FCC/ ISED RF TEST REPORT

ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

WiFi/BT Combo Module

ISSUED TO
Dongguan Digital AV Technology Corp., Ltd.

2nd floor F2-S3 district, No.18 Haibin road, Wusha, Changan, Dongguan, Guangdong

Prepared by: _____
Cao Shaodong
(Engineer)
Date: Mar. 31, 2016

Approved by: _____
Wei Yanquan
(Chief Engineer)
Date: Mar. 31, 2016

Report No.:	BL-SZ15C0294-604
EUT Type:	WiFi/BT Combo Module
Model Name:	WUS-AC13
Brand Name:	OPPO
Test Standard:	47 CFR Part 15 Subpart E
	RSS-Gen (Issue 4, November 2014)
	RSS-247 (Issue 1, May 2015)
FCC ID:	2AGM4-WUS13
ISED Number:	20960-WUS13
Test conclusion:	Pass
Test Date:	Feb. 15, 2016 ~ Feb. 24, 2016
Date of Issue:	Mar. 31, 2016

Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong, P. R. China 518055
TEL: +86-755-66850100, FAX: +86-755-61824271
Email: info@baluntek.com
www.baluntek.com

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Mar. 15, 2016	Initial Issue
Rev. 02	Mar. 31, 2016	Revise the entire channel “CH161” to “CH165” in the test data table

TABLE OF CONTENTS

1 ADMINISTRATIVE DATA (GENERAL INFORMATION) 6

1.1 Identification of the Testing Laboratory 6

1.2 Identification of the Responsible Testing Location 6

1.3 Laboratory Condition 6

1.4 Announce 6

2 PRODUCT INFORMATION 7

2.1 Applicant 7

2.2 Manufacturer 7

2.3 Factory 7

2.4 General Description for Equipment under Test (EUT) 7

2.5 Ancillary Equipment 7

2.6 Technical Information 8

2.7 Additional Instructions 9

2.8 Channel List 12

3 SUMMARY OF TEST RESULTS 16

3.1 Test Standards 16

3.2 Verdict 17

4 GENERAL TEST CONFIGURATIONS 18

4.1 Test Environments 18

4.2 Test Equipment List 18

4.3 Description of Test Setup 19

4.3.1 For Antenna Port Test 19

4.3.2 For AC Power Supply Port Test 19

4.3.3 For Radiated Test (Below 30 MHz) 20
4.3.4 For Radiated Test (30 MHz-1 GHz) 20
4.3.5 For Radiated Test (Above 1 GHz) 21
4.3.6 For Frequency Stability Test 21
5 TEST ITEMS 22
5.1 RF Output Power 22
5.1.1 Test Limit 22
5.1.2 Test Setup 22
5.1.3 Test Procedure 22
5.1.4 Test Result 22
5.2 Emission Bandwidth and 6 dB Bandwidth 23
5.2.1 Limit 23
5.2.2 Test Setup 23
5.2.3 Test Procedure 23
5.2.4 Test Result 23
5.3 Power Spectral density (PSD) 24
5.3.1 Limit 24
5.3.2 Test Setup 24
5.3.3 Test Procedure 24
5.3.4 Test Result 24
5.4 Conducted Emission 25
5.4.1 Limit 25

5.4.2 Test Setup 25
5.4.3 Test Procedure 25
5.4.4 Test Result 25
5.5 Conducted Spurious Emission and Band Edge (Authorized-band) 26
5.5.1 Limit 26
5.5.2 Test Setup 26
5.5.3 Test Procedure 26
5.5.4 Test Result 27
5.6 Radiated Spurious Emissions and Band Edge (Restricted-band) 28
5.6.1 Limit 28
5.6.2 Test Setup 28
5.6.3 Test Procedure 28
5.6.4 Test Result 31
5.7 Frequency Stability 32
5.7.1 Limit 32
5.7.2 Test Setup 32
5.7.3 Test Procedure 32
5.7.4 Test Result 32
5.8 Receiver Spurious Emissions 33
5.8.1 Limit 33
5.8.2 Test Setup 33
5.8.3 Test Procedure 33

5.8.4 Test Result 33

ANNEX A TEST RESULT 34

A.1 RF Output Power 34

A.2 Emission Bandwidth & 99% Bandwidth 42

A.3 6 dB Bandwidth 102

A.4 Power Spectral Density 117

A.5 Conducted Emissions 184

A.6 Conducted Spurious Emission and Band Edge (Authorized-band) 186

A.7 Radiated Spurious Emissions and Band Edge (Restricted-band) 243

A.8 Frequency Stability 407

A.9 Receiver Spurious Emissions 431

ANNEX B TEST SETUP PHOTOS 435

ANNEX C EUT EXTERNAL PHOTOS 435

ANNEX D EUT INTERNAL PHOTOS 435

1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625. The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Laboratory Condition

Ambient Temperature	20 to 25℃
Ambient Relative Humidity	45% - 55%
Ambient Pressure	100 kPa - 102 kPa

1.4 Announce

(1) The test report reference to the report template version v1.0.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.

(5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.

(6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

2 PRODUCT INFORMATION

2.1 Applicant

Applicant	Dongguan Digital AV Technology Corp., Ltd.
Address	2nd floor F2-S3 district, No.18 Haibin road, Wusha, Changan, Dongguan, Guangdong

2.2 Manufacturer

Manufacturer	Dongguan Digital AV Technology Corp., Ltd.
Address	2nd floor F2-S3 district, No.18 Haibin road, Wusha, Changan, Dongguan, Guangdong

2.3 Factory

Factory	Dongguan Digital AV Technology Corp., Ltd.
Address	2nd floor F2-S3 district, No.18 Haibin road, Wusha, Changan, Dongguan, Guangdong

2.4 General Description for Equipment under Test (EUT)

EUT Type	WiFi/BT Combo Module
Model Name	WUS-AC13
Hardware Version	A1
Software Version	N/A
Network and Wireless connectivity	Bluetooth 3.0, Bluetooth 4.0 Low Energy (BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n(HT20/40) and 802.11ac

2.5 Ancillary Equipment

N/A

2.6 Technical Information

Frequency Range		Band I: 5150 MHz to 5250 MHz, Band II: 5250 MHz to 5350 MHz, Band III: 5470 MHz to 5725 MHz Band IV: 5725 MHz to 5850 MHz
Modulation technology		OFDM
Modulation Type		256QAM, 64QAM, 16QAM, BPSK, QPSK
Product Type		Indoor for IC standard Mobile and portable for FCC standard
Transfer Rate (Mbps)		802.11a: 54/ 48/ 36 / 24 / 18 / 9/ 6 Mbps 802.11n: up to 300 Mbps 802.11ac: up to V9
Channel Bandwidth		802.11a: 20 MHz 802.11n: 20 MHz, 40 MHz 802.11ac: 20 MHz, 40 MHz, 80 MHz
Maximum Output Power		Band I: 18.86 dBm Band II: 18.75 dBm Band III: 18.63 dBm Band IV: 17.93 dBm
Antenna System (eg., MIMO, Smart Antenna)		Cyclic Delay Diversity (CDD)
Categorization as Correlated or Completely Uncorrelated		Correlated
Antenna Type	Antenna 0 (ANT 0)	PCB Antenna
	Antenna 1 (ANT 1)	
Antenna Gain	Antenna 0 (ANT 0)	Band I: 5150 MHz to 5250 MHz: 6.3 dBi Band II: 5250 MHz to 5350 MHz: 6.4 dBi Band III: 5470 MHz to 5725 MHz: 5.3 dBi Band IV: 5725 MHz to 5850 MHz: 3.7 dBi
	Antenna 1 (ANT 1)	Band I: 5150 MHz to 5250 MHz: 3.4 dBi Band II: 5250 MHz to 5350 MHz: 3.2 dBi Band III: 5470 MHz to 5725 MHz: 3.3 dBi Band IV: 5725 MHz to 5850 MHz: 3.7 dBi
Total directional gain	For power spectral density(PSD) measurements	Band I: 5150 MHz to 5250 MHz: 6.3 dBi Band II: 5250 MHz to 5350 MHz: 6.4dBi Band III: 5470 MHz to 5725 MHz: 5.3 dBi Band IV: 5725 MHz to 5850 MHz: 3.7 dBi Formulas: Directional gain = GANT + Array Gain, *Array Gain = 10 log(NANT/NSS) dB*. *NSS* =2, GANT set equal to the gain of the antenna having the highest gain.
	For power measurements	Band I: 5150 MHz to 5250 MHz: 6.3 dBi Band II: 5250 MHz to 5350 MHz: 6.4 dBi Band III: 5470 MHz to 5725 MHz: 5.3 dBi Band IV: 5725 MHz to 5850 MHz: 3.7 dBi Formulas: Directional gain = GANT + Array Gain, *Array Gain* = 0.

	For Conducted Out-of-Band and Spurious Measurements	Band I: 5150 MHz to 5250 MHz: 6.3 dBi Band II: 5250 MHz to 5350 MHz: 6.4dBi Band III: 5470 MHz to 5725 MHz: 5.3 dBi Band IV: 5725 MHz to 5850 MHz: 3.7 dBi Formulas: Directional gain = GANT + Array Gain, *Array Gain = 10 log(NANT/NSS) dB*. *NSS* =2, GANT set equal to the gain of the antenna having the highest gain.
About the Product		The equipment is Wi-Fi Speaker, intended for used with information technology equipment.

2.7 Additional Instructions

Mode	☒ Special software is used. The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

During testing. Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

EUT Software Settings:

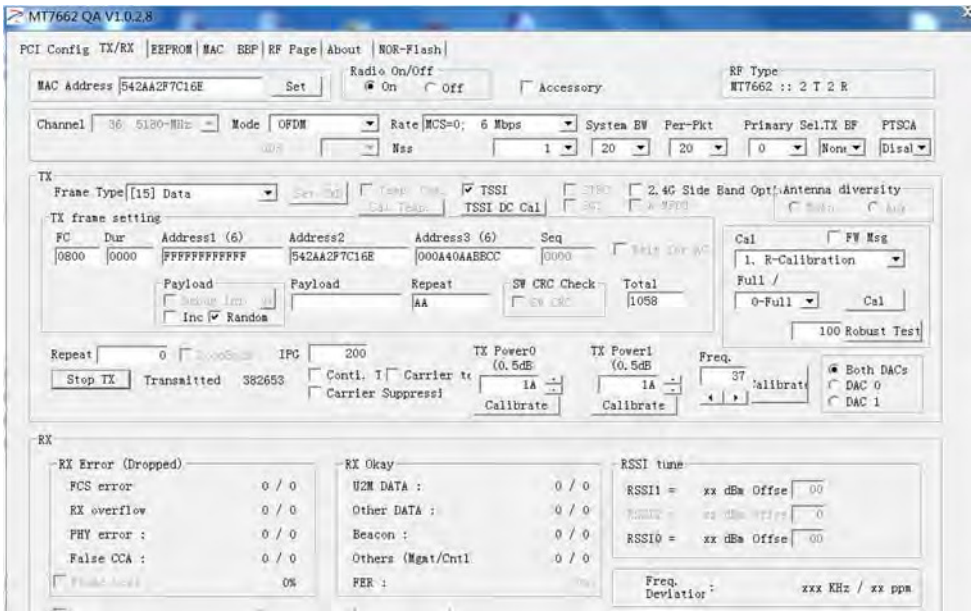
Band I (5150 - 5250 MHz) Power level setup in software				
Test Software Version	MT7662 QA V1.0.2.8			
Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH36	5180	17	17
11a	CH44	5220	17	17
11a	CH48	5240	17	17
11n (HT20)	CH36	5180	1a	1a
11n (HT20)	CH44	5220	1a	1a
11n (HT20)	CH48	5240	1a	1a
11n (HT40)	CH38	5190	1b	1b
11n (HT40)	CH46	5230	1f	1f
11ac (HT20)	CH36	5180	19	19
11ac (HT20)	CH44	5220	19	19
11ac (HT20)	CH48	5240	19	19
11ac (HT40)	CH38	5190	1c	1c
11ac (HT40)	CH46	5230	1c	1c
11ac (HT80)	CH42	5210	1c	1c

Band II (5250 - 5350 MHz) Power level setup in software				
Test Software Version	MT7662 QA V1.0.2.8			
Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH52	5260	17	17
11a	CH60	5300	17	17
11a	CH64	5320	17	17
11n (HT20)	CH52	5260	1a	1a
11n (HT20)	CH60	5300	1a	1a
11n (HT20)	CH64	5320	1a	1a
11n (HT40)	CH54	5270	1c	1c
11n (HT40)	CH62	5310	1c	1c
11ac (HT20)	CH52	5260	18	18
11ac (HT20)	CH60	5300	18	18
11ac (HT20)	CH64	5320	18	18
11ac (HT40)	CH54	5270	1c	1c
11ac (HT40)	CH62	5310	1c	1c
11ac (HT80)	CH58	5290	1c	1c

Band III (5470 - 5725 MHz) Power level setup in software				
Test Software Version	MT7662 QA V1.0.2.8			
Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH100	5500	17	17
11a	CH116	5580	17	17
11a	CH140	5700	17	17
11n (HT20)	CH100	5500	1a	1a
11n (HT20)	CH116	5580	1a	1a
11n (HT20)	CH140	5700	1a	1a
11n (HT40)	CH102	5510	1c	1c
11n (HT40)	CH134	5670	1c	1c
11ac (HT20)	CH100	5500	1a	1a
11ac (HT20)	CH116	5580	1a	1a
11ac (HT20)	CH140	5700	1a	1a
11ac (HT40)	CH102	5510	1e	1e
11ac (HT40)	CH134	5670	1e	1e
11ac (HT80)	CH106	5530	1c	1c

Band IV (5725 - 5850 MHz) Power level setup in software				
Test Software Version	MT7662 QA V1.0.2.8			
Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH149	5745	17	17
11a	CH157	5785	17	17
11a	CH165	5825	17	17
11n (HT20)	CH149	5745	1a	1a
11n (HT20)	CH157	5785	1a	1a
11n (HT20)	CH165	5825	1a	1a
11n (HT40)	CH151	5755	1c	1c
11n (HT40)	CH159	5795	1c	1c
11ac (HT20)	CH149	5745	1a	1a
11ac (HT20)	CH157	5785	1a	1a
11ac (HT20)	CH165	5825	1a	1a
11ac (HT40)	CH151	5755	1e	1e
11ac (HT40)	CH159	5795	1e	1e
11ac (HT80)	CH155	5775	1c	1c

Run Software



2.8 Channel List

20 MHz		40 MHz		80 MHz	
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230	58	5290
44	5220	54	5270	106	5530
48	5240	62	5310	155	5775
52	5260	102	5510		
56	5280	110	5550		
60	5300	134	5670		
64	5320	151	5755		
100	5500	159	5790		
104	5520				
108	5540				
112	5560				
116	5580				
132	5660				
136	5680				
140	5700				
149	5745				
153	5765				
157	5785				
161	5805				
165	5825				

The Lowest frequency, the middle frequency and the highest frequency of channel were selected to perform the test, and the selected channel see below:

For 802.11a/n (HT20)/ac(HT20)

Band I (5150 - 5250 MHz)			Band II (5250 - 5350 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
36	Low	5180	52	Low	5260
44	Mid	5220	60	Mid	5300
48	High	5240	64	High	5320

Band III (5470 - 5725 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
100	Low	5500	149	Low	5745
116	Mid	5580	157	Mid	5785
140	High	5700	165	High	5825

For 802.11n (HT40)/ac (HT40)

Band I (5150 - 5250 MHz)			Band II (5250 - 5350 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
38	Low	5190	54	Low	5270
46	High	5230	62	High	5310

Band III (5150 - 5250 MHz)			Band IV (5725 - 5850 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
102	Low	5510	151	Low	5755
134	High	5670	159	High	5795

For 802.11ac(HT80)

Band I (5150 - 5250 MHz)			Band II (5250 - 5350 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
42	Low	5210	58	Low	5290

Band III (5150 - 5250 MHz)			Band IV (5470 - 5725 MHz)		
Channel Number	Channel	Frequency (MHz)	Channel Number	Channel	Frequency (MHz)
106	Low	5530	155	Low	5775

Note: Preliminary tests were performed in different data rate in above table to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Modulation Technology	Modulation Type	Band I	Band II	Band III	Band IV
					Channel	Channel	Channel	Channel
RF Output Power	11a	6	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11ac(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(80 MHz)	V0	OFDM	BPSK	42	58	106	155
Emiss	11a	6	OFDM	BPSK	48/44/36	64/60/52	144/140/116/	165/157/149

ion Band width & 99% Occupied Bandwidth							100	/144
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	144/140/116/100	165/157/149
	11n(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11ac(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(80 MHz)	V0	OFDM	BPSK	42	58	106	155
6 dB bandwidth	11a	6	OFDM	BPSK	N/A	N/A	N/A	165/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	N/A	N/A	N/A	165/157/149
	11n(40 MHz)	13.5	OFDM	BPSK	N/A	N/A	N/A	159/151
	11ac(20 MHz)	6.5	OFDM	BPSK	N/A	N/A	N/A	165/157/149 /144
	11ac(40 MHz)	13.5	OFDM	BPSK	N/A	N/A	N/A	159/151
	11ac(80 MHz)	V0	OFDM	BPSK	N/A	N/A	N/A	155
Power Spectral Density	11a	6	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11ac(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(80 MHz)	V0	OFDM	BPSK	42	58	106	155
Conducted Spurious Emissions	11a	6	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11ac(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(80	V0	OFDM	BPSK	42	58	106	155

	MHz)							
Radiated Spurious Emissions	11a	6	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11n(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	165/157/149
	11ac(40 MHz)	13.5	OFDM	BPSK	46/38	62/54	134/102	159/151
	11ac(80 MHz)	V0	OFDM	BPSK	42	58	106	155
Frequency Stability	11a	6	OFDM	BPSK	44	60	116	157
	11n(20 MHz)	6.5	OFDM	BPSK	44	60	116/100	157
	11n(40 MHz)	13.5	OFDM	BPSK	38	54	102	151
	11ac(20 MHz)	6.5	OFDM	BPSK	44	60	116	157
	11ac(40 MHz)	13.5	OFDM	BPSK	38	54	102	151
	11ac(80 MHz)	V0	OFDM	BPSK	42	58	106	155
Band Edge	11a	6	OFDM	BPSK	36	64	140/100	165/149
	11n(20 MHz)	6.5	OFDM	BPSK	36	64	140/100	165/149
	11n(40 MHz)	13.5	OFDM	BPSK	38	62	134/102	159/151
	11ac(20 MHz)	6.5	OFDM	BPSK	36	64	140/100	165/149
	11ac(40 MHz)	13.5	OFDM	BPSK	38	62	134/102	159/151
	11ac(80 MHz)	V0	OFDM	BPSK	42	58	106	155

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15 Subpart E	Unlicensed National Information Infrastructure Devices
2	KDB Publication 789033 D02v01	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
3	KDB Publication 662911 D01v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)
4	RSS-Gen (Issue 4, Nov. 2014)	General Requirements for Compliance of Radio Apparatus
5	RSS-247 (Issue 1, May 2015)	Digital Transmission Systems (DTSs), Frequency Hopping Systems(FHSs) and Licence-Exemp Local Area Network (LE-LAN) Devices
6	ANSI C63.4-2014	American National Standard for Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
7	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.2 Verdict

No.	Description	FCC Part No.	RSS Part No.	Test Result	Verdict
1	Antenna Requirement	15.203	RSS-247, 6.2	--	Pass Note 1
2	RF Output Power	15.407(a)	RSS-247, 6.2	ANNEX A.1	Pass
3	Emission Bandwidth & 99% Occupied Bandwidth	15.407(a)	RSS-247, 6.2	ANNEX A.2	Pass
4	6 dB bandwidth	15.407(e)	RSS-247, 6.2	ANNEX A.3	Pass
5	Power Spectral Density	15.407(a)	RSS-247, 6.2	ANNEX A.4	Pass
6	Conducted Emission	15.207	RSS-GEN, 8.8	ANNEX A.5	Pass
7	Conducted Spurious Emissions	15.407(b) 15.209	RSS-247, 6.2	ANNEX A.6	Pass
8	Radiated Spurious Emissions and Band Edge	15.407(b)	RSS-247, 6.2	ANNEX A.7	Pass
9	Frequency Stability	2.1055 90.213	--	ANNEX A.8	Pass
10	Receiver Spurious Emissions	--	RSS-Gen, 7.1.2	ANNEX A.9	Pass
Note 1: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.					

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

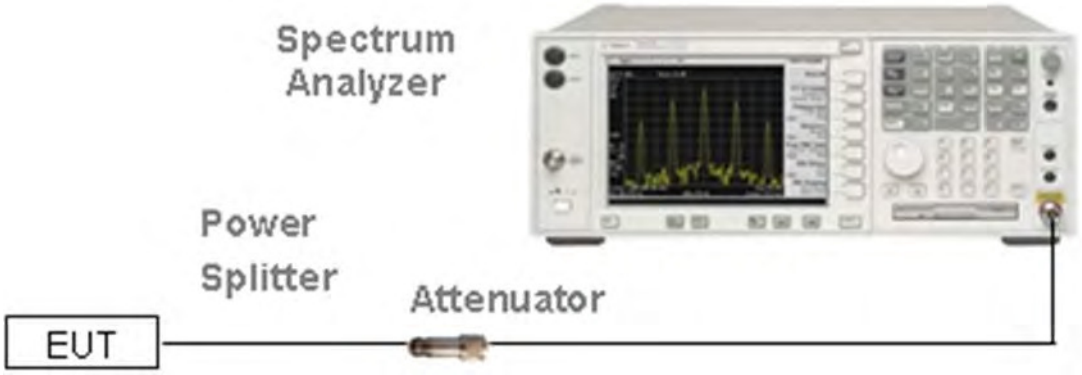
Relative Humidity	45% - 55%	
Atmospheric Pressure	100 kPa - 102 kPa	
Temperature	NT (Normal Temperature)	+22℃ to +25℃
	LT (Low Temperature)	-10℃
	HT (High Temperature)	+40℃
Working Voltage of the EUT	NV (Normal Voltage)	3.3 V
	LV (Low Voltage)	2.97 V
	HV (High Voltage)	3.63 V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-30	103118	2015.07.16	2016.07.15
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	177746	2015.07.16	2016.07.15
Signal Generator	ROHDE&SCHWARZ	SMB100A	260592	2015.07.16	2016.07.15
Switch Unit with OSP-B157	ROHDE&SCHWARZ	OSP120	101270	2015.07.16	2016.07.15
Spectrum Analyzer	AGILENT	E4440A	MY45304434	2015.10.18	2016.10.17
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-40	101008	2015.10.18	2016.10.17
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2015.07.14	2016.07.13
LISN	SCHWARZBECK	NSLK 8127	8127-687	2015.07.14	2016.07.13
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2015.07.16	2016.07.15
Power Splitter	KMW	DCPD-LDC	1305003215	2015.07.01	2016.06.30
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2015.07.21	2016.07.20
Attenuator (20 dB)	KMW	ZA-S1-201	110617091	--	--
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189	--	--
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2015.07.17	2016.07.16
Temperature Chamber	ANGELANTIONI SCIENCE	NTH64-40A	1310	2015.08.07	2016.08.06
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2015.07.22	2017.07.21
Test Antenna-Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2015.07.22	2017.07.21
Test Antenna-Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1148	2015.07.22	2017.07.21
Test Antenna-Horn(18-40 GHz)	SCHWARZBECK	BBHA 9170	9170-1025	2015.07.22	2017.07.21
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2015.02.28	2017.02.27
Shielded Enclosure	ChangNing	CN-130701	130703	--	--

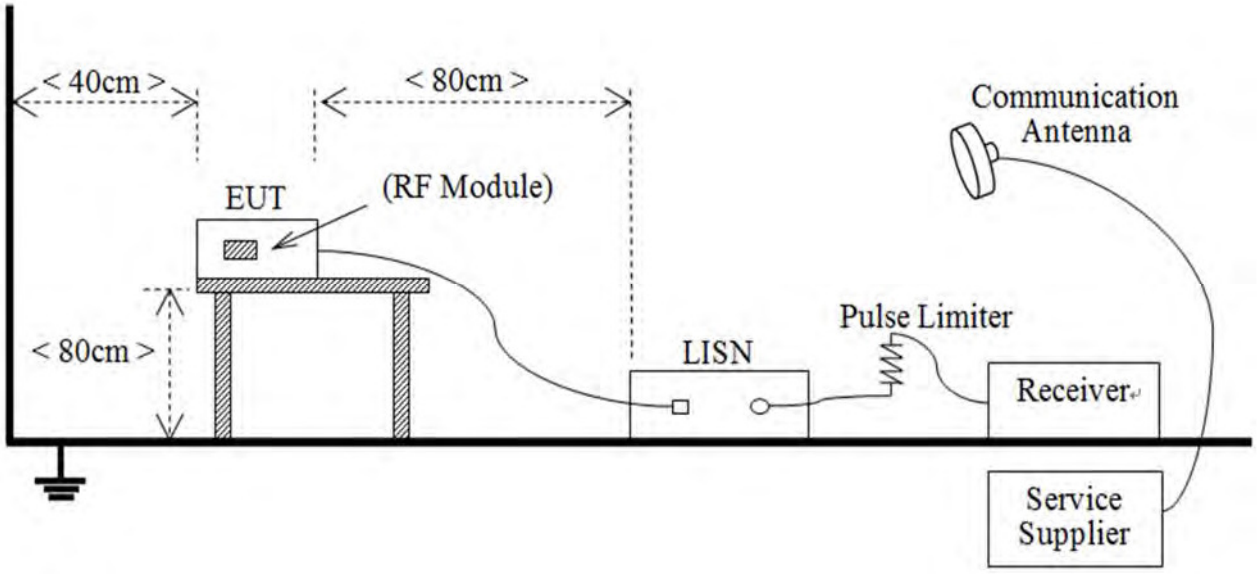
4.3 Description of Test Setup

4.3.1 For Antenna Port Test



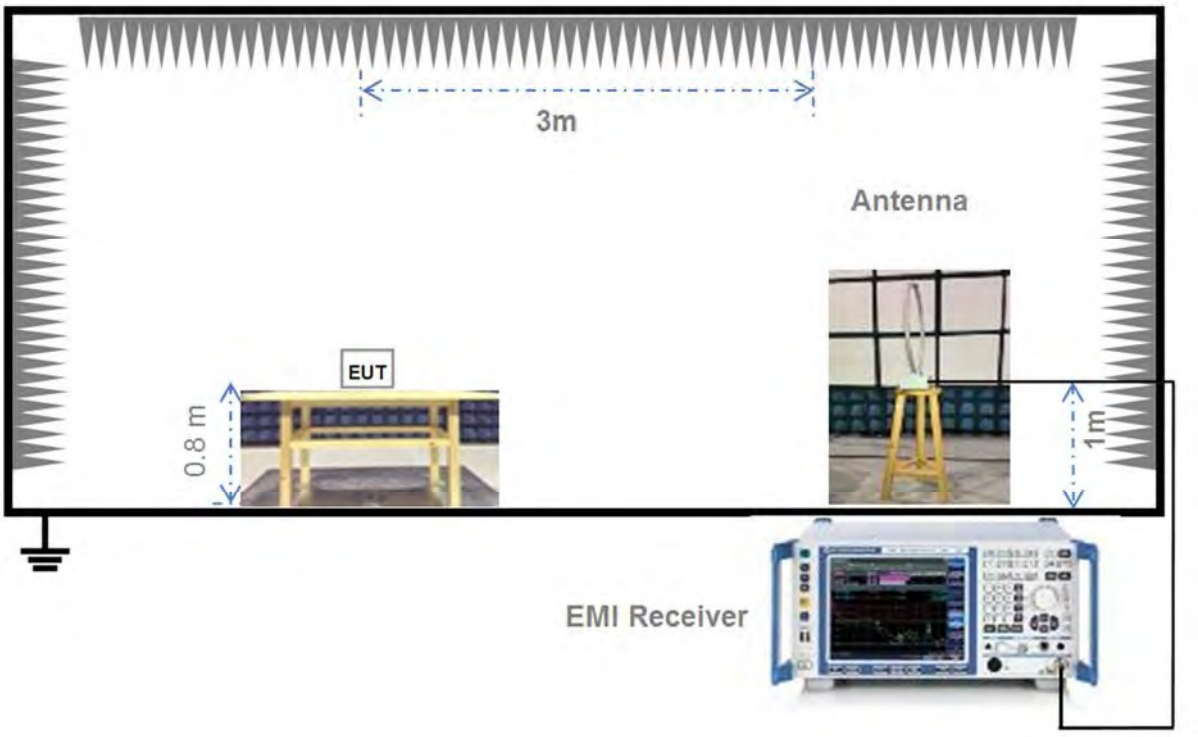
(Diagram 1)

4.3.2 For AC Power Supply Port Test



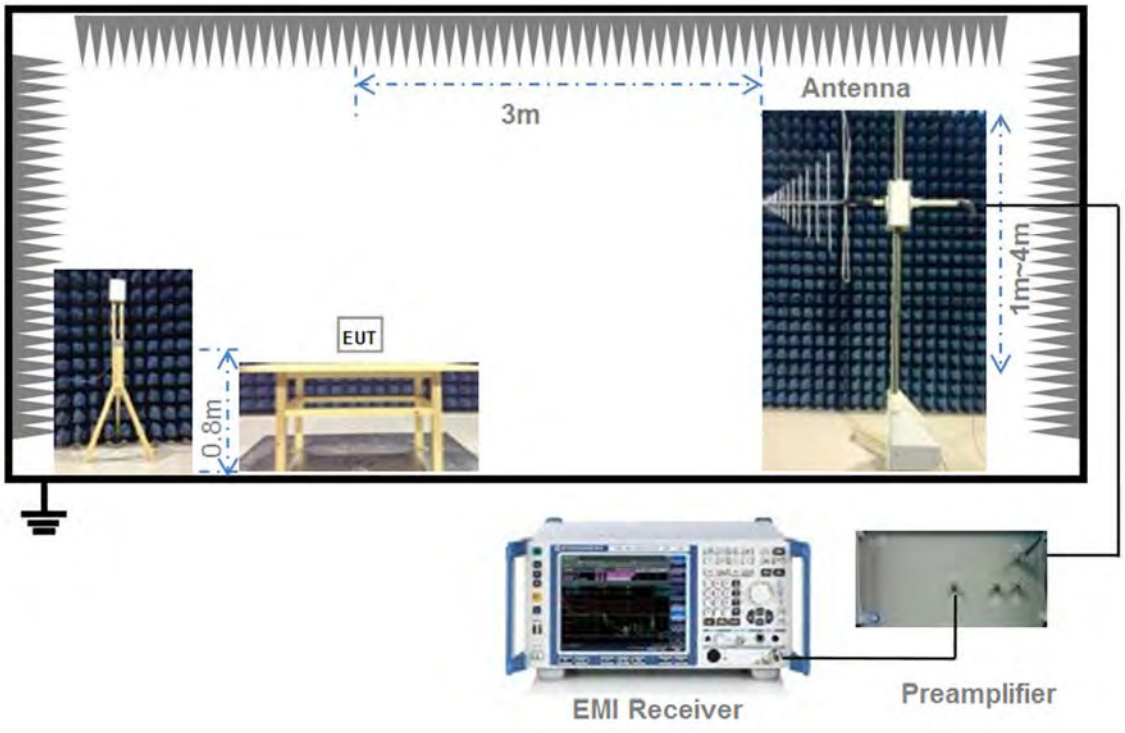
(Diagram 2)

4.3.3 For Radiated Test (Below 30 MHz)



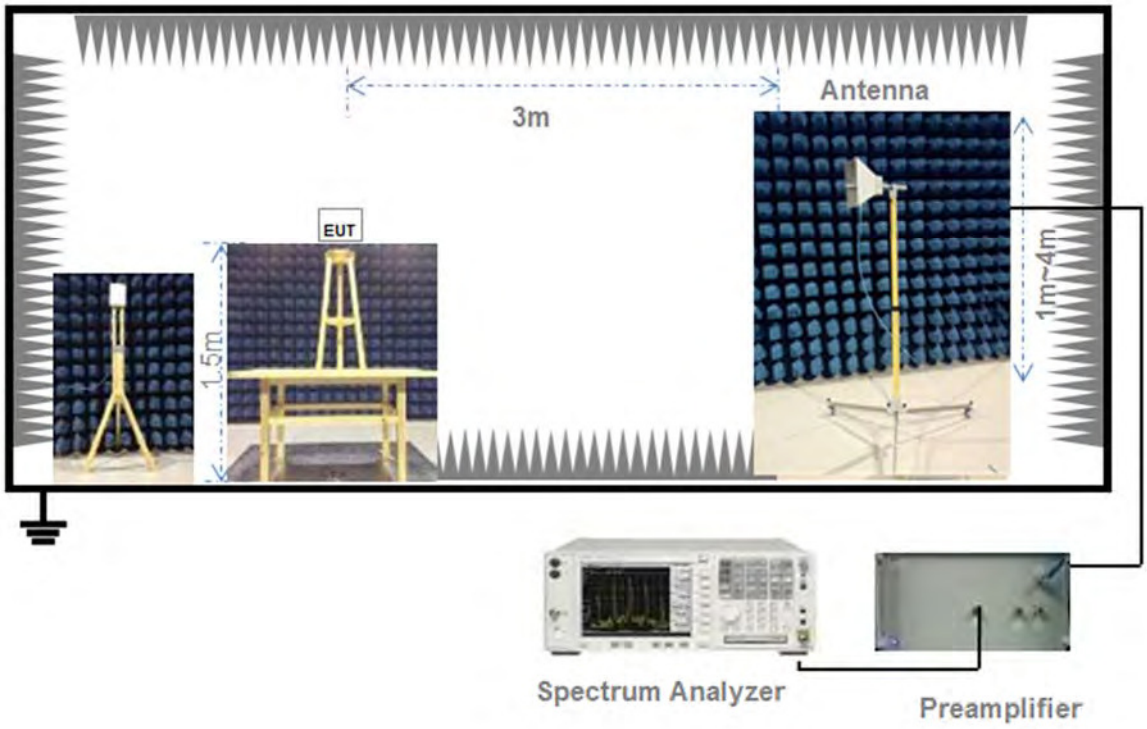
(Diagram 3)

4.3.4 For Radiated Test (30 MHz-1 GHz)



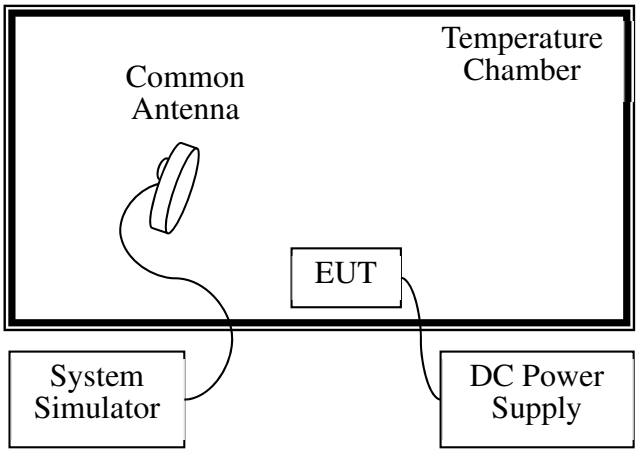
(Diagram 4)

4.3.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.3.6 For Frequency Stability Test



(Diagram 6)

5 TEST ITEMS

5.1 RF Output Power

5.1.1 Test Limit

FCC §15.407(a)

The maximum conducted output power should not exceed:

Frequency Band (MHz)	Limit
5150-5250	250 mW
5250-5350	250 mW or 11 dBm + 10log B, whichever is less.
5470-5725	250 mW or 11 dBm + 10log B, whichever is less.
5725-5850	1 W
Note: Where “B” is the 26 dB emissions bandwidth in MHz.	

RSS-247, 6.2

The maximum conducted output power shall not exceed:

Frequency Band (MHz)	Limit
5150-5250	N/A
5250-5350	250 mW or 11 dBm + 10log B, whichever is less.
5470-5725	250 mW or 11 dBm + 10log B, whichever is less.
5725-5850	1 W
Note: Where “B” is the 99% emissions bandwidth in MHz.	

The maximum e.i.r.p. shall not exceed:

Frequency Band (MHz)	Limit
5150-5250	200 mW or 10 dBm + 10log B, whichever is less.
5250-5350	1W or 17 dBm + 10log B, whichever is less.
5470-5725	1W or 17 dBm + 10log B, whichever is less.
5725-5850	N/A
Note: Where “B” is the 99% emissions bandwidth in MHz.	

5.1.2 Test Setup

The section 4.3.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.1.3 Test Procedure

The maximum peak conducted output power may be measured using a broadband Average RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the emission bandwidth and utilize a fast-responding diode detector.

The E.I.R.P used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.

5.1.4 Test Result

Please refer to ANNEX A.1.

5.2 Emission Bandwidth and 6 dB Bandwidth

5.2.1 Limit

FCC §15.407(a), RSS-247, 6.2

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

5.2.2 Test Setup

The test setup photo please refer to 4.3.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.2.3 Test Procedure

Emission bandwidth

1. Set RBW = approximately 1% of the emission bandwidth.

2. Set VBW ≥ 3*RBW,

3. Detector = Peak.

4. Trace mode = Max hold.

5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission.

Occupied Bandwidth

1. Set Span = 1.5 times to 5.0 times the OBW

2. Set RBW = 1% to 5% of the OBW.

3. Set VBW ≥ 3*RBW, Detector = Peak.

4. Trace mode = Max hold.

5. Use the 99% power bandwidth function of the instrument.

6 dB bandwidth

1. Set RBW = 100 kHz, VBW = 300 kHz.

2. Detector = Peak.Trace mode = Max hold.

3. Allow the trace to stabilize.

4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.2.4 Test Result

Please refer to ANNEX A.2 and ANNEX A.3.

5.3 Power Spectral density (PSD)

5.3.1 Limit

FCC §15.407(a)

The maximum power spectral density should not exceed:

Frequency Band (MHz)	Limit
5150-5250	11 dBm/MHz
5250-5350	11 dBm/MHz
5470-5725	11 dBm/MHz
5725-5850	30 dBm/500kHz

RSS-247, 6.2

The maximum power spectral density should not exceed:

Frequency Band (MHz)	Limit
5150-5250	N/A
5250-5350	11 dBm/MHz
5470-5725	11 dBm/MHz
5725-5850	30 dBm/500kHz

The e.i.r.p. spectral density should not exceed:

Frequency Band (MHz)	Limit
5150-5250	10 dBm/MHz
5250-5350	N/A
5470-5725	N/A
5725-5850	N/A

5.3.2 Test Setup

The section 4.3.1 (Diagram 1) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

Set the spectrum analyzer or EMI receiver span to view the entire emission bandwidth.

1. Set RBW = 510 kHz/1 MHz, VBW ≥ 3*RBW, Sweep time = Auto, Detector = RMS.
2. Allow the sweeps to continue until the trace stabilizes.
3. Use the peak marker function to determine the maximum amplitude level.
4. The E.I.R.P spectral density used radiated test method. At a test site that has been validated using the procedures of ANSI C63.4 or the latest CISPR 16-1-4 for measurements above 1 GHz, so as to simulate a near free-space environment.

5.3.4 Test Result

Please refer to ANNEX A.4.

5.4 Conducted Emission

5.4.1 Limit

FCC §15.207, RSS-GEN, 8.8

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 within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.4.2 Test Setup

The section 4.4.2 (Diagram 2) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

5.4.4 Test Result

Please refer to ANNEX A.5.

5.5 Conducted Spurious Emission and Band Edge (Authorized-band)

5.5.1 Limit

FCC §15.407(b)

Un-restricted band emissions	
Frequency Band (MHz)	Limit
5150 - 5250	Outside of the 5.15-5.35 GHz band: e.i.r.p. -27 dBm
5250 - 5350	Outside of the 5.15-5.35 GHz band: e.i.r.p. -27 dBm
5470 - 5725	Outside of the 5.47-5.725 GHz band: e.i.r.p. -27 dBm
5725 - 5850	5715 -5725 MHz: e.i.r.p. -17 dBm 5850 -5860 MHz: e.i.r.p. -17 dBm Other un-restricted band: e.i.r.p .-27 dBm

RSS-247, 6.2

Un-restricted band emissions	
Frequency Band (MHz)	Limit
5150 - 5250	Outside of the 5.15-5.35 GHz band: e.i.r.p. -27 dBm, However, any unwanted emissions that fall into the band 5250-5350 MHz must be 26 dBc, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth, above 5.25 GHz.
5250 - 5350	Outside of the 5.15-5.35 GHz band: e.i.r.p. -27 dBm. And any emissions within the band 5150-5250 MHz shall meet the power spectral density limits of 10 dBm/MHz, The device shall be labelled “for indoor use only.”
5470 - 5725	Outside of the 5.47-5.725 GHz band: e.i.r.p. -27 dBm
5725 - 5850	5715 -5725 MHz: e.i.r.p. -17 dBm 5850 -5860 MHz: e.i.r.p. -17 dBm Other un-restricted band: e.i.r.p .-27 dBm

5.5.2 Test Setup

See section 4.4.2 (Diagram 2) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

5.5.4 Test Result

Please refer to ANNEX A.6.

5.6 Radiated Spurious Emissions and Band Edge (Restricted-band)

5.6.1 Limit

FCC §15.209 & 15.407(b), RSS-247, 6.2

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note 1: The Limit for radiated test was performed according to FCC Part 15C
Note 2: The tighter limit applies at the band edge.

Un-restricted band emissions	
Out Operating Band (MHz）	Limit
5150 - 5250	e.i.r.p. -27 dBm (68.2 dBuV/m@3m)
5250 - 5350	e.i.r.p. -27 dBm (68.2 dBuV/m@3m)
5470 - 5725	e.i.r.p. -27 dBm (68.2 dBuV/m@3m)
5725 - 5850	5715 -5725 MHz: e.i.r.p. -17 dBm (78.2 dBuV/m@3m) 5850 -5860 MHz: e.i.r.p. -17 dBm (78.2 dBuV/m@3m) Other un-restricted band: e.i.r.p.(68.2 dBuV/m@3m)

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength.

5.6.2 Test Setup

The section 4.3 (Diagram 3 - Diagram 5) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

Since the emission limits are specified in terms of radiated field strength levels, measurements performed to demonstrate compliance have traditionally relied on a radiated test configuration. Radiated measurements remain the principal method for demonstrating compliance to the specified limits; however antenna-port conducted measurements are also now acceptable to demonstrate compliance (see below for details). When radiated measurements are utilized, test site requirements and procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 shall be followed.

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

General Procedure for conducted measurements in restricted bands

a) Measure the conducted output power (in dBm) using the detector specified (see guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see guidance on determining the applicable antenna gain)

c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:

$E = EIRP - 20\log D + 104.8$

where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

f) Compare the resultant electric field strength level to the applicable limit.

g) Perform radiated spurious emission test.

Quasi-Peak measurement procedure

The specifications for measurements using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

Peak power measurement procedure

Peak emission levels are measured by setting the instrument as follows:

a) RBW = as specified in Table 1.

b) VBW ≥ 3 x RBW.

c) Detector = Peak.

d) Sweep time = auto.

e) Trace mode = max hold.

f) Allow sweeps to continue until the trace stabilizes. (Note that the required measurement time may be longer for low duty cycle applications).

Table 1—RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

If the peak-detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

Trace averaging across on and off times of the EUT transmissions followed by duty cycle correction

If continuous transmission of the EUT (i.e., duty cycle ≥ 98 percent) cannot be achieved and the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent), then the following procedure shall be used:

a) The EUT shall be configured to operate at the maximum achievable duty cycle.

b) Measure the duty cycle, x, of the transmitter output signal as described in section 6.0.

c) RBW = 1 MHz (unless otherwise specified).

d) VBW ≥ 3 x RBW.

e) Detector = RMS, if span/(# of points in sweep) ≤ (RBW/2). Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.

f) Averaging type = power (i.e., RMS).

1) As an alternative, the detector and averaging type may be set for linear voltage averaging.

2) Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

g) Sweep time = auto.

h) Perform a trace average of at least 100 traces.

i) A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

1) If power averaging (RMS) mode was used in step f), then the applicable correction factor is 10 log(1/x), where x is the duty cycle.

2) If linear voltage averaging mode was used in step f), then the applicable correction factor is 20 log(1/x), where x is the duty cycle.

3) If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

NOTE: Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

Determining the applicable transmit antenna gain

A conducted power measurement will determine the maximum output power associated with a restricted band emission; however, in order to determine the associated EIRP level, the gain of the transmitting antenna (in dBi) must be added to the measured output power (in dBm).

Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, 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. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

See KDB 662911 for guidance on calculating the additional array gain term when determining the effective antenna gain for a EUT with multiple outputs occupying the same or overlapping frequency ranges in the same band.

Radiated spurious emission test

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these cabinet radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in ANSI C63.10. All detected emissions shall comply with the applicable limits.

The measurement frequency range is from 30 MHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

5.6.4 Test Result

Please refer to ANNEX A.7 and Please refer to ANNEX A.9

5.7 Frequency Stability

5.7.1 Limit

FCC §15.407(g)

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

5.7.2 Test Setup

The section 4.3.1 (Diagram 6) test setup description was used for this test. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

The EUT is installed in an environment test chamber with external power source.
Set the chamber to operate at 50 centigrade and external power source to output at nominal voltage of EUT.
A sufficient stabilization period at each temperatures is used prior to each frequency measurement.
When temperature is stabled, measure the frequency stability.
The test shall be performed under -30 to 50 centigrade and 85 to 115 percent of the nominal voltage.
Change setting of chamber and external power source to complete all conditions.

5.7.4 Test Result

Please refer to ANNEX A.8.

5.8 Receiver Spurious Emissions

5.8.1 Limit

IC RSS-Gen, 7.1.2

Radiated spurious emission measurements shall be performed with the receiver antenna connected to the receiver antenna terminals. Spurious emissions from receivers shall not exceed the radiated limits shown in the table below:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

1. Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK).

5.8.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

The measurement frequency range is from 30 MHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

Test Plots for the Whole Measurement Frequency Range:

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

5.8.4 Test Result

Please refer to ANNEX A.9.

ANNEX A TEST RESULT

A.1 RF Output Power

Note 1: For FCC standard, if transmitting antennas of directional gain greater than 6 dBi are used, all band maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note 2: For IC standard, the band IV (5725 - 5850 MHz) maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Data

Conducted Power

Band I (5150 - 5250 MHz)								
Note1: Transmitting antennas of directional gain in Band I(5150 MHz to 5250 MHz) is 6.3 dBi Formulas: Directional gain = GANT + Array Gain, *Array Gain* = 0. Note2: FCC Limit=24dBm(250mW)-(6.3-6)dbi=23.7dBm(234.42mW)								
Mode	Channel	Frequency (MHz)	Conducted Power 0 (dBm)	Conducted Power 1 (dBm)	Conducted Power Total (dBm)	Conducted Power Total (mW)	FCC Limit (mW)	Verdict
11a	CH36	5180	13.08	13.34	16.22	41.90	234.42	Pass
11a	CH44	5220	12.44	13.81	16.19	41.58	234.42	Pass
11a	CH48	5240	12.47	13.73	16.16	41.27	234.42	Pass
11n (HT20)	CH36	5180	13.60	14.01	16.82	48.09	234.42	Pass
11n (HT20)	CH44	5220	13.75	14.01	16.89	48.89	234.42	Pass
11n (HT20)	CH48	5240	13.78	14.31	17.06	50.86	234.42	Pass
11n (HT40)	CH38	5190	15.83	15.86	18.86	76.83	234.42	Pass
11n (HT40)	CH46	5230	15.66	15.44	18.56	71.81	234.42	Pass
11ac (HT20)	CH36	5180	13.25	13.26	16.27	42.32	234.42	Pass
11ac (HT20)	CH44	5220	13.29	13.03	16.17	41.42	234.42	Pass
11ac (HT20)	CH48	5240	13.37	13.35	16.37	43.35	234.42	Pass
11ac (HT40)	CH38	5190	15.22	15.12	18.18	65.77	234.42	Pass
11ac (HT40)	CH46	5230	15.59	15.65	18.63	72.95	234.42	Pass
11ac (HT80)	CH42	5210	14.61	14.78	17.71	58.97	234.42	Pass

Band II (5250 - 5350 MHz)										
Note1: Transmitting antennas of directional gain in Band II(5250 MHz to 5350 MHz) is 6.4 dBi Formulas: Directional gain = GANT + Array Gain, *Array Gain* = 0. Note2: The limit is 250 mW or 11 dBm + 10log B, whichever is less. In IC Standard, Where “B” is the 99% emissions bandwidth in MHz. In FCC Standard, Where “B” is the 26dB emissions bandwidth in MHz. (Please refer to the section A.2). Note3:The final FCC Limit={24dBm(250 mW) or 11 dBm + 10log B, whichever is less} -(6.4-6)dbi										
Mode	Channel	Conducted Power 0 (dBm)	Conducted Power 1 (dBm)	Conducted Power Total (dBm)	Conducted Power Total (mW)	FCC: 11 dBm + 10log B (mW)	IC: 11 dBm + 10log B (mW)	FCC Limit (mW)	IC Limit (mW)	Verdict
11a	CH52	14.04	13.67	16.87	48.63	247	208	225.14	208	Pass
11a	CH60	14.44	13.85	17.17	52.06	247	208	225.29	208	Pass
11a	CH64	14.13	14.37	17.26	53.23	245	209	223.64	209	Pass
11n (HT20)	CH52	14.97	13.71	17.40	54.90	251	222	228.00	222	Pass
11n (HT20)	CH60	14.87	14.23	17.57	57.18	276	222	228.00	222	Pass
11n (HT20)	CH64	15.20	13.66	17.51	56.34	255	222	228.00	222	Pass
11n (HT40)	CH54	15.72	15.71	18.73	74.56	502	455	228.00	250	Pass
11n (HT40)	CH62	15.64	15.64	18.65	73.29	604	455	228.00	250	Pass
11ac (HT20)	CH52	13.15	13.20	16.19	41.55	248	222	226.03	222	Pass
11ac (HT20)	CH60	15.16	13.78	17.53	56.69	253	221	228.00	221	Pass
11ac (HT20)	CH64	13.41	13.04	16.24	42.07	251	222	228.00	222	Pass
11ac (HT40)	CH54	15.52	15.55	18.55	71.54	509	454	228.00	250	Pass
11ac (HT40)	CH62	15.73	15.75	18.75	74.99	505	453	228.00	250	Pass
11ac (HT80)	CH58	14.34	14.39	17.38	54.64	1012	942	228.00	250	Pass

Band III (5470 - 5725 MHz)										
Note1: Transmitting antennas of directional gain in Band III (5470 MHz to 5725 MHz) is 5.3 dBi Formulas: Directional gain = GANT + Array Gain, *Array Gain* = 0. Note2: The limit is 250 mW or 11 dBm + 10log B, whichever is less. In IC Standard, Where “B” is the 99% emissions bandwidth in MHz. In FCC Standard, Where “B” is the 26dB emissions bandwidth in MHz. (Please refer to the section A.2).										
Mode	Channel	Conducted Power 0 (dBm)	Conducted Power 1 (dBm)	Conducted Power Total (dBm)	Conducted Power Total (mW)	FCC: 11 dBm + 10log B (mW)	11 dBm + 10log B (mW)	FCC Limit (mW)	IC Limit (mW)	Verdict
11a	CH100	12.92	12.49	15.72	37.33	242	208	242	208	Pass
11a	CH116	12.30	12.76	15.55	35.86	247	209	247	209	Pass
11a	CH140	12.16	12.55	15.37	34.43	245	209	245	209	Pass
11n (HT20)	CH100	13.61	13.60	16.62	45.87	254	221	250	221	Pass
11n (HT20)	CH116	12.84	13.49	16.19	41.57	252	222	249	222	Pass
11n (HT20)	CH140	12.62	13.53	16.11	40.82	250	222	250	222	Pass
11n (HT40)	CH102	13.38	13.46	16.43	43.96	515	454	250	250	Pass
11n (HT40)	CH134	13.55	13.57	16.57	45.40	507	454	250	250	Pass
11ac (HT20)	CH100	13.26	13.40	16.34	43.06	252	222	250	222	Pass
11ac (HT20)	CH116	13.77	13.53	16.66	46.37	247	221	247	221	Pass
11ac (HT20)	CH140	12.96	13.07	16.03	40.05	249	221	249	221	Pass
11ac (HT40)	CH102	15.37	15.85	18.63	72.89	542	455	250	250	Pass
11ac (HT40)	CH134	15.29	15.13	18.22	66.39	506	454	250	250	Pass
11ac (HT80)	CH106	11.70	11.95	14.84	30.46	1006	945	250	250	Pass

Band IV (5725 - 5850 MHz)								
Note: Transmitting antennas of directional gain in Band IV (5725 MHz to 5850 MHz) is 3.7 dBi Formulas: Directional gain = GANT + Array Gain, *Array Gain* = 0.								
Mode	Channel	Frequency (MHz)	Conducted Power 0 (dBm)	Conducted Power 1 (dBm)	Conducted Power Total (dBm)	Conducted Power Total (mW)	FCC/IC Limit (W)	Verdict
11a	CH149	5745	11.82	13.25	15.60	36.34	1.00	Pass
11a	CH157	5785	12.18	12.08	15.14	32.66	1.00	Pass
11a	CH165	5825	11.92	11.99	14.97	31.37	1.00	Pass
11n (HT20)	CH149	5745	12.12	13.18	15.69	37.09	1.00	Pass
11n (HT20)	CH157	5785	12.31	13.12	15.74	37.53	1.00	Pass
11n (HT20)	CH165	5825	12.71	12.44	15.59	36.20	1.00	Pass
11n (HT40)	CH151	5755	13.97	13.83	16.91	49.10	1.00	Pass
11n (HT40)	CH159	5795	12.28	13.55	15.97	39.55	1.00	Pass
11ac (HT20)	CH149	5745	12.63	12.21	15.44	34.96	1.00	Pass
11ac (HT20)	CH157	5785	11.99	12.18	15.10	32.33	1.00	Pass
11ac (HT20)	CH165	5825	12.06	11.83	14.96	31.31	1.00	Pass
11ac (HT40)	CH151	5755	14.79	15.04	17.93	62.05	1.00	Pass
11ac (HT40)	CH159	5795	14.43	14.57	17.51	56.37	1.00	Pass
11ac (HT80)	CH155	5775	12.57	12.57	15.58	36.14	1.00	Pass

EIRP Power

Band I (5150 - 5250 MHz)								
Note: The limit is 200 mW or 10 dBm + 10log B, whichever is less. Where “B” is the 99% emissions bandwidth in MHz (Please refer to the section A.2).								
Mode	Channel	Frequency (MHz)	EIRP Power Total (dBm)	EIRP Power Total (mW)	99% EBW (MHz)	10 dBm + 10log B (mW)	IC Limit (mW)	Verdict
11a	CH36	5180	22.01	158.85	16.39	164	164	Pass
11a	CH44	5220	21.48	140.60	16.53	165	165	Pass
11a	CH48	5240	21.47	140.28	16.56	166	166	Pass
11n (HT20)	CH36	5180	22.35	171.79	17.64	176	176	Pass
11n (HT20)	CH44	5220	22.42	174.58	17.65	176	176	Pass
11n (HT20)	CH48	5240	22.36	172.19	17.63	176	176	Pass
11n (HT40)	CH38	5190	22.55	179.89	36.08	361	200	Pass
11n (HT40)	CH46	5230	22.42	174.58	36.10	361	200	Pass
11ac (HT20)	CH36	5180	21.20	131.83	17.63	176	176	Pass
11ac (HT20)	CH44	5220	21.47	140.28	17.58	176	176	Pass
11ac (HT20)	CH48	5240	21.45	139.64	17.64	176	176	Pass
11ac (HT40)	CH38	5190	22.96	197.70	36.08	361	200	Pass
11ac (HT40)	CH46	5230	22.84	192.31	35.98	360	200	Pass
11ac (HT80)	CH42	5210	22.36	172.19	74.79	748	200	Pass

Band II (5250 - 5350 MHz)								
Note: The limit is 1W or 17 dBm + 10log B, whichever is less. Where “B” is the 99% emissions bandwidth in MHz (Please refer to the section A.2).								
Mode	Channel	Frequency (MHz)	EIRP Power Total (dBm)	EIRP Power Total (mW)	99% EBW (MHz)	17 dBm + 10log B (mW)	IC Limit (mW)	Verdict
11a	CH52	5260	22.59	181.36	16.52	828	828	Pass
11a	CH56	5280	23.93	247.45	16.54	829	829	Pass
11a	CH64	5320	22.64	183.62	16.59	831	831	Pass
11n (HT20)	CH52	5260	22.58	181.28	17.65	884	884	Pass
11n (HT20)	CH60	5300	23.21	209.31	17.62	883	883	Pass
11n (HT20)	CH64	5320	23.82	241.02	17.60	882	882	Pass
11n (HT40)	CH54	5270	24.53	283.81	36.16	1812	1000	Pass
11n (HT40)	CH62	5310	25.00	316.20	36.17	1813	1000	Pass
11ac (HT20)	CH52	5260	22.37	172.66	17.60	882	882	Pass
11ac (HT20)	CH56	5280	23.88	244.56	17.59	882	882	Pass
11ac (HT20)	CH64	5320	22.92	196.06	17.66	885	885	Pass
11ac (HT40)	CH54	5270	24.45	278.82	36.04	1806	1000	Pass
11ac (HT40)	CH62	5310	24.50	282.04	35.95	1802	1000	Pass
11ac (HT80)	CH58	5290	23.75	237.34	74.81	3750	1000	Pass

Band III (5470 - 5725 MHz)								
Note: The limit is 1W or 17 dBm + 10log B, whichever is less. Where “B” is the 99% emissions bandwidth in MHz (Please refer to the section A.2)								
Mode	Channel	Frequency (MHz)	EIRP Power Total (dBm)	EIRP Power Total (mW)	99% EBW (MHz)	17 dBm + 10log B (mW)	IC Limit (mW)	Verdict
11a	CH100	5500	20.96	124.84	16.54	829	829	Pass
11a	CH116	5580	20.46	111.27	16.56	830	830	Pass
11a	CH140	5700	20.37	108.81	16.58	831	831	Pass
11n (HT20)	CH100	5500	21.15	130.41	17.59	881	881	Pass
11n (HT20)	CH116	5580	21.44	139.32	17.65	884	884	Pass
11n (HT20)	CH140	5700	21.09	128.56	17.60	882	882	Pass
11n (HT40)	CH102	5510	21.05	127.30	36.10	1809	1000	Pass
11n (HT40)	CH134	5670	21.31	135.25	36.07	1808	1000	Pass
11ac (HT20)	CH100	5500	21.09	128.42	17.63	884	884	Pass
11ac (HT20)	CH116	5580	21.20	131.70	17.58	881	881	Pass
11ac (HT20)	CH140	5700	20.65	116.10	17.59	881	881	Pass
11ac (HT40)	CH102	5510	22.69	185.90	36.15	1812	1000	Pass
11ac (HT40)	CH134	5670	22.67	185.11	36.03	1806	1000	Pass
11ac (HT80)	CH106	5530	20.10	102.30	75.04	3761	1000	Pass

Band IV (5725 - 5850 MHz)				
Note: The eirp for “Band IV (5725 – 5850 MHz)” is not require in FCC/IC standard. It is only reported.				
Mode	Channel	Frequency (MHz)	EIRP Power Total (dBm)	EIRP Power Total (mW)
11a	CH149	5745	19.30	85.11
11a	CH157	5785	18.84	76.56
11a	CH165	5825	18.67	73.62
11n (HT20)	CH149	5745	19.39	86.90
11n (HT20)	CH157	5785	19.44	87.90
11n (HT20)	CH165	5825	19.29	84.92
11n (HT40)	CH151	5755	20.61	115.08
11n (HT40)	CH159	5795	19.67	92.68
11ac (HT20)	CH149	5745	19.14	82.04
11ac (HT20)	CH157	5785	18.80	75.86
11ac (HT20)	CH165	5825	18.66	73.45
11ac (HT40)	CH151	5755	21.63	145.55
11ac (HT40)	CH159	5795	21.21	132.13
11ac (HT80)	CH155	5775	19.28	84.72

A.2 Emission Bandwidth & 99% Bandwidth

Test Data

ANT 0

Band I (5150 - 5250 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH36	5180	19.400	16.3871
11a	CH44	5220	19.692	16.5326
11a	CH48	5240	19.749	16.5590
11n (HT20)	CH36	5180	20.644	17.6354
11n (HT20)	CH44	5220	19.811	17.6493
11n (HT20)	CH48	5240	19.858	17.6314
11n (HT40)	CH38	5190	40.697	36.0843
11n (HT40)	CH46	5230	40.858	36.0951
11ac (HT20)	CH36	5180	19.954	17.6250
11ac (HT20)	CH44	5220	19.866	17.5848
11ac (HT20)	CH48	5240	19.884	17.6364
11ac (HT40)	CH38	5190	39.914	36.0788
11ac (HT40)	CH46	5230	42.820	35.9771
11ac (HT80)	CH42	5210	80.143	74.7854

Band II (5250 - 5350 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH52	5260	19.609	16.5212
11a	CH60	5300	19.622	16.5443
11a	CH64	5320	19.478	16.5898
11n (HT20)	CH52	5260	19.919	17.6454
11n (HT20)	CH60	5300	21.955	17.6155
11n (HT20)	CH64	5320	20.235	17.6002
11n (HT40)	CH54	5270	39.899	36.1607
11n (HT40)	CH62	5310	47.976	36.1654
11ac (HT20)	CH52	5260	19.686	17.6046
11ac (HT20)	CH60	5300	20.121	17.5910
11ac (HT20)	CH64	5320	19.966	17.6587
11ac (HT40)	CH54	5270	40.411	36.0354
11ac (HT40)	CH62	5310	40.138	35.9462
11ac (HT80)	CH58	5290	80.385	74.8127

Band III (5470 - 5725 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH100	5500	19.248	16.5445
11a	CH116	5580	19.649	16.5632
11a	CH140	5700	19.491	16.5812
11n (HT20)	CH100	5500	20.187	17.5882
11n (HT20)	CH116	5580	20.048	17.6480
11n (HT20)	CH140	5700	19.821	17.5966
11n (HT40)	CH102	5510	40.919	36.0970
11n (HT40)	CH134	5670	40.262	36.0692
11ac (HT20)	CH100	5500	20.047	17.6325
11ac (HT20)	CH116	5580	19.593	17.5779
11ac (HT20)	CH140	5700	19.745	17.5866
11ac (HT40)	CH102	5510	43.055	36.1547
11ac (HT40)	CH134	5670	40.216	36.0282
11ac (HT80)	CH106	5530	79.898	75.0397

Band IV (5725 - 5850 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH149	5745	19.453	16.5759
11a	CH157	5785	19.771	16.5584
11a	CH165	5825	19.298	16.4477
11n (HT20)	CH149	5745	19.793	17.5810
11n (HT20)	CH157	5785	19.633	17.6025
11n (HT20)	CH165	5825	19.791	17.5869
11n (HT40)	CH151	5755	44.590	36.1290
11n (HT40)	CH159	5795	45.904	36.0701
11ac (HT20)	CH149	5745	19.897	17.6165
11ac (HT20)	CH157	5785	20.036	17.6386
11ac (HT20)	CH165	5825	19.986	17.6295
11ac (HT40)	CH151	5755	41.914	36.1536
11ac (HT40)	CH159	5795	40.132	36.1330
11ac (HT80)	CH155	5775	80.209	74.8598

ANT 1

Band I Band I (5150 - 5250 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH36	5180	19.277	16.3989
11a	CH44	5220	19.391	16.5666
11a	CH48	5240	19.512	16.5822
11n (HT20)	CH36	5180	20.189	17.6208
11n (HT20)	CH44	5220	19.914	17.6417
11n (HT20)	CH48	5240	20.044	17.6136
11n (HT40)	CH38	5190	42.090	36.0685
11n (HT40)	CH46	5230	40.236	36.0200
11ac (HT20)	CH36	5180	20.254	17.6210
11ac (HT20)	CH44	5220	20.054	17.6141
11ac (HT20)	CH48	5240	19.669	17.6944
11ac (HT40)	CH38	5190	42.342	36.1140
11ac (HT40)	CH46	5230	45.561	36.1362
11ac (HT80)	CH42	5210	80.687	75.0004

Band II (5250 - 5350 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH52	5260	19.566	16.5691
11a	CH60	5300	19.829	16.5302
11a	CH64	5320	19.945	16.5241
11n (HT20)	CH52	5260	20.013	17.5970
11n (HT20)	CH60	5300	20.138	17.6574
11n (HT20)	CH64	5320	20.824	17.6321
11n (HT40)	CH54	5270	39.714	36.0168
11n (HT40)	CH62	5310	50.375	36.1241
11ac (HT20)	CH52	5260	19.693	17.6679
11ac (HT20)	CH60	5300	19.978	17.6005
11ac (HT20)	CH64	5320	20.388	17.6384
11ac (HT40)	CH54	5270	41.685	36.0976
11ac (HT40)	CH62	5310	40.008	36.0602
11ac (HT80)	CH58	5290	83.091	75.0142

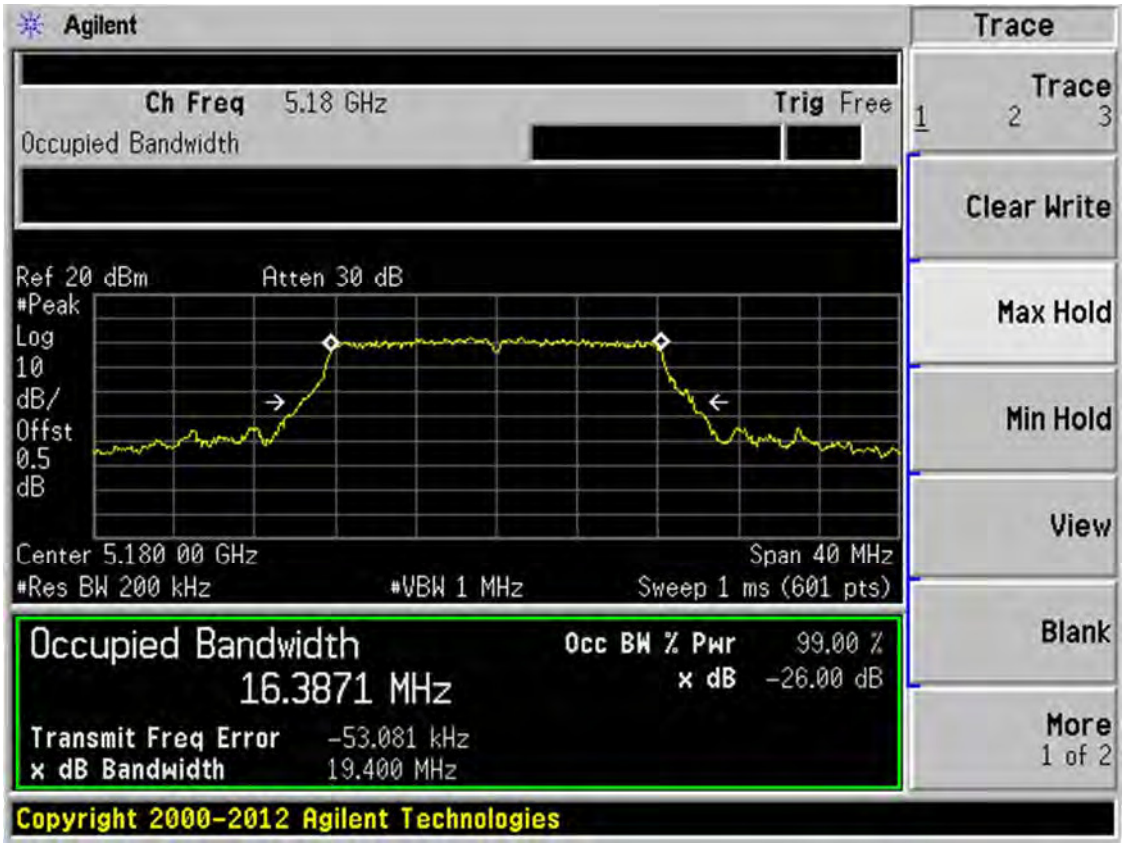
Band III (5470 - 5725 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH100	5500	19.881	16.5502
11a	CH116	5580	19.589	16.5131
11a	CH140	5700	20.666	16.5512
11n (HT20)	CH100	5500	20.247	17.6189
11n (HT20)	CH116	5580	20.113	17.6046
11n (HT20)	CH140	5700	19.760	17.6392
11n (HT40)	CH102	5510	40.672	36.0863
11n (HT40)	CH134	5670	40.619	35.9301
11ac (HT20)	CH100	5500	19.818	17.5856
11ac (HT20)	CH116	5580	20.326	17.6238
11ac (HT20)	CH140	5700	19.896	17.6346
11ac (HT40)	CH102	5510	40.821	36.0568
11ac (HT40)	CH134	5670	40.372	36.0505
11ac (HT80)	CH106	5530	80.233	74.7724

Band IV (5725 - 5850 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH149	5745	19.677	16.5180
11a	CH157	5785	19.933	16.5728
11a	CH165	5825	19.478	16.4603
11n (HT20)	CH149	5745	19.824	17.6082
11n (HT20)	CH157	5785	21.103	17.5639
11n (HT20)	CH165	5825	19.815	17.5802
11n (HT40)	CH151	5755	48.761	36.2207
11n (HT40)	CH159	5795	43.721	36.1131
11ac (HT20)	CH149	5745	19.851	17.5882
11ac (HT20)	CH157	5785	20.056	17.6054
11ac (HT20)	CH165	5825	19.778	17.5957
11ac (HT40)	CH151	5755	44.825	36.1368
11ac (HT40)	CH159	5795	40.123	36.1000
11ac (HT80)	CH155	5775	80.253	74.7496

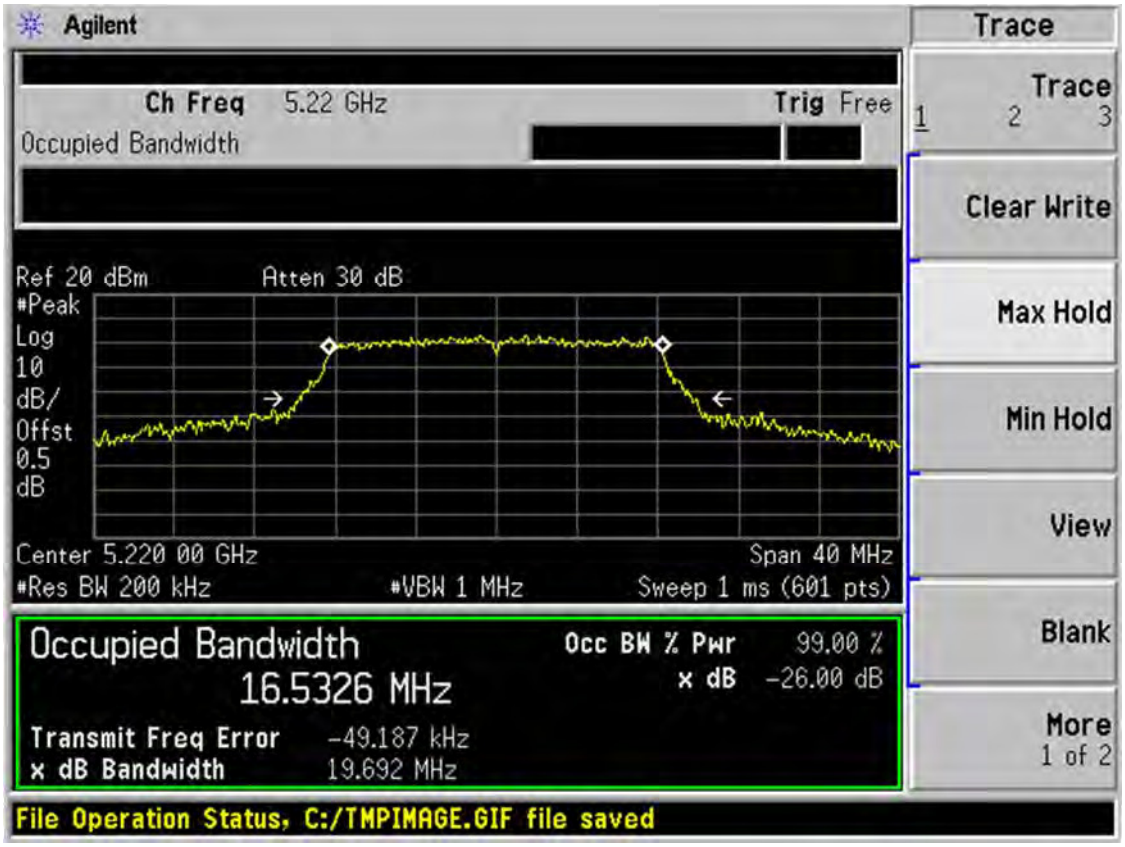
Test Plots

ANT 0

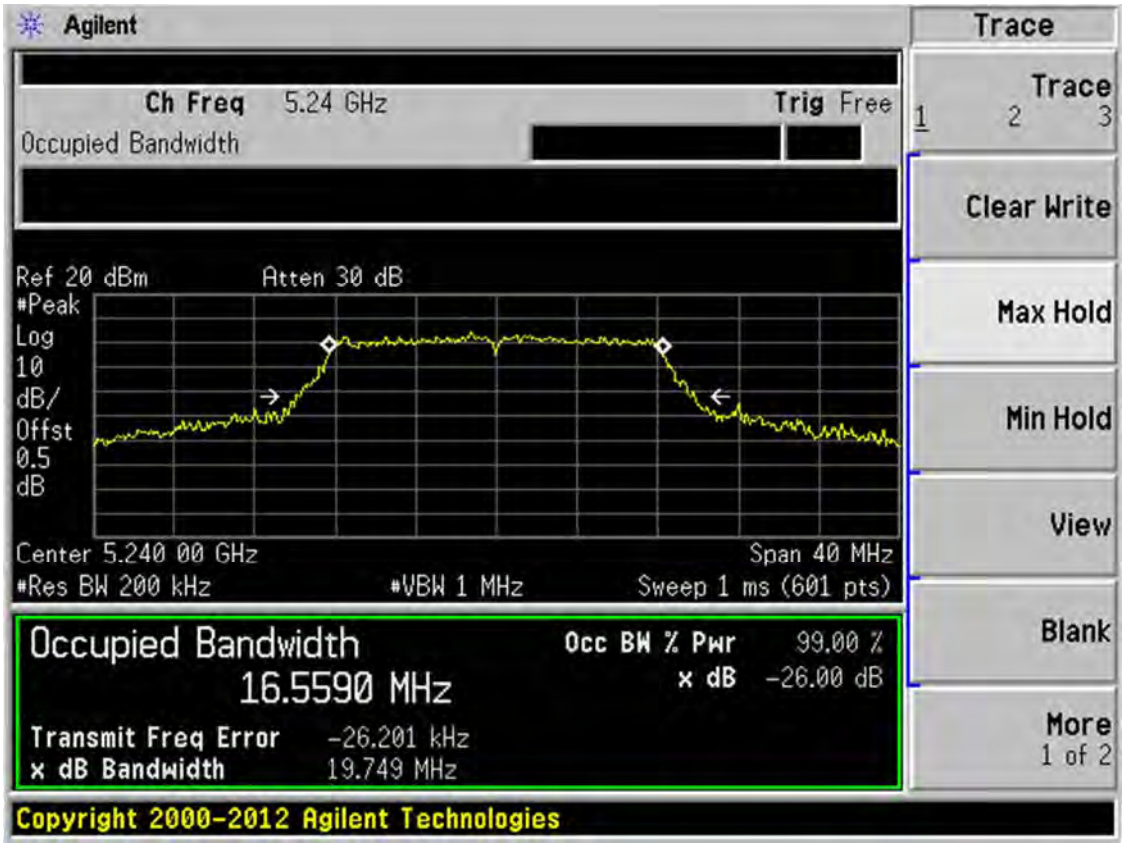
Band I 11a CH36



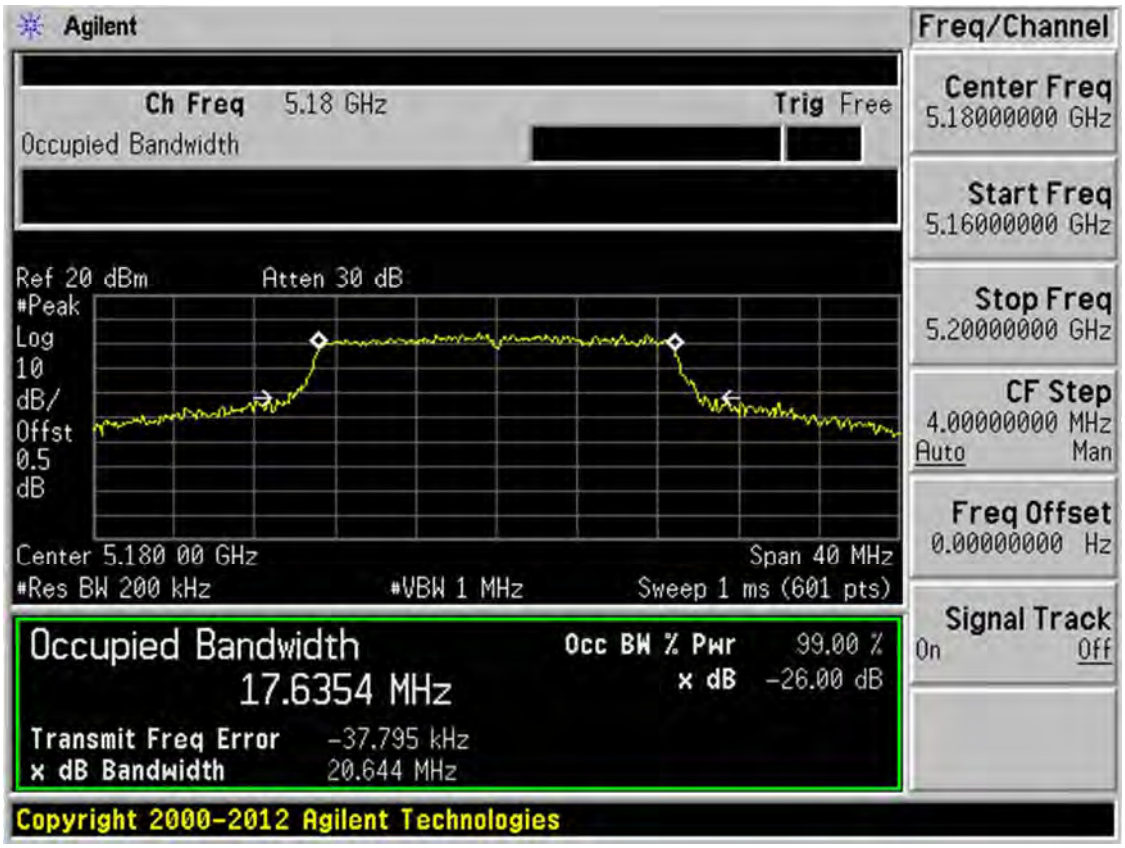
Band I 11a CH44



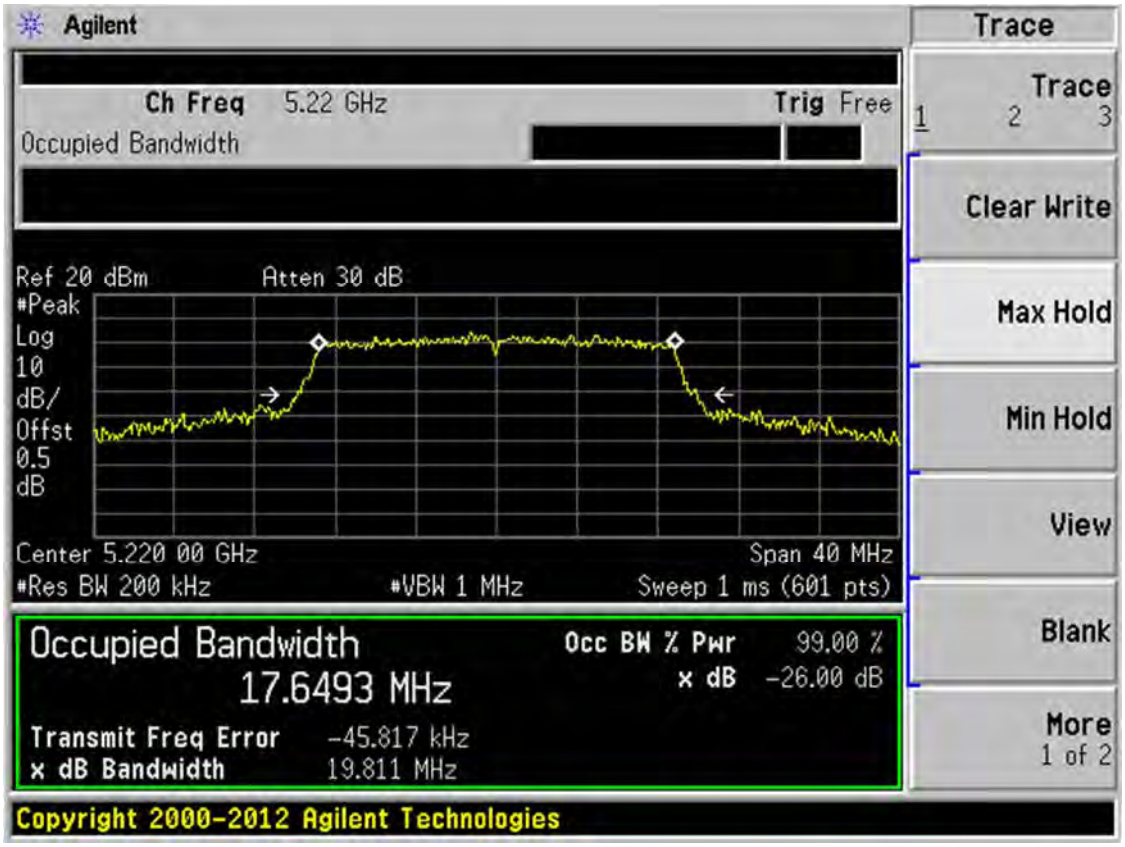
Band I 11a CH48



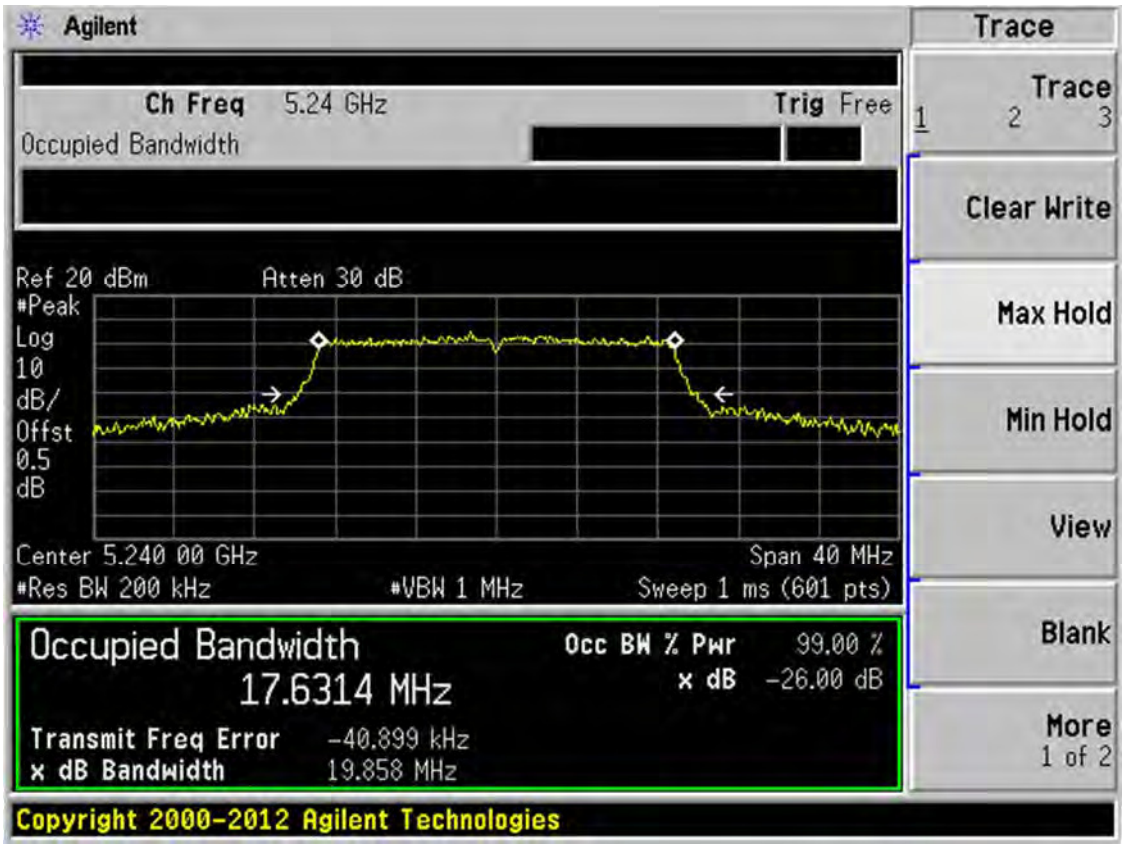
Band I 11n(HT20) CH36



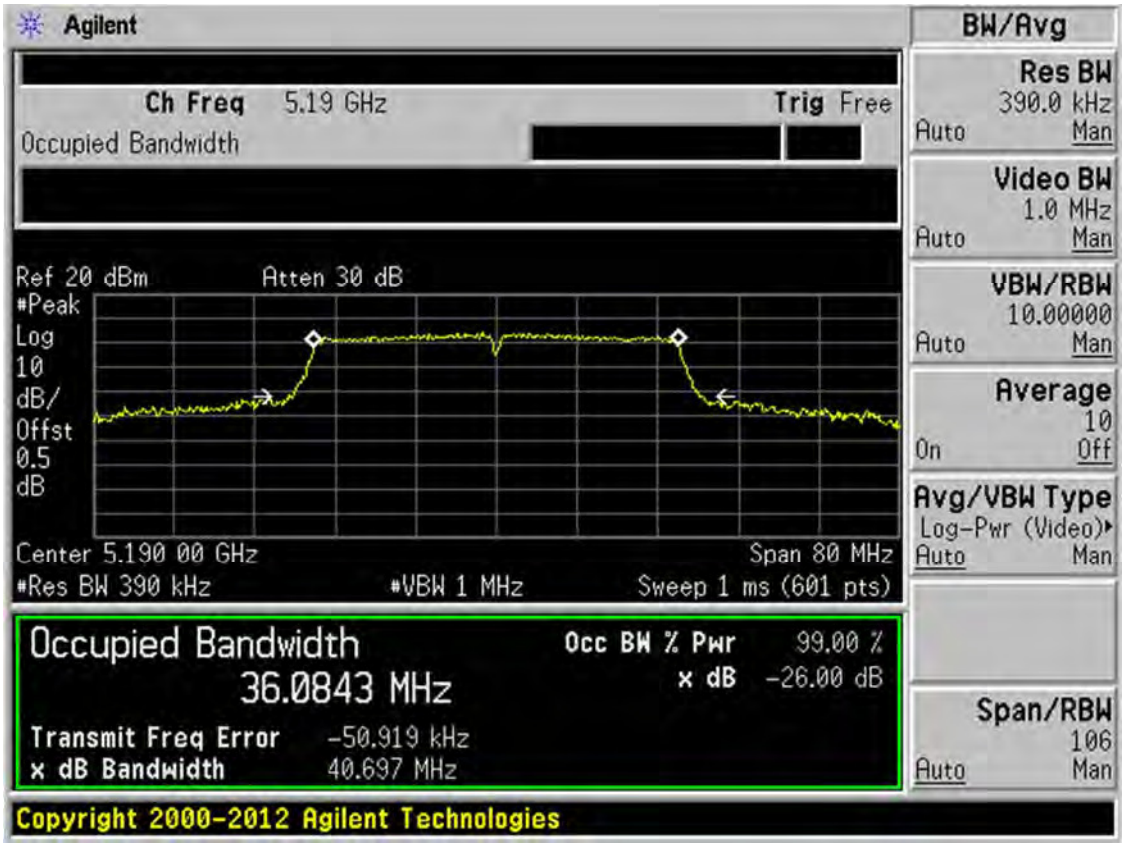
Band I 11n(HT20) CH44



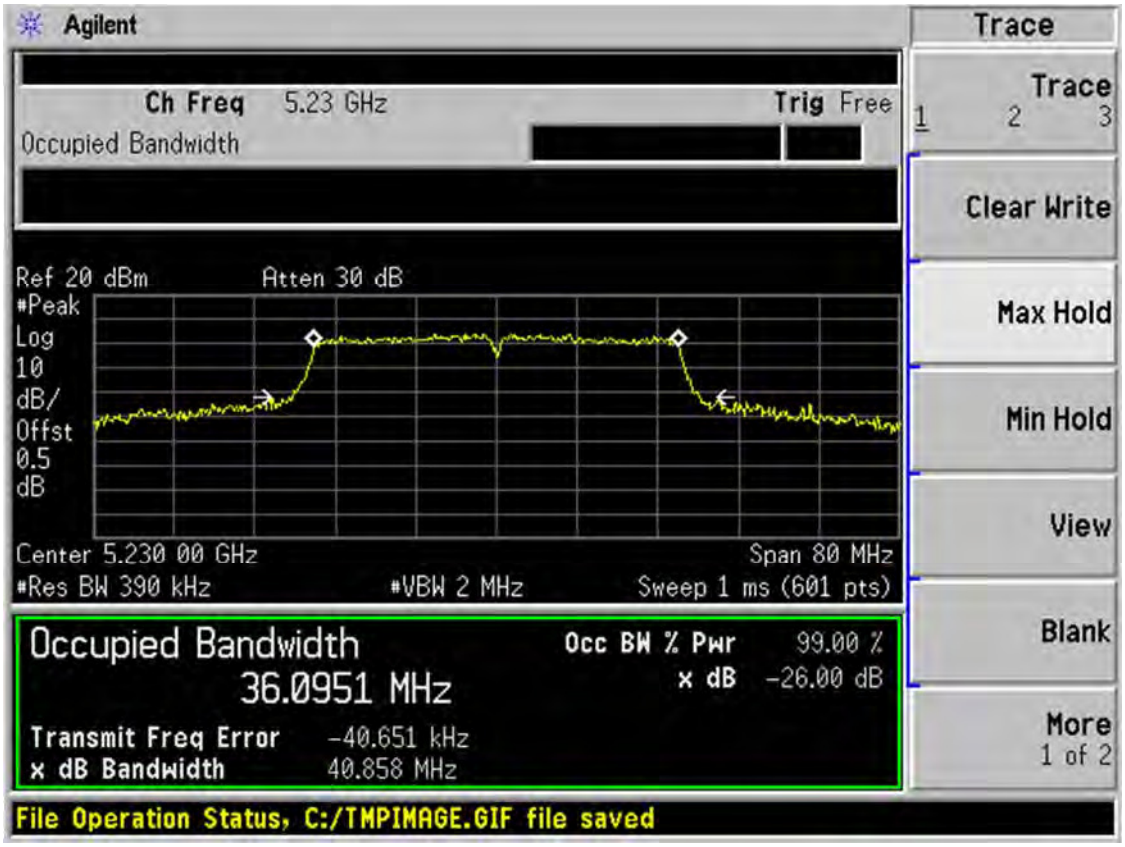
Band I 11n(HT20) CH48



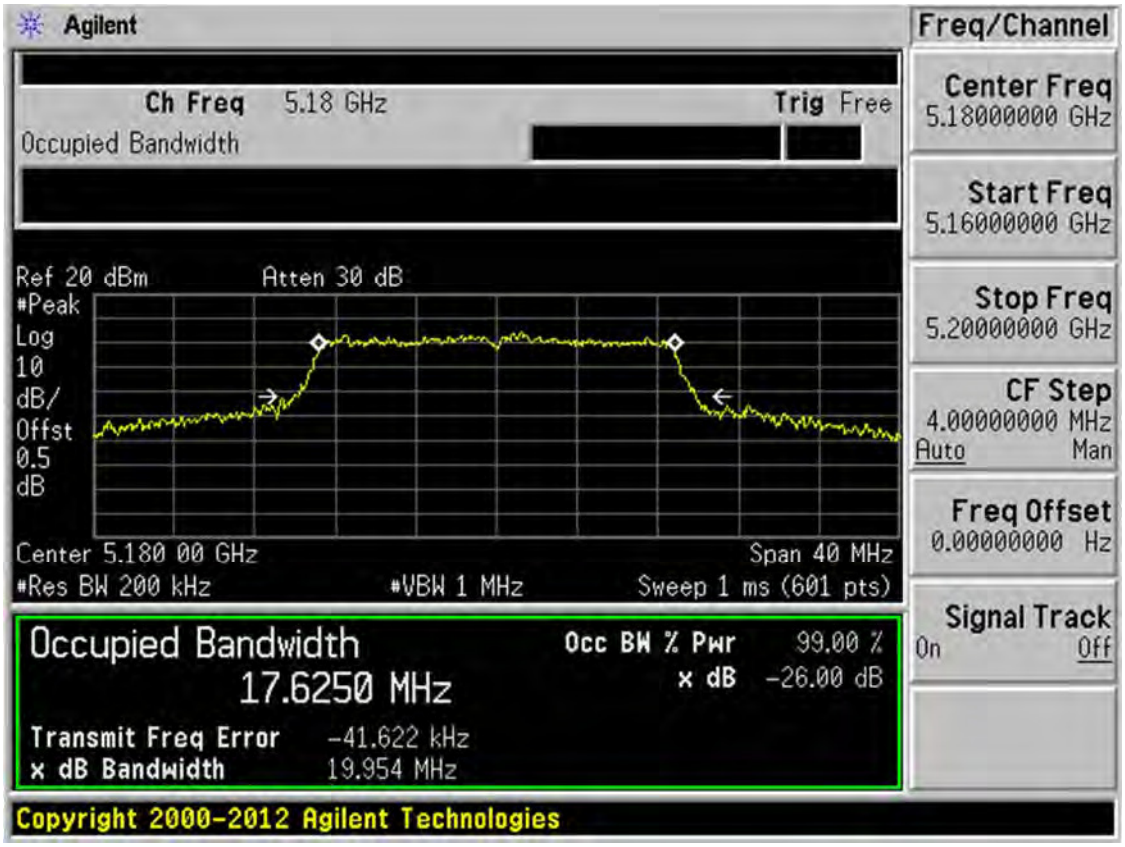
Band I 11n(HT40) CH38



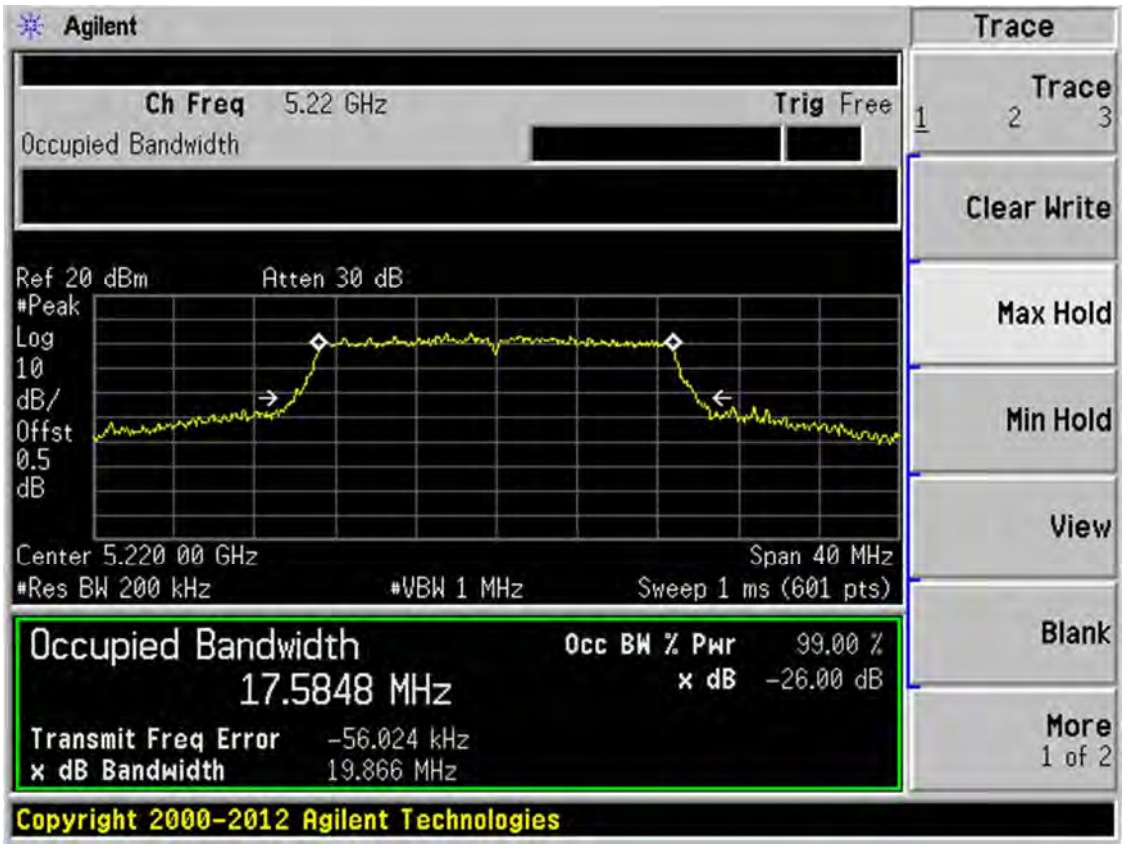
Band I 11n(HT40) CH46



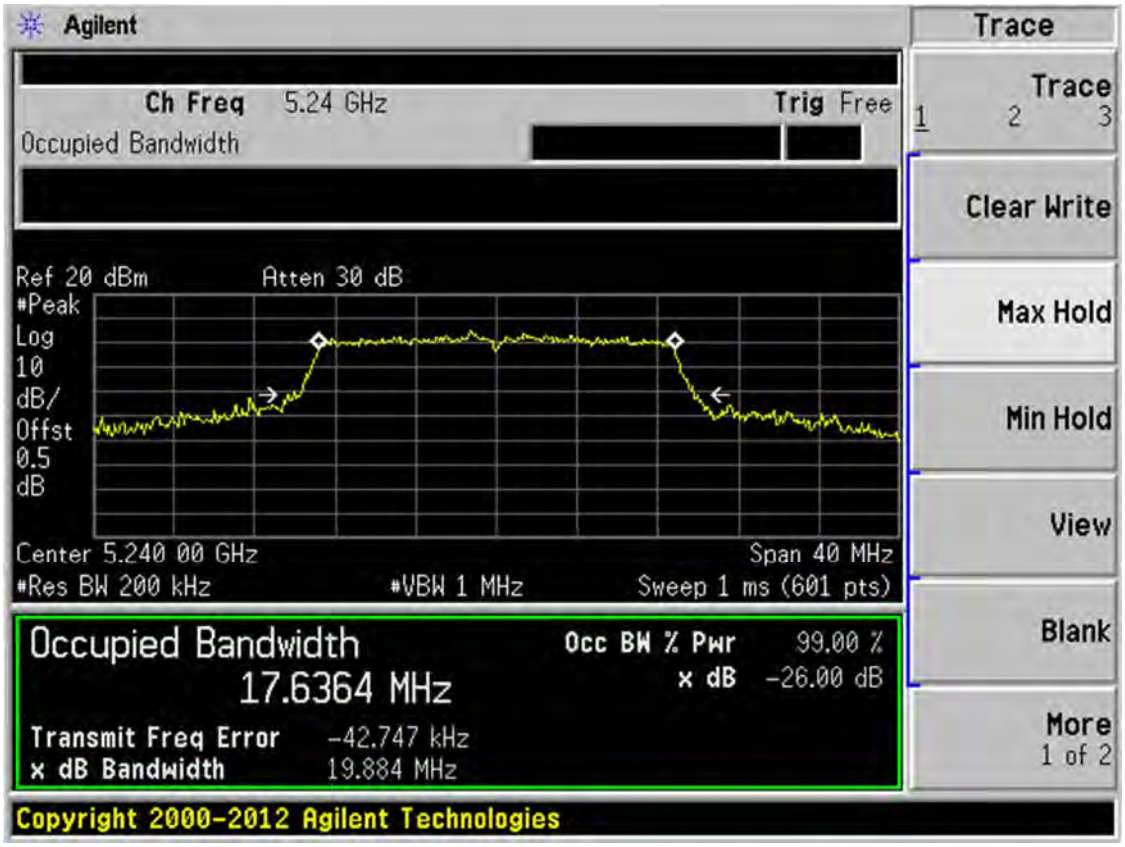
Band I 11ac(HT20) CH36



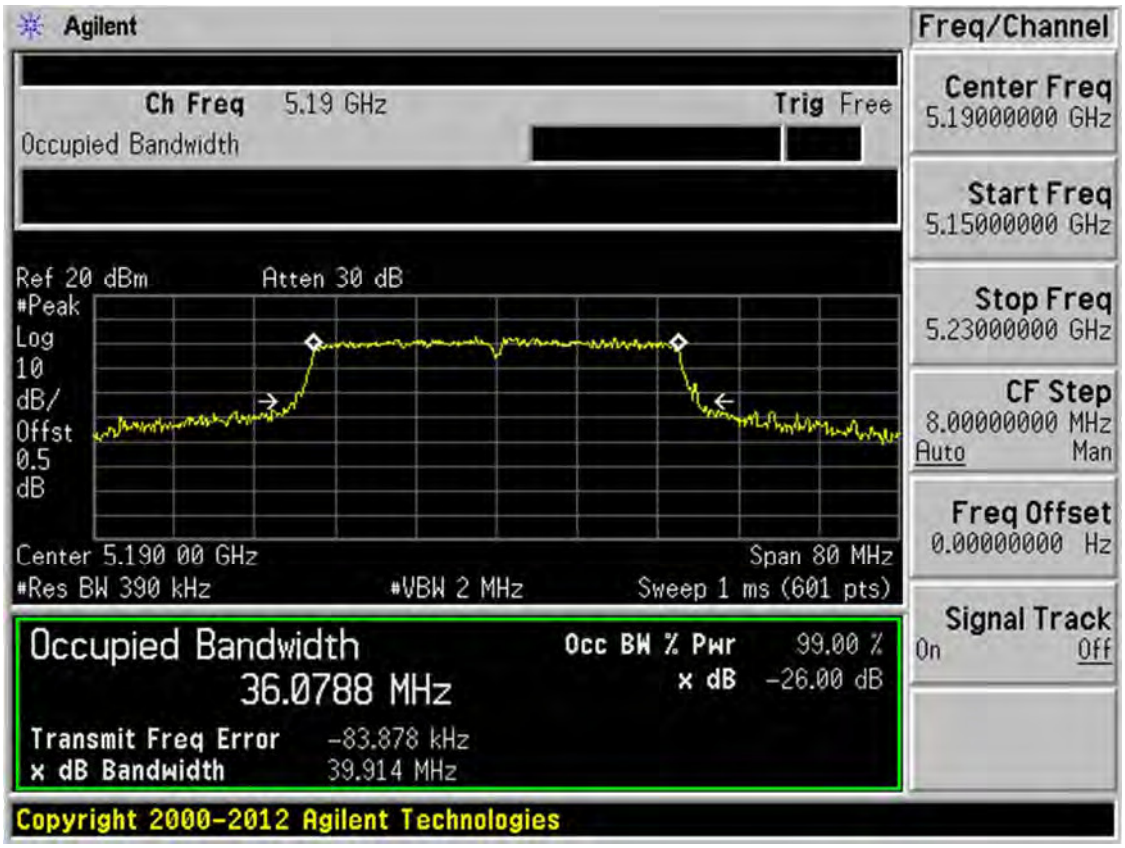
Band I 11ac(HT20) CH44



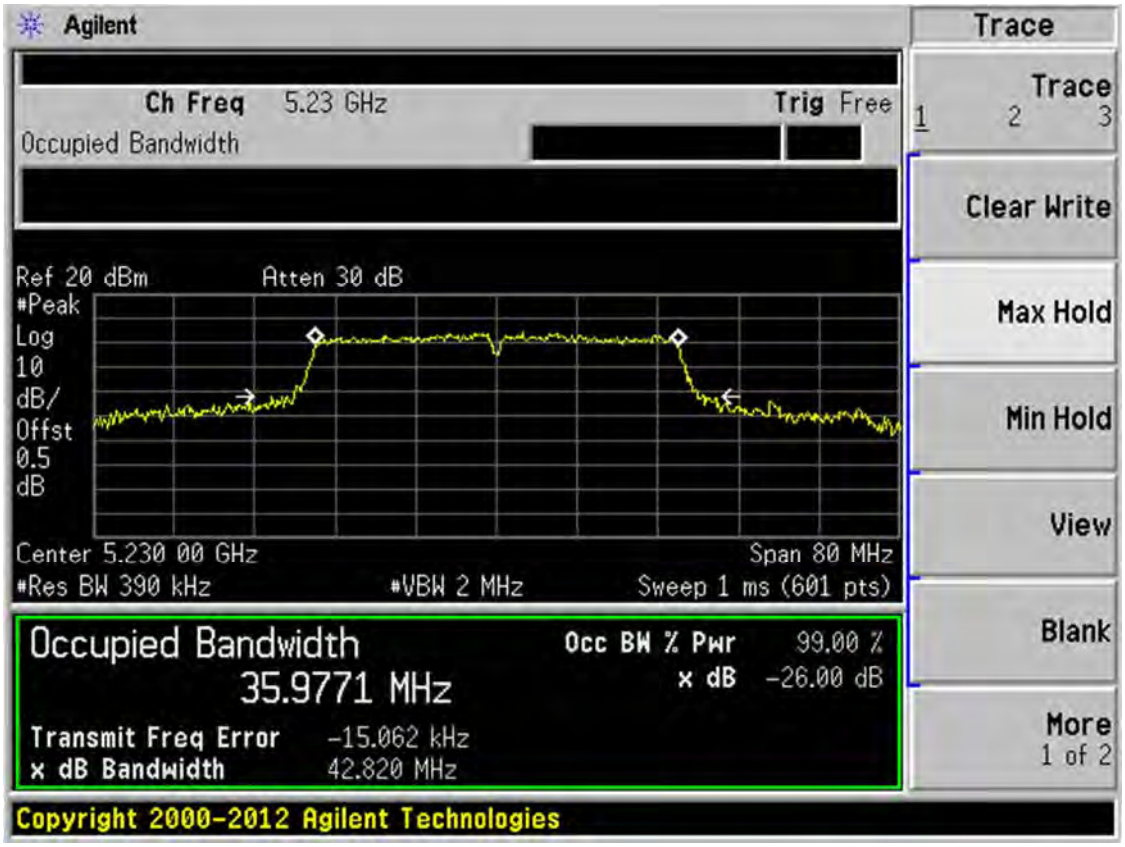
Band I 11ac(HT20) CH48



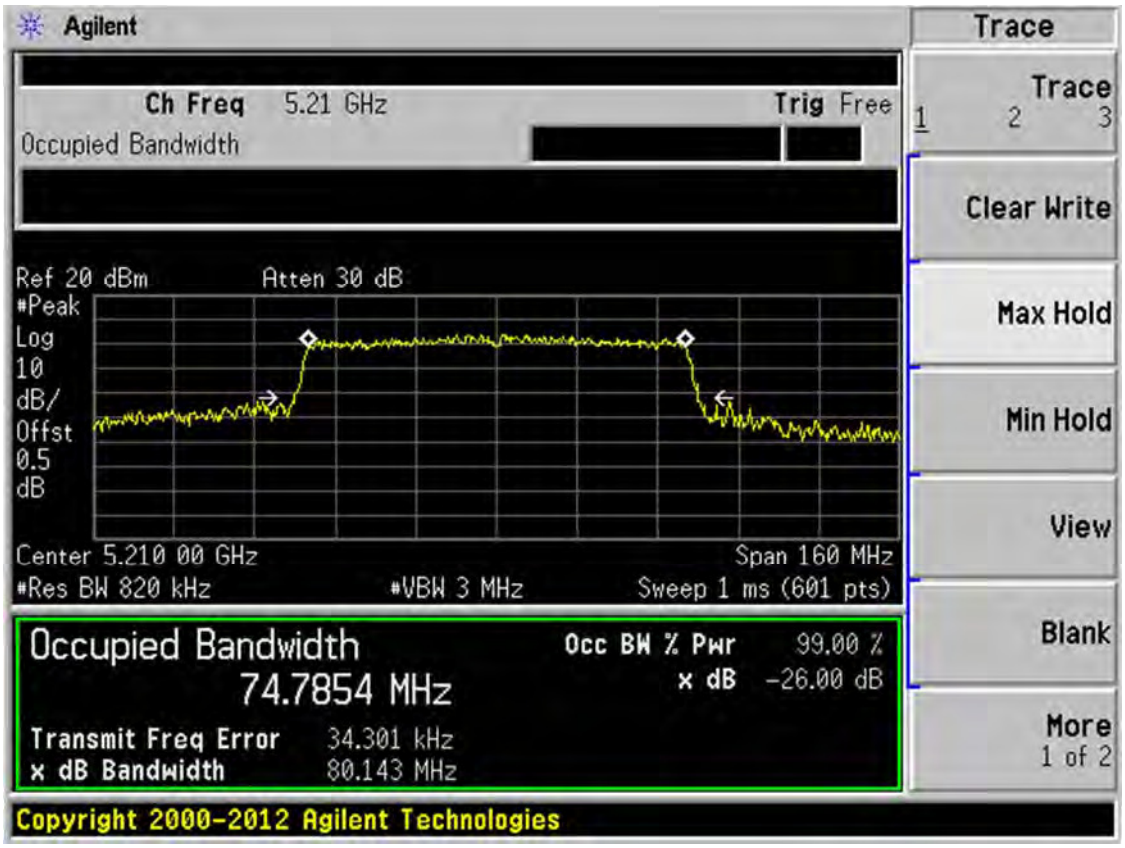
Band I 11ac(HT40) CH38



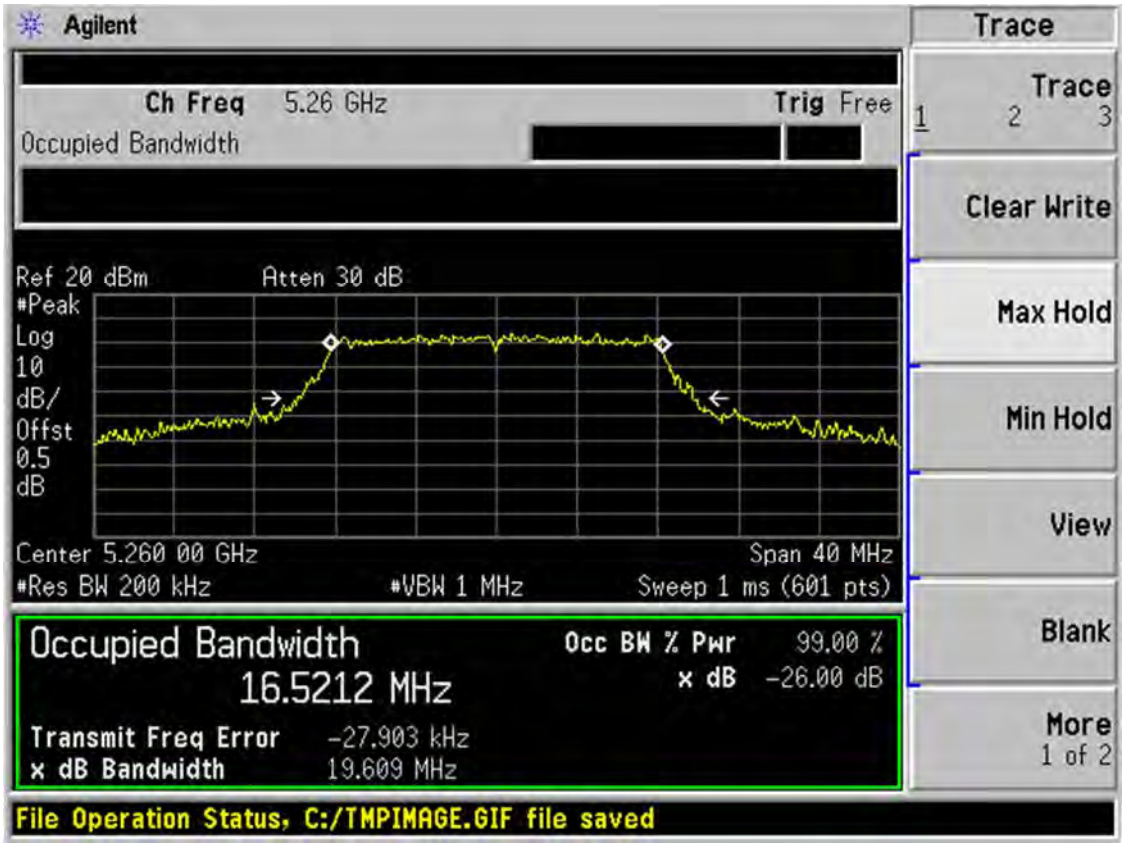
Band I 11ac(HT40) CH46



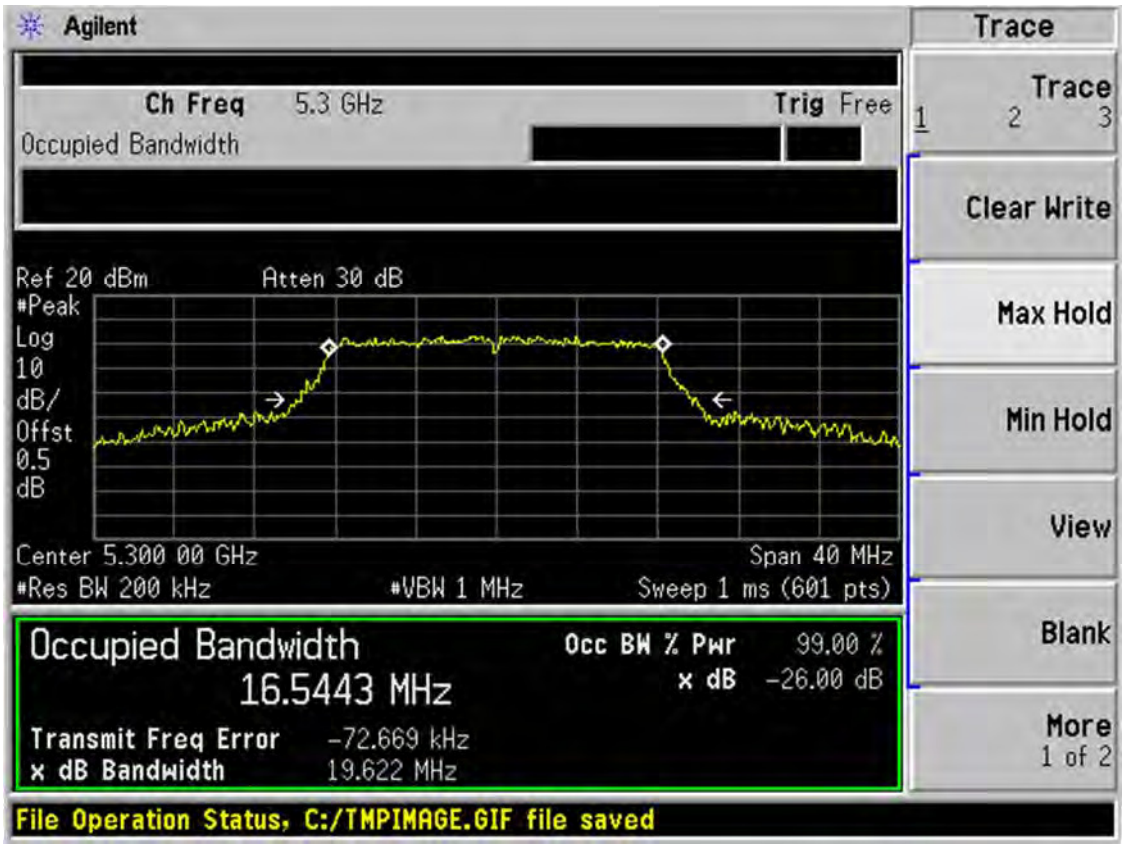
Band I 11ac(HT80) CH42



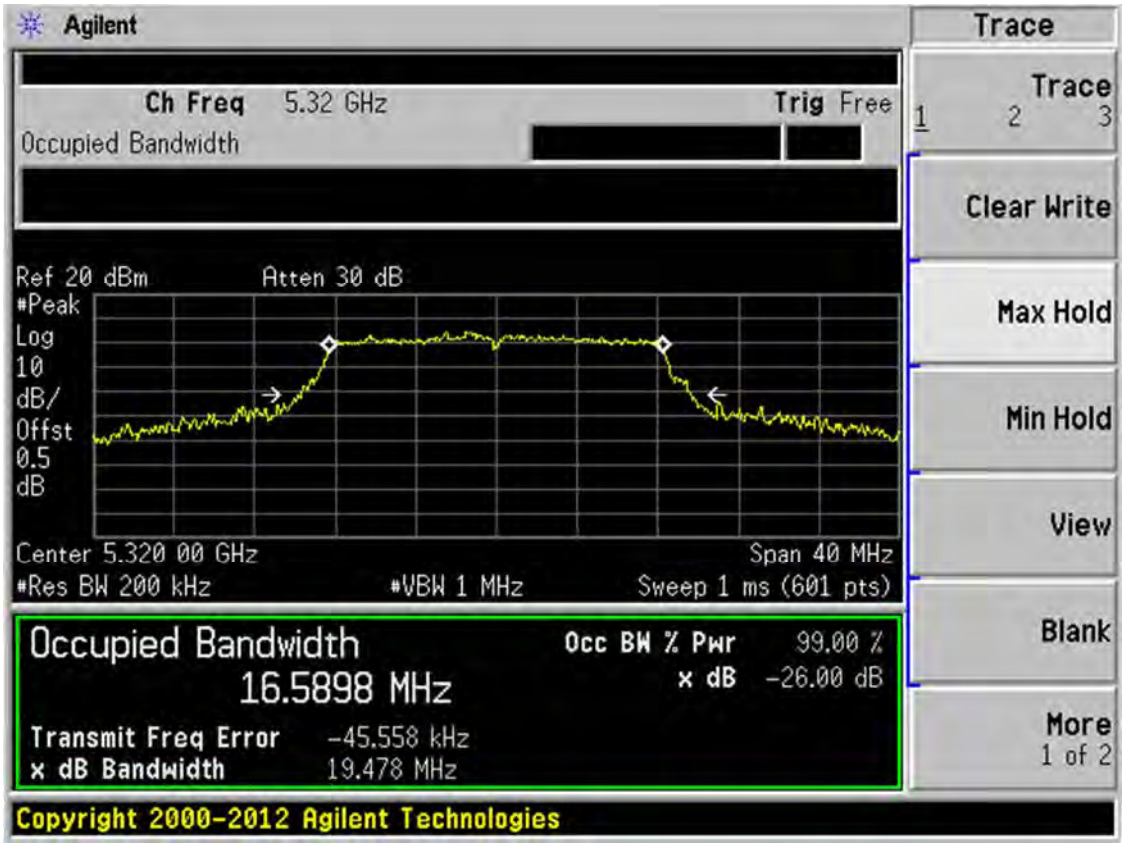
Band II 11a CH52



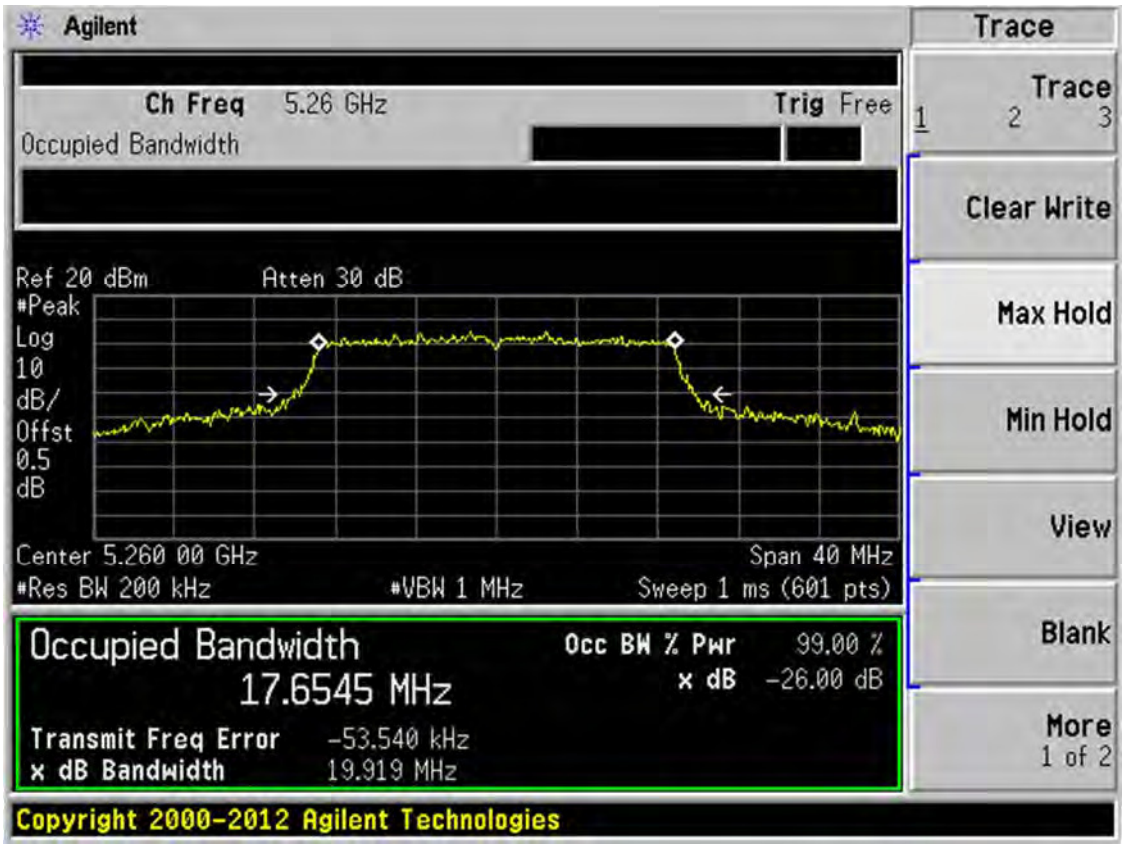
Band II 11a CH60



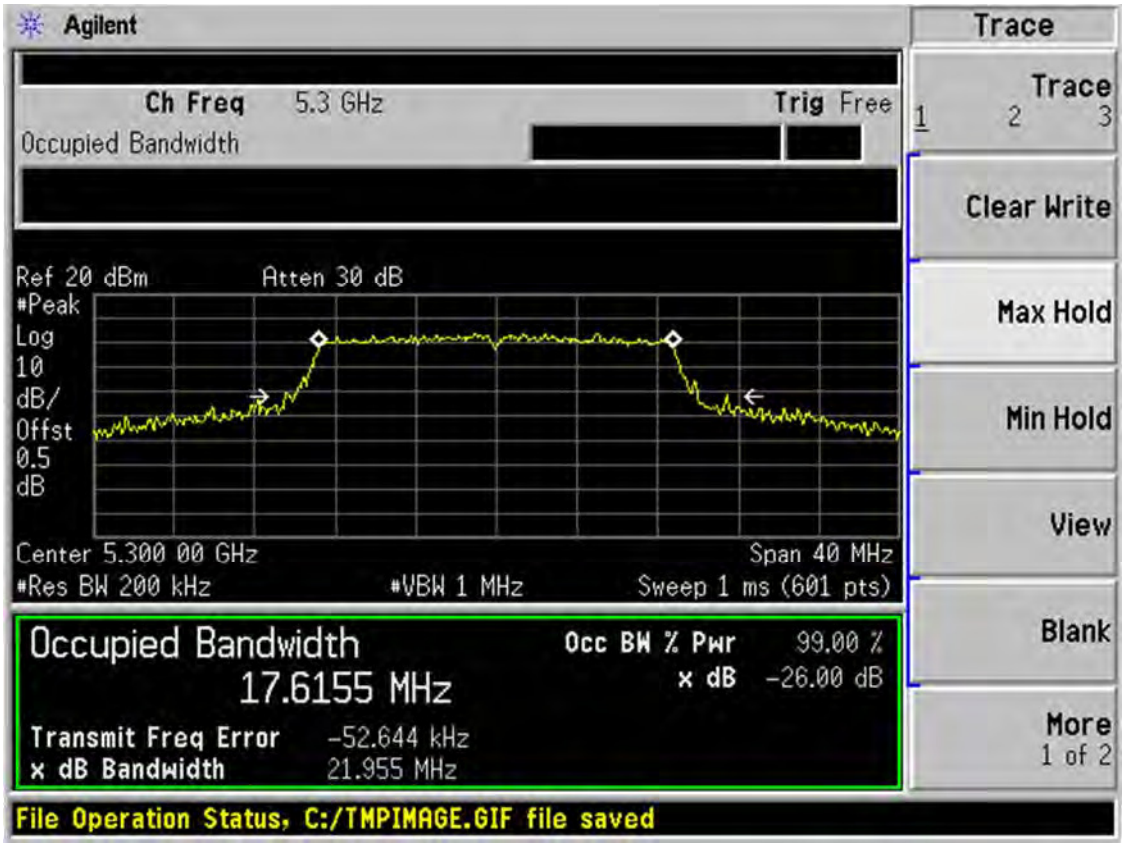
Band II 11a CH64



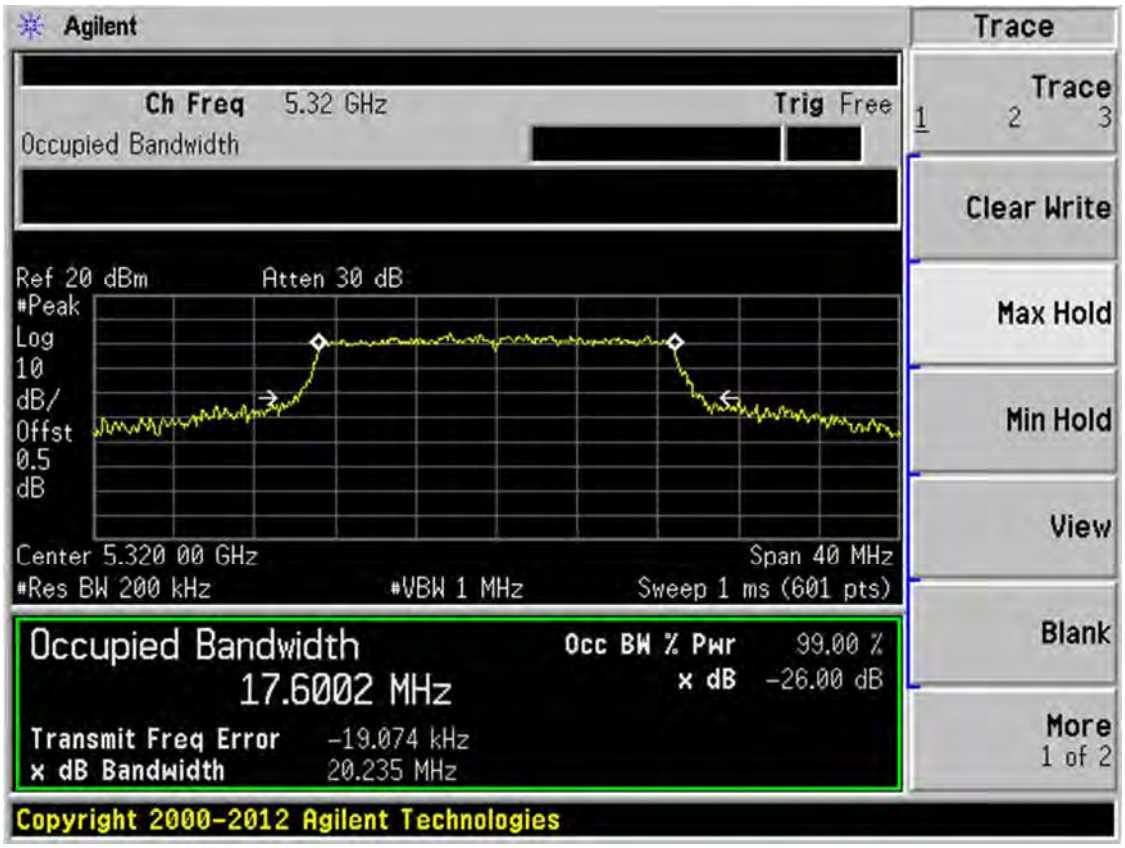
Band II 11n(HT20) CH52



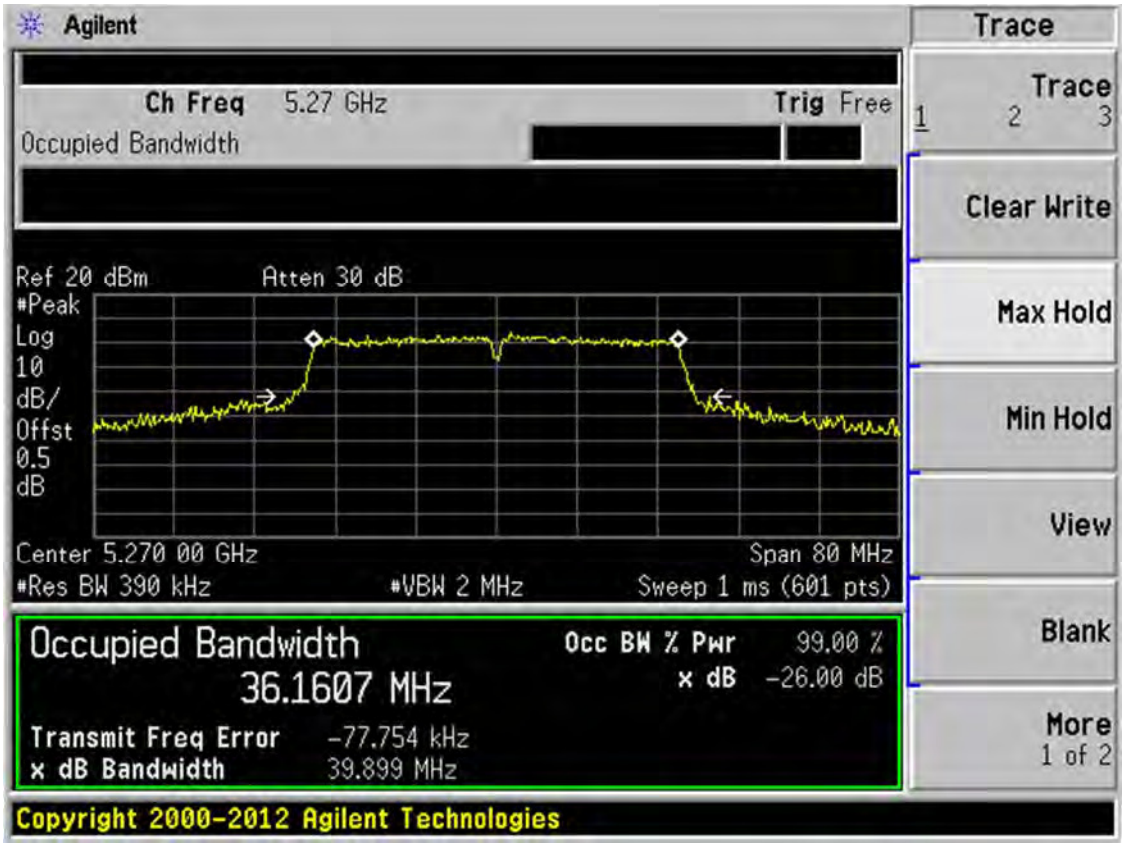
Band II 11n(HT20) CH60



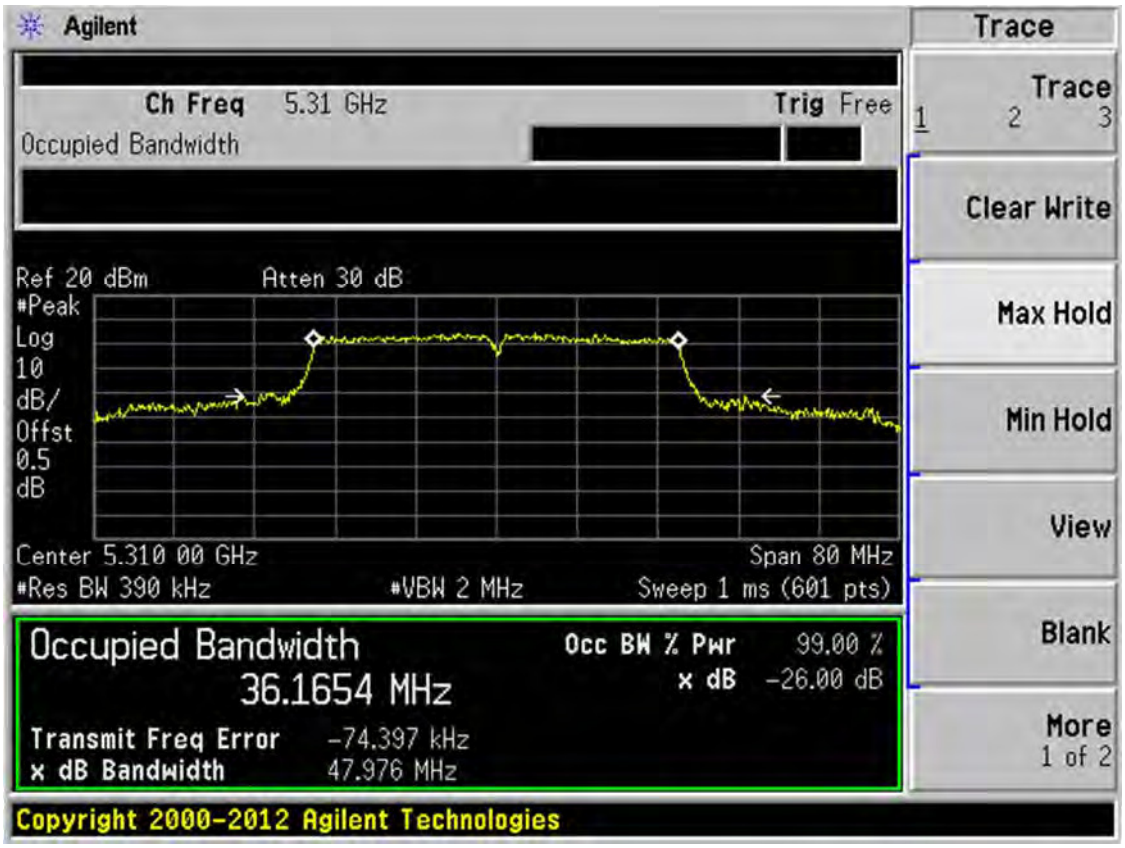
Band II 11n(HT20) CH64



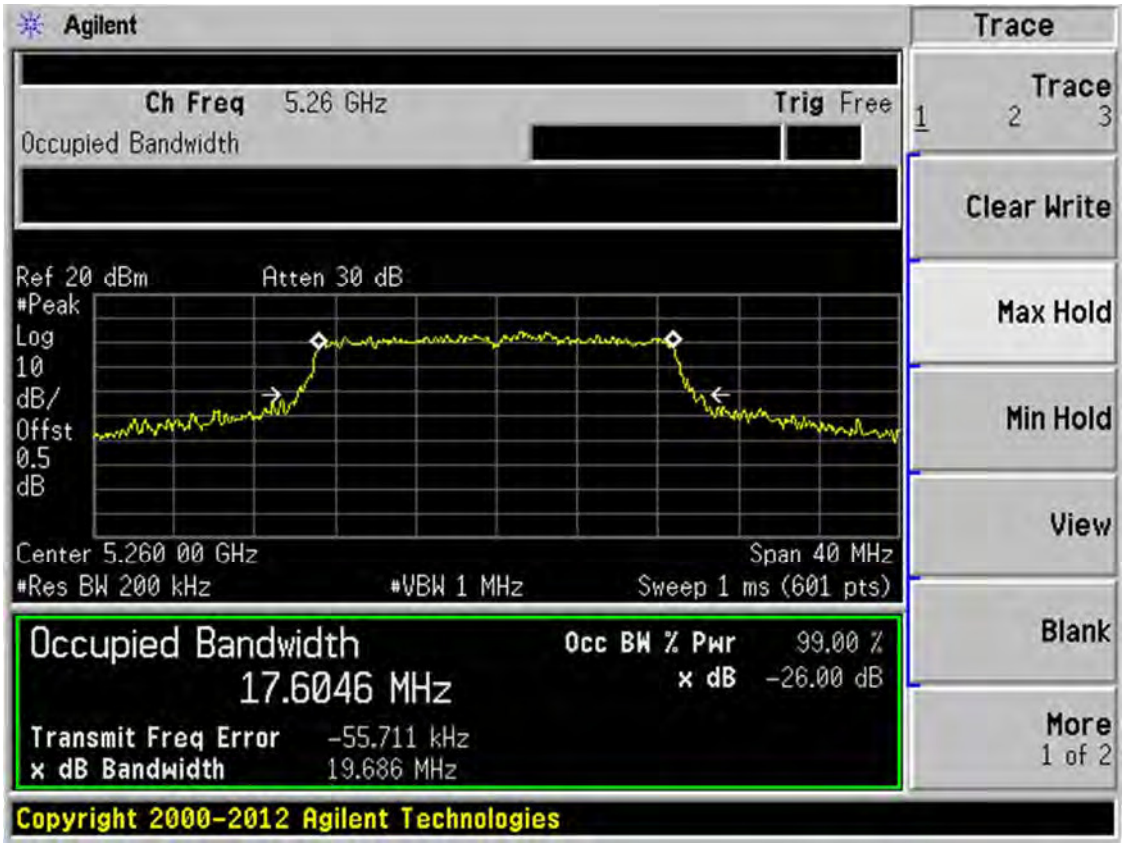
Band II 11n(HT40) CH54



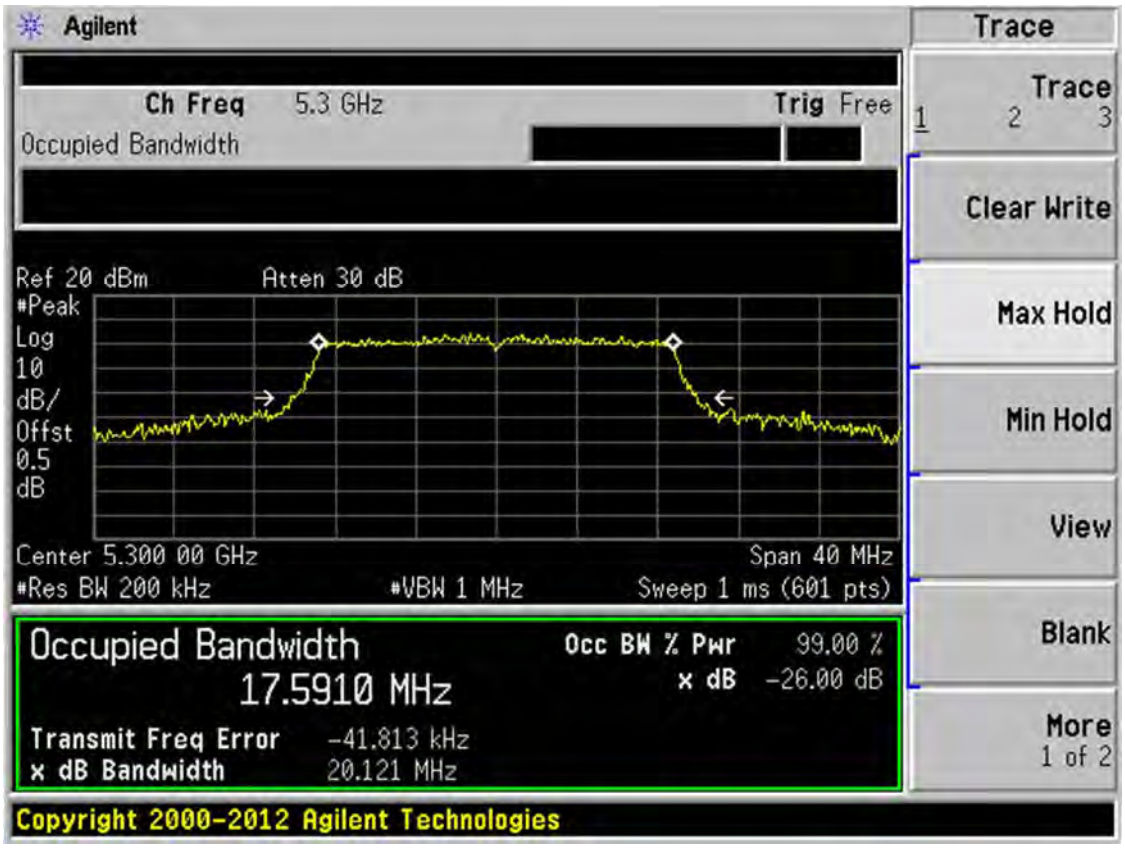
Band II 11n(HT40) CH62



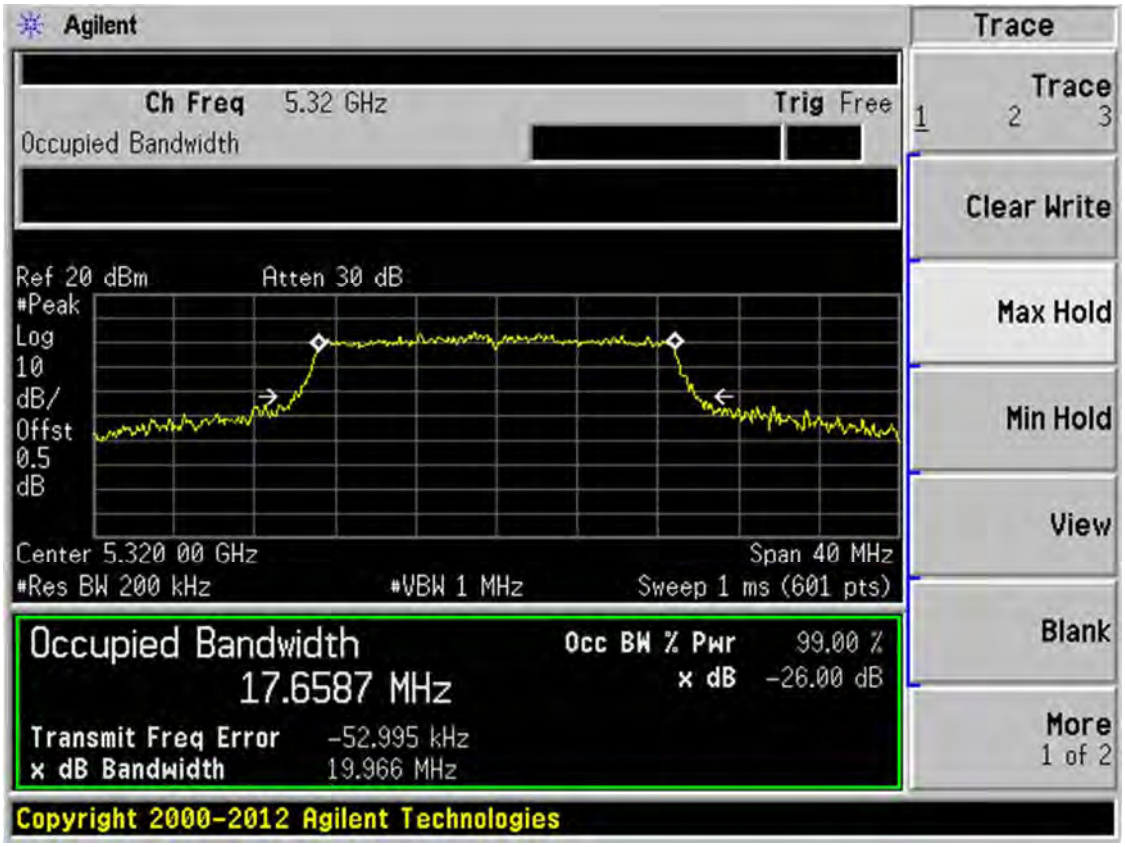
Band II 11ac(HT20) CH52



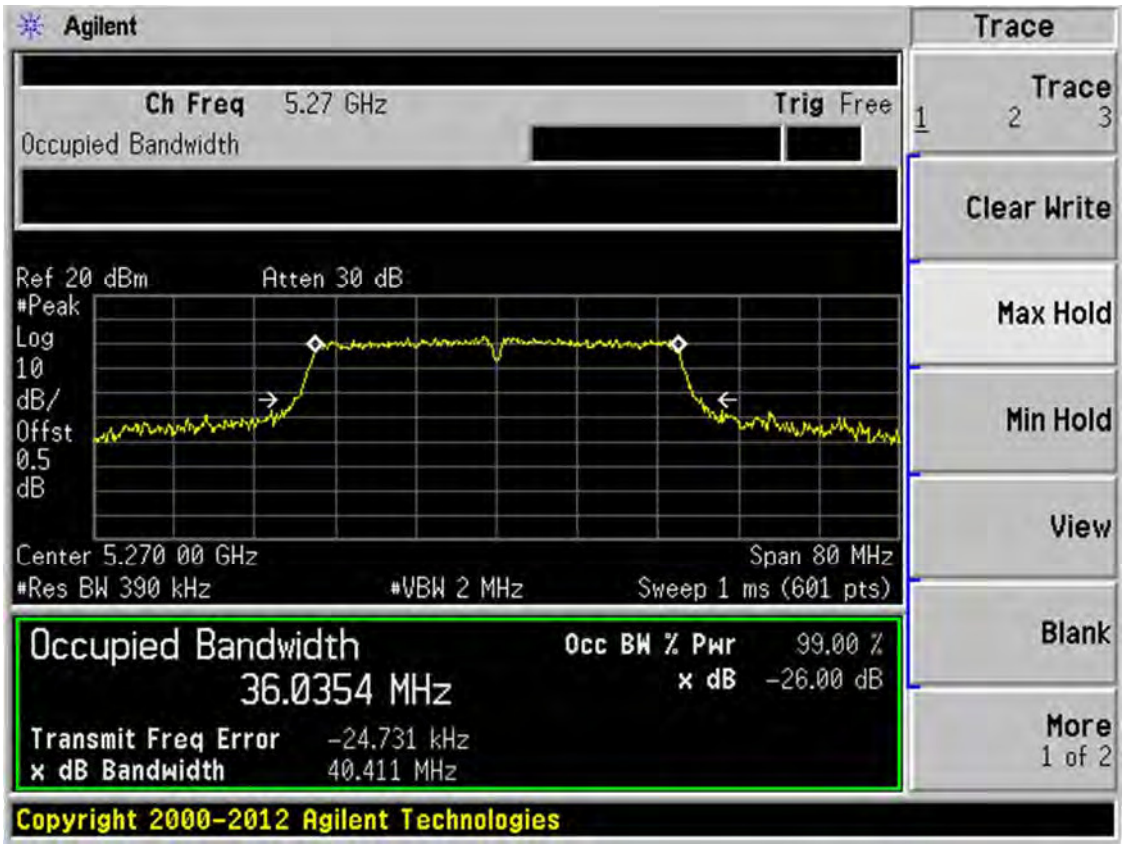
Band II 11ac(HT20) CH60



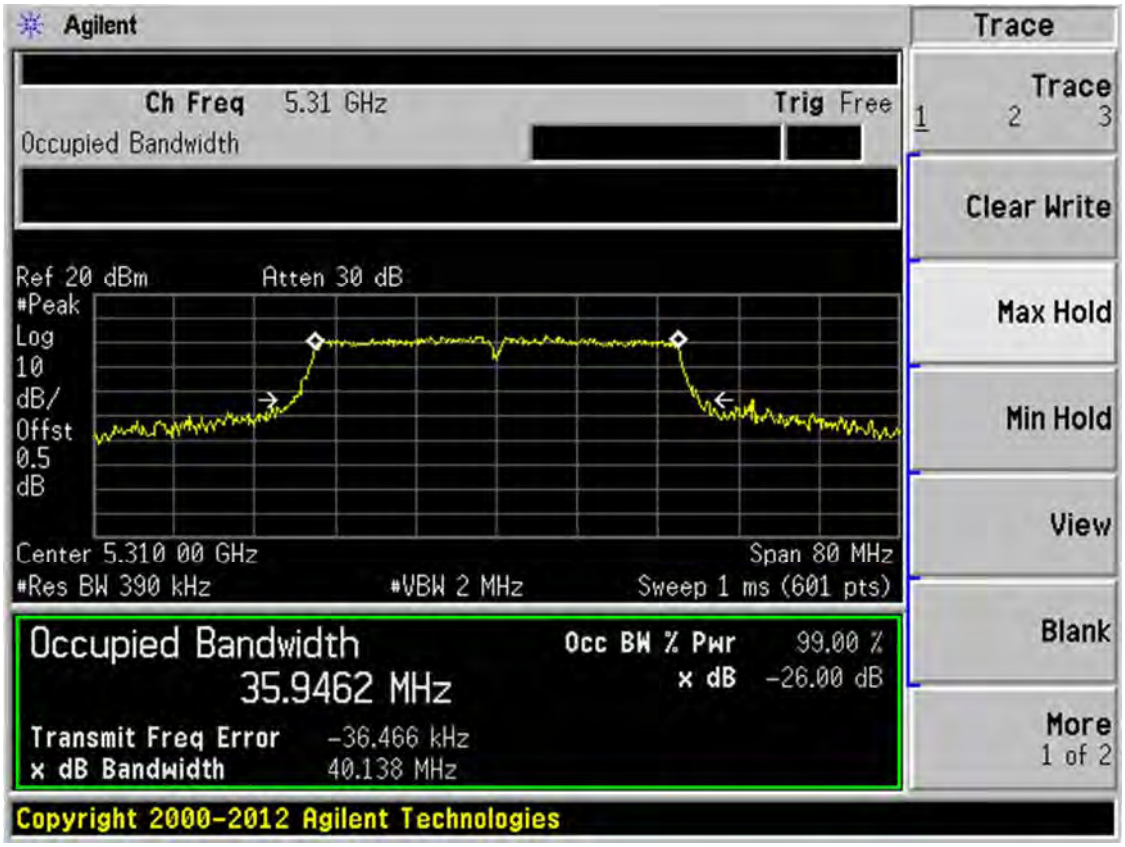
Band II 11ac(HT20) CH64



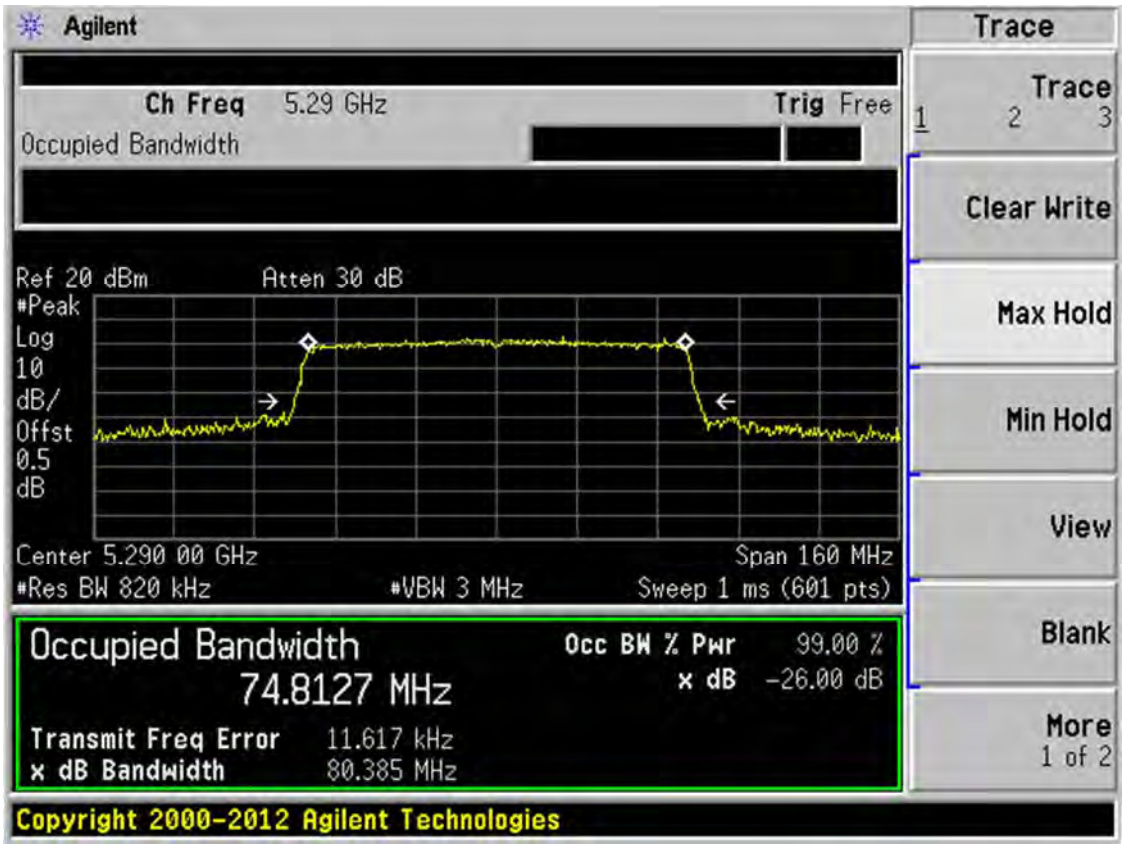
Band II 11ac(HT40) CH54



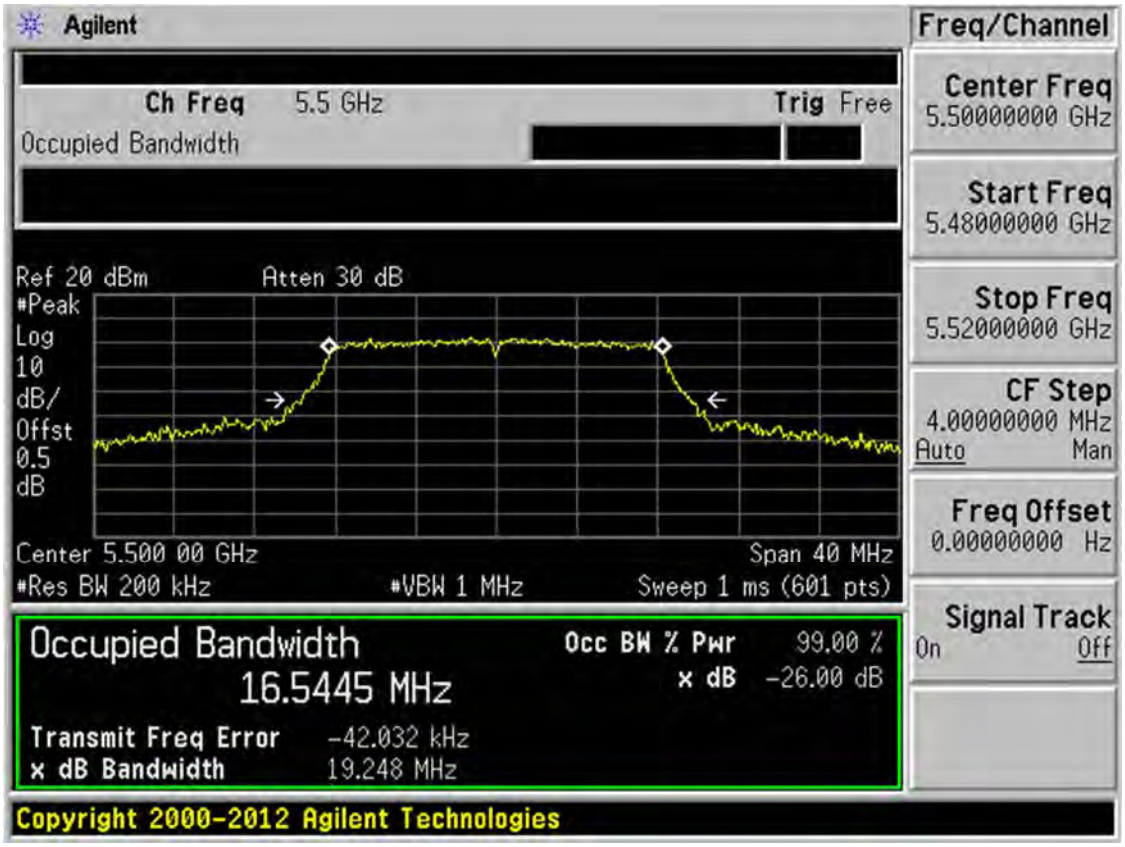
Band II 11ac(HT40) CH62



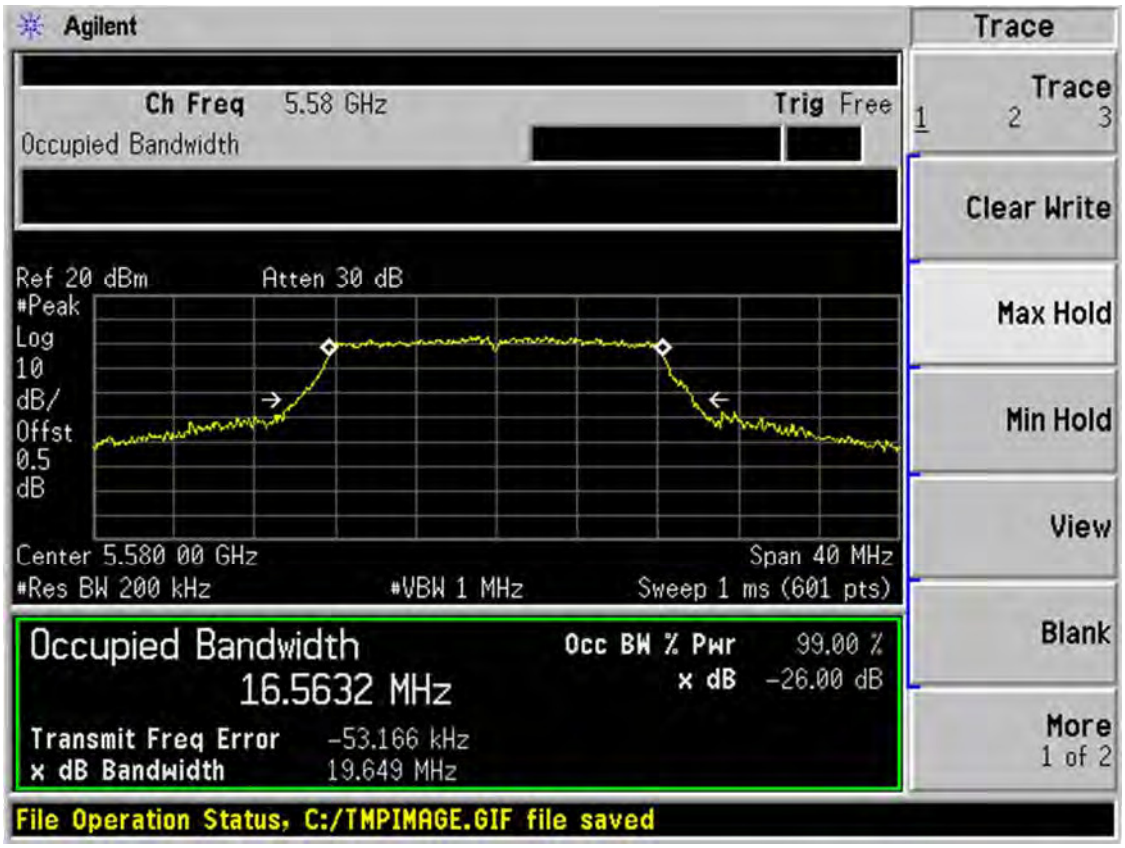
Band II 11ac(HT80) CH58



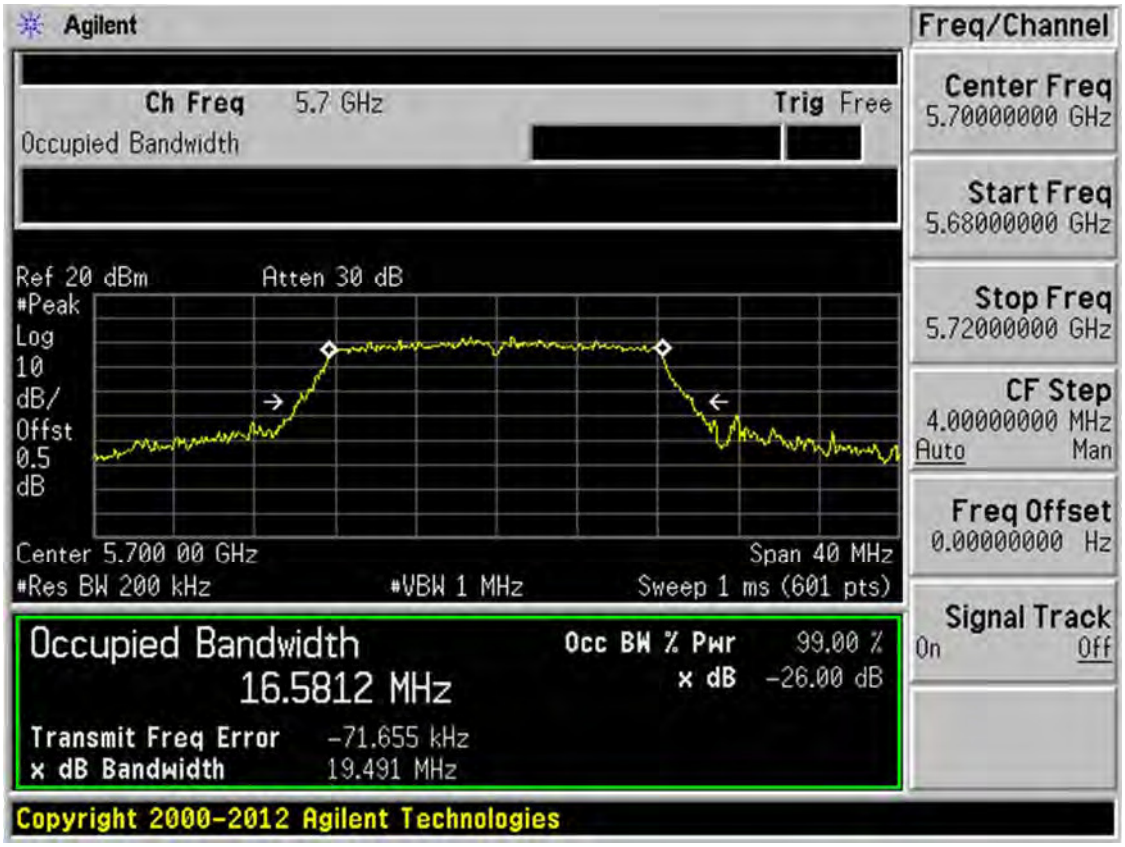
Band III 11a CH100



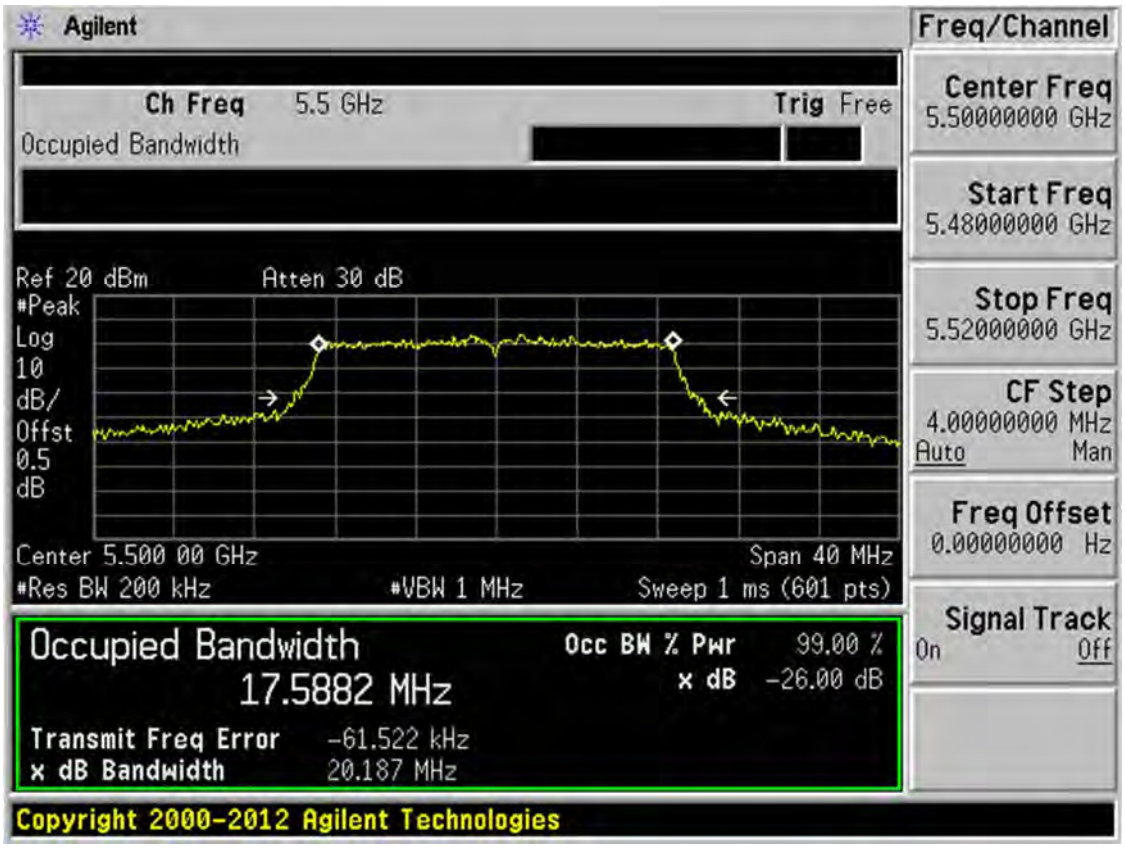
Band III 11a CH116



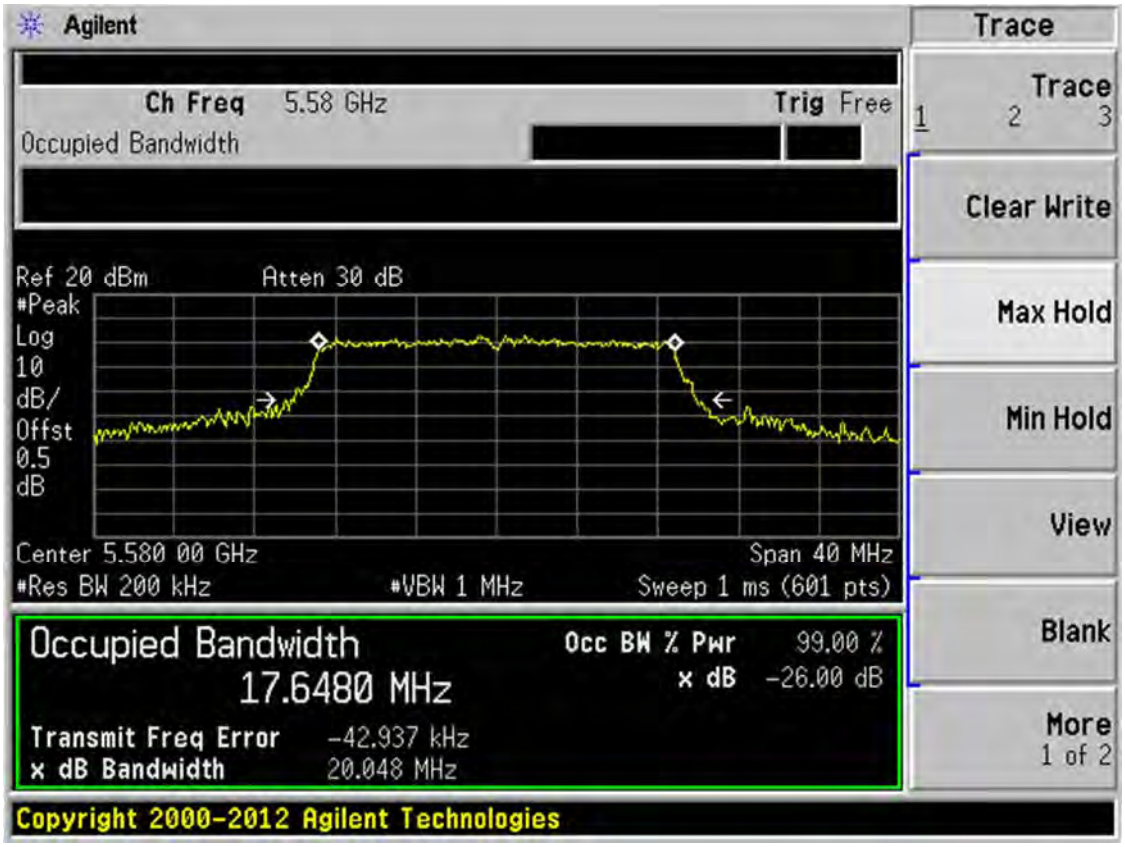
Band III 11a CH140



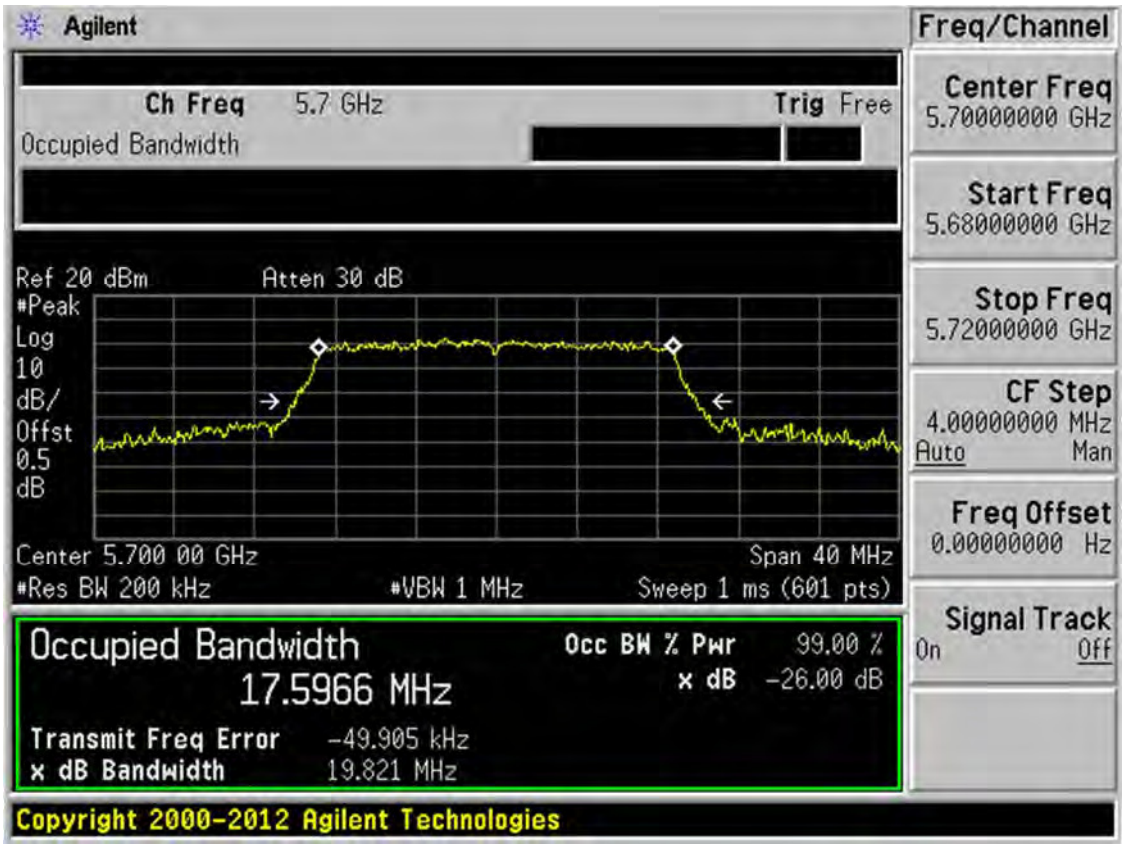
Band III 11n(HT20) CH100



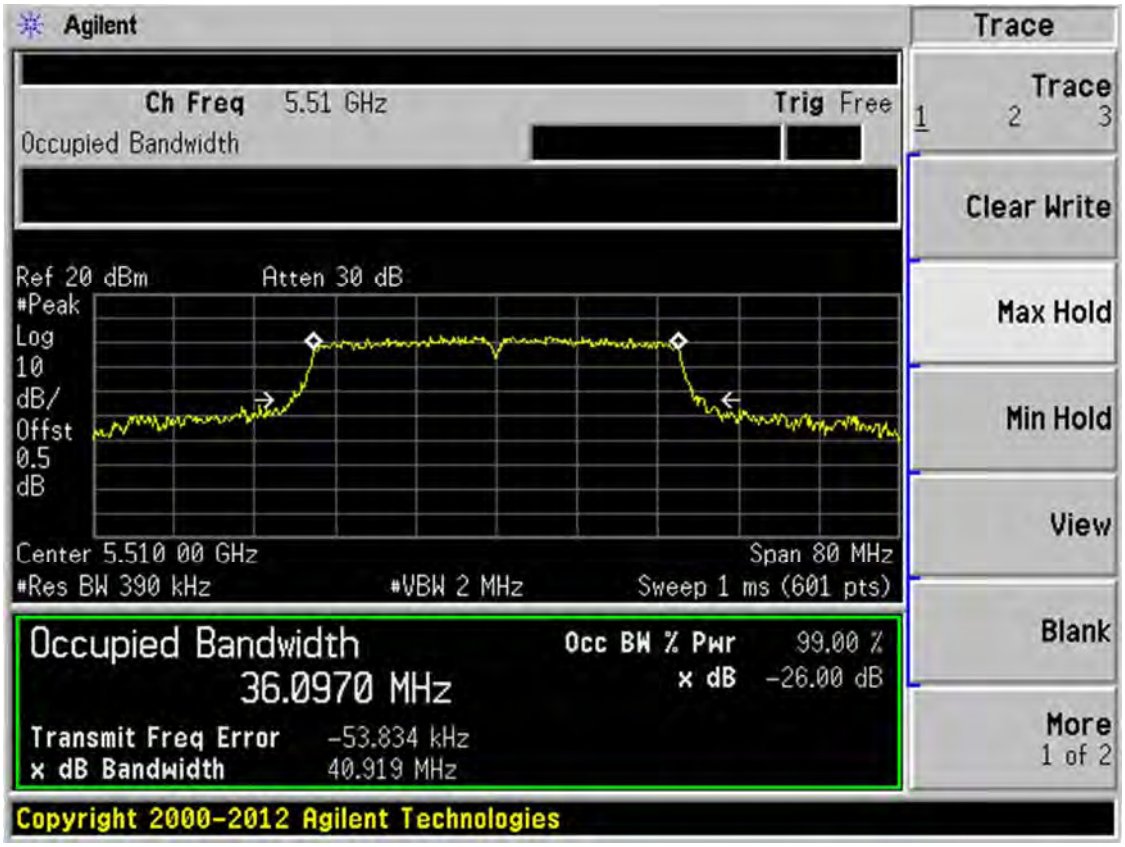
Band III 11n(HT20) CH116



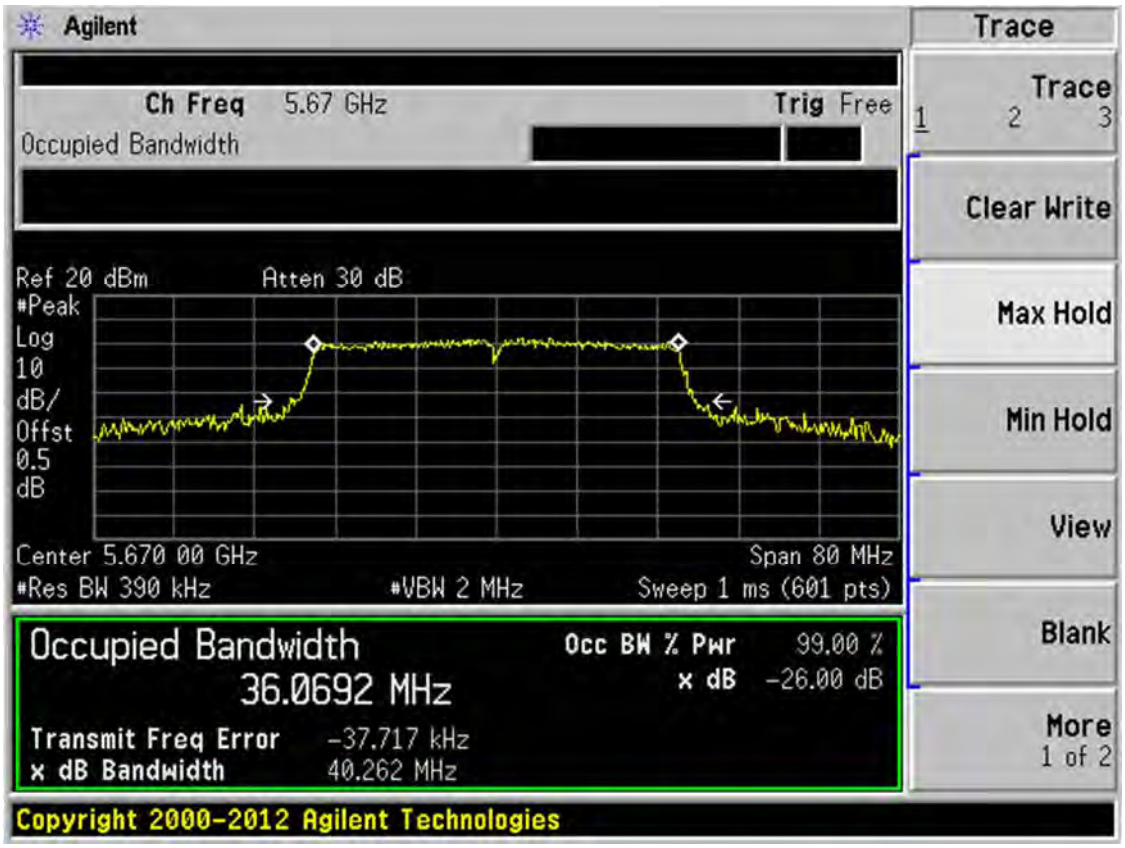
Band III 11n(HT20) CH140



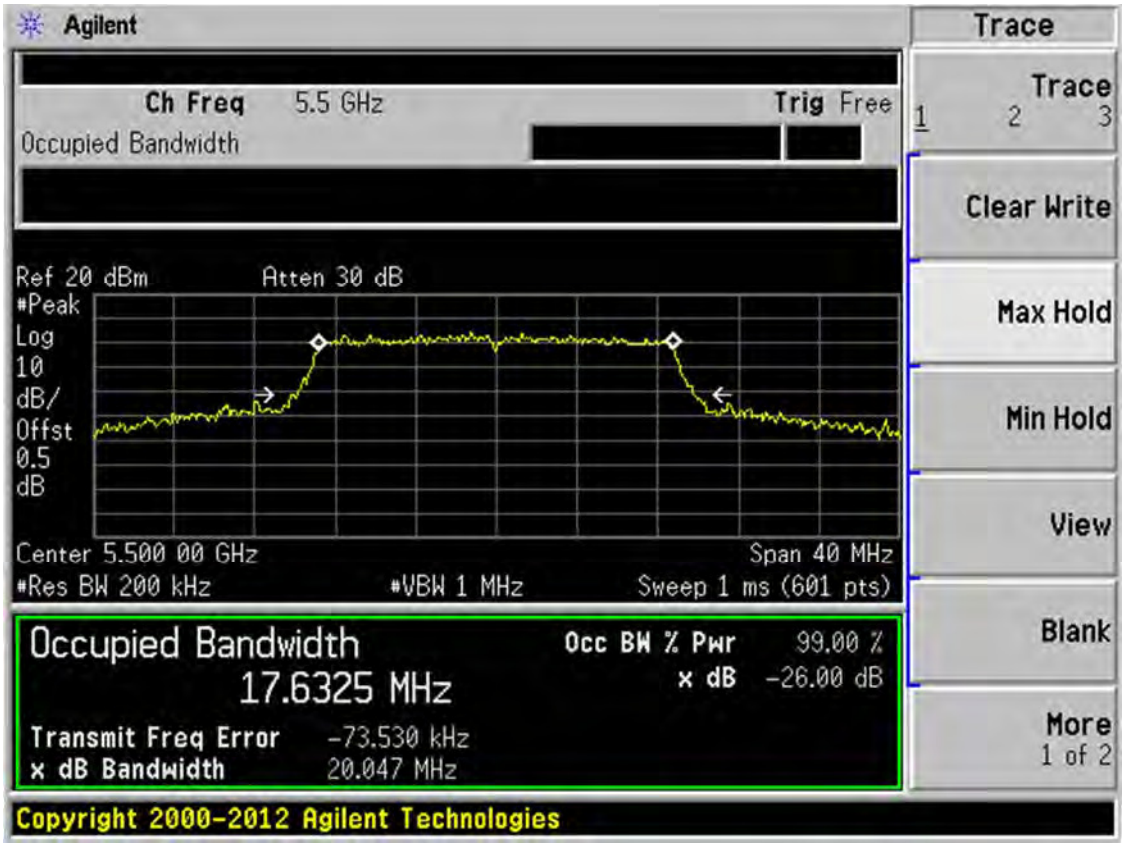
Band III 11n(HT40) CH102



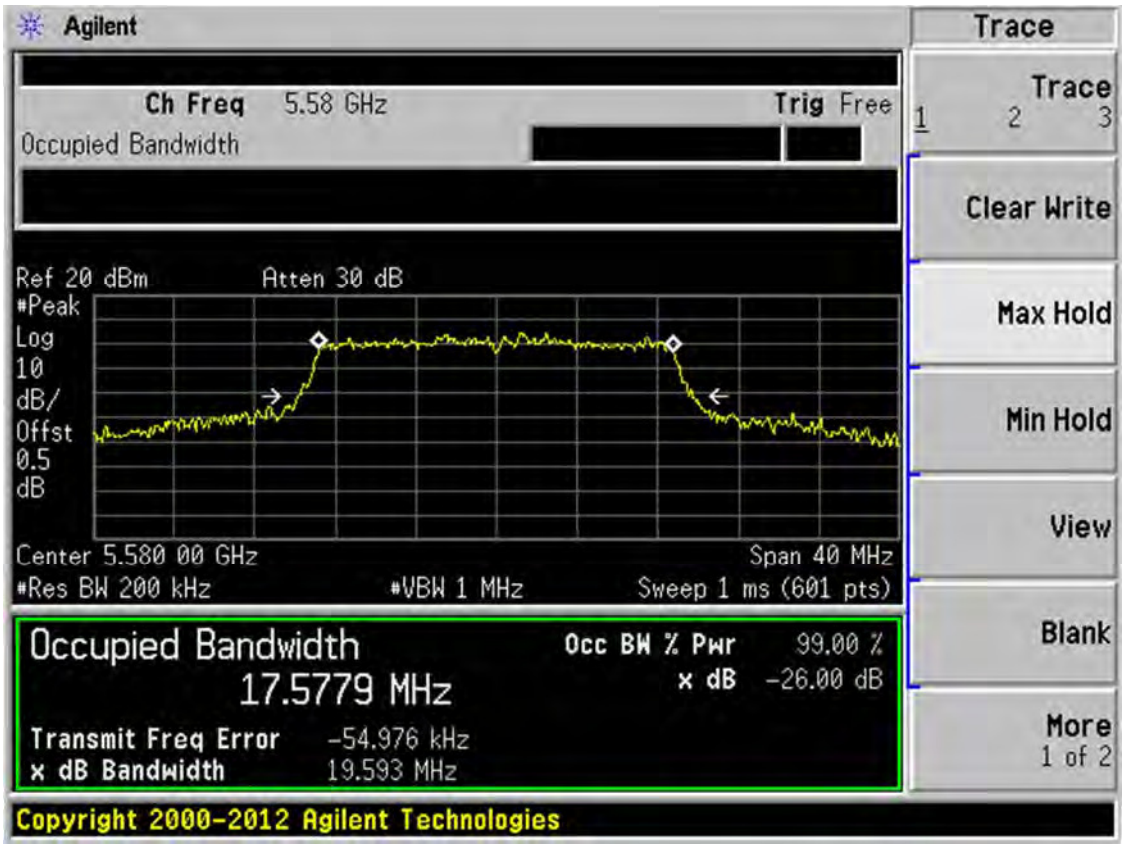
Band III 11n(HT40) CH134



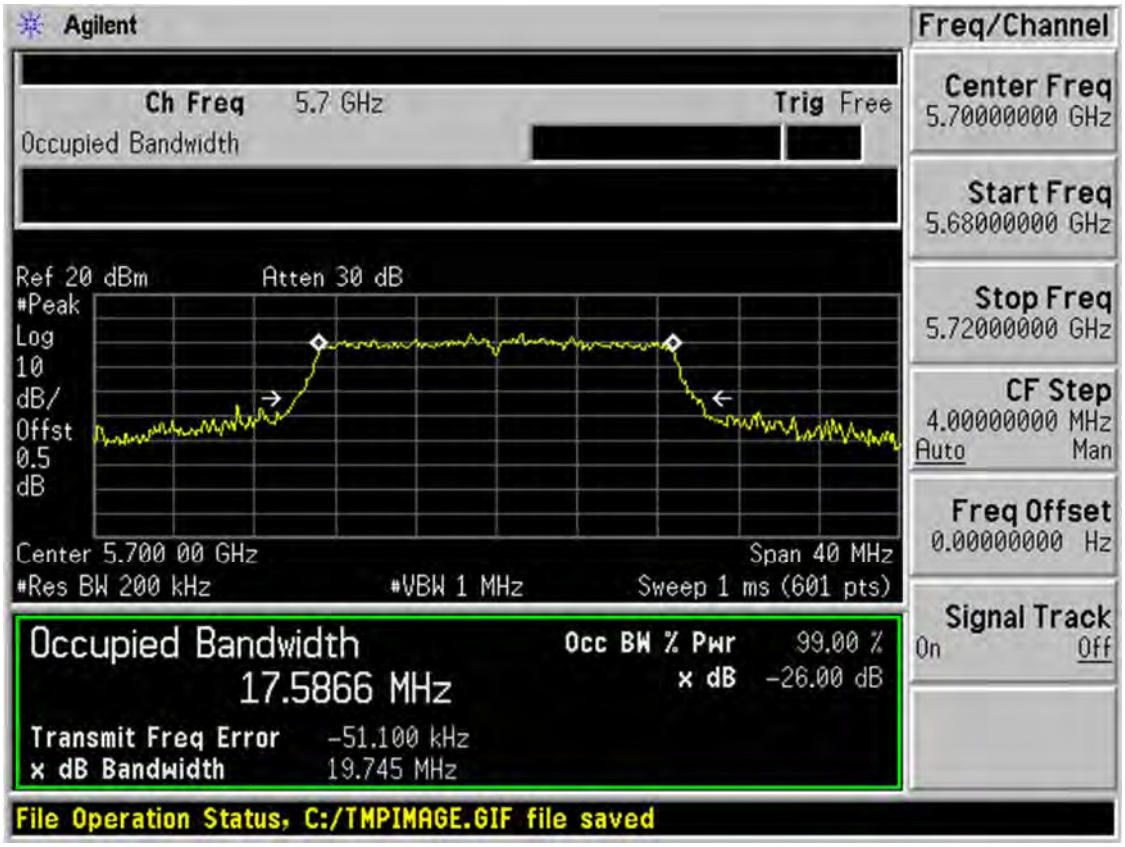
Band III 11ac(HT20) CH100



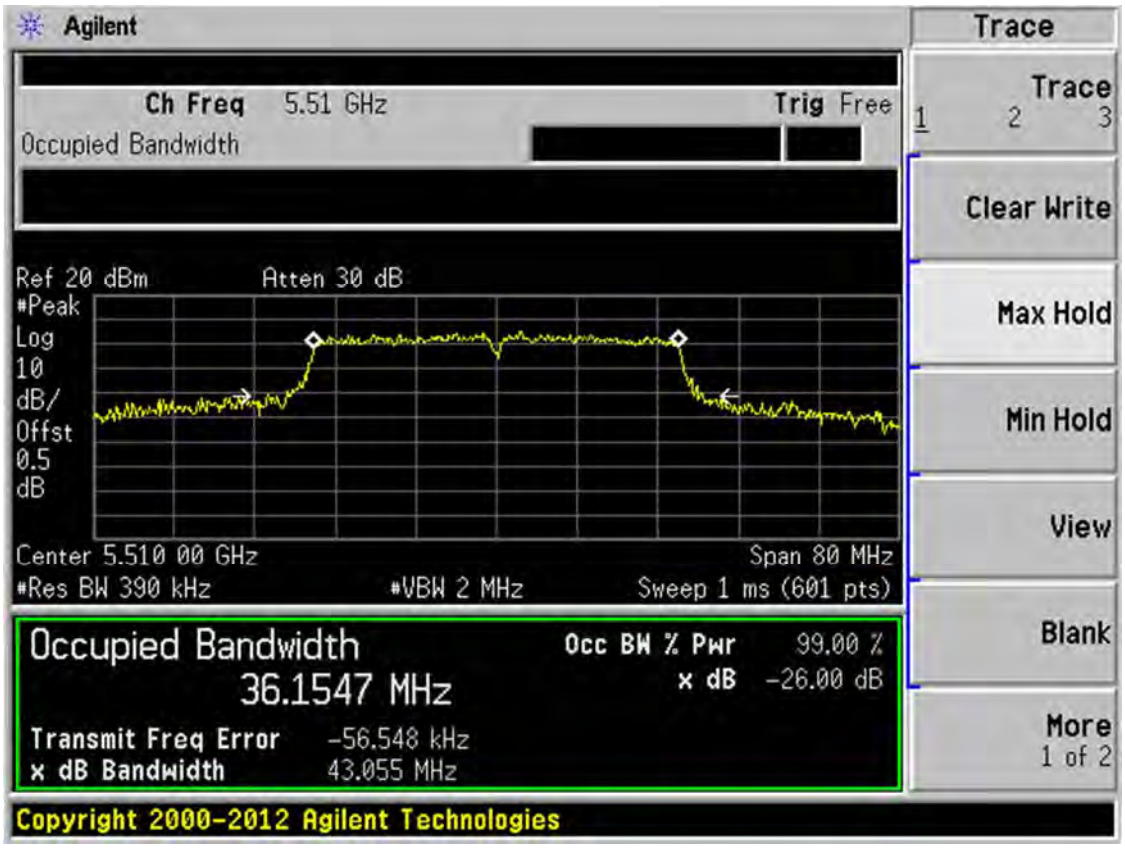
Band III 11ac(HT20) CH116



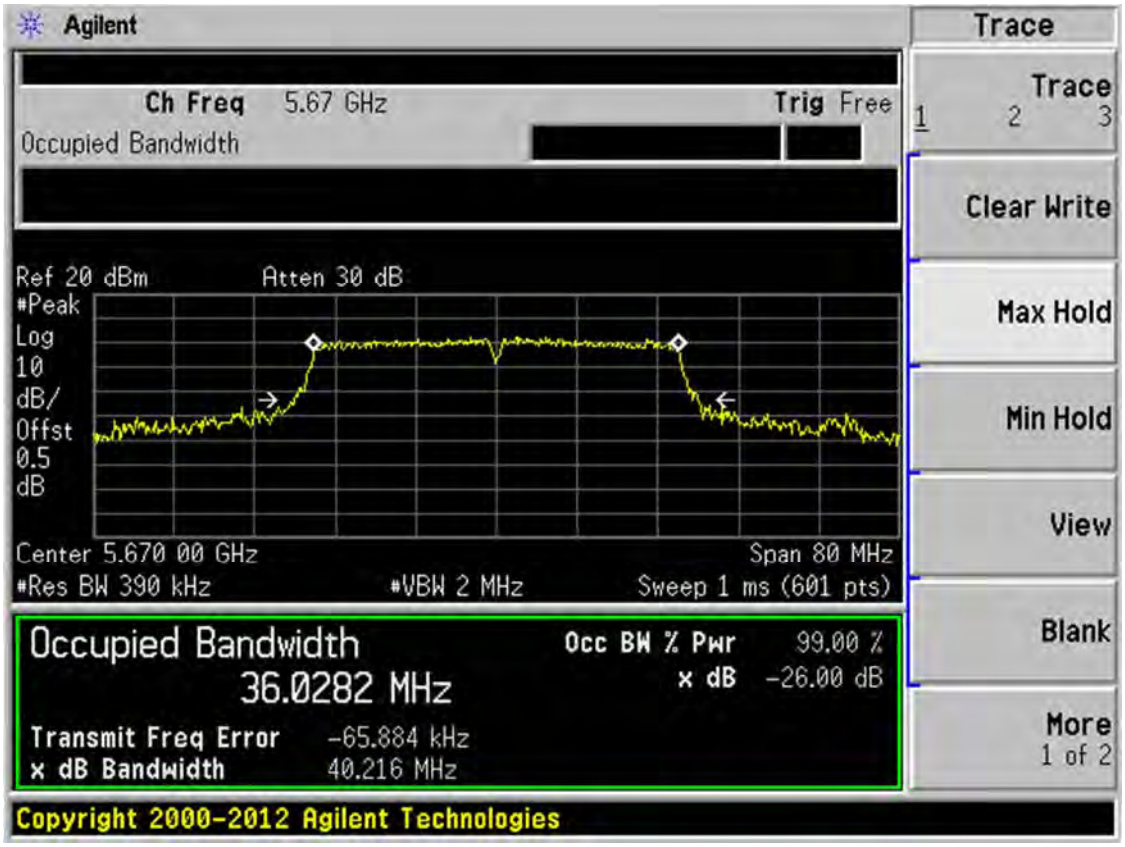
Band III 11ac(HT20) CH140



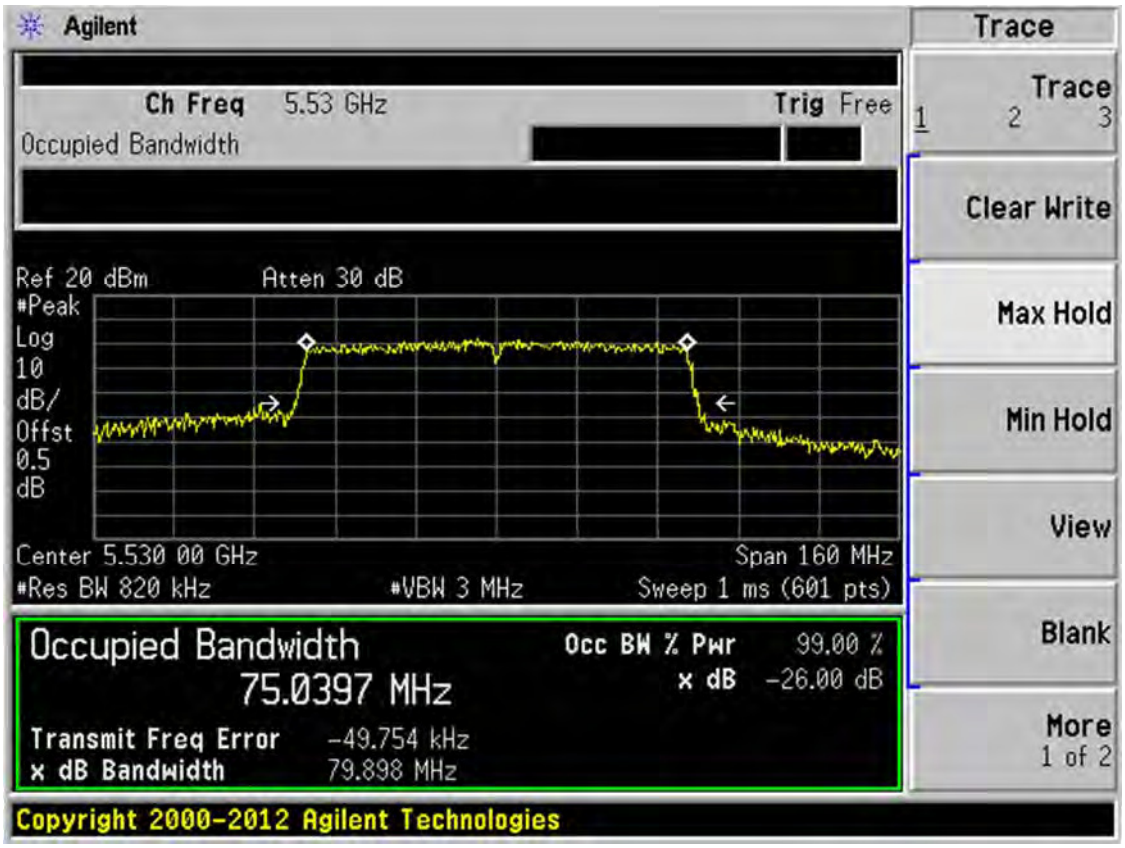
Band III 11ac(HT40) CH102



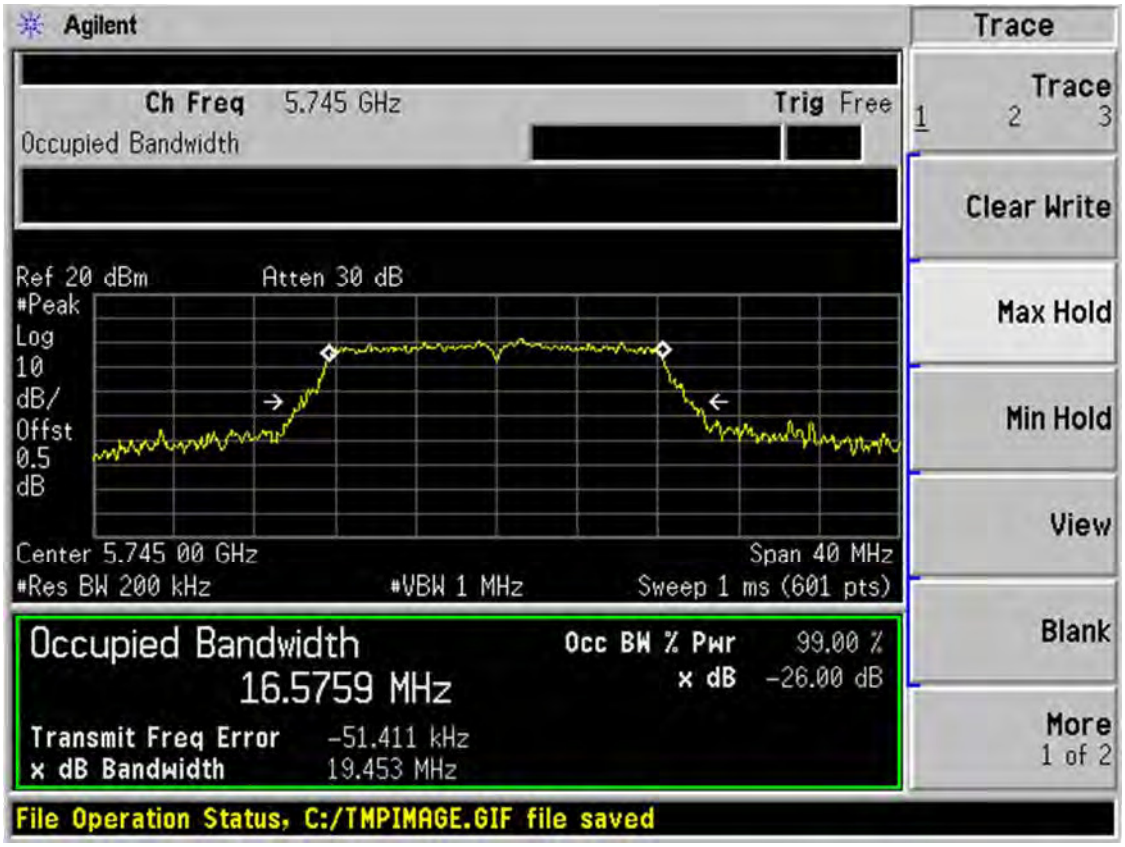
Band III 11ac(HT40) CH134



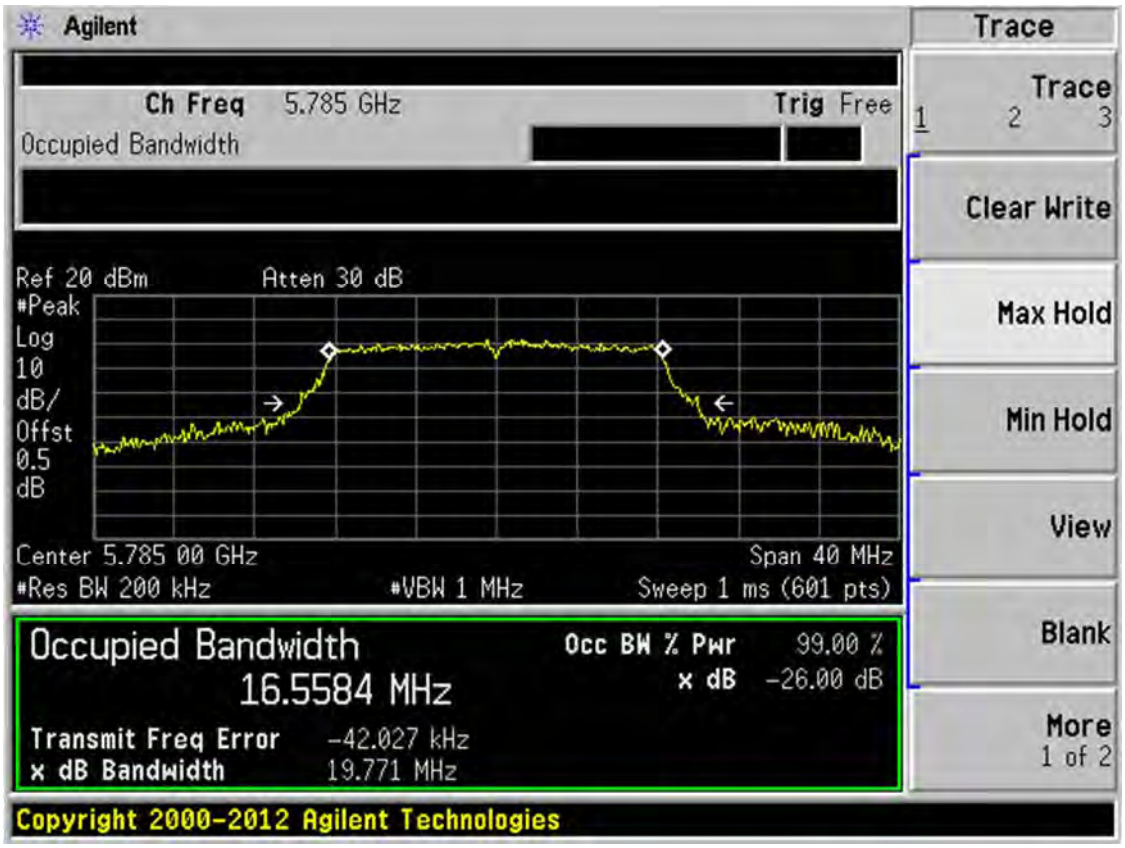
Band III 11ac(HT80) CH106



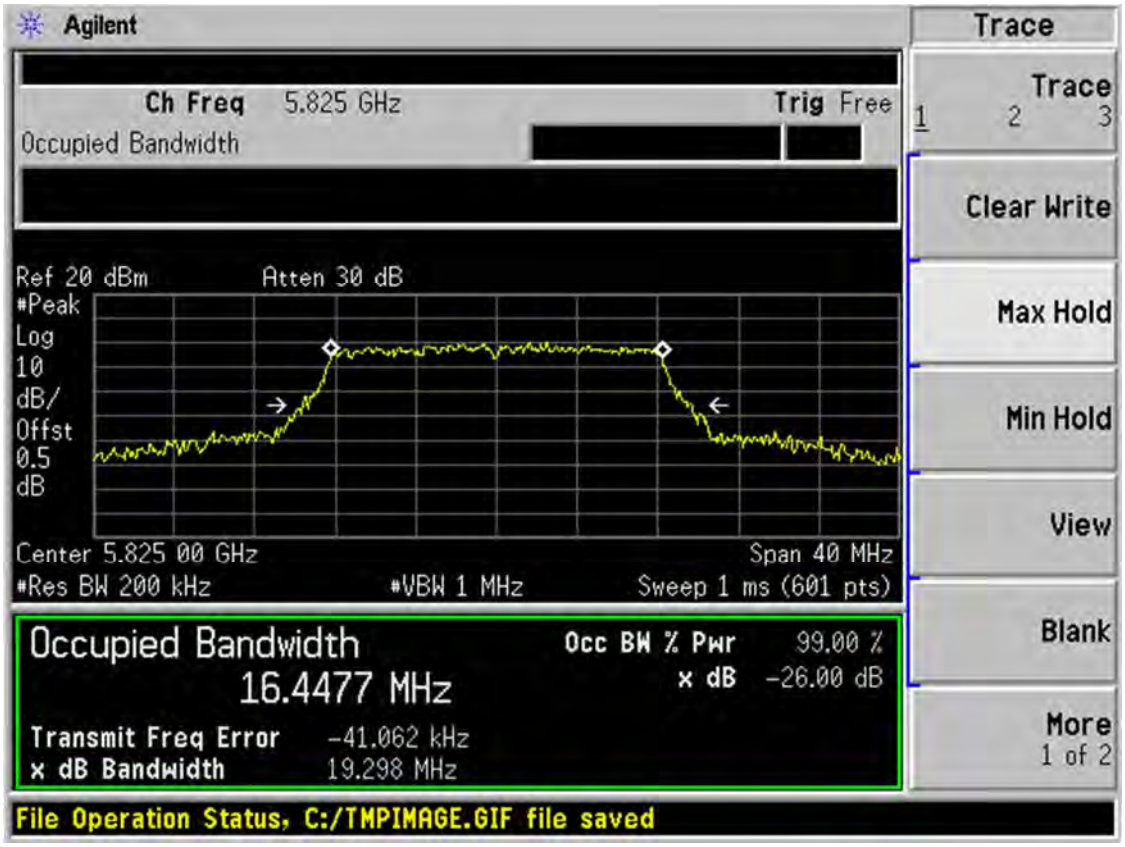
Band IV 11a CH149



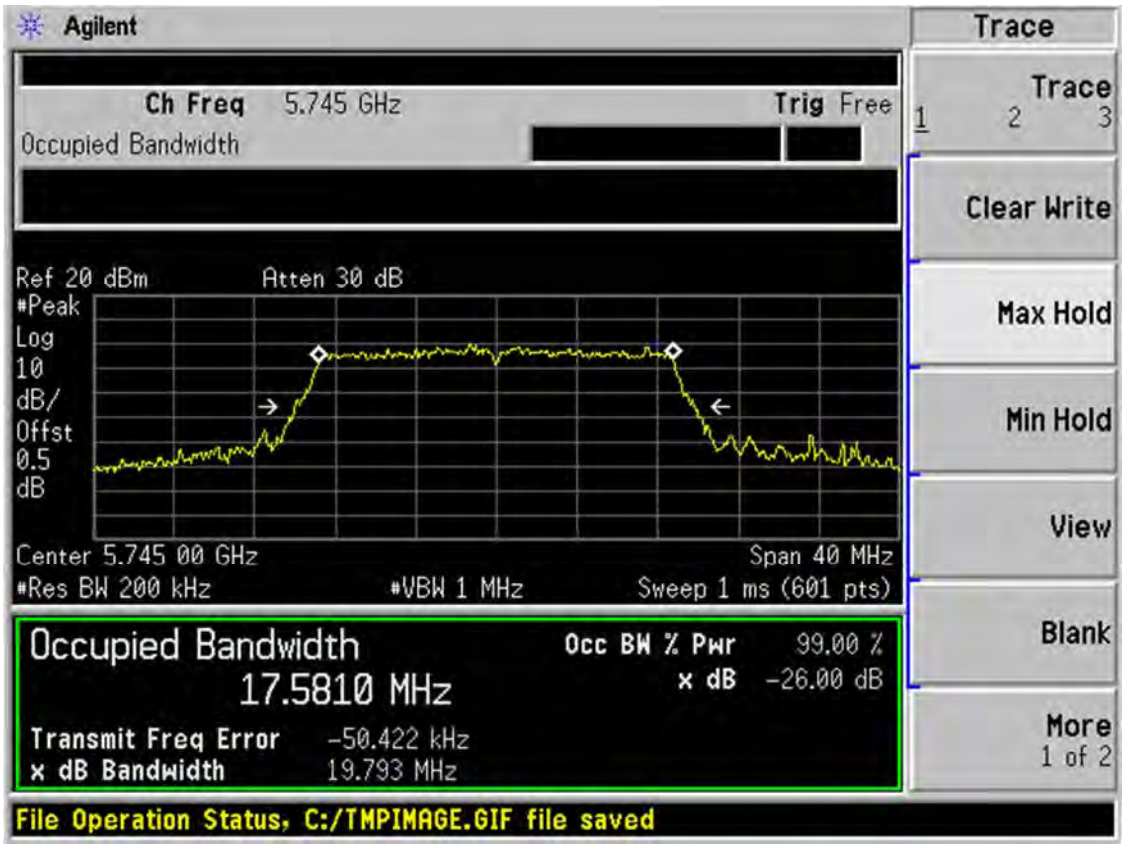
Band IV 11a CH157



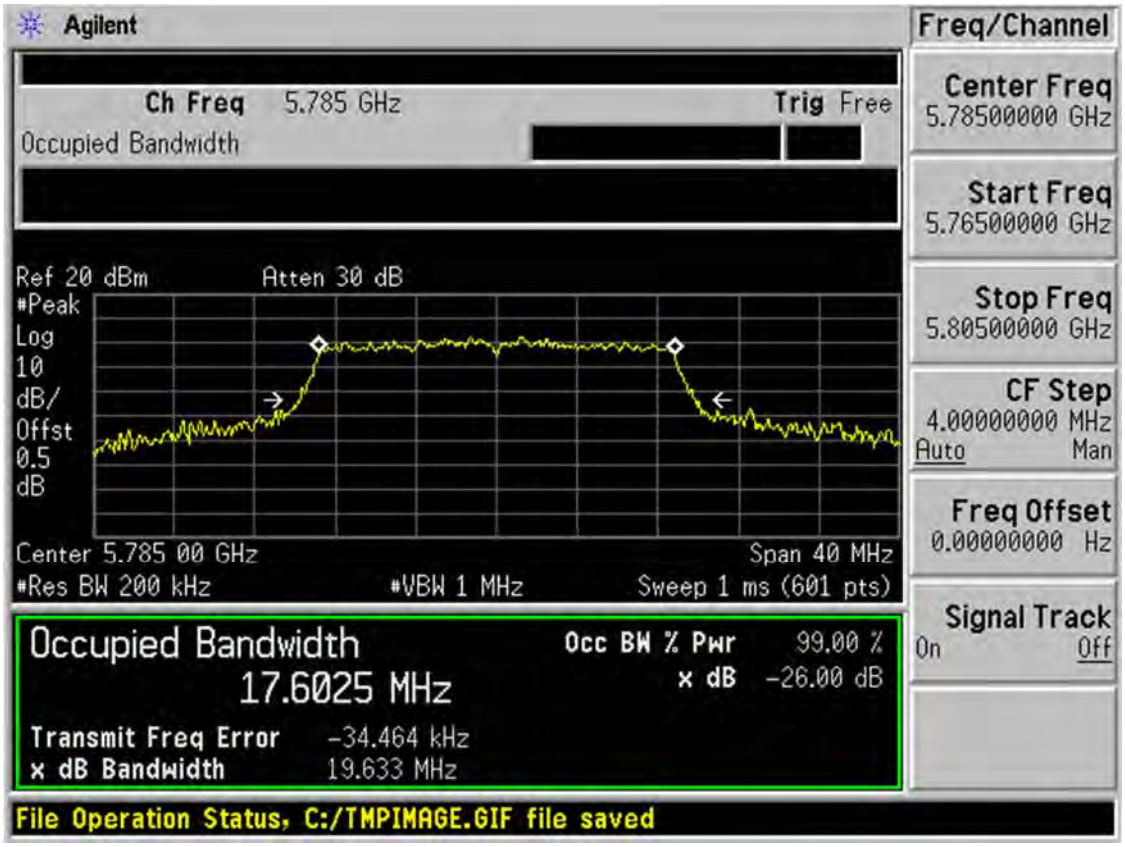
Band IV 11a CH165



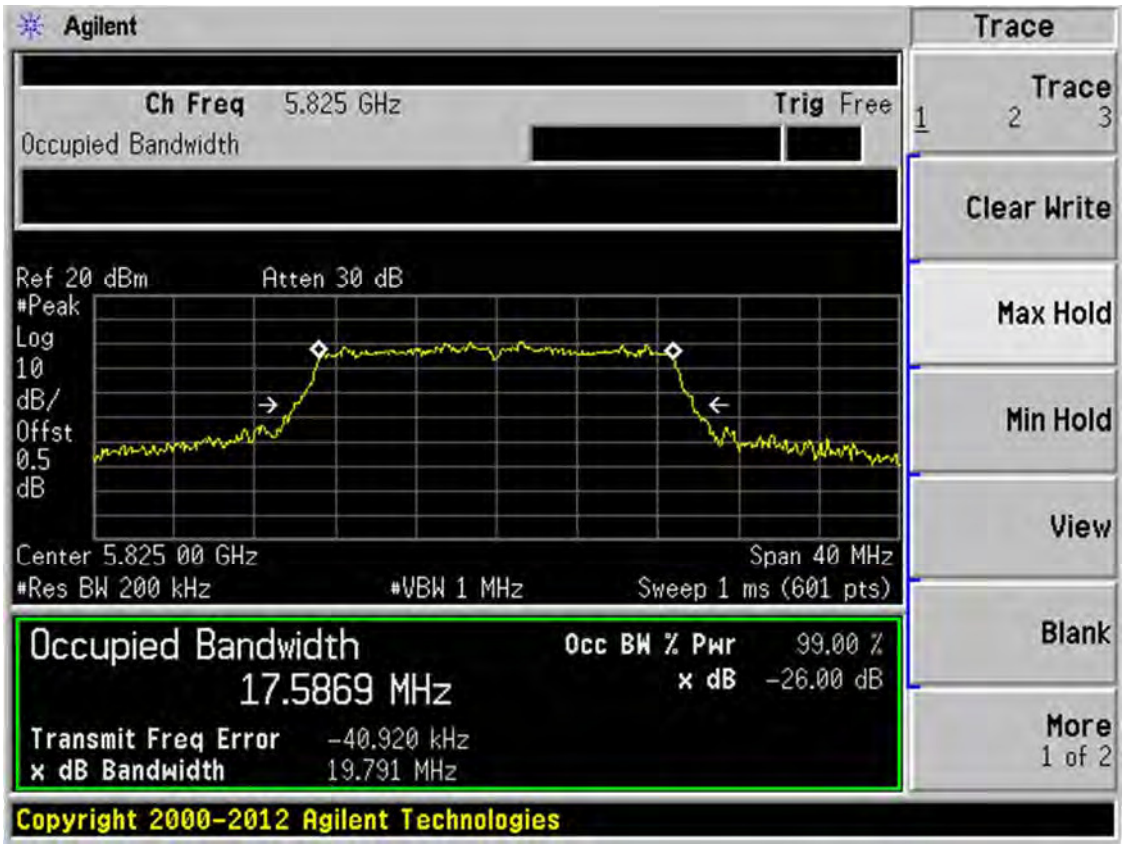
Band IV 11n(HT20) CH149



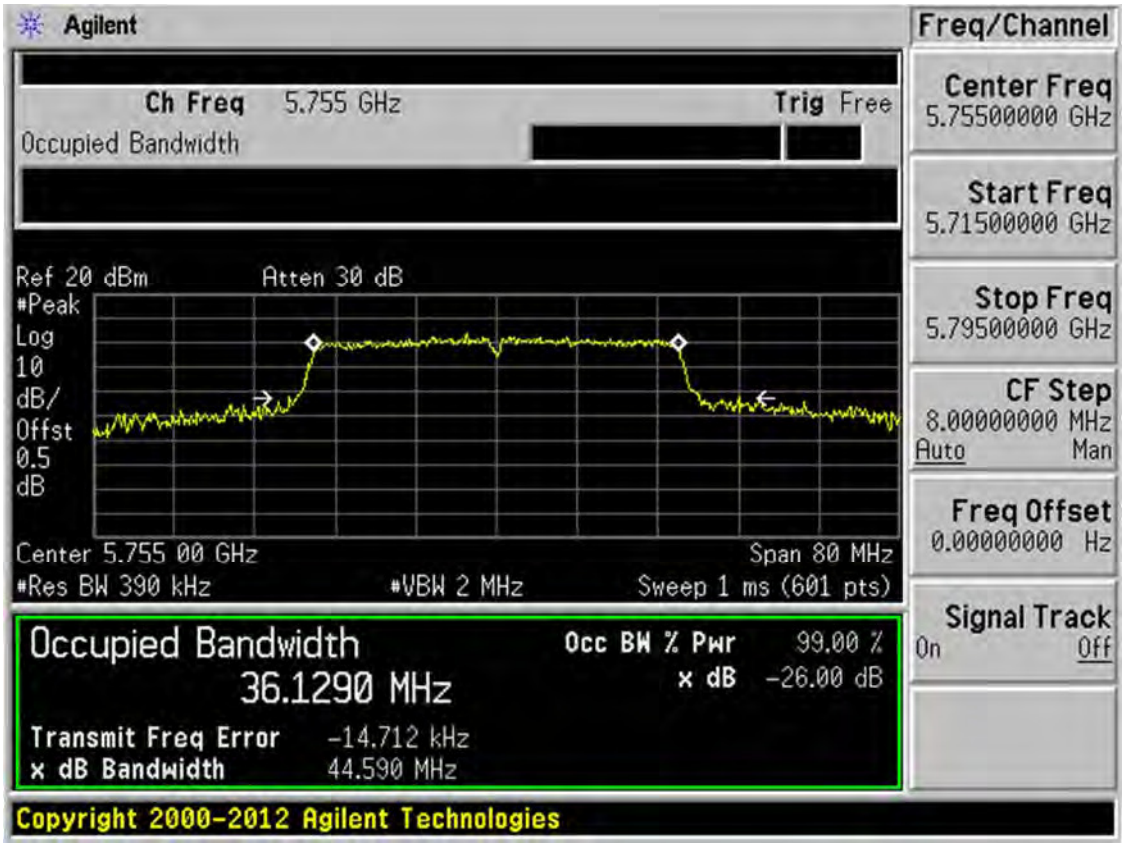
Band IV 11n(HT20) CH157



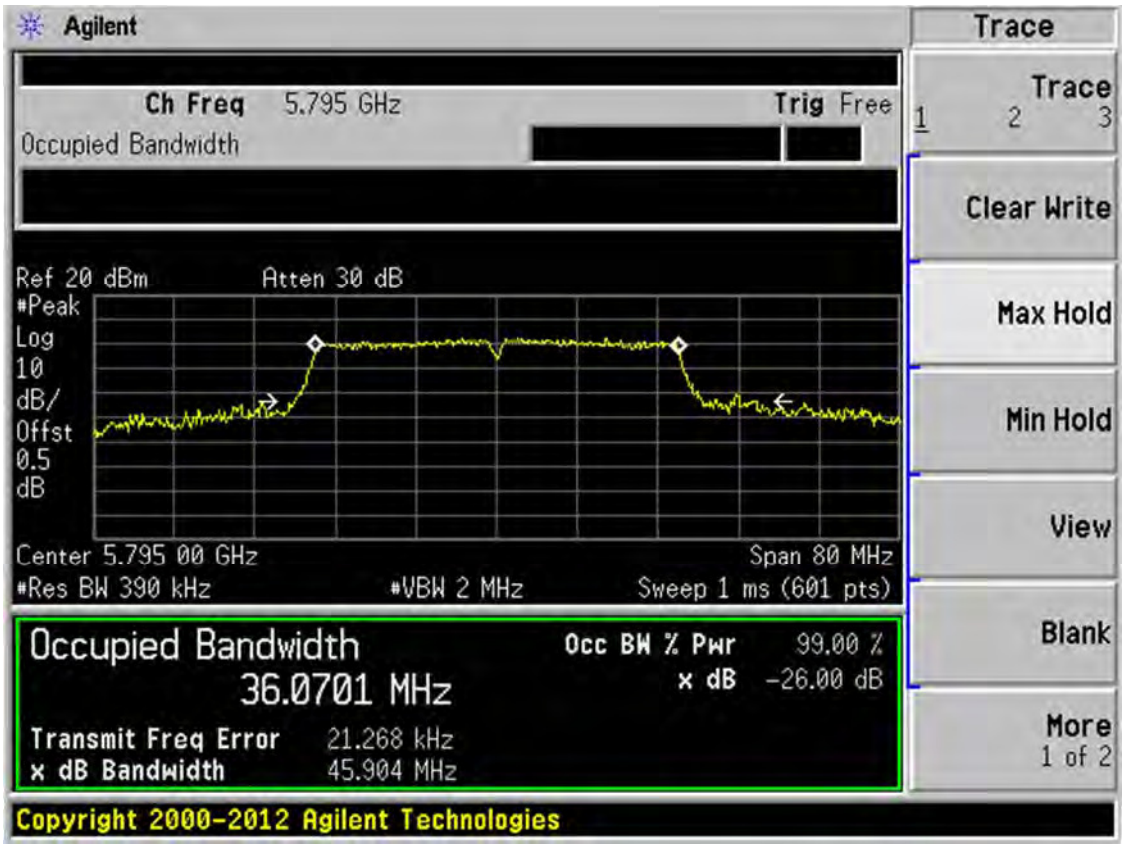
Band IV 11n(HT20) CH165



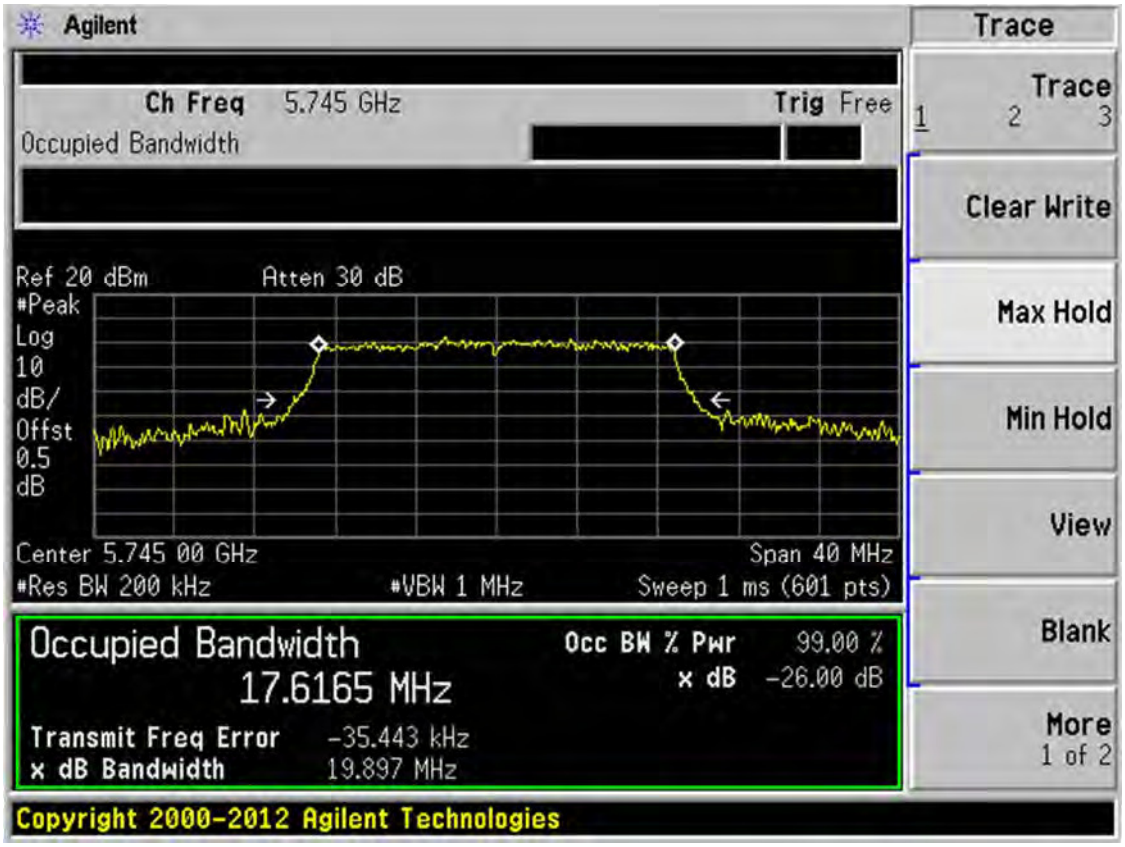
Band IV 11n(HT40) CH151



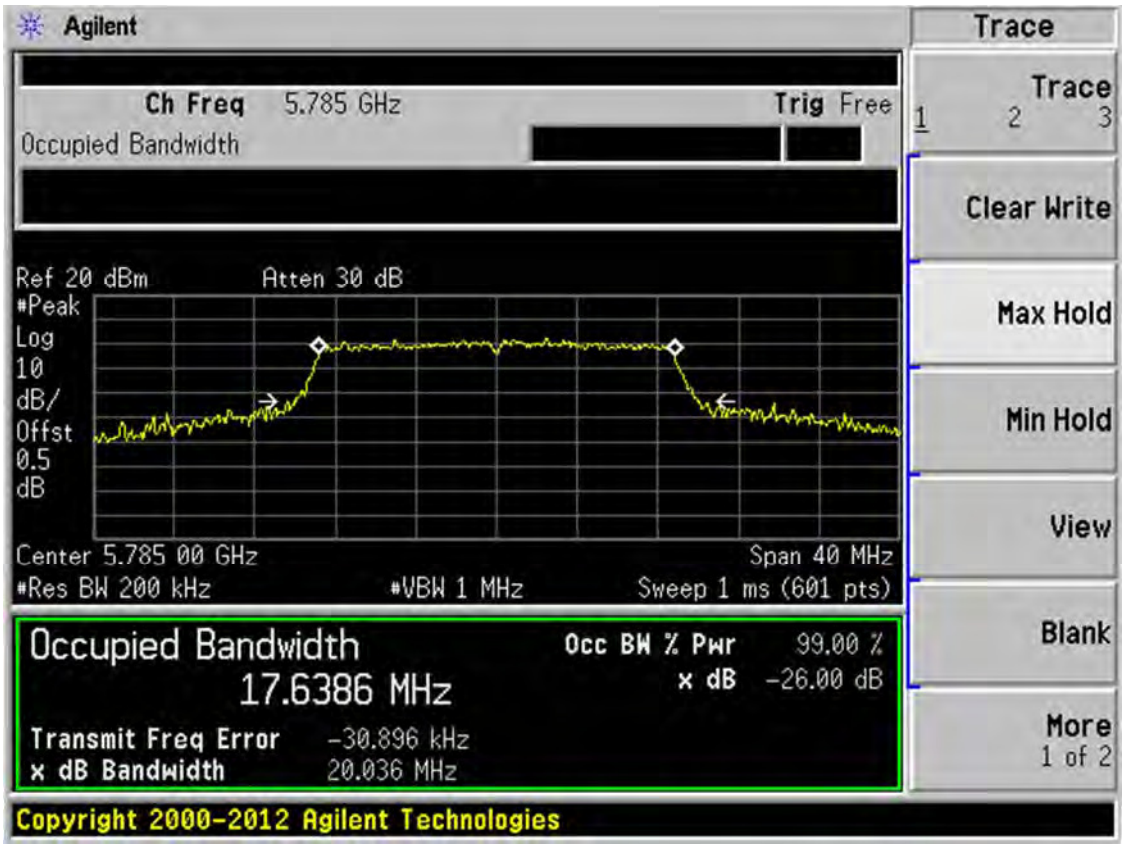
Band IV 11n(HT40) CH159



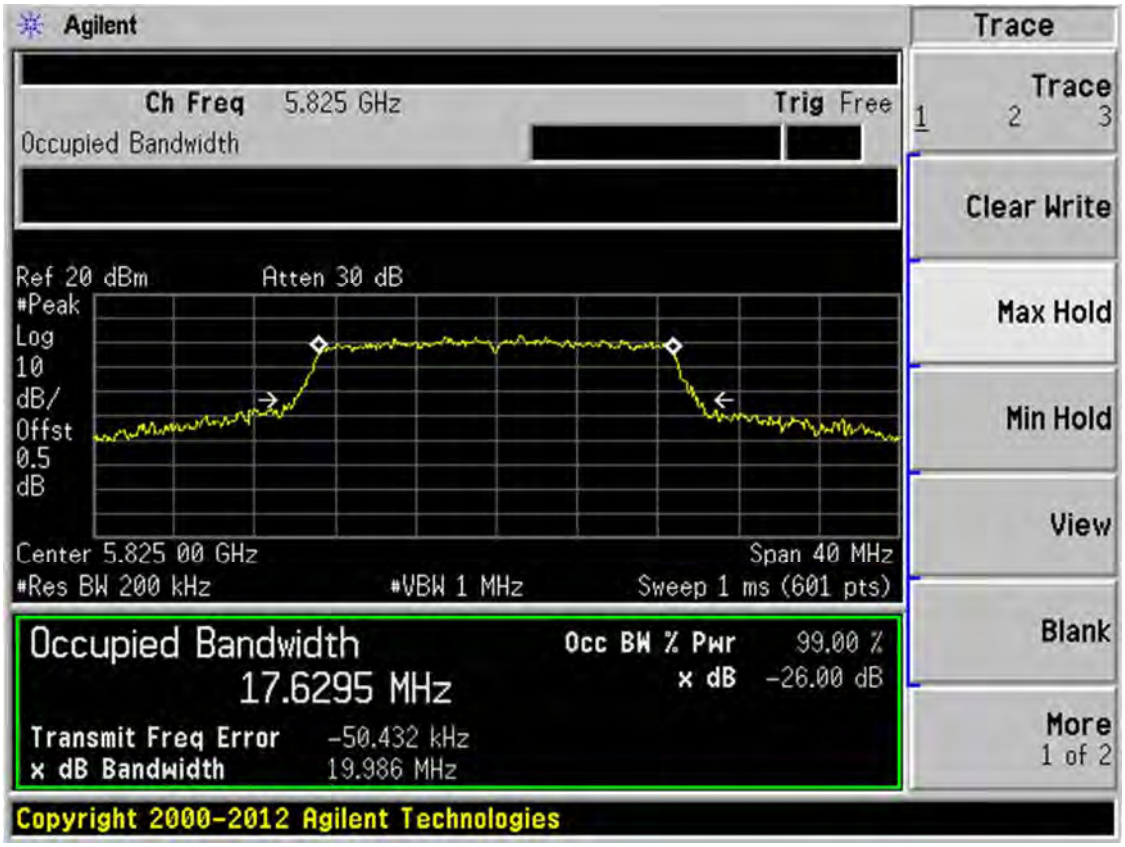
Band IV 11ac(HT20) CH149



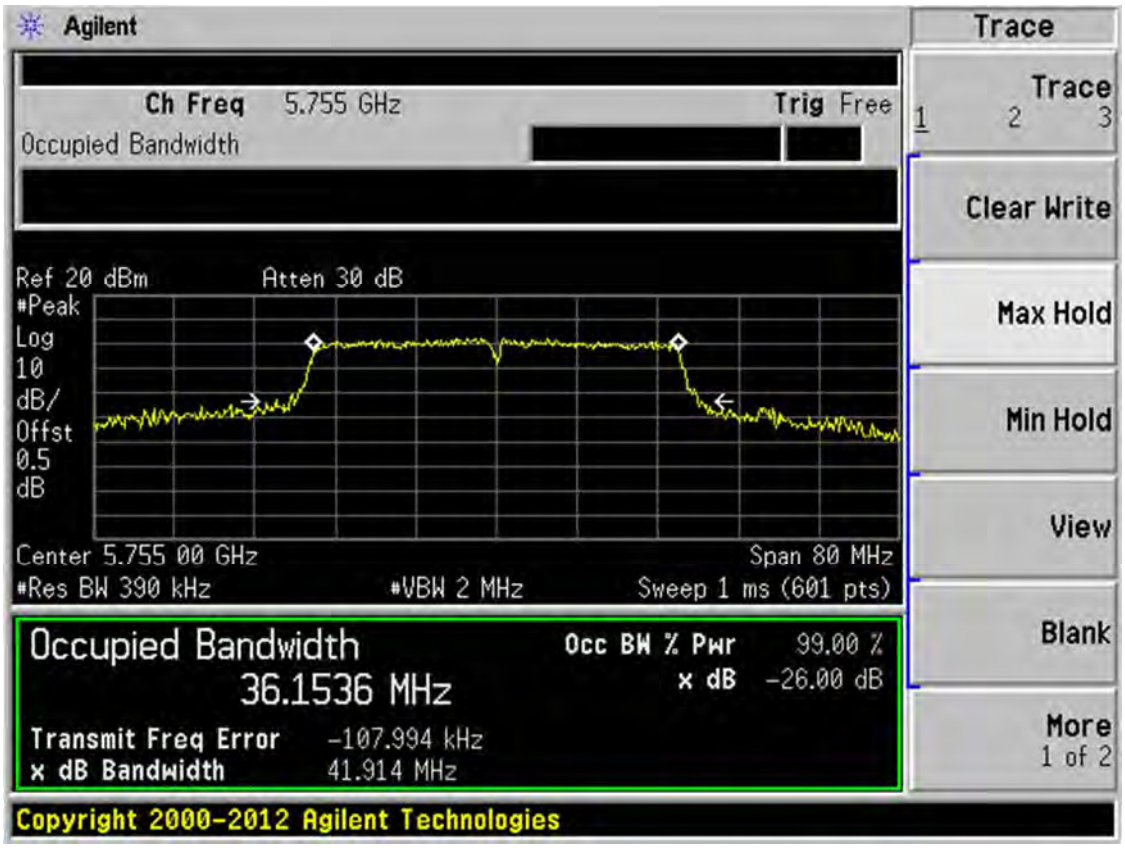
Band IV 11ac(HT20) CH157



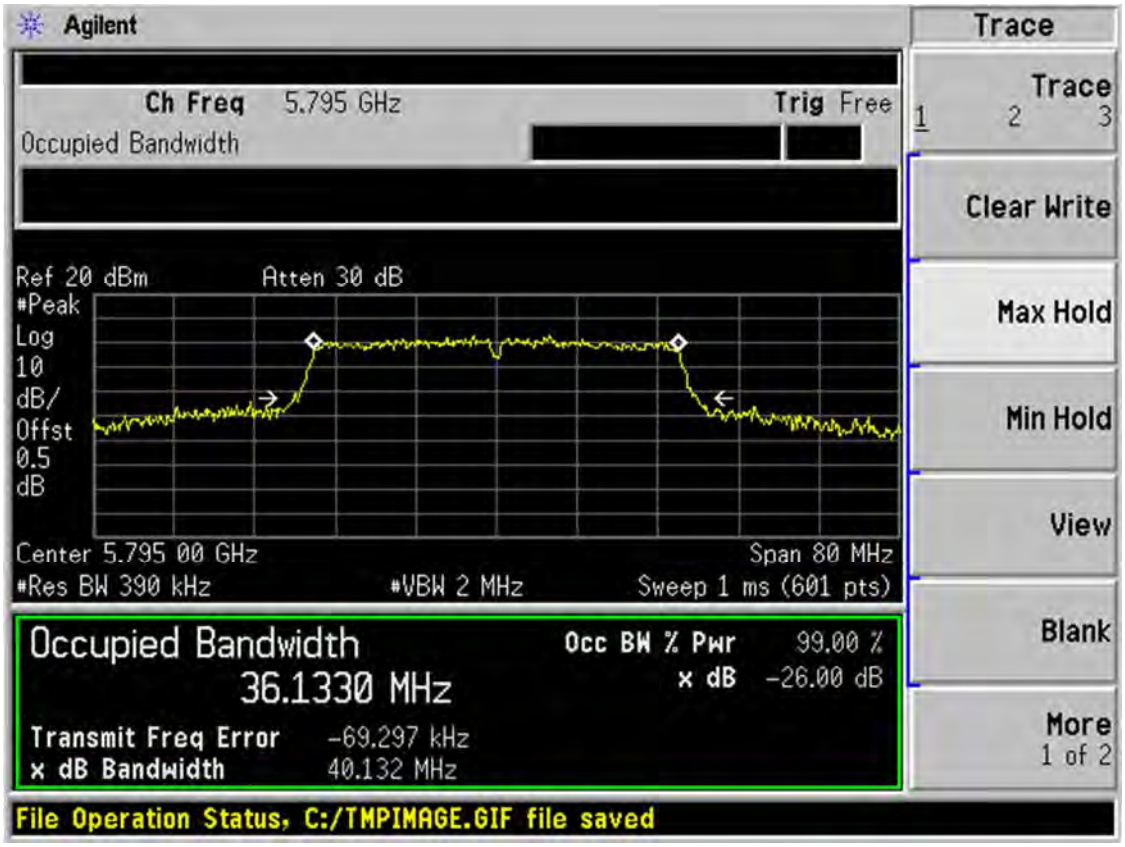
Band IV 11ac(HT20) CH165



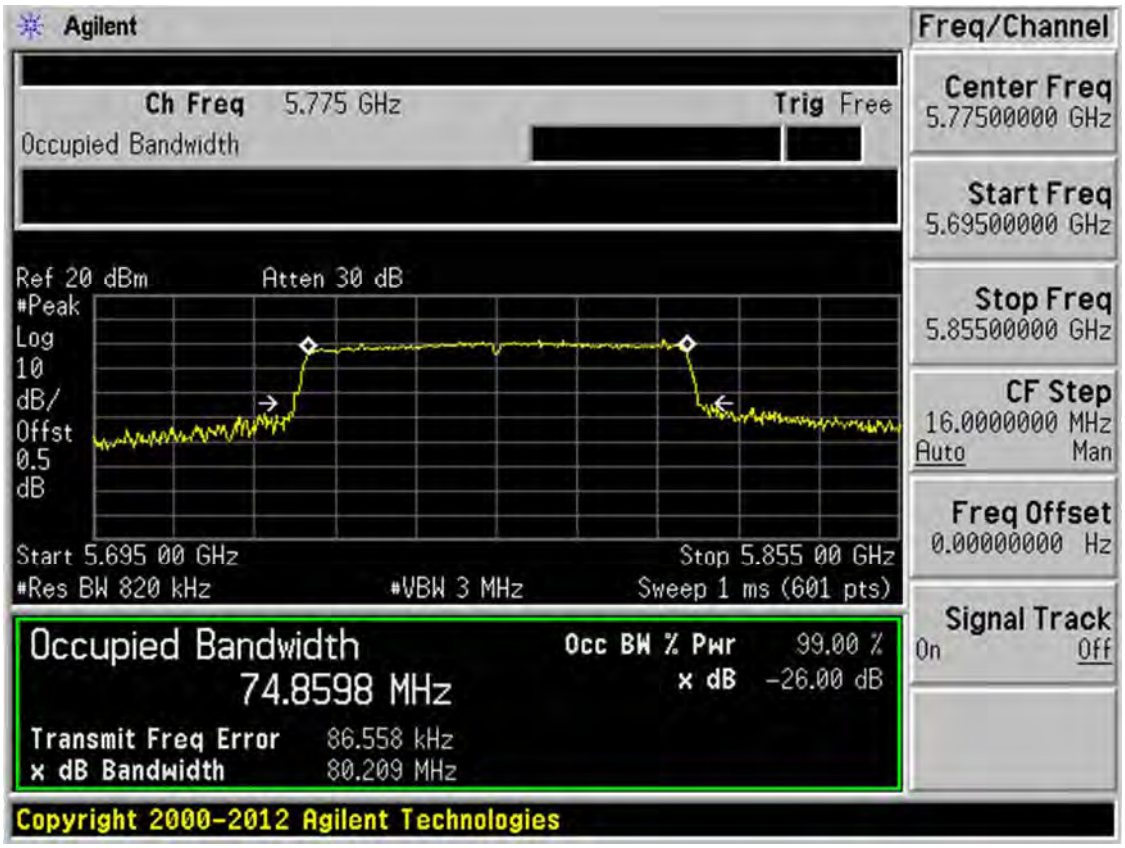
Band IV 11ac(HT40) CH151



Band IV 11ac(HT40) CH159

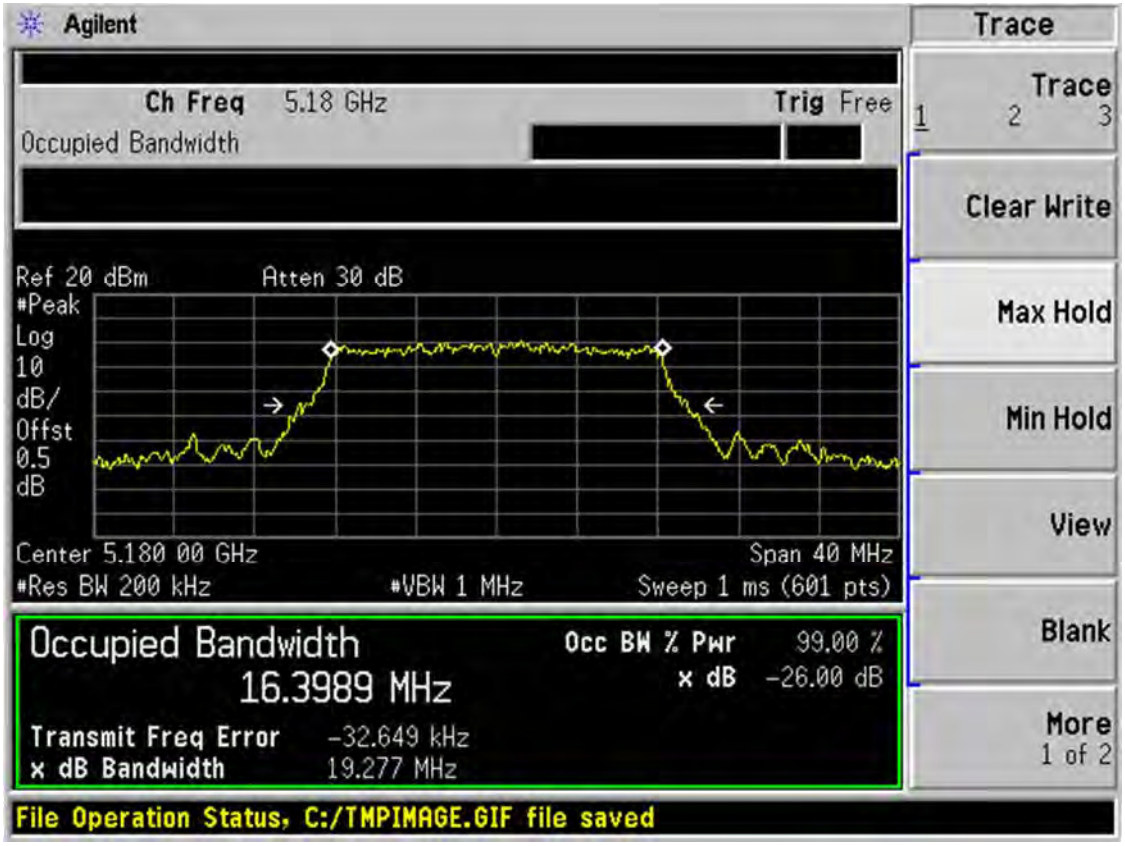


Band IV 11ac(HT80) CH155

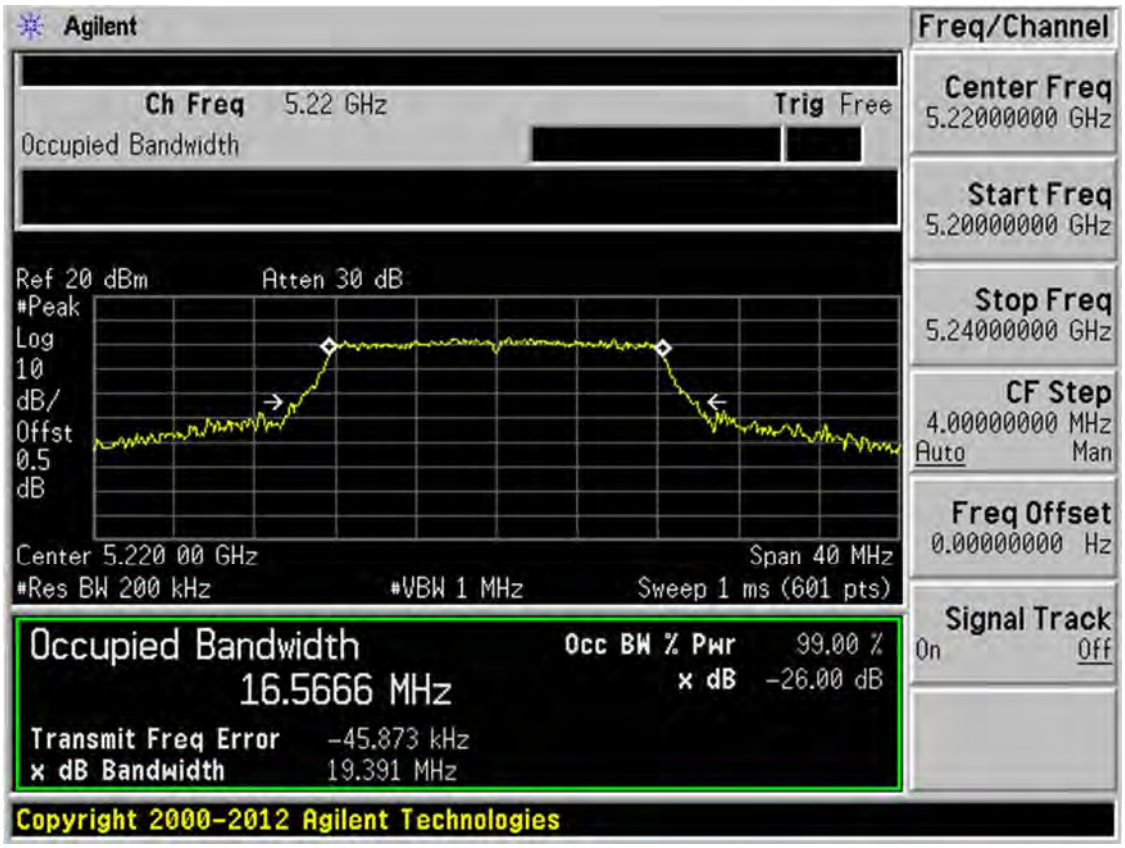


ANT 1

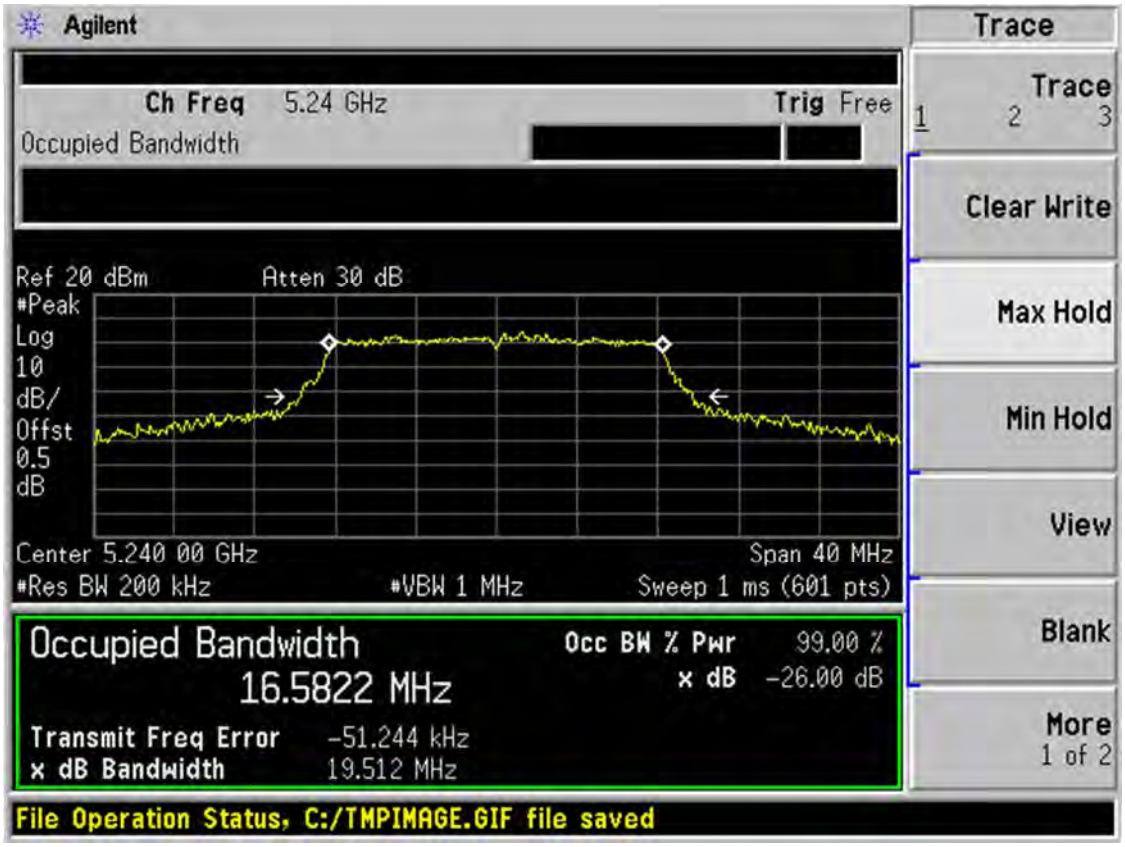
Band I 11a CH36



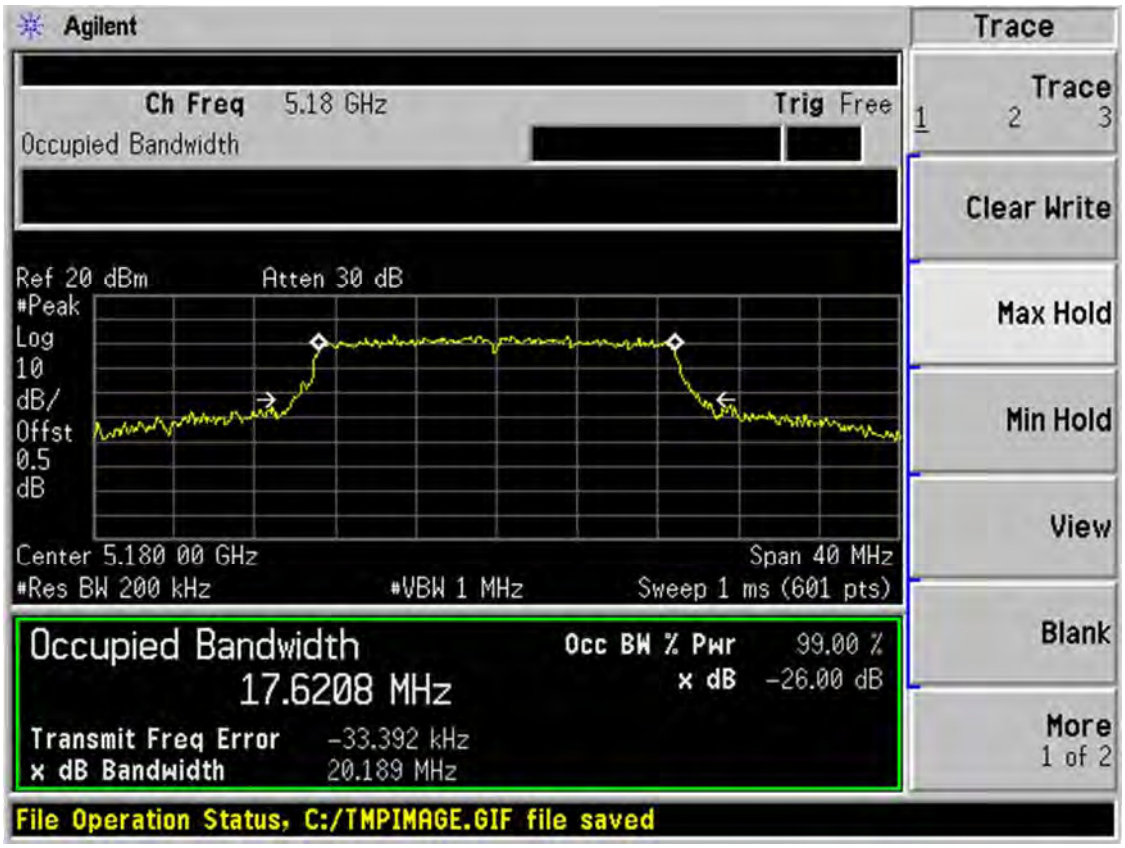
Band I 11a CH44



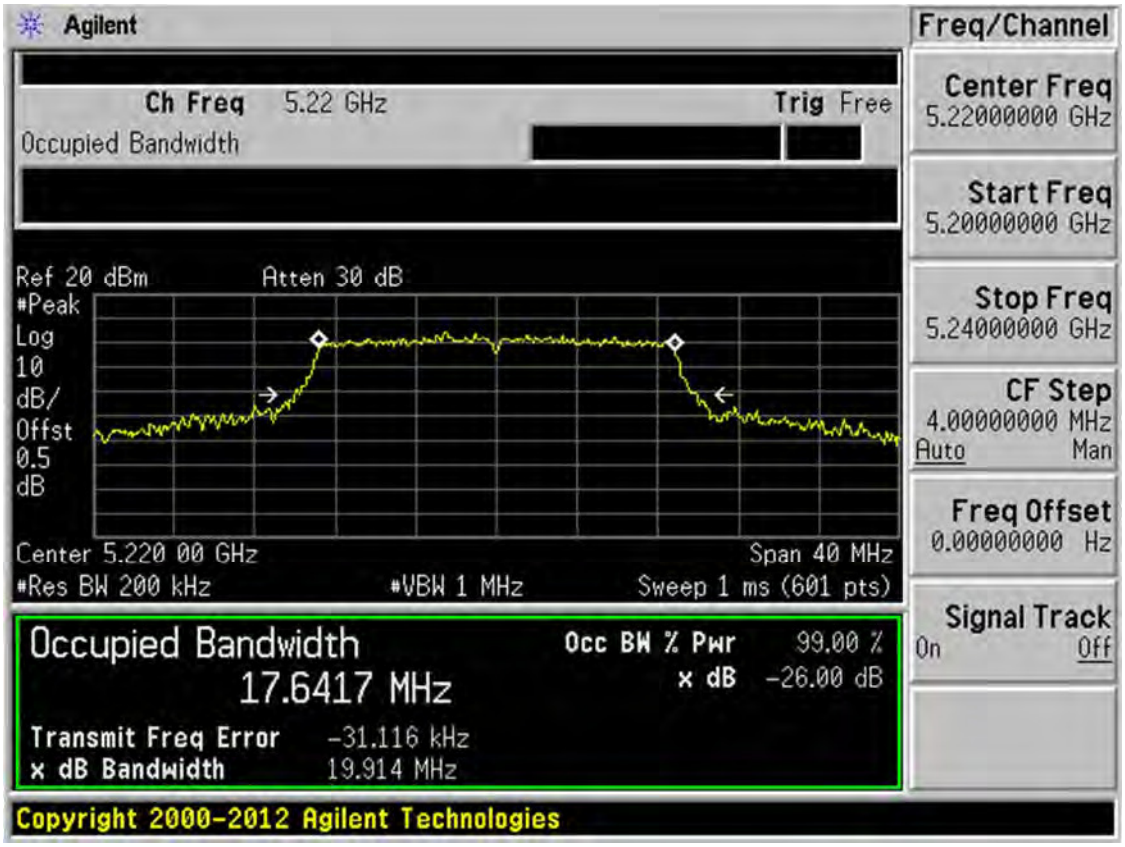
Band I 11a CH48



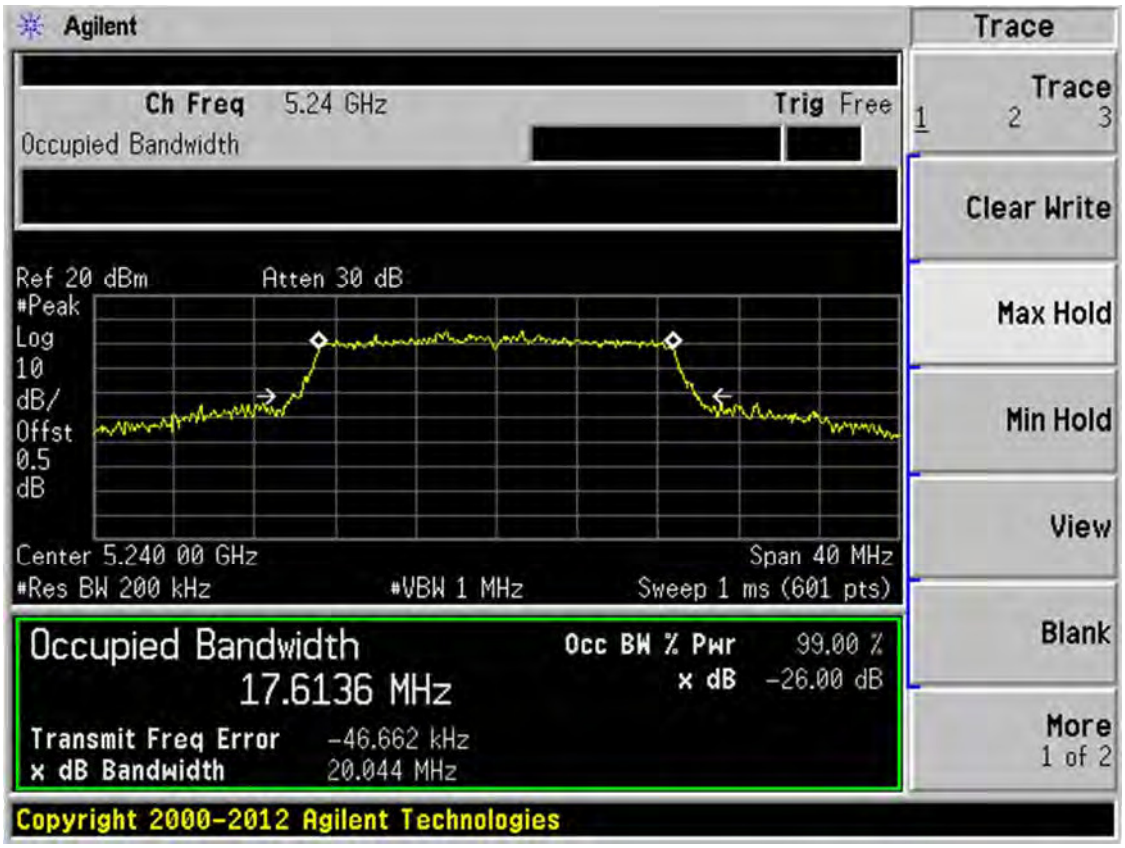
Band I 11n(HT20) CH36



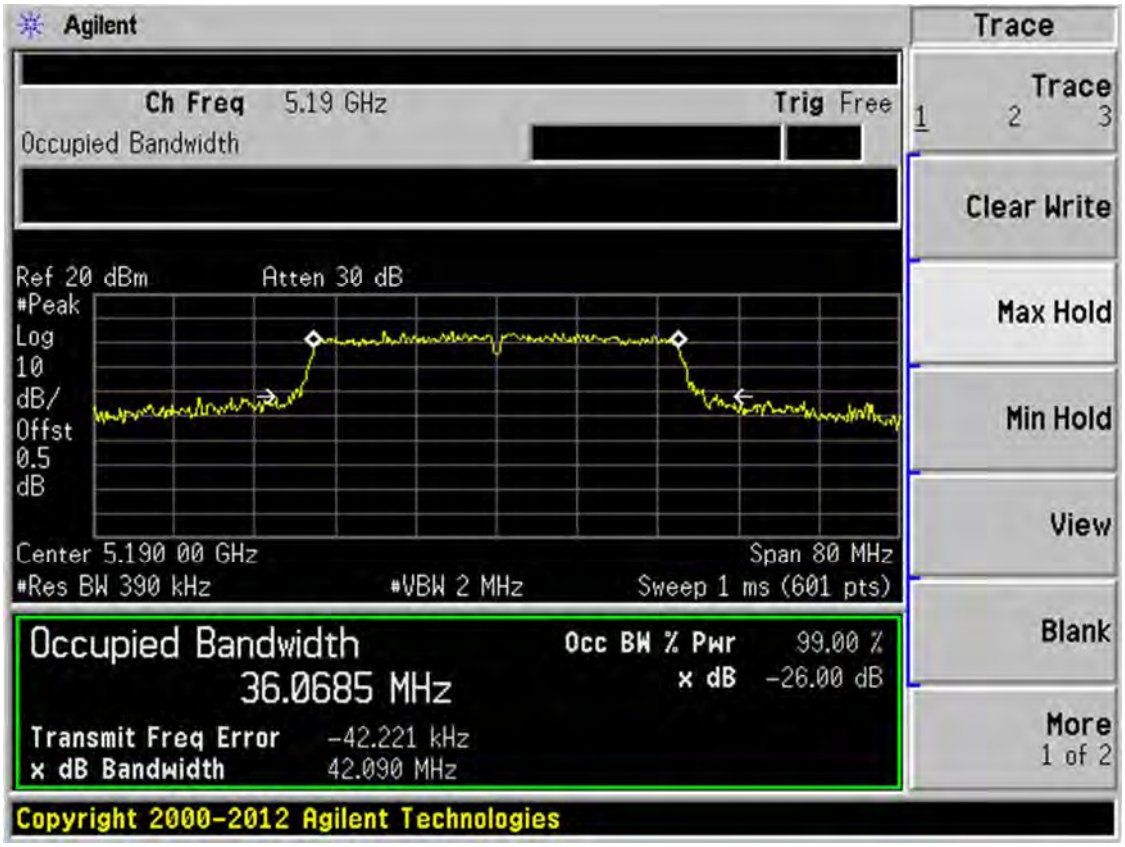
Band I 11n(HT20) CH44



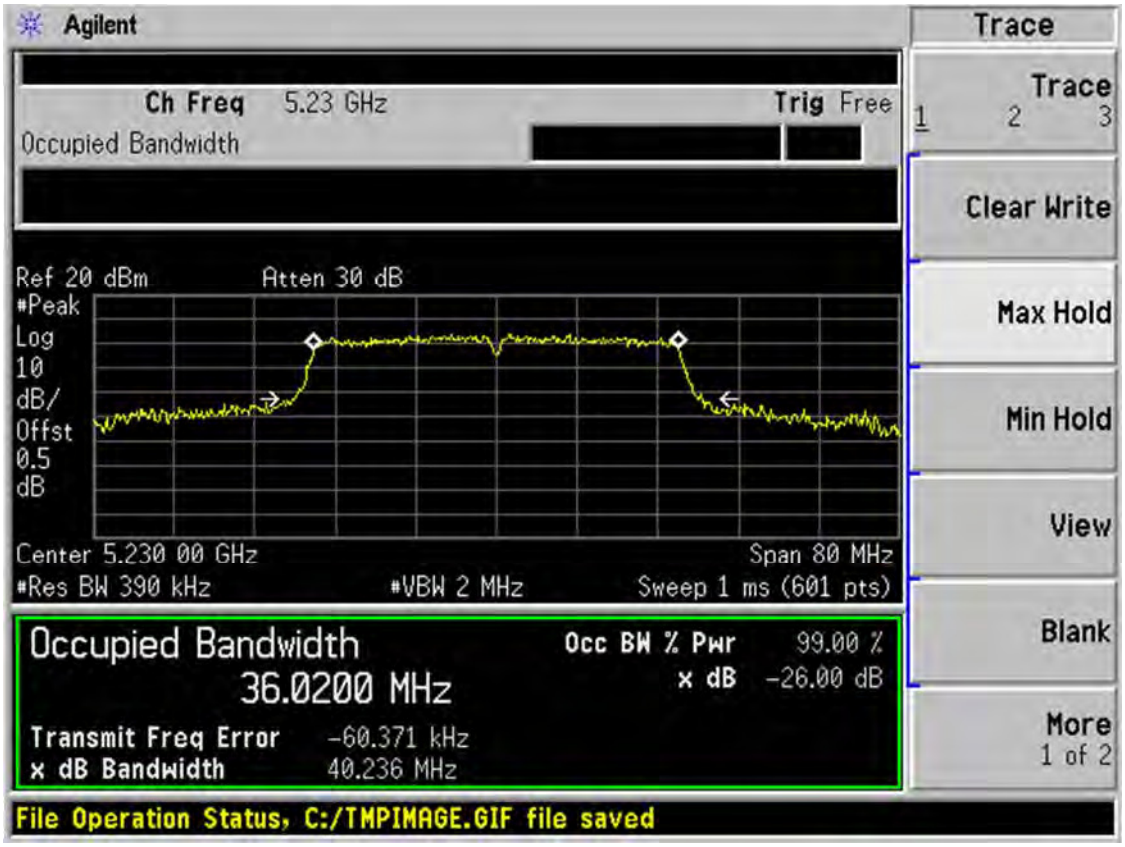
Band I 11n(HT20) CH48



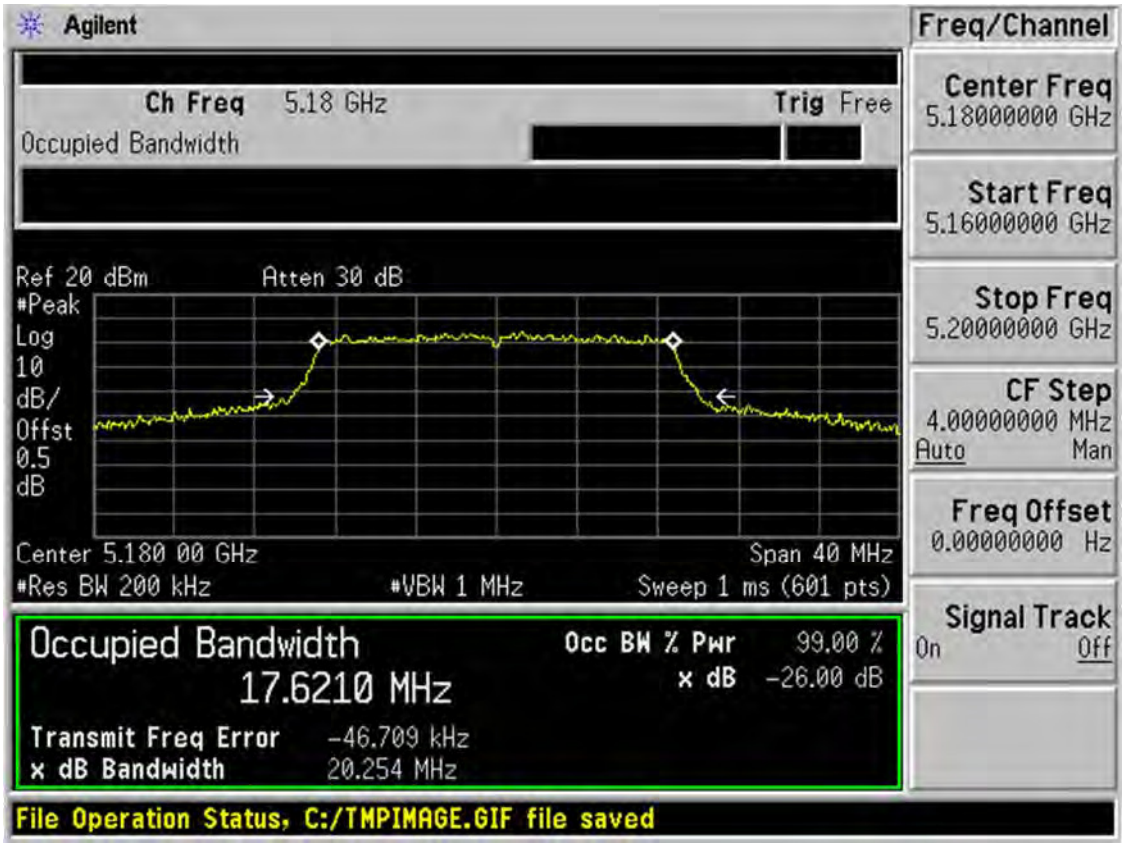
Band I 11n(HT40) CH38



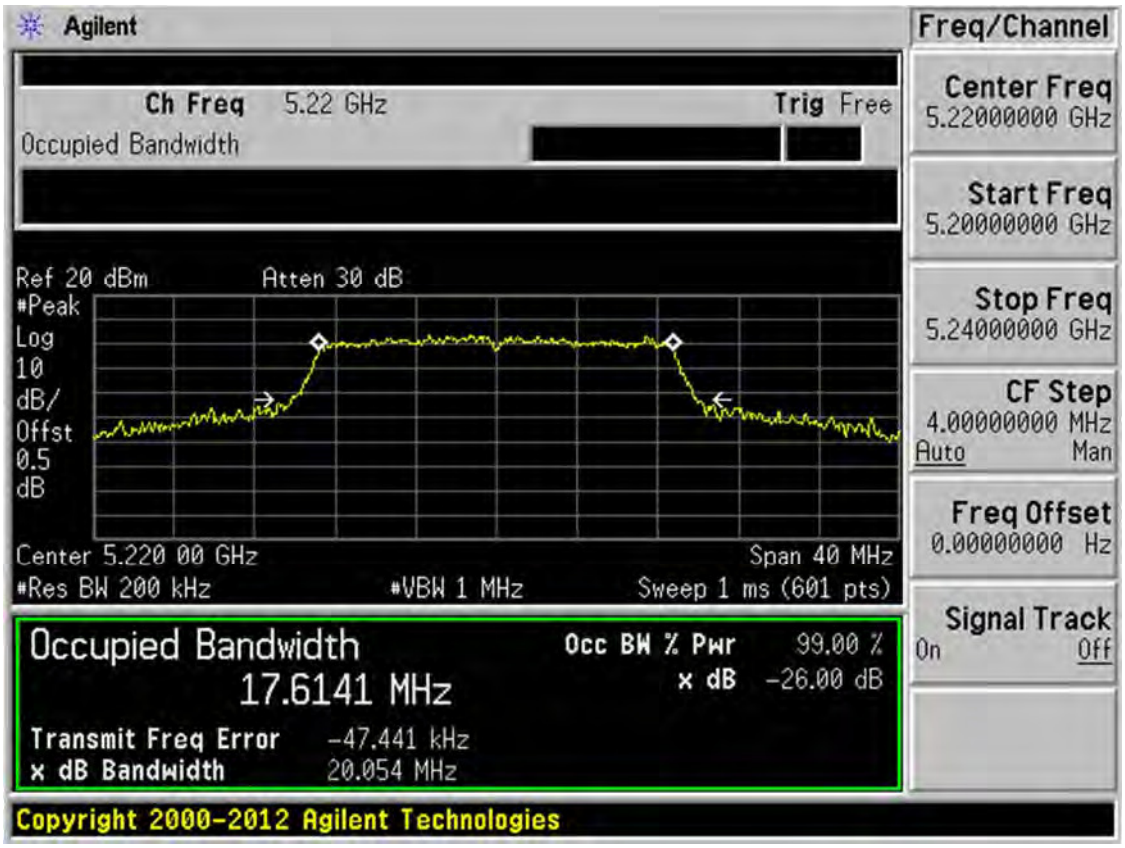
Band I 11n(HT40) CH46



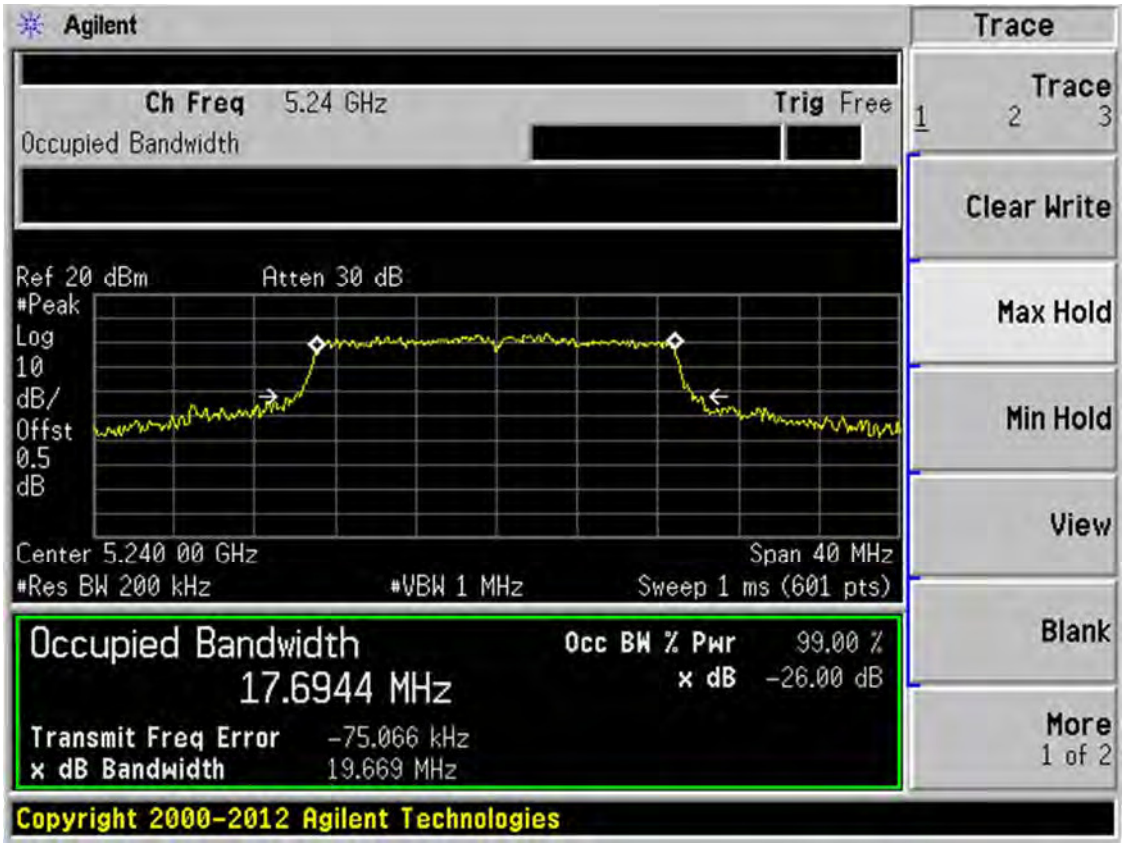
Band I 11ac(HT20) CH36



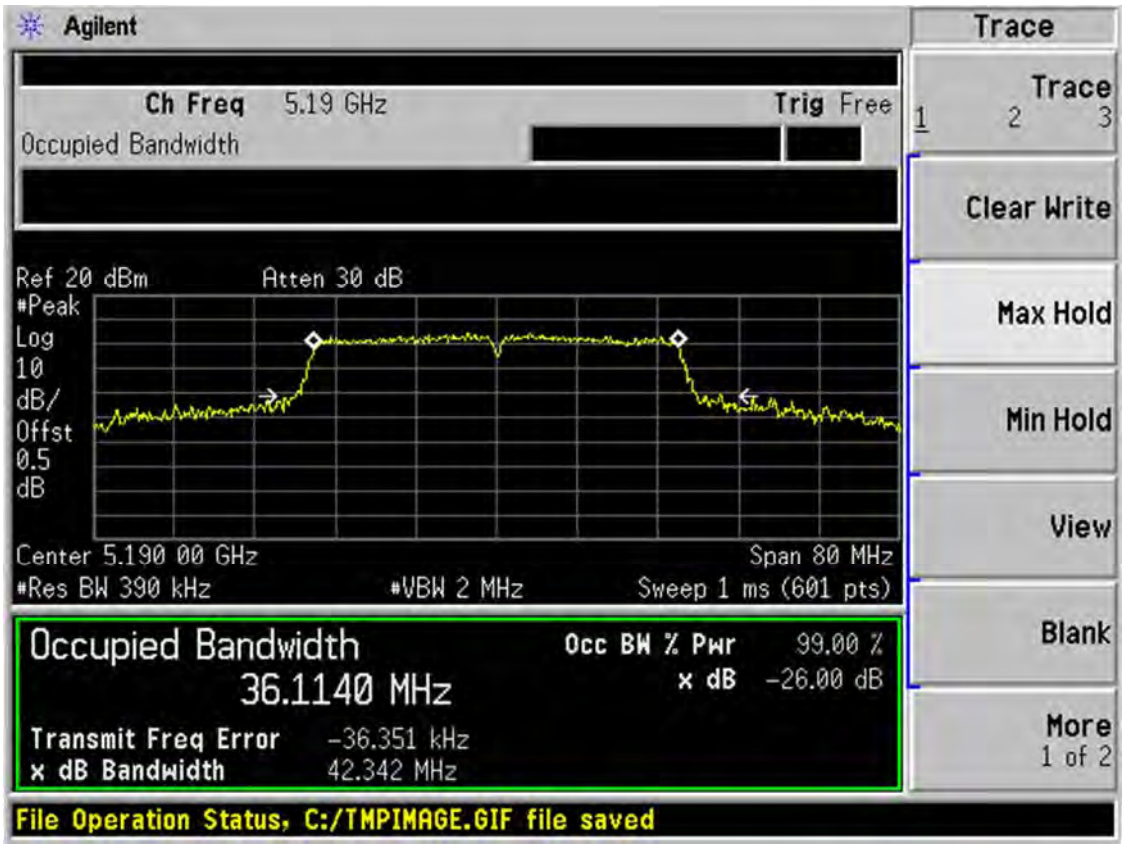
Band I 11ac(HT20) CH44



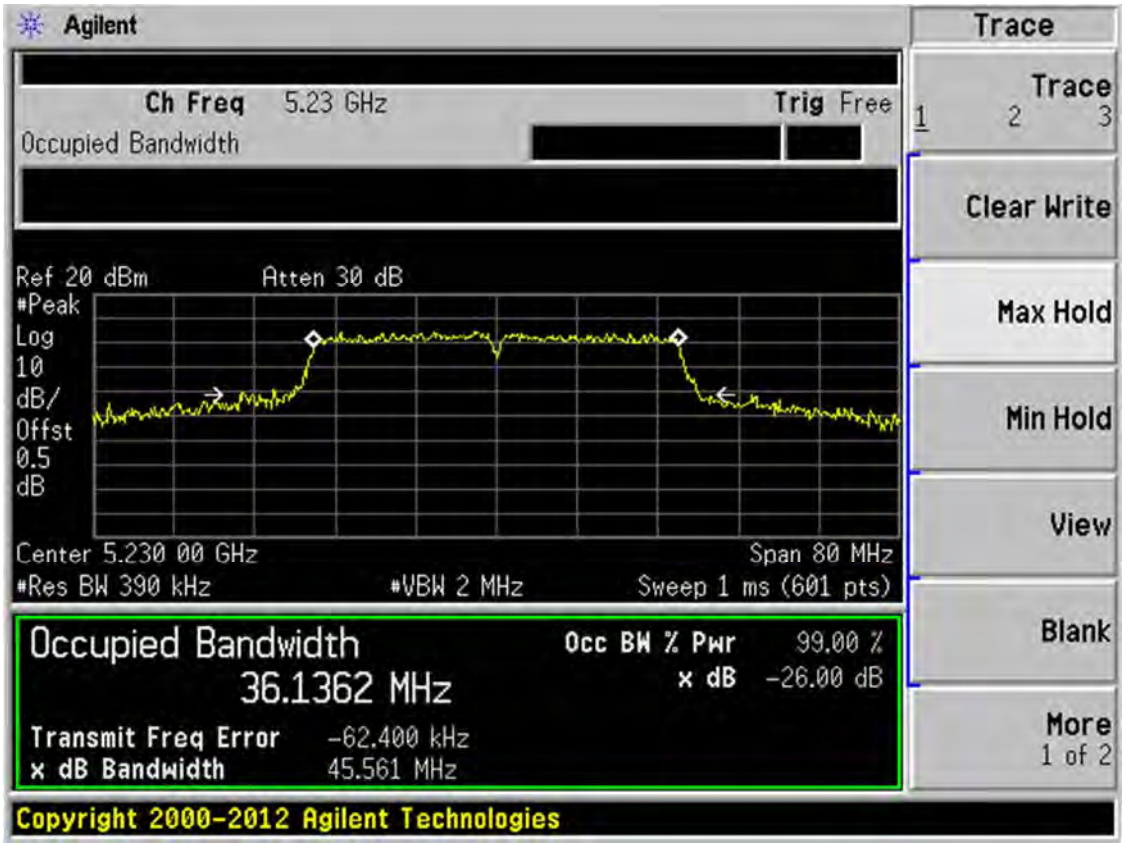
Band I 11ac(HT20) CH48



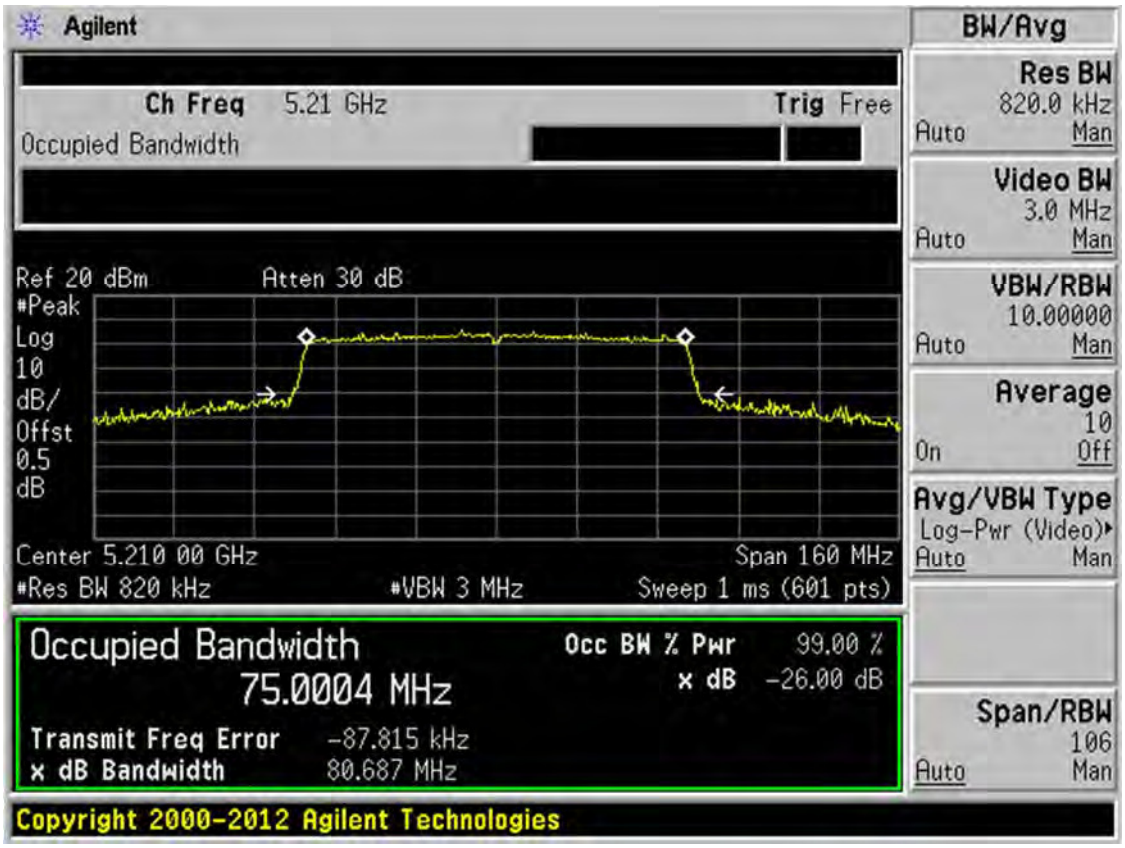
Band I 11ac(HT40) CH38



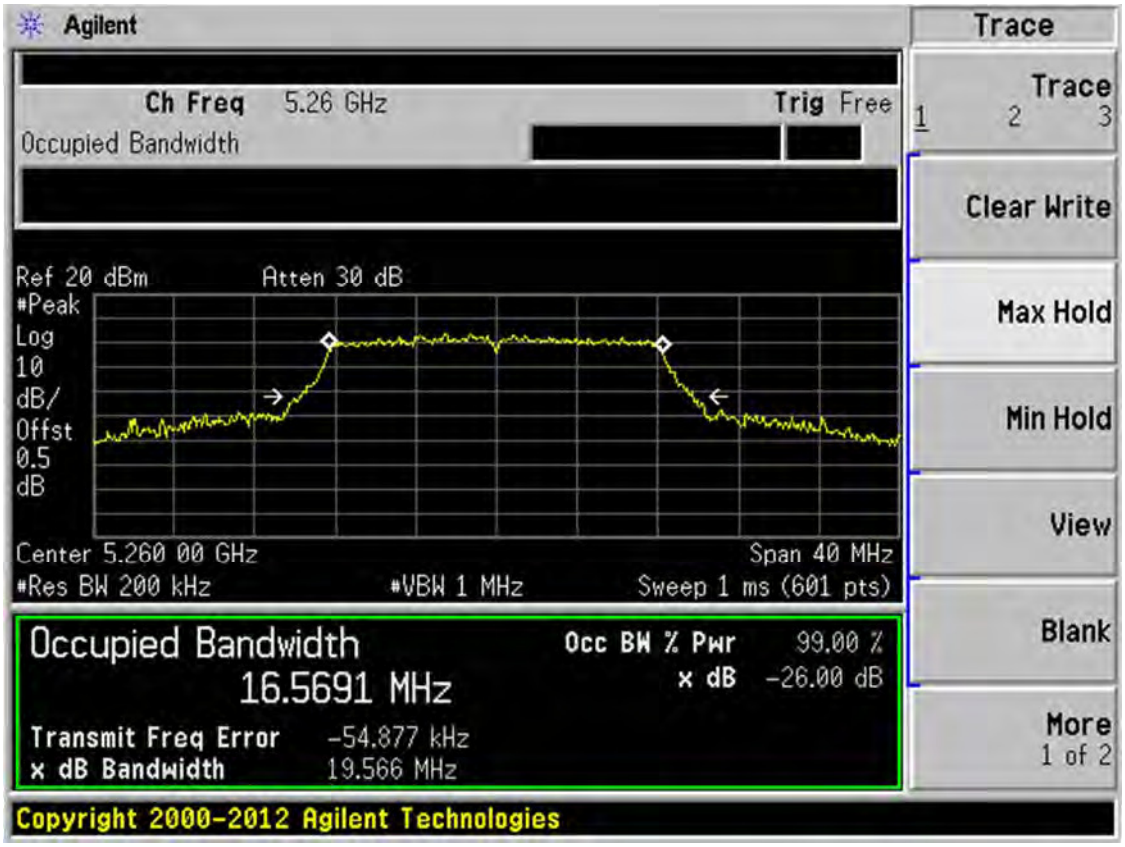
Band I 11ac(HT40) CH46



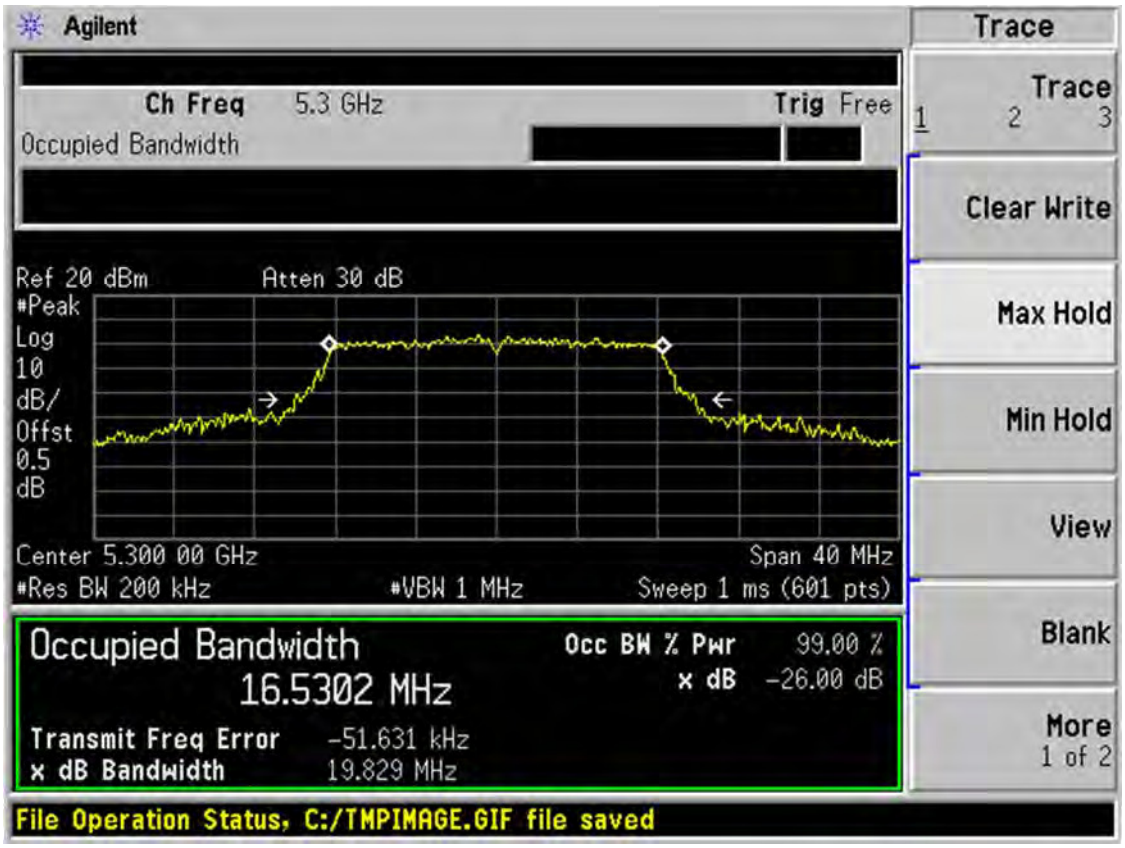
Band I 11ac(HT80) CH42



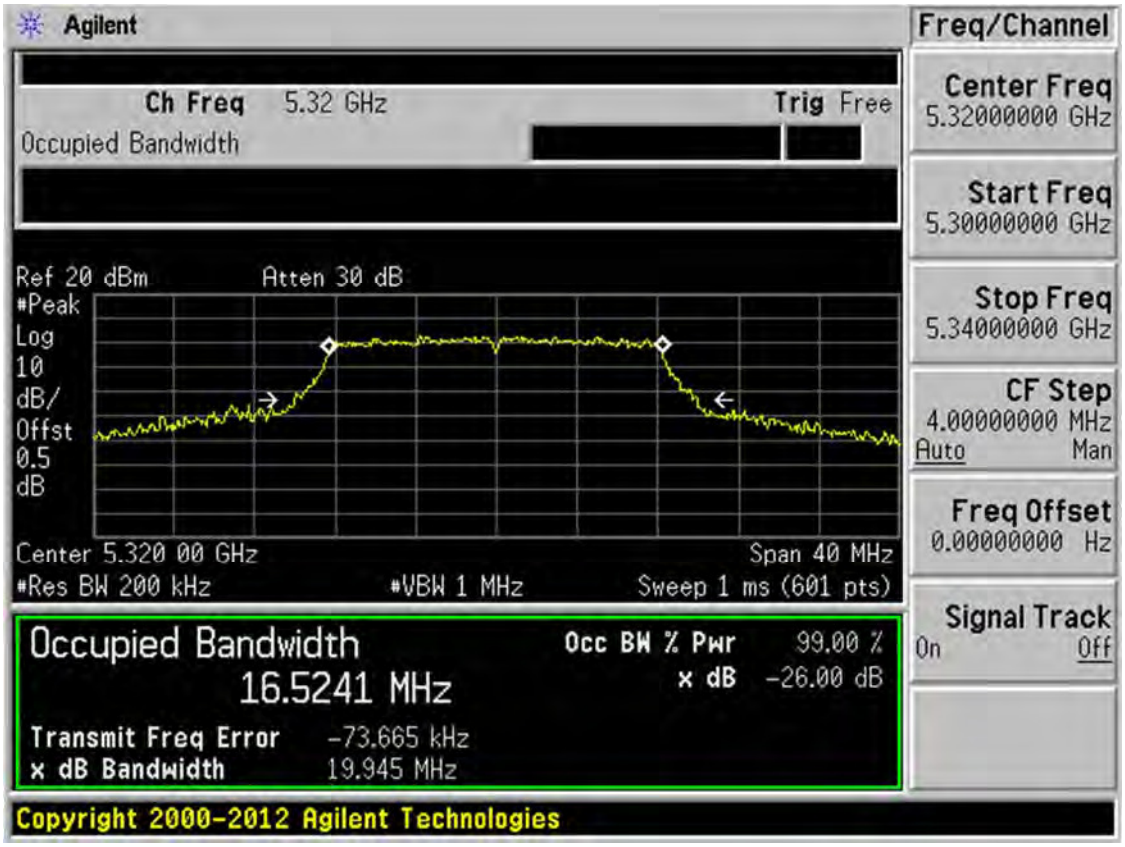
Band II 11a CH52



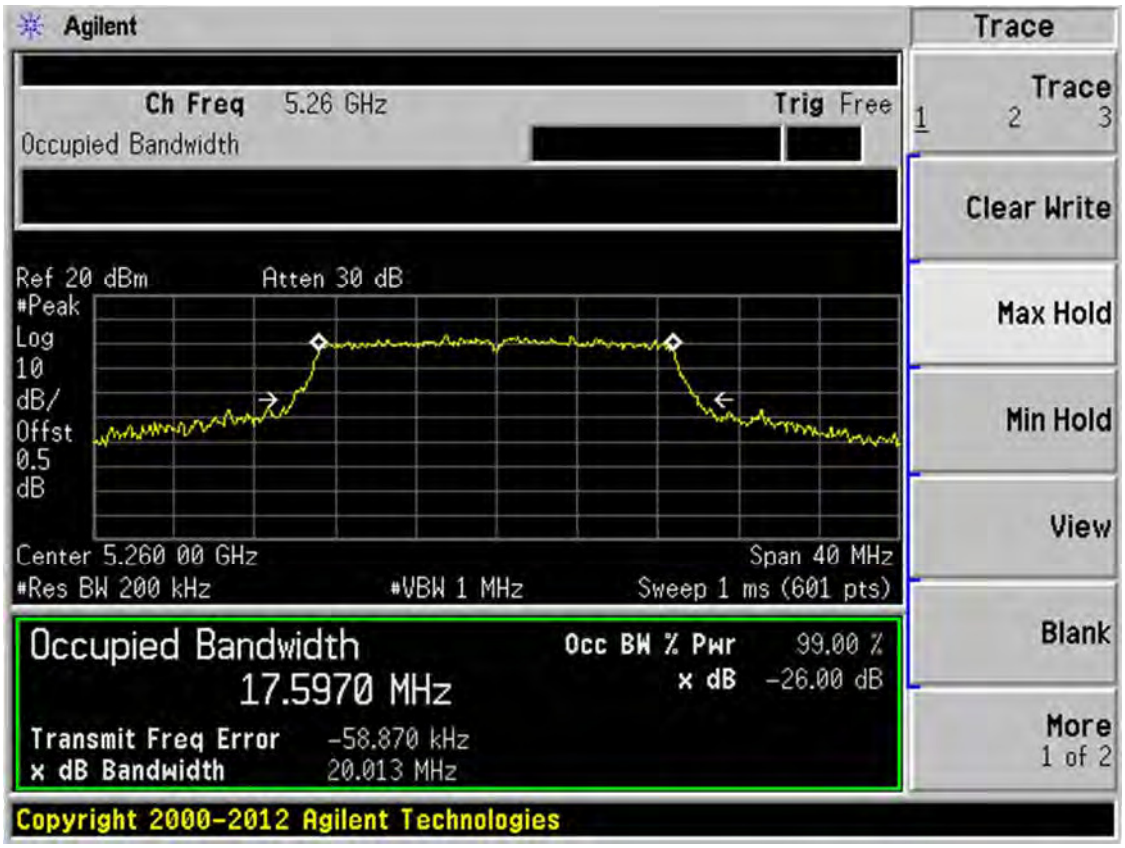
Band II 11a CH60



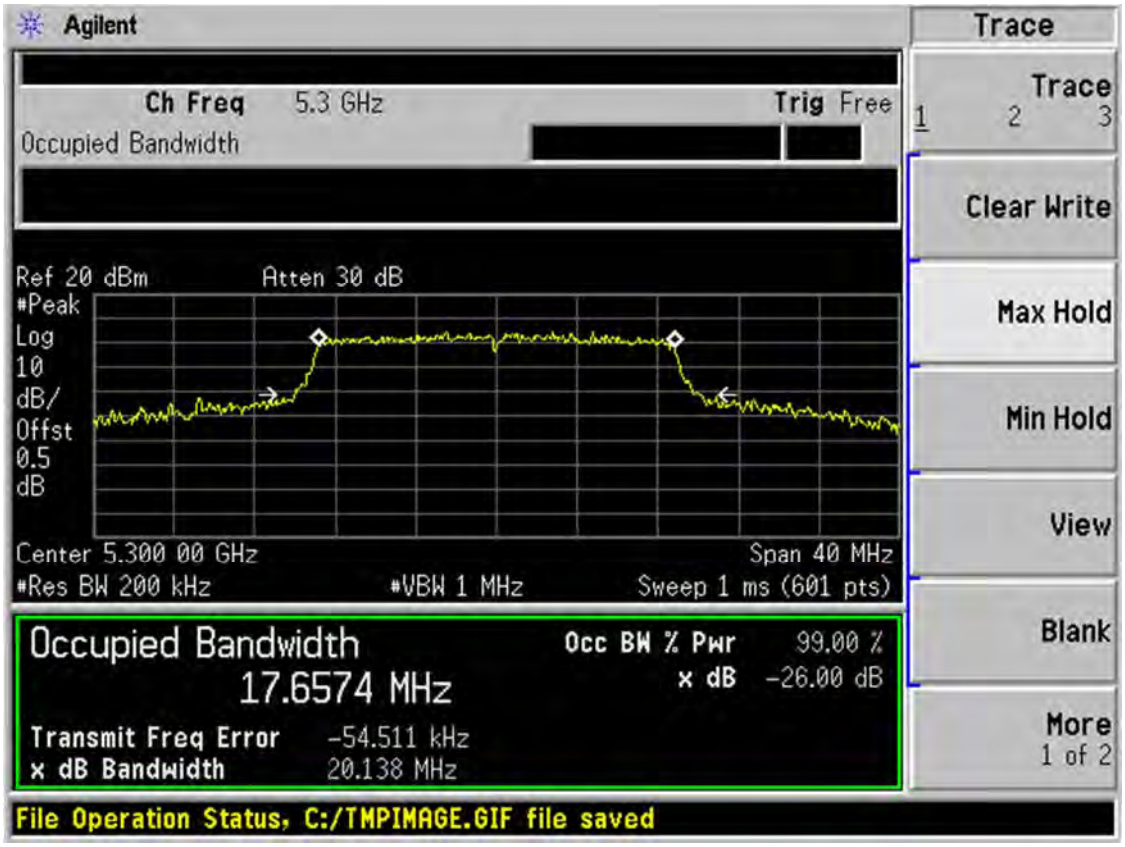
Band II 11a CH64



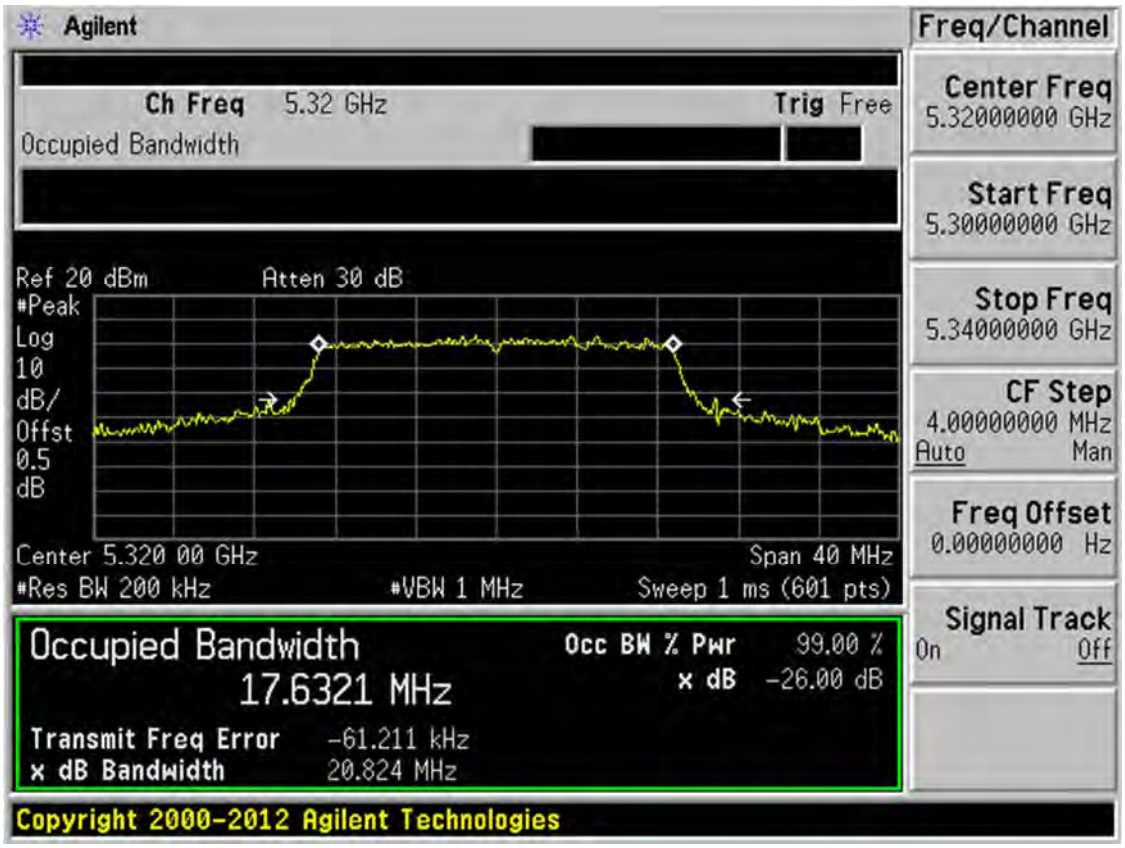
Band II 11n(HT20) CH52



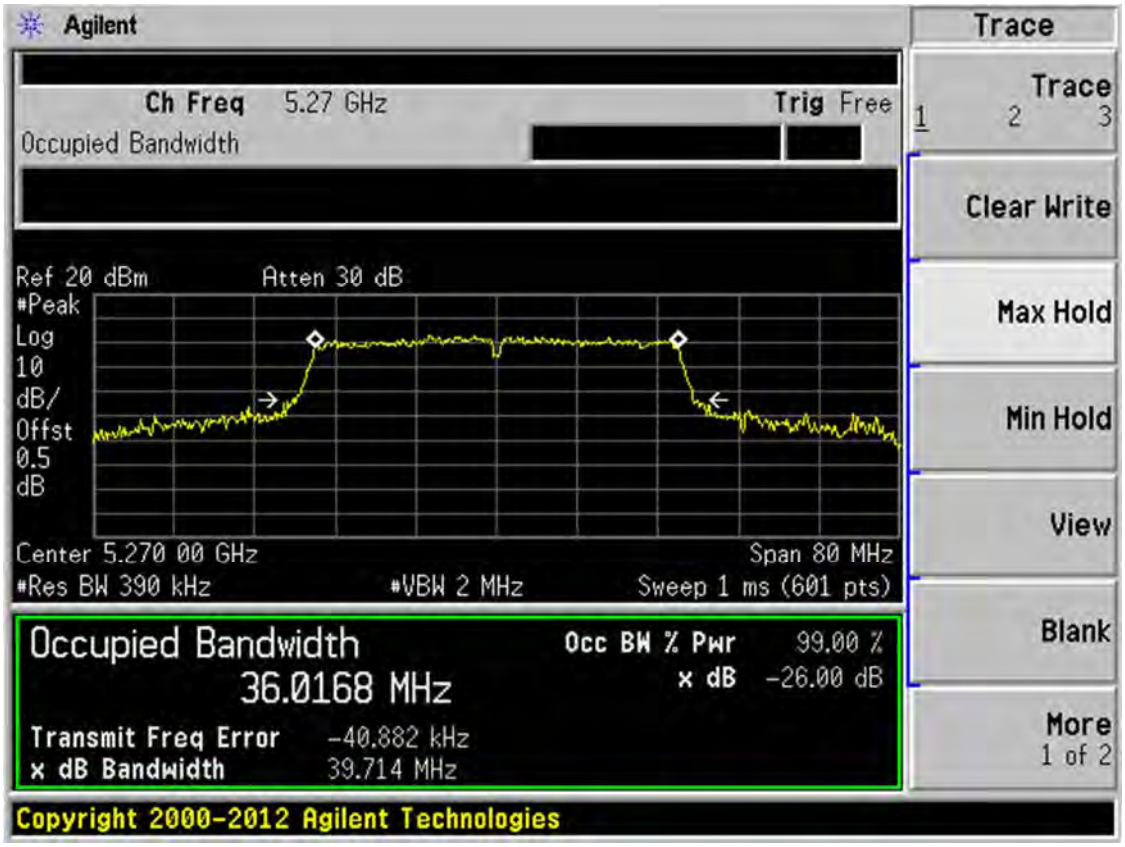
Band II 11n(HT20) CH60



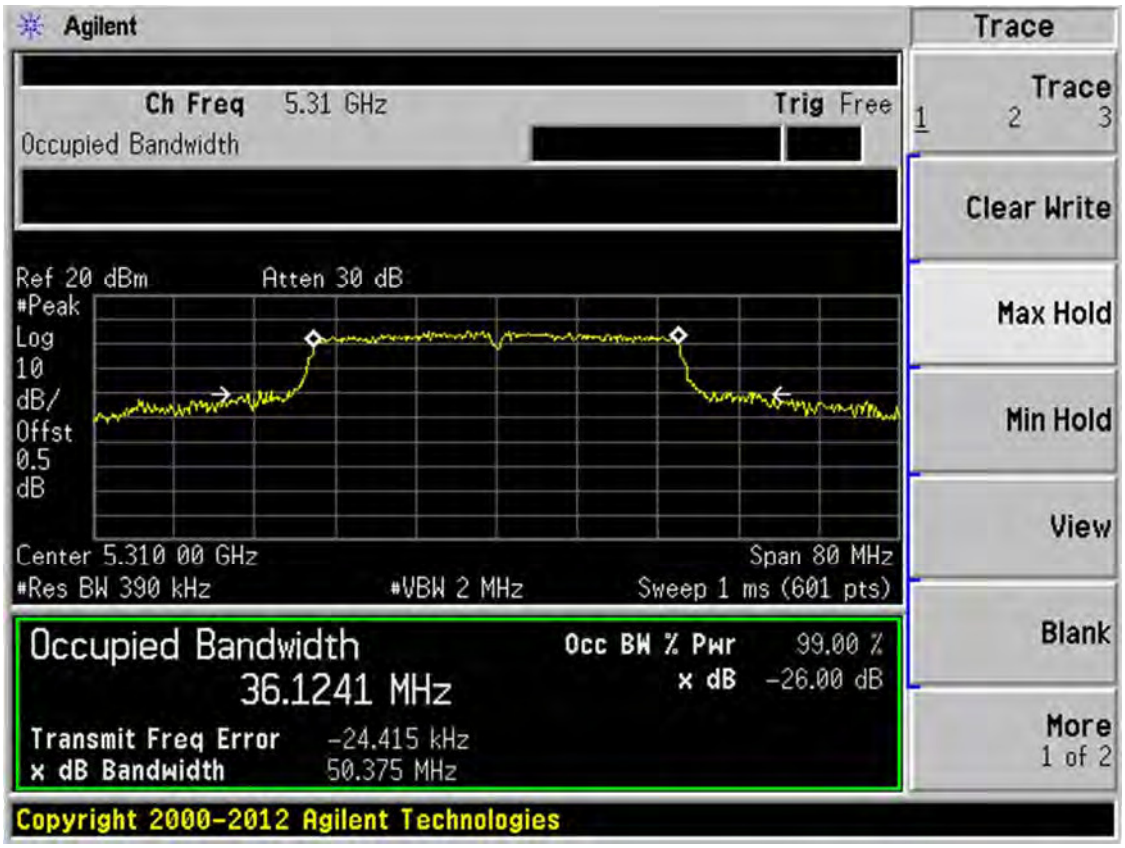
Band II 11n(HT20) CH64



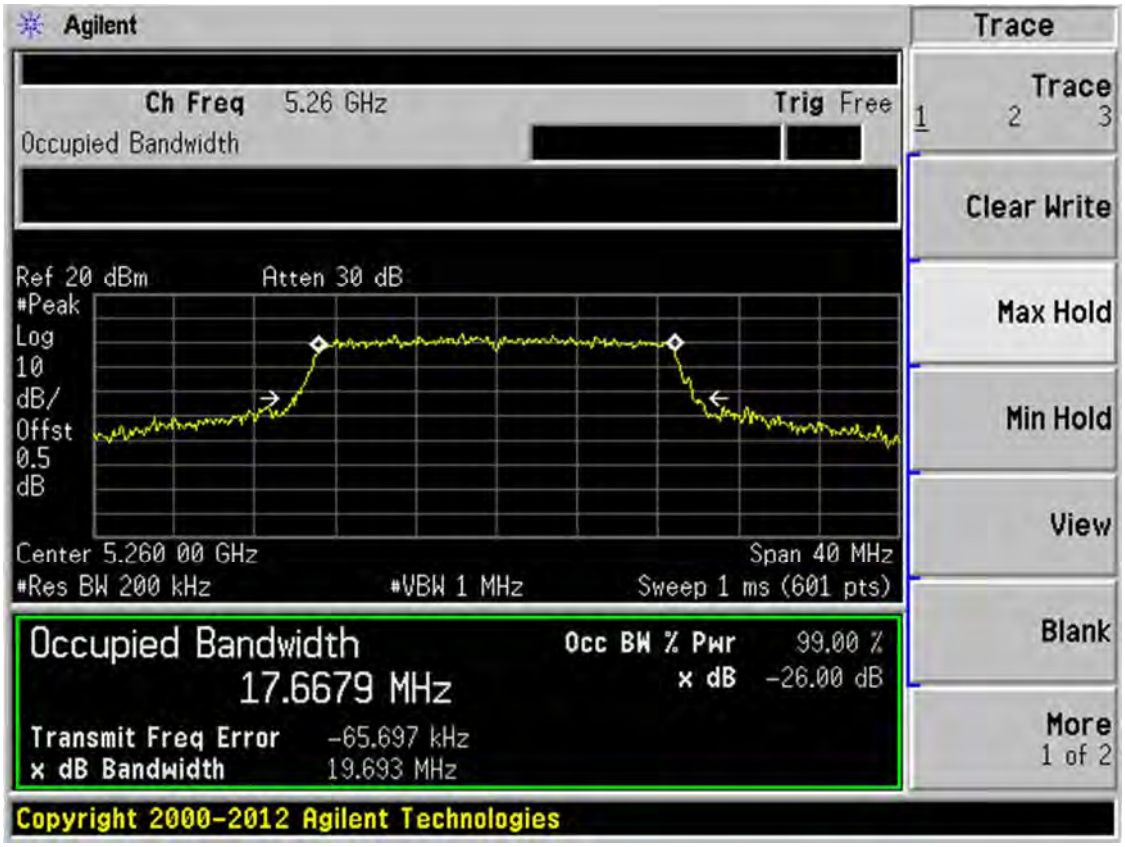
Band II 11n(HT40) CH54



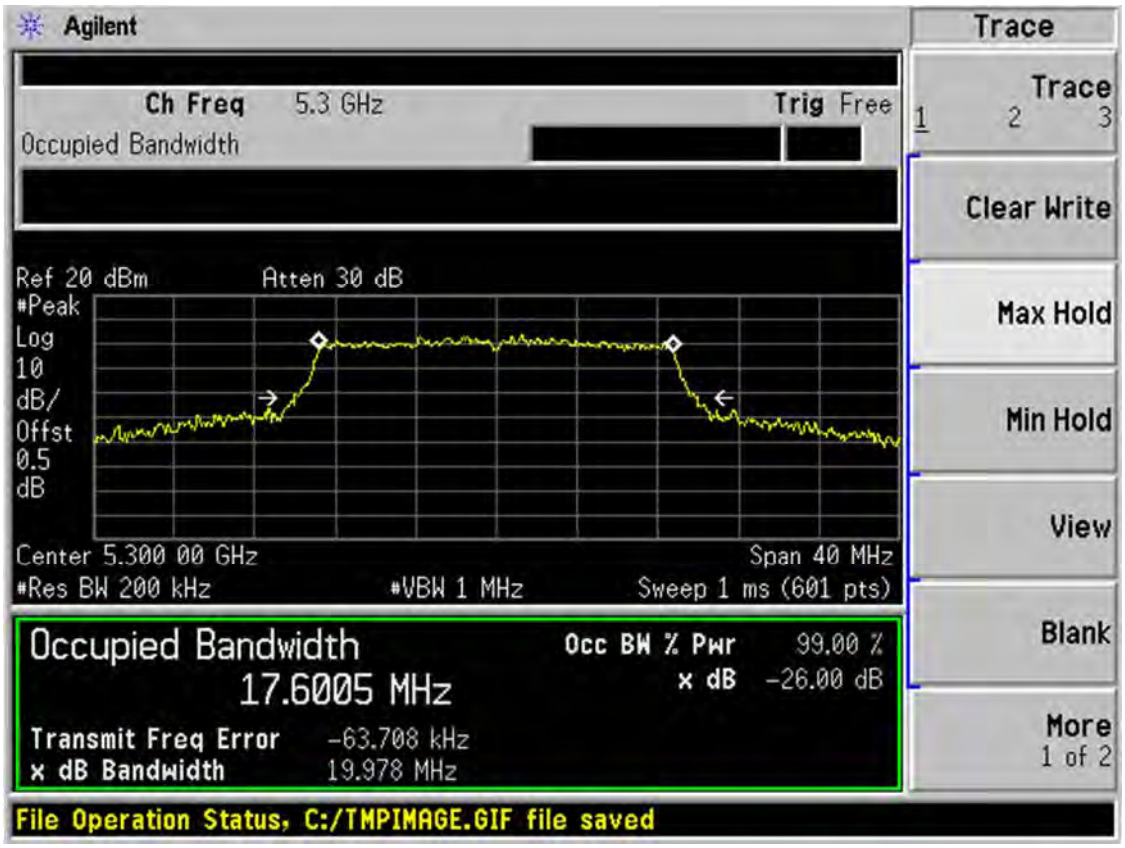
Band II 11n(HT40) CH62



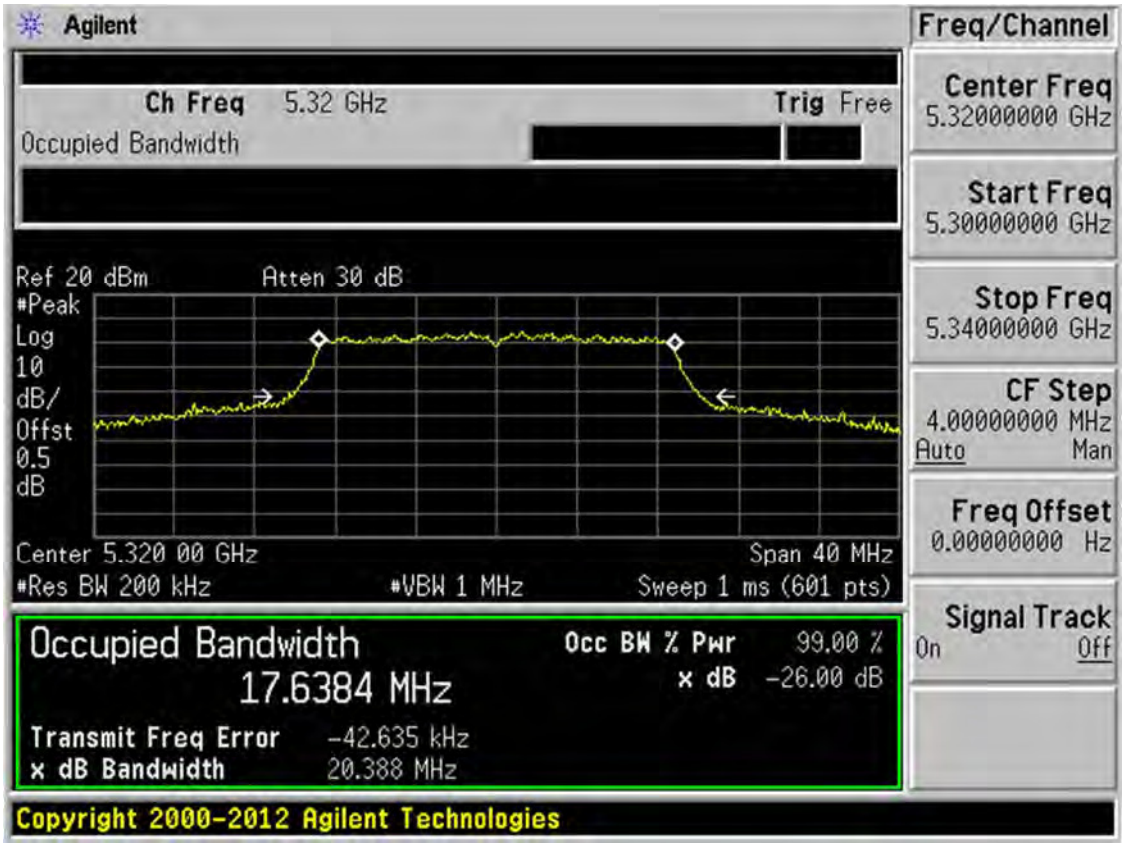
Band II 11ac(HT20) CH52



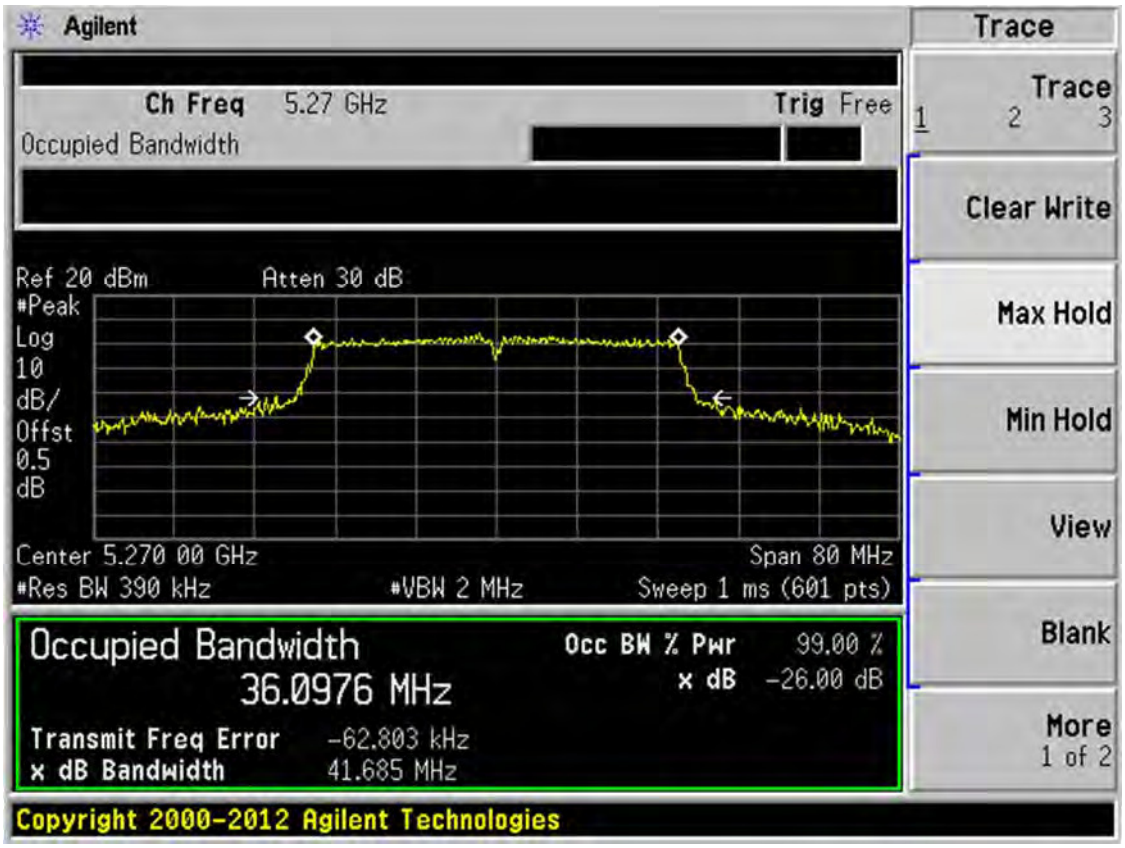
Band II 11ac(HT20) CH60



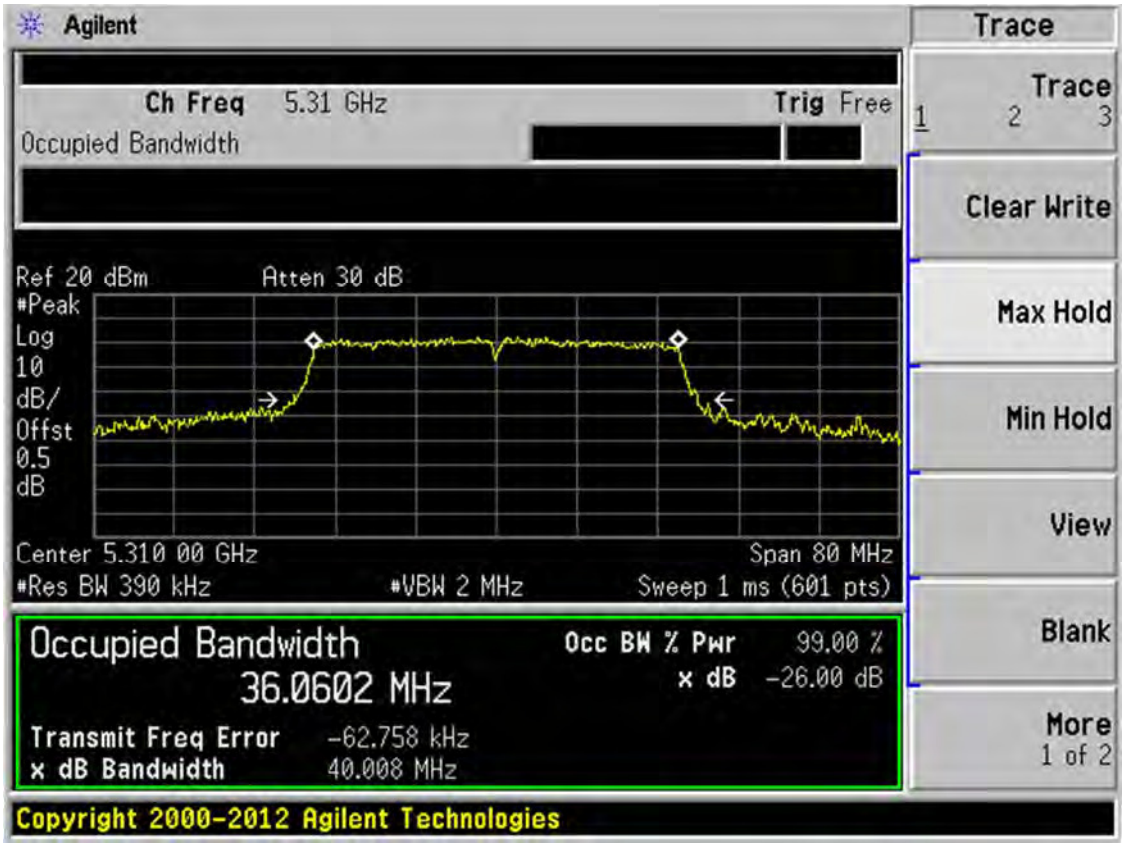
Band II 11ac(HT20) CH64



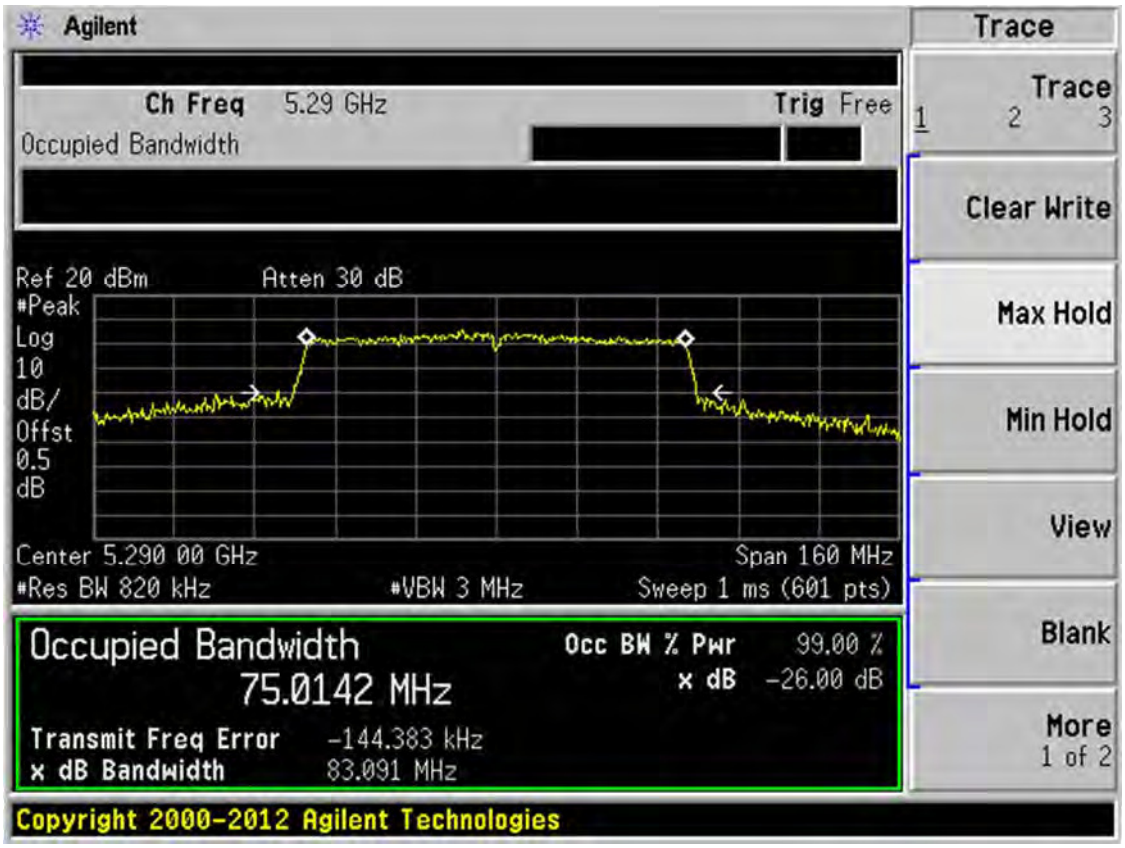
Band II 11ac(HT40) CH54



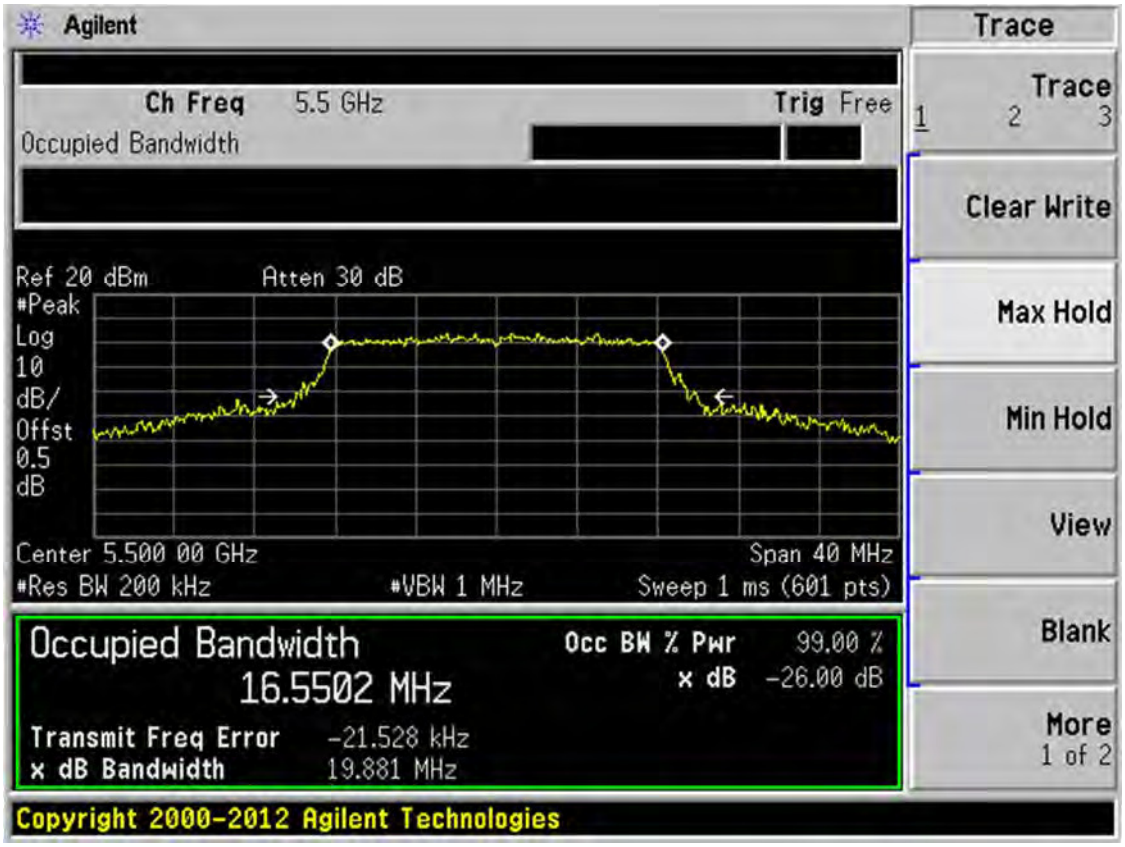
Band II 11ac(HT40) CH62



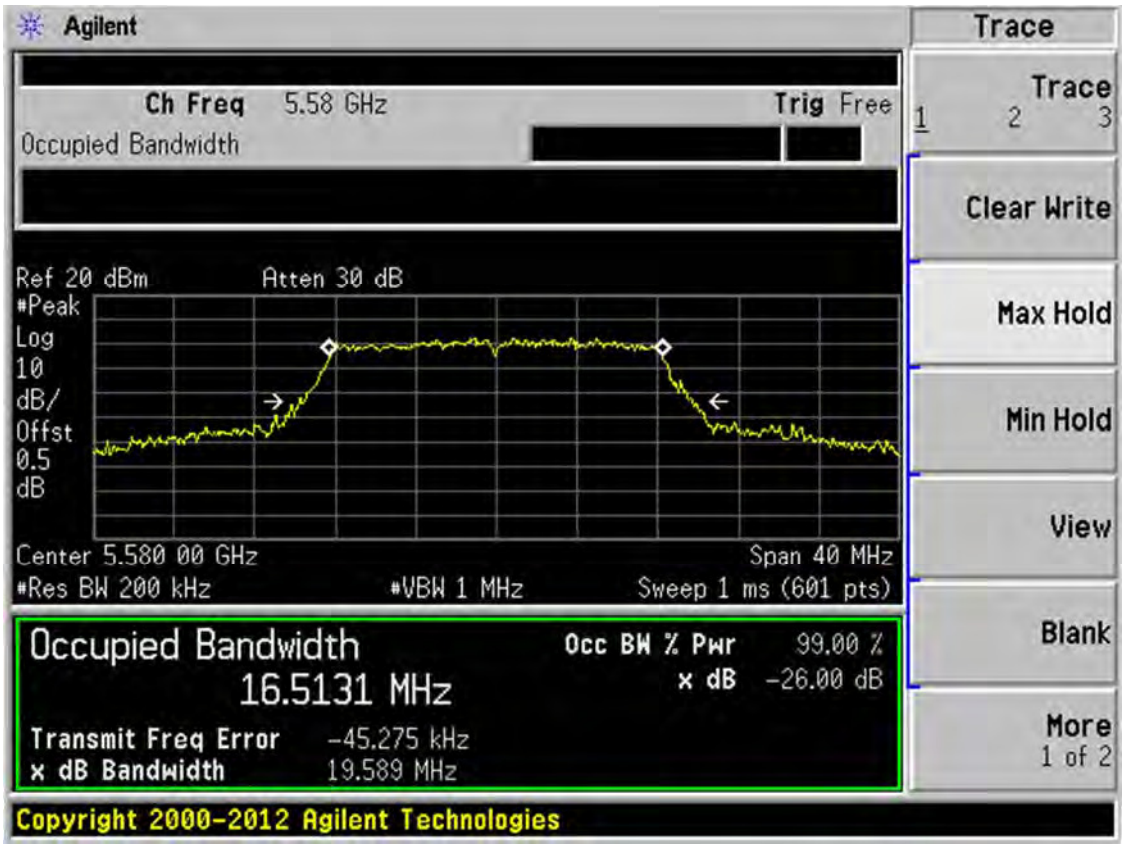
Band II 11ac(HT80) CH58



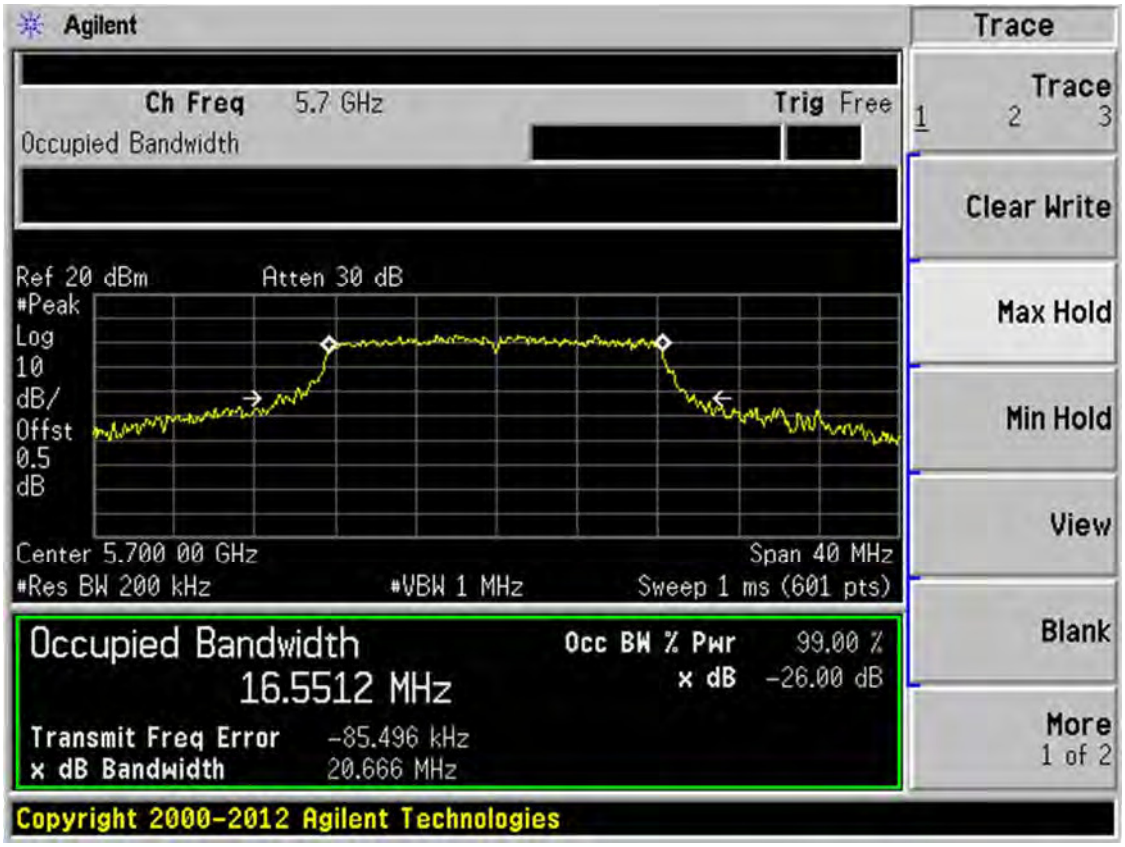
Band III 11a CH100



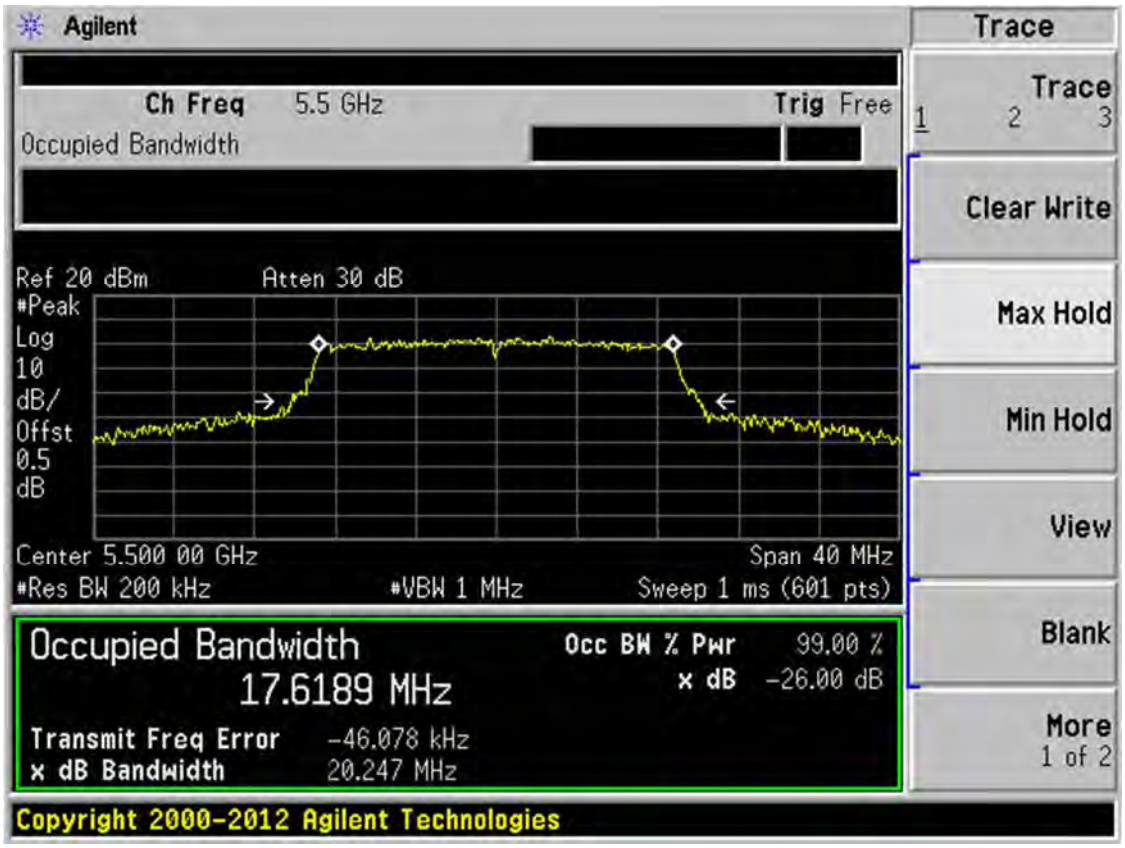
Band III 11a CH116



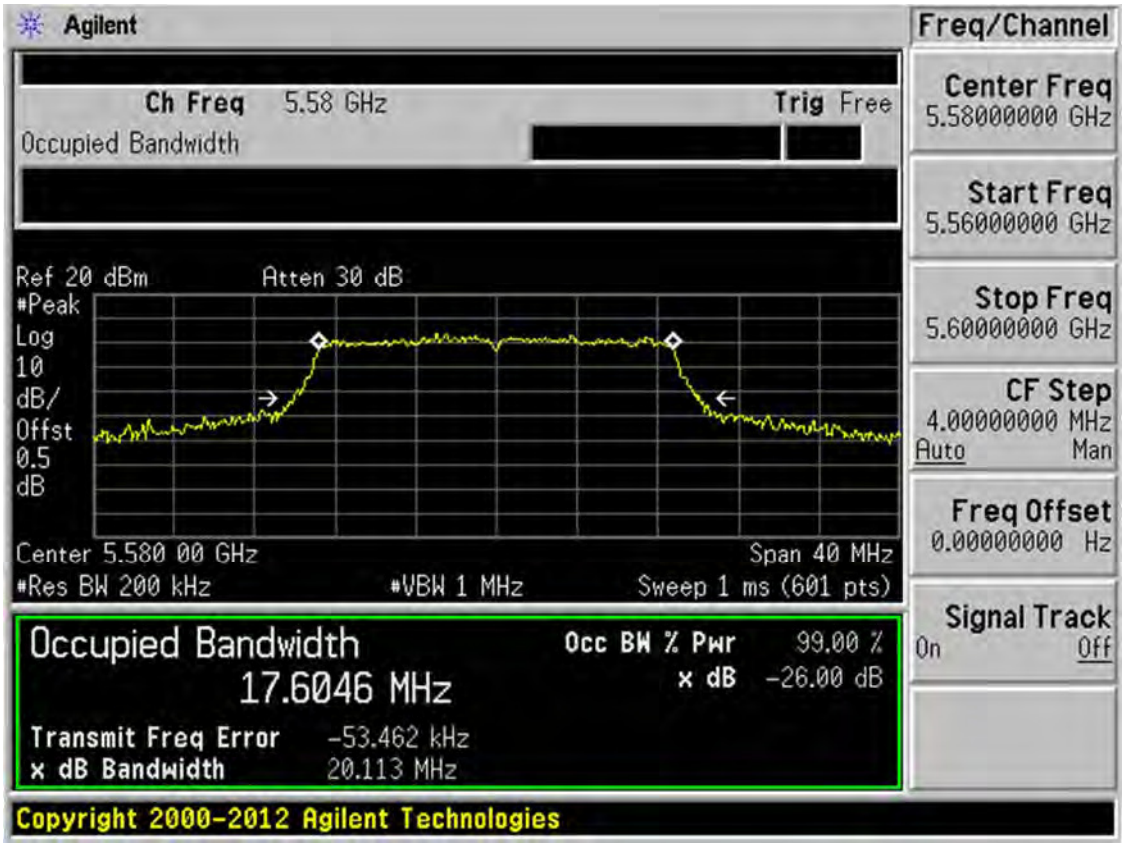
Band III 11a CH140



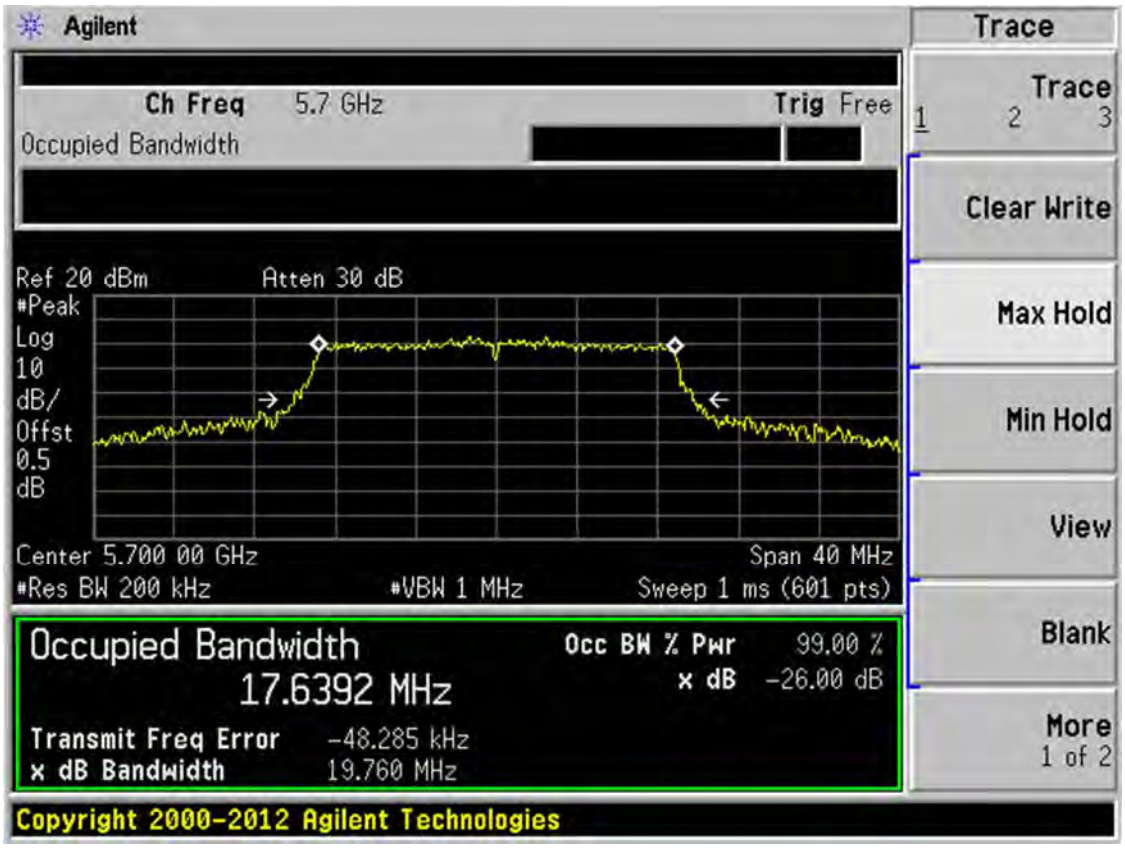
Band III 11n(HT20) CH100



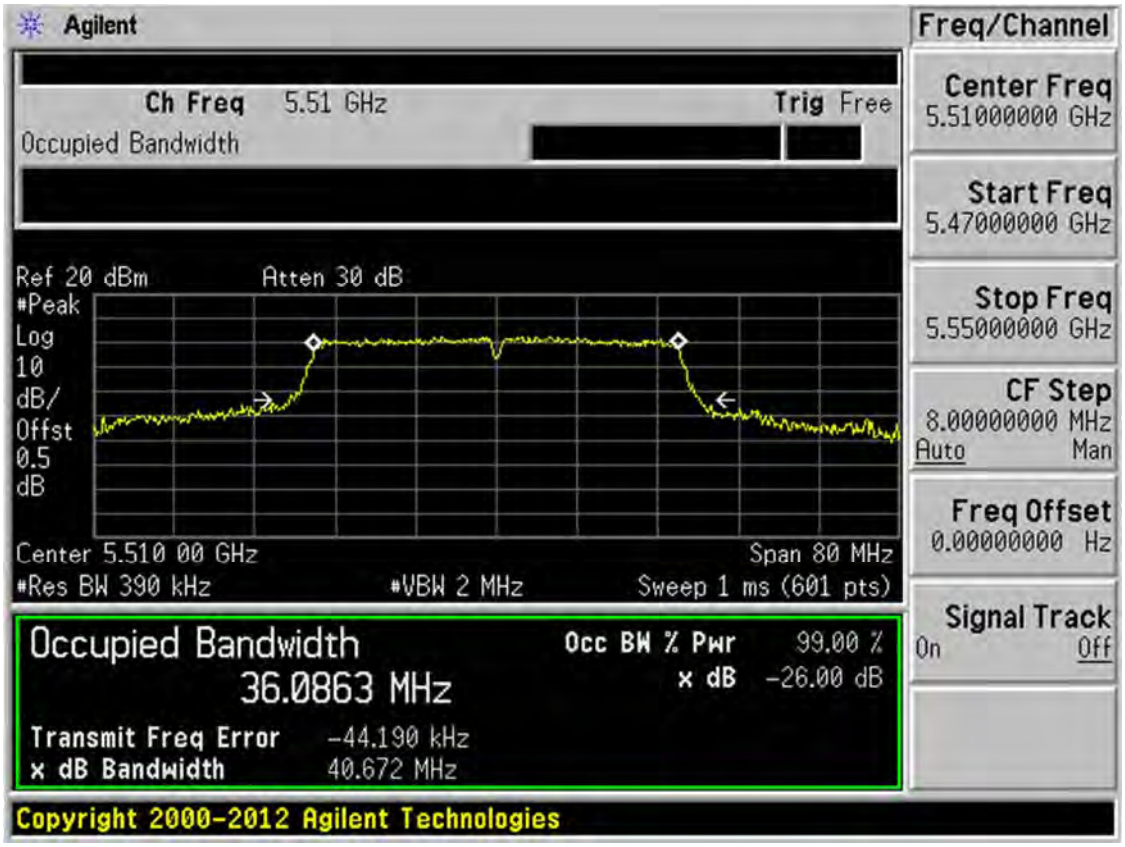
Band III 11n(HT20) CH116



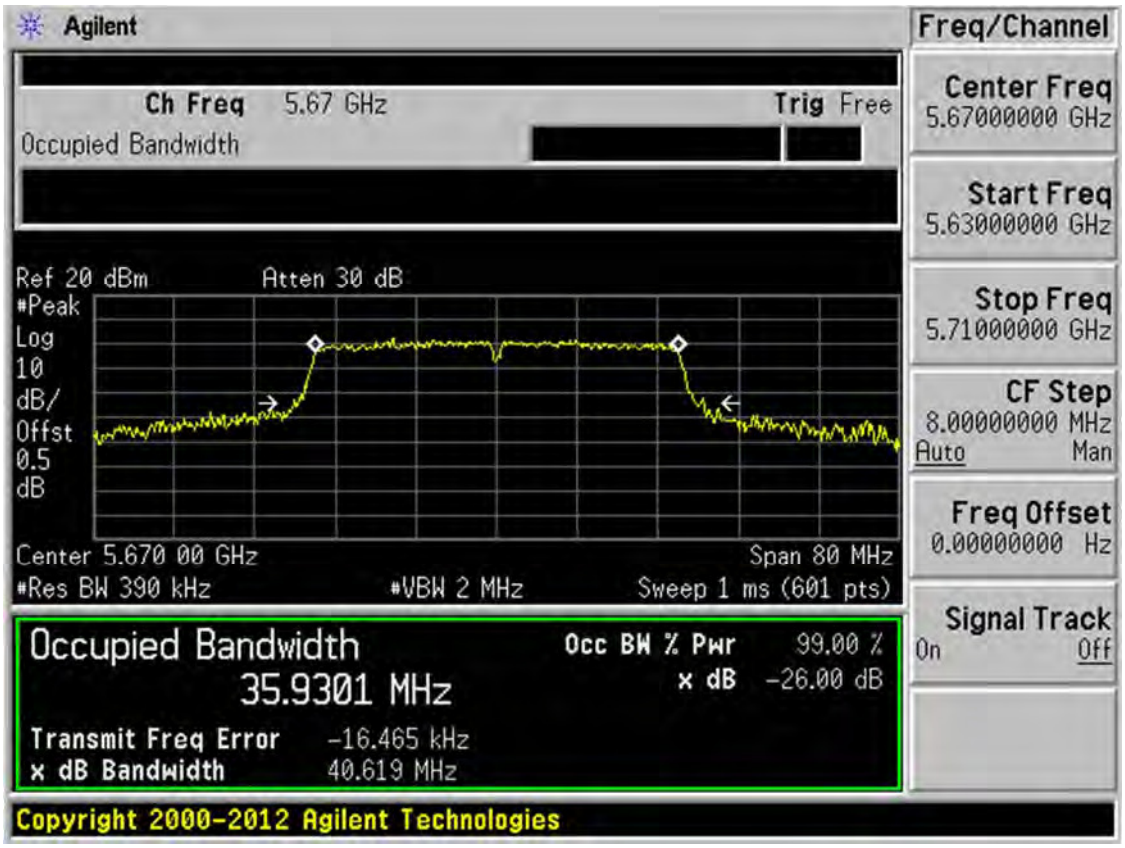
Band III 11n(HT20) CH140



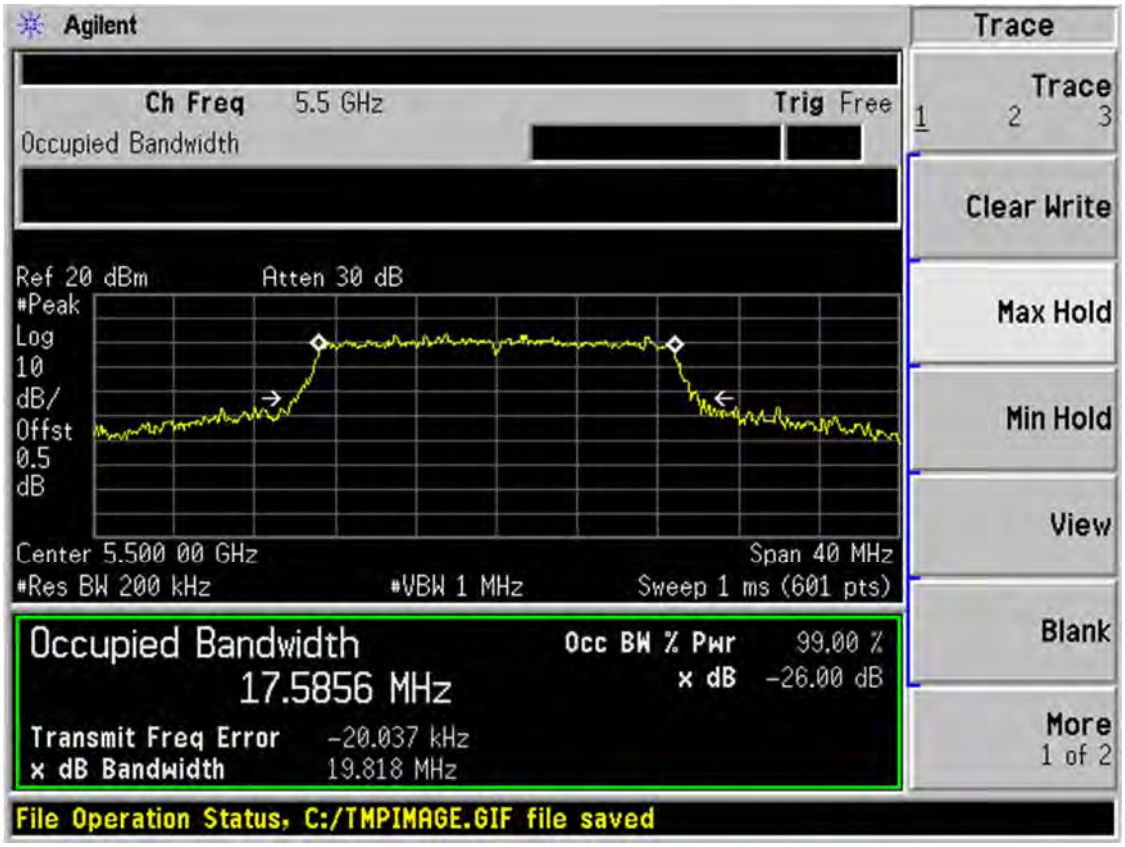
Band III 11n(HT40) CH102



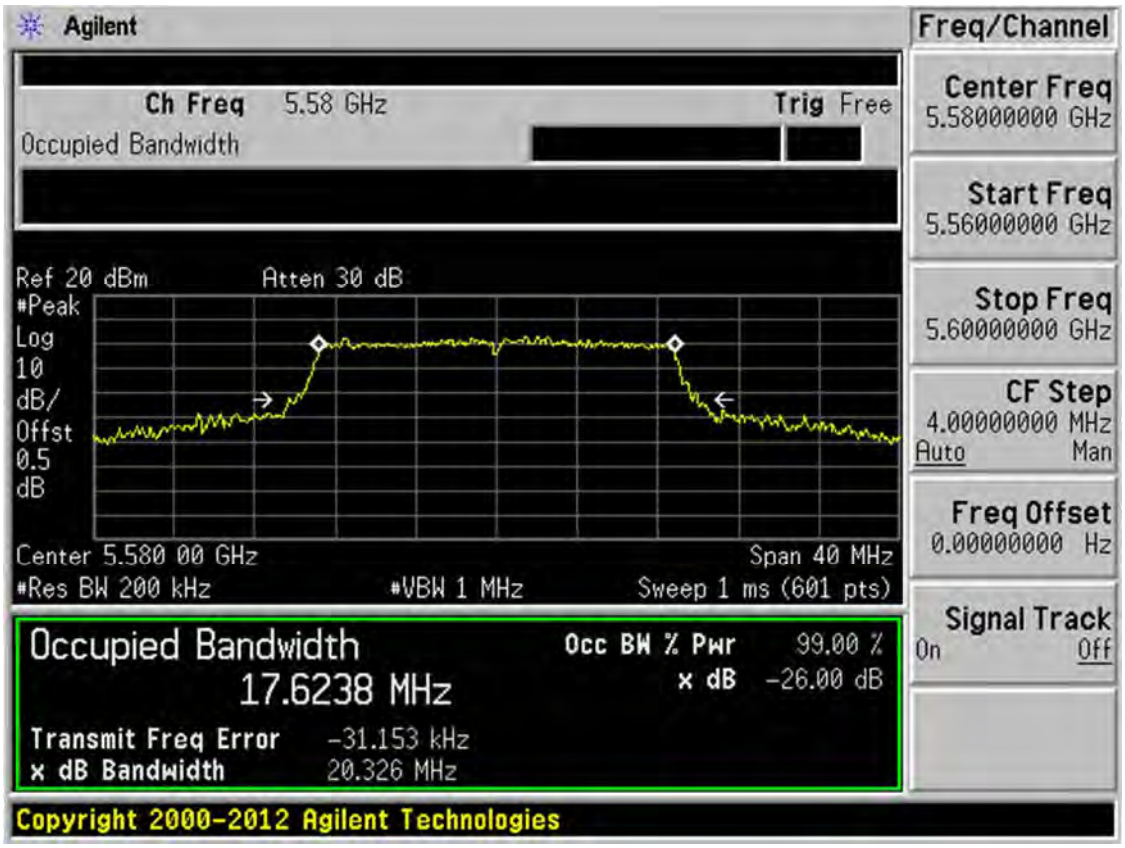
Band III 11n(HT40) CH134



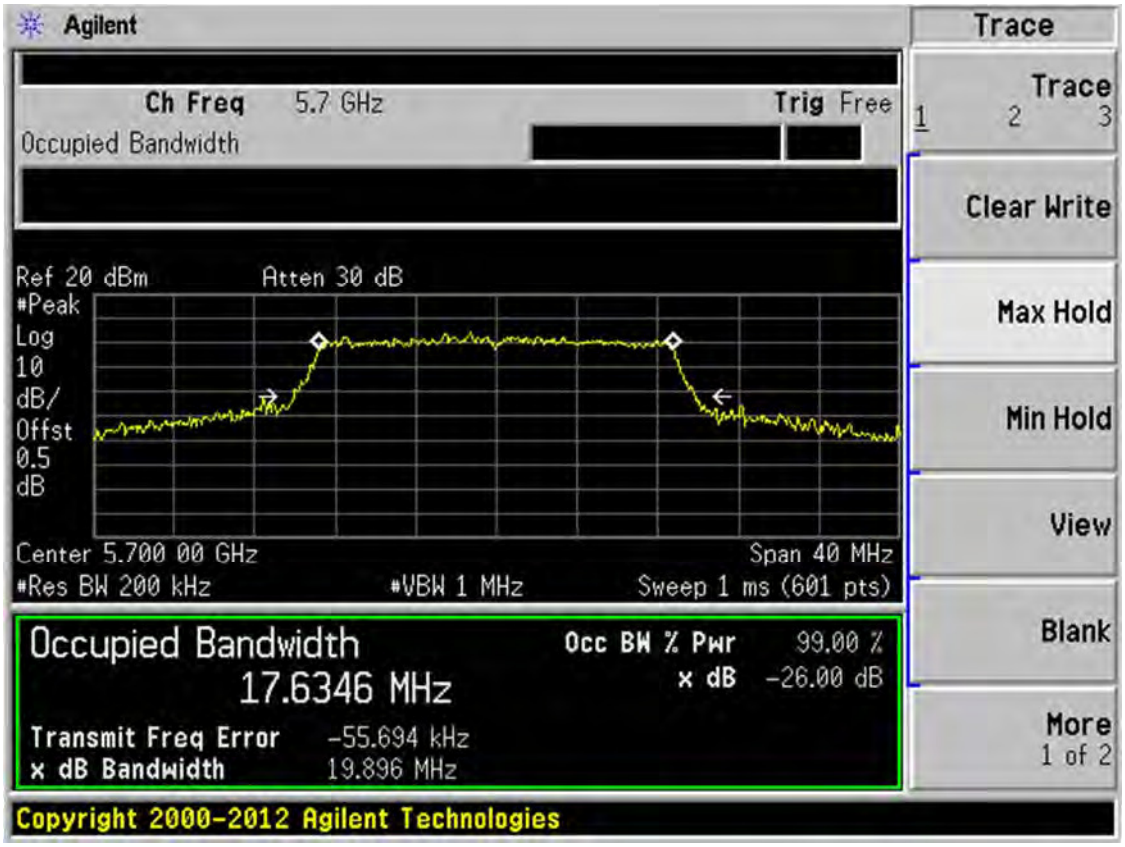
Band III 11ac(HT20) CH100



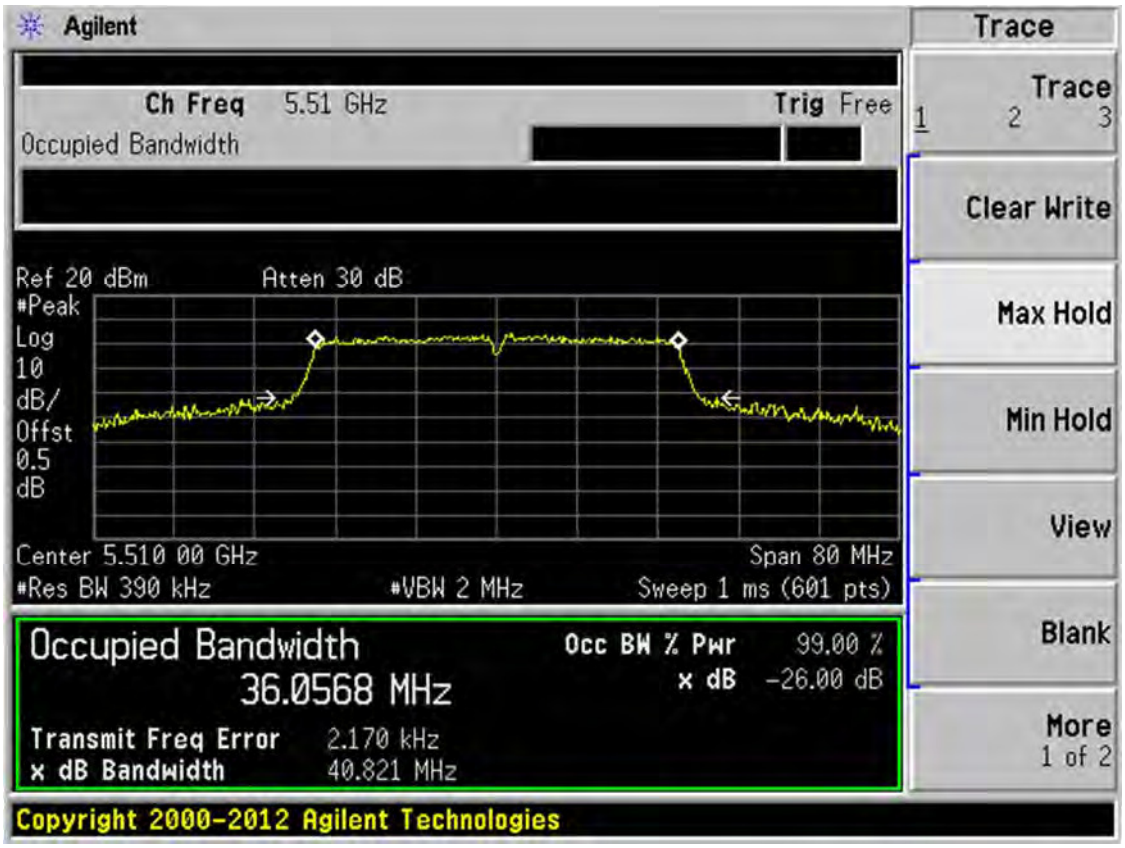
Band III 11ac(HT20) CH116



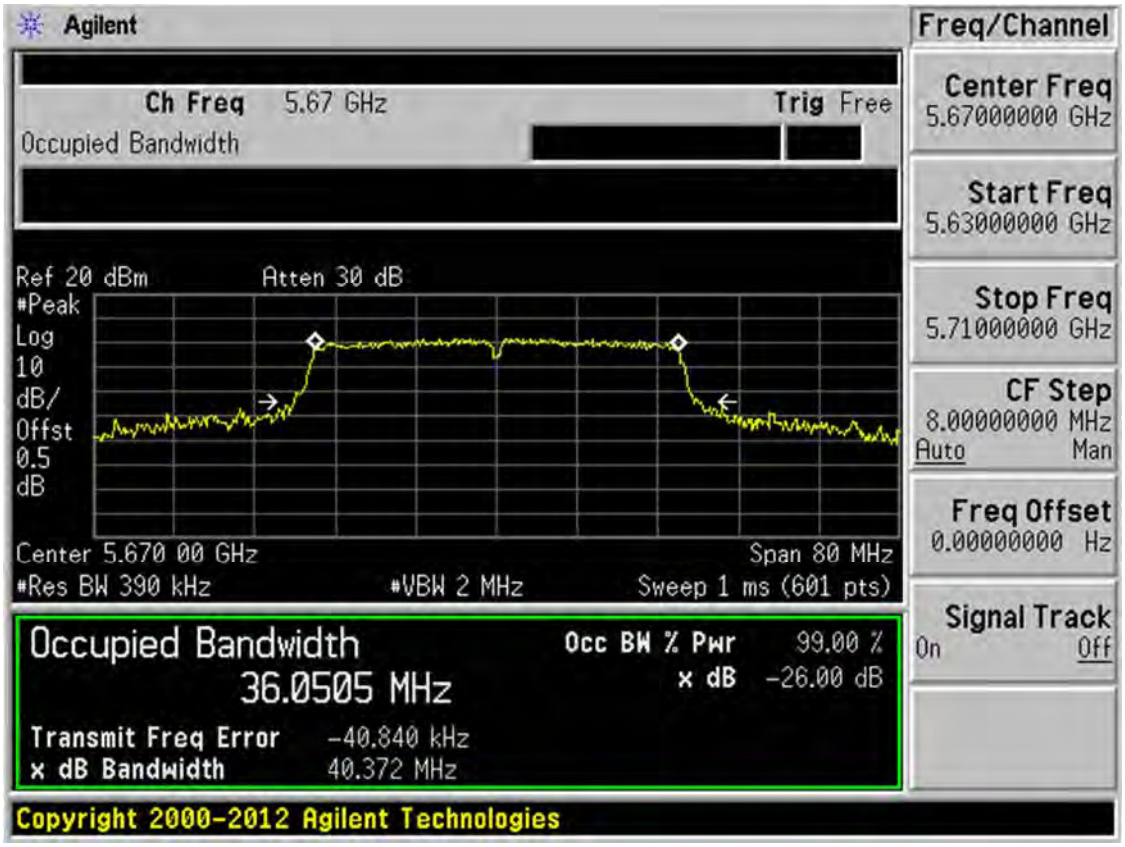
Band III 11ac(HT20) CH140



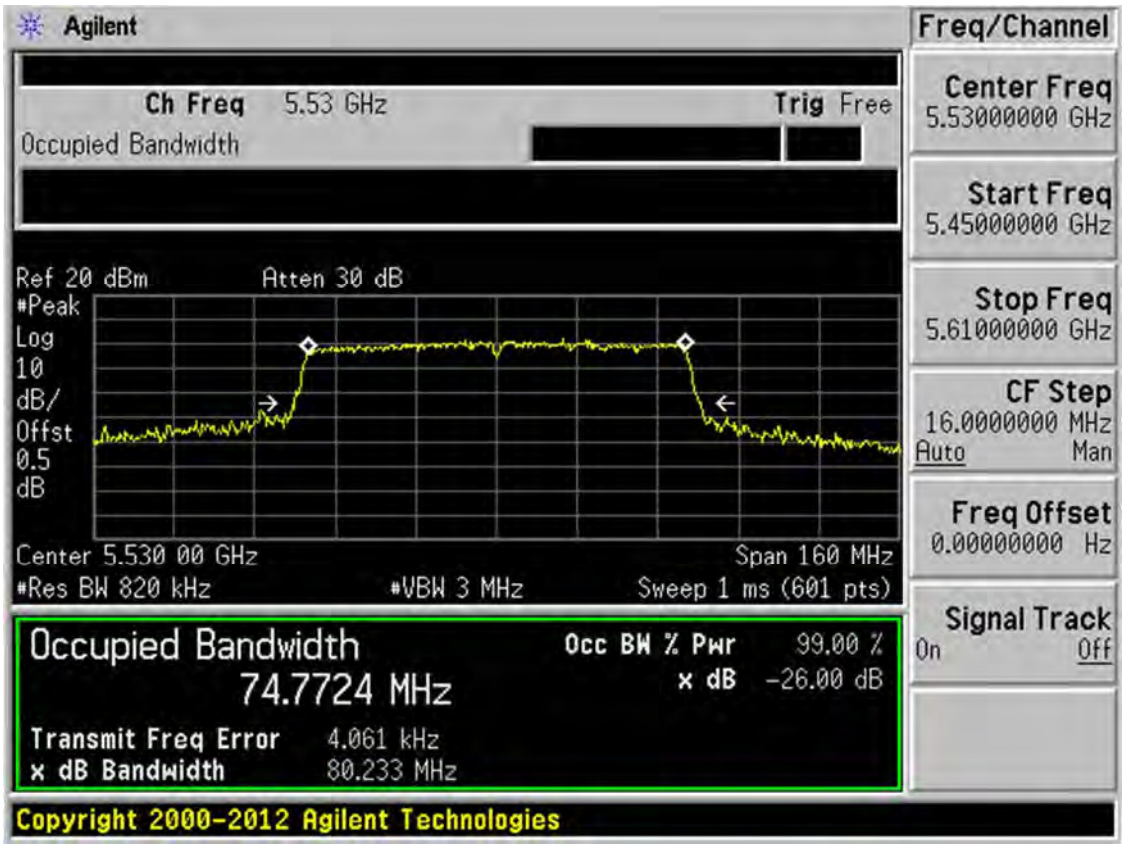
Band III 11ac(HT40) CH102



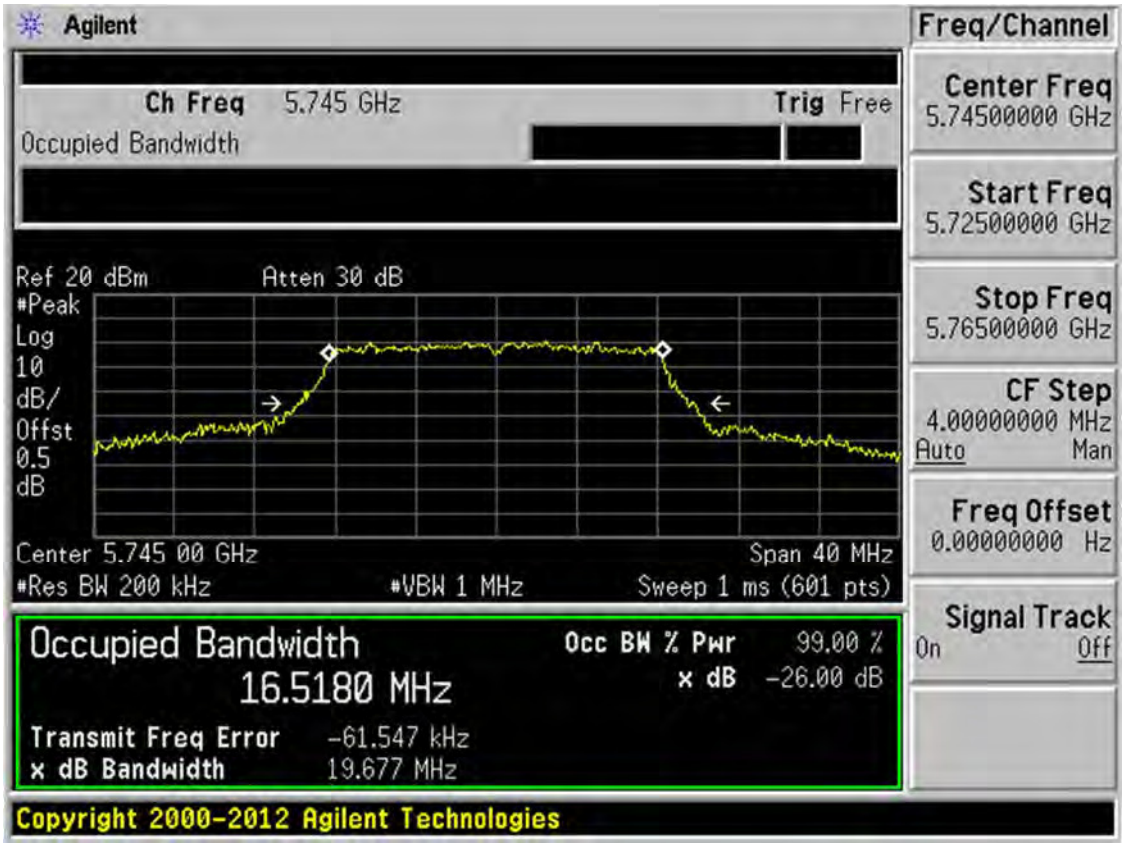
Band III 11ac(HT40) CH134



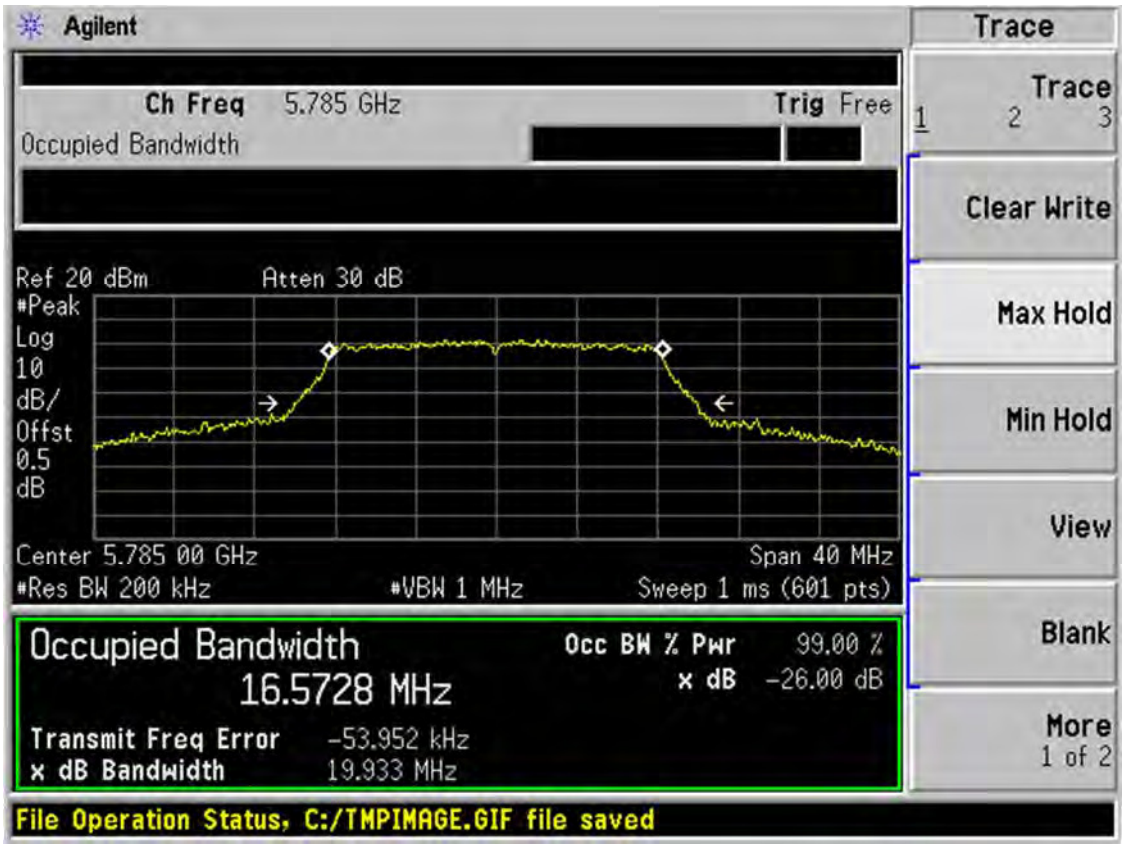
Band III 11ac(HT80) CH106



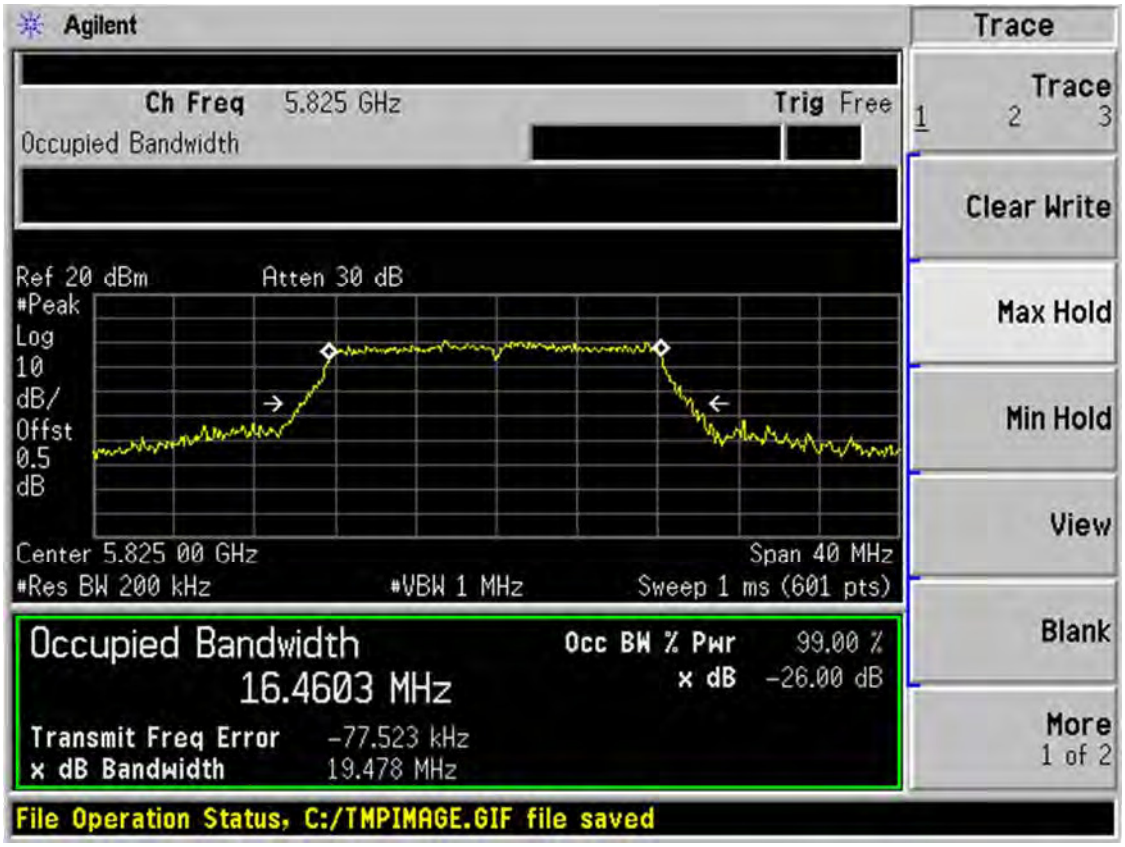
Band IV 11a CH149



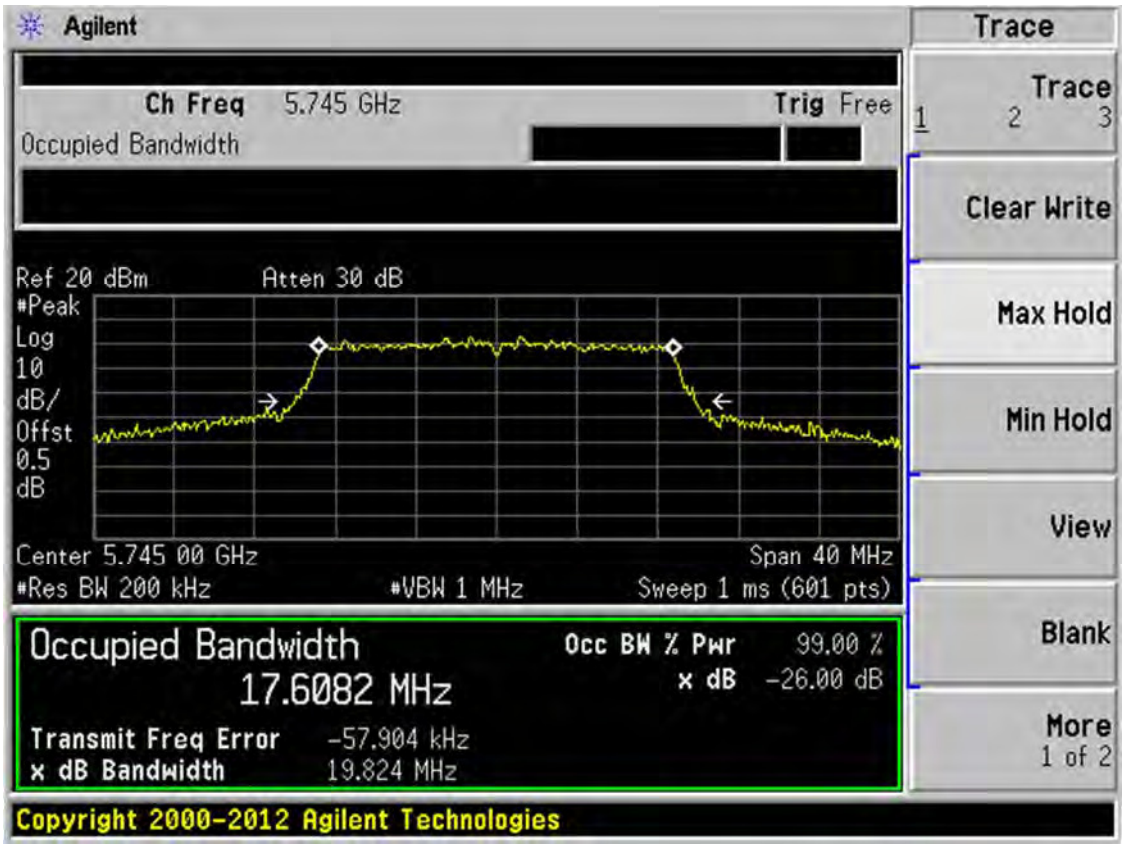
Band IV 11a CH157



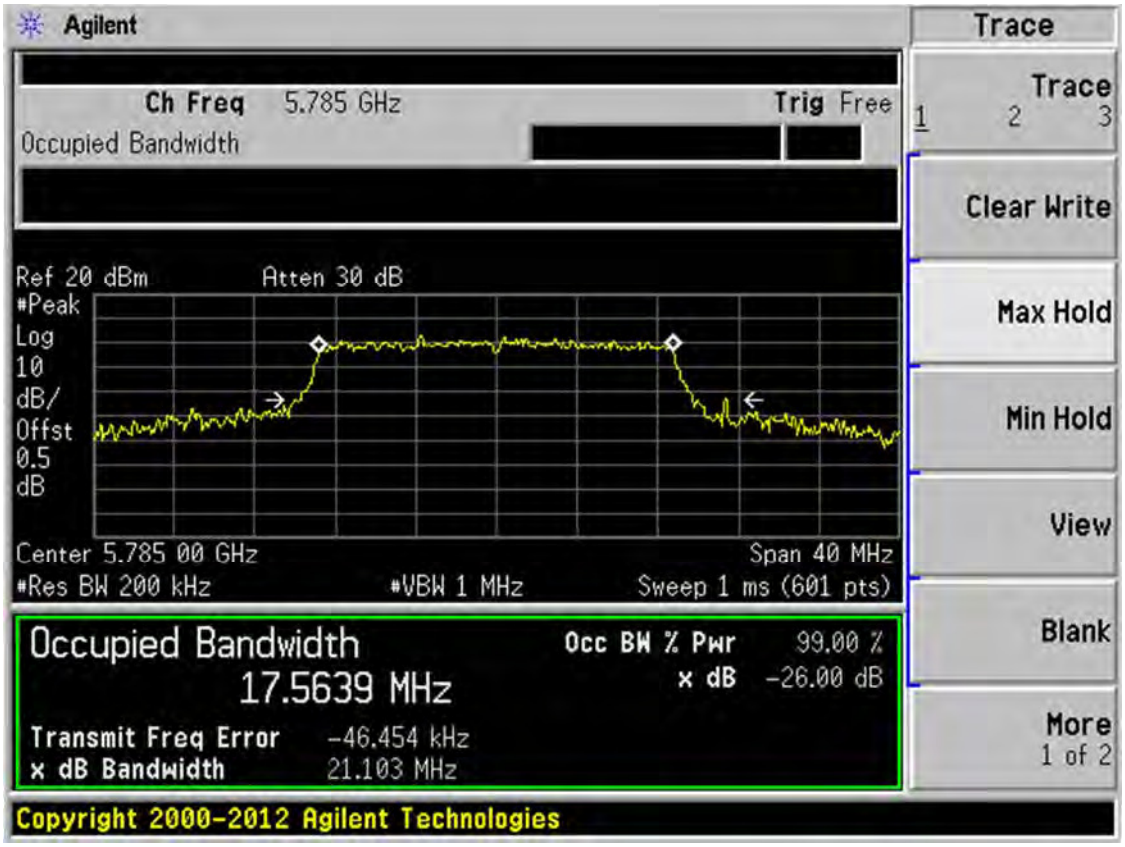
Band IV 11a CH165



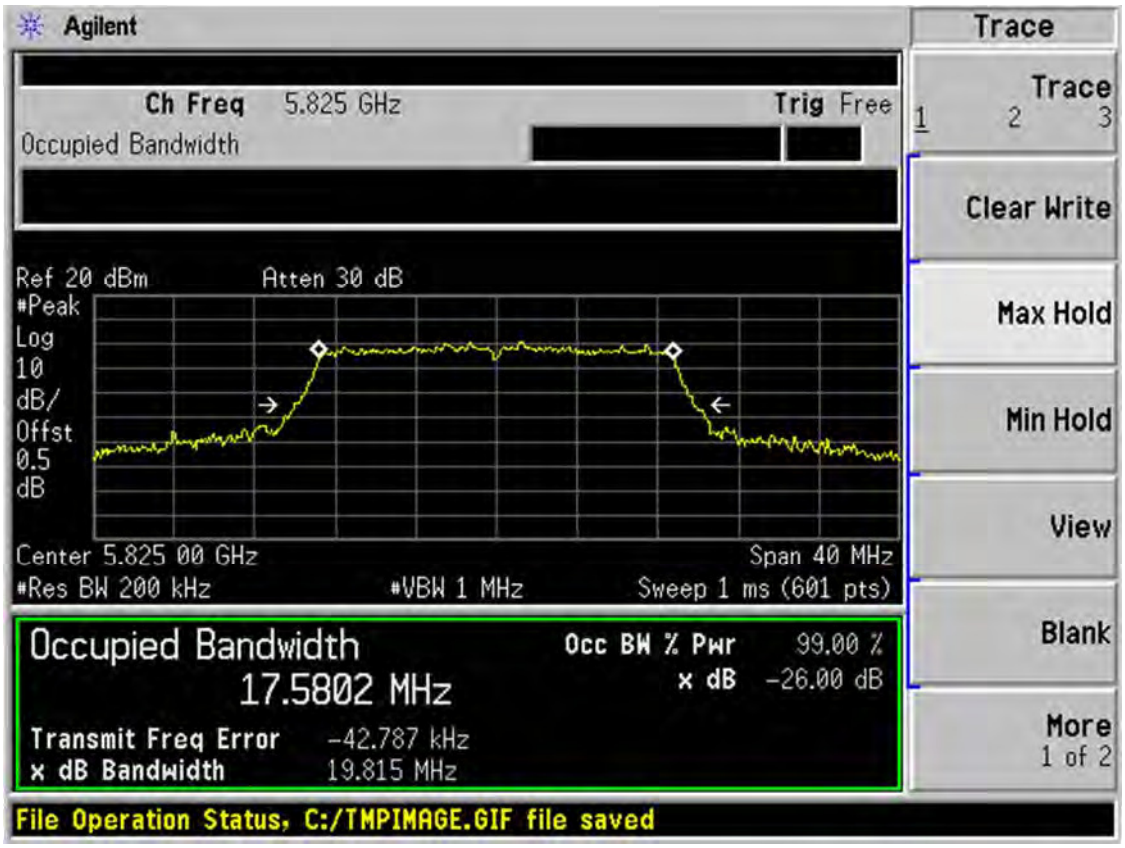
Band IV 11n(HT20) CH149



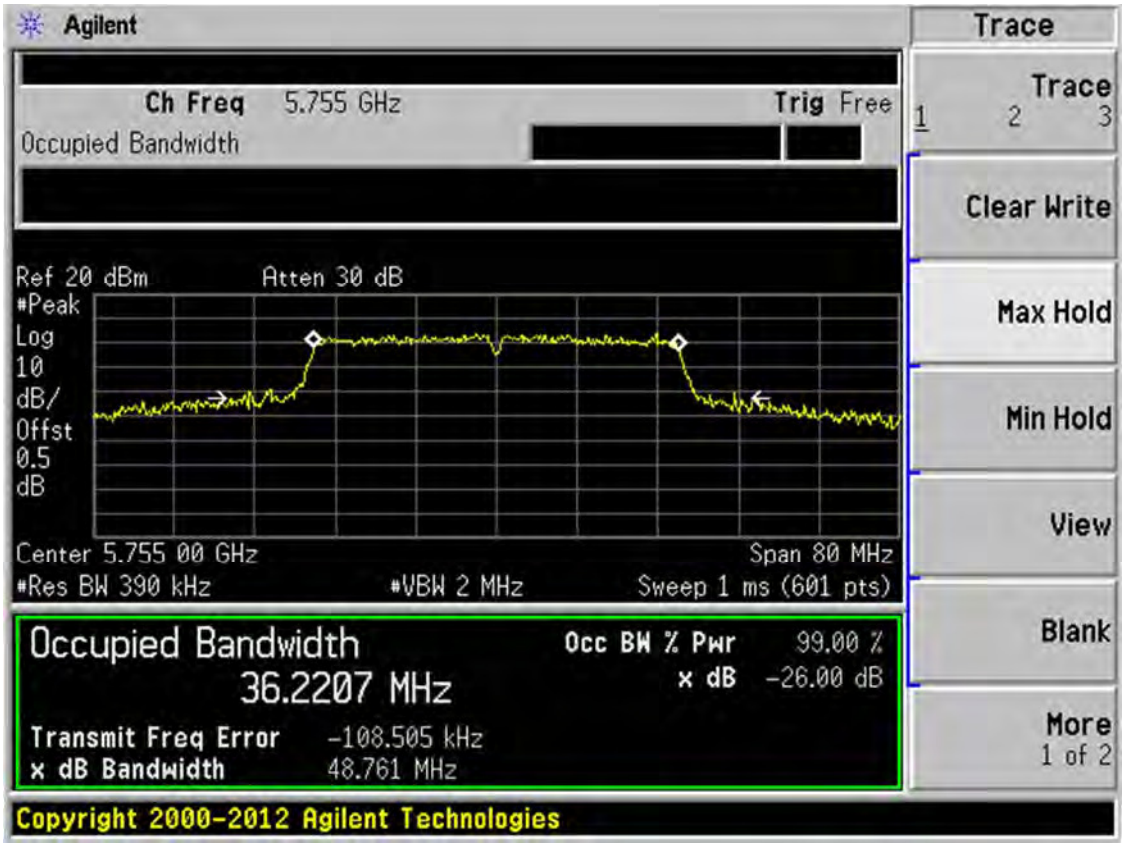
Band IV 11n(HT20) CH157



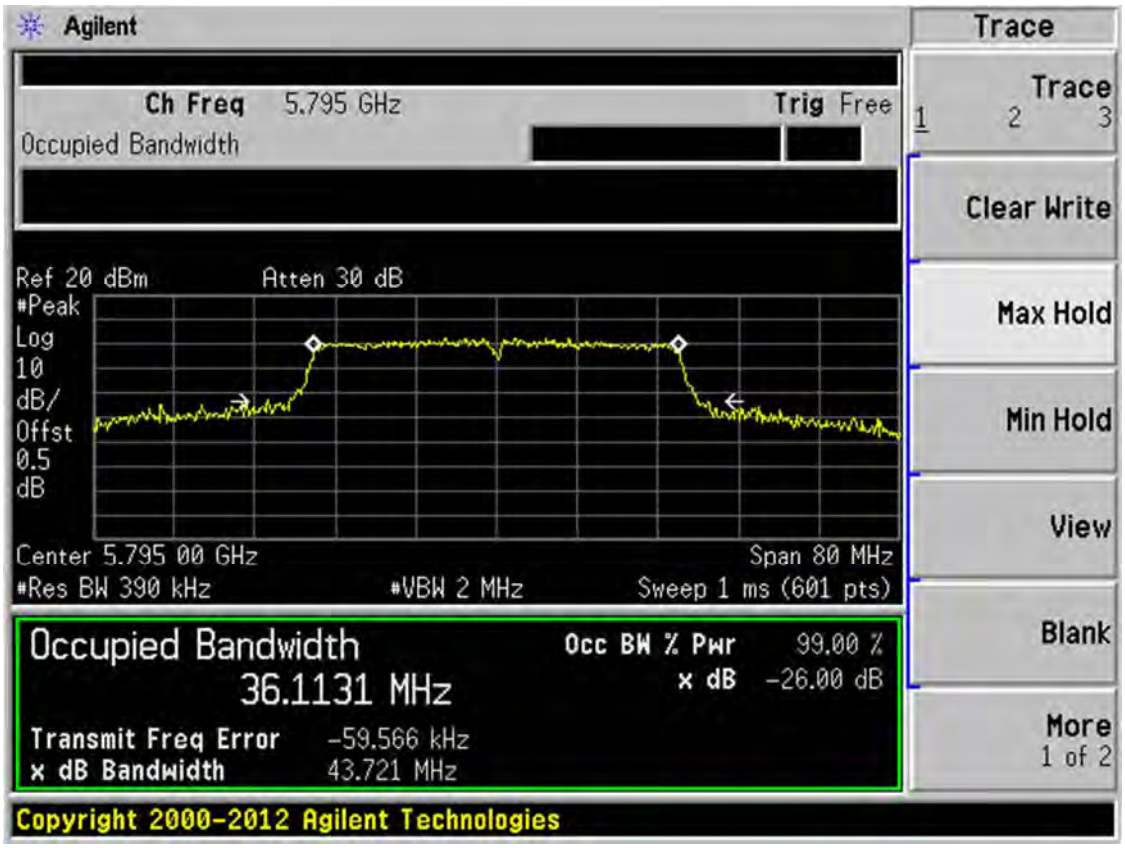
Band IV 11n(HT20) CH165



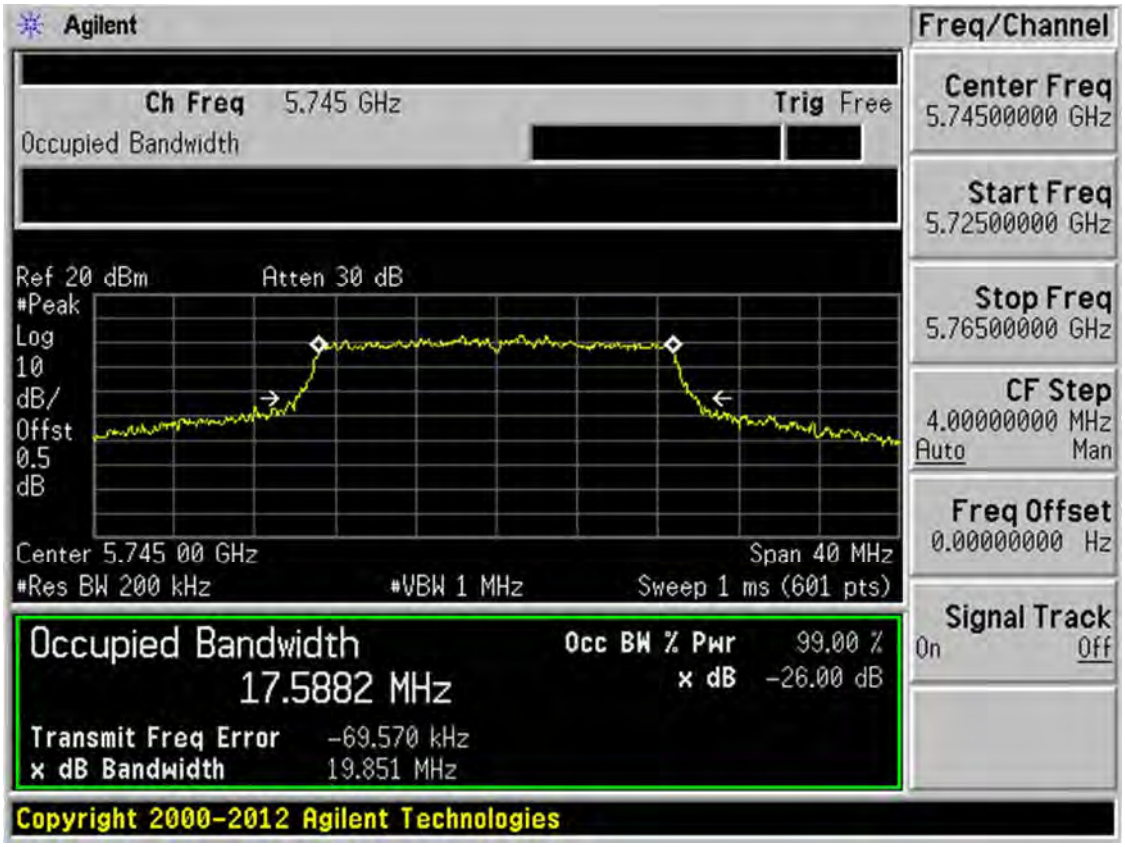
Band IV 11n(HT40) CH151



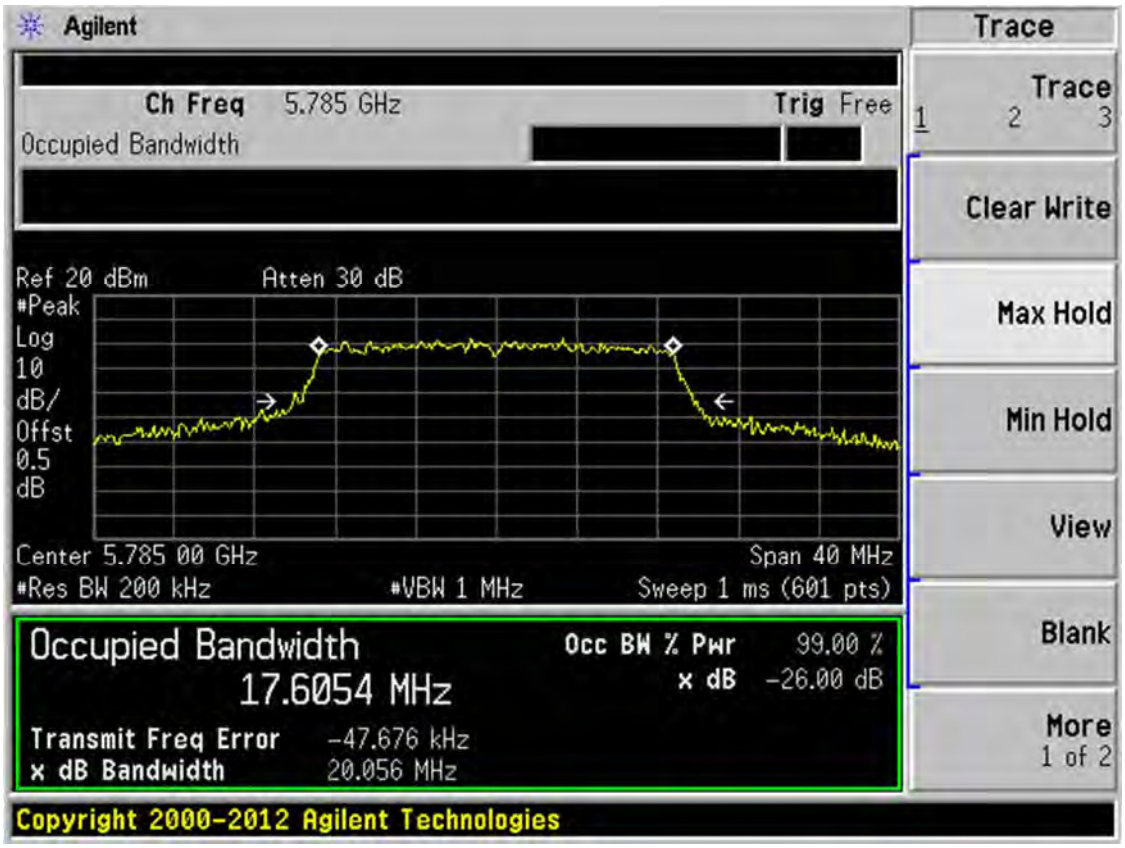
Band IV 11n(HT40) CH159



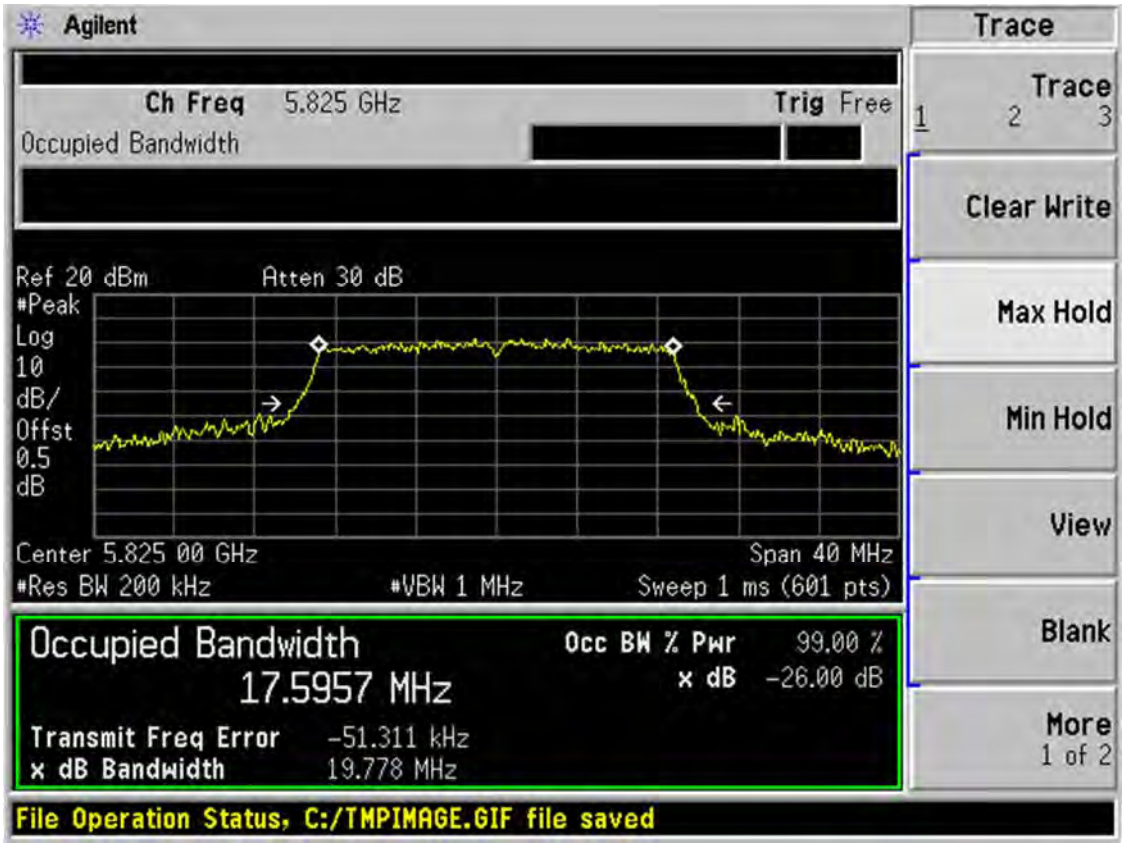
Band IV 11ac(HT20) CH149



Band IV 11ac(HT20) CH157



Band IV 11ac(HT20) CH165



Band IV 11ac(HT40) CH151