SG-211

The Zero Power Smartuner

Catalog Number 54-26

April 2004

Thank you for buying your new SG-211 Antenna Coupler. The SG-211 incorporates the very latest American-made technology as well as our experience in having delivered more than 100,000 Smartuners since 1985. It is a state-of-the-art tuner providing a new and unique level of usefulness.

The concept of the SG-211 is quite different from the rest of our line of Smartuners. It is a unique departure designed to provide flexible matching capabilities in a portable environment where power is at a premium. The ease of installation and flexible operation make this an ideal choice when power is limited. We know that the simplicity, reliability, and flexibility of the SG-211 will enhance your HF operation for years to come.

SGC continues to focus on providing the most useful products and services for our customers around the world. Please feel free to call to discuss your antenna system requirements at any time. We look forward to making your HF experience the very best.

Pamela Goral
President

Pierre Goral
Founder
1936-2004

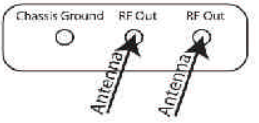
Mailing: PO Box 3526, Bellevue, WA. 98009
Shipping: 13737 SE 26th St. Bellevue, WA. 98005
Toll Free: 800-259-7331 * Phone: 425-746-6310 * Fax: 425-746-6384
www.sgcworld.com * Email: sgc@sgcworld.com

Warnings

IMPORTANT NOTE: A random antenna wire will radiate RF. Not only is this an RF Hazard within the station, but it can cause local interference both within the station and in the vicinity depending on your power level.

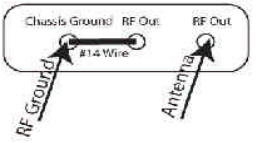
CAUTION: Unbalanced antennas are radiating from the line as soon as they leave the SG-211. Minimize the amount of wire inside the radio room to prevent interference with electronic equipment. Minimizing power will also minimize interference caused by this kind of antenna.

Connecting your Antenna



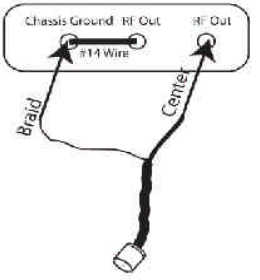
Balanced Antennas

Connect the two sides of the balanced antenna to the two connectors labeled RF Out as shown



Unbalanced Antennas

* Connect a jumper between the Chassis Ground and the left RF Out connector
* Connect the RF Ground or Counterpoise to the Chassis Ground
* Connect the Antenna to the right RF Out connector



Using Coaxial Cable

* Strip 4" from the Outer Cover
* Pull center insulator out through the braid
* Cut 2" from the inner insulation
* Connect center conductor to the RIGHT RF Out
* Connect the braid to the Chassis Ground

1 Introduction

1.1 Specifications

The SG-211 is a revolution. You've never seen a coupler so light weight or so flexible. Never has there been one so easy to carry and use. And NEVER have you seen one that will tune for 5 years on a single set of AA cells!

HF Frequency Range:	1.8-60 MHz
Power Input Range: (approximate)	60 watts (PEP) 30 watts key-down 30 watts (PEP) with short antennas below 3.5 Mhz 20 watts data continuous operation
Minimum Sensitivity	Approximately 1 watt
Memory bins:	256
Input Impedance Range:	.3-6000 ohms
VSWR:	Typically less than 2:1
DC Input Requirement:	None (internal battery)
Input Current:	Zero
Random set time:	Average 4 seconds
Recurrent set time:	Typically less than 500 milliseconds
Antenna Length:	25 foot wire or whip from 1.8-60 Mhz
	8 foot wire or whip from 3.5-60 Mhz
Installation:	Any position
Operating Temperature:	-30° to +60°C
Size:	8.66 inches X 4.69 inches X 1.55 inches
Weight:	1 lb
Case Construction:	Irridited Aluminum
Antenna types:	1. Whip
	2. Backstay (marine, sail)
	3. Dipole centerfed
	4. Dipole with feedline
	5. Loop (small) 2x2 multi turn
	6. Loop (large) 10 ft. and up single turn
	7. Longwire
	8. Ladder feed
	9. Coaxial Fed Antennas
Power Source	4 AA Batteries lasting 5 years
Front Panel Connections	SO-239 RF Input Connector
Rear Panel Connections	Balanced and Unbalanced Wing Nuts
Indicators	1 Red LED on Front Panel: Steady for 2 seconds for tuned Blinking for 2 seconds for not tunable Morse B for 10 seconds for battery low

1.2 Mechanical Design

The SG-211 is in an Irridited Aluminum case. The RF input connector is an SO-239 on the front of the case. RF Output is from balanced and unbalanced connectors on the back. Internal construction makes the SG-211 suitable for portable or fixed location use. Corrosion-resistant hardware and passive alloys are used throughout.

2 SG-211 Setup

Setup on the SG-211 is so easy there is almost nothing to do. It comes with AA batteries already installed. All you need to do is connect the coax from your transceiver, attach your antenna to the terminals on the back, and the SG-211 is ready to go.

2.1 Connections to the SG-211

2.1.1 RF Input from your transceiver

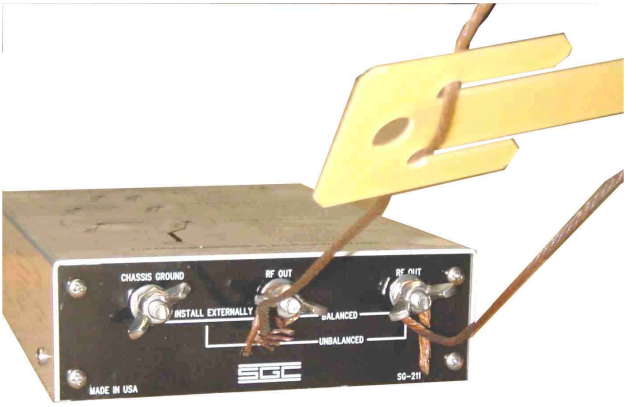
RF input to the SG-211 is through a standard SO-239 connector on the front. Choose good quality coaxial cable with a PL-259 connector. You may want to add a Power/SWR meter between the transceiver and the SG-211 to monitor conditions. We recommend that you select one that measures Forward and Reverse power as well as SWR. This will provide more useful information about conditions on the line.

2.1.2 Antenna and RF Ground Connections

A wide variety of antennas can be connected to the SG-211. A set of wing nuts for connecting balanced or unbalanced antennas is provided on the back.

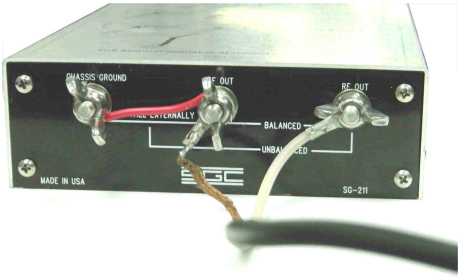
Optimum use of the SG-211 Smartuner is to put it directly at the antenna feed point. This may require enclosing it in a waterproof enclosure to protect it from the weather. Either a balanced or an unbalanced antenna can be connected directly to the wing nuts provided on the back of the coupler.

If the Smartuner must be away from the antenna feed point, it is best to connect to the antenna with balanced feed line. The feed line can be connected to the balanced terminals on the back of the coupler. When it is not possible to use balanced feedline, then the antenna may be connected with coax.



When feeding an unbalanced antenna directly, the RF Ground lug is connected with a jumper strap to one side of the balanced feed and the other side of the balanced feed is used for RF Hot.

If you are feeding your antenna with coaxial cable, then the cable is connected to the back panel by connecting the center conductor to the right RF Out connection and the braid to the Chassis Ground with a jumper to the left RF Out connection as shown below.



A short pigtail connector with an SO-239 female connector on it will make it easier to use Coaxial cable with the SG-211.

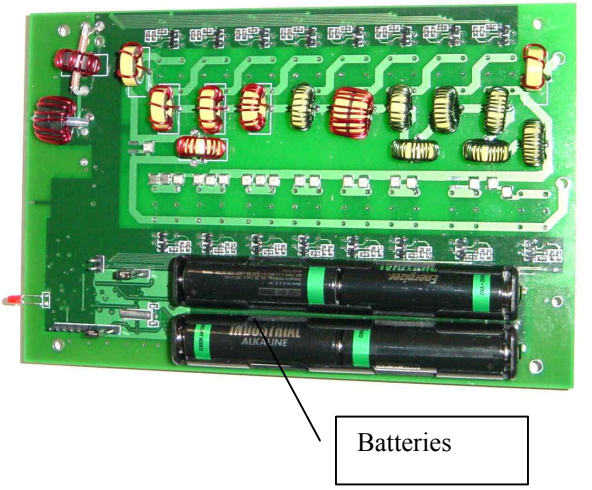
2.2 Battery Replacement

To replace the batteries inside the SG-211, you must unscrew the cover and remove it. The screws are on the left and right sides of the SG-211 as shown below.

Two Cover Screws on each side, none on front and back

The batteries are in two battery holders on the SG-211 circuit board. Any suitable alkaline AA batteries may be

used. We recommend using the highest quality alkaline AA batteries available to assure the longest life with no battery leakage that could damage the circuit board.



3 Antennas and the SG-211

The SG-211 can accommodate a wide variety of antennas.

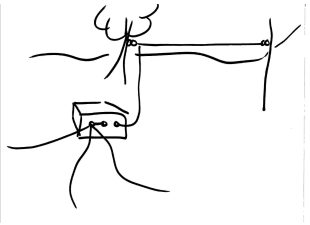
3.1 Optimum Coupling

Optimum use of the SG-211 is to place it at the antenna feed point. This keeps SWR on the feed line to an absolute minimum.

3.2 Connecting Antennas

The SG-211 is provided with an SO-239 connector on the front panel for RF in. It has balanced and unbalanced connections on the back panel.

The SO-239 connector is intended to connect to a normal Coaxial feedline.

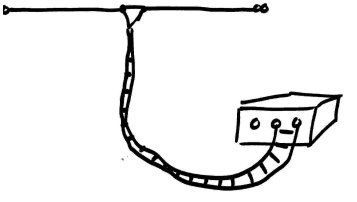


Unbalanced antennas, such as a long or random wire, are fed by connecting the radiator to the right RF Out connection and the RF Grounding system to the left RF Out and Chassis Ground.

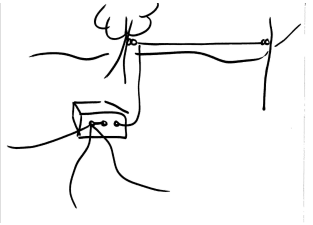
IMPORTANT NOTE: Antenna wire connected to the SG-211 directly will radiate RF. This is an RF Hazard and it can cause local interference within the station and in the vicinity depending on your power level.

The balanced feed connection supports ladder line feed to a balanced antenna such as a dipole or a loop.

3.3 Balanced vs. Unbalanced Antennas



The distinction between balanced and unbalanced antennas is that balanced antennas are electrically balanced at the feed point while unbalanced antennas require an RF Ground to provide the balance. Dipoles and loops are typical balanced antennas.



Unbalanced antennas need an RF Ground such as a radial wire system or a counterpoise to create electrical balance. They depend on the quality of the ground for a maximum radiated signal. Without a good quality ground, unbalanced antennas will cause interference, RF in the radio room, and radiate poorly. Long wires and verticals are typical unbalanced antennas.

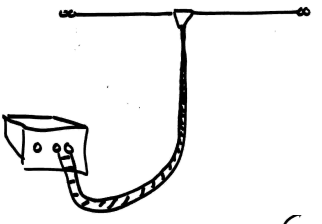
3.4 Antenna Recommendations

There are many ways to connect antennas for use. Here are some common examples that can help you get started with your SG-211. For additional information about antennas, we recommend that you obtain a copy of our HF User's Guide from our website at

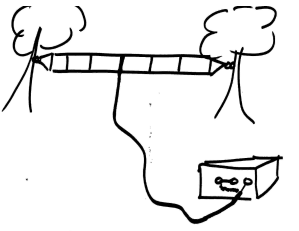
http://www.sgcworld.com/ftp/Books/hfguide.pdf

For detailed technical information about antennas, the consistently best source is the ARRL Antenna Handbook.

3.4.1 Dipoles

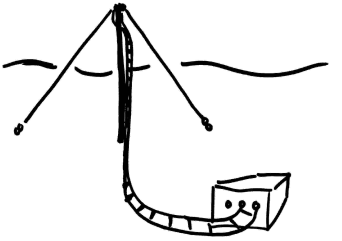


Balanced antennas are connected to the balanced line terminals on the back of the SG-211.



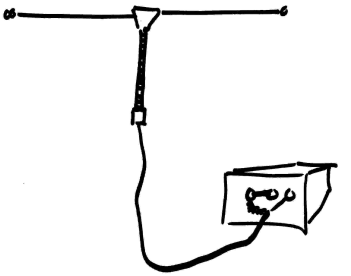
Some balanced antennas, such as the folded dipole are usually constructed with a coax feed at the center point. Simply connect your coax feed line to the SG-211 as shown.

3.4.2 The Inverted V Antenna



The Inverted-V antenna can be fed with ladder line run from the balanced line connection on the SG-211. It is also commonly fed from coaxial cable with the center conductor to one side and the shield to the other.

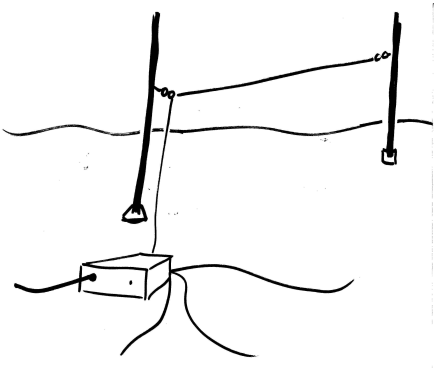
3.4.3 Dipoles with Matching Lines



Some antennas, such as the G5RV, use a section of ladder line as a matching device. The ladder line transforms the feed point impedance to something near 50 ohms at the antenna's design frequency. Usually, the ladder line terminates in a 1:1 balun. Coaxial line from the transceiver connects to the balun.

When operated away from the design frequency, these antennas need a tuner such as the SG-211 to match the coaxial line from the transceiver. The SG-211 can be used with either coaxial cable on output to the balun or direct connected to the ladder line section with the balun removed.

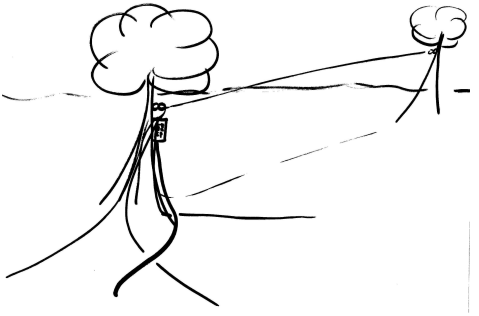
3.4.4 Long Wires & Inverted Ls



Long wire and inverted L antennas are unbalanced antennas. They are fed from the right RF Out connection directly with a single wire. The RF Ground system is connected to the Chassis Ground and that is jumpered to the left RF Out connector.

CAUTION: Unbalanced antennas are radiating from the line as soon as they leave the SG-211. Minimize the amount of wire inside the radio room to prevent interference with electronic equipment. Minimizing

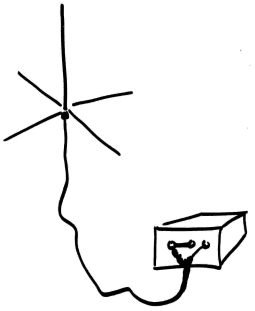
power will also minimize interference caused by this kind of antenna.



More than any other factor, a good RF ground will help to improve the radiated signal from these antennas and minimize RFI generated by the antenna.

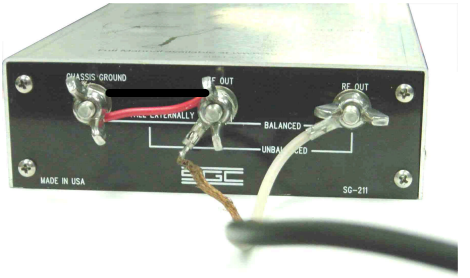
As a minimum, an RF Ground can consist of a wire 5-10% longer than the wire antenna and laid out so that it does not cross over itself or form a loop. A far better RF ground can be constructed by adding ground radials connected to the Chassis Ground connector of the SG-211.

3.4.5 Vertical Antennas

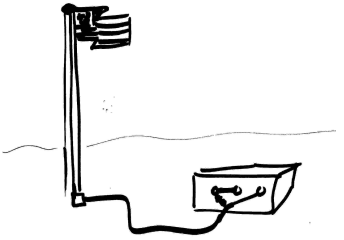


A vertical antenna may be connected to the SG-211 in a number of ways. Vertical antennas require an RF Ground system to function properly, but this may be incorporated into the design of the antenna itself.

A typical vertical antenna is the GROUND PLANE that includes radials in the design. This, and many other vertical antennas use an SO-239 connector or equivalent to feed the antenna. This type of antenna can be connected directly to the SG-239 or via a pigtail as shown below.

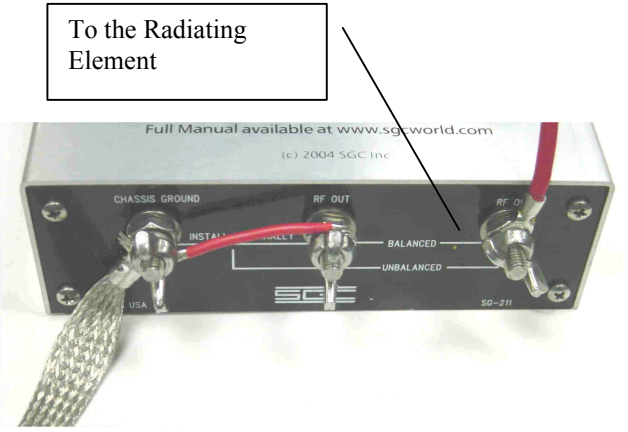


Any vertical antenna fed with Coaxial cable can be connected in this way.

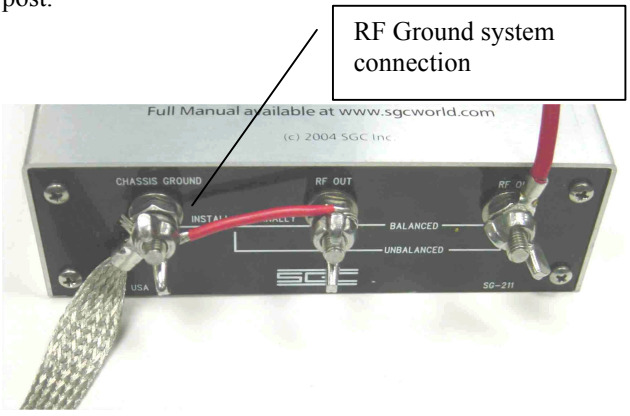


Home made vertical antennas are commonly made in one of two ways. A very common type of construction builds the radial system at the base of the antenna. Flagpole antennas are normally built in this way. Coax line can be run from the SG-211 to the base of the antenna. The center lead of the coax will feed the radiating element in the flagpole vertical while the coax shield will be connected to the RF grounding system.

Another way that a vertical can be fed is to have it fed with a wire directly from the SG-211 right-most RF hot terminal to the radiating element.



The RF ground system is connected to the Chassis ground which should be connected by a jumper to the left RF Hot post.



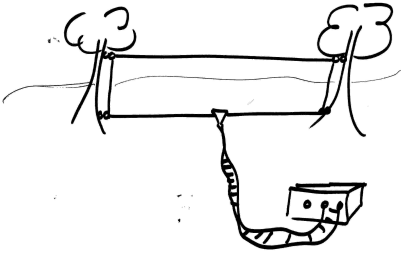
If you are using coaxial cable to connect the antenna, then the center conductor goes to the right-most RF Hot post and the braid goes to the left most which is jumpered to the Chassis ground post as shown.

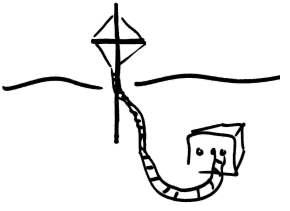
A properly installed antenna should not have RF power getting on the outside of the coaxial line.

3.4.6 Loops

Loop antennas are balanced antennas. They are very simple to feed from balanced feed line. Ideally, the SG-211 will be at the loop feed point, but when it must be at some distance from the feed point, balanced feedline will tolerate the SWR better between the antenna and the SG-211 than will coaxial cable. A loop is connected to the SG-211 at the two RF Out connectors.

Loops can be conveniently arranged either horizontally or vertically. The feeding arrangement is the same.





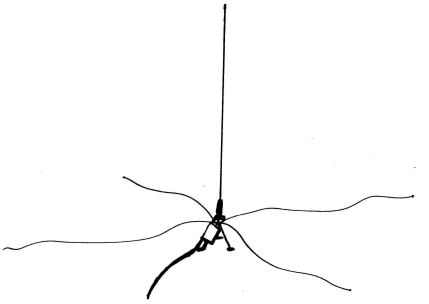
Loops can take on nearly any closed shape such as a square, rectangle, triangle, or diamond shape and they can be fed on the sides or in the corners. The effect of different configurations and feed points is well documented in the many books on antennas.

It is also possible to feed a loop from a coaxial cable by connecting one side of the feed point to the center

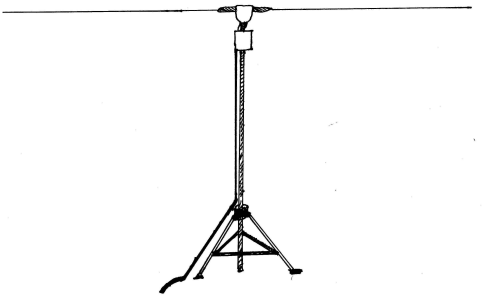
conductor and the other side of the feed point to the coax shield.

3.4.7 Portable Antennas

Portable whip antennas make excellent radiators and can be used in a number of configurations. Examples include fixed whip antennas like SGC's SG-307 whip and 10 foot collapsible whips available from a number of vendors.



One popular antenna uses a whip erected as a vertical antenna with radial wires extending from its base. There are a number of stands available commercially or a simple stand can be created with an antenna mounting and several pieces of wood.



Another antenna built using whips is a horizontal dipole with two whips, one on each side of the feed point mounted to create a balanced dipole. A pair of SG-307 whips in this configuration will be tunable from 1.8 to 60 Mhz. Ten foot collapsible whips will be tunable from 3.5 to 60 Mhz.

Representative sources for the equipment you will need to assemble one of these portable antennas are:

Tripod	Buddipole Tripod	W3FF
Mast	Buddipole Mast	W3FF
	16 Foot Buddipole Mast	W3FF
	12-30 Foot Painter's Pole	Costco Home Depot Most Hardware Stores
Tripod&Mast	6 Foot Portable Antenna Stand	MFJ
Tee Mount	Center Tee Mount	W3FF
Whips	SG-307 Helically Wound Whip	SGC
	10 & 12 Foot Extra Long Whips	MFJ
	Replacement Whips #270-1408B	Radio Shack
	AT271/A Collapsible Whip	APEX

Check the following web sites for current prices and ordering information:

APEX	Brooklyn. NY
MFJ	http://www.mfjenterprises.com
Radio Shack	http://www.radioshack.com
SGC	http://www.sgcworld.com
W3FF	http://www.buddipole.com

3.4.8 Beams

The radiating element of a beam is a dipole antenna fed with coaxial cable. Connecting a beam to the SG-211 is accomplished by connecting the coax to a coax pigtail.

3.5 Tips & Tricks

1. The most frequent source of problems in unbalanced antenna systems is the RF Ground. RF grounding is frequently misunderstood and poorly implemented. See our book The HF User's Guide available free for download from www.sgcworld.com.

2. Be aware of the difference between a SAFETY ground and an RF ground. Safety grounding is necessary to protect your life and property from coming into contact with lethal doses of electricity. RF grounds, when required, are necessary to the operation of your antenna system. Connecting the two together can inject

RF into your other electronic equipment and VICE VERSA. Your other electronics can inject RF Noise into your receiver and obliterate your received signal completely.

3. Plan your antenna installation carefully!

4. Don't commit to a final installation until you have tried out your antennas in as near to final form as possible.

3.6 References on Antennas

3.6.1 From SGC

SGC, HF User's Guide, available free from
http://www.sgcworld.com/ftp/Books/hfguide.pdf
SGC, Stealth Antenna Manual, available free from
http://www.sgcworld.com/ftp/Books/STEALTHman.pdf
SGC, Smartuners for Stealth Antennas,
http://www.sgcworld.com/ftp/Books/stealth.pdf

3.6.2 Books

Carr, Joseph, Practical Antenna Handbook, 3rd Edition,
McGraw-Hill, New York, 1998.
Hale, Bruce, Editor, The ARRL Handbook, ARRL,
Newington, Ct., 1988.
Hall, Gerald, Editor, The ARRL Antenna Book, ARRL,
Newington, Ct., 1991
Kleinschmidt, Kirk, Stealth Amateur Radio, ARRL,
Newington, Ct., 2001.

3.7 The Golden Rules of HF Installation

These rules apply to all types of stations, including base, mobile, air-borne and marine. They are very important for planning and installing your HF system, if you want to achieve good communications.

1. Install the transceiver as close to operation site and power supply system as possible (whether it is an external power supply or battery system).
2. The antenna must be installed in an open space and as far as possible from your operating point. Example: on a sailboat use the backstay as the antenna, since it is the farthest point away from the rest of the vessel.
3. The antenna coupler should be installed at the feed point of the antenna.
4. Always create your own ground with radial wire or copper straps. They are the only ones that will guarantee a solid and proper ground system.
5. All cables - power supply, control or coaxial - must always be as short as possible and/or necessary. Any excess cable should be shortened to the proper length - never coiled.

Following these rules will minimize marginal installations and problem sources such as RF feedback in the radio, power supply or cables and "hot" or RF burning microphones. If all 5 above points are followed during the

design and installation of your HF system, the operator can expect top performance. Further information regarding applications, installation and operation can be downloaded from our website www.sgcworld.com. These publications include:

- HF User's Guide
- Go Mobile at 500 Watts
- Stealth Antennas
- Smartuner Antenna Coupler Manuals

3.8 Do-it-Yourself Light Bulb Test

Any time a transmitter is used, its output must go to a load. A load is anything that the output power can be pumped into. If the transmitter is operated without a load connected, the final amplifier stage could be severely damaged. Never test a transmitter on the air for the first time if you are unsure about how to operate it or if you are unsure whether it is working properly. You could create harmful interference to other stations.

To test transmitters without actually operating into an antenna, dummy loads were created. A dummy load is a load that will dissipate the energy from the transmitter instead of emanating it into the ionosphere. Nearly all commercial dummy loads are large oil-filled cans. These dummy loads change the transmitted energy into heat, which is absorbed by the oil. Because different transmitters output different amounts of power, different sizes of dummy loads must be used. Dummy loads for typical amateur powers (<500 watts) are relatively inexpensive and are readily available.

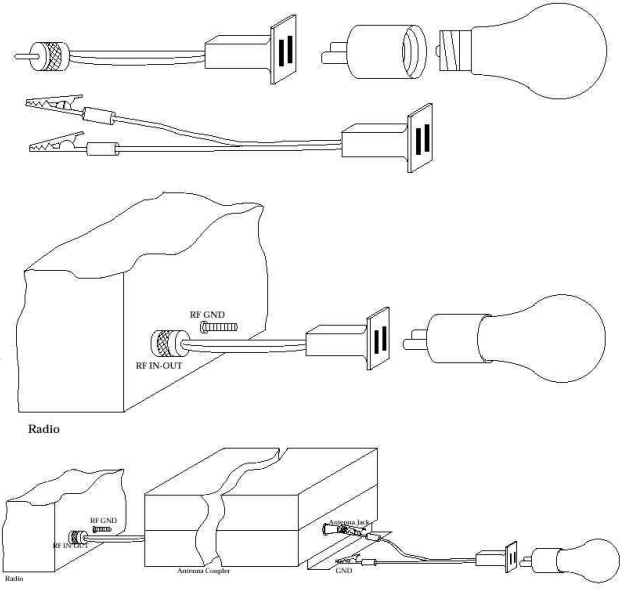
Unfortunately, when you use a can-type dummy load, you can't see "what's happening" with your transmitter. In this case, you can use a light-bulb dummy load to test your transmitter. Here, the light bulb is directly connected to the output of the transmitter and it dissipates the RF energy as light. The light bulb dummy load is more useful than the oil-can type because you can guess how much power is being output, you can see the voice modulate the SSB (the light will flicker with your voice peaks), and you can tune the transmitter for maximum out-put (if the transmitter is an older model that requires tuning).

Before building or using the light-bulb dummy load, remember that these models typically don't dissipate the transmitter's output as well as an oilcan dummy load. The result is that RF will "leak" out; we have heard a few stories of amateurs who were heard around town while operating their transmitters into a light-bulb dummy load. If you use this system, make sure that you test the equipment on a clear, harmless frequency (NEVER test with the transmitter set on an emergency frequency, such as 2182 KHz).

SGC recommends that you build the light-bulb dummy load with the following parts (although we have made one with an old light fixture and a makeshift version with just alligator clip leads and a light bulb):

- AC socket to cable with a PL-259 connector (for transceiver)
- AC socket to cable with alligator clips (needed with coupler)
- Light bulb to AC adapter
- 3 to 25 watt light bulb, 120 to 220 VAC
- 10-60 watt radio transceiver
- Any SGC Smartuner or equivalent

ATTENTION: Some retuning may take place as the impedance of the light bulb varies with the power level. If the power level is held constant with a continuous carrier such as produced by CW mode operation, the coupler setting will settle after a short period of time.



RADIO TEST PROCEDURE

1. Connect the transceiver light bulb load to the radio RF in/out jack.
2. Turn on the radio and set the CW mode.
3. Key the PTT switch on the microphone and look at the light bulb. If the light bulb load is connected and the radio is transmitting, the light should turn on.
4. Set the radio to SSB mode.

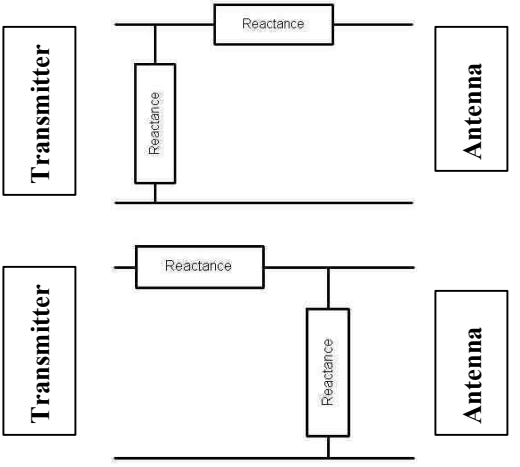
5. Key the PTT switch on the microphone and talk into the microphone. Notice that the light turns on when you talk.

COUPLER TEST PROCEDURE

1. Connect the coupler to the radio.
2. Connect coupler light bulb load to Smartuner coupler antenna out-put.
3. Turn on the radio and the Smartuner coupler.
4. Set the radio to the CW mode.
5. Key the PTT switch on the microphone and look at the light bulb. The light should turn on if the coupler has completed its' tuning cycle and if the radio is transmitting.
6. For further testing, follow steps 4 & 5 of the radio test procedure. Note: The light bulb might not turn on immediately if the coupler has not yet been tuned for the frequency of the transmitter. The output power (light-bulb brightness) is greatest when the coupler is properly tuned. This test will ensure that the radio and coupler are working properly.

4 Theory of Operation

The SG-211 tuner is built around the L network. An L network as viewed from the transceiver may be configured with the shunt reactance on the input or the output as shown below:



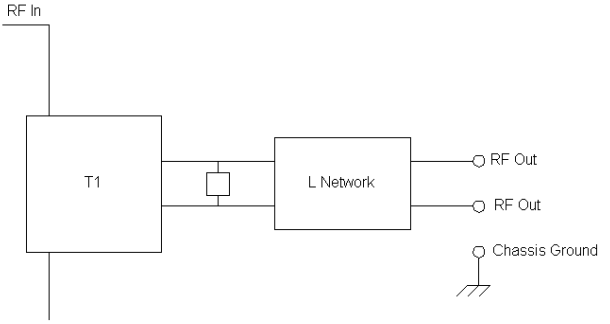
4.1 No External Power Required

The SG-211 automatic antenna tuner is unique. It requires no external source of power. This means that the unit can be located remotely without the inconvenience of additional wiring to provide power. For portable use, the antenna tuner draws no power from station batteries.

With normal use, the internal batteries have a service life that approaches the shelf life of the batteries themselves. Battery replacement will be required at intervals of five years or more. The very low average current drain is achieved by using low power latching relays that draw power only during the matching process. A very low power standby mode for the sensors and the microprocessor limits standby current to a few microamperes.

4.2 The Matching Network

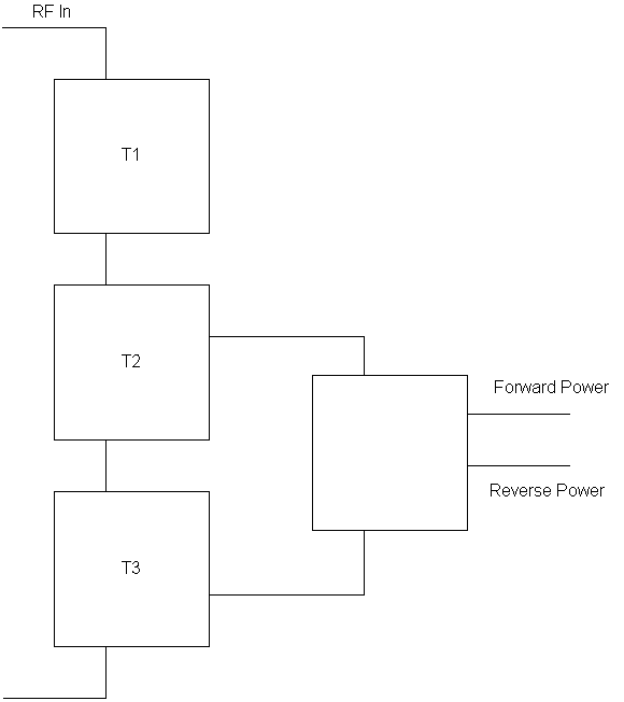
The matching network consists of a four-to-one step down transformer that also performs an unbalanced to balanced matching function. The output of the transformer T1, at12.5 ohms, serves as the input to an adjustable L network. Shunt inductor L1 across the transformer output steps down the effective impedance, especially at lower frequencies. The L network transforms the impedance up to match the complex impedance of the antenna. This is a well established matching concept in military manpack applications spanning many years.



The output of the L network can be left floating to drive balanced antennas or one side can be grounded for unbalanced antennas. Providing the balun on the input side of the network means that it is normally operated with a matched load. Locating the balun on the output side as in some other tuners, means that the balun sees much more stress with a mismatched load.

4.3 The Sensor

Transformers T2 and T3 form a directional coupler. D1, D2 and associated circuitry detect forward and reverse power that is fed to the microprocessor A/D inputs. The microprocessor wakes up when the forward power exceeds the minimum threshold. If significant reflected power is detected, the matching sequence is initiated.



4.4 The Relay Driver Matrix

Page one of the schematic diagram shows the matrix used to drive the relay coils. The latching relays have two coils; one for turn-on and one for turn-off. With 16 relays, the circuit needs to drive 32 coils. A matrix of six columns and six rows allows selection of 36 coils with only 12 microprocessor outputs.

A diode pair is associated with each coil. The series diode provides isolation necessary for proper operation of the matrix. The shunt diode prevents voltage spikes on turnoff.

Extensive capacitor bypassing is used to prevent RF from interfering with the proper operation of the matrix.

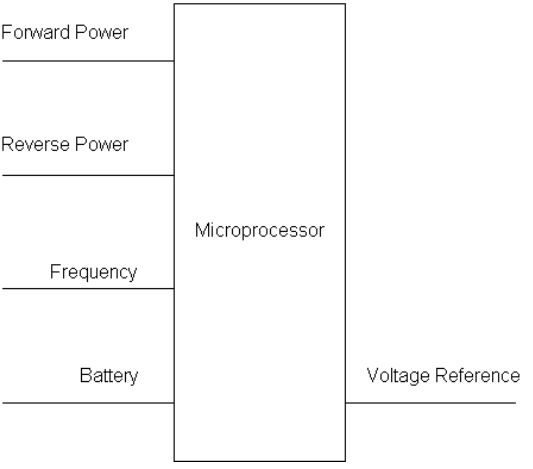
On page two of the schematic diagram transistors Q1 through Q12 provide pulldown drive for the rows and pullup drive for the columns of the matrix.

4.5 Microprocessor

A PIC flash microprocessor was selected for the very low sleep mode current drain that is key to long battery life.

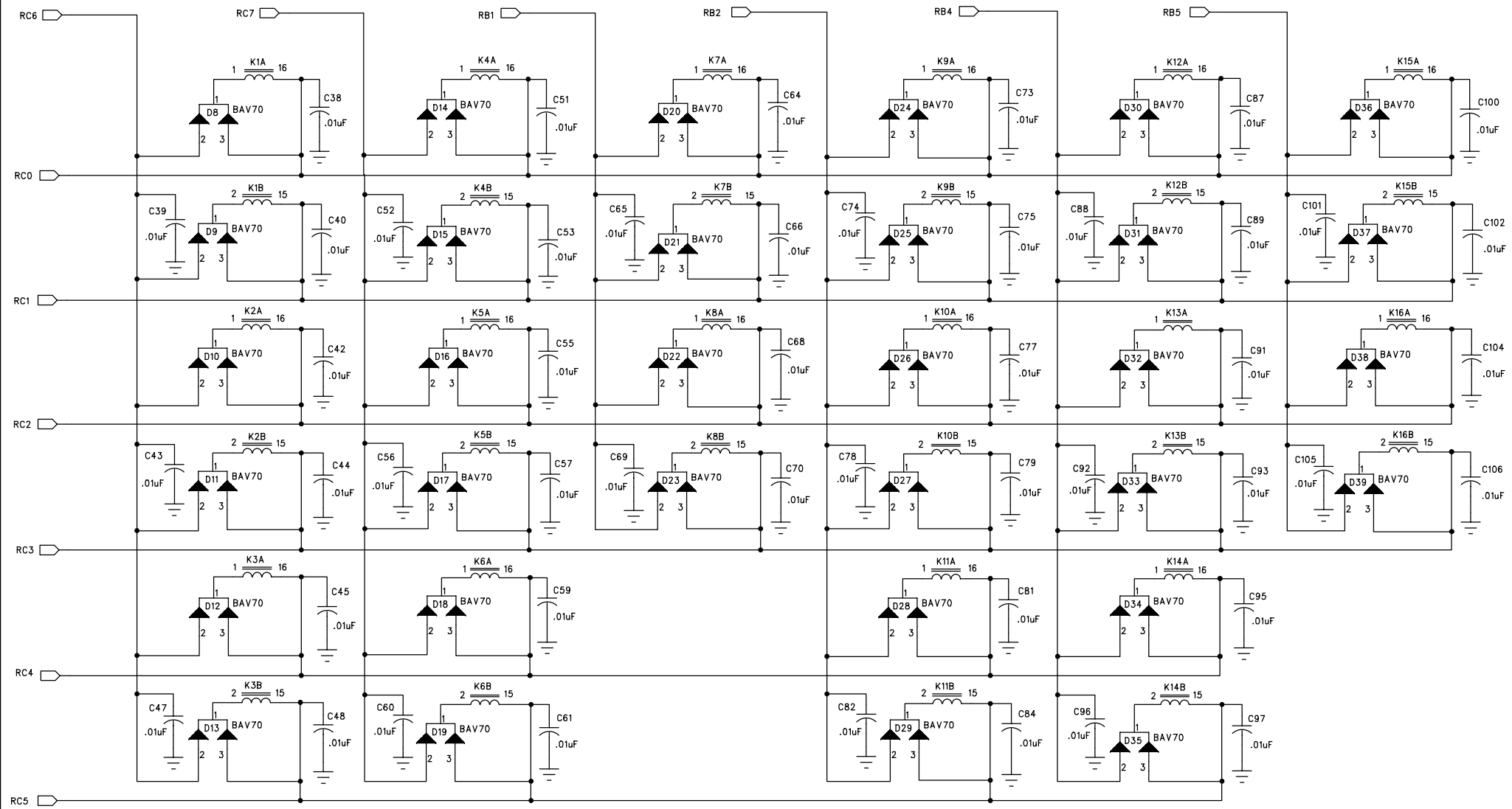
Inputs to the microprocessor are forward and reverse power, and a sample of the input signal from which the frequency is measured. The frequency measurement makes it possible for the processor to store historical values for a correct match over the frequency range. Thus, when changing frequency, the previous values are recalled, greatly speeding the matching process.

U2 provides a reference to one of the A/D inputs to measure battery voltage. The processor flashes LED DS1 when a low battery condition is detected.



Because a flash programmable microprocessor is used, software can be changed without removing the processor or proms. J1 provides connection to the programmer for this purpose.

Since the processor is dormant except during the actual matching process, the possibility of generating RF interference in the receiver is eliminated.



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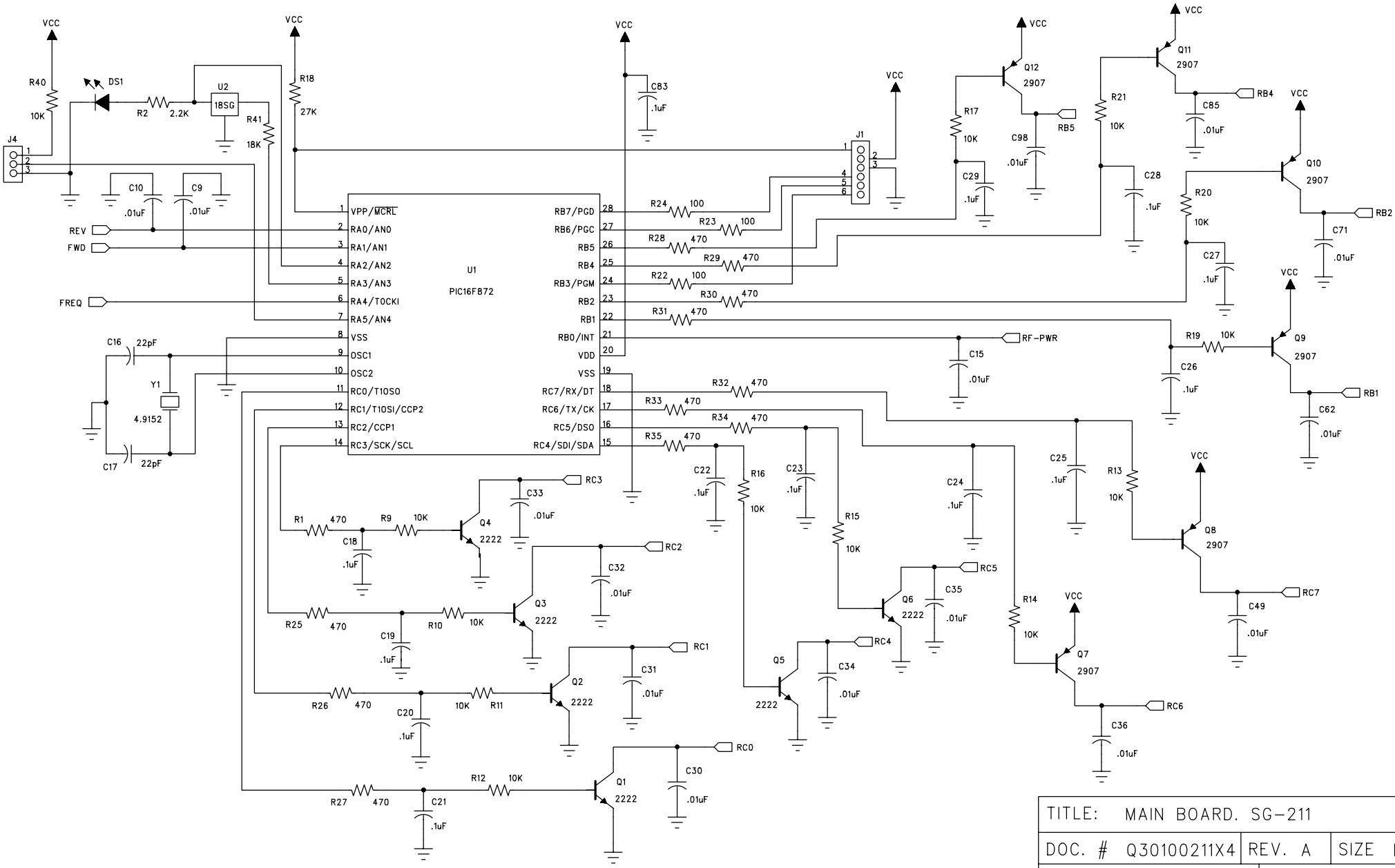
DOC. # Q30100211A	REV. A	SIZE B
DATE: 1/15/2004	PAGE 1 OF 3	



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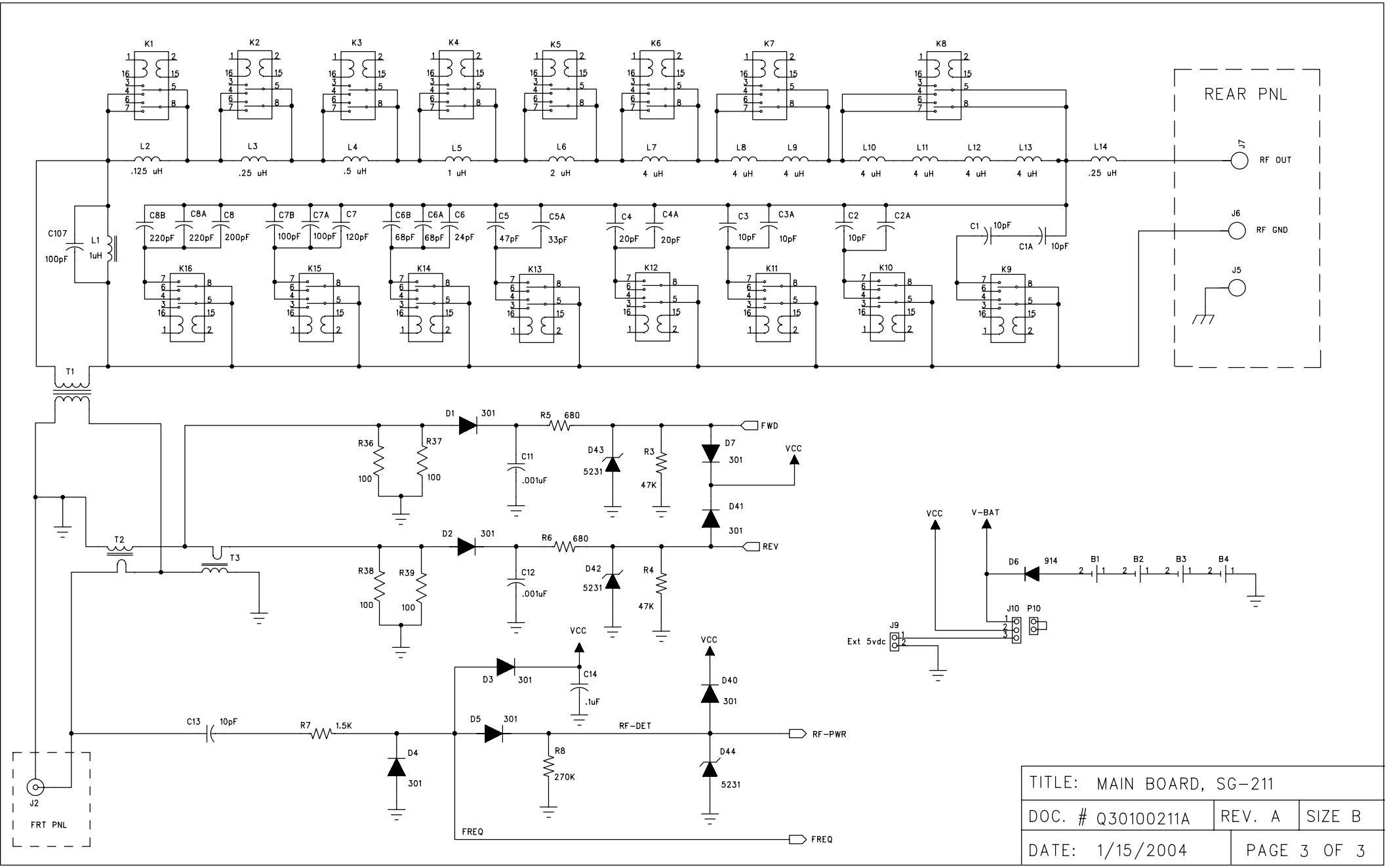

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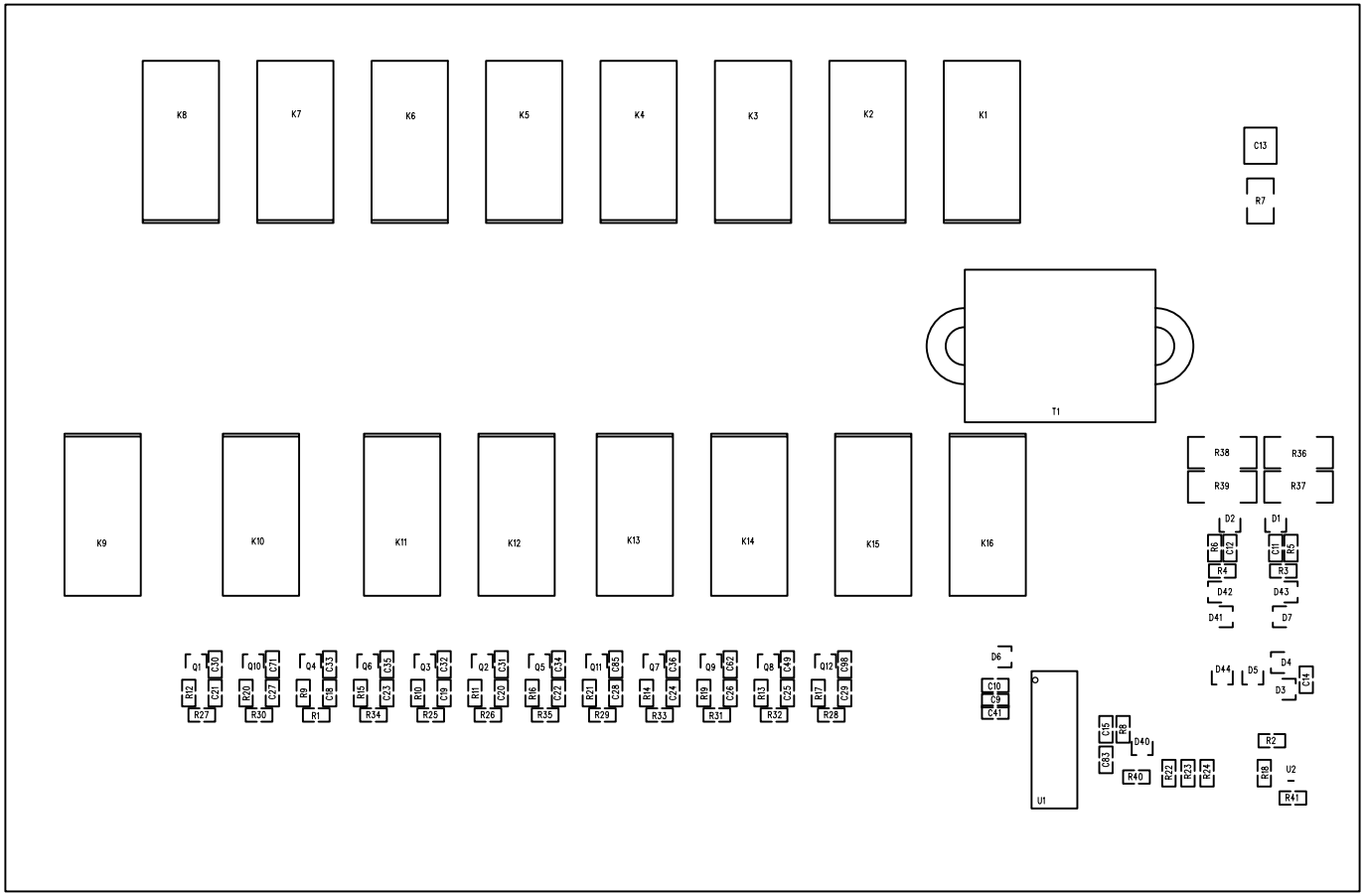
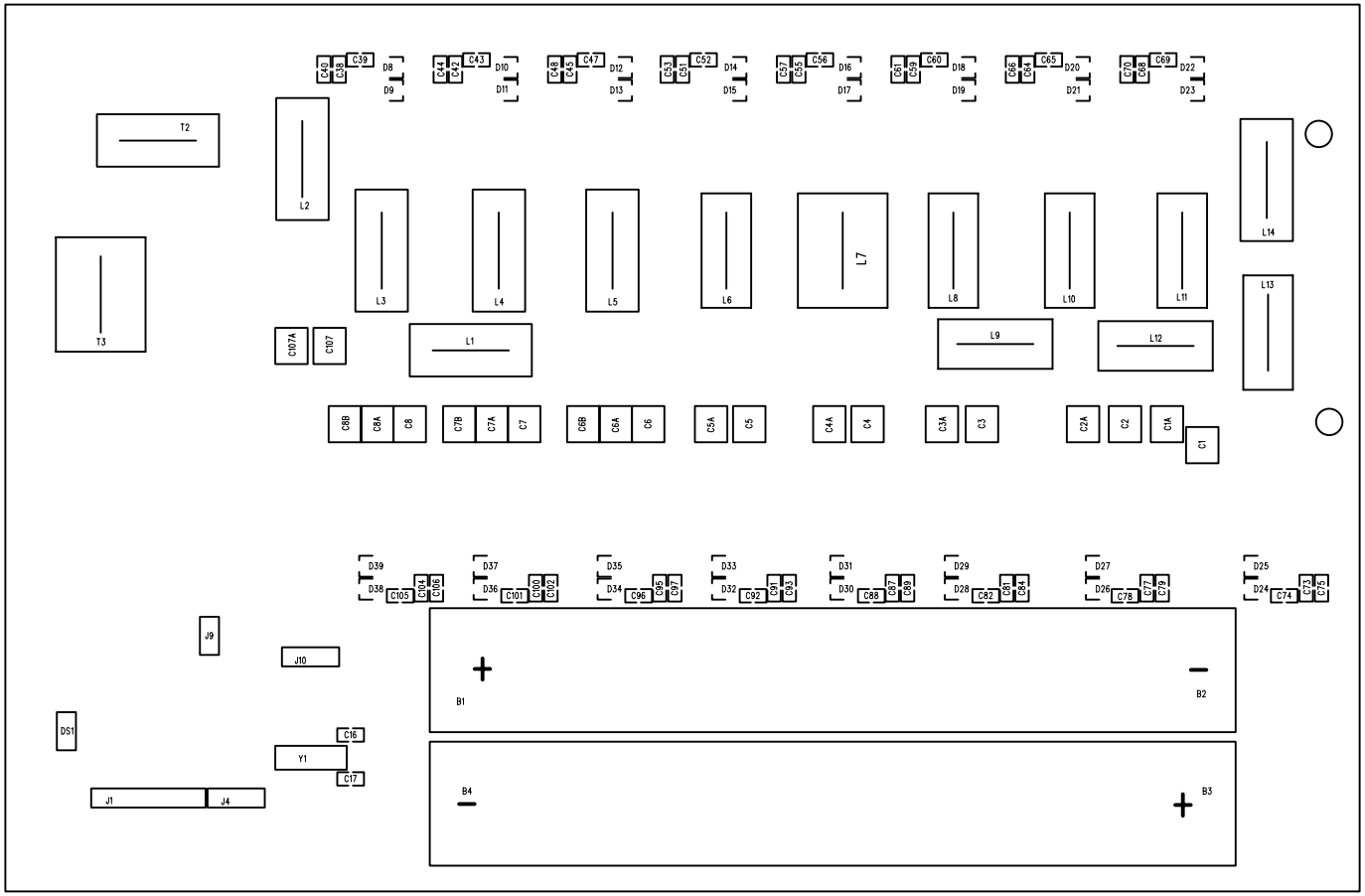

K8
K7
K6
K5
K4
K3
K2
K1
C13
R7
T1
K9
K10
K11
K12
K13
K14
K15
K16
R38
R36
R39
R37
D2
D1
R6
C52
C51
R5
R4
R3
D42
D43
D41
D7
Q1
C30
R2
C21
R27
Q10
C70
R20
C27
R30
Q4
C53
R9
C8
R1
Q6
C55
R15
C23
R34
Q3
C32
R10
C9
R25
Q2
C31
R11
C20
R26
Q5
C34
R6
C22
R35
Q11
C65
R21
C28
R29
Q7
C56
R14
C24
R33
Q9
C62
R19
C26
R31
Q8
C49
R13
C25
R32
Q12
C66
R17
C29
R28
D6
C10
C9
C41
U1
D44
D5
D4
D3
C14
C65
R8
D40
C63
R40
E22
E23
E24
R2
R38
U2
R41


C40
C39
D8
D9
C44
C42
C43
D10
D11
C48
C45
C47
D12
D13
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C52
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C107
C8B
C8A
C8
C7B
C7A
C7
C6B
C6A
C6
C5A
C5
C4A
C4
C3A
C3
C2A
C2
C1A
C1
D39
D38
C105
C104
C106
D37
D36
C101
C100
C102
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D27
D26
C78
C77
C79
D25
D24
C74
C73
C75
J9
J10
B1
B2
DS1
C16
Y1
C17
B4
B3
J1
J4

7 Standard Warranty

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

You have purchased an SGC equipment 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 (a) modify or adapt SGC's software or to merge it into another program (b) reverse engineer, disassemble, or otherwise attempt to discover SGC's software source code or © sub license or otherwise transfer SGC's software for any use other than operating the product originally purchased from SGC.

Description	SG-239	SG-237	SG-230	SG-231	SG-235
HF Frequency Range	1.8 - 30MHz	1.8 - 60MHz	1.6 - 30MHz	1 - 60MHz	1.8 - 30MHz
Power Input Range (PEP watts)	1.5-200	3-100	3-200	3-100	3-500
Continuous CW Power (watts)	80	40	80	60	200
Input Impedance Range (ohms)	45-55	45-55	45-55	45-55	45-55
VSWR (Typical)	<2:1	<2:1	<2:1	<1.4:1	<1.4:1
DC Input Requirement (VDC) Nominal	13.8	13.6	13.6	13.6	13.6
DC Operating Range (VDC)	10 to 18.5	10 to 18	10 to 18	10 to 18	10 to 18
Input Current (average amps)	0.23	0.3	0.9	0.5	1.4
Random Set Times (seconds)	<2	<4	<2	<4	<2
Recurrent Set Times(millisec)	<10	<10	<10	<10	<10
Non-Volatile Memory Addresses	170	170	170	170	170
Total combinations using all elements	1/8 million	half million	half million	four million	half million
Antenna Length operating higher than 3.3 MHz	40 feet min.	8 feet min.	8 feet min.	8 feet min.	50 feet min.
Antenna Length operating from the lowest frequency to 3.3 MHz	100 feet min.	28 feet min.	23 feet min.	23 feet min.	315 feet min.
Elements configuration	Pi & L	Pi & L	Pi & L	Pi & L	Pi & L
Input Capacitance minimum	50pf	50pf	100pf	50pf	100pf
Input Capacitance maximum	3150pf	6400pf	6400pf	6400pf	6400pf
Inductance minimum	0.25µH	0.125µH	0.25µH	0.125µH	0.125µH
Inductance maximum	15.875µH	32µH	64µH	64µH	32µH
Output Capacitance minimum	50pf	12.5pf	25pf	12.5pf	12.5pf
Output Capacitance maximum	740pf	200pf	800pf	400pf	400pf
Installation	Any position	Any position	Any position	Any position	Any position
Operating Temperature (Celsius)	-35C to +70C	-35C to +70C	-35C to +70C	-35C to +70C	-35C to +70C
Environmental	None	Waterproof at immersion of two feet, half hour	Waterproof at immersion of two feet, half hour	Waterproof at immersion of two feet, half hour	Waterproof at immersion of two feet, half hour
Size Overall (inches)	7.5Dx6Wx1.85H	6Dx7Wx1.5H (5.5x6x1.7 PCB Only)	16Dx12Wx3H	11.5Dx9.5Wx1.7H	16Dx12Wx3H
Size Overall (centimeters)	19Dx15Wx5H	22.9Dx17.8Wx3.8H	40.6Dx 30.5Wx7.6H	29.2Dx 24.1Wx4.32H	40.6Dx 30.5Wx7.6H
Weight (pounds)	2 lbs.	<2	8	3.8	8
Weight (kilos)	.75 kg	<0.75	3.5	1.6	3.5
Case Construction	Aluminum Case	Plastic ABS Waterproof metal base	Plastic ABS Waterproof case	Plastic ABS Waterproof case metal base	Plastic ABS Waterproof case
Cable(s) (NOTE: All couplers require RF and 12 volt lines only. SGC cables are required for additional features only.)	Terminals	SGC cable, 9 feet coaxial and two power wire input, and RMT tune and SmartLock wire.	SGC cable, 9 feet coaxial and two power wire input, and RMT tune and SmartLock wire	10 feet RG-58 power cable, 10 feet RG-58 coax cable with PL259 connectors	SGC cable, 9 feet coaxial and two power wire input, and RMT tune and SmartLock wire.

A Perfect Complement to the SG-211 The SG-2020

Use it at your base or in your backpack or travel bag. The SG-2020 goes where you want to go!

Specifications

Operating Modes	USB, LSB and CW
Frequency Range	1.8-29.7 MHz
Dimensions	7.25"L x 6"W x 2.75"H 18.5cm x 15cm x 7cm
Approximate Weight	4.5 lbs. (2kg)
DC Voltage	10-18 VDC
Total current (receive)	Typical 400mA
Transmitter power	Adjustable from 0-20W PEP

All the Power you'll need for base, backpack or business travel

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