MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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January 25, 2017

Vuzix Corporation
25 Hendrix Road
West Henrietta, NY 14586

Dear Devrin Talen,

Enclosed is the EMC Wireless test report for compliance testing of the Vuzix Corporation, M300 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Part 15 Subpart C for Intentional Radiators.

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 feel free to contact me.

Sincerely yours,
MET LABORATORIES, INC.

Joel Huna
Documentation Department

Reference: (\Vuzix Corporation\EMC91667A-FCC247 WiFi Rev. 2)

Electromagnetic Compatibility Criteria
Test Report

for the

Vuzix Corporation
M300

Tested under
the FCC Certification Rules
contained in
15.247 Subpart C for Intentional Radiators

MET Report: EMC91667A-FCC247 WiFi Rev. 2

January 25, 2017

Prepared For:

Vuzix Corporation
25 Hendrix Road
West Henrietta, NY 14586

Prepared By:
MET Laboratories, Inc.
914 West Patapsco Avenue,
Baltimore, MD 21230

Electromagnetic Compatibility Criteria
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the FCC Certification Rules
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15.247 Subpart C for Intentional Radiators

Donald Salguero, Project Engineer
Electromagnetic Compatibility Lab

Joel Huna
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 the FCC Rules Part 15.247 under normal use and maintenance.

Asad Bajwa,
Director, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 11, 2017	Initial Issue.
1	January 11, 2017	Addition of FCC ID and updated antenna list
2	January 25, 2017	TCB Review Corrections

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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**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**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 Vuzix Corporation M300, with the requirements of Part 15, §15.247. 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 M300. Vuzix Corporation should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the M300, 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 15, §15.247, in accordance with Vuzix Corporation, purchase order number 507684. All tests were conducted using measurement procedure ANSI C63.4-2014.

FCC Reference 47 CFR Part 15.247:2005	Description	Compliance
Title 47 of the CFR, Part 15 §15.203	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15 §15.207(a)	Conducted Emission Limits	Compliant
Title 47 of the CFR, Part 15 §15.247(a)(2)	6dB Occupied Bandwidth	Compliant
Title 47 of the CFR, Part 15 §15.247(b)	Peak Power Output	Compliant
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	Radiated Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15 §15.247(d)	RF Conducted Spurious Emissions Requirements	Compliant
Title 47 of the CFR, Part 15; §15.247(e)	Peak Power Spectral Density	Compliant

Table 1. Executive Summary of EMC Part 15.247 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by Vuzix Corporation to perform testing on the M300, under Vuzix Corporation's purchase order number 507684.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Vuzix Corporation, M300.

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

Model(s) Tested:	M300	
Model(s) Covered:	M300	
EUT Specifications:	Primary Power: 5VDC	
	FCC ID: 2AA9D-446	
	Type of Modulations:	OFDM
	Equipment Code:	DTS
	Peak RF Output Power:	23.58dBm
	EUT Frequency Ranges:	2412-2462 MHz
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:	Donald Salguero	
Report Date(s):	January 25, 2017	

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
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
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
KDB 558074 D01	DTS Measurements Guidance v03r05

Table 3. References

C. Test Site

All testing was performed at MET Laboratories, Inc., 914 West Patapsco Avenue, 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 Vuzix Corporation M300, Equipment Under Test (EUT), is a smart glasses device that is worn on the head. The device includes a display, processor, camera, speaker, and wireless connectivity, and runs the Android operating system. The user runs applications on the device that assist them in their job or provide environmental information.
The M300 must always be connected to an external battery pack. The connection is a custom 8-pin cable designed by Vuzix that connects the M300 to custom battery packs. The default battery pack is an 860 mAh cell with onboard electronics to monitor state of charge and provide battery charging over USB.

E. Equipment Configuration

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Rev. #
A		Smart Glasses	M300	446MA0101	TBD	3
B		Vuzix Power Cable		446CA0002	N/A	1
C		Glasses Battery Pack		446MA0116	TBD	2
D		Glasses Frames		446MA0123	N/A	1

Table 4. Equipment Configuration

F. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
E	USB Cable			Not Applicable
F	Laptop	Lenovo		Not Applicable
The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.				

Table 5. Support Equipment

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
1	8-pin Connector	Vuzix 8-pin Cable	1	30”		Yes	8-pin Connector on Battery
2	USB Micro A/B	USB A to Micro-B	1	2	2	Yes	Laptop

Table 6. Ports and Cabling Information

H. Mode of Operation

Non-wireless test mode: The M300 will enable all peripherals, including the camera, flash, display, orientation sensors, proximity sensors, battery charging and communication with the battery pack. The M300 will stay in this mode until explicitly disabled.
Bluetooth test mode: The M300 will be configured to continuously transmit either in normal or hop mode via a test application.
WiFi test mode: The M300 will be configured to continuously transmit with modulation applied with the ability to change channels as well as changing between B, G, N, and AC modes via a test application.

I. Method of Monitoring EUT Operation

1: The unit will continue to display the camera feed and show the sensor readouts in the display.
2: Any other condition or sensor readout will say FAIL.

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 Vuzix Corporation upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The EUT as tested is compliant the criteria of §15.203. EUT has integral antennas..

Test Engineer(s): Donald Salguero

Test Date(s): January 6, 2017

Gain (dBi)	Type	Model	Manufacturer	Comment
0	LDS antenna	Custom	Sunway	WiFi/GPS antenna
0	FPC antenna	Custom	Sunway	WiFi/BT/BLE antenna

Table 7. Antenna List

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207(a) Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Σ line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 8. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

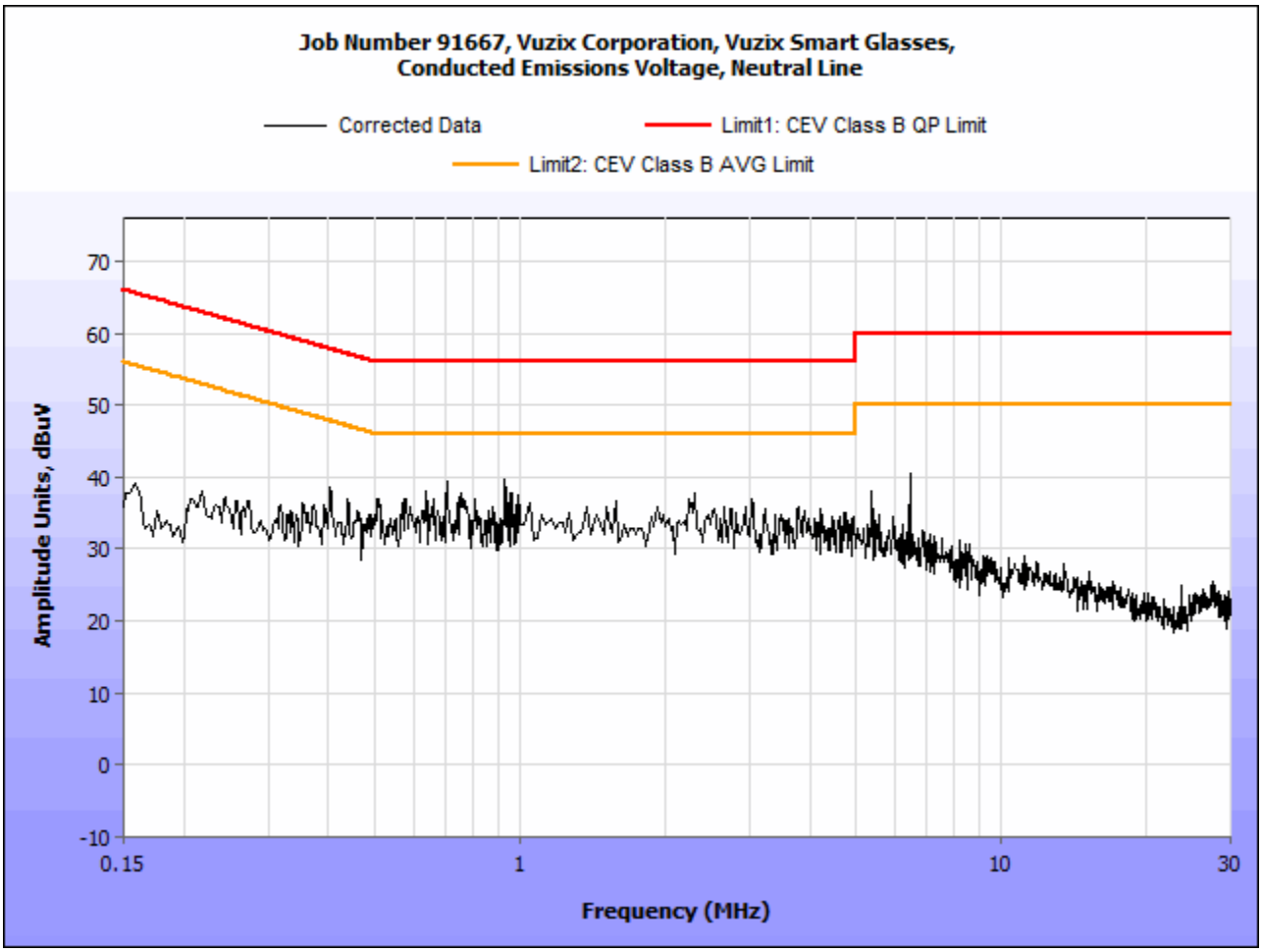
Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 μH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2014 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 μH LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement. Measured emissions were within applicable limits.

Test Engineer(s): Donald Salguero

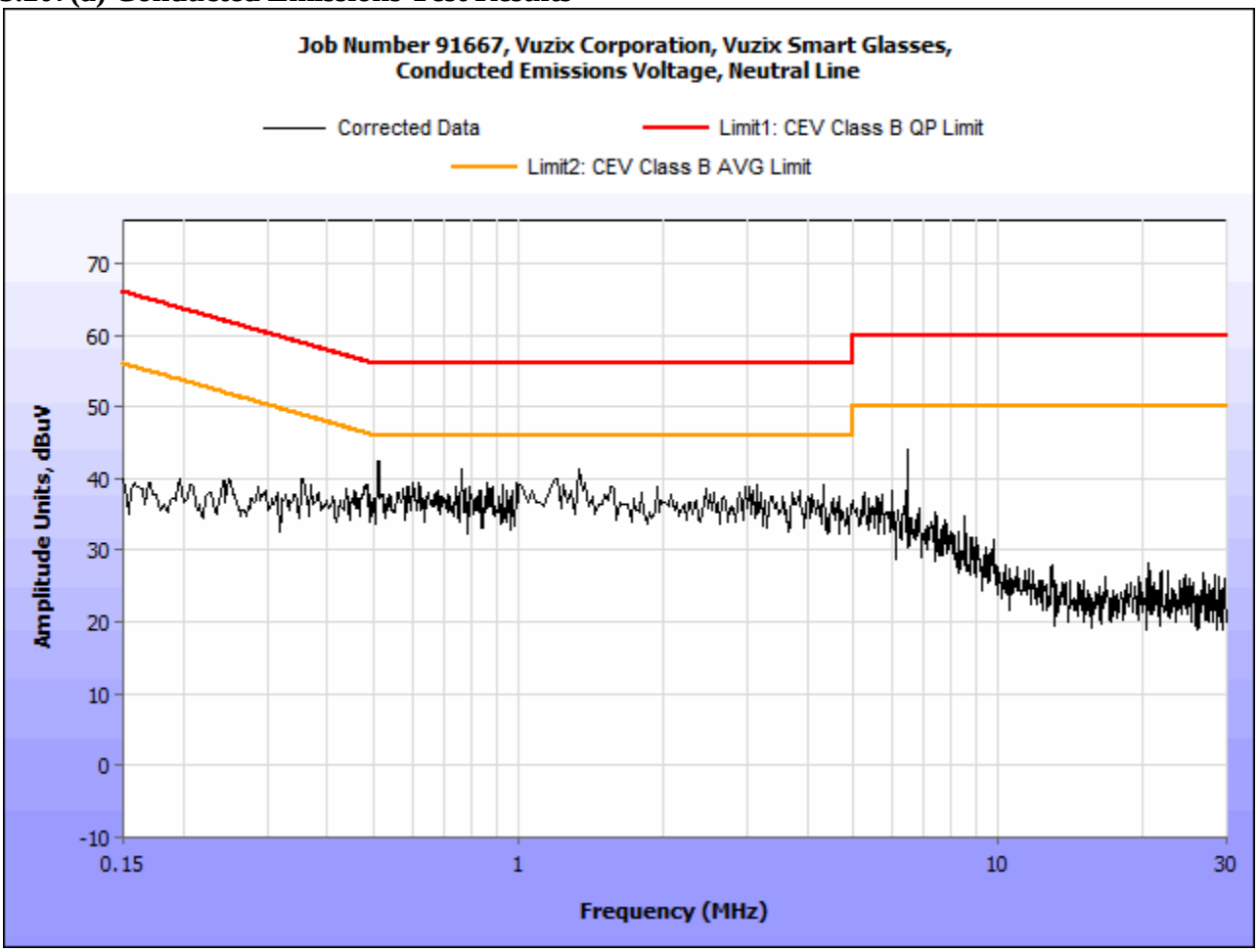
Test Date(s): November 14, 2016

15.207(a) Conducted Emissions Test Results



Plot 1. Conducted Emissions, 15.207(a), Phase Line

15.207(a) Conducted Emissions Test Results



Plot 2. Conducted Emissions, 15.207(a), Neutral Line

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(a)(2) 6 dB Bandwidth

Test Requirements: **§ 15.247(a)(2):** Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded. The measurements were performed on the low, mid and high channels.

Test Results The EUT was compliant with § 15.247 (a)(2). No anomalies detected.

The 6 dB Bandwidth was determined from the plots on the following pages.

Test Engineer(s): Donald Salguero

Test Date(s): January 6, 2017

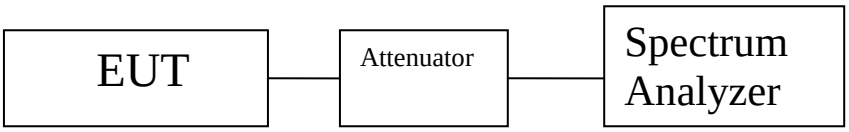
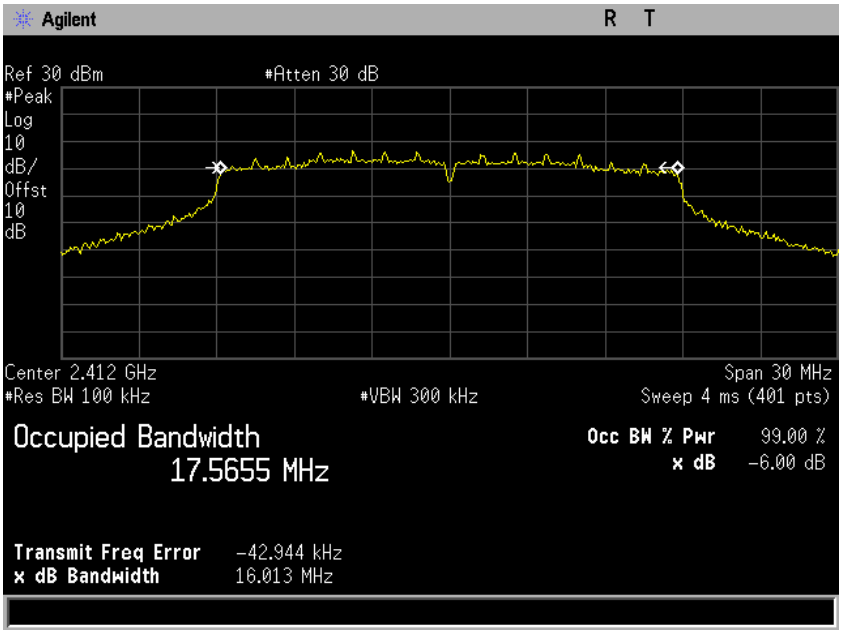
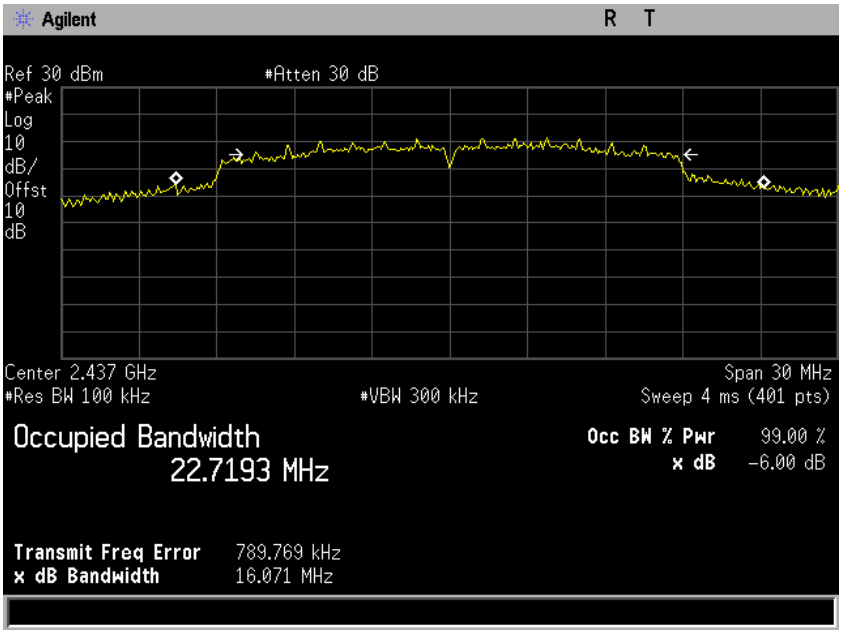


Figure 1. Block Diagram, Occupied Bandwidth Test Setup

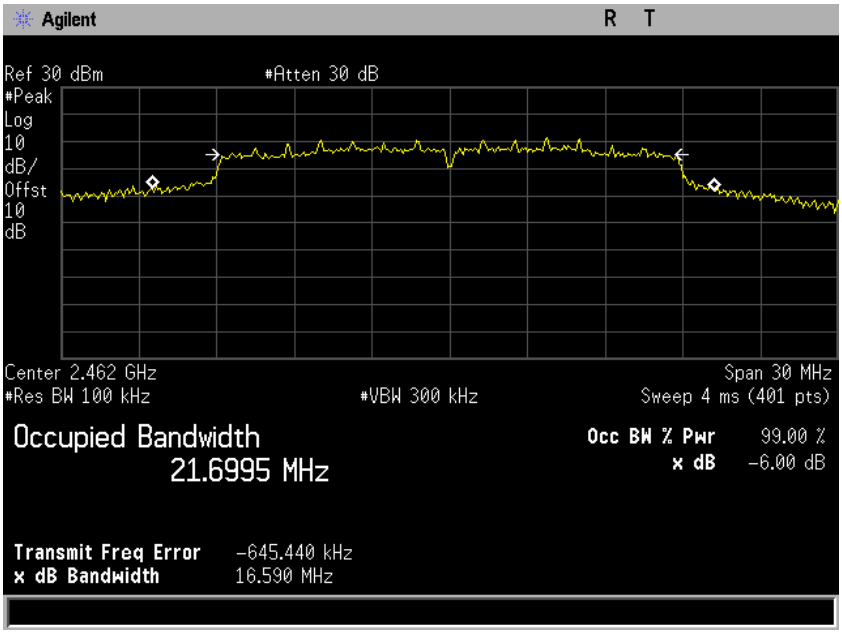
6 dB Occupied Bandwidth Test Results



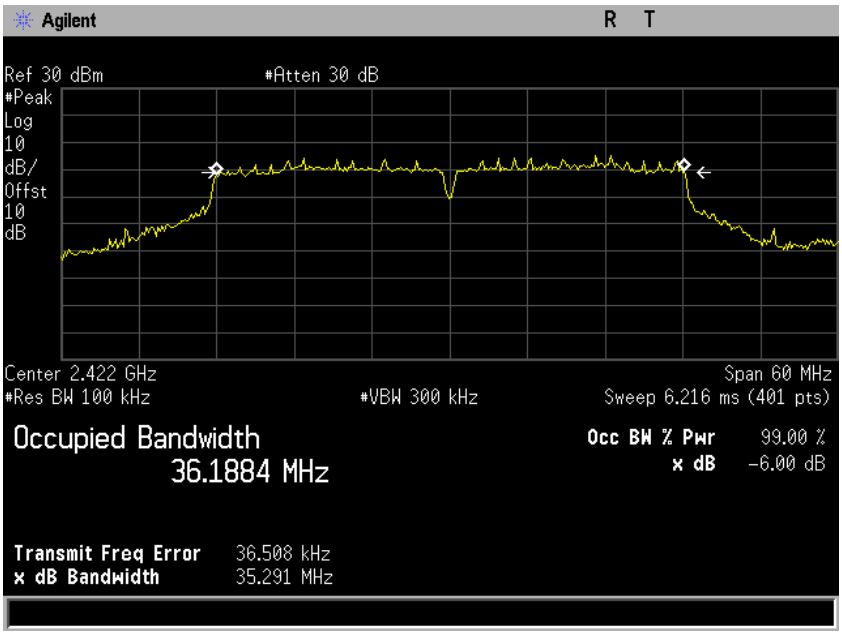
Plot 3. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2412, Port a



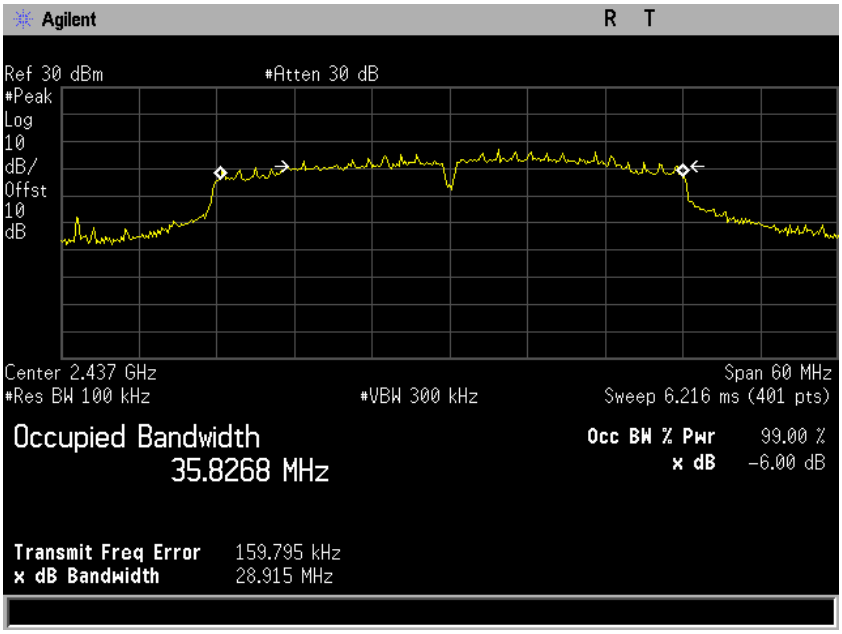
Plot 4. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2437, Port a



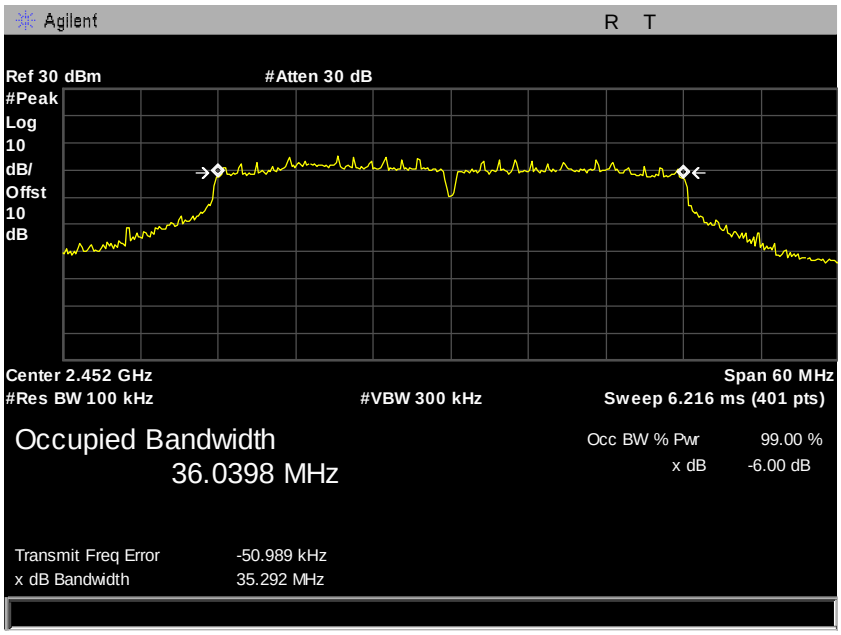
Plot 5. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2462, Port a



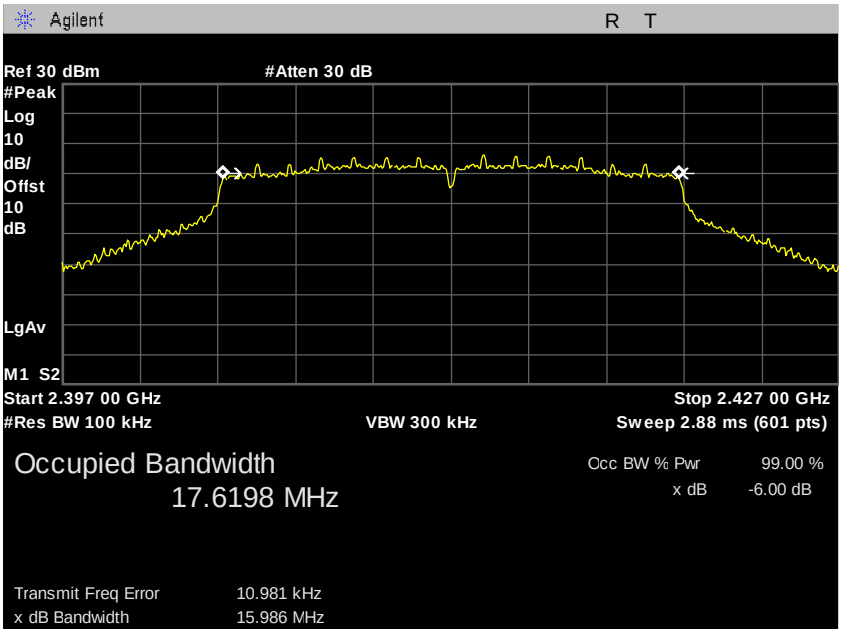
Plot 6. 6 dB Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2422, Port a



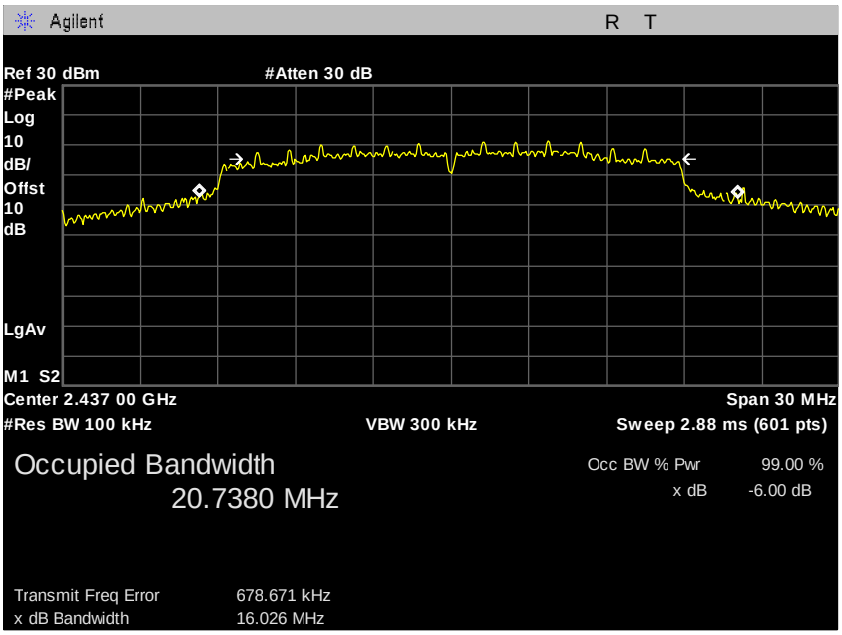
Plot 7. 6 dB Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2437, Port a



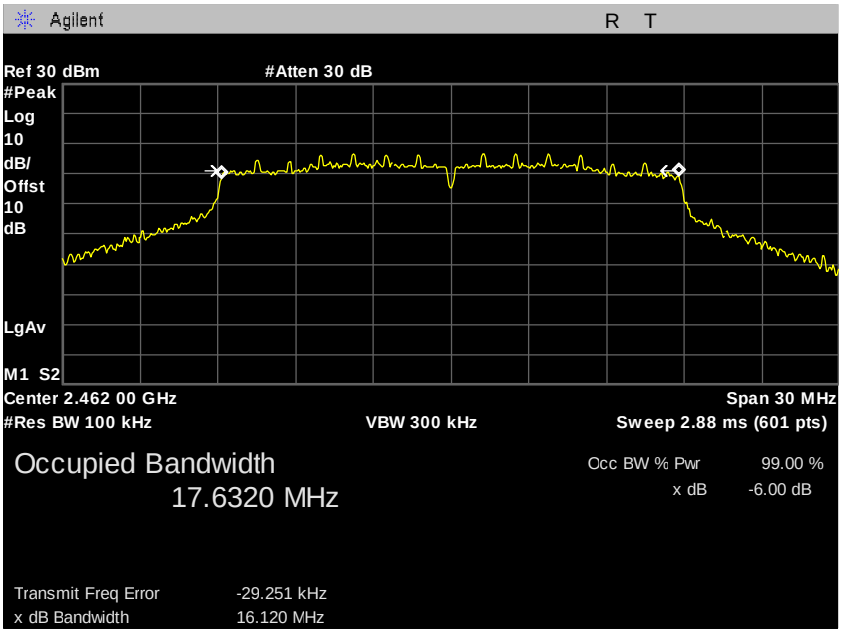
Plot 8. 6 dB Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2452, Port a



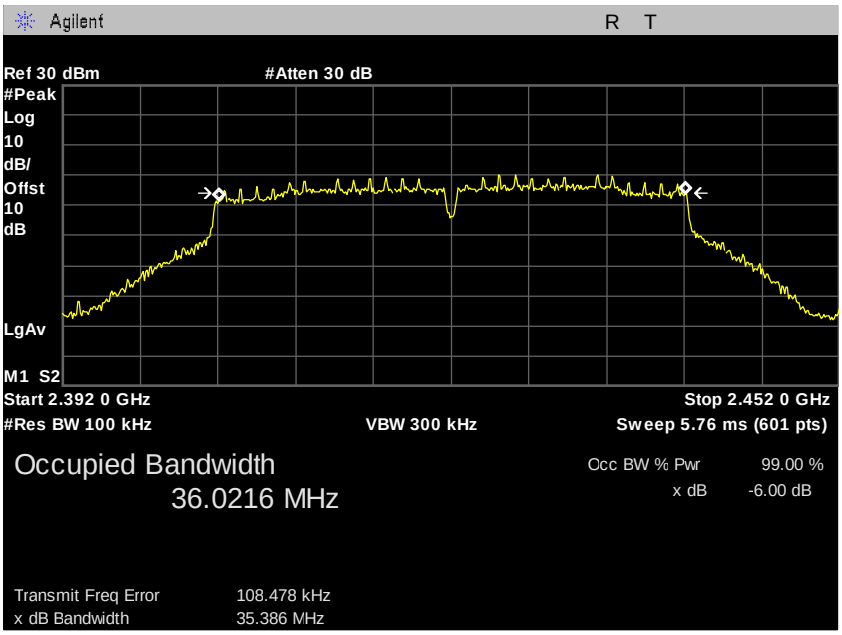
Plot 9. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2412, Port b



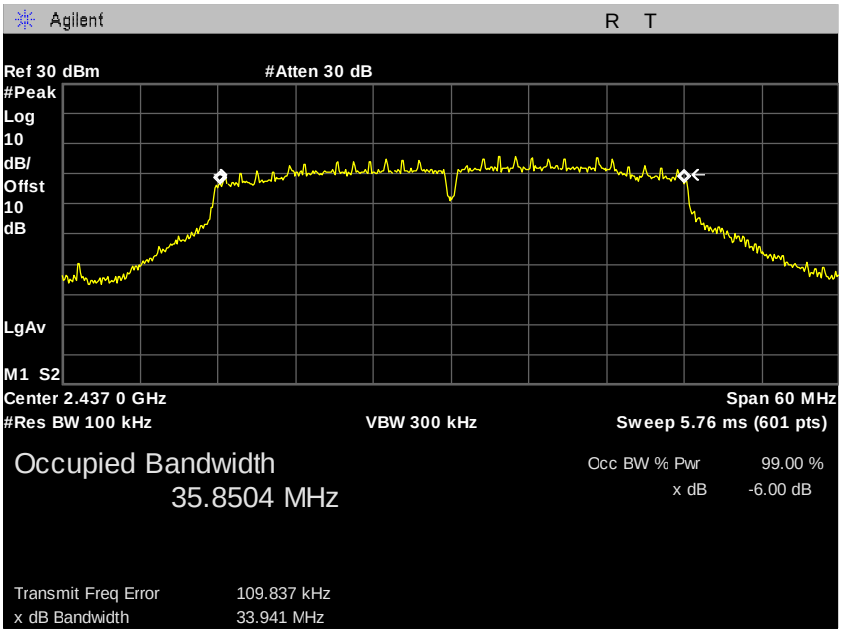
Plot 10. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2437, Port b



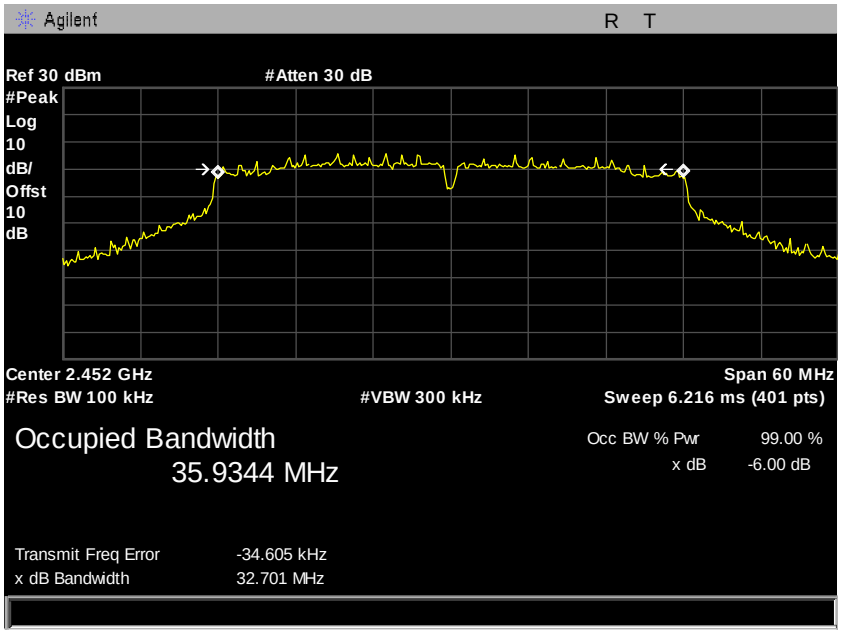
Plot 11. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2462, Port b



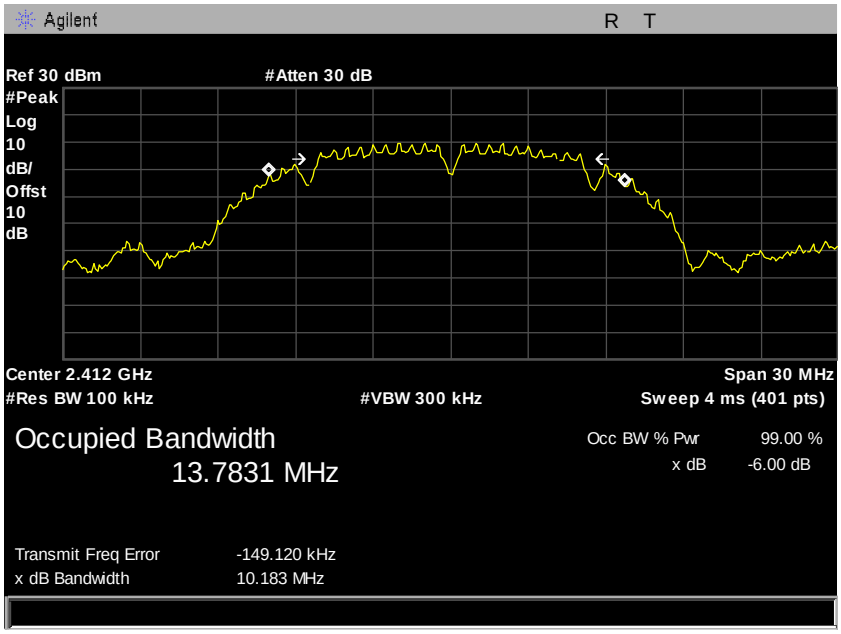
Plot 12. 6 dB Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2422, Port b



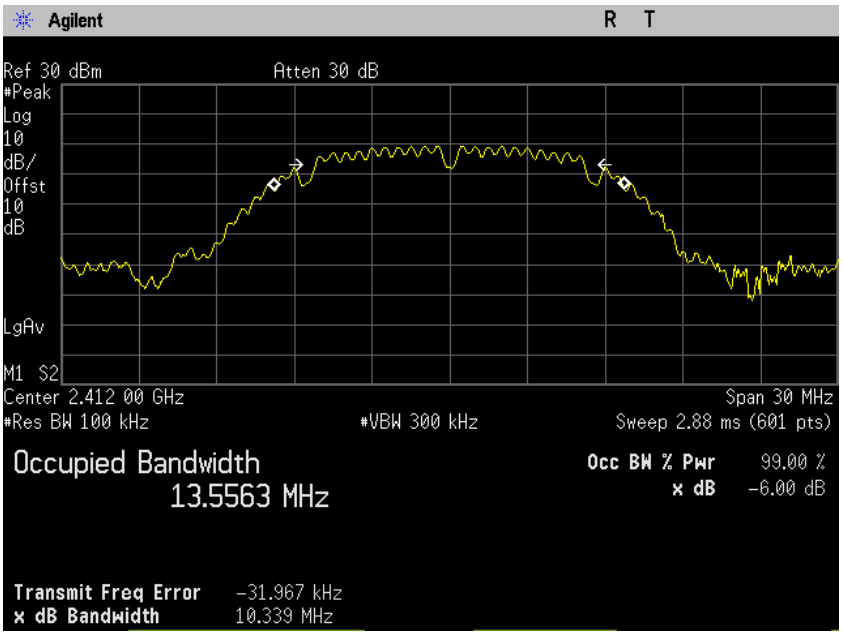
Plot 13. 6 dB Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2437, Port b



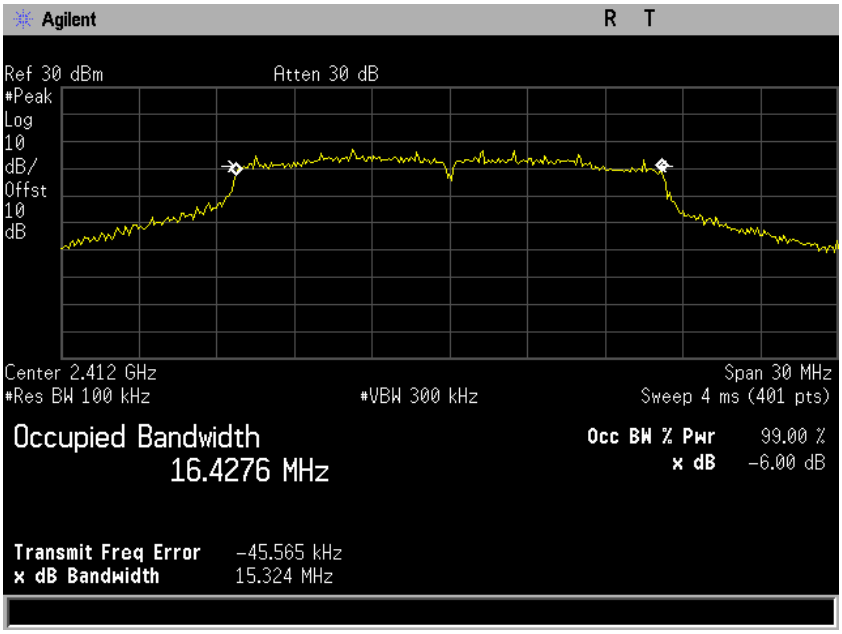
Plot 14. 6 dB Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2452, Port b



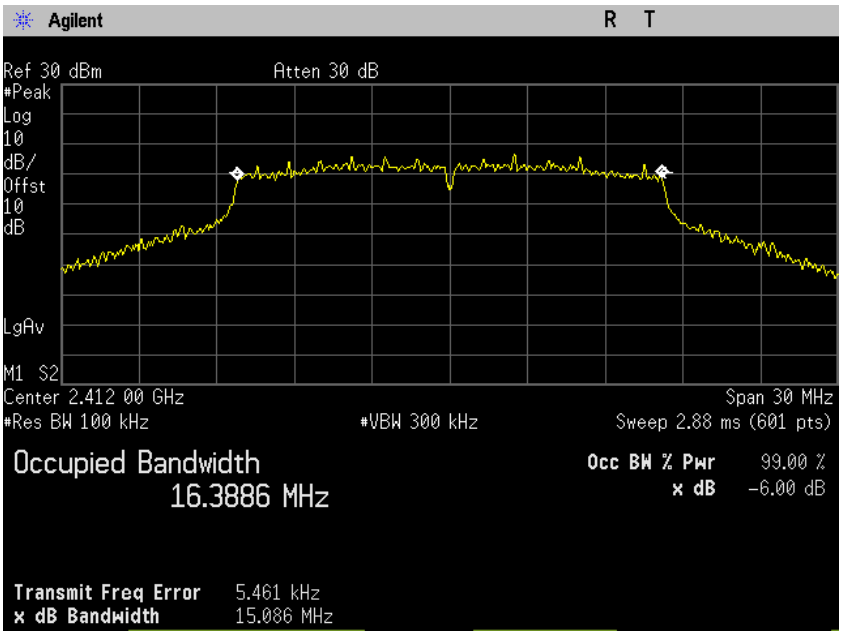
Plot 15. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2412M, b mode, Port a



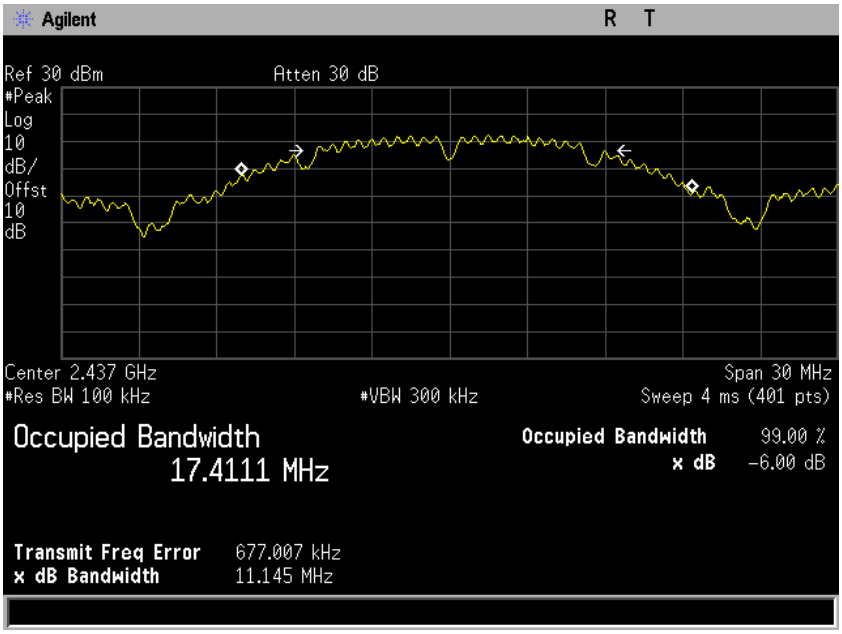
Plot 16. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M Ch. 2412M, b mode, Port b



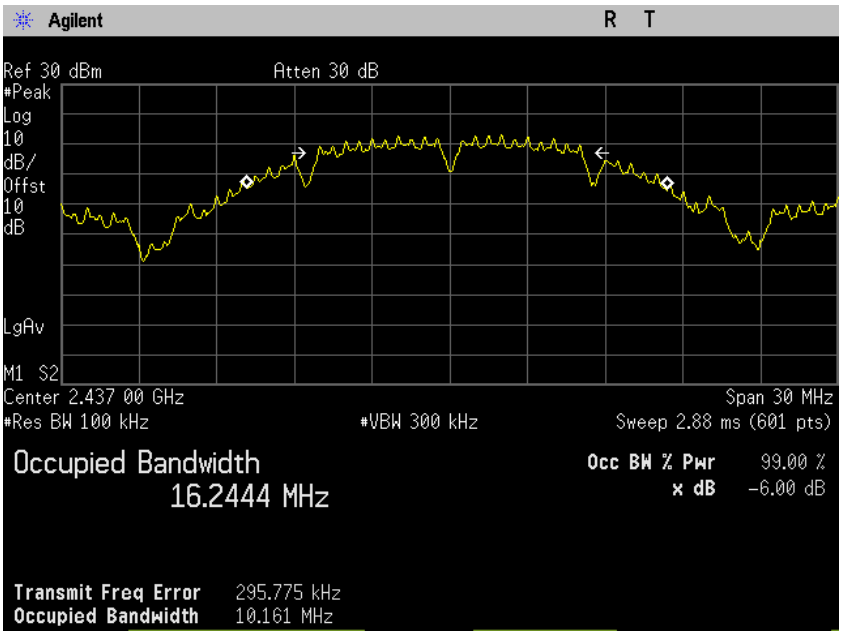
Plot 17. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2412M, g mode, port a



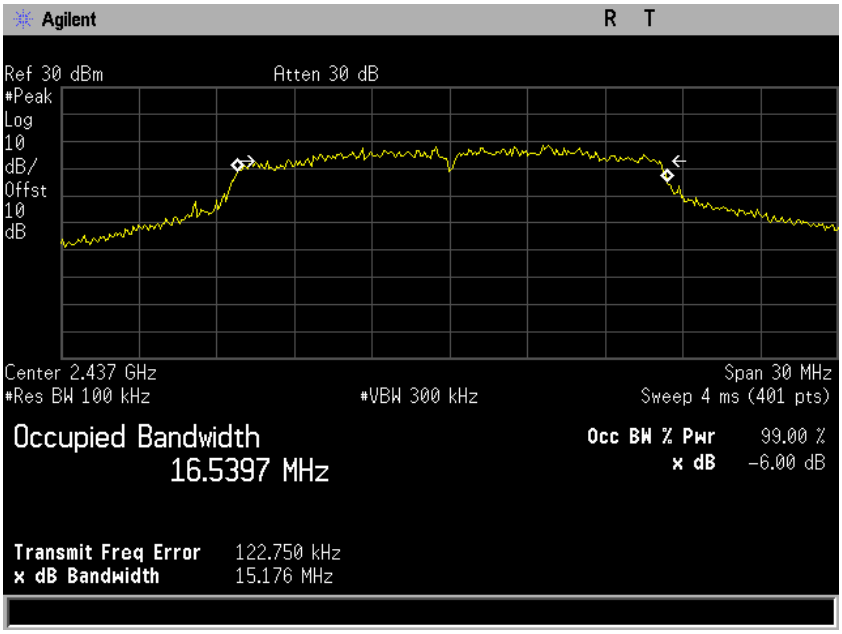
Plot 18. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2412M, g mode, port b



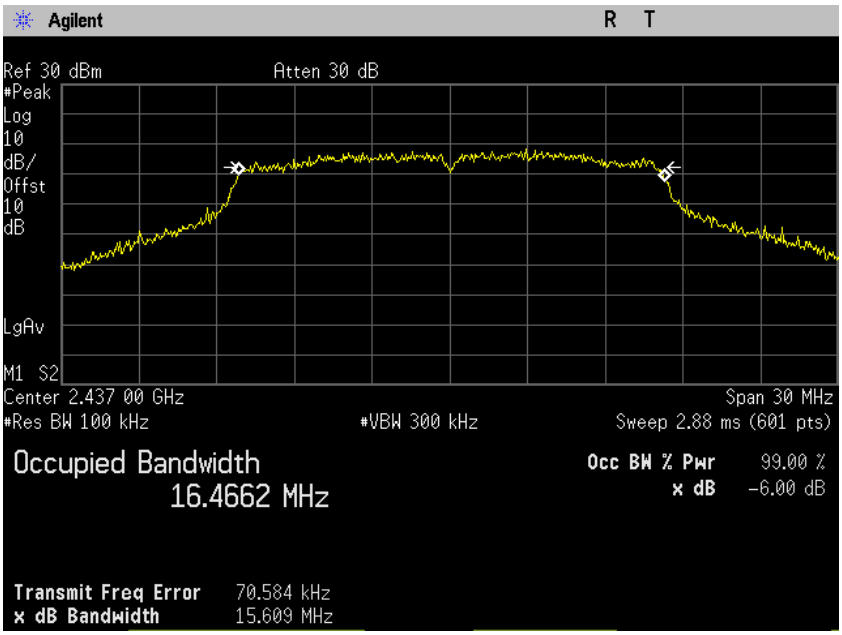
Plot 19. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2437M, b mode, port a



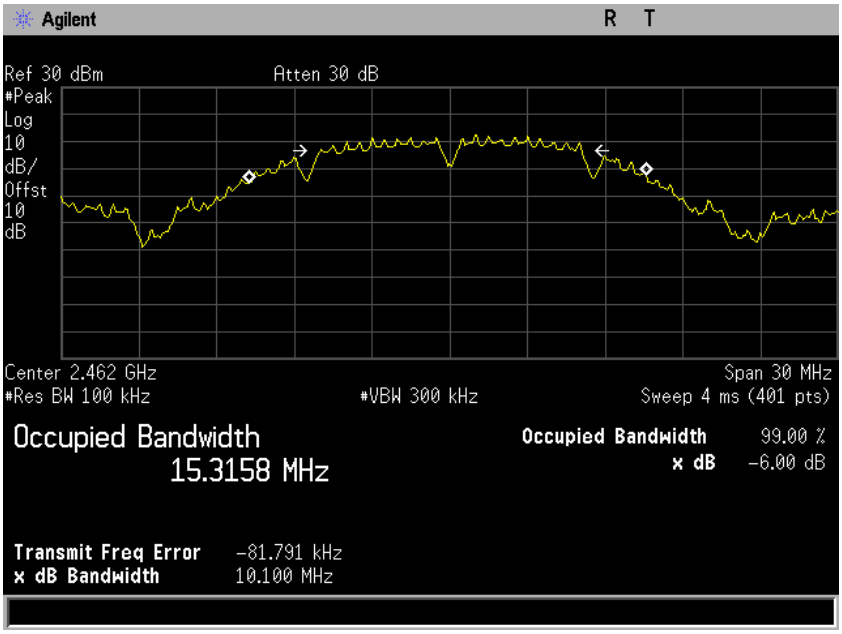
Plot 20. 6 dB Occupied Bandwidth, Bandwidth 20M, SISO, Ch. 2437M, b mode, port b



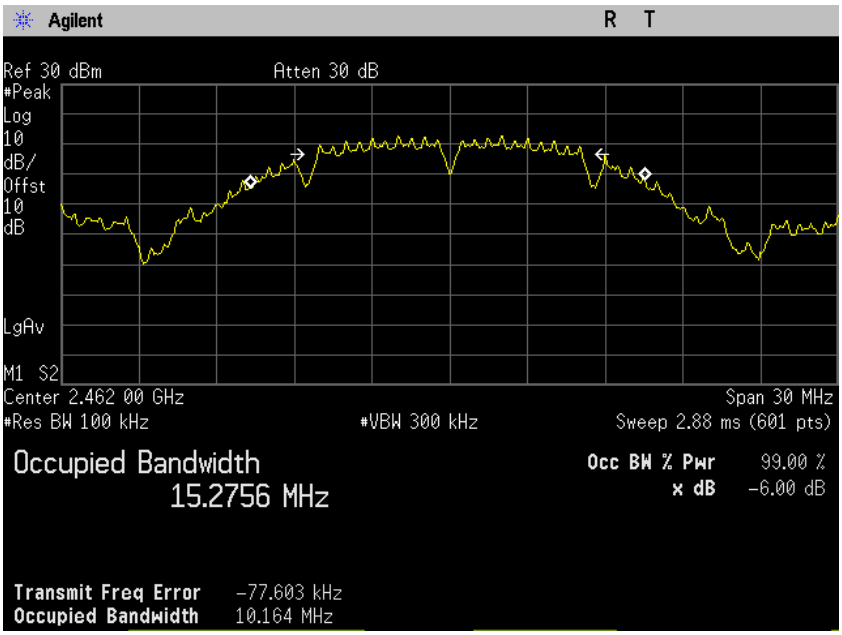
Plot 21. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2437M, g mode, port a



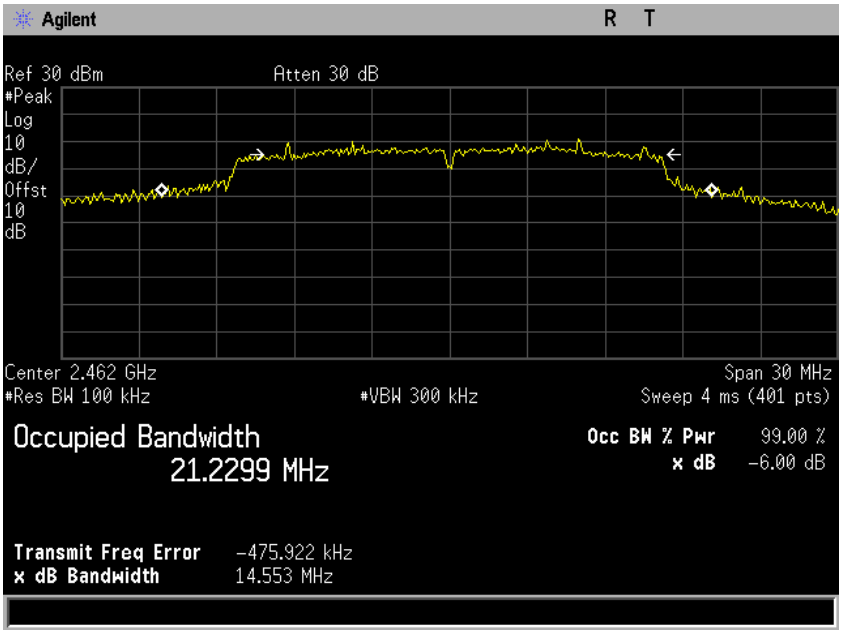
Plot 22. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2437M, g mode, port b



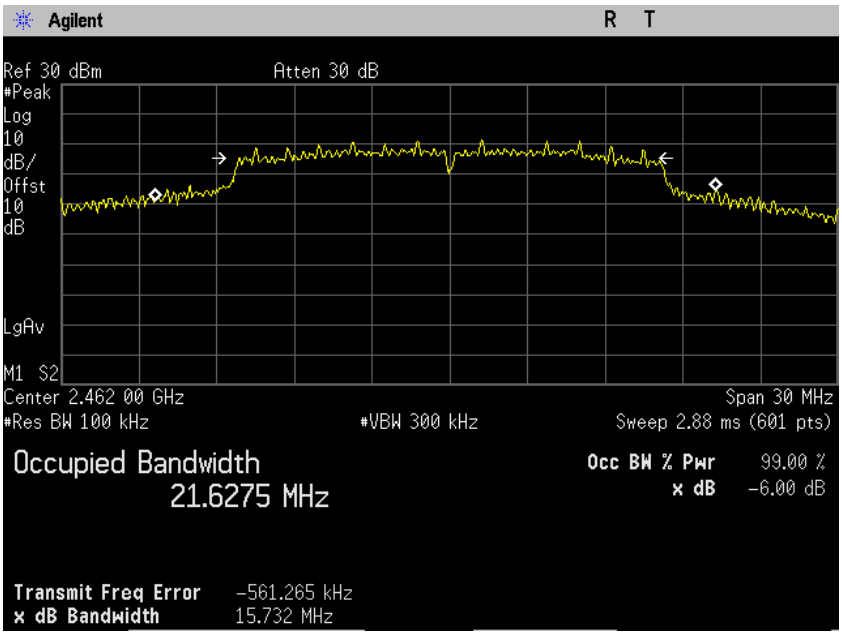
Plot 23. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, b mode, port a



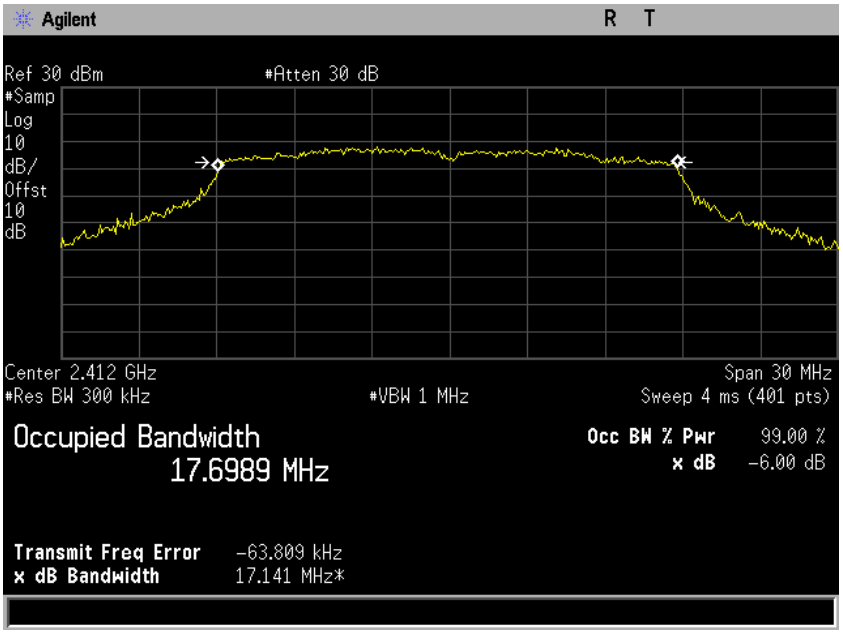
Plot 24. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, b mode, port b



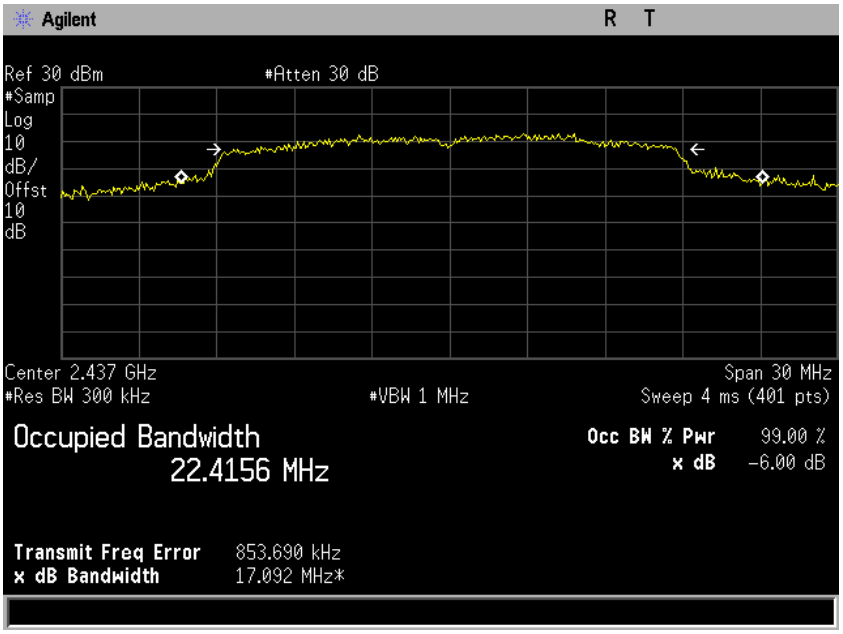
Plot 25. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, g mode, port a



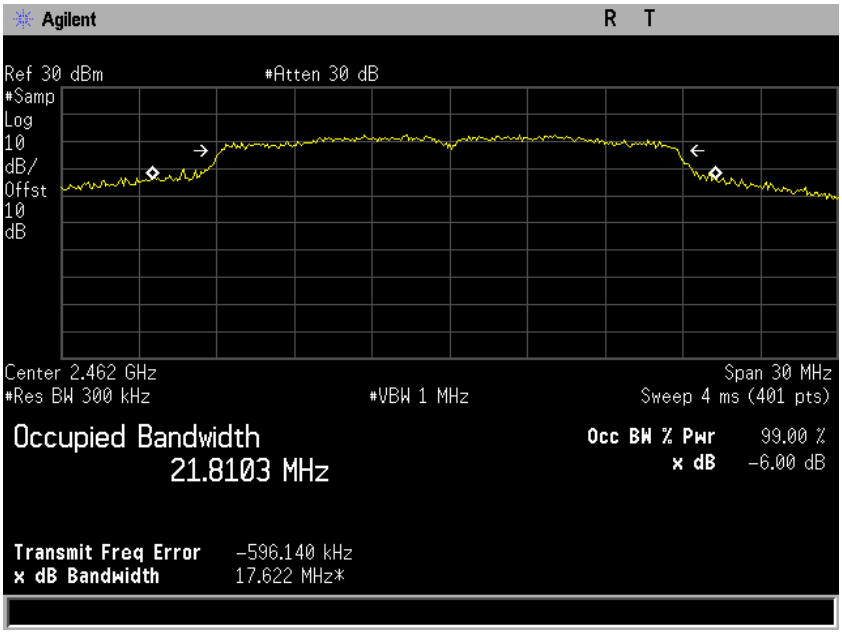
Plot 26. 6 dB Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, g mode, port b



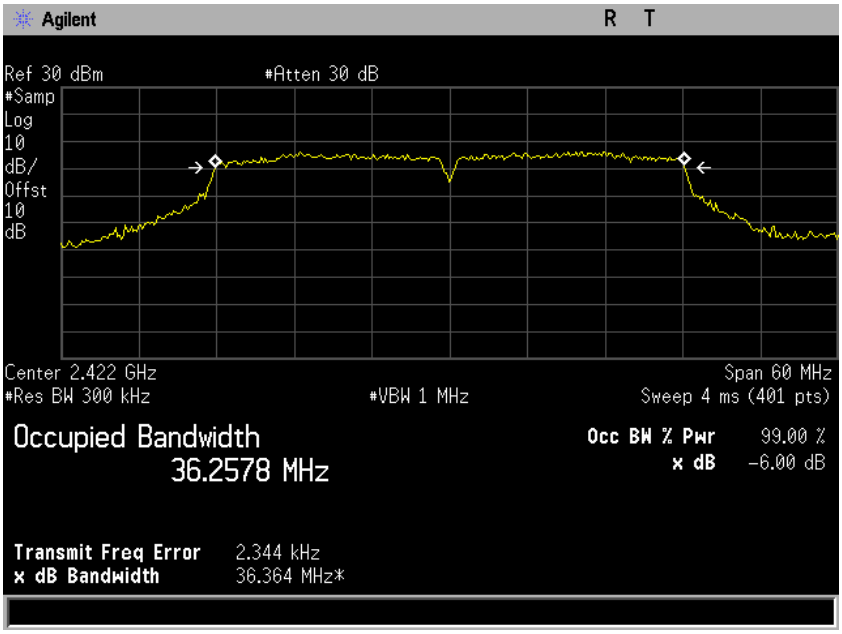
Plot 27. 99% Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2412, Port a



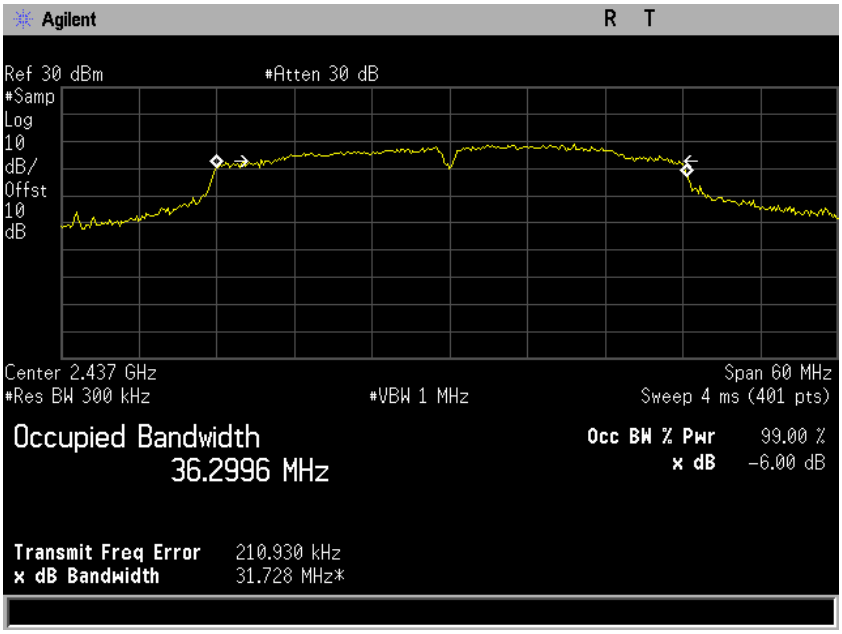
Plot 28. 99% Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2437, port a



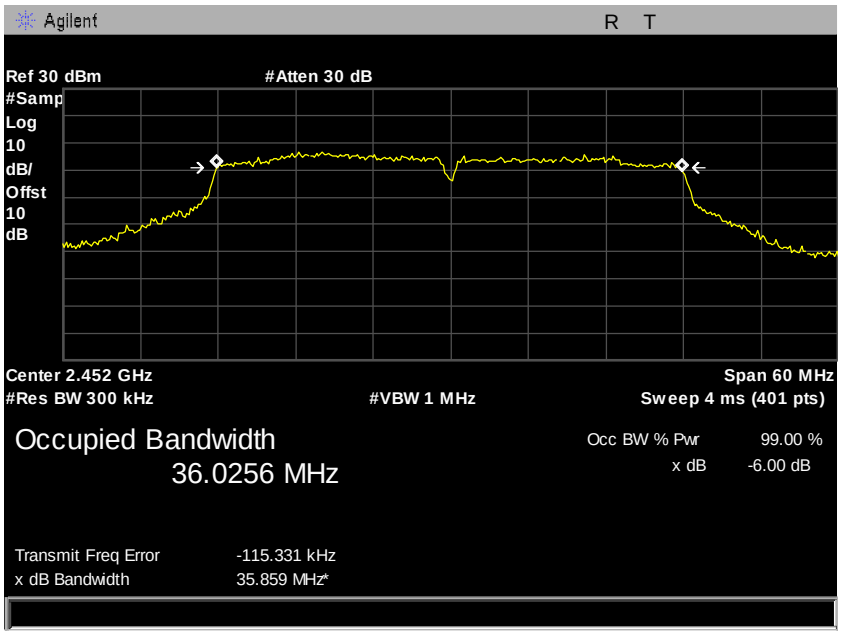
Plot 29. 99% Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2462, port a



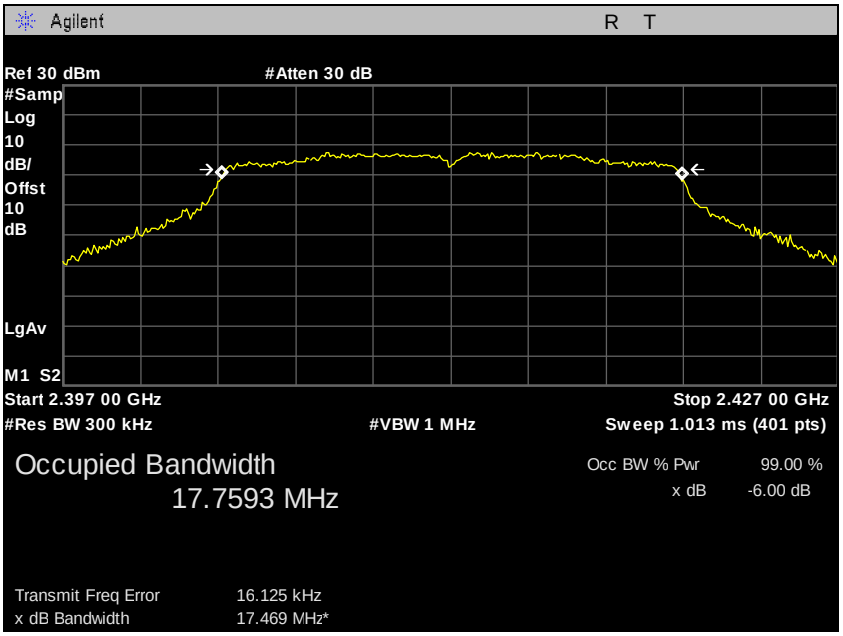
Plot 30. 99% Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2422, port a



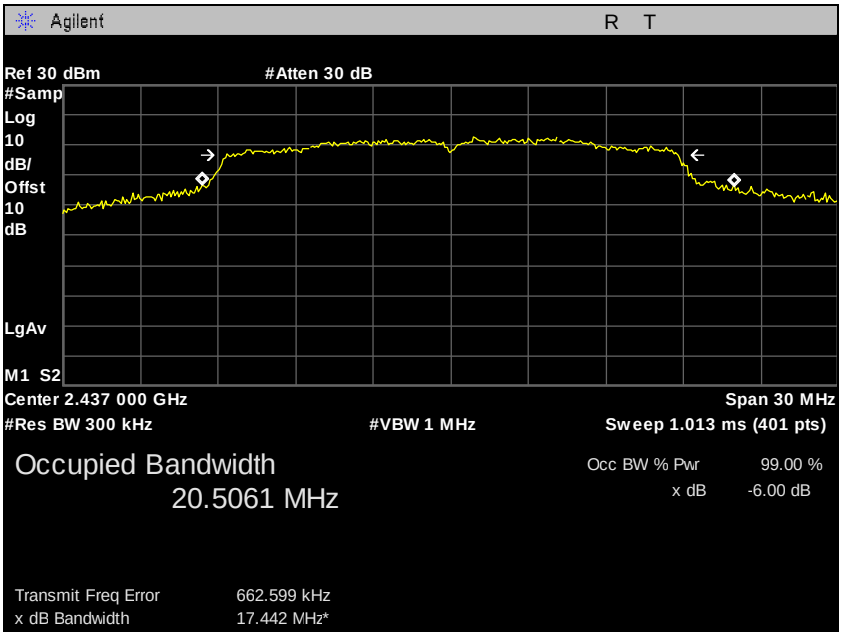
Plot 31. 99% Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2437, port a



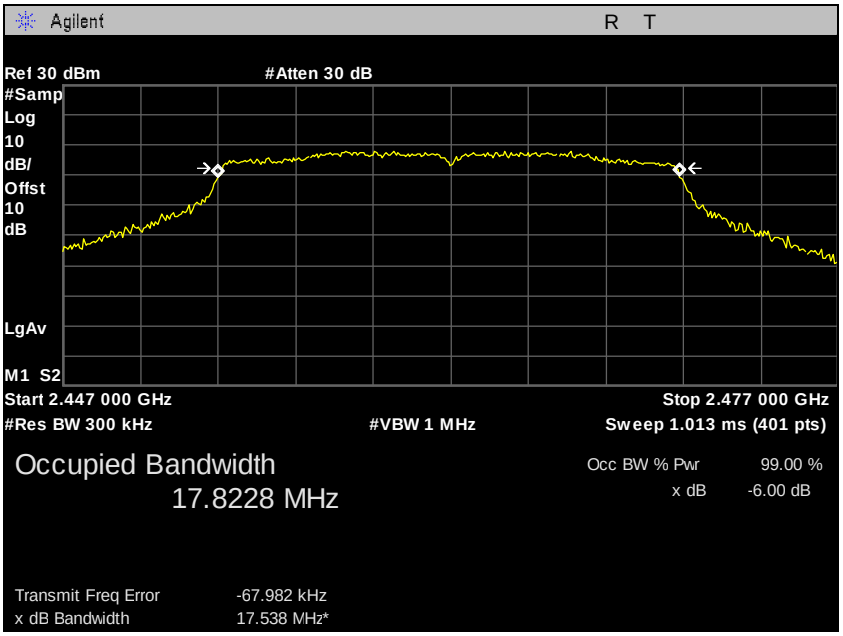
Plot 32. 99% Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2452, port a



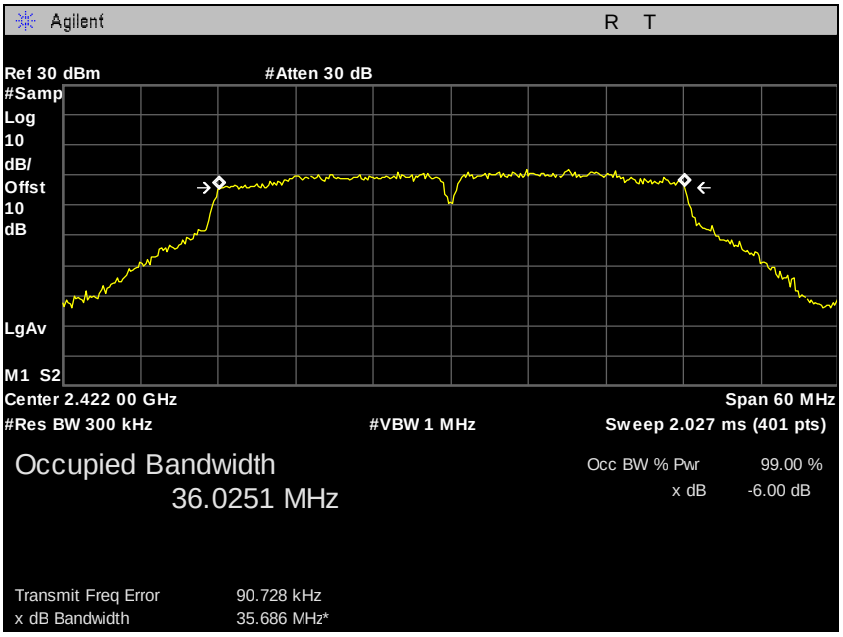
Plot 33. 99% Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2412, port b



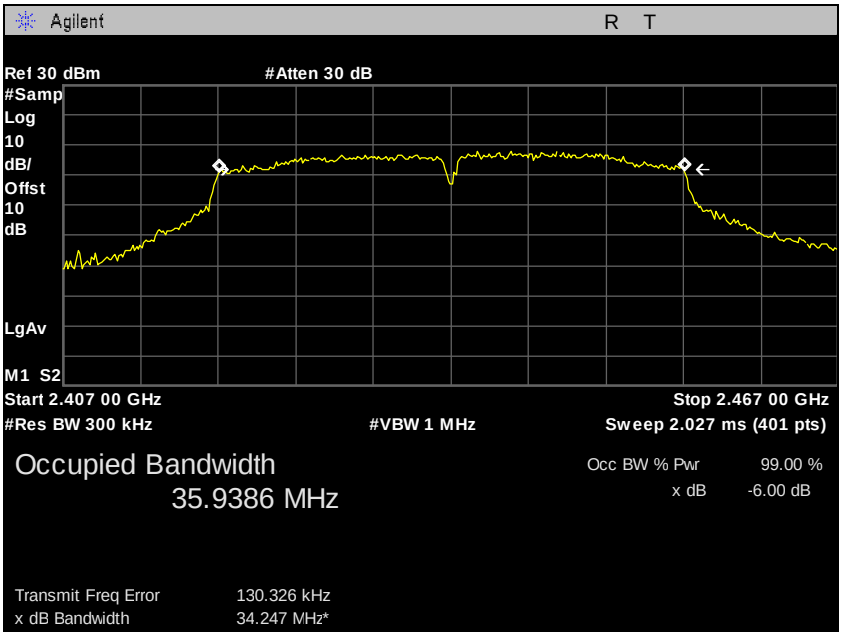
Plot 34. 99% Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2437, port b



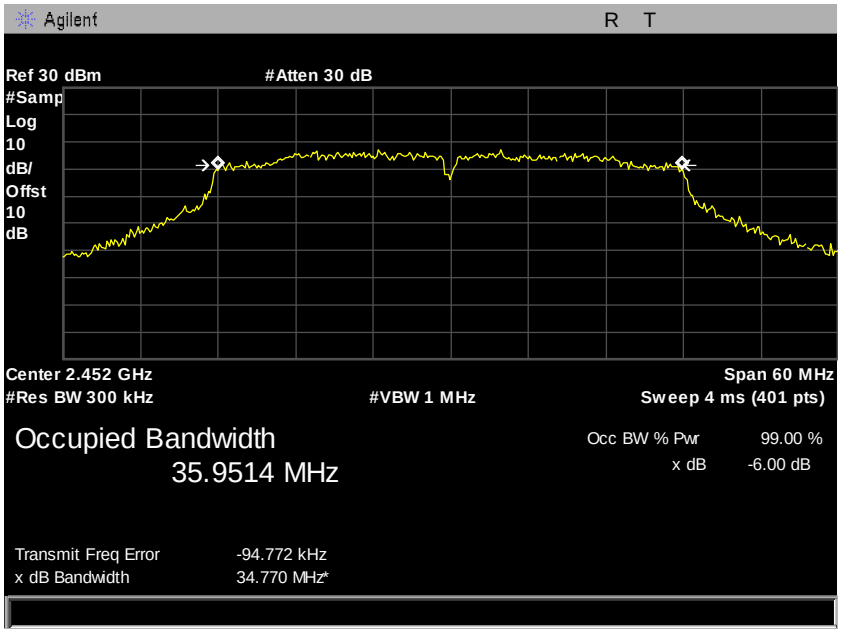
Plot 35. 99% Occupied Bandwidth, SISO, Bandwidth 20M, n mode, 2462, port b



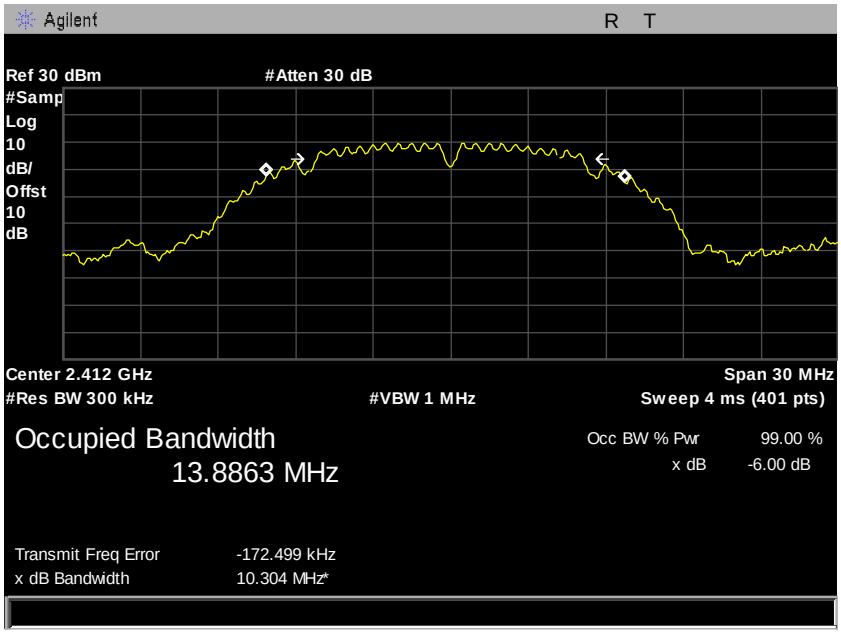
Plot 36. 99% Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2422, port b



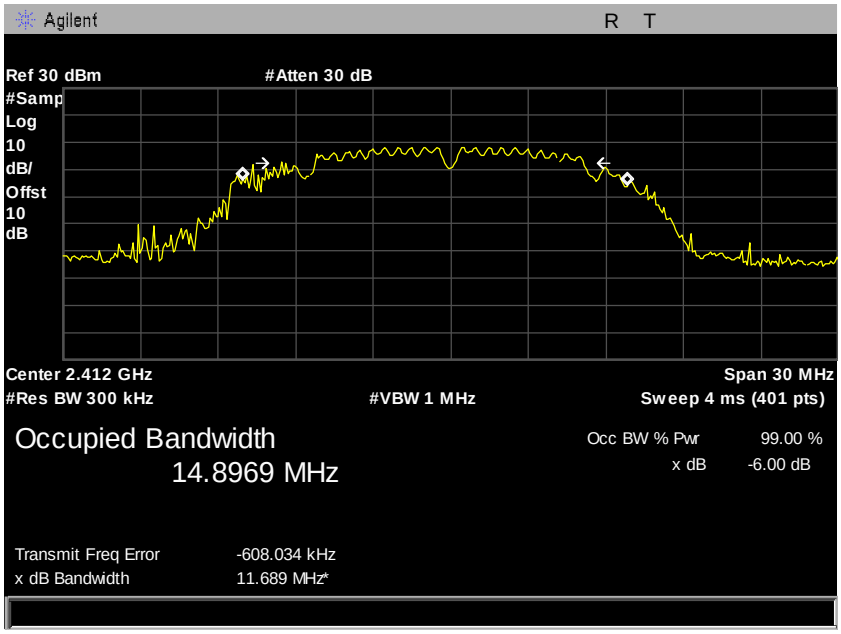
Plot 37. 99% Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2437, port b



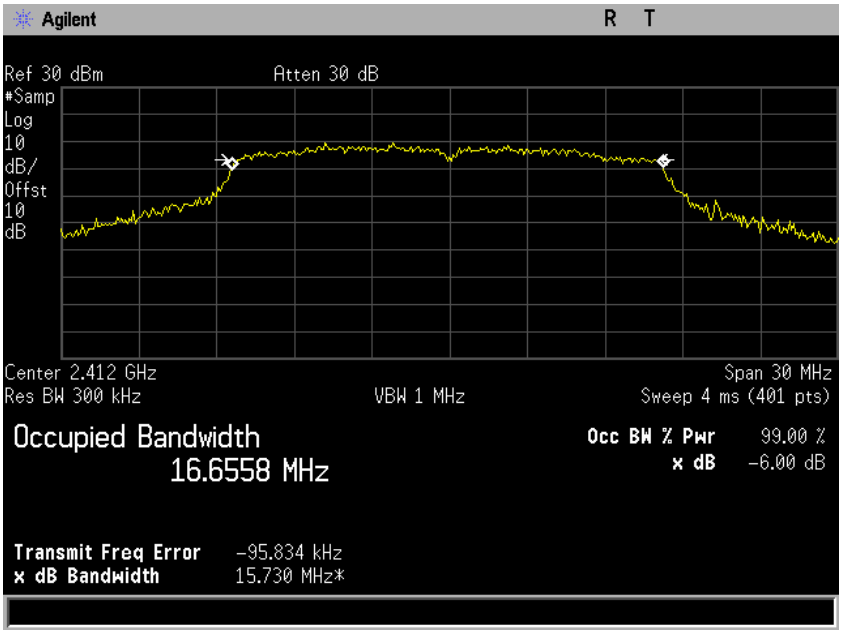
Plot 38. 99% Occupied Bandwidth, SISO, Bandwidth 40M, n mode, 2452, port b



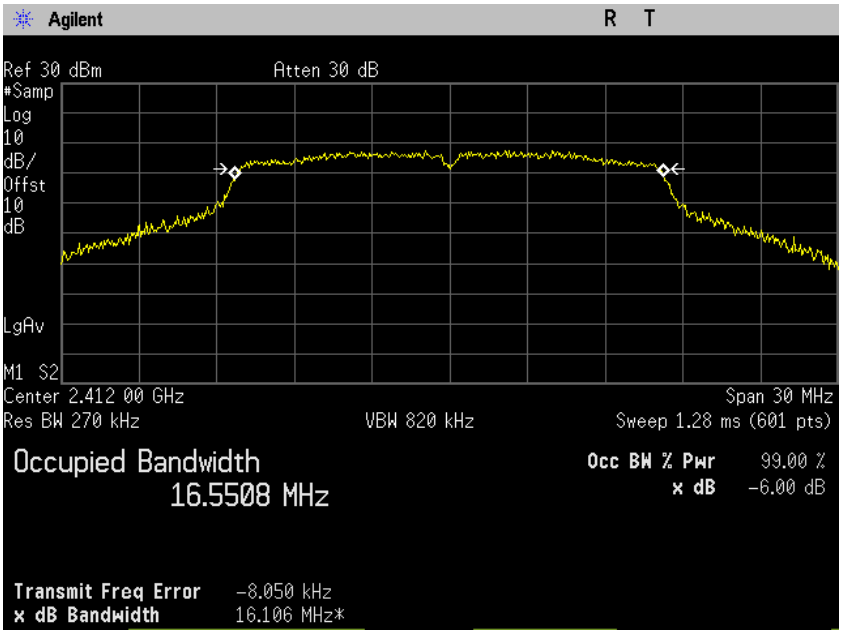
Plot 39. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2412M, b mode, port a



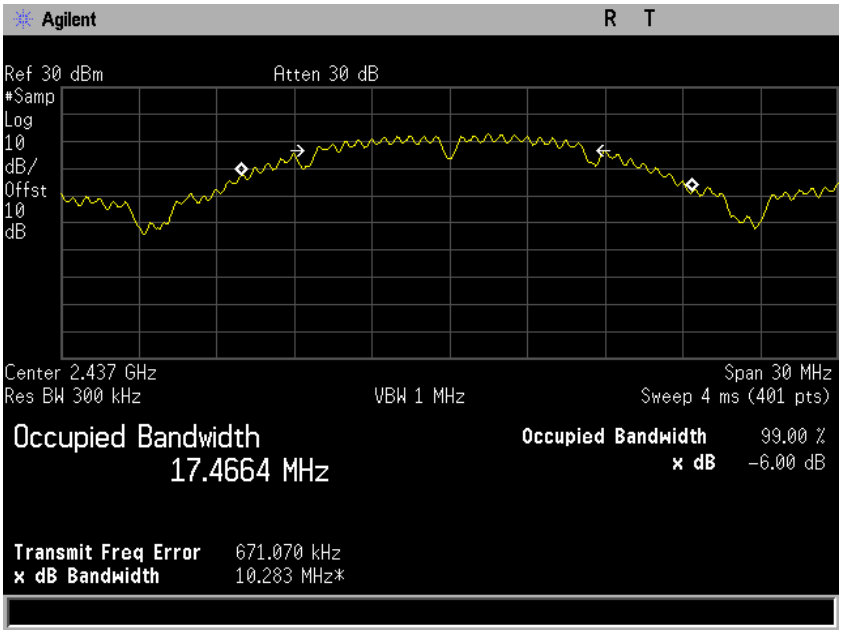
Plot 40. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2412M, b mode, port b



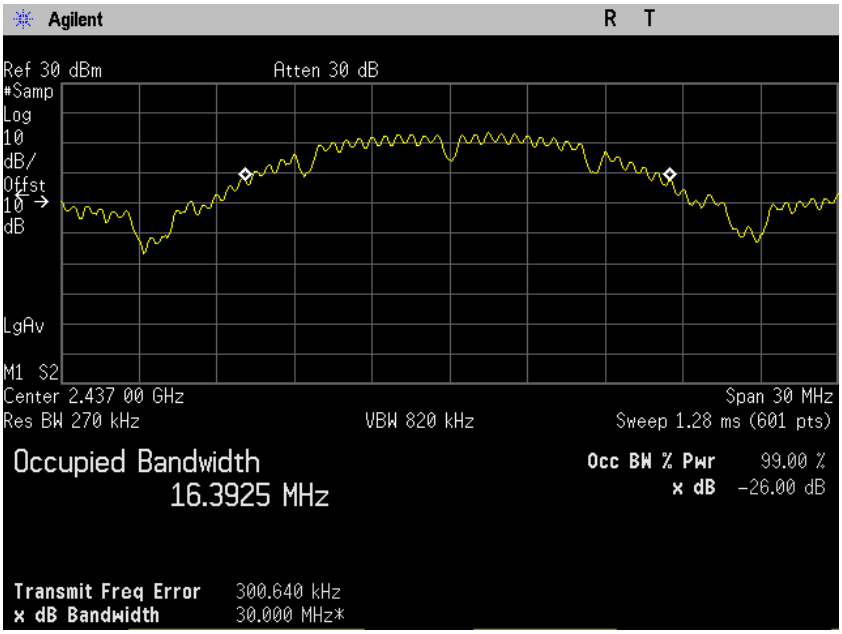
Plot 41. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2412M, g mode, port a



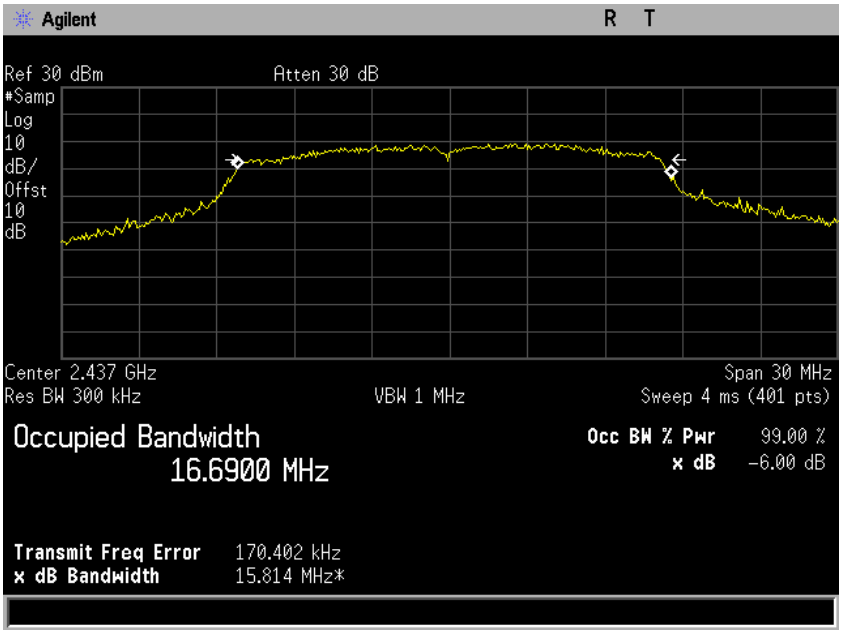
Plot 42. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2412M, g mode, port b



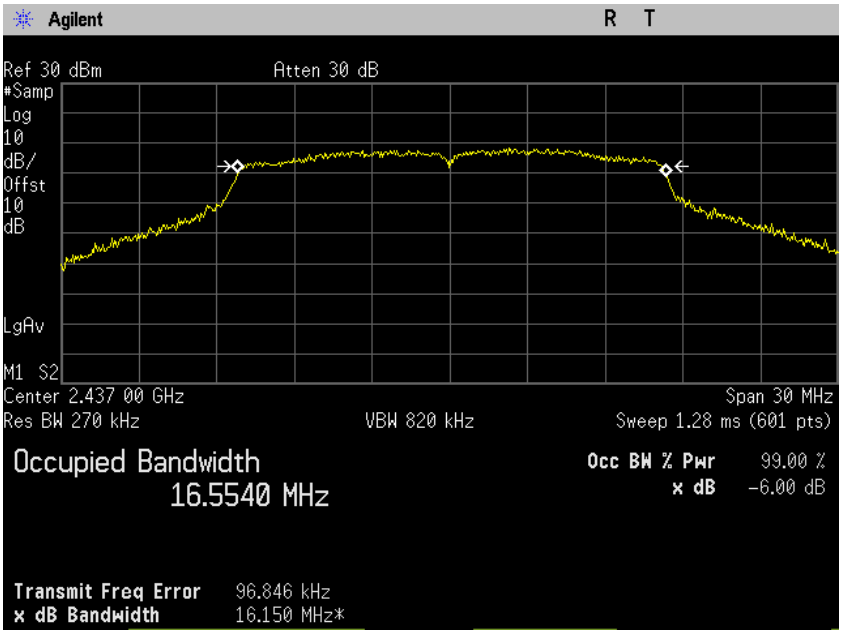
Plot 43. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2437M, b mode, port a



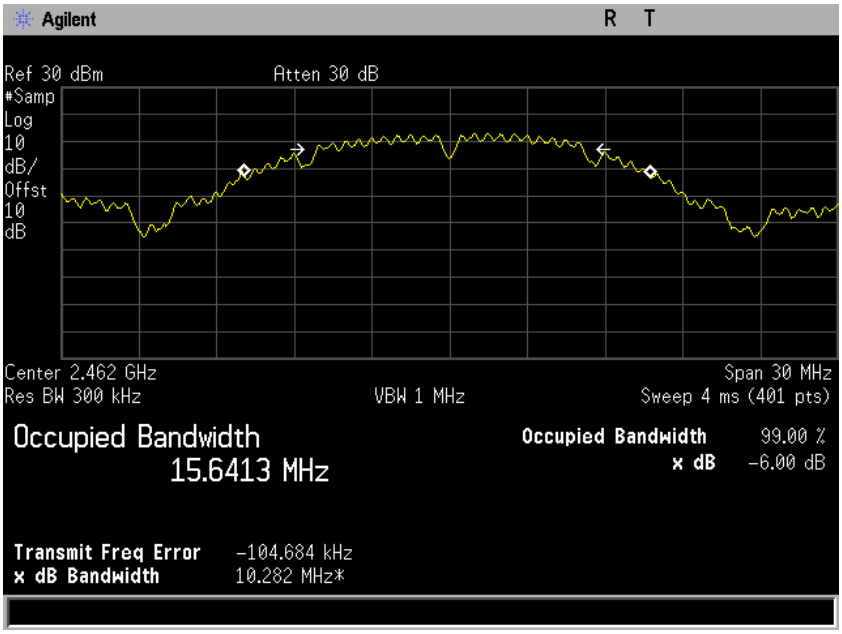
Plot 44. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2437M, b mode, port b



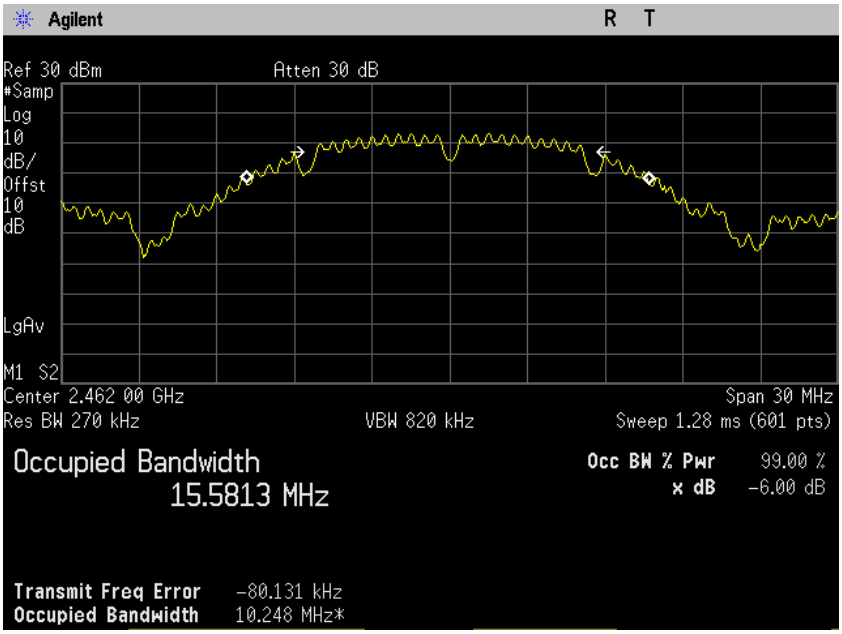
Plot 45. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2437M, g mode, port a



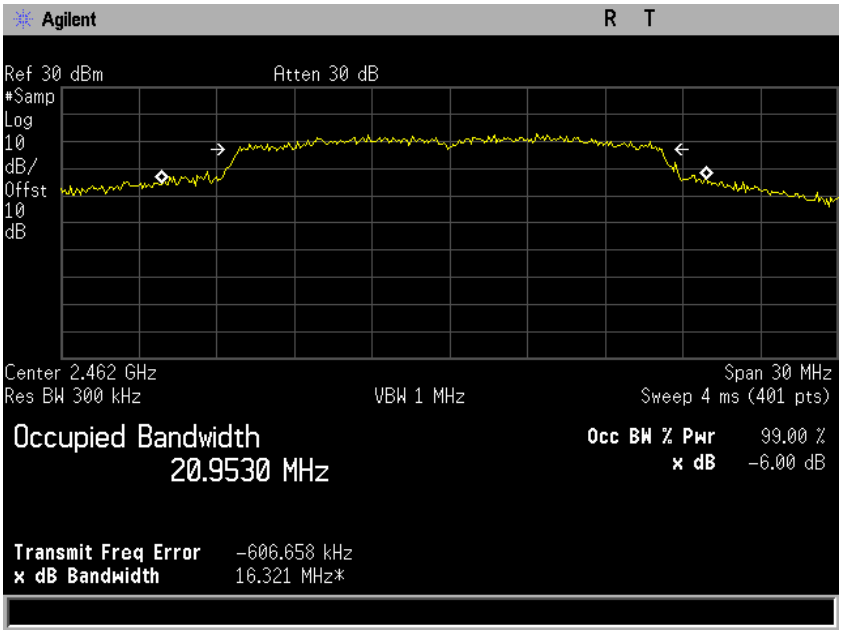
Plot 46. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2437M, g mode, port b



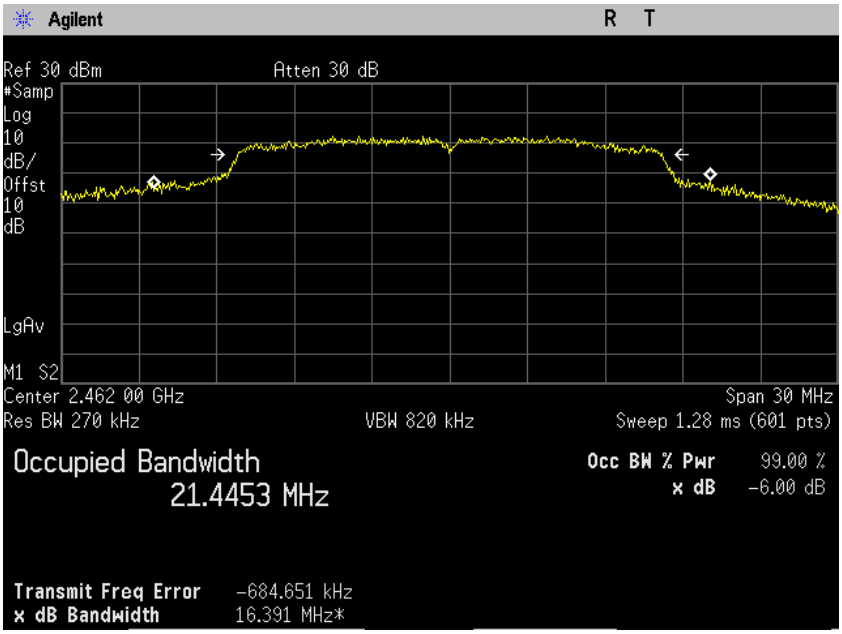
Plot 47. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, b mode, port a



Plot 48. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, b mode, port b

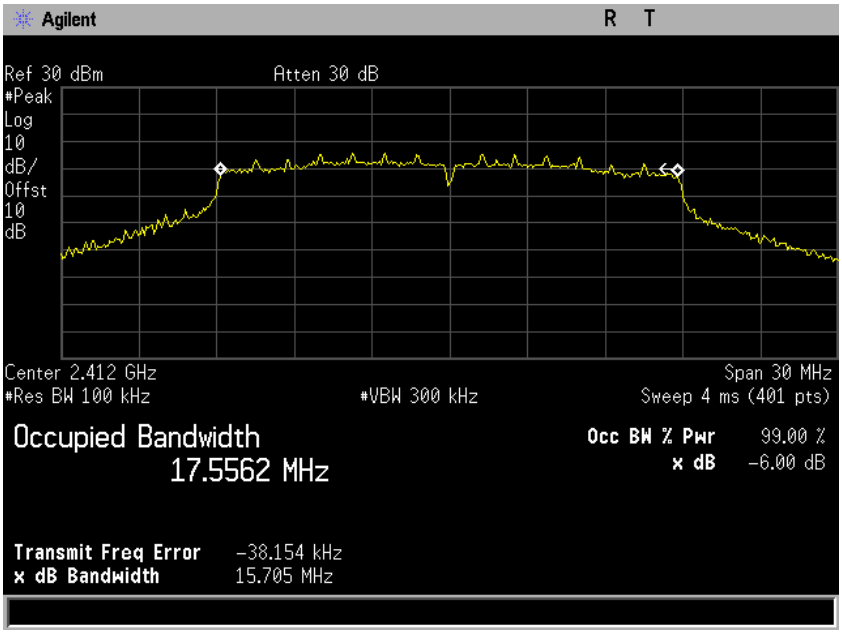


Plot 49. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, g mode, port a

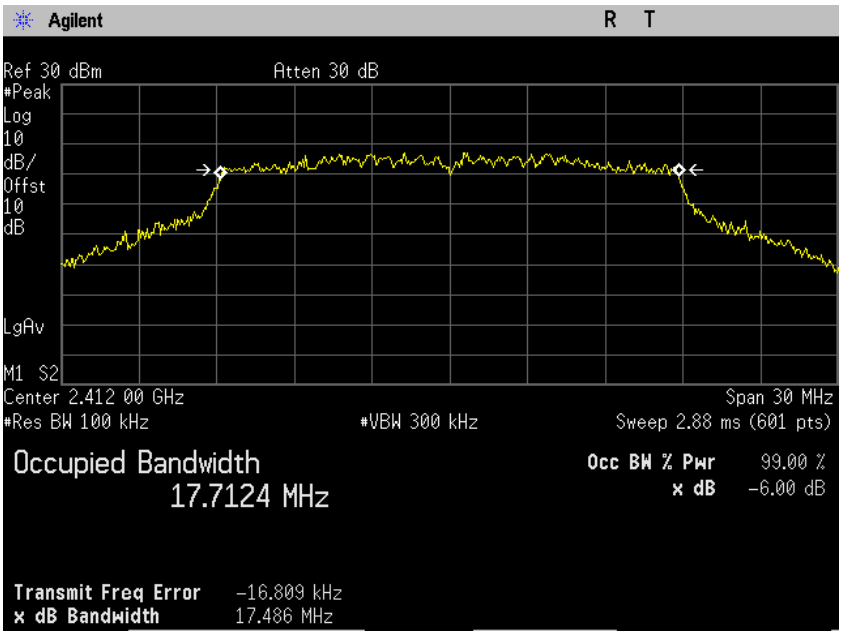


Plot 50. 99% Occupied Bandwidth, SISO, Bandwidth 20M, Ch. 2462M, g mode, port b

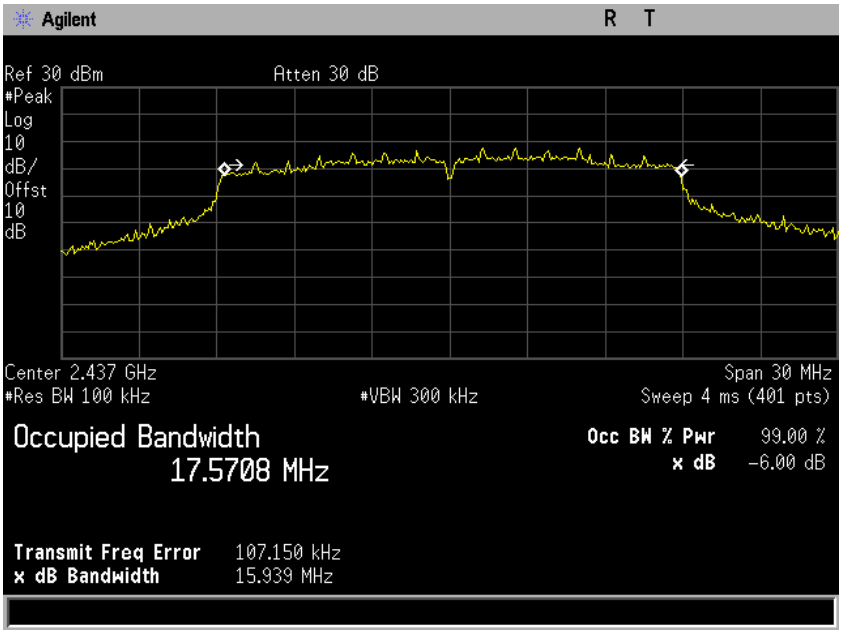
MIMO



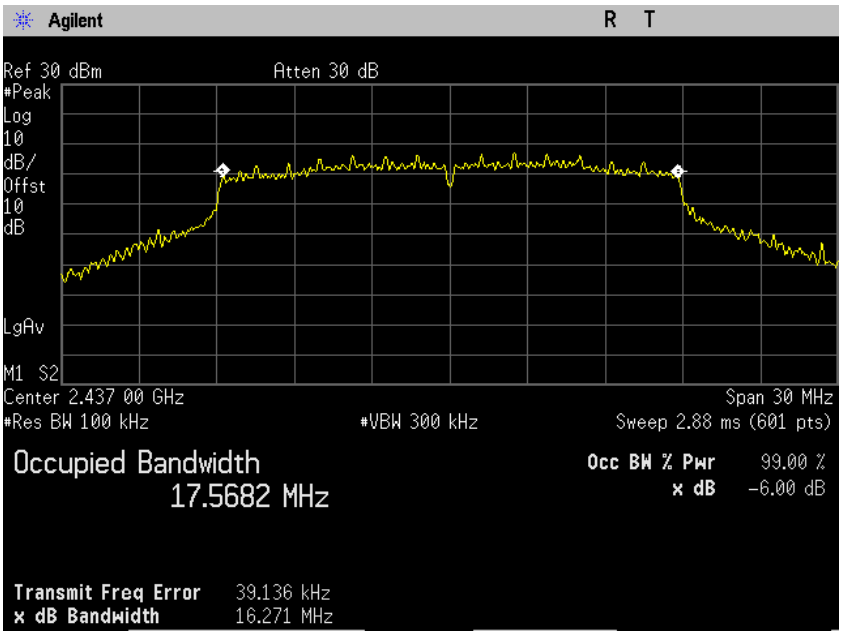
Plot 51. 6 dB Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2412M, n mode, port a



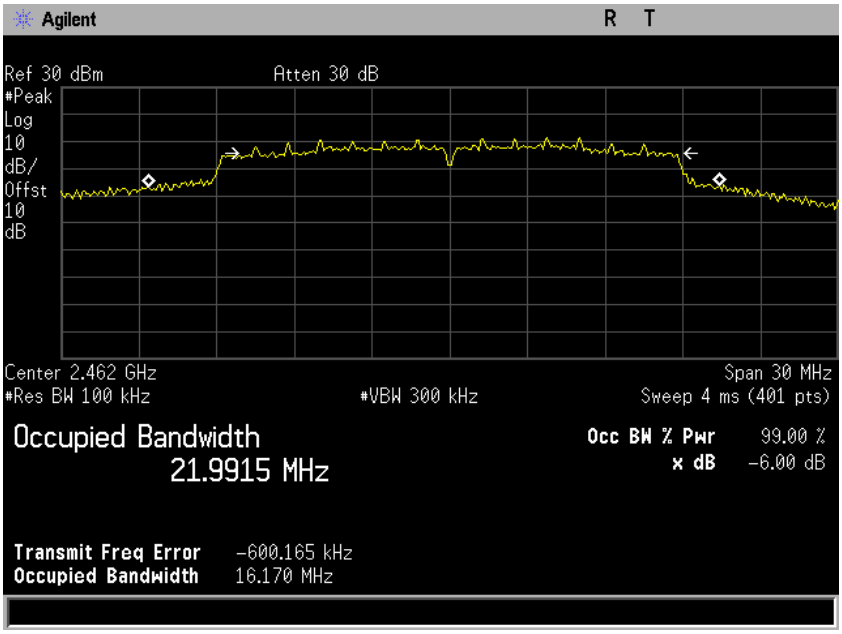
Plot 52. 6 dB Occupied Bandwidth, MIMO, Bandwidth 20M Ch. 2412M, n mode, port b



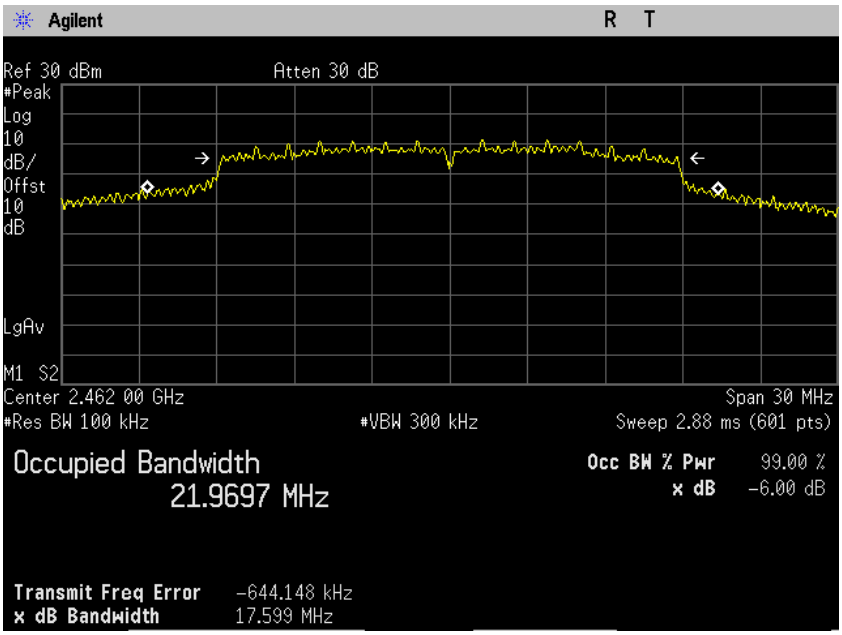
Plot 53. 6 dB Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2437M, n mode, port a



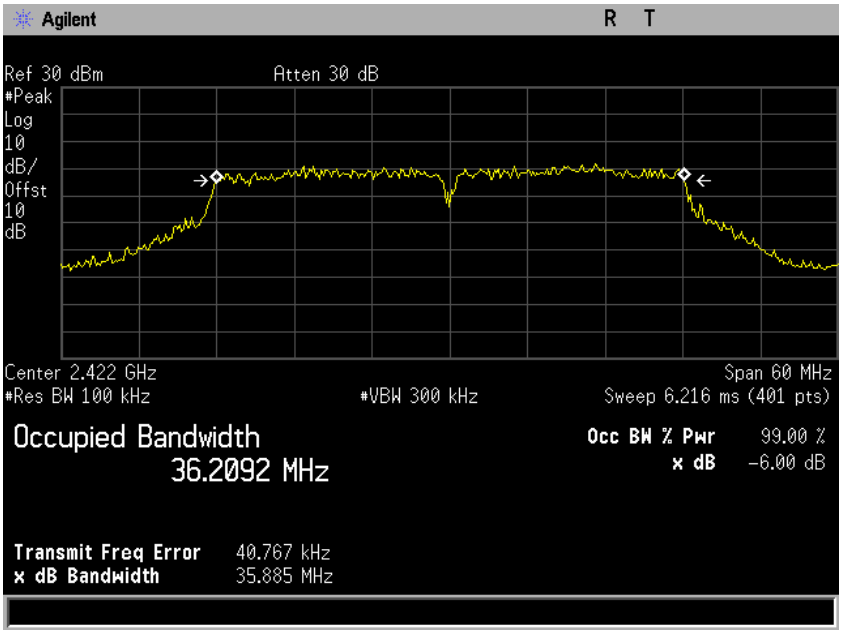
Plot 54. 6 dB Occupied Bandwidth, Bandwidth 20M, MIMO, Ch. 2437M, n mode, port b



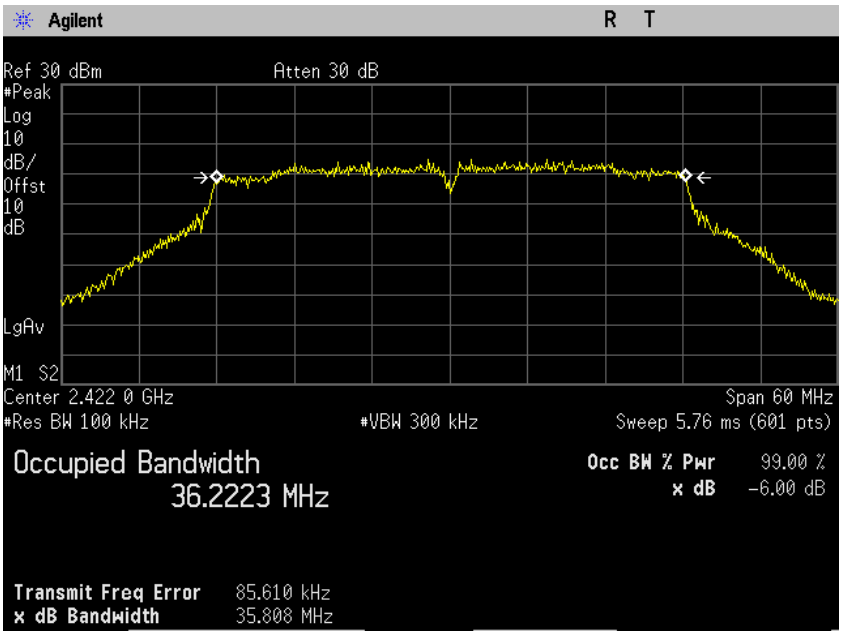
Plot 55. 6 dB Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2462M, n mode, port a



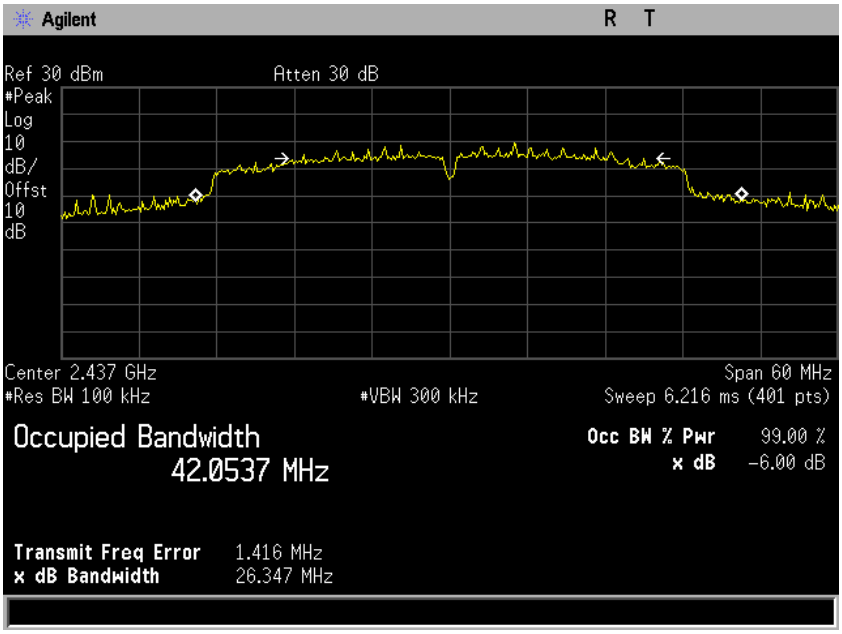
Plot 56. 6 dB Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2462M, n mode, port b



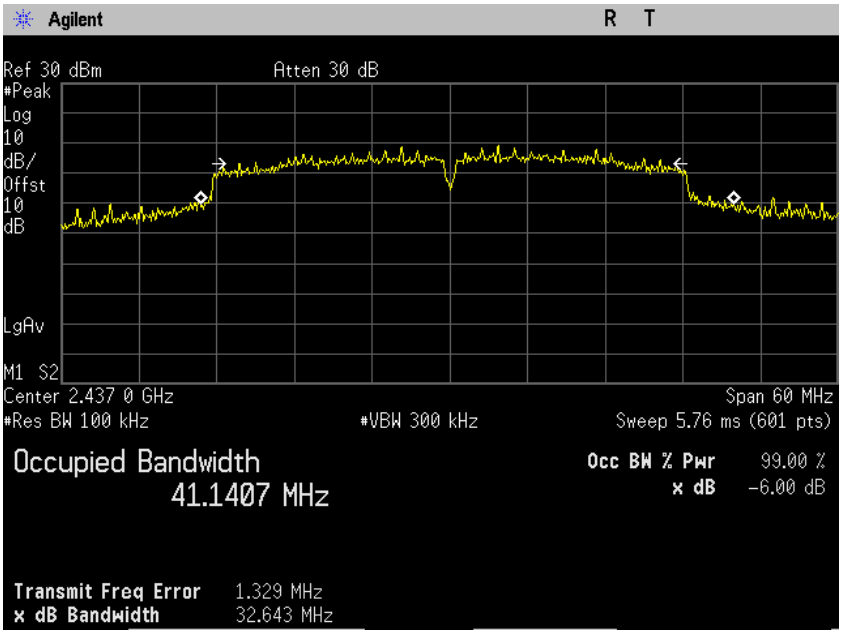
Plot 57. 6 dB Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port a



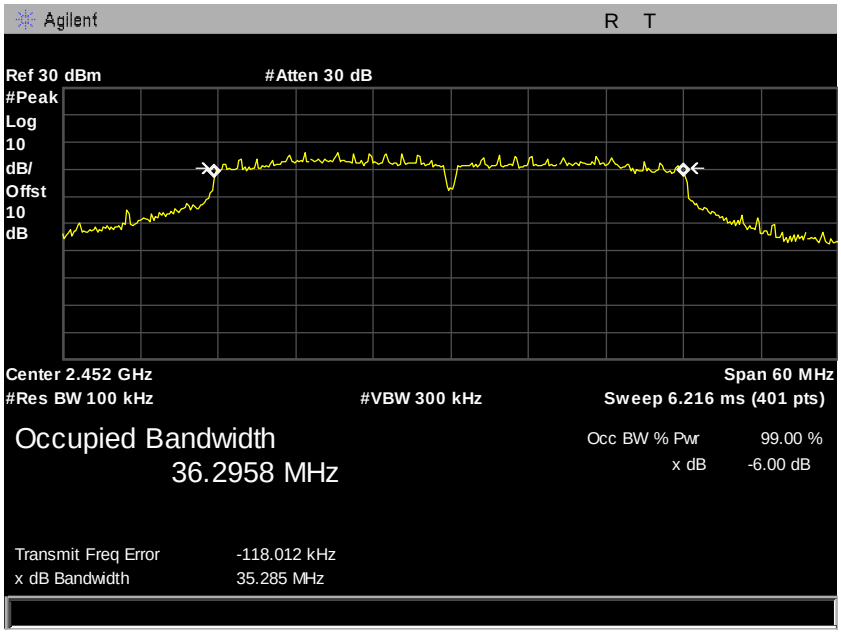
Plot 58. 6 dB Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port b



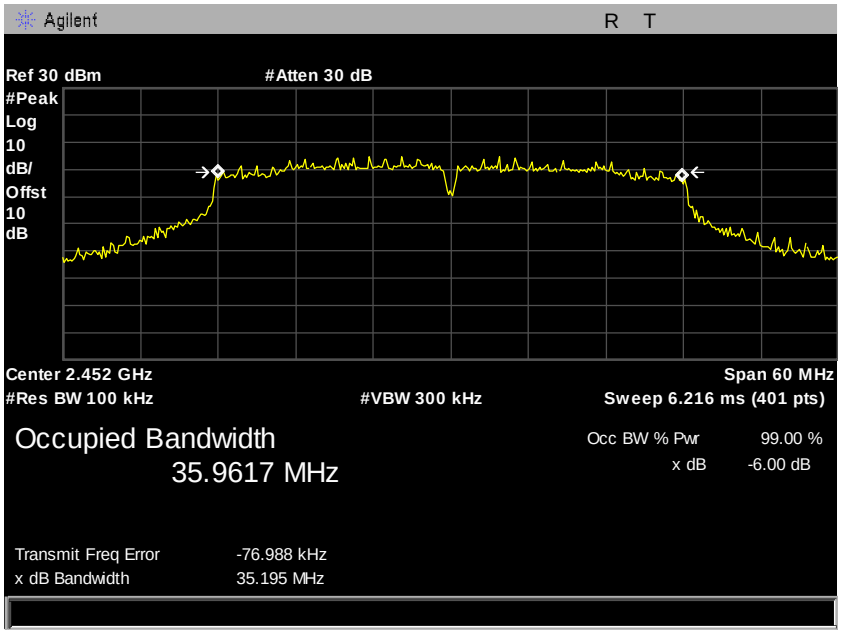
Plot 59. 6 dB Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2437M, n mode, port a



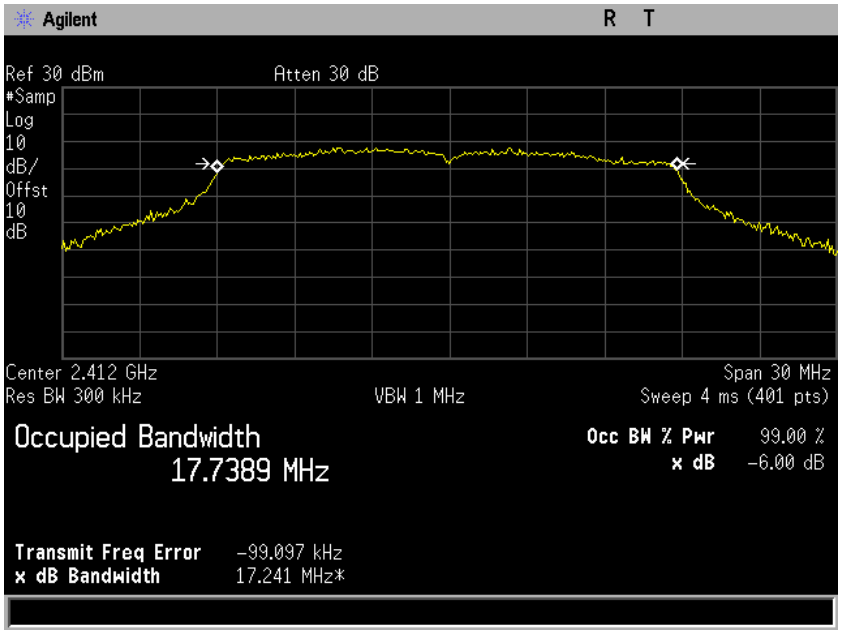
Plot 60. 6 dB Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2437M, n mode, port b



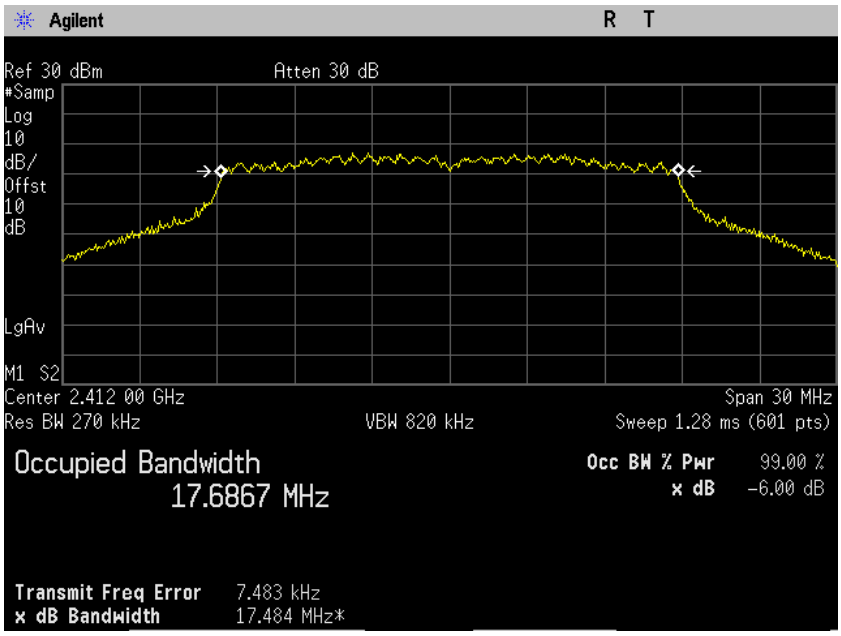
Plot 61. 6 dB Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port a



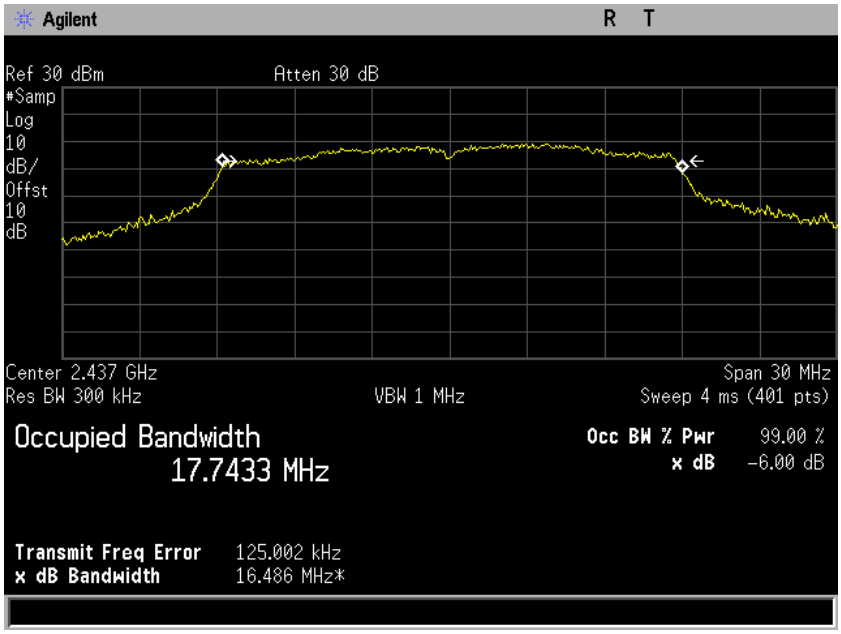
Plot 62. 6 dB Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port b



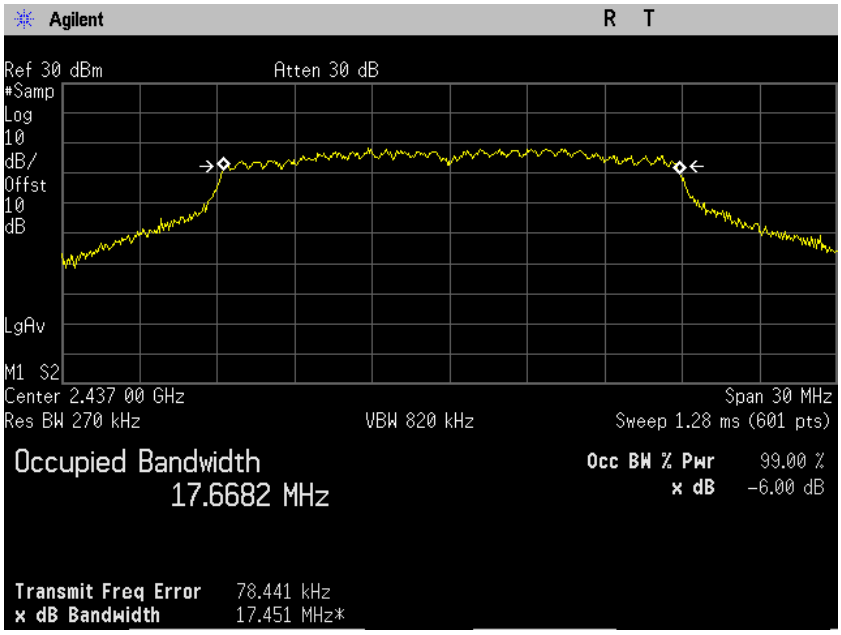
Plot 63. 99% Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2412M, n mode, port a



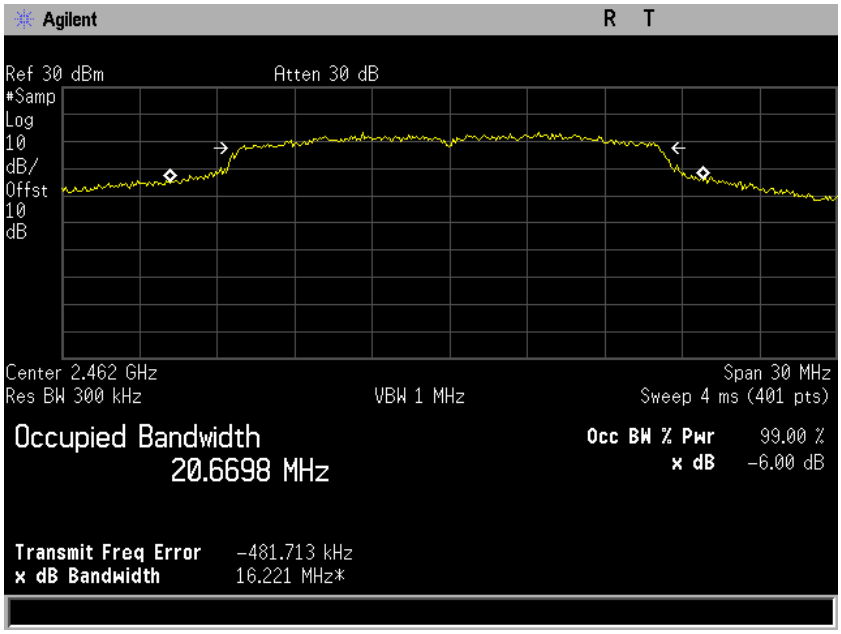
Plot 64. 99% Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2412M, n mode, port b



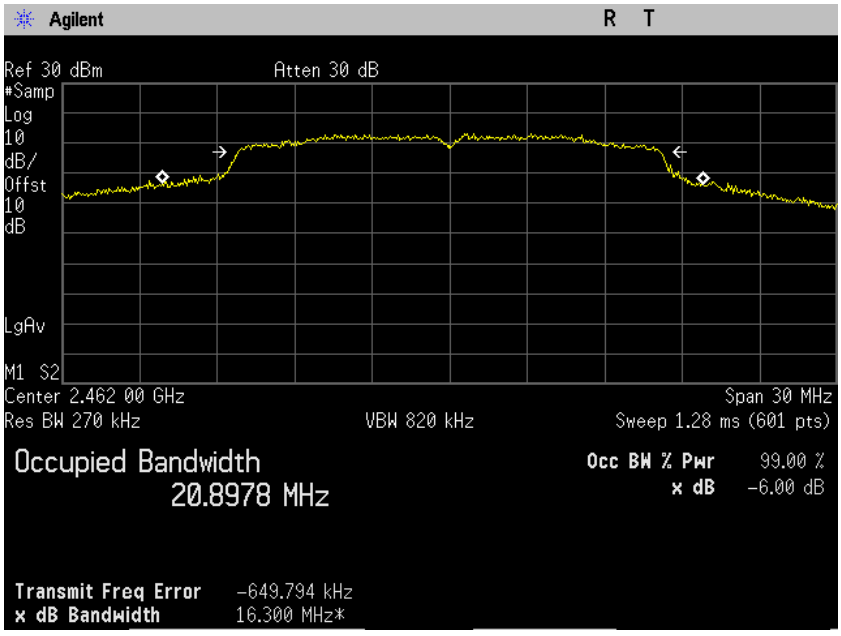
Plot 65. 99% Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2437M, n mode, port a



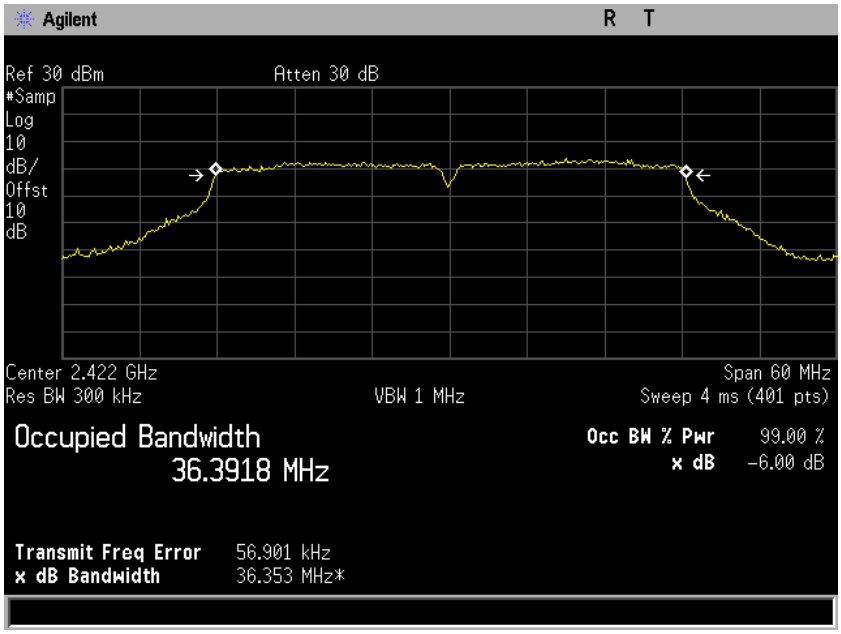
Plot 66. 99% Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2437M, n mode, port b



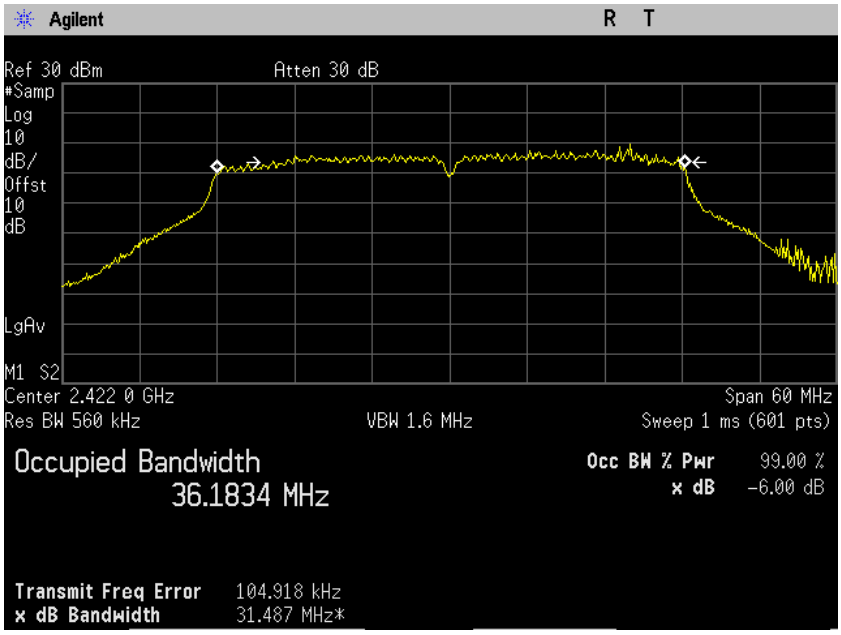
Plot 67. 99% Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2462M, n mode, port a



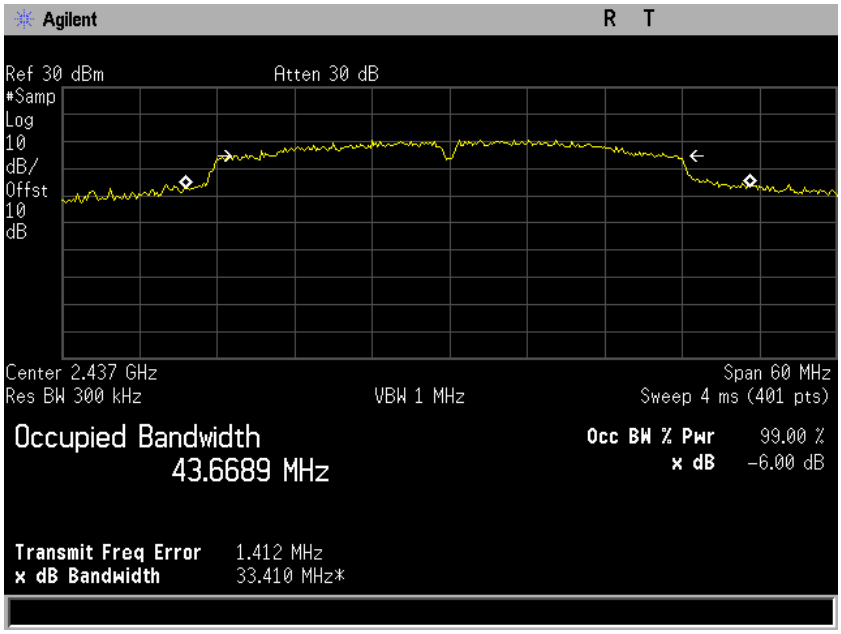
Plot 68. 99% Occupied Bandwidth, MIMO, Bandwidth 20M, Ch. 2462M, n mode, port b



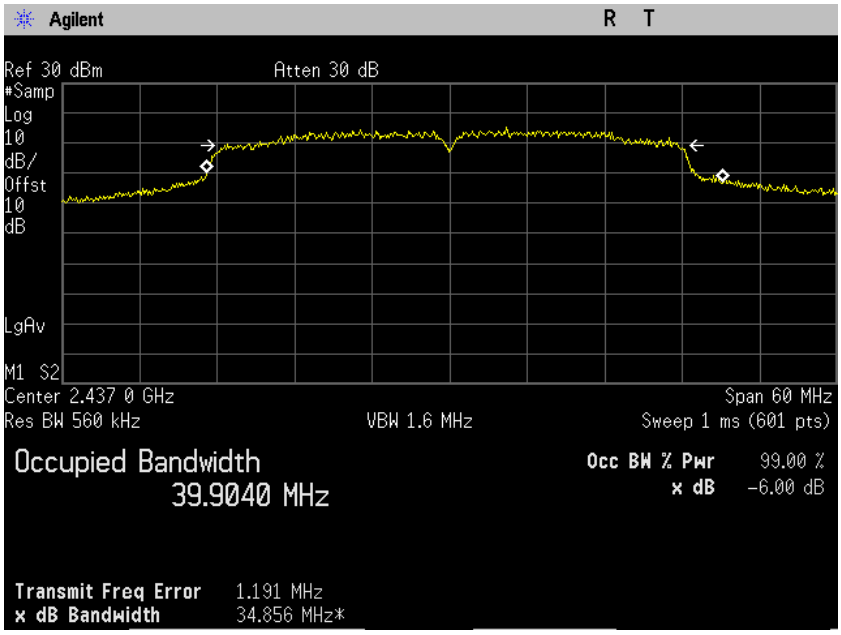
Plot 69. 99% Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port a



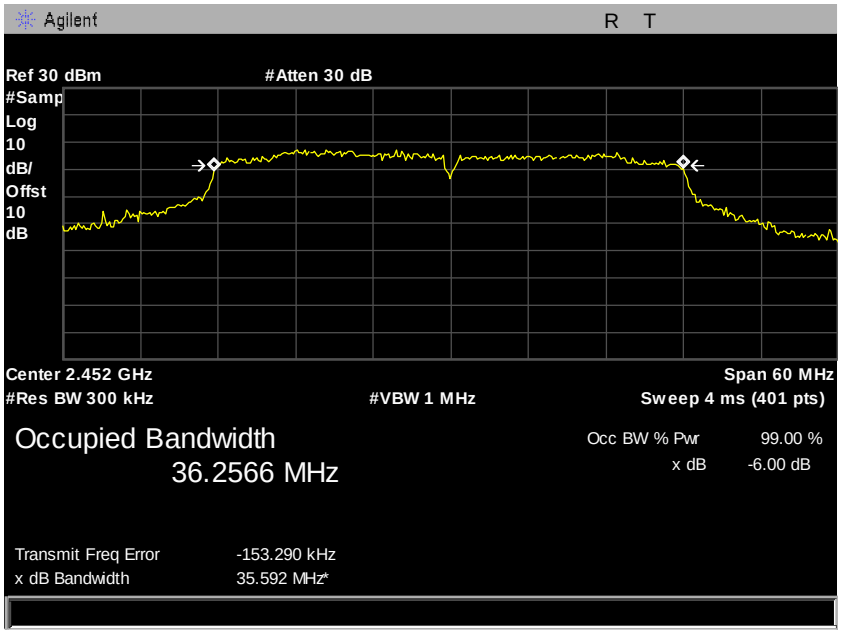
Plot 70. 99% Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port b



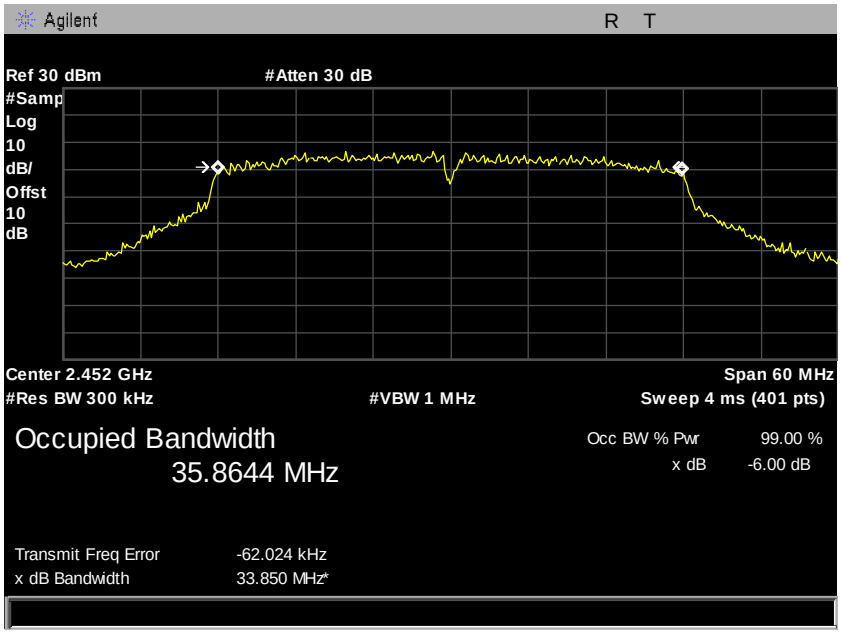
Plot 71. 99% Occupied Bandwidth, MIMO, Bandwidth, 40M, Ch. 2437M, n mode, port a



Plot 72. 99% Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2437M, n mode, port b



Plot 73. 99% Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port a



Plot 74. 99% Occupied Bandwidth, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port b

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(b) Peak Power Output

Test Requirements: **§15.247(b):** The maximum peak output power of the intentional radiator shall not exceed the following:

Digital Transmission Systems (MHz)	Output Limit (Watts)
902-928	1.000
2400–2483.5	1.000
5725– 5850	1.000

Table 9. Output Power Requirements from §15.247(b)

§15.247(c): if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in the Table 9, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400 – 2483.5 MHz band and using a point to point application may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, Omni-directional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

Test Procedure: The transmitter was connected to a calibrated spectrum analyzer. The EUT was measured at the low, mid and high channels of each band at the maximum power level.

Test Results: The EUT was compliant with the Peak Power Output limits of **§15.247(b)**. No anomalies detected.

Test Engineer(s): Donald Salguero

Test Date(s): January 6, 2017

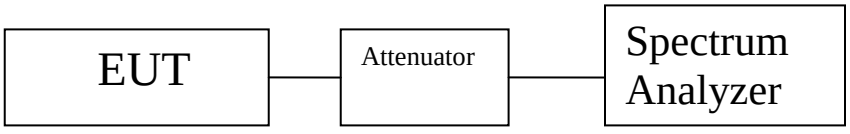


Figure 2. Peak Power Output Test Setup

Peak Power Output Test Results

Channel	Power Port A (dBm)	Limit (dBm)	Margin
BW 20M Ch 2412M b Mode	17.95	30	12.05
BW 20M Ch 2412M g Mode	16.59	30	13.41
BW 20M Ch 2412M n Mode	15.04	30	14.96
BW 20M Ch 2437M b Mode	20.62	30	9.38
BW 20M Ch 2437M g Mode	20.26	30	9.74
BW 20M Ch 2437M n Mode	19.84	30	10.16
BW 20M Ch 2462M b Mode	21.02	30	8.98
BW 20M Ch 2462M g Mode	19.73	30	10.27
BW 20M Ch 2462M n Mode	20.05	30	9.95
BW 40M Ch 2422M n Mode	16.3	30	13.7
BW 40M Ch 2437M n Mode	17.18	30	12.82
BW 40M Ch 2452M n Mode	15.90	30	14.10

Table 10. Power Table, SISO, Port A

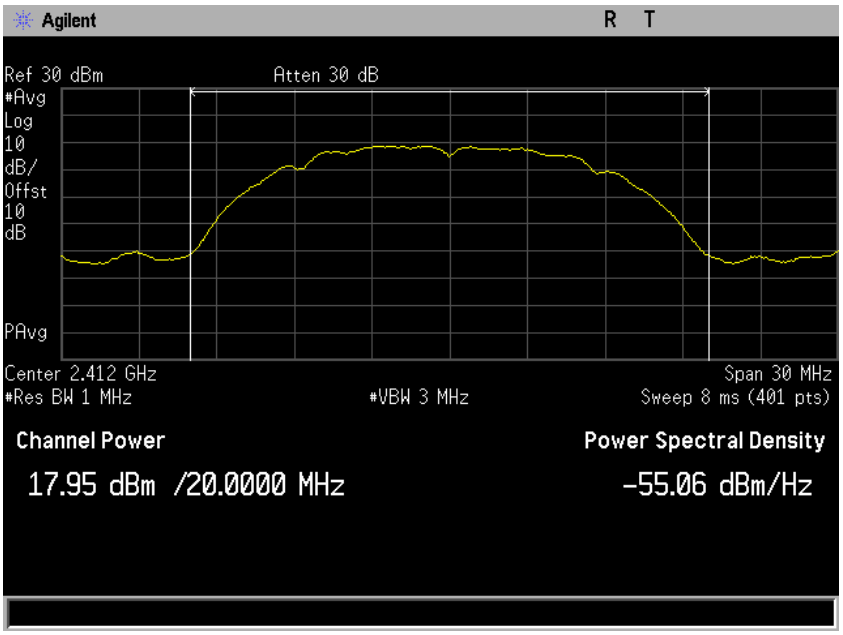
Channel	Power Port B (dBm)	Limit (dBm)	Margin
BW 20M Ch 2412M b Mode	18.41	30	11.59
BW 20M Ch 2412M g Mode	16.98	30	13.02
BW 20M Ch 2412M n Mode	16.21	30	13.79
BW 20M Ch 2437M b Mode	22.38	30	7.62
BW 20M Ch 2437M g Mode	21.47	30	8.53
BW 20M Ch 2437M n Mode	21.1	30	8.9
BW 20M Ch 2462M b Mode	22.2	30	7.8
BW 20M Ch 2462M g Mode	21.16	30	8.84
BW 20M Ch 2462M n Mode	17.1	30	12.9
BW 40M Ch 2422M n Mode	12.9	30	17.1
BW 40M Ch 2437M n Mode	18.38	30	11.62
BW 40M Ch 2452M n Mode	15.99	30	14.01

Table 11. Power Table, SISO, Port B

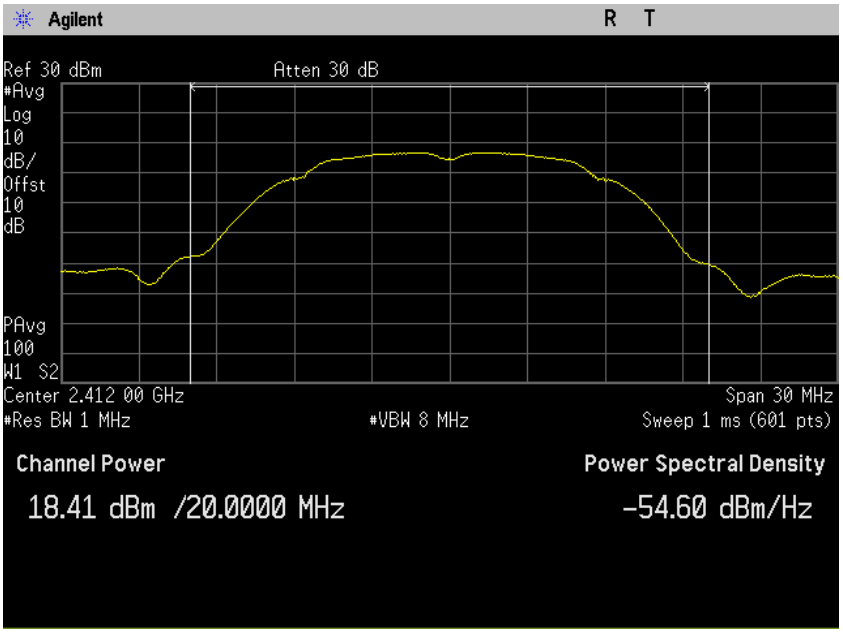
Channel	Port A (dBm)	Port B (dBm)	Sum (dBm)	Limit (dBm)	Margin
BW 20M Ch 2412M n Mode	14.26	14.95	17.63	30	12.37
BW 20M Ch 2437M n Mode	19.61	21.36	23.58	30	6.42
BW 20M Ch 2462M n Mode	16.08	17.41	19.81	30	10.19
BW 40M Ch 2422M n Mode	12.27	12.61	15.45	30	14.55
BW 40M Ch 2437M n Mode	19.03	20.53	22.85	30	7.15
BW 40M Ch 2452M n Mode	17.03	16.00	19.56	30	10.44

Table 12. Power Table, MIMO

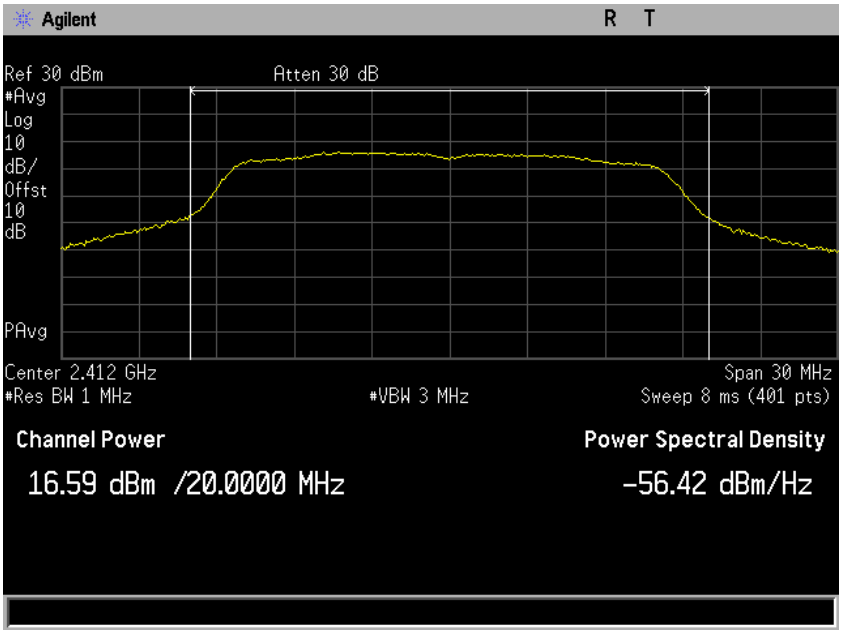
Peak Power Output Test Results
SISO



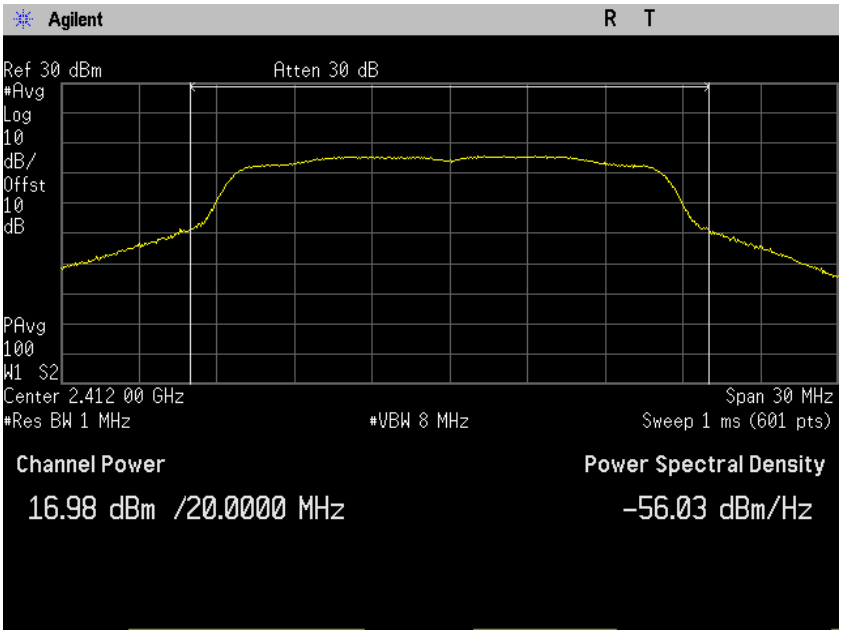
Plot 75. Peak Power Output, SISO, Bandwidth 20M, Ch. 2412M, b mode, port a



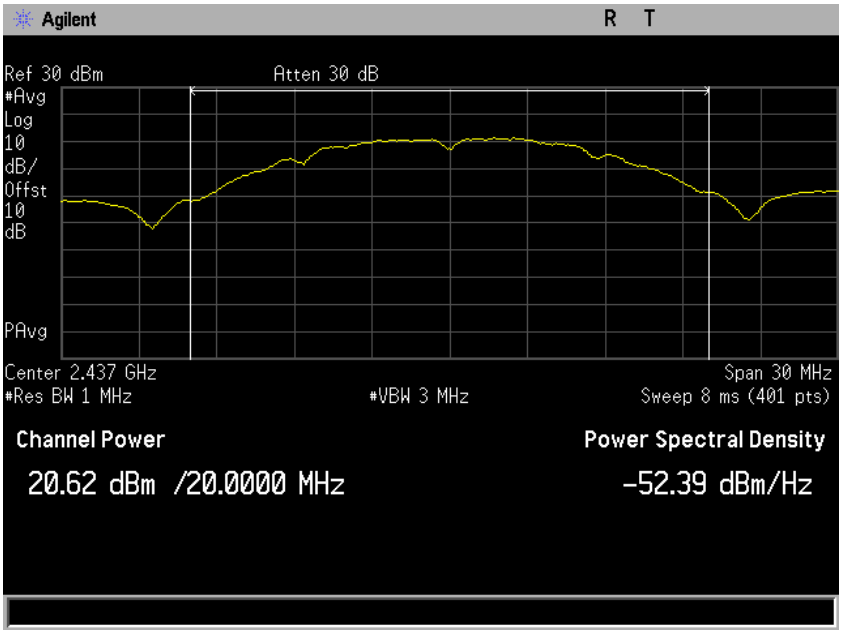
Plot 76. Peak Power Output, SISO, Bandwidth 20M, Ch. 2412M, b mode, port b



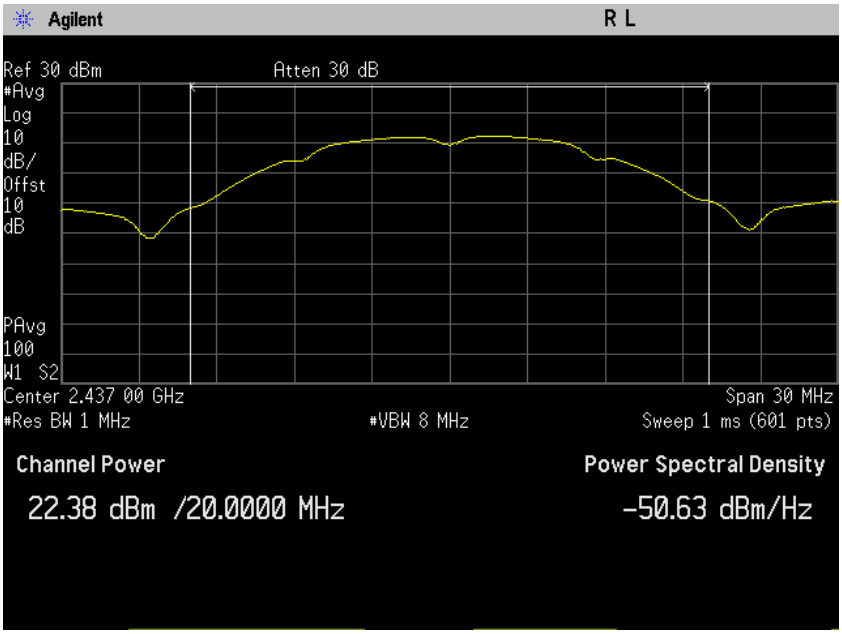
Plot 77. Peak Power Output, SISO, Bandwidth 20M, Ch. 2412M, g mode, port a



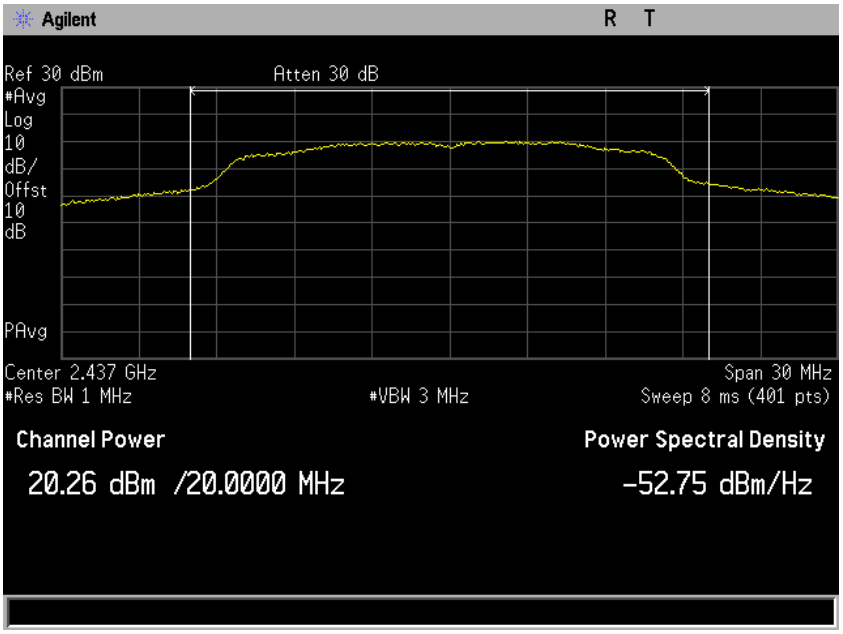
Plot 78. Peak Power Output, SISO, Bandwidth 20M, Ch. 2412M, g mode, port b



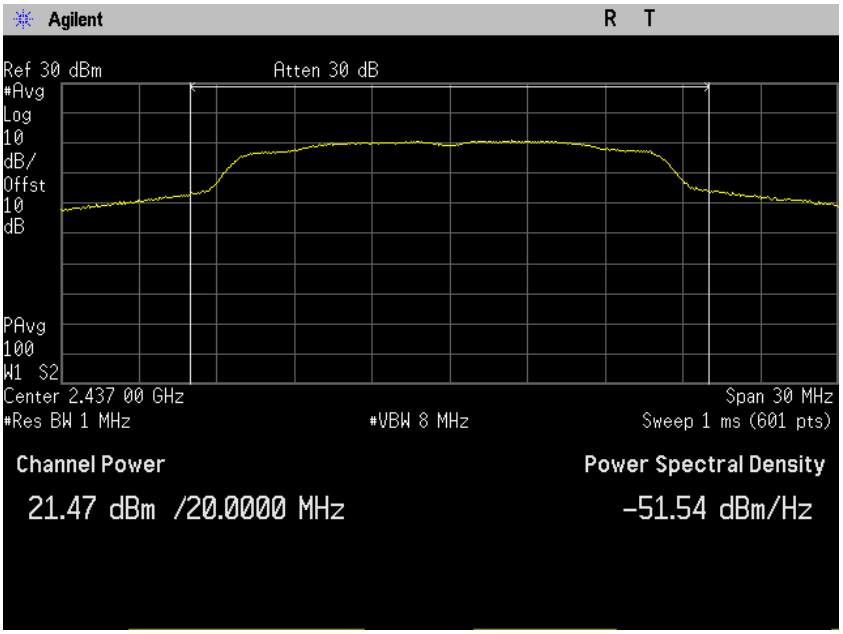
Plot 79. Peak Power Output, SISO, Bandwidth 20M, Ch. 2437M, b mode, port a



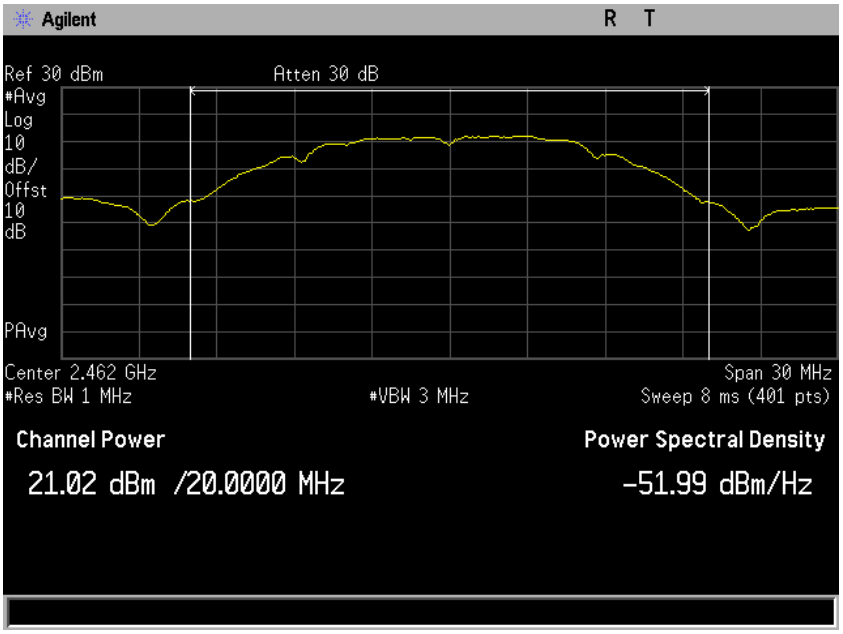
Plot 80. Peak Power Output, SISO, Bandwidth 20M, Ch. 2437M, b mode, port b



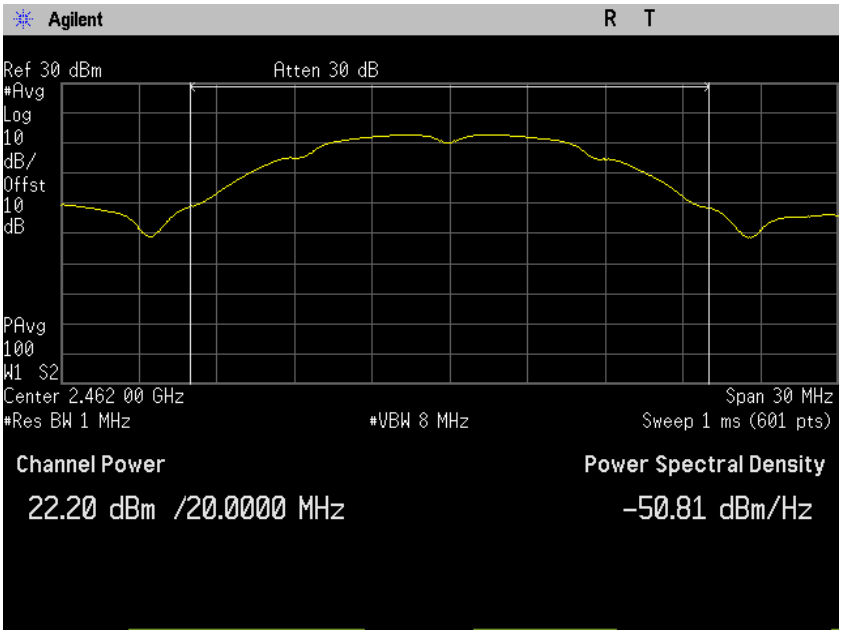
Plot 81. Peak Power Output, SISO, Bandwidth 20M, Ch. 2437M, g mode, port a



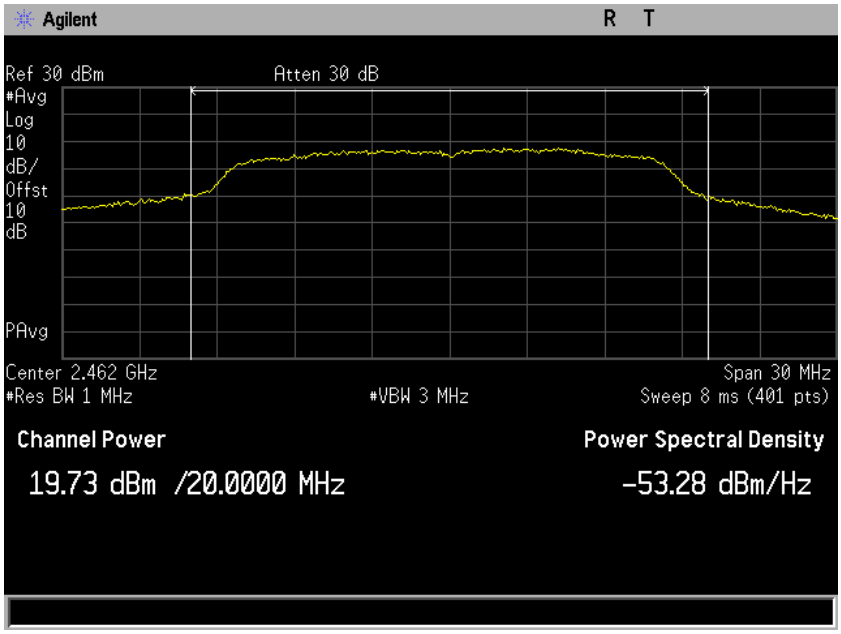
Plot 82. Peak Power Output, SISO, Bandwidth 20M, Ch. 2437M, g mode, port b



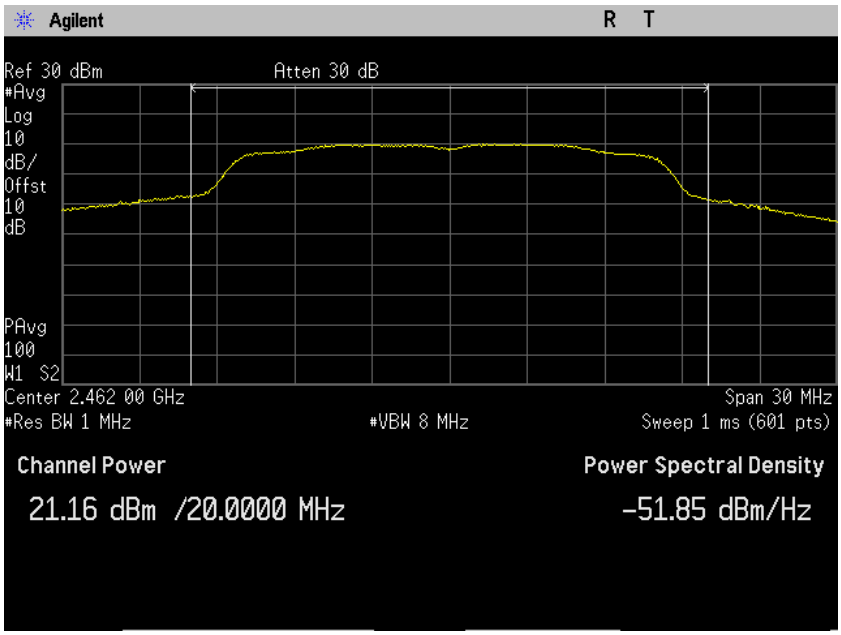
Plot 83. Peak Power Output, SISO, Bandwidth 20M, Ch. 2462M, b mode, port a



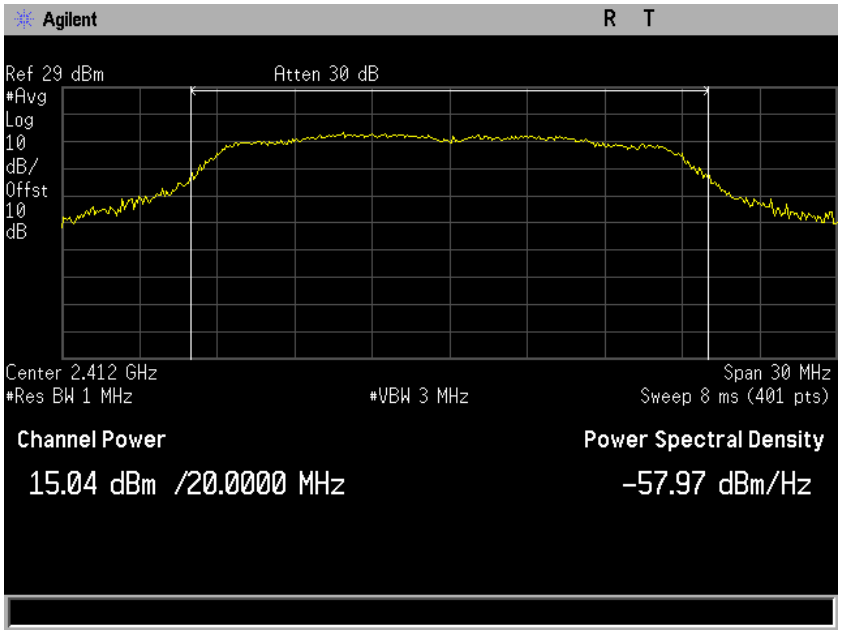
Plot 84. Peak Power Output, SISO, Bandwidth 20M, Ch. 2462M, b mode, port b



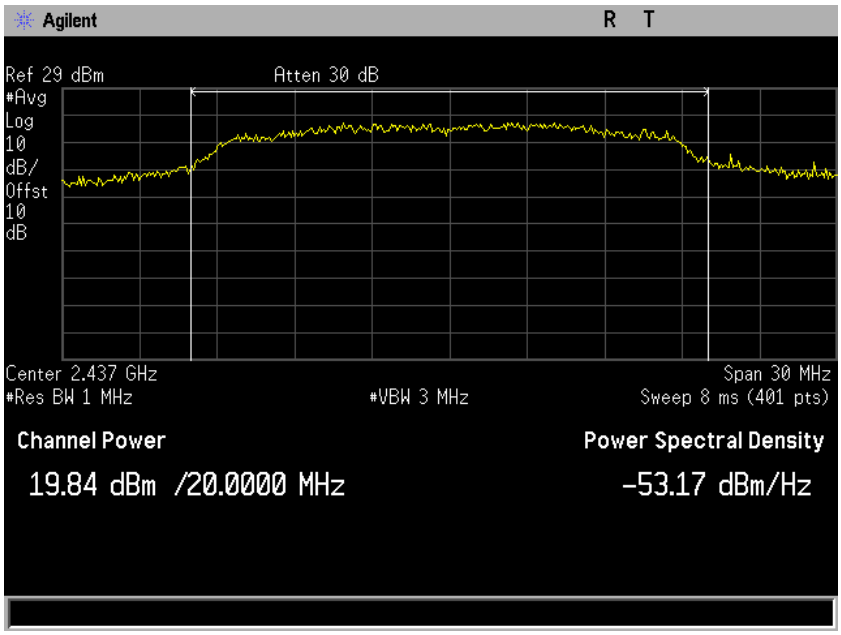
Plot 85. Peak Power Output, SISO, Bandwidth 20M, Ch. 2462M, g mode, port a



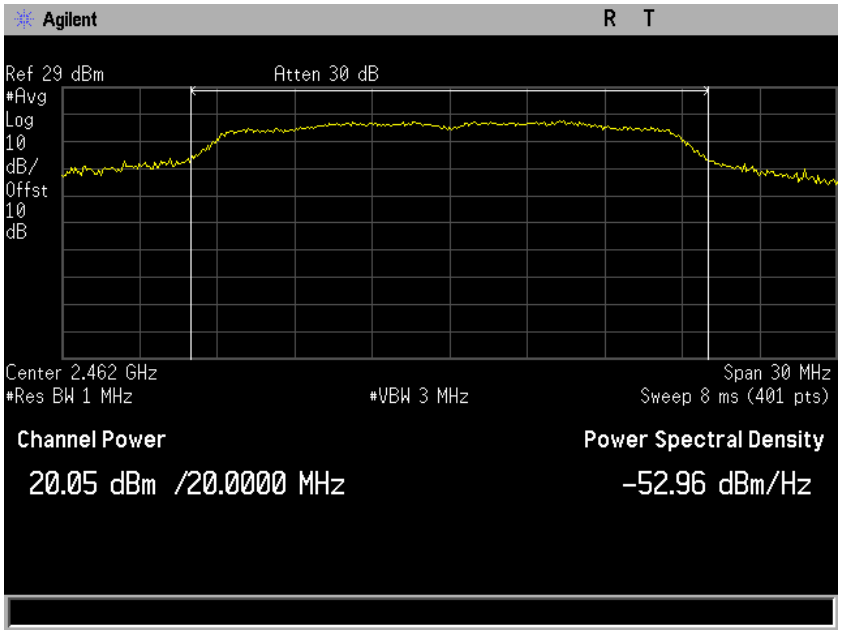
Plot 86. Peak Power Output, SISO, Bandwidth 20M, Ch. 2462M, g mode, port b



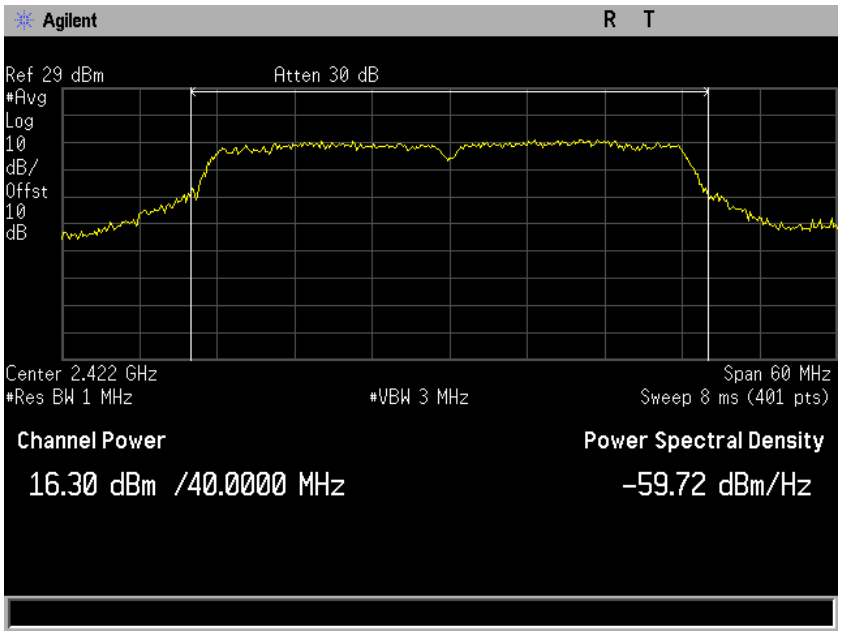
Plot 87. Peak Power Output, SISO, Bandwidth 20M, n mode, 2412, port a



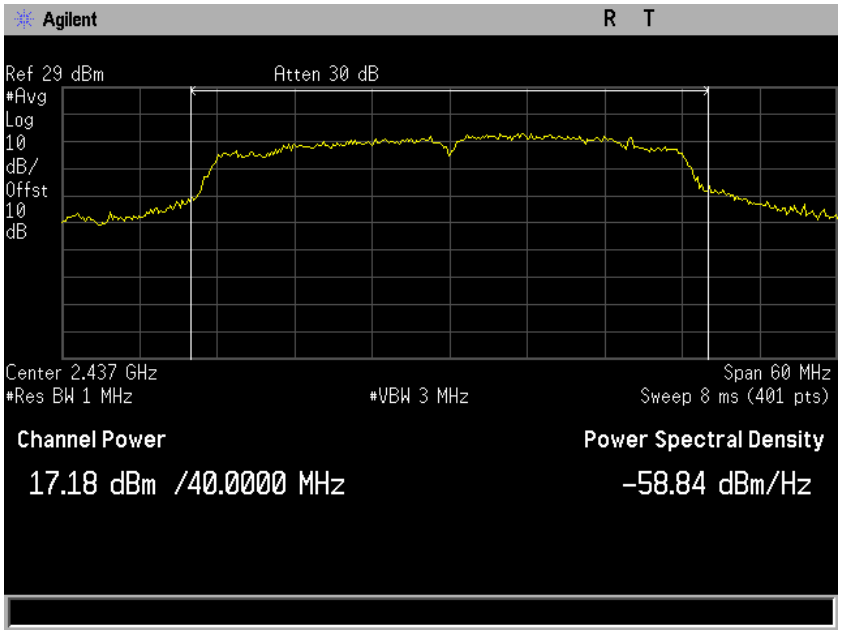
Plot 88. Peak Power Output, SISO, Bandwidth 20M, n mode, 2437, port a



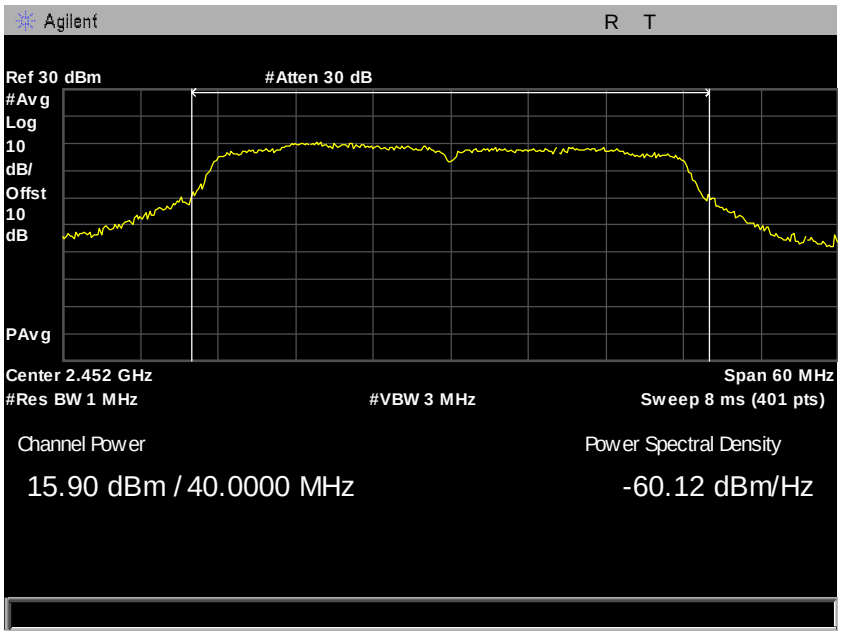
Plot 89. Peak Power Output, SISO, Bandwidth 20M, n mode, 2462, port a



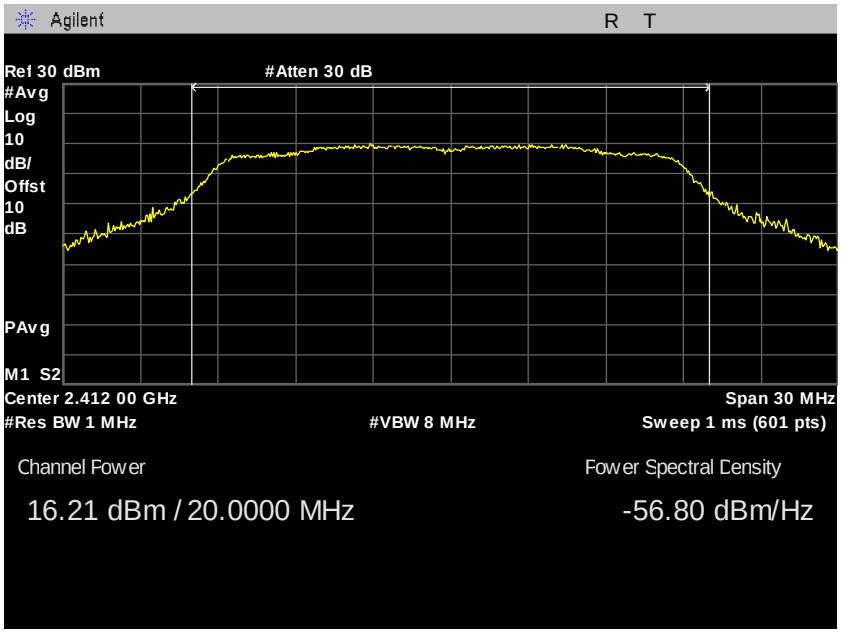
Plot 90. Peak Power Output, SISO, Bandwidth 40M, n mode, 2422, port a



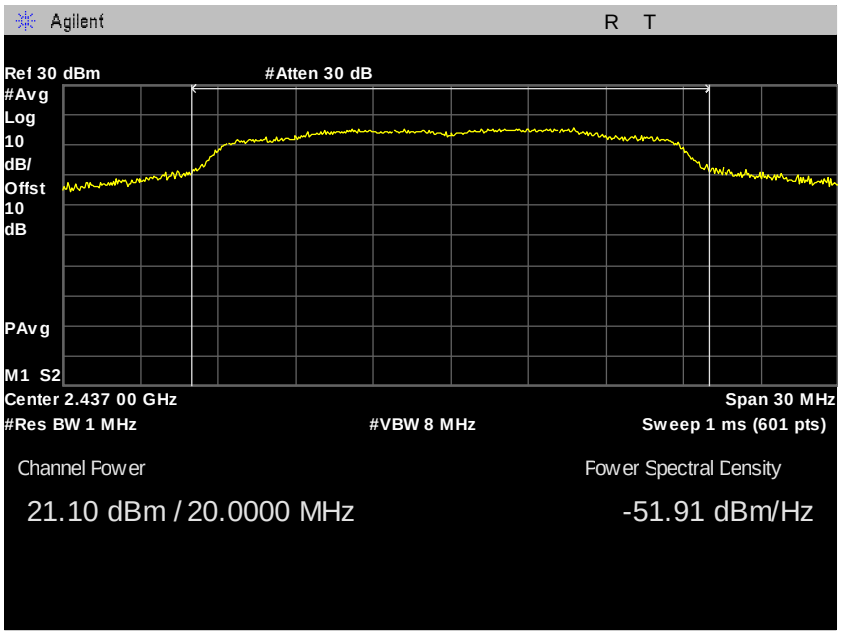
Plot 91. Peak Power Output, SISO, Bandwidth 40M, n mode, 2437, port a



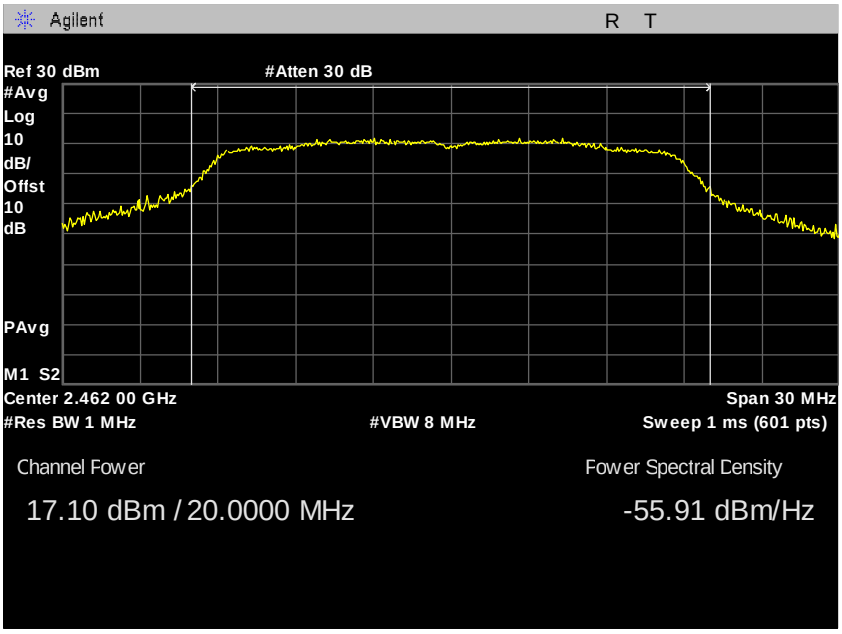
Plot 92. Peak Power Output, SISO, Bandwidth 40M, n mode, 2452, port a



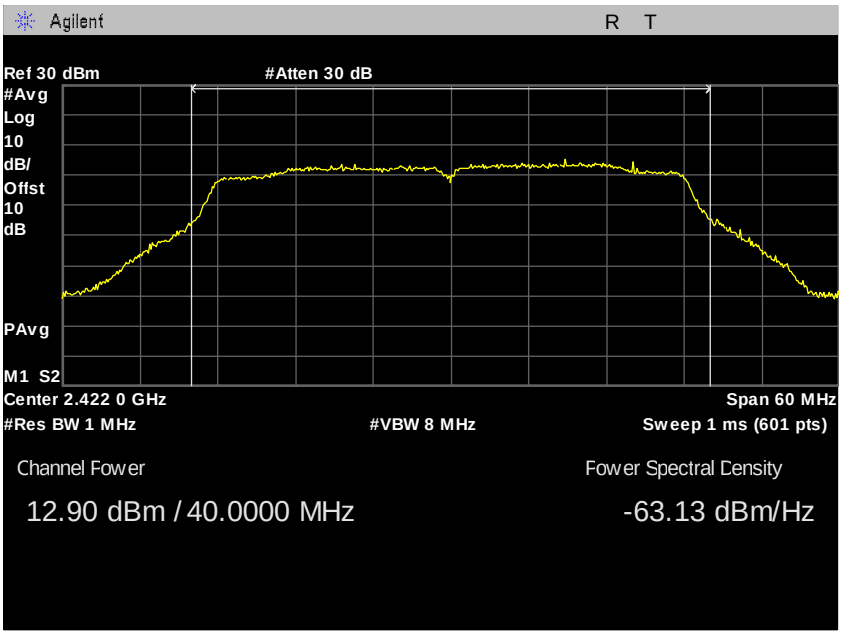
Plot 93. Peak Power Output, SISO, Bandwidth 20M, n mode, 2412, port b



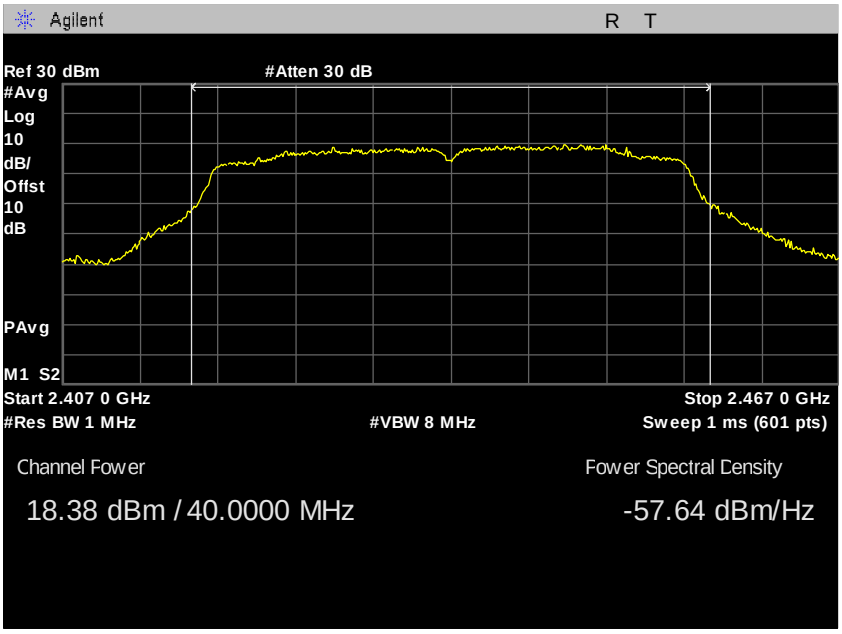
Plot 94. Peak Power Output, SISO, Bandwidth 20M, n mode, 2437, port b



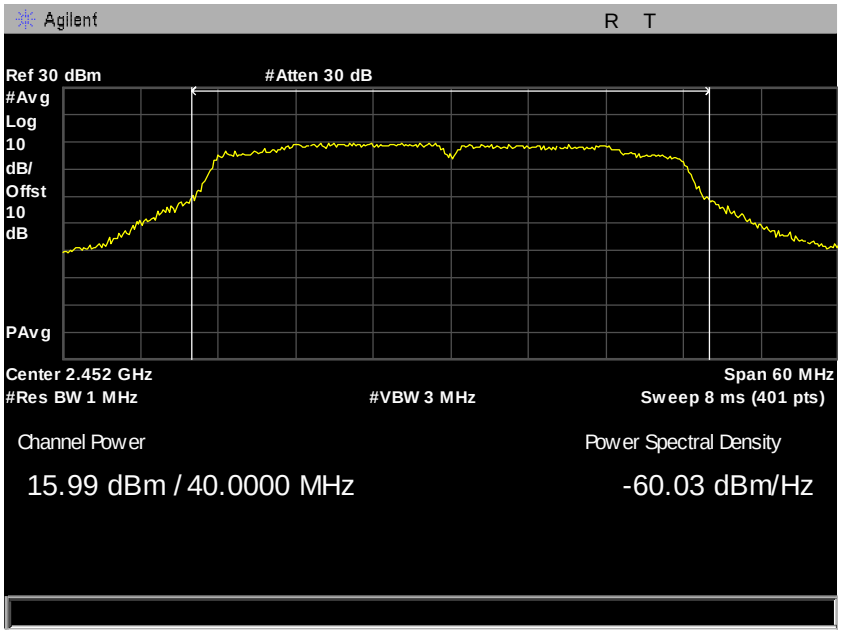
Plot 95. Peak Power Output, SISO, Bandwidth 20M, n mode, 2462, port b



Plot 96. Peak Power Output, SISO, Bandwidth 40M, n mode, 2422, port b

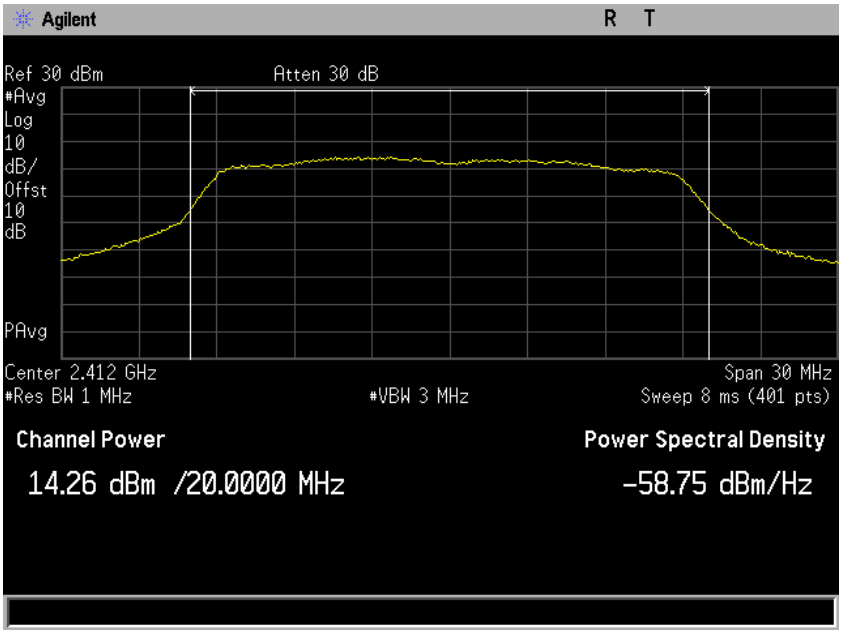


Plot 97. Peak Power Output, SISO, Bandwidth 40M, n mode, 2437, port b

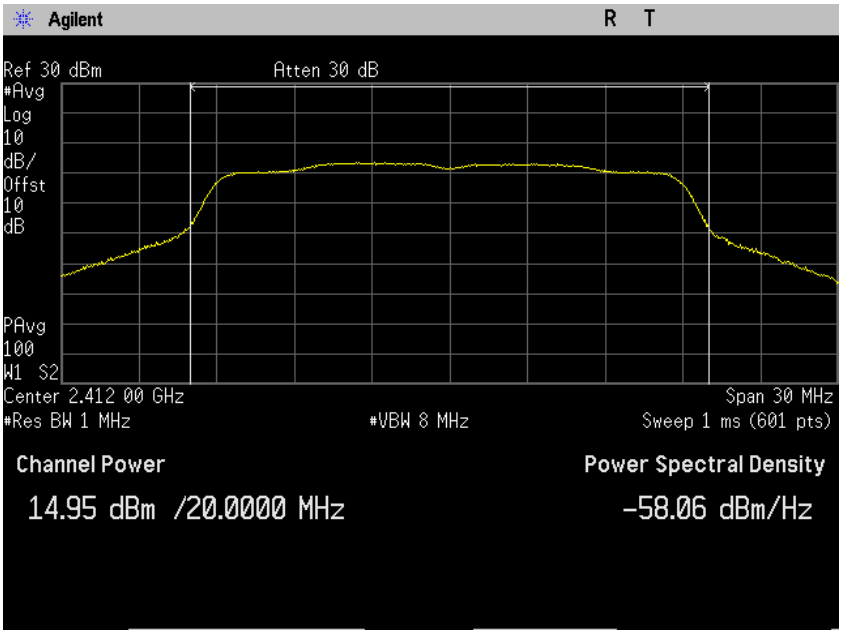


Plot 98. Peak Power Output, SISO, Bandwidth 40M, n mode, 2452, port b

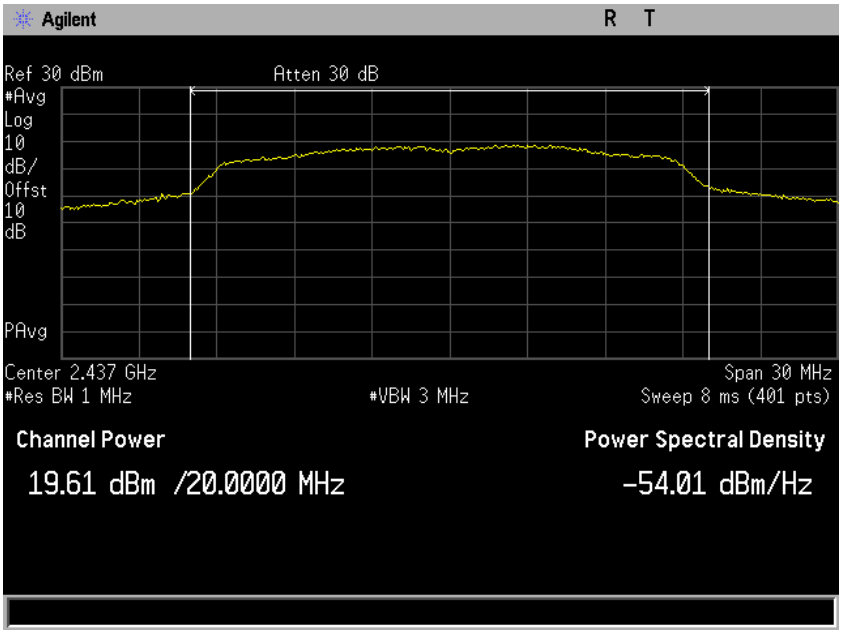
MIMO



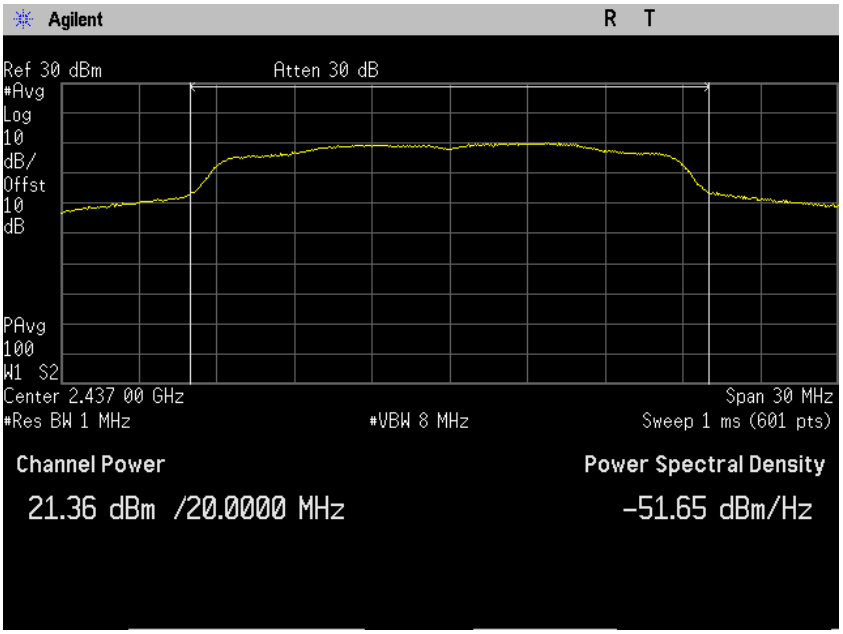
Plot 99. Peak Power Output, MIMO, Bandwidth 20M, Ch. 2412M, n mode, port a



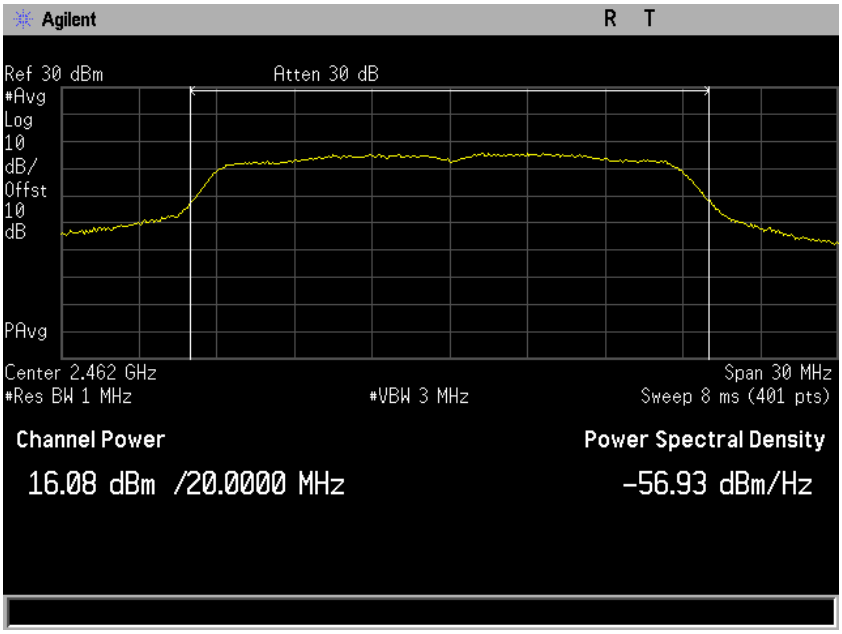
Plot 100. Peak Power Output, MIMO, Bandwidth 20M, Ch. 2412M, n mode, port b



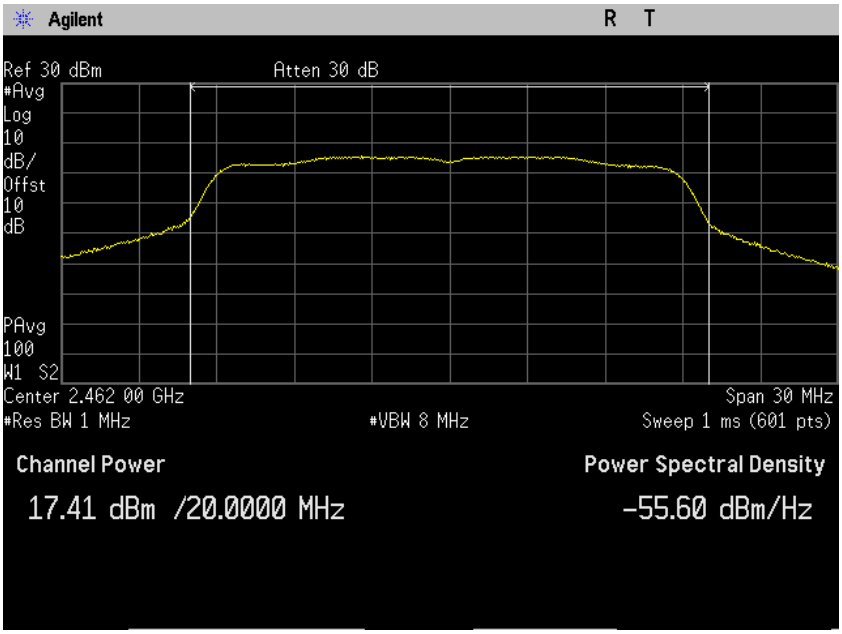
Plot 101. Peak Power Output, MIMO, Bandwidth 20M, Ch. 2437M, n mode, port a



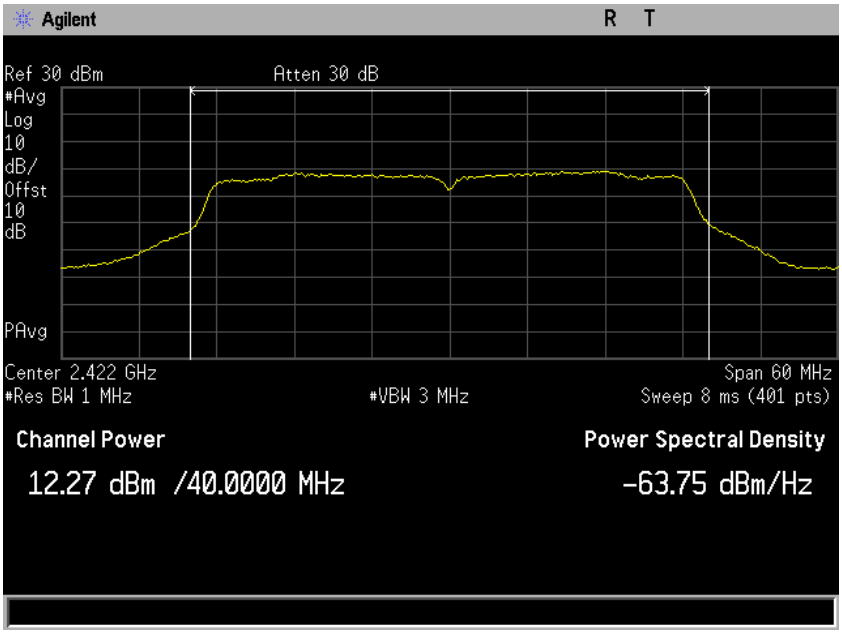
Plot 102. Peak Power Output, MIMO, Bandwidth 20M, Ch. 2437M, n mode, port b



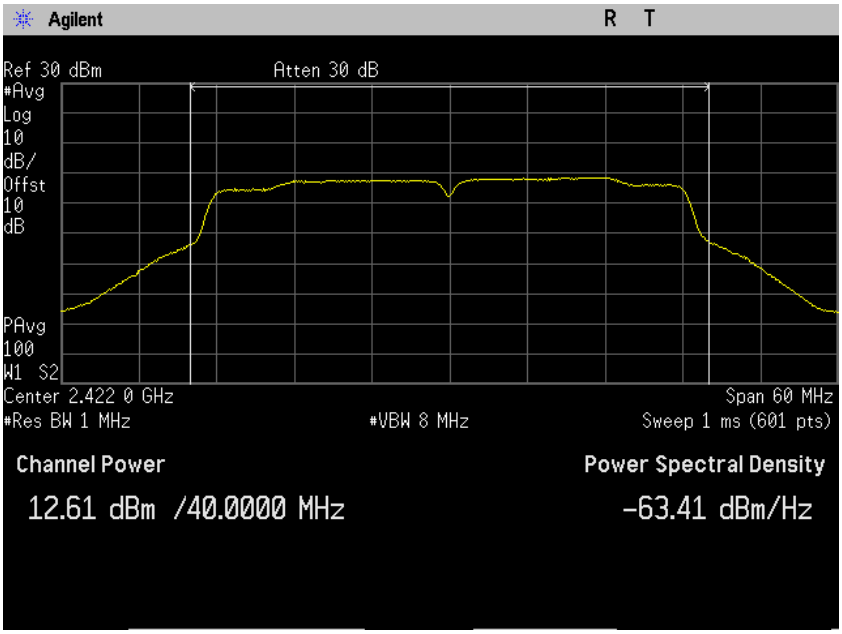
Plot 103. Peak Power Output, MIMO, Bandwidth 20M, Ch. 2462M, n mode, port a



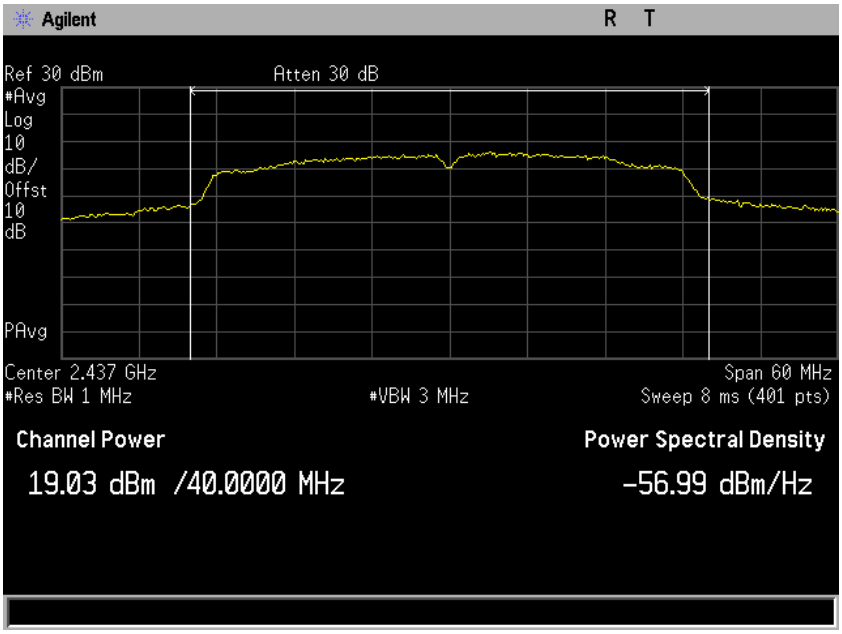
Plot 104. Peak Power Output, MIMO, Bandwidth 20M, Ch. 2462M, n mode, port b



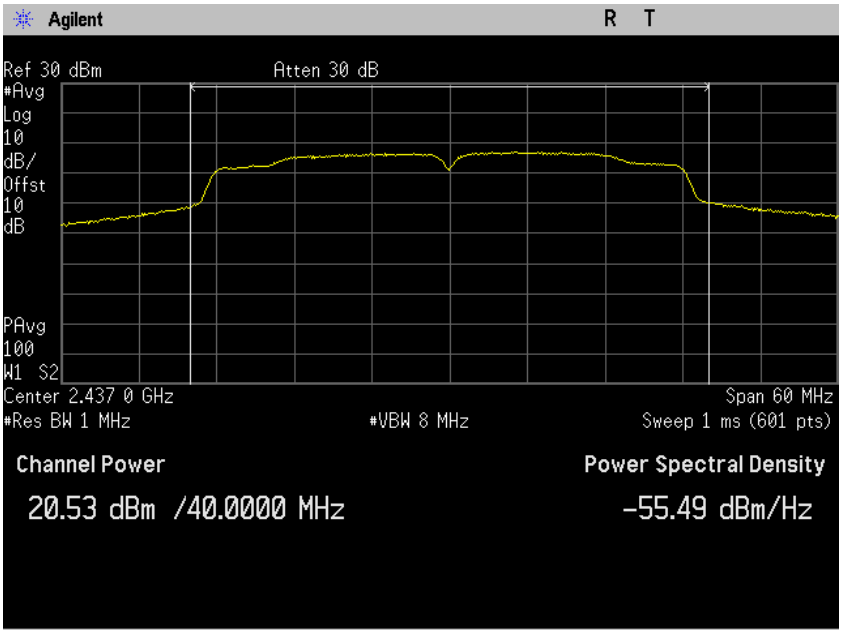
Plot 105. Peak Power Output, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port a



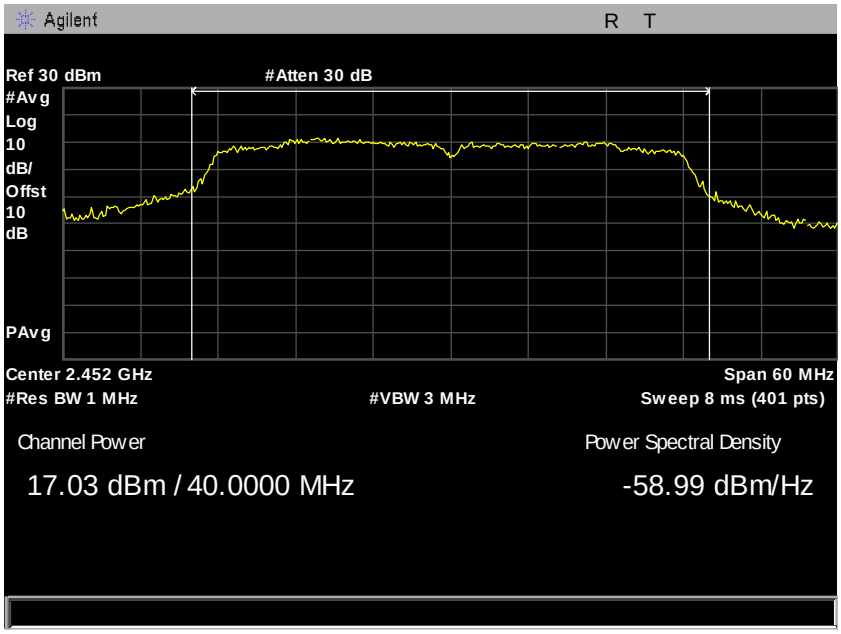
Plot 106. Peak Power Output, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port b



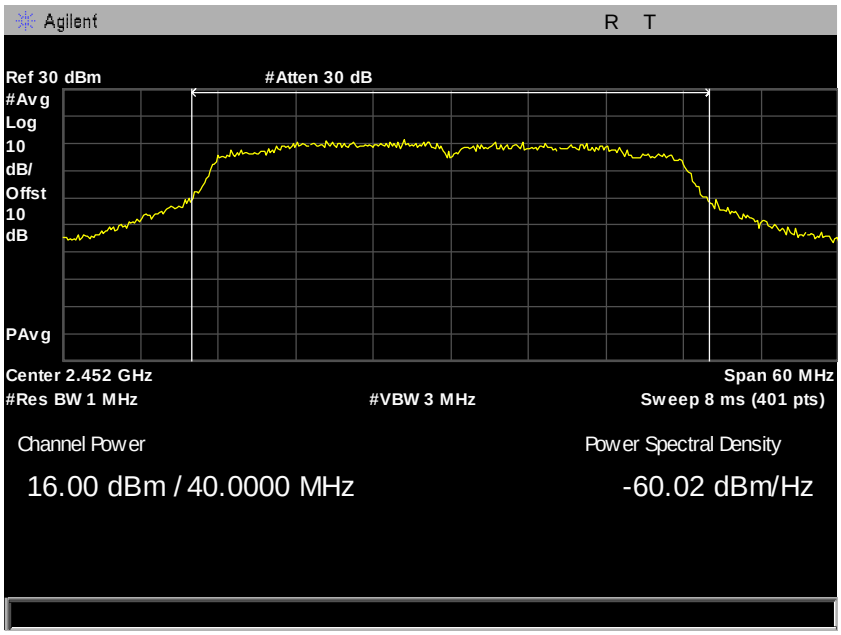
Plot 107. Peak Power Output, MIMO, Bandwidth 40M, Ch. 2437M, n mode, port a



Plot 108. Peak Power Output, MIMO, Bandwidth 40M, Ch. 2437M, n mode, port b



Plot 109. Peak Power Output, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port a



Plot 110. Peak Power Output, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port b

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

Test Requirements: **§15.247(d); §15.205:** Emissions outside the frequency band.

§15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110----------	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505----------	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905----------	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128----------	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775----------	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775----------	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218----------	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825----------	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225----------	123–138	2200–2300	14.47–14.5
8.291–8.294----------	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366----------	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675----------	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475----------	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293----------	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025----------	240–285	3345.8–3358 36.	43–36.5
12.57675–12.57725----------	322–335.4	3600–4400	([2])

Table 13. Restricted Bands of Operation

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.
[2] Above 38.6

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 14.

Frequency (MHz)	§ 15.209(a),Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Table 14. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedures: The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

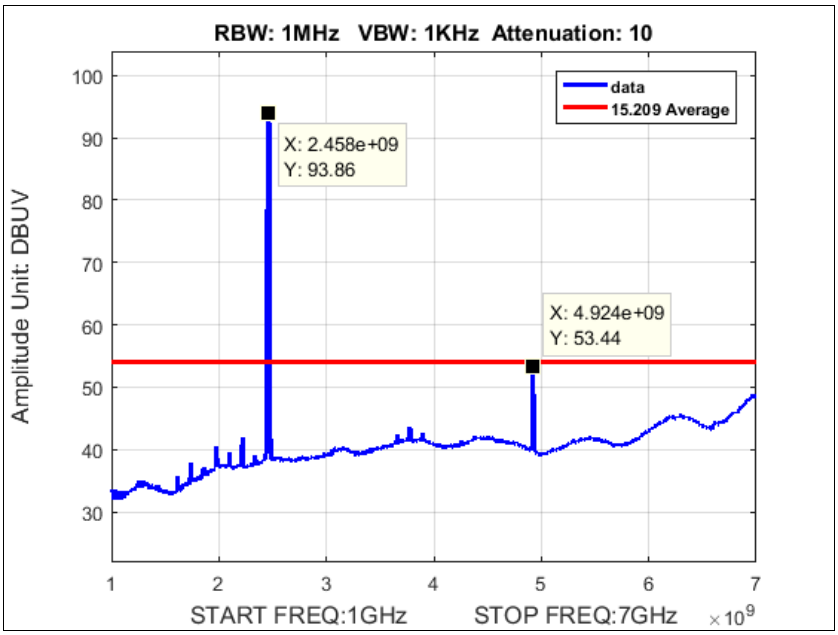
Test Results: The EUT was compliant with the Radiated Spurious Emission limits of **§ 15.247(d)**. Measured emissions were within applicable limits.

Test Engineer(s): Donald Salguero

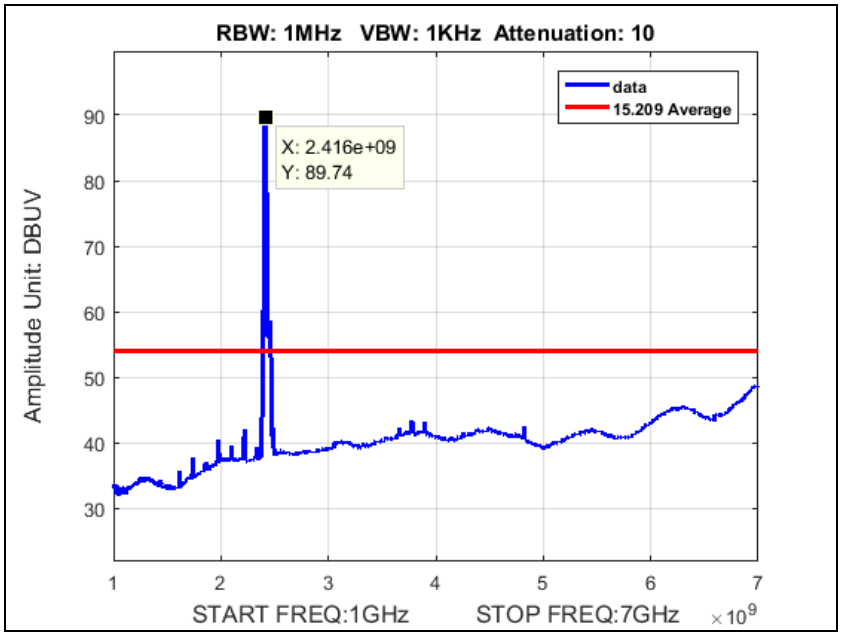
Test Date(s): January 6, 2017

Radiated Spurious Emissions Test Results

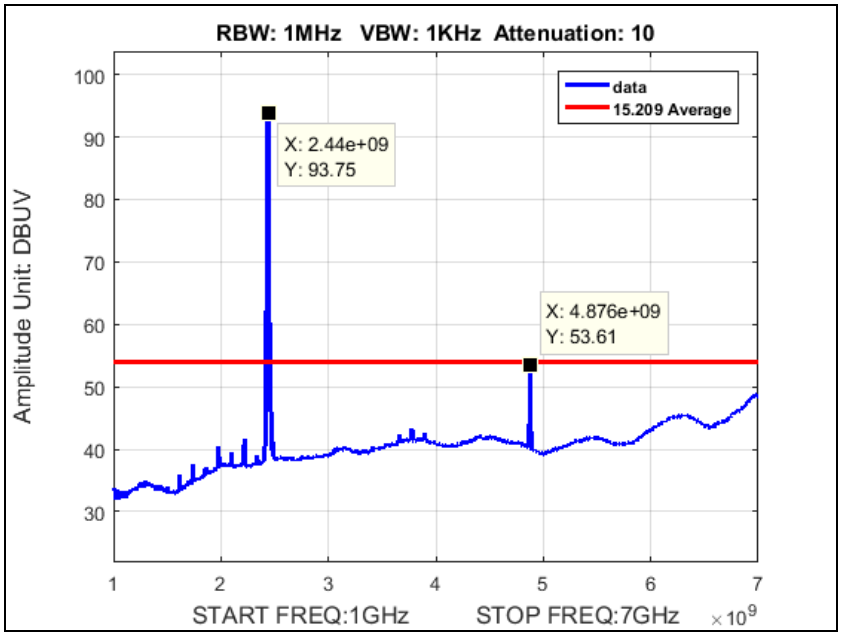
SISO



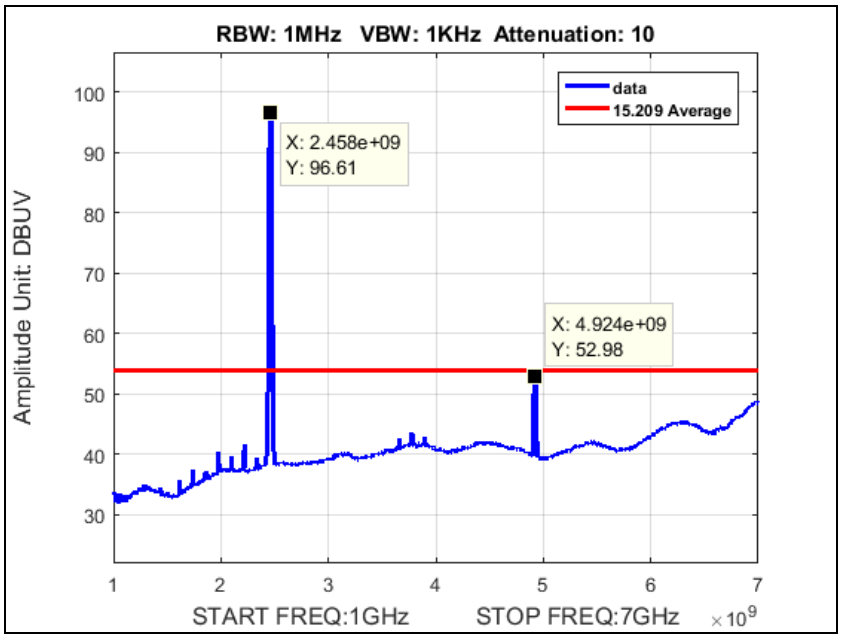
Plot 111. Radiated Emissions, SISO, Average Radiated Spurious Emissions, 20M, High Channel, b mode, 2462 at 13.25 dBm, 17-GHz



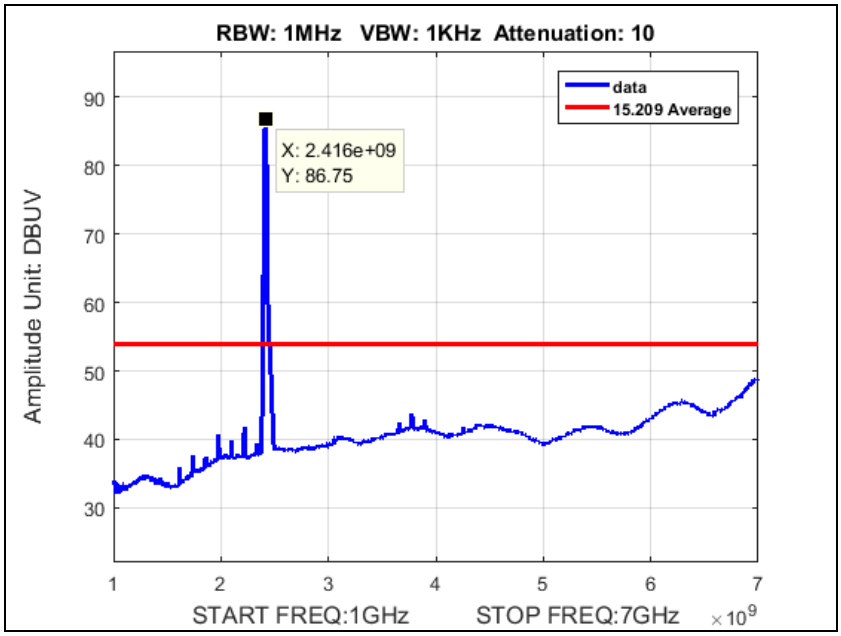
Plot 112. Radiated Emissions, SISO, Average Radiated Spurious Emissions, 20M, low channel, b mode, 2412, 1-7GHz



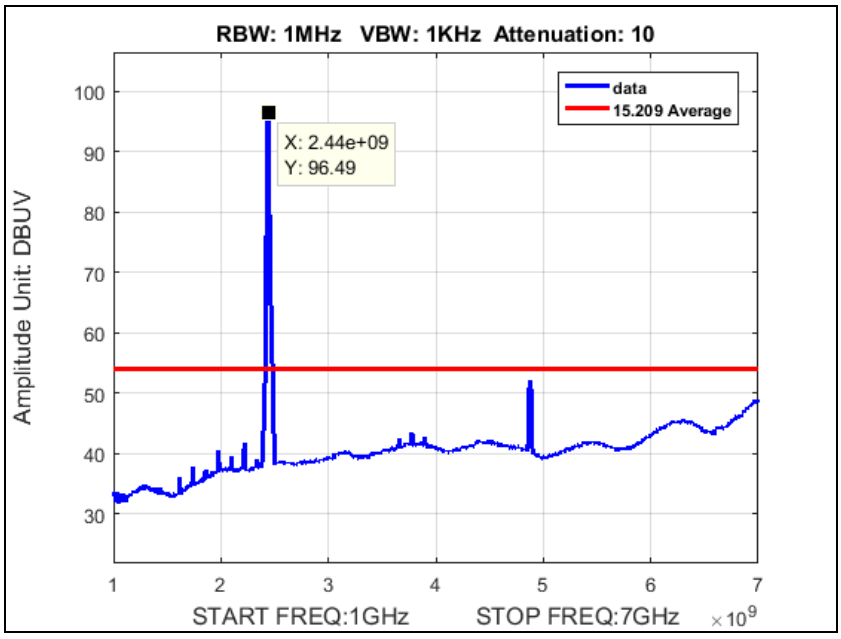
Plot 113. Radiated Emissions, Average Radiated Spurious Emissions, SISO, 20M, Mid Channel, 2437 at 17.25 dBm, 1-7 GH



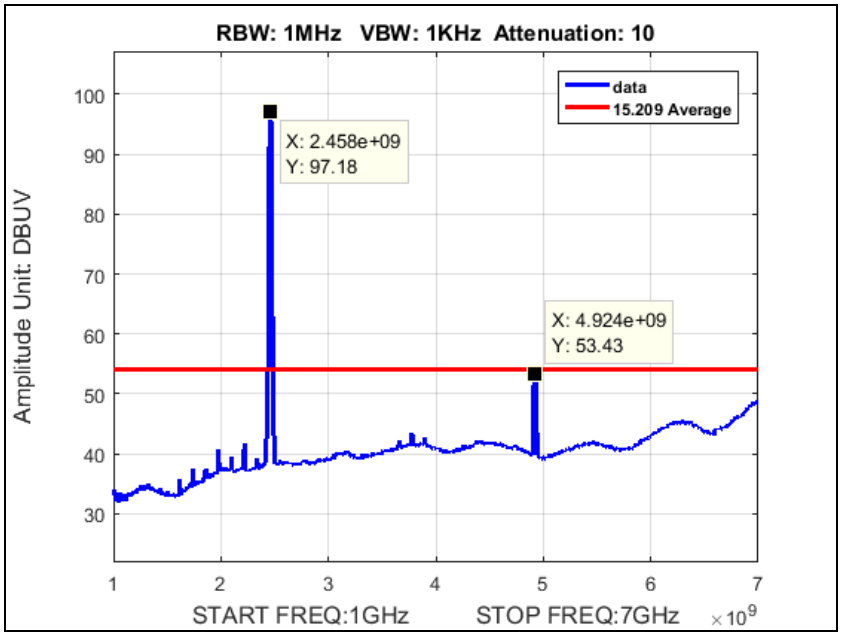
Plot 114. Radiated Emissions, Average Radiated Spurious Emissions, 20M, g mode, High Channel, 2462 at 18 dBm, 1-7 GHz



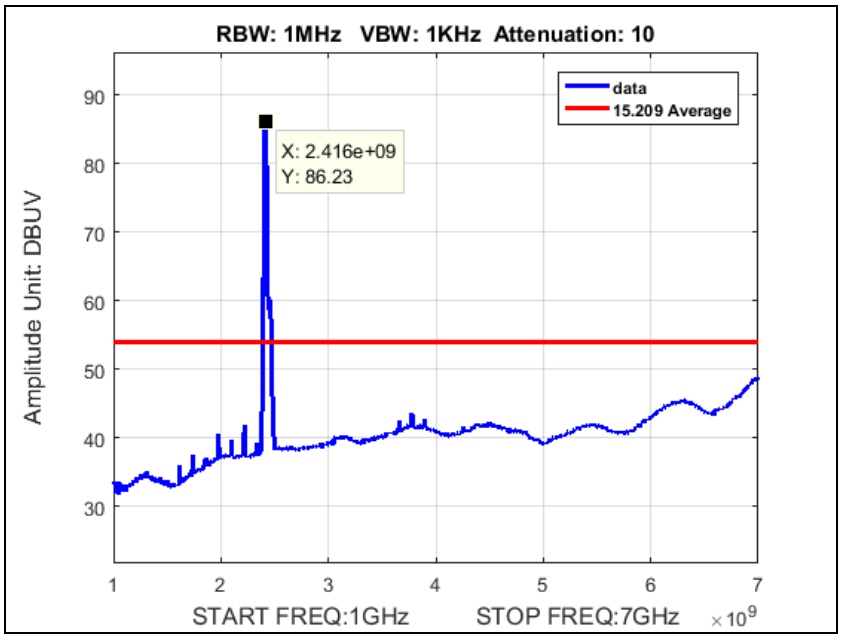
Plot 115. Radiated Emissions, Average Radiated Spurious Emissions, 20M, g mode, Low Channel, 2412, 1-7 GHz



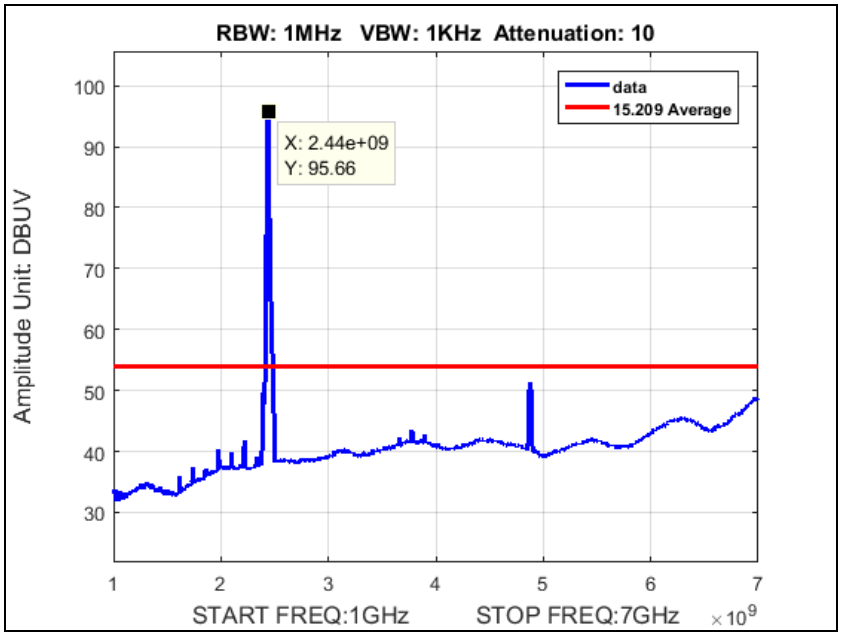
Plot 116. Radiated Emissions, Average Radiated Spurious Emissions, 20M, g mode, Mid Channel, 2437, 1-7 GHz



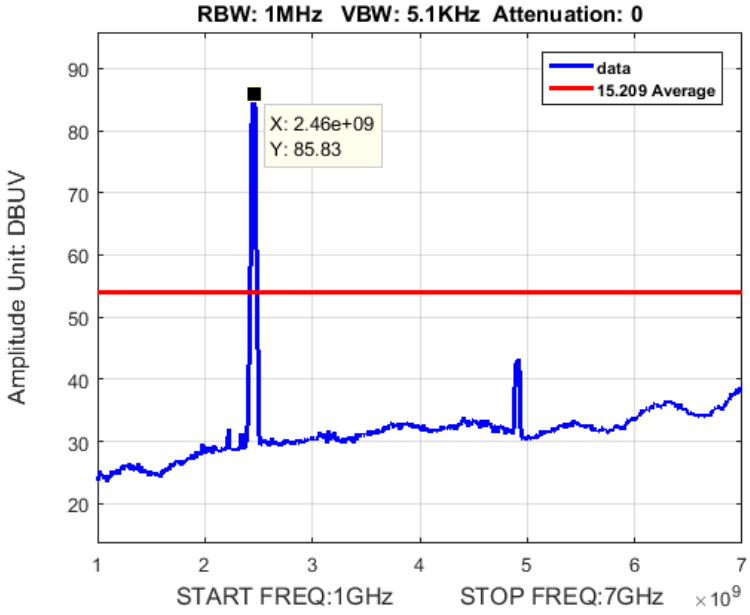
Plot 117. Radiated Emissions, Average Radiated Spurious Emissions, N20, 20M, High Channel, 2462 at 19 dBm 1-7 GHz



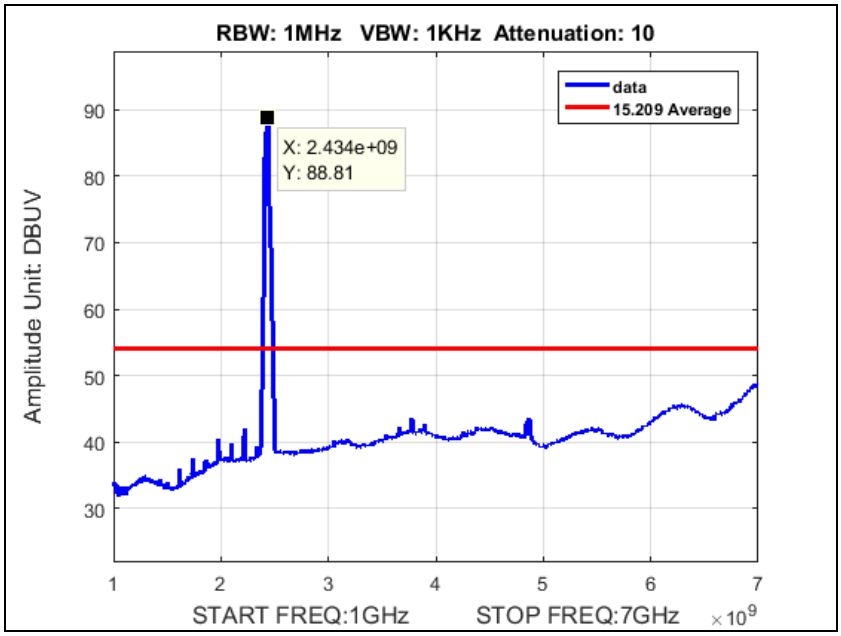
Plot 118. Radiated Emissions, Average Radiated Spurious Emissions, N20, 20M, Low Channel, 2412, 1-7 GHz



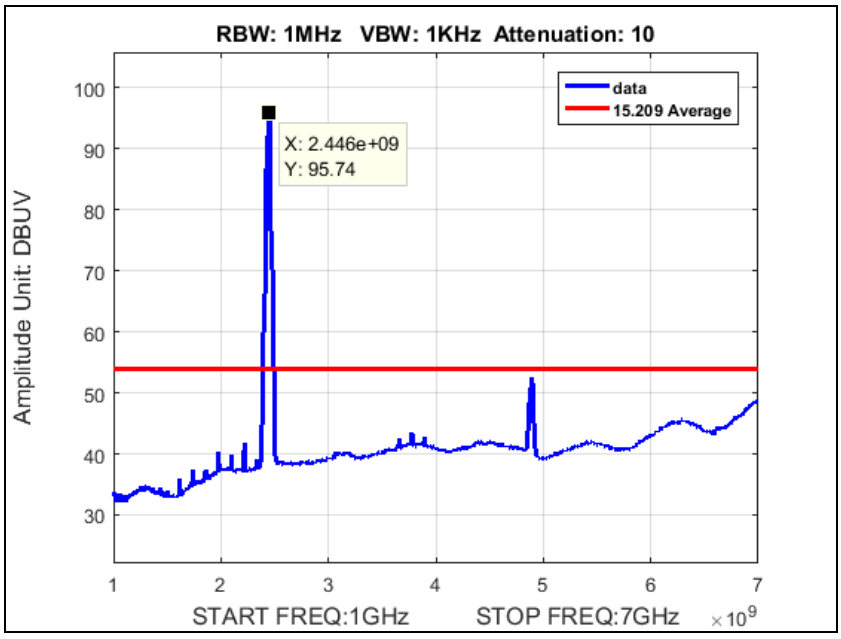
Plot 119. Average Radiated Spurious Emissions, N20, 20M, Mid Channel, 2437, 1-7 GHz



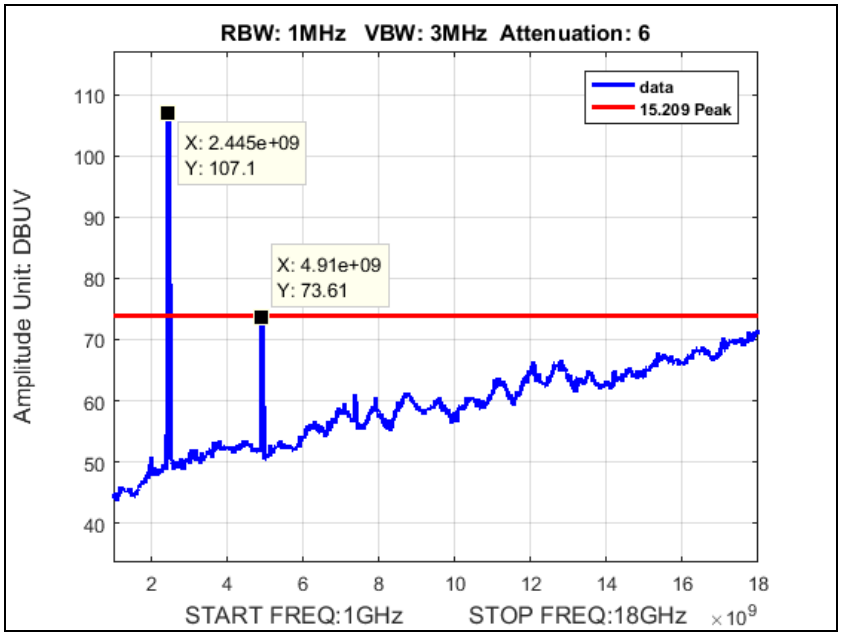
Plot 120. Average Radiated Spurious Emissions, N40, 40M, High Channel, 2452 at 20 dBm 1-7 GHz



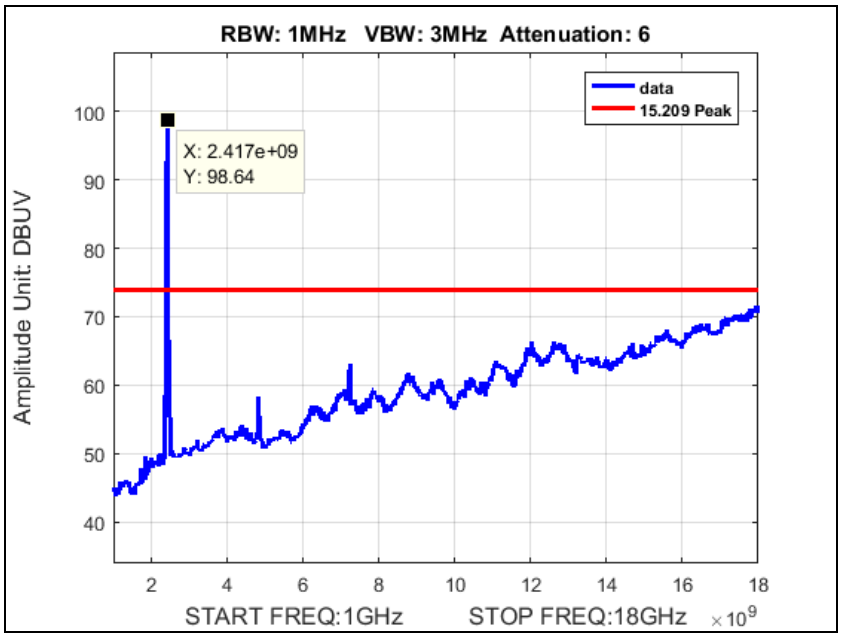
Plot 121. Average Radiated Spurious Emissions, N40, 40M, Low Channel, 2422, 1-7 GHz



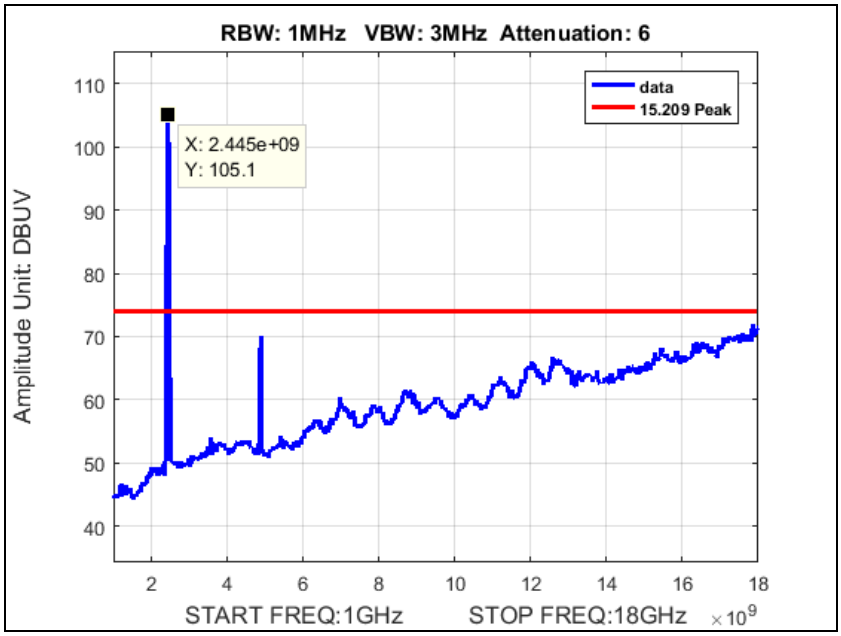
Plot 122. Average Radiated Spurious Emissions, N40, 40M, Mid Channel, 2437, 1-7 GHz



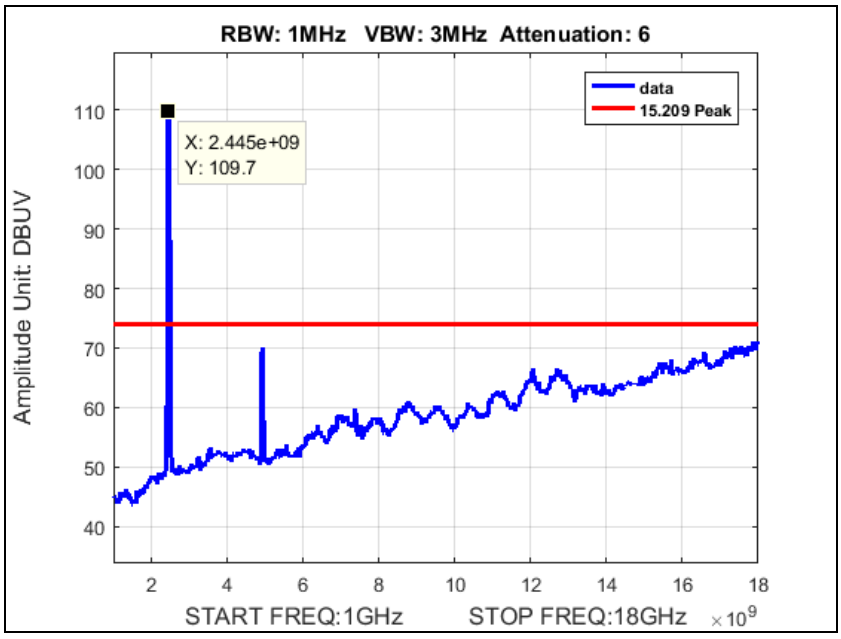
Plot 123. Peak Radiated Spurious Emissions, 20M, b mode, High Channel, 2462 at 22 dBm, 1-18 GHz



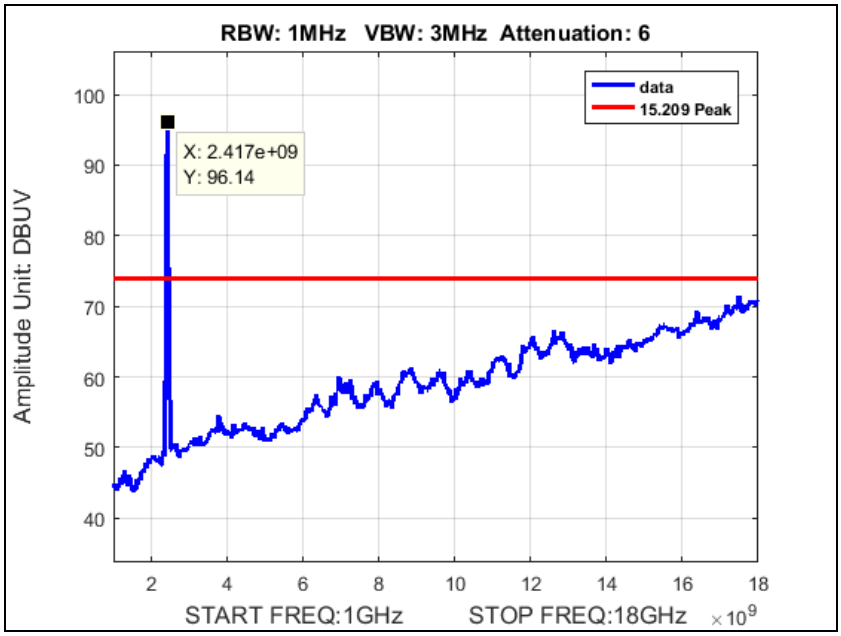
Plot 124. Peak Radiated Spurious Emissions, 20M, b mode, Low Channel, 2412, 1-18 GHz



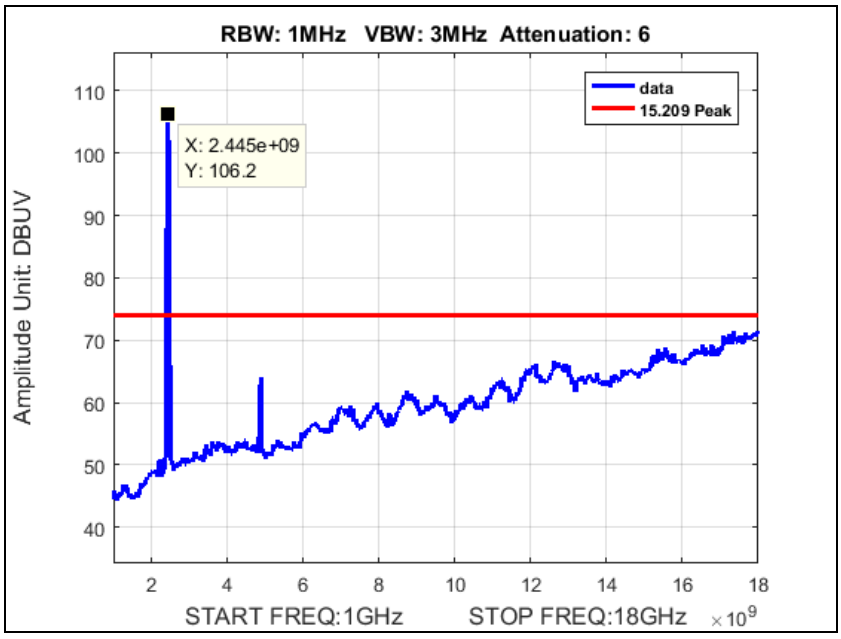
Plot 125. Peak Radiated Spurious Emissions, 20M, b mode, Mid Channel, 2437, 1-18 GHz



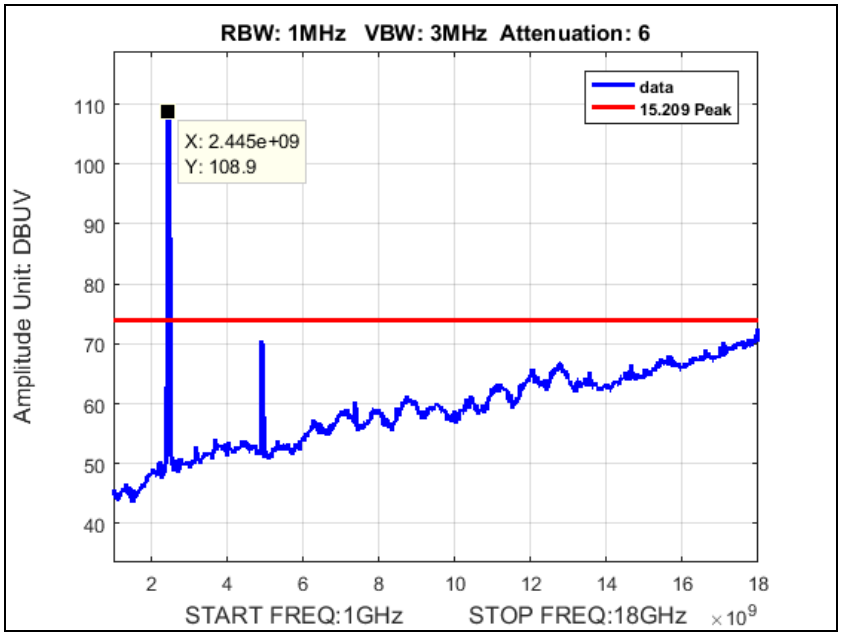
Plot 126. Peak Radiated Spurious Emissions, 20M, g mode, High Channel, 2462, 1-18 GHz



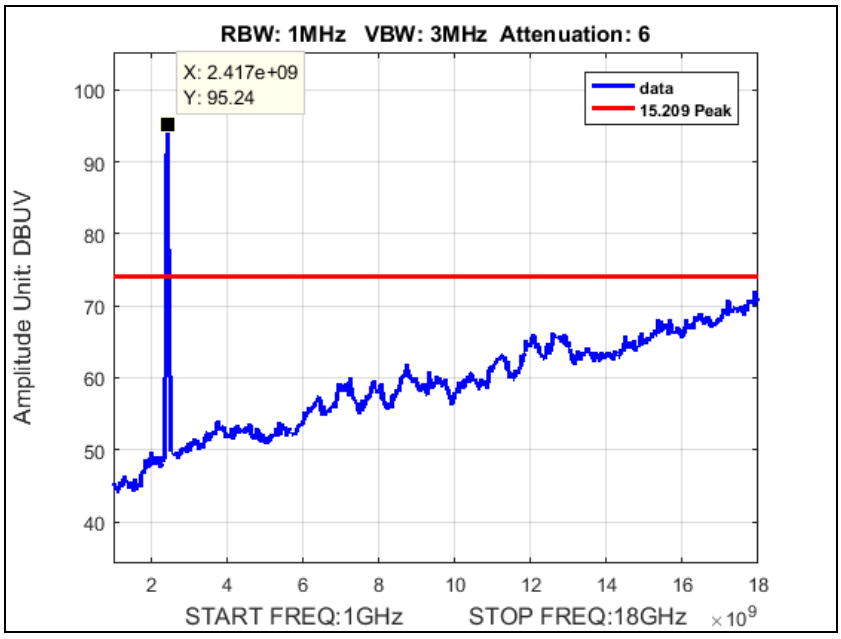
Plot 127. Peak Radiated Spurious Emissions, 20M, g mode, Low Channel, 2412, 1-18 GHz



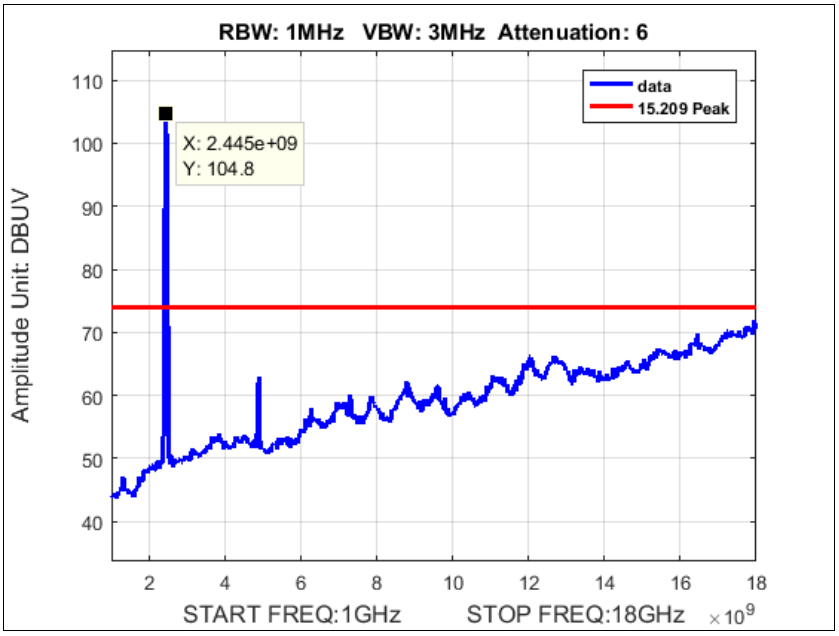
Plot 128. Peak Radiated Spurious Emissions, 20M, g mode, Mid channel, 2437, 1-18 GHz



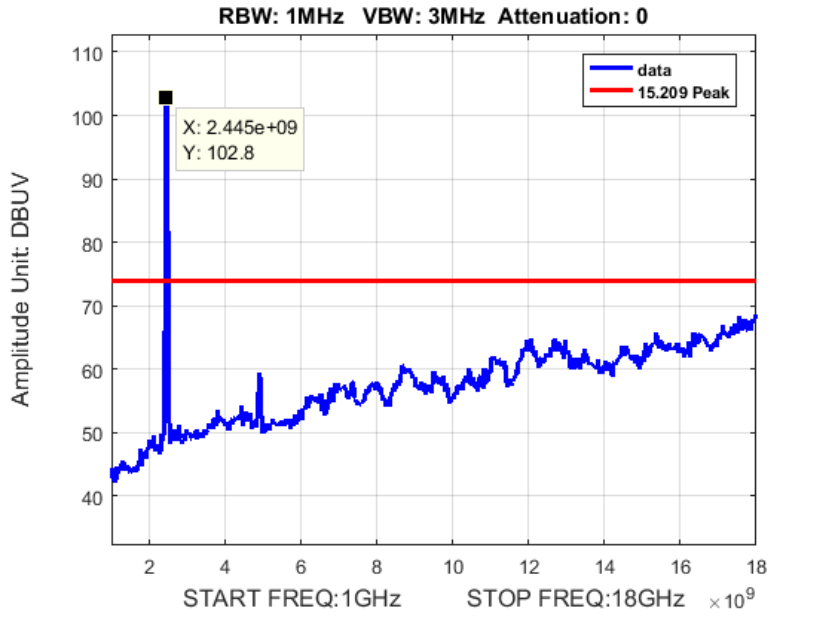
Plot 129. Peak Radiated Spurious Emissions, N20, 20M, High Channel, 2462, 1-18 GHz



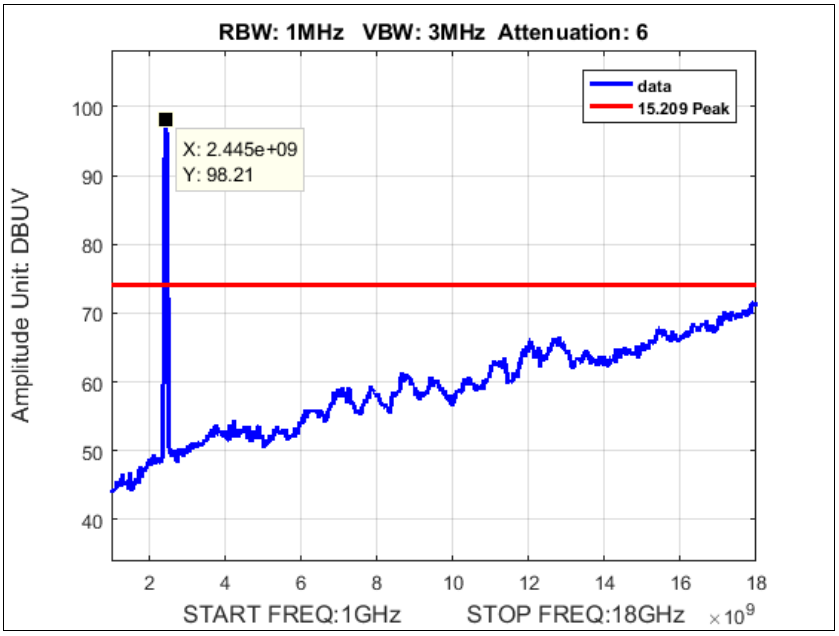
Plot 130. Peak Radiated Spurious Emissions, N20, 20M, Low Channel, 2412, 1-18 GHz



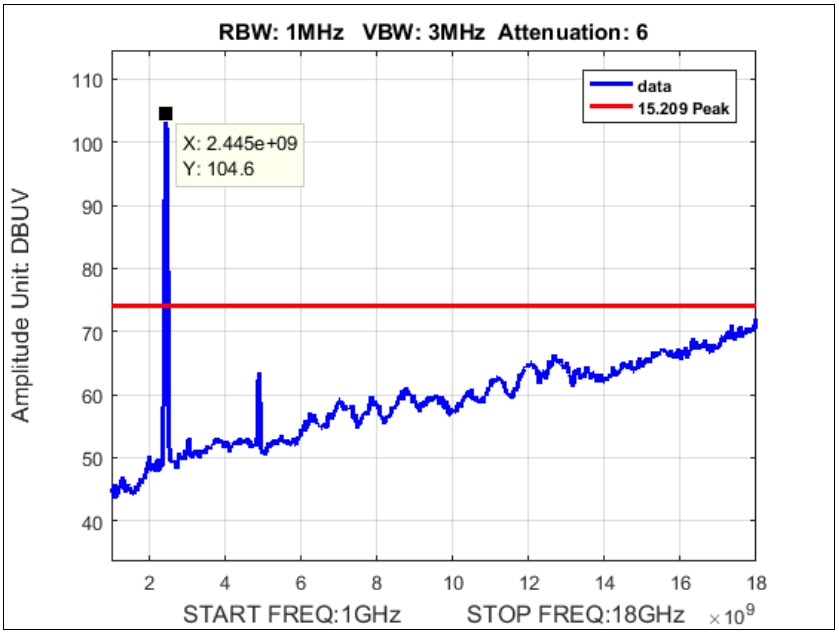
Plot 131. Peak Radiated Spurious Emissions, N20, 20M, Mid Channel, 2437, 1-18 GHz



Plot 132. Peak Radiated Spurious Emissions, N40, 40M, High Channel, 2452, 1-18 GHz

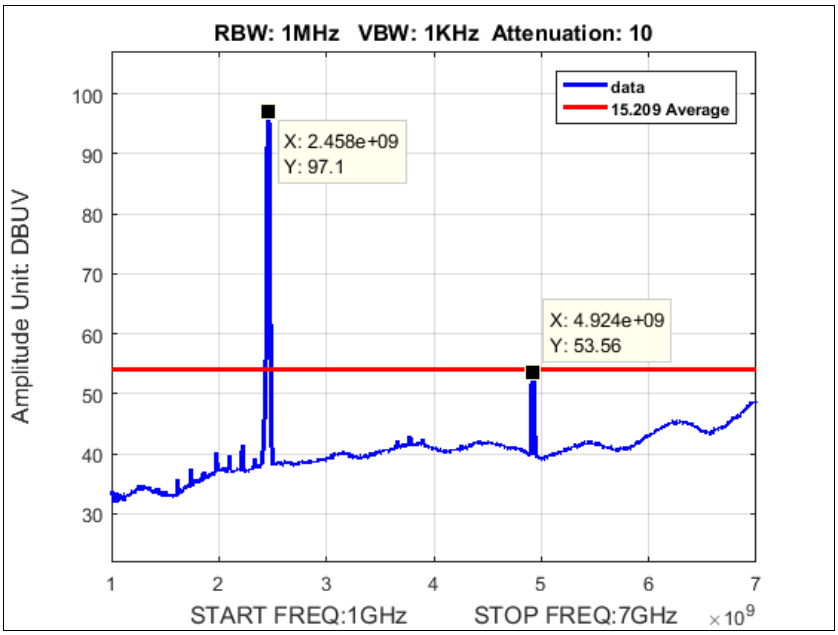


Plot 133. Peak Radiated Spurious Emissions, N40, 40M, Low Channel, 2422, 1-18 GHz

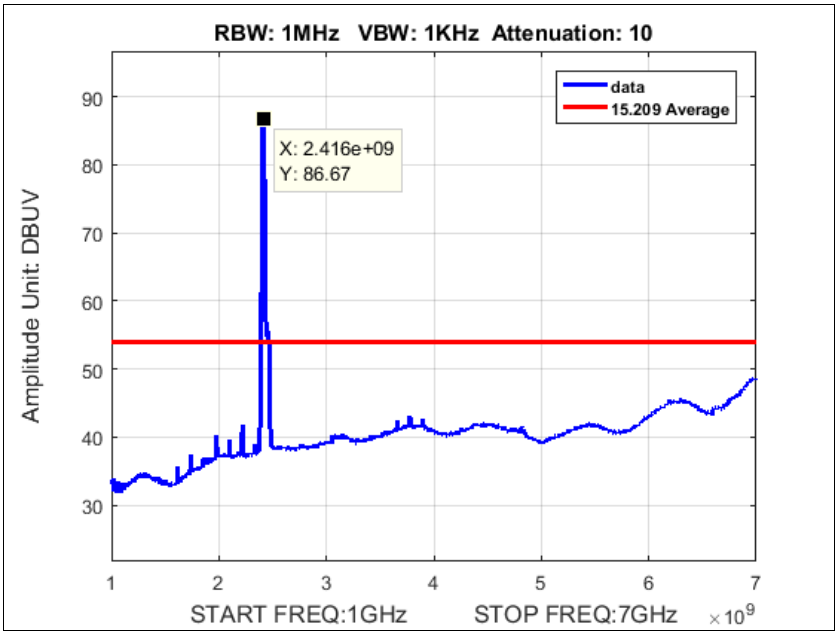


Plot 134. Peak Radiated Spurious Emissions, N40, 40M, Mid Channel, 2437, 1-18 GHz

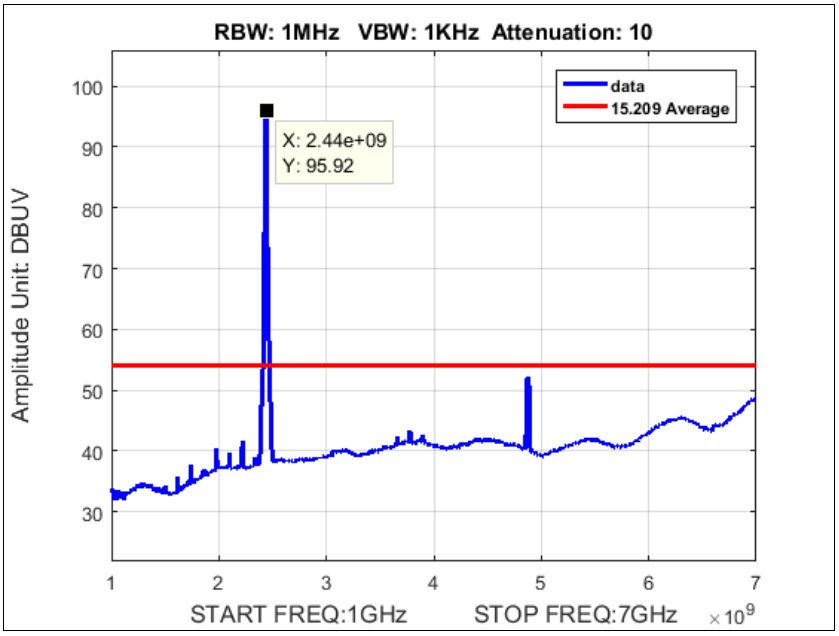
MIMO



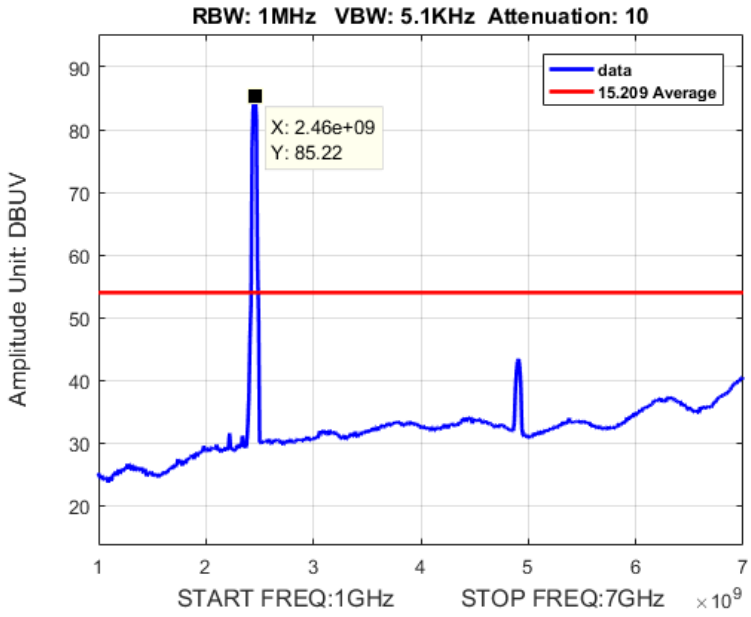
Plot 135. Average Radiated Spurious Emissions, MIMO, HT8, 20M, High Channel, 2462 at 17 dBm, 1-7 GHz



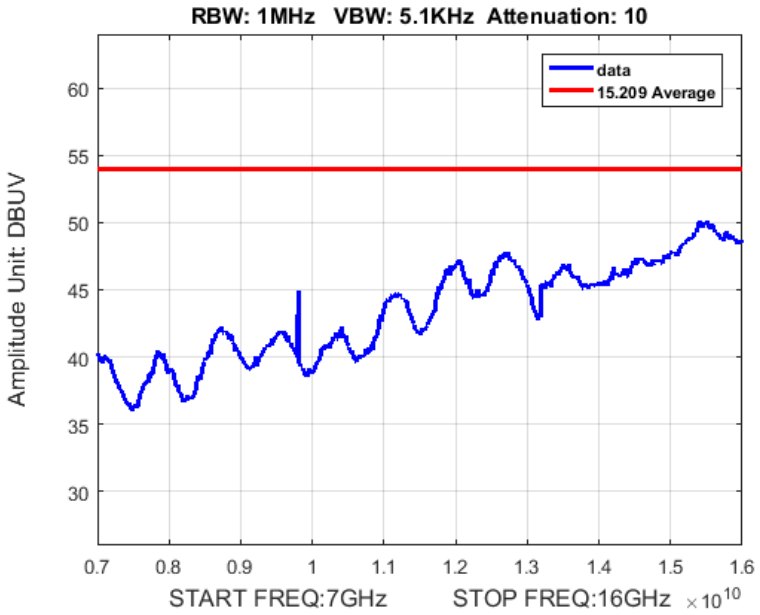
Plot 136. Average Radiated Spurious Emissions, MIMO, 20M, HT8, Low Channel, 2412, 1-7 GHz



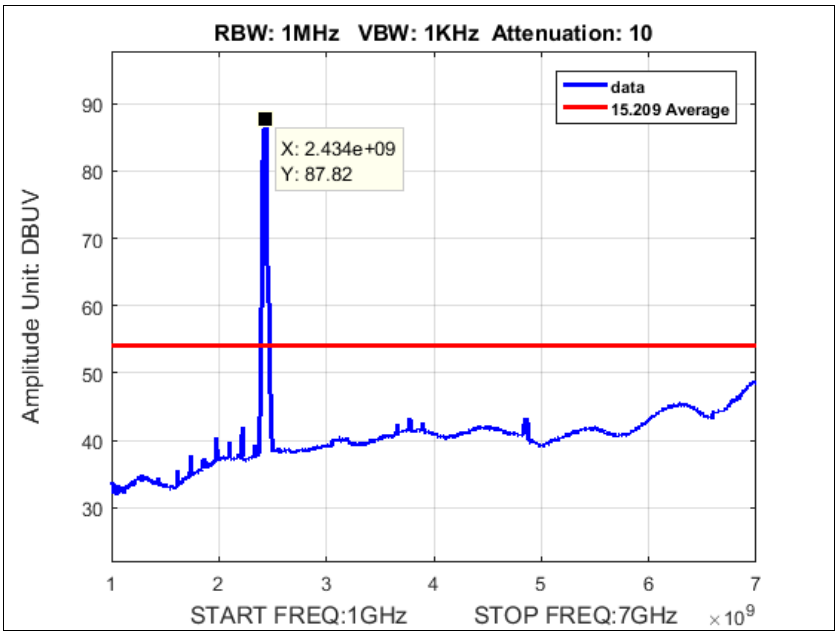
Plot 137. Average Radiated Spurious Emissions, MIMO, HT8, 20M, Mid Channel, 2347, 1-7 GHz



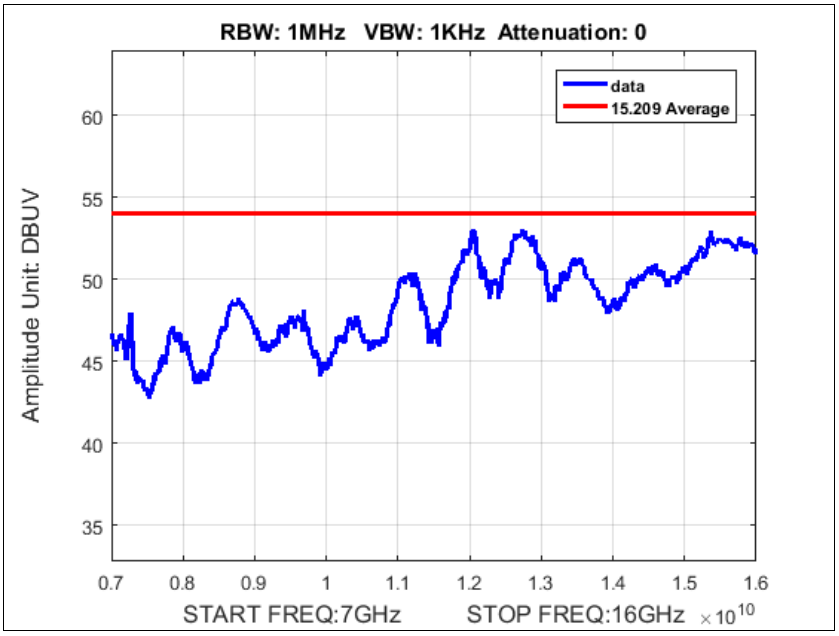
Plot 138. Average Radiated Spurious Emissions, MIMO, HT8, 40M, High Channel, 2452, 1-7 GHz



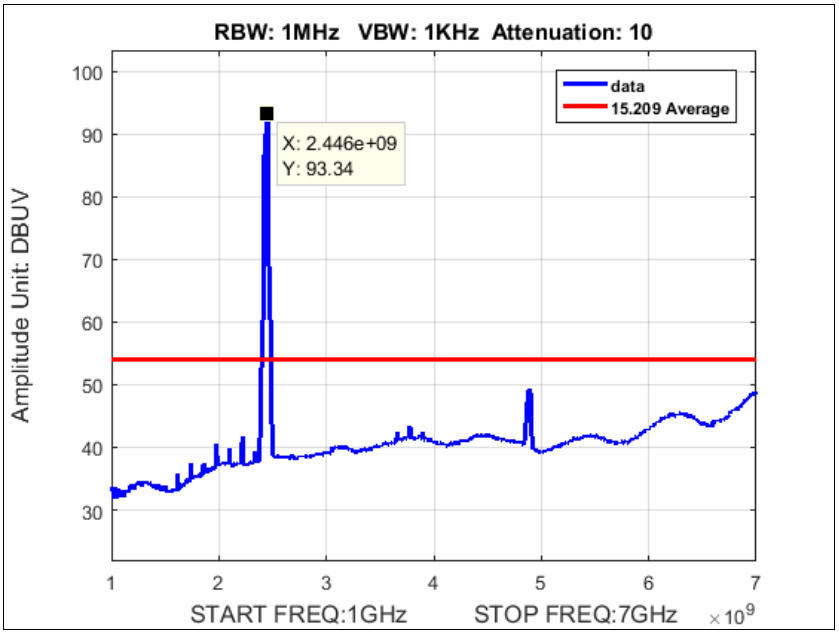
Plot 139. Average Radiated Spurious Emissions, MIMO, HT8, 40M, High Channel, 2452, 7-16 GHz



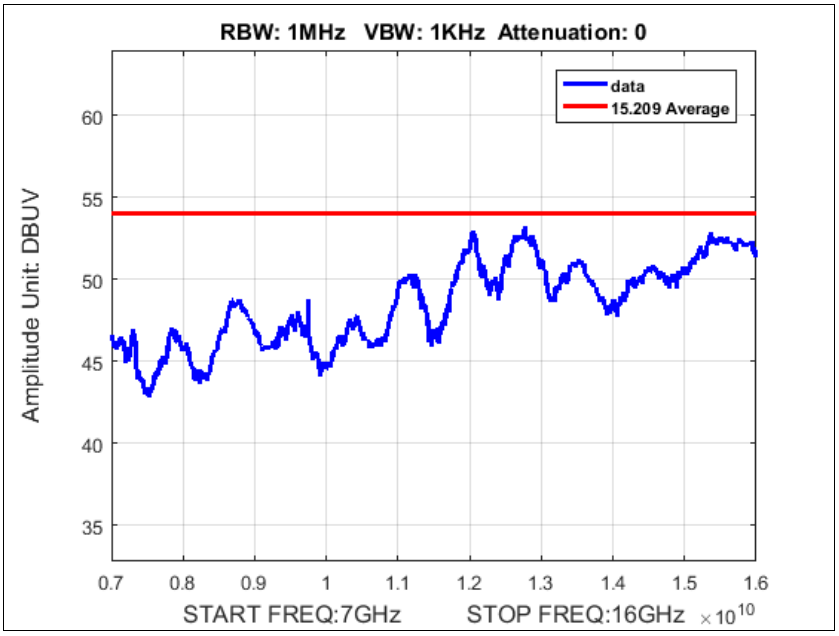
Plot 140. Average Radiated Spurious Emissions, MIMO, HT8, 40M, Low Channel, 2422, 1-7 GHz



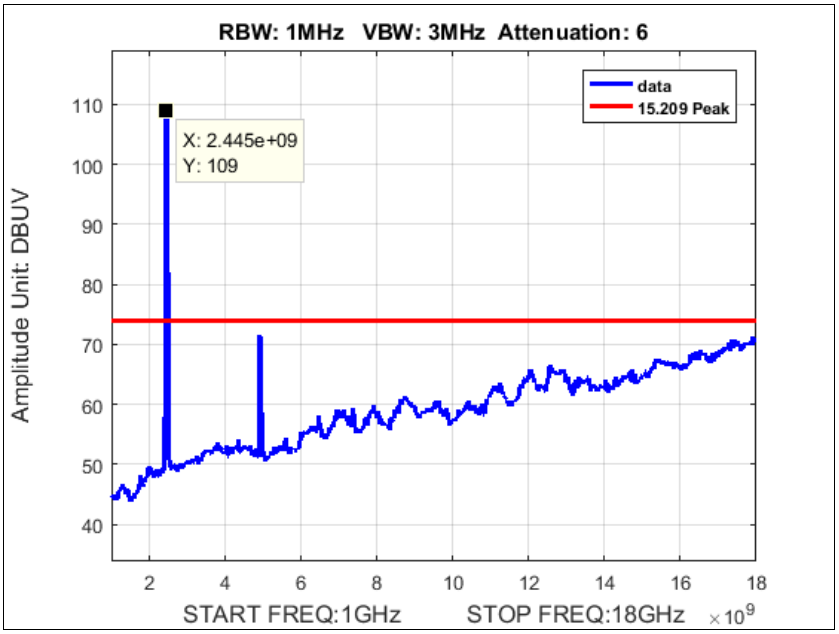
Plot 141. Average Radiated Spurious Emissions, MIMO, HT8, 40M, Low Channel, 2422, 7-16 GHz



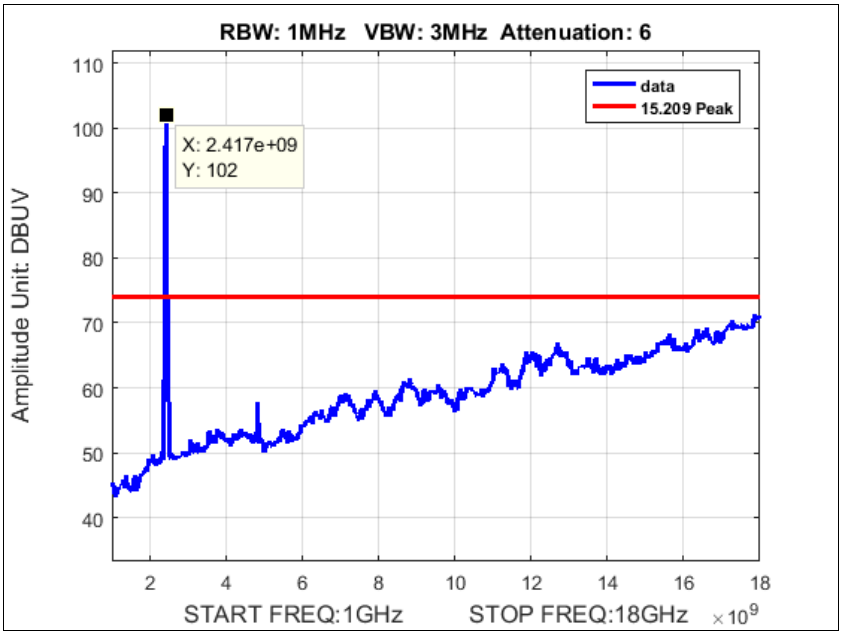
Plot 142. Average Radiated Spurious Emissions, MIMO, HT8, 40M, Mid Channel, 2437, 1-7 GHz



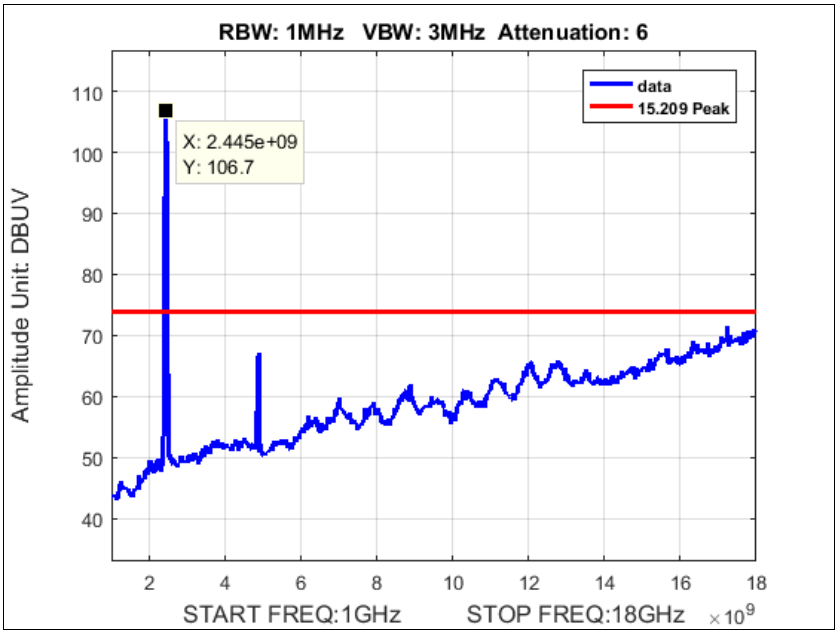
Plot 143. Average Radiated Spurious Emissions, MIMO, HT8, 40M, Mid Channel, 2437, 7-16 GHz



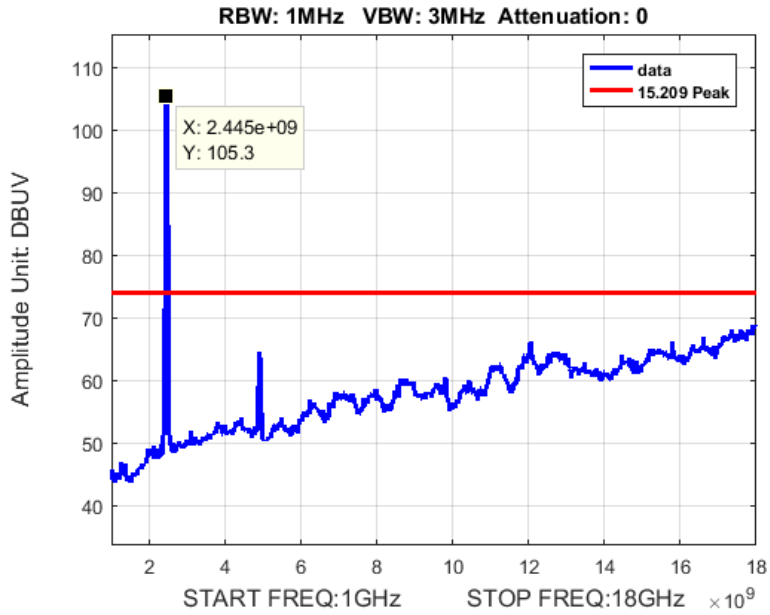
Plot 144. Peak Radiated Spurious Emissions, MIMO, HT8, 20M, High Channel, 2462, 1-18 GHz



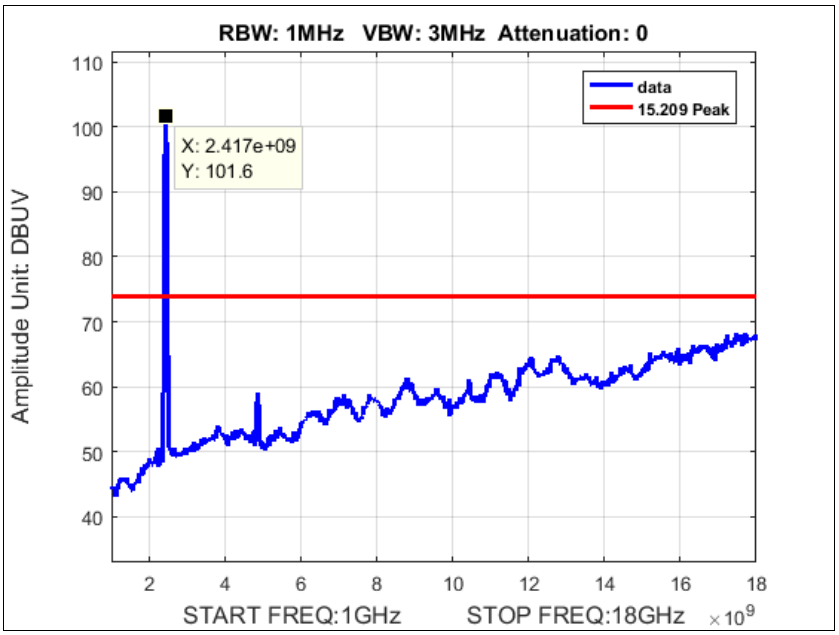
Plot 145. Peak Radiated Spurious Emissions, MIMO, HT8, 20M, Low Channel, 2412, 1-18 GHz



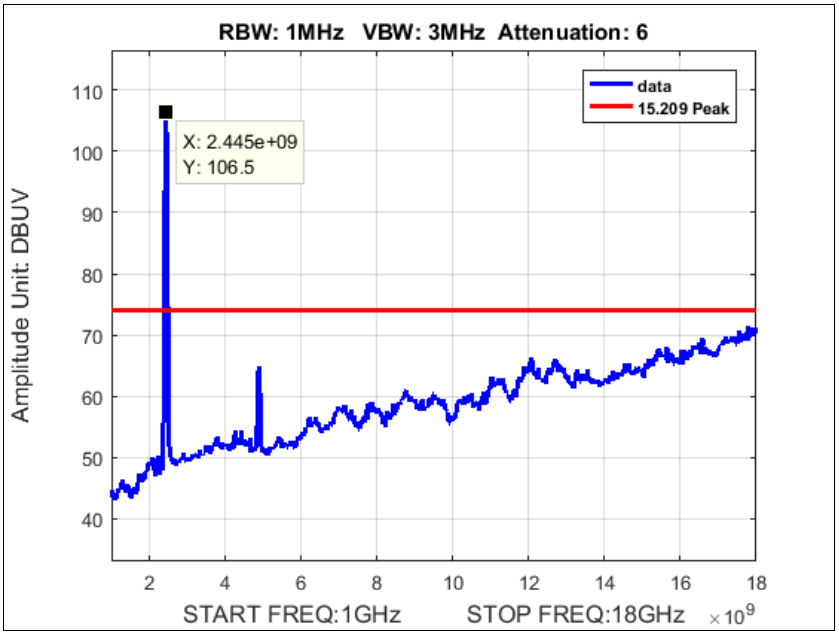
Plot 146. Peak Radiated Spurious Emissions, MIMO, HT8, 20M, Mid Channel, 2437, 1-18 GHz



Plot 147. Peak Radiated Spurious Emissions, MIMO, HT8, 40M, High Channel, 2452, 1-18 GHz



Plot 148. Peak Radiated Spurious Emissions, MIMO, HT8, 40M, Low Channel, 2422, 1-18 GHz

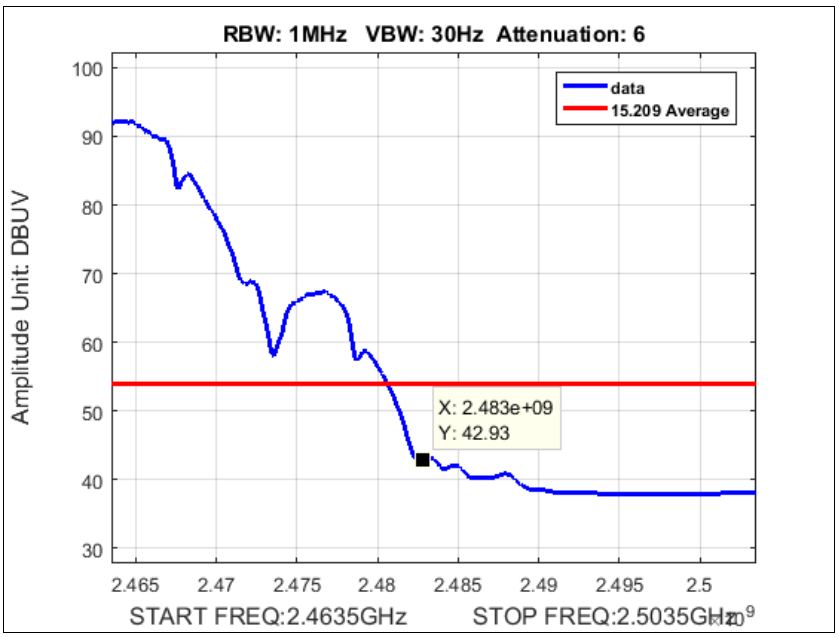


Plot 149. Peak Radiated Spurious Emissions, MIMO, HT8, 40M, Mid Channel, 2437, 1-18 GHz

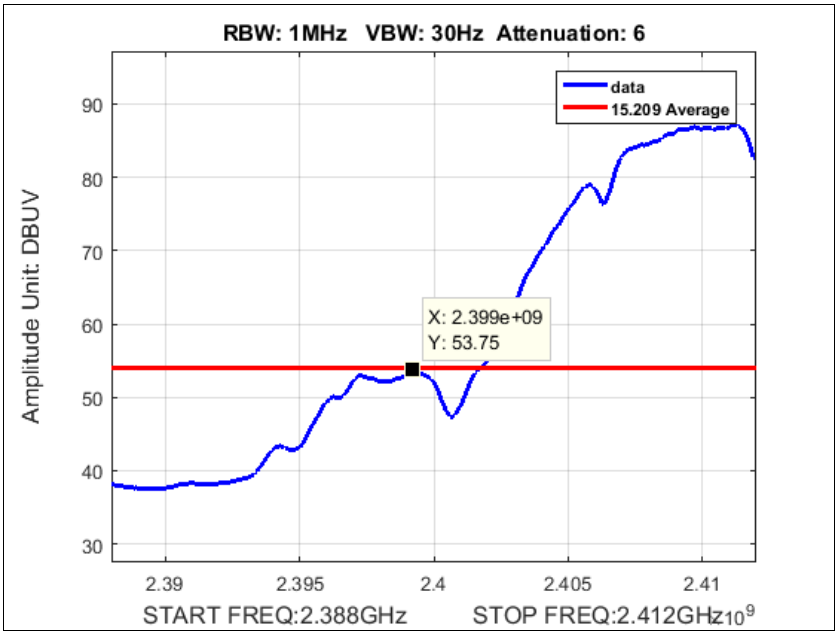
Radiated Band Edge Measurements

Test Procedures: The transmitter was turned on. Measurements were performed of the low, and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line.

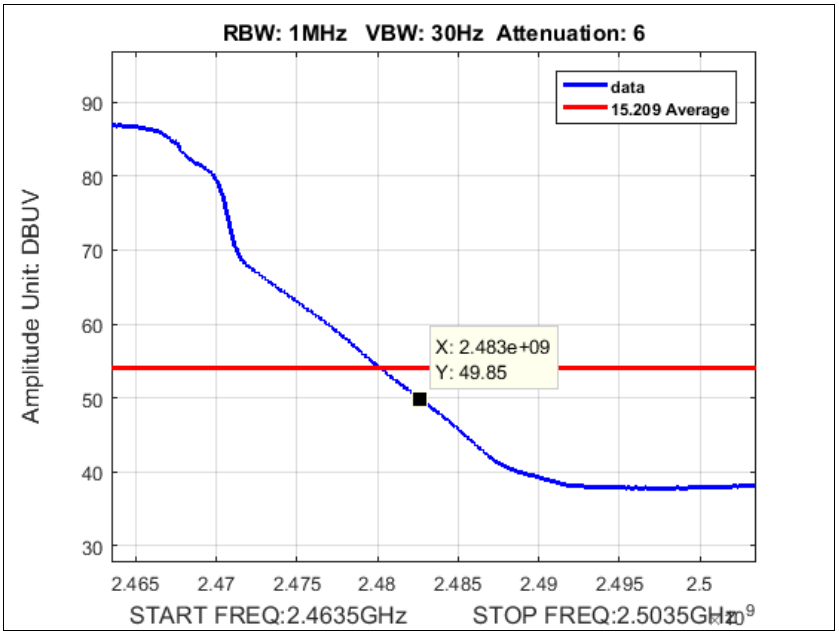
SISO



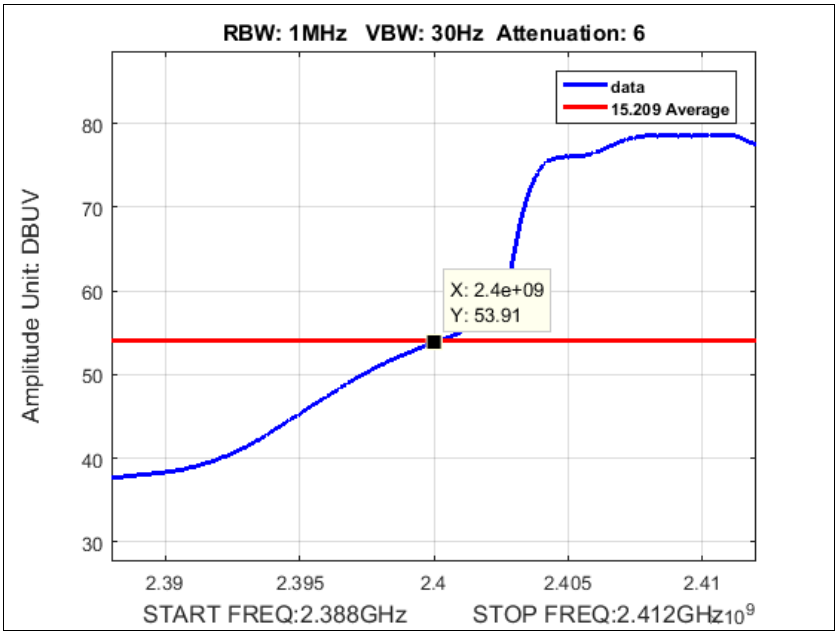
Plot 150. Average Radiated Spurious Band Edge, SISO, b mode, port a, High Channel, 2462M at 24 dBm



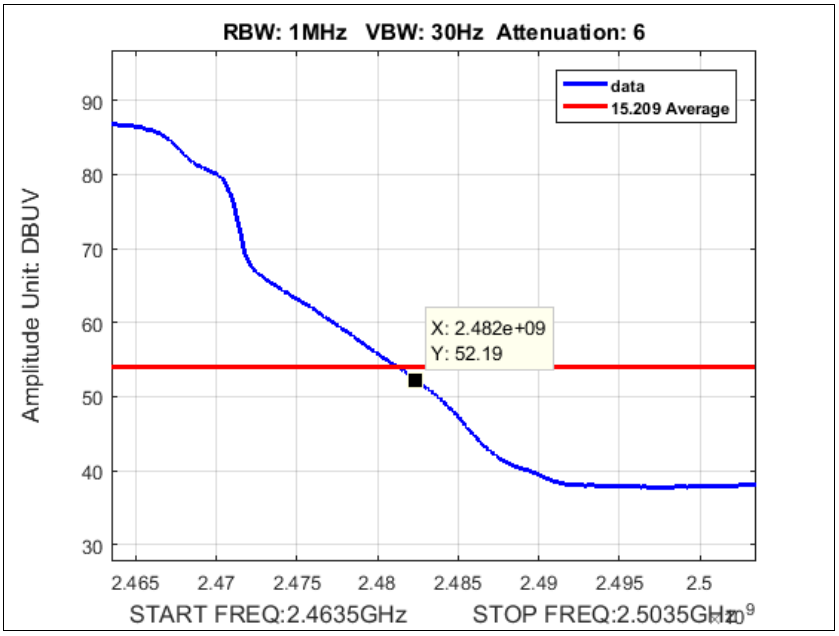
Plot 151. Average Radiated Band Edge, SISO, b mode, port a, Low Channel, 2412M at 19.375 dBm



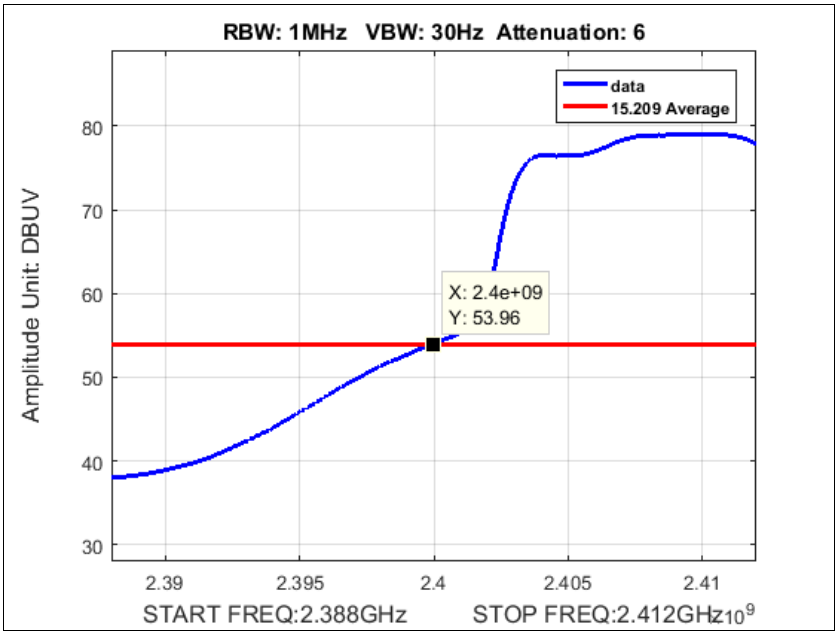
Plot 152. Average Radiated Band Edge, SISO, g mode, port a, High Channel, 2462M at 24 dBm



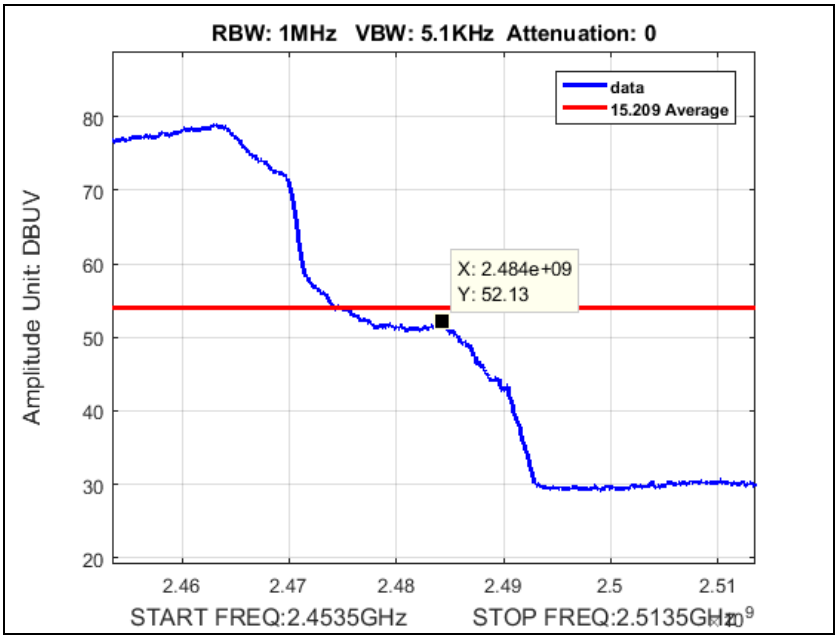
Plot 153. Average Radiated Band Edge, SISO, g mode, port a, Low Channel, 2412M at 17 dBm



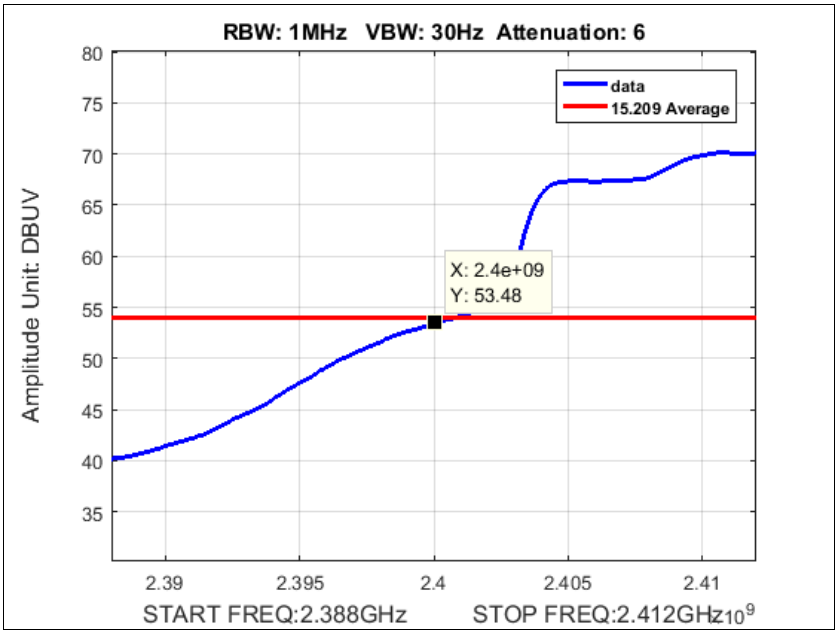
Plot 154. Average Radiated Band Edge, SISO, N20, port a, High Channel, 2462M at 24 dBm



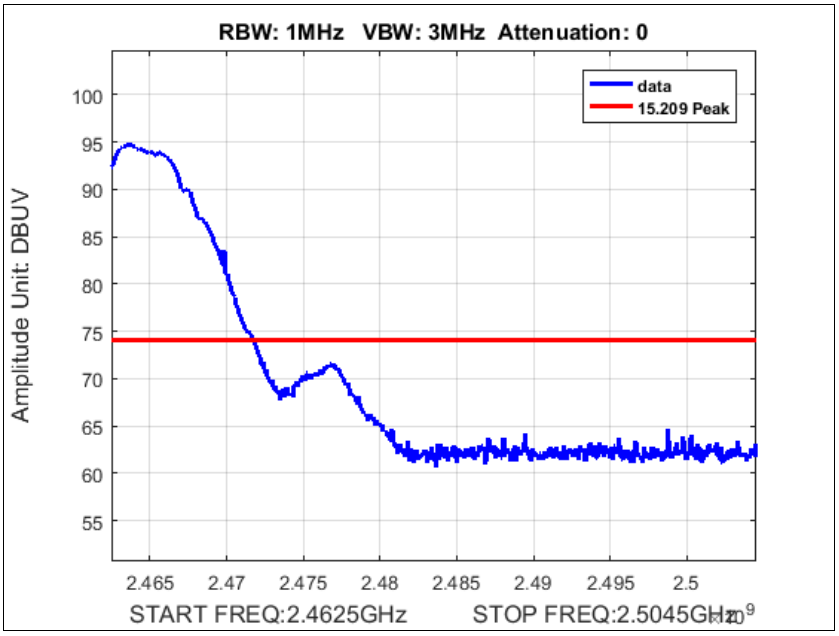
Plot 155. Average Radiated Band Edge, SISO, N20, port a, Low Channel, 2412M at 17 dBm



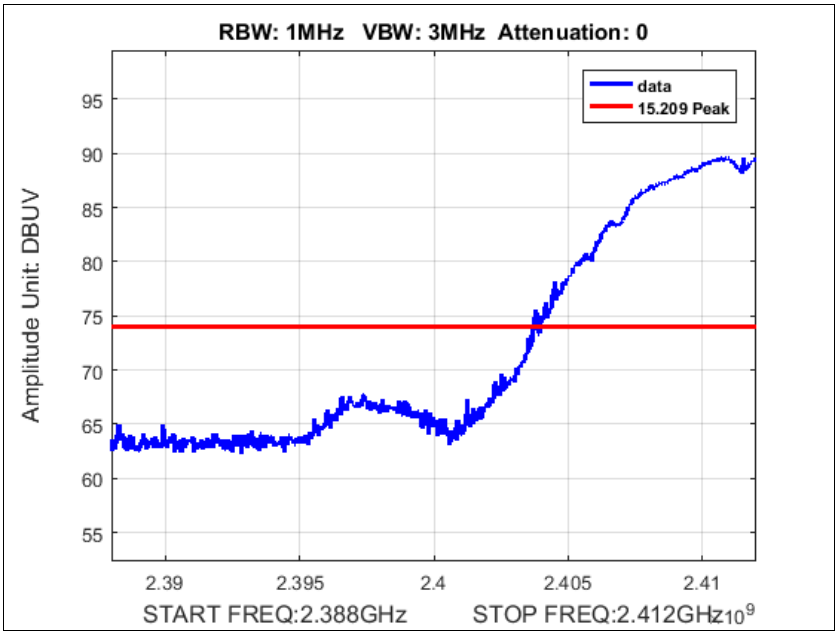
Plot 156. Average Radiated Band Edge, SISO, N40, port a, High Channel, 2452M at 20 dBm



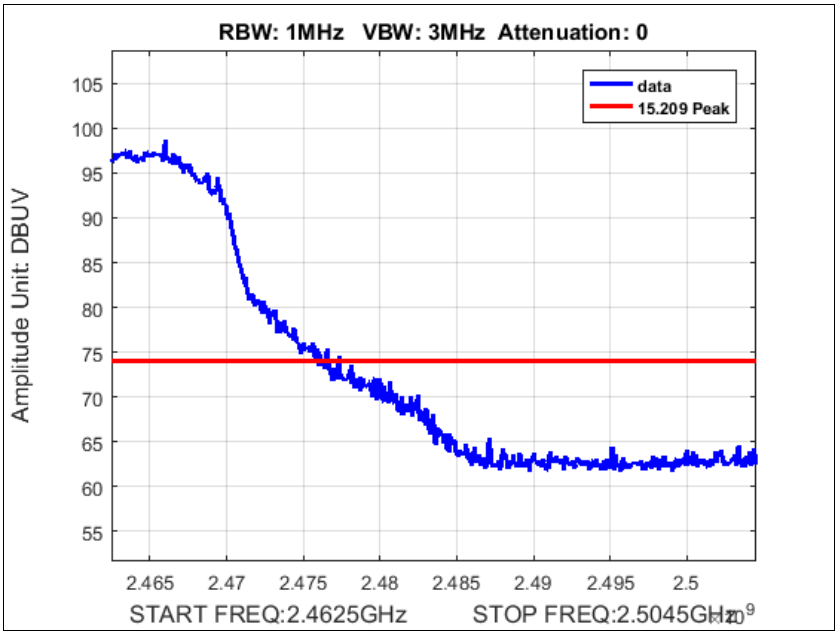
Plot 157. Average Radiated Band Edge, SISO, N40, port a, Low Channel, 2422M at 18.25 dBm



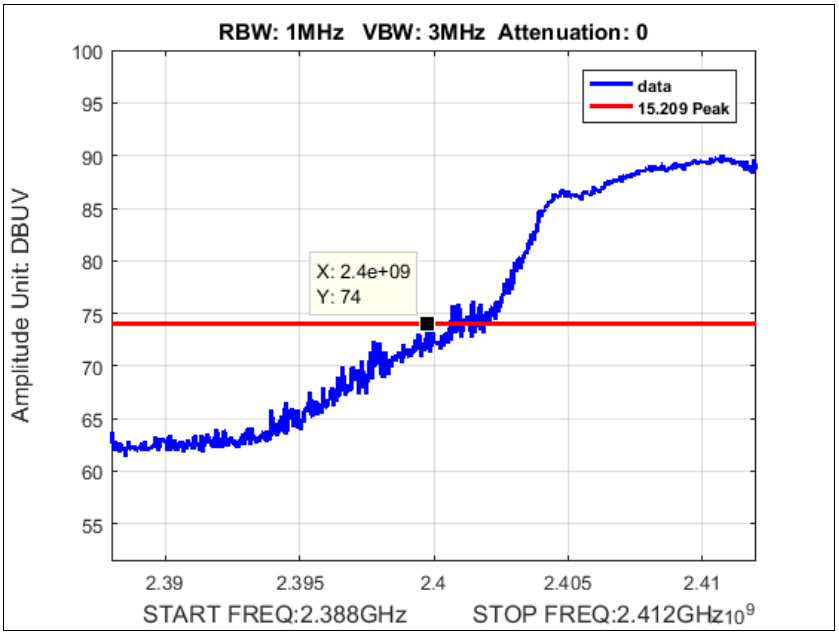
Plot 158. Peak Radiated Band Edge, SISO, b mode, port a, High Channel, 2462M at 24 dBm



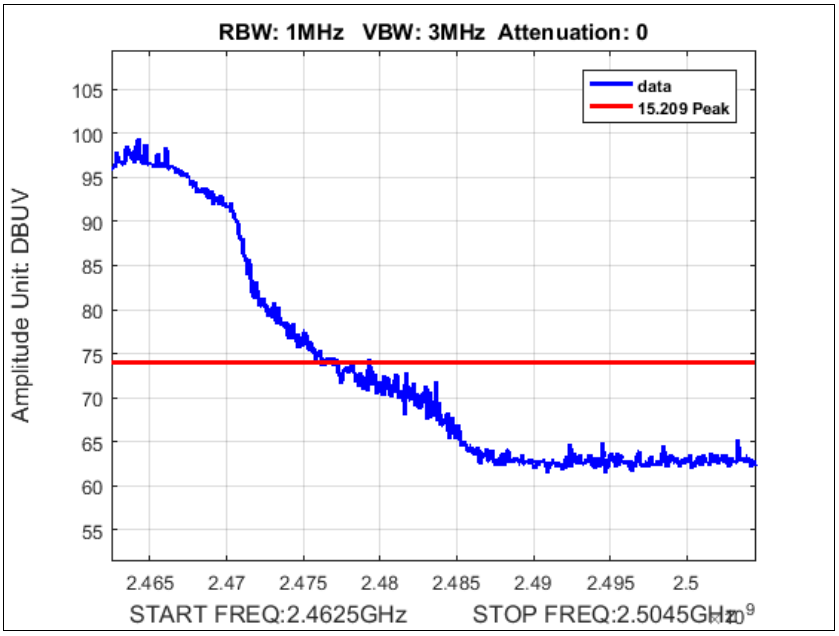
Plot 159. Peak Radiated Band Edge, SISO, b mode, port a, Low Channel, 2412M at 24 dBm



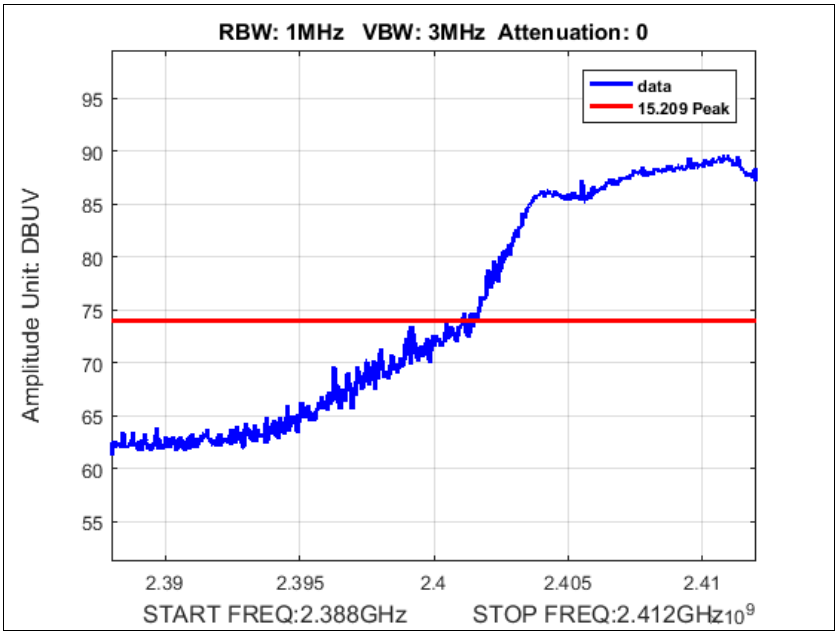
Plot 160. Peak Radiated Band Edge, SISO, g mode, port a, High Channel, 2462M at 24 dBm



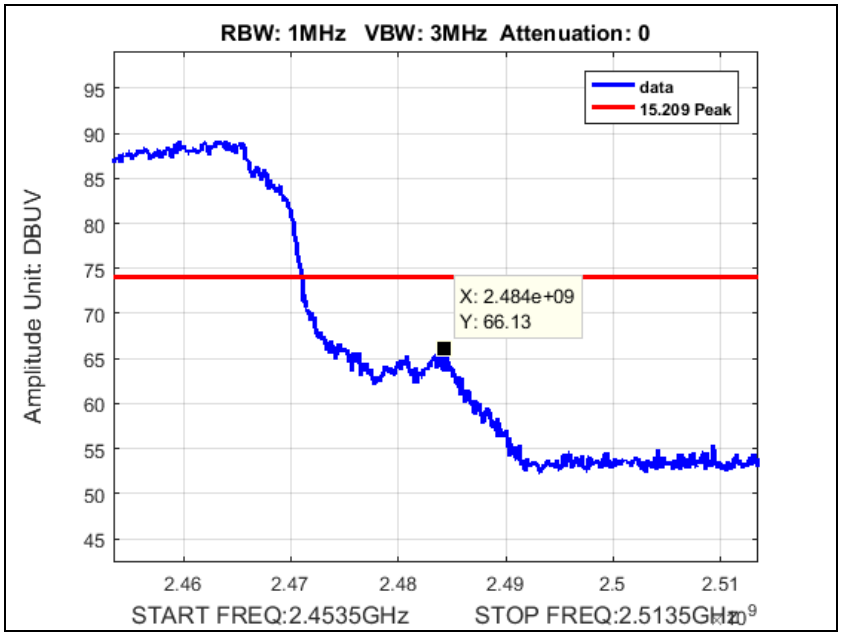
Plot 161. Peak Radiated Band Edge, SISO, g mode, port a, Low Channel, 2412M at 18 dBm



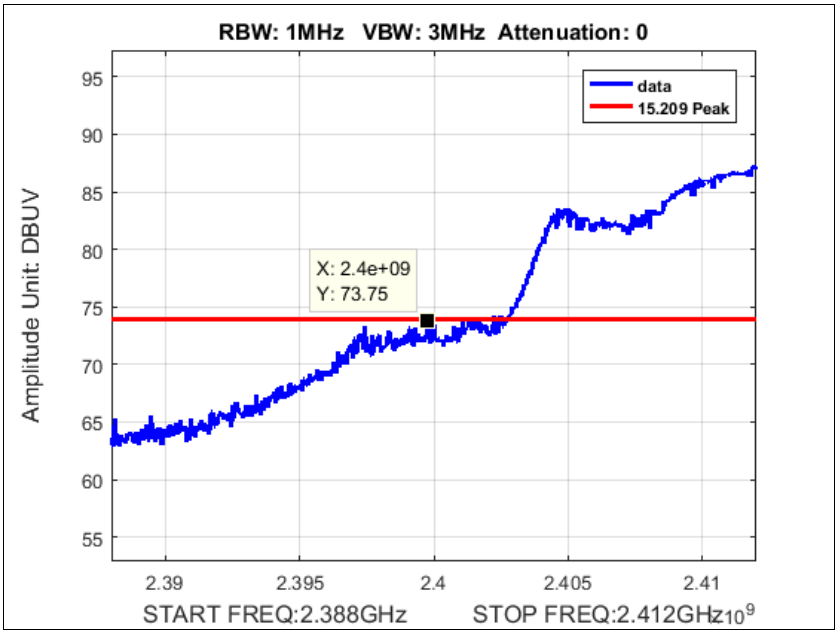
Plot 162. Peak Radiated Band Edge, SISO, N20, port a, High Channel, 2462M at 24 dBm



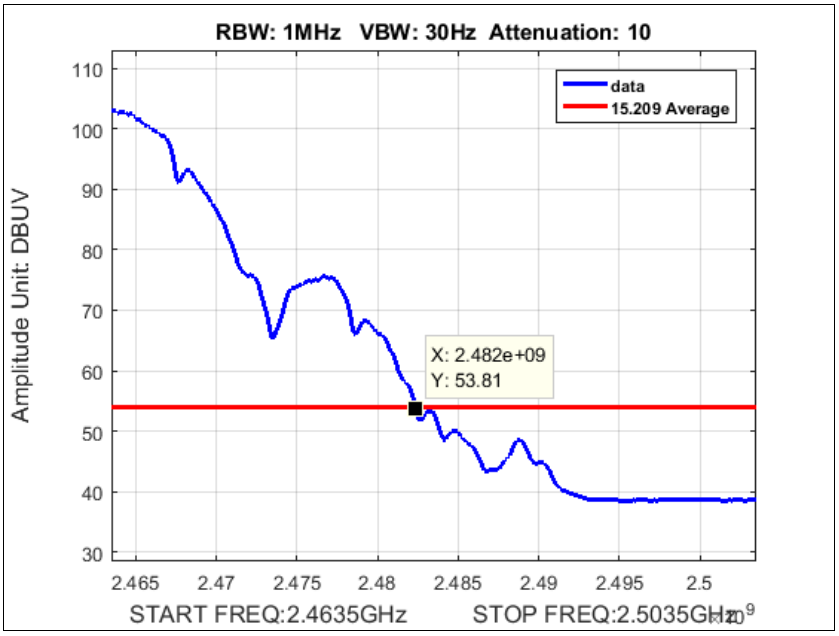
Plot 163. Peak Radiated Band Edge, SISO, N20, port a, Low Channel, 2412M at 17.5 dBm



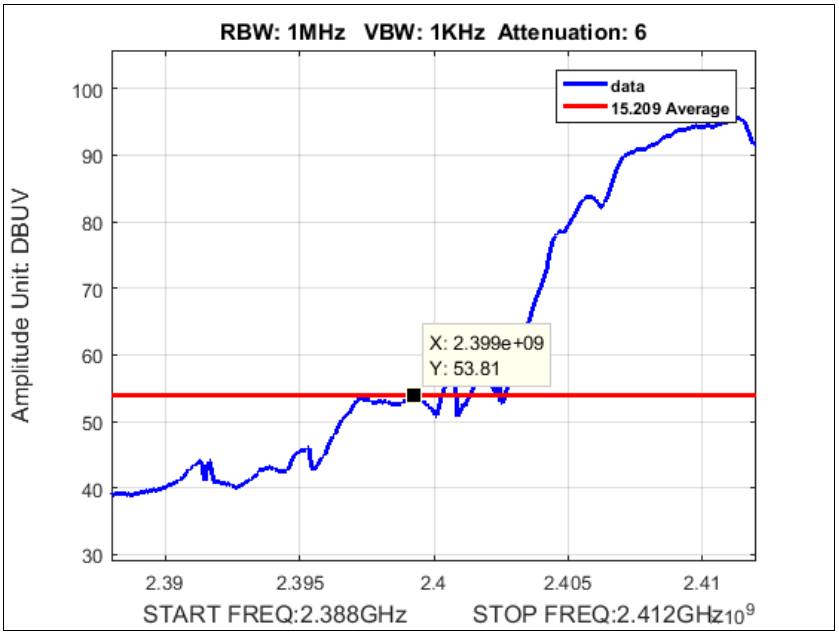
Plot 164. Peak Radiated Band Edge, SISO, N40, port a, 2452M at 20 dBm



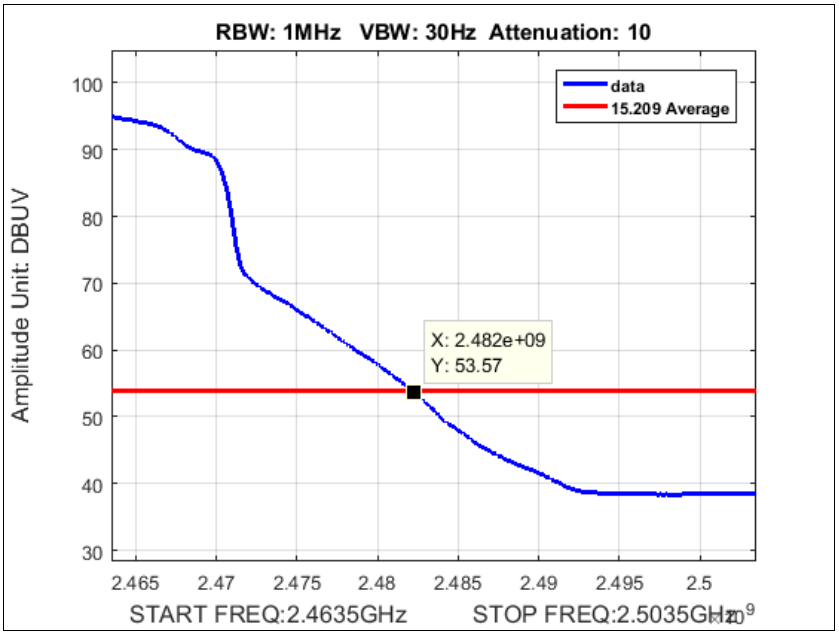
Plot 165. Peak Radiated Band Edge, SISO, N40, port a, Low Channel, 2422M at 21 dBm



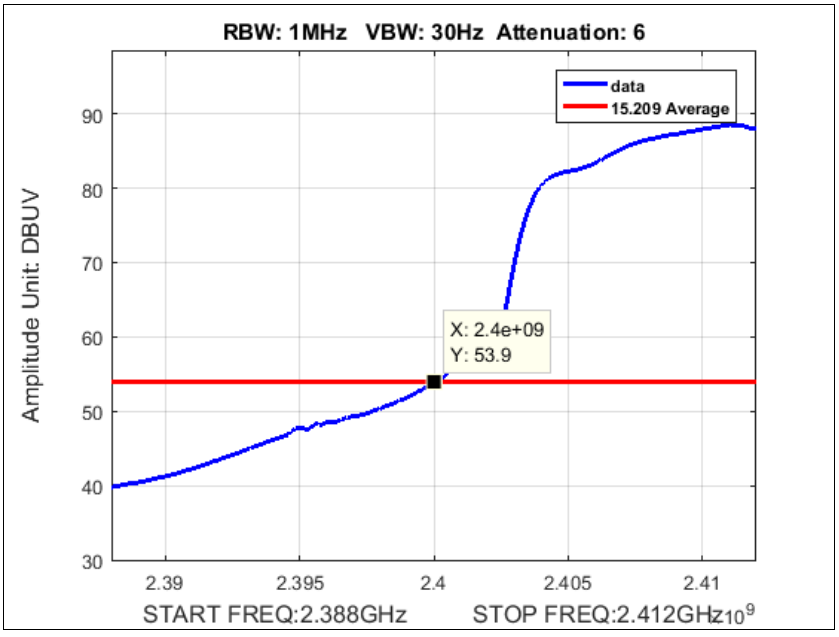
Plot 166. Average Radiated Band Edge, SISO, b mode, port b, 2462M at 22 dBm



Plot 167. Average Radiated Band Edge, SISO, b mode, port b, Low Channel, 2412M at 18 dBm

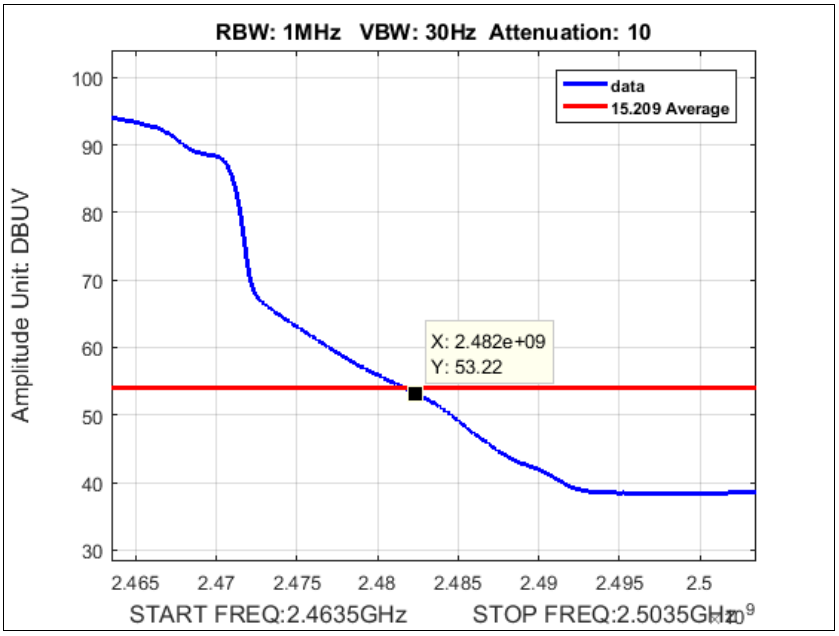


Plot 168. Average Radiated Band Edge, SISO, g mode, port b, High Channel, 2462M at 19 dBm

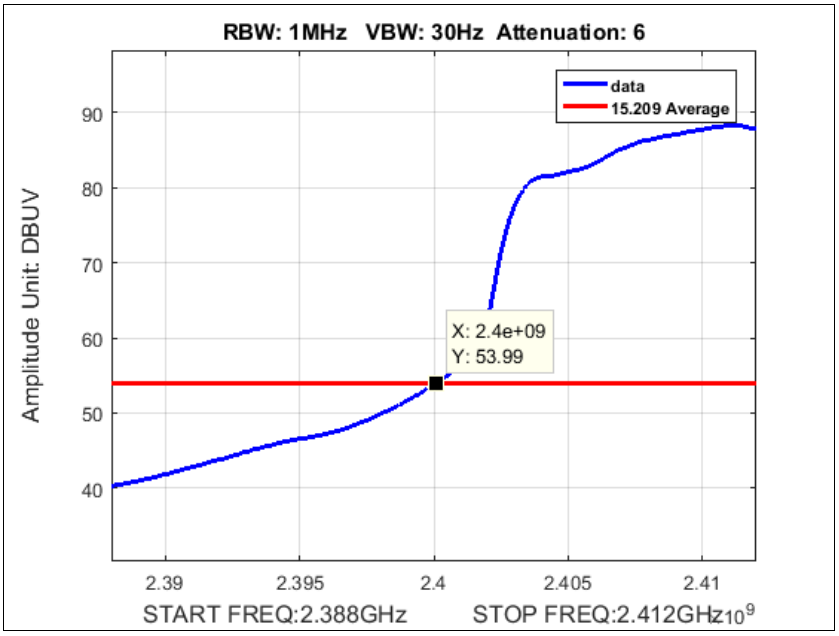


Plot 169. Average Radiated Band Edge, SISO, g mode, port b, Low Channel, 2412M at 17.25 dBm

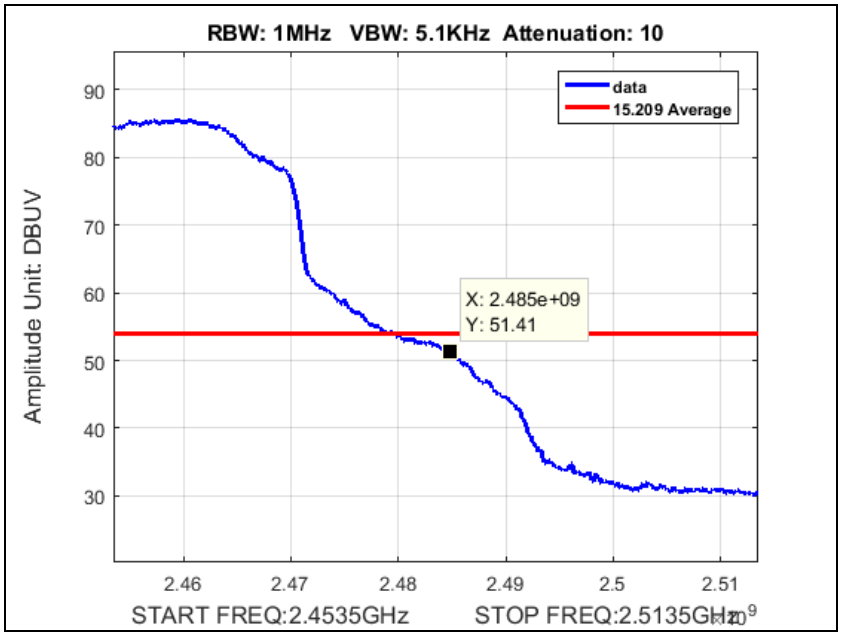
I



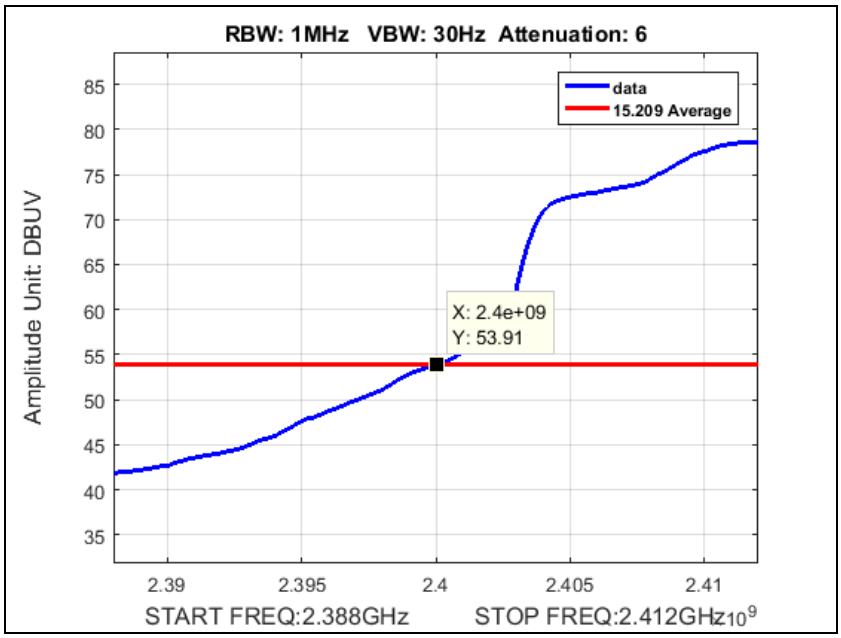
Plot 170. Average Radiated Band Edge, SISO, N20, port b, High Channel, 2462M at 18.25 dBm



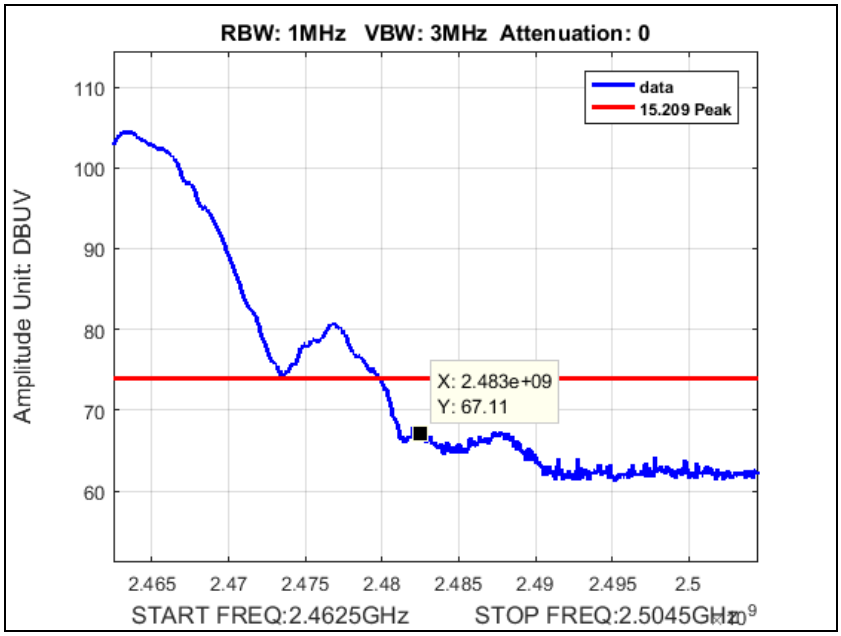
Plot 171. Average Radiated Band Edge, SISO, N20, port b, Low Channel, 2412M at 17.25 dBm



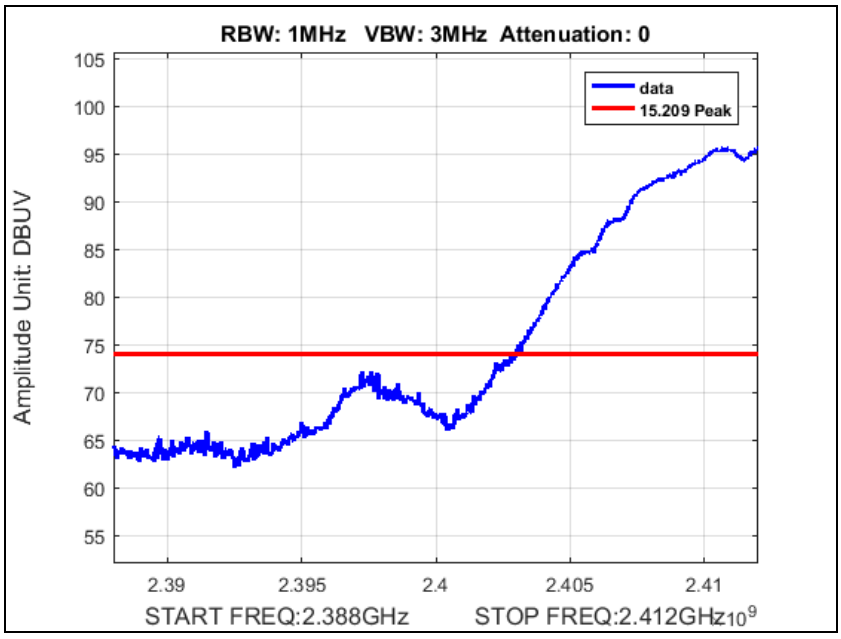
Plot 172. Average Radiated Band Edge, SISO, N40, port b, 2452M at 19 dBm



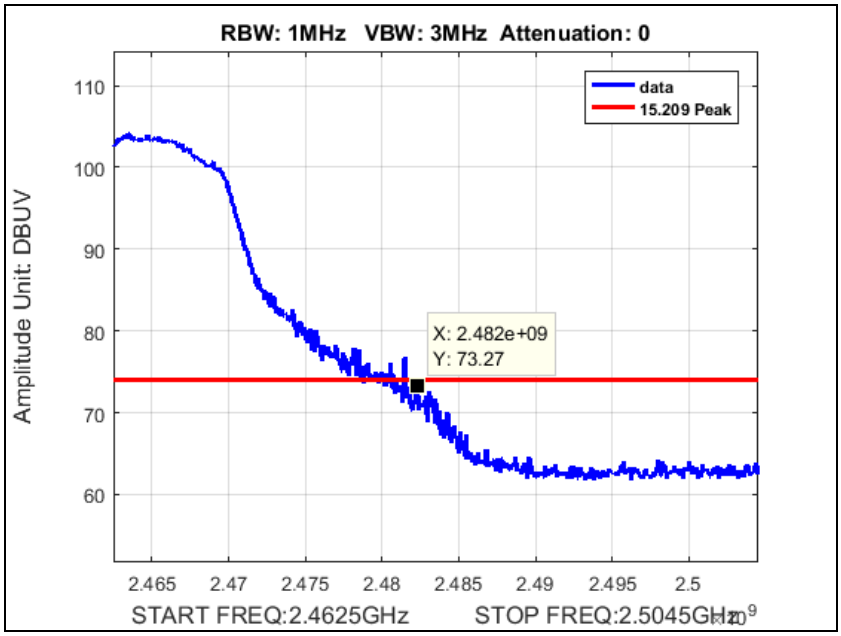
Plot 173. Average Radiated Band Edge, SISO, N40, port b, Low Channel, 2422M at 13.75 dBm



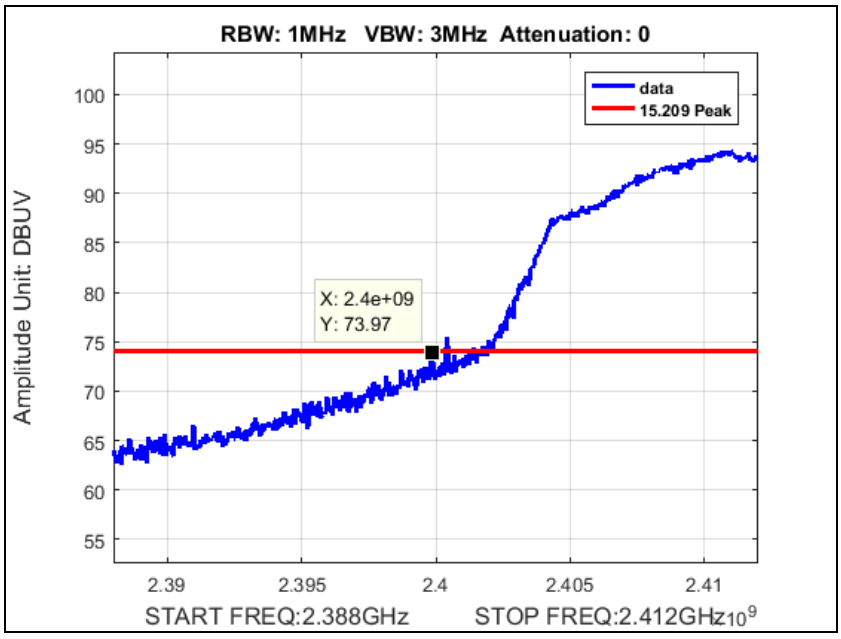
Plot 174. Peak Radiated Band Edge, SISO, b mode, port b, High Channel, 2462 at 24 dBm



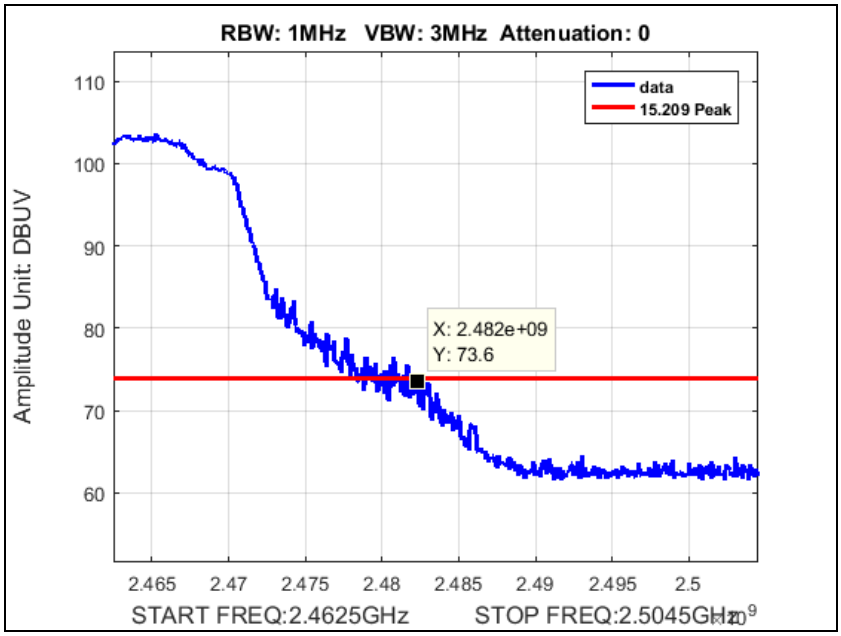
Plot 175. Peak Radiated Band Edge, SISO, b mode, port b, Low Channel, 2412M at 24 dBm



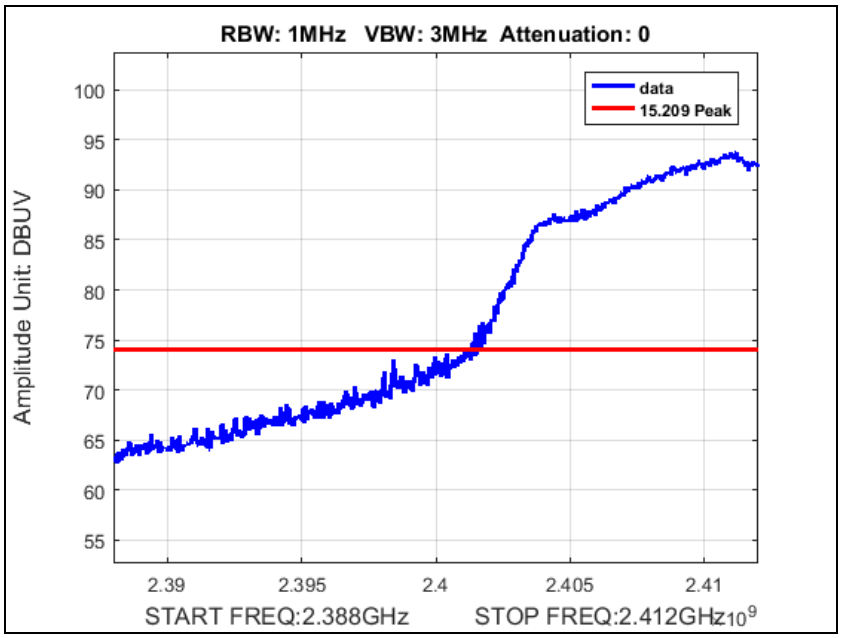
Plot 176. Peak Radiated Band Edge, SISO, g mode, port b, High Channel, 2462M at 19.25 dBm



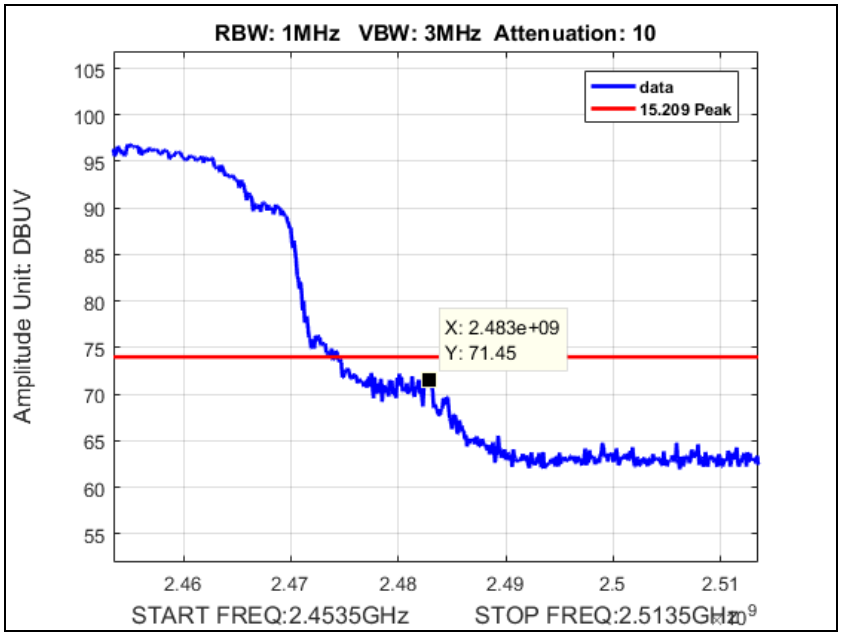
Plot 177. Peak Radiated Band Edge, SISO, g mode, port b, Low Channel, 2412M at 20.25 dBm



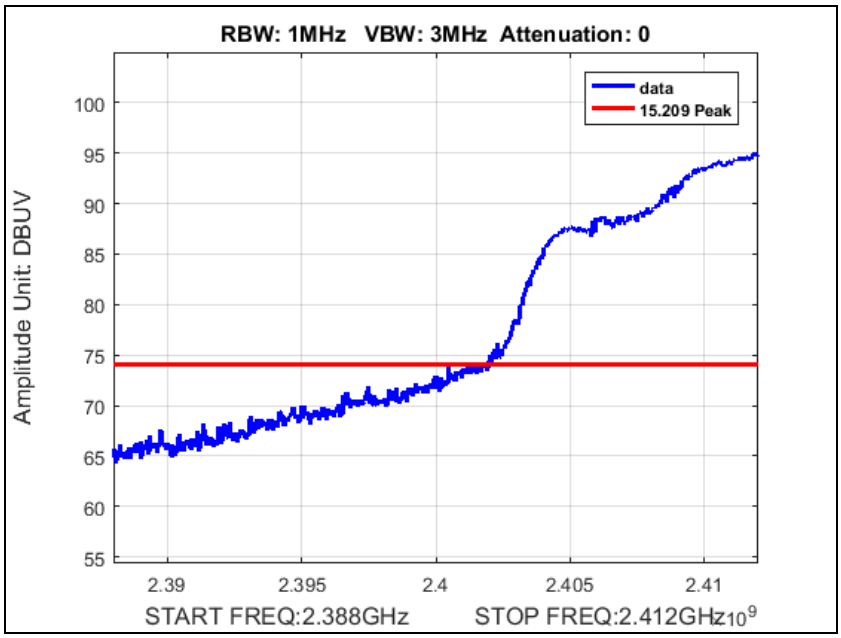
Plot 178. Peak Radiated Band Edge, SISO, N20, port b, High Channel, 2462M at 19.25 dBm



Plot 179. Peak Radiated Band Edge, SISO, N20, port b, Low Channel, 2412M at 20.5 dBm

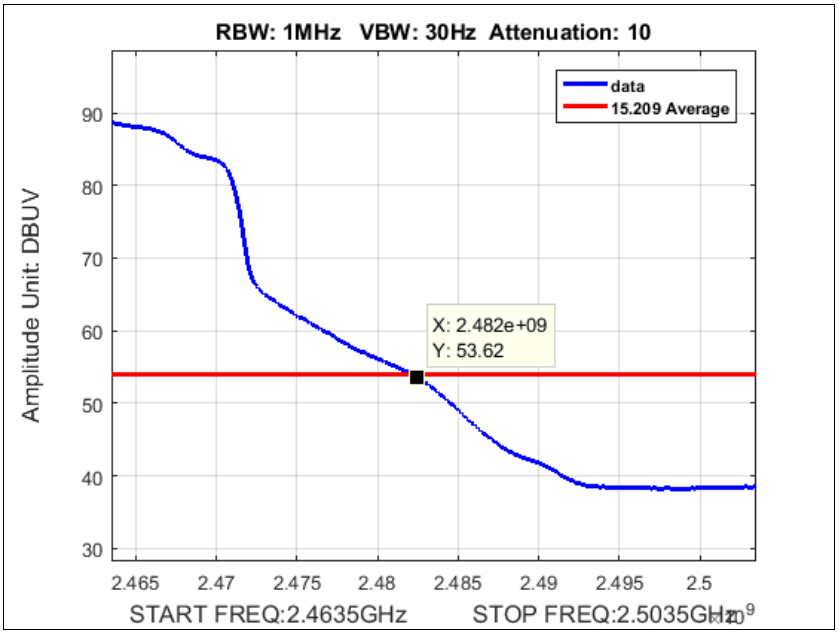


Plot 180. Peak Radiated Band Edge, SISO, N40, port b, High Channel, 2452M at 19 dBm

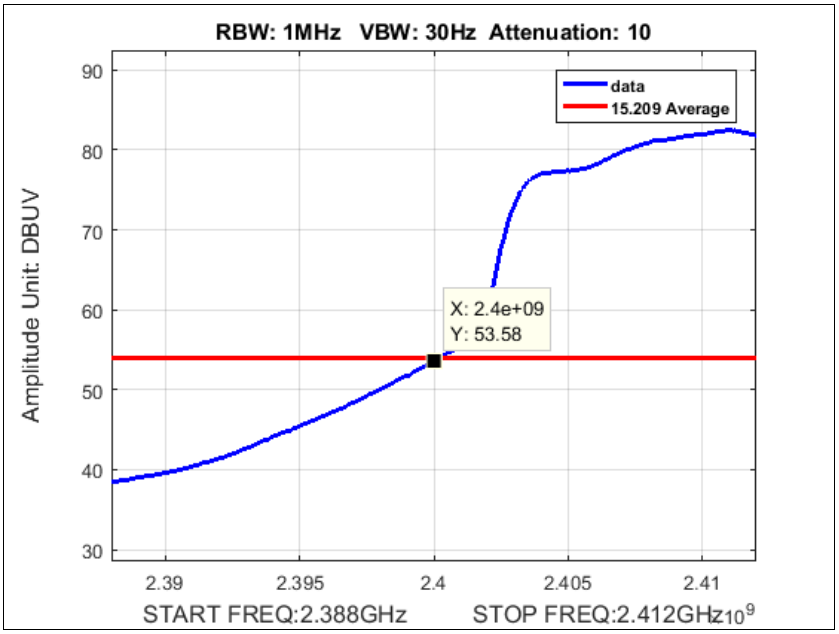


Plot 181. Peak Radiated Band Edge, SISO, N40, port b, Low Channel, 2422M at 21 dBm

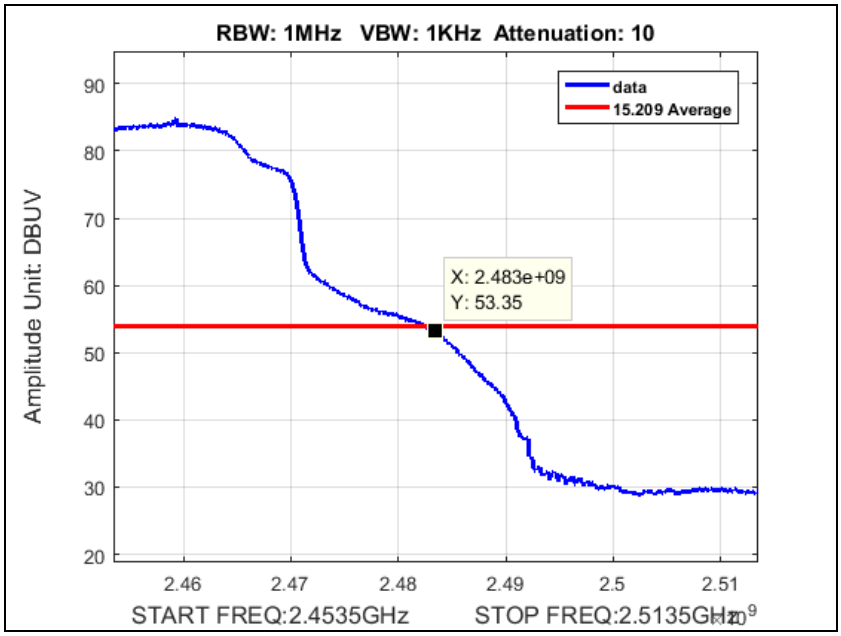
MIMO



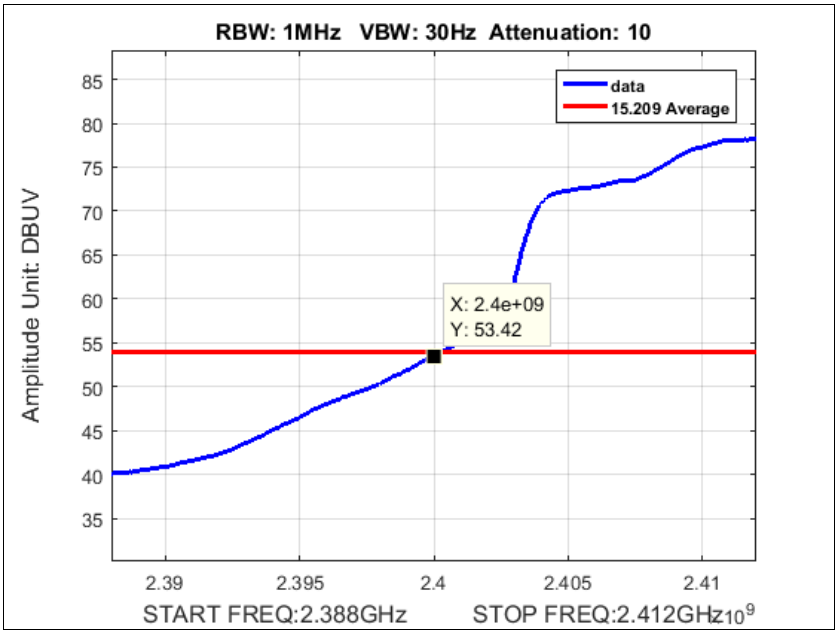
Plot 182. Average Radiated Band Edge, MIMO, HT8, 20M, High Channel, 2462M at 18 dBm



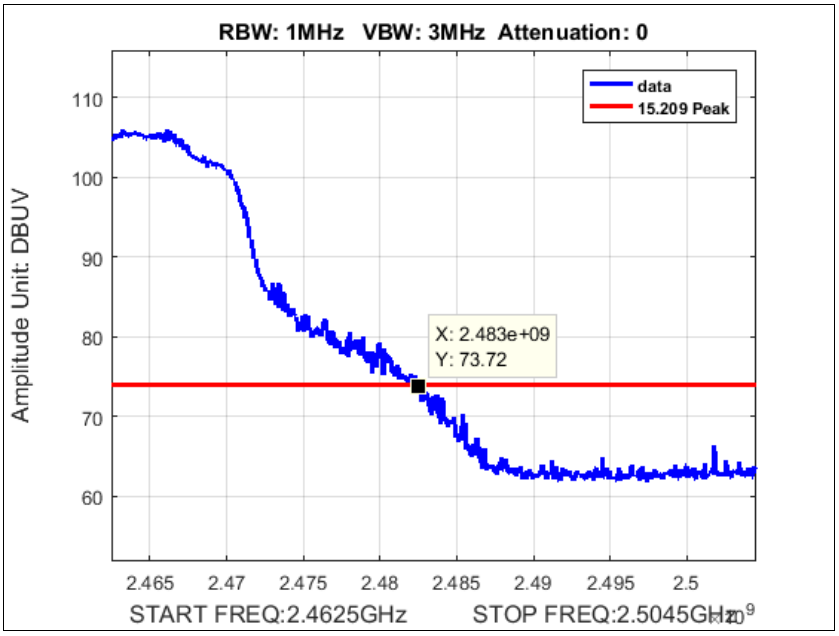
Plot 183. Average Radiated Band Edge, MIMO, HT8, 20M, Low Channel, 2412M at 15.5 dBm



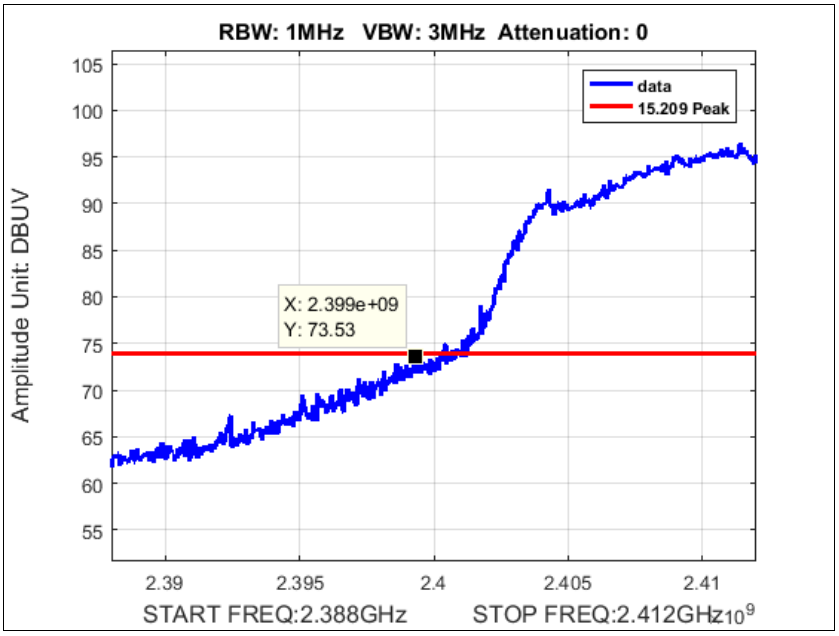
Plot 184. Average Radiated Band Edge, MIMO, HT8, 40M, High Channel, 2452M at 19 dBm



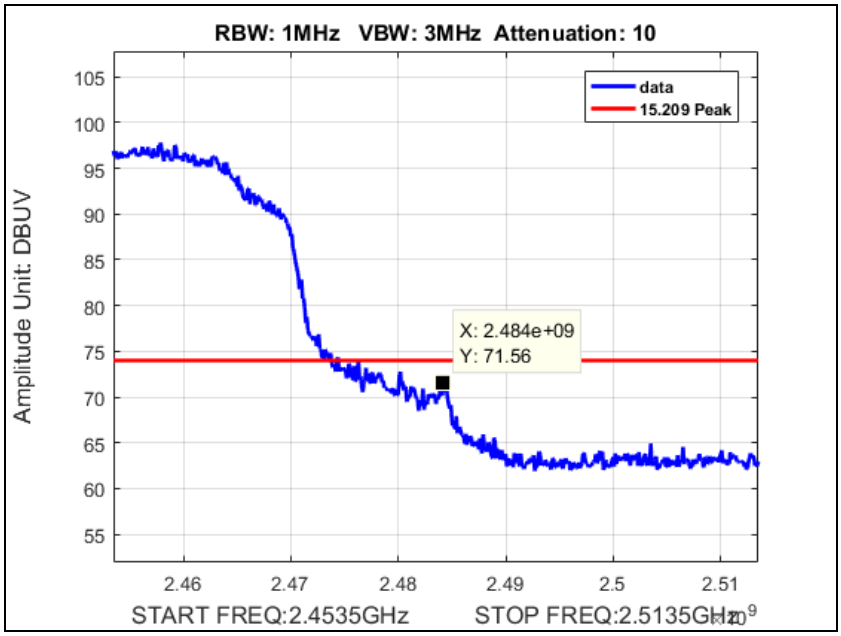
Plot 185. Average Radiated Band Edge, MIMO, HT8, 40M, Low Channel, 2422M at 14 dBm



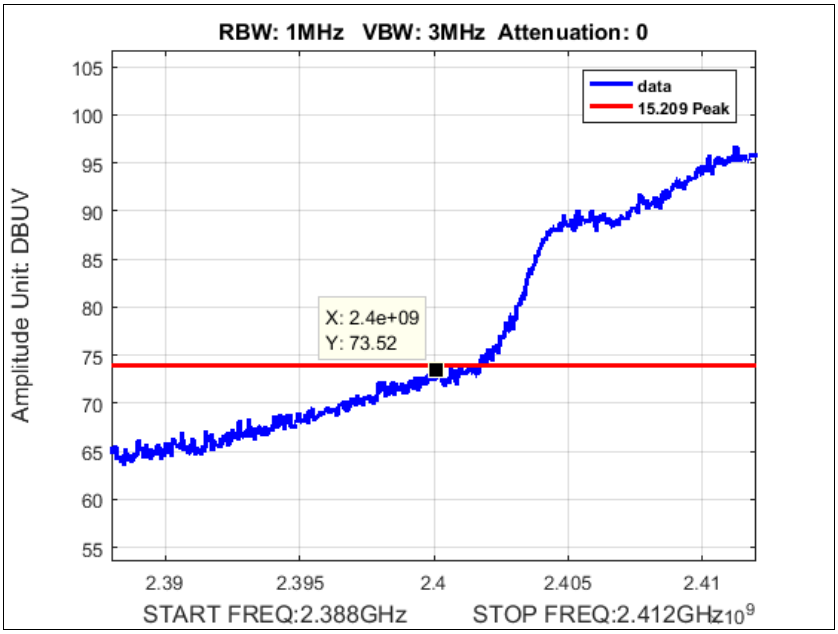
Plot 186. Peak Radiated Band Edge, MIMO, HT8, 20M, High Channel, 2462M at 19 dBm



Plot 187. Peak Radiated Band Edge, MIMO, HT8, 20M, Low Channel, 2412M at 18 dBm



Plot 188. Peak Radiated Band Edge, MIMO, HT8, 40M, 2452M at 19 dBm



Plot 189. Peak Radiated Band Edge, MIMO, HT8, 40M, Low Channel, 2422M at 19 dBm

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(d) RF Conducted Spurious Emissions Requirements and Band Edge

Test Requirement: **15.247(d)** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Test Procedure: For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

See following pages for detailed test results with RF Conducted Spurious Emissions.

Test Results: The EUT was compliant with the Conducted Spurious Emission limits of **§15.247(d)**. Measured emissions were within applicable limits.

Test Engineer(s): Donald Salguero

Test Date(s): January 6, 2017

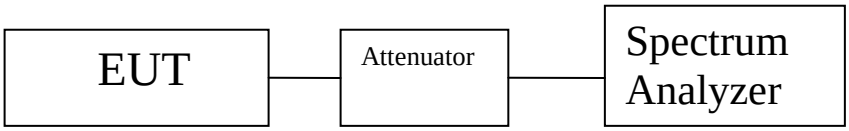
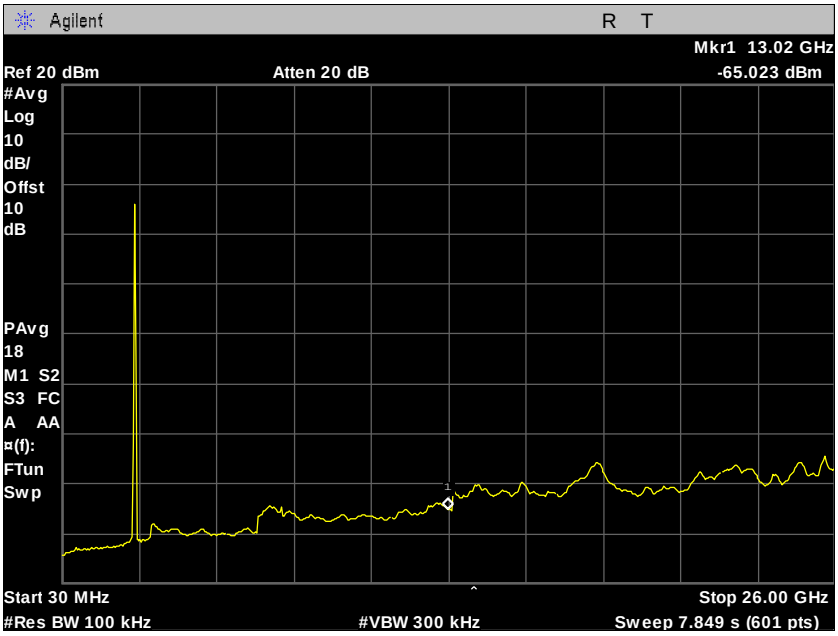
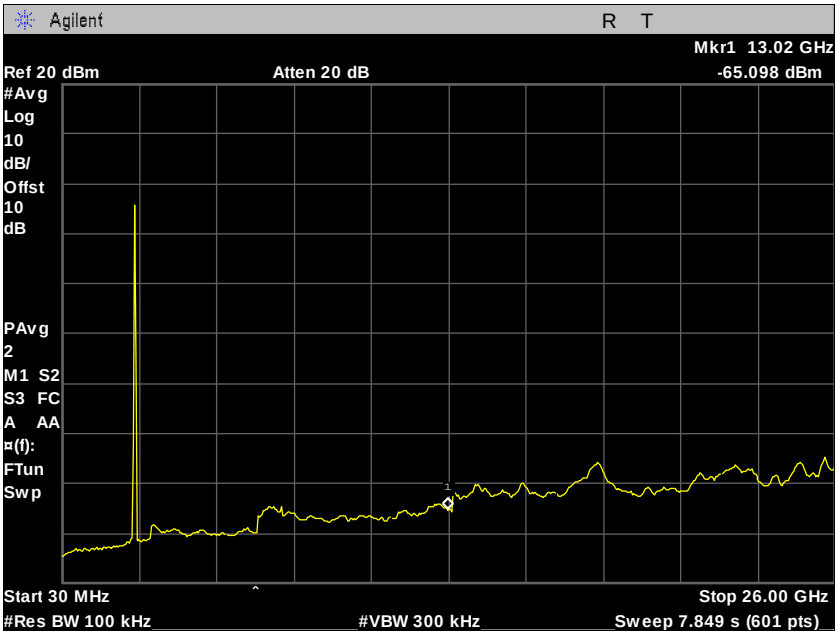


Figure 3. Block Diagram, Conducted Spurious Emissions Test Setup

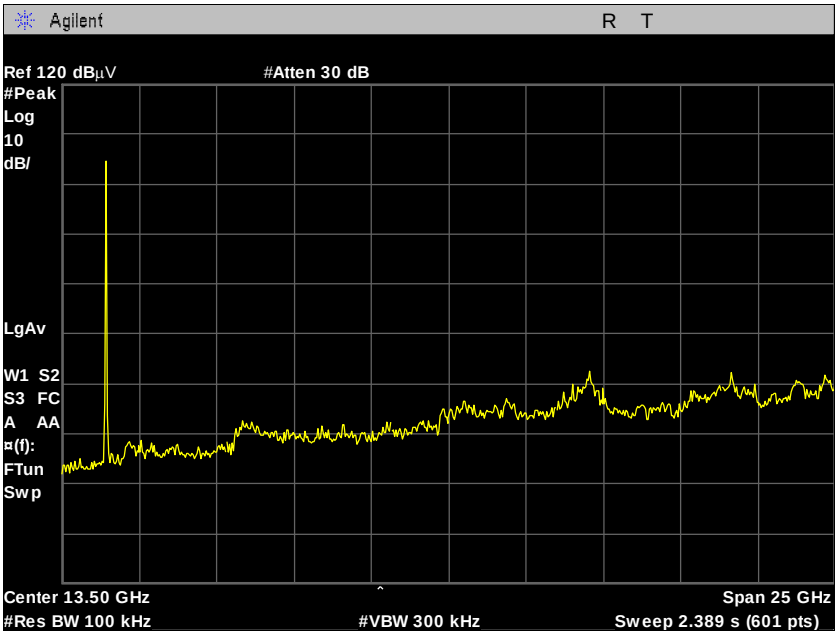
Conducted Spurious Emissions Test Results
SISO



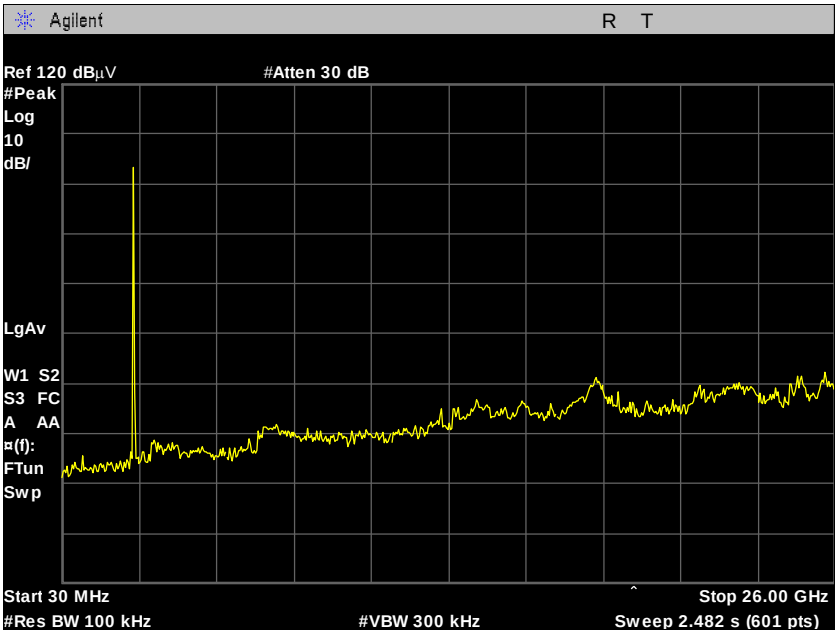
Plot 190. Conducted Spurious Emissions, SISO, b mode, port a, High Channel



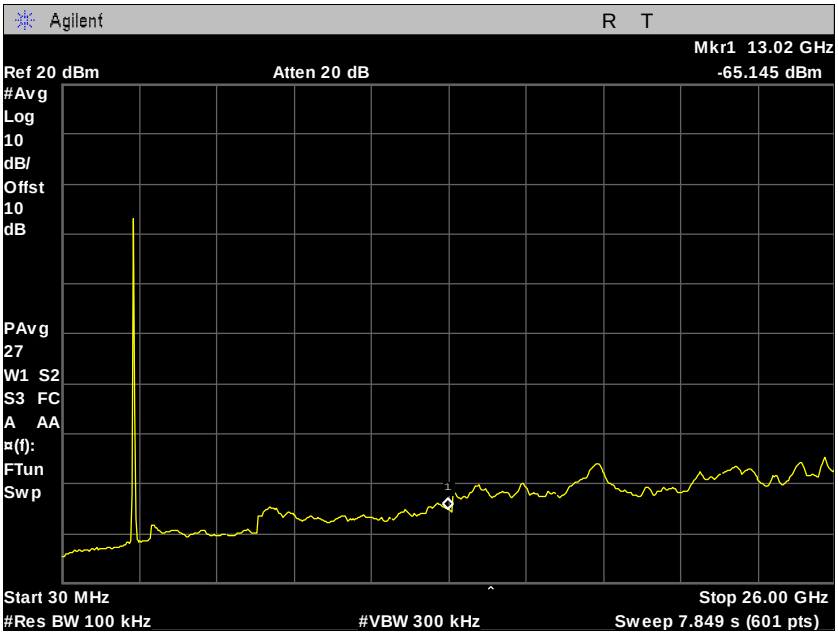
Plot 191. Conducted Spurious Emissions, SISO, b mode, port b, High Channel



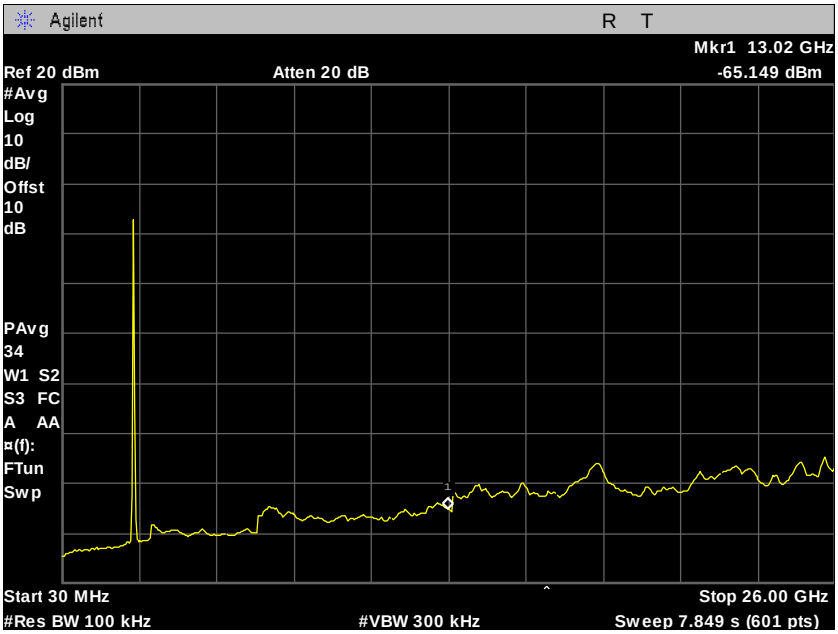
Plot 192. Conducted Spurious Emissions, SISO, b mode, port a, Low Channel



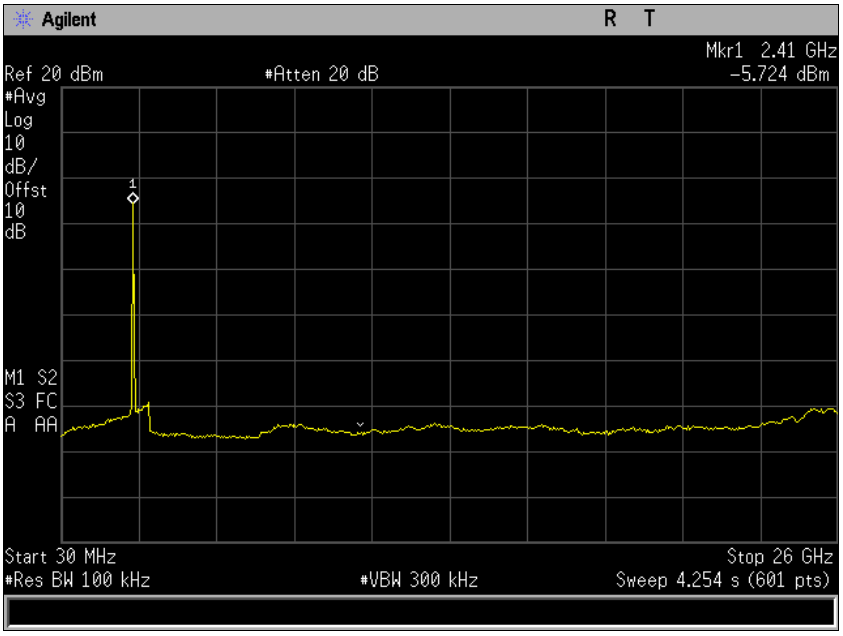
Plot 193. Conducted Spurious Emissions, SISO, b mode, port b, Low Channel



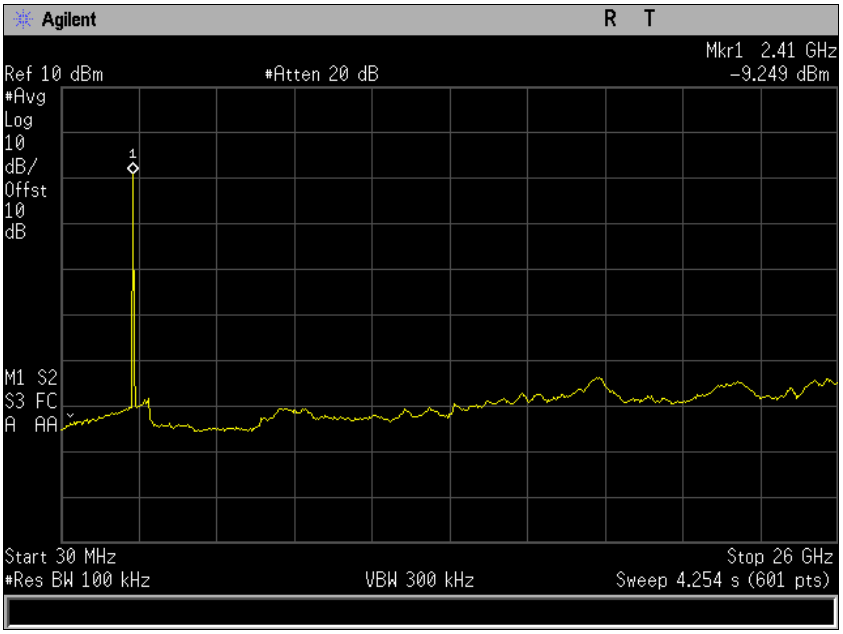
Plot 194. Conducted Spurious Emissions, SISO, b mode, port a, Mid Channel



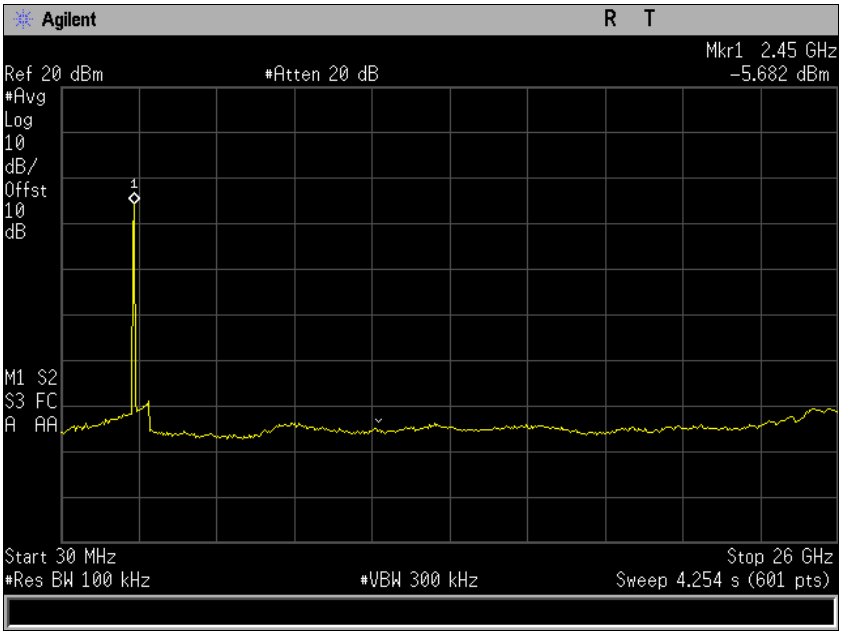
Plot 195. Conducted Spurious Emissions, SISO, b mode, port b, Mid Channel



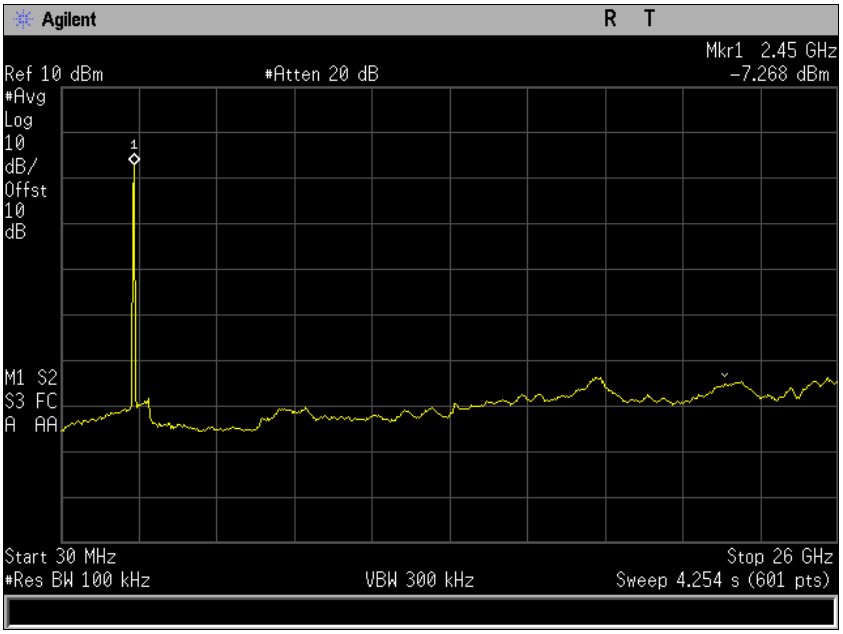
Plot 196. Conducted Spurious Emissions, SISO, 20 MHz, n mode, Port A, Low Channel



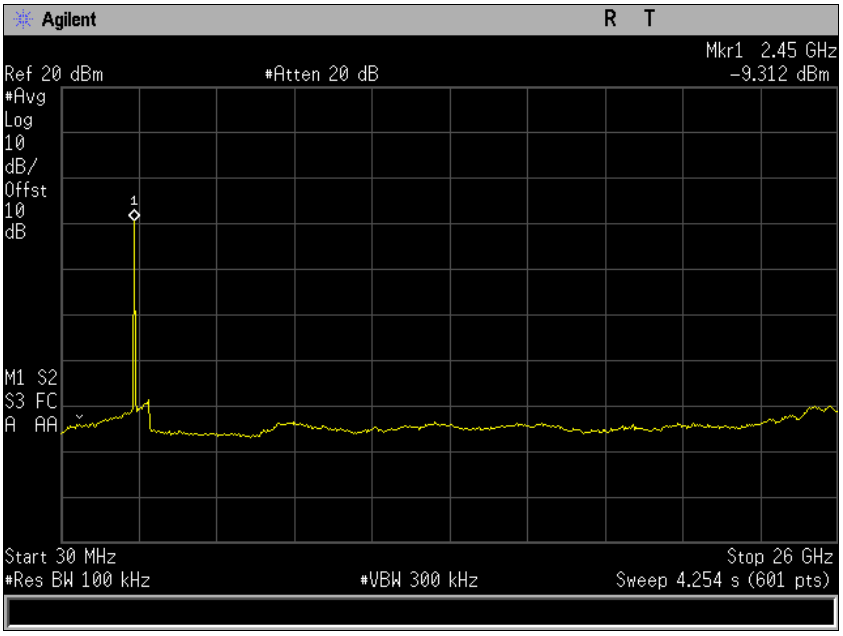
Plot 197. Conducted Spurious Emissions, SISO, 20 MHz, n mode, port b, Low Channel



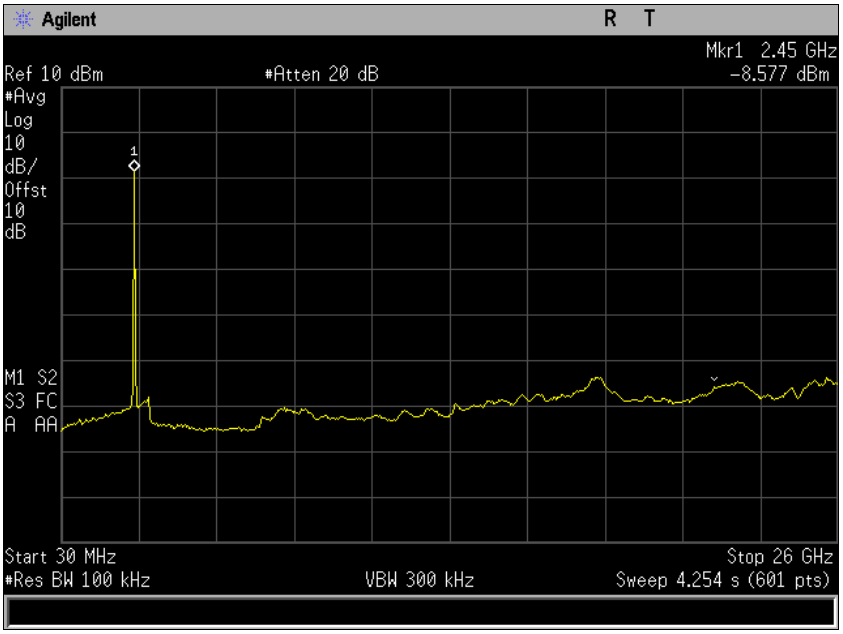
Plot 198. Conducted Spurious Emissions, SISO, 20 MHz, n mode, port a, Mid Channel



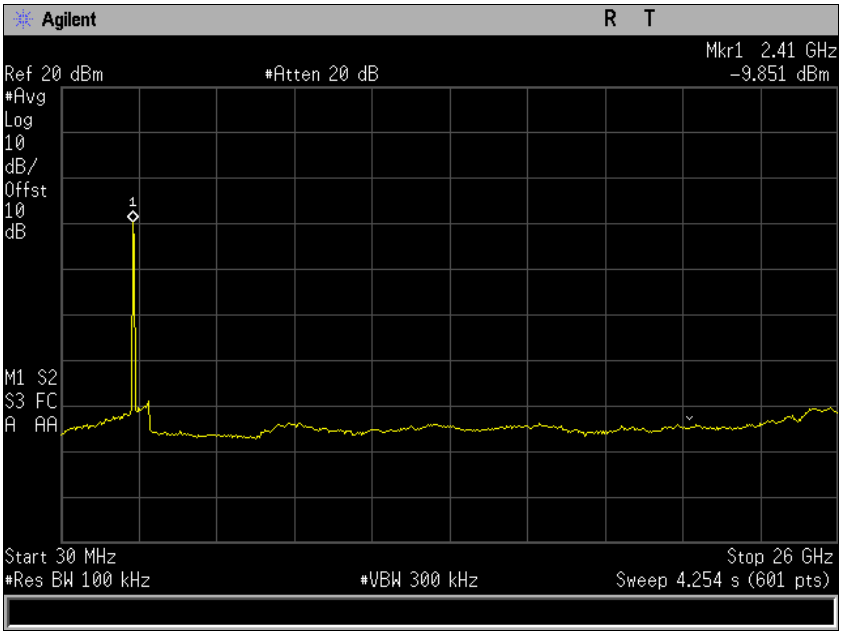
Plot 199. Conducted Spurious Emissions, SISO, 20 MHz, n mode, port b, Mid Channel



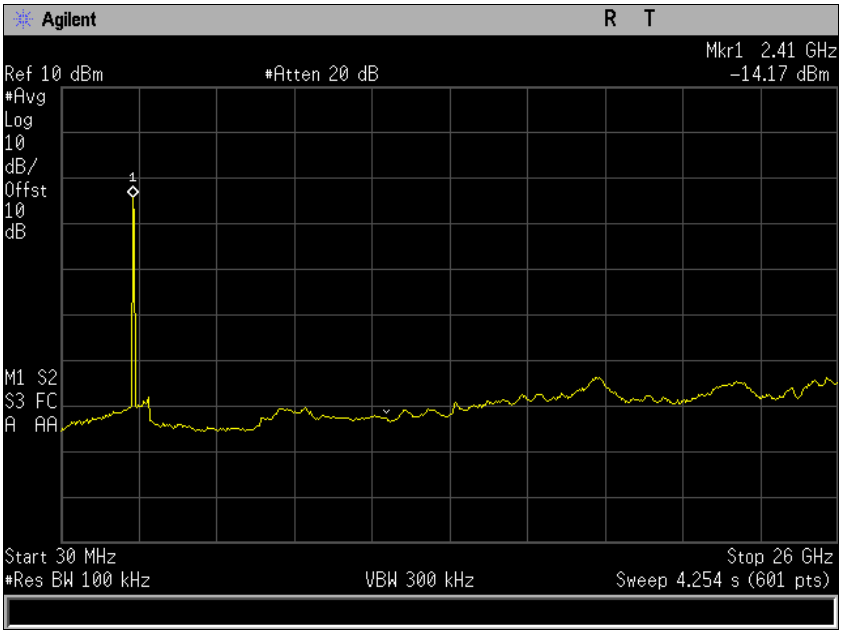
Plot 200. Conducted Spurious Emissions, SISO, 20 MHz, n mode, port a, High Channel



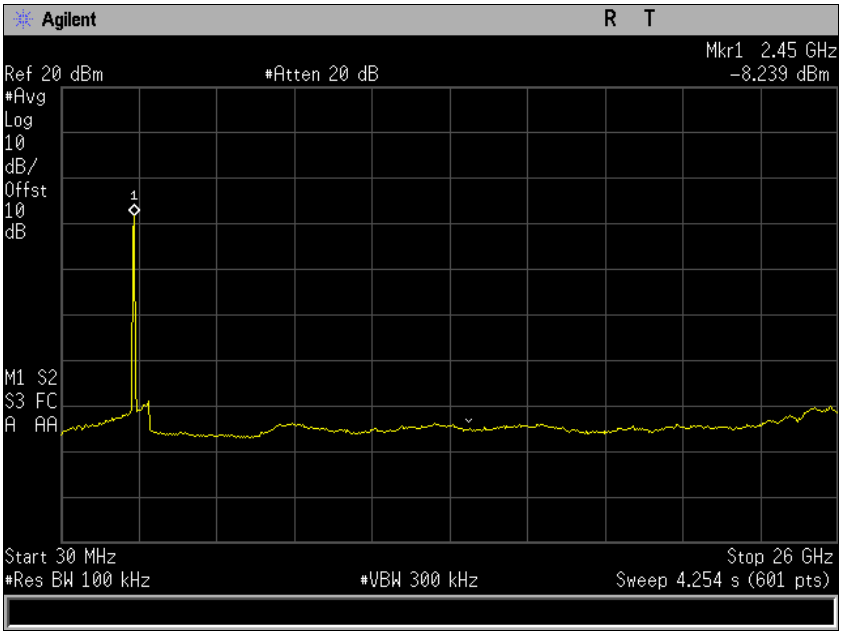
Plot 201. Conducted Spurious Emissions, SISO, 20 MHz, n mode, port b, High Channel



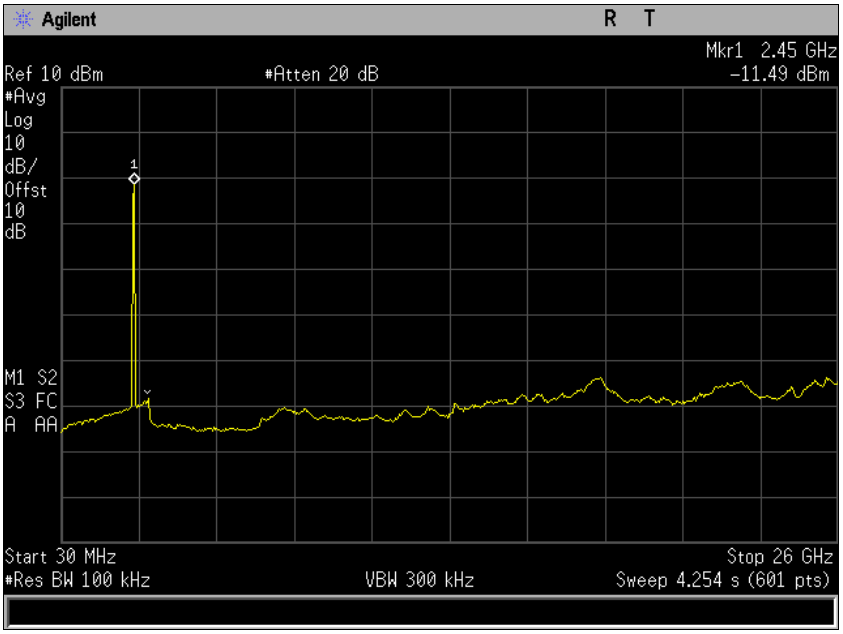
Plot 202. Conducted Spurious Emissions, SISO, 40 MHz, n mode, port a, Low Channel



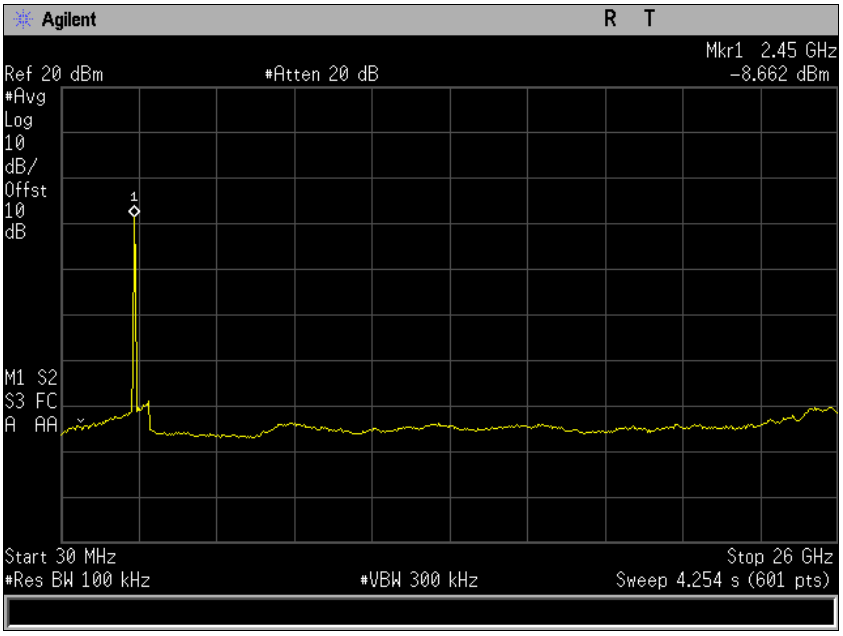
Plot 203. Conducted Spurious Emissions, SISO, 40 MHz, n mode, port b, Low Channel



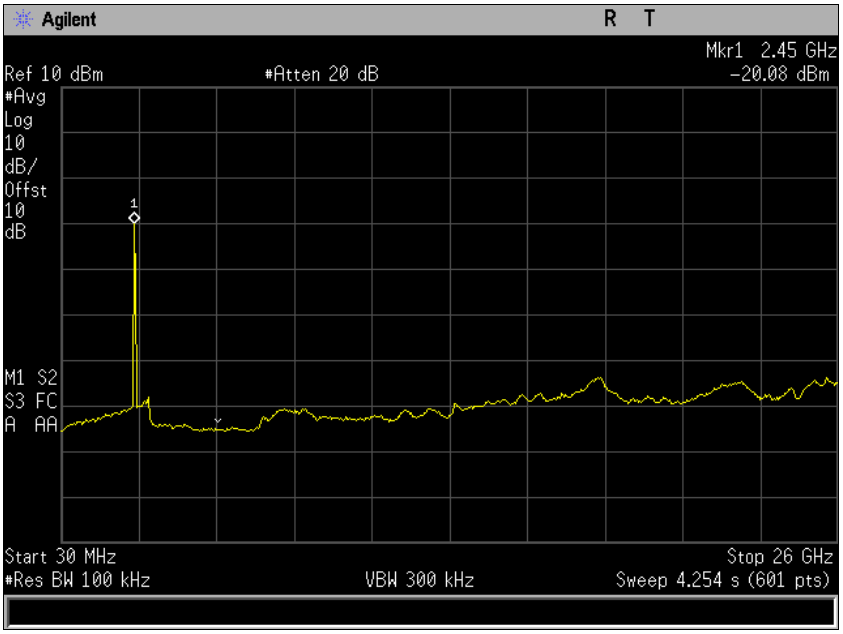
Plot 204. Conducted Spurious Emissions, SISO, 40 MHz, n mode, port a, Mid Channel



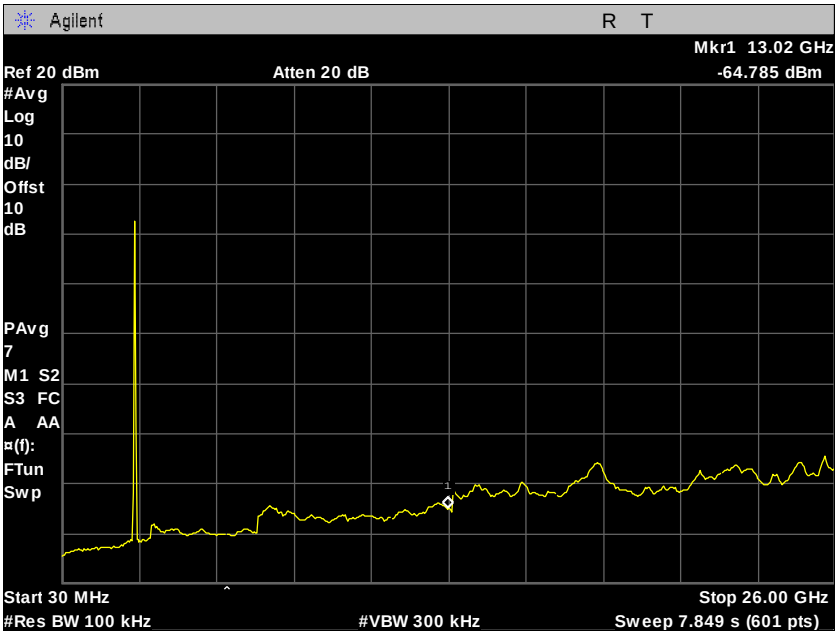
Plot 205. Conducted Spurious Emissions, SISO, 40 MHz, n mode, port b, Mid Channel



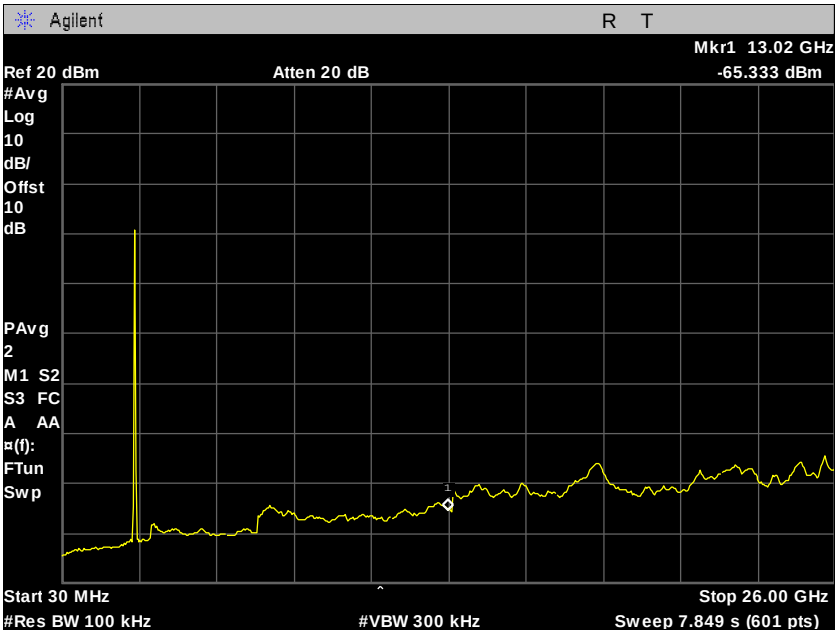
Plot 206. Conducted Spurious Emissions, SISO, 40 MHz, n mode, port a, High Channel



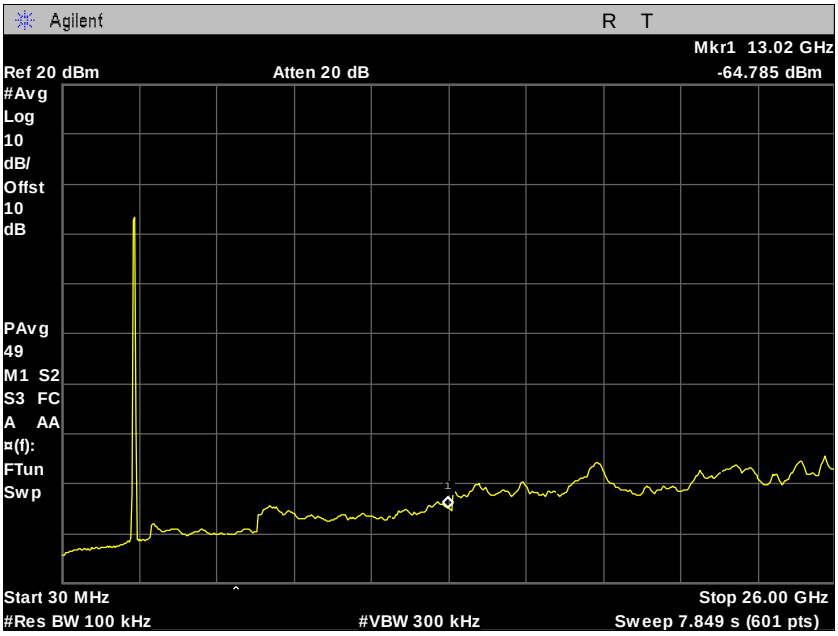
Plot 207. Conducted Spurious Emissions, SISO, 40 MHz, n mode, port b, High Channel



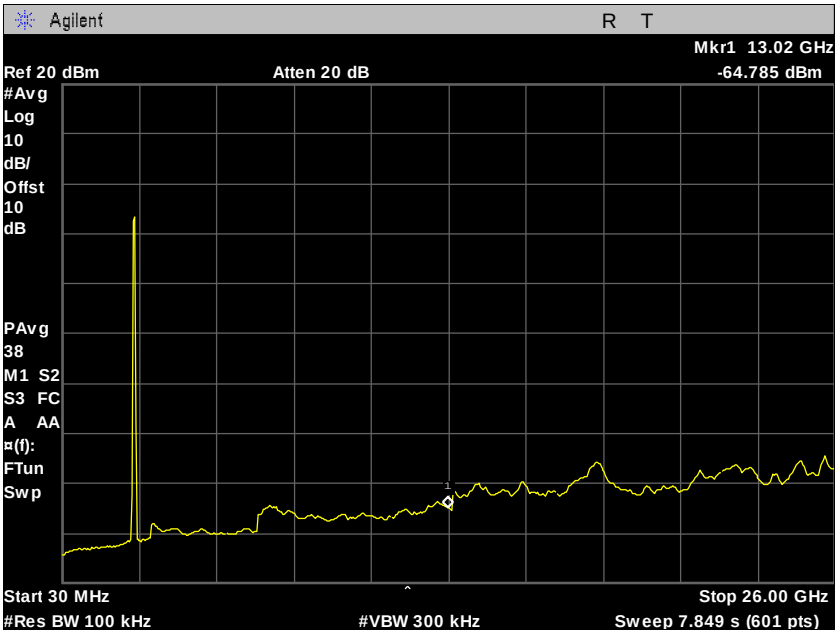
Plot 208. Conducted Spurious Emissions, SISO, g mode, port a, High Channel



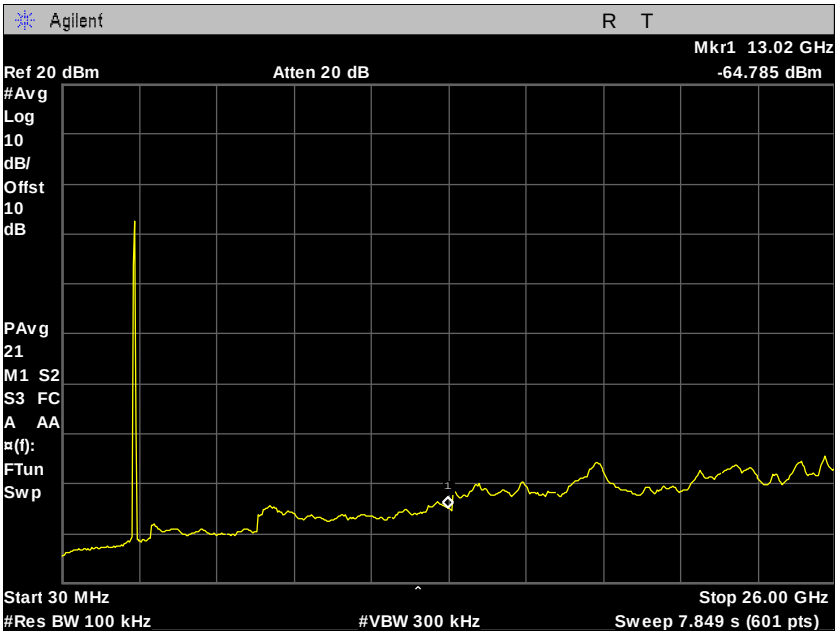
Plot 209. Conducted Spurious Emissions, SISO, g mode, port b, High Channel



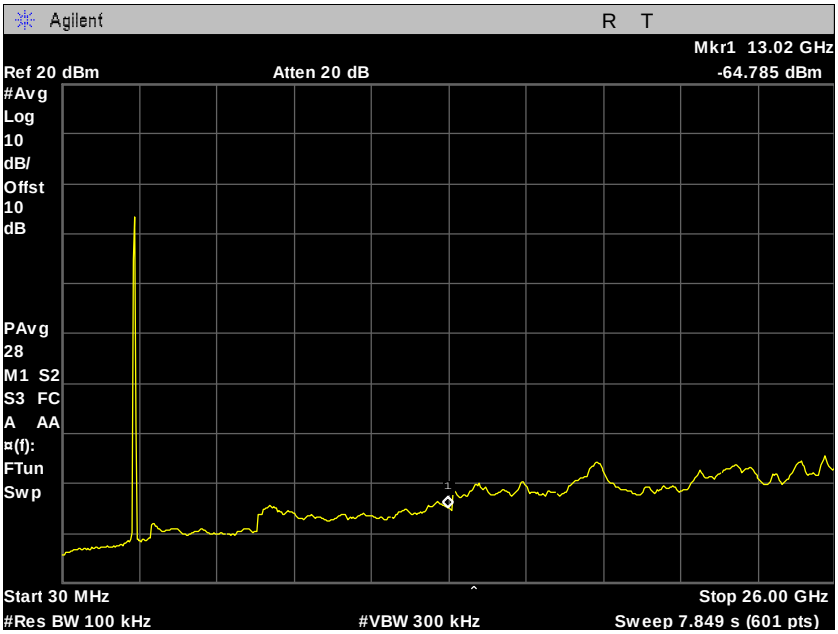
Plot 210. Conducted Spurious Emissions, SISO, g mode, port a, Low Channel



Plot 211. Conducted Spurious Emissions, SISO, g mode, port b, Low Channel

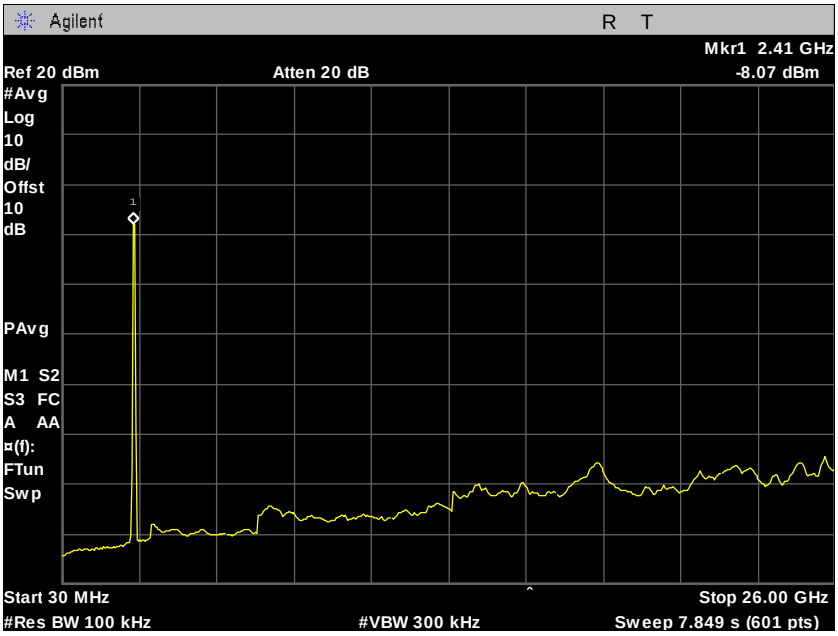


Plot 212. Conducted Spurious Emissions, SISO, g mode, port a, Mid Channel

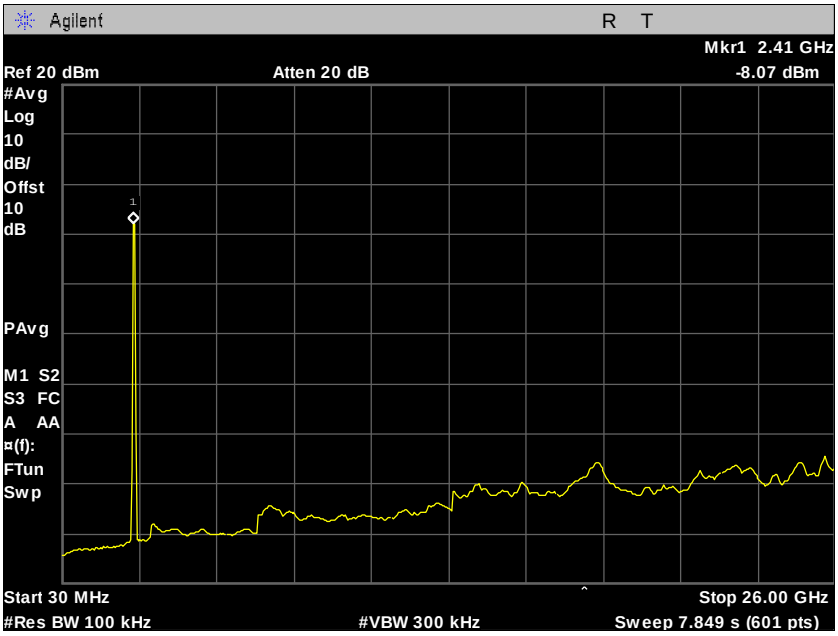


Plot 213. Conducted Spurious Emissions, SISO, g mode, port b, Mid Channel

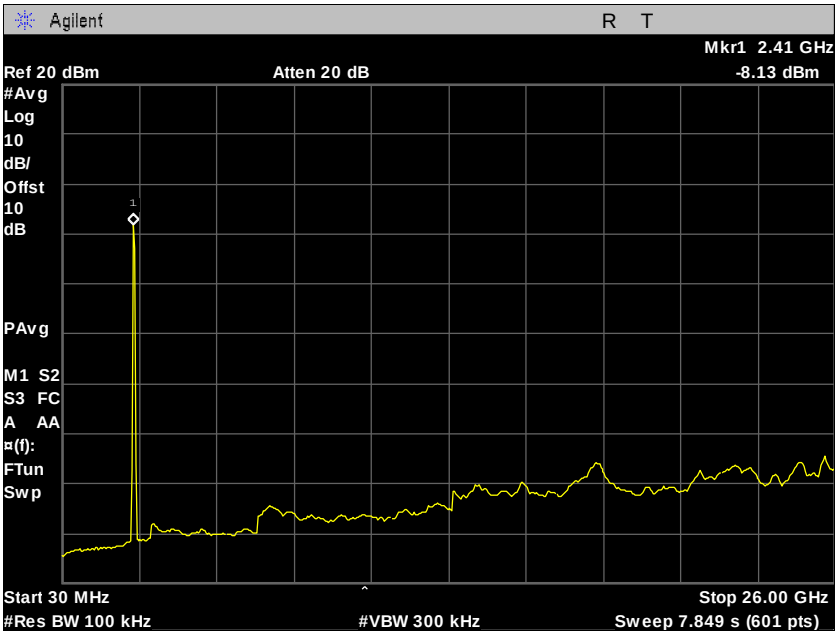
MIMO



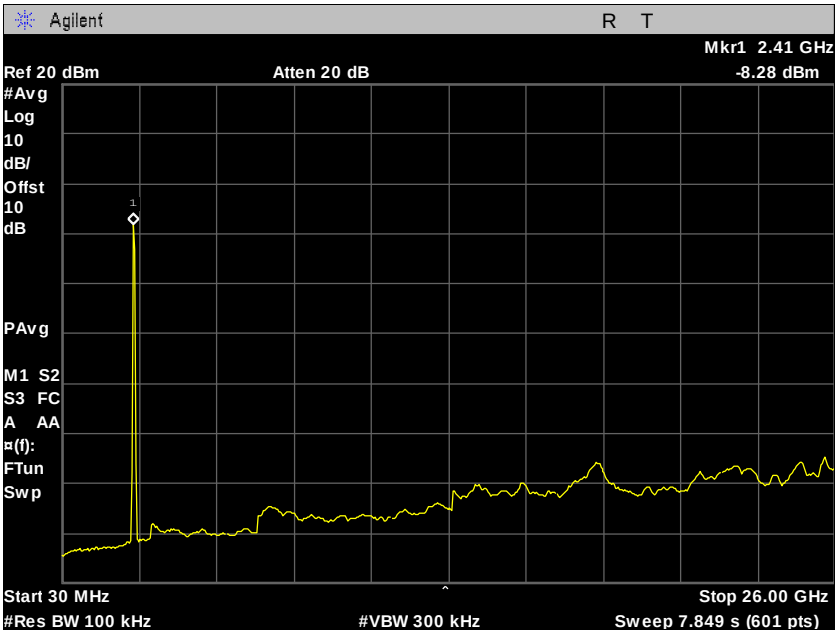
Plot 214. Conducted Spurious Emissions, MIMO, 40 MHz, n mode, port a, High Channel



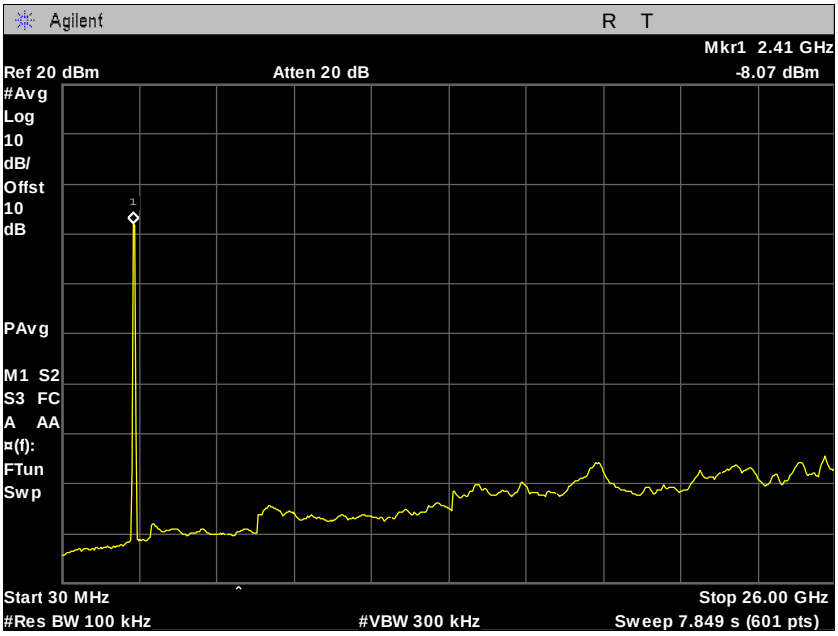
Plot 215. Conducted Spurious Emissions, MIMO, 40 MHz, n mode, port b, High Channel



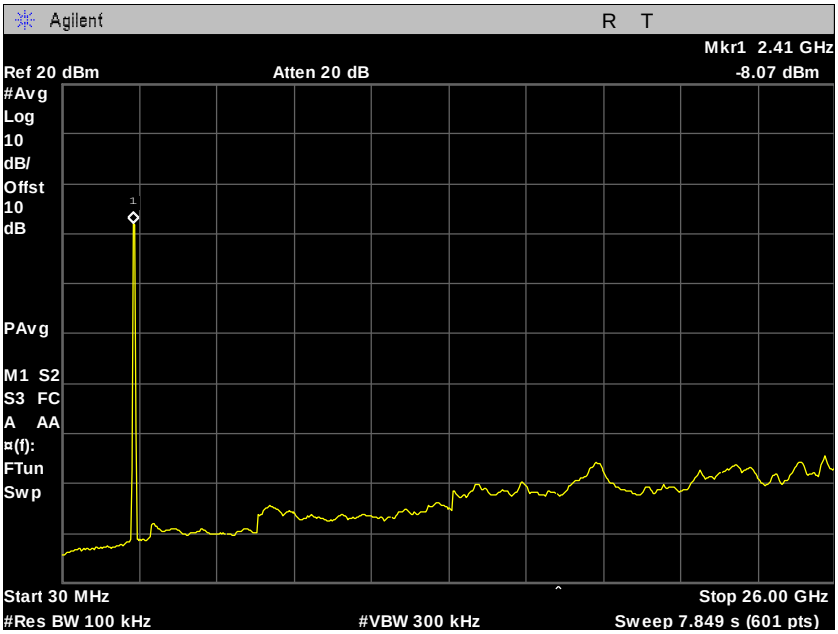
Plot 216. Conducted Spurious Emissions, MIMO, 40 MHz, n mode, port a, Low Channel



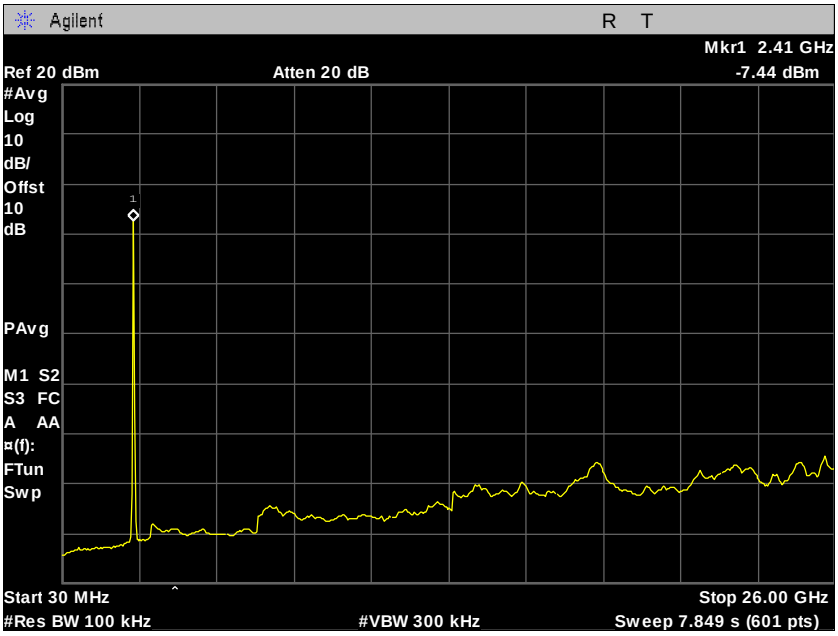
Plot 217. Conducted Spurious Emissions, MIMO, 40 MHz, n mode, port b, Low Channel



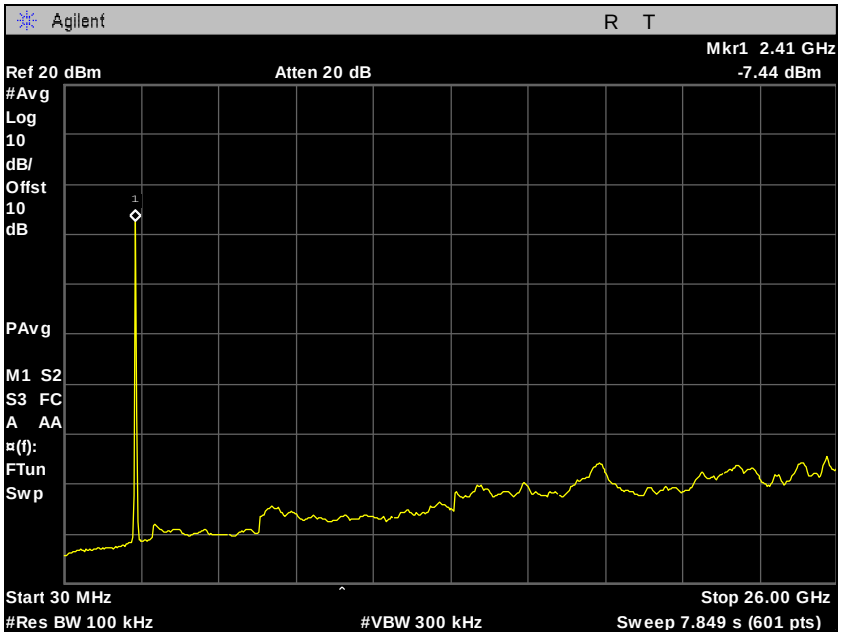
Plot 218. Conducted Spurious Emissions, MIMO, 40 MHz, n mode, port a, Mid Channel



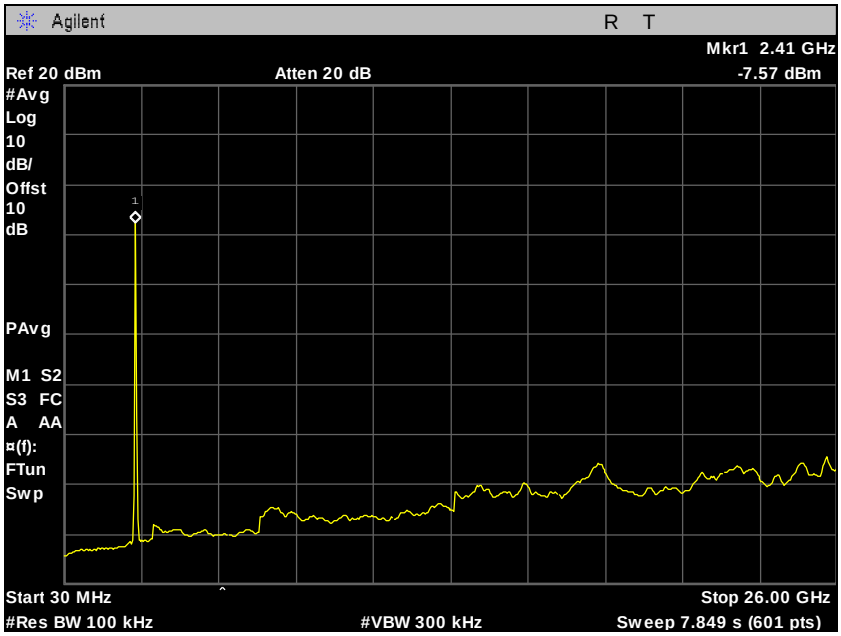
Plot 219. Conducted Spurious Emissions, MIMO, 40 GHz, n mode, port b, Mid Channel



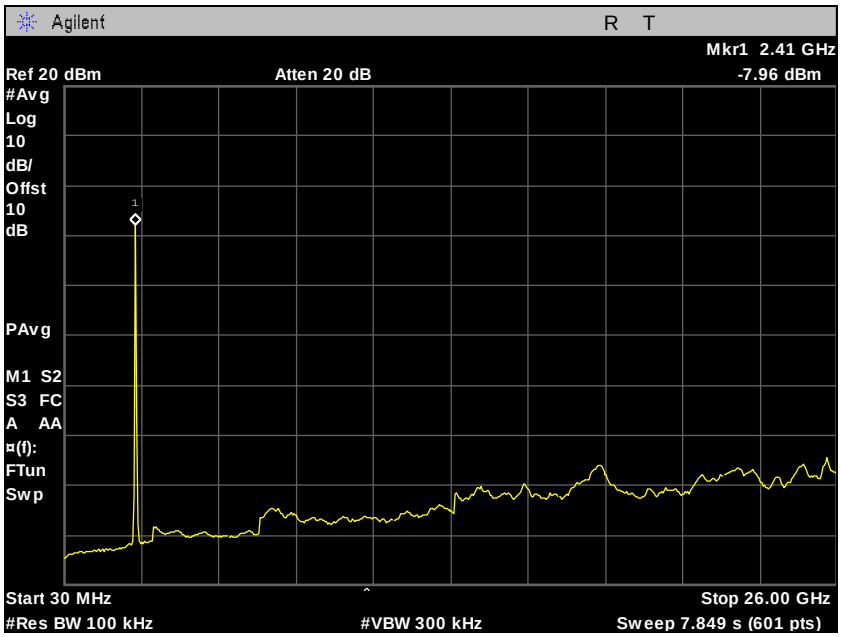
Plot 220. Conducted Spurious Emissions, MIMO, 20 MHz, n mode, port a, High Channel



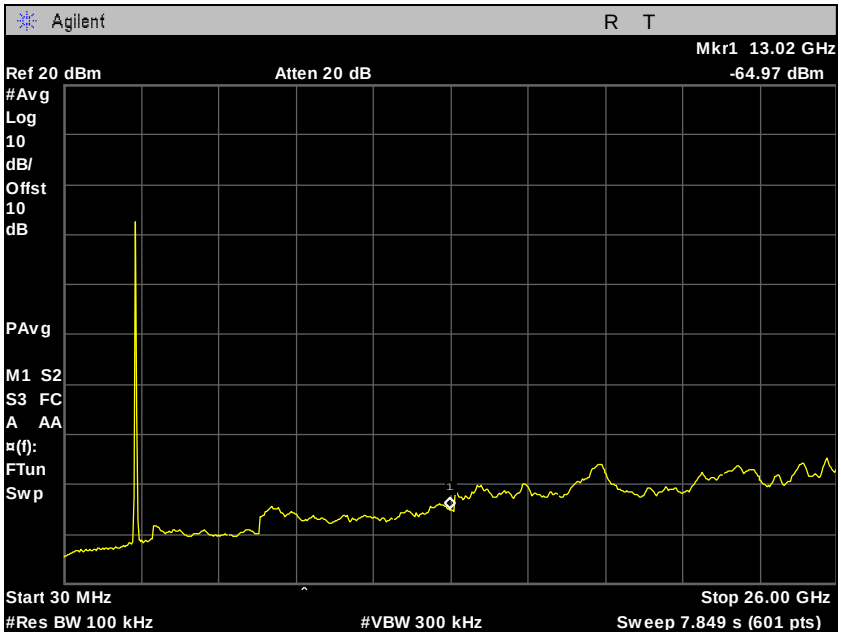
Plot 221. Conducted Spurious Emissions, MIMO, 20 MHz, n mode, port b, High Channel



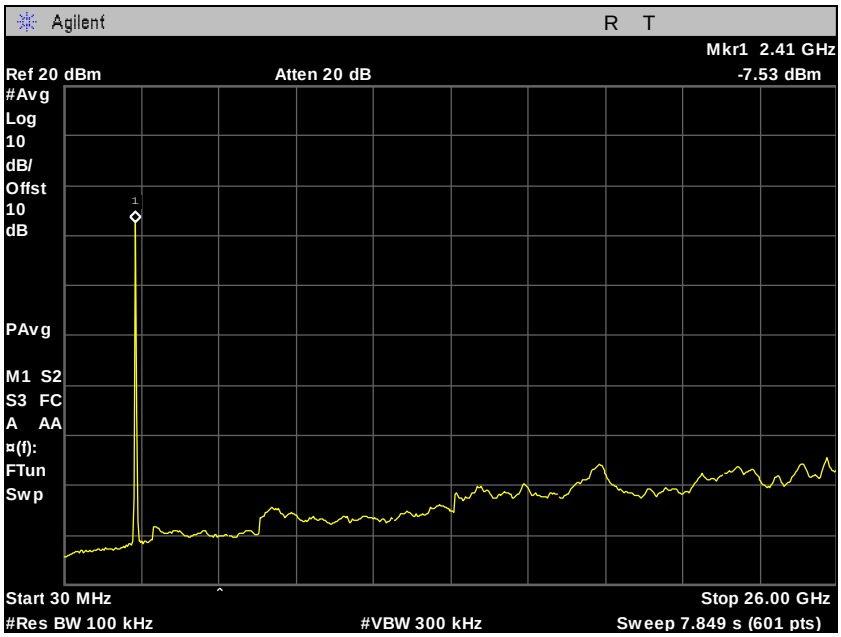
Plot 222. Conducted Spurious Emissions, MIMO, 20 MHz, n mode, port a, Low Channel



Plot 223. Conducted Spurious Emissions, MIMO, 20 MHz, n mode, port b, Low Channel

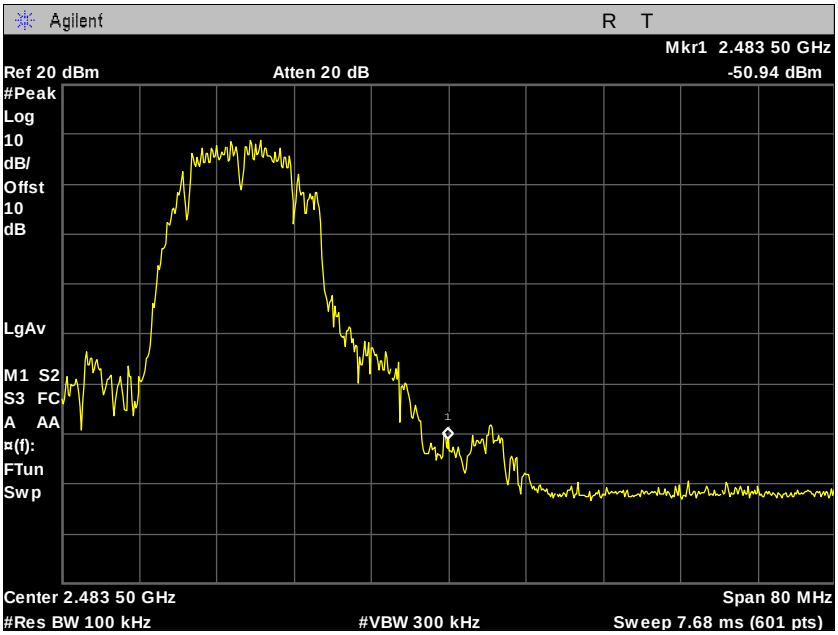


Plot 224. Conducted Spurious Emissions, MIMO, 20 MHz, n mode, port a, Mid Channel

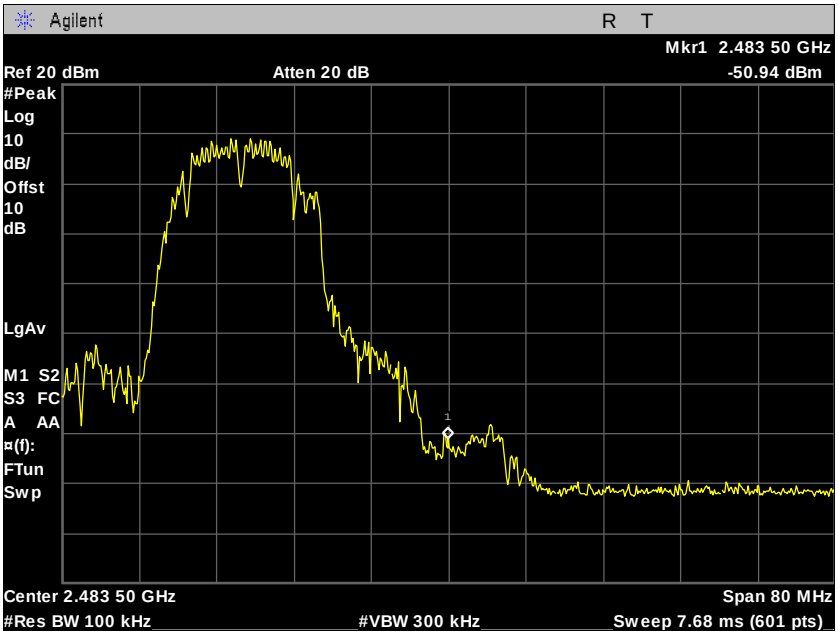


Plot 225. Conducted Spurious Emissions, MIMO, 20 MHz, n mode, port b, Mid Channel

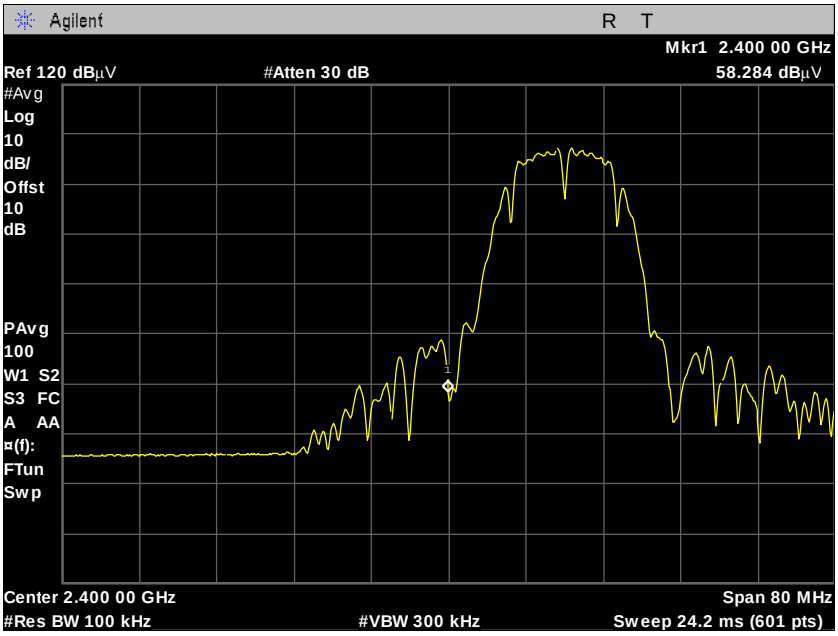
Conducted Band Edge Test Results
SISO



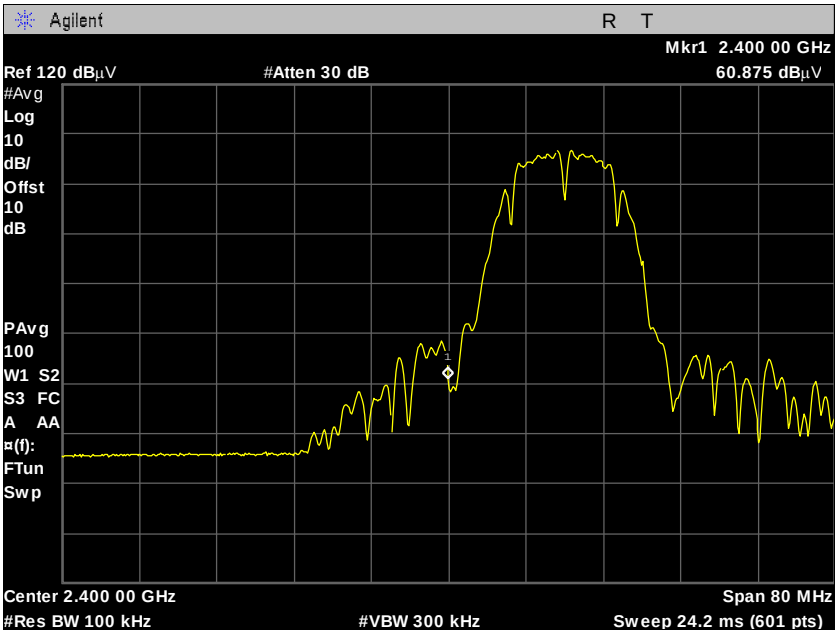
Plot 226. Conducted Band Edge, SISO, b mode, Port a, High Channel,



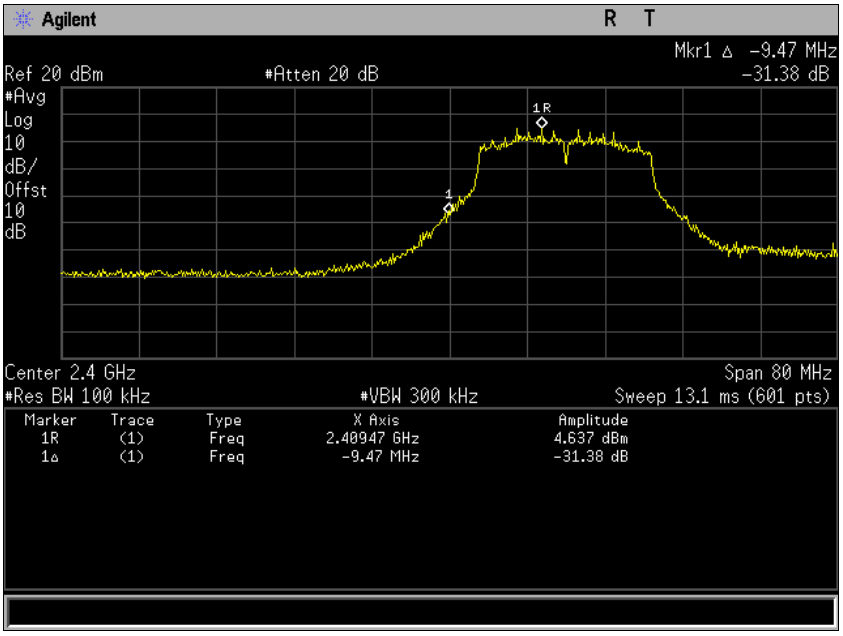
Plot 227. Conducted Band Edge, SISO, b mode, port b, High Channel



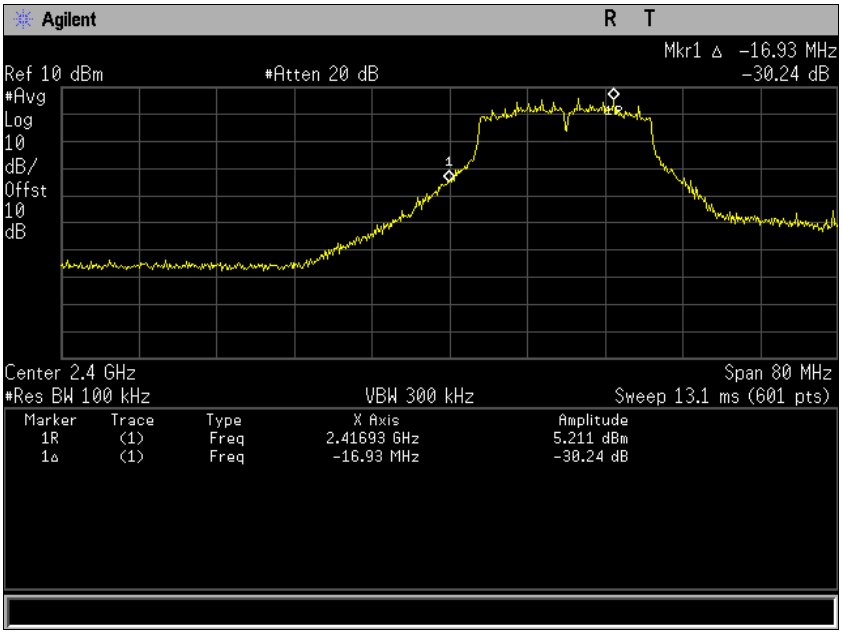
Plot 228. Conducted Band Edge, SISO, b mode, port b, Low Channel



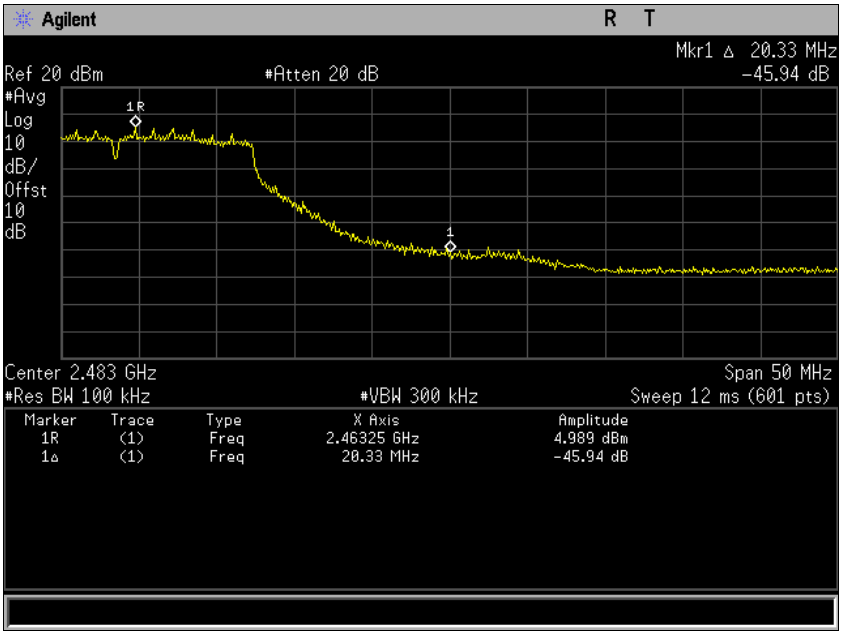
Plot 229. Conducted Band Edge, SISO, b mode, port a, Low Channel



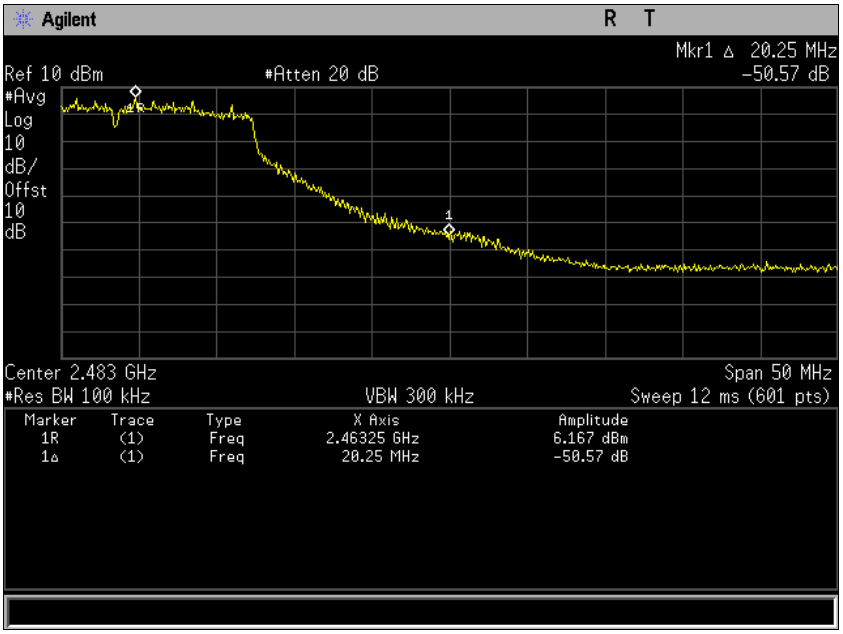
Plot 230. Conducted Spurious Band Edge, SISO, 20 MHz, n mode, port a, Low Channel at 16 dBm



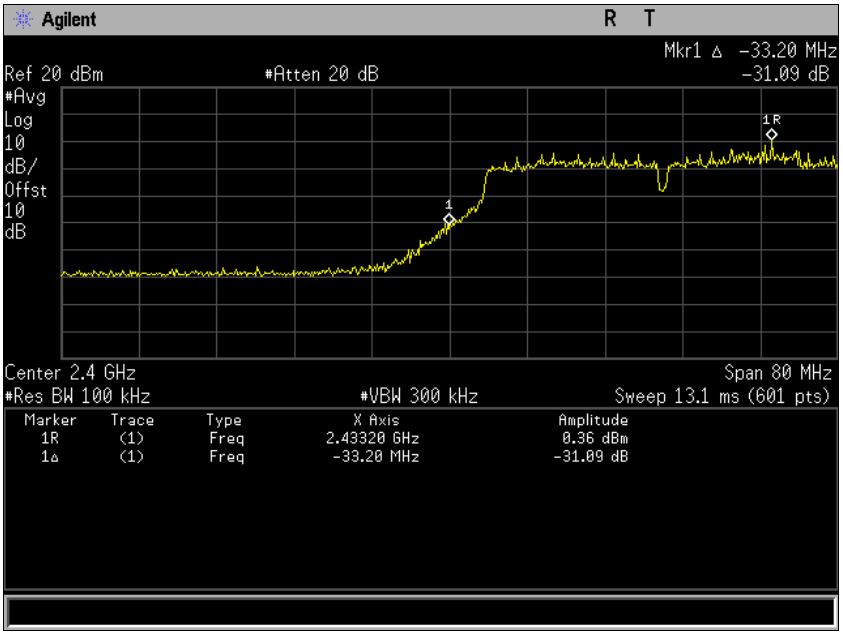
Plot 231. Conducted Spurious Band Edge, SISO, 20 MHz, n mode, port b, Low Channel



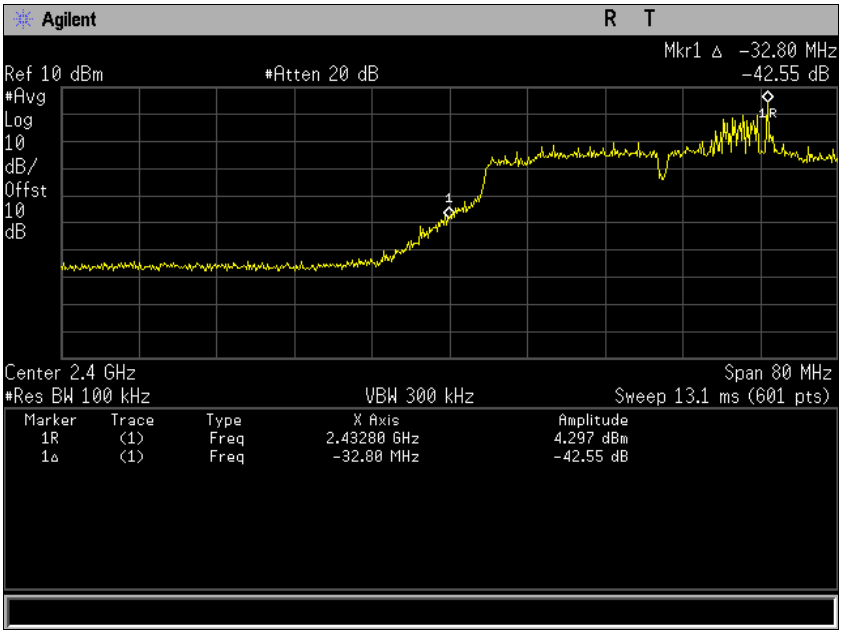
Plot 232. Conducted Spurious Band Edge, SISO, 20 MHz, n mode, port a, High Channel



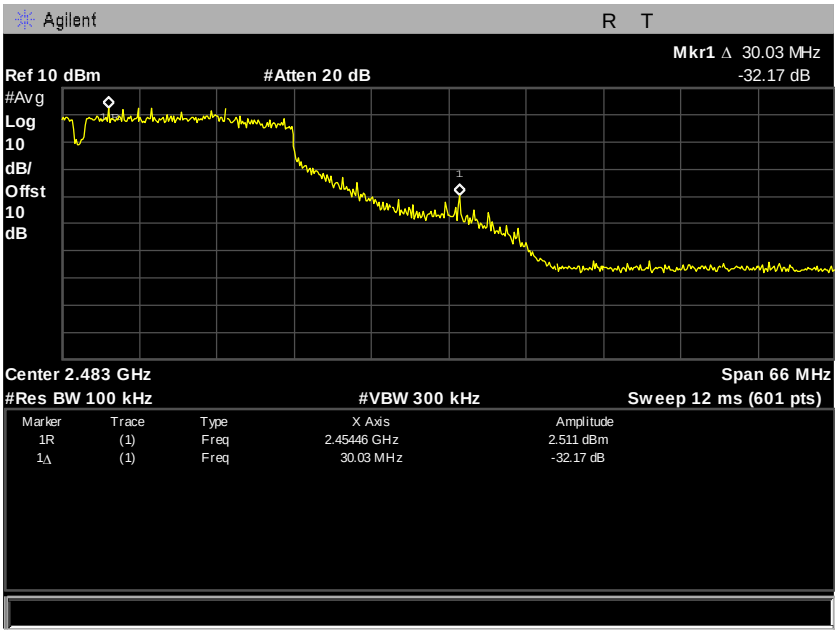
Plot 233. Conducted Spurious Band Edge, SISO, 20 MHz, n mode, port b, High Channel



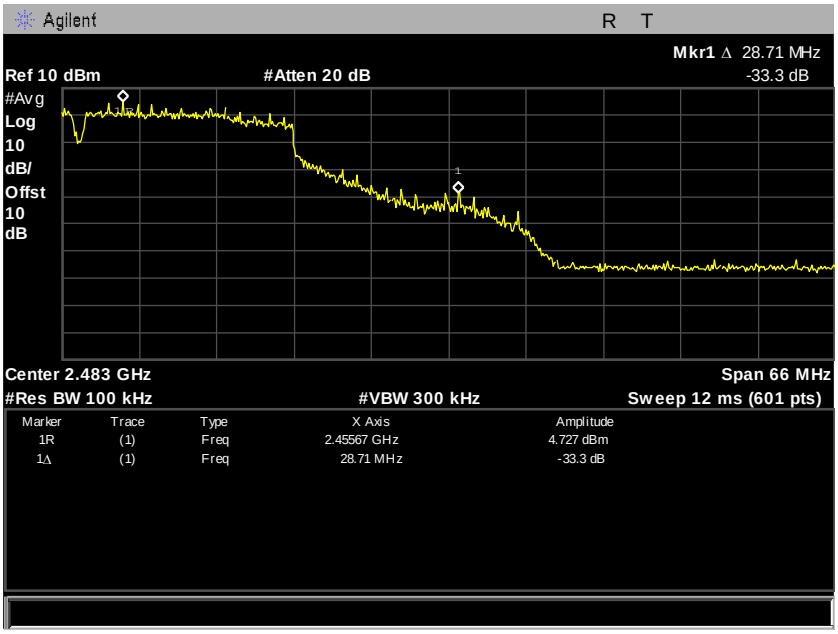
Plot 234. Conducted Spurious Band Edge, SISO, 40 MHz, n mode, port a, Low Channel at 10.25 dB



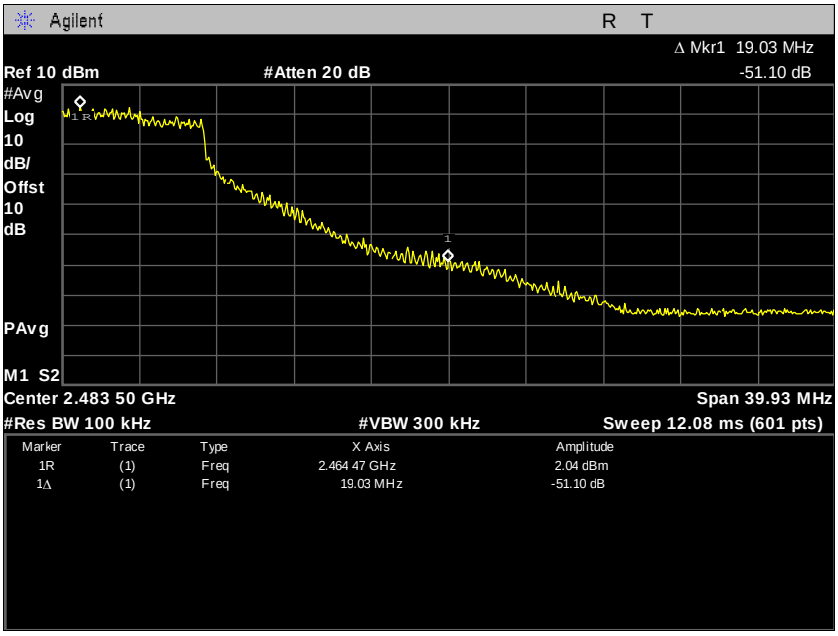
Plot 235. Conducted Spurious Band Edge, SISO, 40 MHz, n mode, port b, Low Channel



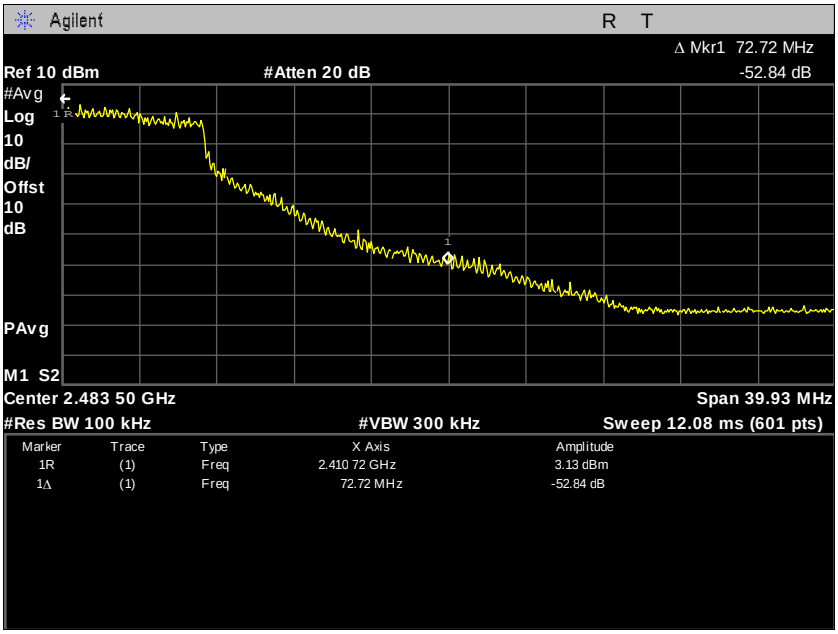
Plot 236. Conducted Spurious Band Edge, SISO, 40 MHz, n mode, port a, High Channel



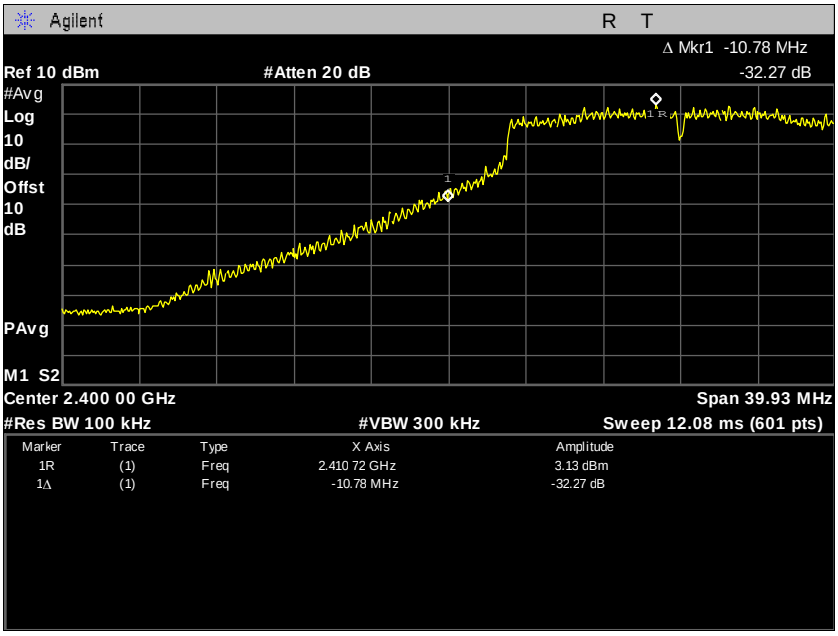
Plot 237. Conducted Spurious Band Edge, SISO, 40 MHz, n mode, port b, High Channel



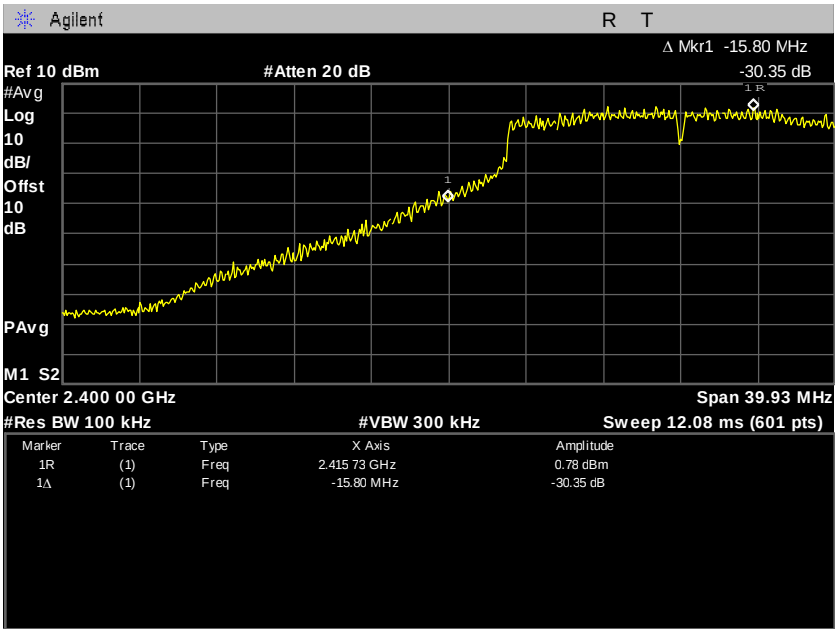
Plot 238. Conducted Band Edge, SISO, g mode, port a, High Channel



Plot 239. Conducted Band Edge, SISO, g mode, port b, High Channel

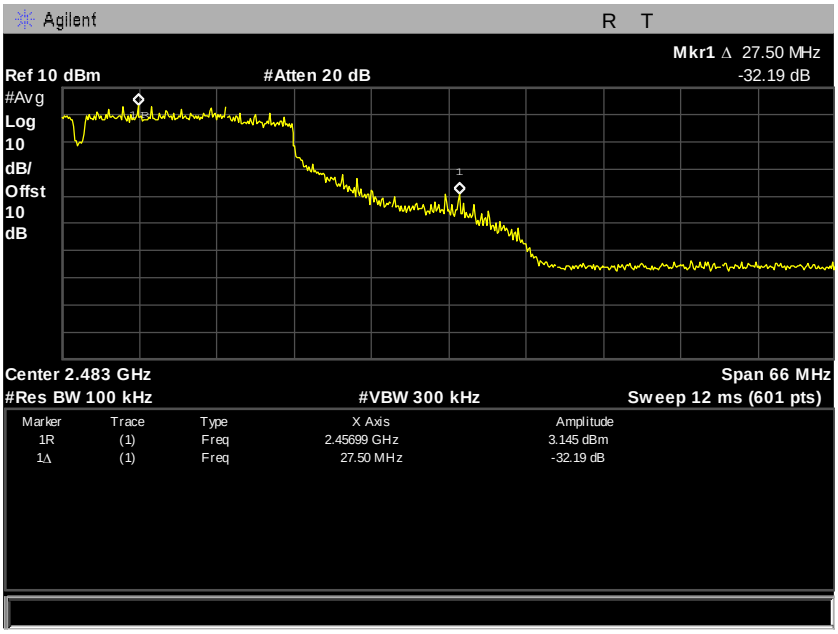


Plot 240. Conducted Band Edge, SISO, g mode, port a, Low Channel

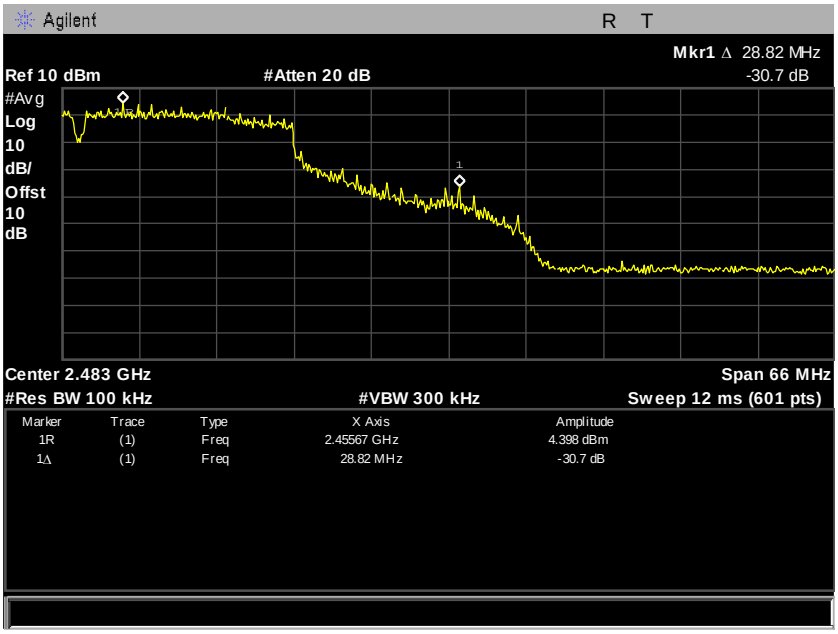


Plot 241. Conducted Band Edge, SISO, g mode, port b, Low Channel

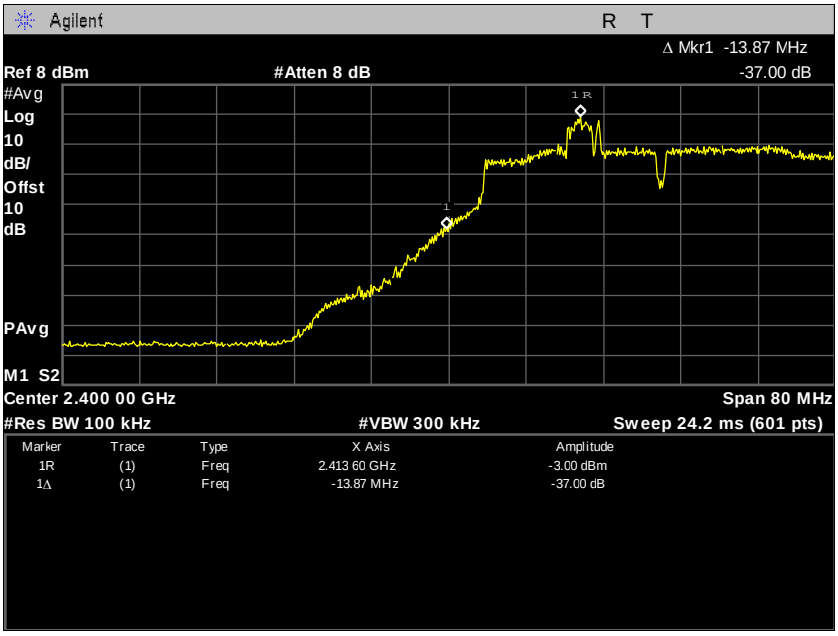
MIMO



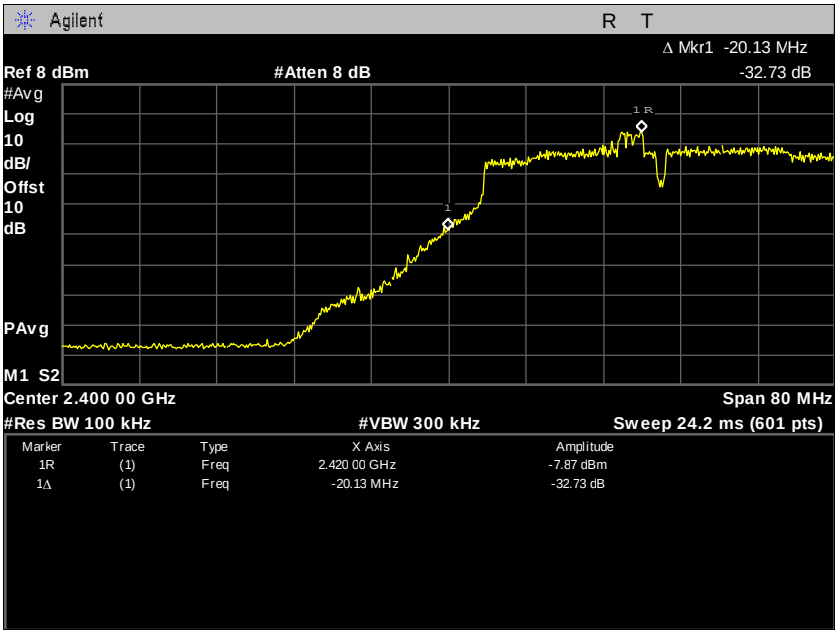
Plot 242. Conducted Band Edge, MIMO, 40 MHz, n mode, port a, High Channel



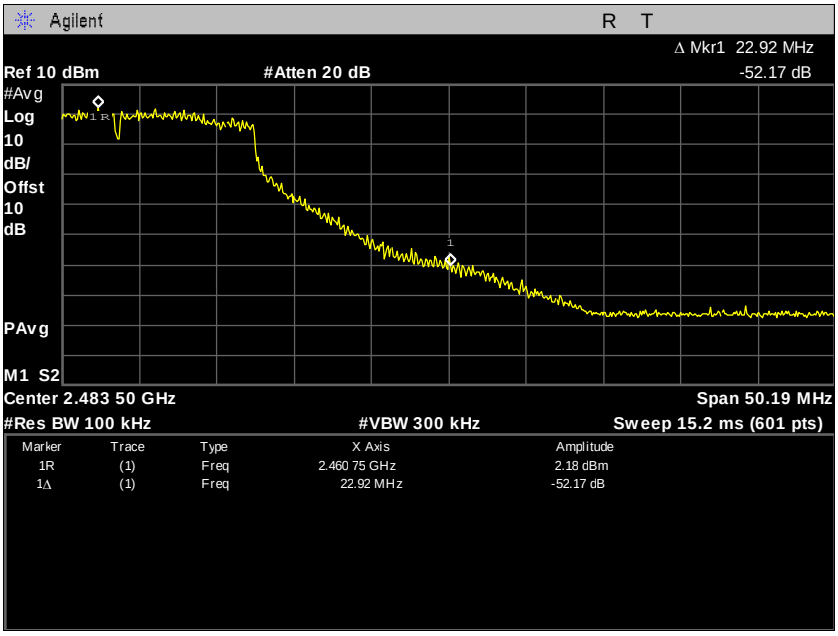
Plot 243. Conducted Band Edge, MIMO, 40 MHz, n mode, port b, High Channel



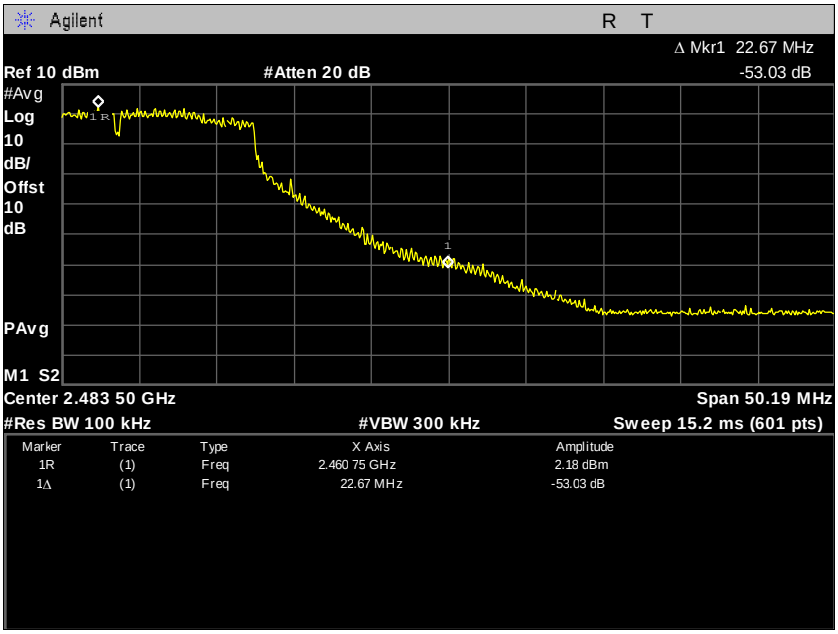
Plot 244. Conducted Band Edge, MIMO, 40 MHz, n mode, port a, Low Channel



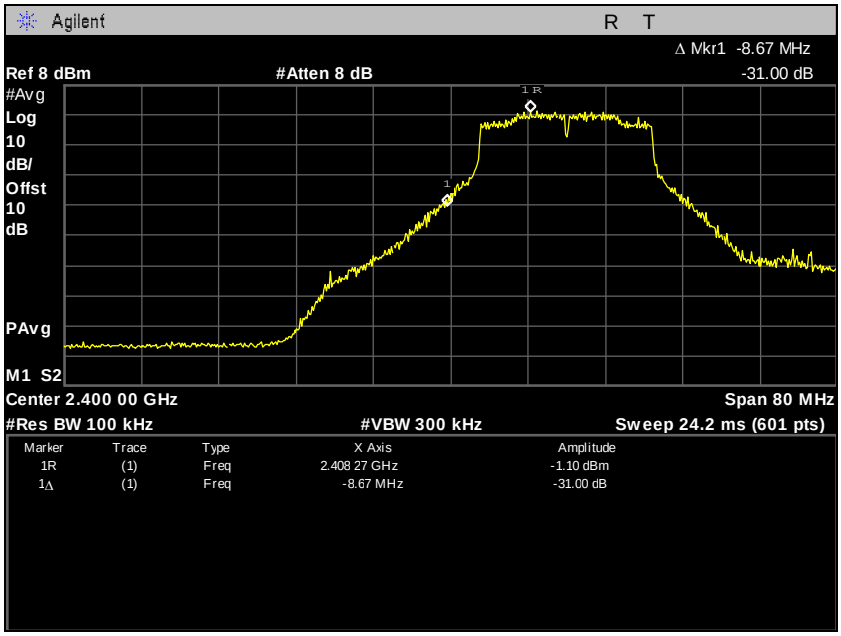
Plot 245. Conducted Band Edge, MIMO, 40 MHz, n mode, port b, Low Channel



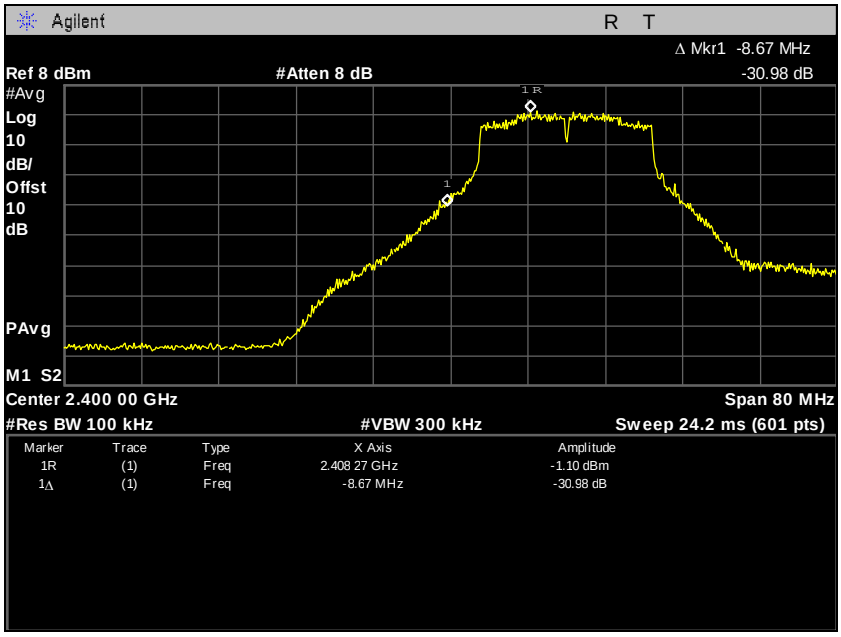
Plot 246. Conducted Band Edge, MIMO, 20 MHz, n mode, port a, High Channel



Plot 247. Conducted Band Edge, MIMO, 20 MHz, n mode, port b, High Channel



Plot 248. Conducted Band Edge, MIMO, 20 MHz, n mode, port a, Low Channel



Plot 249. Conducted Band Edge, MIMO, 20 MHz, n mode, port b, Low Channel

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.247(e) Peak Power Spectral Density

Test Requirements: **§15.247(e):** For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level throughout each of the 100 sweeps of power averaging. The RBW was set to 3 kHz and a VBW set to 9 kHz or greater. The spectrum analyzer was set to an auto sweep time and a peak detector was used. Measurements were carried out at the low, mid and high channels.

Test Results: The EUT was compliant with the peak power spectral density limits of **§ 15.247 (e)**. No anomalies detected.

The peak power spectral density was determined from plots on the following page(s).

Test Engineer: Donald Salguero

Test Date: January 6, 2017

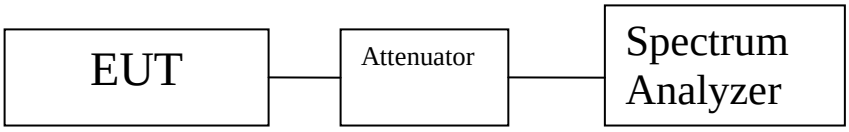


Figure 4. Block Diagram, Peak Power Spectral Density Test Setup

Peak Power Spectral Density Test Results

Channel	Power Port A (dBm)	Limit (dBm)	Margin
BW 20M Ch 2412M b Mode	-3.029	8	11.029
BW 20M Ch 2412M g Mode	-7.878	8	15.878
BW 20M Ch 2412M n Mode	-6.688	8	14.688
BW 20M Ch 2437M b Mode	-2.871	8	10.871
BW 20M Ch 2437M g Mode	-4.490	8	12.490
BW 20M Ch 2437M n Mode	-3.570	8	11.570
BW 20M Ch 2462M b Mode	-1.865	8	9.865
BW 20M Ch 2462M g Mode	-4.762	8	12.762
BW 20M Ch 2462M n Mode	-2.999	8	10.999
BW 40M Ch 2422M n Mode	-8.816	8	16.816
BW 40M Ch 2437M n Mode	-7.920	8	15.920
BW 40M Ch 2452M n Mode	-9.092	8	17.092

Table 15. Power Spectral Density Table, Port A SISO

Channel	Power Port B (dBm)	Limit (dBm)	Margin
BW 20M Ch 2412M b Mode	-5.340	8	13.340
BW 20M Ch 2412M g Mode	-8.460	8	16.460
BW 20M Ch 2412M n Mode	-8.116	8	16.116
BW 20M Ch 2437M b Mode	-2.140	8	10.140
BW 20M Ch 2437M g Mode	-3.790	8	11.790
BW 20M Ch 2437M n Mode	-5.095	8	13.095
BW 20M Ch 2462M b Mode	-1.080	8	9.080
BW 20M Ch 2462M g Mode	-3.630	8	11.630
BW 20M Ch 2462M n Mode	-6.886	8	14.886
BW 40M Ch 2422M n Mode	-14.770	8	22.770
BW 40M Ch 2437M n Mode	-7.616	8	15.616
BW 40M Ch 2452M n Mode	-9.876	8	17.876

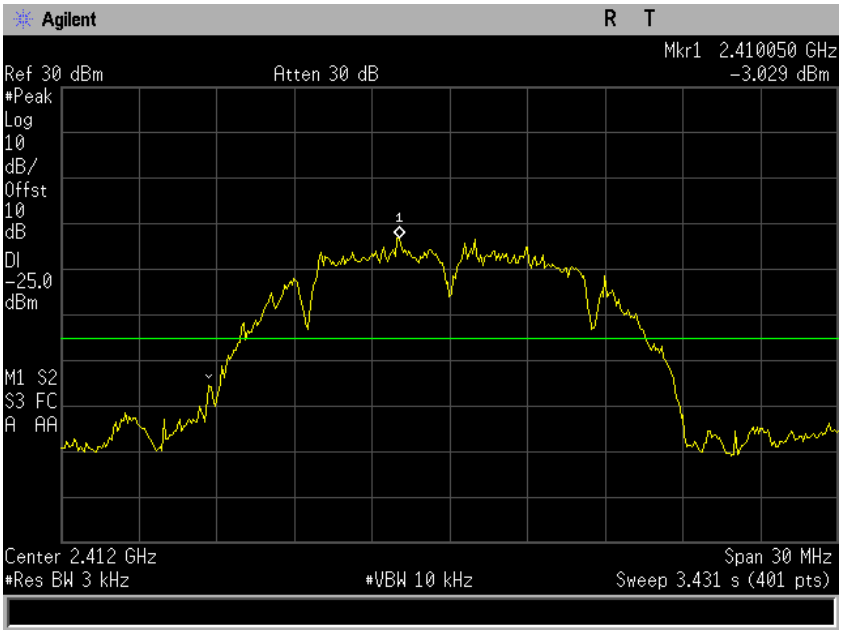
Table 16. Power Spectral Density Table, Port B, SISO

Channel	Port 1 (dBm)	Port 2 (dBm)	Sum (dBm)	Limit (dBm)	Margin
BW 20M Ch 2412M n Mode	-9.932	-9.91	-6.91	8	14.91
BW 20M Ch 2437M n Mode	-3.873	-4.99	-1.39	8	9.39
BW 20M Ch 2462M n Mode	-7.669	-8.85	-5.21	8	13.21
BW 40M Ch 2422M n Mode	-14.19	-15.14	-11.63	8	19.63
BW 40M Ch 2437M n Mode	-7.336	-6.68	-3.99	8	11.99
BW 40M Ch 2452M n Mode	-9.527	-9.89	-6.69	8	14.69

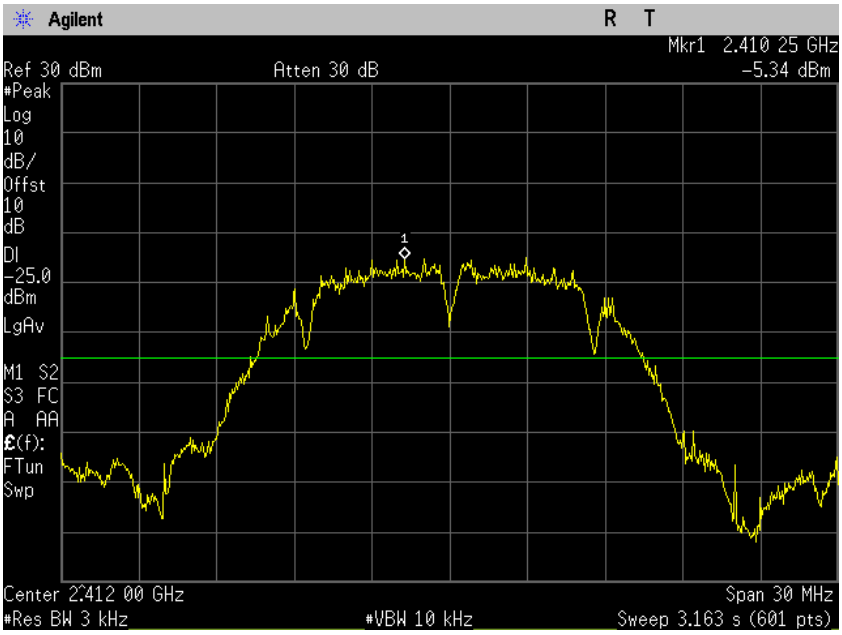
Table 17. Power Spectral Density Table, MIMO

Peak Power Spectral Density

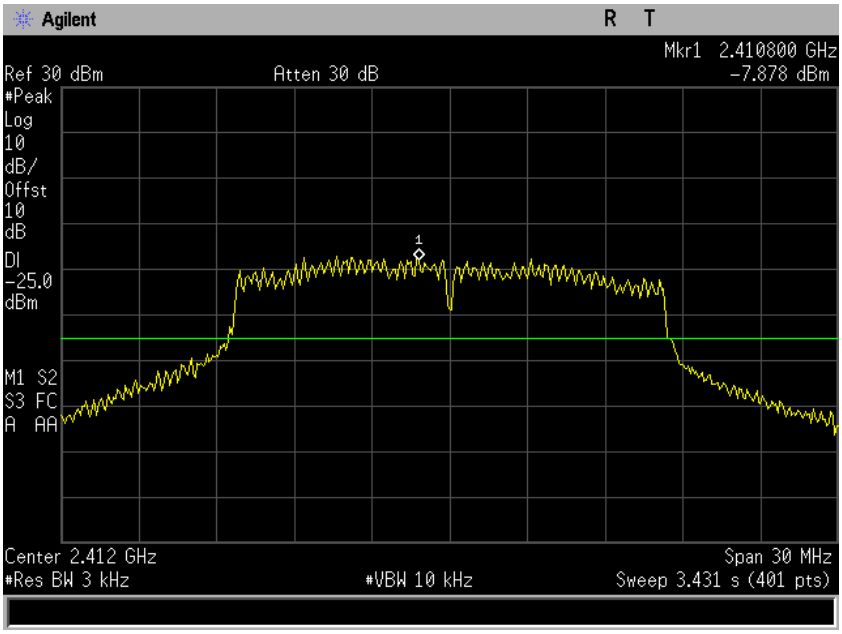
SISO



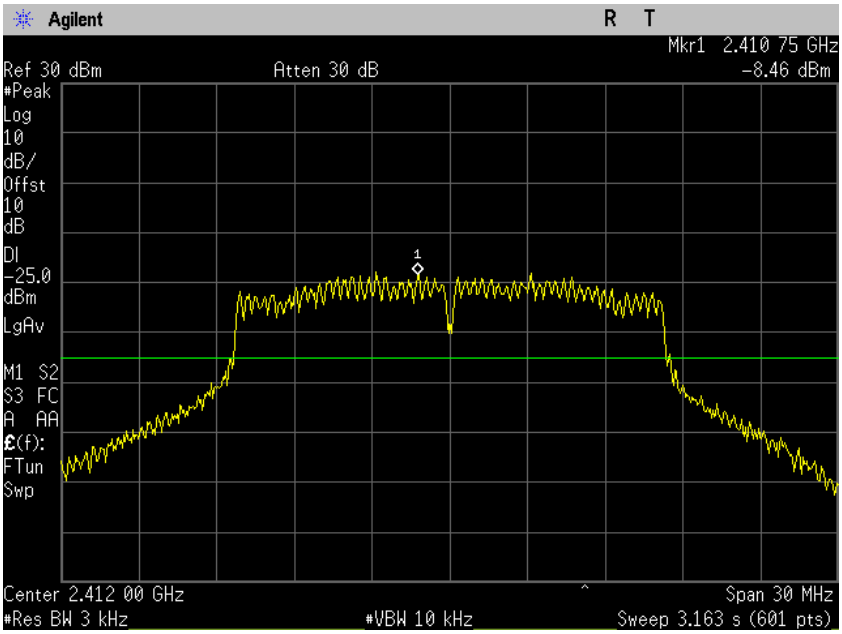
Plot 250. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2412, b mode,port a



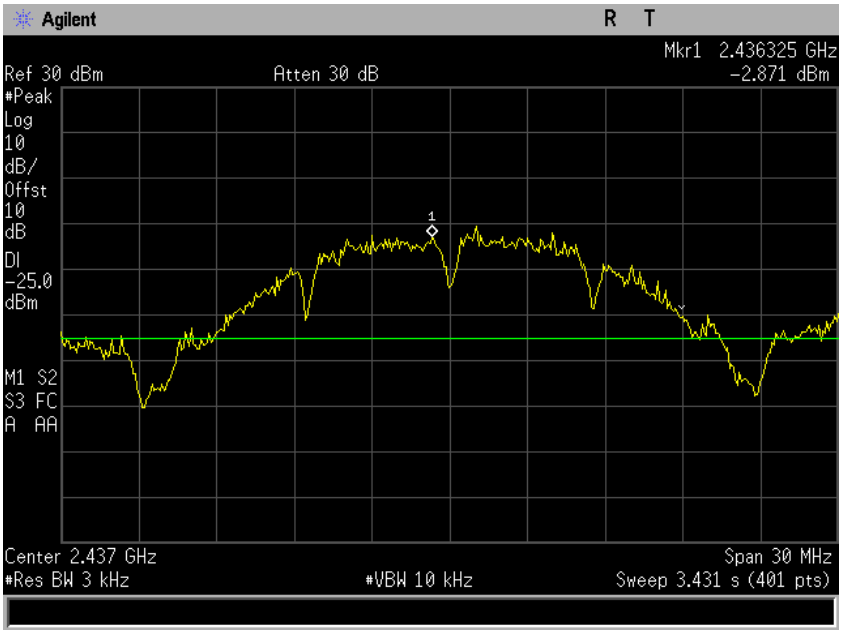
Plot 251. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2412M, b mode, port b



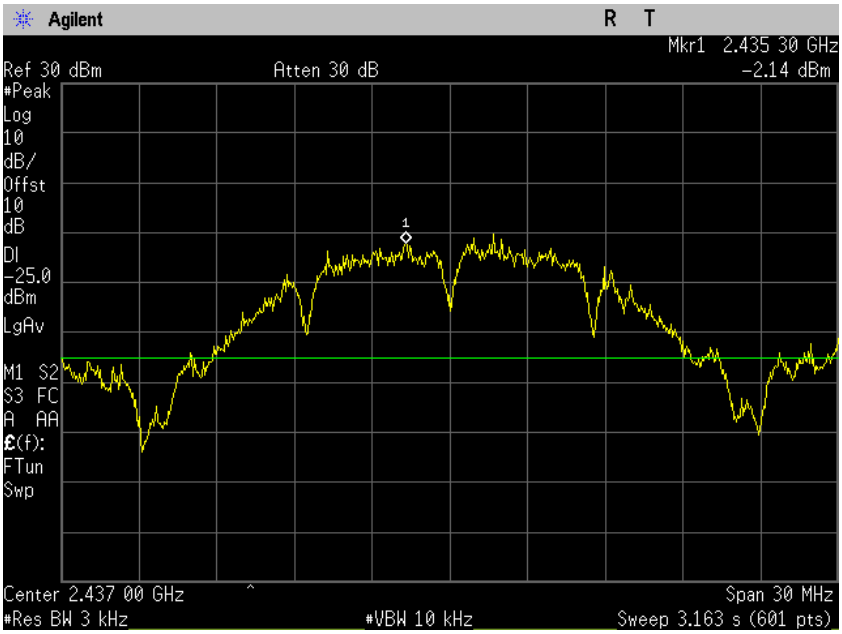
Plot 252. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2412M, g mode, port a



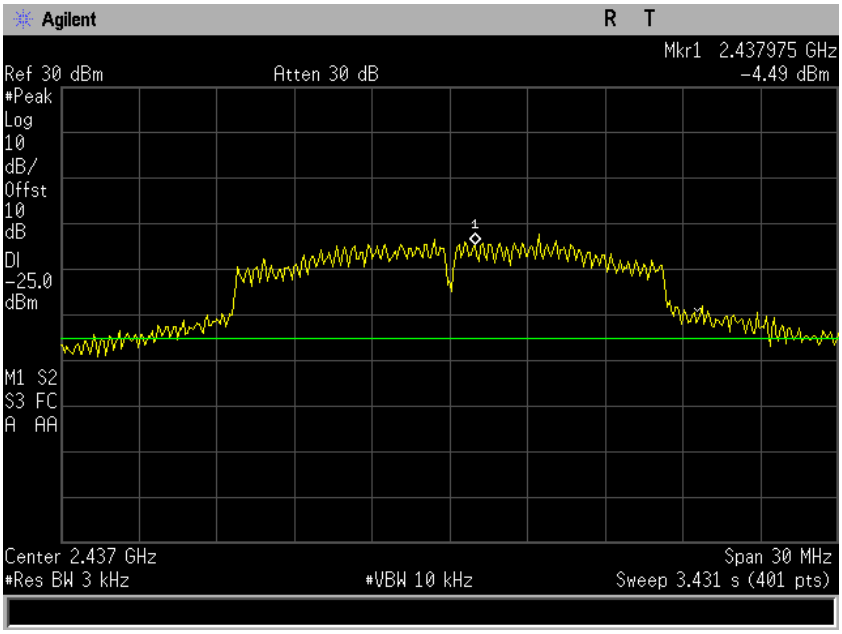
Plot 253. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2412M, g mode, port b



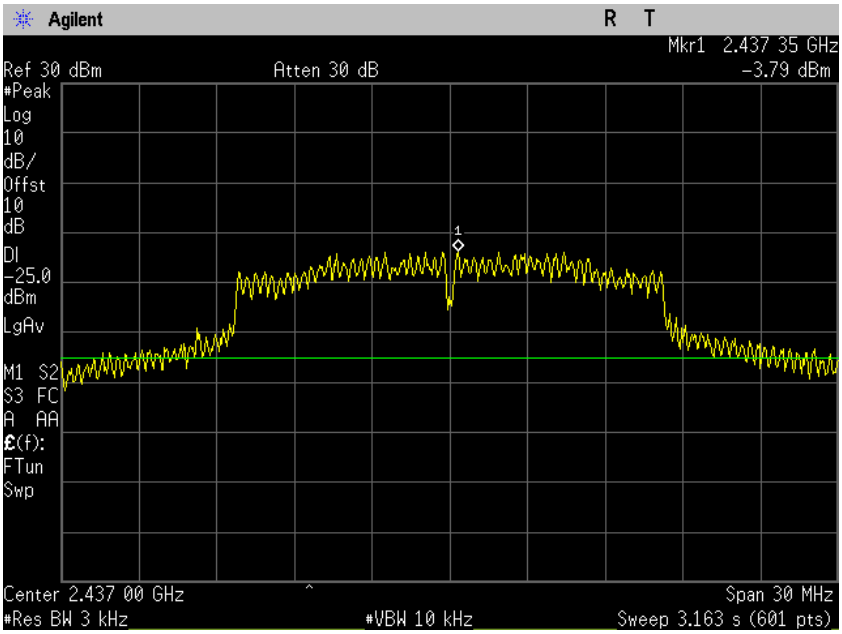
Plot 254. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2437M, b mode, port a



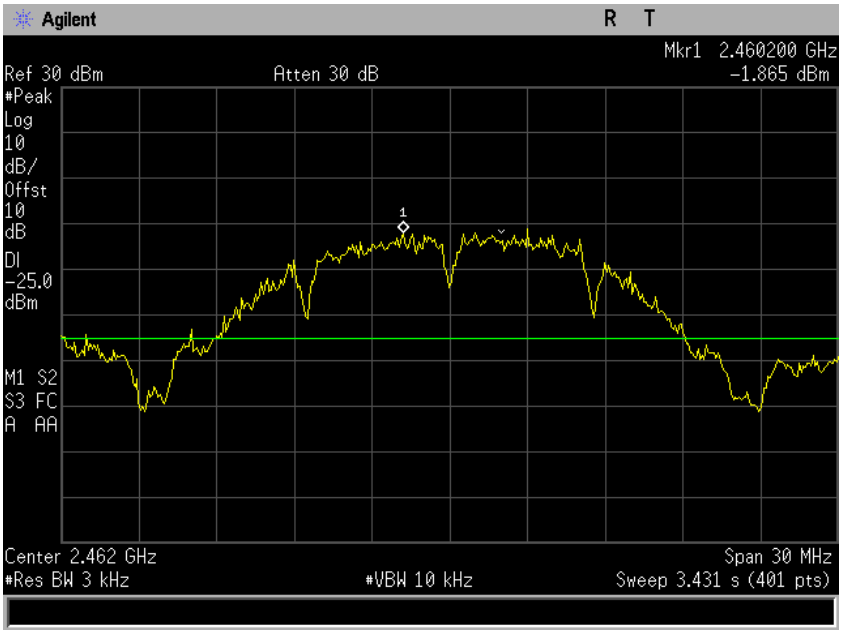
Plot 255. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2437M, b mode, port b



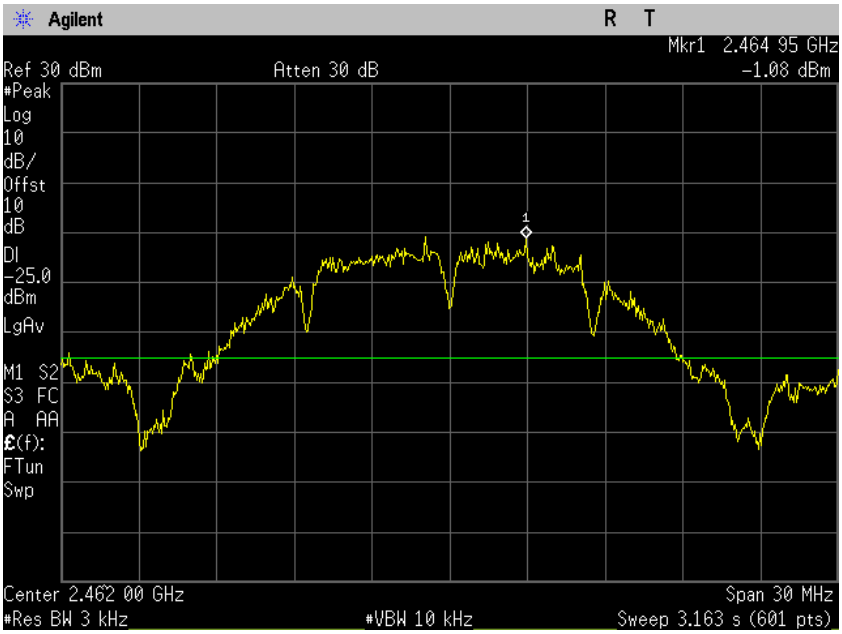
Plot 256. Power Spectral Density, SISO, 20M, Ch. 2437M, g mode, port a



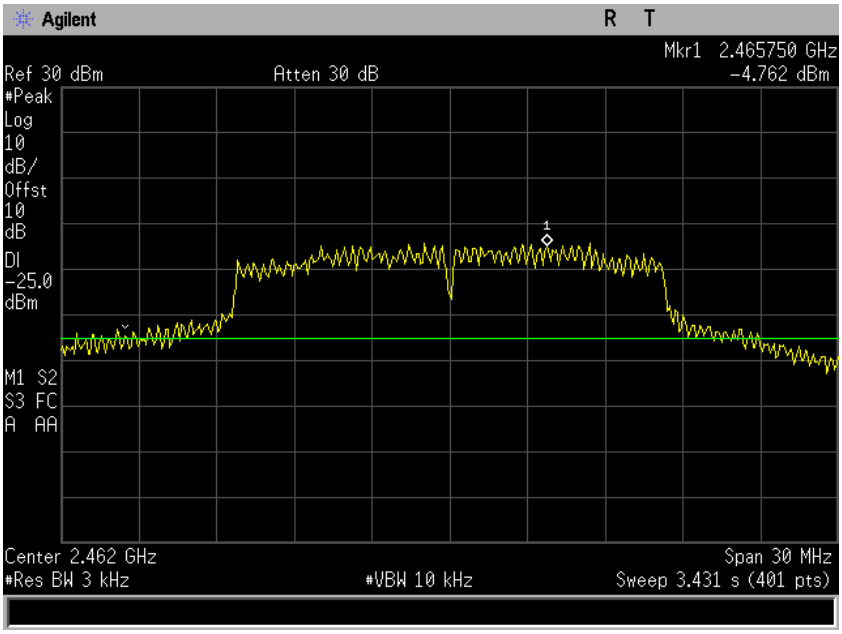
Plot 257. Power Spectral Density, SISO, 20M, Ch. 2437M, g mode, port b



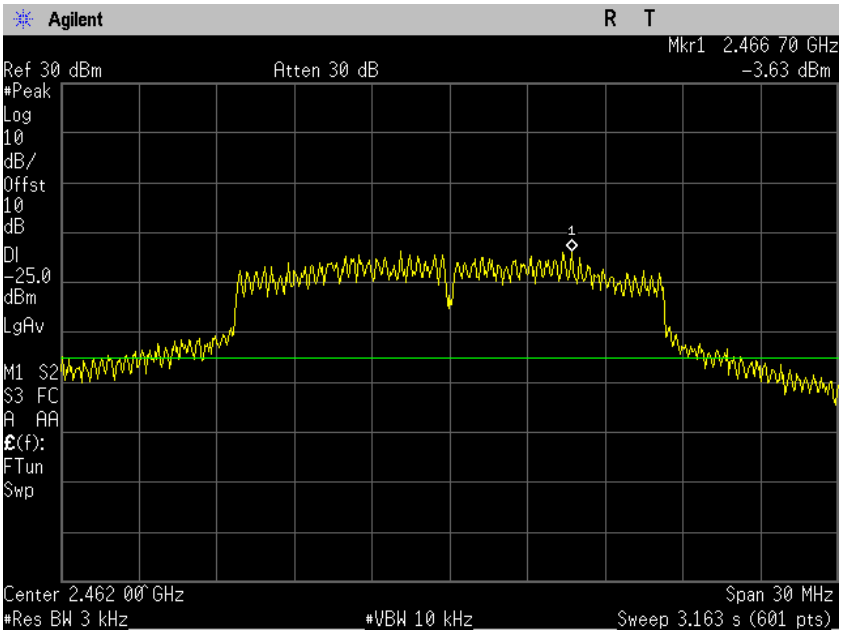
Plot 258. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2462M, b mode, port a



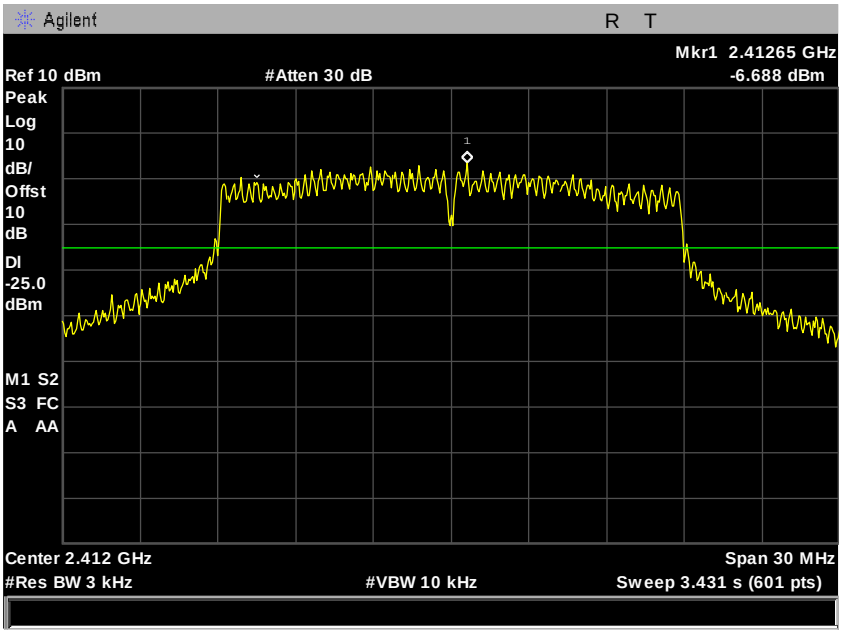
Plot 259. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2462M, b mode, port b



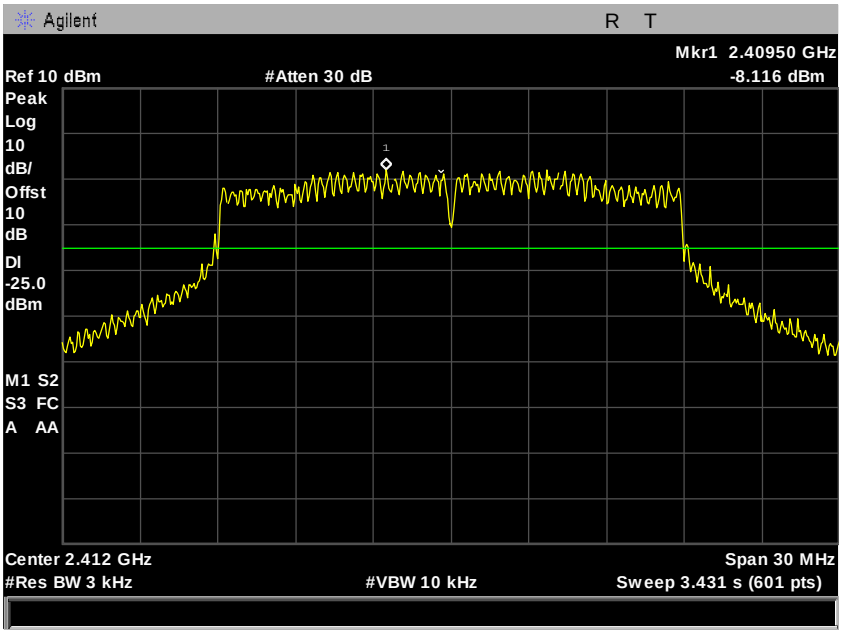
Plot 260. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2462M, g mode, port a



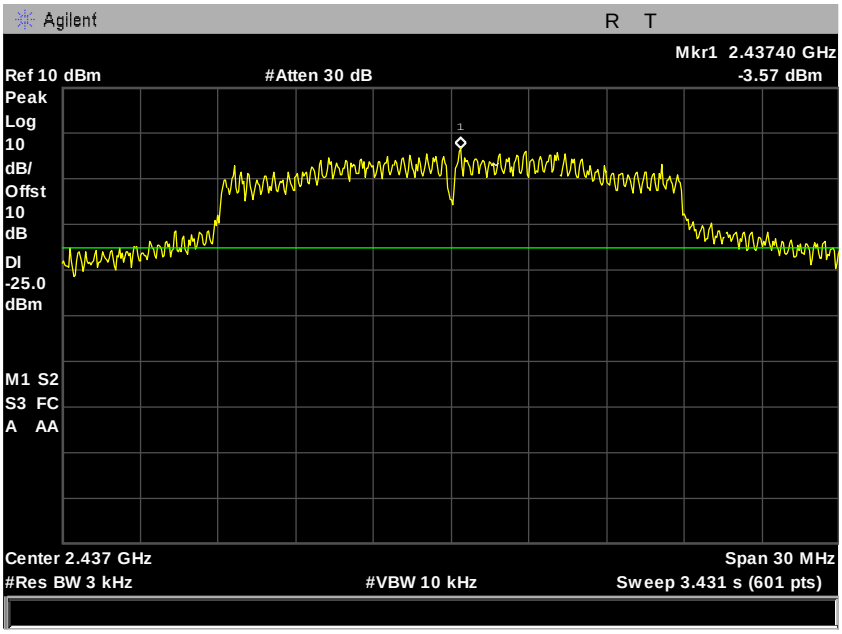
Plot 261. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2462M, g mode, port b



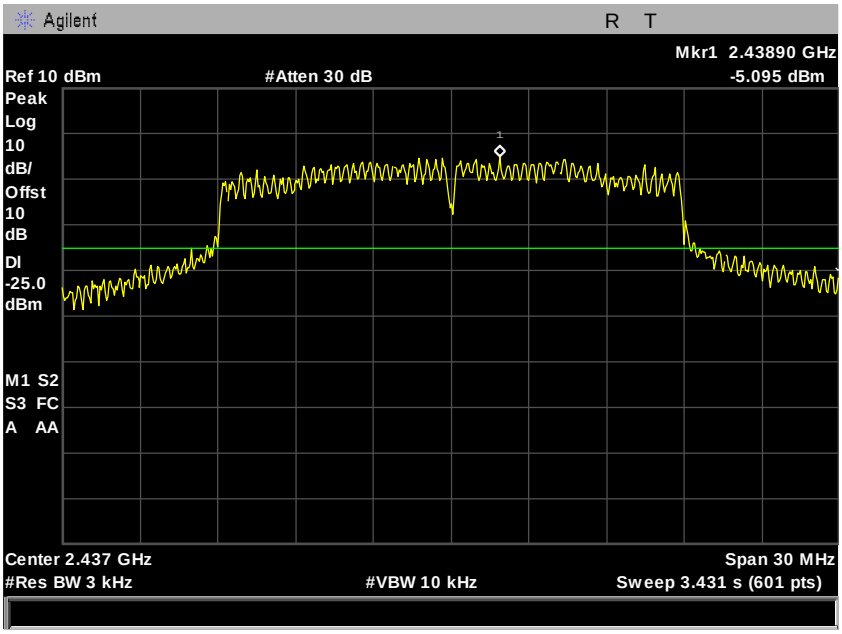
Plot 262. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2412M, n mode, port a



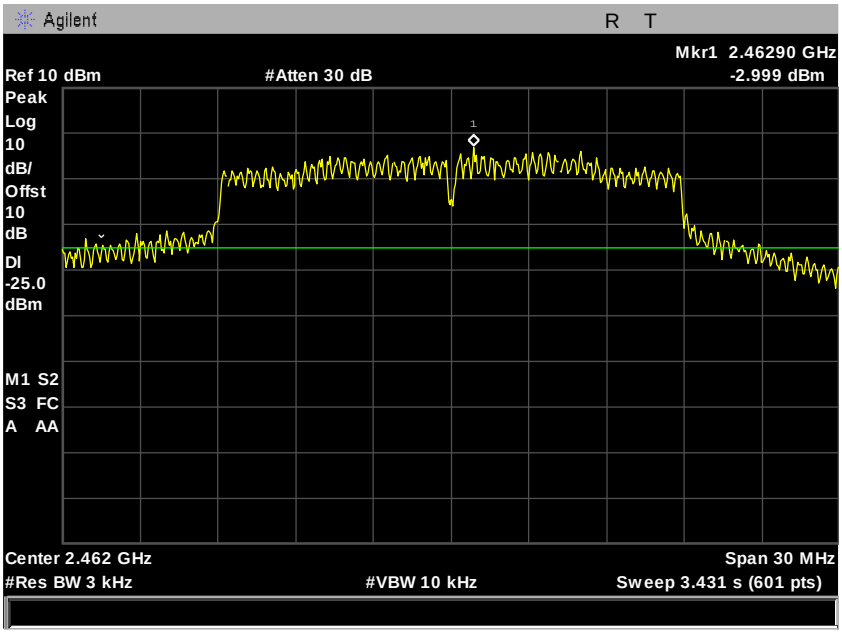
Plot 263. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2412M, n mode, port b



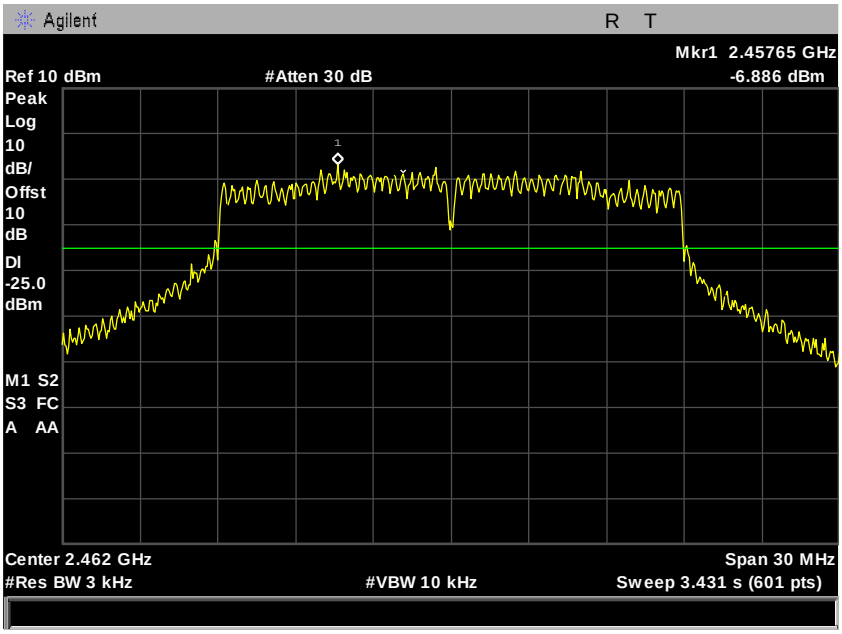
Plot 264. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2437M, n mode, port a



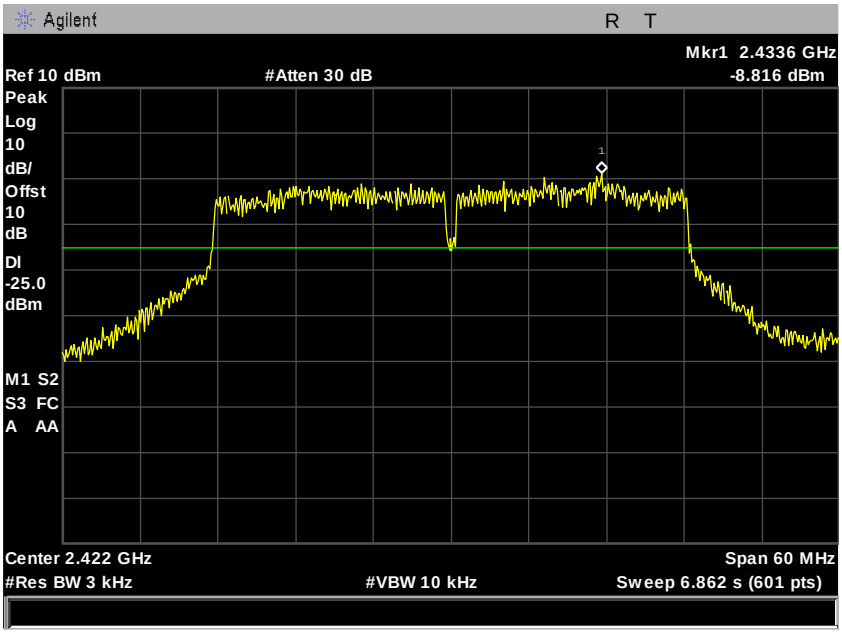
Plot 265. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2437M, n mode, port b



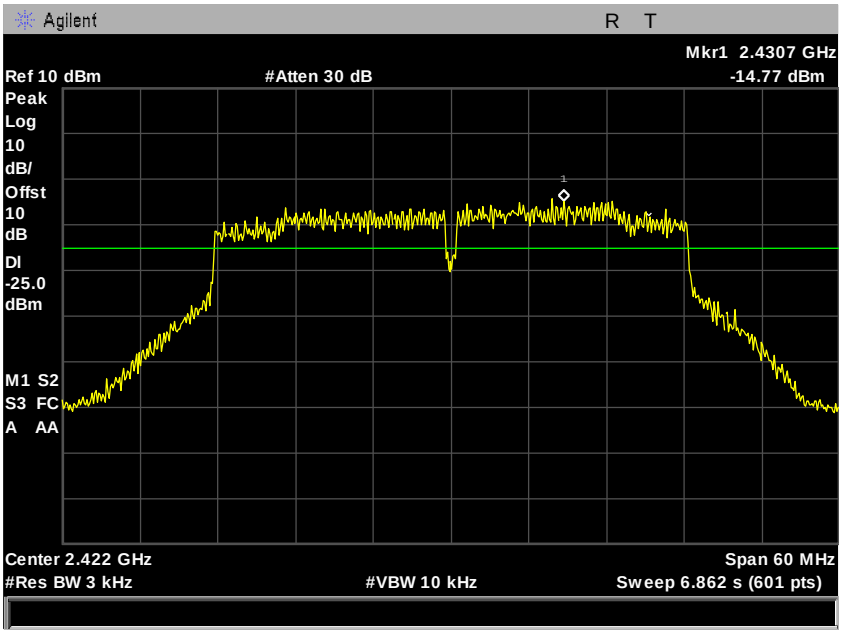
Plot 266. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2462M, n mode, port a



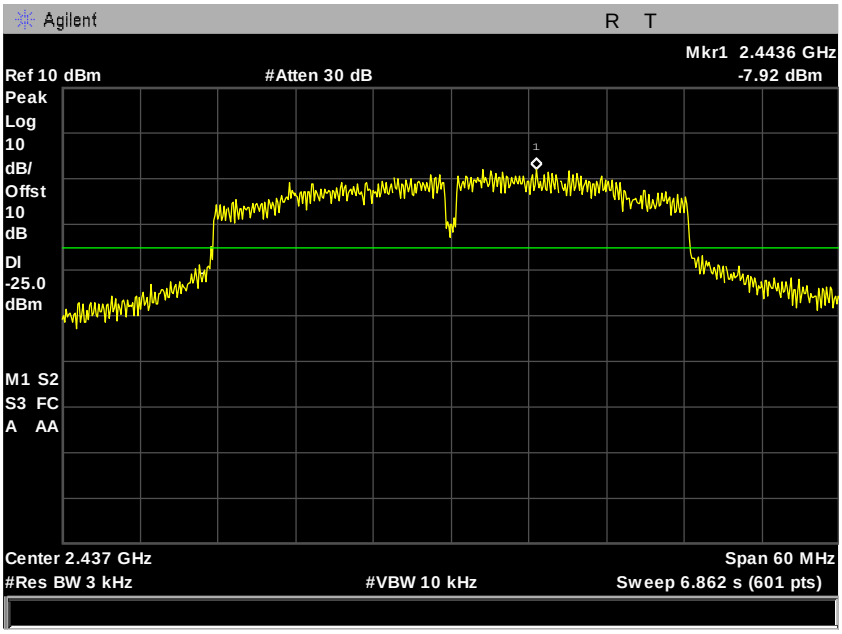
Plot 267. Power Spectral Density, SISO, Bandwidth 20M, Ch. 2462M, n mode, port b



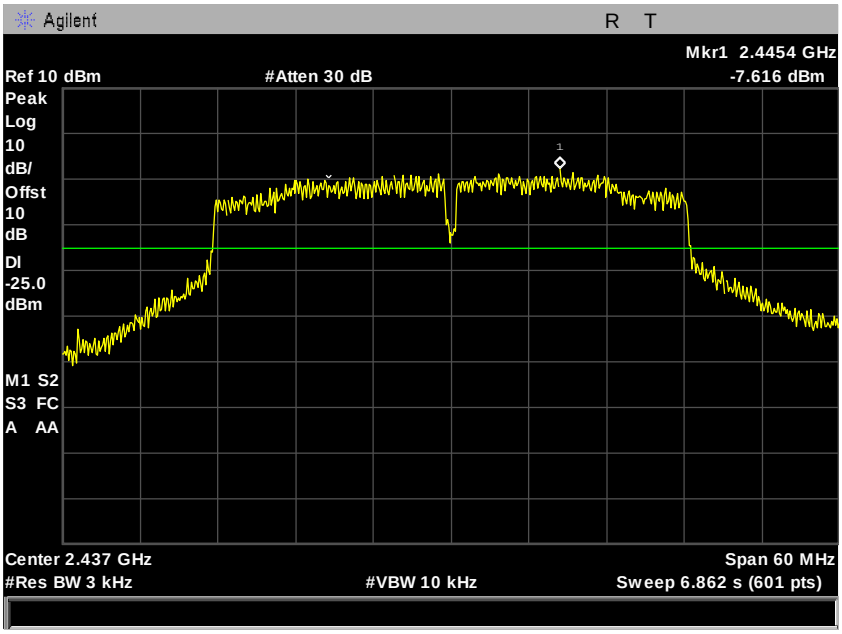
Plot 268. Power Spectral Density, SISO, Bandwidth 40M, Ch. 2422M, n mode, port a



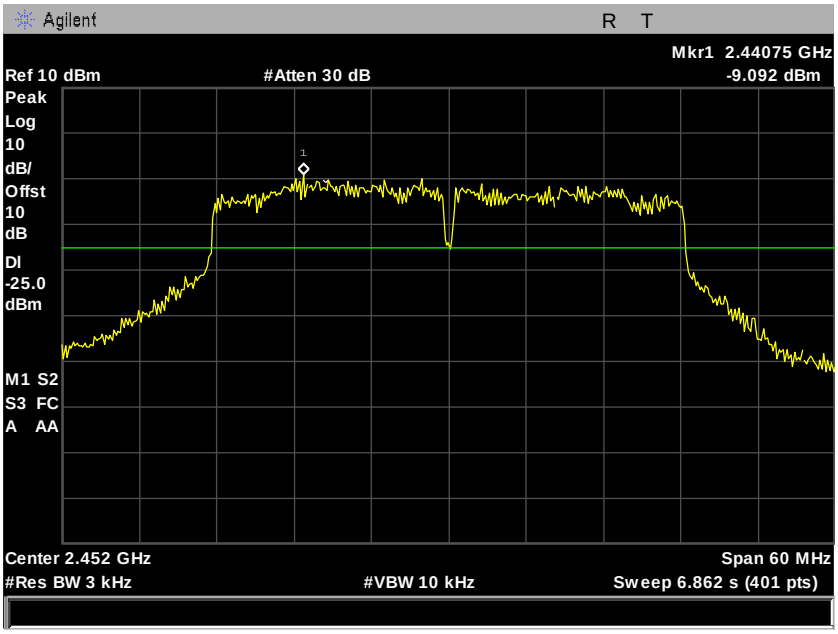
Plot 269. Power Spectral Density, SISO, Bandwidth 40M, Ch. 2422M, n mode, port b



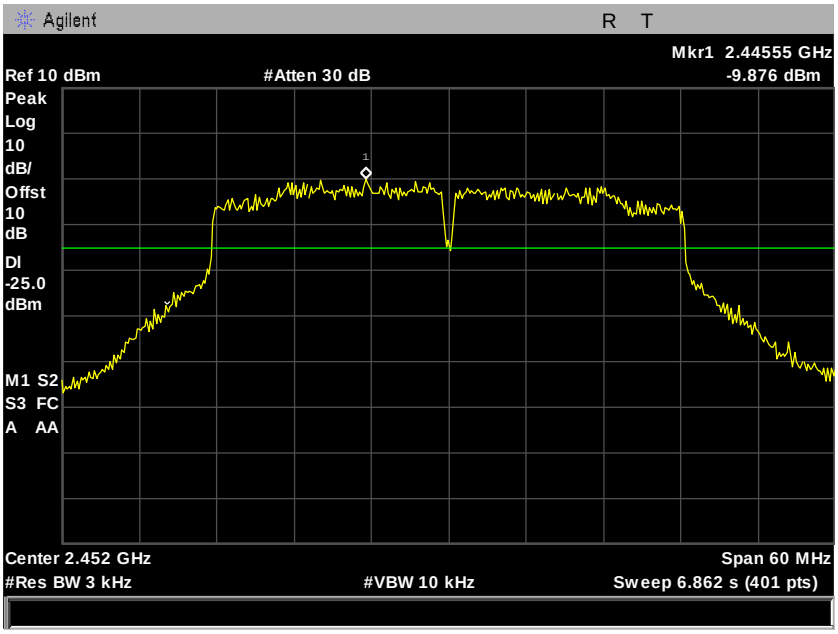
Plot 270. Power Spectral Density, SISO, Bandwidth 40M, Ch. 2437M, n mode, port a



Plot 271. Power Spectral Density, SISO, Bandwidth 40M, Ch. 2437M, n mode, port b

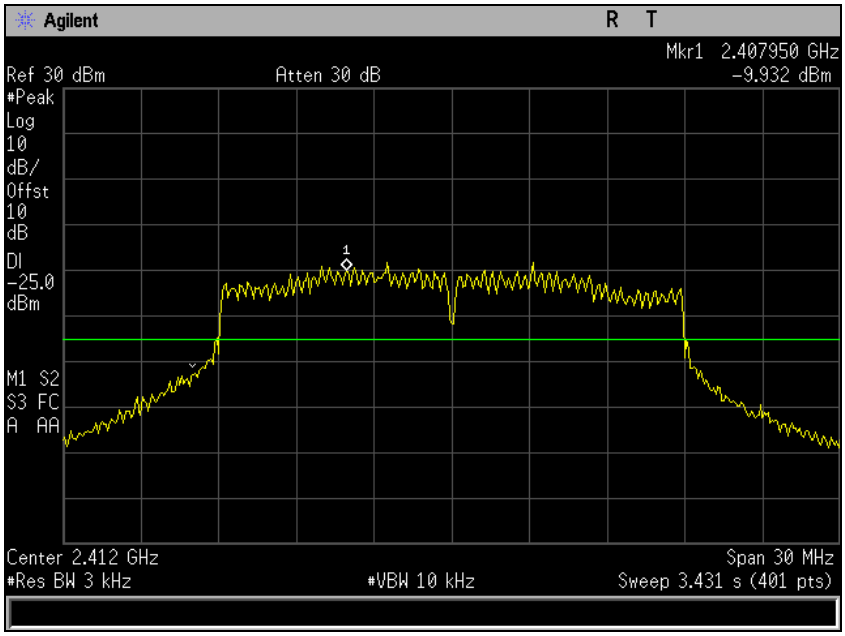


Plot 272. Power Spectral Density, SISO, Bandwidth 40M, Ch. 2452M, n mode, port a

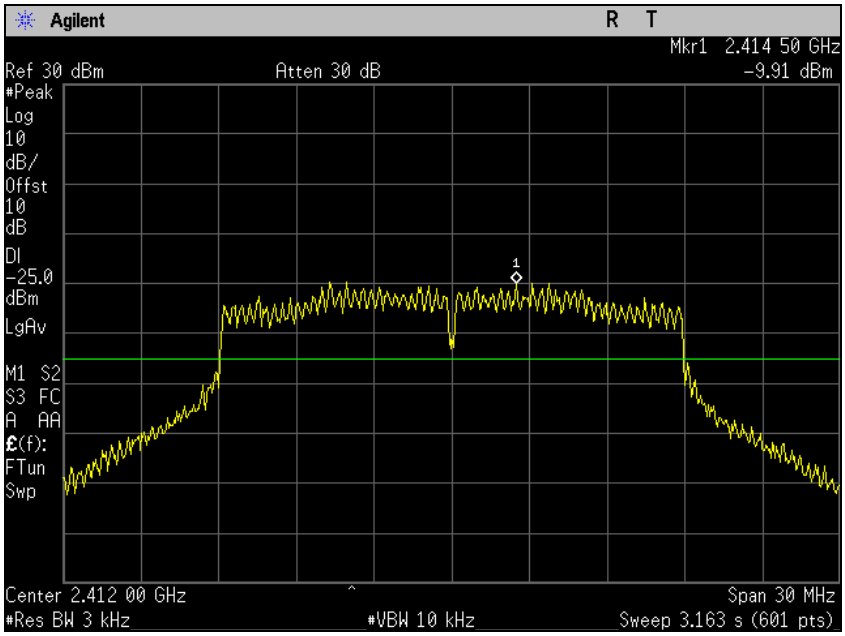


Plot 273. Power Spectral Density, SISO, Bandwidth 40M, Ch. 2452M, n mode, port b

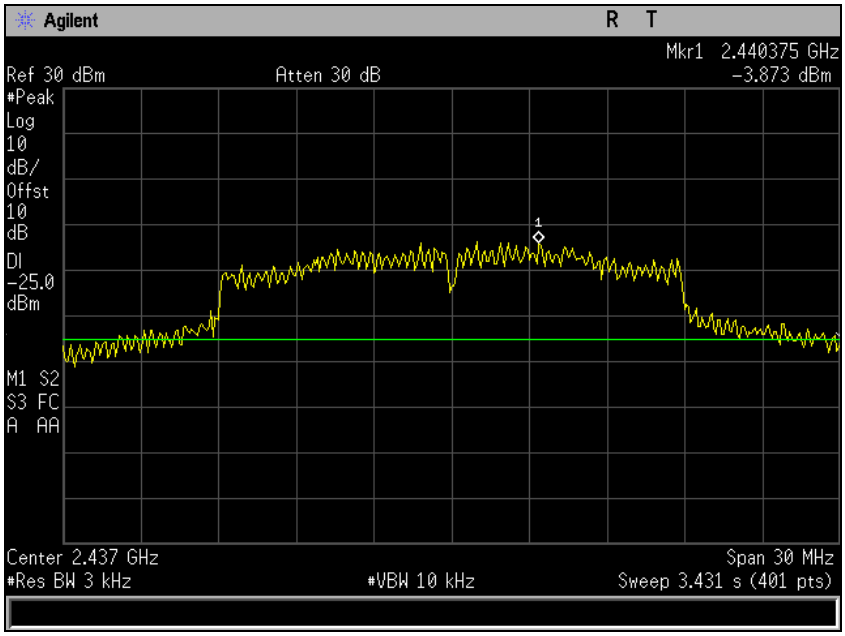
MIMO



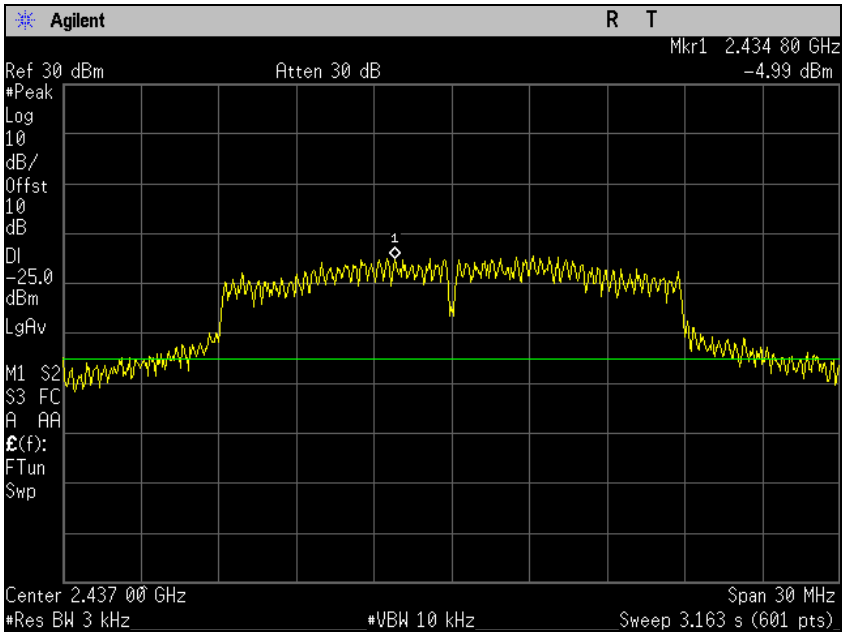
Plot 274. Power Spectral Density, MIMO, Bandwidth 20M, Ch. 2412M, n mode, port a



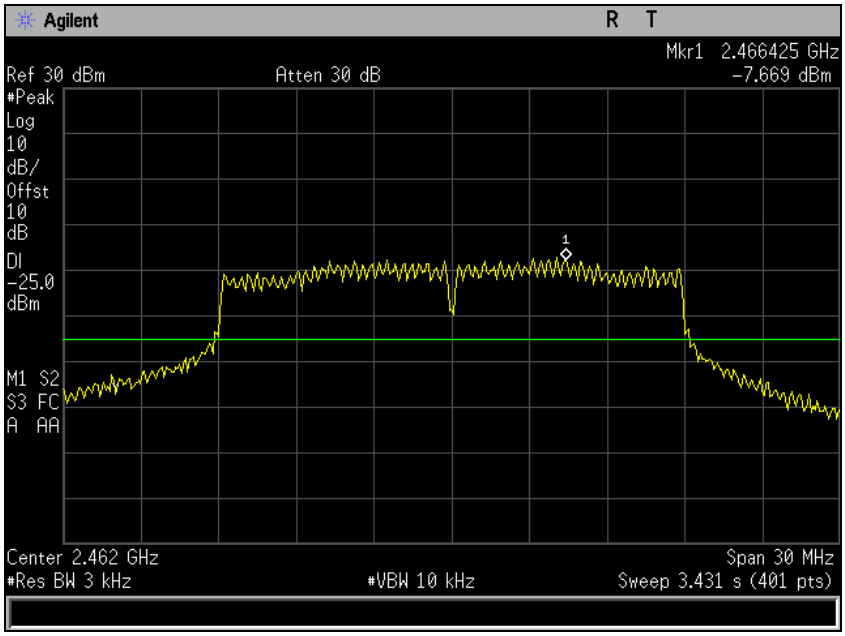
Plot 275. Power Spectral Density, MIMO, Bandwidth 20M, Ch. 2412M, n mode, port b



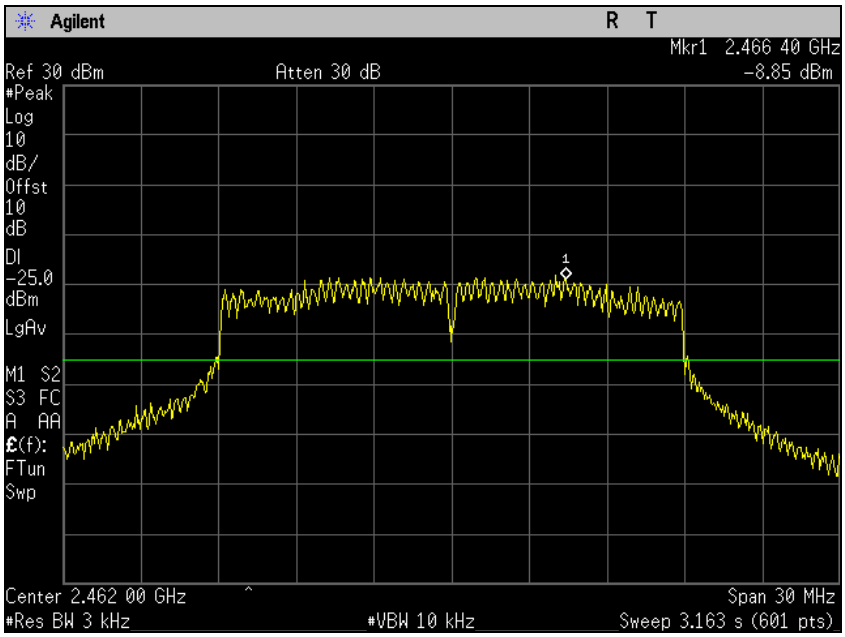
Plot 276. Power Spectral Density, MIMO, Bandwidth 20M, Ch. 2437M, n mode, port a



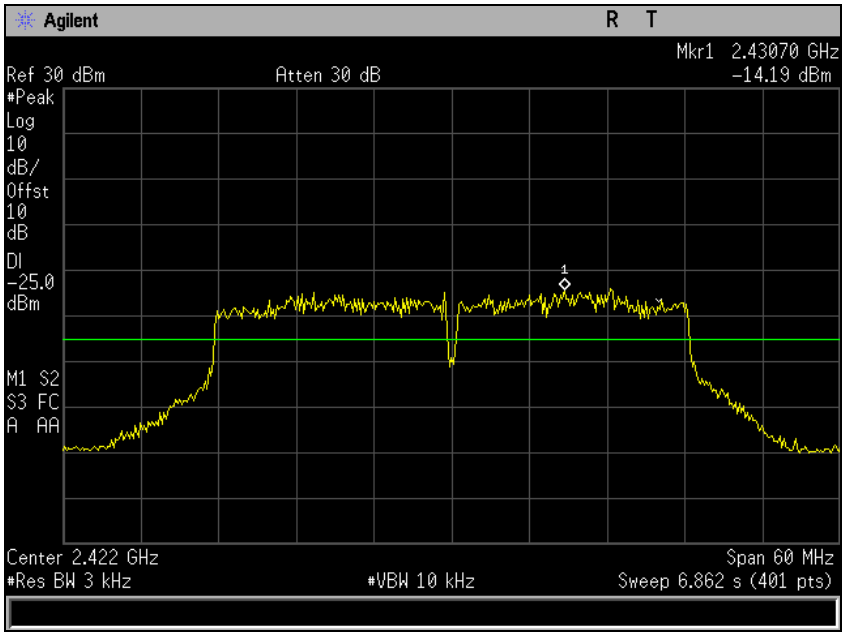
Plot 277. Power Spectral Density, Bandwidth 20M, Ch. 2437M, n mode, port b



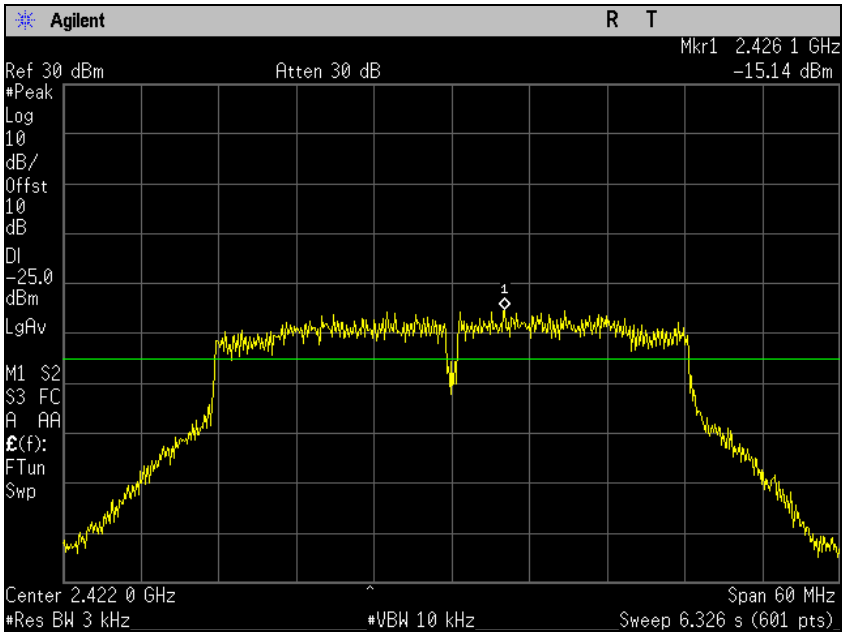
Plot 278. Power Spectral Density, Bandwidth 20M, Ch. 2462M, n mode, port a



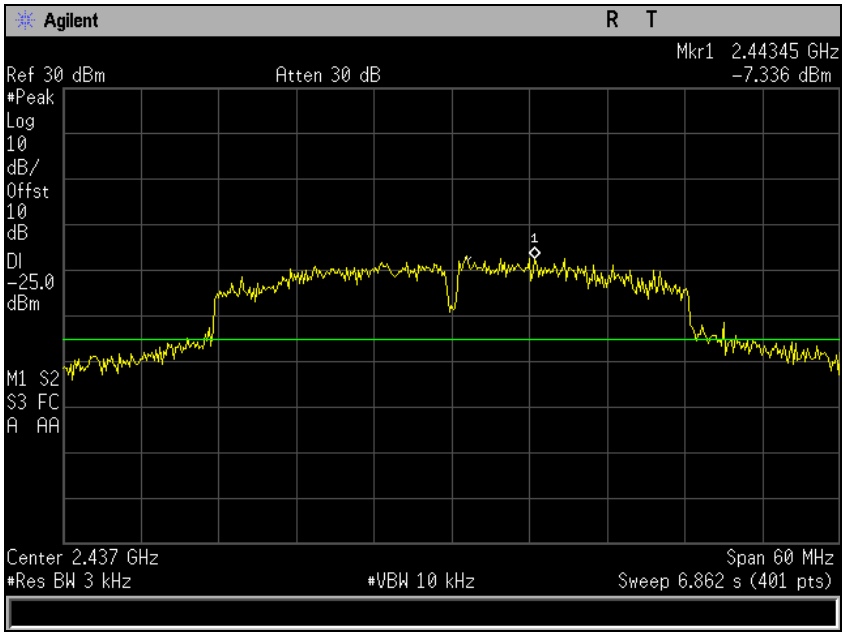
Plot 279. Power Spectral Density, MIMO, Bandwidth 20M, Ch 2462M, n mode, port b



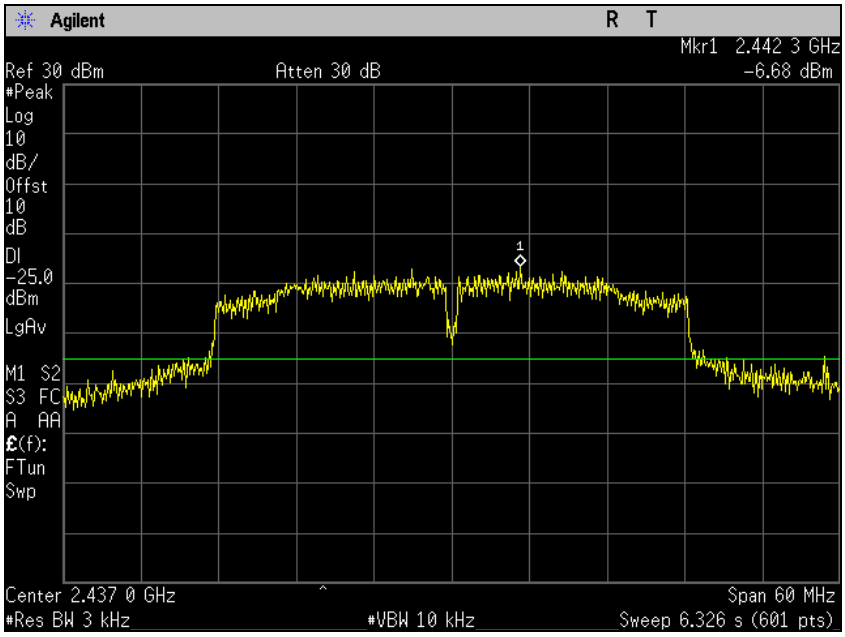
Plot 280. Power Spectral Density, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port a



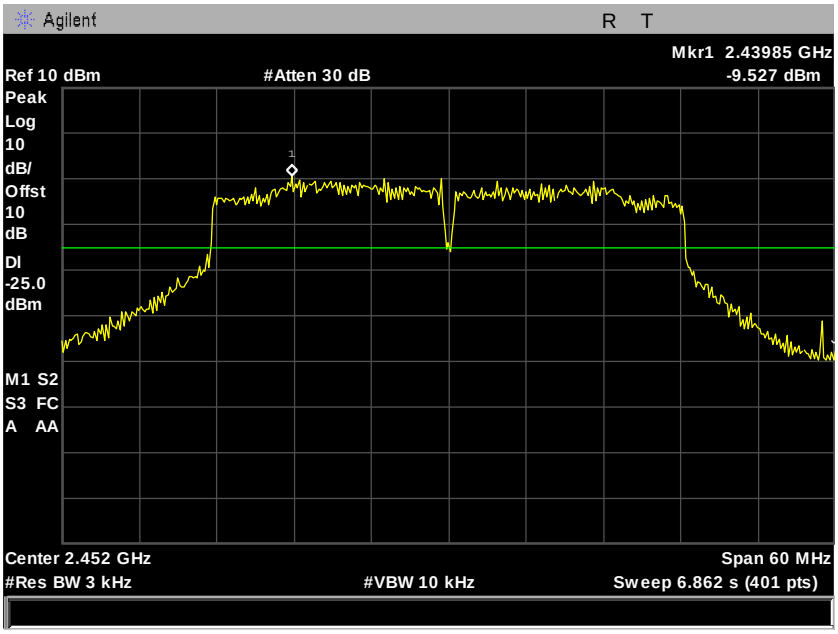
Plot 281. Power Spectral Density, MIMO, Bandwidth 40M, Ch. 2422M, n mode, port b



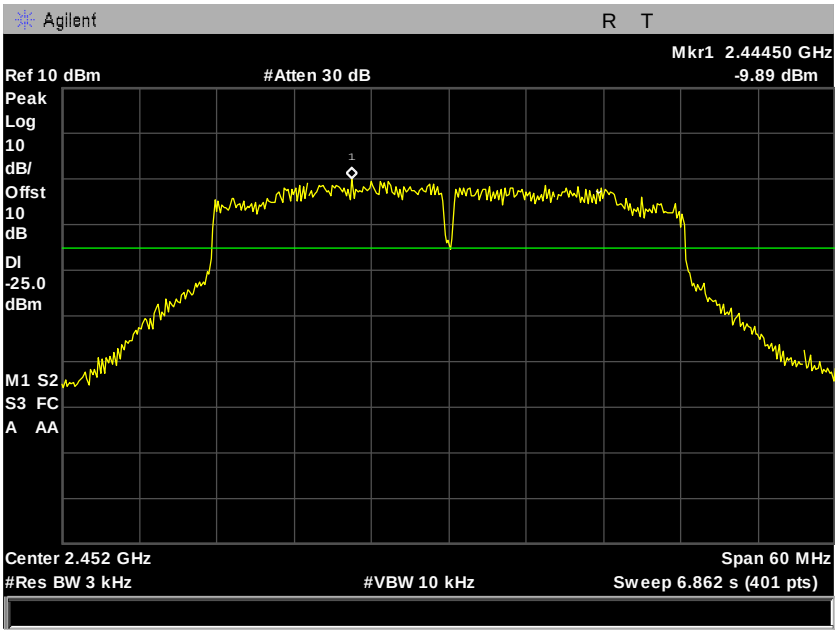
Plot 282. Power Spectral Density, MIMO, Bandwidth 40M, Ch. 2437M, n mode, port a



Plot 283. Power Spectral Density, MIMO, Bandwidth 40M, Ch. 2437M, n mode, port b



Plot 284. Power Spectral Density, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port a



Plot 285. Power Spectral Density, MIMO, Bandwidth 40M, Ch. 2452M, n mode, port b

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
1T6658	SPECTRUM ANALYZER	AGILENT	E4407B	12/21/2016	12/21/2017
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	10/08/2015	04/08/2017
1T4771	PSA SPECTRUM ANALYZER	AGILENT TECHNOLOGIES	E4446A	8/10/2016	02/10/2018
1T4300B	SEMI-ANECHOIC 3M CHAMBER # 1 D (2043A-1) (IC)	EMC TEST SYSTEMS	NONE	01/11/2015	01/11/2018
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	12/7/2016	12/7/2018
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	2/26/2016	8/26/2017
331T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY PROOF	81	NOT REQUIRED	

Table 18. Test Equipment List

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

V. Certification & User's Manual Information

Certification & User's Manual Information

A. Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

§ 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

(a) The various types of radio communication transmitting devices described throughout this chapter.

(b) The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.

(c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.

(d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

§ 2.803 Marketing of radio frequency devices prior to equipment authorization.

(a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:

(1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or

(2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.

(d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.

(e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:

(i) Compliance testing;

(ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;

(iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or

(v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.

(e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.

(f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.

Certification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:

§ 2.901 Basis and Purpose

(a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.[1] *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.

(b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

§ 2.907 Certification.

(a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.

(b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

[1] In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.

Certification & User's Manual Information

§ 2.948 Description of measurement facilities.

(a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.

(1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.

(i) If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.

(ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.

(2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.

Certification & User's Manual Information

1. Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

§ 15.19 Labeling requirements.

(a) In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

§ 15.21 Information to user.

The user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 15.105 Information to the user.

(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at own expense.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

– Reorient or relocate the receiving antenna.

– Increase the separation between the equipment and receiver.

– Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

– Consult the dealer or an experienced radio/TV technician for help.

End of Report

