



**LB-951**

**COLOR SUBCARRIER FREQUENCY**

**MEASUREMENT EQUIPMENT**

**RADIO CORPORATION OF AMERICA  
RCA LABORATORIES DIVISION  
INDUSTRY SERVICE LABORATORY**

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**Measurement Equipment**

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Approved

A handwritten signature in cursive script, reading "Stuart W. Selby", is written over a horizontal line.



# Color Subcarrier Frequency Measurement Equipment

## Introduction

The FCC color television signal standards specify that the color subcarrier frequency be 3.579545 Mc  $\pm 0.0003$  per cent ( $\pm 10.7$  cycles). Even though stable crystal oscillators are used they must be initially set on frequency and their frequency checked periodically. This bulletin describes equipment which, when used in conjunction with the interlaced sampling-signal generator (LB-853 and 853A)<sup>1</sup> and a receiver, provides a simple and accurate method of checking the subcarrier frequency against the WWV standard frequency transmissions. A 4.5-Mc signal is also generated for checking the frequency difference between the picture and sound carrier frequencies.

## Principle of Operation

In the color signal standard the color subcarrier and horizontal line frequencies were chosen to make the 4.5-Mc sound carrier the 572nd harmonic of one-half line frequency; and the color subcarrier frequency, the 455th harmonic of one-half line frequency. The relationship between 500 kc, harmonics of which can be used to beat directly with WWV, and 3.579545 Mc can be derived as follows:

$$\text{one-half line frequency} = \frac{3.579545}{455} = \frac{4.5 \text{ Mc}}{572}$$

$$4.5 \text{ Mc} = \frac{572}{455} \times 3.579545 \text{ Mc}$$

$$500 \text{ kc} = \frac{1}{9} \times 4.5 \text{ Mc} = \frac{572}{455} \times \frac{1}{9} \times 3.579545 \text{ Mc}$$

$$500 \text{ kc} = \frac{44}{315} \times 3.579545 \text{ Mc}$$

A divider capable of generating 500 kc from 3.579545 Mc must have an overall frequency

<sup>1</sup>LB-853, *Interlaced Sampling-Signal Generator*.  
LB-853A, *Modification of Interlaced Sampling-Signal Generator*.

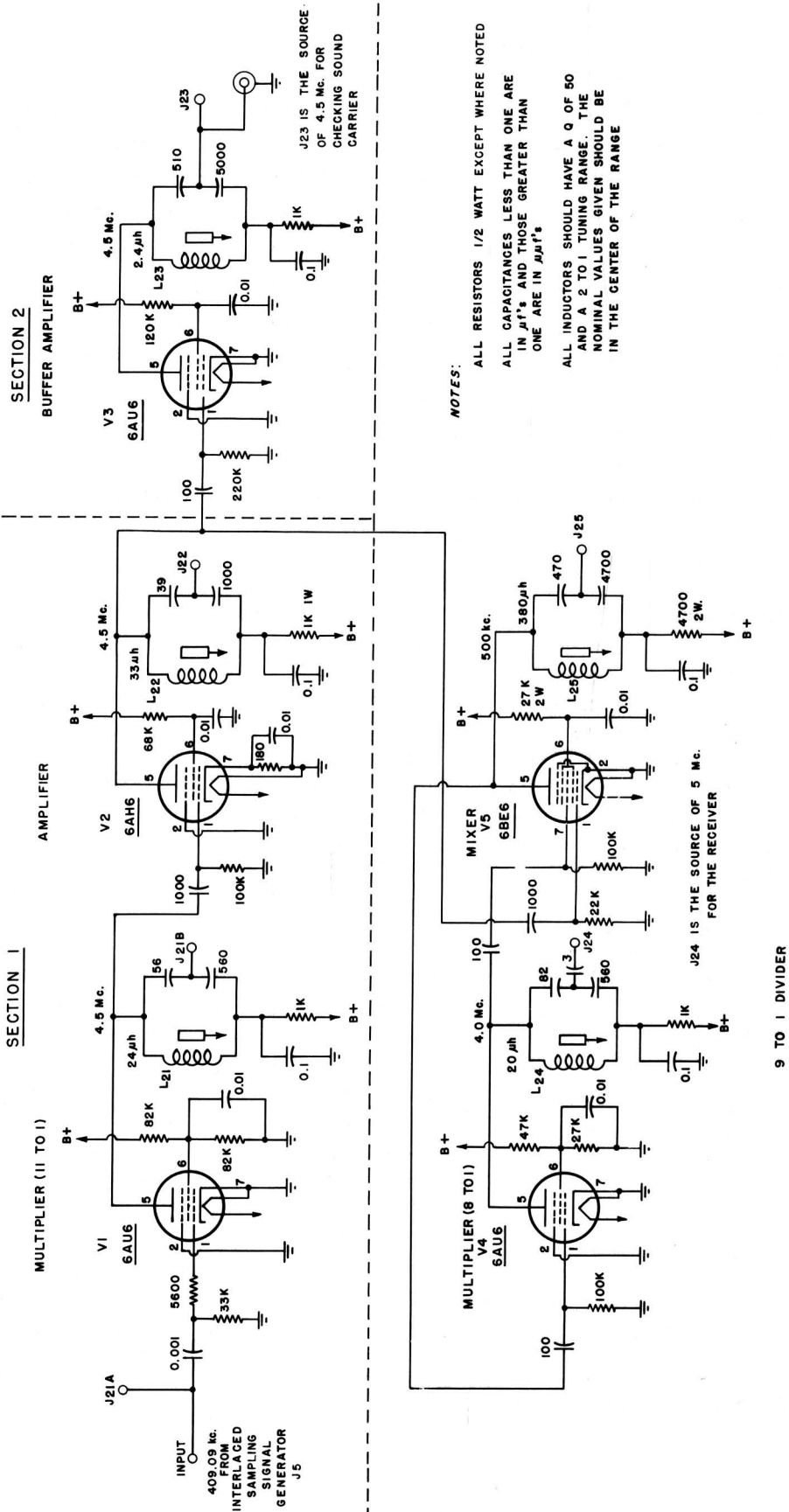
multiplication of 44/315. In the equipment described here the 500-kc signal is generated using multiplications of  $4/5 \times 1/7 \times 11 \times 1/9$ , in the given order. The first two stages of multiplication ( $4/5 \times 1/7$ ) are the same as those required in the interlaced sampling-signal generator (LB-853 and LB-853A) which divides 3.579545 Mc down to 31.5 kc. An output from the 1/7 multiplier in that generator can be used to feed a supplemental frequency checking unit consisting of three sections, an eleven-times frequency multiplier and amplifier, a 4.5-Mc buffer amplifier, and a nine-to-one divider stage. Fig. 1 shows a schematic diagram of this unit. The output of the eleven-to-one multiplier stage is 4.5 Mc which can be used to check the frequency difference between the sound and picture carrier frequencies. The plate circuit of the eight-to-one multiplier tube of the nine-to-one divider stage contains relatively strong harmonics of 500 kc in the vicinity of 5 Mc which can be compared with WWV in a receiver.

## Description of Circuits

The first section is the eleven-to-one frequency multiplier and amplifier. The circuit



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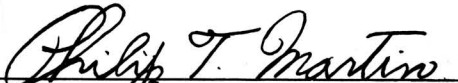
input signal, and adjust L24 for a stable figure when the B+ and input signal are turned off and on individually.

### Operation

To adjust the color subcarrier frequency to the desired frequency (3.579545 Mc), the

frequency of the color subcarrier oscillator must be adjusted until an appropriate harmonic of 500 kc from this frequency-checking unit zero beats with WWV.

To insure zero beating with the carrier and not a side band of WWV the adjustments should be made during the period when there is no audio modulation on WWV.

  
Philip T. Martin