



Underground  
Communications  
Solutions



# ABOUT US

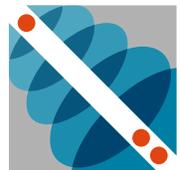
[www.sigma-telecom.com](http://www.sigma-telecom.com)

## SIGMA – UNDERGROUND COMMUNICATIONS SOLUTIONS

SIGMA has provided communication solutions to more than 1000 underground mines and tunnels in the 5 continents. We contribute with innovation to the mining industry, backed for many years of experience installing communication systems, at a low cost and a high performance. Furthermore, we provide added value by integrating solutions concerning security and productivity on state-of-the-art communication platforms that grant your Company with a clear competitive advantage.

From the begging SIGMA has developed permanent innovations to its underground communication systems, to provide the mining industry and confined spaces with the most advanced technology, from the continuous re-design of its Leaky Feeder networks, to the design of DRS networks, that allow multiple wireless signals to be sent underground.

SIGMA started on 2010, based in Concon city, central cost of Chile.



# Underground communications

## SIGMA PRODUCE UNDERGROUND COMMUNICATIONS FOR :

- ✓ Underground mining
- ✓ Vehicular tunnels
- ✓ Confined environments

### UNDERGROUND MINING

Underground mining requires coordinating tasks in each work shift, in the same way open pit mining does with radio systems. For that purpose we have designed a fully reliable communication network, easy to install, easy to manage and modify. On the other hand, it is a system especially robust for harsh mining environments.

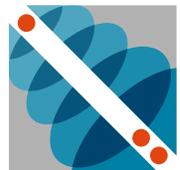
### VEHICULAR TUNNELS

The new vehicular tunnels include advanced safety systems. For that reason we have designed a communications systems that allows various signals to be entered and broadcast wirelessly within the tunnels (FM music, BREAK IN, VHF, UHF, TETRA, P25, Cellular, etc.)

### CONFINED ENVIRONMENTS

Other practical purposes for our communication networks are:

- ✓ Water tunnels, for its construction coordination
- ✓ Service tunnels. There are several underground services below cities, such as mains network, underground railway, etc.
- ✓ Big ships.
- ✓ Wide underground levels, underground parking, and every closed space without any surface connection.



# Distributed Radiant System

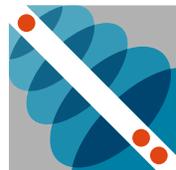
Leaky feeder networks have a perfect performance just on VHF band. Underground mining, due to its fast technological evolution, is requiring the use of wireless signals, many of which do not operate on VHF.

To solve these requirements, SIGMA designed the DRS system especially for underground mines and confined spaces, allowing carry any band below 1 GHz, reliably through any type of tunnel.

The DRS system allows more than one band simultaneously on the same underground network infrastructure. The Master unit captures the signal on the surface, distributes it through fiber optics to the Remote equipment located in the tunnels and they these restore the signal to its original state and sends it wirelessly using radiant cables, specially designed for these purposes.

The SIGMA DRS system is designed especially for tunnel usage; they include by default the following functions:

- ✓ Redundancy rings, automatically activated when network fails
- ✓ Auto-sync of all the networks elements
- ✓ Digital service aggregation, allows adding distant services.
- ✓ Local / Remote Ethernet Control and monitoring.



## DRS:

### MASTER UNIT:

It allows signal gathering ( diverse frequency bands) to be sent through the tunnels via optical fibre.



### RADIANT CABLE:

It broadcasts every signal the Remote Stations sends.



### REMOTE STATION:

It converts and adapts all the signals that the Master Unit sends.



### SYSTEM CAPACITY:

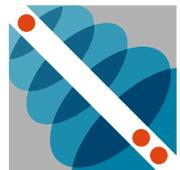
The DRS system allows to send the signal through the tunnels.

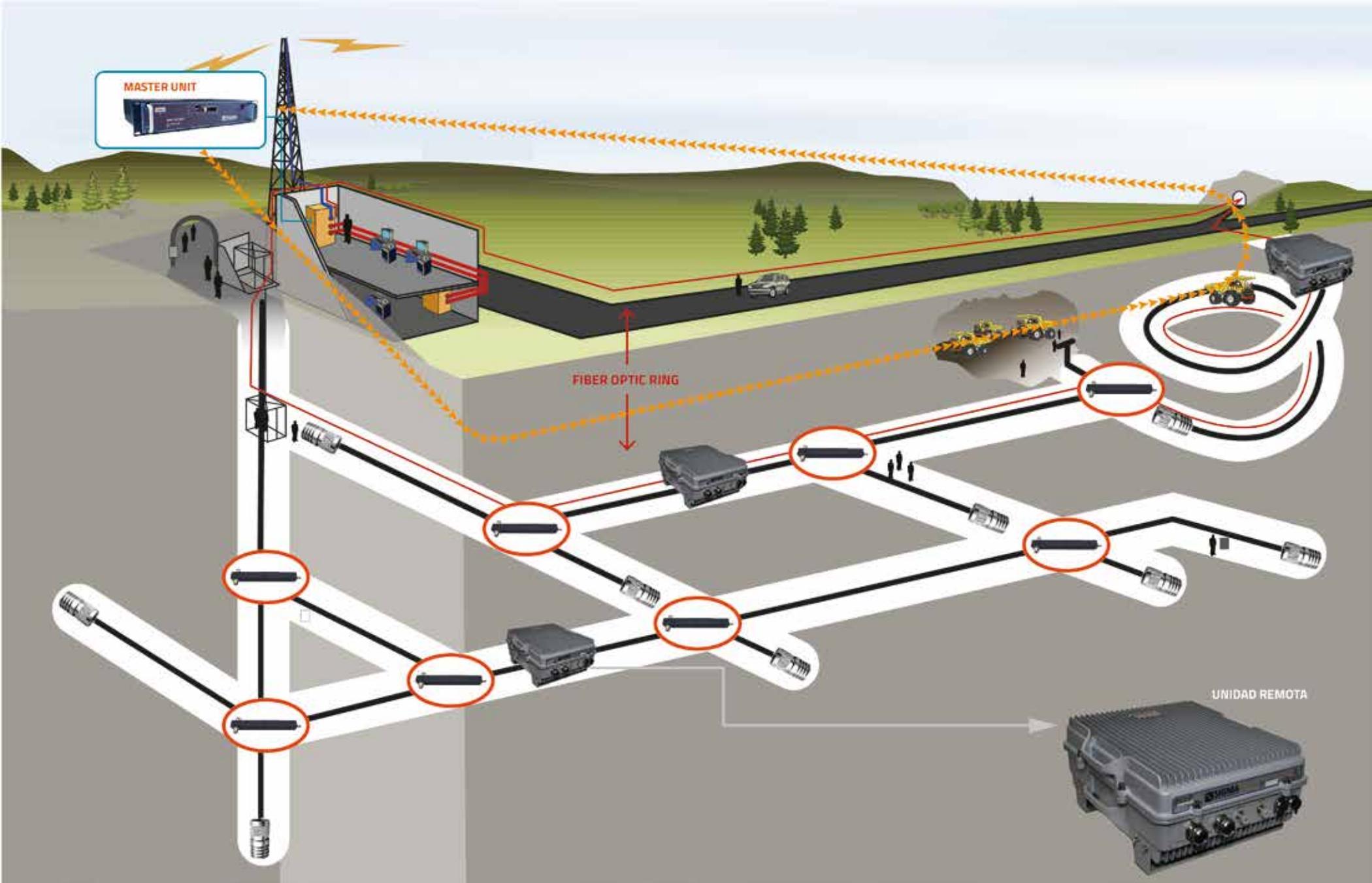
The following bands:

FM, VHF, UHF, 700, 800, AWS, 1900, 2600

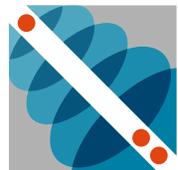
The following systems:

DMR, NEXEDGE, P16, P25, TETRA, LTE, GSM, UMTS

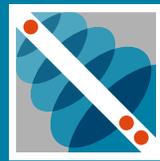




Distributed Radiant System: Redundant fiber optic ring



Chile 



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