

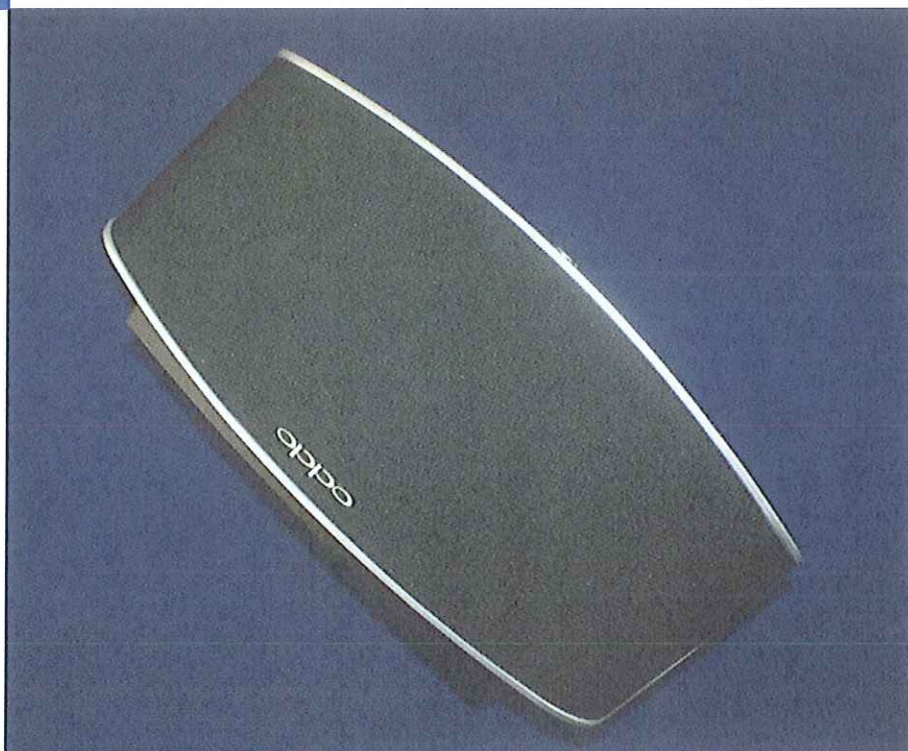
RF

TEST REPORT



ISSUED TO
Dongguan Digital AV Technology Corp., Ltd.

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



Date Feb. 2. 2016

Date Feb. 2, 2006

Report No.:	BL-SZ15B0132-604
EUT Type:	Wi-Fi Speaker
Model Name:	Sonica
Brand Name:	OPPO
Test Standard:	47 CFR Part 15 Subpart E IC RSS-Gen (Issue 4, November 2014) IC RSS-247 (Issue 1, May 2015)
FCC ID:	2AGM4-SONICA
IC Number:	20960-SONICA
Test conclusion:	Pass
Test Date:	Nov. 15, 2015 ~ Jan. 31, 2016
Date of Issue:	Feb. 2, 2016

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Revision History

Version	Issue Date	Revisions
<u>Rev. 01</u>	<u>Dec. 17, 2015</u>	<u>Initial Issue</u>
<u>Rev. 02</u>	<u>Jan. 7, 2016</u>	<u>Chapter 5.1, 5.3, A.1 and A.4 are updated</u>
<u>Rev. 03</u>	<u>Feb. 2, 2016</u>	<u>A.4 are updated.</u>

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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 has met the requirements of the IAS Accreditation Criteria for Testing Laboratories (AC89), has demonstrated compliance with ISO/IEC Standard 17025:2005. The accreditation certificate number is TL-588. 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°C
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	Wi-Fi Speaker
Model Name	Sonica
Hardware Version	1.0
Software Version	Linux 3.10.26
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

Ancillary Equipment 1	Power Cable	
	Brand Name	N/A
	Model No.	N/A
	Length(Approx.)	1.7 m

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
Transfer Rate (Mbps)		802.11a: 54/ 48/ 36 / 24 / 18 / 9/ 6 Mbps 802.11n: up to 135 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: 17.35 dBm Band II: 19.15 dBm Band III: 19.38 dBm Band IV: 19.34 dBm
Antenna System (eg., MIMO, Smart Antenna)		Cyclic Delay Diversity (CDD)
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 = $G_{ANT} + \text{Array Gain}$, <i>Array Gain</i> = $10 \log(N_{ANT}/N_{SS})$ dB. $N_{SS}=2$, G_{ANT} 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 = $G_{ANT} + \text{Array Gain}$, <i>Array Gain</i> = 0.
	For Conducted Out-of-Band and Spurious	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

	Measurements	Band IV: 5725 MHz to 5850 MHz: 3.7 dBi Formulas: Directional gain = $G_{ANT} + \text{Array Gain}$, $\text{Array Gain} = 10 \log(N_{ANT}/N_{SS}) \text{ dB}$. $N_{SS} = 2$, G_{ANT} 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.

Band I (5150 - 5250 MHz) Power level setup in software

Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH36	5180	1a	1a
11a	CH44	5220	1a	1a
11a	CH48	5240	1a	1a
11n (HT20)	CH36	5180	1e	1e
11n (HT20)	CH44	5220	1e	1e
11n (HT20)	CH48	5240	1e	1e
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	1a	1a
11ac (HT40)	CH46	5230	1c	1c
11ac (HT80)	CH42	5210	1a	1a

Band II (5250 - 5350 MHz) Power level setup in software

Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH52	5260	1a	1a
11a	CH56	5280	1a	1a
11a	CH64	5320	1a	1a
11n (HT20)	CH52	5260	1e	1e
11n (HT20)	CH56	5280	1e	1e
11n (HT20)	CH64	5320	1e	1e
11n (HT40)	CH54	5270	1f	1f
11n (HT40)	CH62	5310	1c	1c
11ac (HT20)	CH52	5260	19	19
11ac (HT20)	CH56	5280	19	19
11ac (HT20)	CH64	5320	19	19
11ac (HT40)	CH52	5260	1c	1c
11ac (HT40)	CH56	5280	1b	1b
11ac (HT80)	CH58	5290	1b	1b

Band III (5470 - 5725 MHz) Power level setup in software

Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH100	5500	1a	1a
11a	CH116	5580	1a	1a
11a	CH140	5700	1a	1a
11n (HT20)	CH100	5500	1e	1e
11n (HT20)	CH116	5580	1e	1e
11n (HT20)	CH140	5700	1e	1e
11n (HT40)	CH102	5510	1c	1c
11n (HT40)	CH134	5670	1f	1f
11ac (HT20)	CH100	5500	19	19
11ac (HT20)	CH116	5580	19	19
11ac (HT20)	CH140	5700	19	19
11ac (HT40)	CH102	5510	1b	1b
11ac (HT40)	CH134	5670	1c	1c
11ac (HT80)	CH106	5530	1b	1b

Band IV (5725 - 5850 MHz) Power level setup in software

Mode	Channel	Frequency (MHz)	Soft Set	
11a	CH149	5745	1a	1a
11a	CH157	5785	1a	1a
11a	CH161	5825	1a	1a
11n (HT20)	CH149	5745	1e	1e
11n (HT20)	CH157	5785	1e	1e
11n (HT20)	CH161	5825	1e	1e
11n (HT40)	CH151	5755	1b	1b
11n (HT40)	CH159	5795	1f	1f
11ac (HT20)	CH149	5745	19	19
11ac (HT20)	CH157	5785	19	19
11ac (HT20)	CH161	5805	19	19
11ac (HT40)	CH151	5755	1c	1c
11ac (HT40)	CH159	5795	1c	1c
11ac (HT80)	CH155	5775	1b	1b

2.7 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	161	High	5805

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	161/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	161/157/149
	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	161/157/149
	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
Emission	11a	6	OFDM	BPSK	48/44/36	64/60/52	144/140/116/100	161/157/149/144

Band width & 99% Occupied Bandwidth	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	144/140/116/100	161/157/149
	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	161/157/149
	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	161/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	N/A	N/A	N/A	161/157/149
	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	161/157/149 /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	161/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	161/157/149
	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	161/157/149
	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	161/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	161/157/149
	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	161/157/149
	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

Radiat ed Spurio us Emissi ons	11a	6	OFDM	BPSK	48/44/36	64/60/52	140/116/100	161/157/149
	11n(20 MHz)	6.5	OFDM	BPSK	48/44/36	64/60/52	140/116/100	161/157/149
	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	161/157/149
	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
Freque ncy Stabilit y	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	100
	11n(20 MHz)	6.5	OFDM	BPSK	36	--	64	100
	11n(40 MHz)	13.5	OFDM	BPSK	38	--	62	102
	11ac(20 MHz)	6.5	OFDM	BPSK	36	--	64	100
	11ac(40 MHz)	13.5	OFDM	BPSK	38	--	62	102
	11ac(80 MHz)	V0	OFDM	BPSK	--	--	58	106

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	IC RSS-Gen (Issue 4, Nov. 2014)	General Requirements for Compliance of Radio Apparatus
5	IC 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.	IC 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°C to +25°C
	LT (Low Temperature)	-20°C
	HT (High Temperature)	+55°C
Working Voltage of the EUT	NV (Normal Voltage)	120 V
	LV (Low Voltage)	100 V
	HV (High Voltage)	240 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	2016.02.27
Shielded Enclosure	ChangNing	CN-130701	130703	--	--

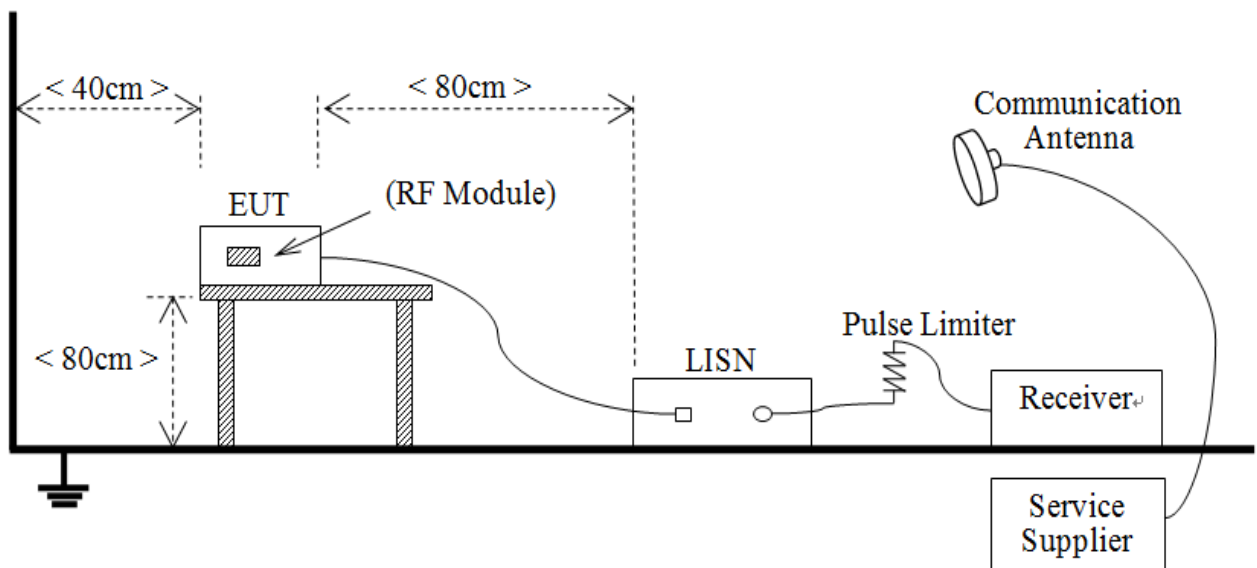
4.3 Description of Test Setup

4.3.1 For Antenna Port Test



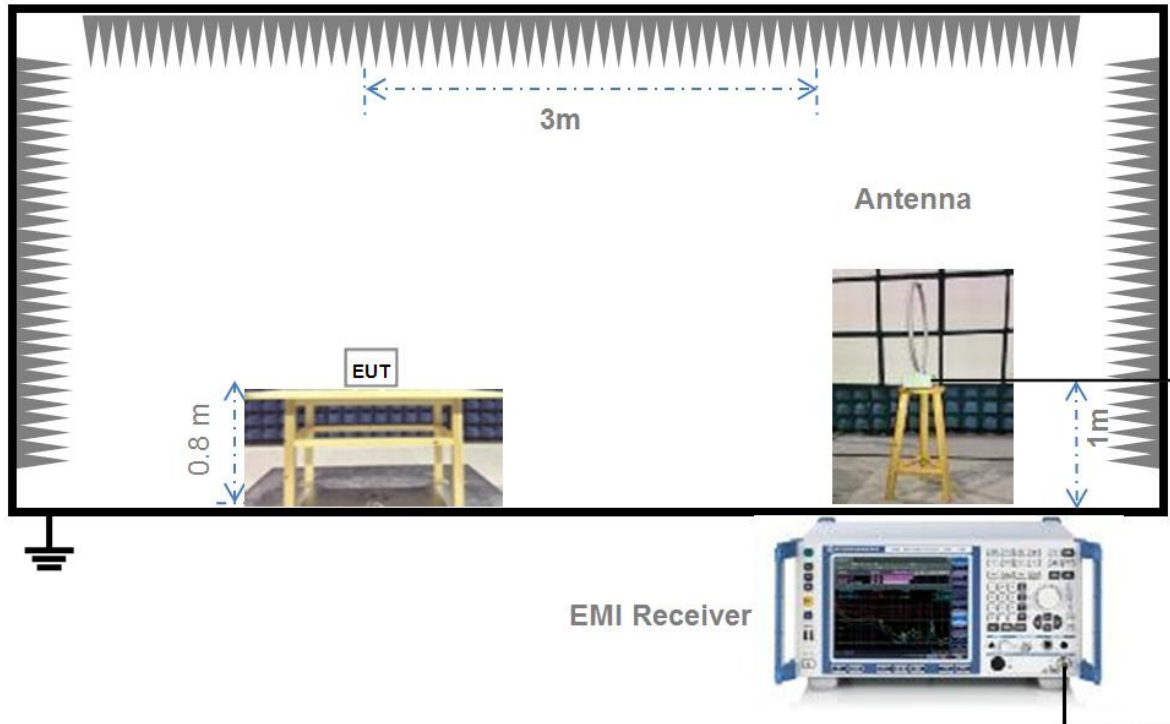
(Diagram 1)

4.3.2 For AC Power Supply Port Test



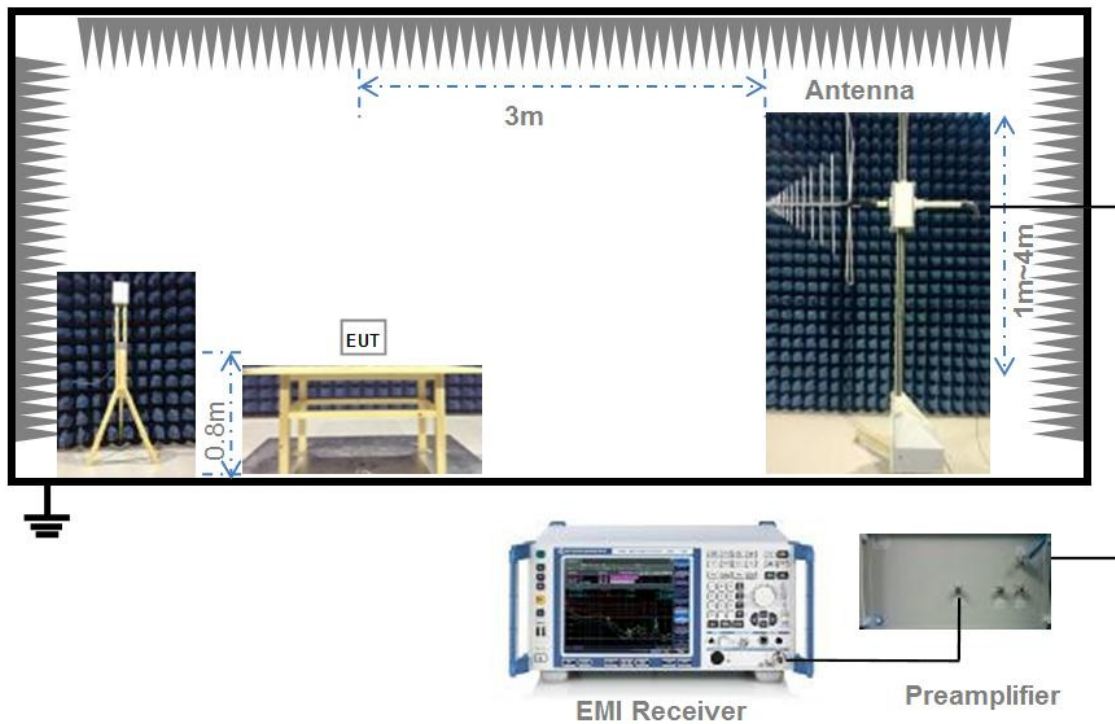
(Diagram 2)

4.3.3 For Radiated Test (Below 30 MHz)



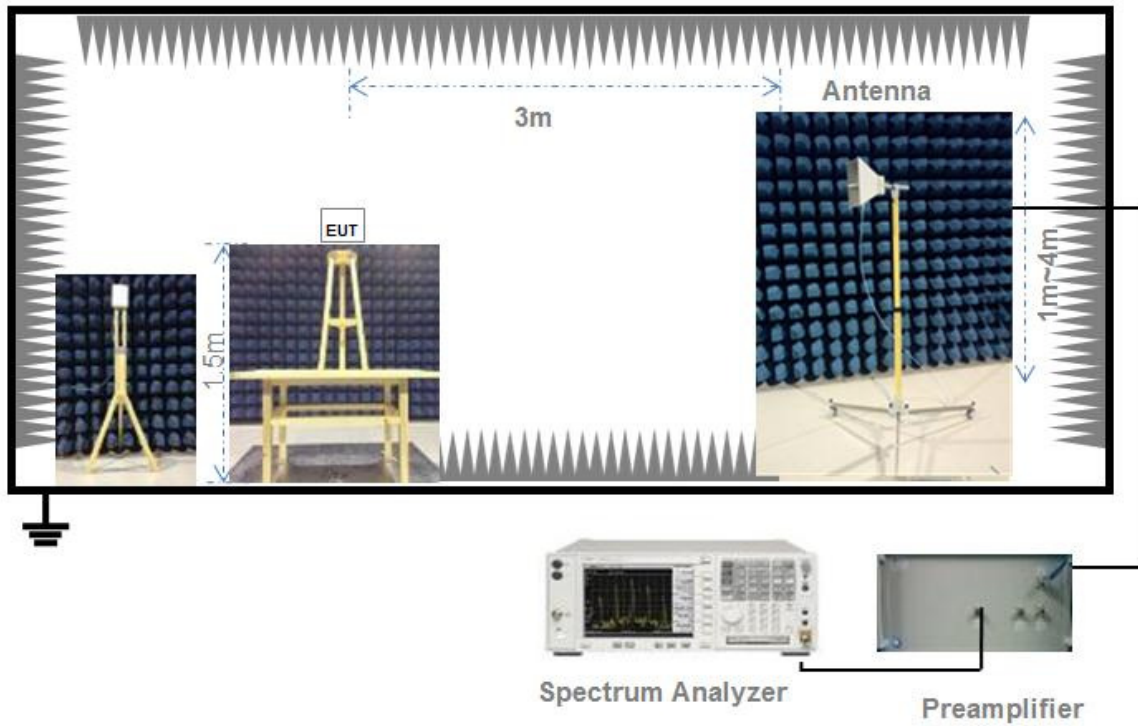
(Diagram 3)

4.3.4 For Radiated Test (30 MHz-1 GHz)



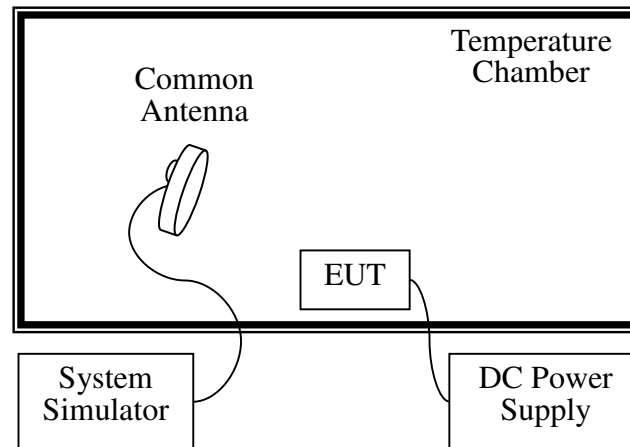
(Diagram 4)

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 $\geq 3 \times$ 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 $\geq 3 \times$ 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 $\geq 3 \times$ 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 50 μ H/50 Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	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 $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ 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 ($\mu\text{V/m}$)	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:

$$E = \text{EIRP} - 20 \log D + 104.8$$

where:

E = electric field strength in dB μ V/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 $\geq 3 \times$ 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:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x , of the transmitter output signal as described in section 6.0.
- RBW = 1 MHz (unless otherwise specified).
- VBW $\geq 3 \times$ RBW.
- Detector = RMS, if $\text{span}/(\# \text{ of points in sweep}) \leq (\text{RBW}/2)$. 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.
- Averaging type = power (i.e., RMS).
 - As an alternative, the detector and averaging type may be set for linear voltage averaging.
 - Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
- Sweep time = auto.
- Perform a trace average of at least 100 traces.
- 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:
 - 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.
 - 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.
 - 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 $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ 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 ($\mu\text{V/m}$)	Measurement Distance (m)
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

1. Field Strength ($\text{dB}\mu\text{V/m}$) = $20 \cdot \log[\text{Field Strength } (\mu\text{V/m})]$.
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 $\text{dB}\mu\text{V/m}@3\text{m}$ (AV) and 74 $\text{dB}\mu\text{V/m}@3\text{m}$ (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 $f \geq 1 \text{ GHz}$, 100 kHz for $f < 1 \text{ GHz}$

VBW $\geq$ 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)									
Note: Transmitting antennas of directional gain in Band I(5150 MHz to 5250 MHz) is 6.3 dBi									
Formulas: Directional gain = G_{ANT} + Array Gain, <i>Array Gain</i> = 0.									
Mode	Channel	Frequency (MHz)	Conducted Power 0 (dBm)	Conducted Power 1 (dBm)	Conducted Power Total (dBm)	Conducted Power Total (mW)	FCC Limit (mW)	IC Limit (mW)	Verdict
11a	CH36	5180	13.55	12.75	16.18	41.48	234	N/A	Pass
11a	CH44	5220	12.68	13.12	15.92	39.05	234	N/A	Pass
11a	CH48	5240	12.93	13.01	15.98	39.63	234	N/A	Pass
11n (HT20)	CH36	5180	13.20	12.94	13.20	40.57	234	N/A	Pass
11n (HT20)	CH44	5220	12.98	13.15	12.98	40.51	234	N/A	Pass
11n (HT20)	CH48	5240	13.10	13.25	13.10	41.55	234	N/A	Pass
11n (HT40)	CH38	5190	12.24	11.92	15.09	32.31	234	N/A	Pass
11n (HT40)	CH46	5230	14.32	14.35	17.35	54.27	234	N/A	Pass
11ac (HT20)	CH36	5180	13.26	13.82	16.56	45.28	234	N/A	Pass
11ac (HT20)	CH44	5220	13.74	14.03	16.90	48.95	234	N/A	Pass
11ac (HT20)	CH48	5240	13.63	13.61	16.63	46.03	234	N/A	Pass
11ac (HT40)	CH38	5190	14.51	14.47	17.50	56.24	234	N/A	Pass
11ac (HT40)	CH46	5230	14.89	14.83	17.87	61.24	234	N/A	Pass
11ac (HT80)	CH42	5210	9.87	9.88	12.89	19.43	234	N/A	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 = $G_{ANT} + \text{Array Gain}$, $\text{Array Gain} = 0$. 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)	IC: 11 dBm + 10log B (mW)	FCC Limit (mW)	IC Limit (mW)	Verdict
11a	CH52	12.90	13.36	16.15	41.18	271	194	229	194	Pass
11a	CH56	13.31	12.96	16.15	41.20	257	193	229	193	Pass
11a	CH64	12.94	12.90	15.93	39.18	397	195	229	195	Pass
11n (HT20)	CH52	13.50	13.53	16.53	44.93	259	204	229	204	Pass
11n (HT20)	CH60	13.51	13.37	16.45	44.17	244	204	229	204	Pass
11n (HT20)	CH64	13.56	13.52	16.55	45.19	307	205	229	205	Pass
11n (HT40)	CH54	14.40	14.46	17.44	32.31	470	414	229	250	Pass
11n (HT40)	CH62	12.60	12.58	15.60	54.27	468	414	229	250	Pass
11ac (HT20)	CH52	14.11	14.45	17.29	53.62	228	201	229	201	Pass
11ac (HT20)	CH56	14.10	13.90	17.01	50.25	244	204	229	204	Pass
11ac (HT20)	CH64	13.42	13.32	16.38	43.46	228	201	229	201	Pass
11ac (HT40)	CH54	16.21	16.07	19.15	82.24	460	414	229	250	Pass
11ac (HT40)	CH62	15.88	15.86	18.88	77.27	460	413	229	250	Pass
11ac (HT80)	CH58	10.84	10.71	13.79	23.91	924	859	229	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 = $G_{ANT} + \text{Array Gain}$, $\text{Array Gain} = 0$.

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	12.76	12.77	15.78	37.80	332	214	250	214	Pass
11a	CH116	13.54	13.31	16.44	44.02	377	216	250	216	Pass
11a	CH140	13.40	13.58	16.50	44.68	298	213	250	213	Pass
11n (HT20)	CH100	13.33	13.40	16.38	43.41	305	224	250	224	Pass
11n (HT20)	CH116	13.82	13.89	16.87	48.59	272	224	250	224	Pass
11n (HT20)	CH140	13.73	13.64	16.70	46.73	258	223	250	223	Pass
11n (HT40)	CH102	12.62	13.06	15.86	38.51	518	455	250	250	Pass
11n (HT40)	CH134	14.27	14.45	17.37	54.59	516	455	250	250	Pass
11ac (HT20)	CH100	13.91	13.73	16.83	48.21	252	220	250	220	Pass
11ac (HT20)	CH116	14.14	13.88	17.02	50.38	253	220	250	220	Pass
11ac (HT20)	CH140	13.79	13.84	16.83	48.14	252	220	250	220	Pass
11ac (HT40)	CH102	16.04	16.04	19.05	80.36	505	454	250	250	Pass
11ac (HT40)	CH134	16.18	16.55	19.38	86.68	506	454	250	250	Pass
11ac (HT80)	CH106	10.60	11.29	11.24	24.94	1013	943	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 = $G_{ANT} + \text{Array Gain}$, $\text{Array Gain} = 0$.								
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	13.5	13.49	16.51	44.72	1.00	Pass
11a	CH157	5785	13.44	12.94	16.21	41.76	1.00	Pass
11a	CH161	5825	13.1	13.26	16.19	41.60	1.00	Pass
11n (HT20)	CH149	5745	13.88	13.91	16.91	49.04	1.00	Pass
11n (HT20)	CH157	5785	13.63	13.57	16.61	45.82	1.00	Pass
11n (HT20)	CH161	5825	13.32	14.07	16.72	47.01	1.00	Pass
11n (HT40)	CH151	5755	12.03	12.03	15.04	31.92	1.00	Pass
11n (HT40)	CH159	5795	11.78	12.25	15.03	31.85	1.00	Pass
11ac (HT20)	CH149	5745	14.08	14.17	17.14	51.71	1.00	Pass
11ac (HT20)	CH157	5785	13.95	14.43	17.21	52.56	1.00	Pass
11ac (HT20)	CH161	5805	14.11	14.03	17.08	51.06	1.00	Pass
11ac (HT40)	CH151	5755	16.13	16.53	19.34	86.00	1.00	Pass
11ac (HT40)	CH159	5795	16.21	15.92	19.08	80.87	1.00	Pass
11ac (HT80)	CH155	5775	10.64	10.69	13.68	23.31	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	22.18	165.20	17.15	171	171	Pass
11a	CH44	5220	22.22	166.72	17.35	174	174	Pass
11a	CH48	5240	22.28	169.04	16.88	169	169	Pass
11n (HT20)	CH36	5180	19.5	89.13	17.76	178	178	Pass
11n (HT20)	CH44	5220	19.28	84.72	17.78	178	178	Pass
11n (HT20)	CH48	5240	19.4	87.10	17.76	178	178	Pass
11n (HT40)	CH38	5190	21.39	137.72	36.12	361	200	Pass
11n (HT40)	CH46	5230	22.65	184.08	36.09	361	200	Pass
11ac (HT20)	CH36	5180	21.86	153.46	17.49	175	175	Pass
11ac (HT20)	CH44	5220	21.2	131.83	17.50	175	175	Pass
11ac (HT20)	CH48	5240	21.93	155.96	17.47	175	175	Pass
11ac (HT40)	CH38	5190	22.8	190.55	36.02	360	200	Pass
11ac (HT40)	CH46	5230	22.17	164.82	36.07	361	200	Pass
11ac (HT80)	CH42	5210	19.19	82.99	74.84	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	22.55	179.89	16.90	847	847	Pass
11a	CH56	5280	22.55	179.89	16.84	844	844	Pass
11a	CH64	5320	22.33	171.00	16.95	850	850	Pass
11n (HT20)	CH52	5260	22.93	196.34	17.79	891	891	Pass
11n (HT20)	CH60	5300	22.85	192.75	17.76	890	890	Pass
11n (HT20)	CH64	5320	22.95	197.24	17.83	893	893	Pass
11n (HT40)	CH54	5270	23.84	242.10	36.08	1808	1000	Pass
11n (HT40)	CH62	5310	22.00	158.49	36.07	1808	1000	Pass
11ac (HT20)	CH52	5260	23.69	233.88	17.49	877	877	Pass
11ac (HT20)	CH56	5280	23.41	219.28	17.76	890	890	Pass
11ac (HT20)	CH64	5320	22.78	189.67	17.50	877	877	Pass
11ac (HT40)	CH54	5270	25.55	358.92	36.05	1807	1000	Pass
11ac (HT40)	CH62	5310	25.28	337.29	36.01	1805	1000	Pass
11ac (HT80)	CH58	5290	20.19	104.47	74.79	3749	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	21.08	128.23	16.97	851	851	Pass
11a	CH116	5580	21.74	149.28	17.16	860	860	Pass
11a	CH140	5700	21.8	151.36	16.90	847	847	Pass
11n (HT20)	CH100	5500	21.68	147.23	17.80	892	892	Pass
11n (HT20)	CH116	5580	22.17	164.82	17.79	892	892	Pass
11n (HT20)	CH140	5700	22	158.49	17.71	887	887	Pass
11n (HT40)	CH102	5510	21.16	130.62	36.13	1811	1000	Pass
11n (HT40)	CH134	5670	22.67	184.93	36.15	1812	1000	Pass
11ac (HT20)	CH100	5500	22.13	163.31	17.49	877	877	Pass
11ac (HT20)	CH116	5580	22.32	170.61	17.50	877	877	Pass
11ac (HT20)	CH140	5700	22.13	163.31	17.49	877	877	Pass
11ac (HT40)	CH102	5510	24.35	272.27	36.03	1806	1000	Pass
11ac (HT40)	CH134	5670	24.68	293.76	36.04	1806	1000	Pass
11ac (HT80)	CH106	5530	16.54	45.08	74.91	3754	1000	Pass

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	29.718	17.1470
11a	CH44	5220	28.917	17.3522
11a	CH48	5240	22.761	16.8813
11n (HT20)	CH36	5180	20.687	17.7616
11n (HT20)	CH44	5220	22.557	17.7842
11n (HT20)	CH48	5240	22.427	17.7618
11n (HT40)	CH38	5190	40.998	36.1209
11n (HT40)	CH46	5230	40.825	36.0876
11ac (HT20)	CH36	5180	19.944	17.4907
11ac (HT20)	CH44	5220	20.001	17.5030
11ac (HT20)	CH48	5240	19.814	17.4690
11ac (HT40)	CH38	5190	40.299	36.0184
11ac (HT40)	CH46	5230	40.279	36.0725
11ac (HT80)	CH42	5210	80.138	74.8352

Band II (5250 - 5350 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH52	5260	23.622	16.9006
11a	CH60	5300	22.388	16.8394
11a	CH64	5320	34.577	16.9499
11n (HT20)	CH52	5260	22.539	17.7859
11n (HT20)	CH60	5300	21.249	17.7623
11n (HT20)	CH64	5320	26.766	17.8274
11n (HT40)	CH54	5270	40.972	36.0792
11n (HT40)	CH62	5310	40.722	36.0692
11ac (HT20)	CH52	5260	19.894	17.4912
11ac (HT20)	CH60	5300	21.249	17.7623
11ac (HT20)	CH64	5320	19.861	17.4989
11ac (HT40)	CH54	5270	40.029	36.0493
11ac (HT40)	CH62	5310	40.076	36.0092
11ac (HT80)	CH58	5290	80.448	74.7937

Band III (5470 - 5725 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH100	5500	26.352	16.9713
11a	CH116	5580	29.977	17.1641
11a	CH140	5700	23.663	16.9031
11n (HT20)	CH100	5500	24.192	17.7977
11n (HT20)	CH116	5580	21.586	17.7890
11n (HT20)	CH140	5700	20.528	17.7063
11n (HT40)	CH102	5510	41.133	36.1279
11n (HT40)	CH134	5670	41.027	36.1467
11ac (HT20)	CH100	5500	19.999	17.4898
11ac (HT20)	CH116	5580	20.069	17.4990
11ac (HT20)	CH140	5700	20.000	17.4929
11ac (HT40)	CH102	5510	40.135	36.0304
11ac (HT40)	CH134	5670	40.221	36.0378
11ac (HT80)	CH106	5530	80.505	74.9077

Band IV (5725 - 5850 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH149	5745	27.883	17.0617
11a	CH157	5785	28.651	17.1535
11a	CH161	5825	29.680	17.3604
11n (HT20)	CH149	5745	22.289	17.7597
11n (HT20)	CH157	5785	24.269	17.8755
11n (HT20)	CH161	5825	25.392	17.8474
11n (HT40)	CH151	5755	40.915	36.0687
11n (HT40)	CH159	5795	40.799	36.0733
11ac (HT20)	CH149	5745	20.286	17.5572
11ac (HT20)	CH157	5785	19.892	17.5179
11ac (HT20)	CH161	5805	20.177	17.5383
11ac (HT40)	CH151	5755	40.216	36.0590
11ac (HT40)	CH159	5795	39.807	36.0572
11ac (HT80)	CH155	5775	80.524	74.8719

ANT 1

Band I Band I (5150 - 5250 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH36	5180	27.019	17.2677
11a	CH44	5220	28.716	17.2357
11a	CH48	5240	22.848	16.8858
11n (HT20)	CH36	5180	21.806	17.7689
11n (HT20)	CH44	5220	21.828	17.7441
11n (HT20)	CH48	5240	20.694	17.7568
11n (HT40)	CH38	5190	40.684	36.0754
11n (HT40)	CH46	5230	41.052	36.1216
11ac (HT20)	CH36	5180	19.942	17.5078
11ac (HT20)	CH44	5220	20.073	17.4980
11ac (HT20)	CH48	5240	20.022	17.4942
11ac (HT40)	CH38	5190	40.299	36.0754
11ac (HT40)	CH46	5230	40.116	36.0150
11ac (HT80)	CH42	5210	80.223	74.8732

Band II (5250 - 5350 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH52	5260	24.068	16.8749
11a	CH60	5300	21.631	16.8793
11a	CH64	5320	23.008	16.9071
11n (HT20)	CH52	5260	22.383	17.7400
11n (HT20)	CH60	5300	21.054	17.7648
11n (HT20)	CH64	5320	23.104	17.8106
11n (HT40)	CH54	5270	41.122	36.1308
11n (HT40)	CH62	5310	40.901	36.0875
11ac (HT20)	CH52	5260	19.815	17.4613
11ac (HT20)	CH60	5300	19.756	17.5324
11ac (HT20)	CH64	5320	19.982	17.5172
11ac (HT40)	CH54	5270	40.089	36.0671
11ac (HT40)	CH62	5310	40.256	35.9716
11ac (HT80)	CH58	5290	80.151	74.7108

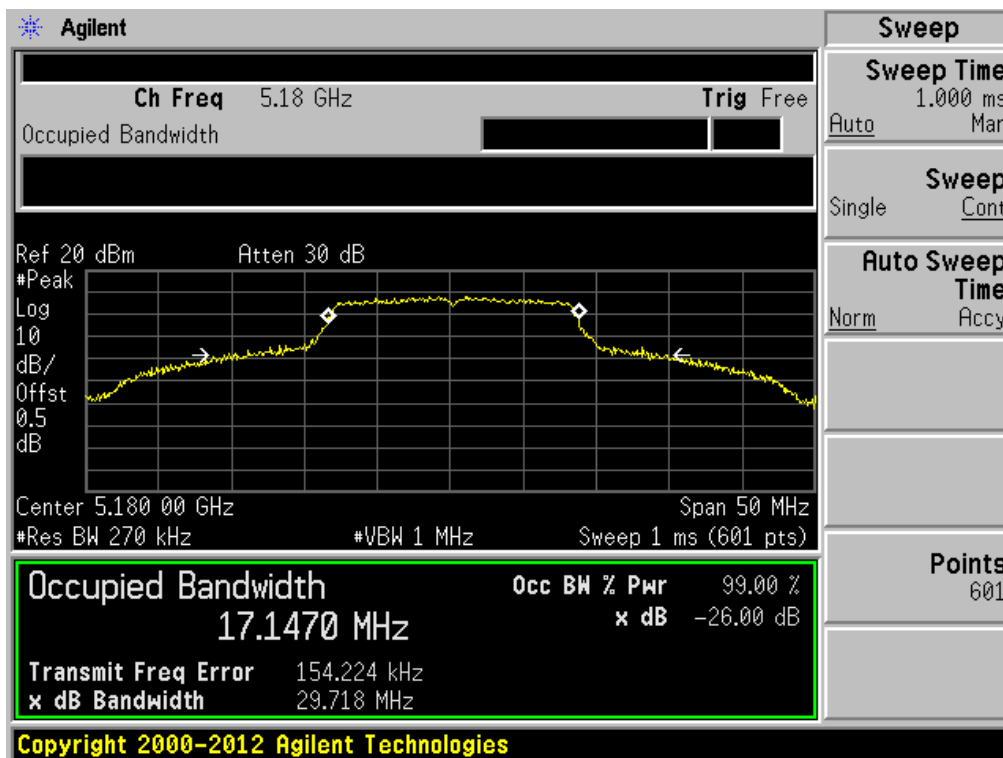
Band III (5470 - 5725 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH100	5500	25.027	16.9876
11a	CH116	5580	28.966	17.1987
11a	CH140	5700	23.758	16.9568
11n (HT20)	CH100	5500	24.706	17.8142
11n (HT20)	CH116	5580	22.605	17.8019
11n (HT20)	CH140	5700	20.657	17.7127
11n (HT40)	CH102	5510	40.728	36.1583
11n (HT40)	CH134	5670	41.676	36.1324
11ac (HT20)	CH100	5500	19.853	17.5135
11ac (HT20)	CH116	5580	20.008	17.5186
11ac (HT20)	CH140	5700	20.004	17.4819
11ac (HT40)	CH102	5510	40.179	36.0300
11ac (HT40)	CH134	5670	40.228	36.0935
11ac (HT80)	CH106	5530	80.284	74.7792

Band IV (5725 - 5850 MHz)				
Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
11a	CH149	5745	20.185	17.5341
11a	CH157	5785	19.955	17.5154
11a	CH161	5825	19.954	17.5563
11n (HT20)	CH149	5745	23.846	17.7980
11n (HT20)	CH157	5785	26.273	17.8651
11n (HT20)	CH161	5825	26.772	17.8099
11n (HT40)	CH151	5755	41.266	36.0680
11n (HT40)	CH159	5795	40.730	36.0833
11ac (HT20)	CH149	5745	20.185	17.5341
11ac (HT20)	CH157	5785	19.955	17.5154
11ac (HT20)	CH161	5805	19.954	17.5563
11ac (HT40)	CH151	5755	40.187	36.0359
11ac (HT40)	CH159	5795	40.155	36.0084
11ac (HT80)	CH155	5775	80.690	74.8172

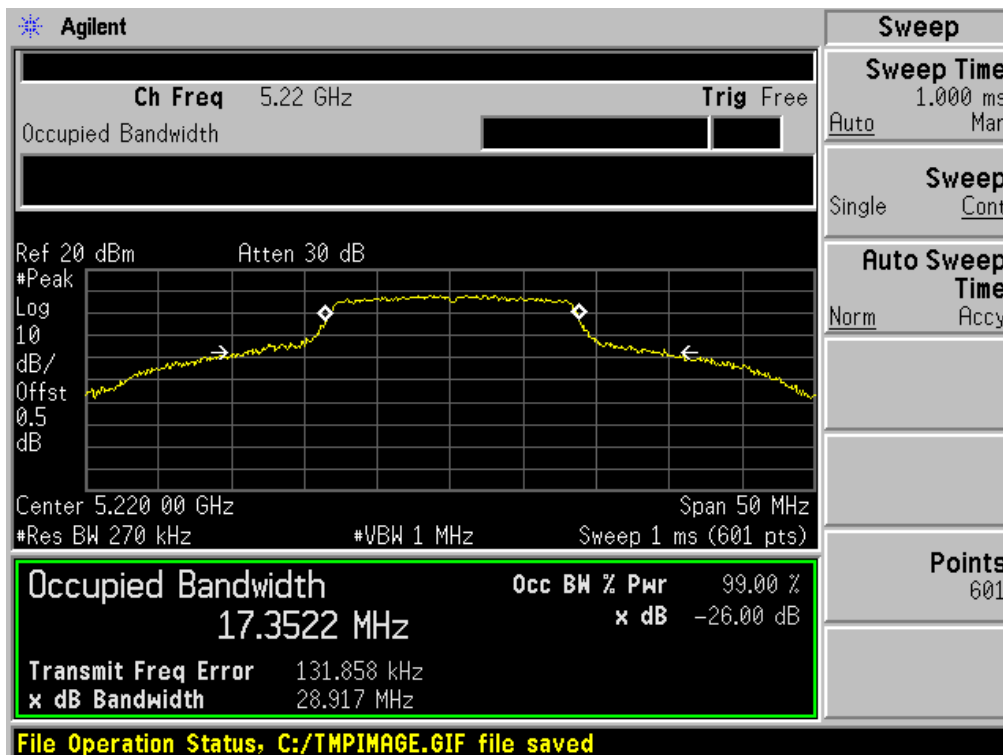
Test Plots

ANT 0

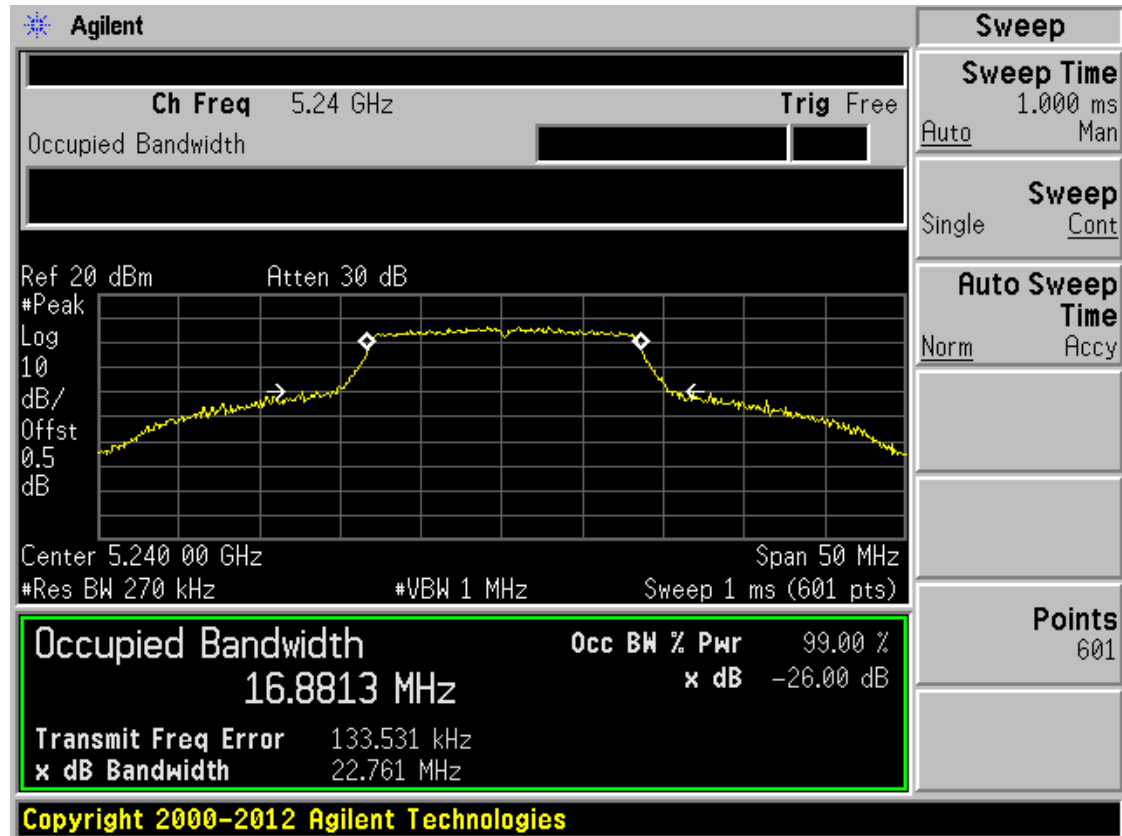
Band I 11a CH36



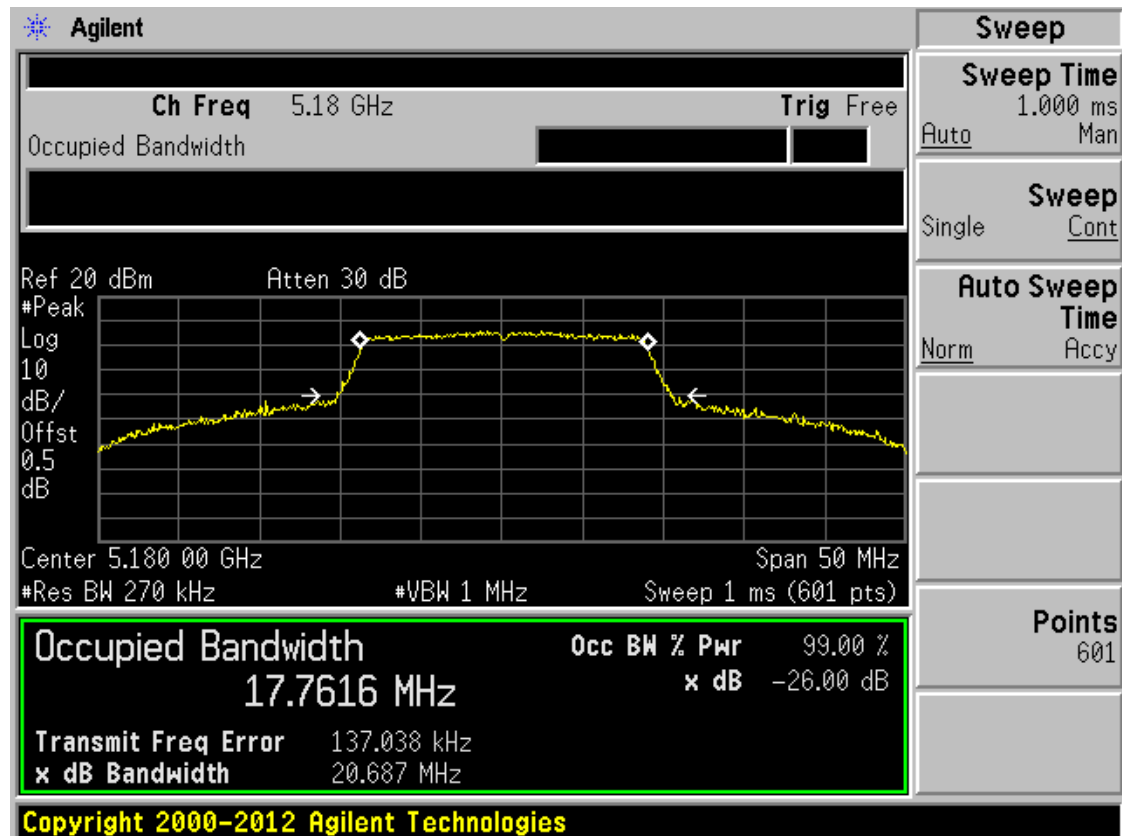
Band I 11a CH44



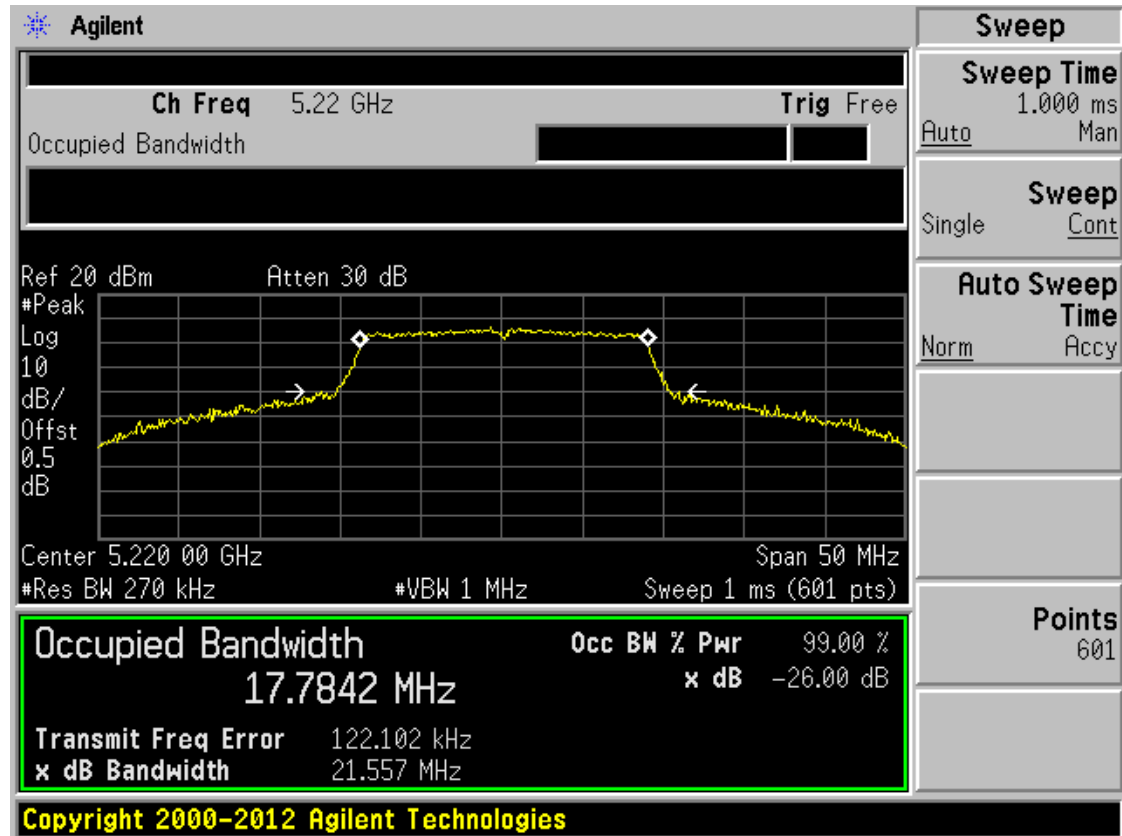
Band I 11a CH48



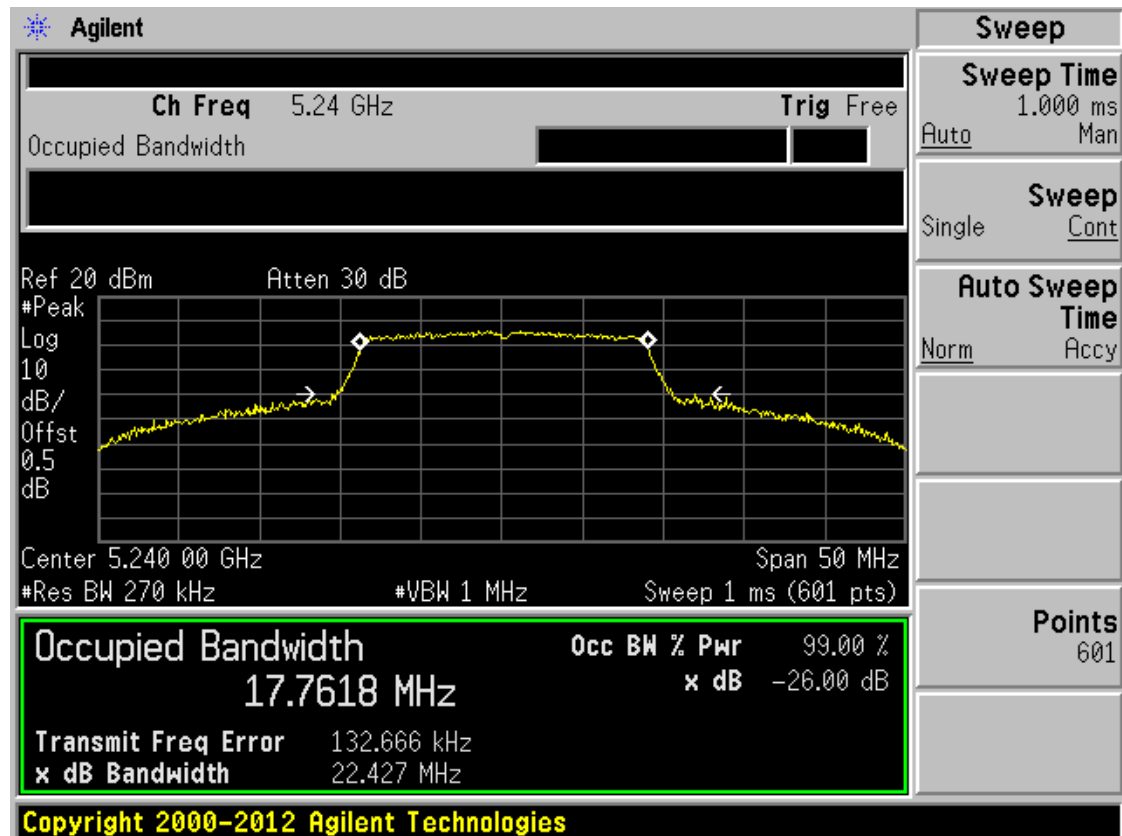
Band I 11n(HT20) CH36



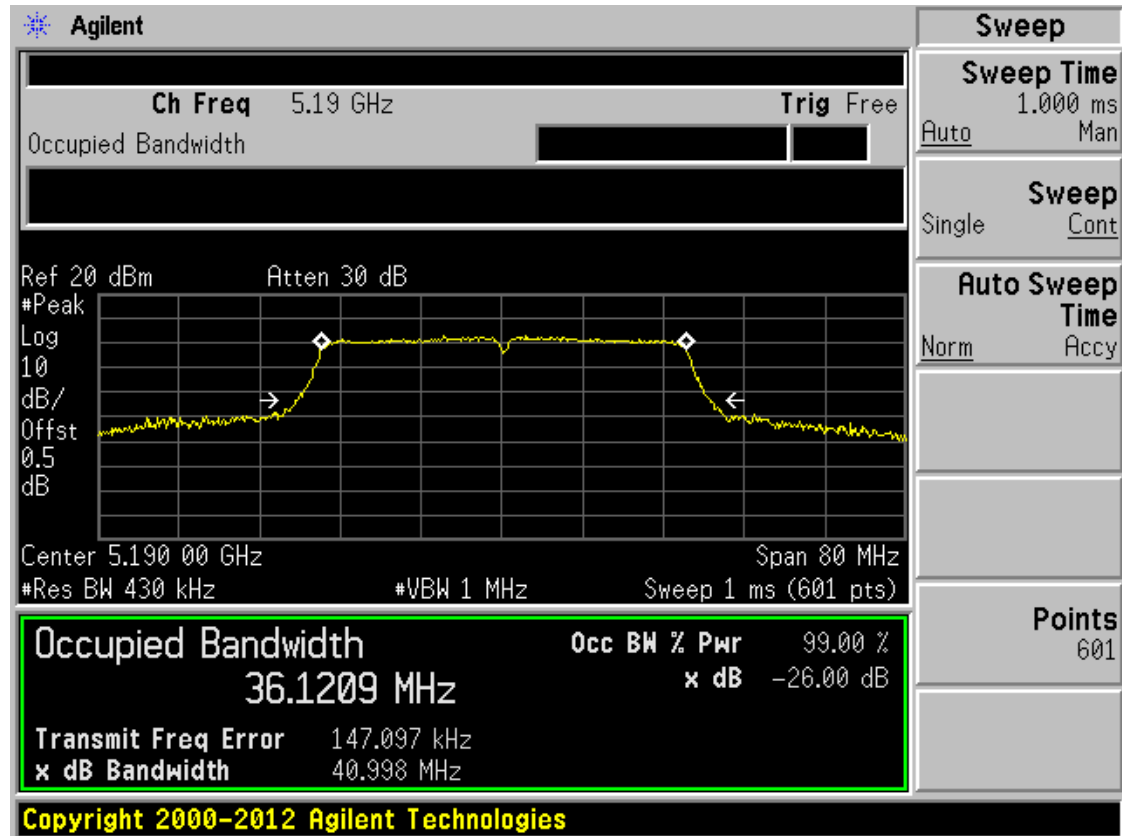
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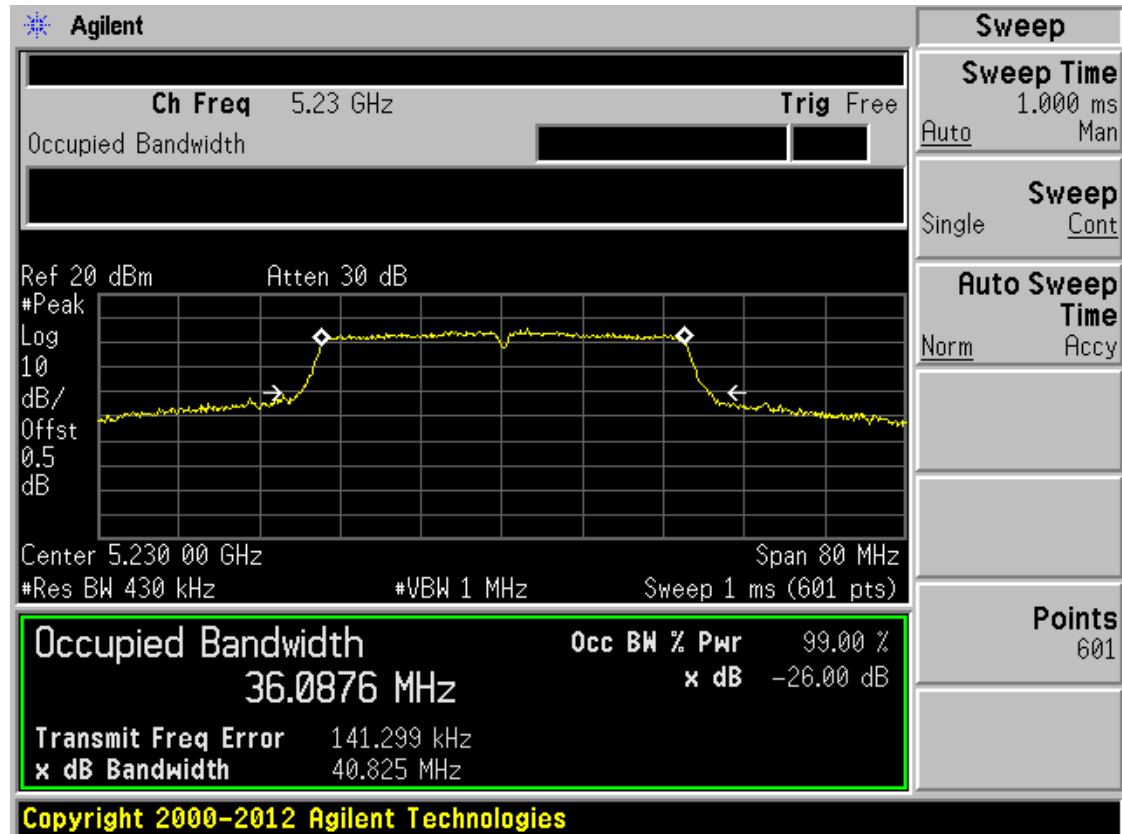
Band I 11n(HT20) CH48



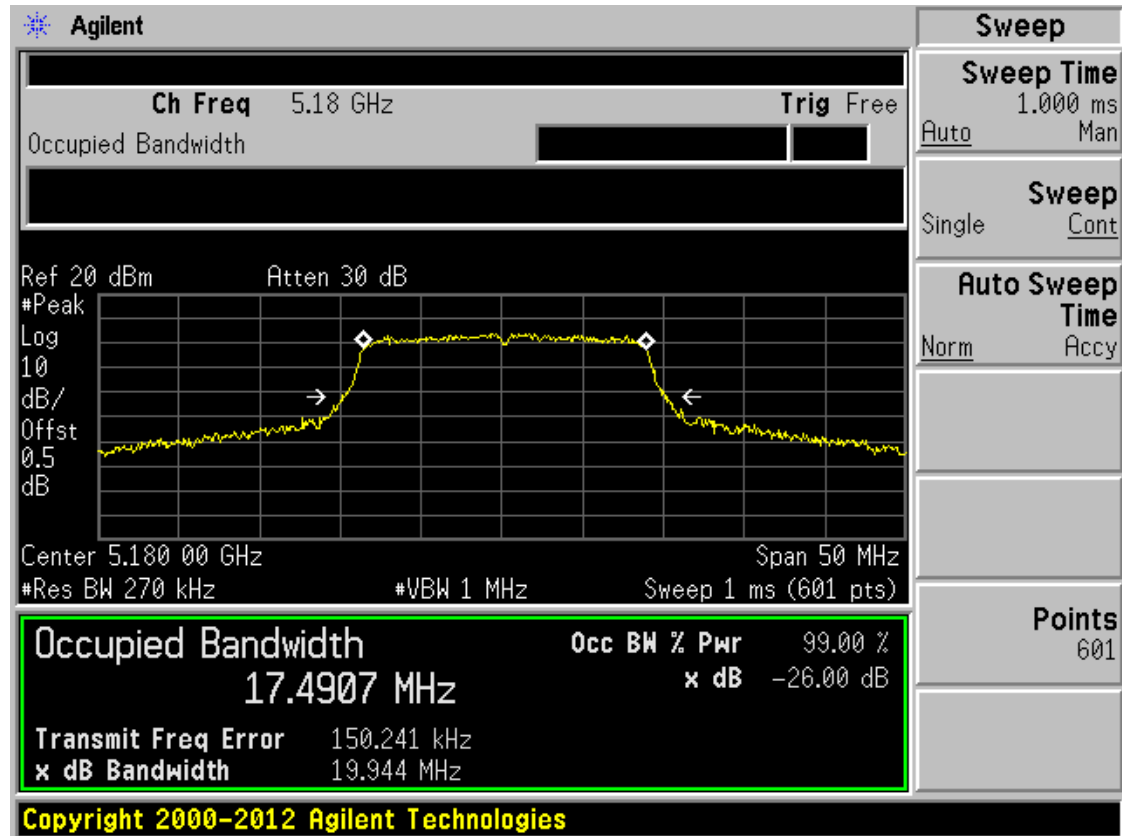
Band I 11n(HT40) CH38



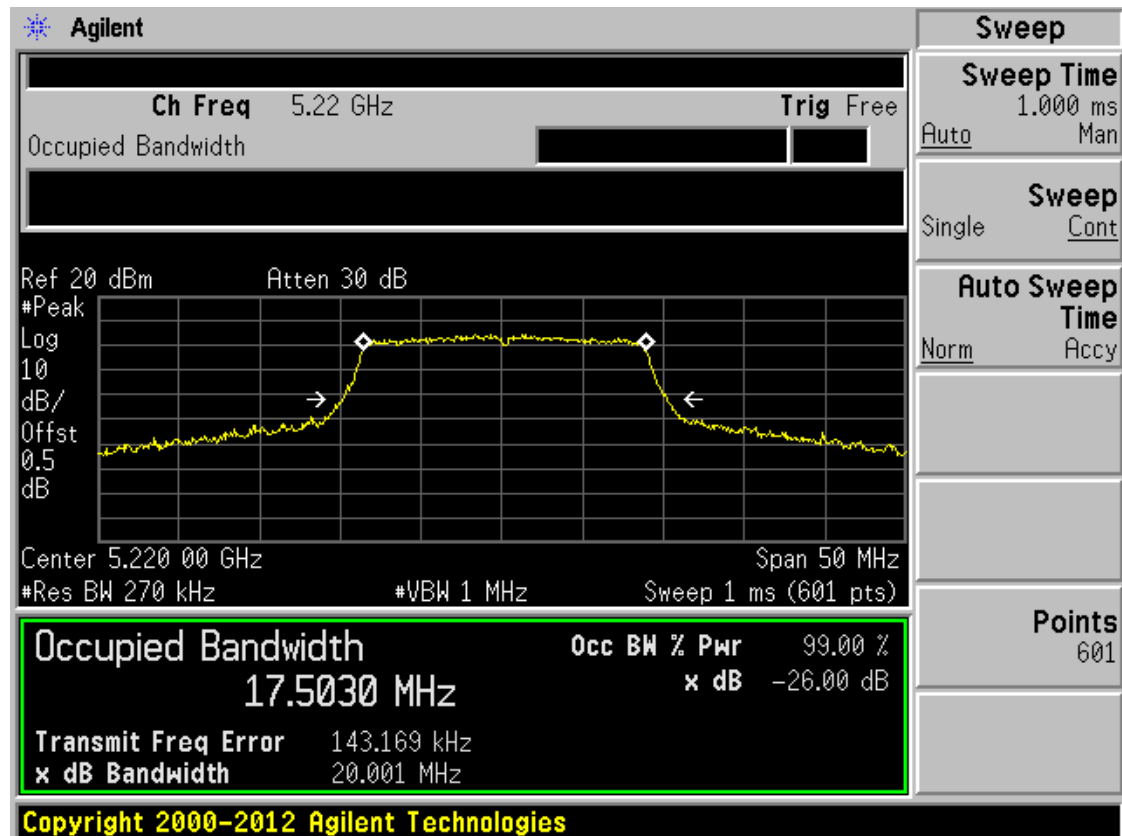
Band I 11n(HT40) CH46



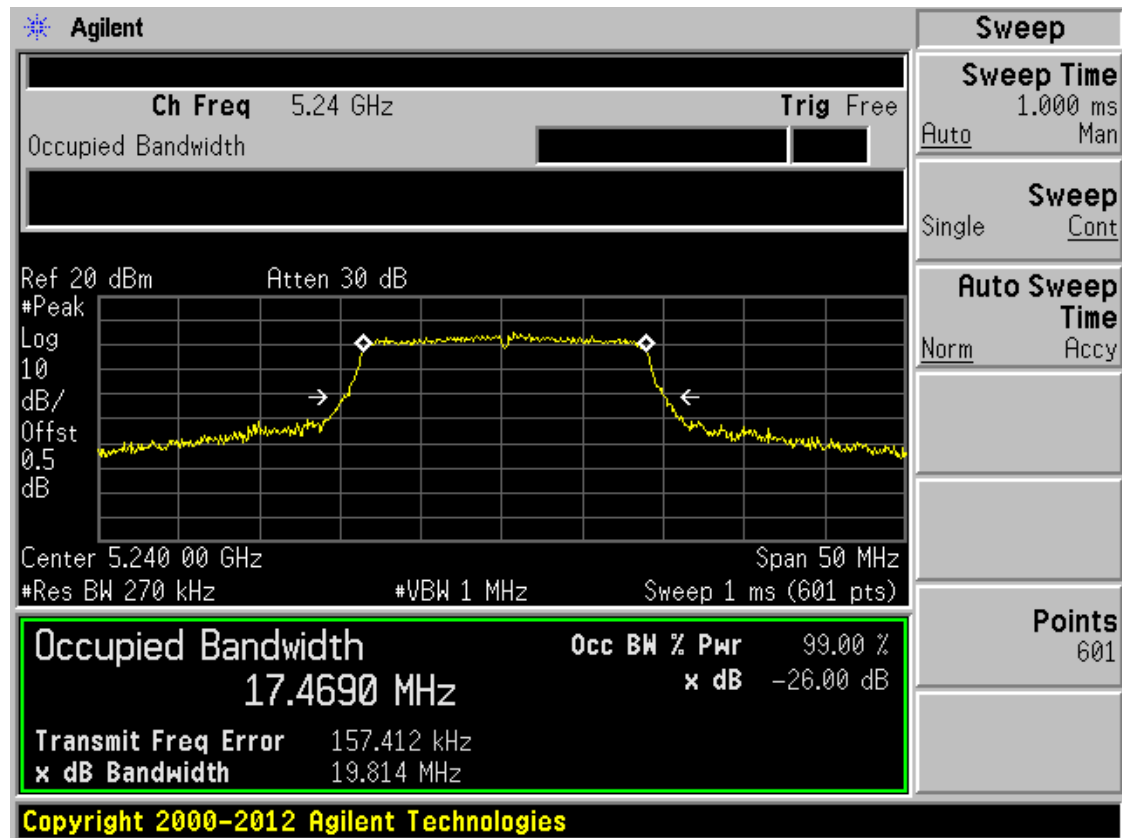
Band I 11ac(HT20) CH36



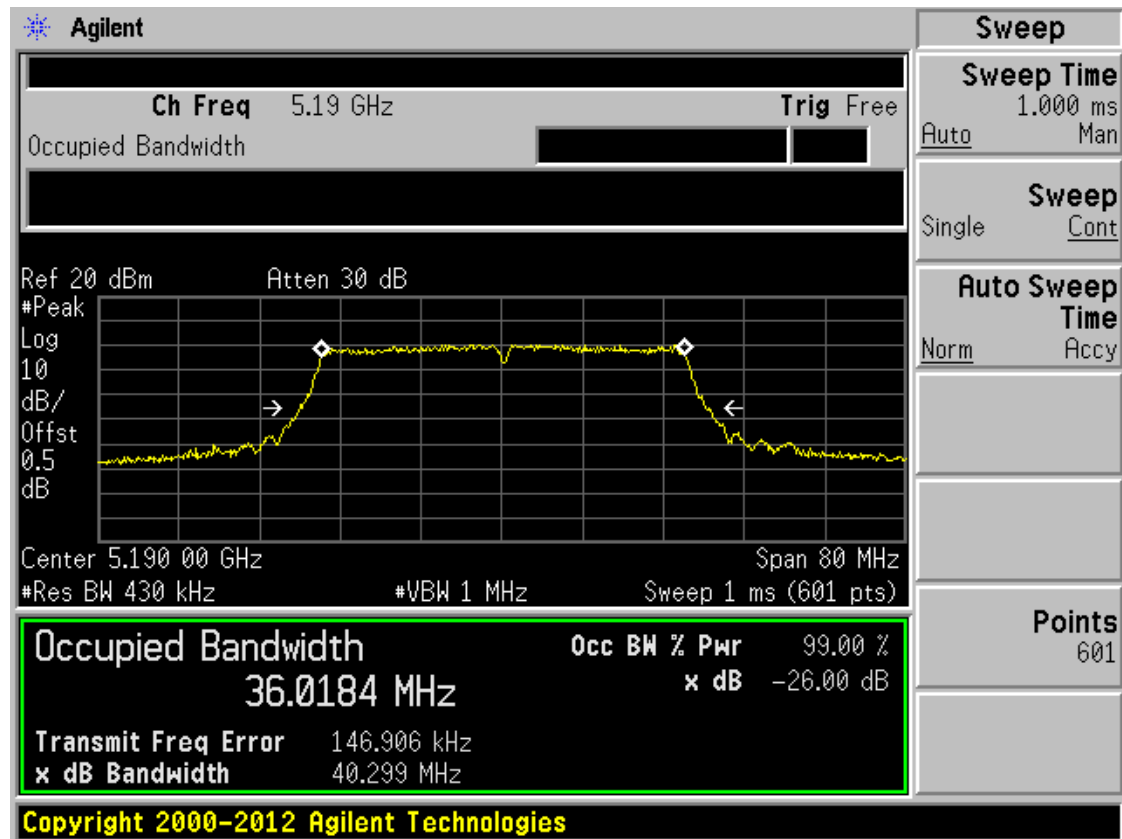
Band I 11ac(HT20) CH44



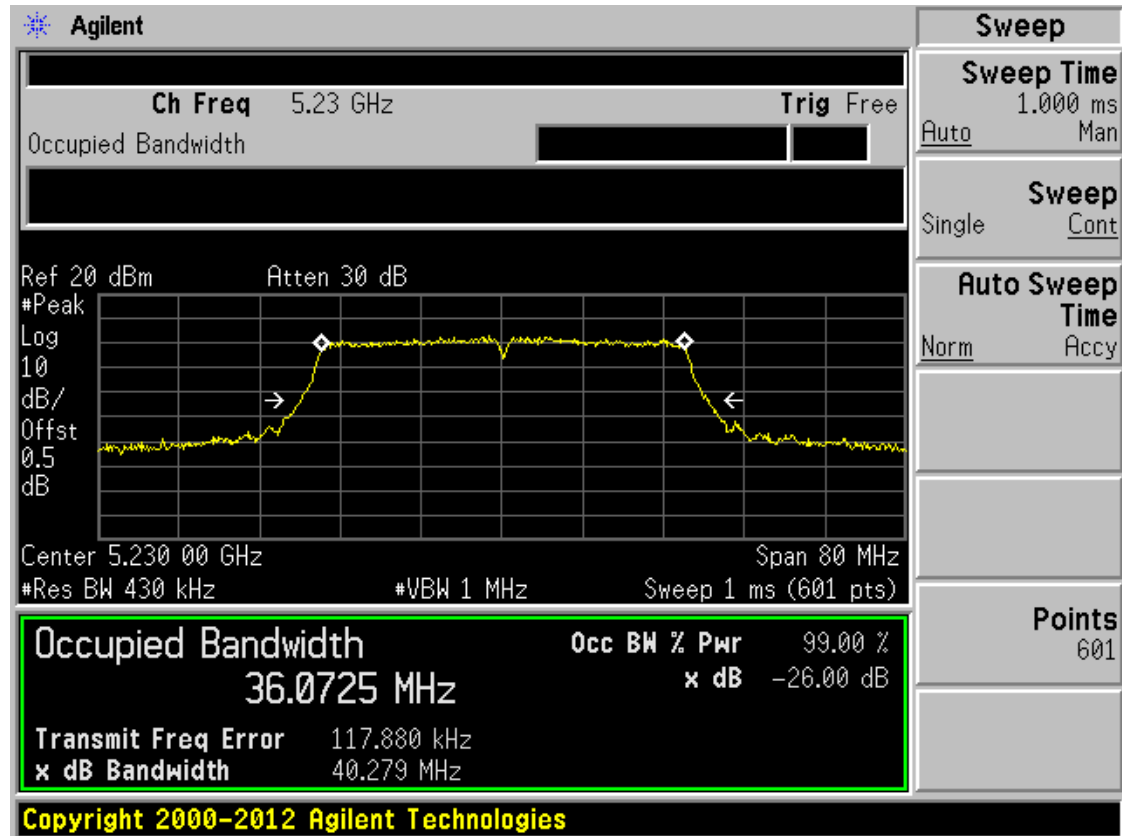
Band I 11ac(HT20) CH48



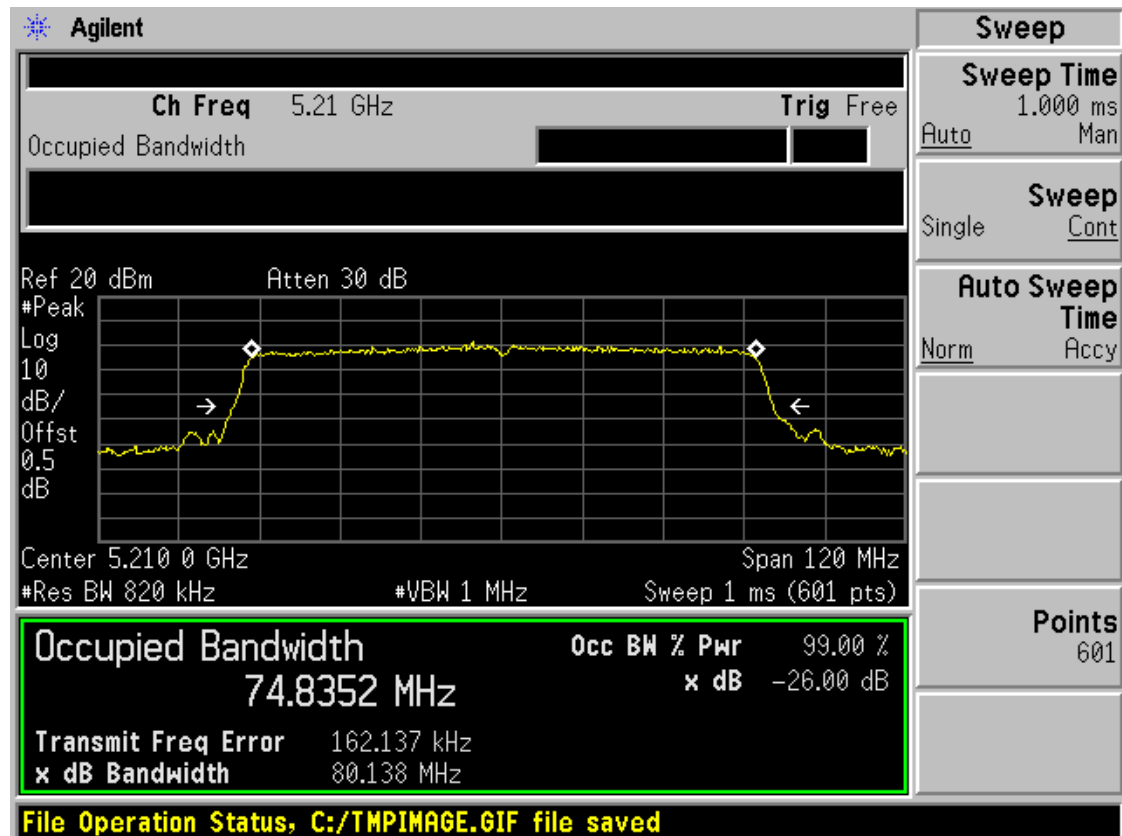
Band I 11ac(HT40) CH38



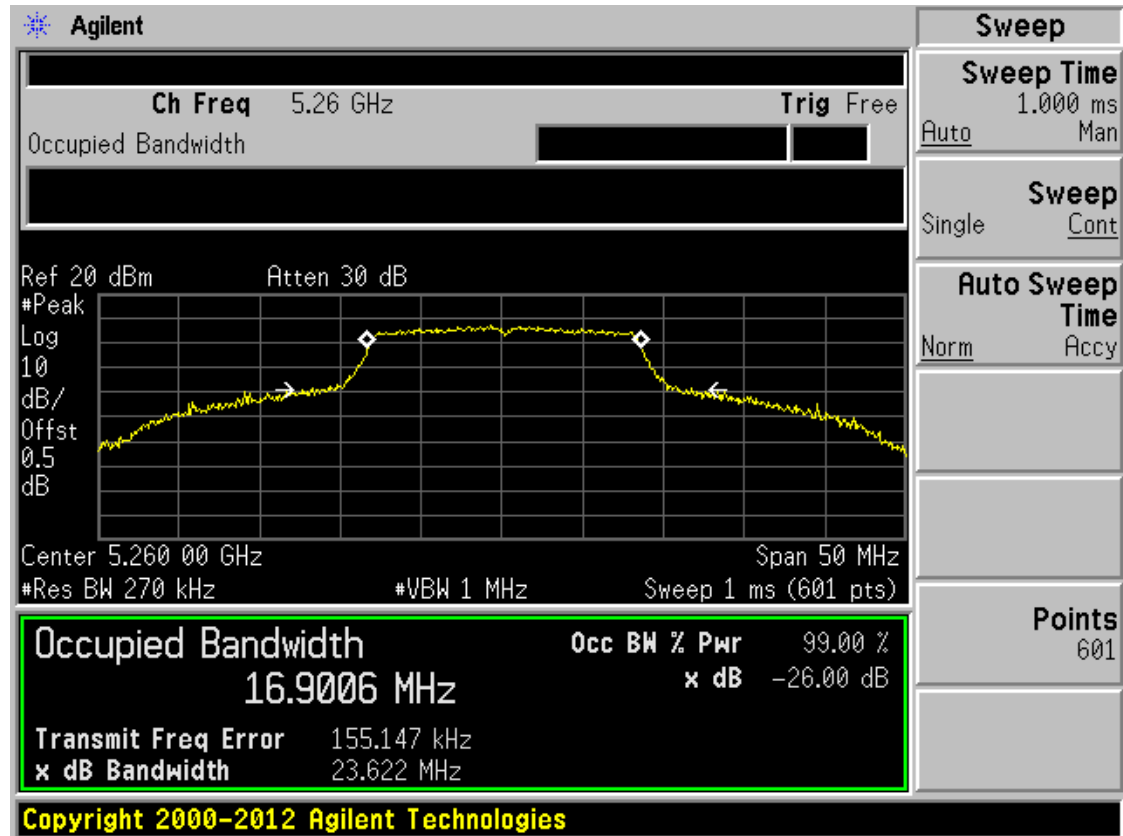
Band I 11ac(HT40) CH46



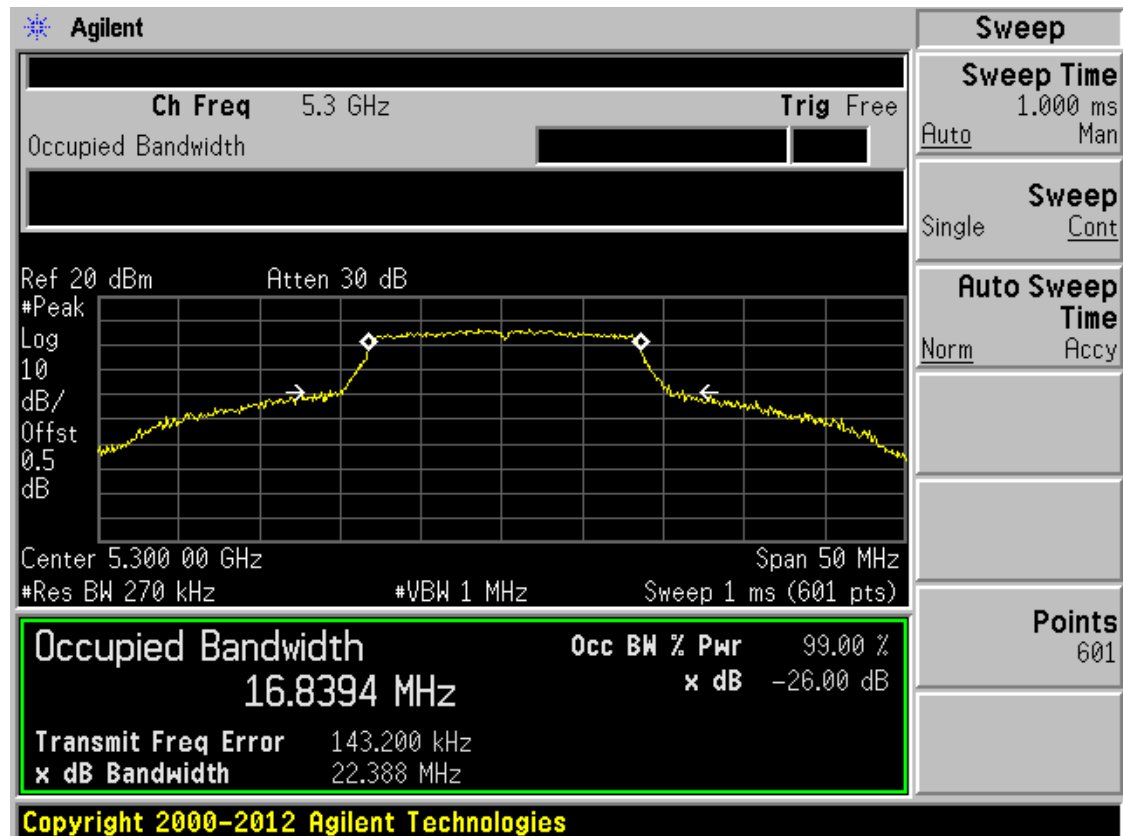
Band I 11ac(HT80) CH42



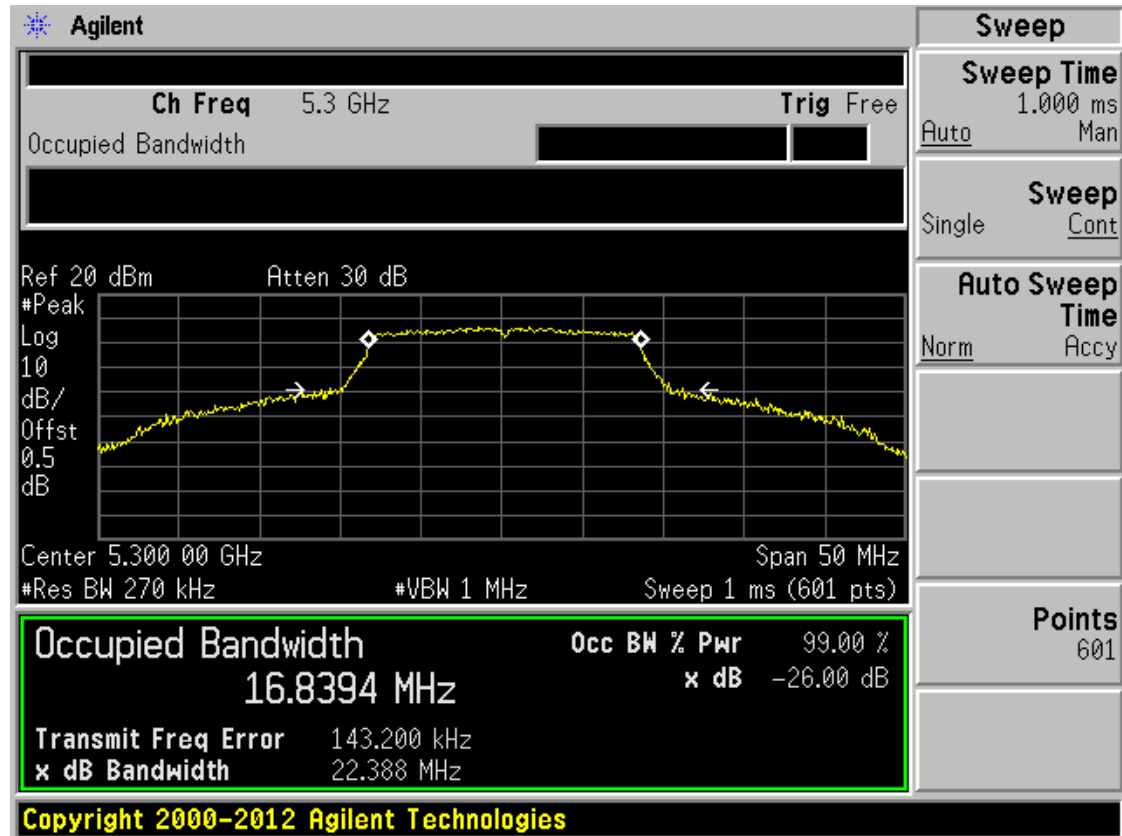
Band II 11a CH52



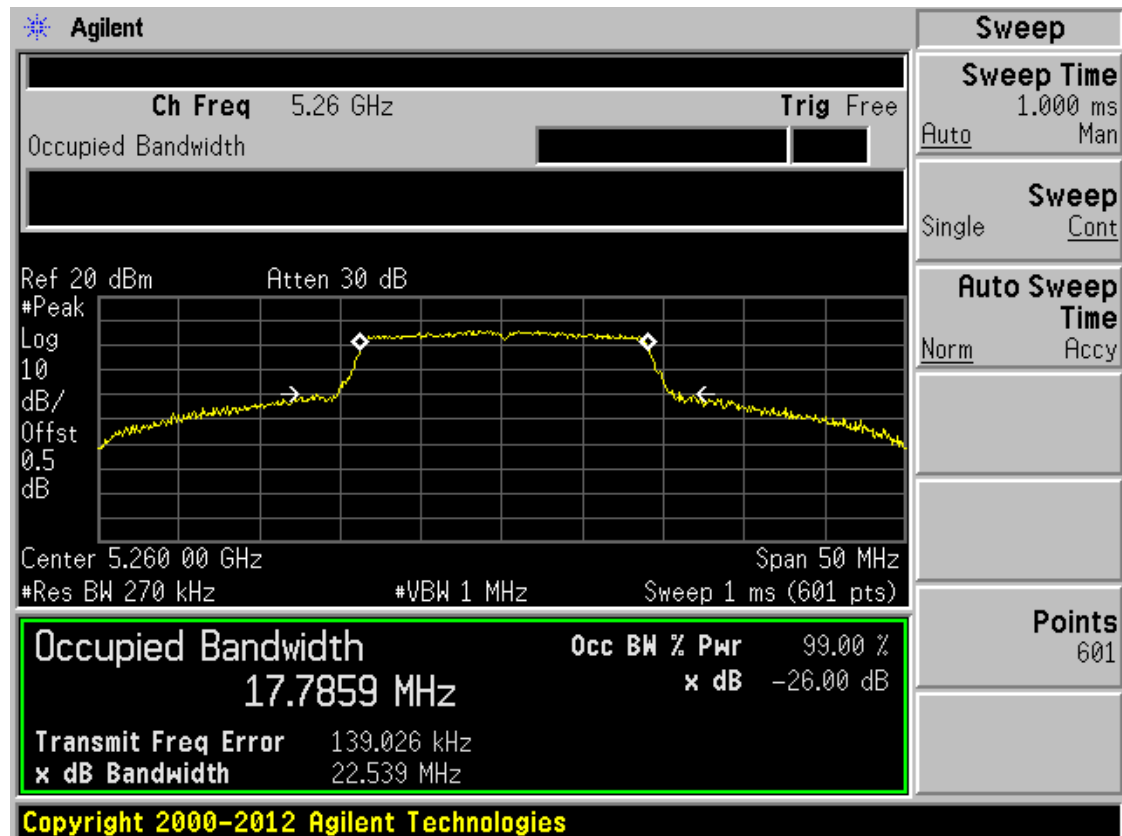
Band II 11a CH60



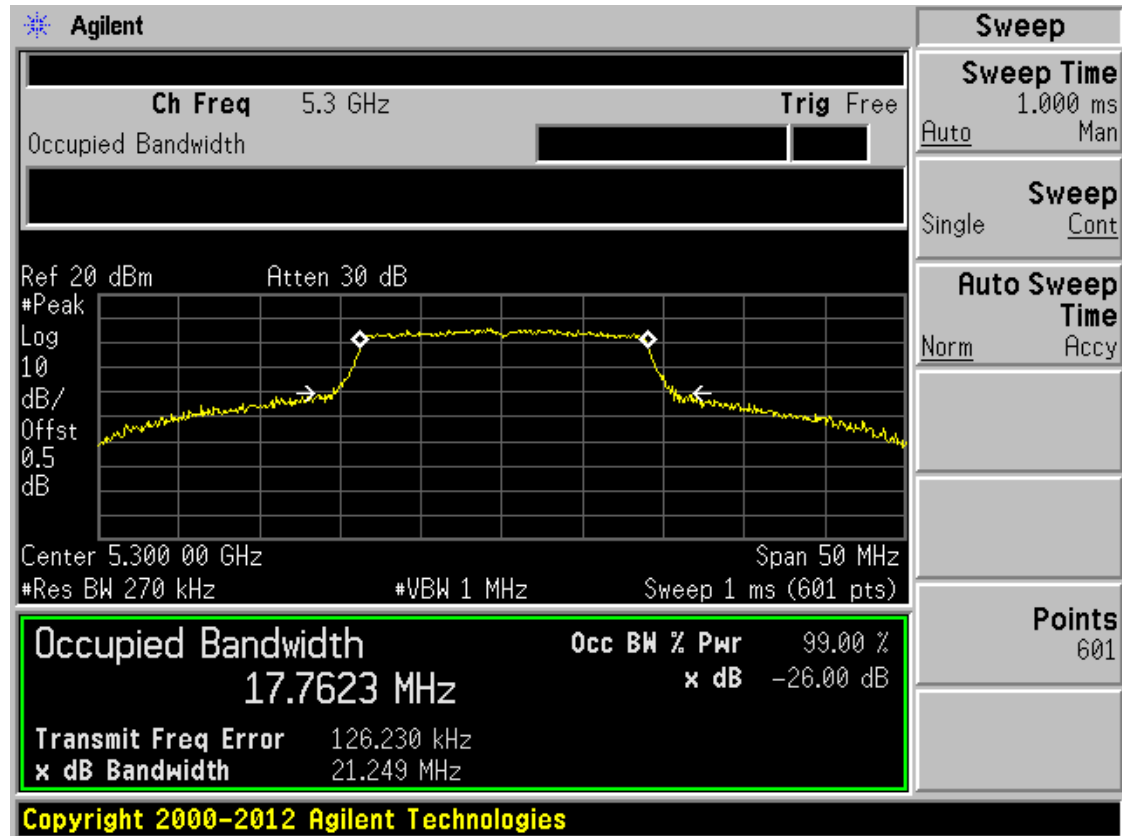
Band II 11a CH64



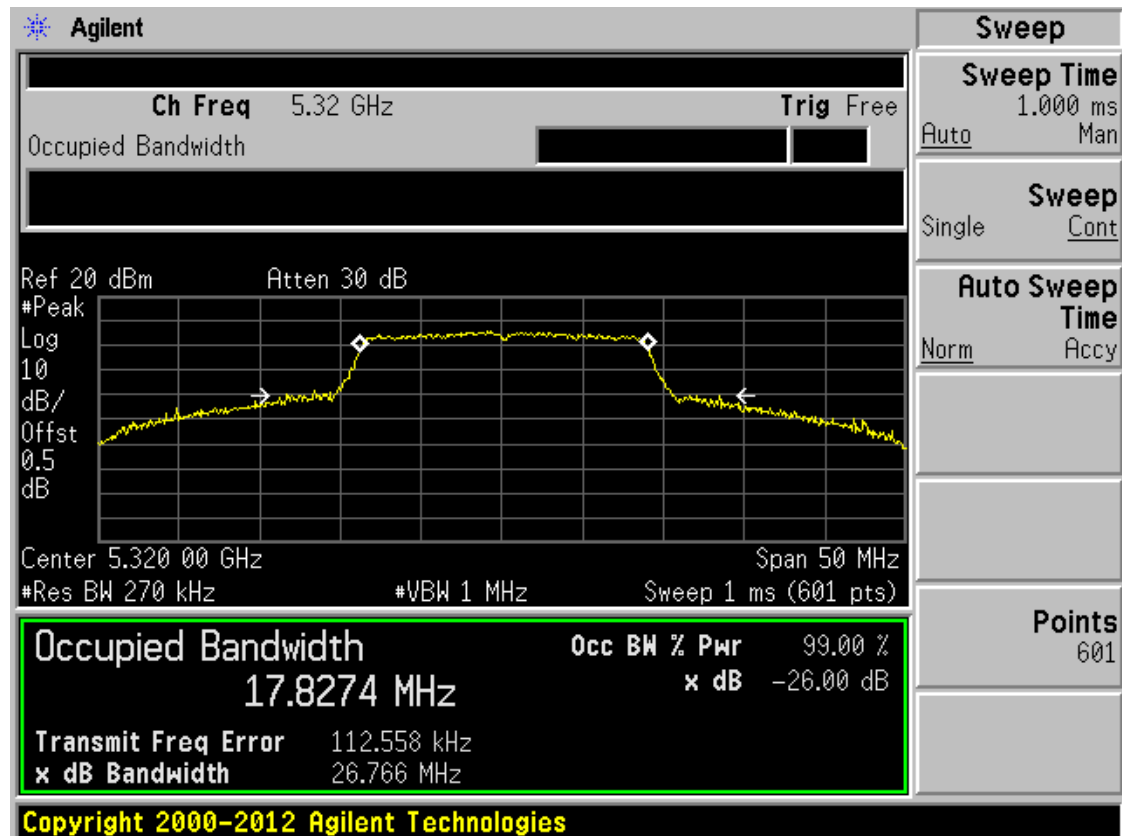
Band II 11n(HT20) CH52



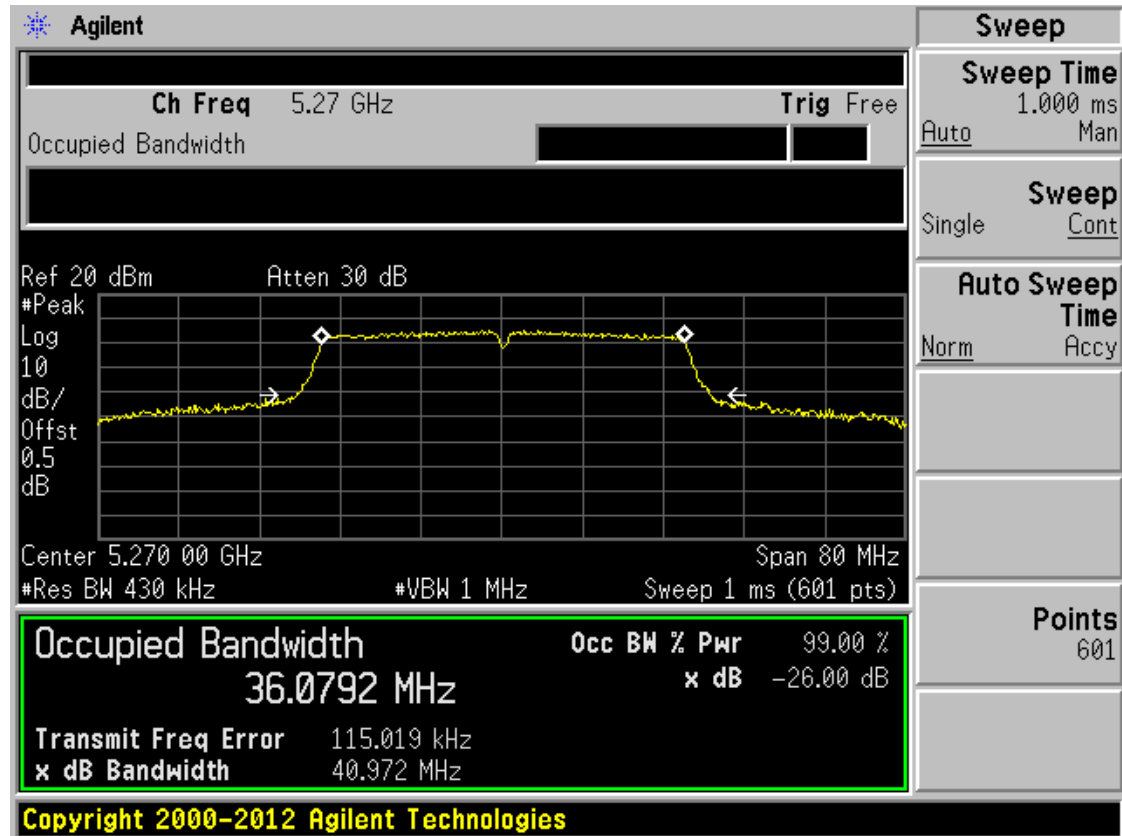
Band II 11n(HT20) CH60



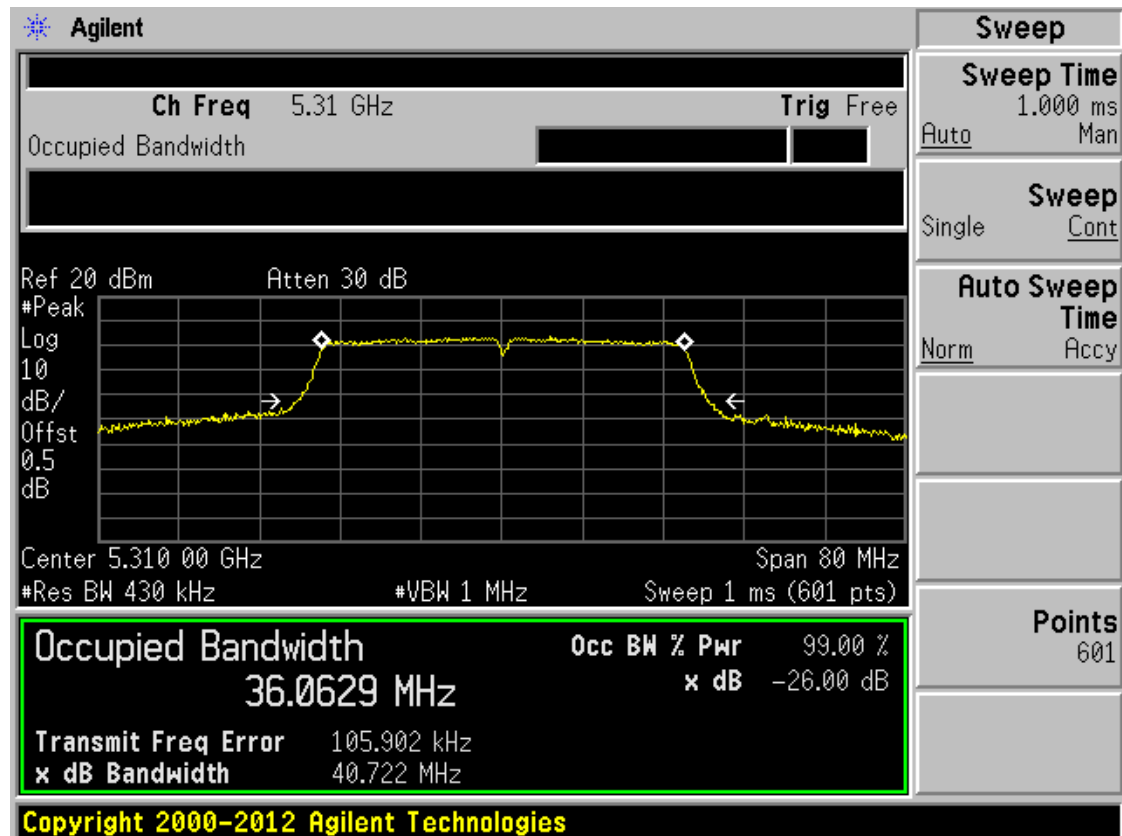
Band II 11n(HT20) CH64



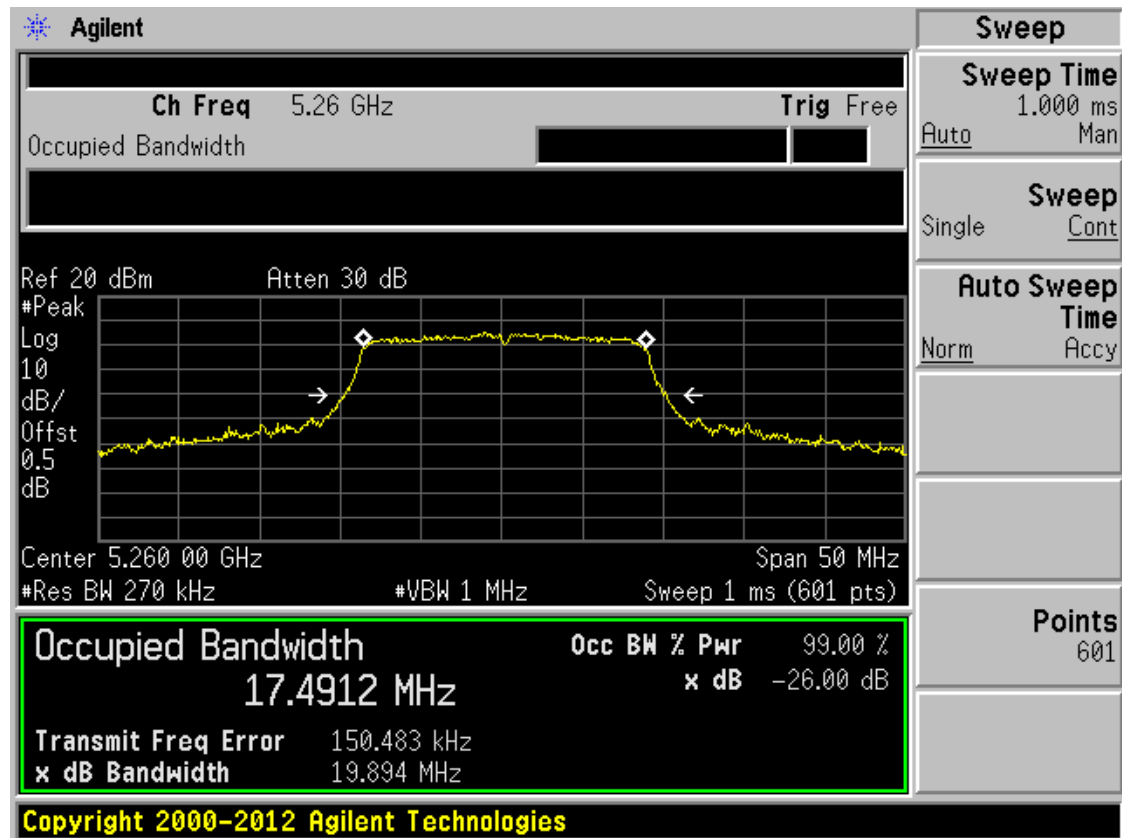
Band II 11n(HT40) CH54



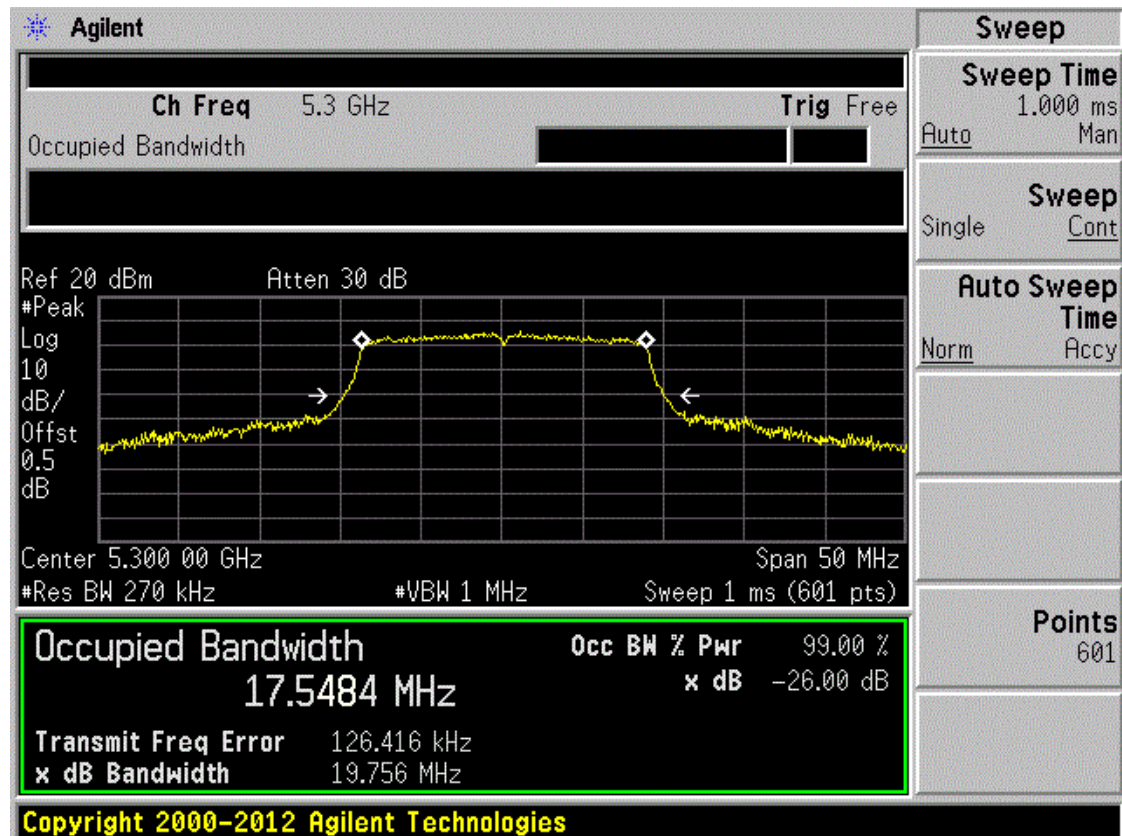
Band II 11n(HT40) CH62



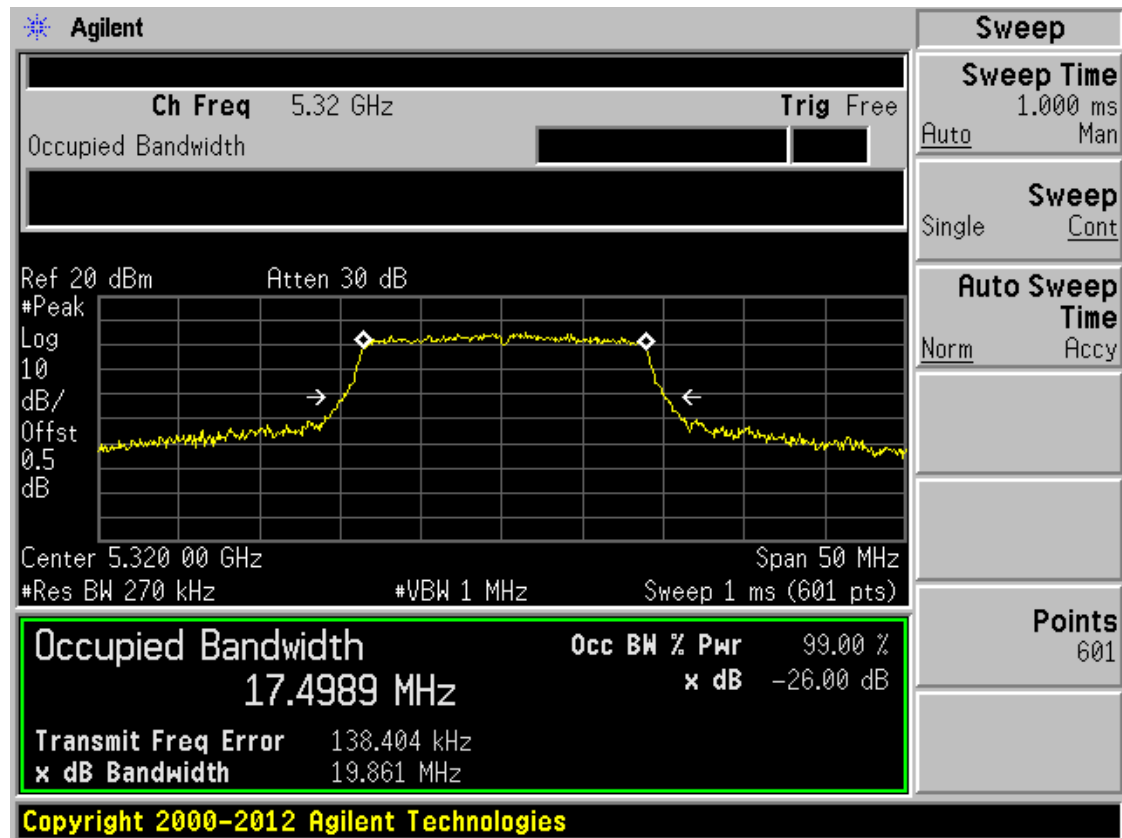
Band II 11ac(HT20) CH52



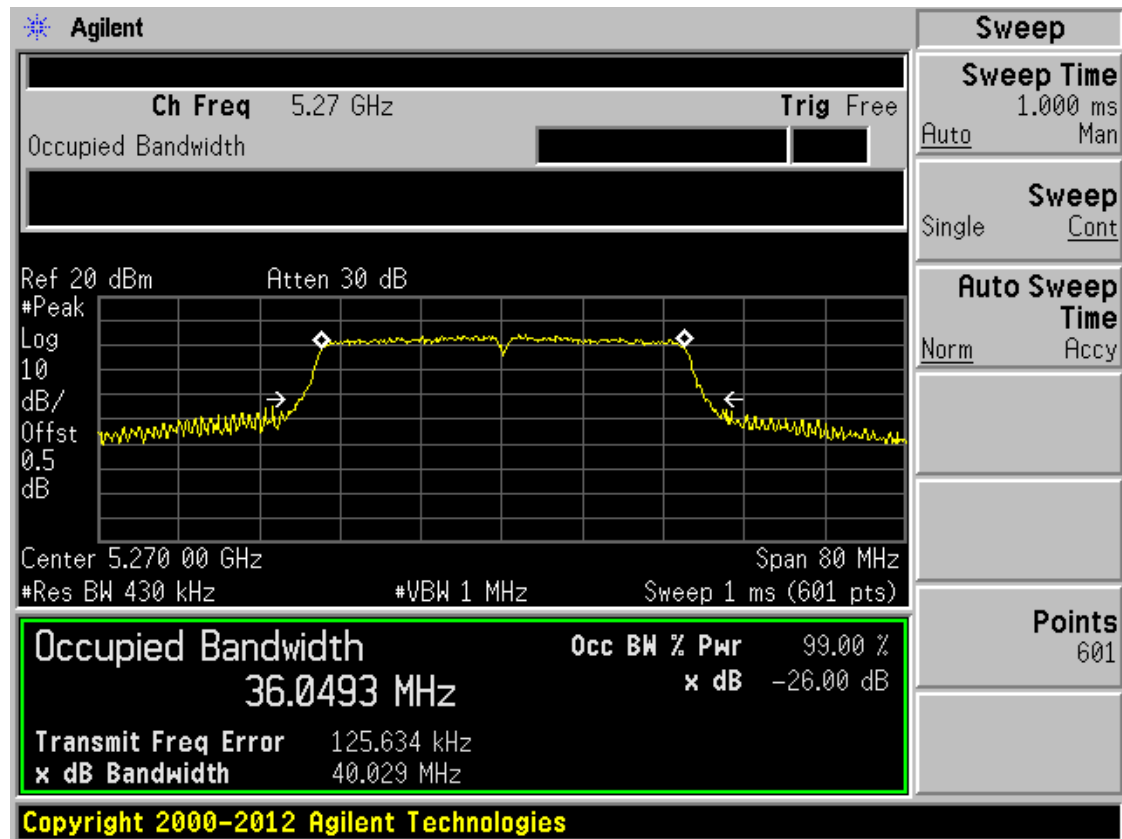
Band II 11ac(HT20) CH60



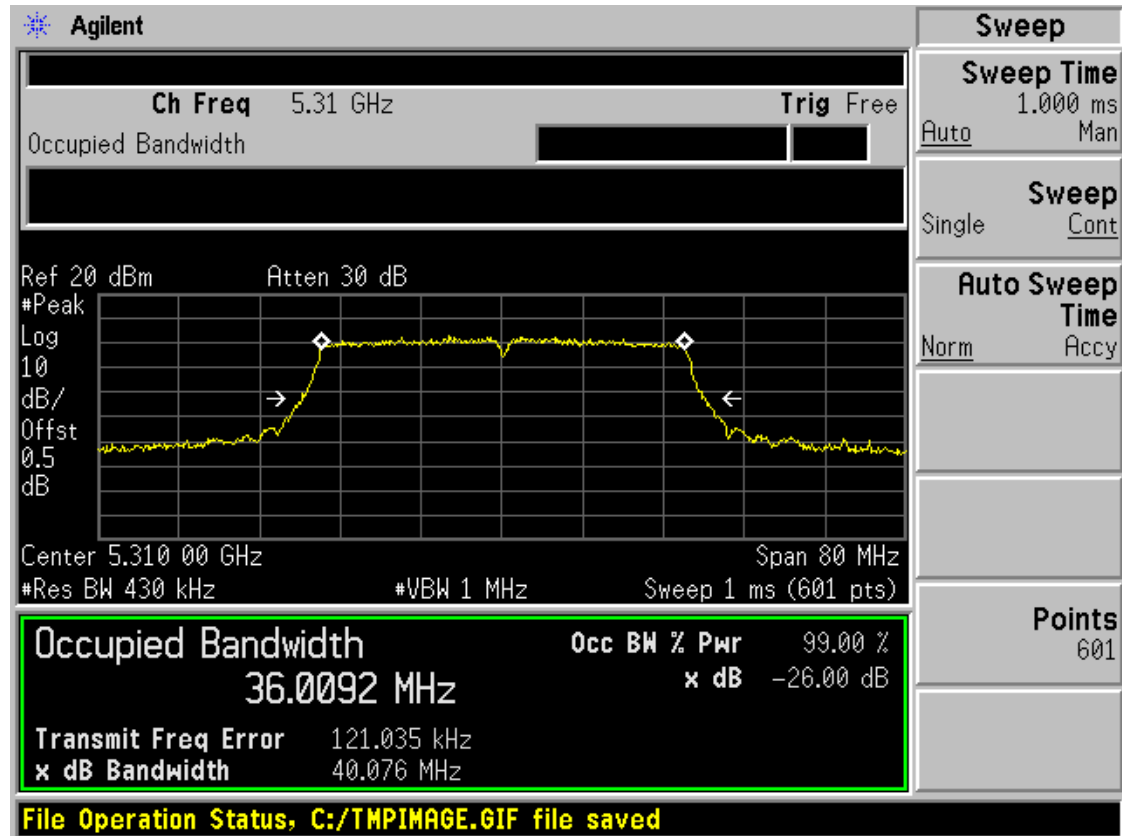
Band II 11ac(HT20) CH64



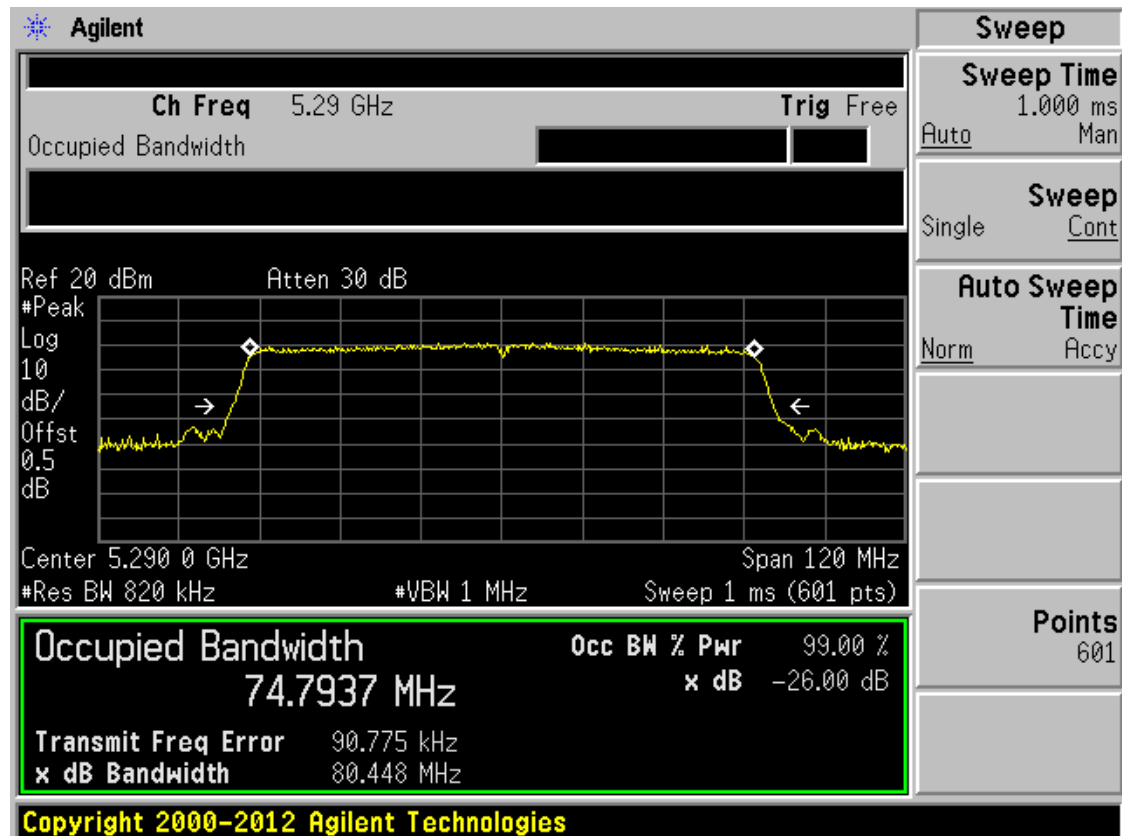
Band II 11ac(HT40) CH54



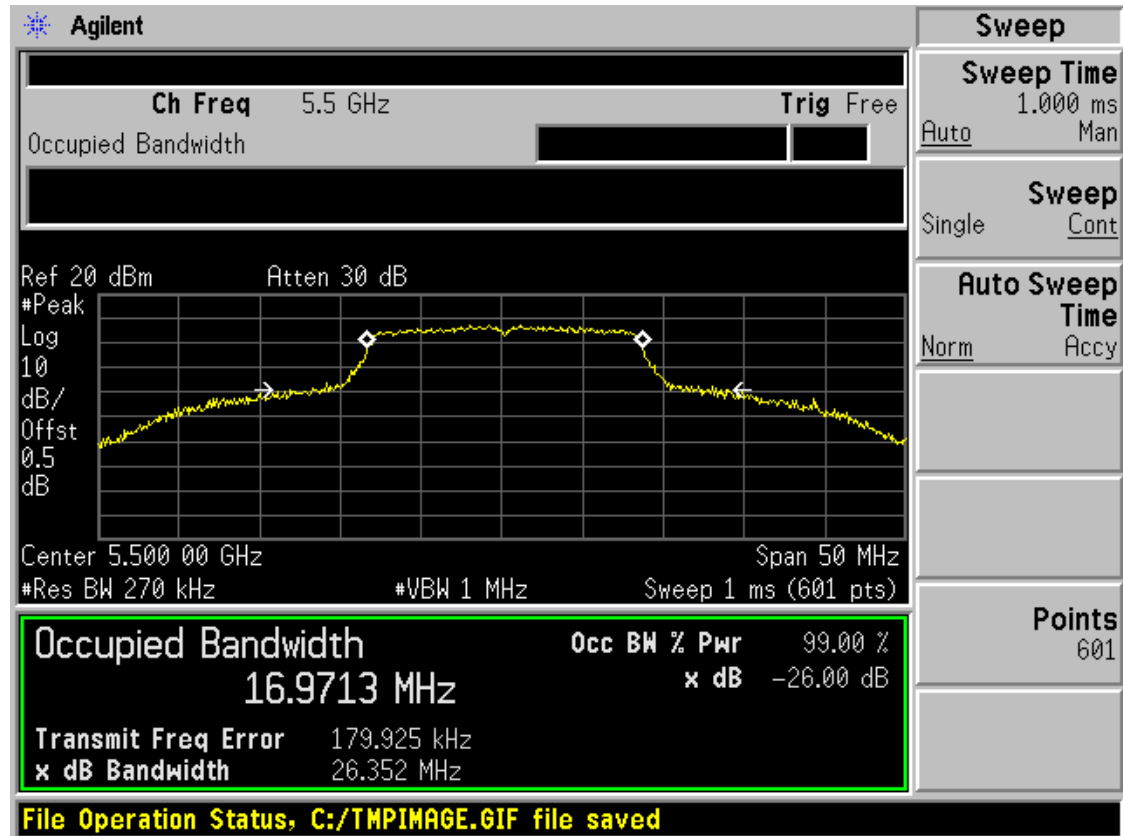
Band II 11ac(HT40) CH62



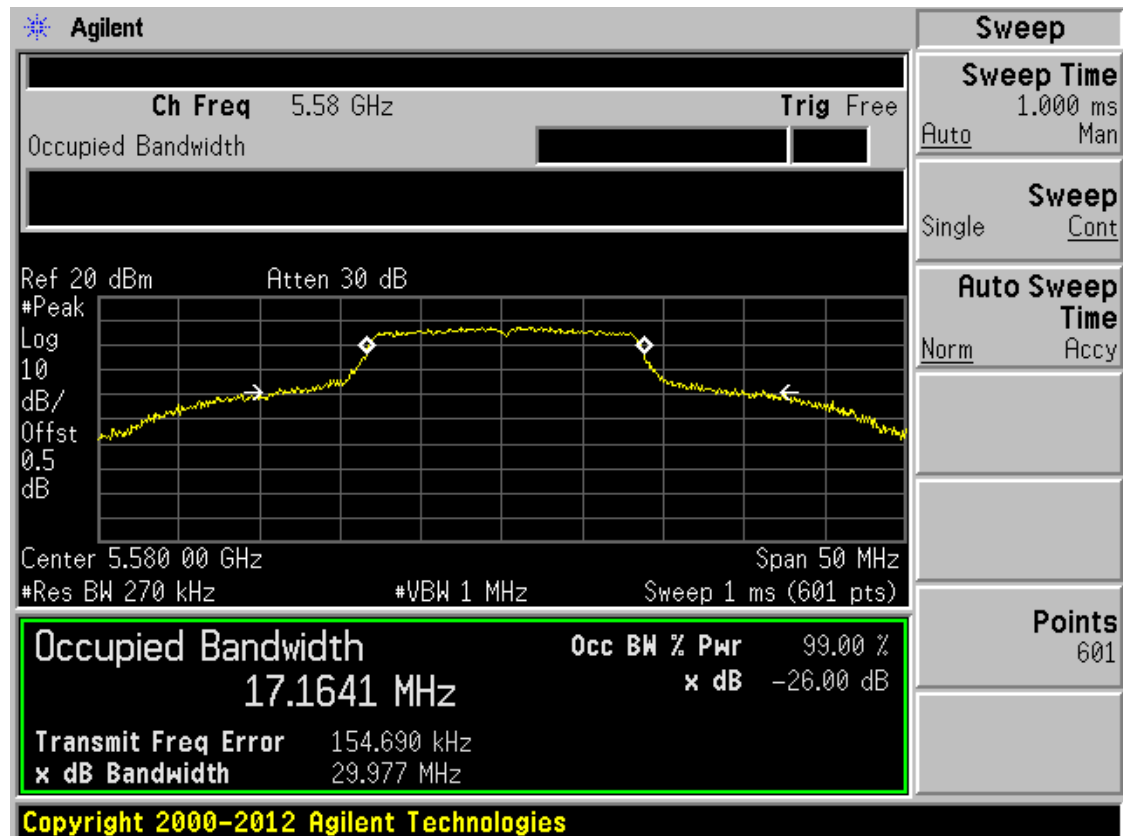
Band II 11ac(HT80) CH58



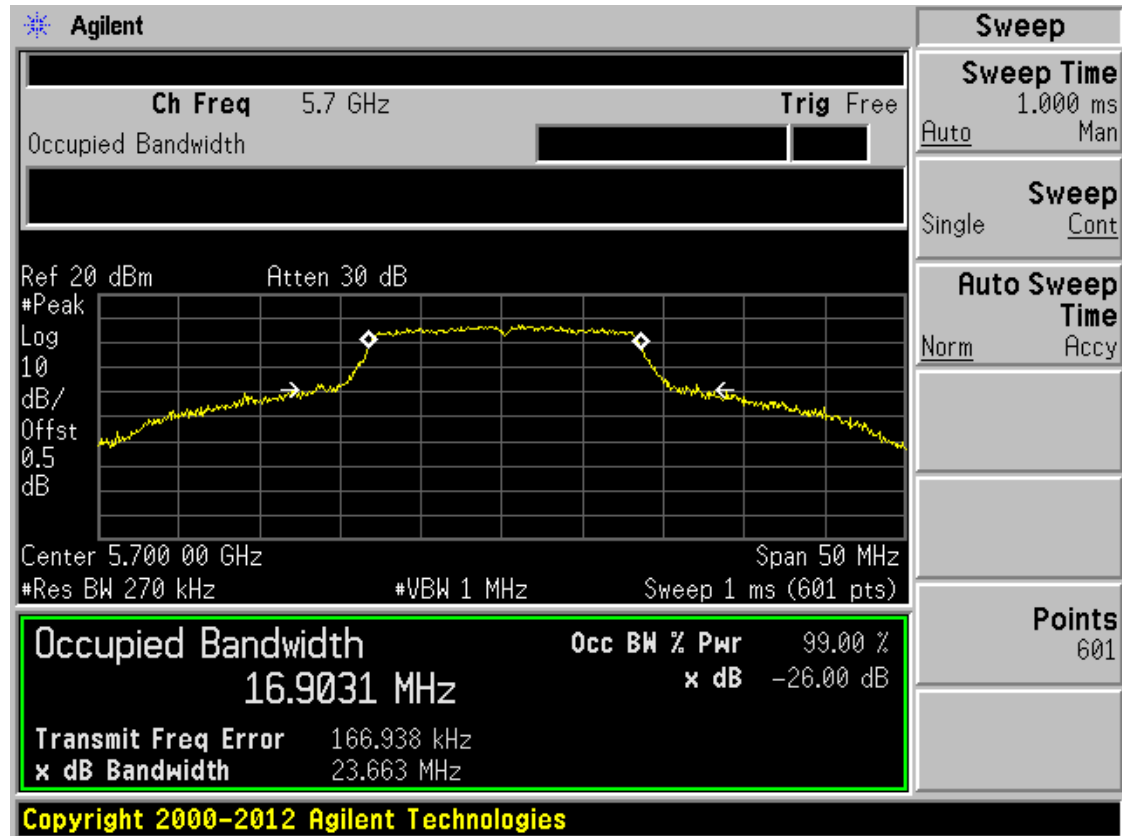
Band III 11a CH100



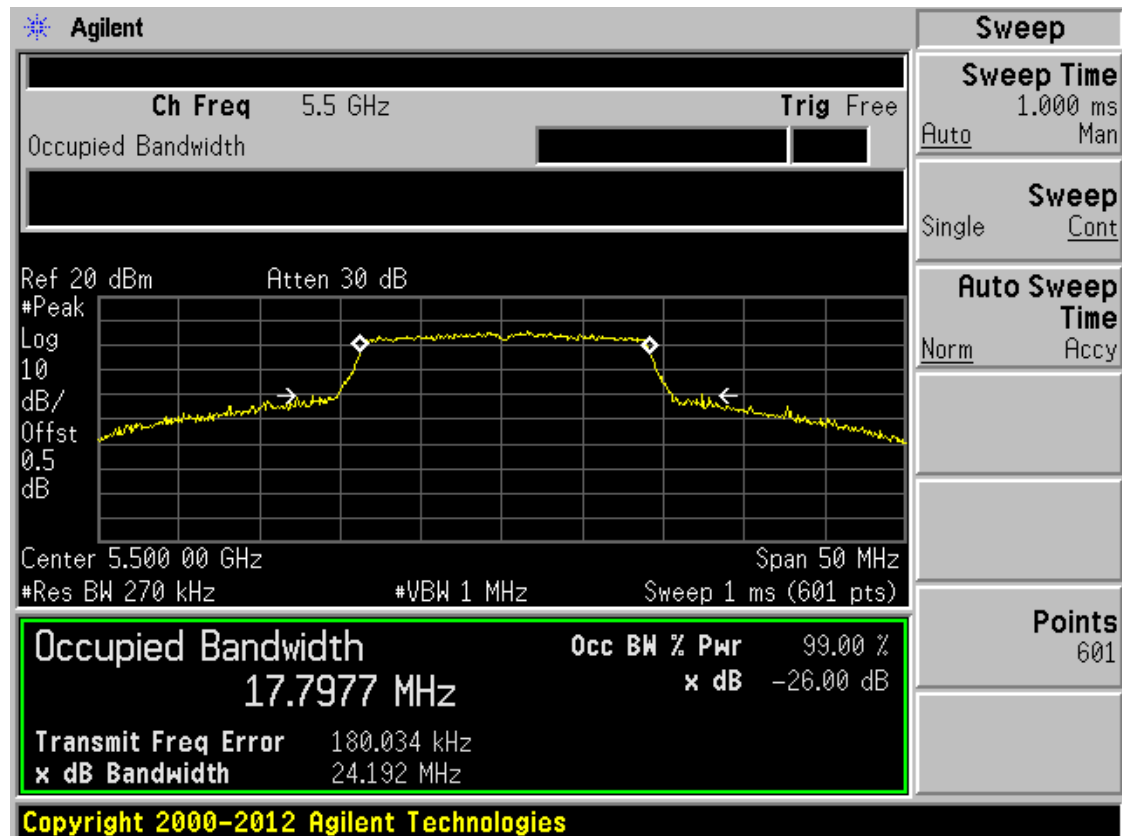
Band III 11a CH116



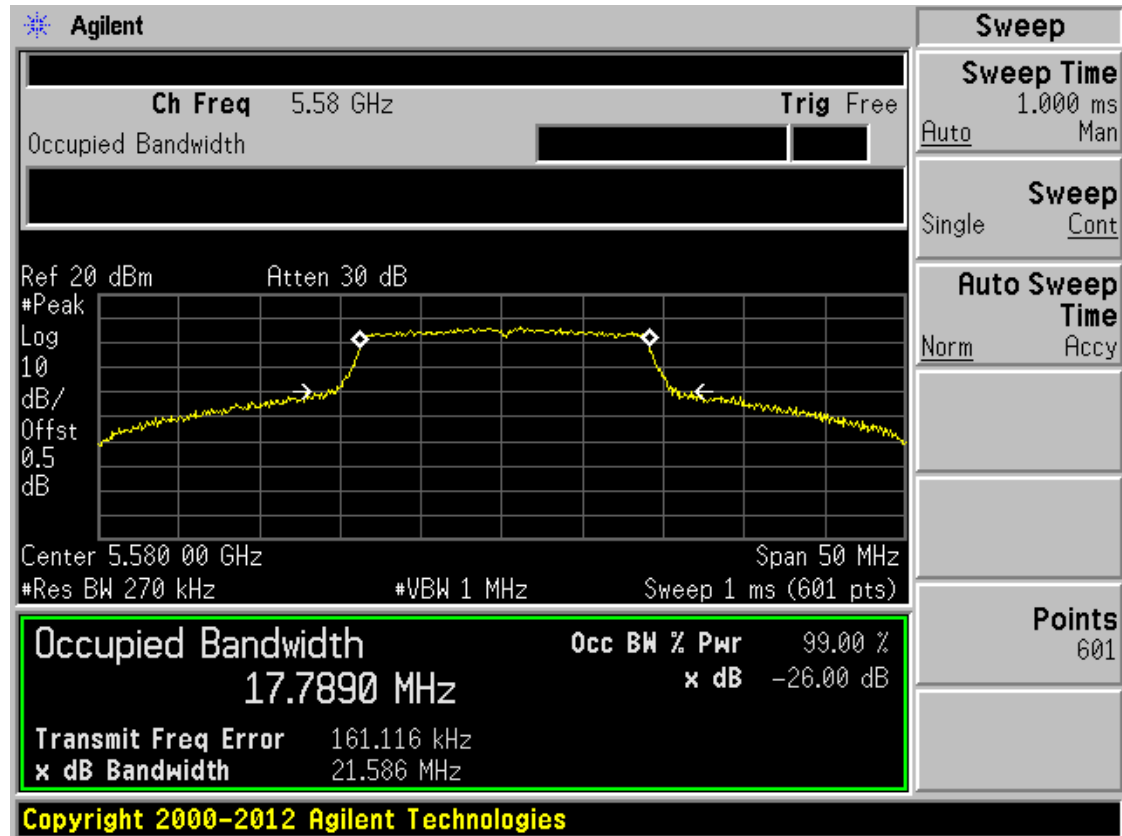
Band III 11a CH140



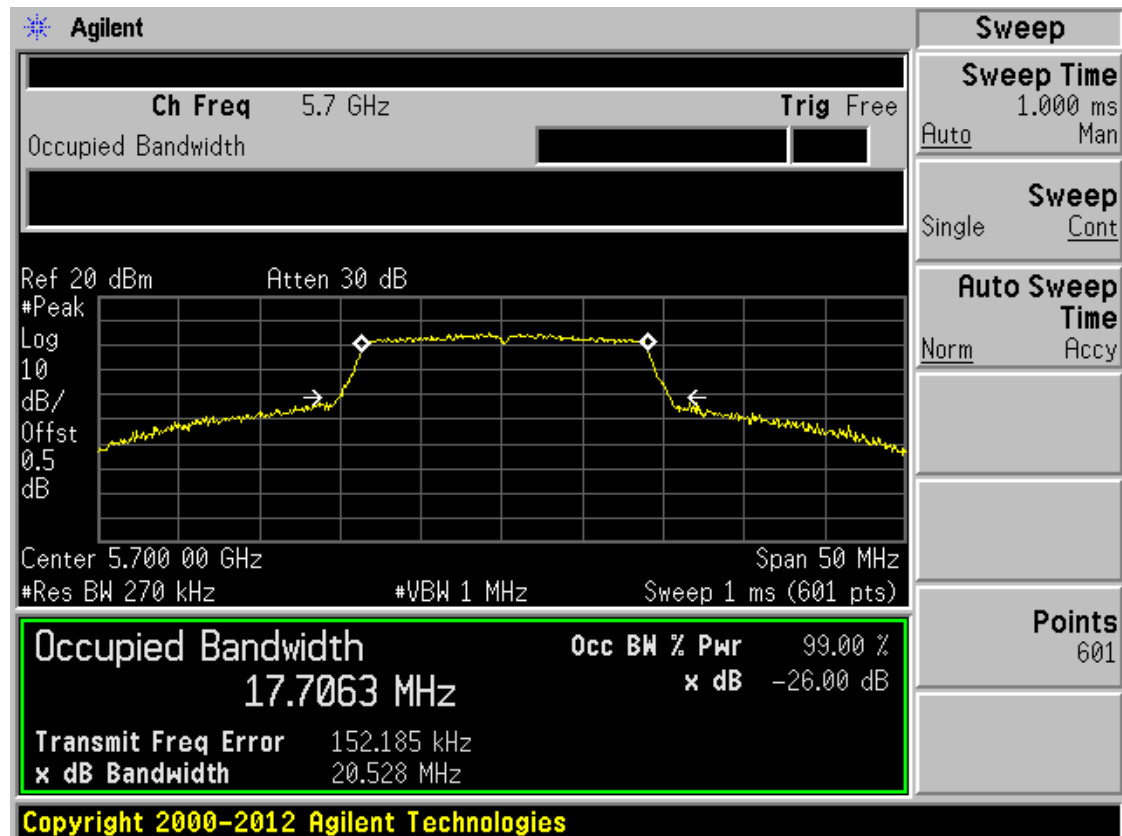
Band III 11n(HT20) CH100



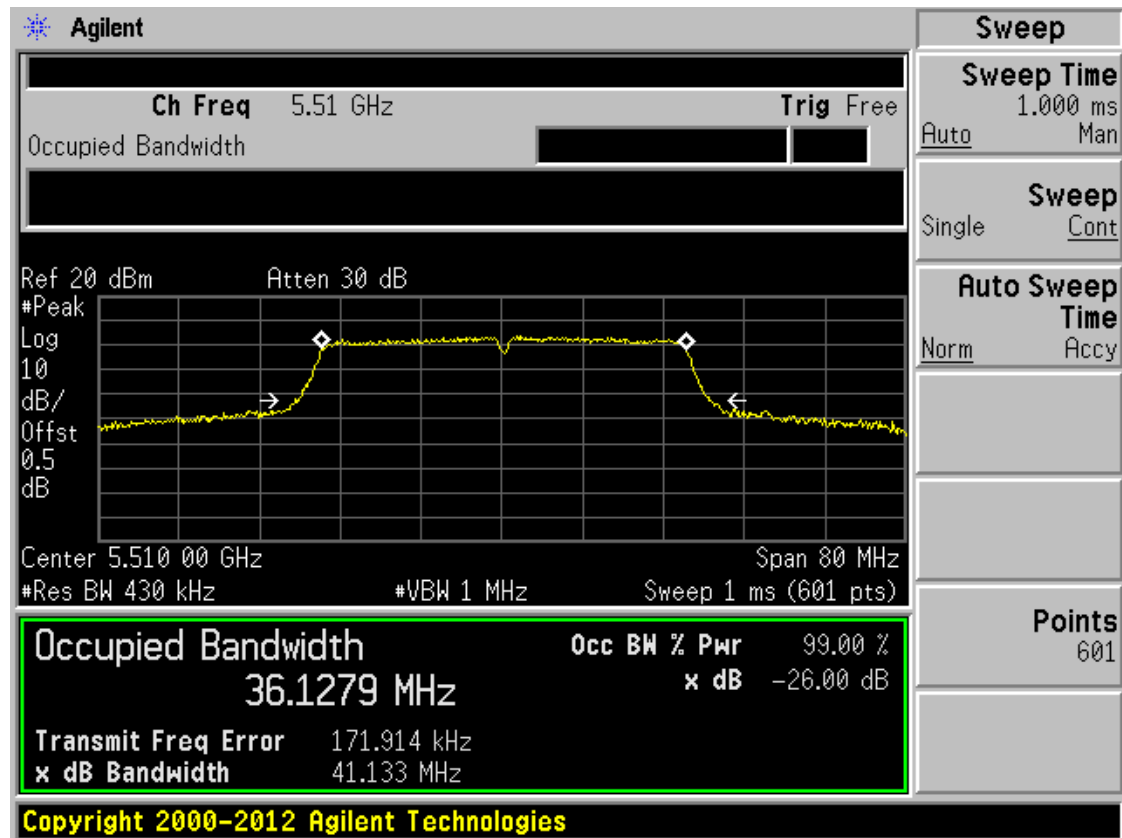
Band III 11n(HT20) CH116



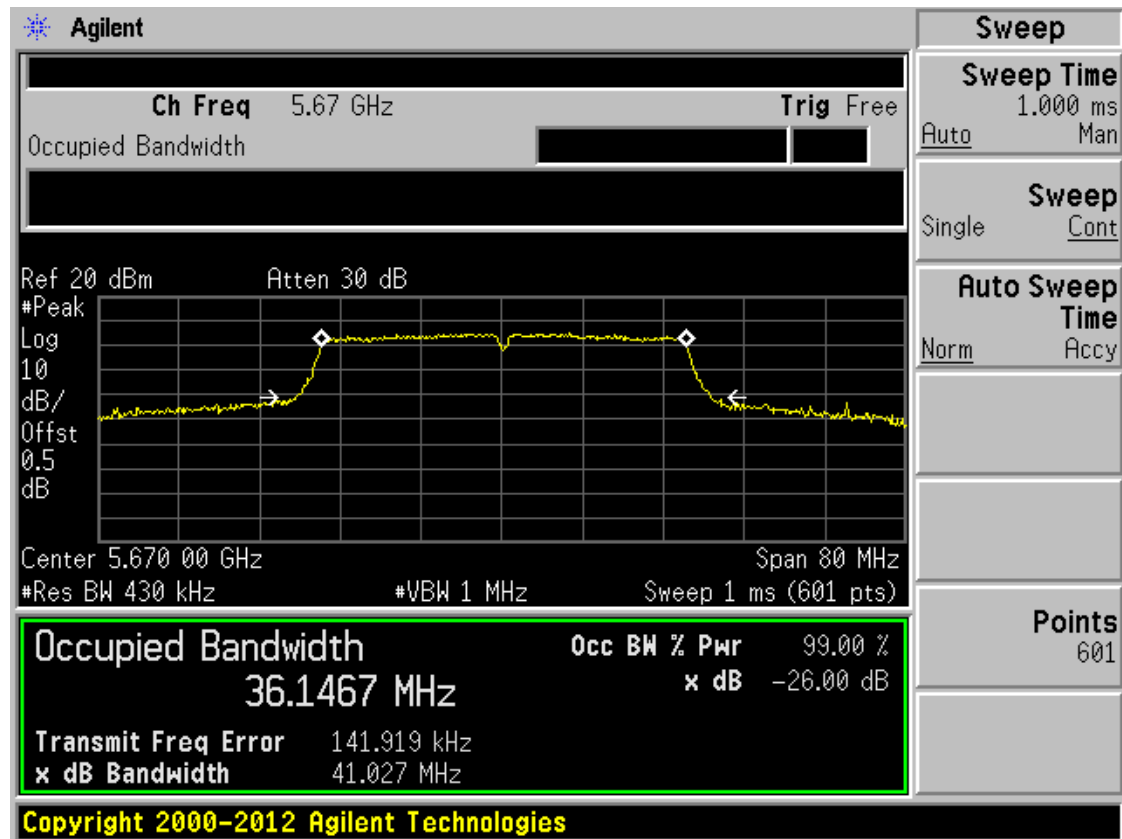
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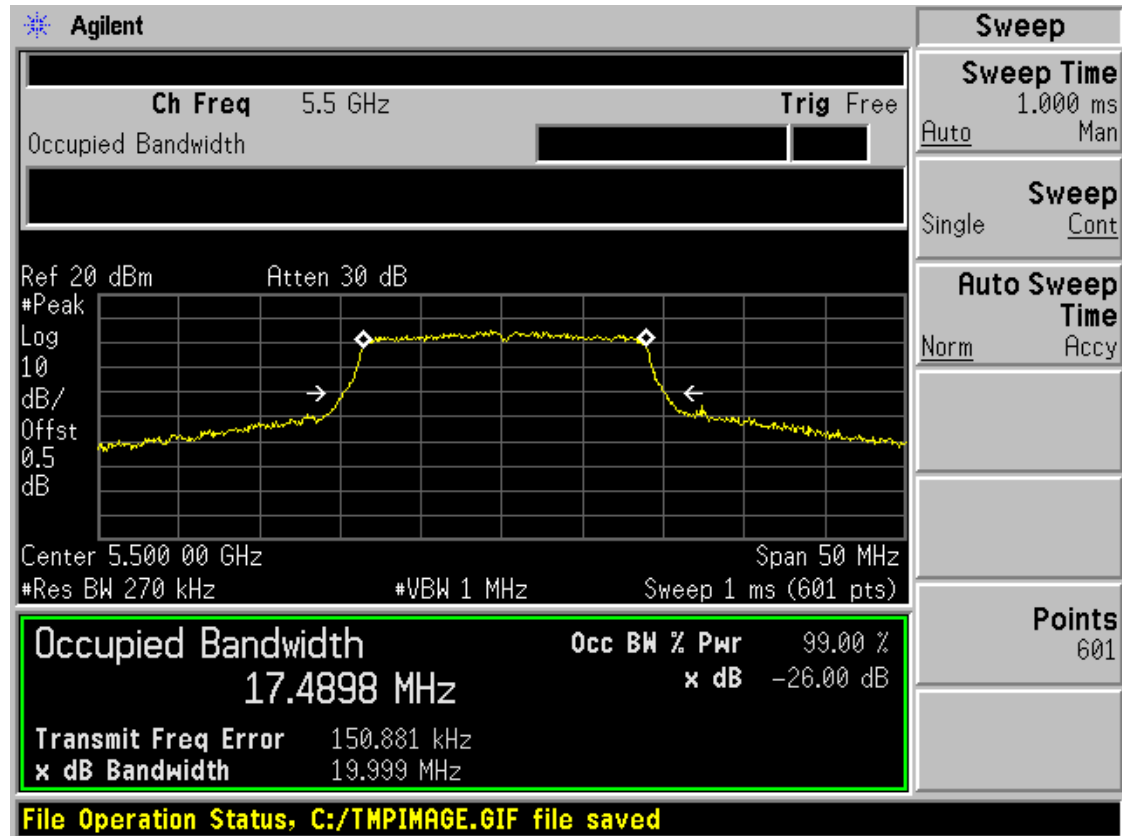
Band III 11n(HT40) CH102



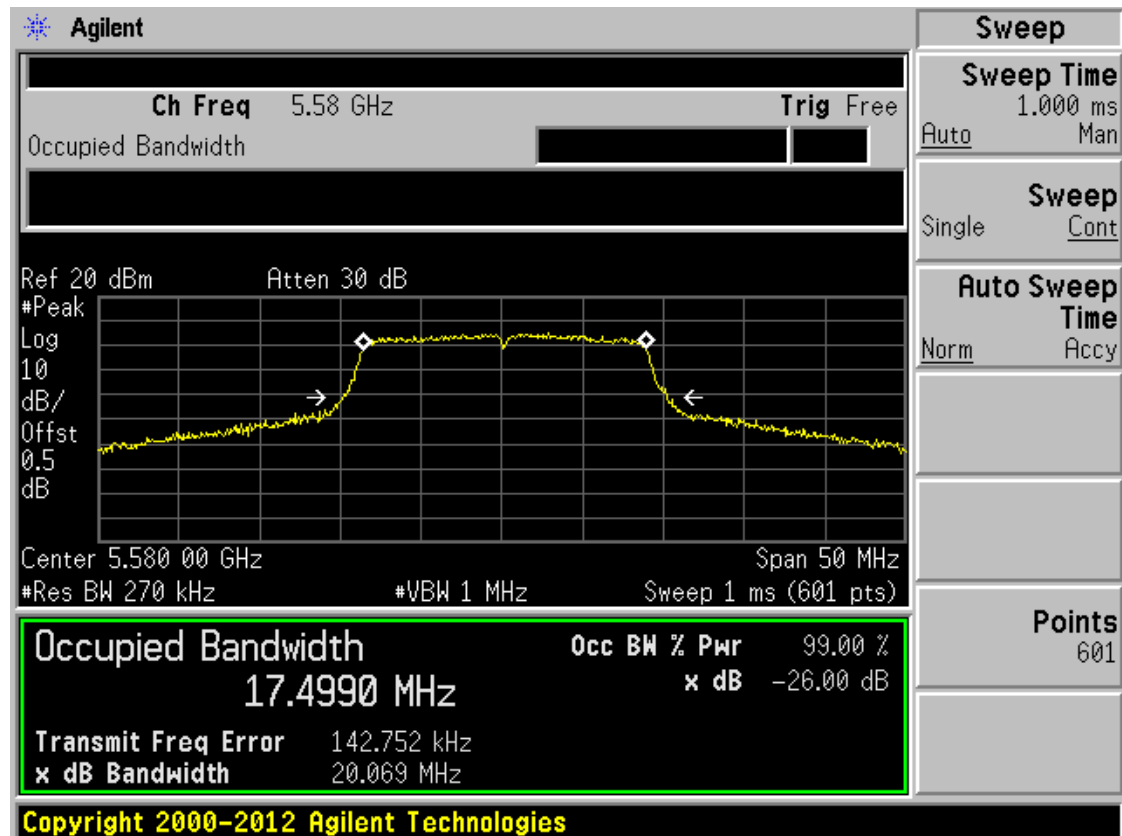
Band III 11n(HT40) CH134



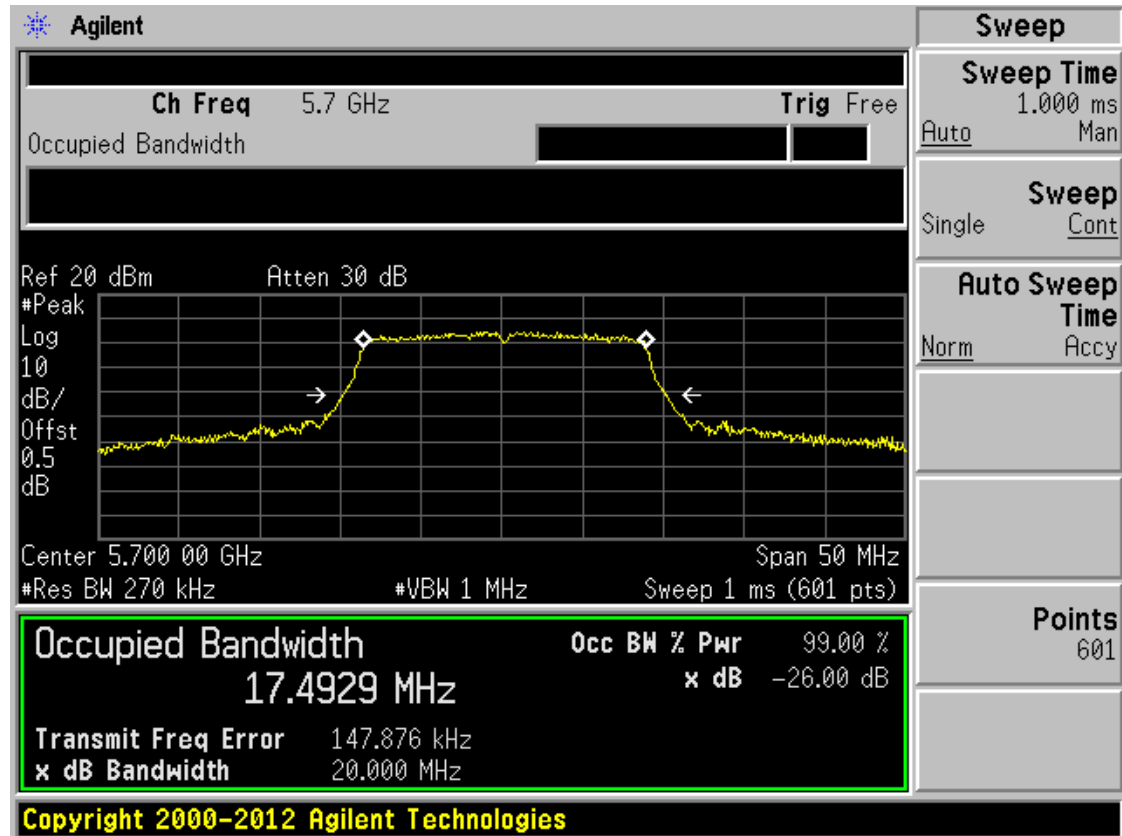
Band III 11ac(HT20) CH100



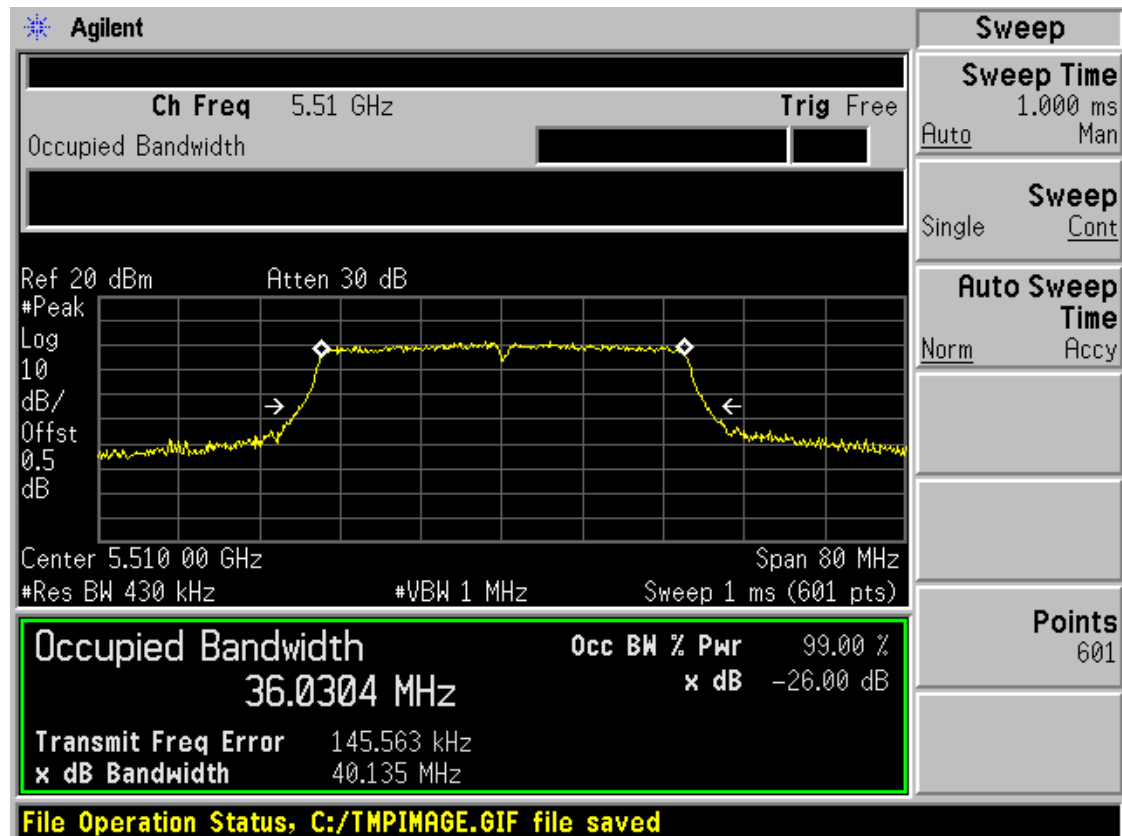
Band III 11ac(HT20) CH116



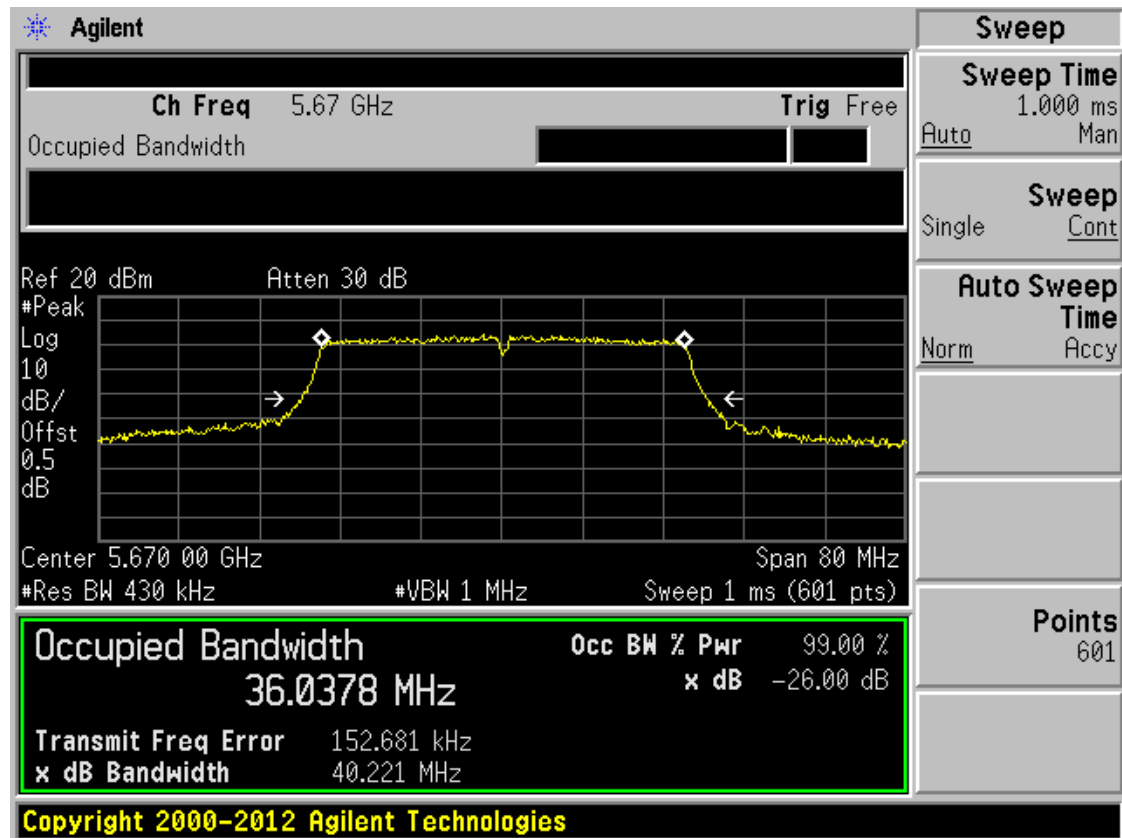
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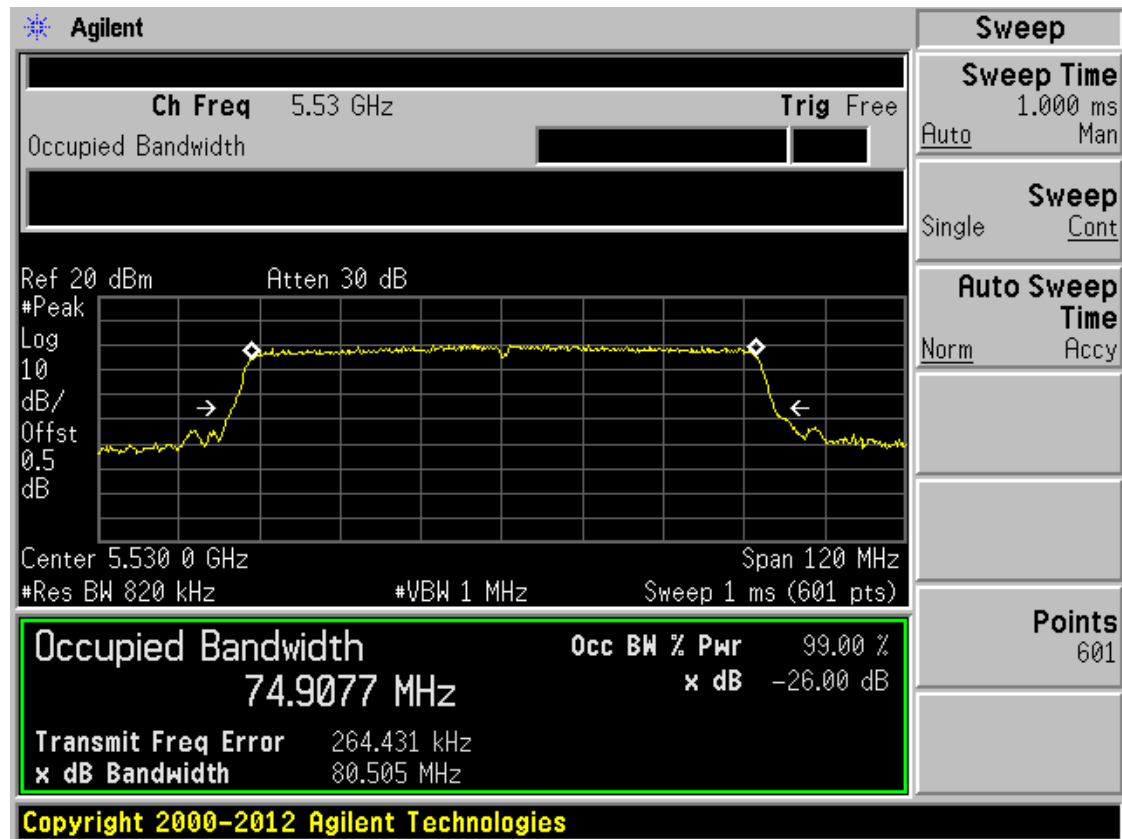
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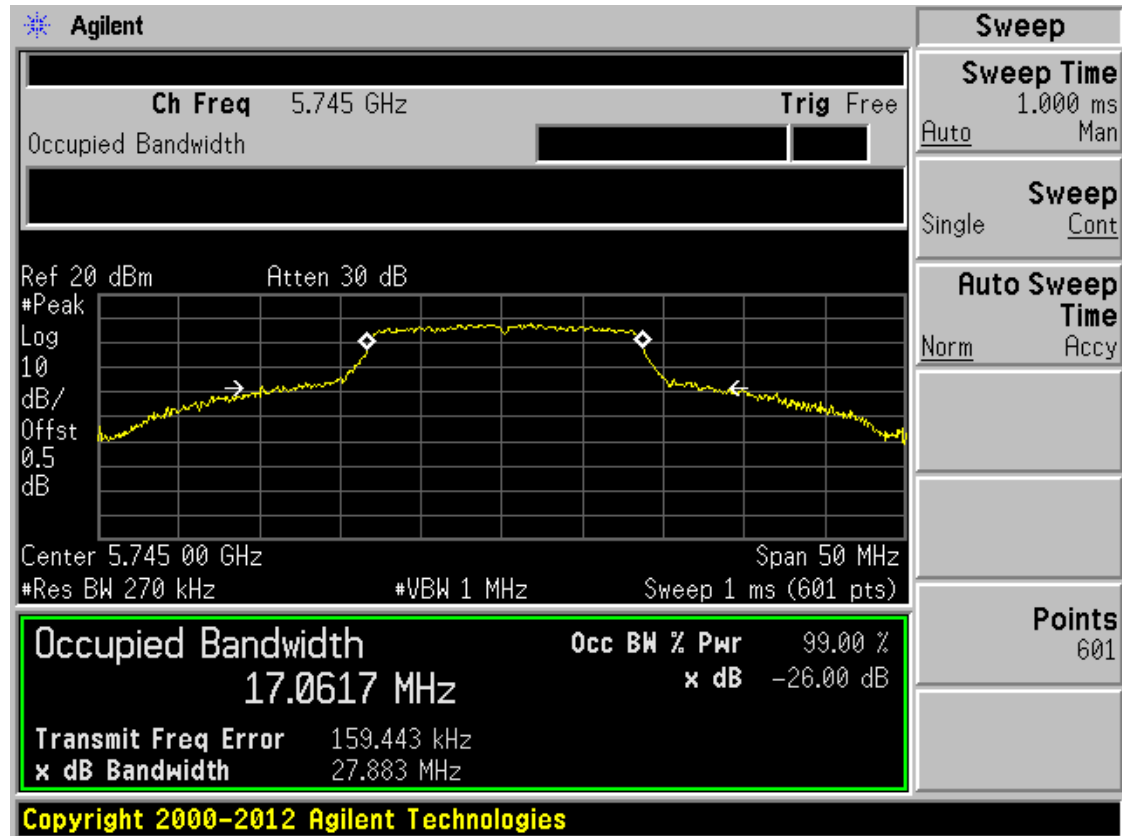
Band III 11ac(HT40) CH134



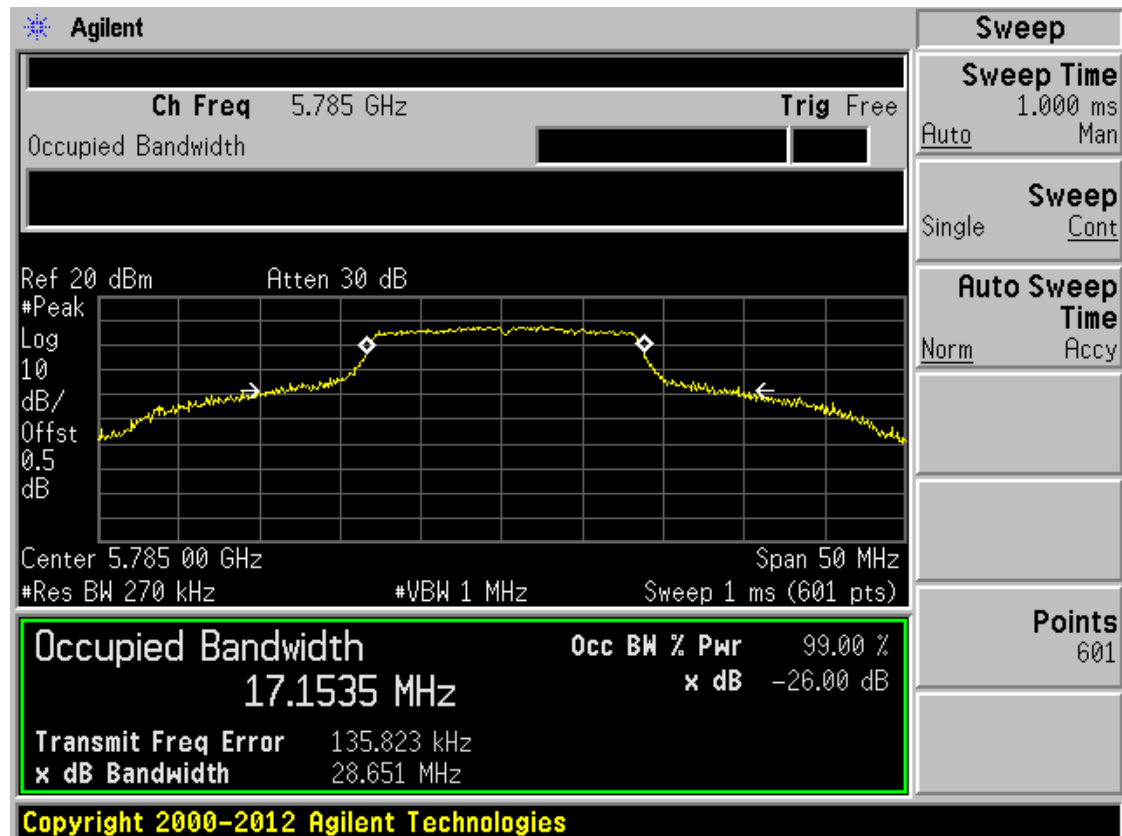
Band III 11ac(HT80) CH106



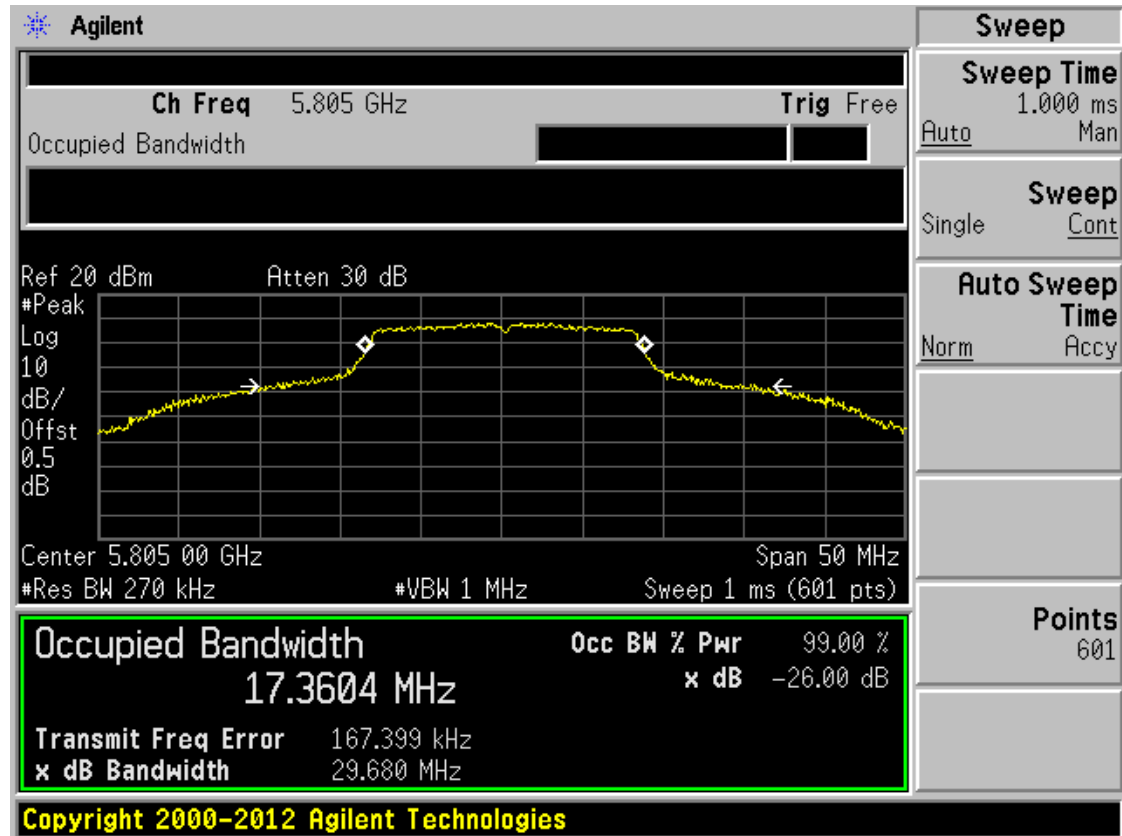
Band IV 11a CH149



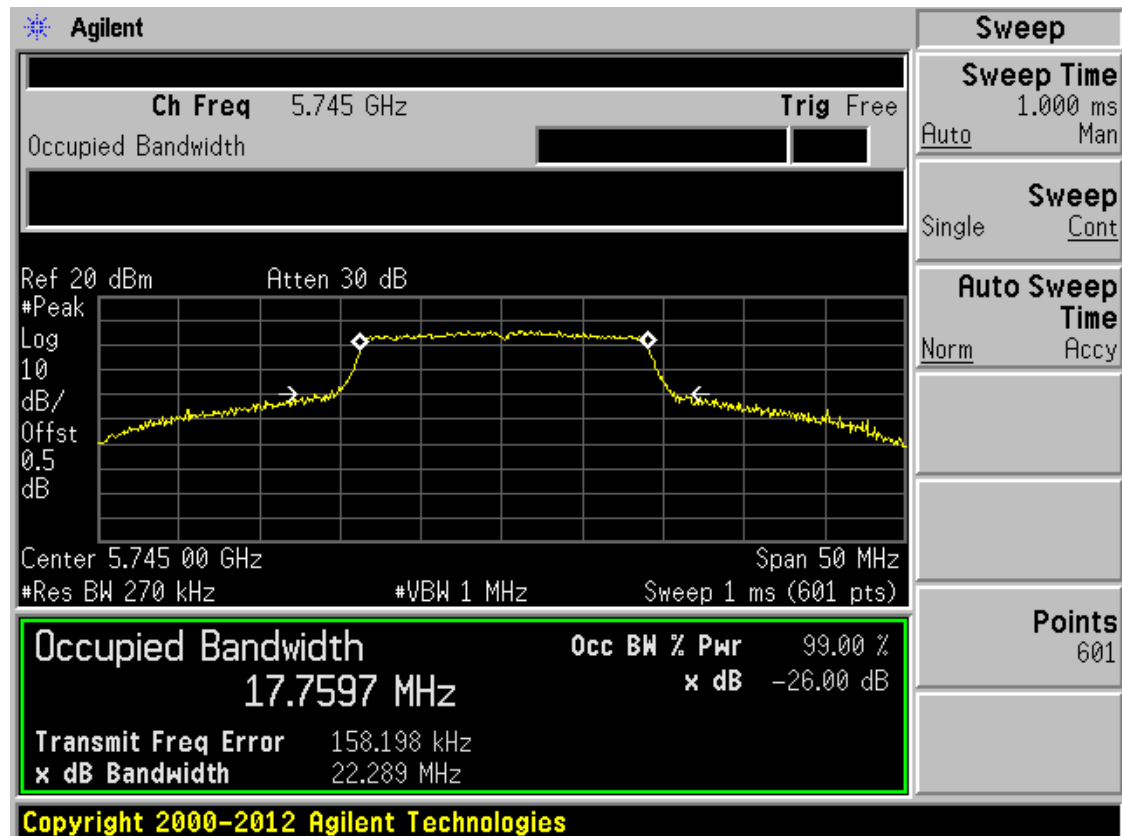
Band IV 11a CH157



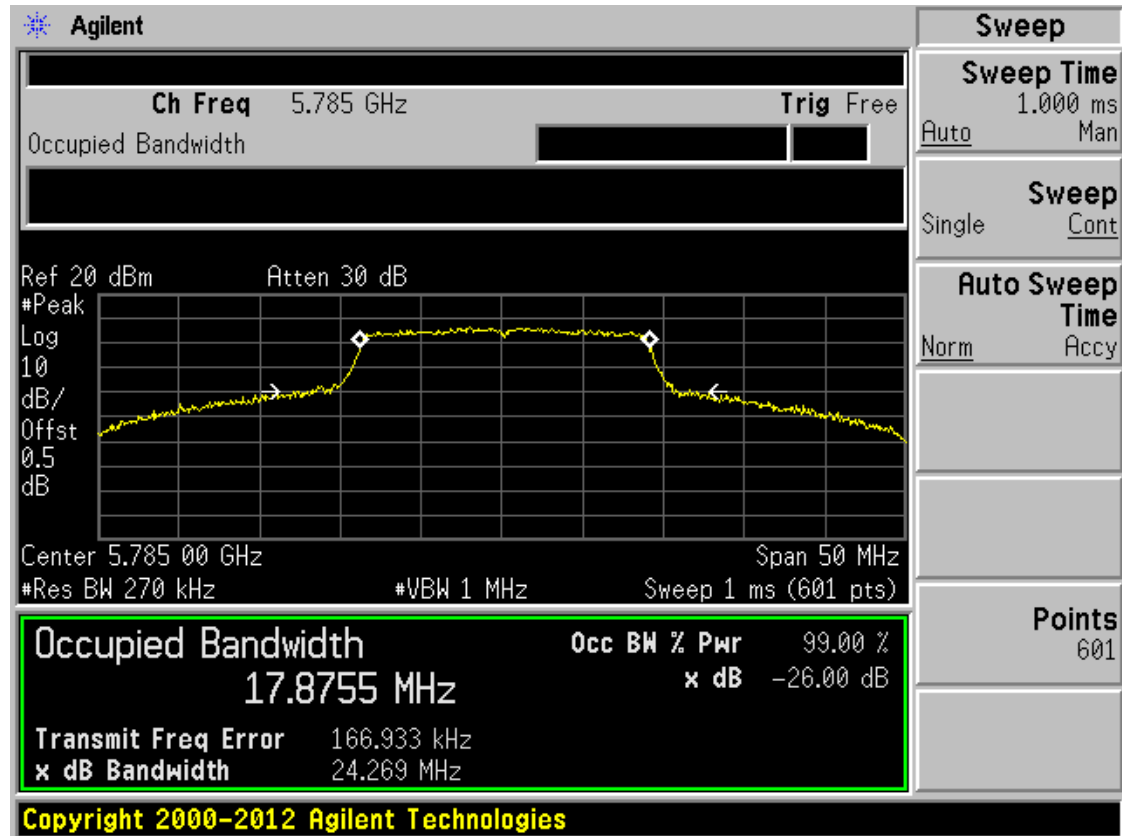
Band IV 11a CH161



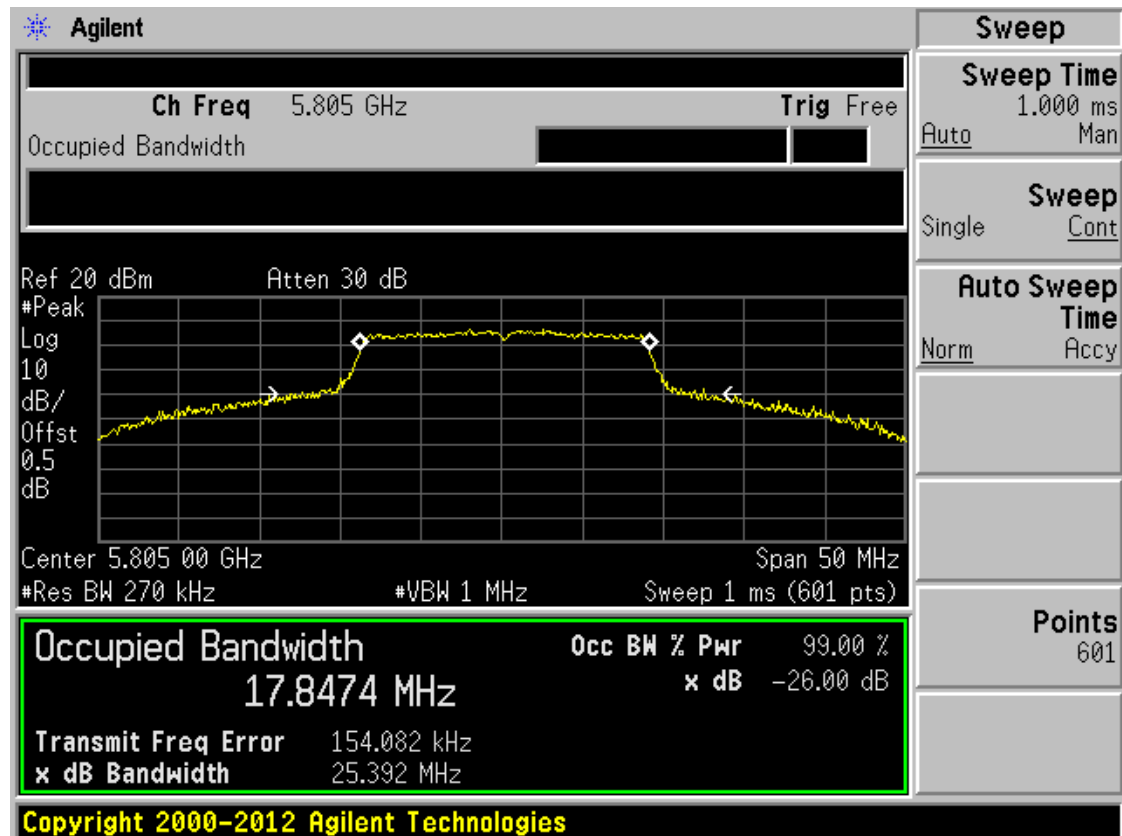
Band IV 11n(HT20) CH149



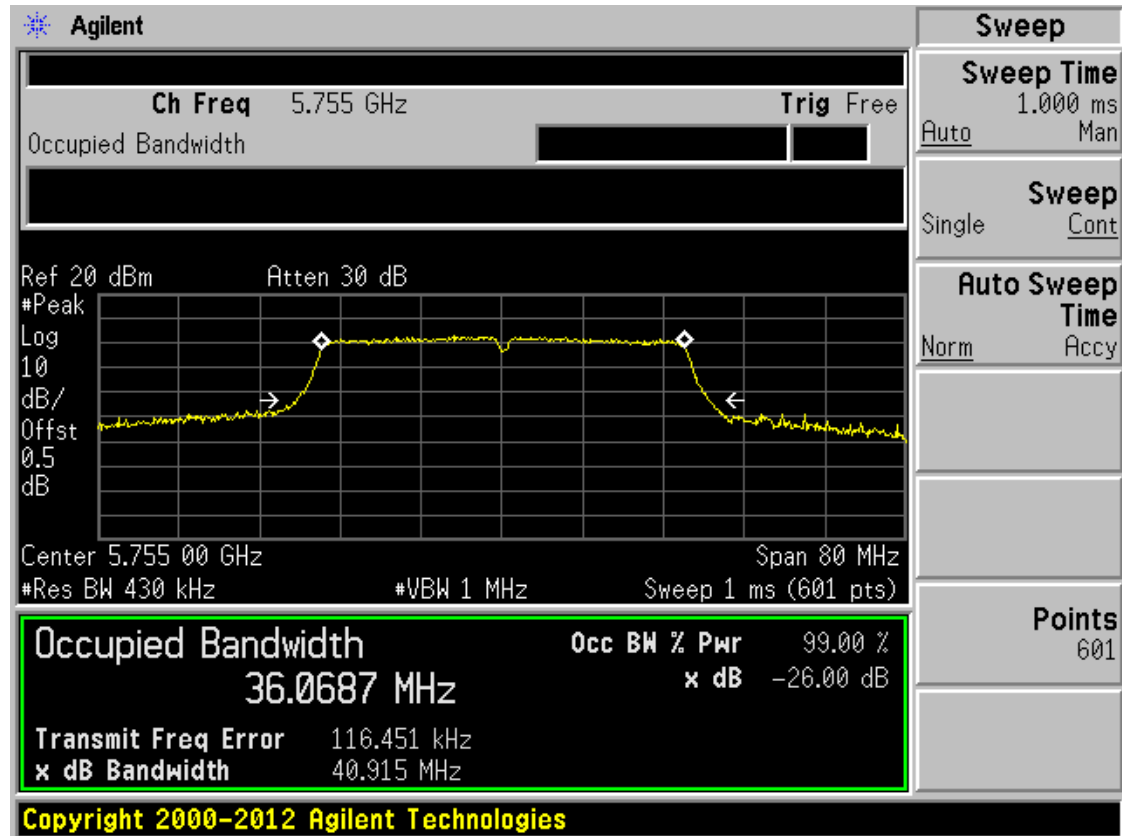
Band IV 11n(HT20) CH157



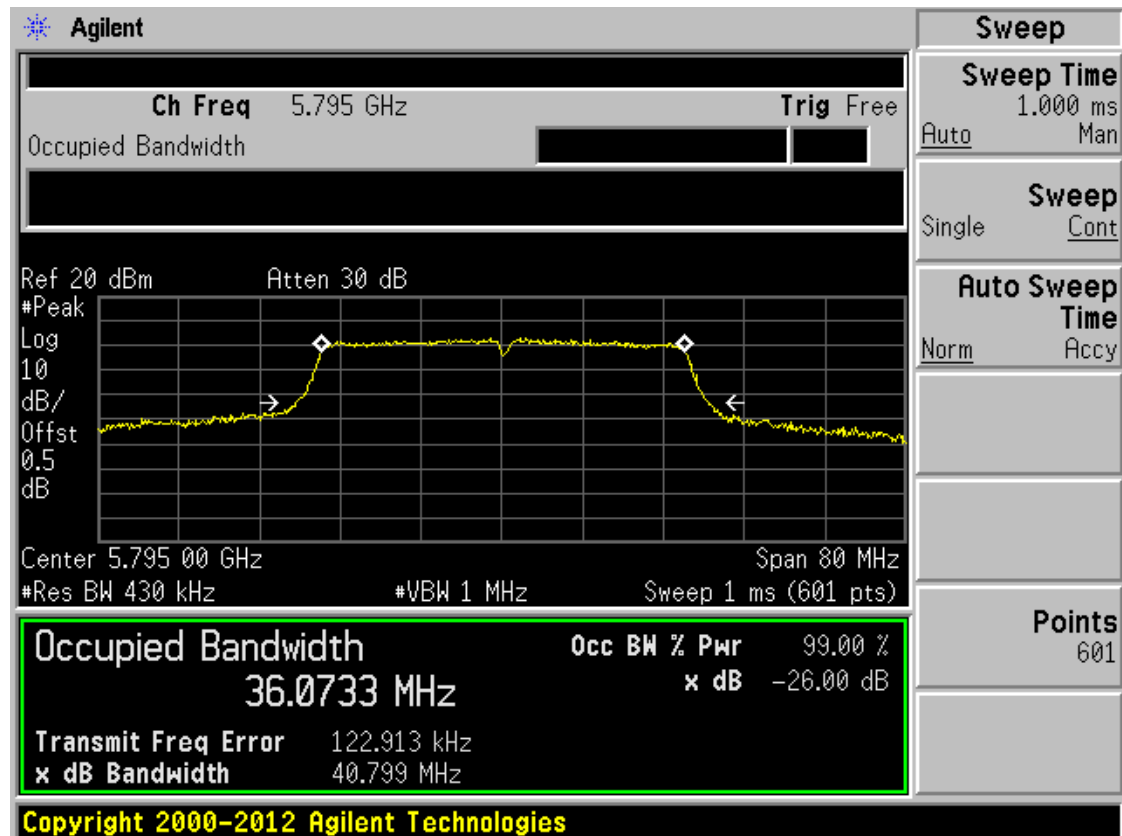
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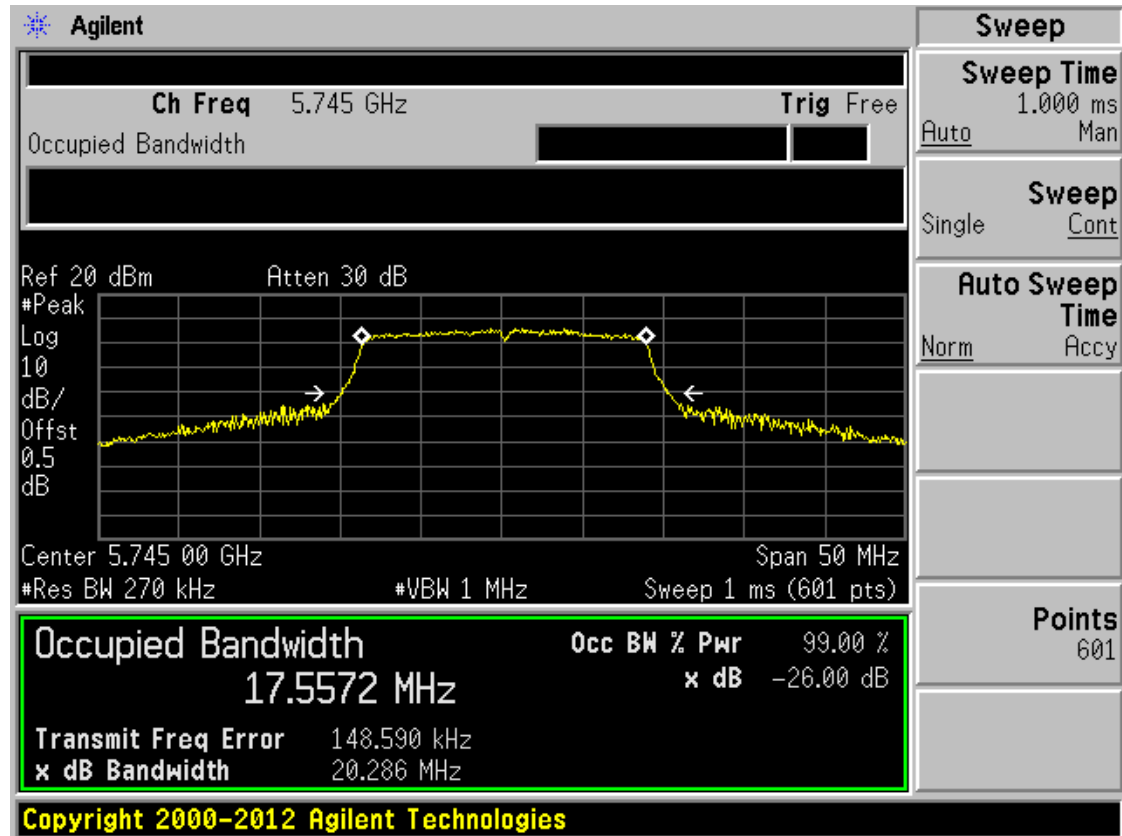
Band IV 11n(HT40) CH151



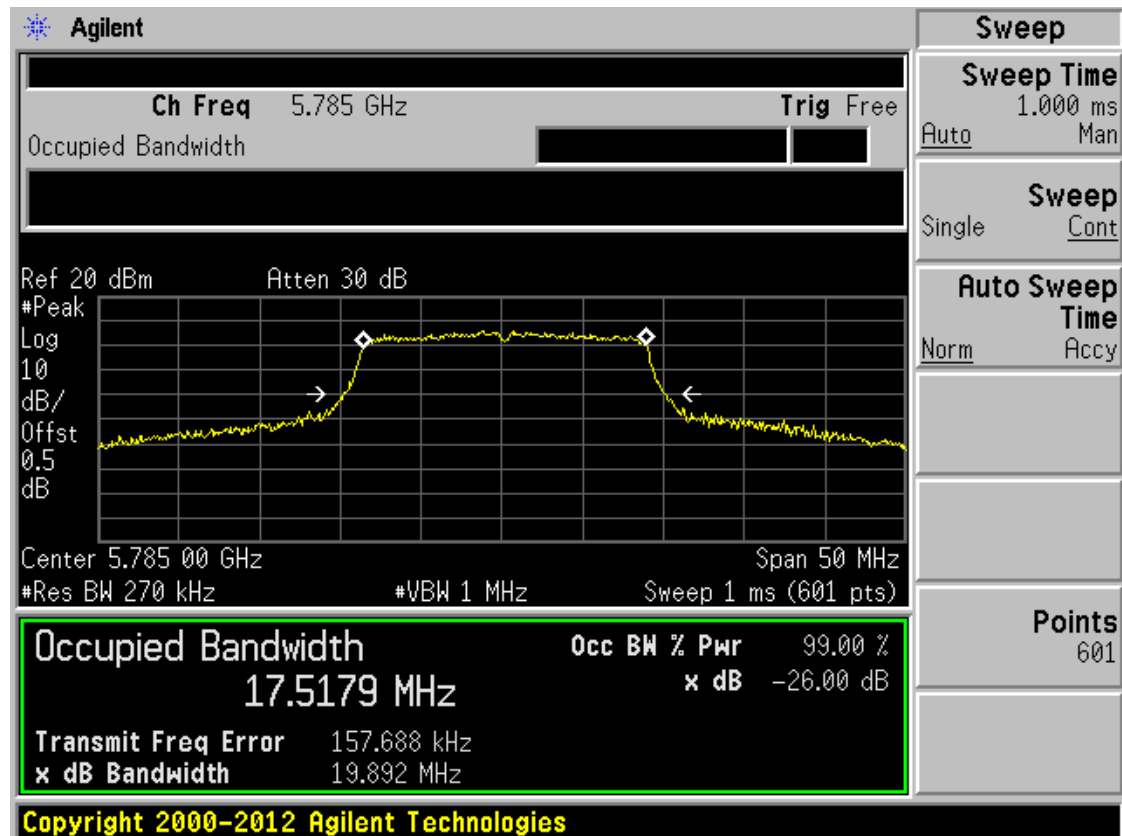
Band IV 11n(HT40) CH159



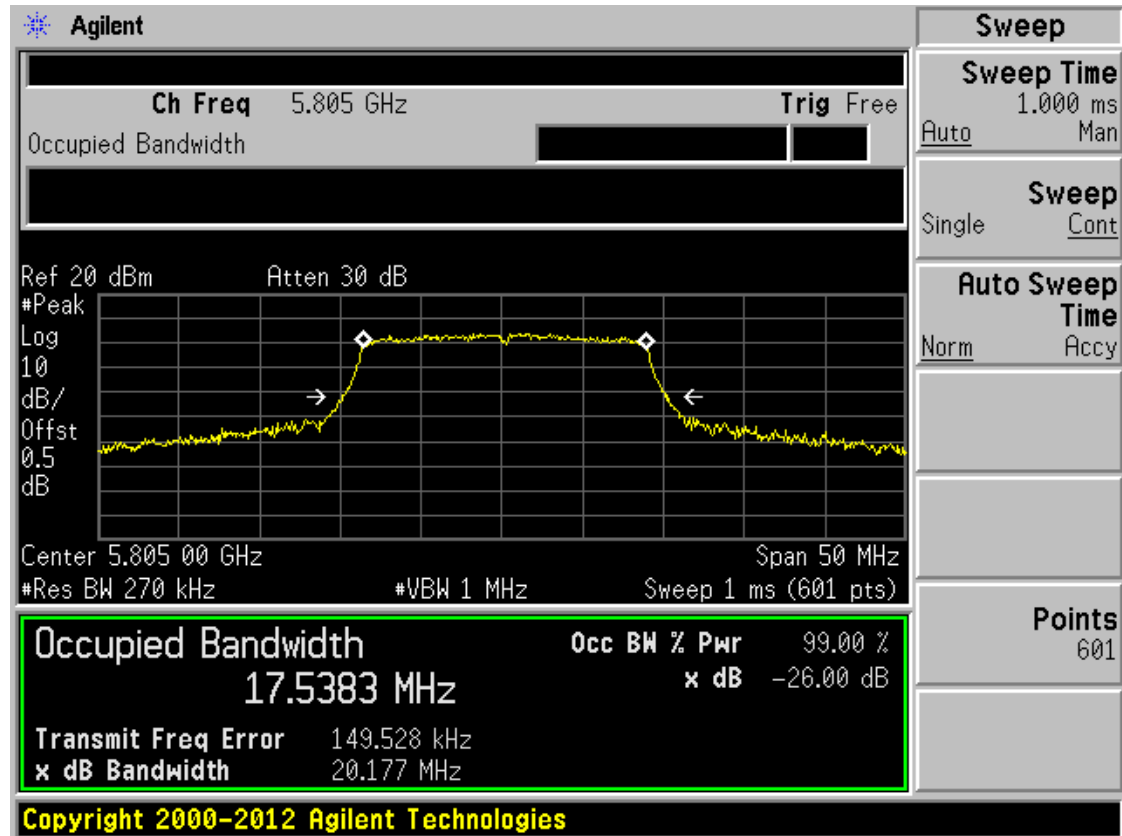
Band IV 11ac(HT20) CH149



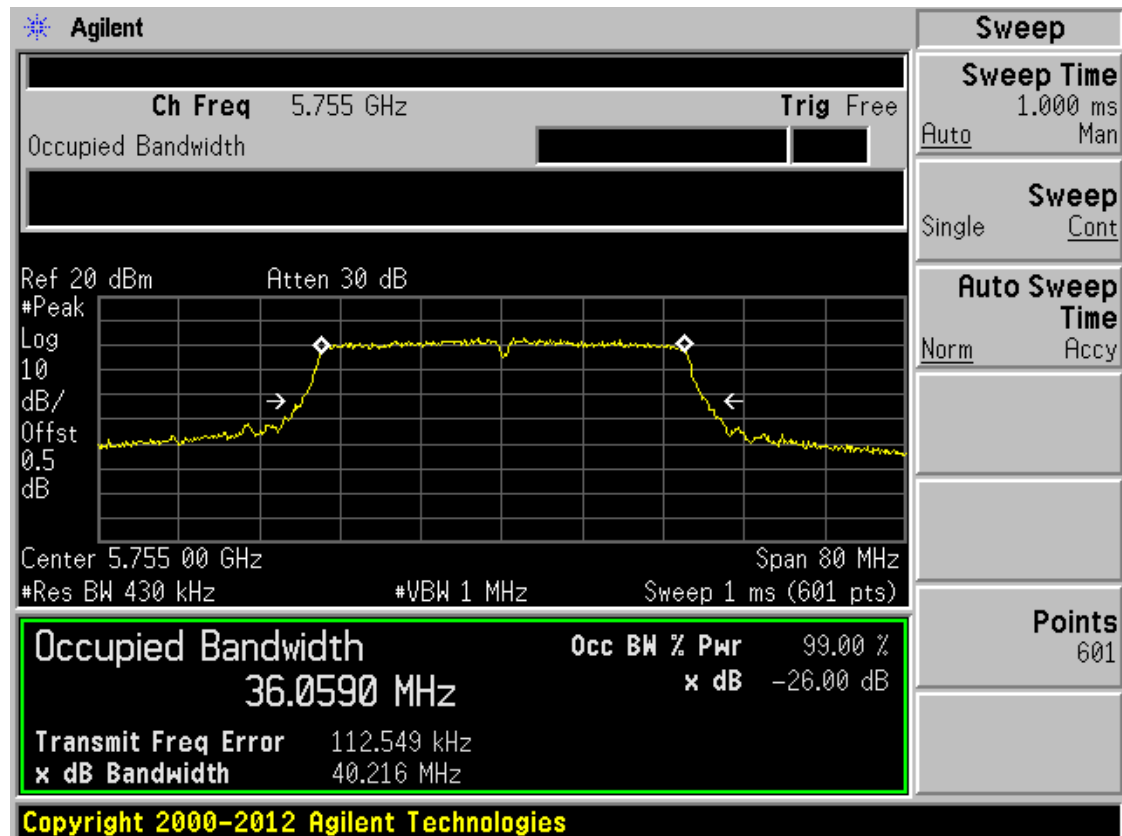
Band IV 11ac(HT20) CH157



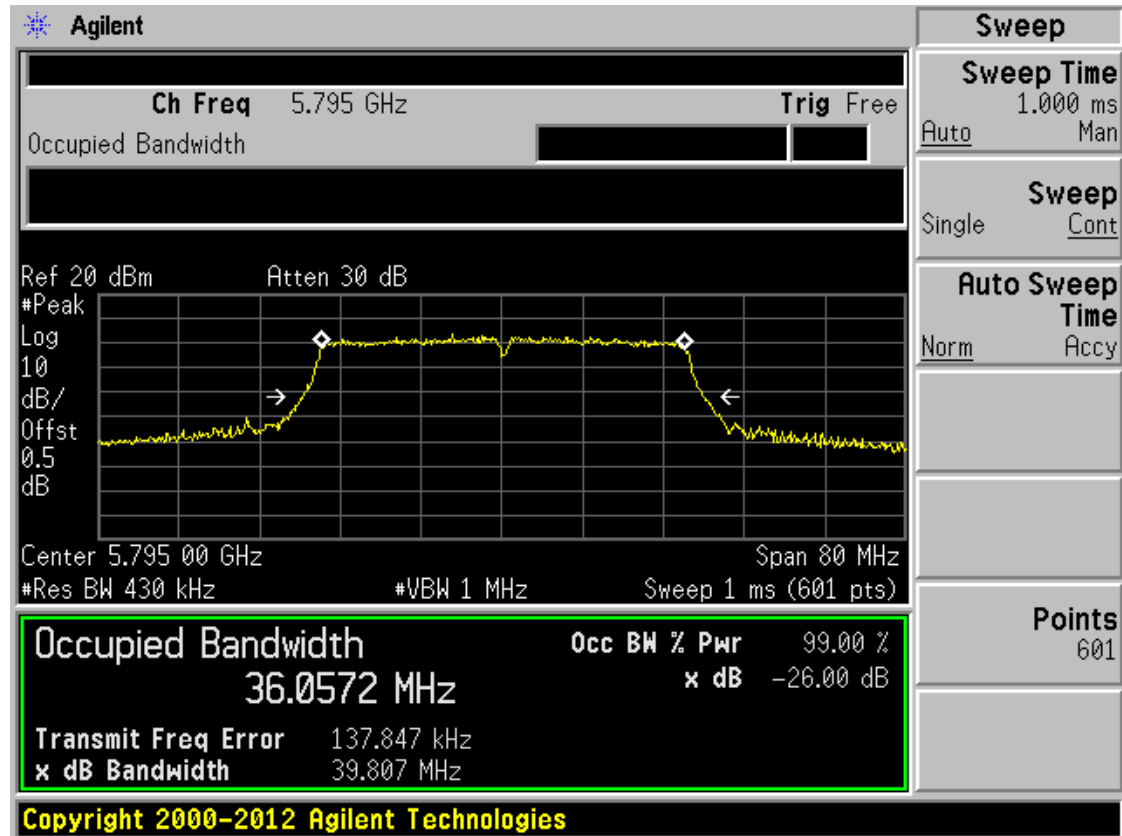
Band IV 11ac(HT20) CH161



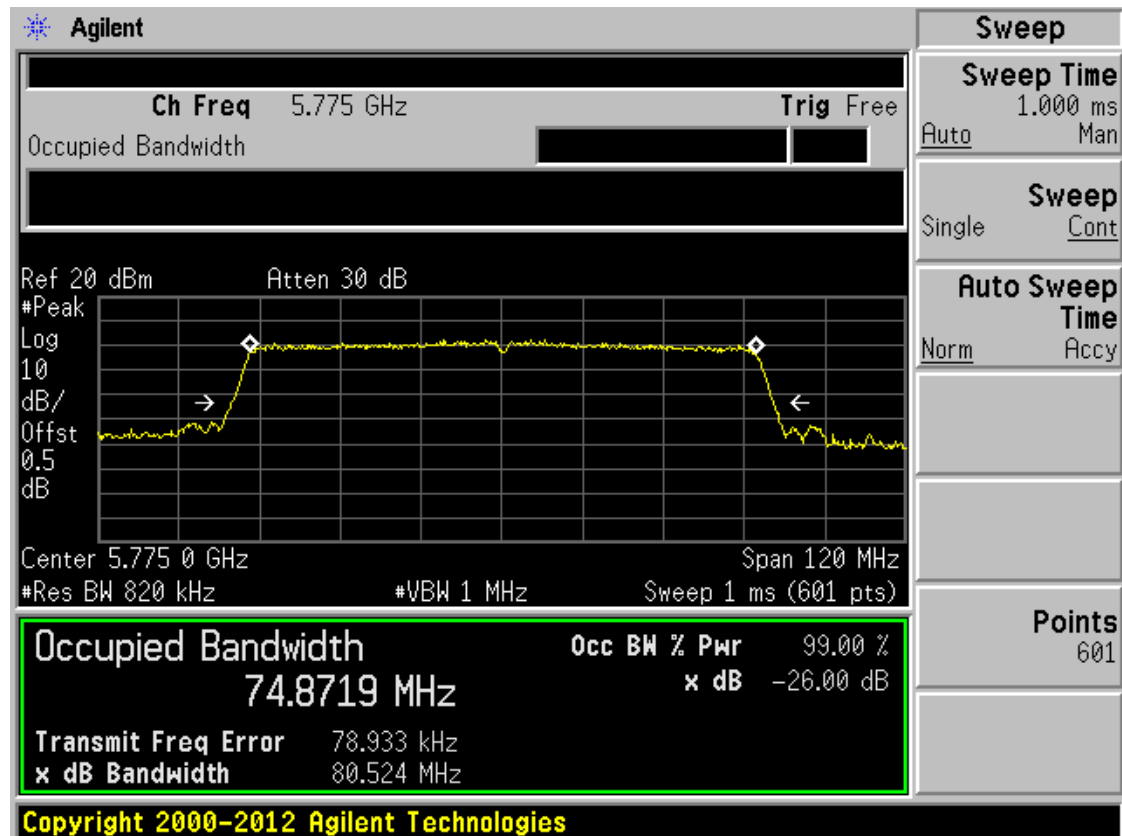
Band IV 11ac(HT40) CH151



Band IV 11ac(HT40) CH159

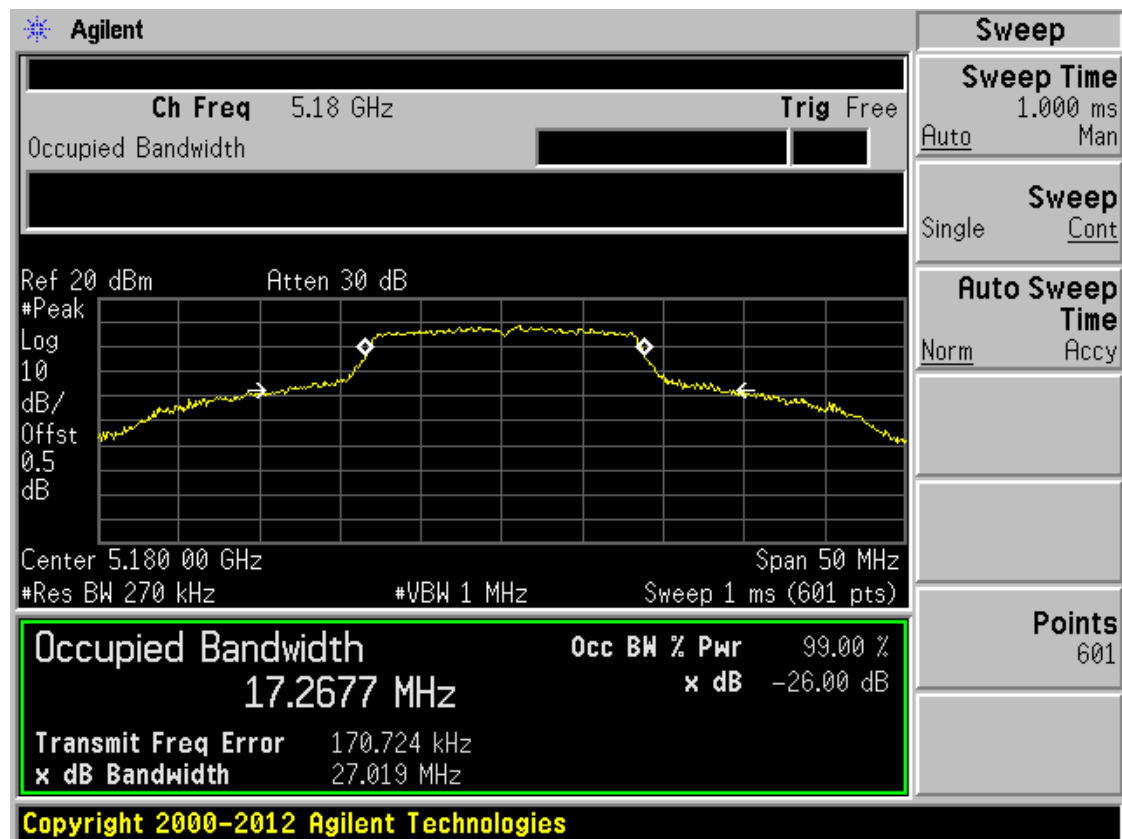


Band IV 11ac(HT80) CH155

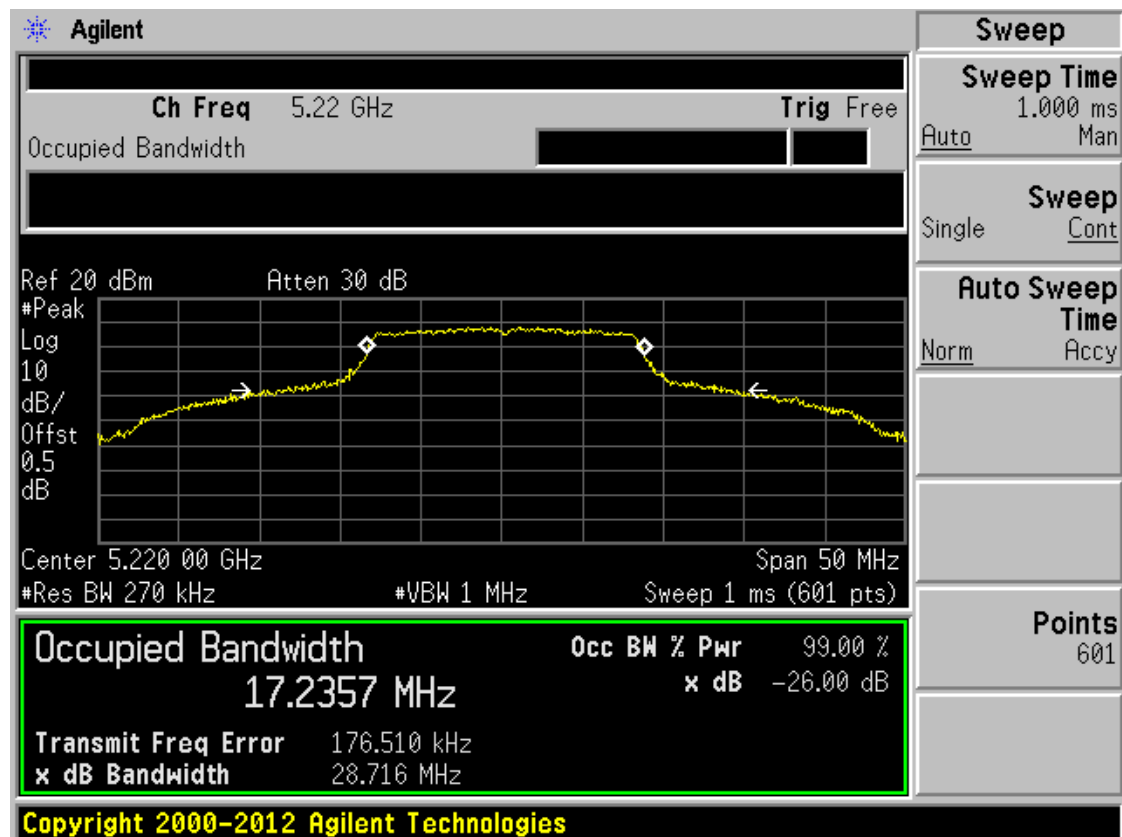


ANT 1

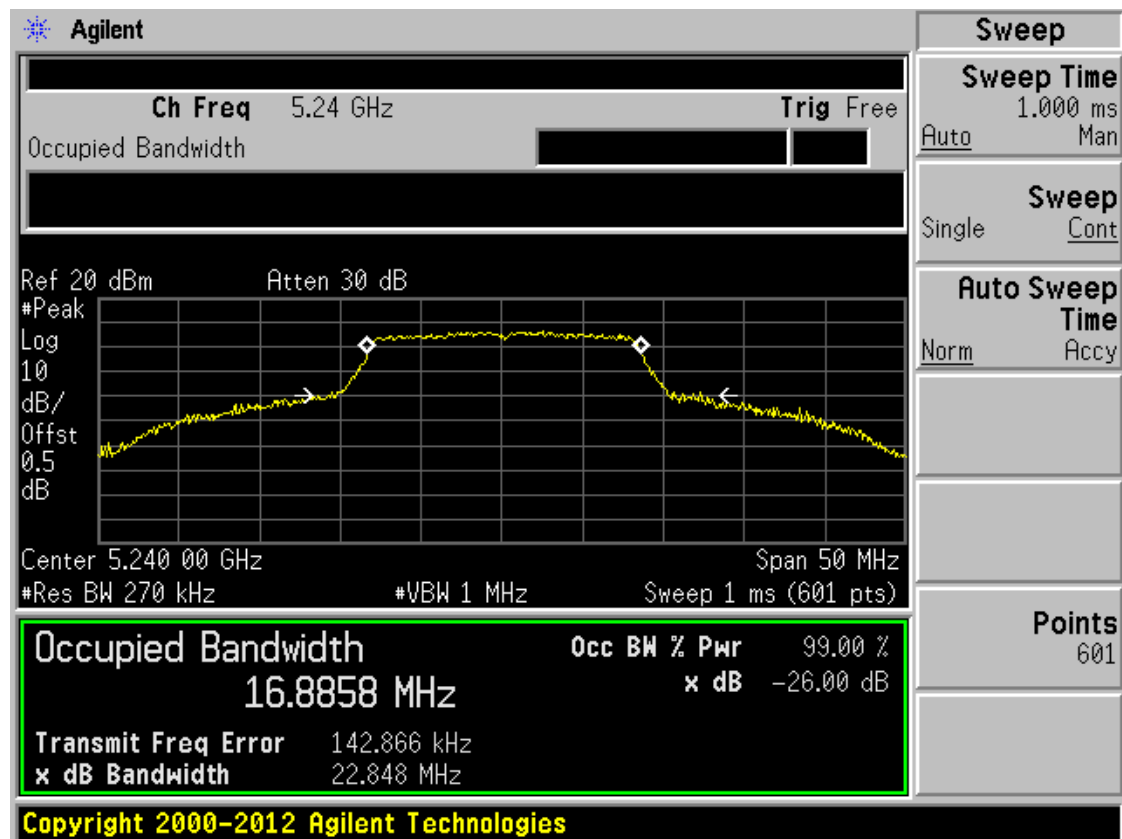
Band I 11a CH36



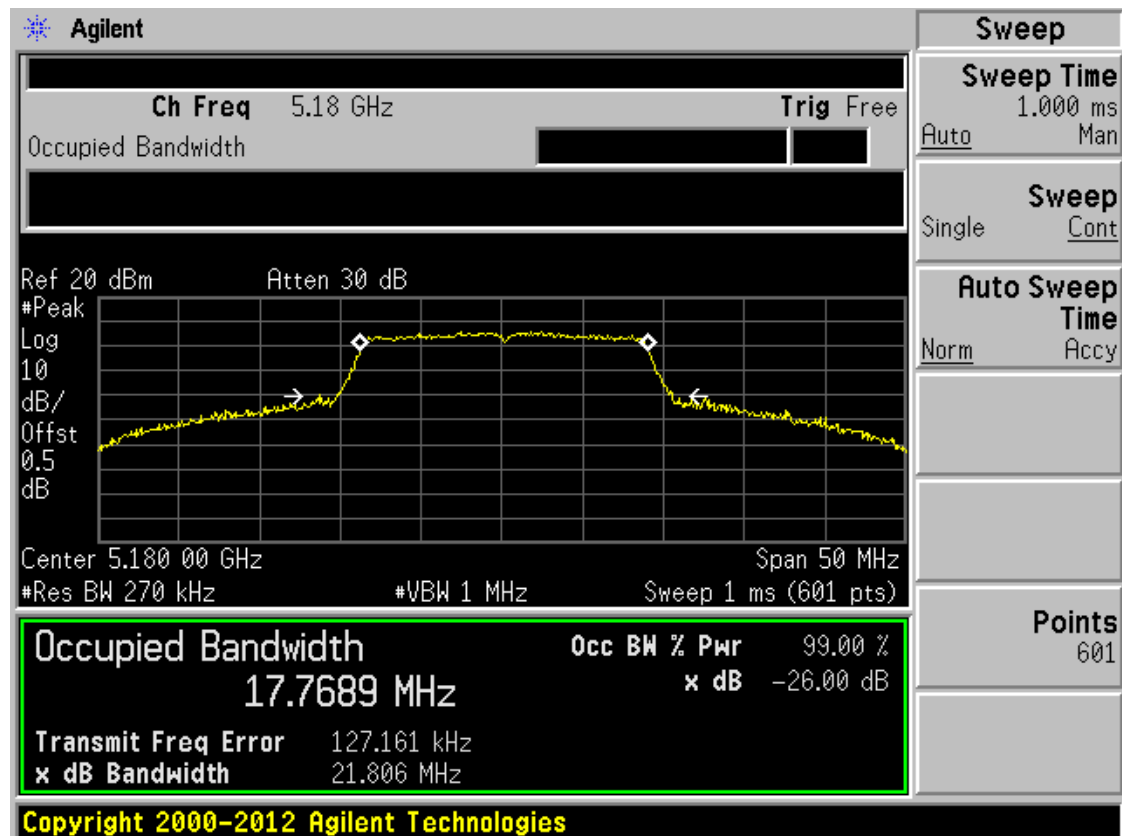
Band I 11a CH44



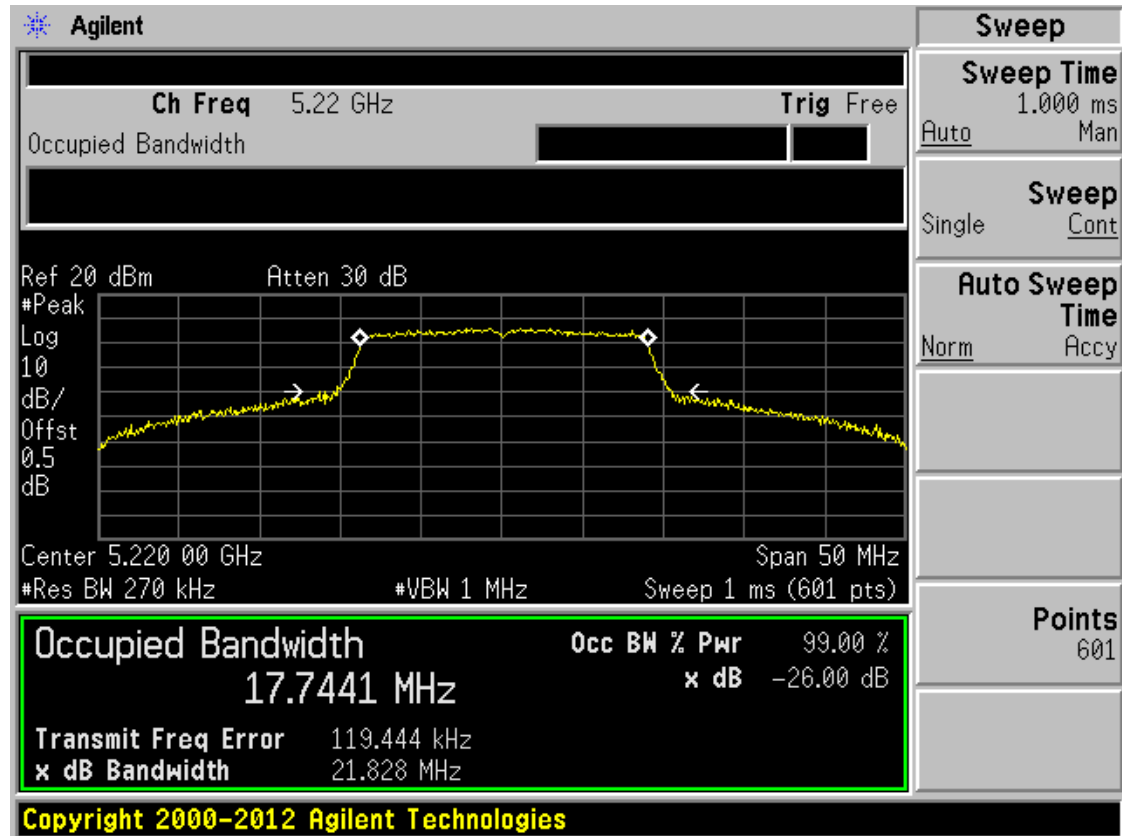
Band I 11a CH48



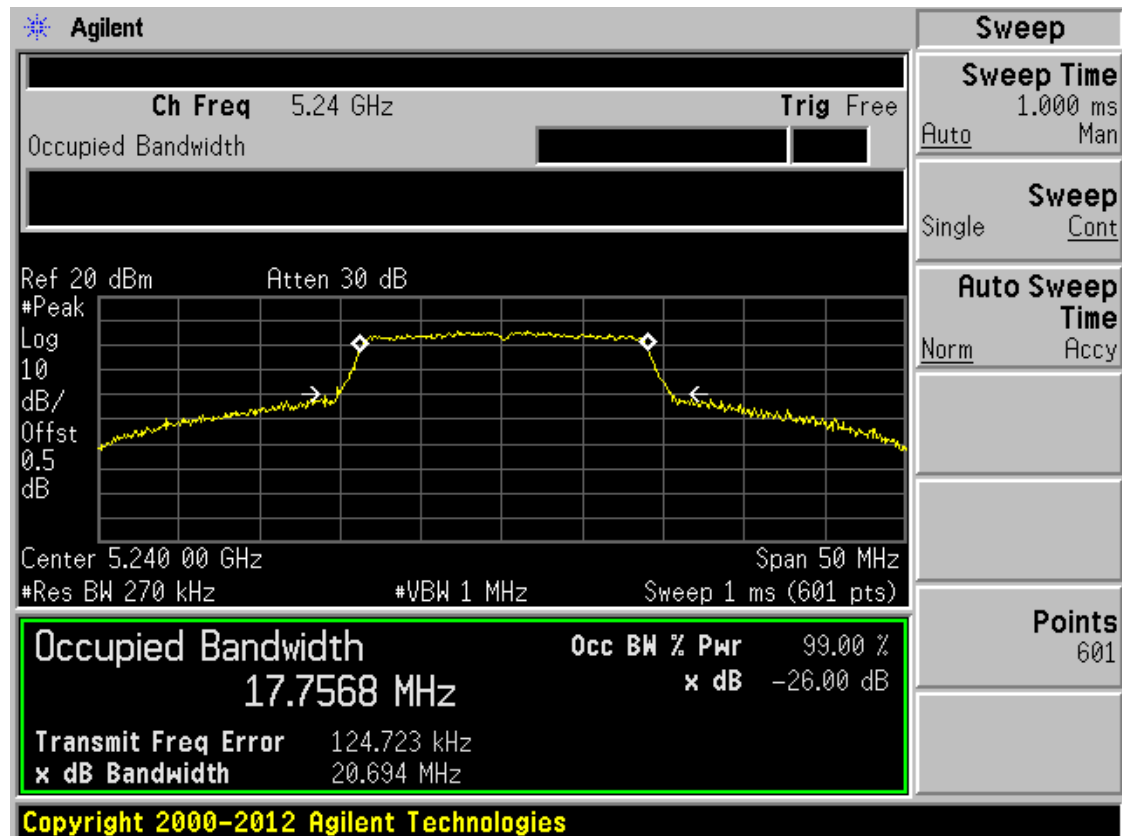
Band I 11n(HT20) CH36



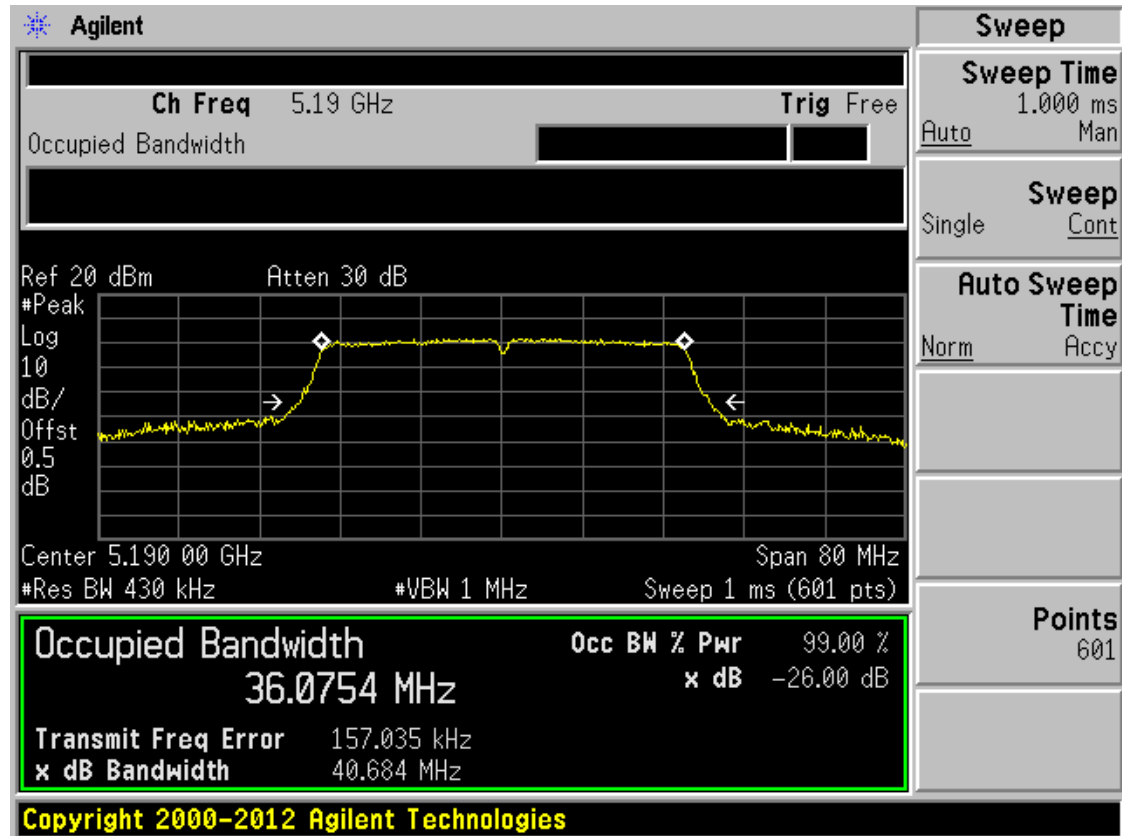
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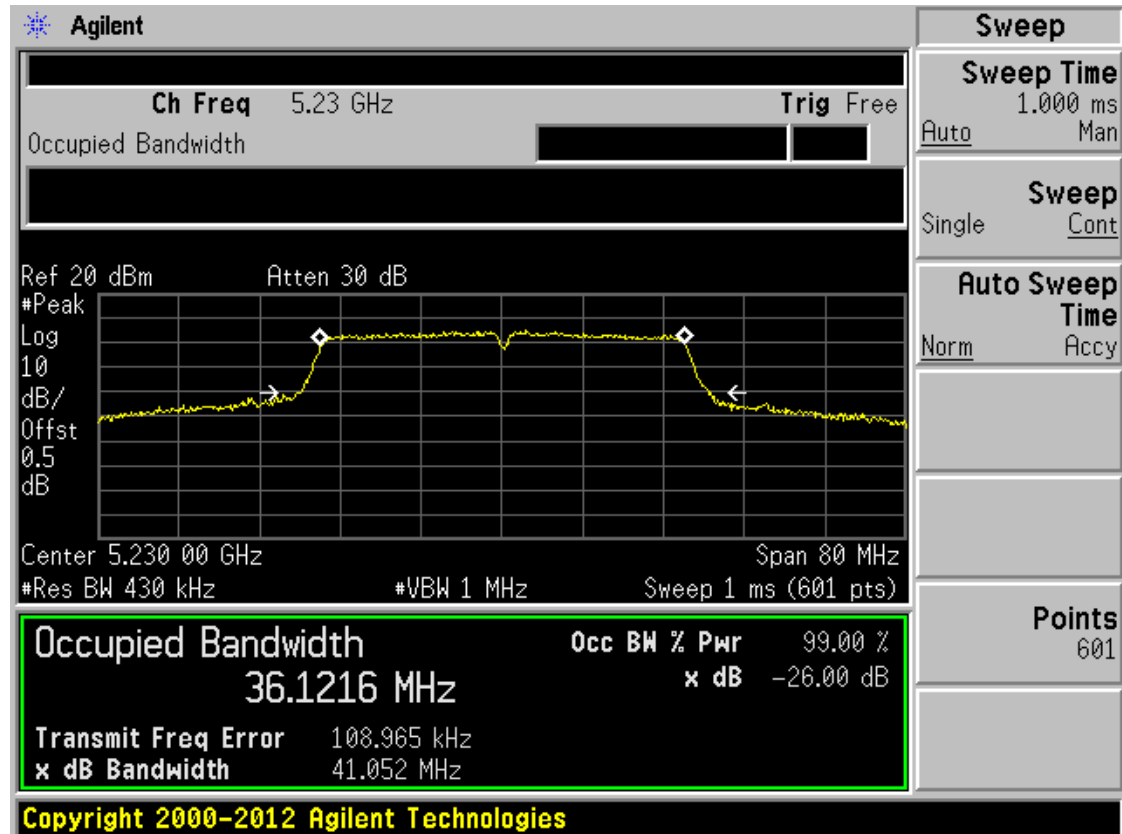
Band I 11n(HT20) CH48



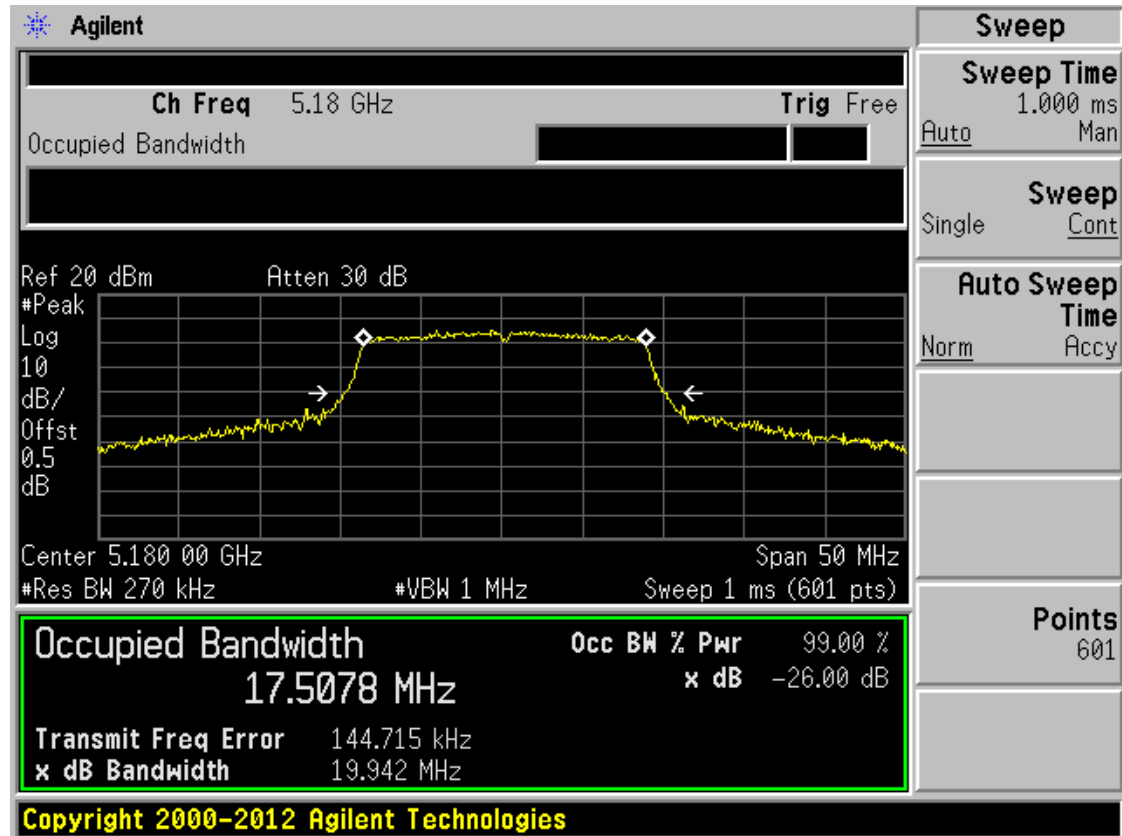
Band I 11n(HT40) CH38



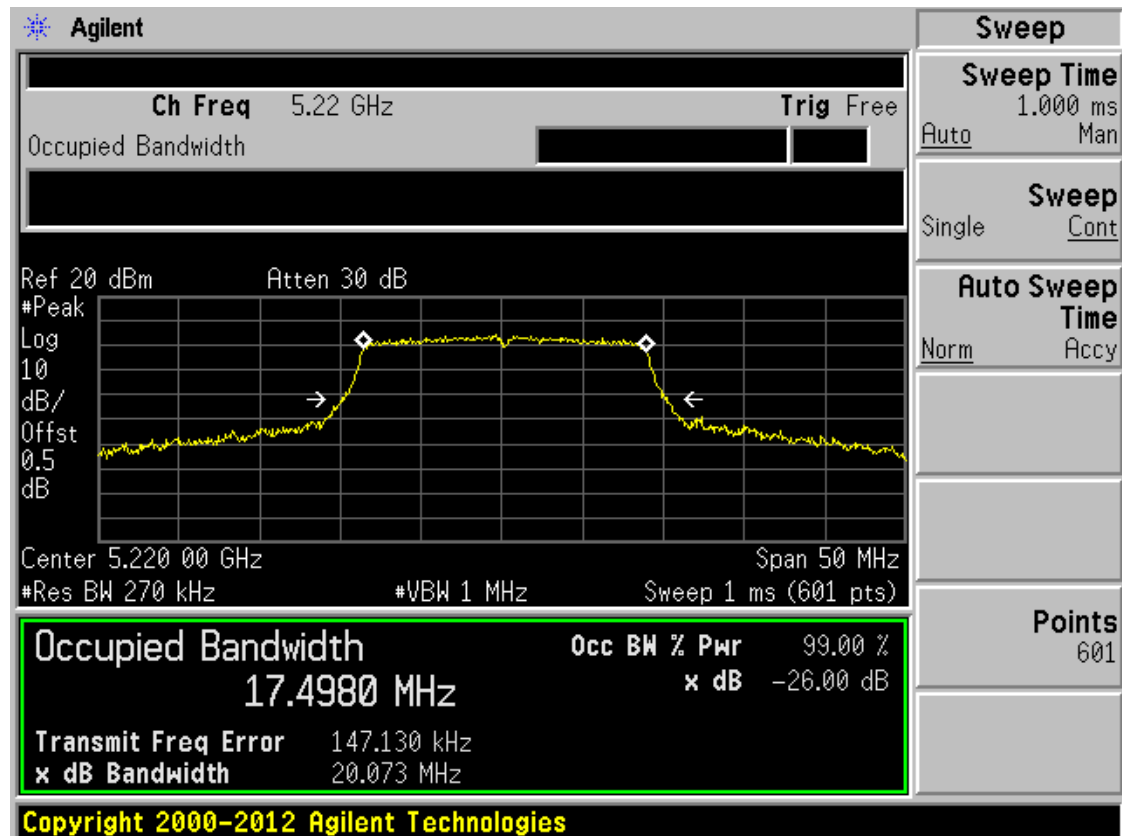
Band I 11n(HT40) CH46



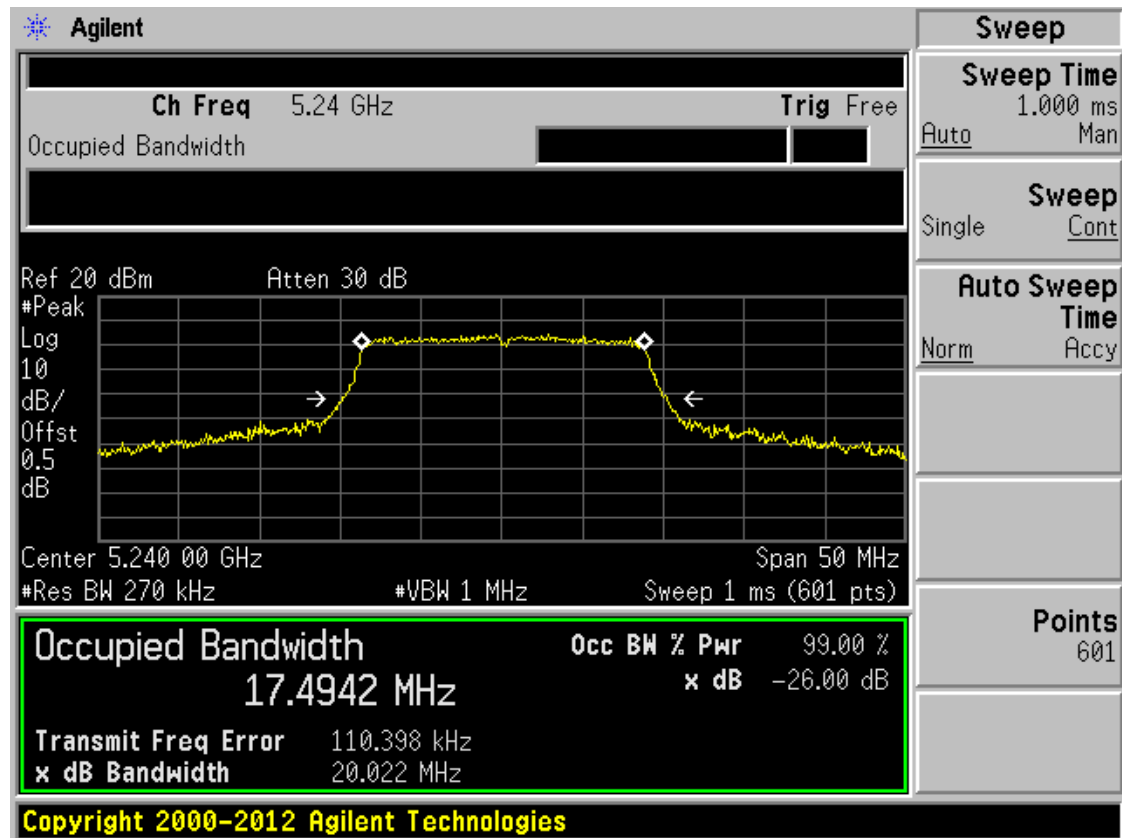
Band I 11ac(HT20) CH36



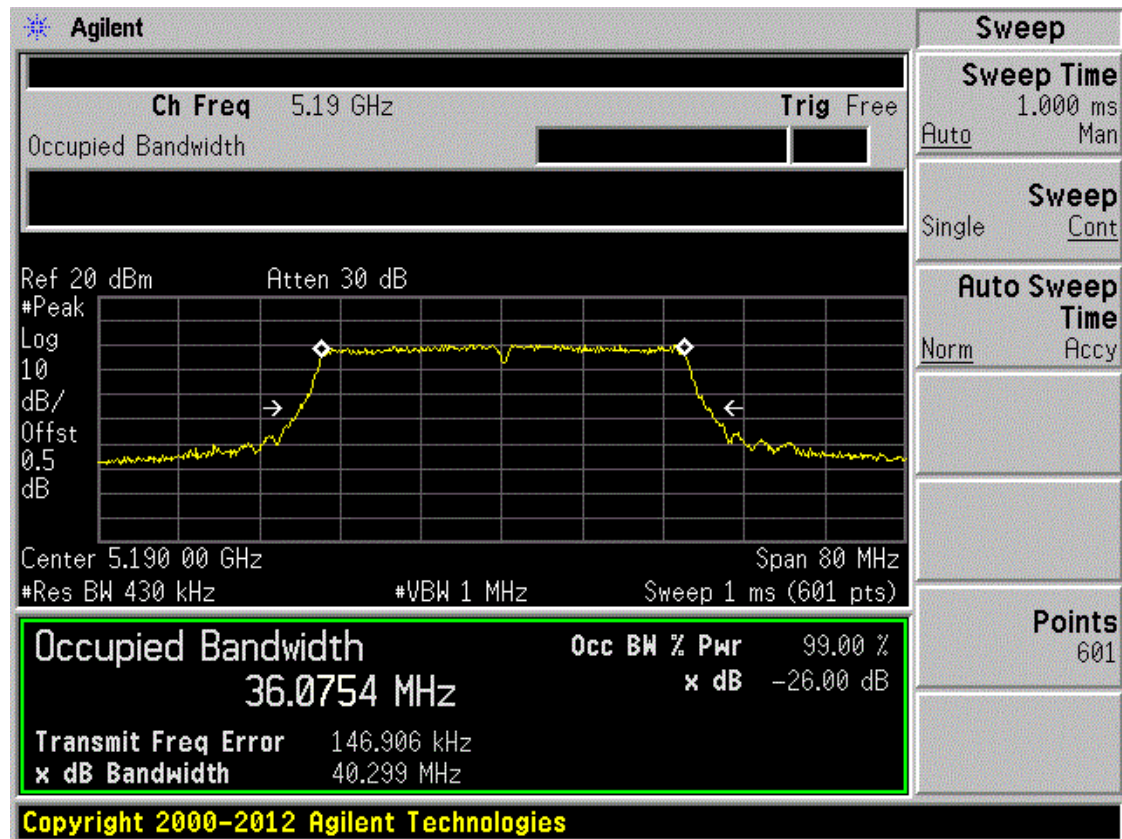
Band I 11ac(HT20) CH44



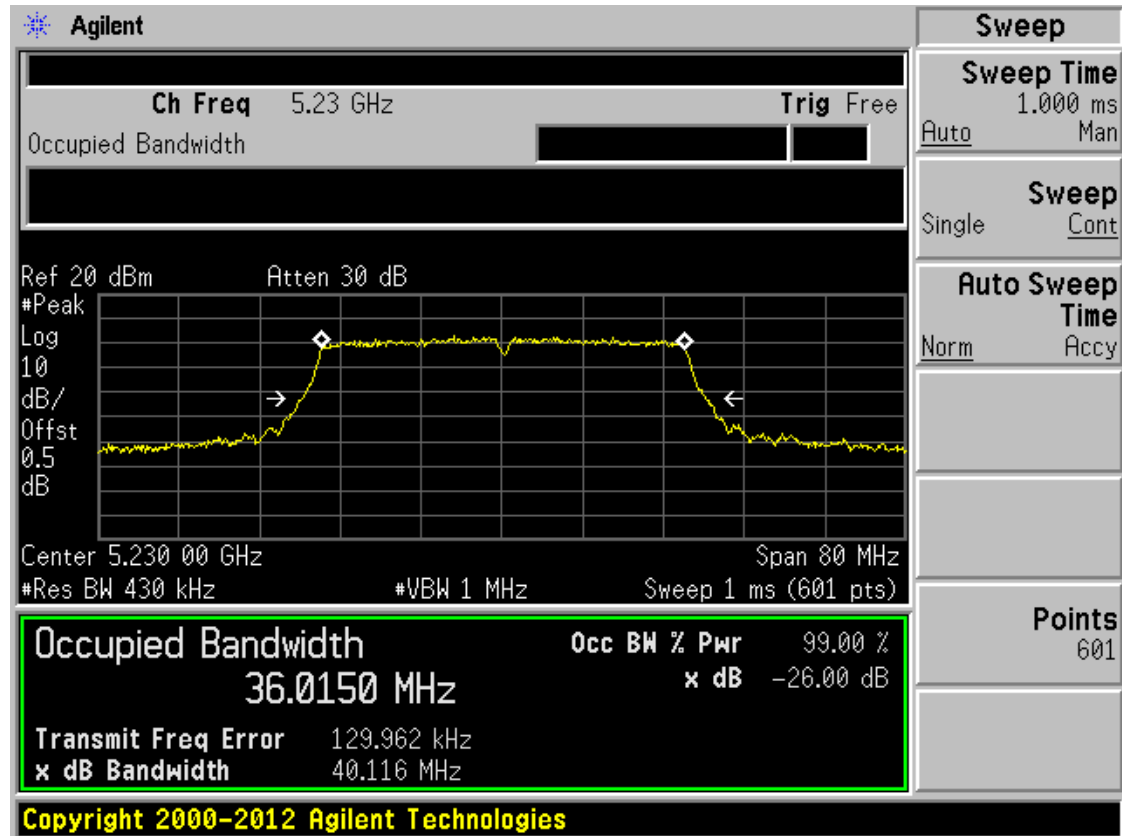
Band I 11ac(HT20) CH48



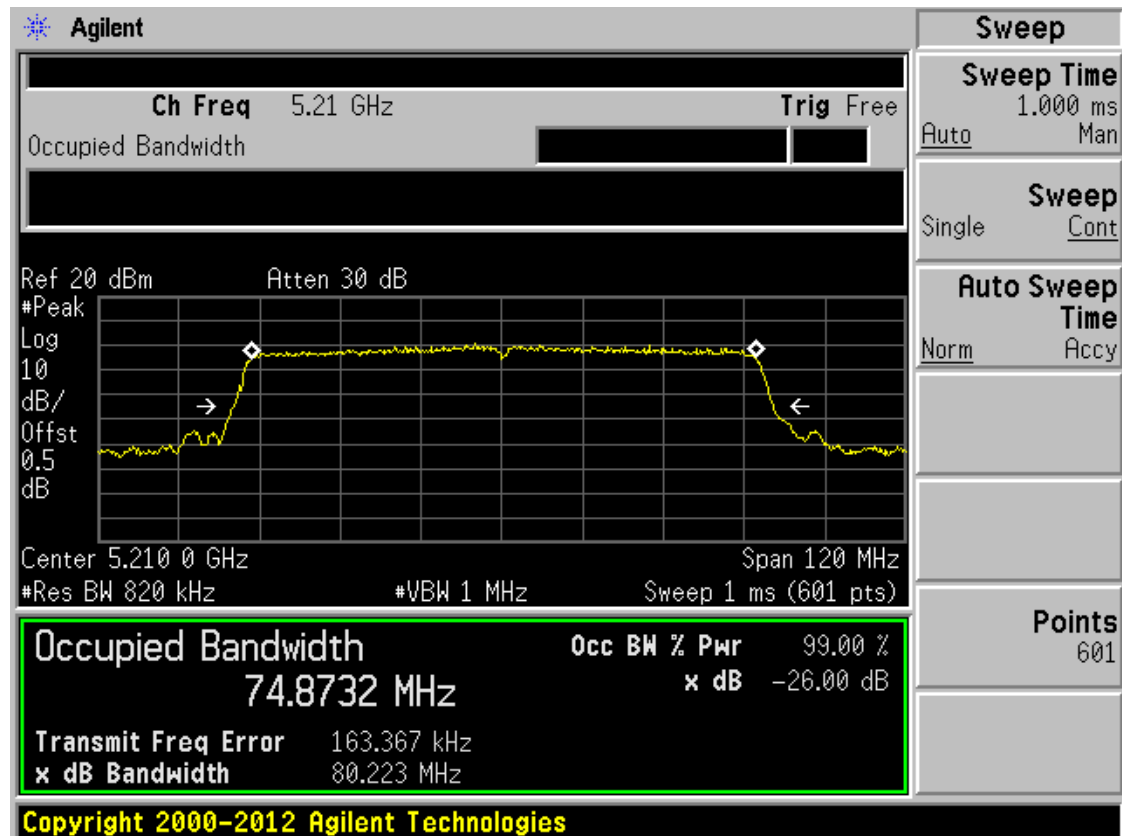
Band I 11ac(HT40) CH38



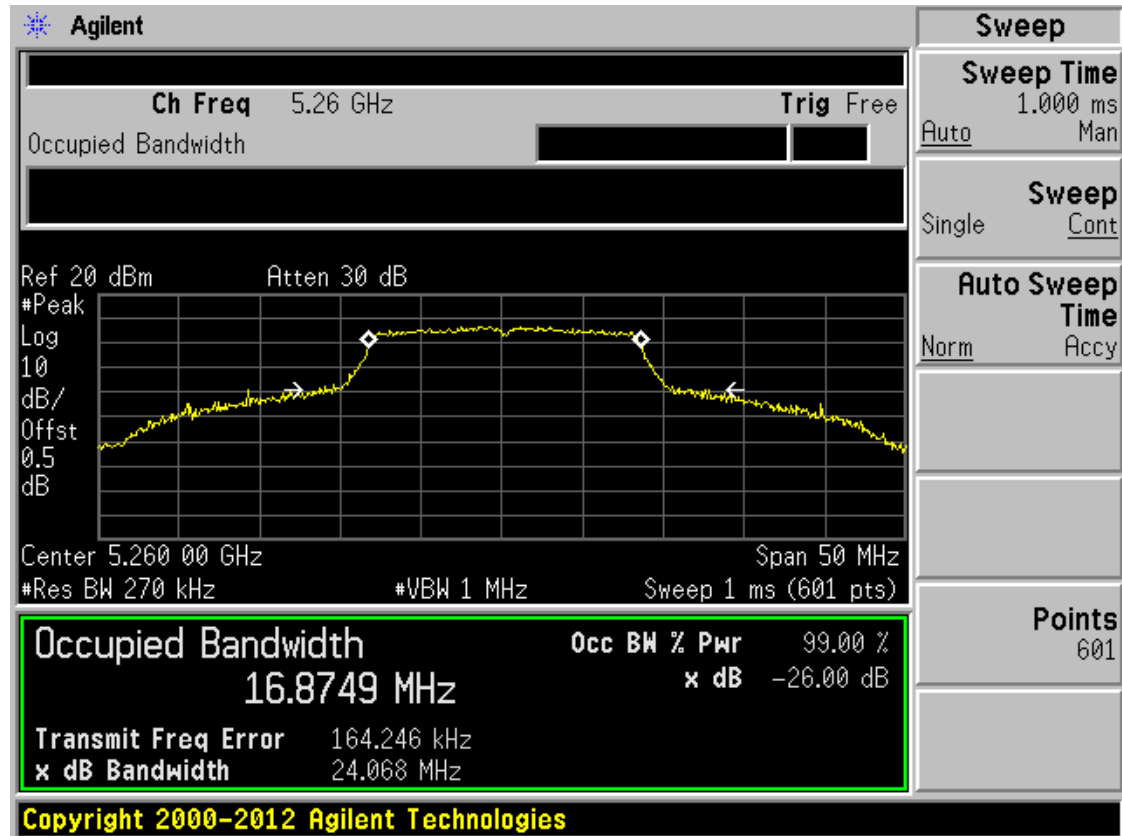
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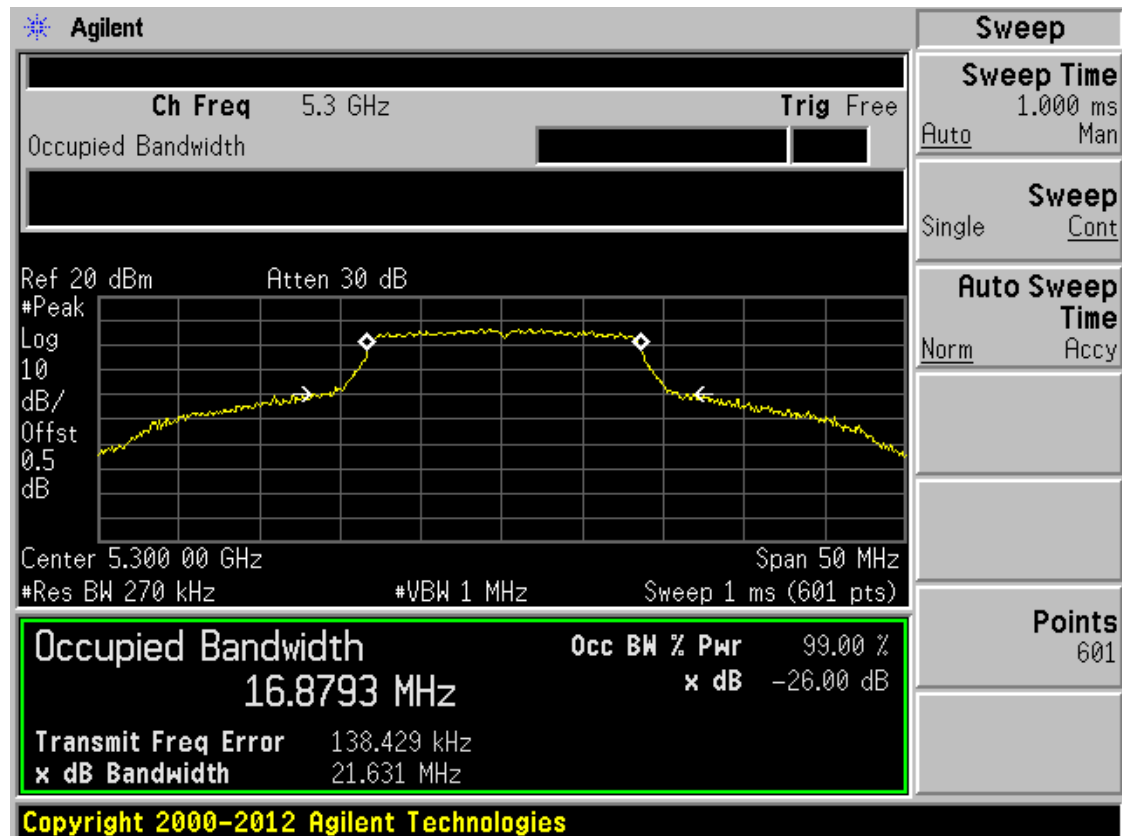
Band I 11ac(HT80) CH42



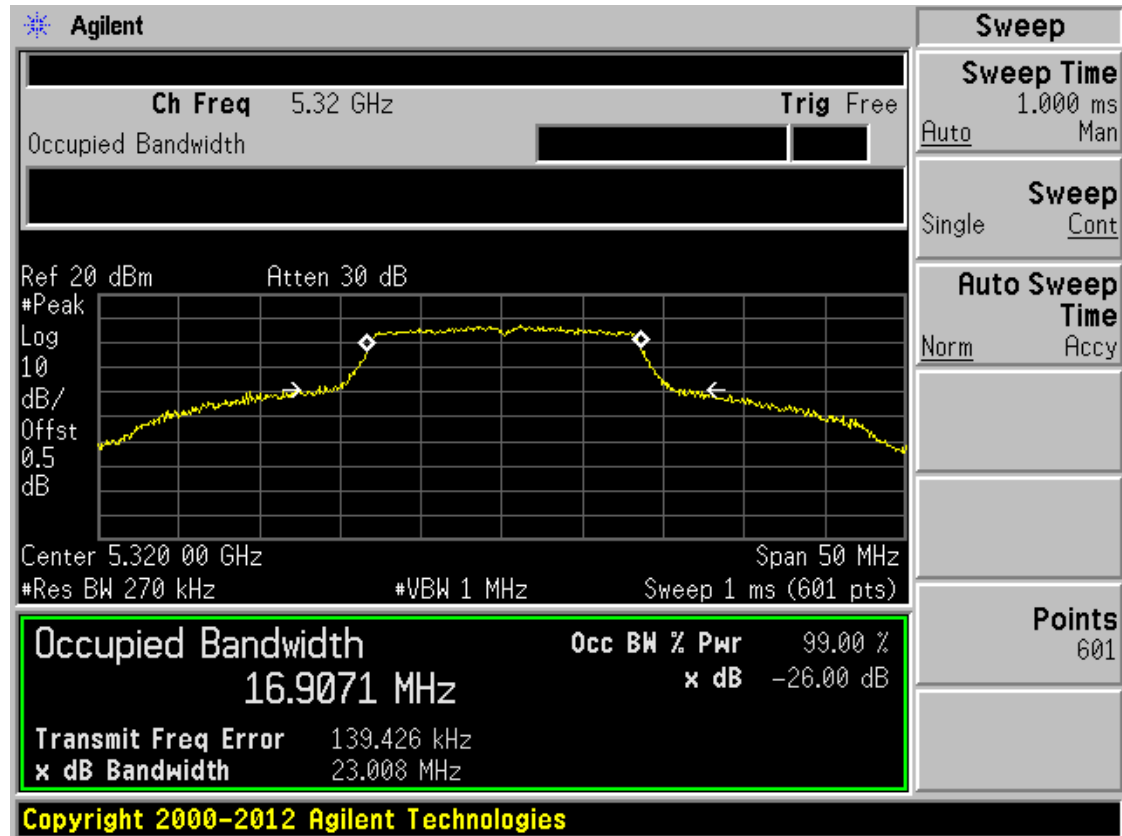
Band II 11a CH52



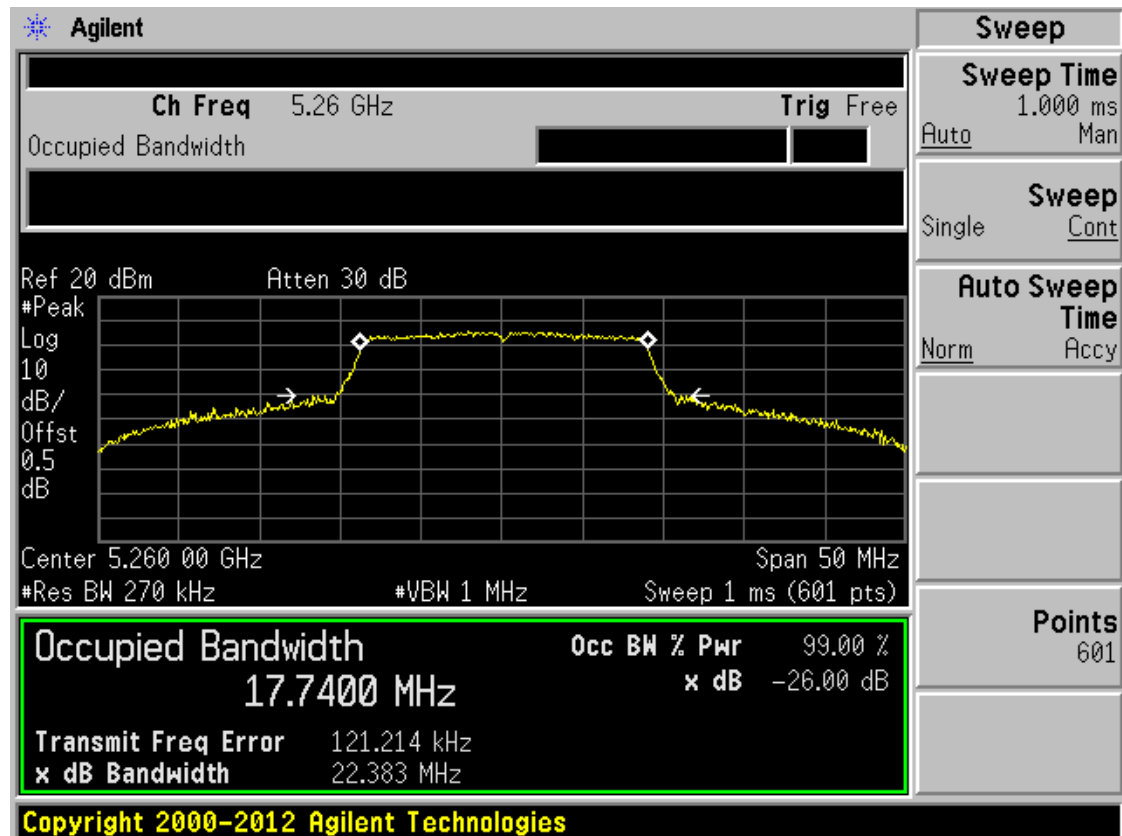
Band II 11a CH60



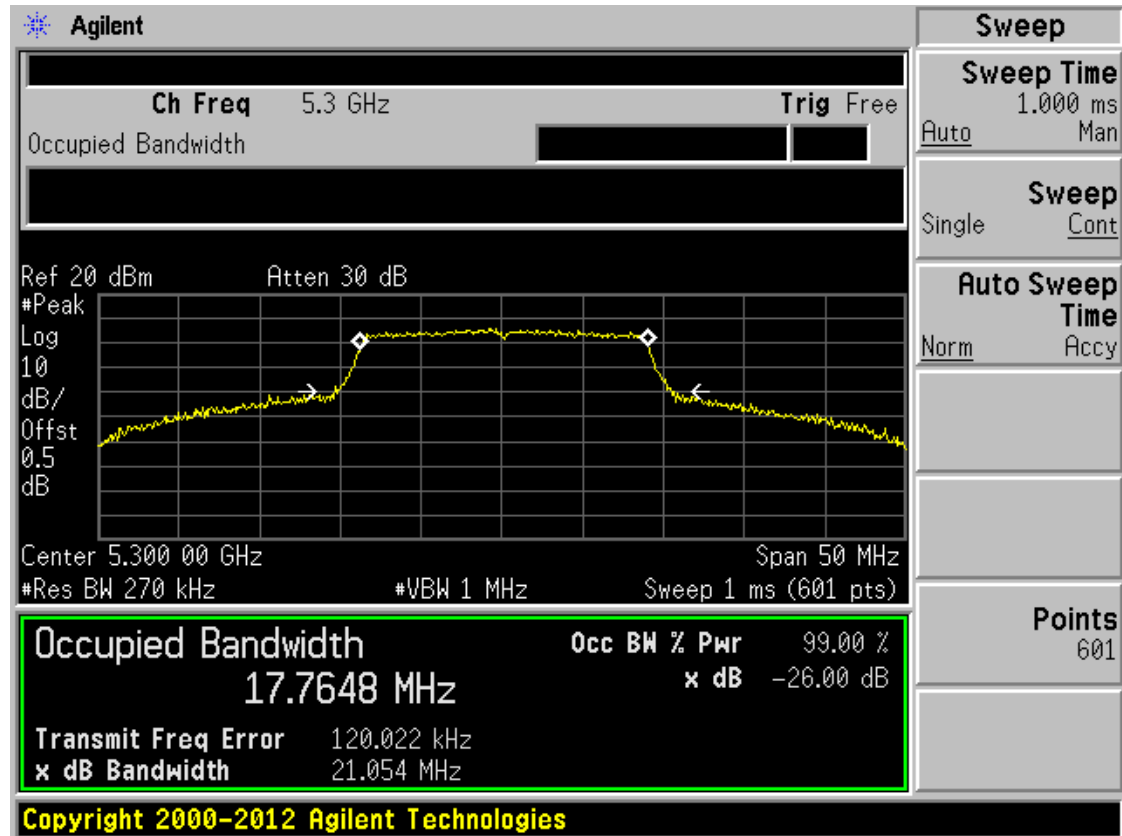
Band II 11a CH64



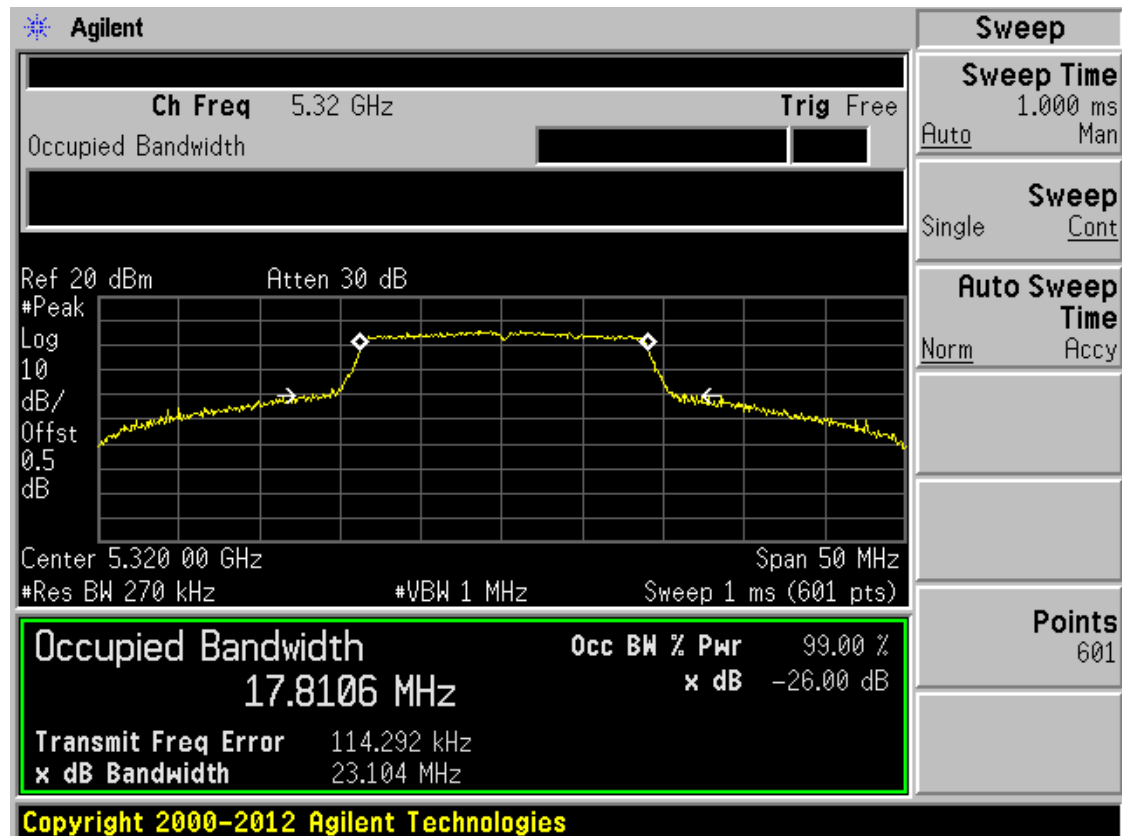
Band II 11n(HT20) CH52



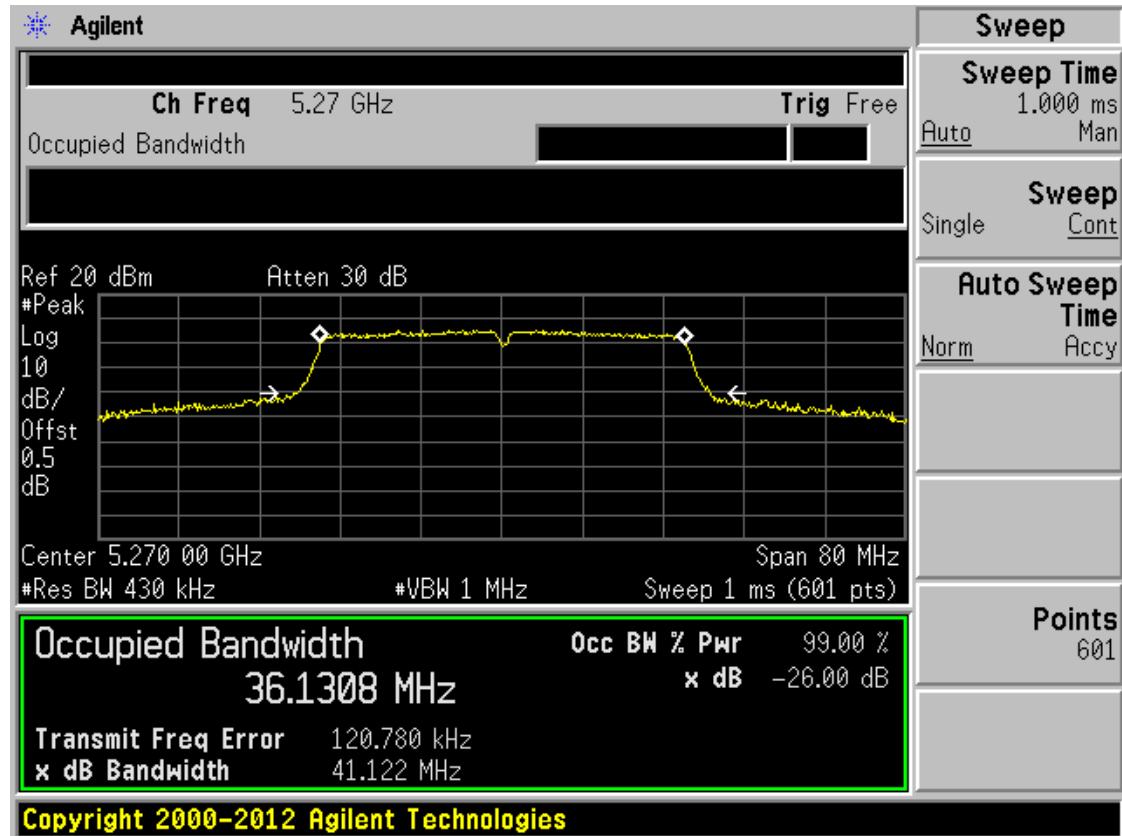
Band II 11n(HT20) CH60



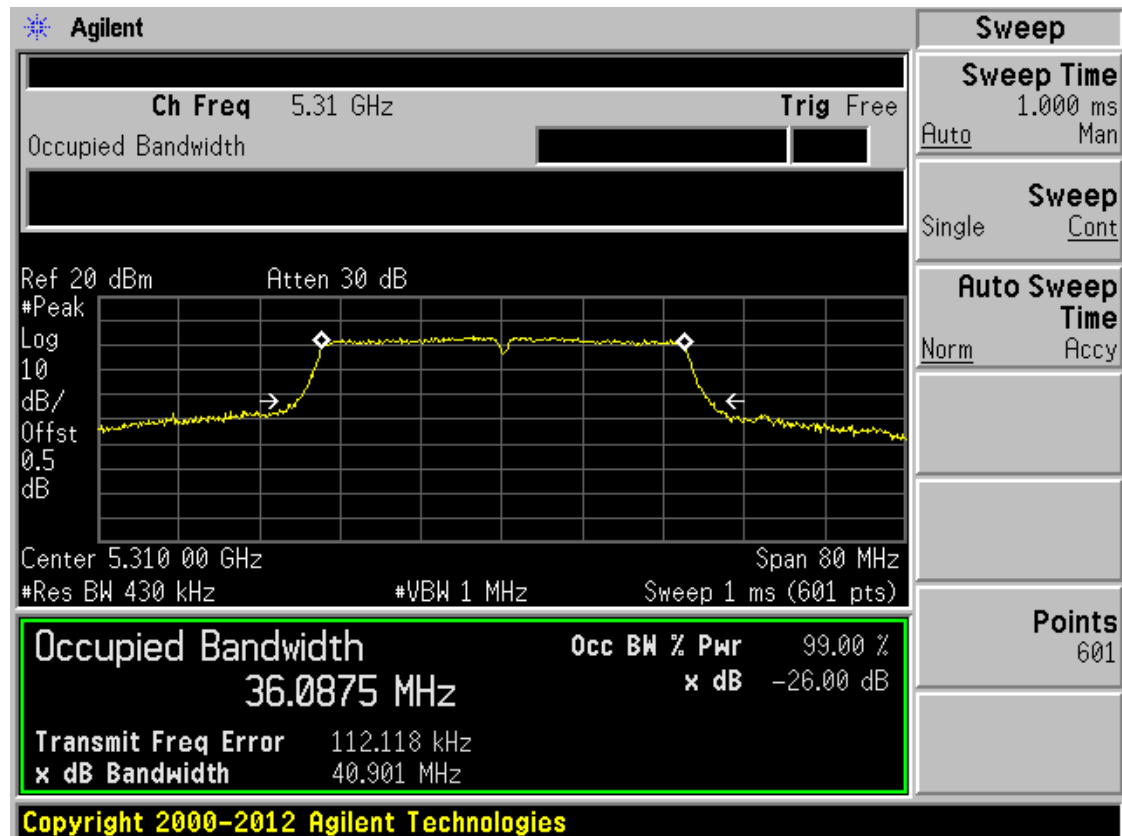
Band II 11n(HT20) CH64



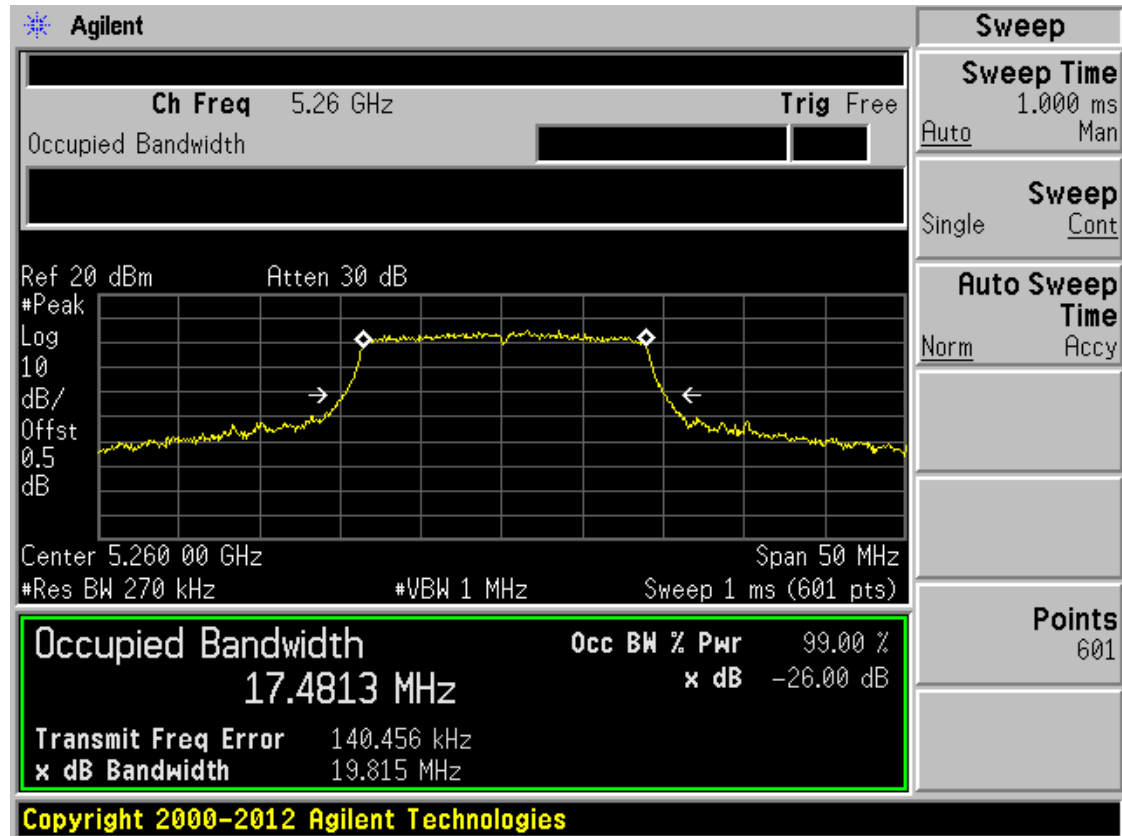
Band II 11n(HT40) CH54



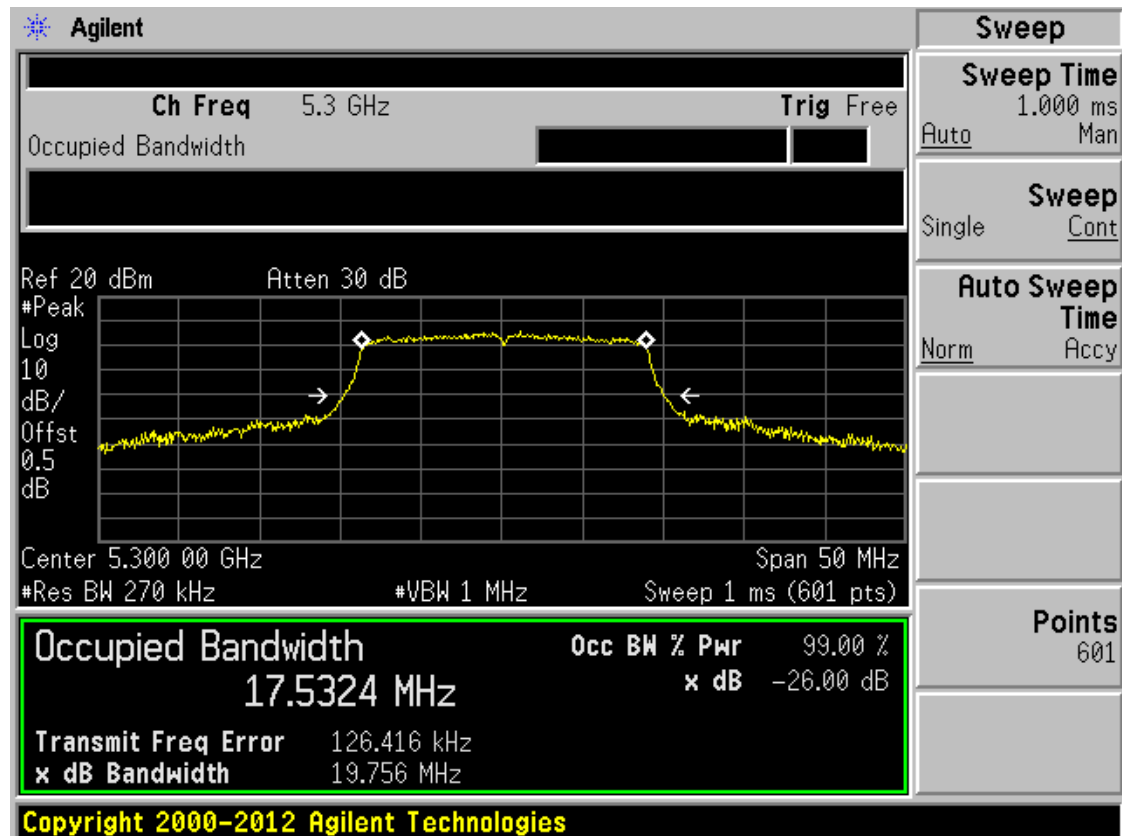
Band II 11n(HT40) CH62



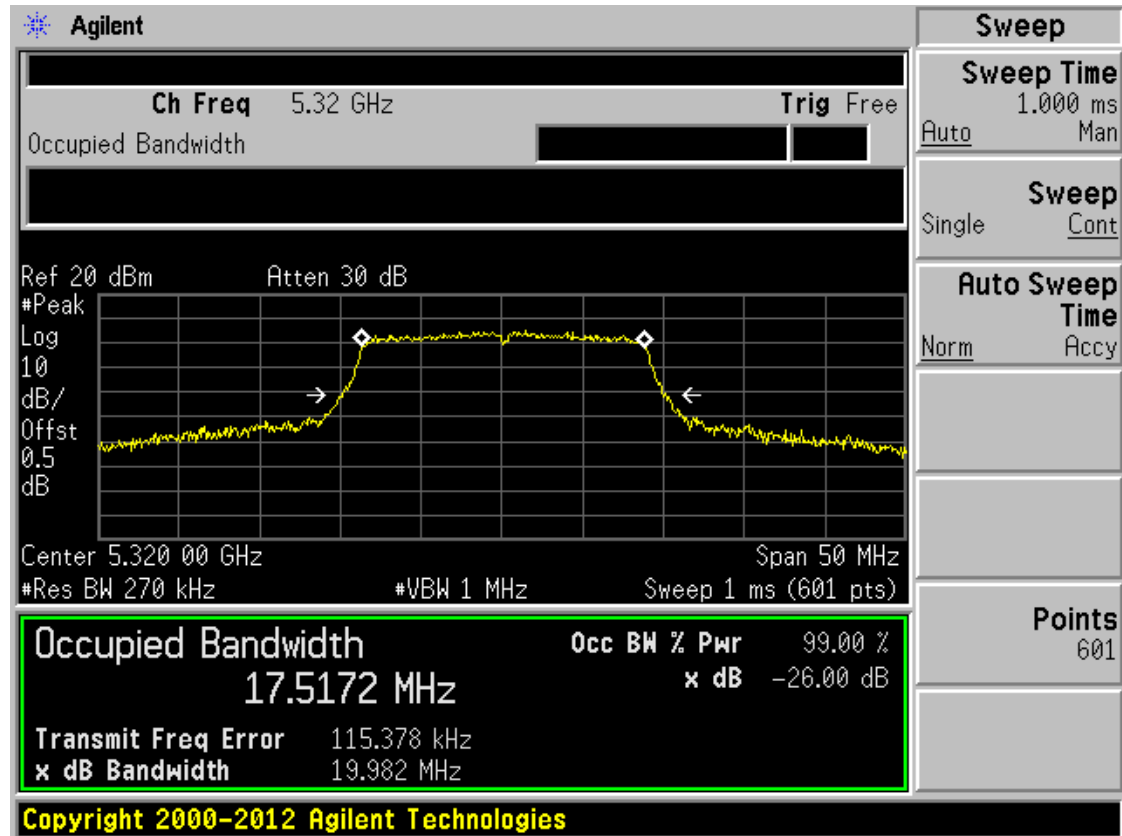
Band II 11ac(HT20) CH52



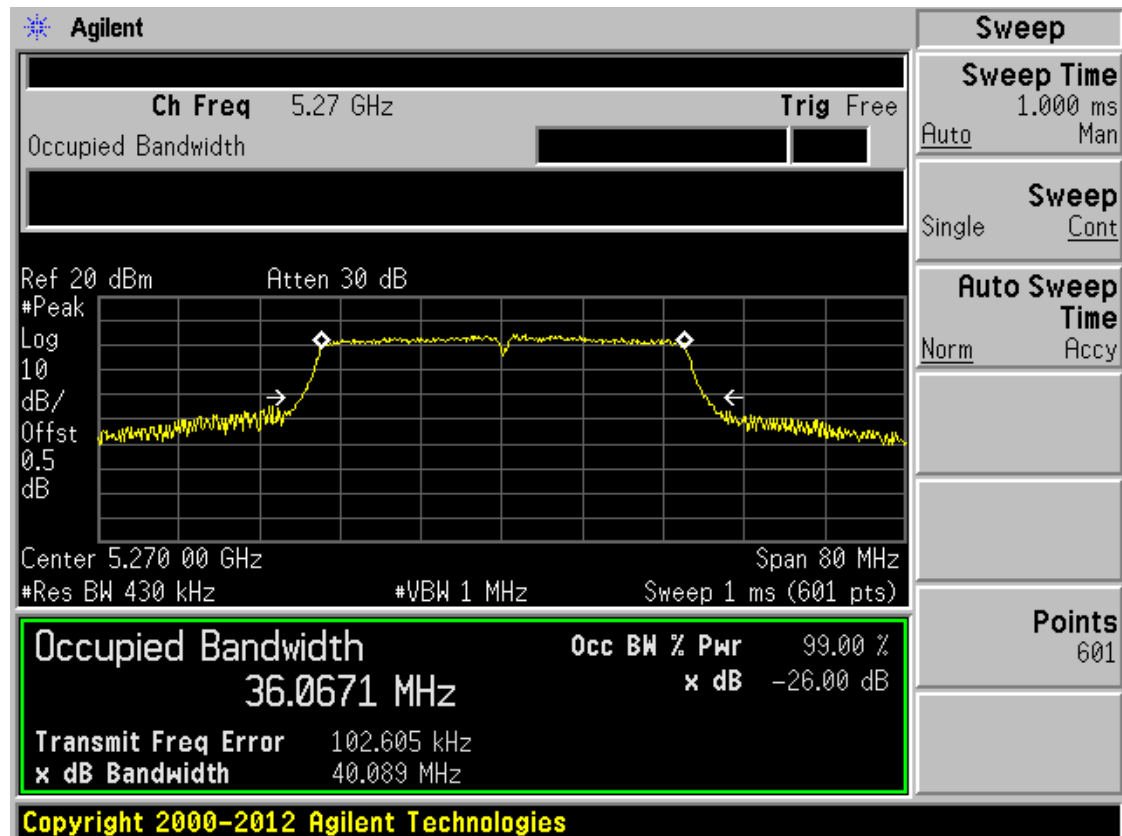
Band II 11ac(HT20) CH60



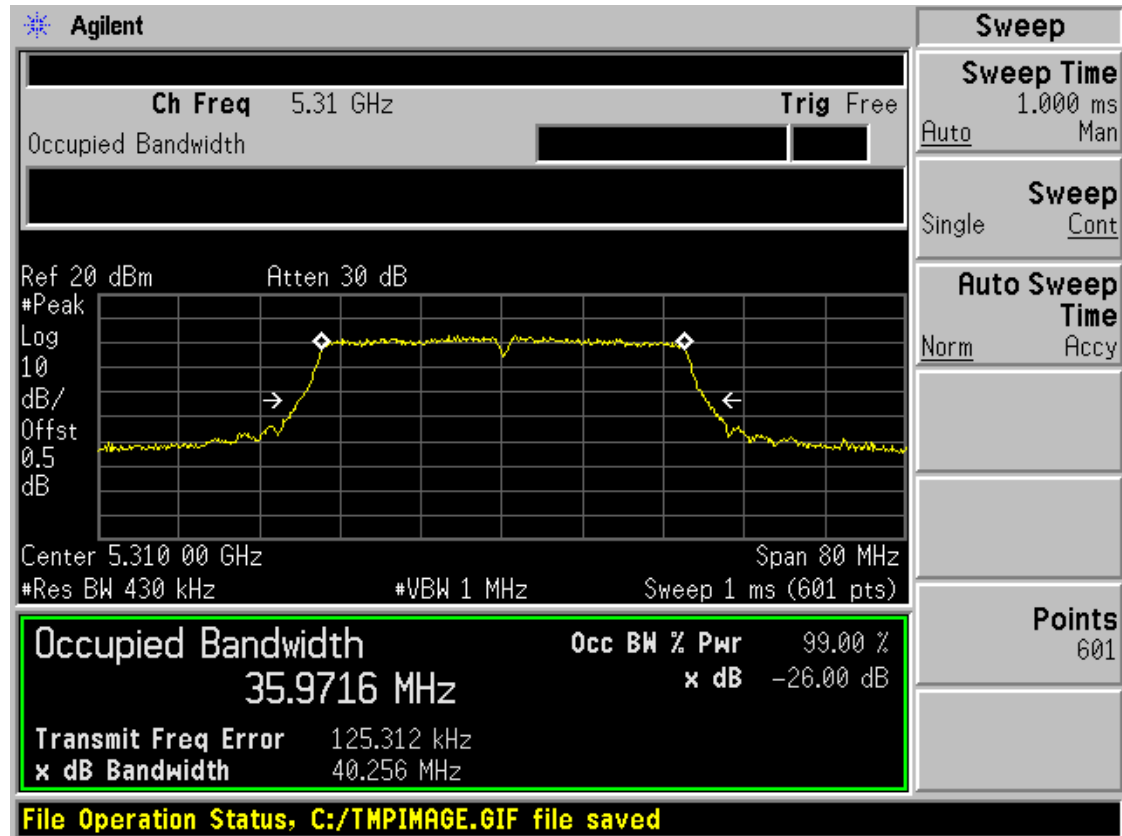
Band II 11ac(HT20) CH64



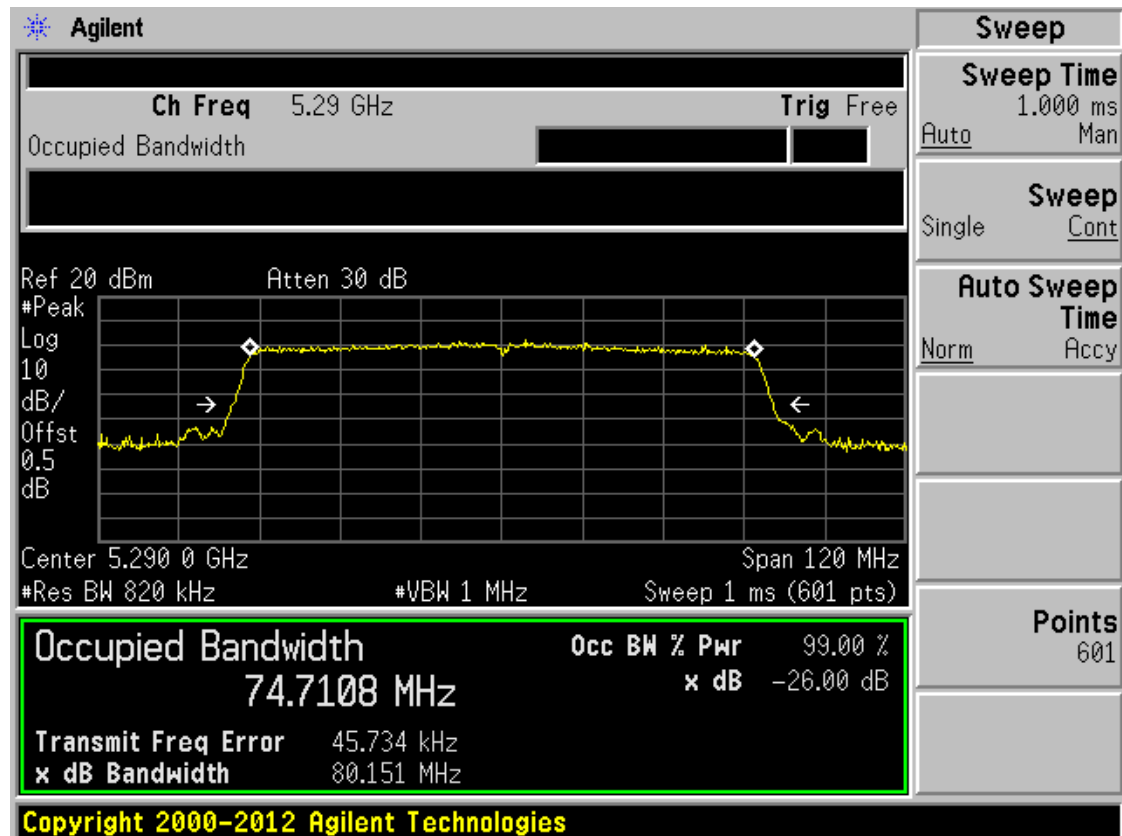
Band II 11ac(HT40) CH54



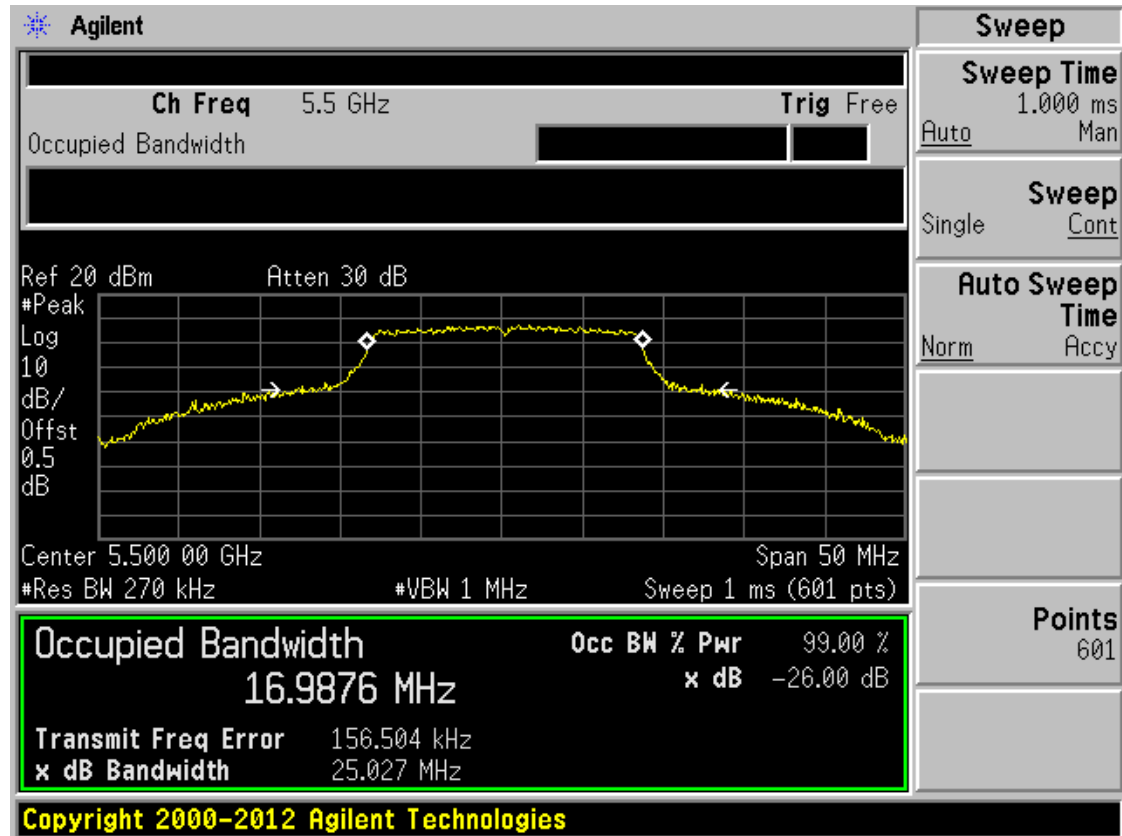
Band II 11ac(HT40) CH62



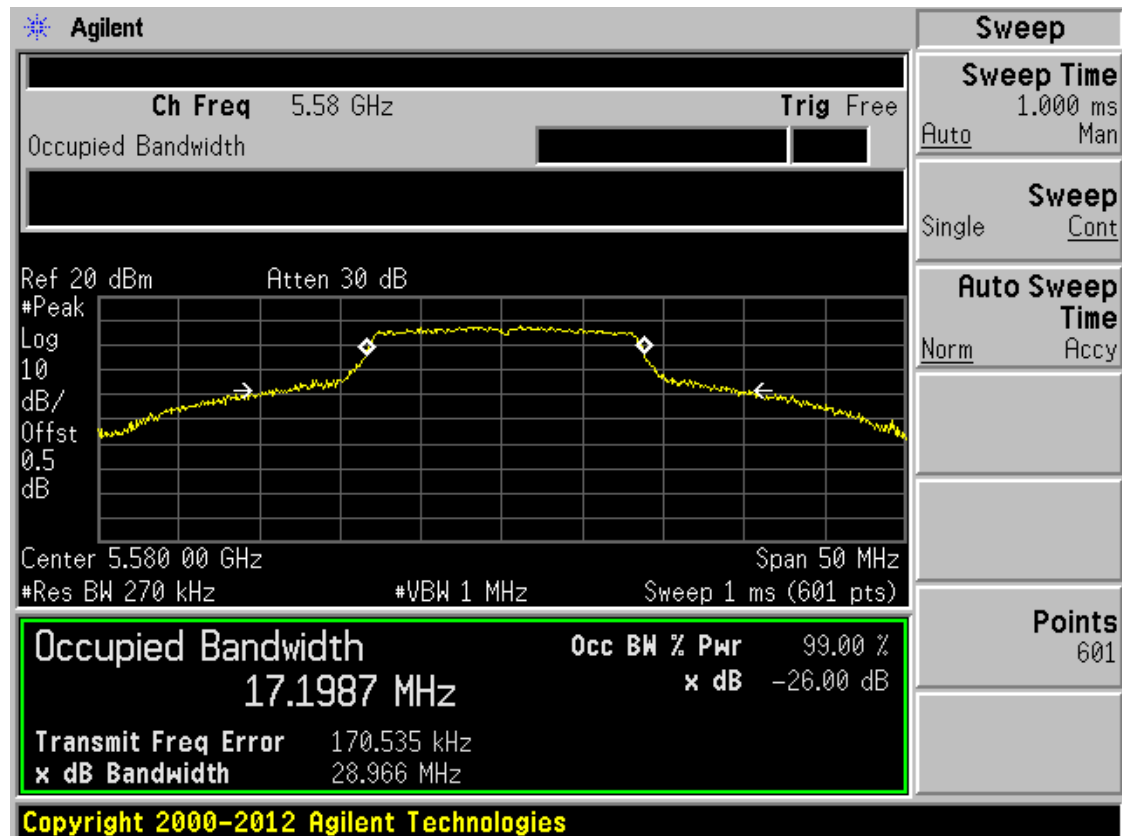
Band II 11ac(HT80) CH58



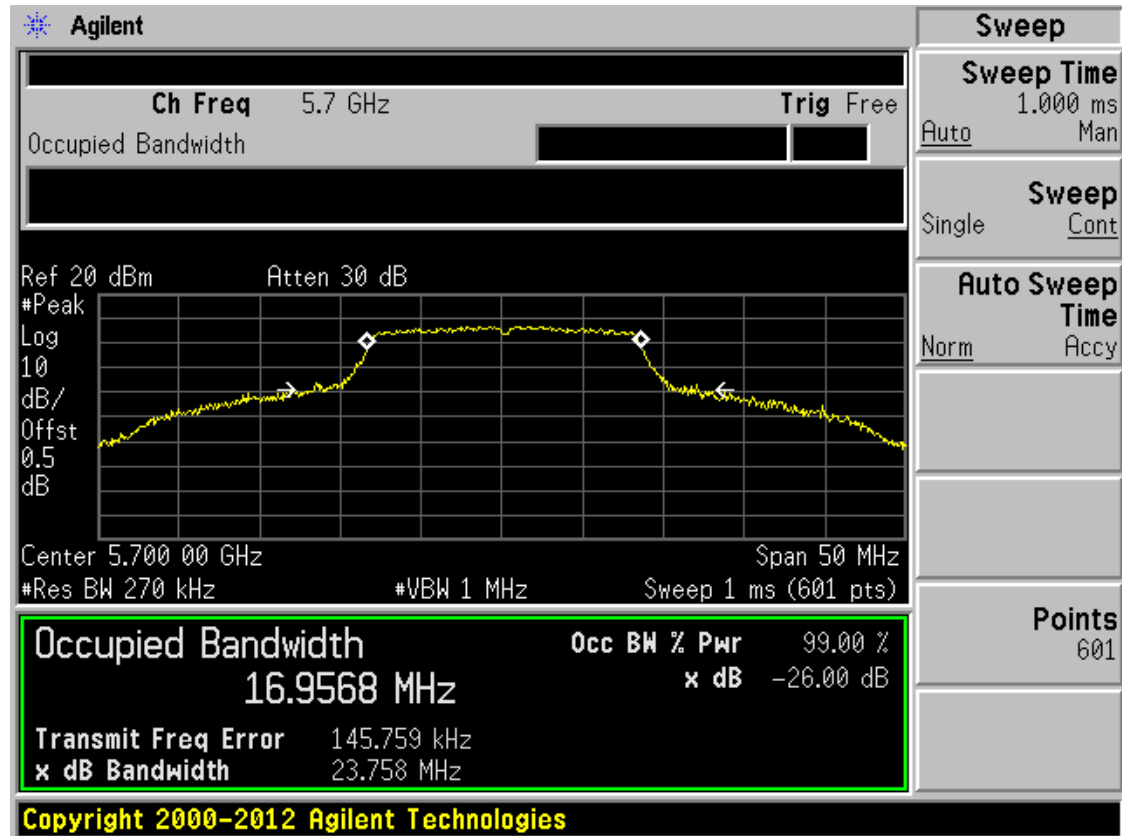
Band III 11a CH100



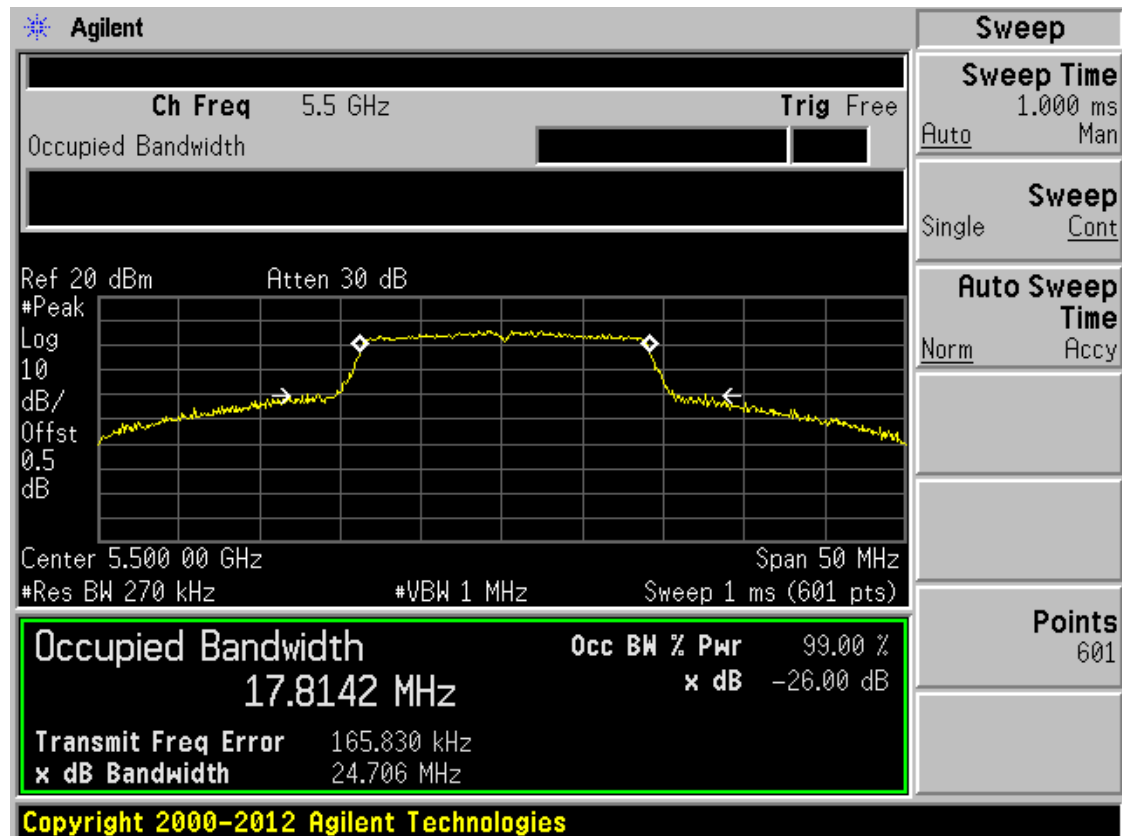
Band III 11a CH116



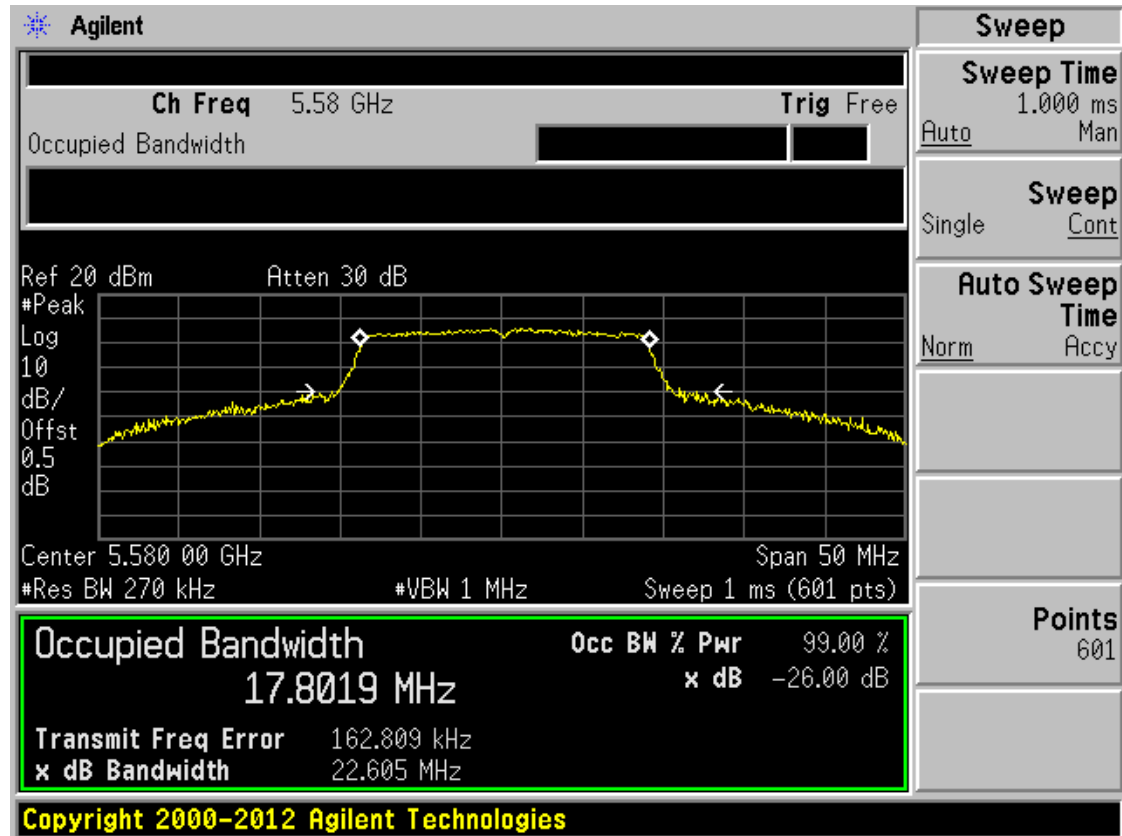
Band III 11a CH140



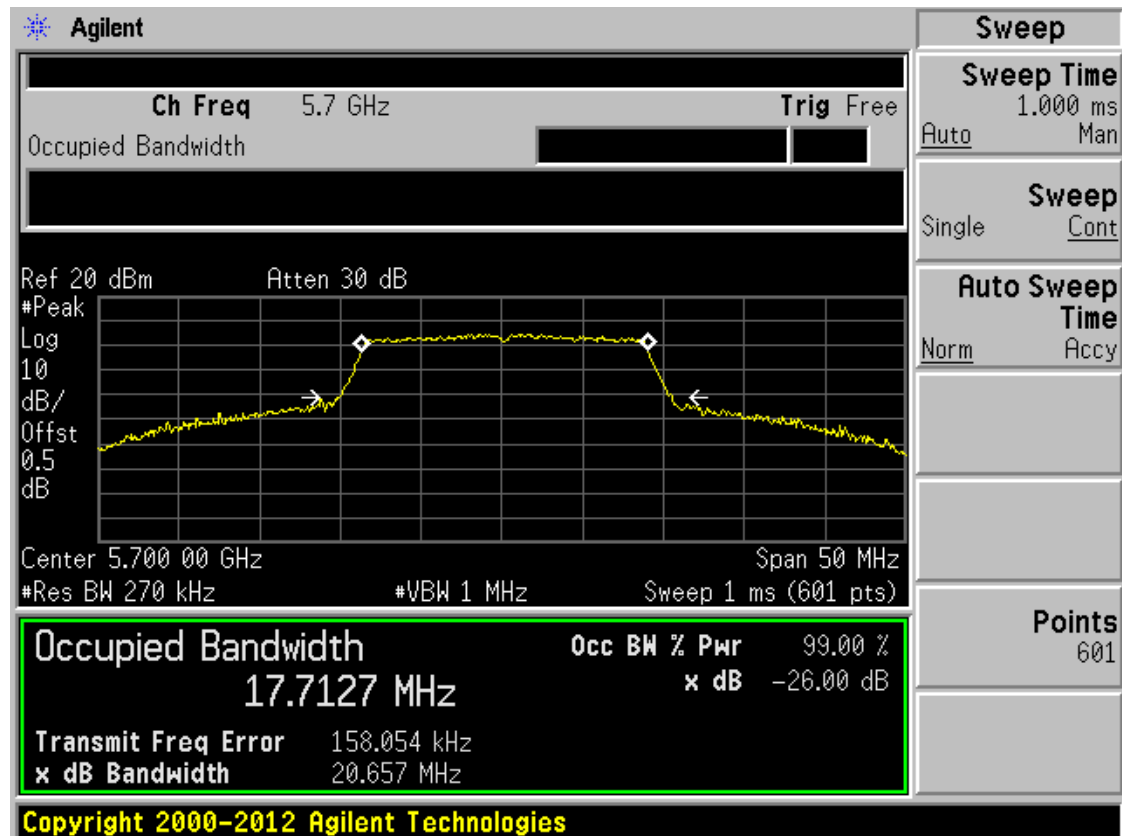
Band III 11n(HT20) CH100



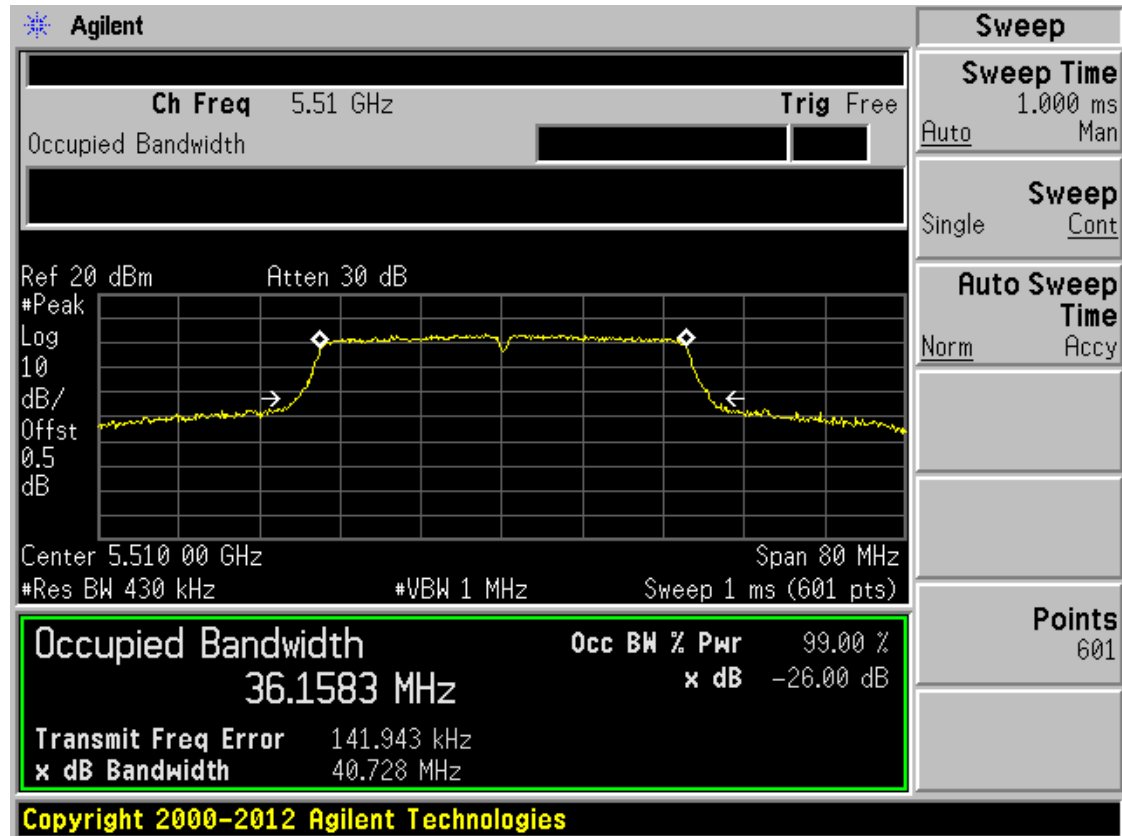
Band III 11n(HT20) CH116



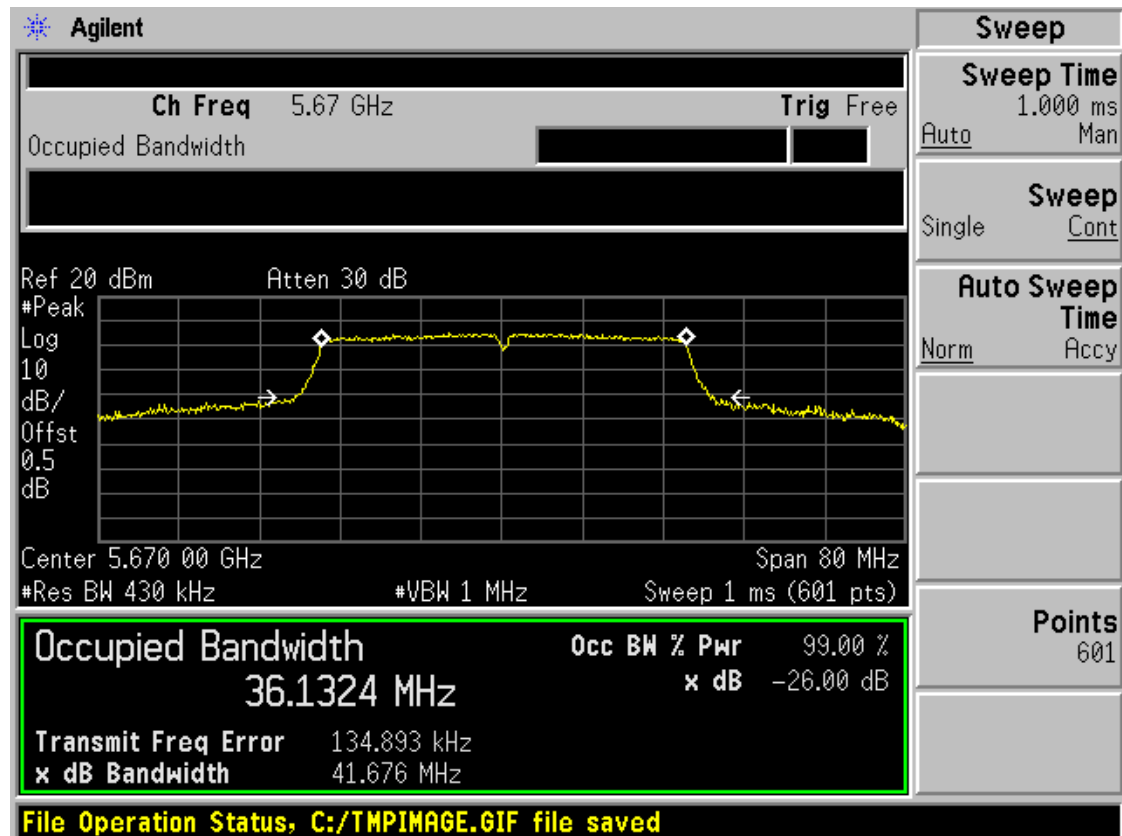
Band III 11n(HT20) CH140



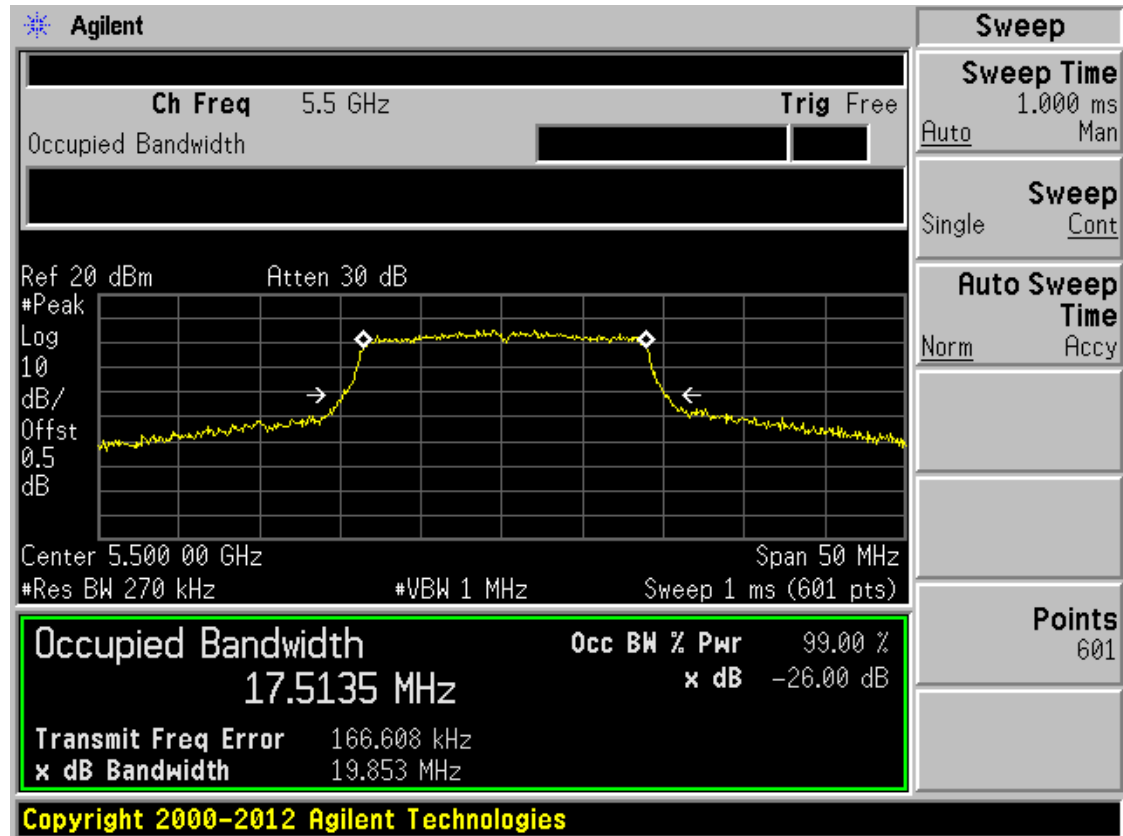
Band III 11n(HT40) CH102



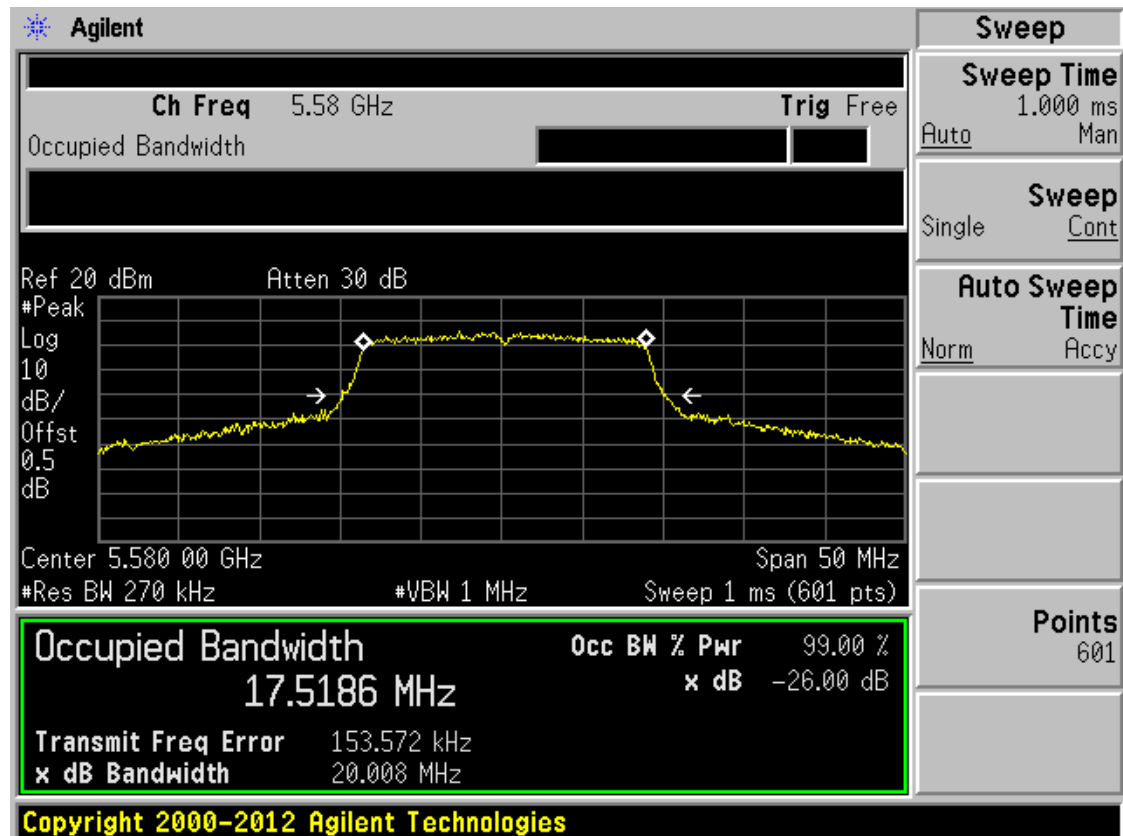
Band III 11n(HT40) CH134



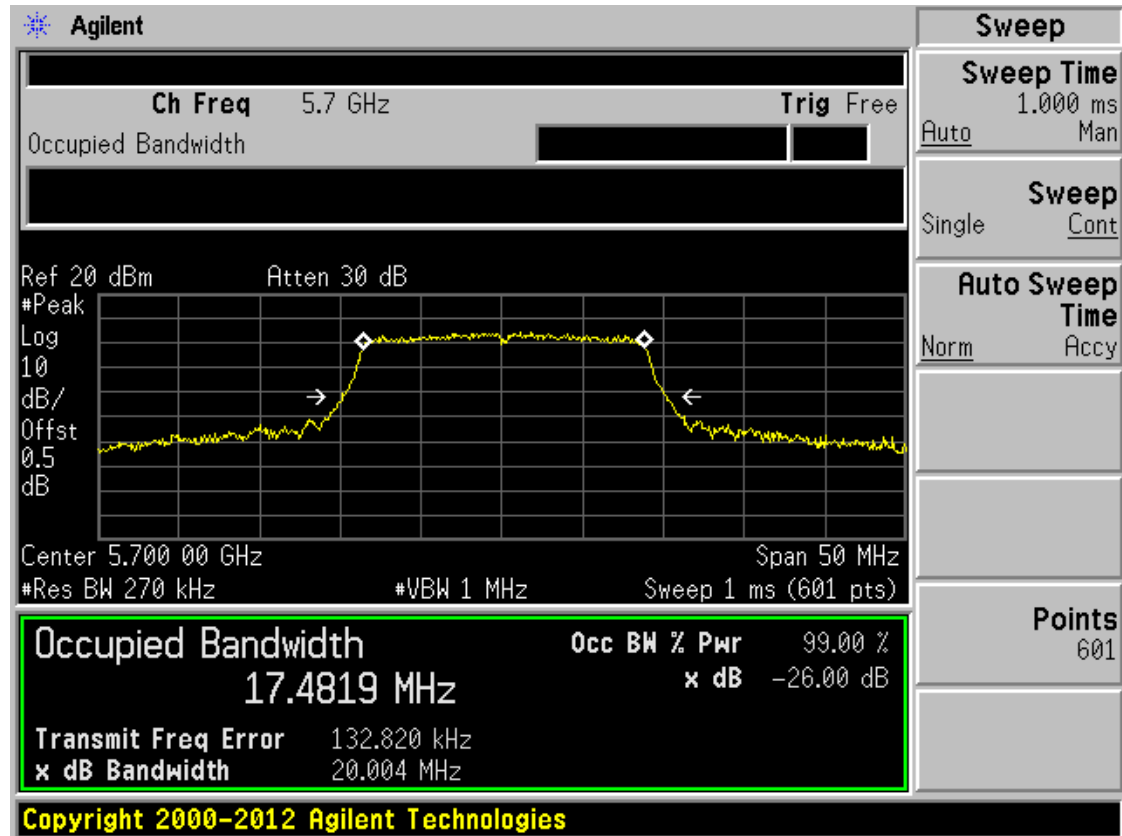
Band III 11ac(HT20) CH100



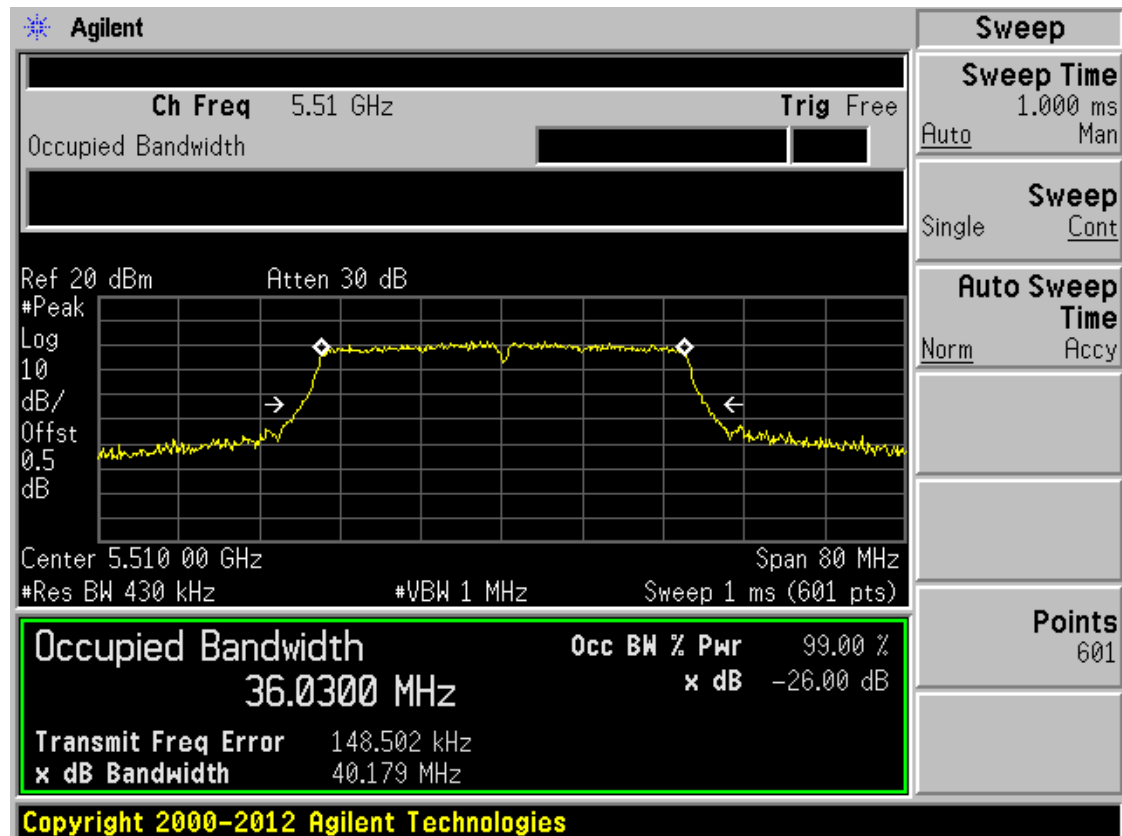
Band III 11ac(HT20) CH116



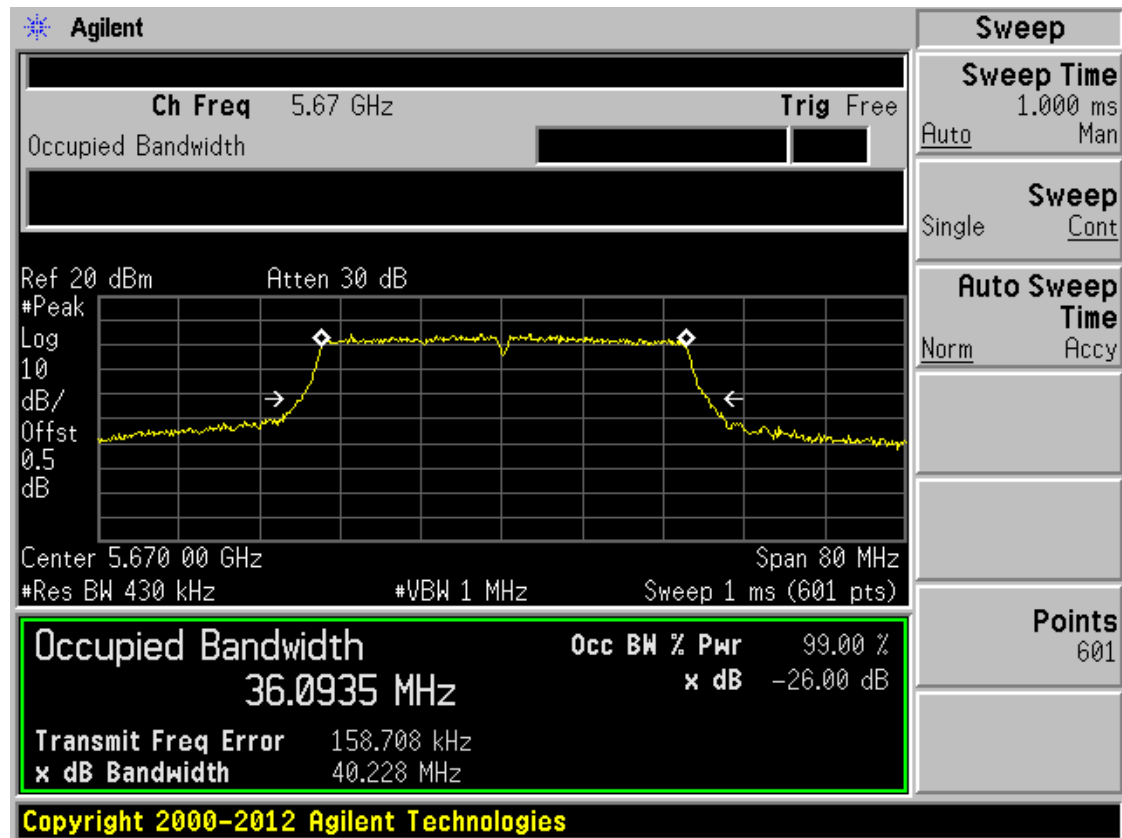
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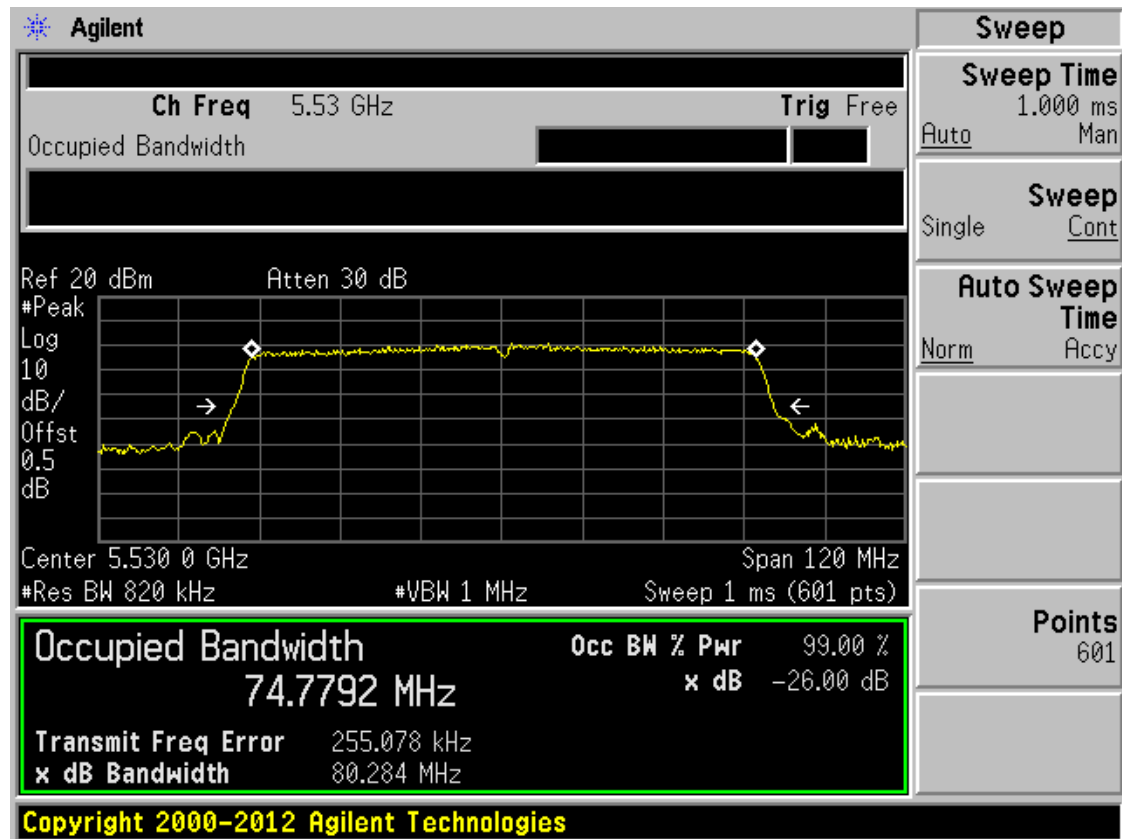
Band III 11ac(HT40) CH102



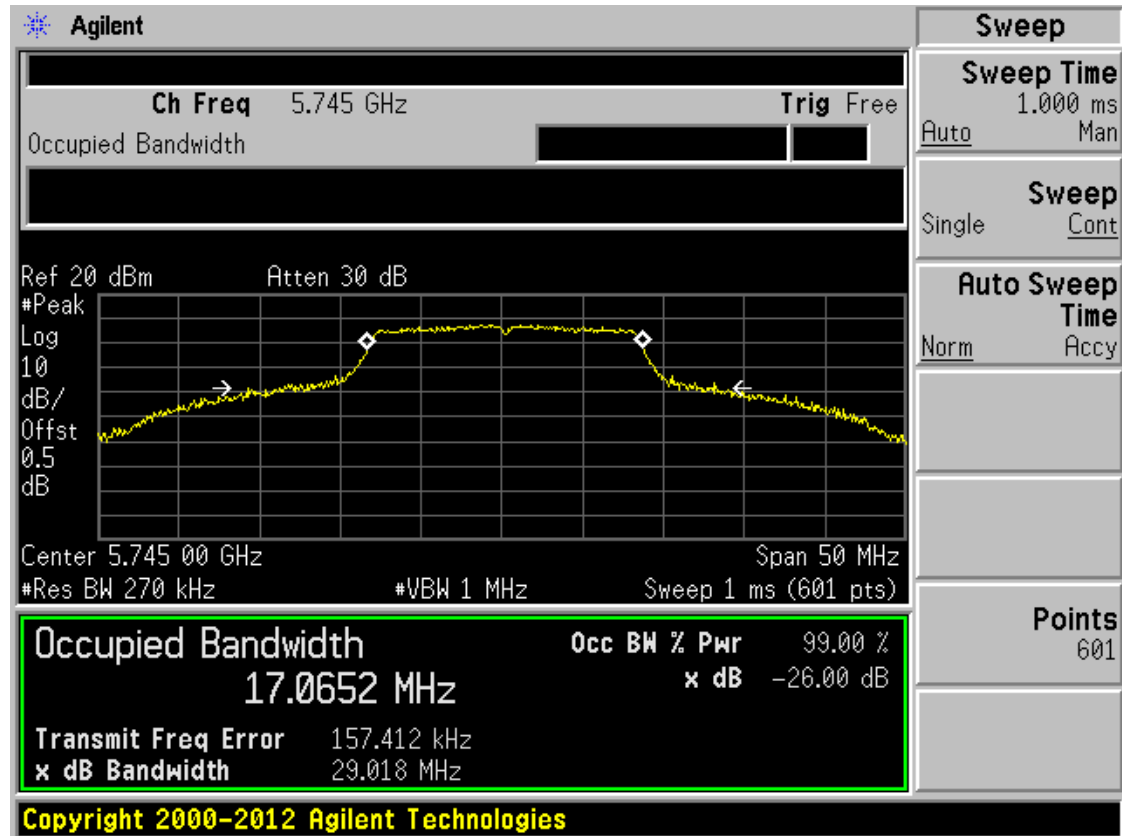
Band III 11ac(HT40) CH134



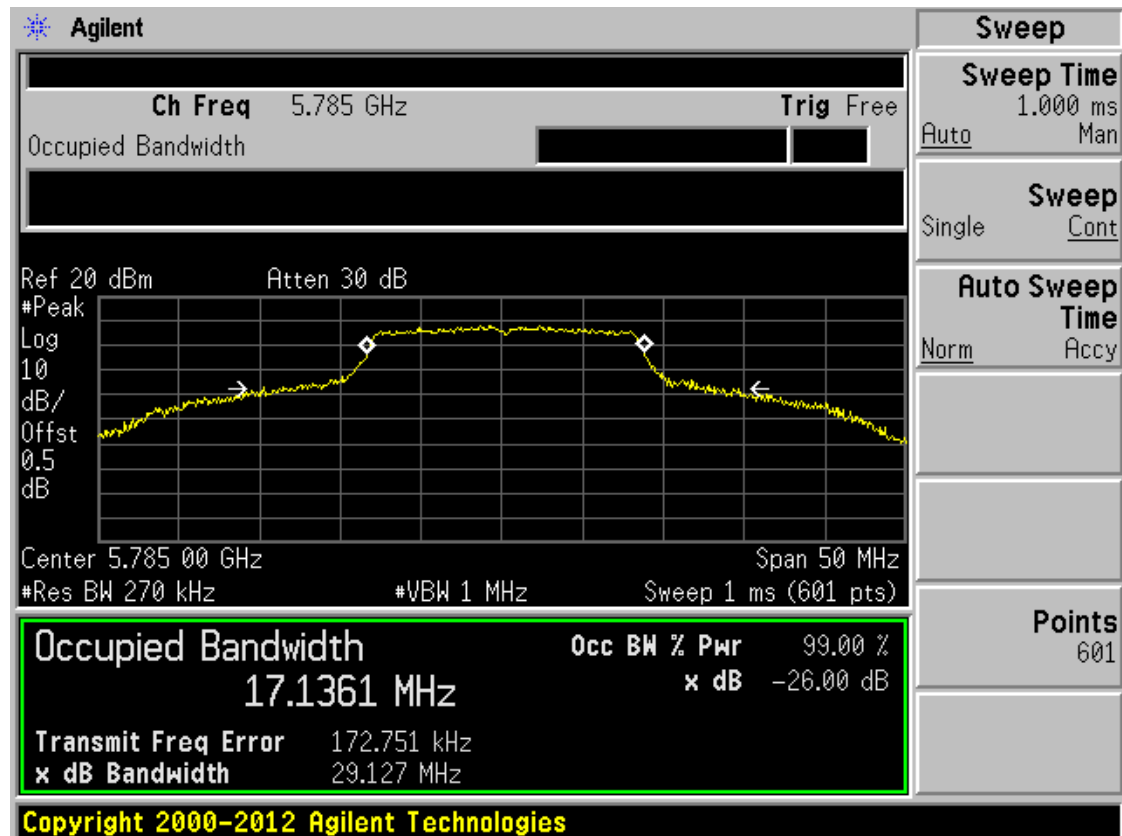
Band III 11ac(HT80) CH106



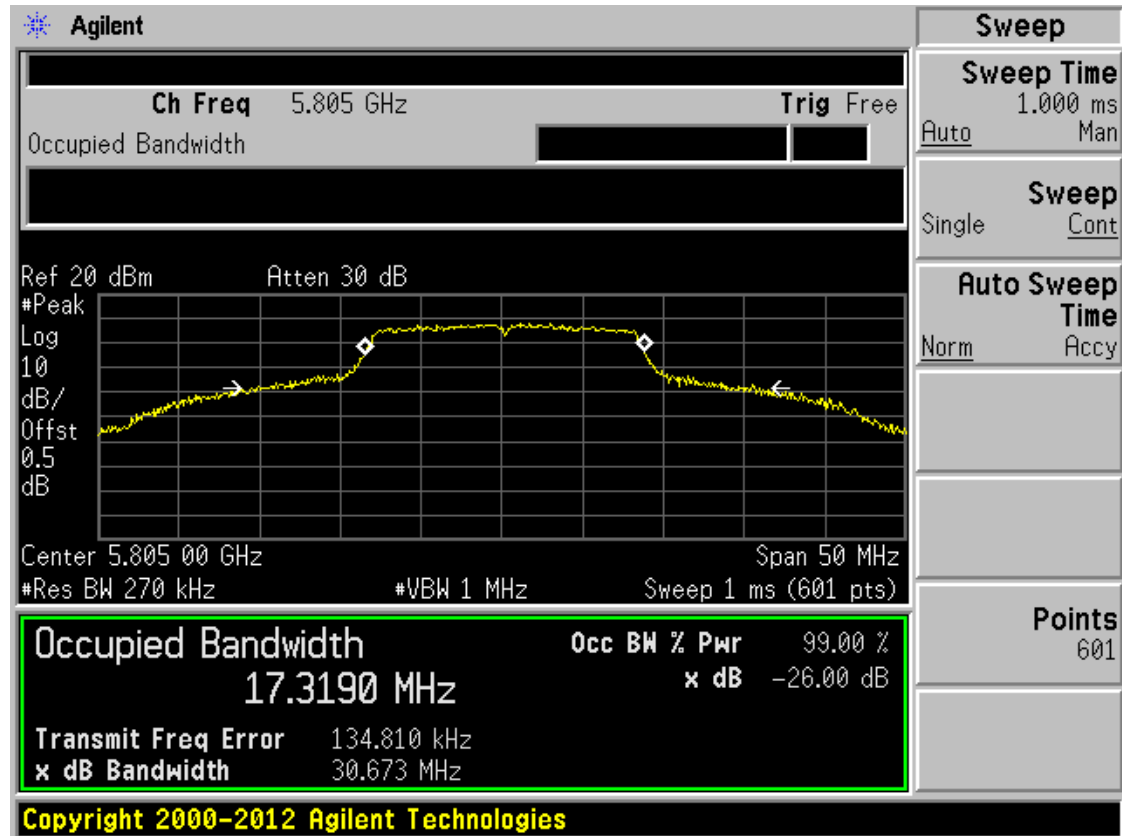
Band IV 11a CH149



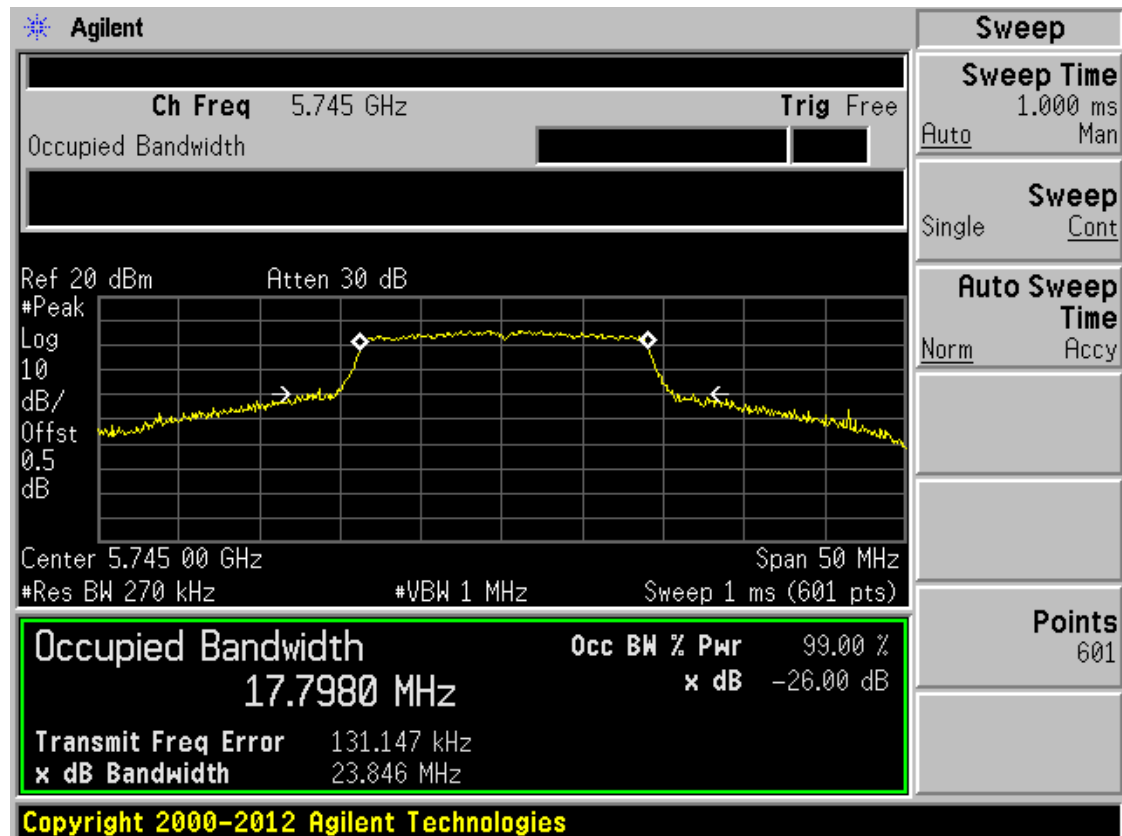
Band IV 11a CH157



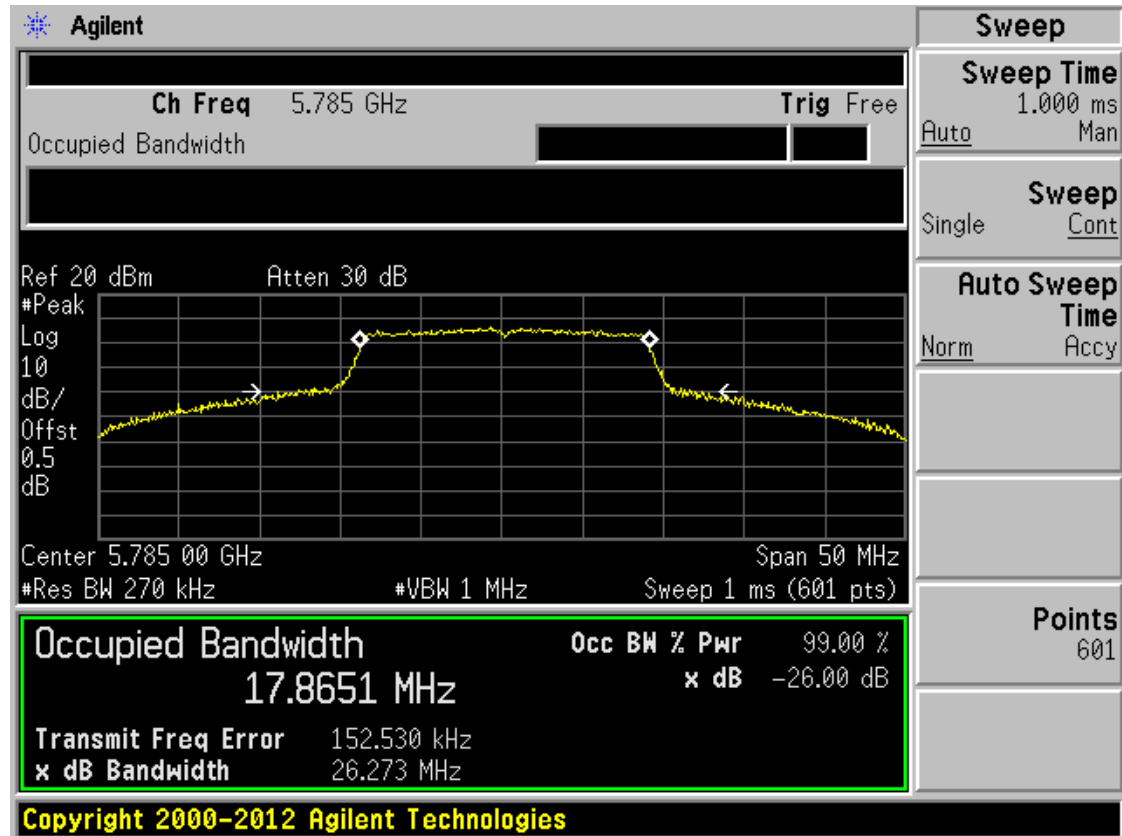
Band IV 11a CH161



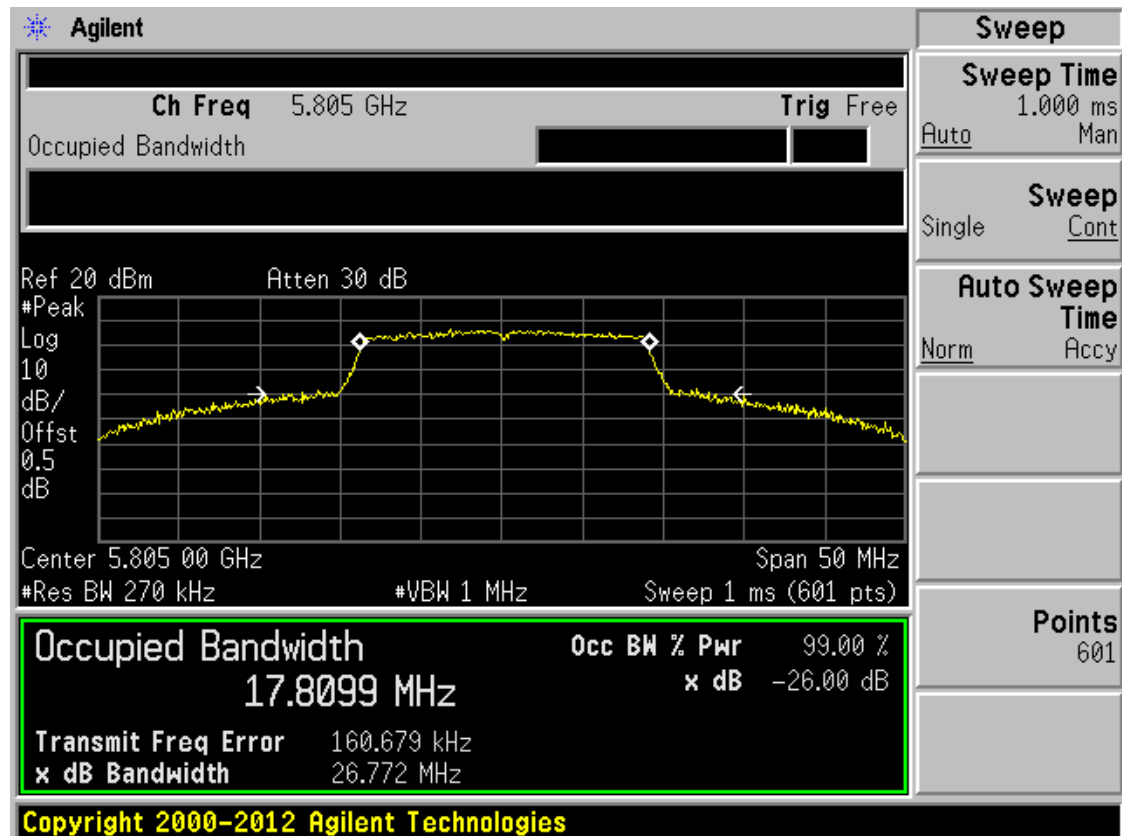
Band IV 11n(HT20) CH149



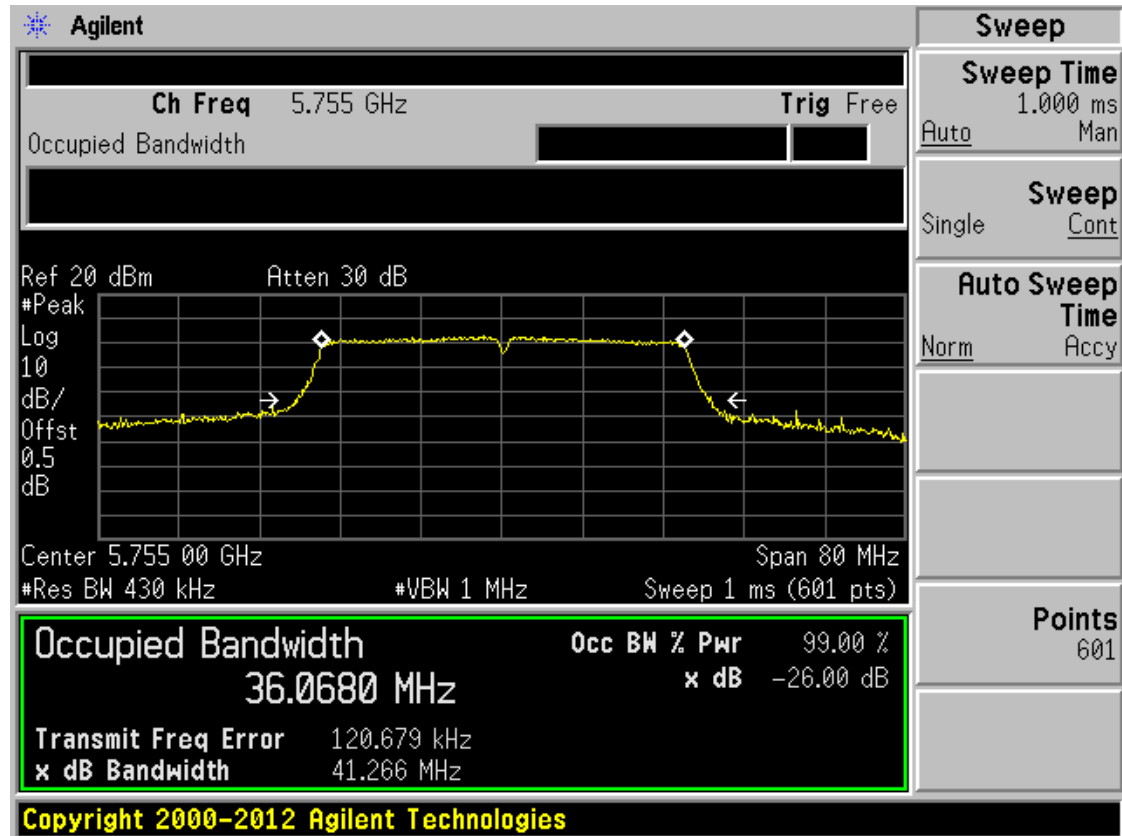
Band IV 11n(HT20) CH157



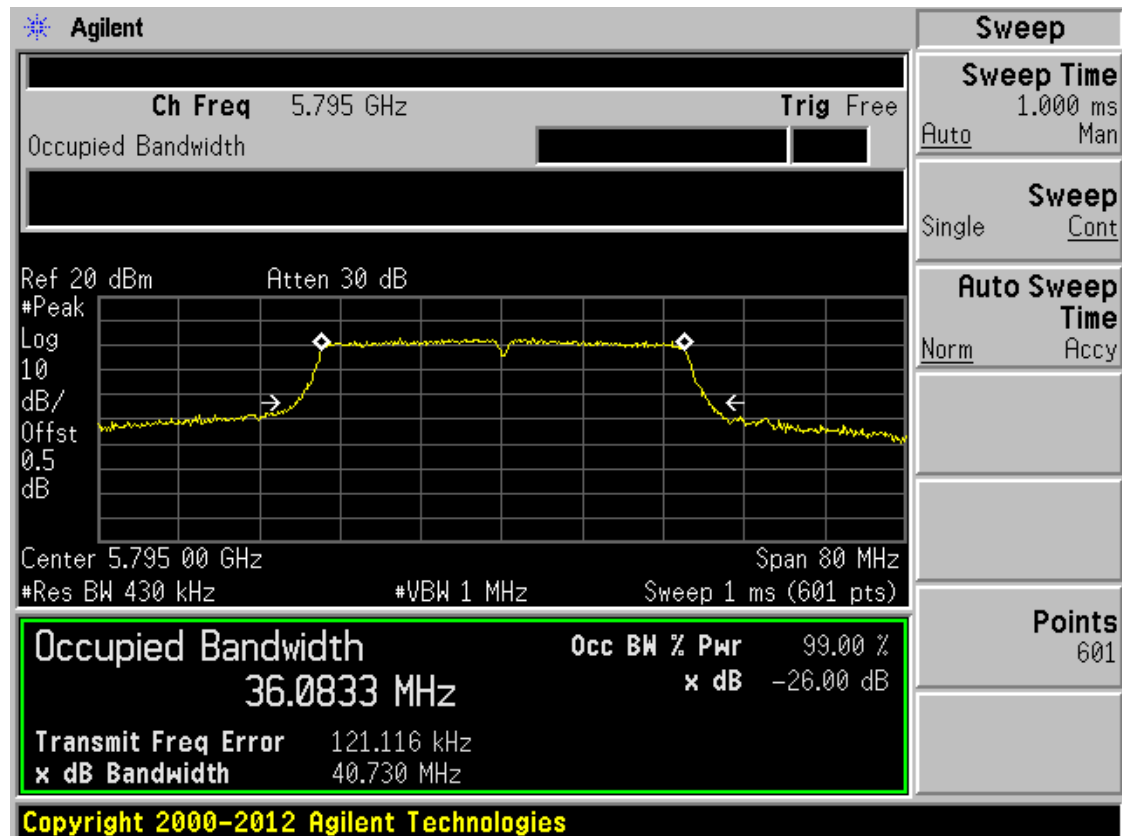
Band IV 11n(HT20) CH161



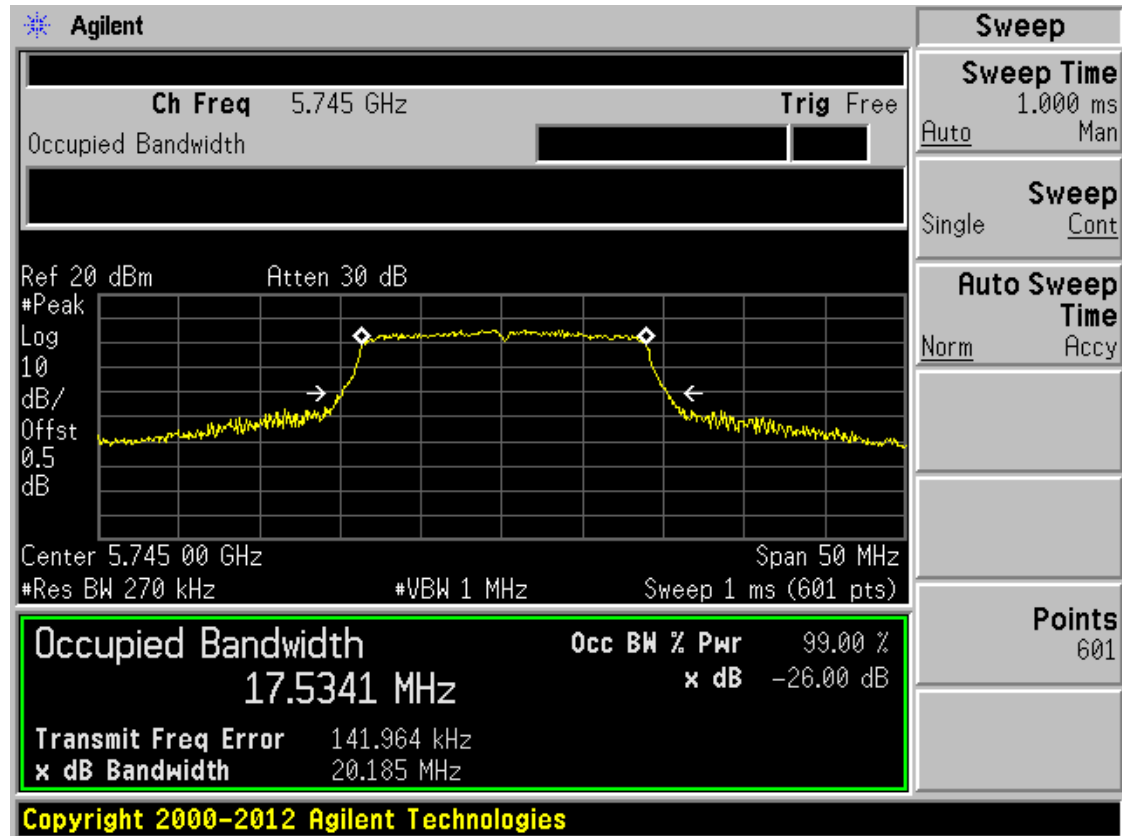
Band IV 11n(HT40) CH151



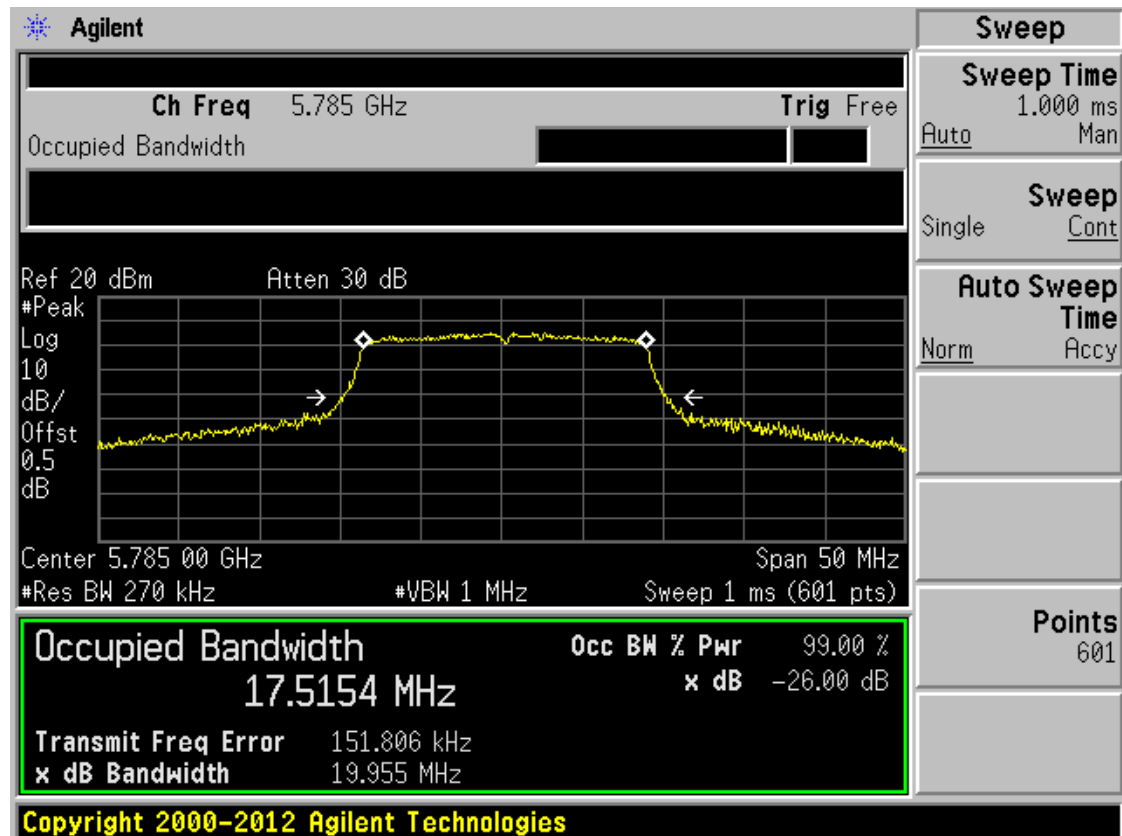
Band IV 11n(HT40) CH159



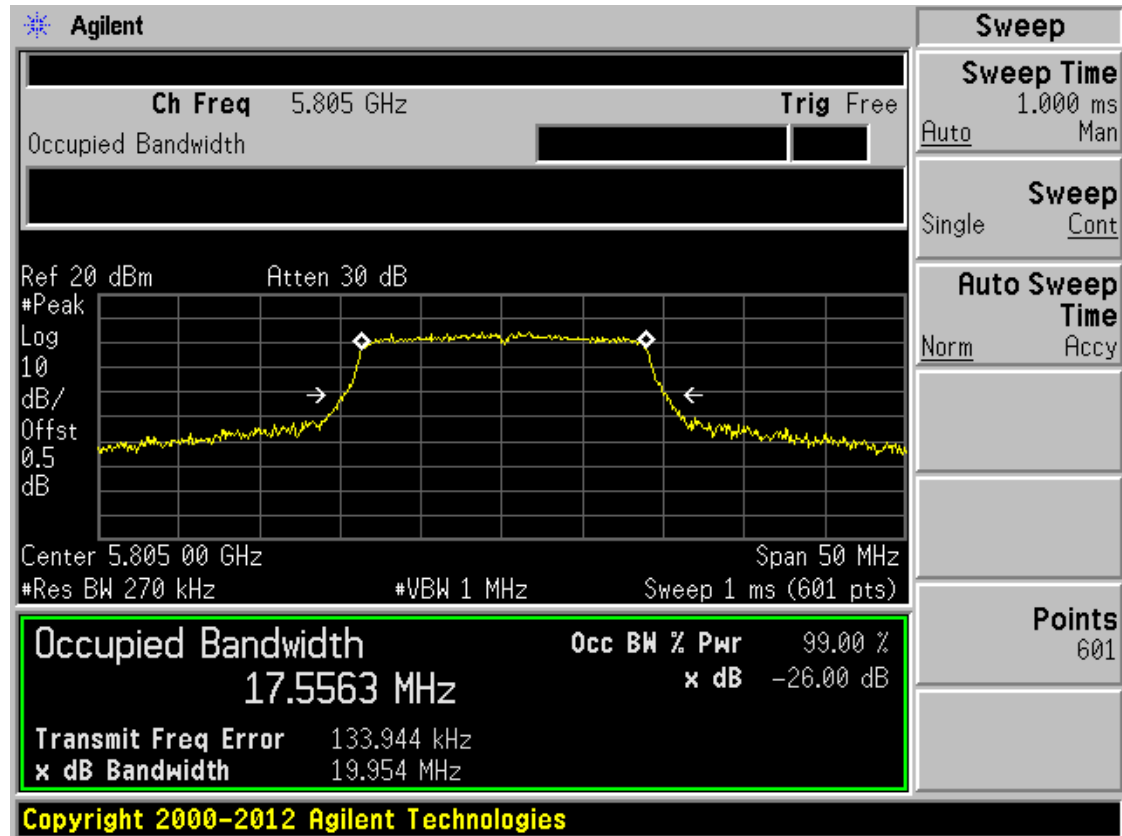
Band IV 11ac(HT20) CH149



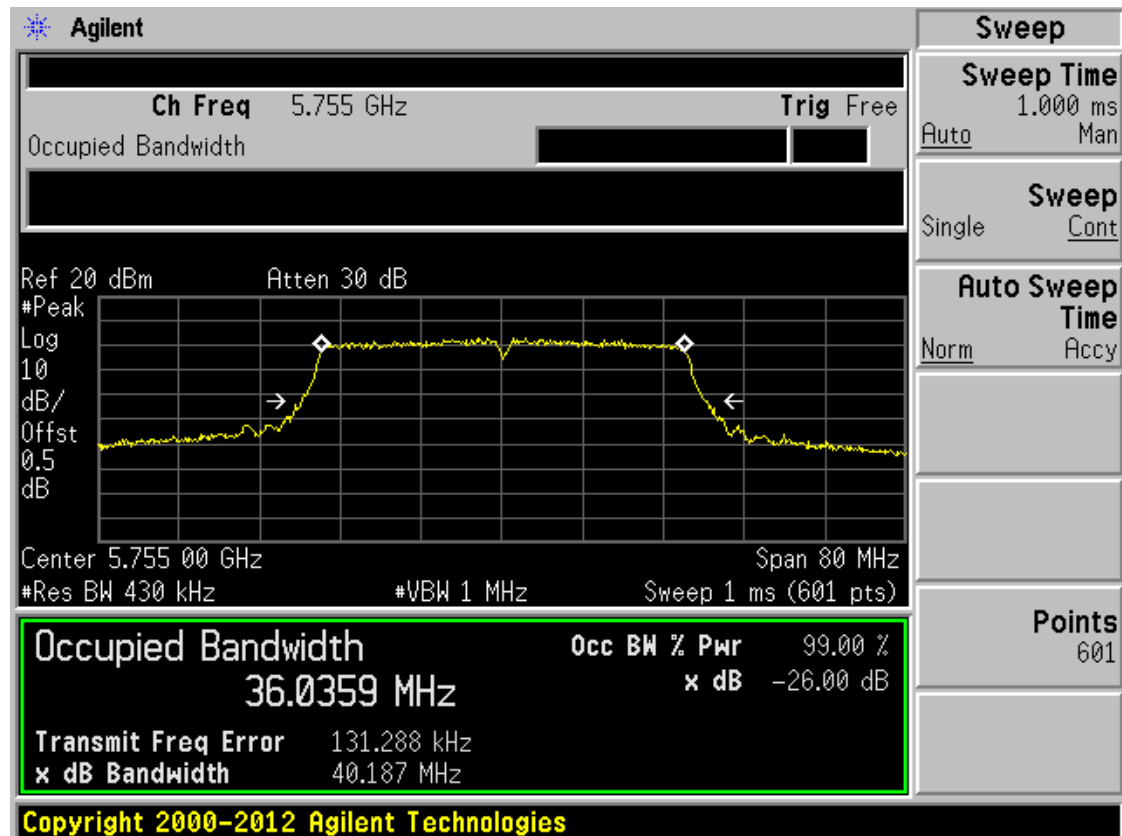
Band IV 11ac(HT20) CH157



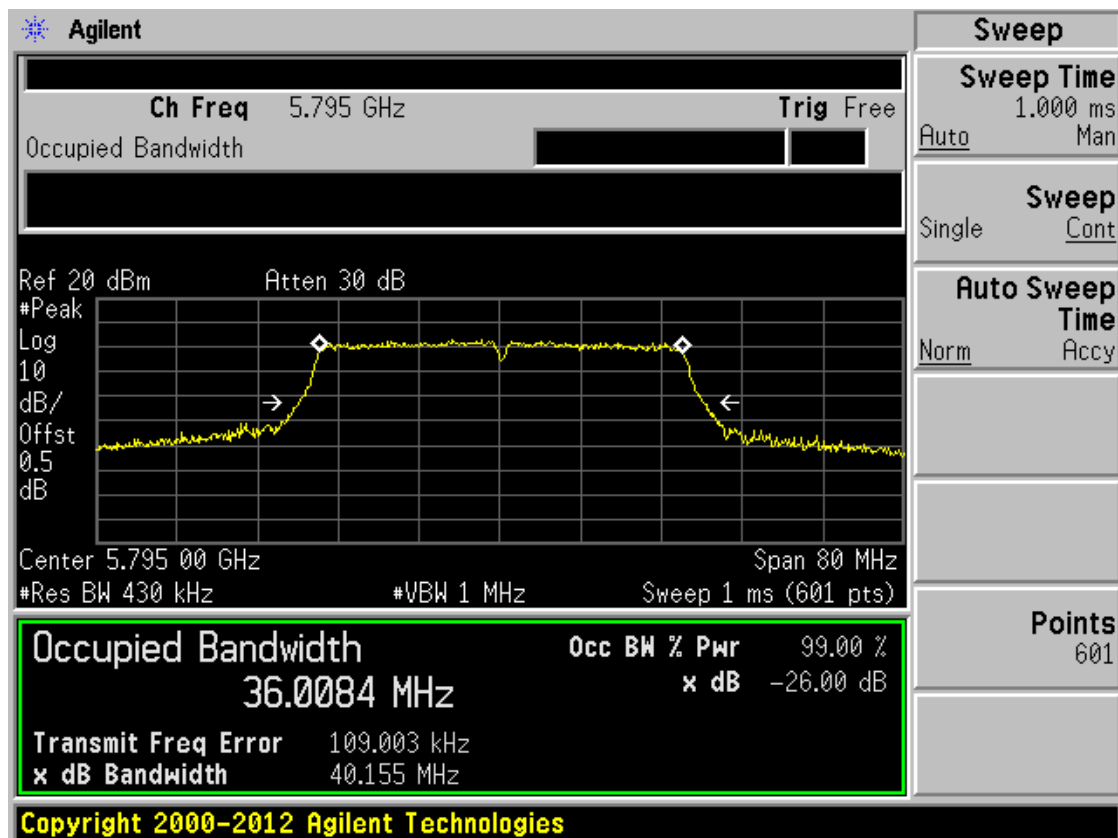
Band IV 11ac(HT20) CH161



Band IV 11ac(HT40) CH151



Band IV 11ac(HT40) CH159



Band IV 11ac(HT80) CH155

