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White Paper

Best Practices for UBR Installation in Urban Areas to Mitigate RF Interference

Optimal Strategies for UBR Installation

The Unlicensed Band Radio (UBR) operates in the 2.5GHz and 5/6GHz frequency bands, which are license-free in most countries and commonly used in Wi-Fi networks. Currently, the 5GHz UBR is employed for providing wireless leased lines with dedicated capacity to enterprise customers in a point-to-multipoint (P2MP) configuration. Additionally, it is utilized for backhauling small cell Base Transceiver Stations (BTS) in point-to-point (P2P) mode within mobile networks.

The license-free status of the 5GHz frequency band makes it the preferred choice for telecom operators, particularly for small cell BTS backhauling.

UBRs are priced significantly lower than traditional licensed-band microwave radios, resulting in substantial cost savings for telecom operators, encompassing equipment costs, operation and maintenance (O&M) expenses, and recurring licensing fees.

Due to the increased deployment of UBRs in Telco networks, interference issues are on the rise. Careful planning and installation of UBRs in the field are essential to mitigate interference impact and enhance overall network performance. As collated based on field experience, below points should be considered while planning and installing UBRs in the field so that optimum performance is achieved and interference impact is reduced.

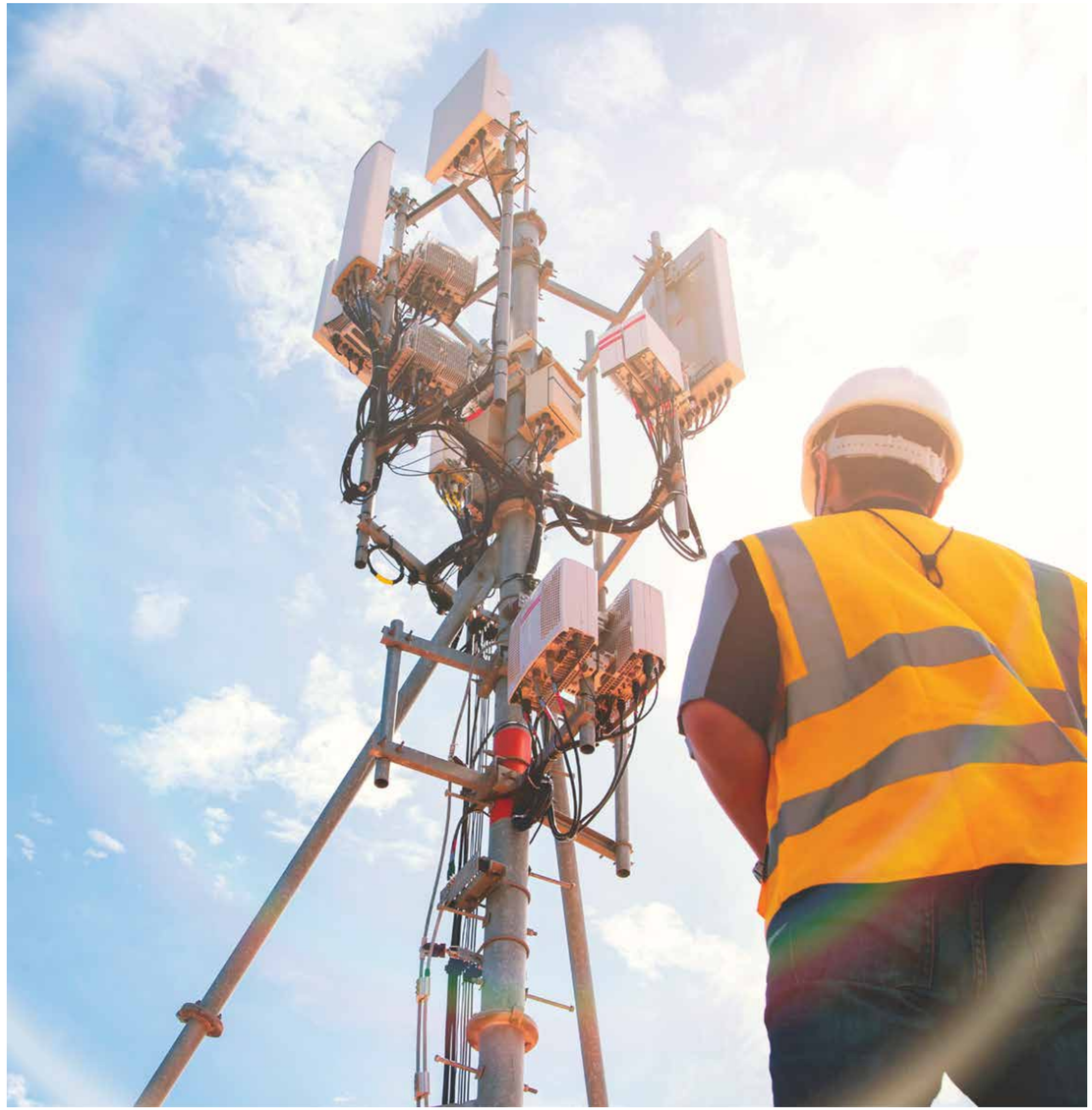
Link Budget & Planning

- Plan the Transmit Power carefully to achieve a Received Signal Level (RSL) around -46dBm for MCS-9 and -40dBm for MCS-11 UBR. This ensures a link fade margin of at least 15dB.
- Avoid using maximum transmit power to prevent interference with other links and to maintain network performance.
- In urban areas, limit UBR deployment plans to a hop distance of a maximum of 5 km. Optimal UBR performance, in terms of throughput and stability, is observed for links with a hop distance equal to or less than 3 km.
- In Rural, the hop distance can be extended to 12 km to 15 km because the deployment of UBRs are very less compared with urban. Therefore, the RF environment in rural areas is much cleaner than in urban areas.
- Plan two or more links from the same site only if the azimuth difference between two adjacent links is more than 60°. Restrict maximum four links from a single site.

Antenna Installation

Install the antenna at the lowest height necessary to maintain a clear Line of Sight (LOS). Avoid placing the UBR antenna at the tower's top, as this location is more susceptible to interference.

Position the UBR antenna at least 2 m away, both horizontally and vertically, from the BTS/RRU. This separation helps eliminate the impact of high-power radiation from the RRU on the UBR. UBRs are equipped with wide-band filters and amplifiers, which may not sufficiently suppress high-power RF signals radiated from nearby BTS/RRU installations, potentially causing interference and impact on UBR performance.

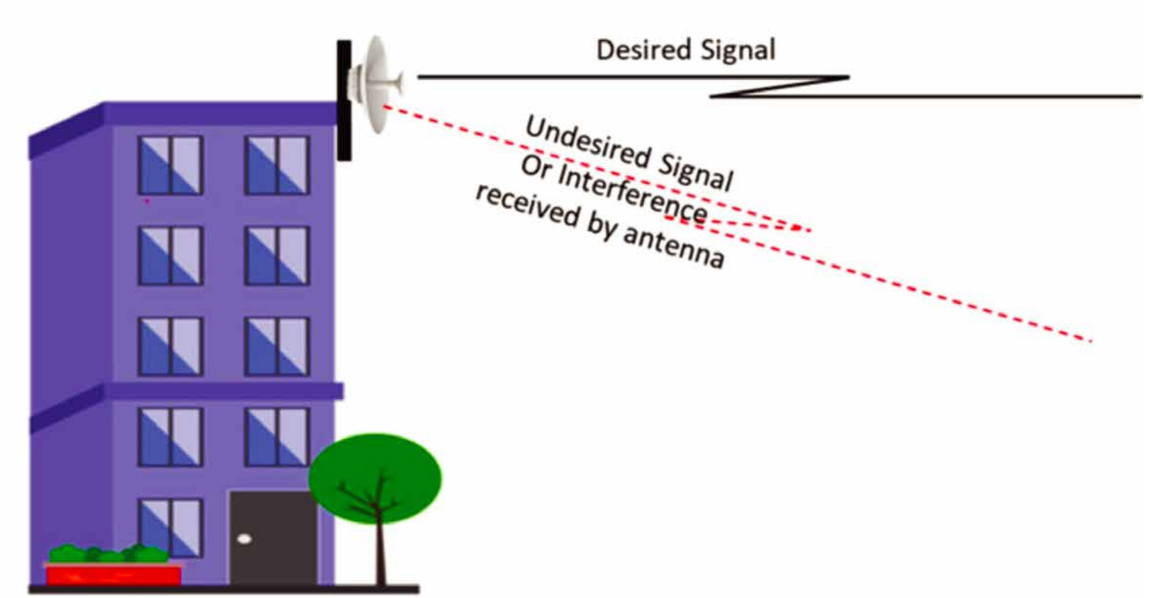


UBR Antenna Installation on the Rooftop of a Building

When installing the UBR antenna on the rooftop of a building, consider the following scenarios to optimize performance by mitigating interference from surrounding signals.

Scenario 1
Edge Installation

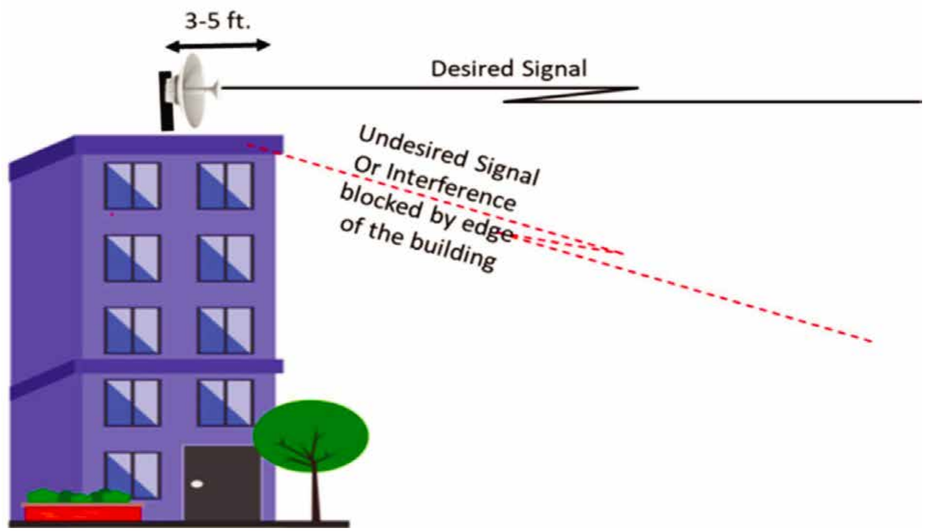
Installation on the edge of the building using a 2 ft pole, as depicted in the diagram below. This type of setup is not recommended as it exposes the antenna to receive undesired and interfering signals.



Scenario 2

Near-Edge Roof Installation

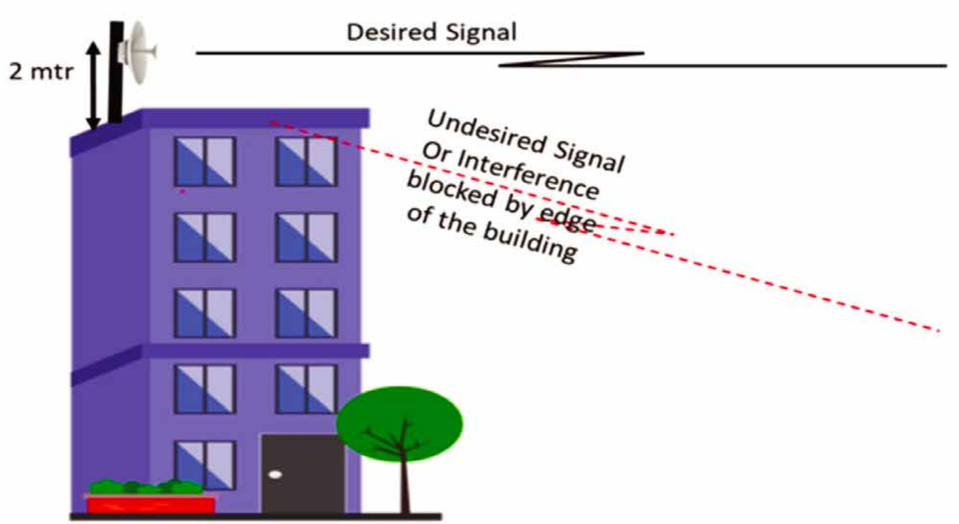
Install the antenna on the roof approximately 3 ft away from the building's edge, as illustrated in the diagram. The building's edge/wall serves as a barrier, blocking interfering signals and improving performance in highly interfered environments. This is the preferred and recommended installation.



Scenario 3

Backside Roof Installation

Install the UBR antenna on the back side of the roof with the roof area in front of the antenna left exposed. The exposed roof in front acts as an effective obstruction against interfering signals from various directions. Refer to the diagram below for this scenario. Maintain a height of approximately 2 m or 7 ft from the roof to ensure that any human activity on the roof does not obstruct the Line of Sight (LOS) for the link. This installation is highly recommended when feasible.



Antenna Alignment Procedure for Optimal RSL Achievement

Performing antenna alignment is crucial to achieving the Received Signal Level (RSL) specified in the link budget. Acceptable RSL variation falls within the range of +/- 2dB. If the planned RSL is not attained, it has been observed that the antenna may be locked in the side lobe. To come out from such a situation, it is advised to do antenna alignment following below steps:

Horizontal Alignment (Azimuth) a

Slowly align the antenna from left to right and then from right to left.

Tighten the alignment at the point where the maximum RSL is achieved.

Vertical Alignment (Tilt) b

Align the antenna from top to bottom and then from bottom to top, adjusting it slowly.

Lock the alignment at the point where the maximum RSL is reached.

Horizontal Realignment c

Repeat the alignment process slowly in the horizontal direction, moving left and right from the previously achieved point in step (a).

Lock the alignment at the maximum RSL point.

Vertical Realignment d

Move the antenna in the vertical direction, both up and down, from the last achieved point in step (b).

Lock the alignment at the point where the maximum RSL is obtained.

Iterative Alignment e

Repeat steps (c) and (d) until the planned RSL is consistently achieved.

Adhering to these alignment steps systematically ensures that the antenna is precisely positioned to meet the desired RSL, contributing to optimal performance in the link configuration.

Optimal Channel Selection

Following antenna alignment, conduct a spectrum scan and choose the channel with the least interference at the specific site. Configure the UBR to operate on the selected optimal frequency channel.

Dynamic Channel Selection (DCS) for Interference-Prone Sites

For sites with high interference susceptibility, consider enabling the Dynamic Channel Selection (DCS) feature in the UBR to enhance channel adaptability and mitigate interference.

Routine Radio Health Check

Perform regular day-to-day health checks on the radio, monitoring critical Key Performance Indicators (KPIs) such as Received Signal Level (RSL), throughput, and latency to ensure ongoing operational integrity.

Summary

The strategic deployment of Unlicensed Band Radios (UBRs) in urban areas offers a compelling solution for wireless communication, balancing cost-efficiency and operational excellence. The detailed considerations provided, encompassing frequency planning, antenna installation, alignment procedures, and interference mitigation, establish a robust framework for telecom operators aiming to enhance UBR performance while navigating the challenges of urban environments. By diligently implementing these practices, operators can optimize wireless networks, ensuring resilience against RF interference and fostering a reliable communication infrastructure for the evolving demands of urban connectivity.

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