Outdoors Installations

Training materials for wireless trainers

The Abdus Salam
International Centre
for Theoretical Physics

Outdoors Installations

Antenna mounting requirements
Wall side mounts
Roof mounts
Guyed towers
Self supporting tower
Typical installation
Antenna Alignment

Antenna Mount Options

Free standing Pole
Side Mount
Roof Mount
Penetrating
Non Penetrating
Climbable tower
Guyed
Self Supporting

Requirements for the base station **mounting structure**

In a point to multipoint deployment,

location of the base station is by far the must important consideration, in order to have the best coverage.

Access to the power grid, security of the equipment and accessibility of the site come next

Requirements for the base station mounting structure

- Sometimes an existing tower can be used for the new install, if an agreement with owner can be arranged
- The alternative is to build a supporting structure of your own

Typical Installation

- The Antenna is the most important part of install
  - Make sure the mount is STRONG
  - Will NOT move in wind (antenna wind loads are high)
  - Well grounded, ground rod or similar
  - COAX is tied down with gentle sweeps
  - Lightning arresting equipment is grounded
  - Use a rubber mat for skids, to protect roof

Typical Installation

- Keep COAX length S H O R T
  - No more than 15 meters
- Tape and secure ALL connections
- Use All Weather Tape
  - NOT Electrical tape or duct tape
- Use BLACK Nylon Ties
  - White ones will break down in UV
- If able, place cable in conduit for protection
- If using PoE, weatherproof UTP is a must as well as weatherproof RJ45 connectors (gland)
- If possible, protect the radio from sun and rain

Base Station Antennas Mounting Considerations

VSWR

A sizable conducting object will reflect part of the signal.

Radio hams some times tune the VSWR of an antenna by changing its distance from the tower.

A number of coaxial cables or waveguides can constitute a big enough reflector.

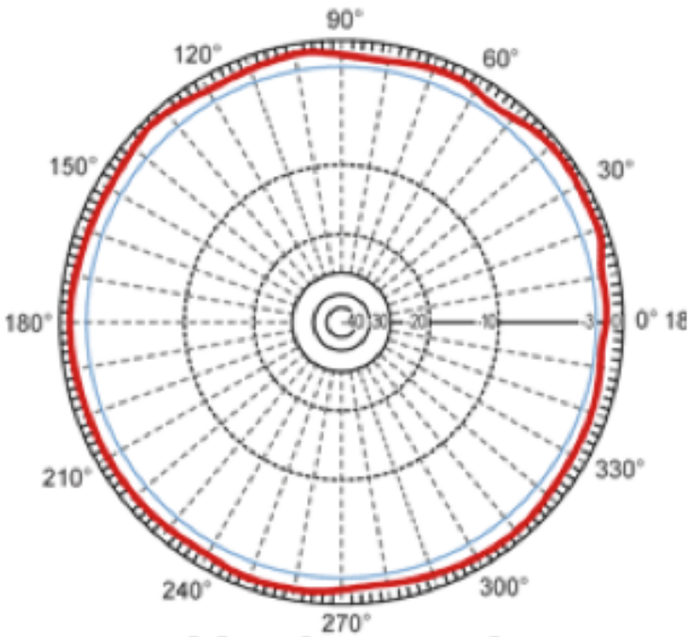
Separating the antenna at least 25 cm will be enough to overcome this effect at 2.4 GHz

Base Station Antennas Mounting Considerations

Horizontal Radiation Pattern

The horizontal pattern of an omni approaches a circle. A small pipe near the antenna can act as a director or reflector, changing the gain up to 3 dB in certain directions, thus disrupting the radiation pattern.

A sizable object like the back of a parabola can completely block the signal in a given direction



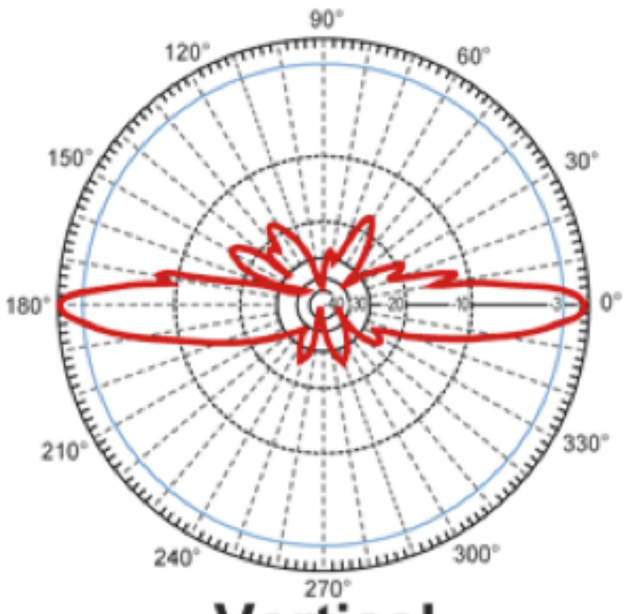
Horizontal

Base Station Antennas Mounting Considerations

Vertical Radiation Pattern

The gain of an omni is obtained by narrowing the vertical pattern.

This applies when the antenna is far from conducting objects, and constitutes a good approximation when the antenna is at the very top of the tower



Vertical

Base Station Antennas Mounting Considerations

A self supporting tower very often has a tapered design, becoming narrower with height. This will uptilt the beam of a side attached omni up to 5 degrees. A typical 15 dBi omni has an 8 degree vertical beamwidth.

The beam can be tilted upwards so much as to send all the signal where it does no good.

Base Station Antennas Mounting Considerations

Sectorial Antennas are less affected by the tower and can easily be downtilted.

This is particularly necessary when the subscriber is close to the base station or when the base station is much higher.

Mechanical downtilting can compensate for the effect of the structure.

Electrical downtilting can be accomplished by changing the phase of feeding elements.

Subscriber Antenna Mounting Considerations

Locate the antennas so that they have clear line of sight to the antennas at the opposite endpoint of the link.

There should be no obstructions within ±10 degrees azimuth of the antenna bore sight.

Beware of possible reflecting structures in or behind the path.

Beware of trees whose growth might obstruct the path.

Avoid trajectories over bodies of water.

Subscriber Antenna Mounting Considerations

Mounting the antennas close to the edge of the rooftop (on a flat top roof) helps to avoid problems with the latter requirement and with reflections. This should be done at the edge facing the air

Free standing pole

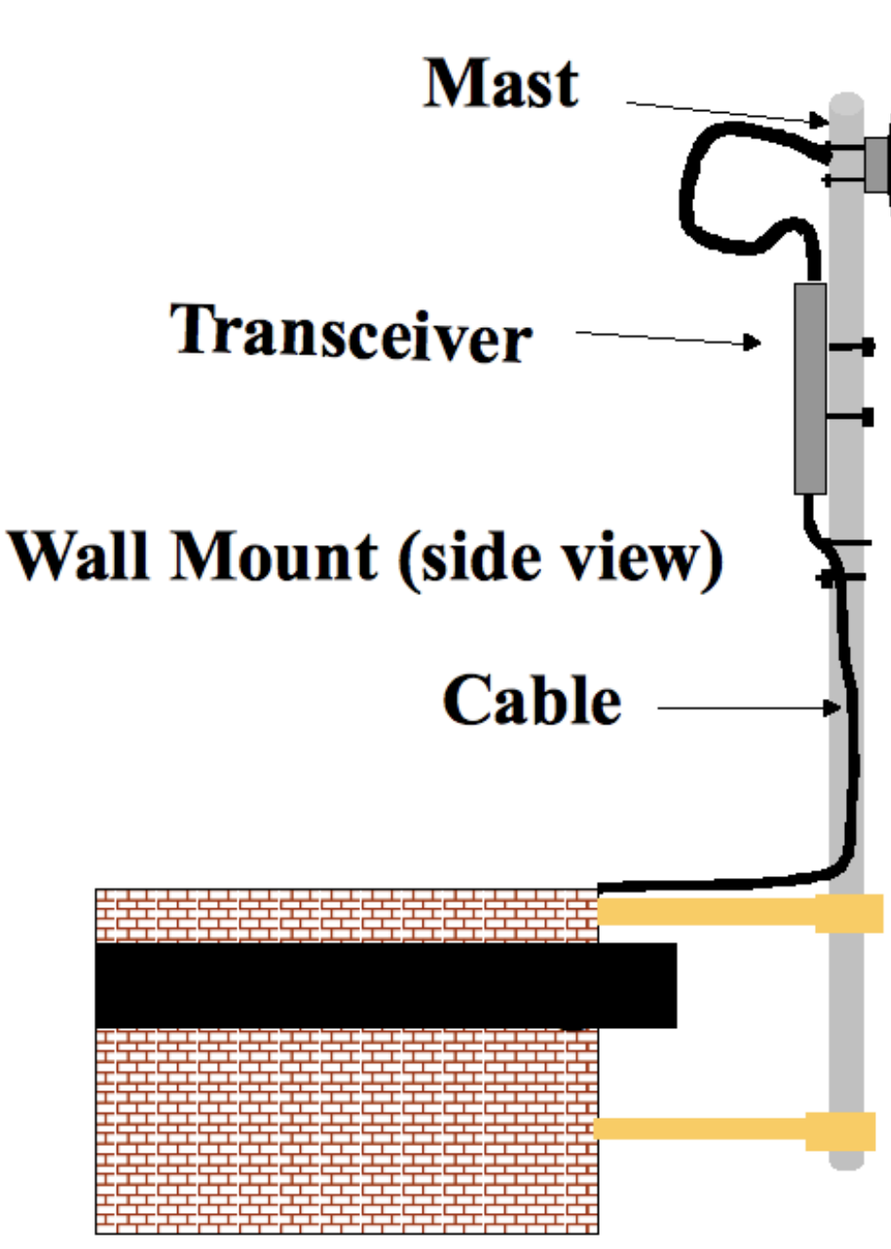
Often it is less expensive than a tower, and can be built by attaching foot rests to any sizable pipe

Non penetrating mount example

This home made example can be fitted with containers filled with water or sand to increase wind resistance

Penetrating Roof Mount

Care must be taken in order to prevent water from seeping in through the attachment bolts



Wall Mount (side view)

For applications where the roof is not flat or strong enough to hold the weight of the non-penetrating roof mount the wall mount is the most effective solution

This mount is affixed to the side of a building, wall or chimney

Wall mount

- The structure must be capable of handling the weight of the mast, antennas, and transceiver plus wind loading stress.
- This type of mount requires drilling four holes into the structure.
- When mounting to masonry expansion type bolts or lead anchors should be inserted into the hole drilled as a means of attaching the mounting bracket to the structure.

Guyed Tower

- A climbable tower is normally made of aluminum with a triangular cross section, about 30 cm per side.
- Each section is about 3 m long and several sections can be bolted together to attain the required height
- The tower must be properly guyed to withstand the expected wind in the area, as well as to support the weight of the equipment and one person

Security

Always use a harness securely attached to the tower when working at heights

Many countries require special training for people to be allowed to work on towers above a certain height

Avoid working on towers during strong winds or storms

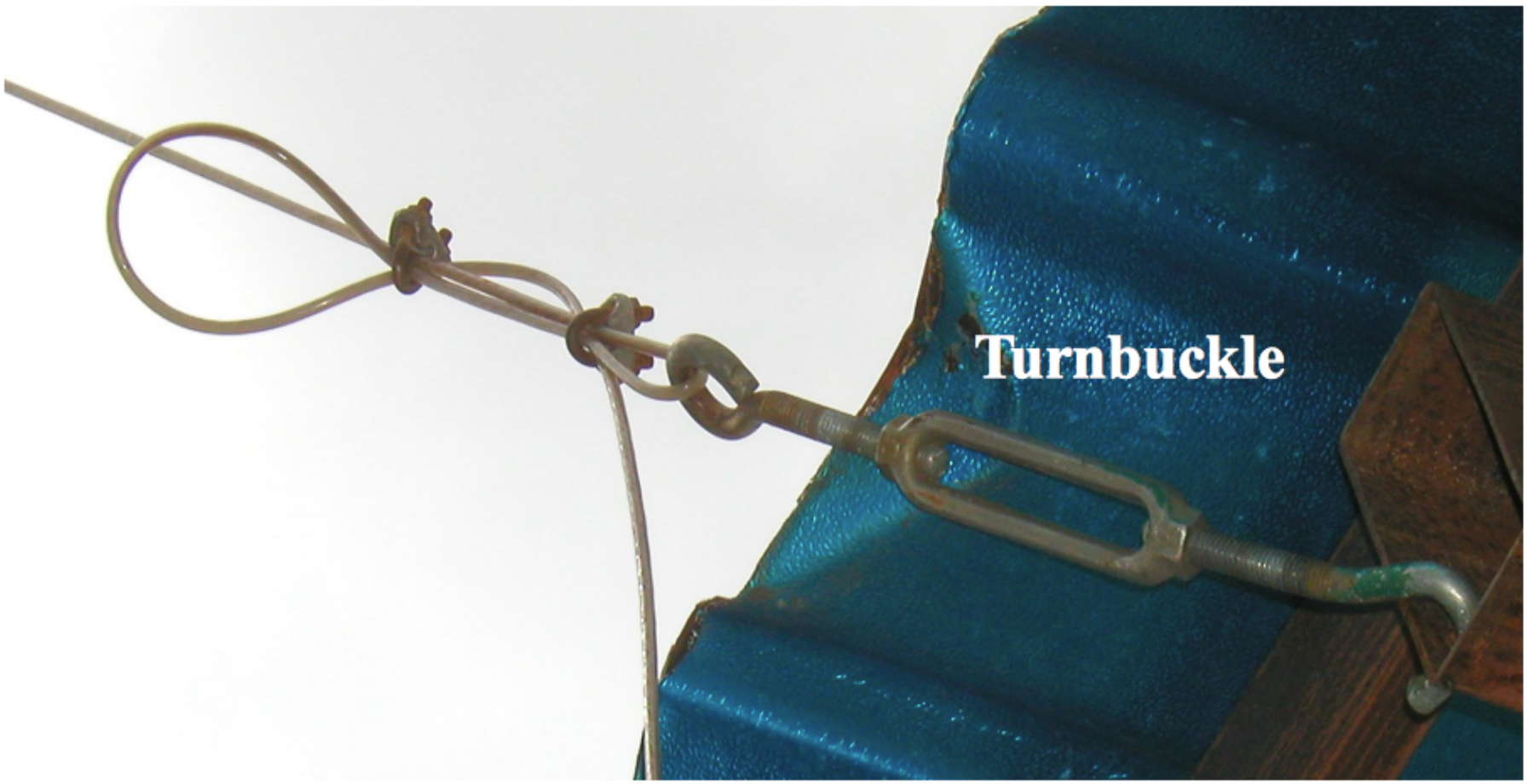
Security

A lightning arrestor is
a must for any structure
elevated above the surrounds.
An inexpensive solution
is to use a grounding rod
properly connected to ground.

Erecting a tower with a pulley

- A pulley attached to the top of a pole will facilitate the tower installation.
- The two tower sections are attached with an articulated joint.

Use tensors and proper fittings for the guy wires



Self Supporting Towers

- Self supporting towers are expensive but sometimes needed for the Base Station
- An existing tower can sometimes be used for subscribers, although AM Transmitting station antennas should be avoided because the whole structure is active.
- FM station antennas are O.K.

Protect connectors from exposure

- Connectors should be protected with special tape or compound, since humidity cropping in is the main observed cause of CPE failures
- Cables should have dripping loops to prevent water getting inside the transceiver

Typical Installation

- Equipment
  - Two or more wireless routers
  - Antennas and mounting brackets
  - Antenna Mount (non penetrating, pole, wall mount, etc)
  - 50 Ohm COAX Cable, LMR400
  - Alternatively, PoE injector and UTP cables
  - Appropriate connectors
  - Lightning Arrestors and ground cable
  - Sealing compound or tape for connectors
  - Laptop for configuration

Thank you for your attention

For more details about the topics presented in this lecture, please see the book ***Wireless Networking in the Developing World***, available as free download in many languages at:

http://wndw.net