

# SG-2020 Transceiver

## Installation and Operations Manual



# SGC

"No Compromise Communications"



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## SGC — The SSB People

SGC develops, manufactures, and sells high performance single sideband (SSB) communications equipment. Since 1971, the company has sold to the marine, military, aviation, and industrial markets world wide. Over these years, SGC has earned an outstanding reputation for product reliability and for service after sale.

The company keeps pace with equipment options, engineering developments, and design requirements. Its products are the most competitive in the entire long distance communication market. SGC equipment is presently being used by the United Nations for inter-communications in developing countries throughout the world. Many competitive racing vessels, as well as fishing boats, tugs, and commercial craft are equipped with SGC equipment. In fact, an SGC radiotelephone provided the only communications available on a past Polar expedition by the National Geographic Society.

SGC also supplies U.S. government agencies, several foreign governmental agencies, and major petroleum companies through Asia and latin America.

All SGC equipment is designed and manufactured in the USA. SGC has qualified people ready to provide technical information, assistance in selecting equipment, and recommendations for any installation.

SGC welcomes your call to discuss your SSB requirements.



*SGC 2020 Staff*

# SG-2020

# Transceiver

## Installation and Operations Manual



*“No Compromise Communications”*

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SGC Inc. SGC Building, 13737 S.E. 26th St. Bellevue, WA. 98005 USA  
P.O.Box 3526, 98009 Fax: 425-746-6384 or 746-7173 Tel: 425- 746-6310 or 1-800-259 7331  
E-mail: [sgc@sgcworld.com](mailto:sgc@sgcworld.com) Web site: <http://www.sgcworld.com>



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***SG-2020 Transceiver Front***

## 1.0 FEATURES

The SG-2020 is a compact low power transceiver with the features and performance you expect in a modern full size transceiver.

- Strong, wide dynamic range receiver
- Selectivity at 2.7 KHz not less than 60 dB rejection on the adjacent channel
- RF Speech processing
- All Band Operation 160 mtrs through 10 mtrs.
- General Coverage Receiver, 1.8 MHz through 29.7 MHz
- Extended receive range from 400 kHz to 1600 kHz available
- 20 memories that are fully user accessible
- Split, RIT / XIT capable
- High performance baseband selectable digital filters
- Single Sideband in USB and LSB
- Full break-in operation in CW
- Built in mode 'B' Iambic Keyer, adjustable from 5 to 60 WPM
- Very low power consumption on receive, less than 400 mA
- Frequency Scan
- Memory scan with adjustable dwell timing
- DC Volt meter
- Operational temperature range of -30 to +70° C

### WARM-UP TIME

The SG-2020 is equipped with a thermistor resistor circuit designed to stabilize the frequency. A warm-up time of 15 to 30 minutes is needed to achieve full stability. The unit is fully operational during this time, but a drift of plus or minus 200 Hz may be noticed.





## 2.0 INTRODUCTION

Thank you for choosing the SGC Model SG-2020 transceiver. We know that you have many options when choosing your communications equipment, and we are glad that your choice was SGC - an American designed and manufactured product. SGC has been manufacturing HF transceivers and equipment form 1971. Our philosophy is to bring unique design innovations to the industry; products that give superior performance and at very affordable prices.

The SG-2020 is by no means just another radio amateur product. It is a professional, commercial grade transceiver, designed for a whole panorama of HF users - amateurs, professionals and others. The SG-2020 is the first in a series of new generation SGC products based on the single I.F. frequency.

SGC introduced the first HF SSB which was mass produced for the marine industry. This product included new features, such as wide-band technology, all solid state and single conversion. This concept led to the cutting edge technology behind the SG-2020 transceiver with its intercept point at +18 dbm. Strong front end, single conversion, structured around an I.F. frequency of 60 MHz, provides for a superior and outstanding receiver with an IF rejection of 90db. Spurious frequencies typically generated by conventional multiple conversion designs are virtually eliminated.

With a custom high performance SGC mixer, we keep the design simple and of superior performance. We have eliminated interfering circuitry found in other transceivers. An additional design goal was to have a low stand-by current, below 400 mA, which would allow this unique product to be used in many applications when others could not.

The SG-2020 incorporates a very basic noise blanker circuit which operates without compromising receiver performance and without

any additional current drain. This allows excellent receiver characteristics to be preserved along with long battery life. We believe these benefits will be highly appreciated by operators in the field and other portable operations.

The rugged transmitter section provides exceptionally clear, clean audio, and provides excellent performance characteristics. The amplifier has the stress power capability of 40 watts. In other words, it is capable of producing 40 saturated watts in mid band and therefore, a rating of 20 watts PEP is very conservative.

The SG-2020 is equal to the performance of only a very few transceivers available in today's market and which cost several thousand dollars. We are very proud of this unit - its' features, performance and price. You check it out and let us know what you think.





## 3.0 SPECIFICATIONS:

### SG-2020 SSB HF TRANSCEIVER

#### GENERAL

General Operating modes:	USB, LSB and CW
Receiver Frequency range:	1.8 to 30.0 MHz, general coverage (400 kHz to 1600 kHz with broadcast filter bypassed)
Transmit Frequency range:	1.8 to 29.7 MHz (US Ham Bands only) 1.8 to 30.0 MHz (general coverage, export)
Operational Temperature Range:	-30 to +70° C
Operational Voltage Range:	9 - 18 VDC
Microprocessor:	MC68HC711E9
Frequency Stability:	3 ppm per 10° C *(see example below)
Frequency Resolution:	10 Hz
Frequency Display:	100 Hz
RX / Tx Changeover:	less than 10 ms
Memories:	20 (factory pre-set, user definable)
Reflected Power Metering:	built in
LCD:	back light selectable
Keyer:	fully adjustable IAMBIC mode 'B', 5 to 60 WPM
Memory Scan:	Adjustable
Dimensions:	2.75H x 6W x 7L
Approximate weight:	4.4 lbs.
Microphone:	fist, dynamic
Battery Volt meter:	digital; front-panel controlled

#### RECEIVER

Sensitivity:	better than .5µV for 10dB S/N+N
Intermodulation:	+18 dbm 3rd order intercept
Selectable AF bandpass:	100Hz to 2700Hz
Audio Output:	1 watt RMS
AF distortion at nominal output power:	less than 3%
Internal Speaker:	5 watts maximum, 4 ohms
Noise Blanker:	pulse / ignition
RF Gain:	front panel controllable
BFO:	processor controlled
Total power consumption:	less than 400 mA (receive only)

#### TRANSMITTER

Output Power:	nominal 1.8-25 MHz 20 watts PEP ( above 25 MHz 12 watts min.)
Output Power Adjustment:	front panel control 1 to 25 watts
RF Speech Processing:	VOGAD baseband and rf clipping
Transmit Current consumption:	4 amperes, typical at 20 watts PEP voice
Transmit intermods, 20 watts:	-28 dB or better
Transmit Spurious:	-50 dB (Ham Bands)

Specifications listed represent optimal conditions and are not subject to warranty. All SGC products must be used with compatible equipment

\*Example: at 14.2 MHz =  $14.2 \times 3 = 42.6$  Hz; A total frequency drift of 42.6 Hz for a temperature change of 10° C. If the ambient temperature changes from 20° to 30° C, there could be a drift of 42.6 Hz.

**SGC reserves the right to modify specifications without notice.**



## 4.0 INSPECTION UPON RECEIPT

Upon receipt, open the shipping carton and inspect your SG-2020 transceiver carefully for any signs of damage. After removing all packing materials, check that all exposed controls move freely, and that the enclosure has no dents or scratches. If you notice any damage to the unit, document it completely and contact the shipping company immediately. Save all packing materials for possible future use.

### 4.1 INSTALLATION ACCESSORIES

Please check to see that the following items are included in your shipping carton:

- (1) 1 - SG-2020 Transceiver (catalog #05-01)
- (2) 1 - microphone (catalog #52-26)
- (3) 1 - power cable and connector (1 meter, #14 gauge)
- (4) 1 - Front Flip Foot (catalog #05-43)
- (5) 1 - SG-2020 Operator's Manual
- (6) 3 - QSL cards

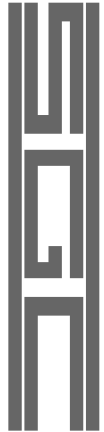
A quick-start information guide is printed on the inside of the SG-2020 packing carton. Use this handy reference as soon as you receive your SG-2020 unit.

## 5.0 MODES OF OPERATION (USB, LSB, CW, DATA, AM)

### 5.1 VOICE (USB, LSB)

Voice communication is accomplished using either upper or lower sideband. To display the current operating mode, press "BW". The display will indicate the current mode and the bandwidth filter setting. To change modes, press REV while holding the "BW" button down. When operating in the ham bands, LSB is normally used below 10 MHz, and USB is used above 10 MHz. The SG-2020 will retain the operating mode and bandwidth settings until a different frequency is chosen using one of the memory selections. Favorite frequencies can be stored in any of the 20 memories, including the mode and bandwidth settings.

**Note: Voice operation will not function if the unit is in "CW" mode.**





### 5.1.1 COUPLER TUNE CAPABILITY

An external automatic antenna coupler can be automatically tuned in SSB by momentarily depressing the "PBT" push button and then pressing the push button on the microphone within 5 seconds. This will insert the CW tone to allow the coupler to tune. The SG-2020 will transmit a tone as long as the microphone push button is depressed. Once you release the push button on the microphone, the radio reverts to SSB with no tone and normal transmission can resume.

**Note:** Once "PBT" has been depressed and released, you must key the microphone with-in 5 seconds or the function will time out. You may also escape this function by depressing any other key, or by moving the main adjustment knob.

### 5.2 CW MODE

The SG-2020 is designed for CW use with many special features. To choose the CW mode, press and hold the "BW" button, and momentarily press the REV button until "CW" appears on the display. Continue to hold the "BW" button while turning the main tuning control knob to adjust the bandwidth for the desired filter setting. Narrowing the bandwidth filter will allow clear reception of CW signals in crowded bands. The bandwidth can be adjusted down to a very narrow 100 Hz, however, 300 Hz should be adequate for clear CW reception. CW transmit can be accomplished with paddle, keyer, or push button (PTT) on the microphone.

The SG-2020 is set to transmit at 650 Hz upper sideband tone. Setting the dial frequency for the same receive and transmit frequency (Push Button "XCVE") will transmit a tone frequency of 650 Hz above the carrier frequency (upper sideband).

CW for optimum performance:

1. Set volume to maximum
2. Set RF gain for comfortable level
3. Reduce bandwidth to 600 Hz approximately
4. If interfering signals are present, use the past band tuning to reduce interference
5. If further rejection is required, reduce bandwidth again to as low as 100 Hz



This setup approach will allow any operator to get superb performance under all conditions or pile ups.

In CW the SG-2020 supports full break in and performs extremely well. Also, in the electronic paddle mode, the break-in is supported, but has been modified to support the overwhelming demand to extend some hold time after the last character and space, in order to limit the fast back and forth TX-RX cycles.

Both modes are supported in the break-in mode as follows:

There are two front panel inputs for CW operation

- (1) PAD - for built in keyer
- (2) KEY - for straight key or external keyer

Only the “KEY” input provides the capability for full break-in. If full break-in is desired with the keyer, use the external keyer attached to the “KEY” input.

“KEY” input: Radio reverts to receive immediately when key is released. This allows traffic to be heard between CW elements.

“PAD” input: Radio remains in transmit for space duration of CW elements and only reverts to receive after a character is sent. This allows for partial break-in.

**Note: CW operation will not function if unit is in “USB” or LSB” mode.**

### 5.3 DATA MODES

The SG-2020 is also designed for various HF data transmission modes, such as RTTY, NAVTEX, weatherfax, and packet. An HF data modem is needed, such as the SG-7200. Connection to the radio is through the microphone jack on the front panel, using standard audio in, audio out, PTT, and ground. See section 19.2 for a diagram of these connections. Select either USB or LSB for data transmission and adjust the bandwidth setting as described above for clear data reception.



## **5.4 AM RECEPTION FOR BROADCAST AND SHORTWAVE**

Reception of AM broadcast and shortwave stations is very effective by using upper sideband or lower sideband. Choice of either sideband will allow the user to avoid nearby interfering signals. For additional information concerning the SG-2020's broadcast filter and how to bypass it for broadcast reception in the 400 to 1600 kHz range, see section 15.1.

## **6.0 INSTALLATION**

### **6.0.1 EQUIPMENT LOCATION**

The SG-2020 can be affected by strong nearby magnetic fields. Therefore, be sure to place any AC supply or other source of strong magnetic fields at least several inches away from the transceiver. Additionally, it is of good practice to avoid locating the unit on top of heat generating devices such as linear amplifiers.

### **6.0.2 ANTENNA CONSIDERATIONS**

Successful operation of any station depends on providing a reasonably efficient and well matched antenna system. The SG-2020 expects a 50 ohm resistive impedance at the operating frequency. The output load conditions are monitored by the SG-2020 to provide protection for the final amplifier's output transistors by automatically reducing power output when an impedance mismatch is detected.

Despite this protection, the transmitter should never be activated unless an antenna or dummy load is connected to the RF connector located on the rear panel. Use 50 ohm coaxial cable with a proper PL-259 plug to connect the transceiver to the antenna load. If the SWR is too high to permit the desired performance, re-configure your antenna system to include an automatic antenna tuner such as the SG-231 or SG-230 between the transceiver and the antenna.

### 6.0.3 GROUNDING THE RADIO

Under normal conditions the radio does not need to be grounded, especially if a dipole antenna or an external coupler is used. In preference and a general rule never ground the radio on the same ground as the coupler, this will avoid harmful RF to come back to the radio. If grounding of the radio is necessary, proceed as described below:

Any of the four rear panel screws can be use to attach the ground.

1. remove the desired screw.
2. attach RF ground to ring lug (not supplied).
3. Re-install rear panel screw and ring lug.

### 6.0.4 FUSE (INTERNAL)

The SG-2020 has an internal self recovering 5 amp fuse. This fuse is not visible and is mounted under the LPA PCB. The fuse will recover within a few seconds after the short in the radio has been removed.

## 6.1 BASE STATION

The SG-2020 requires a power source of 9 to 18 volts DC, capable of up to 5 or more amperes peak when operating at full transmitter output power. A power supply with an output current rating of 1 or more amperes will be sufficient if the SG-2020 is used in receive mode only. Power supply voltages greater than 18 volts can damage the SG-2020 while voltages of less than 9 Volts may shut the unit down. For base station operation, it is advised that a well filtered linear power supply with an output voltage of 12 to 18 VDC be used for best performance. Avoid using switching supplies as they may generate receiver noise and be less immune to RF environments during transmit.

Before connecting any power supply to the transceiver or AC line, make sure that the supply is properly wired for the local line voltage and that the correct value of fuse is installed.

### **NEVER CONNECT AC OR DC ABOVE 18 VOLTS DIRECTLY TO THE SG-2020**

Make sure that the polarity of the power connections on the rear panel is correct before turning on the transceiver.





## 6.1.1 DESK TOP INSTALLATION

A Flip Front Foot is supplied with the radio.



This foot can be flipped up to raise the front of the radio 3 inches above the desk level. Additional front flip feet can be ordered separately, catalog number 05-43.

## 6.1.2 DESK OR BASE MOUNTING (option 05-42)

To mount the SG-2020 in a secure installation, use the optional mounting plate in the *transverse or longitudinal position* as described below:

- A. Remove 3 screws in the bottom of the chassis.
- B. Line up the mounting plate so the 3 holes match the screw holes in the chassis.
- C. Re-install the 3 pan head screws provided with the plate to secure the radio to the mounting plate.
- D. Secure the radio to a flat surface using four self-tapping wood or sheet metal screws.

## 6.2 MOBILE

### 6.2.1 POWER CONNECTION

(Negative Ground vehicles only)

The DC power cable for mobile installation should be made with AWG #12 stranded copper wire. Please review all power supply considerations throughout this manual and apply all recommenda-



tions as appropriate. The DC cable should be connected directly to the vehicle battery, rather than to the ignition or accessory circuitry. Route the cable as far away from the ignition wiring and other cables as possible. Keep the length of this cable as short as possible to minimize voltage drop losses.

- Do not plug in the DC power cable to the transceiver until the proper connections are made to the battery; by convention, we recommend a RED cable lead to the POSITIVE battery terminal, and a BLACK cable lead to the NEGATIVE battery terminal. Do not rely on the vehicle chassis to provide the DC negative return path. Make sure the battery terminal connections are tight and remember to check them periodically to assure they remain tight and corrosion free.
- Measure the voltage across the battery terminal with the engine running fast enough to show a charge. This voltage cannot exceed 18 Volts DC as that is the maximum allowable DC Voltage for the SG-2020.
- Measure the voltage at the transceiver end of the cable and confirm that the proper voltage and polarity exist for the SG-2020. The center position of the 3 contact connector is POSITIVE while the left contact (facing the rear of the radio) provides the NEGATIVE connection to the radio.
- Insert the DC power cable connector into the mating connector on the rear panel of the SG-2020, connect antenna coax to the ANTENNA connector, and external speaker connection via the 3.5 mm **stereo phone jack** if desired.

## 6.2.2 ANTENNA CONNECTION

Please take a moment to review the base station antenna information in the previous section of this manual. An antenna tuner such as the SG-231 or SG-230 is particularly desirable in a mobile installation as short antennas typical of mobile installations usually provide a hostile load impedance to any HF transceiver. Even if the antenna is resonant near the operating frequency, the bandwidth of such antennas is extremely narrow limiting operating frequency agility.



### **6.2.3 MOBILE MOUNTING OPTIONS**

Velcro mobile mounts (option 05-42) with peel-off adhesive are supplied (to be installed by the operator). When using the velcro mount, we recommend the use of a secure cable, which should be attached between the radio chassis (or mounting plate) and the vehicle for added safety. For a more secure and versatile installation, an optional pedestal mount system is also available from your dealer.

**Note:** SGC assumes no liability for damage or injury which could occur in the event of an accident or collision.

## **7.0 SG-2020 APPLICATIONS**

### **7.1. HAM GEAR VOICE**

The SG-2020 is a multi-purpose ham radio, ideally suited for base, mobile, or portable use. Because of its unique characteristics, it will out perform many of its more expensive competitors in the market place.

Low current consumption, both in receive and transmit allows this equipment to operate when others will not. In addition, it can be operated by simple “D” size drycell batteries. Its transmit characteristics with 20W output and adequate speech compression, allows “on air” performance to be perceived as a 100W transceiver. The simple but effective settings capability from the RF gain, pass band tuning, and audio frequency band width allows the unit to operate efficiently in any severe communication environment. This, combined with low intermodulation of + 18 dbm and the frequency scanning feature, make this low cost transceiver ideal as a base station monitor.

The SG-2020 HF radio is unique as a portable product on the global market, because its outstanding performance, small size, quality, and multi application capability.





## 7.2 HAM GEAR CW

In the development of this product, special attention was given to design a product with excellent CW operation. Two key jacks are provided; one for a straight key (**mono** jack) and the other for an electronic keyer (**stereo** jack). The straight key allows the operator full break in capability, and also the transmitter can be keyed by using a separate foot switch or depressing the push button on the microphone. The second jack is designed for operation with the internal electronic keyer that preconditions the speed of the keying from 5 to 60 words per minute. The software design is highly sophisticated and has been acclaimed by many hard core CW operators. Power adjustment capability is provided from the front panel; from 25 watts to below 1 watt. Accurate adjustment or reading from the indicator is not supported. At 5 watts the reading may be within plus or minus 1 watt and 15 watts it maybe within plus or minus 2 watts. Higher deviation in some instances may be recorded and the operator can set his own table for the particular radio. Combining the proper use of audio level, RF level, passband tuning, audio frequency and bandwidth tuning, the CW operator will enjoy superb CW communications world wide. From a home base station or to the North Pole or the, Amazon jungle, the SG-2020 functions as a remarkable CW portable unit.

## 7.3 HAM AND COMMERCIAL DATA COMMUNICATION

The SG-2020 is well suited for data communication especially if operated with modern DSP data modems such as the SG-7200 or SCS PACTOR. This provides a well balanced combination for efficient data communication. Most DSP data modems have a 12 to 20 dB signal to noise ratio advantage over an analog modem; therefore power output of 1 to 20 watts is more than sufficient to provide reliable world wide communications. Future developments of the SG-2020 will be available with external power and frequency adjustments to allow adjustment of both elements depending on the signal quality.



The SG-2020 will switch between receive and transmit in less than 10 milli seconds and is well suited for this type of data operation.

#### **7.4 MARINE**

The SG-2020 is an ideal marine radio. Since it is not FCC type approved for this operation, it should be used as an auxiliary hobby radio. The low power requirements enable the unit to operate when other equipment on board may not, (i.e. because of a power failure or major accident at sea). In this situation it is perfectly legal to use this radio for emergency transmission. Many marine radio nets exist; the most popular frequency is 14.313 kHz and is run every-day. As an addition to your regular marine electronic equipment, the SG-2020 will give you hours of enjoyment and provide additional safety on your boat. Depending on your cruising area and habits, we recommend you program into the memory channels some popular ship to ship marine frequencies (simplex) and some US Coast Guard high seas frequencies. Appendix A is provided for popular ham net frequencies and marine frequencies.

#### **7.5 AVIATION**

The SG-2020 was also designed for aviation operation. It is not FAA type approved for such use, and should be installed on a voluntary basis only. The SG-2020 fits the standard aviation panel width which is under 6 1/4 inches. The units low power current consumption will allow it to work when the rest of the electronic gear in a small airplane may not. It is the perfect companion radio to be operated in a single or double seated airplane from the jungles of Brazil to Indonesia, and from Alaska to the icy Alps.

We recommended programming the preferred frequencies of the operator for fast retrieval. The unit can also be locked so only these channel frequencies are accessible to the operator. This is a practical way to insure that a casual operator calls on the proper frequency and mode settings.

## 7.6 COMMERCIAL USE

The SG-2020 is a practical radio for commercial applications, because it can be programmed with only a few necessary channels and then locked. The casual or unfamiliar operator can access only these channels through the main tuning knob. Scanning can be easily accessed allowing perfect channel monitoring of only the channels in use. If only 3 frequencies are required for a normal network; we recommend entering the first operating frequency in the first 8 memory channels 1 thru 8, then the second operating frequency in memory channels 9 thru 13, then the third frequency in memory channels 14 thru 20 and locking the unit. Now when; the operator depresses the MEM push button and rotates the main tuning knob then only the 3 preset channels will be accessible. Scanning will automatically cover only these 3 frequencies.

*Note: all memories must be frequency programmed and can not be left empty. Also, the unit is not designed to lock out only a few selective channels.*

## 7.7 POWER AMPLIFIER

The SG-2020 is fully compatible with our SG-500 watt amplifier. Expected power from 3 to 18 MHz is not less than 450 watts and not less than 300 watts on the extreme ends of the HF bands. Only RF is required to control the SG-500. However any suitable linear SSB amplifier can be used with the SG-2020 transceiver.

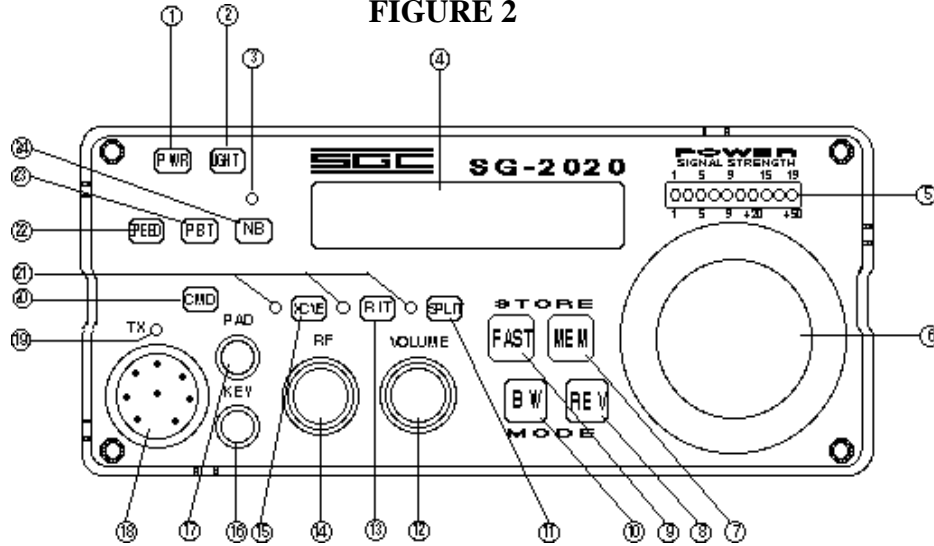
## 7.8 MONITOR BASE STATION

The special receive and scanning characteristics of the SG-2020 combined with its very low cost allows several transceivers to be used to monitor many different frequencies simultaneously. This provides a flexible and versatile base system. One single, expensive HF radio may not provide the same performance, and its power consumption may be restricted in some applications. The SG-2020 is the most suited product for this type of application.





FIGURE 2



KEY	NAME	PRIMARY FUNCTION
1.	PWR	Power On / Off.
2.	LIGHT	Backlight On / Off
3.	LED	Noise Blanker Indicator
4.	LCD	Liquid Crystal Display
5.	BARGRAPH	LED Array Display
6.	SPINNER	Main Tuning Control
7.	MEM	Memory Function
8.	REV	Reverse
9.	FAST	Fast Tuning - adjustable rate .1 kHz, .5 kHz, 1.0 kHz, or 10 KHz per step
10.	"BW"	Bandwidth (SCAF setting function)
11.	SPLIT	Split Frequency Operation
12.	VOLUME	Audio Frequency Gain Control (receiver)
13.	RIT	RIT / XIT (Receiver / Transmitter Incremental Tuning)
14.	RF	Radio Frequency Gain Control (receiver)
15.	"XCVE"	Transmit and Receive on same Frequency (simplex)
16.	KEY	3.5 mm <b>mono phone jack</b> for CW straight KEY
17.	PAD	3.5 mm <b>stereo phone jack</b> for CW paddles
18.	MIC	Microphone Input Plug; 8P circular
19.	LED	Transmit Active Indicator
20.	CMD	Command; used in conjunction with other buttons
21.	LED (3)	"XCVE", RIT or SPLIT operation Indicators
22.	SPEED	Speed of the built in keyer, adjustable from 5 to 60 WPM
23.	"PBT"	Pass Band Tuning (variable IF passband)
24.	NB	Impulse noise blanker

## **8.0 FRONT PANEL** (see figure 2)

The following legend presents the PRIMARY function of each individual control and indicator. Several controls have secondary functions when used in conjunction with the spinner knob or other buttons, as described in the SECONDARY SWITCH FUNCTIONS chapter of this manual.

### **8.1 CONTROLS**

Location of push buttons - (see figure 2)

All four main push buttons: FAST, MEM, BW, REV have been designed and located for convenient one-hand operation. A few users have complained that two hands are required and that the push buttons are too close. Users should become familiar with the use of one hand, using these push buttons and the main tuning knob.

#### **8.1.1 PWR**

The PWR button turns the radio on and off. When turned on the display will first show the serial number followed by SGC (SGC will also be in CW sidetone), and then the DC voltage of the power supply. Finally, the operating frequency will be displayed and the transceiver is then ready for operation.

#### **8.1.2 LIGHT**

Pressing the LIGHT button turns the display backlight on and off. Battery life when operating portable can be extended by turning the backlight off when not needed.

#### **8.1.3 SPEED**

This button controls the speed of the internal keyer when operating in the CW mode. Press and hold the SPEED button. The keyer speed will be displayed in (WPM) words per minute. To adjust the keyer to the desired speed, turn the main tuning knob while the speed button is depressed, and adjust the speed to the desired rate. The range of adjustments in 1 word increments from 5 WPM to 45 WPM, and 5 word increments from 45 through 60 WPM. The speed is retained in the SG-2020's non-volatile memory.

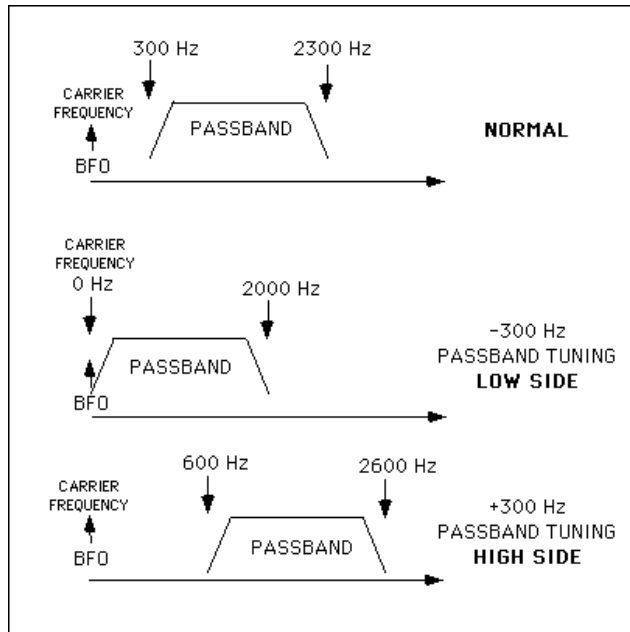




### 8.1.4 "PBT" (Passband Tuning)

The "PBT" button will activate passband tuning. The display will show the passband offset in KHz. Turn the main tuning knob while pressing the "PBT" button to change the passband tuning as desired.

This will shift the IF passband relative to the BFO frequency. The adjustment rate is from -1000 Hz to +300 Hz in 100 Hz steps.



Shown at left is the effect of the passband tuning. Assume the bandwidth is set at 2.0 KHz. For lower sideband, all adjustments are symmetrical in relation to the upper sideband.

#### Note:

**Accurate calibration is not supported in Passband Tuning**

### 8.1.5 NB (Noise Blanker)

This button controls the noise blanker. The LED above the NB button is lit when the blanker is activated. The noise blanker is designed to provide modest blanking of impulse (ignition) type noise without degrading the performance of the receiver. Normally the blanker would remain in the off condition.

### 8.1.6 "XCVE" / RIT / SPLIT

The receiver is general coverage and can be tuned to any frequency between 1.8 MHz and 29.7 MHz. The transmitter will not operate if the frequency is set outside the amateur bands. Inside

the amateur bands it is the operator's responsibility to transmit only on modes and frequencies consistent with his or her class of license and regional recommended band plan.

In the "XCVE" position the SG-2020 receives and transmits on the same frequency.

Press the RIT(Receiver Incremental Tuning) button and the transmit frequency remains fixed while the receive frequency can be varied. Push the REV button while in RIT and the transmit frequency will be displayed and can be tuned while the receive frequency remains fixed. (XIT-Transmitter Incremental Tuning)  
Working Split: (receiving on one frequency while transmitting on a different frequency)

**Example:** The DX station is listening up band by about 5 kHz.

1. Tune in the DX station while in "XCVE".
2. Press SPLIT.
3. Press and hold the REV button while tuning to listen for other stations calling the DX station upband (by about 5 KHz).
4. When you have found the DX station's listening frequency, release the REV button and make your call. You will be transmitting on his listening frequency and listening on his transmitting frequency.
5. Remember to switch off the SPLIT when moving for another QSO.

When changing from RIT to "XCVE" the RIT transmit frequency will become the active frequency.

**Note:** Pressing the SPLIT button also serves to 'lock' the receive frequency.

### 8.1.7 FAST

By pressing the FAST button while turning the main tuning knob, the tuning rate will be set to one of four different values: .1 kHz, .5 kHz, 1.0 kHz, or 10 KHz (see section 9.7). Normal tuning rate is .1 KHz in 10 Hz steps. This feature allows the operator to move to different parts of the band quickly.





### 8.1.8 MEM (Memory)

The SG-2020 has 20 user accessible memories. The unit comes from the factory with the memories preset to a few frequencies in each amateur band for convenience. However, these preselected frequencies may be changed by the operator at any time desired. Press the MEM button and turn the main tuning knob to step from one stored frequency to another. Tune to a new frequency using the FAST button if the new frequency is some distance from the previous one. Press the FAST button and hold while pressing the MEM button. The new frequency is now stored in the current memory.

It is possible to toggle between two frequencies through use of the MEM button. For example, suppose you want to check a net frequency periodically while operating elsewhere on the band. Press the MEM button and the frequency will change to the current memory frequency. Tune to a new frequency. If you press it once more you will return to the last used frequency. Each time you press MEM you will alternate between the current memory and the frequency last used.

The following frequencies have been preset as defaults into the memory locations at the factory:

Memory	Frequency	Memory	Frequency
1	1850 KHz	11	14150 KHz
2	1950 KHz	12	14300 KHz
3	3700 KHz	13	18100 KHz
4	3900 KHz	14	18150 KHz
5	7040 KHz	15	21050 KHz
6	7140 KHz	16	21350 KHz
7	7230 KHz	17	24900 KHz
8	10105 KHz	18	24950 KHz
9	10125 KHz	19	28200 KHz
10	14050 KHz	20	28450 KHz

**Note:** Each memory retains the following parameters: receive frequency, transmit frequency, mode (USB/LSB/CW), XCVE/RIT/SPLIT, bandwidth setting, and transmitter output power. Memories can be retuned to the factory presets by pressing MEM button while turning the power on. Channel numbers are not assigned, and therefore are not displayed.





### **8.1.9 "BW" (Bandwidth)**

Press the "BW" button. The display will show the receiver bandwidth. Turn the main tuning control while pressing the "BW" button to change bandwidth. It is adjustable from 2.7 KHz to 100 Hz in 100 Hz steps.

### **8.1.10 MODE SELECTION ("BW" + REV)**

To display the current operating mode (USB / LSB / CW), press "BW". To select another mode, hold "BW" and momentarily press REV until desired mode appears on the display. Release "BW" to return to frequency display.

### **8.1.11 RF GAIN**

The RF knob controls the RF gain of the receiver. When receiving extremely strong stations, it may be desirable to reduce the receiver's RF gain by adjusting this control in the counter clockwise direction. Normal position for this control is in its maximum or fully clockwise position.

### **8.1.12 VOLUME**

The VOLUME knob controls the AF gain of the receiver. Maximum receive audio is when this control is in its fully clockwise position.

## **9.0 SECONDARY SWITCH FUNCTIONS**

### **9.1 BARGRAPH MODE (CMD + LIGHT)**

When pressing CMD and LIGHT simultaneously, the bargraph display toggles between 'full' bar display and 'peak' bar display.

### **9.2 DC INPUT VOLTMETER (CMD + SPEED)**

When pressing and holding CMD and SPEED simultaneously, but momentarily, the LCD will display DC Input Voltage. The voltage will be displayed until one of the following actions is performed:

- a. move the tuning knob.
- b. Initiate transmit while in CW mode.
- c. depress any of the following keys:



1. any 'CMD' + 'XXX' combination
2. 'SPEED'
3. "PBT"
4. 'MEM'
5. "BW"

### 9.3 Tx OUTPUT POWER LEVEL ADJUST (CMD + NB)

When pressing CMD and NB simultaneously, but momentarily, Tx output power level is adjustable by rotating the main tuning knob. Adjustment levels are made in increments of approximately one watt, from 0 to 20 watts. To return to the frequency display, press MEM. To enter this setting in the last recalled memory, press FAST + MEM. Accurate calibration is not supported.

### 9.4 MEMORY SCAN (CMD + MEM)

To initiate memory scan mode, press CMD and MEM simultaneously, but momentarily. The SG-2020 will begin scanning the 20 memories. To stop memory scan, press any button or transmit.

### 9.5 FREQUENCY SCAN (CMD + "PBT")

To initiate frequency scan mode, first tune to the desired starting frequency using the main tuning control. Pressing CMD and "PBT" simultaneously begins the frequency scan. Blinking LED's will indicate the direction of the scan. To reverse the scan direction, press REV momentarily. To stop frequency scan, rock the tuning knob back and forth.

### 9.6 ADJUST FREQUENCY SCAN VARIABLES (CMD + REV)

The following scan variables may be adjusted by the user by pressing CMD and REV simultaneously but momentarily:

DWELL TIME: 0.1 thru 10 seconds, 0.1 second increments

**Dwell: 'd' is displayed** (Press MEM to enter).

PAUSE on DETECTION: 1 thru 120 seconds, 1 second increment.

**Pause: 'P' is displayed** (Press MEM to enter).

DETECTION THRESHOLD: S1 thru S9, 1 'S' unit increment .

**Threshold: 'S' is displayed** (Press MEM to enter).

AUDIO BLANKING TIME: 0 - 1.28 seconds in 10 ms intervals

**Blanking: 'b' is displayed** (Press MEM to enter).  
FREQUENCY STEP: .1, .5, 1.0, or 2.5 kHz.  
**FREQ Step: 'F' is displayed** (Press MEM to enter).

## **9.7 ADJUST 'FAST' INCREMENTAL VALUE (CMD + FAST)**

While pressing CMD and FAST simultaneously, but momentarily, turn main tuning knob to adjust the incremental value by .1, .5, 1.0, or 10 kHz. To store this value into memory, press MEM.

## **9.8 CALIBRATE FREQUENCY DISPLAY (CMD + "XCVE")**

To calibrate the frequency display, press CMD and "XCVE" simultaneously, but momentarily. All three mode LED's ("XCVE", RIT, SPLIT) will be on. Adjust by turning the main tuning knob. To store this calibration, press MEM.

Note: If the frequency display has been re-calibrated, the default channel memory frequencies will be offset by the same corrected value. If an adjustment has been made, it may be necessary to re-enter the frequency into the 20 memories.

# **10.0 POWER - ON OPTIONS**

## **10.1 "CMD" BUTTON**

Note: Holding the "CMD" button upon power up will cause the LCD to display "C". This has no user function and is for factory use only. The sequence will abort to normal radio operation about a second after the "CMD" button is released.

## **10.2 RESTORE FACTORY MEMORY DEFAULTS (MEM)**

To restore factory memory defaults, hold MEM upon powering up of unit.

## **10.3 BACKLIGHT DEFAULT ON / OFF and LED Test**

Power up the radio while depressing the 'LIGHT' button. Hold it until either 'dl ON' or 'dl OFF' is displayed. Select whether you





want the backlight on or off when the radio is turned on. This is done by using the 'REV' button to toggle between 'dl ON' and 'dl OFF'. Store the choice by depressing the 'MEM' button. Once the 'MEM' button is released, a sequential test is performed on each LED and the backlight. The radio then reverts to normal operation.

#### **10.4 LOCKOUT ("PBT" + RIT)**

To toggle the lockout function on or off, hold "PBT" and RIT simultaneously upon power up. This command locks out all functions except LIGHT, "BW", MEM (select or scan), NB, and DC VOLT METER. 'REV' toggles the choice between 'on' and 'off.' To store this choice into the memory, press MEM.

#### **10.5 CODE REVISION DISPLAY (REV)**

Pressing REV upon power up displays firmware revision.

#### **10.6 MEMORY CHANNEL RECOVERY PROCEDURE**

The following procedure will cure the loss of the 20 memory channels, when the display reads 66 MHz at power up .

- (A) Power up the radio
- (B) Engage "channel scan" mode, by doing the following:
  - (1) depress and hold "CMD" button
  - (2) depress "MEM" button
  - (3) release "MEM" button
  - (4) release "CMD" button

**NOTE:** It may take up to 5 minutes to re-establish the memories, although it is usually accomplished in just a few seconds.

- (C) Exit "channel scan" by depressing any key.

**Warning:** This problem can occur

- A. If power is removed intermittently.
  - B. If battery or low DC voltage exist and transmit is operated
- Please avoid the above conditions.

**NOTE:** For proper and faster recovery please insure the input voltage is higher than 12 volts DC.

## 11.0 BARGRAPH DISPLAY

### 11.1 POWER / S-METER

In receive the bargraph shows relative signal strength in S units. In transmit the output power is also displayed. Hold the “REV” button while transmitting and the reflected power will be displayed. The display returns to forward power indication when the “REV” button is released. Remember, that when operating SSB voice transmission the displayed peak reading on the bargraph will be substantially lower than the actual peak output power being transmitted and does not indicate a transmitter fault.

#### S-METER LEVEL DEFINITIONS

LED	Approximate Level
S1	Always on
S2	.8 $\mu$ v
S5	3 $\mu$ v
S7	12 $\mu$ v
S9	50 $\mu$ v
+10	150 $\mu$ v
+30	500 $\mu$ v
+40	1.5mv
+50	15mv

**NOTE 1:** The above S-Meter levels are approximate, and accurate calibration is not supported.

**NOTE 2:** The power levels in transmit are approximate, and accurate calibration is not supported. The bargraph will also work in the Iambic key mode.





## 12.0 FRONT PANEL CONNECTORS

### 12.1 PAD

Keyer paddles can be plugged into the 3.5 mm **stereo phone jack** to utilize the built in electronic keyer. A 3.5 mm stereo plug is required to make proper connections to the paddles. The shell of the plug is ground, the ring is dash and the tip is dot. The keyer is similar to the Curtis type B format iambic keyer.

### 12.2 KEY

A 3.5 mm **mono phone jack** is provided on the front panel for a straight key. The key sees +5 Volts at a few milli amperes. The SG-2020 is set up for full break-in operation and transmits when the key is closed. A sidetone of 650 Hz is also activated. If the SG-2020 is tuned to a frequency outside the amateur bands, it will not transmit when the key is closed. The shell is ground and the tip is key.

**Note:** *This PAD connector is a stereo jack, use only a 3 contact stereo plug.*



**Note:** *This KEY connector is a mono jack, use only a 2 contact mono plug.*

### 12.3 MICROPHONE

The large circular 8 pin connector on the front panel is provided for the microphone. Wired to this connector is Tx and Rx audio and push to talk. The wiring of this connector is compatible with most Kenwood microphones such as the MC-43.

# 13.0 REAR PANEL CONNECTORS

(see figure 3 below)

## 13.1 ANTENNA (rear panel)

The antenna is connected to the ANTENNA connector. An SO-239 connector is on the transceiver and is intended to be mated with a standard PL-259 coaxial plug connector. The transmitter expects a 50 ohm matched load at the operating frequency. If the load is mismatched, the SWR protection will reduce the output power with minor mismatches or shut the transmitter down with more severe mismatches.

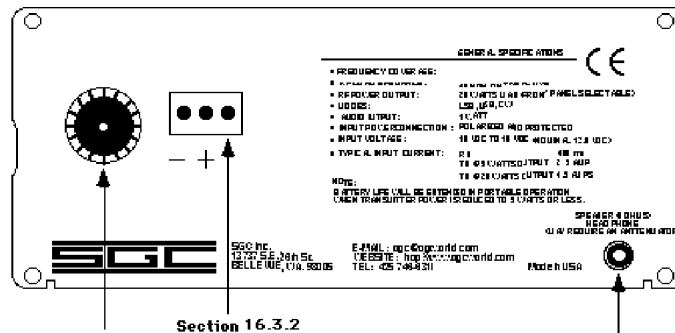
## 13.2 13.6 VDC - + (DC power connection, rear panel)

The power connector uses two contacts. The left contact (facing the rear of the radio) provides the negative connection to the power supply, and the center contact is the POSITIVE connection. The unit requires 9 to 18 VDC at a key down current of 4 amperes with a nominal voltage of 13.6 VDC.

## 13.3 EXTERNAL SPEAKER (rear panel)

The earphone connector is a 3.5 mm stereo jack. Walkman type stereo headphones can be connected directly to the radio, or an external speaker may be connected via this jack. When this connection is used, the internal speaker is automatically disconnected.

FIGURE 3.







## 14.0 CIRCUIT DESCRIPTION

The SG-2020 uses a single conversion up-converting design. The IF is at 60 MHz. Bi-directional circuitry is used in the IF and filter chain.

Selectivity is provided by a 7 pole ladder filter at 60 MHz and variable SCAF digital filters at the baseband.

The synthesizer is a single loop design. The basic synthesizer uses 10 KHz steps with intermediate steps of approximately 10 Hz obtained through direct microprocessor control of the reference.

### 14.1 RECEIVE

An incoming signal is routed through the selected low pass filter. The low pass filters are used on the receive and transmit. Next, lightning and static protection circuitry, a high pass filter to avoid interference from strong broadcast stations and then to the custom high performance double balanced diode ring mixer. The mixer converts the incoming signal up to an IF of 60 MHz.

The synthesizer tunes from 61.8 MHz to 89.7 MHz. This corresponds to signals from 1.8 MHz to 29.7 MHz. The synthesizer uses a Motorola IC and a 19.44 MHz VCXO reference. Particular attention is given to provide the lowest possible phase noise.

The 60 MHz IF signal goes through a strong bipolar amplifier to the 7 pole ladder filter. The noise blanker samples the 60 MHz signal and gates noise pulsed after the first stage of the filter. The crystal filter is set to 2.7 KHz bandwidth and its principle function is to reject the opposite sideband. Overall receiver bandwidth and filter shape factors are established by the digital SCAF filters.

From the crystal filter, the signal is routed through a high gain, low noise IF amplifier. Wide range AGC control is provided and IF clipping avoids overload and distortion.

The product detector is a standard diode ring mixer. The audio chain consists of a preamplifier, the filters and an output amplifier.

Most existing HF transceivers are designed with 2, 3 or 4 IF stages.





Many users believe that just one IF stage (as in the SG-2020) provides inferior performance. Actually, the contrary is true. The less IF stages there are, the less receiver and transmitter spurious frequencies are apparent. Generally, if the design is done right, one IF stage is sufficient. This also provides superior receiver performance. The SG-2020 receiver is equal or better than most transceivers available in the commercial or ham markets.

## 14.2 SSB TRANSMIT

The signal from the microphone is amplified by the VOGAD circuit. The gain is automatically set to the correct value, compensating for different microphones and voices. The audio is applied to a balanced modulator and the resulting RF is limited which provides speech processing. A wide range ALC circuit establishes the output power level and further increases average power. Transmitter linearity is the best in the industry with the special VOGAD system providing signal transmission strength equivalent to much higher 100 watt transmitters.

## 14.3 CW TRANSMIT

When the key is closed, the microprocessor performs all the switching functions with appropriate delays to ensure smooth break-in operation. A voltage is applied to unbalance the balanced modulator and the BFO frequency is shifted 650 Hz to be inside the pass-band. This creates a 60 MHz carrier with the correct frequency offset. From this point the CW and SSB signals follow the same path.

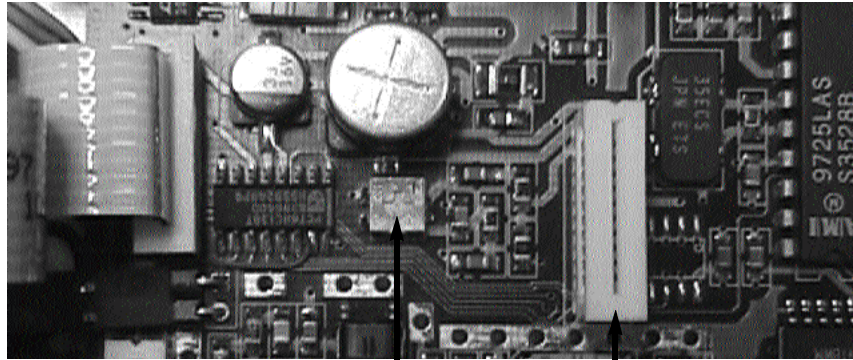
Also operating under microprocessor control are the sidetone and keyer functions.

The IF and mixer are bi-directional, that is, the transmit signal passes through the same stages in the reverse direction as the receive signal. First the balance modulator, the IF amplifier, the crystal filter, a buffer amplifier and the mixer.

The remainder of the transmitter consists of four broadband gain stages building the signal to 20 watts output. A bank of 6 low pass filters eliminates harmonics and an SWR circuit provides signals for the ALC and to the microprocessor for bargraph control.

## 14.4 CW SIDE TONE

The CW side tone level can be adjusted by turning R46 on the exciter printed circuit board. See picture below.



**R46 Flex Cable Removed**

**Note:** The SG-2020 is set to transmit at 650 Hz upper sideband tone. Setting the dial frequency for the same receive and transmit frequency “pressing button RCVE” will transmit a tone frequency of 650 Hz above the carrier frequency (upper sideband).

## 15.0 AM BROADCAST RECEPTION

The SG-2020 is capable of receiving AM broadcast stations and NAVTEX data information from 400 kHz to 1600 kHz. However, calibration of the frequency display is not supported in this range. Differences of up to 3 kHz may be noticed, but this will not affect the receiver’s ability to deliver maximum performance. To receive signals in this frequency range, it is necessary to bypass the SG-2020’s broadcast filter as described below. Strong local AM stations will still be heard if the filter is not bypassed. Bypassing the filter will only be necessary if full receive sensitivity is required. (Note: the filter has an attenuation greater than 30dB in the AM broadcast frequency range.)

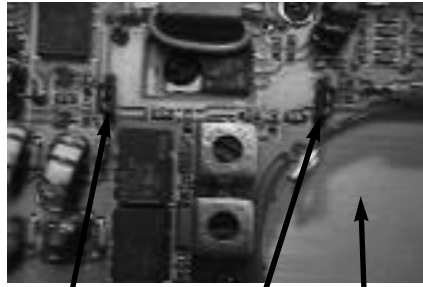
### 15.1 BROADCAST FILTER BYPASS

To enable the SG-2020 to receive signals in the 400 kHz to 1600 kHz range, it is necessary to bypass the broadcast filter located on the LPA board. To disable this filter, locate the two jumpers (J6 & J7) with three pins on the LPA board. Simply move the two





jumpers over to the alternate position; this will bypass the broadcast filter and enable reception.



**J7      J6      Speaker removed**

The broadcast filter is designed to reject any broadcast station that may be in the vicinity of the receiving station using the SG-2020 that could cause interference. In some cases, the rejection may not be sufficient and may be heard in the SG-2020 receiver. Stations using 100 kilowatts within 10 miles may cause excessive interference.

## **15.2 ADJUSTING THE HIGH PASS ELLIPTICAL FILTERS**

Broadcast stations causing excessive interference may be tuned out by adjusting the resonance point of the SG-2020's high pass elliptical filters. Two resonances with rejection better than 50 db are available and can be tuned directly on the interfering station to suppress the unwanted signal.



**L1    L2    Speaker Removed**

L1 of the filter is normally adjusted for a dip at 700 kHz. L2 is normally adjusted for a dip at 1200 kHz (see XMTR PCB ASSY schematics for location). Adjust the coil nearest in frequency to the interfering station until the interference is reduced below the noise level. Tuning will normally go through a dip in audio level.



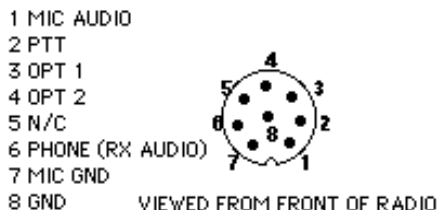
## 16.0 QUICK TOUR OF USER CONNECTORS

There are a total of six 'user accessible' connectors on the SG-2020. Three connectors on the front panel provide connections for microphone, iambic paddle and standard key. The remaining three connectors are located on the rear panel and provide connections for antenna, power and earphones.

### 16.1 FRONT PANEL CONNECTORS

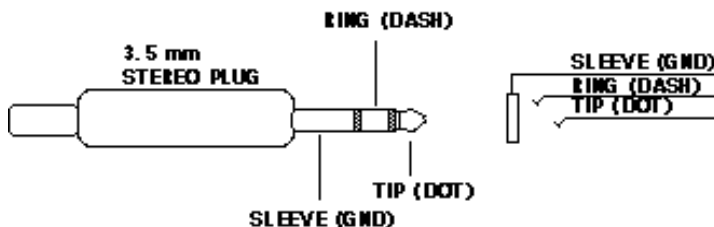
#### 16.1.1 MICROPHONE

This connector is a standard 8 pin microphone connector that is common to all SGC transceivers and others such as the Kenwood MC-43. Wiring connections are shown below.



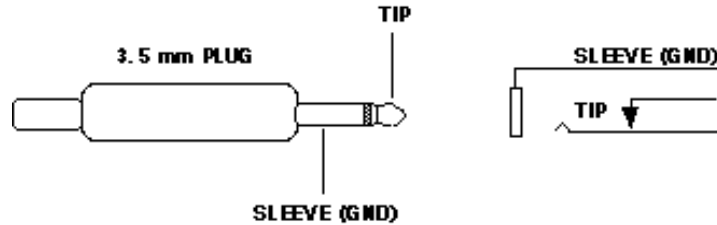
#### 16.1.2 PAD (PADDLE)

A 3.5 mm **stereo jack** is provided for the keyer paddle. The 'tip' connects to the 'dot' paddle and the ring connects to the 'dash' paddle. Wiring connections are shown below.



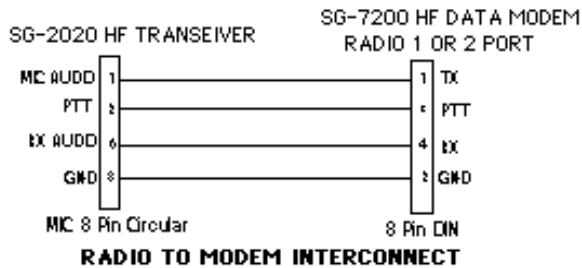
#### 16.1.3 KEY

A 3.5 mm **mono phone jack** is provided for the CW key. The key sees +5 volts at a few milli amperes. The SG-2020 is set up for full break- in operation and transmits when the key is closed. A sidetone of 650 Hz is also activated.



## 16.2 DATA MODE CONNECTION

Below is an example of a data mode inter connection.



## 16.3 REAR PANEL CONNECTORS

There are three connectors on the rear panel of the SG-2020 transceiver.

### 16.3.1 ANTENNA

Unlike most solid state transmitters, the SG-2020 is not readily damaged by a mismatch or high SWR. However, intentional operation under mismatched conditions should be avoided. It is possible that the unit can generate spurious signals under certain extreme mismatched conditions and transmitter performance will be generally compromised when not operating into a nominal 50 ohm load.

The antenna connection is made via a standard PL-259 type coaxial connector.

### 16.3.2 13.6 VDC - + (DC power connection, rear panel)

The SG-2020 requires a source of 12V DC capable of supplying sufficient current for the mode and power levels of operation. A well filtered power supply of 5 amperes capacity is recommended





## **17.0 ALIGNMENT/TEST PROCEDURES**

### **17.1. PHASE LOCK LOOP ERROR VOLTAGE**

#### Required Test Equipment

- a) Digital Volt Meter

#### Procedure

Connect the DVM to the PLL error voltage test point (TP3) on the Exciter PCB and Gnd. Tune the SG-2020 to 29.7 MHz and verify the voltage is less than 16 V. If the voltage is greater than 16 V when tuned to 29.7 MHz adjust spacing between windings of L18. Tune to 1.8 MHz and verify the voltage is greater than 3 V .

### **17.2 ALIGN RECEIVE IF TRANSFORMERS**

#### Required Test Equipment

- a) Digital Volt Meter
- b) HP8640 RF signal generator or equivalent

#### Procedure

Tune to 14.2 MHz and connect the DVM to the AGC test point (TP13) and Gnd on the Exciter PCB. Set the signal generator to the receive frequency and adjust the output level of the generator, so the AGC is approximately 5 volts. Adjust T3 and T4 for maximum AGC voltage, reducing the output level of the signal generator as necessary to keep the voltage near 5 volts.

### **17.3 RECEIVER AGC TEST**

#### Required Test Equipment

- a) Digital Volt Meter
- b) HP8640 RF signal generator or equivalent
- c) Frequency Counter

#### Procedure

Set RF and VOLUME controls to maximum fully CW. Adjust RF generator to 14.2 MHz. Set bandwidth to 2.7 USB and tune radio to 14.2 MHz and adjust tuning for 1 KHz at the speaker output. Speaker output levels should be as follows:





<u>RF Input level</u>	<u>AF output level</u>
.3 $\mu$ V	>200 mV RMS
3 $\mu$ V	> 2 V RMS
30 $\mu$ V	> 2 V RMS
3 mV	>2.25 V RMS
3 V	> 2.25 V RMS

## 17.4 SET TRANSMITTER BIAS

### Required Test Equipment

- Digital Volt Meter
- RF Power Meter
- Dummy Load

### Procedure

Tune the SG-2020 to 14.2 MHz.  
Connect the power meter and dummy load to the SG-2020.  
Connect the DVM to TP1 & TP2 on the LPA PCB.  
Ensure the Mode is not CW.  
With no signal connected to the mic. input activate the PTT line.  
Use milli volt scale on DVM.  
Adjust R7 on the LPA for 7 mV .

## 17.5 SWR NULL

### Required Test Equipment

- Digital Volt Meter
- Audio signal generator
- RF Power Meter
- Dummy Load

### Procedure

Tune to 14.2 MHz  
Connect the power meter and dummy load to the SG-2020.  
Connect the audio generator to the mic. input.  
Connect the DVM between TP5 on the LPA PCB (DVM set on mV scale) and Gnd.

Set the radio for 20 Watts output. Set the audio generator to 1000 Hz at a level of approximately 20 milli volts. Activate the PTT and verify 20 Watts output on the power meter.



Adjust C56 on the LPA for minimum reverse swr detector voltage (typically 3 mV).

## 17.6 FREQUENCY CALIBRATION

Is factory set only.

**Note:** Any adjustments made to the SG-2020, besides R46 CW sidetone are NOT covered by the warranty.

## 17.7 NOMINAL OUTPUT POWER TEST

Set output capability of the transceiver by setting the output level to "20". Set generator to 1300 Hz 20 mV AF input to the microphone connector; measured output power level should be:

1.8 - 25 MHz	20 watts $\pm$ 3 watts
above 25 MHz	14 watts minimum

## 17.8 STRESS POWER (MAXIMUM OUTPUT POWER)

Set maximum output capability of the transceiver by setting the output level to "M" for maximum. With 20 mV AF input at the microphone connector output power level should be:

<u>Frequency</u>	<u>Power Range</u>
<u>1.8 MHz</u>	<u>23 to 27 watts</u>
<u>3.7 MHz</u>	<u>23 to 35 watts</u>
<u>7 MHz</u>	<u>30 to 40 watts</u>
<u>14 MHz</u>	<u>35 to 45 watts</u>
<u>18 MHz</u>	<u>30 to 42 watts</u>
<u>29 MHz</u>	<u>14 to 23 watts</u>

The above readings are for reference and orientation only and may change without notice.

**ATTENTION:** The above stress power test should *not* be extended more than ten seconds.

*This test is not covered under warranty.*

## 17.9 OPENING THE SG-2020

Should it become necessary to open the unit for modification or inspection, please note the following instructions and comments:

1. Remove the three screws on the bottom of the chassis
2. Push the back panel gently toward the front through the case
3. **CAUTION:** Please note that the speaker is pressed toward the outer case with foam padding. Handle with care when removing the chassis from its case.
4. To reassemble, push gently down on the speaker and push the chassis back slowly. When the chassis back in position, install the three screws.

## 18.0 EXCITER VOLTAGE MEASUREMENTS

**Note:** All listings are for temporary reference only, and are subject to change.

Measurements taken with a FLUKE 77 multimeter.

In Receive mode only. No signal applied.

PART	V DC	PART	V DC	PART	V DC
U6P1	1.4	U2P13	5.0	U8P1	0
U6P2	0.8	U2P14	5.0	U8P2	0
U6P3	0	U26P1	12.0	U8P3	0
U6P4	5.7	U26P2	0	U8P4	0
U6P5	12	U26P3	10.0	U8P5	5.0
U3P1	5	U1P1	0.6	U8P6	5.0
U3P2	0	U1P2	0.6	U8P7	0
U3P3	0	U1P3	0.6	U8P8	0
U3P6	0	U1P4	0	U8P9	0
U3P7	0	U1P5	0	U8P10	10.0
U3P8	11.8	U1P6	10.0	U8P11	0.6
U2P1	5	U1P7	5.0	U8P12	10.0
U2P2	0	U1P8	5.0	U8P13	0.6
U2P3	5.0	U1P9	5.0	U8P14	0.6
U2P4	5.0	U1P10	5.0	U8P15	0.6
U2P5	5.0	U1P11	5.0	U8P16	0.6
U2P6	5.0	U1P12	5.0	U8P17	10.0
U2P7	5.0	U1P13	4.2	U8P18	10.0
U2P8	X	U1P14	4.0	Q12P1	4.1
U2P9	5.0	U1P15	5.0	Q12P2	3.5
U2P10	X	U1P16	10.0	Q12P3	4.9
U2P11	5	U1P17	10.0	Q11P1	5.0
U2P12	0	U1P18	0.6	Q11P2	5.0





## 18.0 EXCITER VOLTAGE MEASUREMENTS-RECEIVE (cont.)

PART	V DC	PART	V DC	PART	V DC
Q11P3	0	U10P4	2.9	Q33P1	3.3
U5P1	10.0	U10P5	4.3	Q33P2	5.3
U5P2	0	U10P6	2.9	Q33P3	0
U5P3	0	U10P7	0	U20P1	17.6
U5P4	10.0	U10P8	9.0	U20P2	2.5
U5P5	2.7	Q23P1	0.2	U20P3	2.5
U5P6	2.7	Q23P2	0	U20P4	0
U5P7	9.7	Q23P3	0.2	U20P5	0
U5P8	10.0	U9P1	9.0	U20P6	8.0
U5P9	0	U9P2	9.0	U20P7	18.0
U5P10	0	U9P3	0	U20P8	17.6
U5P11	0	U9P4	2.9	U14P1	0
U5P12	5.0	U9P5	4.2	U14P2	5.0
U5P13	5.0	U9P6	2.9	U14P3	0
U5P14	5.0	U9P7	0	U14P4	0.09
Q17P1	5.0	U9P8	9.0	U14P5	0.2
Q17P2	5.0	Q22P1	2.4	U14P6	0
Q17P3	0	Q22P2	1.7	U14P7	4.9
Q10P1	5.0	Q22P3	9.0	U14P8	10.0
Q10P2	5.0	Q19P1	0.7	U18P1	2.2
Q10P3	0	Q19P2	0	U18P2	2.3
Q9P1	10.0	Q19P3	0	U18P3	0
Q9P2	10.0	Q25P1	0.06	U18P4	2.4
Q9P3	0	Q25P2	1.6-2.5	U18P5	0
Q7P1	0	Q25P3	0.2	U18P6	5.0
Q7P2	0.2	U13P1	10.0	U18P7	0
Q7P3	0.2	U13P2	10.0	U18P8	0
Q8P1	0	U13P3	0	U18P9	0
Q8P2	0.2	U13P4	3.3	U18P10	0
Q8P3	0	U13P5	4.9	U18P11	0
Q6P1	9.25	U13P6	3.3	U18P12	0
Q6P2	0	U13P7	0	U18P13	2.5
Q6P3	10.0	U13P8	10.0	U18P14	5.0
Q5P1	9.25	Q31P1	9.4	U18P15	5.0
Q5P2	10.0	Q31P2	10.0	U18P16	5.0
Q5P3	10.0	Q31P3	4.5	U15P1	3.0
Q4P1	10.0	Q34P1	0.7	U15P2	0
Q4P2	10.0	Q34P2	0	U15P3	2.4
Q4P3	0.2	Q34P3	8.4	U15P4	5.0
U10P1	9.0	Q36P1	1.8	U16P1	0
U10P2	9.0	Q36P2	10.0	U16P2	0
U10P3	0	Q36P3	0	U16P3	5.0

**18.0 EXCITER VOLTAGE MEASUREMENTS-RECEIVE (cont.)**

<b>PART</b>	<b>V DC</b>	<b>PART</b>	<b>V DC</b>	<b>PART</b>	<b>V DC</b>
U16P4	5.0	U4P2	0	U7P6	10.0
U16P5	0	U4P3	0	U7P7	0
U16P6	2.0	U4P6	0	U7P8	0
U16P7	2.7	U4P7	0	U7P9	0
U16P8	5.0	U4P8	10.0	U7P10	0
U23P1	0	U17P1	5	U7P11	0
U23P2	0	U17P2	0	U7P12	0
U23P3	5.0	U17P3	0	U7P13	0.2
U23P4	5.0	U17P6	0	U7P14	10.0
U23P5	0	U17P7	0	Q13P1	5.0
U23P6	2.0	U17P8	10.0	Q13P2	5.0
U23P7	2.7	U21P1	5	Q13P3	4.5
U23P8	5.0	U21P2	0	Q15P1	2.8
Q35P1	2.6	U21P3	0	Q15P2	9.0
Q35P2	2.2	U21P6	0	Q15P3	0
Q35P3	10.0	U21P7	0	Q16P1	9.0
Q32P1	2.2	U21P8	10.0	Q16P2	9.7
Q32P2	2.2	U24P1	5	Q16P3	2.8
Q32P3	10.0	U24P2	0	Q14P1	10.0
U25P1	5.0	U24P3	0	Q14P2	10.0
U25P2	5.0	U24P6	0	Q14P3	0
U25P3	5.0	U24P7	0	Q41P3	9.7
U25P4	0	U24P8	10.0	Q27P1	10.0
U25P5	0	U19P1	8.0	Q27P2	10.0
U25P6	5.0	U19P2	0	Q27P3	0
U25P7	0	U19P3	0	Q28P1	0
U25P8	0	U19P6	0	Q28P2	0
U25P9	5.0	U19P7	0	Q28P3	10.0
U25P10	5.0	U19P8	10.0	Q29P1	0.6
U25P11	5.0	U16P1	0	Q29P2	0
U25P12	5.0	U16P2	5.0	Q29P3	0
U25P13	5.0	U16P3	5.0	Q30P1	9.4
U25P14	5.0	U16P4	5.0	Q30P2	10.0
U25P15	5.0	U16P5	0	Q20P3	0.2
U25P16	5.0	U16P6	2.0	Q26P1	.05
Q38P1	0.7	U16P7	3.0	Q26P2	0
Q38P2	0	U16P8	5.0	Q26P3	0.2
Q38P3	0	U7P1	10.0	Q18P1	0
Q37P1	0.7	U7P2	0	Q18P2	0
Q37P2	0	U7P3	0	Q18P3	10.0
Q37P3	0	U7P4	0		
U4P1	5	U7P5	0		





**EXCITER PCB SIGNAL INJECTION POINTS FOR RECEIVE TROUBLE SHOOTING**

SEE NOTES 1, 2, 3 & 4 BEFORE MAKING ANY OF THESE MEASUREMENTS

	AF SECIICN			IF SECIICN			RF SECIICN				
Signal	1 k Hz AF			60 MHz RF			14.2 MHz RF				
Test Point	1R	2R	3R	4R	5R	6R	7R	8R	9R	10R	11R
Measurement	29 mV	35 mV	7 mV	11 mV	1 mV	15 uV	25 uV	15 uV	3.5 uV	1 uV	1 uV

Note (5,6)

Note (5)

Note (5)

**EXCITER PCB SIGNAL TEST POINTS**

Signal	LC	BFC(USB)	BFC(USB)	AGC
Test Point	TP10	TP6	SPEAKER	TP 10
Measurement	275 mV p/p	1.4 V p/p	1.4 V p/p	3.3 V
				6.84 V

Note (5,7)

Note (5,7)

**Note: Any adjustments made to the SG-2020, besides R46 CW sidetone are NOT covered by the warranty.**

1. all measurements for 1 volt RMS at speaker terminal unless otherwise noted, radio tuned to 14.2 MHz
2. signal injected thru a 1 uF tantalum cap. for test point 1R - 11R measurements
3. set volume & rf controls fully clockwise
4. test points 1 - 11 R are marked on the exciter schematic
5. peak signal generator frequency for max. output at speaker terminal
6. peak T3 & T4 for max. output at speaker terminal
7. 14.2 MHz @ 10 m V applied to antenna input

## EXCITER PCB SIGNAL TRACING POINTS FOR TRANSMIT TROUBLE SHOOTING

SEE NOTES 1, 2 & 3 BEFORE MAKING ANY OF THESE MEASUREMENTS

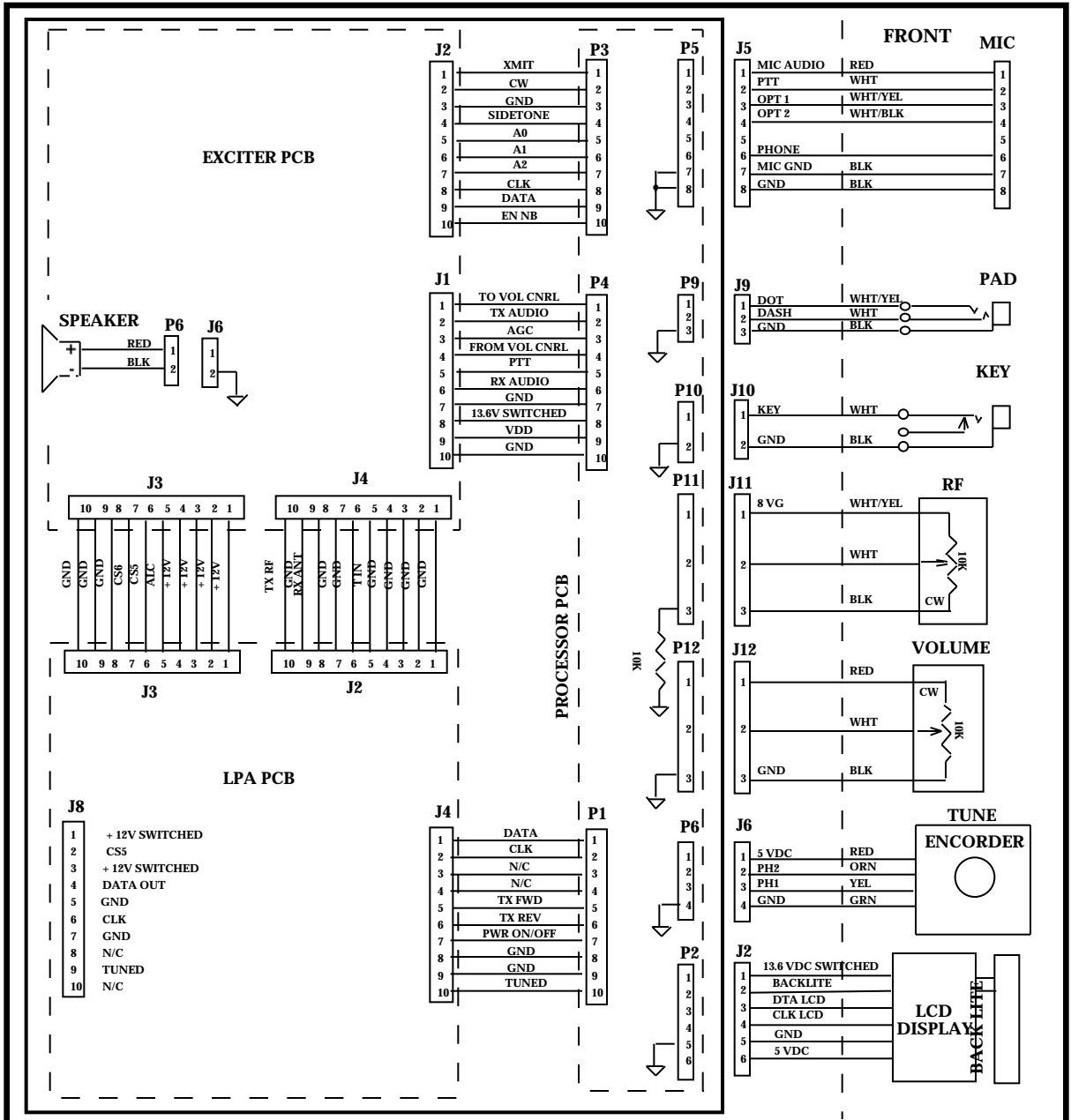
	AF SECTION			IF SECTION					RF SECTION		
	1T	2T	3T	4T	5T	6T	7T	8T	9T	10T	11T
Test Point											
Measurement	4 mV	200 mV	50 mV	25 mV	60 mV	10 mV	25 mV	20 mV	350 uV		5 V

Max. output	
11T	AF Gen. Output
8 V	20 mV

**Note: Any adjustments made to the SG-2020, besides R46 CW sidetone are NOT covered by the warranty.**

1. adjust AF Sig. Gen. output for 5 V P/P at exciter output (11T) into a 50 ohm resistor
2. set volume & rf controls fully clockwise; tune radio to 14.2 MHz
3. test points 1 - 11 T are marked on the exciter schematic





CONTRACT NO. :	
DRAFTING:	11-30-98
ENGINEERING:	
PRODUCTION:	
APPROVAL:	
PROCUREMENT:	

**SGC** SGC Inc.  
13737 S. E. 26TH ST.  
BELLEVUE, WA 98005

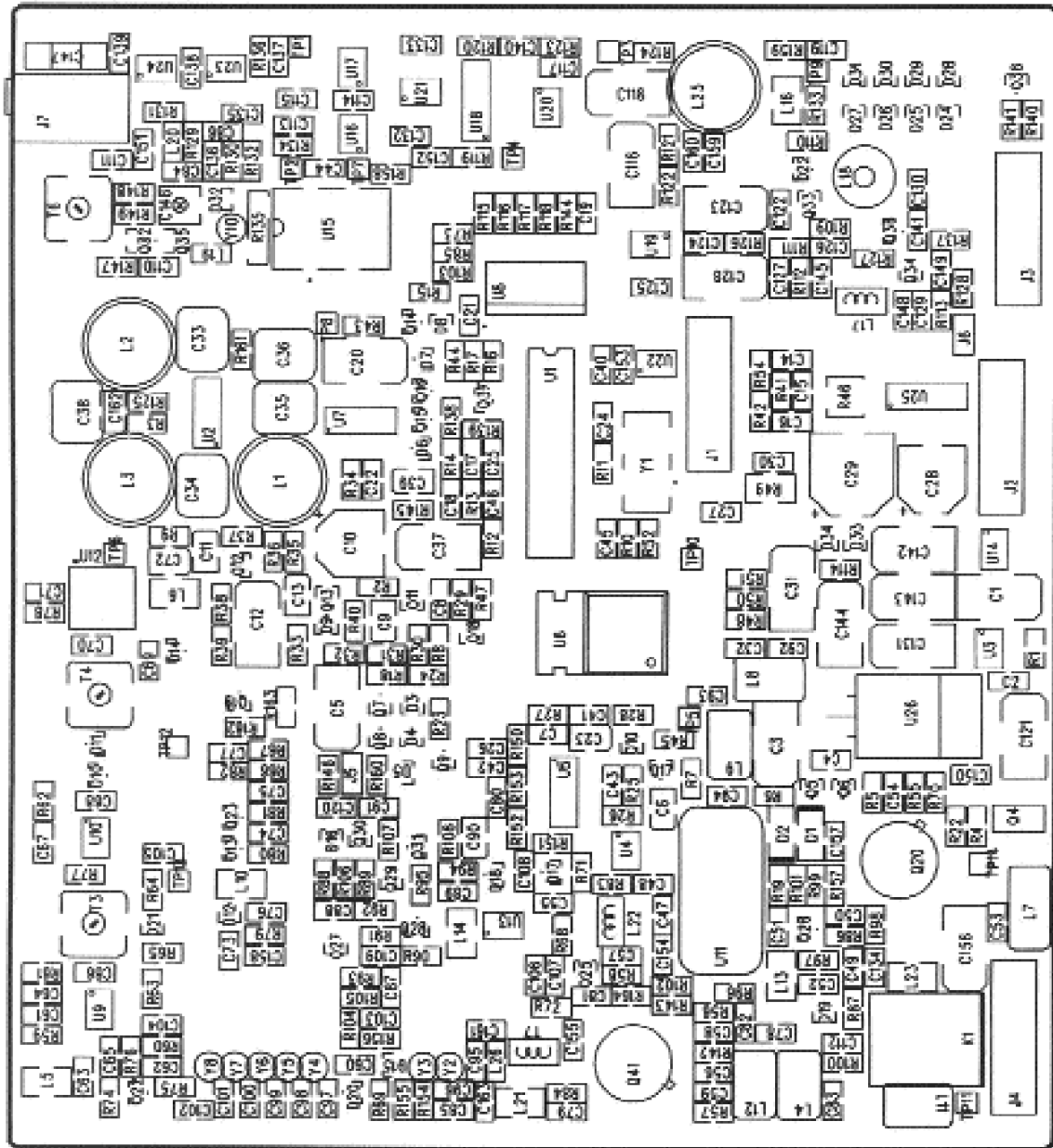
**INTERCONNECT  
SG-200**

DATE	REV	DESCRIPTION	AUTH
12/98	A	ORIGINAL DWG	RT

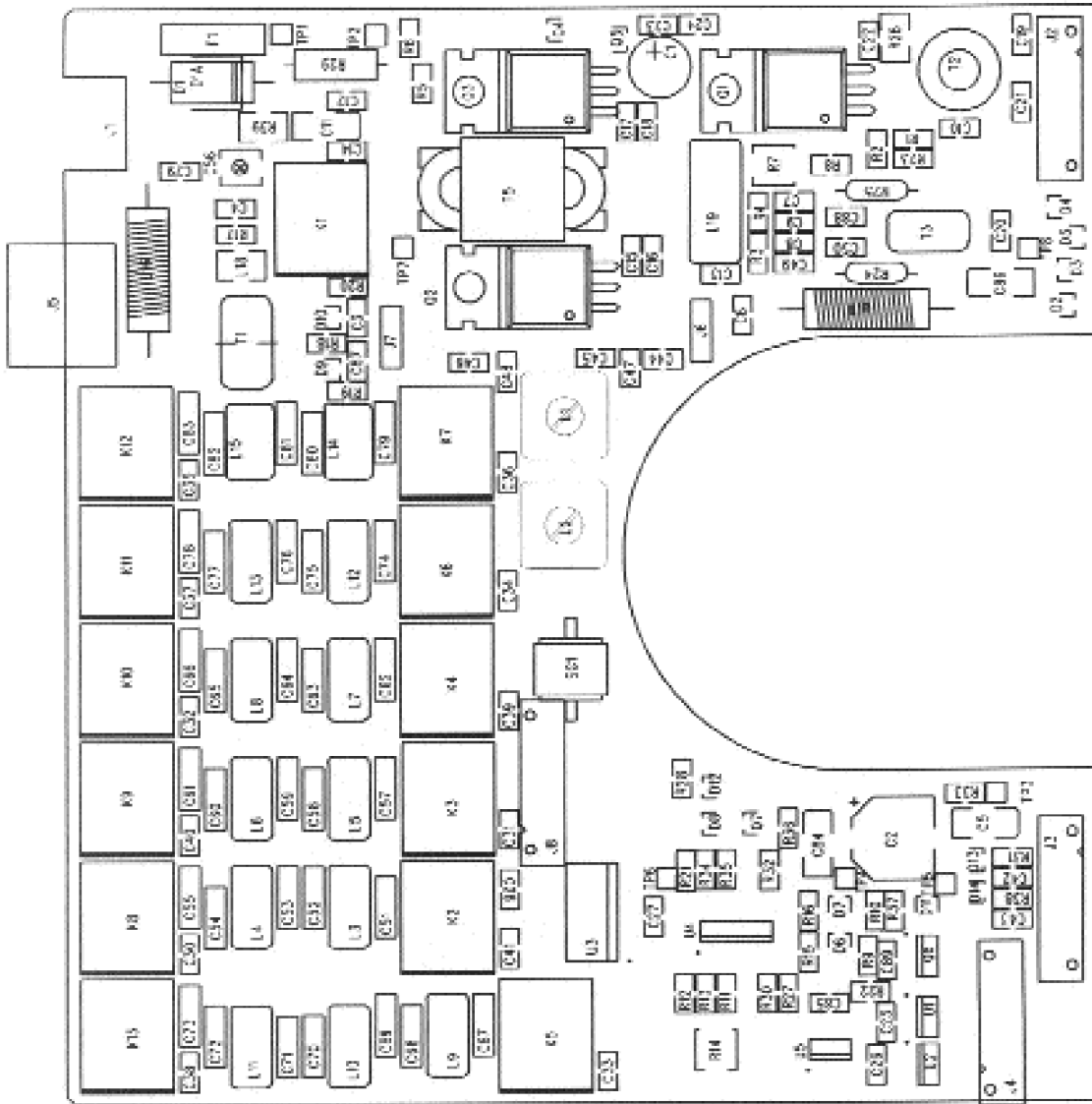
SIZE	DWG. NO.	REV.
<b>A</b>	<b>N4010200</b>	<b>B</b>
SCALE:	SHEET 1 OF 1	



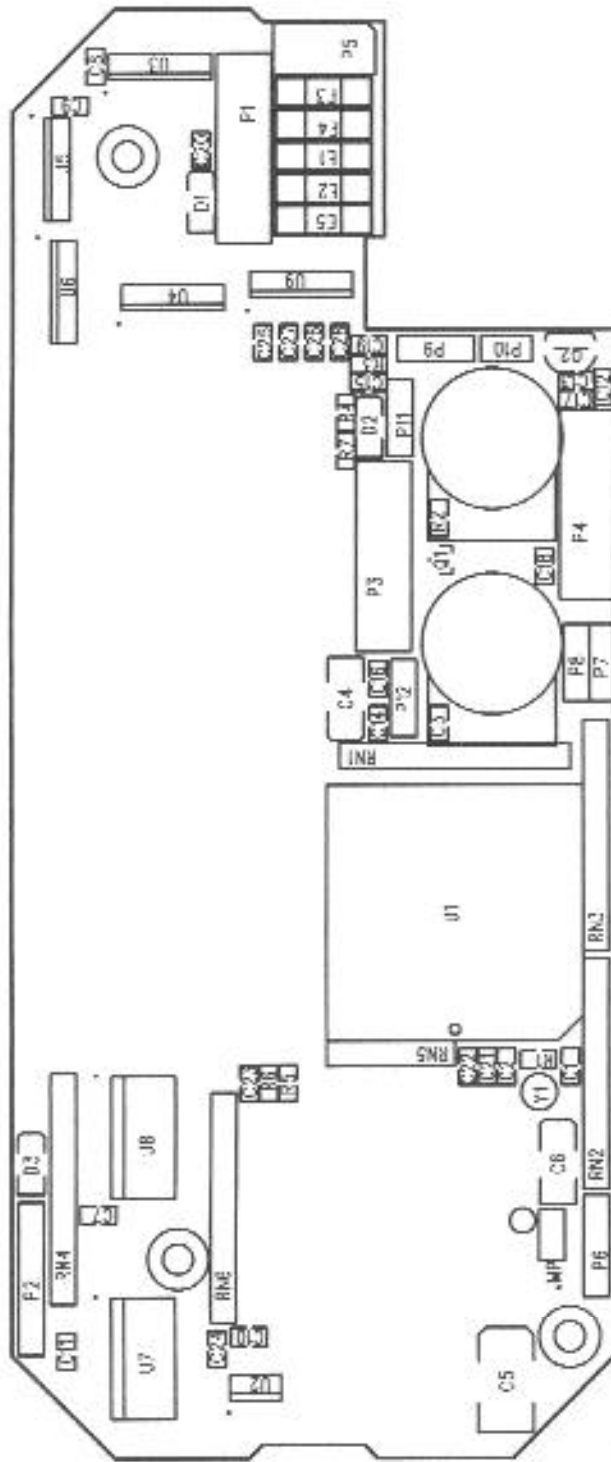
# 19.0 PCB LAYOUT AND SCHEMATICS



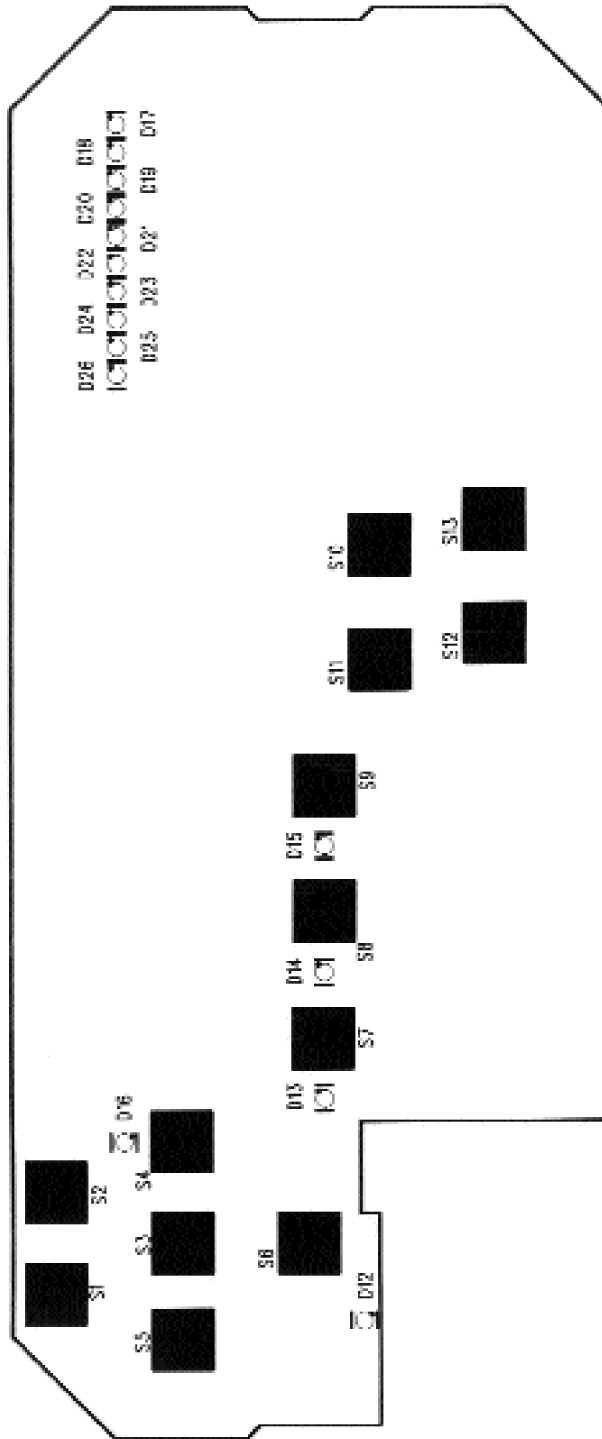
**COMPONENT LAYOUT EXCITER**



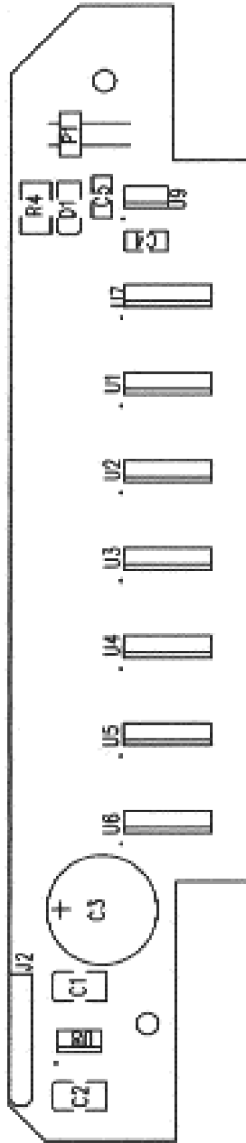
## **COMPONENT LAYOUT LPA**



**COMPONENT LAYOUT PROCESSOR REAR**

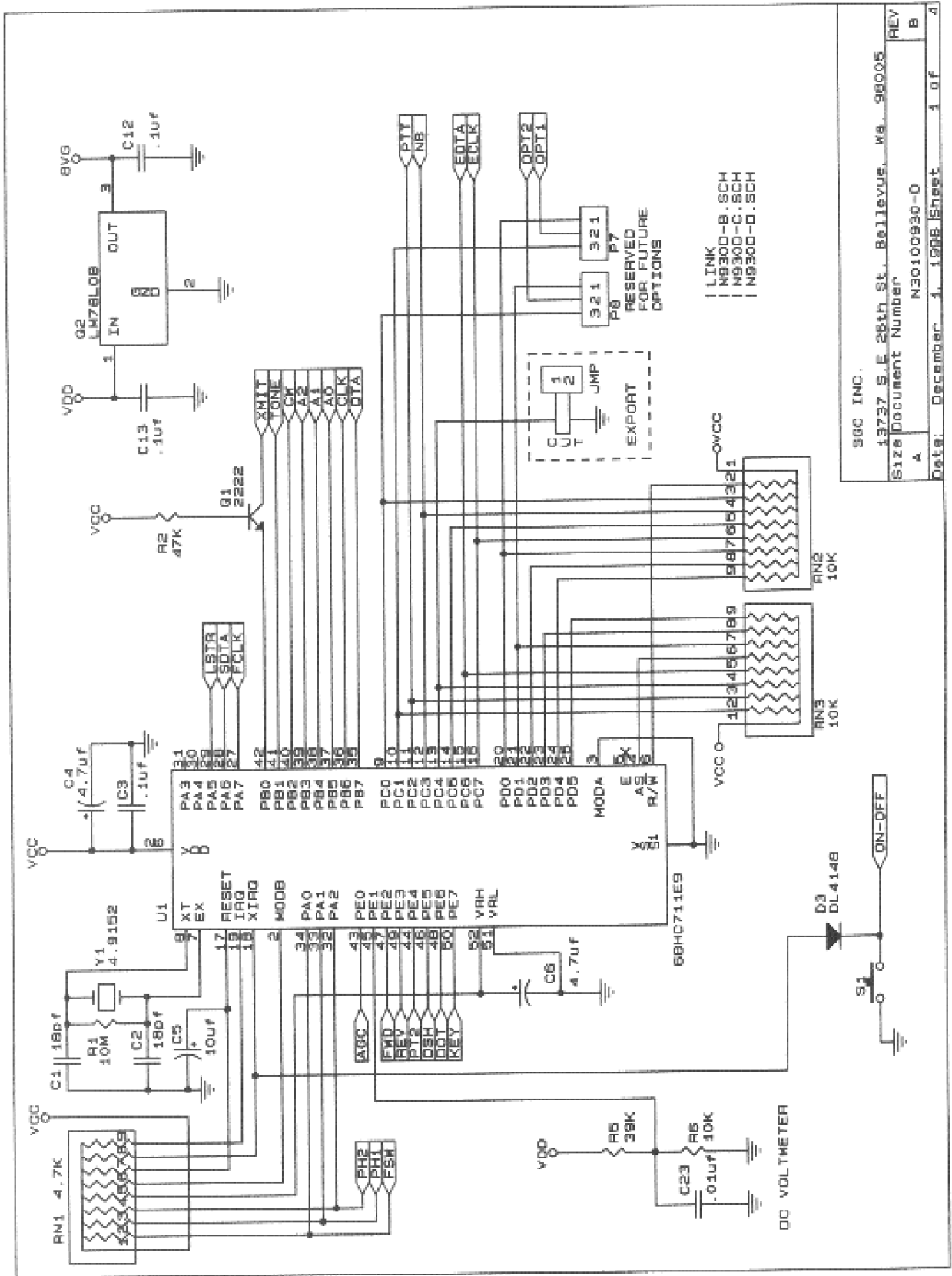


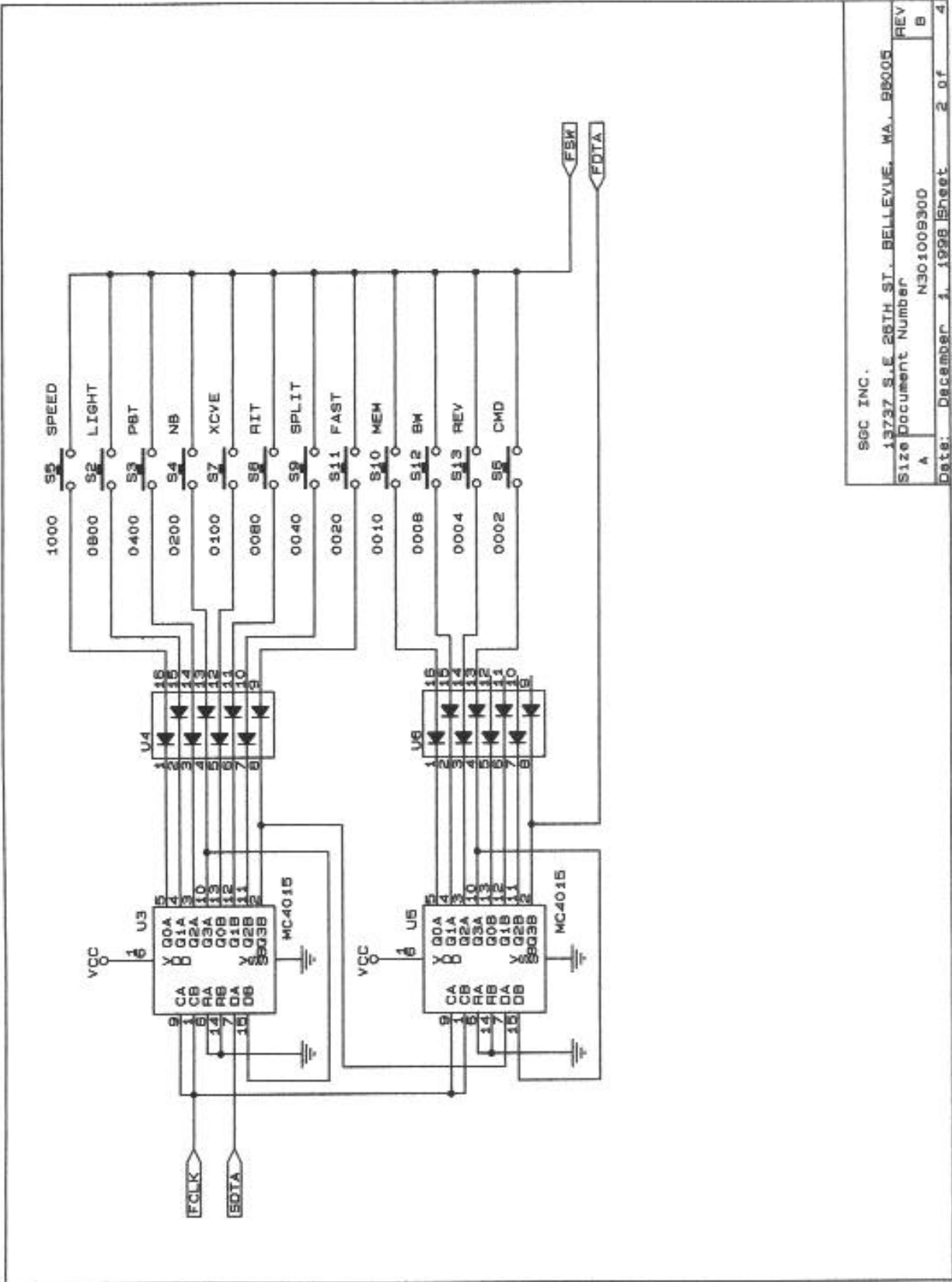
**COMPONENT LAYOUT PROCESSOR FRONT**



**COMPONENT LAYOUT DISPLAY**

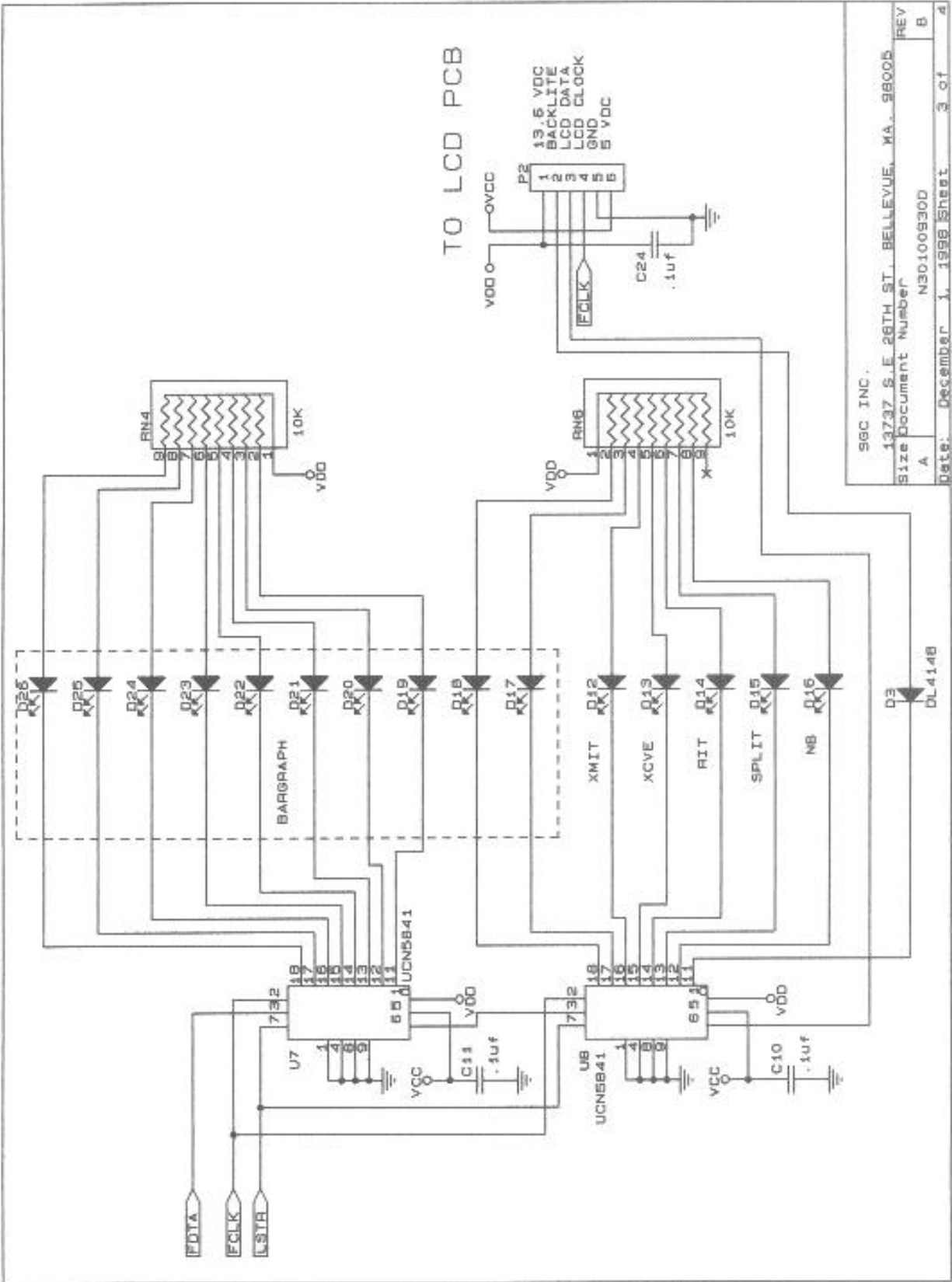
PROCESSOR PCB SCHEMATIC 1 OF 4





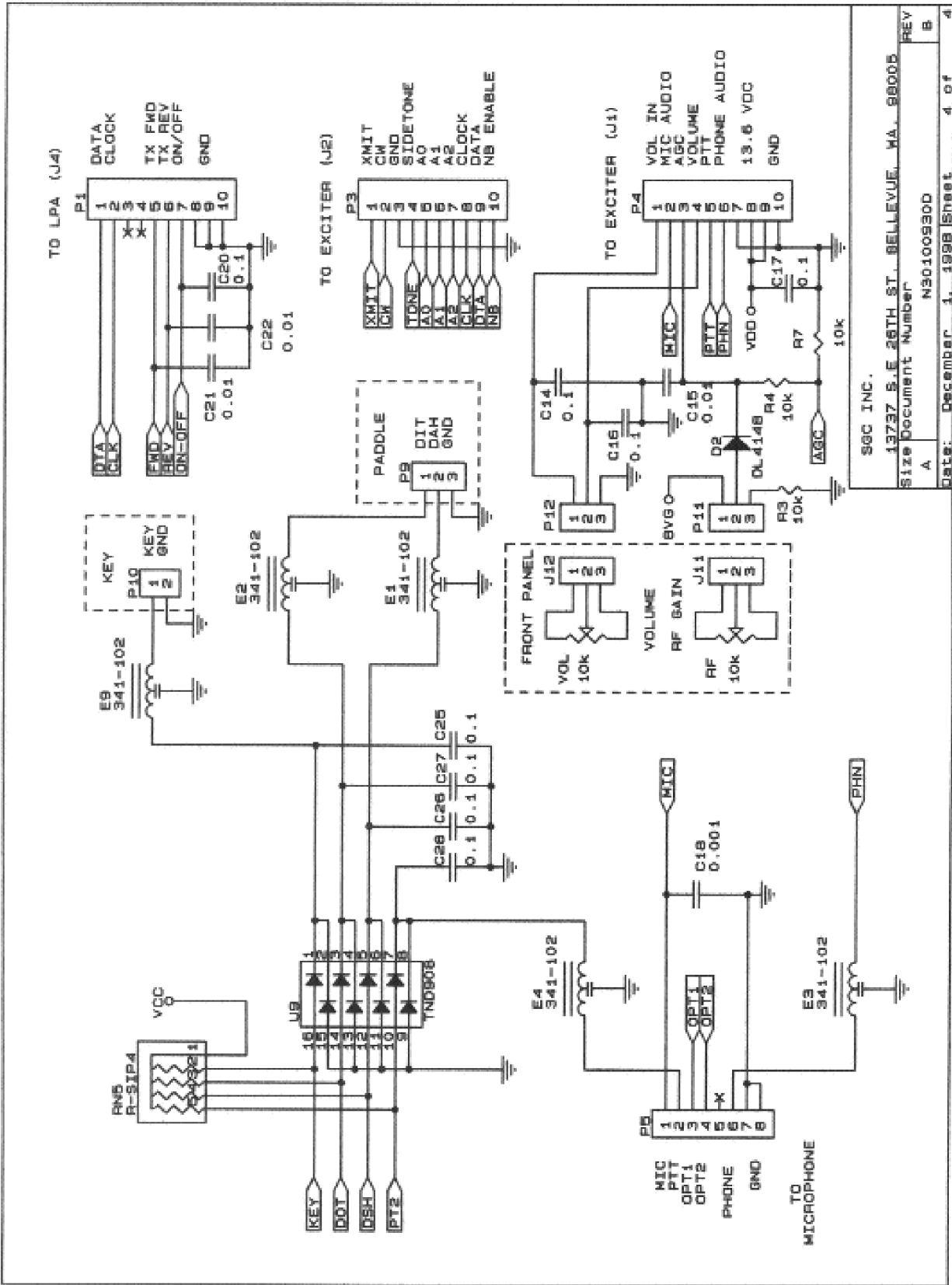
SGC INC.  
 13737 S.E. 26TH ST., BELLEVUE, WA, 98005  
 Size Document Number: N301009300  
 A  
 Date: December 1, 1998 Sheet 2 of 4

PROCESSOR PCB SCHEMATIC 3 OF 4



SGC INC.  
 13737 S.E. 26TH ST., BELLEVUE, WA, 98005  
 Size Document Number A N301009300  
 Date: December 1, 1998 Sheet 3 of 4



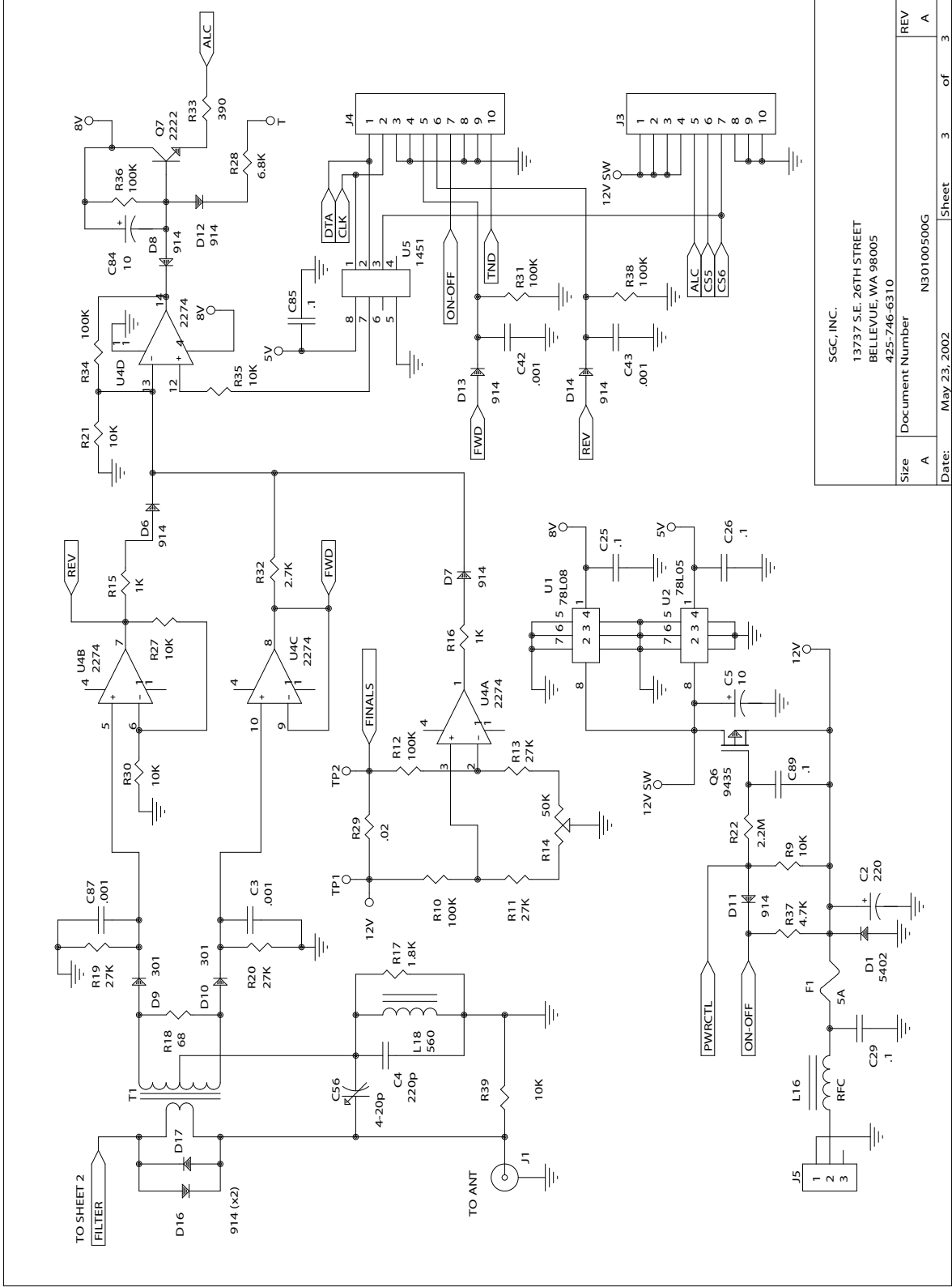


SGC INC.  
 13737 S.E. 26TH ST., BELLEVUE, WA. 98005  
 Size Document Number  
 A N301009300  
 Date: December 1, 1998 Sheet 4 of 4

**PROCESSOR PCB SCHEMATIC 4 OF 4**





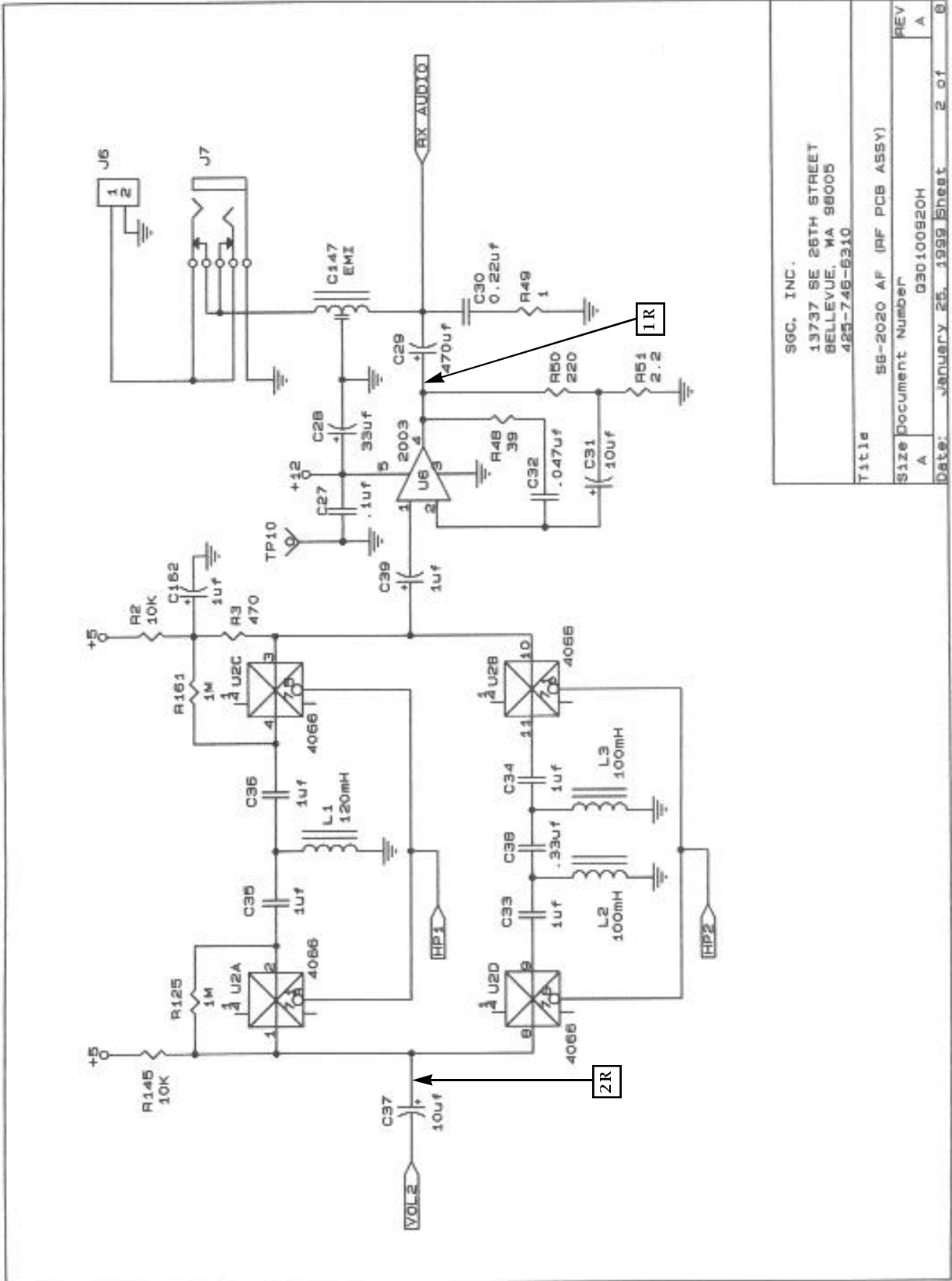


SGC, INC.  
 13737 S.E. 26TH STREET  
 BELLEVUE, WA 98005  
 425-746-6310

Size	A	Document Number	N30100500G
Date:	May 23, 2002	Sheet	3 of 3
REV	A		

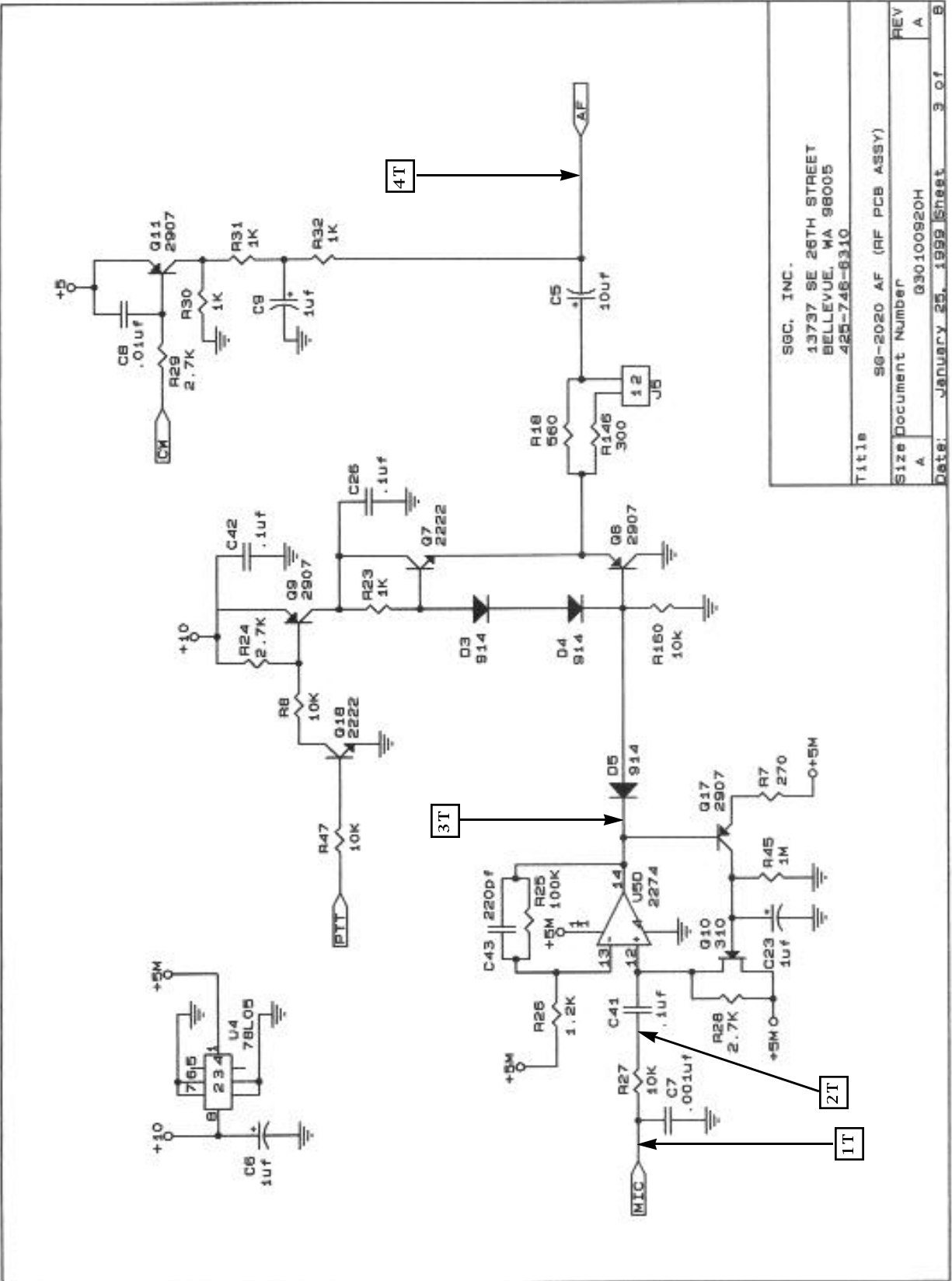


EXCITER PCB SCHEMATIC 2 OF 8



SGC, INC.  
 13737 SE 26TH STREET  
 BELLEVUE, WA 98005  
 425-746-6310

Title: 56-2020 AF (RF PCB ASSY)  
 Size: Document Number: 030100920H  
 A  
 Date: January 25, 1999 Sheet 2 of 8



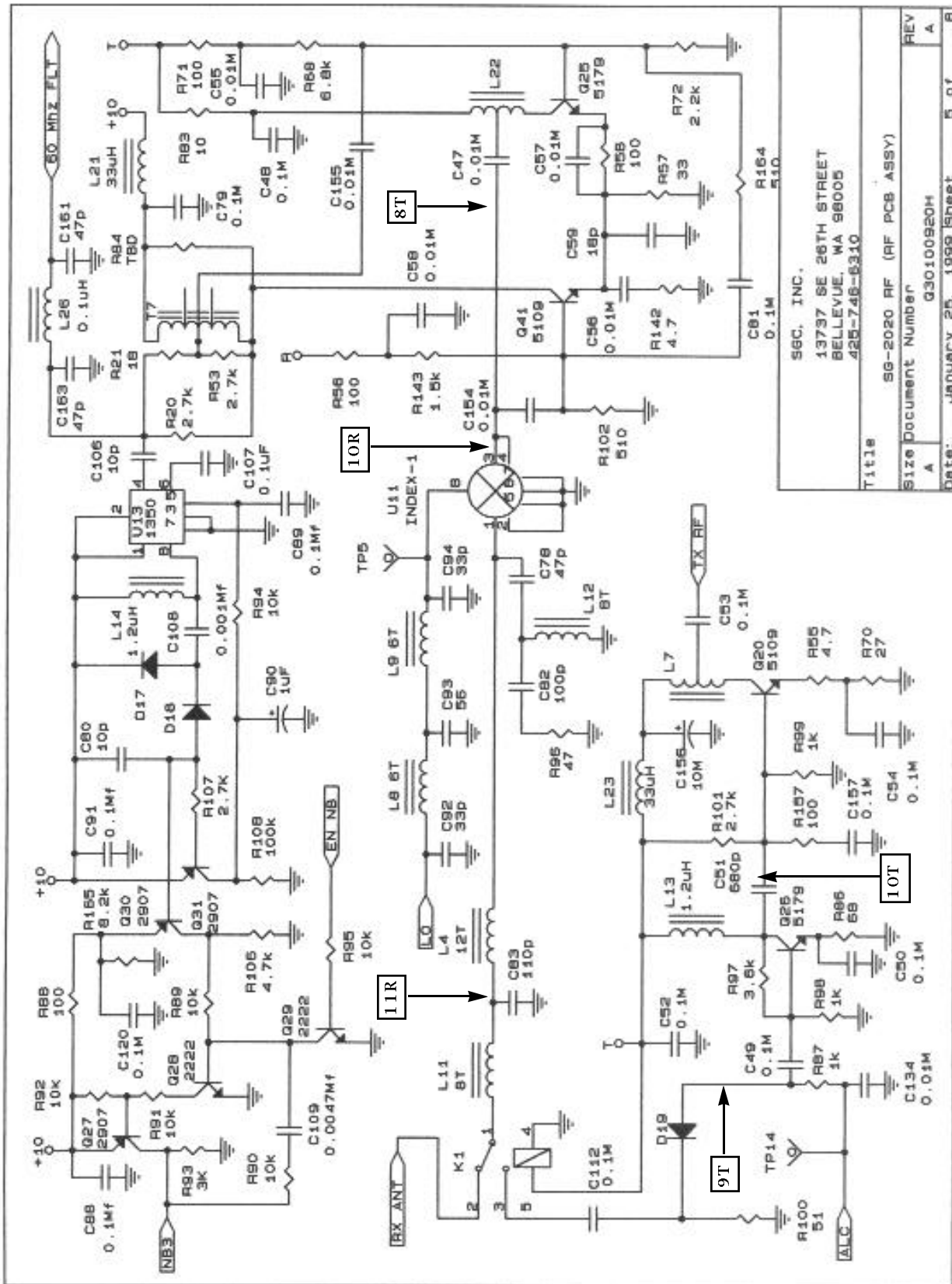
SGC, INC.  
 13737 SE 26TH STREET  
 BELLEVUE, WA 98005  
 425-748-6310

Title: SG-2020 AF (RF PCB ASSY)  
 Size: Document Number: 030100920H  
 REV: A  
 Date: January 25, 1999 Sheet 3 of 8

**EXCITER PCB SCHEMATIC 3 OF 8**

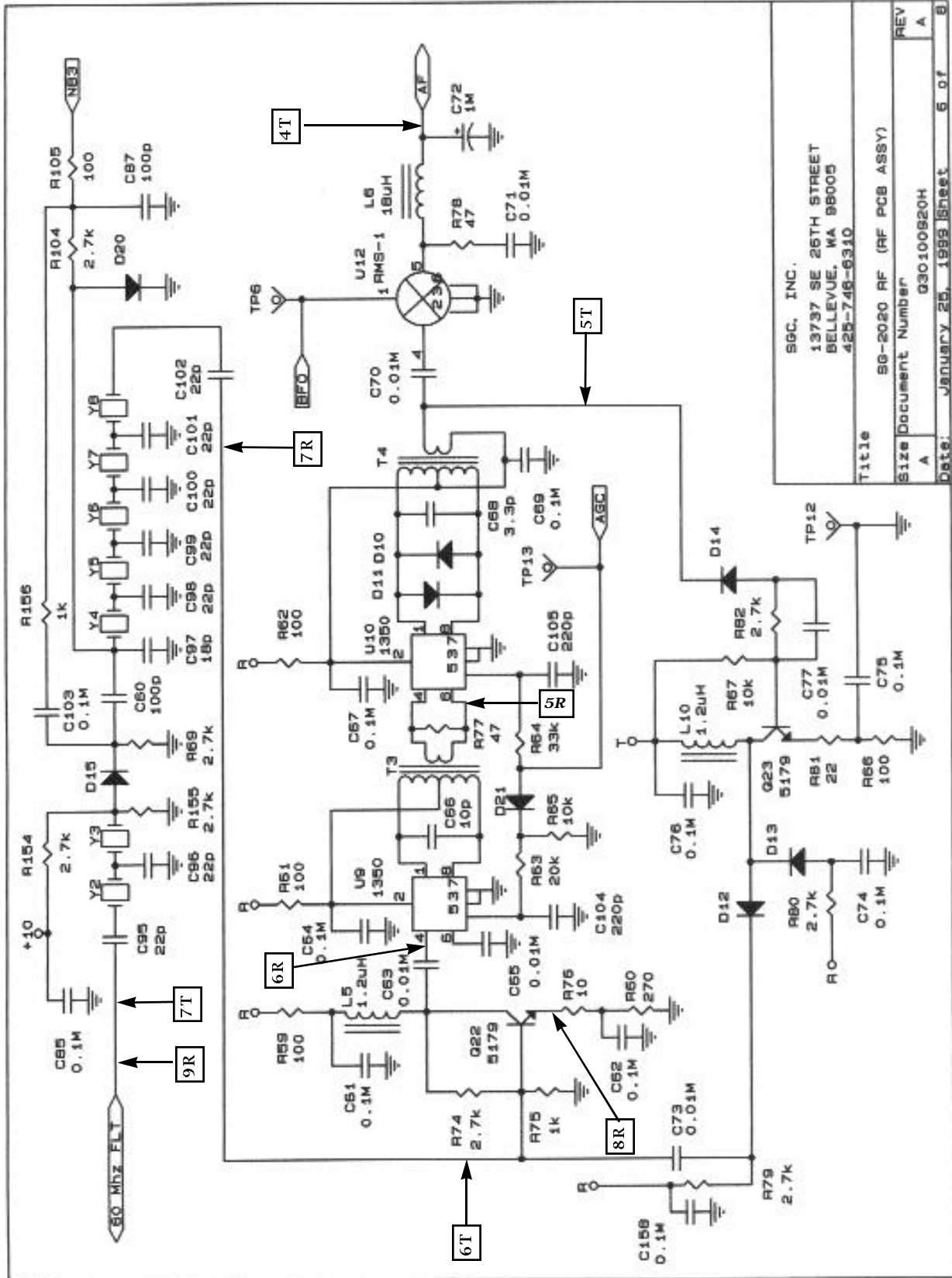


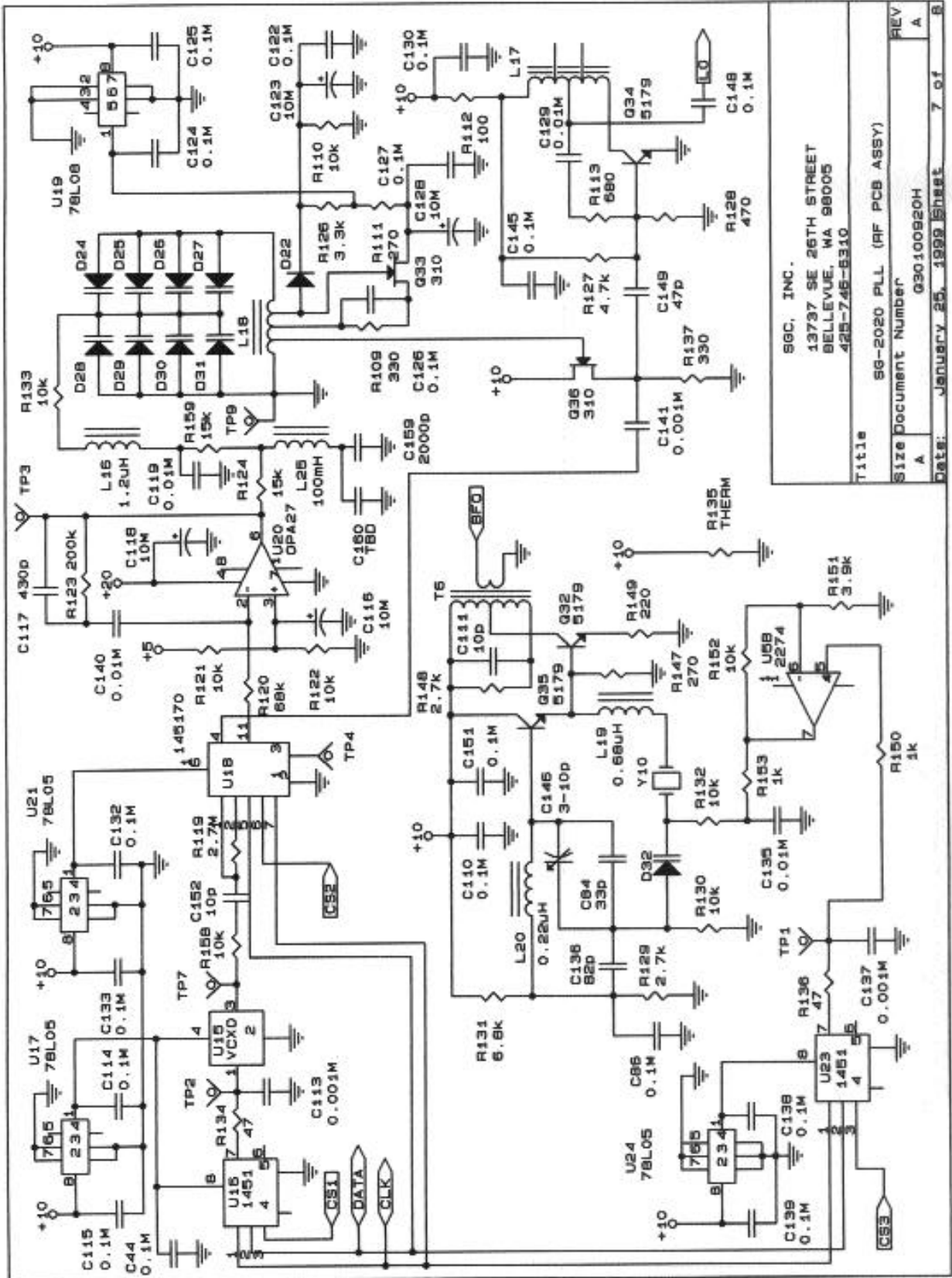




**EXCITER PCB SCHEMATIC 5 OF 8**

EXCITER PCB SCHEMATIC 6 OF 8

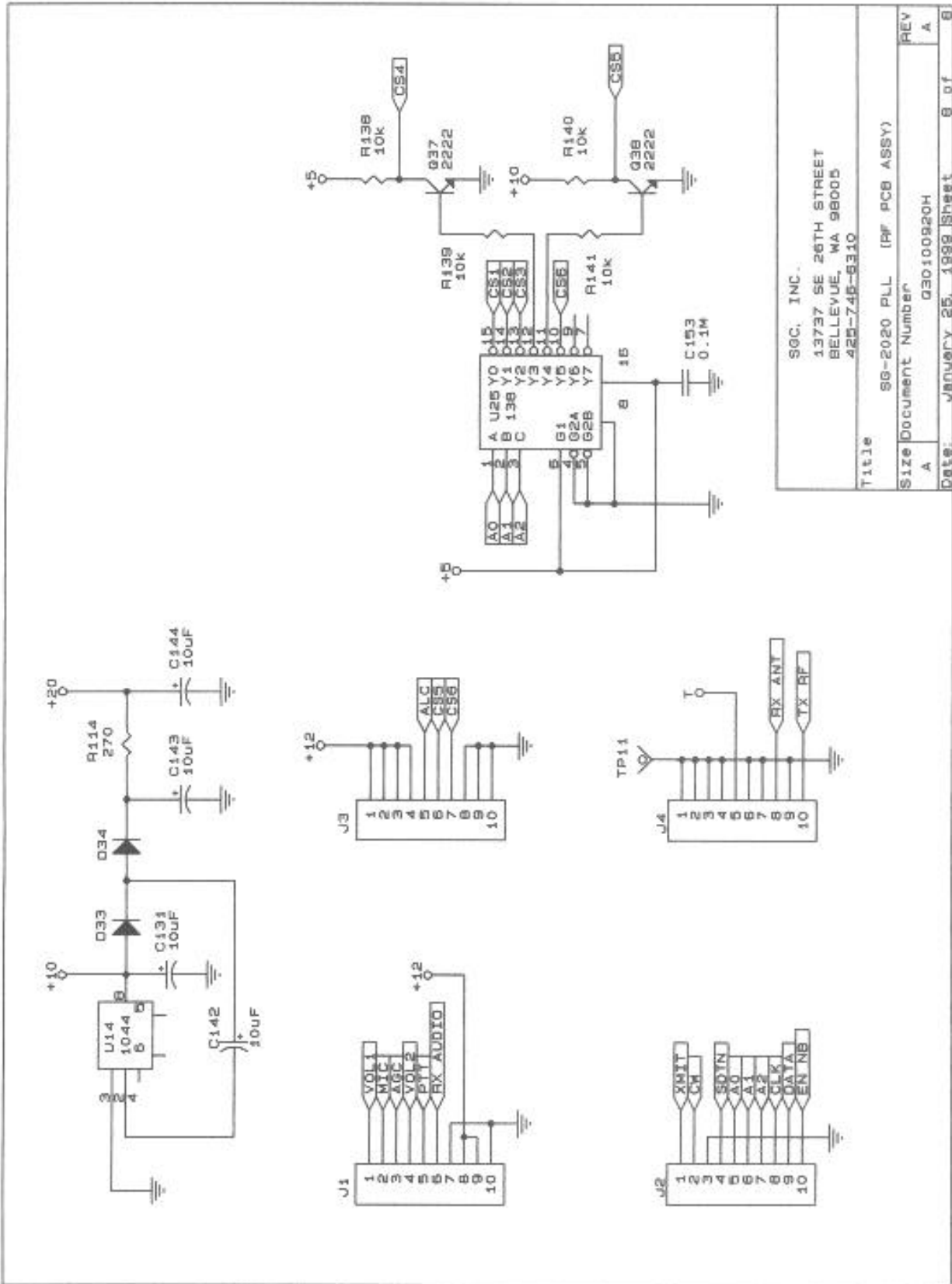




SGC, INC.  
 13737 SE 26TH STREET  
 BELLEVUE, WA 98005  
 425-746-5310

Title SG-2020 PLL (RF PCB ASSY)  
 Size Document Number G30100920H  
 A  
 Date: JANUARY 25, 1999 Sheet 7 of 8

EXCITER PCB SCHEMATIC 8 OF 8



SGC, INC.  
 13737 SE 26TH STREET  
 BELLEVUE, WA 98005  
 425-745-9310

Title: SG-2020 PLL (RF PCB ASSY)  
 Size: Document Number: 030100920H  
 Date: JANUARY 25, 1998 Sheet 8 of 8





## 19.0 CATALOG ITEMS

On the following pages, you will find an updated list of SG-2020 accessories, which includes prices. **Please note that price and delivery must be confirmed at the time of order.**

All items can be ordered directly from SGC using your Mastercard or Visa. Note that some items may not be in stock at the time of the order.

Shipping and handling charges for items weighing less than one pound is \$12.00 USD (via UPS surface delivery). For expedited shipping and items which are heavier, SGC will provide a shipping quote upon request.

5.00

051  \$50

Model SG-2020 Synthesized single sideband radiotelephone  
-Power Output: 20 watts PEP  
-20 Channels  
-Voltage: 12 VDC  
-Internal 5 watt speaker  
-Including: single 50output antenna connector  
-Dynamic fist microphone included  
-Pending DOC certification as applicable; CE Certified

051  \$80

- includes SG-2020 transceiver (05-01)
- includes battery container (05-37) to hold ten "D" cell batteries (batteries not included)
- includes front panel cover with facility to store standard SGC microphone (supplied)
- includes adjustable carry case strap for hand or shoulder 0% overall sizes of the unit, including battery case: 2 7/8 x 7 x 16 3/8 inches
- overall weight including standard batteries (not supplied): 11 pounds

052  \$60

- includes battery container (05-37) to hold ten "D" cell batteries (batteries not included)
- includes front panel cover with facility to store standard SGC microphone (not supplied)
- includes adjustable carry case strap for hand or shoulder

053  \$60

- includes battery container (05-37) to hold ten "D" cell batteries (batteries not included)
- includes adjustable carry case strap for hand or shoulder

054  \$60

- includes front panel cover with facility to store standard SGC microphone (not supplied)
- includes adjustable carry case strap for hand or shoulder.

055  \$60

- includes ten "D" cell type rechargeable SGC batteries, 4 AH each
- includes one AC charger 110 VAC.

056  \$60

- includes ten "D" cell type rechargeable SGC batteries, 4 AH each
- includes one AC charger 220 VAC.

057  \$60

- Container to hold ten "D" cell batteries (batteries not included)

050  \$5

Cable is 3 ft long and 14 gauge

051  \$5

Separate DC connector, three pin for cable size up to 14 gauge





52		\$25
<p>Mount plate is to be attached at the lower part of the radio to secure as a base, mobile or pedestal mount for both base and mobile installation. Includes four adhesive rubber feet and two, 5 inch Velcro strips for alternate use. Pedestal hardware is not supplied</p>		
53		\$5
<p>Flip-foot stand to elevate radio 2 inches; for desk or bench operation.</p>		
57		\$95
<p>Premium Warranty: Extended 3 year warranty for the SG-2020 radiotelephone must be purchased within 90 days after original purchase date. Warranty provides factory repair, parts and labor for 3 years, and one free software upgrade during warranty period. Warranty must be purchased directly from SGC, and does not include any shipping charges.</p>		
<p>51.00 INTERNAL RADIO ACCESSORIES</p>		
51		\$10
<p>Customized front panels for special applications or large purchases are available. One time lot purchase not less than 30 units for the SG-2000 and not less than 100 units for the SG-2020.</p>		
<p>52.00 EXTERNAL RADIO ACCESSORIES</p>		
56		\$10
<p>Solar battery charger provides full charge to SG-2020 PowerPak. Receiver can be operated directly from solar cell in overcast weather conditions. Battery will charge in one sunny daylight exposure. (Note: not a stock item).</p>		
52		\$10
<p>Shoulder back-pack permits use of radio while in maneuvers. Pack accommodates microphone/handset, and whip antennas in side pouches. Separate pouch is for dipole antennas, reserve batteries and DC/DC charger. (Note: not a stock item).</p>		
53		\$95
<p>Fully waterproof and floating travel case can be immersed to depths of 10 feet. The virtually indestructible case is equipped with an air pressure lock. Case accommodates one SG-2020 unit with microphone and power cable. Dimensions are 11x10x5 inches. (Note: not a stock item).</p>		
56		\$150
<p>The SmartPowerCube™ unit provides in excess of one KW DC input for 500 watts power output. Designed for mobile and base station operation at 13.8 VDC input voltage and 40 Amps for PEP, 80 amps for CW output. Fully microprocessor controlled for all functions including 7 band selections, PTT, VSWR protection, input power from 50 to 150 watts, collector current balance and level and operating temperature control. All functions are selected by sensing only the drive input power and frequency. Amplifier will work with any SSB, AME, CW or RTTY transmitter or transceiver from 1.8 to 30 MHz and 50 to 150 watts. No control connections are required from the driver unit.", 12x12x12 in"</p>		



527

~~527~~

~~\$50~~

Halliburton™ aluminum travel case, charcoal grey. Case accommodates one SG-2020 PortaPak unit (catalog number 05-31) with DC/DC charger and adjustable shoulder strap. (Note: not a stock item).

53.00

POWER SUPPLIES

521

~~521~~

~~\$95~~

Model PS-10 direct rectified power supply for 115/230 volts AC, 50/60 Hz. Output voltage nominal 14.5 volts, 8 amps continuous and 12 amps intermittent. For operation up to 50 watts PEP only. 1.5 feet of DC power cable included.

54.00

ANTENNA COUPLERS & OPTIONS

547

~~547~~

~~547~~

\$595.00

Model SG-231 Smartuner™ automatic microprocessor antenna coupler. Coupler can be used within its' power rating with any SSB in range of 1.0- 60 MHz. Designed for marine, mobile and fixed base applications for any type of radios within frequency range. For antenna types: 19 ft for 1.0 to 60 MHz and with 8 ft. minimum antenna for 1.8- 30 MHz operation. Antennas up to several hundred feet can be used.

- Number of channels: unlimited
- Frequency range: 1.0- 60 MHz
- Power rating: 100W PEP maximum or CW 75W HF and 100W VHF.
- SWR: Less than 1.3 to 1
- Tune power: 3 watts nominal
- Supplied with 2 9 ft. cables for coaxial and DC power.
- Black anodized aluminum base and ABS cover
- Water proof
- 1.8x10x11.5 inches 3 pounds", "

548

~~548~~

~~548~~

\$295.00

Extra small SG-237 Smartuner™ automatic microprocessor antenna coupler with 6811 microprocessor. Coupler can be used within its' power rating with any SSB in range of 3.5- 60 MHz. Designed for marine, mobile and fixed base applications. For antenna types: 9 ft mobile or marine whip for 3.5 to 30 MHz operation.

- Number of channels: unlimited
- Frequency range: 3.5- 60 MHz
- Power rating: 100W PEP maximum: 12 VDC operation.
- SWR: Less than 1.5 to 1
- Tune power: 3 watts nominal
- Supplied with 9 ft. cable for coaxial and DC power.
- Overall dimensions 6x7x1.5 inches.
- Under 2 pounds

55.00

ANTENNAS and ANTENNA ACCESSORIES

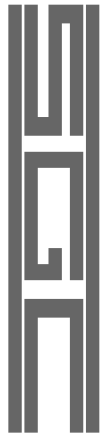
554

~~554~~

~~554~~

\$249.50

Exclusive SGC base station broadband dipole antenna system for 2-28 MHz operating range. Maximum power rating 150 watts CW. VSWR on all frequencies better than 2 to 1. 90 ft. long for installation as a flat-top antenna, inverted 'V' or a sloper. Supplied with 50 connector SO-239. (Coaxial feed cable is not supplied and must be ordered separately 55-91, 55-92, 55-93 or 55-94).





~~55~~ ~~SG-103-T~~ ~~\$0~~ ~~\$0~~  
 SG-103-T tactical antenna, designed for multi frequency medium and long range communication and can be used with any radio.  
 - Operating range: 2-28 MHz.  
 - Maximum power rating 150 watts CW.  
 - VSWR on all frequencies better than 2 to 1.  
 - 90 ft. long for installation as flat-top antenna, inverted 'V' or sloper.  
 - Supplied with 50 connector, PL-259 and 60 ft. coaxial feed cable.  
 - Including black canvas manpack carry case.  
 (Note: not a stock item). 6.5 Lbs", "21 x 5 x 5 in"

~~59~~ ~~QMS™~~ ~~\$0~~ ~~\$0~~ **\$1,430.00**  
 QMS™ (catalog number 55-44) supplied with the SG-231 (catalog number 54-17) microprocessor controlled antenna coupler and the SG-307 (catalog number 55-28) HF (1 to 60 MHz) antenna system.

~~55~~ ~~VariTune~~ ~~\$0~~ ~~\$0~~  
 VariTune system. Tunable whip antenna that collapses into 8 sections, each (13.5 in.) long. Overall system is 10 ft. For use during march and semi-stationary conditions. Includes 30 ft. counterpoise cable and 9 ft cable with alligator clip for grounding on metal structure.  
 Frequency range: 2-10 MHz. Maximum input power: 150W PEP voice.  
 (Note: not a stock item).

~~52~~ ~~VariTune~~ ~~\$0~~ ~~\$0~~  
 VariTune system. Tunable tape whip antenna for use during transit or march. Overall system is 6 ft; tape whip is 2 ft. long. Includes 30 ft. counterpoise cable and 3 ft. cable with alligator clip for grounding on metal structure. Frequency range: 3-15 MHz.  
 Maximum input power: 150W PEP voice.  
 (Note: not a stock item).

~~51~~ ~~VariTune~~ ~~\$0~~ ~~\$0~~  
 2 ft. tape whip folds into 3 sections. Frequency range: 3.3-15 MHz when used with Varitune element.  
 (Note: not a stock item).

~~52~~ ~~VariTune~~ ~~\$0~~ ~~\$0~~  
 9 ft. whip collapses into 8 sections, each 13.5 in. Frequency range: 2-9 MHz when used with Varitune element.  
 (Note: not a stock item).

90.00	SPARES KITS
-------	-------------

~~91~~ ~~SPARES~~ ~~\$0~~ ~~\$0~~  
 Contains special items not found through local sources. Consists of anticipated spare parts sufficient to service up to 5 basic units for one year.

~~92~~ ~~SPARES~~ ~~\$0~~ ~~\$0~~  
 Contains a complete set of anticipated spare parts, for use where commercial components are not available and where continuity of communications is vital. Sufficient to service up to 10 basic units 3 years.

91.00	PUBLICATIONS & MANUALS
-------	------------------------

917	<del>MANUAL</del>	<del>\$0</del>
	Complete installation, operation and service manual containing all necessary servicing, testing and maintenance information.	
918	<del>SG-2020</del>	<del>\$95</del>
	Package of 25 attractive SG-2020 QSL cards.	

**Please note that price and delivery must be confirmed at the time of order.**



## Glossary

<b>10-meters:</b>	28.0 - 29.7 MHz	<b>12-meters:</b>	24.890 - 24.990 MHz
<b>15-meters:</b>	21.0 - 21.450 MHz	<b>17-meters:</b>	18.068 - 18.168 MHz
<b>20-meters:</b>	14.0 - 14.350 MHz	<b>30-meters:</b>	10.100 - 10.150 MHz
<b>40-meters:</b>	7.0 - 7.3 MHz	<b>80-meters:</b>	3.5 - 4.0 MHz
<b>160-meters:</b>	1.8 - 2.0 MHz		

(+): Positive (power supply input).

(-): Negative (power supply input).

**A3A:** Mode of single sideband with -16dB pilot carrier.

**A3H:** AME or AM compatible (carrier with only upper sideband).

**A3J:** Telephony; single sideband with suppressed carrier.

**AGC:** Automatic gain control which prevents receiver overload.

**ALC:** Automatic loading control which prevents transmitter over load.

**AMP:** Amplifier.

**AMTOR:** Amateur radio equivalent of SITOR with slightly different standards

**ATTN:**Attenuator which reduces a received signal.

**ADSP:** Adaptive Digital Signal Processing; exclusive to SGC, a DSP technology which processes the signal to eliminate unwanted noise and improve incoming signal.

**AM:** Amplitude modulation, low efficiency type of radio transmission. generally used for broadcast AM radio station bands with 100% carrier inserted.

**AMVER:** Coast Guard operated system for rescue "automated mutual assistance vessel rescue system."

**AM BROADCAST BAND:** A band ranging from 530 to 1605 KHz.

**AMATEUR BANDS:** Frequency bands set aside for amateur radio operators.

**AMPLITUDE:** The height of a radio or sound wave—loudness.

**AMPLITUDE MODULATION:** Adding information to an RF carrier by increasing and decreasing amplitude.

**ANALOG:** Representing data with physical quantities (a watch with hour and minute hands is an analog time display).

**ANTENNA:** any part of any SSB system that radiates radio energy.

**ARQ:** automatic repeat request; a mode to compare transmission; a repeat signal is sent only when requested by the receiving station.

**BAND:** a range of frequencies, usually within a one MHz span.

**BANK:** a collection of channels to be scanned as a group in order.

**BINARY:** A system of numbers represented only by digits 0 and 1.

(Contrast with decimal which uses digits 0 through 9.)

**CAPACITOR:** A device to store electrical energy.



**CARRIER:** An unmodulated RF signal.

**CHAN:** Channel.

**CHASSIS GND:** Chassis or cabinet ground.

**CLAR:** Clarifier; allows receiver frequency to be offset slightly from transmitter frequency.

**COMM:** Communication; also used to reference serial communications computer port.

**CW:** Continuous wave; to transmit the mode of Morse code.

**CRYSTAL:** A piece of quartz mineral that will resonate at a particular frequency and used as a reference in transceivers.

**COAX:** An electrical conductor which carries radio energy from a transmitter to an antenna system; the inner conductor is insulated from an external wire mesh shield.

**CHIP:** A wafer of semiconductor material used in an electronic circuit.

**COPY:** When radio operators hear and write down a message, they "copy."

**DATA I/O:** Data input/output.

**DC:** Direct current.

**DUPLEX:** A method in which ship stations transmit on one frequency while shore stations transmit a different frequency

**DSP:** Digital signal processing; technology which eliminates unwanted noise to enhances a signal.

**DXpedition:** A contest in which amateur radio operators try to reach distant stations.

**EMER:** Emergency.

**FEC:** Forward error correction; a mode to compare transmission; each character is sent twice and the redundancy of the code serves as the check.

**FEEDLINE:** The method of connecting the antenna to the radio.

**FREQUENCY:** The number of polarity alternations per second measured in Hertz. KHz=thousand Hertz; MHz = million Hz.

**FM:** Frequency modulation.

**FWD:** Forward transmit power going to the antenna.

**GAIN:** The amount of amplification a system has; in antenna systems, the gain is the measurement of the directional characteristics.

**GROUND:** A connection to earth or an earth counterpoise.

**GROUNDPLANE:** An artificial ground used for antenna systems.

**GROUNDWAVE:** A radio signal that travels along the earth, bending over the horizon.

**GMT:** Greenwich Mean Time (universal time) the international standard time referred to the zero degree meridian.

**HETERODYNE:** The frequency that results when two radio frequencies "beat" together (one frequency minus the second frequency = heterodyne).

**HERTZ:** See Hz.



- HF:** A range of frequencies from 3 to 30 MHz.
- Hz (Hertz):** A measure of frequency: one cycle per second.
- INDUCTOR:** Electronic component that stores energy in a magnetic field, usually a coil.
- IMPEDANCE:** The apparent opposition in an electrical circuit to the flow of an alternating current.
- IONOSPHERE:** Electricity conducting layers in the earth's upper atmosphere.
- KHz:** 1000 Hertz.
- LCD:** Liquid crystal display.
- LPA:** Linear power amplifier.
- LSB:** Lower sideband.
- LED:** (Light-Emitting Diode) A semiconductor that lights up; used in digital displays.
- MEMORY:** A computer memory address to which channel information may be assigned.
- MHz:** 1 million Hertz.
- MF:** (Medium Frequency), a band of frequencies 300 KHz - 3 MHz range used for short range communications.
- MICROPROCESSOR:** A computer processor contained on a chip.
- MODULATION:** The process of varying the amplitude, frequency or phase of a carrier or signal.
- OSCILLATOR:** A device that produces alternating current.
- OSCILLOSCOPE:** A display of frequency on a cathode ray tube.
- PCB:** Printed circuit board.
- PHASE-SHIFT:** Removing an unwanted frequency (or side band) by imposing a mirror-image frequency so the two cancel each other.
- PTT:** Push to talk.
- PEP:** Peak envelope power; commonly a power output rating.
- PROPAGATION:** The characteristics of different radio frequency transmissions, generally in regard to usable distance in relation to frequency and time of day.
- RF:** Radio frequency; any frequency higher than a person can hear.
- RESONATE:** The frequency that a circuit is tuned to
- RADIATE:** The movement of energy away from a place, as in the radiation of an antenna.
- SSB:** Single Side Band; a high efficiency type of radio transmission generally used for long distance communications where energy is not radiated until modulation is present.
- SQL:** Squelch.
- SIMPLEX:** A method of frequency use in which stations transmit and receive on the same frequency.
- SITOR:** A commercial system of radio teletype for ship to shore, ship to ship and between ships and any telex subscriber; "ship international

transmitting over radio."

**SKIP:** The bounce of the radio signal off the ionosphere.

**SKYWAVE:** A radio signal which is projected into the ionosphere and bounces one or more times before returning to earth.

**SYNTHESIZER:** The device that produces and controls frequencies through synthetic results.

**SNS:** Exclusive to SGC; spectral noise subtraction; works with DSP in signal processing to improve incoming signals.

**TELEX:** A commercial service involving teletypewriters connected through automatic exchange; "teleprinter + exchange."

**TRANSCIVER:** A term applied to equipment that both transmits and receives.

**USB:** Upper sideband.

**UTC:** Coordinated universal time; same as GMT.

**VCO:** Voltage controlled oscillator.

**VHF:** Very High Frequency; commonly refers to a short range type of radio whose signal is transmitted on a line of sight from antenna to antenna.

**VSWR:** Voltage standing wave ratio; a measurement of the efficiency of an antenna system; it measures the energy which is projected out and reflected back from the antenna.

**VOLTAGE:** A measurement of electrical pressure of the current times resistance.

**VDC:** Voltage direct current.

**WAVELENGTH:** Distance between two successive radio waves.

**WORK:** To be in radio contact or communication with another station.

**XMT:** Transmit.

**XFMR:** Transformer.



## APPENDIX A



### Marine Ham Net Frequencies

Freq KHz	Time(UTC)	Days	Coverage. Area
3968	0000+	Dly	Baja, W/Mex
21402	0200/0100+	M-F	PAC/ Baja, C/A
7284	0230/0130+	Dly	US
7294	0330/0230+	Dly	W/C , Baja
7241	1100>1200+	Dly	CAR
3963	1230/1130+	Sun	N/E US
7268	1245/1145+	Dly	E/C , CAR
21400	1300>1400+	Dly	N/ATL,CAR
3968	1400/1430+	Dly	Baja, So Cal
7294	1530/1430+	Dly	Baja, So Cal
7238	1600/1500+	Dly	Baja, So Cal
14300	1600>0200+	Dly	ATL, CAR, PAC
14313	1600>0200+	Dly	ATL, CAR, PAC
3865	1630/1530+	Dly	WA State
14323	1700+	Sat	US / Canada
14340	1700+	M-F	E/PAC
14340	1830/1730+	M-Sa	W/C, E/PAC
14340	1900/1800+	M-Sa	W/C, E/PAC
21402	2200+	M-F	PAC, C/A, Baja
21412	2200+	M-F	PAC
3815	2230		CAR
3390	2310	Dly	P/R, V/I
14325	As Needed	A/R	ATL, CAR, PAC



## 2 MHz Marine Radiotelephone Frequencies



Intership Safety and Operational Communications	
Carrier	Geographic Area
Freq. kHz	Geographic Area
2003.0	Great Lakes only
2082.5	All Areas. Also, intership non-commercial fishing.
2093.0	All Areas
2142.0	Pacific Coast. Also, intership non-commercial fishing.
2182.0	Distress, safety and calling.
2203.0	Gulf of Mexico. Also, intership non-commercial fishing.
2214.0	All Areas.
2635.0	ITU Regions 2-3 ITU RR 4193). Not in FCC rules.
2638.0	All Areas.
2670.0	U.S. Coast Guard Liaison and Maritime Safety Broadcasts.
2738.0	All Areas, except Great Lakes.
2830.0	Gulf of Mexico only.

Business and Operational Frequencies	
Carrier	Geographic Area
Freq. kHz	Geographic Area
2065.0	All Areas.
2079.0	All Areas.
2096.0	All Areas. Government shore, ship and aircraft
3023.0	stations for search and rescue coordination.



## U.S. COAST GUARD MF/HF High Seas Voice Broadcasts

### U.S. COAST GUARD HF RADIOTELEPHONE (SINGLE SIDEBAND) BROADCAST SCHEDULE

All broadcasts are upper single sideband (USB) and include weather forecasts and warnings. Broadcasts on 2670 kHz include navigational warnings, search and rescue broadcasts, and weather forecasts and warnings. Frequencies are carrier (dial) frequencies.

**Station: USCG Communications Area Master Station Atlantic Portsmouth VA/NMN**

Time(UTC)	Frequency (kHz)		
0300	4426	6501	8764
0500	4426	6501	8764
0930	4426	6501	8764
1130	6501	8764	13089
1600	6501	8764	13089
1730	8764	13089	17314
2200	6501	8764	13089
2330	6501	8764	13089

**Station: USCG Communications Area Master Station Pacific San Francisco CA/NMC**

Time(UTC)	Frequency (kHz)		
0430	4426	8764	13089
1030	4426	8764	13089
1630	8764	13089	17314
2230	8764	13089	17314

**Station: USCG Communications Station Honolulu HI/NMO**

Time(UTC)	Frequency (kHz)	
0600	6501	8764
1200	6501	8764
1800	8764	13089
0000	8764	13089

**Station: USCG Communications Station Honolulu HI/NMO**

Time(UTC)	Frequency (kHz)
0203	6501
1645	6501
- - *	2670

\* Broadcasts, announced on 2182 kHz, include urgent marine information broadcasts and severe weather warnings only.

**Station: USCG Marianas Section Guam**

Time(UTC)	Frequency (kHz)
0300	13089
0750	2670
0930	6501
1530	6501
2130	13089
2205	2670

Note: Except for 2670 kHz, these frequencies are also the coast-transmit portion of radiotelephone channels used for distress and safety calls to the Coast Guard.

Note: CAMSPAC, MARSEC Guam and most USCG Groups in the Atlantic, Gulf and Pacific Coasts also broadcast maritime safety information on 2670 kHz, after announcing the broadcast on 2182 kHz.



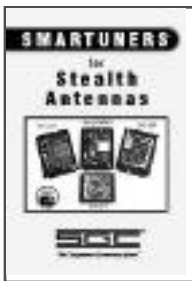


## These informative SGC publications are available for FREE download:



### **HF SSB USER'S GUIDE**

<http://www.sgeworld.com/pub/sgc/Books/hfguide.pdf>



### **SMARTUNERS FOR STEALTH ANTENNAS**

<http://www.sgeworld.com/pub/sgc/Books/stealth.pdf>



### **SG-231 SMARTUNER MANUAL**

<http://www.sgeworld.com/pub/sgc/Books/231man.pdf>



### **GO MOBILE AT 500 WATTS**

<http://www.sgeworld.com/pub/sgc/Books/GoMobile.pdf>



### **DSP FACTS AND EQUIPMENT**

<http://www.sgeworld.com/pub/sgc/Books/dsp.pdf>

For more great information, check out our website at  
**[www.sgeworld.com](http://www.sgeworld.com)**

# **SGC Product Warranty**

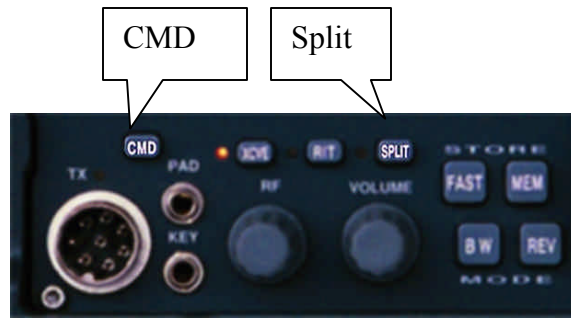
## **SGC LIMITED PRODUCT WARRANTY (1 Year Parts and Labor) And SOFTWARE LICENSE**

You have purchased an SGC product together with a license to use the software installed in that product. Please return the warranty registration card that accompanies this product, so that we can assure that you receive proper warranty service and important notices that may affect the product. This SGC product is warranted to be free from defects in workmanship and material for a period of 1 year from the original buyer's date of purchase. In the event of a defect, malfunction or failure of which SGC receives notice during the 1 year period, SGC, at its' option, will repair or replace the product free of charge to the buyer. The buyer must contact SGC for a Return Material Authorization Number (RMA) and deliver the product back to SGC with this RMA number and written proof as to date of purchase. SGC will ship a new or repaired product to the buyer, reserving discretionary right to return a newer model that offers at least equal performance. The foregoing warranty extends to the original buyer and does not include (1) buyer's cost to return the product to SGC, (2) buyer's costs to remove or reinstall the product for warranty work, or (3) added costs of special expedited shipment that may be requested by buyer. Except for the limited warranty stated above, and to the full extent permitted by law, SGC disclaims any other express or implied warranties and liability for any incidental, consequential, special or exemplary damages in connection with its product, even if SGC or its agents are advised that such damages are foreseeable. (Note: Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you). There is no warranty with respect to (1) the product's transmission range or geographical coverage which can vary by location (2) non-performance caused by using an inadequate or improper antenna or grounding system or (3) routine maintenance, periodic adjustment and performance testing of the product or system. SGC customarily charges a flat fee for repairs performed outside of the warranty coverage. To inquire about such charges, please contact SGC.

## **END USER SOFTWARE LICENSE**

SGC warrants that the SOFTWARE included in this product will perform in substantial accordance with the documentation. SGC grants to the original end user of its product a non-exclusive worldwide license to operate the software installed therein. This license shall be transferred to any person or entity that subsequently acquires lawful ownership of the product. This license shall be limited to using the software for contemplated operation of SGC's product. This license does not permit any end user to (1) modify or adapt SGC's software or to merge it into another program (2) reverse engineer, disassemble, or otherwise attempt to discover SGC's software source code or (3) sub license or otherwise transfer SGC's software for any use other than operating the product originally purchased from SGC.

On the SG-2020, ADSP<sup>2</sup> is activated by a combination of the CMD + SPLIT key.



NOTE: this is different from the original SG2020 ADSP which used CMD+BW for ADSP switching

Bandwidth Filters are activated by CMD + BW.



Each activation steps to the next filter or DSP level in a loop. For example, The ADSP<sup>2</sup> will step through 13 dB Noise Reduction, then 26 dB Noise Reduction, then back to no ADSP<sup>2</sup>.

	<b>CMD+Split</b>	<b>CMD+BW</b>
<b>Off</b>	No Noise Reduction	No Filters
<b>1<sup>st</sup> Step</b>	Original ADSP	1800 Hz Bandwidth
<b>2<sup>nd</sup> Step</b>	ADSP <sup>2</sup>	500 Hz Bandwidth
<b>3<sup>rd</sup> Step</b>	No Noise Reduction	100 Hz Bandwidth

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## SG-2020 Product Evaluation Report

Please help us by providing your impressions of the new SG-2020 transceiver. Rate each feature on a scale of 0 - 5, as follows:

0=Not Acceptable	3=Good
1=Poor	4=Very Good
2=Acceptable	5=Excellent

	0	1	2	3	4	5
1 - First impression from the box.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2 - First impression, front panel function and features.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3 - Ease of operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4 - Receiver sensitivity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5 - Receiver selectivity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6 - Noise blanker, and SCAF performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7 - Receiver audio quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8 - Receiver audio volume.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9 - Transmitter overall performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 - Transmitted Audio quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11 - General features.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12 - Built in keyer, features and function.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13 - Overall CW operation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14 - Tuning and frequency agility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15 - Ease of operation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16 - Instruction Manual	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**We are interested in your comments, please give us as much input as you like! Thank you.**

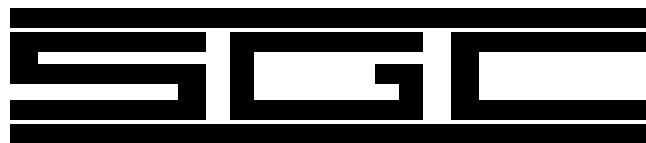


# SG-2020 PortaPak

## USER MANUAL

SGC catalog number: 05-32

Document number: N80100533•D



*“No Compromise Communications”*





## SGC — The SSB People

SGC develops, manufactures, and sells high performance single sideband (SSB) communications equipment. Since 1971, the company has sold to the marine, military, aviation, and industrial markets world wide. Over these years, SGC has earned an outstanding reputation for product reliability and for service after sale.

The company keeps pace with equipment options, engineering developments, and design requirements. Its products are the most competitive in the entire long distance communication market. SGC equipment is presently being used by the United Nations for inter-communications in developing countries throughout the world. Many competitive racing vessels, as well as fishing boats, tugs, and commercial craft are equipped with SGC equipment. In fact, an SGC radiotelephone provided the only communications available on a past Polar expedition by the National Geographic Society.

SGC also supplies U.S. government agencies, several foreign governmental agencies, and major petroleum companies through Asia and latin America.

All SGC equipment is designed and manufactured in the USA. SGC has qualified people ready to provide technical information, assistance in selecting equipment, and recommendations for any installation.

SGC welcomes your call to discuss your SSB requirements.



*SGC 2020 Staff*



A. Contents:

Description

Schematic

Picture

B. Product description

The SG-2020 PortaPack is designed to provide a built-in portable power supply for SG-2020 radio transceiver. The PortaPack configuration allows the popular SG-2020 to be used in remote areas, and for backpack and mobile applications.

When used in mobile applications, PortaPack units can be loaded with either 10 "D" size ordinary dry cell batteries , or with 10 "D" size rechargeable batteries, such as nickel-cadmium (NiCad) cells.

Following are length of operation estimates when using dry cells and rechargeable batteries. Note that these times are approximate and will depend on the charge of the battery as well as other factors.

Mode	Dry Cell 12 AH	Rechargeable 4 AH
Receive	20 to 30 hrs	4 to 10 hrs
Receive/ transmit	6 to 10 hours	2 to 5 hours

Note: Rx/Tx ratio is 1/10 at 5 Watts transmit power output.



Depending on the transmit/receive ratio specific to each field application, the PortaPack will, in most cases, provide continuous radio communication operations. An additional feature of the PortaPack is a connector, provided with the system, which allows rechargeable batteries to be charged while the unit is in operation.

Batteries and a charger are not supplied with this product.

A battery charger for the PortaPack can be purchased from SGC. Any other charger used for this purpose should meet the following characteristics:

- DC out: 15 V
- Current out: Minimum 1.0 Amps
- PortaPack's charging connector has the central pin connected to "+" and the outside pin to chassis. A charger must match this configuration.

B. Test for proper operation with battery system.

This is a quick test to determine that the system is operational.

Requirements: 10 'D' batteries either dry cell or rechargeable NiCad (NOT included)

1. Loosen the three thumb screws on the battery container.
2. Slide and remove the locking plate from the container.
3. Lift the top battery PCB / Spring assembly up and to the side of the container. Note that this assembly is attached to the container.
4. Install 10 'D' size batteries. These may be NiCad or dry cell.  
**NOTE: DO NOT MIX DRY CELL WITH NICAD.**
5. Replace the top PCB assembly ( from step 3 ).
6. Replace the locking plate ( from step 2 ).
7. Tighten the three thumb screws.
8. Connect the antenna cable from the battery container to the



- radio antenna connector.
9. Connect the power cable from the battery container to the radio power connector.
  10. Turn on the radio.
  11. Press and hold the 'CMD' and 'SPEED' buttons to activate the Voltmeter Display.
  12. The radio LCD should display:
    - 16 to 18 volts if you are using new dry cells
    - or
    - 12.8 to 14 volts for fully charged NiCads.

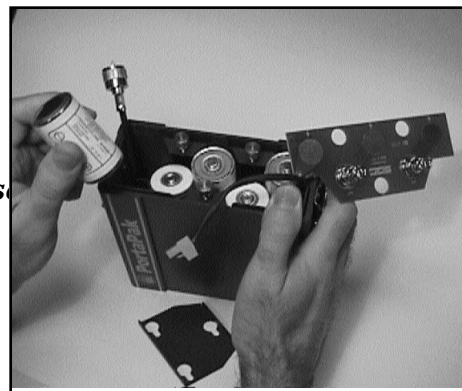
End of test

**NOTE:** Replacing the locking plate may be difficult; the unit has been designed with a tight fit so that the batteries are not subject to movement. This provides reliable and durable battery contact.



***Battery Case***

***Placing batteries into the case***





*This is the correct way to store the microphone*

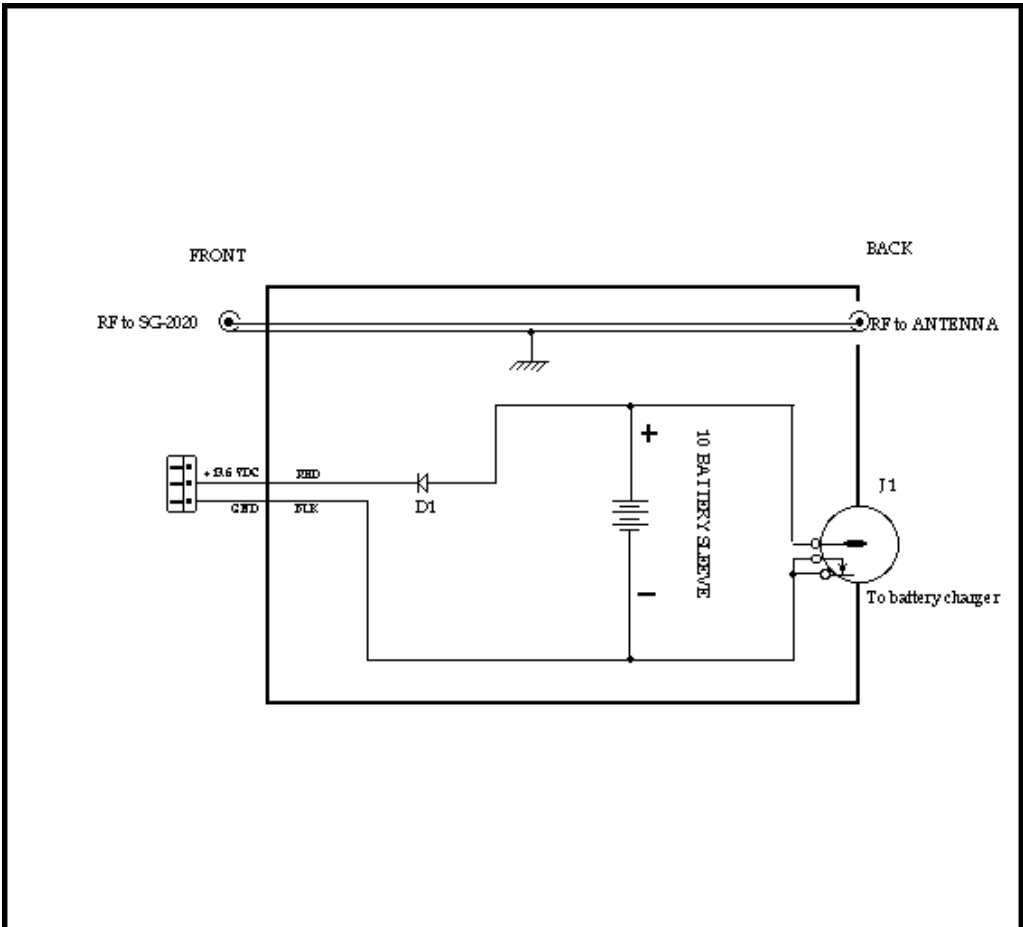
*The PortaPak has an adjustable nylon strap, and can be easily carried over the shoulder or ...*



*... it can also be carried by hand.*

*Professional, high quality stainless steel latches provide reliable and secure connection of the battery pack and front cover. The cover provides protection of the front of the radio and storage for the microphone.*





NOTE 1. Use charger only with rechargeable batteries

DATE REV DESCRIPTION AUTH				CONTRACT NO. :		SGC Inc 13737 S. E. 26TH ST. BELLEVUE, WA 98006		
12/03	A	ORIGINAL DWG	ET	DRAFTED: DESIGNED: PRODUCED: APPROVAL: PROCSUBST:	12-23-98	<b>BATTERY PAK</b> <b>SG-2020</b>		
								SIZE <b>A</b>
				SCALE:		SHEET 1 OF 1		