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

914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372
13501 MCCALLEN PASS ● AUSTIN, TX 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

October 23, 2015

ARRIS
101 Tournament Drive
Horsham, PA 19044

Dear Mark Hageali,

Enclosed is the EMC Wireless test report for compliance testing of the ARRIS, DCX3635 as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-06 ed.), Title 47 of the CFR, Part 15.407 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.

Jennifer Warnell
Documentation Department

Reference: (\ARRIS\EMC86201-FCC407 UNII 3 Rev. 2)

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

914 WEST PATAPSCO AVENUE ● BALTIMORE, MARYLAND 21230-3432 ● PHONE (410) 354-3300 ● FAX (410) 354-3313
33439 WESTERN AVENUE ● UNION CITY, CALIFORNIA 94587 ● PHONE (510) 489-6300 ● FAX (510) 489-6372
3162 BELICK STREET ● SANTA CLARA, CALIFORNIA 95054 ● PHONE (408 748-3585 ● FAX (510) 489-6372
13501 MCCALLEN PASS ● AUSTIN, TX 78753 ● PHONE (512) 287-2500 ● FAX (512) 287-2513

Electromagnetic Compatibility Criteria
Test Report

for the

ARRIS
DCX3635

Tested under
the Certification Rules
contained in
Title 47 of the CFR, Part 15.407 Subpart E
for Intentional Radiators

MET Report: EMC86201-FCC407 UNII 3 Rev. 2

October 23, 2015

Prepared For:

ARRIS
101 Tournament Drive
Horsham, PA 19044

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

Electromagnetic Compatibility Criteria
Test Report

for the

ARRIS
DCX3635

Tested under
the Certification Rules
contained in
Title 47 of the CFR, Part 15.407 Subpart
for Intentional Radiators

Surinder Singh, Project Engineer
Electromagnetic Compatibility Lab

Jennifer Warnell
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 15.407 of the FCC Rules under normal use and maintenance.

Asad Bajwa, Director
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	September 29, 2015	Initial Issue.
1	October 13, 2015	Corrected FCC ID.
2	October 23, 2015	Engineer corrections.

Table of Contents

List of Tables

List of Figures

List of Photographs

List of Plots

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
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 ARRIS DCX3635, 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 DCX3635. ARRIS should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the DCX3635, 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 ARRIS, purchase order number AR1062669. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	Description	Results
15.203	Antenna Requirements	Compliant
15.207	AC Conducted Emissions	Compliant
15.403 (i)	26dB Occupied Bandwidth	Compliant
15.407 (a)(1)	Conducted Transmitter Output Power	Compliant
15.407 (a)(1)	Power Spectral Density	Compliant
15.407 (b)(4), (6)	Undesirable Emissions (15.205/15.209 - General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Compliant
15.407(f)	RF Exposure	Compliant
15.407(g)	Frequency Stability	Compliant

Table 1. Executive Summary of EMC Part 15.407 ComplianceTesting

II. Equipment Configuration

A. Overview

MET Laboratories, Inc. was contracted by ARRIS to perform testing on the DCX3635, under ARRIS's purchase order number AR1062669.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the ARRIS DCX3635.

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

Model(s) Tested:	DCX3635	
Model(s) Variants:	DCX3635/6K00/0522/0500 DCX3635/6K80/0522/0500 DCX3635/6K00/0522/1000 DCX3635/6K80/0522/1000	
EUT Specifications:	Primary Power: 120 VAC, 60 Hz	
	FCC ID: ACQ-DCX3635M	
	Type of Modulations:	OFDM
	Equipment Code:	NII
	Peak RF Output Power:	19.81dBm
	EUT Frequency Ranges:	5745 – 5825 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:	Surinder Singh	
Report Date(s):	October 23, 2015	

Table 2. EUT Summary

B. References

CFR 47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices (UNII)
ANSI C63.4:2003	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
KDB 662911	OET 13TR1003 Directonal Gain of 802 11 MIMO with CDD 04 05 2013
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

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

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

D. Description of Test Sample

The ARRIS DCX3635, Equipment Under Test (EUT), is a media gateway with an embedded multi-channel full-band capture QAM and DOCSIS 3.0 front-end receiver that bridges to a video back-end processor supporting video presentation and transcoding as well as other embedded functions. It also functions as an Access Point (AP) through dual concurrent WiFi, specifically IEEE802.11n and IEEE802.11ac supporting 3x3 MIMO, with IP data routing capability through dual Gigabit Ethernet ports. It is capable of presenting encrypted SD and HD video content through HDMI™ and Analog Composite (SD content only), digital audio is presented through HDMI™ and Optical SPDIF, and analog audio is presented through baseband left and right connectors. The DCX3635W is home networking capable through WiFi, MoCA®, and Gigabit Ethernet. This model has removable CableCard for content security. User interface is through IR or RF4CE remote control.

E. Mode of Operation

Normal operation will not be simulated. This device will be configured to perform the required functions for FCC part 15 intentional radiators.

F. Method of Monitoring EUT Operation

Spectrum Analyzer.

G. 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.

H. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to ARRIS 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. The EUT employs an integrated antenna.

Test Engineer(s): Surinder Singh

Test Date(s): 07/08/15

	A2 (dBi)	A4 (dBi)	A5 (dBi)	3Tx Correlated (dBi)
5.2G	5.1	5.8	3.25	9.6
5.3G	5.1	5.3	3.5	9.4
5.5G	5.8	5.6	3.8	9.9
5.8G	4.7	5.6	4.7	9.8

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(6) Conducted Emissions Limits

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.

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 4. 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 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"*. Scans were performed with the transmitter on.

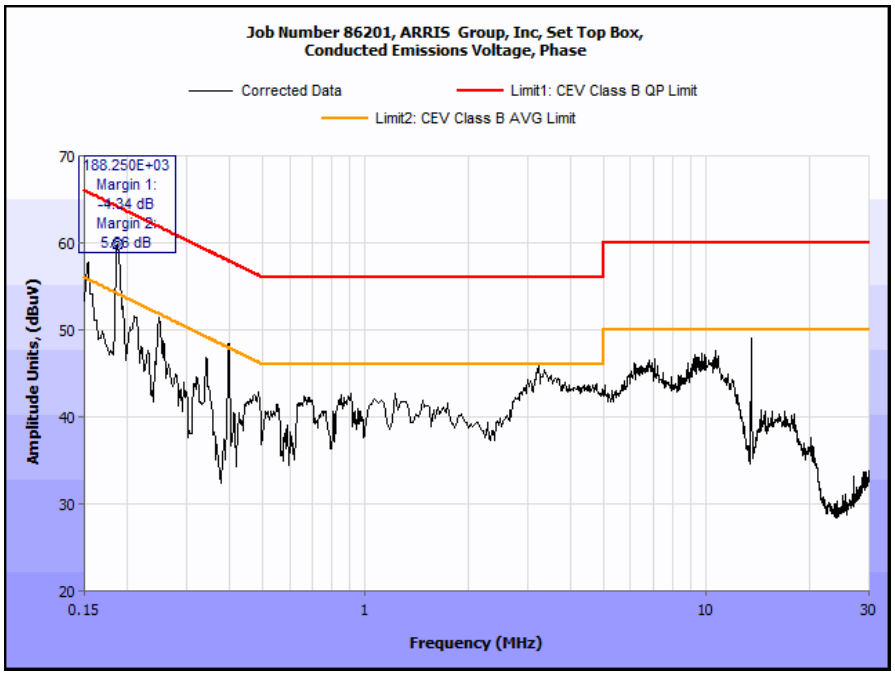
Test Results: The EUT was compliant with the requirement(s) of this section.

Test Engineer(s): Surinder Singh

Test Date(s): 08/20/15

Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.16	54.63	0	54.63	65.46	-10.83	21.28	0	21.28	55.46	-34.18
0.395	48.23	0	48.23	57.96	-9.73	14.79	0	14.79	47.96	-33.17
1.78	37.16	0	37.16	56	-18.84	12.49	0	12.49	46	-33.51
3.27	38.16	0	38.16	56	-17.84	14.59	0	14.59	46	-31.41
8.64	25.14	0.17	25.31	60	-34.69	16.49	0.17	16.66	50	-33.34
26.46	19.64	0.17	19.81	60	-40.19	8.16	0.17	8.33	50	-41.67

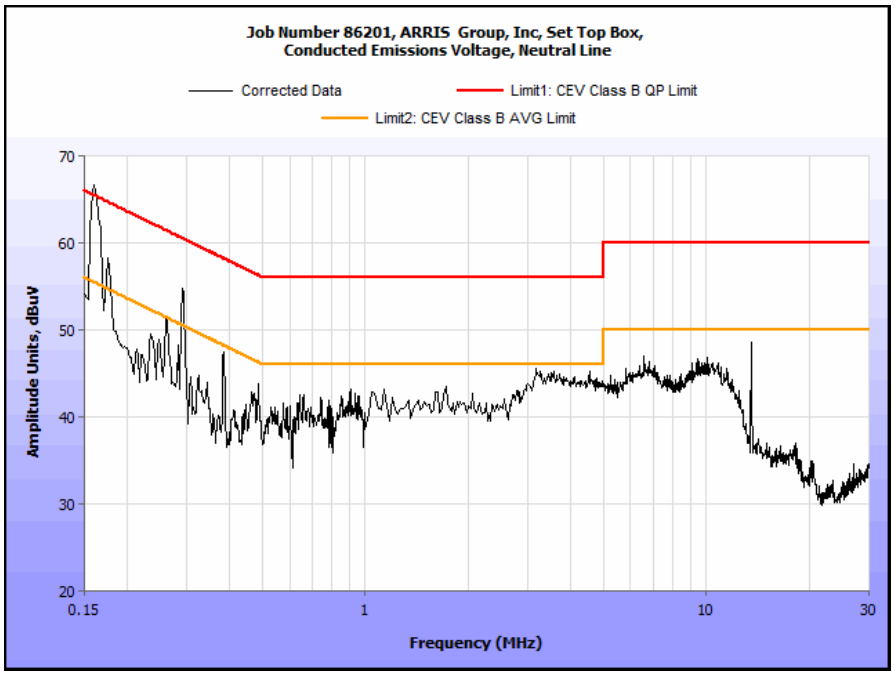
Table 5. Conducted Emissions, Phase Line, Test Results



Plot 1. Conducted Emissions, Phase Line

Frequency (MHz)	Uncorrected Meter Reading (dBµV) QP	Cable Loss (dB)	Corrected Measurement (dBµV) QP	Limit (dBµV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBµV) Avg.	Cable Loss (dB)	Corrected Measurement (dBµV) AVG	Limit (dBµV) AVG	Margin (dB) AVG
0.17	52.14	0	52.14	64.96	-12.82	20.19	0	20.19	54.96	-34.77
0.3	43.46	0	43.46	60.24	-16.78	19.84	0	19.84	50.24	-30.4
0.38	38.13	0	38.13	58.28	-20.15	16.34	0	16.34	48.28	-31.94
1.67	32.16	0	32.16	56	-23.84	12.54	0	12.54	46	-33.46
3.15	36.43	0	36.43	56	-19.57	23.64	0	23.64	46	-22.36
16.73	33.16	0	33.16	60	-26.84	12.56	0	12.56	50	-37.44

Table 6. Conducted Emissions, Neutral Line, Test Results



Plot 2. Conducted Emissions, Neutral Line

Conducted Emission Limits Test Setup

Photograph 1. Conducted Emissions, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 403(i) 26dB Bandwidth

Test Requirements: **§ 15.403 (i):** For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

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 26 dB Bandwidth was measured and recorded.

Test Results The 26 dB Bandwidth was compliant with the requirements of this section and was determined from the plots on the following pages.

Test Engineer(s): Surinder Singh

Test Date(s): 07/16/15

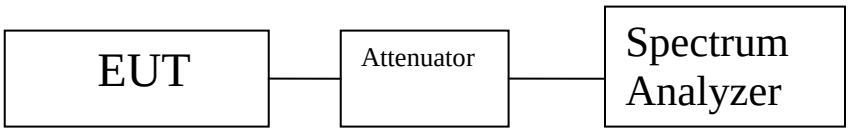
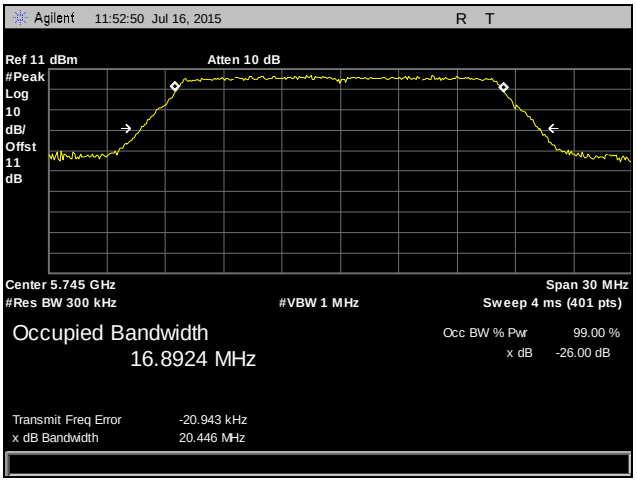


Figure 1. Occupied Bandwidth, Test Setup

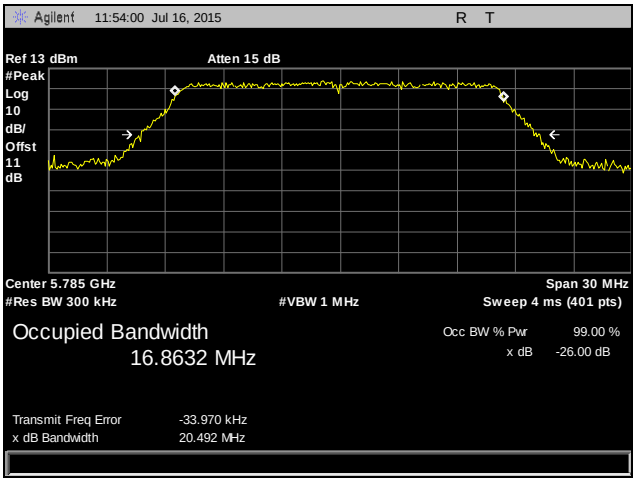
Occupied Bandwidth		
Carrier Channel Mode	**Frequency (MHz)**	**Measured 26 dB Bandwidth (MHz)**
802.11a	5745	20.446
	5785	20.492
	8525	20.354
802.11ac 20MHz	5745	20.480
	5785	20.325
	5825	20.407
802.11ac 40MHz	5755	39.595
	5795	39.204
802.11ac 80MHz	5775	82.545
802.11n 20 MHz	5745	20.589
	5785	20.522
	5825	20.725
802.11n 40MHz	5755	39.458
	5795	39.719

Table 7. Occupied Bandwidth, Test Results

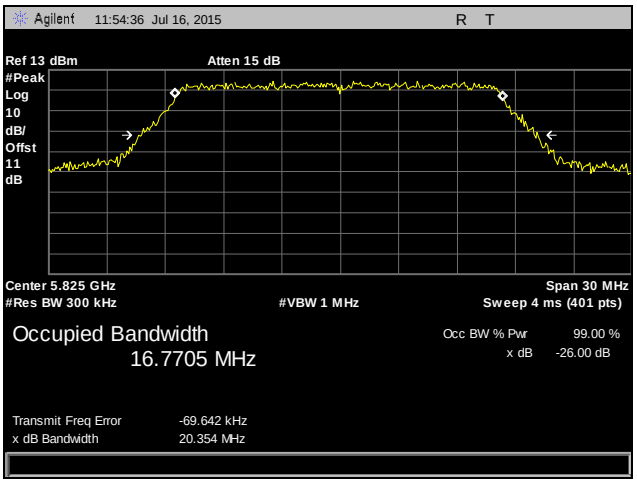
Occupied Bandwidth Test Results, 802.11a



Plot 3. Occupied Bandwidth, 802.11a, 5745 MHz

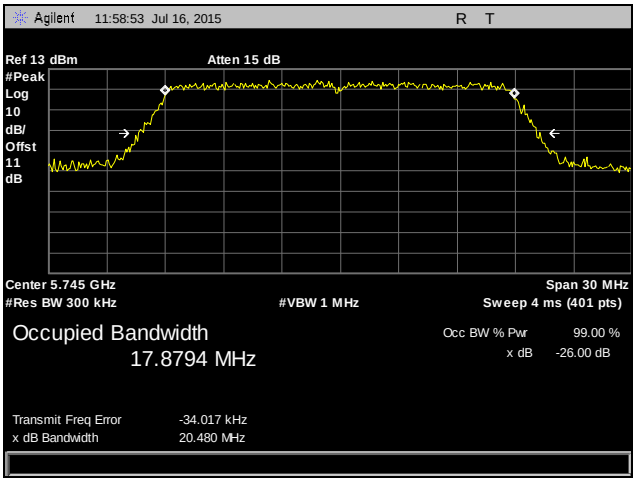


Plot 4. Occupied Bandwidth, 802.11a, 5785 MHz

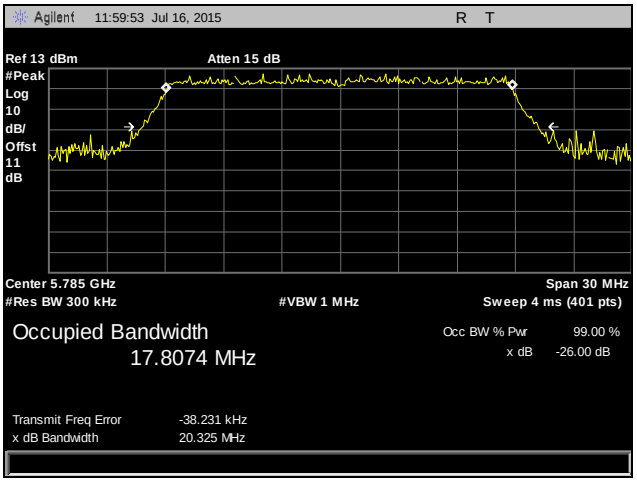


Plot 5. Occupied Bandwidth, 802.11a, 8525 MHz

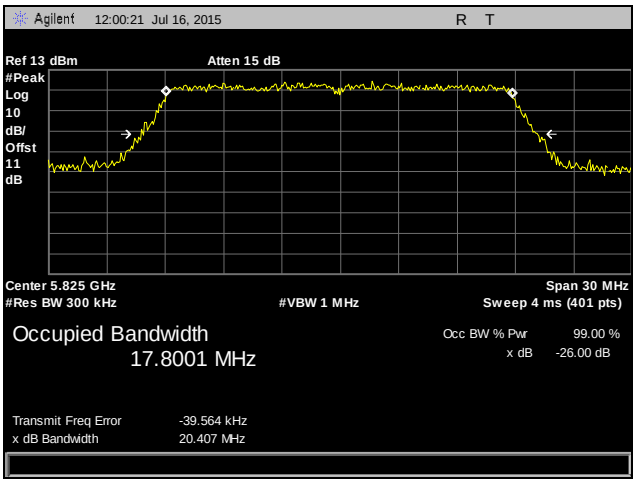
Occupied Bandwidth Test Results, 802.11ac 20 MHz



Plot 6. Occupied Bandwidth, 802.11ac 20 MHz, 5745 MHz

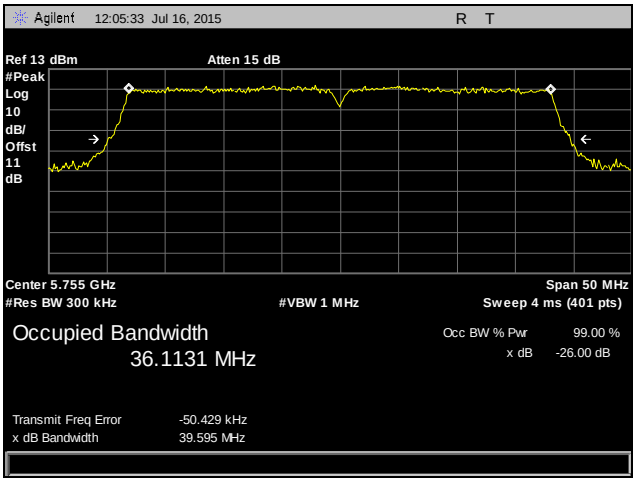


Plot 7. Occupied Bandwidth, 802.11ac 20 MHz, 5785 MHz

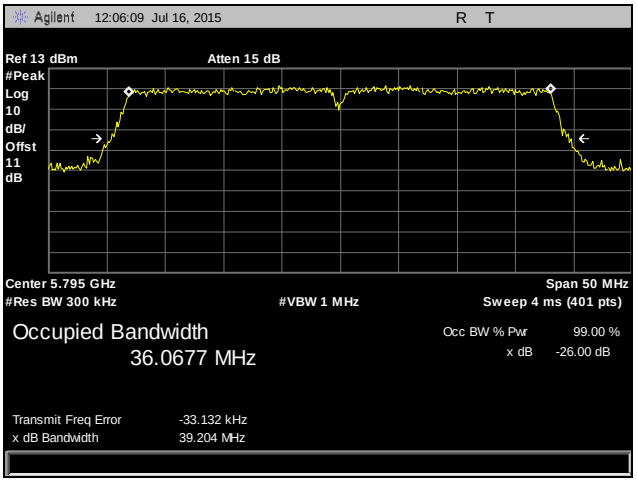


Plot 8. Occupied Bandwidth, 802.11ac 20 MHz, 5825 MHz

Occupied Bandwidth Test Results, 802.11ac 40 MHz

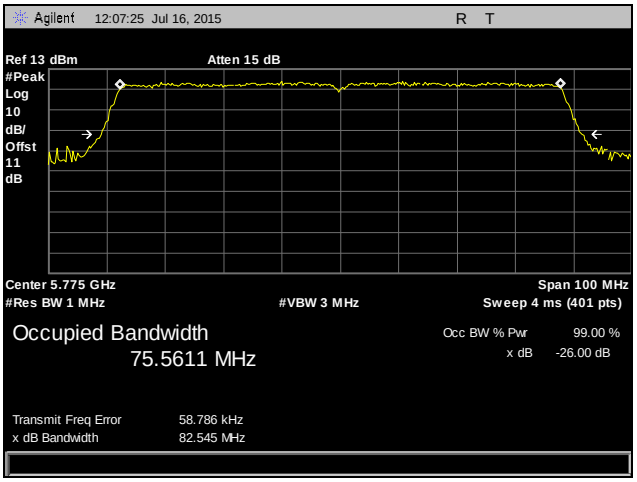


Plot 9. Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz



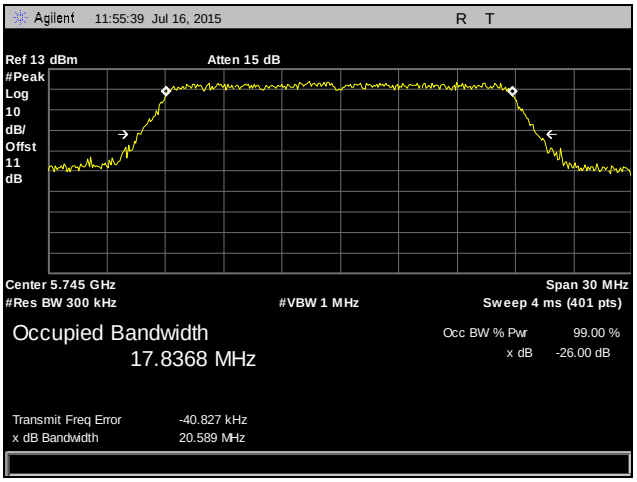
Plot 10. Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz

Occupied Bandwidth Test Results, 802.11ac 80 MHz

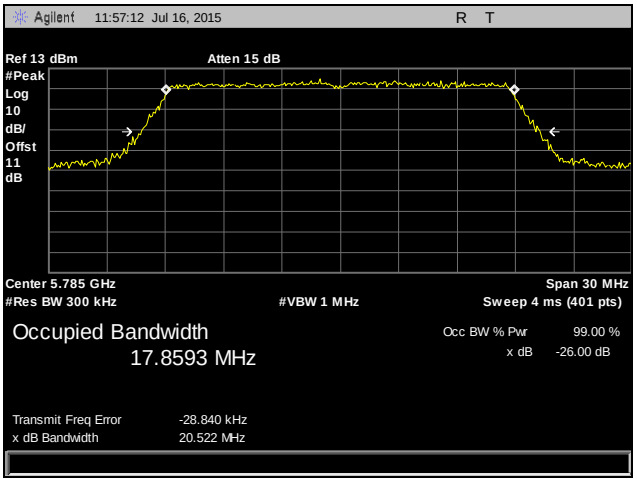


Plot 11. Occupied Bandwidth, 802.11ac 80 MHz, 5775 MHz

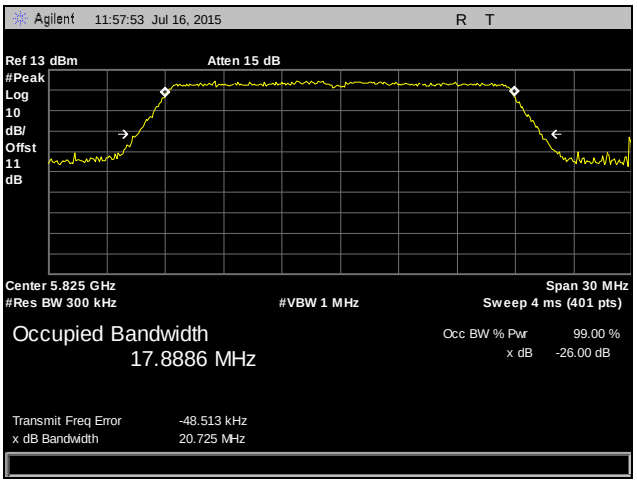
Occupied Bandwidth Test Results, 802.11n 20 MHz



Plot 12. Occupied Bandwidth, 802.11n 20 MHz, 5745 MHz

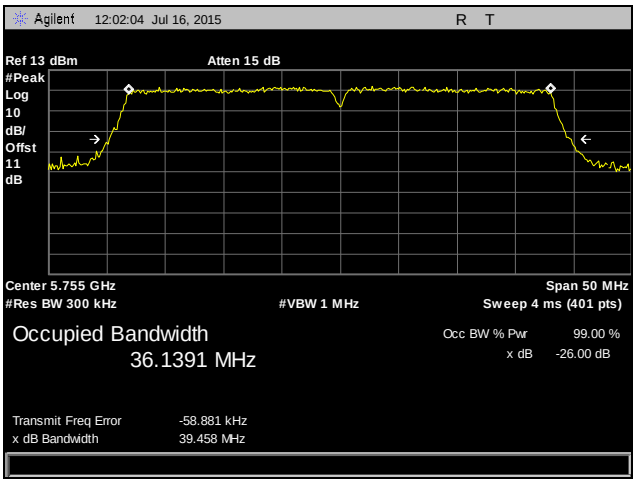


Plot 13. Occupied Bandwidth, 802.11n 20 MHz, 5785 MHz

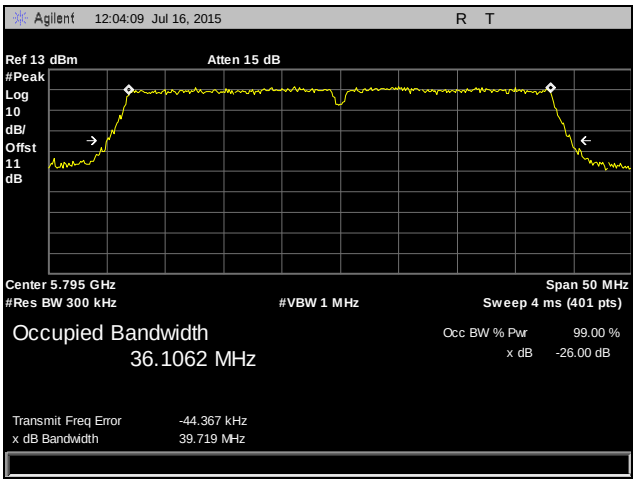


Plot 14. Occupied Bandwidth, 802.11n 20 MHz, 5825 MHz

Occupied Bandwidth Test Results, 802.11n 40 MHz



Plot 15. Occupied Bandwidth, 802.11n 40 MHz, 5755 MHz



Plot 16. Occupied Bandwidth, 802.11n 40 MHz, 5795 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15. 407(a)(3) RF Power Output

Test Requirements: **§15.407(a)(3):** The maximum output power of the intentional radiator shall not exceed the following:

§15.407(a) (3): For the band 5.725-5.850 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz

Test Procedure: The EUT was connected to a spectrum analyzer through a attenuator and set to transmit continuously on the low, mid, and high channels. Its power was measured according to measurement method SA-1, as described in 789033 D02 General UNII Test Procedures New Rules v01.

Test Results: Equipment was compliant with the Peak Power Output limits of **§ 15.407(a)(3)**. The power was measured on both channels.

Test Engineer(s): Surinder Singh

Test Date(s): 09/09/15

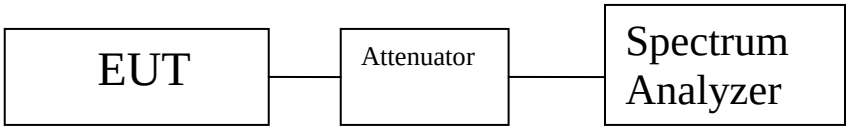


Figure 2. Power Output Test Setup

Maximum Conducted Output Power 20MHz Band 802.11a/ac/n						
Channel	**Frequency GHz**	**Measured Peak Output Power (dBm)/20MHz Ant 1**	**Mode**	**Power Limit (dBm)**	**Antenna Gain (dB)**	**Margin (dB)**
149	5745	19.43	a	30	5.6	-10.57
157	5785	18.25	a	30	5.6	-11.75
165	5825	18.65	a	30	5.6	-11.35
149	5745	19.81	n	30	5.6	-10.19
157	5785	17.31	n	30	5.6	-12.69
165	5825	18.35	n	30	5.6	-11.65
149	5745	19.5	ac	30	5.6	-10.5
157	5785	18.6	ac	30	5.6	-11.4
165	5825	18.35	ac	30	5.6	-11.65

Table 8. RF Power Output, 802.11a/ac/n 20 MHz

Maximum Conducted Output Power 20MHz Band 802.11a/n/ac Mode MIMO (3*3) (dBm)									
Chanel Carrier	**Frequency MHz**	**Measured Peak Output Power (dBm)/20MHz Ant 0**	**Output Power (dBm)/20MHz Ant 1**	**Output Power (dBm)/20MHz Ant 2**	**Mode**	**Total Output Power (dBm)**	**Antenna Gain (dB)**	**Power Limit (dBm)**	**Margin (dB)**
149	5745	9.38	9.6	9.49	a	14.26	9.8	26.2	-11.94
157	5785	9.59	9.55	9.94	a	14.47	9.8	26.2	-11.73
165	5825	9.64	9.61	9.48	a	14.35	9.8	26.2	-11.85
149	5745	10.16	10.75	10.49	n	15.24	9.8	26.2	-10.96
157	5785	9.34	9.37	9.56	n	14.20	9.8	26.2	-12.00
165	5825	9.85	9.77	9.49	n	14.48	9.8	26.2	-11.72
149	5745	10.78	10.68	10.34	ac	15.38	9.8	26.2	-10.82
157	5785	9.84	9.73	9.65	ac	14.51	9.8	26.2	-11.69
165	5825	9.4	9.43	9.34	ac	14.16	9.8	26.2	-12.04

Table 9. RF Power Output, 802.11a/ac/n 20 MHz, MIMO

Maximum Conducted Output Power 40MHz Band 802.11a/ac/n Mode (dBm)						
Channel	**Frequency GHz**	**Output Power (dBm)/40MHz Ant 0**	**Mode**	**Power Limit (dBm)**	**Antenna Gain (dB)**	**Margin (dB)**
149	5755	15.21	n	30	5.8	-14.79
149	5755	15.47	ac	30	5.8	-14.53
157	5795	18.59	n	30	5.8	-11.41
157	5795	18.72	ac	30	5.8	-11.28

Table 10. RF Power Output, 802.11ac/n 40 MHz

Maximum Conducted Output Power 40MHz Band 11n/ac mode MIMO (3*3) (dBm)									
Chanel Carrier	**Frequency MHz**	**Output Power (dBm)/40MHz Ant 0**	**Output Power (dBm)/40MHz Ant 1**	**Output Power (dBm)/40MHz Ant 2**	**Mode**	**Total Output Power (dBm)**	**Antenna Gain (dB)**	**Power Limit (dBm)**	**Margin (dB)**
149	5755	9.77	9.89	10.02	n	14.67	9.8	26.2	-11.53
149	5755	10.79	10.84	10.94	ac	15.63	9.8	26.2	-10.57
157	5795	11.59	11.48	11.84	n	16.41	9.8	26.2	-9.79
157	5795	11.56	11.77	11.85	ac	16.50	9.8	26.2	-9.70

Table 11. RF Power Output, 802.11ac/n 40 MHz, MIMO

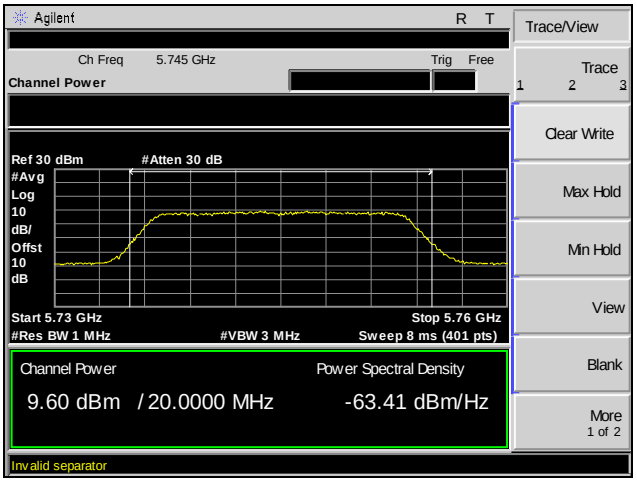
Maximum Conducted Output Power 80MHz Band 802.11ac mode SISO (dBm)						
Channel	**Frequency GHz**	**Measured Peak Output Power (dBm)/80MHz Ant 0**	**Mode**	**Power Limit (dBm)**	**Antenna Gain (dB)**	**Margin (dB)**
149	5775	15.06	ac	30	5.8	-16.27

Table 12. RF Power Output, 802.11ac 80 MHz, SISO

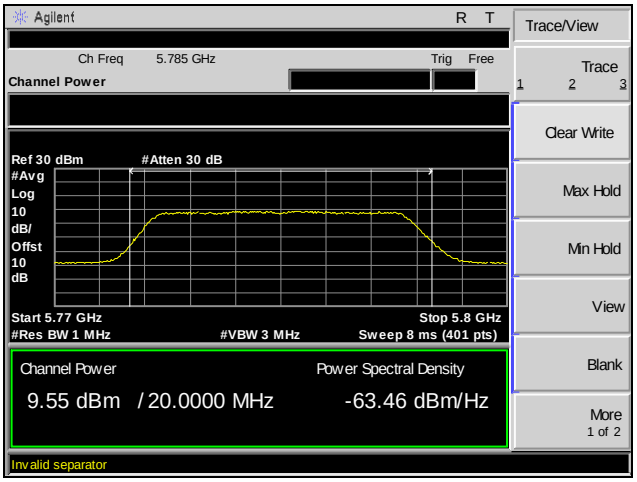
Maximum Conducted Output Power 80MHz Band 802.11ac mode MIMO (3*3) (dBm)								
Chanel Carrier	**Frequency MHz**	**Output Power (dBm)/80MHz Ant 0**	**Output Power (dBm)/80MHz Ant 1**	**Output Power (dBm)/80MHz Ant 2**	**Total Output Power (dBm)**	**Antenna Gain (dB)**	**Power Limit (dBm)**	**Margin (dB)**
149	5775	8.19	8.24	8.34	13.03	9.6	26.4	-13.37

Table 13. RF Power Output, 802.11ac 80 MHz, MIMO

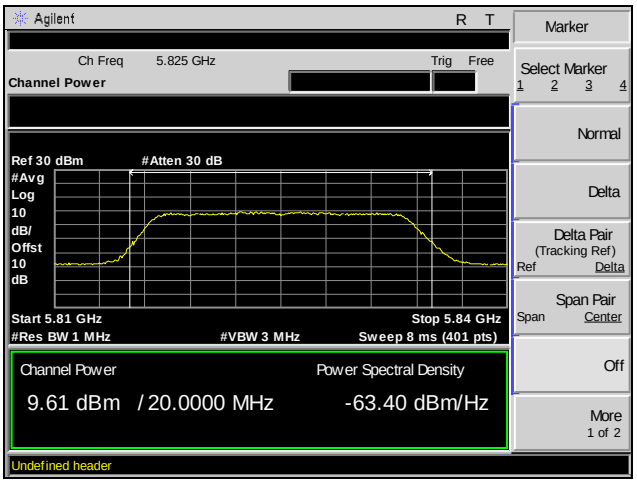
RF Power Output, 802.11a 20 MHz, MIMO



Plot 17. RF Power Output, Channel 149, 802.11a 20 MHz, MIMO

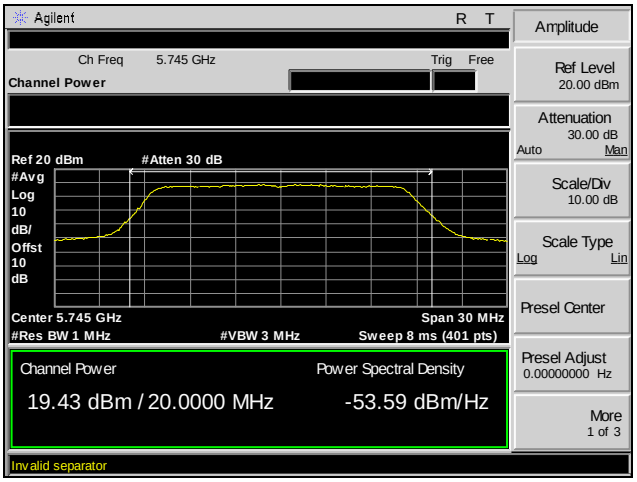


Plot 18. RF Power Output, Channel 157, 802.11a 20 MHz, MIMO

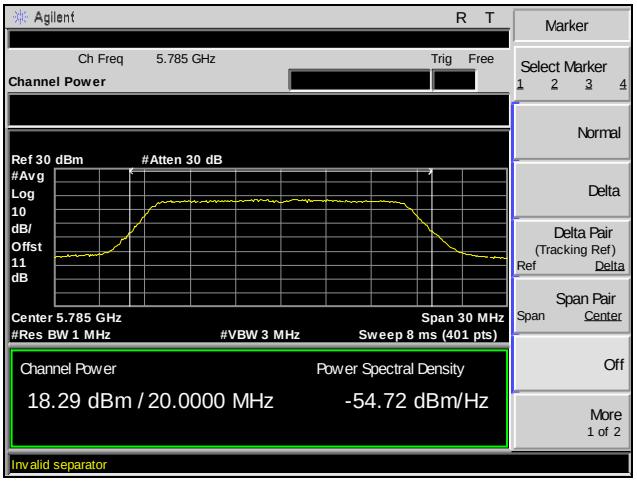


Plot 19. RF Power Output, Channel 165, 802.11a 20 MHz, MIMO

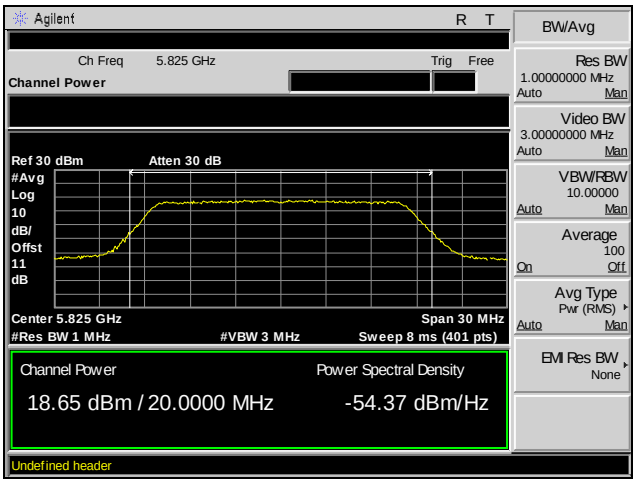
RF Power Output, 802.11a 20 MHz, SISO



Plot 20. RF Power Output, Channel 149, 802.11a 20 MHz, SISO

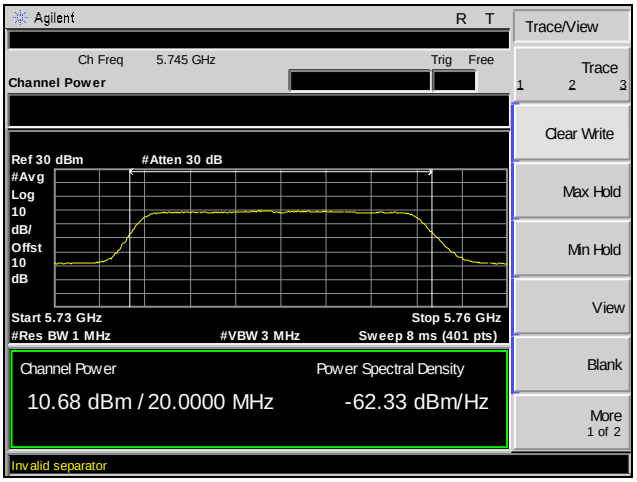


Plot 21. RF Power Output, Channel 157, 802.11a 20 MHz, SISO

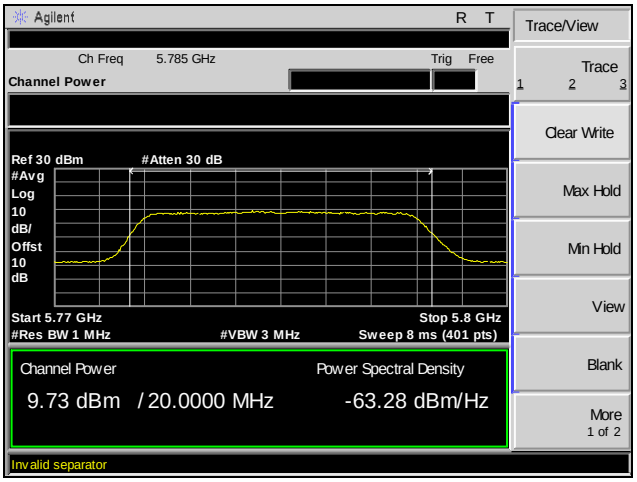


Plot 22. RF Power Output, Channel 165, 802.11a 20 MHz, SISO

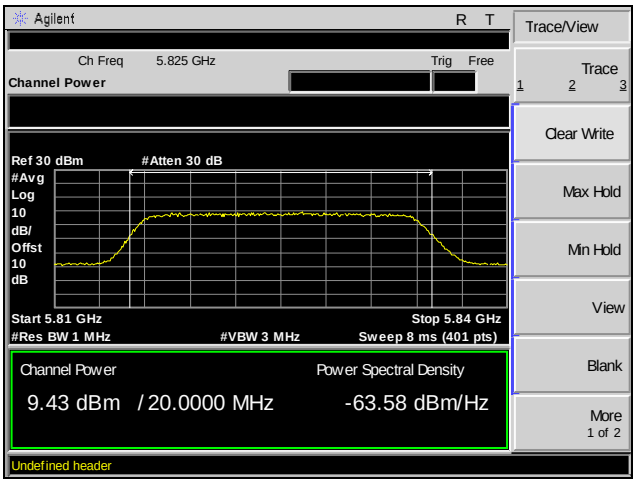
RF Power Output, 802.11ac 20 MHz, MIMO



Plot 23. RF Power Output, Channel 149, 802.11ac 20 MHz, MIMO

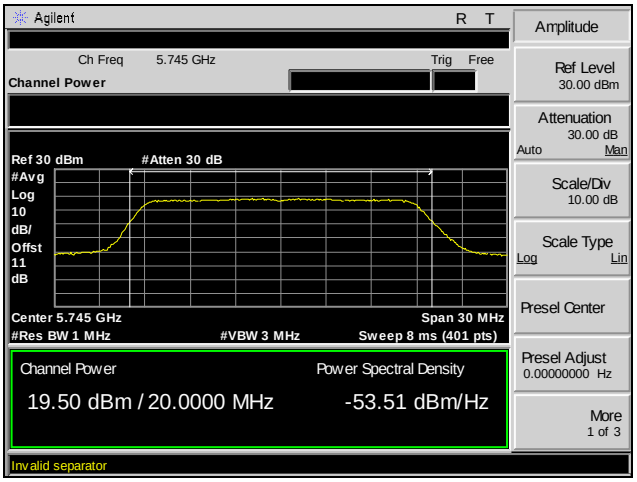


Plot 24. RF Power Output, Channel 157, 802.11ac 20 MHz, MIMO

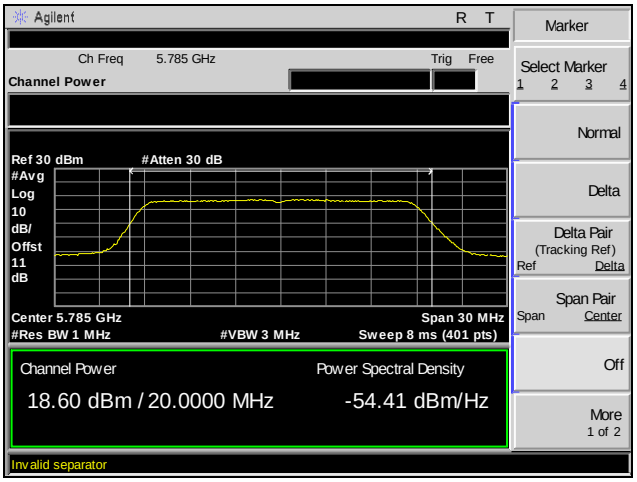


Plot 25. RF Power Output, Channel 165, 802.11ac 20 MHz, MIMO

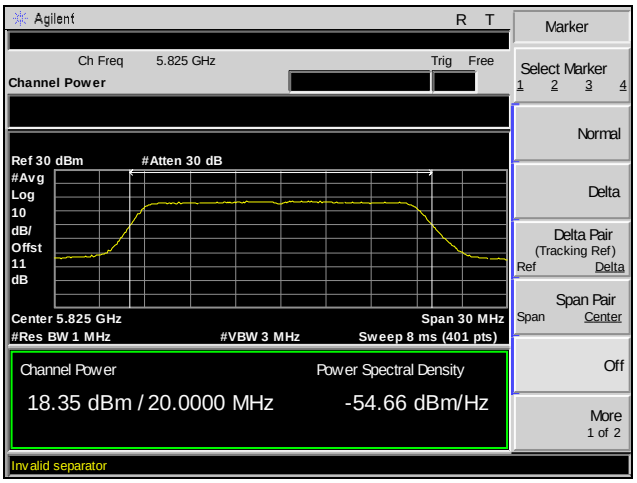
RF Power Output, 802.11ac 20 MHz, SISO



Plot 26. RF Power Output, Channel 149, 802.11ac 20 MHz, SISO

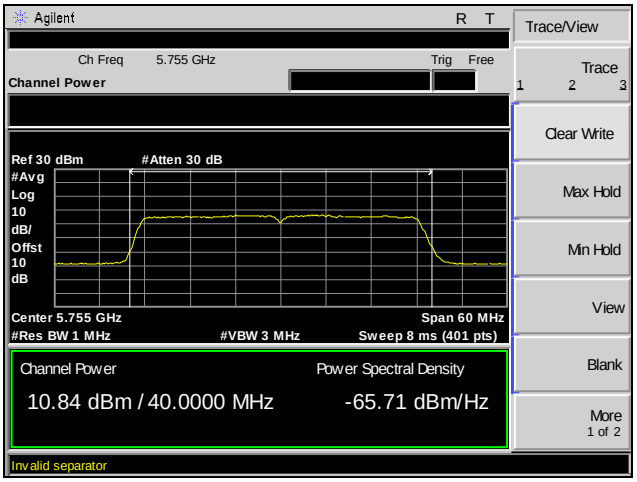


Plot 27. RF Power Output, Channel 157, 802.11ac 20 MHz, SISO

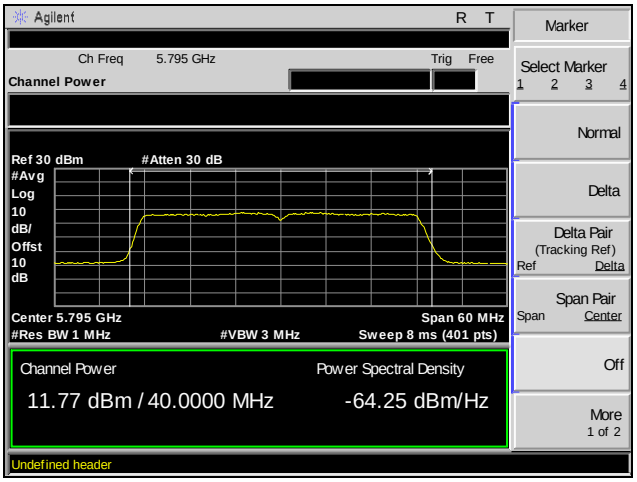


Plot 28. RF Power Output, Channel 165, 802.11ac 20 MHz, SISO

RF Power Output, 802.11ac 40 MHz, MIMO

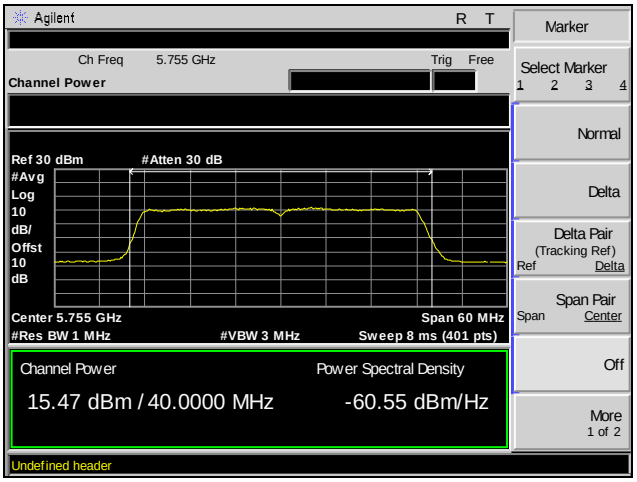


Plot 29. RF Power Output, Channel 149, 802.11ac 40 MHz, MIMO

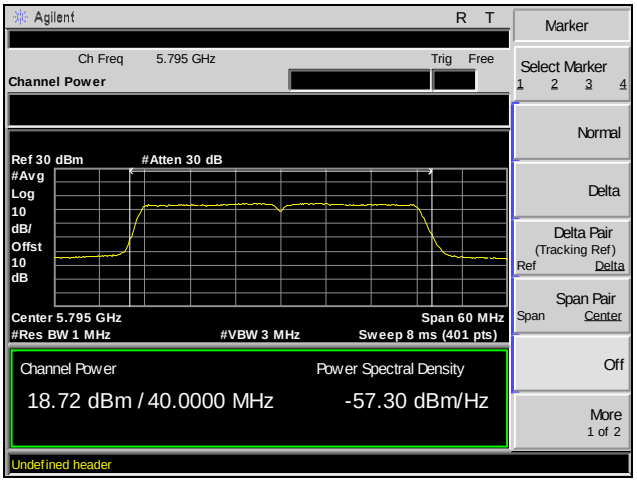


Plot 30. RF Power Output, Channel 157, 802.11ac 40 MHz, MIMO

RF Power Output, 802.11ac 40 MHz, SISO

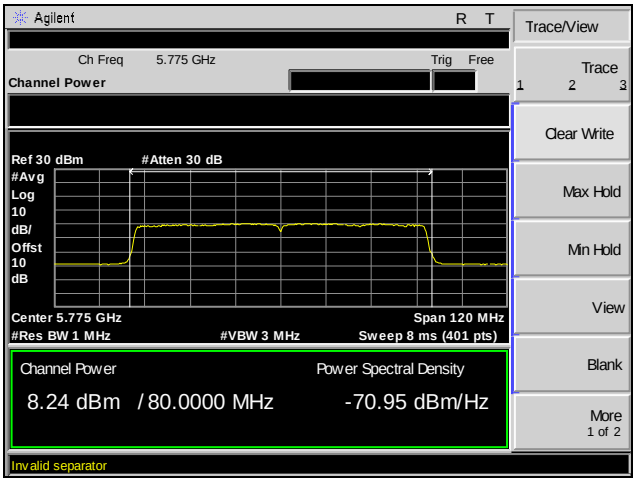


Plot 31. RF Power Output, Channel 149, 802.11ac 40 MHz, SISO



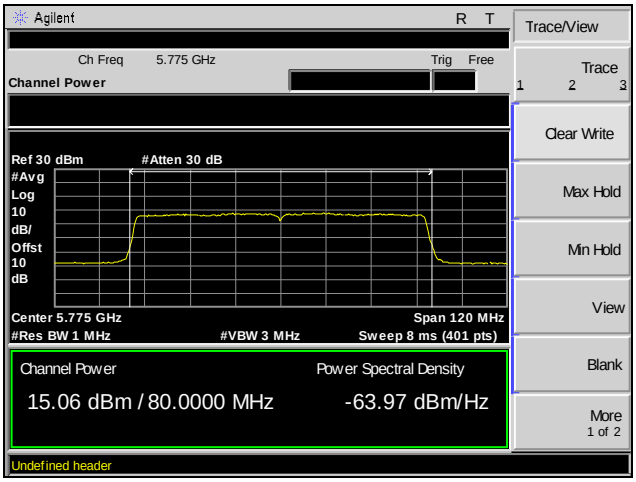
Plot 32. RF Power Output, Channel 157, 802.11ac 40 MHz, SISO

RF Power Output, 802.11ac 80 MHz, MIMO



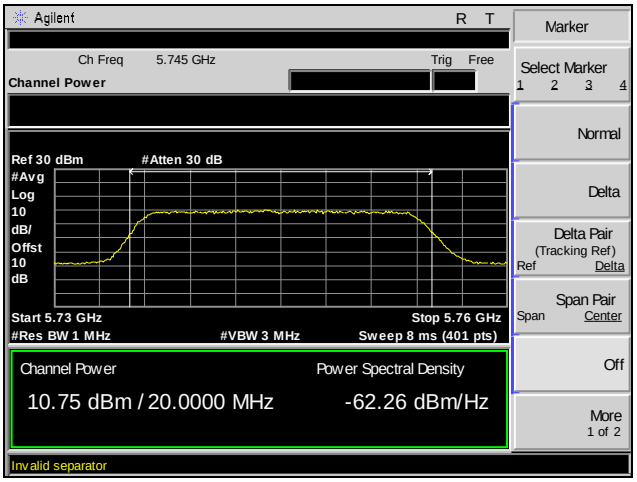
Plot 33. RF Power Output, Channel 157, 802.11ac 80 MHz, MIMO

RF Power Output, 802.11ac 80 MHz, SISO

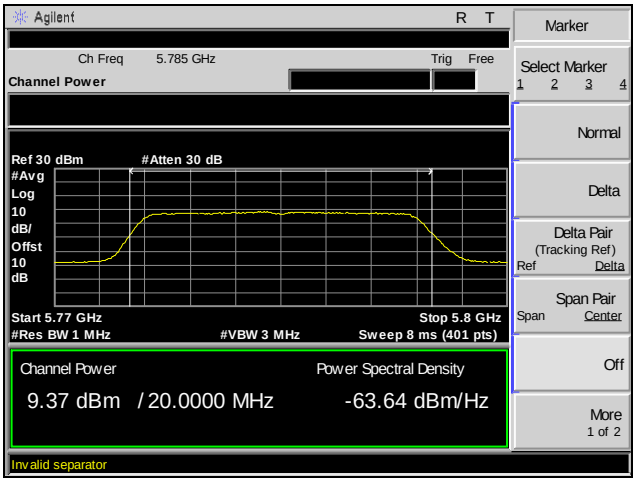


Plot 34. RF Power Output, Channel 149, 802.11ac 80 MHz, SISO

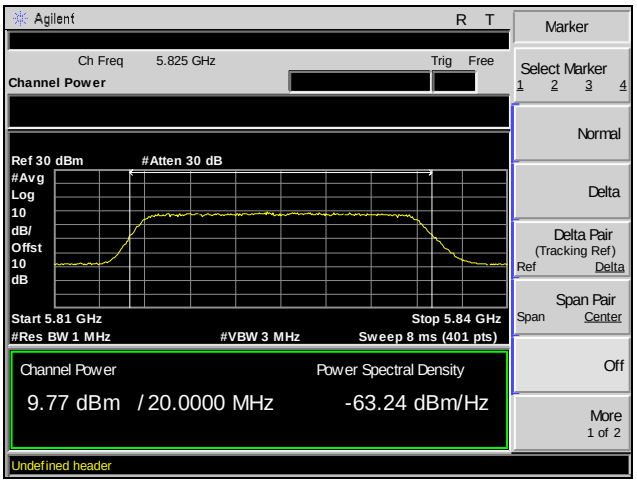
RF Power Output, 802.11n 20 MHz, MIMO



Plot 35. RF Power Output, Channel 149, 802.11n 20 MHz, MIMO



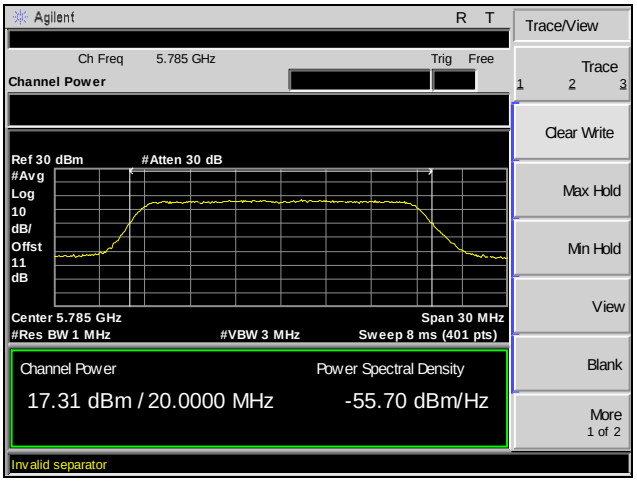
Plot 36. RF Power Output, Channel 157, 802.11n 20 MHz, MIMO



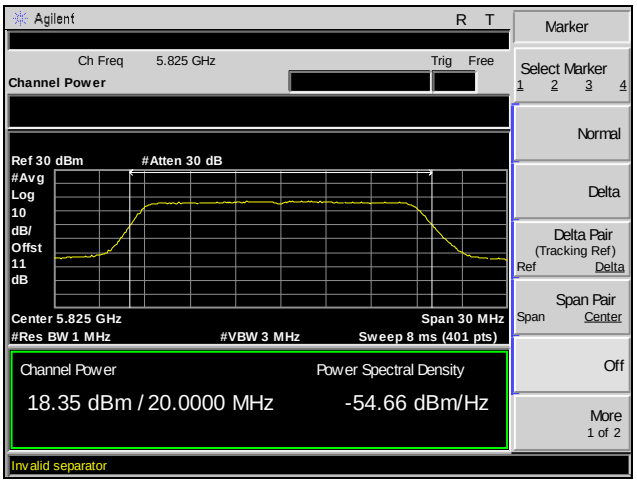
Plot 37. RF Power Output, Channel 165, 802.11n 20 MHz, MIMO

RF Power Output, 802.11n 20 MHz, SISO

Plot 38. RF Power Output, Channel 149, 802.11n 20 MHz, SISO

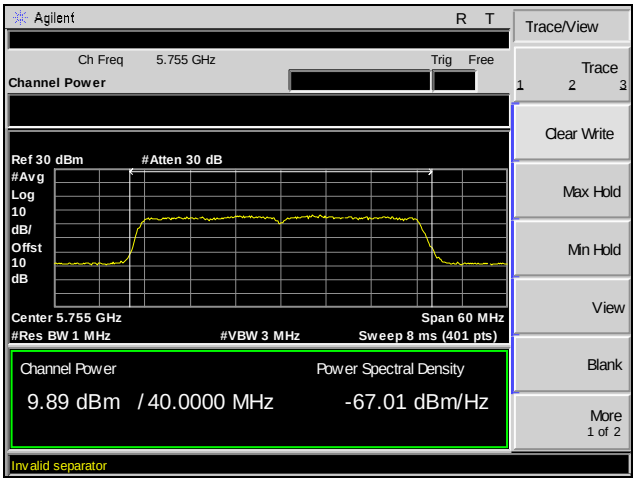


Plot 39. RF Power Output, Channel 157, 802.11n 20 MHz, SISO

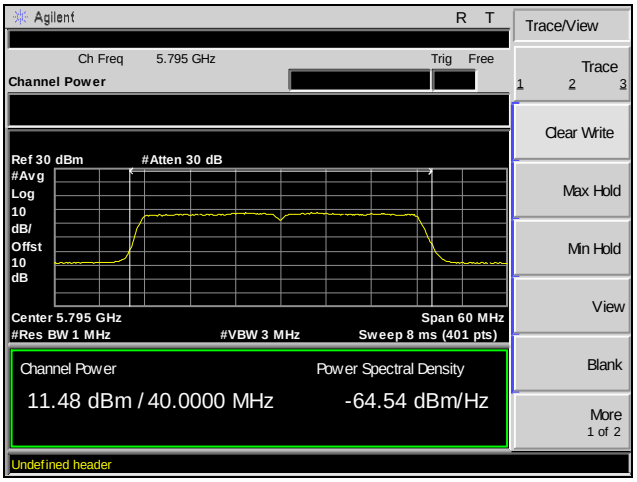


Plot 40. RF Power Output, Channel 165, 802.11n 20 MHz, SISO

RF Power Output, 802.11n 40 MHz, MIMO

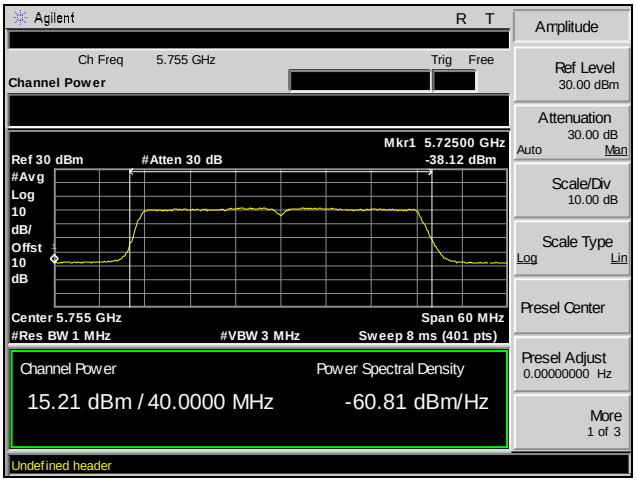


Plot 41. RF Power Output, Channel 149, 802.11n 40 MHz, MIMO

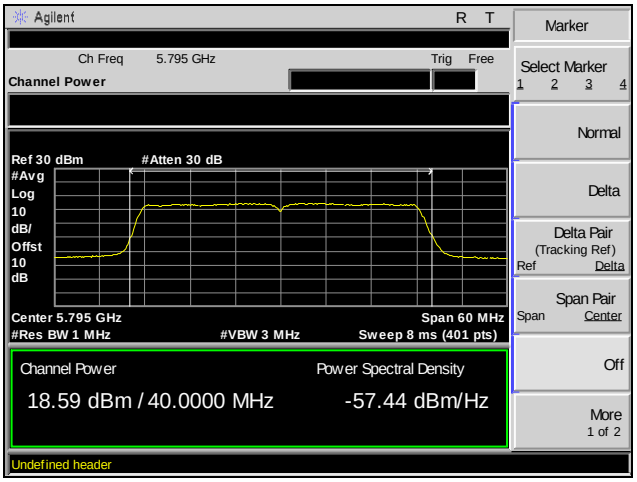


Plot 42. RF Power Output, Channel 157, 802.11n 40 MHz, MIMO

RF Power Output, 802.11n 40 MHz, SISO



Plot 43. RF Power Output, Channel 149, 802.11n 40 MHz, SISO



Plot 44. RF Power Output, Channel 157, 802.11n 40 MHz, SISO

Electromagnetic Compatibility Criteria for Intentional Radiators

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

Test Requirements: **§ 15.407(a)(3):** 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

Test Procedure: The transmitter was connected directly to a Spectrum Analyzer through an attenuator. The power level was set to the maximum level on the EUT. The RBW was set to 1MHz and the VBW was set to 3MHz. The method of measurement from FCC Publication 789033 was used.

Test Results: Equipment was compliant with the peak power spectral density limits of **§ 15.407 (a)(3).** The peak power spectral density was determined from plots on the following page(s).

Test Engineer(s): Surinder Singh

Test Date(s): 09/09/15

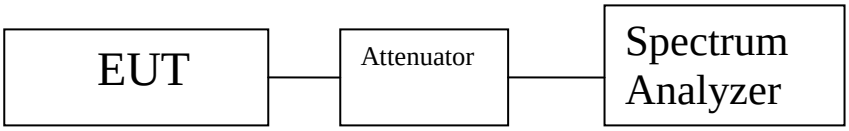


Figure 3. Power Spectral Density Test Setup

Maximum Conducted Output Power 20MHz Band 802.11a/ac/n						
Channel	**Frequency GHz**	**Measured Peak Output Power (dBm)/20MHz Ant 1**	**Mode**	**Power Limit (dBm)**	**Antenna Gain (dB)**	**Margin (dB)**
149	5745	8.87	a	30	5.6	-21.13
157	5785	7.04	a	30	5.6	-22.96
165	5825	7.03	a	30	5.6	-22.97
149	5745	8.78	n	30	5.6	-21.22
157	5785	6.84	n	30	5.6	-23.16
165	5825	7.48	n	30	5.6	-22.52
149	5745	8.72	ac	30	5.6	-21.28
157	5785	7.6	ac	30	5.6	-22.4
165	5825	7.25	ac	30	5.6	-22.75

Table 14. RF Power Output, 802.11a/ac/n 20 MHz

Maximum Conducted Output Power 20MHz Band 802.11a/n/ac Mode MIMO (3*3) (dBm)									
Chanel Carrier	**Frequency MHz**	**Measured Peak Output Power (dBm)/20MHz Ant 0**	**Output Power (dBm)/20MHz Ant 1**	**Output Power (dBm)/20MHz Ant 2**	**Mode**	**Total Output Power (dBm)**	**Antenna Gain (dB)**	**Power Limit (dBm)**	**Margin (dB)**
149	5745	-1.56	-1.28	-1.64	a	3.28	9.8	26.2	-22.92
157	5785	-1.05	-1.07	-1.34	a	3.62	9.8	26.2	-22.58
165	5825	-0.9	-0.62	-1.05	a	3.92	9.8	26.2	-22.28
149	5745	-0.34	-0.28	-0.64	n	4.35	9.8	26.2	-21.85
157	5785	-1.94	-1.83	-1.56	n	3.00	9.8	26.2	-23.20
165	5825	-1.55	-1.73	-1.88	n	3.05	9.8	26.2	-23.15
149	5745	-1.22	-1.04	-1.34	ac	3.57	9.8	26.2	-22.63
157	5785	-1.55	-1.32	-1.52	ac	3.31	9.8	26.2	-22.89
165	5825	-1.94	-2.05	-2.33	ac	2.67	9.8	26.2	-23.53

Table 15. RF Power Output, 802.11a/ac/n 20 MHz, MIMO

Maximum Conducted Output Power 40MHz Band 802.11a/ac/n Mode (dBm)						
Channel	**Frequency GHz**	**Output Power (dBm)/40MHz Ant 0**	**Mode**	**Power Limit (dBm)**	**Antenna Gain (dB)**	**Margin (dB)**
149	5755	1.56	n	30	5.8	-28.44
149	5755	1.22	ac	30	5.8	-28.78
157	5795	4.7	n	30	5.8	-25.3
157	5795	4.1	ac	30	5.8	-25.9

Table 16. RF Power Output, 802.11ac/n 40 MHz

Maximum Conducted Output Power 40MHz Band 11n/ac mode MIMO (3*3) (dBm)									
Chanel Carrier	**Frequency MHz**	**Output Power (dBm)/40MHz Ant 0**	**Output Power (dBm)/40MHz Ant 1**	**Output Power (dBm)/40MHz Ant 2**	**Mode**	**Total Output Power (dBm)**	**Antenna Gain (dB)**	**Power Limit (dBm)**	**Margin (dB)**
149	5755	-4.11	-4.2	-4.31	n	0.57	9.8	26.2	-25.63
149	5755	-3.32	-3.2	3.26	ac	4.86	9.8	26.2	-21.34
157	5795	-2.99	-2.8	-2.64	n	1.96	9.8	26.2	-24.24
157	5795	-1.99	-2.06	-2.16	ac	2.70	9.8	26.2	-23.50

Table 17. RF Power Output, 802.11ac/n 40 MHz, MIMO

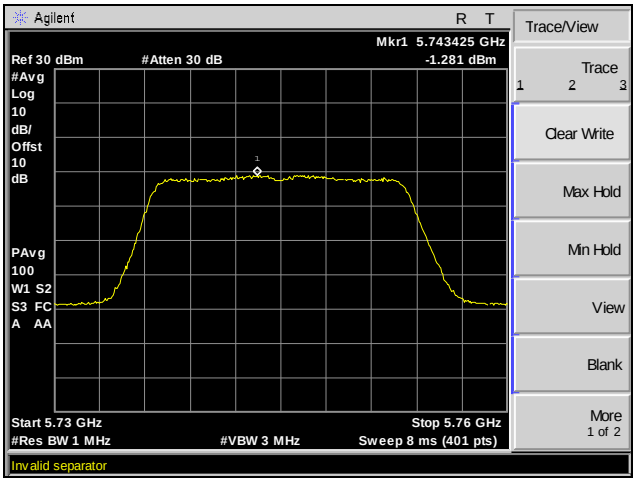
Maximum Conducted Output Power 80MHz Band 802.11ac mode SISO (dBm)						
Channel	**Frequency GHz**	**Measured Peak Output Power (dBm)/80MHz Ant 0**	**Mode**	**Power Limit (dBm)**	**Antenna Gain (dB)**	**Margin (dB)**
149	5775	-3.37	ac	30	5.8	-33.37

Table 18. RF Power Output, 802.11ac 80 MHz, SISO

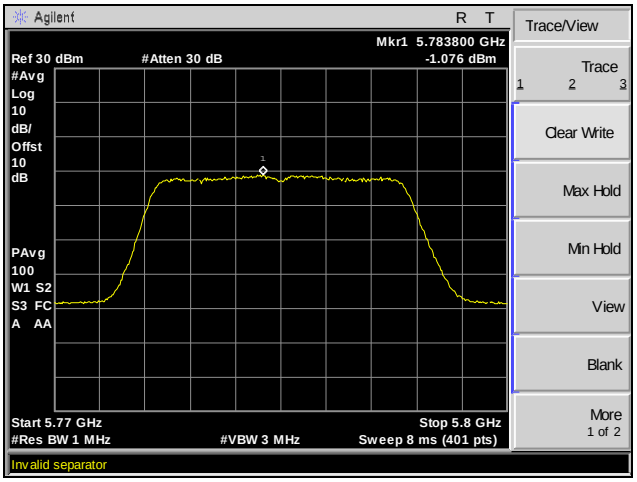
Maximum Conducted Output Power 80MHz Band 802.11ac mode MIMO (3*3) (dBm)								
Chanel Carrier	**Frequency MHz**	**Output Power (dBm)/80MHz Ant 0**	**Output Power (dBm)/80MHz Ant 1**	**Output Power (dBm)/80MHz Ant 2**	**Total Output Power (dBm)**	**Antenna Gain (dB)**	**Power Limit (dBm)**	**Margin (dB)**
149	5775	-10.34	-10.87	-10.26	-5.71	9.6	26.4	-32.11

Table 19. RF Power Output, 802.11ac 80 MHz, MIMO

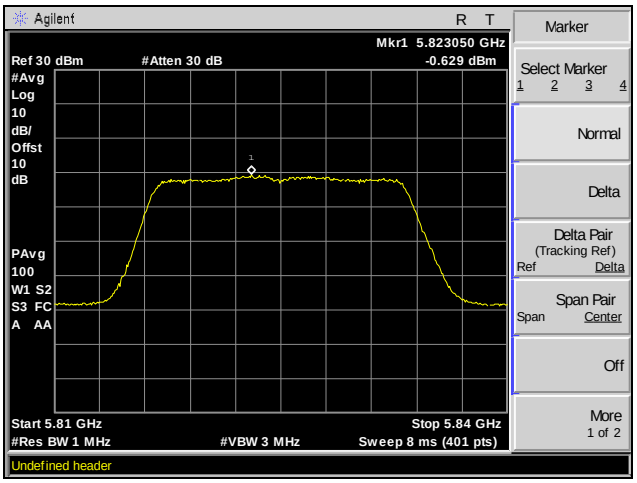
Peak Power Spectral Density, 802.11a 20 MHz, MIMO



Plot 45. Peak Power Spectral Density, Channel 149, 802.11a 20 MHz, MIMO

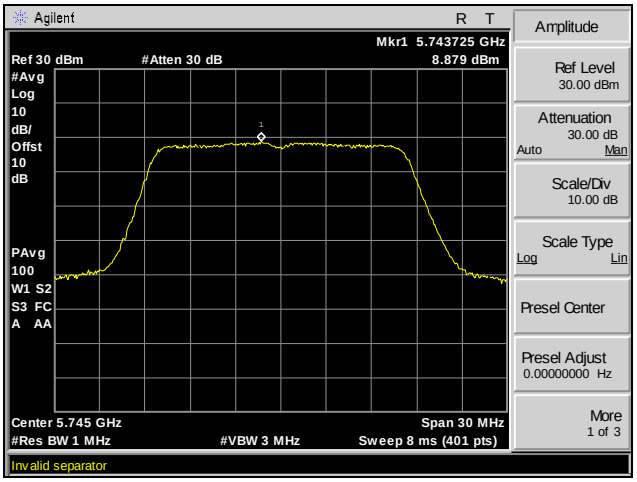


Plot 46. Peak Power Spectral Density, Channel 157, 802.11a 20 MHz, MIMO

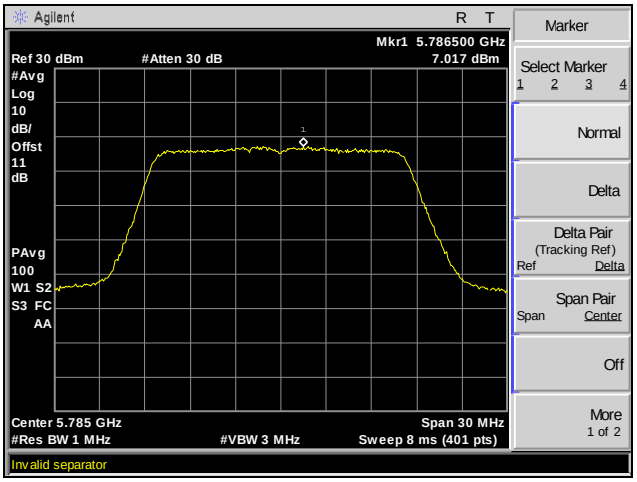


Plot 47. Peak Power Spectral Density, Channel 165, 802.11a 20 MHz, MIMO

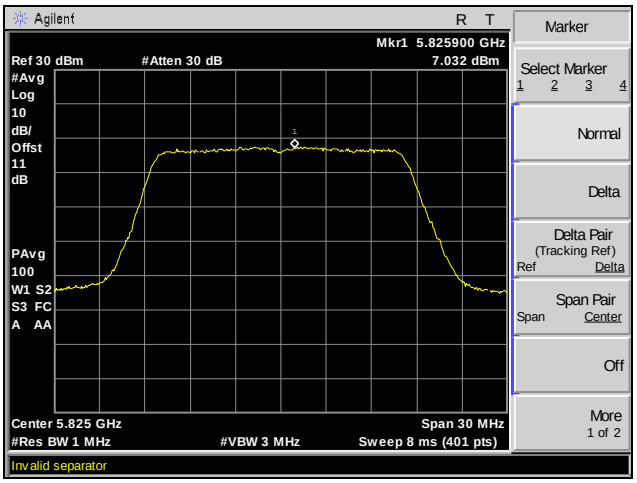
Peak Power Spectral Density, 802.11a 20 MHz, SISO



Plot 48. Peak Power Spectral Density, Channel 149, 802.11a 20 MHz, SISO

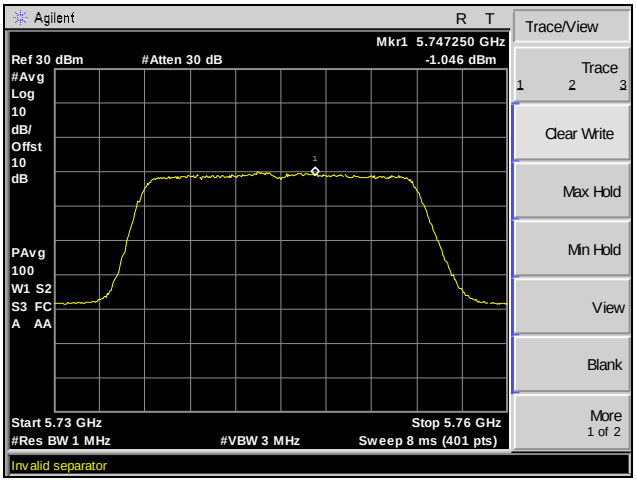


Plot 49. Peak Power Spectral Density, Channel 157, 802.11a 20 MHz, SISO

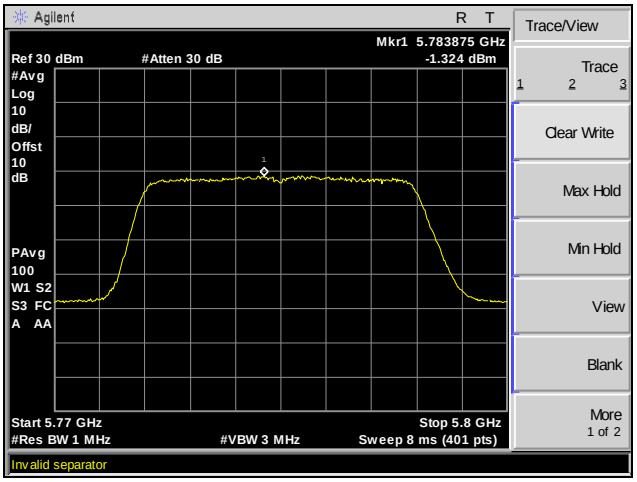


Plot 50. Peak Power Spectral Density, Channel 165, 802.11a 20 MHz, SISO

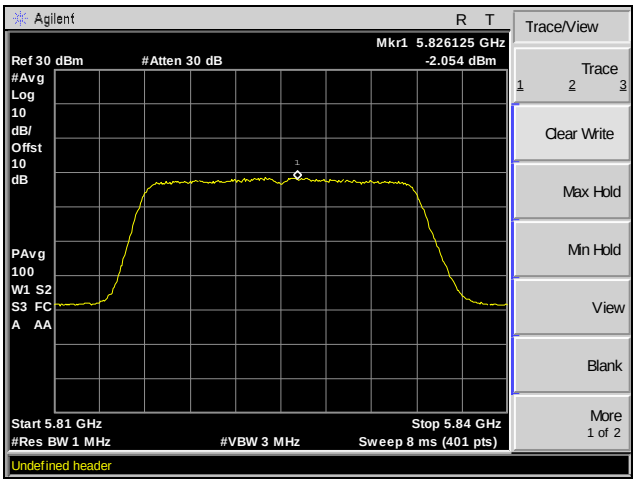
Peak Power Spectral Density, 802.11ac 20 MHz, MIMO



Plot 51. Peak Power Spectral Density, Channel 149, 802.11ac 20 MHz, MIMO

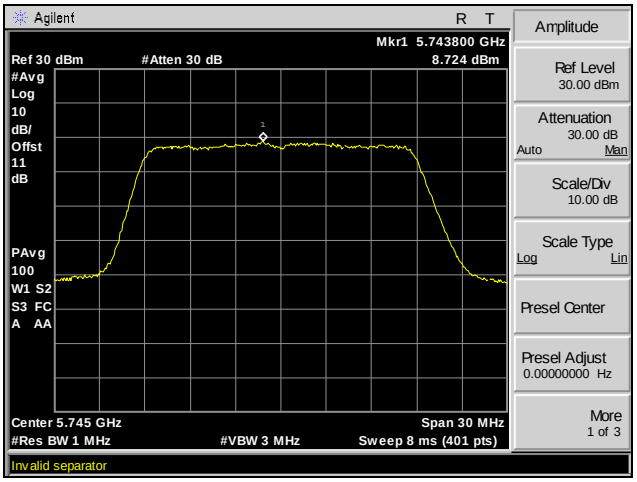


Plot 52. Peak Power Spectral Density, Channel 157, 802.11ac 20 MHz, MIMO

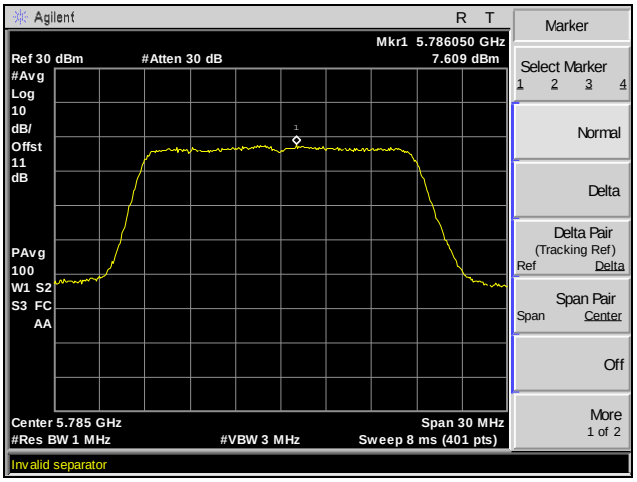


Plot 53. Peak Power Spectral Density, Channel 165, 802.11ac 20 MHz, MIMO

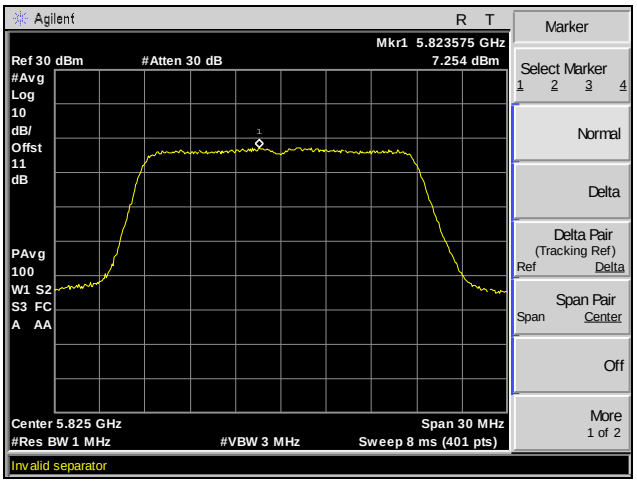
Peak Power Spectral Density, 802.11ac 20 MHz, SISO



Plot 54. Peak Power Spectral Density, Channel 149, 802.11ac 20 MHz, SISO

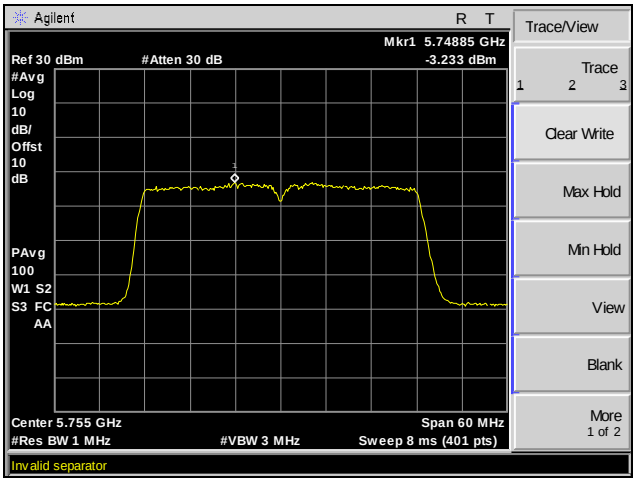


Plot 55. Peak Power Spectral Density, Channel 157, 802.11ac 20 MHz, SISO

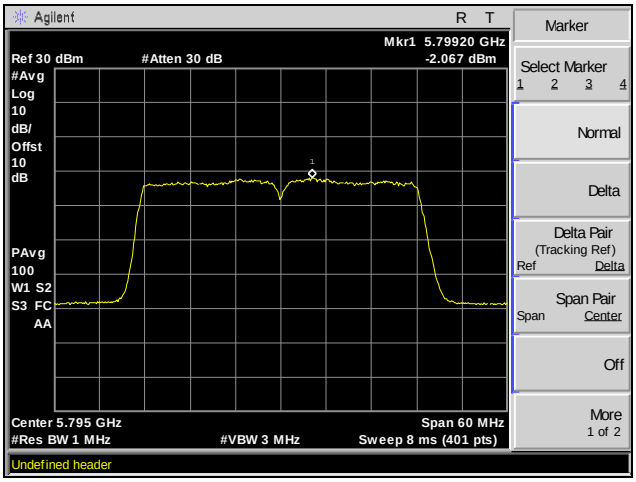


Plot 56. Peak Power Spectral Density, Channel 165, 802.11ac 20 MHz, SISO

Peak Power Spectral Density, 802.11ac 40 MHz, MIMO

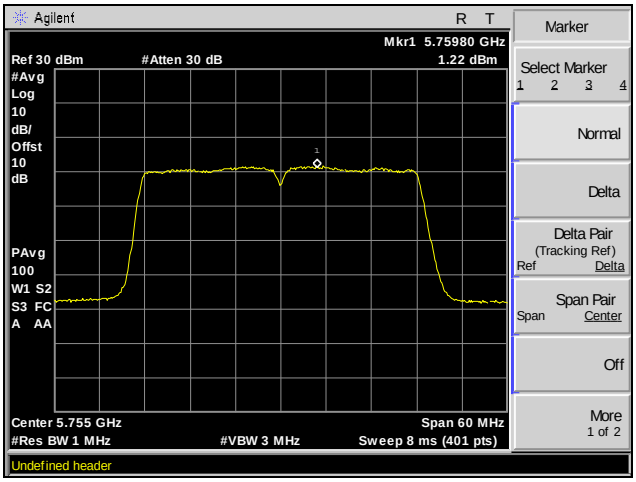


Plot 57. Peak Power Spectral Density, Channel 149, 802.11ac 40 MHz, MIMO

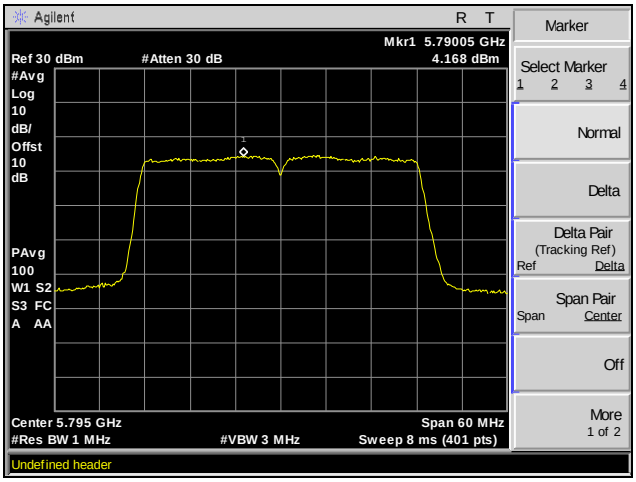


Plot 58. Peak Power Spectral Density, Channel 157, 802.11ac 40 MHz, MIMO

Peak Power Spectral Density, 802.11ac 40 MHz, SISO

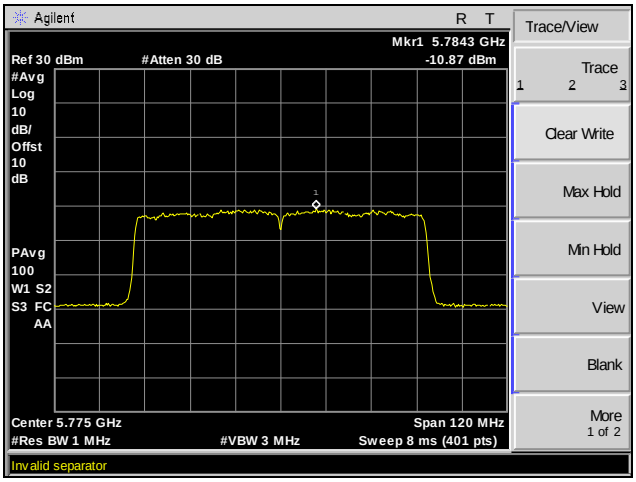


Plot 59. Peak Power Spectral Density, Channel 149, 802.11ac 40 MHz, SISO



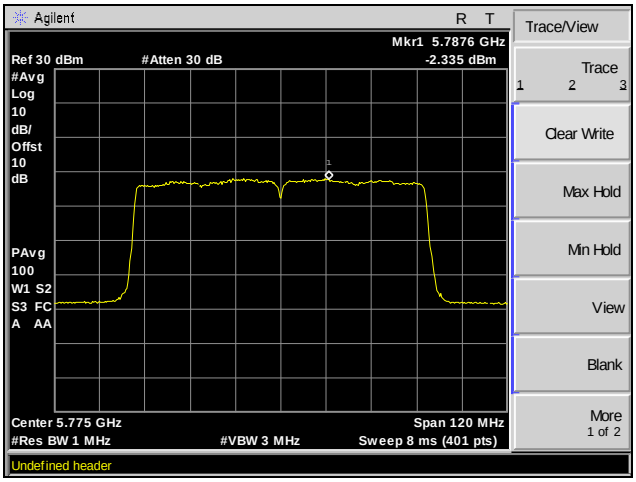
Plot 60. Peak Power Spectral Density, Channel 157, 802.11ac 40 MHz, SISO

Peak Power Spectral Density, 802.11ac 80 MHz, MIMO



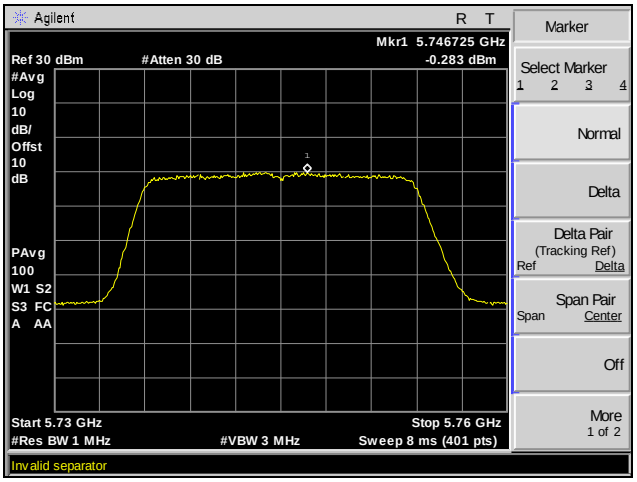
Plot 61. Peak Power Spectral Density, Channel 157, 802.11ac 80 MHz, MIMO

Peak Power Spectral Density, 802.11ac 80 MHz, SISO

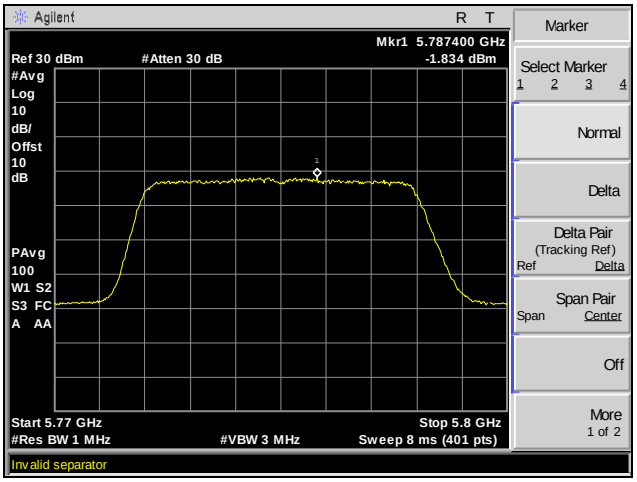


Plot 62. Peak Power Spectral Density, Channel 149, 802.11ac 80 MHz, SISO

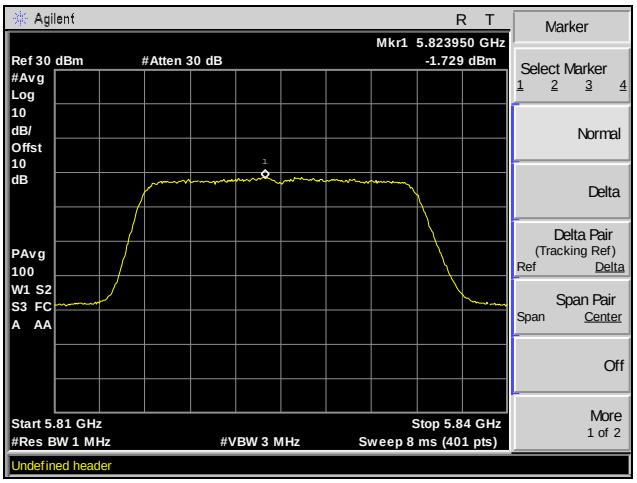
Peak Power Spectral Density, 802.11n 20 MHz, MIMO



Plot 63. Peak Power Spectral Density, Channel 149, 802.11n 20 MHz, MIMO

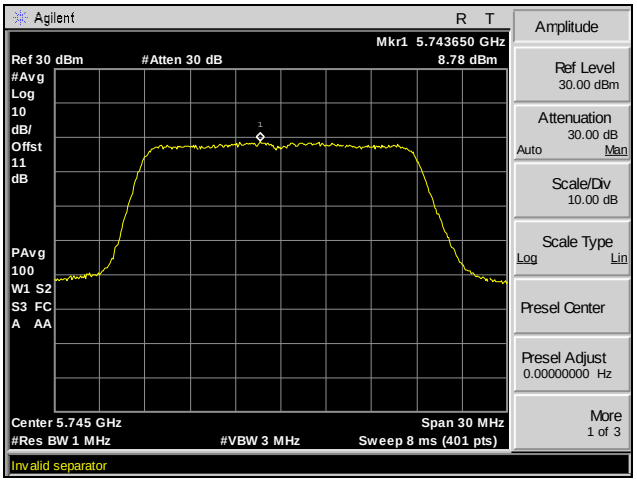


Plot 64. Peak Power Spectral Density, Channel 157, 802.11n 20 MHz, MIMO

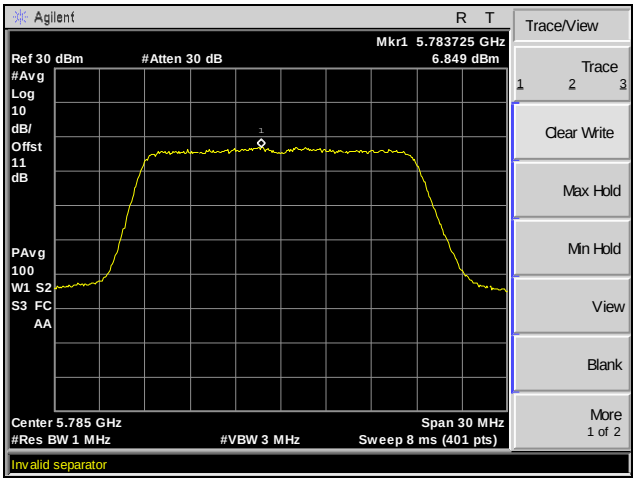


Plot 65. Peak Power Spectral Density, Channel 165, 802.11n 20 MHz, MIMO

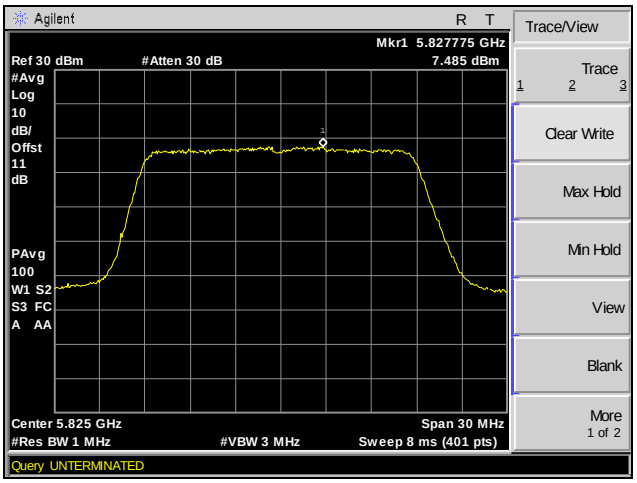
Peak Power Spectral Density, 802.11n 20 MHz, SISO



Plot 66. Peak Power Spectral Density, Channel 149, 802.11n 20 MHz, SISO

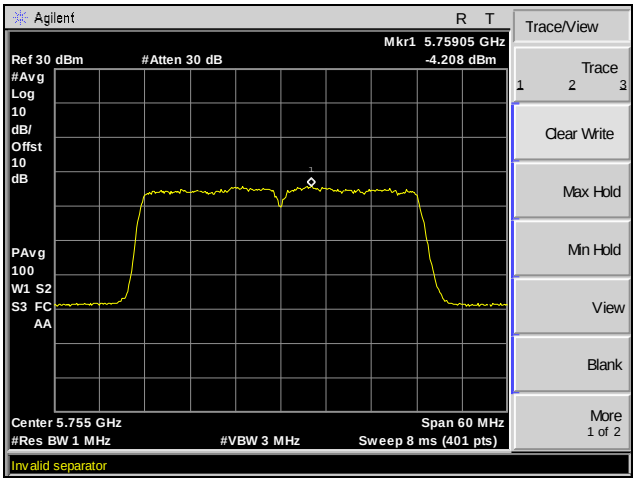


Plot 67. Peak Power Spectral Density, Channel 157, 802.11n 20 MHz, SISO

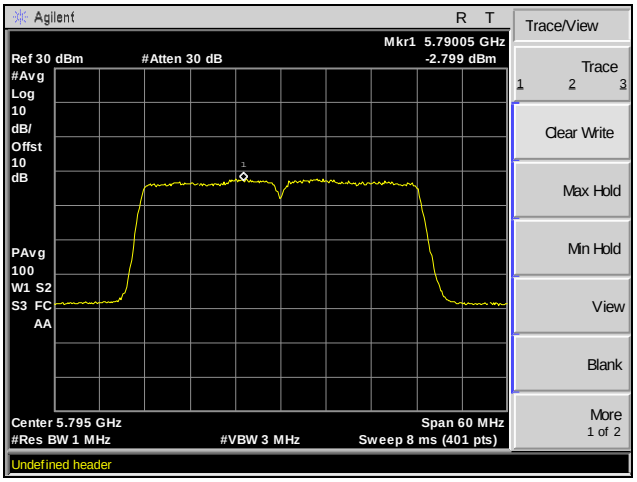


Plot 68. Peak Power Spectral Density, Channel 165, 802.11n 20 MHz, SISO

Peak Power Spectral Density, 802.11n 40 MHz, MIMO

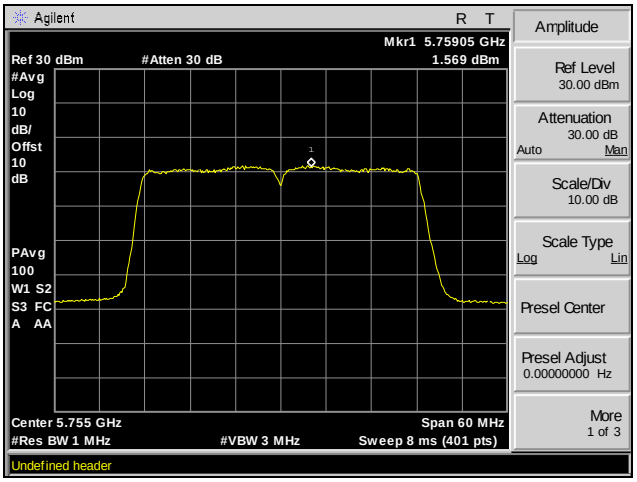


Plot 69. Peak Power Spectral Density, Channel 149, 802.11n 40 MHz, MIMO

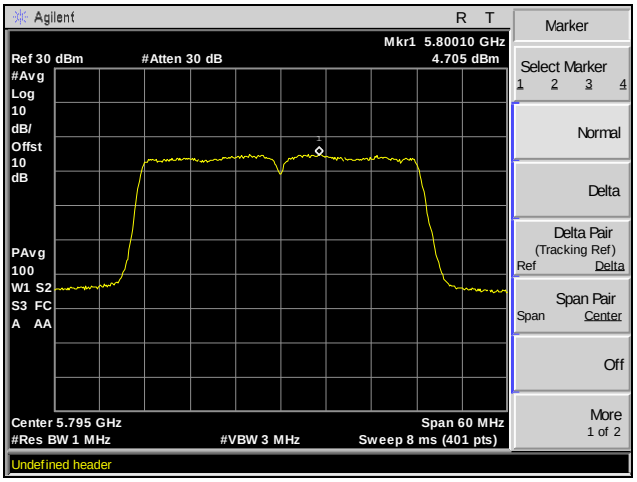


Plot 70. Peak Power Spectral Density, Channel 157, 802.11n 40 MHz, MIMO

Peak Power Spectral Density, 802.11n 40 MHz, SISO



Plot 71. Peak Power Spectral Density, Channel 149, 802.11n 40 MHz, SISO



Plot 72. Peak Power Spectral Density, Channel 157, 802.11n 40 MHz, SISO

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(b)(4), (6), (7) Undesirable Emissions

Test Requirements: **§ 15.407(b)(4), (6), (7)**; **§15.205:** Emissions outside the frequency band.

§ 15.407(b)(4): For transmitters operating in the 5.725-5.825 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 EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP 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:: Antenna-port conducted measurements in conjunction with cabinet emissions tests were performed to demonstrate compliance with the requirement of unwanted emission in the spurious domain. The following tests and methods were used as per KDB 789033 D02 General UNII Test Procedures New Rules v01

1. Cabinet emissions measurements. A radiated test shall be performed to ensure that cabinet emissions are below the emission limits. For the cabinet-emission measurements the antenna may be replaced by a termination matching the nominal impedance of the antenna.

2. EIRP calculation. A value representative of an upper bound on out-of-band antenna gain (in dBi) shall be added to the measured antenna-port conducted emission power to compute EIRP within the specified measurement bandwidth. (For emissions in the restricted bands, additional calculations are required to convert EIRP to field strength at the specified distance.)

   EIRP = E (Restricted band field strength limit) + 20*log(d) - 104.77 (1)
   Where d=3 meter is measurement distance specified in FCC 15.209 requirement.
   E= 54dBuV/m is the limit for spurious emission in restricted band.
   Plugging these values to equation (1) above
   EIRP= 54+9.54-104.77 = -41.22dBm. This was the limit used for restricted band spurious emission measurement.

3. The upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands or 2 dBi, whichever is greater.3 However, for devices that operate in multiple bands using the same transmit antenna, the highest gain of the antenna within the operating band nearest to the out-of-band frequency being measured may be used in lieu of the overall highest gain when measuring emissions at frequencies within 20 percent of the absolute frequency at the nearest edge of that band, but in no case shall a value less than 2 dBi be selected.

4. EIRP adjustments for multiple outputs. For devices with multiple outputs occupying the same or overlapping frequency ranges in the same band (e.g., MIMO or beamforming devices), the total EIRP was calculated as follows:

a. Computed EIRP on one of the antenna port since output power remain uniform across all antenna port for this DUT when operated under MIMO mode.

b. Adjusted emission levels measured on individual output by 10 log(NANT), where NANT is the number of outputs (For this DUT NANT is 3). Therefore 10log(3)= 4.77dB was used on spectrum analyzer as reference offset to account for MIMO summation.

c. Added the array gain term specified in KDB Publication 662911 for out-of-band and spurious signals.

The total reference level offset used on spectrum analyzer
Offset= 10dB (external attenuator) + 4.77dB (MIMO Summation factor) + Array Gain (dBi)

For Cabinet measurement: 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.

Test Results: For below 1 GHz, the EUT was compliant with the requirements of this section. Only worse case plot was included in the test report.

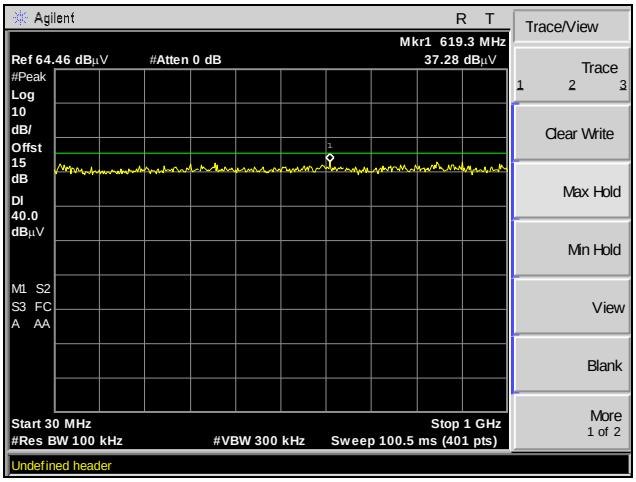
For above 1 GHz, the EUT was compliant with the requirements of this section.

Only noise floor was observed 18GHz.

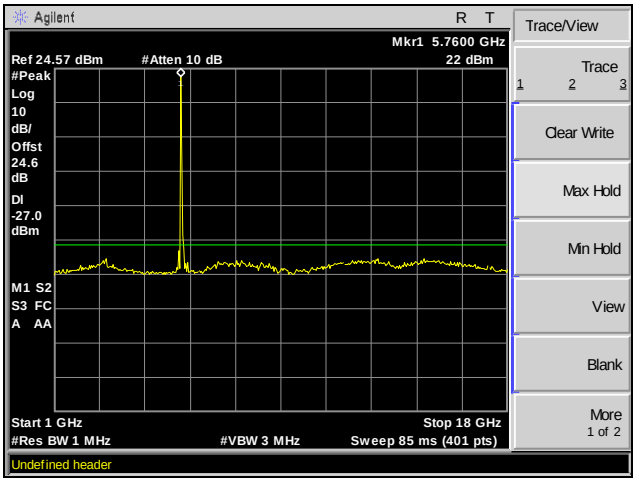
Test Engineer(s): Surinder Singh

Test Date(s): 09/09/15

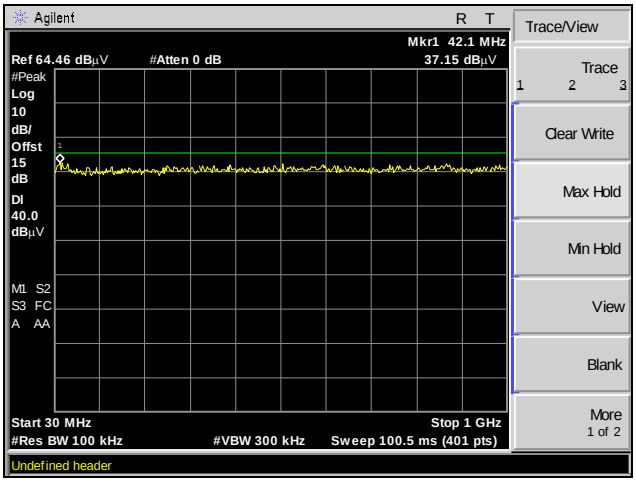
Spurious Emissions, 802.11a 20 MHz, MIMO



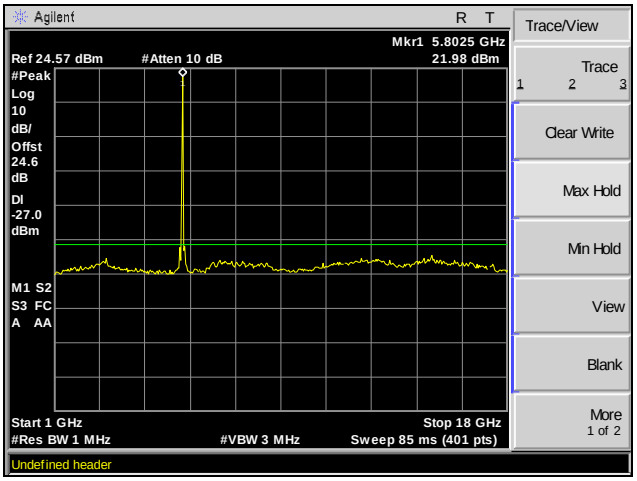
Plot 73. Spurious Emissions, Channel 149, 802.11a 20 MHz, MIMO, 30 MHz – 1 GHz



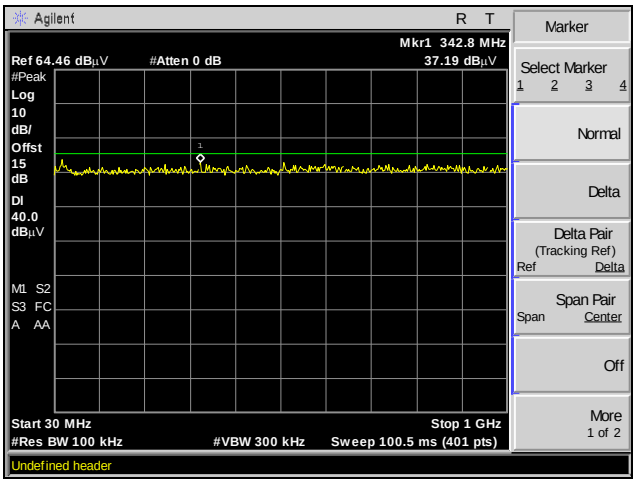
Plot 74. Spurious Emissions, Channel 149, 802.11a 20 MHz, MIMO, 1 GHz – 18 GHz



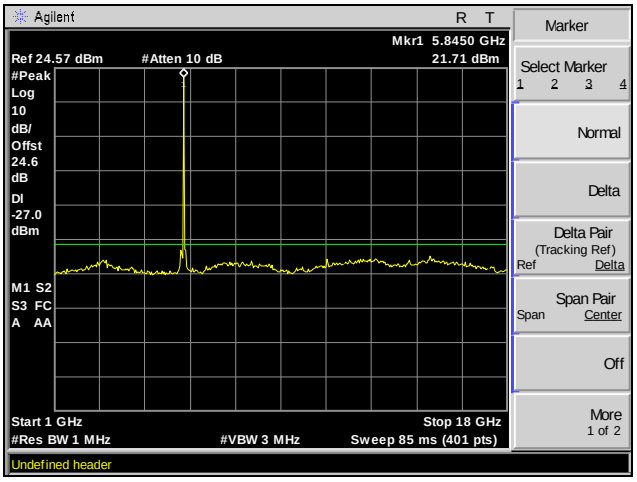
Plot 75. Spurious Emissions, Channel 157, 802.11a 20 MHz, MIMO, 30 MHz – 1 GHz



Plot 76. Spurious Emissions, Channel 157, 802.11a 20 MHz, MIMO, 1 GHz – 18 GHz

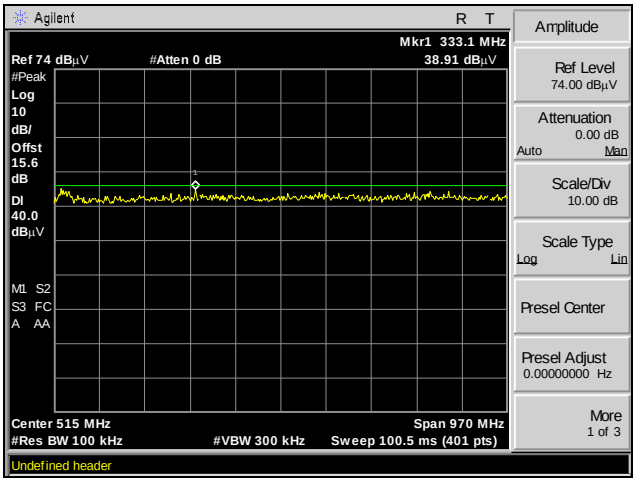


Plot 77. Spurious Emissions, Channel 165, 802.11a 20 MHz, MIMO, 30 MHz – 1 GHz

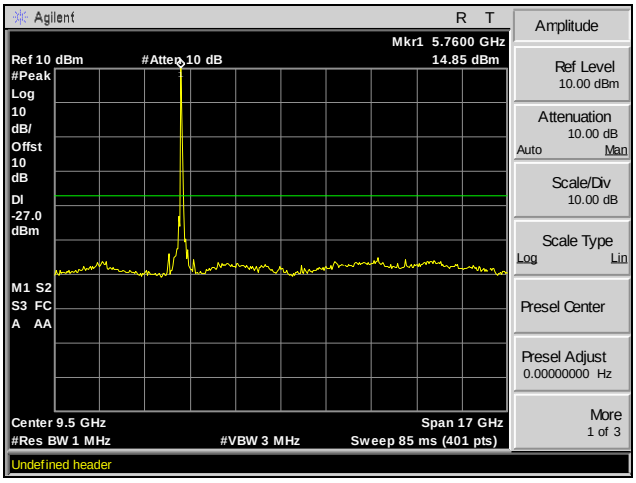


Plot 78. Spurious Emissions, Channel 165, 802.11a 20 MHz, MIMO, 1 GHz – 18 GHz

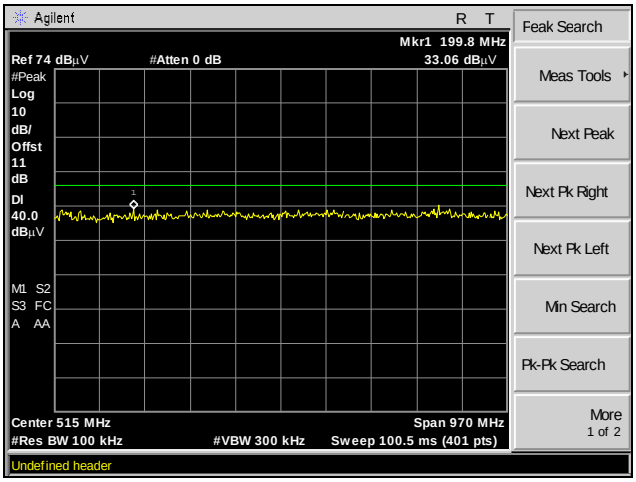
Spurious Emissions, 802.11a 20 MHz, SISO



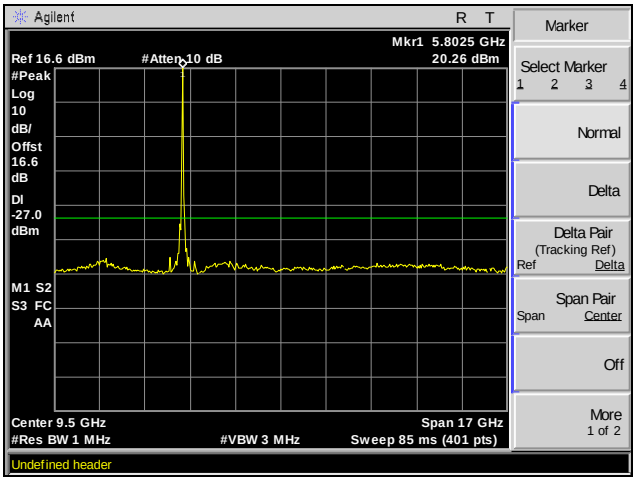
Plot 79. Spurious Emissions, Channel 149, 802.11a 20 MHz, SISO, 30 MHz – 1 GHz



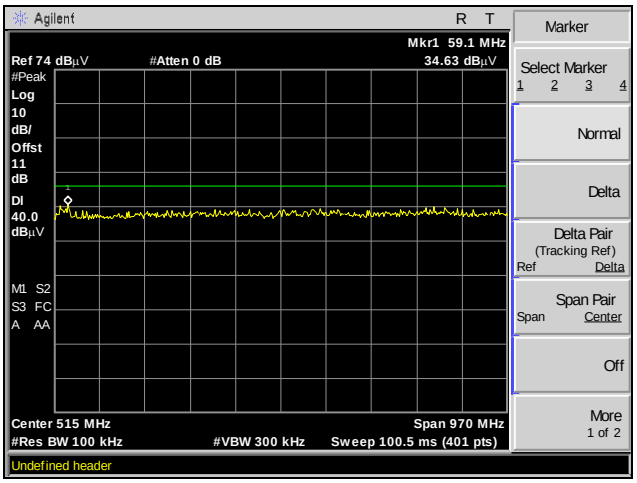
Plot 80. Spurious Emissions, Channel 149, 802.11a 20 MHz, SISO, 1 GHz – 18 GHz



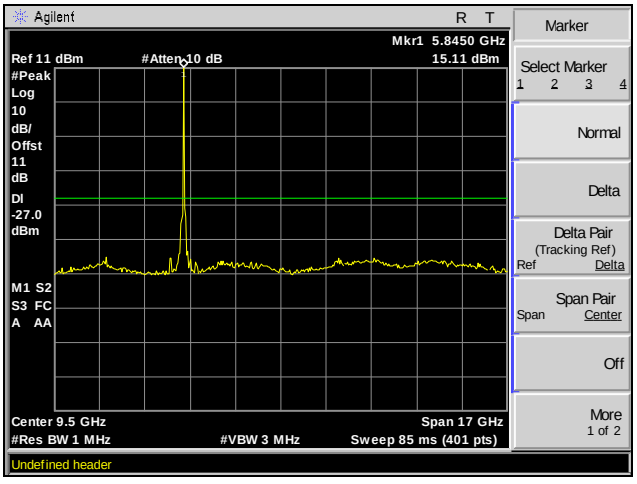
Plot 81. Spurious Emissions, Channel 157, 802.11a 20 MHz, SISO, 30 MHz – 1 GHz



Plot 82. Spurious Emissions, Channel 157, 802.11a 20 MHz, SISO, 1 GHz – 18 GHz

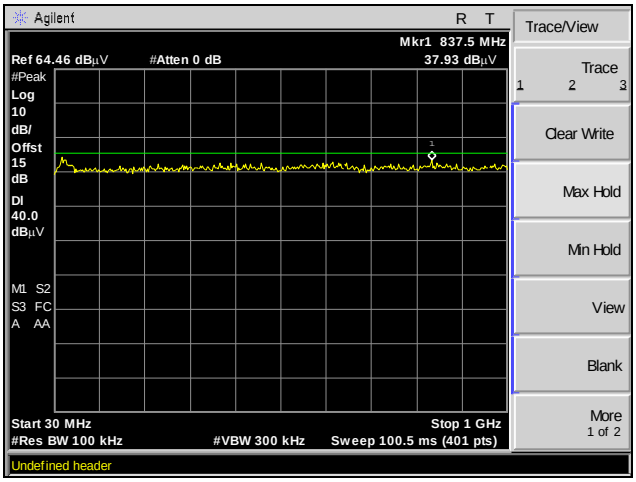


Plot 83. Spurious Emissions, Channel 165, 802.11a 20 MHz, SISO, 30 MHz – 1 GHz

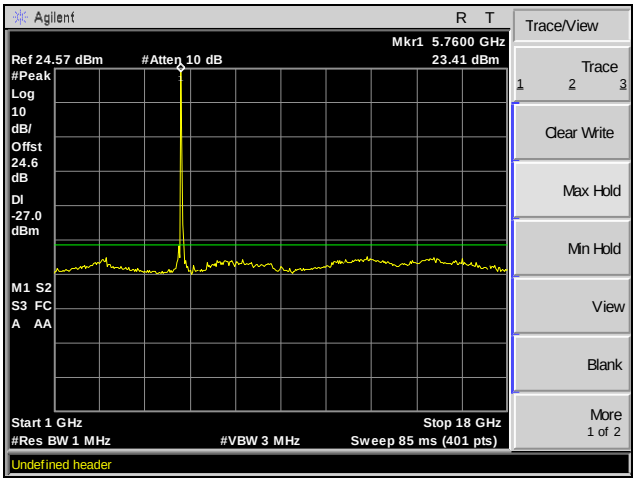


Plot 84. Spurious Emissions, Channel 165, 802.11a 20 MHz, SISO, 1 GHz – 18 GHz

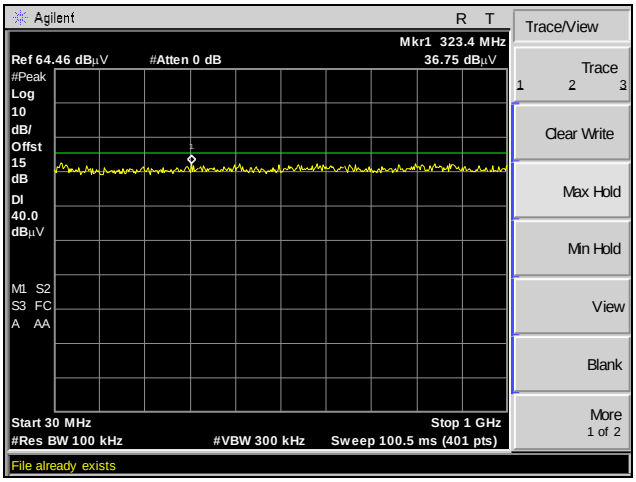
Spurious Emissions, 802.11ac 20 MHz, MIMO



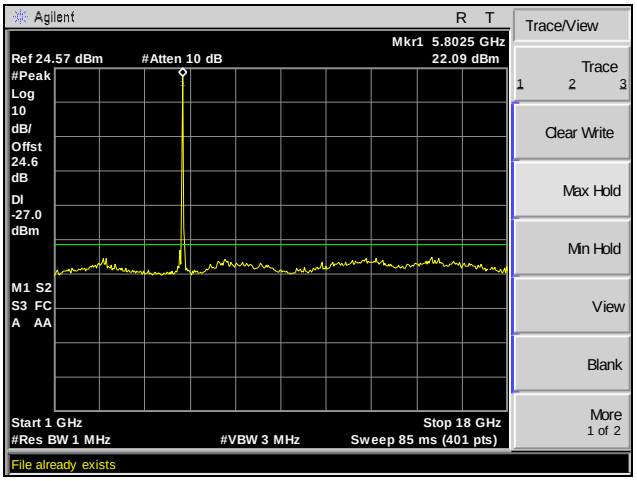
Plot 85. Spurious Emissions, Channel 149, 802.11ac 20 MHz, MIMO, 30 MHz – 1 GHz



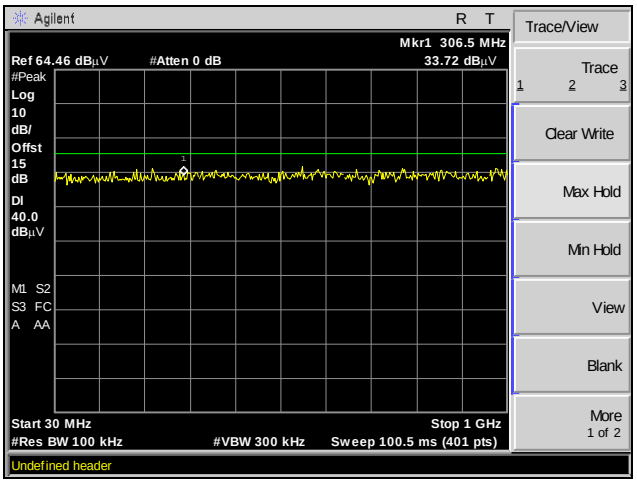
Plot 86. Spurious Emissions, Channel 149, 802.11ac 20 MHz, MIMO, 1 GHz – 18 GHz



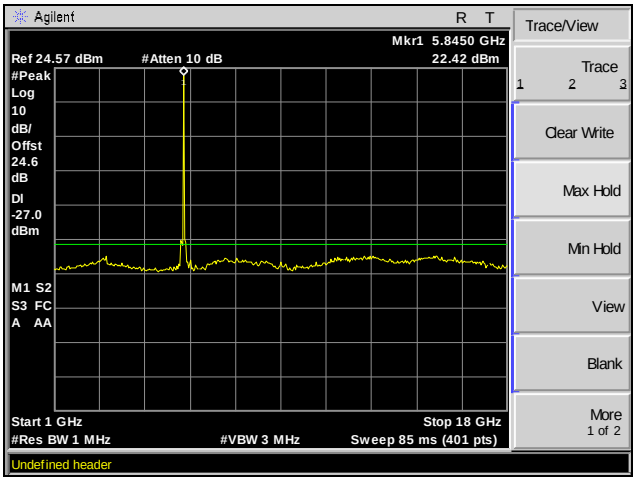
Plot 87. Spurious Emissions, Channel 157, 802.11ac 20 MHz, MIMO, 30 MHz – 1 GHz



Plot 88. Spurious Emissions, Channel 157, 802.11ac 20 MHz, MIMO, 1 GHz – 18 GHz

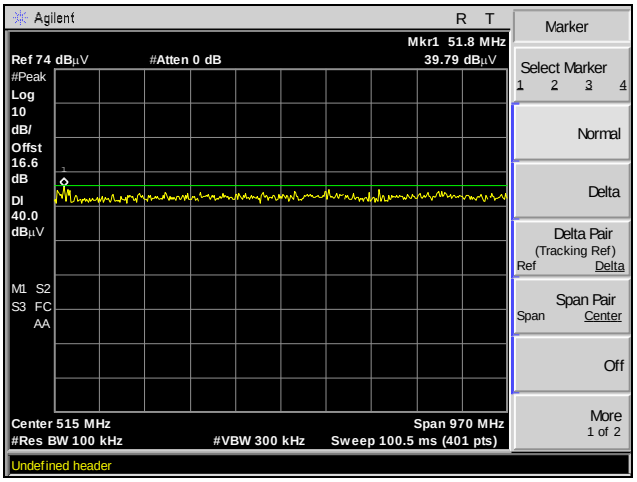


Plot 89. Spurious Emissions, Channel 165, 802.11ac 20 MHz, MIMO, 30 MHz – 1 GHz

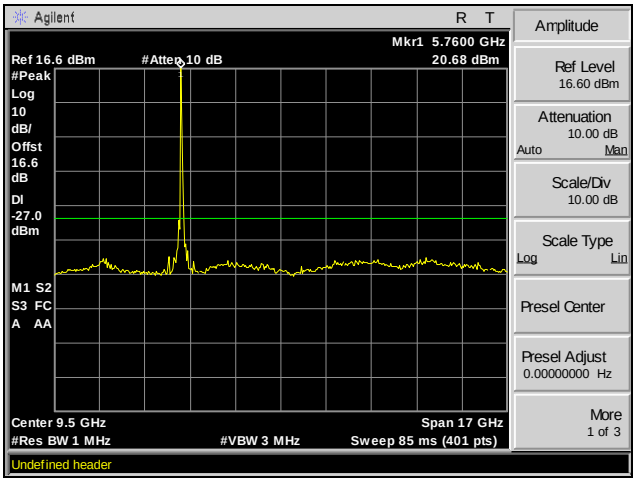


Plot 90. Spurious Emissions, Channel 165, 802.11ac 20 MHz, MIMO, 1 GHz – 18 GHz

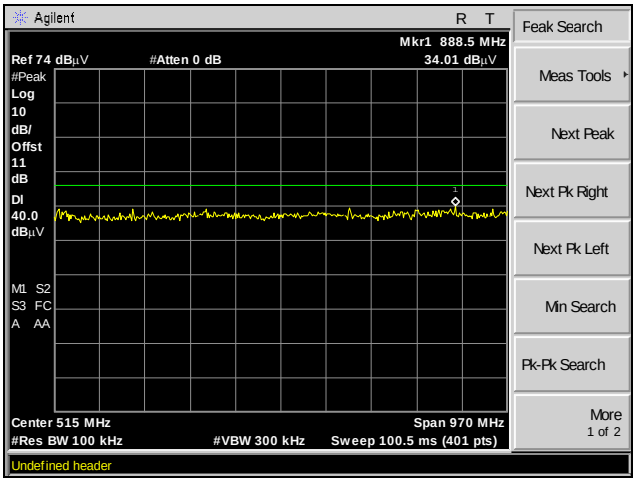
Spurious Emissions, 802.11ac 20 MHz, SISO



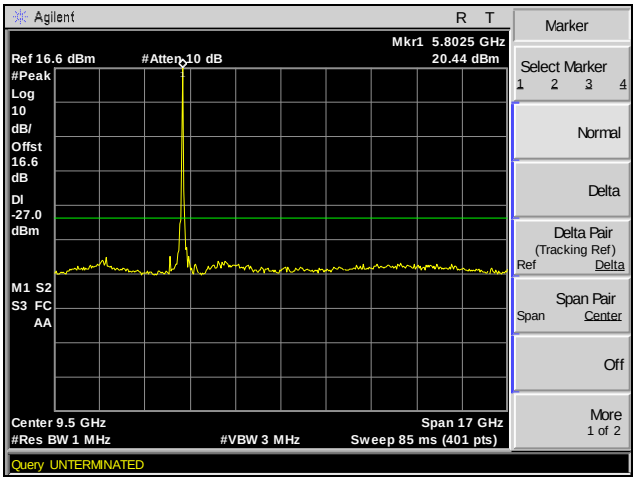
Plot 91. Spurious Emissions, Channel 149, 802.11ac 20 MHz, SISO, 30 MHz – 1 GHz



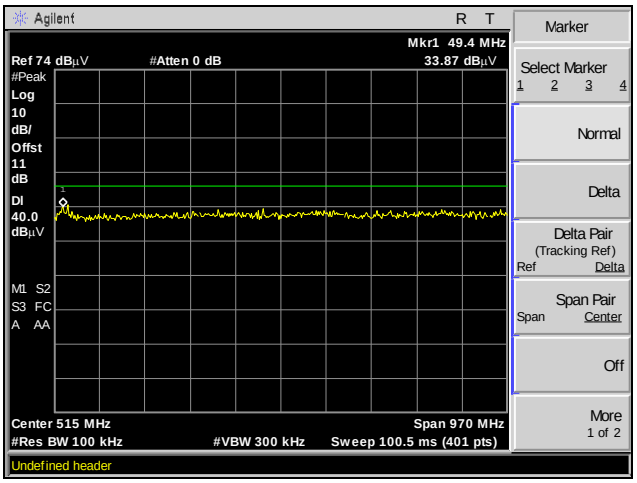
Plot 92. Spurious Emissions, Channel 149, 802.11ac 20 MHz, SISO, 1 GHz – 18 GHz



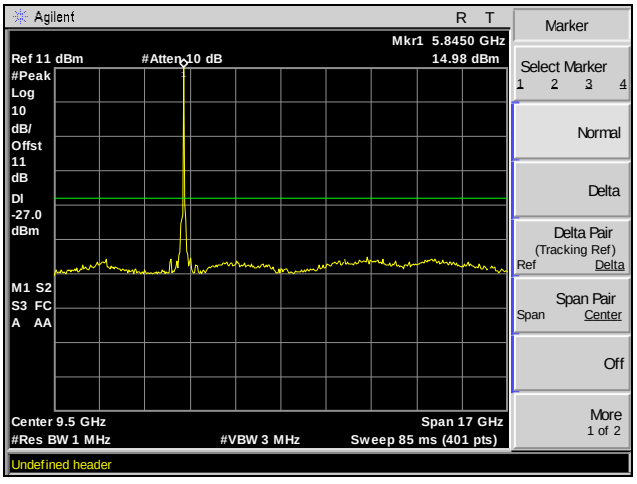
Plot 93. Spurious Emissions, Channel 157, 802.11ac 20 MHz, SISO, 30 MHz – 1 GHz



Plot 94. Spurious Emissions, Channel 157, 802.11ac 20 MHz, SISO, 1 GHz – 18 GHz

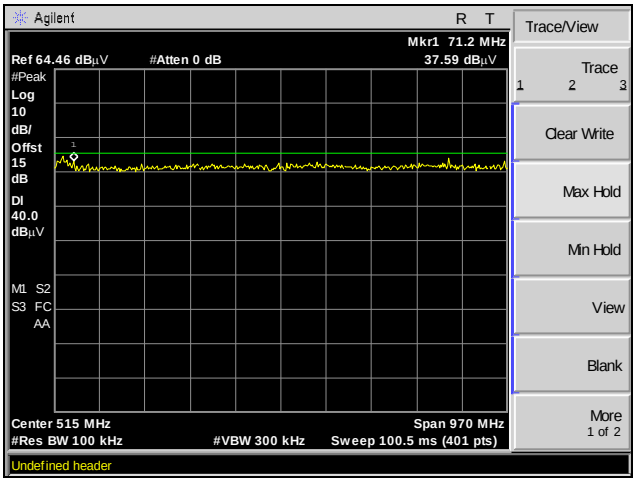


Plot 95. Spurious Emissions, Channel 165, 802.11ac 20 MHz, SISO, 30 MHz – 1 GHz

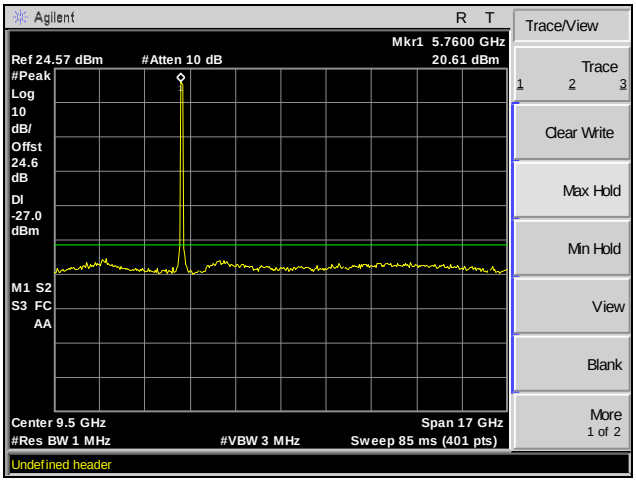


Plot 96. Spurious Emissions, Channel 165, 802.11ac 20 MHz, SISO, 1 GHz – 18 GHz

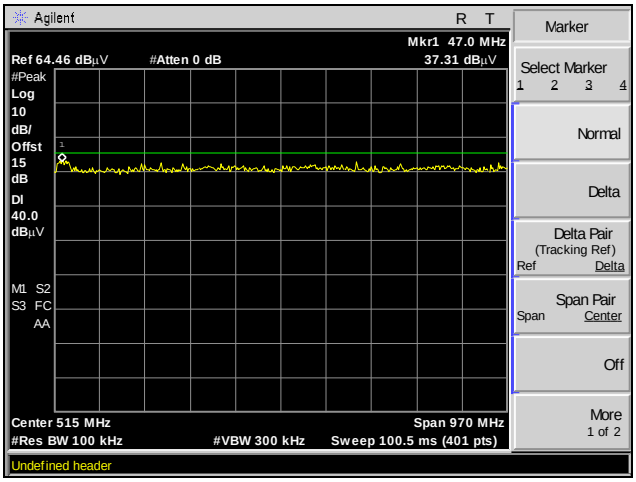
Spurious Emissions, 802.11ac 40 MHz, MIMO



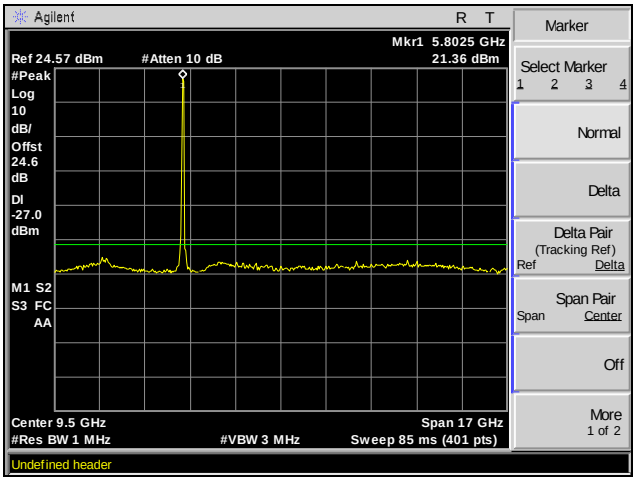
Plot 97. Spurious Emissions, Channel 149, 802.11ac 40 MHz, MIMO, 30 MHz – 1 GHz



Plot 98. Spurious Emissions, Channel 149, 802.11ac 40 MHz, MIMO, 1 GHz – 18 GHz

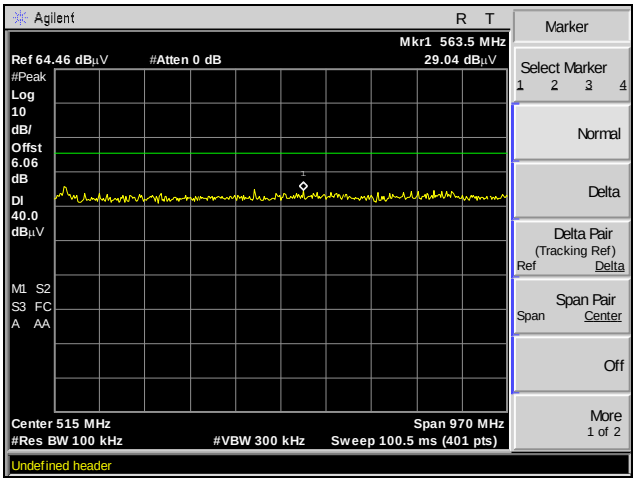


Plot 99. Spurious Emissions, Channel 157, 802.11ac 40 MHz, MIMO, 30 MHz – 1 GHz

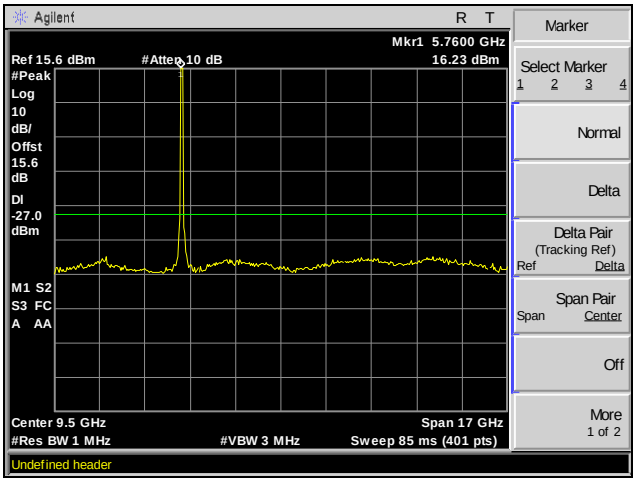


Plot 100. Spurious Emissions, Channel 157, 802.11ac 40 MHz, MIMO, 1 GHz – 18 GHz

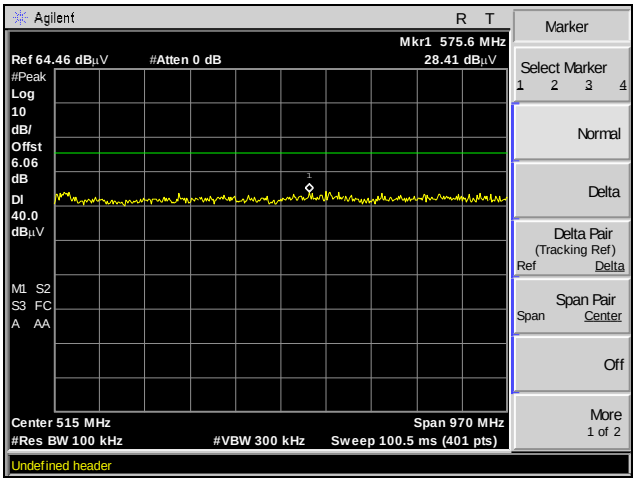
Spurious Emissions, 802.11ac 40 MHz, SISO



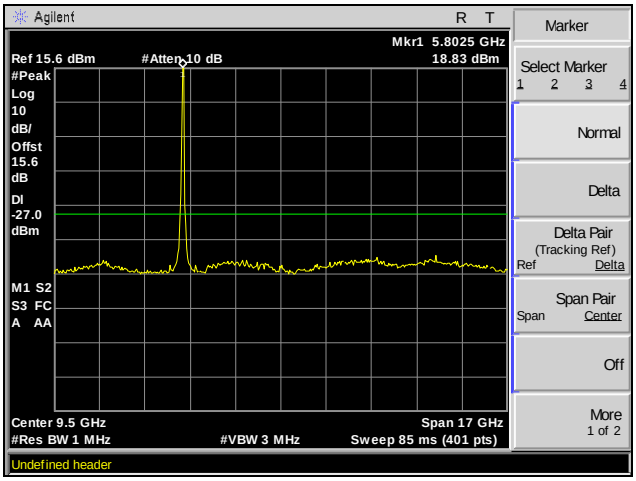
Plot 101. Spurious Emissions, Channel 149, 802.11ac 40 MHz, SISO, 30 MHz – 1 GHz



Plot 102. Spurious Emissions, Channel 149, 802.11ac 40 MHz, SISO, 1 GHz – 18 GHz

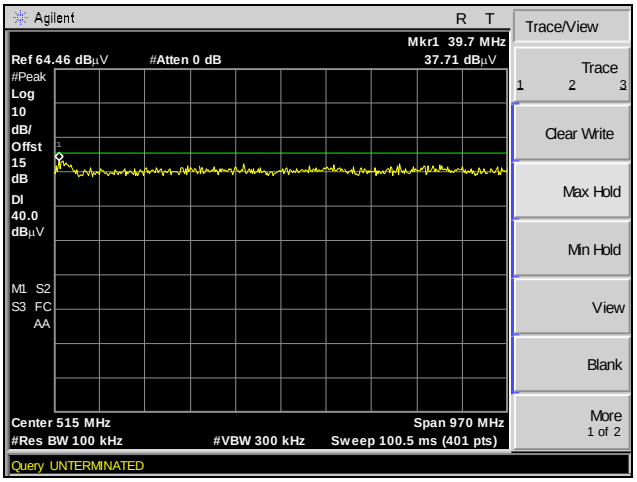


Plot 103. Spurious Emissions, Channel 157, 802.11ac 40 MHz, SISO, 30 MHz – 1 GHz

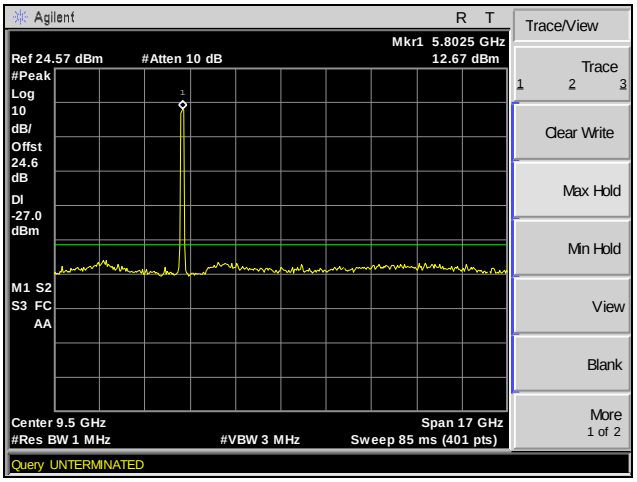


Plot 104. Spurious Emissions, Channel 157, 802.11ac 40 MHz, SISO, 1 GHz – 18 GHz

Spurious Emissions, 802.11ac 80 MHz, MIMO

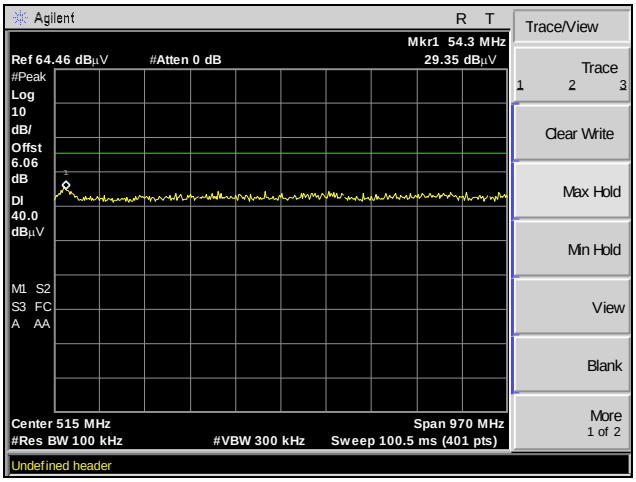


Plot 105. Spurious Emissions, Channel 157, 802.11ac 80 MHz, MIMO, 30 MHz – 1 GHz

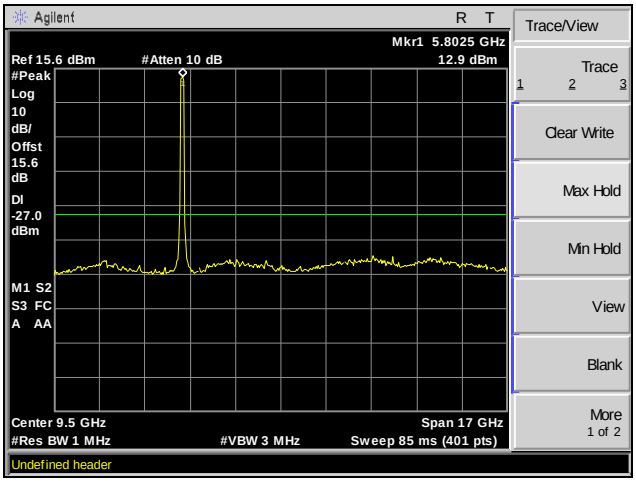


Plot 106. Spurious Emissions, Channel 157, 802.11ac 80 MHz, MIMO, 1 GHz – 18 GHz

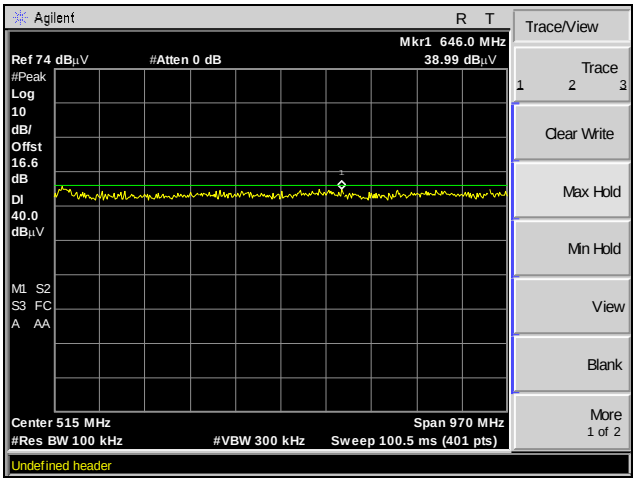
Spurious Emissions, 802.11ac 80 MHz, SISO



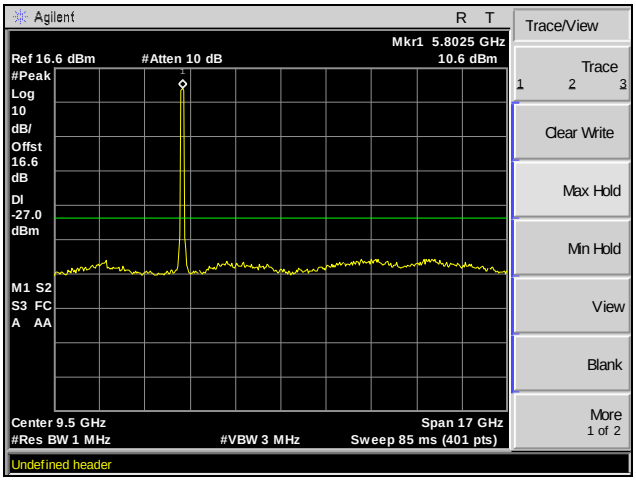
Plot 107. Spurious Emissions, Channel 149, 802.11ac 80 MHz, SISO, 30 MHz – 1 GHz



Plot 108. Spurious Emissions, Channel 149, 802.11ac 80 MHz, SISO, 1 GHz – 18 GHz

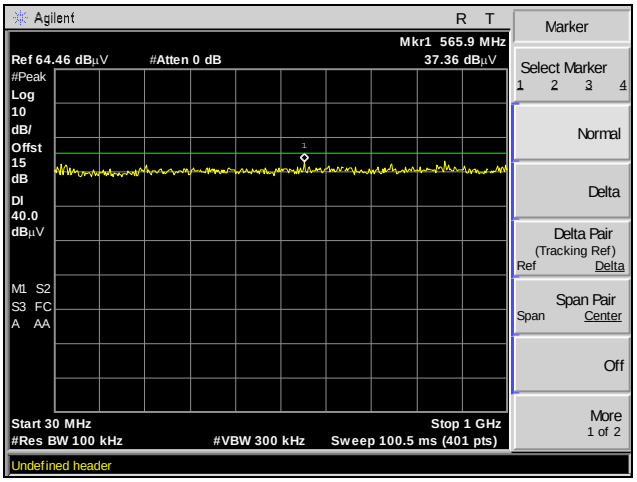


Plot 109. Spurious Emissions, Channel 157, 802.11ac 80 MHz, SISO, 30 MHz – 1 GHz

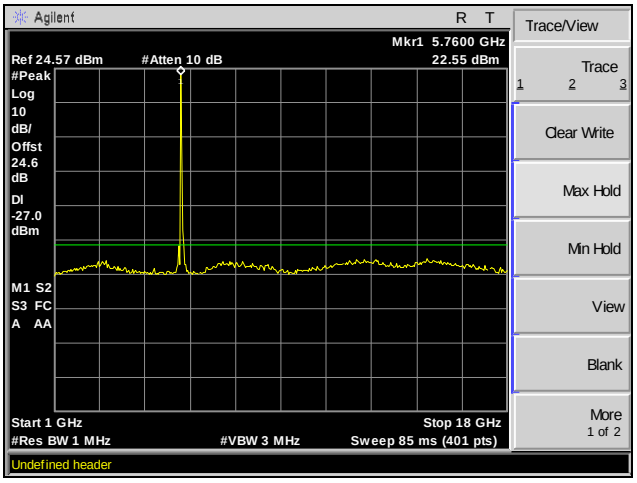


Plot 110. Spurious Emissions, Channel 157, 802.11ac 80 MHz, SISO, 1 GHz – 18 GHz

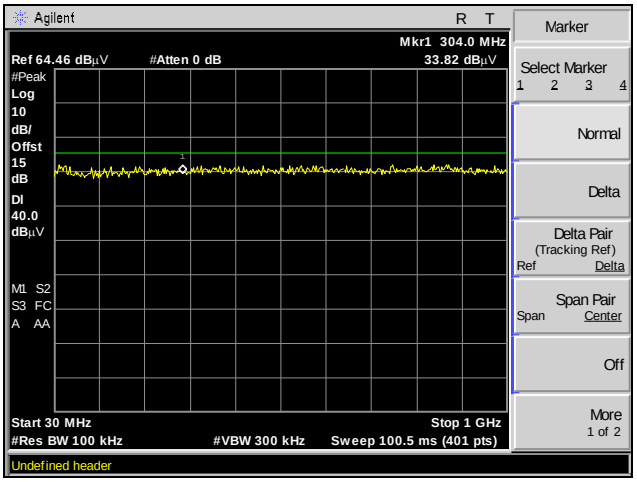
Spurious Emissions, 802.11n 20 MHz, MIMO



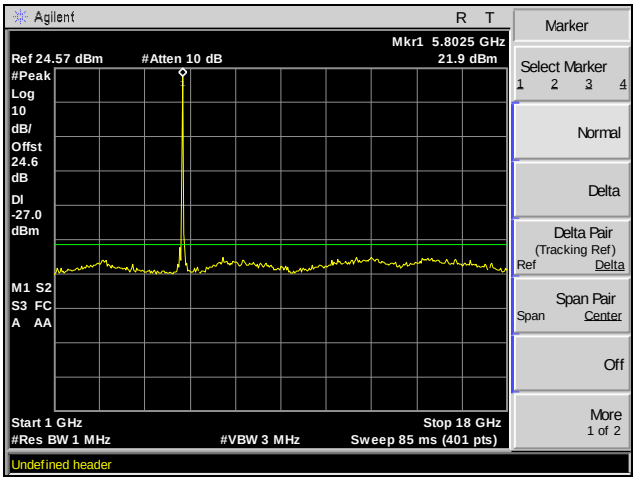
Plot 111. Spurious Emissions, Channel 149, 802.11n 20 MHz, MIMO, 30 MHz – 1 GHz



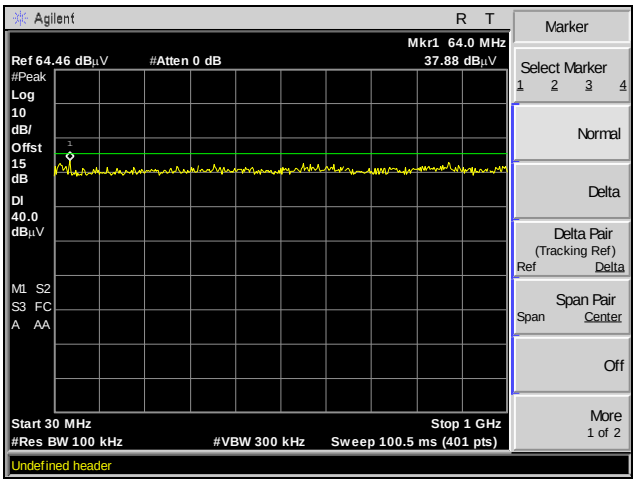
Plot 112. Spurious Emissions, Channel 149, 802.11n 20 MHz, MIMO, 1 GHz – 18 GHz



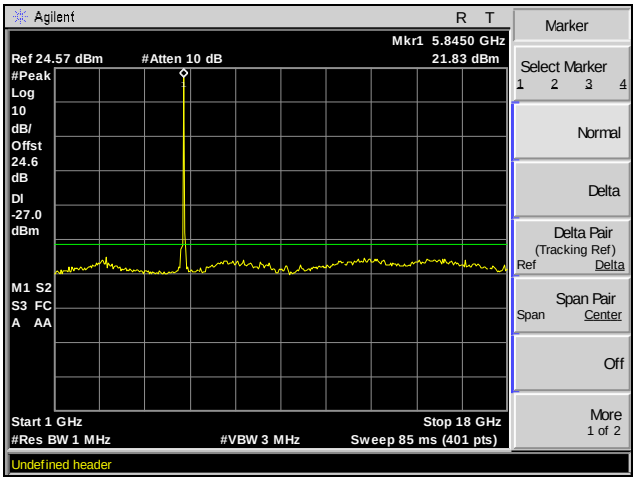
Plot 113. Spurious Emissions, Channel 157 802.11n 20 MHz, MIMO, 30 MHz – 1 GHz



Plot 114. Spurious Emissions, Channel 157, 802.11n 20 MHz, MIMO, 1 GHz – 18 GHz

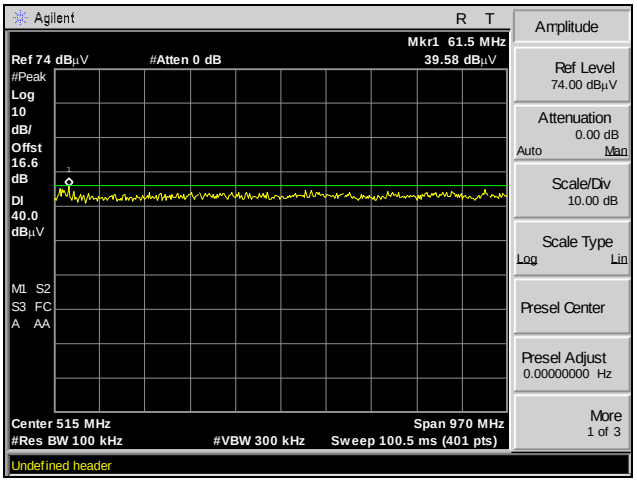


Plot 115. Spurious Emissions, Channel 165, 802.11n 20 MHz, MIMO, 30 MHz – 1 GHz

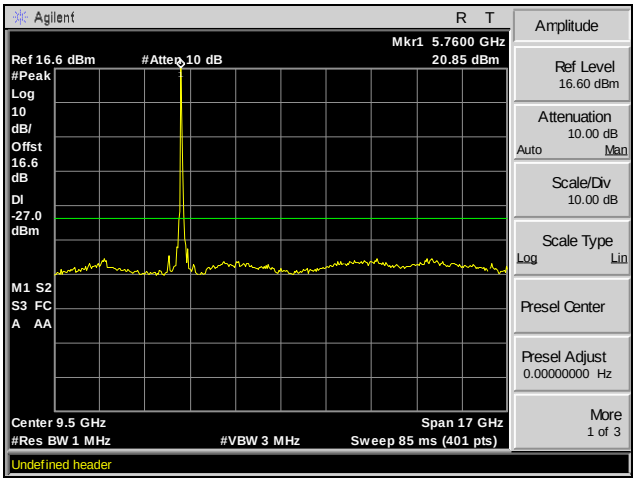


Plot 116. Spurious Emissions, Channel 165, 802.11n 20 MHz, MIMO, 1 GHz – 18 GHz

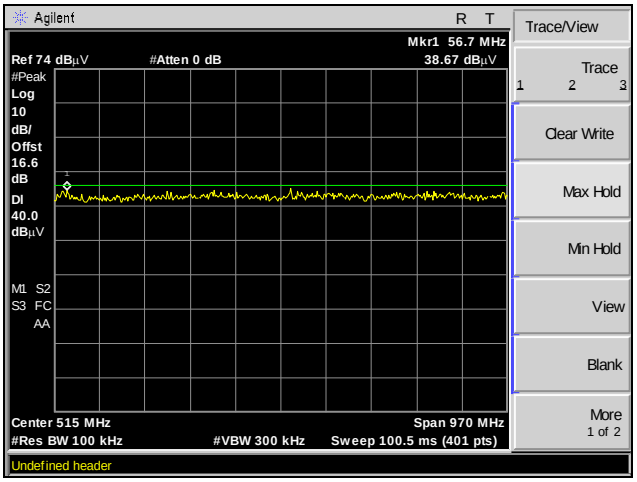
Spurious Emissions, 802.11n 20 MHz, SISO



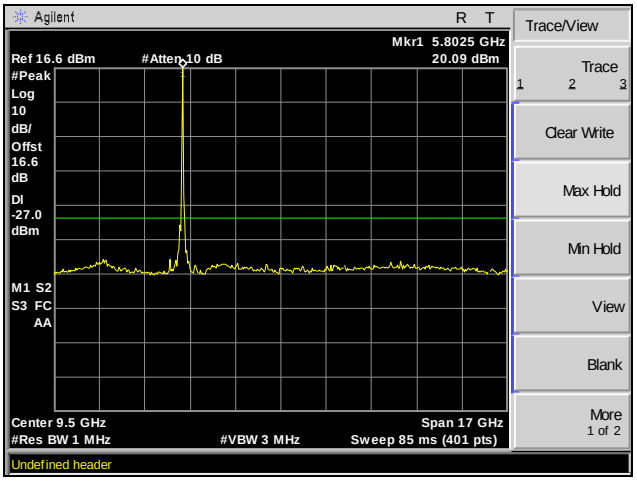
Plot 117. Spurious Emissions, Channel 149, 802.11n 20 MHz, SISO, 30 MHz – 1 GHz



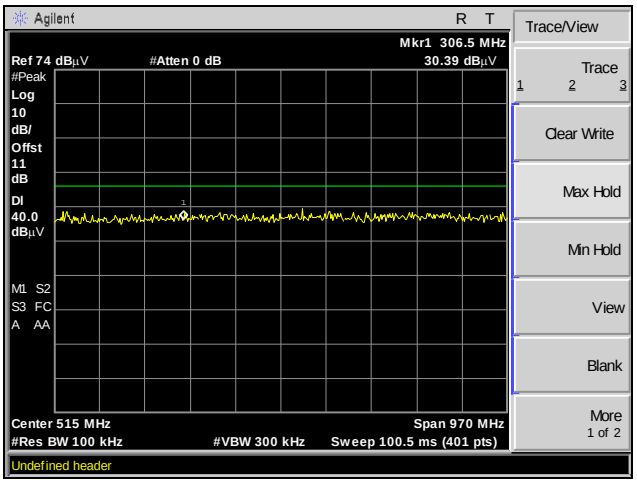
Plot 118. Spurious Emissions, Channel 149, 802.11n 20 MHz, SISO, 1 GHz – 18 GHz



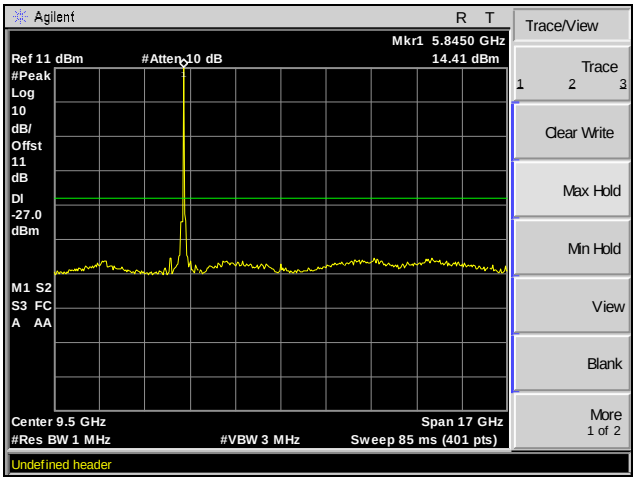
Plot 119. Spurious Emissions, Channel 157, 802.11n 20 MHz, SISO, 30 MHz – 1 GHz



Plot 120. Spurious Emissions, Channel 157, 802.11n 20 MHz, SISO, 1 GHz – 18 GHz

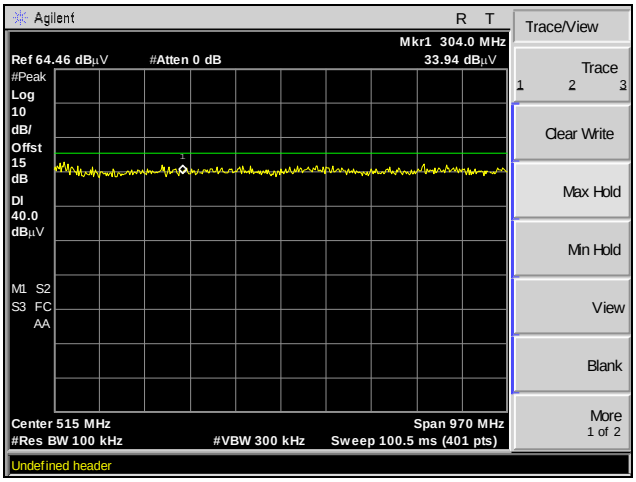


Plot 121. Spurious Emissions, Channel 165, 802.11n 20 MHz, SISO, 30 MHz – 1 GHz

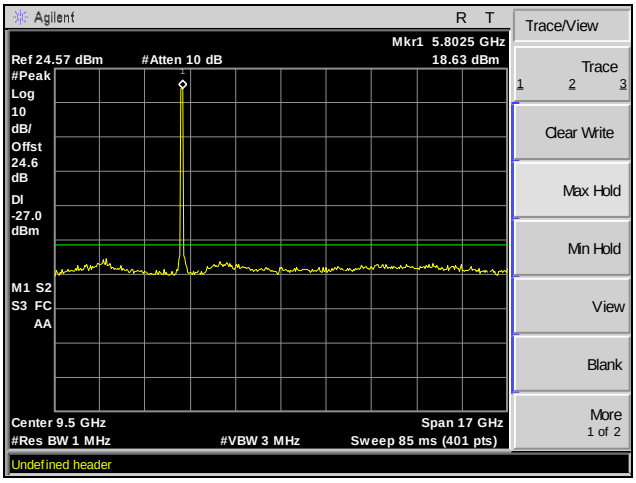


Plot 122. Spurious Emissions, Channel 165, 802.11n 20 MHz, SISO, 1 GHz – 18 GHz

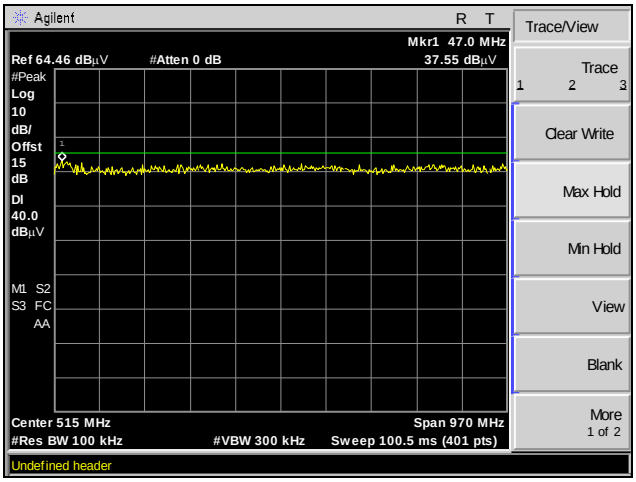
Spurious Emissions, 802.11n 40 MHz, MIMO



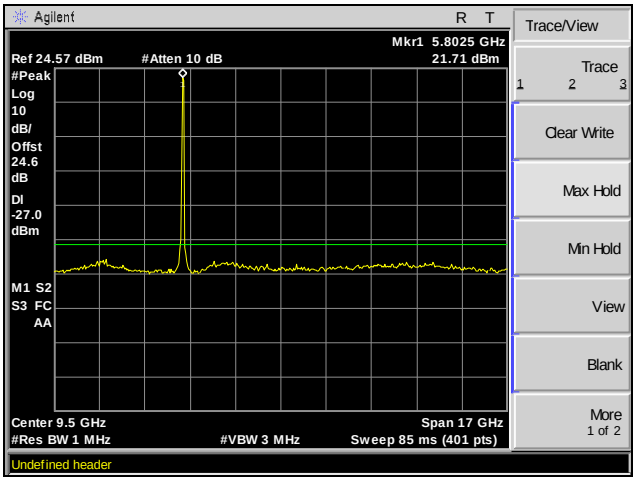
Plot 123. Spurious Emissions, Channel 149, 802.11n 40 MHz, MIMO, 30 MHz – 1 GHz



Plot 124. Spurious Emissions, Channel 149, 802.11n 40 MHz, MIMO, 1 GHz – 18 GHz

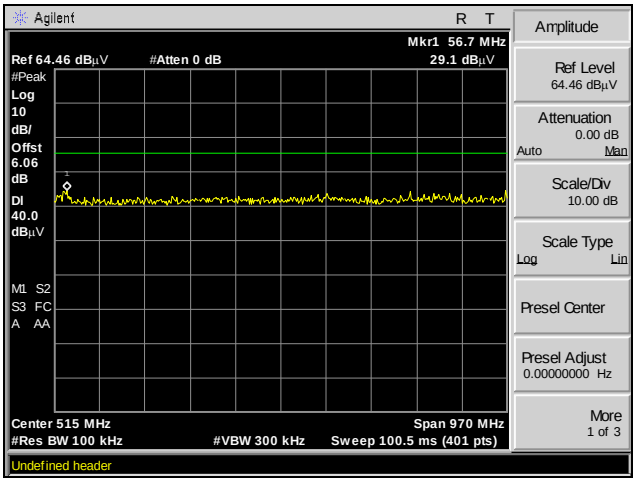


Plot 125. Spurious Emissions, Channel 157, 802.11n 40 MHz, MIMO, 30 MHz – 1 GHz

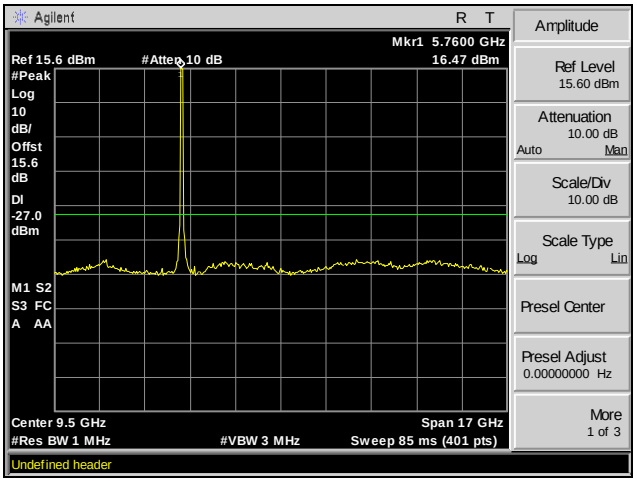


Plot 126. Spurious Emissions, Channel 157, 802.11n 40 MHz, MIMO, 1 GHz – 18 GHz

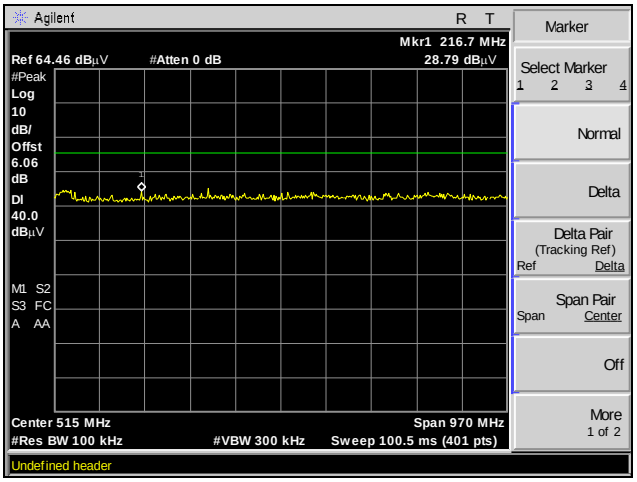
Spurious Emissions, 802.11n 40 MHz, SISO



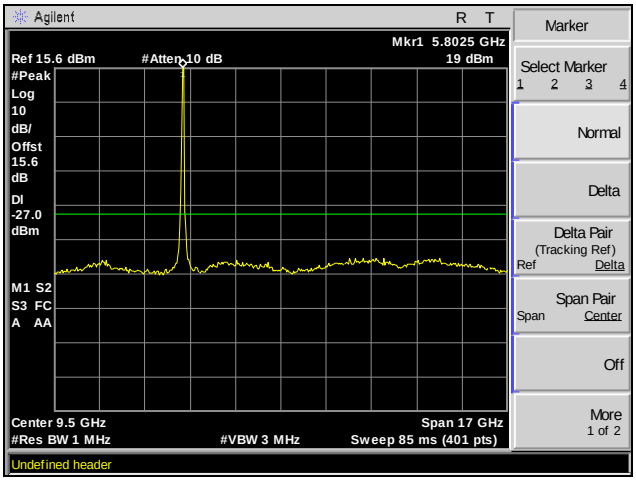
Plot 127. Spurious Emissions, Channel 149, 802.11n 40 MHz, SISO, 30 MHz – 1 GHz



Plot 128. Spurious Emissions, Channel 149, 802.11n 40 MHz, SISO, 1 GHz – 18 GHz

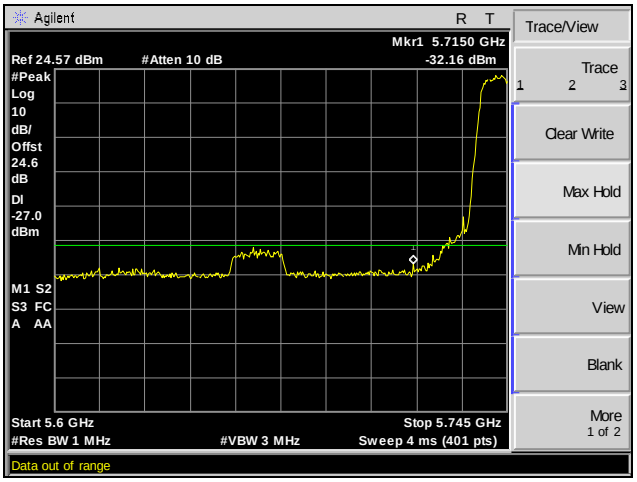


Plot 129. Spurious Emissions, Channel 157, 802.11n 40 MHz, SISO, 30 MHz – 1 GHz

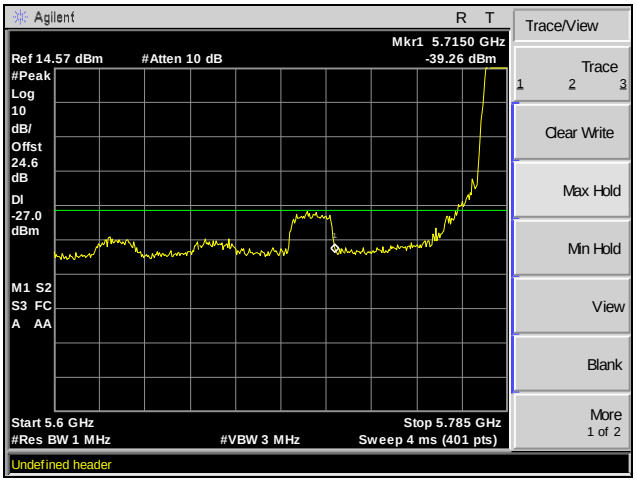


Plot 130. Spurious Emissions, Channel 157, 802.11n 40 MHz, SISO, 1 GHz – 18 GHz

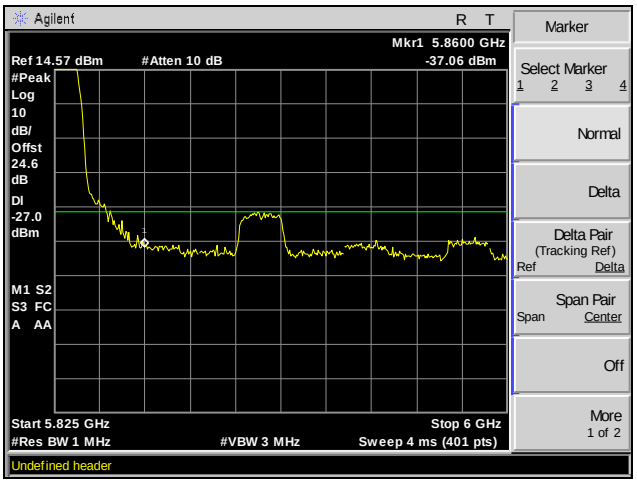
Band Edge, 802.11a 20 MHz, MIMO



Plot 131. Band Edge, Channel 149, 802.11a 20 MHz, MIMO

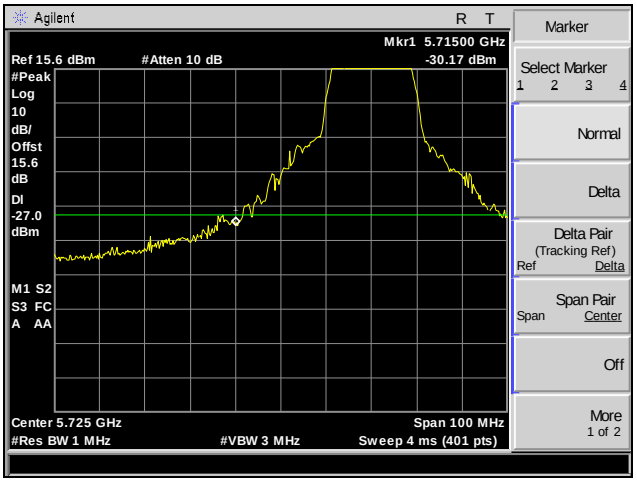


Plot 132. Band Edge, Channel 157, 802.11a 20 MHz, MIMO

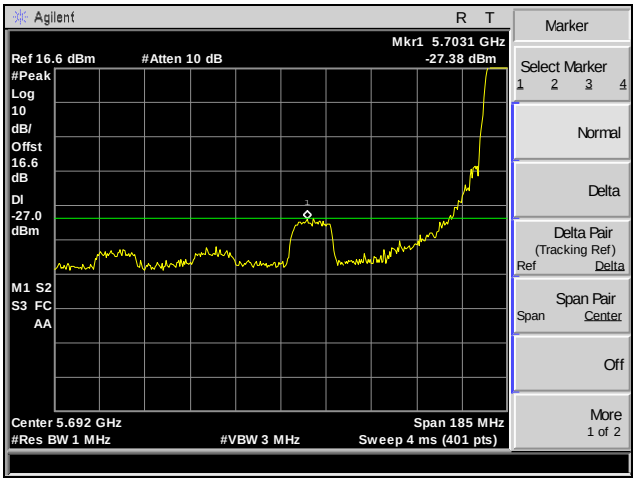


Plot 133. Band Edge, Channel 165, 802.11a 20 MHz, MIMO

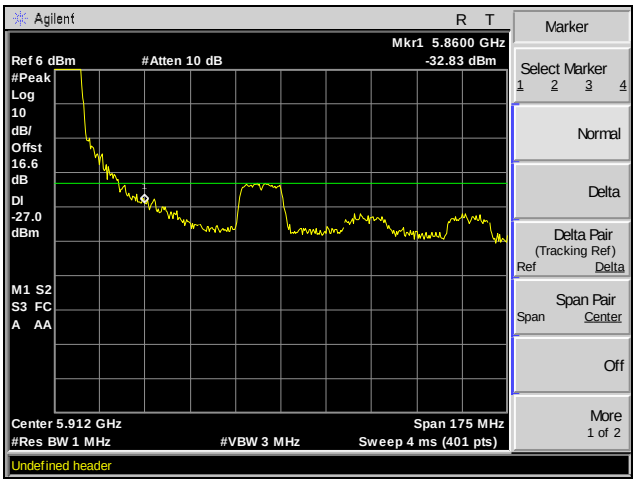
Band Edge, 802.11a 20 MHz, SISO



Plot 134. Band Edge, Channel 149, 802.11a 20 MHz, SISO

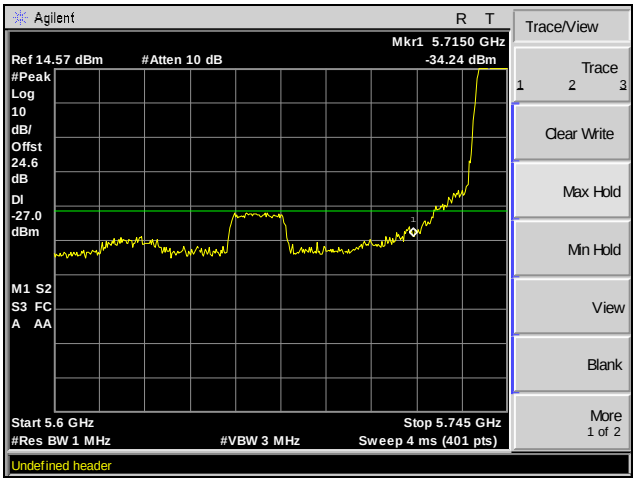


Plot 135. Band Edge, Channel 157, 802.11a 20 MHz, SISO

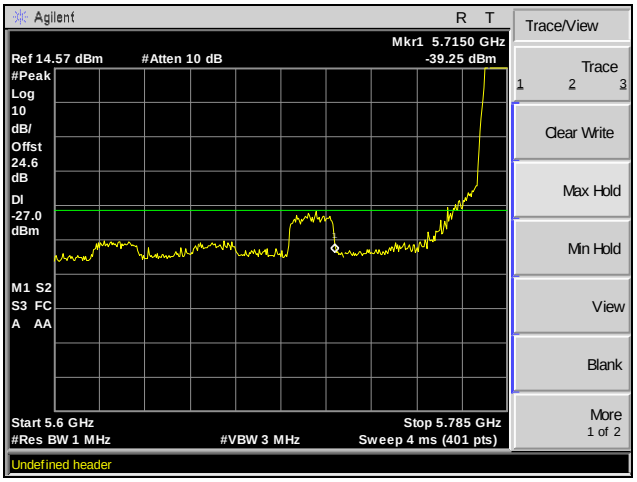


Plot 136. Band Edge, Channel 165, 802.11a 20 MHz, SISO

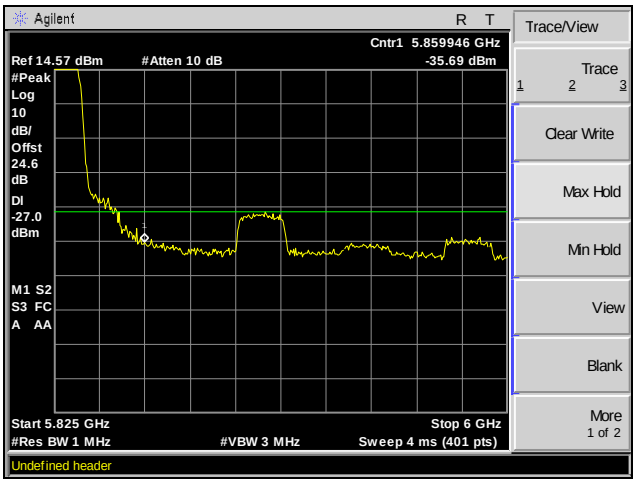
Band Edge, 802.11ac 20 MHz, MIMO



Plot 137. Band Edge, Channel 149, 802.11ac 20 MHz, MIMO

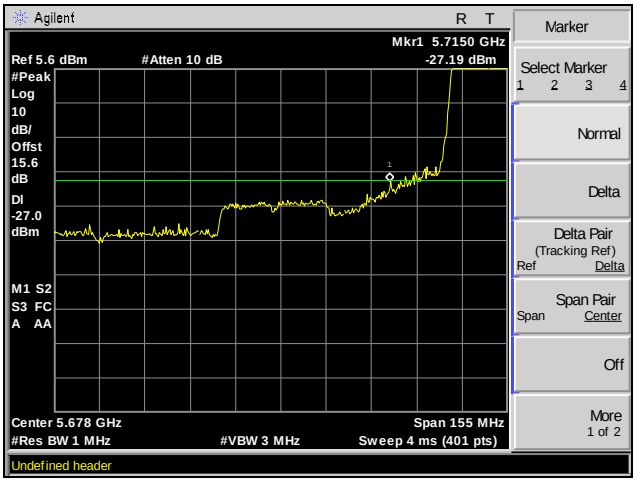


Plot 138. Band Edge, Channel 157, 802.11ac 20 MHz, MIMO

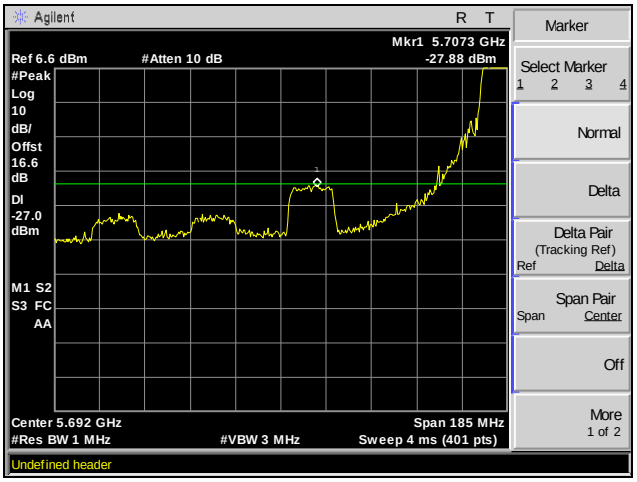


Plot 139. Band Edge, Channel 165, 802.11ac 20 MHz, MIMO

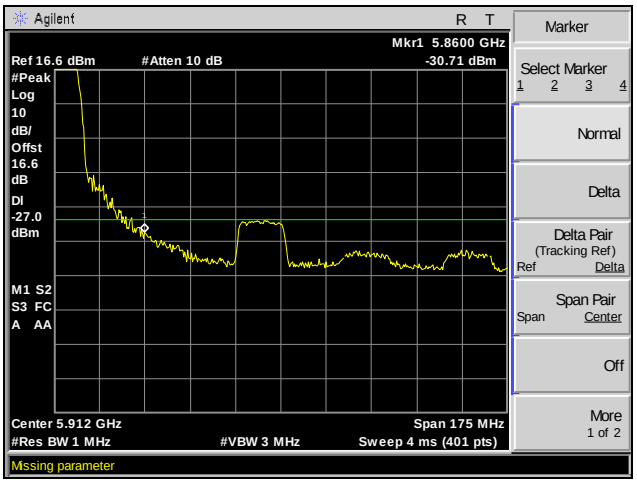
Band Edge, 802.11ac 20 MHz, SISO



Plot 140. Band Edge, Channel 149, 802.11ac 20 MHz, SISO

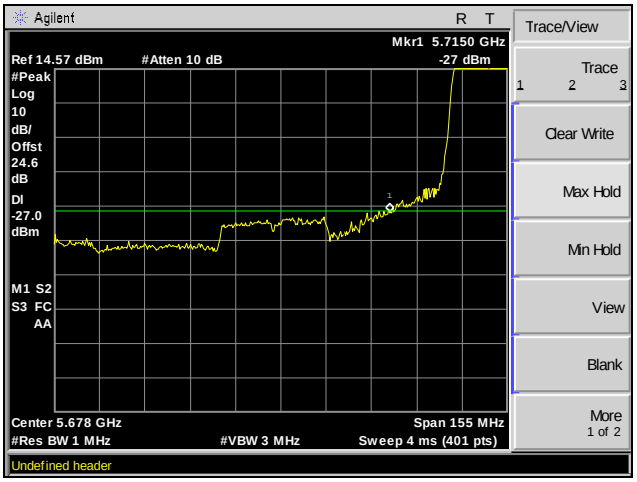


Plot 141. Band Edge, Channel 157, 802.11ac 20 MHz, SISO

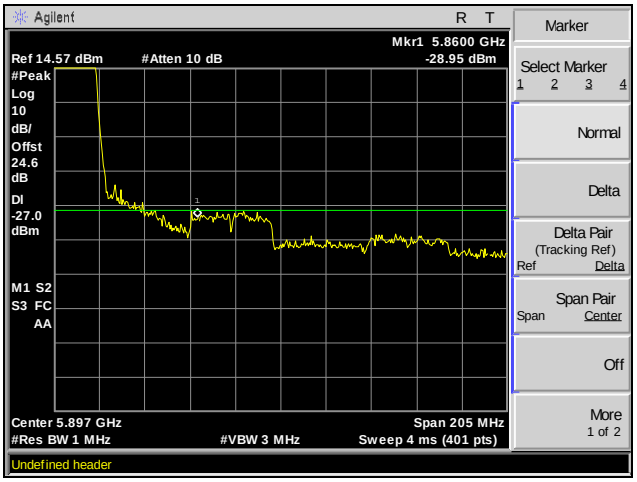


Plot 142. Band Edge, Channel 165, 802.11ac 20 MHz, SISO

Band Edge, 802.11ac 40 MHz, MIMO

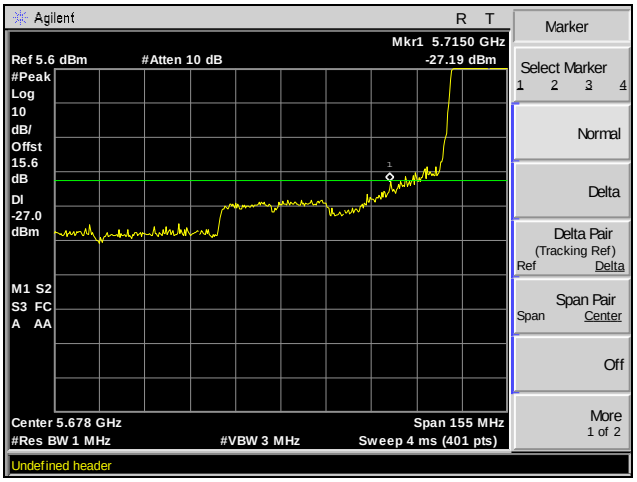


Plot 143. Band Edge, Channel 149, 802.11ac 40 MHz, MIMO

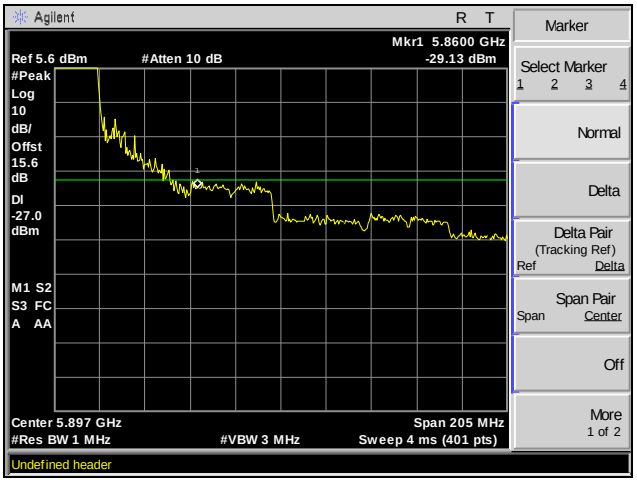


Plot 144. Band Edge, Channel 157, 802.11ac 40 MHz, MIMO

Band Edge, 802.11ac 40 MHz, SISO

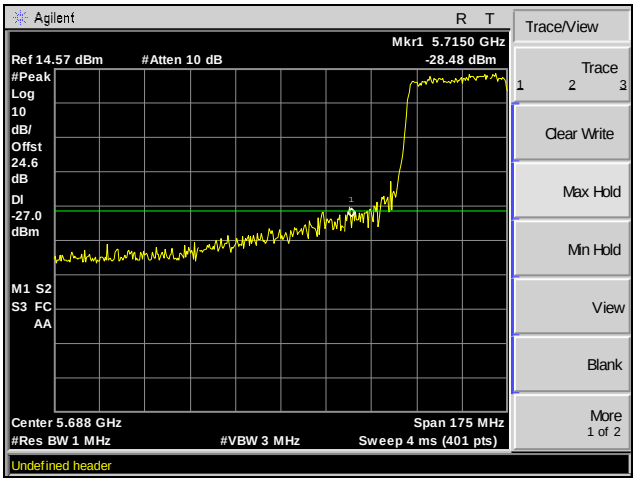


Plot 145. Band Edge, Channel 149, 802.11ac 40 MHz, SISO



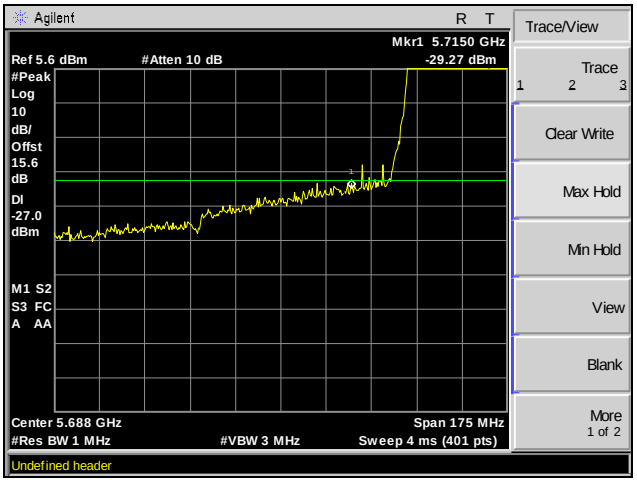
Plot 146. Band Edge, Channel 157, 802.11ac 40 MHz, SISO

Band Edge, 802.11ac 80 MHz, MIMO

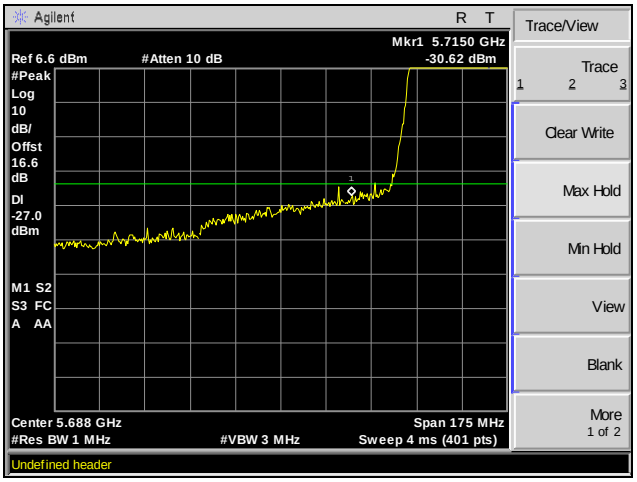


Plot 147. Band Edge, Channel 157, 802.11ac 80 MHz, MIMO

Band Edge, 802.11ac 80 MHz, SISO

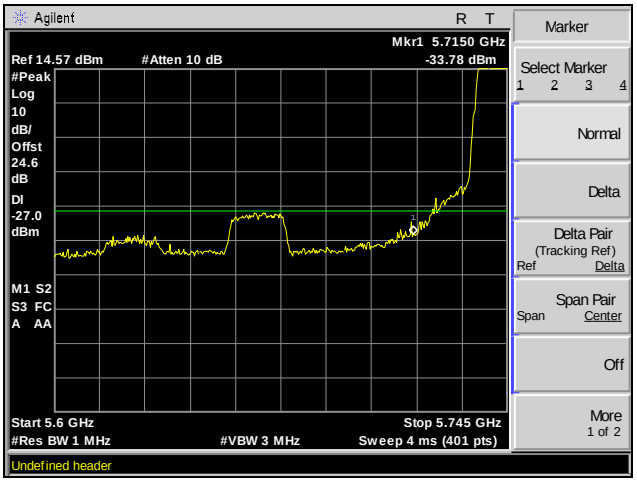


Plot 148. Band Edge, Channel 149, 802.11ac 80 MHz, SISO

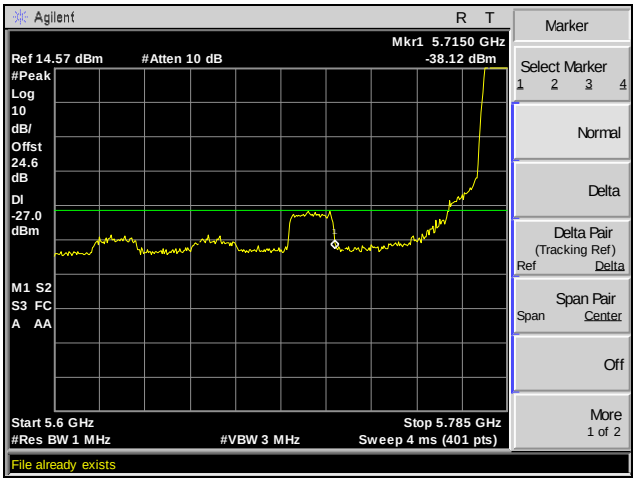


Plot 149. Band Edge, Channel 157, 802.11ac 80 MHz, SISO

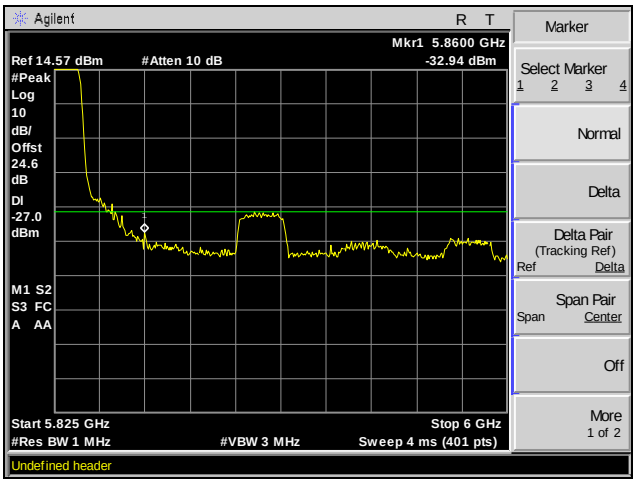
Band Edge, 802.11n 20 MHz, MIMO



Plot 150. Band Edge, Channel 149, 802.11n 20 MHz, MIMO



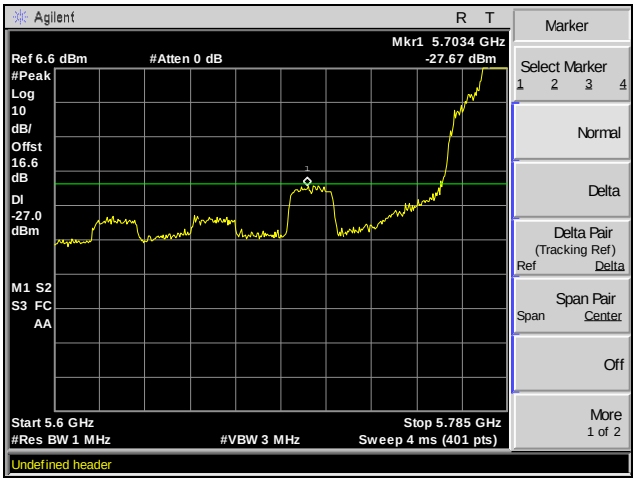
Plot 151. Band Edge, Channel 157, 802.11n 20 MHz, MIMO



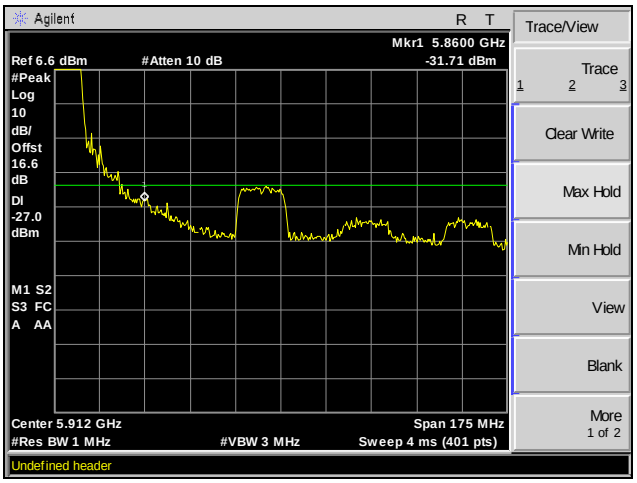
Plot 152. Band Edge, Channel 165, 802.11n 20 MHz, MIMO

Band Edge, 802.11n 20 MHz, SISO

Plot 153. Band Edge, Channel 149, 802.11n 20 MHz, SISO

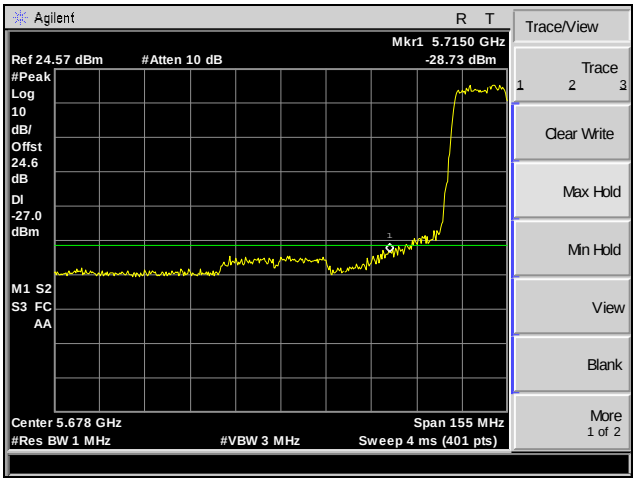


Plot 154. Band Edge, Channel 157, 802.11n 20 MHz, SISO

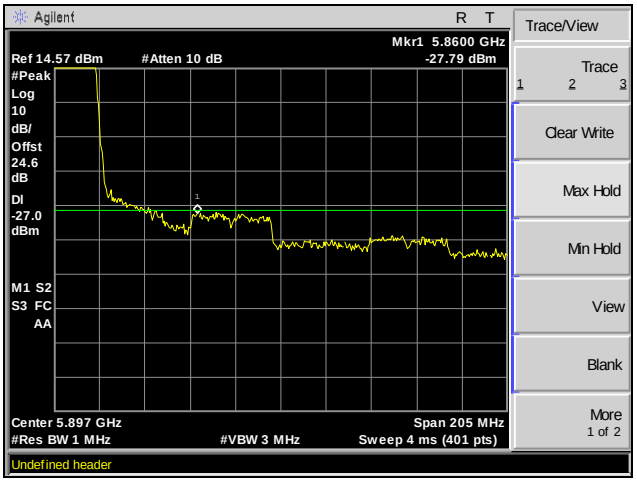


Plot 155. Band Edge, Channel 165, 802.11n 20 MHz, SISO

Band Edge, 802.11n 40 MHz, MIMO

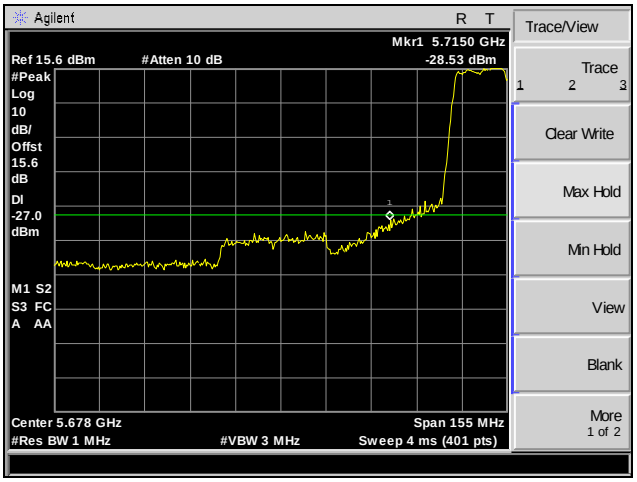


Plot 156. Band Edge, Channel 149, 802.11n 40 MHz, MIMO

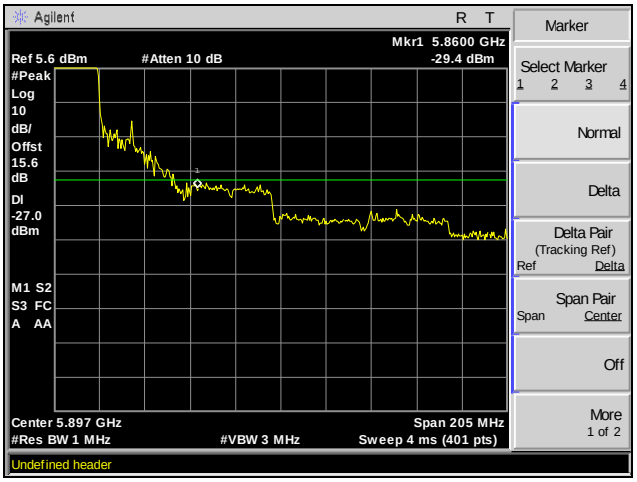


Plot 157. Band Edge, Channel 157, 802.11n 40 MHz, MIMO

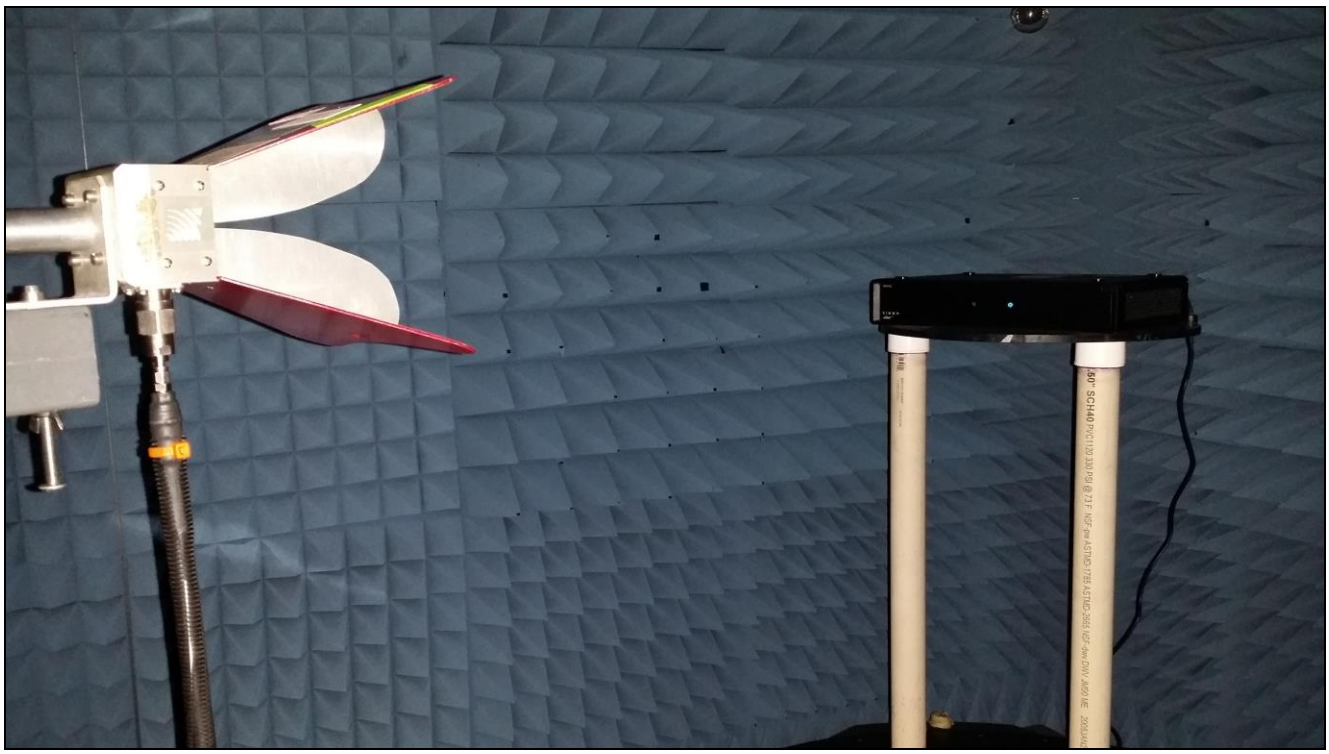
Band Edge, 802.11n 40 MHz, SISO



Plot 158. Band Edge, Channel 149, 802.11n 40 MHz, SISO



Plot 159. Band Edge, Channel 157, 802.11n 40 MHz, SISO



Photograph 2. Spurious Emissions, Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.407(f) RF Exposure

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.

Peak Conducted Power of 9.6dBi antenna= 19.81dBm =95.72mW
9.6dBi antenna gain in terms of linear value= 9.12
The limit for maximum RF exposure for 5GHz device is 1mW/cm^2
The formula for calculating RF exposure is given as $S= \frac{PG}{4\pi R^2}$
P=95.72mW, G= 9.12 & R=20cm, then S comes out to be 0.174mW/cm^2 which was under the limit specified in 1.1310

IV. Test Equipment

Test Equipment

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

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1T4870	THERM./CLOCK/HUMIDITY MONITOR	CONTROL COMPANY	06-662-4, FB70258	3/14/2014	3/14/2016
1T4829	SPECTRUM ANALYZER	AGILENT	E4407B	9/30/2014	3/30/2016
1T4818	COMB GENERATOR	COM-POWER	CGO-520	SEE NOTE	
1T4751	ANTENNA - BILOG	SUNOL SCIENCES	JB6	7/29/2014	1/29/2016
1T4505	TEMPERATURE CHAMBER	TEST EQUITY	115	2/11/2015	2/11/2016
1T4483	ANTENNA; HORN	ETS-LINDGREN	3117	2/28/2014	8/28/2015
1T4442	PRE-AMPLIFIER, MICROWAVE	MITEQ	AFS42-01001800-30-10P	SEE NOTE	
1T4418	LISN	SOLAR ELECTRONICS	9233-50-TS-50-N	10/24/2014	4/24/2016
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	7/18/2014	7/18/2016
1T4300	SEMI-ANECHOIC CHAMBER # 1 (NSA)	EMC TEST SYSTEMS	NONE	7/24/2015	7/24/2016
1T4149	HIGH-FREQUENCY ANECHOIC CHAMBER	RAY-PROOF	81	NOT REQUIRED	
1T2665	ANTENNA; HORN	EMCO	3115	4/3/2014	10/3/2015
1T4870	THERM./CLOCK/HUMIDITY MONITOR	CONTROL COMPANY	06-662-4, FB70258	3/14/2014	3/14/2016

Table 20. 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

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

