

## Digital Broadcast Receiver

The customer is a Japanese consumer electronics company.

In the next few years, Japan, USA, Europe and other technologically advanced nations would find their television sets transforming into a central, interactive, networked information appliance in homes. The key facilitator for this would be the transformation of terrestrial broadcasting mode from analog to digital enabling the delivery of audio, video and data in the digital form with interactive features, to television receivers. In a similar way, digital receivers would also revolutionize the In-car entertainment systems and would transform the personal hand-held devices into a very powerful entertainment window.

### Business Objective

All the present TV and Radio receivers use analog demodulation techniques so there was requirement for a broadcast Receiver that is fully digital one, which can be used in Digital Radio, Digital TV, Digital HDTV. The client requirement was to design and develop a Digital Broadcast Receiver, which can receive MPEG 2 stream and render the same on to LCD screen and speakers. But client's broadcasting system was a terrestrial broadcasting system, which made it impossible to do the developments in India. To overcome this geographical limitation, we deputed our team of software engineers' onsite at the client site in Japan to develop the complete system.

### System Overview

The prime functionality of the system is to receive the MPEG 2 TS stream containing MPEG 4 Video, MPEG 2 AAC Audio and Data, **Demultiplex, decode** the video and audio and **render** the same on to LCD screen and speakers respectively. The firmware is embedded in a Flash memory, making the system a standalone digital receiver.

The media formats we have worked on includes the most sought after ones like **MPEG 4 Video Simple Profile Level 3** - 384Kbps data rate, 15/30 Frames per second and **AAC audio Simple Profile** - 5.1 channels, 384/256 Kbps data rate, 32/41.1/48 KHz sampling rate. We have also successfully implemented an algorithm for extracting DSMCC data from MPEG 2TS using Digital Fountain technology.

Key system features include:

- Receive the digital broadcast stream (MPEG 2 TS) and demodulate it
- Decode the MPEG 4 video and MPEG 2 AAC from MPEG 2 TS in real time using Trimedia Libraries
- System design is based on Trimedia System Software Architecture
- The complete system firmware is embedded in a Flash memory
- Could be used as a stand alone digital receiver as well as in DTVs



# Digital Broadcast Receiver

## Interfaces and Functional units

- Tuner/OFDM interface  
I2C interface master mode - Control Tuner/OFDM unit from central module
- Input TS interface  
8-bit parallel data interface - Sample input TS stream @ 2 to 20 Mbps
- User Interface - Remote control  
Serial interrupt based control units  
Software functional units confirming to ARIB standard
- Audio Render Interface  
I2S interface to 5.1-channel audio DAC unit.
- Video Render Interface  
8 bit data and I2C serial controller unit to interface to the video encoder IC on Display Device

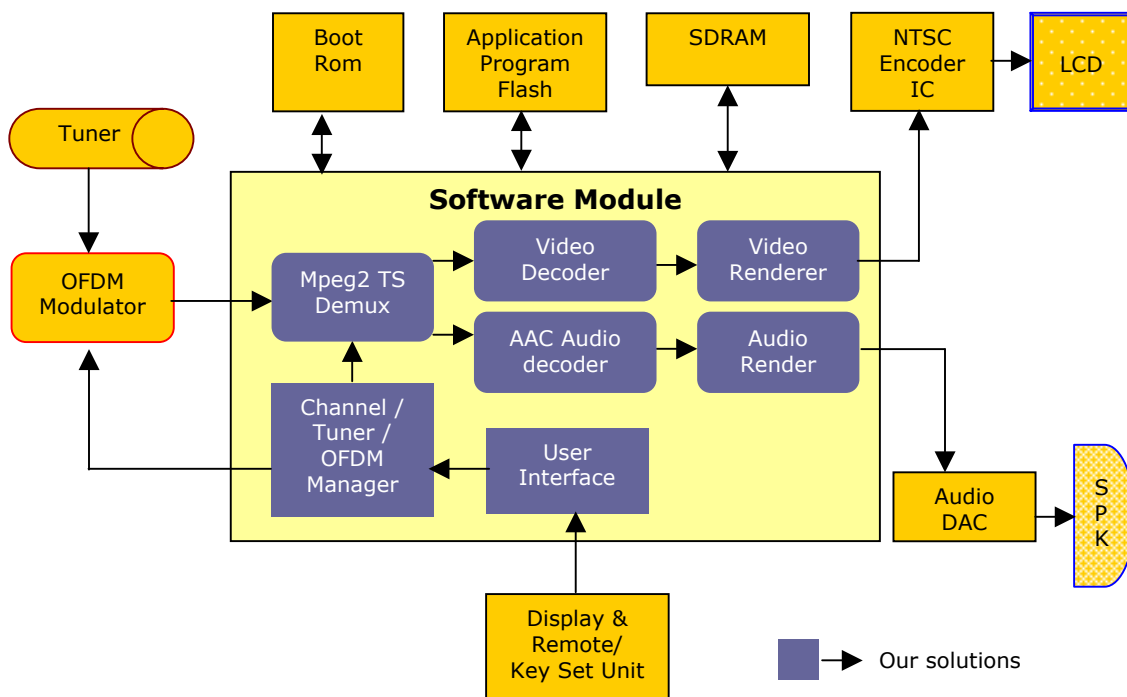


Fig: DBR – System architecture Diagram

- Memory Stick Interface  
FAT File systems for storing files in memory stick  
Serial data /control interface to Sony's memory stick  
Complete software implementation of TPC layer (implementation of serial interface between controller and the memory stick)

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- USB Interface with Host Processor  
USB1.1/2.0 interface with Host processor to download data and music files. Act as a USB device.
- Touch Panel Interface
- DVD player interface
- Camera module interface

### **Middleware and Application Support**

- MPEG 2 TS Demux library
- Content Management
- BML Parser
- Data presentation
- Interactive content Services
- Messaging service integration
- Interactive Tele-shopping options



### **Benefits**

- HDTV – High quality image and sound services
- Data broadcasting - Simple program searching and retrieval of information at any time
  - Weather Information
  - News Updates
  - Statistics and analysis of sports
  - Information on the latest movies & TV programs
- Realization of multiple channels
- Interactive TV – Communication Services and linked services
  - Online Quizzes
  - Tele-shopping
  - Movie on request
- Advanced Options
  - Enrichment of services that are kindly to elderly and handicapped
  - Program selection and processing

### **Development Tools**

For Trimedia and Nexperia:

- pSOS on target side and Windows98SE/Win2K on the host side.
- Trimedia SDE and Nexperia NDK (Trimedia/Nexperia compilation tools, Debugger and simulator)
- MKS toolkit for Cross platform development
- CygWin for Linux/Unix emulation on Windows

For FRV403:

- axLinux on target and TurboLinux on Host and uses the NFS mounting for communicating with host and target
- axLinux SDE (FRV compilation tools, gdb sever etc)
- Sophia Systems FRV ICE using USB interface