RF TEST REPORT

Test item	:	Miracast Dongle
Model No.	:	RTSD5000, RTSD5000W
Order No.	:	DEMC1307-02180
Date of receipt	:	2013-07-12
Test duration	:	2013-08-12 ~ 2013-08-20
Date of issue	:	2013-08-26
Use of report	:	Original Grant

Applicant : TO21 Co.,Ltd.
9F, Nasan Suite, 395-68, Shindaebang-2dong, Dongjak-ku, Seoul, 156-710

Test laboratory : Digital EMC Co., Ltd.
683-3, Yubang-Dong, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, 449-080, Korea

Test specification	:	FCC Part 15.407 Subpart E ANSI C63.10-2009, KDB 789033 v01r03
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of Digital EMC Co., Ltd.

Tested by:	Witnessed by:	Reviewed by:
Engineer HyunSu Son	N/A	Deputy General Manager HongHee Lee

Test Report Version

Test Report No.	Date	Description
DRTFCC1308-0815	Aug. 26, 2013	Initial issue

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1. EUT information

1.1 EUT description

FCC Equipment Class	Unlicensed National Information Infrastructure(UNII)
Product	Miracast Dongle
Model Name	RTSD5000
Add Model Name	RTSD5000W
Equipment serial no.	Identical prototype
Frequency Range	802.11n(20MHz) : Band I: 5180 ~ 5240MHz
	802.11n(40MHz) : Band I: 5190 ~ 5230MHz
Channels	802.11n(20MHz): 4 802.11n(40MHz): 2
Modulation type	802.11n(20MHz/40MHz) : OFDM
Data rate	802.11n(20MHz/40MHz): MCS0~MCS7
Antenna Specification	Wire type antenna (1TX / 1RX) Max. peak gain: 1.527 dBi
Power Supply	DC 5 V

1.2 Ancillary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

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2. Information about test items

2.1 Test mode / Channel Information

5GHz Band	Mode	Data Rate
Band I	802.11n(20MHz)	MCS0
	802.11n(40MHz)	MCS0

For all test items, the low, middle and high channels of the modes were tested with above worst case data rate.

2.2 Tested Channel Information

5GHz Band	802.11n(20MHz)		802.11n(40MHz)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]
Band I	36	5180	38	5190
	40	5200	-	-
	48	5240	46	5230

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

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2.4 Tested environment

Temperature	:	24 ~ 25 °C
Relative humidity content	:	43 ~ 52 % R.H.
Details of power supply	:	DC 5 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

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3. Test Report

3.1 Summary of tests

FCC Part Section(s)	RSS Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)					
15.407(a)	N/A	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C
15.407(a)	RSS-210 [A9.2]	Maximum Conducted Output Power	5150 ~ 5250MHz For FCC 50mW or <4 + 10log$_{10}$(B) dBm, whichever power is less. 5150 ~ 5250MHz For IC 200mW or <10 + 10log$_{10}$(B) dBm, whichever power is less. 5250 ~ 5350MHz For FCC & IC 250mW or <11 + 10log$_{10}$(B) dBm, whichever power is less. 5470 ~ 5725MHz For FCC & IC 250mW or <11 + 10log$_{10}$(B) dBm, whichever power is less.		C
15.407(a)	RSS-210 [A9.2]	Peak Power Spectral Density	5150 ~ 5250MHz For FCC: 4dBm/MHz 5150 ~ 5250MHz For IC: 10dBm/MHz 5250 ~ 5350MHz For FCC & IC: 11dBm/MHz 5470 ~ 5725MHz For FCC & IC: 11dBm/MHz		C
15.407(a)	N/A	Peak Excursion	< 13 dB/MHz maximum difference		C
15.407(g)	N/A	Frequency Stability	N/A		C
-	RSS Gen [4.6.1]	Occupied Bandwidth (99%)	N/A		N/A
15.407(b)	RSS-210 [A9.2]	Undesirable Emissions	< -27 dBm/MHz EIRP	Radiated	C
15.205 15.209 15.407(b)	RSS-Gen [7.2.5]	General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		C Note.2
15.407(h)	RSS-210 [A9.3]	Dynamic Frequency Selection	FCC 15.407	-	N/A Note.3
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions	FCC 15.207	AC Line Conducted	C
15.203	RSS-Gen [7.1.2]	Antenna Requirements	FCC 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: These test items were performed in each axis and the worst case data was reported.

Note 3: This device does not support the DFS band.

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3.2 Transmitter requirements

3.2.1 26 dB Bandwidth

Test Requirements

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. The 26dB bandwidth is used to determine the conducted output power limit.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033**.

1. Set resolution bandwidth (RBW) = approximately **1 %** of the EBW.
2. Set the video bandwidth **(VBW) > RBW**.
3. Detector = **Peak**.
4. Trace mode = **max hold**.
   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%.

▣ TEST RESULTS: Comply

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]
802.11n (20MHz)	Band I	36	5180	21.731
		40	5200	21.841
		48	5240	21.538
802.11n (40MHz)	Band I	38	5190	43.275
		-	-	-
		46	5230	43.360

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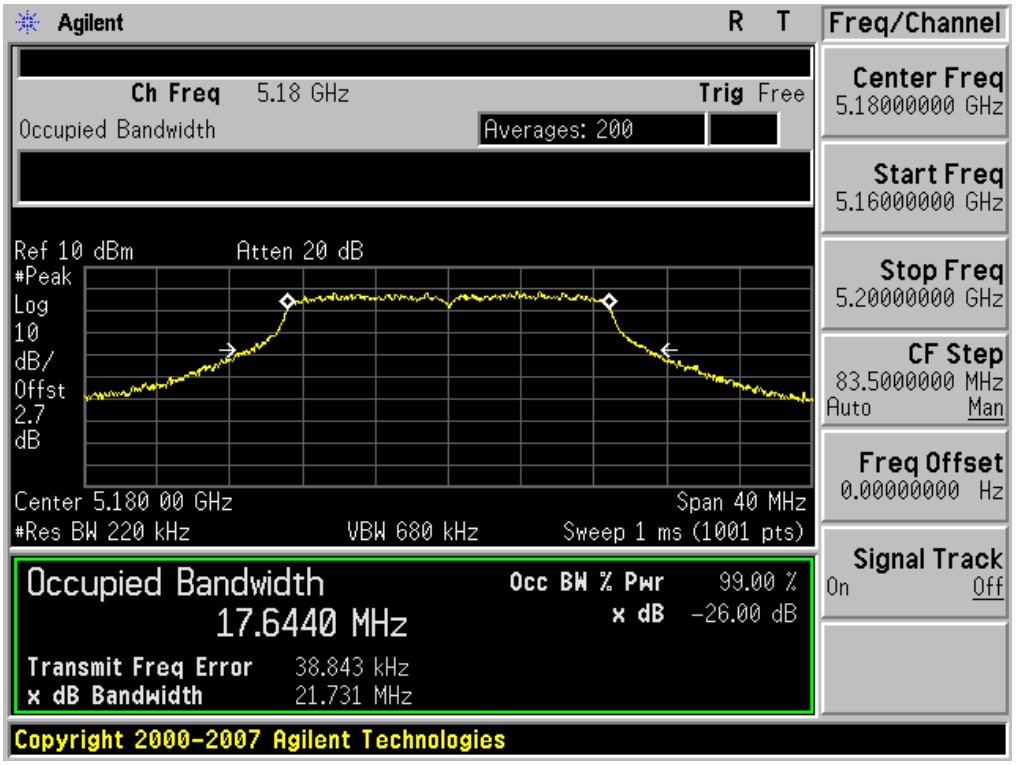
▣ RESULT PLOTS

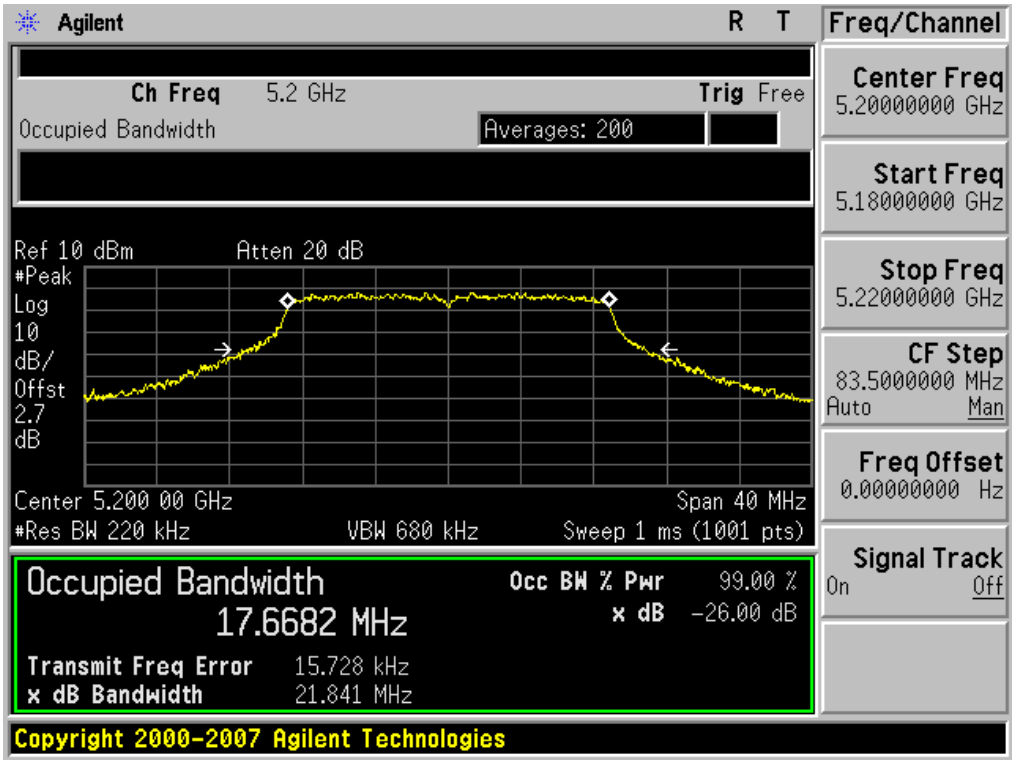
26 dB Bandwidth

Test Mode: 802.11n-HT20 & Ch.36



26 dB Bandwidth

Test Mode: 802.11n-HT20 & Ch.40



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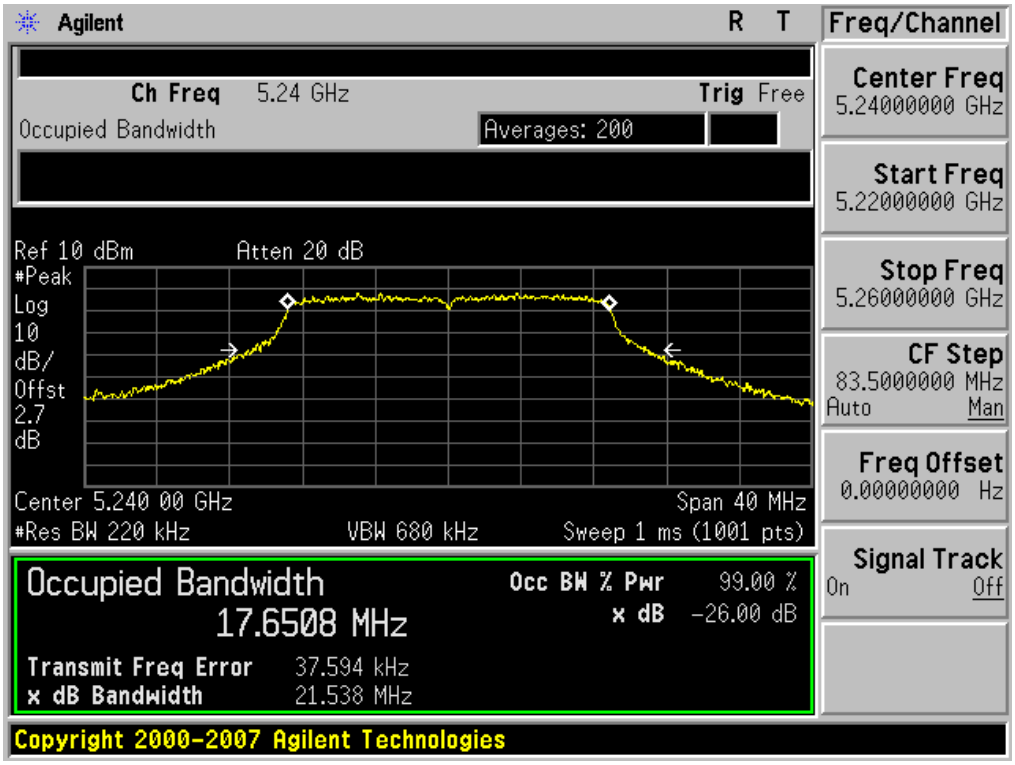
26 dB Bandwidth Test Mode: 802.11n-HT20 & Ch.48



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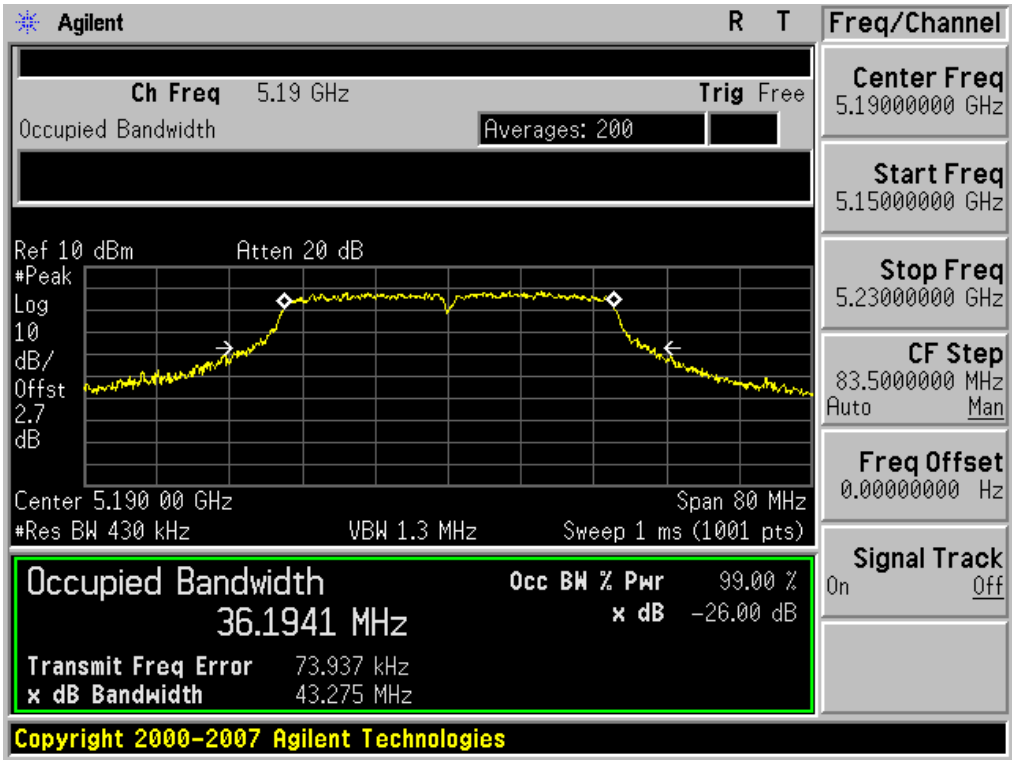
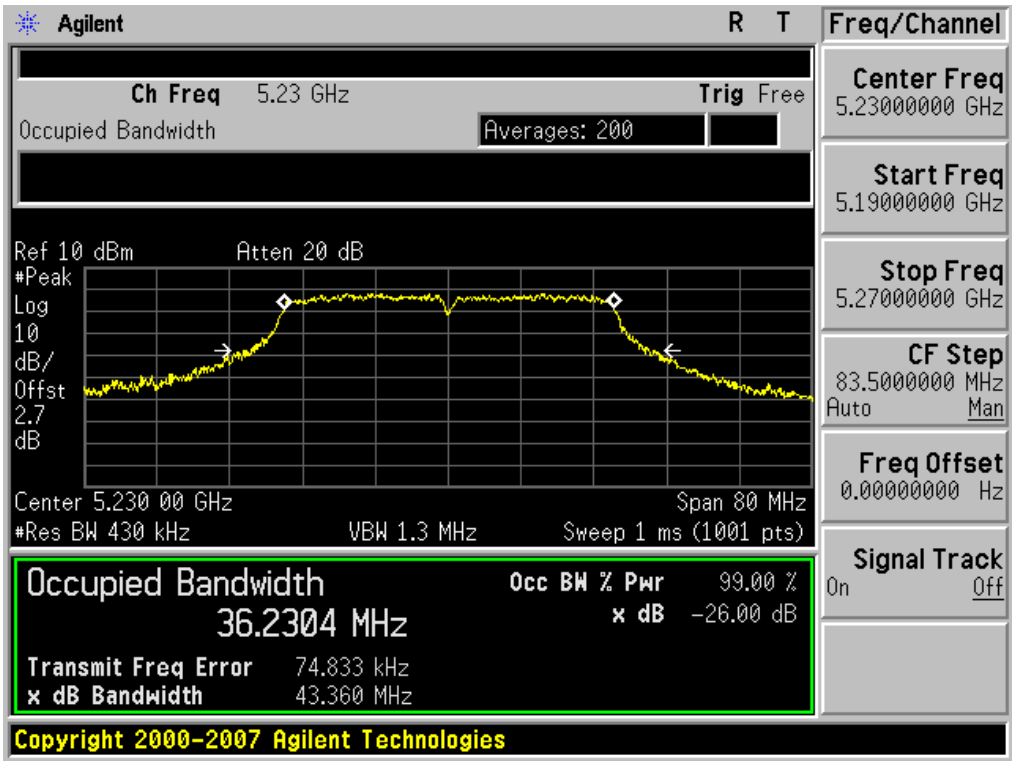
26 dB Bandwidth Test Mode: 802.11n-HT40 & Ch.38



26 dB Bandwidth Test Mode: 802.11n-HT40 & Ch.46



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3.2.2 Output Power

Test Requirements

(1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10log 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 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.

(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 + 10log B, where B is the 26 dB emission bandwidth in megahertz. 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.

- Output power Limit Calculation

Bands	Mode	Power Limit [mW] / Least 26dBC BW [MHz]	Calculated Limit [dBm]	ANT Gain	Determined Limit [dBm]
	802.11n HT20	50	**16.98**	**1.527**	**16.98**
		21.538	17.33		
	802.11n HT40	50	**16.98**		**16.98**
		43.275	20.36		

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

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▣ **TEST PROCEDURE:**

Maximum Conducted Output Power is measured using Measurement Procedure **Method SA-2 of KDB789033**

1. Set the **RBW = 1 MHz** & **VBW ≥ 3 MHz**.
2. Set span to encompass the **26 dB EBW** (or, alternatively, the entire 99% occupied bandwidth) of the signal.
3. Detector = **RMS (power averaging)**
4. Sweep time = **auto couple**.
5. **Trace average at least 100 traces in power averaging**.
6. **Compute power by integrating the spectrum across the 26 dB EBW** (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges.
7. **Add 10 log(1/x), where x is the duty cycle**, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission)

▣ **TEST RESULTS: Comply**

Mode	Channel	Frequency [MHz]	Reading [dBm]	Duty Cycle			DCF [dB]	Result
				On Time[ms]	On+Off Time[ms]	X		
802.11n (20MHz)	36	5180	9.080	1.920	1.950	0.98	0.09	9.170
	40	5200	9.110					9.200
	48	5240	9.070					9.160
802.11n (40MHz)	38	5190	9.350	0.942	0.972	0.96	0.18	9.530
	46	5230	9.280					9.460

Note 1 : DCF = 10log(1 / X), X = On Time / (On+Off time), For Duty cycle information, please refer to APPENDIX II.
Note 2 : Test Result = Measurement Data + DCF

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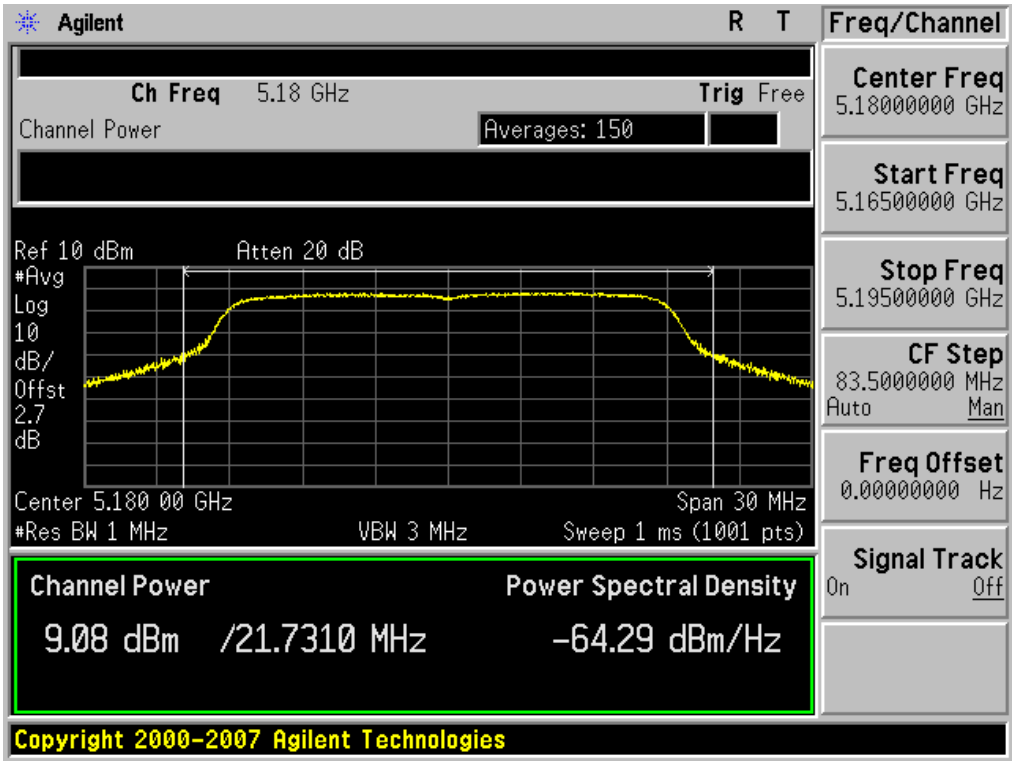
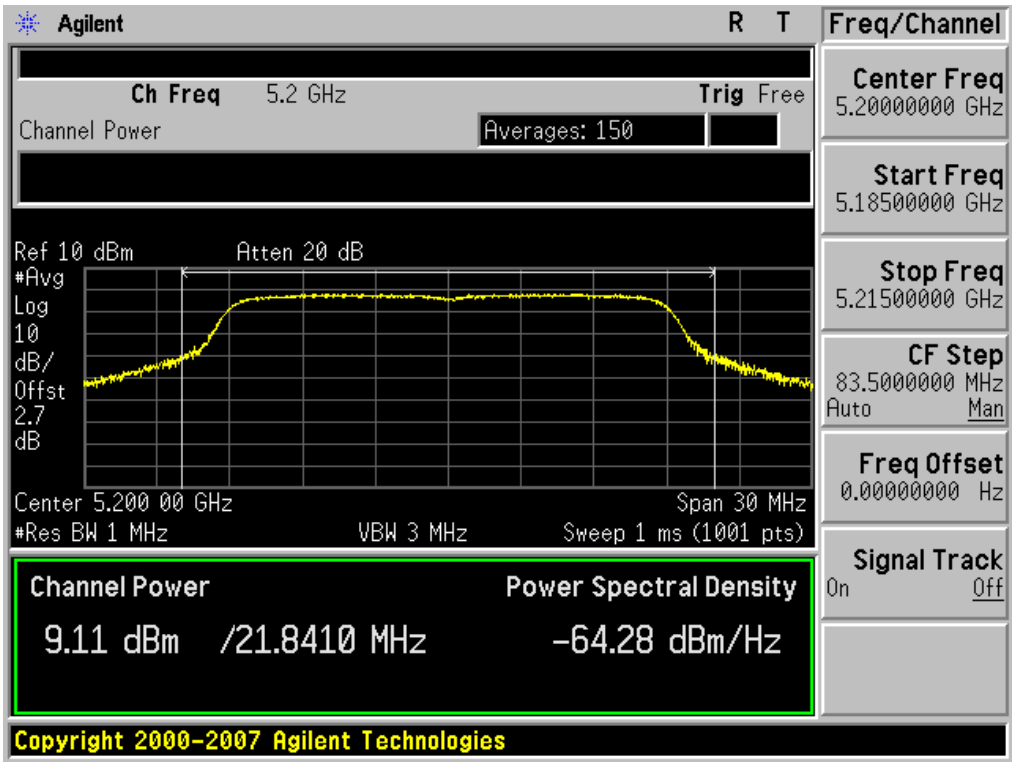
▣ Measurement Data PLOTS

Output Power Test Mode: 802.11n HT20 & Ch.36



Output Power Test Mode: 802.11n HT20 & Ch.40



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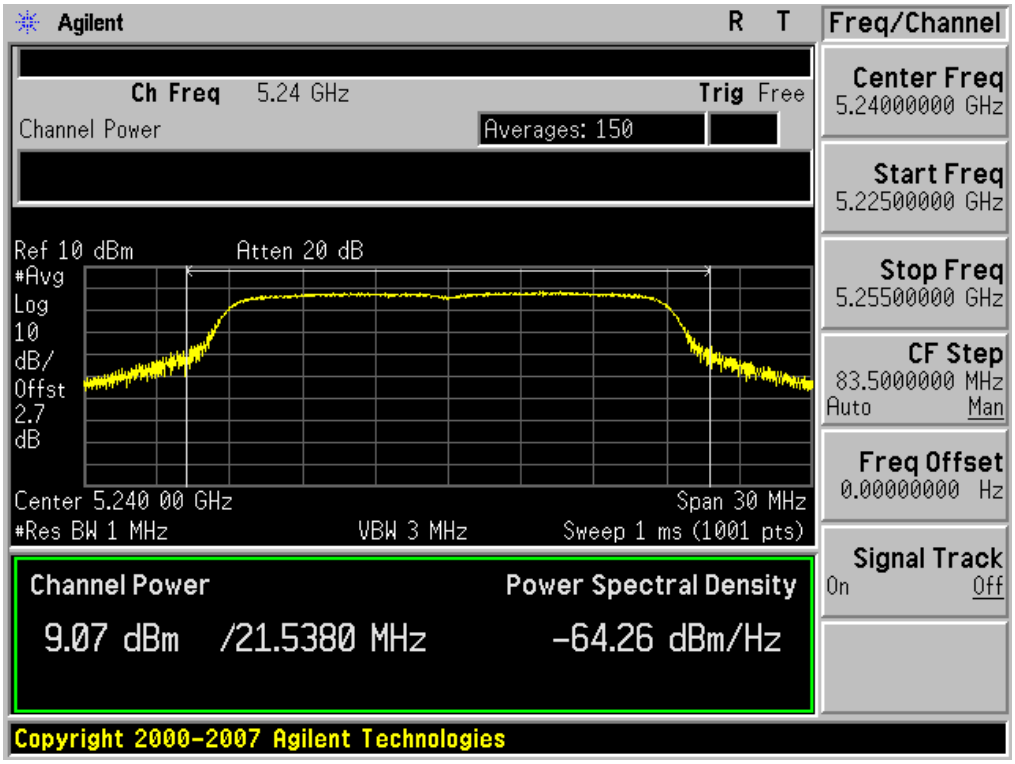
Output Power Test Mode: 802.11n HT20 & Ch.48



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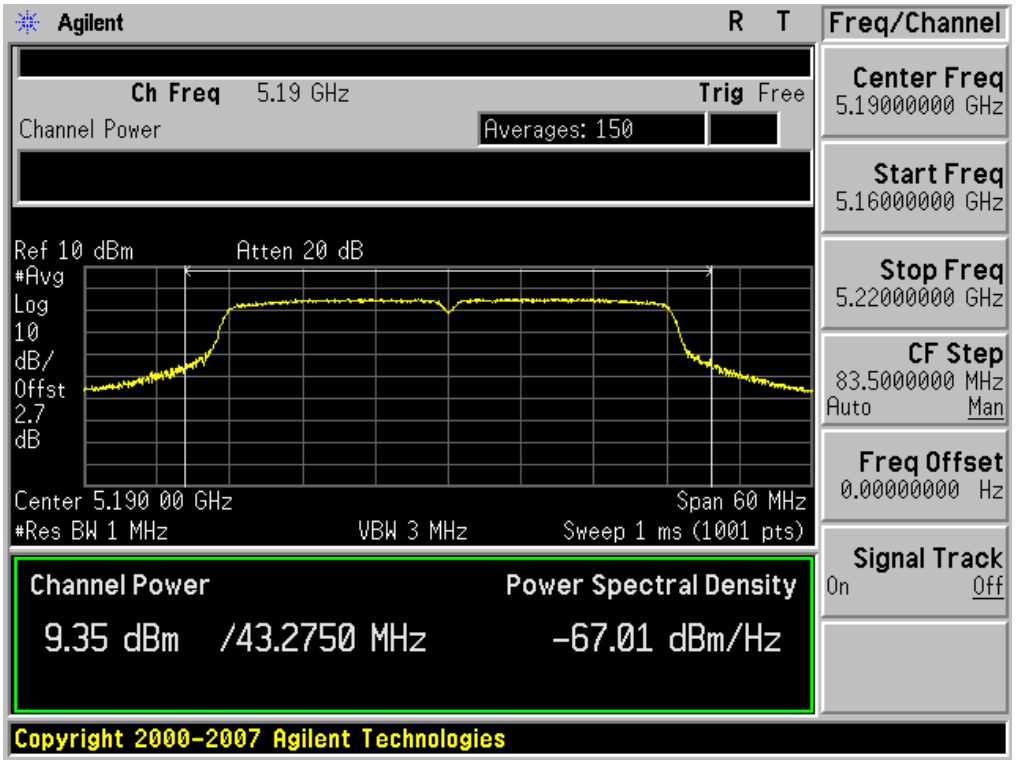
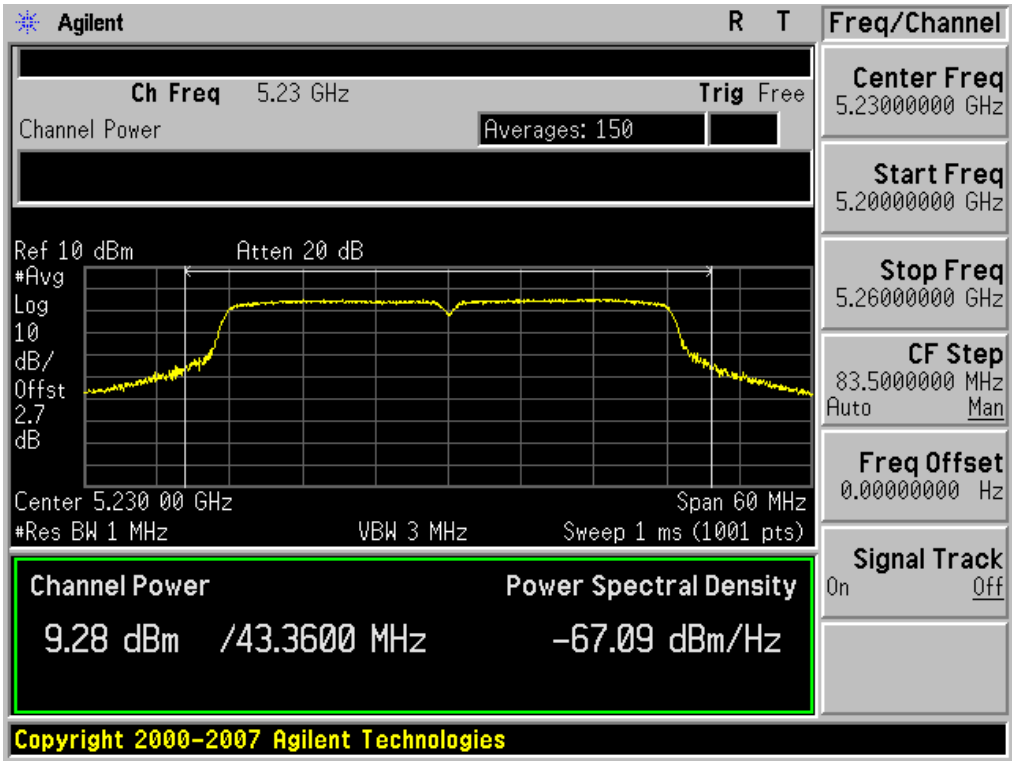
Output Power Test Mode: 802.11n HT40 & Ch.38



Output Power Test Mode: 802.11n HT40 & Ch.46



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3.2.3 Peak Power Spectral Density

Test requirements

(1) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1MHz band.
(2) For the 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 MHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

- Peak Power Spectral Density Limit Calculation

Band	Limit [dBm]	ANT Gain [dBi]	Determined Limit [dBm]
Band I	**4**	**1.527**	**4**
Band II	**11**	**-**	**-**
Band III	**11**	**-**	**-**

▣ **TEST CONFIGURATION**

Refer to the APPENDIX I.

▣ **TEST PROCEDURE**

Peak Power Spectral Density is measured using Measurement Procedure **of KDB789033**

1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”. (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2) Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
3) Make the following adjustments to the peak value of the spectrum, if applicable:
a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.
b) If Method SA-3 Alternative was used and the linear mode was used in step E)2)g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4) The result is the PPSD.

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▣ **TEST RESULT : Comply**

Mode	Channel	Frequency [MHz]	Reading [dBm]	Duty Cycle			DCF [dB]	Test Result [dBm]
				On Time[ms]	On+Off Time[ms]	X		
802.11n (20MHz)	36	5180	-2.702	1.920	1.950	0.98	0.09	-2.612
	40	5200	-2.848					-2.758
	48	5240	-2.423					-2.333
802.11n (40MHz)	38	5190	-5.476	0.942	0.972	0.96	0.18	-5.296
	46	5230	-5.751					-5.571

Note 1 : DCF = 10log(1 / X), X = On Time / (On+Off time)
Note 2 : Test Result = Measurement Data + DCF

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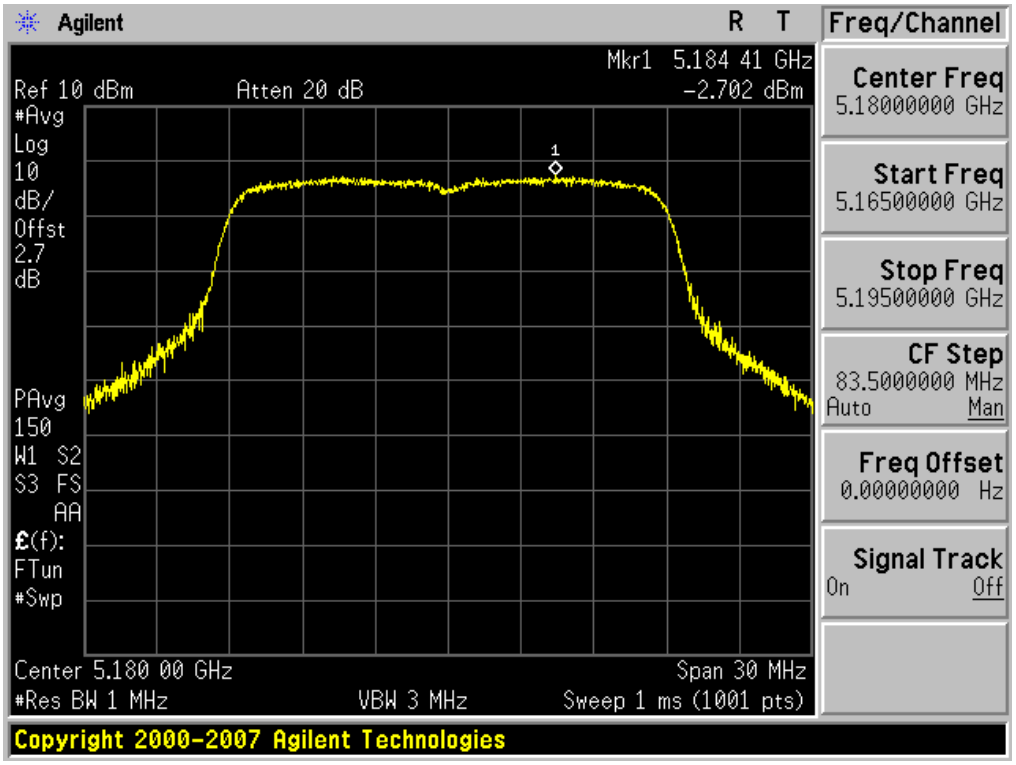
▣ Measurement Data PLOTS

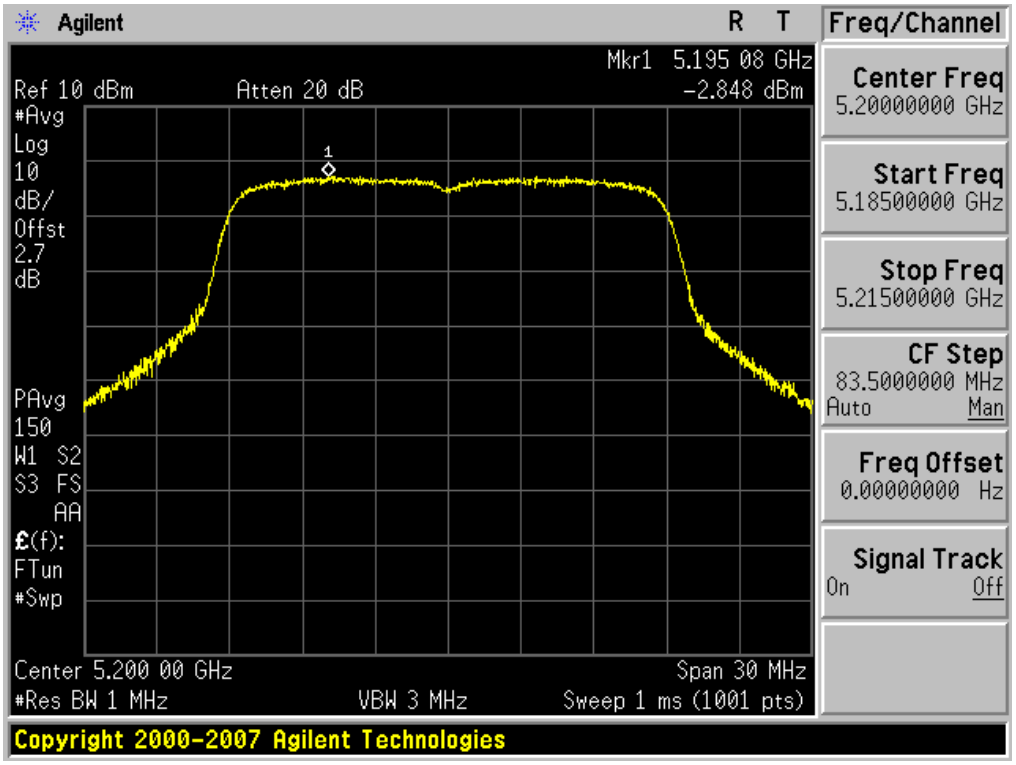
Peak Power Spectral Density

Test Mode: 802.11n HT20 & Ch.36



Peak Power Spectral Density

Test Mode: 802.11n HT20 & Ch.40



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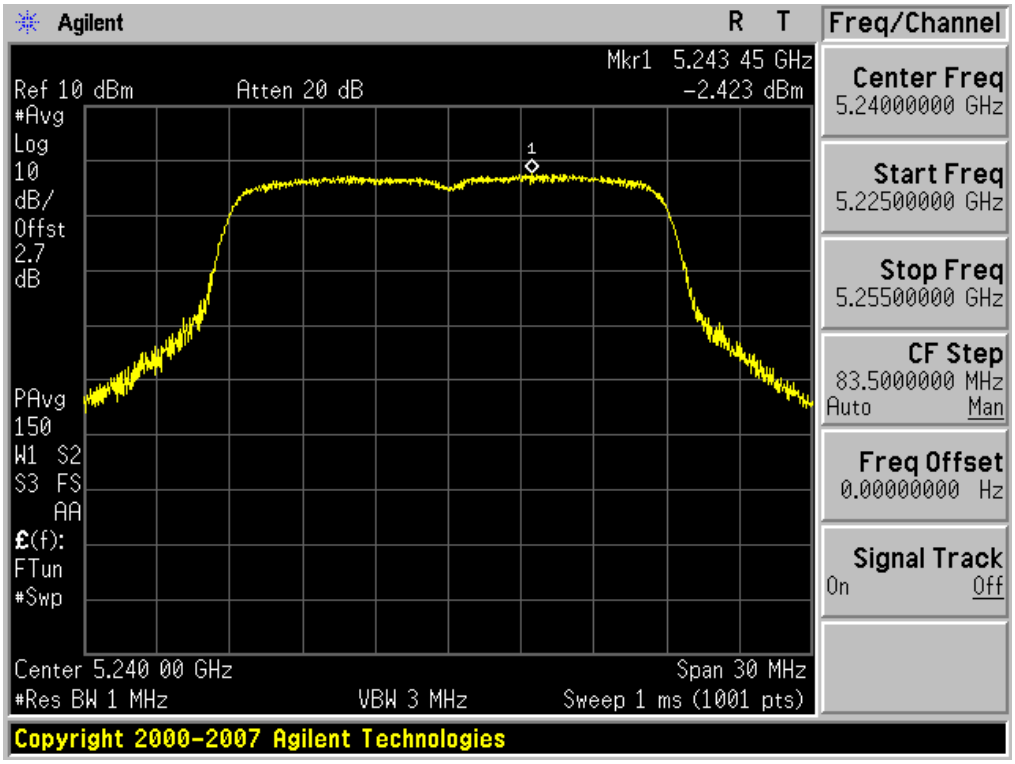
Peak Power Spectral Density Test Mode: 802.11n HT20 & Ch.48



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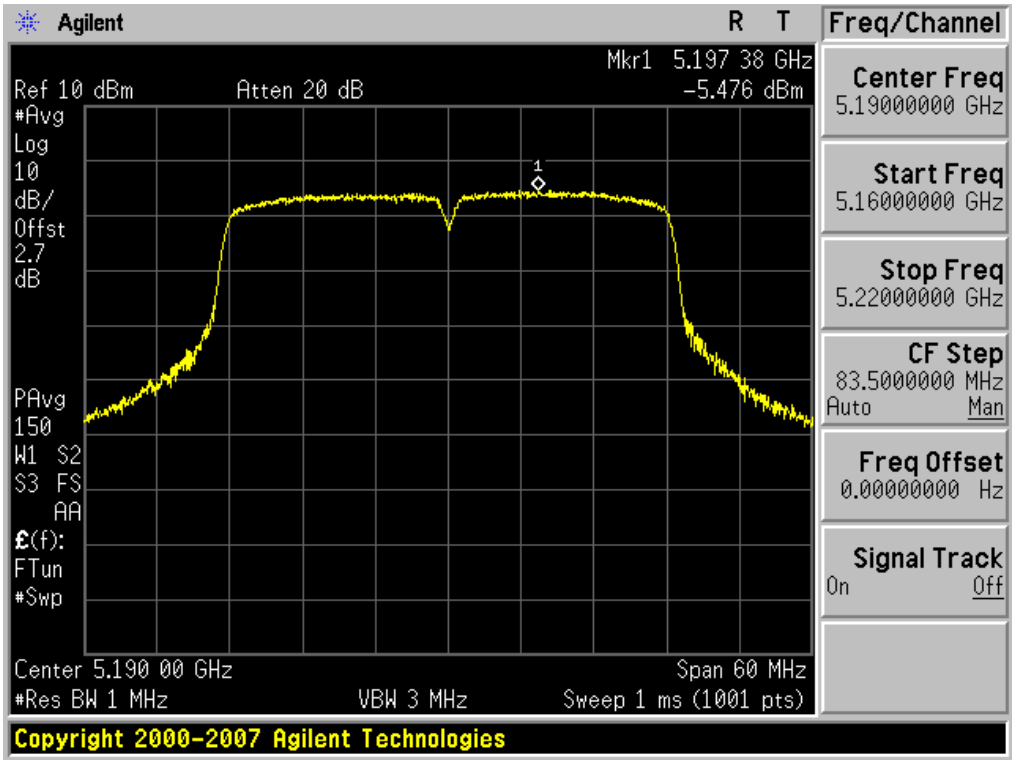
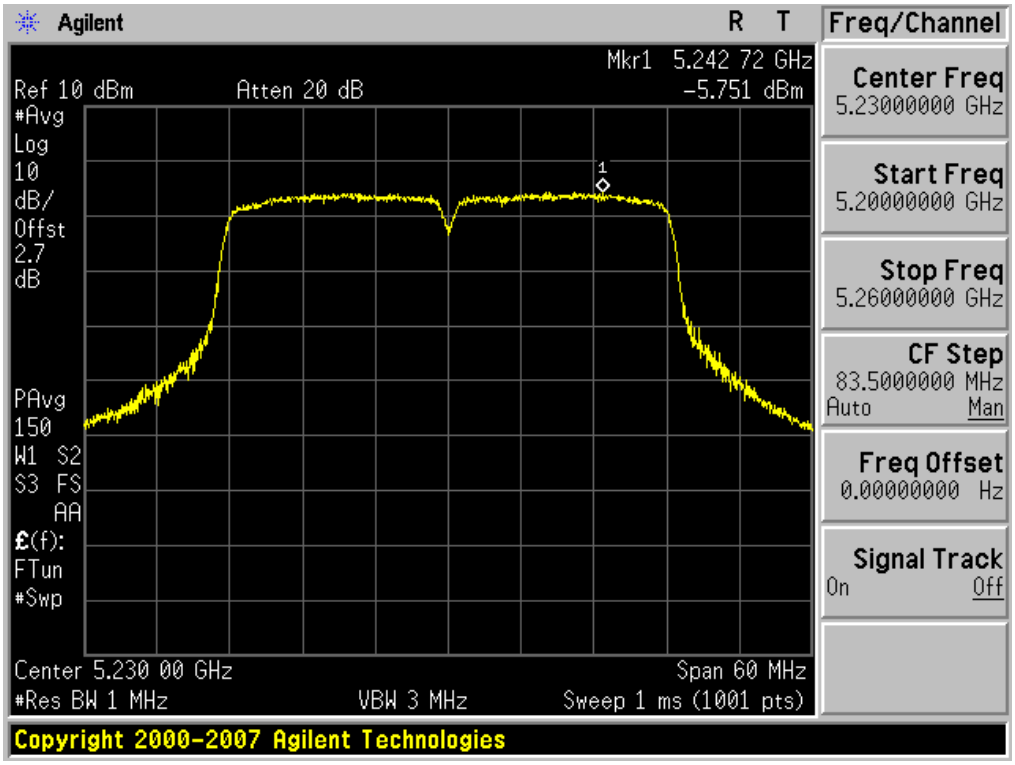
Peak Power Spectral Density Test Mode: 802.11n HT40 & Ch.38



Peak Power Spectral Density Test Mode: 802.11n HT40 & Ch.46



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3.2.4 Peak Excursion Ratio

Test requirements

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/MH**z.

▣ **TEST CONFIGURATION**

Refer to the APPENDIX I.

▣ **TEST PROCEDURE**

Peak Excursion Ratio is measured using Measurement Procedure **of KDB789033**

1) Compliance with the peak excursion requirement of Section 15.407(a)(6) shall be demonstrated by confirming that the ratio of the maximum of the peak-max-hold spectrum to the maximum of the average spectrum for continuous transmission does not exceed 13 dB. (Earlier procedures that required computing the ratio of the two spectra at each frequency across the emission bandwidth can lead to unintended failures at band edges and will no longer be required.)
2) Set the spectrum analyzer span to view the entire emission bandwidth.
3) Find the maximum of the peak-max-hold spectrum.
   a) Set **RBW = 1 MHz.**
   b) **VBW ≥ 3 MHz**.
   c) **Detector = peak.**
   d) **Trace mode = max-hold.**
   e) Allow the sweeps to continue until the trace stabilizes.
   f) Use the peak search function to find the peak of the spectrum.
4) **Use the procedure found under F) to measure the PPSD.**
5) Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

▣ **TEST RESULT: Comply**

Mode	Band	Channel	Frequency [MHz]	Test Result [dB/MHz]	Limit [dB/MHz]
802.11n (20MHz)	Band I	36	5180	7.285	13.00
		40	5200	8.033	
		48	5240	7.759	
802.11n (40MHz)	Band I	38	5190	7.578	
		46	5230	7.685	

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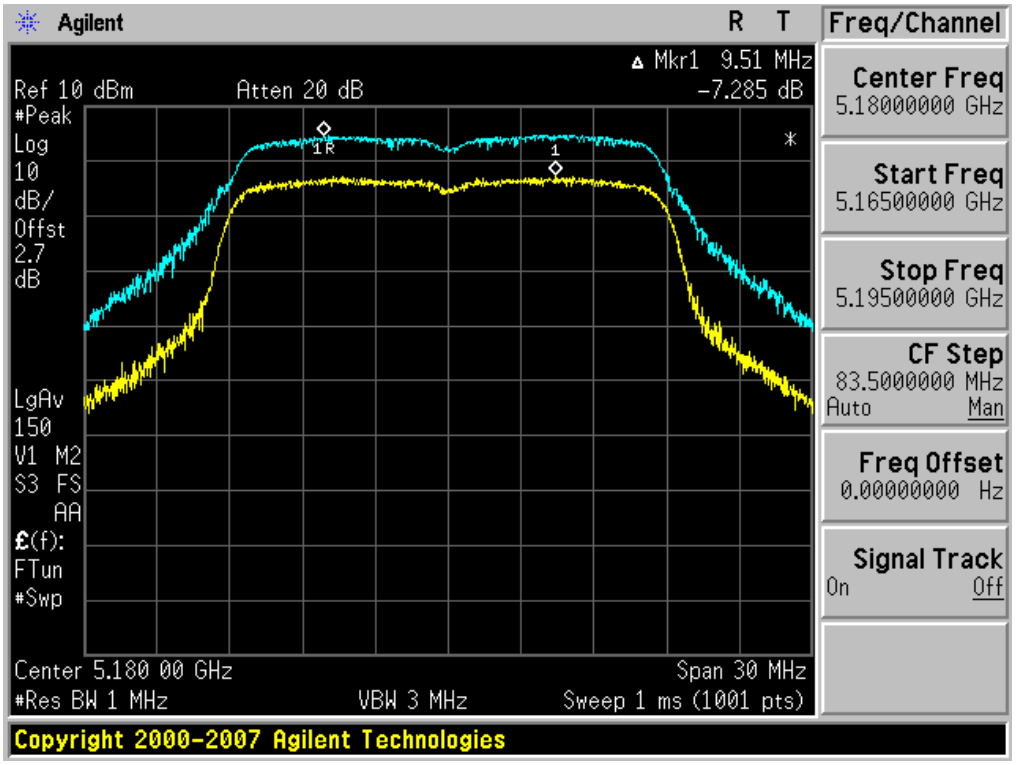
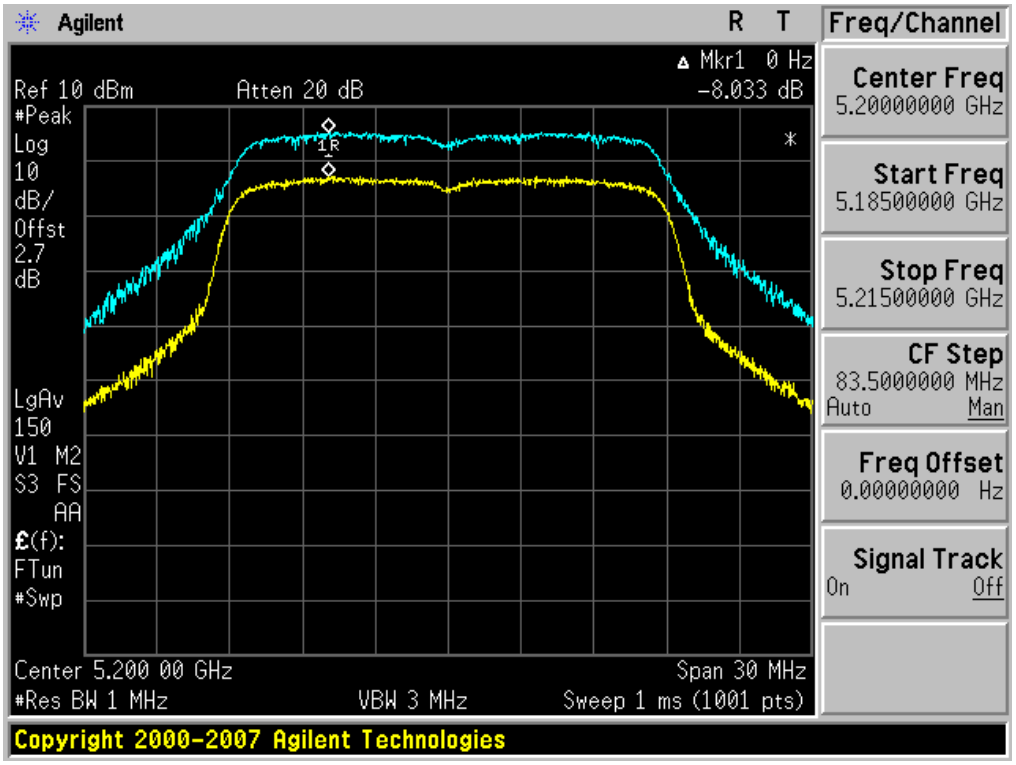
▣ Measurement Data PLOTS

Peak Excursion Ratio Test Mode: 802.11n HT20 & Ch.36



Peak Excursion Ratio Test Mode: 802.11n HT20 & Ch.40



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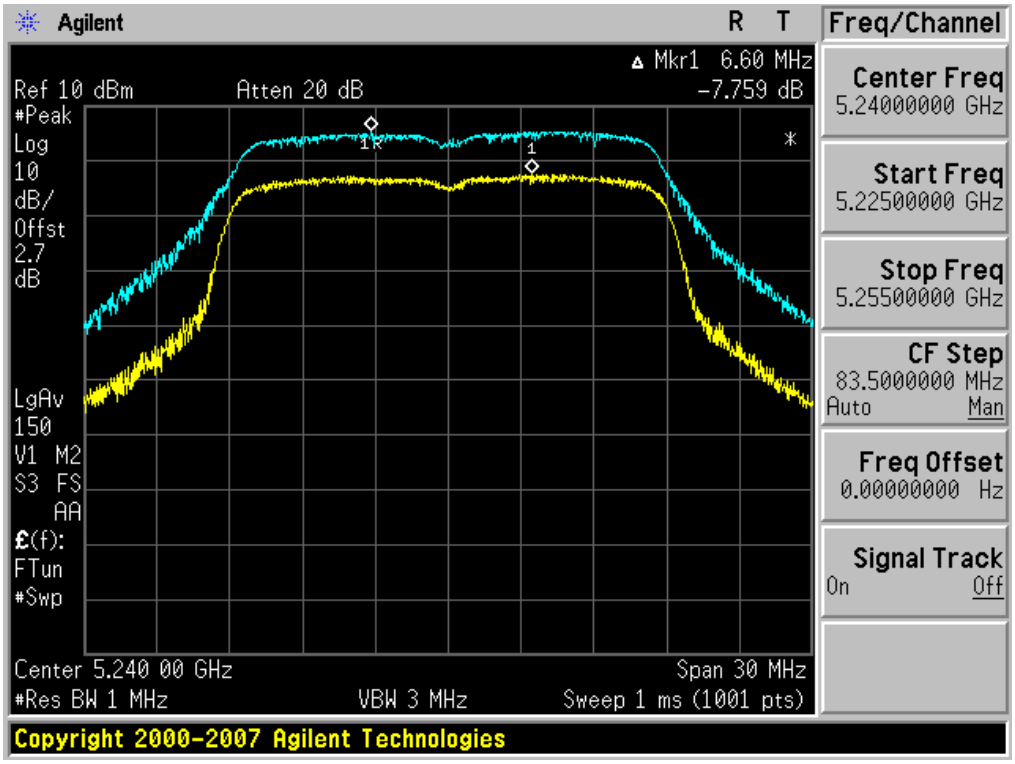
Peak Excursion Ratio Test Mode: 802.11n HT20 & Ch.48



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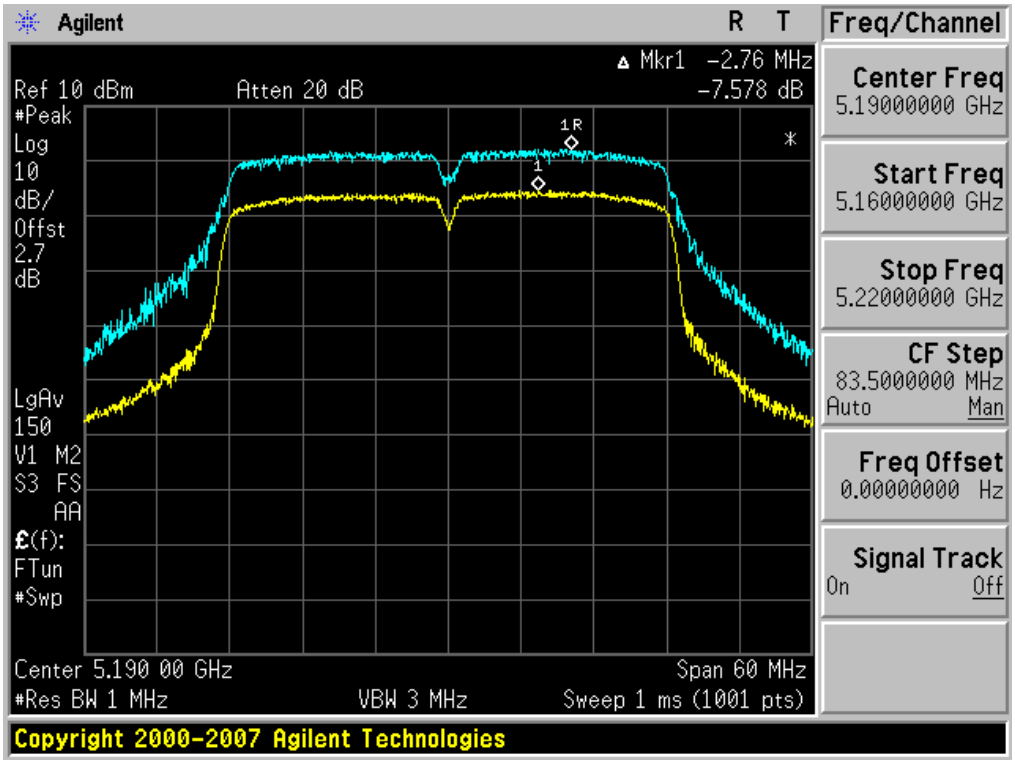
Peak Excursion Ratio Test Mode: 802.11n HT40 & Ch.38



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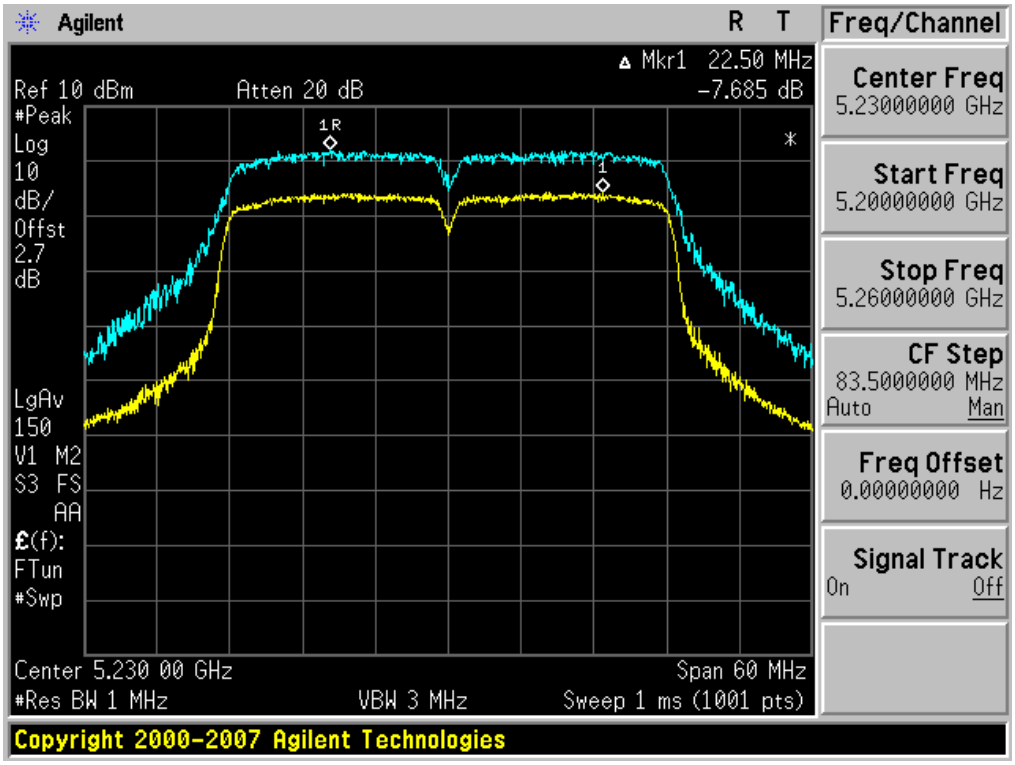

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3.2.5 Frequency Stability

Test requirements

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

▣ **TEST PROCEDURE**

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -30℃ and +50℃. The temperature was incremented by 10℃ intervals and the unit was allowed to stabilize at each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

▣ **TEST RESULT: Comply**

- Measurement Data:

OPERATING FREQUENCY : 5,200,000,000 Hz
CHANNEL : 40
REFERENCE VOLTAGE : 5.000 V DC

VOLTAGE (%)	POWER (V DC)	TEMP (℃)	FREQ (Hz)	Deviation (%)
100%	5.000	+25(Ref)	5,200,006,438	0.000124
100%		-30	5,199,996,430	-0.000069
100%		-20	5,200,002,138	0.000041
100%		-10	5,219,998,546	0.383114
100%		0	5,200,001,687	0.000032
100%		+10	5,200,006,127	0.000118
100%		+20	5,200,008,584	0.000165
100%		+30	5,200,019,360	0.000372
100%		+40	5,200,035,671	0.000686
100%		+50	5,200,051,369	0.000988
100%		+60	5,200,052,134	0.001003
85%	4.250	+25	5,200,008,346	0.000160
115%	5.750	+25	5,200,008,125	0.000156
END POINT	3.100	+25	5,200,005,607	0.000108

- Minimum Standard: The emission is maintained within the band of the operation.

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3.2.6 Radiated Spurious Emission Measurements

▣ **TEST PROCEDURE**

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in semi anechoic chamber. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine the worst-case orientation for maximum emissions.

Radiated spurious emission measured using following Measurement Procedure **of KDB789033**

- **Measurements Below 1000MHz**

a) Follow the requirements in section H)3), "General Requirements for Unwanted Emissions Measurements"
b) Compliance shall be demonstrated using **CISPR quasi-peak detection**; however, **peak detection** is permitted as an alternative to quasi-peak detection.

H)3), General Requirements for Unwanted Emissions Measurements. The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

a) EUT Duty Cycle

(1) The EUT shall be configured or modified to **transmit continuously** except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (**to no lower than 98 percent**) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(2) If **continuous transmission (or at least 98 percent duty cycle) cannot be achieved** due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x, of the transmitter output signal.
- Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
- The test report shall include the following additional information:
  - The reason for the duty cycle limitation.
  - The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
  - The sweep time and the amount of time used for trace stabilization during max-hold measurements for peak emission measurements.

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

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- **Measurements Above 1000MHz (Peak)**

a) Follow the requirements in section H)3), “General Requirements for Unwanted Emissions Measurements”.
b) Peak emission levels are measured by setting the analyzer as follows:
(1) **RBW = 1 MHz**.
(2) **VBW ≥ 3 MHz**.
(3) **Detector = Peak.**
(4) Sweep time = auto.
(5) Trace mode = max hold.
(6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

- **Measurements Above 1000MHz (Method AD)**

(1) **RBW = 1 MHz.**
(2) **VBW ≥ 3 MHz.**
(3) **Detector = RMS**, if span/(# of points in sweep) ≤ RBW/2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.
(4) Averaging type = power (i.e., RMS)
• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
(5) Sweep time = auto.
(6) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces should be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100 percent duty cycle—rather than turning on and off with the transmit cycle, at least 100 traces shall be averaged.)
(7) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
• **If power averaging (RMS) mode was used in step (4) above, the correction factor is 10 log(1/x), where x is the duty cycle**. For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
• If linear voltage averaging mode was used in step (4) above, the correction factor is 20 log(1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.
• If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

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▣ **Minimum Standard:**

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F(KHz)	300
0.490 – 1.705	24000/F(KHz)	30
1.705 – 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	3600 ~ 4400	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	4.5 ~ 5.15	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	5.35 ~ 5.46	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	7.25 ~ 7.75	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	8.025 ~ 8.5	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.0 ~ 9.2	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	9.3 ~ 9.5	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	10.6 ~ 12.7	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900	13.25 ~ 13.4	
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

▪ **FCC Part 15.407 (b):** Undesirable Emission Limits: Except as shown in Paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) 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**.
(2) 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.
(3) 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.**
(4) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.
(5) The above emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions **below 1 GHz** must comply with the general field strength limits set forth in **Section 15.209**. Further, any U-NII devices using an **AC power line** are required to comply also with the conducted limits set forth in **Section 15.207**.

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▣ **Measurement Data:**

9KHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT20 & 5180MHz(Ch. 36)*

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector	Reading (dBuV)	T.F (dB/m)	DUTY Correction Factor (dB)	Distance Correction Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5149.35	H	X	PK	44.45	6.51	-	-	50.96	74.00	23.04
5148.55	H	X	AV	35.45	6.51	0.09	-	42.05	54.00	11.95
11356.25	H	Z	PK	48.75	10.16	-	-9.54	49.37	68.20	18.83
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

9KHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT20 & 5200MHz(Ch. 40)*

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector	Reading (dBuV)	T.F (dB/m)	DUTY Correction Factor (dB)	Distance Correction Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10404.15	H	Z	PK	49.60	10.31	-	-9.54	50.37	68.20	17.83
-	-	-	-	-	-	-	-	-	-	-

9KHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT20 & 5240MHz(Ch. 48)*

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector	Reading (dBuV)	T.F (dB/m)	DUTY Correction Factor (dB)	Distance Correction Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10477.55	H	Z	PK	50.03	10.61	-	-9.54	51.10	68.20	17.10
-	-	-	-	-	-	-	-	-	-	-

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result
   Result = Reading + T.F + DUTY Correction Factor + Distance Correction Factor
   T.F = AF + CL – AG
   DUTY Correction Factor : 0.09 dB = 10*log(1/0.98) for Method AD.
3. Measurement Distance above 10 GHz = 1m. So Distance Correction Factor : -9.54dB = 20*log(1m/3m)

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▣ **Measurement Data:**

9KHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT40 & 5190MHz(Ch. 38)*

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector	Reading (dBuV)	T.F (dB/m)	DUTY Correction Factor (dB)	Distance Correction Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
5149.15	H	X	PK	50.51	6.51	-	-	57.02	74.00	16.98
5150.00	H	X	AV	38.78	6.51	0.18	-	45.47	54.00	8.53
10383.40	H	Z	PK	44.64	10.16	-	-9.54	45.26	68.20	22.94
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

9KHz ~ 40GHz Radiated Spurious Emissions: *802.11n HT40 & 5230MHz(Ch. 46)*

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector	Reading (dBuV)	T.F (dB/m)	DUTY Correction Factor (dB)	Distance Correction Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10461.58	H	Z	PK	46.18	10.61	-	-9.54	47.25	68.20	20.95
-	-	-	-	-	-	-	-	-	-	-

Note.

1. This test item was performed in each axis and the worst case data were reported.
2. Sample Calculation.
   Margin = Limit – Result
   Result = Reading + T.F + DUTY Correction Factor + Distance Correction Factor
   T.F = AF + CL – AG
   DUTY Correction Factor : 0.18 dB = 10*log(1/0.96) for Method AD.
3. Measurement Distance above 10 GHz = 1m. So Distance Correction Factor : -9.54dB = 20*log(1m/3m)

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3.2.7 AC Conducted Emissions

▣ **TEST PROCEDURE :**

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. Emissions closest to the limit are measured in the quasi-peak mode (QP) and average mode (AV) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

▣ **Measurement Data: Comply**

Note 1: See next pages for actual measured spectrum plots and data.

▣ **Minimum Standard: FCC Part 15.207(a)/EN 55022**

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

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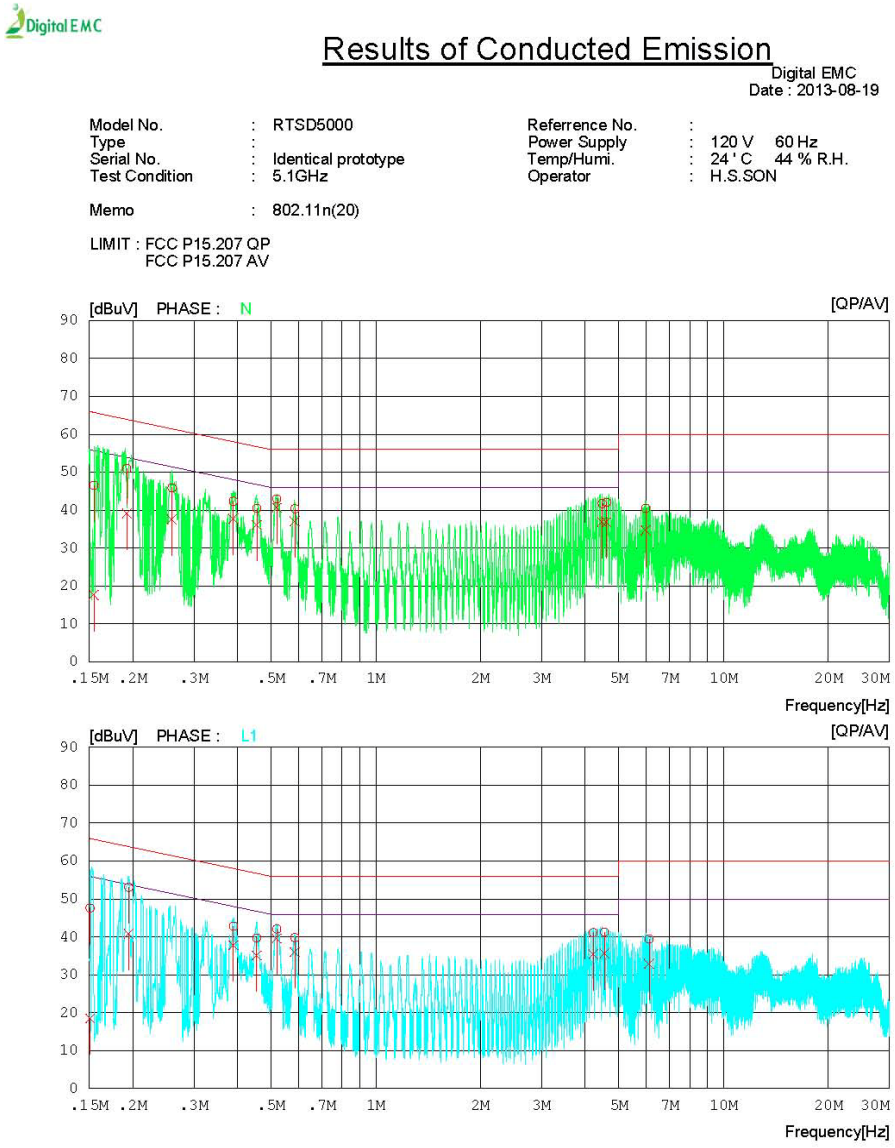
AC Line Conducted Emissions (Graph)

AC Line Conducted Emissions (Graph)

Test Mode: 802.11n(HT20)_5.1G



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AC Line Conducted Emissions (Data List)

Test Mode: 802.11n(HT20)_5.1G

Results of Conducted Emission

Digital EMC
Date : 2013-08-19

Model No.	: RTSD5000		Referrence No.	:	
Type	:		Power Supply	:	120 V 60 Hz
Serial No.	: Identical prototype		Temp/Humi.	:	24 ' C 44 % R.H.
Test Condition	: 5.1GHz		Operator	:	H.S.SON

Memo : 802.11n(20)

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15462	46.4	17.5	0.1	46.5	17.6	65.7	55.7	19.2	38.1	N
2	0.19250	50.8	39.0	0.1	50.9	39.1	63.9	53.9	13.0	14.8	N
3	0.25970	45.8	37.5	0.1	45.9	37.6	61.4	51.4	15.5	13.8	N
4	0.38967	42.3	37.6	0.1	42.4	37.7	58.1	48.1	15.7	10.4	N
5	0.45493	40.3	36.1	0.1	40.4	36.2	56.8	46.8	16.4	10.6	N
6	0.51964	42.9	40.5	0.1	43.0	40.6	56.0	46.0	13.0	5.4	N
7	0.58515	40.3	37.0	0.1	40.4	37.1	56.0	46.0	15.6	8.9	N
8	4.48040	41.4	36.6	0.3	41.7	36.9	56.0	46.0	14.3	9.1	N
9	4.60940	41.5	36.3	0.5	42.0	36.8	56.0	46.0	14.0	9.2	N
10	5.97520	40.0	34.2	0.5	40.5	34.7	60.0	50.0	19.5	15.3	N
11	0.15087	47.5	18.4	0.1	47.6	18.5	66.0	56.0	18.4	37.5	L1
12	0.19493	53.0	40.8	0.1	53.1	40.9	63.8	53.8	10.7	12.9	L1
13	0.38965	42.7	37.7	0.1	42.8	37.8	58.1	48.1	15.3	10.3	L1
14	0.45481	39.6	35.0	0.1	39.7	35.1	56.8	46.8	17.1	11.7	L1
15	0.51959	42.0	39.4	0.1	42.1	39.5	56.0	46.0	13.9	6.5	L1
16	0.58523	39.7	35.9	0.1	39.8	36.0	56.0	46.0	16.2	10.0	L1
17	4.22220	40.8	35.1	0.3	41.1	35.4	56.0	46.0	14.9	10.6	L1
18	4.54700	40.9	35.2	0.4	41.3	35.6	56.0	46.0	14.7	10.4	L1
19	6.10660	38.9	32.5	0.5	39.4	33.0	60.0	50.0	20.6	17.0	L1

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3.2.8 Antenna Requirements

▣ **Procedure:**

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

▣ **Conclusion:** **Comply**

The internal antenna of this E.U.T is permanently attached using the soldering.

▣ **Minimum Standard:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

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3.2.9 Occupied Bandwidth

▣ **TEST Requirements**

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured

▣ **TEST CONFIGURATION**

▣ **TEST PROCEDURE:**

The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual

▣ **TEST RESULT: N/A**

Minimum Standard : N/A

▣ **RESULT PLOT: N/A**

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4. LIST OF TEST EQUIPMENT

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Horn Antenna	ETS	3115	13/02/28	15/02/28	00021097
Multimeter	HP	34401A	13/02/27	14/02/27	3146A13475
Signal Analyzer	Rohde Schwarz	FSQ26	13/02/14	14/02/14	200445
Horn Antenna	A.H.Systems Inc.	SAS-574	13/03/20	15/03/20	154
High-pass filter	Wainwright Instruments	WHNX8.5	12/09/17	13/09/17	1
Thermohygrometer	BODYCOM	BJ5478	13/01/14	14/01/14	090205-4
PreAmplifier	Agilent	8449B	13/02/27	14/02/27	3008A00370
3dB Attenuator	Aeroflex/Weinschel	56-3	12/09/17	13/09/17	Y2342
Spectrum Analyzer	Agilent Technologies	E4440A	12/10/22	13/10/22	US45303051
Loop Antenna	Schwarzbeck	FMZB1513	12/09/24	13/09/24	1513-128
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	12/09/12	13/09/12	U5542113
DC Power Supply	SM techno	SDP30-5D	13/02/14	14/02/14	305DLJ204
MXA Signal Analyzer	Agilent	N9020A	13/04/10	14/04/10	MY50200816
Signal Generator	Rohde Schwarz	MF100A	13/07/22	14/07/22	102341
BILOG ANTENNA	SCHAFFNER	CBL6112B	12/11/06	14/11/06	2737
Amplifier	HP	8447E	13/01/08	14/01/08	2945A02865
EMI TEST RECEIVER	R&S	ESU	13/01/08	14/01/08	100014
EMI TEST RECEIVER	R&S	ESCI	13/02/27	14/02/27	100364
CVCF	KIKUSUI	PCR1000L	12/09/15	13/09/15	14110610
LISN	R&S	ESH2-Z5	12/09/18	13/09/18	828739/006
Harmonic Mixer	OML	M28HWD	13/02/14	14/02/14	Ka100224-1

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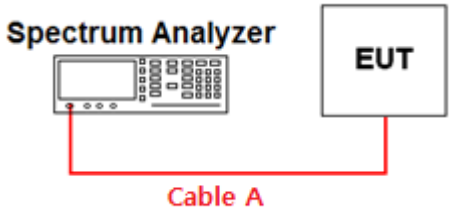
APPENDIX I
Conducted Test set up Diagram & Path loss Information

- **Conducted Measurement**



Path loss value information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
5180	2.64	5230	**2.70**	-	-
5190	2.67	5240	2.69	-	-
5200	2.67	-	-	-	-

Note. 1: The path loss from EUT to Spectrum analyzer was measured and used for test.
Path loss (=S/A's offset value) = Cable A
Note. 2: The worst case path loss was used as below.
BAND1: 2.70dB

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APPENDIX II
Duty cycle plots

▣ **TEST PROCEDURE**

Duty Cycle [X = On Time / (On + Off time)] is measured using Measurement Procedure **of KDB789033**

1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.
2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW.
4. Set detector = peak.
5. Note : The zero-span measurement method shall not be used unless both **RBW and VBW are > 50/*T***, where *T* is defined in section B)1)a), and **the number of sweep points across duration *T* exceeds 100**. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if *T* ≤ 16.7 microseconds.)

- **Summary of Duty Cycle Calculation Table**

Mode	Channel	Frequency [MHz]	Maximum Achievable Duty Cycle (*x*) = On / (On+Off)		
			On Time [ms]	(On+Off) Time [ms]	*x*
802.11n (20MHz)	36	5180	1.920	1.950	0.98
	40	5200			
	48	5240			
802.11n (40MHz)	38	5190	0.942	0.972	0.96
	46	5230			

- Description for duty cycle plot data on next pages : **1 Δ = On Time , 2Δ = (On + Off) Time So Off Time = 2Δ -1 Δ**
- *T* : The minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
  (***T* = On time** of the above table since the EUT operates with above fixed Duty Cycle and it is the minimum On time)
  For Duty Cycle with zero span method, both RBW/VBW > 50/*T*
  (For example, this case **RBW/VBW (8 MHz) > 50/0.000942 = 53.08 KHz**)
- The reason for the Duty Cycle Limitation : The test S/W provided by the applicant supports transmission with above maximum fixed duty cycle.
- The number of sweeps were increased by factor of **1/*x*** until the trace stabilizes for Peak Measurement
  The number of average traces were increased by factor of **1/*x*** for Method AD

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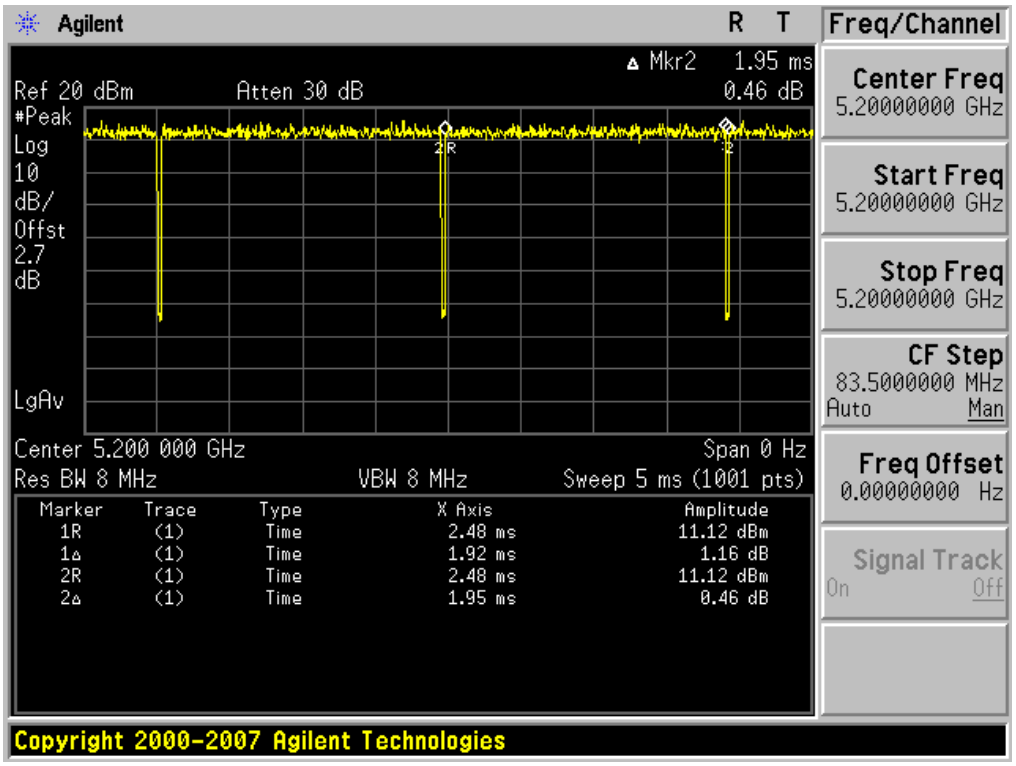
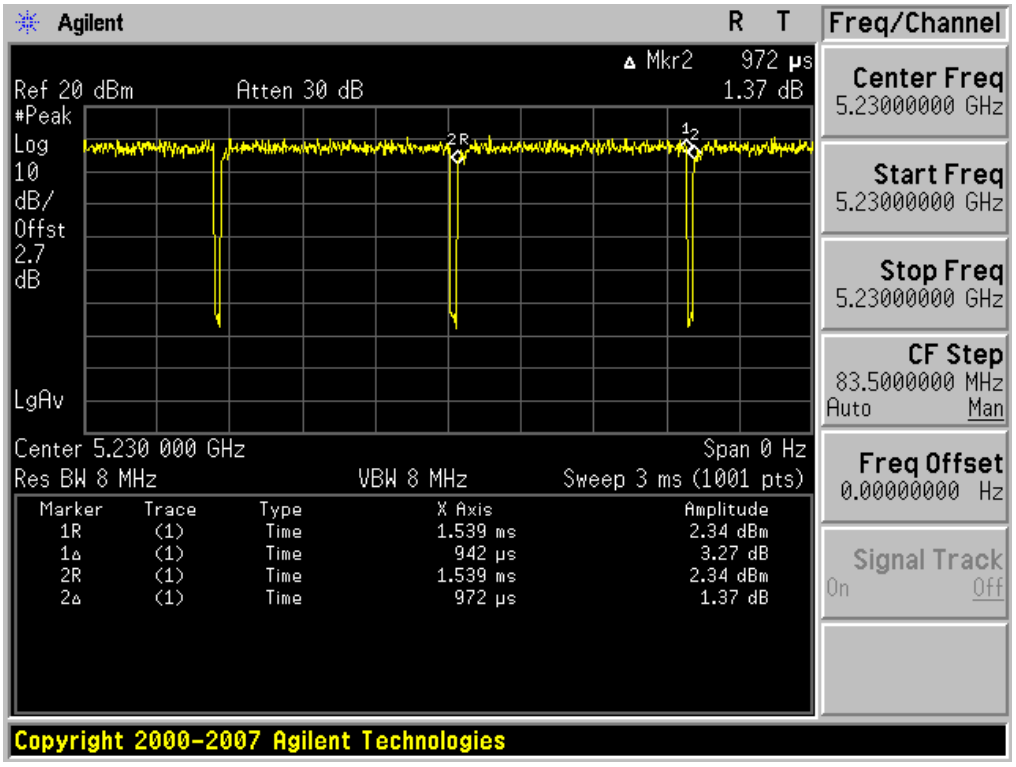
Duty Cycle Test Mode: 802.11n(HT20) & Ch.40



Duty Cycle Test Mode: 802.11n(HT40) & Ch.46



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