

Application Note

DTV Channel Converter
Model Number: DCC-150E



Introduction

This application note describes the DCC-150E DTV Channel Converter and its applications.

Product Description

The DCC-150E is used for reception of an 8VSB RF signal and 8VSB remodulation to another CATV or VHF/UHF Channel. It demodulates 8VSB RF signals into baseband signals, updates the PSIP VCT's Station ID, Major and Minor Channel Numbers, remodulates the baseband signal into an 8VSB 44.0 MHz IF signal and upconverts the 44.0 MHz IF signal into an 8VSB RF signal.

The main features of the DCC-150E are:

- ✂ ✂ Frequency agile RF output that covers both CATV and VHF/UHF frequency ranges in 12.5KHz steps from 55-858 MHz
- ✂ ✂ RF Power Level Output adjustment from +45 dBmV to +62 dBmV in 1 dBmV steps
- ✂ ✂ 8-VSB RF (CATV #1-125 and VHF/UHF #2-69), SMPTE-310M, and DVB-ASI@19.392 Mbps Inputs
- ✂ ✂ Simultaneous SMPTE-310M, DVB-ASI @19.392 Mbps and 8-VSB RF Signal Outputs
- ✂ ✂ Easy to use front panel interface with VFD screen display
- ✂ ✂ Front panel 44.0 MHz IF Output (-20 dB coupled) and DVB-ASI Output Testpoints
- ✂ ✂ Firmware Upgradeable through RS232
- ✂ ✂ Loss of Transport Stream Alarm
- ✂ ✂ Remote Control via RS232 (optional)
- ✂ ✂ 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

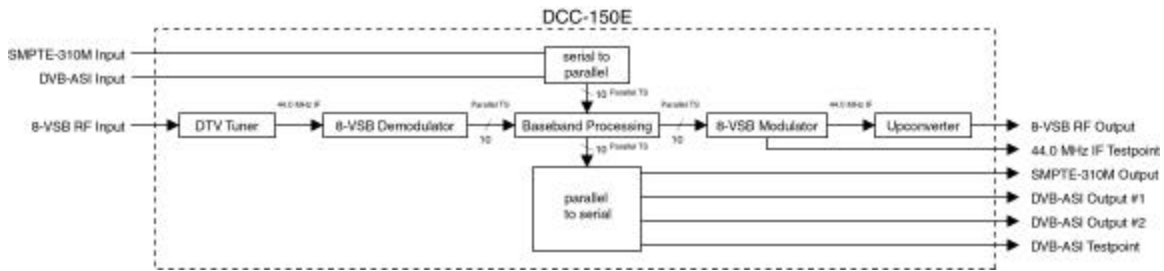


Figure 1: Functional Block Diagram of the DCC-150E

DTV Tuner

The DTV Tuner accepts an 8VSB RF signal and down converts it to a 44.0 MHz IF signal. The DTV Tuner accepts 8VSB RF signal inputs for CATV channels #1-125 and VHF/UHF channels #2-69.

8-VSB Demodulator

The 8-VSB Demodulator demodulates the 44.0 MHz IF 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.

Serial to Parallel Conversion

The serial SMPTE-310M and DVB-ASI input signals need to be converted to parallel MPEG2 Transport Format before Baseband Processing. Note: The DCC-150E can accept any DVB-ASI signal that has a rate less than or equal to 19.392 Mbps.

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:

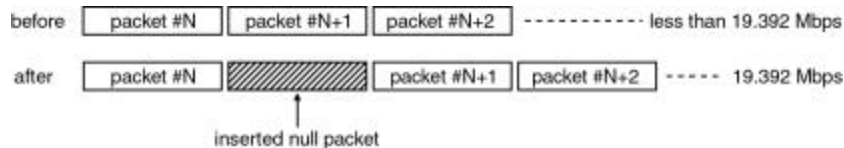


Figure 3-2: Null Packet Insertion

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.

Parallel to Serial Conversion

After baseband processing, the parallel MPEG2 Transport Format is converted back to serial for SMPTE-310M or DVB-ASI Outputs. SMPTE-310M encoding also occurs here. Note: The transport stream at the DVB-ASI output will be at 19.392 Mbps.

8-VSB Modulator

The 8-VSB Modulator modulates the Parallel MPEG2 Transport Stream into an 8-VSB 44.0 MHz IF signal.

Upconverter

The Upconverter takes 44.0 MHz IF signal and converts it up to a higher frequency. It's RF output is frequency agile in 12.5 KHz steps over a range of 55 MHz to 858 MHz. These frequencies cover both the CATV and VHF/UHF bands.

Front and Back Panel

The front panel of the DCC-150E is shown below in Figure 2.

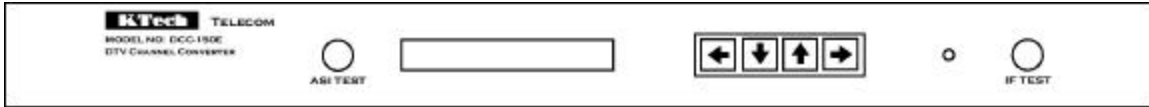


Figure 2: Front Panel of the DCC-150E

Signal	Connector
DVB-ASI Output Testpoint	BNC
44.0 MHz IF Output Testpoint	BNC

The back panel of the DCC-150E is shown below in Figure 3.



Figure 3: Back Panel of the DCC-150E

Signal	Connector
DVB-ASI Output #1	BNC
DVB-ASI Output #2	BNC
DVB-ASI Input	BNC
SMPTE-310M Output	BNC
RS232	DSUB 9 Socket
Alarm	3 terminal Phoenix
SMPTE-310M Input	BNC
RF Input	75Ω F
RF Output	BNC

Applications

The DCC-150E can be used in private cable systems as a digital channel converter. In this application, the user can receive an 8VSB RF VHF/UHF signal off the air, update the PSIP VCT and convert it to a desired CATV Channel frequency. By using this remodulation technique, the 8-VSB signal quality is preserved for CATV distribution. The DCC-150E's receiver removes channel errors that are present in the signal due to multipath interference or noise, by baseband digital equalization and a powerful forward error correction technique that is embedded in the 8 VSB signal structure. The signal is then remodulated into an 8-VSB signal at 44.0 MHz IF, and the resulting copy of the DTV signal is translated to the desired CATV channel frequency.

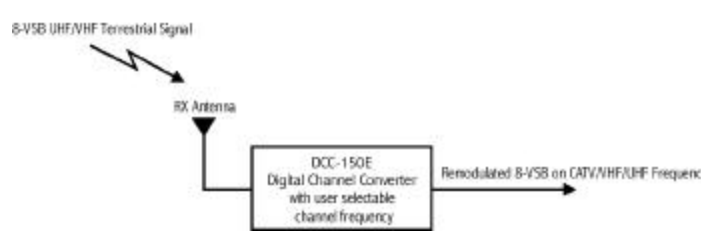


Figure 4: Application of the DCC-150E for CATV Company

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	8,000	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	-5.9?S to +40?S	
Data Rate	19.392658 Mbps	
SNR Threshold	15dB	

SMPT E310M 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 19.39265 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	

Modulator

Parameter	Specification	Comments
Mode		8-VSB
Compliance	ATSC Spec	per ATSC A53 Document

44.0 MHz I.F. Output Testpoint

Parameter	Min	Typical	Max	Units	Comments
IF Output					
Output Frequency Band	41.00	44.00	47.00	MHz	
Carrier Phase Noise			-105	dbc/Hz	20KHz Offset
Output Connector Type		BNC			
Output Impedance		50		Ohms	
Output Power Level		-20		dBm	Over 6MHZ
In-Band SNR		33		dB	Over 6MHZ
Stopband IMD Level	-50			dB	
In-Band Flatness		0.5		dB	Over 6MHZ

RF Output

Description	Specification	Condition
Frequency Range	55-858 MHz	band center
Frequency Step Size	12.5 KHz	
Frequency Accuracy	<±2 ppm	at 23°C
Frequency Stability	<±2 ppm	
Aging	<±1 ppm/year	
RF Output Level	+45 to +62 dBmV	
RF Output Level Step Size	1 dBmV	
Impedance	75 ohm	
Connector	F	
Spurious	-60 dBc	including harmonics
Return Loss	>16 dB	

Ordering Information

Part Number	Description
DCC-150E	DTV Channel Converter

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