

Radio Test Report: EDCS - 1248893

## **CP-DX650**

## **Next Generation Video Endpoint**

### 5250-5350 MHz

Against the following Specifications: CFR47 Part 15.407 RSS210

### Cisco Systems

EMC Laboratory 170 West Tasman Drive San Jose, CA 95134

> Author: Phillip Carranco Approved By: Dilip Patel Title: Regulatory Compliance Manager

This report replaces any previously entered test report under EDCS - 1248893

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### Section 1: Overview

### 1.1 Test Summary

# samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

Emission	Immunity
CFR47 Part 15.407 RSS210	N/A

The specifications listed above represent actual tests performed to demonstrate compliance against the specifications

and basic standards listed on the front cover of this report. This list is not a one to one match to the front cover for one or more of the following reasons.

- 1. Basic standards call up many different test phenomena specifications such as the 61000-4-X series. The basic standards define which elements and levels shall be applied from these specifications and as such it is not appropriate to list the individual specifications on the front cover.
- 2. A Standard listed on the front cover may be required in a particular country but is not appropriate for the particular technologies included in the equipment under test. E.g. You cannot test a DC product to the mains Harmonics requirements in EN61000-3-2. See section 3.2.
- 3. Test results against a particular standard or specification may be included in a different test report. See section 3.2 for an EDCS reference of this data.
- 4. Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
- 5. Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.
- 6. Testing may have been performed to an equivalent test that satisfies the requirements of the standards and specifications listed on the front cover of the report. See section 3.2.
- Where radiated emissions testing has been performed to EN55022/CISPR22 the additional requirements of VCCI: V- 3/2006.04, EN55022: 1994 +A1/2 and CAN/CSA- CISPR 22-02 have also been evaluated unless otherwise stated.
- Testing to the requirements of CFR47 Part 15 was performed against the CISPR22 limits. The results are therefore deemed satisfactory evidence of compliance with Industry Canada Interference Causing Equipment Standard ICES-003.
- 9. Where assessment has been performed to CISPR24, all the applicable test requirements may have not been covered. Refer to the results section for the tests performed.

Notes:

- 1) Where a specification listed on the front cover of this report has deviations from the basic standards listed above, the additional technical requirements of the specification were also assessed.
- 2) Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
- 3) Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.

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### Section 2: Assessment Information

### 2.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

- a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.
- b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.
- c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).
- d) All testing was performed under the following environmental conditions:

Temperature	15°C to 35°C (54°F to 95°F)

Atmospheric Pressure 860mbar to 1060mbar (25.4" to 31.3")

Humidity 10% to 75\*%

\*[Where applicable] For ESD testing the humidity limits used were 30% to 60% and for EFT/B tests the humidity limits used were 25% to 75%.

e) All AC testing was performed at one or more of the following supply voltages:

110V 60 Hz (+/-20%) 220V 50 Hz (+/-20%)

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### 2.2 Date of testing

15-October-2012

### 2.3 Report Issue Date

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### 2.4 Testing facilities

This assessment was performed by:

### **Testing Laboratory**

Cisco Systems, Inc., 170 West Tasman Drive San Jose, CA 95134, USA

#### **Registration Numbers for Industry Canada**

Cisco System Site	Site Identifier			
Building P, 10m Chamber	Company #: 4624-2			
Building P, 5m Chamber	Company #: 4624-1			
Building N, 5m Chamber	Company #: 6111			
Building I, 5m Chamber	Company #: 6112			

### **Test Engineers**

Phillip Carranco

### 2.5 Equipment Assessed (EUT)

CP-DX650 Next Generation Video Endpoint

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### 2.6 EUT Description

The CP-DX650 is the next generation 1080p Video Endpoint with key expansion module support. This new generation of desktop phone incorporates an Android based operating system. Three USB ports, one micro OTG USB port, one higher powered USB-proprietary connector combination (AUX) and one standard USB Port. Support HDMI with a maximum external resolution of 1920 x 1200, also includes a single 3.5mm headset jack.

WiFi (802.11 A/B/G/N) & Bluetooth 3.0 capabilities (Bluetooth operating at ver 2.1 + EDR) Murata module, LBEH1ZNSXC-526, supports for 802.11/a/b/g/n + Bluetooth 3.0 module SDIO interface to WLAN - Omap4 SD host controller port 5 PCM (McBSP1) interface to Bluetooth WiFi + BT chip - Marvell 88W8787 Clocks – 38.4MHz 20ppm for main clock, 32.768KHz sleep clock Supports 802.11i security standard Coexistence between WiFi and BT with one antenna to both connected to the 2.4GHz radios Single antenna for 2.4 and 5GHz bands with diplex inside the module Up to 72Mbps (20 MHz channel)

Non HT-20, One Antenna, 6 to 54 Mbps

HT-20, One Antenna, M0 to M7

HT-40, One Antenna, M0 to M7

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### Section 3: Result Summary

#### **Conducted emissions**

Basic Standard	Result
99% and 26dB Bandwidth	Pass
Peak Output Power	Pass
Power Spectral Density	Pass
Peak Excursion	Pass
Conducted Spurious Emissions	Pass
Restricted Band Edge Measurements	Pass

### **Radiated emissions**

Basic Standard	Result
Radiated Spurious and Harmonic Emissions	Pass
Co-Locator Radiated Spurious Emissions	Pass

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### Section4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. During preliminary testing all three planes (X,Y & Z) were evaluated to determine "Worst Case". The orientation used for this report was demined "Worst Case".

### 4.1 Sample Details

Sample Number	Equipment Details	Serial Number	Part Number
S01	CP-DX650	FCH1627A5AU	73-15144-01

The following antennas were evaluated as part of this testing process. The antennas listed reflect the maximum gain allowed for each family type of antenna:

Fixed internal Amphenol Dual Band Antenna at 5GHz, Gain: (no external antenna can be used.)

5150 – 5250MHz: 2.4 dBi 5250 – 5350MHz: 3.9 dBi 5500 – 5700MHz: 3.8 dBi 5745 – 5805MHz: 3.3 dBi

### 4.2 System Details

System #	Description	Samples
1	Radio Test Sample	S01

### 4.3 Mode of Operation Details

Mode# Description Comments		Comments
1	802.11AN Test Mode	System is placed in a continuous Transmit Mode at various channels per Test Requirements. Worse Case Data Rate used for all Testing. 802.11A set to 6Mbps, HT20 set to M0 & HT40 set to M0

### **Section 5: Modifications**

### 5.1 Sample Modifications Performed During Assessment

No modifications were performed during assessment.

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Testing Laboratory: Cisco Systems, Inc., 4125 Highlander Parkway, Richfield, OH, USA

### Target Maximum Channel Power

The following table details the maximum supported Total Channel Power for all operating modes.

	Maximum Ch (dB			
	Frequency (MHz)			
Operating Mode	5260 5280 5300 5320			
Non HT-20, 6 to 54 Mbps	16	16	16	16
HT-20, M0 to M23	16	16	16	16
	5190	5230		
HT-40, M0 to M23	16	16		

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### 99% and 26dB Bandwidth

Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

Center Frequency: Span: Reference Level: Attenuation:	Frequency from table below 2 x Nominal Bandwidth (e.g. 40MHz for a 20MHz channel) 20 dBm 10 dB
Sweep Time:	5 s
I	
Resolution Bandwidth: Video Bandwidth: ≥Res	
X dB Bandwidth: 26 dB	3
Detector:	Peak
Trace:	Single

Place the radio in continuous transmit mode. View the transmitter waveform on the spectrum analyzer, and record the pertinent measurements:

### 99% and 26dB Bandwidth for 802.11A

Frequency (MHz)	Data Rate (Mbps)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
5260	6	17.043	20.344
5280	6	17.095	20.414
5300	6	17.035	20.368
5320	6	17.103	20.345

99% and 26dB Bandwidth for 802.11AN (HT20)

Frequency (MHz)	Data Rate (Mbps)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
5260	6.5	17.974	20.565
5280	6.5	17.995	20.557
5300	6.5	17.997	20.526
5320	6.5	17.964	20.551

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### Graphical Test Results for 802.11a:

* Agilent	Freq/Channel
Ch Freq 5.26 GHz T Occupied Bandwidth	rig Free Center Freq 5.26000000 GHz
Center 5.260000000 GHz	<b>Start Fred</b> 5.24000000 GHz
Ref 10 dBm Atten 20 dB *Peak Log 10	Stop Freq 5.28000000 GHz
dB/	
	n 40 MHz
*Res BW 390 kHz *Sweep 5 s (1 Occupied Bandwidth осс вм % Рмг 17.0431 MHz × dB -3	99.00 % 99.00 % 26.00 dB
Transmit Freq Error –92.636 kHz x dB Bandwidth 20.344 MHz*	
File Operation Status, A:\SCREN146.GIF file saved	
* Agilent	Freq/Channel
Ch Freq 5.28 GHz T Occupied Bandwidth	rig Free Center Freq 5.28000000 GHz
	5.28000000 GHz
Occupied Bandwidth Center 5.280000000 GHz Ref 10 dBm Atten 20 dB #Peak Log	5.28000000 GHz 5.28000000 GHz Start Freq 5.26000000 GHz
Occupied Bandwidth Center 5.280000000 GHz Ref 10 dBm Atten 20 dB Peak Log 10 dB/ dB/ offst 1.56	Start Freq 5.26000000 GHz 5.26000000 GHz Stop Freq
Occupied Bandwidth Center 5.280000000 GHz Ref 10 dBm Atten 20 dB *Peak Log 10 dB/ offst 1.56 dB Center 5.280 000 GHz Spa	Fig Free         5.28000000 GHz           Start Freq         5.26000000 GHz           Stop Freq         5.30000000 GHz           CF Step         4.00000000 MHz           Auto         Man           Freq Offset         0.0000000 Hz
Occupied Bandwidth Center 5.280000000 GHz  Ref 10 dBm Atten 20 dB PPeak Log 0 dB 0 dB 0 dB 0 offst 1.56 dB Center 5.280 000 GHz Res BW 390 kHz VBW 4 MHz Spa PRes BW 390 kHz VBW 4 MHz Ccc BW Z PWr	Fig Free         5.28000000 GHz           Start Freq         5.26000000 GHz           Stop Freq         5.30000000 GHz           CF Step         4.00000000 MHz           Auto         Man           Freq Offset         0.0000000 Hz
Occupied Bandwidth Center 5.280000000 GHz Ref 10 dBm Atten 20 dB PPeak Log 0 dB Offst 1.56 dB Center 5.280 000 GHz Res BW 390 kHz VBW 4 MHz Spa Spa Res BW 390 kHz VBW 4 MHz Ccc BW Z Pwr	Fig Free         5.28000000 GHz           Start Freq         5.26000000 GHz           Stop Freq         5.30000000 GHz           Stop Freq         5.30000000 GHz           CF Step         4.00000000 MHz           Auto         Man           Freq Offset         0.0000000 Hz           Signal Track         0n

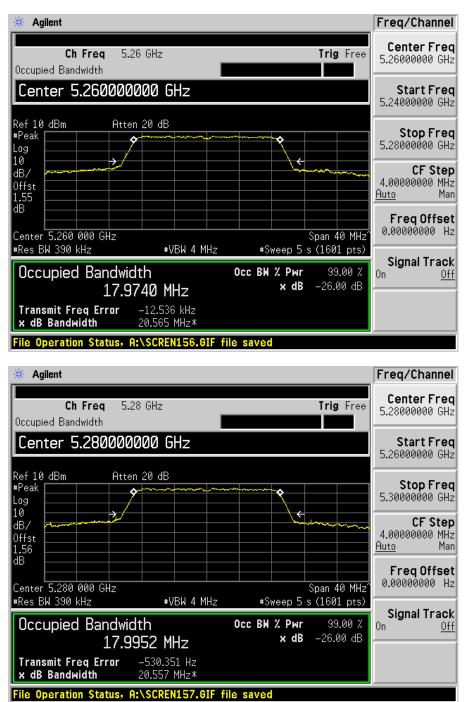
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* Agilent	Freq/Channel
Ch Freq 5.3 GHz Trig Free Occupied Bandwidth	Center Freq 5.30000000 GHz
Center 5.300000000 GHz	<b>Start Freq</b> 5.28000000 GHz
Ref 10 dBm Atten 20 dB #Peak	<b>Stop Freq</b> 5.32000000 GHz
10 dB/ 0ffst 1.58	<b>CF Step</b> 4.00000000 MHz <u>Auto</u> Man
dB Center 5.300 000 GHz #Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (1601 pts)	FreqOffset 0.00000000 Hz
Occupied Bandwidth         Осс ВМ % Рыг         99.00 %           17.0353 MHz         * dB         -26.00 dB	Signal Track <sup>On <u>Off</u></sup>
Transmit Freq Error –93.659 kHz × dB Bandwidth 20.368 MHz* File Operation Status, A:\SCREN148.6IF file saved	
* Agilent	Freq/Channel
Ch Freq 5.32 GHz Trig Free Occupied Bandwidth	Center Freq 5.32000000 GHz
Center 5.320000000 GHz	Start Freq 5.30000000 GHz

Ref 10 dBm Atten 20 dB Stop Freq 5.34000000 GHz #Peak .og 10 ÷ **CF Step** 4.00000000 MHz <u>Auto</u> Man dB <u>nfi</u> <u>Auto</u> Freq Offset 0.00000000 Hz Center 5.320 000 GHz #Res BW 390 kHz Span 40 MHz #VBW 4 MHz #Sweep 5 s (1601 pts) Signal Track Occupied Bandwidth Occ BW % Pwr 99.00 % 0n <u> 0ff</u> x dB -26.00 dB 17.1028 MHz Transmit Freq Error x dB Bandwidth –54.325 kHz 20.345 MHz\* Operation Status, A:\SCREN149.GIF file save

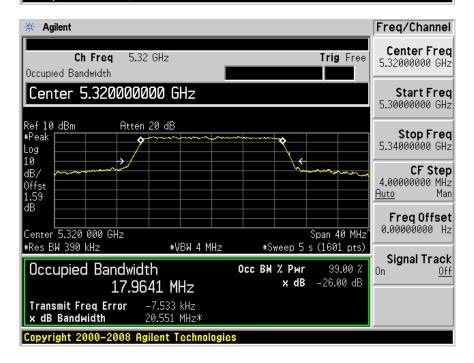
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Graphical Test Results for 802.11A (HT20):



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🔆 Agilent				Freq/Channel
<b>Ch Freq</b> 5. Occupied Bandwidth	3 GHz		Trig Free	Center Fred 5.30000000 GHz
Center 5.300000	000 GHz			<b>Start Fred</b> 5.28000000 GHz
#Peak	n 20 dB	*		<b>Stop Fred</b> 5.32000000 GHz
10 dB/ 0ffst 1.58				CF Step 4.0000000 MHz <u>Auto</u> Mar
dB Center 5.300 000 GHz			Span 40 MHz^	Freq Offset 0.00000000 Hz
*Res BW 390 kHz Occupied Bandwid 17.91	<sup>#VBW 4 MHz</sup> Ith 366 MHz	#Sweep 5 : Occ BW % Pwr x dB	s (1601 pts) 99.00 % –26.00 dB	<b>Signal Track</b> On <u>Of</u> i
Transmit Freq Error × dB Bandwidth File Operation Status, C	20.526 MHz*			

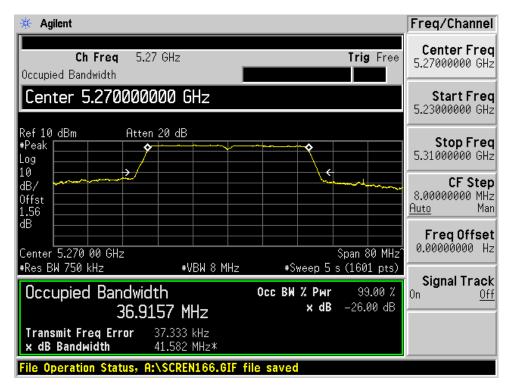


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### 99% and 26dB Bandwidth for 802.11AN (HT40)

Frequency (MHz)	Data Rate (Mbps)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
5270	13.5	36.916	41.582
5310	13.5	36.890	41.872

Graphical Test Results for 802.11A (HT40):



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🔆 Agilent			Freq/Channel
<b>Ch Freq</b> 5.3 Occupied Bandwidth	31 GHz	Trig Free	Center Freq 5.31000000 GHz
Center 5.310000	000 GHz		<b>Start Freq</b> 5.27000000 GHz
#Peak	n 20 dB		<b>Stop Freq</b> 5.35000000 GHz
10 dB/ 0ffst 1.58			<b>CF Step</b> 8.00000000 MHz <u>Auto</u> Man
dB Center 5.310 00 GHz		Span 80 MHz	Freq Offset 0.00000000 Hz
*Res BW 750 kHz	#VBW 8 MHz	#Sweep 5 s (1601 pts) Occ BW % Pwr 99.00 %	Signal Track
	904 MHz	<b>x dB</b> -26.00 dB	
Transmit Freg Error × dB Bandwidth	45.048 kHz 41.872 MHz≭		
File Operation Status, A	:\SCREN167.GIF f	ile saved	

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### Peak Output Power

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 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, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The smallest 26dB bandwidth for all channels is 20.279MHz. The maximum conducted output power is calculated as 11dBm+ $10^{10}$ (20.279 MHz) = 24.07dBm. Which is greater than 250mW?

### **Power Spectral Density**

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, 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.

The maximum supported antenna gain is 4dBi

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Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below.

Enable "Channel Powe	r" function of analyzer
Center Frequency:	Frequency from table below
Span:	20 MHz (must be greater than 26dB bandwidth, adjust as
necessary)	
Ref Level Offset:	Correct for attenuator and cable loss.
Reference Level:	20 dBm
Attenuation:	20 dB
Sweep Time:	100ms, Single sweep
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Sample
Trace:	Trace Average 100 traces in Power Averaging Mode
Integration BW:	=99% BW from 99% Bandwidth Data

After averaging 100 traces of the transmitter waveform on the spectrum analyzer, record the spectrum analyzer Channel Power. Perform a Marker Peak Search function, and record this value as the Power Spectral Density.

### Peak Output Power for 11a:

Frequency (MHz)	Data Rate (Mbps)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
5260	6	14.29	24	-9.71
5280	6	14.03	24	-9.97
5300	6	14.28	24	-9.72
5320	6	13.99	24	-10.01

Power Spectral Density for 11a:

Frequency (MHz)	Data Rate (Mbps)	Peak Power Spectral Density (dBm/MHz)	Limit (dBm)	Margin (dB)
5260	6	1.613	11	-9.387
5280	6	1.132	11	-9.868
5300	6	1.567	11	-9.433
5320	6	1.154	11	-9.846

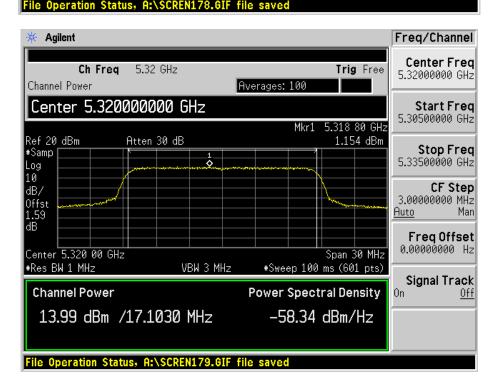
### Graphical Test Results for 802.11a:

* Agilent			Freq/Channel
Ch Freq 5.26 Channel Power	GHz	Trig Free Averages: 100	Center Freq 5.26000000 GHz
Center 5.260000	- 100 GHz	Mkr1 5.257 45 GH	Start Freq 5.24500000 GHz
#Samp K	30 dB	1.613 dBm	<b>Stop Freq</b> 5.27500000 GHz
10 dB/ 0ffst 1.55			<b>CF Step</b> 3.00000000 MHz <u>Auto</u> Man
dB		Span 30 MHz	
*Res BW 1 MHz Channel Power	VBW 3 MHz	*Sweep 100 ms (601 pts) Power Spectral Density	<b>Signal Track</b> On <u>Off</u>
14.29 dBm /17.0	1430 MHz	-58.03 dBm/Hz	
File Operation Status, A:	\SCREN176.GIF f	ile saved	

* Agilent	Peak Search
Ch Freq 5.28 GHz Trig Free Channel Power Averages: 100	Next Peak
Marker 5.274100000 GHz Mkr1 5.274 10 GHz	Next Pk Right
Ref 20 dBm Atten 30 dB 1.132 dBm *Samp 1 Log	Next Pk Left
10 dB/ 0ffst 1.56	Min Search
dB Center 5.280 00 GHz #Res BW 1 MHz VBW 3 MHz #Sweep 100 ms (601 pts)	Pk-Pk Search
Channel Power Power Spectral Density	Mkr → CF
14.03 dBm /17.0950 MHz -58.30 dBm/Hz	More 1 of 2
File Operation Status, A:\SCREN177.GIF file saved	

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* Agilent		Freq/Channel
Ch Freq 5.3 GHz Channel Power	<b>Trig</b> Free Averages: 100	Center Freq 5.3000000 GHz
Center 5.300000000 GHz	Mkr1 5.298 80 GHz	Start Freq 5.28500000 GHz
Ref 20 dBm Atten 30 dB #Samp	1.567 dBm	<b>Stop Freq</b> 5.31500000 GHz
10 dB/ 0ffst 1.58		<b>CF Step</b> 3.0000000 MHz <u>Auto</u> Man
dB	Span 30 MHz	FreqOffset 0.00000000 Hz
*Res BW 1 MHz VBW 3 MHz Channel Power	#Sweep 100 ms (601 pts) Power Spectral Density	Signal Track On Off
14.28 dBm /17.0350 MHz	-58.04 dBm/Hz	<u></u>
File Ameration Status, At\SCDEN178 GIF		



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### Peak Output Power – 802.11an (HT-20)

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 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, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The smallest 26dB bandwidth for all channels is 20.491MHz. The maximum conducted output power is calculated as 11dBm+10\*log(20.491MHz) = 24.12dBm. Which is greater than 250mW?

### Power Spectral Density

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, 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.

The maximum supported antenna gain is 4dBi

### Peak Output Power for 802.11an (HT20):

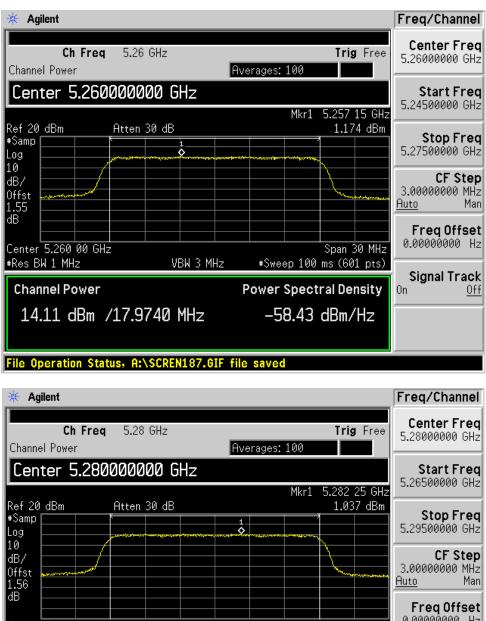
Frequency (MHz)	Data Rate (Mbps)	Peak Output Power (dBm)		Margin (dB)
5260	6.5	14.11	24	-9.89
5280	6.5	14.02	24	-9.98
5300	6.5	14.33	24	-9.67
5320	6.5	13.99	24	-10.01

Power Spectral Density for 11a:

Frequency (MHz)	Data Rate (Mbps)	Peak Power Spectral Density (dBm/MHz)	Limit (dBm)	Margin (dB)
5260	6	1.174	11	-9.826
5280	6	1.037	11	-9.963
5300	6	1.23	11	-9.77
5320	6	1.174	11	-9.826

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Graphical Test Results for 802.11an (HT20):



 1.56 dB
 Huto
 Man

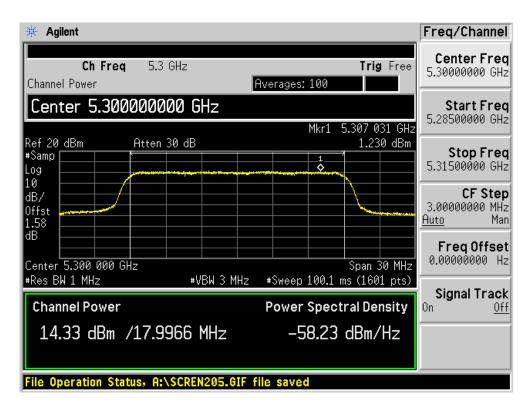
 Center 5.280 00 GHz \*Res BW 1 MHz
 Span 30 MHz VBW 3 MHz
 Span 30 MHz \*Sweep 100 ms (601 pts)

 Channel Power
 Power Spectral Density 14.02 dBm
 Signal Track 0n

 14.02 dBm
 /17.9952 MHz
 -58.53 dBm/Hz

 File Operation Status, A:\SCREN188.GIF file saved

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🔆 Agilent				Peak Search
Ch Freq 5.32 Channel Power		verages: 100	Trig Free	Next Peak
Marker 5.3131500				Next Pk Right
Ref 20 dBm Atten #Samp 1 Log 2	30 dB	Mkr1	5.313 15 GHz 1.174 dBm	Next Pk Left
10 dB/ 0ffst 1.59				Min Search
dB Center 5.320 00 GHz #Res BW 1 MHz	VBW 3 MHz	#Sweep 100 m	Span 30 MHz	Pk-Pk Search
Channel Power	VDW 3 MHZ	Power Spectr		Mkr → CF
13.99 dBm /17.9	641 MHz	-58.56 d	dBm/Hz	More 1 of 2
File Operation Status, A:	SCREN190.GIF fi	le saved		

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### Peak Output Power – 802.11an (HT-20)

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 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, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The smallest 26dB bandwidth for all channels is 41.511MHz. The maximum conducted output power is calculated as 11dBm+10\*log(41.511MHz) = 27.18dBm. Which is greater than 250mW?

### Power Spectral Density

15.407: For the bands 5.25-5.35 and 5.47-5.725 GHz, 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.

The maximum supported antenna gain is 4dBi

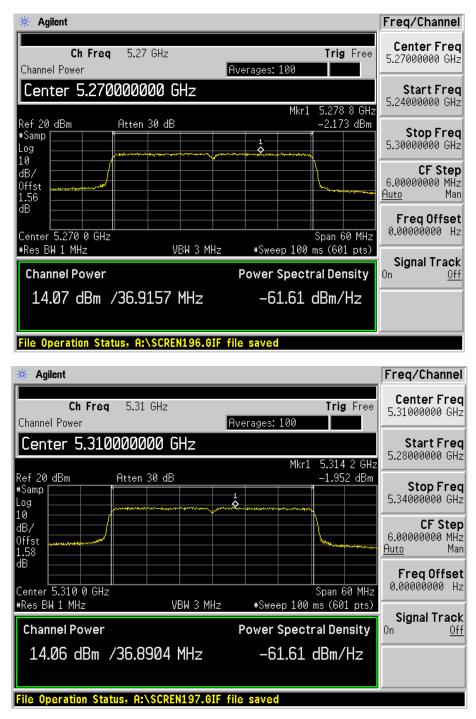
### Peak Output Power for 802.11an (HT40):

Frequency (MHz)	Data Rate (Mbps)	Peak Output Power (dBm)	· · ·	Margin (dB)
5270	MO	14.07	17	-2.93
5310	MO	14.06	24	-9.94

Power Spectral Density for 802.11an (HT40):

Frequency (MHz)	Data Rate (Mbps)	Peak Power Spectral Density (dBm/MHz)	Limit (dBm)	Margin (dB)
5270	M0	-2.173	4	-6.173
5310	M0	-1.952	11	-12.952

Graphical Test Results for 802.11an (HT40):



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### **Peak Excursion**

15.407: 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.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces must be <= 13 dB for all frequencies across the emission bandwidth.

```
1st Trace: (Peak)
```

Set Span to encompass the entire emission bandwidth of the signal.

```
RBW = 1 MHz, VBW = 3 MHz

Detector = Peak

Sweep = Auto

Trace 1 = Max-hold

Ref Level Offset = correct for attenuator and cable loss

Ref Level = 20dBm

Atten = 10dBm

2nd Trace: (Average)

Trace 2 = clear right

Detector = Sample

Avg/VBW type = Pwr(RMS)

Average = 100

Sweep = single

Set marker Deltas

Trace 1 & Peak search
```

Marker Delta

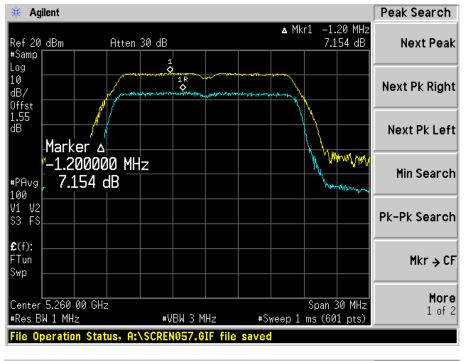
Trace 2 & Peak search

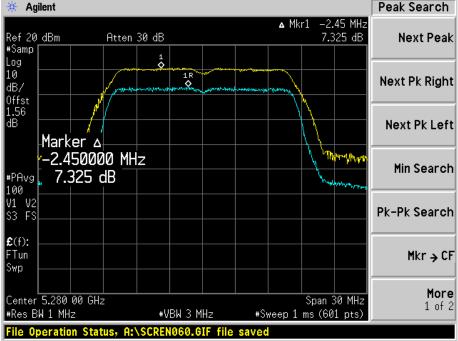
Record the difference between the Peak and Average Markers

### Results for 802.11a:

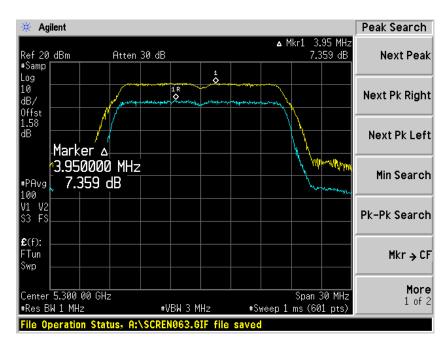
Frequency (MHz)	Data Rate (Mbps)	Peak Excursion (dB)	Limit (dBm)	Margin (dB)
5260	6	7.154	13	-5.846
5280	6	7.325	13	-5.675
5300	6	7.359	13	-5.641
5320	6	7.276	13	-5.724

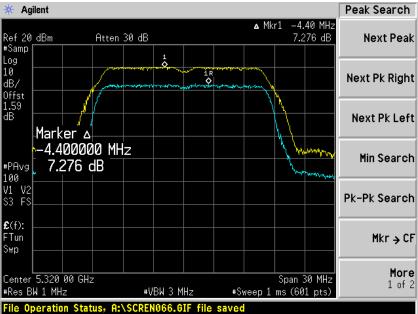
### Graphical Test Results for 802.11a:





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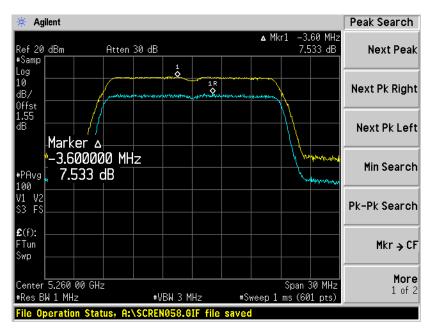


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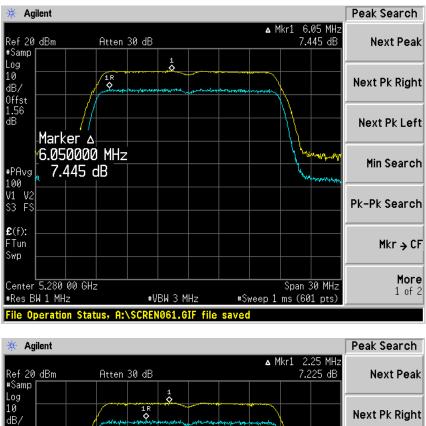
### Results for 802.11an (HT-20):

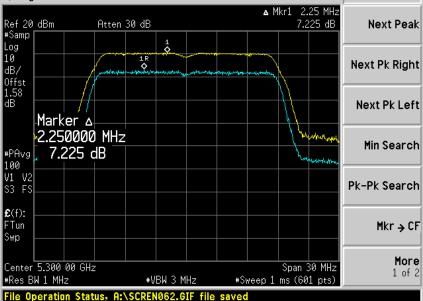
Frequency (MHz)	Data Rate (Mbps)	Peak Excursion (dB)	Limit (dBm)	Margin (dB)
5260	MO	7.533	13	-5.467
5280	M0	7.445	13	-5.555
5300	M0	7.225	13	-5.775
5320	M0	7.642	13	-5.358

### Graphical Test Results for 802.11an (HT20):

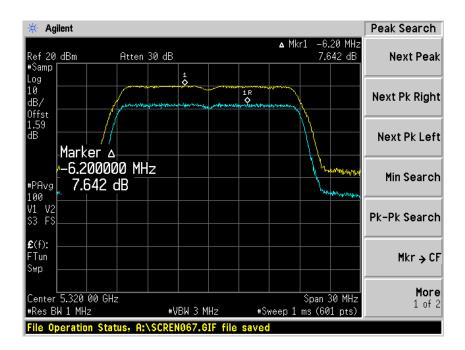


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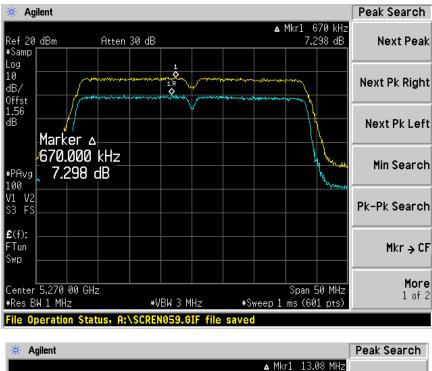


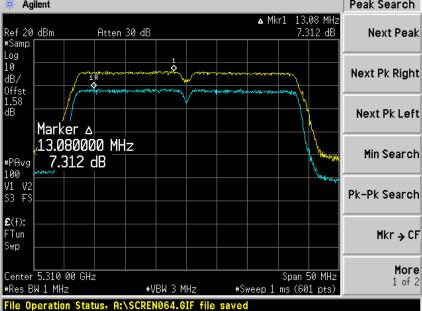
Results for 802.11an (HT-40):

Frequency (MHz)		Peak Excursion	Limit (dBm)	Margin (dB)
	(Mbps)	(dB)		
5270	13.5	7.298	13	-5.702
5310	13.5	7.312	13	-5.688

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Graphical Test Results for 802.11an (HT40):





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### **Conducted Spurious Emissions**

15.407: For transmitters operating in the 5.25-5.35 and 5.47-5.725 GHz band: all emissions outside of the 5.25-5.35 and 5.47-5.725 GHz bands shall not exceed an EIRP of -27dBm/MHz.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

Span:	30 MHz-40 GHz
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	10 s
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Peak
Trace:	Single
Marker:	Peak

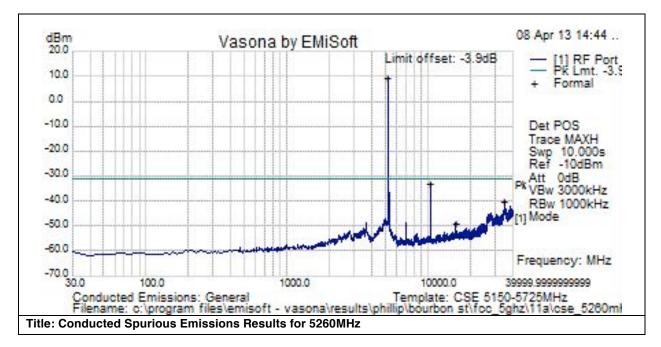
Record the marker waveform peak to spur difference

Note: Worse Case data rate was set during all measurements.

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#### 802.11a Graphical Test Results at 5260MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

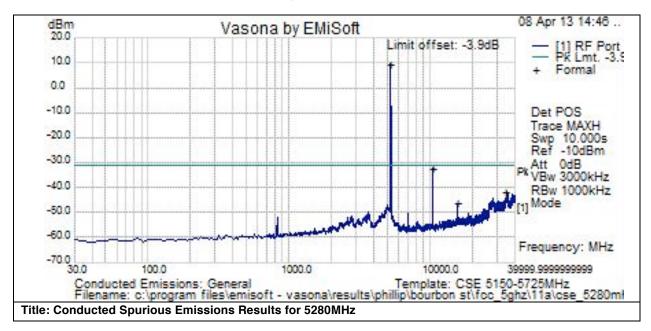


### **Test Results Table**

Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5259.27	-12.5	22.1	0	9.6	Pk	RF	-30.9	40.5	Fail	Tx Signal
10524.48	-53.8	20.9	0	-32.9	Pk	RF	-30.9	-2	Pass	
35187.25	-62.8	22.8	0	-40	Pk	RF	-30.9	-9.1	Pass	
15789.69	-70.1	21.3	0	-48.8	Pk	RF	-30.9	-17.9	Pass	

#### 802.11a Graphical Test Results at 5280MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



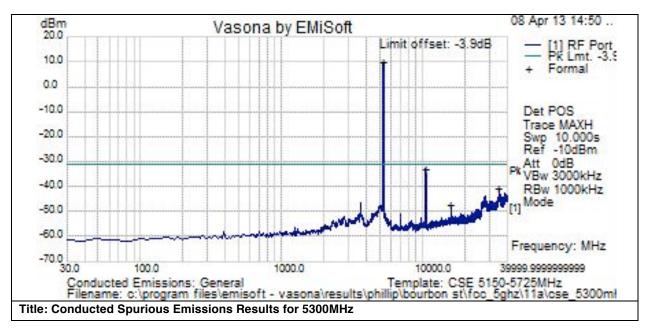
Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5277.24	-12.5	22.1	0	9.6	Pk	RF	-30.9	40.5	Fail	Tx Signal
10560.42	-53.1	20.9	0	-32.2	Pk	RF	-30.9	-1.3	Pass	
35167	-64.4	22.8	0	-41.6	Pk	RF	-30.9	-10.7	Pass	
15843.6	-67.8	21.3	0	-46.5	Pk	RF	-30.9	-15.6	Pass	

### **Test Results Table**

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### 802.11a Graphical Test Results at 5300MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5295.21	-12.4	22.1	0	9.7	Pk	RF	-30.9	40.6	Fail	Tx Signal
10605.345	-53.8	20.9	0	-33	Pk	RF	-30.9	-2	Pass	
35221	-63.8	22.8	0	-41	Pk	RF	-30.9	-10.1	Pass	
15888.525	-68.8	21.3	0	-47.5	Pk	RF	-30.9	-16.6	Pass	

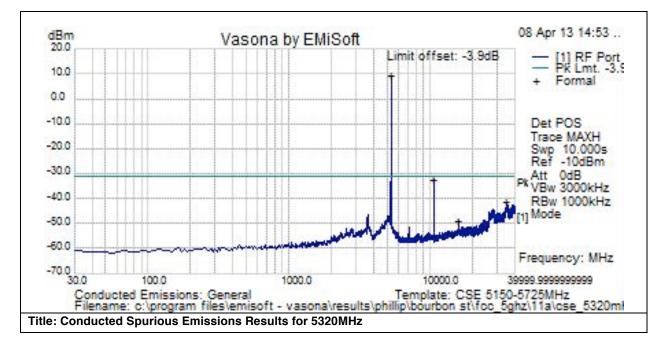
### **Test Results Table**

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### 802.11a Graphical Test Results at 5320MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

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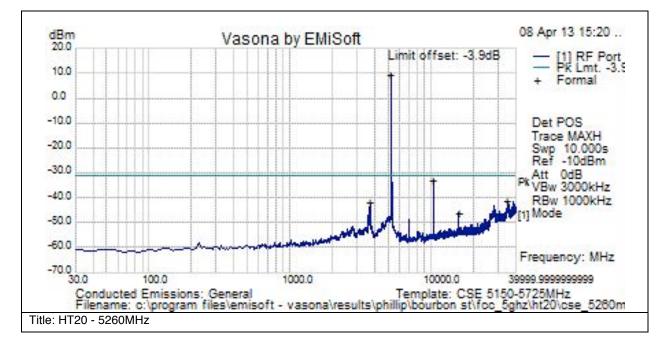
### **Test Results Table**

Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5313.18	-12.8	22.1	0	9.3	Pk	RF	-30.9	40.2	Fail	Tx Signal
10641.285	-53.2	20.9	0	-32.3	Pk	RF	-30.9	-1.4	Pass	
35194	-64.3	22.8	0	-41.5	Pk	RF	-30.9	-10.6	Pass	
15960.405	-70.1	21.3	0	-48.8	Pk	RF	-30.9	-17.9	Pass	

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### Graphical Test Results for802.11an (HT-20) at 5260MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



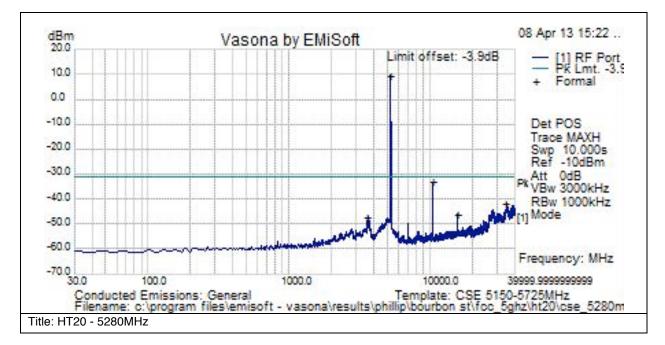
#### **Test Results Table**

Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5259.27	-12.5	22.1	0	9.6	Pk	RF	-30.9	40.5	Fail	Tx Signal
10515.495	-53.9	20.9	0	-33	Pk	RF	-30.9	-2.1	Pass	
35187.25	-64.4	22.8	0	-41.6	Pk	RF	-30.9	-10.7	Pass	
3731.82	-63.6	21.5	0	-42	Pk	RF	-30.9	-11.2	Pass	
15780.705	-67.5	21.3	0	-46.2	Pk	RF	-30.9	-15.3	Pass	

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#### Graphical Test Results for 802.11an (HT-20) at 5280MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



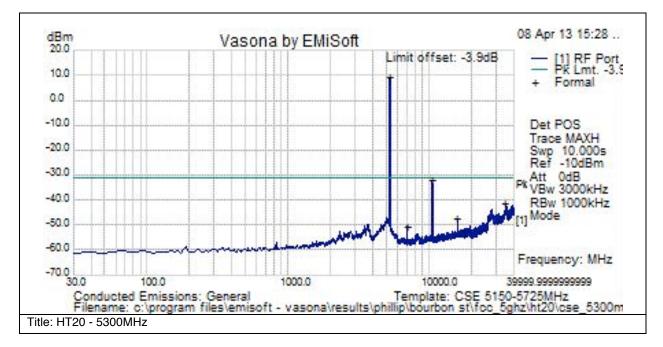
### **Test Results Table**

Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5277.24	-12.6	22.1	0	9.5	Pk	RF	-30.9	40.4	Fail	Tx Signal
10560.42	-54	20.9	0	-33.2	Pk	RF	-30.9	-2.2	Pass	
35241.25	-64.5	22.8	0	-41.7	Pk	RF	-30.9	-10.8	Pass	
15843.6	-67.3	21.3	0	-46	Pk	RF	-30.9	-15.1	Pass	
3624	-68.8	21.6	0	-47.2	Pk	RF	-30.9	-16.3	Pass	

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### Graphical Test Results for 802.11an (HT-20) at 5300MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements



### **Test Results Table**

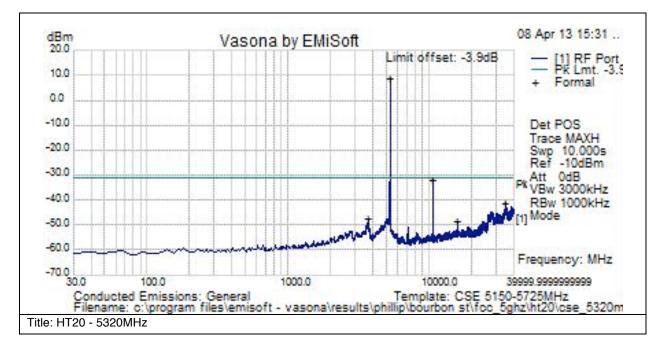
Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5295.21	-12.9	22.1	0	9.2	Pk	RF	-30.9	40.1	Fail	Tx Signal
10596.36	-52.8	20.9	0	-32	Pk	RF	-30.9	-1.1	Pass	
35248	-64.3	22.8	0	-41.4	Pk	RF	-30.9	-10.5	Pass	
15897.51	-68.9	21.3	0	-47.6	Pk	RF	-30.9	-16.7	Pass	
7065.255	-71.1	20.6	0	-50.4	Pk	RF	-30.9	-19.5	Pass	

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### Graphical Test Results for 802.11an (HT-20) at 5320MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

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### **Test Results Table**

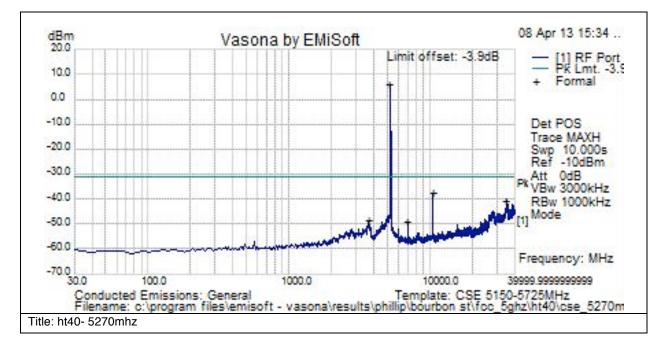
Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5313.18	-13.1	22.1	0	9	Pk	RF	-30.9	39.9	Fail	Tx Signal
10641.285	-52.7	20.9	0	-31.8	Pk	RF	-30.9	-0.9	Pass	
35180.5	-63.9	22.8	0	-41	Pk	RF	-30.9	-10.1	Pass	
3740.805	-69	21.5	0	-47.5	Pk	RF	-30.9	-16.6	Pass	
15960.405	-69.8	21.3	0	-48.5	Pk	RF	-30.9	-17.6	Pass	

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#### Graphical Test Results for 802.11an (HT-40) at 5270MHz:

Note that the data displayed on the plots detailed in this appendix were measured using a 'Peak Detector'. Please refer to the results table for the detectors used during formal measurements

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### **Test Results Table**

Frequency MHz	Raw dBm	Cable Loss	Factors dB	Level dBm	Measurement Type	Line	Limit dBm	Margin dB	Pass /Fail	Comments
5259.27	-16	22.1	0	6.1	Pk	RF	-30.9	37	Fail	Tx Signal
10551.435	-58.4	20.9	0	-37.5	Pk	RF	-30.9	-6.6	Pass	
35227.75	-63.4	22.8	0	-40.6	Pk	RF	-30.9	-9.7	Pass	
3686.895	-70.2	21.5	0	-48.7	Pk	RF	-30.9	-17.8	Pass	
7029.315	-69.9	20.6	0	-49.2	Pk	RF	-30.9	-18.3	Pass	