UTStarcom

User's Manual

January, 2003

Definition & Acronyms

ACS	Adaptive Cell Station
ADPCM	Adaptive Differential Pulse Code Modulation
ATC	Air Traffic Controller
BRI	Basic Rate Interface
CCM	CS Control Module
CDR	Call Description Record
CO	Central Office
CS	Cell Station
RPC	CS Controller
CSIF	CS Interface Module
DDF	Digital distributed Frame
DTMF	Dual Tone Multi Frequency
DWRT	Data Wireless Remote Terminal
E1-IF	E1 Interface Module
E1MW	W1 Module Wireless
EBAM	Extension Bus Adapter Module
ECNT	Enhanced Main Control Card
FDDI	Fiber Distributors Data Interface
FSK	Frequency Shift Keying
FSU	Fixed Subscriber Unit
FXOW	Foreign exchange Office Wireless
GND	Ground
HGND	Protection Ground or High-voltage Ground
HLR	Home Location Register
IP	Internet Protocol
LE	Local Exchange
LED	Light Emitting Diode
MCU	Monitor and Control Unit
MDF	Main Distributed Frame
NMS	Network Management System
OAM&P	Operation Administration Maintenance and Provisioning
PAS	Personal Access System
PC	Personal Computer
PDP	Power Distribution Panel
PGT	PAS Gateway Terminal
PGTC	PAS Gateway Terminal-Central
PGTS	PAS Gateway Terminal-Satellite
PHS	Personal Hand phone System

PIAFS	PS-PHS Internet Access Forum Specification
PS	Personal Station
PSM	Power Supply Module
PSTN	Public Switched Telephone Network
QFE	Quad Fast Ethernet Card
RCM	Roaming Control Module
RF	Radio Frequency
RP	Radio Port
RPC	Radio Port Controller
RP-IF	RP Interface Module
RT	Remote Terminal
RX	Receiving Data
RxD	Receive Data
SATC	Server-based ATC
SCMW	System Control Module Wireless
TCM	Traffic Control Module
TE1M	Traffic E1 Module
TX	Transmitting Data
TxD	Transmit Data
VLR	Visitor Location Register

Overview

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1. Overview

ACS (Adaptive Cell Station, i.e. ACS) is a kind of wireless equipment. The ADPCM signals from the RPC□ACS controller□ enter into the standard 2B+D interface via twisted pair wire; The signals are transmitted in the form of radio frequency modulation wave, which makes up a wireless link between the ACS and PS (Personal Station). The link provides voice/data communications to terminal subscribers via RPC, central terminal equipment and central switch office. In terms of wireless communication, the ACS provides RCR STD-28 air interface.

It applies Time Division Multiple Access (TDMA) and Time Division Duplex (TDD) techniques. Each individual radio link between the ACS and FSU/PS is assigned 1 time slot for a control channel (C-Ch) and 3 time slots for traffic (speech) channels (T-Chs). The C-channel time slot of RCR STD-28 does not need to be specially located, so, in the system, any one of the 4 time slots can be selected as the control time slot.

ACS Type

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2. ACS Type

In terms of the installation environment, ACSs are sorted into Indoor ones and Outdoor ones.

2.1 Indoor ACS

Indoor ACS is installed in the wall and ceiling of the place like hotel, government building, bank. It provides the services of PS, telephone and data terminal in the building. It has two antennas that are connected with the main body.

The indoor ACS is shown in Figure 2-1.

Figure 2-1 indoor ACS

2.2 Outdoor ACS

As per the number of ACSs connected, Outdoor ACSs can be sorted into Singe-ACS outdoor type and 4-ACS outdoor type.

2.2.1 Singe-ACS outdoor type

Singe-ACS outdoor type is usually installed on sidewall, top of the building. It is waterproof, need not to be maintained which has with high reliability. Its antennas are usually placed at high positions, so that the coverage area can be relatively larger.

This type of ACS is line-powered over ordinary twisted-pair cabling from RPC, so no joint box is needed. It adopts 2-antennas diversity. Please refer to Chapter 4 for detailed information.

The Singe-ACS outdoor type is shown in Figure 2-2.

Figure 2-2 Singe-ACS outdoor type

2.2.2 4-ACS outdoor Type

For this type of ACS, 4 single-ACSs are placed in a waterproof case. It adopts group control mode as well as 4-antennae diversity.

These ACSs are usually installed on pole, top of the building. The antennae of 4-ACS outdoor are generally placed at high positions, so that the coverage area can be relatively larger. It is also waterproof, need not to be maintained which has with high reliability.

This type of ACS is line-powered over ordinary twisted-pair cabling from RPC, so no joint box is needed. It adopts 4-antennas diversity. Please refer to Chapter 4 for detailed information.

The 4-ACS outdoor type is shown in Figure 2-3.

Figure 2-3 4-ACS outdoor Type

2.3 ACS Antenna

The ACS adopts omni-directional antenna or other kind of antenna. Details of the ACS antenna capabilities are depicted in its technical specifications.

Technical Introduction

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3. Technical Introduction

3.1 ACS Coverage Range

For ACS installation, the quantity and distribution of ACSs are affected by the factors below:

- Geographical condition of the service area
- Subscriber distribution in the service area
- Expected traffic and service quality

3.1.1 Wireless Signal Transmission Mode

The frequency range of the PAS system is 1.9GHz which belongs to WIRELESS LOCAL LOOP system; the wavelength is about 16cm, which is far shorter than the building. The electric wave is poor at diffraction; the direct wave and reflect wave are more intense than the diffraction wave. Figure3-1 shows the direct and reflect of the electric wave in the urban area, where buildings are concentrated.

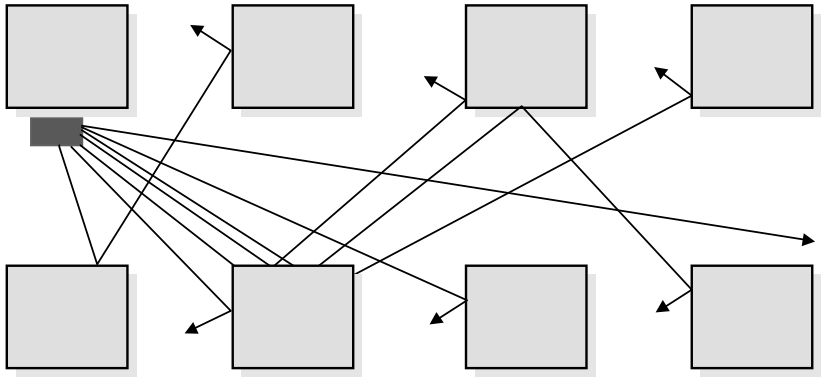

Figure3-1 Transmission Mode in Urban Area

The ACS coverage range in urban area is different from that in suburban area. Moreover, the ACS coverage range is also influenced by the antenna height; the higher is the antenna, the wider is the coverage range.

3.1.2 Micro-zone Overlap

The service will be the best if ACSs are installed as per the micro-zone overlap structure.

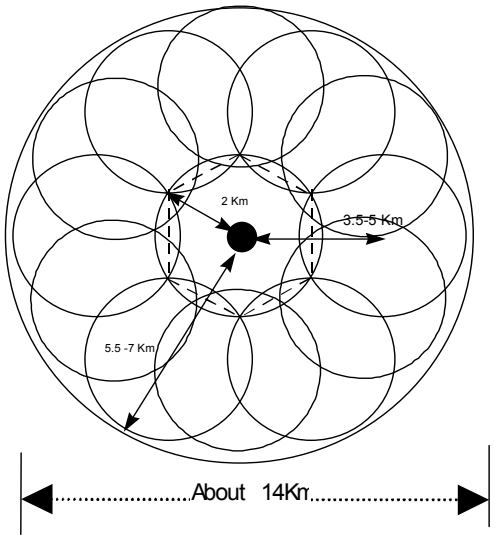

Figure3-2 Coverage Area in Micro-zone Overlap Structure

The application of micro-zone overlap and dynamic channel allocation makes the system more flexible and enlarges the system capacity. Because the ACSs are installed considering coverage overlapped, subscribers can use all the channels while calling or called. Thus, the micro-zone overlap structure enhances the system reliability and quality of service. Even if a ACS is broken down, the system capacity will not be affected. Due to its dynamic channel allocation, operators' requirements can be easily satisfied without frequency planning, which is also convenient for expansion.

3.2 Traffic Management

3.2.1 Stand-alone ACS

In the case of an isolated ACS 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 ACS covering the zone calculated according to the Erlang-B model is as follows:

Erlang per zone: (3 T-chs, GOS=5%) = 0.899 Er

Subscribers (FSU or PSs): (0.899 ÷ 0.05) = 18 Subscribers

3.2.2 Group controlled ACSs

Using a group configuration, up to eight ACSs in the same group share one Control Channel, which is useful for high traffic areas. One master ACS can control a maximum of seven slave ACSs in the same area. The master ACS has one control channel while the left 31 channels of these 8 ACSs are for traffic channels.

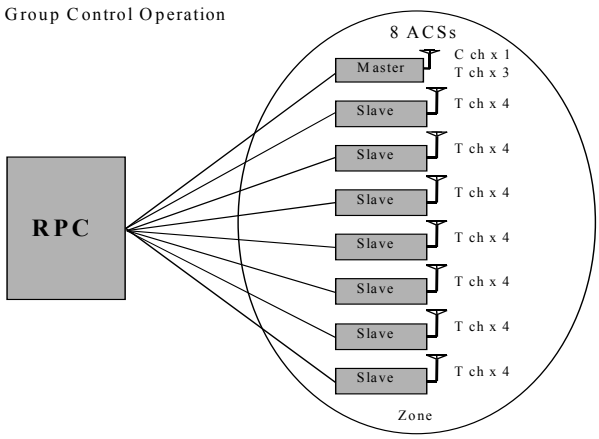

Figure3-3 Group Control ACSs

In an eight ACSs 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=5%) = 25.773 Er
- Subscribers (FSU or PSs): (25.773 ÷ 0.05) = 515 Subscribers

The comparison for the number of accommodated subscribers between the group controlled ACSs and non-group ACSs is shown in Figure3-4.

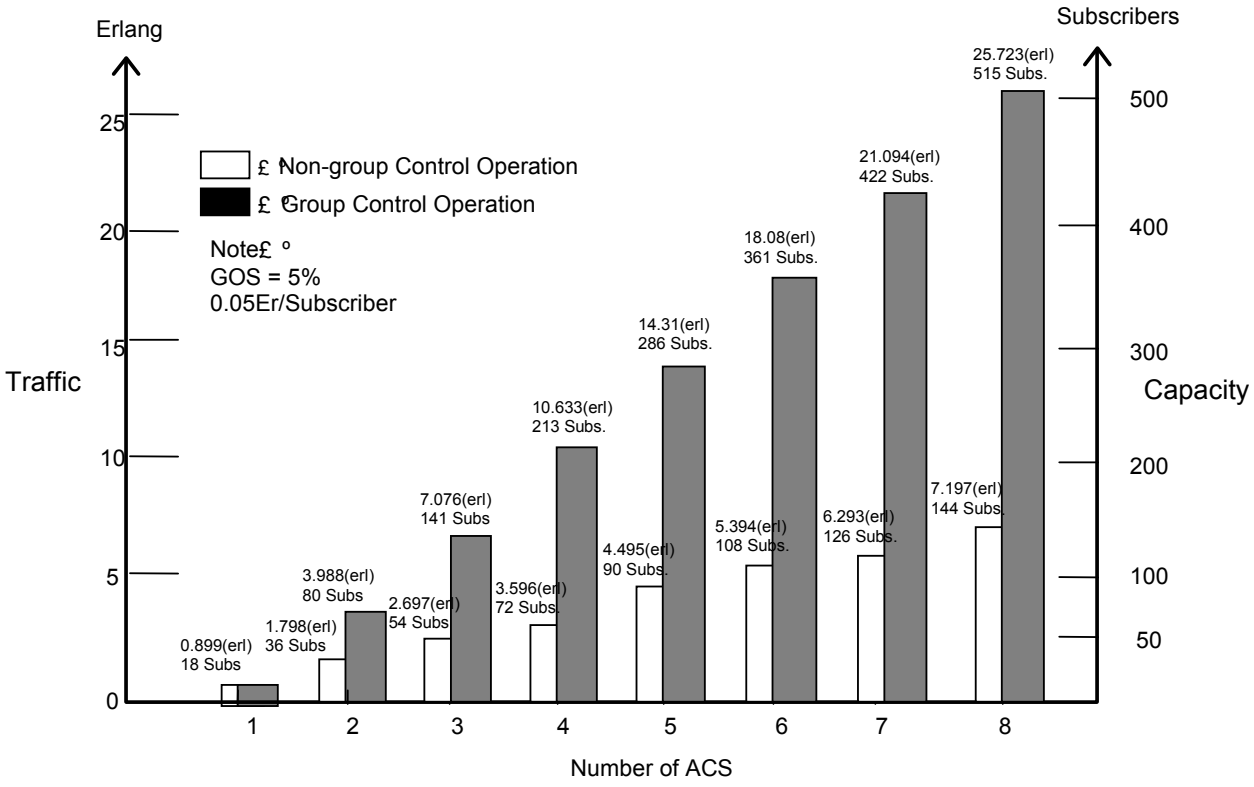

Figure3-4 Subscribers per ACS in Group and Non-group Control

The deployment of ACSs are decided by the subscribers distribution:

- In the area consist of clusters of small populations. Non-group method (i.e. Stand-alone ACS control mode) is introduced to use.
- In the area of high-density populations. Group control mode is highly recommended to use.

3.3 Air Interface

Each ACS provides one C-channel and 3 T-channels.

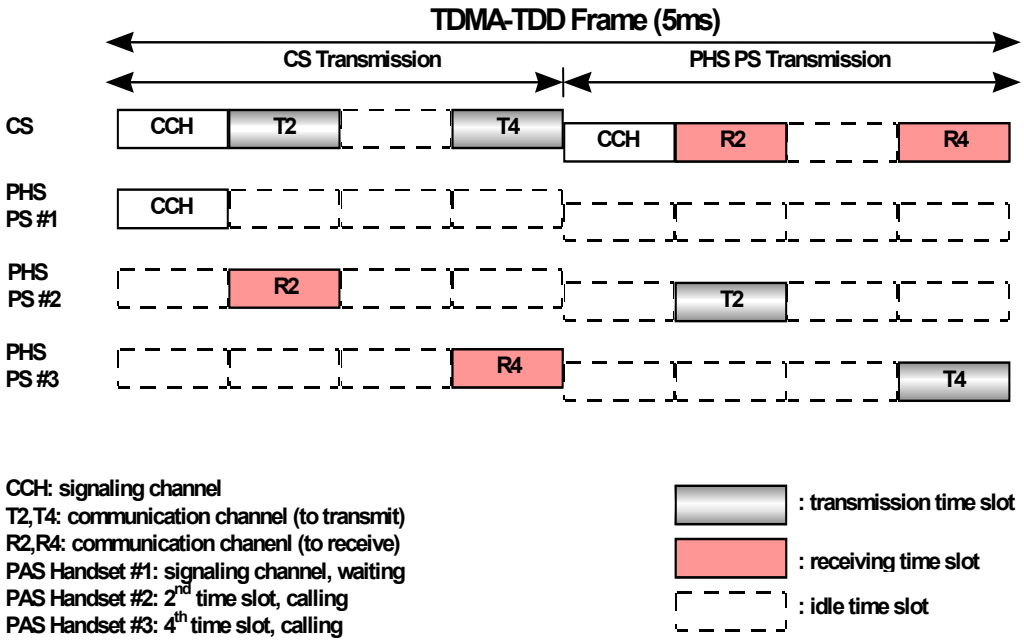

Figure3-5 Wireless Channel Frame Structure

The radio frequency channel allocation diagram shown in Figure3-5 depicts a typical wireless channel structure, where, 3 subscribers can communicate in single ACS control mode.

The channels are not preassigned; channels are allocated automatically by a dynamic channel allocation system. It is an outstanding feature of the PAS system. With a settled algorithm, the system dynamically chooses a frequency from the available frequency resources as the communication carrier frequency, and timely adjusts the frequency as per the signal disturbance. In this sense, the PAS system is a slow frequency-hopping system.

3.4 Synchronization Technology

The ACS in the system adopts air synchronization technology. Master ACS synchronizes with other master ACSs via GPS. By receiving the air synchronization signal from master ACS, slave ACS synchronize with master ACS. For RPC synchronization solution, please refer to “GSG2 user guide”.

3.5 Self-Adaptive Mode

ACS is a kind of self-adaptive CS, which can adjust its transmission power. The transmission power ranged from 0mW to 200 mW can be adjusted on-line.

3.6 ACS Operation Mode

ACS adopts the sending after detecting operation mode (receiving then sending). Before sending signals, ACS detects the utilization of the surrounding WIRELESS LOCAL LOOP radio channels. According to the signal strength of

the occupied channel, ACS will appropriately assign the new voice channels. The unoccupied channels and channels with low signal strength are preferred to be taken as the new voice channels. Thus, the newly built WIRELESS LOCAL LOOP system will not affect the normal running of other systems. Moreover, the new system can easily come into use, so that the limited WIRELESS LOCAL LOOP frequency resources can be exploit scientifically and reasonably.

4. Technical Specifications

Table4-1 Indoor ACS Technical Specifications

Item		Specifications
RF average output power		40mW (peak 230mW)
Modulation		Pi/4 QPSK
Frequency		1880.15 MHz --- 1909.85 MHz
Dynamic sensitivity		≤-97dBm
Antenna (diversity)		Indoor antenna (2 branches) 2.14dBi
Air interface		Based on RCR STD-28 release 2/3.3
RPC interface		2B+D
Voice encoding rate		32kbit/s (ADPCM)
Maximum connection length from RPC to ACS		3.5 km(ϕ0.4mm) 5 km (ϕ0.5mm)
Power		4 W
Operating requirements	Temperature	-10°C~50°C
	Humidity	<95% (no condensing)

Table 4-2 Outdoor Type Technical Specifications

Item	Specifications
RF average output power	40mW (peak 230mW)
Dynamic sensitivity	≤-97dBm
Modulation	Pi/4 QPSK
Frequency	1880.15 MHz --- 1909.85 MHz
Antennae (diversity)	Outdoor antenna (2 branches) 7.2dBi/4.5dBi
Air interface	Based on RCR STD-28 release 2/3.3
RPC interface	2B+D
Voice encoding rate	32kbit/s (ADPCM)

Item		Specifications
Maximum connection length from RPC to ACS		3.5 km(ϕ0.4mm) 5 km (ϕ0.5mm)
Power		4 W
Operating requirements	Temperature	-10°C~50°C
	Humidity	<95% (no condensing)

US Federal Communications Commission (FCC) Warnings:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device cannot be collocated with other transmitter.

RF Exposure Statement:

To maintain compliance with the FCC`s RF exposure guidelines, please keep the device at least 20cm from human body