



# KAITEC

Ingenieurleistungen für  
Nachrichten- und Übertragungstechnik



## TETRA-SIMULCAST SYSTEM NETWORK RANGE EXTENDER

# TETRA-SIMULCAST SYSTEM: NETWORK RANGE EXTENDER

Frequencies are one of the major challenges for the planning and implementation of a radio communication network including a TETRA radio system. To set up a TETRA simulcast system is an affordable solution which meets the requirements of critical coverage demands in conjunction with low cost and low frequency availability. KAITEC's leading-edge product allows the enhancement of the TETRA site coverage area and works as the donor cell for the simulcast transmission. This system optimizes efficiently in- and outdoor coverage in challenging environments such as mining, tunnel or industrial complexes. It is characterized by low power consumption as a compact design and supports the full range of the TETRA features. The system has a Range Extender (RE) Master and a Range Extender Slave. The RE-Master generates coherent signals, balances 4-wire losses as well as delays and forwards these signals to the connected Range Extender Slave (RE-Slave). The connection is made by, for example, four-wire copper cables.

As it converts the TETRA signal into the base band, the connection between the transmission sites can be standard (plain old) 4-wire copper cables, hence it can reuse existing cable installation in buildings, where the biggest advantage is the reuse of fire retardant cables. The simulcast repeating sites – RE-Slaves - send with high TX power relatively to i.e. on air repeaters, therefore significantly reduce the number of active sites which allows the laying of cheaper radiating cables and provides a better overall link balance. TETRA time slot adjusted RX diversity offers always the best signal even under high dynamic field strength differences.

This is an eminent benefit because it allows the reuse of existing communication infrastructure, particularly indoor.

Lower CAPEX, lower OPEX and better performance.  
KAITEC Technology

## PERFORMANCE FEATURES

- RE-Master centrally switches all units between active and standby mode
- Digital adjustable transmitter powers up to 1 watt per carrier
- Monitoring of transmit power and VSWR including alarm reporting
- No interference with surrounding TETRA networks
- Independency of Radio Base Station vendor being used
- No handoffs within areas of overlap
  - Compensation of additional insertion
  - Compensation of phase shift
  - Compensation of different delay
- Up to 8 RE-Slave units possible as standard
- 32 units at maximum in an extended version
- Alarm reporting at the RE-Master for each remote RE-Slave:
  - Loss of transmitter power
  - Power failure
  - General alarm
- Monitored four-wire cable connection for each remote RE-Slave
- 12 VDC supply with low power consumption
- Low operating and maintenance costs
- Central interface for radio network control panel
- Compact 19-inch modules, controls on the front panel
- Interface to Fire Alarm systems (BMA/BMZ)



RE-Master with TETRA-System

# TETRA-SINGLE FREQUENCY NETWORK: BACKGROUND INFORMATION

The TETRA simulcast system can be operated with four-wire cables as the interconnection backbone, which may be an existing standard copper cable as used in analogue networks. The connection is required between the central input module - the Range Extender Master (RE-Master) - and the remote units, the Range Extender Slaves (RE-Slaves), from where the signal is sent to radiating elements (antennas, leaky feeder).

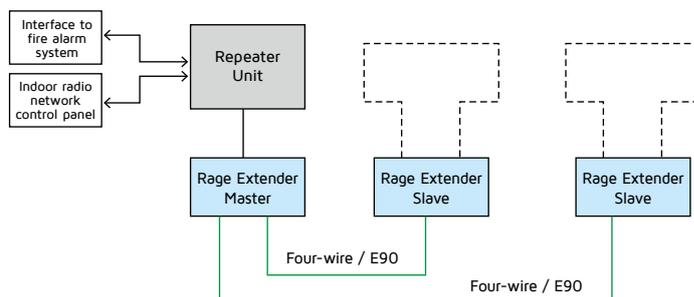
Following the same principle as an optical distribution system, the TETRA simulcast system is used for the transmission of the data stream. For each radio channel (TETRA frequency pair) a dedicated interconnection channel is required. In principle, the system is converting the high frequency radio signal into a low frequency data signal considering a TETRA channel bandwidth of 25 kHz. The operation of the simulcast system is independent of the used TETRA Base Station.

The data signals are bi-directionally transmitted through the connections from the Range Extender Master to each of the Range Extender Slaves and re-converted to RF signals.

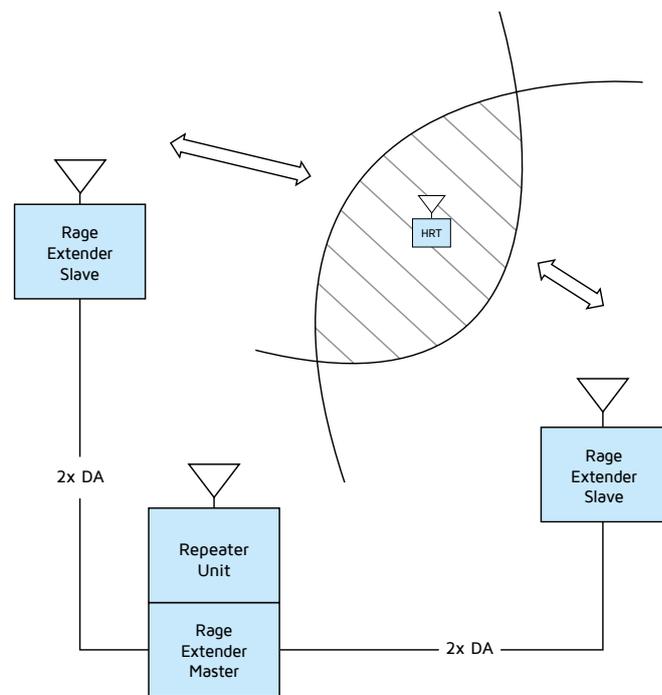
Accordingly, the input source, here the TETRA channel, is available in the transmitting and receiving path in many remote locations, since on this principle both coherent transmission signals and multiple receive paths can be used. The attenuation of the low frequency signals through several kilometers of cable can be compensated and is uncritical due to the digital phase modulation.

Also the Range Extender Master has the capability to compensate losses generated by four-wire connections, provided the delays are within the required ETSI standards. The integrated low-noise amplifiers are providing an optimized signal-to-noise ratio. In conjunction with an automatic regulated amplifier a high dynamic range of up to 100 dB in the Uplink path can be achieved.

The noise figure on the 4-wire connections in the overall receiving path is very low. In addition the sensitivity of the concerned TETRA cells is increased, as the noise from inactive receiving chains is suppressed.



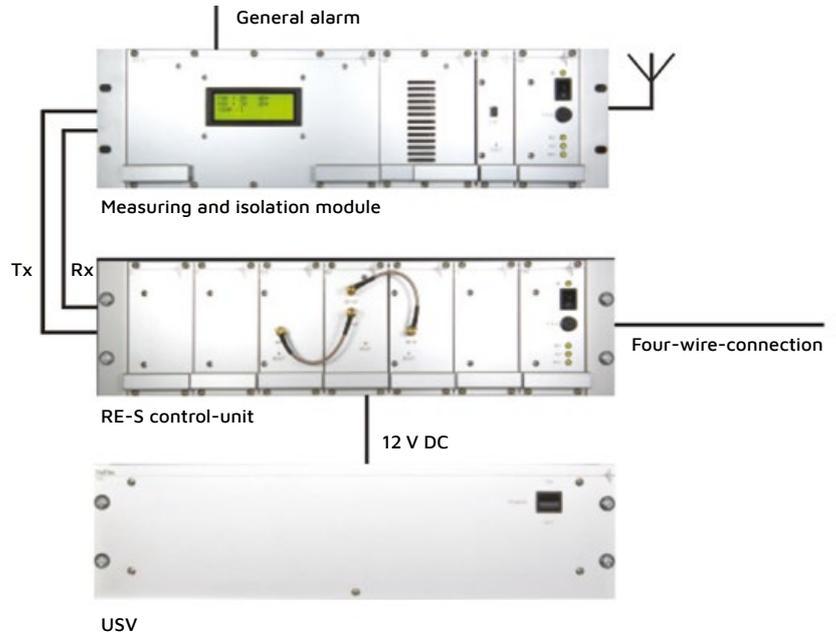
*TETRA-Single frequency network for TMO-A infrastructure with E90 four-wire connections*



*Interference-free radio communication even in areas of overlap (hatched in gray)*

## BLOCKDIAGRAM

### RE-Slave Modules



## TECHNICAL DETAILS:

<b>Power supply:</b>	230 V AC / 120 VA
<b>Frequency band:</b>	TETRA Band III / TETRA Band IV
<b>Frequency bandwidth:</b>	25 kHz due programmed channel
<b>Operating temperature range:</b>	0° C to +55° C
<b>System cabinet dimensions:</b>	RE-Master: 38 RU – 600 x 1800 x 600 mm (W x H x D) RE-Slave: 15 RU – 600 x 746 x 473 mm (W x H x D)
<b>Power consumption:</b>	Standby 15 W / Control Unit RE-M 185 W / Slave RE-S 75 W
<b>Specifications:</b>	ETSI EN 300 392-2 V3.4.1 (2010-08) ETSI TS 101 789-1 V1.1.1 (2007-04)



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