

Radio Test Report: EDCS - 1206159

CP-DX650

Next Generation Video Endpoint

5470-5725 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 - 1206159

Page No: 1 of 87



This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

| SECTION 1: OVERVIEW | 3 |
|---|--|
| 1.1 Test Summary | 3 |
| SECTION 2: ASSESSMENT INFORMATION | 4 |
| 2.1 GENERAL 2.6 EUT DESCRIPTION | |
| SECTION 3: RESULT SUMMARY | 7 |
| SECTION 4: SAMPLE DETAILS | 8 |
| APPENDIX A: EMISSION TEST RESULTS | 9 |
| Target Maximum Channel Power 99% and 26dB Bandwidth Peak Output Power Power Spectral Density Conducted Spurious Emissions Conducted Bandedge | 10 16 16 19 21 24 31 41 |
| APPENDIX B: EMISSION TEST RESULTS | 50 |
| RADIATED SPURIOUS EMISSIONS CO-LOCATOR RADIATED SPURIOUS EMISSIONS RADIATED EMISSIONS MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS | |
| APPENDIX C: TEST EQUIPMENT USED TO PERFORM THE TEST | |

Page No: 2 of 87

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.

Page No: 3 of 87

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%)

This report must not be reproduced except in full, without written approval of Cisco Systems.

Page No: 4 of 87



2.2 Start Date of Testing

15-Oct-2012

2.3 Report Issue Date

Cisco Systems, Inc. uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

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 | | |

Registration Numbers for Industry Canada

Test Engineers

Phillip Carranco

2.5 Equipment Assessed (EUT)

CP-DX650

Page No: 5 of 87



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.
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)

2.7 Scope of Assessment

Tests have been performed in accordance with the relevant Test and Assessment Plan (TAP), a copy of which is contained in Appendix F of this report, and the relevant Cisco Systems, Inc. radio test procedures (EDCS-420238). This test report may not cover all of the tests highlighted in the test plan.

2.8 Units of Measurement

The units of measurements defined in the appendices are reported in specific terms, which are test dependent. Where radiated measurements are concerned these are defined at a particular distance. Basic voltage measurements are defined in units of [dBuV]

As an example, the basic calculation for all measurements is as follows:

Emission level [dBuV] = Indicated voltage level [dBuV] + Cable Loss [dB] + Other correction factors [dB]

The combinations of correction factors are dependent upon the exact test configurations [see test equipment lists for further details] and may include:-

Antenna Factors, Pre Amplifier Gain, LISN Loss, Pulse Limiter Loss and Filter Insertion Loss..

Note: to convert the results from dBuV/m to uV/m use the following formula:-

Level in uV/m = Common Antilogarithm [(X dBuV/m)/20] = Y uV/m

Page No: 6 of 87

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 Spurions Emissions | Pass |

Page No: 7 of 87

Section 4: 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. Please also refer to the "Justification for worst Case test Configuration" section of this report for further details on the selection of EUT samples.

4.1 Sample Details (Photographs of the test samples, where appropriate can be found in appendix H)

| Sample Number | Equipment Details | Serial Number | Part Number |
|------------------|-------------------|---------------|----------------|
| S01 | CP-DX650-K9 | 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 | |
|-------|--------------------|--|--|
| 1 | 802.11AN Test Mode | System is placed in a continuous Tx State at various channels per Test Requirements. 802.11A running at 6Mbps , HT20 running at 6.5Mbps and HT40 running 13.5Mbps. | |

Section 5: Modifications

5.1 Sample Modifications Performed During Assessment

No modifications were performed during assessment.

Page No: 8 of 87

Appendix A: Emission Test Results

Target Maximum Channel Power

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

..........

| | Maximum Channel Power (dBm) Frequency (MHz) | | |
|-------------------------|--|------|------|
| Operating Mode | 5500 | 5580 | 5700 |
| Non HT-20, 6 to 54 Mbps | 16 | 16 | 16 |
| HT-20, M0 to M23 | 16 | 16 | 16 |
| | 5510 | 5590 | 5670 |
| HT-40, M0 to M23 | 16 | 16 | 16 |

Page No: 9 of 87

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 |
| Resolution Bandwidth: Video Bandwidth: ≥Res X dB Bandwidth: 26 dE | |
| 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) |
|--------------------|---------------------|------------------------|----------------------------|
| 5500 | 6 | 17.042 | 20.279 |
| 5580 | 6 | 17.120 | 20.385 |
| 5700 | 6 | 17.108 | 20.309 |

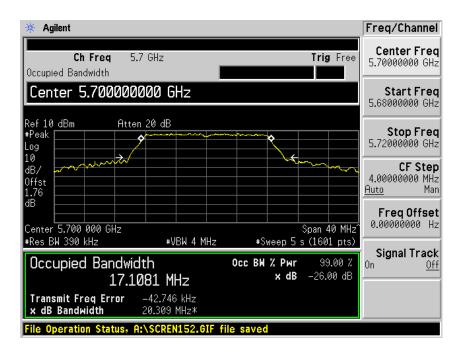
Graphical Test Results for 802.11a:

| * Agilent | Freq/Channel |
|--|---|
| Ch Freq 5.5 GHz Trig Free Occupied Bandwidth | Center Freq 5.50000000 GHz |
| Center 5.500000000 GHz | Start Freq 5.48000000 GHz |
| Ref 10 dBm Atten 20 dB #Peak | Stop Freq 5.52000000 GHz |
| dB/ | CF Step 4.00000000 MHz <u>Auto</u> Man |
| dB Span 40 MHz | FreqOffset 0.00000000 Hz |
| #Res BW 390 kHz #VBW 4 MHz #Sweep 5 s (1601 pts) | Signal Track |
| Occupied Bandwidth Occ BW % Pwr 99.00 % 17.0419 MHz × dB -26.00 dB | On <u>Off</u> |
| Transmit Freq Error-69.092 kHzx dB Bandwidth20.273 MHz* | |
| File Operation Status, A:\SCREN150.GIF file saved | |
| Page No: 10 of 87 | |

| 🔆 Agilent | | | Freq/Channel |
|--|---|--|---|
| Ch Freq 5.5 Occupied Bandwidth | 8 GHz | Trig Free | Center Freq 5.58000000 GHz |
| Center 5.580000 | 000 GHz | | Start Freq 5.56000000 GHz |
| #Peak | 1 20 dB | ************************************** | Stop Freq 5.60000000 GHz |
| 10 dB/ 0ffst 1.74 | | | CF Step 4.00000000 MHz <u>Auto</u> Man |
| dB Center 5.580 000 GHz | | Span 40 MHz | FreqOffset 0.00000000 Hz |
| *Res BW 390 kHz Occupied Bandwid | | #Sweep 5 s (1601 pts) | Signal Track On <u>Off</u> |
| 17.12 Transmit Freq Error × dB Bandwidth | L 97 MHz -45.436 kHz 20.385 MHz* | × dB -26.00 dB | |
| File Operation Status, A | :\SCREN151.GIF fi | ile saved | |

սիսիս

cisco

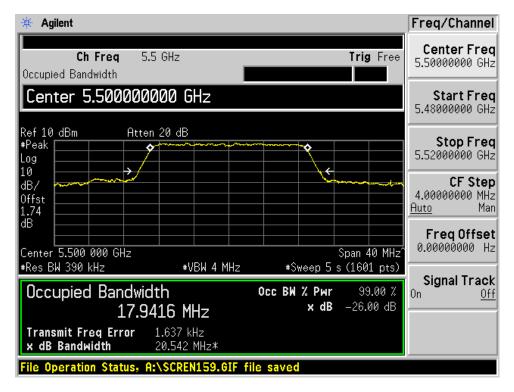


Page No: 11 of 87

| Frequency (MHz) | Data Rate (Mbps) | 99% Bandwidth (MHz) | 26dB Bandwidth (MHz) |
|--------------------|---------------------|------------------------|----------------------------|
| 5500 | M0 | 17.942 | 20.542 |
| 5580 | M0 | 17.982 | 20.491 |
| 5700 | M0 | 17.969 | 20.52 |

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

Graphical Test Results for 802.11A (HT20):



Page No: 12 of 87

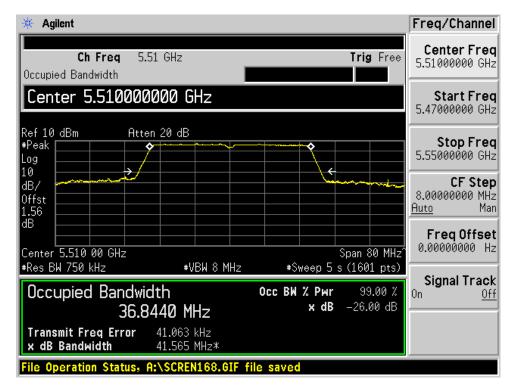
🔆 Agilent Freq/Channel Center Freq Trig Free Ch Freq 5.58 GHz 5.58000000 GHz Occupied Bandwidth Center 5.58000000 GHz Start Freq 5.56000000 GHz Ref 10 dBm Atten 20 dB Stop Freq #Peak 5.60000000 GHz Log 10 **CF** Step dB/ 4.00000000 MHz Offst Man Auto 74 ΉB Freq Offset 0.0000000 Hz Center 5.580 000 GHz Span 40 MHz #Res BW 390 kHz #Sweep 5 s (1601 pts) ₩VBW 4 MHz Signal Track Occupied Bandwidth Occ BW % Pwr 99.00 % 0n Off -26.00 dB x dB 17.9816 MHz Transmit Freq Error 6.291 kHz x dB Bandwidth 20.491 MHz* :\SCREN160.GIF file saved Operation 🔆 Agilent Freq/Channel Center Frea Ch Frea 5.7 GHz Trig Free 5.70000000 GHz Occupied Bandwidth Center 5.700000000 GHz Start Freq 5.68000000 GHz Ref 10 dBm #Peak Atten 20 dB Stop Freq 5.72000000 GHz Log 10 CF Step dB/ 4.00000000 MHz Auto Man Offst Auto 1.76 dB Freq Offset 0.00000000 Hz Center 5.700 000 GHz #Res BW 390 kHz Span 40 MHz #Sweep 5 s (1601 pts) ₩VBW 4 MHz Signal Track Occupied Bandwidth Occ BW % Pwr 99.00 % 0n <u>Off</u> x dB -26.00 dB 17.9694 MHz Transmit Freq Error -4.789 kHz x dB Bandwidth 20.520 MHz* Operation Status, A:\SCREN161.GIF file saved

Page No: 13 of 87

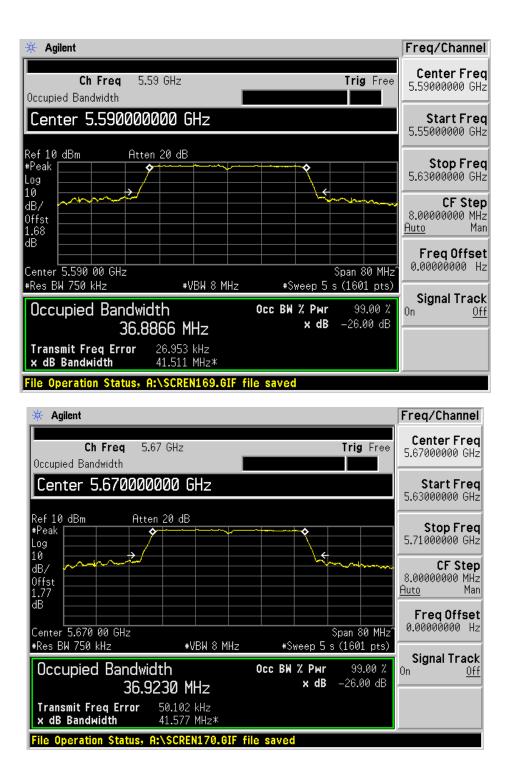
99% and 26dB Bandwidth for 802.11AN (HT40)

| Frequency (MHz) | Data Rate (Mbps) | 99% Bandwidth (MHz) | 26dB Bandwidth (MHz) |
|--------------------|---------------------|------------------------|----------------------------|
| 5510 | MO | 36.844 | 41.565 |
| 5590 | MO | 36.887 | 41.511 |
| 5670 | MO | 36.923 | 41.577 |

Graphical Test Results for 802.11A (HT40):



Page No: 14 of 87



Page No: 15 of 87

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*log(20.279 MHz) = 24.07dBm. This 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 3.8dBi.

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.

Page No: 16 of 87

Peak Output Power for 11a:

| Frequency (MHz) | Data Rate (Mbps) | Peak Output Power (dBm) | Limit (dBm) | Margin (dB) |
|--------------------|---------------------|----------------------------|-------------|-------------|
| 5500 | 6 | 15.20 | 24 | -8.80 |
| 5580 | 6 | 15.32 | 24 | -8.68 |
| 5700 | 6 | 14.95 | 24 | -9.05 |

Power Spectral Density for 11a:

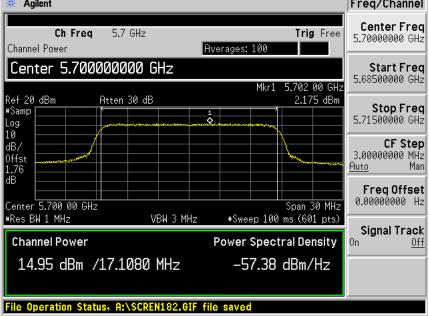
| Frequency (MHz) | Data Rate (Mbps) | Peak Power Spectral Density (dBm/MHz) | Limit (dBm) | Margin (dB) |
|--------------------|---------------------|--|----------------|----------------|
| 5500 | 6 | 2.603 | 11 | -8.397 |
| 5580 | 6 | 2.854 | 11 | -8.146 |
| 5700 | 6 | 2.175 | 11 | -8.825 |

Graphical Test Results for 802.11a:

| 🔆 Agilent | | | Freq/Channel |
|--|--------------|--|---|
| Ch Freq 5.5 G Channel Power | | Trig Free Averages: 100 | Center Freq 5.50000000 GHz |
| Center 5.50000000 | | Mkr1 5.493 65 GHz | Start Freq 5.48500000 GHz |
| Ref 20 dBm Atten 3 #Samp 1 Log 2 10 | | 2.603 dBm | Stop Freq 5.51500000 GHz |
| dB/ Offst | | | CF Step 3.00000000 MHz <u>Auto</u> Man |
| dB | | Span 30 MHz | Freq Offset 0.00000000 Hz |
| *Res BW 1 MHz Channel Power | VBW 3 MHz | #Sweep 100 ms (601 pts) Power Spectral Density | Signal Track On <u>Off</u> |
| 15.20 dBm /17.04 | 20 MHz | -57.11 dBm/Hz | |
| File Operation Status, A:\S | SCREN180.GIF | file saved | |

Page No: 17 of 87

🔆 Agilent Freq/Channel Center Freq Ch Freq 5.58 GHz Trig Free 5.58000000 GHz Channel Power Averages: 100 Center 5.580000000 GHz Start Freq 5.56500000 GHz Mkr1 5.578 95 GHz 2.854 dBm Ref 20 dBm Atten 30 dB Stop Freq #Samp ò 5.59500000 GHz Log 10 **CF** Step dB, 3.00000000 MHz Offs Auto Man Freq Offset 0.00000000 Hz Center 5.580 00 GHz Span 30 MHz #Res BW 1 MHz VBW 3 MHz #Sweep 100 ms (601 pts) Signal Track **Channel Power Power Spectral Density** 0n <u>0ff</u> 15.32 dBm /17.1200 MHz -57.02 dBm/Hz File Operation Status, A:\SCREN181.GIF file save 🔆 Agilent Freq/Channel



Page No: 18 of 87

Peak Output Power for HT20:

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. This 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 3.8dBi.

Peak Output Power for 802.11an (HT20):

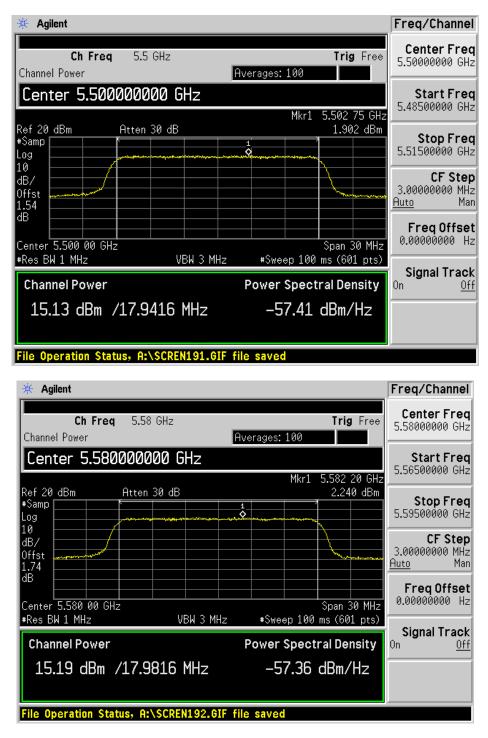
| Frequency (MHz) | Data Rate (Mbps) | Peak Output Power (dBm) | • • • | Margin (dB) |
|--------------------|---------------------|----------------------------|-------|-------------|
| 5500 | MO | 15.13 | 24 | -8.87 |
| 5580 | MO | 15.19 | 24 | -8.81 |
| 5700 | MO | 14.81 | 24 | -9.19 |

Power Spectral Density for 11a:

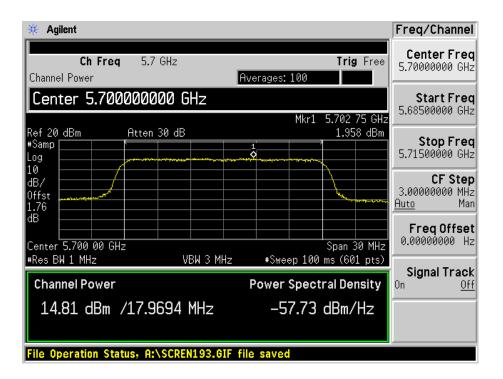
| Frequency (MHz) | Data Rate (Mbps) | Peak Power Spectral Density (dBm/MHz) | Limit (dBm) | Margin (dB) |
|--------------------|---------------------|--|----------------|----------------|
| 5500 | MO | 1.902 | 11 | -9.098 |
| 5580 | MO | 2.24 | 11 | -8.76 |
| 5700 | MO | 1.958 | 11 | -9.042 |

cisco

Graphical Test Results for 802.11an (HT20):



Page No: 20 of 87



Peak Output Power for HT20:

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. This 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 3.8dBi.

Page No: 21 of 87

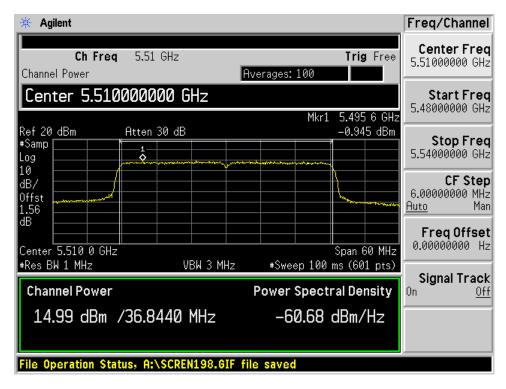
| Frequency (MHz) | Data Rate (Mbps) | Peak Output Power (dBm) | Limit (dBm) | Margin (dB) |
|--------------------|---------------------|----------------------------|-------------|-------------|
| 5510 | MO | 14.99 | 24 | -9.01 |
| 5590 | MO | 15.07 | 24 | -8.93 |
| 5670 | MO | 14.81 | 24 | -9.19 |

Peak Output Power for 802.11an (HT40):

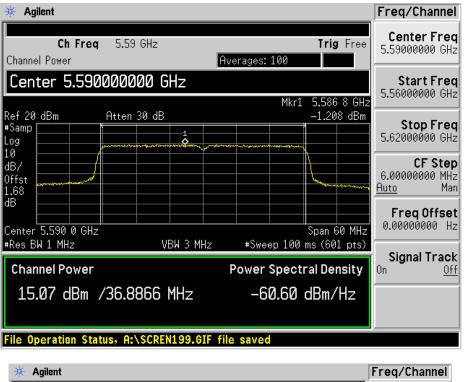
Power Spectral Density for 802.11an (HT40):

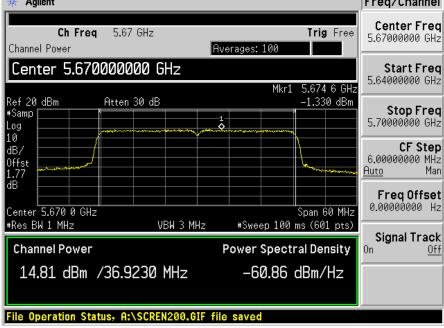
| Frequency (MHz) | Data Rate (Mbps) | Peak Power Spectral Density (dBm/MHz) | Limit (dBm) | Margin (dB) |
|--------------------|---------------------|--|----------------|----------------|
| 5510 | M0 | -0.945 | 11 | -11.945 |
| 5590 | M0 | -1.208 | 11 | -12.208 |
| 5670 | MO | -1.33 | 11 | -12.33 |

Graphical Test Results for 802.11an (HT40):



Page No: 22 of 87





Page No: 23 of 87

This document is uncontrolled. Please refer to the electronic copy within EDCS for the most up to date version. Cisco Systems, Inc. Company Confidential



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:

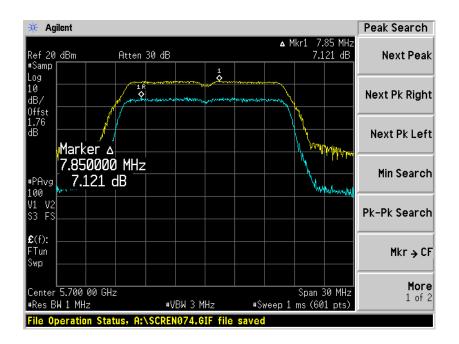
| | | Peak Excursion | | Margin |
|-------|--------|----------------|-------|--------|
| (MHz) | (Mbps) | (dB) | (dBm) | (dB) |
| 5500 | 6 | 7.376 | 13 | -5.624 |
| 5580 | 6 | 7.31 | 13 | 5.69 |
| 5700 | 6 | 7.121 | 13 | 5.879 |

Peak Search 🔆 Agilent ▲ Mkr1 6.00 MHz Ref 20 dBm Atten 30 dB 7.376 dB Next Peak #Samp 1 Log 10 1R 🔷 Next Pk Right Offst 54 Next Pk Left ٩R Marker ∆ 6.000000 MHz Min Search #PAvg 100 7.376 dB V1 S3 V2 FS Pk-Pk Search £(f): FTun Mkr → CF Swp More Center 5.500 00 GHz Span 30 MHz 1 of 2 ŧRes BW 1 MHz ∗VBW 3 MHz #Sweep 1 ms (601 pts) A:\SCREN069.GIF File Operation Peak Search 🔆 Agilent ▲ Mkr1 3.30 MHz Atten 30 dB 7.310 dB Ref 20 dBm Next Peak #Samp Log 10 1 R Next Pk Right dB7 Offst .74 Next Pk Left Min Search d. de **#**PAvg Whenn 100 V1 V2 Pk-Pk Search ES **£**(f): Marker ∆ 3.300000 MHz-FTun Mkr→CF Swp 7.310 dB More Center 5.580 00 GHz Span 30 MHz 1 of 2 Sweep 1 ms (601 pts) #Res BW 1 MHz ₩VBW 3 MHz

Graphical Test Results for 802.11a:

Page No: 25 of 87

yright 2000–2008 Agilent Technologie



Peak Excursion for HT20:

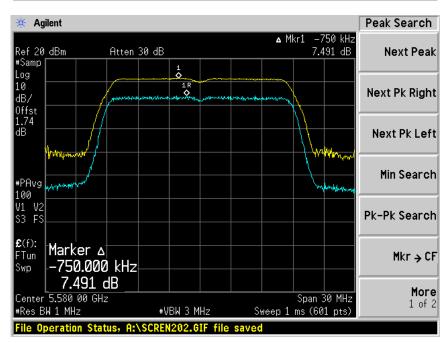
15.407: The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

| Frequency (MHz) | Data Rate (Mbps) | Peak Excursion (dB) | Limit (dBm) | Margin (dB) |
|--------------------|------------------------|---------------------------|----------------|----------------|
| 5500 | M0 | 7.387 | 13 | -5.613 |
| 5580 | M0 | 7.491 | 13 | 5.509 |
| 5700 | M0 | 7.527 | 13 | 5.473 |

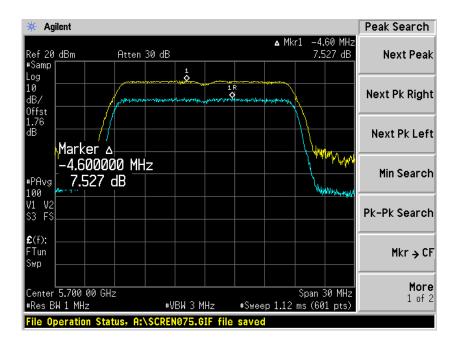
Page No: 26 of 87

🔆 Agilent Peak Search ▲ Mkr1 3.35 MHz 7.387 dB Atten 30 dB Ref 20 dBm Next Peak #Samp 1 .og 10 1 R 🔷 Next Pk Right łR.)ffst Next Pk Left Marker **5** 3.350000 MHz all they Min Search 7.387 dB #PAvg 100 V1 V2 S3 FS Pk-Pk Search £(f): FTun Mkr→CF Swp More Center 5.500 00 GHz Span 30 MHz 1 of 2 #VBW 3 MHz #Sweep 1 ms (601 pts) #Res BW 1 MHz Status, A:\SCREN068.GI

Graphical Test Results for 802.11an (HT20):



Page No: 27 of 87



Peak Excursion for HT40:

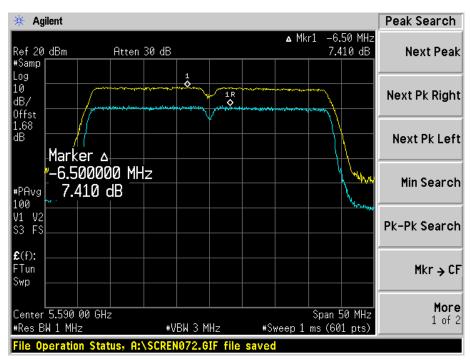
15.407: The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

| Frequency (MHz) | | Peak Excursion (dB) | Limit (dBm) | Margin (dB) |
|--------------------|----|---------------------------|----------------|----------------|
| 5510 | M0 | 7.369 | 13 | -5.631 |
| 5590 | M0 | 7.41 | 13 | -5.59 |
| 5670 | M0 | 7.338 | 13 | -5.662 |

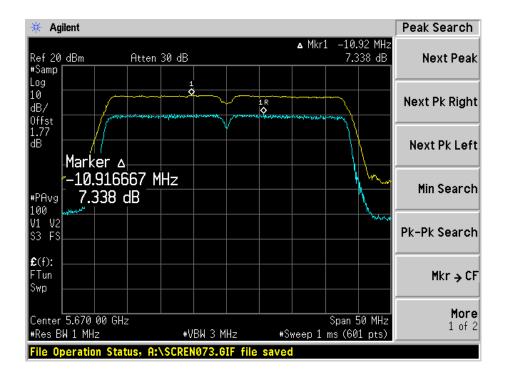
Page No: 28 of 87

Peak Search 🔆 Agilent ▲ Mkr1 9.50 MHz 7.369 dB Ref 20 dBm Atten 30 dB Next Peak #Samp Log 10 dB/ Offst 1.56 dB ¢ Next Pk Right 1R 🔷 Next Pk Left Marker 🛆 9.500000 MHz Min Search 7.369 dB #PAvg 100 V1 V2 S3 FS Pk-Pk Search **£**(f): FTun Mkr→CF Swp More Center 5.510 00 GHz Span 50 MHz 1 of 2 #Sweep 1 ms (601 pts) #Res BW 1 MHz #VBW 3 MHz File Operation Status, A:\SCREN065.GIF file save

Graphical Test Results for 802.11an (HT40):



Page No: 29 of 87



սիսիս

cisco

Page No: 30 of 87

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).

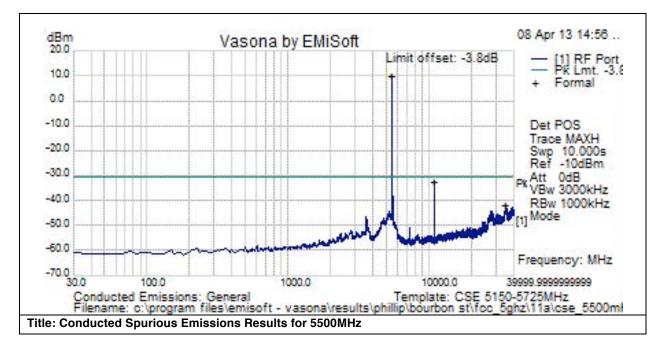
| Span: | 30 MHz-40 GHz |
|-----------------------|---------------|
| Reference Level: | 20 dBm |
| Attenuation: | 10 dB |
| Sweep Time: | 10 s |
| Resolution Bandwidth: | 1 MHz |
| Video Bandwidth: | 3 MHz |
| Detector: | Peak |
| Trace: | Single |
| Marker: | Peak |

Record the marker waveform peak to spur difference

Page No: 31 of 87

802.11A Graphical Test Results at 5500MHz:

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



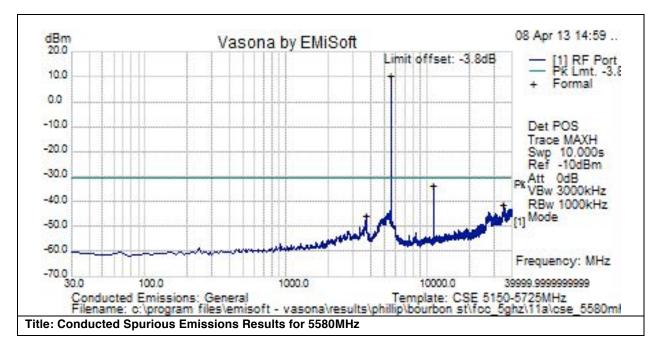
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factors dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|---------------|--------------|---------------------|------|--------------|--------------|---------------|-----------|
| 5492.88 | -12 | 22.1 | 0 | 10.1 | Pk | RF | -30.8 | 40.9 | Fail | Tx Signal |
| 11000.685 | -53.2 | 20.9 | 0 | -32.2 | Pk | RF | -30.8 | -1.4 | Pass | |
| 35234.5 | -64.5 | 22.8 | 0 | -41.7 | Pk | RF | -30.8 | -10.9 | Pass | |

Page No: 32 of 87

802.11A Graphical Test Results at 5580MHz:

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



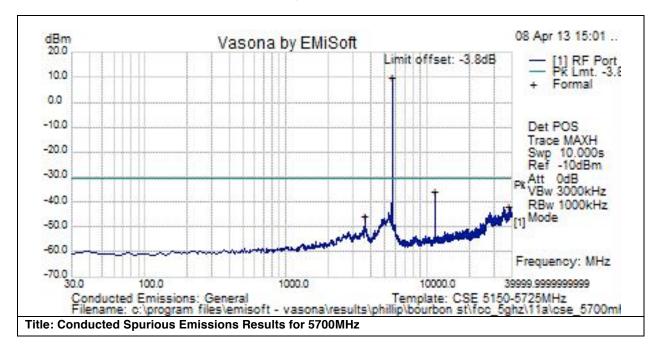
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factor s dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|----------------|--------------|---------------------|------|--------------|--------------|---------------|-----------|
| 5573.745 | -11.8 | 22.1 | 0 | 10.3 | Pk | RF | -30.8 | 41.1 | Fail | Tx Signal |
| 11153.43 | -54.5 | 20.9 | 0 | -33.6 | Pk | RF | -30.8 | -2.8 | Pass | |
| 35234.5 | -64 | 22.8 | 0 | -41.2 | Pk | RF | -30.8 | -10.4 | Pass | |
| 3713.983 | -67.1 | 21.5 | 0 | -45.6 | Pk | RF | -30.8 | -14.8 | Pass | |

Page No: 33 of 87

802.11A Graphical Test Results at 5700MHz:

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



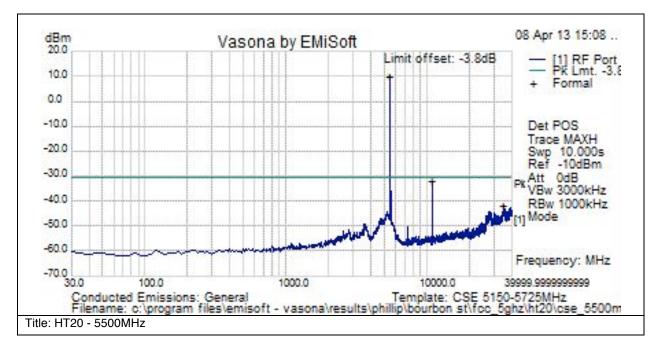
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factor s dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|----------------|--------------|---------------------|------|--------------|--------------|---------------|-----------|
| 5699.535 | -12.4 | 22.3 | 0 | 9.9 | Pk | RF | -30.8 | 40.7 | Fail | Tx Signal |
| 11405.01 | -56.8 | 21 | 0 | -35.8 | Pk | RF | -30.8 | -5 | Pass | |
| 38535.25 | -64.8 | 22.8 | 0 | -42 | Pk | RF | -30.8 | -11.2 | Pass | |
| 3659.94 | -67.2 | 21.5 | 0 | -45.7 | Pk | RF | -30.8 | -14.9 | Pass | |

Page No: 34 of 87

Graphical Test Results for 802.11an (HT-20) 5500MHz:

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



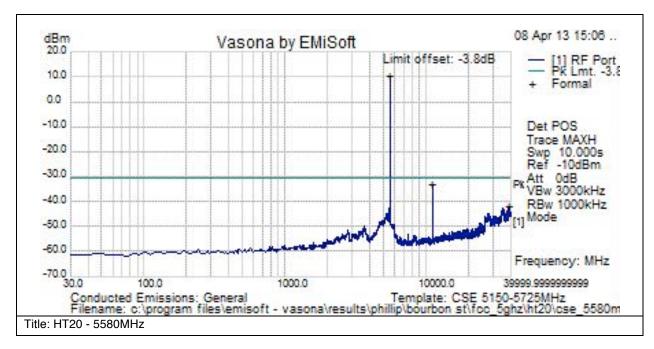
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factors dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|---------------|--------------|---------------------|------|--------------|--------------|---------------|-----------|
| 5501.865 | -12.1 | 22.1 | 0 | 10 | Pk | RF | -30.8 | 40.8 | Fail | Tx Signal |
| 11009.67 | -52.8 | 20.9 | 0 | -31.9 | Pk | RF | -30.8 | -1.1 | Pass | |
| 35200.75 | -64.5 | 22.8 | 0 | -41.7 | Pk | RF | -30.8 | -10.9 | Pass | |

Page No: 35 of 87

Graphical Test Results for 802.11an (HT-20) 5580MHz:

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



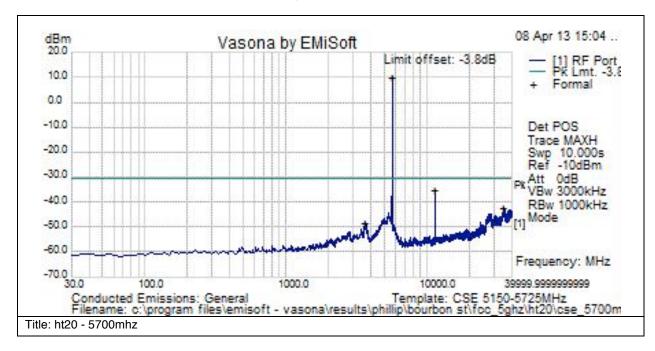
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factors dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|---------------|--------------|---------------------|------|--------------|--------------|------------|-----------|
| 5573.745 | -11.9 | 22.1 | 0 | 10.3 | Pk | RF | -30.8 | 41.1 | Fail | Tx Signal |
| 11162.415 | -54 | 20.9 | 0 | -33.1 | Pk | RF | -30.8 | -2.3 | Pass | |
| 39048.25 | -64.9 | 22.8 | 0 | -42.1 | Pk | RF | -30.8 | -11.3 | Pass | |

Page No: 36 of 87

Graphical Test Results for 802.11an (HT-20) 5700MHz:

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



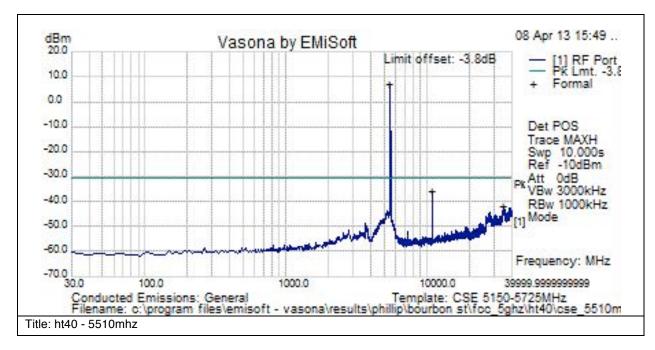
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factors dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|---------------|--------------|---------------------|------|--------------|--------------|------------|-----------|
| 5699.535 | -12.3 | 22.3 | 0 | 10 | Pk | RF | -30.8 | 40.8 | Fail | Tx Signal |
| 11396.025 | -56.1 | 21 | 0 | -35.1 | Pk | RF | -30.8 | -4.3 | Pass | |
| 35200.75 | -65 | 22.8 | 0 | -42.2 | Pk | RF | -30.8 | -11.4 | Pass | |
| 3668.925 | -69.8 | 21.5 | 0 | -48.3 | Pk | RF | -30.8 | -17.5 | Pass | |

Page No: 37 of 87

Graphical Test Results for 802.11an (HT-40) 5510MHz:

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



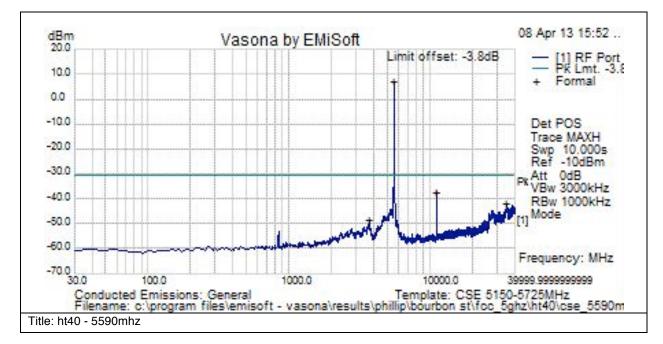
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factors dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|---------------|--------------|---------------------|------|--------------|--------------|------------|-----------|
| 5501.865 | -15.1 | 22.1 | 0 | 7 | Pk | RF | -30.8 | 37.7 | Fail | Tx Signal |
| 11018.655 | -56.8 | 20.9 | 0 | -35.9 | Pk | RF | -30.8 | -5.1 | Pass | |
| 35214.25 | -64.7 | 22.8 | 0 | -41.9 | Pk | RF | -30.8 | -11.1 | Pass | |

Page No: 38 of 87

Graphical Test Results for 802.11an (HT-40) 5590MHz:

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



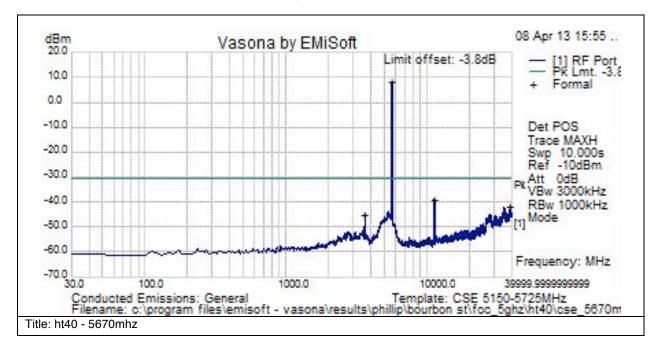
Test Results Table

| Frequency MHz | Raw dBm | Cable Loss | Factors dB | Level dBm | Measurement Type | Line | Limit dBm | Margin dB | Pass /Fail | Comments |
|------------------|------------|---------------|---------------|--------------|---------------------|------|--------------|--------------|------------|-----------|
| 5591.715 | -15 | 22.2 | 0 | 7.2 | Pk | RF | -30.8 | 38 | Fail | Tx Signal |
| 11180.385 | -58.3 | 20.9 | 0 | -37.4 | Pk | RF | -30.8 | -6.6 | Pass | |
| 35241.25 | -64.7 | 22.8 | 0 | -41.9 | Pk | RF | -30.8 | -11.1 | Pass | |
| 3758.775 | -70.2 | 21.5 | 0 | -48.7 | Pk | RF | -30.8 | -17.9 | Pass | |

Page No: 39 of 87

Graphical Test Results for 802.11an (HT-40) 5670MHz:

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 |
|------------------|------------|---------------|---------------|--------------|---------------------|------|--------------|--------------|------------|-----------|
| 5663.595 | -14.2 | 22.3 | 0 | 8.1 | Pk | RF | -30.8 | 38.9 | Fail | Tx Signal |
| 11342.115 | -59.8 | 21 | 0 | -38.8 | Pk | RF | -30.8 | -8 | Pass | |
| 39257.5 | -64.7 | 22.9 | 0 | -41.8 | Pk | RF | -30.8 | -11 | Pass | |
| 3624 | -66.5 | 21.6 | 0 | -45 | Pk | RF | -30.8 | -14.2 | Pass | |

Page No: 40 of 87

Conducted Bandedge

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 sall 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 |
| | |

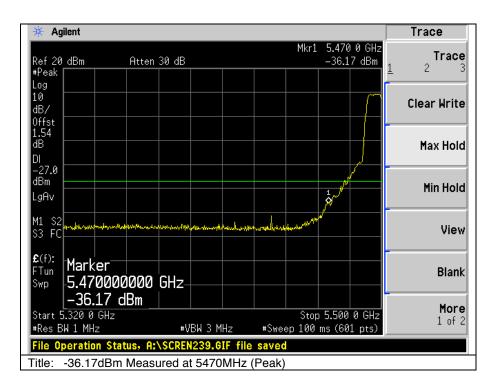
Record the marker waveform peak to spur difference

802.11an (HT-40) Marker-Delta Test Results:

| Frequency Tested | Radiated Pk Measurement | Radiated Ave Measurement | Conducted Delta | Limit (dBm) | Margin (dBm) |
|---------------------|----------------------------|-----------------------------|--------------------|----------------|-----------------|
| | | | Measurement | | |
| 5700 (Hortz) | 108.55 | 101.7 | -40.08 | -74 | -33.92 |
| 5700 (Vert) | 108.42 | 101.53 | -40.08 | -54 | -13.92 |

Page No: 41 of 87

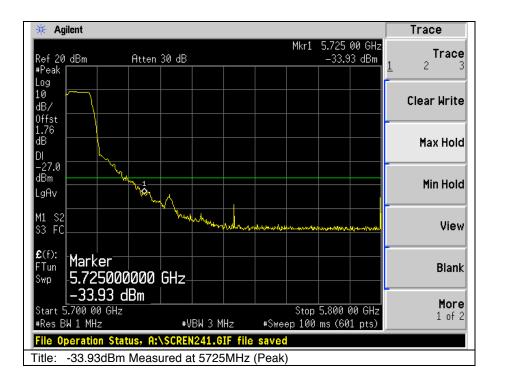
Graphical Test Results for 802.11A:



սիսիս

cisco

Page No: 42 of 87







Radiated Graphical Test Results for 802.11A – HT20 Mode (Peak):

Page No: 43 of 87