SR500
Long Range, High Speed, Data and Voice, Point to multipoint
Telecommunication Network

Industrial Applications

Powerstorm, together with our European partners support, maintain and manufacture SR500 systems and components
What is SR500?

- The SR500 point-to-multipoint (PMP) microwave radio system, has the following characteristics:
  - Operates in various frequency bands: 1.3 - 2.7 GHz, 3.4 - 3.7 GHz, and 10.15 - 10.65 GHz
  - Uses Time Division Multiple Access (TDMA) Technology
  - One system supports 60 full-duplex (64 Kbps) trunks for voice and data circuits
  - Supports: linear, star, or tree network configurations
  - Trunk usage can be mixed: dedicated for data and Supervisory Control and Data Acquisition (SCADA), or demand-access for voice or data
  - Redundancy on: CS, Repeaters and Out stations.

- Its applications cover a wide range of industries:
  - Oil and Gas (pipelines, on-shore and off-shore operations)
  - Electric utilities (generation, line protection and substation controls)
  - Flood control (monitoring reservoir levels and rainfall rates)
  - Resource industries (mining, forestry, agriculture, and factories)
What is SR500?
Applications SR500 PMP Systems

SR500 Wireless Access Network

- 2.4-512 Kbps
- n * 64 Kbps
- 1.2-19.2 Kbps
- n * 64 Kbps
- 64 Kbps

- 2-W
- 4-W
- Trunk Mobile Base Station

- Router

- Video conferencing
- Video Surveillance

- Modem
Services:

- Field survey
  - Site survey, Frequency survey

- Network design – Reference to ITU radio standards
  - Traffic calculation
  - Frequency planning
  - Link profile
  - Power consumption
  - Interference calculation
  - Link budget and availability

- Installation

- Commissioning

- Acceptance test

- Factory training
  - Product overview
  - Troubleshooting Level 1
  - Insight Network Management System
  - Installation & commissioning
  - Troubleshooting Level 2

- Field training

- Various technical support contracts
  - Hot line, field maintenance, troubleshooting…etc.
Benefits of SR500 PMP Systems

- Reliable performance in harsh environments
- Proven digital technology in over 110 countries
- Easy maintenance
- Supports a full range of interfaces for data, SCADA, and voice services
- Broad coverage with a single system (Transmit power up to +35dBm)
- System can be expanded, reconfigured, and redeployed easily
- Comprehensive Network Management System
- Efficient RF spectrum use with TDMA technology
- Low power consumption - Solar Plant supply
Benefits of SR500 PMP Systems

Flexible network structure to answer geographical or frequency constraints
Benefits of SR500 PMP Systems

System Coverage Area

- Coverage extends to 1400 km in diameter
- A single system can serve up to 511 sites using any combination of SR500 remote stations
- Up to 11 repeaters in line are possible
- Configurations can include any mix of radial, branched, or linear networks
- Sites can be added or removed without traffic interruption
Benefits of SR500 PMP Systems

System Coverage Area

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Station</td>
<td></td>
</tr>
<tr>
<td>Repeater</td>
<td></td>
</tr>
<tr>
<td>Outstation</td>
<td></td>
</tr>
</tbody>
</table>

1,400 km (875 miles)
Benefits of SR500 PMP Systems

- Network Extender Module

  - The NEM is an SR500 transceiver module option.
  - The NEM permits an SR500 central station to be linked to a downstream SR500 repeater using an existing point-to-point digital transmission link, such as coaxial cable, optical fiber or microwave radio.
  - A NEM link can use 4 T1 links (4 * 1.544 Mbps) or 3 E1 links (3 * 2.048 Mbps).
  - NEM stand-by protection is available
Benefits of SR500 PMP Systems

Network Extender Module
Applications: Pipeline Control System

Pipeline Control System in Colombia

VASCONIA
V29, V28, V27
RIO MAGDALENA
BOGOTA Headquarters
Frequency Pairs:
- F1/F1' (dotted line)
- F2/F2' (solid line)
- F3/F3' (dashed line)

400 km

SCADA Host
TENAY
V2, V3, V1

Powerstorm
Application: Electric Utility Application
SR500 - Supported Interfaces

**Standard or Compact CS**

- E1 CAS for telephony access: ITU-T Rec. G703, G704, G706, G732, G821 & G823
- E1 V5.2 for telephony access: ITU-T Rec. G965
- E1 Channelized for Data access: ITU-T Rec. G703

**Remote stations**

- POTS or payphones (metering 12 or 16kHz) on 2 wires lines
- G703 (64 kbps) Co-directional and Contra-directional data lines
- V35, X21, Ethernet 10BaseT, N * 64kbps (N =1,2, 4, 6, 8) data line

**Associated services**

- Telephony: on demand / dedicated channel – Metering, Fax, Modem
- Data services: dedicated channels for: LAN, Frame Relay CCTV networks, video-conferencing services, SCADA Remote Terminal Units (RTU)
SR500 - Supported Interfaces

**Standard Central Station**
- 2-wire analogue telephone line
- 4-wire with E&M signalling for inter-PBX or mobile trunking
- RS-232, RS4222, or V35. Synchronous / Asynchronous data interface up to 64kbps

**Remote stations**
- POTS or payphones (metering 12 or 16kHz) on 2 wires lines
- 4-wire with E&M signalling for inter-PBX or mobile trunking
- RS-232, RS422, or V35. Synchronous / Asynchronous data interface up to 64kbps

**Associated services**
- Telephony: on demand / dedicated channel – Metering, Fax, Modem
- 4-wire E&M for inter-PBX or mobile trunking
- SCADA Remote Terminal Units (RTU)
SR500 - Supported Interfaces
SR500 Central Station

- The SR500 central station equipment mounts on standard 19-inch EIA racks.
- Various rack sizes are available.
- Central station shelves accommodate plug-in modules.
- **Stand-by protection** is available for the central station’s power supplies, transceiver, and system controller.
- Standard CS Shelves can be custom-equipped for UDI, voice (2-wire or 4-wire E&M), or data interface requirements.
- The power input to the SR500 is -48 VDC nominal.
- Voice connections are made through Insulation Displacement Connections (IDC) or RJ-21X 50-pin connectors.
- Suitable for indoor installation over a temperature range of **-5 to +55° C**
SR500 Compact Central Station

- Modular power system
- Main transceiver
- Digital interfaces
- Modular controller system
- Service panel
- Stand-by transceiver
Weatherproof Out Stations

- HCO Red
- SLIM 10
- SLIM 34
- HCO 50
- HCO 100
Weatherproof Repeaters

SLIM Drop Rep

Redundant HC Rep 24
Auxiliaries for line capacity expansion

SLIM Aux 34

HC Aux 100

HC Aux 50
Weatherproof Remote Stations

• The SLIM remote stations are suitable for Outdoor (or Indoor) installations over an ambient temperature range of **-40 to +55°C**

• The appropriate remote station is selected to match line and data capacity requirements

• Stand by protection is available on HC Repeater (HC Rep 24) and HC Out station (HCO Red)

• A combination of voice and data lines can be accommodated

• SLIM and HC remote stations accommodate hot-swap modules

• Power Input options:
  • 120/240 VAC, 50/60 Hz
  • - 48 VDC
# Station Line Capacity

<table>
<thead>
<tr>
<th>Station</th>
<th>2-wires POTS Payphone</th>
<th>4-wires E&amp;M</th>
<th>Data</th>
<th>DSU</th>
<th>Ethernet</th>
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</thead>
<tbody>
<tr>
<td>SR500 Central Station</td>
<td>1024</td>
<td>256</td>
<td>256</td>
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<tr>
<td>SLIM 10</td>
<td>10</td>
<td>4</td>
<td>4</td>
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<tr>
<td>SLIM 34 / AUX 34</td>
<td>34</td>
<td>16</td>
<td>8</td>
<td>8</td>
<td>4</td>
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<tr>
<td>HCO 50 / AUX 50</td>
<td>58</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
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<tr>
<td>HCO 100 / AUX 100</td>
<td>102</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
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<tr>
<td>HCO Red</td>
<td>26</td>
<td>8</td>
<td>4</td>
<td>2</td>
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<tr>
<td>SLIM Repeater</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>-</td>
<td>-</td>
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<tr>
<td>HC Repeater</td>
<td>26</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Indoor Out Stations

- The TS-4 remote station is available for **indoor** applications.
- The TS-4 supports voice and data services.
- Power Input options:
  - 120/240 VAC, 50/60 Hz
  - - 48 VDC

<table>
<thead>
<tr>
<th>Station</th>
<th>2-wires POTS</th>
<th>4-wire E&amp;M</th>
<th>Data</th>
<th>Remote DSU</th>
<th>Ethernet</th>
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<td>TS-4</td>
<td>18</td>
<td>-</td>
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</table>
Integrated battery backup (17 Ah) is provided with SLIM 10, SLIM AUX 34, HCO50, and AUX 50 remote stations.

Battery backup for SLIM and HC repeaters, SLIM 34, HCO 100, and AUX 100 remote stations can be provided by a weatherproof power pack with the following characteristics:

- Capacity for one or two 35 Ah batteries (12 V option) or four or eight 17 Ah batteries (-48 V option)
- Integrated power converter operates from a 120/240 VAC, 50/60 Hz power source.
- AC voltage protection
- Open-door sensor alerts central station when the power pack door is opened.
- Optional battery warmer for very cold climates.
Insight Network Management System

Network management can be centralized at one facility.

Insight NMS is based on a client/server architecture and can be linked by direct or dial-up lines to each central station.

The following features can be managed with Insight NMS:

- Real-time alarm surveillance
- System performance (BER, RF Power, subscriber line integrity)
- System configuration
- Fault and maintenance management
- Security management
Insight Network Management System

Insight™ NMS can manage multiple SR500 systems.
Network design – Digital Map

• Calculation based on a Digital map up-to 30m resolution
**Network design - Path Profile**

Central station:
- Latitude: 32° 20' 56.10 N
- Longitude: 0° 47' 42.34' 60 E
- Azimuth: 24.78°
- Elevation: 156 m AGL
- Antenna CL: 24.3 m AGL

Repeater station:
- Latitude: 32° 32' 39.00 N
- Longitude: 0° 47' 48.56 E
- Azimuth: 204.85°
- Elevation: 382 m AGL
- Antenna CL: 25.3 m AGL

Frequency (MHz) = 2500.0
K = 1.33
%F1 = 60.00
Network Design – RF Link Calculation

- **Reliability method:** ITU-R P.530-9
- **Link availability complies with ITU RF 697 local grade:** 99.985%
- **Link availability objective:** exceed 99.99%

<table>
<thead>
<tr>
<th>Description</th>
<th>Chashmahkhoz</th>
<th>DP-4</th>
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<tbody>
<tr>
<td>Elevation (m)</td>
<td>150.33</td>
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<tr>
<td>Latitude</td>
<td>32.20 56.10 N</td>
<td>32.31 51.00 N</td>
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<tr>
<td>Longitude</td>
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<td>047 10 46.00 E</td>
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<tr>
<td>True azimuth (°)</td>
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<td>Vertical angle (°)</td>
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<td>Antenna height (m)</td>
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<td>Antenna gain (dB)</td>
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<td>Antenna Azimuth (°)</td>
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<td>Path length (km)</td>
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<td>Atmospheric absorption loss (dB)</td>
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<td>Net path loss (dB)</td>
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<td>TX power (watts)</td>
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<td>RX signal (dBm)</td>
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<td>Thermal fade margin (dB)</td>
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<td>Effective fade margin (dB)</td>
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<td>Geoclimatic factor</td>
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<td>Path inclination (°)</td>
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<td>Fade occurrence factor (Po)</td>
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<td>Annual - multipath (%)</td>
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<tr>
<td>(%) - sec</td>
<td>600.95</td>
<td>606.95</td>
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Ken, Dec 05 2008
Chashmahkhoz/DP-4.p4
Reliability Method - ITU-R P.530-9

Powerstorm