

Packet Data Terminal for Telemetry “DoPa Mobile Ark 9601P”

For the purpose of using DoPa for metering and monitoring applications, DoCoMo has developed a box type terminal called DoPa Mobile Ark 9601P.

In this article, we would like to examine DoPa Mobile Ark 9601P in detail with specific examples of how the terminal is implemented in the market.

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Introduction

DoCoMo's packet communication service (DoPa) has been providing the service with a normal cellular phone type terminal used also for voice communications. However, there are user demands to use DoPa in the telemetry system and the system requiring machine communication to get the most out of DoPa. In order to meet such user demands and enable to use DoPa in applications of this field, we have developed a box type single packet (9,600bit/s) dedicated mobile terminal “DoPa Mobile Ark 9601P”. The exterior of DoPa Mobile Ark 9601P is shown in Picture 1.

In this article, we explain main specifications (Table 1), hardware and software configurations, functions of DoPa Mobile Ark 9601P (hereinafter referred to as Mobile Ark) and application examples of the system using this equipment.

Configuration of the Equipment

Configuration of the equipment is almost the same as that of PDC system mobile station (Figure 1).

The differences between the DoPa series terminals for voice communication and enabling 28.8kbit/s full slot packet communication (301, 302) and Mobile Ark are as follows [1].

① Since the transmit slot is 1 slot, a common transmission and reception device to transmit and receive the whole slots simultaneously shall not be necessary and cooling measures can easily be taken. As for a wireless part, the same parts as Digital mova series can be used, thus being able to shorten the development time.



Picture 1 DoPa Mobile Ark 9601P

- ② Number of components were reduced because it has no voice communication interface. By equipping DTE (Data Terminal Equipment) interface (RS-232C), it has made to allow the direct connection to personal computers, etc. Also, by adopting the industry standard TCP (Transmission Control Protocol)/IP (Internet Protocol) as communication protocol, it has become possible to use the communication software developed on the PC without any changes [2].
- ③ The antenna can still be used only with the one side system (TRx side) connection when stable electric field strength can be obtained like equipment installation. This was confirmed by a small simplified antenna which was developed at the same time. As for connector part, TNC connector was selected so that the external antenna that has currently been under commercial use can be used.
- ④ As for power supply system, we have decided to have the power supply only from the outside. Assuming the

Table 1 Specification of DoPa Mobile Ark 9601P

Communications System	PDC (Personal Digital Cellular Telecommunication System) Packet communication system (Communication speed 9600bit/s)
Communication Function	Only for packet communication (No terminals for microphone for voice communication, speaker, earphone, etc.)
Data Interface	Mobile DP card 2896P2 equivalent (packet communication function only)
Power Switch	Slide switch (External control is possible under power ON state.)
3 Pin Power Connector	Rated voltage : DC5.0±0.25V Rated current : 800mA or more Power control terminal
Data Terminal Equipment (DTE) Interface	RS-232C Dsub9 pin AT command compatible modem Driver supports standard modem 0.3~19.2kbit/s
16 Pin Connector	For power supply use (Optional AC/DC adapter connection) For maintenance use
Antenna Connector	TNC connector ×2 for external antenna (1 for TRX, 1 for reception only) (no build-in antenna)
LED (Light Emitting Diode) Display	Power, Within packet service area, Connecting, SD (Sending data), RD (Receiving data)
Dimensions and Volume	Approx. 106mm (W)×80mm (D)×26mm (H) Approx. 220cc
Weight	Approx. 250g
Surrounding Environment Conditions	Assured temperature -20°C~+70°C Operational temperature -20°C~+60°C Operational humidity 20%~90%

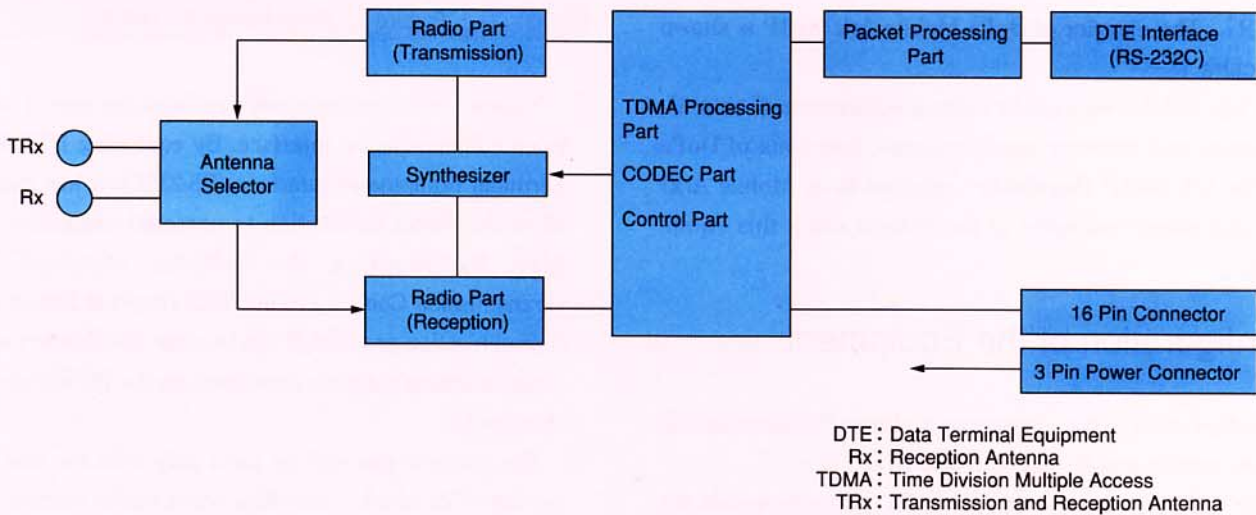
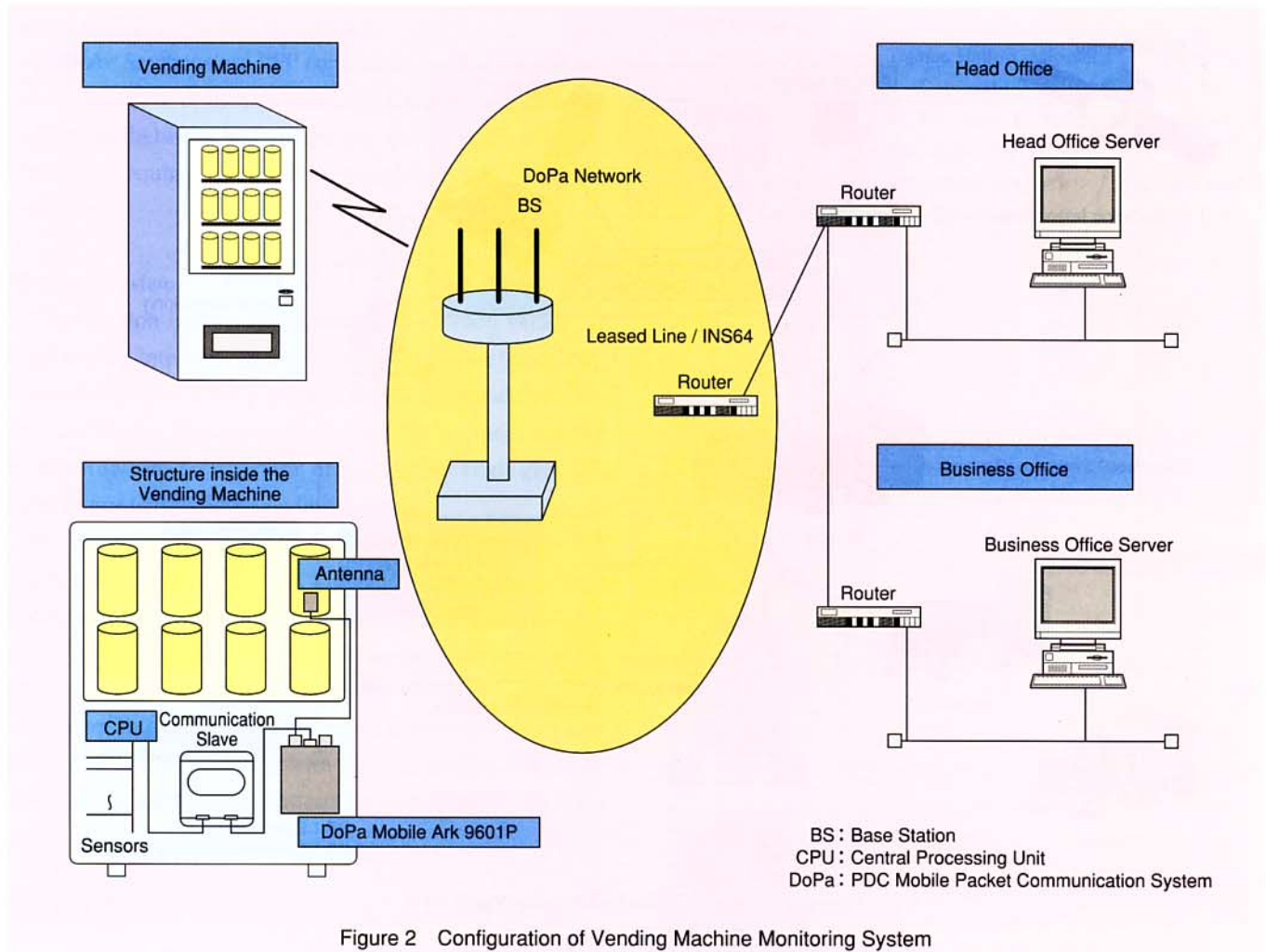


Figure 1 Configuration of DoPa Mobile Ark 9601P

power control will be remotely installed, we have selected a slide switch which enables to turn the power on without touching it so as to minimize effects of power shutdown such as in the case of outage.

Application Example 1 (Vending Machine Monitoring System)

First, we would like to introduce the vending machine monitoring system as an example of the system using



Mobile Ark.

The vending machine monitoring system is used to monitor sales of soft drink, etc. on-line from a remote center, take statistics of the sales trend, make distribution planning, etc. by having the communication equipment built into each vending machine.

This system has been partly implemented by using no-ringing line, etc. However, there are such problems as the expense for wiring work with the moving of the vending machine, or the lease of the line at the installation site. Accordingly, DoPa using Mobile Ark was introduced as a measure to solve these problems and is now expected to be successful.

In the following, we explain the equipments comprising the system. Also, system configuration is shown in Figure 2.

■ Vending Machine

(1) Mobile Ark

Mobile Ark is a box type mobile station. By developing small mobile station, it has become possible to install the

mobile station in the vending machine where space is limited. Also, with the introduction of the external antenna, general versatility of the installation site has improved.

(2) Antenna

Due to the development of micro antenna as an external antenna connected to Mobile Ark, it has become possible to install the antenna to the location that is invisible from the outside appearance.

(3) Communication slave

This is the unit which connects the vending machine and Mobile Ark.

It conducts data collection of vending machine PPP (Point to Point Protocol) connecting origination and termination of Mobile Ark, termination of TCP/IP and power supply.

■ Center System

Collection and edit of sales data of each vending machine, delivery to business offices, distribution planning are conducted by the center system.

Introduction of Mobile Ark has enabled communications

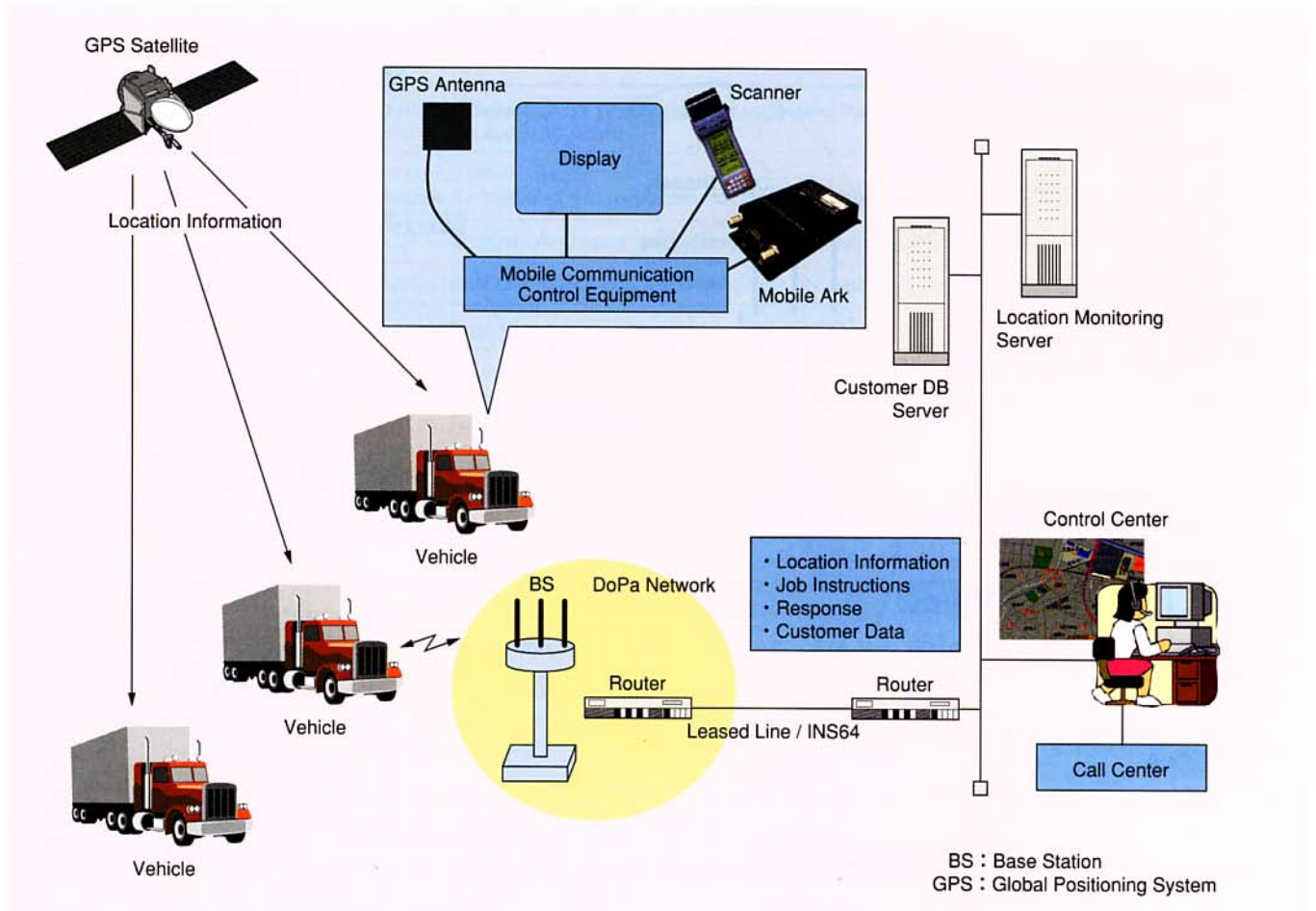


Figure 3 Location / Monitoring System with GPS

with multiple vending machines to be made almost simultaneously, thus the process time has become shortened.

Application Example 2 (Location and Monitoring System with GPS)

The second example of the system using Mobile Ark is location and monitoring system with GPS. In this system, the center collects the vehicle location information and the information about switch, sensor, etc. installed in vehicles at regular time intervals and puts them under the centralized control. By doing so, it becomes possible to give vehicles for business use a proper dispatch instruction or to grasp the work progress on-line in the center system.

Previously, systems using MCA radio or special wave were constructed. However, because of the facts that the information from vehicle is intermittent and that widespread mobility is required, DoPa's such advantages as charge on an as-used basis and nationwide service area are appreciated, rapidly increasing the cases of the system with DoPa is rapidly increasing.

In the following, the equipments comprising the system shall be explained. Also, system configuration is shown in Figure 3.

■ Vehicle Side Equipments

(1) Mobile Ark

Mobile Ark sends location information, status information and information from various sensors to the center and receives job instructions from the center.

(2) GPS receiver

GPS (Global Positioning System) receiver is equipped as a measure to keep track of the vehicle location. Latitude, longitude and accurate time information received from GPS satellite can be obtained.

(3) Peripheral equipments

Such input and output equipments as button type switch handy terminal, small printer, liquid crystal display, etc. to show the work progress are included.

(4) Mobile communication control equipment

This is a communication control equipment which mediates the information of Mobile Ark and GPS receiver and the

data of various peripheral equipments.

Software functions are PPP connecting origination and termination control of Mobile Ark, power supply, and protocol conversion between non-procedure and TCP/IP. RS-232C interface is equipped and various peripheral equipments are connected.

■ Center System

The location information collected from each vehicle at regular time intervals shall be plotted on an electronic map thereby enabling to keep track of the location and the moving conditions. According to the vehicle location and the work situation, an operator of the center shall give job instructions to the corresponding vehicles.

Not only the vehicle location and the work situation, but also the bar code information, the information of the vehicle speed and temperature sensors can be put together at the center, enabling to implement a comprehensive logistics system.

Also, an application for the effective customer support window-service by interlocking with CTI (Computer Telephone Integration) technology is attracting considerable attention today.

Closing

In this article, we described the equipment outline and application examples of Mobile Ark 9601P that has started the service in our packet communication service.

We shall strive for the development of the mobile terminals and application systems, giving consideration to user demands and market trends.

References

- [1] Takami, Nakatsuchi, Yajima, Hattori, Miyashita : "Special Issue for Mobile Packet Communication System ' Mobile Station/Card' " , NTT DoCoMo Technical Journal Japanese Version Vol.5, No.2, pp.34-42, Jul.1997.
- [2] NTT Mobile Communications Network : "DoCoMo Packet Communication Service 'Reference Material for using DoPa' " March.1997.