Development of MediaFLO Handset

MediaFLO 端末の開発

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Abstract

Sharp, in collaboration with a partner **, has developed a mobile handset with the capability to receive and display MediaFLO content. MediaFLO is a multimedia broadcast technology that delivers television content to mobile devices. Our handset was one of the first MediaFLO prototype phones in the industry and was successfully demonstrated at the CTIA2006 trade show (Las Vegas, April 2006).

**Qualcomm Inc.

シャープは他社と共同して注MediaFLO機能を搭載した携帯端末を開発した。MediaFLOはマルチメディアブロードキャスティングの新技術およびシステムであり，携帯端末にテレビのコンテンツを配信するものである。業界で最初のMediaFLO試作機の一つである本端末は2006年4月ラスベガスでのCTIA2006ショーに展示され，実網を使ったデモンストレーションが行われた。

注：Qualcomm Inc.社

Introduction

Many cellular network operators have deployed first generation multimedia content delivery services using on-demand unicast (one signal to one receiver) delivery mechanisms. Subscribers have responded positively to early offerings such as music and short video clip downloads.

Meanwhile, in an effort to maintain momentum, operators desire to offer more advanced services such as television-like entertainment (Mobile TV). The problem is that existing unicast delivery mechanisms quickly deplete cellular network resources with only a few active Mobile TV viewers. Moreover, multicast approaches (one signal sent to multiple receivers), while more efficient than unicast, also suffer from lack of scalability and are thus similarly unsuitable for simultaneous delivery of video content to large numbers of subscribers.

The solution is to deliver Mobile TV services using an overlay Mobile TV broadcast network separate from the existing 2G/3G network. Cellular handsets will then require additional hardware and software to access content delivered by this new broadcast network.

Table 1   Mobile TV technologies.

	MediaFLO	ISDB-T	DVB-H	S-DMB	T-DMB
Market	US, and potentially other countries	Japan	Europe, US	Korea, Japan	Korea, and other countries
Major Player	Qualcomm	Japanese operators and vendors	Nokia, European companies	Korean Companies	Korean Companies
RF Band	700MHz UHF	UHF	UHF or L Band	S Band	174~240MHz
Commercial Deployment	2007	2006	2006	2005	2006

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1. Mobile TV Technologies

Today there exist several standards/technologies for Mobile TV, including DVB-H (Digital Video Broadcasting-Handheld), S-DMB (Satellite-Digital Multimedia Broadcasting), T-DMB (Terrestrial-Digital Multimedia Broadcasting), ISDB-T (Integrated Services Digital Broadcasting-Terrestrial) and MediaFLO. Table 1 summarizes the various Mobile TV technologies.

2. MediaFLO System

MediaFLO, where FLO stands for Forward Link Only, is a proprietary technology developed by Qualcomm Inc. Like DVB-H and ISDB-T, it uses an OFDM (Orthogonal Frequency Division Multiplexing) carrier to transmit data. MediaFLO provides up to 30 frames-per-second (fps) video streaming coded in the H.264 format with a maximum resolution of QVGA (240x320). Its "layered modulation" allows simultaneous support of 30fps high-quality video for receivers in good radio conditions and a reduced frame rate for receivers operating in weaker radio environments. Table 2 shows the MediaFLO high-level specifications.
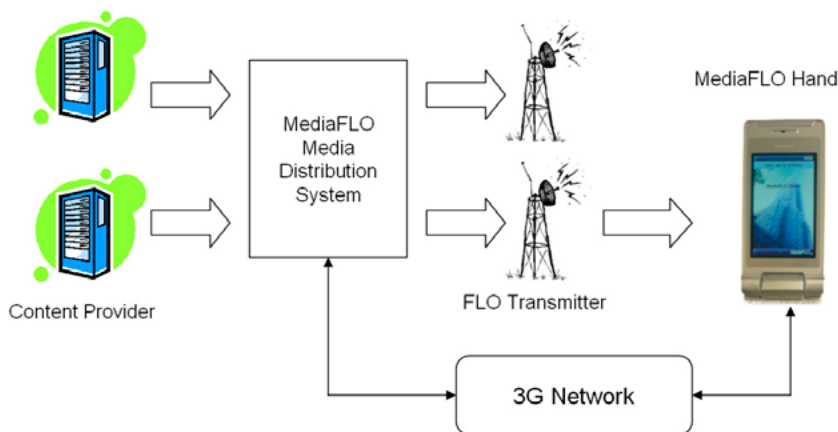
The MediaFLO system is illustrated in Fig. 1. Since the

MediaFLO network has no uplink, a 3G cellular network is used to facilitate subscription management and to exchange security keys.

Qualcomm established MediaFLO USA Inc. to be the operator of a nationwide distribution network using 700 MHz licensed spectrum. MediaFLO USA Inc. will offer wholesale services to existing cellular network operators who will in turn resell branded services to individual subscribers. Verizon Wireless plans to deploy nationwide MediaFLO commercial services in 2007.

3. MediaFLO End-user Experiences

MediaFLO technology will offer best in class Mobile TV service consisting of:

•TV-like Video Services

MediaFLO is similar to traditional television services, targeted for a mass market. Unlike Internet-based on-demand services, what and when to provide is determined by the cellular network operator. Users may scan and select a program available at given time.

•Media Program Guide

The media program guide provides users available programs and schedules.

•Low Latency Channel Changing

The MediaFLO system was designed to support fast channel switching.

4. Working Sample Development

In collaboration with Qualcomm, we developed handset prototypes with the MediaFLO feature (Photo 1). The following section describes the key handset features.

Table 2   MediaFLO specifications.

Modulation	OFDM, QPSK/16-QAM
Bandwidth	6 MHz
Channel Coding	Turbo + Reed Solomon
Maximum Resolution	QVGA (240x320)
Video Frame Rate	15/30 fps
Video Coding	H.264
Audio Coding	HE-AAC
Channel Switching Time	1.5 second

Fig. 1   MediaFLO system.

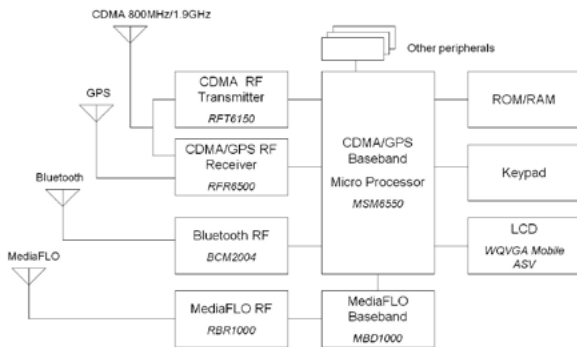Photo 1   MediaFLO handset.

Fig. 2   Hardware block diagram.

4・1   Hardware

Fig. 2 shows the hardware block diagram of the MediaFLO handset. The key components for baseband and RF processing are provided by Qualcomm.

MSM6550, the core component of the handset, includes CDMA(1x/Ev-DO)/GPS baseband processing and a built-in microprocessor. MBD1000 and RBR1000 support MediaFLO baseband and RF respectively. For CDMA (1x/Ev-DO) and GPS RF processing, the handset is also equipped with RF transmitter (RFT6150) and receiver (RFR6500).

The handset features a 2.6 inch Wide QVGA (240x400) Mobile ASV LCD. ASV (Advanced Super V) is a Sharp proprietary technology that offers high contrast and wide viewing angle.

Sharp developed antennas for multiple transmitter/ receivers supported in the handset, including MediaFLO, CDMA, Bluetooth and GPS. One of the challenges
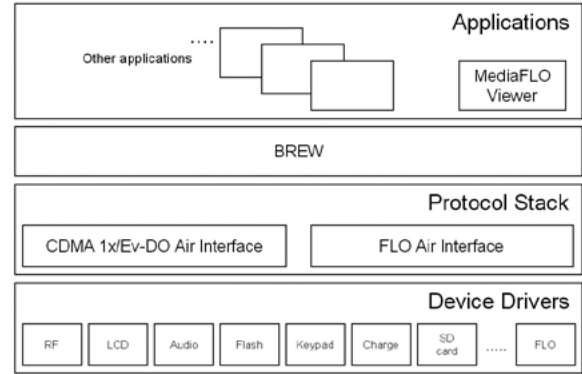

Fig. 3   Software block diagram.

was to minimize the interference between the 800MHz CDMA transmitter and the 700MHz MediaFLO receiver. By fine-tuning the design of the antennas and carefully selecting optimal placement, we exceeded the targeted -5dB antenna gain.

In addition, we added a dedicated "FLO" key for quick access to MediaFLO Viewer.

4・2   Software

Fig. 3 depicts the high-level software block diagram of the MediaFLO handset. Our software is based on the reference software provided by Qualcomm, which offers CDMA 1x/EV-DO protocol stack, FLO protocol stack, BREW application platform, MediaFLO viewer application and device drivers for reference evaluation hardware.

As part of this work, we developed device drivers to support the LCD, the flash memory device, the SD card drive, the charger circuit and miscellaneous peripherals.

For the LCD driver, various parameters were fine-tuned based on field trials to realize subtle gradation in shadow tones. This ensures an optimized viewing experience especially when playing movies with heavy use of dark colors. In addition, new audio driver algorithms were developed to provide more lifelike sound reproduction.

4・3   Testing
4・3・1   Lab testing

In early 2006, Sharp and Qualcomm jointly conducted indoor signal reception testing at Qualcomm's MediaFLO test lab and validated successful viewing of video content. The receiver performance of our handset was demonstrated to match Qualcomm's reference hardware.

4・3・2   Field testing

Sharp also conducted live network field testing in San

Diego and Las Vegas. We confirmed successful reception of 30 fps video streaming in areas of good radio condition, and switching to 15 fps with marginal signal strength. In addition, stable video reception was observed in a vehicle traveling at speeds over 100km/h.

4・3・3　CTIA2006

The handset was successfully demonstrated in the CTIA2006 trade show (Las Vegas), along with prototype handsets from other vendors.

Acknowledgement

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