

# **INSTRUCTION MANUAL**

## **MODEL 2455T SUBCARRIER MODULATOR**

Data, drawings, and other material contained herein are proprietary to Cross Technologies, Inc., and may not be reproduced or duplicated in any form without the prior permission of Cross Technologies, Inc.

When ordering parts from Cross Technologies, Inc., be sure to include the equipment model number, equipment serial number, and a description of the part.

First Edition, **JUNE 2002**     **6/17/02 Rev 0**

**CROSS TECHNOLOGIES, INC.**  
**6170 SHILOH ROAD**  
**ALPHARETTA, GEORGIA 30005**

**(770) 886-8005**  
**FAX (770) 886-7964**

**web [www.crosstechnologies.com](http://www.crosstechnologies.com)**  
**e-mail [info@crosstechnologies.com](mailto:info@crosstechnologies.com)**

# INSTRUCTION MANUAL MODEL 2455T SUBCARRIER MODULATOR

<u>TABLE OF CONTENTS</u>	<u>PAGE</u>
Warranty .....	2
1.0 General.....	3
1.1 Equipment Description.....	3
1.2 Technical Characteristics.....	3
2.0 Installation .....	4
2.1 Mechanical .....	4
2.2 Controls and Indicators.....	4
2.3 Input / Output Signals .....	4
2.4 Removing PCB from Extrusion.....	4
2.5 Installation / Operation .....	5
2.5.1 Operation .....	5
3.0 Circuit Description.....	7
3.1 Block Diagram Description .....	7

**WARRANTY** - The following warranty applies to all Cross Technologies, Inc. products.

All Cross Technologies, Inc. products are warranted against defective materials and workmanship for a period of one year after shipment to customer. Cross Technologies, Inc.'s obligation under this warranty is limited to repairing or, at Cross Technologies, Inc.' option, replacing parts, subassemblies, or entire assemblies. Cross Technologies, Inc. shall not be liable for any special, indirect, or consequential damages. This warranty does not cover parts or equipment which have been subject to misuse, negligence, or accident by the customer during use. All shipping costs for warranty repairs will be prepaid by the customer. There are not other warranties, express or implied, except as stated herein.

**CROSS TECHNOLOGIES, INC.  
6170 SHILOH ROAD  
ALPHARETTA, GEORGIA 30005**

**(770) 886-8005**

**FAX (770) 886-7964**

**web [www.crosstechnologies.com](http://www.crosstechnologies.com)  
e-mail [info@crosstechnologies.com](mailto:info@crosstechnologies.com)**

## MODEL 2455T SUBCARRIER MODULATOR

### SECTION 1 GENERAL

**1.1 Equipment Description-** The Model 2455T Subcarrier modulator provides an FM modulated signal in the 5.4 to 8.5 MHz subcarrier band at a frequency set at the factory and specified by the customer. The 2455T provides non-emphasized, 150 kHz peak deviation for a 1.0 Vrms input into a balanced 600 ohm input impedance. The output provides 50 to 250 mV p-p out into 75 ohms. Audio connectors are barrier strip and the subcarrier output connector is BNC female. The unit is mounted on a standard 19", 1 3/4 " high rack mount panel and DC power is supplied by a wall mount power supply.



**Model 2455T Modulator**

**FIGURE 1.0 Model 2455T Subcarrier Modulator**

### **1.2 Technical Characteristics**

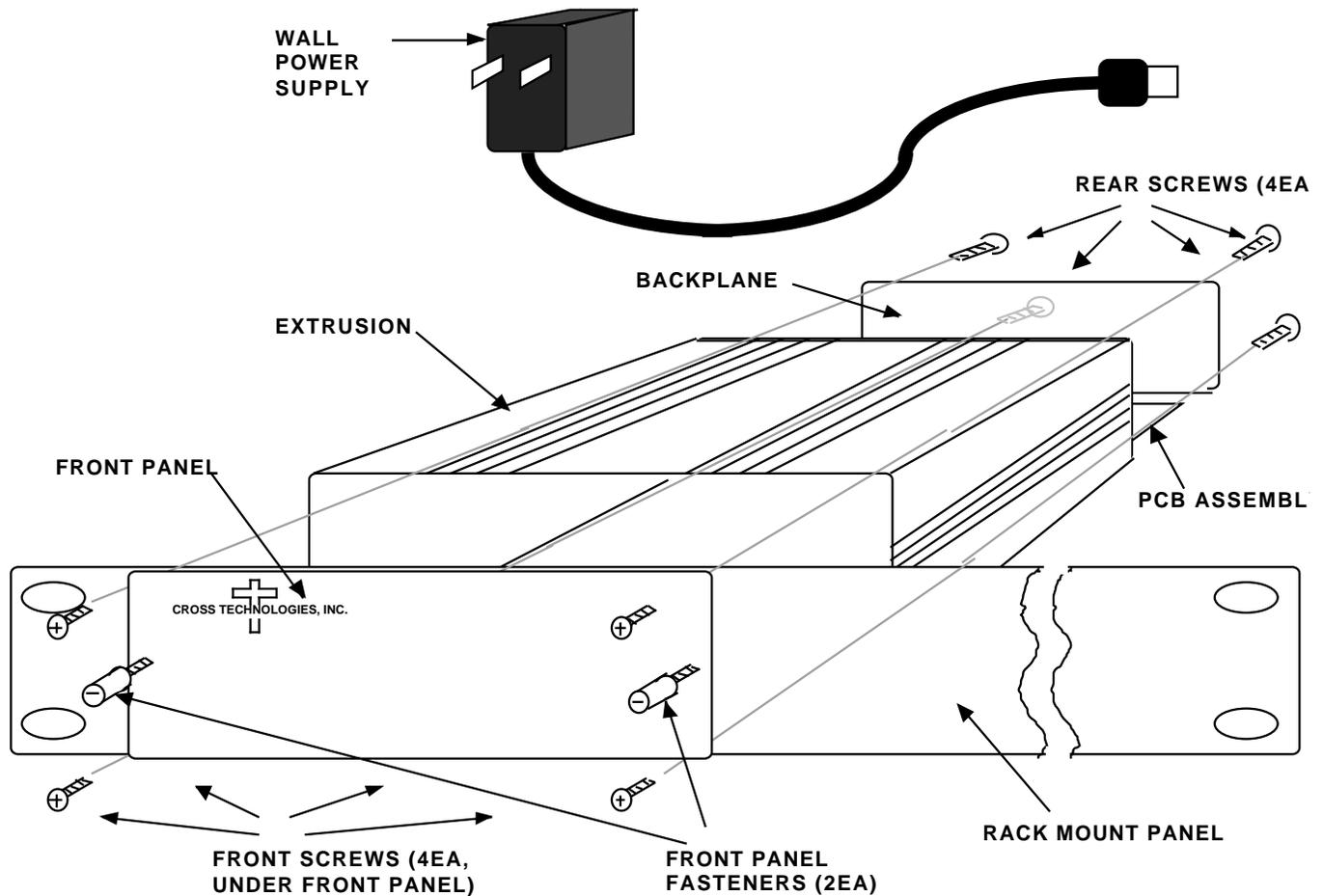
**TABLE 1.0 2455T MODULATOR SPECIFICATIONS**

<u>Characteristics</u>	<u>Specifications*</u>
<b>Audio Input Characteristics</b>	
Impedance	600 ohms, balanced
Frequency	50 Hz to 120 kHz
Input Level	Factory set for 1 Vrms into 600    for 150 kHz Peak deviation (adjustable)
<b>SC Output Characteristics</b>	
Impedance	> 1.5K ohms (bridging)
Frequency range	5.4 - 8.5 MHz, factory set
Level	50 - 250 mVp-p into 75
<b>Channel Characteristics</b>	
Deviation	150 kHz peak
Pre-emphasis	None
Frequency Response	±1.0 dB, 50 Hz - 120 kHz
Distortion	1 %, 1 kHz
<b>Controls</b>	
Output level adjust	10 turn pot adjusts the subcarrier output over 50 - 250 mV p-p
Input level adjust	10 turn pot adjusts the audio deviation; factory set for 1 Vrms for 150 kHz peak deviation
<b>Indicators</b>	
PLL/ALC Alarm	Red LED (with open collector out)
Peak Deviation	Yellow Led, lights at PPL audio level
<b>Other</b>	
DC Power, max.	+15VDC, 125 ma; -15VDC, 50ma; via wall power supply
RF, IF Connectors	BNC, female

\*+10 to +40 degrees C; Specifications subject to change without notice

## 2.0 Installation

**2.1 Mechanical** - The 2455T Modulator PCB is packaged in an aluminum extrusion. The 2455T is mounted on a 1 3/4" X 19" panel that can be mounted to a rack using the 4 holes at the ends. The unit derives  $\pm 15V$  from the wall power supply. See Figure 2.1.



**FIGURE 2.1 SERIES 2700 ASSEMBLY DRAWING**

**2.2 Controls and Indicators** - Figure 2.2 shows front panel controls and indicators.

**2.3 Input / Output Signals** - Figure 2.3 shows the input and output signals to the 2455T.

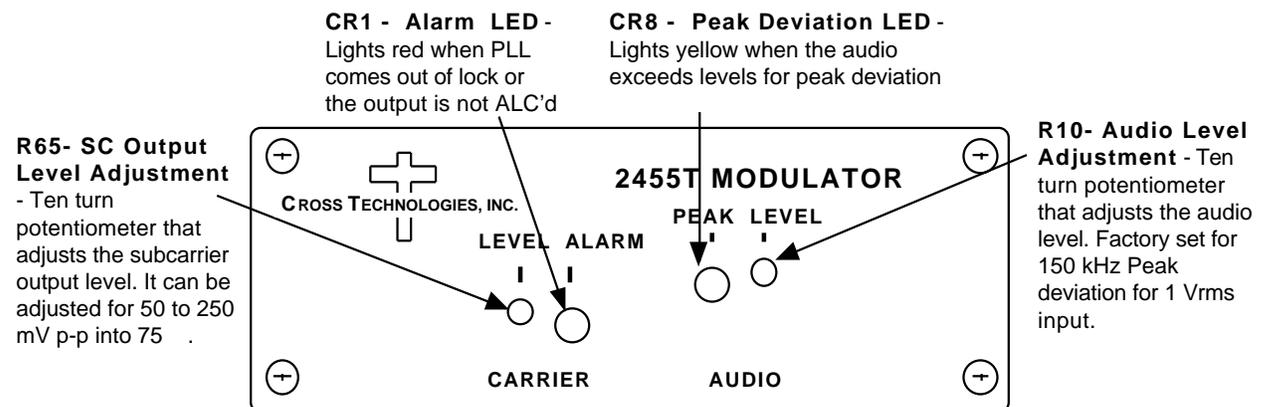
**2.4 Removing the Printed Circuit Board (PCB) From the Extrusion** - There are no on-card jumpers or other on-card controls. To remove the printed circuit board (PCB) from the extrusion:

- 1.) Remove four (4) **rear panel screws** (see Figure 2.1).
- 2.) **Gently** pull the backplane and PCB assembly completely out of the extrusion.
- 3.) **Always remove power** when removing or installing the PCB in to the extrusion. Make sure the shield goes in the lower channel and the PCB in the next channel above that in the extrusion.
- 4.) **Gently** push the backplane and PCB assembly completely in to the extrusion.
- 5.) Install four (4) **rear panel screws**.

## 2.5 Installation / Operation -

### 2.5.1 Operation -

- 1.) Connect the wall power supply to the 2455T and the wall power supply to 115 VAC, 60 Hz (Figure 2.1)
- 2) **AUDIO INPUT** - Pins 16 and 17 of J4 (terminal strip on the back panel, see Figure 2.3 and Table 2.1) are the balanced audio inputs. Pin 18 is ground.
- 3) **SUBCARRIER OUTPUT** - The subcarrier output is available on J1, the BNC connector on the back panel (Figure 2.3). JP1 may be placed in the "TERM" position for a 75 ohm termination. If video is being looped through, this jumper it should be placed in "non-term" (JP1 pins 2 -3) position. Use a BNC "T" to add the subcarrier output to the video if using the high impedance loop through. Be sure a 75 ohm termination is provided at some point in the loop, preferably at the end.
- 4.) The output level is adjustable from 50 to 250 mV p-p into a 75 ohm load with R65 (Figure 2.2).
- 5.) The alarm indicator CR1 (Figure 2.2) will illuminate if the output level is adjusted beyond the ALC range of the module. It will also illuminate if the PLL comes out of lock.
- 6.) The peak deviation indicator, CR8 (Figure 2.2) flashes when the modulator exceeds 150 kHz /peak deviation.

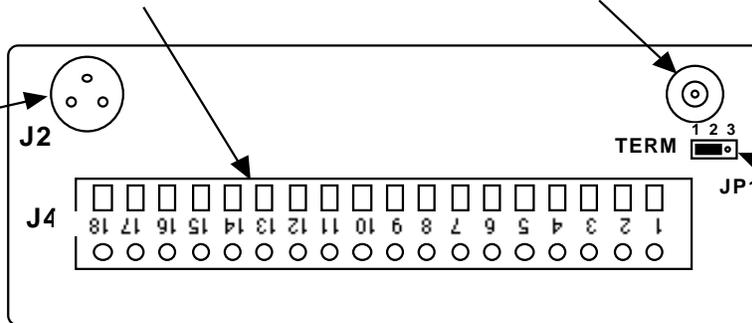
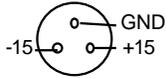


**FIGURE 2.2 2455T Front Panel Controls and Indicators**

**J4 - I/O BARRIER STRIP** - Provides connections for audio, data, alarm signals, etc. Pin numbers are as shown upside down on the connector. See Table 2.1

**J1 - BNC IN/OUT** - Signal from pin 2 or 3 (as set by strap beside J1) of PCB which is for subcarrier, video, IF and RF signals.

**J2 - DC IN** - The +15 VDC AND -15 VDC regulated DC voltage from the wall power supply



**JP1 - J1 OUTPUT TERMINATION**  
 TERM = 75 TERMINATION  
 2-3 = NO 75 TERMINATION

**FIGURE 2.3 2455T Inputs and Outputs**

TABLE 2.1 INPUT AND OUTPUT SIGNALS			
CONNECTOR	GENERAL FUNCTION	2455T FUNCTION	COMMENTS
J1	BNC IN/OUT	SUBCARRIER OUTPUT	50 TO 250 MV P-P
J2	DC IN	DC IN	± 15 VDC, 3PIN MINI-DIN
J3	PCB EDGE CONNECTOR	PCB EDGE CONNECTOR	INTERNAL USE
J4 - PIN			
1	GROUND	GROUND	
2	BB IN/OUT	NOT USED	
3	RF/IF OUT/IN.	NOT USED	
4	+AUDIO - L; +CLK	NOT USED	
5	-AUDIO - L; -CLK; RS232	NOT USED	
6	MISC; AGC; CC; BCD-0	NOT USED	
7	UNBAL AUDIO - L.	NOT USED	
8	MISC; CC; BCD-1	NOT USED	
9	+15 VOLTS.	+15 VOLTS.	
10	MISC; CC; BCD-2	NOT USED	
11	-15 VOLTS	-15 VOLTS	
12	MISC; CC; BCD-3	NOT USED	
13	UNBAL AUDIO - R.	NOT USED	
14	MISC; CC;	NOT USED	
15	ALARM; CC.	ALARM OPEN COLLECTOR	(+30 VDC, 30ma MAX).
16	+AUDIO - R ; +DATA.	+AUDIO IN	1 Vrms at PPL, 600 balanced for 150 kHz Peak
17	-AUDIO - R ; -DATA; RS232.	-AUDIO	1 Vrms at PPL, 600 balanced for 150 kHz Peak
18	GROUND	GROUND	

### 3.0 Circuit Description

#### 3.1 Block Diagram Description - 2455T (Figure 3.1) -

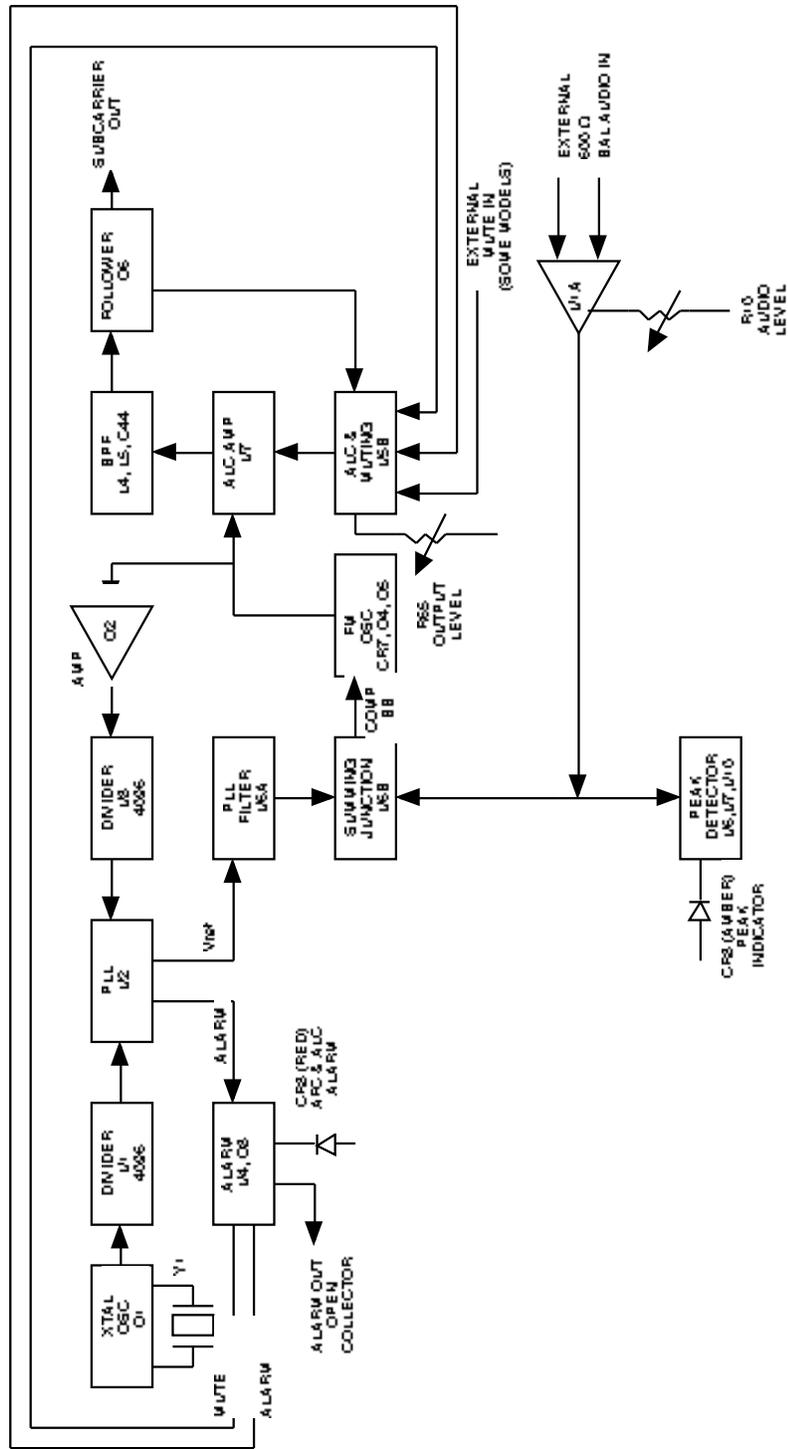
The subcarrier modulator generates a frequency modulated carrier in the 5.4 to 8.5 MHz range for use in a subcarrier transmission system. Its output power is variable, permitting various injection levels. Refer to Figure 3.1 and the following detailed description.

The FM oscillator is a varactor tuned, modified Colpitts oscillator whose frequency is stabilized by a phase locked-loop (PLL) to a crystal reference. The output from the FM oscillator is amplified in the ALC amplifier to a sufficient level for use in the transmission system. The bandpass filter is a three pole LC filter with a bandwidth sufficient to pass the FM carrier and its significant sidebands. An emitter follower isolates the output from external conditions. The output impedance is relatively high (nominally 2 k ohms), permitting bridging onto a low impedance baseband with minimal loading. A portion of the output is sampled for control of the alarm and mute circuit. Should the unloaded carrier level decrease below 40 mV p-p either by failure, loading, or external mute, the ALC and muting circuit biases the ALC amplifier off and activates the alarm circuitry. The alarm circuit consists of several logic gates which monitor the PLL performance and status of the ALC bias. Should the PLL break lock, U4 detects the PLL state and:

- a. Biases Q3 on for external alarm indications.
- b. Illuminates CR1 to provide a visual indication of alarm
- c. Biases U5B positive which, in turn, shuts off the ALC amplifier.

The external mute (available in some models) forces a similar condition and causes alarm conditions

The PLL system maintains frequency stability of the FM oscillator. A portion of the FM oscillator output is sampled in U3; the crystal standard oscillator is sampled in U1. The resulting square waves OUT of U1 and U3 respectively are processed in the PLL, U2. The PLL attempts to maintain phase lock between U3 and U1 outputs by providing a DC bias which is filtered in the PLL filter, and applied to the varactor diode in the FM oscillator. The summing junction, U6B, sums the modulating frequency with the DC bias, then applies the composite baseband to the varactor diode, CR7. The center frequency of the FM oscillator is dependent on the DC component of composite baseband provided by Vref, which stabilizes the capacitance of CR7. The PLL filter has a very slow time constant which prevents excessive frequency shift of the FM oscillator due to modulation.



**Figure 3.1 Subcarrier Modulator Block Diagram**