KTech TELECOMMUNICATIONS, INC.

Application Note

8-VSB to DVB-ASI / SMPTE-310M Converter
Model Number: VSB-FRQ-200

Introduction

This application note describes the VSB-FRQ-200 and its applications.

Product Description

The VSB-FRQ-200 is an 8-VSB Receiver that demodulates an 8-VSB terrestrial signal, updates the PSIP VCT, and generates DVB-ASI and SMPTE-310M output signals simultaneously.

The main features of the VSB-FRQ-200 are:

- Demodulates an 8-VSB RF signal to DVB-ASI and SMPTE-310M
- Updates the Station Identification (STID), Major Channel Number, and Minor Channel Number for each channel listed (up to six programs) in the Virtual Channel Table (VCT)
- Inputs: RF (CH 2-69), SMPTE-310M, and DVB-ASI
- Simultaneous Outputs: SMPTE-310M, (2) DVB-ASI @19.392 Mbps and (1)Front Panel DVB-ASI @19.392Mbps Testpoint
- (2) IEEE 1394-2000 Firewire Outputs (Optional)
- Loss of Transport Stream Alarm
- Null Packet Insertion & Deletion and PCR Correction
- Remote Control User Interface and Firmware Upgrade via RS232
- Easy to use front panel interface with VFD screen display
- STID, Major & Minor Ch #'s are saved in memory for SMPTE-310M, DVB-ASI, and the most current RF channel in case of power failure or power-off
- Upon power-up, unit will display the last menu before power-off and if necessary update the VCT from memory
- Complies with ATSC A53 specification for 8-VSB modulation for terrestrial broadcast of a high definition digital TV signal
- 1U Rack Mountable

Functional Block Diagram

The signal flow through the VSB-FRQ-200 is shown below in Figure 1.

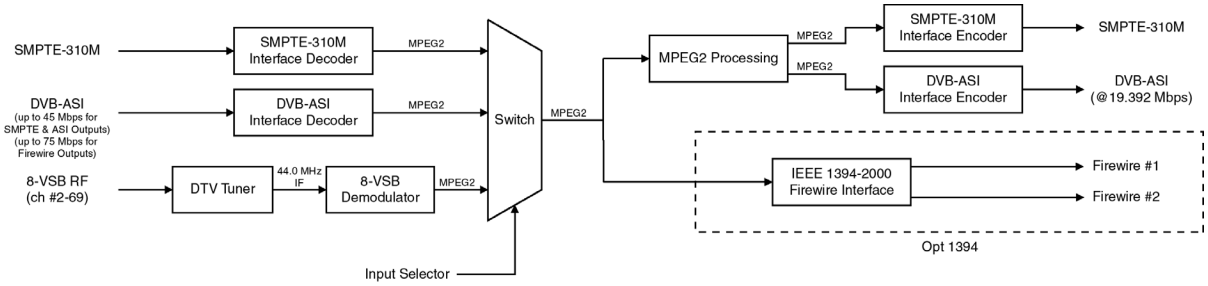

Figure 1: Functional Block Diagram of the VSB-FRQ-200

DTV Tuner

The DTV Tuner accepts an 8-VSB RF signal and down converts it to a 44.0 MHz IF signal. The DTV Tuner accepts 8-VSB RF signal inputs for VHF/UHF channels #2-69.

8-VSB Demodulator

The 8-VSB Demodulator demodulates the 44.0 MHz IF signal into an MPEG2 baseband signal. It's equalizer and Reed Solomon decoding techniques, help correct channel multipath errors. It also performs digital matched filtering to optimize performance over noise.

Interface Decoders

DVB-ASI or SMPTE-310M transport streams can be fed into the VSB-FRQ-200. These signals feed into interface decoders that output MPEG2 Transport Streams. Note: The VSB-FRQ-200 can accept any DVB-ASI signal that has a rate less than or equal to:

- 45 Mbps if Firewire, SMPTE-310M & DVB-ASI Outputs are desired
- 75 Mbps if only Firewire Outputs are desired

Switch and Input Selector

All three MPEG2 Streams that are present are fed into the switch. The Input Selector chooses the MPEG2 stream that will be present at the output. The input selector is controlled using the Front Panel User Interface or via RS232.

Baseband Processing

The baseband processing includes the Null Packet Insertion or Removal, PCR Correction and PSIP Modification. The first step in the process is Null Packet Insertion or Removal. Note: Baseband Processing only occurs for DVB-ASI Inputs less than or equal to 45 Mbps. If SMPTE-310M and DVB-ASI outputs are desired, the DVB-ASI Input should not exceed 45 Mbps.

The Null Packet Insertion/Removal does the following:

Figure 2: Null Packet Insertion/Removal

When the MPEG2 Transport Stream is greater than 19.292 Mbps, the null packets in the stream are removed before entering the FIFO. When the MPEG2 Transport Stream output of the FIFO is less than 19.392 Mbps, null packets are inserted into the MPEG2 Transport Stream to bring the rate back up to 19.392 Mbps.

The second step is PCR Correction. The Program Clock Reference (PCR), embedded within the transport stream, is used to synchronize a receiver's clock with an encoder's clock. The original PCR values that were stamped into the stream by the original encoder will not be the correct PCR values for the receiver after null packets are inserted into or deleted from the stream. Therefore the PCR values need to be re-stamped so that the receiver will have the correct PCR values, thus avoiding PCR clock jitter at the receiver end.

The final step is the PSIP modification where the VCT's STID, Major & Minor Channel Numbers are modified within the stream.

Interface Encoders

The Interface Encoders transform the 19.292 Mbps MPEG2 signal into the DVB-ASI or SMPTE-310M I/O Interface Standards. The SMPTE-310M signal at 19.392Mbps is available at the SMPTE Output. The DVB-ASI at a fixed rate of 19.392Mbps is available at the two ASI Outputs and at the ASI Testpoint on the front panel.

IEEE 1394-2000 Firewire Interface (optional)

The MPEG2 transport stream from the MUX is fed directly into the Firewire Interface. The Firewire Interface transforms the MPEG2 transport stream signal into the IEEE 1394-2000 standard interface, also known as Firewire. Null Packet Insertion, PCR Correction or PSIP updating does not occur on the Firewire outputs, i.e. baseband processing does not occur on the MPEG2 stream that is input into the Firewire Interface. Note: The VSB-FRQ-200 can accept any DVB-ASI signal that has a rate less than or equal to:

- 45 Mbps if Firewire, SMPTE-310M & DVB-ASI Outputs are desired
- 75 Mbps if only Firewire Outputs are desired

Applications

Application #1: Cable Television Service Providers

One application of the VSB-FRQ-200 is at the head end of a digital CATV Service Provider where it may be desired to receive a local 8-VSB DTV broadcast. The VSB-FRQ-200 demodulates the 8-VSB signals to baseband where the PSIP VCT can be updated if so desired. The DVB-ASI output of the unit can then be connected to a QAM Modulator and the DTV signal can be delivered to the consumer's digital set top box.

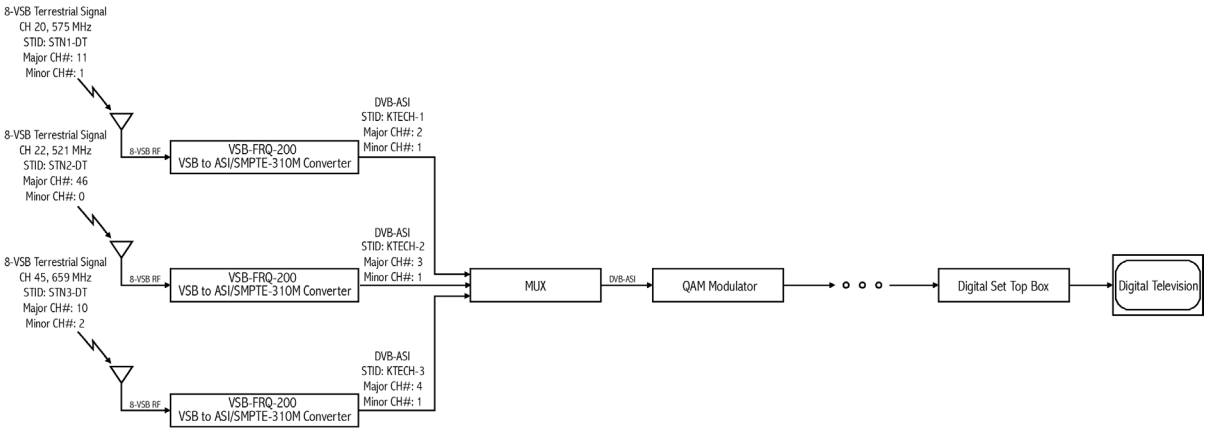

Figure 1: Application of the VSB-FRQ-200 for a Cable Service Provider

Application #2: Public Broadcasting Stations

The VSB-FRQ-200 is also well suited for Public Broadcasting Station use since the satellite feed at a local station is usually available in DVB-ASI format. In this application the VSB-FRQ-200 acts as a DVB-ASI to SMPTE-310M converter. The satellite feed signal is connected to the VSB-FRQ-200's DVB-ASI input and the Major Channel Number, the Minor Channel Number, and the Station ID are changed. The signal from the SMPTE-310M output can then be sent to a DTV exciter for broadcast transmission. The signal now contains properly updated PSIP information to be used in a local broadcast.

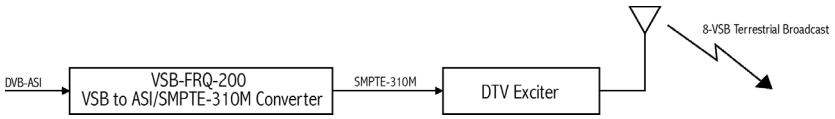

Figure 2: Application of the VSB-FRQ-200 for a Public Broadcasting Station

Application #3: Post Production Facilities

Another Application of the VSB-FRQ-200 is at postproduction facilities where audio and video stored on a D5 Digital Videotape needs to be transferred to a Digital VHS tape or Hard Disk. Using Firewire, digital audio & video information can be transferred to external electronic equipment with virtually no loss in quality. The Firewire outputs can be very useful to post production facilities since they give the user the ability to record digital audio & video content onto digital VHS decks as well as DVD-R/W decks. In this application the main function of the VSB-FRQ-200 is to convert the DVB-ASI output of the MPEG2 HD Encoder into an IEEE 1394 Firewire Interface for the input of the Digital VHS Recorder. The audio and video on the D5 Digital Video tape is uncompressed, therefore an HD Encoder must first compress it into MPEG2. The output interface of most HD Encoders is DVB-ASI and the input to the Digital VHS Recorders is Firewire. The VSB-FRQ-200 is the bridge that closes the gap between the two different interfaces and allows the transfer from uncompressed D5 videotape to MPEG2 compressed digital VHS tape to occur. For computer's with a Firewire input and the necessary software, the Compressed Video can also be stored on the computer's hard disk using the VSB-FRQ-200 Firewire Output.

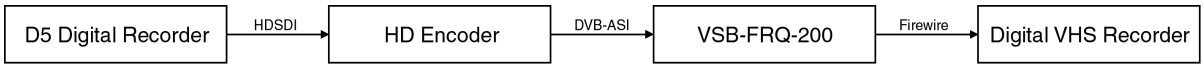

Figure 3: Application of the VSB-FRQ-200 for transferring D5 Digital Video to VHS Digital Video

Front Panel

The front panel of the VSB-FRQ-200 is shown below in Figure 4.

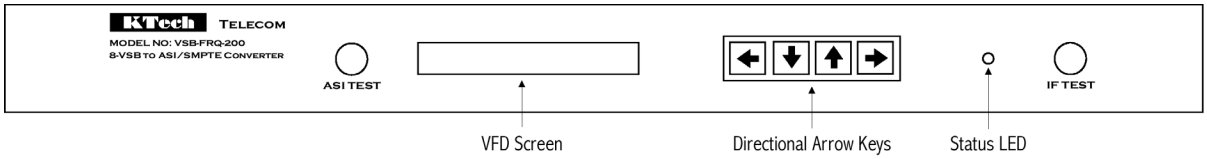

Figure 4: Front Panel of the VSB-FRQ-200

Signal	Connector
DVB-ASI Output Testpoint	BNC
IF Test	Not available on this model

Back Panel

The back panel of the VSB-FRQ-200 is shown below in Figure 5.

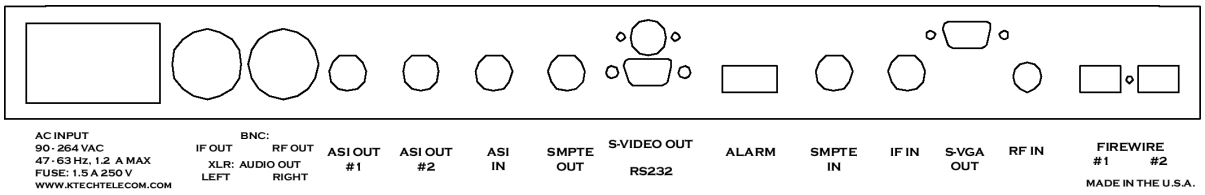

Figure 5: Back Panel of the VSB-FRQ-200

Signal	Connector
IF Out	Not available on this model
RF Out	Not available on this model
LEFT	Not available on this model
RIGHT	Not available on this model
DVB-ASI Output #1	BNC
DVB-ASI Output #2	BNC
DVB-ASI Input	BNC
SMPTE-310M Output	BNC
S-Video Out	Not available on this model
RS232	DSUB 9 Socket
Alarm	3 terminal Phoenix
SMPTE-310M Input	BNC
IF In	Not available on this model
S-VGA Out	Not available on this model
RF Input	75Ω F
Firewire #1	6-pin IEEE 1394 Firewire Connector
Firewire #2	6-pin IEEE 1394 Firewire Connector

Specifications

General

Description	Range	Units
AC Power		
Frequency	47-63	Hz
Voltage	90-264	VAC
Current	1.2	Amp (max)
Operating Conditions		
Temperature	0-50	°C
Altitude	12,000	ft (max)
Humidity (non-condensing)	95	%
Materials		
Aluminum chassis		
Weight		
Net	10	lbs.
Gross (shipping)	13	lbs.
Dimensions		
Height	1.75	inches (1RU)
Width	19	inches
Depth	18	inches
Cooling		
Blower	Located on the left side towards the back of the unit	

RF Input Specifications

	Specification	Comments
Frequency	50-860 MHz	
USA Channel Numbers	2-69	
CATV Channel Numbers	1-125	
Impedance	75 ohms	
Connector	F	
RF Band	6.0 MHz	

Demodulator

Parameter	Specification	Comments
Mode	8-VSB Terrestrial	
Equalizer Span	-5.9μS to +40μS	
Data Rate	19.392658 Mbps	
SNR Threshold	15dB	

SMPTE310M Serial Interface (Baseband Data Input/Output)

Parameter	Specification	Comments
Connector	BNC	
Source Impedance	75 ohms	
Output Coupling	AC	AC inductively coupled
Signal Overshoot	<10%	
Data Format	Biphase Mark Coding	
Transport Stream Bit Rate	19.39265 Mbps	Raw serial data rate ± 2.8 ppm

DVB-ASI Serial Interface (Baseband Data Input/Output)

Parameter	Specification	Comments
Connector	BNC	
Source Impedance	75 ohms	
Output Coupling	AC	AC inductively coupled
Transport Stream Bit Rate (input)	2.6 Mbps Min 45 Mbps Max	
Transport Stream Bit-Rate (output)	19.39265 Mbps	

PSIP Update

Parameter	Specification	Comments
Station Identification	Up to seven letters	
Major Channel Number	# 2-69	
Minor Channel Number	# 0-9	

IEEE 1394-2000 Firewire Interface

Parameter	Specification	Comments
Connector	6-pin	Firewire Connector
Number of Ports	2	
Power Class	Class 0	
Transfer Speed	200 Mbps	
Interface	IEEE 1394-2000	

Ordering Information

Part Number	Description
VSB-FRQ-200	8-VSB RF to DVB-ASI/SMPTE-310M Converter
VSB-FRQ-200 Opt 1394	With (2) IEEE 1394-2000 Firewire Outputs

Additional Information at KTech Web Site: www.ktechtelecom.com
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