

**Rosenberger**

# Rosenberger Leaky Cable Coverage Solution



## Topic

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- **Rosenberger Leaky Cable Series**

- **Active System Overview**

Off-air/Optic Tetra Repeater

- **Passive Components Portfolio**
- **Complete Leaky Cable Coverage Solution for Tunnels**
- **Case Study and Reference**

# Radiated mode leaky cable

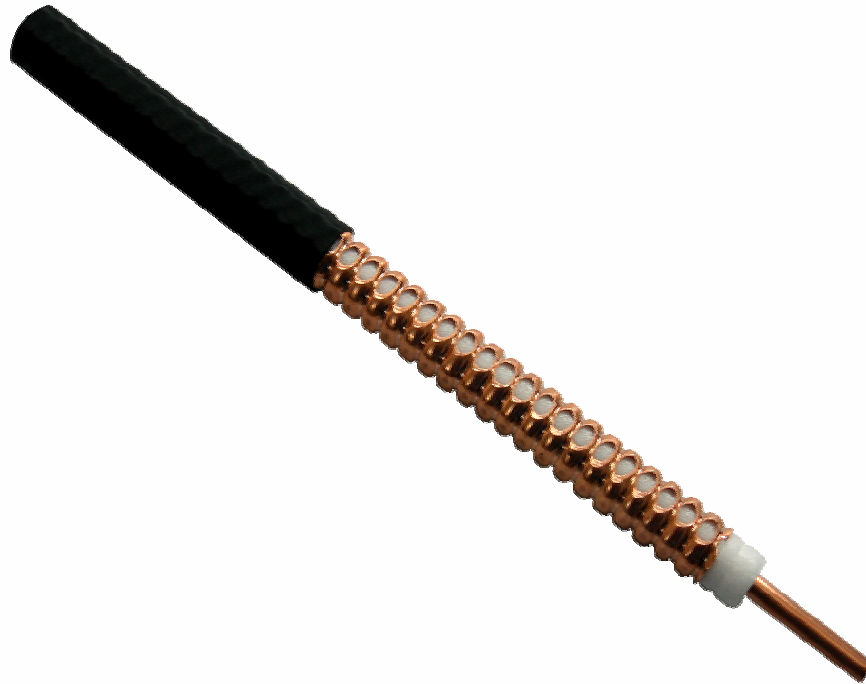
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- Rosenberger RK FRNC is optimized for specific frequency bands and operates in the "radiating mode" and is designed for single or dual-band RF systems. It is ideally suited for single or dual-band systems containing the following bands: TETRA, Cellular, GSM.

# Coupled mode leaky cable

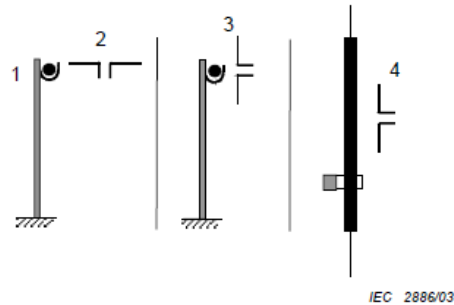
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- Rosenberger CK FRNC is designed for applications that require multiple RF bands, to handle frequency bands from 50MHz to 2.4GHz. The cable is successfully used in tunnels, metro, and outdoor environments.

# Coupling loss test --- IEC66191-4

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- |   |        |   |            |
|---|--------|---|------------|
| 1 | Cable  | 3 | Orthogonal |
| 2 | Radial | 4 | Parallel   |

Figure B.2 – Antenna orientations with free-space method



# Halogen-free and fire retardant



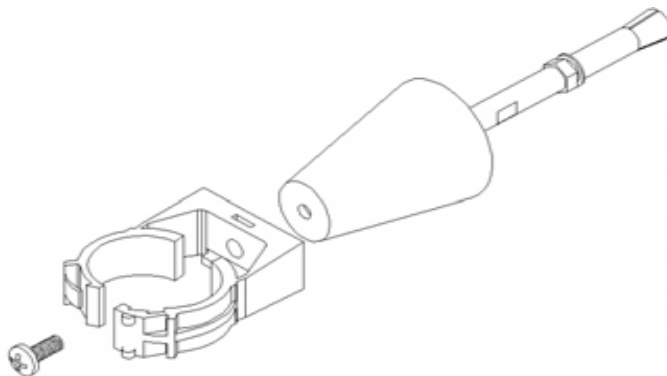
Our Leaky cable meet the following international standards

- ✓ IEC 60332-1-2 (flame test)
- ✓ IEC 60332-3-24 (cable bundle test)
- ✓ IEC 61034 (flow smoke emission)
- ✓ IEC 60754-1 (halogen-free)
- ✓ IEC 60754-2 (non-corrosive)

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# Connector and Accessories

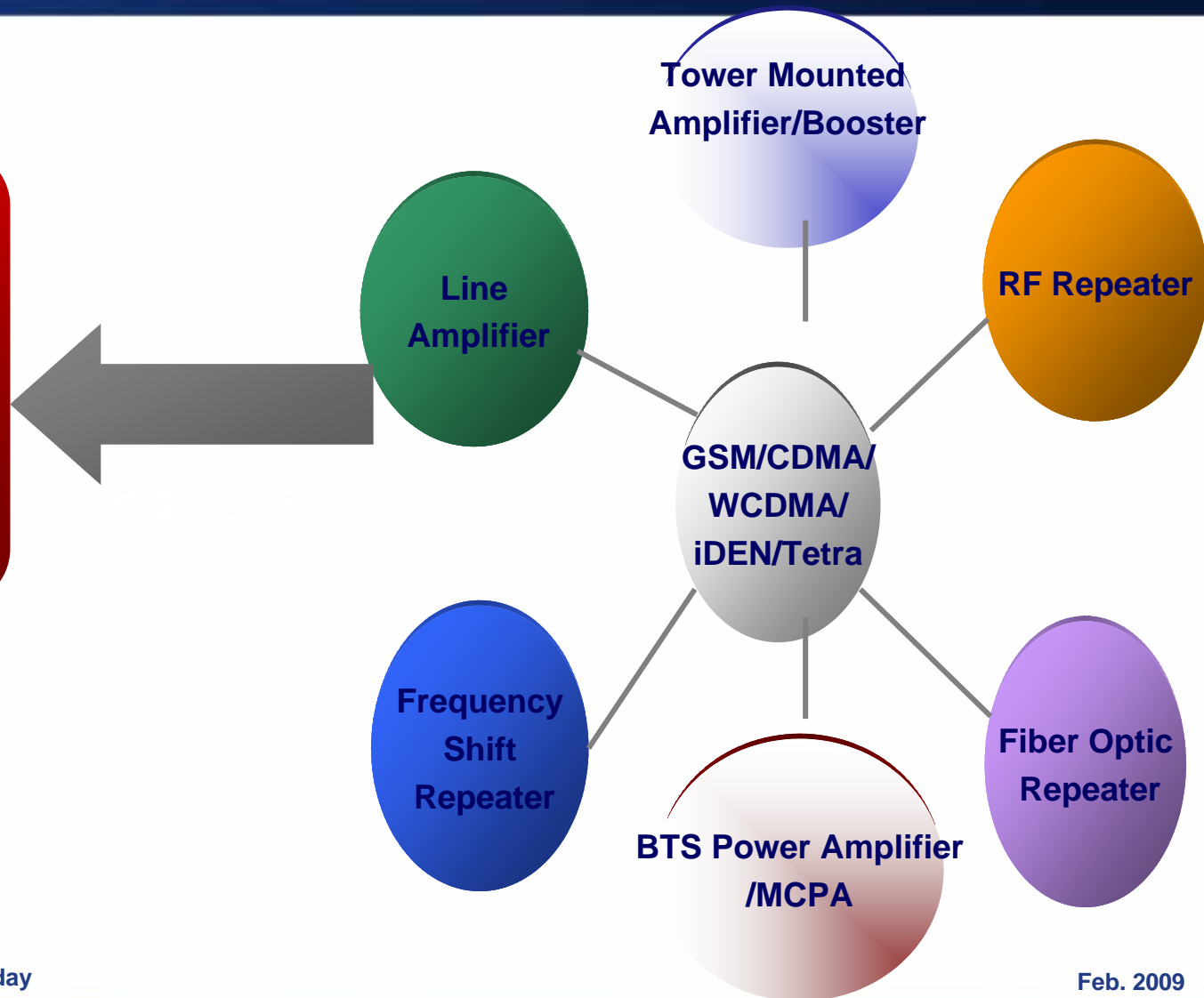
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# Active System

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- Highly-integrated
- Cost-effective
- Seamless coverage





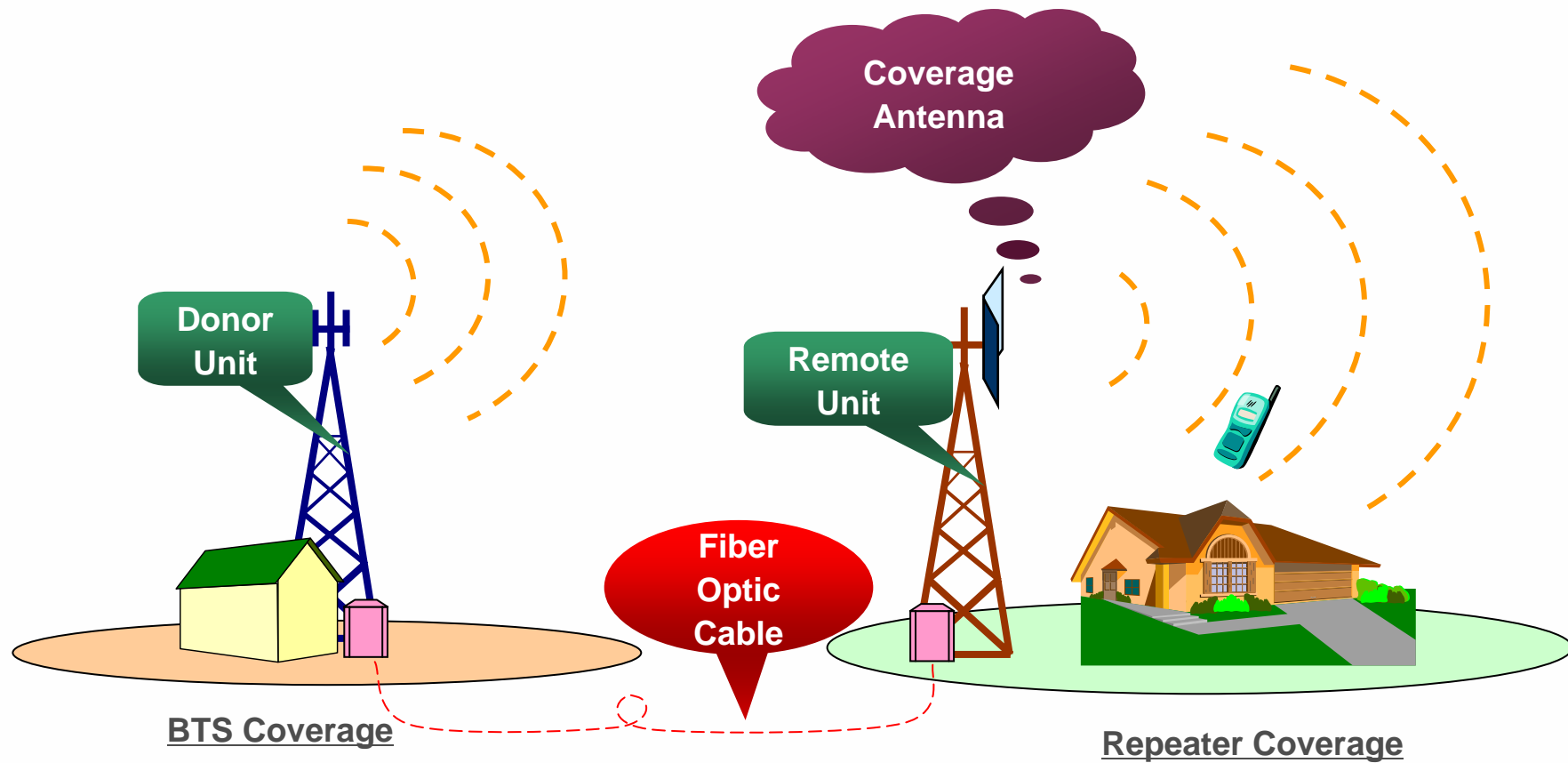
# RF Repeater Category

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		27dBm	30dBm	33dBm	37dBm	40dBm	43dBm
Channel Selective Repeater	CDMA						
	GSM/DCS						
	iDEN/Tetra						
	WCDMA						
Band Selective Repeater	CDMA						
	GSM/DCS						
	iDEN/Tetra						
	WCDMA						
Dual Band Repeater	GSM & DCS						
	GSM & WCDMA						
	DCS & WCDMA						

# Fiber Optic Repeater

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# Fiber Optic Repeater

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	33dBm	37dBm	40dBm	43dBm
CDMA				
GSM				
DCS				
WCDMA				



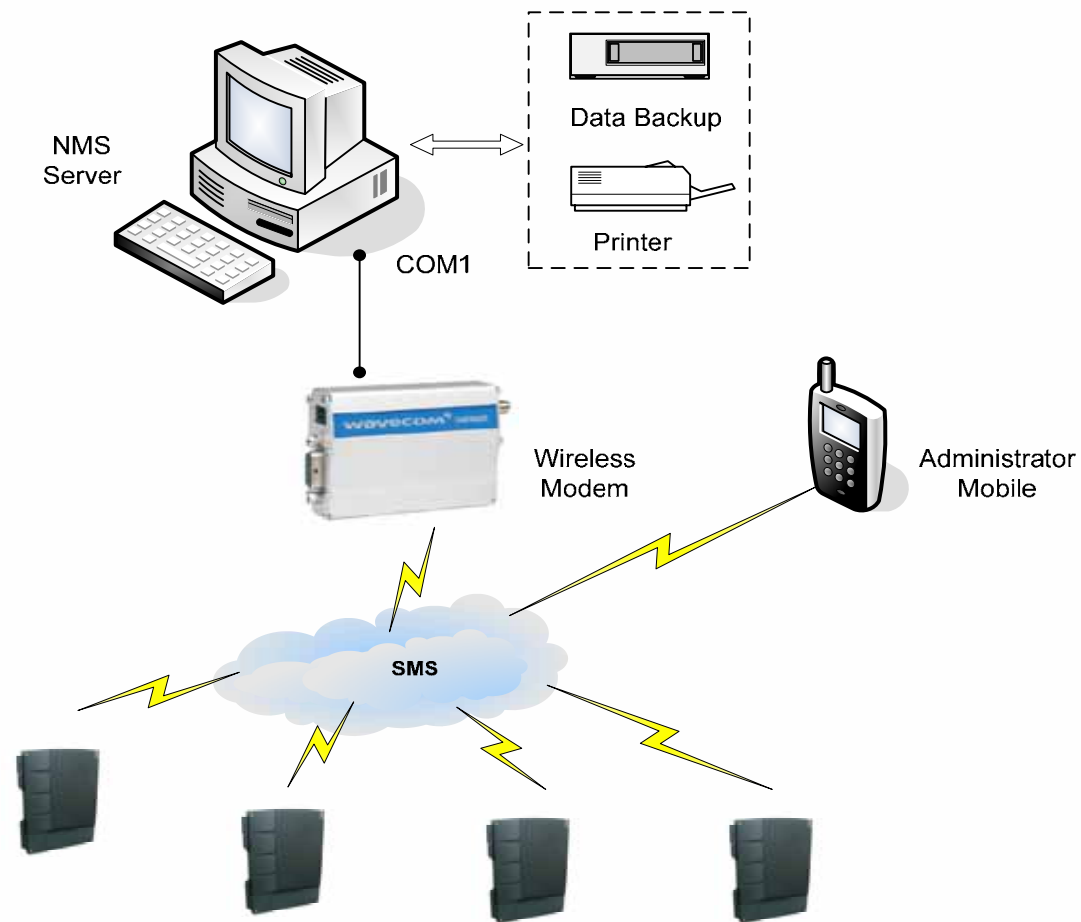
**Master Unit**



**Remote Unit**

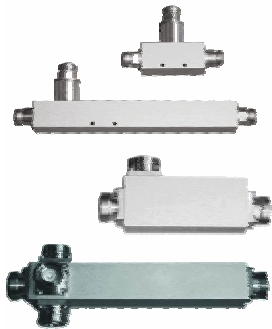
# Network Management System (NMS)

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# Passive Components and Portfolio **Rosenberger**

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Group		Type	Connector	Main Spec	
				Frequency Range	Power Handling
Splitter	Microstrip power splitter	2-way,3-way,4-way	N-type or 7/16 type	800~2500MHz, 800~2700MHz	Low Power
	Cavity power splitter	2-way,3-way,4-way	N-type or 7/16 type	800~2500MHz, 800~2700MHz	High Power
Coupler	Microstrip directional coupler	6,10,15,20....40dB	N-type or 7/16 type	800~2500MHz, 800~2700MHz	Low Power
	Cavity coupler	6,10,15,20....40dB	N-type or 7/16 type	800~2500MHz, 800~2700MHz	High Power
Hybrid Coupler		3dB	N-type or 7/16 type	800~2500MHz, 800~2700MHz	High Power
Duplexer		Indoor or outdoor	SMA-type N-type or 7/16 type	Customized bandwidth	200W
Filter		Indoor or outdoor	SMA-type N-type or 7/16 type	Customized bandwidth	200W
Diplexer & Triplexer		CDMA+GSM/DCS+UMTS	N-type or 7/16 type	Wide-band	200W
		DCS/UMTS			
		Cellular/WLAN			

# Rosenberger's experience in Leaky cable solution



- Rosenberger team comprises experienced technical sales staff and highly qualified communications engineers, working together to engineer solutions for each unique project; if an existing product is not appropriate our team can design a new or optimized solution that meets your exact needs.
- Rosenberger is capable to provide all the products of leaky cable and the accessories, specific services can range from initial design to full turnkey solutions.
- Over ten years experience in tunnel/metro solution:
  - 1.Short tunnels
  - 2.Medium tunnels
  - 3.Long tunnels or Metros

# Complete Leaky cable Coverage Solution **Rosenberger**

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## Key Facts about Tunnel Coverage

- Seamless coverage from outside in to the tunnel
- Single or multiple frequency bands
- Controlled environment
- Often requirements for system redundancy
- Often many RF carriers present outside

## Design Considerations – Tunnels

- Required signal strengths
- Alarming
- Redundancy
- Equipment Locations
- External Signal Strengths
- Length of Tunnel
- Frequencies required in tunnel

# Application in Road & Rail Tunnels

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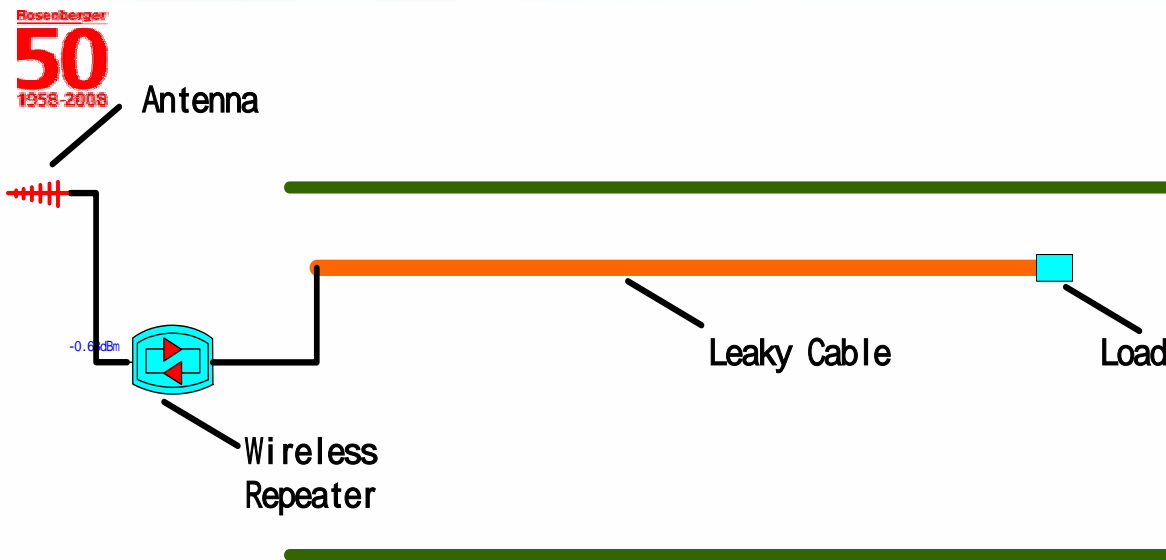




# Short Road & Rail tunnels

## -- Off Air Amplifier

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### Applications :

- 2G , 3G , GSM-R , Tetra
- Security and safety
- Wireless train dispatching system
- FM

### Products :

- Off air Amplifier
- Leaky cable, feeder cable
- Jumper Cable & connector
- Load or tunnel antenna

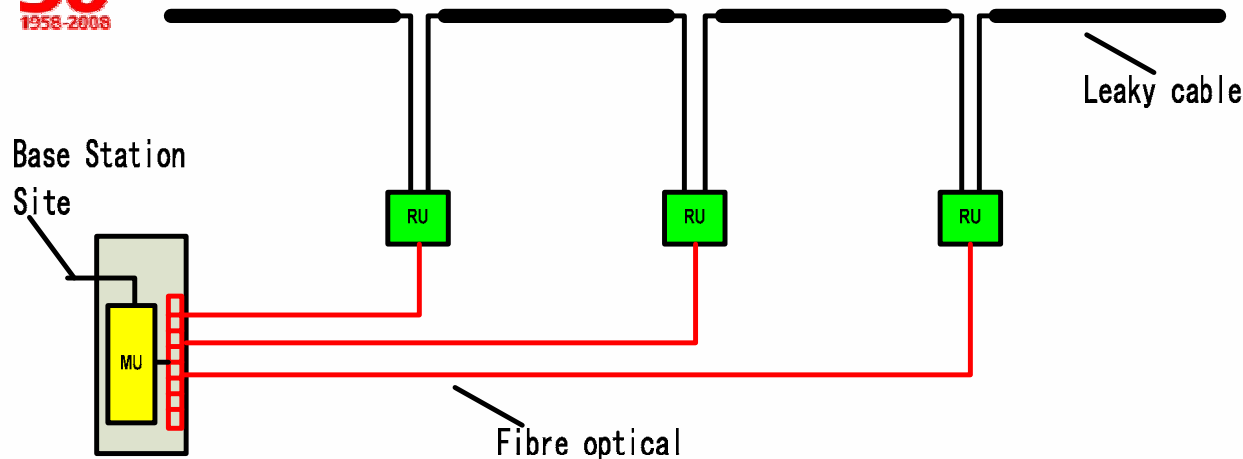
### Features :

- Low loss system
- Easy to install
- Lacks system redundancy

- This is the simple and efficient solution for short tunnel with far away signal source
- Can use tunnel antenna instead of the terminal load to extend the coverage
- Can select different coupling loss level's leaky cable cascade together to reduce signal dynamic range and extend coverage

# Longer tunnels or Metros --- F.O Repeater

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- F.O Amplifiers are placed in the tunnel and are feeding the signal in a T-shaped radiating cable configuration.
- In case the cable is damaged/interrupted due to a fire or accident, one still has RF power from both sides of the tunnel section.
- The solution with fibre-optic backbone and amplifiers allows to cover tunnels up to a length of 20 km

## Applications :

- Wireless train dispatching system
- Security and safety system
- 2G, 3G, GSM-R, Tetra

## Productions :

- FO Amplifier
- Leaky cable, feeder cable
- Jumper cable & connector
- Load

## Features :

- Easy to install
- Improved system redundancy
- Lower noise and Intermodulation
- Remotely manageable

# Functions of System Components



## **The network comprises**

- Leaky cables, POIs, antennas, amplifiers, fibre-optic equipment, and general passive components including combiners or dividers and cable components.

## ● **Components function**

### ➤ **Leaky cables**

1. Transmits and receives signal in tunnel
2. Multiple frequency band operation and easy to extend system for future

### ➤ **POIs**

1. Transmitter combiner and receiver multi-coupler
2. Integrate different frequency signals from different operators

### ➤ **Antennas**

1. Transmits and receives signal in station

### ➤ **Amplifiers**

1. Compensate the cable loss to enhance the coverage

### ➤ **General passive components**

1. Feeder cables provide a low-loss transmission medium for signals, connected either to antennas or leaky cables
2. Splitters, combiners and couplers split or combine signals from different leaky or feeder cables

# Subway Coverage Cases Study...

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**The metro underground system of Guangzhou Metro Line 2 comprise 19.216 route-kilometers with 17 stations. Deployed by China mobile.**



# Guangzhou Metro Line 2- Design Idea

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**Signal Source :**

**BTS , Micro BTS,**

**BBU+RRU**

**One cell each station**

**Considering Points :**

- High-density Population in compact area
- High traffic
- Coverage requirement for both tunnel and platform
- Easy for upgrading



# Guangzhou Metro Line 2- Design Idea

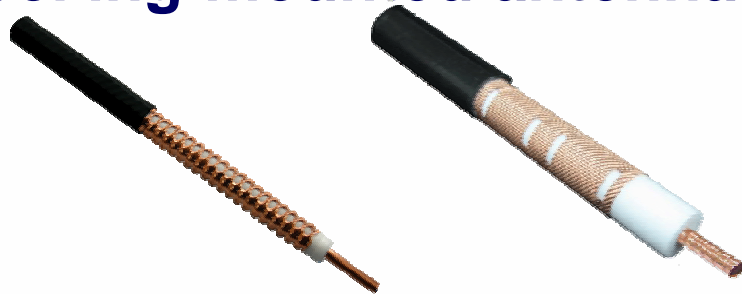
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**Distribution Antenna**

**System:**

**leaky cable,**

**Ceiling-mounted antenna**

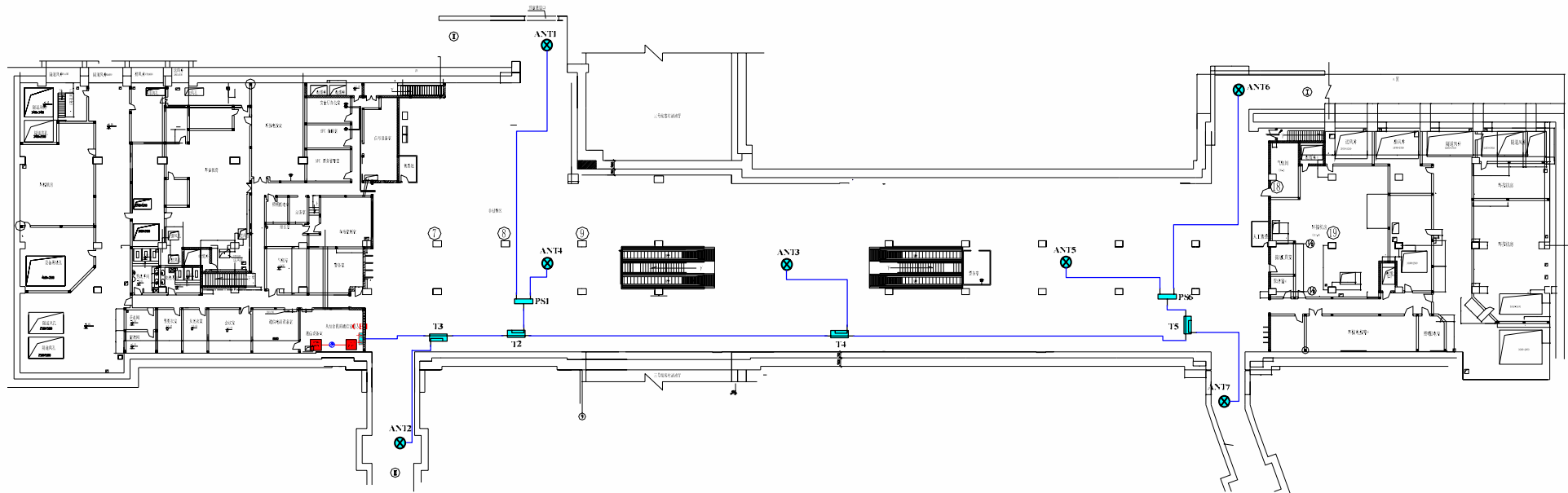


**Advantages :**

- **Cover the Confined areas**
- **Distribute the available signal power uniformly**
- **Support Multiple services**

# Guangzhou Metro Line 2- Design Idea

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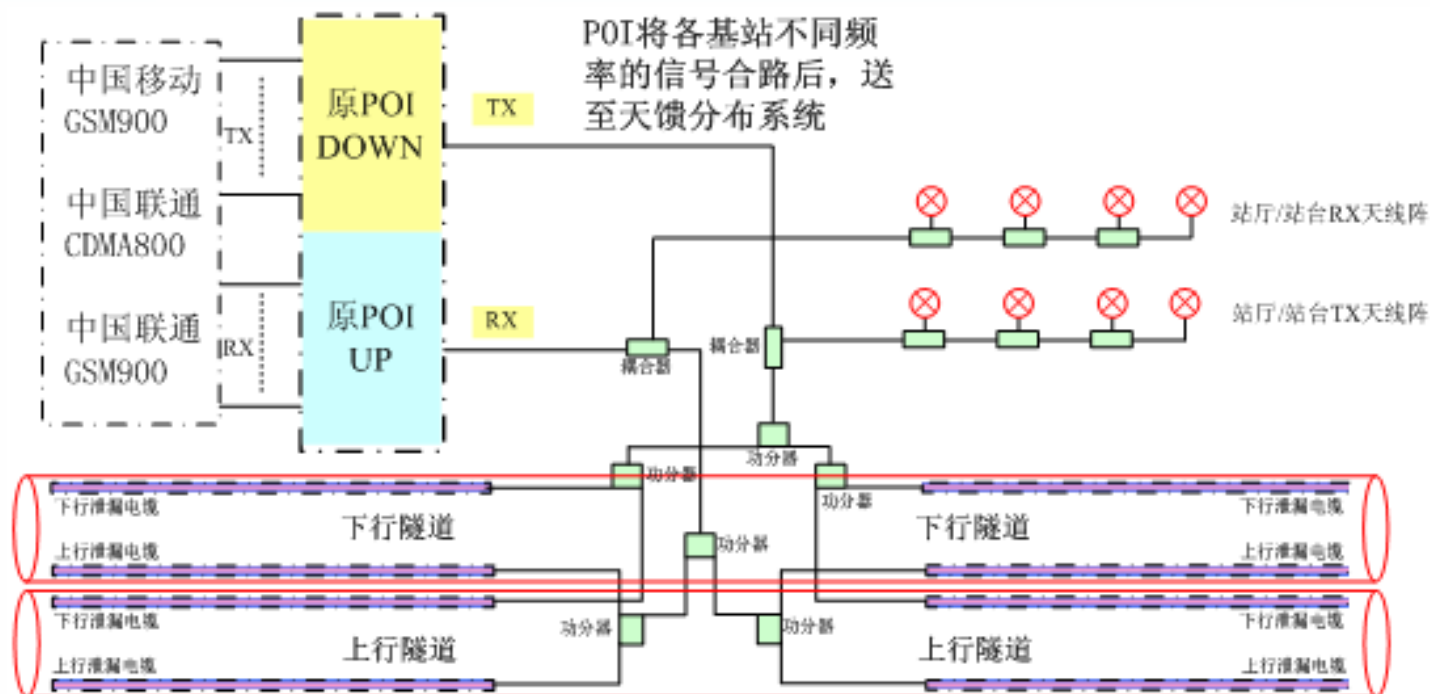


**Platforms Coverage use Indoor Ceiling-mounted Antennas due to space is open.  
Basically using multiple antennas with small output power to cover in average.**



# Guangzhou Metro Line 2- Design Idea

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系统组成图-1

**BTS or Micro BTS are installed in Metro Stations respectively.**

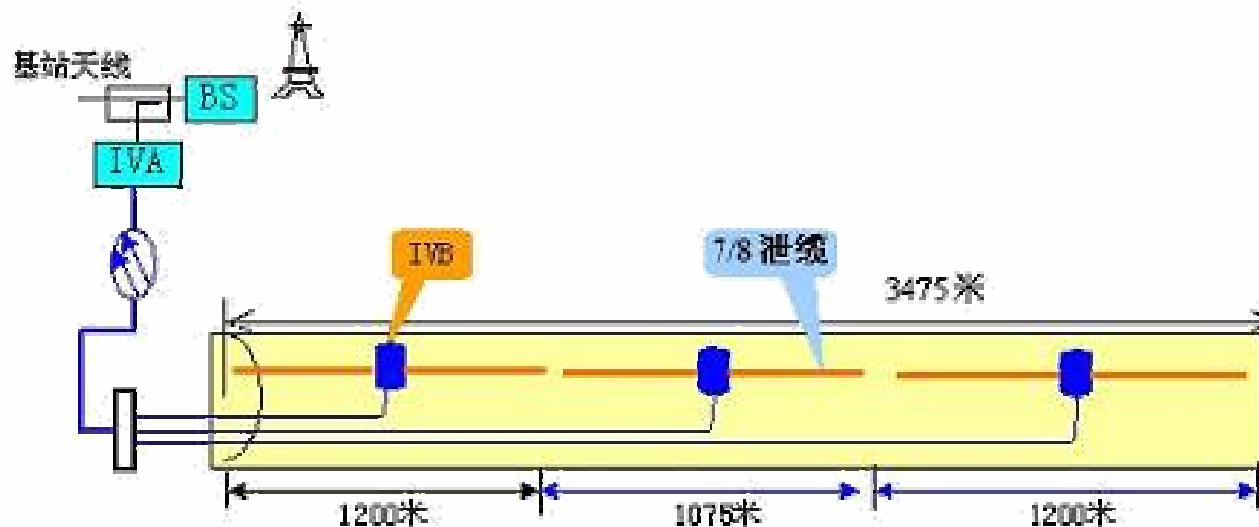
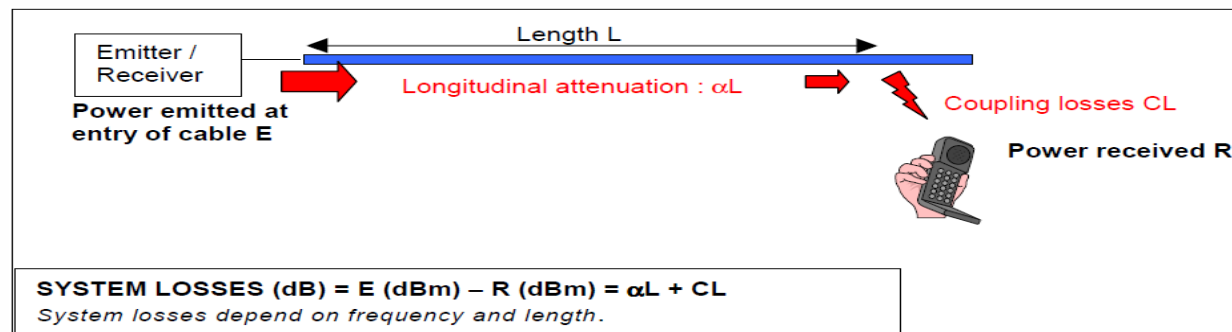
**POI combine the multi-band signals, transmit to the DAS.**

**Platforms Coverage use Indoor Ceiling Antennas.**

**Tunnel coverage use leakage cables.**

# Key point 1 - Calculation of Leaky Cable

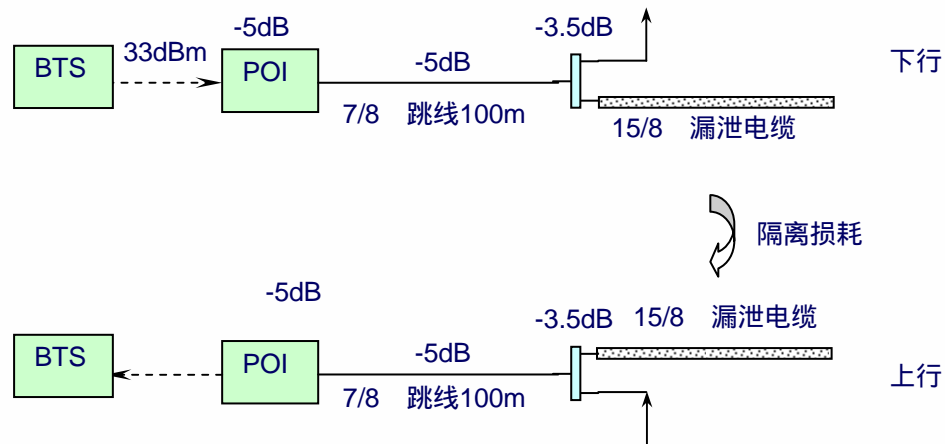
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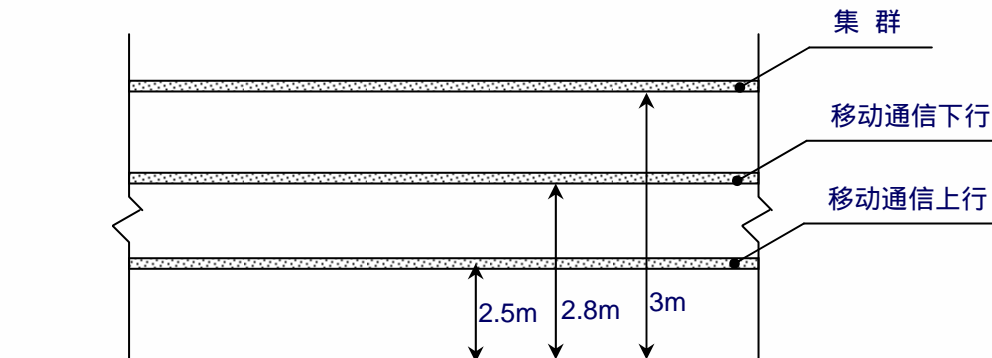
Using line amplifiers or fiber optical repeaters to extend the distance of leaky cable.

## Key point 2 - Analysis of extreme distances of uplink and downlink

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干扰信号要求小于-124dBm



**Separating uplink DAS from downlink DAS to achieve high isolation degree .**

## Key point 3 - Analysis of Multi-band System

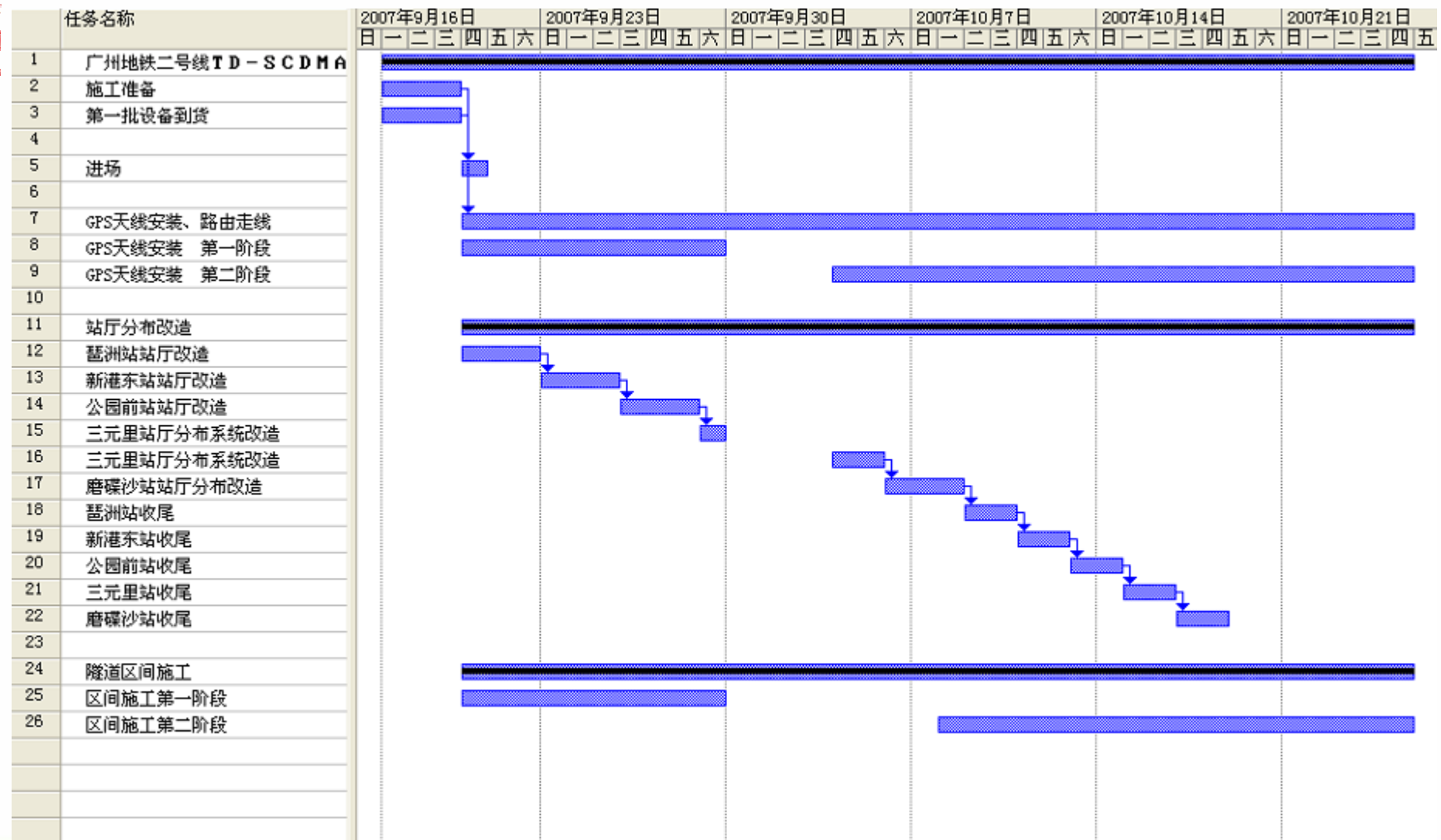
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**It is necessary to reserve input ports Considering system expansion.**

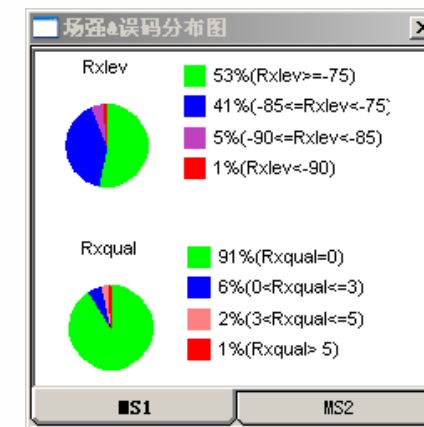
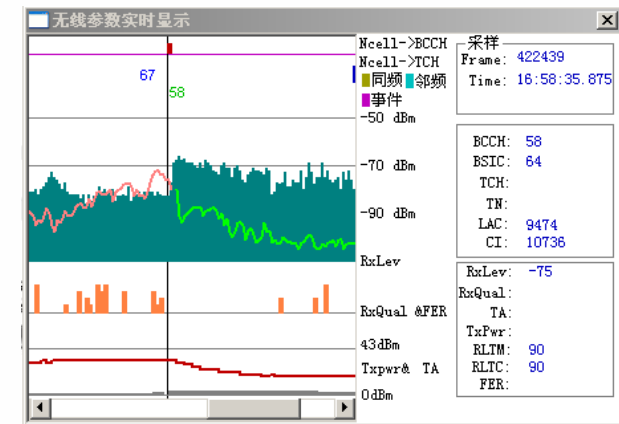
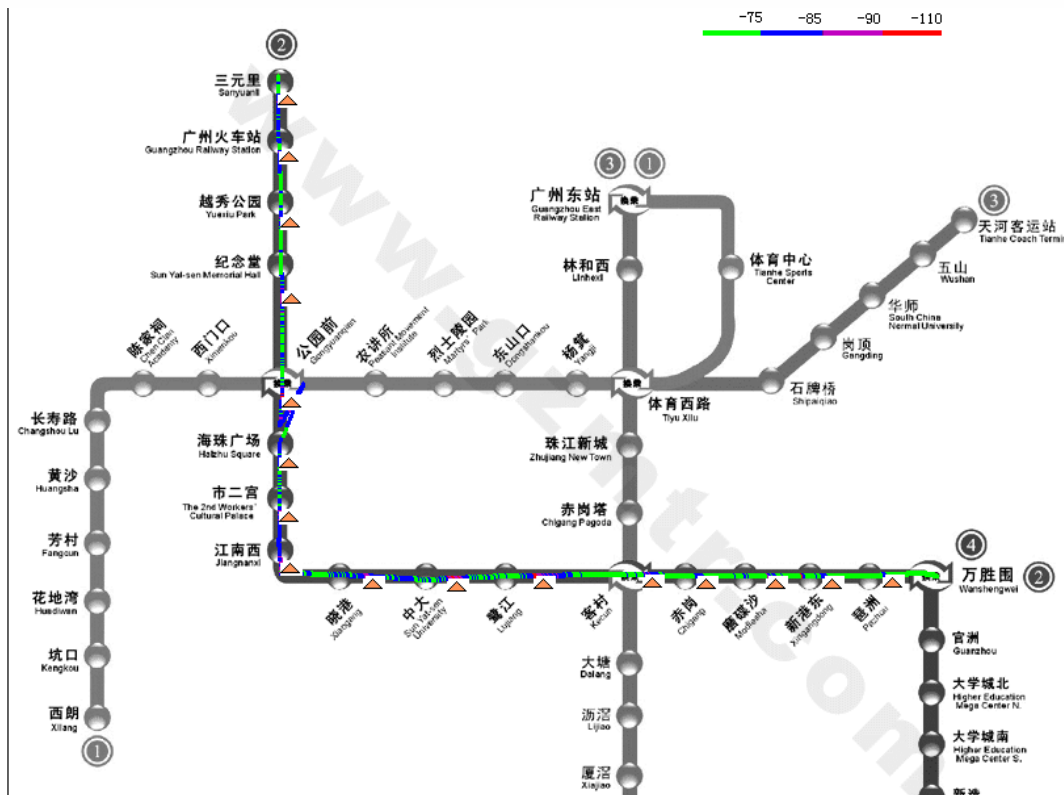
# Case Study – Project implementation

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# Case Study – After completion - Driving Test

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The metro Tunnel driving test analysis.



# One-Stop Shopping Experience at Rosenberger

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- **Complete Suite of Products and Total Solutions**
- **Consistent High Quality**
- **Cost Effective**
- **Flexible Delivery**
- **On-site Services**
- **Customized Designs and Solutions**





A photograph of a rock climber in a red shirt and dark pants scaling a steep, orange-brown rock face. The climber is positioned in the center-right of the frame, with a red rope visible. The background shows a clear blue sky and dark, jagged mountain peaks in the distance. The text "Thank you!" is overlaid in white, bold, sans-serif font in the center of the image.

**Thank you!**