Design of Signal Conversion module for T-DMB system

Jung-Tae Kim, *Member, KIMICS*

Abstract— Layered structure of the Korean terrestrial Digital Multimedia Broadcasting (TDMB) transmission system for multimedia broadcasting service is presented in this paper. We made a switching module which is called the Ensemble Remultiplexer. It is designed to remultiplex the Ensemble Transport Interface (ETI) for T-DMB service. This paper describes the remultiplexing process of the Ensemble Remultiplexer.

Keywords—Digital Audio Broadcasting, Digital Multimedia Broadcasting, Ensemble Transport Interface (ETI)

I. Introduction

Commercial service of DMB and DAB system begin at 1995 in England. Recently, many countries service the DMB system. In Korea, we make a committee to review the feasibility study and to introduce digital radio broadcasting service. We adopt Eureka-147 method as domestic standard with formal in 2002. Government, research institute and broadcasting station involved to service the DMB system in the end of 2003. DMB service is the unique media with superior advantage in several view point compared to conventional analog broadcasting system. It service audio with clear signal such as CD, data broadcasting, moving imaging service and multimedia service. To assist the service, research institute an industry concentrate on developing receiver for DMB. The market of DMB is increased as multimedia service is required to meet customer's demand. Therefore, the technique for convert analog to digital signal equipment is required. The DMB system, which is also based on the Eureka-147standard, has a 2.3-Mbps data-delivery capability, which is sufficient for multimedia broadcasting services as well as CD quality digital audio services. However, the data payload reduces to 1.5 Mbps when we take into account the overhead such as the bits needed for synchronization, error correction and multiplex configuration information. Therefore, for multimedia broadcasting services at a low data-delivery transfer rate,

Manuscript received on May 6, 2008; revised on August 2, 2008. Jung-Tae Kim is with the Mokwon University, Department of Electronic Engineering (phone: 82-42-829-7657, fax: 82-42-829-7653, e-mail: jtkim3050@mokwon.ac.kr)

II. Design of Hardware

T-DMB transmission system is realized based on Eureka-147 standard. The service of moving pictures is compressed by T-DMB A/V encoder, the signal of video is encoded by MPEG4- Part(H.264) using compression standard. The audio signal is decoded by audio standard such as MPEG-4 BSAC.

The ETI is an interface signal which allows ensemble information to be routed between the ensemble provider and the transmission network provider, and is defined in a number of layers. Among them, ETI(NI, G.703) is the most commonly used form of ETI which may be used for a direct connection or a connection via a relatively simple network

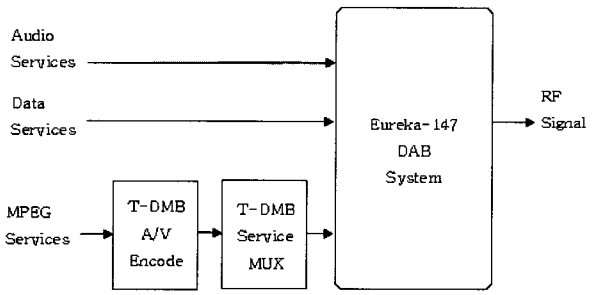


Fig. 1 Configuration of Total Crypto System

The compressed video and audio signal transfer to Eureka-147 DAB system with data service type using T-DMB service MUX. The T-DMB service MUX consist of MPEG-4 SL Packetizer MPEG-2 TS MUX, RS Encoder(204,188) and conventional interleaver. The structure is shown in figure 1.

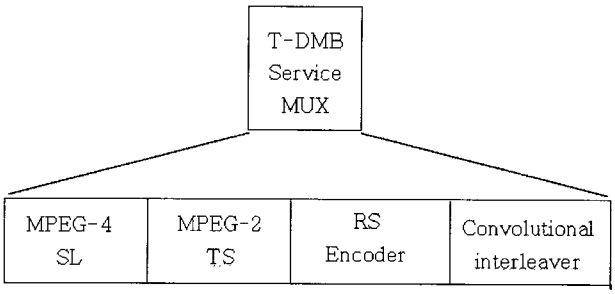


Fig. 2 T-DMB service MUX

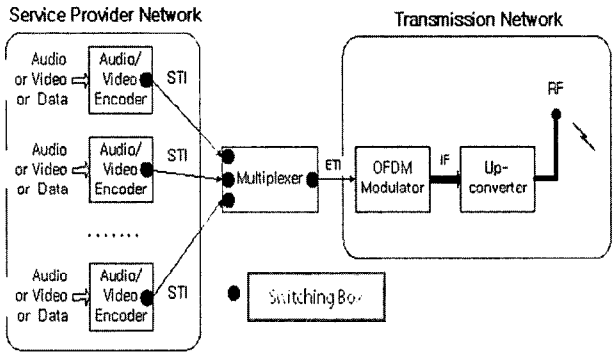


Fig. 3 The proposed DMB transmission system

DMB transmission system for multimedia broadcasting services through the conventional DAB transmission system. The proposed system does not change the main structure of the conventional DAB transmission system but simply adds a newly developed sub-system, which is called the Ensemble remultiplexer. This means that broadcasting stations and private enterprises which have already been equipped with the conventional DAB transmission system can reduce the cost of the DMB transmission system equipment for multimedia broadcasting service.

III. T-DMB Receiver Structure

T-DMB receiver is system that video and audio processing is added to Eureka-147 receiver structure. The bit stream is extracted in Eureka-147 DAB receiver module or Eureka-147 DAB channel decoder, the video and audio signal is decoded in T-DMB Service DEMUX and T-DMB A/V Decoder.

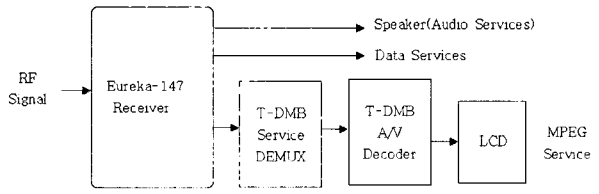


Fig. 4 T-DMB receiver structure

The decoded signal is generated at LCD and speaker. In the case of T-DMB Service DEMUX, the process is contrary to transmitter and consist of Convolutional Deinterleaver, RS decoder(204, 188), MPEG-2 TS DEMUX and MPEG-4 SL Depacketizer. The main goal of Control part is that it controls function in receiver. Its function is tuner control, baseband chipset control, data decoding, USB controller control, control of PC, status display LED control and command process of API function. The TMS320C6713 is used to implement for control part. Figure 1 shows configuration of DMB API receiver based on hardware

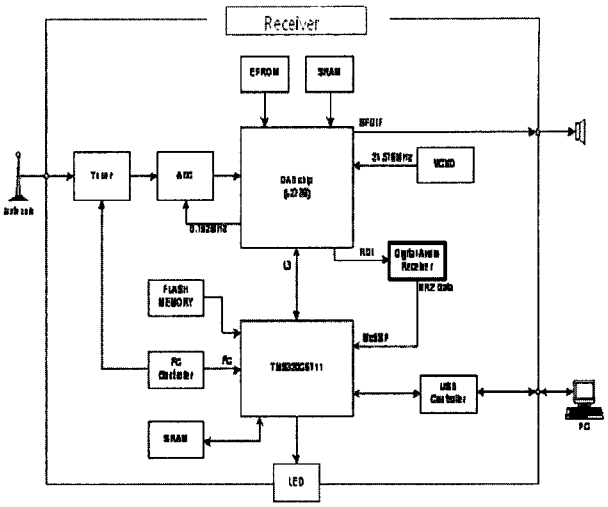


Fig. 5 Receiver for signal processing

Figure 2 shows that the interface of main processor consists of its interface unit.

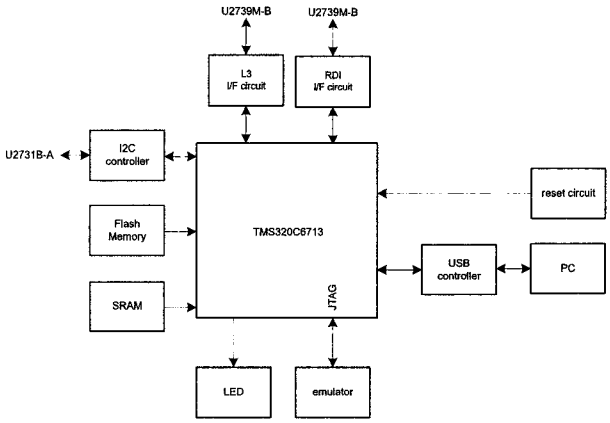


Fig. 6 Configuration of Control for DMB API Receiver Module

The control of tuner for DMB API Receiver Module is executed through I2C interface by control of processor. After power on, data is downloaded frequency and parameter in tuner, we can check success of synchronization by check the flag bit. If the flag bit is changed, the initialization of tuner gives a success. We do not need control the tuner except synchronization is generated. The control of baseband processing part is executed by L3 interface with MC_MODE, MC_CLK, MC_DAT interfaces. After reset the U2739M signal, we can analyze ensemble information and channel configuration information. The function of DMB receiver operates when audio channel and data channel setting is done. The audio channel data can transfer it by using SPDIF interface to external interface. The received signal is stored in control part or transfer through RDI, HSSO interface. Moving pictures is transferred by USB interface through external equipment such as PC. The command is activated by PC through USB interface. Control part executes API function to be processed and gives results to PC. The transmission of data is executed

by defined API functions. USB controller uses USB2.0 with speed 12 Mbps. Figure 3 shows configuration of USB controller. The communication of PC and USB is controlled by USB controller.

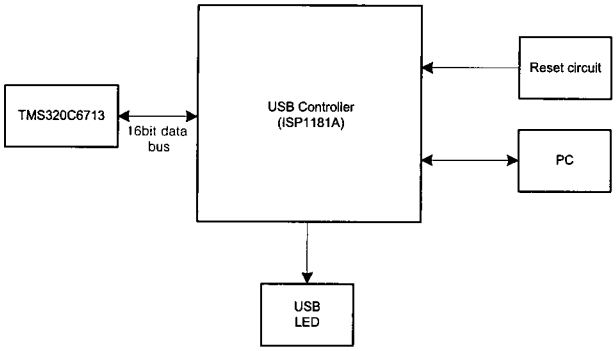


Fig. 7 Configuration of USB Controller

Control part gives status of DMB receiver equipment by using LED. The status shows DMB synchronization status, channel setting display, audio output display, USB transmission status display, error generation display and power status display.

IV. Design of Software

DMB-UE04 Manager Software is designed to connect DMB-UE04 equipment and PC by using USB interface. Manager software can generate ETI signal by contents stored in PC. Manager software has three menus. They are File ETI Mode, ETI Synthesis Mode and ETI Capture Mode.

4.1 File ETI Mode

The DMB-UE04 and PC is connected using USB cable when ETI signal is generated using file ETI mode. First, we power on DMB-UE04, we connected it to USB port of PC using USB cable We control the manage software on PC. Figure 6 shows screen of manager software in file ETI mode.

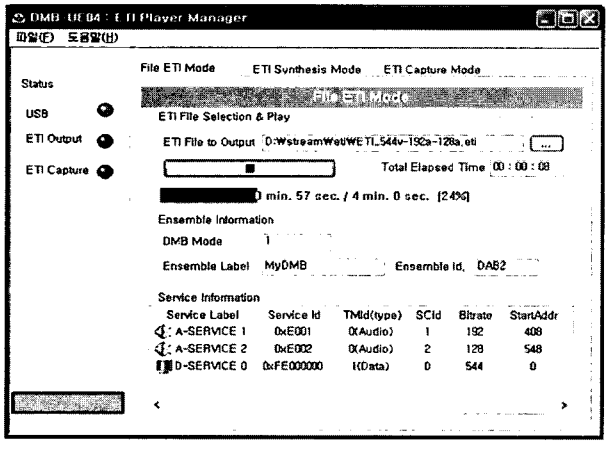


Fig. 8 Manager software capture in ETI mode

4.2 Start ETI Out

The configuration of ensemble is established using service edit. By pushing "▶"button showing start of output, ETI stream is synthesized and transmitted data to DMB-EU04. The output and ETI syntheses start by pushing "▶" button.

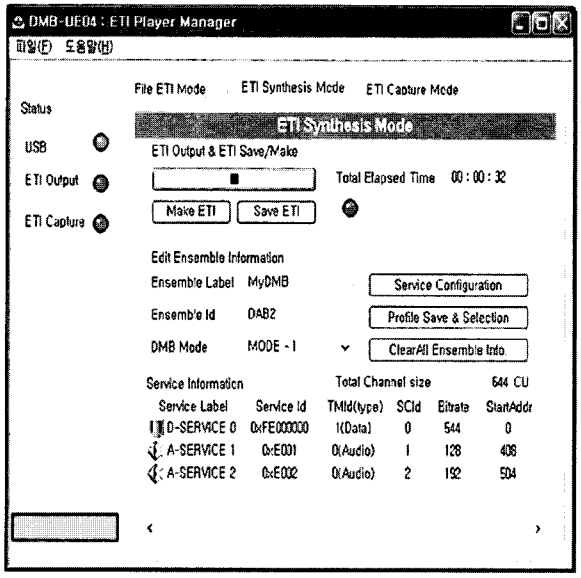


Fig. 9 ETI Synthesis and Output Screen

V. Conclusions

In this paper, we proposed the new architecture of a DMB transmission system based on Eureka-147 for a multimedia broadcasting service. The proposed system provides a solution with high flexibility and low cost to service multimedia broadcasting by using the conventional DAB transmission system. T-DMB service will be initiated in the near future, and various commercial products including our Ensemble Remultiplexer, multimedia contents, and other related services relevant to it will come onto the market.

REFERENCES

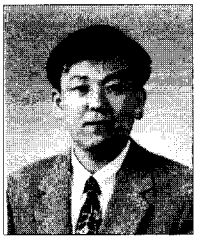
[1] T. Elgamal, "A public key cryptosystem and a signature based on discrete logarithms", IEEE Transactions on Information Theory, 1985. IEEE, v.IT-31, pp.469-472

[2] Certicom Research, "SEC2: Recommended elliptic curve cryptography domain parameter". 1999.

[3] D. Handkerson, J.L, etcs, "Software implementation of elliptic curve cryptography over binary fields," LNCS, vol. 1965, 2001, pp.1-24

[4] Y. Jeong and W. Burleson, "VLSI array synthesis for polynomial GCD computation and application to finite field division," IEEE Trans on Circuit and System, pp.891-897, 1994

[5] B. Roscher, H. Weissleder, G. Fuchs, H. Kling, and M. Isken, "Experiences in the Design of DAB Front-Ends," IEEE Proc. Consumer Electronics, June 1998, pp. 386-387.
[6] ETSI EN 300 401 v1.3.3, Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to Mobile, Portable and Fixed Receivers, Sept. 2001.
[7] Wolfgang Hoeg and Thomas Lauterbach, Digital Audio Broadcasting, Principles and Applications, John Wiley & Sons,
[8] ETSI ETS 300 799, Digital Audio Broadcasting (DAB); Distribution Interface, Ensemble Transport Interface (ETI), Sept.1997.
[9] ETSI EN 300 744, Digital Video Broadcasting (DVB); Framing Structure, Channel Coding and Modulation for Digital Terrestrial Television, July 1999.



Jung-Tae Kim
received his Ph.D. degrees in Electronic Engineering from the Yonsei University in 2001. From 1991 to 1996, he joined at ETRI, where he worked as Senior Member of Technical Staff. In 2002, he joined the department of Electronic Engineering, Mokwon University, Korea, where he is presently professor. His research interest is in the area of Information security system technology that includes Network security system design, Quantum cryptosystem, ASIC design of cryptosystem and Wireless communication.