SBE Shasta II and Shasta III Service Manual

Shasta II and III

MODELS SBE-24CB,-25CB

SERVICE MANUAL

SBE®

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SECTION 1
GENERAL

1.1 CUSTOMER SERVICE

The SBE Technical Services Department functions as a source of information on the application, installation and use of SBE products. In addition, the Technical Services Department provides technical consultation on service problems and availability of local and factory repair facilities.

In any communications to the Technical Services Department, please include a complete description of your problems or needs, including model and serial numbers of the unit or units in question, accessories being used, any modifications or attachments in use, or any non-standard installation details.

For assistance on any of the above matters, please contact SBE, Incorporated, Technical Services Department, 220 Airport Boulevard, Watsonville, California 95076. Phone: 408/722-4177.

1.2 PARTS ORDERS

SBE original replacement parts are available from the Factory Parts Department at 1045 Main Street, Watsonville, California 95076.

When ordering parts, please supply the following information:

Model number of the unit.
Serial number of the unit.
Part number.
Description of the part.

1.3 FACTORY RETURNS

Repair services are available locally through SBE Certified Service Stations across the country. A list of these Service Stations is available upon request from the Technical Services Department. Do not return any merchandise to the Factory without authorization from the Factory.

SECTION 2

SPECIFICATIONS

2.1 GENERAL

Channels	2 (SBE-24CB), 3 (SBE-25CB)
Frequency	26.965 to 27.255 MHz
Frequency Control	Precision Quartz Crystal
Frequency Tolerance	0.005%
Operating Temperature Range	–30°C to +50°C
Microphone	Internal speaker operates as dynamic microphone in Transmit Mode.
Operating Power	Batteries (self-contained) or with external accessory power supply.
Operating Voltage	12.5 VDC Nominal
Size	2-1/4"D (58mm), 2-3/4"W (70mm), 7-5/8"H (194mm)
Weight	1-1/2 lbs., 0.68 Kg.
Battery Types	(Not supplied) Eight (8) AA-size 1.5V flashlite cells or Ten (10) AA-size Rechargeable Ni/cad cells.
Recharge Provisions	Receptacle provided for accessory external charger for recharging Ni/cad batteries when used.

2.2 TRANSMITTER

Power Output	0.8 watts (SBE-24CB), 1.7 watts (SBE-25CB)
Current Drain	Full Modulation .36 amps (SBE-24CB), .46 amps (SBE-25CB)
Modulation	AM, 100% capability
Frequency Response	300-3KHz ±3db

2.3 RECEIVER

Sensitivity	1μV for 10db S+N/N Ratio, @ .2 watts audio out.
Selectivity	6db @ 3 KHz, 30db @ 10 KHz, 35db @ 20 KHz

Spurious	60db or better
Automatic Gain Control	Less than 10db change in audio output for signal inputs from 10-100,000μV
Squelch Threshold	2μV or better
Audio Output	.3 watts @ 10% distortion
Frequency Response	300-3KHz ±3db
Earphone	Plug provided for earphone

2.4 ANTENNAS

Internal	Collapsible whip, 1/8 wave length
External	Provisions for external antenna resonant type, 50Ω unbalanced.

SECTION 3

INSTALLATION

3.1 BATTERY INSTALLATION

The Shasta II and III require either eight, 1.5 volt, size "AA" penlite cells or ten, 1.25 volt, size "AA" rechargeable nickel cadmium cells. To install, loosen the screw at each end of the radio and remove back of radio. Install batteries in holder. **Observe Polarity.**

The two "dummy batteries" must be installed if dry batteries are used.

3.2 BATTERY CHARGING

A battery charger with an output voltage of 12.5 volts @ 50 ma is required to charge nickel cadmium batteries. Connect the charger's DC plug to the jack labeled "CHG" on the side of the Shasta II or III. Discharged cells will require about 14 hours to completely recharge. SBE's model SBE-2AC is capable of charging two Shasta II's or III's.

3.3 EXTERNAL POWER OPERATION

The Shasta II and III may be operated directly from an external 12.5 VDC power source such as a vehicle electrical source or AC adapter designed for this purpose. The AC adapter should have a current capability of at least 1.0 amp. The external power source is connected to the "PWR" jack on the side of the transceiver. The SBE-2AC will operate the Shasta II and III as an external power supply.

3.4 EXTERNAL ANTENNA

A base station type or physically shortened antenna may be used with either the Shasta II or III for extended range or operation in confined spaces. Connection is made to the "EXT ANT" jack located on the side of the transceiver. The external antenna must be resonant at 27 MHz and have an impedance of 50Ω. The internal antenna must be collapsed when an external antenna is connected.

3.5 EXTERNAL MICROPHONE – EARPHONE

A suitable external microphone may be connected to the "MIC" jack. The push-to-talk button must be depressed for transmission. An earphone may be connected to the "EAR" jack when private listening is desired. The internal speaker is disabled when the earphone is plugged in.

3.6 CRYSTAL INSTALLATION

The Shasta II and III are supplied with one set of channel 11 crystals installed in Channel "A". To install additional crystals for other channels, loosen the screw at each end of the transceiver and remove the back panel. Refer to the decal inside the back panel for crystal socket position. Matched crystal pairs may be obtained from your SBE distributor.

SECTION 4

CIRCUIT DESCRIPTION

4.1 INTRODUCTION

The SBE-24CB and -25CB are AM transceivers with single-conversion receivers using intermediate frequencies of 455 KHz.

Refer to the block and schematic diagrams while following the circuit description.

4.2 RECEIVER

GENERAL

In the receive mode, the RF signal is fed from the antenna to the RF AMP (Q2). The amplified RF signal is then fed to Q3 – the mixer – where it is mixed with an injection signal, from the RX OSCILLATOR Q1, 455 KHz below the receive channel frequency. The filter formed by T3 selects the 455 KHz converted signal to be fed to the 1st IF amplifier Q4, through ceramic filter CF-1 and to the 2nd IF amplifier Q5. The amplified IF signal is then detected by D2. After passing through the automatic noise limiter D3, the detected audio signal is applied across potentiometer VR2 – the volume control. The audio signal developed on the VR2 wiper is then fed to the 1st AUDIO AMP Q9. The output of Q9 is transformer coupled to push-pull speaker driver amplifier Q10 and Q11.

AUTOMATIC GAIN CONTROL CIRCUIT

The AGC (Automatic Gain Control) reduces the gain of the RF and IF amplifiers in response to a strong signal by lowering their bias voltage. The rectified output of D2 is filtered by R23 and C20 to produce the AGC voltage which is then fed to the bases of Q2 by R6, Q3 by R9, Q4 by R14, and Q5 by R19.

AUTOMATIC NOISE LIMITER

The ANL circuit prevents impulse noise, such as ignition noise, from being amplified. R26 and R27 form a voltage divider that biases the anode of D3 – the ANL diode – slightly positive. The audio output from the detector diode D2 is fed through R25 and R28 to C24 where it is filtered and then fed through R29 to the cathode of D3. The detector output is also fed to the anode of D3 through DC blocking capacitor C23. Since the audio signal is negative, the signal at the cathode is normally more negative than the anode and the diode is forward biased providing a low impedance path for the audio to the first audio stage. When a noise pulse appears in the output of the detector, the time constant of R28 and C24 prevents the cathode from responding as fast as the anode. The anode is thus driven more negative than the cathode causing D3 to become backed biased. D3 then becomes a high impedance that blocks the noise.

SQUELCH CIRCUIT

The squelch circuit turns the audio off when the received signal is less than the threshold level as determined by the squelch control – VR3. If Q8 is off, R39, R40 and R41 form a voltage divider network that provides the proper forward bias to the base of Q9 permitting it to amplify the audio signal.

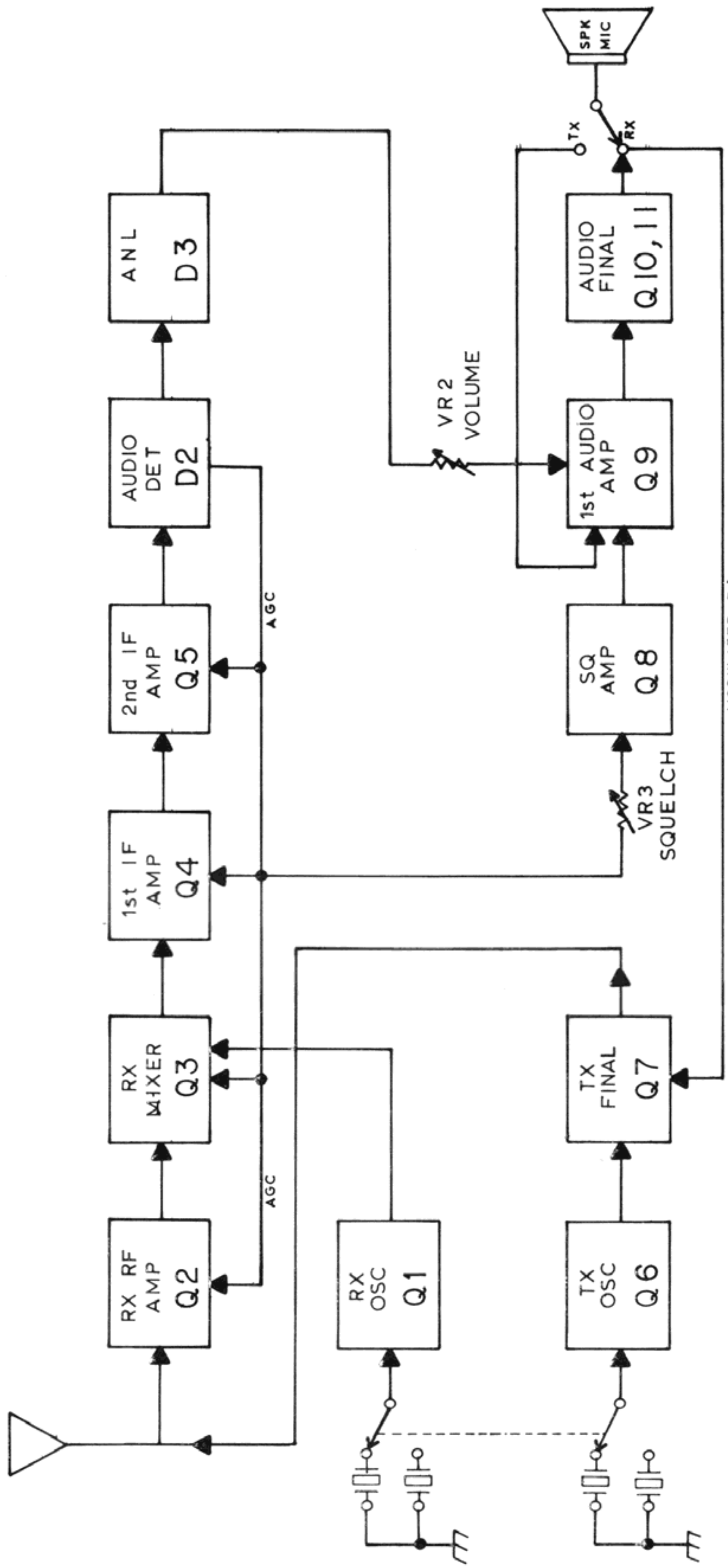
Raising the wiper on VR3 tends to forward bias the base of Q8 turning it on. When Q8 is on, the bias is removed from the base of Q9 thus preventing amplification of the audio signal. As the received signal becomes stronger, the AGC voltage lowers the bias on the base of Q8. Lowering the base voltage on Q8 turns it off permitting Q9 to amplify audio. Thus raising the wiper on VR3 increases the threshold level a signal must overcome to turn Q8 off and permit Q9 to amplify audio.

4.3 TRANSMITTER

GENERAL

In transmit mode, the output of oscillator Q6 is fed through band pass filter T5 to the TX FINAL Q7. The output of the TX FINAL is then fed through low pass filter, L5, L6, C34, and C35, and antenna loading coil L1 to the antenna. Modulation is accomplished by driving the collector of the TX FINAL from the top of the secondary of T7 — the AUDIO OUTPUT transformer.

FIG. 4-1 TRANSCEIVER BLOCK DIAGRAM



SECTION 5

SERVICING

5.1 INTRODUCTION

Read this section carefully before attempting any repair of the SBE-24CB, -25CB. Refer to the circuit description, block and schematic diagrams. The transistor case diagrams are shown on the schematic diagram. Refer to these diagrams before checking transistors. Component layout and location prints are provided to aid troubleshooting and alignment. Use only recommended replacement parts. Refer to the parts list in the back of this book. **Never replace blown fuses with higher rated ones or fast acting with slow blow.** To check operation of the unit, refer to Table 5-1, PERFORMANCE VERIFICATION PROCEDURE. Figures 5-2 and 5-3, TRANSMITTER TEST CONNECTION and RECEIVER TEST CONNECTION respectively, show the proper manner to connect the unit to test instruments for performance verification or alignment. Table 5-12 lists RECOMMENDED TEST INSTRUMENTS. Tables 5-4 and 5-5 show the proper TRANSMITTER ALIGNMENT PROCEDURE and RECEIVER ALIGNMENT PROCEDURE respectively. Figure 5-8 ALIGNMENT LAYOUT is placed near to the alignment procedures to show alignment adjustments at a glance.

5.2 TEST SIGNALS

OSCILLOSCOPE WAVEFORMS are shown which were taken from various points in the SBE-24CB, -25CB during normal operation. Figure 5-6 shows RF amplification through a properly aligned transmitter. Figure 5-7 shows 50%, 100% and overmodulation respectively.

VOLTAGE MEASUREMENTS are shown on the schematic diagram for normal operation. RECEIVER INJECTION VOLTAGES are given in Table 5-9. This table specifies the voltage level, carrier frequency and particular points in the receiver string at which a 30% — 1 KHz modulated signal injected through a .01 MFD capacitor should produce at least 2 VAC of audio across the speaker or 8Ω load plugged into the speaker jack, EXT SP.

AGC VOLTAGES versus RF INPUT LEVEL are shown in Table 5-11. This table should be consulted before any adjustments are made on the squelch circuit since squelch is a function of AGC.

5.3 TROUBLESHOOTING

Troubleshooting the SBE-24CB, -25CB transceiver is not essentially different than troubleshooting any other electronic device. Be a detective; suspect everything and everyone. Carefully inspect the unit for evidence of overheated components, cold solder joints, or tampering. Understand thoroughly the circuit description and block diagram. Try to start big and isolate the problem. Devise tests that will divide the transceiver in two and isolate the trouble to a particular half. Continue to divide into two parts until the trouble is located. For example, it is determined that a problem exists in a particular transceiver. The unit is divided into:

TRANSMITTER — RECEIVER.

Suppose that the transmitter puts out properly modulated carrier, but the receiver will not respond to a modulated RF signal at the proper frequency fed into the antenna jack. Since the transmitter modulates, it can be assumed that all of the audio amplifier is working. After checking the TX/RX switch and receiver B+, the receiver is then divided into:

BEFORE IF – IF and AFTER IF.

Table 5-9, RECEIVER INJECTION VOLTAGES, shows that the proper signal level to inject at the base of Q3 – the 1st IF AMP – to produce a 2 VAC signal at the speaker is 455 KHz @ 300μV through a .01 MFD capacitor. If the signal appears at the speaker, the problem is in the RF amplifier. Divide this and continue until the trouble is found.

This technique is sometimes called, "partitioning," "boxing-in-the-trouble," "divide and conquer," or "binary search"; it is mandatory for complex electronic systems, but can save time and energy on almost any electronic device.

A blown fuse should only be replaced by one of the proper rating and type. If the fuse blows again, replace it, but place an Ω meter at the power terminals in place of the supply. Make certain that the + side of the Ω meter is connected to the red power wire of the SBE-24CB, -25CB. Some VOM's place the – side of the Ω meter out the red test jack. The push-to-talk and PA/CB switch can be used to start isolating the short. Shorts can also be located by connecting a lamp in series with the power supply. Intermittent shorts will cause the lamp to flash. A voltage drop will appear across the path of a continuous short.

The second harmonic trap (L5 and C48) is adjusted at the Factory; field adjustment should not be attempted without proper equipment.

FIG. 5-1 PERFORMANCE VERIFICATION PROCEDURE

TRANSMITTER

INITIAL SET-UP

Connect the transceiver to a 12.5 VDC supply. Connect a wattmeter, dummy load and oscilloscope to the antenna jack. (See Figure 5-2.)

STEP 1

Key the transmitter and observe that the wattmeter indicates an output of at least 0.6 watts (24CB) or 1.1 watts (25CB).

STEP 2

Whistle into microphone with transmitter keyed. Check for 90-100% modulation. (See Figure 5-7.)

STEP 3

Connect counter to dummy load and check transmit frequencies on the channels installed. (See Table 5-10.)

RECEIVER

INITIAL SET-UP

Connect the transceiver to a 12.5 VDC supply. Connect an RF signal generator to the antenna jack and set to one of the transceiver's channels 30% — 1 KHz modulation. Turn the volume control full clockwise and squelch control full counterclockwise. Connect 8Ω load to external speaker jack and connect an AC voltmeter to 8Ω load. (See Figure 5-3.)

STEP 1

Adjust signal generator for 0.7μV output. Verify that at least 2 VAC appear across the 8Ω load.

STEP 2

Increase signal generator output to 200μV. Rotate squelch knob full clockwise. Receiver should squelch.

FIG. 5-2 TRANSMITTER TEST CONNECTION

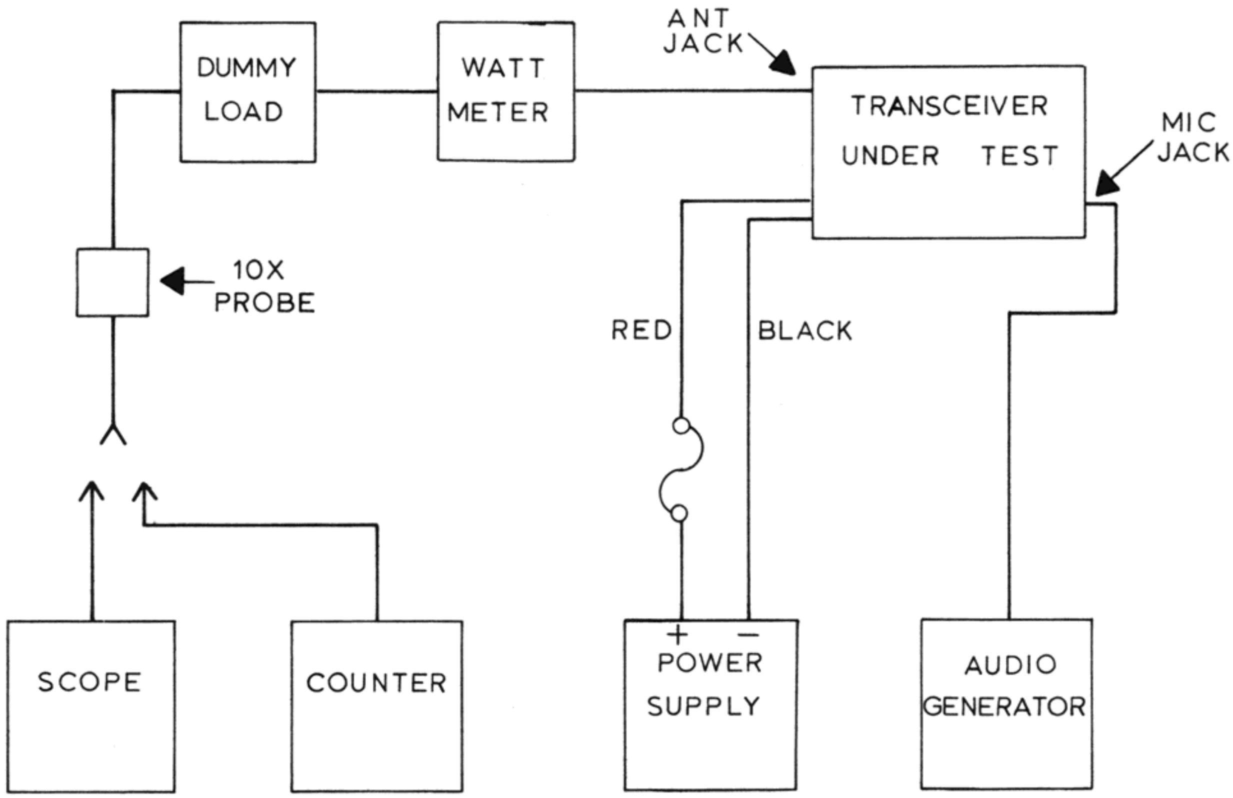


FIG. 5-3 RECEIVER TEST CONNECTION