
**The University of Michigan
Network Working Group
IT Commons Initiative**

This document has been assembled and published to provide a guideline for units who wish to install a highly robust 5 GHz 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 5 GHz Wireless LAN design at The University of Michigan

- Pre-Survey walkthroughs shall consider placement based on proximity to cable trays, minimizing conduit installations, aesthetic restrictions / considerations, minimize vandalism / theft, existing 2.4 GHz equipment that can be upgraded / supplemented by 5 GHz radios, and building material type effects on signal propagation for antenna placement.
- Only a Laptop PC shall be used.
- PDA's shall not be used for site survey work, but may be used for troubleshooting purposes.
- Client Card shall be a Cisco AIR-CB21-A-K9 Tri-Mode type. Other cards will be evaluated for use in the future.
- AP's shall be Cisco 1200 with IOS software, or other as agreed upon in advance.
- 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.
- 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.
- The use of power levels greater than 20mW is discouraged, especially in multi-floor environments. However, it is understood that some installations will require higher power levels, and these should be thoroughly surveyed and documented.
- Use of external antennas, especially in combined 2.4GHZ / 5 GHz installations is encouraged whenever practical. 5 GHz antennas shall be physically located at least 12" from any 2.4 GHz antennas.
- Alternatives to ceiling mounted patch antennas shall be considered in multi-floor environments. When in doubt, antenna types / installations shall be discussed with U-M ITCOM engineers and / or appropriate unit staff before or during the survey process.
- The 5 GHz sub-band used for the survey, channels 36 – 48, 52 – 64, 100 – 140, and 149 – 161, shall be assigned to the target access point / location.
- Signal contours for 802.11(a) shall be developed such that –75dbm is the least acceptable signal level, and –69dbm is the highest acceptable signal level for channels 36 - 140. Target signal level shall be –72dbm.

Requirements for 5 GHz Wireless LAN design at The University of Michigan

- Signal contours for 802.11(a) shall be developed such that -73dbm is the least acceptable signal level, and -67dbm is the highest acceptable signal level for channels 149 - 161. Target signal level shall be -70dbm .
- Adjacent cells / AP's (including those located on floors immediately above and below) shall not use adjacent channels.
- If noise levels exceed -90dbm , steps should be taken to provide for channel changes or determine and mitigate the source of the noise / interference.
- Incidental coverage, such as floors above and below, or outside the building shall be measured and documented at a signal contour level of -82dbm to -85dbm for channels 36 – 140 and -80dbm to -83dbm for channels 149 - 161
- 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.
- In multi-floor environments, incidental coverage on the floors above and below a proposed installation shall be measured with Air Magnet and considered in the design using the aforementioned guidelines. If in doubt, the contour shall be mapped and provided to U-M ITCOM engineers and / or appropriate unit staff for evaluation.
- Auditorium designs shall consider densities of approximately 25 - 30 users per AP. 2.4 GHz AP's may be included as part of the density constraints. Use of adjacent channels shall be prohibited in a single auditorium. If the entire auditorium cannot be adequately covered per the target specifications, the adjacent / bleed-through contours may be used if approved in advance. The design constraints shall be evaluated with U-M ITCOM engineers and / or appropriate unit staff prior to the pre-site survey.
- The design guideline shall be zero potential for co-channel interference at the specified incident contour levels of -82dbm to -85dbm for channels 36 - 140, and -80dbm to -83dbm for channels 149 – 161.
- All Incidental RF coverage on floors above and below the surveyed floor / AP shall be documented in the Pre-Site Survey coverage maps. Incidental RF coverage shall be indicated on the same floor plan as that of the desired RF coverage, by floor, unique AP identifier, and appropriate channel color.
- The laptop model and serial numbers, client card MAC address, and AP MAC address used in the survey shall be provided in the pre-site survey report.
- 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.

Requirements for 5 GHz Wireless LAN design at The University of Michigan

- Photographs of each intended installations shall be provided, it 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.
- Any proprietary information contained in the report shall be clearly identified in writing.
- Post site surveys shall be conducted and documented using the same signal level criteria and factors as the pre-site survey.

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Document History

Date	Rev	Description of Change
January 17, 2005	1.0	Initial Release

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