

COVERAGE SYSTEMS

Kirunavaara and Gällivare

Powerwave GSM Coverage Solutions Deployed in Kirunavaara and Gällivare Mines

Powerwave and Swedish telecom operator Telia Mobile Luleå successfully implemented GSM coverage in the Kirunavaara and Gällivare mines in northern Sweden. The Kirunavaara mountain contains the world's largest subsurface iron-ore mine, owned by Luleå Kirunavaara AB (LKAB). The new system is part of a novel communications solution for LKAB provided by Telia. LKAB implemented the GSM system to replace an existing internal VHF safety and communications system. Miners can now use GSM cellular phones all the way down to the deepest level, some 1045 meters below.

The Kirunavaara Mine

Transport roads wind through long tunnels down into the mine, to restaurants, tool shops, offices, and production facilities at various levels. Roughly hewn wall surfaces glisten wet, with average temperatures hovering around +10°centigrade – truly a challenging environment for implementing cellular coverage.

Site Survey

The purpose of the coverage system innovations site survey was to pinpoint suitable repeater sites and antenna locations, and where to drill holes for the shortest possible routes for fiber optic and coaxial cables. RF propagation measurements were taken throughout the mine. With fiber optic cables up to 7 km long, good signal overlap in hand-over zones was a crucial factor. Other vital considerations in designing the system focused on timing advance and multi-path limitations.

System Design

Two base stations were installed at the 775 m level. One of these base stations serves a tool shop and offices on one level. Both base stations transmit low level signals to the Powerwave base-station master unit located in the service area. The transmitted signal modulates lasers in the base-station master unit, which fiber optically distributes the signal to the fiber optic repeaters. Each repeater receives, filters, and amplifies the GSM signal, then retransmits it via a distributed antenna system, covering a well-defined section of the mine.



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Saving Money on Optical Fiber

With only limited fiber optic capacity available in the mines, a system using wavelength division multiplexing (WDM) technology was chosen. In such a system, optical uplink and downlink signals share the same optical fiber. To match cell sectorization, each fiber optic repeater has its own optical transceiver in the base-station master unit.

Hands-on Training

Early on in the project, a live test of the system was run at the Telia Mobile office in Luleå, northern Sweden. Commissioning activities were combined with a course on fiber optic repeaters, and with practical on-site training for installation and service personnel.

System Verification

At system start-up, optical and RF output power was checked and general system performance verified. Fiber optic repeater and base-station parameters were then optimized for handovers, signal strength, call quality, and system sensitivity.

Final optimization was performed using TEMS equipment and analyzers. Some 15 km of transport road, offices, workshops and restaurants inside the mine now had efficient cellular coverage. Finally, the system was thoroughly documented, then turned over to LKAB.



Powerwave's Coverage System Innovations Team is a team of RF and system engineers within Powerwave who manage, or assist you in, your projects for cellular coverage worldwide.

Increasing complexity of wireless systems today combines with regulatory restrictions and a variety of practical considerations to demand comprehensive experience and knowhow for cost-efficient cellular coverage solutions. Based on Powerwave's outstanding track record of customer projects completed, and on our extensive experience and know-how in quality wireless communications, Powerwave offers novel solutions that are carefully tailored to your specific needs.

About Powerwave Technologies

A global leader in end-to-end wireless coverage and capacity solutions, Powerwave Technologies, Inc. offers cutting edge wireless infrastructure to address the demands of enterprise and commercial customers. Powerwave offers a comprehensive suite of solutions, including Antennas, Base Station Solutions and Coverage Solutions. Powerwave's product line supports all wireless network protocols and frequencies including Next Generation Networks in 4G technology such as WiMAX™ and LTE®. Powerwave solutions, products and services also help wireless operators and OEMs reduce capital and operating expenses, speed rollout of services, improve coverage and capacity, and reduce environmental impact. For more information, visit us at www.powerwave.com.



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