Electro Magnetic Interference Testing and Engineering
Wireless Testing, Electrical Safety Testing,
PCB Designs, and Hardware Design Engineering
360 Herndon Parkway, Suite 1400, Herndon, VA 20170
Tel: 703-689-0368, Fax: 703-689-2056

August 8, 2002

Joe Dichoso
Federal Communication Commission

Reference: LDK102045
Correspondence number: 23502
Applicant: Cisco Systems Inc.

1) Users manual pg 6 5 for example shows access point configuration. EMC test setup photos do not seem to match access point and/or device external photos. Please clarify/correct/re test as necessary.

RESPONSE: The EUT sent as a separate application was tested as a standalone device in a laptop. This configuration will typically be used in laptop PCMCIA configurations. In order to demonstrate co-location, the only configuration in which the Osprey 5 GHz Transmitter and the Venus 2.4 GHz antenna will be used is in the access point configuration displayed on page 6-5 of the user manual. In conclusion, we must have two configuration pictures, the 5.5 GHz Osprey EUT in a laptop and the second in the access point. Please see the EMC radiated test data with both the 2.4 GHz and 5.5 GHz in simultaneous active mode uploaded with this correspondence.

2) Antenna options are flipup=dipole, flipdown=patch. Sister filing EA465289 has radiated EMC tests in actual final config. access point, while here radiated is done in laptop with extender card. Need 5 GHz band radiated tests with device in access point.

RESPONSE: Please see the 5 GHz band radiated test data, uploaded with this correspondence.

3) FCC ID is wrong in op desc exhibit

RESPONSE: It appears that this number is correct, please verify once again.

4) EMC radiated test needed with both 2.4 and 5 GHz active, or was that done already?

RESPONSE: The data for the 2.4 GHz and 5 GHz was initially done individually. Attached is the test result for both devices in the active mode.

5) Please explain the user installed compliance label scheme in users manual pg 6 6.

RESPONSE: The AP1200 is designed to be modular in nature. If the customer orders the access point and 5 GHz radio at the same time, the unit will be properly labeled with the information for the 5 GHz radio. If the customer has previously purchased a 2.4 GHz version of the access point, and at a later date orders the 5 GHz radio module, labeling will be provided with the radio module to be placed by the end user on the exterior of the access point following installation of the module. This section explains this labeling procedure.

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6) Please confirm that antenna orientations for "wall mounted" MPE test is correct. Users manual and op desc do not seem to clearly describe antenna orientations for each mounting configuration.

RESPONSE: The photograph 3.2.2 correctly depicts the antenna orientations for wall-mounted equipment. See the Quick Start Guide uploaded with this correspondence response for the mounting instructions.

7) grant condition should state that RF exposure was evaluated for colocation with LDK102042

RESPONSE: Test Report includes statement "RF exposure was evaluated for co-location with 2.4 GHz, model #

8) users manual mentions quick start guide with antenna connection instructions. please submit. include diagrams or photos of recommended antenna installations.

RESPONSE: Quick Start Guide with antenna connection instructions uploaded with the correspondence response.

9) MPE Fig 3.1.1 matches Photo 3.2.1, but Fig 3.1.2 does not match Photo 3.2.2, and Fig 3.1.3 does not match Photo 3.2.3. Please explain, including description of normal installation conditions.

RESPONSE: Fig 3.1.2 and Fig. 3.1.3 do not exactly match the pictures. The purpose of these diagrams was to represent different possible configurations. The normal operation/installation configurations are:

1) Wall Mount; Flip Up/Flip Down 5 GHz antenna, Flip Up/Flip Down 2.4 GHz dipole antenna
2) Ceiling Mount
3) Desktop

An evaluation was performed with respect to field strength and height. It was determined that the field strength values determined above the EUT were the same as those below the ceiling mounted position at the same distance from the EUT. Therefore, it was concluded that the desktop and ceiling mounted position would yield the same results, data for the ceiling mount antenna was not provided.

10) MPE equipment list shows two probes. was same probe (TYPE 9) used for all stand alone and simultaneous tests? if no, why not? if not, do tests with only TYPE 8 give correct comparison for simultaneous tests?

RESPONSE: We apologize for any misrepresentation. Only the Type 9 probe was used for the stand alone and simultaneous tests.

11) MPE please submit probe calibration certificates including 2.4 and 5.25 GHz factors.

RESPONSE: Rhein Tech Laboratories has calibration certificate and calibration factors for the probe at these frequencies.
These were uploaded with this correspondence.

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12) MPE what are units for data tables in section 5? Note low range from W&G Type 9 datasheet is 1.2 V/m or 3.2 mW/m^2.

Two types of units for MPE data in section 5 were used; power density measured in mW/cm^2 and field strength in V/m. In the far-field region, measurements were taken in power density mode and in the near-field region field strength measurements were taken. Since OET Bulletin 65C displays MPE limits for the investigated frequencies as power density limits only, for all measurements made as field strength, calculation using far field approximation into power density were made, this data is presented in the updated report. Furthermore, additional justification with respects to validity of this calculation is presented in the updated report.

Some MPE data shown in the report are below the specified low range level of the measurement probe; essentially noise floor values. Our decision was to state the actual probe value instead of stating noise floor in the test data tables. In the updated report, the low level range of the EMR-200 is stated.

13) MPE please confirm/demonstrate that probe responds correctly to device modulations. Some modulations and amplitudes can cause diode probes to over or under estimate actual rms field strength levels

To investigate the influence of signal modulation on the EMR-200 measurement results the substitution method was chosen. Namely: measurement with a standard receiving horn antenna/ Spectrum analyzer, and the EMR Isotropic measurement unit. First set of measurements was performed with the EUT transmitting in CW mode and 100% duty cycle modulation mode to a receiving horn antenna connected to a Spectrum Analyzer (Model 8564E). This antenna (Electro-Metrics, Model RGA, 1-18GHz) and the EUT was placed 20 cm away from each other and at a height of one meter. A second set of measurements was performed with the EMR-200 measurement unit; its isotropic probe was placed on the same position and height as the receiving antenna in the first measurement. All equipment with exception of the Spectrum Analyzer was placed in the anechoic room.

Each set of measurements included the following steps:

- Power 1 (or power density – for the EMR-200) was measured from the EUT set in un-modulated mode at 2.4 GHz
- Power 2 (or power density) was measured from the EUT set in 11MBPS digital frequency modulation used in this device
- Ratio of Power 1 to Power 2 (or the ratio of the power densities for the EMR-200) was calculated.

The results of the third steps for the two sets of measurements were compared.
See test data below in Table 1.
Note: Spectrum Analyzer settings was Rbw/Vbw = 1MHz

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Table 1: Investigation of influence of modulation to the EMR-200:

Description of the test	Spectrum Analyzer, dBm or mW		EMR-200, mW/cm^2
	dBm	mW	
Measurement of the un-modulated signal	- 4.4	0.36308	0.0126
Measurement of modulated signal	- 5.5	0.28184	0.0102
Ration of un-modulated signal to modulated signal		1.28882	1.2353

Comparison of the measurements performed with the Spectrum Analyzer and the probe demonstrates that a difference of less than 5% exists. This is a proof that the EMR display unit does not produce erroneous levels when modulated signals are present.

14) MPE please confirm/demonstrate that probe responds correctly to simultaneous 2.4 and 5.25 GHz signals. Multiple signals with some diode probes can over or under estimate actual rms field strength levels

The probe was investigated to determine its response when multiple signals at the same or different frequencies were present with the substitution method in an anechoic room. Two signal sources were used: One was the EUT configured to transmit in the un-modulated mode, and the second was a 5 GHz generated signal from a signal generator (HP, Model 83752A) and transmitting horn (Electro-Metrics, Model 3115, 1-18GHz) configuration. First set of measurements was performed with the Spectrum Analyzer connected to the receiving horn antenna (both, the analyzer and the antenna are described in question 13 of the FCC's response. The second set of measurements was made with the EMR-200, placed in the same position and height as the receiving horn antenna configuration from the first set of measurement. Then the results of two sets of measurements were compared. The test setups photos are shown below. All other equipment except the Spectrum Analyzer was placed inside the anechoic room. Note: Spectrum Analyzer settings was Rbw/Vbw = 1MHz including a span that includes both signals set at 5 GHz. A 4 GHz measurement bandwidth was used in the Power density measurement mode. For the EMR-200 measurements calibration factor of 1 for both frequencies was used.

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Photo 1: Test setup for the measurements made with the Spectrum Analyzer

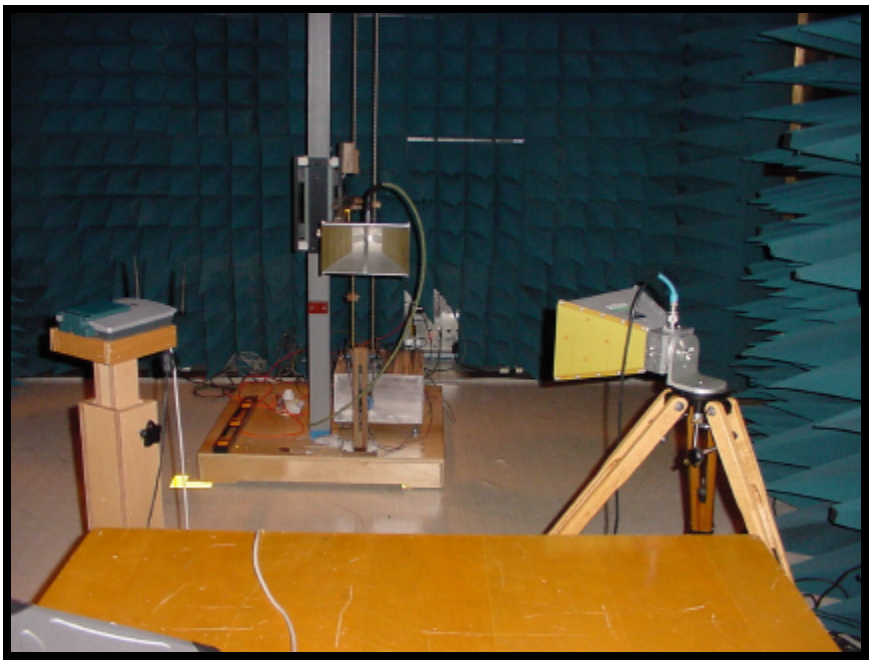
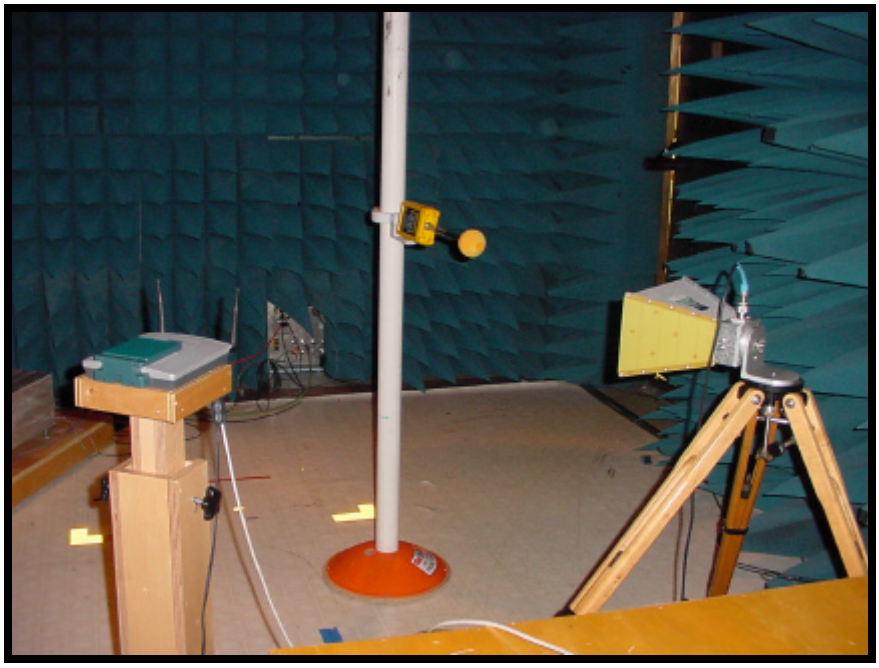


Photo 2: Test setup for the measurements made with the EMR-200



Each set of measurements included the following steps:

- Power measurements (or power density measurements – for the EMR) were made for the 2.4 GHz signal with the 5 GHz signal turned off.
- Power measurements (or power density measurements – for the EMR) were made for the 5 GHz signal with the 2.4 GHz signal turned off.
- Power measurements (or power density measurements – for the EMR) were made with the both signals turned on.

Results of these measurements are shown in Table 2.

Table 2: Investigation of the probe response to two signals

Description of the test	Spectrum Analyzer, dBm or mW		EMR-200, mW/cm^2
	dBm	mW	
Measurement of the 2.4 GHz signal	- 23.4	0.00457	0.00035
Measurement of the 5 GHz signal	- 24.2	0.00380	0.00029
Measurement of both signals radiating simultaneously.	-20.7	0.00851	0.00060

Comparison of the measurements performed with the Spectrum Analyzer and the probe demonstrates that when two simultaneous transmitting signals are present, they produce power/power density equal to the sum of the two signals generated separately. This is a proof that the EMR display unit does not produce erroneous levels when two simultaneous signals are present.

15) MPE LDK102042 original grant has 110mW, for 13.5 dBi antenna gives 33.9 dBm EIRP. Please justify reported value of 30.1 dBm in Table 2.2.1.

RESPONSE: The EIRP was measured on the test range. This method was chosen because we did not have the cable loss associated with the cable. A 1m cable was used between the antenna and the port, which typically has a loss of 1.5 - 2 dB at 2.4 GHz.

16) MPE section 4.2 6 minute and 30 minute time averaging does not apply for general population mobile devices. Please clarify/explain/justify affect of these time averagings and relation to device duty factors.

RESPONSE: The W&G EMR 200 Meter operating manual specifies an averaging time of 6 minutes; all documentation for this device refers to 6 minutes averaging times only on our equipment. These 6 minutes measurements repeated 5 times over a 30-minute period were averaged and reported as 30 minute averaging data in our results with the EUT configured to transmit at 100% duty cycle. The worst-case position with respect to MPE data was determined from the result of MPE measurement vs. azimuth with 6 minutes averaging time. This position was chosen for the final measurements vs. height, which were taken with 30 minutes averaging time in the manner described above.

17) MPE W&G EMR 200 meter datasheet list 15-minute max averaging time. Explain/justify 30 minute averaging time mentioned in section 4.2.

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Averaging time:
The W&G EMR 200 Meter operating manual specifies an averaging time of 6 minutes; all documentation for this device refers to 6 minutes averaging times only on our equipment. Measurements were taken every 6 minutes over a period of 30 minutes with the EUT configured to transmit at 100% duty cycle, hence the reference to 30 minutes averaging time in our report. These 6 minutes measurements were averaged and they are shown in our test results received with 30 min averaging time.

18) MPE section 4.2 three step test sequence with 6 minute averaging in azimuth scan followed by 30 minute averaging for 2 meter height scan at max azimuth position. Does that mean field strength was averaged across all positions in a 6-minute azimuth scan time?

RESPONSE: Yes, you are right (see responses to 16 and 17)

19) appendix F antenna specs are patterns for antennas only or with final installation of all in access point?

RESPONSE: The 2.4 GHz antenna plots cover the antennas only. The Osprey antennas include installation in the AP.

20) MPE Due to off center reference points, it is difficult to make conclusions about simultaneous MPE at any particular 20 cm locations. It may be more useful to reference center point and use perimeter/diagonal of EUT as start of 20cm spacing. After response to these RTs, we may have more comments about procedures and results.

RESPONSE: At the beginning of the MPE measurement the EUT was rotated to determine the angle of the highest directivity for each antenna, this was the basis for the choice of antenna reference points. These reference points did not coincide with the center of the EUT, but nonetheless, these points represent the reference points of the radiating structures. The RF safe distance is always the distance from the radiating structures.

21) MPE 3/28/02 LDK102042 grant states Yagi is for outdoor fixed mount use at 2m+ spacing. Why was that tested here with desktop and wall mounted EUT configurations?

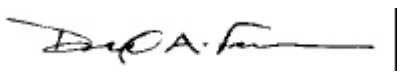
RESPONSE: It is possible that this can be utilized inside a building, such as a warehouse. Yagi's are sometimes deployed indoors to supply coverage in long, narrow corridors.

22) users manual exposure statement a) OET65C does not have MPE evaluation procedures, please revise; b) 20 cm and 30 cm are contradictory, please revise.

RESPONSE: A revised User Manual was uploaded with this correspondence response.

Sincerely,

Desmond A. Fraser



President