

PHS MoU Group News

No. 6 October 1996

Singapore Moves Ahead with Indoor PHS System

In a continuing effort to upgrade the services of the Singapore International Convention and Exhibition Centre (or Singapore Suntec Centre for short), the Centre has recently completed the installation of the Personal Handy-phone System (PHS). The system was introduced commercially in Japan in 1995 and Singapore Suntec Centre is the first outside of Japan to install this system on commercial basis.



Suntec Centre Singapore

The advanced wireless telephone system, valued at \$3.5 million, and was commissioned by Singapore based Hutchison Corporate Access. The first phase of this project involved the use of 250 personal stations (PSs), 110 cell stations (CSs) and a digital PABX system. The

personal stations will be available to delegates and visitors to the centre on a rental basis from the centre.

Just like a home cordless, upon allocation of a PABX line, those people can receive and make calls anywhere in the centre.

This service will be particularly useful to overseas convention delegates or exhibitors. With this PHS

system, they can be reached anywhere in the centre during the event.

The centre is committed to Service Excellence and is constantly looking for avenues to upgrade its facilities and services. Suntec's investment in the PHS system will further strengthen the telecommunications infrastructure at the Singapore Suntec Centre by providing an advanced world-class telecommunications amenity which enables visitors to the Centre to be accessible to their offices, homes and other contacts throughout the world. With the advanced PHS system available at Singapore International Convention & Exhibition Centre, Singapore's position as a leading international convention and exhibition hub will be further enhanced. The installation of the PHS system is a demonstration of the centre's promise to provide a state-of-the-art, value-added facility for the international MICE (Meeting, Incentives, Convention and Exhibition) industry.

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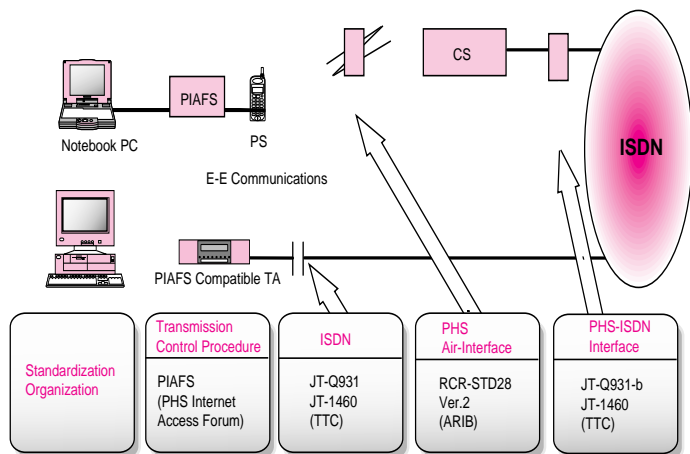
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Standards Set for PHS Data Communications

PHS Internet Access Forum (PIAF) was organized in July 1995 in order to promote multimedia communications via PHS. (Refer to News No. 2 of December 1995.) As of October 1 1996, the Forum is constituent of 87 members representing from most of the PHS related businesses, such as PHS and other operating companies, hardware and software makers, and so on. Following is the outline of PIAFS proposed by the forum. (Commentary by the News Editorial Committee)

Standardized protocols must be incorporated in the network to facilitate the provision of data communications services via the Personal Handy-phone System (PHS). An outline of the standardization work related to PHS data services is given in Fig. 1.

Fig. 1 Standardization of PHS Data Communications



The Association of Radio Industries and Businesses (ARIB) revised the standard for the common air interface (CAI) at a standards meeting in December 1995. Last April, the Telecommunication Technology Committee (TTC) revised and adopted additional standards pertaining to the network portion. Moreover, the PHS Internet Access Forum proposed the PHS Internet Access Forum Standard (PIAFS) concerning Internet access from PHS personal stations (PSs) and the end-to-end transmission control procedure for error correction when transmitting various types of data. Interconnectivity tests have been under way since August.

1. Standardization of air interface portion

The CAI for 32 kbps data communications via PHS has been standardized as 32 kbps unrestricted digital data transmission in Version 2 of RCR

STD-28 approved at the Standards Meeting of ARIB.

One of the major revisions made was the addition of an “unrestricted digital data” provision to the bearer capability element of call control (Fig. 2). During call setup for 32 kbps unrestricted digital data communications, the speech coding function (Adaptive Differential Pulse Code Modulation; ADPCM) for voice service is turned off at both the PHS PS and cell station (CS). This enables unrestricted digital data to be transmitted over the speech channel at 32 kbps.

2. Standardization of network portion

With regard to the network portion of PHS, the interface for interconnecting the PHS network with ISDN to support voice service has been standardized in JT-Q931-b drawn up by TTC.

However, this standard was revised as a result of the addition of an unrestricted digital data transmission provision to RCR STD-28 Version 2. Moreover, JT-Q931 and its supplement, which specify the ISDN user-network interface, were also revised. In order to specify rate adoption at the cell stations and ISDN terminals, a provision has been defined in both JT-Q931-b and JT-Q931 that prescribes the TTC Standard Rate Adoption for the layer 1 protocol of the bearer capability element and 32 kbps (JT-1460) for the user bit rate.

3. Transmission control procedure

The completion of 32 kbps unrestricted digital data standard for the CAI portion and the network interface portion means that 32 kbps bit stream can now be transmitted end-to-end via PHS.

However, because errors occur on the PHS radio transmission path due to Rayleigh fading, handover and chan-

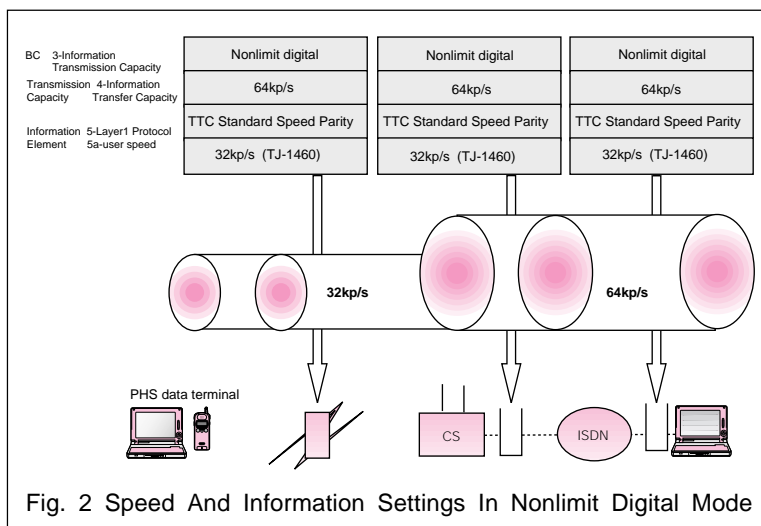


Fig. 2 Speed And Information Settings In Nonlimit Digital Mode

nel switching, a control procedure must be provided in layer 2 to eliminate such errors and secure the desired effective transmission speed (throughput).

Transmission control procedures are generally selected according to the communication method of the wired communications network and include HDLC (high level data link control), V.42, MNP and other protocols. The PHS Internet Access Forum has proposed PIAFS which is well suited to the PHS environment.

4. Basic concepts and features of PIAFS

The basic concepts underlying the development of PIAFS are explained below.

(1) Provision of error-free transmission paths for end-to-end communications

Transmission paths that include a wireless section like that of PHS are susceptible to transmission errors caused by Rayleigh fading, handover, channel switching and other factors. An error correction scheme is therefore necessary to remove such errors efficiently.

(2) Attainment of high throughput

PIAFS adopts a system that retransmits frames when errors are detected in order to provide error-free transmission and improve throughput under the PHS environment. The retransmission system is based on the selective repeat (SR) and automatic repeat request (ARQ) scheme, whereby the receiving side repeatedly requests retransmission of frame numbers in which errors occurred. The highest throughput obtained in the absence of error is 29.2 kbps.

(3) Performance guarantee against transmission path delay in end-to-end communications

Transmission path delay in end-to-end communications varies depending on the receiving party and is especially large in long-distance and satellite communications. To increase throughput in these situations as well, PIAFS adopts frame synchronization at the onset of transmission and measures the round trip frames (RTF) in end-to-end communications, enabling adaptive control of transmission delay. In addition, it allows the use of a simple control procedure to improve throughput even when backward data are lost because of bursty error. For example, because it adopts initial synchronization, the frame timing can be known without inserting any special frame pattern, which works to enhance efficiency.

(4) Low-cost equipment

As described in (3) above, PIAFS adopts a frame synchronization scheme that allows the control algorithm to be simplified, making it possible to design equipment with simpler configurations.

(5) Support for full duplex communications

(6) Capabilities for handover and channel switching

A flow control function is provided to facilitate

handover by preventing loss of data.

(7) Manual establishment and release of links

(8) Assurance of flexibility for higher-level software

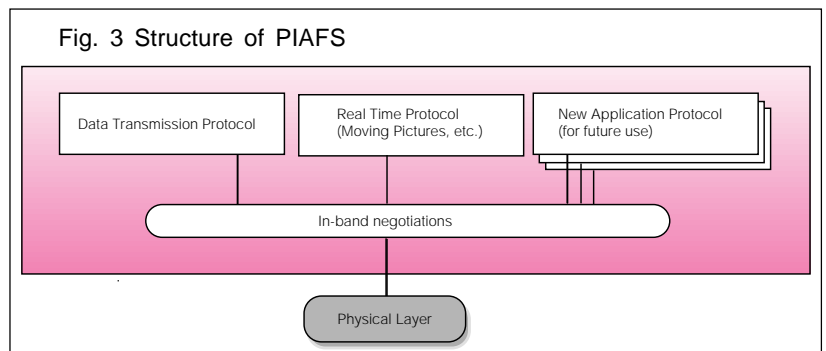
Flexibility is secured by providing data assembly and disassembly functions. For example, large volumes of data must be divided and sent in separate units. A data unit indicator has been defined to facilitate this. When the indicator indicates “1”, it means the data are continuous, and when it indicates “0”, the data are independent. This function makes it possible to transmit various types of higher-level protocol data, which gives flexibility to higher-level software.

5. Structure and configuration of PIAFS

(1) In addition to data transmission, PHS is expected to be used for transmitting full motion video and other types of communications requiring real-time qualities, as well as for still other new applications in the future. To support such uses, PIAFS includes from the outset an in-band negotiation part that assures extensibility to future applications (**Fig. 3**).

(2) Frame format

A fixed frame length of 640 bits is adopted.



A modulus identifier is used to distinguish modulus cycles (i.e., whether they are new or old) on the basis of the inversion or non-inversion of the data of this part. This doubles the number of frames that can be accommodated, resulting in higher efficiency. Moreover, a Cyclic Redundancy Check (CRC) is used to detect errors in received data. CRC32, defined as an option in ITU-TV.42, is employed for this purpose.

6. PHS data terminals

Since mobile communications services at present are still dominated primarily by voice (telephone) traffic, a major factor in any consideration of the types of multimedia terminals desired at the initial stage is their relationship with telephones. The principal types of terminals proposed at this time are shown in **Fig. 4 (next page)**.

(1) Integrated terminal

This type of terminal merges telephone functions with a data terminal. The terminal has to be compact and lightweight because of the requirement that a mobile phone must always be portable. Due to this limitation,

it might not be possible to incorporate all the functions desired of a data terminal. Yet, simple mail exchanges and other uses should be fully possible, and many different kinds of models are expected to appear.

(2) Combined terminal

This type of terminal can be used as a conventional personal station, and connected through a PIAFS adapter to a data terminal via a cable or some other type of link to facilitate data communications. Conceivable connection methods include the RS232C interface and the PCMCIA interface. A personal station with a built-in PIAFS adapter is also being considered in view of strong demands from users who mainly want telephone functions. In this case, data communications can be supported by connecting a data terminal and the personal station using a cable or an infrared (Ir) link.

(3) Data-oriented type

One version envisioned for this type is a data terminal with a built-in PHS module. Another version has a PCMCIA card and a PHS module combined into one unit. When the data terminal is being used, voice calls are possible via an earphone and a microphone. However, this type emphasizes the functions of a data terminal.

7. Applications for PHS data communications

Full-fledged PHS data communications services are set to start in the near future. A summary is given here of the major services undergoing testing.

(1) E-mail service

E-mail is seen as being a basic service of the PHS multimedia communications menu. This service will make it possible to send and receive memos, schedules, daily reports and other information from locations around town, from the office and from home. PHS users want various types of service features, such as a function for screening mail by the sender or title and downloading only essential messages.

(2) Fax service

Uses envisaged for this service include sending handwritten memos or faxing data stored in a Personal Digital Assistant (PDA). It is expected that faxes will be frequently used as a simple and convenient means of communicating other than by telephone.

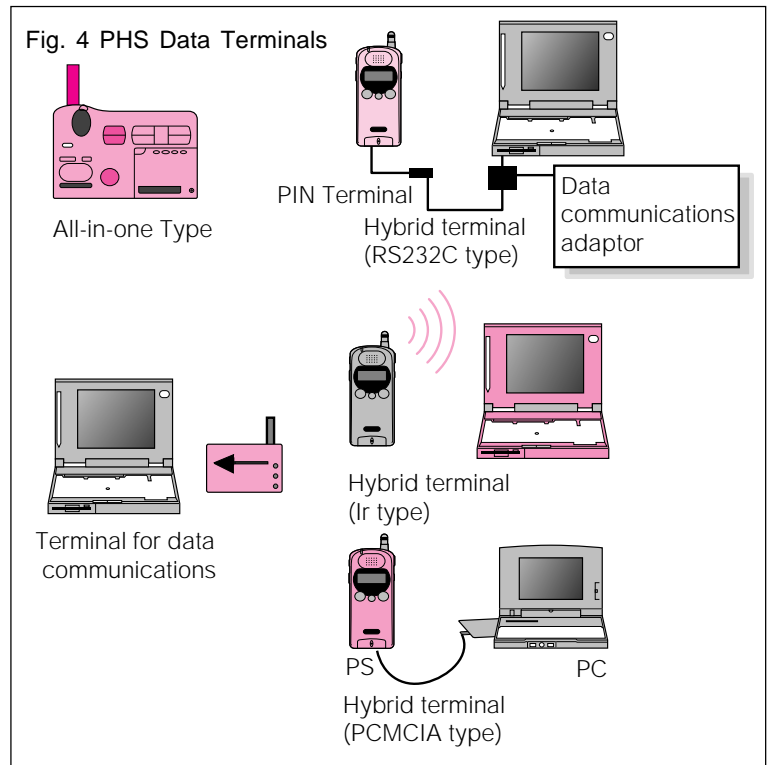
(3) Internet access

Internet access services have mushroomed in recent years, as there are many people who want to obtain information from around the world via the World Wide Web (WWW). This trend has also influenced PHS in that many users want to be able to obtain necessary information in a timely manner when they are outdoors. It is also projected that PHS will be used extensively to form Intranets for in-house communications by facili-

tating the expansion of office LAN access points.

(4) Photograph transmission service

This service can be realized by transmitting the signals of a digital still camera directly or through the me-



um of a personal computer. As such, it can be regarded as another variation of data transmission service. Since it involves transmitting large volumes of data and has a wide range of potential business applications, this service is predicted to become a major multimedia offering of PHS with its high-speed capability.

(5) Mobile office service

The spread of groupware recently has led to frequent instances where groups share common databases in carrying out or supporting the execution of collaborative work. There are demands to extend this collaborative environment even to outside locations through the use of mobile communications. The quantities of information being handled have also increased considerably to include the latest product information and business information. Thus, there are strong expectations for PHS data communications.

Many other types of services are also being considered besides the ones outlined here. Together with the ongoing advancement of telephone services, still other new ideas will likely be created, which suggests that users will be looking increasingly to the further evolution of PHS.

8. Outlook for PHS data communications

The following scenario can be considered for the future evolution of PHS in the context of its features for supporting data communications.

(1) High-speed capability

PHS provides high-speed transmission at 32 kbps, an

epochal capability for a mobile communications system. Moreover, research is now under way to achieve a transmission capacity of 64 kbps through the use of two channels. Consequently, PHS is expected to be extended to a variety of other services, including full motion video, in the future. PHS combined with a small, lightweight portable data terminal might also be used to realize network computing, whereby users would download at high speed application software stored on the network and use it as needed. It is also conceivable that an integrated PHS-information terminal compatible with a programming language like Java will make it possible to obtain and process necessary information without having to select a particular application.

(2) Capability for seamless connections

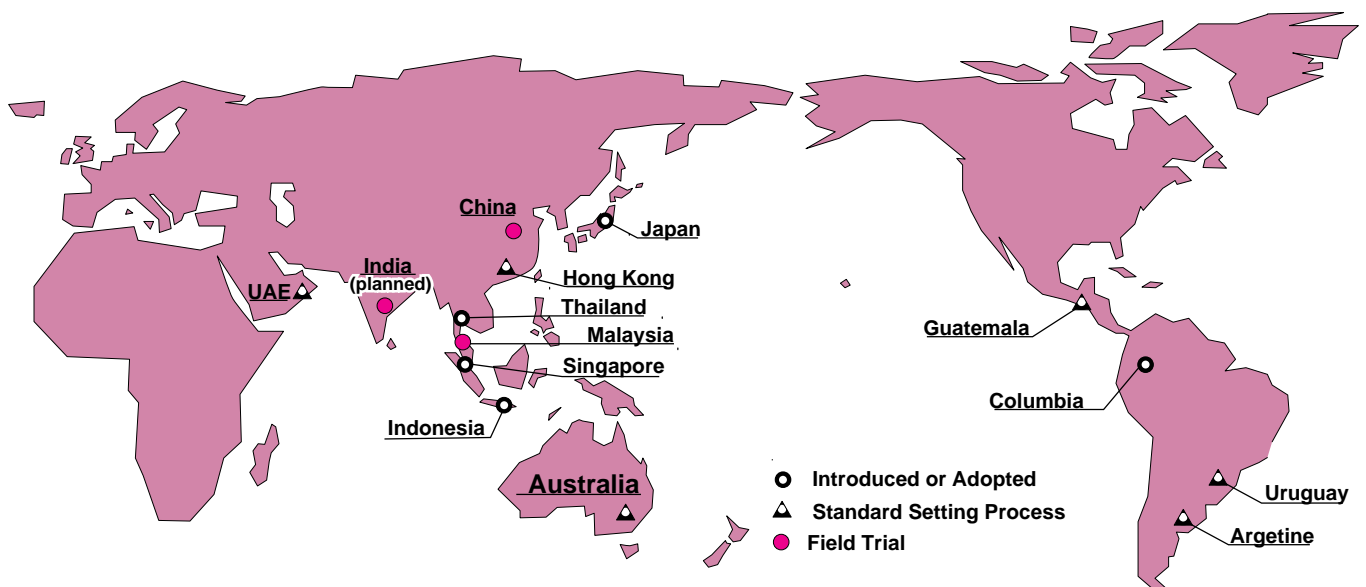
Although PHS cannot be used while traveling at high speeds, such as in a train or a car, at walking speeds, on the other hand, it provides seamless connections at home,

outdoors and in the office. This seamless feature will become even more important in future applications, such as one where a PHS terminal could be used anywhere as an electronic wallet, as a result of incorporating an electronic money function in portable information terminals.

(3) Smaller, lighter terminals and longer-life batteries

PHS terminals are classified as special low-power radio equipment with transmitting power of no more than 10 mW. Compared with cellular phones, their transmitting power is one to two orders of magnitude smaller. Together with the remarkable technological innovations seen in recent years, portable equipment has been substantially reduced in size and weight. As a result, it is now much easier to incorporate a PHS radio function in compact information terminals. This offers the possibility of creating compact portable information devices with all-in-one capabilities.

PHS Penetration



Commercial PHS services began in Japan July 1995. Presently, there are three PHS carriers, ASTEL group, DDI Pocket group, and NTT Personal group, offering PHS mobile communications services. Their total subscribers reached about 4 million as of September 1996.

The introduction of PHS service is also becoming increasingly active around the world. In Singapore and Thailand, the Indoor System is already in operation. In Bangkok, Thailand, PHS mobile communications services will begin around middle of next year by Telecom Asia. In Hong Kong and Australia, the technical stan-

dards for the PHS Indoor System are now being formulated, and Hong Kong's franchising service is now in the authorization process. In Indonesia, a PHS pilot project is being implemented, while Thailand has already decided to introduce PHS into the Fixed Network Operator, and the United Arab Emirates, Indonesia, Argentina, Columbia, Guatemala, and Uruguay will introduce it as a Wireless Local Loop system.

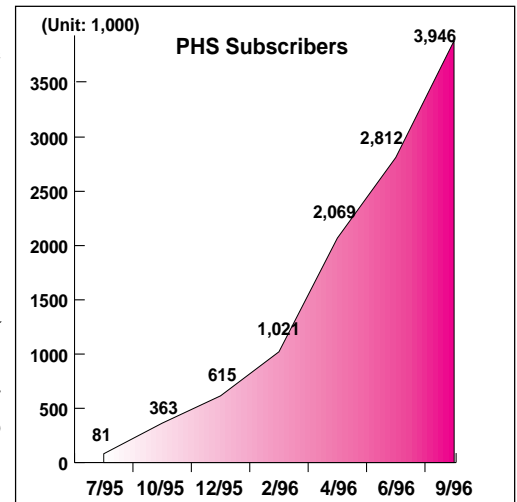
Moreover, PHS field trials are now being carried out in China and Malaysia. In India, preparations are being made for PHS Wireless Local Loop field trials.

2.4 Million New Subscribers

In September alone, 383,000 new PHS service subscribers and the rate of new subscriptions is still rising. The total of new subscriptions for the first half of FY 96 amounted to 2,348,000. In the 15 months since its inception, the PHS service has grown at such a tremendous pace that it won't be long until the four million subscriptions mark is passed.

Sales promotions are currently intensifying competition in the PHS market, however there remains plenty of room for future growth as a large portion of the potential market remains untapped.

From the end of 1996 or early next year, a new high speed data communications service will be launched, bringing new opportunities to bring even more new subscribers into the PHS fold.



Home Pages of MoU Group & Members

The current PHS MoU Group Internet home page at :

http://www.tokio.co.jp/_PHSweb/PHSindex.html, will be moving to its own server.

The new URL will be: <http://www.phsmou.or.jp>

All articles contained in the PHS MoU News are now available at the PHS MoU Group site.

Additional information and resources will be made available in the future.

Following is the available home page addresses (URL) of the Members.

Company Name	URL	Company Name	URL
• ArrayComm, Inc.	http://www.arraycom.com	• Mitsubishi Electric Corporation	http://www.melco.co.jp
• CASIO COMPUTER CO., LTD.	http://www.casio.co.jp	• NEC Corporation	
• Cirrus Logic K.K.	http://www.cirrus.com	• Nippon Telegraph and Telephone Corporation	http://www.ntt.jp
• FUJITSU LIMITED	http://fujitsu.co.jp	• Nitsuko Corporation	http://www.nitsuko.co.jp
• Hitachi, Ltd.	http://www.hitachi.co.jp/Div/jyotsu/jpn	• NTT Central Personal Communication Network Inc.	http://www.nttphs.co.jp
• Hong Kong Telecommunications Ltd.	http://www.hkt.net	• PHS International Ltd.	http://www.phsi.com
• IKEGAMI TSUSHINKI CO., LTD.	http://www.ikegami.co.jp	• Pioneer Electronic Corporation	http://www.pioneer.co.jp
• ITOCHU Corporation	http://itochu.co.jp	• Sharp Corporation	http://www.sharp.co.jp
• Japan Radio Co., Ltd.	http://www.nihonmusen.co.jp	• Sumitomo Electric Industries, Ltd.	http://www.sumiden.co.jp
• Kokusai Denshin Denwa Co., Ltd.	http://www.kdd.co.jp	• Tokyo Electric Power Co., Inc.	http://www.tepco.co.jp/
• Kyushu Matsushita Electric Co., Ltd.	http://www.kme-lab.co.jp/indexj.html	• TOSHIBA CORPORATION	http://www.toshiba.co.jp
• Kyushu Matsushita Electric Co., Ltd.	http://www.kme-lab.co.jp	• UNIDEN CORPORATION	http://uniden.co.jp
• Lucent Technologies Japan, Ltd.	http://www.lucent.com	• Victor Company of Japan, Ltd.	http://www.jvc-victor.co.jp
• Matsushita Communications Industrial Co., Ltd.	http://panasonic.co.jp/mci		

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