The Problem – Provide wireless communication coverage capacity for both Ipanema and Copacabana beach in Rio de Janeiro

The two famous beaches in Rio de Janeiro, Ipanema and Copacabana, provide unique challenges when designing a wireless communications system to provide seamless cellular coverage that can meet the demands of millions of visitors during the peak tourist season.

The Challenges

- Sun, Heat, salt spray and sand
- Capacity challenges with millions of visitors during the peak vacation season
- Restrictions on construction of “ugly” cell towers with a desire to use existing structures
- Providing coverage for all operators and all frequency bands

Sun, Heat, Salt Spray and Sand

All successful beach vacations include significant amounts of sun, hot weather, sand and of course the ocean. These are great for tourists but can create potential problems and affect the reliability of communications networks. Salt spray corrodes enclosures, blowing sand destroys antennas and infiltrates enclosures and the sun creates excessive heat through “greenhouse cycles” that impact the performance of amplifiers and circuit board components.

Capacity for Millions of Visitors

Our wireless networks today are more about providing data services than voice communications. We want to receive our emails and text messages everywhere, including the beach. Additionally, we want to take pictures of our vacation and instantly send them to Facebook or to our friends and relatives. Thousands of visitors simultaneously uploading pictures to social media can overwhelm a poorly designed network.

No More “Ugly” Cell Towers

Local ordinances are restricting new construction of cell towers and are requiring that any new structures meet local aesthetic requirements. No one wants a cell tower obstructing their view of the ocean or inadvertently becoming a center piece of their Rio beach picture.

All Operators and All Bands

Ipanema and Copacabana beaches have visitors from all over the world. The communications network must be able to provide service to all of the users, regardless of the frequency band or communications protocol their cellular phone utilizes. The system must be expandable for new frequency bands, services and protocols like LTE-A.
Fortunately, both Ipanema and Copacabana beach have existing structures that can be utilized to create the coverage needed. The ability to install a system with a low visual footprint while creating small coverage sectors that can provide high data rates and excellent coverage will meet the requirements of both the user and the city planning department. The photo below highlights the existing lifeguard structures that can be used for an unobtrusive coverage system.

Because of the limited coverage area required for each sector an antenna height of approximately 10 meters is ideal. The lifeguard stations, at approximately 8 meters high and 800 meters apart, provide the best solution for mounting discreet panel antennas and breaking the coverage area into small enough sectors to provide the high speed data rates needed. The photo demonstrates the potential location for the Bird Remote and Panel antennas.

The beach layout is ideal for feeding both Ipanema and Copacabana from a single Base Station Hotel. The beaches have a network of existing cable ducts that can be used to run the communications cabling from the single Master Unit to the Remotes located at the lifeguard stations. Depending on the coverage map, the Bird solution can utilize either panel mount antennas with 90° of coverage or collinear “stick” antennas with 180° of coverage.

**DAS System Architecture**

The Bird solution involves installing a single Master Unit to feed the Remotes for both beaches from the single Base Station Hotel. The flexibility of the Bird solution allows alternative methods for running the fiber optic cabling and arranging the connections to create the best sectorization and coverage model. Cascading the Remotes results in less fiber being used.
Bird can also deploy a “Single-Net Solution”. This concept utilizes a fiber-optic distributed antenna system which can be built as a shared neutral host solution for all wireless operators and all frequency bands. Additionally, other services such as Gigabyte Ethernet, WiFi, and CCTV can be extended over that same DAS Solution.

The Bird solution has an industry leading noise figure of 3dB allowing more remotes per sector and improved uplink performance. Additionally, the system’s 15dB optical link budget allows large areas to be covered with a single head-end location as well as the versatility to handle the potential fiber losses of existing fiber infrastructure.

Master Unit

The DAS network utilizes a flexible Master Unit that can be equipped with Base Station Interfaces for each operator, sector and frequency band allowing the system to be fully optimized for each operator. This approach also allows all services to be supplied to the Remote unit on a single fiber link. Additionally, the Bird approach is MIMO ready for future LTE deployments. Emergency services can be supplied from an off-air antenna or a direct fiber link allowing the public safety system to be balanced with the Commercial Wireless system.

- Coverage for individual frequency bands from 88-2700 MHz
- All frequency bands, operators and sectors together in a single master rack
- Easy to add new services in existing frequency bands, connect and go
- Compact 19” rack design
- Web based UI for monitoring and control
- Alarm options include SNMP traps and local connections
- VPN tunnel to your Network Operations Center

Remote Unit

All Bird remotes are configured for multi-band, multi-operator operation with separate amplifiers for each frequency band to provide the best possible coverage. The Remote design and color allow them to blend in to the beach environment and provide the coverage and capacity required for wireless voice and data with a low visual impact.

The Remotes are designed for outdoor applications and the IP65 rating means they resist the effects of sand and salt spray.

- IP65, -25°C to +55°C, no fans, minimal maintenance
- Wall mount or pole mount as needed
- 1-4 frequency bands in a single unit
- Compact and discreetly colored
- Up to 4 Remote Units on single fiber
- Output power up to 43 dBm per band

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The Coverage Results

The picture above highlights the coverage provided by the Bird solution with Remotes and Antennas installed on the lifeguard stations. The results indicate that 3 sectors on each beach can provide the desired coverage map and create seamless wireless service for the beach as well as the adjacent buildings.

| Distance between two life-gaurd towers | Approximately | 800 meters |
| Distance between two light poles       | Up to         | 150 meters |
| Antenna types                         |               |            |
| Alternative 1                         | 120°          | Multiband  |
| Alternative 2                         | 2 x 90°       | Multiband  |
| Number of bands in one single remote  | 1-4           | Bands      |
| Number of sectors employed in example | 3             | Sectors    |

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