SVR-200
Vehicular Repeater

This manual is intended for use by qualified technicians and includes all necessary information pertaining to the SVR-200 operation, circuit design and maintenance. Changes that occur after date of printing will be incorporated in supplemental service publications.

Foreword

Scope of this manual

This manual contains the specifications, functional description, operating instructions, schematic, parts locator and parts list for the SVR-200 synthesized vehicular repeater.

This manual is intended for use by qualified service technicians to aid them with installation, interfacing, alignment and trouble shooting of the SVR-200 when used with other land mobile radios.

Service manual revisions

Component changes, additions and deletions may occur in the circuit design to improve operation and will be reflected in future releases of this service manual. Specifications and circuit changes are subject to change without prior notice or obligation by Pyramid Communications.

Safety Information

The SVR-200 is designed to operate within all applicable Federal regulations at the time of manufacture. Proper operation and service procedures will assure continued compliance with these regulations:

- Do not operate the SVR-200 without an antenna or appropriate RF load connected to the antenna connector.
- Do not operate the SVR-200 in the presence of unshielded electrical blasting caps or explosive environmental conditions.
- Do not operate the SVR-200 while refueling the vehicle or in the presence of explosive fumes.
- Do not operate the SVR-200 with persons standing closer than 2 feet from the mobile or repeater antenna.

FCC information

The SVR-200 complies with the FCC rules parts 90 and 22 for radio frequency transmitters. The user must apply for a license to operate the SVR-200 transmitter pursuant to parts 90.243 and 90.247. Other FCC rules may apply depending on the class of service the user qualifies for. A complete listing of FCC rules and regulations may be ordered from:

Superintendent of Documents
Government printing office
Washington DC 20402

The following information pertaining to the SVR-200 should be included in the FCC license application:

	VHF	UHF	700/800/900 MHz
Type Acceptance:	LRUSVR-200VB	LRUSVR-200U	LRUSVR-200M
Output Power:	0.25-2.0W	0.25-2.0W	100mW-600mW
Emission designator:	11K0F3E/16K0F3E	11K0F3E/16K0F3E	11K0F3E/16K0F3E
Frequency band:	150-174 MHz	400-512MHz	764-806(700M), 806-824 or 850-870(800M) 897-902 or 936-941 (900M)
Number of Channels:	1/14	1/14	1/14

Specifications

Transmitter:	**VHF**	**UHF**	**700/800/900 MHz**
Frequency Range:	150-174 MHz	405-425 MHz (UA)[1] 450-470 MHz (UD) 470-490 MHz (UE)[1]	764-776, 794-806 (MC,MD) 806-824, 850-870 (MB,MA) 897-902, 936-941 (ME,MF)
Rf power out:	250mW - 2W	250mW - 2W	100mW - 600mW
Spurious emissions:	-50dBc	-50 dBc	-50dBc
Freq stability -30°~+60°C:	1.5 PPM	1.5 PPM	1.5 PPM
Modulation:	16K0F3E/11K0F3E	16K0F3E/11K0F3E	16K0F3E[2]/11K0F3E
Hum and Noise:	-40/-37dB (25/12.5kHz)	-40/-37dB (25/12.5kHz)	-40/-37dB (25/12.5kHz)
Audio response (300-3kHz):	Flat or +6dB/octave	Flat or +6dB/octave	Flat or +6dB/octave
Audio distortion:	<3% @ 60% deviation	<3% @ 60% deviation	<3% @ 60% deviation
Local mic sensitivity:	300mV-5VPP	300mV-5VPP	300mV-5VPP
FCC Type Acceptance:	LRUSVR-200VB	LRUSVR-200U	LRUSVR-200M
Industry Canada Approval:	2390 195 458A	2390 212 113A	2390A-SVR200M
Receiver:			
Frequency Range:	150-174 MHz	405-425 MHz (UA)[1] 450-470 MHz (UD) 470-490 MHz (UE)[1]	764-776, 794-806 (MC,MD) 806-824, 850-870 (MB,MA) 897-902, 936-941 (ME,MF)
RF sensitivity:	.35µV	.35µV	.35µV
Squelch sensitivity:	.2µV to 2µV adjustable	.2µV to 2µV adjustable	.2µV to 2µV adjustable
Modulation acceptance:	±7.5/±3.75kHz	±7.5/±3.75kHz	±7.5[2]/±3.75kHz
Selectivity:	60/57dB (25/12.5 kHz)	60/57dB (25/12.5 kHz)	50dB
Spurious/image rejection:	60db	60db	60db
IMD response:	60db	60db	60db
Frequency stability:	1.5 PPM	1.5 PPM	1.5 PPM
Audio response (300-3kHz):	Flat or -6db/octave	Flat or -6db/octave	Flat or -6db/octave
Audio output:	0-5VPP AC coupled	0-5VPP AC coupled	0-5VPP AC coupled
Local Rx Audio:	400 mW 8 Ohms	400 mW 8 Ohms	400 mW 8 Ohms
Power Requirements:			
DC Supply	13.6 VDC	13.6VDC	13.6VDC
Standby	170 mA	170mA	170mA
Receive	250 mA	250mA	250mA
Transmit	1 A @ 2W	1.5A @ 2W	700mA @ 600mW
Physical:			
Dimensions:	5.275"W x 6"L x 1.12"H		
Weight:	18 oz.		
Case:	One piece extruded aluminium		

[1]405-425 and 470-490 available as special order Only
[2]16K0F3E & ±7.5kHz available on 806-824 and 850-870 MHz Only

Functional Description

Generally, vehicular repeaters are used as mobile extenders in cross-band operation: the link is VHF/UHF/800 MHz simplex and the mobile is Lo-band, VHF, UHF or trunking. In-band operation is possible, but care must be taken to prevent interference between the mobile's higher power transmitter and the repeater receiver. Proper frequency selection and antenna placement are important even in cross-band operation, but especially for inband use. The use of low power pre-selector cavities may be placed in line with the repeater antenna cable since it is simplex and low power.

Important Note

The SVR-200 operates on simplex frequencies; part of the multi-vehicle format dictates that all of the SVR-200s must be able to monitor all link traffic on site and be able to determine if a handheld is transmitting, or if other repeaters are transmitting. The handhelds must transmit CTCSS, but should be carrier squelch receive. ***The handhelds should not use CTCSS decode if the repeater is utilizing the multi-vehicle format***, as this will interfere with the priority sampling which is essential for multi-vehicle operation. Also, the handhelds would have to have different encode and decode tones in order for the repeater to be able to tell the difference between handhelds and other repeaters, so the handhelds would not be able to hear each other. ***The repeaters should not transmit CTCSS unless used only in a single vehicle environment***.

When the user leaves the vehicle, they activate the SVR-200 via their mobile radio front panel or a separate switch. When the mobile radio is receiving carrier and proper tone, the SVR-200 will begin transmitting on the handheld's receive frequency. The user is able to hear and respond to all radio traffic, including other handhelds at the site. The SVR-200 can be programmed to give the handhelds priority in a conversation by periodically sampling for handheld activity (carrier and proper tone) during base-to-portable transmissions. During sampling, if the SVR-200 detects a handheld transmission, it will cease transmissions, key the mobile radio and repeat portable-to-base. This allows the handheld to respond during repeater hang time or during full duplex interconnect calls. Priority sampling can be enabled/disabled through PC programming and the interval can be programmed between .25 seconds and 2.5 seconds in .25 second increments.

The SVR-200 has a fixed 3 minute time out timer for base-to-portable transmissions. If the mobile COR is active for more than 3 minutes (and the SVR-200 is the priority unit) it will send a double blip and cease transmission until the mobile COR is inactive. The 3 minute time-out is in affect regardless of whether the SVR-200 is programmed for priority sampling or not.

Multi-vehicle operation

When the SVR-200 is first activated, it will transmit a short "lock tone" that alerts the user that the system is functioning. It will then assume the priority status and be ready to repeat any base-to-portable or portable-to-base transmissions. If another unit arrives on scene and is activated, it too will transmit the "lock tone"; when the first SVR-200 detects the lock tone from the second unit, it will increment a "priority counter" and will no longer repeat any transmissions. The recently arrived unit will be the priority repeater, and the first unit will be 1 count away from priority. This process will continue for each unit that arrives at the site, creating a priority hierarchy for up to 256 vehicles, each with a unique count and only one unit at priority status. The SVR-200 will not transmit it's lock tone if the radio channel is busy when first enabled. It will wait in non-priority status until all transmissions cease, then send its lock tone and become the priority unit.

Even though the other SVR-200s are not at priority status, they will continue to monitor the channel for activity. If the priority unit were to leave the scene or become disabled, the other units will detect the condition to repeat and determine that there is no priority unit repeating the transmission. They will then begin to decrement their priority counters until one of them reaches the priority status and begins repeating the transmission. Since the SVR-200s are all at different counts, only one will reach priority status and begin transmitting. The other units will sense the new priority repeater and cease counting down, preserving the priority hierarchy.

If another unit were to arrive from a different scene and it is still the active priority, there will be two active repeaters on the air when a condition to repeat exists. When one of the SVR-200s unkeys to check for handheld activity, it will detect the presence of the other active SVR-200 and increment it's priority counter and cease transmission. This is the self clearing mode to prevent radio collisions.

If the handheld operator is out of the vehicle and their partner still in the vehicle were to key the mobile radio using the local mic, the SVR-200 will detect the local PTT and repeat the transmission to the other handhelds so that both sides of the conversation will be heard by everyone on the link. The local mic repeat function can be enabled/disabled via the PC software.

The SVR-200 also has a local receive audio speaker jack that enables the person in the vehicle to monitor portable-to-base transmissions that are being repeated through the mobile.

If the users wish to communicate portable-to-portable without accessing the mobile repeater, they may transmit on the same frequency without CTCSS (or a different CTCSS); the SVR-200 only responds to carrier and proper tone from the handhelds.

Trunking operation

When the SVR-200 is connected to a trunking mobile and the handheld operator wishes to access the system, they key their handheld briefly then release. The SVR-200 will attempt to acquire a voice channel on the trunking system by keying the mobile for 200mS and monitoring the on-air detect line from the mobile. If it does not see the radio transmit at all (system is busy), it will send a low tone to the hand held operator to alert them that the system is busy. The SVR-200 will automatically retry every 5 seconds and send busy tone to the handheld with each unsuccessful attempt to indicate progress of the call attempt. If unsuccessful after 30 seconds, the SVR-200 will transmit intercept tone to alert the handheld operator that the call attempt failed.

When the SVR-200 detects that the mobile is transmitting, it will continue to monitor the on-air line until the transmitter remains keyed for at least 250mS to ensure that the radio is merely handshaking or retrying. After successful acquisition of a voice channel, it will continue to hold the mobile PTT active for 2 seconds and transmit a go-ahead blip to the handheld operator. The user then keys their handheld to speak on the voice channel. If the user does not key up within the 2 second period, the SVR-200 will unkey the mobile and send intercept tone as before.

If the user keys their handheld only once, or they key the first time for more than 1 second, the SVR-200 will cancel the call attempt and send intercept tone to the handheld operator. All of the queuing and error tones will only be sent if the handheld is not transmitting to ensure that the user hears the proper tones.

LEDs

CPU:	Flashes at a 1 Hz rate to indicate proper operation of the microprocessor.
PRI:	When on, indicates that the unit is at priority count zero and will repeat all transmissions.
RCOR:	Repeater Carrier detect.
RTONE:	Repeater sub-audible decode; when on, indicates a condition to repeat portable-to-base.
RTX:	Repeater transmit indicator.
MCOR:	Mobile unmute detector indicating a condition to repeat base-to-portable.
MTX:	Mobile transmit indicator.
OPT:	Should be on steady during programming operations only. If OPT LED flashes at 10Hz rate, it is an indication that the PLL did not lock within the allotted 50mS and the unit should be serviced.

Installation

Before installing the SVR-200, ensure that the RF and repeater sections are properly aligned per the tuning instructions on pages 8-14 of this manual. Additionally, ensure that the SVR-200 jumpers are properly configured for use with the particular mobile radio that it will be connected to:

J1 Controls the maximum drive level of the transmit audio output to the mobile radio. If J1 is installed, output amp U1B will have an adjustment range of 0-100 mVPP. If J1 is removed, U1B can be adjusted between 0-5VPP.

J2 Controls the output impedance of the transmit audio line to the mobile radio. If connected to a low impedance point in the mobile, installing JP2 sets the output impedance to 600 ohms. If JP2 is open, the output impedance is 2.2Kohms. Install the jumper for radios that require a lot of modulation drive or that have low impedance microphone circuits. Remove the jumper if the SVR-200 installation decreases local microphone audio at the mobile.

J3 Used for testing the SVR-200 receiver and setting the lock tone deviation transmit level. If JP3 is shorted at power up, the SVR-200 receiver will be active all of the time and receiver audio will be heard at the speaker regardless of the repeater squelch setting or CTCSS tone decoded. Remove the jumper and turn the SVR-200 off to return to normal operation. If JP3 is shorted while power is applied, the SVR-200 will go into transmit mode and send lock tone for as long as the jumper is shorted. Remove the jumper to return to normal operation.

J4 Used to internally tie the local mic input of the SVR-200 to the transmit audio output line which is usually connected to the mic hi line in the mobile.

J5 Used to internally tie the on-air detect input of the SVR-200 to the PTT output. Do so *only on conventional radios*; trunking radios *must have the on-air detect line connected to a line indicating that the radio is transmitting*.

J6 Changes the maximum gain of the local mic input amp from unity (Out) to 10x (In).

J7 Changes the maximum gain of the receive audio line input from unity (Out) to 7x (In).

J8 Adds a pull up (+ position) or pull down (- position) resistor to the remote enable line (blue).

J9 Adds a pull up resistor (10K to 5VDC) to mobile COR line (violet)

J11 Removing J11 adds 100K ohm resistor in series with SVR-200 mobile transmit audio path. Used for situations where mobile radio has noise on transmit audio.

J12 Enables external speaker circuit.

Make the connections between the mobile radio and the SVR-200 cable as follows:

Pin 1: *Black/Shield* — Ground. Connect to the radio's chassis or ground plane.

Pin 2: *White* — Mobile transmit audio. Connect to the mobile transmit audio path or tone input. If connected before pre-emphasis, ensure that the SVR-200 is programmed for de-emphasis (common data). If connected after pre-emphasis, ensure that the SVR-200 transmit audio path is programmed as flat. Pin 2 is AC coupled and has an output impedance of 600 or 2.2Kohms (determined by J2). RV3 sets the transmit audio output level and J1 sets the adjustment range between 0-5VPP (J1 open) or 0-100mVPP (J1 shorted).

Pin 3: *Blue* — Remote enable/disable. Connect to the radio's auxiliary output or a separate switch to remotely enable or disable the repeater. If this line goes high to activate the repeater, ensure that JP1 is set to the "+" position. If this line goes to ground, set JP1 to the "-" position. J8 has two positions to add a pull up (+) or pull down (-) resistor to this line if used with an open collector or dry contact output.

Pin 4: *Green* — Mobile PTT output. Connect to mic PTT on the mobile radio, or a line that goes active low to transmit. Pin 4 is an open collector output rated at 100mA at 50VDC.

Pin 5: *Red* — 12 VDC input. Connect to the radios 12V switched supply or a point capable of supplying at least 1.5A of current.

Pin 6: *Yellow* — Mobile receive audio. Connect this line to the mobile receive audio path before the volume control. If pin 6 is connected before de-emphasis, ensure that the SVR-200 receive path is programmed as flat (common data). If connected after de-emphasis, program the receive path for pre-emphasis. Pin 6 is AC coupled and high impedance (>15K ohm). RV5 sets the receive audio level sensitivity; this input should be between 30mVPP and 5VPP. J7 sets the gain of the receive input amp. If open, the input has a maximum gain of one; if installed, the input has a maximum gain of 7.

Pin 7: *Violet* — Mobile COR detect. This line is used to indicate when the SVR-200 should repeat the transmission to the handheld. Connect to a logic point in the radio that indicates proper tone and carrier have been detected or the audio unmute line. If this line goes more positive during an unmute condition, program the mobile COR line as active high (common data). If the line goes more negative during an unmute condition, program the mobile COR line as active low. The input from pin 7 is high impedance and does not have to go rail to rail. The SVR-200 uses a voltage comparator as a COR threshold detector. RV1 sets the mobile COR threshold level and should be set for half way between the mute and unmute levels at pin 7. Example: If Pin 7 is connected to a point that goes from 0VDC (mute) to 5VDC (unmute), set RV1 for 2.5VDC and program the mobile COR line as active high. If Pin 7 goes between 7.2VDC (mute) and 5.8VDC (unmute), set RV1 for 6.5VDC and program the mobile COR line as active low.

Pin 8: *Brown* — Local mic audio. If programmed for local mic repeat, the SVR-200 will go into transmit mode and repeat the audio from this line whenever the mobile radio is keyed by the local mic. Connect this line to the mobile transmitter audio path before limiting or filtering. This input is AC coupled and high impedance (>5.6Kohms). The input level at this pin should be 300mV to 5VPP. RV2 sets the local mic sensitivity. If the mic high line has sufficient drive for this input, install J4 and leave pin 8 unconnected. J6 sets the gain of the local mic input amp. If open, the maximum gain is one; if installed, the maximum gain is 10.

Pin 9: *Gray* — On-Air detect.

Trunking: Connect to a point in the radio that indicates the mobile transmitter is actually on the air. This is not the same as mic PTT. If pin 9 goes positive during transmit, program the on-air detect line for active high (common data). If pin 9 goes to ground during transmit, program the on air detect line for active low.

Conventional: Used for local mic repeat indication from the mobile. Connect pin 9 to pin 4 of the SVR-200 and program the on-air detect line for active low. Solder jumper J5 will connect pin 9 to pin 4 (PTT output) and can be used on *conventional systems only*. ***Do not install J5 for trunking operation***.

Install the SVR-200 in the vehicle using the supplied mounting bracket and hardware. Install the unit where it will be easily visible by the driver and will not interfere with the drivers vision or constitute a hazard during a vehicle collision. The SVR-200 mounts in the bracket using the four 8-32 x ¼" machine screws. Do not use longer screws to mount the SVR-200 to the bracket or circuit damage may result.

Alignment VHF

Before aligning the SVR-200, ensure that the mobile radio is aligned per the manufacturer's service procedure; Ensure that the SVR-200 is properly programmed and the jumpers are set per the previous section.
In order to properly align the SVR-200, you will need two service monitors and the mobile radio that the repeater will be installed with. Refer to figure 1 for alignment points.

Dis-assemble the repeater by removing the two cap screws on the rear panel and the phillips screw on the bottom. Slide the main circuit board out of the housing with the rear panel attached. Connect one service monitor to the SVR-200 TNC jack and the other to the mobile antenna jack. Connect the cable from the mobile radio to the SVR-200 (See figure 4 on page 14). Turn on the mobile and activate the SVR-200.

Adjust the repeater squelch control (RV9) so that the repeater COR led is off. Adjust the mobile so that the audio is squelched.

SVR-200 VHF Transmitter

1. ***Transmitter Output***: Short J3 and adjust RV10 for maximum. Confirm the SVR-200 RF Power out is at least 2W. Adjust RV10 for 250 mW. The SVR-200 case is integral to the voltage regulator heat sink and the unit should not transmit at full power when removed from the case for extended periods.
2. ***Transmitter frequency***: Adjust the TCXO on the RF board for the transmit frequency.
3. ***Maximum deviation/lock tone deviation***: Adjust RV7 (lock tone deviation) for maximum. If the SVR-200 is programmed for sub-audible encode, adjust RV6 (CTCSS) for minimum. Adjust RV8 (repeater deviation) for 95% deviation. Adjust RV7 for 60% deviation. Remove J3.
4. ***Mobile COR***: Measure the voltage at TP2 on the SVR-200 main PCB and record. Set the mobile service monitor for the mobile receive frequency, 1mV RF output and CTCSS modulation of 15% deviation. Measure the voltage again at TP2 and record. Turn the mobile service monitor off and adjust RV1 on the SVR-200 main board for the halfway point between the two voltage readings as read at pin 3 of U1.
5. ***RX audio sensitivity/CTCSS deviation***: Set the service monitor connected to the mobile for the mobile receive frequency and 1mV RF output. Modulate the signal generator with a 1kHz tone at 60% deviation and CTCSS tone at 15% deviation. Ensure that the SVR-200 mobile COR and repeater PTT LED's are on. Adjust RV5 on the SVR-200 main board for 60% deviation as read on the service monitor connected to the SVR-200. If programmed for sub-audible encode, remove the 1kHz tone deviation from the mobile service monitor and adjust RV6 on the SVR-200 main board for 15% deviation. Turn the RF output from the mobile service monitor off and ensure that the SVR-200 mobile COR and repeater PTT LEDs are off.
6. ***Local mic repeat***: If the SVR-200 is programmed for local mic repeat, key the mobile local mic and inject an audio signal into the local mic to produce 60% deviation on the service monitor connected to the mobile. Confirm that the SVR-200 repeater PTT LED is on; adjust RV2 for 60% deviation as read on the service monitor connected to the SVR-200. Unkey the mobile radio.
7. ***RF power out***: Short J3 and adjust RV10 for the operating power output. Open J3.

VHF Receiver

1. ***Receiver front end***: Connect a DC voltmeter to TP1 on the SVR-200 main board. Set the service monitor connected to the SVR-200 to the generate mode, receive frequency with a 1kHz tone and 60% deviation. Adjust the RF output of the monitor for a 1VDC reading at TP1. Adjust L1-L5 on the RF board for a maximum reading at TP1.

2. ***Repeater squelch***: Adjust the service monitor RF output for .5µV. Adjust RV9 on the SVR-200 main board so the repeater COR LED is just on. Decrease the service monitor RF output to .3µV and ensure that the repeater COR LED is off.

3. ***Transmit audio output***: Adjust the service monitor RF output for 1mV. Turn the CTCSS modulation on and set for 15% deviation. Confirm that the repeater COR, CTCSS and mobile PTT LED's are on. Adjust RV3 on the SVR-200 main board for 60% deviation as read on the service monitor connected to the mobile radio.

4. ***Local Rx audio***: Connect an 8 ohm speaker to P4 and set RV4 for the desired listening level. Turn off the CTCSS modulation of the service monitor connected to the SVR-200. Confirm that the repeater CTCSS and mobile PTT LED's are off.

5. ***Lock Tone Decode***: Change the 1kHz tone modulation to the lock tone frequency. Confirm that the PRI LED goes off after approximately .5 seconds.

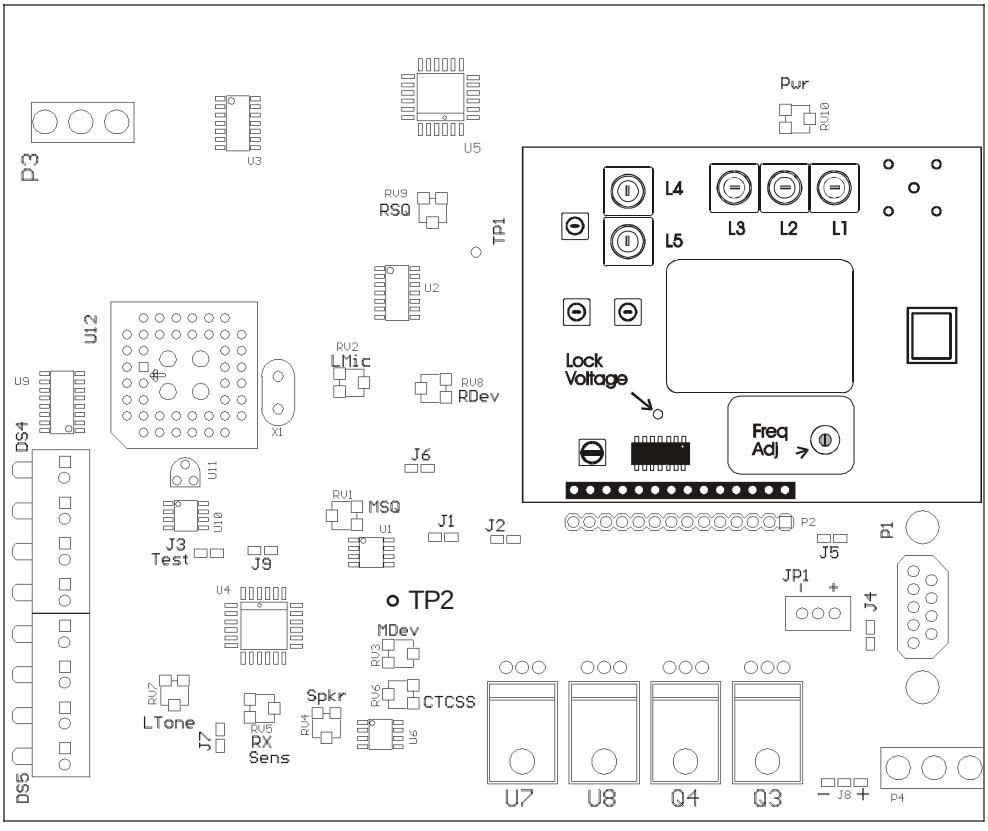


Figure 1

Alignment UHF

Before aligning the SVR-200, ensure that the mobile radio is aligned per the manufacturer's service procedure; Ensure that the SVR-200 is properly programmed and the jumpers are set per the previous section.
In order to properly align the SVR-200, you will need two service monitors and the mobile radio that the repeater will be installed with. Refer to figure 2 for alignment points.

Dis-assemble the repeater by removing the two cap screws on the rear panel and the phillips screw on the bottom. Slide the main circuit board out of the housing with the rear panel attached. Connect one service monitor to the SVR-200 TNC jack and the other to the mobile antenna jack. Connect the cable from the mobile radio to the SVR-200 (See figure 4 on page 14). Turn on the mobile and activate the SVR-200.

Adjust the repeater squelch control (RV9) so that the repeater COR led is off. Adjust the mobile so that the audio is squelched.

SVR-200 UHF Transmitter

1. ***Transmitter Output***: Short J3 and adjust RV10 for maximum. Confirm the SVR-200 RF Power out is at least 2W . Adjust RV10 for 250 mW. The SVR-200 case is integral to the voltage regulator heat sink and the unit should not transmit at full power when removed from the case for extended periods.
2. ***Transmitter frequency***: Adjust the TCXO on the RF board for the transmit frequency.
3. ***Maximum deviation/lock tone deviation***: Adjust RV7 (lock tone deviation) for maximum. If the SVR-200 is programmed for sub-audible encode, adjust RV6 (CTCSS) for minimum. Adjust RV8 (repeater deviation) for 95% deviation. Adjust RV7 for 60% deviation. Remove J3.
4. ***Mobile COR***: Measure the voltage at TP2 on the SVR-200 main PCB and record. Set the mobile service monitor for the mobile receive frequency, 1mV RF output and CTCSS modulation of 15%. Measure the voltage again at TP2 and record. Turn the mobile service monitor off and adjust RV1 on the SVR-200 main board for the halfway point between the two voltage readings as read at pin 3 of U1.
5. ***RX audio sensitivity/CTCSS deviation***: Set the service monitor connected to the mobile for the mobile receive frequency and 1mV RF output. Modulate the signal generator with a 1kHz tone at 60% deviation and CTCSS tone at 15% deviation. Ensure that the SVR-200 mobile COR and repeater PTT LED's are on. Adjust RV5 on the SVR-200 main board for 60% deviation as read on the service monitor connected to the SVR-200. If programmed for sub-audible encode, remove the 1kHz tone deviation from the mobile service monitor and adjust RV6 on the SVR-200 main board for 15% deviation. Turn the RF output from the mobile service monitor off and ensure that the SVR-200 mobile COR and repeater PTT LEDs are off.
6. ***Local mic repeat***: If the SVR-200 is programmed for local mic repeat, key the mobile local mic and inject an audio signal into the local mic to produce 60% deviation on the service monitor connected to the mobile. Confirm that the SVR-200 repeater PTT LED is on; adjust RV2 for 60% deviation as read on the service monitor connected to the SVR-200. Unkey the mobile radio.
7. ***RF power out***: Short J3 and adjust RV10 for the operating power output. Open J3.

UHF Receiver

1. ***Receiver front end***: Connect a DC voltmeter to TP1 on the SVR-200 main board. Set the service monitor connected to the SVR-200 to the generate mode, receive frequency with a 1kHz tone and 60% deviation. Adjust the RF output of the monitor for a 1VDC reading at TP1. Adjust BPF1 and BPF2 on the RF board for a maximum reading at TP1.

2. ***Repeater squelch***: Adjust the service monitor RF output for .5µV. Adjust RV9 on the SVR-200 main board so the repeater COR LED is just on. Decrease the service monitor RF output to .35µV and ensure that the repeater COR LED is off.

3. ***Transmit audio output***: Adjust the service monitor RF output for 1mV. Turn the CTCSS modulation on and set for 15% deviation. Confirm that the repeater COR, CTCSS and mobile PTT LED's are on. Adjust RV3 on the SVR-200 main board for 60% deviation as read on the service monitor connected to the mobile radio.

4. ***Local Rx audio***: Connect an 8 ohm speaker to P4 and set RV4 for the desired listening level. Turn off the CTCSS modulation of the service monitor connected to the SVR-200. Confirm that the repeater CTCSS and mobile PTT LED's are off.

5. ***Lock Tone Decode***: Change the 1kHz tone modulation to the lock tone frequency. Confirm that the PRI LED goes off after approximately .5 seconds.

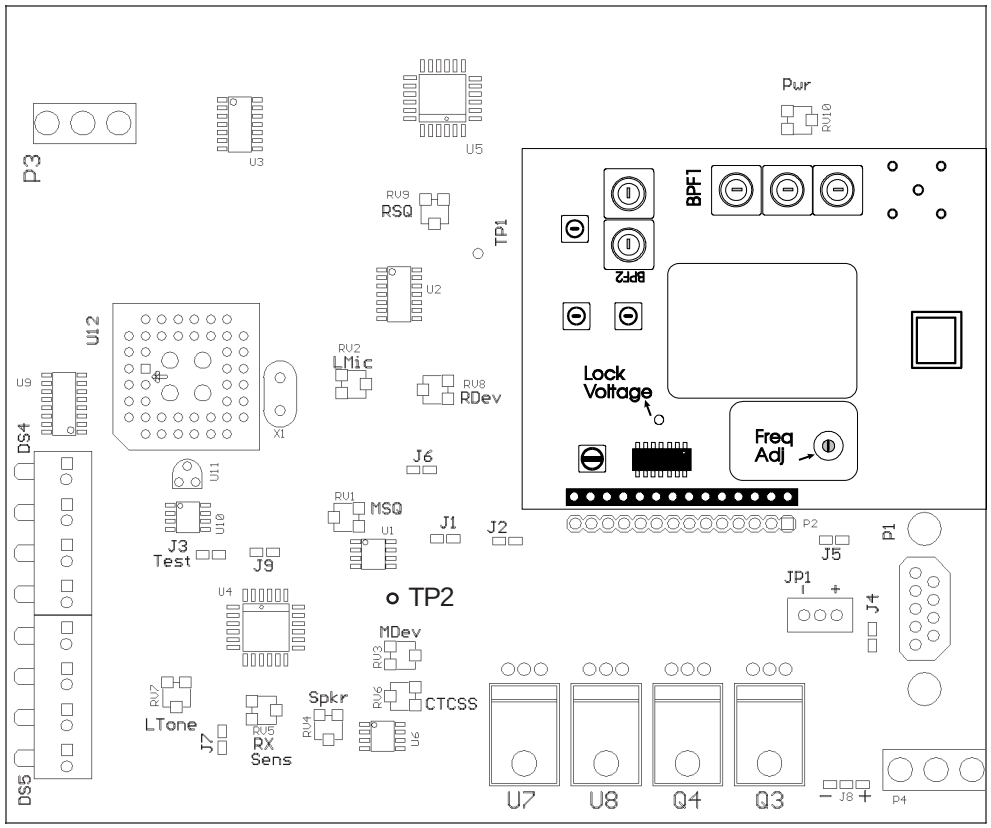


Figure 2

Alignment 700/800/900 MHz

Before aligning the SVR-200, ensure that the mobile radio is aligned per the manufacturer's service procedure; Ensure that the SVR-200 is properly programmed and the jumpers are set per the previous section.
In order to properly align the SVR-200, you will need two service monitors and the mobile radio that the repeater will be installed with. Refer to figure 3 for alignment points.

Dis-assemble the repeater by removing the two cap screws on the rear panel and the phillips screw on the bottom. Slide the main circuit board out of the housing with the rear panel attached. Connect one service monitor to the SVR-200 TNC jack and the other to the mobile antenna jack. Connect the cable from the mobile radio to the SVR-200 (See figure 4 on page 14). Turn on the mobile and activate the SVR-200.

Adjust the repeater squelch control (RV9) so that the repeater COR led is off. Adjust the mobile so that the audio is squelched.

SVR-200 700/800/900 MHz Transmitter

1. ***Transmitter Output***: Short J3 and adjust RV10 for maximum. Confirm the power out is at least 600mW. Adjust RV10 for 100 mW. The SVR-200 case is integral to the voltage regulator heat sink and the unit should not transmit at full power when removed from the case for extended periods.
2. ***Transmitter frequency***: Adjust the TCXO on the RF board for the transmit frequency ±100 Hz.
3. ***Maximum deviation/lock tone deviation***: Adjust RV7 (lock tone deviation) for maximum. If the SVR-200 is programmed for sub-audible encode, adjust RV6 (CTCSS) for minimum. Adjust RV8 (repeater deviation) for 95% deviation. Adjust RV7 for 60% deviation. Remove J3.
4. ***Mobile COR***: Measure the voltage at TP2 on the SVR-200 main PCB and record. Set the mobile service monitor for the mobile receive frequency, 1mV RF output and CTCSS modulation of 15%. Measure the voltage again at TP2 and record. Turn the mobile service monitor off and adjust RV1 on the SVR-200 main board for the halfway point between the two voltage readings as read at pin 3 of U1.
5. ***RX audio sensitivity/CTCSS deviation***: Set the service monitor connected to the mobile for the mobile receive frequency and 1mV RF output. Modulate the signal generator with a 1kHz tone at 60% deviation and CTCSS tone at 15% deviation. Ensure that the SVR-200 mobile COR and repeater PTT LED's are on. Adjust RV5 on the SVR-200 main board for 60% deviation as read on the service monitor connected to the SVR-200. If programmed for sub-audible encode, remove the 1kHz tone deviation from the mobile service monitor and adjust RV6 on the SVR-200 main board for 15% deviation. Turn the RF output from the mobile service monitor off and ensure that the SVR-200 mobile COR and repeater PTT LEDs are off.
6. ***Local mic repeat***: If the SVR-200 is programmed for local mic repeat, key the mobile local mic and inject an audio signal into the local mic to produce 60% deviation on the service monitor connected to the mobile. Confirm that the SVR-200 repeater PTT LED is on; adjust RV2 for 60% deviation as read on the service monitor connected to the SVR-200. Unkey the mobile radio.
7. ***RF power out***: Short J3 and adjust RV10 for the operating power output. Open J3.

700/800/900 MHz Receiver

1. ***Receiver front end***: Connect a DC voltmeter to TP1 on the SVR-200 main board. Set the service monitor connected to the SVR-200 to the generate mode, receive frequency at .5µV RF output with a 1kHz tone and 60% deviation. Confirm a reading of 1VDC ±.2VDC at TP1.

2. ***Repeater squelch***: Adjust the service monitor RF output for .5µV. Adjust RV9 on the SVR-200 main board so the repeater COR LED is just on. Decrease the service monitor RF output to .25µV and ensure that the repeater COR LED is off.

3. ***Transmit audio output***: Adjust the service monitor RF output for 1mV. Turn the CTCSS modulation on and set for 15% deviation. Confirm that the repeater COR, CTCSS and mobile PTT LED's are on. Adjust RV3 on the SVR-200 main board for 60% deviation as read on the service monitor connected to the mobile radio.

4. ***Local Rx audio***: Connect an 8 ohm speaker to P4 and set RV4 for the desired listening level. Turn off the CTCSS modulation of the service monitor connected to the SVR-200. Confirm that the repeater CTCSS and mobile PTT LED's are off.

5. ***Lock Tone Decode***: Change the 1kHz tone modulation to the lock tone frequency. Confirm that the PRI LED goes off after approximately .5 seconds.

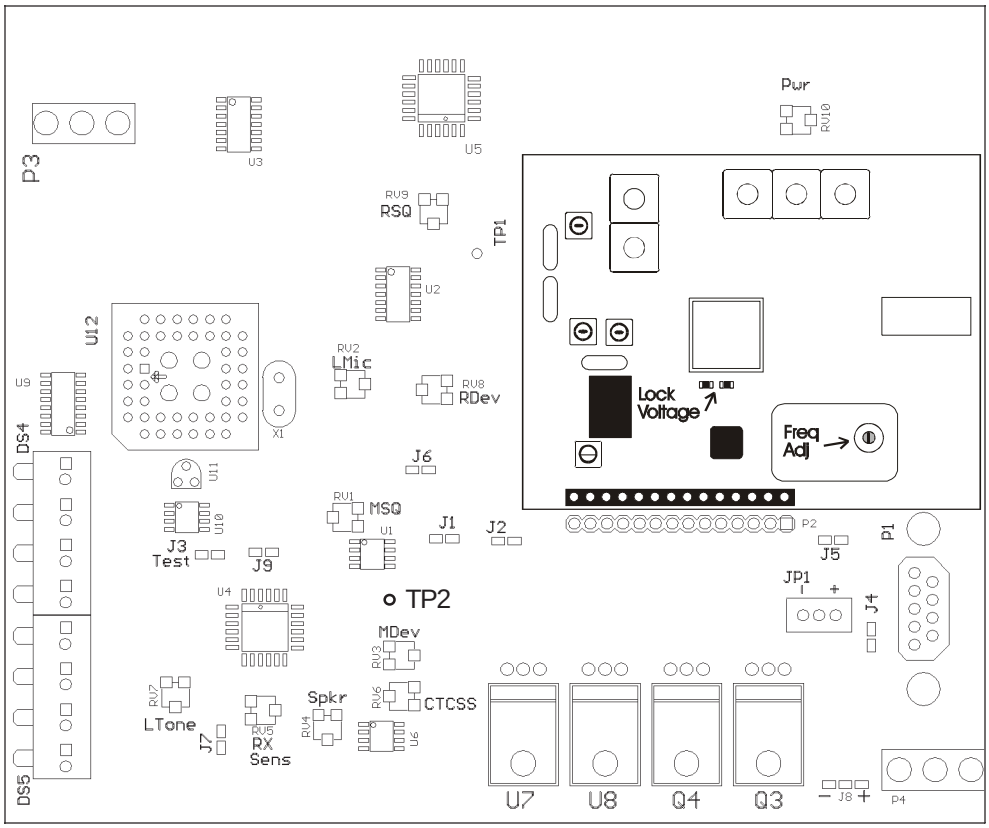


Figure 3

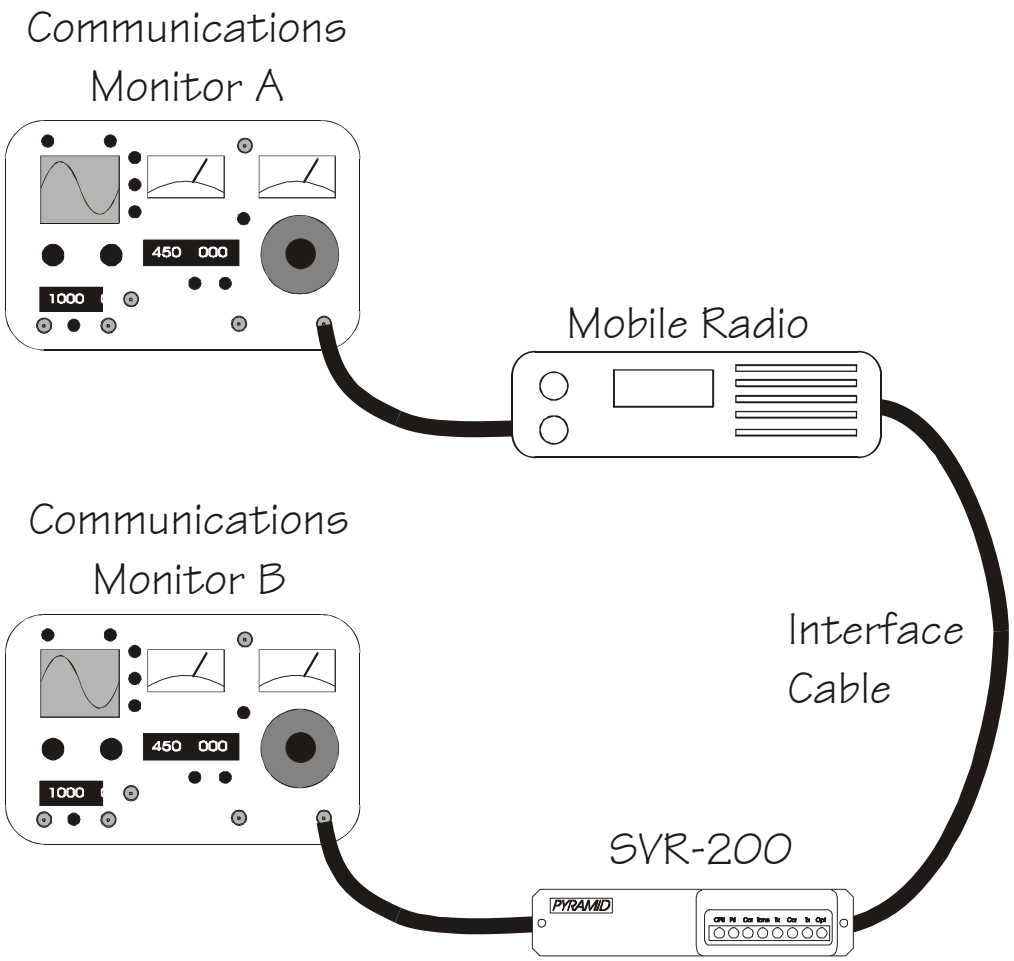

Communications
Monitor A
450 000
1000
Mobile Radio
Communications
Monitor B
450 000
1000
Interface
Cable
SVR-200
PYRAMID

Figure 4

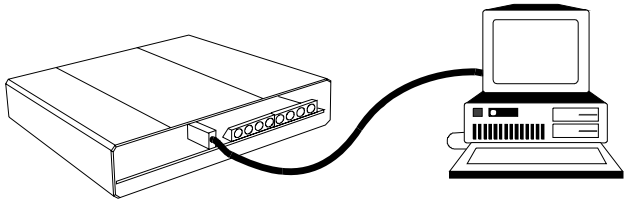
Programming

Using the Software

The SVRCPS personalization software is used to program the SVR-200 for all of the operating parameters and options. The software is compatible with Windows 2000 and later operating systems The software is menu driven and on-line help is available at any time by clicking the left mouse button on the HELP icon on the right side of the tool bar.

Important Note:

Before attempting to program the SVR-200 start the software and ensure the FY-1 programming cable is plugged into the correct serial port. The com port may be selected under the "Transfer" menu. Plug the FY-1 programming cable into P3 on the front of the SVR-200; the OPT LED on the SVR-200 front panel should be on continuously:



Menu selections

File

Open: Allows you to load a previously saved file from disk. Enter the file name or select from the Windows Dialog box. Only files with the .VR2 extension can be loaded.

Save: Allows you to save the current configuration to disk. Enter the file name to save as or select a previous file from the Windows Dialog box to overwrite. The .VR2 extension is automatically added to the file name. The program will prompt you before overwriting an existing file.

Print: Sends the current configuration to the selected printer. Make sure the printer is on line and paper is loaded before executing this command.

Exit: You will be asked to confirm before exiting the program. The software will also prompt you if the configuration has changed since program start up and data has not been saved to disk.

Data

Frequencies: Enter the transmit and receive frequencies and select the encode and decode sub-audio data. The program will automatically round off the frequencies to the nearest channel step if incorrect data is entered. To enter VHF offset frequencies (6.25kHz channel steps), go to common data and select the "VHF Offset" band. To disable sub-audio encode operation, select "------"; sub-audio decode cannot be disabled.

Common data: Controls all of the options and input polarities of the SVR-200. Make sure all of the settings are correct for the type of mobile radio the repeater is connected to or improper operation may result.

File name: This data is stored in the E²PROM of the SVR-200 during downloads.

Model: Select either SVR-200 (single frequency) or SVR-214 (14 channel).

Band: Select the proper frequency band to correspond with the model SVR-200 you are programming. This selection is automatically set by reading the SVR-200. The IF frequency, injection side and channel step are displayed next to the band selection. Select VHF Offset band for 6.25kHz channel steps.

Mobile COR polarity: Determines if the COR signal from the mobile is active high or active low.

Radio Type: Select either conventional or trunking. If a trunking mobile is selected, the SVR-200 will go through the voice channel acquisition procedure during portable-to-base repeat mode.

On-air polarity: Select either active high or active low. This line is used to monitor the local mobile PTT for local mic repeat on conventional radios. On trunking radios, it is also used to determine if the mobile is actually transmitting.

TX Audio: If the mobile transmit audio output from the SVR-200 is connected after pre-emphasis in the mobile, select ***Flat*** response. If connected before pre-emphasis or to the mic input, select ***De-Emp***.

RX Audio: If the receive audio coming from the mobile is connected to the discriminator or before de-emphasis, select ***Flat*** response. If connected after de-emphasis, select ***Pre-Emp***.

Lock Tone: Select either 682.5, 832.5 or 847.5 Hz. All units in the system must have the same lock tone frequency.

Local mic repeat: Enables or disables the local mic repeat function; if enabled, ensure that the on-air polarity input is correctly configured.

***Courtesy Blip*:** (Firmware version 3.02 & above) Enables or disables the courtesy tone at the end of each portable-to-base transmission. The tone verifies the handheld is within range of the repeater and transmission was successful. It also serves to notify other handheld users that the channel is clear for use.

Pri-sampling: Enables or disables the pri-sampling feature of the SVR-200. ***If used in multi-vehicle applications, this must be enabled for proper operation***. During base-to-portable repeat mode, the SVR-200 transmitter will switch to receive mode to check for other repeaters or handheld activity. If another repeater is detected (carrier without/wrong tone) the repeater will cease activity to prevent radio "collisions". If handheld activity is detected (carrier & correct tone) the SVR-200 will switch to portable-to-base repeat mode.

Sampling rate: If pri-sampling is enabled, this selects the sampling interval. The range is 0.25 seconds to 2.5 seconds in .25 second increments. The higher this setting, the longer the handheld operator must wait before speaking after pressing PTT during base-to-portable repeat mode, since the repeater may still be in transmit mode (there is no delay if the repeater is idle). If the interval is too short, some users may complain about the "chop" that is heard in the handhelds.

Transfer

Send: Downloads the current configuration to the repeater. The program will prompt you to make the FY-1 connection before downloading. Download takes approximately 5 seconds.

Receive: Uploads the current data from the repeater. The program will prompt you to make the FY-1 connection before uploading. Upload takes approximately 4 seconds.

Comm Port: Selects the serial port to use for uploading and downloading between the PC and the SVR-200. Comm ports 1-4 are supported.

Help

Help is available at any time by clicking the left mouse button on the HELP icon on the right side of the tool bar. The help is context sensitive and will depend upon where the cursor is located on particular menu displayed.

Theory of Operation

Receiver:

The receiver is a double-conversion superheterodyne type, designed for narrow band FM reception. The first local oscillator is derived from the frequency synthesizer. The second LO is crystal controlled.

RF Stage: The incoming RF signal from the antenna jack is directed to the first RF bandpass filter to improve selectivity and then to the input of the RF amplifier. The output of the RF amplifier is then presented to a second bandpass filter.

First LO/Mixer: The first LO signal is developed by the synthesizer and is mixed with the incoming signal to produce the first IF frequency (45 MHz). The IF frequency is filtered by FL1A and FL1B and amplified by the IF amplifier before being presented to the second LO/Mixer IC.

Second LO/Mixer: The first I.F. signal is presented to the second IF IC (MC3371) which performs the functions of second LO, second I.F. amp and mixer, FM discriminator and squelch. The second LO crystal (44.545 MHz) is mixed with the 45 MHz first I.F. signal to produce the second I.F. frequency of 455 kHz. A 6 pole ceramic filter provides selectivity for the 455 kHz signal.

Detector/Squelch: The MC3371 demodulates the 455 kHz signal via quadrature coil to produce the audio and noise components. The output of the MC3371 is the recovered audio and the RSSI voltage (receiver signal strength indicator) which is compared by the controller board with a threshold voltage level for squelch setting.

VHF Transmitter

The output of VCO buffer U8 is input to the predriver transistor U7. The output of U7 drives the RF driver Q8. The collector of Q8 is fed by the transmit 9V line from Q10. The final amp Q13 is a class C power amplifier and drives the output lowpass and harmonic filter, C47-C50 and L20-L22. D3 is the transmit output switch and L19 is a ¼ wave transmission line to isolate the receiver switching diode D2. RF output power is controlled by changing the bias on the gate of Q13 via the TX 9V line (pin 3) from the controller PCB.

UHF Transmitter

The output of VCO buffer U6 is input to the predriver transistor U5. The output of U5 drives the RF driver transistor Q4. The collector of Q4 is fed by the transmit 9V line from Q5. The final amp Q3 is a class C power amplifier and drives the output lowpass and harmonic filter, C39-C42 and L26-L28. D3 is the transmit output switch and L14 is a ¼ wave transmission line to isolate the receiver switching diode D2. RF output power is controlled by changing the bias on the gate of Q3 via the TX 9V line (pin 3) from the controller PCB.

700/800/900 MHz Transmitter

The output of the transmit VCO is buffered by U5 input to the driver transistor U1. The output of U1 drives the RF hybrid output amp U4 through lowpass filter FL3. The final amp U4 is a class C power amplifier and drives the output lowpass and harmonic filter FL4. U7 is the Tx/Rx antenna switch. RF output power is controlled by changing the voltage on pin 1 of U4 via the TX 9V line (pin 3) from the controller PCB.

Control Board

Power Supply: DC power comes from the mobile radio via P1 pins 1 and 5. Fuse F1 and MOV VAR1 provide over current and voltage spike protection. Q3 is the remote enable/disable pass switch, controlled by Q1 and Q2 via P1 pin 3. Q3 output is switched 12VDC and is presented to audio amp U6, and voltage regulators U7 and U8. Bias voltage for the op-amp circuits is provided by voltage divider R68, R69 and buffer amp U2A.

Transmit audio path: Receiver audio from the mobile is input to the mic amp portion of U4; PC programming of the SVR-200 provides flat response or +6db/octave pre-emphasis. The output of the mic amp is internally connected to the limiter and lowpass filter. When a condition to repeat exists (base-to-portable) U4 audio is switched on and audio is presented to amplifier/limiter and lowpass filter to remove audio components above 3kHz. U4 provides -48db/octave of attenuation to out of band signals. Transmit audio is output on pin 22 of U4 and passes through the final lowpass filter U2C to remove any clock noise generated by U4's switched capacitive filters before being presented to the RF module on P2 pin 6.

Receive audio path: Receiver audio from the transceiver module is input on P2 pin 13 and presented to U5 pin 10 and pin 16. Pin 10 is the input of the receiver highpass filter to remove any sub-audible signals before being output on pin 11 and sent to U4 for receiver audio processing. Pin 16 is the input to the sub-audible tone decoder section of U5. Receive audio entering pin 7 of U4 is processed as flat, or -6db/octave depending upon PC programming. The receive audio then passes through the internal lowpass filters to remove unwanted noise and output on pin 21, where it is sent to the local receiver audio amp and mobile transmit audio output amp U1B. J1 selects either high sensitivity (open) or low sensitivity (shorted) and J2 selects the output impedance (600/2.2K Ohms).

Sub-Audible tone signalling: U5 processes the sub-audible signal from the receiver by comparing the incoming signal to previous samples in a noise correlator. If the signal is sufficiently coherent, the output of the comparator is counted by the internal circuitry and an interrupt is generated to the main microprocessor. U12 reads the data from U5 in 2 bytes: byte one contains the number of complete cycles detected within 122mS, and byte 2 contains the number of internal clock cycles elapsed for the remainder. U12 performs a comparison of minimum and maximum values allowed in a look up table and determines if the data is within the decode bandwidth for the programmed tone.

In band tone signalling: Audio from the transceiver is also fed to U3B where it is amplified and limited for input to the commutating switched capacitive filter made up by C23-C26 and P0.4-P0.7 of the microprocessor. The microprocessor outputs four identical signals with 90° phase difference on the respective port pins. The resultant wave form will be a function of the difference between the incoming signal frequency and the decode frequency output by the microprocessor. The signal is buffered by U3C and amplified by U3A before being rectified and filtered by D1 and C2. The resulting DC voltage is compared to the reference voltage by U3D. If the incoming signal is within the decode bandwidth, the output of U3D will be a logic 1 and read by the microprocessor.

Logic and control: U12 is an Atmel 89C52 microprocessor with flash E²PROM memory. The microprocessor provides all of the logic and control functions for the repeater including mobile/repeater PTT output, local mobile PTT sense, mobile transmitter activity sense, audio switching, in-band & CTCSS detect, and repeater status indications via DS4 and DS5 led arrays.

The 89C52 has four 8 bit ports that interface with the rest of the hardware on the controller board; a brief description of each port follows:

P0.0-0.3 Channel Selector input; used only on SVR-214 version.

P0.4-0.7 These four lines make up the input to the switched capacitive filter network of C23-C26. During receive mode, the lock tone frequency will be output on each of these lines with a 90° phase difference between them at any given time. During transmit mode, these lines are in active and open collector.

P1.0-P1.2 LED data is output on P1.0 line every 10mSec. Data is loaded into shift register U9 8 bits at a time and is clocked by P1.1. P1.2 latches the data into U9 for display.

P1.3 PLL latch enable output to the RF module. During transmit to receive and receive to transmit transitions, this line is used to latch the serial data into the PLL shift registers. The serial data and clock lines are shared with U10 (E²PROM) U4 (audio processor) and U5 (sub-audio processor).

P1.4 E²PROM chip enable, active high. Data is output to the E²PROM on P1.6 and clocked by P1.5. Data is input from the E²PROM on P1.7. P1.4 will go active during read and write operations with U10. U10 is written to every time the unit is programmed. U10 is read only at power up.

P1.5 Serial clock line output. Serial data that is sent to the PLL, the E²PROM and the audio processor chips are clocked by each low-high-low transition on this line.

P1.6 Serial data output. Data sent to U10, U4 and U5 are output on this line and clocked by P1.5.

P1.7 Data input to the microprocessor. Serial data is read from U10 (E²PROM) and U5 (sub-audio processor) on this line.

P2.0 Lock tone output. Lock tone encode is generated by this pin at power up and during lock tone test mode. All of the queuing tones are also generated by this pin for trunking operation.

P2.1 Lock tone decode input, active high. The output of lock tone decoder U3D is input on this line and checked during receiver activity. If lock tone is detected, the microprocessor increments its priority counter and ceases activity as priority unit.

P2.2 Repeater Tx enable. This line is used to turn on the TX 9V signal to the RF PCB. The output drives buffers Q7 and Q6. The output of Q6 switches Q4 on during transmit for TX 9V. RV10 and APC circuit U13 are used to set the TX 9V level for RF power control.

P2.3 Mobile PTT output, active low. This line is brought low to key the mobile radio during portable-to-base repeat operations.

P2.4 Mobile COR input. U1A is a threshold detector for the mobile COR input on pin 7 of P1. The output of U1A is read by the microprocessor on this port to determine if the SVR-200 should repeat base to portable. Polarity of this input is determined by PC programming.

P2.5 Repeater COR input, active low. RSSI output from the RF module is sent to threshold detector U2D for comparison with the squelch setting at RV9. R47 and R70 provide hysteresis to prevent chatter. Repeater COR is used to enable the CTCSS decoder circuitry; the microprocessor will not decode the signal from U5 unless repeater COR is also active.

P2.6 Chip select output for U4 (audio processor), active low. Serial data is sent to U4 on P1.6 and clocked by P1.5. These lines are shared by U5, U10 and the PLL; data is ignored by U4 unless the chip select line is asserted during data write operations.

P2.7 Chip select output for U5 (sub-audio processor), active low. Serial data is sent to U5 on P1.6 and clocked by P1.5. These lines are shared by U4, U10 and the PLL; data is ignored by U5 unless the chip select line is asserted during data read and write operations.

INT0 External interrupt #0. This line monitors the PLL lock detector output. The line is active high to indicate the PLL is functioning on frequency during transmit-receive and receive to transmit changes. The output will go briefly unlocked, then revert back to a locked condition. If the PLL does not achieve lock within 50mS, the transmitter will be disabled and the OPT LED will flash rapidly to alert the user that the unit should be brought in for service.

INT1 External interrupt #1 active low. This line is used by U5 to signal the microprocessor that it has completed a decode cycle and data can be read. During receiver activity, this line will go active approximately every 122 mS in the presence of sub-audio signalling. During transmit mode and receiver activity without sub-audio signalling, this line will be inactive.

T0 — Test input, active low. Shorting J3 puts the microprocessor into test mode for alignment purposes. If shorted at power up, the receiver will operate open squelch mode and audio will be heard at the local speaker port regardless of carrier or tone input to the receiver. Although alignment is normally done with the RSSI output at TP1, a Sinad reading can be obtained using this mode of the test input. All other functions of the SVR-200 are disabled in this mode and power will have to be turned off then on to reset the unit.

If J3 is shorted after power has been applied, the microprocessor will enter the lock tone test mode, key the repeater and send the programmed lock tone for as long as J3 is shorted. Remove the short from J3 to return to normal operation.

T1 — On-air detect input. The on-air detect line (P1 pin 9) is used to detect local mic PTT from the mobile, and in trunking mode, this line is used to detect that the mobile transmitter is actually on the air. The input is buffered by Q10 and the polarity of the signal is determined by PC programming.

WR — Turns the Rx 5V line on or off to the RF PCB.

RD — Detects the version of RF PCB installed (UHF only).

TXD — Transmit data output for programming. Data is sent to the PC on this line at 300 baud, 8 data bits, 1 stop bit and no parity. This line is active only during programming mode.

RXD — Receive data input for programming. Data is received from the PC on this line at 300 baud, 8 data bits, 1 stop bit and no parity. This line is also used to sense when the programming cable is inserted. If RXD is grounded, the SVR-200 operates in the normal mode. If this line is high, programming mode is entered and the OPT LED is on continuously.

Reset — Active high input to reset the microprocessor. U11 provides a 350mSec delayed high signal to this pin during power up or if the 5V line falls below 4.5VDC.

Xtal — The microprocessor uses a 4.032MHz xtal for all of the timing and program execution clock cycles. The output of the on board oscillator also drives the xtal input to U5. The output of U5 xtal oscillator drives the input of U4.

Notes

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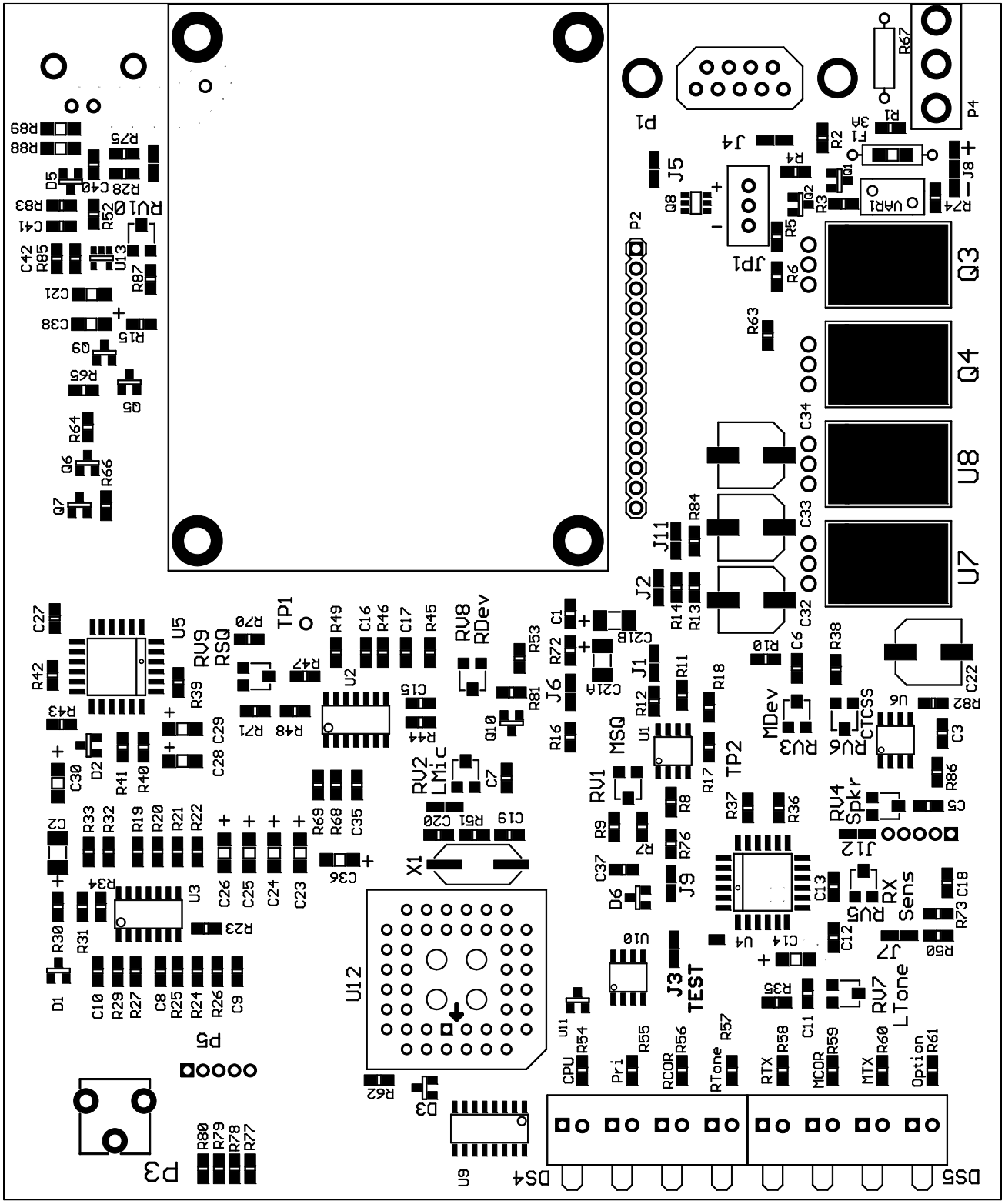
Parts List

Reference	Description	Part #
C1,C5,C6,C9,C10,C12,C15,C18,C35,C37	.1µFd chip capacitor	1010-03-5104
C2	22µFd 16V tantalum chip capacitor	1610-25-6226
C3,C27	.047µFd chip capacitor	1010-03-5473
C7,C8,C13,C41	220pFd chip capacitor	1010-03-5221
C11	.0033µFd chip capacitor	1010-03-5332
C16	1000pFd chip capacitor	1010-03-5102
C17	.0022µFd chip capacitor	1010-03-5222
C19,C20	22pFd chip capacitor	1010-03-5220
C40	0.5pFd chip capacitor	1010-03-5050
C21A,C21B	6.8µFd tantalum chip capacitor	1610-05-6685
C22,C32,C33,C34	100µFd elctrolytic cap	1400-08-7107
C21,C23,C24,C25,C26	0.47µFd tantalum chip capacitor	1610-04-6474
C28,C29,C36	1.0µFd tantalum chip capacitor	1610-04-6105
C14,C30,C38	2.2µFd tantalum chip capacitor	1610-04-6225
D1,D2,D3,D6	BAV99 dual diode SOT23	3110-01-0099
D4,D5	Schotkey diode SOT23	3110-01-0301
DS4/DS5	8 position multi-color LED	4003-08-0200
F1	2A SMT Pica fuse	2610-04-0020
JP1	0.1" 3 position vertical header	7300-53-0103
P1	DB-9 M right angle PCB	7400-00-0011
P2	0.1" 14 position vertical header	7300-83-0114
P3	2.5mm RA programming jack	7401-02-0250
P4	3.5mm RA speaker jack	7401-02-0051
Q1,Q2,Q6,Q7,Q9,Q10	2N4401 NPN transistor SOT23	3010-01-4401
Q3	IRF-9540 P Ch MOSFET TO220	3300-08-9540
Q4	TIP 32 PNP transistor TO220	3000-08-0032
Q5	2N4403 PNP transistor SOT23	3010-01-4403
Q8	NPN Darlington SOT23	3010-01-0038
RV1,RV8,RV9,RV10	10K 3mm SMT pot	2030-08-8103
RV2,RV3,RV5,RV7	100K 3mm SMT pot	2030-08-8104
RV4	20K 3mm SMT pot	2030-08-8203
RV6	200K 3mm SMT pot	2030-08-8204
R82	10 Ohm chip resistor	2010-03-5100
R10,R23,R41,R52,R76	10K chip resistor	2010-03-5103
R8,R11,R16,R21,R22,R24,R26,R30,R35,R44, R47,R53,R66,R73	100K chip resistor	2010-03-5104
R1,R2,R4,R6,R15,R17,R18,R31,R36,R74,R83	22K chip resistor	2010-03-5223
R3,R12,R13,R65,R72,R87	2.2K chip resistor	2010-03-5222
R5,R14,R86	820 Ohm chip resistor	2010-03-5821
R7,R48,R49,R63,R71	5.6K chip resistor	2010-03-5562
R9,R81	56K chip resistor	2010-03-5563
R19,R20	470K chip resistor	2010-03-5474
R25,R29,R34,R51	1.0M chip resistor	2010-03-5105
R27,R33,R37,R38,R45,R46,R85	33K chip resistor	2010-03-5333
R32,R70	27K chip resistor	2010-03-5273
R39,R40	150K chip resistor	2010-03-5154
R42	330K chip resistor	2010-03-5334

R50,R77-R80	15K chip resistor	2010-03-5153
R54-R62,R64	330 Ohm chip resistor	2010-03-5331
R68,R69	4.7K chip resistor	2010-03-5472
R43	68K chip resistor	2010-03-5683
R67	8.2 Ohm 1W resistor	2000-10-5829
U1	TS922 dual op-amp	3410-01-0922
U2,U3	MC3403 quad op-amp	3410-01-3403
U4	MX-806ALH audio processor	3710-02-0806
U5	MX-805ALH sub-audio processor	3710-02-0805
U6	LM386 audio amp	3410-01-0386
U7	LM7805 1A regulator	3400-08-7805
U8	LM7809CV 1.5A regulator	3400-08-7809
U9	CD4094 shift register	3410-01-4094
U10	93C46 1Kbit Serial E²PROM	3610-01-9346
U11	MCP101-450 reset controller	3410-11-0450
U12	AT89C52-12JC Microprocessor	3610-02-8952
U13	LM321 opamp	3410-12-0321
X1	4.032 MHz HC18/U	6000-07-4032
VAR1	18V MOV	2580-02-0018
	Extruded aluminium case	8100-01-5010
	Aluminium end panel	8200-04-5010
	ABS Plastic front panel	8200-03-2502
	TNC PCB mount RA connector	7401-02-0007
	10ft. radio cable with DB-9F conn.	7500-10-1001
	Shorting block for JP1	7200-03-0102
	TP1, RF Ant connection	7300-13-0101
	Mounting bracket	9600-05-0001
	RF interconnect board	9100-00-0001
	4-40 SS jack screw	8000-42-4404
	8-32 x ¼" SS philips	8000-24-8324
	4-40 x 3/8" SS cap screw	8000-34-4406
	4-40 SS nut	8000-54-4400
	4-40 x ¼" SS philips	8000-24-4404
	2-56 x 3/16" SS philips	8000-24-2563
	4-40 x 3/16" SS philips	8000-24-4403
	2-56 x 1/8" aluminium spacer	8000-65-2562
	Aluminium heat sink (U7 & U8)	8400-05-0001
	Right Angle heat sink (RF module)	8400-05-0007


P1
P2
P3
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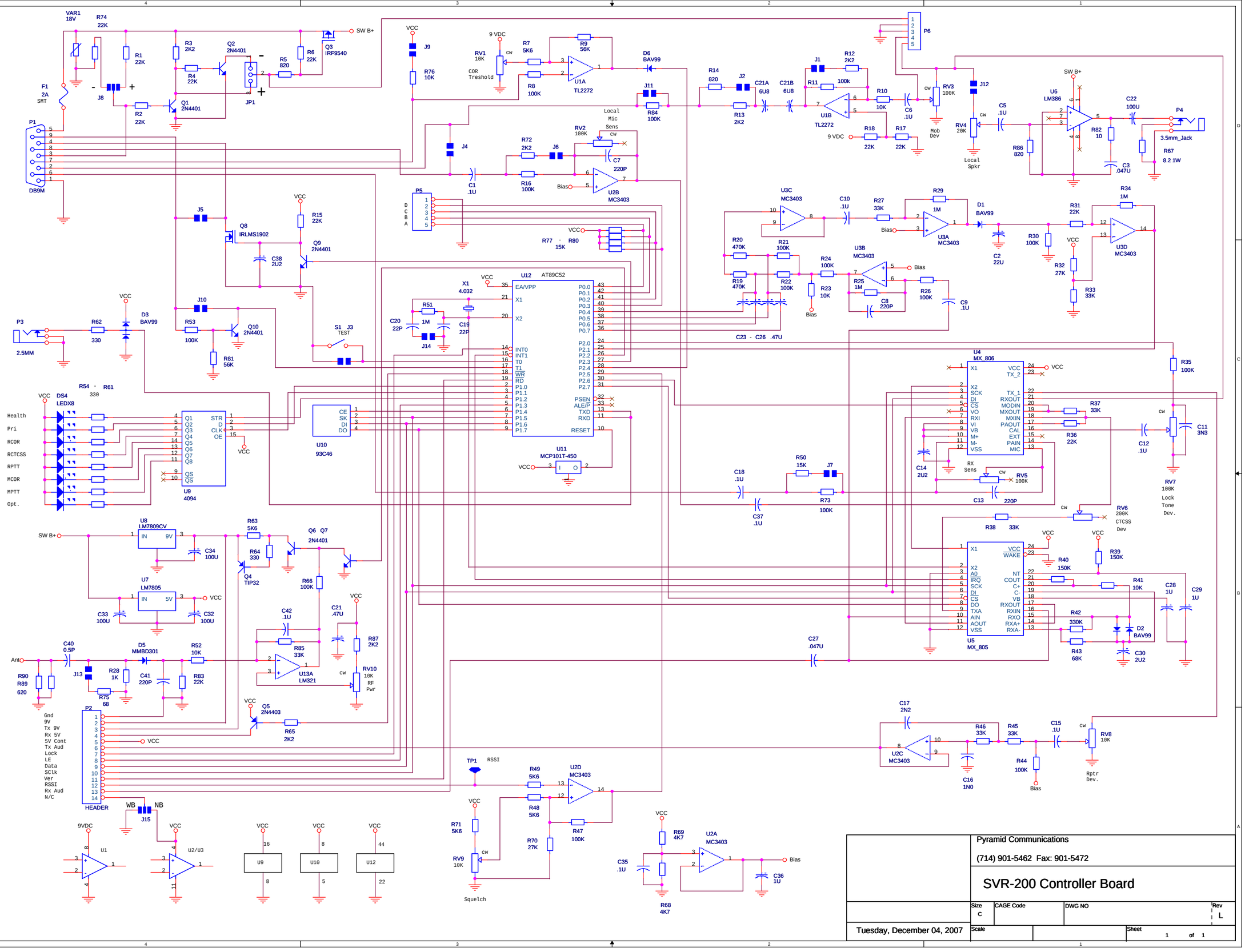
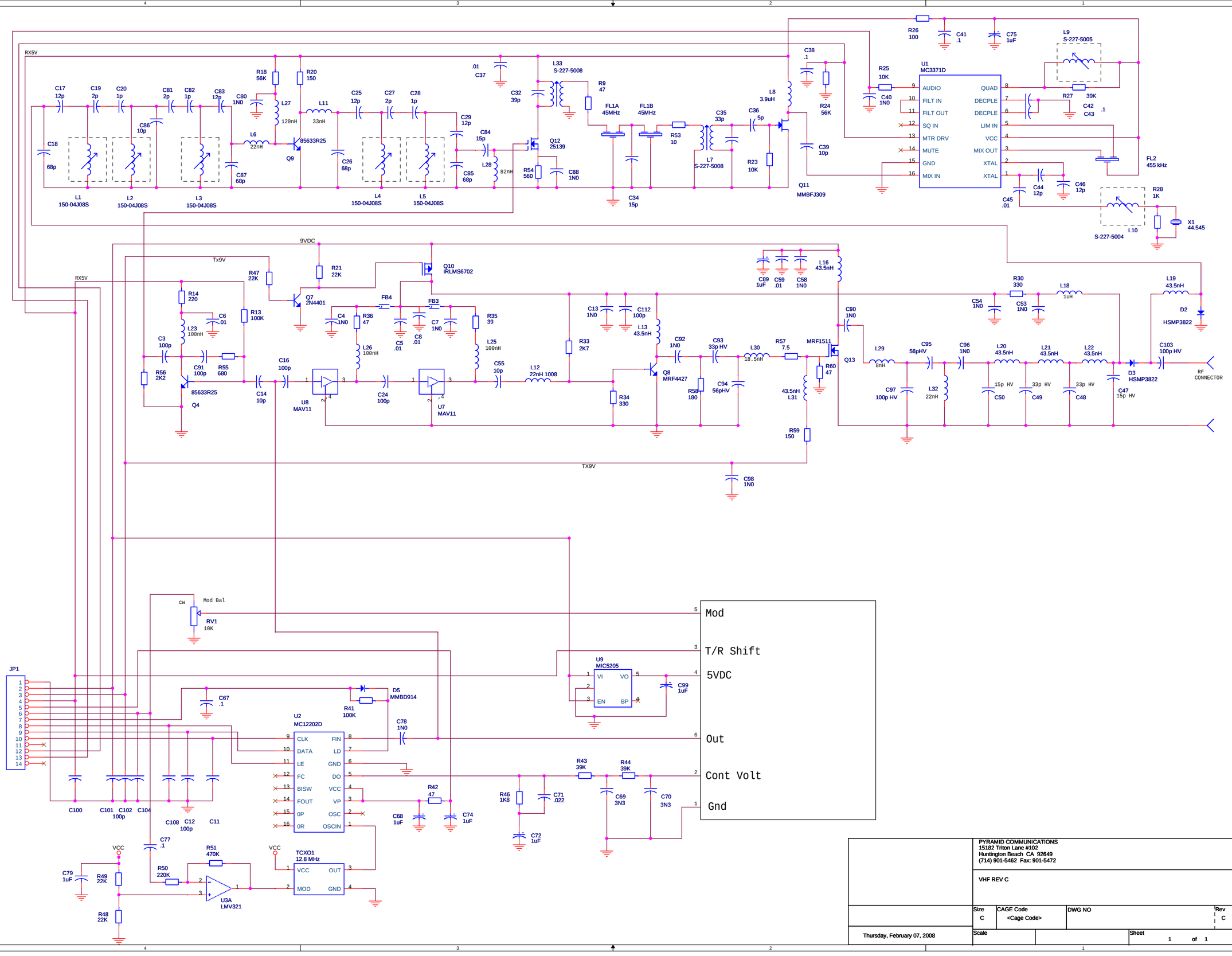
P5
J1
J2
J3
J4
J5
J6
J8
J9
J11
JP1
Q3
Q4
U7
U8
U12
DS4
DS5
RV1
RV2
RV3
RV4
RV5
RV6
RV7
RV8
RV9
RV10
MSQ
Mic
MDev
Spkr
RX Sens
LTone
CTCSS
TEST
TP1
TP2
CPU
Pri
RCOR
RTone
RTX
MCOR
MTX
Option



	Pyramid Communications (714) 901-5462 Fax: 901-5472			
	SVR-200 Controller Board			
	Size: C	CAGE Code	DWG NO	Rev: L
Tuesday, December 04, 2007	Scale		Sheet: 1 of 1	



	PYRAMID COMMUNICATIONS 15182 Triton Lane #102 Huntington Beach CA 92649 (714) 901-5462 Fax: 901-5472			
	VHF REV C			
	Size: C	CAGE Code: <Cage Code>	DWG NO	Rev: C
Thursday, February 07, 2008	Scale		Sheet: 1 of 1	

RX5V

C17 12p
C19 2p
C20 1p
C81 2p
C82 1p
C83 12p
C18 68p
C86 10p
L1 150-04J08S
L2 150-04J08S
L3 150-04J08S
C80 1N0
R18 56K
L27 120nH
L6 22nH
C87 68p
R20 150
L11 33nH
Q9 85633R25
C25 12p
C27 2p
C28 1p
C26 68p
L4 150-04J08S
L5 150-04J08S
C29 12p
C85 68p
C37 .01
C32 39p
C84 15p
L28 82nH
L33 S-227-5008
R54 560
C88 1N0
Q12 25139
R9 47
FL1A 45R15
FL1B 45R15
C34 15p
R53 10
L7 S-227-5008
C35 33p
C36 5p
R23 10K
L8 3.9uH
Q11 MMBFJ309
C39 10p
C38 .1
R24 56K
R26 100
C41 .1
C75 1uF
R25 10K
C40 1N0
U1 MC3371D
AUDIO
FILT IN
FILT OUT
SQ IN
MTR DRV
MUTE
GND
MIX IN
QUAD
DECPLE
DECPLE
LIM IN
VCC
MIX OUT
XTAL
XTAL
L9 S-227-5005
R27 39K
C42 .1
C43
C1 1N0
C2 1N0
C44 12p
C46 12p
C45 .01
L10 1uH
R28 1K
X1 44.545
VCC
R83 2K2
R82 2K2
Q1 XN4210
FL2 455E WB
FL3 455G NB
U5 HMC544
U6 HMC544
B RF1
O/P GND
A RF2
RF1 B
GND O/P
RF2 A

9VDC
R21 22K
R47 22K
Tx9V
Q7 2N4401
Q10 IRLMS6702
C89 1uF
C59 .01
C58 1N0
R14 220
C6 .01
R13 100K
L23 100nH
C3 100p
C91 100p
R55 680
R56 2K2
Q4 85633R25
C14 10p
C16 100p
U8 MAV11
U7 MAV11
C24 100p
FB4
FB3
C4 1N0
R36 47
L26 100nH
C5 .01
C8 .01
C7 1N0
R35 39
L25 100nH
C55 10p
L12 22nH
C13 1N0
C112 100p
R33 2K7
R34 330
L13 43.5nH
C92 1N0
C93 33p HV
L30 18.5nH
R57 7.5
Q8 MRF4427
R58 180
C94 56pHV
L31 43.5nH
R59 150
C98 1N0
TX9V
L16 43.5nH
Q13 MRF1511
C90 1N0
L29 8nH
C95 56pHV
C96 1N0
L20 43.5nH
L21 43.5nH
L22 43.5nH
C97 100p HV
L32 22nH
C50 15p HV
C49 33p HV
C48 33p HV
C47 15p HV
R60 47
C54 1N0
C53 1N0
R30 330
L18 1uH
L19 43.5nH
D2 HSMP3822
D3 HSMP3822
C103 100p HV

CW
Mod Bal
RV1 10K
JP2
VCC
C67 .1
D5 MMBD914
R41 100K
U2 MC12202D
CLK
DATA
LE
FC
BISW
FOUT
0P
0R
FIN
LD
GND
DO
VCC
VP
OSC
OSCIN
C78 1N0
C100 C101 C102 C104 C105 100p
C108 C12 100p
C11
C77 1uF
C79 1uF
R49 22K
R48 22K
R50 220K
R51 470K
U3 LM321
TCXO1 12.8 MHz
VCC
MOD
OUT
GND
C68 1uF
R42 47
C74 1uF
TP1
R46 1K8
C71 .022
C72 1uF
R43 39K
R44 39K
C69 3N3
C70 3N3
Q2 0 Ohm
Mod
5VDC
T/R Shift
Cont Volt
Gnd
VCO
Out
Gnd

PYRAMID COMMUNICATIONS
15182 Triton Lane #102
Huntington Beach CA 92649
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VHF Rev D

Friday, October 17, 2008

Size C | CAGE Code | DWG NO | Rev D
Scale
Sheet 1 of 1

Rx Audio
RSSI
Rx 5V
BPF1
302MXPR-1110-D
L1
15nH
R19
100K
R20
220
C34
.01
BPF2
7HW-45025A-460
C36
27p
Q2
85633-S
C35
8p
R37
150K
R38
220
C76
1N0
C3
39p
S-227-5008
L21
3.3nH
Q7
NE25139U72
L10
100nH
C77
100p
R40
330
C74
5p
R39
1K
C75
1N0
C5
5p
Q9
85633-S
L22
56nH
R1
220
FL1A
45MHz
FL1B
45MHz
C7
12p
R2
10
C8
33p
L5
S-227-5008
C9
5p
R3
10K
.01
C11
L6
3.9uH
C12
.047
C10
5p
Q1
MMBFJ309
R22
56K
R4
10K
C58
1N0
U2
MC3371D
AUDIO
FILT IN
FILT OUT
SQ IN
MTR DRV
MUTE
GND
MIX IN
QUAD
DECPLE
DECPLE
LIM IN
VCC
MIX OUT
XTAL
XTAL
L7
S-227-5005
R6
39K
C15
C16
.1U
R5
47
C14
1uF
FL2
455 kHz
C19
.01
C17
12p
C18
12p
L8
S-227-5004
R7
1K
X1
44.545MHz
C70
12p
D2
3822
C60
1N0
R32
330
C59
1N0
L15
1uH
L14
18nH
9VDC
Tx 9V
R41
22K
R18
22K
Q6
2N4401
Q5
IRLMS6702
FB1
FB2
R23
47
L16
100nH
C2
27p
C1
.01
C6
27p
R24
39
L17
100nH
C44
.01
L20
18nH
C45
100p
R25
8K2
Q4
5812
C13
100p
C37
100p
C38
39p
L19
4N7
R26
1K2
C22
100p
U6
MAV11
U5
MAV11
C49
1N0
R29
133
L3
12nH
Q3
MRF1517
L18
43nH
C50
1N0
C51
.1U
C52
22U
C55
3N3
L23
2N5
L24
1N8
L25
1N8
L26
12nH
L27
12nH
L28
12nH
C53
100p HV
D3
3822
C54
100p HV
L11
2N5
L12
2N5
L13
2N5
C46
8p
C47
3p
C48
8p
R30
47
C56
8P2 HV
C57
10p HV
C61
5P1 HV
C39
6.8p HV
C40
10p HV
C41
10p HV
C42
6.8P HV
9VDC
R8
10
RV1
10K
Mod
Rx 5v
VCO
Out
Mod
T/R
5VDC
Control
Ground
JP1
VCC
Lock Det
D1
MMBD914
R13
10K
C26
.1U
U4
MC12202
CLK
DATA
LE
FC
BISW
FOUT
0P
0R
FIN
LD
GND
DO
VCC
VP
OSC
OSCIN
C43
220p
U3
MIC5205
VI
EN
VO
BP
C20
1uF
C78 - C82
100p
C23
C24
100p
C25
R12
10
C31
1uF
R14
39K
R15
39K
R11
2K7
C30
.1U
C63
2N2
C64
2N2
C29
1uF
C27
.1U
C28
.1U
R10
470K
R9
330K
U1A
LMV321
C33
1uF
R16
22K
R17
22K
VCC
12.8 MHz
MOD
OUT
GND
X2

PYRAMID COMMUNICATIONS
Huntington Beach CA 92649
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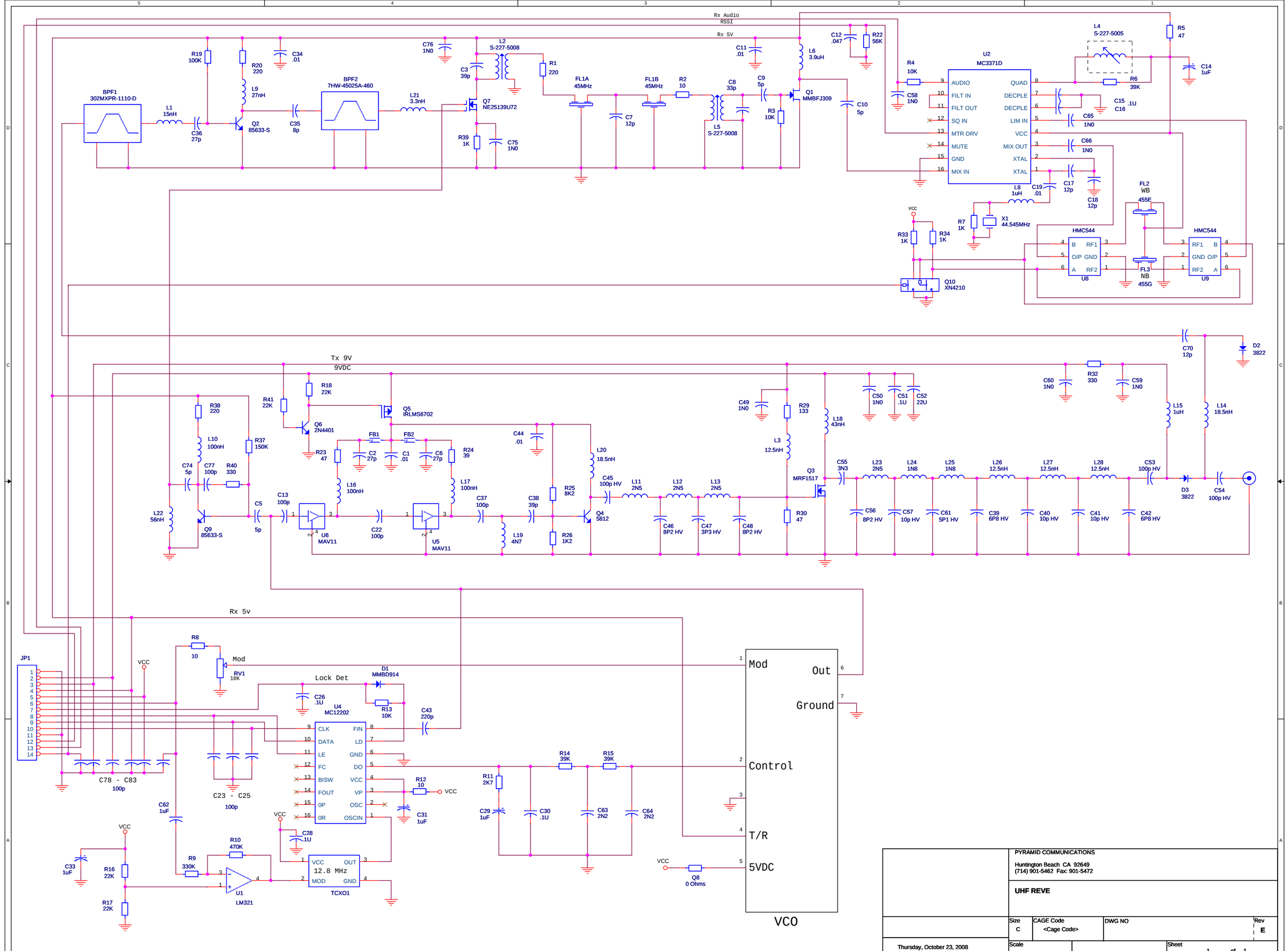
UHF VOICE/DATA TRANSCEIVER

Size	CAGE Code	DWG NO	Rev
C	<Cage Code>		D

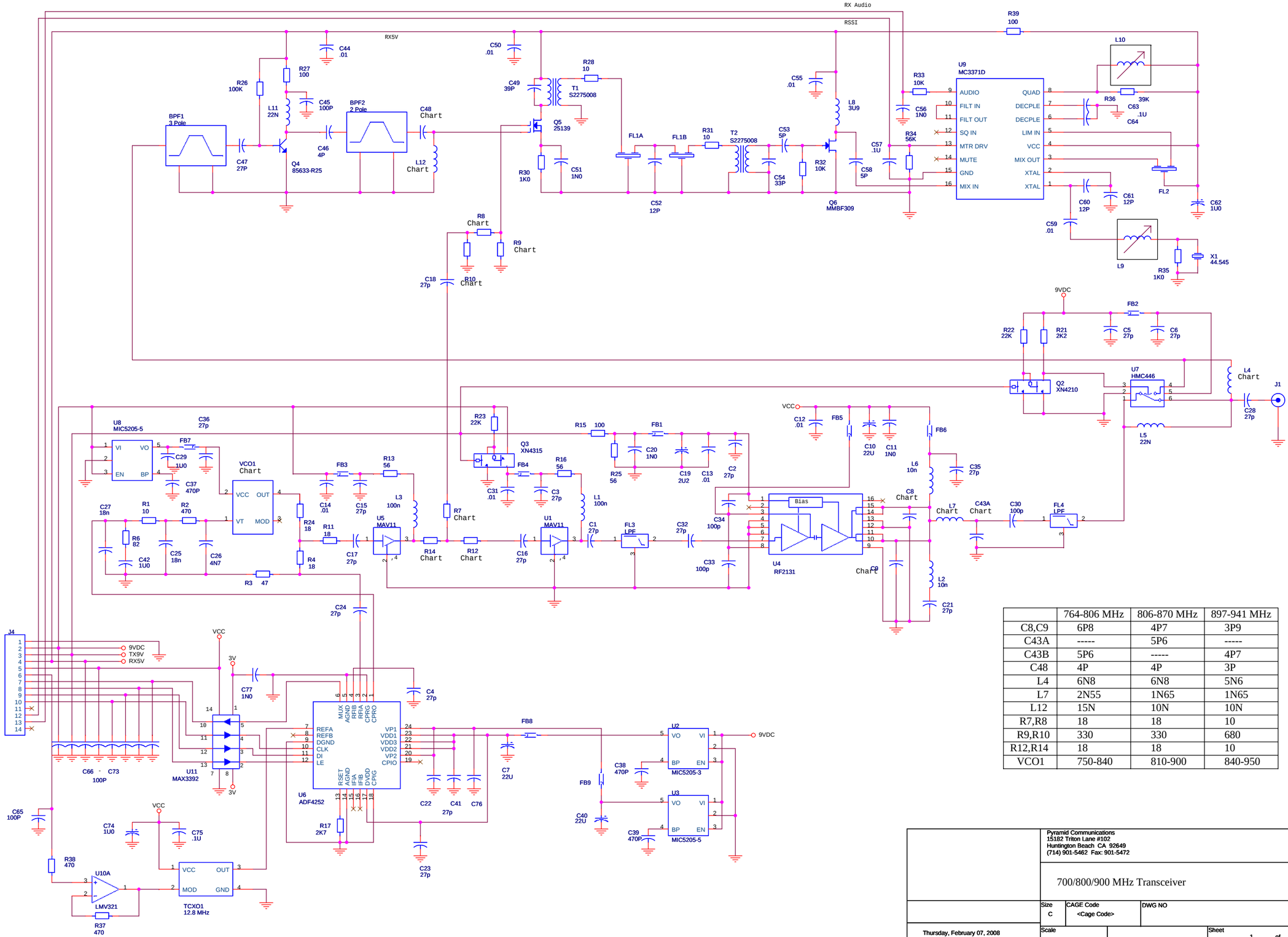
Friday, February 08, 2008

Scale

Sheet 1 of 1



	PYRAMID COMMUNICATIONS Huntington Beach CA 92649 (714) 901-5462 Fax: 901-5472			
	UHF REVE			
	Size: C	CAGE Code: <Cage Code>	DWG NO	Rev: E
Thursday, October 23, 2008	Scale		Sheet: 1 of 1	



	764-806 MHz	806-870 MHz	897-941 MHz
C8,C9	6P8	4P7	3P9
C43A	-----	5P6	-----
C43B	5P6	-----	4P7
C48	4P	4P	3P
L4	6N8	6N8	5N6
L7	2N55	1N65	1N65
L12	15N	10N	10N
R7,R8	18	18	10
R9,R10	330	330	680
R12,R14	18	18	10
VCO1	750-840	810-900	840-950

Pyramid Communications
15182 Triton Lane #102
Huntington Beach CA 92649
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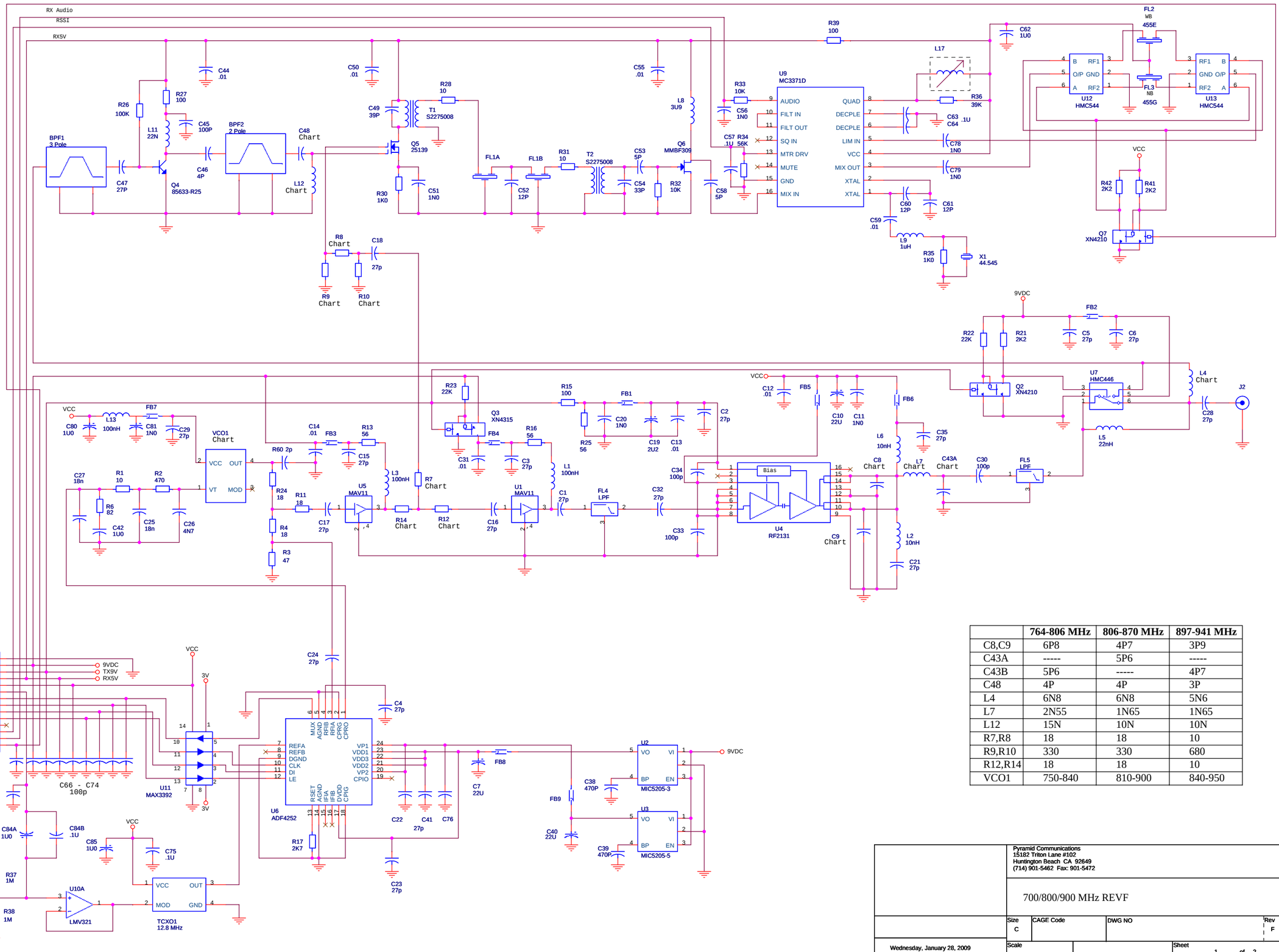
700/800/900 MHz Transceiver

Size	CAGE Code	DWG NO	Rev
C	<Cage Code>		E

Thursday, February 07, 2008

Scale

Sheet 1 of 1



	764-806 MHz	806-870 MHz	897-941 MHz
C8,C9	6P8	4P7	3P9
C43A	-----	5P6	-----
C43B	5P6	-----	4P7
C48	4P	4P	3P
L4	6N8	6N8	5N6
L7	2N55	1N65	1N65
L12	15N	10N	10N
R7,R8	18	18	10
R9,R10	330	330	680
R12,R14	18	18	10
VCO1	750-840	810-900	840-950

Pyramid Communications
15182 Triton Lane #102
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700/800/900 MHz REVF

Size	CAGE Code	DWG NO	Rev
C			F

Wednesday, January 28, 2009

Scale

Sheet 1 of 2