
**The University of Michigan
Network Working Group
IT Commons Initiative
2.4 GHz Outdoor Wireless Local Area Network Technical Paper
June 10, 2005**

This document has been assembled and published to provide a guideline for units who wish to install a highly robust 2.4 GHz Outdoor Wireless Local Area Network (WLAN). It is understood that factors such as funding, low user density, or other specific issues may require installations that need not completely follow the guidelines set forth. In such cases, these guidelines should still provide a useful starting point. We recommend that any departures from these guidelines should be made only after careful consideration of all relevant engineering and desired performance factors.

This document was originally published as a vendor requirements document. The purpose was to enable maximum user density and to minimize Radio Frequency (RF) related concerns for larger deployments.

U-M units who have questions about or are interested in installing a wireless network should contact their ITCOM Project Manager:

<http://www.itcom.itd.umich.edu/customer/projectmanager.html>



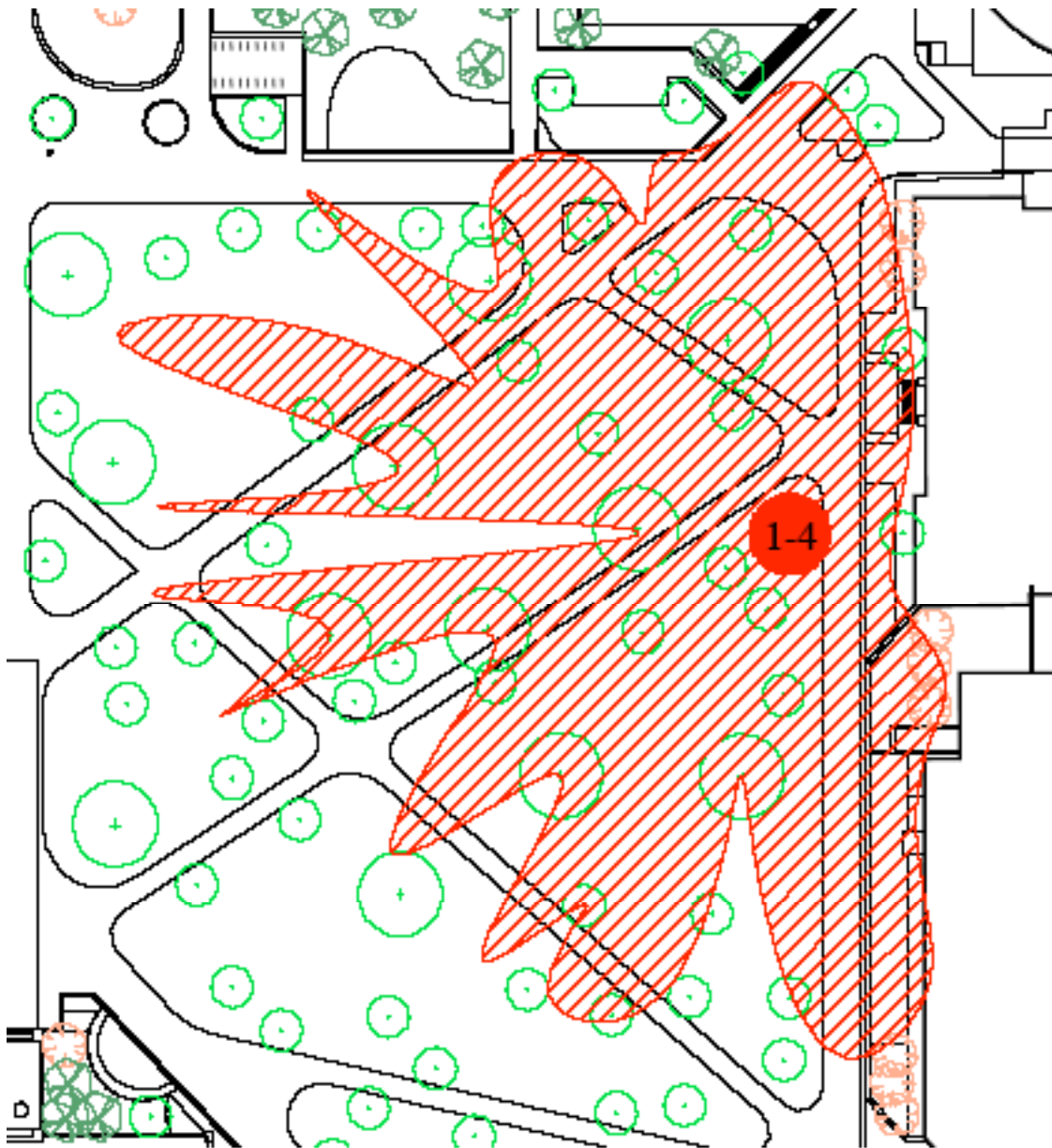
Requirements for 2.4 GHz Outdoor Wireless LAN design at The University of Michigan

1. Pre-Survey walkthroughs shall consider placement based on proximity to building infrastructure, minimizing conduit installations, aesthetic restrictions / considerations, minimize vandalism / theft, and building material type effects on signal propagation for antenna placement.
2. Specific buildings and locations of AP / Antenna installations shall be agreed upon during the pre-survey walkthrough. Specific rooftop installations, kiosks, emergency telephones, building locations, etc. are to be identified during the walkthrough. The goal is to maintain building aesthetics and avoid foliage obstructions.
3. Only a Laptop PC shall be used.
4. PDA's shall not be used for site survey work, but may be used for troubleshooting purposes.
5. Client Card shall be a Cisco AIR-CB21-A-K9. Only those client cards manufactured after December 2004 shall be used. Those cards are identified as described in Appendix 1.
6. AP's shall be Cisco IOS 1300 or other as agreed upon in advance.
7. Air Magnet shall be used in active site survey mode on the laptop. Later versions with the calibration option shall be set to AIR-CB21 calibration settings on the pull down menu.
8. Surveyor shall insure that the associated AP is the correct AP, that the displayed data rate is 54 Mbps at close proximity to the AP (< 10 feet), and that standard OFDM data rates are displayed as the signal level decreases. CCK transmissions shall be disabled on the AP when surveying.
9. Outdoor signal encroachment, from indoor WLANs shall be mapped prior to beginning the outdoor survey and design. These areas shall not present co-channel interference issues, and should be used as part of the overall design for the outdoor installation. Every consideration should be given to co-exist with current University operated WLANs. Coverage shall be coordinated with the appropriate network administrator(s).
10. Encroachment of the outdoor signal, into the building interiors shall be documented for every floor affected. The outdoor installation shall not present co-channel interference nor interfere in any manner with existing University operated WLANs. Coverage shall be coordinated with the appropriate network administrator(s).

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11. Only radome style antennas, approved for outdoor use shall be used. Antenna manufacturer and types shall be agreed upon in advance. The AP internal antenna may be used where appropriate to provide coverage.
12. Target signal contours for 802.11(g) shall be $-77\text{dbm} \pm 3\text{db}$.
13. If noise levels exceed -90dbm , steps should be taken to provide for channel changes or determine and mitigate the source of the noise / interference.
14. Any documented data rate contours shall be based on the Air Magnet active site survey data rate and shall not be discerned from other sources.
15. Post site surveys shall be conducted and documented with a -77dbm to -80dbm contour.
16. A best effort should be given to avoid interference with non-University WLAN's, but only so far as to avoid service degradation for University clients, on University owned properties.
17. The design guideline shall be zero potential for co-channel interference at the specified contour level of $-77\text{dbm} \pm 3\text{db}$.
18. The laptop model and serial numbers, client card MAC address, AP MAC address, date the survey was performed, and name of the person conducting the survey shall be provided in the pre-site survey report.
19. Antenna manufacturer and part number shall be included in the pre-site survey report. These specific antennas, including cable lengths, shall be used for the pre-survey when prescribed in the report.
20. Photographs are required for each AP / Antenna installation. The photograph shall show only the single antenna type to be installed and the proper orientation. Additional graphics shall be included to clarify orientation or other critical details, as appropriate.
21. The photographs shall clearly display the location and orientation of the antenna installation. Graphics should be added while writing the report to clarify details.
22. Coverage of intended areas shall be mapped to identify vegetation and building RF shadowing. Typical "clouds" as depicted for Indoor WLAN are not acceptable, as low hanging branches, trees, and other obstructions greatly attenuate RF signals. An example is provided in Figure 1.

Figure 1 – Typical Outdoor Coverage Pattern



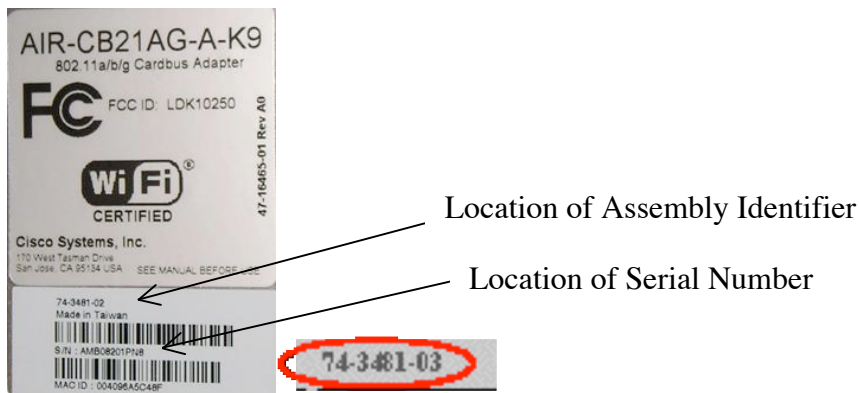
Appendix 1 – Identification of proper Cisco Client Card

The new version of the CB21AG can be identified in two ways: (1) via the Assembly Identifier shown on the MAC / Serial Number label and (2) via the Serial Number shown on the MAC / Serial Number label and Aironet Desktop Utility (ADU).

Assembly Identifier

The Assembly Identifier is located on the top of the MAC / Serial Number label as indicated below:

Old Assembly Identifier (located on MAC / Serial Number label)	New Assembly Identifier (located on MAC / Serial Number label)
74-3481-02	74-3481-03



Serial Number

The new version of the CB21AG can also be identified by Serial Numbers (S/N) starting with S/N FOC0849N1BD. The S/N is readable on the MAC / Serial Number label and via the Aironet Desktop Utility (ADU).

Interpreting the Cisco Serial Number

Cisco S/N format is LLLYYWWXXXX.

Legion:

LLL = Location code (i.e. FOC = FoxConn China)

YY = Year code (08 = 2004...09=2005...etc...)

WW = Week code (weeks 01 to 52)

XXXX = Base-34 Alpha Numeric Unique identifier (Includes 0 to 9 & entire alphabet except I & O).

Any CB21AG S/N with year/week code of 0849 (YYWW) or greater is the new, reworked card.

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Document History

Date	Rev	Description of Change
June 10, 2005	1.0	Initial Release