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Project No.:	12CA41629
File No.:	MC17075
Report No.:	12CA41629-FCC-2
Date:	July 23, 2012
Model No.:	SWB-A52H
FCC ID.:	E2XSWB-A52H

FCC Test Report

in accordance with
FCC Part 15 Subpart E §15.407

for

WiFi Module

Samsung Electro-Mechanics Co., Ltd.

150 Maeyoungro, Yeongtong-gu, Suwon, Gyeonggi-do, Korea

Summary of Test Results:

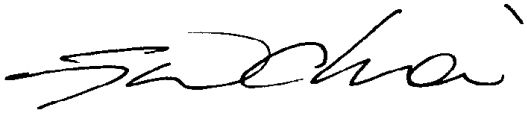
The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 15 E Section 15.407

No	Reference Clause No.	FCC Part15 Subpart E Conformance Requirements	Result Verdict	Remark
1	15.205(a) 15.209(a) 15.407(b)(1) 15.407(b)(2) 15.407(b)(3)	Transmitter radiated spurious emissions and Conducted spurious emission	Complied	
2	15.407(a)(1) 15.407(a)(2)	Output power	Complied	
3	15.407(a)(1) 15.407(a)(2)	Peak power spectral density	Complied	
4	15.407(a)(6)	Peak excursion	Complied	
5	15.207	Transmitter AC power line conducted emission	Complied	
6	15.407(h)	DFS Channel closing transmission time Channel move time Non occupied period	Complied	

Conclusion:

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

Tested by
Kyung Duk Ko, WiSE Project Engineer
UL Verification Services- 3014ASEO
UL Korea Ltd.
July 23, 2012



Tested by
Jeawoon, Choi, WiSE Engineering Leader
UL Verification Services- 3014ASEO
UL Korea Ltd.
July 23, 2012

Test Report Details

Tests Performed By:	UL Korea Ltd. 33rd FL. GFC Center, 737 Yeoksam-dong, Gangnam-gu, Seoul, 135-984, Korea
Test Site:	ESTECH CO., LTD. 97-1, Hoeok-Ri, Majang-Myun, Icheon-City, Kyunggi-Do, 467-811, Korea
Applicant:	Samsung Electro-Mechanics Co., Ltd. 150 Maeyoungro, Yeongtong-gu, Suwon, Gyeonggi-do, Korea
Applicant Contact:	Seung Pil Jung
Title:	Senior Engineer
Phone:	+82-31-210-5748
Fax:	+82-31-210-6363
E-mail:	seungpil.jung@samsung.com
Product Type:	WiFi Module
Model Number:	SWB-A52H
Trademark	SEMCO
Sample Serial Number:	N/A
Test standards:	FCC Part 15 E Unlicensed National Information Infrastructure Devices Section 15.407 General technical requirements
Sample Serial Number:	N / A
Sample Receive Date:	2012-07-02
Testing Date:	2012-07-02 ~ 2012-07-20
Overall Results:	**Pass**

UL Korea Ltd. reports apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

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1. General Product Information

1.1 Equipment Description

SWB-A52H is the module that integrates Wireless LAN (WLAN). This embedded module is optimized for WLAN enabled handheld mobile device.

1.2 Details of Test Equipment (EUT)

- Equipment Type : WiFi Module
- Model No. : SWB-A52H
- Trade name : SEMCO
- Type of test Equipment : module type
- Operating characteristic : FCC Part 15 E Unlicensed National Information Infrastructure Devices Section 15.407 General technical requirements
- Manufacturer : Samsung Electro-Mechanics Co., Ltd. Samsung Electro-Mechanics(Thailand), Ltd/93 Moo 5 T.Bangsmak, A.Bangpakong, Chachoengsao 24180, Thailand

1.3 Equipment Configuration

The EUT is consisted of the following component provided by the manufacturer.

Use*	Product Type	Manufacturer	Model	Comments
EUT	Module	Samsung Electrical-Mechanics	SWB-A52H	-
EUT	Antenna	SEMCO	MSA-4008-25GC1-A1-500002	-
Note: Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

1.4 Technical Data

Item	Type of WiFi module
Frequency Ranges	2400 – 2483.5 MHz 5150 – 5350 MHz, 5470 – 5725 MHz, 5725 – 5850 MHz,
Output power	2.4 G : Max. 22.11 dBm 5 G : Max. 15.58 dBm
Kind of modulation (s)	CCK, OFDM, BPSK, QPSK, 16QAM, 64QAM
Emission Designator	G1D, D2D
Channel	2.4 G : 13 channel(11b/g/n_HT20) 5 G : 5 channel (11a/n_HT20 – DTS), 2 channel (11n_HT40 – DTS) 4 channel(11a/n_HT20 – Non DFS), 2 channel(11a/n_HT40 – Non DFS) 15 channel (11a/n_HT20_DFS), 7 channel (11a/n_HT40_DFS)
Antenna Gain	2.4 G : Max. 3.51 dBi, 5 G : Max. 4.07 dBi
Antenna information	Integral antenna (Metal Stamping Antenna Assembly)
Working temperature	-20 ~ 70 ℃
Supply Voltage	DC 3.3 V

Note ;
1. All the technical data described above were provided by the manufacturer.

1.5 Antenna Information

Antenna Model Name : MSA-4008-25GC1-A1-500002
Antenna Type : Metal Stamping Antenna Assembly
Manufacturer : MAG. LAYERS SCUENTIFIC-TECHNICS CO., LTD.
Transmit Gain dBi : 2.4 G : Max. 3.51 dBi, 5 G : Max. 4.07 dBi
Azimuth Beam Pattern : Linear vertical

1.6 Equipment Type :

☒ Radio and ancillary equipment for fixed or semi-fixed use
☐ Radio and ancillary equipment for vehicular mounted use
☐ Radio and ancillary equipment for portable or handheld use

☒ Stand alone ☐ Host connected ☐ Host connected

☐ Self contained single unit ☒ Module with associated connection or interface

1.7 Technical descriptions and documents

The following documents was provided by the manufacturer.

No.	Document Title and Description
1	User Manual
2	MAG. LAYERS SCUENTIFIC-TECHNICS CO., LTD., APPROVAL SHEET (RoHS) / MSA-4008-25GC1-A1-500002

1.8 Description of additional model name

Model name	Model name Designation	Description of design
SWB-A52H	Basic model	-

1.9 Maximum Output Power (Baseline Measurement)

5.15 ~ 5.25 GHz	Rate		Peak Power(dBm)		
			5.18 GHz	5.22 GHz	5.24 GHz
802.11a	6	Mbps	13.77	13.14	13.24
	9	Mbps	13.95	13.67	13.71
	12	Mbps	14.12	13.74	13.77
	18	Mbps	1426	13.85	13.7
	24	Mbps	14.18	13.71	13.82
	36	Mbps	14.23	13.82	13.75
	48	Mbps	14.31	13.88	13.77
	54	Mbps	**14.36**	**13.93**	**13.85**
802.11n-HT20	MCS	0	13.99	13.34	13.10
	MCS	1	14.34	13.64	13.24
	MCS	2	14.51	13.59	13.52
	MCS	3	14.68	13.72	13.66
	MCS	4	14.59	13.77	13.74
	MCS	5	14.72	13.84	13.78
	MCS	6	14.75	13.86	13.82
	MCS	7	**14.87**	**13.89**	**13.85**

802.11n-HT40	Rate		5.19 GHz	5.23 GHz
	MCS	0	14.43	14.58
	MCS	1	14.77	14.85
	MCS	2	14.89	14.91
	MCS	3	14.92	14.96
	MCS	4	14.88	14.99
	MCS	5	14.90	14.90
	MCS	6	14.93	15.05
	MCS	7	**15.02**	**15.11**

5.25 ~ 5.35 GHz	Rate		Peak Power(dBm)		
			5260 MHz	5280 MHz	5320 MHz
802.11a	6	Mbps	13.36	14.56	14.30
	9	Mbps	13.89	14.62	14.65
	12	Mbps	14.05	14.69	14.78
	18	Mbps	14.16	14.78	14.81
	24	Mbps	14.22	14.85	14.88
	36	Mbps	14.31	14.81	14.85
	48	Mbps	14.25	14.92	14.83
	54	Mbps	14.44	14.99	14.97
802.11n-HT20	MCS	0	13.35	14.12	13.93
	MCS	1	13.84	14.36	14.62
	MCS	2	13.95	14.59	14.66
	MCS	3	13.99	14.62	14.59
	MCS	4	13.92	14.60	14.71
	MCS	5	14.05	14.68	14.48
	MCS	6	14.11	14.61	14.88
	MCS	7	14.13	14.72	14.90
802.11n-HT40	Rate		5.27 GHz		5.31 GHz
	MCS	0	14.24		14.97
	MCS	1	14.78		15.26
	MCS	2	14.85		15.34
	MCS	3	14.93		15.41
	MCS	4	14.99		15.39
	MCS	5	15.02		15.44
	MCS	6	14.91		15.51
	MCS	7	15.05		15.58

5.47 – 5.725 MHz	Rate		Peak Power(dBm)		
			5.5 GHz	5.58 GHz	5.7 GHz
802.11a	6	Mbps	13.87	14.02	14.07
	9	Mbps	14.25	14.52	14.52
	12	Mbps	14.36	14.69	14.67
	18	Mbps	14.48	14.77	14.69
	24	Mbps	14.66	14.82	14.78
	36	Mbps	14.62	14.88	14.88
	48	Mbps	14.71	14.84	14.95
	54	Mbps	14.78	14.93	15.02
802.11n-HT20	MCS	0	13.67	14.33	14.27
	MCS	1	14.51	14.74	14.85
	MCS	2	14.59	14.79	14.92
	MCS	3	14.63	14.81	14.99
	MCS	4	14.68	14.88	14.88
	MCS	5	14.54	14.92	15.02
	MCS	6	14.71	14.94	15.07
	MCS	7	14.74	14.98	15.11
802.11n-HT40	Rate		5.51 GHz	5.55 GHz	5.67GHz
	MCS	0	14.75	14.71	14.30
	MCS	1	14.88	14.82	14.78
	MCS	2	14.91	14.88	14.81
	MCS	3	14.81	14.93	14.88
	MCS	4	14.79	14.96	14.68
	MCS	5	14.83	14.97	14.91
	MCS	6	14.90	14.99	15.05
	MCS	7	14.98	15.03	15.10

2. Test Specification

The following test specifications and standards have been applied and used for testing.

1) FCC Part 15 E Unlicensed National Information Infrastructure Devices, Section 15.407 General technical requirements

2) ANSI C63.4:2009 : American National 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

3) ANSI C63.10:2009: American National Standard for Testing Unlicensed Wireless Devices

4) KDB 789033 : Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices

3. Test Conditions

3.1 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	WiFi module	Samsung Electro-Mechanics	SWB-A52H	-
AE	Note PC	Dell	X61	-
Note: Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

3.2 Input/Output Ports

No	Port Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
1	Power Input	DC	N	N	Connected to DC Power supply
2	Radio Antenna	I/O	N	Y	-
Note: *AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports					

3.3 Power Interface

Mode #	**Voltage (V)**	**Current (A)**	**Power (W)**	**Frequency (DC/AC-Hz)**	**Phases (#)**	**Comments**
Rated	3.3 V	-	-	DC	-	Normal operating voltage
1	2.97 V	-	-	DC	-	V_{MIN}
2	3.63 V	-	-	DC	-	V_{MAX}

3.4 Operating Frequencies

Mode #	Frequency tested
1	5.15 ~ 5.25 GHz : 11a/n_HT20 - Low : 5 180 MHz / CH = 36 - Mid : 5 220 MHz / CH = 44 - High : 5 240 MHz / CH= 48
2	5.25 ~ 5.35 GHz : 11n_HT40 - Low : 5 190 MHz / CH = 36 - High : 5 230 MHz / CH= 44
3	5.25 ~ 5.35 GHz : 11a/n_HT20 - Low : 5 260 MHz / CH = 52 - Mid : 5 300 MHz / CH = 60 - High : 5 320 MHz / CH= 64
4	5.25 ~ 5.35 GHz : 11n_HT40 - Low : 5 270 MHz / CH = 52 - High : 5 310 MHz / CH= 60
5	5.47 ~ 5.725 GHz : 11a/n_HT20 - Low : 5 500 MHz / CH = 100 - Mid : 5 580 MHz / CH = 116 - High : 5 700 MHz / CH= 140
6	5.47 GHz ~ 5.725 GHz : 11n_HT40 - Low : 5 510 MHz / CH = 100 - High : 5 670 MHz / CH= 132

3.5 Operation Modes

Mode #	Description
1	Carrier on mode: Signal from the RF module was generated continuously for the representative channels (Low, Mid, High) by the test program incorporated
2	Carrier off (Idle) mode: RF carrier was not activated by the RF module

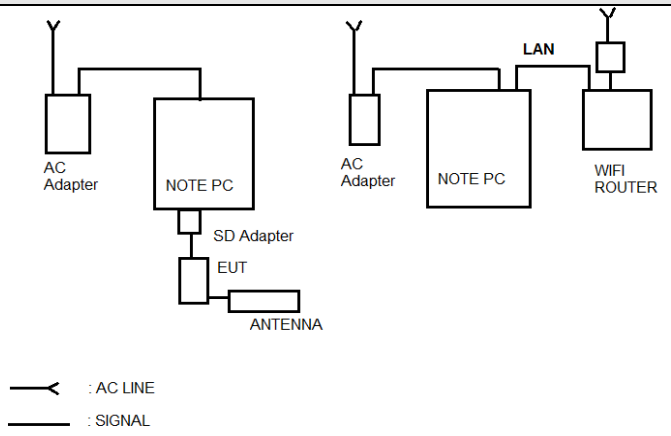
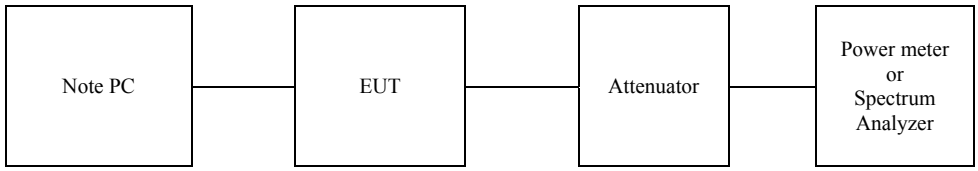
Note :
1. The measurements of the spurious emissions for transmitter on stand-by mode were performed as the receiver spurious emissions.
2. The worst-case condition is determined by the baseline measurement of rf output power out of various modulations and data rates. The worst-case channel was determined as the channel with highest output power. The worst-case data rates in below were used for final measurement.
   - 802.11a mode: 54Mbps
   - 802.11n_HT20 mode: MCS7
   - 802.11n_HT40 mode: MCS7

3.6 Environment Conditions

Parameters	Normal condition	Extreme condition
Temperature	+ 15℃ ~ +35℃	-20℃ / +55℃
Humidity	20% ~ 75%	No excessive condensation occur
Supply voltage	3.3 Vdc (Rated nominal voltage)	2.97 Vdc / 3.63 Vdc

Note ;
- The extreme condition is applied to the boundary limits of the declared operational environmental condition by the manufacturer.
- The operating condition for humidity requirement has not been declared in the manufacturer's specification.
- Test has been carried out for three frequencies specified above under the normal condition and for the extreme condition, minimum and maximum frequencies has been tested.

3.7 Test Configurations

Mode #	Description
1	
2	

3.8 List of Test Equipment

No	Description	Manufacturer	Model	Identifier	Cal. Due
1	Spectrum Analyzer	Agilent	E4407B	US42041281	2012/9/8
2	Signal Analyzer	ROHDE&SCHWARZ	FSV	100939	2013/1/26
3	Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	256663	2013/1/27
4	Attenuator	HP	8491A	54297	2012/12/29
5	Attenuator	HP	8498A	1801A04999	2013/2/23
6	Attenuator	Bird Electronic Corp.	100-SA-MFN-30	0138	2013/6/5
7	Attenuator	SRT	F04-K1830-01	11060801	2013/6/5
8	Power divider	HP	11636B	10211	2012/7/21
9	Power divider	PULSAR	PS4-24-452/10S	0832	2012/7/21
10	LISN	Rohde & Schwarz	ESH3-Z5	836679/025	2012/09/27
11	TEST Receiver	Rohde & Schwarz	ESHS 30	828765/002	2012/12/16
12	Pulse Limiter	Rohde & Schwarz	ESH3Z2	NONE	2013/01/25
13	Logbicon Antenna	SCHWARZBECK	VULB 9168	237	2013/01/20
14	TEST Receiver	Rohde & Schwarz	ESCI7	1166.5950.07	2013/03/28
15	Horn Antenna	SCHWARZBECK	BBHA9120D	469	2012/09/06
16	SPECTRUM ANALYZER	ADVANTEST	R3273	110600592	2013/01/26
17	Amplifier	Agilent	8449B	3008A00581	2013/01/27
18	Pyramidal Horn Antenna	ETS-LINDGREN	3160-09	00102642	2012/09/07

4. Overview of Technical requirements

The following essential requirements and test specifications are relevant to the presumption of conformity FCC Part 15 E Section 15.407			Reported
Reference Clause No.	Essential technical requirements	Test method	
15.407(a)(1) 15.407(a)(2)	Output power	ANSI C63.10-2009 KDB 789033	[X]
15.407(a)(1) 15.407(a)(2)	Peak power spectral density	ANSI C63.10-2009 KDB 789033	[X]
15.407(a)(6)	Peak excursion	ANSI C63.10-2009 KDB 789033	[X]
15.205(a) 15.209(a) 15.407(b)(1) 15.407(b)(2) 15.407(b)(3)	Transmitter radiated spurious emissions and Conducted spurious emission	ANSI C63.4-2009 KDB 789033	[X]
15.207	Transmitter AC power line conducted emission	ANSI C63.4-2009	[X]
15.407(h)	DFS - Channel closing transmission time - Channel move time - Non occupied period	FCC 06-09	[X]

5. Test Results

5.1 26 dB Bandwidth

TEST: 26 dB Bandwidth		
Method	Transmitter rf output is connected to the spectrum analyzer. Under the spectrum analyzer setting condition shown in below, the 26 dB Bandwidth from the EUT were measured according to the KDB 789033. 1. Set RBW: approximately 1% of the emission bandwidth. 2. Set the VBW > 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. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 % Note: The automatic bandwidth measurement capability of a spectrum analyzer may be employed if it implements the functionality described above.	
Reference Clause	For reporting purpose only	
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	36 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz	Antenna port

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	2
Supplementary information: None		

Limits

None; for reporting purpose only

Measurement Result

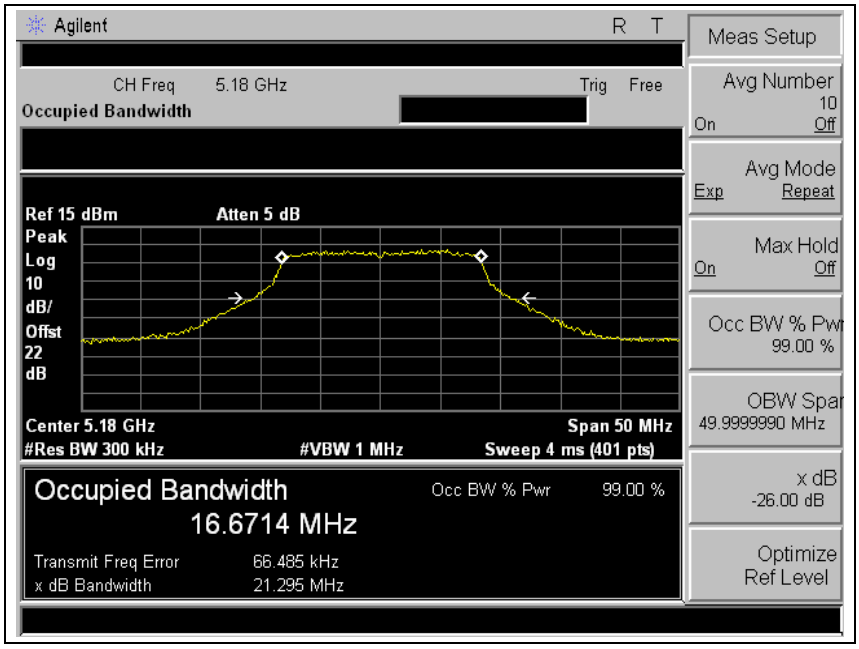
Table 1. Data Table of 26 dB Bandwidth

Operating Mode	Data Rate (Mbps)	Channel	Frequency (MHz)	Result (MHz)
5.2 GHz band 802.11a	54	Low	5180	21.30
		Middle	5220	21.53
		High	5240	21.86
5.2 GHz band 802.11n-HT20	MCS7	Low	5180	22.17
		Middle	5220	21.89
		High	5240	21.88
5.2 GHz band 802.11n-HT40	MCS7	Low	5190	42.57
		High	5230	42.93
5.3 GHz band 802.11a	54	Low	5260	21.28
		Middle	5300	21.14
		High	5320	21.39
5.3 GHz band 802.11n-HT20	MCS7	Low	5260	21.90
		Middle	5300	22.07
		High	5320	22.11
5.3 GHz band 802.11n-HT40	MCS7	Low	5270	42.72
		High	5310	42.88
5.6 GHz band 802.11a	54	Low	5500	21.09
		Middle	5580	21.46
		High	5700	21.59
5.6 GHz band 802.11n-HT20	MCS7	Low	5500	21.86
		Middle	5580	21.72
		High	5700	21.83
5.6 GHz band 802.11n-HT40	MCS7	Low	5510	42.77
		Middle	5550	42.88
		High	5670	42.91

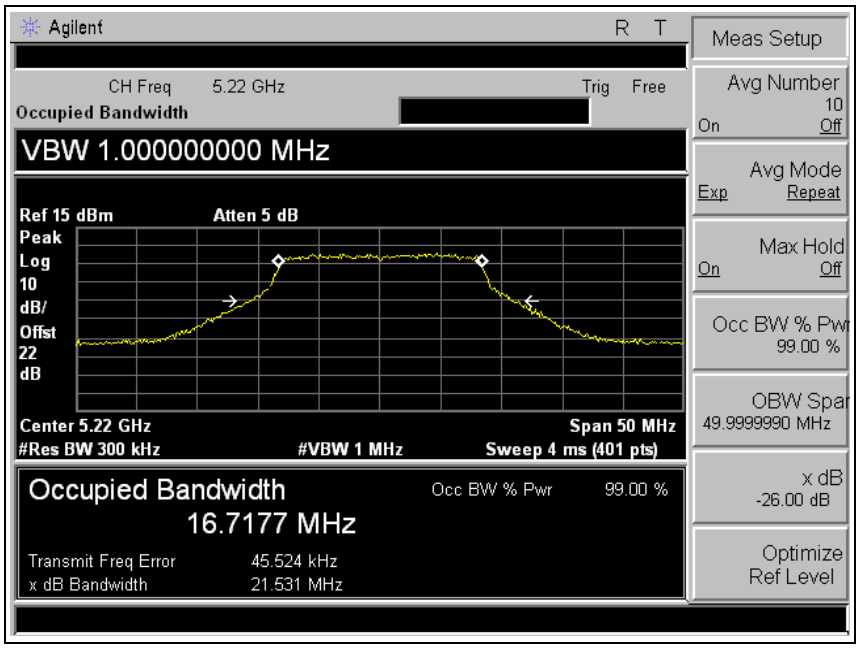
Figure 1. Captured images of 26 dB Bandwidth

802.11a (Non-DFS)

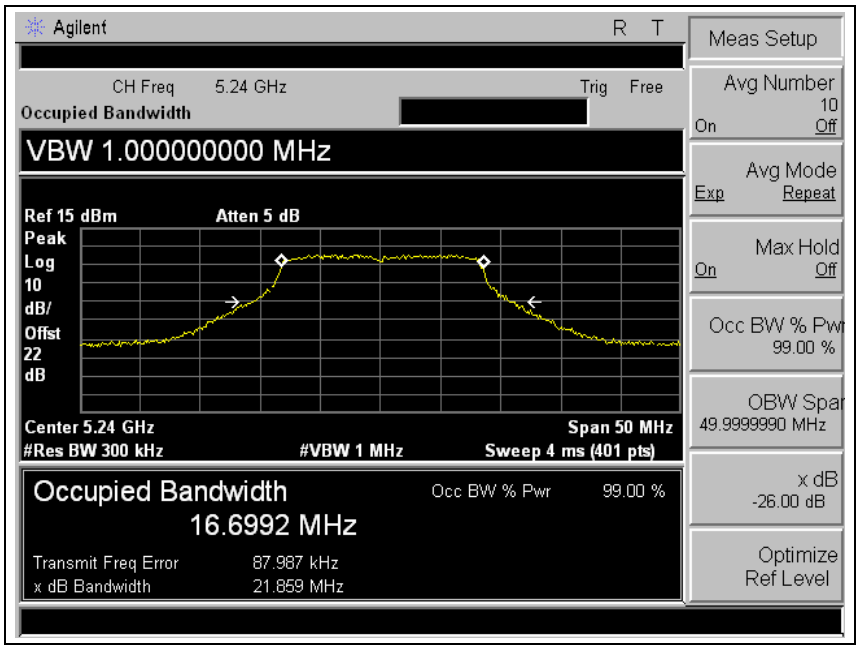
Low Channel (5180 MHz)



Middle Channel (5220 MHz)

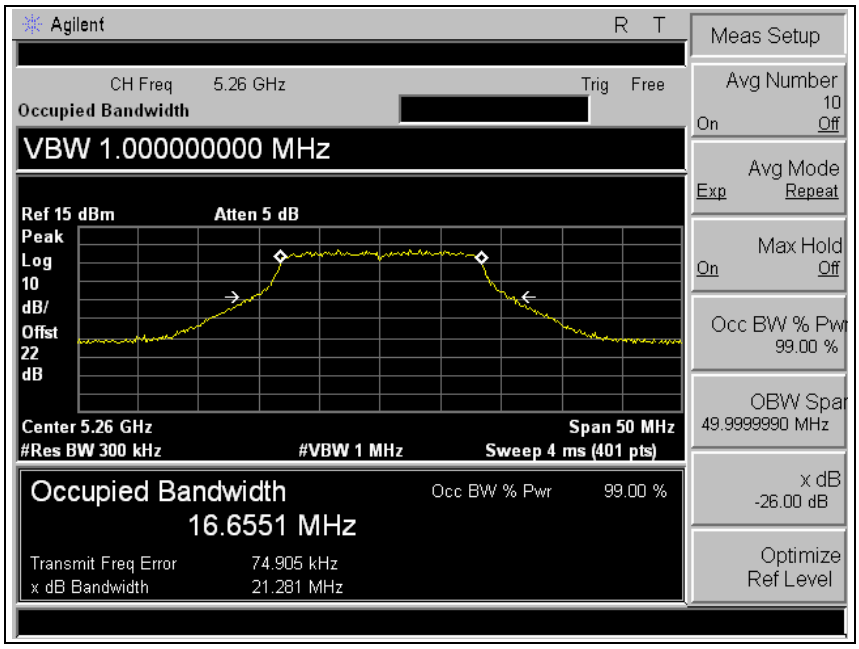


High Channel (5240 MHz)

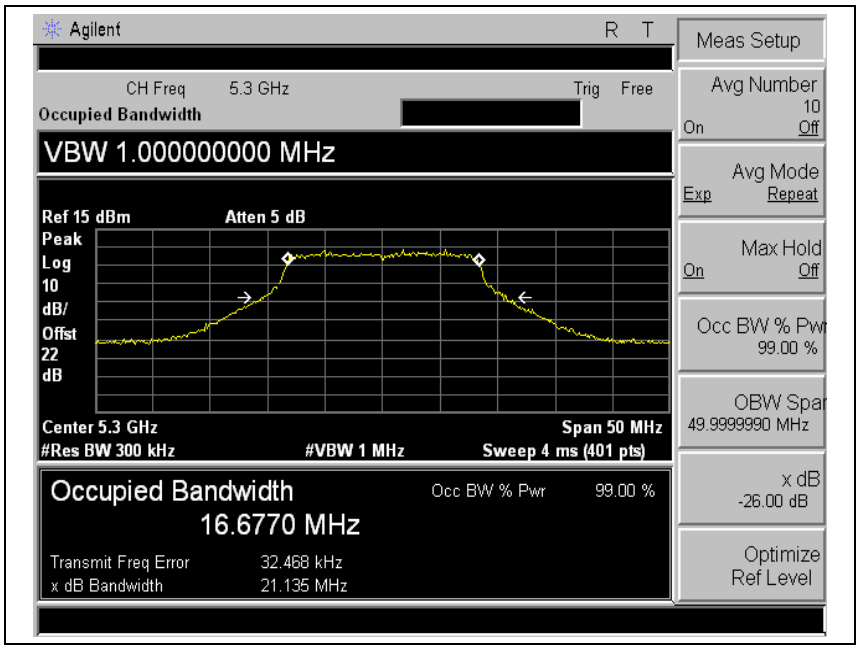


802.11a (DFS)_Lower

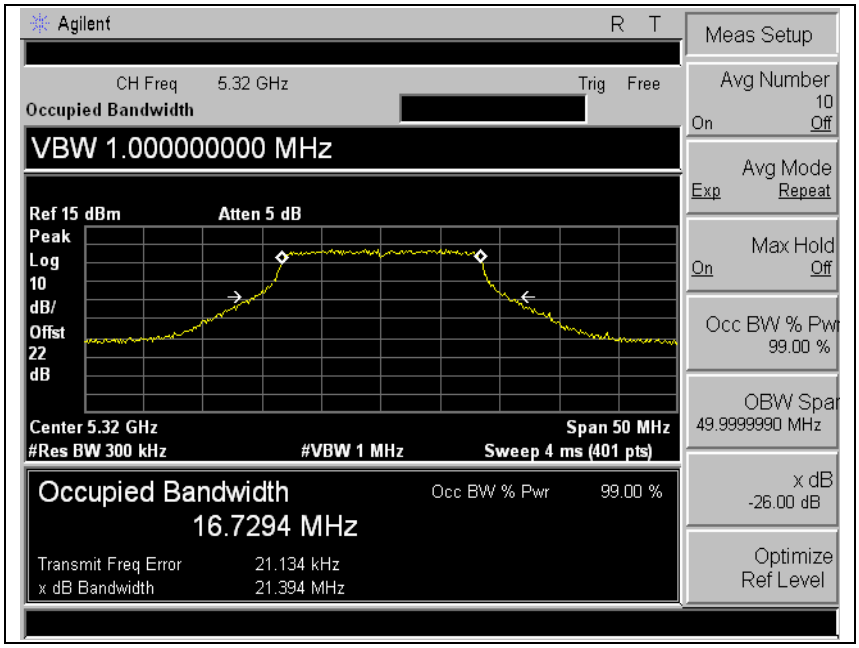
Low Channel (5260 MHz)



Middle Channel (5300 MHz)

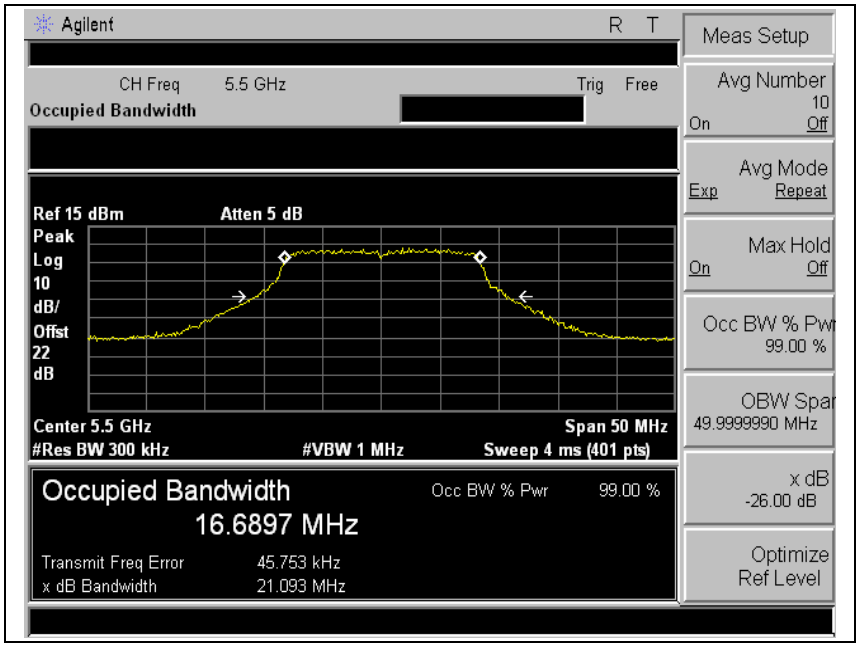


High Channel (5320 MHz)

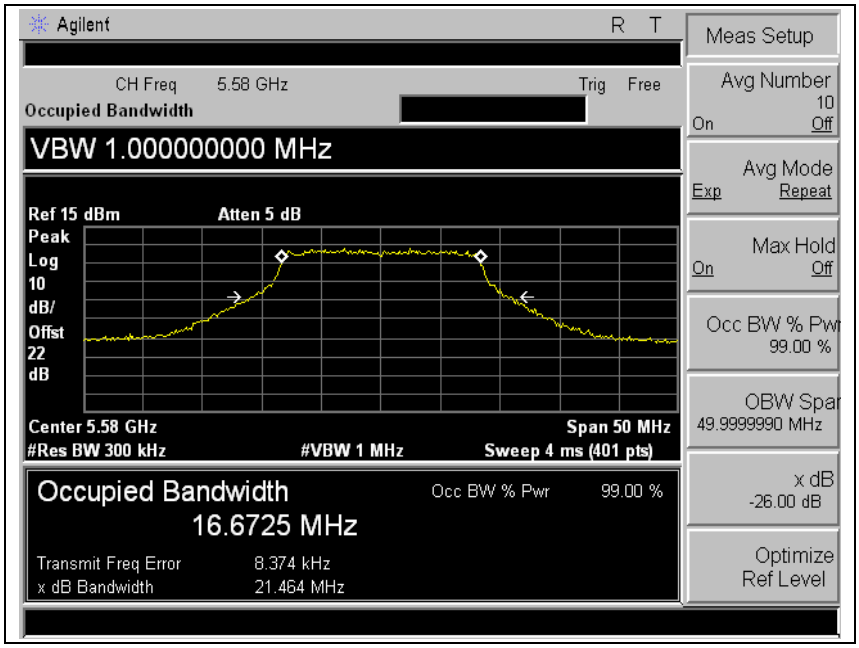


802.11a (DFS)_Upper

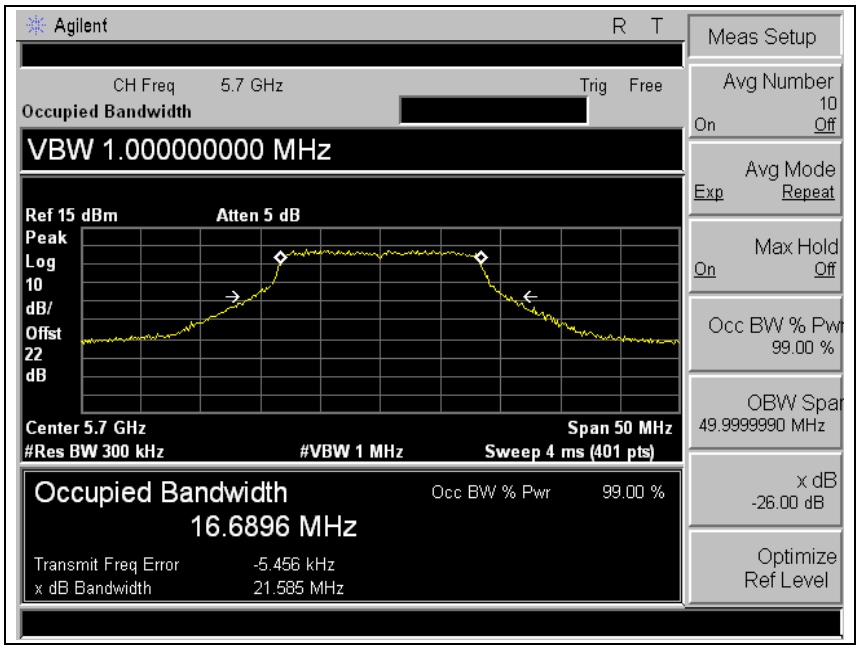
Low Channel (5500 MHz)



Middle Channel (5580 MHz)

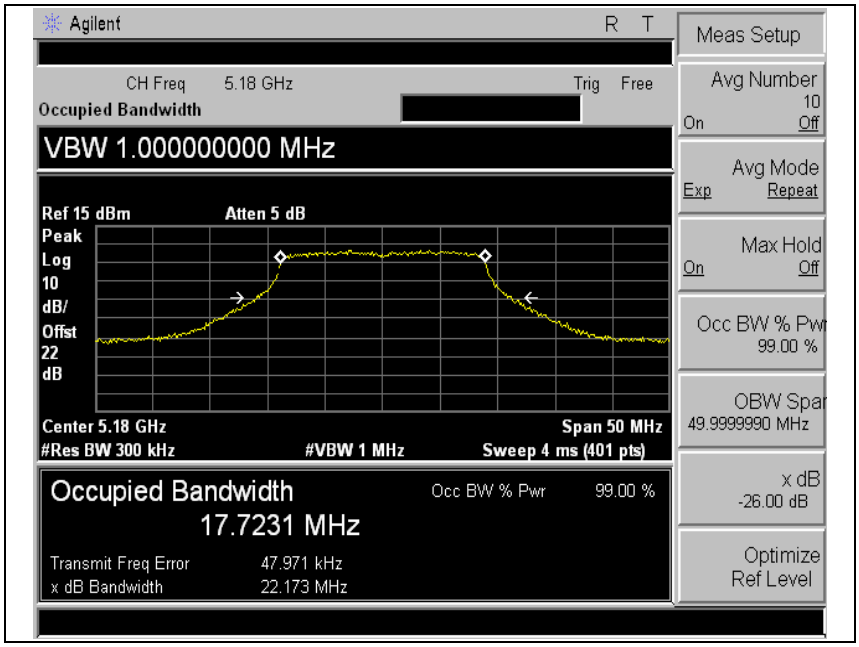


High Channel (5700 MHz)

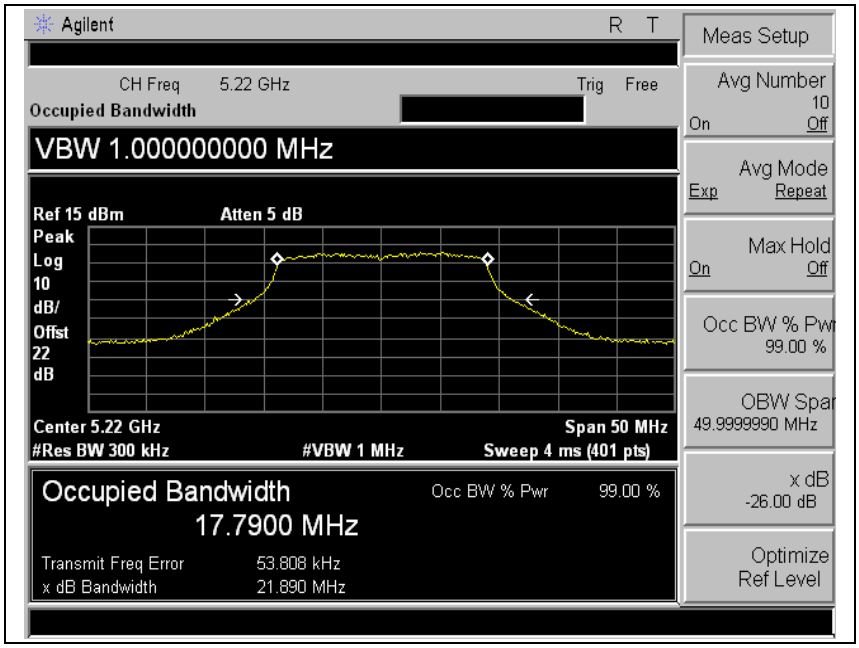


802.11n-HT20 (Non-DFS)

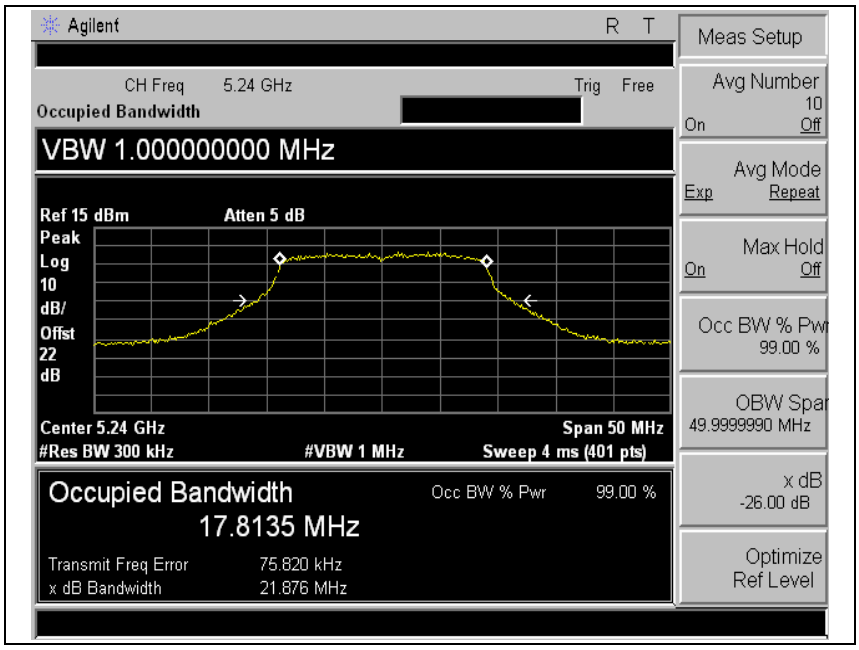
Low Channel (5180 MHz)



Middle Channel (5220 MHz)

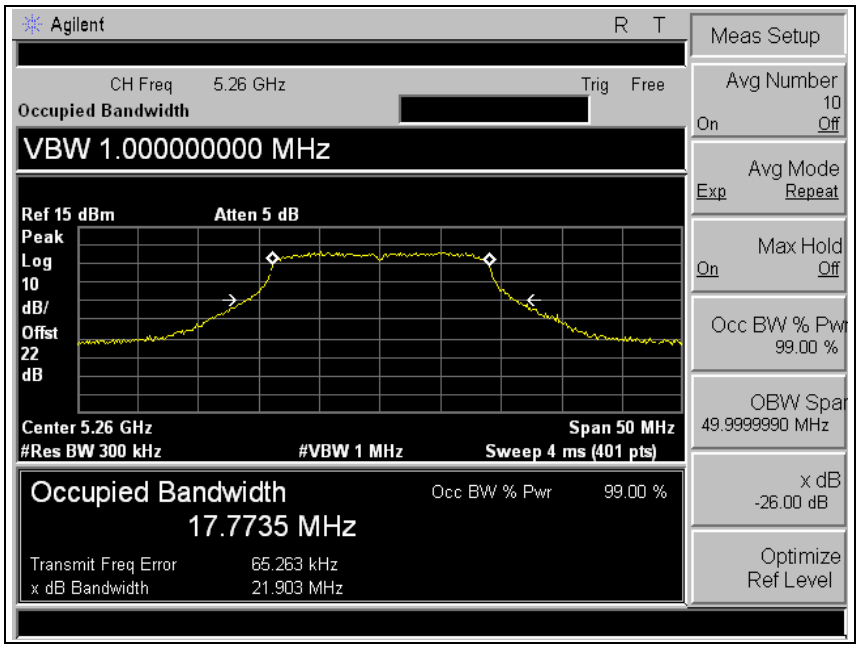


High Channel (5240 MHz)

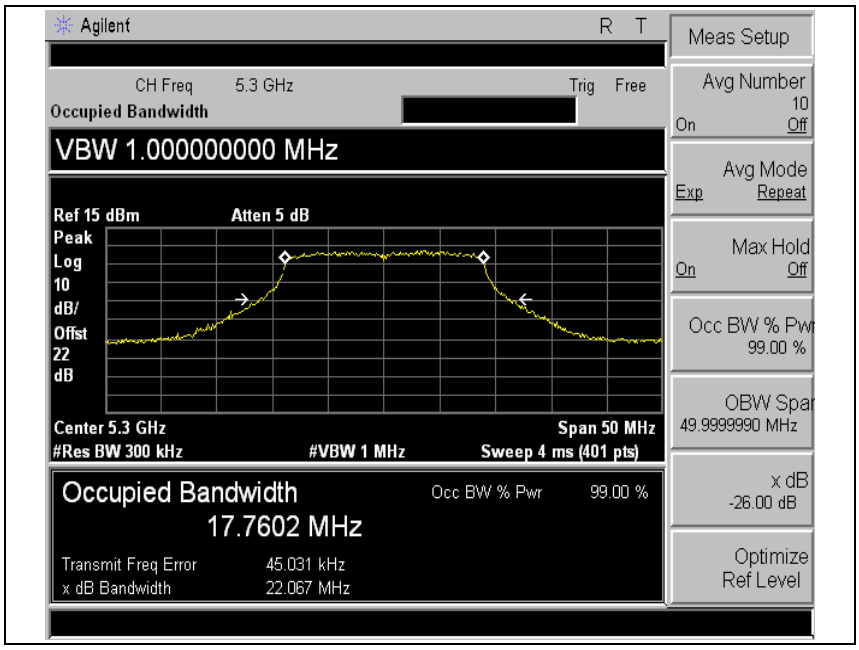


802.11n-HT20 (DFS)_Lower

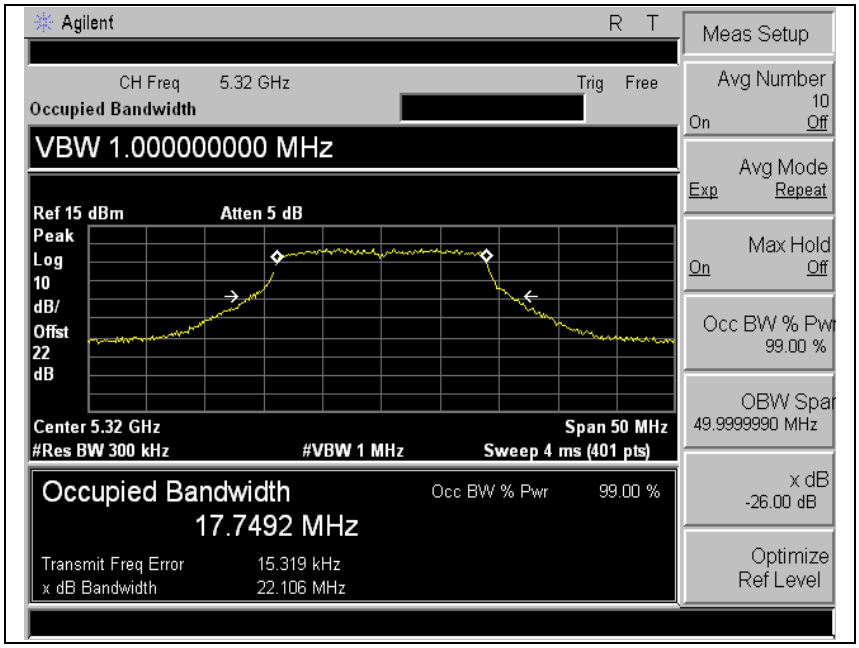
Low Channel (5260 MHz)



Middle Channel (5300 MHz)

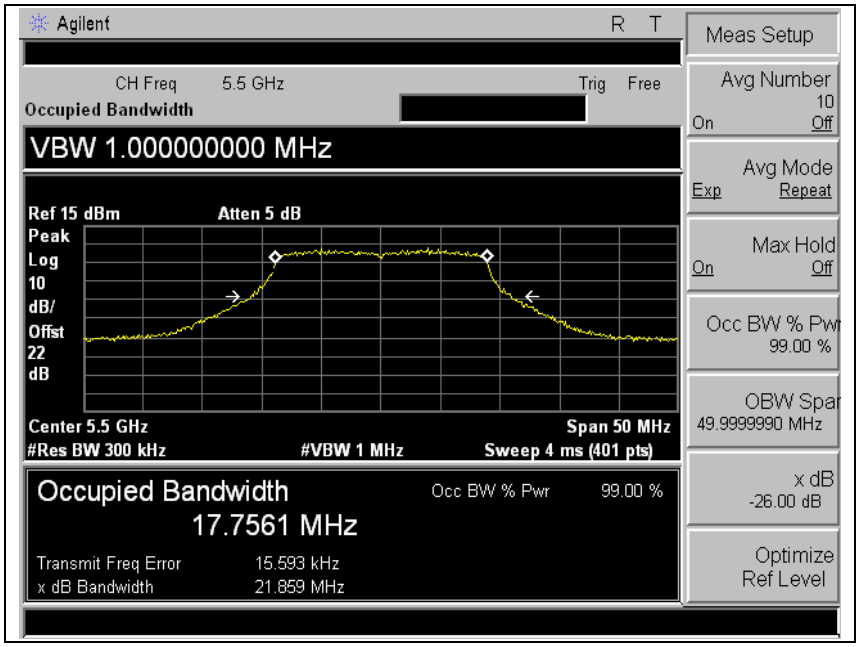


High Channel (5320 MHz)

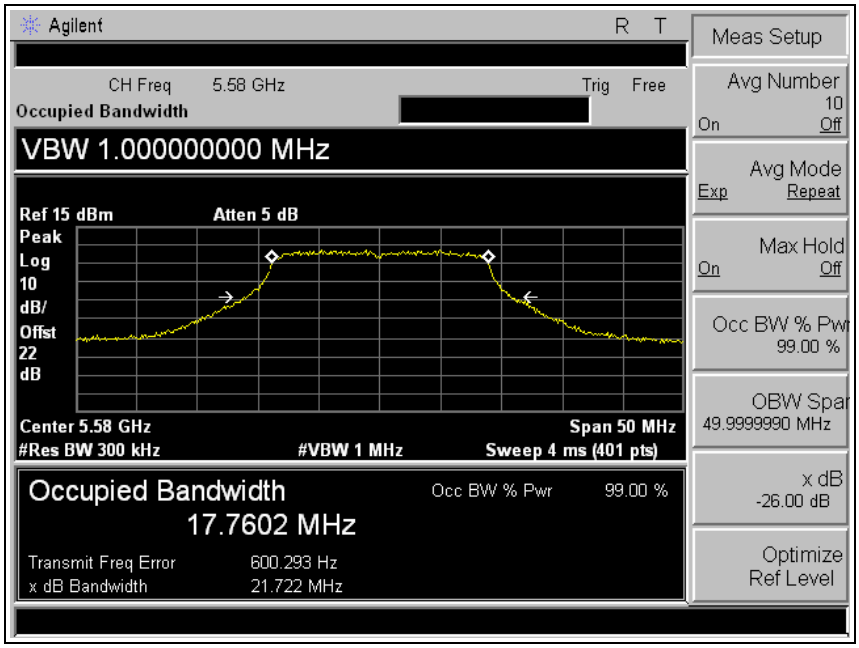


802.11n-HT20 (DFS)_Upper

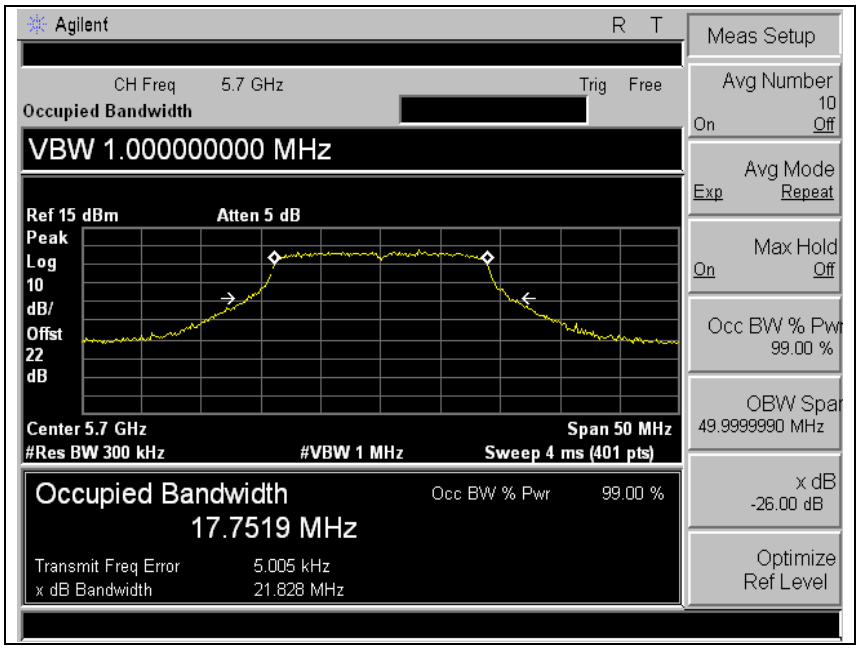
Low Channel (5500 MHz)



Middle Channel (5580 MHz)

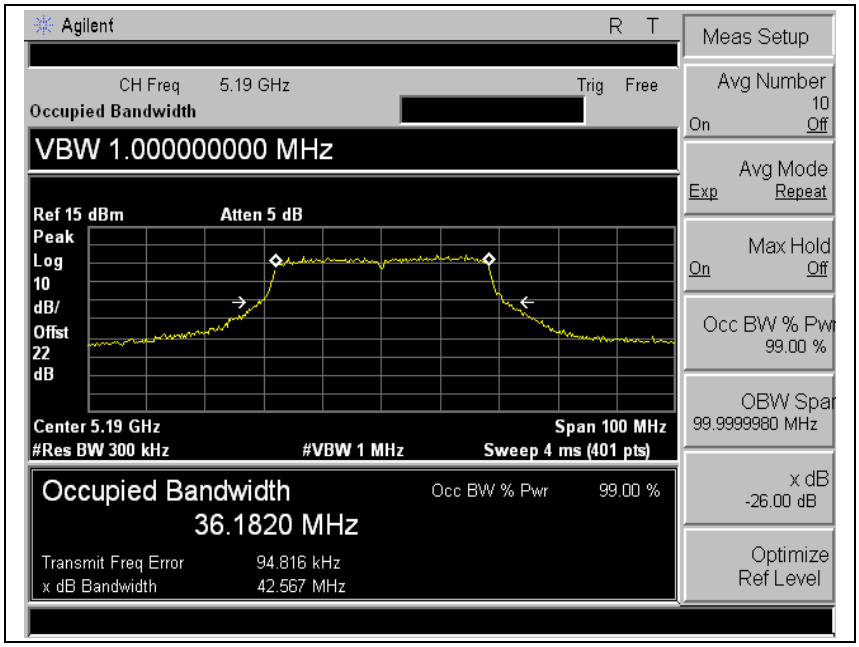


High Channel (5700 MHz)

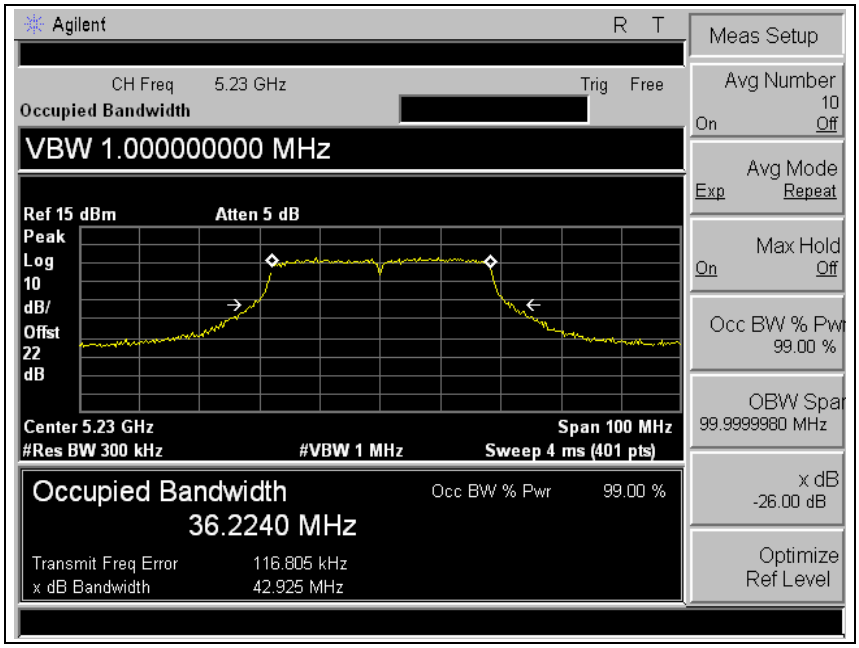


802.11n-HT40 (Non-DFS)

Low Channel (5190 MHz)

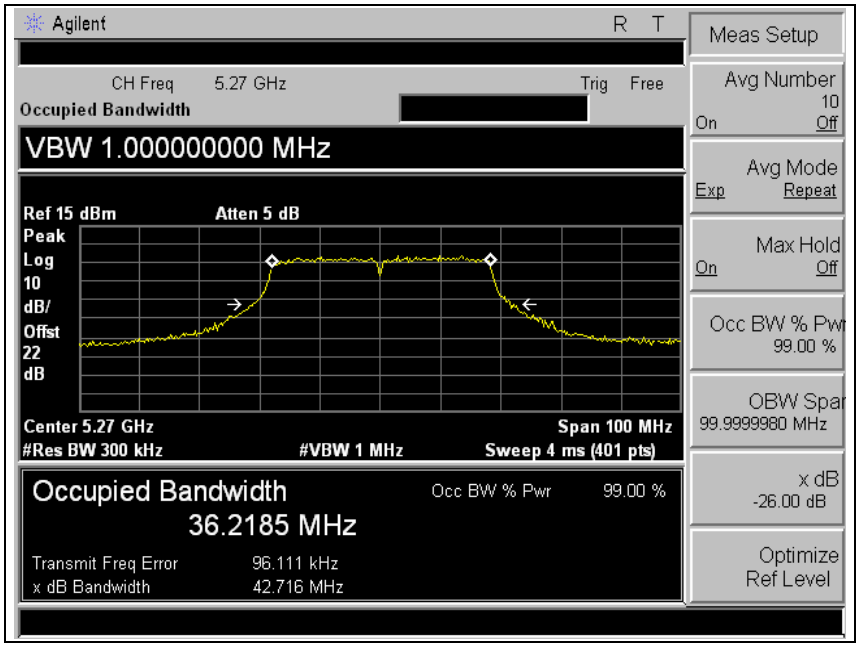


High Channel (5230 MHz)

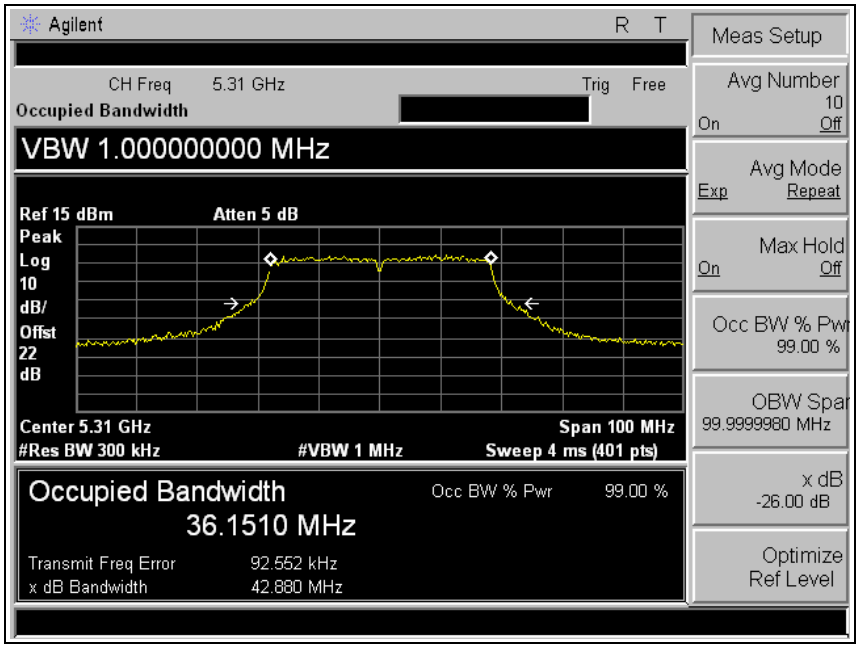


802. 11n-HT40 (DFS)_Lower

Low Channel (5270 MHz)

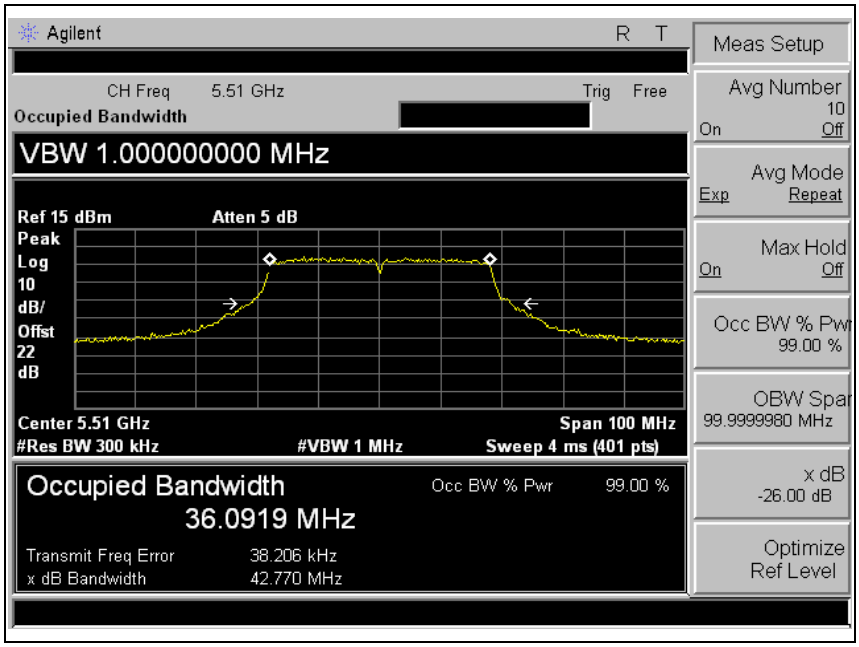


High Channel (5310 MHz)

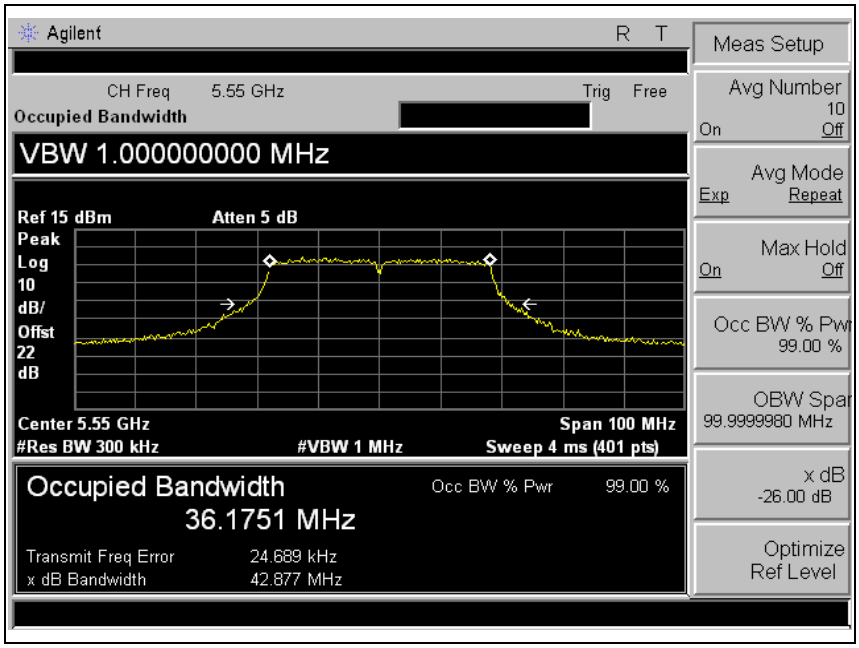


802. 11n-HT40 (DFS)_Upper

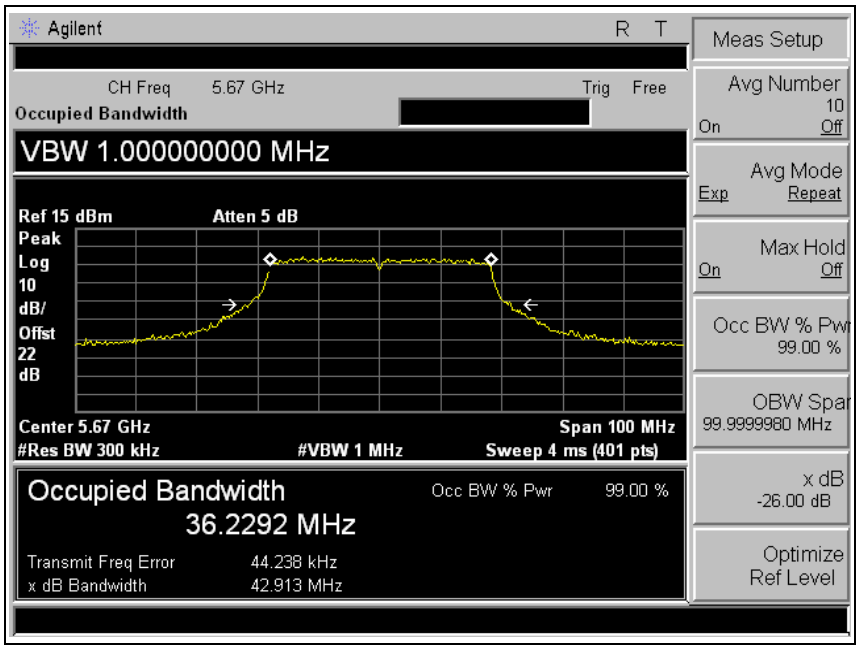
Low Channel (5510 MHz)



Middle Channel (5550 MHz)



High Channel (5670 MHz)



5.2 Output Power

TEST: Output Power			
Method	Output from the EUT were measured according to the dictates in section C 3) f) of KDB 789033 1. Measure the duty cycle, x, of the transmitter output signal 2. Set span to encompass the entire emission bandwidth (EBW) of the signal. 3. Set RBW = 1 MHz. 4. Set VBW ≥ 3 MHz. 5. Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) 6. Manually set sweep time ≥ 10 * (number of points in sweep) * (total on/off period of the transmitted signal). 7. Set detector = RMS. Otherwise, use sample detector mode. 8. Trace mode = max hold 9. Compute power by integrating the spectrum across the 26 dB EBW of the signal using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges. If the spectrum analyzer does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW of the spectrum.		
Reference Clause	Part15 E Section 15.407 (a)		
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C	
	Relative Humidity	36 %	
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz	Antenna port	

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	2
Supplementary information: None		

Limits

(a)(1)
For the 5.15~5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dB m + 10 log B, where B is the 26 dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(a)(2)
For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 MHz emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Table 2. Limit for 5150 ~ 5250 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Fixed Limit (dBm)	26 dB BW (MHz)	4+10LogB (dBm)	Limit (dBm)
11a	5180	54	17	21.30	17.28	17
	5220	54	17	21.53	17.33	17
	5240	54	17	21.86	17.40	17
11n-HT20	5180	MCS7	17	22.17	17.46	17
	5220	MCS7	17	21.89	17.40	17
	5240	MCS7	17	21.88	17.40	17
11n-HT40	5190	MCS7	17	42.57	20.29	17
	5230	MCS7	17	42.93	20.33	17

Table 3. Limit for 5250 ~ 5725 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Fixed Limit (dBm)	26 dB BW (MHz)	11+10LogB (dBm)	Limit (dBm)
11a	5260	54	24	21.28	24.28	24
	5300	54	24	21.14	24.25	24
	5320	54	24	21.39	24.30	24
	5500	54	24	21.09	24.24	24
	5580	54	24	21.46	24.32	24
	5700	54	24	21.59	24.34	24
11n-HT20	5260	MCS7	24	21.90	24.40	24
	5300	MCS7	24	22.07	24.44	24
	5320	MCS7	24	22.11	24.45	24
	5500	MCS7	24	21.86	24.40	24
	5580	MCS7	24	21.72	24.37	24
	5700	MCS7	24	21.83	24.39	24
11n-HT40	5270	MCS7	24	42.72	27.31	24
	5310	MCS7	24	42.88	27.32	24
	5510	MCS7	24	42.77	27.31	24
	5550	MCS7	24	42.88	27.32	24
	5670	MCS7	24	42.91	27.33	24

Table 4. Output Power for 5150 ~ 5250 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Result (dBm)	Limit (dBm)
11a	5180	54	14.36	17
	5220	54	13.93	17
	5240	54	13.85	17
11n-HT20	5180	MCS7	14.87	17
	5220	MCS7	13.89	17
	5240	MCS7	13.85	17
11n-HT40	5190	MCS7	15.02	17
	5230	MCS7	15.11	17

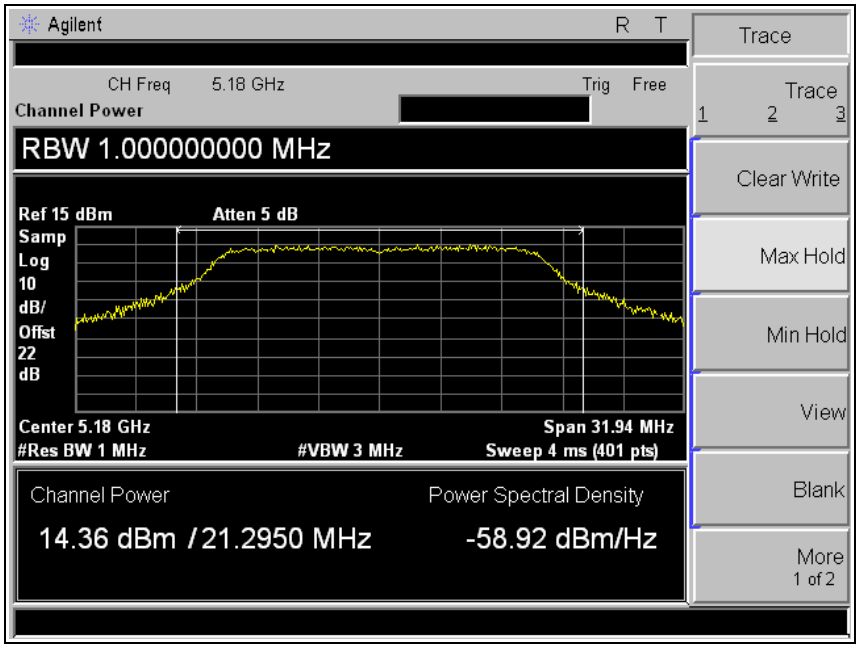
Table 5. Output Power for 5250 ~ 5725 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Result (dBm)	Limit (dBm)
11a	5260	54	14.44	24
	5300	54	14.99	24
	5320	54	14.97	24
	5500	54	14.78	24
	5580	54	14.93	24
	5700	54	15.02	24
11n-HT20	5260	MCS7	14.13	24
	5300	MCS7	14.72	24
	5320	MCS7	14.90	24
	5500	MCS7	14.74	24
	5580	MCS7	14.98	24
	5700	MCS7	15.11	24
11n-HT40	5270	MCS7	15.05	24
	5310	MCS7	15.58	24
	5510	MCS7	14.98	24
	5550	MCS7	15.03	24
	5670	MCS7	15.10	24

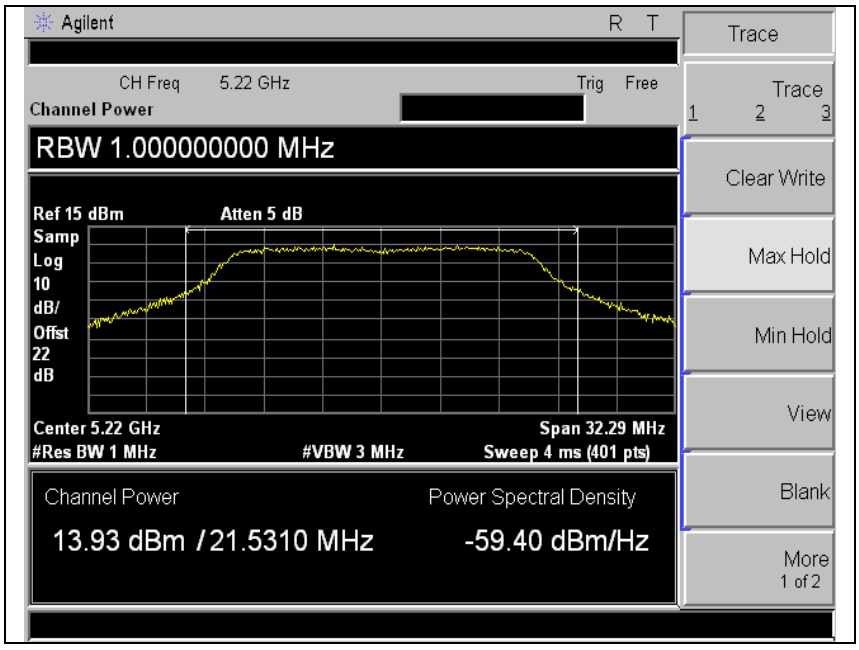
Figure 2. Captured images of Output Power

802.11a (Non-DFS)

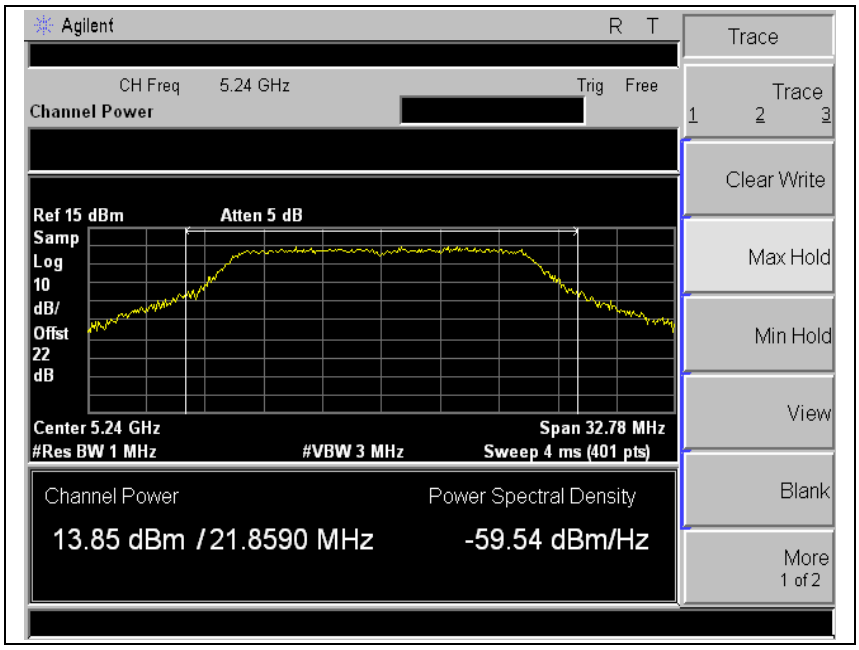
Low Channel (5180 MHz)



Middle Channel (5220 MHz)

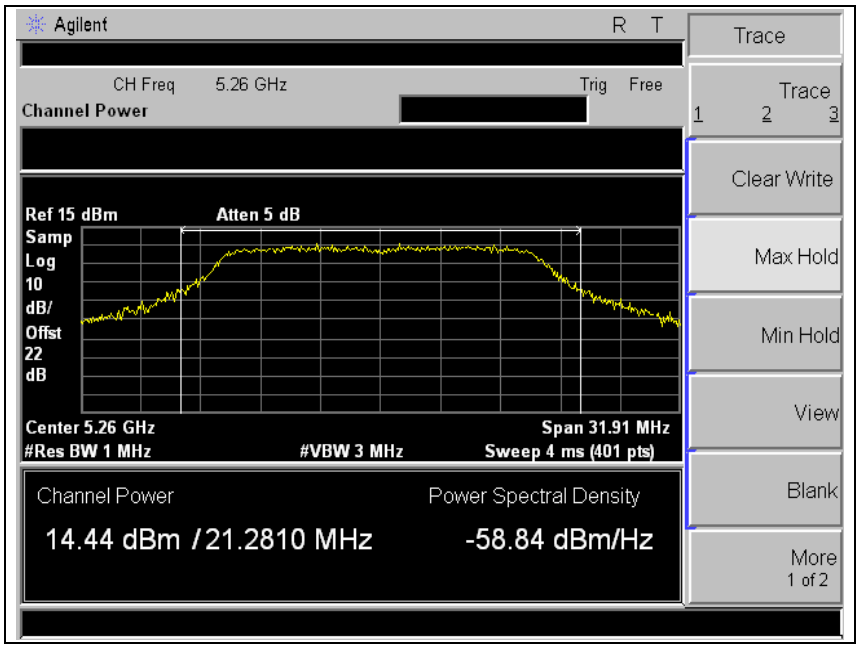


High Channel (5240 MHz)

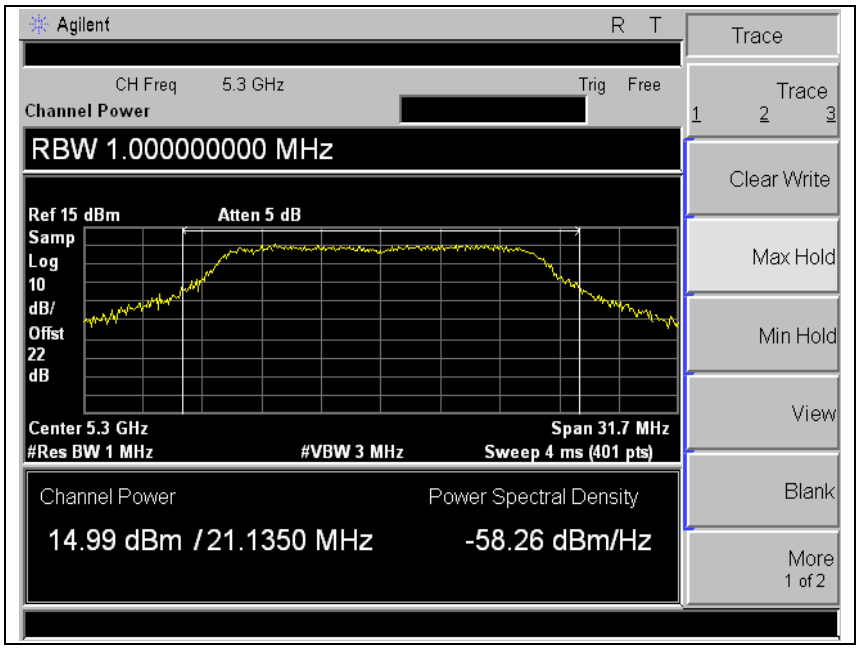


802.11a (DFS)_Lower

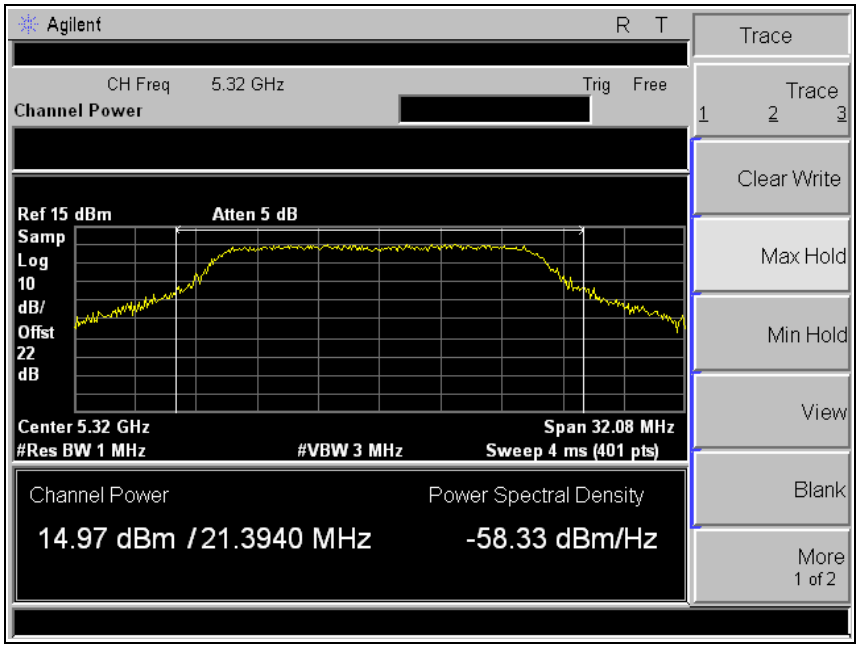
Low Channel (5260 MHz)



Middle Channel (5300 MHz)

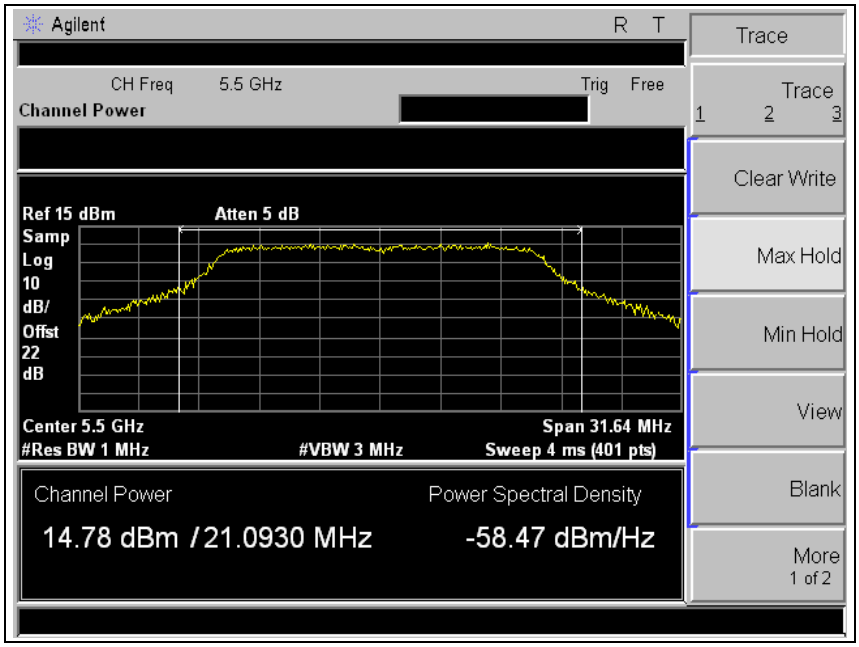


High Channel (5320 MHz)

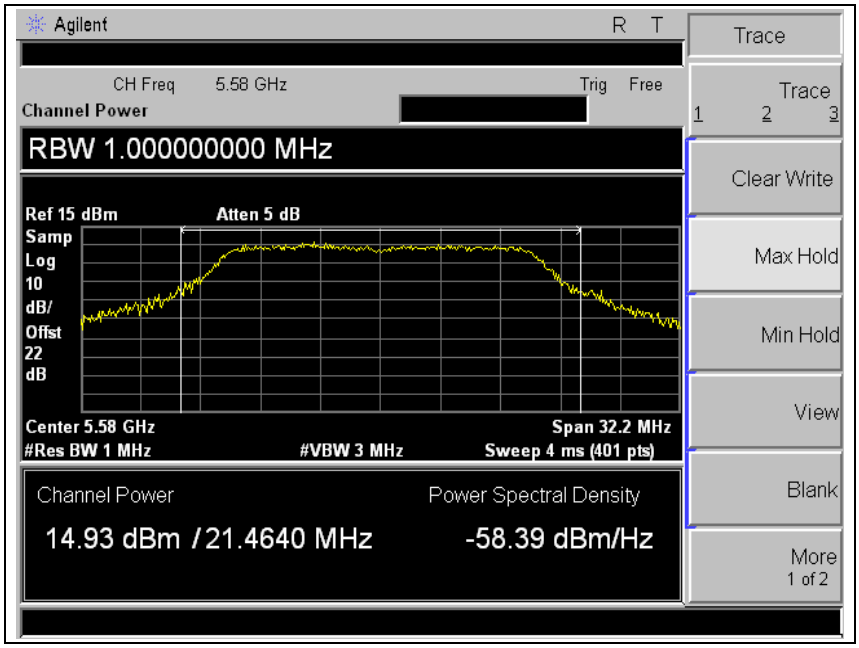


802.11a (DFS)_Upper

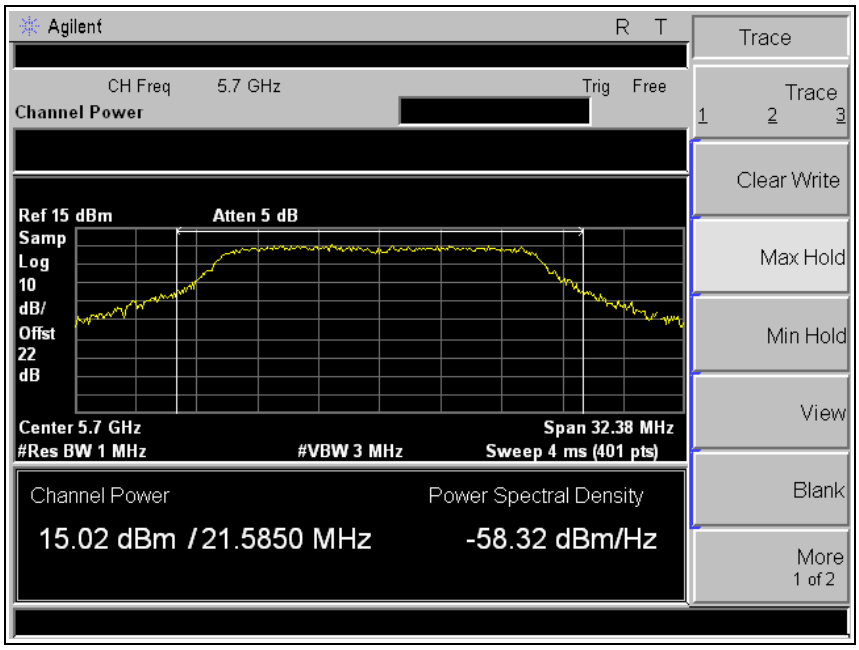
Low Channel (5500 MHz)



Middle Channel (5580 MHz)

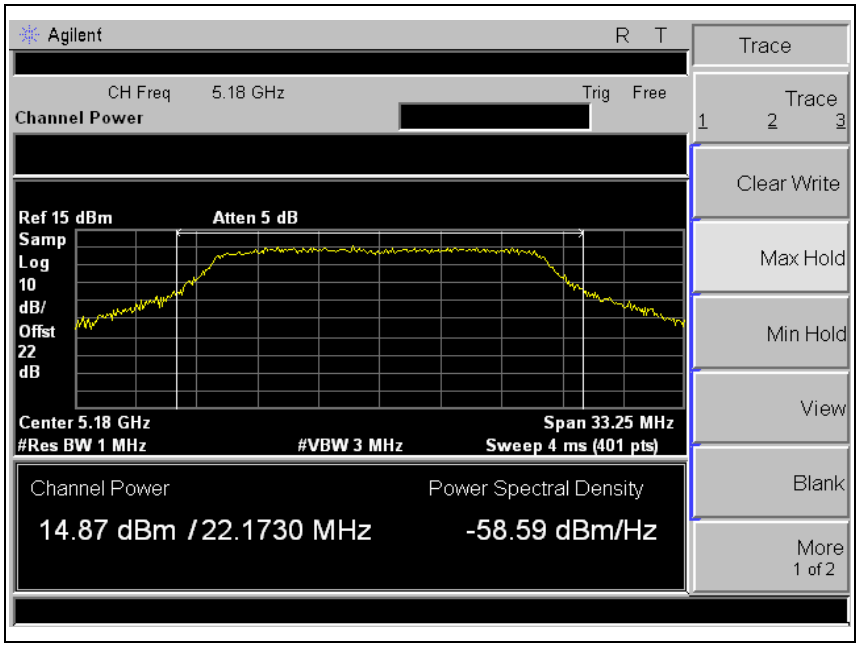


High Channel (5700 MHz)

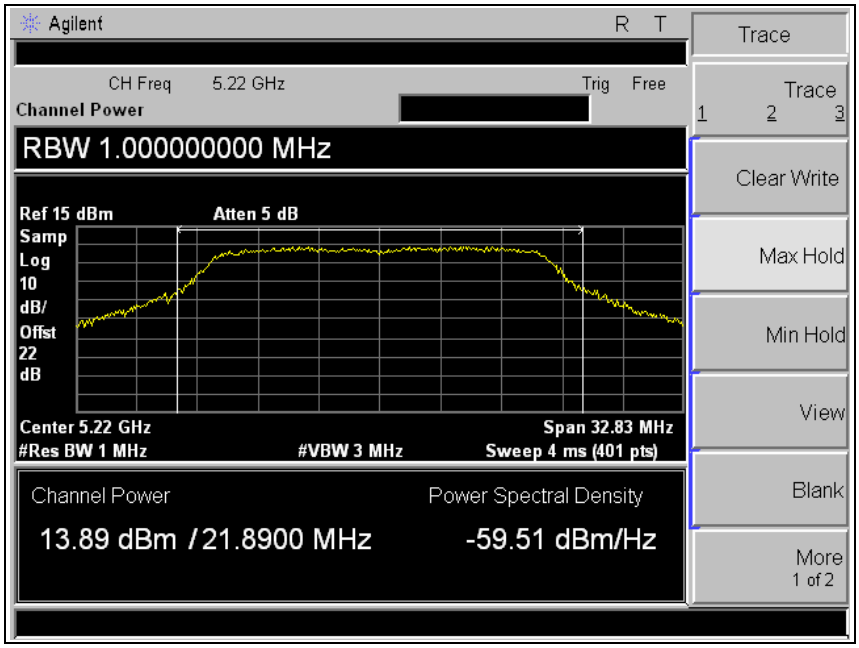


802.11n-HT20 (Non-DFS)

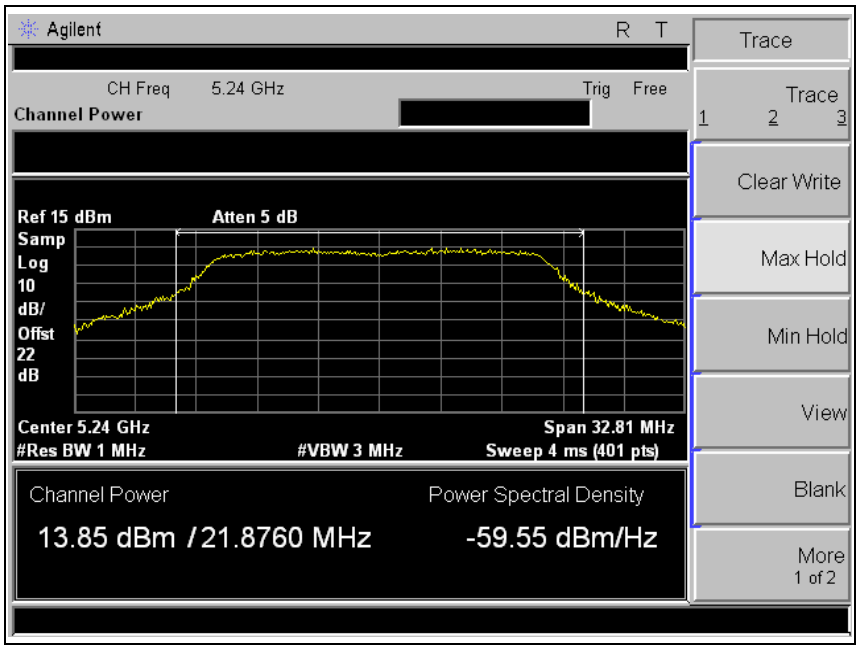
Low Channel (5180 MHz)



Middle Channel (5220 MHz)

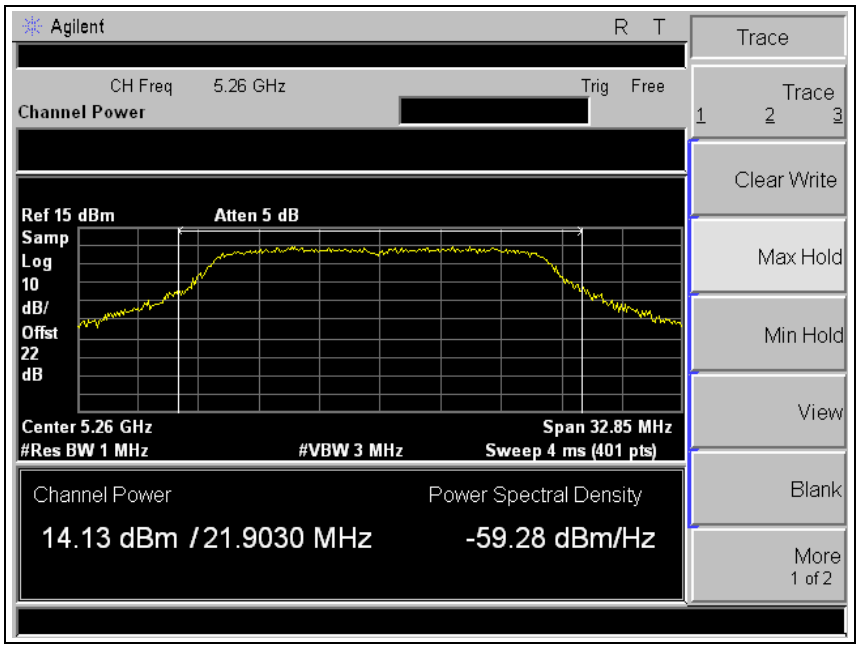


High Channel (5240 MHz)

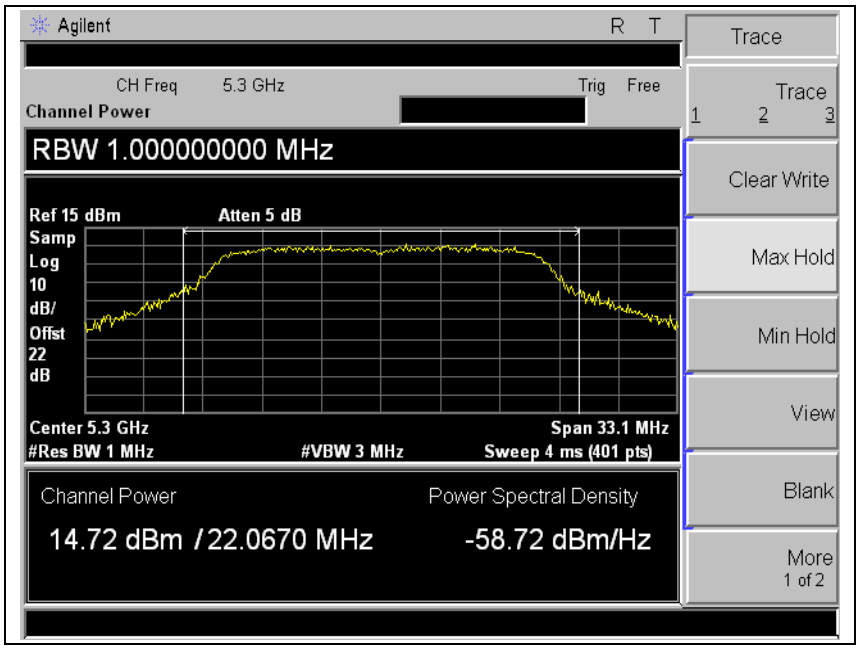


802.11n-HT20 (DFS)_Lower

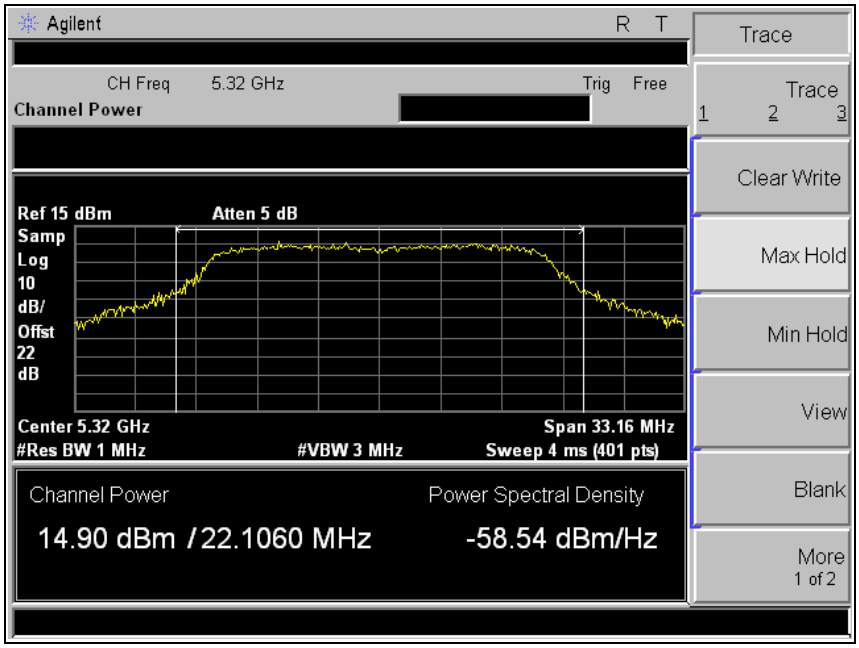
Low Channel (5260 MHz)



Middle Channel (5300 MHz)

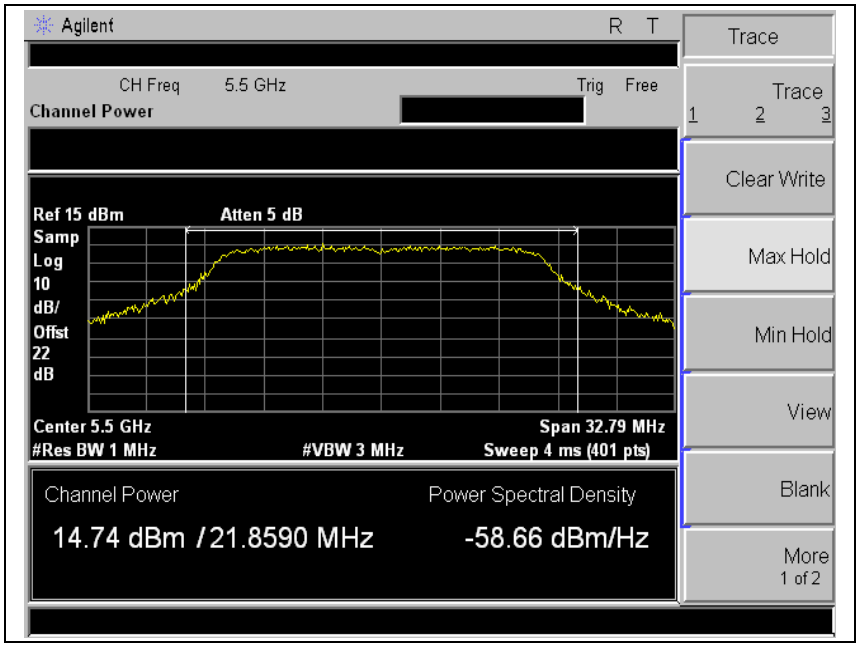


High Channel (5320 MHz)

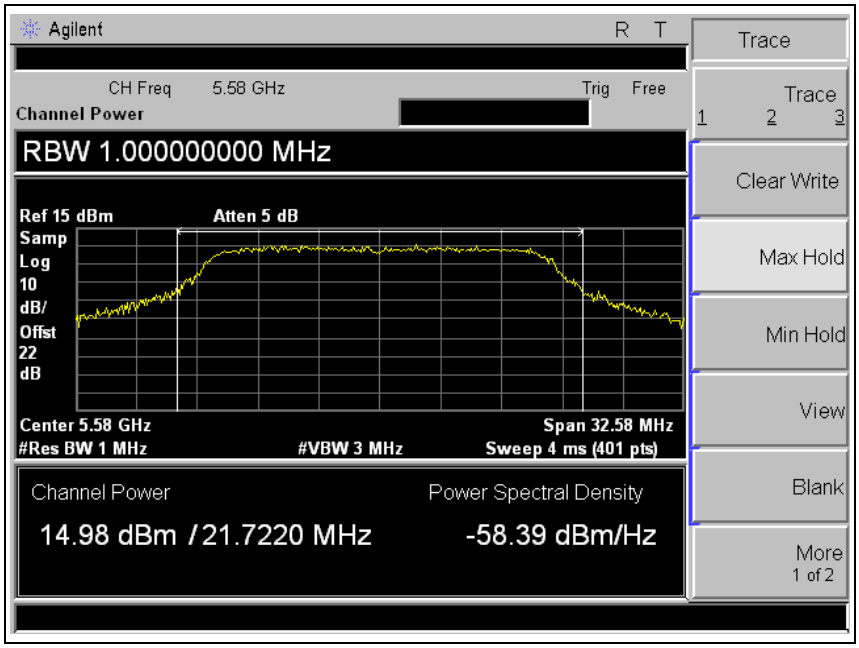


802.11n-HT20 (DFS)_Upper

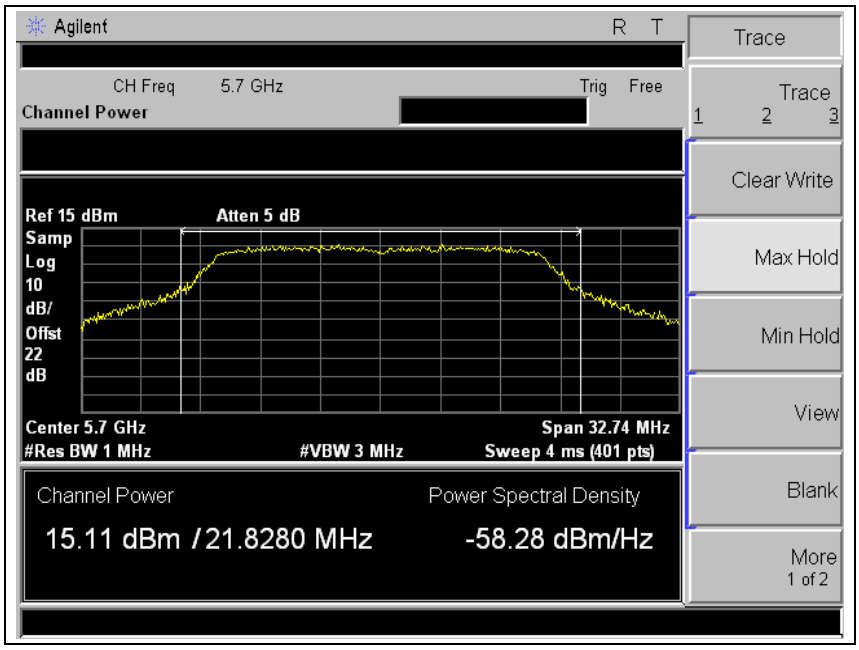
Low Channel (5500 MHz)



Middle Channel (5580 MHz)

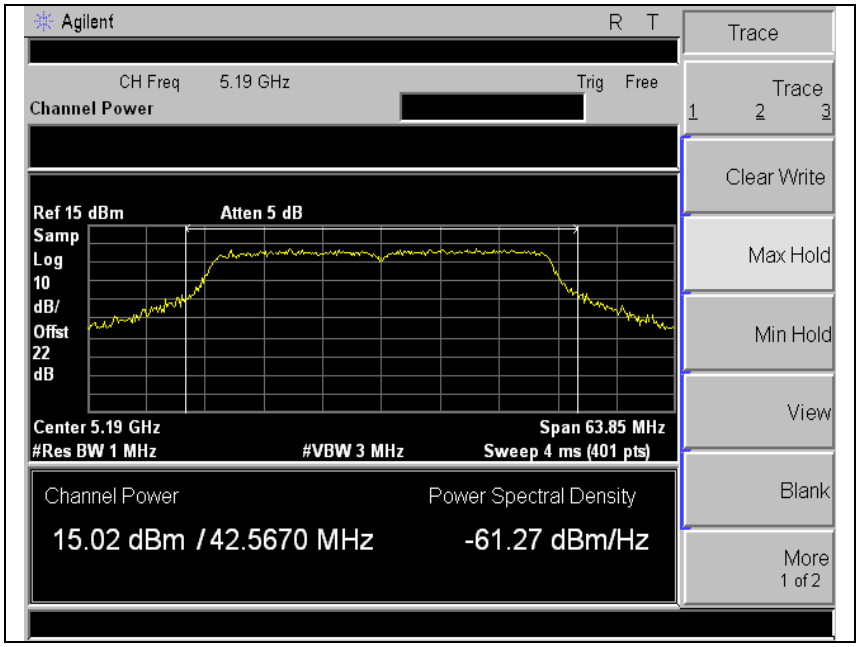


High Channel (5700 MHz)

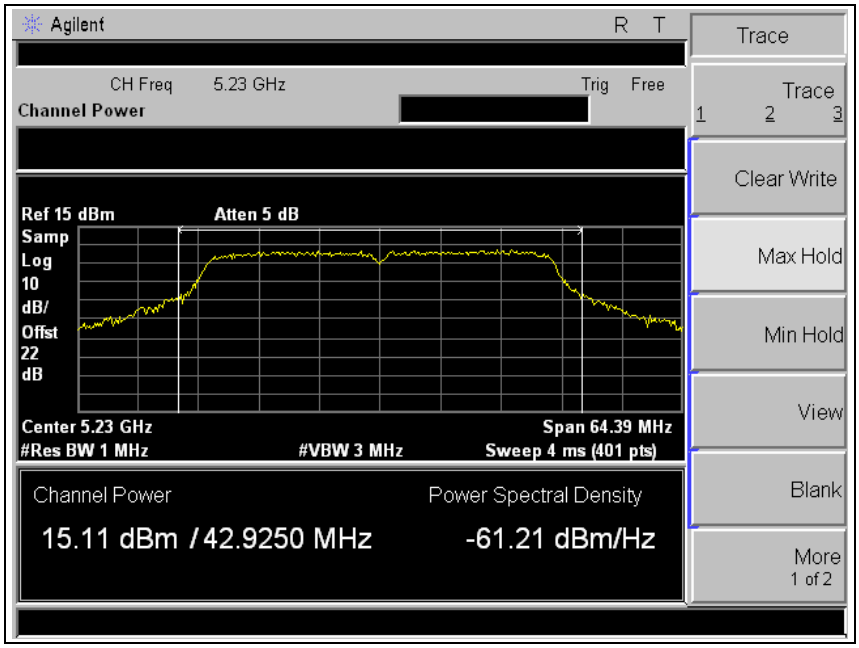


802.11n-HT40 (Non-DFS)

Low Channel (5190 MHz)

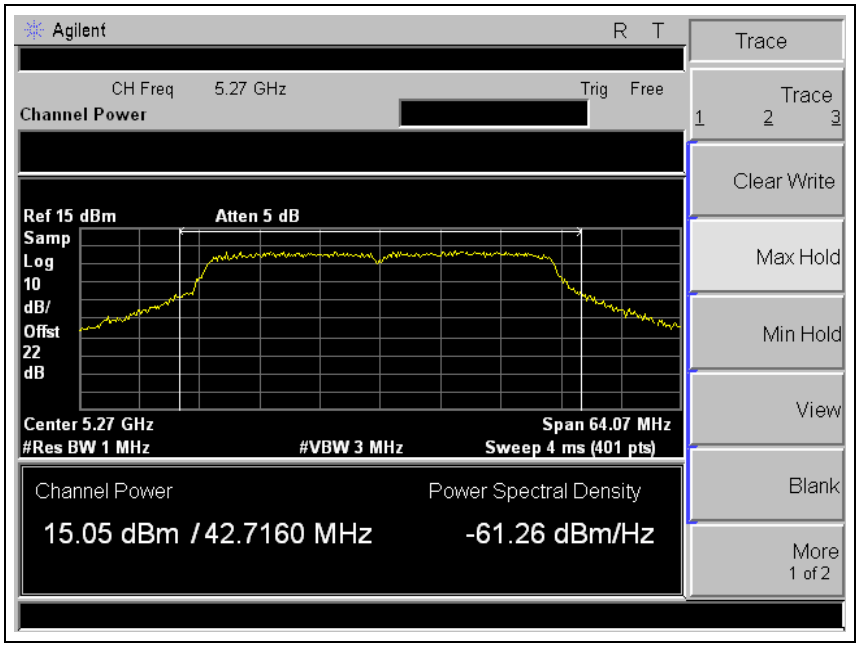


High Channel (5230 MHz)

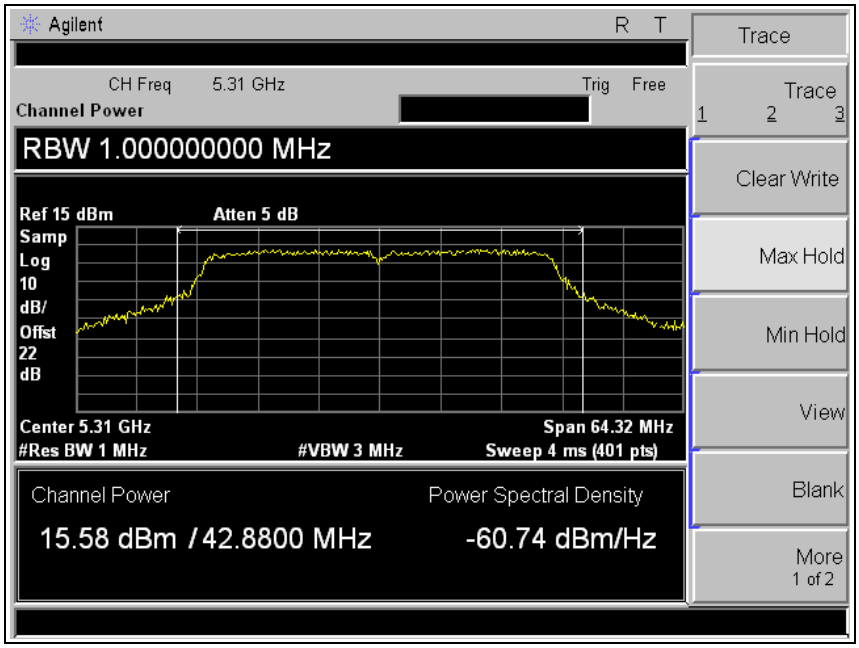


802. 11n-HT40 (DFS)_Lower

Low Channel (5270 MHz)

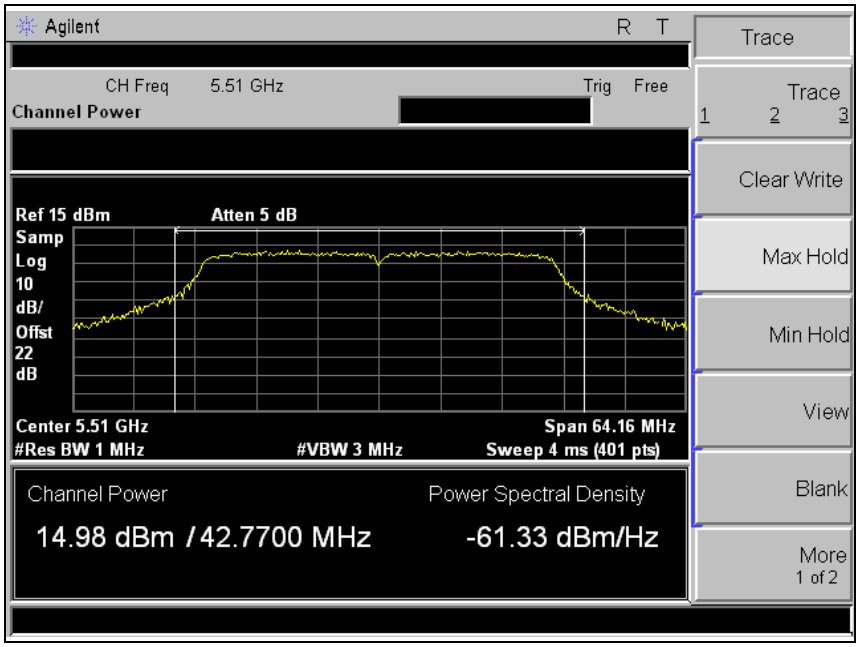


High Channel (5310 MHz)

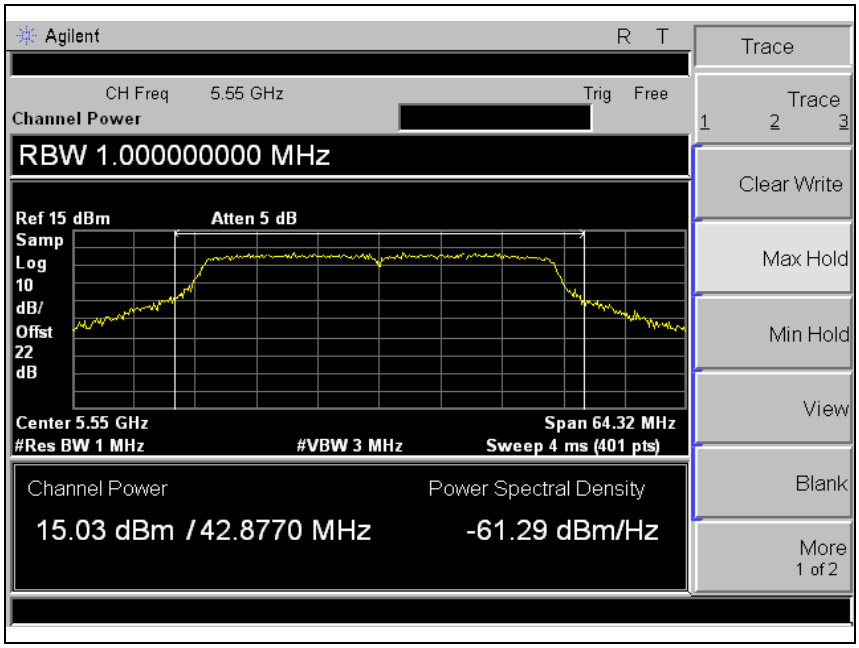


802. 11n-HT40 (DFS)_Upper

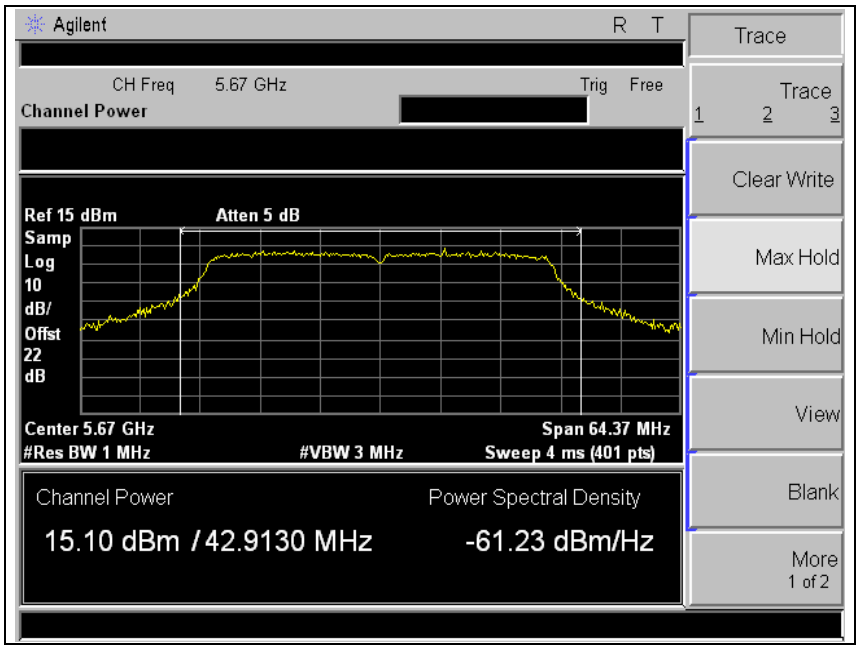
Low Channel (5510 MHz)



Middle Channel (5550 MHz)



High Channel (5670 MHz)



5.3 Peak Power Spectral Density

TEST: Peak Power Spectral Density			
Method	Output from the EUT were measured according to the dictates in section E) of KDB 789033 1. Measure the duty cycle, x, of the transmitter output signal 2. Set span to encompass the entire emission bandwidth (EBW) of the signal. 3. Set RBW = 1 MHz. 4. Set VBW ≥ 3 MHz. 5. Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) 6. Manually set sweep time ≥ 10 * (number of points in sweep) * (total on/off period of the transmitted signal). 7. Set detector = RMS. 8. Trace mode = max hold.		
Reference Clause		Part15 E Section 15.407 (a)	
Parameters recorded during the test		Laboratory Ambient Temperature	22 °C
		Relative Humidity	36 %
		Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range		5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz	Antenna port

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	2
Supplementary information: None		

Limits

(a)(1)
For the band 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(a)(2)
For the band 5.25-5.35 GHz and 5.47-5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Table 6. Data Table for 5150 ~ 5250 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Result (dBm)	Limit (dBm)
11a	5180	54	3.30	4
	5220	54	2.44	
	5240	54	3.54	
11n-HT20	5180	MCS7	2.79	
	5220	MCS7	2.42	
	5240	MCS7	2.05	
11n-HT40	5190	MCS7	-0.33	
	5230	MCS7	0.26	

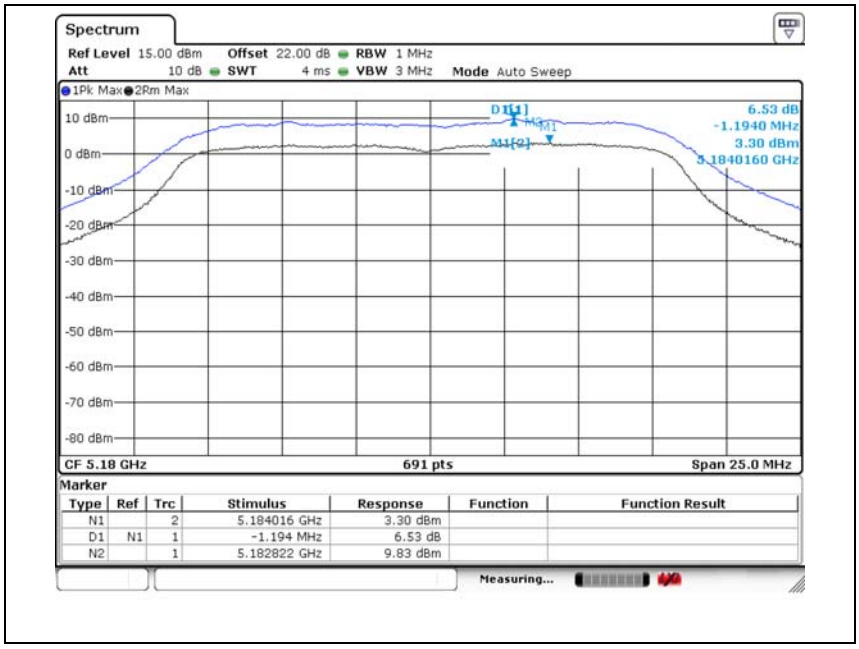
Table 7. Data Table for 5250 ~ 5725 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Result (dBm)	Limit (dBm)
11a	5260	54	2.26	11
	5300	54	3.22	
	5320	54	3.19	
	5500	54	2.51	
	5580	54	2.73	
	5700	54	2.05	
11n-HT20	5260	MCS7	1.91	
	5300	MCS7	2.38	
	5320	MCS7	1.97	
	5500	MCS7	2.08	
	5580	MCS7	2.32	
	5700	MCS7	2.01	
11n-HT40	5270	MCS7	-0.99	
	5310	MCS7	0.22	
	5510	MCS7	-1.51	
	5550	MCS7	-1.96	
	5670	MCS7	-1.87	

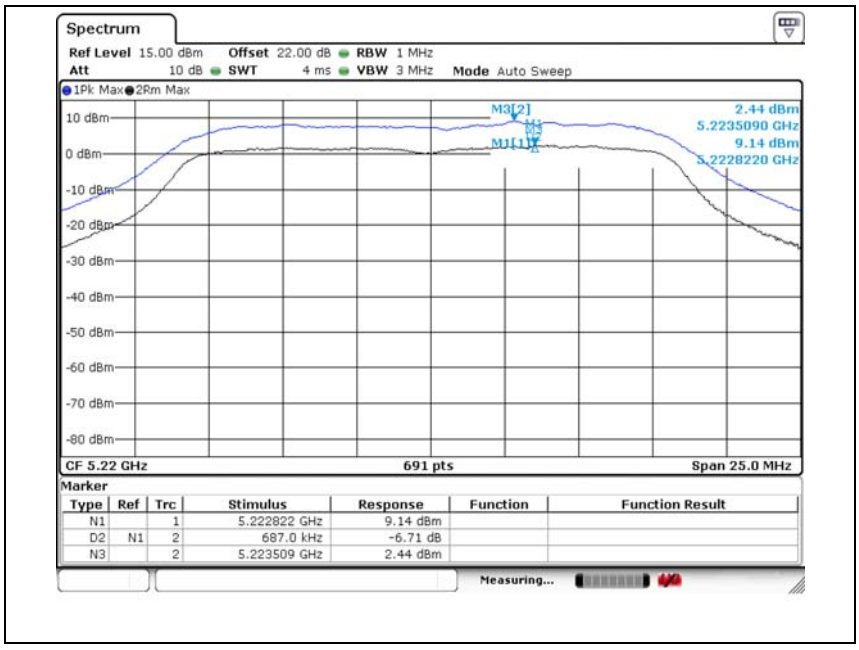
Figure 3. Captured images of Peak Power Spectral Density

802.11a (Non-DFS)

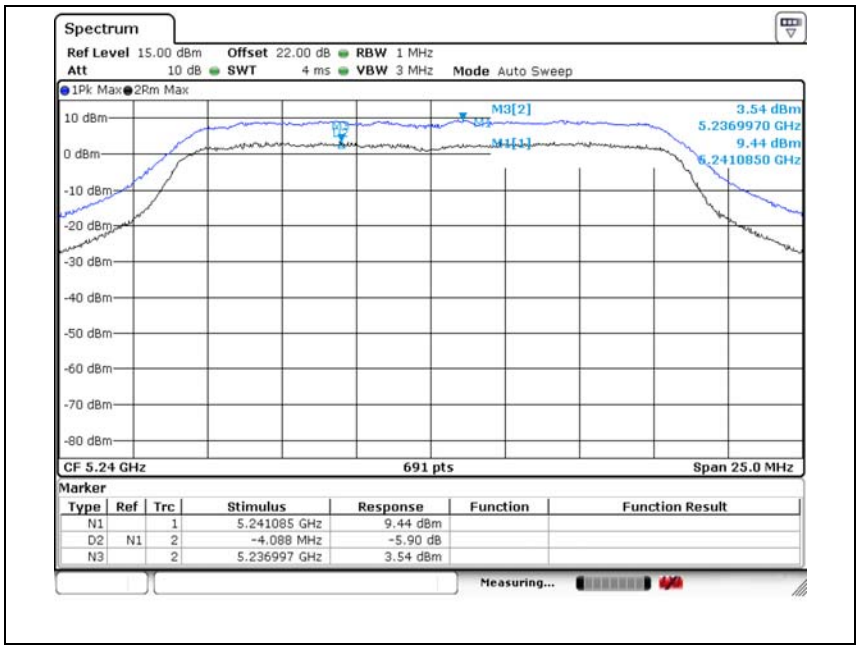
Low Channel (5180 MHz)



Middle Channel (5220 MHz)

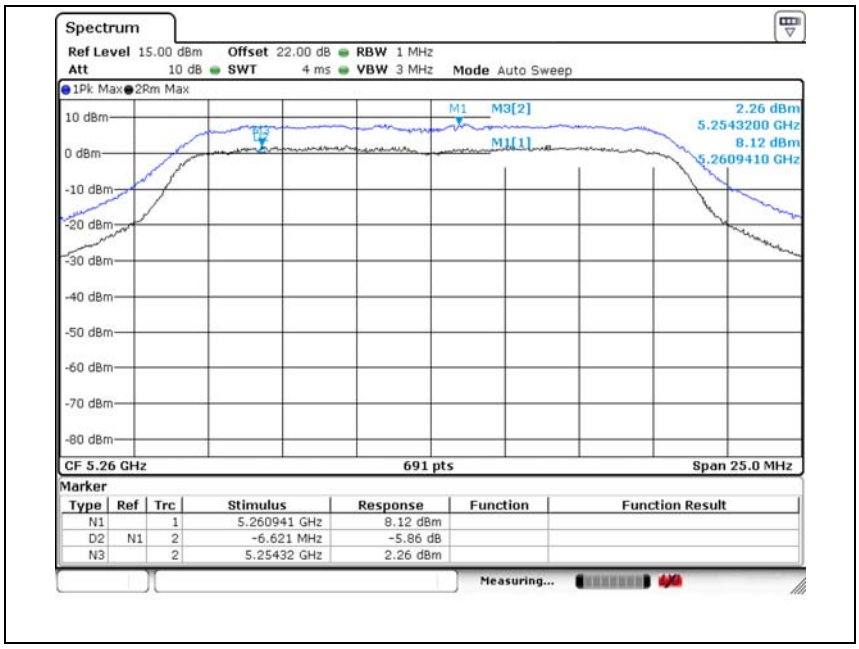


High Channel (5240 MHz)

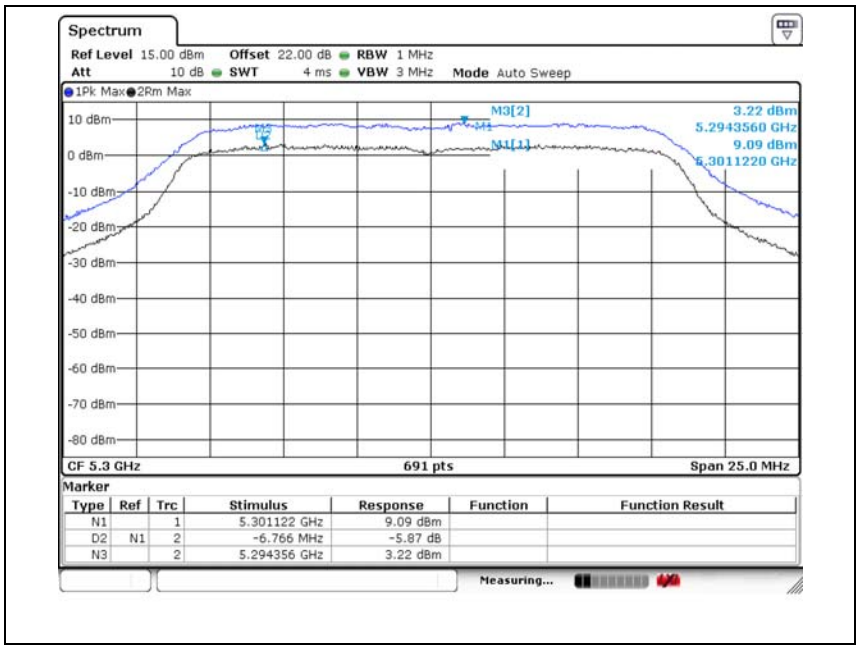


802.11a (DFS)_Lower

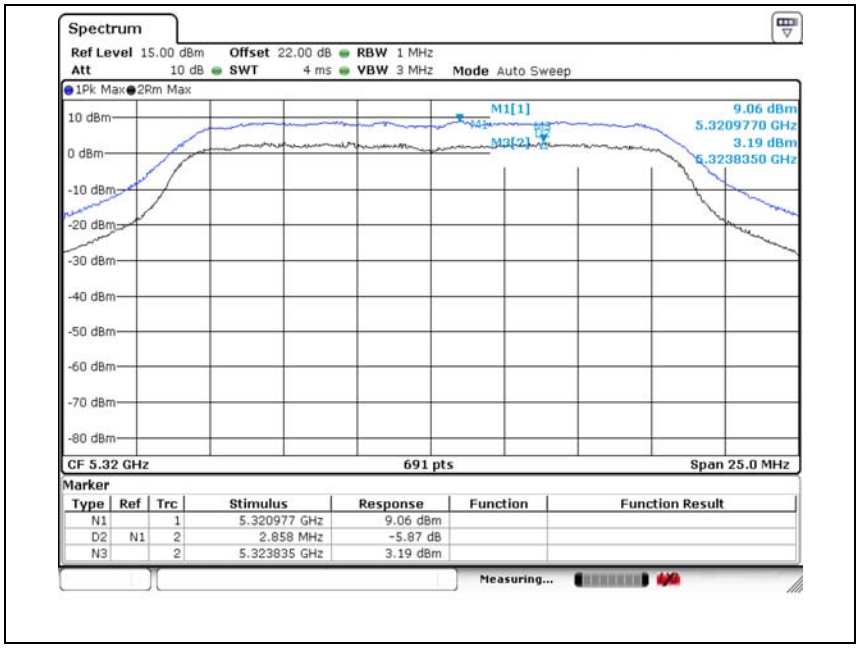
Low Channel (5260 MHz)



Middle Channel (5300 MHz)

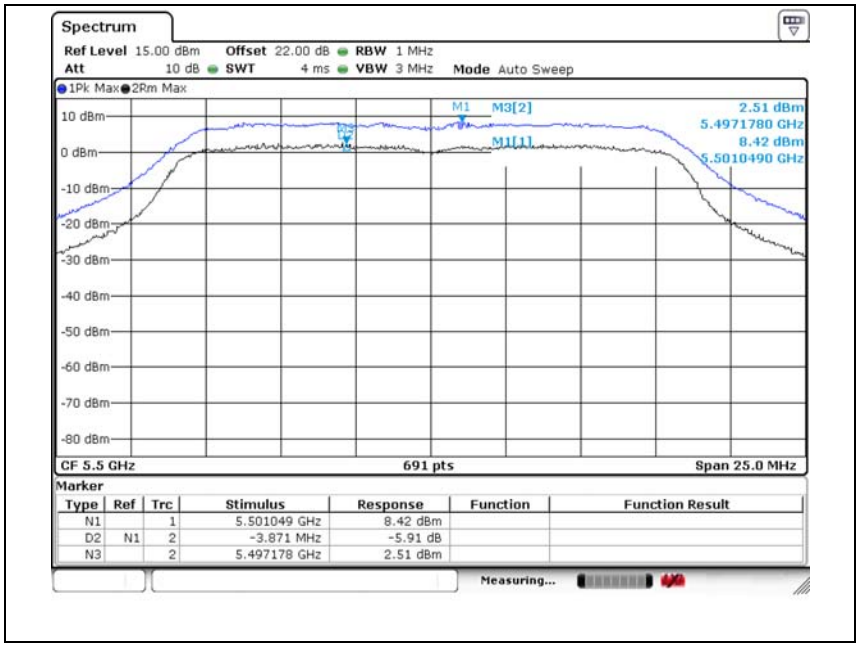


High Channel (5320 MHz)

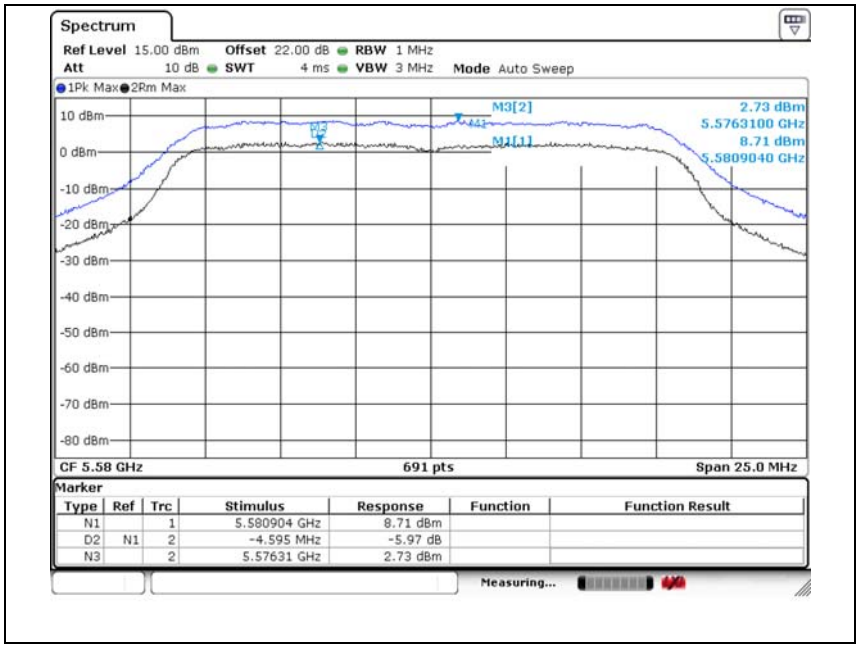


802.11a (DFS)_Upper

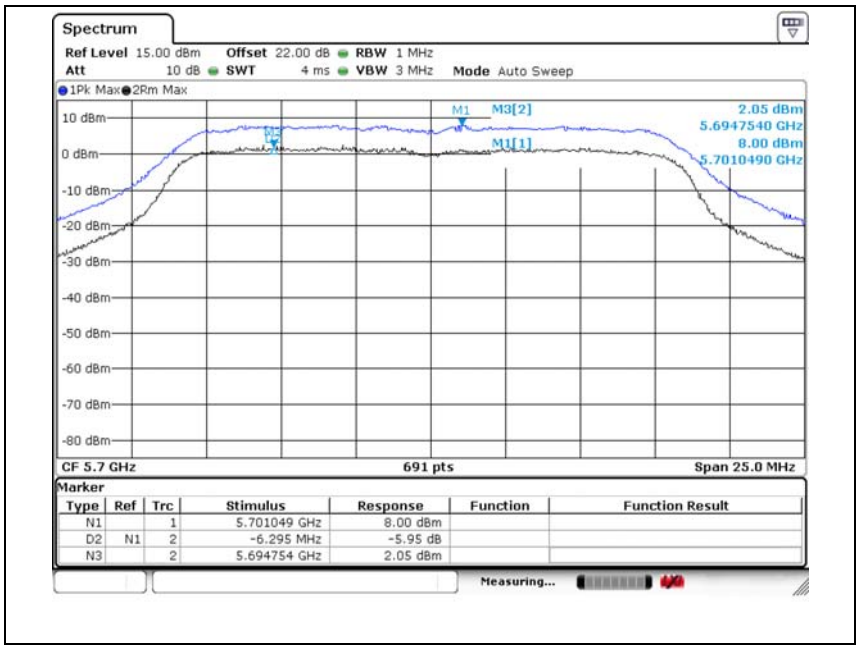
Low Channel (5500 MHz)



Middle Channel (5580 MHz)

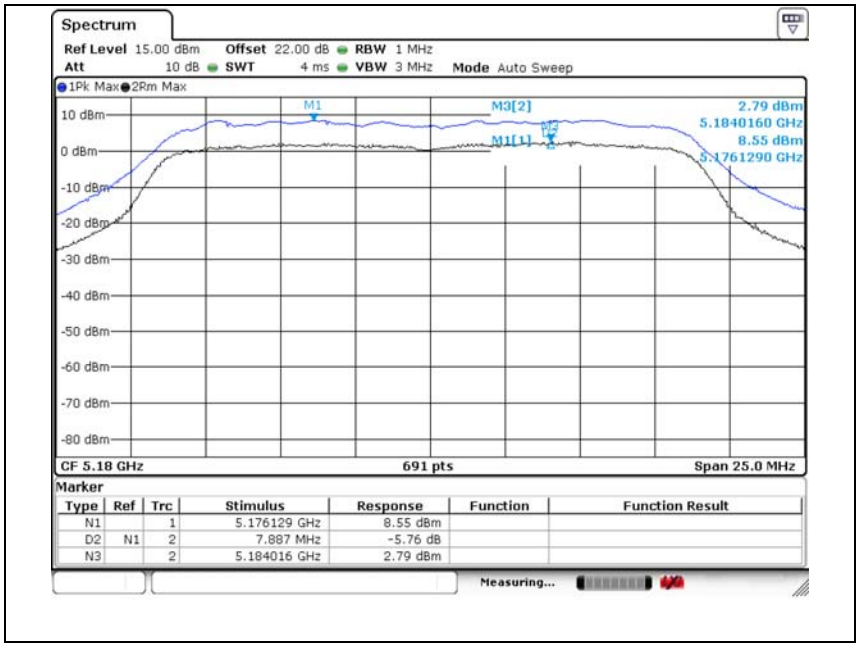


High Channel (5700 MHz)

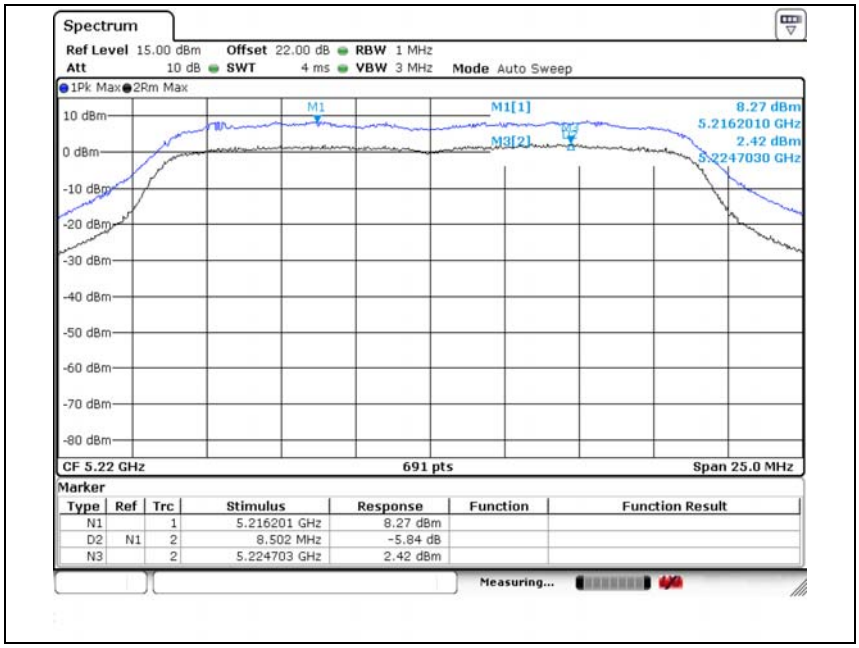


802.11n-HT20 (Non-DFS)

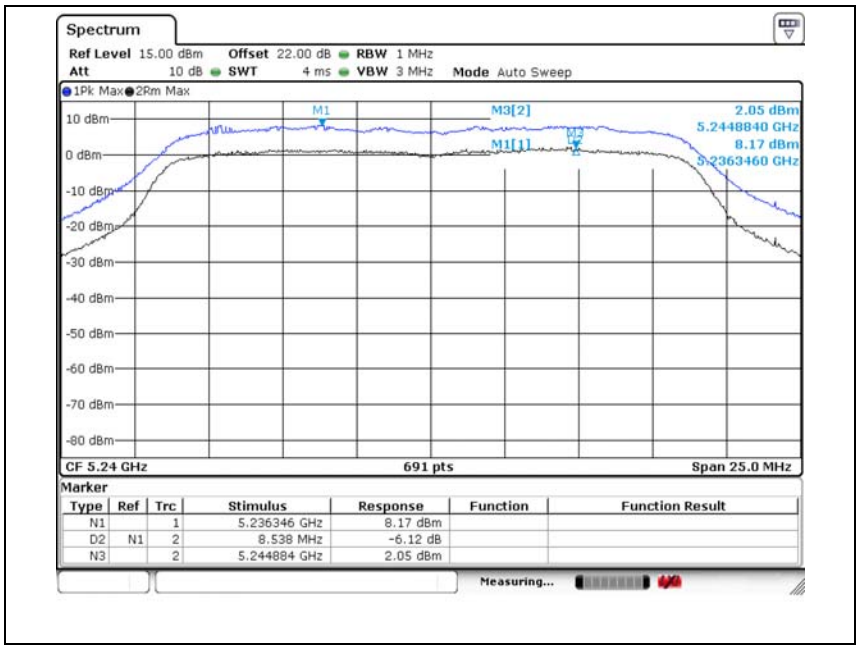
Low Channel (5180 MHz)



Middle Channel (5220 MHz)

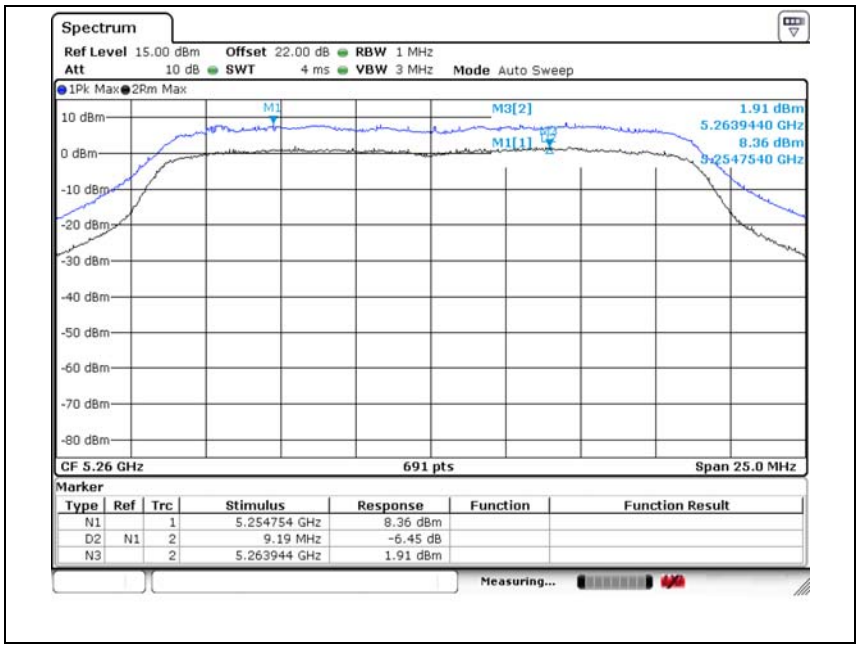


High Channel (5240 MHz)

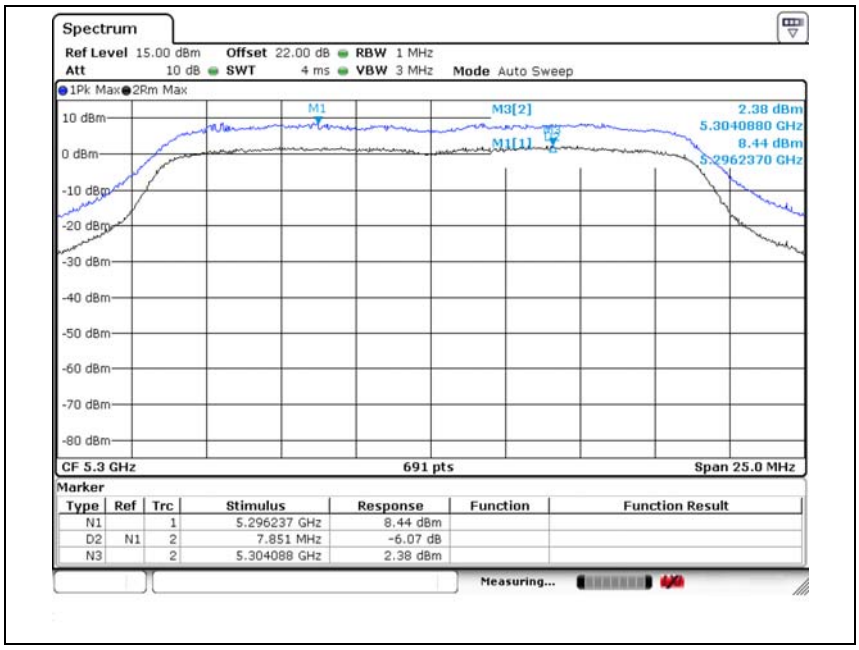


802.11n-HT20 (DFS)_Lower

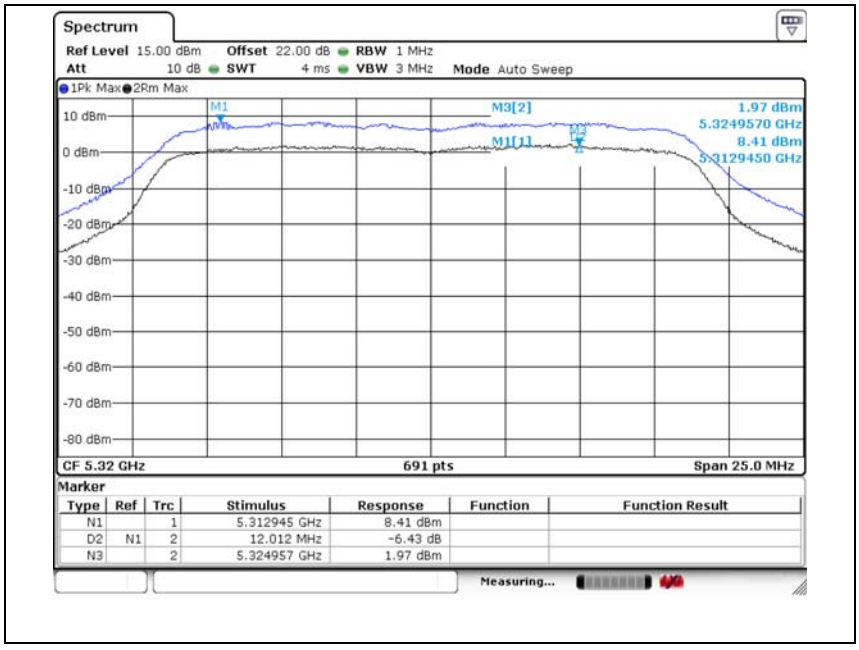
Low Channel (5260 MHz)



Middle Channel (5300 MHz)

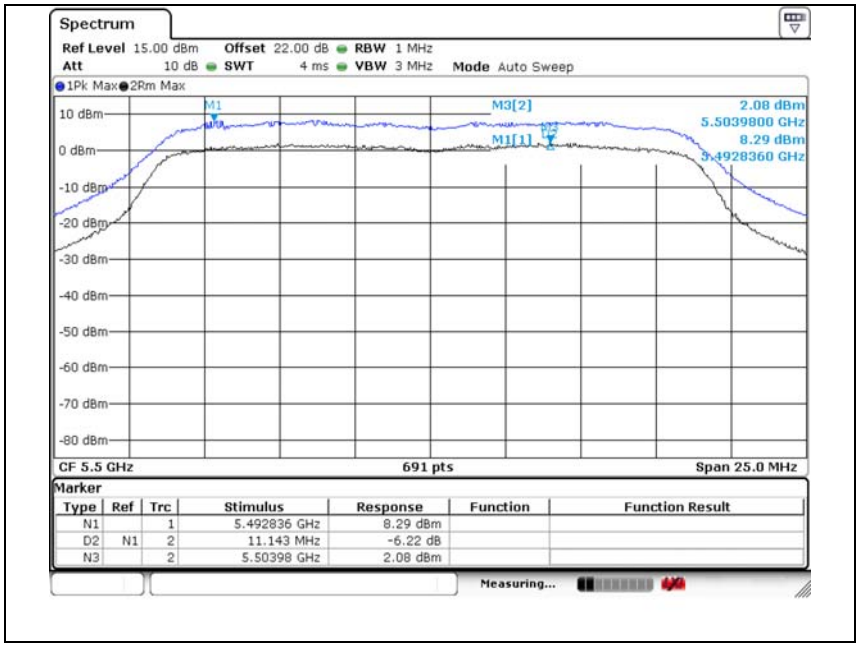


High Channel (5320 MHz)

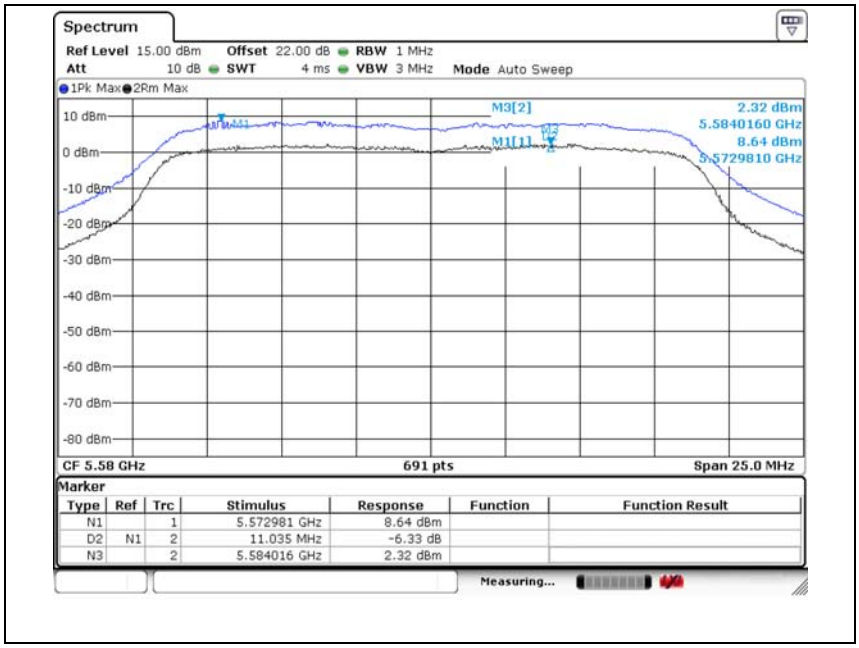


802.11n-HT20 (DFS)_Upper

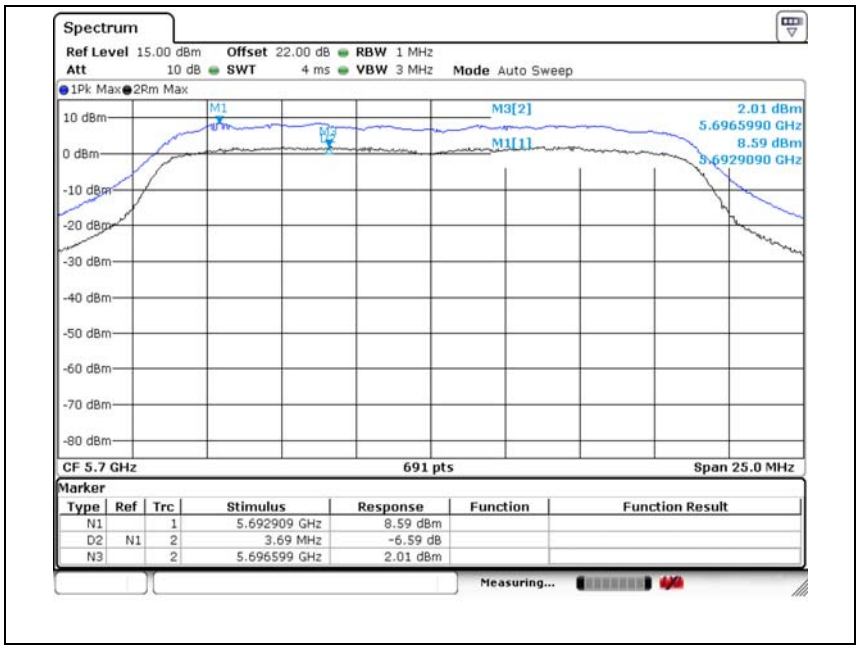
Low Channel (5500 MHz)



Middle Channel (5580 MHz)

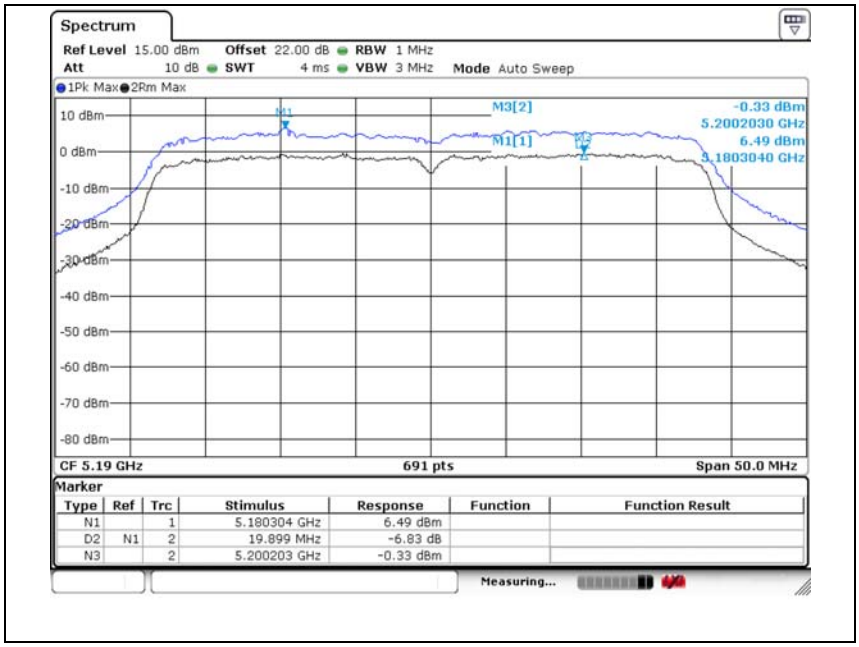


High Channel (5700 MHz)

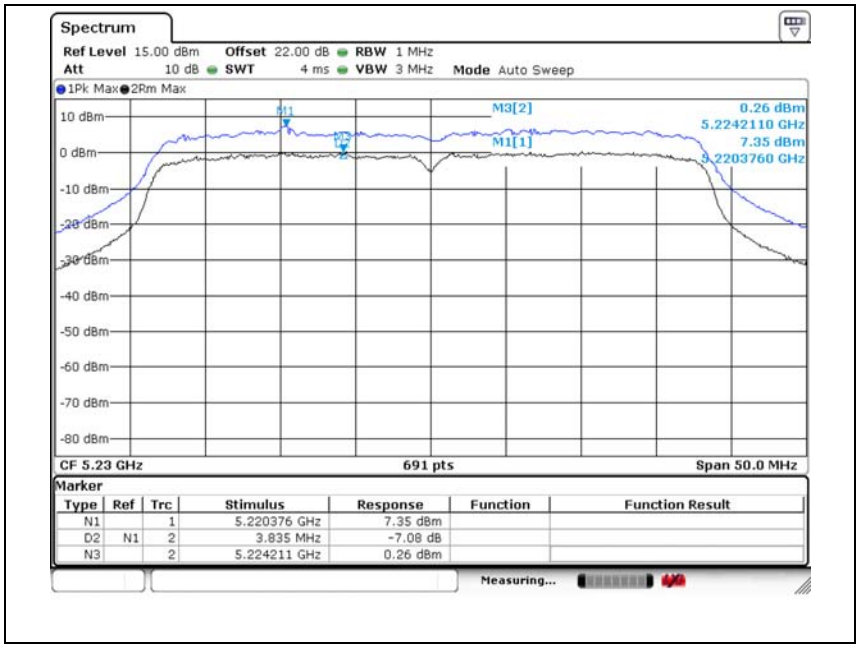


802.11n-HT40 (Non-DFS)

Low Channel (5190 MHz)

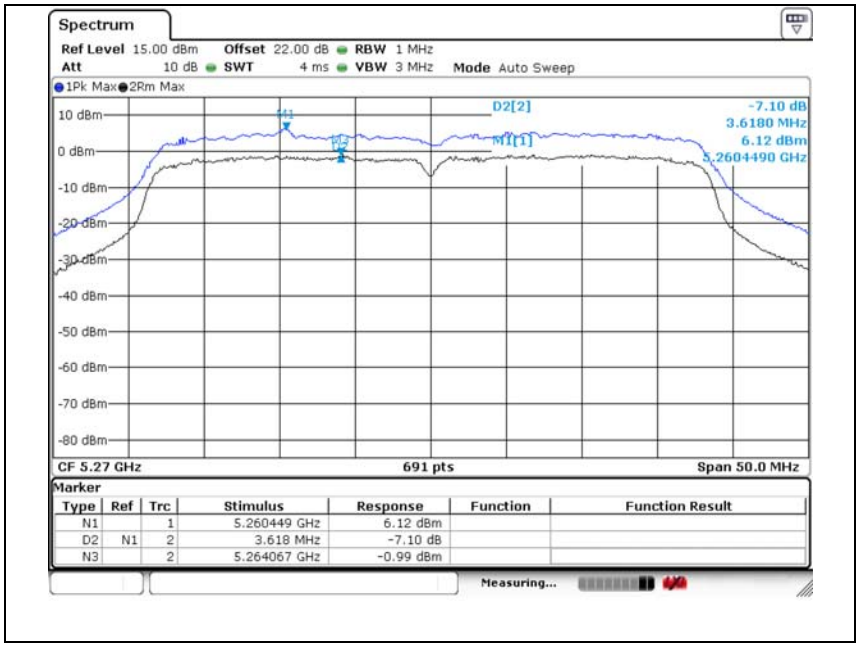


High Channel (5230 MHz)

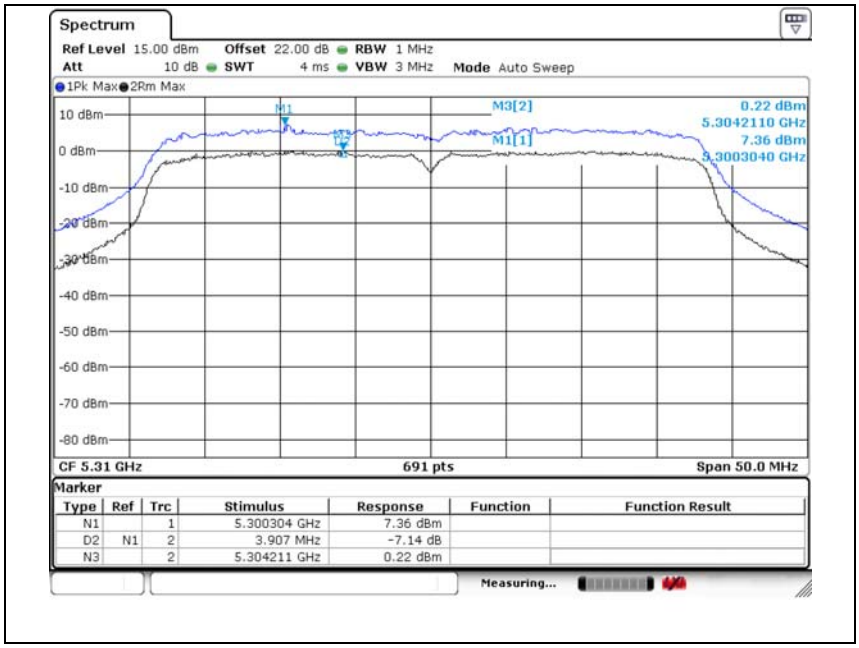


802. 11n-HT40 (DFS)_Lower

Low Channel (5270 MHz)

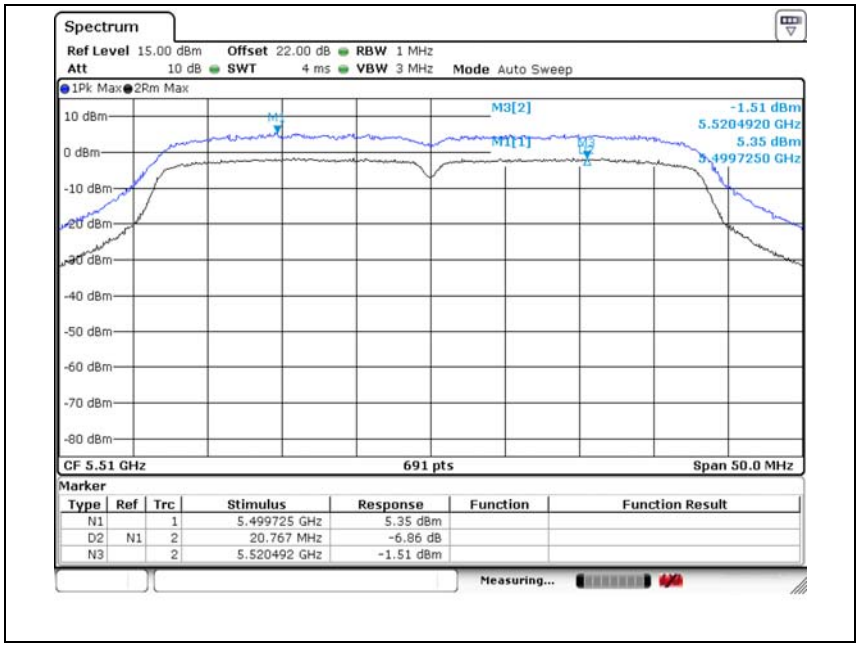


High Channel (5310 MHz)

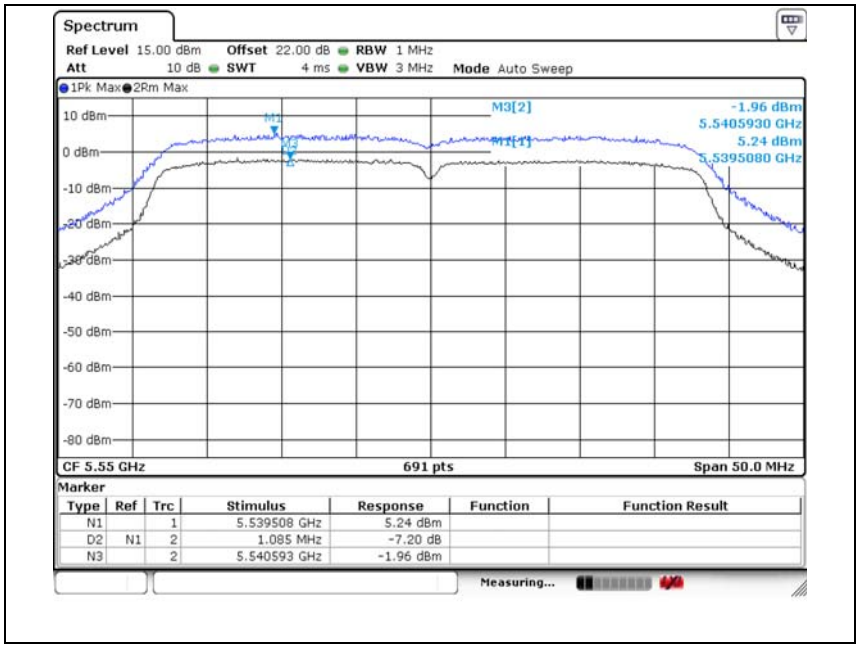


802. 11n-HT40 (DFS)_Upper

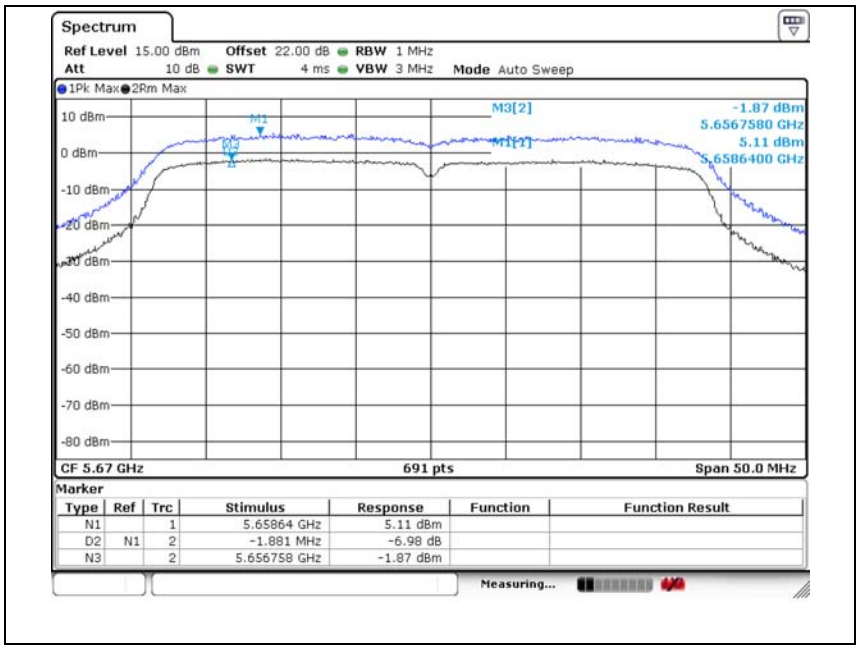
Low Channel (5510 MHz)



Middle Channel (5550 MHz)



High Channel (5670 MHz)



5.4 Peak Excursion

TEST: Peak Excursion		
Method	Output from the EUT were measured according to the dictates in section F) of KDB 789033 1. Set the spectrum analyzer span to view the entire emission bandwidth. 2. Find the maximum of the peak-max-hold spectrum. 3. Set RBW = 1 MHz. 4. Set VBW ≥ 3 MHz. 5. Detector = Peak. 6. Trace mode = max-hold. 7. Allow the sweeps to continue until the trace stabilizes. 8. Use the peak search function to find the peak of the spectrum. 9. Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.	
Reference Clause	Part15 E Section 15.407 (a)(6)	
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	36 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz	Antenna port

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Rated	1	2
Supplementary information: None		

Limits

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Table 8. Data Table for 5150 ~ 5250 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Result (dB)	Limit (dB)
11a	5180	54	6.53	13
	5220	54	6.71	
	5240	54	5.90	
11n-HT20	5180	MCS7	5.76	
	5220	MCS7	5.84	
	5240	MCS7	6.12	
11n-HT40	5190	MCS7	6.83	
	5230	MCS7	7.08	

Table 9. Data Table for 5250 ~ 5725 MHz

Mode	Frequency (MHz)	Data Rate (Mbps)	Result (dB)	Limit (dB)
11a	5260	54	5.86	13
	5300	54	5.87	
	5320	54	5.87	
	5500	54	5.91	
	5580	54	5.97	
	5700	54	5.95	
11n-HT20	5260	MCS7	6.45	
	5300	MCS7	6.07	
	5320	MCS7	6.43	
	5500	MCS7	6.22	
	5580	MCS7	6.33	
	5700	MCS7	6.59	
11n-HT40	5270	MCS7	7.10	
	5310	MCS7	7.14	
	5510	MCS7	6.86	
	5550	MCS7	7.20	
	5670	MCS7	6.98	

Figure 4. Captured images of Peak Excursion

Please refer to the Peak Power Spectral Density captured images as above

5.5 Transmitter Conducted Spurious Emission Measurement

TEST: Transmitter Conducted spurious emission measurement		
Method	Radiated emissions from the EUT were measured according to the dictates in section G of KDB 789033 **Conducted spurious emissions** 1. The transmitter output was connected to the spectrum analyzer through an attenuator. 2. Peak emission levels are measured by setting the analyzer as follows: RBW = 1 MHz, VBW ≥ 3 MHz, Detector = Peak, Sweep time = auto, Trace hold = max hold.	
Reference Clause	Part15 C 15.205(a), 15.209(a), Part15 E Section 15.407 (b)	
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C
	Relative Humidity	36 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	5 180 MHz - 5 240 MHz 5 260 MHz - 5 320 MHz 5 500 MHz - 5 700 MHz	Antenna port

Configuration Settings

Test Item	Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Conducted Spurious emission	Rated	1	2
Supplementary information: None			

Limits

For transmitters operating in the 5.15 ~ 5.25 GHz band: all emissions outside of the 5.15 ~ 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the 5.25 ~ 5.35 GHz band: all emissions outside of the 5.15 ~ 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

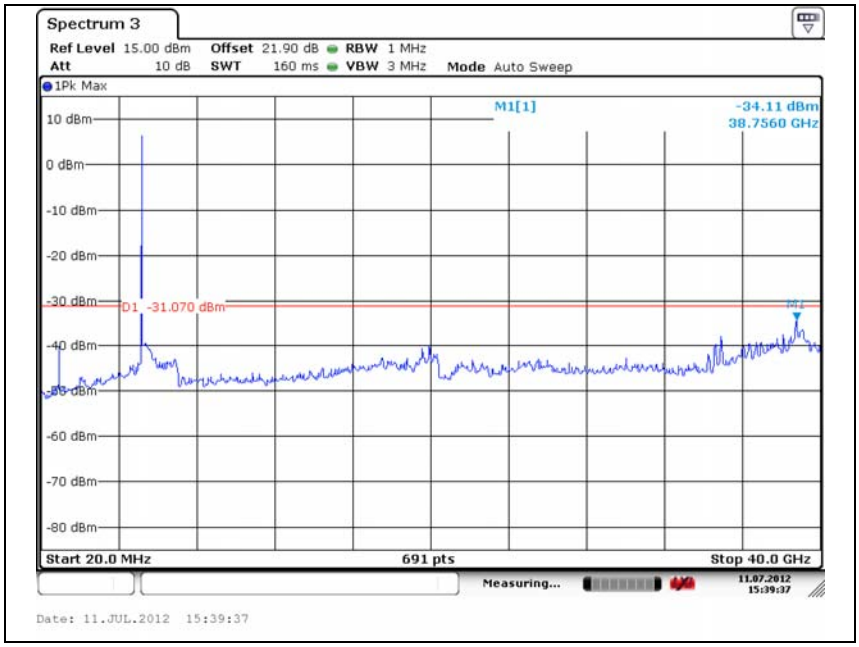
Devices operating in the 5.25 ~ 5.35 GHz band that generate emissions in the 5.15 ~ 5.25 GHz band must meet all applicable technical requirements for operation in the 5.15 ~ 5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15 ~ 5.25 GHz band.

For transmitters operating in the 5.47 ~ 5.725 GHz band: all emissions outside of the 5.47 ~ 5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.

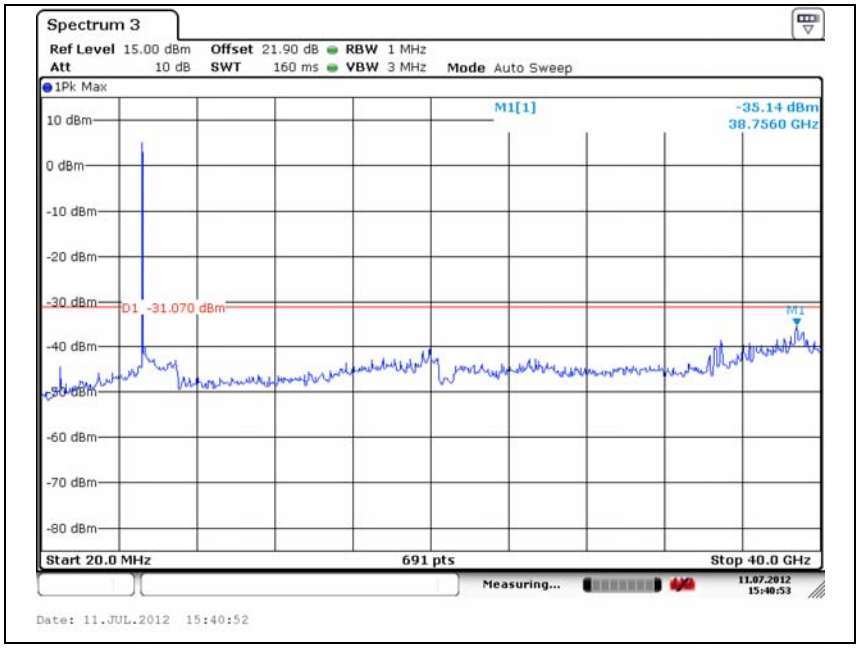
For 5.15 – 5.25 MHz**, the antenna gain is 4.07** dB**i, So the EIRP limit is -31.07** dB**m/**MHz

Figure 5. Captured images for 802.11a _Non DFS (5150-5250 MHz)

Low Channel (5180 MHz)



Middle Channel (5 220 MHz)



High Channel (5 240 MHz)

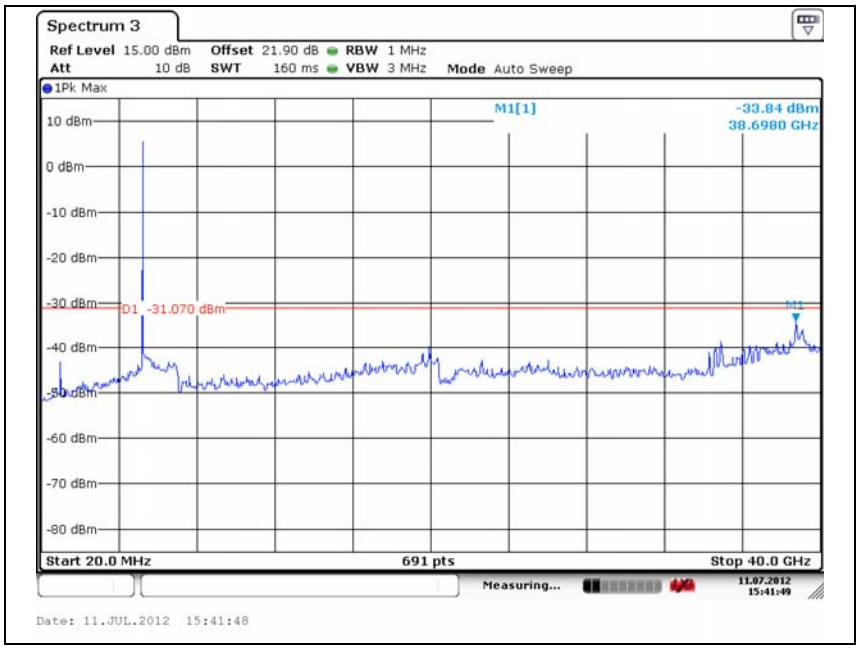
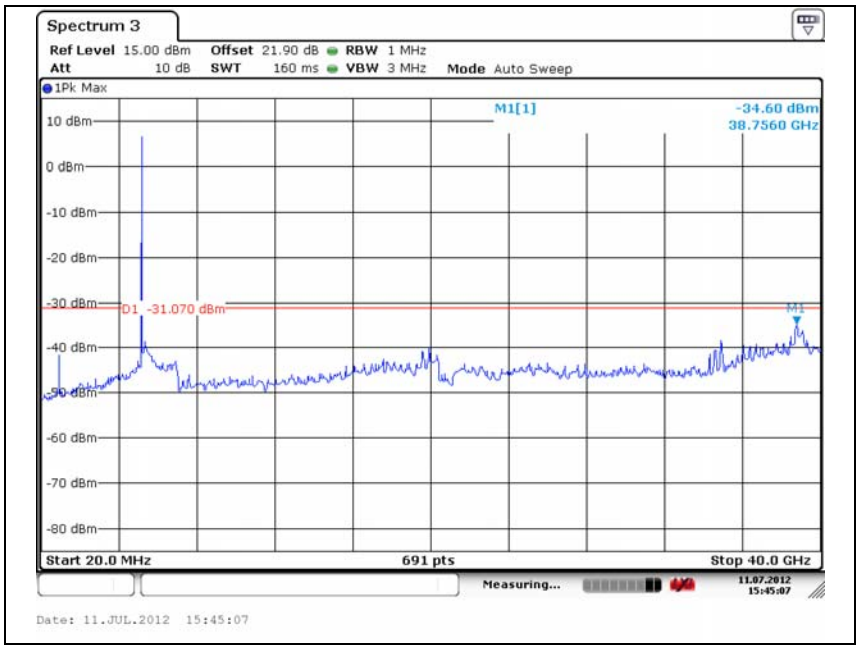
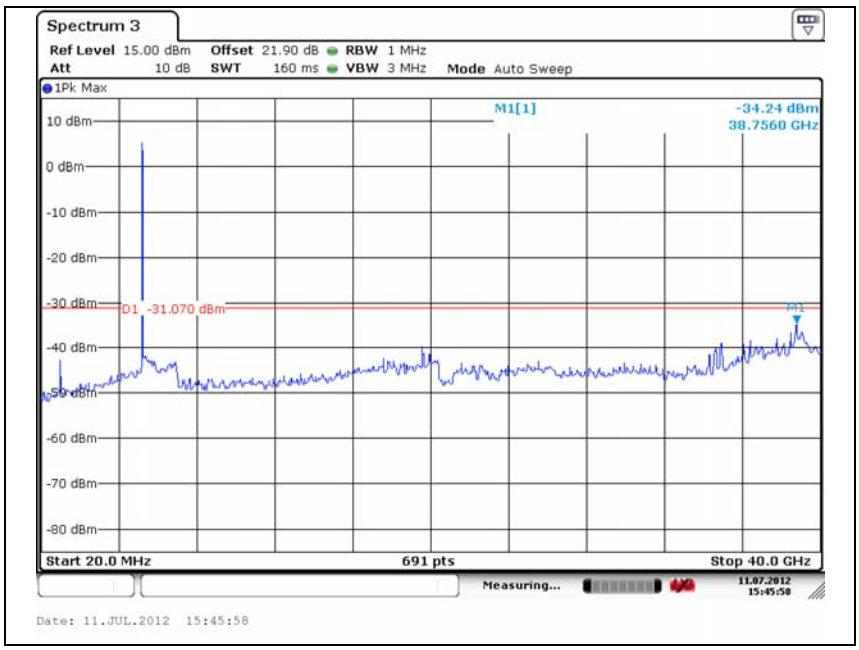


Figure 6. Captured images for 802.11n-HT20 _Non DFS (5150-5250 MHz)

Low Channel (5180 MHz)



Middle Channel (5 220 MHz)



High Channel (5 240 MHz)

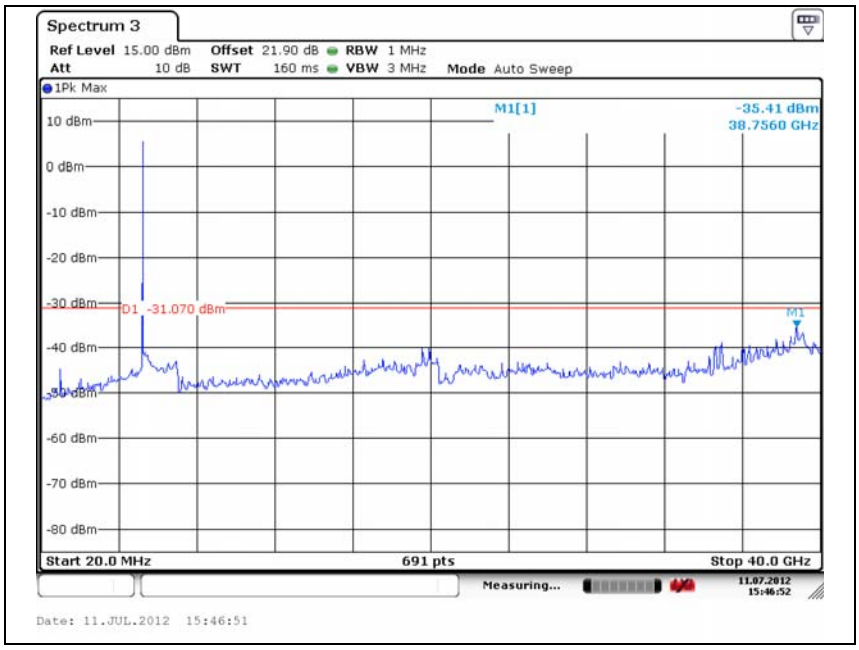
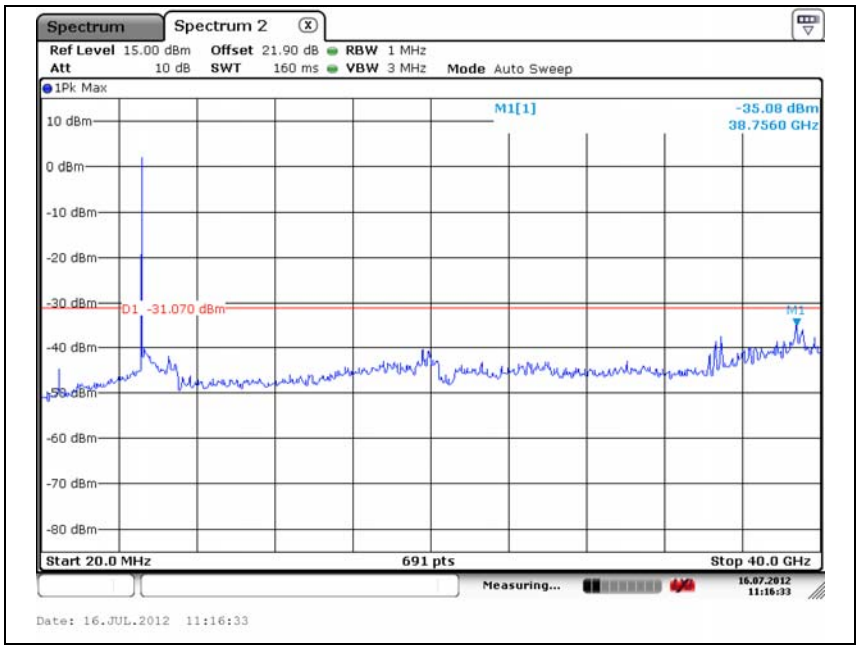
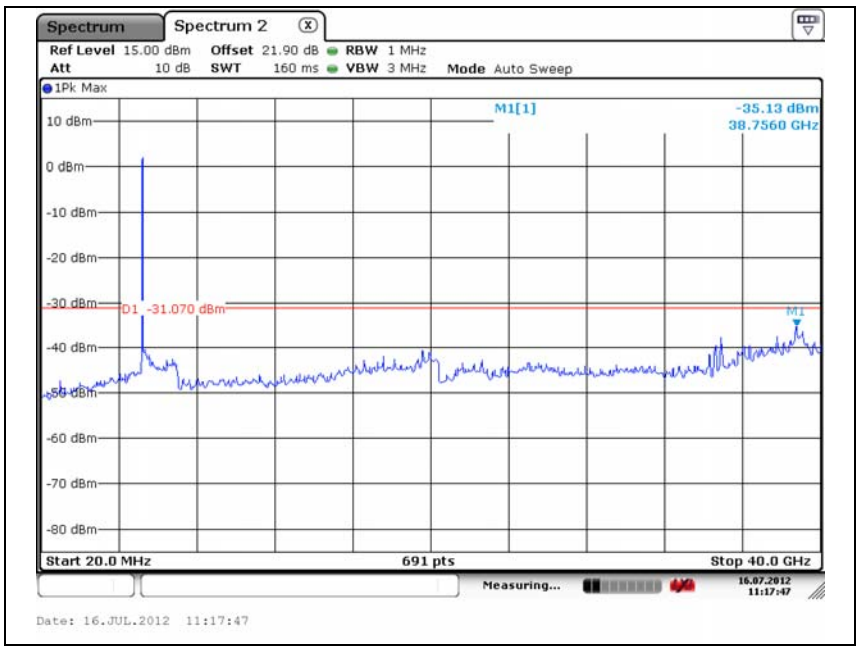


Figure 7. Captured images for 802.11n-HT40 _Non DFS (5150-5250 MHz)

Low Channel (5190 MHz)



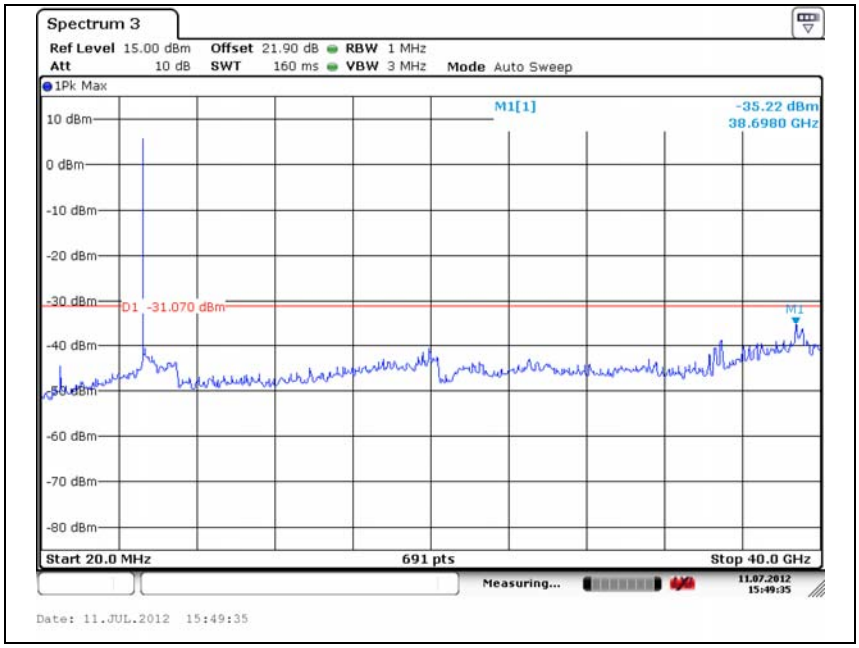
High Channel (5 230 MHz)



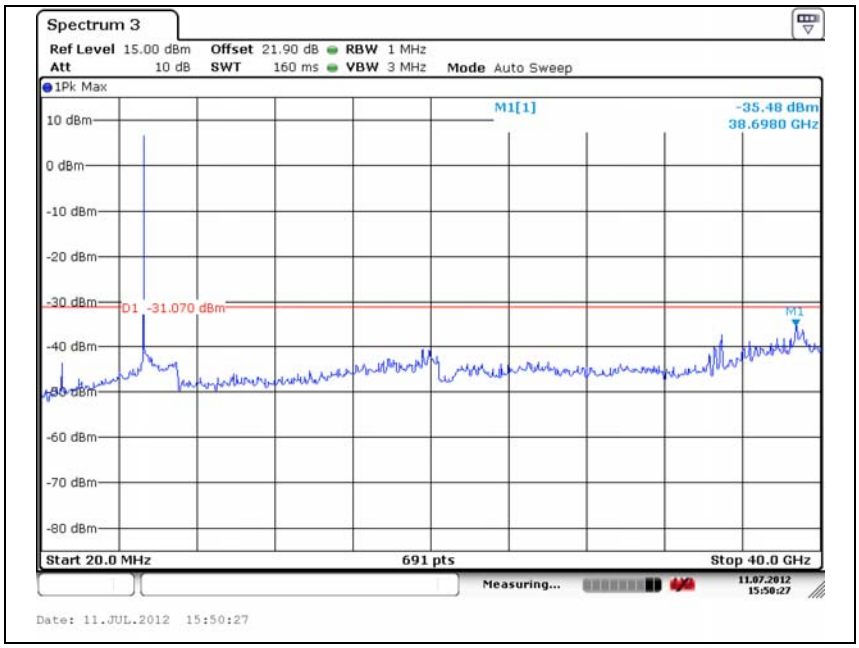
The antenna gain is 4.07 dB**i, So the EIRP limit is –31.07** dB**m/**MHz

Figure 8. 802.11a_DFS (5 260 – 5 320 MHz)

Low Channel (5 260 MHz)



Middle Channel (5 300 MHz)



High Channel (5 320 MHz)

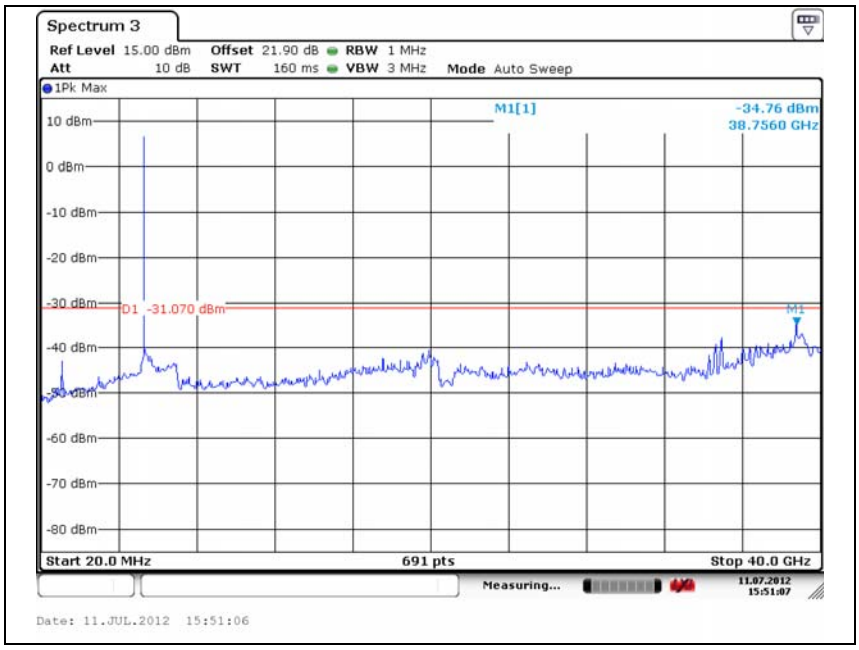
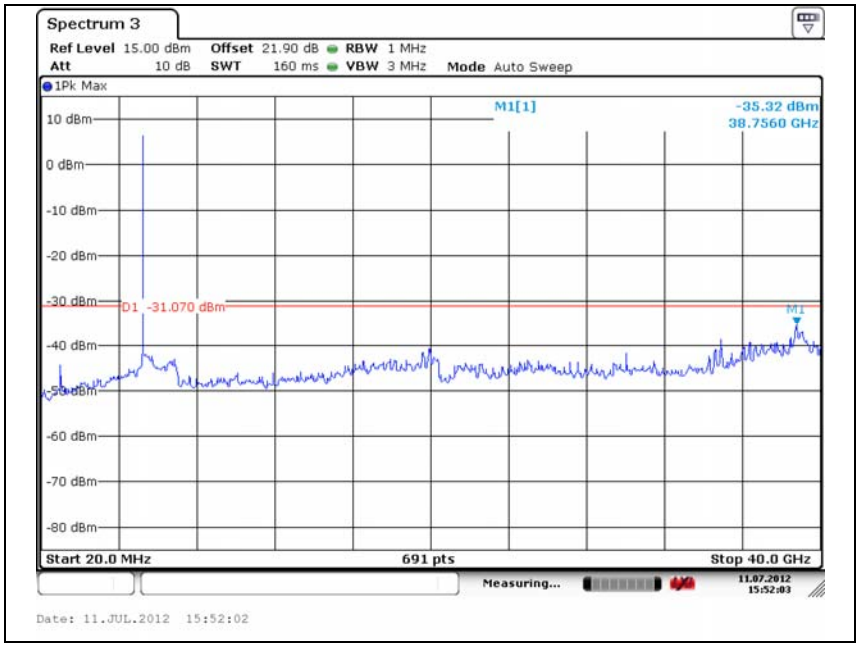
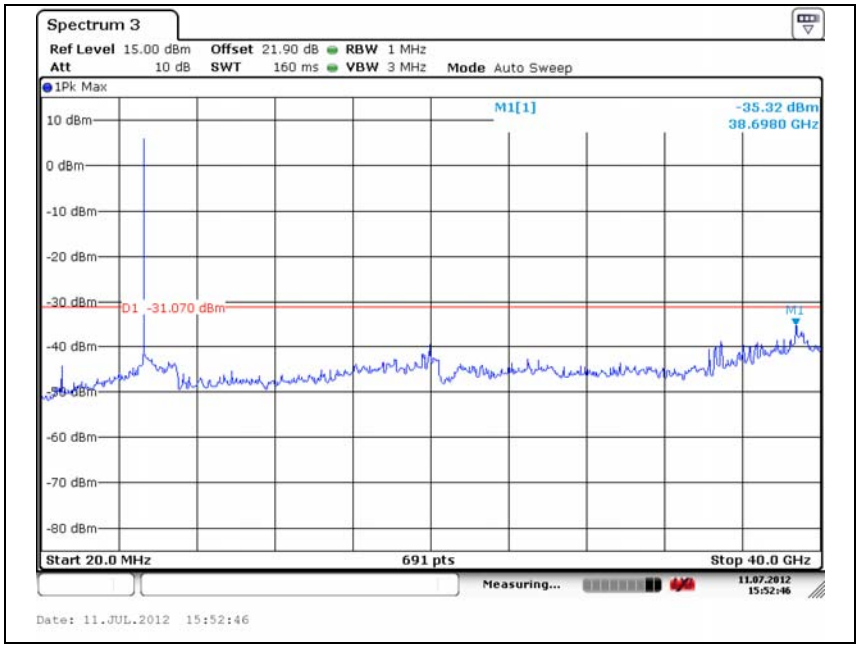


Figure 9. 802.11n-HT20_DFS (5 260 – 5 320 MHz)

Low Channel (5 260 MHz)



Middle Channel (5 300 MHz)



High Channel (5 320 MHz)

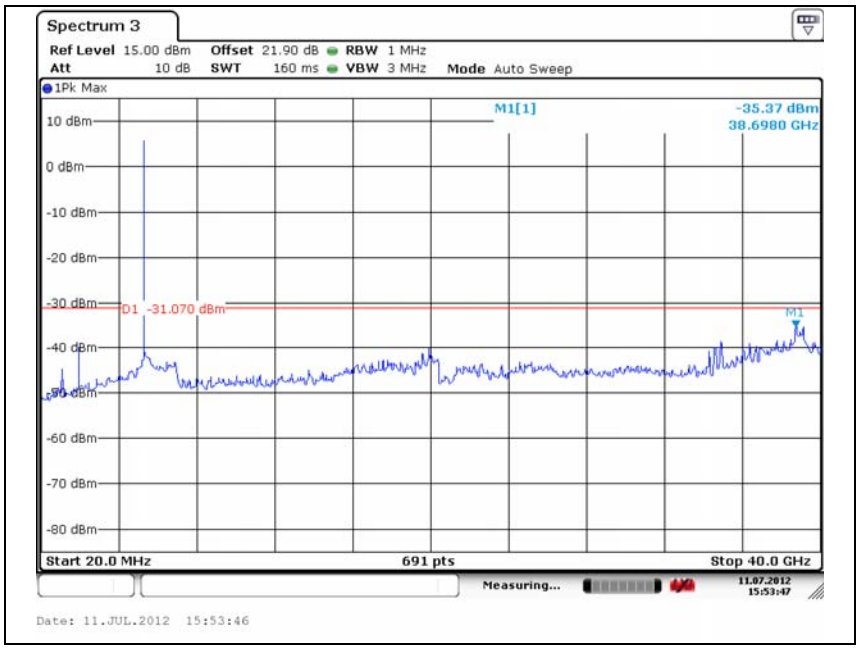
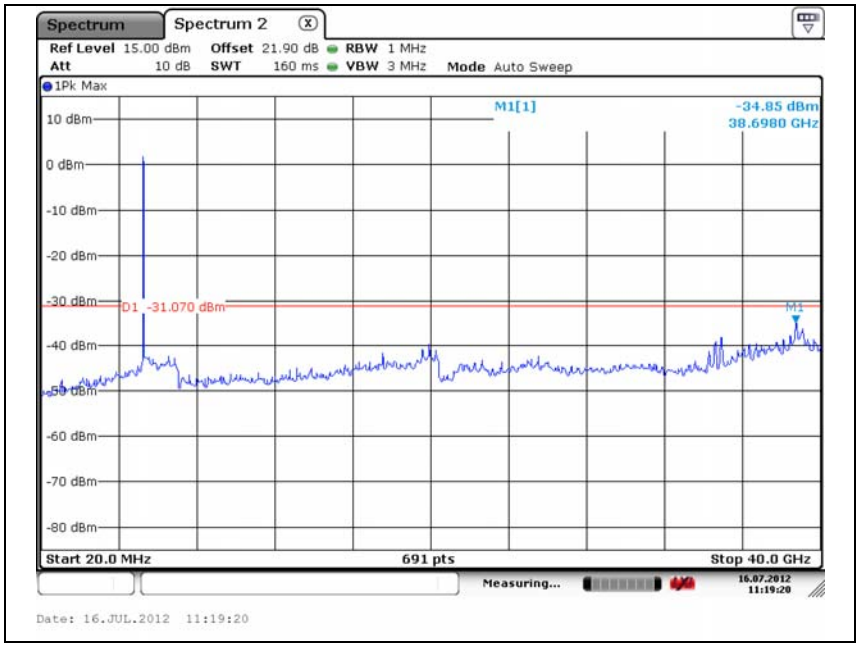


Figure 10. 802.11n-HT40_DFS (5 260 – 5 320 MHz)

Low Channel (5 270 MHz)



High Channel (5 310 MHz)

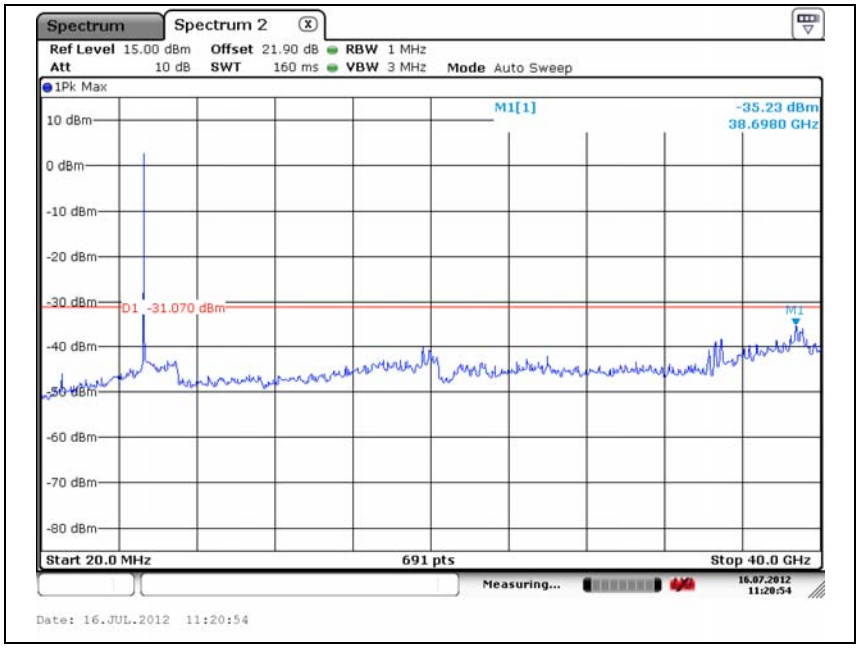
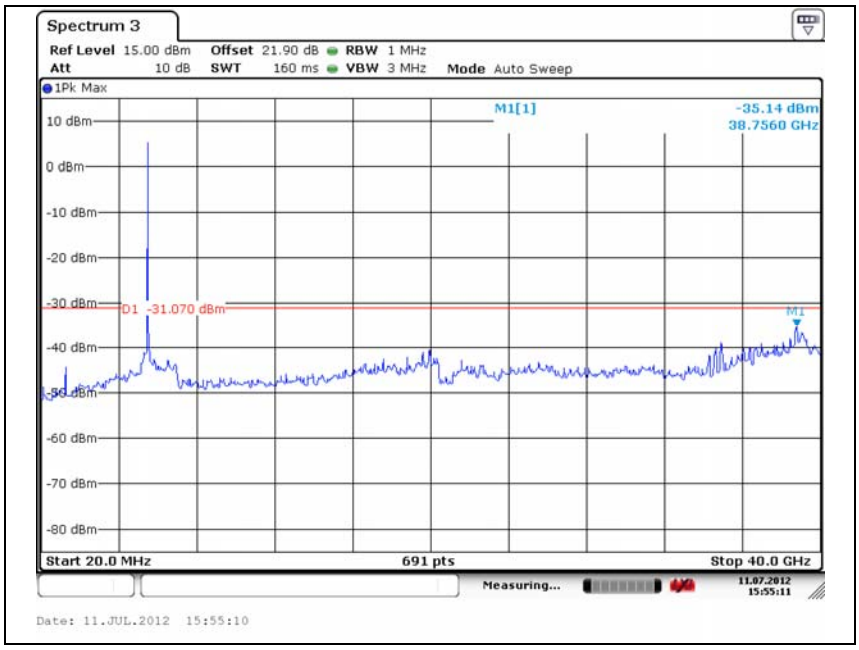
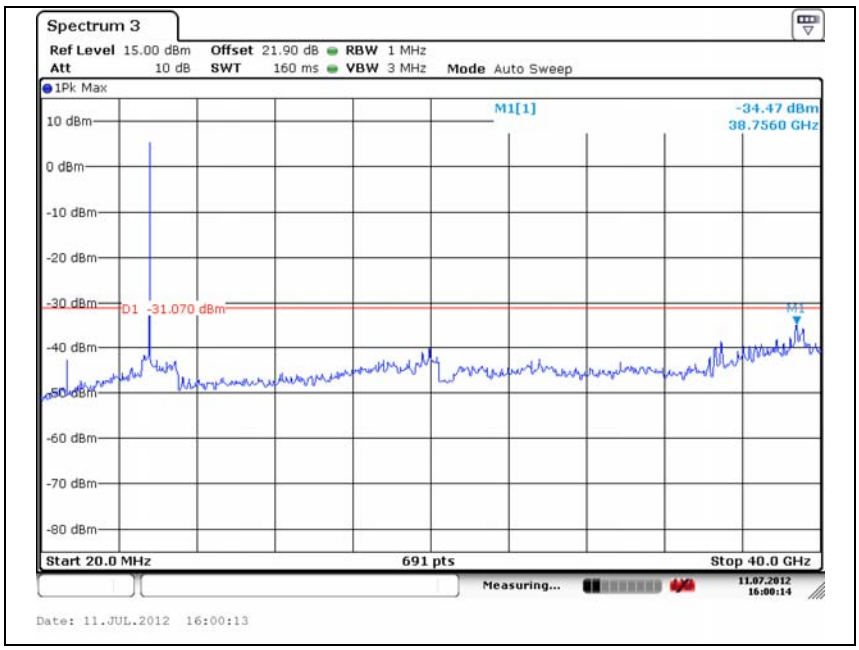


Figure 11. 802.11a_DFS (5 500 – 5 700 MHz)

Low Channel (5 500 MHz)



Middle Channel (5 580 MHz)



High Channel (5 700 MHz)

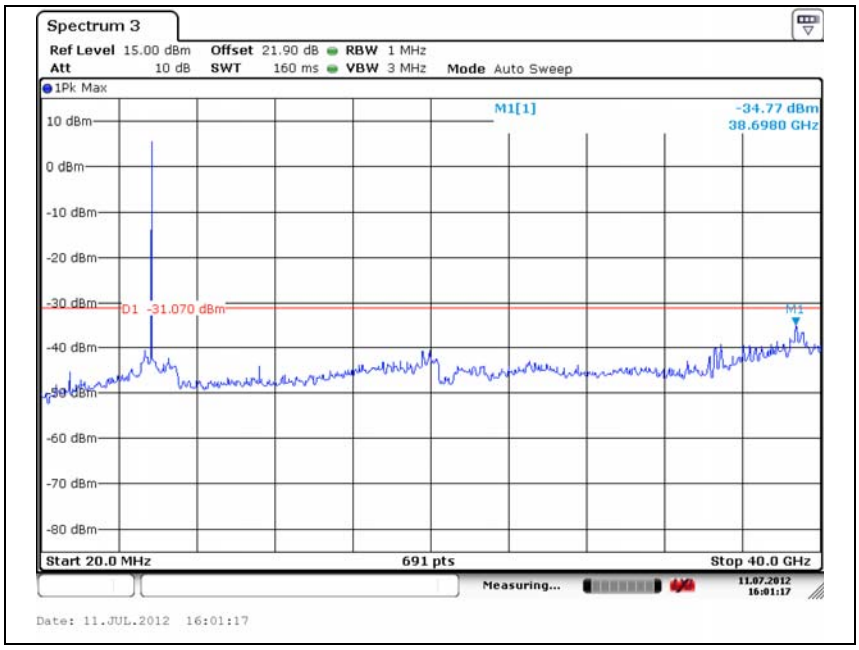
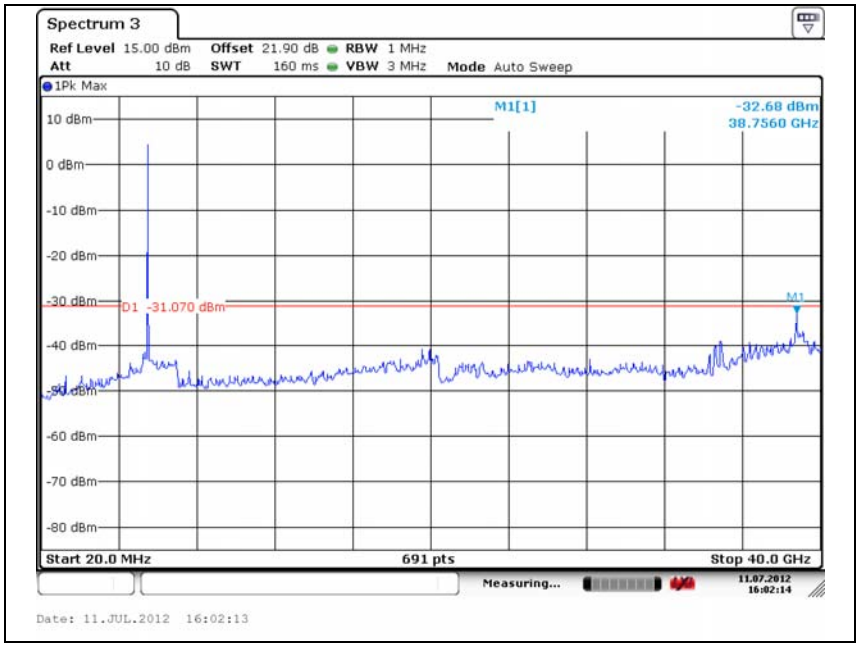
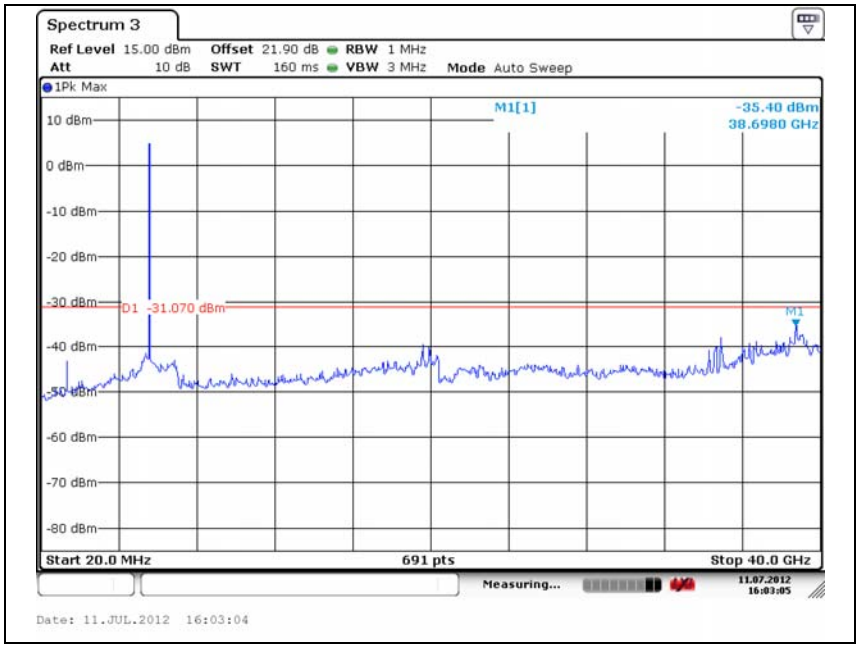


Figure 12. 802.11n-HT20_ DFS (5 500 – 5 700 MHz)

Low Channel (5 500 MHz)



Middle Channel (5 580 MHz)



High Channel (5 700 MHz)

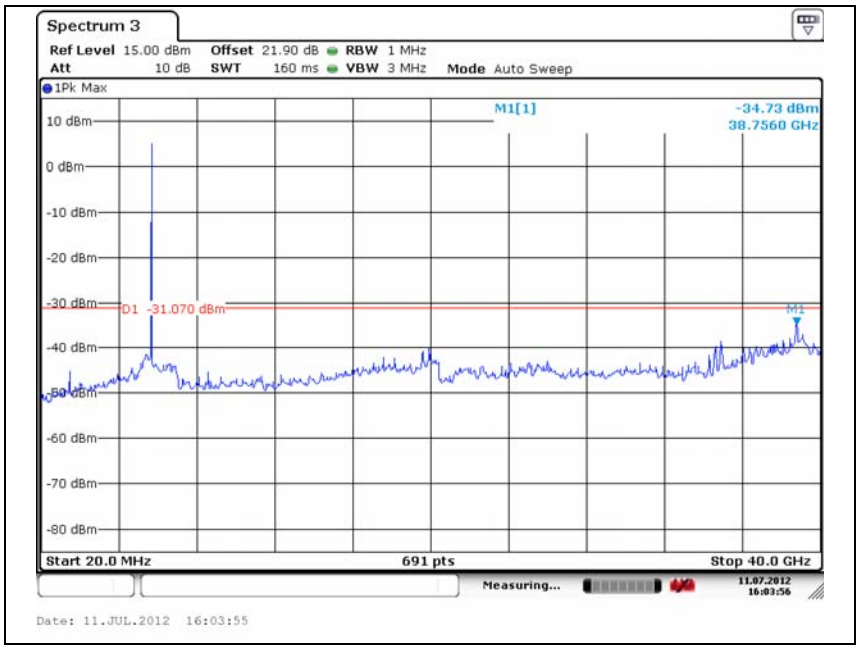
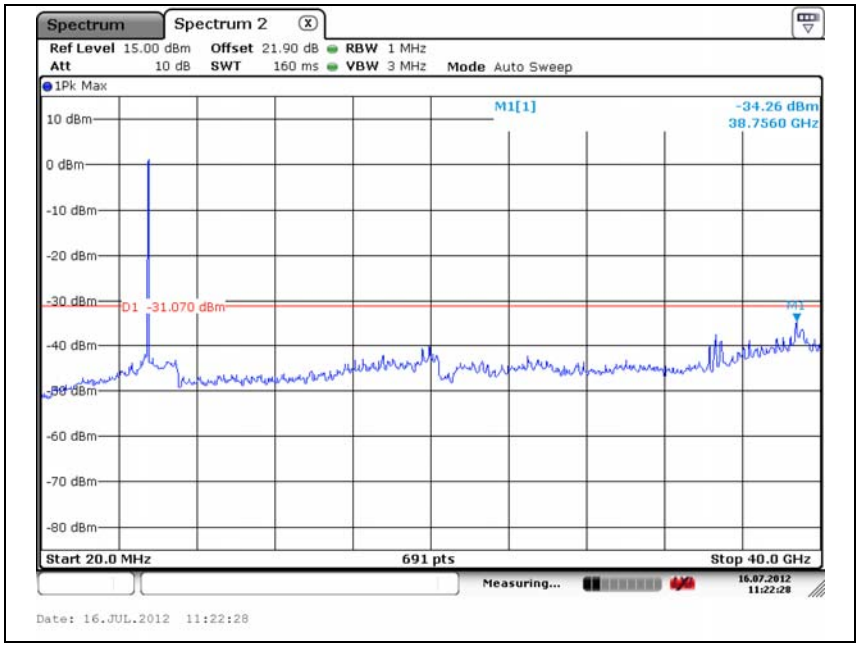
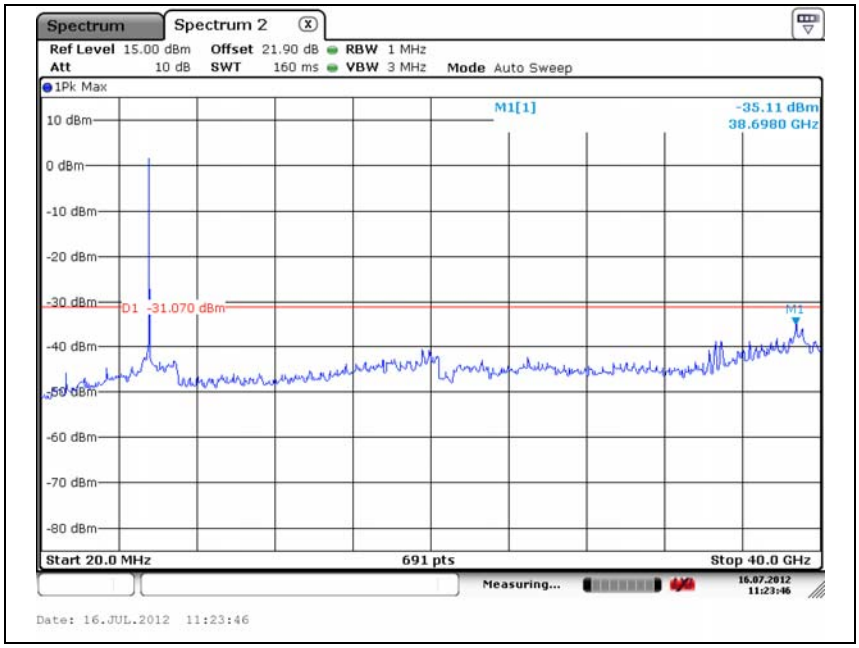


Figure 13. 802.11n-HT40_ DFS (5 500 – 5 700 MHz)

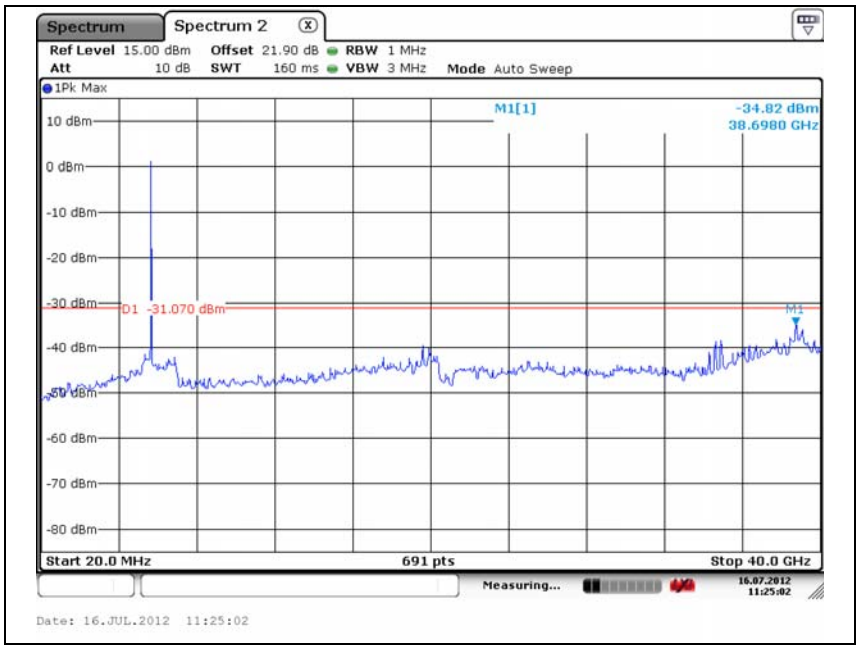
Low Channel (5 510 MHz)



Low Channel (5 550 MHz)



High Channel (5 670 MHz)



5.6 Transmitter Radiated Spurious Emissions Measurement

TEST: Transmitter radiated spurious emissions measurement			
Method	Radiated emissions from the EUT were measured according to the dictates in section G of KDB 789033 **Radiated Spurious Emissions** 1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation. 2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna. 3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. ▣ Note All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section. 1. The measurements for below 1 GHz Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection. 2. The measurements for above 1 GHz 1) Peak emission levels are measured by setting the analyzer as follows: Set to RBW = 1 MHz, VBW ≥ 3 MHz, Detector = Peak, Sweep time = auto, Trace mode= Max hold. 2) Average emission levels are measured by setting the analyzer as follows: Set to RBW = 1 MHz, Detector = Peak, Sweep time = auto, Trace mode= Max hold. - If duty cycle ≥ 98 percent: VBW < RBW/100 (i.e., 10 kHz) but not less than 10 Hz. - If duty cycle < 98 percent: VBW ≥ 1/T. 3. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.		
Reference Clause	Part15 C 15.205(a), 15.209(a), Part15 E Section 15.407 (b)		
Parameters recorded during the test	Laboratory Ambient Temperature	22 °C	
	Relative Humidity	36 %	
	Frequency range	Measurement Point	
Fully configured sample scanned over the following frequency range	5 180 MHz - 5 240 MHz 5 260 MHz - 5 320 MHz 5 500 MHz - 5 700 MHz	Antenna port	

Configuration Settings

Test Item	Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
Radiated Spurious emission	Rated	1	1
Supplementary information: None			

Limits

For transmitters operating in the 5.15 ~ 5.25 GHz band: all emissions outside of the 5.15 ~ 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

For transmitters operating in the 5.25 ~ 5.35 GHz band: all emissions outside of the 5.15 ~ 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

Devices operating in the 5.25 ~ 5.35 GHz band that generate emissions in the 5.15 ~ 5.25 GHz band must meet all applicable technical requirements for operation in the 5.15 ~ 5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15 ~ 5.25 GHz band.

For transmitters operating in the 5.47 ~ 5.725 GHz band: all emissions outside of the 5.47 ~ 5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz.

According to § 15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Distance (meters)	Field Strength (dBuV/m)	Field Strength (uV/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

5.6.1. Radiated Spurious Emissions for Below 1 GHz

Measurement method : ☒ Radiated ☐ Conducted
Mode of operation : Continuous Wave
Power setting : Max. Power condition declared by the manufacturer
Worst case configuration : 11n-HT40 MCS7

Table 10. Test data for Radiated emission for Below 1 GHz

Radiated emissions			Ant	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
48.00	3.24	Peak	V	N/A	12.65	1.06	16.95	40.00	23.05
72.00	9.04	Peak	V	N/A	10.67	1.24	20.95	40.00	19.05
74.10	10.27	Peak	V	N/A	10.28	1.28	21.84	40.00	18.16
101.90	9.77	Peak.	V	N/A	8.27	1.60	19.64	43.50	23.86
117.30	23.57	Peak	V	N/A	9.65	1.67	34.89	43.50	8.61
119.80	23.10	Peak	V	N/A	9.87	1.70	34.67	43.50	8.83
123.10	23.79	Peak	V	N/A	10.21	1.70	35.70	43.50	7.80
184.30	7.74	Peak	V	N/A	10.63	2.04	20.41	43.50	23.09
245.50	10.01	Peak	H	N/A	11.00	2.36	23.37	46.00	22.63
282.90	7.48	Peak	H	N/A	12.49	2.53	22.50	46.00	23.50
562.50	5.74	Peak	V	N/A	19.01	3.64	28.39	46.00	17.61
662.80	5.12	Peak	H	N/A	20.31	4.00	29.43	46.00	16.57

Supplementary information:
-. The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 30 dB. All reading values are peak values.

Remark
a. To get a maximum emission level from the EUT, the EUT was moved throughout the x-axis, Y-axis and Z-axis. The worst case is x-axis.
b. Actual = Reading + AF + CL (AF : Antenna factor, CL : Cable loss)
c. Distance factor = 20log(Measurement distance / The measured distance)
d. Margin = Limit (dBuV/m) - Actual (dBuV/m)

5.6.2. Radiated Spurious Emissions for Above 1 GHz

Measurement method : ☒ Radiated ☐ Conducted
Mode of operation : Continuous Wave
Power setting : Max. Power condition declared by the manufacturer
Worst case configuration : 11a - 54 Mbps, 11n - MCS7

802.11a_Non DFS (5 180 – 5 240 MHz)

Table 11. Low Channel (5 180 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5180.0	67.77	Peak	H	N/A	32.00	8.57	-	108.34	OB
5180.0	58.63	Peak	V	N/A	32.00	8.57	-	99.20	OB
5180.0	54.28	Average	H	N/A	32.00	8.57	-	94.85	OB
5180.0	44.96	Average	V	N/A	32.00	8.57	-	85.53	OB
*5150.0	48.69	Peak	H	N/A	31.97	-21.87	74.00	58.79	15.21
*5150.0	46.70	Peak	V	N/A	31.97	-21.87	74.00	56.80	17.20
*5150.0	35.98	Average	H	N/A	31.97	-21.87	54.00	46.08	7.92
*5150.0	34.16	Average	V	N/A	31.97	-21.87	54.00	44.26	9.74
10360.0	43.11	Peak	H	N/A	39.48	-16.42	68.23	66.17	2.06
10360.0	42.20	Peak	V	N/A	39.48	-16.42	68.23	65.26	2.97
10360.0	26.12	Average	H	N/A	39.48	-16.42	68.23	49.18	19.05
10360.0	25.71	Average	V	N/A	39.48	-16.42	68.23	48.77	19.46

Table 12. Middle Channel (5 220 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5220.0	68.12	Peak	H	N/A	32.04	8.62	-	108.77	OB
5220.0	58.79	Peak	V	N/A	32.04	8.62	-	99.44	OB
5220.0	53.61	Average	H	N/A	32.04	8.62	-	94.26	OB
5220.0	44.38	Average	V	N/A	32.04	8.62	-	85.03	OB
10440.0	42.17	Peak	H	N/A	39.64	-16.43	68.23	65.38	2.85
10440.0	42.14	Peak	V	N/A	39.64	-16.43	68.23	65.35	2.88
10440.0	26.14	Average	H	N/A	39.64	-16.43	68.23	49.35	18.88
10440.0	26.01	Average	V	N/A	39.64	-16.43	68.23	49.22	19.01

Table 13. High Channel (5 240 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5240.0	66.97	Peak	H	N/A	32.06	8.63	-	107.66	OB
5240.0	58.79	Peak	V	N/A	32.06	8.63	-	99.48	OB
5240.0	52.98	Average	H	N/A	32.06	8.63	-	93.67	OB
5240.0	44.96	Average	V	N/A	32.06	8.63	-	85.65	OB
10480.0	41.41	Peak	H	N/A	39.72	-16.43	68.23	64.70	3.53
10480.0	41.47	Peak	V	N/A	39.72	-16.43	68.23	64.76	3.47
10480.0	26.11	Average	H	N/A	39.72	-16.43	68.23	49.40	18.83
10480.0	25.91	Average	V	N/A	39.72	-16.43	68.23	49.20	19.03

802.11a_DFS (5 260 – 5 320 MHz)

Table 14. Low Channel (5 260 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5260.0	67.66	Peak	H	N/A	32.08	8.65	-	108.38	OB
5260.0	58.43	Peak	V	N/A	32.08	8.65	-	99.15	OB
5260.0	53.07	Average	H	N/A	32.08	8.65	-	93.79	OB
5260.0	44.61	Average	V	N/A	32.08	8.65	-	85.33	OB
10520.0	42.17	Peak	H	N/A	39.80	-16.38	68.23	65.59	2.64
10520.0	42.10	Peak	V	N/A	39.80	-16.38	68.23	65.52	2.71
10520.0	26.01	Average	H	N/A	39.80	-16.38	68.23	49.43	18.80
10520.0	25.71	Average	V	N/A	39.80	-16.38	68.23	49.13	19.10

Table 15. Middle Channel (5 300 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5300.0	67.11	Peak	H	N/A	32.12	8.68	-	107.90	OB
5300.0	57.96	Peak	V	N/A	32.12	8.68	-	98.75	OB
5300.0	53.00	Average	H	N/A	32.12	8.68	-	93.79	OB
5300.0	43.71	Average	V	N/A	32.12	8.68	-	84.50	OB
*10600.0	41.17	Peak	H	N/A	39.96	-16.17	74.00	64.96	9.04
*10600.0	42.20	Peak	V	N/A	39.96	-16.17	74.00	65.99	8.01
*10600.0	25.07	Average	H	N/A	39.96	-16.17	54.00	48.86	5.14
*10600.0	25.61	Average	V	N/A	39.96	-16.17	54.00	49.40	4.60

Table 16. High Channel (5 320 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5320.0	66.89	Peak	H	N/A	32.13	8.69	-	107.71	OB
5320.0	58.11	Peak	V	N/A	32.13	8.69	-	98.93	OB
5320.0	52.81	Average	H	N/A	32.13	8.69	-	93.63	OB
5320.0	44.36	Average	V	N/A	32.13	8.69	-	85.18	OB
*5350.0	48.11	Peak	H	N/A	32.16	-21.69	74.00	58.59	15.41
*5350.0	47.87	Peak	V	N/A	32.16	-21.69	74.00	58.35	15.65
*5350.0	34.76	Average	H	N/A	32.16	-21.69	54.00	45.24	8.76
*5350.0	34.79	Average	V	N/A	32.16	-21.69	54.00	45.27	8.73
*10640.0	41.91	Peak	H	N/A	40.04	-16.07	74.00	65.88	8.12
*10640.0	42.01	Peak	V	N/A	40.04	-16.07	74.00	65.98	8.02
*10640.0	25.81	Average	H	N/A	40.04	-16.07	54.00	49.78	4.22
*10640.0	26.01	Average	V	N/A	40.04	-16.07	54.00	49.98	4.02

802.11a_DFS (5 500 – 5 700 MHz)

Table 17. Low Channel (5 500 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5500.0	66.72	Peak	H	N/A	32.31	8.80	-	107.83	OB
5500.0	57.17	Peak	V	N/A	32.31	8.80	-	98.28	OB
5500.0	53.46	Average	H	N/A	32.31	8.80	-	94.57	OB
5500.0	44.14	Average	V	N/A	32.31	8.80	-	85.25	OB
*5460.0	44.91	Peak	H	N/A	32.27	-21.62	74.00	55.55	18.45
*5460.0	43.76	Peak	V	N/A	32.27	-21.62	74.00	54.40	19.60
*5460.0	32.90	Average	H	N/A	32.27	-21.62	54.00	43.54	10.46
*5460.0	33.21	Average	V	N/A	32.27	-21.62	54.00	43.85	10.15
*11000.0	42.11	Peak	H	N/A	40.76	-15.15	74.00	67.72	6.28
*11000.0	41.24	Peak	V	N/A	40.76	-15.15	74.00	66.85	7.15
*11000.0	24.11	Average	H	N/A	40.76	-15.15	54.00	49.72	4.28
*11000.0	24.07	Average	V	N/A	40.76	-15.15	54.00	49.68	4.32

Table 18. Middle Channel (5 580 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5580.0	65.17	Peak	H	N/A	32.38	8.84	-	106.39	OB
5580.0	56.14	Peak	V	N/A	32.38	8.84	-	97.36	OB
5580.0	54.11	Average	H	N/A	32.38	8.84	-	95.33	OB
5580.0	43.03	Average	V	N/A	32.38	8.84	-	84.25	OB
*11160.0	42.13	Peak	H	N/A	40.28	-15.03	74.00	67.38	6.62
*11160.0	42.11	Peak	V	N/A	40.28	-15.03	74.00	67.36	6.64
*11160.0	24.14	Average	H	N/A	40.28	-15.03	54.00	49.39	4.61
*11160.0	24.14	Average	V	N/A	40.28	-15.03	54.00	49.39	4.61

Table 19. High Channel (5 700 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5700.0	66.21	Peak	H	N/A	32.50	8.88	-	107.59	OB
5700.0	56.89	Peak	V	N/A	32.50	8.88	-	98.27	OB
5700.0	54.12	Average	H	N/A	32.50	8.88	-	95.50	OB
5700.0	43.33	Average	V	N/A	32.50	8.88	-	84.71	OB
*11400.0	42.31	Peak	H	N/A	39.57	-14.86	74.00	67.02	6.98
*11400.0	43.01	Peak	V	N/A	39.57	-14.86	74.00	67.72	6.28
*11400.0	24.42	Average	H	N/A	39.57	-14.86	54.00	49.13	4.87
*11400.0	24.42	Average	V	N/A	39.57	-14.86	54.00	49.13	4.87

802.11n-HT20_Non DFS (5 180 – 5 240 MHz)

Table 20. Low Channel (5 180 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5180.0	68.71	Peak	H	N/A	32.00	8.57	-	109.28	OB
5180.0	58.63	Peak	V	N/A	32.00	8.57	-	99.20	OB
5180.0	54.71	Average	H	N/A	32.00	8.57	-	95.28	OB
5180.0	44.91	Average	V	N/A	32.00	8.57	-	85.48	OB
*5150.0	47.11	Peak	H	N/A	31.97	-21.87	74.00	57.21	16.79
*5150.0	48.71	Peak	V	N/A	31.97	-21.87	74.00	58.81	15.19
*5150.0	34.96	Average	H	N/A	31.97	-21.87	54.00	45.06	8.94
*5150.0	35.01	Average	V	N/A	31.97	-21.87	54.00	45.11	8.89
10360.0	43.71	Peak	H	N/A	39.48	-16.42	68.23	66.77	1.46
10360.0	42.36	Peak	V	N/A	39.48	-16.42	68.23	65.42	2.81
10360.0	25.72	Average	H	N/A	39.48	-16.42	68.23	48.78	19.45
10360.0	25.66	Average	V	N/A	39.48	-16.42	68.23	48.72	19.51

Table 21. Middle Channel (5 220 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5220.0	68.20	Peak	H	N/A	32.04	8.62	-	108.85	OB
5220.0	58.17	Peak	V	N/A	32.04	8.62	-	98.82	OB
5220.0	53.91	Average	H	N/A	32.04	8.62	-	94.56	OB
5220.0	44.87	Average	V	N/A	32.04	8.62	-	85.52	OB
10440.0	43.81	Peak	H	N/A	39.64	-16.43	68.23	67.02	1.21
10440.0	43.72	Peak	V	N/A	39.64	-16.43	68.23	66.93	1.30
10440.0	25.81	Average	H	N/A	39.64	-16.43	68.23	49.02	19.21
10440.0	25.91	Average	V	N/A	39.64	-16.43	68.23	49.12	19.11

Table 22. High Channel (5 240 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5240.0	67.71	Peak	H	N/A	32.06	8.63	-	108.40	OB
5240.0	57.74	Peak	V	N/A	32.06	8.63	-	98.43	OB
5240.0	53.46	Average	H	N/A	32.06	8.63	-	94.15	OB
5240.0	43.96	Average	V	N/A	32.06	8.63	-	84.65	OB
10480.0	43.84	Peak	H	N/A	39.72	-16.43	68.23	67.13	1.10
10480.0	43.60	Peak	V	N/A	39.72	-16.43	68.23	66.89	1.34
10480.0	24.96	Average	H	N/A	39.72	-16.43	68.23	48.25	19.98
10480.0	25.21	Average	V	N/A	39.72	-16.43	68.23	48.50	19.73

802.11n-HT20_DFS (5 260 – 5 320 MHz)

Table 23. Low Channel (5 260 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5260.0	67.52	Peak	H	N/A	32.08	8.65	-	108.24	OB
5260.0	57.72	Peak	V	N/A	32.08	8.65	-	98.44	OB
5260.0	53.46	Average	H	N/A	32.08	8.65	-	94.18	OB
5260.0	44.01	Average	V	N/A	32.08	8.65	-	84.73	OB
10520.0	43.72	Peak	H	N/A	39.80	-16.38	68.23	67.14	1.09
10520.0	43.72	Peak	V	N/A	39.80	-16.38	68.23	67.14	1.09
10520.0	25.61	Average	H	N/A	39.80	-16.38	68.23	49.03	19.20
10520.0	25.22	Average	V	N/A	39.80	-16.38	68.23	48.64	19.59

Table 24. Middle Channel (5 300 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5300.0	67.24	Peak	H	N/A	32.12	8.68	-	108.03	OB
5300.0	57.82	Peak	V	N/A	32.12	8.68	-	98.61	OB
5300.0	53.46	Average	H	N/A	32.12	8.68	-	94.25	OB
5300.0	44.21	Average	V	N/A	32.12	8.68	-	85.00	OB
*10600.0	44.81	Peak	H	N/A	39.96	-16.17	74.00	68.60	5.40
*10600.0	43.23	Peak	V	N/A	39.96	-16.17	74.00	67.02	6.98
*10600.0	25.72	Average	H	N/A	39.96	-16.17	54.00	49.51	4.49
*10600.0	25.62	Average	V	N/A	39.96	-16.17	54.00	49.41	4.59

Table 25. High Channel (5 320 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5320.0	67.24	Peak	H	N/A	32.13	8.69	-	108.06	OB
5320.0	57.84	Peak	V	N/A	32.13	8.69	-	98.66	OB
5320.0	54.11	Average	H	N/A	32.13	8.69	-	94.93	OB
5320.0	44.22	Average	V	N/A	32.13	8.69	-	85.04	OB
*5350.0	48.12	Peak	H	N/A	32.16	-21.69	74.00	58.60	15.40
*5350.0	47.87	Peak	V	N/A	32.16	-21.69	74.00	58.35	15.65
*5350.0	34.04	Average	H	N/A	32.16	-21.69	54.00	44.52	9.48
*5350.0	35.01	Average	V	N/A	32.16	-21.69	54.00	45.49	8.51
*10640.0	43.21	Peak	H	N/A	40.04	-16.07	74.00	67.18	6.82
*10640.0	44.57	Peak	V	N/A	40.04	-16.07	74.00	68.54	5.46
*10640.0	25.21	Average	H	N/A	40.04	-16.07	54.00	49.18	4.82
*10640.0	25.46	Average	V	N/A	40.04	-16.07	54.00	49.43	4.57

802.11n-HT20_DFS (5 500 – 5 700 MHz)

Table 26. Low Channel (5 500 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5500.0	67.21	Peak	H	N/A	32.31	8.80	-	108.32	OB
5500.0	58.11	Peak	V	N/A	32.31	8.80	-	99.22	OB
5500.0	54.61	Average	H	N/A	32.31	8.80	-	95.72	OB
5500.0	44.21	Average	V	N/A	32.31	8.80	-	85.32	OB
*5460.0	44.87	Peak	H	N/A	32.27	-21.62	74.00	55.51	18.49
*5460.0	44.37	Peak	V	N/A	32.27	-21.62	74.00	55.01	18.99
*5460.0	32.80	Average	H	N/A	32.27	-21.62	54.00	43.44	10.56
*5460.0	33.01	Average	V	N/A	32.27	-21.62	54.00	43.65	10.35
*11000.0	43.44	Peak	H	N/A	40.76	-15.15	74.00	69.05	4.95
*11000.0	43.51	Peak	V	N/A	40.76	-15.15	74.00	69.12	4.88
*11000.0	25.01	Average	H	N/A	40.76	-15.15	54.00	50.62	3.38
*11000.0	24.21	Average	V	N/A	40.76	-15.15	54.00	49.82	4.18

Table 27. Middle Channel (5 580 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5580.0	67.28	Peak	H	N/A	32.38	8.84	-	108.50	OB
5580.0	57.87	Peak	V	N/A	32.38	8.84	-	99.09	OB
5580.0	53.89	Average	H	N/A	32.38	8.84	-	95.11	OB
5580.0	43.61	Average	V	N/A	32.38	8.84	-	84.83	OB
*11160.0	44.21	Peak	H	N/A	40.28	-15.03	74.00	69.46	4.54
*11160.0	43.82	Peak	V	N/A	40.28	-15.03	74.00	69.07	4.93
*11160.0	24.46	Average	H	N/A	40.28	-15.03	54.00	49.71	4.29
*11160.0	24.28	Average	V	N/A	40.28	-15.03	54.00	49.53	4.47

Table 28. High Channel (5 700 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5700.0	67.29	Peak	H	N/A	32.50	8.88	-	108.67	OB
5700.0	57.54	Peak	V	N/A	32.50	8.88	-	98.92	OB
5700.0	54.04	Average	H	N/A	32.50	8.88	-	95.42	OB
5700.0	43.81	Average	V	N/A	32.50	8.88	-	85.19	OB
*11400.0	43.96	Peak	H	N/A	39.57	-14.86	74.00	68.67	5.33
*11400.0	43.17	Peak	V	N/A	39.57	-14.86	74.00	67.88	6.12
*11400.0	24.40	Average	H	N/A	39.57	-14.86	54.00	49.11	4.89
*11400.0	24.17	Average	V	N/A	39.57	-14.86	54.00	48.88	5.12

802.11n-HT40_Non DFS (5 190 – 5 230 MHz)

Table 29. Low Channel (5 190 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5190.0	60.43	Peak	H	N/A	32.01	8.58	-	101.02	OB
5190.0	54.77	Peak	V	N/A	32.01	8.58	-	95.36	OB
5190.0	43.64	Average	H	N/A	32.01	8.58	-	84.23	OB
5190.0	37.96	Average	V	N/A	32.01	8.58	-	78.55	OB
*5150.0	48.11	Peak	H	N/A	31.97	-21.87	74.00	58.21	15.79
*5150.0	48.76	Peak	V	N/A	31.97	-21.87	74.00	58.86	15.14
*5150.0	35.11	Average	H	N/A	31.97	-21.87	54.00	45.21	8.79
*5150.0	34.90	Average	V	N/A	31.97	-21.87	54.00	45.00	9.00
10380.0	43.11	Peak	H	N/A	39.52	-16.43	68.23	66.20	2.03
10380.0	43.21	Peak	V	N/A	39.52	-16.43	68.23	66.30	1.93
10380.0	25.11	Average	H	N/A	39.52	-16.43	68.23	48.20	20.03
10380.0	24.96	Average	V	N/A	39.52	-16.43	68.23	48.05	20.18

Table 30. High Channel (5 230 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5230.0	60.21	Peak	H	N/A	32.05	8.62	-	100.88	OB
5230.0	54.36	Peak	V	N/A	32.05	8.62	-	95.03	OB
5230.0	43.24	Average	H	N/A	32.05	8.62	-	83.91	OB
5230.0	36.81	Average	V	N/A	32.05	8.62	-	77.48	OB
10460.0	43.21	Peak	H	N/A	39.68	-16.43	68.23	66.46	1.77
10460.0	44.20	Peak	V	N/A	39.68	-16.43	68.23	67.45	0.78
10460.0	25.01	Average	H	N/A	39.68	-16.43	68.23	48.26	19.97
10460.0	24.11	Average	V	N/A	39.68	-16.43	68.23	47.36	20.87

802.11a_DFS (5 270 – 5 310 MHz)

Table 31. Low Channel (5 270 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5270.0	60.22	Peak	H	N/A	32.09	8.65	-	100.96	OB
5270.0	54.21	Peak	V	N/A	32.09	8.65	-	94.95	OB
5270.0	43.21	Average	H	N/A	32.09	8.65	-	83.95	OB
5270.0	37.36	Average	V	N/A	32.09	8.65	-	78.10	OB
10540.0	43.49	Peak	H	N/A	39.84	-16.33	68.23	67.00	1.23
10540.0	44.01	Peak	V	N/A	39.84	-16.33	68.23	67.52	0.71
10540.0	25.01	Average	H	N/A	39.84	-16.33	68.23	48.52	19.71
10540.0	25.00	Average	V	N/A	39.84	-16.33	68.23	48.51	19.72

Table 32. High Channel (5 310 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5310.0	60.21	Peak	H	N/A	32.12	8.68	-	101.02	OB
5310.0	54.11	Peak	V	N/A	32.12	8.68	-	94.92	OB
5310.0	43.62	Average	H	N/A	32.12	8.68	-	84.43	OB
5310.0	36.84	Average	V	N/A	32.12	8.68	-	77.65	OB
*5350.0	48.14	Peak	H	N/A	32.16	-21.69	74.00	58.62	15.38
*5350.0	47.96	Peak	V	N/A	32.16	-21.69	74.00	58.44	15.56
*5350.0	34.01	Average	H	N/A	32.16	-21.69	54.00	44.49	9.51
*5350.0	35.11	Average	V	N/A	32.16	-21.69	54.00	45.59	8.41
*10620.0	43.41	Peak	H	N/A	40.00	-16.12	74.00	67.29	6.71
*10620.0	44.17	Peak	V	N/A	40.00	-16.12	74.00	68.05	5.95
*10620.0	25.11	Average	H	N/A	40.00	-16.12	54.00	48.99	5.01
*10620.0	25.01	Average	V	N/A	40.00	-16.12	54.00	48.89	5.11

802.11a_DFS (5 510 – 5 670 MHz)

Table 33. Low Channel (5 510 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5510.0	59.41	Peak	H	N/A	32.31	8.81	-	100.53	OB
5510.0	54.01	Peak	V	N/A	32.31	8.81	-	95.13	OB
5510.0	43.52	Average	H	N/A	32.31	8.81	-	84.64	OB
5510.0	36.91	Average	V	N/A	32.31	8.81	-	78.03	OB
*5460.0	43.81	Peak	H	N/A	32.27	-21.62	74.00	54.45	19.55
*5460.0	43.40	Peak	V	N/A	32.27	-21.62	74.00	54.04	19.96
*5460.0	33.10	Average	H	N/A	32.27	-21.62	54.00	43.74	10.26
*5460.0	33.40	Average	V	N/A	32.27	-21.62	54.00	44.04	9.96
*11020.0	43.21	Peak	H	N/A	40.70	-15.14	74.00	68.77	5.23
*11020.0	43.70	Peak	V	N/A	40.70	-15.14	74.00	69.26	4.74
*11020.0	24.10	Average	H	N/A	40.70	-15.14	54.00	49.66	4.34
*11020.0	24.41	Average	V	N/A	40.70	-15.14	54.00	49.97	4.03

Table 34. Middle Channel (5 550 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5550.0	59.81	Peak	H	N/A	32.35	8.83	-	100.99	OB
5550.0	53.87	Peak	V	N/A	32.35	8.83	-	95.05	OB
5550.0	43.17	Average	H	N/A	32.35	8.83	-	84.35	OB
5550.0	37.01	Average	V	N/A	32.35	8.83	-	78.19	OB
*11100.0	43.14	Peak	H	N/A	40.46	-15.08	74.00	68.52	5.48
*11100.0	43.69	Peak	V	N/A	40.46	-15.08	74.00	69.07	4.93
*11100.0	24.01	Average	H	N/A	40.46	-15.08	54.00	49.39	4.61
*11100.0	23.94	Average	V	N/A	40.46	-15.08	54.00	49.32	4.68

Table 35. High Channel (5 670 MHz)

Radiated emissions			Ant	Correction factors			Limit	Total	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	Distance (dB)	AF (dB/m)	Amp gain+CL (dB)	Limit (dBuV/m)	Actual (dBuV/m)	Margin (dB)
5670.0	60.18	Peak	H	N/A	32.47	8.87	-	101.52	OB
5670.0	54.61	Peak	V	N/A	32.47	8.87	-	95.95	OB
5670.0	42.52	Average	H	N/A	32.47	8.87	-	83.86	OB
5670.0	37.88	Average	V	N/A	32.47	8.87	-	79.22	OB
*11340.0	43.11	Peak	H	N/A	39.75	-14.91	74.00	67.95	6.05
*11340.0	43.22	Peak	V	N/A	39.75	-14.91	74.00	68.06	5.94
*11340.0	24.60	Average	H	N/A	39.75	-14.91	54.00	49.44	4.56
*11340.0	24.91	Average	V	N/A	39.75	-14.91	54.00	49.75	4.25

Supplementary information:

-. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental Frequency. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.

Remark

a. "OB" means Operating band.
b. "*" means the restricted band.
c. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using Peak/average detector mode if frequency was in restricted band. Otherwise the frequency was in outside of restricted band, only peak detector should be used.
d. Average test would be performed if the peak result were greater than the average limit and frequency was in the restricted band.
e. To get a maximum emission level from the EUT, the EUT was moved throughout the x-axis, Y-axis and Z-axis. The worst case is x-axis.
f. For Fundamental : Actual = Reading + AF + CL (AF : Antenna factor, CL : Cable loss)
g. For Spurious : Actual = Reading + AF + AMP + CL (AF : Antenna factor, AMP : Amp gain, CL : Cable loss)
h. Distance factor = 20log(Measurement distance / The measured distance)
i. Margin = Limit (dBuV/m) - Actual (dBuV/m)
j. If frequency was outside of restricted band, the calculation method for peak limit is same as below: 68.23 dBuV/m = EIRP – 20 log(d) + 104.77 = -27 – 20 log (3) + 104.77
*distance: 3 m, *EIRP: -27 dBm/MHz

5.7 Transmitter AC Power Line Conducted Emission

TEST: Transmitter AC Power Line Conducted Emission		
Method	All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section. AC line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4-2003 1. The test procedure is performed in a 6.5m × 3.6m× 3.6m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. 2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. 3. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT were moved to find the maximum emission.	
Basic Standard	FCC Part 15.207(a)	
Parameters recorded during the test	Laboratory Ambient Temperature	25°C
	Relative Humidity	39%
-	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150 kHz to 30 MHz	A.C. Input port of A.C. to D.C. adapter.

Configuration Settings

EUT Configuration Settings:		
Power Interface Mode # (See Section 3.3)	Test Configurations Mode # (See Section 3.7)	EUT Operation Mode # (See 3.5)
Rated	1	1

Limits

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 - 56*	56 - 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

Transmitter AC Power Line Conducted Emission

Measurement method : ☐ Radiated ☒ Conducted
Mode of operation : Continuous Wave
Power setting : Max. Power condition declared by the manufacturer
Worst case configuration :

Table 36. Test data for conducted emission

Frequency (MHz)	Correction Factor (dB)		Line (H/N)	Quasi-peak Value (dBuV)			Average Value (dBuV)		
	LISN	Cable etc.		Limit	Reading	Result	Limit	Reading	Result
0.17	0.13	0.35	N	65.0	52.07	52.55	54.96	45.00	45.48
0.35	0.15	0.36	H	59.0	40.44	40.96	49.0		
0.53	0.16	0.37	H	56.0	37.17	37.70	46.0		
0.88	0.16	0.41	H	56.0	36.45	37.02	46.0		
1.06	0.18	0.47	N	56.0	39.47	40.12	46.0		
1.23	0.18	0.46	N	56.0	38.99	39.64	46.0		
Remark	H : Hot Line, N : Neutral Line Correction factor=LISN factor + Cable loss								

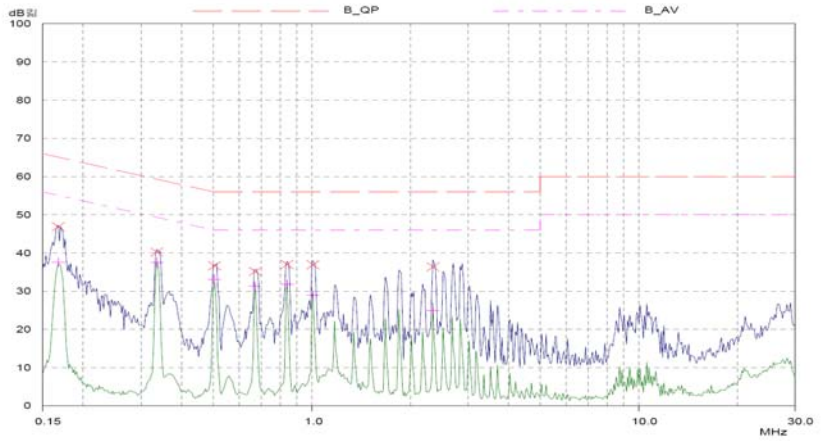
Figure 14. Graphical representation of Conducted Emission

HOT LINE

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	0.8%	10kHz	PK+AV	10msec	Auto	OFF	60dB

Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 0 dB

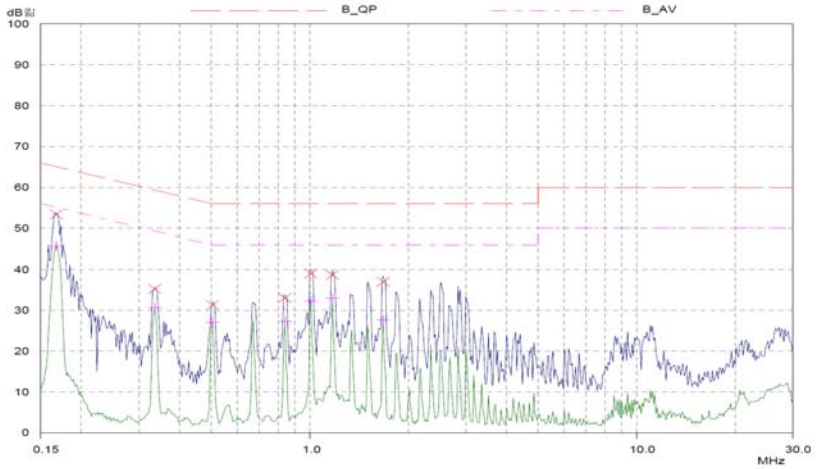


NEUTRAL LINE

Scan Settings (1 Range)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz	0.8%	10kHz	PK+AV	10msec	Auto	OFF	60dB

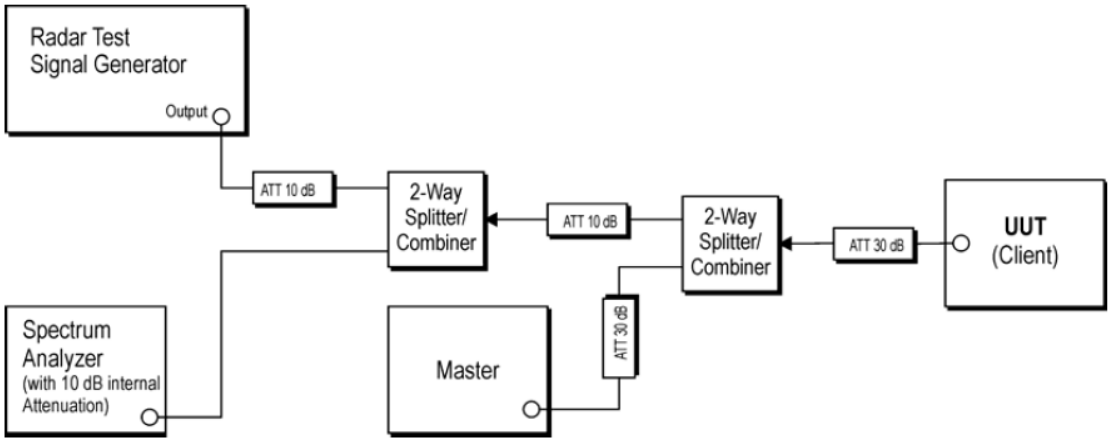
Final Measurement: Detectors: X QP / + AV
Meas Time: 1sec
Subranges: 25
Acc Margin: 0 dB



5.8 DFS (Dynamic Frequency Selection)

5.7.1. System overview

5.7.2. Set up of EUT



The radar signal generation equipment consists of a vector signal generator

The signal monitoring equipment consists of a spectrum analyzer set to display 8001 bins on the horizontal axis. The time domain resolution is 2 msec/bin with a 16 second sweep time, meeting the 10 second short pulse reporting criteria. The aggregate ON time is calculated by multiplying the number of bins above a threshold during a particular observation period by the dwell time per bin, with the analyzer set to peak detection and max hold.

The Slave is tested separately for compliance with the Channel Shutdown requirements, for the situation when the Slave device vacates the channel in response to detection of a radar by the Master.

All tests were performed at a channel center frequency of 5 310 MHz and 5 510 MHz. Measurements were performed using conducted test methods.

5.7.3. Limit

§15.407 (h) and FCC 06-96 APPENDIX "COMPLIANCE MEASUREMENT PROCEDURES FOR UNLICENSED-NATIONAL INFORMATION INFRASTRUCTURE DEVCIES OPERATING IN THE 5250-5350 MHz AND 5470-5725 MHz BANDS INCORPORATING DYNAMIC FREQUENCY SELECTION

Applicability of DFS requirements prior to use of a channel

Requirement	Operational Mode		
	Master	Client (without DFS)	Client (with DFS)
Non-Occupancy Period	Yes	Yes (according to KDB 848637)	Yes
DFS Detection Threshold	Yes	Yes (according to KDB 848637)	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required

Applicability of DFS requirements during normal operation

Requirement	Operational Mode		
	Master	Client (without DFS)	Client (with DFS)
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes

Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value (see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming a 0 dBi receive antenna Note 2: Throughout these test procedures an additional 1 dB has been added to the amplitude of the test transmission waveforms to account for variations in measurement equipment. This will ensure that the test signal is at or above the detection threshold level to trigger a DFS response.		

KDB 848637 : Non-Occupancy Period for Client Device without radar detection

· Test results demonstrating an associated client link is established with the master on a test frequency;
· The client and DFS-certified master device are associated, and a movie can be streamed as specified in the DFS Order for a non-occupancy period test;
· The test frequency has been monitored to ensure no transmission of any type has occurred for 30 minutes. Note: If the client moves with the master, the device is considered compliant if nothing appears in the client non-occupancy period test. For devices that shut down (rather than moving channels), no beacons should appear;
· An analyzer plot that contains a single 30-minute sweep on the original channel.

DFS Response requirement values

Parameter	Value
Non-occupancy period	30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
Channel Closing Transmission Time	200 milliseconds + approx. 60 milliseconds over remaining 10 second period
The instant that the Channel Move Time and the Channel Closing Transmission Time begins is as follows: For the Short pulse radar Test Signals this instant is the end of the Burst. For the Frequency Hopping radar Test Signal, this instant is the end of the last radar burst generated. For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission. The Channel Closing Transmission Time is comprised of 200 milliseconds starting at the beginning of the Channel Move Time plus any additional intermittent control signals required to facilitate channel changes (an aggregate of approximately 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.	

Short Pulse Radar Test Waveforms

Radar Type	Pulse Width (Microseconds)	PRI (Microseconds)	Pulses	Minimum Percentage of Successful Detection	Minimum Trials
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (Radar Types 1-4)				80%	120

Long Pulse Radar Test Signal

Radar Waveform	Bursts	Pulses per Burst	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Minimum Percentage of Successful Detection	Minimum Trials
5	8-20	1-3	50-100	5-20	10002000	80%	30

Frequency Hopping Radar Test Signal

Radar Waveform	Pulse Width (µsec)	PRI (µsec)	Burst Length (ms)	Pulses per Hop	Hopping Rate (kHz)	Minimum Percentage of Successful Detection	Minimum Trials
6	1	333	300	9	0.333	70%	30

5.7.4. Description of EUT

The EUT operates over the 5 260 MHz ~ 5 320 MHz (11a/n-HT20-DFS), 5 270 MHz ~ 5 310 MHz (11n-HT40-DFS), 5 500 MHz ~ 5700 MHz (11a/n-HT20-DFS), and 5 510 MHz ~ 5670 MHz (11n-HT40-DFS) range.

The gain antenna assembly utilized with the master has a gain of 0 dBi.

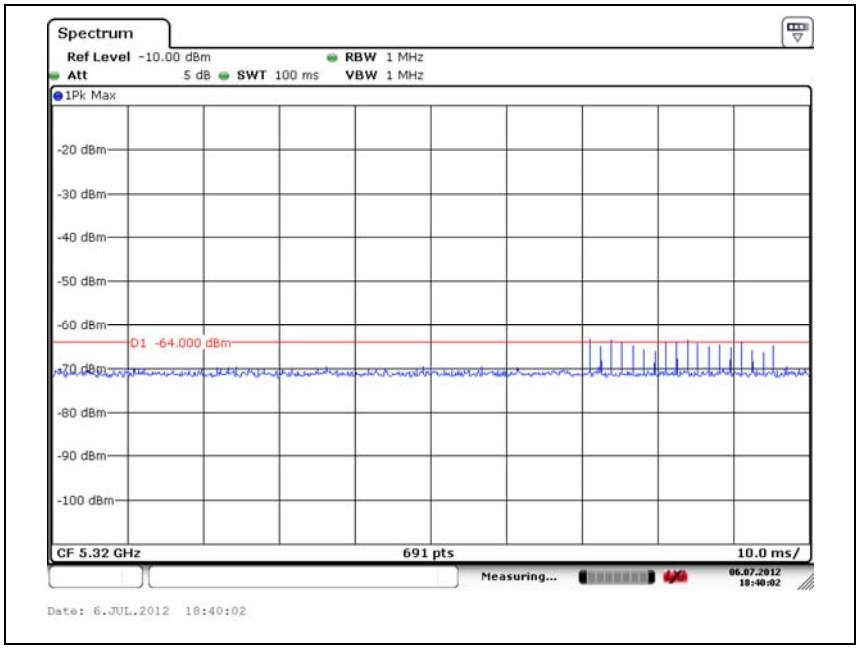
The rated output power of the master unit is <200 milliwatt. Therefore the required interference threshold level is -62 dBm. After correction for antenna gain and procedure adjustments the required conducted threshold at the antenna port is -62 (dBm) + (0 dBi) = -62 (dBm)

The calibrated conducted DFS Detection Threshold level is is -64 dBm

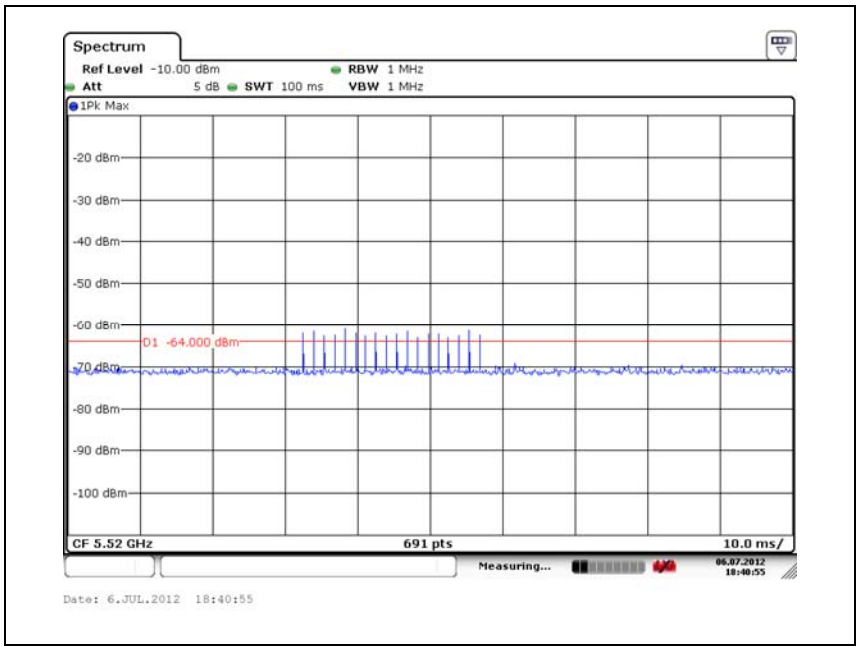
Figure 15. Plots of radar waveforms and wlan traffic

Plot of radar waveform type 1

5 310 MHz

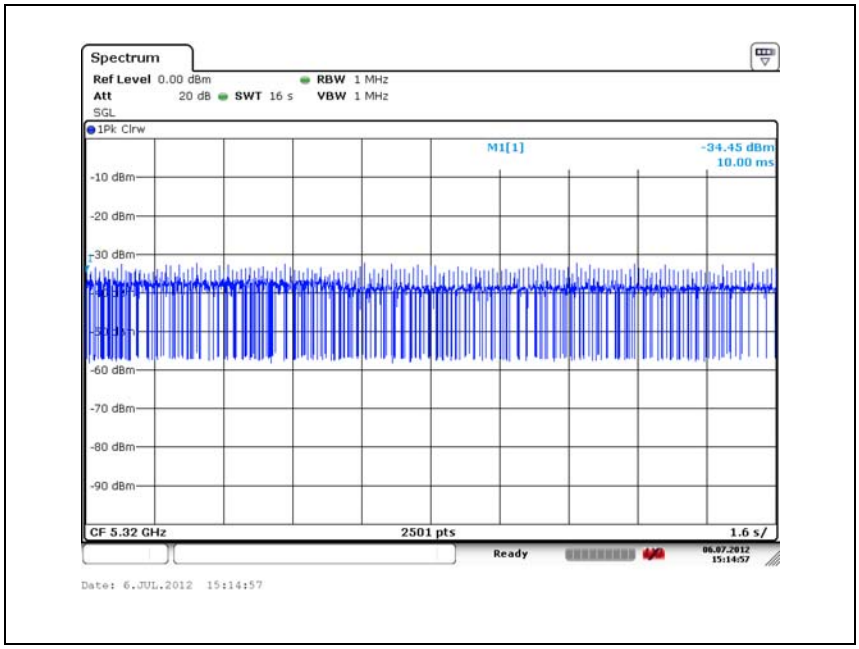


5 510 MHz

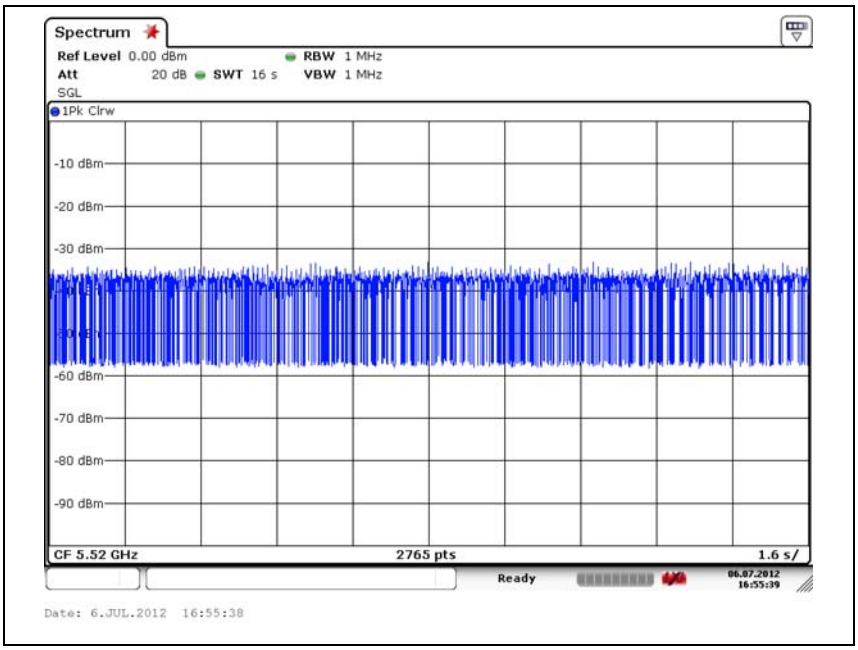


Plot of LAN traffic

5 310 MHz



5 510 MHz



The reference maker is set at the end of Last radar pulse.

The delta maker is set at the end of the last WLAN transmission following the radar pulse. This delta is the channel move time.

The aggregate channel closing transmission time is calculated as follows:

Aggregate Transmission Time= (Number of analyzer bins showing transmission)*(dwell time per bin)

The observation period over which the aggregated time is calculated begins at (Reference Maker) and ends no earlier than (Reference Maker +10 sec)

Table 37. Test result

Frequency (MHz)	Channel Move Time (sec)	Limit
5 310	0.67	Not exceed 10 sec
5 510	0.80	
Frequency (MHz)	**Aggregate channel closing transmission time (msec)**	**Limit**
5 310	16	Not exceed 1 000 msec
5 510	24	

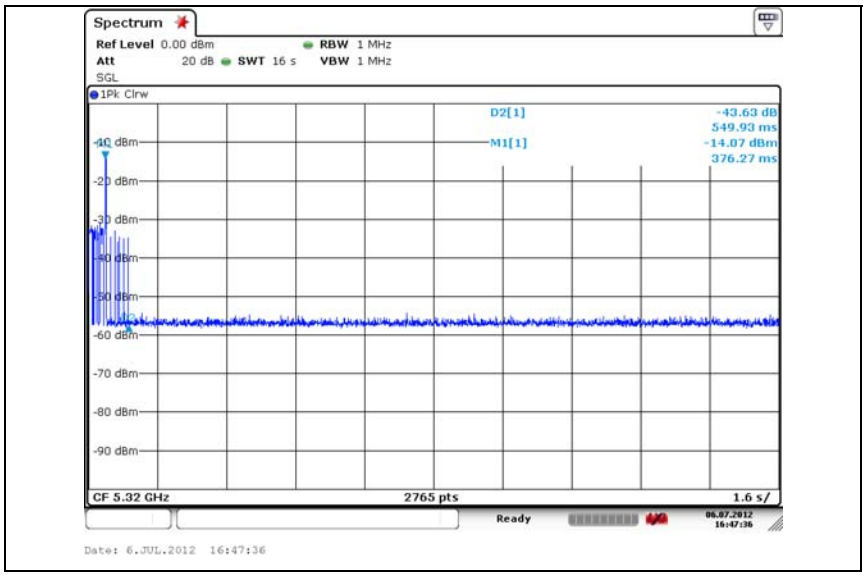
5 310 MHz : 2 * 8 = 16 msec
5 510 MHz : 2 * 12 = 24 msec

Frequency (MHz)	Non-occupancy period (min)	Limit
5 310	30	Not be less than 30 minute
5 510	30	

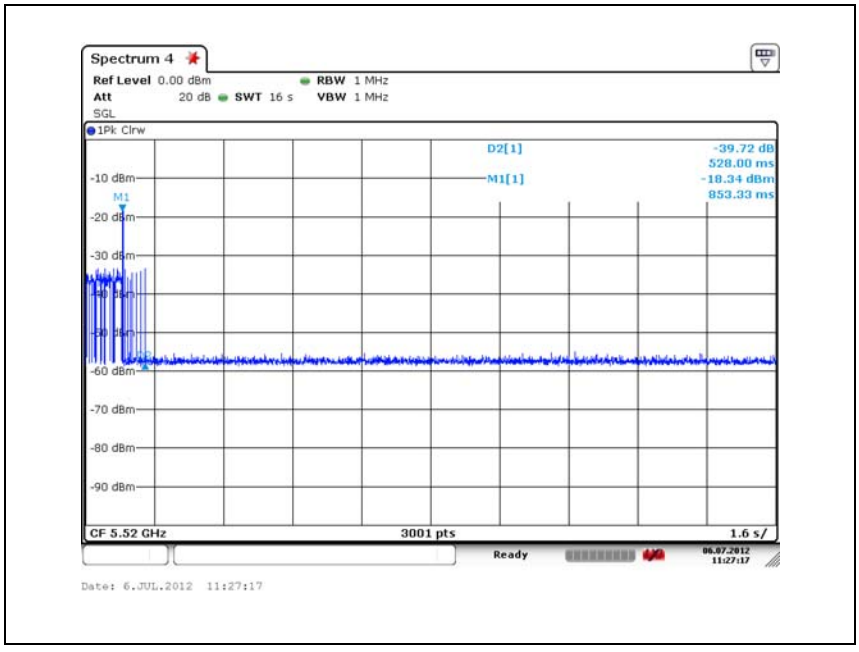
Figure 16. Captured images for DFS Test

Plot of channel move time & aggregate channel closing transmission time

5 310 MHz

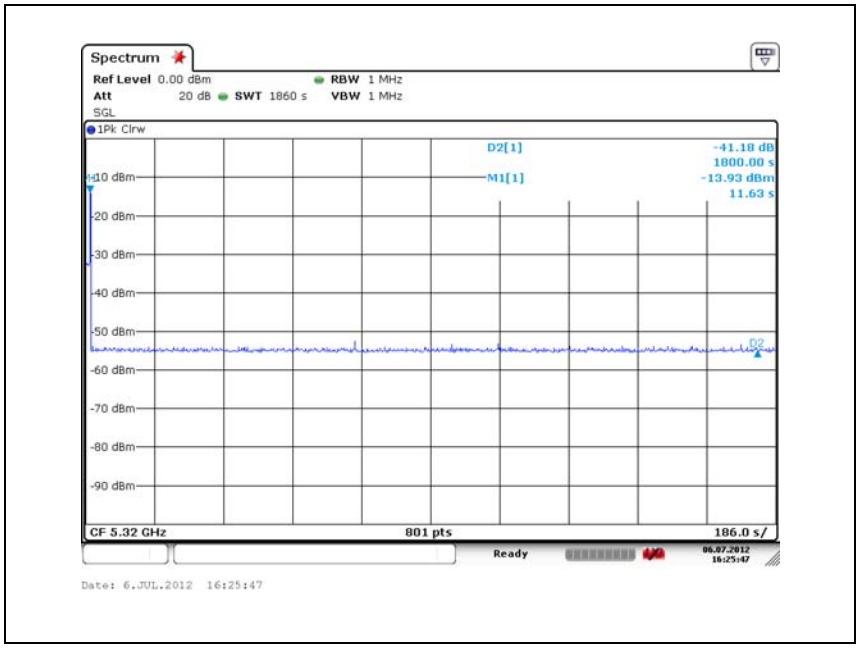


5 510 MHz

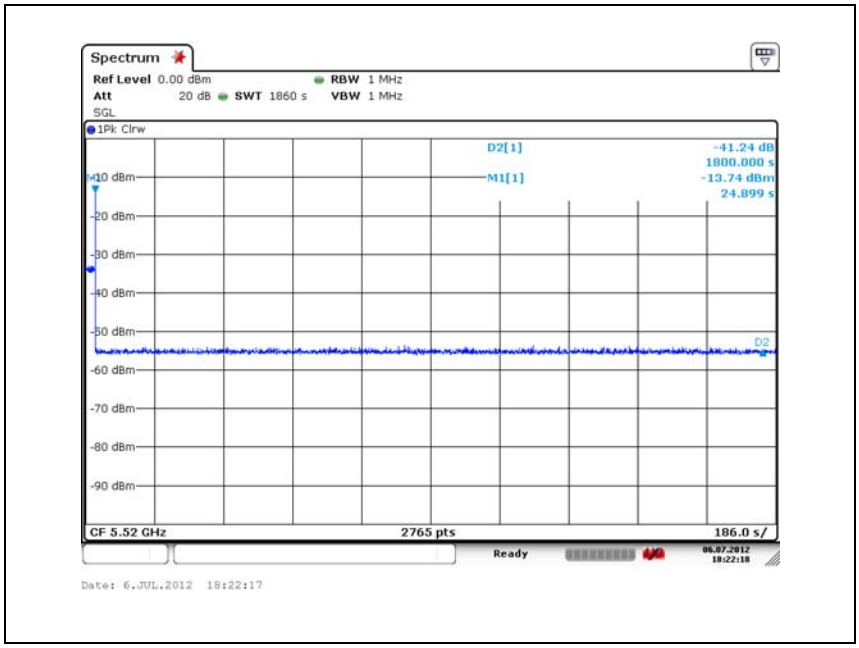


Plot of Non-occupancy period

5 310 MHz



5 510 MHz



5.9 Antenna Requirement

5.8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section § 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

5.8.2. Antenna Connected Construction

The antenna used of this product is Metal Stamping Antenna Assembly and peak max gain of each antennas as below . :

Band	2412 – 2462 MHz	5745 – 5825 MHz 5180 – 5320 MHz 5500 – 5700 MHz
Antenna Gain (dBi)	3.51	4.07

APPENDIX A. Accreditations and Authorizations

ESTECH CO., LTD. has been accredited / filed / authorized by the agencies listed in the following table;

Certificate	Nation	Agency	Code	Mark
Accreditation	Korea	KOLAS	KT141	ISO/IEC 17025
Site Filing	USA	FCC	659627	Test Facility list & NSA Data
Certification	Korea	KC	KR0019	Test Facility list & NSA Data

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competent of calibration and testing