AMT5000

Low Power AM Broadcast Radio Transmitter Kit

Assembly and Operating Instructions

Instruction Manual Revision: R1
PCB 5000-03
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SSTRAN
Dedicated to Quality Engineering

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Change History

Rev R1 Changes:

- Added ware ties to Parts List

1 Getting Organized

This manual provides step-by-step assembly instructions to help you complete your kit with the least possible chance for error. Keeping your parts, tools and work area organized will further reduce the chance for error and keep you from getting frustrated looking for a part or tool.

Inventory and Organize Your Parts

Unpack your kit carefully and check each part against the parts list in section 2, "Parts List". Refer to section 17, "Component Identification", for help with identifying parts. During your inventory, put a check mark in the box next to each part in the Parts List.

Some parts, such as resistors and ceramic capacitors, are marked only with color codes or numeric codes. Other parts, such as transistors, voltage regulators and integrated circuits are marked with part numbers. A generic part number shown in the parts list may not correspond exactly with what you see on a component. However, the generic part number will appear somewhere within the sometimes longer part number on the component. For example, a 74HC40103 (generic part number) integrated circuit may be marked as CD74HC40103E. The generic number is embedded in the actual part number along with varying prefixes and suffixes, which can be ignored.

If there are missing or damaged parts, e-mail support@sstran.com, and we will send you a replacement. Describe the part completely in your e-mail. Include the Reference Designator, Value, Part Marking, and Description from the parts list. Also, include your name and mailing address.

Tools You Will Need

You will need a few inexpensive tools to assemble your kit:

- a low-wattage (15 - 25 watt) or temperature controlled pencil-type soldering iron with a small diameter tip
- small gauge electronic solder, .032" (.81 mm) or smaller diameter flux-core for use in electronic assembly
- small long-nose pliers
- flush-cutting wire cutters
- wire insulation stripping tool (a sharp knife is an acceptable substitute)
- solder removal tool
- small screwdriver with an approximately .1" (2.5mm) wide blade
- No. 1 Phillips screwdriver
- Inexpensive digital multimeter to measure DC voltage with range capability to display d.ddd V resolution

If you don't have one or more of these tools you can purchase them at your local Radio Shack or Home Depot store or from a mail-order electronics supplier such as www.mouser.com or www.digikey.com. Here are some examples from the Radio Shack at www.radioshack.com and Home Depot at www.homedepot.com.

Radio Shack catalog # 64-2051. **"**15-Watt with Grounded Tip. Good choice for integrated circuit work." -- It is important that your soldering iron have a small diameter tip like this one. The best type of soldering iron is a "temperature controlled" type of any wattage rating.

Radio Shack catalog # 64-005: "Standard 60/40 formula rosin core solder. .032", 2.5 oz."

Radio Shack catalog # 64-062 : "4.5" Mini Long-Nose Pliers"

Home Depot Model # D275-5. "Klein Tools 5 in. Lightweight Flush Cutter"

Home Depot Model # 06007. "Commercial Electric 5 in. Wire Stripper and Cutter"Radio Shack Catalog # 64-069. "6-Piece Assorted Precision Screwdriver Set"Radio Shack Catalog # 64-069. "6-Piece Assorted Precision Screwdriver Set"

Radio Shack catalog #: 64-2098. “Vacuum Desoldering Tool”

Radio Shack catalog #: 22-813. “29-Range Digital Multimeter”

2 Parts List

Refer to section 17, "Component Identification" for help with parts identification. Refer to section 18, "Resistor Color Code Charts" for instructions on how to read resistor color codes.

Reference Designator	Qty	Value	Part Marking	Description
Fixed and Variable Resistors				
☐ R14	1	24 ohms	red-yellow-black-gold	1/4w carbon film res. 5%
☐ R7	1	220 ohms	red-red-brown-gold	1/4w carbon film res. 5%
☐ R6	1	820 ohms	gray-red-brown-gold	1/4w carbon film res. 5%
☐ R20	1	1K ohms	brown-black-red-gold	1/4w carbon film res. 5%
☐ R11	1	1.5K ohms	brown-green-red-gold	1/4w carbon film res. 5%
☐ R15,R33	2	3K ohms	orange-black-red-gold	1/4w carbon film res. 5%
☐ R22	1	4.7K ohms	yellow-violet-red-gold	1/4w carbon film res. 5%
☐ R21	1	5.1K ohms	green-brown-red-gold	1/4w carbon film res. 5%
☐ R17	1	6.2K ohms	blue-red-red-gold	1/4w carbon film res. 5%
☐ R13, R27, R31	4	10K ohms	brown-black-orange-gold	1/4w carbon film res. 5%
☐ R25	1	15K ohms	brown-green-orange-gold	1/4w carbon film res. 5%
☐ R10	1	24K ohms	red-yellow-orange-gold	1/4w carbon film res. 5%
☐ R4	1	33K ohms	orange-orange-orange-gold	1/4w carbon film res. 5%
☐ R12	1	39K ohms	orange-white-orange-gold	1/4w carbon film res. 5%
☐ R5	1	51K ohms	green-brown-orange-gold	1/4w carbon film res. 5%
☐ R9	1	100K ohms	brown-black-yellow-gold	1/4w carbon film res. 5%
☐ R30	1	220K ohms	red-red-yellow-gold	1/4w carbon film res. 5%
☐ R18, R24	2	1Meg ohms	brown-black-green-gold	1/4w carbon film res. 5%
☐ R	1	5.1Meg ohms	green-brown-green-gold	1/4w carbon film res. 5%
☐ R3	1	10 ohms	brown-black-black-gold-brown	1/4w metal film res. 1%
☐ R26, R29	2	100 ohms	brown-black-black-black-brown	1/4w metal film res. 1%
☐ R28, R32	2	105K ohms	brown-black-green-orange-brown	1/4w metal film res. 1%
☐ R19	1	10K ohms	10A103GA	10K ohms x 9, 10 Pin Common Bus Resistor Network.

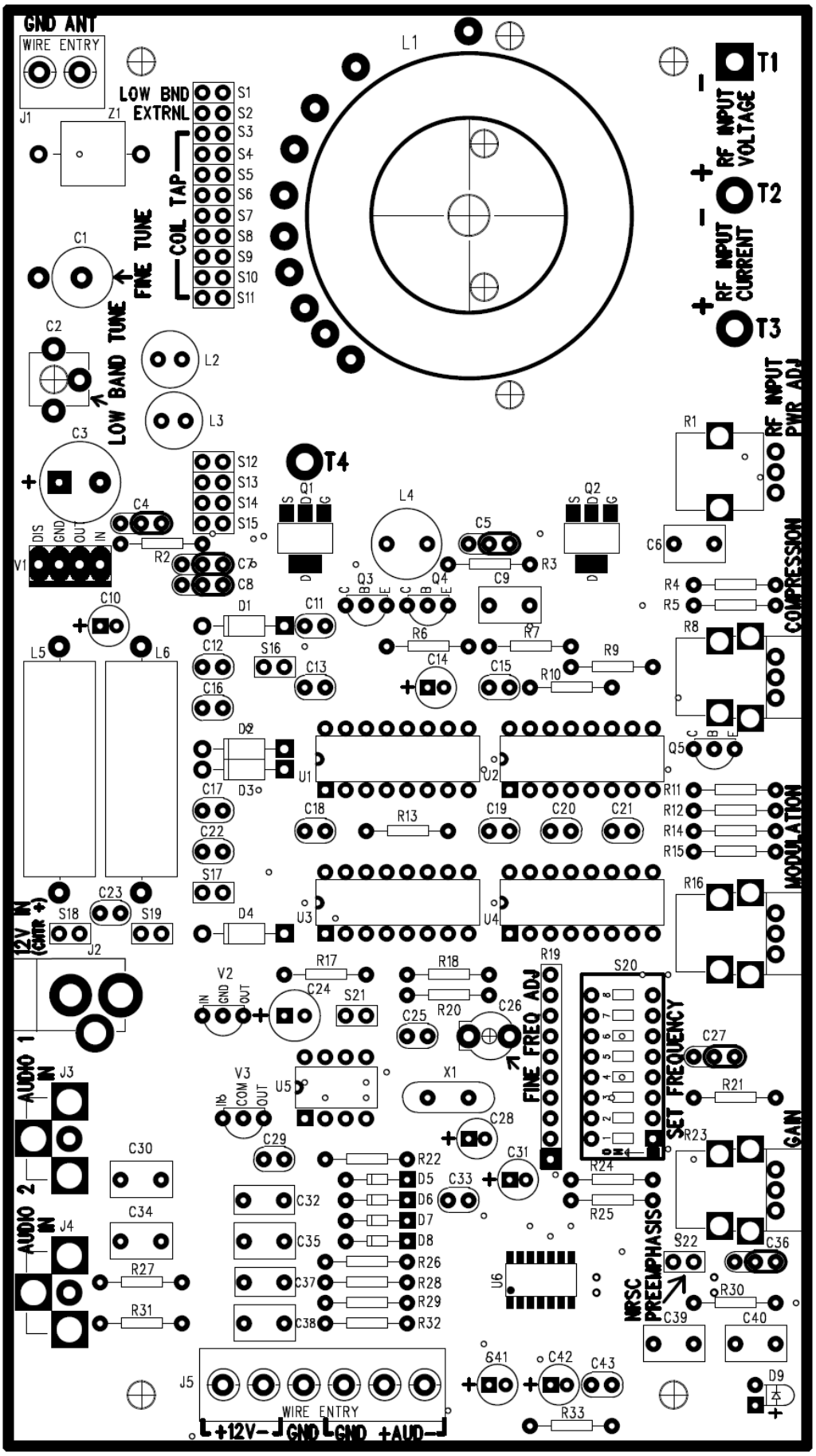
Reference Designator	Qty	Value	Part Marking	Description
Jacks, Terminal Blocks and Variable Resistors				
☐ J1	1			Eurostyle Terminal Block 5.0MM PCB MOUNT 2P
☐ J2	1			DC Power Connector 2.0mm PCB JACK CRIMPED LEADS
☐ J3	1	red		PHONO JACK R/A PCB RED
☐ J4	1	white		PHONO JACK R/A PCB WHITE
☐ J5	1			Eurostyle Terminal Block 5.0MM PCB MOUNT 6P
☐ R1	1	50K ohms	50K	Vertical PC Mount Black Shaft Snap-in Potentiometer 9mm Linear 50K
☐ R8	1	20K ohms	20K	POT 20K OHM 9MM HORZ NO BUSHING
☐ R16, R23	2	50K ohms	50K	POT 50K OHM 9MM HORZ NO BUSHING
Fixed and Variable Capacitors				
☐ C25	1	33pF	33	Multilayer Ceramic Capacitor, 50V C0G 5%
☐ C21, C43	2	180pF	181	Multilayer Ceramic Capacitor, 50V C0G 5%
☐ C8, C29	2	470pF	471	Multilayer Ceramic Capacitor, 50V C0G 5%
☐ C7	1	1500pF	152	Multilayer Ceramic Capacitor, 50V C0G 5%
☐ C27	1	1800pF	182	Multilayer Ceramic Capacitor, 50V C0G 5%
☐ C36	1	.01uF	103	Multilayer Ceramic Capacitor, 50V X7R 5%
☐ C32, C37	2	.022uF	223 or 22n or .022	Polyester Film Capacitor 50V 5%
☐ C4	1	0.047uF	473	Multilayer Ceramic Capacitor, 50V C0G 5%
☐ C5, C11, C12, C13, C15, C16, C17, C18, C19, C22, C23, C33	12	0.1uF	104	Multilayer Ceramic Capacitor, 50volts X7R 10%
☐ C6, C30, C34, C35, C38, C39, C40,	7	.47uF	.47	Polyester Film Capacitor 50V 5%
☐ C28	1	4.7uF	4.7uF	Aluminum Electrolytic Capacitor, 35V
☐ C14, C31	2	10uF	10uF	Aluminum Electrolytic Capacitor, 35V
☐ C10, C41, C42	3	47uF	47uF	Aluminum Electrolytic Capacitor, 25V
☐ C24	1	220uF	220uF	Aluminum Electrolytic Capacitor, 16V
☐ C3	1	470uF	470uF	Aluminum Electrolytic Capacitor, 35V
☐ C9 (Vacant component location)	0	-	-	No component is installed in this location
☐ C20 (Vacant component location)	0	-	-	No component is installed in this location
☐ C1	1	.6-6pf		.6-6pf Air Trimmer capacitor
☐ C2	1	3-36pf		3-36pf FILMTRIM trimmer 8mm PP
☐ C26	1	9-50		Trimmer / Variable Capacitor GREEN 9.0-50 PFD
Inductors				
☐ L3, L4	2	330uH	334	RF Inductor 330uH 10% 380mA
☐ L2	1	1000uH	105	RF Inductor 1000uH 10% 170mA

Reference Designator	Qty	Value	Part Marking	Description
☐ L5, L6	2	1000uH	1000uH	RFI Suppression Coil 1000uH .8A
☐ L1	1	336.4uH overall, 9 taps		Toroid Inductor, 336.4uH, 1.57" OD, 9 Taps, 10 Leads
Diodes, Transistors, Voltage Regulators, Surge Arrester and Crystal				
☐ D1, D2, D3, D4	4	1.0A, 100V	1N4002	Silicon rectifier diode, DO-204AL 1.0A 100V
☐ D5, D6, D7, D8,	4	0.2A, 100V	Red with black end band	Silicon small signal diode, 1N4148 or 1N914A DO-35
☐ D9	1			T-1 LED LAMP GRN 2.2V 10mA 32 mcd
☐ Q4	1		PN2907A	PN2907A TO-92 PNP Transistor
☐ Q3, Q5	2		PN2222A	PN2222A TO-92 NPN Transistor
☐ Q1, Q2 (Check circuit board for presence of pre-soldered surface-mount transistors)	2		LL014	IRLL014 power MOSFET N-Chan 55V 2.0A SOT-223
☐ V1	1		78R12	KA78R12CTU Low Dropout Regulator 1A Fixed 12V LDO
☐ V2	1		78L05	L78L05 TO-92 +5V 0.1A VREG
☐ V3	1		2426	TLE2426 PRECISION VIRTUAL GROUND
☐ X1	1		4.000000 (Used in model AMT5000) **OR** 3.6000 (Used in models AMT5000-9K and AMT5000-9KNT)	HC-49U Microprocessor Crystal 4.0 MHZ 20pF **OR** HC-49U Microprocessor Crystal 3.6 MHZ 20pF
☐ Z1	1		1000	Gas Plasma Arrester 2 Electrode 8x8mm high voltage, 1000V, 10KA
IC Sockets, DIP Switch, and Integrated Circuits				
☐ IC sockets for U1, U2, U3, U4	4			16 PIN DIP Sockets
☐ IC socket for U5	1			8 PIN DIP Socket
☐ U1, U4	2		74HC40103	74HC40103
☐ U2	1		74HC4046A	74HC4046A Phase-Locked Loop
☐ U3	1		74HC4060	74HC4060 14-Stage Ripple Binary Counter price per 250
☐ U5	1		1200	THAT 1200P08-U 0dB Gain Difference Amplifier High-CMRR Bal Input Line Rec. DIP-8
☐ U6 (Check circuit board for presence of pre-soldered surface-mount IC)	1		SSM2166A	SSM2166A Microphone Preamplifier with Variable Compression & Limiting 14-pin SOIC surface mount
☐ S20	1			8 Pos DIP switch
Miscellaneous				
☐ S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S22 (20 strip header pairs plus 1 spare pair)	21			Two-Row, Straight, .100" Pin Strip Headers..

Reference Designator	Qty	Value	Part Marking	Description
☐ S21 (Vacant component location)	0	-	-	No component is installed in this location
☐ Various per instructions (Strip header jumper plugs)	12			2-Position Jumper
☐ Control Knobs	3			Black .50"D X .61"H Plastic Knob
☐ Enclosure PC board mounting screws	4			Pan Head Phillips Screw Type B #4 X 1/4"
☐ Enclosure bottom pads	4			Plastic self-adhesive protective pads.
☐ Nylon wire ties	2			Nylon wire tie, 4"Lx0.1"W
☐ Enclosure bottom section	1			Enclosure bottom 8.08X4.26X.400 Color: bone
☐ Enclosure top section	1			Enclosure top 8.08X4.26X1.150 Color: bone
☐ Enclosure front panel	1			Enclosure Front Panel 7.755X1.307, Color: black, with white printing
☐ Enclosure rear panel	1			Enclosure Rear Panel 7.755X1.307, Color: black, with white printing
☐ Enclosure screws	2			Pan Head Phillips Screw Type B #4 X 3/4"
☐ Antenna Wire	1			White wire, 22AWG, 7/30 stranded, PVC, 118 in. (2.99 m)
☐ Ground Wire	1			Black wire, 22AWG, 7/30 stranded, PVC, 6 ft. (183 cm)
☐ PC Board	1		5000-03	7" x 3.9" printed circuit board with 3 surface-mount components pre-soldered
☐ AC Adapter	1		Input: 120VAC Ooutput: 12VAC	12VAC 500mA 2.1MM F AC Adapter

3 Circuit Board Component Locations

The top of the circuit board is screen printed with component outlines and component reference designators to assist you with finding where to insert parts and which way to orient certain parts that must be inserted in a specific direction. The reference designator numbers begin at the top left corner of the board and increment from left to right across the board along each row of components which are spaced on a 0.1 inch grid. The references then continue to increment at the left in the next row of components. The highest numbered references are at the bottom right corner. This is a guideline only, since the components are not always in well defined rows and board layout revisions may have led to some components being moved.


GND ANT
WIRE ENTRY
J1
Z1
LOW BND
EXTRNL
COIL TAP
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
FINE TUNE
C1
LOW BAND TUNE
C2
L2
L3
C3
S12
S13
S14
S15
T4
Q1
Q2
L4
C4
C5
C6
R1
RF INPUT PWR ADJ
DIS
GND
OUT
IN
V1
R2
C7
C8
R3
Q3
Q4
C9
R4
R5
COMPRESSION
C10
D1
C11
R6
R7
R8
L5
L6
C12
S16
C13
C14
C15
R9
R10
C16
D2
D3
U1
U2
Q5
C17
C18
R13
C19
C20
C21
R11
R12
R14
R15
MODULATION
C22
S17
C23
S18
S19
12V IN (CHR +)
D4
U3
U4
R16
J2
V2
IN
GND
OUT
R17
C24
S21
R18
C25
R20
C26
R19
FINE FREQ ADJ
S20
SET FREQUENCY
C27
R21
GAIN
V3
IN
COM
OUT
U5
X1
C28
C29
R22
D5
D6
D7
D8
C30
C31
R23
R24
R25
AUDIO 1 IN
J3
C32
C33
C34
C35
R26
R28
R29
R32
AUDIO 2 IN
J4
R27
R31
C37
C38
U6
S22
C36
R30
NRSC PREEMPHASIS
C39
C40
J5
WIRE ENTRY
+12V
GND
GND
+AUD
C41
C42
C43
R33
D9
T1
RF INPUT VOLTAGE
T2
RF INPUT CURRENT
T3

4 Tips for Inserting and Soldering Components

Inserting Components

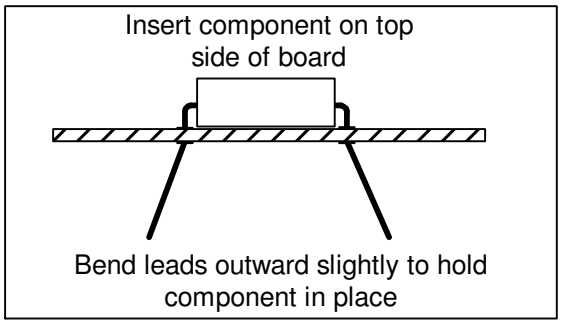
Except as noted later for transistors, all components should be mounted flush with the surface board.

All axial lead components such as resistors, inductors and diodes require the leads to be bent at right angles. Bend the leads to match the hole spacing for each component. Leads can be bent by hand by holding the component body with on hand, placing a finger of the other hand near the end of a lead and pressing down with the finger in one quick, smooth motion.

All other components such as capacitors, switches, IC sockets, controls and jacks, have radial leads or pins that do not require bending other than to straighten or align leads to fit the hole spacing.

Never force a component into the board. If a component doesn't go in easily, remove it and re-bend the leads until they match the board hole pattern.

After inserting each component that has wire leads, bend the leads outward slightly at the bottom surface of the board to hold the component flush with the board while you apply solder later.



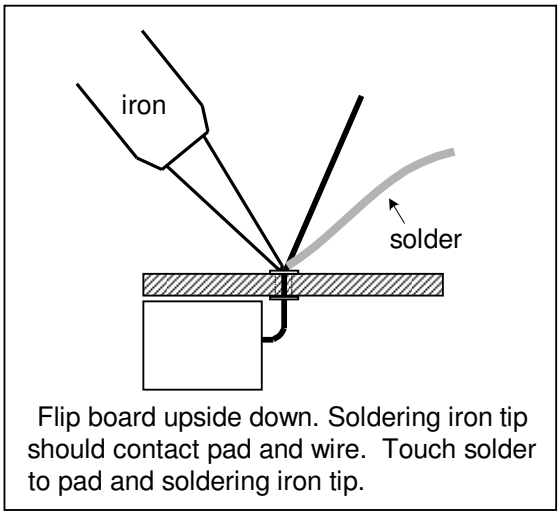
Soldering

The board has "plated-through" holes connecting the top pad to the bottom pad, so it is only necessary to solder the pads on the bottom side of the board. Assembly will go faster if you insert several components before you turn the board over for soldering.

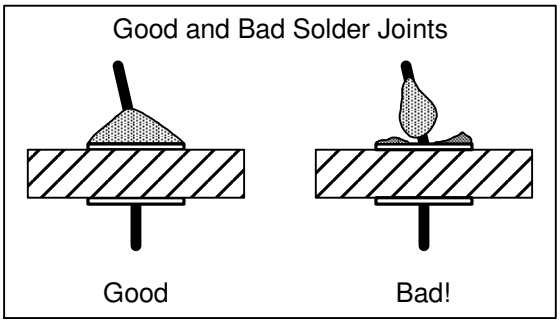
Before soldering, be sure the iron is hot. This will take a few minutes after applying power to the iron. Clean the soldering iron tip by wiping it on a slightly damp cloth or sponge. Tin the tip by melting a small amount of solder over the surface of the tip. The tip should always be shiny before soldering. It will get dull with oxidation after a few minutes. When this happens, wipe and tin the tip again.

A component lead is soldered correctly when solder flows onto both the lead and the board pad, and forms a small, shiny mound over the pad. This creates a good electrical connection. A poor solder connection will cause failure of your kit to operate properly. All components used in this kit are highly reliable. If the kit doesn't work properly, the cause is very likely to be a bad solder connection.

To solder a connection, place the soldering iron tip such that it contacts both the board pad and the lead at the same time. Feed the solder by touching the end of the solder to the soldering iron tip and pad simultaneously. Stop feeding solder when it looks like enough has melted to form a mound over the pad. Continue heating the connection for about 2 seconds after the solder starts flowing. Never heat a connection for more than 5 seconds at a time or you could damage the component or the board.

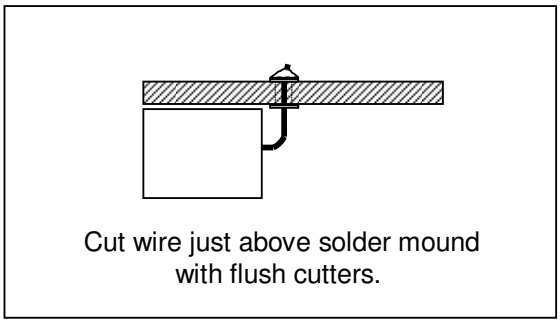


If a soldered connection doesn't look good, clean and tin the soldering iron tip again and reheat the connection while applying a little more solder.



If you accidentally apply too much solder or bridge two nearby pads on the board, use your solder removal tool to remove the excess solder. Then, re-apply a small amount of solder until the connection looks good.

After soldering, cut the wire leads just above the solder mound with your flush-cutting wire cutter. Components that mount with lugs (controls and jacks) or pins (IC sockets and DIP switches) do not require cutting.



Cut wire just above solder mound with flush cutters.

Temporary "Tack Soldering"

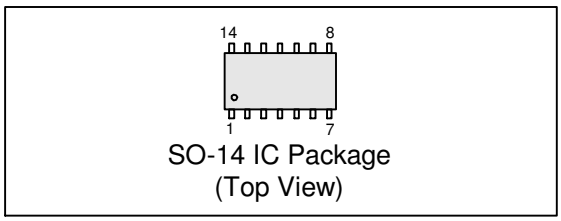
At several places in the assembly instructions, we refer to the term "tack solder". This is a technique for holding a part in place before you apply solder properly. To tack solder a lead or pin to its board pad, clean and tin your iron and then apply addition solder to the tip until a small ball forms. Immediately touch the tip to the wire and pad to get some solder flow. This is only temporary. After you solder the other leads or pins on the component, go back and re-solder the tacked pads by re-heating and adding a small amount of solder.

5 Step-by-Step Assembly Instructions

Put a check mark in the box next to each step after you complete the step. If applicable, the value marked on the component is shown in parenthesis in each step.

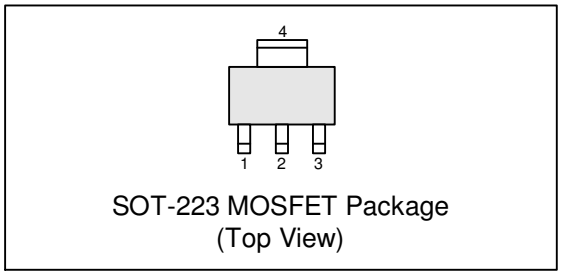
Verify Surface Mount Components

These devices are already soldered on your circuit board. There are no assembly steps required. You should look for them to verify their presence and familiarize yourself with their appearance and location.



SO-14 IC Package
(Top View)

☐ **U6 Audio Processor IC, SOIC-14 (SSM2166A), Verify already installed on PC board**



SOT-223 MOSFET Package
(Top View)

☐ **Q1 IRLL014 MOSFET transistor, SOT-223 (LL014) , Verify already installed on PC board**

☐ **Q2 IRLL014 MOSFET transistor, SOT-223 (LL014) , Verify already installed on PC board**

Fixed Resistors (5% Tolerance)

☐ **R14 24 ohms 5% (red-yellow-black-gold)**

☐ **R7 220 ohms 5% (red-red-brown-gold)**

☐ **R6 820 ohms 5% (gray-red-brown-gold)**

☐ **R20 1K ohms 5% (brown-black-red-gold)**

☐ **R11 1.5K ohms 5% (brown-green-red-gold)**

☐ **R15 3K ohms 5% (orange-black-red-gold)**

☐ **R33 3K ohms 5% (orange-black-red-gold)**

☐ **R22 4.7K ohms 5% (yellow-violet-red-gold)**

☐ **R21 5.1K ohms 5% (green-brown-red-gold)**

☐ **R17 6.2K ohms 5% (blue-red-red-gold)**

☐ **R13 10K ohms 5% (brown-black-orange-gold)**

☐ **R27 10K ohms 5% (brown-black-orange-gold)**

☐ **R31 10K ohms 5% (brown-black-orange-gold)**

☐ **R25 15K ohms 5% (brown-green-orange-gold)**

☐ **R10 24K ohms 5% (red-yellow-orange-gold)**

☐ **R4 33K ohms 5% (orange-orange-orange-gold)**

☐ **R12 39K ohms 5% (orange-white-orange-gold)**

☐ **R5 51K ohms 5% (green-brown-orange-gold)**

☐ **R9 100K ohms 5% (brown-black-yellow-gold)**

☐ **R30 220K ohms 5% (red-red-yellow-gold)**

☐ **R18 1Meg ohms 5% (brown-black-green-gold)**

☐ **R24 1Meg ohms 5% (brown-black-green-gold)**

☐ **R2 5.1Meg ohms 5% (green-brown-green-gold)**

Fixed Resistors (1% Tolerance)

☐ **R3 10 ohms 1% (brown-black-black-gold-brown)**

☐ **R26 100 ohms 1% (brown-black-black-black-brown)**

☐ **R29 100 ohms 1% (brown-black-black-black-brown)**

☐ **R28 105K ohms 1% (brown-black-green-orange-brown)**

☐ **R32 105K ohms 1% (brown-black-green-orange-brown)**

Diodes

Important: Orient diodes so the band on one end of the component is over the line on one end of the board outline.

☐ **D1 1N4002 silicon rectifier diode (large, black with white end band)**

☐ **D2 1N4002 silicon rectifier diode (large, black with white end band)**

☐ **D3 1N4002 silicon rectifier diode (large, black with white end band)**

☐ **D4 1N4002 silicon rectifier diode (large, black with white end band)**

☐ **D5 1N4148 silicon small signal diode (small, red with black end band)**

☐ **D6 1N4148 silicon small signal diode (small, red with black end band)**

☐ **D7 1N4148 silicon small signal diode (small, red with black end band)**

☐ **D8 1N4148 silicon small signal diode (small, red with black end band)**

IC Sockets

Important: Orient each socket such that the semicircular notch on one end of the socket is over the notch on one end of the board outline. If you mistakenly orient a socket the wrong way, it will still work. Don't bother trying to remove it. Just be careful later when inserting the IC to orient it according to the board outline and not the reversed socket.

Before inserting, visually check that all pins are straight. Don't force the socket into the board holes. If you feel resistance, straighten any pins that aren't aligned properly. Seat the socket against the board. While holding the socket in place with a finger, tack solder 2 diagonally opposite end pins on the bottom side of the board. Solder the remaining pins and properly solder the previously tack-soldered end pins.

☐ **U1 16-pin DIP socket.**

☐ **U2 16-pin DIP socket.**

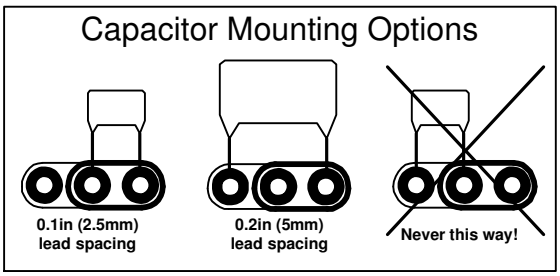
☐ **U3 16-pin DIP socket.**

☐ **U4 16-pin DIP socket.**

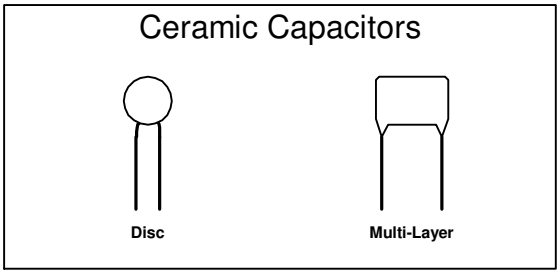
☐ **U5 8-pin DIP socket.**

Ceramic and Polyester Film Capacitor Mounting Options

Important: provision has been made to accommodate capacitors having either 0.1in (2.5mm) or 0.2in (5mm) standard lead spacing. When the component location has the three-hole symbol illustrated below, insert your capacitor into the holes that best match your capacitor's lead spacing.



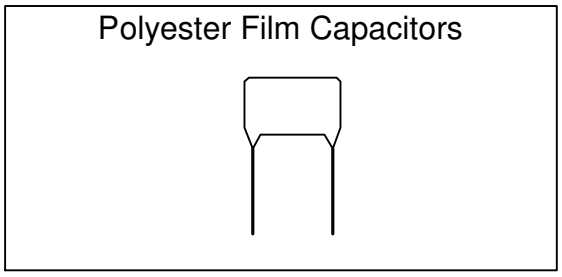
Ceramic Capacitors



The number shown in parenthesis is the value code marked on the device.

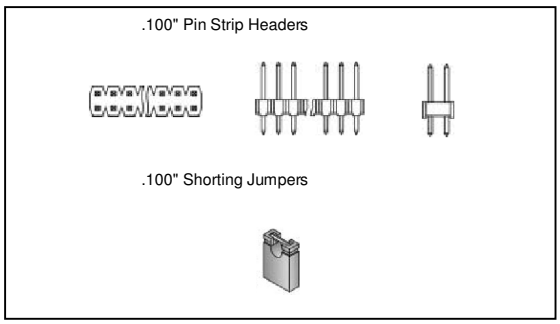
- ☐ **.C25 33 pF ceramic (33)**
- ☐ **C21 180 pF ceramic (181)**
- ☐ **C43 180 pF ceramic (181)**
- ☐ **C8 470 pF ceramic (471)**
- ☐ **C29 470 pF ceramic (471)**
- ☐ **C7 1500 pF ceramic (152)**
- ☐ **C27 1800 pF ceramic (182)**
- ☐ **C36 .01uF ceramic (103)**
- ☐ **C4 .047uF ceramic (473)**
- ☐ **C5 .1uF ceramic (104)**
- ☐ **C11 .1uF ceramic (104)**
- ☐ **C12 .1uF ceramic (104)**
- ☐ **C13 .1uF ceramic (104)**
- ☐ **C15 .1uF ceramic (104)**
- ☐ **C16 .1uF ceramic (104)**
- ☐ **C17 .1uF ceramic (104)**
- ☐ **C18 .1uF ceramic (104)**
- ☐ **C19 .1uF ceramic (104)**
- ☐ **C22 .1uF ceramic (104)**
- ☐ **C23 .1uF ceramic (104)**
- ☐ **C33 .1uF ceramic (104)**

Polyester Film Capacitors



- ☐ **C32 .022uF polyester film (223 or 22n or .022)**
- ☐ **C37 .022uF polyester film (223 or 22n or .022)**
- ☐ **C6 .47uF polyester film (474 or .47)**
- ☐ **C30 .47uF polyester film (474 or .47)**
- ☐ **C34 .47uF polyester film (474 or .47)**
- ☐ **C35 .47uF polyester film (474 or .47)**
- ☐ **C38 .47uF polyester film (474 or .47)**
- ☐ **C39 .47uF polyester film (474 or .47)**
- ☐ **C40 .47uF polyester film (474 or .47)**

Jumper Headers



The jumper headers are typically supplied as strips containing multiple header pairs, for a total of 22 header pairs. 21 will be used. One spare is included in case you damage or lose one while separating them.

First, you will need to cut the multiple-pair strips into two shorter strips containing 11 pairs and 4 pairs. Then cut the remaining strips into individual single-pair pieces.

Cutting procedure: Lay the strip on its side on a flat surface. Place the blade of a sharp utility knife in the groove separating the jumper header pairs. Hold the knife so the blade will cut vertically downward. If the blade is angled to one side, you may damage the parts. When cutting the jumper header strip, one or both parts may fly. Use two fingers to restrain the strip on both sides of the utility knife. Apply gradually increasing downward pressure until the strip snaps at the groove.

Insert the short, tinned leads into the board. The long, gold leads receive the shorting plugs (installed later). Hold the header in place vertically with a finger while tack soldering one pin on the bottom of the board. Then solder the remaining pin(s) and then reflow the tack-soldered pin.

- ☐ **S1 - S11 11-pair jumper header.**

☐ **S12 - S15 4-pair jumper header.**

☐ **S16 single-pair jumper header.**

☐ **S17 single-pair jumper header.**

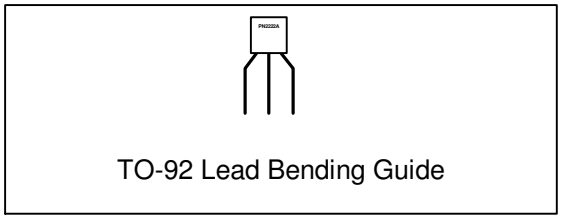
☐ **S18 single-pair jumper header.**

☐ **S19 single-pair jumper header.**

☐ **S22 single-pair jumper header.**

☐ **S21 vacant component location. No component installed**

Transistors and Small Voltage Regulators



TO-92 Lead Bending Guide

Important: All transistors and small voltage regulators have the same TO-92 package style. Because they all look alike, carefully check the part markings before insertion to get them all in the right places. Orient each component to match the board outline. Some may be packaged on a cardboard strip with the leads already formed as shown above. Simply cut the leads at the cardboard strip to remove the devices. Others may have straight leads. To form the leads as shown above, begin at the body of the component, bend the two outer leads outward 45 degrees. Then, make a second bend with pliers to match the illustration. You should be able to insert the component so that the bottom of the plastic body is about 1/8 in. or less from the board. Don't force it down. Remove and re-form the outer leads if necessary.

☐ **Q3 PN2222A NPN transistor, TO-92 package (2222A)**

☐ **Q5 PN2222A NPN transistor, TO-92 package (2222A)**

☐ **Q4 PN2907A PNP transistor,TO-92 package (2907A)**

☐ **V2 +5V voltage regulator, TO-92 package (78L05)**

☐ **V3 precision virtual ground, TO-92 package (2426)**

Large Voltage Regulator

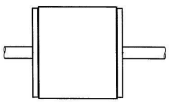
1. Vin 2. V_O 3. GND 4. Vdis

+12 Volt Regulator

Important: insert the +12 voltage regulator oriented such that the flat side of the regulator is on the same side as the wide line on the component symbol printed on the board.

☐ **V1 +12V voltage regulator (78R12)**

Gas Plasma Surge Arrester



Gas Plasma Surge Arrester

Note: before bending the leads, check the fit in both holes on the PC board. If the leads won't go in easily, hold the device vertically and rotate it back and forth while pushing down gently into the hole. This will help to clear any excess metal from the holes and allow the leads to pass easily.

☐ **Z1 gas plasma surge arrester (1000)**

Trimmer Capacitors

Trimmer Capacitors

Air Piston Trimmer Capacitor | FILMTRIM Trimmer Capacitor | Ceramic Trimmer Capacitor

Match the shape of the trimmer capacitor to the component symbol printed on the board for each trimmer. Hold each trimmer in place with a finger while tack-

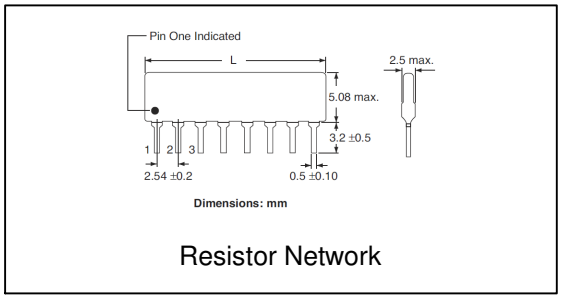
soldering one lead. Then, solder the other lead(s) and re-flow the solder thoroughly on the tack-soldered lead.

☐ **C1 .6-6pF air piston trimmer capacitor**

☐ **C2 3-36pf FILMTRIM trimmer 8mm PP**

☐ **C26 9-50 pF ceramic trimmer capacitor**

Resistor Network

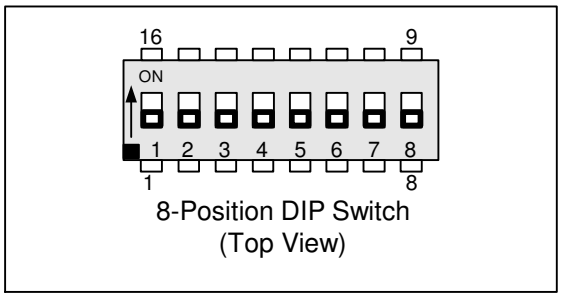


Resistor Network

Important: orient the resistor network SIP component such that the dot marking pin 1 on the component is over the pad outlined with a square on the symbol printed on the board.

☐ **R19 10K ohms x 9, 10-Pin SIP Common Bus Resistor Network (10A103GA)**

DIP Switch



8-Position DIP Switch
(Top View)

Important: Orient the switch package such that the pin-1 corner is over the square dot on the symbol printed on the board.

Before inserting, visually check that all pins are straight. Don't force the switch into the board holes. If you feel resistance, straighten any pins that aren't aligned properly. Seat the switch against the board. While holding the switch in place with a finger, tack solder 2 diagonally opposite end pins on the bottom side of the board. Solder the remaining pins and re-flow the solder thoroughly on the tack-soldered pins.

☐ **S20 8 position DIP switch**

Screw Terminal Blocks

The terminal blocks fit in the holes loosely. You can press them against the board with a finger while tack soldering the end pins, then solder the other pins and re-flow the solder thoroughly on the tack-soldered pins. Some pins (as noted below) do not have "thermal relief" solder pads and will require holding the iron on the pad for an extended period to ensure proper solder flow.

- J1 2-position screw terminal block .
- Pin 1 does not have thermal relief pad.
- J5 6-position screw terminal block.
- Pins 3 and 4 do not have thermal relief pads

Power and Audio Jacks

Important: All jacks must be seated squarely in place against the board before soldering to ensure proper alignment with the holes in the enclosure rear panel. The jacks will snap into the board holes, holding them in place adequately for soldering. When soldering all jacks, flow plenty of solder until all holes are completely filled. This will enhance reliability.

☐ **J2 Power jack**

☐ **J3 RCA phono jack with red insulator**

☐ **J4 RCA phono jack with white insulator**

Small Inductors

☐ **L3 330 uH (334)**

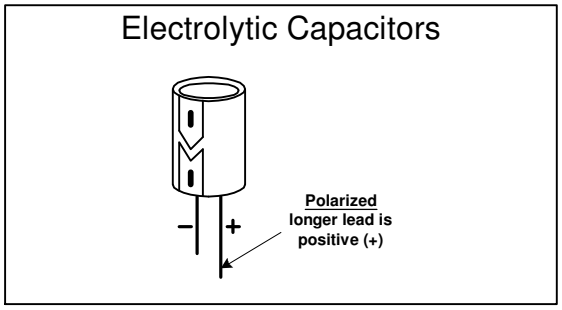
☐ **L4 330 uH (334)**

☐ **L2 1000 uH small radial-mount (105)**

☐ **L5 1000uH RFI suppression coil, larger axial-mount (1000uH)**

☐ **L6 1000uH RFI suppression coil, larger axial-mount (1000uH)**

Electrolytic Capacitors



Important: Electrolytic capacitors are polarized and must be inserted in the proper direction. The shorter negative (-) lead is on the side with the vertical stripe. The longer positive (+) lead is opposite the stripe. You must insert the longer "+" lead into the hole marked with a "+" next to the board symbol. During assembly think: "longer lead goes in "+" hole".

The number shown in parenthesis is the value marked on the device.

☐ **C28 4.7 uF electrolytic (4.7uF)**

☐ **C14 10 uF electrolytic (10uF)**

☐ **C31 10 uF electrolytic (10uF)**

☐ **C10 47 uF electrolytic (47uF)**

☐ **C41 47 uF electrolytic (47uF)**

☐ **C42 47 uF electrolytic (47uF)**

☐ **C24 220 uF electrolytic (220uF)**

☐ **C3 470 uF electrolytic (470uF)**

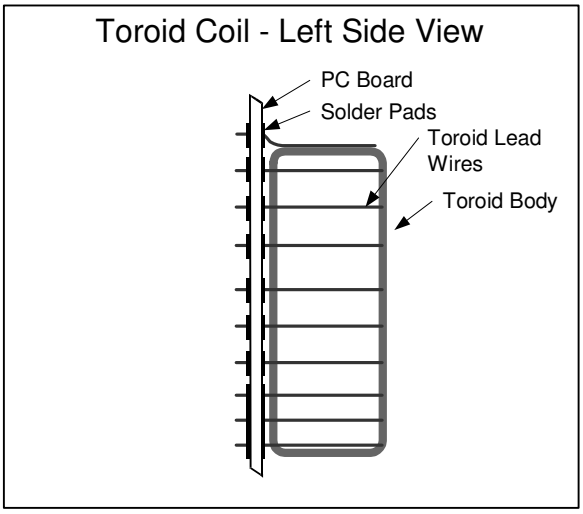
Quartz Crystal

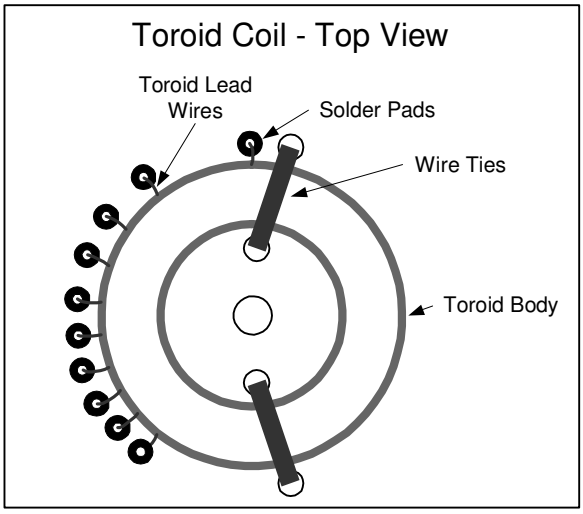
☐ **X1 4MHz microprocessor crystal for model AMT5000, 10kHz channel spacing (4.000)**

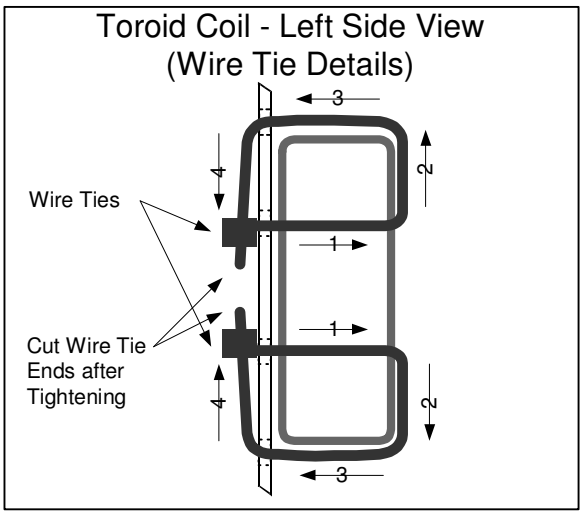
OR

☐ **X1 3.6MHz microprocessor crystal for models AMT5000-9K.. , 9kHz channel spacing (3.600)**

Toroid Inductor







Important: read the following toroid mounting instructions carefully before proceeding to install the toroid. Do not drop the toroid on a hard surface. The core is brittle and may crack if dropped.

The toroid coil has 10 wire leads emerging from the bottom. Carefully straighten all 10 wires so they point straight down form the points where they emerge from the toroid. This will align them to make insertion into the PC board easier.

Referring to the "Toroid Coil Top-View" diagram above, hold the toroid over the PC board and position the 10 leads over the 10 solder pads on the board. Starting at one end and with the toroid tilted up slightly, gently insert each lead part way into its corresponding hole. When all 10 leads have been inserted, gently move the toroid down until it rests on the PC board. If any leads don't engage their holes properly, lift the toroid as required to reposition the wires. When the toroid is resting on the board, nudge the toroid horizontally as required to position it exactly over the circular outlines on the board.

Tack solder the two end leads on the top side of the board. Then, if required, nudge the toroid again to position it exactly over the circular outlines on the board.

☐ **L1 Toroid Inductor, 1.57" OD, 9 Taps, 10 Leads**

☐ **Wire Ties (qty. 2) for holding L1 in place**

Variable Resistors

Important: like the jacks above, the variable resistors (R1, R8, R16 and R23) must be seated squarely in place against the board before soldering so they will align properly with the holes in the enclosure front panel. They will snap into the board holes, holding them in place adequately for soldering.

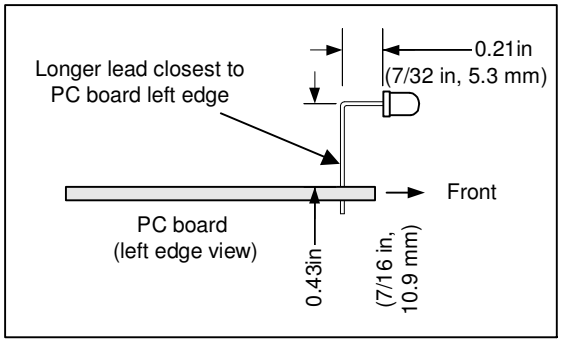
☐ **R1 50K ohms short shaft vertical mount (50K)**

☐ **R8 20K ohms long shaft horizontal mount (20K)**

☐ **R16 50K ohms long shaft horizontal mount (50K)**

☐ **R23 50K ohms long shaft horizontal mount (50K)**

LED Power Indicator Lamp

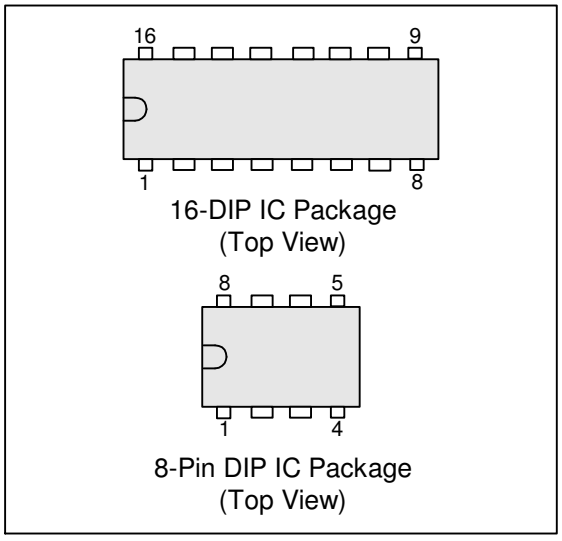


Important: the LED is a polarized device and must be inserted observing proper polarity. The longer lead must be inserted into the square-pad hole (marked "+") nearest to the left edge of the board.

To allow the LED lamp to properly engage the enclosure front panel hole, the leads must be bent as shown. The illustration above is printed actual size so you may use it as a template. Hold the LED horizontally with the LED body facing right and the longer lead facing you. Bend both leads downward at a right angle at a point .21" (7/32", 5.3 mm) from the LED body. Insert the leads into the board at location D9 with the longer lead in the hole on the "+" side of the board symbol. Slide the LED up or down in the holes until you measure .43" (7/16", 10.9 mm) from the top of the board to the bend in the leads. Tack-solder one lead on the top side of the board. Re-check the height measurement then, solder the other lead and reflow solder to the tacked lead.

☐ **D9 Green LED lamp**

Insert ICs Into DIP Sockets



Important: Integrated Circuits are static sensitive. Before handling ICs you should be sure to discharge any static electricity from your body by touching a grounded metal surface. Avoid shuffling your feet or sliding around on a chair while handling the ICs. Touch a grounded surface frequently while working with the ICs.

The ICs must be mounted in their sockets in one direction only. If they are reversed, they will be damaged when power is applied. The ICs are keyed with a notch in the top of one end and/or a dimple on top over pin 1. Align the keyed end with the notched end of the socket (which should have been mounted on the board with the notched end of the socket over the notch symbol on the board outline).

Before inserting the ICs into their sockets you must first bend the leads on each side slightly inward to engage the socket pins properly. This can be done neatly by laying the IC on its side on a flat surface and pressing downward lightly on the IC body until the bottom leads start to bend slightly. This will keep all leads in a straight line. Do this to each side equally. Straighten any misaligned pins with your fingers or small pliers. Trial fit the IC into its socket. Re-bend any pins that are still out of alignment. When you are satisfied that all pins are aligned, press the IC as far as it will go down into the socket using firm, equal pressure on both ends. If it won't go, one or more pins may not be aligned. Remove the IC and re-bend any pins as necessary. You can remove an IC from its socket by alternately prying each end slightly with a small screwdriver until it is free.

☐ **U1 74HC40103 8-bit synchronous binary down counter, 16-pin DIP (74HC40103)**

☐ **U4 74HC40103 8-bit synchronous binary down counter, 16-pin DIP (74HC40103)**

☐ **U2 74HC4046A Phase-Locked Loop, 16-pin DIP (74HC4046A)**

☐ **U3 74HC4060 14-Stage Ripple Binary Counter, 16-pin DIP (74HC4060)**

☐ **U5 8-pin THAT 1200 Difference Amplifier (1200)**

Initial Jumper Plug Installation

Install 6 jumper plugs according to the following steps. You will be changing some jumpers later during tuning, and you may change jumpers according to the information in section 10, "PC Board Jumper Options", but this will get you started for operation with the standard 12VAC wall adapter. A jumper plug is in the "shorted" or "ON" position when it is plugged onto both header pins.

Save the remaining jumper plugs in a safe place. You will need them later.

☐ **S1 Empty. No jumper.**

☐ **S2 Empty. No jumper.**

☐ **S3 Empty. No jumper.**

☐ **S4 Empty. No jumper.**

☐ **S5 Empty. No jumper.**

☐ **S6 Empty. No jumper.**

☐ **S7 Install in shorted position.**

☐ **S8 Empty. No jumper.**

☐ **S9 Empty. No jumper.**

☐ **S10 Empty. No jumper.**

☐ **S11 Empty. No jumper.**

☐ **S12 Install in shorted position.**

☐ **S13 Install in shorted position.**

☐ **S14 Install in shorted position.**

☐ **S15 Empty. No jumper.**

☐ **S16 Empty. No jumper.**

☐ **S17 Empty. No jumper.**

☐ **S18 Install in shorted position.**

☐ **S19 Install in shorted position.**

☐ **S21 Vacant. No header, no jumper.**

☐ **S22 Empty. No jumper.**

Antenna and Ground Wires

Using wire strippers, remove about 1/4" (6.35mm) of insulation from one end of the white antenna wire and one end of the black ground wire, being careful not to nick or cut any of the wire strands. Tin the wire ends by flowing a small amount of solder onto the wire ends.

☐ **J1 "GND" Terminal. Insert BLACK wire and tighten screw.**

☐ **J1 "ANT" Terminal. Insert WHITE wire and tighten screw.**

Congratulations! Your board is now fully assembled.

6 Final Checks

Your board is now fully assembled. Take a little time now to visually check your work. Here are some final inspection steps.

☐ Are all step-by-step assembly instructions checked in this manual?

☐ Are all electrolytic capacitors, diodes, transistors, voltage regulators and ICs installed in the proper direction?

☐ Visually inspect the board with a magnifying glass. Systematically examine every pad on the bottom of the. Look for: unsoldered or poorly soldered connections, wires not clipped properly, solder bridges between adjacent pads, and wires that may be bent over and touching a nearby pad.

7 Power On Check

Place the assembled circuit board on an insulated surface such as cardboard, plastic or heavy paper.

Plug the AC adapter cord into the power jack, J2.

For initial testing, string the white antenna wire out away from the board and at least a foot from any wires or conductive surfaces. The ground wire doesn't need to be connected to ground for initial testing. Just leave it rolled up near the board.

Connect an audio source such as a CD or cassette player to the audio input jacks, J3 and J4.

Plug the AC adapter into a 120-volt outlet. The green LED power indicator should light up.

Follow the procedures in section 8, "RF Tuning" and section 9, "Audio Adjustments" to verify the unit is operational.

8 RF Tuning

First, some **very important information** about trimmer capacitors C1 and C2.

C1 is a multi-turn air-piston trimmer having an adjustment range of about 7 and 1/2 turns clockwise from top to bottom. The top position (minimum capacitance) is when the top of the tuning slug is flush with the top of the capacitor. At the bottom position (maximum capacitance), the slug will hit a stop and cannot be turned further in the clockwise direction. Do not try to turn it clockwise beyond the bottom stop or damage may occur. Do not turn the slug counterclockwise above the top position to avoid having the slug fall out and being lost.

C2 is a "single-turn" plastic film trimmer. Look closely at the side of the trimmer while rotating the shaft with a screwdriver. You will see two stacks of plates, each stack occupying one half of the trimmer circumference. One stack of plates is fixed in position and is called the "stator". The other stack of plates rotates as you turn the shaft. This stack is called the "rotor". Maximum capacitance occurs when the rotor plates are fully meshed inside the stator plates. Minimum capacitance occurs when the rotor plates are fully un-messed from the stator plates. The fully meshed to fully un-meshed positions occur in 1/2 turn of the shaft. Turning the shaft further begins meshing the rotor and stator plates until they are fully meshed again at one full turn. The full minimum to maximum capacitance adjustment range is only 1/2 turn of the shaft.

Mark a dot on C2 tuning shaft:
Take a moment to place a mark on the top of the trimmer tuning shaft with a felt tipped permanent marker at the maximum capacitance position. Rotate the shaft until the rotor and stator plates are fully meshed (maximum capacitance). Mark a dot on the top of the shaft at the point immediately adjacent to the center terminal . In the future you will know that the trimmer will be at maximum capacitance when the dot points to the center terminal and will be a minimum capacitance when the dot is 180 degrees opposite the center terminal.

Set the Operating Frequency

- Find a clear frequency between 530 kHz and 1700 kHz on a nearby AM radio receiver. The AMT5000 will perform most efficiently in the 1350 kHz to 1700 kHz range due to lower coil losses, but any frequency in the AM broadcast band can be selected.
- Find your desired frequency in the tables in section 19, "Synthesizer Frequency Selection Tables".
- Set the 8-position frequency selection DIP switch (S20) according to the table information. Use your finger nail or a small diameter plastic or wood rod to slide each of the eight switches to the specified on or off position. Avoid using a screwdriver or other metal tool to prevent damage to the plastic switch sliders after repeated switching.

Set the RF Output Tuning Range Jumpers

Referring to the tables in section 20, "RF Output Tuning Range Jumper Setting Tables", set jumpers S1 through S15 for the frequency range that includes your operating frequency.

Note: the Tuning Range charts were developed using a typical antenna capacitance of 30 pF. Your antenna will likely vary up to plus or minus 6 pF from the typical value. You may find that the best tuning range setting is one line up or one line down in the chart. You will need to experiment a little for the best jumper settings.

Set Controls to Initial Positions

- Set all three front panel audio controls fully counter-clockwise to eliminate any possible modulation which may interfere with the tuning procedure.
- Set oscillator fine tuning adjustment trimmer C26 to mid-range. The mid-range position is set when the screwdriver slot on the trimmer is aligned along a line directly from the front to the back of the PC board (front = audio controls, back = jacks)..
- Set RF INPUT PWR ADJ control, R1 to its middle position.
- Set trimmer capacitor C2 to minimum capacitance (where the marked dot is adjacent to the "C2" label).
- If operating frequency is above 1350 kHz, set trimmer capacitor C1 to minimum capacitance (where the top of the tuning slug is flush with the top of the trimmer capacitor). Otherwise, set C1 to mid-point capacitance (about 3 and 1/2 turns clockwise form top).

Peak the RF Output

Insert multimeter probes into the test point holes labeled "RF INPUT CURRENT", T2 and T3 on the board. Connect the red probe to T3 (+) and the black probe to T2 (-). Set the meter to read DC Volts with auto-ranging ON.

If you select manual mode, select the range displays d.ddd Volts.

In the following paragraph you will be adjusting ***trimmer*** C1 if operating above 1350 kHz or ***trimmer*** C2 if operating below 1350 kHz.

While watching the meter, rotate the ***trimmer*** clockwise with a small screwdriver. Allow the meter reading to stabilize after each small adjustment. You should see the reading rise to a peak and then fall off. Adjust to the peak value. The actual value is not important at this point. If you can't find the peak reading over the entire range of the ***trimmer***, double check your jumper settings and if OK, change the jumpers to select the next lower or higher tuning range until you are able to set for peak when the ***trimmer*** is not at minimum or maximum extremes.

Adjust RF Tuning Slightly for Higher Efficiency

After adjusting for the peak above, rotate C1 one full turn clockwise. This sets the tuning for good Class E mode efficiency. Don't be concerned that the current falls off when you do this. The next adjustment will compensate for the reduction.

Adjust RF Input Power to 100 mW

Take note of the RF INPUT VOLTAGE (T1-T2) and RF INPUT CURRENT (T2-T3) readings. Calculate the RF input power using the following equation:

RF input power =
RF INPUT VOLTAGE * RF INPUT CURRENT / 10

The division factor of 10 accounts for the RF INPUT CURRENT being measured as a DC voltage across the 10 ohm, 1% resistor, R3.

You probably will need to adjust the "RF INPUT PWR ADJ" control, R1 to get to 100 mW. Adjusting this control will change both the RF INPUT VOLTAGE and RF INPUT CURRENT readings, so re-calculating each time would be tedious. The table in section 21, "RF Input Voltage-Current 100 mW Equivalence Table" is included as an aid. Each time you change the R1 setting, look up the voltage and current readings in the table and make adjustments accordingly. Don't knock yourself out with this procedure. Getting 100 mW plus/minus 10% or so is OK.

Adjust Oscillator Fine Tuning Trimmer (Optional)

The crystal frequency can be adjusted by a few hundred Hz by trimmer C26 to zero out any small frequency difference between the transmitter signal and a residual signal from a distant transmitter on the same AM channel.

The initial setting at the mid-range position is adequate and will produce a signal that is within a few tens of Hz of the actual frequency. You can fine tune the frequency by adjusting trimmer C26 slightly to eliminate "fluttering" in the received signal due to "beating" of the transmitter carrier with the carrier of another station on the same frequency.

9 Audio Adjustments

Front Panel Control Functions

GAIN Control

The gain control varies the audio level feeding the SSM2166 preamplifier stage and serves to compensate for a wide range of possible audio input levels. Rotating the control clockwise increases the gain.

MODULATION Control

The modulation control sets the limiting level of the compressor/limiter . Rotating the control clockwise increases the limiting level, which in turn, increases the maximum amplitude of the audio to the modulation stage which increases the modulation percentage.

COMPRESSION Control

The compression control varies the audio compression over a range between 1:1 (no compression) and 5:1 (maximum compression). Rotating the control clockwise increases compression. Compression is analogous to AVC (Automatic Volume Control).

Audio Adjustment Procedure

Before adjusting the audio controls, be sure you have completed the tuning procedure in 8, "RF Tuning" including setting the RF input power to 100 mW.

Connect an audio source playing music that has a high average volume level. Listen on a nearby radio. Follow these steps:

- Initially set the three front panel controls as follows:
  - GAIN fully clockwise,
  - MODULATION fully counterclockwise
  - COMPRESSION fully counterclockwise

- Rotate the MODULATION control clockwise until the received signal begins to distort due to over-modulation. Back off from this point until

the distortion goes away. This is approximately the 100% modulation point.

- Rotate the GAIN control counterclockwise until you reach a point where the volume just begins to decrease significantly. At this point limiting will occur only on audio peaks.

- The COMPRESSION control may be set in any position according to your preferences. A good way to observe the effect of the Compression control is to play a classical music CD with very quiet and very loud portions. As the Compression control is rotated clockwise, you will notice that the volume of the quiet and loud portions begin to be the same.

Note: if you change the "RF INPUT PWR ADJ" above or below its original position, you will need to repeat steps 2 and 3 above The MODULATION control setting must increase for higher RF power and decrease for lower RF power.

Don't confuse over-modulation distortion with distortion that may be caused by your receiver being overloaded by the strong RF signal from the transmitter. If necessary, move the receiver farther away or reorient it to reduce the signal being picked up by it's antenna.

Your audio source level may not be high enough if you can't reach the distortion point in step 2 with both the Gain and Modulation controls in their maximum clockwise positions and the Compression control in the full counterclockwise position. You can compensate for lower level inputs by increasing the Compression. This will boost the audio signal, but since the limiting level will not be reached, there will be no prevention from over modulation on audio peaks.

10 PC Board Jumper Options

Table 10.1 Jumper Functions

Jumper	Label	Function
S1	LOW BAND	Enable trimmer C2
S2	EXTRNL	Disable all internal tuning inductors for external coil
S3	TOROID COIL TAP	Enable toroid tap 336.4 uH
S4	TOROID COIL TAP	Enable toroid tap 302.5 uH
S5	TOROID COIL TAP	Enable toroid tap 274.4 uH
S6	TOROID COIL TAP	Enable toroid tap 247.6 uH
S7	TOROID COIL TAP	Enable toroid tap 225.8 uH
S8	TOROID COIL TAP	Enable toroid tap 205.0 uH
S9	TOROID COIL TAP	Enable toroid tap 188.4 uH
S10	TOROID COIL TAP	Enable toroid tap 172.5 uH
S11	TOROID COIL TAP	Enable toroid tap 157.3 uH
S12	(none)	Disable inductor L2 1000 uH
S13	(none)	Disable inductor L3 330 uH
S14	(none)	Enable capacitor C8
S15	(none)	Enable capacitor C7
S16	(none)	*Disable rectifier diode D2(note)*
S17	(none)	*Disable rectifier diode D4(note)*
S18	(none)	Disable filter inductor L5
S19	(none)	Disable filter inductor L6
S21	(none)	(not used)
S22	NRSC PREEMPHASIS	Audio Treble Boost

(note): Caution about Jumpers S16 and S17:

Jumpers S16 and S17 must both be **OFF** except when powering from is a 12V battery, then both jumpers must be ON. Observe proper battery polarity to prevent circuit damage.

Jumper S1: LOW BAND - Enable Trimmer C2

Enable trimmer C2 for tuning the "Low Band", frequencies below 1350 kHz. See section 20, "RF Output Tuning Range Jumper Setting Tables" for setting.

Jumper S2: EXTRNL - Disable All Internal Tuning Inductors For External Coil

Normal setting is ON. Remove jumper only if you wish to use an external loading coil in series with the antenna.

Jumpers S3 - S11: Toroid Coil Taps

Select inductance tap for toroid col. See section 20, "RF Output Tuning Range Jumper Setting Tables" for settings.

Jumper S12: Disable inductor L2 1000 uH

When jumper is ON, it shorts across inductor L2 to remove L2 from the tuning circuit. See section 20, "RF Output Tuning Range Jumper Setting Tables" for settings.

Jumper S13: Disable inductor L3 330 uH

When jumper is ON, it shorts across inductor L3 to remove L3 from the tuning circuit. See section 20, "RF Output Tuning Range Jumper Setting Tables" for settings.

Jumper S14: Enable capacitor C8

When jumper is ON, capacitor C8 is connected from Q1 drain to ground for optimizing Q1 voltage and current waveforms for Class E mode.

Jumper S15: Enable capacitor C7

When jumper is ON, capacitor C7 is connected from Q1 drain to ground for optimizing Q1 voltage and current waveforms for Class E mode.

Jumpers S16 and S17: Disable rectifier diodes D2 and D4 for powering from 12V battery

S16 and S17 should be either both ON or both OFF, never mixed. Install these jumpers only if you are powering your AMT5000 from a 12 battery (minimum standard lead-acid or gel nominal voltage of 12.5 VDC). These

jumpers short across rectifier diodes D2 and D4, eliminating the approximately 1.6 V drop caused by the diodes.

Important: be sure to carefully observe battery polarity to prevent circuit damage.

Jumper S18 and S19: Disable filter inductors L5 and L6

L5 and L6 provide and inductive RF filter at the power input terminals. These can help to reduce RF conducted emissions from the AC power wiring. It is recommended to bypass these inductors by installing jumpers S18 and S19.

A Word About AC Building Wiring Interference Problems

RF isolation of the transmitter ground from the AC building wiring may be of benefit if you experience hum induced on the transmitted signal due to interaction of the transmitted RF field and the AC building wiring. The RFI suppression coils (L5 and L6) may optionally be inserted in series with the AC wall adapter. With the coils enabled (not shorted by jumper plugs), you must connect the transmitter black ground wire to an earth ground or the transmitter will not function properly. Before you use the isolation option to reduce possible hum, thoroughly check your audio source connection for hum problems in the audio feed.

In general it is better to operate without RF ground isolation since your transmitter range will generally be farther without RF ground isolation due to the AC wiring acting as part of the antenna.

Jumper S22: NRSC PREEMPHASIS - Audio Treble Boost

Installing jumper plug S22 in the shorted position will add about 9.5 dB of treble boost to the audio with the midpoint of the boost curve at 1.7 kHz and maximum boost at 10 kHz. With jumper S22 removed, audio response be flat. The treble boost curve is similar, but not the same as the standard 75 uS NRSC boost curve. The boost mid-point is at 1.7 kHz instead of 3.5 kHz specified in the NRSC curve and there is no abrupt cutoff above 10 kHz.

Since treble boost occurs after the SSM2166 compressor/limiter, you will probably need to readjust the modulation control counterclockwise somewhat to prevent over-modulation distortion at the boosted higher audio frequencies.

If you want to use an external audio processor or audio equalizer, remove this jumper (Treble Boost OFF, flat response).

11 Mounting the Board in the Enclosure

First locate all enclosure parts:

- 3 control knobs, black .50"D X .61"H plastic knob
- 1 enclosure bottom section, 8.08 X 4.26 X .400 color: bone
- 1 enclosure top section, 8.08 X 4.26 X 1.150 color: bone
- 1 enclosure front panel, 7.755 X 1.307, color: black, with white printing
- 1 enclosure rear panel, 7.755 X 1.307, color: black, with white printing
- 2 enclosure screws, pan head Phillips screw type B #4 X 3/4" thread forming
- 4 enclosure PC board mounting screws, pan head Phillips screw type B #4 X 1/4" thread forming
- 4 enclosure bottom pads , plastic self-adhesive protective pads

Mount the printed circuit board and assemble the enclosure using the following steps:

1. One at a time, separate each of the four enclosure bottom pads from the backing paper and press the adhesive side of the pad on to the bottom of the enclosure bottom section near the four corners.
2. Slide the front panel down into the slot on one of the wide sides of the enclosure bottom section (the enclosure is symmetrical with respect to front and rear, it doesn't matter which wide side you pick).
3. Lay the PC board down on the enclosure bottom section and slide the PC board forward so the control shafts protrude through the front panel holes.
4. Lift the rear of the board slightly and hold the enclosure rear panel over the jacks while sliding the rear panel down into the slot at the rear of the bottom enclosure section.
5. Reposition the board slightly as required to align the four mounting screw holes in the board with the four plastic screw bosses on the bottom enclosure section. Check that the power indicator LED is engaged into the hole in the front panel. You may need to bend the LED leads slightly to properly position the LED in the front panel hole.
6. Secure the board to the bottom enclosure section with four #4 X 1/4" thread forming screws. Tighten the screws only to the point where there

is no longer any movement of the board. Do not over tighten.

7. Mount the three control knobs on the front-panel control shafts. To mount a knob, loosen the set screw with a small-blade screwdriver, slide the knob onto the shaft as far as it will go and position the knob so the set screw is over the flat side of the shaft. Tighten the set screw lightly against the flat side of the control shaft to hold the knob in place.

Leave the top enclosure section off for now to allow access for re-tuning after you move the transmitter to its final location.

12 Final Installation

The location of your transmitter will affect its range. Generally the higher the better. However, its range is adequate to cover a whole house no matter where it is located, even in a basement. Because it draws so little AC power, you may elect to place it out of the way on a shelf or in a closet and leave it powered on continuously. Once you set the tuning and audio controls properly, your transmitter will not require further adjustment. You may use long audio cables to feed the transmitter if it is located remotely from the audio source.

FCC Antenna Rules

When installing your transmitter, keep in mind the FCC rule that governs antenna and ground lengths. Rule 15.219 states: "The total length of the transmission line, antenna and ground lead (if used) shall not exceed 3 meters."

Your transmitter does not have a transmission line, so you only need to be concerned with the total length of the white antenna wire and the black ground wire (if used).

Generally, indoor installations need not comply exactly with the 3 meter rule with regard to the ground lead length because the range of transmission is mostly confined within the building plus a few hundred feet outside the building.

Antenna Location

For best range the white antenna wire should be strung as vertically as possible and should be positioned away from grounded metal objects and electrical wiring. Secure the antenna wire as needed to keep it from moving around to prevent tuning variations.

Ground

A good, low impedance, ground is required for best range. Just as a transmitter will not work without an antenna, it likewise will not work without a ground. A "ground" is simply any path from the transmitter circuit ground to earth ground that provides a low RF impedance. The AMT5000 has been designed to provide a low RF impedance path to ground through the AC adapter and your building wiring. Additionally, when you connect the transmitter via audio cables to an AC powered audio source, there is likely to be a low RF impedance through the audio cable outer shields and then through the building wiring connected to the audio source device. These "built in" ground paths will provide good performance in many cases, but variations in building wiring and transmitter location may require you to ground the transmitter directly to a separate earth ground. You should experiment by connecting the AMT5000 black ground wire to whatever ground sources are available at your transmitter location until you find the optimum arrangement. You can try connecting the ground wire to the center screw on a wall outlet, a copper water pipe, a copper heating pipe, or possibly a forced air heating register if your ductwork provides a continuous conductive path back to the furnace ground. Also one or more interconnected grounding rods driven into the earth will work well. Grounding rods are available at electrical supply stores. Also a very good ground can be established by burying bare copper wires so they fan out in a radial pattern from a center common point connected to the transmitter ground wire.

Refer back to section 10, "PC Board Jumper Options" for the optional ground isolation jumper settings. You can experiment with different jumper options and ground wire connections if you are not satisfied with the "default" shorted position of jumpers S18 and S19.

Check Tuning

Whenever you change the antenna position or ground connection you will likely need to re-peak the RF output. Generally, all that is required is to readjust the trimmer capacitor, but in some cases, you may need to change the tuning range jumper settings to the next higher or lower tuning range. Refer to section 8, "RF Tuning"" for information regarding setting the tuning range jumpers and setting the trimmer capacitor.

Finish Assembling Enclosure

Orient the top enclosure section with respect to the bottom section so that the tabs and slots on the sides will engage properly (the top mates with the bottom only one way).

Slip the top enclosure section down over the front and rear panels so that the panels engage the slots in the front and rear of the top enclosure section.

Secure the top enclosure section to the bottom enclosure sections using the two Pan Head Phillips Screw Type B #4 X 3/4" thread forming screws inserted through the two holes on the bottom side of the enclosure. Tighten only to the point where there is no longer any play between the enclosure sections. These two screws may be removed at any time to access the circuit board for frequency changes or re-tuning if the location of the transmitter or antenna is changed.

13 Troubleshooting

If your transmitter does not work, the cause is most likely one of the following:

- Unsoldered or poorly soldered connections.
- Solder shorts across adjacent pads
- Components mounted in the wrong locations
- Polarized components mounted in the wrong orientation
- Misinterpretation or mistakes made when setting DIP switches or jumpers.

Start troubleshooting by carefully inspecting all the solder connections. Look for unsoldered connections and solder bridges across adjacent pads. While inspecting, keep your soldering iron plugged in and ready. If you see any connection that looks the least bit suspect, re-solder it just to be sure.

Check the installation of all parts for proper location and orientation. Check the 16-pin ICs for any pins that may have been bent while plugging them into their sockets.

In the unlikely event of a component failure, you will need some knowledge of electronic troubleshooting methods and an understanding of how the transmitter operates. Refer to section 14, "Theory of Operation" and section 23, "Circuit Diagram" to learn how the transmitter works.

Start by checking the voltages at the power pin of all IC's with a meter. Also check the voltages marked in italics on the schematic around the transistors in the modulator and RF output stages and at some IC pins.

You can home in on a problem by first determining whether it is in the RF or the Audio section of your transmitter. If you can receive the carrier at the frequency you have selected, but there is no audio, then the problem is in the audio sections. If you can't receive the carrier at all, then the problem is in the synthesizer of RF output stage.

Use of an oscilloscope to trace back to the failing area will make troubleshooting much easier.

If you are really stuck, or don't want to spend the time fixing it, refer to section 15, "Warranty, Return and Service Policy" for information on our repair service.

14 Theory of Operation

This section presents a description of the operation of the AMT5000. Referring to the circuit diagram in section 23, "Circuit Diagram" will aid in understanding the description.

The AMT5000 has six major functional sections: (1) Oscillator, (2) RF Frequency Synthesizer, (3) RF Power Output, (4) Preamplifier and Compressor/Limiter (5), Modulator and (6) Power Supply.

Oscillator

IC U3 (74HC4060) serves as both a crystal oscillator and a frequency divider. The oscillator produces a 4 MHz signal whose frequency is determined by the 4.000 MHz Quartz Crystal (X1). The crystal frequency can be adjusted by a few hundred Hz by trimmer C26 to zero out any small frequency difference between the transmitter signal and a residual signal from a distant transmitter on the same AM channel.

RF Frequency Synthesizer

IC U3 also internally divides the oscillator output frequency by 16 to produce a 250 kHz square wave at U3 pin 7. IC U1 (74HC40103) further divides the 250 kHz output of U3 by 25 to produce a 4 us. low-going pulse repeating with a frequency of 10 kHz at U1 output pin 14 This is called the reference signal. The accuracy and stability of this reference signal is the same as the crystal.

ICs U2 and U4 work together as a programmable frequency multiplier to multiply the 10 kHz reference signal by an integer value selected by dip switch (S20) to produce the final AM band output frequency in 10 kHz increments at U2 pin 4. U2 is a phase locked loop (PLL), containing a phase comparator and a voltage controlled oscillator (VCO). The free-running VCO frequency is set to operate in the AM broadcast band range by capacitor C21 and resistor R10. The VCO output at U2 pin 4 feeds the CP (clock pulse) input of counter U4 (pin 1). IC U4 counts down by one on every clock pulse. When the counter reaches zero, it automatically parallel loads from dip switch S20 connected to the 8 data input pins U4 P7-P0. Each of the U4 data input pins, P7-P0, is high (logic 1) when its associated S20 switch is open or low (logic 0) when its switch is closed. U4 output pin 14 pulses low for one clock cycle while the count equals zero, producing a waveform that has a frequency equal to the VCO frequency divided by $n+1$ where n is the binary value of S20. The divided VCO frequency is connected back to the PLL phase comparator COMPIN input, U2 pin 3.

The phase comparator output, P2OUT, U2 pin 13, is connected to VCOIN, U2 pin 9 to control the VCO frequency. P2OUT produces high-level pulses when the divided VCO frequency is lower than the 10 kHz reference frequency at SIGIN, U2 pin 14, and produces low-level pulses when the divided VCO frequency is higher than the 10 kHz reference frequency. When the two frequencies are equal, the P2OUT output goes to the high impedance state and the PLL is in the locked state.

Resistors R9, R7 and capacitor C14 form a low-pass filter to smooth the pulses from the P2OUT output pin resulting in a DC voltage which is feeds VCOIN, U2 pin 9 to control the VCO frequency. The average value of VCOIN will rise or fall, raising or lowering the VCO frequency, until the SIGIN and COMPIN frequencies and phases are identical at which point the PLL becomes locked. This voltage is held by capacitor C14 while the P2OUT output is in the high impedance state. Any drifting of the VCO frequency causes P2OUT to pulse high or low as required until the frequency is corrected.

Complete descriptions of the 74HC-series ICs used in the AMT5000 are provided in datasheets available in downloadable PDF form from various manufacturer's websites. You can find the datasheet for a particular part by searching the web for "74HCxxxx datasheet".

RF Power Output

The RF power output transistor, Q1, operates in the Class E switching mode achieving 98% transistor efficiency when properly tuned. Q1 works as a switch that is on or off with a 50% duty cycle at the carrier frequency rate. Class E mode causes negligible power to be dissipated in Q1, so almost all of the input power from the power supply is available as RF power to the input of the antenna tuning circuit.

The On resistance of Q1 drain is less than 0.16 ohms to ground. The inductance and capacitance components connected to Q1 drain shape the current and voltage waveforms such that when high current is flowing in Q1 during one half cycle, the voltage across Q1 is near zero, and when the voltage across Q1 is high during the other half-cycle, nearly zero current flows through Q1. This results in only about 2% power dissipation in Q1.

With no modulation, the voltage at Q1 drain will be maintained at a steady DC value that results in 100 mW power to Q1. This power level is adjustable by means of variable resistor R1 so the user can ensure compliance with FCC rules. Modulation is applied to Q1 by varying the Q1 drain voltage at audio rate above and below the steady zero modulation DC value . 100% modulation is achieved when the voltage at Q1 drain swings between zero and twice the un-modulated voltage. At higher modulation voltage swings, the voltage at Q1 drain will clip at zero, but will still swing higher in the positive direction. This characteristic allows greater than 100% positive modulation. Normally, this causes severe distortion, but can be useful when an external audio processor is connected that has separate limiting levels for positive and negative audio peaks (asymmetrical limiting).

The RF signal path begins with the carrier-frequency signal at VCOUT, U2 pin 4. This is a square wave swinging from 0V to 5V. It is applied to the bases of Q3 and Q4. These transistors amplify the signal current to provide a fast rise and fall time signal in the presence of the relatively high input gate capacitance of MOSFET transistor Q1. Gate current only flows in short pulses on the rising and falling edges of the square wave at Q1 gate. Q1 has a very high input impedance and the short current pulses are caused by charging and discharging the gate capacitance.

The transmitter RF output is taken from the drain of Q1, through DC blocking capacitor C4, to the tuning and antenna matching circuit. Jumper-selected capacitors C7 and C8 shape the waveform at Q1 drain for maximum Class E efficiency. In some cases, the inherent drain capacitance of Q1 is sufficient and the added capacitance of C7 and C8 is not required.

Jumper-selected inductors L1, L2 and L3 form a series-resonant circuit with the antenna capacitance (typically about 30 pF) which is in parallel with trimmer C1 and optionally trimmer C2. When this resonant circuit is tuned properly, maximum power is transferred from Q1 to the antenna and harmonic radiation is minimized.

The gas-discharge surge arrestor, Z1, shunts external voltage surges on the antenna to ground to protect the circuitry. Resistor R2 bleeds off static electricity potential that otherwise may build up on the antenna.

Preamplifier and Compressor/Limiter

IC U6 provides the functions of audio amplification and variable audio compression and limiting.

The AMT5000 allows connecting either a Consumer Audio or Professional Audio source.

A Consumer Audio source can be connected to rear-panel RCA jacks J3 and J4. These jacks are isolated from each other by R27 and R31 and summed across the GAIN control (R23). The two inputs are provided for properly mixing stereo audio sources. A mono source may be connected to either J3 or J4.

A Professional Audio mono source can be connected via standard shielded twisted par cable to 3 adjacent screw

terminals labeled GND + AUD - on connector block J5 on the board. The differential audio inputs (+ and -) connect to differential amplifier U5 via a conditioning network consisting of resistors, capacitors and diodes. This collection of components serve to control the input impedance, filter stray RF frequencies on the audio line, and provide a safe static discharge path to prevent damage to U6 from static surges on the audio line. The Pro Audio input is suitable for long audio cable runs on the order of hundreds of feet. The output of U6 connects to the top of the GAIN control (R23) via resistor R30. The GAIN control potentiometer serves as an attenuator to allow adjusting the audio level into the such that audio peaks arr at or somewhat above the limiting level.

The audio signal from the GAIN control is applied through C40 to U6 pin 7 (+IN). Capacitor C43 bypasses RF to ground preventing coupling of stray transmitter RF into the high impedance input of U6. The gain of the U6 buffer stage is set at 0 dB (unity gain) by the direct feedback connection between BUF, pin 5 and -IN, pin 6. Capacitor C42 couples the buffer output to the Voltage Controlled Amplifier (VCA) input of U6.

The VCA is where the compression and limiting functions occur. Resistor R33 sets the fixed VCA gain at 9.5 dB. The output of the VCA appears on U6 pin 13 (OUTPUT) and feeds the transmitter modulation stage. The COMPRESSION control, variable resistor R8, controls the audio compression ratio. R8 may be adjusted to set compression anywhere between a minimum 1:1 dB ratio (no compression) to a maximum 5:1 dB ratio. Audio compression "compresses" the dynamic range of the original audio source, which in turn allows maintaining a more constant average modulation level. The MODULATION control, variable resistor R16, controls the limiter function "rotation point". Any audio input peaks above the selected rotation point level are compressed at a very high 15:1 dB ratio. This prevents the output of the VCA from significantly exceeding the rotation point amplitude. R16 is normally adjusted so the rotation point is just below the 100% modulation point, preventing over-modulation distortion.

A complete description of the SSM2166 is provided in the datasheet available in downloadable PDF form at the Analog Devices website, which may be found by searching the web for "SSM2166 datasheet".

Modulator

The audio output signal from U6 pin 13 is coupled to the base of amplifier transistor Q5 through C28, R25 and R21. Treble boost capacitor, C36, can be optionally connected in parallel with R25 by shorting jumper S22 to emphasize audio high frequencies. Emphasis occurs because the impedance of C36 is much lower than the resistance of R25 at higher audio frequencies. Lower frequencies are attenuated by R25, while higher frequencies are bypassed around R25 by C36.

The output of Q5 is coupled to the gate input of MOSFET transistor Q2, which is the modulation driver to the final RF transistor Q1. The DC bias level at the gate of Q2 is set by variable resistor R1 (RF INPUT PWR ADJ). This control sets the DC voltage level at the source pin of Q2 which in turn sets the DC voltage at the RF amplifier transistor, Q1. This determines the input power to Q1.

The voltage at Q2 source varies with the audio signal symmetrically above and below the DC bias voltage causing the RF output stage to be amplitude modulated. 100% negative modulation occurs when the Q2 source voltage drops to zero. At this point, no current flows to the RF output transistor and it is cut off completely. Any further increase in the amplitude of the audio waveform at Q2 source will cause the modulation waveform to clip at zero on negative peaks, but the modulated waveform will continue to follow the positive modulation peaks without distortion.

Power Supply

The power supply section consists of an RF filter section, a bridge rectifier, a +12 volt low-dropout voltage regulator (V1) and a +5 volt voltage regulator (V2).

The standard AC wall adapter supplies 12 volt RMS AC power to the AMT5000 at the power jack (J2) or optionally at screw terminals 1 and 2 of terminal block J5. Inductors L5 and L6 can optionally be included in the path or not by opening or shorting jumpers S18 and S19. With the jumpers in the open position L5 and L6 prevent transmitter RF from being coupled back to the AC power lines to help alleviate hum problems that are sometimes encountered due to interaction of the AC power lines with transmitter RF coupled to the power lines through the wall transformer. For most installations jumpers S18 and S19 can be kept in the shorted position to take advantage of the additional ground path provided by the AC lines.

The full wave bridge rectifier, consisting of diodes D1, D2, D3 and D4, converts the AC input to pulsating DC, which is then smoothed by filter capacitor C3. Each diode is bypassed with a .1 uF capacitor to ensure a low RF impedance across the diode when the diode is in the non-conductive reverse-biased portion of the AC cycle. This prevents possible 120 Hz hum modulation that can be induced when the RF impedance to earth ground through the power lines varies with the on/off state of the diodes. Voltage regulator V1 supplies regulated +12 volts DC to the RF output and modulation stages. It also feeds voltage regulator V2, which provides regulated +5 volts DC for powering the ICs.

The 12 volt AC RMS input voltage level results 16 volts average DC with some ripple at the input of V1. This is conservatively high enough to ensure that the ripple troughs of the smoothed DC at the input to the +12 volt regulator are well above the minimum value of 12.5 VDC specified for the 78R12 regulator.

15 Warranty, Return and Service Policy

Warranty

SSTRAN guarantees that all AMT5000 kit parts listed in section 2, "Parts List", of this manual will be included in your kit and are not damaged at the time the kit is shipped. A part is damaged if it is physically broken, cracked or crushed. Parts with bent wire leads or pins that can be straightened and aligned are not considered to be damaged. If a part is missing from your kit or a part is damaged, we will replace it at no charge. If your kit has been severely damaged during shipment, it is your responsibility to report the damage to the shipper and arrange a settlement with the shipper. If minor shipping damage occurs, we will replace the damaged parts free of charge. If you damage a part during kit assembly, we will replace it for a reasonable charge. You may request a replacement part by sending an e-mail to support@sstran.com. Be sure to include your name, shipping address, the date when you ordered your kit, a description of the damage, and the complete description of the part as shown in the parts list. We will reply promptly with price and ordering instructions.

Returns

If for any reason you are not satisfied with your AMT5000 kit, you may return it for a full refund within 30 days provided that the returned kit has all parts in their original condition. We cannot accept returns of kits that have been partially or completely assembled.

Service

For a flat fee of $60.00, we will repair and test your assembled kit. We will evaluate the condition of your assembled kit, correct soldering problems, replace defective parts, test it for proper operation and return it to you. If our evaluation indicates that your transmitter is actually working properly or is not reasonably repairable, we will return it to you and refund the repair fee.

To return your assembled kit for repair, pack just the PC board (to save postage cost) with padding in a small box. Enclose a check for $60 payable to: SSTRAN. Mail to:

SSTRAN
3053 Griffith Rd.
Eagleville, PA 19403-1029

How to Contact SSTRAN

Send an e-mail to: support@sstran.com.

If you prefer to contact us by mail, send your request to:

Customer Service
SSTRAN
3053 Griffith Rd.
Eagleville, PA 19403-1029

16 About FCC Part 15 Regulations

For users in the United States it is important that you be aware of the FCC rules applying to the use of unlicensed low-power transmitters. You can access the rules at: http://www.fcc.gov/oet/info/rules/. If this link becomes outdated, you can find the information by searching the web for "FCC part 15 rules".

The FCC rules exist to prevent harmful interference to other electrical devices such as radio receivers, telephones and sensitive electronic equipment. It is your responsibility to take precautions to ensure that your transmitter does not cause harmful interference. If you use your transmitter responsibly, you are not likely to experience any problems with the FCC. Always select the clearest frequency available in your area. This will reduce the likelihood that you will interfere with a licensed station that other people within your transmitter's range may be receiving. Do not broadcast offensive material that may result in complaints to the FCC. If the FCC does investigate a complaint, they will usually just request that you change your operation to remove the cause of the complaint. This may just involve switching to a different frequency or reducing your signal level by changing your antenna configuration. You must comply with FCC directives. FCC part 15.5 applies to this situation.

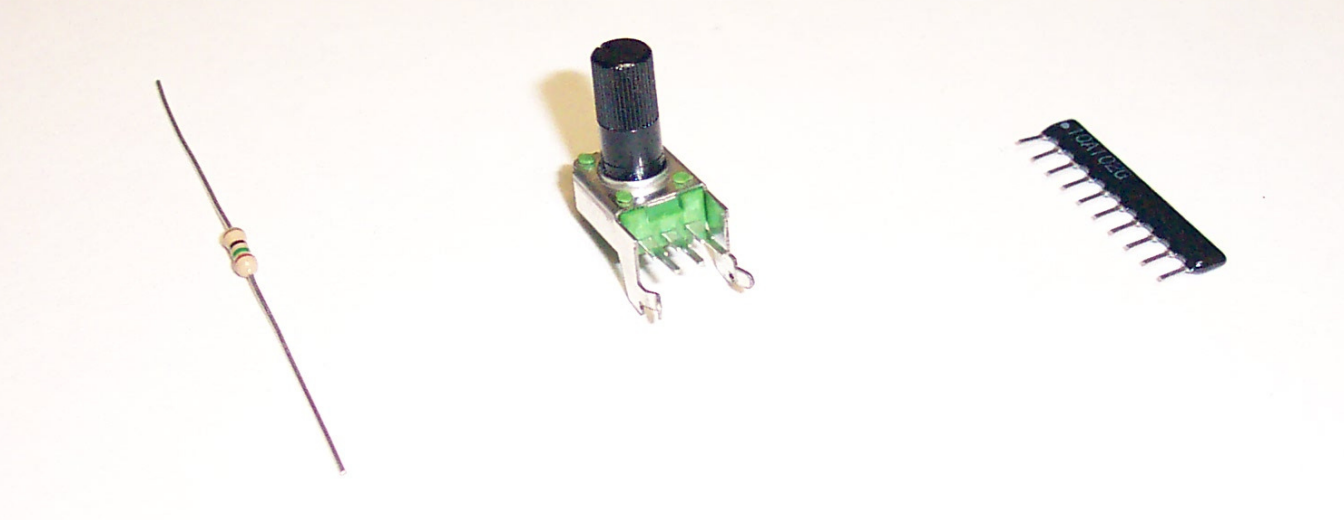
Most of the rules in part 15 do not apply to operation of low-power AM transmitters. Part 15 regulates the operation of all sorts of intentional and unintentional radiators. There are, however, some important paragraphs that you should read to gain an understanding of the applicable rules:

15.5 General conditions of operation.
15.35 Measurement detector functions and bandwidths.
15.203 Antenna requirement.
15.205 Restricted bands of operation.
15.209 Radiated emission limits; general requirements.

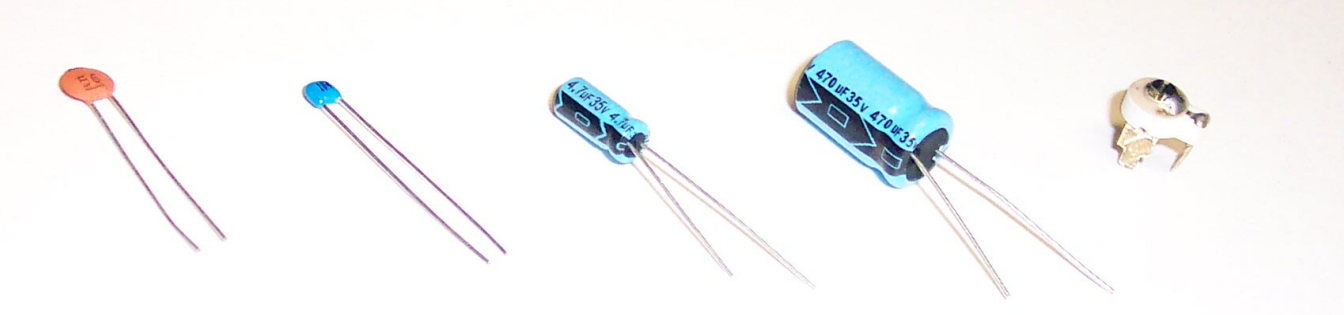
15.215 Additional provisions to the general radiated emission limitations.
15.219 Operation in the band 510-1705 kHz.

Rule 15.219 is particularly important for legal operation of the AMT5000. The AMT5000 input power to the final RF stage is intended to be adjusted to 100 milliwatts. As long as you do not exceed the 3 meter limit for the total length of the antenna and ground lead wires, your transmitter will be compliant.

17 Component Identification

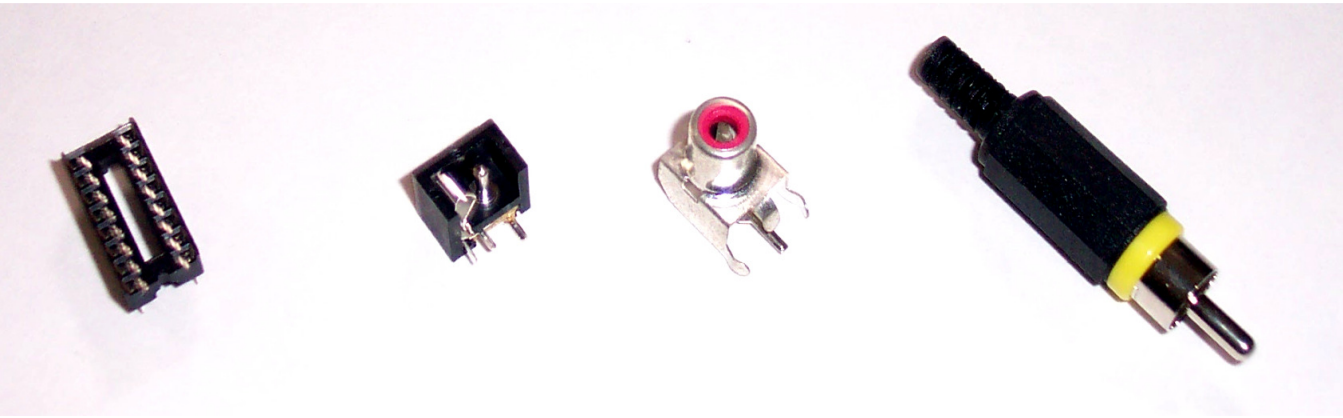


Fixed 1/4 Watt Resistor | Variable Resistor | Resistor SIP Pack

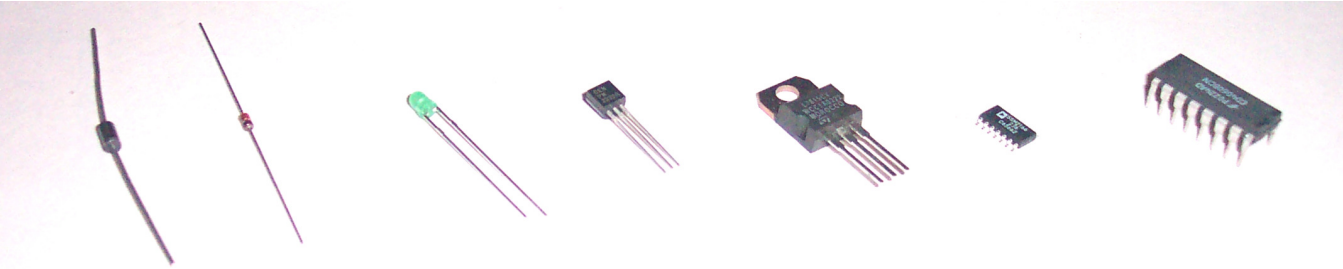


Ceramic Disc Capacitor | Multi-Layer Ceramic Capacitor | Small Electrolytic Capacitor | Large Electrolytic Capacitor | Ceramic Trimmer Capacitor

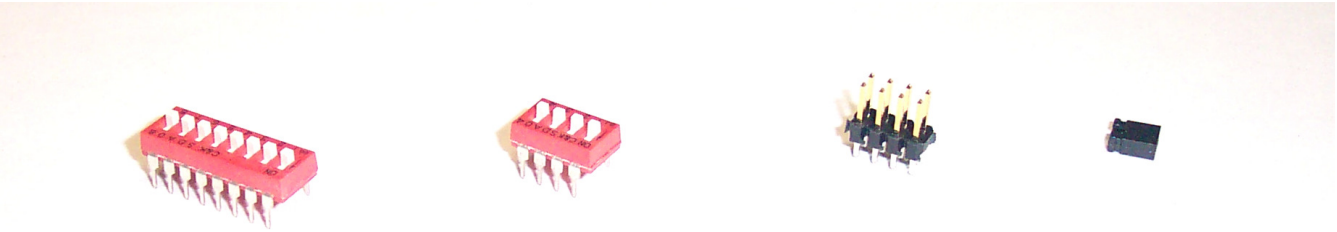
Epoxy Coated Choke | RFI Suppression Coil | Quartz Crystal



16 Pin DIP Socket | Power Jack | RCA Phono Jack | RCA Phono Plug



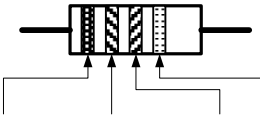
Silicon Rectifier | Silicon Diode | Green LED Lamp | TO-92 Transistor or Voltage Reg | TO-220 Voltage Reg | SSM2166 Surface Mount IC | 16-Pin DIP IC



8-Position DIP Switch | 4-Position DIP Switch | Header Strip | Header Jumper

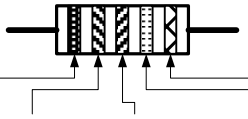
18 Resistor Color Code Charts

4-Band Resistor Color Code



COLOR	1st DIGIT	2nd DIGIT	MULTIPLIER	TOLERANCE
BLACK	0	0	1	
BROWN	1	1	10	+- 1%
RED	2	2	100	+- 2 %
ORANGE	3	3	1,000	
YELLOW	4	4	10,000	
GREEN	5	5	100,000	
BLUE	6	6	1,000,000	
VIOLET	7	7	10,000,000	
GRAY	8	8	100,000,000	
WHITE	9	9	1,000,000,000	
GOLD			.1	+- 5 %
SILVER			.01	+- 10 %

5-Band Resistor Color Code



COLOR	1st DIGIT	2nd DIGIT	3rd DIGIT	MULTIPLIER	TOLERANCE
BLACK	0	0	0	1	
BROWN	1	1	1	10	+- 1 %
RED	2	2	2	100	+- 2 %
ORANGE	3	3	3	1,000	
YELLOW	4	4	4	10,000	
GREEN	5	5	5	100,000	
BLUE	6	6	6	1,000,000	
VIOLET	7	7	7	10,000,000	
GRAY	8	8	8	100,000,000	
WHITE	9	9	9	1,000,000,000	
GOLD				.1	+- 5 %
SILVER				.01	+- 10 %

19 Synthesizer Frequency Selection Tables

S20 Switch Settings For 10 kHz Channel-Spacing Models

Kit model AMT5000 uses a 4.000 MHz quartz crystal, which produces a 10 kHz PLL reference frequency resulting in a frequency spacing between incremental S20 switch settings of 10 kHz. Use the following chart to find the S20 switch setting for your desired frequency in increments of 10 kHz.

Frequency	S20 Setting (10 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
530	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑
540	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑
550	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑
560	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑
570	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
580	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
590	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
600	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
610	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
620	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
630	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
640	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
650	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
660	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
670	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
680	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
690	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
700	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
710	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
720	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑

Frequency	S20 Setting (10 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
730	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
740	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
750	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
760	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
770	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
780	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
790	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
800	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON↑
810	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
820	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
830	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
840	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
850	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
860	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
870	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
880	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
890	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
900	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
910	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
920	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
930	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
940	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
950	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
960	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
970	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
980	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
990	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
1000	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
1010	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
1020	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
1030	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
1040	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
1050	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1060	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1070	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1080	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1090	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1100	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1110	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1120	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1130	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1140	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1150	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1160	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑

Frequency	S20 Setting (10 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
1170	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1180	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1190	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1200	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1210	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1220	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1230	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1240	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1250	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1260	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1270	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1280	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1290	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1300	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1310	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1320	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1330	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1340	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1350	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1360	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1370	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1380	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1390	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1400	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1410	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1420	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1430	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1440	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1450	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1460	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1470	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1480	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1490	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1500	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1510	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1520	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1530	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1540	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1550	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1560	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1570	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1580	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1590	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1600	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓

Frequency	S20 Setting (10 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
1610	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1620	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1630	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1640	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1650	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1660	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1670	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1680	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓
1690	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓
1700	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓

S20 Switch Settings For 9 kHz Channel-Spacing Models

Kit models AMT5000-9K and AMT5000-9KNT use a 3.600 MHz quartz crystal, which produces a 9 kHz PLL reference frequency resulting in a frequency spacing between incremental S20 switch settings of 9 kHz. Use the following chart to find the S20 switch setting for your desired frequency in increments of 9 kHz.

Frequency	S20 Setting (9 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
522	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
531	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
540	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
549	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
558	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
567	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
576	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑
585	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
594	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
603	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
612	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
621	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
630	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
639	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
648	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑
657	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
666	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
675	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
684	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
693	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
702	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
711	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
720	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑
729	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑
738	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑

Frequency	S20 Setting (9 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
747	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
756	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
765	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
774	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
783	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
792	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON↑
801	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
810	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
819	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
828	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
837	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
846	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
855	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
864	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON↑
873	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
882	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
891	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
900	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
909	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
918	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
927	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
936	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON↑
945	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
954	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
963	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
972	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
981	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
990	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
999	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1008	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON↑
1017	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1026	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1035	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1044	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1053	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1062	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1071	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1080	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON↑
1089	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1098	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1107	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1116	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1125	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1134	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1143	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑

Frequency	S20 Setting (9 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
1152	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON↑
1161	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1170	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1179	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1188	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1197	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1206	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1215	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1224	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF↓
1233	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1242	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1251	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1260	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1269	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1278	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1287	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1296	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF↓
1305	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1314	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1323	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1332	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1341	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1350	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1359	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1368	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF↓
1377	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1386	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1395	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1404	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1413	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1422	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1431	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1440	OFF ↓	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF↓
1449	ON ↑	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1458	OFF ↓	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1467	ON ↑	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1476	OFF ↓	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1485	ON ↑	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1494	OFF ↓	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1503	ON ↑	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1512	OFF ↓	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF↓
1521	ON ↑	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓
1530	OFF ↓	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓
1539	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓

Frequency	S20 Setting (9 kHz Spacing)							
kHz	1	2	3	4	5	6	7	8
1548	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓
1557	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓
1566	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓
1575	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓
1584	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF↓
1593	ON ↑	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1602	OFF ↓	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1611	ON ↑	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1620	OFF ↓	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1629	ON ↑	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1638	OFF ↓	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1647	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1656	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	ON ↑	OFF↓
1665	ON ↑	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF↓
1674	OFF ↓	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF↓
1683	ON ↑	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF↓
1692	OFF ↓	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF↓
1701	ON ↑	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF↓
1710	OFF ↓	ON ↑	OFF ↓	OFF ↓	OFF ↓	OFF ↓	ON ↑	OFF↓

20 RF Output Tuning Range Jumper Setting Tables

The tables in this section provide jumper installation information for various frequency ranges. Refer to section 8, "RF Tuning"" for the detailed tuning procedure.

For Operating Frequencies Above 1350 kHz

The frequency range column gives approximate minimum and maximum resonant frequencies over the tuning range of trimmer capacitor C1 for a typical antenna capacitance of 30 pF. If the desired frequency falls within more than one range, pick the lowest range (highest inductance) that includes the desired frequency. This will achieve resonance with the lowest C1 capacitance, resulting in slightly more power to the antenna. If you can't get a resonant peak with your chosen jumper setting, try higher or lower range settings incrementally.

Toroid inductor Only

Trimmer C1 only. C1 to be adjusted between maximum and minimum in each frequency range.

Frequency Range (kHz)	Jumper Setting														
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
1290 - 1390	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1330 - 1430	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1380 - 1480	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1430 - 1530	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1480 - 1580	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1530 - 1630	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1570 - 1670	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	**ON**	**ON**	**ON**	OFF
1610 - 1720	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	**ON**	**ON**	**ON**	OFF
1660 - 1770	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	**ON**	OFF
1700 - 1820	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	**ON**	**ON**	**ON**	OFF

1750 - 1880	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	**ON**	**ON**	**ON**	OFF
1800 - 1930	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	**ON**	OFF

For Operating Frequencies Below 1350 kHz

The frequency range column gives approximate minimum and maximum resonant frequencies over the tuning range of the large trimmer capacitor, C2 for a typical antenna capacitance of 30 pF. If the desired frequency falls within more than one range, pick the lowest range (highest inductance) that includes the desired frequency. This will achieve resonance with the lowest C2 capacitance, resulting in slightly more power to the antenna. If you can't get a resonant peak with your chosen jumper setting, try higher or lower range settings incrementally.

Set trimmer capacitor C1 to mid-point (about 3 and 1/2 turns clockwise from the top where the tuning slug is flush with the top of the trimmer capacitor).

Toroid Inductor Only

Trimmer C1=mid-point. Trimmer C2 to be adjusted between maximum and minimum in each frequency range.

Frequency Range (kHz)	Jumper Setting														
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**
930 - 1290	**ON**	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1080 - 1490	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	OFF
1220 - 1680	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	**ON**	OFF

Toroid Inductor + 330uH Inductor

Trimmer C1=mid-point. Trimmer C2 to be adjusted between maximum and minimum in each frequency range.

Frequency Range (kHz)	Jumper Setting														
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**
680 - 950	**ON**	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	**ON**	OFF
730 - 1020	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	**ON**	OFF	**ON**	OFF
760 - 1070	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	OFF	**ON**	OFF

Toroid Inductor + 1000uH Inductor

Trimmer C1=mid-point. Trimmer C2 to be adjusted between maximum and minimum in each frequency range.

Frequency Range (kHz)	Jumper Setting														
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**
470 - 650	**ON**	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	OFF
490 - 670	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	OFF
500 - 690	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	**ON**	**ON**	OFF

Toroid Inductor + 1330uH Inductor

Trimmer C1=mid-point. Trimmer C2 to be adjusted between maximum and minimum in each frequency range.

Frequency Range (kHz)	Jumper Setting														
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**	**S14**	**S15**
450 - 630	**ON**	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF
460 - 640	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF
470 - 650	**ON**	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	**ON**	OFF

21 RF Input Voltage-Current 100 mW Equivalence Table

RF INPUT VOLTAGE (DC Volts)	"RF INPUT CURRENT" (DC Volts)
1.50	0.667
1.55	0.645
1.60	0.625
1.65	0.606
1.70	0.588
1.75	0.571
1.80	0.556
1.85	0.541
1.90	0.526
1.95	0.513
2.00	0.500
2.05	0.488
2.10	0.476
2.15	0.465
2.20	0.455
2.25	0.444
2.30	0.435
2.35	0.426
2.40	0.417
2.45	0.408
2.50	0.400
2.55	0.392
2.60	0.385
2.65	0.377
2.70	0.370
2.75	0.364
2.80	0.357
2.85	0.351
2.90	0.345
2.95	0.339
3.00	0.333
3.05	0.328
3.10	0.323
3.15	0.317
3.20	0.313
3.25	0.308
3.30	0.303
3.35	0.299
3.40	0.294
3.45	0.290

"RF INPUT VOLTAGE" (DC Volts)	"RF INPUT CURRENT" (DC Volts)
3.50	0.286
3.55	0.282
3.60	0.278
3.65	0.274
3.70	0.270
3.75	0.267
3.80	0.263
3.85	0.260
3.90	0.256
3.95	0.253
4.00	0.250
4.05	0.247
4.10	0.244
4.15	0.241
4.20	0.238
4.25	0.235
4.30	0.233
4.35	0.230
4.40	0.227
4.45	0.225
4.50	0.222
4.55	0.220
4.60	0.217
4.65	0.215
4.70	0.213
4.75	0.211
4.80	0.208
4.85	0.206
4.90	0.204
4.95	0.202
5.00	0.200
5.05	0.198
5.10	0.196
5.15	0.194
5.20	0.192
5.25	0.190
5.30	0.189
5.35	0.187
5.40	0.185
5.45	0.183

22 Specifications

Frequency Coverage	Model AMT5000: 530 to 1700 kHz in 10 kHz steps. Model AMT5000-9K: 522 to 1710 kHz in 9 kHz steps.
Carrier Frequency Generation	Crystal controlled PLL synthesizer
Frequency Selection Method	8-position DIP switch
Frequency Tolerance @ 25ºC	±.003%
Modulation Type	Amplitude Modulation (AM)
Maximum Modulation Level	100% (130% positive modulation with external processor)
Power Input to Final RF Stage	100 mW, adjustable to compensate for varying load conditions
RF Circuit Configuration	MOSFET Class E switching mode, 98% RF transistor efficiency.
RF Spurious Emissions	43 dB below carrier level.
Antenna	Standard: 118" wire (supplied with kit) Uuser-supplied: 102" CB whip or 118" copper or aluminum pipe
Antenna Matching	Low-loss iron-powder toroid loading coil series resonates with antenna capacitance. Jumper-selectable option for user-supplied external loading coil.
Output Tuning	1350kHz - 1700kHz: jumpers select toroid inductance, screwdriver adjusted air piston trimmer capacitor for peak tuning. 530kHz - 1350kHz: jumpers select supplemental inductors and toroid tap, screwdriver adjusted FILMTRIM trimmer capacitor for peak-tuning.
RF Output Metering	Test points on circuit board for measuring RF stage input voltage and current with inexpensive user-supplied digital or analog multimeter.
RF Grounding Options	Jumper options for including/excluding RF isolation inductors in power feed lines to suppress conducted emission
Modulation Circuit Configuration	Common-source MOSFET modulation driver in series with RF output MOSFET drain.
Internal Audio Response	20 Hz - 20 kHz ± 0.5 dB Jumper selects flat response or NRSC standard pre-emphasis.
Modulated RF 3-dB Response	20 Hz - 16.5 kHz audio response with 20-30 ohm RF ground (typical). Modulated audio response is higher when supplemental inductors are jumper-selected at frequencies below 1350 kHz.
Audio Distortion	Less than 0.5% THD through audio stages to final high-level modulator stage.
Audio Input Level	Consumer Audio: -10 dBV, 0.316 Vrms Pro Audio: +4 dBu, 1.228 Vrms
Audio Input Impedance	Consumer Audio: 18k ohms at 1 kHz Pro Audio: 14.3k ohms differential at 1 kHz
Audio Compression	Compression ratio adjustable from 1:1 to 5:1. Attack time less than 1 ms. Medium release time suitable for both voice and music.
Audio Limiting	Adjustable threshold. 15:1 compression above threshold. True RMS limiting ensures no distortion in limiting region.
Front Panel Controls and Indicators	Audio input GAIN, MODULATION level, COMPRESSION ratio. Green LED power light.
Rear Panel Jacks	Consumer Audio (unbalanced): 2 RCA audio in jacks mixed equally on board for stereo-to-mono conversion or two mono sources. 2.1 mm power input jack.
On board screw terminals	Antenna RF ground Mono Pro Audio (balanced): +, -, Gnd Power: AC or DC(+, -)
Input Power Options	12VAC wall adapter, 12VDC wall adapter, 12V battery.
On-Board Power Conditioning	RF bypassed bridge rectifier for 12VAC operation mode. Low-dropout 12V regulator provides stable, regulated and filtered even when operating from 12V battery (nominal lead acid battery voltage is 12.63V). Below 12.3VDC, input voltage is passed to output without regulation. Separate 5VDC regulator provides stable, regulated and filtered power to ICs.

Power Consumption	120 VAC, 2 watts with standard 12VAC wall adapter.
Circuit Board	7”W x 3.9”D x .062”H FR4, two layers, 1 oz. copper, top and bottom solder masks, top silkscreen with component identifiers and labels.
Enclosure Options	Indoor option: 1.5”H x 8.1”W x 4.2”D ABS plastic, color bone and black. Drilled, silk-screened front and rear panels. Outdoor option: NEMA 4, 4X. 8.66”H x 4.72”W x 3.54”D, fiberglass, color gray

23 Circuit Diagram