FOMA New Terminal 2102V Series

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This article introduces the new FOMA terminal 2102V series (F2102V/N2102V/P2102V) that was launched to the market in March 2003. The 2102V series comes with a Visual Phone as standard function, an expanded i-motion function that allows playing high audio quality, large capacity contents and an SSL client authentication function that supports the FirstPass service.

1. Introduction

In order to promote the Freedom Of Mobile multimedia Access (FOMA) service as a full-fledged mobile multimedia service, it is crucial to develop attractive FOMA terminals. The newly developed 2102V series comes standard with a Visual Phone function in order to provide mobile visual communication. The audio quality and capacity of the i-motion services that handle video mails, and multimedia contents were improved as well. It is thus expected that visual communication services with enhanced expression capabilities be developed and utilized more widely.

This article provides the characteristics overview of each 2102V series terminal and discusses the Visual Phone function installed in each model of the series as standard, the newly enhanced i-motion functions in F2102V/N2102V and a Secure Sockets Layer (SSL) client authentication function that supports the FirstPass service launched in July 2003.

2. Characteristics of Each Terminal

2.1 F2102V

F2101V achieves the longest standby time (still condition: approx. 310 hours, moving condition: approx. 240 hours) of any FOMA terminal. This was made possible by optimization of intermittent reception processing and reduction of operating current. Moreover, it is equipped with a twin-CCD camera with resolutions of approx. 330,000 pixels for the outer camera and

Table 1 Basic specifications of the 2102V series

Model	F2102V	N2102V	P2102V
Continuous talk time	Approx. 130 minutes (voice)	Approx. 130 minutes (voice)	Approx. 130 minutes (voice)
	Approx. 90 minutes (Visual Phone)	Approx. 90 minutes (Visual Phone)	Approx. 90 minutes (Visual Phone)
Continuous standby time	Approx. 310 hours (still)	Approx. 270 hours (still)	Approx. 250 hours (still)
	Approx. 240 hours (moving)	Approx. 200 hours (moving)	Approx. 180 hours (moving)
Dimensions (height×width×thickness)	101mm×50mm×26mm	104mm×50mm×25mm	104mm×50mm×25mm
Volume	108cc	98cc	110cc
Weight	115g	109g	133g
Battery pack capacity	800mAh	850mAh	800mAh
Main display	Color TFT 176×220	Color TFT 176×240	Color TFT 176×240
	65536 colors	65536 colors	260,000 colors
Sub-display	Monochrome STN 96×28	Color TFT 88×72	Monochrome STN 120×30
Outer camera	Approx. 330,000 (number of effective pixels)	Approx. 320,000 (number of effective pixels)	Approx. 310,000 (number of effective pixels)
Inner camera	Approx. 110,000 (number of effective pixels)	Approx. 110,000 (number of effective pixels)	Approx. 100,000 (number of effective pixels)

110,000 pixels for the inner camera, as well as a one-touch light that is effective for taking picture in dim places or at night for the outer and inner cameras, respectively. Moreover, in addition to the rear speaker, a front speaker is mounted; the audio quality when using the Visual Phone and i-motion is improved.

Furthermore, it is equipped with a miniSD card interface to allow saving videos and still images shot by the users. **Table 1** shows the basic specifications.

It is possible to connect commercially available USB cables instead of conventional dedicated cables and AC adapters to the desk holder, which is equipped with a cradle function that allows data communication even during charging. Moreover, by using the cradle function, it made it easier to synchronize phonebook and scheduler data edited on the F2102V with a PC.

2.2 N2102V

N2102V has enhanced image display function under the concept of rich and comfortable visual communication. First of all, a new function is equipped for creating still image with voice data attached. Files created with this function can be sent/received as i-motion mails. This allows communication of emotinal still images.

It also comes with a function that combines multi-tasking and multi-access to allow sending images taken during voice telephone calls as mails to the person speaking. Since it eliminates the needs to input the mail address of the person speaking, still image communication becomes easier. Moreover, a hands-free voice function is included, which makes it possible to continue talking while using various functions, including browsing i-mode and checking schedule.

Furthermore, the memory part of the Large Scale Integration (LSI) circuit was optimized to reduce the size of the circuit. N2102V is thus the smallest and lightest terminal among those we have developed at this point.

2.3 P2102V

The biggest feature of P2102V is the employment of a bi-axial structure chassis not seen before in conventional terminals (**Photo 1**).

Table 1 shows the basic specifications. While it was made smaller than conventional FOMA terminals (110 cc), the stand-by time was improved to up to approx. 250 hours under still

Photo 1 2102V series (F2102V, N2102V and P2102V from the left)

condition and 180 hours under moving condition. It comes with a 310,000-pixel camera, together with the video mail function and photo memo function. Moreover, it includes an SD card interface to allow recording and playing high quality image movies at 128 kbit/s. It is possible to record up to approx. one hour of images in the self mode. Images recorded in the SD card can be played using external AV devices.

3. Visual Phone

P2102V has a processor dedicated for the Visual Phone function that handles video COder DECoder (CODEC), audio CODEC, multiplexing and demultiplexing of video and audio signal simultaneously in order to achieve full Visual Phone functionality. As a result, it keeps the load on the CPU low even during Visual Phone calls, making it possible to record images sent from the other party as well as to send video files during calls.

F2102V and N2102V use a combination of CPU processing and Digital Signal Processor (DSP) processing to achieve Visual Phone functionality via software processing, i.e., without incorporating a separate processor dedicated for the Visual Phone function. In the software processing, the DSP mainly takes care of the CODEC processing, while the CPU takes charge of multiplexing and demultiplexing processing of video and audio signal, thereby achieving the same call performance as a Visual Phone with a dedicated processor. Compared to the method with a built-in dedicated processor, the implementation of the Visual Phone via software processing makes it possible to reduce the size and cost of terminals. **Table 2** shows the Visual Phone specifications. As the CPU performance of handheld terminals improves, it is expected that the Visual Phone functionality is further enhanced in the software processing as well in the future.

4. Enhancement of i-motion Functions

F2102V and N2102V employ a streaming play method in addition to the conventional downloading method as acquisition methods of i-motion files in order to increase the file size of available contents dramatically from 300 kB to 2 MB. This allows playing contents of up to approx. five minutes. Since the streaming is performed via i-mode packets using the HTTP protocol, it can be implemented while networks and servers maintain the same functionality as for the conventional i-motion. **Figure 1** shows the network configuration. The streaming play method can be implemented on mobile terminals in two ways; either all data is acquired by the mobile terminal, or the data flow can be controlled according to the buffer size of the mobile terminal. With the latter method, it is possible to perform streaming with a buffer size that is smaller than the data size.

F2102V and N2102V also support new audio CODEC, so the audio quality was significantly improved. The audio CODEC of conventional i-motion employed Adaptive Multi Rate (AMR) CODEC for voice communication, which was not suitable for music and similar contents for which the audio quality of the higher audio frequencies is important. Now that these terminals adopt Moving Picture Experts Group (MPEG)-4 Advanced Audio Coding (AAC), they can even play high frequency components clearly. As a result, music promotion videos and movie introductions can be played with higher quality. The video CODEC also supports H.263 in addition to con-

Table 2 Visual Phone specifications of the 2102V series

Image part	CODEC	MPEG-4
	Number of pixels	QCIF
	Frame rate	15f/s (max.)
	Bitrate	64kbit/s (max.)
Voice part	CODEC	3GPP-AMR
	Bitrate	64kbit/s: 12.2kbit/s 32kbit/s: 6.7kbit/s

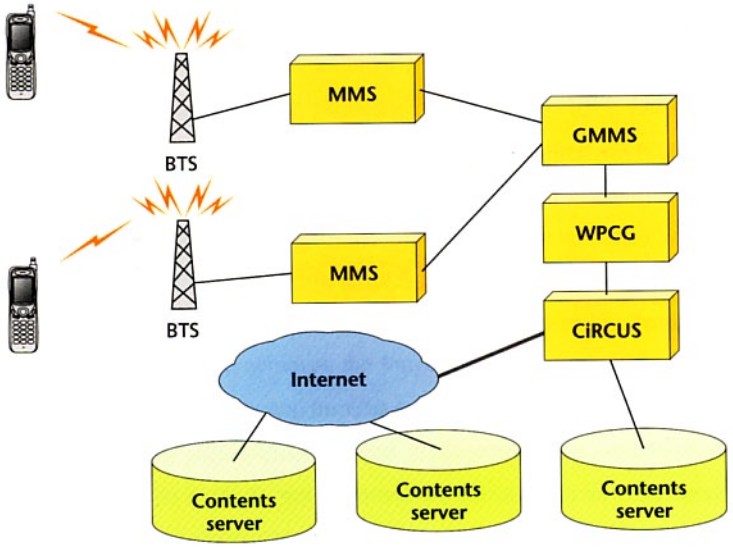

Figure 1 i-motion network configuration

Table 3 Specifications of i-motion

Image processing part	CODEC	MPEG-4 Visual Simple Profile Level 0 H.263 baseline	
	Display size	Sub-QCIF (128 × 96 dots) QCIF (176 × 144 dots)	
	Frame rate	Up to 15 f/s	
Voice processing part	CODEC	AMR	MPEG-4 AAC
	Number of channels	1ch	1ch, 2ch
Multiplexed file format	Format type	Mobile MP4	
	Maximum file size	Download contents: 300 kB Streaming contents: 2 MB	

ventional MPEG-4. **Table 3** shows the specifications of i-motion.

i-motion uses a file format called Mobile MPEG-4 file format (MP4), which combines DoCoMo's own specifications with MP4 files standardized by 3rd Generation Partnership Project (3GPP). This format allows adding title information etc. and is more user friendly. It also supports copyright protection via the external output settings.

We have been providing development aid to Apple Computer, Inc. in order to allow creating and playing i-motion contents with Quicktime, which is widely used on PCs as a contents creation tool. In June 2003, QuickTime Version 6.3, which supports Mobile MP4, was released. We also disclose the Mobile MP4 specifications to tool vendors as needed; it is thus possible to create contents for i-motion with diverse softwares.

5. SSL Client Authentication (Supporting FirstPass[1])

The following two functions are added to F2102V and N2102V in order to support the newly launched FirstPass service.

- User Certificate Download Function

  Function to connect to the FirstPass center and safely download a user certificate within the FOMA card.
- SSL Client Authentication Function

  Function to send a user certificate and digital signature to contents servers etc. when using the SSL protocol.

Mainly, the following three types of processing are added in order to implement the function to download a user certificate to the FOMA card.

1) Processing for identifying (authenticating) that the connected target (server) is the DoCoMo's FirstPass center.
2) Processing for converting the protocol of the command from the FirstPass center to a format that can be interpreted by the FOMA card when the FirstPass center writes data to the FOMA card.
3) Processing for requesting the FirstPass center to issue a user certificate using a pair of keys in the FOMA card.

Moreover, the following two types of processing are added to implement the SSL client authentication function.

1) Processing for reading a user certification from the FOMA card to the browser cache.
2) Processing for requesting appropriate preprocessing (calculation) and signature calculation to the FOMA card.

The main feature of this functional addition is this strengthened link between the FOMA card and terminal browser.

6. Conclusion

This article described the characteristics of our recently developed FOMA 2102V series and provided an overview of the functions added. In the 2102V series, the mobile visual communications were enhanced by equipping Visual Phone as standard and expanding i-motion functions. Moreover, the SSL client authentication function was implemented to enable supporting the FirstPass service for the first time.

We will promote development of new FOMA terminals to enrich the FOMA services in the future as well.

REFERENCES

[1] Nakamura et al: "Special Articles: FirstPass Digital Authentication Service", NTT DoCoMo Technical Journal, Vol. 5, No.3, PP.4–23, Dec. 2003.

ABBREVIATIONS

3GPP: 3rd Generation Partnership Project
AAC: Advanced Audio Coding
AMR: Adaptive Multi Rate
BTS: Base Transceiver Station
CiRCUS: treasure Casket of i-mode service, high Reliability platform for CUStomer
CODEC: COder DECoder
CPU: Central Processing Unit
DSP: Digital Signal Processor
FOMA: Freedom Of Mobile multimedia Access
GMMS: Gateway Mobile Multimedia switching System
LSI: Large Scale Integration circuit
MMS: Mobile Multimedia switching System
MPEG: Moving Picture Experts Group
PDC: Personal Digital Cellular
QCIF: Quarter CIF (Common Intermediate Format)
SSL: Secure Sockets Layer
WPCG: Wireless Protocol Conversion Gateway