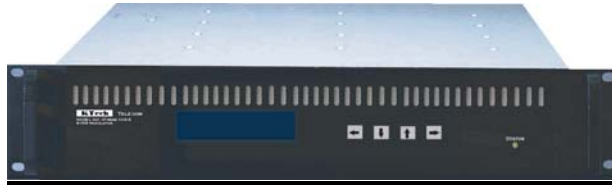


Application Note

8VSB DTV Exciter
Model Number: Xtreme-1000E
Version: 4.0
Date: Sept 27, 2007



Introduction

This application note describes the XTREME-1000E 8VSB Digital Exciter and its applications.

Product Description

The XTREME-1000E is used for reception of an 8-VSB RF signal and demodulation into baseband signals, updates the PSIP VCT's Station ID, Major and Minor Channel Numbers, and remodulates the baseband signal into an 8-VSB RF signal.

The main features of the XTREME-1000E are:

- ❑ 8VSB Off-Air input, 8VSB demodulation to base-band Transport Stream
- ❑ Agile RF Input channel frequency (VHF & UHF CH2~69)
- ❑ Automatic/Fixed (user selectable) Adaptive linear and non-linear Pre-Correction without external equipment
- ❑ RF Output, Agile Frequency on UHF Band. (Fixed channel on VHF available)
- ❑ Inputs for SMPTE-310M, DVB-ASI, and ATSC RF input (CH2~CH69)
- ❑ MPEG2 Transport Stream SMPTE-310M output from ATSC RF Input
- ❑ Digital AGC/ MGC with Front Panel Switch
- ❑ External 10MHZ Reference input
- ❑ Fine Pilot Frequency Adjust
- ❑ Firmware Upgradeable through RS232
- ❑ Loss of RF signal Alarm, Loss of Transport Stream Alarm, Loss of PLL Lock Alarm
- ❑ Correction Settings stored on Flash Memory and called upon Power Up
- ❑ PSIP Modification
- ❑ Complies with ATSC A53 specification for 8-VSB modulation for terrestrial broadcast of a high definition digital TV signal
- ❑ 2U Rack Mountable

1.0 Functional Block Diagram

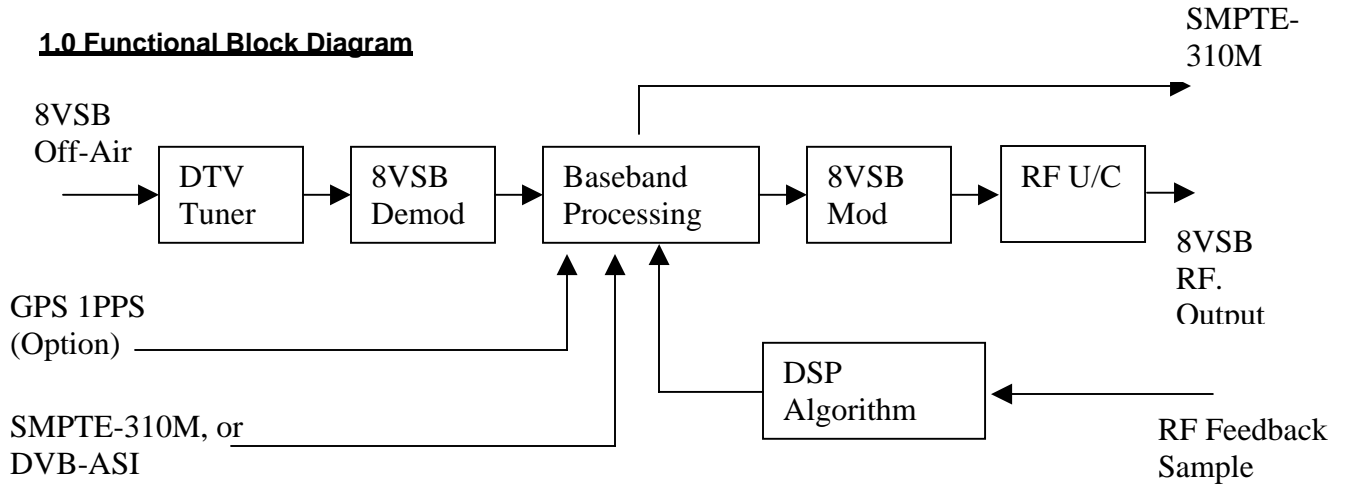


Figure 1-1: Functional Block Diagram of the XTREME-1000E

DTV Tuner

The DTV Tuner accepts an 8-VSB RF off-the-air signal (CH2~CH69) and down converts it to a 44.0 MHz IF signal. The DTV Tuner accepts 8-VSB RF signal inputs for a user selectable via a front panel on any of the VHF/UHF channels #2-69.

8-VSB Demodulator

The 8-VSB Demodulator demodulates the 44.0 MHz I.F. signal into a baseband signal, i.e. MPEG2. It's equalizer and Reed Solomon decoding techniques, help correct channel multipath errors. It also performs digital matched filtering to optimize performance over noise. This unit is implemented with LG 5th Generation 8VSB demodulation chip.

Baseband Processing

The baseband processing includes the PSIP VCT Update, Null Packet Insertion and PCR Correction. The first step in baseband processing involves updating the PSIP. The PSIP Virtual Channel Table's (VCT) Station ID, Major Channel and Minor Channel Numbers are updated. The next step in the process is Null Packet Insertion. The Null Packet Insertion does the following:

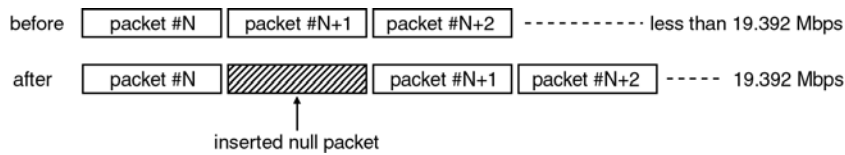


Figure 1-2: Null Packet Insertion

If the MPEG2 Transport Stream is less than 19.392 Mbps, null packets are inserted into the MPEG2 Transport Stream to bring the rate up to 19.392 Mbps. The final 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 the stream. 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 Baseband Processing also performs TS input processing for SMPTE-310M or DVB-ASI inputs, and converts the TS signal into parallel format suitable for the 8VSB Modulator.

In addition, the 8VSB input signal is converted into SMPTE-310M TS signal as an output.

RF Upconverter

The Upconverter takes the 44.0 MHz IF transmit signal and converts it up to a higher frequency. The RF up-Converter places the 8VSB transmit I.F. onto any of the user specified UHF channels. This channel number is selectable by user using the front panel keypads and tunes to any channels in the UHF band. The VHF channel is available as an option and only available as a fixed channel.

RF Feedback Sample/DSP Algorithm

The RF Feedback sample is used to measure linear and non-linear distortions. The DSP algorithm adjusts its internal FIR taps to maximize the output SNR values. The baseband processing also includes DSP electronics to measure feedback signal and generation of self-contained automatic linear and non-linear pre-correction. The linear and nonlinear pre-correction can be set for automatic mode or fixed mode upon user selection. The transmit power Automatic Gain Control (AGC) and Manual Gain Control (MGC) is available upon user selection from the front panel menu.

GPS 1PPS (optional)

The unit is capable of accepting GPS 10MHz reference signal and GPS 1PPS pulse timing signal to properly align the beginning of 8VSB frames within a network of 8VSB translators. This configuration is typically useful for on-channel booster application and allows users to time advance or delay by $1/10^{\text{th}}$ of 8VSB symbols.

Front and Back Panel

The front panel of the XTREME-1000E is shown below in Figure 2-1.

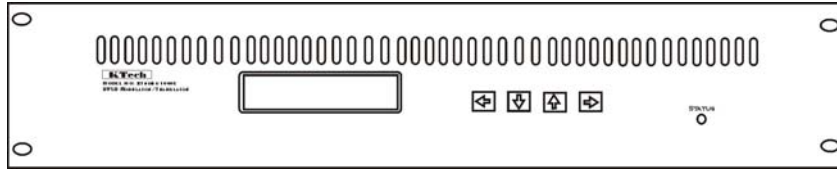


Figure 2-1: Front Panel of the XTREME-1000E

The back panel of the XTREME-1000E is shown below in Figure 2-2.

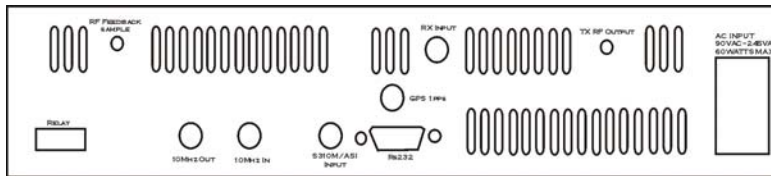


Figure 2-2: Back Panel of the XTREME-1000E

I/O Connector Description

Signal	Connector	Description
SMPTE-310M/ASI INPUT	BNC	MPEG2 Transport Stream Input. SMPTE-310M is limited to precisely at 19.39MBPS. ASI input is limited to data rate less than 19.39MBPS. User selectable between 310M and ASI input.
SMPTE-310M OUTPUT	BNC	SMPTE-310M MPEG2 Transport Stream Output. This signal is generated from the RF input tuner with the channel number selected by user on the front panel manu.
RF INPUT	BNC	Input for Off-the-Air 8VSB reception.
RF FEEDBACK SAMPLE	SMA	Input for RF feedback sample to be used for linear and non-linear pre-correction. The power level should be 0dBm +/- 1dB
TX RF OUTPUT	SMA	RF output for 8VSB Modulator, 0dBm output
10MHZ Output	BNC	10MHz Internal Reference output. This is typically looped back into 10MHZ Input
10MHZ INPUT	BNC	10MHZ Reference Input. All internal clocks for symbol clock, pilot tone, and carrier frequency is generated with PLL to this 10MHZ Input.

GPS 1PPS	BNC	Input for GPS 1PPS TTL input to time lock the start of 8VSB symbols. It is aligned with the start of a field sync within 8VSB signal structure. This feature shall be used together with GPS 10MHZ reference source on 8VSB translators to be synchronized in the network
RS232	DSUB 9 Socket	General purpose communications port. This port used to update the firmware, monitor health and status
Alarm	3 terminal Phoenix	Normally closed/opened contact closure. Activated upon PLL unlock, MPEG2 Loss, Tuner RF Signal Loss, Demod SNR Threshold, AC Power Loss

Applications

The XTREME-1000E is designed to be used as a part of an 8VSB Digital Translator. In this configuration, Ktech provides the Translator and customer provides the rest of the components such as a Power Amplifier and an output Transmit Band-Pass Filter (BPF). Typically, the BPF is an 8th-order FCC Mask Filter.

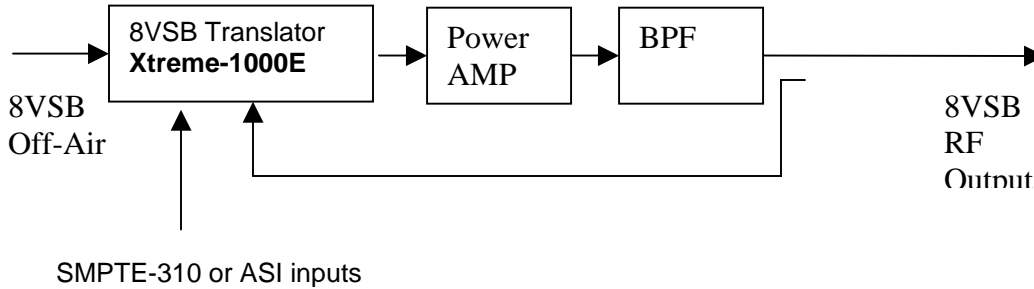


Figure 4: Application of the XTREME-1000E for 8VSB Digital Translator

The unit is also capable of accepting SMPTE-310M and ASI input signals upon front panel selection. Using the unit's proprietary Phase Noise correction capability, the unit is able to isolate its transmit phase noise from the received carrier. This allows translators implemented with XTREME-1000 to be hopped as many times as desired and not add carrier phase noise every time the system is repeated.

The unit also uses the RF feedback sample to control its output power level to within +/-5% of the total output power. This is performed by a digital AGC and temperature compensated to hold the output power upon its operating temperature range. User also has a front panel manual setting option to increase or decrease the transmitted output power.

The linear pre-correction measures the linear distortion present at the output of the translator and pre-correct its modulator output such that the output linear distortion is minimized. Upon detection of performance degradation due to linear distortion, the unit self-corrects such linear distortions. Linear distortions are created typically due to change in temperature and change in output filter response and cause SNR, MER, Group delay, and Magnitude response degradation.

The non-linear pre-correction measures the non-linear distortion present at the output of the translator and pre-correct its modulator output such that the output non-linear distortion is minimized. Upon detection of performance degradation due to non-linear distortion, the unit self-corrects such non-linear distortions. Non-linear distortions are created typically due to change in temperature and change in amplifier's transistor response over time and cause increase IMD levels. Such increased IMD levels may violate the FCC mask or create adjacent channel interference.

Specifications

General

Description	Range	Units
AC Power		
Frequency	47-63	Hz
Voltage	90-264	VAC
Current	1.2	Amp (max)
Operating Conditions		
Temperature	-10 ~ +45	°C
Altitude	12,000	ft (max)
Humidity (non-condensing)	95	%
Materials		
Aluminum chassis	0.060" thick AL	
Weight		
Net	25	lbs.
Gross (shipping)	30	lbs.
Dimensions		
Height	3.5	inches (2RU)
Width	19	inches
Depth	18	inches
Cooling		
Blower	Draws air from Front Panel and Exits to the Rear Panel	

RF Input Specifications

	Specification	Comments
Frequency	50-860 MHz	
USA Channel Numbers	2-69	Frequency Agile
Impedance	75 ohms	
Input RF Power Level	-79dBm ~ -14dBm	Measured over 6MHz band
Input minimum SNR threshold	15dB	
Connector	BNC	
RF Band	6.0 MHz	

Demodulator

Parameter	Specification	Comments
Mode	8-VSB Terrestrial	
Equalizer Span	-5.9 μ S to +40 μ S	LG 5 th Gen Demod
Data Rate	19.392658 Mbps	+/- 54 bps
SNR Threshold	15dB	

SMPTE310M Serial Interface (Baseband Data Input)

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 \pm 2.8 ppm

DVB-ASI Serial Interface (Baseband Data Input)

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

PSIP Update (optional)

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

Modulator

Parameter	Specification	Comments
Mode	ATSC A53	8-VSB Terrestrial
Symbol Rate	10,762,238 Hz	+/- 30 Hz
Linear Correction		
- Group Delay Correction	+/- 500nS max	Max group delay correction
- Typical SNR after correction	34dB	
- Control	Automatic/Manual	On/off selectable
Non-Linear Correction		
- Typical IMD Correction	4dB	
- Typical SNR after correction	34dB	
- Control	Automatic/Manual	On/off selectable
Compliance	ATSC Spec	per ATSC A53 Document

RF Output

Description	Specification	Condition
Frequency Range	55-858 MHz	band center
Frequency Channel Selection	Agile - UHF Agile - VHF	UHF VHF
Frequency Stability	<±0.5 ppm	
Aging	<±1 ppm/year	
RF Output Level	0 dBm	
Phase Noise	>-105dBc	At 20 Khz
Impedance	50 ohm	
Connector	SMA	
Spurious	-60 dBc	including harmonics
Return Loss	>18 dB	

RF Feedback

Description	Specification	Condition
Frequency Range	55-858 MHz	band center
RF Input Level	0 dBm	+/- 1dB
Impedance	50 ohm	
Connector	SMA-Jack	
Return Loss Required	>18 dB	

Ordering Information

Part Number	Description
XTREME-1000E	8VSB DTV Modulator with automatic linear & non-linear pre-correction. SMPTE-310M input/output standard. - Includes RF demodulator to receive off-air ATSC 8VSB signal
- GPS	GPS lock and generation of channel booster signals

Additional Information at KTech Web Site: www.ktechtelecom.com
For Pricing and Delivery information: sales@ktechtelecom.com

KTech TELECOMMUNICATIONS, INC.

DTV Broadcast Products

21540 Prairie St., Unit B
Chatsworth, CA 91311
Phone (818) 773-0333 Fax (818) 773-8330