Sidebander II

MODEL SBE-12CB

SERVICE MANUAL

SBE®

TABLE OF CONTENTS

SUBJECT	NUMBER
P/N MOD	
NOISE BLANKER	
VOX	

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

Compliance	F.C.C. Type Accepted (Part 95, Class D)
Channels	23
Frequency Range	(26.965 - 27.255) MHz
Frequency Control	Crystals, Synthesized
Frequency Tolerance	±0.003%
Operating Temperature Range	-30°C to +50°C
Humidity	95%
Input Voltage	(11.7 - 15.9) VDC negative ground. Either with P/N mod.
Microphone	Dynamic
Size	2¼"H (57mm), 7½"W (190mm), 9½"D (240)
Weight	7 lbs. (3 Kg)
PA Output	3 watts into an external 8Ω speaker
Current Drain	13.8 VDC Receive: (squelched) 0.3 amps (2 watts audio) 1.0 amps Transmit: (AM 0 mod) 1.2 amps (SSB, 25W PEP) 2.8 amps
Fuse	4 amp fast blow (Type 3AG)
Antenna Connector	UHF, SO-239

2.2 RECEIVER

Sensitivity	0.7μV for 10db S+N/N
Selectivity	AM: 6db @ 3.5 KHz, 60db @ 8 KHz SSB: 6db @ 2.1KHz, 50db @ 5.5 KHz
IF Frequency	7.8 MHz
AGC Response	Less than 10db for 10 - 100,000μV
Squelch Threshold	Less than 0.7μV
Audio Power Output	3 watts @ 10% distortion

External Speaker	(Not Supplied) 4 or 8Ω. Disables internal speaker when connected.
Squelch Range	Better than 200μV

2.3 TRANSMITTER

Power Output	AM, 4 watts SSB, 25 watts, PEP
Modulation	AM, 95-100%
Intermodulation Distortion	SSB: 3rd order -20db 5th order -25db
Carrier Suppression	-35db or better
Unwanted Sideband	-40db or better

SECTION 3
INSTALLATION

GENERAL

The first step in installation of the mobile transceiver is selection of antenna and transceiver mounting positions.

The selection of an antenna and its mounting position is the most critical factor in determining the end performance of an installation. Generally, the most satisfactory installation position for most vehicles is the center of the passenger compartment roof. As a second choice, the trunk can be a satisfactory antenna mounting point, especially on those cars where the trunk is large and flat. Due to increased susceptibility to ignition noise, mounting the antenna in the hood area is discouraged. Follow antenna manufacturer's recommendations carefully during installation.

The SBE-12CB is supplied with a universal mounting bracket and microphone holder. The transceiver may be mounted in any position and on any rigid surface, such as underneath an automobile dashboard, truck roof or vertically on a boat bulkhead.

The transceiver should be mounted with accessibility and operation convenience in mind.

CAUTION: Avoid mounting the transceiver in the direct air stream of the vehicle's heater. Temperatures in this area can exceed 150° F and can result in serious damage to the unit.

It is recommended that the mounting bracket be installed on the transceiver and mounting clearances checked, with the unit held in the desired mounting position. It is especially important to leave sufficient space behind the unit for antenna and accessory cable connections.

When the most desirable mounting installation point has been decided upon, a pencil or other marking device should be used to outline the mounting bracket on the mounting surface. The transceiver should then be removed from the mounting bracket and the bracket held against the dash or other mounting surface, in the position marked, so that mounting holes may be marked and drilled.

CAUTION: Be sure to check behind the dash or other mounting surface to insure against damage of wiring and other devices before drilling any holes.

Install the microphone holder on the radio or other mounting surface as desired.

Install any accessories at this time, including external speaker, public address speaker, etc.

This unit is designed for either 12 volt positive or negative ground systems. In either system, the positive battery terminal always connects to the red supply wire, and the negative battery terminal always connects to the black supply wire. If the transceiver's power lead must be lengthened, use No. 14 or larger wire.

CAUTION: When using this radio in a positive ground system, it is important that none of the accessories are electrically connected to the vehicle's chassis (external speakers, P.A. speakers, etc.). Positive ground installations must utilize an additional 2 ampere fuse in the negative (black) supply lead to avoid possible damage to the transceiver. NOTE: The transceiver power lead may be connected to the accessory section of the ignition switch if desired. However, due to the possible presence of high-level noise from the ignition and accessories, this connection may not be desirable. In cases where excessive noise is present on the accessory line, a direct connection to the battery is recommended.

3.2 ANTENNA TUNING

The final step in installation is to trim the antenna for minimum S.W.R. The recommended method of antenna tuning is to use an in-line wattmeter or S.W.R. bridge to adjust the antenna for minimum reflected power on channel 11. A properly tuned antenna system will present a suitable load to the transceiver and will insure that maximum power is transfered from the radio to the antenna. If the antenna system in use presents a poor load, as indicated by a high S.W.R. reading, transmitter range will be substantially reduced and damage to the transmitter final amplifier transistor may occur. Poor S.W.R. can usually be corrected by altering the antenna's electrical length in accordance with the manufacturer's instruction. Extremely high S.W.R. readings may be indicative of a defective transmission line, antenna, or connections.

To determine whether the antenna should be lengthened or shortened, test the S.W.R. on channels 1 and 23. If the S.W.R. is the highest on channel 23, the antenna is too long and if highest on channel 1, the antenna is too short. When the antenna system has been tuned correctly, channel 11 should have the lowest S.W.R. and channels 1 and 23 will be slightly higher.

3.3 FINAL CHECK

Test drive the vehicle and make an operational check-out of the transceiver to insure proper operation of it and all the accessories installed. At this time, note any degradation of performance due to vehicle noise and take appropriate action to correct any noise suppression and deficiencies as outlined in the following section.

3.4 NOISE SUPPRESSION

The first step in assuring minimum ignition noise is to insure that the engine ignition system is in a good state of tune, and all factory original noise suppression devices are installed and operational. This includes an inspection of distributor points and condenser. Check to see that the spark plugs are clean and properly adjusted. The condition of the ignition wiring should be checked (radio resistor type ignition wire is standard on most late model vehicles and should be installed on vehicles not so equipped). The distributor cap should be checked for traces of carbon tracking or signs of arcing. Resistor type spark plugs are helpful in further reducing ignition noise and are standard as original equipment on many late model vehicles.

Alternator noise may be minimized by the installation of an alternator line filter, available from radio parts distributors.

Installation of bonding straps in the engine compartment will further reduce ignition noise. Short lengths of metal strap or heavy shield braid between the engine and frame, engine and fire wall, alternator and frame, exhaust pipe and frame, or hood to frame, will in many cases, greatly reduce ignition noise. Extremely high ignition noise levels or noise levels that become worse after a period of time are usually indicative of deterioration of the vehicle's electrical system. In some cases, interference may be caused by dash instruments including gasoline gauges, heater blowers and fans, etc. This interference may often be reduced by the installation of bypass capacitors from the terminals of the interfering instruments to ground. .01 microfarad capacitors of the ceramic disc variety rated at 500 working volts DC are recommended for this purpose.

For further information on the suppression of ignition noise in the automotive and marine environment, the Champion Spark Plug Company publication "Giving Two Way Radio Its Voice" is highly recommended. This publication is available from the automotive technical service department Champion Spark Plug Company, Post Office Box 910, Toledo, Ohio 43661. This publication is also available, at no charge, from the SBE Technical Services Department, upon request.

SECTION 4

CIRCUIT DESCRIPTION

4.1 SINGLE SIDEBAND (SSB) THEORY

When two signals are mixed, new signals are produced with frequencies that are the sum and difference of the original signals. When a CARRIER is AM modulated with an AUDIO frequency, three distinct frequencies are present: CARRIER FREQUENCY, CARRIER + AUDIO FREQUENCY (Upper Sideband), and CARRIER - AUDIO FREQUENCY (Lower Sideband). Single sideband refers to a signal with only an upper or lower sideband and no carrier. Basically, the single sideband signal is produced in the transmitter by driving a BALANCED MODULATOR with an audio amplifier. The output of the BALANCED MODULATOR is a signal with both upper and lower sidebands but suppressed carrier. The undesired sideband is then removed from this signal by a sharp filter. Usually, the SSB signal is first produced at a frequency lower than transmit frequency and then added or subtracted from a higher frequency to produce transmit frequency.

The BALANCE MODULATOR in the SBE-12CB is driven by a 7.8025 MHz signal, and its output is fed through a filter which passes only the LSB. This LSB signal is then added to a signal around 19 MHz to produce a LSB transmit signal at channel frequency (about 27 MHz). (See Table 5-4.)

Subtracting a SSB signal from a higher frequency "inverts" the sidebands. USB is achieved in the SBE-12CB by inverting a LSB signal to make a USB signal. The 7.8025 signal is doubled to 15.605 MHz which is then added to the 19 MHz signal to produce a signal around 34 MHz. The 7.8 MHz LSB signal out of the BALANCED MODULATOR is then subtracted from the 34 MHz signal to produce a USB transmit signal at channel frequency (about 27 MHz).

Demodulation can be viewed as the mixing of carrier with sidebands to yield audio. It is necessary in SSB demodulation to reinsert the carrier at the receiver. The SBE-12CB receiver demodulates a SSB signal in somewhat the reverse order in which it would be synthesized in an SBE-12CB transmitter. An incoming LSB signal is mixed with 19 MHz to produce a 7.8 MHz LSB IF while a USB signal is mixed with 34 MHz which inverts the sidebands to produce the same 7.8 MHz LSB IF. By mixing this LSB IF with the 7.8025 signal, audio is demodulated.

SSB has several advantages over AM. In AM transmission, at least two-thirds of the power is expended to produce the carrier while all of the power in SSB goes to produce a single sideband – the only part of transmission conveying intelligence. Since only one sideband is produced, only half of the bandwidth is used. Also, since a steady carrier is reinserted at the receiver, flutter effects often caused by vehicle motion are reduced.

4.2 TRANSCEIVER – OVERVIEW

The SBE-12CB Sidebander II is a single-conversion, single sideband and AM citizens band transceiver.

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

The CB/PA switch S2 determines whether the unit operates as a CB transceiver or a PA amplifier.

The B+ BUS (BB) is energized by the power switch S1.

The push-to-talk switch energizes TX/RX relay RL-1 which in conjunction with the LSB, USB, AM selector switch S5 determines the mode of operation of the unit by energizing certain +9 VDC buses.

These buses are shown on the schematic diagram and are labeled:

ARB	AM RECEIVE BUS	TP9 *
ATB	AM TRANSMIT BUS	TP10
SRB	SSB RECEIVE BUS	TP11
STB	SSB TRANSMIT BUS	TP12
ASRB	AM/SSB RECEIVE BUS	TP13
ASTB	AM/SSB TRANSMIT BUS	TP14

* TP numbers correspond to numbers in boxes on schematic diagram and component location drawing.

4.3 RECEIVER

GENERAL

In AM receive mode the RF signal is fed from the antenna to the 1st RF AMP Q1. The amplified signal is then fed to Q2 – the 1st RX MIXER – where it is mixed with an injected signal about 7.8 MHz **below** the receive channel frequency. The crystal filter FL-1 selects the 7.8 MHz converted signal which is then fed to Q5 – the 1st IF AMP. The output of Q5 feeds the 2nd IF AMP Q6 which feeds the 3rd IF AMP Q7 which then feeds the AGC DETECTOR D14-D17, the S-METER DETECTOR D18 and D19 and the AUDIO DETECTOR D20 and D21. The detected audio is fed through the NOISE LIMITER UNIT NL-1 and VOLUME CONTROL VR11 to AUDIO AMP Q27 which feeds AUDIO AMP Q24 which then feeds AUDIO DRIVER Q25 and Q26. The AUDIO DRIVER drives the speaker.

In LSB (Lower Sideband) mode, the RF signal arrives at the 2nd IF AMP Q6 in the same manner as in AM mode. The output of Q6, however, in LSB is fed to the PRODUCT DETECTOR Q10 and Q11 where it is detected by the 7.8 MHz injected signal and then fed through the VOLUME CONTROL VR11 to AUDIO AMP Q27. Q27 feeds the AUDIO AMP Q24 which feeds AUDIO DRIVER Q25 and Q26 which then drives the speaker.

The receiver signals involved in USB (Upper Sideband) mode are similar to LSB except that the signal injected at Q2 – the 1st RX MIXER – is about 7.8 MHz **above** the receive channel frequency.

THE AUDIO DETECTOR

The AUDIO DETECTOR demodulates the AM received signal by rectifying the IF signal. When the signal on the top of the primary of T5 swings negative, D21 conducts current on to C145. As the signal swings positive, C145 discharges through D20. The voltage on C148 thus tends to follow the peak-to-peak voltage of the received signal and is thus the demodulated audio signal.

PRODUCT DETECTOR

The PRODUCT DETECTOR demodulates the SSB received signal by mixing the IF signal with the 7.8 MHz signal and selecting the audio frequency. The IF signal is fed from T6 to Q10 and Q11 bases while the 7.8 MHz signal is capacitively coupled to their emitters. C152 filters the audio frequencies from the mix and thus the output across the collector resistor R141 is the demodulated signal.

AUTOMATIC GAIN CONTROL

The AGC circuit reduces the gain of the receiver in response to a strong signal by lowering the bias on the RF and IF amplifier. The IF signal is fed to D14 and D15 by C132 and to D16 and D17 by C131. Both sets of diodes rectify the signal. The voltage produced by D14 and D15 responds fast to a strong signal and is referred to as the "attack," while the voltage produced by D16 and D17 decays slowly and is referred to as "release." Since in SSB the signal is present only during modulation, it is necessary for good performance that the attack be fast, but the release be longer than the time between syllables. This is accomplished in the SBE-12CB by S5-5 which switches C128 into the circuit during SSB operation. Q4, operating as a source follower, reduces the impedance of the rectified voltage and feeds it to the base of the 1st RF AMP Q1 and through R123 to the base of the 1st IF AMP Q5.

SQUELCH

The squelch circuit shuts the audio off when the received signal is less than the threshold level as determined by the SQUELCH CONTROL – VR9. Raising the wiper on VR9 tends to forward bias the base of Q8 which turns it on. Q8 turns Q9 on which in turn raises the emitter voltage of R45 and disables Q27 – the 1st AUDIO AMP. As the received signal becomes stronger, however, the AGC voltage lowers the bias on Q8 which turns it and Q9 off and permits Q27 to output audio. Thus raising the wiper on VR9 increases the threshold level a signal must overcome to "break squelch" – turn Q8 and Q9 off and permit Q27 to amplify audio.

Since RF GAIN CONTROL VR10 affects signal level, squelch threshold will be changed by VR10 adjustments.

SUPER NOISE BLANKER (OPTION)

The SNB (SBE-1NB) blanks the IF signal when pulse noise appears in the CB band. The input to amp IC-1 is peaked at 24.5 MHz, but nulled at CB frequencies. 24.5 MHz is a clear frequency where wide band pulse noise can be sampled. To prevent strong adjacent channel signals from activating the SNB, it is fed IF which is taken before the filter FL-1. If this signal reaches about 4MV, the blanker is disabled.

4.4 TRANSMITTER

GENERAL

In AM transmit mode, the ATB bus applies voltage at the bottom of R159 biasing the BALANCE MODULATOR and causing it to feed 7.8 MHz through the FILTER FL-1 to Q5. The output of Q5 then feeds the 2nd TX MIXER Q20. The 7.8 MHz signal is mixed at Q20 with the 19 MHz output of Q5. The sum of these frequencies is selected by T13 and T14, and is the channel frequency which is amplified by TX RF AMP Q21, by TX DRIVER Q22, and by TX FINAL Q23. Modulation is accomplished by feeding the microphone output to the MIC AMP Q28 which feeds Q29. The output of Q29 then feeds Q24 – the audio driver – which drives push-pull audio amp Q25 and Q26. The output of Q25 and Q26 then drives the primary of T16. Since the top of T16 is connected to B+, modulated B+ appears at the bottom, and is fed to the collectors of Q22 – the TX DRIVER, and Q23 – the TX FINAL.

In SSB mode, the microphone output is amplified by Q28, Q29, Q30, and then fed to the balanced modulator. The output of the balanced modulator is fed through ceramic filter FL-1 to Q5 and then through the T3 primary to the TX MIXER Q20. In LSB the 7.8 MHz signal is mixed with 19 MHz from Q15 and the sum of the frequencies is selected by T13 and T14 and is the channel frequency which is amplified. In USB the 7.8 MHz signal is mixed with 34 MHz from Q17 and the difference of the frequencies is selected.

D32 and D33 are connected as a voltage doubler in SSB mode and apply about 24 volts to the TX FINAL Q23 and DRIVER Q24.

OVERMODULATION LIMITER

In AM mode, the OML regulates the gain of the audio amplifier to accommodate a wide range of voice levels without overmodulating the carrier. The audio signal is capacitively coupled off the modulated B+ through VR7 – the OM adjust. It is then rectified by D34, filtered by C413, R411 and C414, and then fed through R501 to the base of Q28 – the MIC AMP. As the sound level into the MIC increases, the voltage at the base of Q28 will thus lower and decrease the amplification of the sound output.

AUTOMATIC LOUDNESS CONTROL

In SSB mode, the ALC regulates the TX RF gain to accommodate a wide range of voice levels. TX RF output is sampled by C103 and C106. It is then rectified by D3 and D4, filtered by C108, and then fed through D12 to the gate of source follower Q4. The output of Q4 is then fed through R123 to the base of RF AMP Q5. As the sound level into the MIC increases, the voltage at the base of Q5 will thus lower and decrease the RF gain.

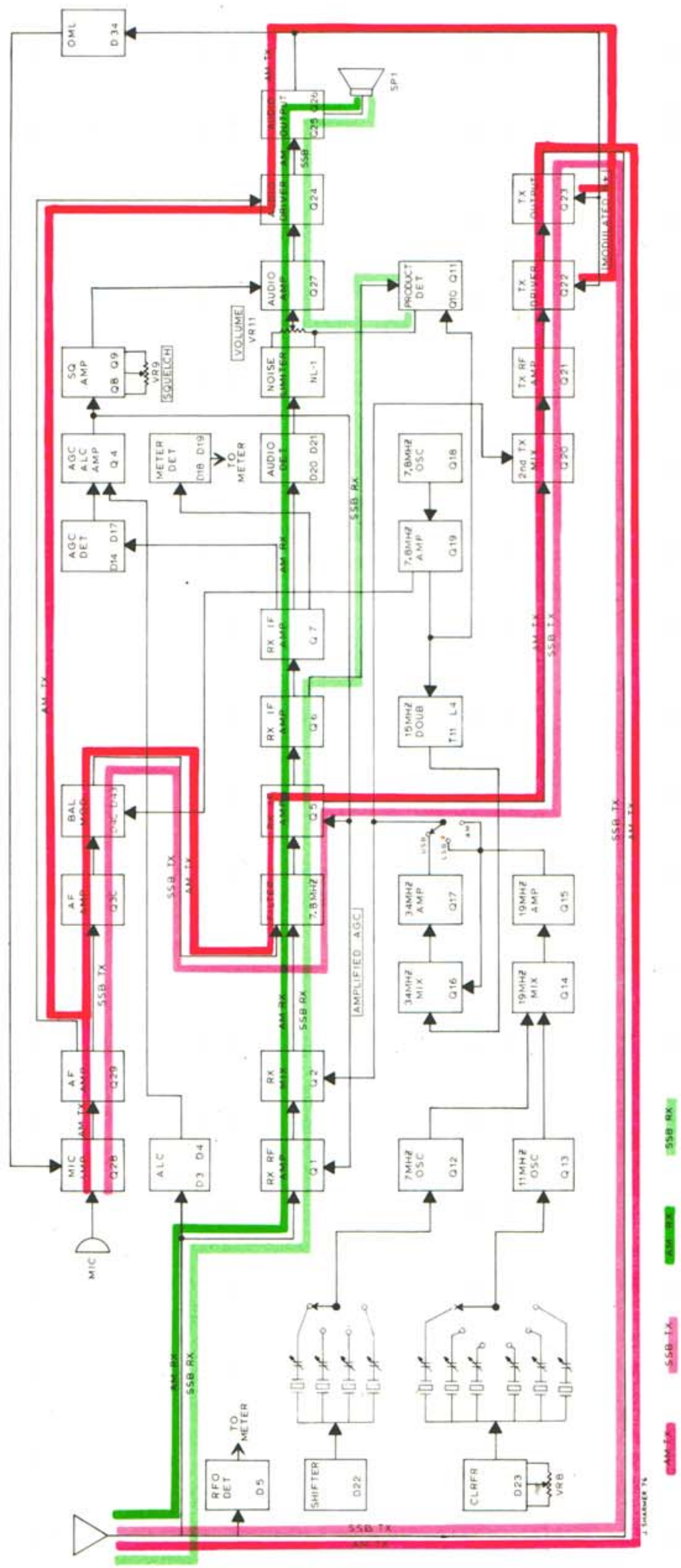
FREQUENCY MIXING SCHEME

Three oscillators are used to synthesize the frequencies used in the SBE-12CB. Q18, referred to as the 7.8 MHz oscillator, is controlled by a single 7.8025 crystal X1. Channel Selector switch S4 selects one of four crystals (X2 – X5) to set the frequency of the 7 MHz oscillator Q12, and one of six crystals (X6 – X11) to set the 11 MHz oscillator Q13. (See Table 5-4.) The 19 MHz signal, used for AM and LSB conversion, is synthesized by mixing the output of the 7 MHz oscillator Q12 together with the output of the 11 MHz oscillator Q13 at Q14 and selecting the sum of the frequencies from the output of Q14 by filter T9. The 19 MHz signal is then amplified by Q15. The 34 MHz signal, used for USB conversion, is synthesized by mixing the 19 MHz signal together with the 15 MHz signal at Q16 and selecting the sum. The 15 MHz signal is synthesized by selecting the 2nd harmonic of the 7.8 MHz signal by filter T11 and L4. Variable capacitors (CV1 – CV11) permit the fine tuning of the resonant frequencies of the crystals. C247 shifts oscillator Q12 up about 2 KHz during AM RX when D22 is not forward biased. This frequency shift is necessary to permit filter FL-1 to pass both AM sidebands. Matching the re-inserted RX carrier in SSB is accomplished by applying a voltage from the wiper of CLARIFIER VR8 across varactor D23 which then varies the 11 MHz (oscillator Q13) frequency.

OSCILLATORS

Crystal controlled oscillators Q12, Q13, and Q18 are common collector, colpitts circuits. Outputs are taken from the emitters; collectors are at AC ground. Fine tuning of these oscillators is accomplished by variable capacitors in series with the crystals. The clarifier – potentiometer VR8 – varies the voltage on varactor D23 which permits fine tuning of oscillator Q13.

FIG. 4-1 TRANSCEIVER BLOCK DIAGRAM



SECTION 5

SERVICING

5.1 INTRODUCTION

Read this section carefully before attempting any repair of the SBE-12CB. 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 5-2, PERFORMANCE VERIFICATION PROCEDURE. Figures 5-5, -6, 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 5-1 lists RECOMMENDED TEST INSTRUMENTS. Tables 5-11, -7 show the proper TRANSMITTER ALIGNMENT PROCEDURE and RECEIVER ALIGNMENT PROCEDURE respectively. Figure 5-9, ALIGNMENT LAYOUT, is placed next 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-12CB during normal operation into a dummy load. TEST POINT numbers next to the waveform pictures correspond to numbers in boxes on both the schematic diagram and component layout drawing. Figure 5-12 shows RF amplification through a properly aligned transmitter. Figure 5-13 shows 50%, 100% and overmodulation respectively. Notice that the waveforms at the TX MIXER – gate 1, gate 2 and drain of Q20 – contain several frequency components. Also notice that the waveform at the TX FINAL is unsymmetrical (Figure 5-12-f). This is proper since the TX FINAL operates class C for greater efficiency. Figure 5-12-g shows how the output should look at the dummy load.

VOLTAGE MEASUREMENTS are shown on the schematic diagram for normal operation. All voltages were measured with an AC VTVM having 10MΩ input impedance. Voltage measurements on high impedance RF points should be taken through a choke. While any choke of about 100μH is suitable, SBE part number 8000-00011-0018 (150μH) may be ordered from the factory. Mini-test clips are very useful for making voltage measurements in hard to reach places.

RECEIVER INJECTION VOLTAGES are given in Table 5-10 together with TEST POINT numbers which correspond to numbers in boxes on both the schematic diagram and component layout drawing. These tables specify 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 2 VAC of audio across the speaker or 8Ω load plugged into the speaker jack, EXT SP. While the value of this capacitor is not critical, capacitive coupling of the signal generator to the circuit is necessary to prevent grounding out the transistor biases.

Before setting up to measure RECEIVER INJECTION VOLTAGES, small hand-held "all-purpose signal generators" can be used to provide a quick check of the receiver string. Basically, these devices generate pulses rich in harmonics from AF to RF to test whether a stage is working.

AGC VOLTAGES versus RF INPUT LEVEL are shown in Table 5-8. This table should be consulted before any adjustments are made on the squelch circuit since squelch is a function of AGC. Also, notice that AGC is a function of RF gain.

TRANSMITTER and RECEIVER ALIGNMENT PROCEDUREs are given in Tables 5-11 and 5-7, respectively. The TRANSMITTER ALIGNMENT PROCEDURE should be done first since it also aligns the frequency synthesizer.

The Troubleshooting Chart (Table 5-3) lists transceiver troubles and possible causes. This list is not meant to exhaust all possibilities, nor are they necessarily the most probable cause; they are the ones that stand out in repair people's minds because they are not obvious. Also, check the back pocket of this manual for later Service Bulletins.

5.3 TROUBLESHOOTING

Troubleshooting the SBE-12CB 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 descriptions and block diagrams. Check the various +9 VDC buses. Follow the signal flow shown on the block and schematic diagrams. Test the transceiver in all modes. 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 in AM, LSB and USB mode, but the receiver will not respond to a properly modulated RF signal at the selected channel frequency fed into the antenna jack. Since the transmitter AM modulates, it can be assumed that those stages of the audio amplifier used for both receive and AM modulation (Q24, Q25 and Q26) are good. Vary the RF signal level fed to the antenna and observe the S METER. If the S METER responds, we may conclude that the receive signal reaches Q7. Since the unit does not receive either AM or SSB and it is unlikely that problems could have occurred in both the PRODUCT DET and the AM AUDIO DET circuits, therefore, suspect Q27 or the squelch circuit. Divide this and continue until the trouble is found.

This technique is variously 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. Never fear to question an earlier assumption. For example, if an SBE-12CB looses SSB TX but not AM TX, logical analysis might indicate a faulty Q30 stage. Actually, it is more likely that either the Q28 or Q29 stages are faulty. This is because the Q28, Q29, Q30 amplifier string needs less gain for AM than SSB modulation. Often such problems are listed in the TROUBLESHOOTING CHART. (See Table 5-3.)

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-12CB. Some VOM's place the - side of the Ω meter out the red test jack. Observe that diode D48 protects the units from a reversed supply.

A fuse may blow only when a unit is connected in a vehicle because the vehicle has a positive ground and there is a short from the PCB ground to the chassis, or a grounded speaker was plugged into the external speaker jack.

The second harmonic trap is adjusted at the Factory; field adjustment should not be attempted without proper equipment. Failure of particular channels to work or be on frequency probably indicates a defective crystal. Refer to Table (5-4) SYNTHESIZER MIXING SCHEME. Notice that the same Transmit and Receive crystals are used every fourth channel while each Master crystal is used on four adjacent channels. Check channel selector switch by swapping crystals.

TABLE 5-1 RECOMMENDED TEST INSTRUMENTS

TEST INSTRUMENT	REQUIRED SPECIFICATIONS	USE	RECOMMENDED INSTRUMENT TYPE
R.F. Signal Generator	Output frequency: 26.965 to 27.255 MHz. Output level calibrated from .1 microvolts to 500,000 microvolts. Internal modulation capability of 30% minimum at 1 KHz. (Calibrated)	Receiver service and alignment.	Hewlett-Packard Model 606A or B. Wavetek Model 3000.
Oscilloscope	Vertical bandwidth of 25 MHz or greater at 3db point. Triggered sweep capability.	Transmitter and receiver test and alignment.	Tektronics Model T932. Tektronics Model 465. Hewlett-Packard Model 180. Phillips Model PM3260E.
Frequency Counter	Frequency range DC to 30 MHz. Sensitivity: 10mv R.M.S. at 30 MHz. Overall timebase accuracy ±.002%, 6 digit resolution.	Transmitter frequency check and synthesizer troubleshooting.	Heath-Schlumburger Model SM128A
Wattmeter	25 watts full scale into 50 ohm load ±5% accuracy.	Measure power output and S.W.R.	Bird Model 43 with type 25A element. (May be terminated with antenna load
AC VTVM	-40 to +20db range.	Measure audio output.	Heath Model IM-21.
Audio Oscillator	400 Hz to 4000 Hz output: Adjustable level, 0-1 volt output impedence 600 ohm.	Audio and modulator tests.	Hewlett-Packard Model 204C. Heath Model SG18A.
DC Power Supply	13.8 volt DC ±10% at 4 amperes.	Primary supply voltage for servicing.	Heath Model SP2720 (SBE Model SBE-4AC may be used if available.)

TABLE 5-2 PERFORMANCE VERIFICATION PROCEDURE

TRANSMITTER

INITIAL SET-UP
Connect the SBE-12CB to a 13.8 VDC supply. Connect a wattmeter, dummy load and oscilloscope to the antenna jack.
STEP 1 Key the transmitter in AM and observe that the wattmeter indicates an output of at least 3.5 watts and that the RFO meter indicates about the same.
STEP 2 Whistle into microphone with transmitter keyed. Check for 90-100% modulation.
STEP 3 Connect counter to dummy load and check transmit frequencies on channels 1, 2, 3, 4, 8, 12, 16, and 20. (See Table 5-4.)
STEP 4 Key the transmitter in LSB without modulation. Check for less than 0.1 P-P carrier on scope.
STEP 5 Whistle into microphone with transmitter keyed. Check for at least 12 watts output.
STEP 6 Repeat steps 4 and 5 in USB.

RECEIVER

INITIAL SET-UP
Connect SBE-12CB to 13.8 VDC supply. Connect RF signal generator to the antenna jack and set to 27.085. Set the unit to channel 11. Turn the volume control full clockwise, the squelch control full counterclockwise, and center CLARIFIER. Connect 8Ω load to external speaker jack, EXT SP, and connect AC voltmeter to 8Ω load. (See Figure 5-6.)
STEP 1 Set the mode selector in AM. Adjust signal generator for 0.7μV output with 30% - 1 KHz modulation. Verify that at least 4 VAC appear across the 8Ω load.
STEP 2 Increase signal generator output to 200μV. Rotate squelch knob full clockwise. Receiver should squelch.
STEP 3 Adjust signal generator for 200μV. S-METER should read about 9.

STEP 4 Remove connection from external speaker jack if used. Adjust signal generator for 0.7μV output with no modulation. Set the mode selector to LSB. Rotate CLARIFIER back and forth. Tone should be heard at one end of the CLARIFIER.
STEP 5 Repeat step 4 in USB.

TABLE 5-3 TROUBLESHOOTING CHART

TROUBLE	REMEDY	
	CHECK	REPLACE
No TX, weak RX		Q23, D29
No TX, RF out of Q23	L9, L11, and L12	
No TX, no Q20 output	D39	
No SSB TX but AM TX O.K.	Q28, Q29, Q30	
No RX or very weak RX	Q1 for E-B short	Q1 and Q6
Weak noisy RX		Q2
No or bad AM RX	7.803 MHz OSC FREQ	
No RX AUDIO, S-MTR shows RX	SQ CKT, C133, Q8 & Q9	

TABLE 5-4 SYNTHESIZER MIXING SCHEME

7.8 MHz OSC XTAL FREQ X1 = 7.8025

CH	FREQ	11 MHz OSC XTAL FREQ	7 MHz OSC XTAL FREQ (AM RX ADD 2 KHz)
1	26.965		X5 = 7.4625
2	26.975	X6 = 11.700	X4 = 7.4725
3	26.985		X3 = 7.4825
4	27.005		X2 = 7.5025
5	27.015		X5
6	27.025	X7 = 11.750	X4
7	27.035		X3
8	27.055		X2
9	27.065		X5
10	27.075	X8 = 11.800	X4
11	27.085		X3
12	27.105		X2
13	27.115		X5
14	27.125	X9 = 11.850	X4
15	27.135		X3
16	27.155		X2
17	27.165		X5
18	27.175	X10 = 11.900	X4
19	27.185		X3
20	27.205		X2
21	27.215		X5
22	27.225	X11 = 11.950	X4
23	27.255		X2

15 MHz signal is produced by doubling the 7.8 MHz signal
15.605 = 2 X (7.8025)

19 MHz signal is produced by mixing 7 MHz with 11 MHz
* 19.2025 = 7.5025 + 11.700 SSB TX, RX & AM TX
* 19.2045 = 7.5045 + 11.700 AM RX

34 MHz signal is produced by mixing 19 MHz with 15 MHz
* 34.8075 = 19.2025 + 15.605

* 27.005 MHz = 19.2025 + 7.8025 LSB
* 27.005 MHz = 34.8075 - 7.8025 USB

*EXAMPLE CHANNEL 4

FIG. 5-5 TRANSMITTER TEST CONNECTION

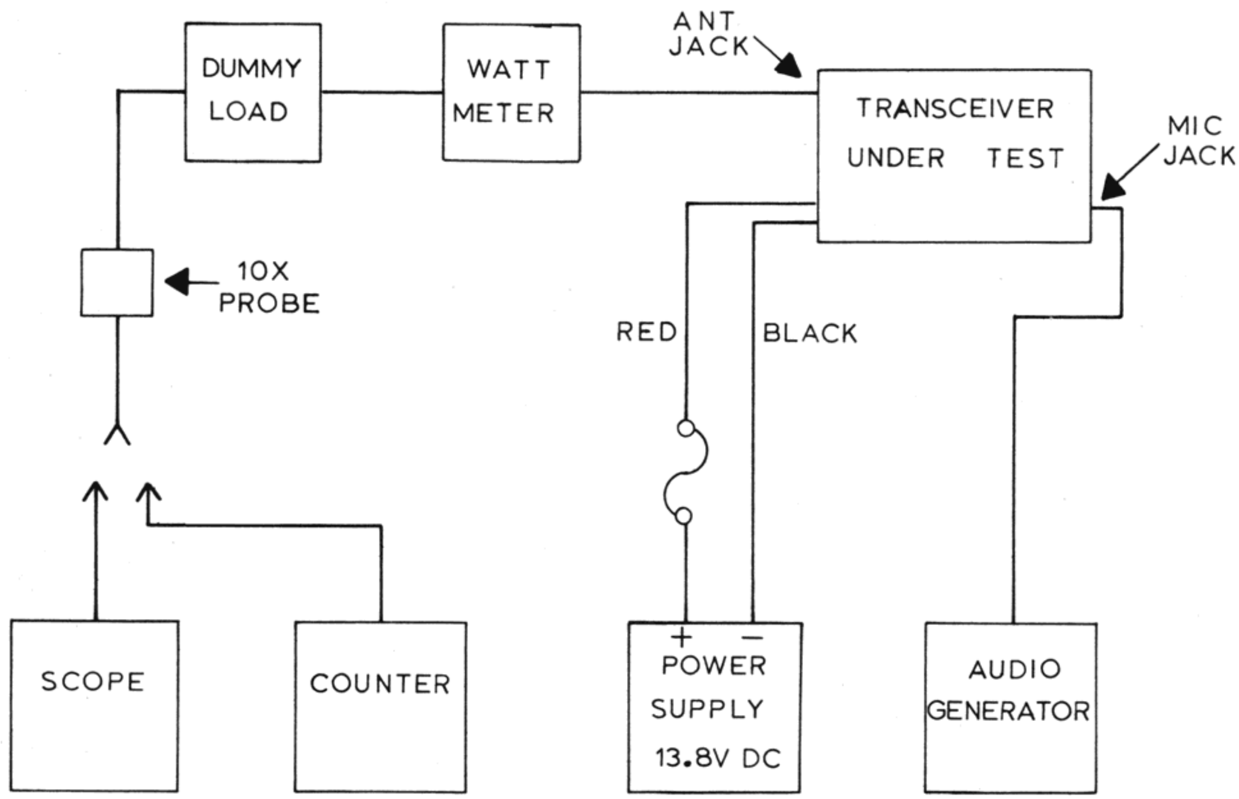


FIG. 5-6 RECEIVER TEST CONNECTION

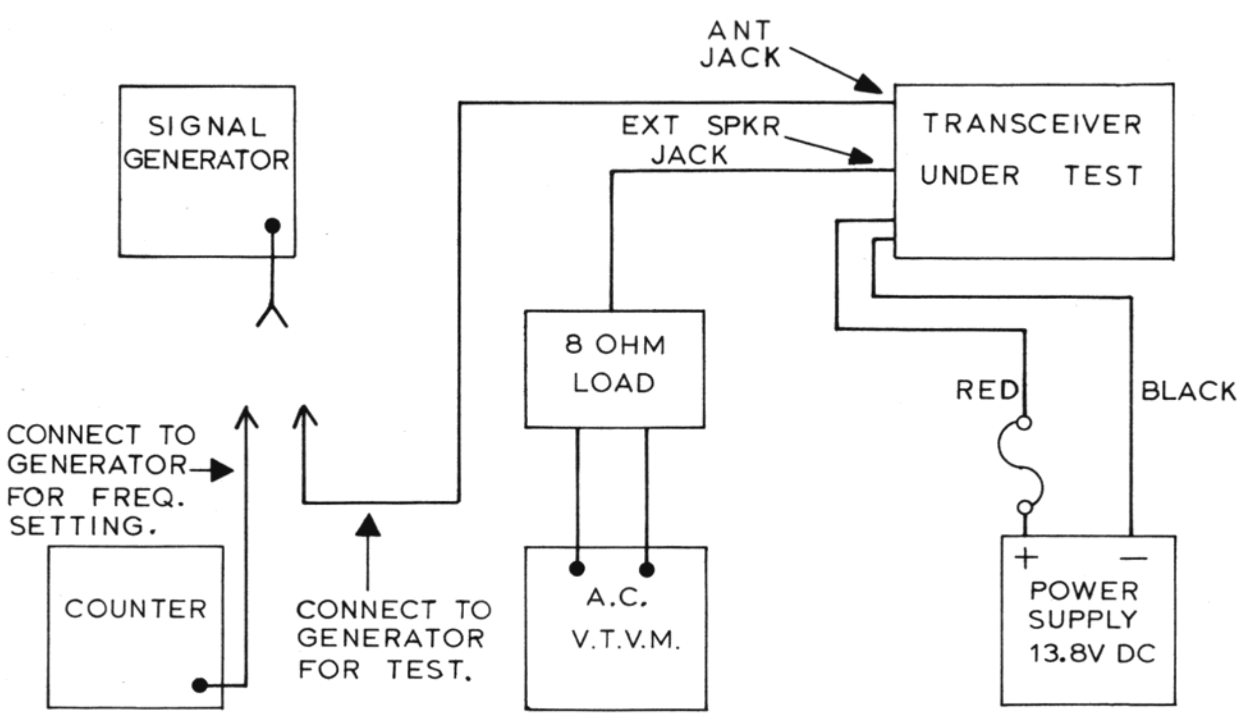


FIG. 5-7 RECEIVER ALIGNMENT PROCEDURE

INITIAL SET-UP
Connect the transceiver to a 13.8 VDC supply. Set channel selector to channel 11, PA/CB switch to CB. Turn squelch control full counterclockwise, and the volume control full clockwise. (See Figure 5-6.)
STEP 1 Connect a voltmeter to TP3. Set mode switch to AM. Without a connection to the antenna jack, adjust AGC potentiometer VR4 for 1.0 VDC.
STEP 2 Set an RF signal generator to 30% - 1 KHz modulation @ 27.085 MHz. Connect this generator to the antenna jack, and adjust to a level just sufficient to produce a slight indication on the S METER. Connect an AC voltmeter across the speaker or 8Ω load plugged into the EXT SP J3. Adjust T1, L1, T2, T4, and T5 for maximum indication on voltmeter. Repeat adjustment until 0.7μV RF signal produces about 2 VAC.
STEP 3 Set output level of RF signal generator to 200μV. Adjust VR3 for an S-9 indication.
STEP 4 Set RF signal generator level to 300μV. Turn squelch control full clockwise. Adjust VR9 until squelch just breaks.
STEP 5 Set RF signal generator to 27.085, without modulation and 0.7μV level. Adjust clarifier and T6 for maximum voltmeter indication.

TABLE 5-8 AGC VOLTAGES versus RF INPUT LEVEL

INPUT LEVEL (1)	AGC VOLTAGES (2)
ANT JACK J1	+1.0
1μV	+0.96
10μV	+0.51
100μV	+0.18
1000μV	+0.08
10,000μV	+0.05

(1) Channel Frequency at Antenna Jack.

(2) Measured with 10MΩ input at TP3.

FIG. 5-9 ALIGNMENT LAYOUT

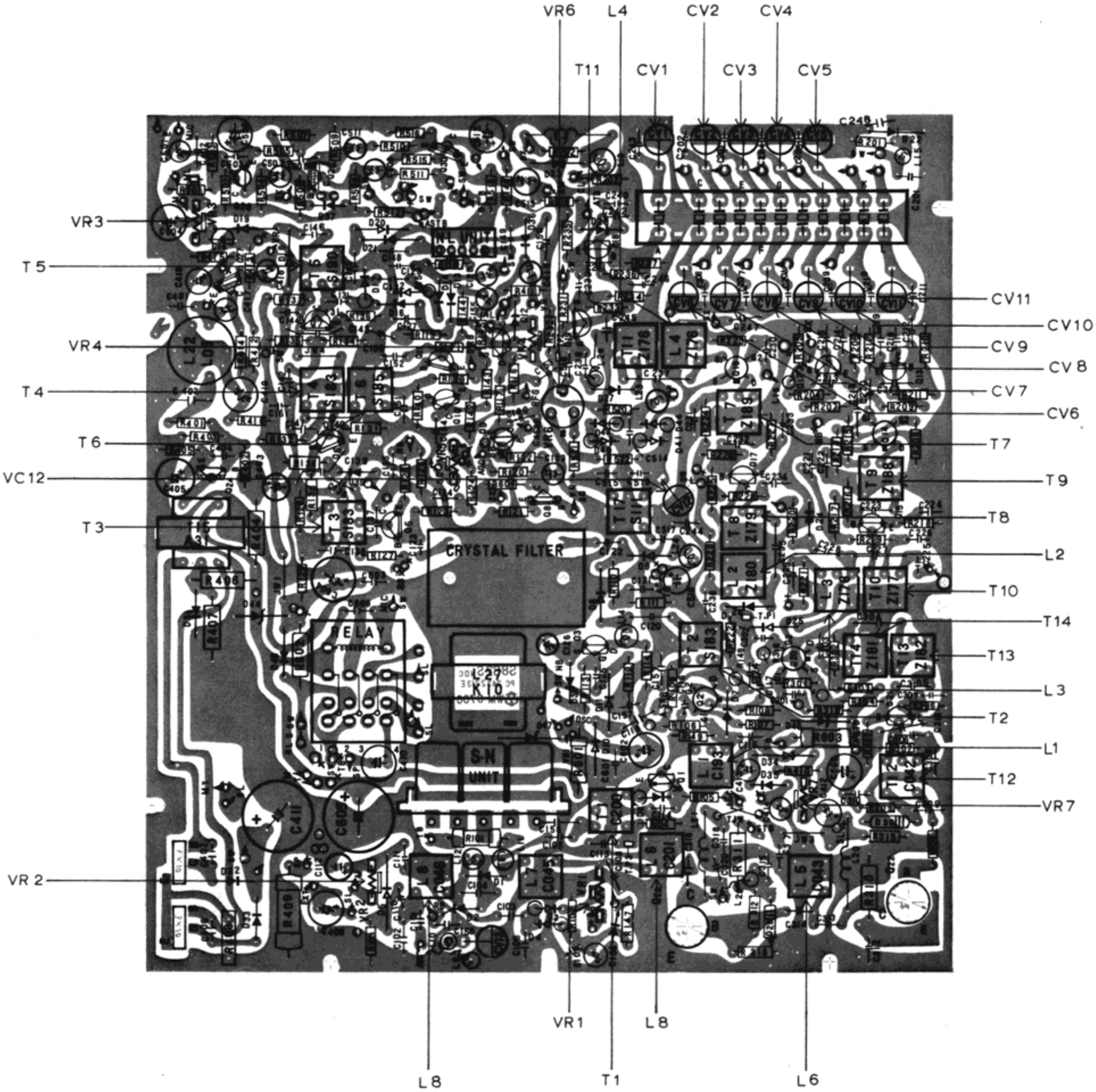


TABLE 5-10 RECEIVER INJECTION VOLTAGES

All injection voltages are at 30% – 1 KHz modulation at the specified frequency fed through a .01 MFD capacitor, and should produce at least 2 VAC audio output measured across the speaker or across an 8Ω load connected at EXT SP J3. Typical audio output voltages are given.

INJECTION POINT	INJECTION LEVEL	FREQUENCY	AUDIO OUTPUT
ANT JACK J1	1μV	Channel Freq.	8.5V
Emitter of Q1 – TP4*	3μV	Channel Freq.	3.5V
Gate 1 of Q2 – TP5	10μV	7.8 MHz	2.9V
Base of Q5 – TP6	10μV	7.8 MHz	6.0V
Base of Q6 – TP7	30μV	7.8 MHz	3.6V
Base of Q7 – TP8	300μV	7.8 MHz	3.5V

* TP numbers correspond to numbers in boxes on schematic diagram and component location drawing.

FIG. 5-11 TRANSMITTER ALIGNMENT PROCEDURE

INITIAL SET-UP

Connect the transceiver to a 13.8 VDC supply. Connect an audio oscillator and AC voltmeter to the MIC input, a wattmeter and dummy load to the antenna jack, an oscilloscope to the dummy load, set the CB/PA switch to CB, center CLARIFIER, and set the channel selector to channel 17. (See Figure 5-5.)

STEP 1

Connect frequency counter to TP-2. Adjust CV1 for 7.8023 MHz.

STEP 2

Connect frequency counter to emitter of Q13. Set the channel selector and adjust:

channel 1, CV6 for 11.700 MHz
channel 5, CV7 for 11.750 MHz
channel 9, CV8 for 11.800 MHz
channel 13, CV9 for 11.850 MHz
channel 17, CV10 for 11.900 MHz
channel 21, CV11 for 11.950 MHz

STEP 3

Connect counter to dummy load. Key transmitter in AM. Set the channel selector and adjust:

channel 1, CV2 for 26.965 MHz
channel 2, CV3 for 26.975 MHz
channel 3, CV4 for 26.985 MHz
channel 4, CV5 for 27.005 MHz

STEP 4

Set the audio oscillator to 1 KHz, key the transmitter in LSB. Adjust ALC control VR1 to end that gives maximum power output.

STEP 5

Set to channel 17. Key transmitter in USB. Set the audio level to indicate about 6 watts on wattmeter. Adjust T11, L4, T9, T10, T7, T8, L2, T3, T14, and T13 for maximum power output.

STEP 6

Key transmitter in LSB. Adjust L3 for maximum power output.

STEP 7

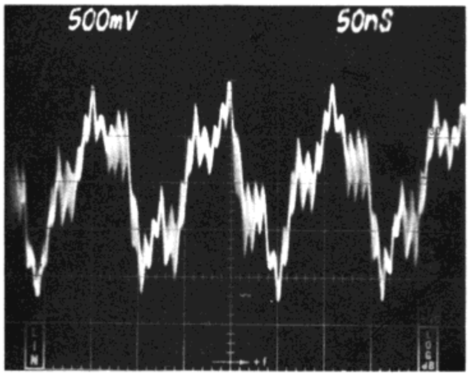
Increase audio oscillator level until maximum indication on wattmeter is reached. Adjust T12, L5, L6, and L8 for maximum power output.

STEP 8

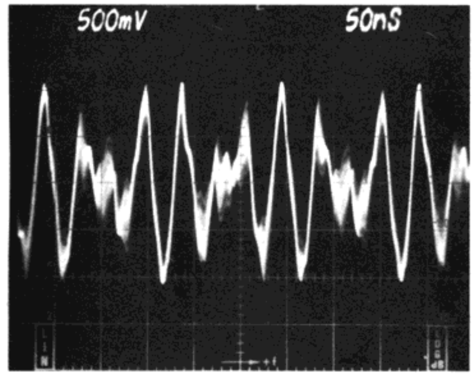
While switching between channels 1 and 23, adjust T14 for least change in power output.

(cont.)

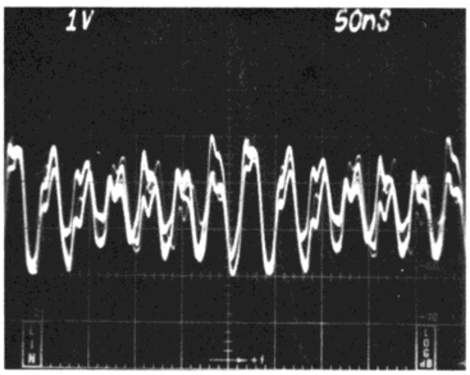
FIG. 5-12 TRANSMITTER ALIGNMENT WAVEFORMS



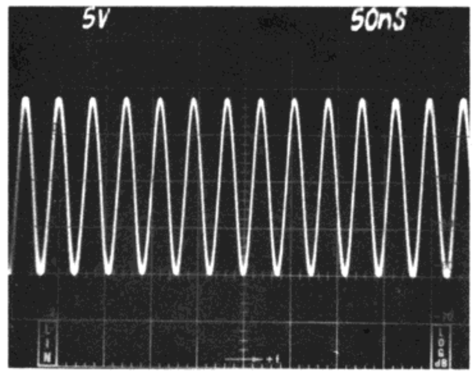
(a) TX Mixer Q20, Gate #1 15



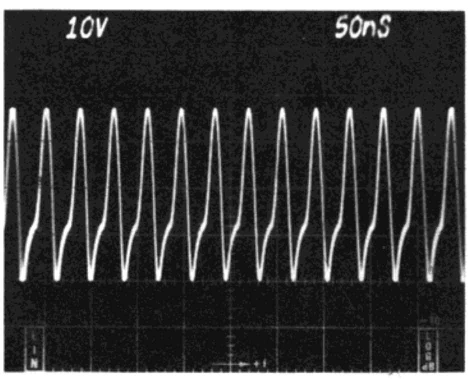
(b) TX Mixer Q20, Gate #2 16



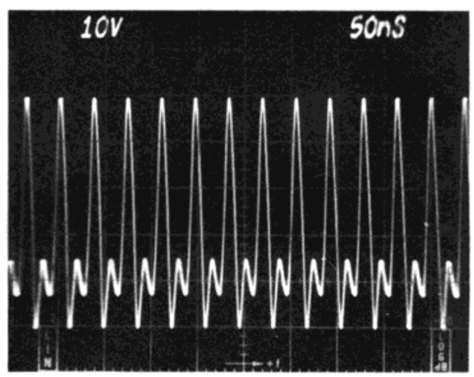
(c) TX Mixer Q20, Drain 17



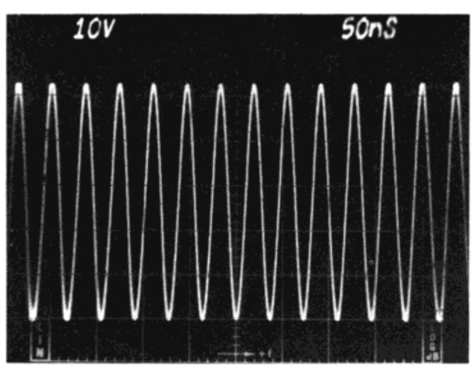
(d) TX Buffer Q21, Collector 18



(e) TX Driver Q22, Collector 19



(f) TX Final Q23, Collector 20



(g) Output Dummy Load

STEP 9

Adjust ALC VR1 for 12 watts output.

STEP 10

Set audio oscillator level to 0. Key transmitter in AM. If output power exceeds 4 watts, install an additional diode (10D4, SBE-8000-00011-0041) in series with those already present on the bottom of PCB near relay RL1.

STEP 11

Adjust VR2 until RFO METER reads the same as wattmeter.

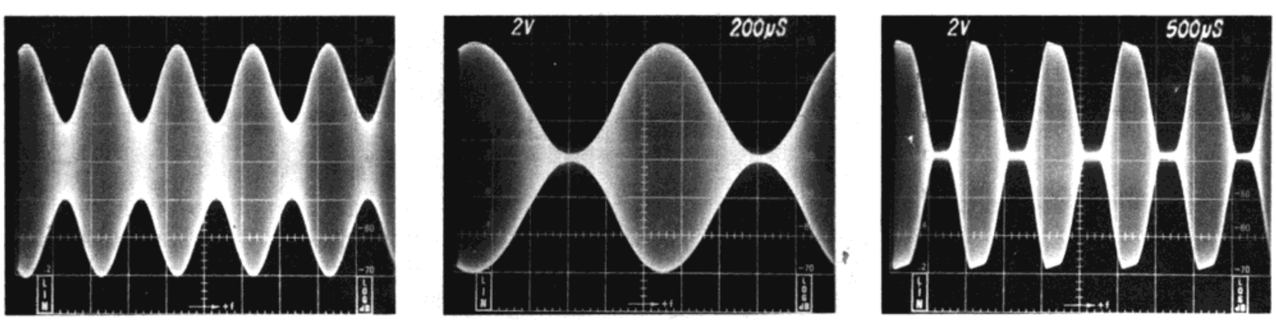
STEP 12

Adjust the audio oscillator's level for 50% modulation. Read level on AC voltmeter and increase level until the AC voltmeter reads 8 times as great (about 18db). Adjust VR7 for 95-100% modulation.

STEP 13

Key the transmitter in LSB. Adjust VR6 and CV12 for minimum indication on the oscilloscope (about .05V P-P).

FIG. 5-13 MODULATION WAVEFORMS



50% Modulation   100% Modulation   Overmodulation

FIG. 5-14 COMPONENT LOCATION

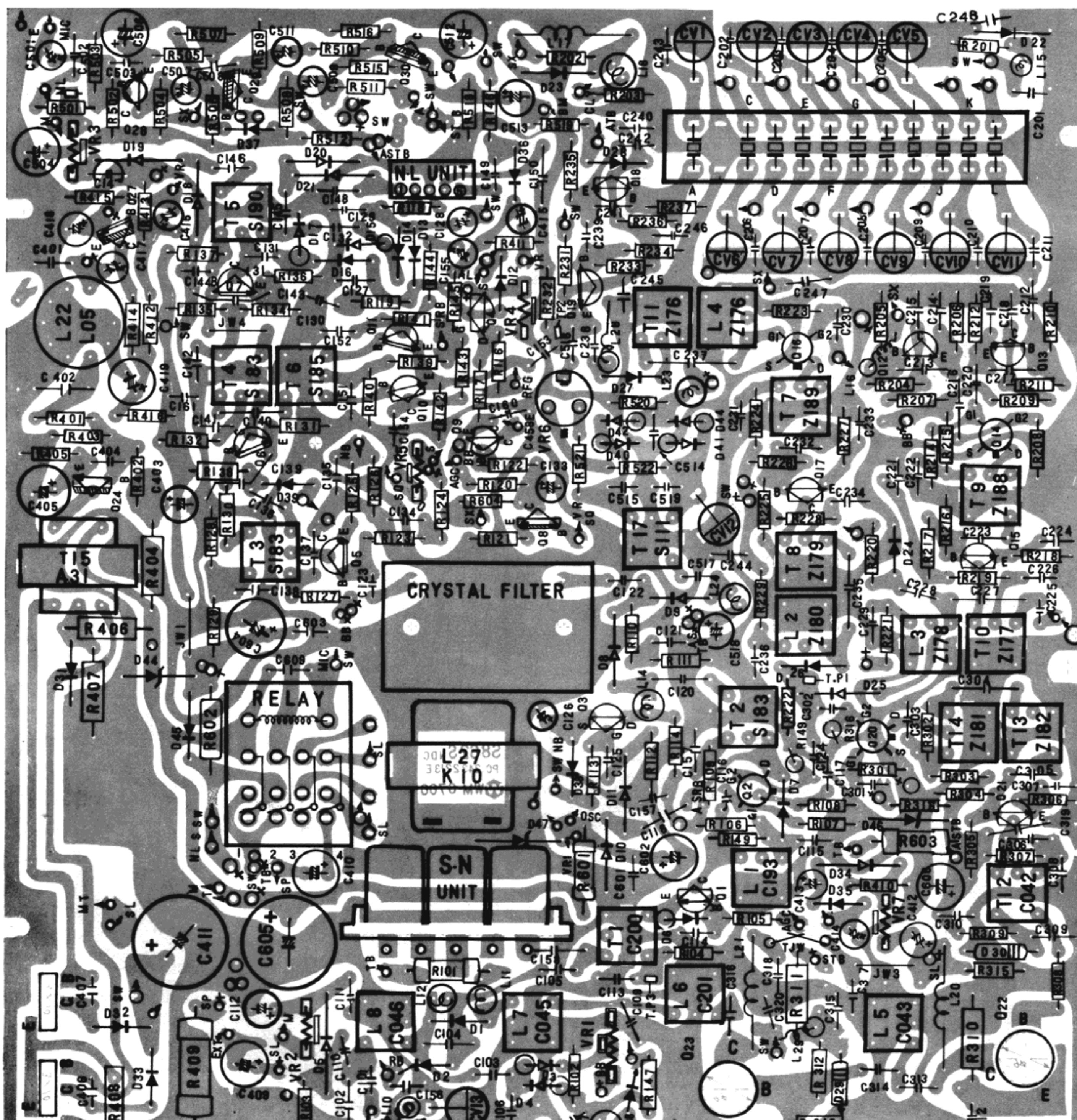
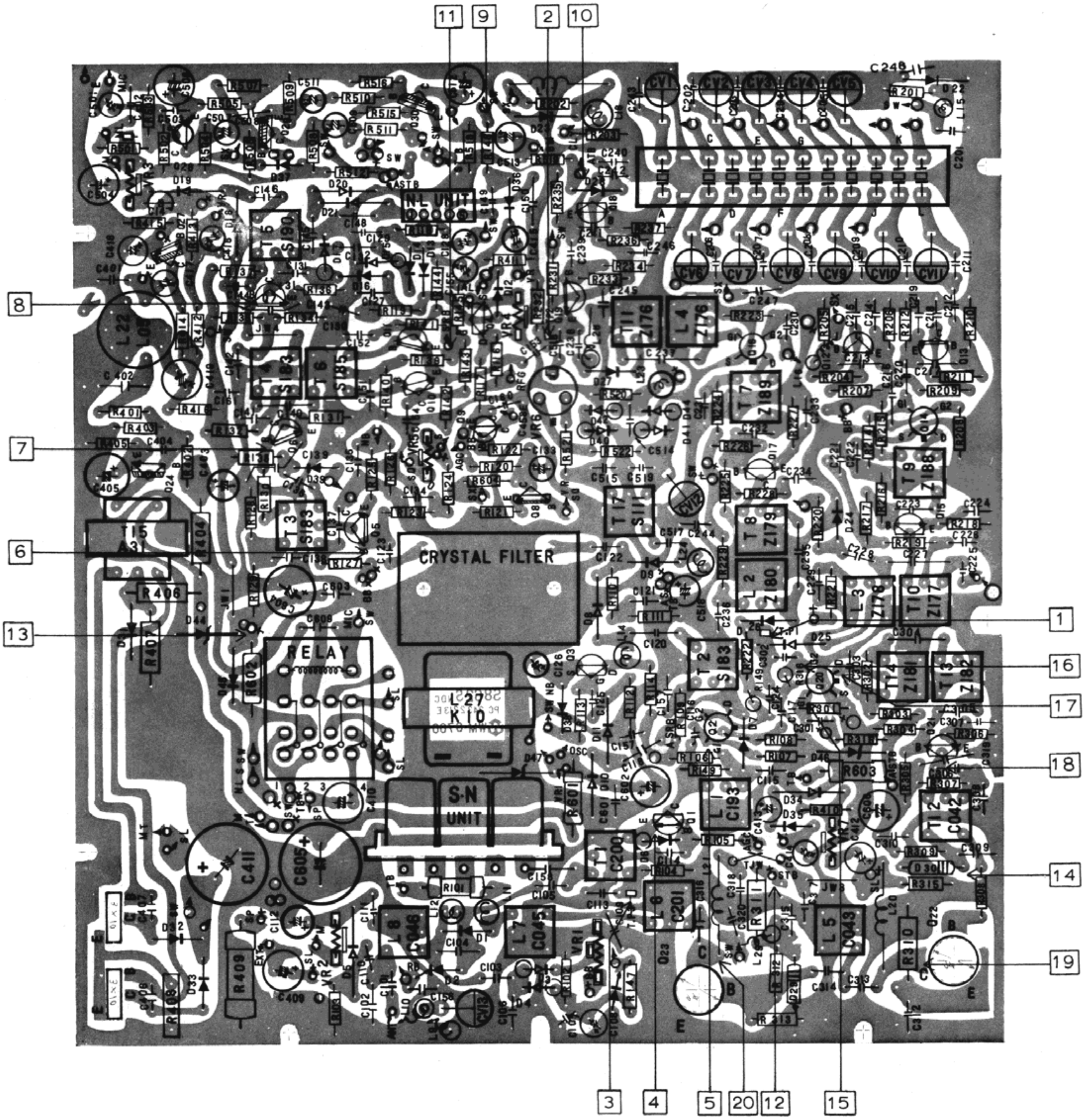


FIG. 5-15 TEST POINT LOCATION



SBE-12CB SIDEBANDER II PARTS LIST

SYMBOL #	PART #	DESCRIPTION
C101	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C102	8000-00004-041	Capacitor, Fixed, 150pfd, 50V, Mica
C103	8000-00004-007	Capacitor, Fixed, 10pfd, 50V, Mica
C104	8000-00004-027	Capacitor, Fixed, 220pfd, 50V, Mica
C105	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C106	8000-00004-021	Capacitor, Fixed, 47pfd, 50V, Mica
C107	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C108	8000-00004-018	Capacitor, Fixed, 0.1mfd, 50V, Mylar
C109	8000-00011-010	Capacitor, Fixed, 170pfd, 50V, Mica
C110	8000-00004-040	Capacitor, Fixed, 3pfd, 50V, Mica
C111	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C112	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C113	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C114	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C115	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C116	8000-00004-007	Capacitor, Fixed, 10pfd, 50V, Mica
C117	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C118	8000-00004-020	Capacitor, Fixed, 100pfd, 50V, Mica
C119	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C120	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C121	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C122	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C123	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C124	8000-00004-040	Capacitor, Fixed, 3pfd, 50V, Mica
C125	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C126	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C127	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C128	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C129	8000-00004-003	Capacitor, Fixed, .04mfd, 50V, Mylar
C130	8000-00004-018	Capacitor, Fixed, .1mfd, 50V, Mylar
C131	8000-00011-008	Capacitor, Fixed, 5pfd, 50V, Mica
C132	8000-00011-008	Capacitor, Fixed, 5pfd, 50V, Mica
C133	8000-00011-002	Capacitor, Fixed, 2.2mfd, 16V, Elect.
C134	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C135	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C136	8000-00004-002	Capacitor, Fixed, 15pfd, 50V, Mica
C137	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C138	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C139	8000-00004-003	Capacitor, Fixed, .04mfd, 50V, Mylar
C140	8000-00011-012	Capacitor, Fixed, 1pfd, 50V,
C141	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer
C142	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C143	8000-00004-003	Capacitor, Fixed, .04mfd, 50V, Mylar
C144	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C145	8000-00004-021	Capacitor, Fixed, 47pfd, 50V, Mica
C146	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C147	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C148	8000-00004-020	Capacitor, Fixed, 100pfd, 50V, Mica
C149	8000-00011-007	Capacitor, Fixed, .001mfd, 50V, Mylar
C150	8000-00004-018	Capacitor, Fixed, .1mfd, 50V, Mylar
C151	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C152	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.

SYMBOL #	PART #	DESCRIPTION
C153	8000-00004-002	Capacitor, Fixed, 15pfd, 50V, Mica
C154	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C155	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C156	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C157	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C158	8000-00004-020	Capacitor, Fixed, 30pfd, 50V, Mica
C160	8000-00004-003	Capacitor, Fixed, .04mfd, 50V, Mylar
C161	8000-00004-003	Capacitor, Fixed, .04mfd, 50V, Mylar
C162	8000-00004-016	Capacitor, Fixed, 20pfd, 50V, Mica
C201	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C202	8000-00004-010	Capacitor, Fixed, N750, 22pfd, 50V, Cer.
C203	8000-00004-010	Capacitor, Fixed, N750, 22pfd, 50V, Cer.
C204	8000-00004-010	Capacitor, Fixed, N750, 22pfd, 50V, Cer.
C205	8000-00004-010	Capacitor, Fixed, N750, 22pfd, 50V, Cer.
C206	8000-00004-022	Capacitor, Fixed, N470, 30pfd, 50V, Cer.
C207	8000-00004-022	Capacitor, Fixed, N470, 30pfd, 50V, Cer.
C208	8000-00004-022	Capacitor, Fixed, N470, 30pfd, 50V, Cer.
C209	8000-00004-022	Capacitor, Fixed, N470, 30pfd, 50V, Cer.
C210	8000-00004-022	Capacitor, Fixed, N470, 30pfd, 50V, Cer.
C211	8000-00004-022	Capacitor, Fixed, N470, 30pfd, 50V, Cer.
C212	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C213	8000-00011-011	Capacitor, Fixed, 300pfd, 50V, Mica
C214	8000-00004-020	Capacitor, Fixed, 100pfd, 50V, Mylar
C215	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C216	8000-00011-008	Capacitor, Fixed, 5pfd, 50V, Mica
C217	8000-00011-011	Capacitor, Fixed, 300pfd, 50V, Mica
C218	8000-00004-020	Capacitor, Fixed, 100pfd, 50V, Mica
C219	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C220	8000-00011-008	Capacitor, Fixed, 5pfd, 50V, Mica
C221	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C222	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C223	8000-00004-027	Capacitor, Fixed, 220 pfd, 50V, Mica
C224	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C225	8000-00004-013	Capacitor, Fixed, 2pfd, 50V, Mica
C226	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer
C228	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C229	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C230	8000-00011-008	Capacitor, Fixed, 5pfd, 50V, Mica
C231	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C232	8000-00011-009	Capacitor, Fixed, 56pfd, 50V, Mica
C233	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer
C234	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C235	8000-00011-012	Capacitor, Fixed, 1pfd, 500V
C236	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C237	8000-00004-040	Capacitor, Fixed, 3pfd, 50V, Mica
C238	8000-00004-002	Capacitor, Fixed, 15pfd, 50V, Mica
C239	8000-00004-002	Capacitor, Fixed, 15pfd, 50V, Mica
C240	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C241	8000-00004-017	Capacitor, Fixed, 500pfd, 50V, Mica
C242	8000-00004-041	Capacitor, Fixed, 150pfd, 50V, Mica
C243	8000-00004-010	Capacitor, Fixed, N750, 22pfd, 50V, Cer.
C244	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C245	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C246	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.

SYMBOL #	PART #	DESCRIPTION
C301	8000-00004-024	Capacitor, Fixed, 30pfd, 50V, Mica
C302	8000-00004-007	Capacitor, Fixed, 10pfd, 50V, Mica
C303	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C304	8000-00011-013	Capacitor, Fixed, 2pfd, 500V
C305	8000-00004-027	Capacitor, Fixed, 220pfd, 50V, Mica
C306	8000-00004-020	Capacitor, Fixed, 100pfd, 50V, Mica
C307	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C308	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C309	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C310	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C311	8000-00004-043	Capacitor, Fixed, .047mfd, 50V, Cer.
C312	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C313	8000-00011-009	Capacitor, Fixed, 56pfd, 50V, Mica
C314	8000-00004-041	Capacitor, Fixed, 150pfd, 50V, Mica
C315	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C316	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C317	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C318	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C319	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C320	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C321	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C401	8000-00004-015	Capacitor, Fixed, .05mfd, 50V, Mylar
C402	8000-00004-018	Capacitor, Fixed, .1mfd, 50V, Mylar
C403	8000-00004-047	Capacitor, Fixed, 10mfd, 16V, Elect.
C404	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C405	8000-00004-044	Capacitor, Fixed, 220mfd, 16V, Elect.
C408	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C409	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C410	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C411	8000-00011-015	Capacitor, Fixed, 470mfd, 35V, Elect.
C412	8000-00011-014	Capacitor, Fixed, 4.7mfd, 35V, Elect.
C413	8000-00004-030	Capacitor, Fixed, 4.7mfd, 16V, Elect.
C414	8000-00004-047	Capacitor, Fixed, 10mfd, 16V, Elect.
C415	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C416	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C417	8000-00004-045	Capacitor, Fixed, .22mfd, 16V, Elect.
C418	8000-00011-003	Capacitor, Fixed, 33mfd, 16V, Elect.
C419	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C501	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C502	8000-00011-006	Capacitor, Fixed, .1mfd, 12V
C503	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C504	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C505	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.
C506	8000-00011-003	Capacitor, Fixed, 33mfd, 16V, Elect.
C507	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C508	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C509	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C511	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C512	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C513	8000-00004-042	Capacitor, Fixed, 1.0mfd, 16V, Elect.
C514	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C516	8000-00004-020	Capacitor, Fixed, 100pfd, 50V, Mica
C517	8000-00004-011	Capacitor, Fixed, .001mfd, 50V, Cer.

SYMBOL #	PART #	DESCRIPTION
C518	8000-00004-047	Capacitor, Fixed, 10mfd, 16V, Elect.
C601	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C602	8000-00004-044	Capacitor, Fixed, 220mfd, 16V, Elect.
C603	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C604	8000-00004-046	Capacitor, Fixed, 100mfd, 16V, Elect.
C605	8000-00004-049	Capacitor, Fixed, 1000mfd, 16V, Elect.
C606	8000-00004-009	Capacitor, Fixed, 47mfd, 16V, Elect.
C607	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
C608	8000-00004-048	Capacitor, Fixed, .001mfd, Feed-Thru
C609	8000-00004-001	Capacitor, Fixed, .01mfd, 50V, Cer.
CV1	8000-00004-050	Capacitor, 20pfd, Variable
CV2	8000-00004-050	Capacitor, 20pfd, Variable
CV3	8000-00004-050	Capacitor, 20pfd, Variable
CV4	8000-00004-050	Capacitor, 20pfd, Variable
CV5	8000-00004-050	Capacitor, 20pfd, Variable
CV6	8000-00004-051	Capacitor, 30pfd, Variable
CV7	8000-00004-051	Capacitor, 30pfd, Variable
CV8	8000-00004-051	Capacitor, 30pfd, Variable
CV9	8000-00004-051	Capacitor, 30pfd, Variable
CV10	8000-00004-051	Capacitor, 30pfd, Variable
CV11	8000-00004-051	Capacitor, 30pfd, Variable
CV12	8000-00004-204	Capacitor, 10pfd, Variable
CV13	8000-00004-204	Capacitor, 10pfd, Variable
D1	8000-00011-041	Diode, 10D-4
D2	8000-00011-041	Diode, 10D-4
D3	8000-00004-060	Diode, 1N34A
D4	8000-00004-060	Diode, 1N34A
D5	8000-00004-060	Diode, 1N34A
D6	8000-00004-060	Diode, 1N34A
D7	8000-00011-046	Diode, 1S-1007
D8	8000-00004-063	Diode, 1N60P
D9	8000-00004-060	Diode, 1N34A
D10	8000-00004-060	Diode, 1N34A
D11	8000-00004-060	Diode, 1N34A
D12	8000-00011-042	Diode, 1S-2472
D13	8000-00011-042	Diode, 1S-2472
D14	8000-00011-042	Diode, 1S2472
D15	8000-00004-060	Diode, 1N34A
D16	8000-00011-042	Diode, 1S2472
D17	8000-00004-060	Diode, 1N34A
D18	8000-00004-060	Diode, 1N34A
D19	8000-00004-060	Diode, 1N34A
D20	8000-00004-060	Diode, 1N34A
D21	8000-00004-060	Diode, 1N34A
D22	8000-00011-046	Diode, 1S-1007
* D23	8000-00004-248	Diode, 1S-352M
D24	8000-00011-042	Diode, 1S-2472
D25	8000-00004-060	Diode, 1N34A
D26	8000-00011-042	Diode, 1S-2472
D27	8000-00011-042	Diode, 1S2472
D28	8000-00011-042	Diode, 1S-2472

SYMBOL #	PART #	DESCRIPTION
D29	8000-00004-184	Diode, 1S-990S
D30	8000-00004-184	Diode, 1S-990S
D31	8000-00011-045	Diode, 1S-1211
D32	8000-00011-041	Diode, 10D-4
D33	8000-00011-041	Diode, 10D-4
D34	8000-00004-060	Diode, 1N34A
D35	8000-00011-044	Diode, VD1210
D36	8000-00011-042	Diode, 1S-2472
D37	8000-00011-042	Diode, 1S-2472
D38	8000-00011-042	Diode, 1S-2472
D39	8000-00011-042	Diode, 1S-2472
D40	8000-00004-063	Diode, 1N60P
D41	8000-00004-063	Diode, 1N60P
D42	8000-00004-063	Diode, 1N60P
D43	8000-00004-063	Diode, 1N60P
D44	8000-00011-043	Diode, BZ-090
D45	8000-00011-042	Diode, 1S-2472
D46	8000-00011-043	Diode, BZ-090
D47	8000-00011-043	Diode, BZ-090
D48	8000-00011-041	Diode, 10D-4
FL1	8000-00011-071	Filter, 7.8 MHz
J1	8000-00004-069	Connector, Socket, Antenna
J2	8000-00004-070	Connector, Microphone Chassis Mount
J3	8000-00004-072	Connector, External Jack, Speaker
J4	8000-00004-071	Connector, P.A. Jack
L1	8000-00011-023	Coil, 27 MHz
L2	8000-00011-024	Coil, 34 MHz
L3	8000-00011-025	Coil, 19 MHz
L4	8000-00011-026	Coil, 15 MHz
L5	8000-00004-075	Coil, 27 MHz
L6	8000-00011-027	Coil, 27 MHz
L7	8000-00004-077	Coil, 27 MHz
L8	8000-00004-078	Coil, 27 MHz
L9	8000-00004-053	Choke, 22 μh
L10	8000-00004-059	Choke, 0.85 μh
L11	8000-00011-018	Choke, RF 150 μh
L12	8000-00011-018	Choke, RF 150 μh
L14	8000-00011-020	Choke, RF 470 μh
L15	8000-00011-020	Choke, RF 470 μh
L16	8000-00011-017	Choke, 5.5 μh
L17	8000-00011-016	Choke, 0.22 μh
L18	8000-00011-020	Choke, RF 470 μh
L20	8000-00004-205	Choke, 1 μh
L21	8000-00011-016	Choke, 0.22 μh
L22	8000-00011-021	Choke AF
L23	8000-00011-019	Choke, RF 22 μh
L24	8000-00011-019	Choke, RF 22 μh
L27	8000-00011-022	Choke, RF
L28	8000-00004-056	Choke, 15 μh
L29	8000-00004-054	Choke, 3.0 μh
L30	8000-00011-019	Choke, RF 22 μh

SYMBOL #	PART #	DESCRIPTION
NL	8000-00011-094	Noise Limiter Unit
PL1	8000-00004-142	Lamp, 16V, 40ma
PL2	8000-00011-056	Lamp, 14V, 75ma
PL3	8000-00004-142	Lamp, 16V, 40ma
Q1	8000-00011-004	Transistor, 2SC710B
Q2	8000-00011-053	Transistor, 3SK45L
Q3	8000-00011-054	Transistor, 2SK34C
Q4	8000-00011-055	Transistor, 2SK34E
Q5	8000-00011-047	Transistor, 2SC710C
Q6	8000-00011-047	Transistor, 2SC710C
Q7	8000-00011-047	Transistor, 2SC710C
Q8	8000-00004-085	Transistor, 2SC458C
Q9	8000-00004-089	Transistor, XA-495C
Q10	8000-00011-047	Transistor, 2SC710C
Q11	8000-00011-047	Transistor, 2SC710C
Q12	8000-00011-048	Transistor, 2SC710D
Q13	8000-00011-048	Transistor, 2SC710D
Q14	8000-00011-053	Transistor, 3SK45L
Q15	8000-00011-047	Transistor, 2SC710C
Q16	8000-00011-053	Transistor, 3SK45L
Q17	8000-00011-047	Transistor, 2SC710C
Q18	8000-00011-048	Transistor, 2SC710D
Q19	8000-00011-047	Transistor, 2SC710C
Q20	8000-00011-053	Transistor, 3SK45L
* Q21	8000-00011-048	Transistor, 2SC710D
Q22	8000-00011-051	Transistor, 2SC776(Y)
* Q23	8000-00011-052	Transistor, 2SC1239
Q24	8000-00004-085	Transistor, 2SC458C
Q25	8000-00011-050	Transistor, 2SC1061
Q26	8000-00011-050	Transistor, 2SC1061
Q27	8000-00011-049	Transistor, 2SC458LGD
Q28	8000-00004-086	Transistor, 2SD77B
Q29	8000-00004-085	Transistor, 2SC458C
Q30	8000-00004-085	Transistor, 2SC458C
R310	8000-00011-001	Resistor, Fixed, 2.2Ω, 1/2W
R408	8000-00004-091	Resistor, Fixed, 1Ω, 1W
R409	8000-00004-266	Resistor, Fixed, 10Ω, 2W
RL1	8000-00004-141	Relay, 4P-2T
S1		Part of VR11
S2	8000-00004-101	Switch, 2P-2T
S3	8000-00011-092	Switch, 4P-2T
S4	8000-00011-058	Switch, Rotary, 24T
S5	8000-00004-102	Switch, Rotary, 8P-3T
SP1	8000-00011-057	Speaker, 8Ω
T1	8000-00011-028	Transformer, 27 MHz
T2	8000-00011-029	Transformer, 7.8 MHz, IF

SYMBOL #	PART #	DESCRIPTION
T3	8000-00011-029	Transformer, 7.8 MHz, IF
T4	8000-00011-029	Transformer, 7.8 MHz, IF
T5	8000-00011-030	Transformer, 7.8 MHz, Detector
T6	8000-00011-031	Transformer, 7.8 MHz, Detector
T7	8000-00011-032	Transformer, 34 MHz
T8	8000-00011-033	Transformer, 34 MHz
T9	8000-00011-034	Transformer, 19 MHz
T10	8000-00011-035	Transformer, 19 MHz
T11	8000-00011-026	Transformer, Z176, 15 MHz
T12	8000-00004-118	Transformer, 27 MHz
T13	8000-00011-036	Transformer, 27 MHz
T14	8000-00011-037	Transformer, 27 MHz
T15	8000-00011-039	Transformer, AF Driver
T16	8000-00011-040	Transformer, AF Output
T17	8000-00011-038	Transformer, 7.8 MHz
VR1	8000-00004-096	Resistor, 10KΩ, Variable
VR2	8000-00004-094	Resistor, 100KΩ, Variable
VR3	8000-00011-083	Resistor, 20KΩ, Variable
VR4	8000-00011-083	Resistor, 20KΩ, Variable
VR5	8000-00004-096	Resistor, 10KΩ, Variable
VR6	8000-00011-084	Resistor, 100KΩ, Variable
VR7	8000-00011-082	Resistor, 1KΩ, Variable
VR8	8000-00004-256	Resistor, 10K x 2, Variable
VR9	8000-00004-256	Resistor, 10K x 2, Variable
VR10	8000-00011-005	Resistor, Variable, 5K—10KΩ, w/switch
VR11	8000-00011-005	Resistor, Variable, 5K—10KΩ, w/switch
X1	8000-00011-059	Crystal, 7.8025 MHz
X2	8000-00011-060	Crystal, 7.5025 MHz
X3	8000-00011-061	Crystal, 7.4825 MHz
X4	8000-00011-062	Crystal, 7.4725 MHz
X5	8000-00011-063	Crystal, 7.4625 MHz
X6	8000-00011-064	Crystal, 11.700 MHz
X7	8000-00011-065	Crystal, 11.750 MHz
X8	8000-00011-066	Crystal, 11.800 MHz
X9	8000-00011-068	Crystal, 11.850 MHz
X10	8000-00011-069	Crystal, 11.900 MHz
X11	8000-00011-070	Crystal, 11.950 MHz
	8000-00011-072	Heat Sink, Driver Transistor
	8000-00011-073	Heat Sink, Final Transistor
	8000-00011-074	Heat Sink, Audio Output Transistor
	8000-00004-176	Mount, Feed-Thru Capacitor
	8000-00011-076	Mount, Meter
	8000-00011-077	Cord Retainer, DC Cable
	8000-00004-151	In-Line Fuse Holder
	8000-00004-153	Microphone, Complete
	8000-00004-164	Microphone, Connector
	8000-00011-078	Fuse, 3 Amp
	8000-00004-162	Channel Window
	8000-00011-075	Cabinet
	8000-00011-079	Front, Die Cast
	8000-00011-080	Overlay, Panel "SIDEBANDER II"
	8000-00004-159	Lamp Assembly, Red, Tx

SYMBOL #	PART #	DESCRIPTION
	8000-00004-145	Knob, Channel Selector
	8000-00004-147	Knob, Mode
	8000-00004-148	Knob, Volume & Squelch
	8000-00004-149	Knob, Squelch & RF Gain
	8000-00011-081	Mounting, Bracket
	8000-00011-086	Meter
	8000-00011-087	Cover for Crystals
	8000-00011-088	Name Plate, FCC
	8000-00011-089	Mount for Speaker
	8000-00004-160	Bolt, Mounting Bracket
	8000-00011-091	Insulator, Rubber, Speaker
	8000-00011-101	Styrofoam Box
	8000-00011-100	Display Box
	8000-00011-153	Positive/Negative Ground Mod Kit

Supplemental Parts List for SBE-12CB/T 25W

Q21	8000-00011-167	Transistor 2SC383
Q23	8000-00011-151	Transistor 2SC1307
D23	8000-00011-166	Diode 1S2688B
	8000-00011-157	Fuse, 4A
	8000-00011-159	Heat Sink for 2SC1307

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