

Concept *Solutions* for Indoor Coverage in **Metros and Tunnels**

For Tunnel and Underground Transport operators reliability and future-proof technologies are of key importance. Often, solutions are rolled out using their own resources though they also turn to specialised integrators for turnkey projects.

Requirements here often centre on security and safety issues using FM, UHF, VHF, GSM-R and Tetra. Commercial requirements include 2G/3G and there is scope to deploy WiFi in certain areas. Products are often highly specific and services can range from initial design to full turnkey solutions.

Solution	Applications	Products
Small Tunnels < 500 m	2G, 3G, GSM-R, Tetra	Off-air repeater, cable
Tunnels up to 4 km	FM	Off-air repeater, cable
Tunnels > 500 m	2G, 3G, GSM-R, Tetra	Off-air repeater, BDA Off-air repeater & F/O repeater
Wagons	Services to passengers 2G, 3G, WiFi	Repeater, cable



Solutions for Tunnels: **< 500 m or far away BTS**

ClearFill®Air: Off-air repeater

Features / Benefits

- High gain for large distances to BTS
- Mid and low power options for most of tunnels
- Cost-effective way to complement an existing BTS
- Bandwidth adjustable to operator frequency
- Local/remote management
- Compact size, easy to install
- Can be complemented with regular antennas
- Compliant to environment standards (IP65)

Typical environment:

Far away BTS or midsize topologies



ClearFill®Line: Passive Solutions

- Radiating cables adapted to building structures & application

Features / Benefits

- Lower cost/best service
- Multi-band
- Future-proof
- Best coverage
- No shading by vehicles
- Smooth everywhere, even in trains
- Proven safety: low smoke, flame & fire retardance
- Better reliability vs antennas
- Tested up to 6GHz - Wimax ready
- Live test environment in Hanover metro
- Not sensitive to reflection
- Less sensitive to wind

Typical environments:

- Many curves
- Small tunnel cross section



The Clear Choice™

For further information please visit us on the internet at <http://www.rfsworld.com>

Solutions for Tunnels: > 500 m and < 4,6 km

ClearFill®Boost:

Extend coverage for optimum cost
Cables extended with BDAs (bi-directional amplifiers)

Features / Benefits

- Remote & local management alarms gain setting
- Radiating or feeder cable

Typical environments:

- Tunnel length up to 4600m

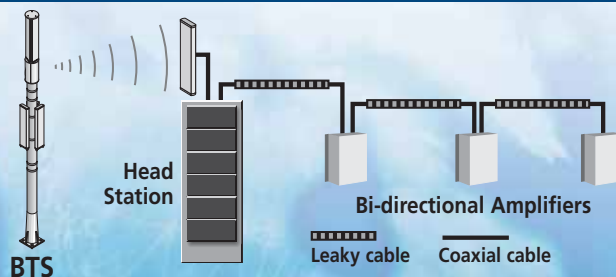
GSM900/EGSM
GSM-R
GSM1800
W-CDMA/UMTS

Dual band 900/3G
Dual band 1800/3G
Dual band 900/1800

PCS1900
CELL800
CELLA800, CELLB800

SMR800, SMR900
Dual band
SMR800/SMR900

CASCADE SYSTEMS



Metro & Tunnels: Solutions for tunnels up to 20 km with fiber-fed repeaters

ClearFill®Space2:

- Optical fiber extension

Features / Benefits

- 1 master unit rack
- Manage up to 6 optic fibers
- Up to 6 remote units
- 1 remote management
- 1 power supply
- Rack usually placed in head station

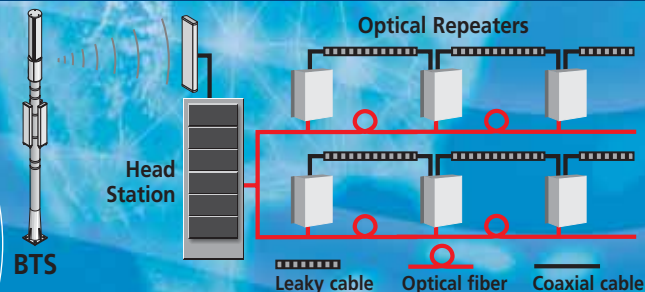
Typical environments:

- Long tunnels

TETRA
CDMA800/CELL800
GSM-R
GSM900/EGSM, GSM1800
Dual band 900/3G
Dual band 1800/3G
Triple band 900/1800/3G



OPTICAL FIBER SYSTEMS



Up to 6 fiber-fed remote units per master unit / rack :
Connected to rack frame up to 20 km optical link
Options: single/dual/triple band
Can drive cables & antennas (passive solution)
Compact size
Local or power from the cable (dc)
Remotely manageable

Metro & Tunnels: Solution for high-speed trains & wagons

ClearFill®Air:

- On-board repeaters for wagons

Features / Benefits

- Small dimensions & light weight
- Railway wagon attenuation compensation
- High reliability (reduced complexity)
- Low interference with operators network
- Multi band - multi operator
- Plug and play
- Totally transparent to frequent planning changes
- Low maintenance, low cost

GSM-R
GSM900/EGSM
GSM1800
W-CDMA/UMTS



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