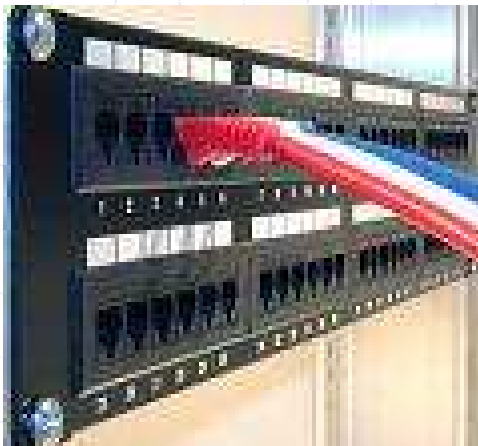




Wireless Networking: An Application Driving PoE+



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We manufacture Ceiling and Wall mounted Telecommunications Enclosures (TEs) for Wireless LAN Access Points and other networking components



Access point enclosure



Ceiling Switch enclosure

- Healthcare
- Education
- Government
- Retail
- Hospitality

- Infrastructure Security
- Aesthetics
- Maintenance
- Code compliance
- FTTE

"n" Wireless Networking



- IEEE 802.11n is a recently ratified amendment to the IEEE 802.11 Standard
- Draft 2.0 802.11n product have been available for several years.
- Uses multiple transmitters and receivers (Multiple Input/Multiple output and beamforming) and advanced over the air modulation and coding methods to achieve unprecedented wireless data rates
- Many client devices and access points from leading vendors are "n" ready
- May operate in the 2.4 GHz band and 5 GHz band

802.11n = More Power



- Operation in two bands (not required by standard, but offered by most vendors)
- Two or more transmitters, two or more receivers, and associated circuitry
- Potential for channel bonding (20 MHz + 20 MHz = 40 MHz) for greater bandwidth
- Higher data throughput (300 Mbps PHY data rates)
- All this functionality requires **MORE POWER!**

802.11n = More Power



Can all of the capabilities of 802.11n be offered simultaneously within the power budget of 802.3af (PoE)?

- Operate single band rather than dual band
- Operate with a single transmitter rather than two
- Do not provide channel bonding
- Transmit a lower power (reduce coverage area) from each antenna

OR.....

- Provide all of these features by designing the access point to be very frugal with its power budget

"n" Antenna Implementations



Power over Ethernet



- Power over Ethernet (PoE) originally conceived to power VoIP telephone sets
- Standardized by IEEE 802.3af
- Rapidly found utility in powering wireless access points (IEEE 802.11 a/b/g)
- Much like a telephone, the wireless access point needs to be placed "where it is needed", not where line power is convenient
- Reduction in installation cost
- IEEE Recently ratified 802.3at amendment (PoE PLUS)

PoEP or PoE+ Objectives



Derived from IEEE 802.3at amendment, which was ratified in September 2009.

Objectives:

- PoE+ will enhance 802.3af and work within its framework
- the target infrastructure for PoE+ will be ISO/IEC 11801-1995 Class D /ANSI/TIA/EIA 568.B-2 category 5 or better systems with a DC Loop resistance of less than 25 ohms.
- IEEE STD 802.3 will continue to comply with the limited power source and SELV requirements defined by ISO/IEC 60950
- The PoE+ PSE shall operate in modes compatible with the existing requirements of IEEE STD 802.3af as well as enhanced modes

PoEP or PoE+ Objectives



Objectives (Continued):

- PoE+ shall support a minimum of 24 Watts of power to the PD (actually supports 25.5 W)
- PoE+ PDs which require a PoE+ PSE, shall provide the user an active indication when connected to 802.3af.
- The standard shall not preclude the ability to meet FCC/CISPR/EN Class A, Class B performance criteria A and performance Criteria B with data for all supported PHYs
- Extend power classifications to support PoE+ modes
- Support operation of midspan PSEs for 1000BASE-T
NOTE: Verify Gigabit Ethernet (1000Base-T) capability on the data port of access point!

PoEP or PoE+ Objectives



Objectives (Continued):

- PoE+ PDs within the power range of 802.3af will work properly with 802.3af PSEs
- PD Operation based on PSE

	802.3af PSE	PoE+ PSE
802.3af PD	Operates	Operates
PoE+ PD < 12.95W	Operates	Operates
PoE+ PD > 12.95 W	PD shall provide active indication	Operates

TIA TSB-184



Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling

- DC Loop resistance and balance
- End-span and Mid-span configurations
- Tables of temperature rise within cable bundles
- References to safety standards

DRIVING NEW WIRELESS APPS



- “Unbridled” 802.11n wireless performance (dual band, more antennas, higher TX power, higher data throughput)
- Cellular and Wi-Max stations
- Multi-purpose access points (wireless LAN, building automation, sensors, etc.)
- Combination or multi-function PDs such as an access point with a PoE drop, access point and a switch, AP and a camera, etc.
- Overlay wireless networks (2 networks in different bands)
- Lower dc resistance on 4 pair dc current distribution

TIA GUIDELINES for CABLING for WIRELESS

TSB-162 states that cabling should be installed and performance tested per existing 568-B.2 standards.

Determination of exact cell size and placement of the AP is outside the scope of the TSB (perform a site survey or simulation)

TSB-162 includes wall-mount above the drop ceiling, wall-mount below the drop ceiling, and in-grid ceiling mount.

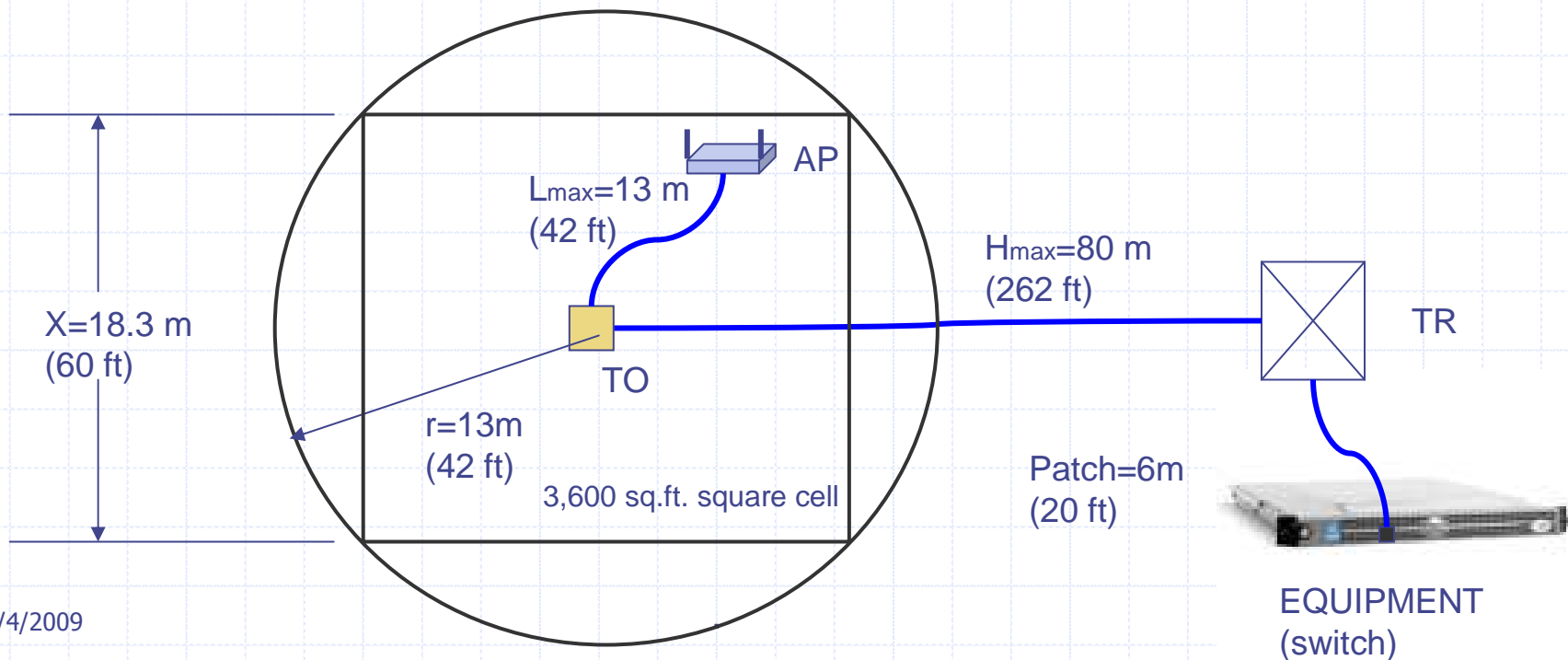
Telecommunications Enclosures (TEs) can be mounted in a ceiling panel to provide locked security or aesthetics for APs

TSB-162 CELL SIZE



The TSB-162 includes an example of a 60-foot by 60-foot square building cell

This agrees reasonably well with vendor recommendations for 3,000 sq. ft. "cell" sizes to support wireless voice over IP



COAX CABLING TO ANTENNAS



- 802.11n access points may require three to six antennas. Anticipate additional antennas enabled by the higher power capability of PoE PLUS
- Ideally, antennas are unobstructed by ceiling tiles and other objects
- Antennas should be spaced about 4" apart (2.4 GHz), and 2" apart (5GHz) or greater. Beyond that, there is *not* a need to "space in increments of a wavelength"
- Use suitably rated coax such as UL Type CL2P



INSTALLING IN THE “PLENUM” vs. THE AIR HANDLING SPACE



ICRA?

UL Listed?

NEC?

OSHPD?

- Ideal location for access point is in the ceiling, but.....

National Electric Code (NEC) regarding the plenum used for environmental air.....

- Article 300.22(b) *“Equipment and devices shall be permitted within such ducts or plenum chambers only if necessary for their direct action upon, or sensing of, the contained air”*

-NEC Article 100 defines plenum as *“A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system”*.

- NEC article 300.22(c) *“The space over a hung ceiling used for environmental air-handling purposes is an example of the type of other space to which this section applies”*, (Air-handling space as opposed to a plenum space)

N.E.C. COMPLIANCE

- NEC article 300.22(C)(2) *“Electrical equipment with a metal enclosure, (or otherwise listed) shall be permitted to be installed in such other space unless prohibited elsewhere in this Code”.*



- NEC article 300.23 *“cables, raceways and equipment installed behind panels, including suspended ceiling tiles, shall be arranged and secured so as to allow removal of panels and access to the equipment.”*



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