

October 28, 2019

Trimble Jena GmbH
Carl-Zeiss-Promenade 10
Jena 07743, Germany

Dear Eyk Taege,

Enclosed is the EMC Wireless test report for compliance testing of the Trimble Comm Board Hurricane, tested to the requirements of Title 47 of the CFR Part 15.407 Subpart E for Intentional Radiators.

Thank you for using the services of Eurofins 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,
Eurofins MET LABORATORIES, INC.



Mae Ramirez
Documentation Department

Reference: (\\Virscient Limited\\EMC102611-FCC407 UNII-3 Rev 2)

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Electromagnetic Compatibility Criteria Test Report

For the

Trimble Comm Board Hurricane (V0013E)

Tested under
the FCC Certification Rules
contained in
15.407 Subpart E for Intentional Radiators

MET Report: EMC102611-FCC407 UNII-3 Rev. 2

October 28, 2019

Prepared For:

**Trimble Jena GmbH
Carl-Zeiss-Promenade 10
Jena 07743 Germany**

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

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Trimble Comm Board Hurricane (V0013E)

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the FCC Certification Rules
contained in
15.407 Subpart E for Intentional Radiators



Arsalan Hasan, Project Engineer
Electromagnetic Compatibility Lab



Mae Ramirez
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 Parts 15C, 15.407, of the FCC Rules under normal use and maintenance.



Sandeep Brar
Manager, Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	October 29, 2019	Initial Issue.
1	February 5, 2020	TCB updates
2	February 10, 2020	TCB updates

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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dB _μ A	Decibels above one microamp
dB _μ V	Decibels above one microvolt
dB _μ A/m	Decibels above one microamp per meter
dB _μ V/m	Decibels above one microvolt per meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	Kilohertz
kPa	Kilopascal
kV	Kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	Microhenry
μ	Microfarad
μs	Microseconds
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Trimble Comm Board Hurricane V0013E, with the requirements of Part 15, §15.407. 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 V0013E. Trimble should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the V0013E, 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, §15.407, in accordance with Trimble Jena GmbH, purchase order number 20180075. All tests were conducted using measurement procedure ANSI C63.10-2013.

FCC Reference	Description	Results
§15.203	Antenna Requirement	Compliant
§15.407 (a)(3)	Maximum Conducted Output Power	Compliant
§15.407 (a)(3)	Maximum Power Spectral Density	Compliant
§15.407 (b)(4)& (6 - 7)	Undesirable Emissions	Compliant
§15.407(b)(6)	Conducted Emission Limits	Not Applicable
§15.407(e)	6 dB Bandwidth	Compliant
§15.407(f)	RF Exposure	Compliant
§15.407(g)	Frequency Stability	Compliant

Table 1. Executive Summary of EMC Part 15.407 Compliance Testing

Note: Frequency stability is provided by the TCXO datasheet provided by the chip manufacturer.

II. Equipment Configuration

A. Overview

Eurofins MET Laboratories, Inc. was contracted by Trimble Jena GmbH to perform testing on the Trimble Comm Board Hurricane, under Trimble's purchase order number 20180075.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Trimble Comm Board Hurricane V0013E.

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

Model(s) Tested:	V0013E		
Model(s) Covered:	V0013E		
EUT Specifications:	Primary Power: 5 VDC		
	FCC ID: YK5-73350047		
	Type of Modulations:	BPSK, QPSK, 16QAM, 64QAM	
	Equipment Code:	NII	
	Max. RF Output Power:	20.33 dBm	
	EUT Frequency Ranges:	5745 MHz - 5825 MHz	
	Duty Cycle Tested:	100%	
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 15-35° C		
	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		
Evaluated by:	Arsalan Hasan		
Report Date(s):	October 20, 2019		

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
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 789033	Procedures for UNII devices
KDB 662911	Guidance for Measurement of Transmitters with Multiple Output MIMO.

Table 3. References

C. Test Site

All testing was performed at Eurofins MET Labs Inc, 3162 Belick St., Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Eurofins MET Labs is a ISO/IEC 17025 accredited site by A2LA, California #0591.02.

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%

Table 4. Measurement Uncertainty

E. Description of Test Sample

The Trimble Hurricane Communication Subsystem is an 802.11a/b/g/n/ac 2.4 GHz and 5 GHz dual-band Wi-Fi and Bluetooth module that acts as a communication controller/bridge for use with a long-range wireless scanner. The core chipset is a Qualcomm QCA9378-7 and a Qualcomm CSR8811.

[2] Dual-band antennas (x2)

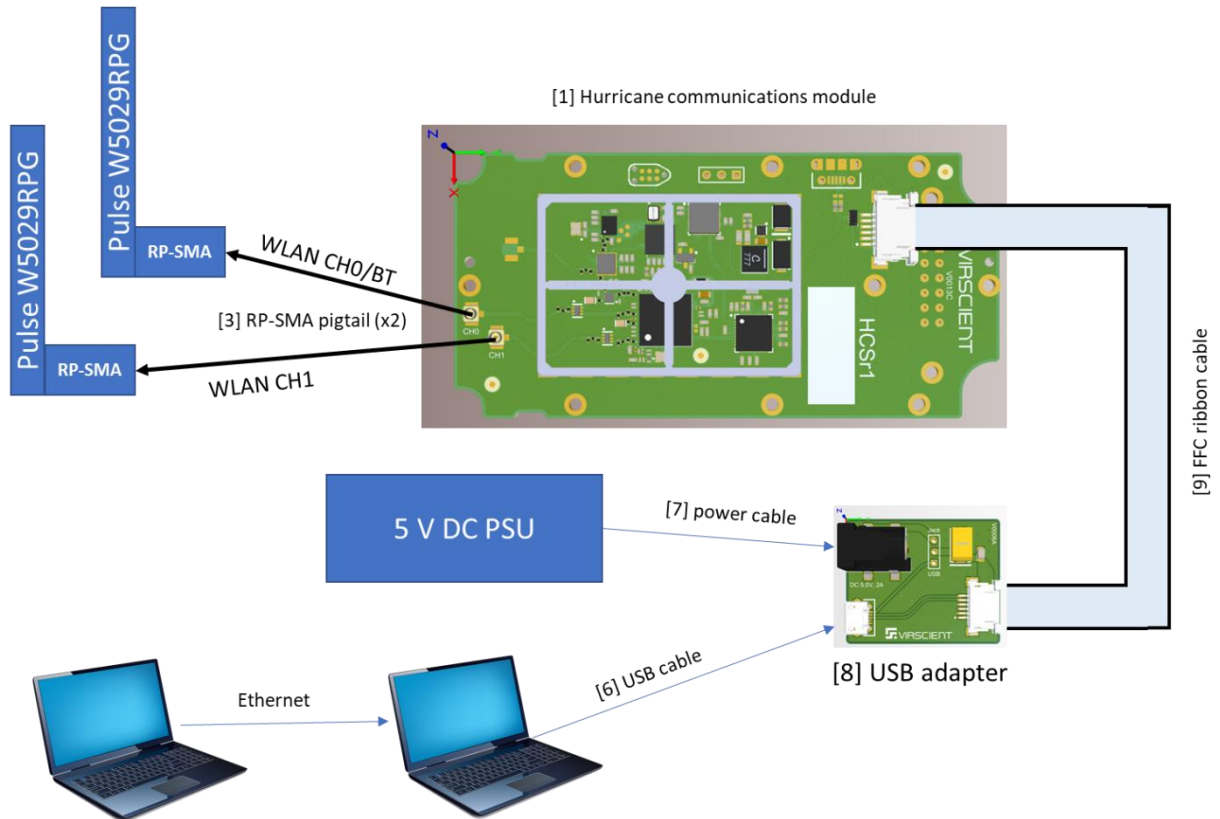


Figure 1. Block Diagram of Test Configuration

Note: EUT modified with antenna terminal only for test purposes. Otherwise, EUT will have permanent antenna.

F. Equipment Configuration

The RP-SMA pigtails and antennas shall be connected to the primary antenna ports of the EUT. The ribbon cable and USB adapter shall be connected to the EUT. The host system, simulated by a laptop, and a DC power supply capable of supplying 2 A shall be connected to the USB adapter.

Tests which require conducted measurements to be made shall be performed by removing the antennas and cabling onto the RP-SMA pigtails.

Ref. ID	Slot #	Name / Description	Model Number	Part Number	Serial Number	Revision
1	N/A	Trimble Comm Board Hurricane	V0013E			A

Table 5. Equipment Configuration

G. 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
4	Linux Laptop	Dell		Yes. fakeboar_fcc.bin and fakeboar_etsi.bin
5	Windows Laptop	Dell		
6	USB data cable	Unknown		Not applicable
7	Banana to jack power cable	Virscient		Not applicable
8	USB adapter	Virscient	V0006A	Not applicable
9	FFC ribbon cable	Molex	0982670211	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 6. Support Equipment

H. Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Max Length	Shielded (Y/N)	Termination Point
1	Antenna port 0	RP-SMA pigtail	1	0.15	0.5	Yes	
2	Antenna port 1	RP-SMA pigtail	1	0.15	0.5	Yes	
3	Antenna port 3	Unused	1				
4	Ribbon connector	FFC ribbon	1	0.2	0.5	No	
5	USB micro B connector	Unused	1				

Table 7. Ports and Cabling Information

I. Mode of Operation

A factory test mode for both WLAN and Bluetooth will be provided for radio-level testing, and instructions on how to operate the device in its normal mode will be provided for WLAN DFS testing.

The factory test mode allows the operator to put the radio into a transmit-only or receive-only mode to aid in performing their measurements. The settings provided by the operator are the same as those used in normal operation, so any emissions will match those expected during normal operation – with the exception that normal mode will have a lower duty cycle. Once configured, the device will continue to operate in the specified manner until the operator disables the EUT.

The normal operating mode for Wi-Fi allows a video to be streamed to simulate real-world traffic. During this simulation, other parameters (such as the EUT's ability to respond to radar waveforms) may be validated. As the video has a fixed length, extended testing will require the video to be restarted every 12 minutes.

A software application called Qualcomm Radio Control Toolkit was used to control the EUT.

J. Method of Monitoring EUT Operation

In factory testing mode, both the WLAN and BT radios maintain communication with the host software and will display an error if the EUT stops working. During a transmit-only test, the output of the transmitter can be measured to confirm operational status.

In the normal operating mode, the EUT will act as a Wi-Fi AP. Using any other Wi-Fi device, one could scan for the AP to confirm the device is operational. Alternatively, the beacon frames may be measured at the antenna port.

K. 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.

L. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Virscient Limited. 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.

Antenna are permanently attached.

Test Engineer(s): Arsalan Hasan

Test Date(s): September 5, 2019

Gain	Type	Model	Manufacturer
2.4 GHz 2.3 dBi 5.0 GHz 5 dBi	IP65 Stick Antenna (Omni) (WiFi)	W5029 RPG	Pulse Larsen

Table 8. Antenna List

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(a)(3) Conducted Output Power

Test Requirements: §15.407(a)(3): For the band 5.725-5.85 GHz, the conducted output power over the frequency band of operation shall not exceed 1 W.
If transmitting antennas of directional gain greater than 6 dBi are used, both the conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

Test Procedure: The EUT was connected to a spectrum analyzer through a cable and attenuator. Measurements were taken with the EUT set to transmit on its low, mid, and high channels. Its power was measured according to measurement method SA-2, as described in 789033 D02 General UNII Test Procedures v02r01.

Test Results: The EUT as tested is compliant with the requirements of this section.

No anomalies detected.

Test Engineer(s): Arsalan Hasan

Test Date(s): August 10, 2019

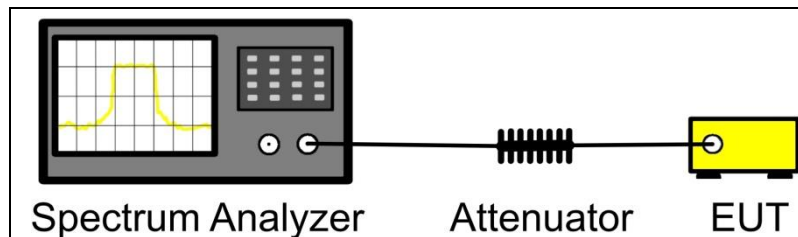
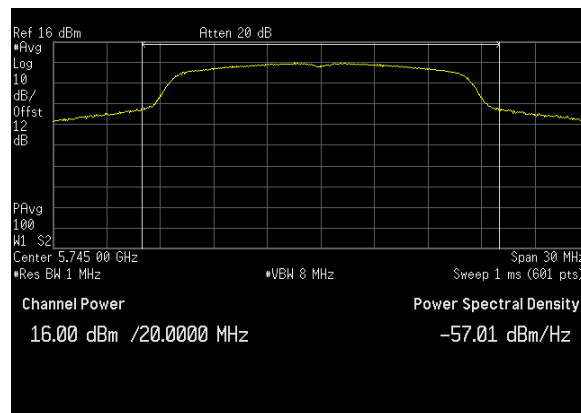


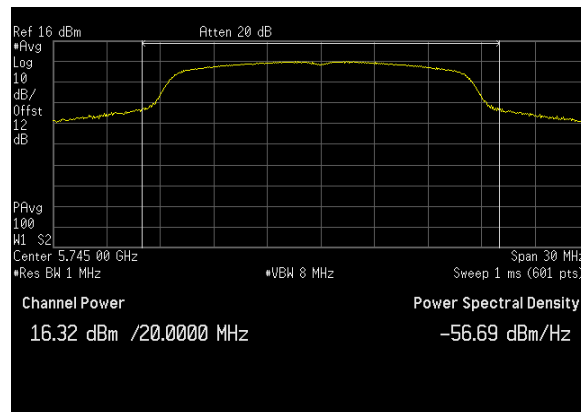
Figure 2. Peak Power Output Test Setup

Frequency (MHz)	Mode	Bandwidth (MHz)	Conducted Power (dBm) ANT 0	Conducted Power (dBm) ANT 1	Total Power (dBm)	Directional Gain (dBi)	Conducted Limit (dBm)	Power Margin (dB)
5745	a	20	16	16.32	19.17	5.0	30.00	-10.83
5785			16.33	17.58	20.01	5.0	30.00	-9.99
5825			16.14	16.5	19.33	5.0	30.00	-10.67
5745	n	20	16.09	16.54	19.33	5.0	30.00	-10.67
5785			16.39	17.74	20.13	5.0	30.00	-9.87
5825			16.15	16.52	19.35	5.0	30.00	-10.65
5755		40	14.69	16.16	18.50	5.0	30.00	-11.50
5795			14.74	16.55	18.75	5.0	30.00	-11.25
5775	ac	80	17.33	17.31	20.33	5.0	30.00	-9.67

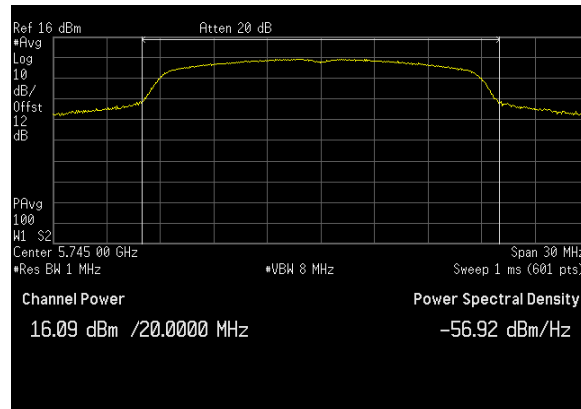
Table 9. Maximum Conducted Output Power, Test Results



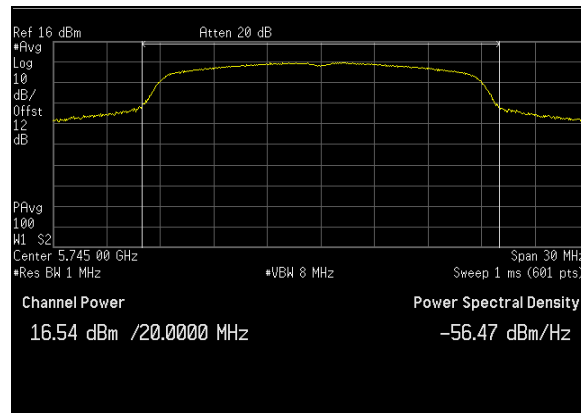
Plot 1. Maximum Conducted Output Power, BW 20M, Ch 5745M, A Mode ANT 0



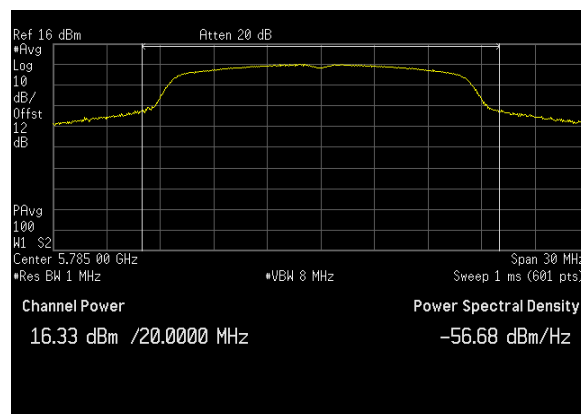
Plot 2. Maximum Conducted Output Power, BW 20M, Ch 5745M, A Mode ANT 1



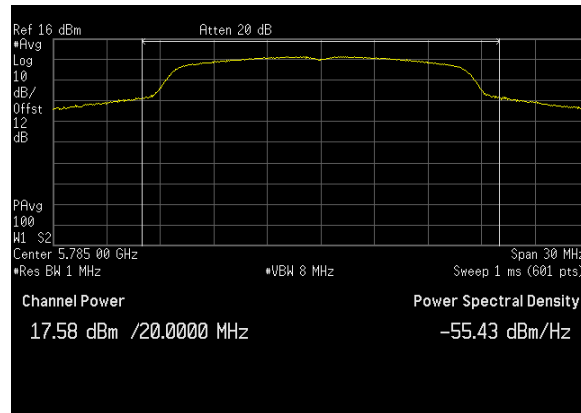
Plot 3. Maximum Conducted Output Power, BW 20M, Ch 5745M, N Mode ANT 0



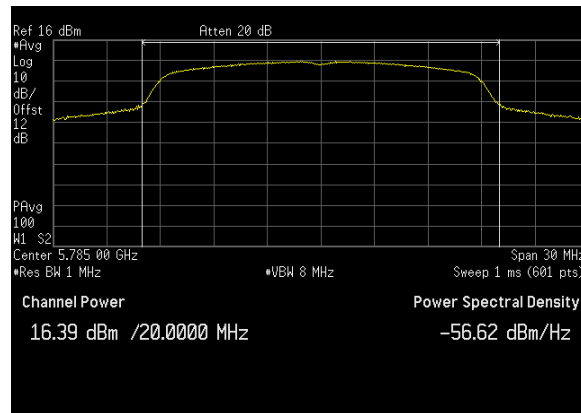
Plot 4. Maximum Conducted Output Power, BW 20M, Ch 5745M, N Mode ANT 1



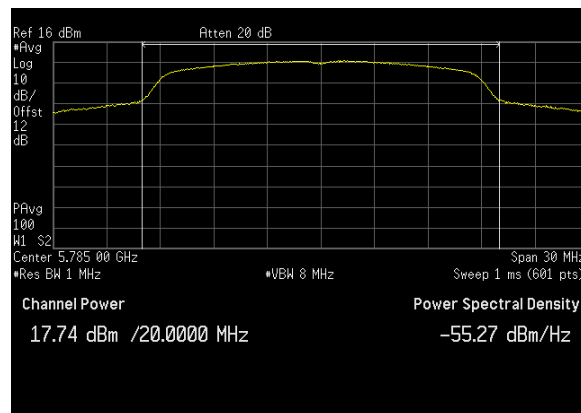
Plot 5. Maximum Conducted Output Power, BW 20M, Ch 5785M, A Mode ANT 0



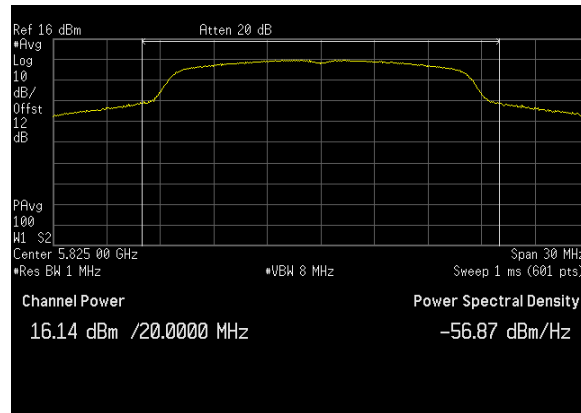
Plot 6. Maximum Conducted Output Power, BW 20M, Ch 5785M, A Mode ANT 1



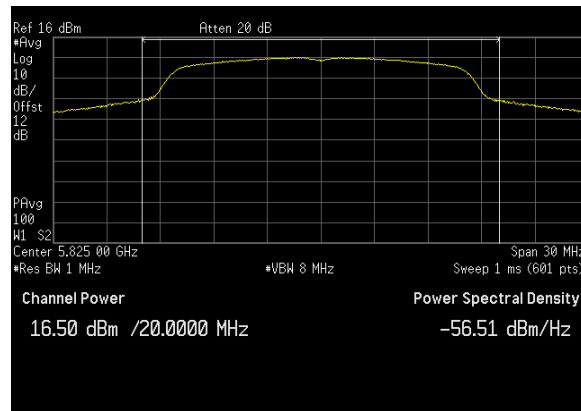
Plot 7. Maximum Conducted Output Power, BW 20M, Ch 5785M, N Mode ANT 0



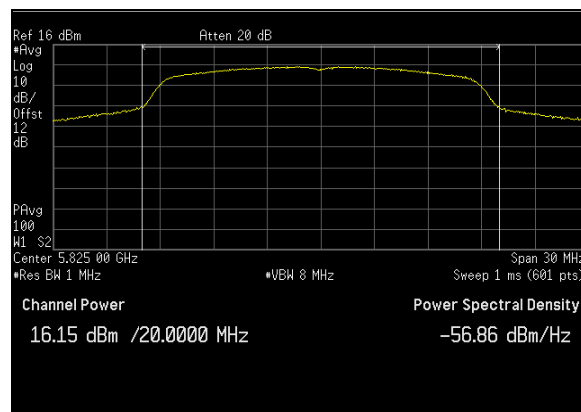
Plot 8. Maximum Conducted Output Power, BW 20M, Ch 5785M, N Mode ANT 1



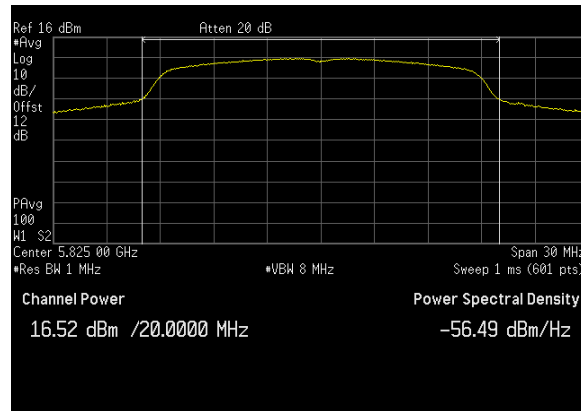
Plot 9. Maximum Conducted Output Power, BW 20M, Ch 5825M, A Mode ANT 0



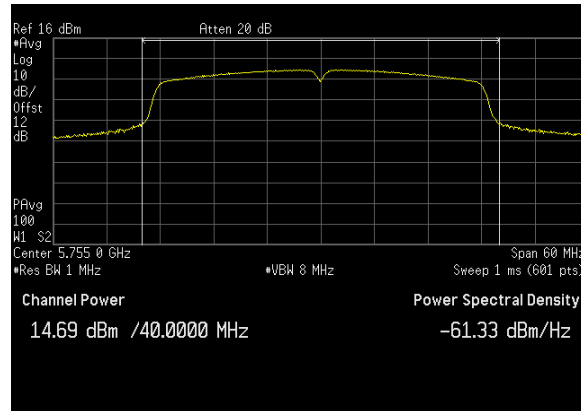
Plot 10. Maximum Conducted Output Power, BW 20M, Ch 5825M, A Mode ANT 1



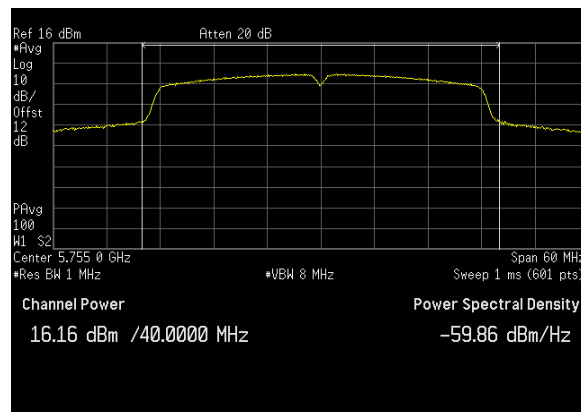
Plot 11. Maximum Conducted Output Power, BW 20M, Ch 5825M, N Mode ANT 0



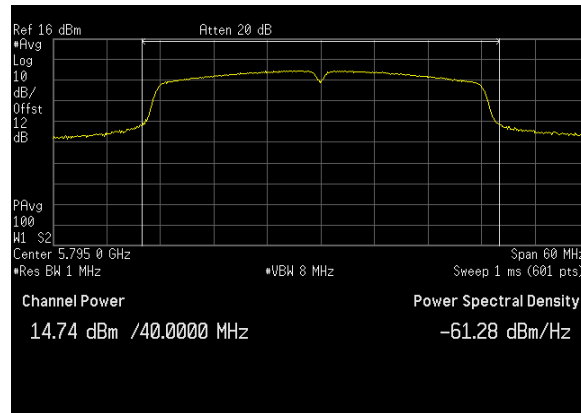
Plot 12. Maximum Conducted Output Power, BW 20M, Ch 5825M, N Mode ANT 1



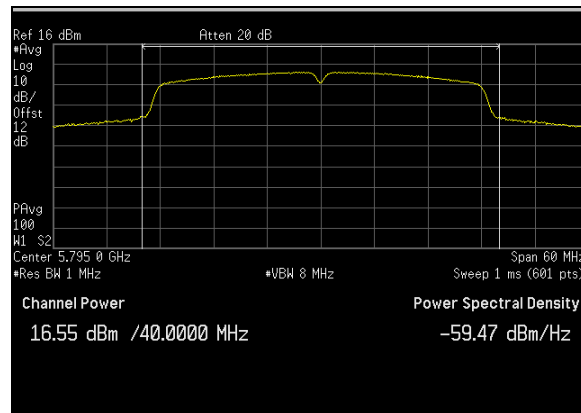
Plot 13. Maximum Conducted Output Power, BW 40M, Ch 5755M, N Mode ANT 0



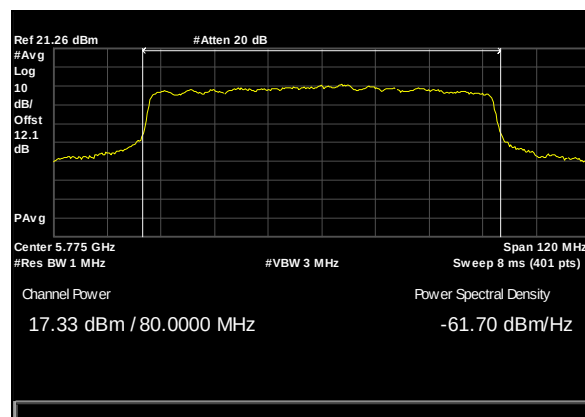
Plot 14. Maximum Conducted Output Power, BW 40M, Ch 5755M, N Mode ANT 1



Plot 15. Maximum Conducted Output Power, BW 40M, Ch 5795M, N Mode ANT 0



Plot 16. Maximum Conducted Output Power, BW 40M, Ch 5795M, N Mode ANT 1



Plot 17. Maximum Conducted Output Power, BW 80M, Ch 5775M, AC Mode ANT 0

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(a)(3) Maximum Power Spectral Density

Test Requirements:

§15.407(a)(3): In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power.

Test Procedure:

The EUT was connected to a spectrum analyzer through a cable and attenuator. Measurements were taken with the EUT set to transmit continuously on its low, mid, and high channels. Its power was measured according KDB 789033 D02 General UNII Test Procedures v01. A 1 MHz RBW was used during testing, as this provides a worst-case scenario.

Test Results:

The EUT as tested is compliant with the requirements of this section.

No anomalies detected.

Test Engineer(s):

Arsalan Hasan

Test Date(s):

August 26, 2019

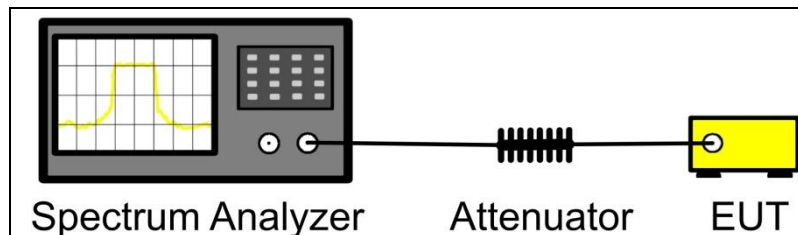
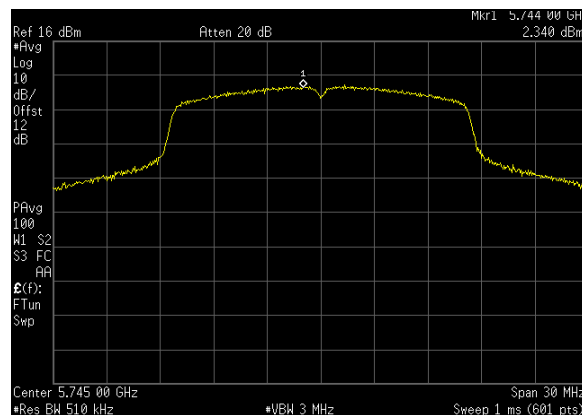


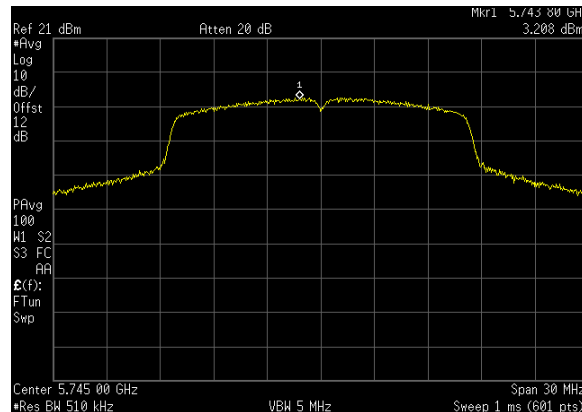
Figure 3. Block Diagram, Peak Power Spectral Density Test Setup

Frequency (MHz)	Mode	Bandwidth (MHz)	Power Spectral Density (dBm) ANT 0	Power Spectral Density (dBm) ANT 1	Total PSD (dBm)	Directional Gain (dBi)	PSD Limit (dBm)	PSD Margin (dB)
5745	a	20	2.34	3.2	5.80	5.0	30.00	-24.20
5785			4.11	4.11	7.12	5.0	30.00	-22.88
5825			2.06	3.21	5.68	5.0	30.00	-24.32
5745	n	20	2.18	3.18	5.72	5.0	30.00	-24.28
5785			3.08	4.63	6.93	5.0	30.00	-23.07
5825			2.83	3.12	5.99	5.0	30.00	-24.01
5755		40	-2.26	-1.06	1.39	5.0	30.00	-28.61
5795			-2.41	-1.2	1.25	5.0	30.00	-28.75
5775	ac	80	1.75	1.76	4.77	5.0	30.00	-25.23

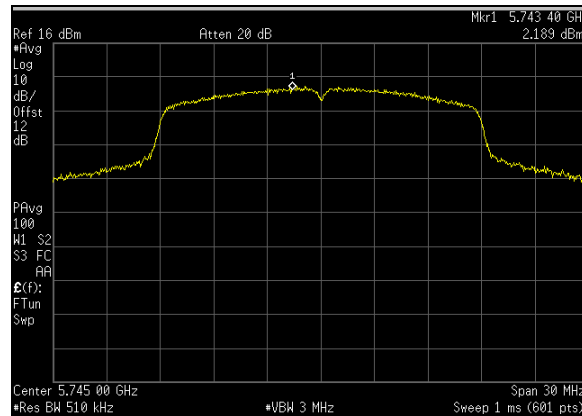
Table 10. Power Spectral Density, Test Results



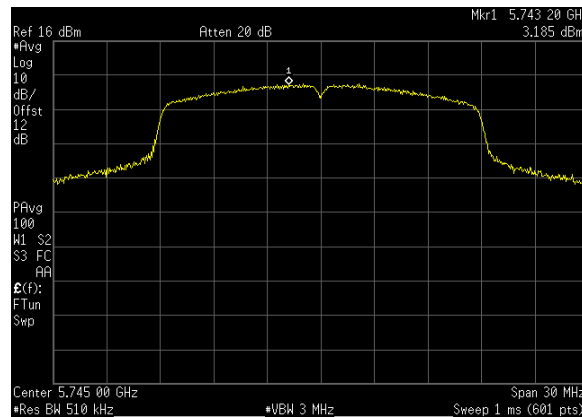
Plot 18. Power Spectral Density, BW 20M, Ch 5745M, A Mode ANT 0



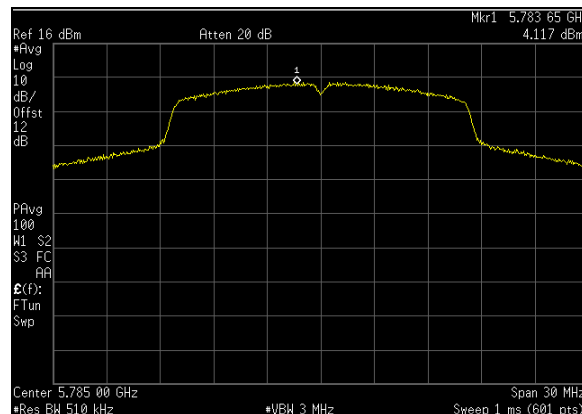
Plot 19. Power Spectral Density, BW 20M, Ch 5745M, A Mode ANT 1



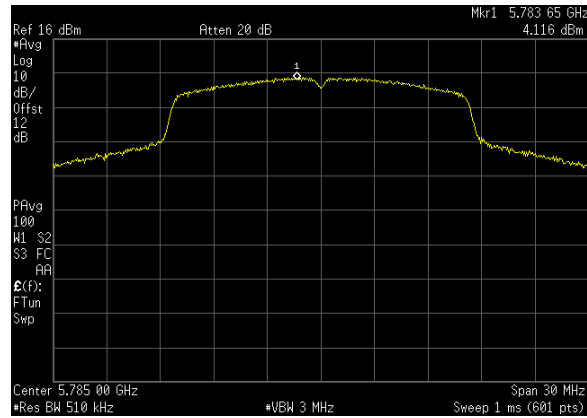
Plot 20. Power Spectral Density, BW 20M, Ch 5745M, N Mode ANT 0



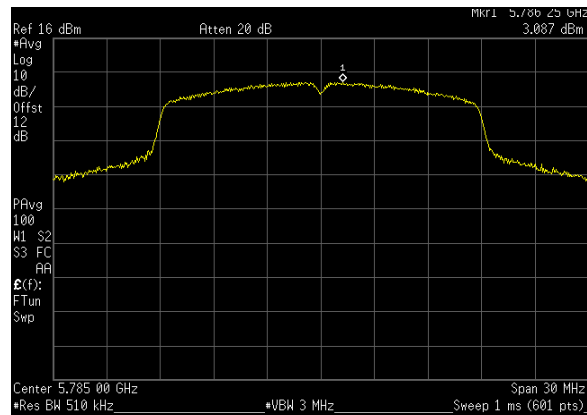
Plot 21. Power Spectral Density, BW 20M, Ch 5745M, N Mode ANT 1



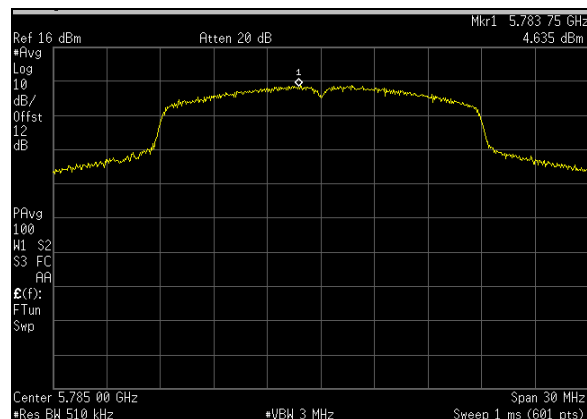
Plot 22. Power Spectral Density, BW 20M, Ch 5785M, A Mode ANT 0



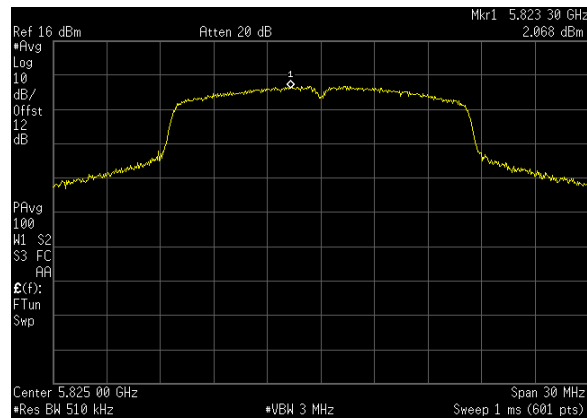
Plot 23. Power Spectral Density, BW 20M, Ch 5785M, A Mode ANT 1



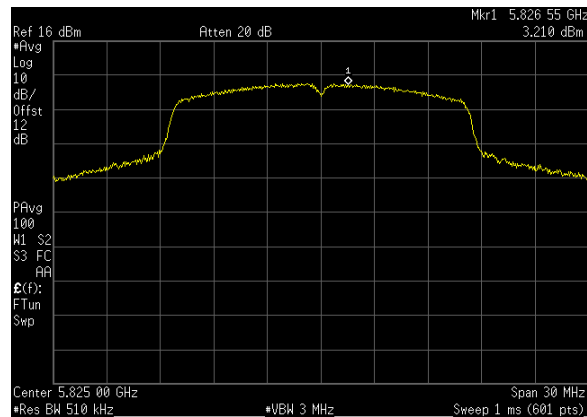
Plot 24. Power Spectral Density, BW 20M, Ch 5785M, N Mode ANT 0



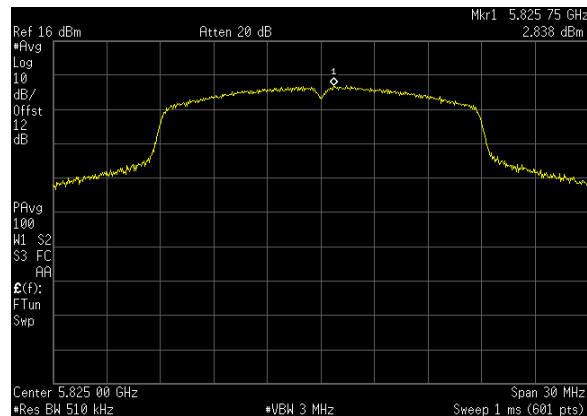
Plot 25. Power Spectral Density, BW 20M, Ch 5785M, N Mode ANT 1



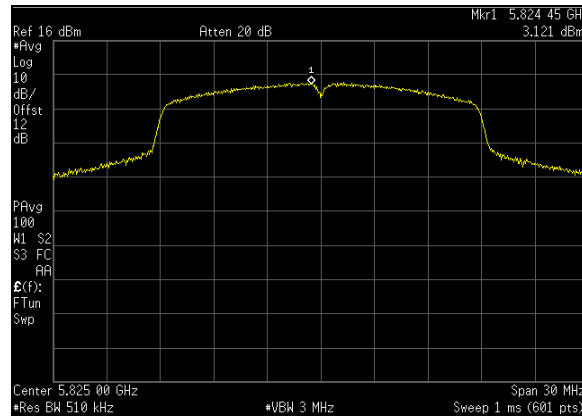
Plot 26. Power Spectral Density, BW 20M, Ch 5825M, A Mode ANT 0



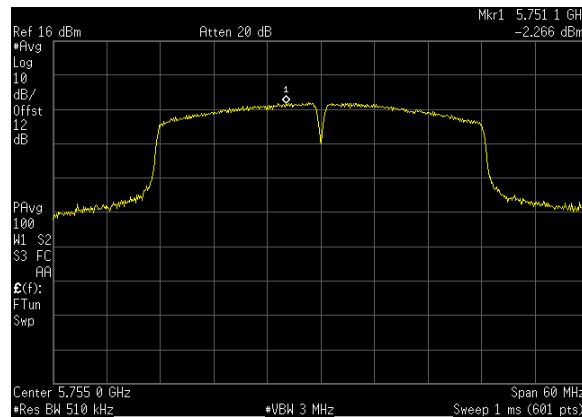
Plot 27. Power Spectral Density, BW 20M, Ch 5825M, A Mode ANT 1



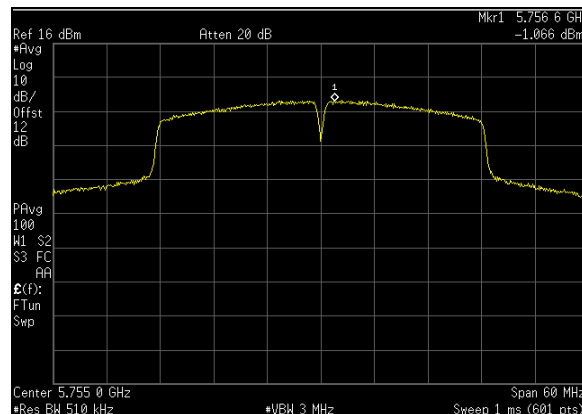
Plot 28. Power Spectral Density, BW 20M, Ch 5825M, N Mode ANT 0



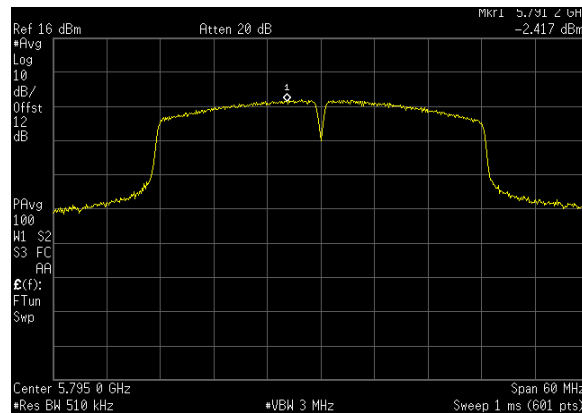
Plot 29. Power Spectral Density, BW 20M, Ch 5825M, N Mode ANT 1



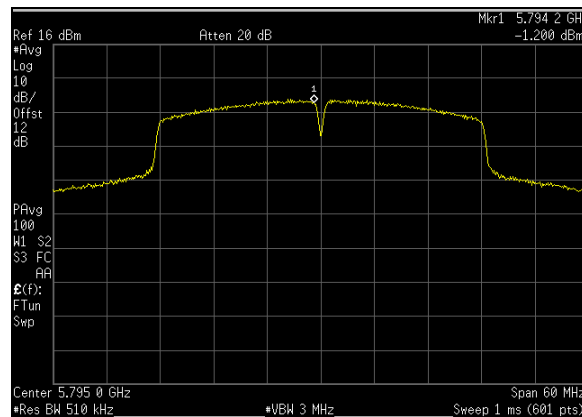
Plot 30. Power Spectral Density, BW 40M, Ch 5755M, N Mode ANT 0



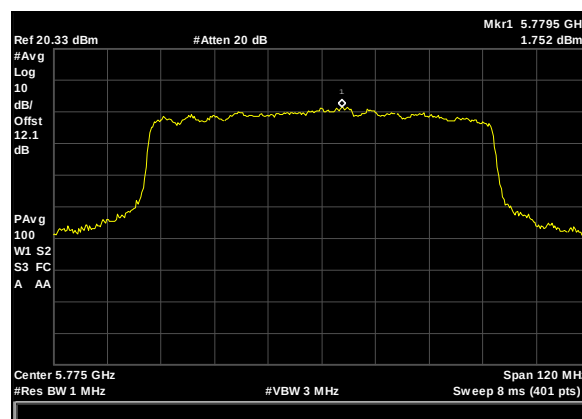
Plot 31. Power Spectral Density, BW 40M, Ch 5755M, N Mode ANT 1



Plot 32. Power Spectral Density, BW 40M, Ch 5795M, N Mode ANT 0



Plot 33. Power Spectral Density, BW 40M, Ch 5795M, N Mode ANT 1



Plot 34. Power Spectral Density, BW 80M, Ch 5775M, AC Mode ANT 0

Electromagnetic Compatibility Criteria for Intentional Radiators

§15.407(b)(4) & (6 – 7) Undesirable Emissions

Test Requirements: § 15.407(b)(4): For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

§ 15.407(b)(6): Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.

§ 15.407(b)(7): The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Test Procedure: The EUT was placed on a non-conducting stand on a turntable in a chamber. To find the maximum emission the EUT was set to transmit on low, mid, and high channels. Additionally, the turntable was rotated 360 degrees, the EUT was oriented through its three orthogonal axes, and the receive antenna height was varied in order to maximize emissions.

For frequencies from 30 MHz to 1 GHz, measurements were first made using a peak detector with a 100 kHz resolution bandwidth. Emissions which exceeded the limits were re-measured using a quasi-peak detector with a 120 kHz resolution bandwidth.

Above 1 GHz, measurements were made pursuant the method described in FCC KDB 789033 D02 General UNII Test Procedure New Rules v02r01.

For emissions above 1 GHz and in restricted bands, measurements of the field strength were made with a peak detector and an average detector and compared with the limits of 15.209.

As an alternative, according to FCC KDB 789033 D02 General UNII Test Procedure New Rules v02r01, all emissions above 1 GHz that comply with the peak and average limits of 15.209 satisfy the requirements of unwanted emissions in 15.407. Emissions were investigated upto 10th harmonics of the fundamental.

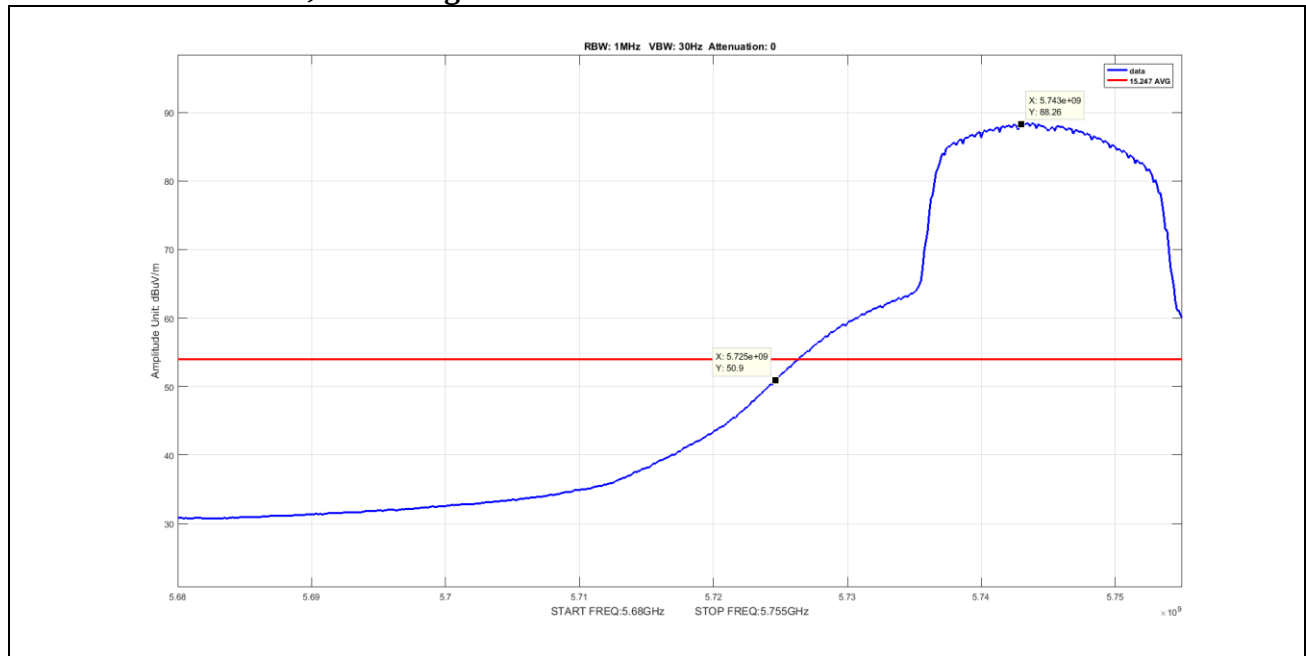
Test Results: The EUT was compliant with the requirements of this section. Only noise was observed above 18 GHz and below 30 MHz.

Measured emissions were within applicable limits.

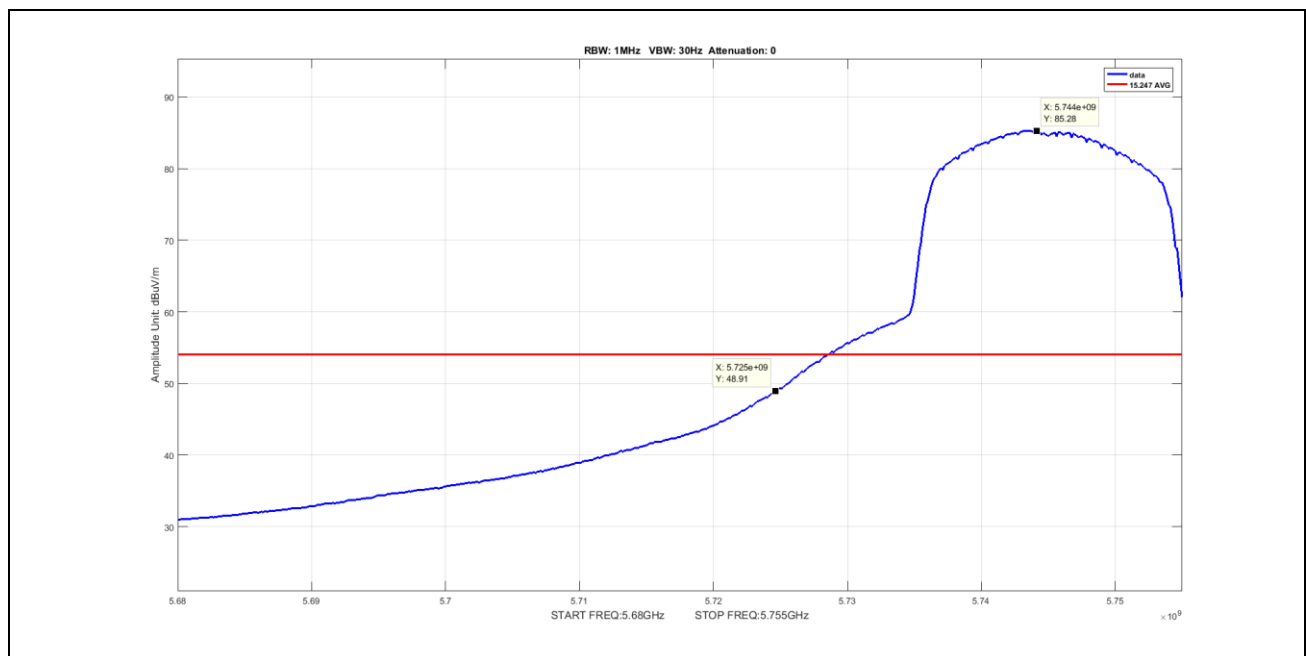
Test Engineer(s): Arsalan Hasan

Test Date(s): August 20, 2019

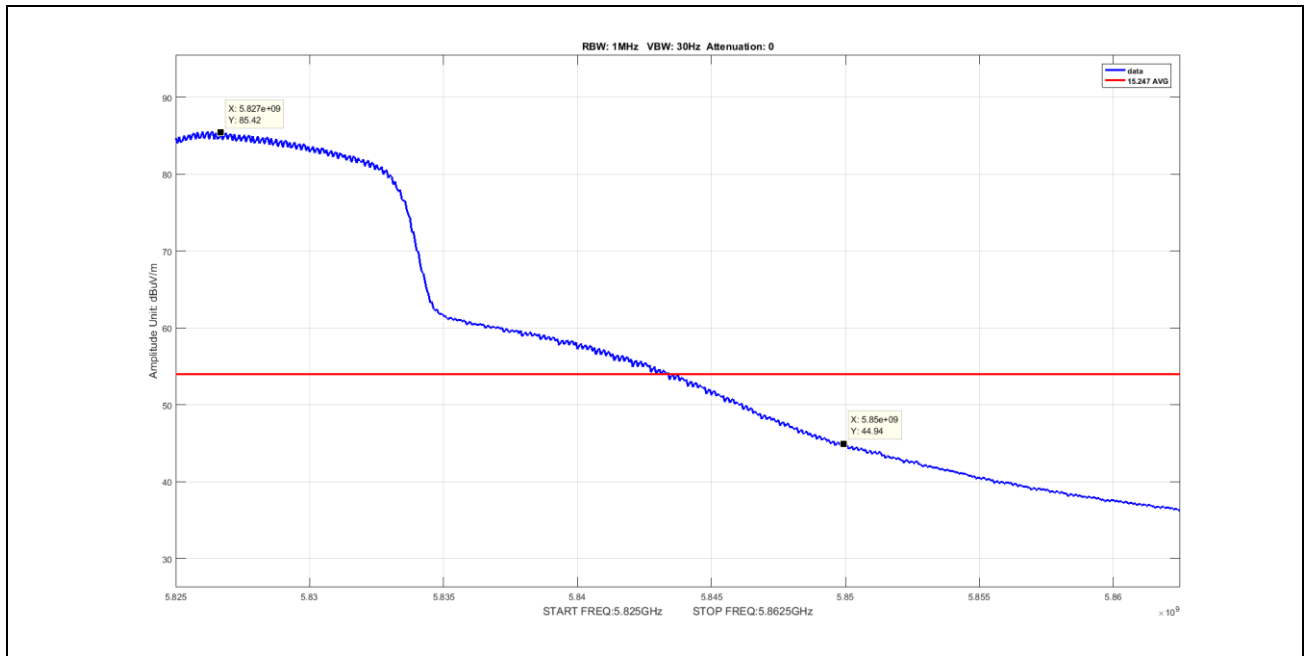
Undesirable Emissions, Band Edge



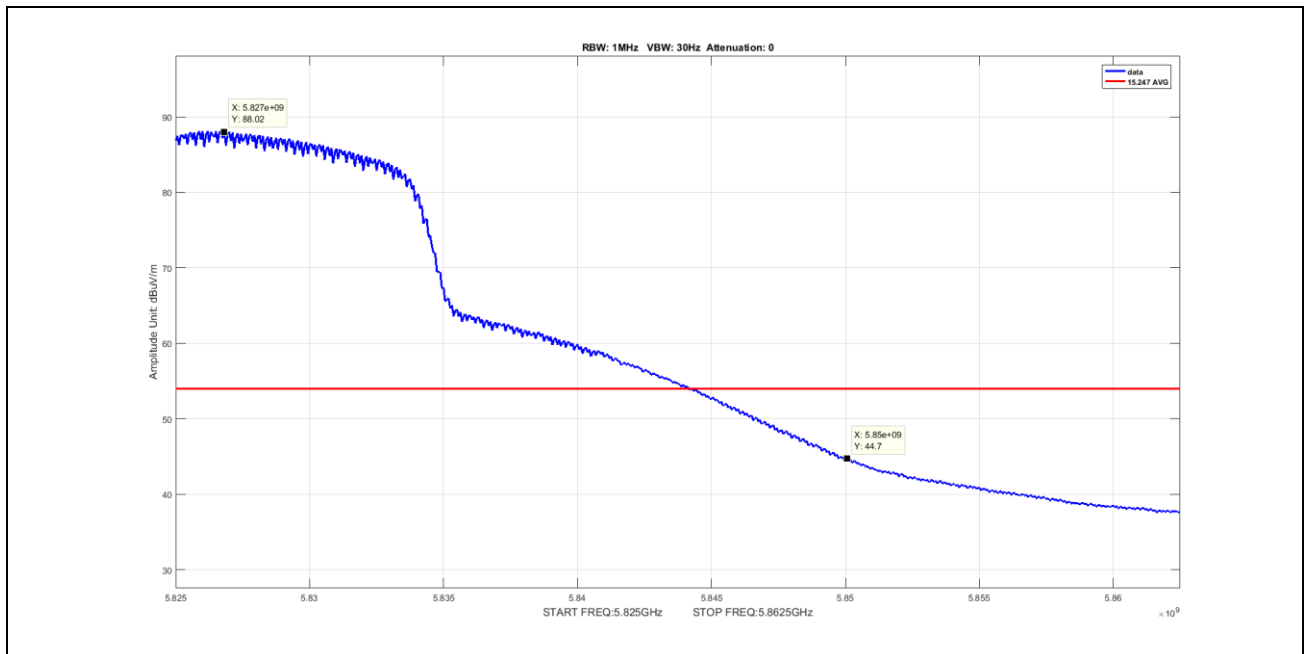
Plot 35. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5745M, A Mode ANT 1 (worst-case) V



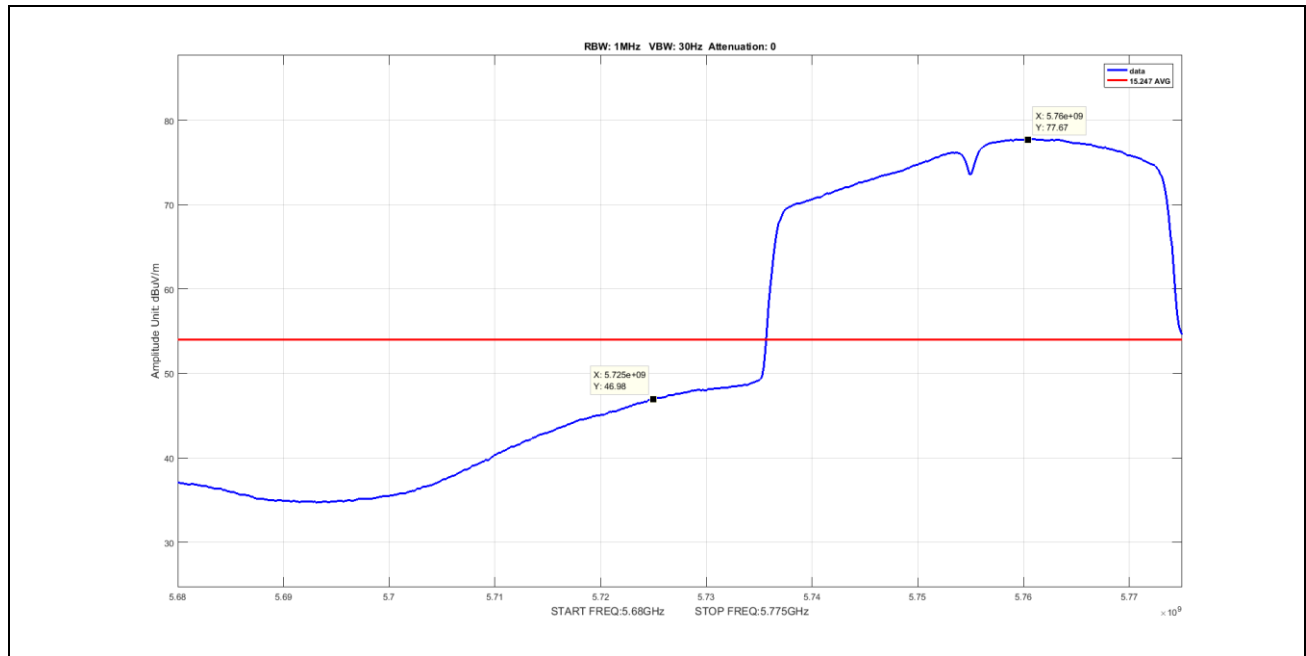
Plot 36. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5745M, N Mode ANT 1 (worst-case) V



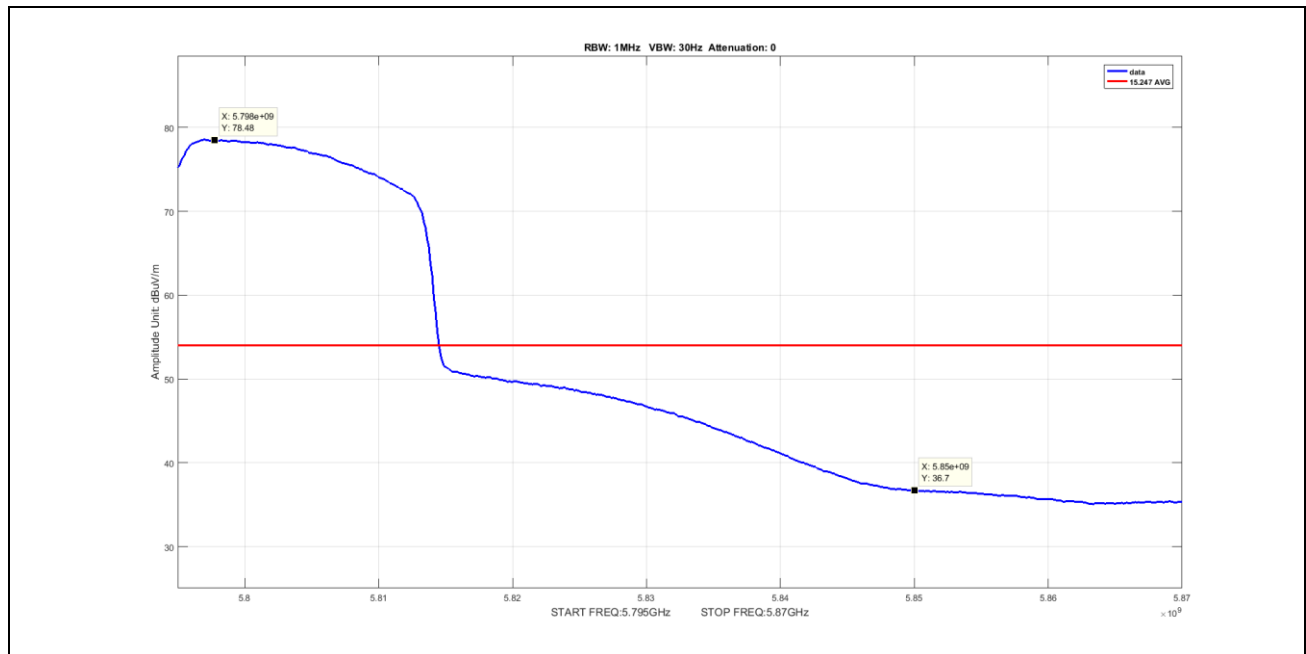
Plot 37. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5825M, A Mode ANT 1 (worst-case) V



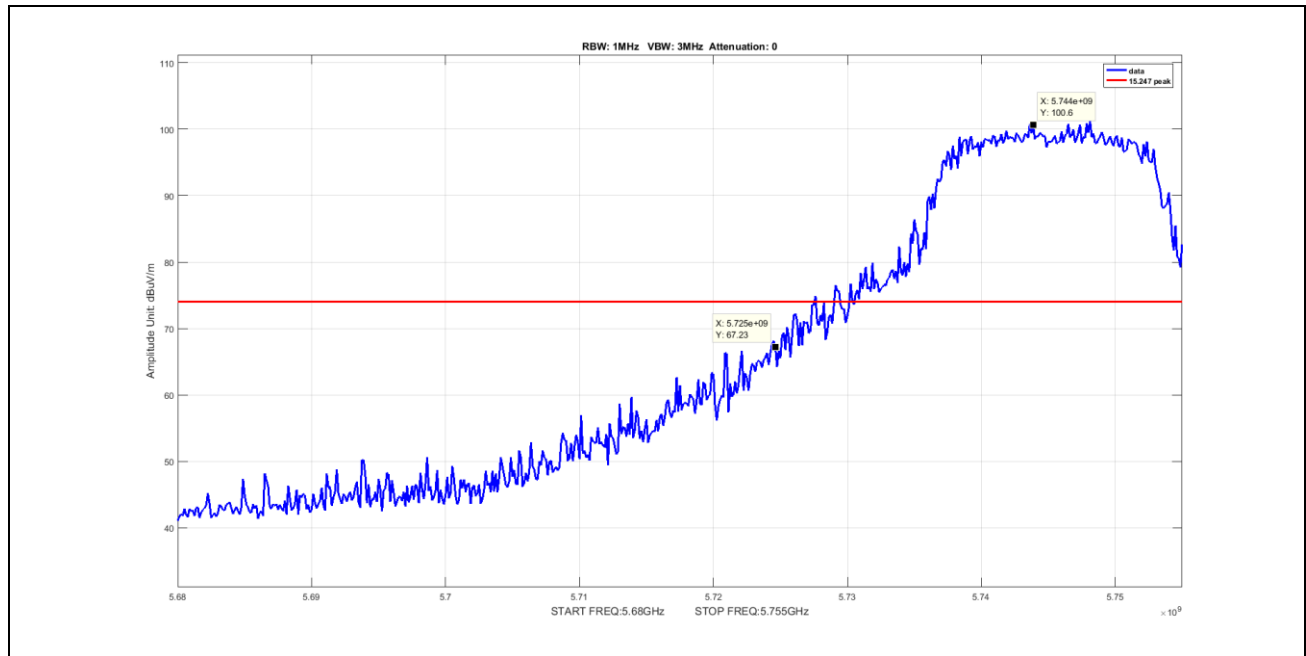
Plot 38. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5825M, N Mode ANT 1 (worst-case) V



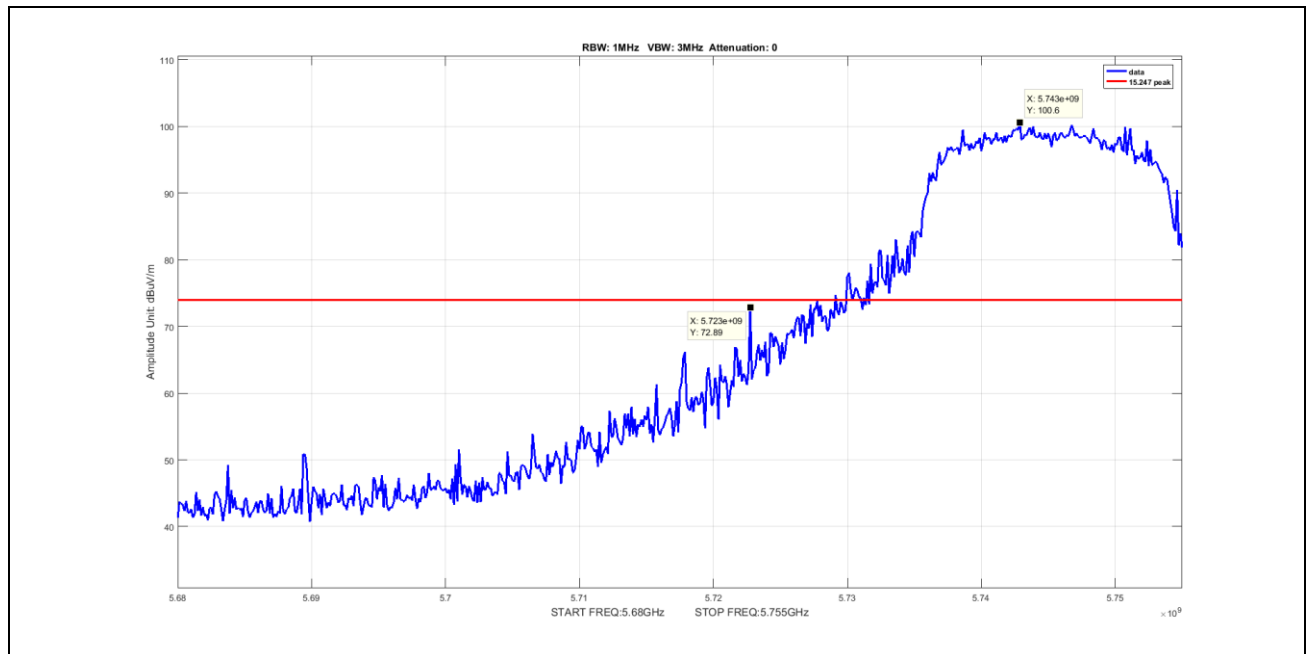
Plot 39. Undesirable Emissions, Average Band Edge Spurious, BW 40M, Ch 5755M, N Mode ANT 1 (worst-case) V



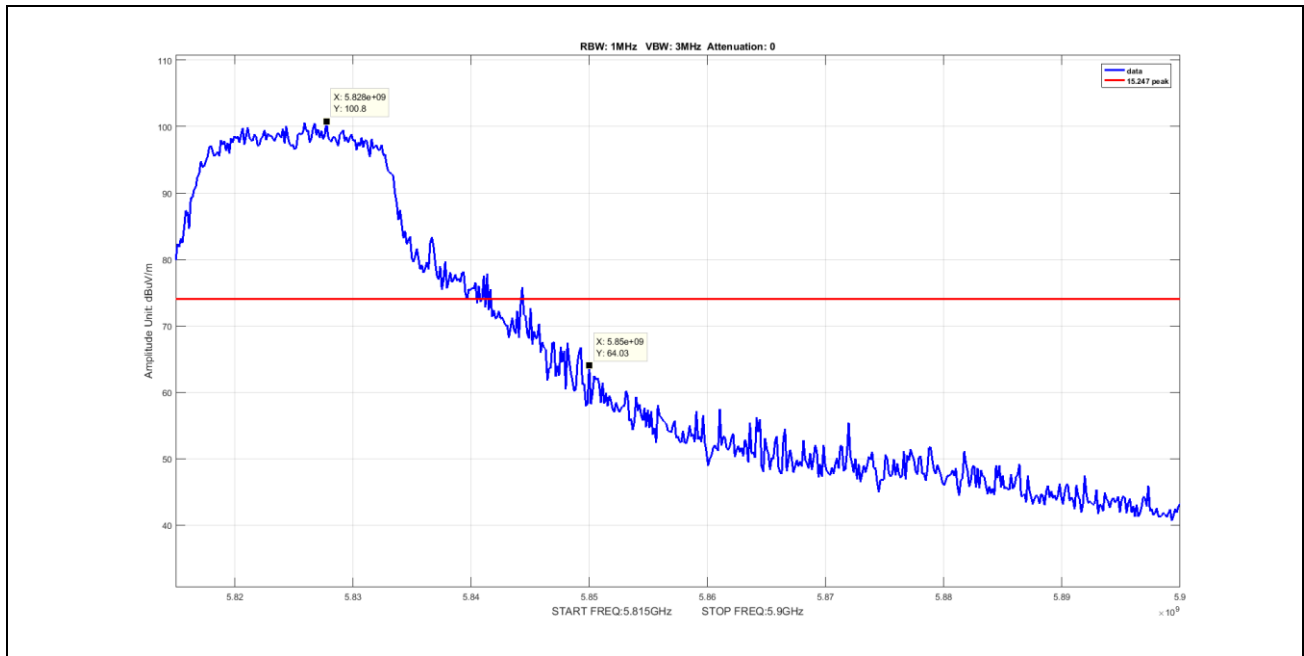
Plot 40. Undesirable Emissions, Average Band Edge Spurious, BW 40M, Ch 5795M, N Mode ANT 1 (worst-case) V



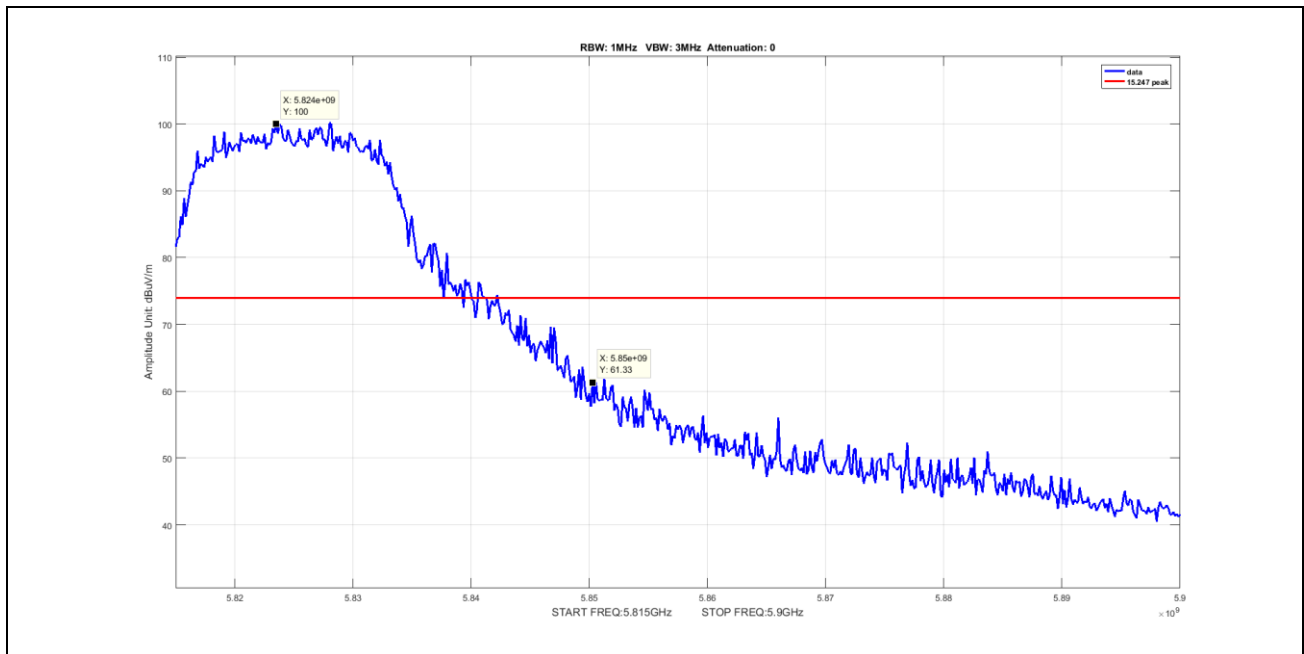
Plot 41. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5745M, A Mode ANT 1 (worst-case) V



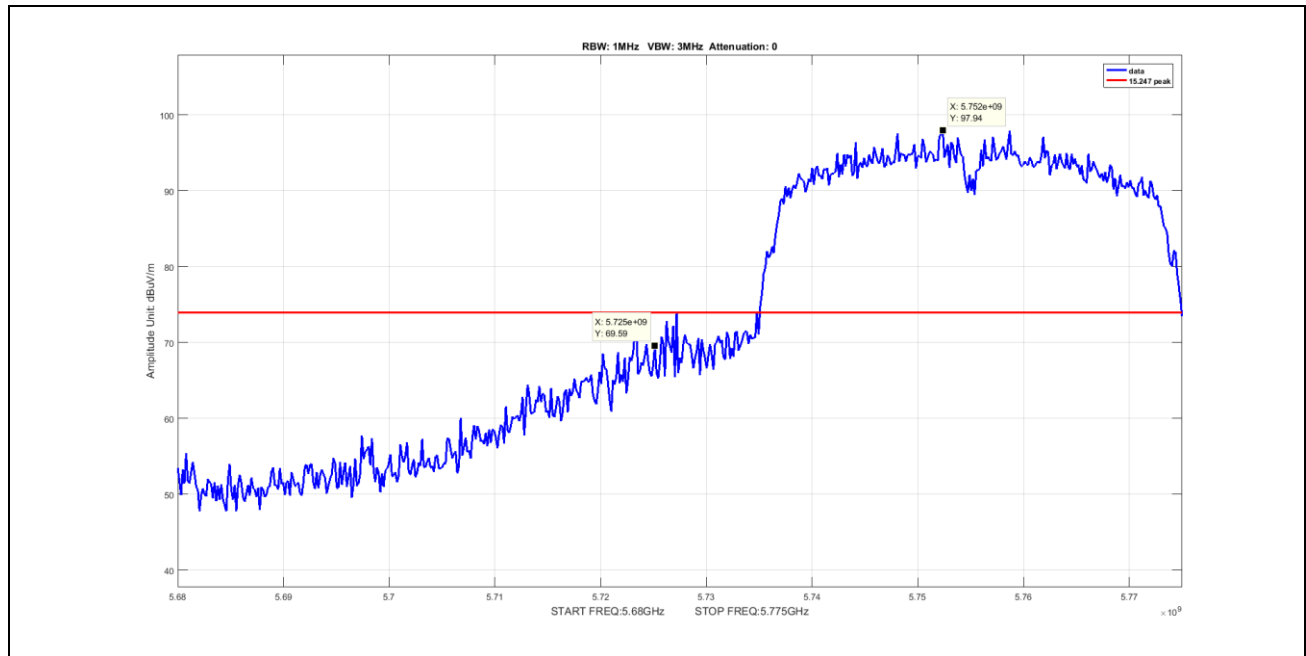
Plot 42. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5745M, N Mode ANT 1 (worst-case) V



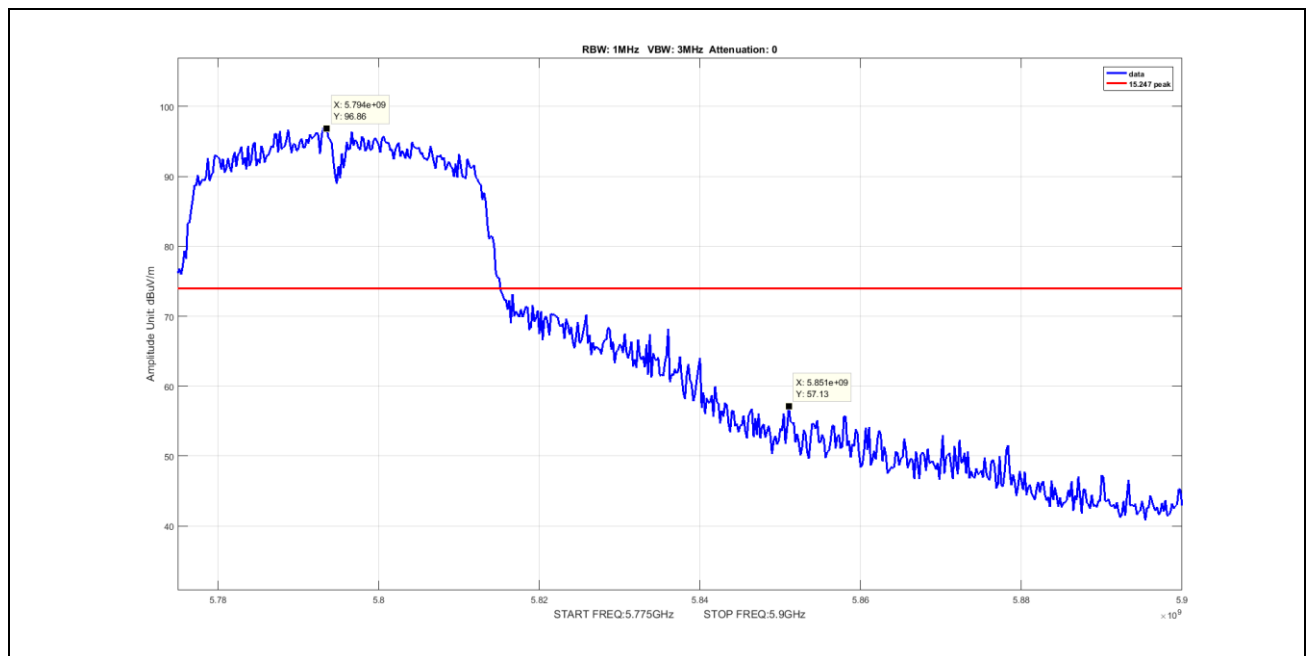
Plot 43. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5825M, A Mode ANT 1 (worst-case) V



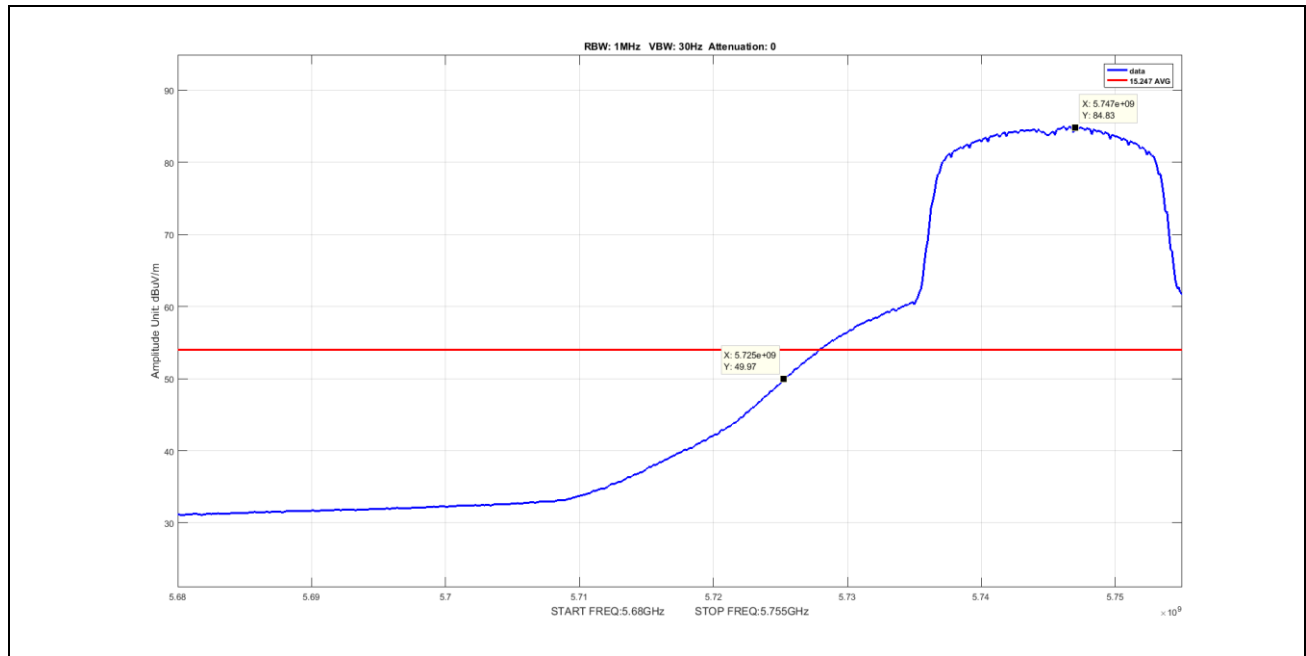
Plot 44. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5825M, N Mode ANT 1 (worst-case) V



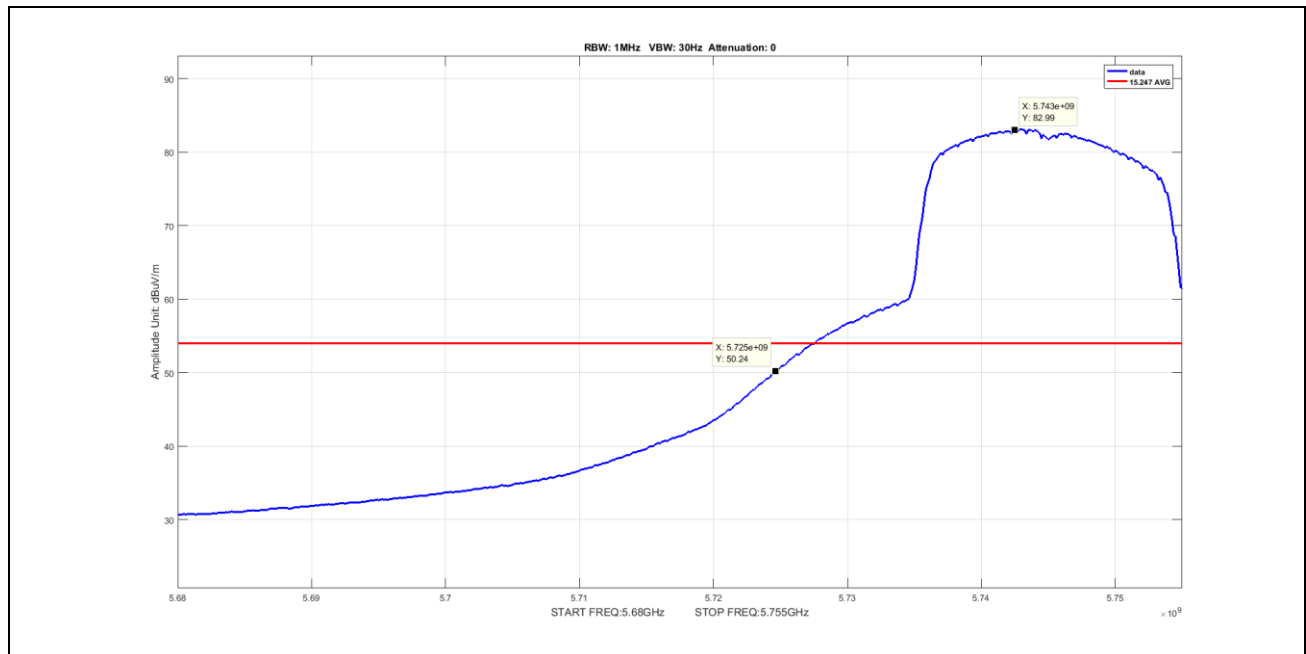
Plot 45. Undesirable Emissions, Peak Band Edge Spurious, BW 40M, Ch 5755M, N Mode ANT 1 (worst-case) V



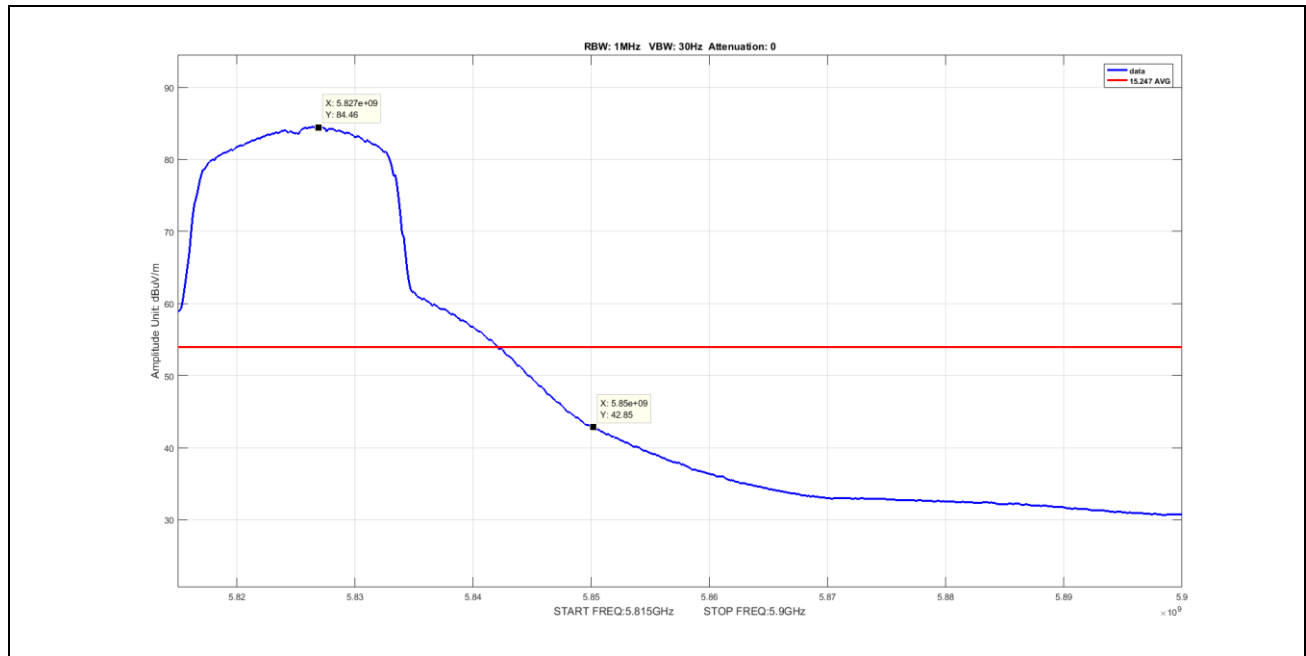
Plot 46. Undesirable Emissions, Peak Band Edge Spurious, BW 40M, Ch 5795M, N Mode ANT 1 (worst-case) V



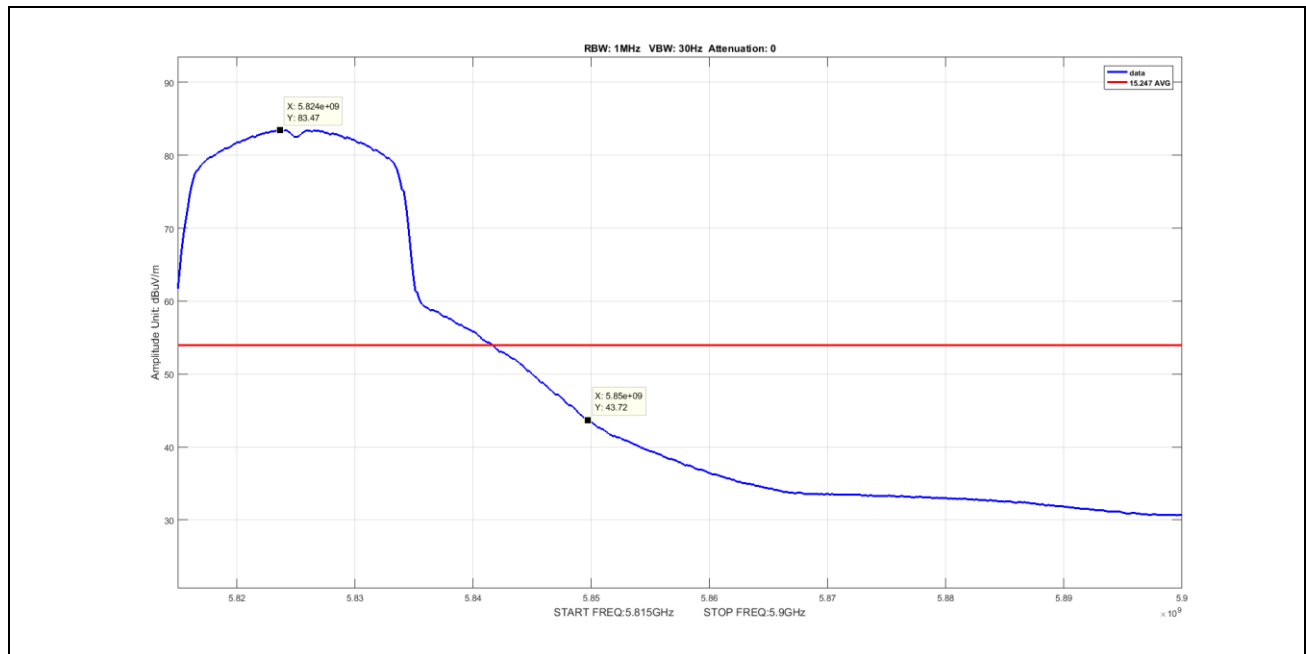
Plot 47. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5745M, A Mode ANT 0 (worst-case) V



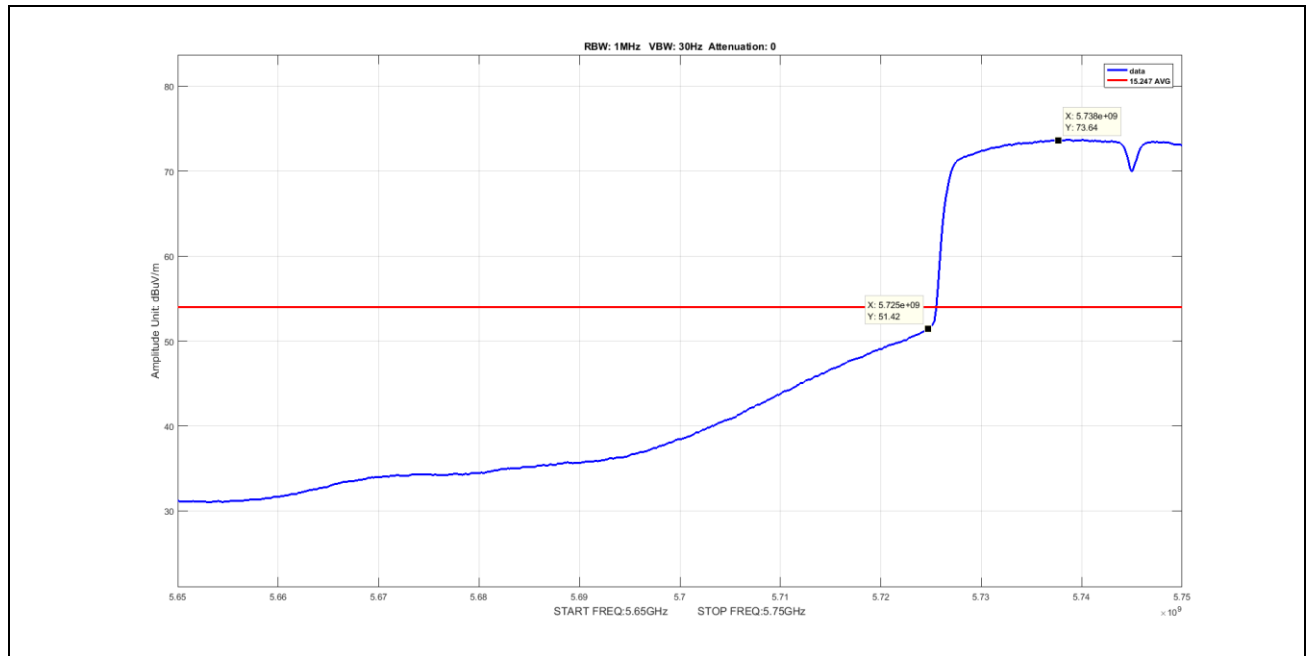
Plot 48. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5745M, N Mode ANT 0 (worst-case) V



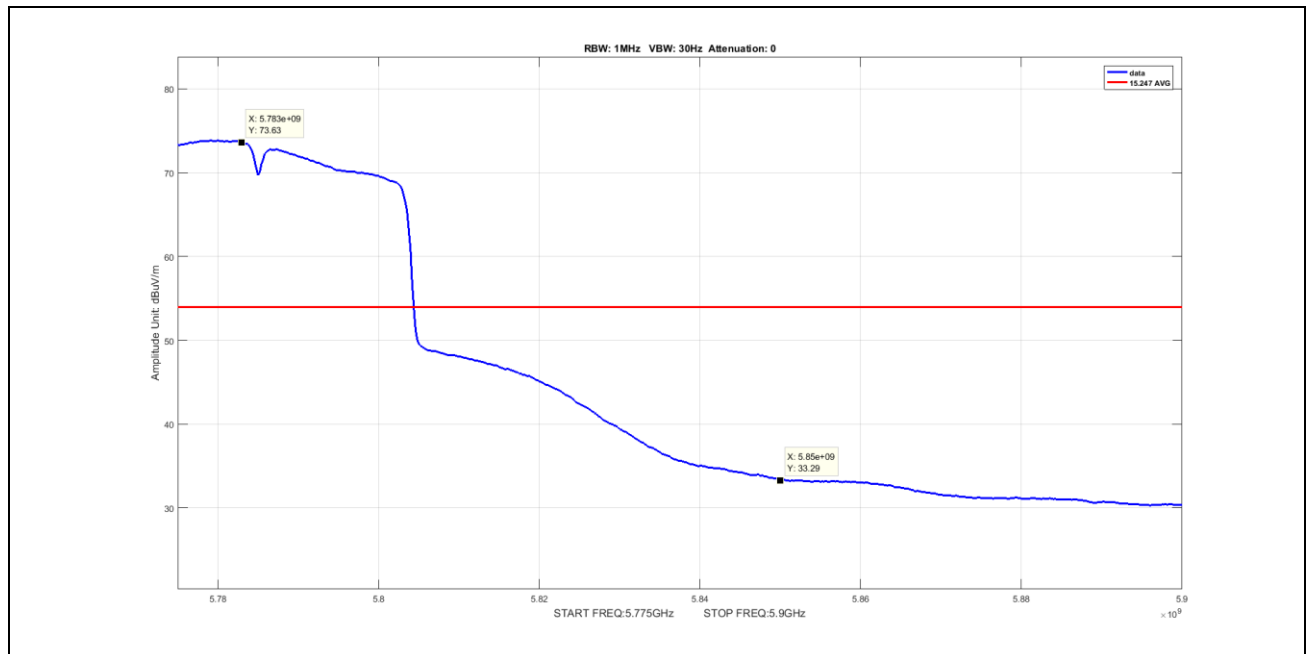
Plot 49. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5825M, A Mode ANT 0 (worst-case) V



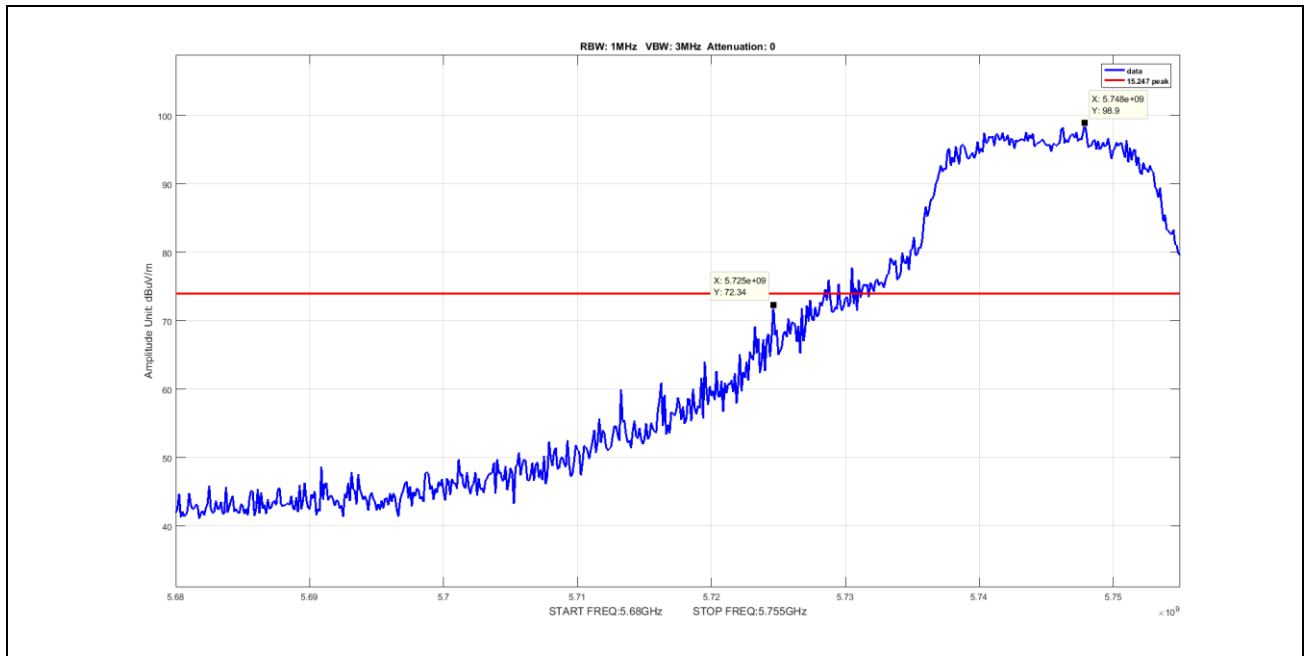
Plot 50. Undesirable Emissions, Average Band Edge Spurious, BW 20M, Ch 5825M, N Mode ANT 0 (worst-case) V



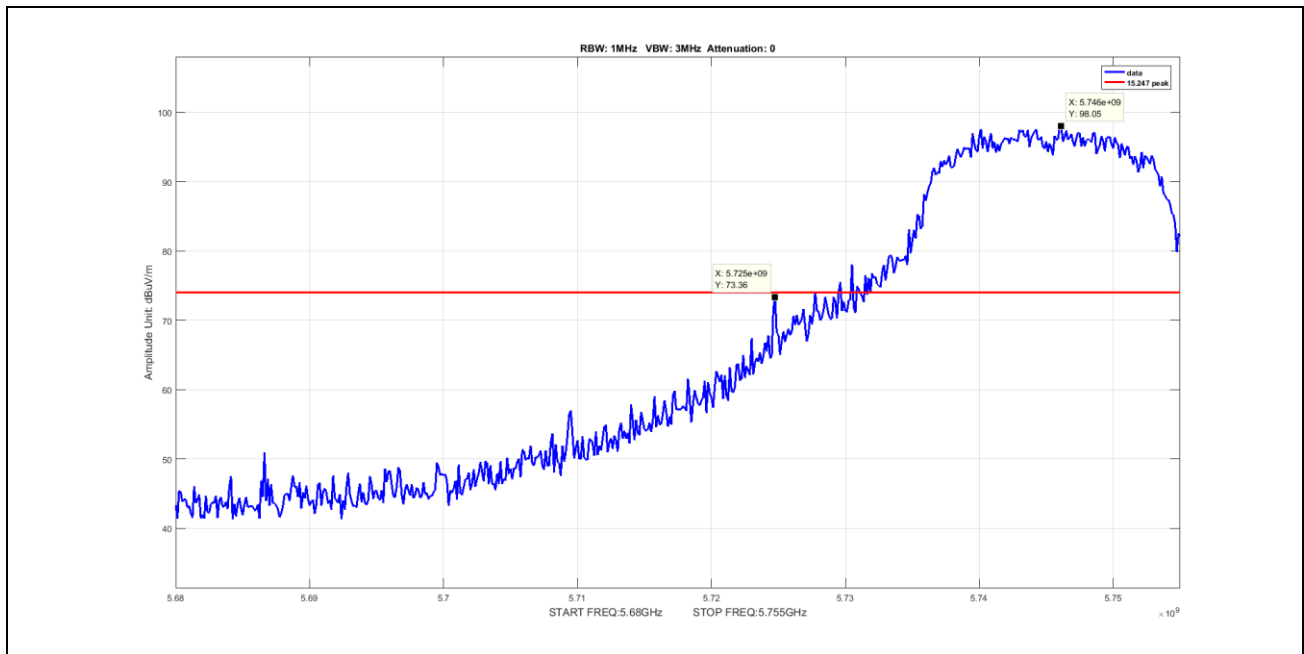
Plot 51. Undesirable Emissions, Average Band Edge Spurious, BW 40M, Ch 5755M, N Mode ANT 0 (worst-case) V



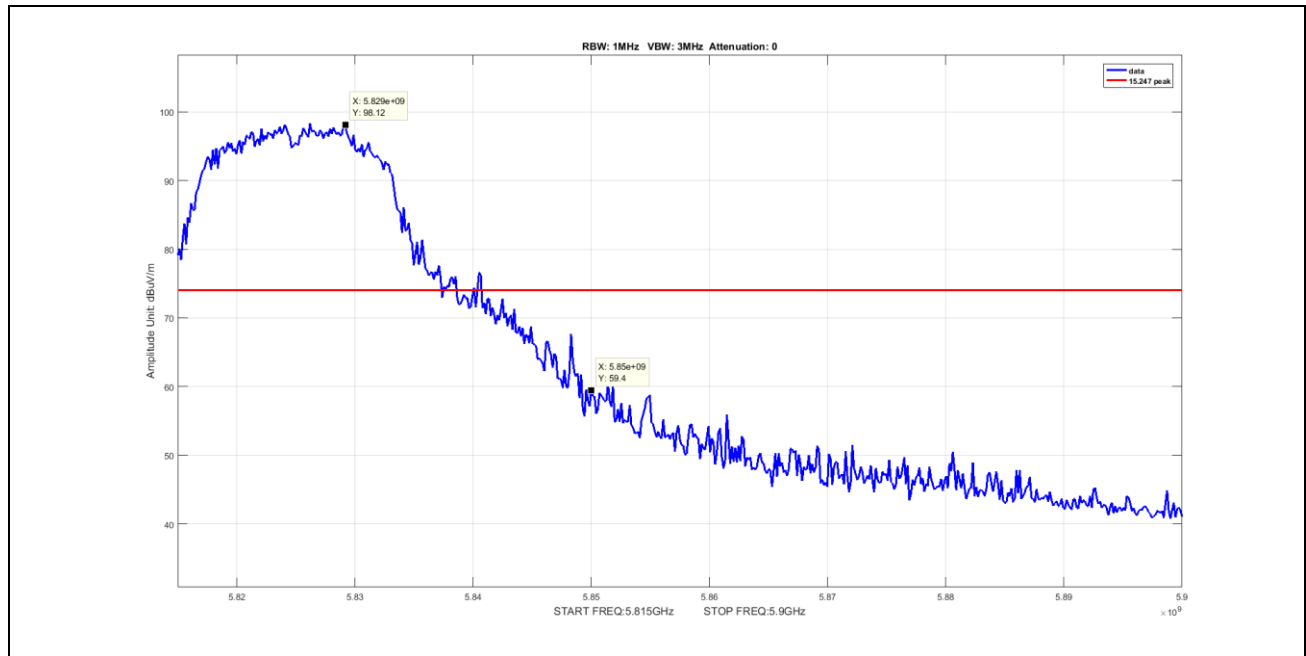
Plot 52. Undesirable Emissions, Average Band Edge Spurious, BW 40M, Ch 5795M, N Mode ANT 0 (worst-case) V



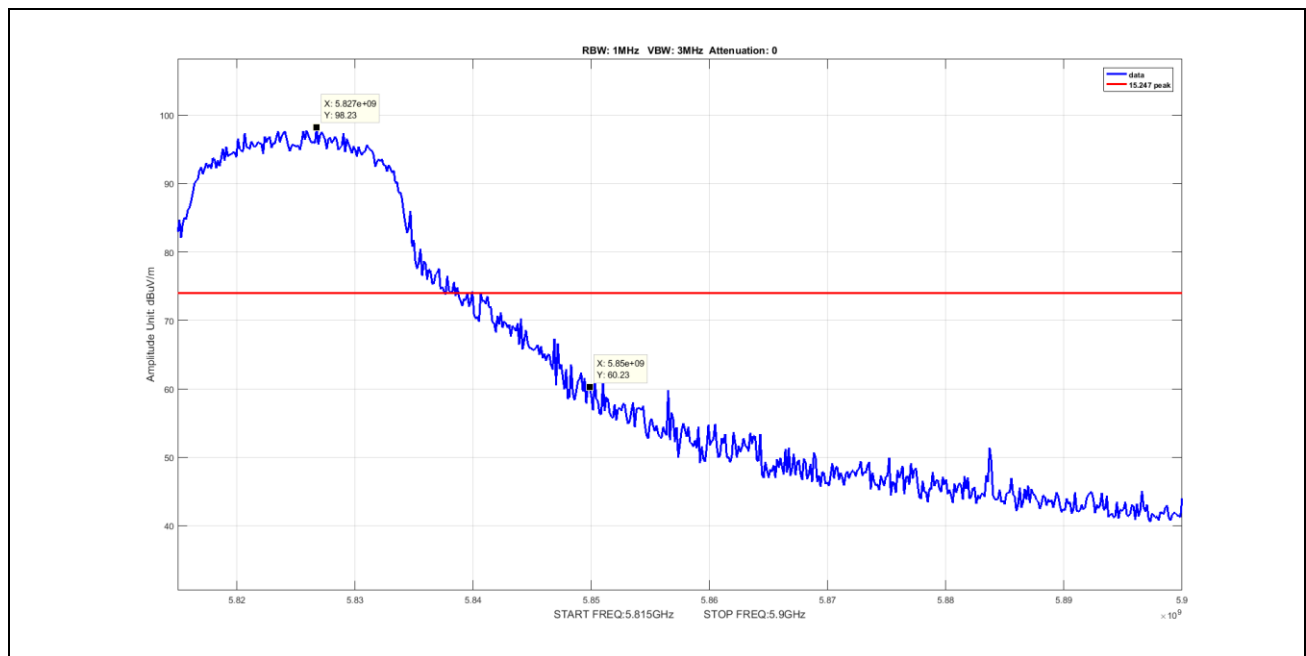
Plot 53. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5745M, A Mode ANT 0 (worst-case) V



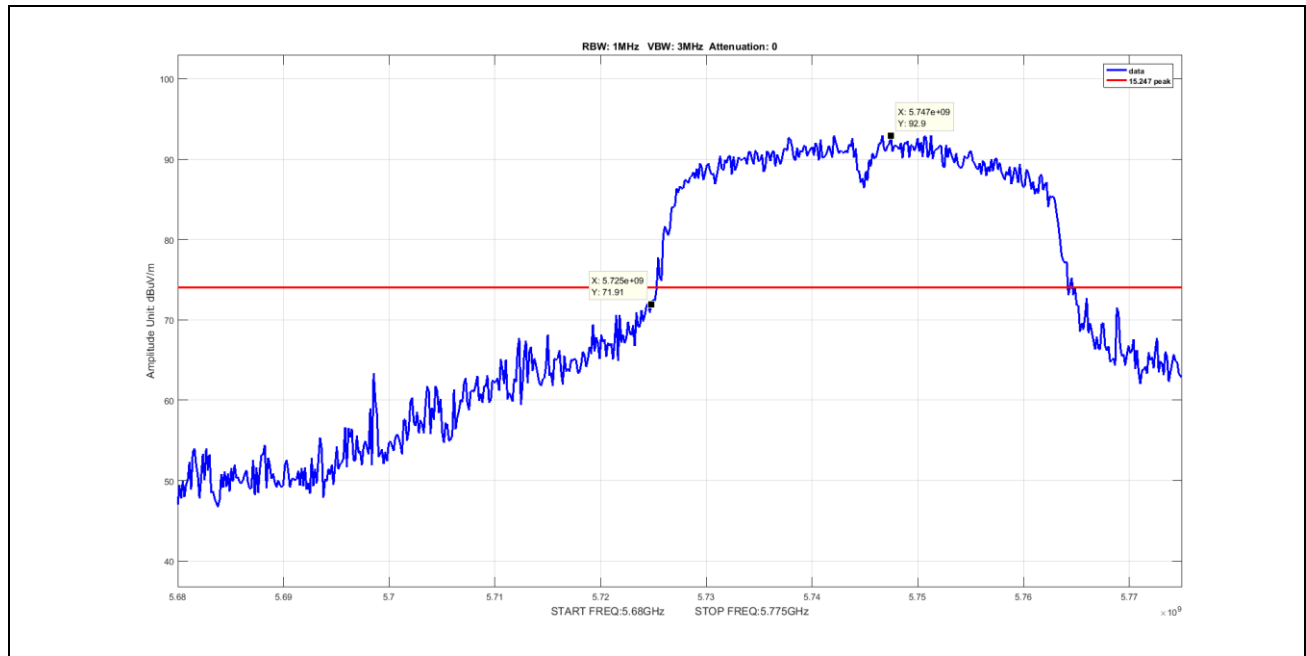
Plot 54. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5745M, N Mode ANT 0 (worst-case) V



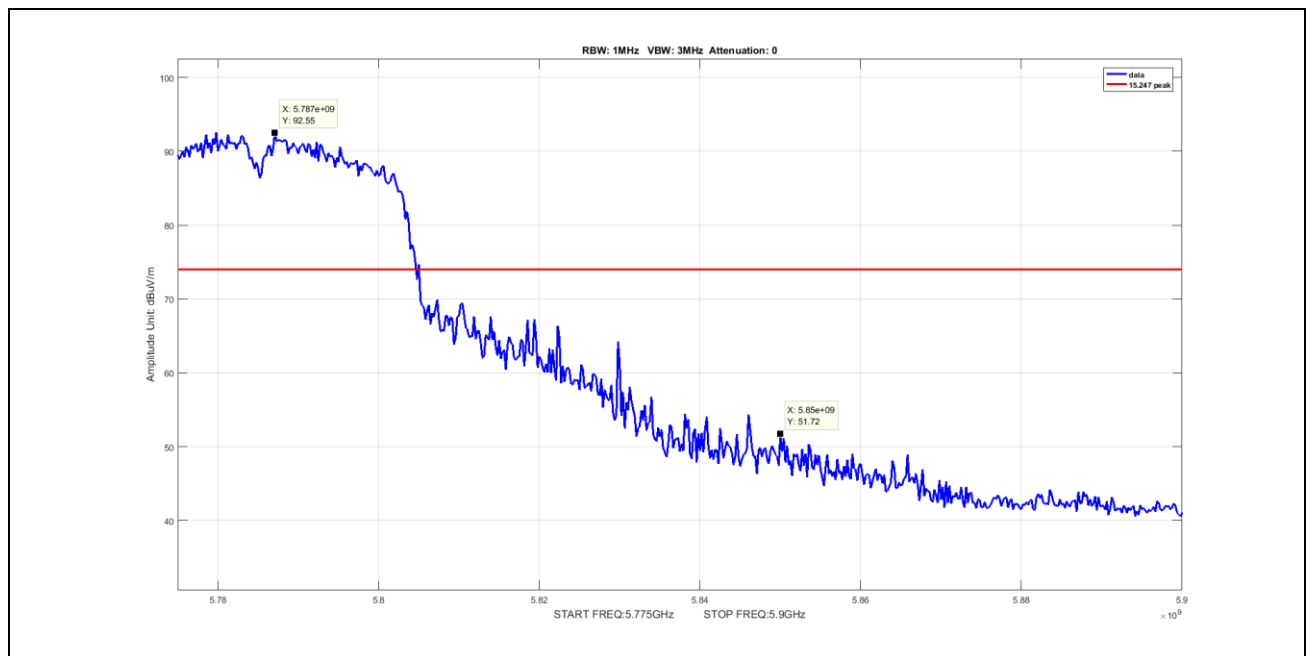
Plot 55. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5825M, A Mode ANT 0 (worst-case) V



Plot 56. Undesirable Emissions, Peak Band Edge Spurious, BW 20M, Ch 5825M, N Mode ANT 0 (worst-case) V

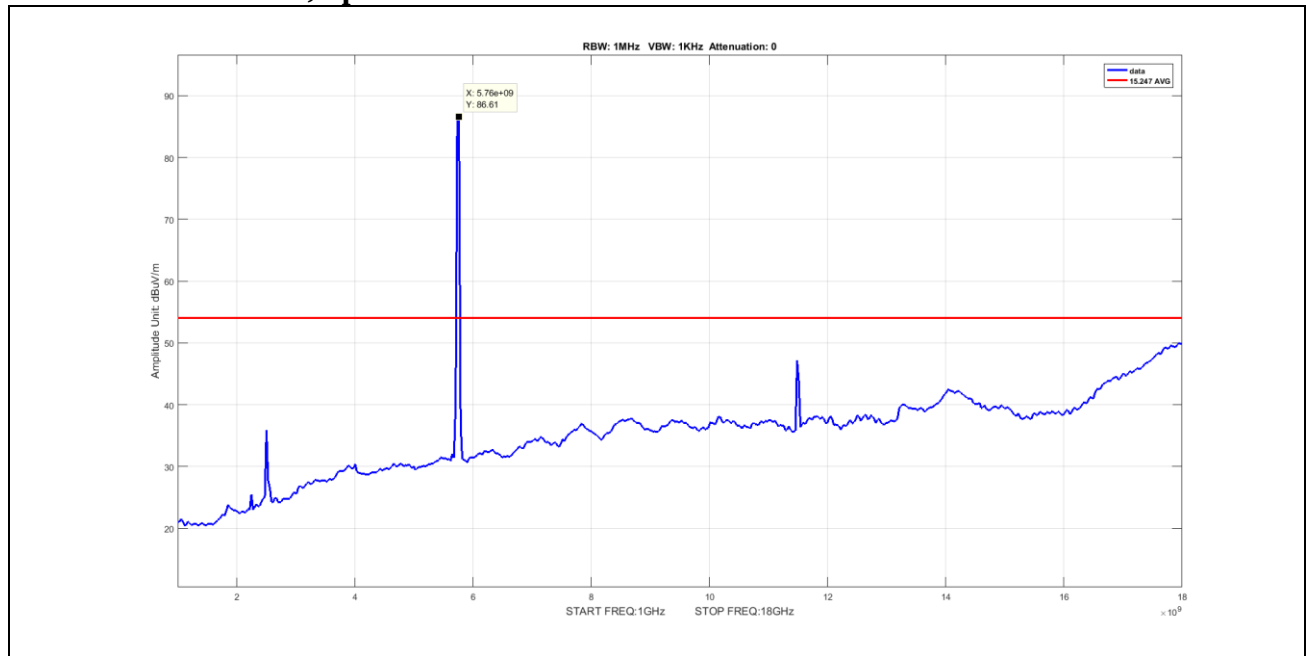


Plot 57. Undesirable Emissions, Peak Band Edge Spurious, BW 40M, Ch 5755M, N Mode ANT 0 (worst-case) V

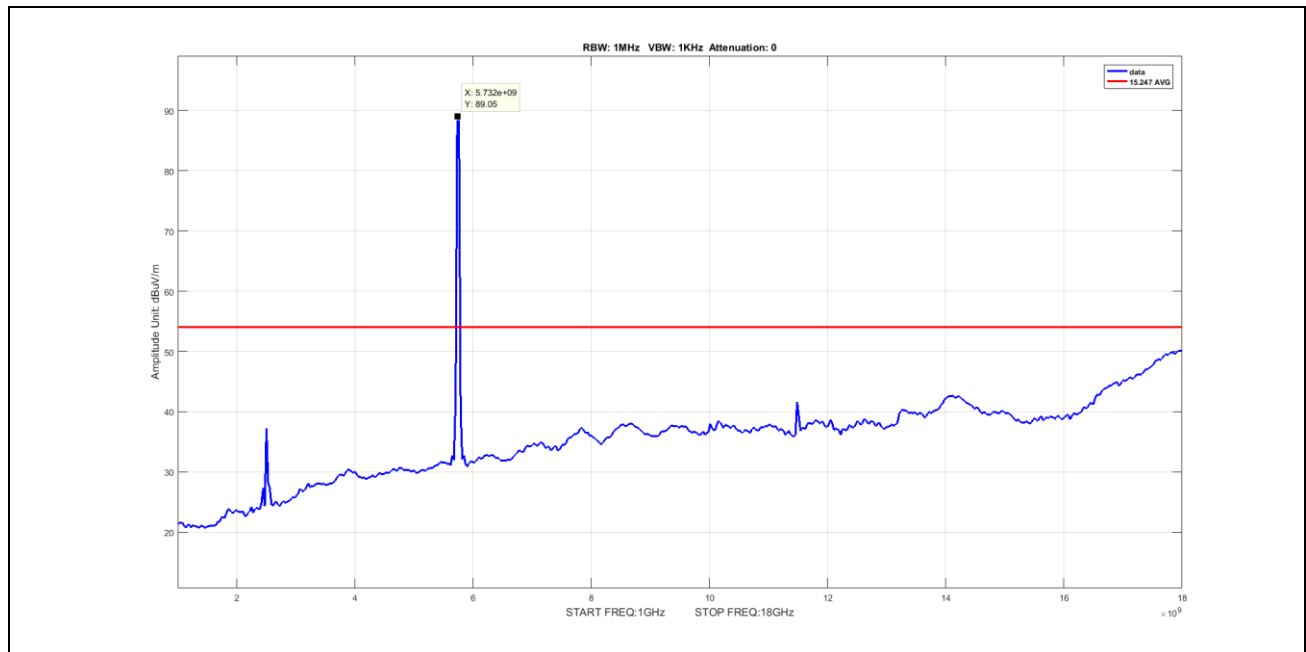


Plot 58. Undesirable Emissions, Peak Band Edge Spurious, BW 40M, Ch 5795M, N Mode ANT 0 (worst-case) V

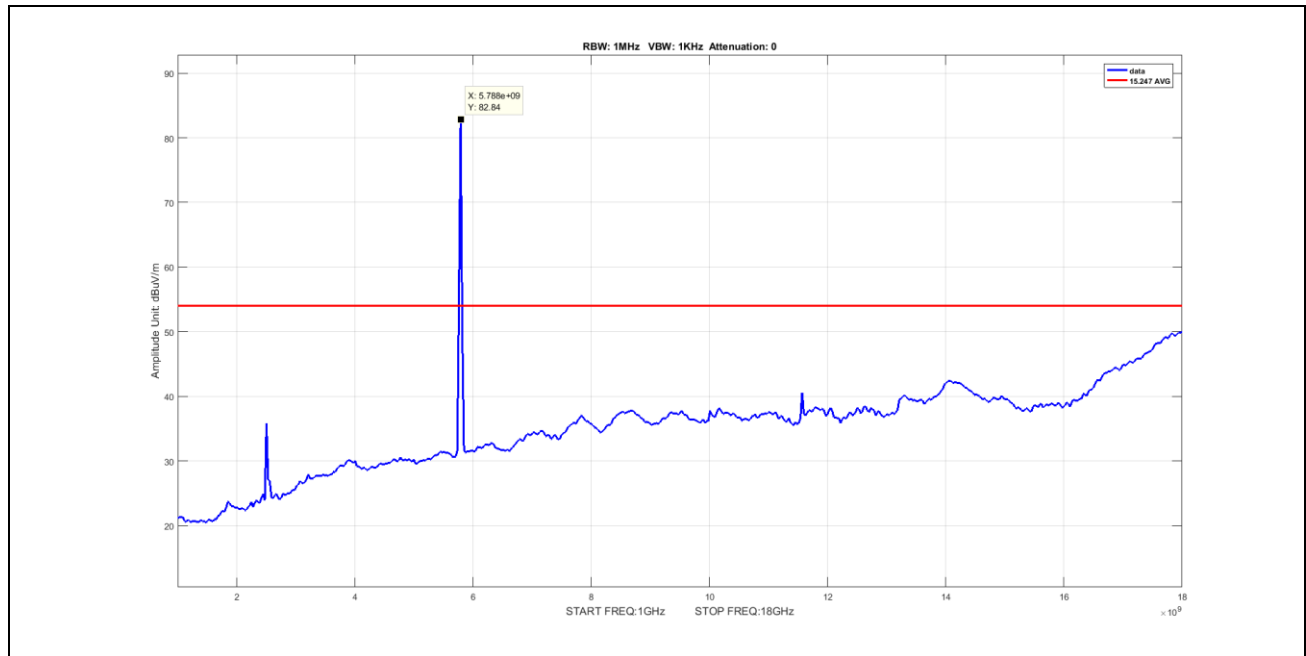
Undesirable Emissions, Spurious Emissions Above 1 GHz



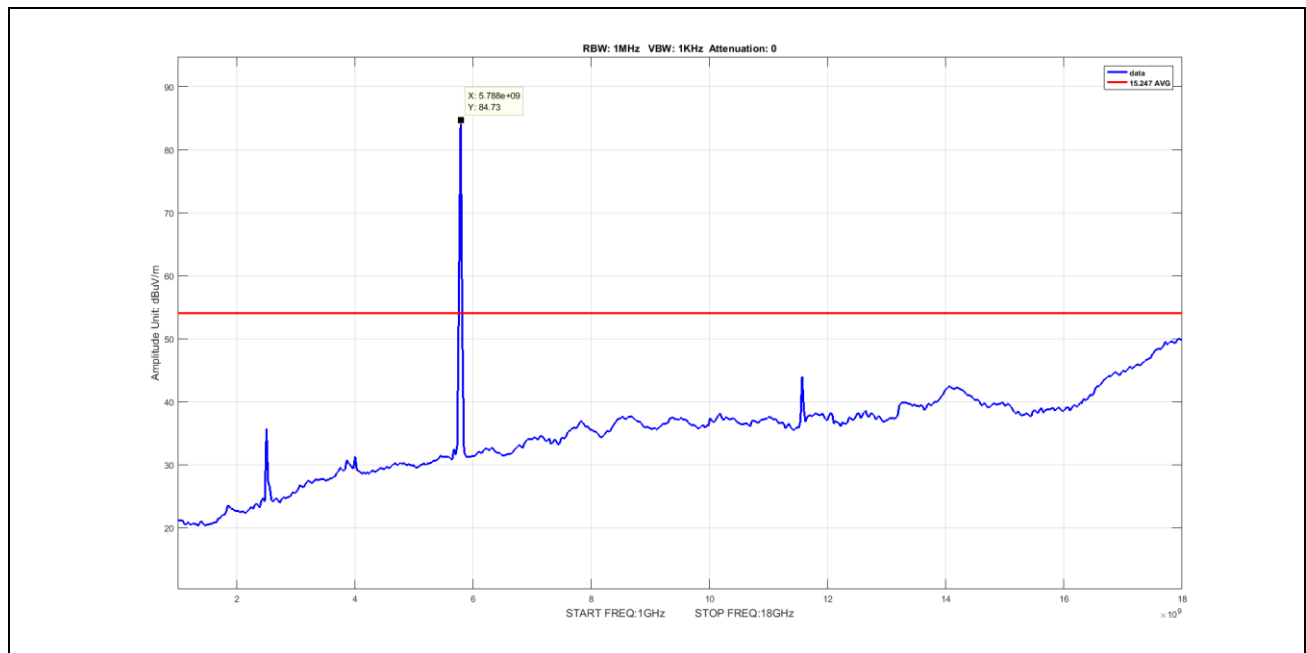
Plot 59. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5745M, A Mode ANT 0 (worst-case) V



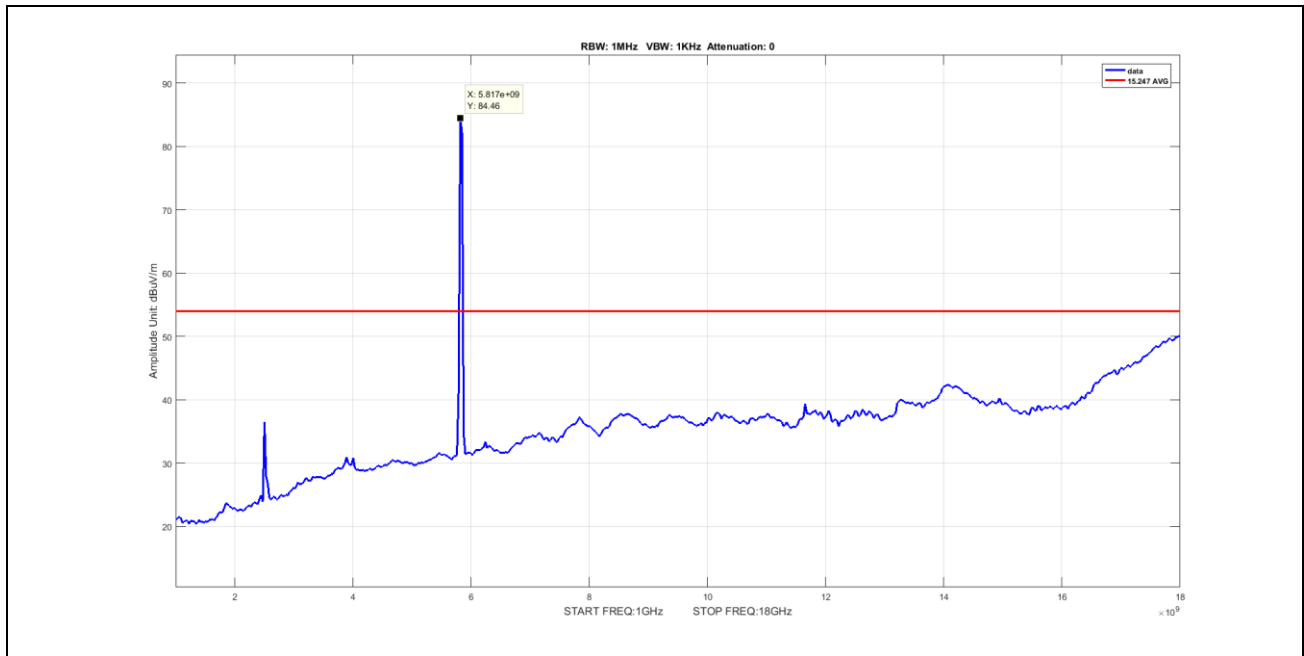
Plot 60. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5745M, N Mode ANT 0 (worst-case) V



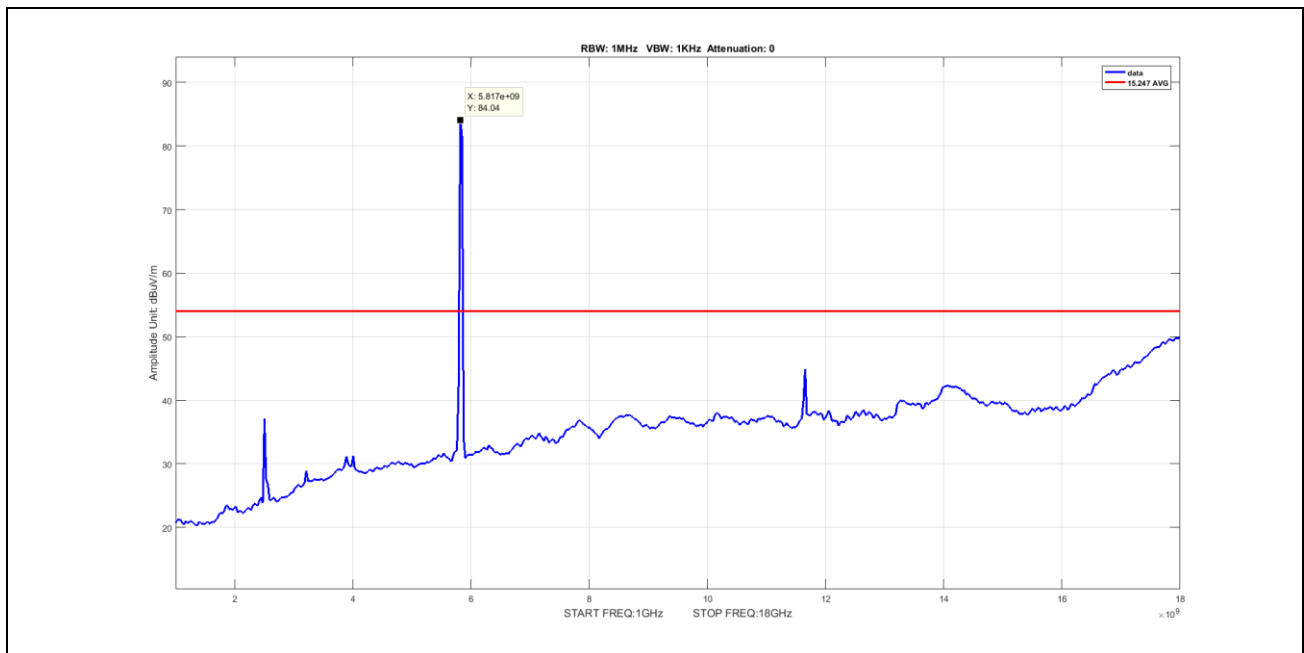
Plot 61. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5785M, A Mode ANT 0 (worst-case) V



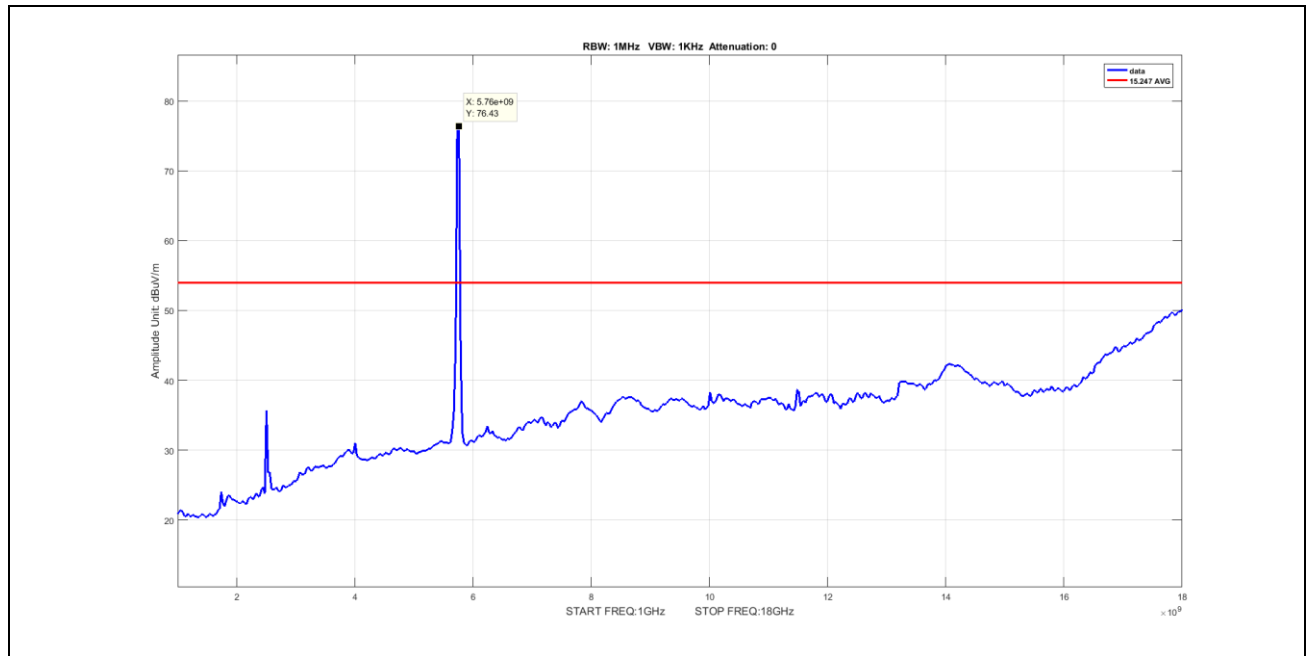
Plot 62. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5785M, N Mode ANT 0 (worst-case) V



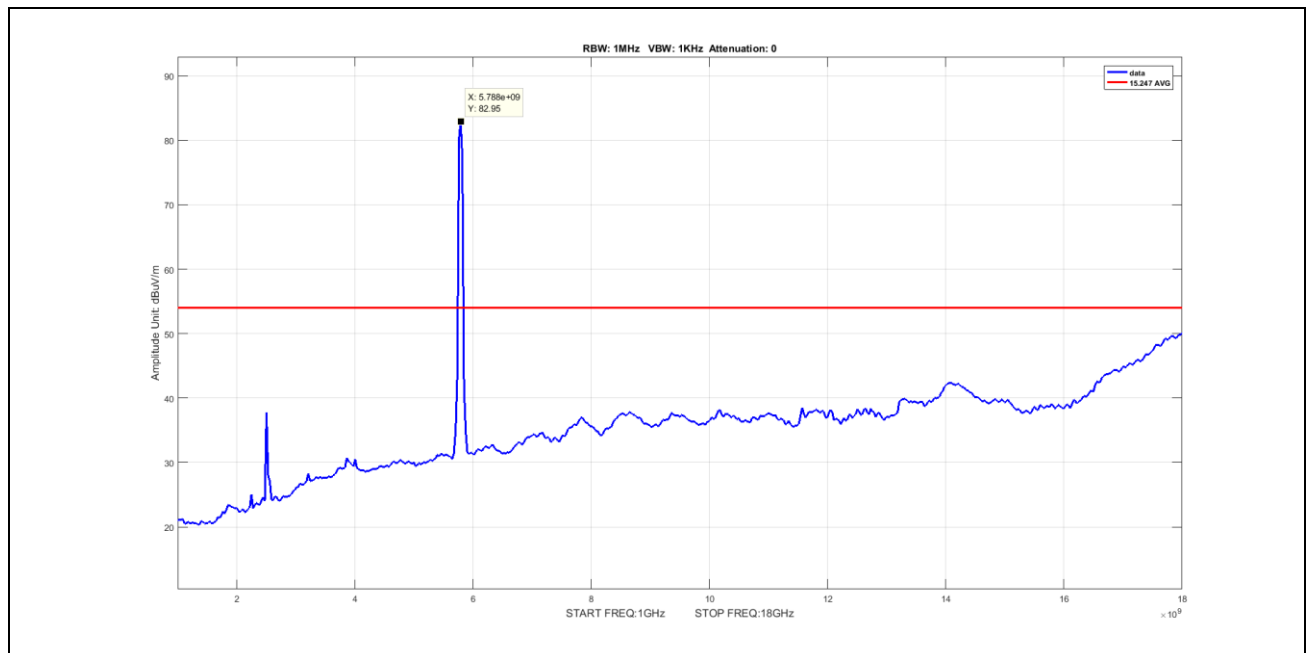
Plot 63. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5825M, A Mode ANT 0 (worst-case) V



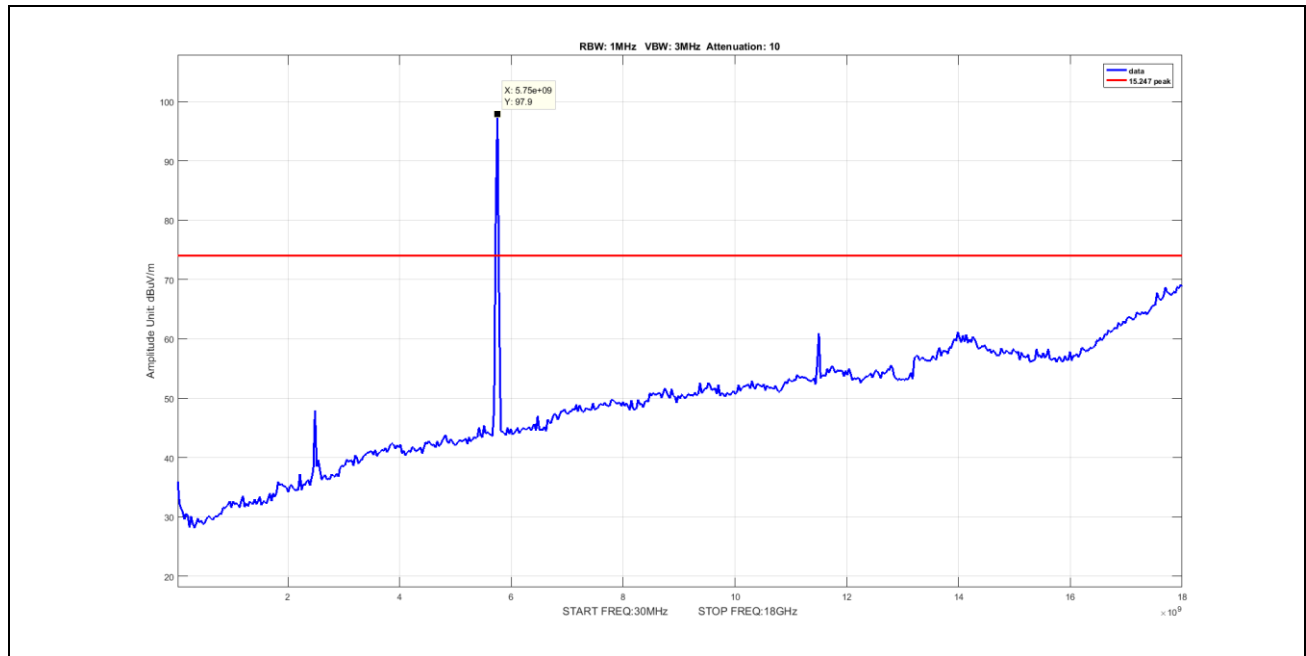
Plot 64. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5825M, N Mode ANT 0 (worst-case) V



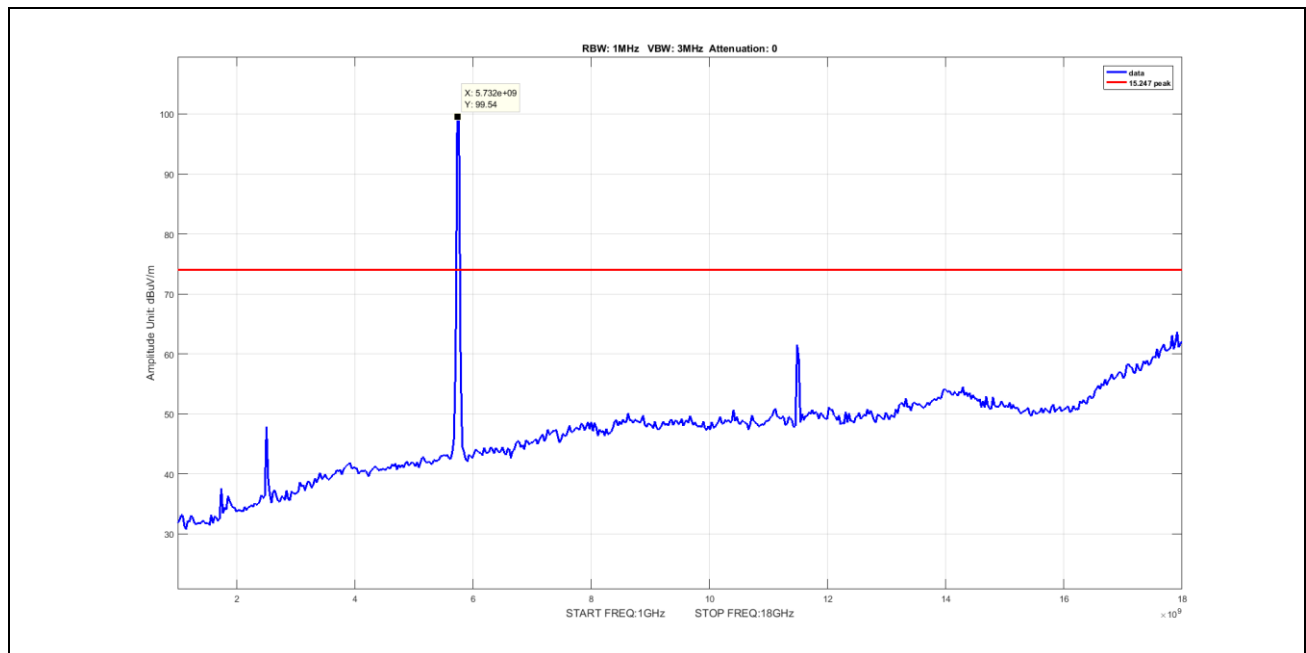
Plot 65. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 40M, Ch 5755M, N Mode ANT 0 (worst-case) V



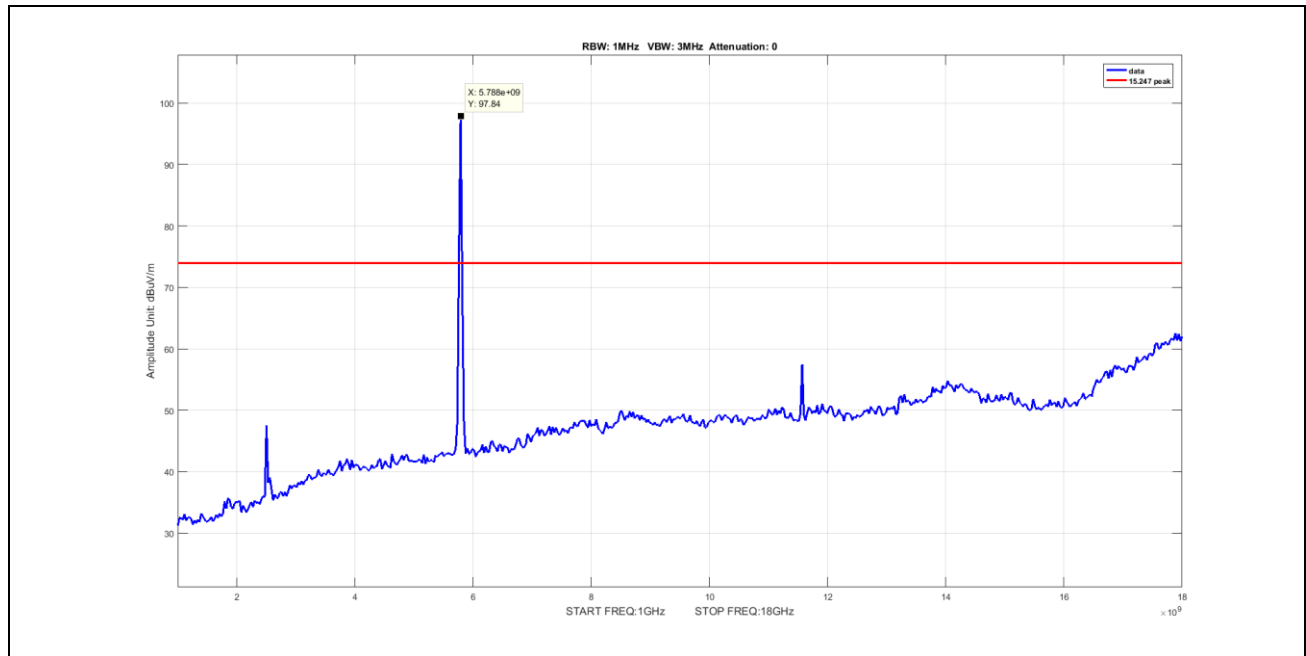
Plot 66. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 40M, Ch 5795M, N Mode ANT 0 (worst-case) V



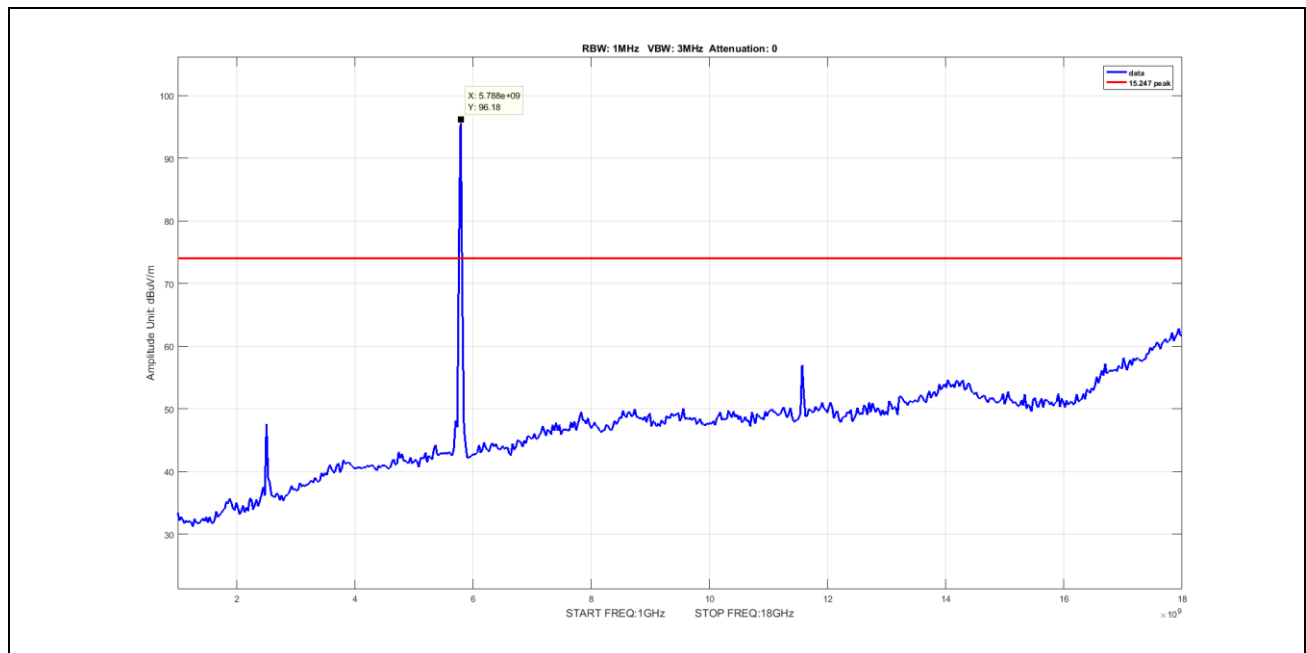
Plot 67. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5745M, A Mode ANT 0 (worst-case) V



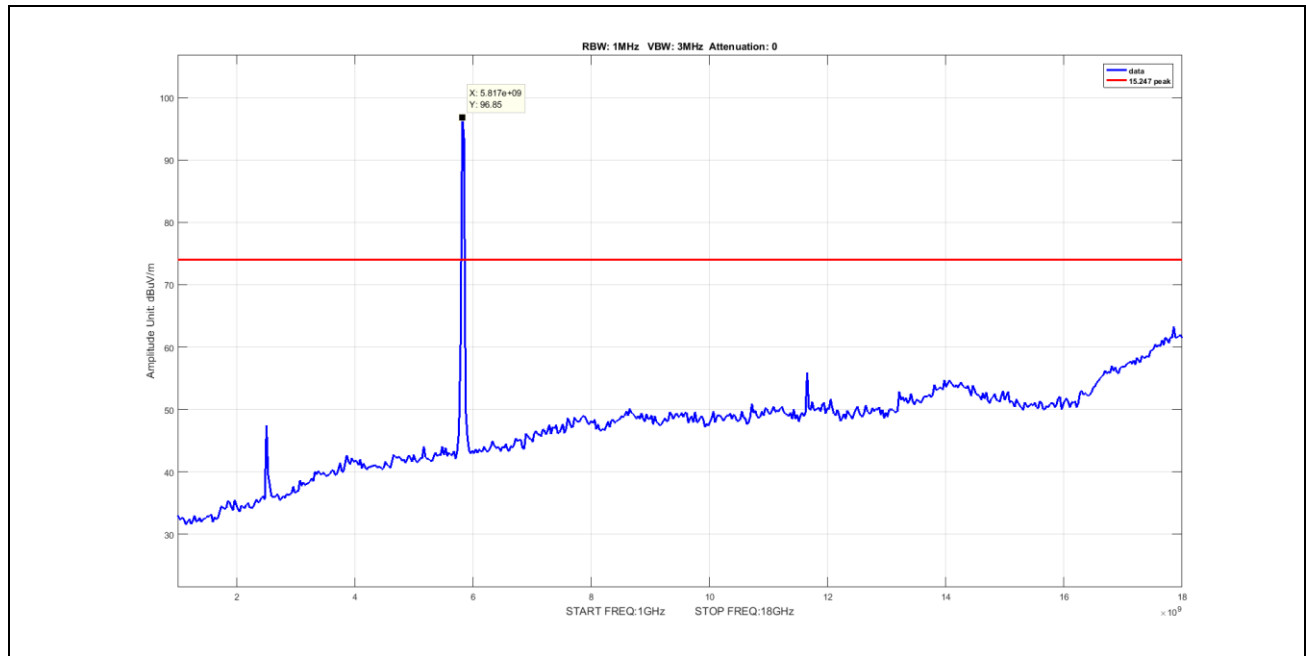
Plot 68. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5745M, N Mode ANT 0 (worst-case) V



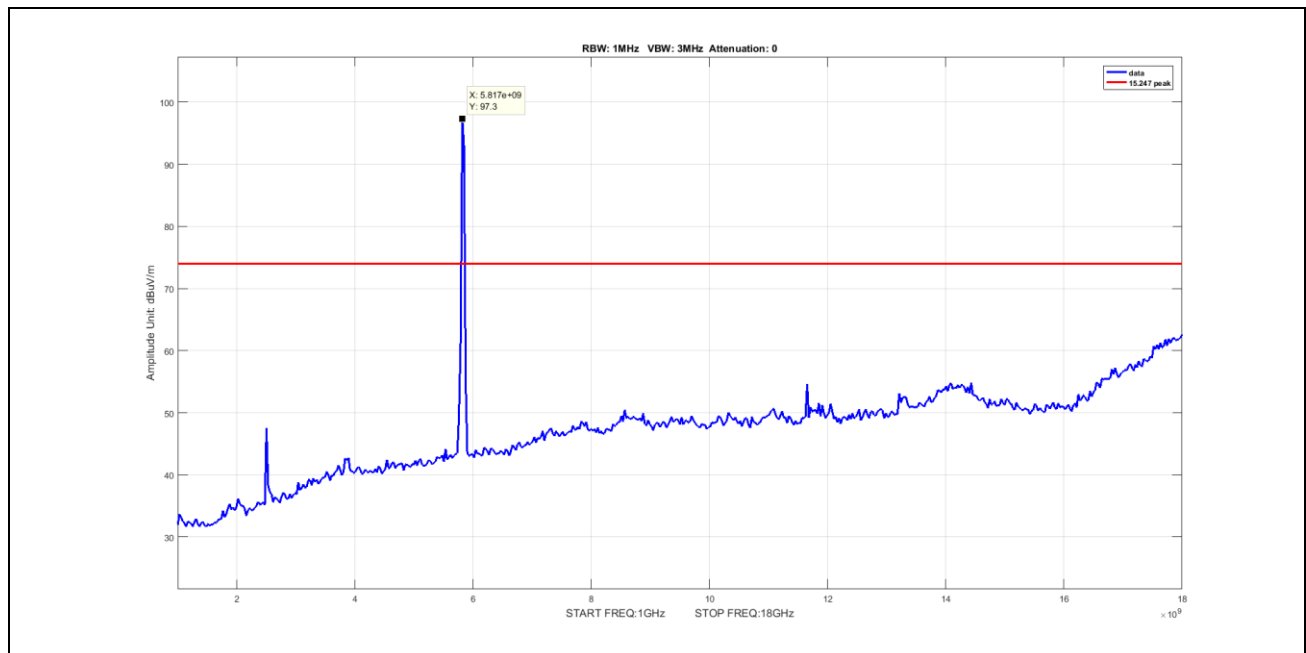
Plot 69. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5785M, A Mode ANT 0 (worst-case) V



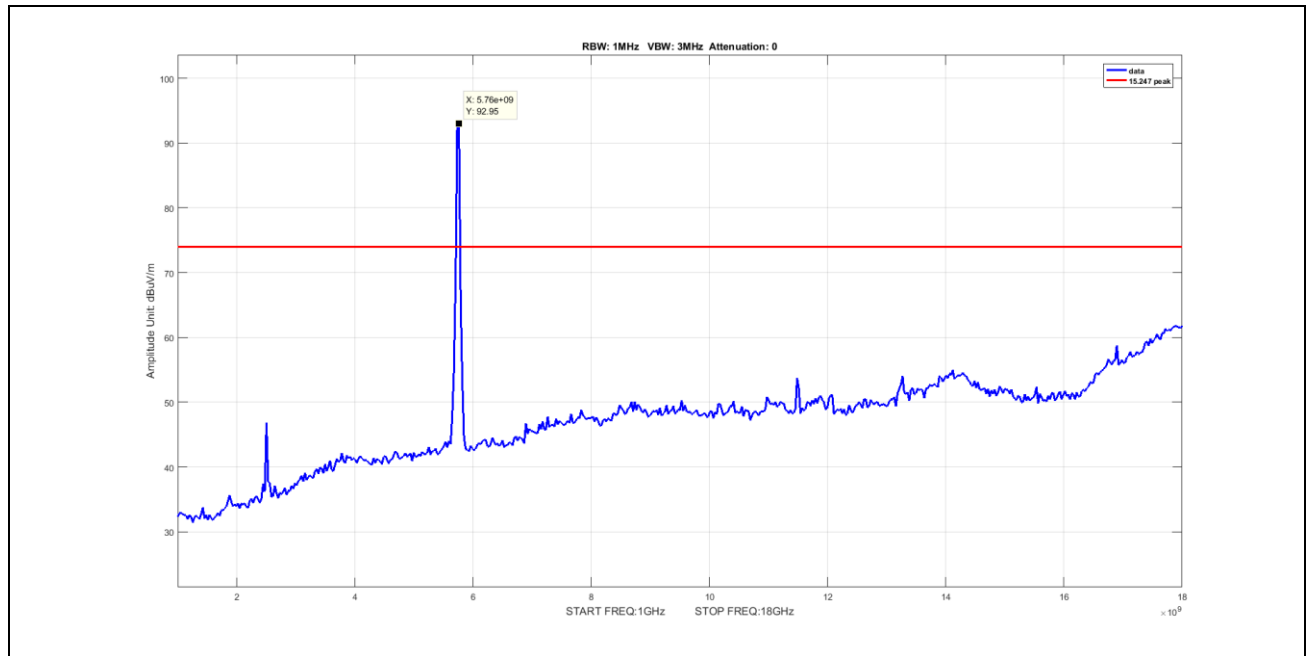
Plot 70. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5785M, N Mode ANT 0 (worst-case) V



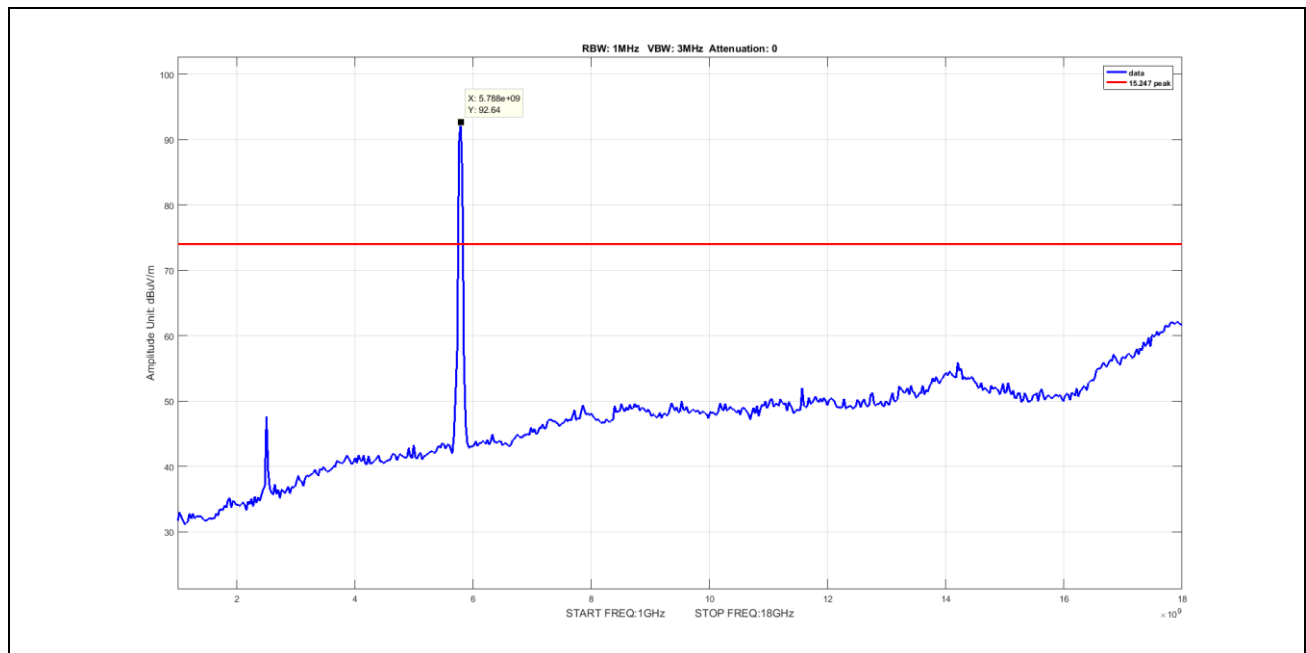
Plot 71. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5825M, A Mode ANT 0 (worst-case) V



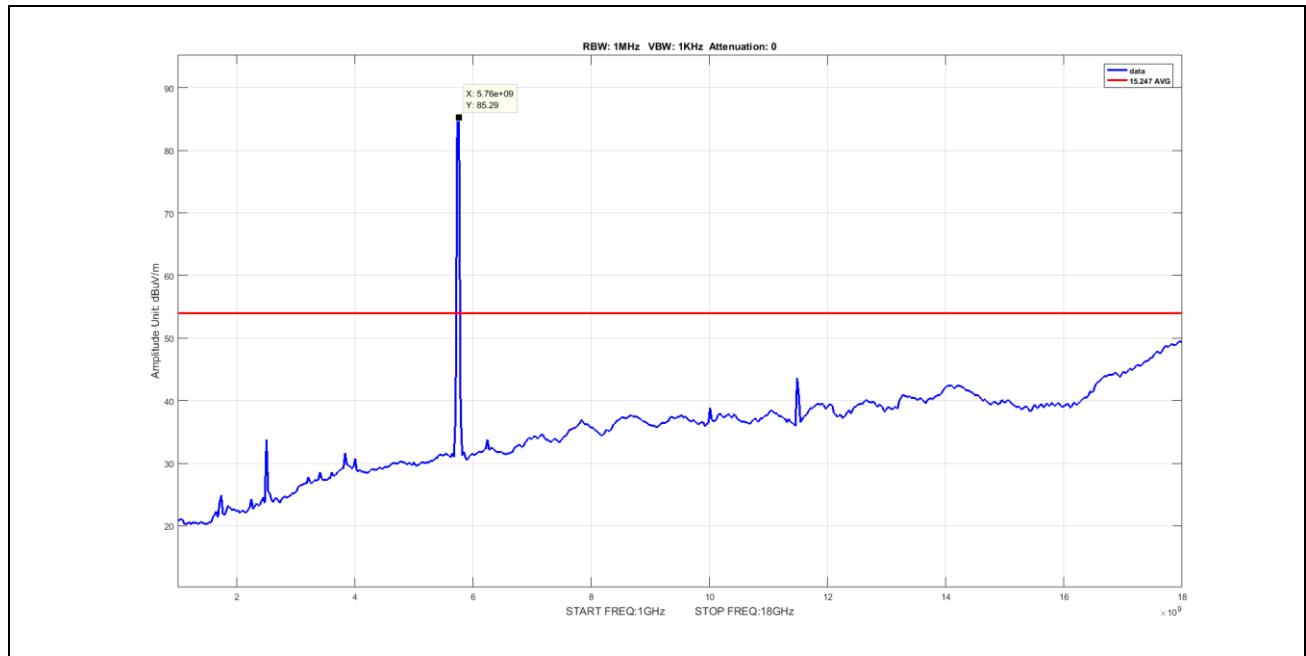
Plot 72. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5825M, N Mode ANT 0 (worst-case) V



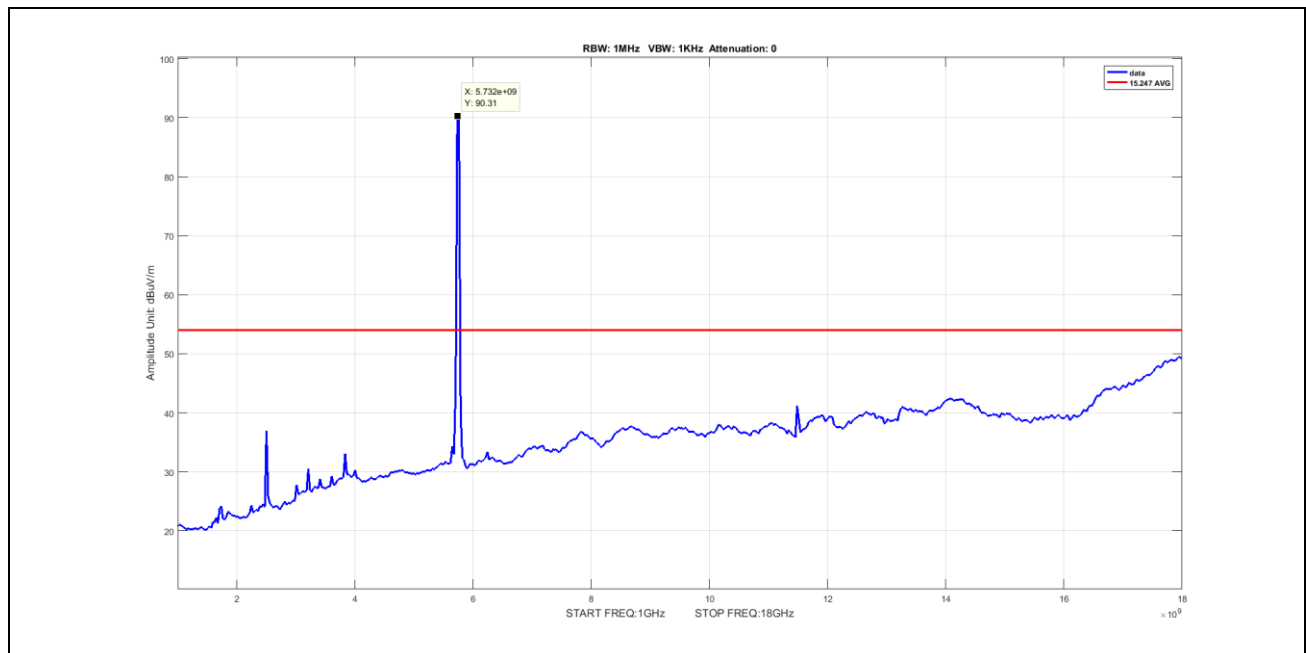
Plot 73. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 40M, Ch 5755M, N Mode ANT 0 (worst-case) V



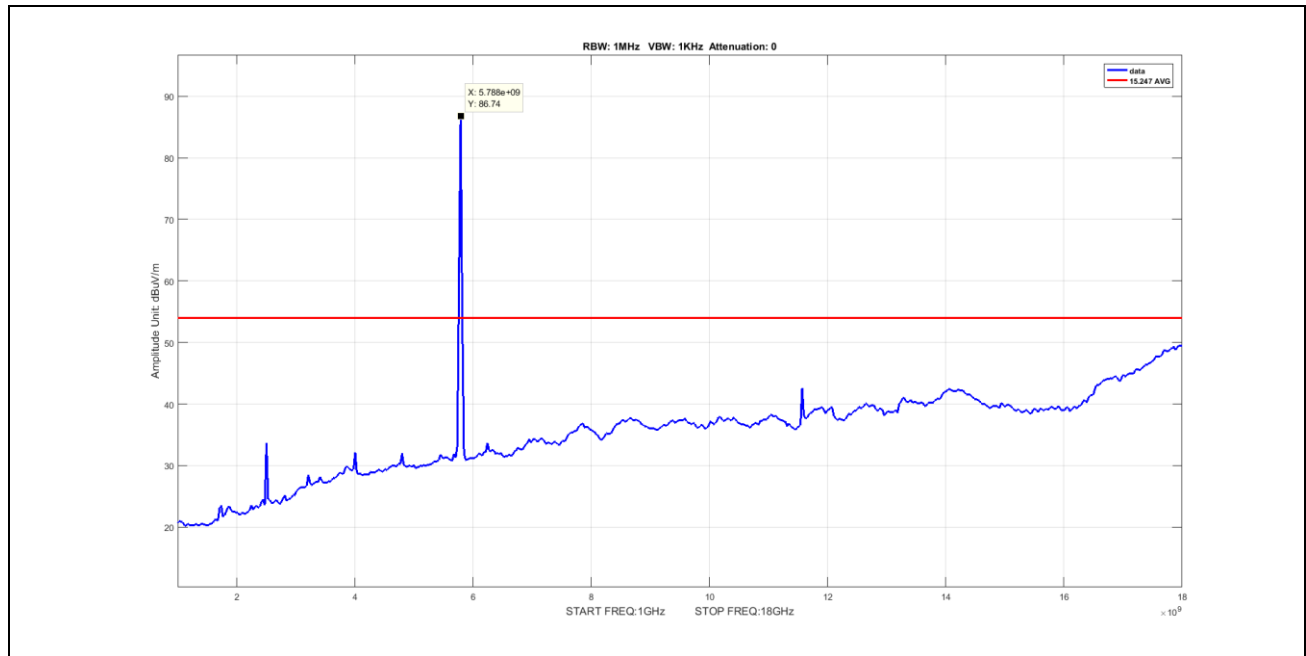
Plot 74. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 40M, Ch 5795M, N Mode ANT 0 (worst-case) V



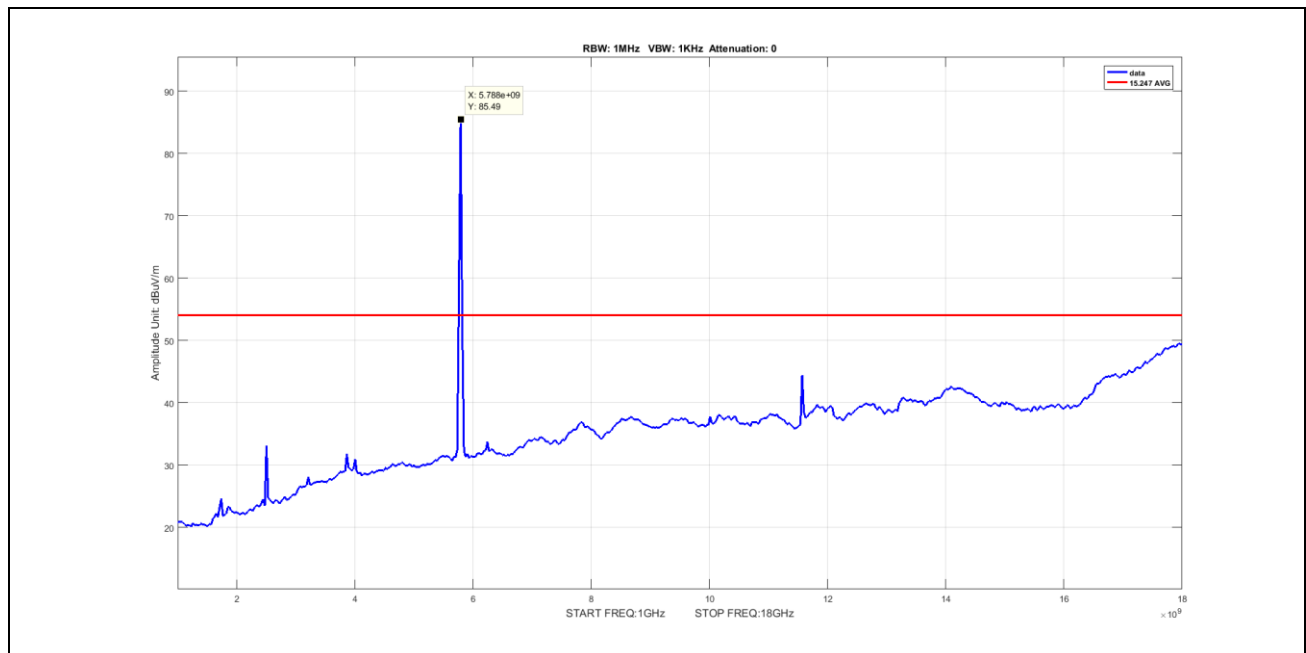
Plot 75. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5745M, A Mode ANT 1 (worst-case) V



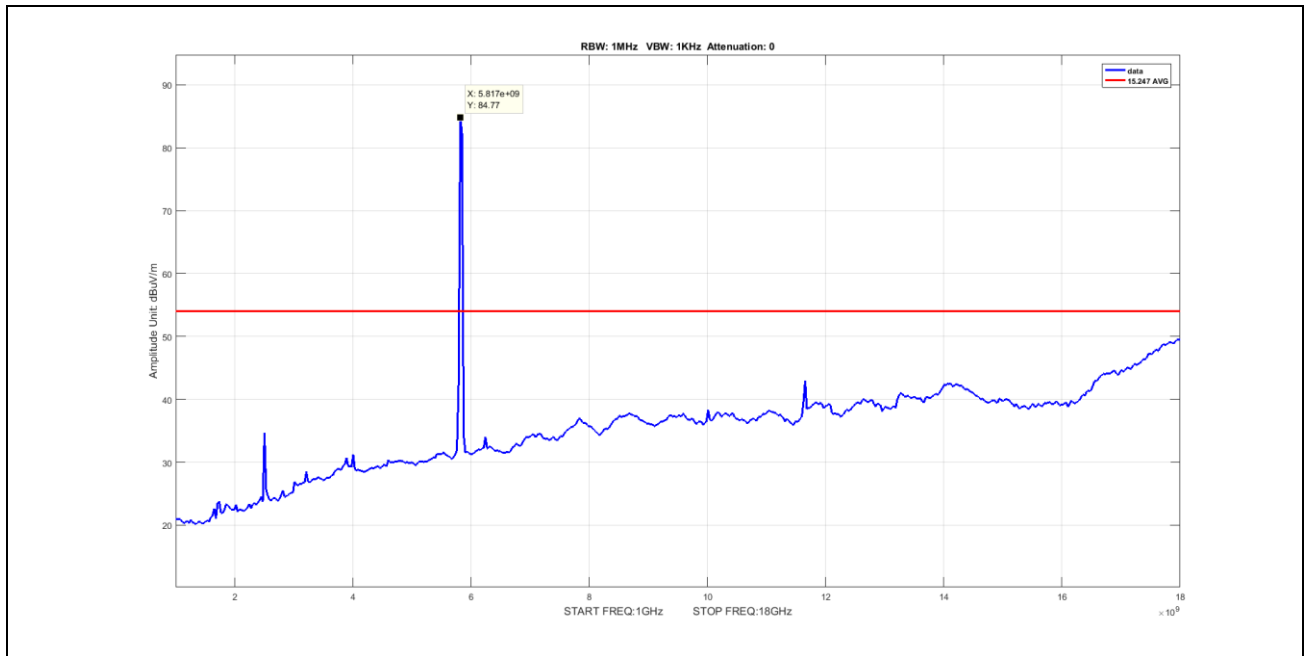
Plot 76. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5745M, N Mode ANT 1 (worst-case) V



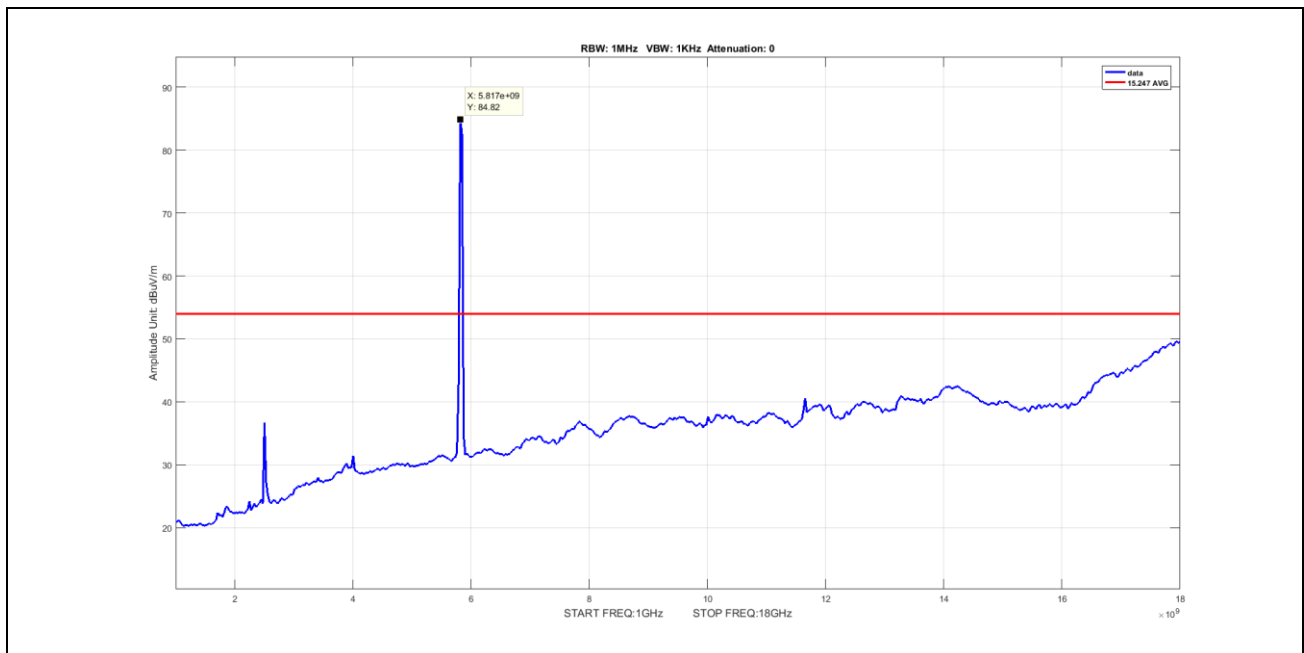
Plot 77. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5785M, A Mode ANT 1 (worst-case) V



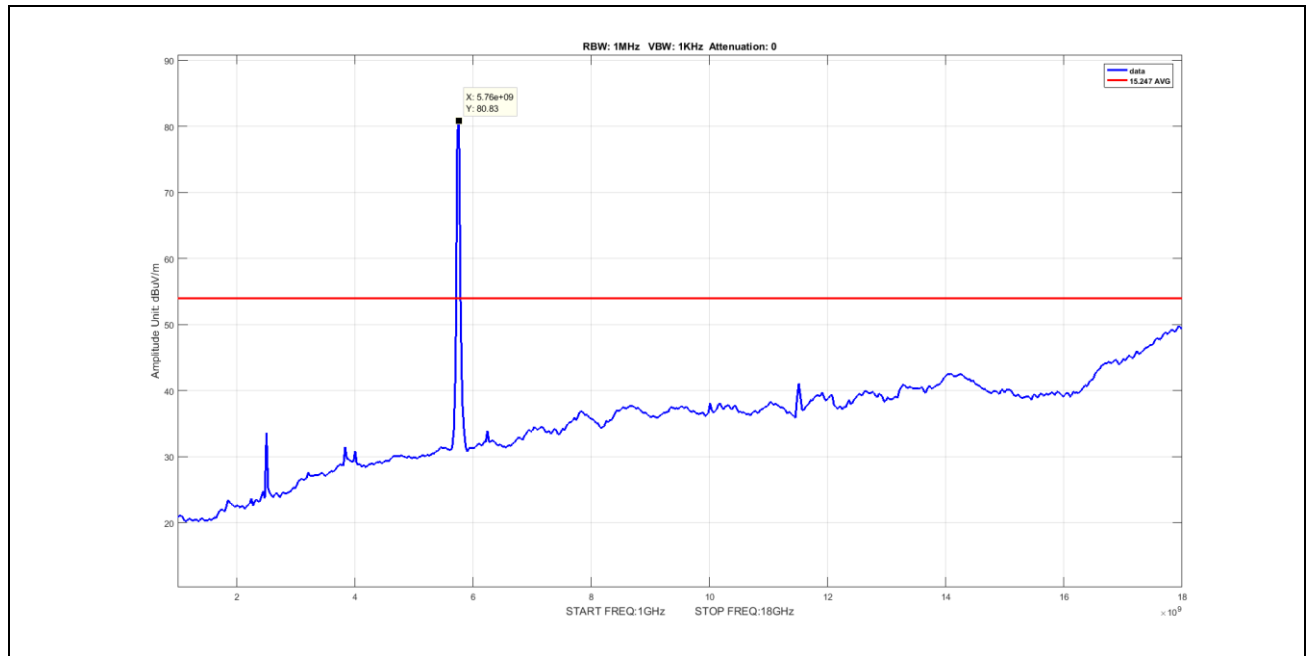
Plot 78. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5785M, N Mode ANT 1 (worst-case) V



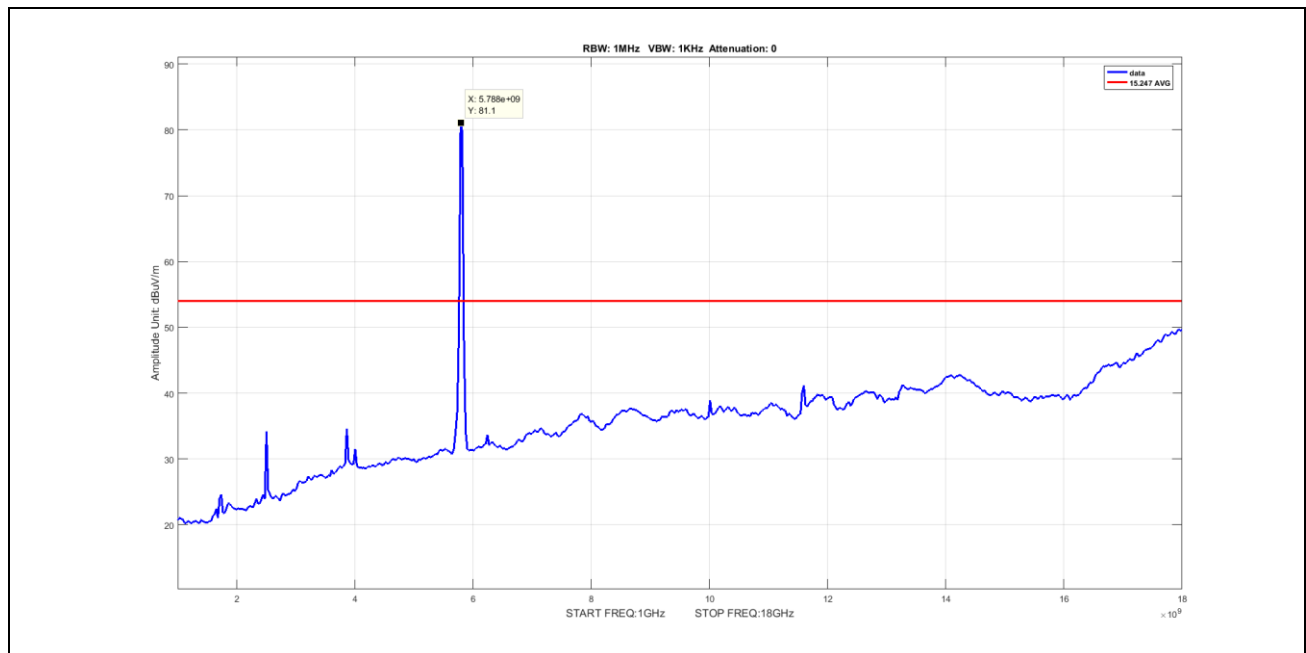
Plot 79. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5825M, A Mode ANT 1 (worst-case) V



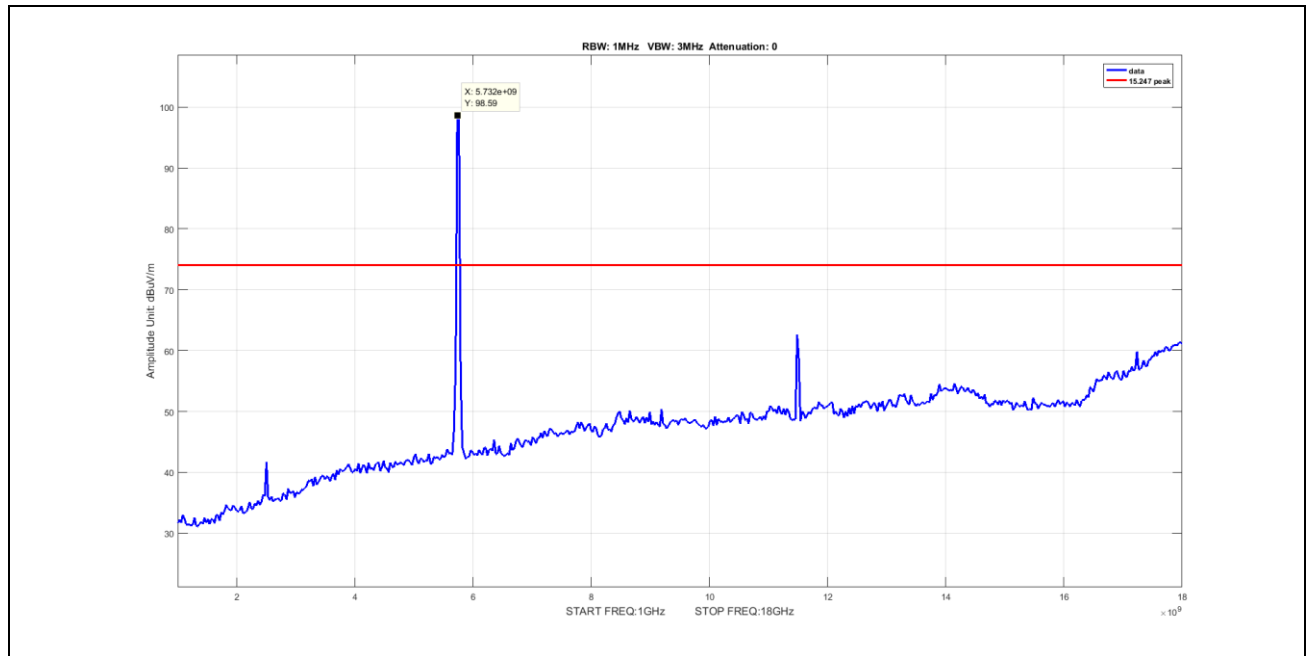
Plot 80. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 20M, Ch 5825M, N Mode ANT 1 (worst-case) V



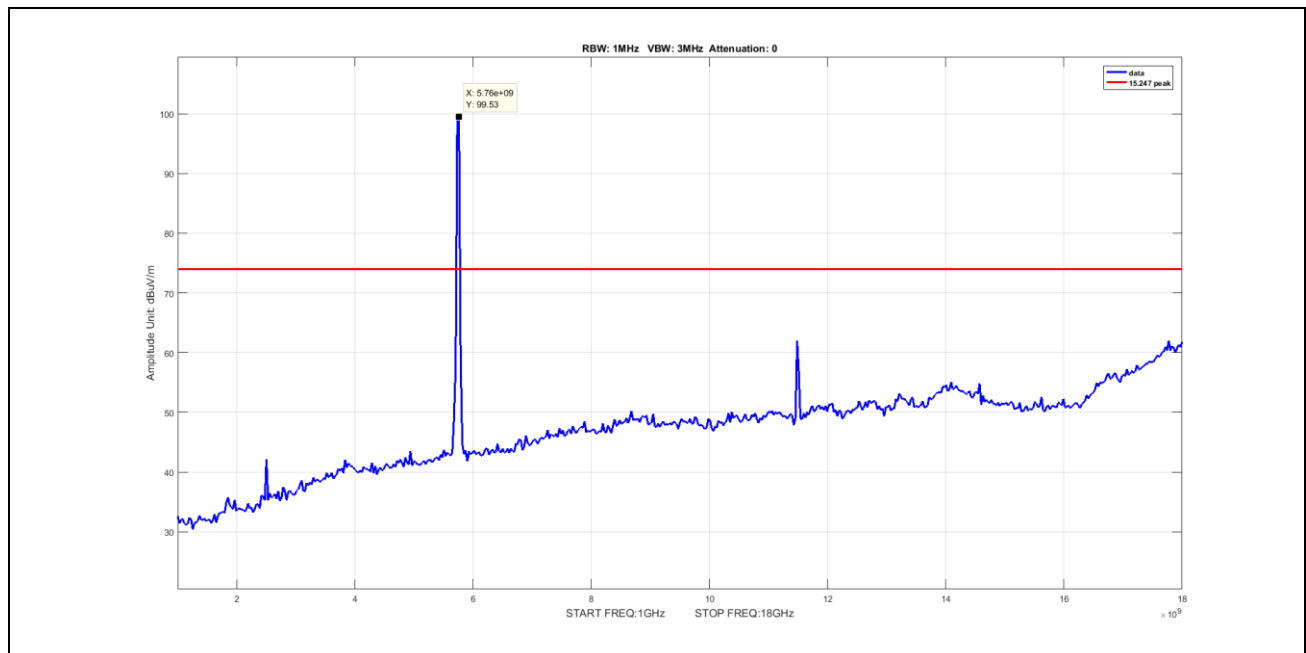
Plot 81. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 40M, Ch 5755M, N Mode ANT 1 (worst-case) V



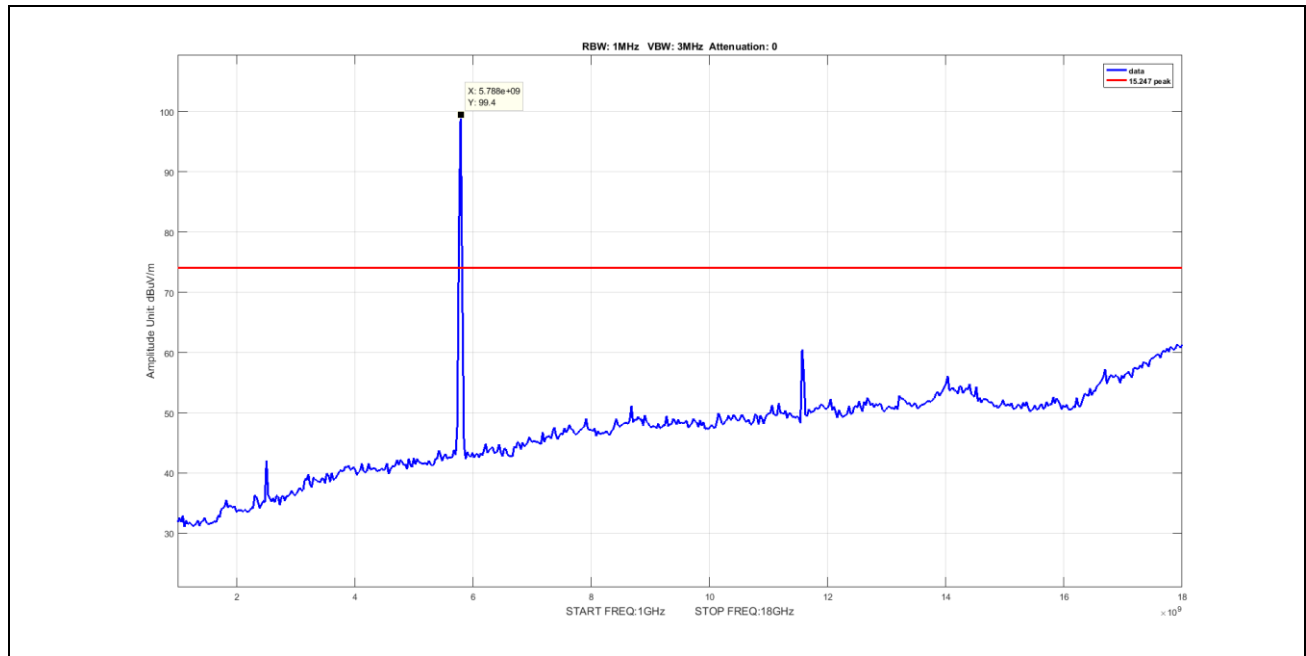
Plot 82. Undesirable Emissions, Average Spurious Emission 1-18GHz, BW 40M, Ch 5795M, N Mode ANT 1 (worst-case) V



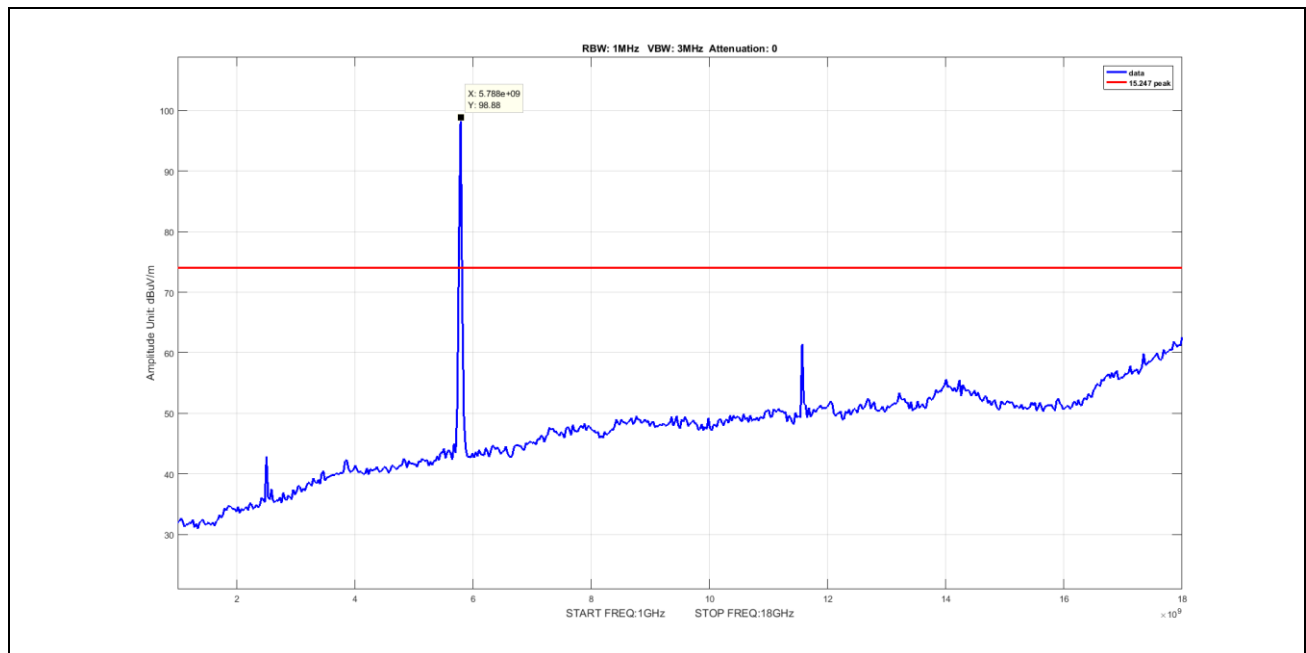
Plot 83. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5745M, A Mode ANT 1 (worst-case) V



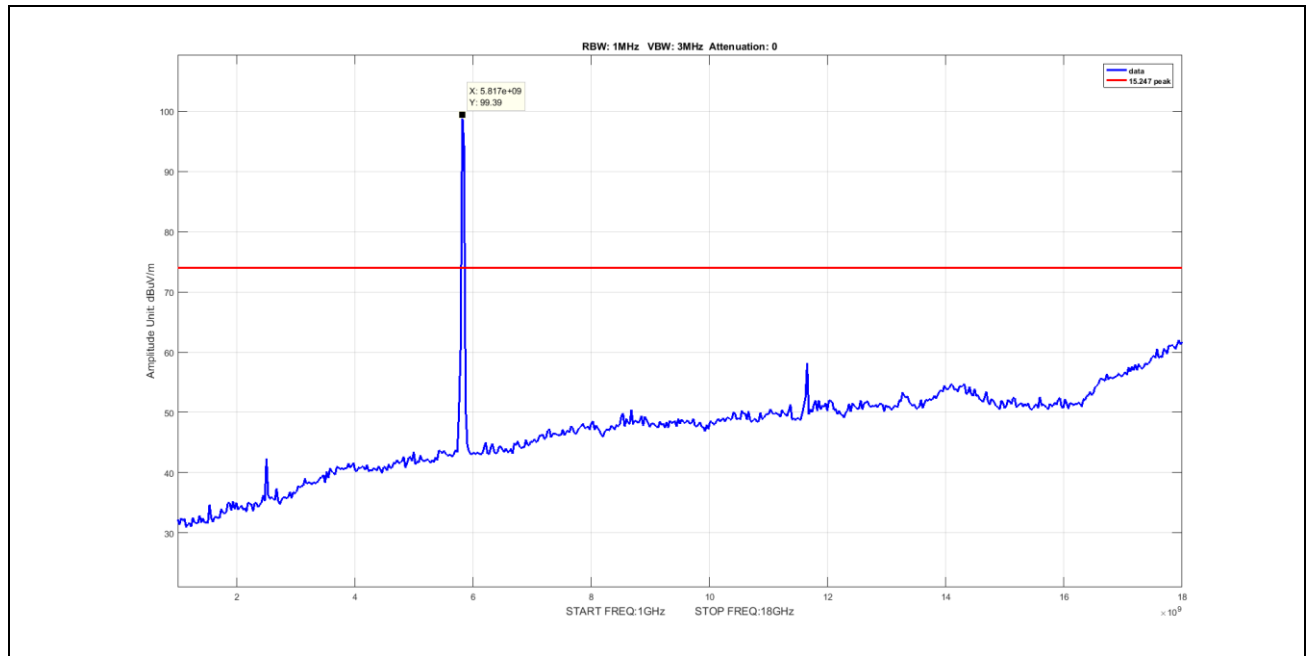
Plot 84. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5745M, N Mode ANT 1 (worst-case) V



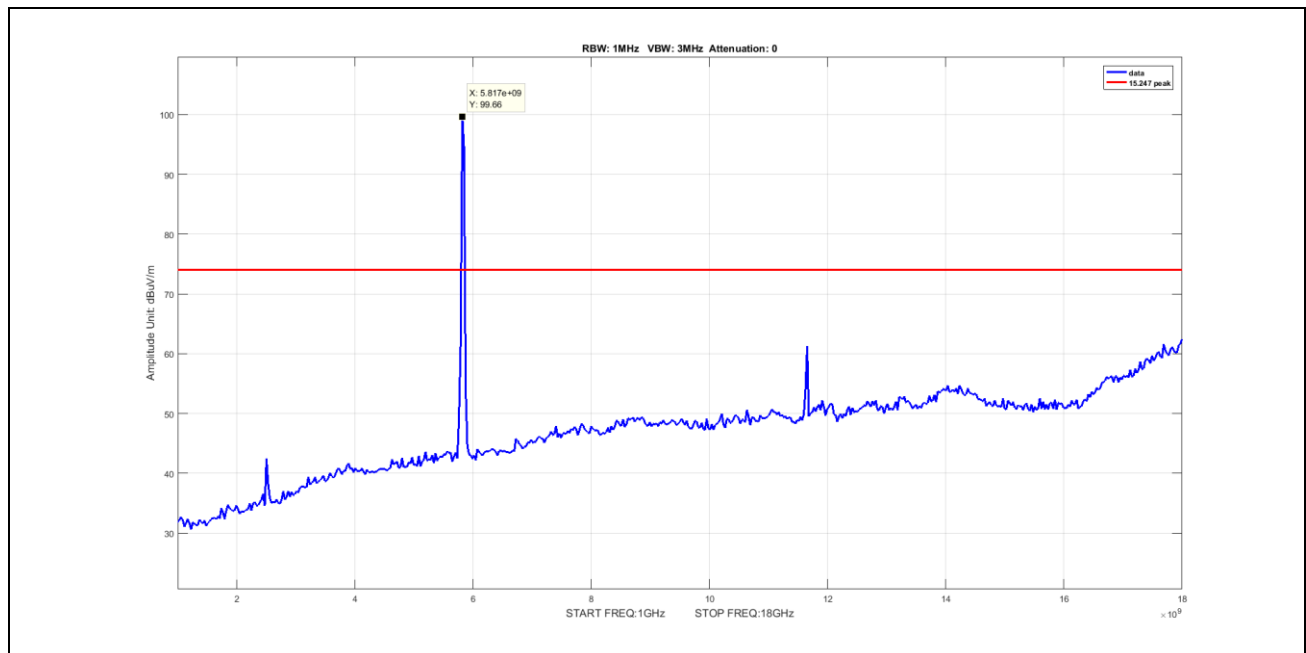
Plot 85. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5785M, A Mode ANT 1 (worst-case) V



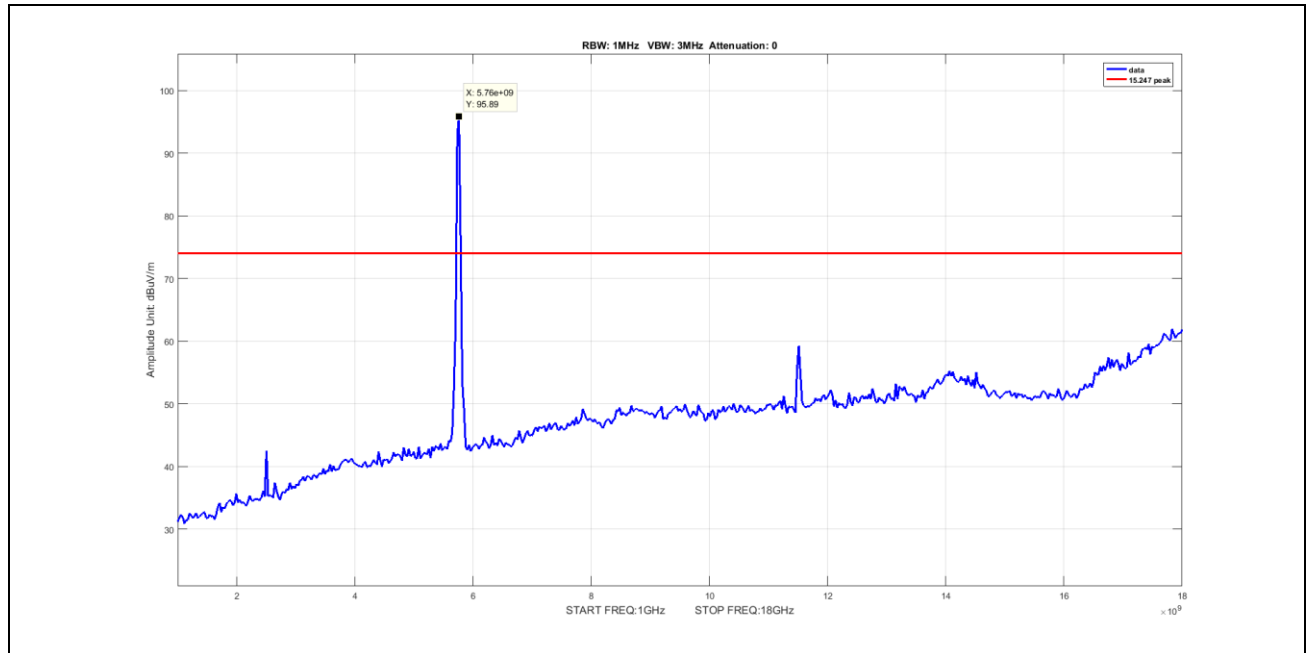
Plot 86. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5785M, N Mode ANT 1 (worst-case) V



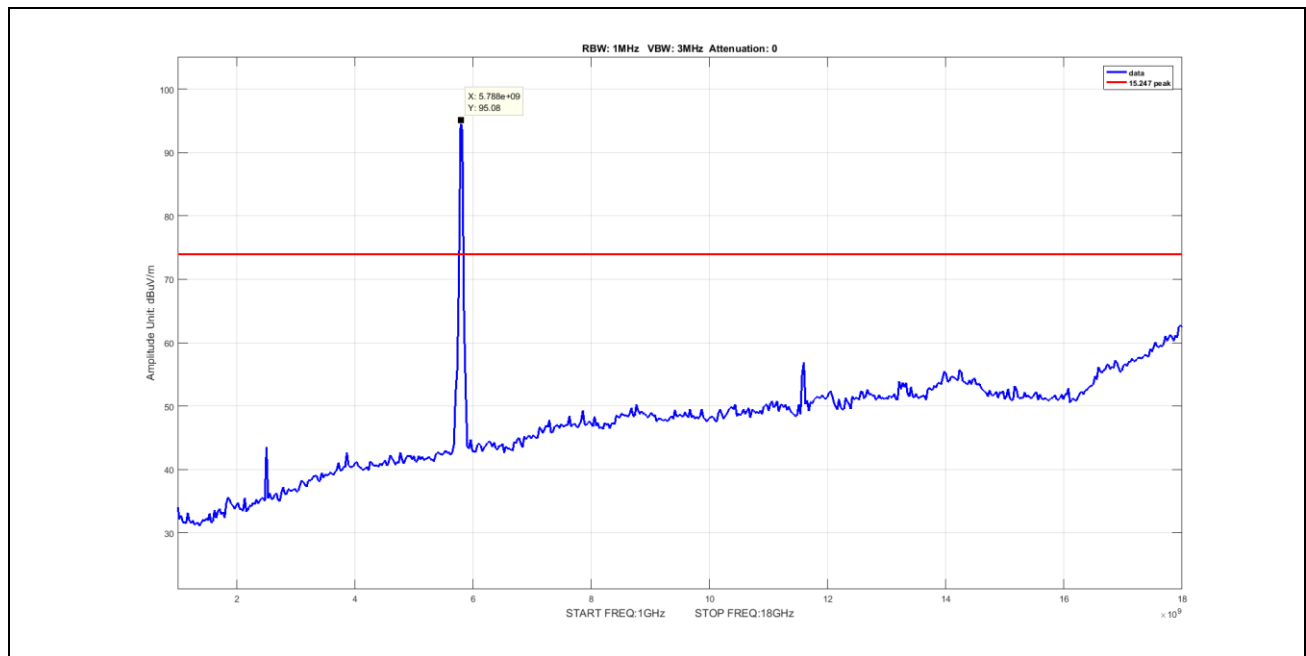
Plot 87. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5825M, A Mode ANT 1 (worst-case) V



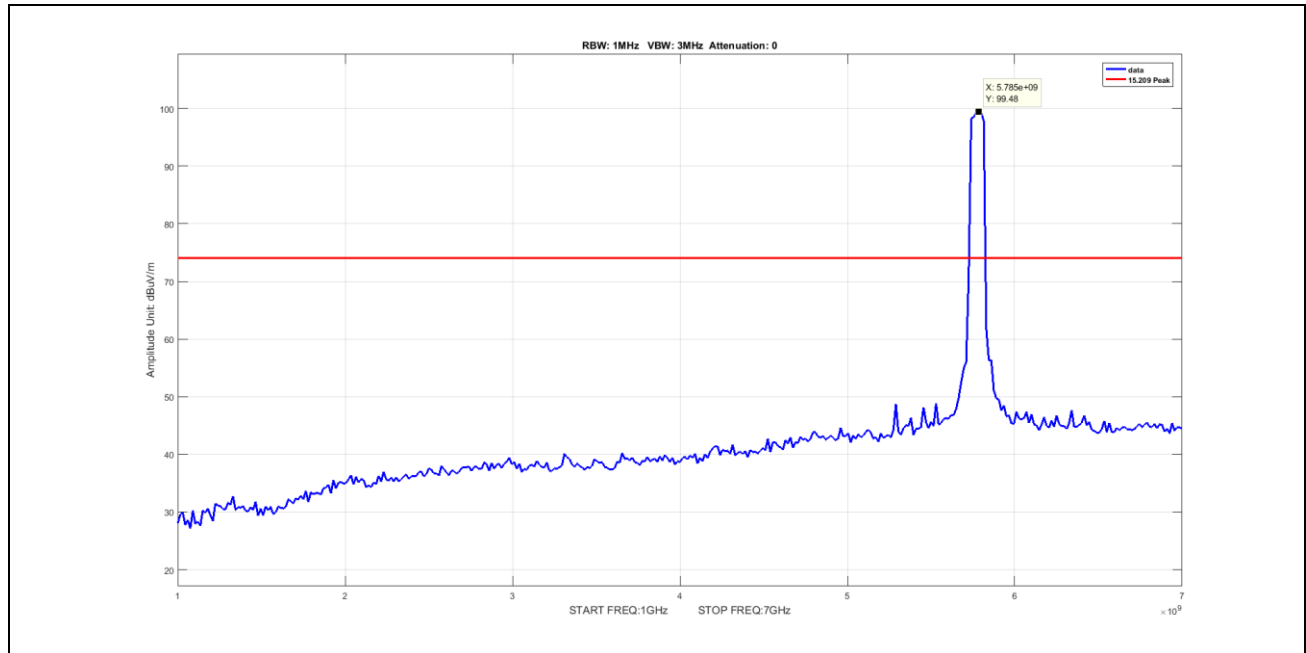
Plot 88. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 20M, Ch 5825M, N Mode ANT 1 (worst-case) V



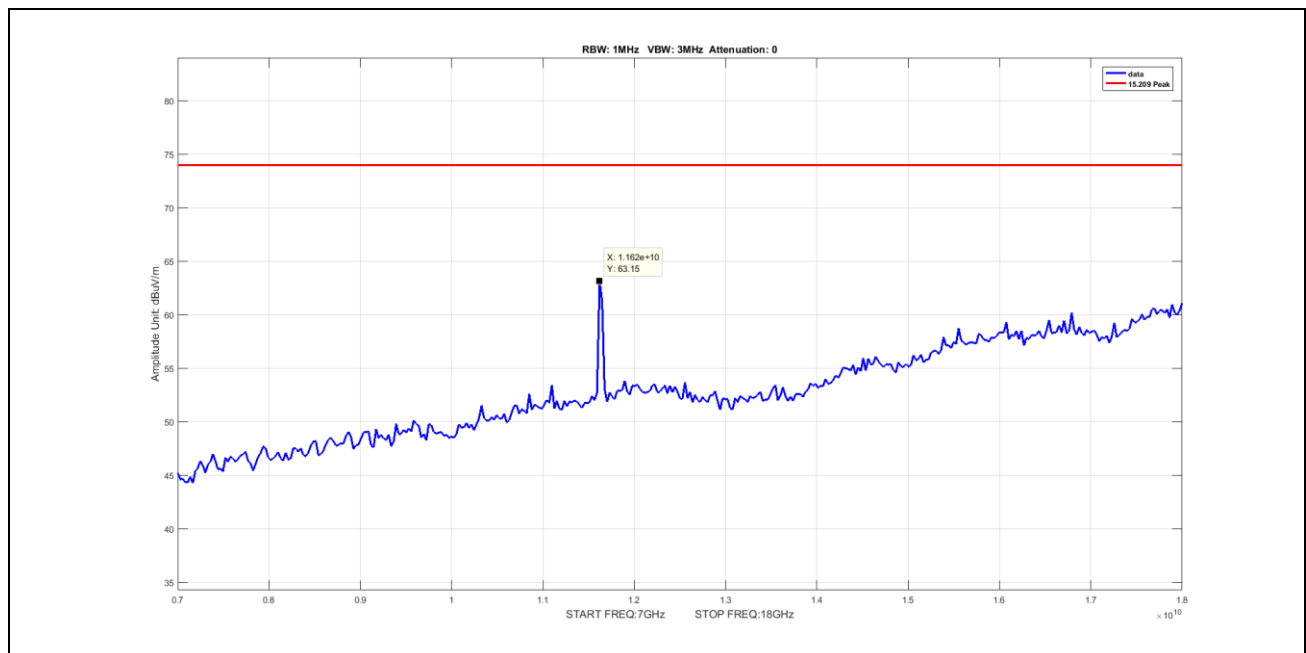
Plot 89. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 40M, Ch 5755M, N Mode ANT 1 (worst-case) V



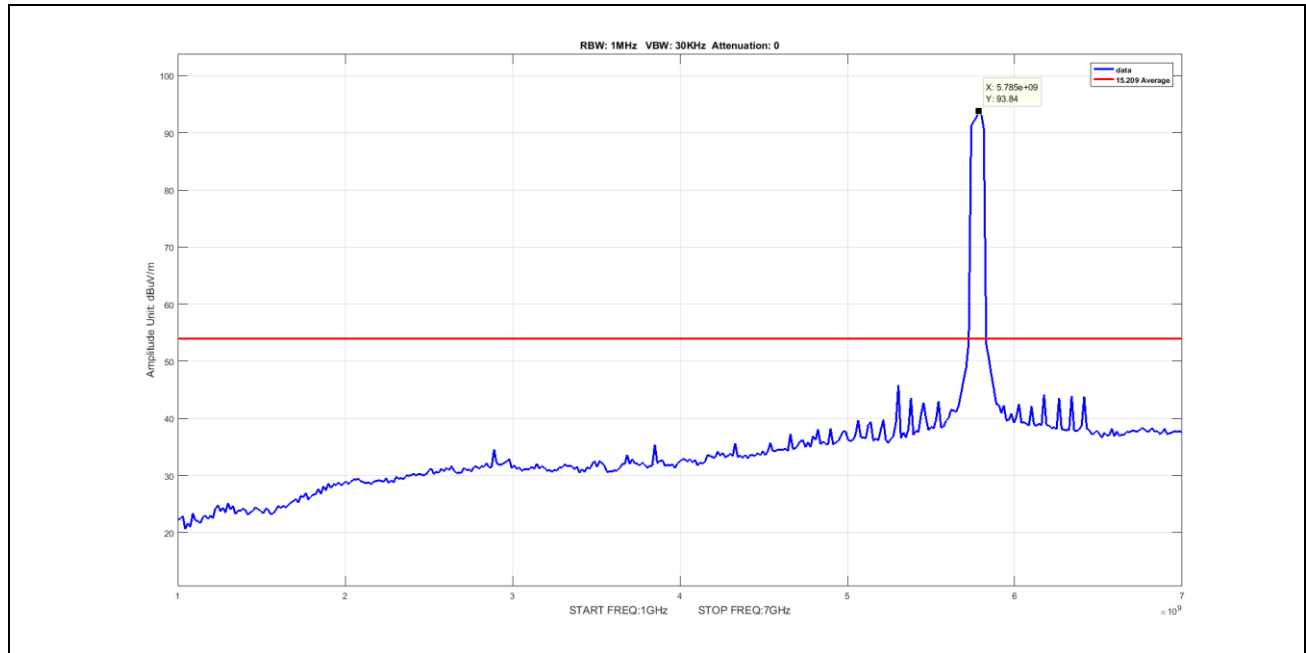
Plot 90. Undesirable Emissions, Peak Spurious Emission 1-18GHz, BW 40M, Ch 5795M, N Mode ANT 1 (worst-case) V



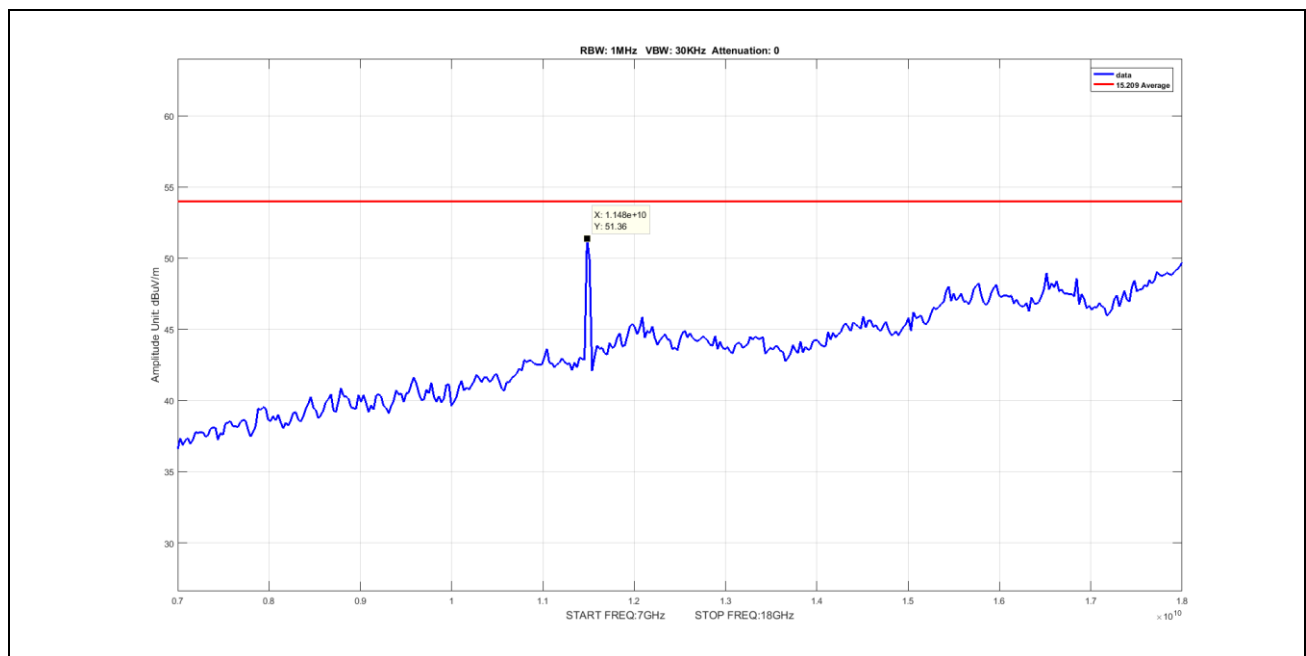
Plot 91. Undesirable Emissions, Peak Spurious Emission 1-7GHz, BW 80M, Ch 5775M, AC Mode ANT 0 (worst-case) V



Plot 92. Undesirable Emissions, Peak Spurious Emission 7-18GHz, BW 80M, Ch 5775M, AC Mode ANT 0 (worst-case) V



Plot 93. Undesirable Emissions, Peak Spurious Emission 1-7GHz, BW 80M, Ch 5775M, AC Mode ANT 1 (worst-case) V

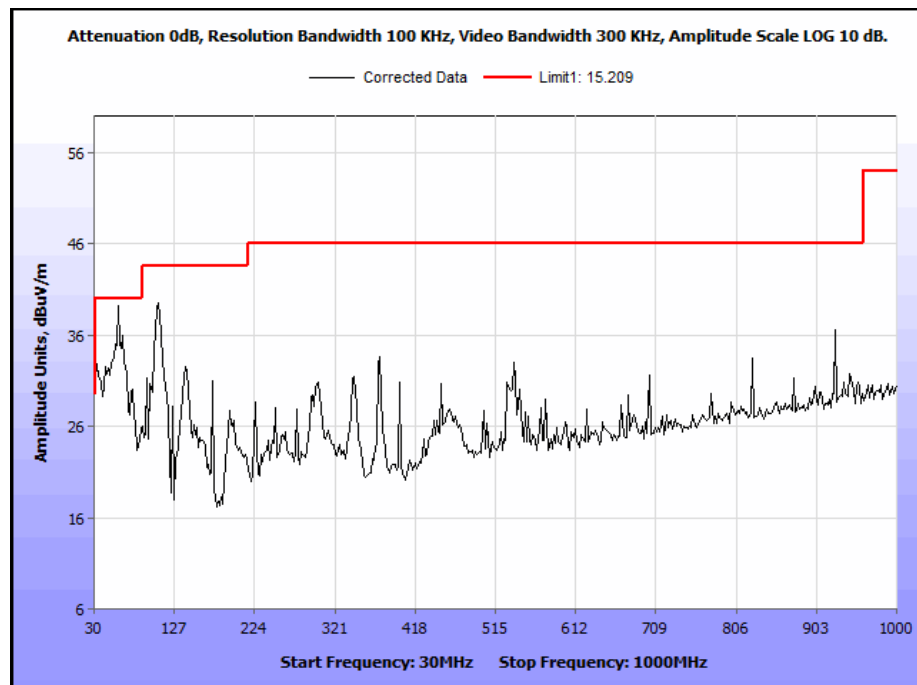


Plot 94. Undesirable Emissions, Peak Spurious Emission 7-18GHz, BW 80M, Ch 5775M, AC Mode ANT 1 (worst-case) V

Undesirable Emissions, Emissions Below 1 GHz

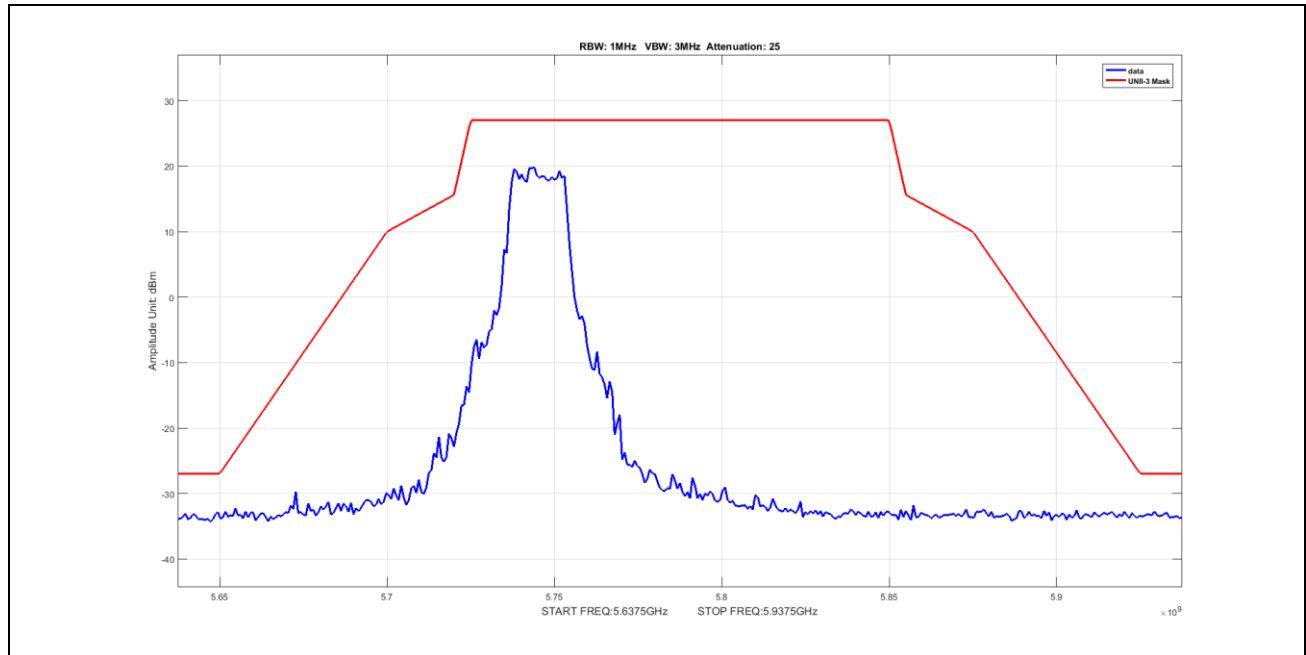
Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected EMI Meter Reading (dBuV)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
62.76	195	H	1.3	27.93	8.47	1.32	0.00	37.72	40.00	-2.28
300.25	263	V	1.1	13.43	14.32	2.71	0.00	30.46	46.00	-15.54
345.64	185	H	1.2	12.03	16.43	2.83	0.00	31.29	46.00	-14.71
365.64	264	V	1.1	12.94	17.54	2.73	0.00	33.21	46.00	-12.79
525.64	342	H	1.8	10.23	18.04	3.94	0.00	32.21	46.00	-13.79
818.43	213	V	1.3	6.54	22.43	4.03	0.00	33.00	46.00	-13.00

Table 12. Power Spectral Density, Test Results

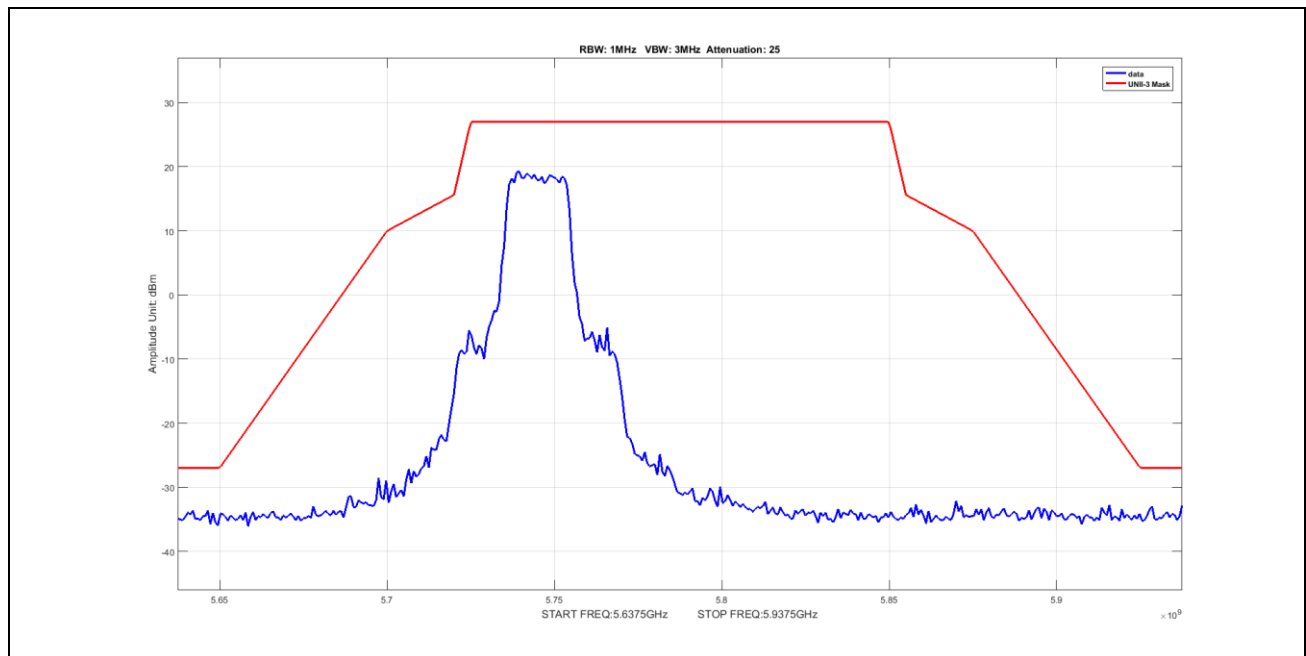


Plot 95. Undesirable Emissions, 30 MHz - 1 GHz (worst-case)

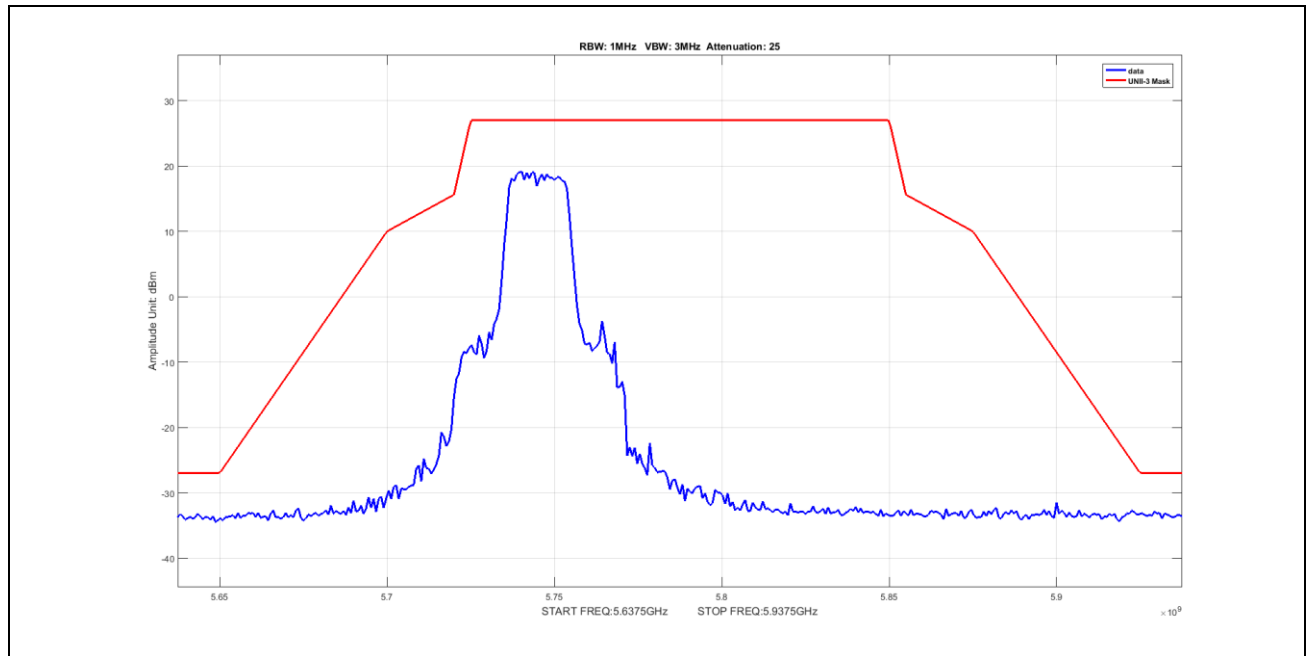
Emission Mask, Test Results



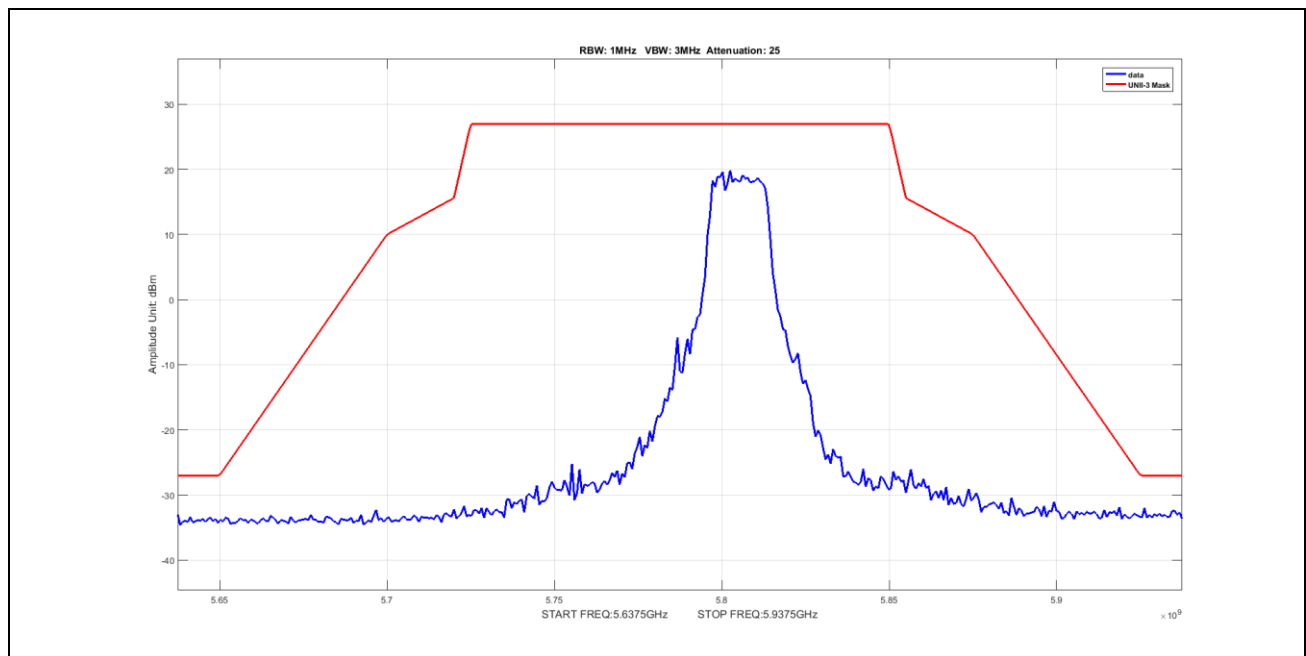
Plot 96. Emission Mask, 20M, ch149, a (worst-case) V



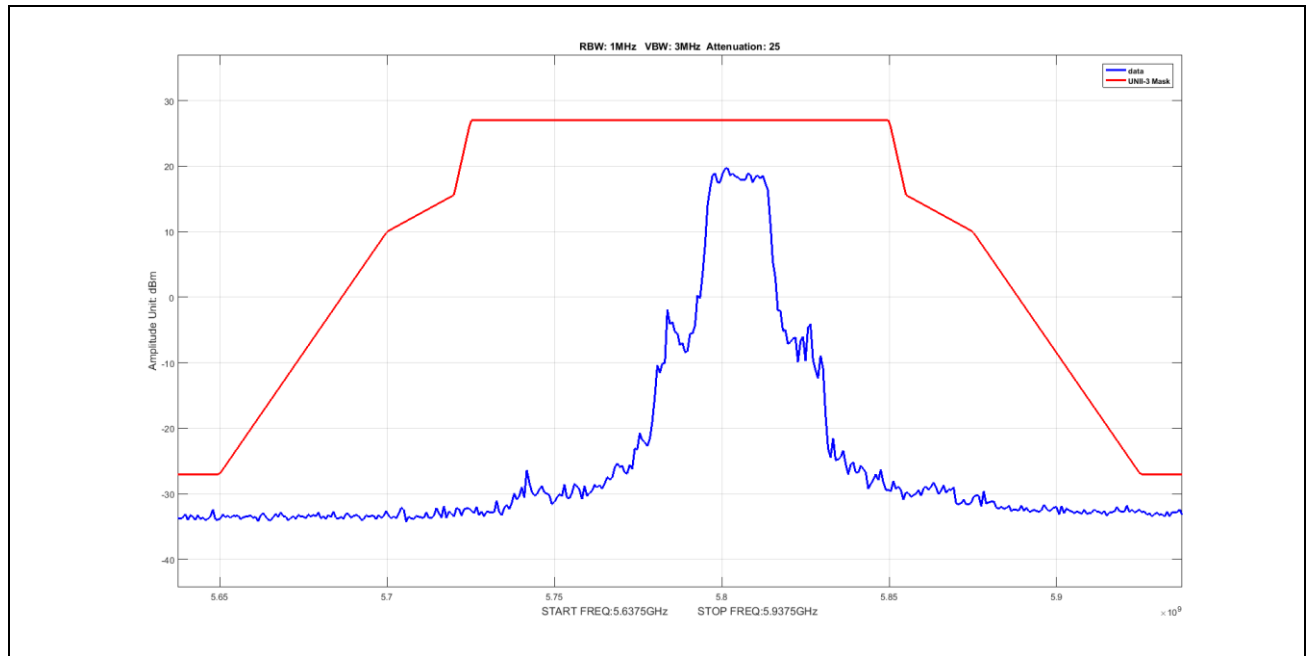
Plot 97. Emission Mask, 20M, ch149, ac (worst-case) V



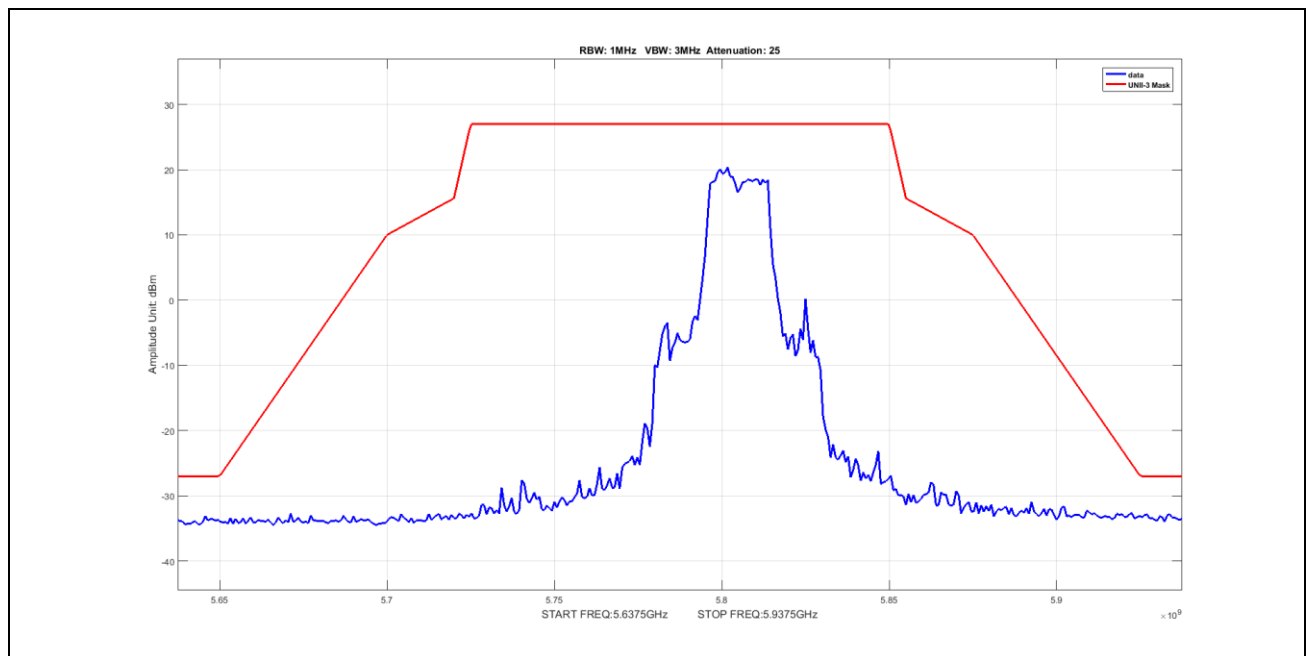
Plot 98. Emission Mask, 20M, ch149, n (worst-case) V



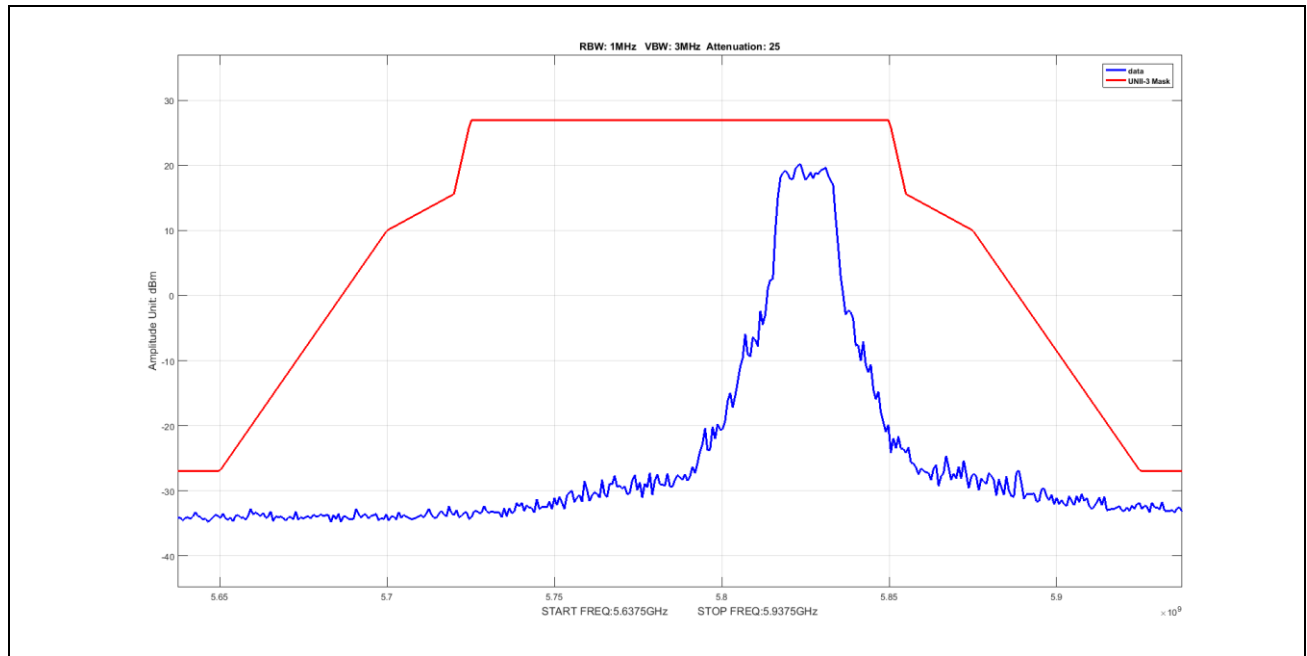
Plot 99. Emission Mask, 20M, ch161, a (worst-case) V



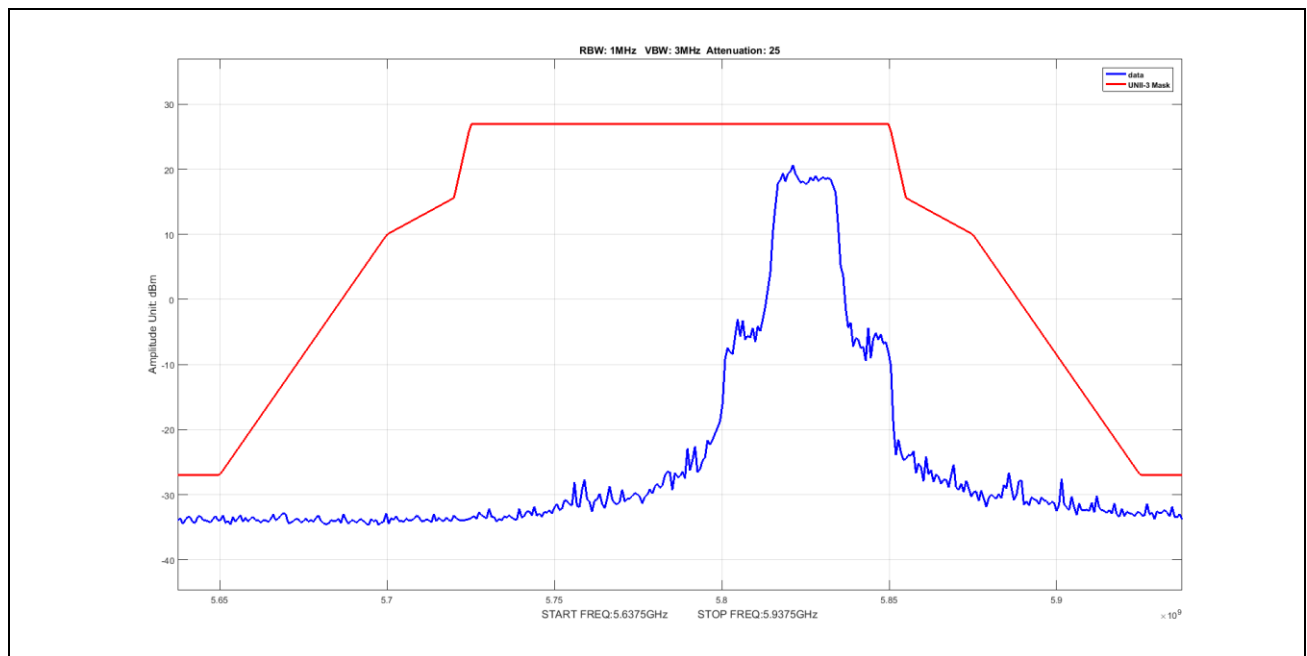
Plot 100. Emission Mask, 20M, ch161, ac (worst-case) V



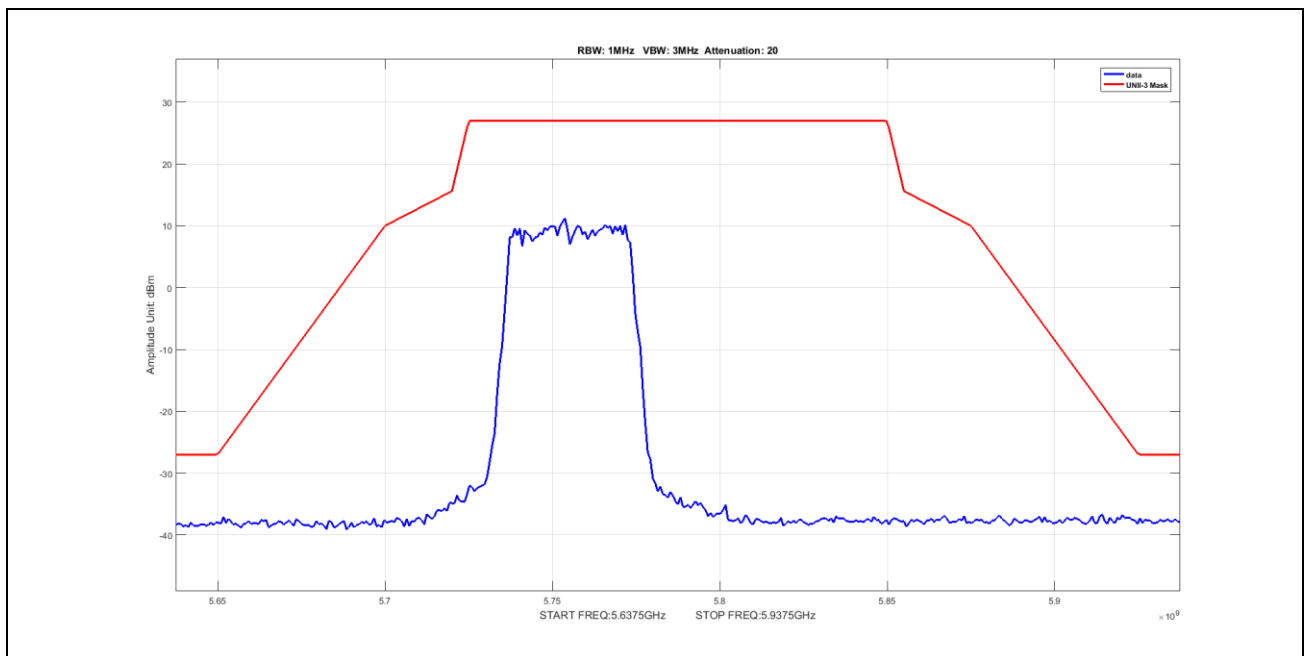
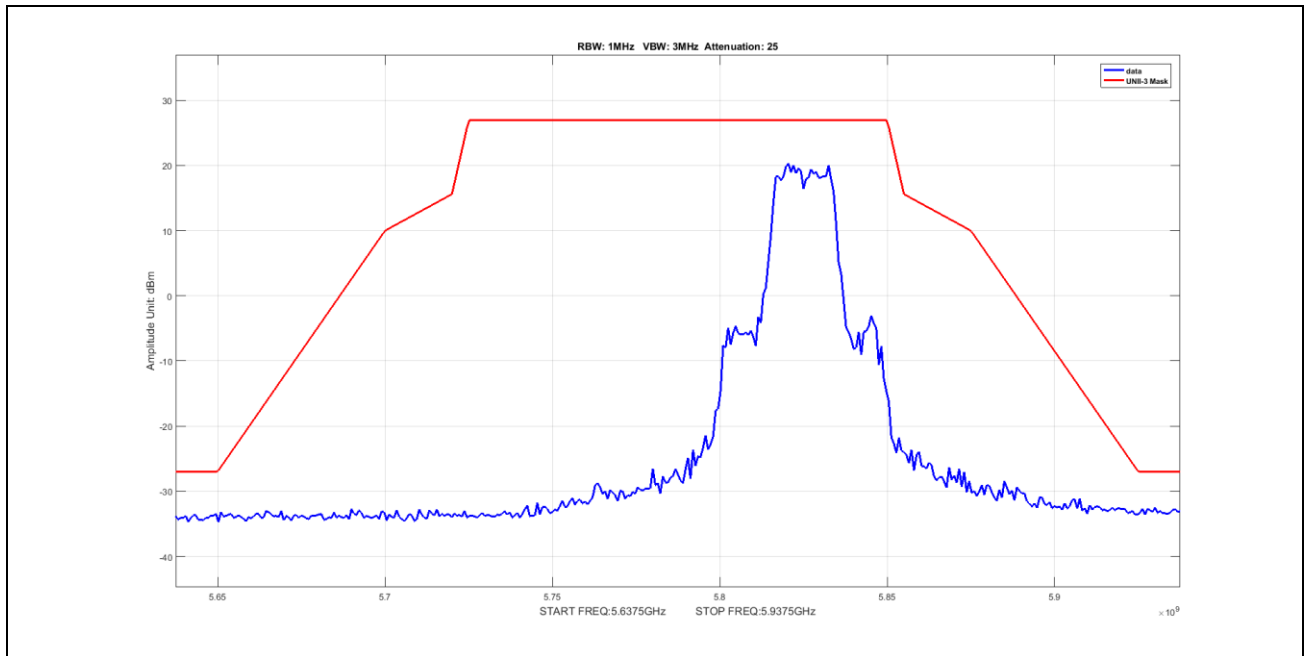
Plot 102. Emission Mask, 20M, ch161, n (worst-case) V

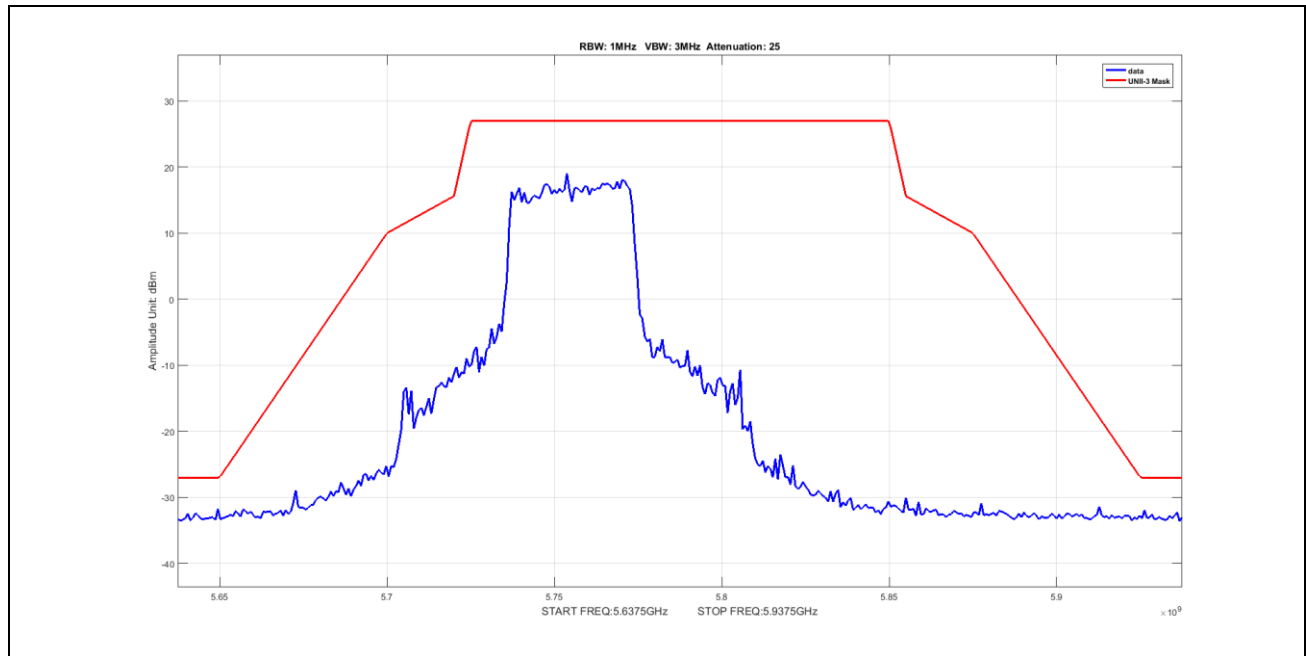


Plot 103. Emission Mask, 20M, ch165, a (worst-case) V

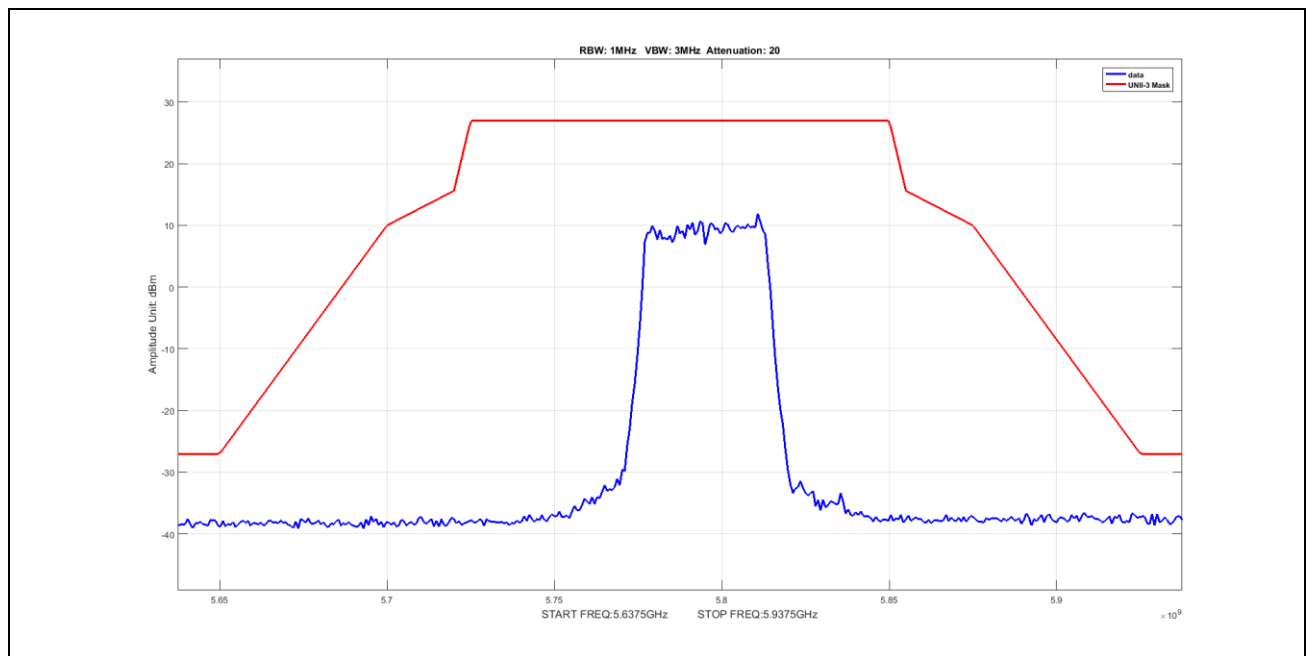


Plot 104. Emission Mask, 20M, ch165, ac (worst-case) V

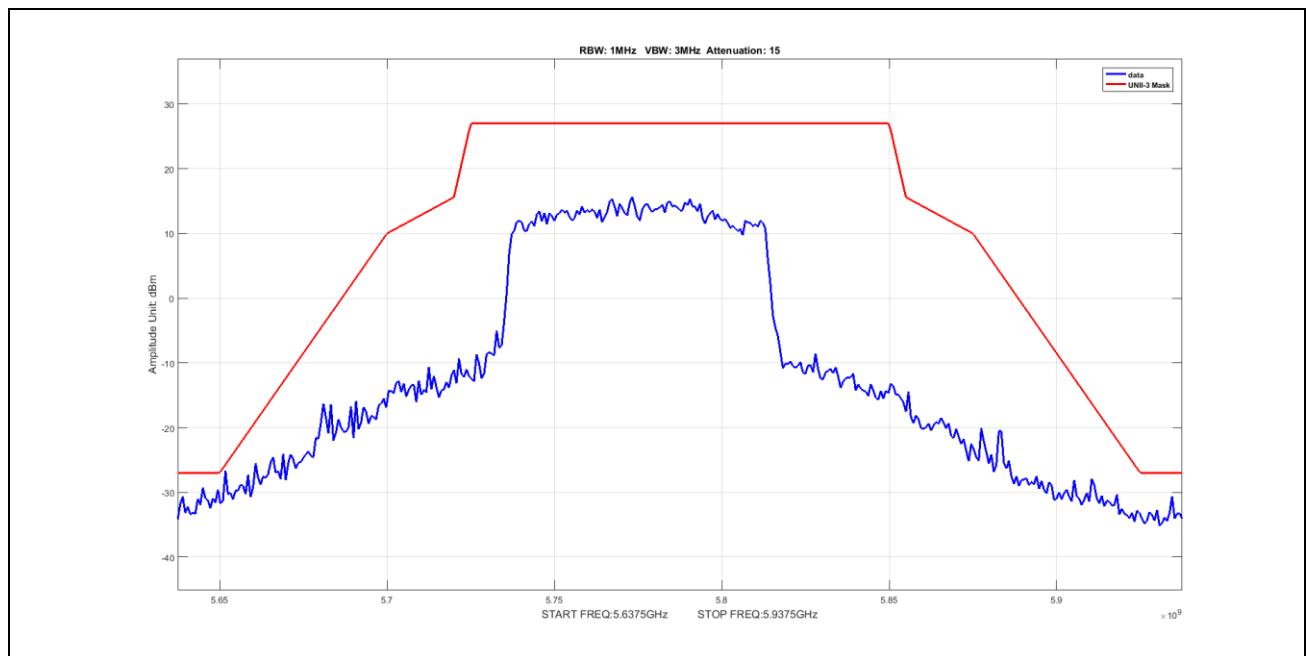
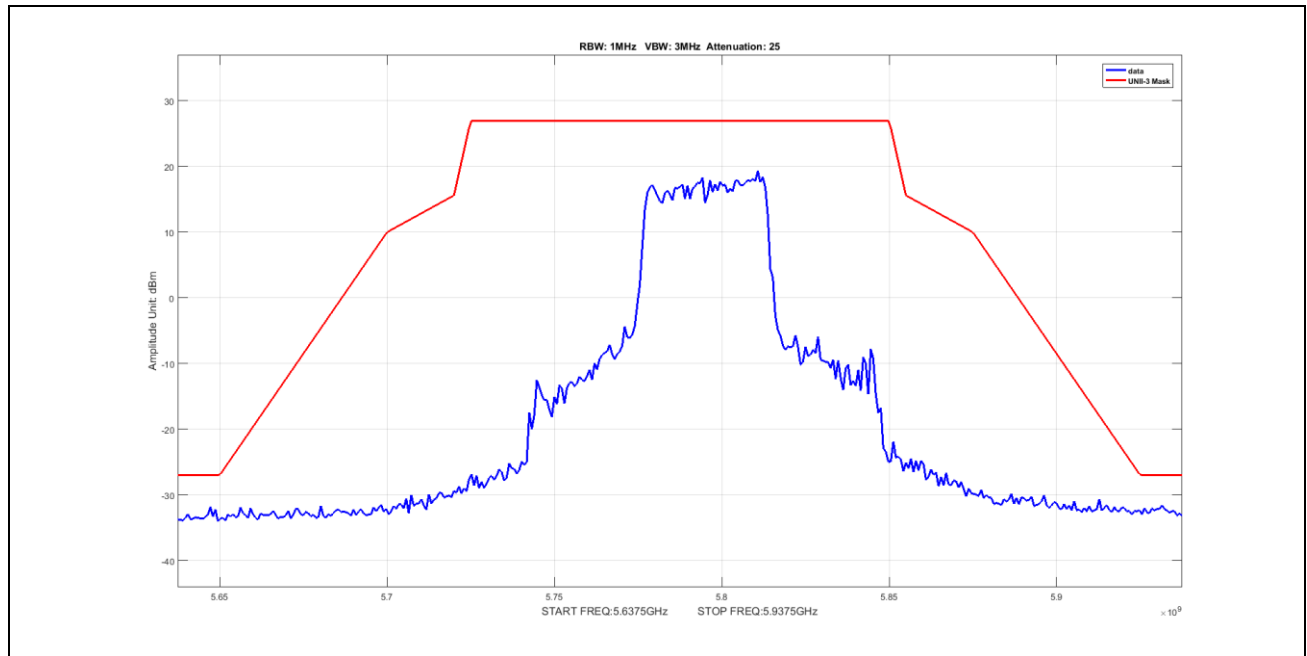




Plot 107. Emission Mask, 40M, ch151, n (worst-case) V



Plot 108. Emission Mask, 40M, ch159, ac (worst-case) V



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(6) Conducted Emissions

Test Requirement(s): § 15.407 (b)(6): Any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

§ 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 μ H/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 (dB μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 – 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 11. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a non-metallic 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 μ H 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". Scans were performed with the transmitter on.

Test Results: The EUT was not applicable with requirements of this section.

EUT utilizes DC power supply.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(e) 6 dB Bandwidth

Test Requirements: § 15.407(e): Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure: The transmitter was set to low, mid, and high operating frequencies at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, VBW > RBW. The 6 dB Bandwidth was measured and recorded.

Test Results The 6 dB Bandwidth was compliant with the requirements of this section.

No anomalies detected.

Test Engineer(s): Arsalan Hasan

Test Date(s): August 24, 2019

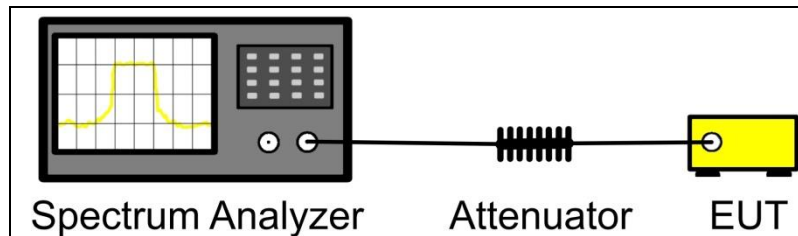
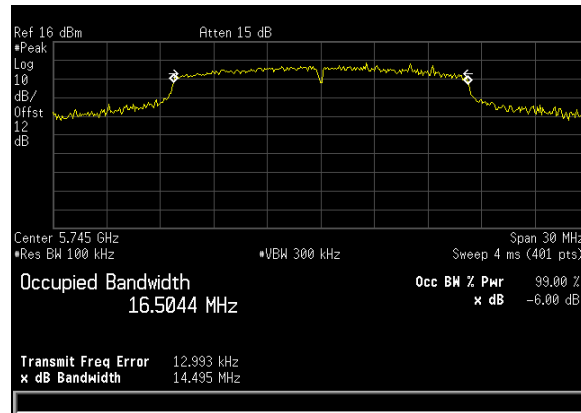


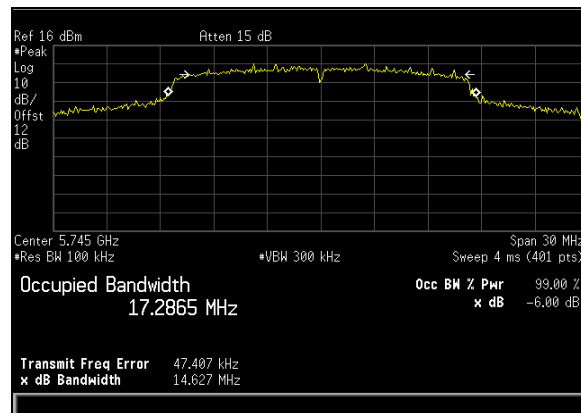
Figure 4. Block Diagram, Occupied Bandwidth Test Setup

Frequency (MHz)	Mode	Bandwidth (MHz)	6 dB Bandwidth (MHz) ANT 0	6 dB Bandwidth (MHz) ANT 1
5745	a	20	14.49	14.62
5785			16.38	13.63
5825			15.09	15.92
5745	n	20	13.83	11.77
5785			12.84	16.03
5825			14.02	13.56
5755		40	31.38	30.06
5795			32.68	26.33
5775	ac	80	75.38	75.39

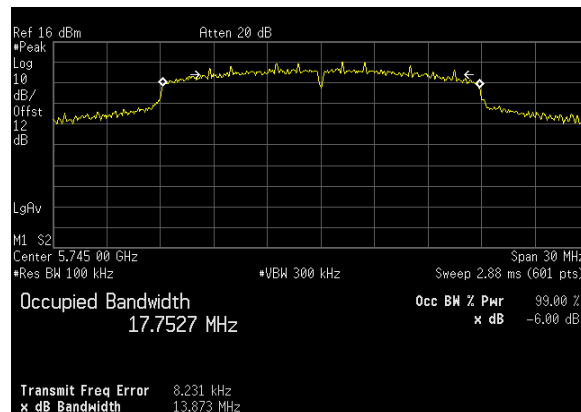
Table 12. 6 dB Occupied Bandwidth, Test Results



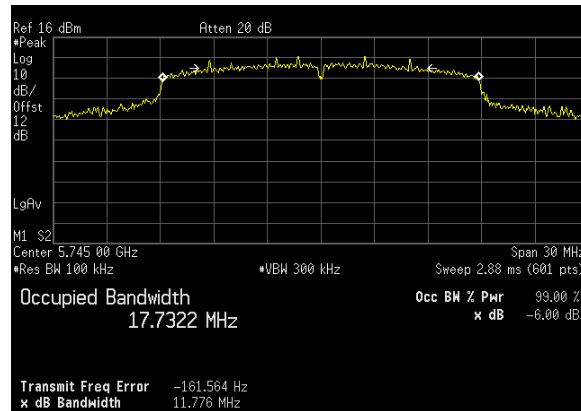
Plot 111. 6 dB Occupied Bandwidth, BW 20M, Ch 5745M, A Mode ANT 0



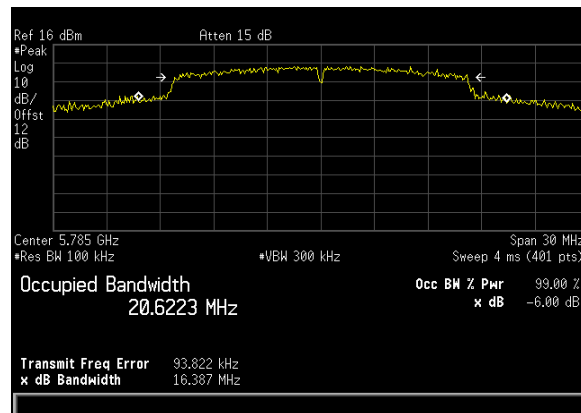
Plot 112. 6 dB Occupied Bandwidth, BW 20M, Ch 5745M, A Mode ANT 1



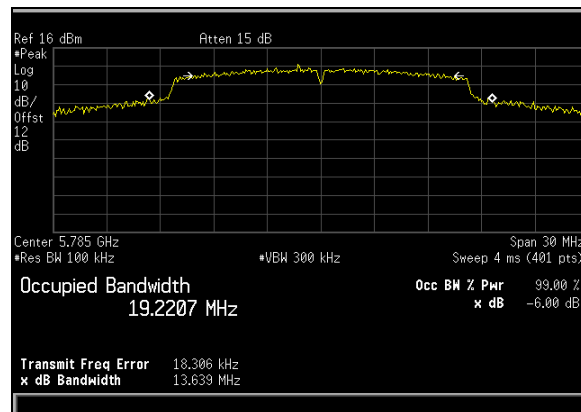
Plot 113. 6 dB Occupied Bandwidth, BW 20M, Ch 5745M, N Mode ANT 0



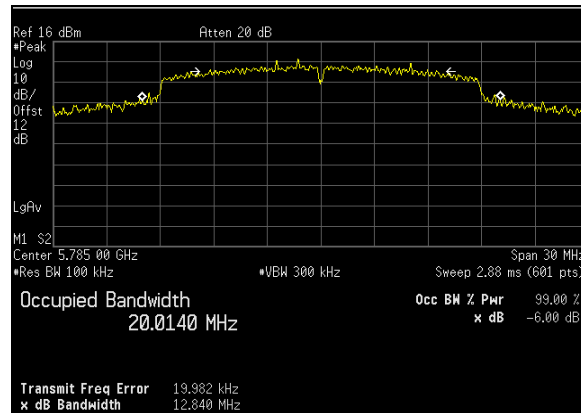
Plot 114. 6 dB Occupied Bandwidth, BW 20M, Ch 5745M, N Mode ANT 1



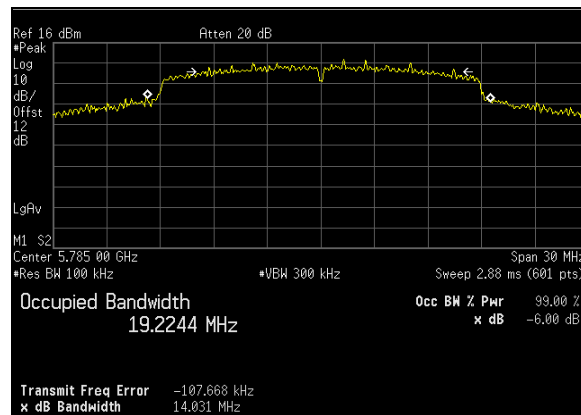
Plot 115. 6 dB Occupied Bandwidth, BW 20M, Ch 5785M, A Mode ANT 0



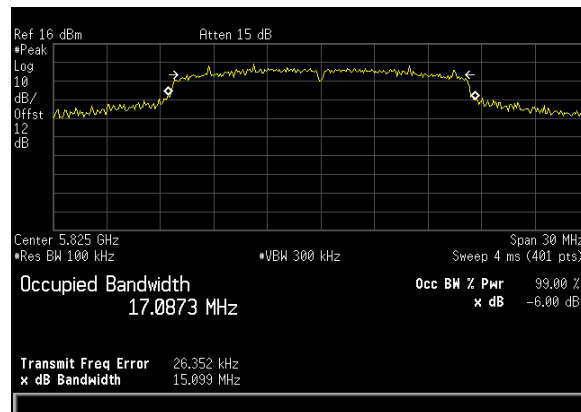
Plot 116. 6 dB Occupied Bandwidth, BW 20M, Ch 5785M, A Mode ANT 1



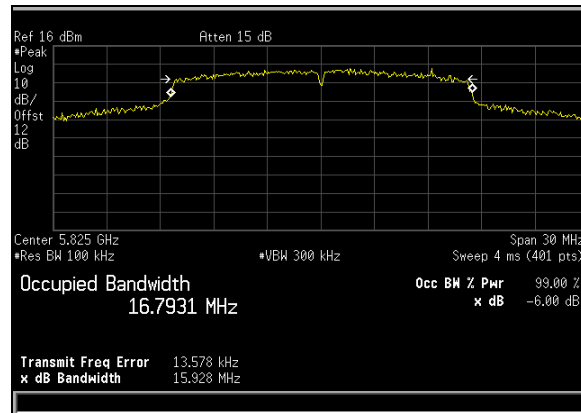
Plot 117. 6 dB Occupied Bandwidth, BW 20M, Ch 5785M, N Mode ANT 0



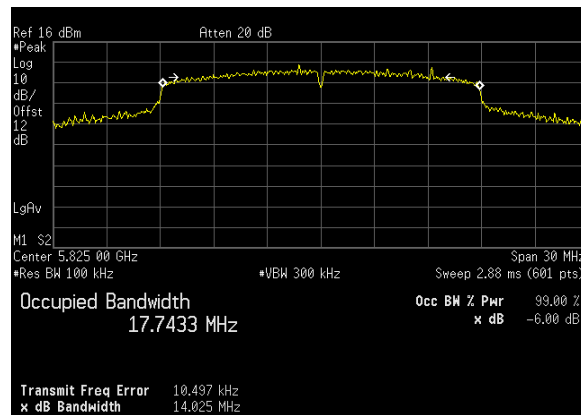
Plot 118. 6 dB Occupied Bandwidth, BW 20M, Ch 5785M, N Mode ANT 1



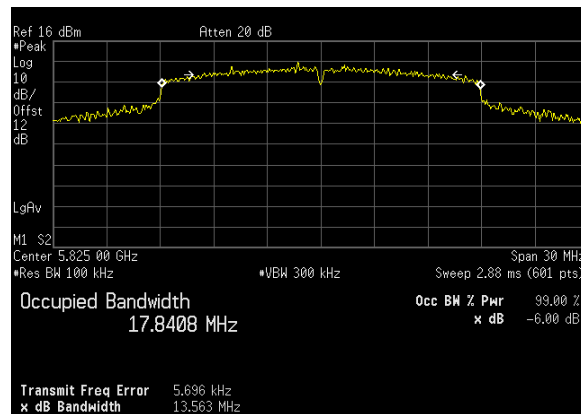
Plot 119. 6 dB Occupied Bandwidth, BW 20M, Ch 5825M, A Mode ANT 0



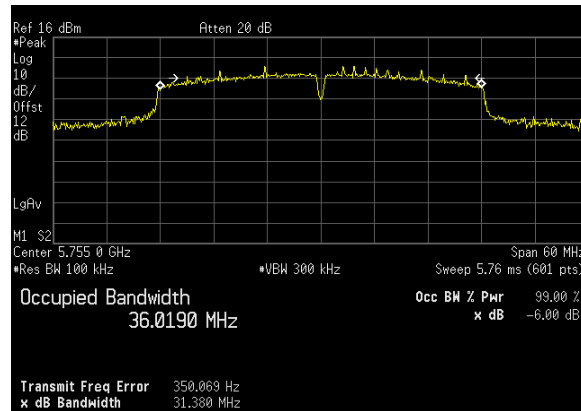
Plot 120. 6 dB Occupied Bandwidth, BW 20M, Ch 5825M, A Mode ANT 1



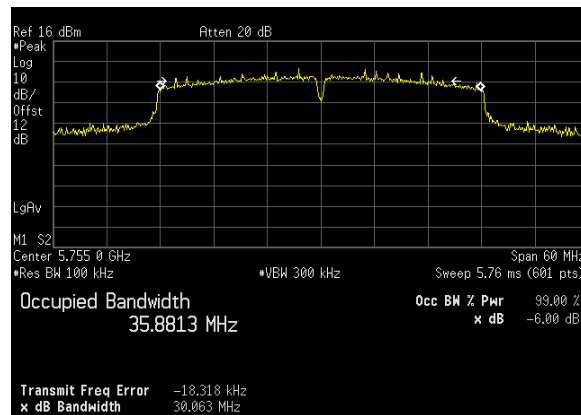
Plot 121. 6 dB Occupied Bandwidth, BW 20M, Ch 5825M, N Mode ANT 0



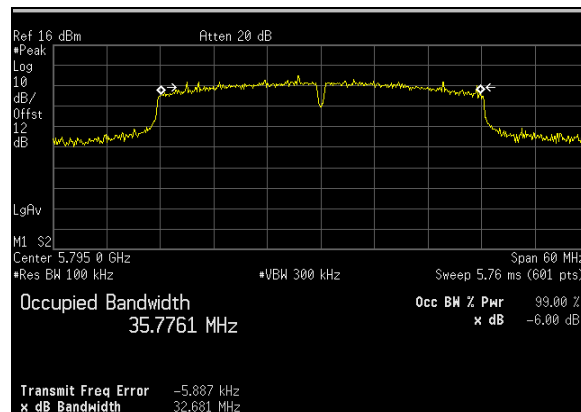
Plot 122. 6 dB Occupied Bandwidth, BW 20M, Ch 5825M, N Mode ANT 1



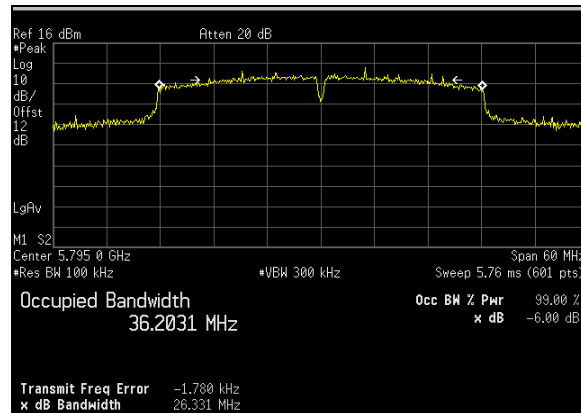
Plot 123. 6 dB Occupied Bandwidth, BW 40M, Ch 5755M, N Mode ANT 0



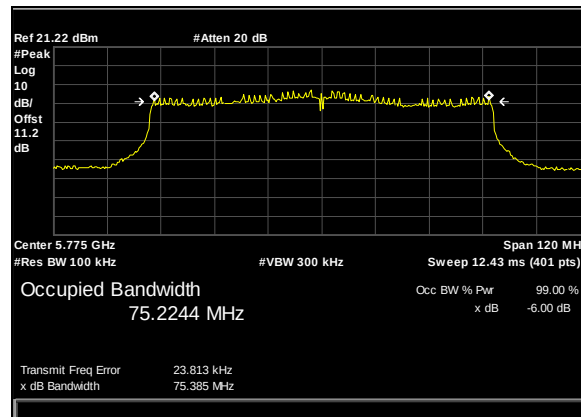
Plot 124. 6 dB Occupied Bandwidth, BW 40M, Ch 5755M, N Mode ANT 1



Plot 125. 6 dB Occupied Bandwidth, BW 40M, Ch 5795M, N Mode ANT 0



Plot 126. 6 dB Occupied Bandwidth, BW 40M, Ch 5795M, N Mode ANT 1



Plot 127. 6 dB Occupied Bandwidth, BW 40M, Ch 5775M, AC Mode ANT 0

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(f) Maximum Permissible Exposure

Test Requirement(s): §15.407(f): U-NII devices are subject to the radio frequency radiation exposure requirements specified in §1.1307(b), §2.1091 and §2.1093 of this chapter, as appropriate. All equipment shall be considered to operate in a “general population/uncontrolled” environment.

RF Exposure Requirements: §1.1307(b)(1) and §1.1307(b)(2): Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission’s guidelines.

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

MPE Limit: EUT’s operating frequencies @ 5725 - 5850 MHz; **Limit for Uncontrolled exposure: 1 mW/cm² or 10 W/m²**

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{PG / 4\pi S}$$

where, S = Power Density (mW/cm²)
P = Power Input to antenna (mW)
G = Antenna Gain (numeric value)
R = Distance (cm)

For Antenna Gain → dBi = 10log(Numeric)

Test Results:

Frequency (MHz)	Conducted Power (dBm)	Conducted Power (mW)	Antenna Gain (dBi)	Antenna Gain (Numeric)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Margin	Distance (cm)	Result
5785	20.33	107.894	5.0	3.162	0.0679	1	0.932	20	Pass

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
1S2399	Turntable Controller	SUNOL SCIENCE	SC99V	See Note	
1S2600	Bilog Antenna	Teseq	CBL6112D	11/28/2018	11/28/2020
1S3835	PSA Spectrum Analyzer	Agilent Technologies	E4448A	04/19/2018	04/19/2020
1S2482A	5 Meter Chamber (FCC)	Panashield	5 Meter Semi-Anechoic Chamber	See Note	
1S2603	Double Ridged Waveguide Horn	ETS-Lindgren	3117	08/09/2018	08/09/2020
1U0258	Spectrum Analyzer	Agilent Technologies	E4407B	02/03/2018	02/03/2020
1S2121	Pre-Amplifier	Hewlett Packard	8449B	See Note	

Table 13. 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

M. 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

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 users 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