

# Special Article on Satellite Packet Communication Service

## Mobile Terminal

A cost-effective and high-speed packet communication service has been added to DoCoMo's current Satellite Mobile Communication Service using the communication satellite N-STAR.

This article outlines the functions of the newly developed mobile terminal that supports this service.

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### 1. Introduction

DoCoMo has been providing voice, 4800bit/s data, and fax communication services via satellite ship phone for maritime use and satellite mobile and car phones for land use. However, the demand for high-speed data communications and remote measurement systems is increasing. Accordingly, to provide these service, a new mobile terminal equipped with a packet communication function "Satellite Phone DoPa N21" was launched in March 2000.

In this article, specifications, hardware and software configurations, and functions of this mobile terminal, which supports the Satellite Packet Communication Service, are described in the following.

### 2. Overview of the Mobile Terminal that supports the Satellite Packet Communication Service

With the addition of a packet communication function, the configuration of the developed mobile terminal "Satellite Phone DoPa N21" is based on the existing mobile terminal [1], which supports the Satellite Mobile Communication Service. The packet communication function mounted on DoPa N21 supports maximum user communication rates 64kbit/s for forward link, and 4.8kbit/s for return link data transmission. Dopa N21 also has voice, 4800bit/s data and fax communication functions. The radio interface of DoPa N21 complies with ARIB STD-T49 Ver. 2.0. The packet communication function supports the Satellite Packet Communication Service (DoPa) provided by DoCoMo. The

configuration of DoPa N21 is such that the existing antenna and handset can be used. The appearance is shown in Photo 1.

The Data Terminal Equipment (DTE) is used to utilize the packet communication service with DoPa N21. The use of DTE enables the Satellite Mobile Communication System to be expanded in the future. By direct connection of a PC (Personal Computer) to the RS-232C interface, Internet and Intranet access via an Internet Protocol (IP) are provided by connection to the DoCoMo packet communication network by a Point-to-Point Protocol (PPP) using general-purpose dial-up connection software. The protocol stack of DoPa N21 is shown in Figure 1, and its specifications are listed in Table 1.

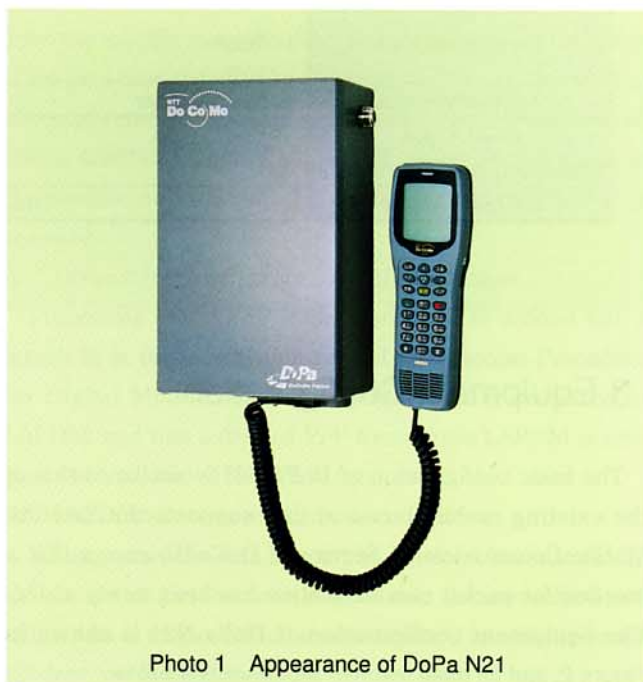


Photo 1 Appearance of DoPa N21

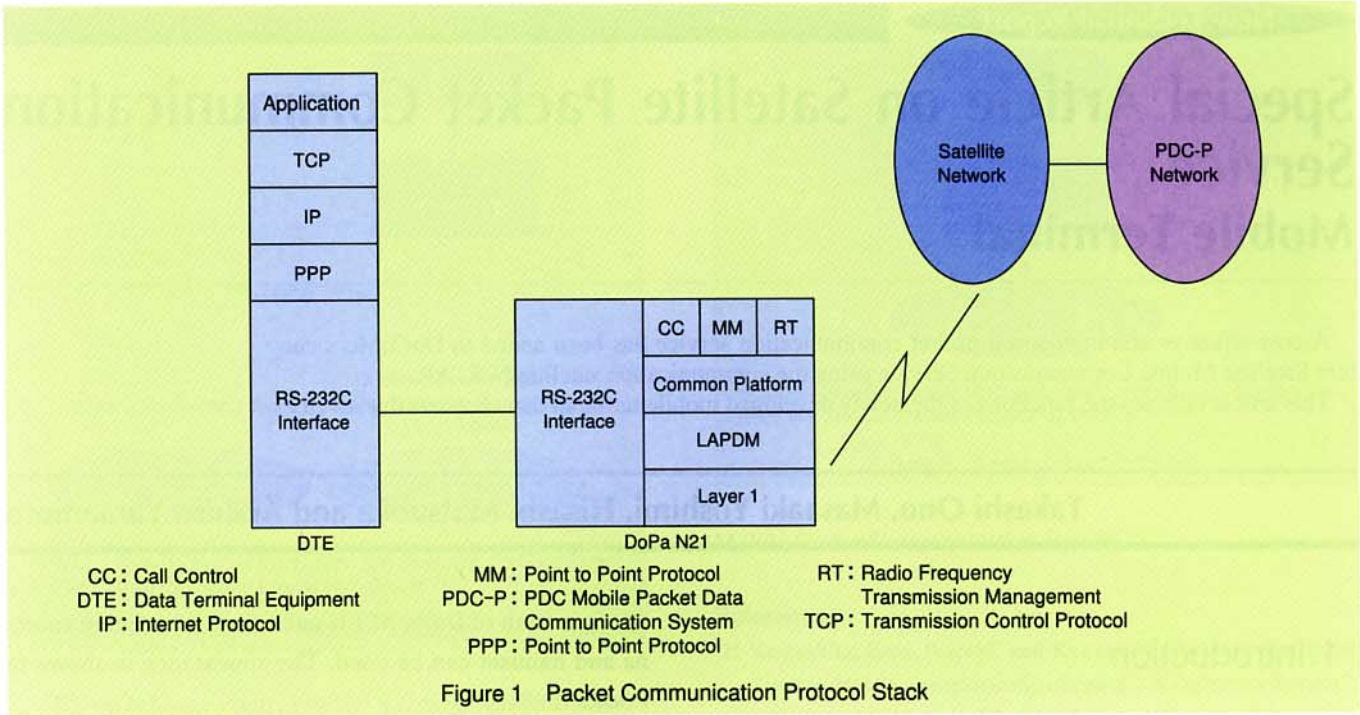


Table 1 Major Parameters of DoPa N21

Item	During Voice, Fax, and Data Communications	During Packet Communication
Frequency Band	Reception Frequency : 2.505~2.535GHz Transmission Frequency : 2.660~2.690GHz	
Frequency Bandwidth	12.5kHz/carrier	150.0kHz/carrier (Reception) 12.5kHz/carrier (Transmission)
Access Method	FDMA	TDM (Reception) FDMA (Transmission)
Transmission/Reception Frequency Interval	155MHz (fixed)	155MHz (variable)
Maximum transmission power	2W	
Modulation	$\pi/4$ shift QPSK	
Transmission Rate	14.0kbit/s	154.0kbit/s (Reception) 14.0kbit/s (Transmission)
Terminal Interface	10-core connector	RS-232C, D-sub 9 pin male
Power Supply	DC10.5V~35.0V	
Maximum Consumption Current	Approx. 8A (during 10.5V input)	
Dimension/Weight	Dimension : 250×155×88mm, Weight : Approx.4kg	

FDMA : Frequency Division Multiple Access  
QPSK : Quadrature Phase Shift Keying  
TDM : Time Division Multiplex

### 3. Equipment Configuration

The basic configuration of DoPa N21 is similar to that of the existing mobile terminal that supports the Satellite Mobile Communication Service of DoCoMo except that a function for packet communication has been newly added. The equipment configuration of DoPa N21 is shown in Figure 2, and its main features are described below.

#### 3.1 Hardware

##### (1) Radio unit for packet communication

Since the reception system receives signals of 64kbit/s (forward link user) maximum rate during packet communication, a synthesizer and a reception unit for packet data have been added. During packet communication, the 4800 bit/s data, and fax data reception unit is switched over to the packet reception unit by the switching device. This reception unit for packet data provides Data Operated Transmission

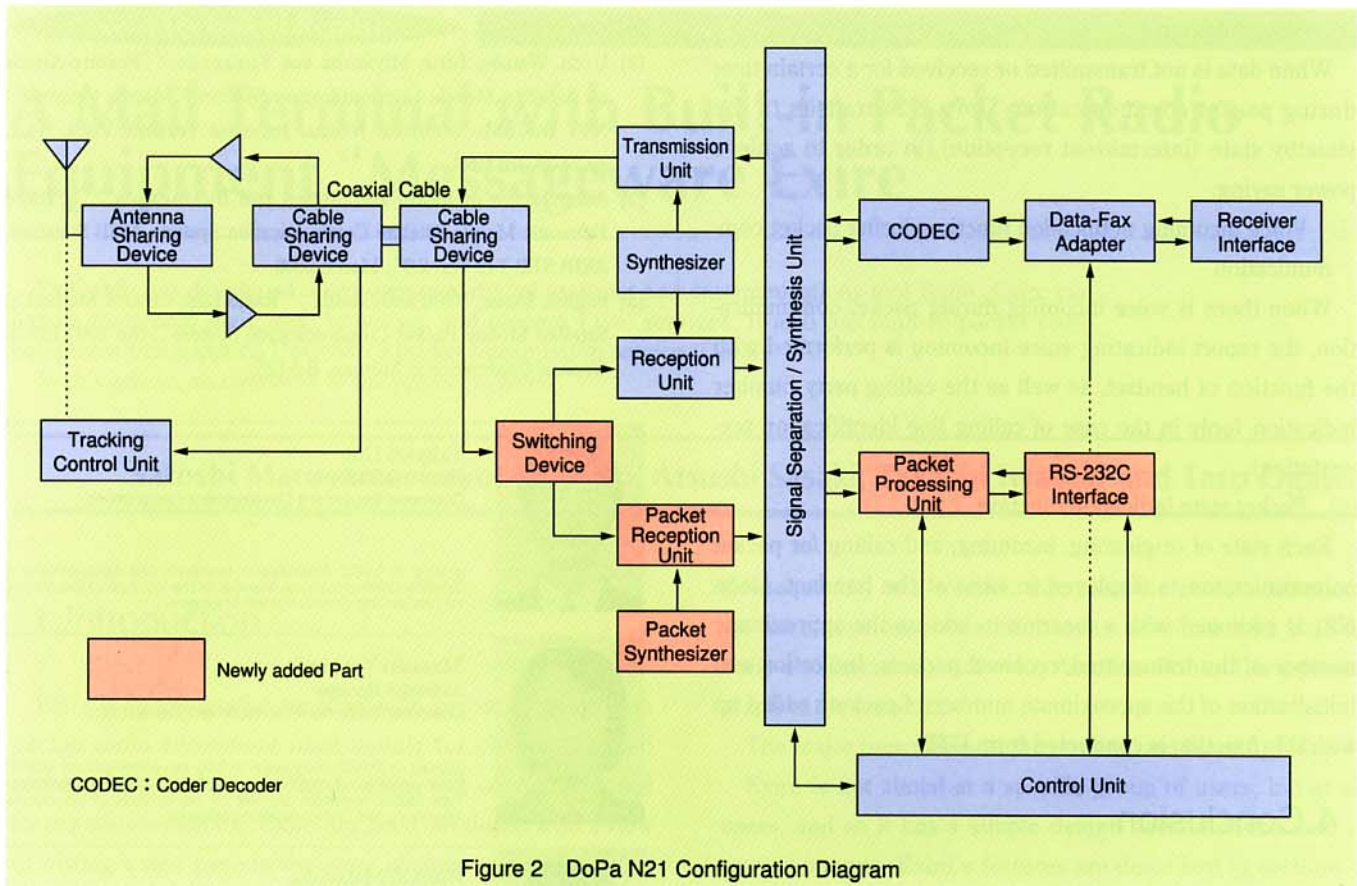


Figure 2 DoPa N21 Configuration Diagram

(DOX) control, by which Satellite Packet Modulation and Demodulation Equipment (SPMDE) conducts on/off control of transmission according forward link data, in order to achieve effective usage of satellite power. In addition, the transmission system of packet data is shared with the transmission unit for voice, 4800bit/s data, and fax communications.

#### (2) Packet processing unit

The processing unit conducts division/coupling processing of PPP frames and processing in conformity to the specification Satellite Packet Communication System Radio Interface (ARIB STD-T49 Ver. 2.0).

#### (3) RS-232C interface

To provide high-speed data transmission of 64kbit/s forward link user maximum rates during packet communication, a DTE rate of 115.2kbit/s and hardware flow control are used. According to these measures, DoPa N21 and PC etc operate as the relationship between Data Circuit-Terminating Equipment (DCE) and DTE.

#### (4) Antenna and antenna interface

To reduce costs and shorten the development period, the existing tracking antenna is used. Consequently, the antenna interface complies with the existing tracking antenna interface.

### 3.2 Software

#### (1) Channel allocation/release request processing

The Satellite Mobile Packet Communication System uses a standard method for allocating the return link packet channels [3]. When data is transmitted from the DTE, a channel allocation request is made to the satellite network. Data is transmitted over the return link packet channel allocated from the satellite network. After data transmission, the timer is set (to a time specified by the satellite network) to hold the allocated return link packet channel. If no data is transmitted before timer expiration, a channel release request is made to the satellite network and the return link packet channel is released.

#### (2) Division/coupling processing of PPP frames

Processing that a PPP frame from DTE is divided into a length fit in the information field of Link Access Procedure for Digital Mobile channel (LAPDM) and transmitted to LAPDM, and that a divided PPP frame from LAPDM is coupled and transmitted to DTE is conducted.

#### (3) LAPDM selective retransmission function

When part of the data can not be received because of signal errors (etc.) in the radio section, only the unreceived part of the data is requested to be retransmitted in order to make efficient use of radio channels.

(4) Sleep function

When data is not transmitted or received for a certain time during packet communication, DoPa N21 transits to the standby state (intermittent reception), in order to achieve power saving.

(5) Voice incoming notification function during packet communication

When there is voice incoming during packet communication, the report indicating voice incoming is performed with the function of handset, as well as the calling party number indication (only in the case of calling line identification presentation).

(6) Packet state indication function

Each state of originating, incoming, and calling for packet communication is displayed in kana at the handset. Dopa N21 is equipped with a function to add up the approximate number of the transmitted/received packets. Indication and initialization of the approximate number of packets added up with this function is conducted from DTE.

## 4. Conclusion

In this article, the mobile terminal that supports the Satellite Packet Communication Service has been described. The Packet Communication Service (DoPa) provided by DoCoMo covers all the land and ocean territory of Japan. And user-friendly mobile terminals with more functions are currently being developed according to market demands.

## References

- [1] Ueda, Watabe, Nitta, Miyashita and Yamamoto : "Feature Article on Satellite Mobile Communication System : Mobile terminal", NTT DoCoMo Technical Journal Japanese Version, Vol.4, No.2, pp.24-28, Jul.1996.
- [2] Association of Radio Industries and Businesses : "S Band Domestic Mobile Satellite Communication System, ARIB Standard, ARIB STD-T49 Ver. 2.0", March 2000.
- [3] Sugino, Inoue, Nishi and Sasada : "Radio Link Control Method in Satellite Mobile Packet Communication System", the 2000 IEICE General Conference in Autumn, B-5-125.