Radio Port 5

5.1 General Description

The Radio Port (RP) is the radio frequency base station that relays the communication between the user side and the operator and network side. The number of RPs and their distribution throughout a service area depend on the following factors:

- Topography of the service area
- Subscriber distribution in the service area
- Desired Grade of Service and traffic load

There are two types of RPs:

Outdoor Type RP - two versions of outdoor RPs are available: standard power and high power. The standard power RP is designed to cover up to 2.5 Km from the base station. The high-power RP extends to coverage range up to 5 Km. The outdoor RP's are weather-proof and installed on poles, buildings or traffic lights.

Indoor Type RP - is small in size and can be installed in public and semi-public houses like government offices, banks, or office buildings.

In the case of the standard power outdoor RP and indoor RP, power is provided remotely via twisted pair wire from the RPC along with the communications signals. The high power RP is powered by a local source.

The radio link between RP, FSU, SSU or PS is based on RCR STD-28 PHS technology, which defines frequency bands, protocol, and so on. The RPs are remotely programmable via software download from Netman.

Figure 5-1 shows the block diagram of a RP.

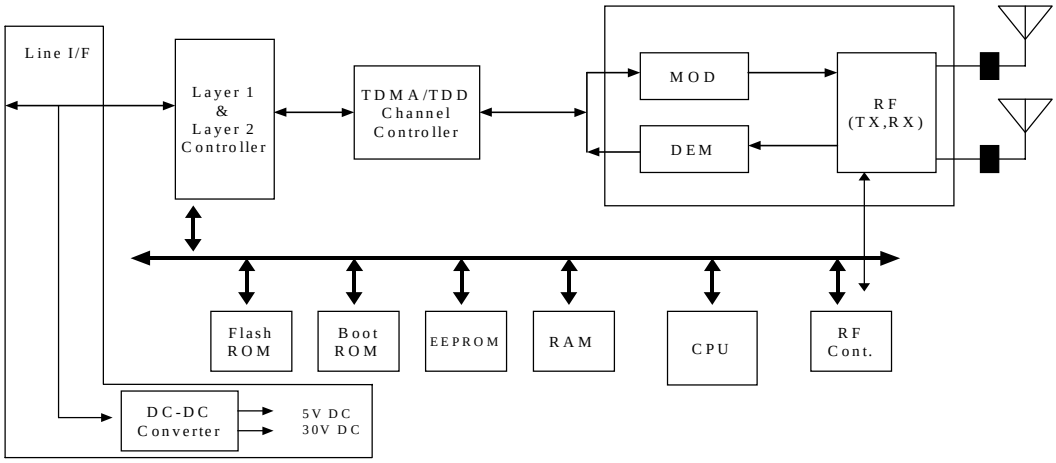

Figure 5-1- Radio Port (RP) Block Diagram

5.2 Traffic Handling

PHS applies Time Division Multiple Access (TDMA) and Time Division Duplex (TDD) techniques. Each individual radio link between an RP and FSU/PS is assigned 1 time slot for a control channel (C-Ch) and 3 time slots for traffic (speech) channels (T-Chs).

5.2.1 Stand-alone RP

In the case of an isolated RP there are 4 time slots installed for radio links. One slot is a control channel for signaling and the other three are traffic channels. The number of accommodated subscribers in that RP covering the zone calculated according to the Erlang-B model is as follows:

- Erlang per zone (3 T-chs, GOS = 99%) = 0.455 Er
- Subscribers (FSUs or PSs) (0.455 ÷ 0.08) = 6 Subscribers

5.2.2 Group controlled RPs

Using a group configuration, up to eight RPs in the same RPC share one Control Channel, which is useful for high traffic areas. One master RP can control a maximum of seven slave RPs in the same area. The master and slave RPs are designated in the RPC.

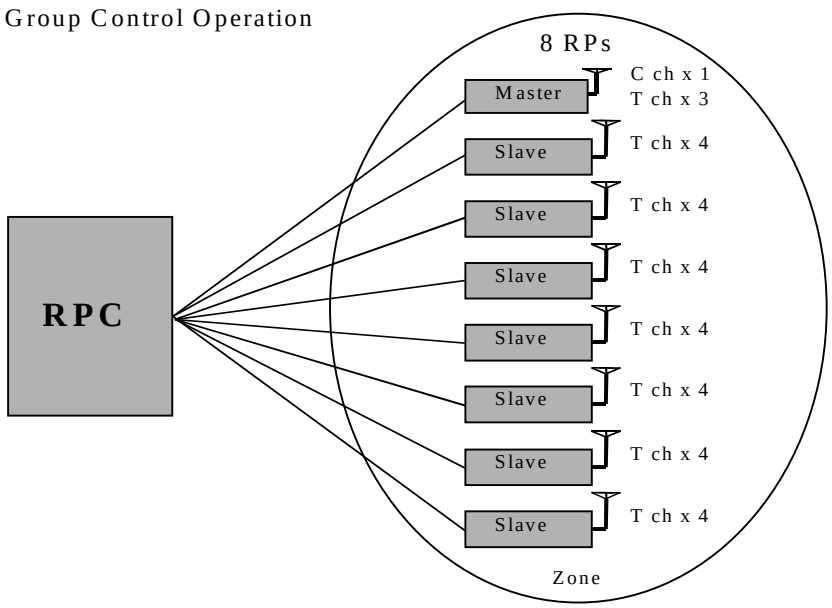

Figure 5-2 - Group Control RPs

In an eight group control mode, the number of accommodated subscribers in the group control coverage zone is calculated in accordance with the Erlang-B model as follows:

- Erlang per zone (31 T-chs, GOS = 99%) = 21.2 Er
- Subscribers (FSUs or PSs) (21.2 ÷ 0.08) = 265 Subscribers

The comparison for the number of accommodated subscribers between the group controlled RPs and non-group RPs is shown in Figure 5-3.

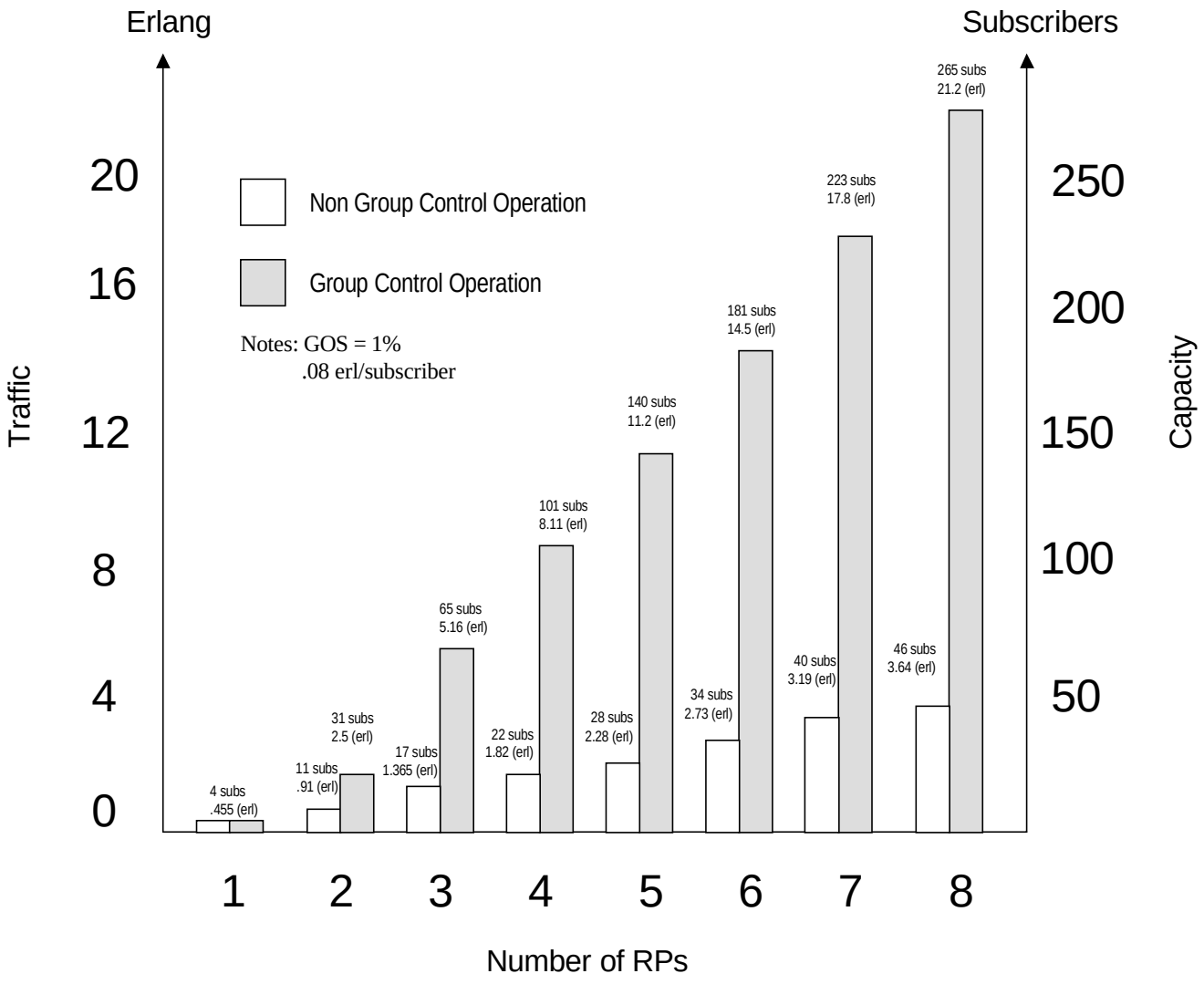

Figure 5-3 - Subscribers per RP in Group and Non-group Control

5.3 Air Interface

The radio interface has four-channel time division multiple access capability with time division duplexing (4-channel TDMA-TDD), which provides one control channel and three traffic channels for each cell station.

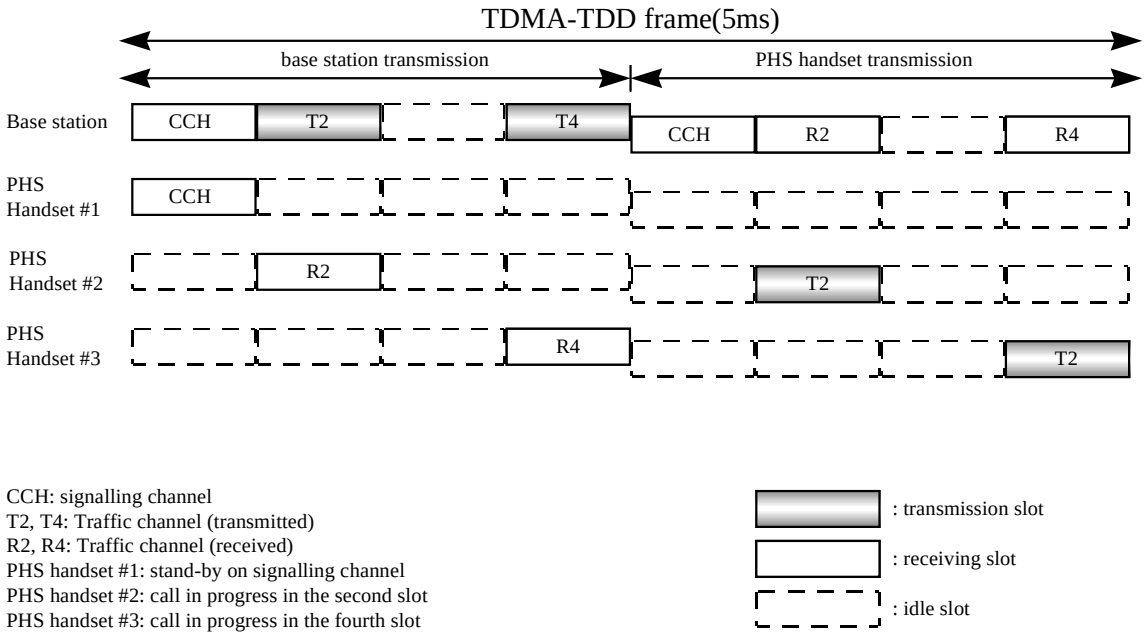

Figure 5-4 - Radio Channel Structure

The radio frequency allocation shown in Figure 5-4 displays a typical radio channel structure in which three wireless local loop subscribers are operating through a single RP. The control channel can be assigned to any of the 4 timeslots.

Traffic channel assignment is performed by the RP using a distributed-autonomous dynamic channel assignment scheme and is an essential function of the Airstar WLL radio system. Channel assignment for new communication is selected from the available channel resources mapped in a two-dimensional frequency-time matrix updated by checking signal strength and interference conditions when the call is established. A channel needs to have less than 17 dBµV to be considered available. The RP also completes handling of the signaling process over the radio link.

Due to the separation of traffic and control channels, traffic channels can be allocated in a distributed and autonomous manner by employing the switching TDMA mechanism.

In addition, when using TDMA-TDD and providing the RP with transmission and reception diversity, it is not necessary to install multiple antennae or receiver-branch diversity mechanisms in the PS handsets to improve data communication quality. TDMA enables the antennas to share both transmitting and receiving with the RF switches. To implement receiving diversity, the receiving units have two receiving branches, while the transmitting unit has switches for switching antennas to provide transmission diversity. The control channel is only transmitted on one antenna.

5.4 Distributed Antenna applications

The Radio Port provides the RX/TX timing signal in TTL format at its auxiliary port. This can be used advantageously in extending the reach of the RP through repeaters, for instance in a leaky coax distributed antenna or a discrete distributed antenna where the output of the antenna is split to multiple antennas located on different floors.

The RX/TX timing signal enables the repeater to switch amplification in either the downlink or uplink without causing instability due to feedback around the repeater. A stable TDD repeater would be much less reliable and more difficult to implement without this signal.

Given the sensitivity of the RPs, signals can be boosted to approx. 2 W with practical noise figure components.

5.5 Physical Configuration

The Indoor Radio Port is shown in Figure 5-5 and Figure 5-6.

Figure 5-5 - Indoor Radio Port

Figure 5-6: Indoor RP installed on wall

The Outdoor Radio Port is shown in Figure 5-7 and Figure 5-8.

Figure 5-7 - Outdoor Radio Port (Low-power)

Figure 5-8: Outdoor 10mW RPs installed on rooftop

5.6 Specifications

5.6.1 Radio features

Table 5-1 - Radio Features

Item	Specifications
Radio frequency	1,893.5 to 1,919.6 MHz
Carrier spacing	300 KHz
Transmit Power	10 mW (80 mW peak)
Radio access	TDMA-TDD
Number of TDMA slots	4
Modulation	π/4 shift QPSK (roll-off factor = 0.5)
Transmission bit rate	384 Kbps
Speech coding	32 Kbps ADPCM

5.6.2 Indoor RP

Table 5-2 - Specifications of the indoor RP

Item		Specifications
Receiver Sensitivity		14 dB μV
Antenna		Built-in antenna (2.4 dBi)
Diversity	RX (uplink)	Antenna selection diversity (frame by frame)
	TX (downlink)	Transmitter antenna selection diversity (2 branch)
Air interface		Based on RCR STD-28
RPC interface		Modified U Interface (4B + D + K + M)
Maximum wire line length (⇔ RPC)		3.5 km (ϕ 0.4mm) 5.0 km (ϕ 0.5mm)
Maximum power consumption		Approx. 3 W
Power source		Line power feeding (phantom) from RPC; 56 – 116 V DC
Operational Environment		
Temperature		-10 to +50 °C
Humidity		Less than 95 % (non-condensing)
Size		154(H) x 142(W) x 47(D) mm w/o antenna
Weight		Approx. 0.6 Kg
Line connection		Modular connector
MTBF		45 years

5.6.3 Outdoor RP

Table 5-3 - Specifications of the outdoor RP

Item		Specifications
Sensitivity (Static BER = 1%)		14 dB μV
Antenna (Diversity)		2 external antennae (2 branch)
Diversity	RX (uplink)	Antenna selection diversity (frame by frame)
	TX (downlink)	Transmitter antenna selection diversity (2 branch)
Air interface		Based on RCR STD-28
RPC interface		Modified U Interface (4B + D + K + M)
Maximum wire line length (⇔ RPC)		3.5 km (ϕ 0.4mm) 5.0 km (ϕ 0.5mm)
Maximum power consumption		Approx. 3 W
Power source		Line power feeding (phantom) from RPC 116 V DC
Operational Environment		
Temperature		-20 to +60 °C
Humidity		Less than 95 % (non-condensing)
Size		260 x 215 x 100 mm
Weight		Approx. 2 Kg
Line connection		Screw-less terminal
Antenna connector		N female connector on 240 mm pigtail
MTBF		45 years

Table 5-4 - The recommended antenna specifications for the outdoor type RP

Items:	Specifications
Type	Omni-directional or Directional
Gain	7 to 10 dBi
Impedance	50 Ω
VSWR	Less than 1.5
Cable	
Length	Up to 5 m
Attenuation	< 0.288 dB/m