

# 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.*

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

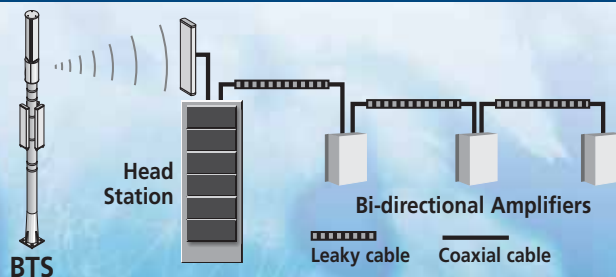
GSM900/EGSM  
GSM-R  
GSM1800  
W-CDMA/UMTS

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

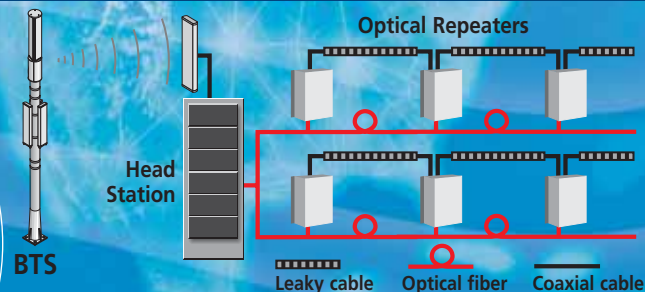
**Typical environments:**

- 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



The Clear Choice™

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