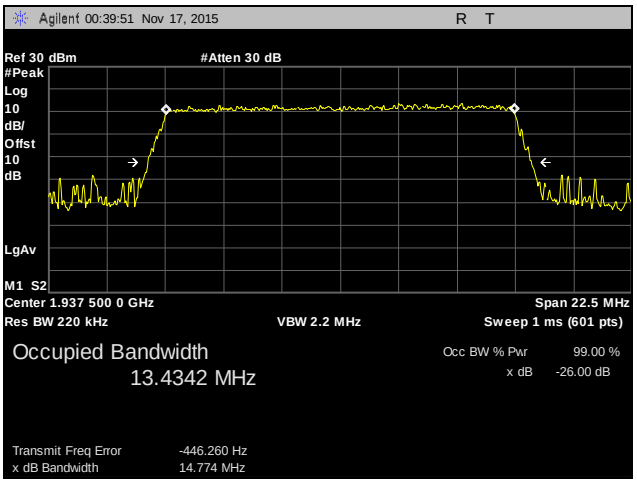


Plot 125. Occupied Bandwidth, LTE Band 2, Mid Channel, 64QAM, 15 MHz

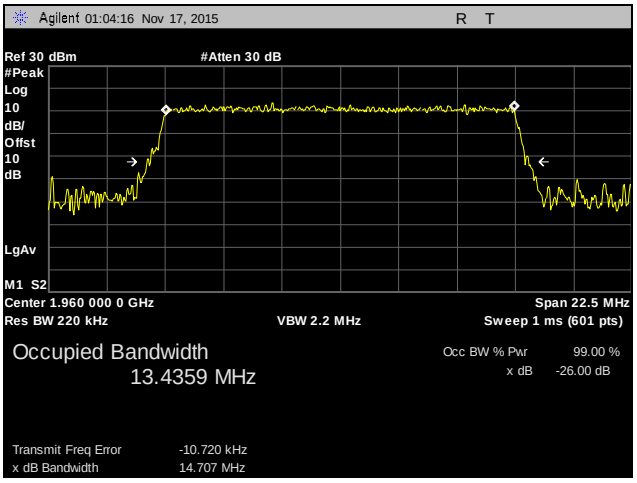


Plot 126. Occupied Bandwidth, LTE Band 2, High Channel, 64QAM, 15 MHz

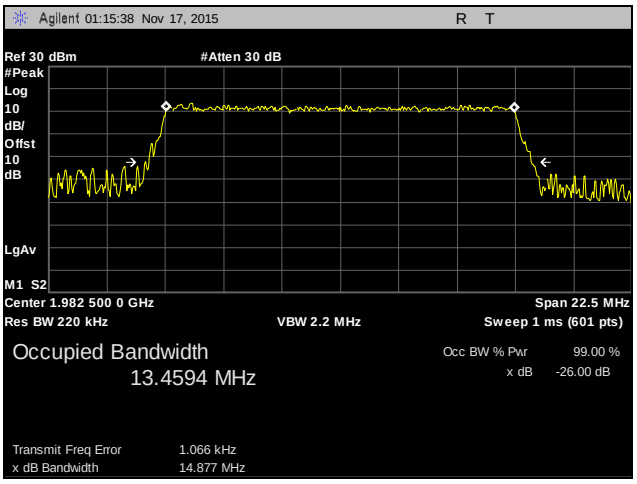
Occupied Bandwidth, LTE Band 2, 15 MHz, QPSK



Plot 127. Occupied Bandwidth, LTE Band 2, Low Channel, QPSK, 15 MHz

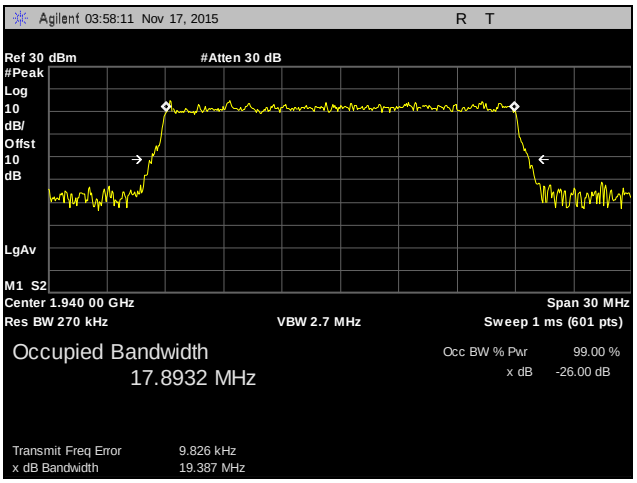


Plot 128. Occupied Bandwidth, LTE Band 2, Mid Channel, QPSK, 15 MHz

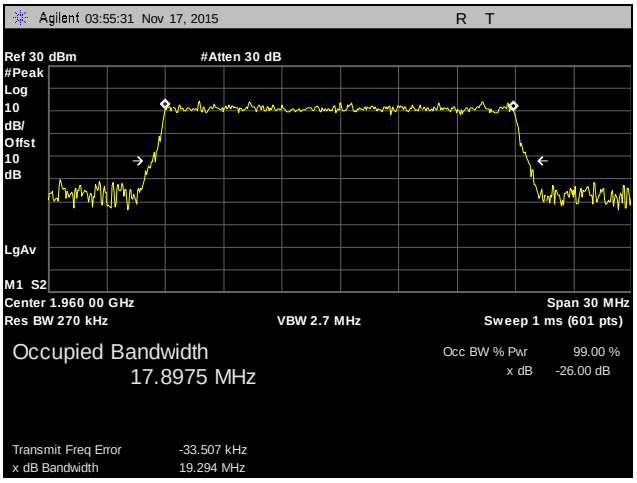


Plot 129. Occupied Bandwidth, LTE Band 2, High Channel, QPSK, 15 MHz

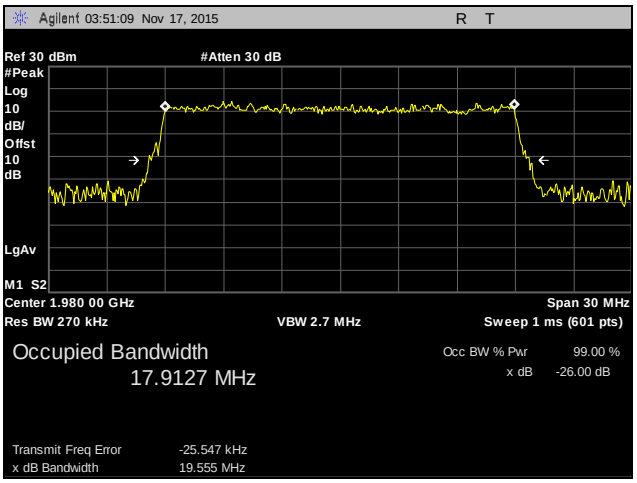
Occupied Bandwidth, LTE Band 2, 20 MHz, 16QAM



Plot 130. Occupied Bandwidth, LTE Band 2, Low Channel, 16QAM, 20 MHz

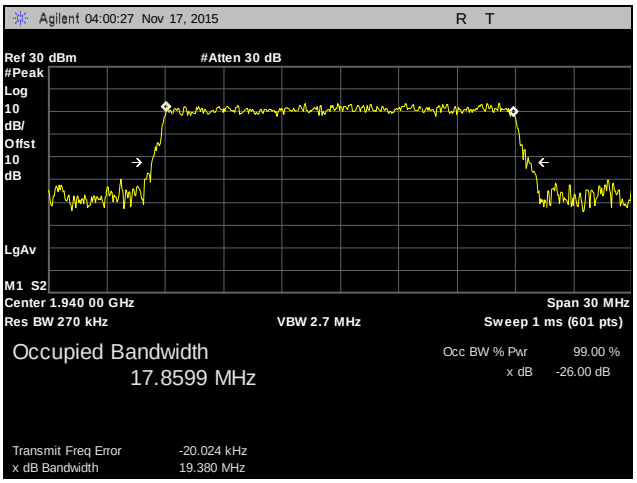


Plot 131. Occupied Bandwidth, LTE Band 2, Mid Channel, 16QAM, 20 MHz

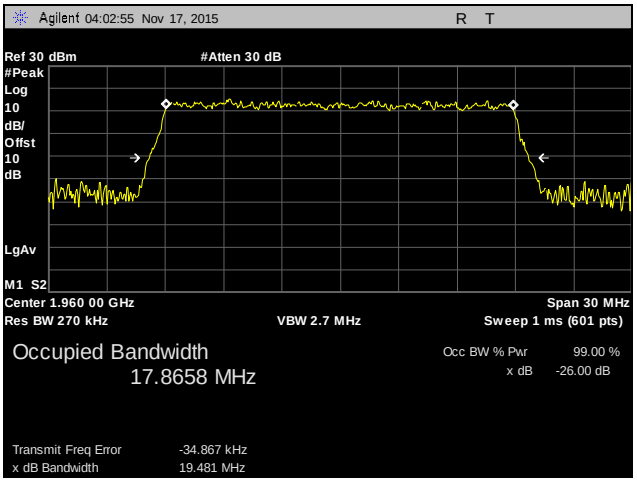


Plot 132. Occupied Bandwidth, LTE Band 2, High Channel, 16QAM, 20 MHz

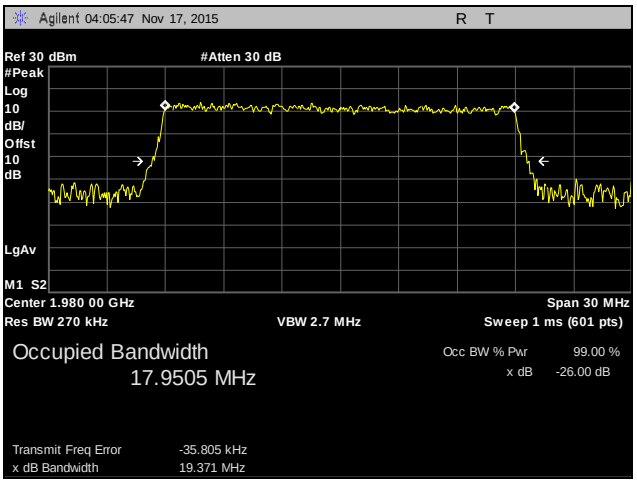
Occupied Bandwidth, LTE Band 2, 20 MHz, 64QAM



Plot 133. Occupied Bandwidth, LTE Band 2, Low Channel, 64QAM, 20 MHz

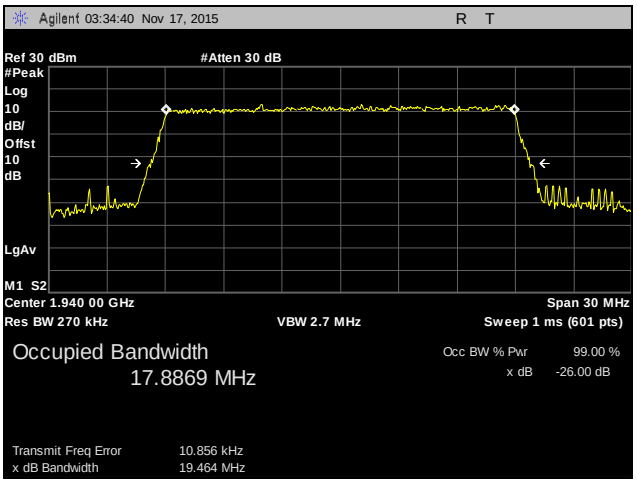


Plot 134. Occupied Bandwidth, LTE Band 2, Mid Channel, 64QAM, 20 MHz

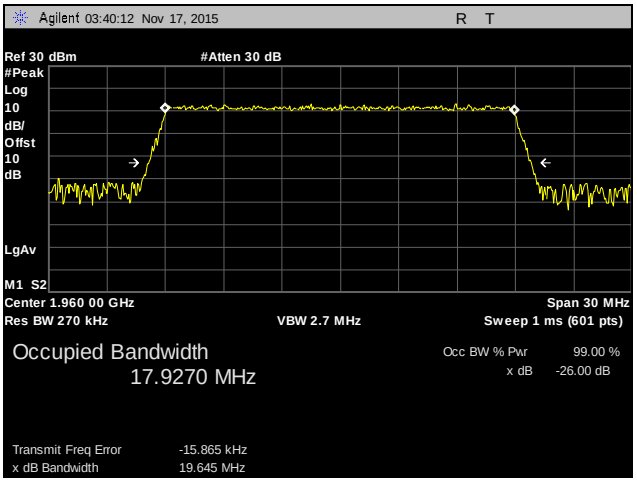


Plot 135. Occupied Bandwidth, LTE Band 2, High Channel, 64QAM, 20 MHz

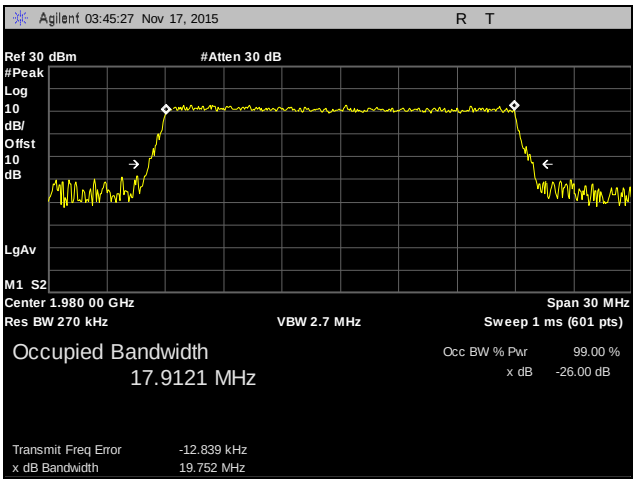
Occupied Bandwidth, LTE Band 2, 20 MHz, QPSK



Plot 136. Occupied Bandwidth, LTE Band 2, Low Channel, QPSK, 20 MHz

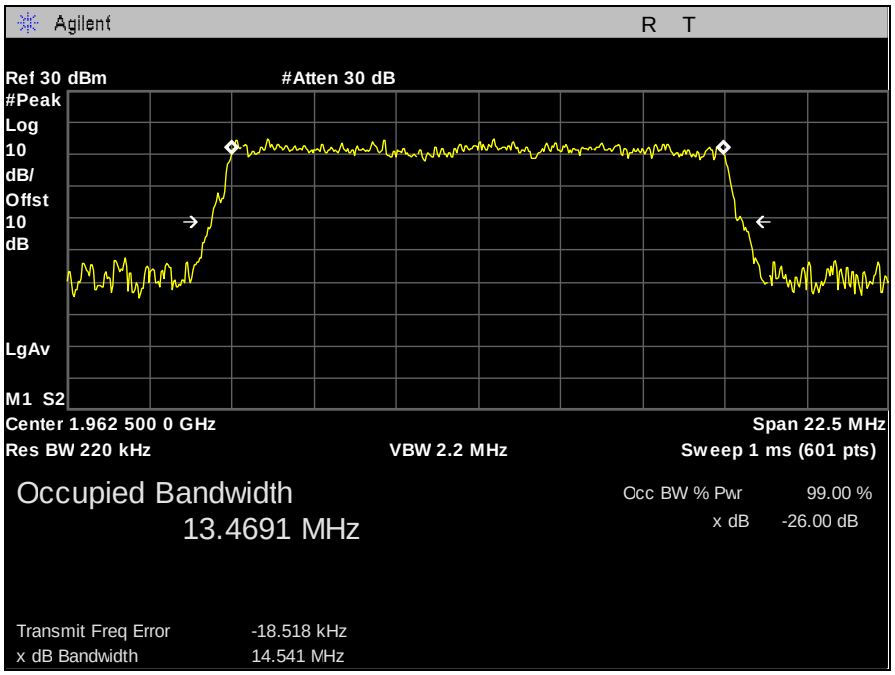


Plot 137. Occupied Bandwidth, LTE Band 2, Mid Channel, QPSK, 20 MHz

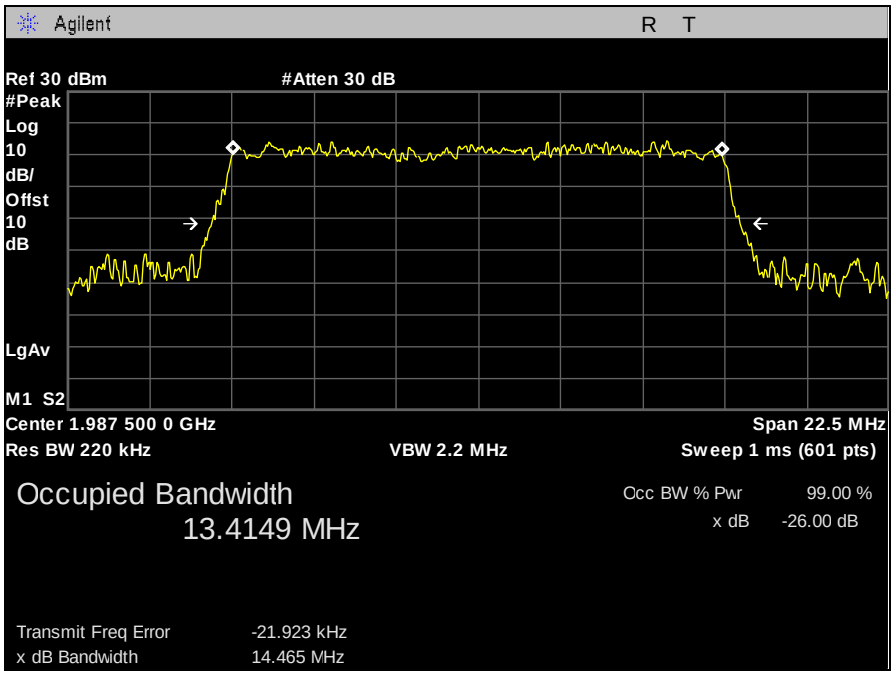


Plot 138. Occupied Bandwidth, LTE Band 2, High Channel, QPSK, 20 MHz

Occupied Bandwidth, LTE Band 25, 15 MHz, 16QAM

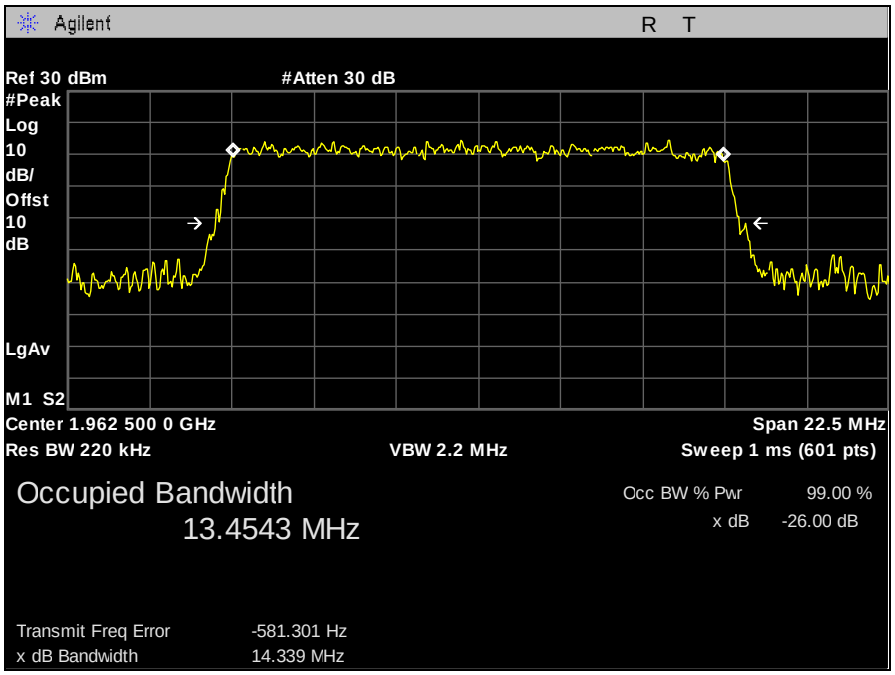


Plot 139. Occupied Bandwidth, LTE Band 25, Mid Channel, 16QAM, 15 MHz

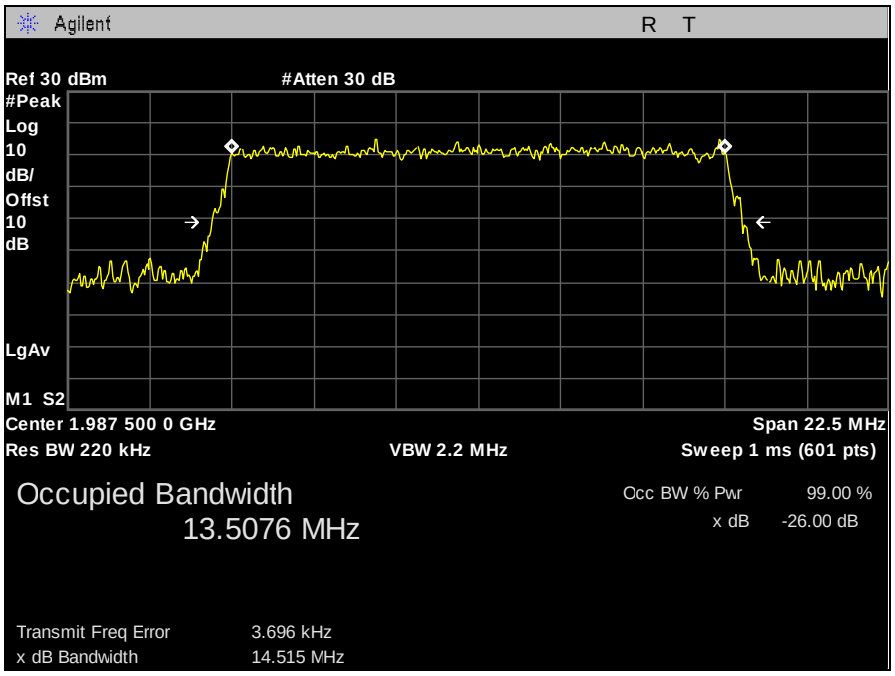


Plot 140. Occupied Bandwidth, LTE Band 25, High Channel, 16QAM, 15 MHz

Occupied Bandwidth, LTE Band 25, 15 MHz, 64QAM

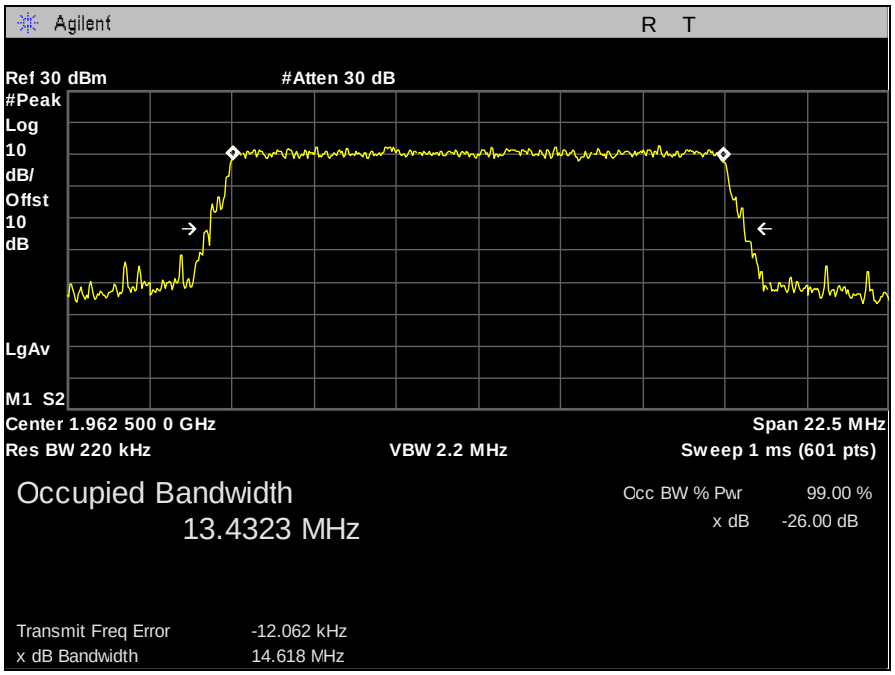


Plot 141. Occupied Bandwidth, LTE Band 25, Mid Channel, 64QAM, 15 MHz

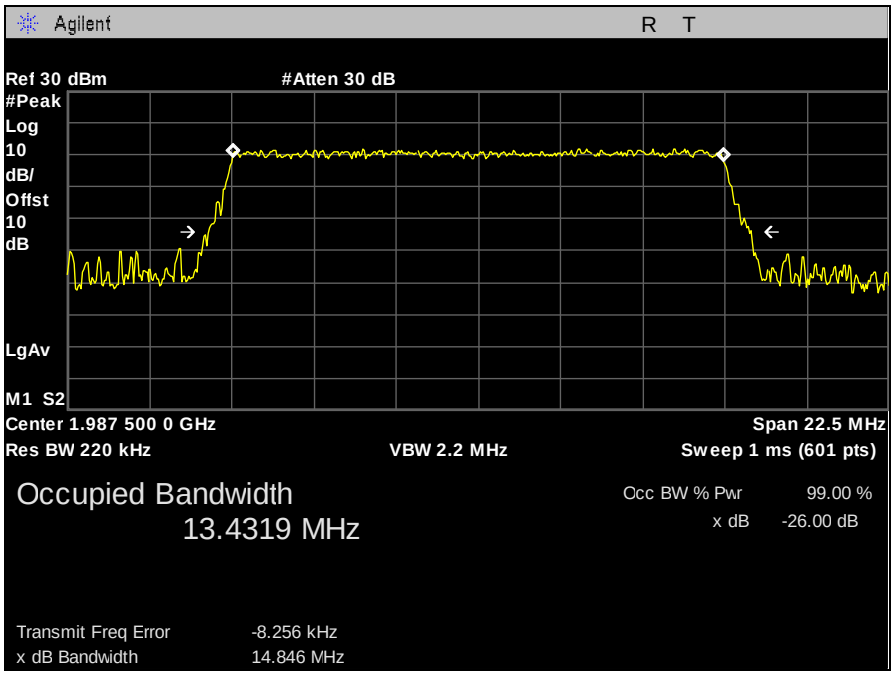


Plot 142. Occupied Bandwidth, LTE Band 25, High Channel, 64QAM, 15 MHz

Occupied Bandwidth, LTE Band 25, 15 MHz, QPSK

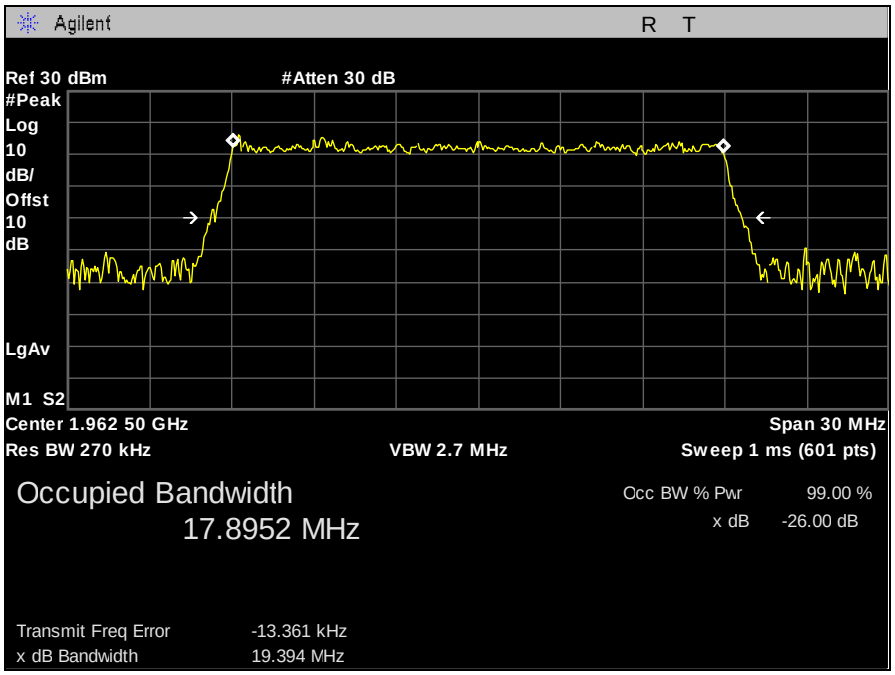


Plot 143. Occupied Bandwidth, LTE Band 25, Mid Channel, QPSK, 15 MHz

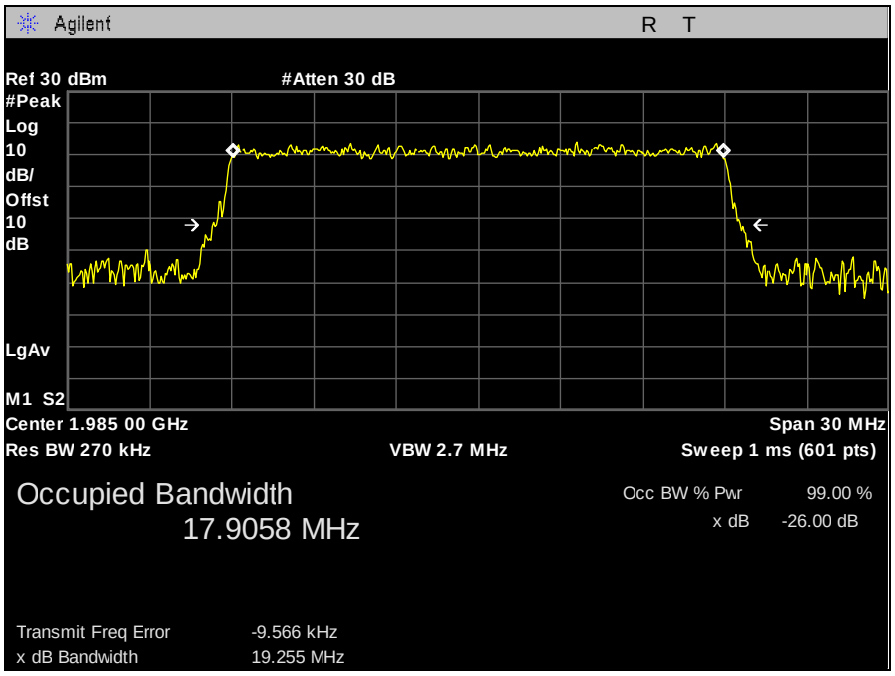


Plot 144. Occupied Bandwidth, LTE Band 25, High Channel, QPSK, 15 MHz

Occupied Bandwidth, LTE Band 25, 20 MHz, 16QAM

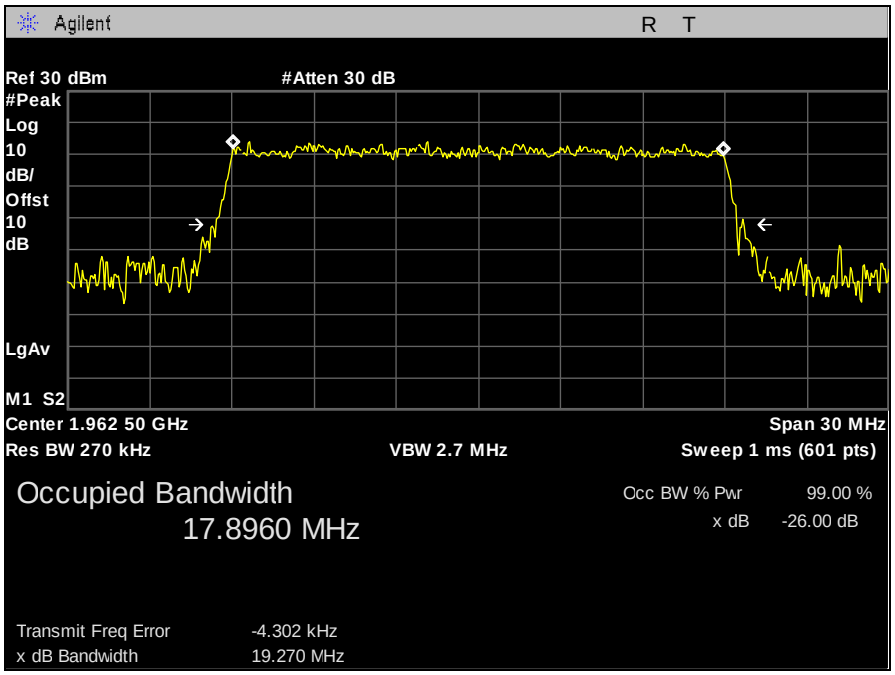


Plot 145. Occupied Bandwidth, LTE Band 25, Mid Channel, 16QAM, 20 MHz

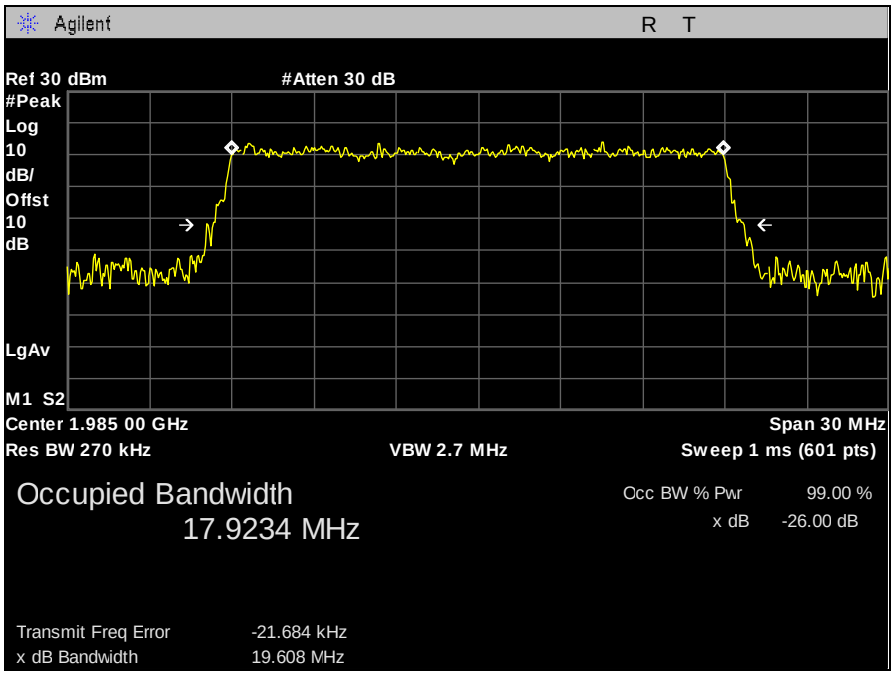


Plot 146. Occupied Bandwidth, LTE Band 25, High Channel, 16QAM, 20 MHz

Occupied Bandwidth, LTE Band 25, 20 MHz, 64QAM

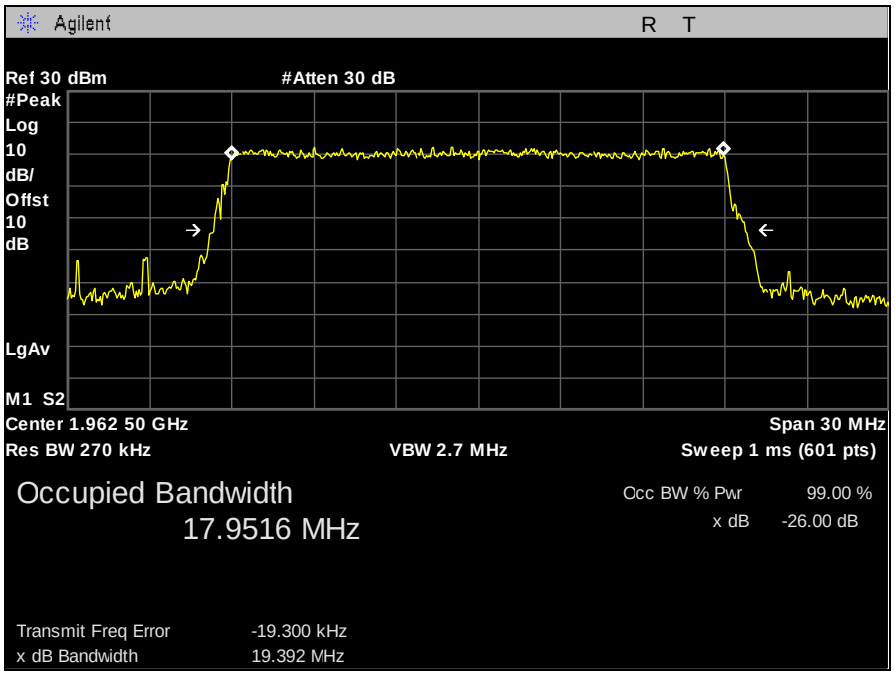


Plot 147. Occupied Bandwidth, LTE Band 25, Mid Channel, 64QAM, 20 MHz

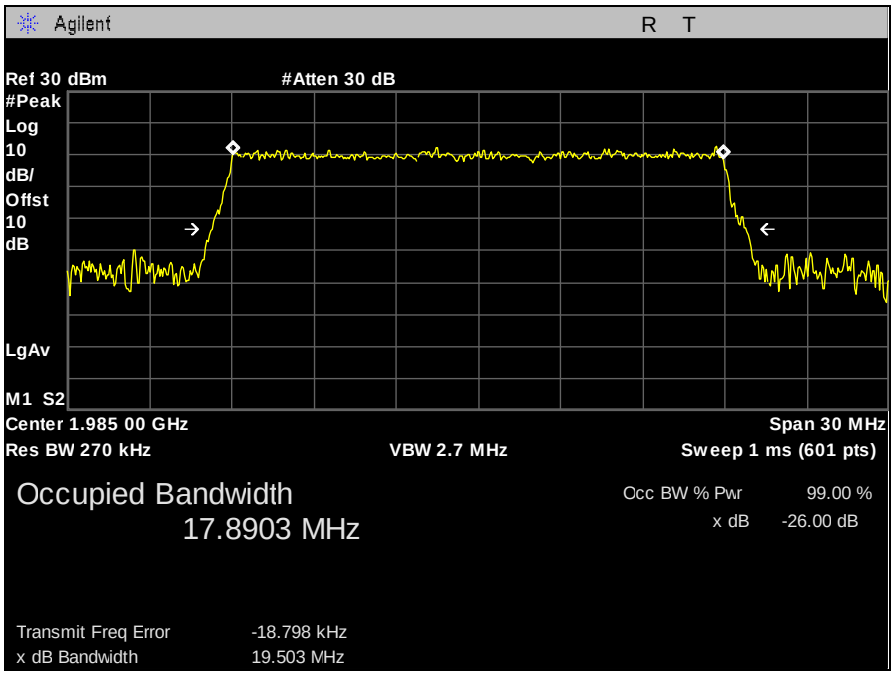


Plot 148. Occupied Bandwidth, LTE Band 25, High Channel, 64QAM, 20 MHz

Occupied Bandwidth, LTE Band 25, 20 MHz, QPSK



Plot 149. Occupied Bandwidth, LTE Band 25, Mid Channel, QPSK, 20 MHz



Plot 150. Occupied Bandwidth, LTE Band 25, High Channel, QPSK, 20 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1053 Radiated Spurious Emissions

Test Requirement(s): **§ 2.1053 Measurements required: Field strength of spurious radiation.**

§ 2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of § 2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required with the measuring instrument antenna located in the far-field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

§ 2.1053 (b): The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.

(2) All equipment operating on frequencies higher than 25 MHz.

(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.

(4) Other types of equipment as required, when deemed necessary by the Commission.

§ 22.917 (a): Out of band emissions. The 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).

§ 24.238 (a) Out of band emissions. The 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

Test Procedures: As required by 47 CFR 2.1053, *field strength of radiated spurious measurements* was made in accordance with the procedures of TIA/EIA-603-A-2001 "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards".

Radiated emission measurements were performed inside a 3 meter semi-anechoic chamber. The EUT's RF port was terminated (as normal) to its internal antenna. The EUT was tested using at the low, mid, and high channels of each applicable band. The EUT was rotated about 360^0 and the receiving antenna scanned from 1-4m in order to capture the maximum emission. The plots are corrected for cable loss, antenna correction factor, and distance correction. The field strength was mathematically corrected to an E.I.R.P. Harmonic emissions up to the 10^{th} or 40GHz, which ever was the lesser, were investigated. Only noise floor was observed above 10 GHz.

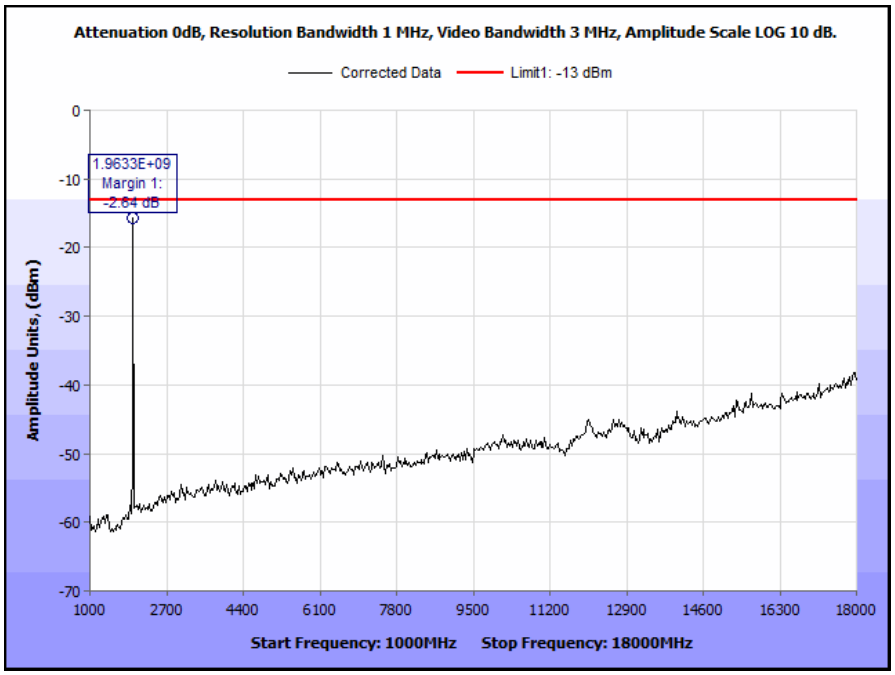
The spectrum analyzer was set to 1MHz RBW and 3MHz VBW above 1 GHz and below 1 GHz. The spectrum was investigated from 30MHz to the 10^{th} harmonic of the carrier; only noise floor was observed below 1GHz and above 18 GHz.

Test Results: The EUT complies with the requirements of this section.

Test Engineer: Surinder Singh

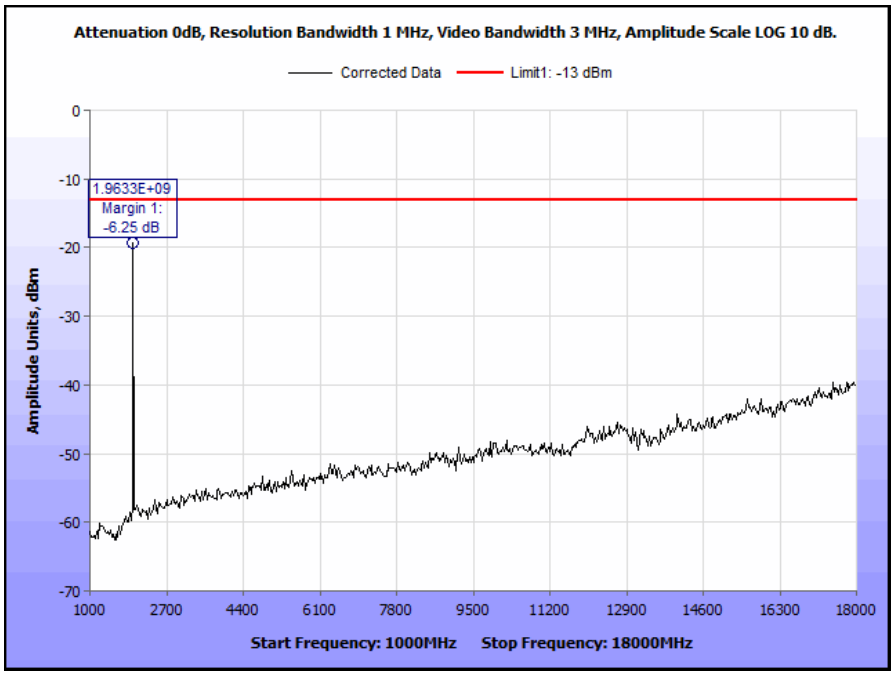
Test Date(s): 11/17/15

Radiated Spurious Emissions, LTE Band 2

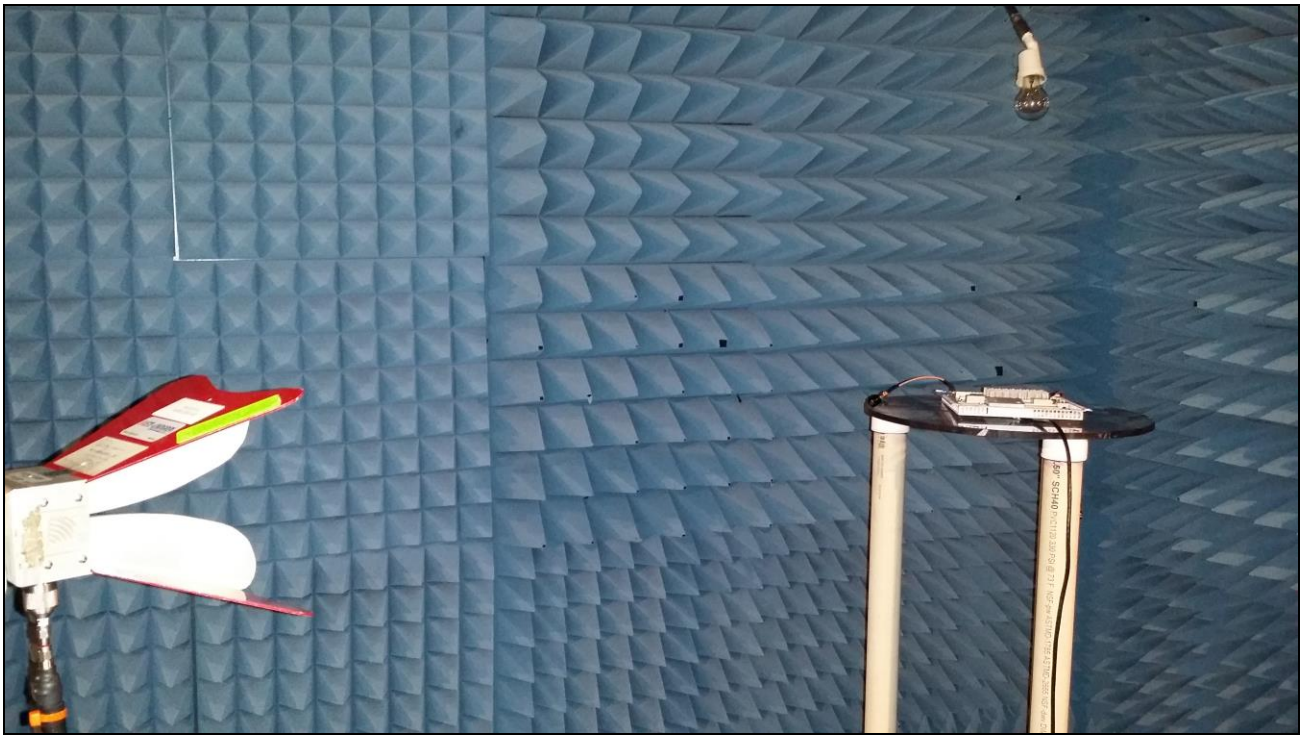


Plot 151. Radiated Spurious Emissions, LTE Band 2, 1 GHz – 18 GHz, Cabinet Emission

Radiated Spurious Emissions, LTE Band 25



Plot 152. Radiated Spurious Emissions, LTE Band 25, 1 GHz – 18 GHz, Cabinet Emission



Photograph 1. Radiated Spurious Emissions above 1 GHz, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 2.1051 Spurious Emissions at Antenna Terminals

Test Requirement(s):

§ 2.1051 Measurements required: Spurious emissions at antenna terminals: The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in § 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

§ 22.917 The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

§ 22.917 (a) Out of band emissions. The 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.

§ 22.917 (b) *Measurement procedure*. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 30 kHz or more. In the 60 kHz bands immediately outside and adjacent to the authorized frequency range or channel, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy approved the measured power is integrated over the full required measurement bandwidth (i.e., 30 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

§24.238 Emission limitations for Broadband PCS equipment: The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

§ 24.238 (a) Out of band emissions. The 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.

§ 24.238 (b) *Measurement procedure*. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e., 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Test Procedures: As required by 47 CFR §2.1051, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a Spectrum Analyzer.

A laptop was connected to EUT to control the RF power output and frequency channel. The EUT was connected to a Spectrum Analyzer through an attenuator. The Spectrum Analyzer was set to sweep 30 MHz and up to 10th harmonic of the fundamental or 40 GHz whichever is the lesser. Measurements were made in all applicable frequency bands.

Test Results: Equipment complies with these requirements.

Test Engineer(s): Surinder Singh

Test Date(s): 11/17/15

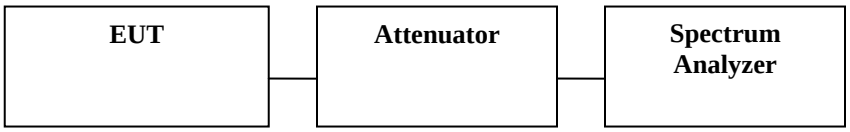
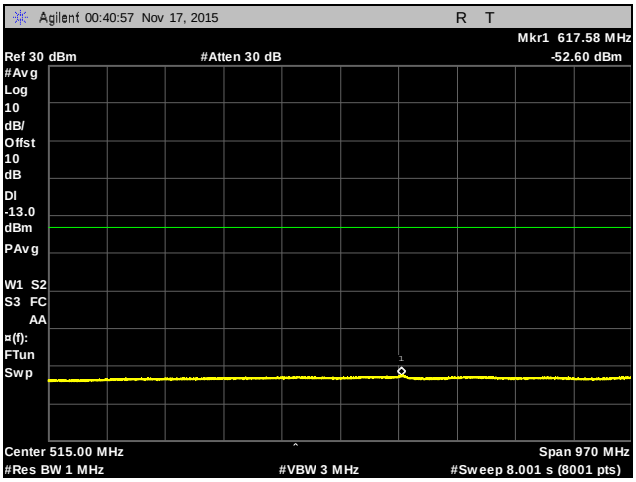
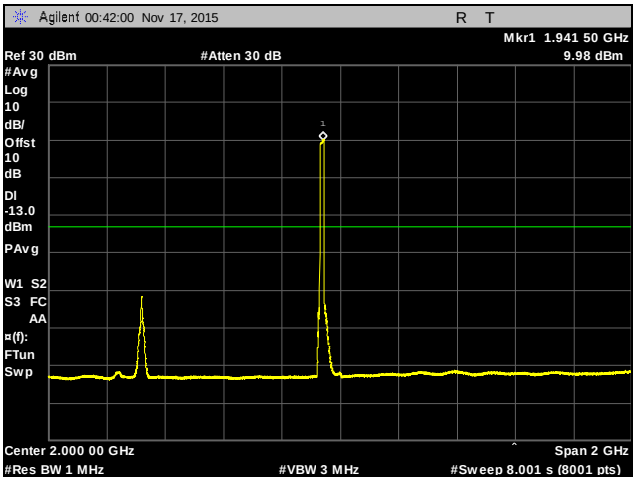


Figure 3. Spurious Emissions at Antenna Terminals Test Setup

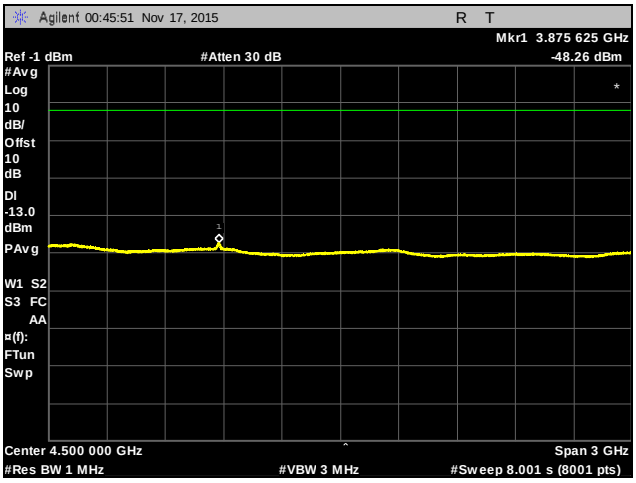
Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel



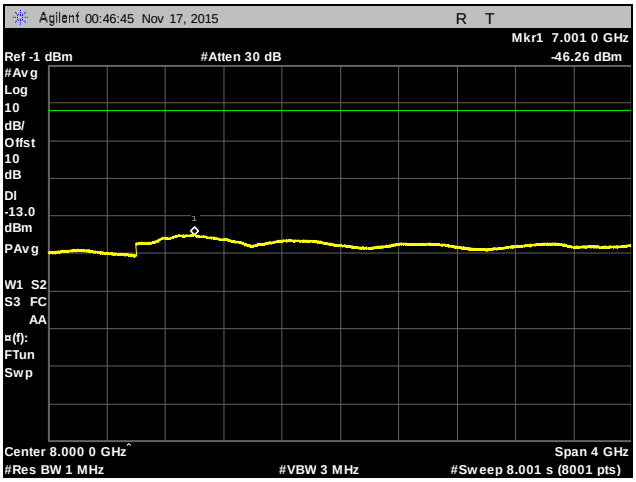
Plot 153. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel, 30 MHz – 1 GHz



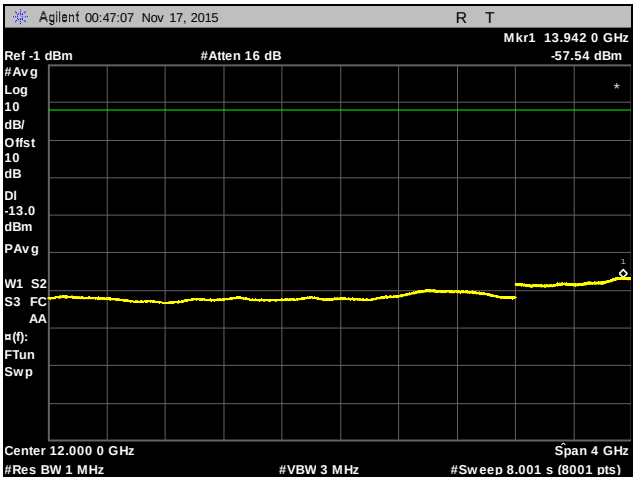
Plot 154. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel, 1 GHz – 2 GHz



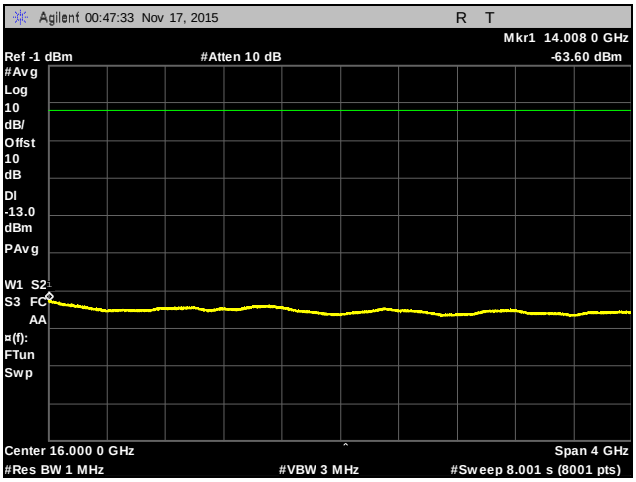
Plot 155. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel, 2 GHz – 6 GHz



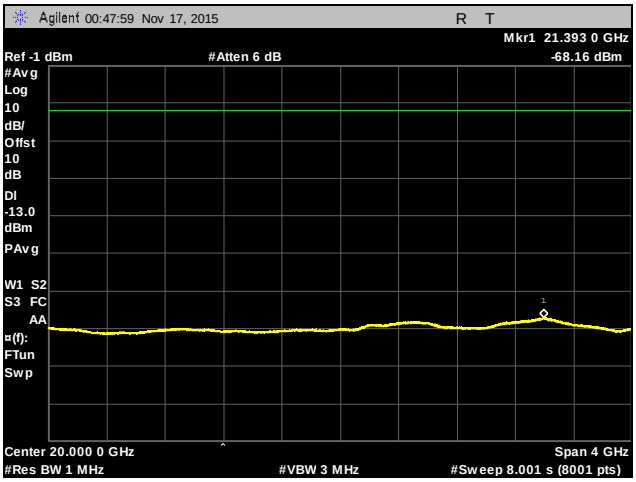
Plot 156. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel, 6 GHz – 10 GHz



Plot 157. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel, 10 GHz – 14 GHz

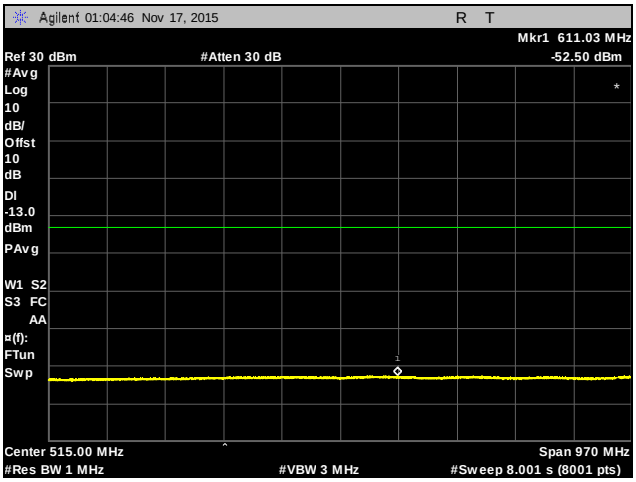


Plot 158. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel, 14 GHz – 18 GHz

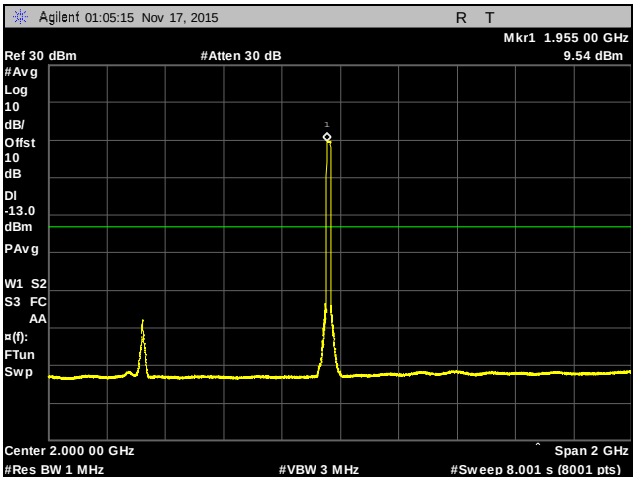


Plot 159. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Low Channel, 18 GHz – 22 GHz

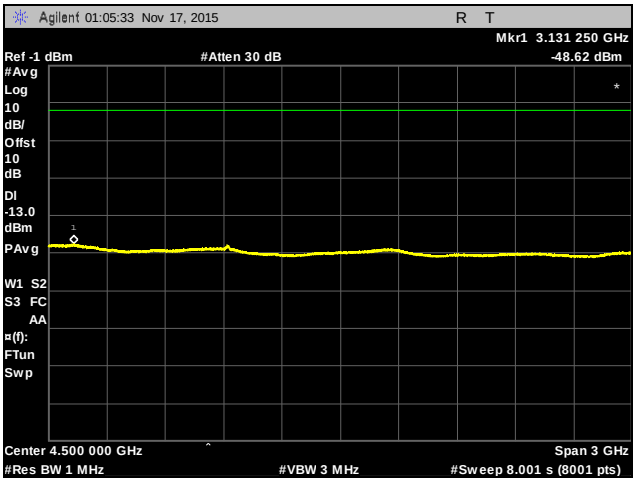
Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel



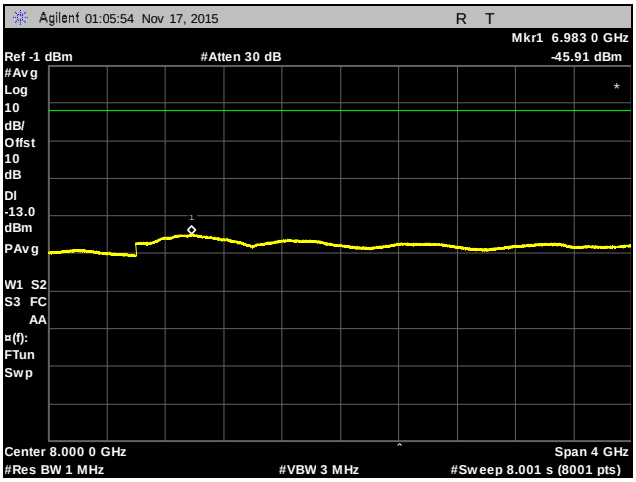
Plot 160. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel, 30 MHz – 1 GHz



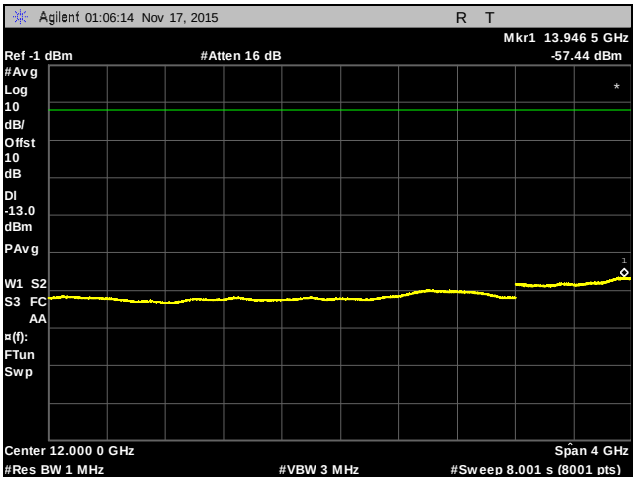
Plot 161. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel, 1 GHz – 2 GHz



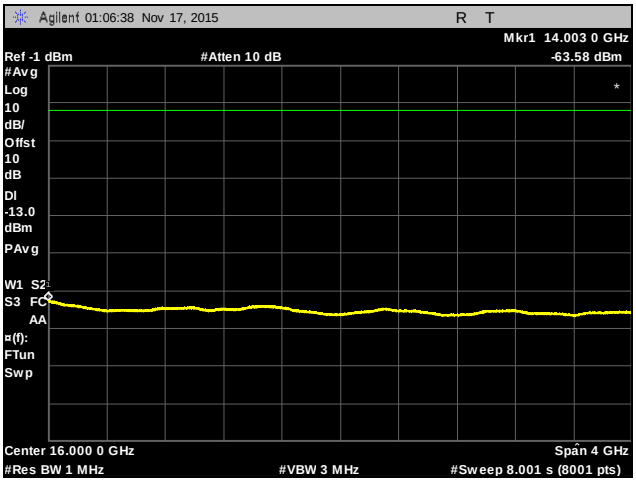
Plot 162. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel, 2 GHz – 6 GHz



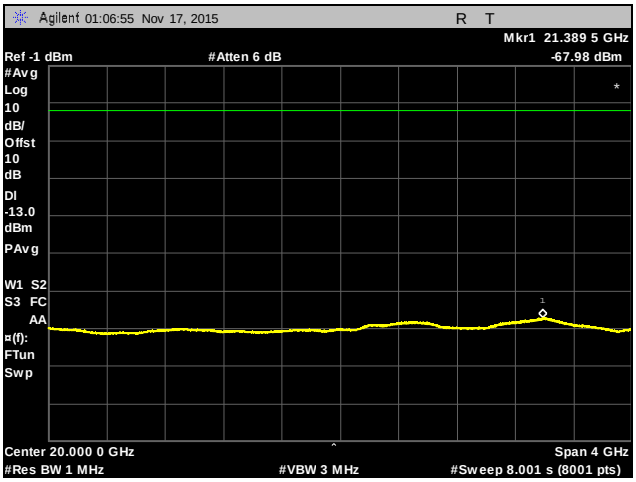
Plot 163. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel, 6 GHz – 10 GHz



Plot 164. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel, 10 GHz – 14 GHz

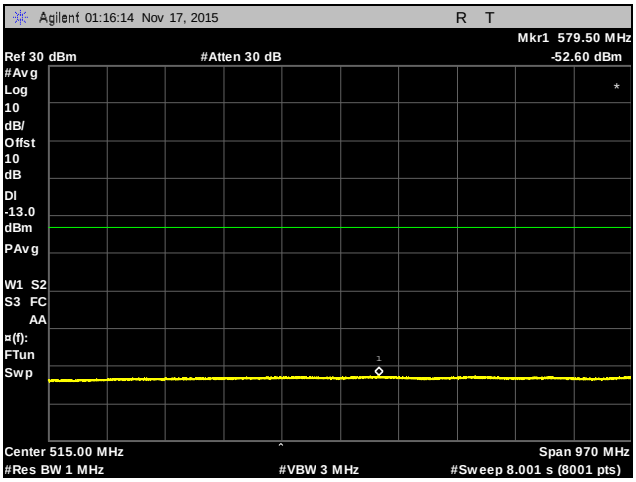


Plot 165. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel, 14 GHz – 18 GHz

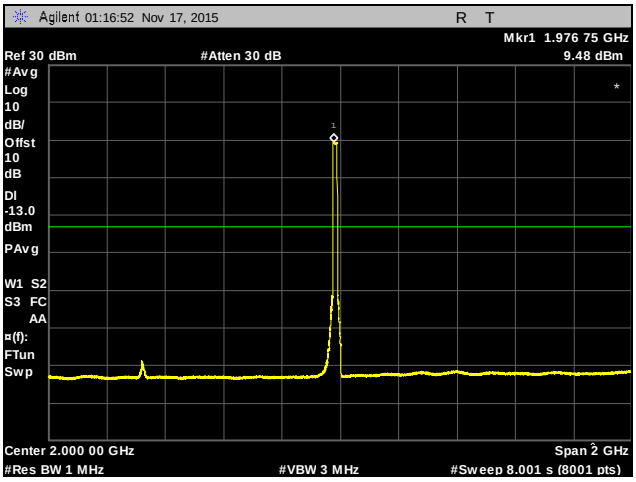


Plot 166. Conducted Spurious Emissions, LTE Band 2, 15 MHz, Mid Channel, 18 GHz – 22 GHz

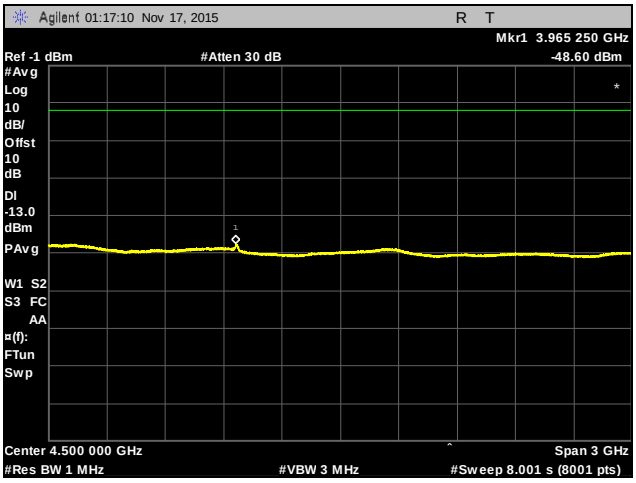
Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel



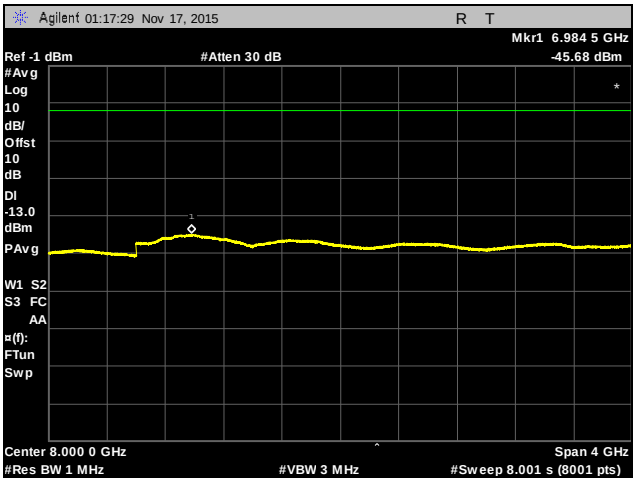
Plot 167. Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel, 30 MHz – 1 GHz



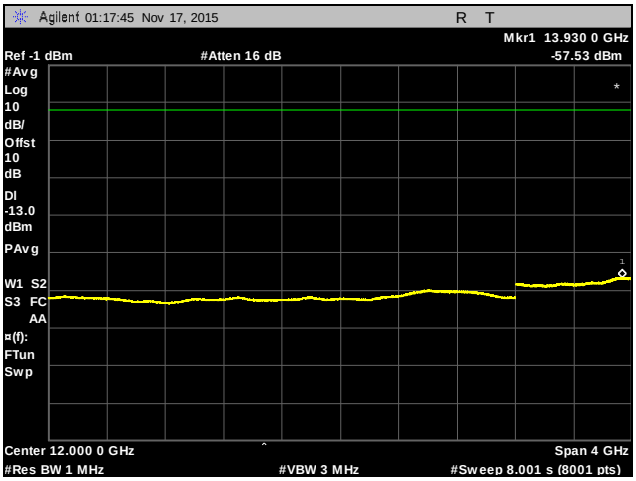
Plot 168. Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel, 1 GHz – 2 GHz



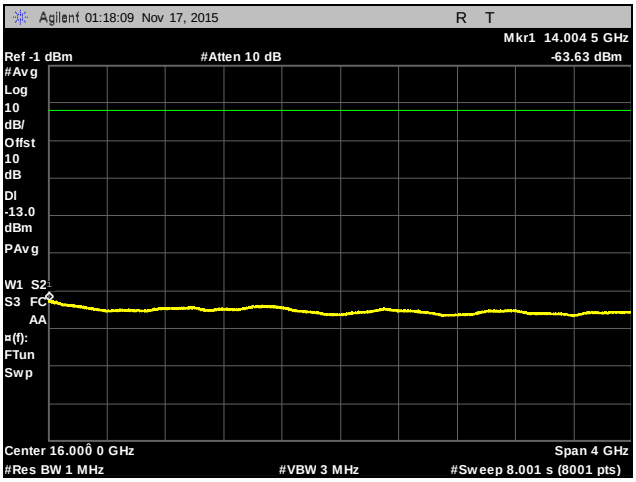
Plot 169. Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel, 2 GHz – 6 GHz



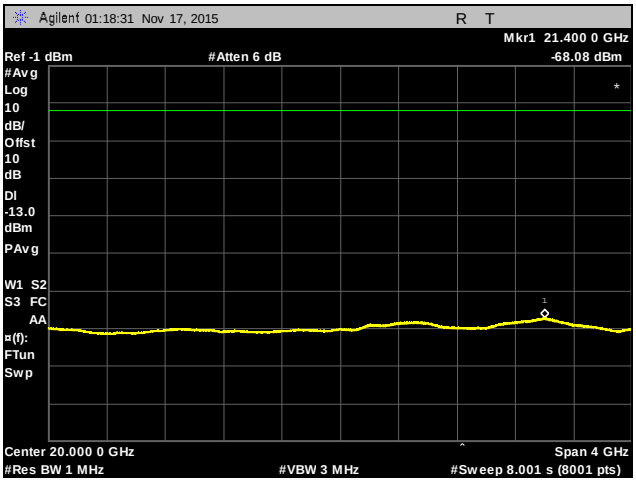
Plot 170. Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel, 6 GHz – 10 GHz



Plot 171. Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel, 10 GHz – 14 GHz

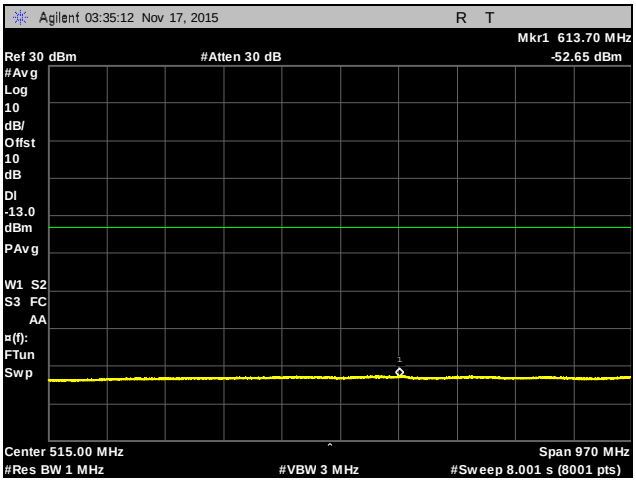


Plot 172. Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel, 14 GHz – 18 GHz

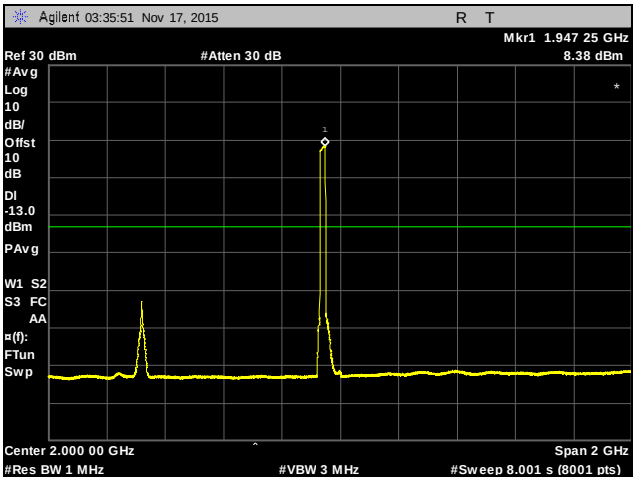


Plot 173. Conducted Spurious Emissions, LTE Band 2, 15 MHz, High Channel, 18 GHz – 22 GHz

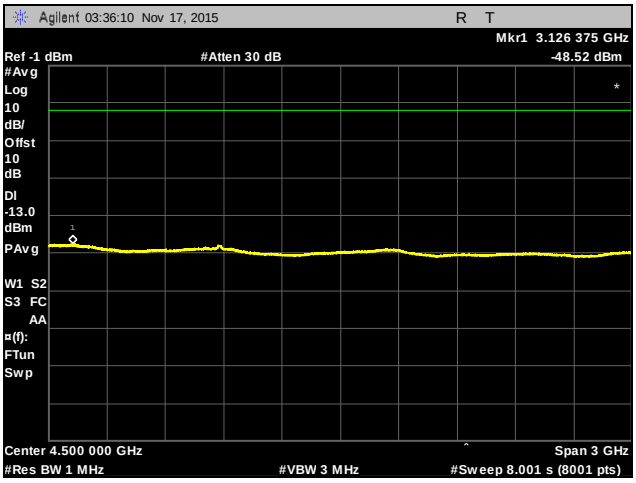
Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel



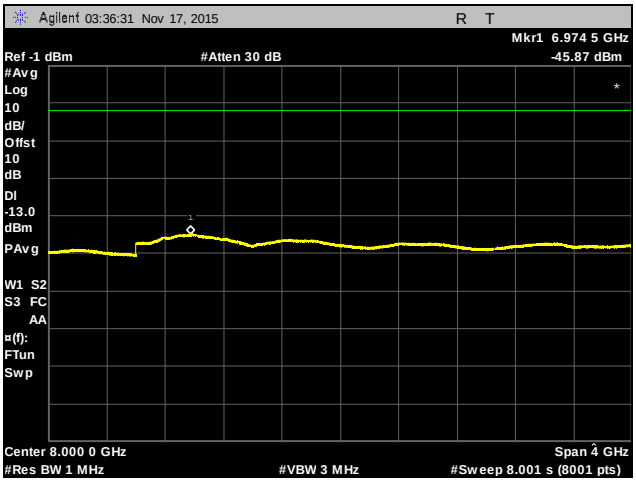
Plot 174. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel, 30 MHz – 1 GHz



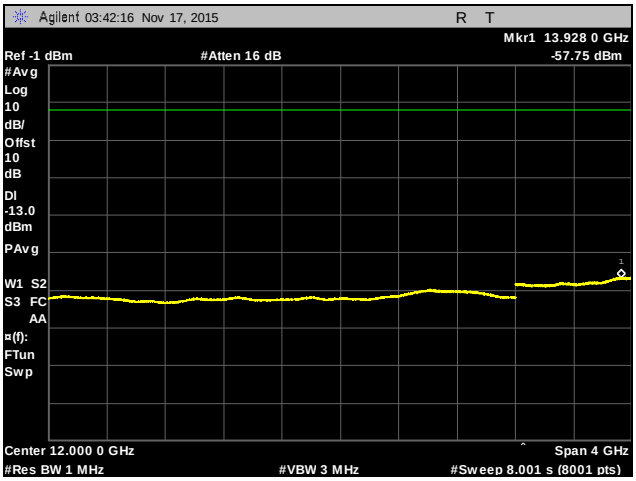
Plot 175. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel, 1 GHz – 2 GHz



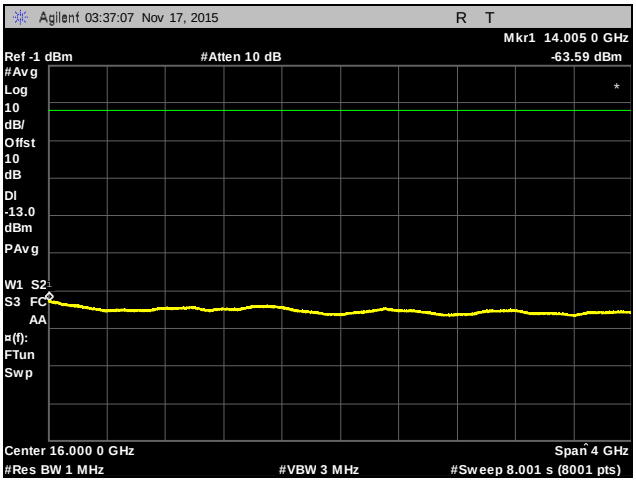
Plot 176. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel, 2 GHz – 6 GHz



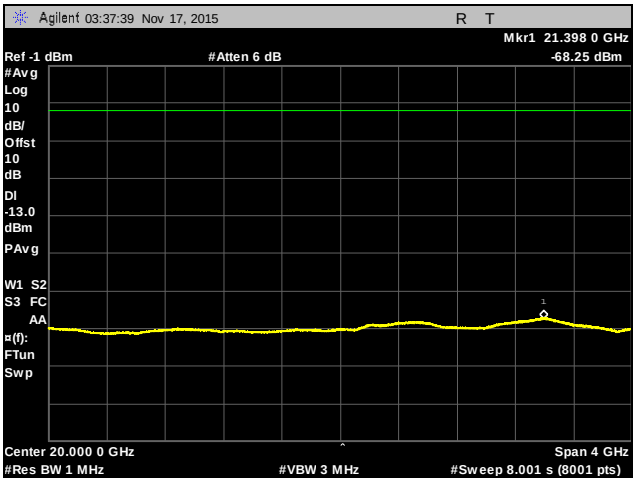
Plot 177. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel, 6 GHz – 10 GHz



Plot 178. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel, 10 GHz – 14 GHz

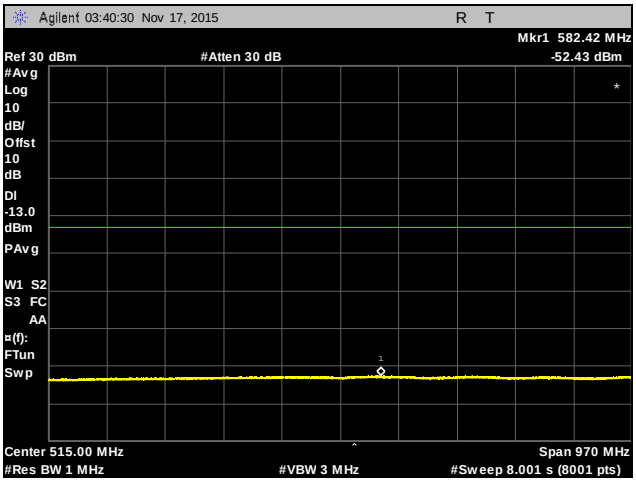


Plot 179. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel, 14 GHz – 18 GHz

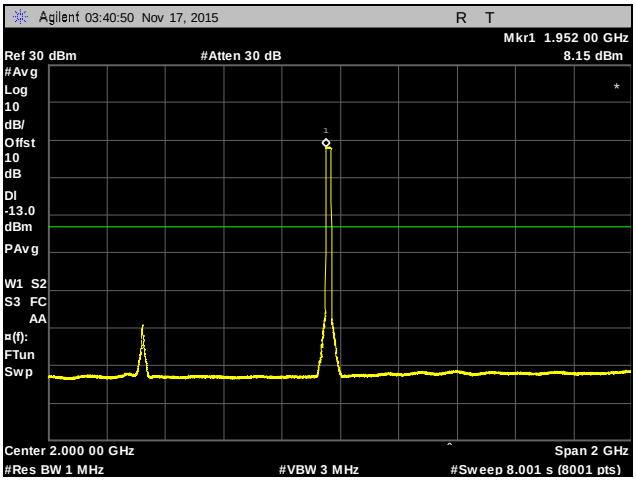


Plot 180. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Low Channel, 18 GHz – 22 GHz

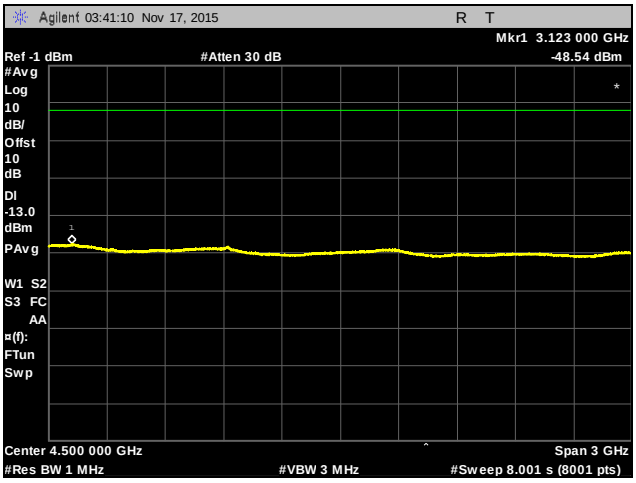
Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel



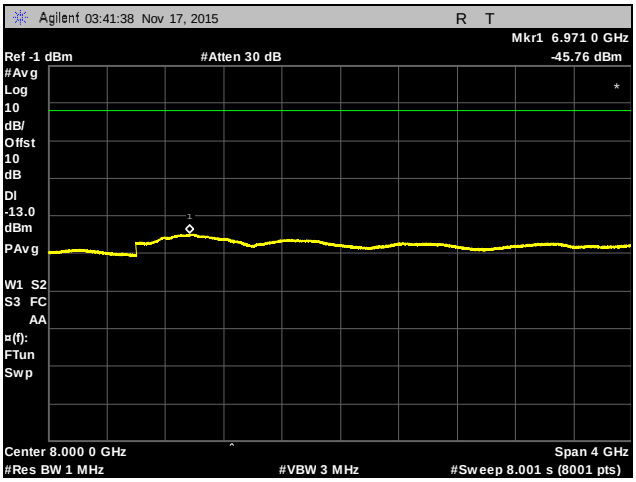
Plot 181. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel, 30 MHz – 1 GHz



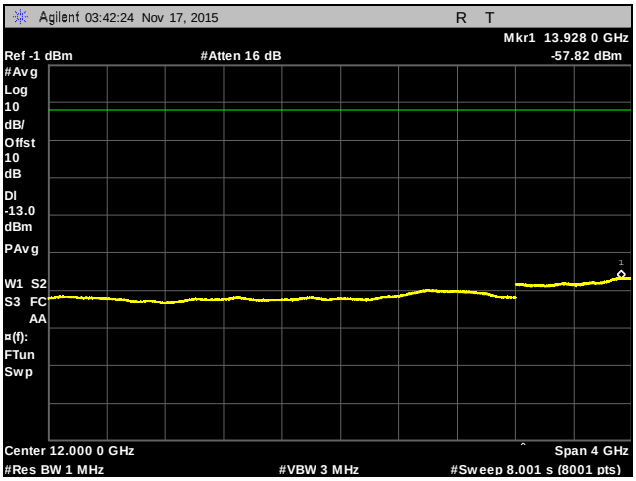
Plot 182. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel, 1 GHz – 2 GHz



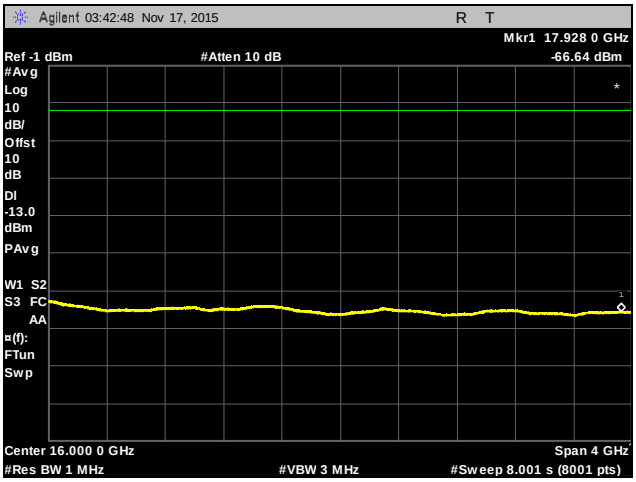
Plot 183. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel, 2 GHz – 6 GHz



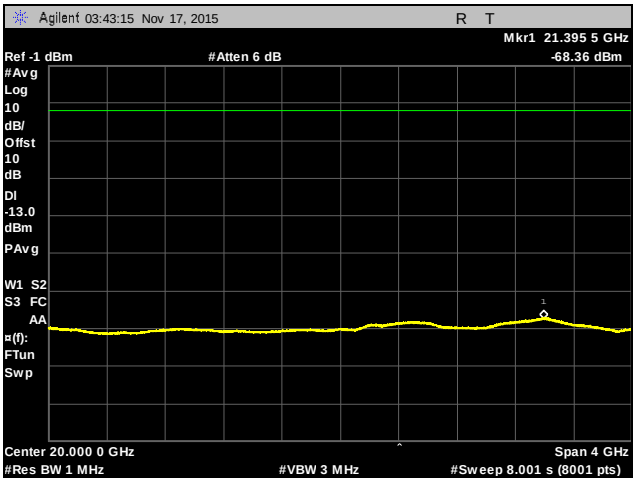
Plot 184. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel, 6 GHz – 10 GHz



Plot 185. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel, 10 GHz – 14 GHz

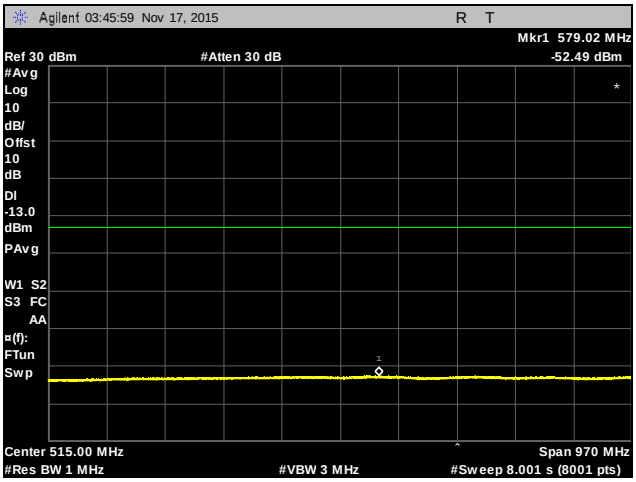


Plot 186. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel, 14 GHz – 18 GHz

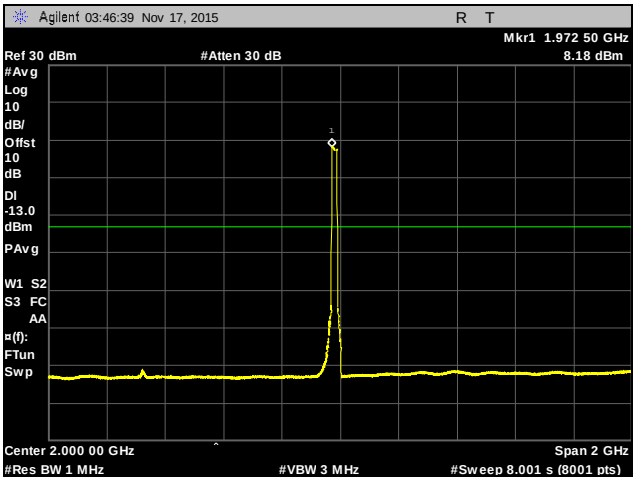


Plot 187. Conducted Spurious Emissions, LTE Band 2, 20 MHz, Mid Channel, 18 GHz – 22 GHz

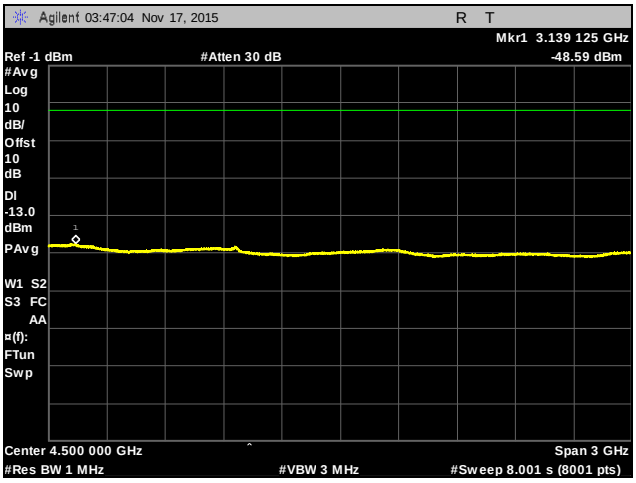
Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel



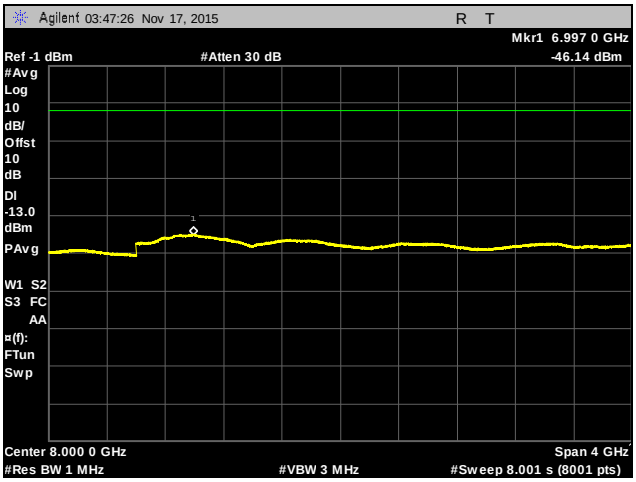
Plot 188. Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel, 30 MHz – 1 GHz



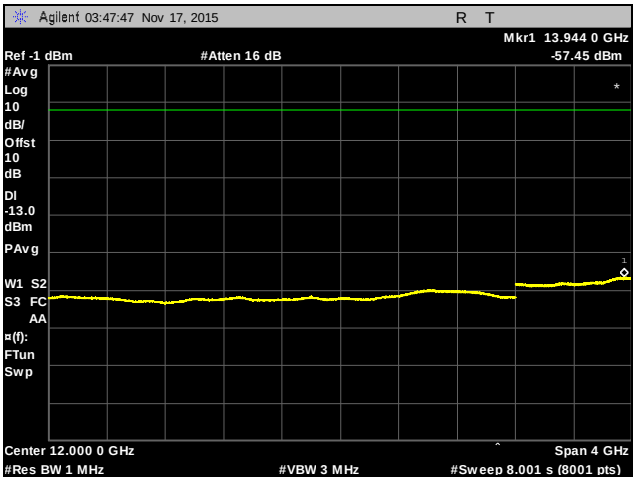
Plot 189. Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel, 1 GHz – 2 GHz



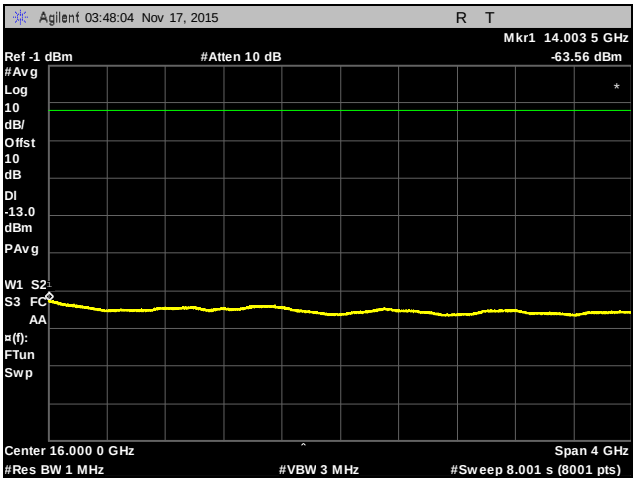
Plot 190. Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel, 2 GHz – 6 GHz



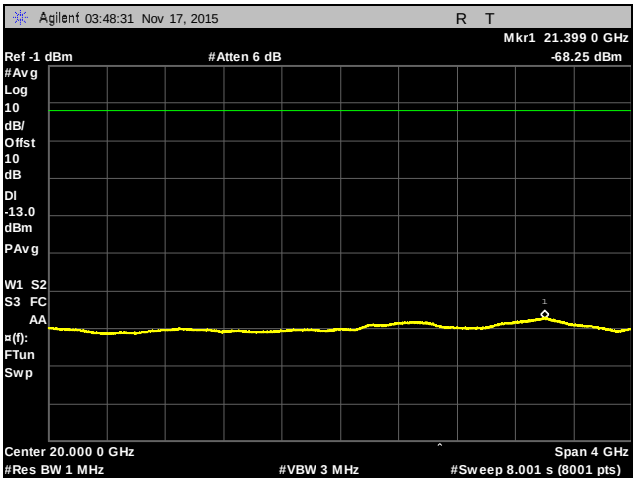
Plot 191. Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel, 6 GHz – 10 GHz



Plot 192. Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel, 10 GHz – 14 GHz

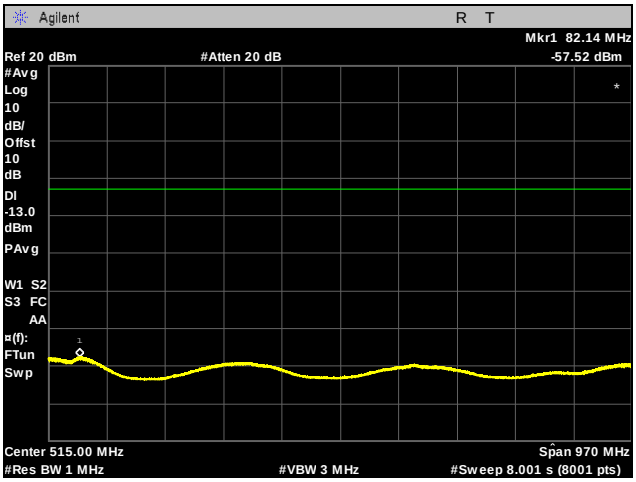


Plot 193. Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel, 14 GHz – 18 GHz

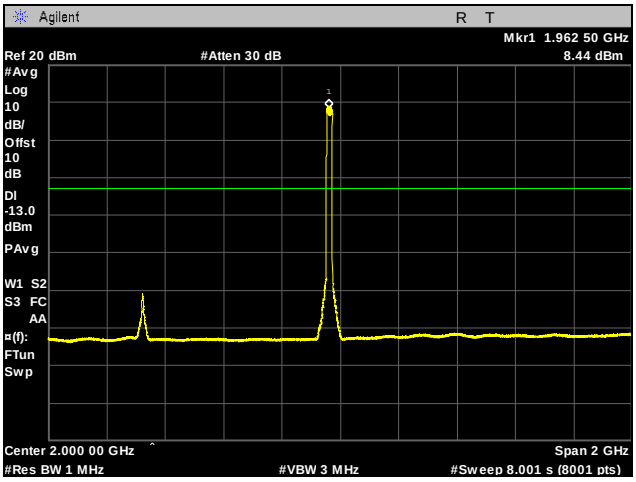


Plot 194. Conducted Spurious Emissions, LTE Band 2, 20 MHz, High Channel, 18 GHz – 22 GHz

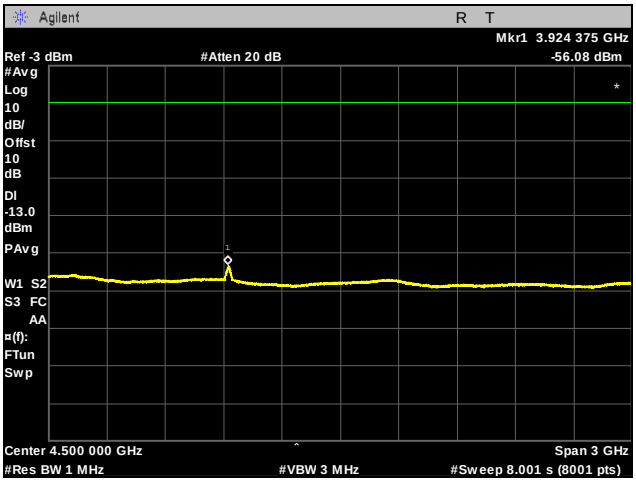
Conducted Spurious Emissions, LTE Band 25, Mid Channel



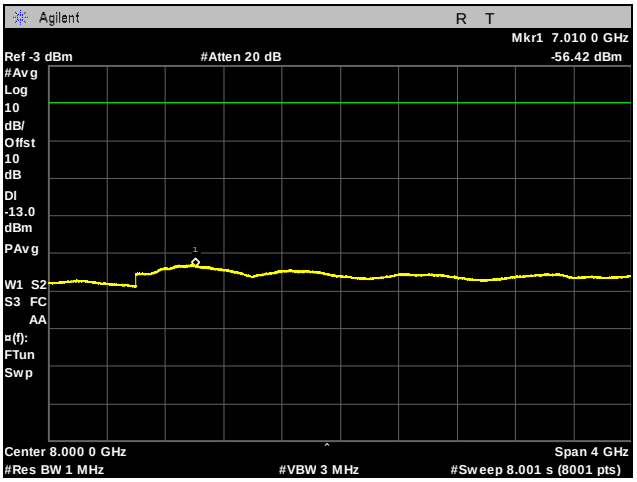
Plot 195. Conducted Spurious Emissions, LTE Band 25, Mid Channel, 30 MHz – 1 GHz



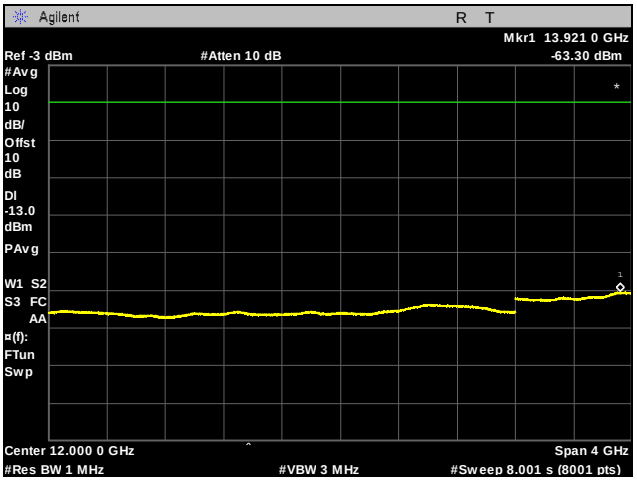
Plot 196. Conducted Spurious Emissions, LTE Band 25, Mid Channel, 1 GHz – 3 GHz



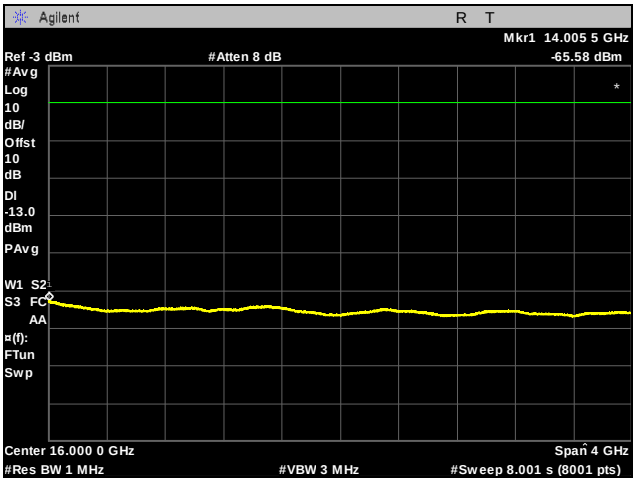
Plot 197. Conducted Spurious Emissions, LTE Band 25, Mid Channel, 3 GHz – 6 GHz



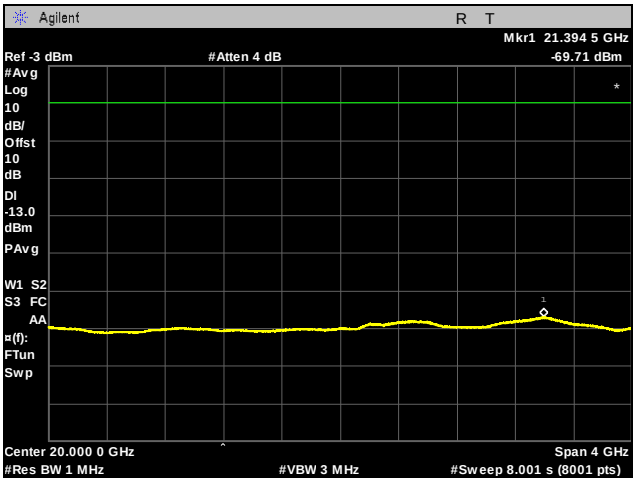
Plot 198. Conducted Spurious Emissions, LTE Band 25, Mid Channel, 6 GHz – 10 GHz



Plot 199. Conducted Spurious Emissions, LTE Band 25, Mid Channel, 10 GHz – 14 GHz

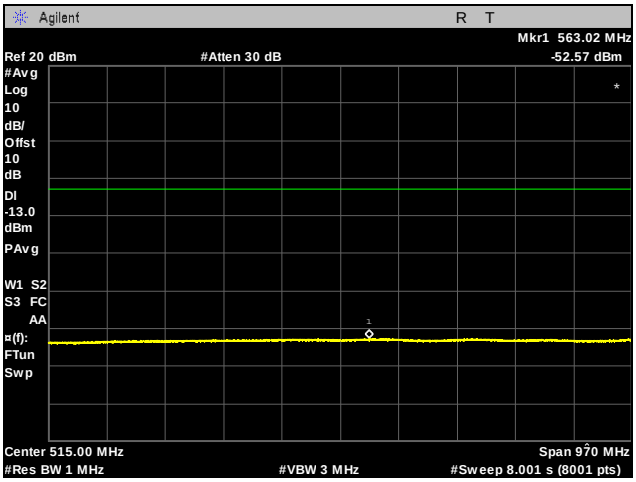


Plot 200. Conducted Spurious Emissions, LTE Band 25, Mid Channel, 14 GHz – 18 GHz

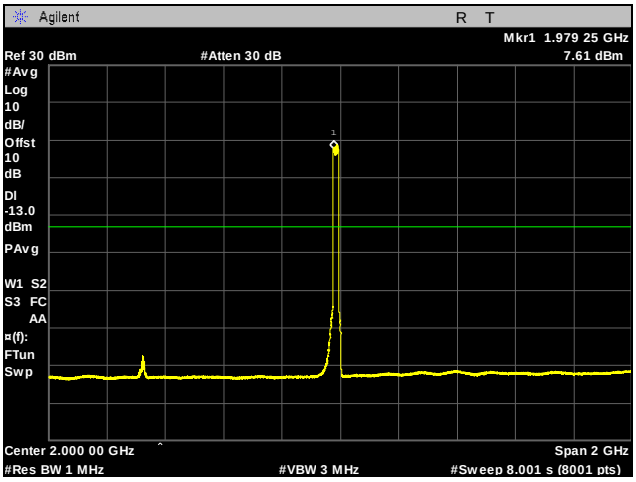


Plot 201. Conducted Spurious Emissions, LTE Band 25, Mid Channel, 18 GHz – 22 GHz

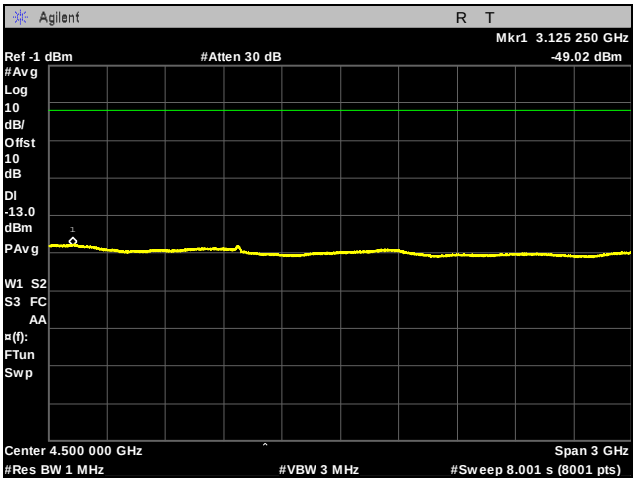
Conducted Spurious Emissions, LTE Band 25, High Channel



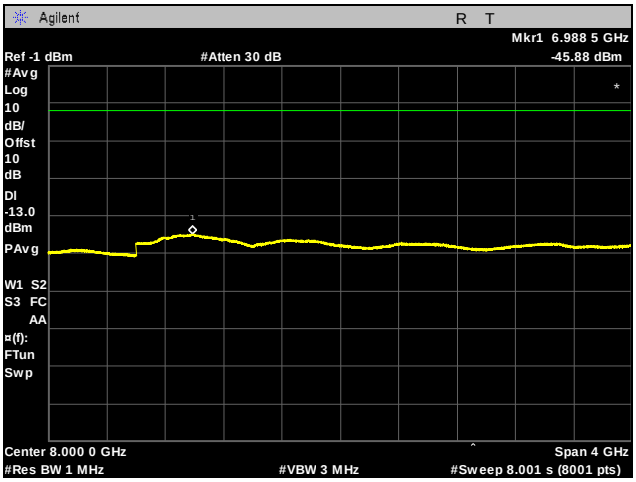
Plot 202. Conducted Spurious Emissions, LTE Band 25, High Channel, 30 MHz – 1 GHz



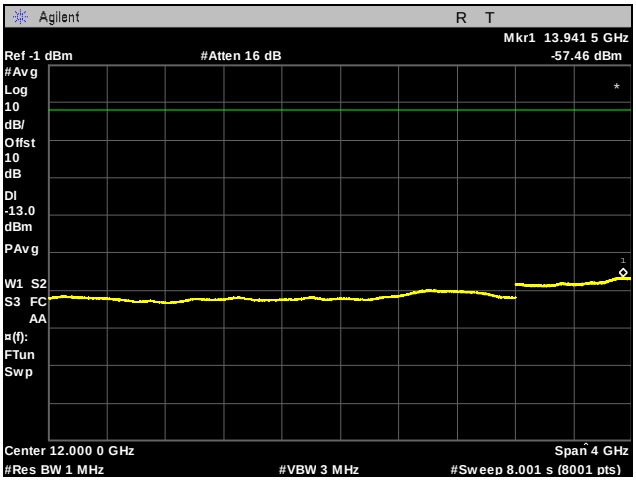
Plot 203. Conducted Spurious Emissions, LTE Band 25, High Channel, 1 GHz – 3 GHz



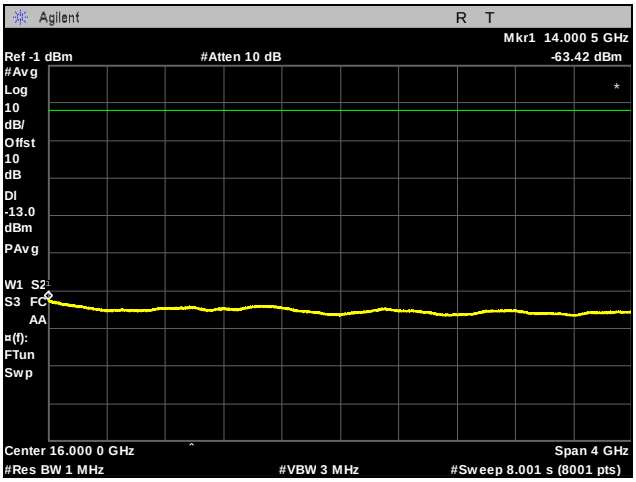
Plot 204. Conducted Spurious Emissions, LTE Band 25, High Channel, 3 GHz – 6 GHz



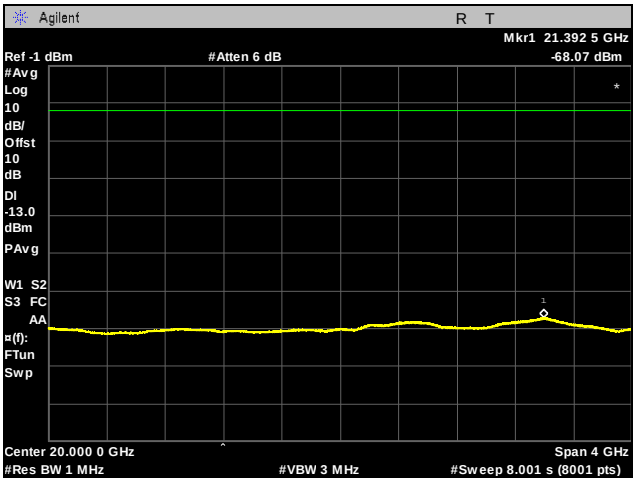
Plot 205. Conducted Spurious Emissions, LTE Band 25, High Channel, 6 GHz – 10 GHz



Plot 206. Conducted Spurious Emissions, LTE Band 25, High Channel, 10 GHz – 14 GHz

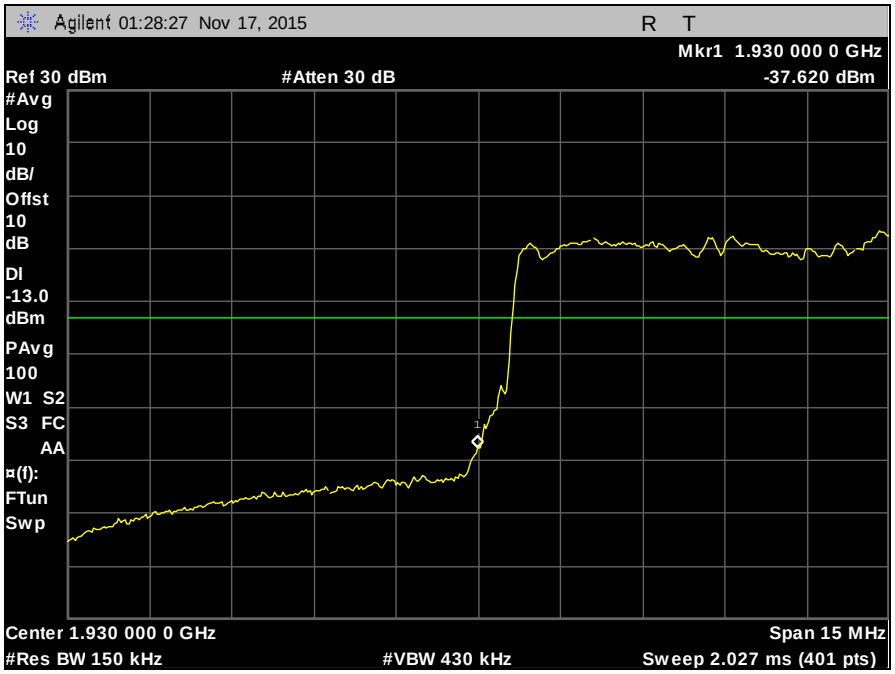


Plot 207. Conducted Spurious Emissions, LTE Band 25, High Channel, 14 GHz – 18 GHz

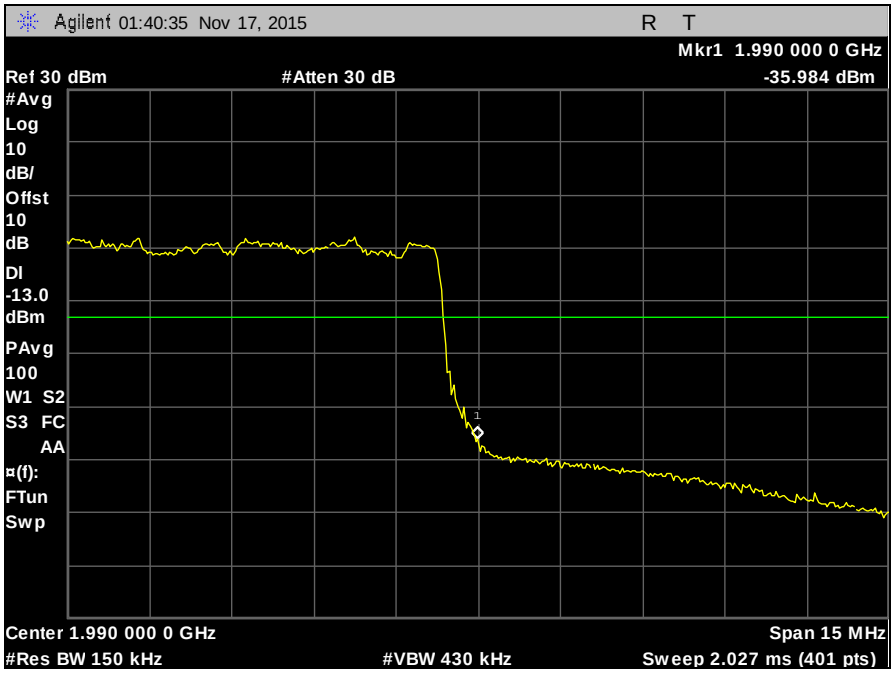


Plot 208. Conducted Spurious Emissions, LTE Band 25, High Channel, 18 GHz – 22 GHz

Band Edge, LTE Band 2, 15 MHz, Port 1, 16QAM

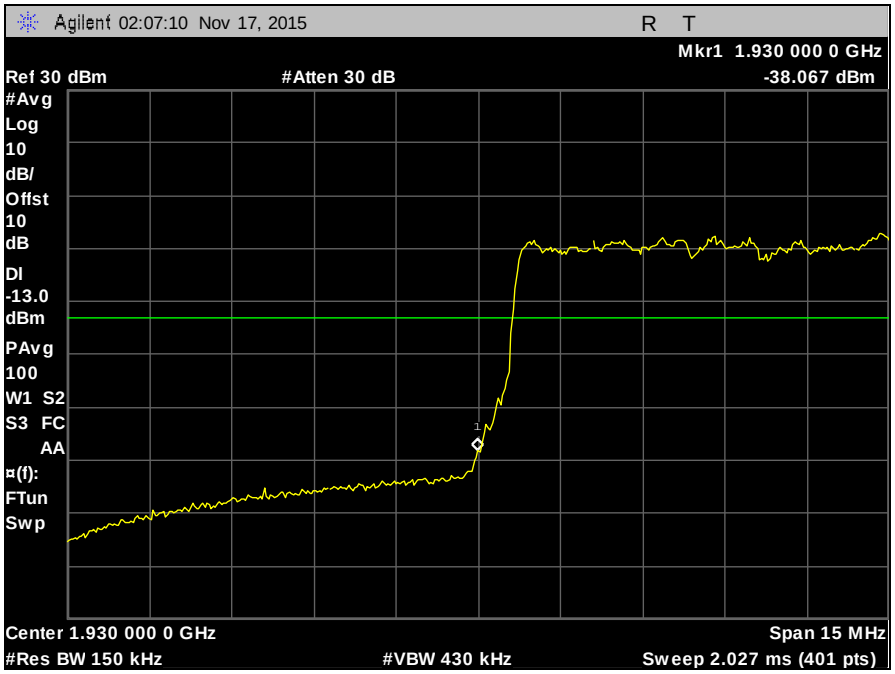


Plot 209. Band Edge Emissions, LTE Band 2, Low Channel, 16QAM, 15 MHz, Port 1

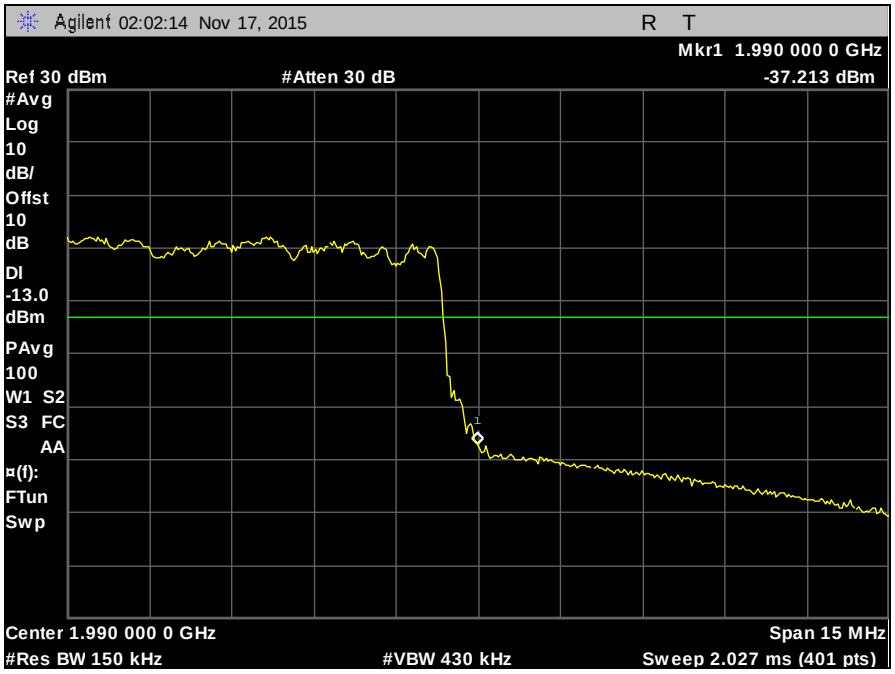


Plot 210. Band Edge Emissions, LTE Band 2, High Channel, 16QAM, 15 MHz, Port 1

Band Edge, LTE Band 2, 15 MHz, Port 1, 64QAM

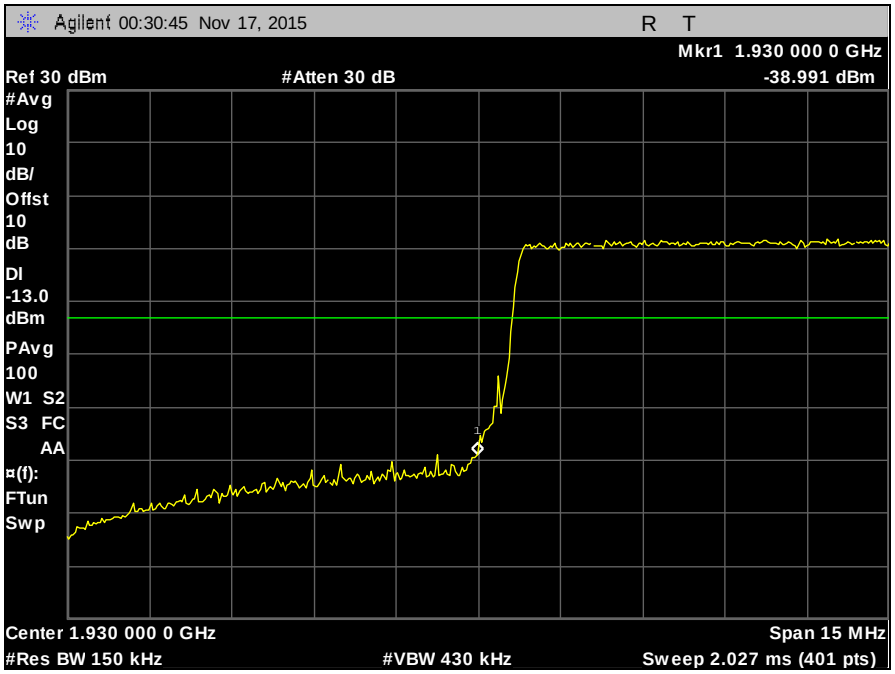


Plot 211. Band Edge Emissions, LTE Band 2, Low Channel, 64QAM, 15 MHz, Port 1

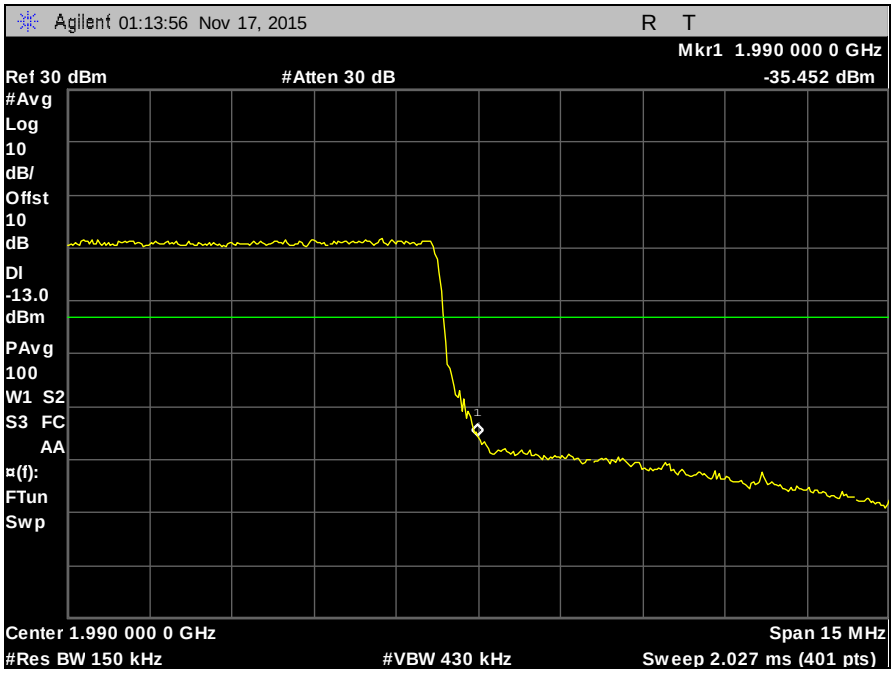


Plot 212. Band Edge Emissions, LTE Band 2, High Channel, 64QAM, 15 MHz, Port 1

Band Edge, LTE Band 2, 15 MHz, Port 1, QPSK

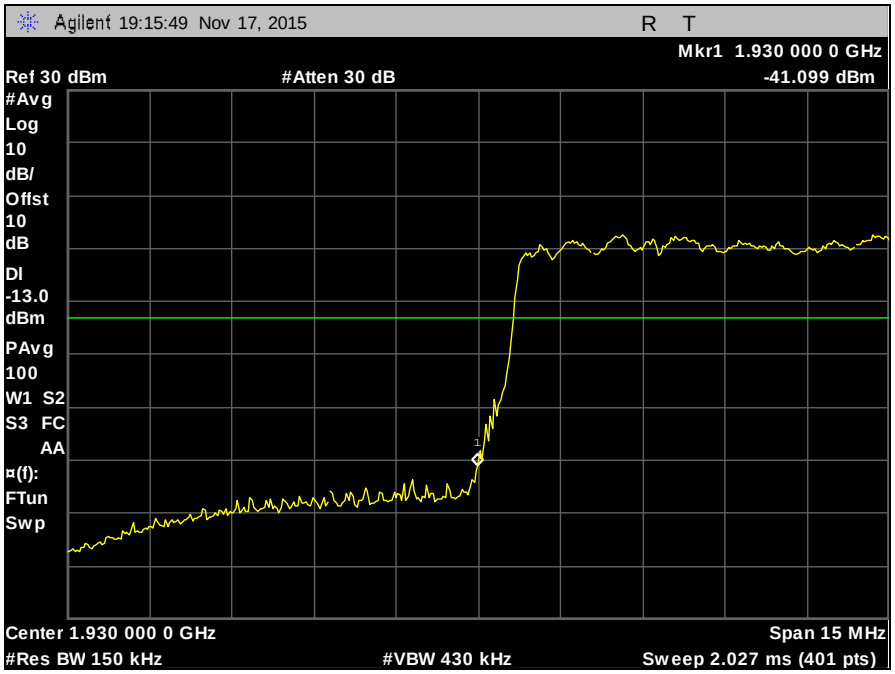


Plot 213. Band Edge Emissions, LTE Band 2, Low Channel, QPSK, 15 MHz, Port 1

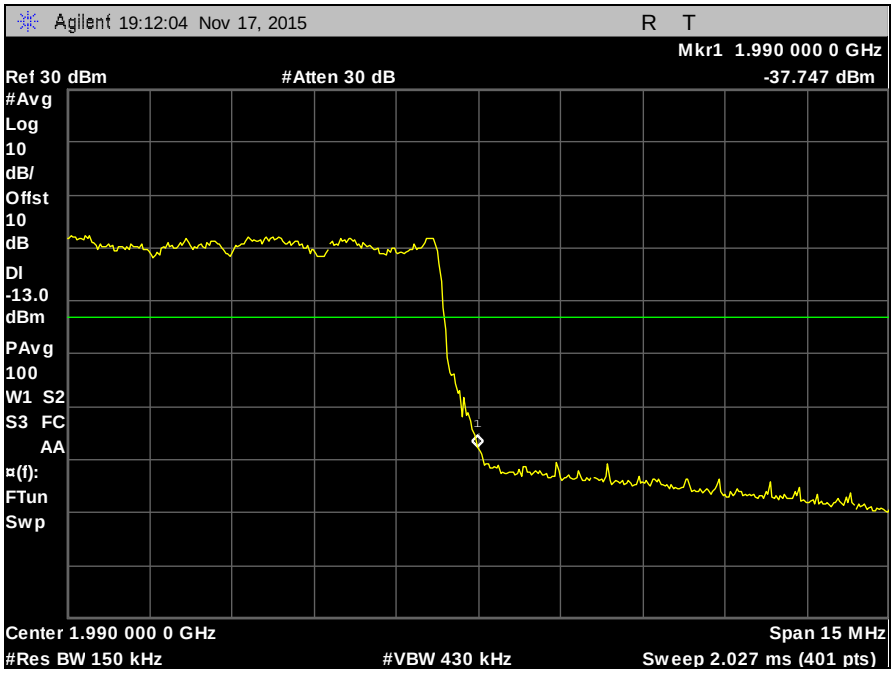


Plot 214. Band Edge Emissions, LTE Band 2, High Channel, QPSK, 15 MHz, Port 1

Band Edge, LTE Band 2, 15 MHz, Port 2, 16QAM

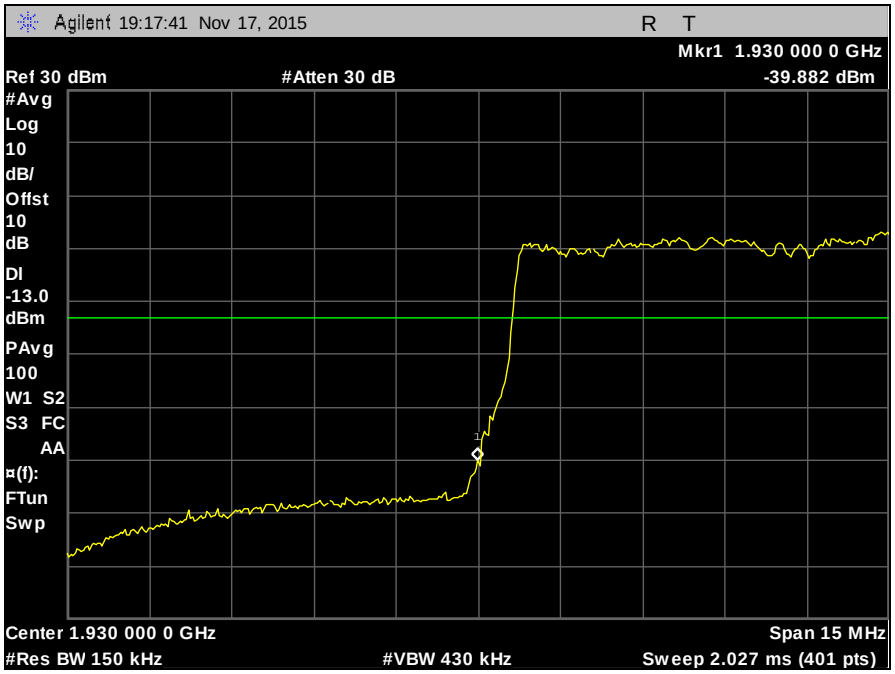


Plot 215. Band Edge Emissions, LTE Band 2, Low Channel, 16QAM, 15 MHz, Port 2

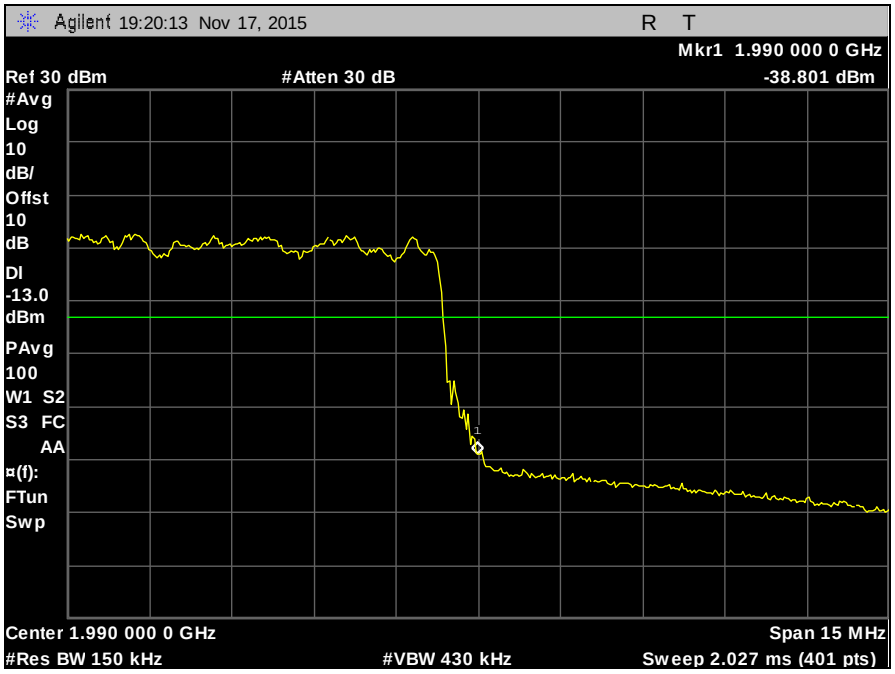


Plot 216. Band Edge Emissions, LTE Band 2, High Channel, 16QAM, 15 MHz, Port 2

Band Edge, LTE Band 2, 15 MHz, Port 2, 64QAM

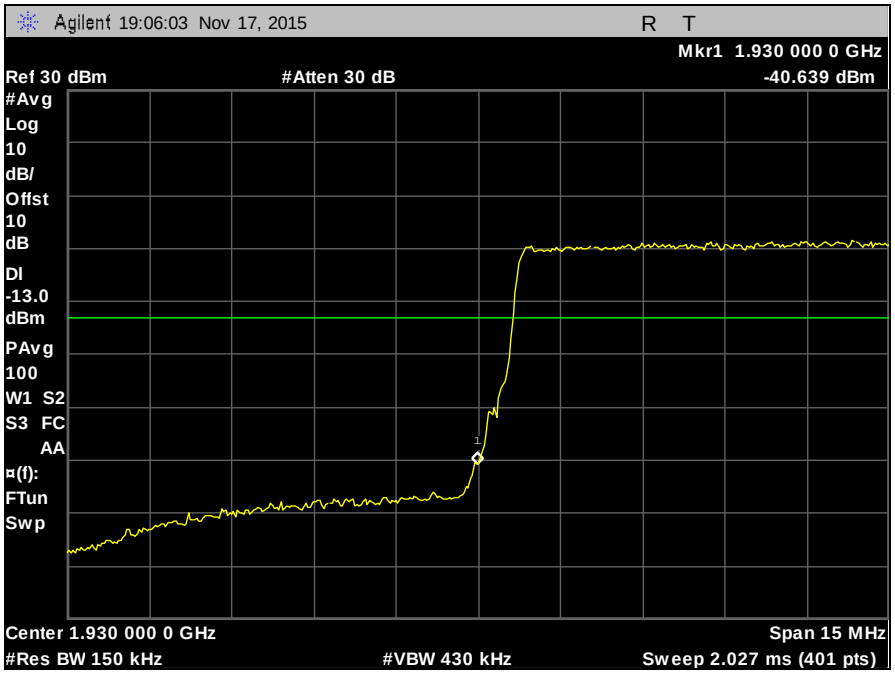


Plot 217. Band Edge Emissions, LTE Band 2, Low Channel, 64QAM, 15 MHz, Port 2

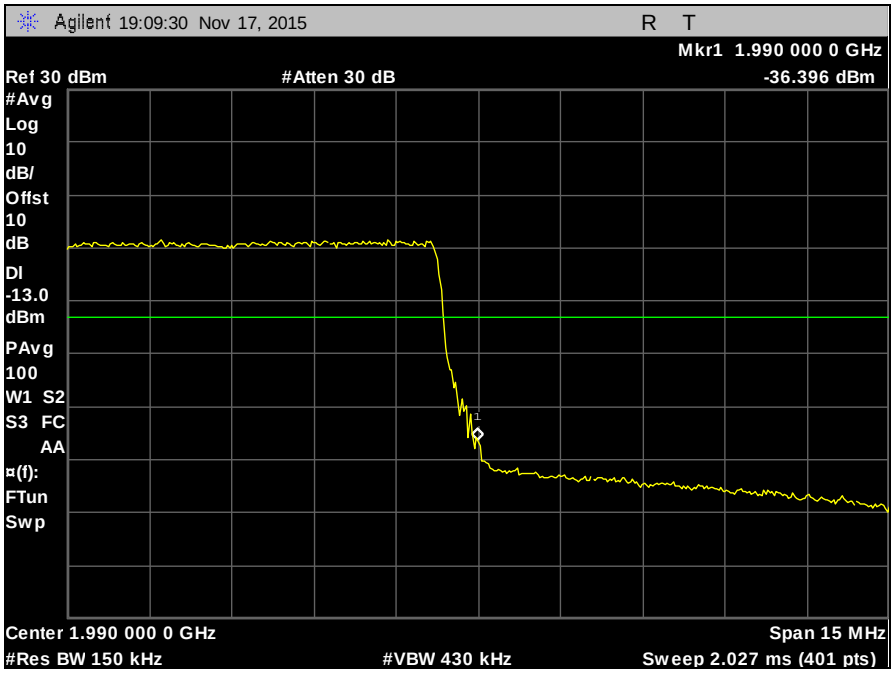


Plot 218. Band Edge Emissions, LTE Band 2, High Channel, 64QAM, 15 MHz, Port 2

Band Edge, LTE Band 2, 15 MHz, Port 2, QPSK

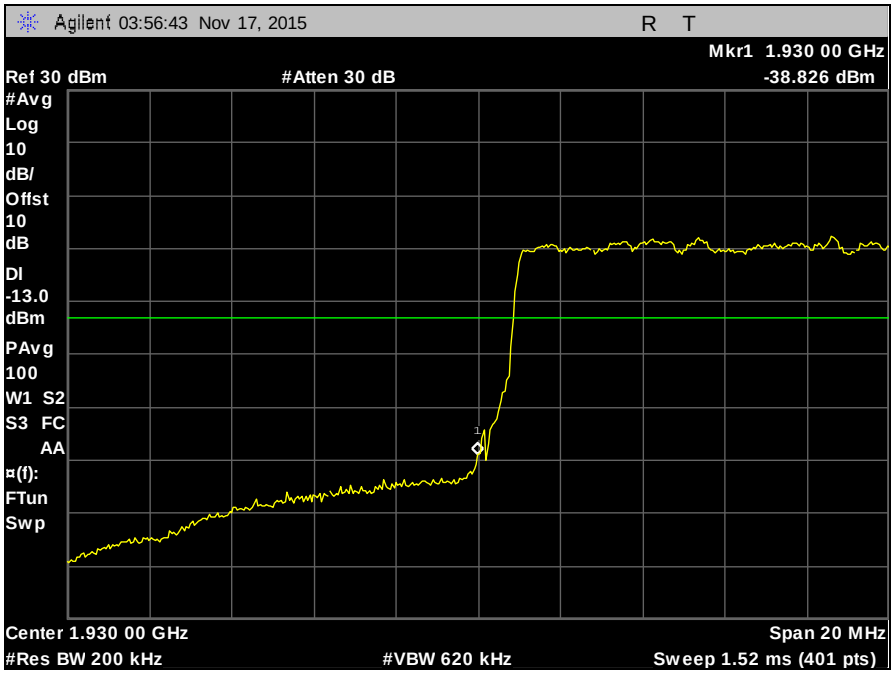


Plot 219. Band Edge Emissions, LTE Band 2, Low Channel, QPSK, 15 MHz, Port 2

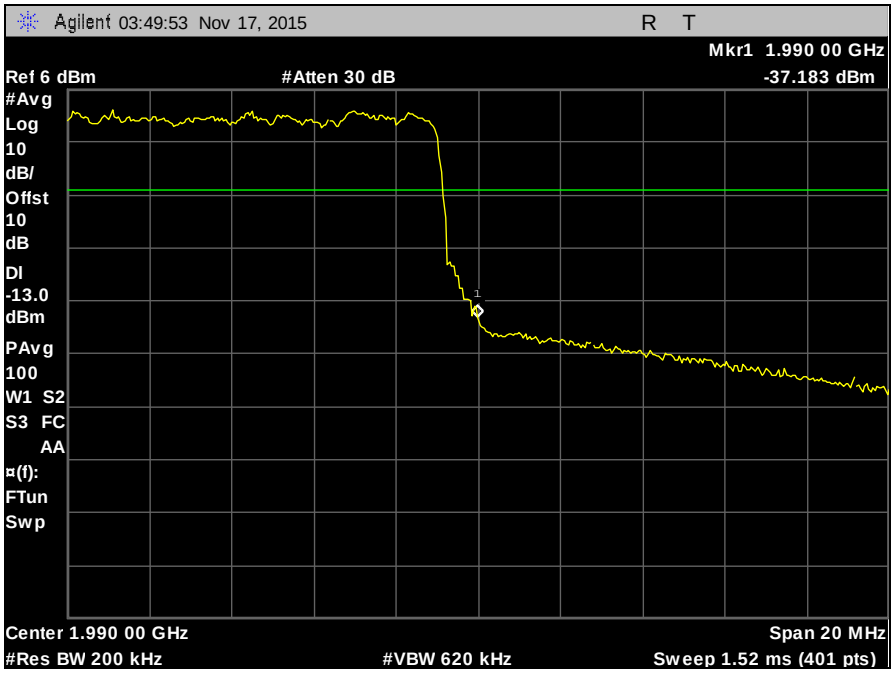


Plot 220. Band Edge Emissions, LTE Band 2, High Channel, QPSK, 15 MHz, Port 2

Band Edge, LTE Band 2, 20 MHz, Port 1, 16QAM

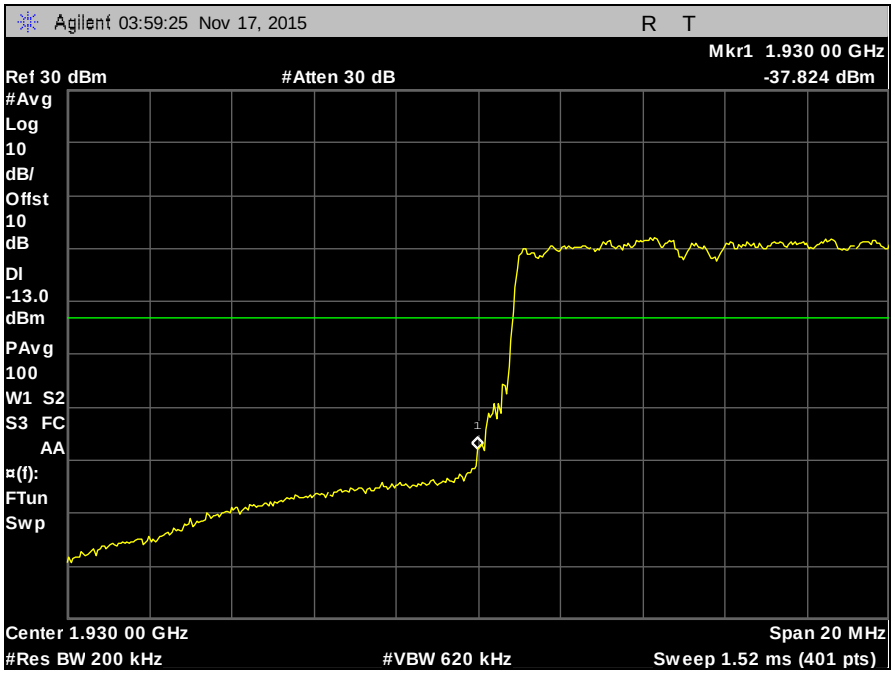


Plot 221. Band Edge Emissions, LTE Band 2, Low Channel, 16QAM, 20 MHz, Port 1

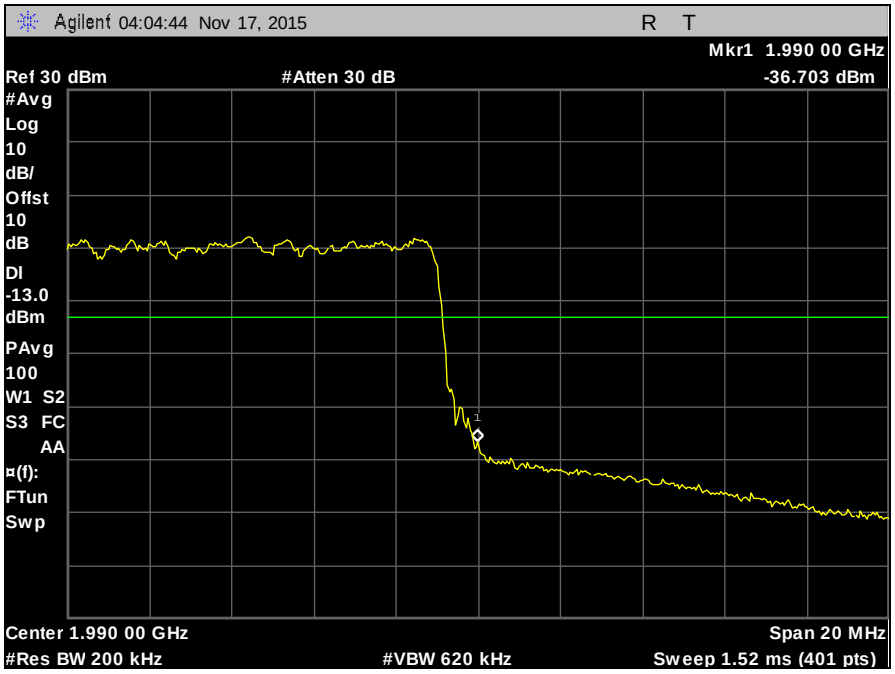


Plot 222. Band Edge Emissions, LTE Band 2, High Channel, 16QAM, 20 MHz, Port 1

Band Edge, LTE Band 2, 20 MHz, Port 1, 64QAM

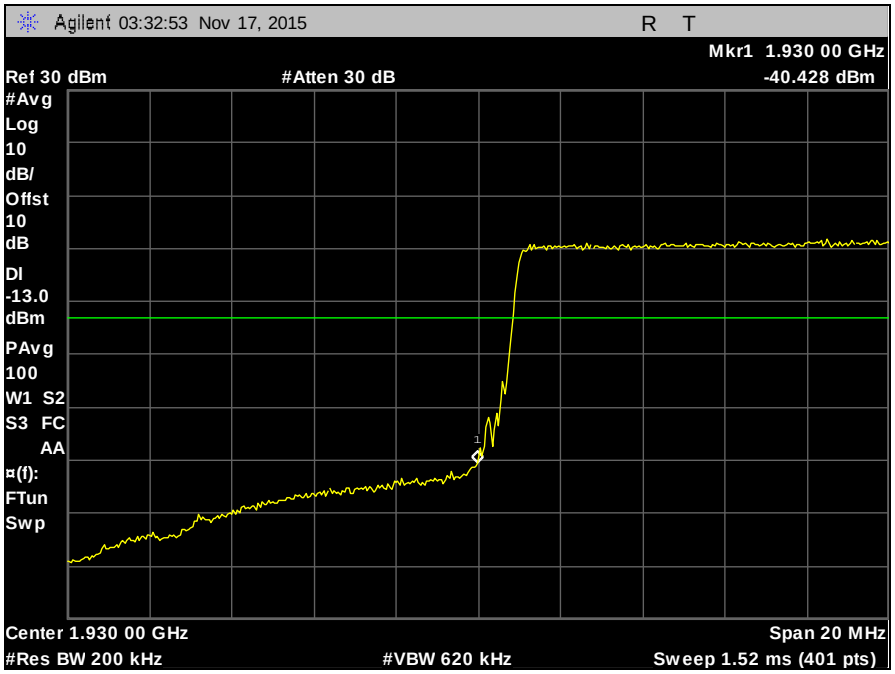


Plot 223. Band Edge Emissions, LTE Band 2, Low Channel, 64QAM, 20 MHz, Port 1

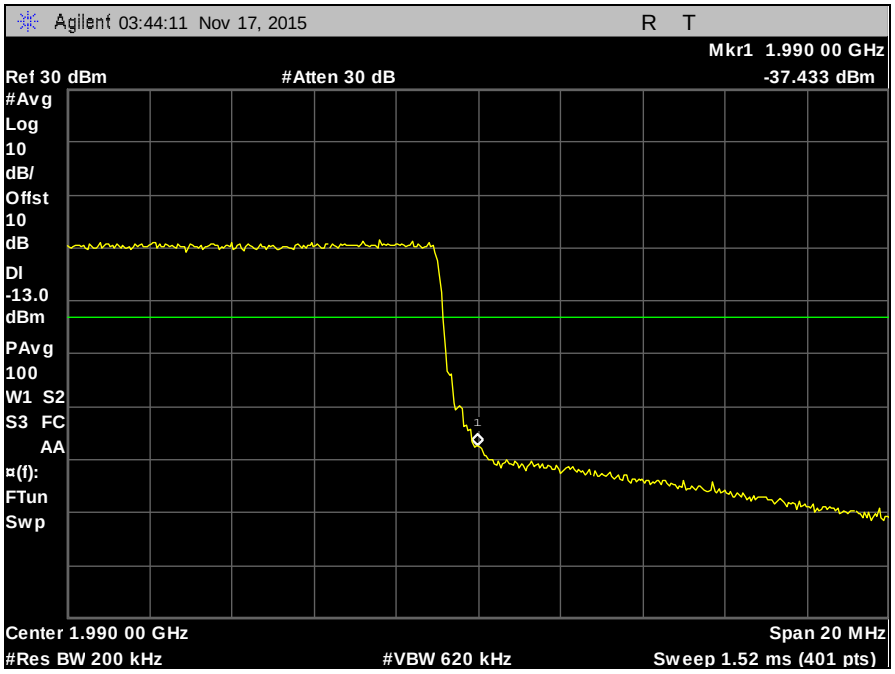


Plot 224. Band Edge Emissions, LTE Band 2, High Channel, 64QAM, 20 MHz, Port 1

Band Edge, LTE Band 2, 20 MHz, Port 1, QPSK

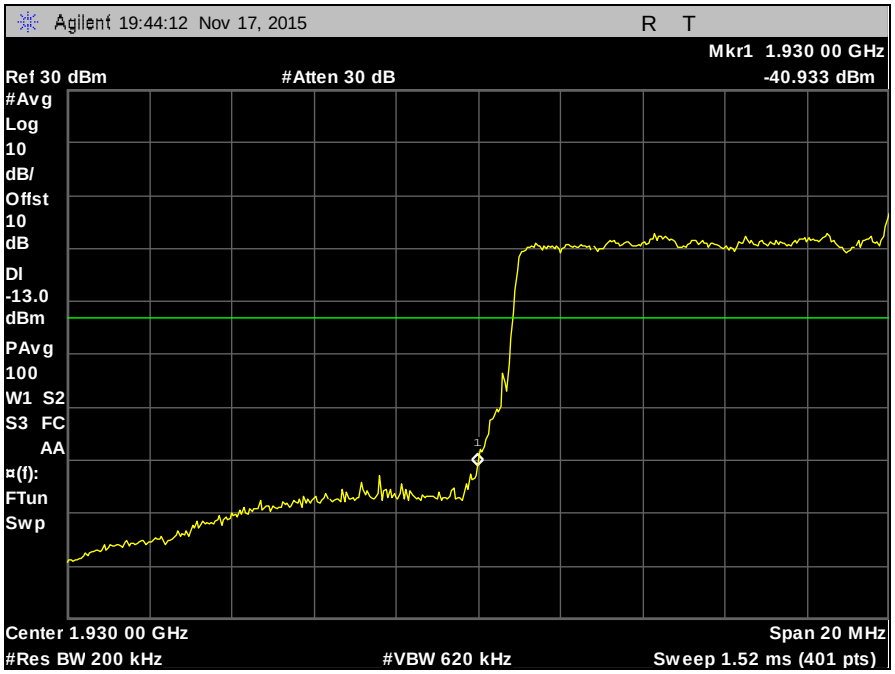


Plot 225. Band Edge Emissions, LTE Band 2, Low Channel, QPSK, 20 MHz, Port 1

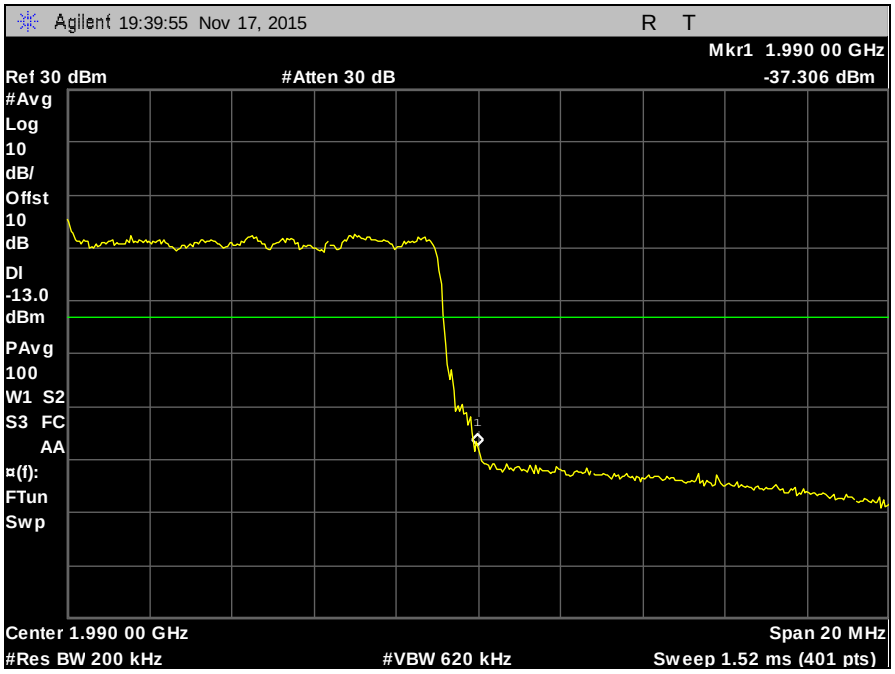


Plot 226. Band Edge Emissions, LTE Band 2, High Channel, QPSK, 20 MHz, Port 1

Band Edge, LTE Band 2, 20 MHz, Port 2, 16QAM

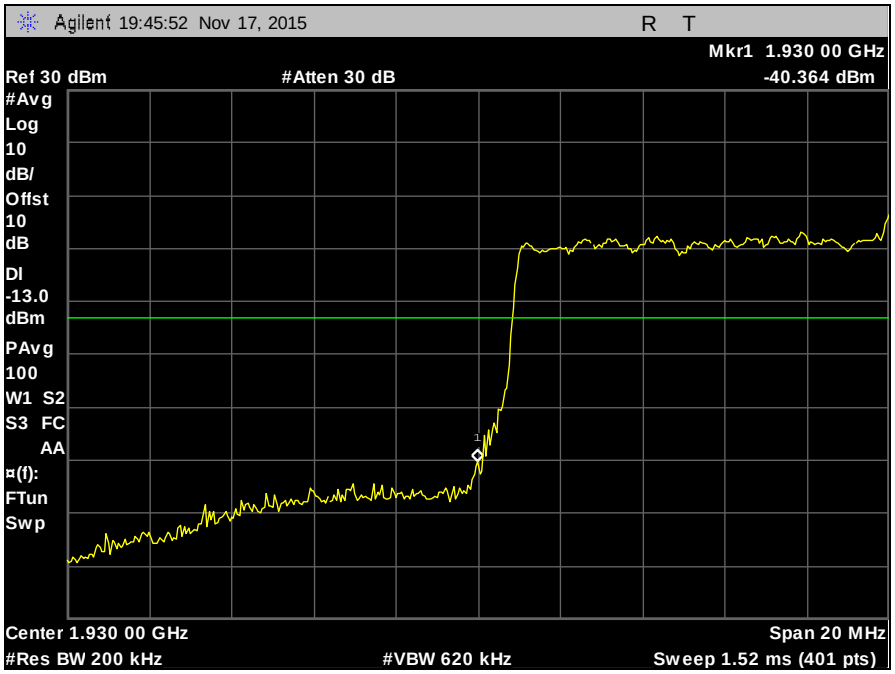


Plot 227. Band Edge Emissions, LTE Band 2, Low Channel, 16QAM, 20 MHz, Port 2

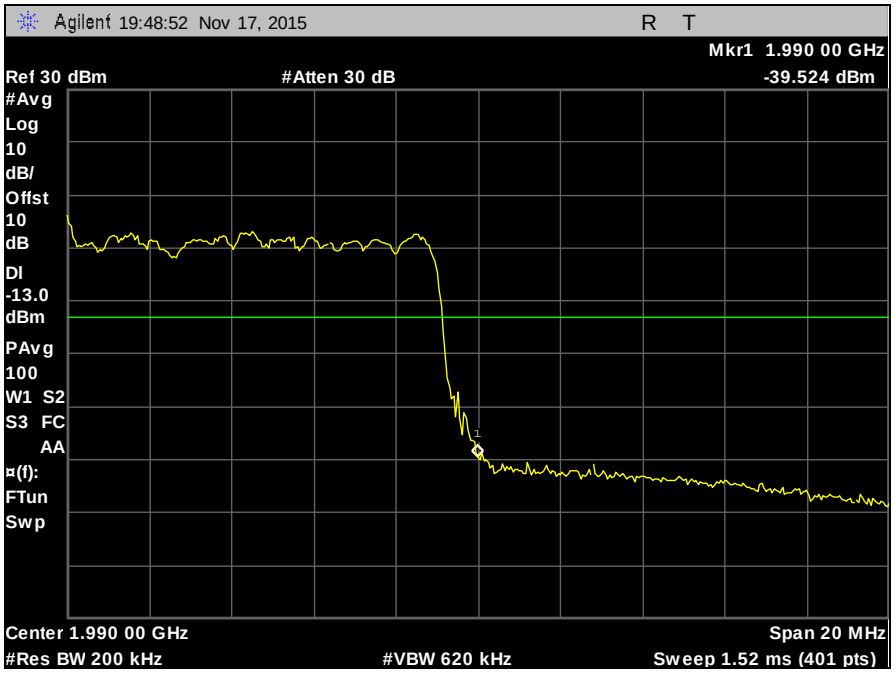


Plot 228. Band Edge Emissions, LTE Band 2, High Channel, 16QAM, 20 MHz, Port 2

Band Edge, LTE Band 2, 20 MHz, Port 2, 64QAM

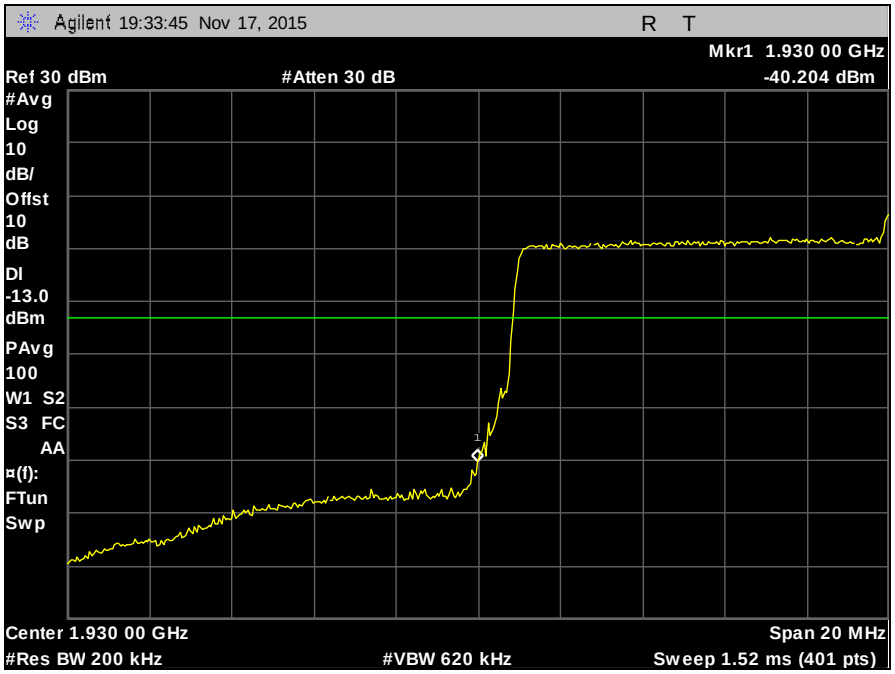


Plot 229. Band Edge Emissions, LTE Band 2, Low Channel, 64QAM, 20 MHz, Port 2

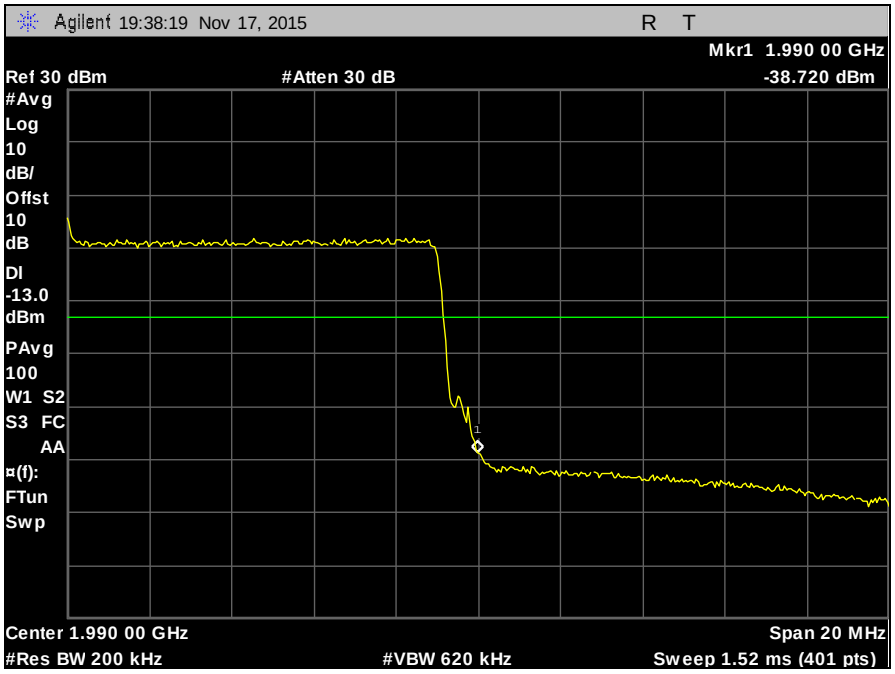


Plot 230. Band Edge Emissions, LTE Band 2, High Channel, 64QAM, 20 MHz, Port 2

Band Edge, LTE Band 2, 20 MHz, Port 2, QPSK

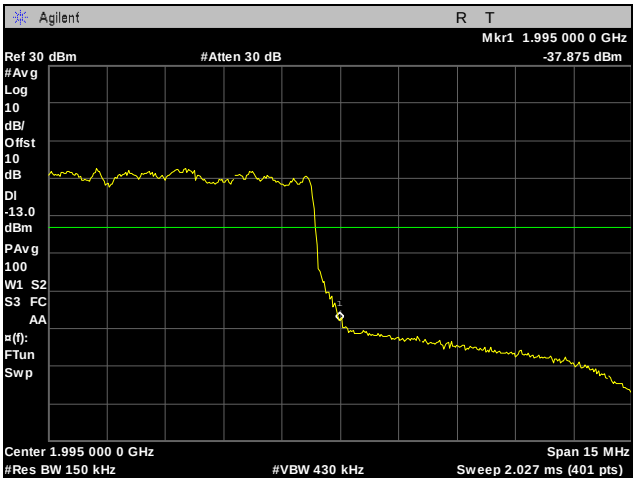


Plot 231. Band Edge Emissions, LTE Band 2, Low Channel, QPSK, 20 MHz, Port 2

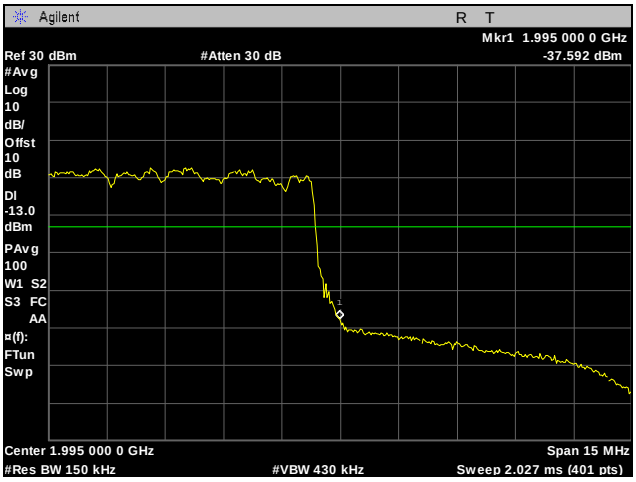


Plot 232. Band Edge Emissions, LTE Band 2, High Channel, QPSK, 20 MHz, Port 2

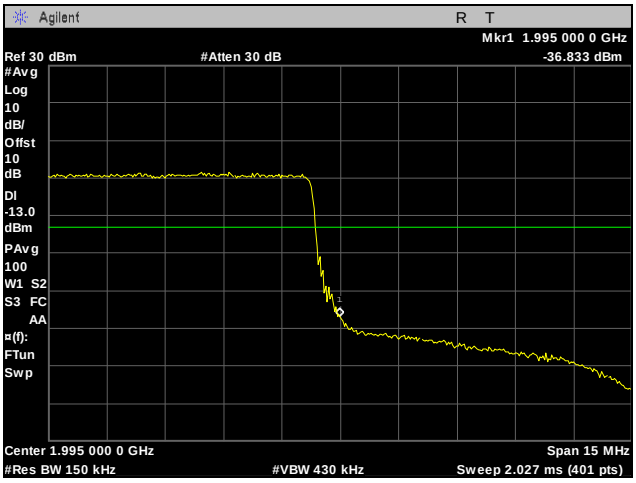
Band Edge, LTE Band 25, 15 MHz, Port 1



Plot 233. Band Edge Emissions, LTE Band 25, High Channel, 16QAM, 15 MHz, Port 1

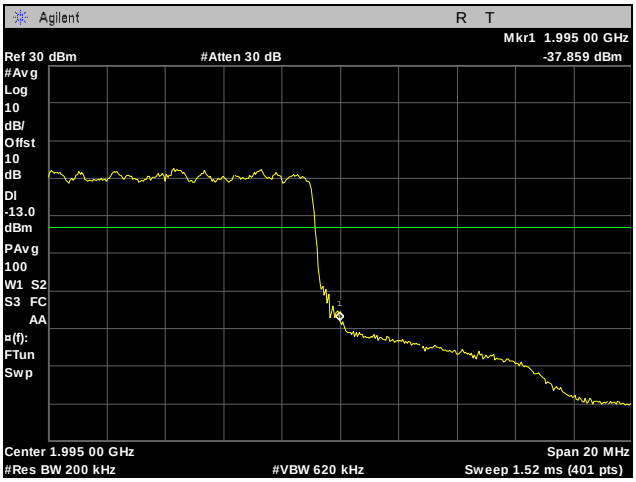


Plot 234. Band Edge Emissions, LTE Band 25, High Channel, 64QAM, 15 MHz, Port 1

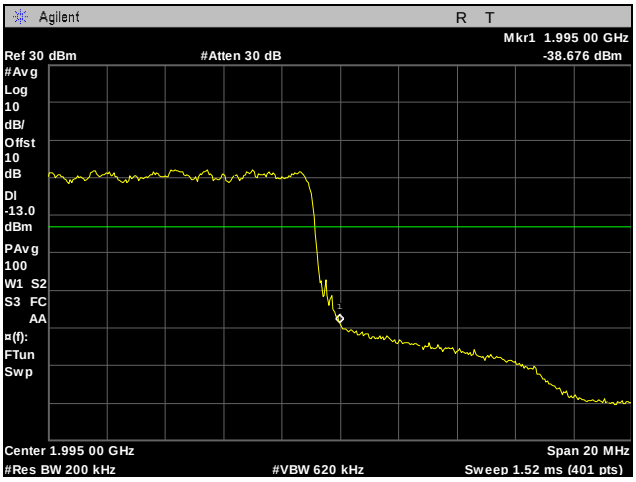


Plot 235. Band Edge Emissions, LTE Band 25, High Channel, QPSK, 15 MHz, Port 1

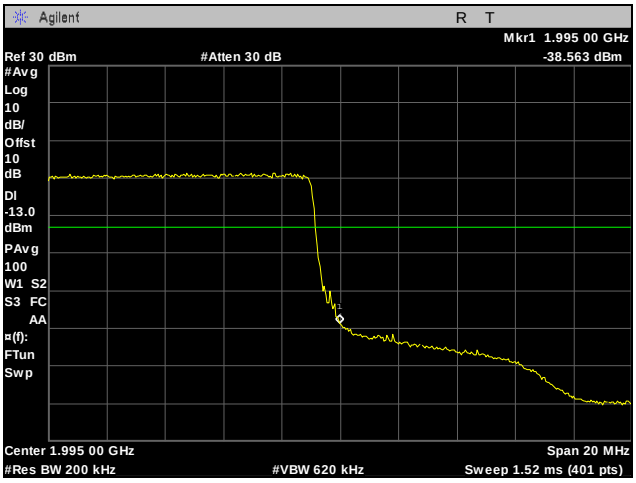
Band Edge, LTE Band 25, 20 MHz, Port 1



Plot 236. Band Edge Emissions, LTE Band 25, High Channel, 16QAM, 20 MHz, Port 1

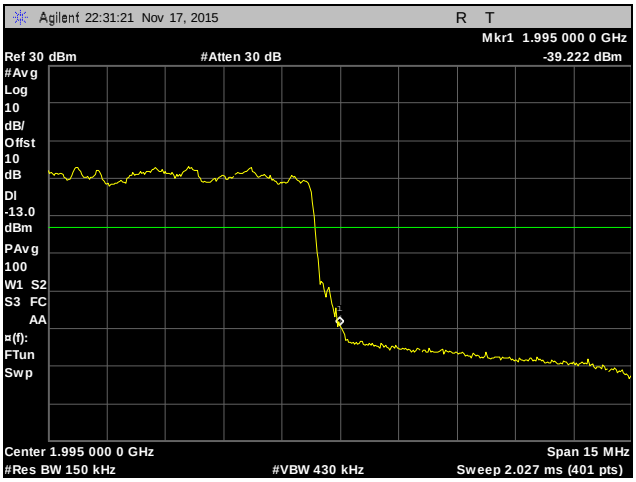


Plot 237. Band Edge Emissions, LTE Band 25, High Channel, 64QAM, 20 MHz, Port 1

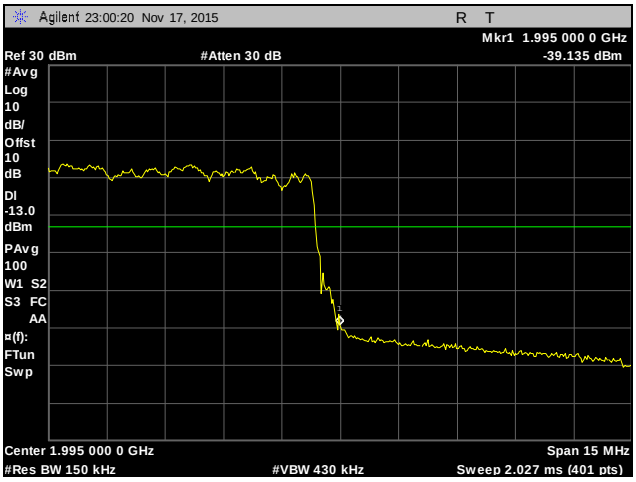


Plot 238. Band Edge Emissions, LTE Band 25, High Channel, QPSK, 20 MHz, Port 1

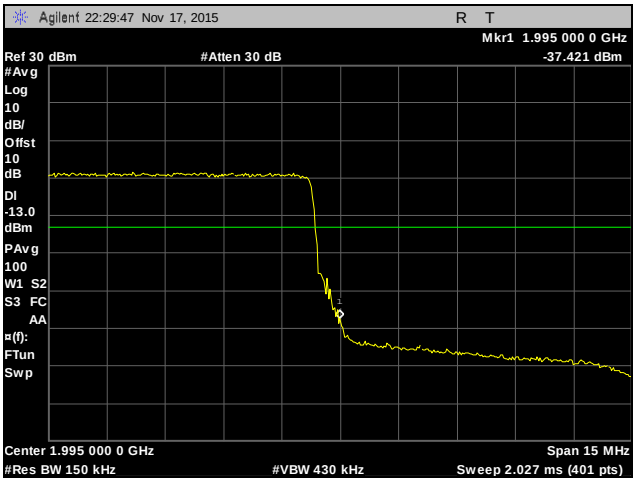
Band Edge, LTE Band 25, 15 MHz, Port 2



Plot 239. Band Edge Emissions, LTE Band 25, High Channel, 16QAM, 15 MHz, Port 2

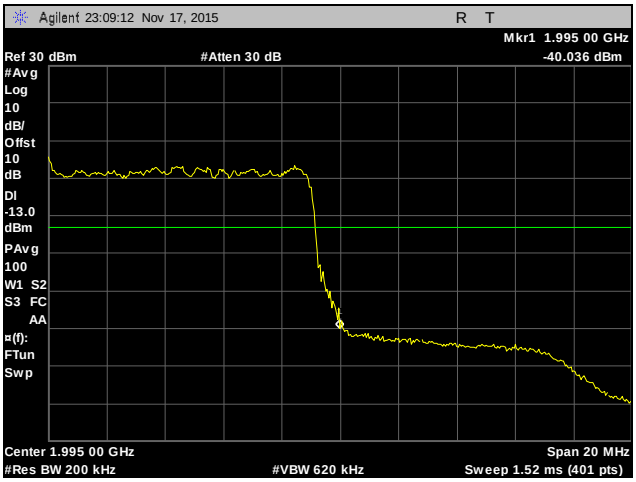


Plot 240. Band Edge Emissions, LTE Band 25, High Channel, 64QAM, 15 MHz, Port 2

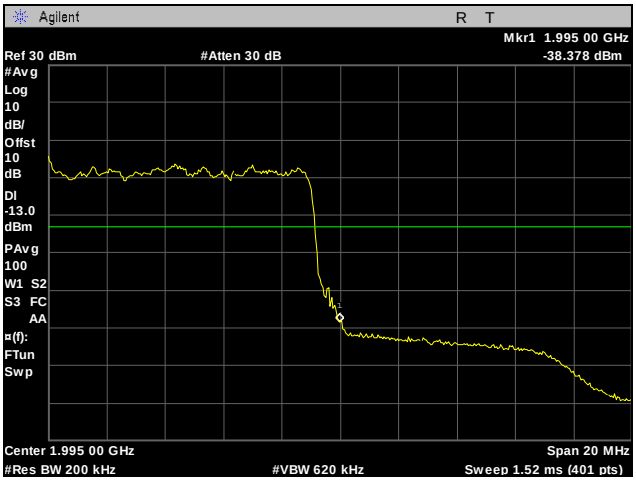


Plot 241. Band Edge Emissions, LTE Band 25, High Channel, QPSK, 15 MHz, Port 2

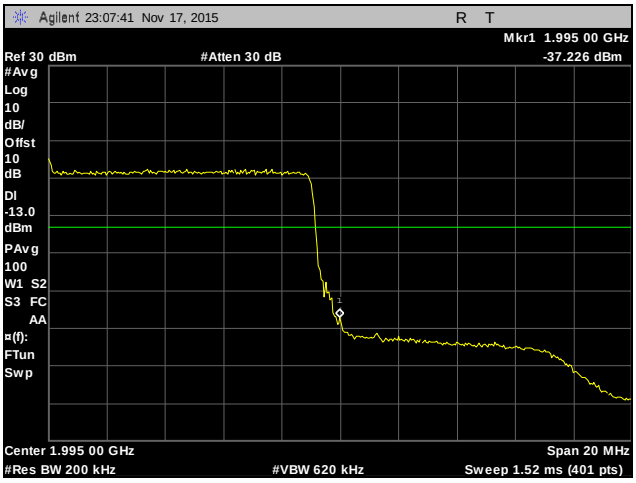
Band Edge, LTE Band 25, 20 MHz, Port 2



Plot 242. Band Edge Emissions, LTE Band 25, High Channel, 16QAM, 20 MHz, Port 2



Plot 243. Band Edge Emissions, LTE Band 25, High Channel, 64QAM, 20 MHz, Port 2



Plot 244. Band Edge Emissions, LTE Band 25, High Channel, QPSK, 20 MHz, Port 2

Electromagnetic Compatibility Criteria for Intentional Radiators

§2.1055 Frequency Stability over Temperature and Voltage Variations

Test Requirement(s): §2.1055(a)(1); §22.355; §24.235

Test Procedures: As required by 47 CFR 2.1055, *Frequency Stability measurements* were made at the RF output terminals using a Spectrum Analyzer and Power Meter.

The EUT was placed in the Environmental Chamber and support equipment outside the chamber on a table. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations. The frequency drift was investigated for every 10^{C} increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -20 to 50^{C}.

Voltage supplied to EUT is 120 VAC reference temperature was done at 20^{C}. The voltage was varied by ± 15 % of nominal.

Test Results: This is class 2 permissive change testing to add 15MHz and 20MHz bandwidth to existing 5MHz and 10MHz FCC approved device with **FCC-ID: QHYRP-A2014.**
Addition of these two 15MHz and 20MHz bandwidth did not result in the expansion of already approved frequency range. Therefore unit is compliant with similarity with the requirement of frequency stability over temperature and voltage variation. Equipment was compliant with Section 2.1055, 22.355 and 24.235.

Test Engineer(s): Surinder Singh

Test Date(s): 11/24/15

Electromagnetic Compatibility Criteria for Intentional Radiators

RF Radiation Exposure Limit:

§1.1310: As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

MPE Limit Calculation: EUT's operating frequencies @ 1937.5-1987.5MHz; **Limit for Uncontrolled exposure: 1 mW/cm^2 or 10 W/m^2**

Output Power= 23.5dBm

Antenna Gain= 8dBi

Power density= 0.28mW/cm^2 at a distance of 20cm

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2005.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4870	THERM./CLOCK/HUMIDITY MONITOR	CONTROL COMPANY	06-662-4, FB70258	3/14/2014	3/14/2016
1T4829	SPECTRUM ANALYZER	AGILENT	E4407B	9/30/2014	3/30/2016
1T4818	COMB GENERATOR	COM-POWER	CGO-520	SEE NOTE	
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY PROOF	81	NOT REQUIRED	
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	2/11/2015	2/11/2016
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	10/8/2015	4/8/2017
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4418	LISN	SOLAR ELECTRONICS	9233-50-TS-50-N	10/24/2014	4/24/2016
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	7/18/2014	7/18/2016
1T4300	SEMI-ANECHOIC CHAMBER # 1 (NSA)	EMC TEST SYSTEMS	NONE	7/24/2015	7/24/2016

Table 9. Test Equipment

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

End of Report

