ON THE DVB-SH SYSTEM ARCHITECTURE INCORPORATING T-DMB

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Abstract: In this paper, we investigate the transmission system architecture to incorporate the terrestrial digital multimedia broadcasting (T-DMB) service contents into the DVB-SH systems. The T-DMB is operating in Korea to provide a TV-like service in mobile or static environments. The DVB-SH system provides a variety of mobile multimedia services through hybrid satellite and terrestrial links and has a universal coverage. We propose two methods to provide the T-DMB contents to handheld or mobile terminals via DVB-SH architectures and investigate the features of them.

1 INTRODUCTION

In February 2007, DVB-SSP working group has approved the DVB-SH (digital video broadcasting for satellite services to handhelds) specification (ETRI, 2007). The DVB-SH, which is a new name of DVB-SSP, is defined as a system which is able to deliver IP based multimedia contents to handheld terminals like mobile phones and PDAs via satellite link at frequencies below 3 GHz. A typical DVB-SH system is based on a hybrid architecture combining a satellite component and a complementary terrestrial component. In satellite link, data is transmitted by orthogonal frequency division multiplexing (OFDM) and/or time division multiplexing (TDM) transmission modes, while only OFDM transmission mode is used in terrestrial link. The OFDM transmission mode is based on the DVB-H air interface, which is originally based on the DVB-T system, and slightly modified for satellite application. On the other hand, the TDM mode is based on DVB-S2 air interface. In both cases, strong channel coding and time interleaving techniques are applied for overcoming the nonlinear effect of the high power amplifier operating near saturation.

Terrestrial digital multimedia broadcasting (T-DMB) is in service successfully in Korea. The T-DMB is based on Eureka-147 digital audio broadcasting (DAB) system. Through the stream mode data channel of DAB system, multimedia contents such as video, audio and data are transmitted with maximum rate of 1.062 Mbits/s.

In this paper, we investigate the architectures of the DVB-SH system to deliver the T-DMB contents via satellite and terrestrial links.

2 DVB-SH ARCHITECTURE INCORPORATING T-DMB

2.1 Structure of the T-DMB System in Korea

The main service of T-DMB is to provide TV broadcasting to handheld or mobile terminals such as mobile phones, PDAs and car TVs. Multimedia data including audio and video (AV) signal are transmitted through the Eureka-147 DAB system (Lee, 2005). The standard structure of the T-DMB system is shown in Figure 1.

Encoded multimedia data are multiplexed into MPEG-2 transport stream (TS) and then encoded for forward error correction (FEC) by using Reed Solomon (RS) coding and convolutional interleaving.

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The encoded stream is then transmitted through the stream mode channel of the existing Eureka-147 DAB system. RS encoder use RS(204, 188, t=8) shortened code derived from the original systematic RS(255, 239, t=8) code as in the DVB-T system (ETSI, 2001). By adding the additional FEC and interleaving, the target bit error rate (BER) of the system is improved from the level of 10^{-4} to 10^{-8}, and by which high quality mobile video service is possible through the Eureka-147 DAB system which is originally designed for CD quality audio data transmission. Fig. 2 shows the total transmission system for T-DMB including the Eureka-147 transmission blocks.

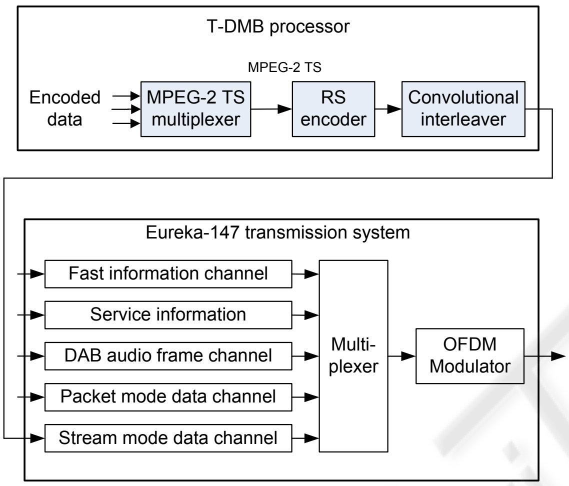

Figure 1: Structure of the T-DMB system.

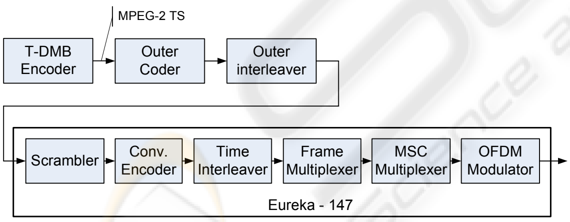

Figure 2: Transmission system of T-DMB.

2.2 DVB-SH System Architecture

The DVB-SH system is developed to provide multimedia services over hybrid satellite and terrestrial networks to a variety of fixed or mobile terminals including handheld, vehicle-mounted, nomadic and stationary terminals at frequencies below 3 GHz. It has a universal coverage by combining a satellite component and a complementary ground component. In the DVB-SH system, there are two architectures applying two modulation methods: SH-A for OFDM terrestrial and OFDM satellite transmission mode, and SH-B for OFDM terrestrial and TDM satellite transmission mode.

Figure 3 shows the two architectures for different modulation method (ETSI, 2007). As shown in the figure, the two transmission systems are designed to maximize the commonalities between them. OFDM transmission mode is mainly based on the existing DVB-T or DVB-H systems, while TDM transmission mode is mainly based on DVB-S2 system. Main blocks newly introduced by DVB-SH includes strong FEC and longer time interleaver which aims to overcome long fading events under the low signal-to-ratio mobile satellite and terrestrial environments. The final sentence of a caption should end with a period.

2.3 DVB-SH System Incorporating the T-DMB

One of the purpose in incorporating the T-DMB system into DVB-SH systems is to maximize the commonalities between the existing T-DMB and DVB-SH systems in order to maximize hardware reuse. The DMB processor in the T-DMB system correspond to the IP encapsulator in the DVB-SH system. However, MPEG-2 TS data are processed by RS encoder in a DMB processor while the output of the encapsulator, which performs RS coding and interleaving, has the form of MPEG-2 TS. Moreover the error correction capability in the two systems are different. In DVB-H, by passing the multi-protocol encapsulation (MPE) with RS(255, 191) coding, the RS decoder allows correcting up to 32 erroneous bytes (Balaguer , 2005). Instead RS decoder gives 8-byte correcting capability in T-DMB system by using RC(204, 188) code (Lee, 2005). Therefore, we cannot input the output of the DMB processor instead of the output of the IP encapsulator in the DVB-SH system.

One method to provide T-DMB contents simultaneously or similarly via DVB-SH network is input the DMB processor output as an input to the DVB-SH, that is, as an input of the IP encapsulator. In this case, the Eureka-147 transmission part in the T-DMB system is replaced with the DVB-SH architecture. Therefore, modularization of the common hardware block is possible between the T-DMB and DVB-SH systems.

Another method to provide T-DMB contents is input the MPEG-4 sync layer (SL) encapsulated data of DMB processor, designated by encoded data in Figure 1, to the input of the IP encapsulator. In this case any block in T-DMB is not common in the DVB-SH system. However, total hardware complexity of DVB-SH architecture is decreased compared to the former method. In Figure 4, the two proposed architectures are represented.

3 CONCLUSIONS

In this paper we have investigated the strategy for constructing the DVB-SH system architecture to provide T-DMB contents broadcasting simultaneously or similarly via DVB-SH network. We have presented two architectures for DVB-SH system. By using the proposed architectures, the modification from the standard DVB-SH system will be minimized.

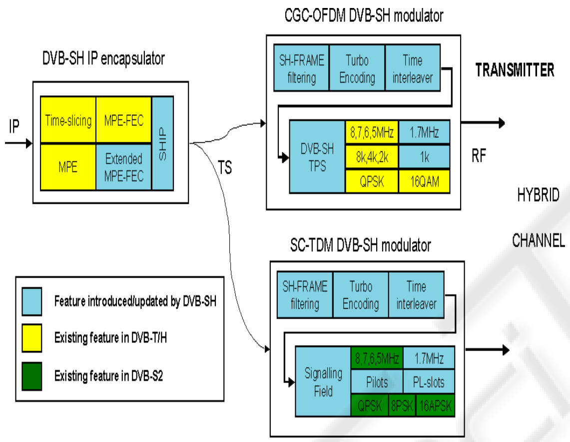

Figure 3: Architectures of the DVB-SH systems.

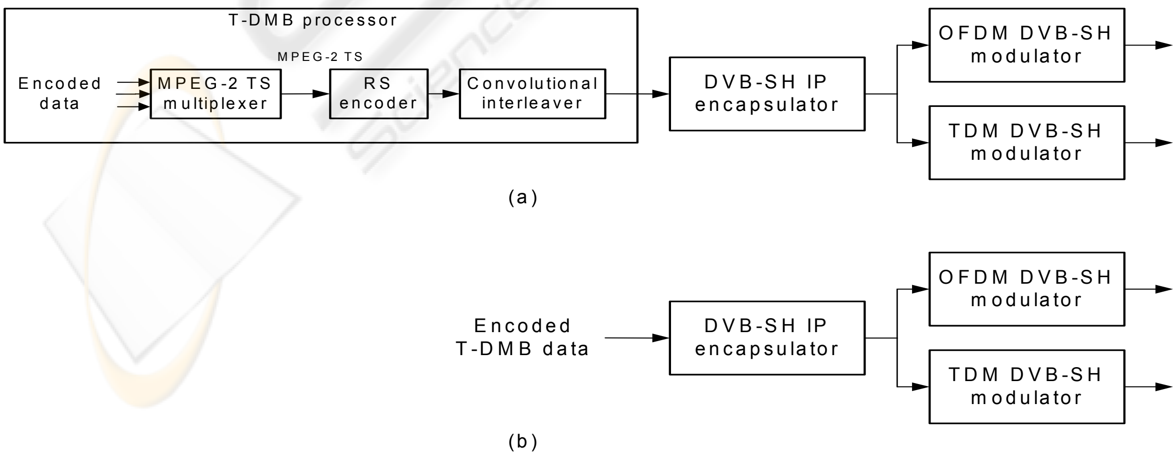

Figure 4: Two architectures of the DVB-SH systems incorporating T-DMB contents.

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