Ensemble RXTX Project

Home Bill of Materials Power Supply USB Power Supply Local Oscillator Dividers RF I/O and Switching RX Mixer (QSD) RX Opamps and Output TX Opamps TX Mixer (QSE) Driver/PA External Connections Comments Acronyms Inventory Revisions as of 3/21/2011 Components By Stage WB5RVZ Main Website

Search: Search selected SDR sites

Project Introduction

General

These notes were developed as the author built the pre-production version of the kit (4/4/2010), resulting in some minor rearrangements of layouts. These will cause the "completed" pictures at the end of each stage to be slightly different, due to the layout changes between that version and the currently documented production version.

PDF Rendition of Notes (TX Kevin AB2ZI)

Kevin Morgan, AB2ZI, has provided a pdf file (large - 16MB) of these notes for those who would prefer to dwnload and selectively print out the builders notes.

This kit is an SDR Transceiver that follows in the very successful line of RXTX Softrocks, the most recent being the RXTX V6.3 multi-band transceiver. The Ensemble kit is essentially the RXTX V6.3, but with its band-specific components fixed and predetermined (as opposed to the plug-in daughtrer boards for these functions in the RXTX V6.3). The kit, therefore, is not compatible with the Mobo series of add-ons, since they depend upon the plug and socket arrangements of the RXTX V6.3. The kit comes in five versions, corresponding to five "super-bands":

1. 160m - covering the 160m band
2. 80m, 40m - covering the 80 and 40 meter bands
3. 40m, 30m, 20m - covering the 40 through 20 meter bands (added 7/12/2010)
4. 30m, 20m, 17m - covering the 30, 20 and 17 meter bands
5. 15m, 12m, 10m - covering trhe 15, 12, and 10 meter bands

In each version, the radio has complete frequency agility within the "super-band" (thanks to the reliable Si570 programmable oscillator), limited only by the fixed/installed band-specific components. This means that, for example, with the 30/20/17m version, the user can operate all modes on all three of those ham bands, anywhere in those bands, subject only to the limitations of their license and the SDR software being used. In fact, the kit can also receive any HF signals within the installed "super-band".

The kit provides an Atmel AVRMicrocontroller on-board, programmed to act as a USB device and installed in a galvanically isolated section of the board. Achange from the earlier transceivers is the addition of jumpers on board to switch the ring and tip assignments of RX and TX I and Q signals.

Another welcome change from the earlier models is that all connections to the outside world are handled via on-board jacks (provided with the kit).

The kit is offered with all of the parts necessary to build it for any one of the five possible versions. Consequently, the builder will always have some parts "left-over" at the end of the build. These documents contain band-specific Bill of Materials listings for each version (in addition to the Bill of Materials for the parts of the radio that are not band-specific.

Availability

Tony Parks has released the following information concerning availability and pricing of this kit (message dated 5/21/2010):

Recent test results with RXTX Ensemble prototype units gives me confidence that the kit is ready for production. Later today 200 circuit boards will be placed on order so that 200 kits can be made available starting the second week of June.

The RXTX Ensemble kit will include all components so that the kit may be built as a one watt SDR transceiver for one of four band groups: 160m, or 80m/40m, 40m/30m/20m, or 30m/20m/17m, or 15m/12m/10m.

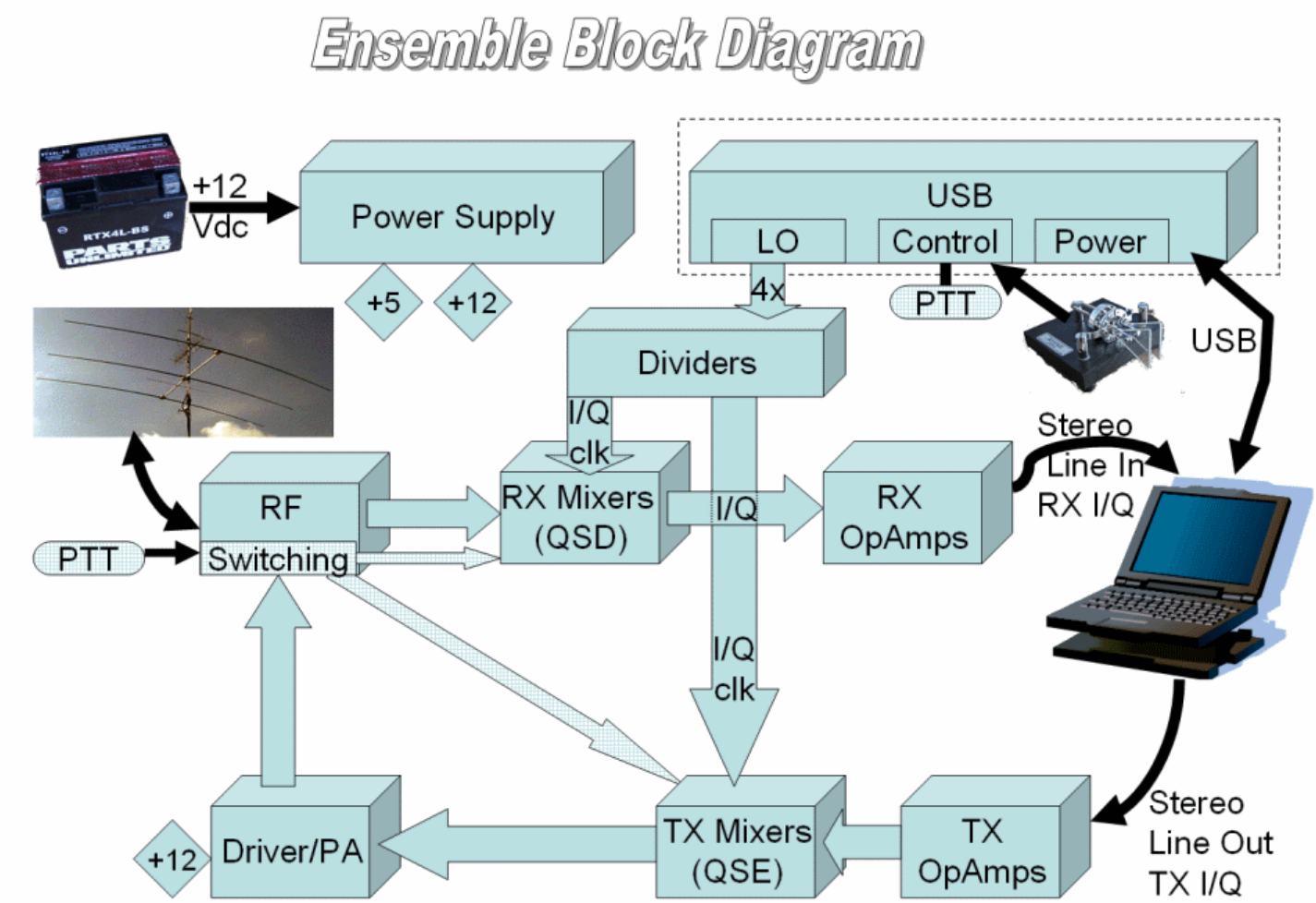
The kit price is $74 plus $3 for US postage or $6 for DX postage. DX kit mailing will be made in two padded envelopes to keep the value of each envelope low. (The $74 kit price compares well to the total price of $84 for the equivalent functions in the v6.3 RXTX.)

If anyone would like to get an RXTX Ensemble kit on order, PayPal $77 for US orders or $80 for DX orders to my e-mail address (kb9yig@gmail.com). Also, I will supply a picture of one of the prototype units to any who make the request.

Theory of Operation

Refer to the block diagram below

(click on any block in the diagram to go to the build stage which implements that block)



Foundation Circuitry

The transceiver is controlled by an Attiny85 microcontroller, programmed as a USB device to provide PTT control, paddles input, and local oscillator frequency control, in a galvanically isolated area of the PCB.

Power (+5 Vdc) for this section is provided by the USB bus from the PC. Power for the programmable local oscillator is provided by converting the USB bus power down to 3.3 Vdc (in the USB Power stage).

The function of the local oscillator is to produce a signal whose frequency is four times the desired "center frequency" of the radio. The "center frequency", plus the sound card in the PC, will determine the width of the "chunk of spectrum" one will see in the RX (and TX) display on the PC's screen - i.e., the available, visible bandwidth. This bandwidth is represented as a number of kHz either side of the "center frequency. That number of kHz is half of the sound card's sampling rate. Normal sampling rates are 48 kHz, 96 kHz, and 192 kHz (corresponding to bandwidths of the "center frequency" plus or minus 24 kHz, 48 kHz, and 96 kHz, respectively. The sampling rate of the sound card is directly proportional to the cost of the sound card - the higher the rate, the higher the cost.

The output of the local oscillator is fed to the dividers stage, where the signal is divided by 4, yielding two signals which are identical except that they are 90 degrees out of phase with each other - i.e., in quadrature. These signals are at the "center frequency" and will clock both the RX mixer and the TX mixer.

RX Circuitry

The transceiver has a common antenna terminal and RF path which is switched between the RX Bandpass filters (default) and the TX low-pass filters, via circuitry in the RF I/O and Switching Stage. The switching is performed in response to the /PTT signal from the microcontroller, as selected by the SDR program on the PC. In the RX chain, the incoming RF is band-pass filtered in T5/L4/C39, with the RF output at T5's secondaries in antiphase.

The antiphase RF signals out of T5 are coupled into the RX Mixer Stage via R53 and R54. The mixer chip (actually a commutating switch, clocked by the two QSD Clock signals from the Dividers Stage) outputs the product and difference signals of the incoming RF against the QSD clock. The effect is to down-convert the incoming RF into its quadrature analogues at frequencies ranging from 0 to roughly 100 kHz.

These quadrature pairs from the RX Mixer, identifcal in all respects except phase, are fed to the RX OpAmp Stage for amplification and filtering into the audio and infra-audio range and delivered to the RX output stereo audio jack, J4, to be input to the PC's STEREO input (line-in or Mic).

The PC's sound card performs a conversion of the two analog signals ("I and Q") to a digital representation, which is then operated upon by modules of the SDR program to perform the many "radio" functions, such as demodulation, filtering, AGC, etc., that are expected of a fine receiver. To do this, it absolutely essential that the soundcard being used supports STEREO input. The sampling rate, quality and specs of the soundcard will determine whether and how well the PC can work signals whose frequency is either sode of the center frequency. Common sound card sampling ratesfor this bandwidth are 48 kHZ, 96 kHz, and 192 kHz. These each correspond to the ability to support SDR processing of "chunks" of bandwidth of 48 kHz, 96 kHz, and 192 kHz, each chunk centered on the center frequency (CF), with "wings" on either side of the CF that are one-half the sampling rate in width.

TX Circuitry

The transmit functionality is essentially the reverse of the RX functionality. In the PC, rather than demodulating input I and Q signals as in the RX, the PC modulates the digital signals (from the microphone or a keyer module. for example) into analog I and Q (infra) audio STEREO outputs, typically output to the line-out jack on the soundcard. The I and Q signals at the line-out are in quadrature (identical in all respects save phase) and appear at stereo jack J3. There are fed to the TX OpAmp Stage. This unitary gain stage translates the I and Q signals into four equal signals, at 0, 90, 180, and 270 degrees of phase.

These four signals from the TX Opamp Stage are coupled via R25-R28 to the TX Mixer Stage. Just as the RX Mixers "mixed" incoming RF with the QSD clock (center frequency) signals to produce (infra)audio signals, the TX Mixer does the reverse, "mixing" modulated (infra) audio signals with the QSE RF clock signals to produce up-converted RF outputs that are analogues of the TX I and Q inputs. This modulated RF output of the TX Mixer (aka "Quadrature Sampling Exciter", or "QSE") is coupled via T2, C20, L1, and C21 to the Driver/PA stage.

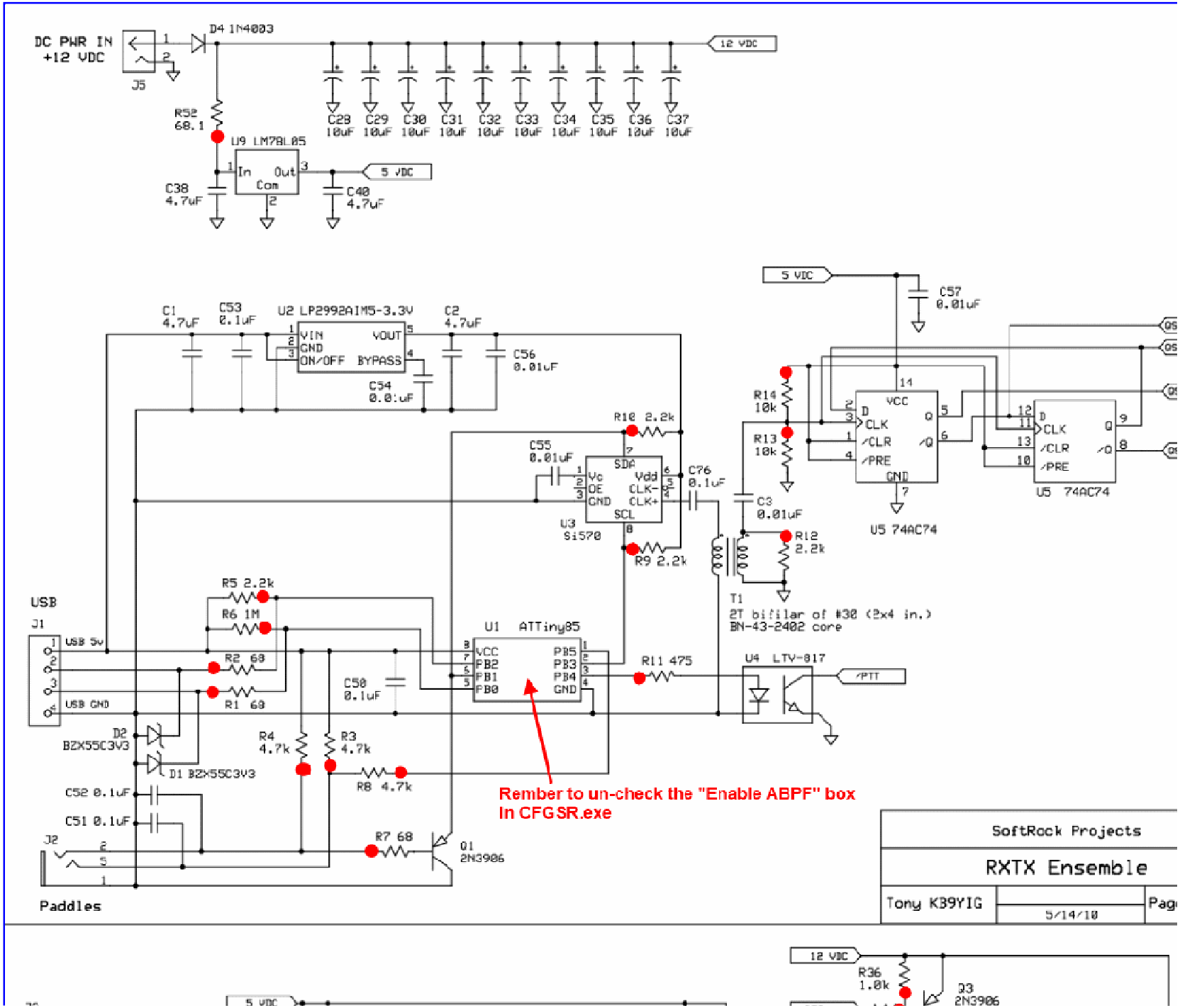
The Driver/PA stage shapes and amplifies the modulated RF output from the TX Mixer stage and feeds the result to the antenna path as switched by the PTT switching circuitry. The switching circuitry activates the Driver/PA stage and forces a S12 line to high (approximately 12 Vdc), to permit switching an external amplifier. This stage will deliver approximately one watt of output into a 50 ohm load.

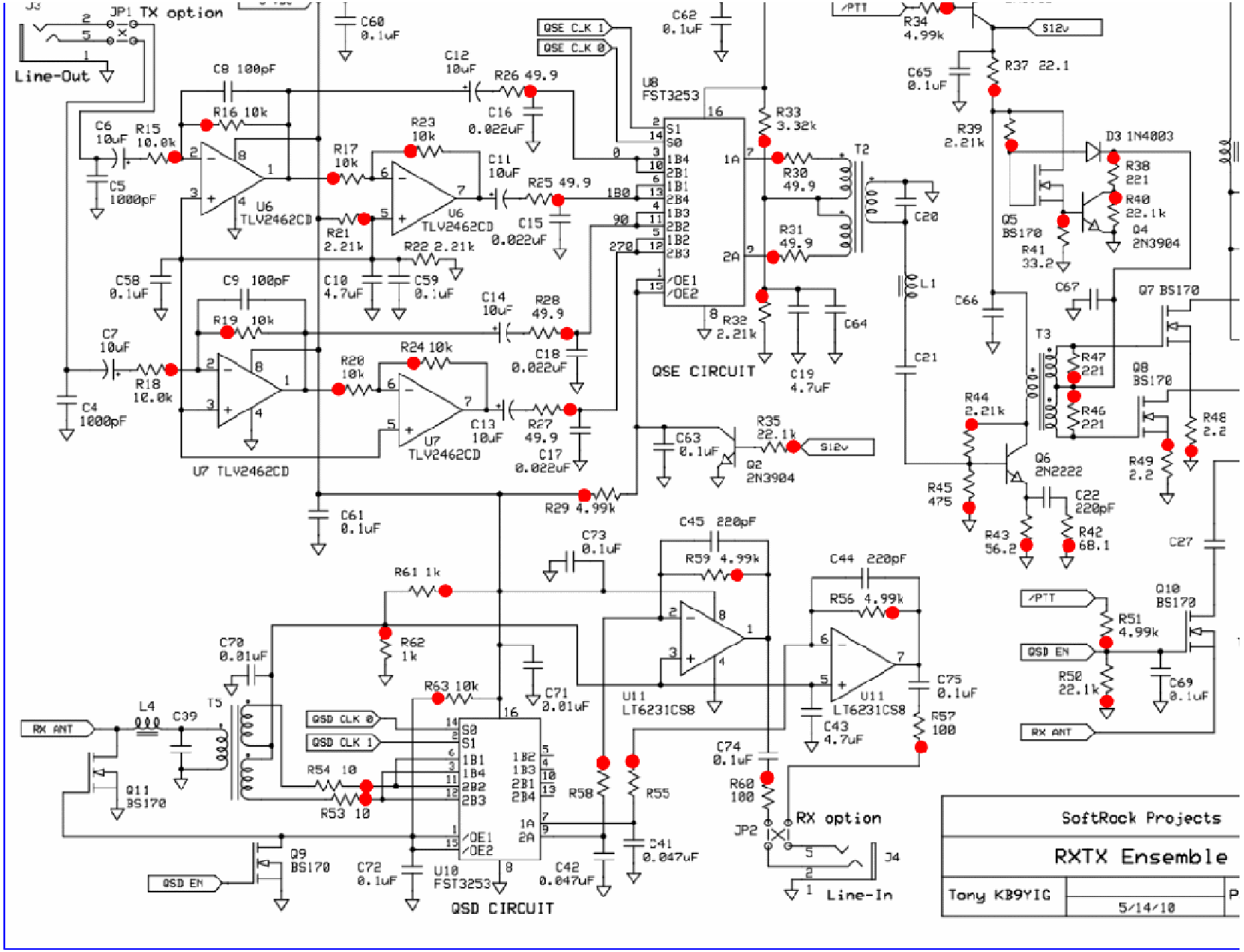
For an excellent, simple discussion of the Theory of SDR, see Tobias DH1TW's "do you truly understand the SDR concept?"

(go directly to build notes)

Project Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)


DC PWR IN
+12 VDC
J5
D4 1N4003
12 VDC
R52
68.1
U9 LM78L05
In
Com
Out
5 VDC
C38
4.7uF
C40
4.7uF
C28 C29 C30 C31 C32 C33 C34 C35 C36 C37
10uF
C1
4.7uF
C53
0.1uF
U2 LP2992AIM5-3.3V
VIN
GND
ON/OFF
VOUT
BYPASS
C54
0.01uF
C2
4.7uF
C56
0.01uF
C57
0.01uF
R14
10k
R13
10k
R10 2.2k
C55
0.01uF
U3
Si570
SDA
SCL
Vc
OE
GND
Vdd
CLK-
CLK+
C76
0.1uF
C3
0.01uF
R12
2.2k
R9 2.2k
T1
2T bifilar of #30 (2x4 in.)
BN-43-2402 core
U5 74AC74
VCC
CLK
/CLR
/PRE
GND
USB
J1
USB 5v
USB GND
R5 2.2k
R6 1M
R2 68
R1 68
C50
0.1uF
U1 ATTiny85
VCC
FB2
FB1
FB0
PB5
PB3
PB4
GND
R11 475
U4 LTV-817
/PTT
D2
BZX55C3V3
D1 BZX55C3V3
R4
4.7k
R3
4.7k
R8 4.7k
C52 0.1uF
C51 0.1uF
J2
R7 68
Q1
2N3906
Paddles
Rember to un-check the "Enable ABPF" box
In CFGSR.exe
SoftRock Projects
RXTX Ensemble
Tony K3YIG
5/14/10
12 VDC
R36
1.0k
Q3
2N3906



(above schematic has clickable areas that can be used for navigation)

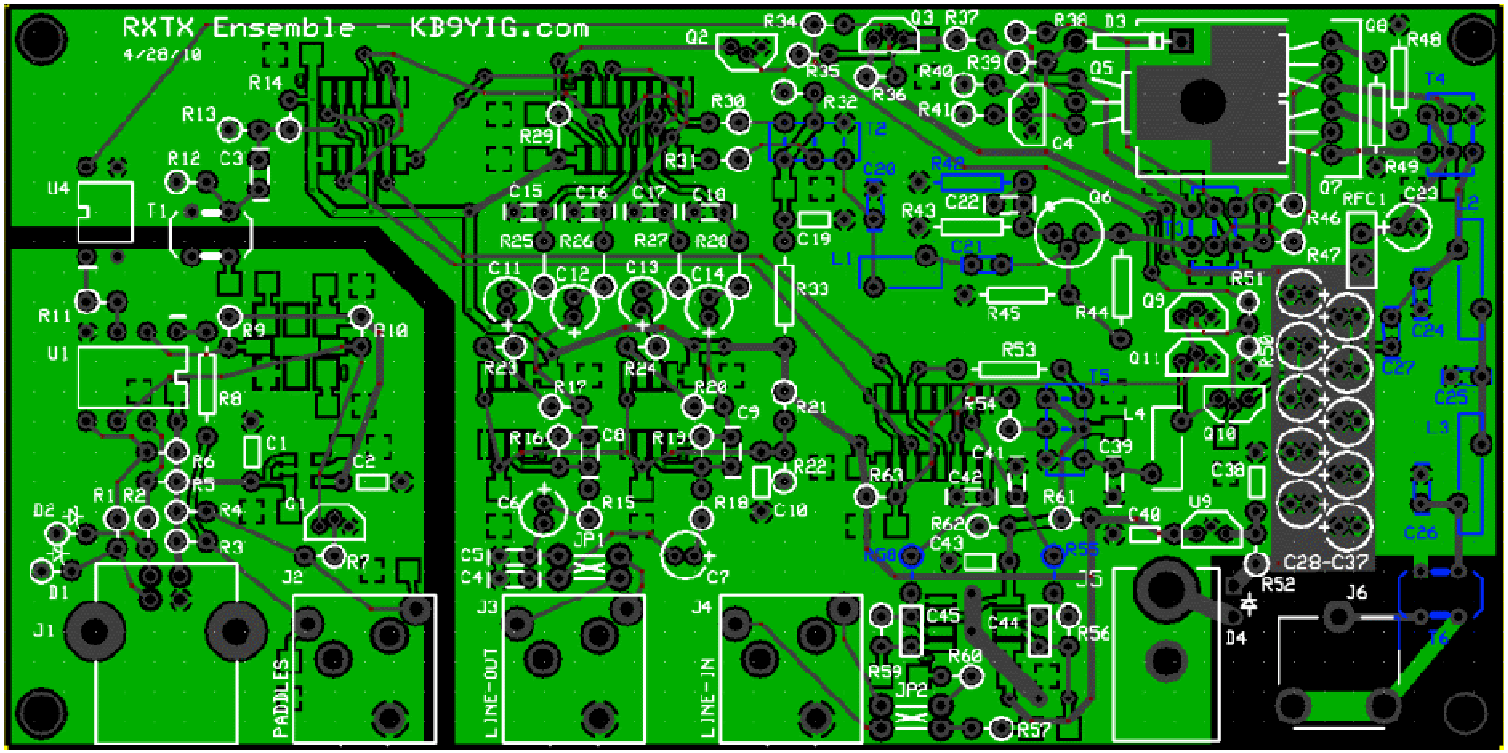
(go directly to build notes)

Project Bill of Materials

See Project Bill of Materials

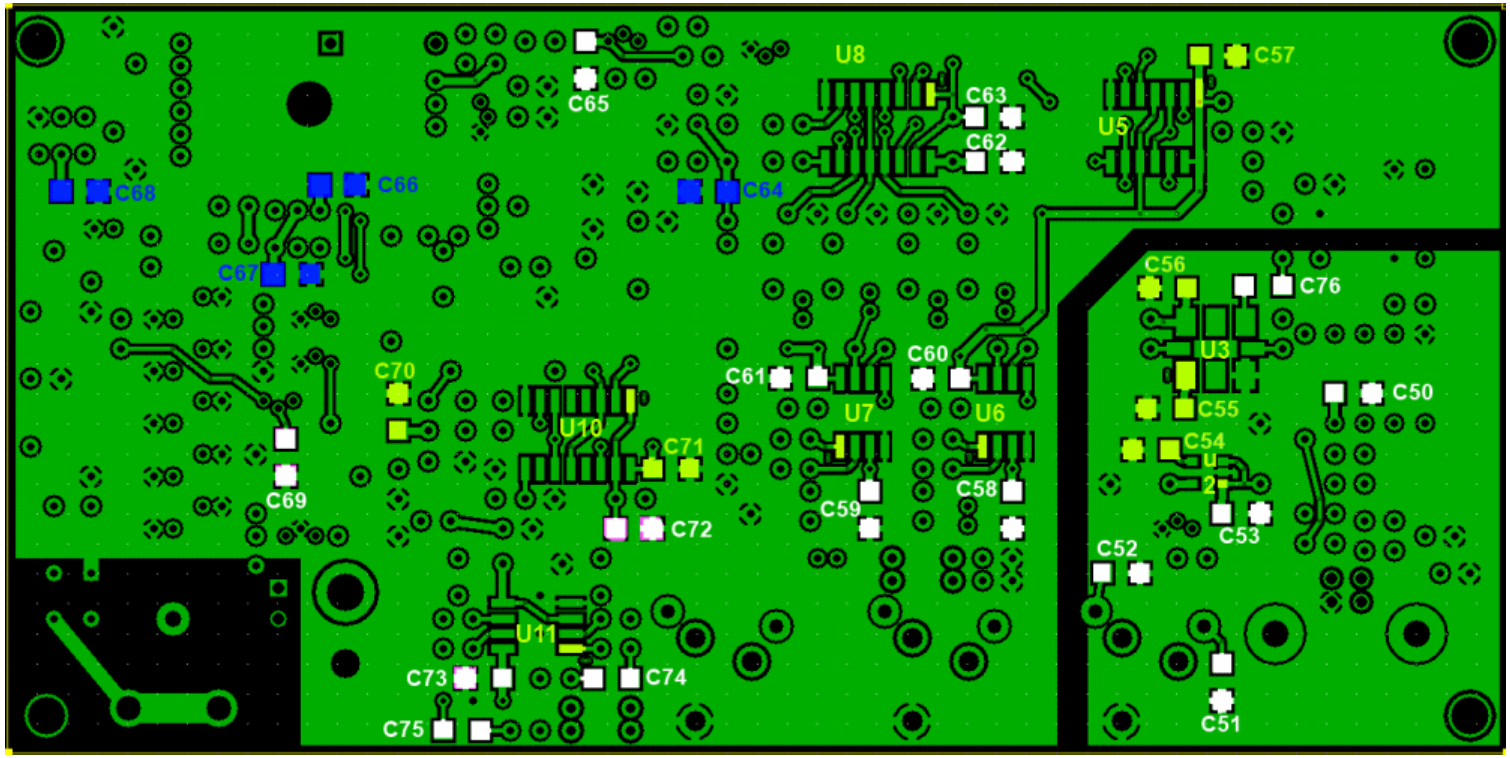
Project Expert's (terse) Build Notes

PCB - Top



(components colored BLUE have band-specific values)

PCB - bottom



(Component colors: BLUE = band-specific; WHITE caps = 0.1 uF SMT - black striped strip; YELLOW caps = 0.01 uF SMT - clear strip)

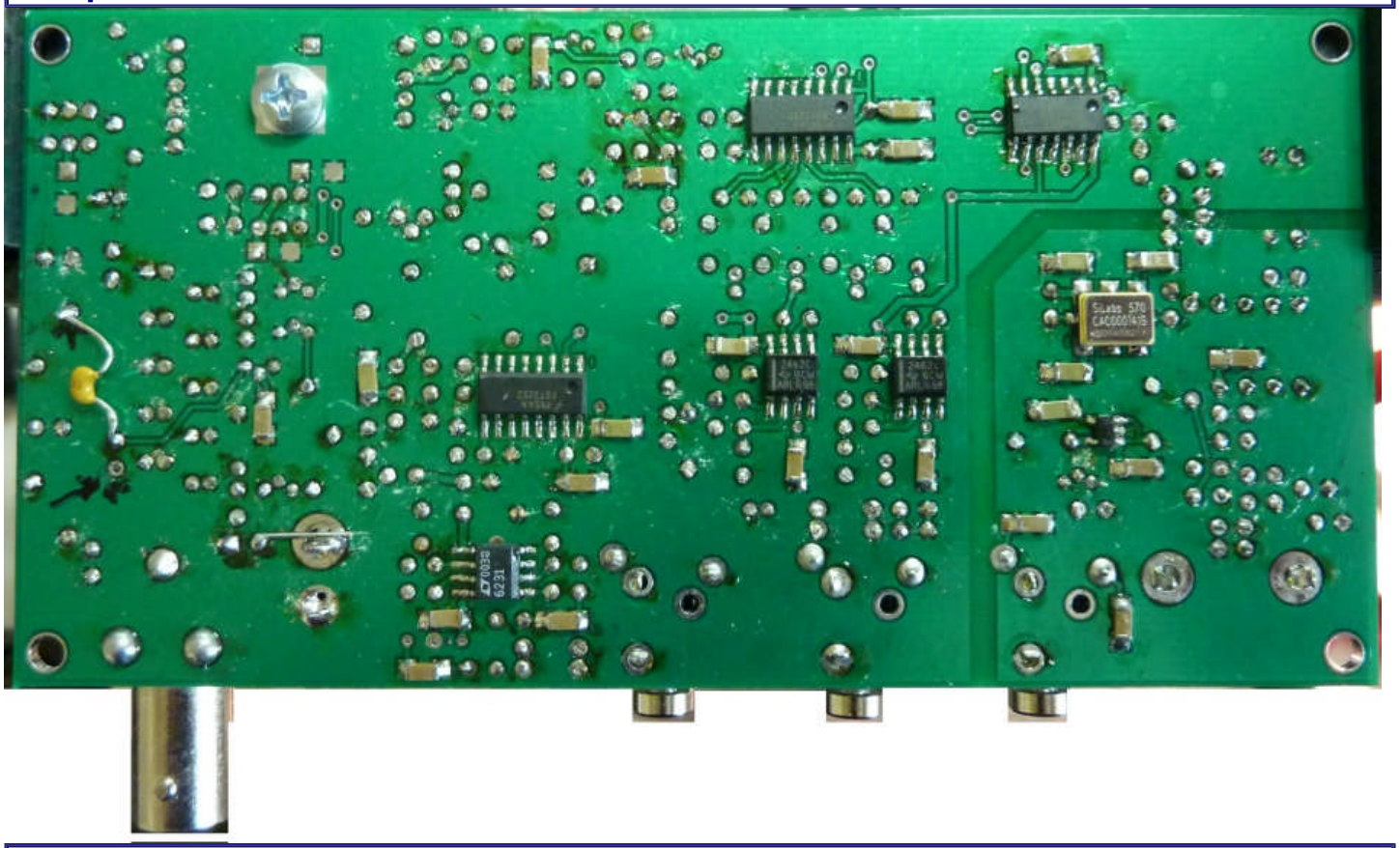
1. Review the schematics sheets: (sheet1, sheet 2, sheet 3))
2. Install Power Supplies (12, 5, and 3.3 Vdc)
3. Install Local Oscillator and Dividers
4. Install RF Chain and Switching Circuitry
5. Install RX: QSD amd OpAmps
6. Install TX: Opamps and QSE

   Experienced builders often hit the case where the TX seems "locked" in transmit mode. This is almost always caused by leaving the ATTINY85 configured for Auto Band Switching. You must un-check the "Enable ABPF" box in CFGSR.EXE.

7. Install Driver/PA
8. Install Software and hookup RXTX

Completed Kit - Top View

Completed Kit - Bottom View



Project Detailed Build Notes

For the non-expert builders among us, this site takes you through a stage-by-stage build of the kit. Each stage is self-contained and outlines the steps to build and test the stage. This ensures that you will have a much better chance of success once you reach the last step, since you will have successfully built and tested each preceding stage before moving on to the next stage.

Each stage is listed below, in build order, and you can link to it by clicking on its name below (or in the header and/or footer of each web page).

- Inventory the Bill of Materials
- Build and Test the Power Supply Stage
- Build and Test the USB Power Supply Stage
- Build and Test the Local Oscillator Stage
- Build and Test the Dividers Stage

- Build and Test the RF I/O and Switching Stage
- Build and Test the RX Mixer (QSD) Stage
- Build and Test the RX Opamps and Output Stage
- Build and Test the TX Opamps Stage
- Build and Test the TX Mixer (QSE) Stage
- Build and Test the Driver/PA Stage
- Build and Test the External Connections Stage

Background Info

Tools

Winding Inductors

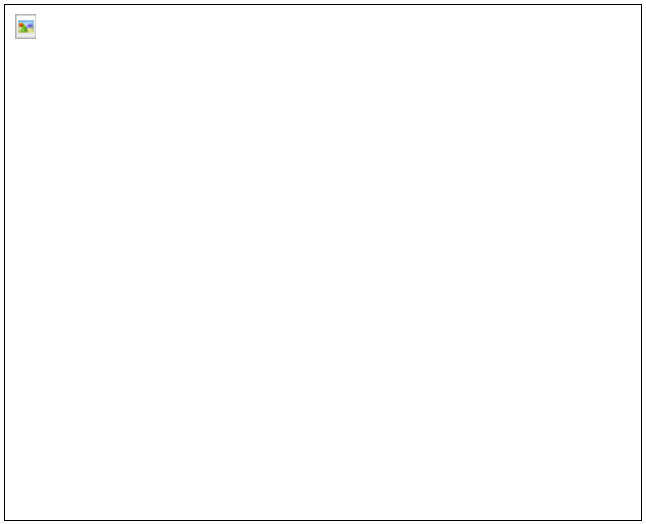
To learn how to wind coils and transformers, please read the

- tips from the experts and then
- view the excellent videos on KC0WOXs Website
- or take a read of Dinesh's VU2FD guidelines.
- You can review the common construction techniques for inductors for details on deciphering the winding specifications, core specifications,and construction of toroidal and binocular inductors.

Soldering

If you are not experienced at soldering (and even if you are somewhat experienced at soldering), refer to Tom N0SS's excellent tutorial on basic soldering techniques.

The video below describes techniques for soldering SOIC 14 (and 16 and 8) SMDs



View the above in full-screen mode on Youtube.

For the more adventurous, there is a process using solder paste and an electric oven called the reflow process, which can be used to install all the SMT chips to one side of the PC Board. This is documented by Guenael Jouchet in the following Youtube segment:

- Read the Primer on SMT Soldering at the Sparkfun site. It is a very good read and it speaks great truths. Then take the time to watch the video tutorial on soldering an SOIC SMD IC.
- Solder Stations. Don't skimp here. Soldering deficiencies account for 80 percent of the problems surfaced in troubleshooting. It is preferable to have an ESD-safe station, with a grounded tip. A couple of good stations that are relatively inexpensive are:
  - 

  - Velleman VTSS5U 50W Solder Station (approx $20 at Frys) (See BGMicro for Spare Tips)
  - Haakko 936 ESD Solder Station (under $100)

ESD Protection

You may wish to review the message topic beginning at Message 43554 for a common-sense discussion on ESD.

- Avoid carpets in cool, dry areas.
- Leave PC cards and memory modules in their anti-static packaging until ready to be installed.
- Dissipate static electricity before handling any system components (PC cards, memory modules) by touching a grounded metal object, such as the system unit unpainted metal chassis.
- If possible, use antistatic devices, such as wrist straps and antistatic mats (see Radio Shack's Set for $25 or the JameCo AntiStatic mat for $15)).
- Always hold a PC card or memory module by its edges. Avoid touching the contacts and components on the memory module.
- Before removing chips from insulator, put on the wrist strap connected to the ESD mat. All work with CMOS chips should be done with the wrist strap on.
- As an added precaution before first touching a chip, you should touch a finger to a grounded metal surface.
- If using a DMM, its outside should be in contact with the ground of the ESD mat, and both leads shorted to this ground before use.
- See the review of ESD Precautions at this link.

Work Area

- You will need a well-lit work area and a minimum of 3X magnification (the author uses a cheap magnifying fluorescent light with a 3X lens. This is supplemented by a hand-held 10 X loupe - with light - for close-in inspection of solder joints and SMT installation.
- You should use a cookie sheet or baking pan (with four sides raised approximately a half an inch) for your actual work space. It is highly recommended for building on top of in order to catch stray parts, especially the tiny SMT chips which, once they are launched by an errant tweezer squeeze, are nigh on impossible to find if they are not caught on the cookie sheet.

Misc Tools

- It is most important to solidly clamp the PCB in a holder when soldering. A "third-hand" (e.g., Panavise or the Hendricks kits PCB Vise) can hold your board while soldering. In a pinch, you can get by with a simple third-hand, alligator clip vise. Jan G0BBL suggests "A very cheap way is to screw a Large Document Clip to a woodblock which will clamp the side of a PCB."
- Magnifying Head Strap
- Tweezers (bent tip is preferable).
- A toothpick and some beeswax - these can be used to pickup SMT devices and hold them steady while soldering.

- Diagonal side cutters.
- Small, rounded jaw needle-nose pliers.
- Set of jewelers' screwdrivers
- An Exacto knife.
- Fine-grit emery paper.

Project Completed Stage

Top of the Board

View of Completed

Bottom of the Board

View of Completed

Project Testing

Each stage will have a "Testing" Section, outlining one or more tests that, when successfully completed, provide you with the confidence and assurance that you are heading in the right direction towards a fully tested and built transceiver.

When you perform a test, you should always record the results of the test where indicated in the Testing section. This will make troubleshooting via the reflector much easier, since you will be communicating with the experts using a standard testing and measurement regime.

> *When comparing measurements to those published in these notes, the builder should be aware that actual and expected values could vary by as much as +/- 10%. The idea behind furnishing "expected/nominal" measurement values is to provide the builder with a good, "ballpark" number to determine whether or not the test has been successful. If the builder has concerns about his measurements, he should by all means pose those concerns as a query in the Softrock reflector so the experts can provide assistance.*

It goes without saying that you should ALWAYS precede any tests with a very careful, minute inspection (using the best light and magnification available to you) to be sure all solder joints are clean and there are no solder bridges or cold joints.

> This kit can be built and reliably tested using nothing more than a common multimeter. Tests assume that the builder has a decent digital multimeter of sufficiently high input impedance as to minimize circuit loading issues. Measurements will be taken of current draws, test point voltages, and resistances.
>
> Most stages will have a current draw test, in which the builder tests the stage's current draw in two different ways:
>
> - First, testing the draw through a current-limiting resistor
> - Then, when that test is OK, removing the current-limiting resistor and measuring the real current draw.

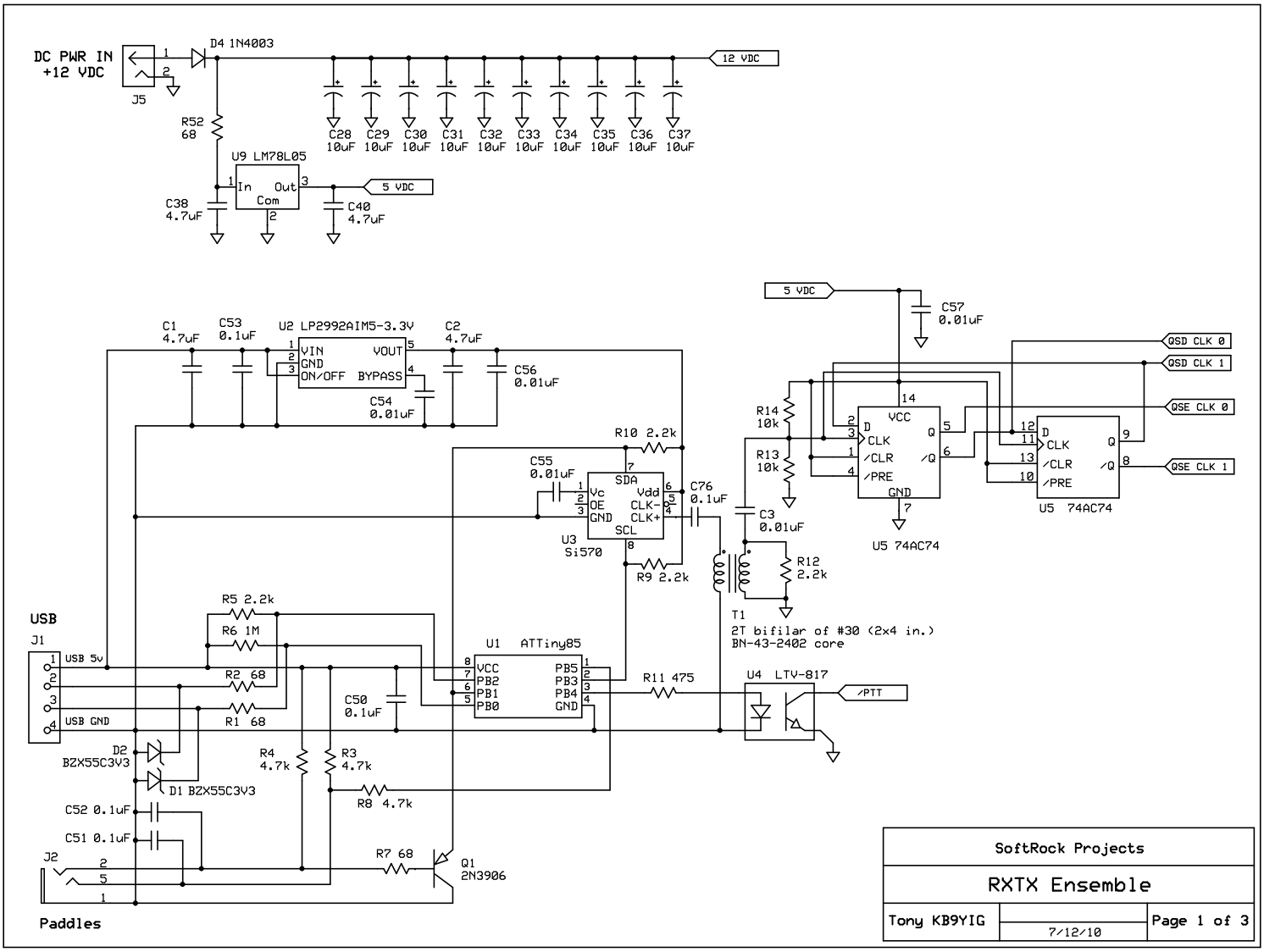
Some tests will require you to use your ham radio to receive or generate a signal of a specified frequency in order to test transmitters, oscillators, dividers, and/or receivers.

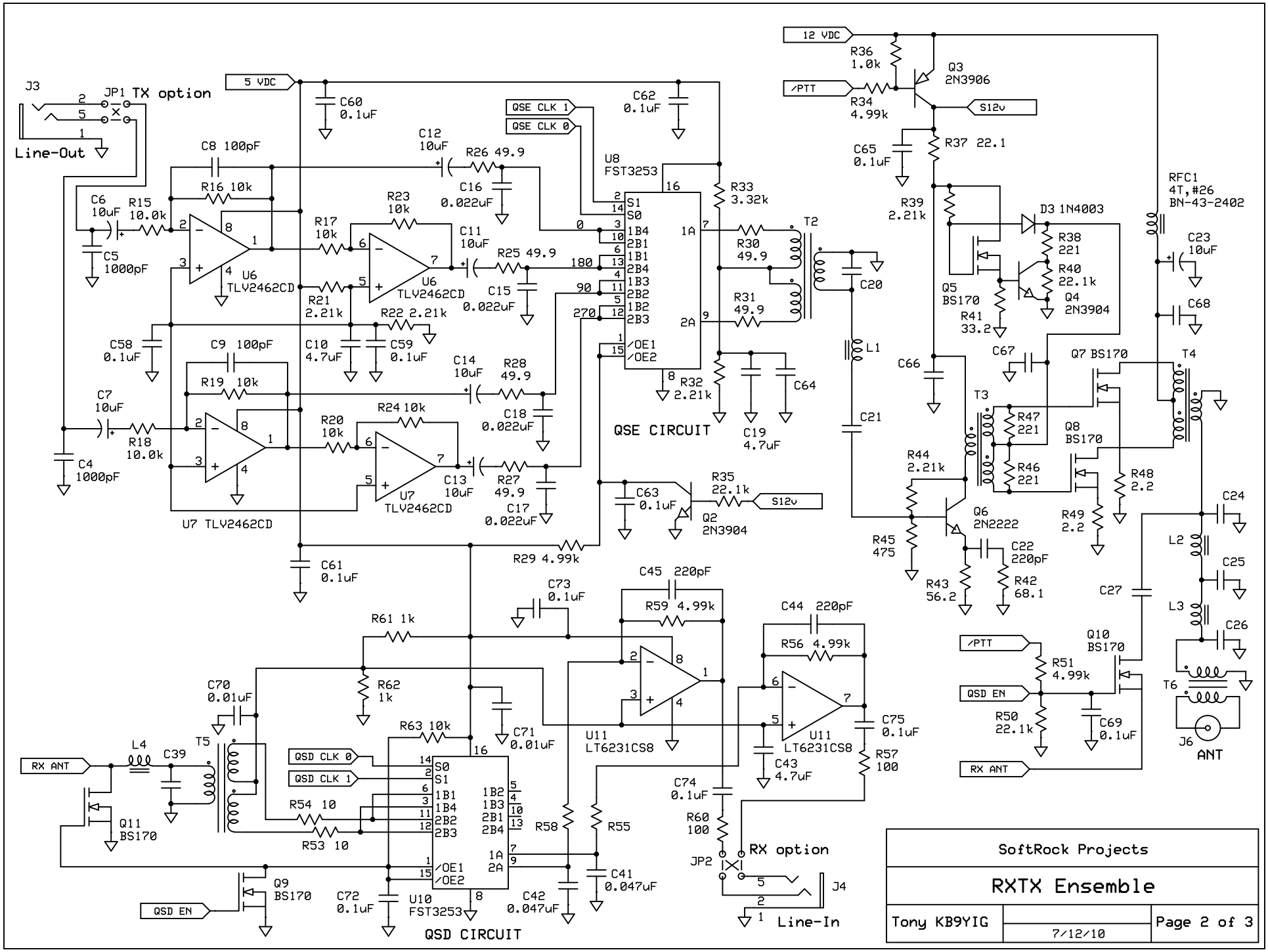
Optional testing. If the builder has (access to) a dual channel oscilloscope, along with an audio signal generator and an RF signal generator, and feels the need to perform tests beyond the basic DMM tests, certain stages will include in their testing section some optional tests involving this advanced equipment.

The IQGen or DQ-Gen programs available free from Michael Keller, DL6IAK, can be used in a pinch to get the sound card to produce audio tones for injection into the circuit.

You can always use Rocky to generate I and Q signals for tests requiring these audio signals (this is the author's preferred way)

Home Bill of Materials Power Supply USB Power Supply Local Oscillator Dividers RF I/O and Switching RX Mixer (QSD) RX Opamps and Output TX Opamps TX Mixer (QSE) Driver/PA External Connections Comments Acronyms Inventory Revisions as of 3/21/2011 Components By Stage WB5RVZ Main Website


DC PWR IN
+12 VDC
J5
D4 1N4003
12 VDC
R52
68
C28 10uF
C29 10uF
C30 10uF
C31 10uF
C32 10uF
C33 10uF
C34 10uF
C35 10uF
C36 10uF
C37 10uF
U9 LM78L05
In
Com
Out
5 VDC
C38
4.7uF
C40
4.7uF
C1
4.7uF
C53
0.1uF
U2 LP2992AIM5-3.3V
VIN
GND
ON/OFF
VOUT
BYPASS
C2
4.7uF
C56
0.01uF
C54
0.01uF
5 VDC
C57
0.01uF
QSD CLK 0
QSD CLK 1
QSE CLK 0
QSE CLK 1
R14
10k
R13
10k
VCC
CLK
/CLR
/PRE
GND
/Q
U5 74AC74
R10 2.2k
C55
0.01uF
SDA
Vc
OE
GND
Vdd
CLK-
CLK+
SCL
U3
Si570
C76
0.1uF
C3
0.01uF
R9 2.2k
R12
2.2k
T1
2T bifilar of #30 (2x4 in.)
BN-43-2402 core
USB
J1
USB 5v
USB GND
R5 2.2k
R6 1M
R2 68
R1 68
U1 ATTiny85
VCC
PB2
PB1
PB0
PB5
PB3
PB4
GND
C50
0.1uF
R11 475
U4 LTV-817
/PTT
D2
BZX55C3V3
D1 BZX55C3V3
R4
4.7k
R3
4.7k
R8 4.7k
C52 0.1uF
C51 0.1uF
J2
R7 68
Q1
2N3906
Paddles
SoftRock Projects
RXTX Ensemble
Tony KB9YIG
7/12/10
Page 1 of 3


J3
JP1 TX option
Line-Out
5 VDC
C60 0.1uF
C62 0.1uF
QSE CLK 1
QSE CLK 0
C8 100pF
C12 10uF
R26 49.9
C16 0.022uF
U8 FST3253
R16 10k
R23 10k
R33 3.32k
C6 10uF
R15 10.0k
R17 10k
C11 10uF
R25 49.9
T2
C5 1000pF
U6 TLV2462CD
C15 0.022uF
R30 49.9
C20
R21 2.21k
R22 2.21k
R31 49.9
C58 0.1uF
C10 4.7uF
C59 0.1uF
C9 100pF
C14 10uF
R28 49.9
L1
R19 10k
R32 2.21k
C64
C7 10uF
R18 10.0k
R20 10k
R24 10k
C18 0.022uF
C19 4.7uF
C21
QSE CIRCUIT
C4 1000pF
C13 10uF
R27 49.9
C17 0.022uF
U7 TLV2462CD
C63 0.1uF
R35 22.1k
S12v
Q2 2N3904
C61 0.1uF
R29 4.99k
12 VDC
R36 1.0k
Q3 2N3906
/PTT
R34 4.99k
C65 0.1uF
R37 22.1
R39 2.21k
RFC1 4T,#26 BN-43-2402
D3 1N4003
R38 221
C23 10uF
R40 22.1k
Q5 BS170
Q4 2N3904
C68
R41 33.2
C66
C67
Q7 BS170
T4
T3
R47 221
Q8 BS170
R44 2.21k
R46 221
R48 2.2
R49 2.2
C24
Q6 2N2222
C22 220pF
L2
R45 475
R43 56.2
R42 68.1
C25
C27
L3
C26
C45 220pF
C73 0.1uF
R59 4.99k
C44 220pF
R61 1k
R56 4.99k
/PTT
Q10 BS170
R51 4.99k
C70 0.01uF
R62 1k
U11 LT6231CS8
C75 0.1uF
QSD EN
R50 22.1k
C69 0.1uF
T6
J6
ANT
RX ANT
L4
C39
T5
R63 10k
C71 0.01uF
U11 LT6231CS8
C43 4.7uF
R57 100
QSD CLK 0
QSD CLK 1
C74 0.1uF
R54 10
R58
R55
R60 100
Q11 BS170
R53 10
JP2
RX option
Q9 BS170
C72 0.1uF
U10 FST3253
C42 0.047uF
C41 0.047uF
J4
Line-In
QSD CIRCUIT
SoftRock Projects
RXTX Ensemble
Tony KB9YIG
7/12/10
Page 2 of 3

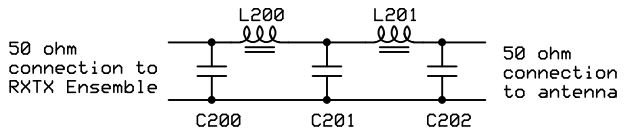
Band specific values

Bands	T2	T3	T4	L1
160m	primaries 20T bifilar #30 (2x12 in.) secondary 7.1uH 40T #30 (22 in.) T30-2 (red) core	primary 6T of #30 (10 in.) secondaries 3T bifilar of #30 (2x5 in.) BN-43-2402 core	primaries 4T bifilar of #30 (2x6 in.) secondary 5T of #30 (9 in.) BN-43-2402 core	30uH 83T #30 (44 in.) T30-2(red) core
80m, 40m	primaries 17T bifilar #30 (2x9.5 in.) secondary 5.0uH 34T #30 (19 in.) T30-2 (red) core	primary 6T of #30 (10 in.) secondaries 3T bifilar of #30 (2x5 in.) BN-43-2402 core	primaries 4T bifilar of #30 (2x6 in.) secondary 5T of #30 (9 in.) BN-43-2402 core	4.7uH 33T #30 (19 in.) T30-2(red) core
40m, 30m, 20m	primaries 13T bifilar #30 (2x9 in.) secondary 2.43uH 26T #30 (15 in.) T30-6 (yellow) core	primary 6T of #30 (10 in.) secondaries 3T bifilar of #30 (2x5 in.) BN-61-2402 core	primaries 3T bifilar of #30 (2x6 in.) secondary 5T of #30 (9 in.) BN-61-2402 core	2.3uH 25T #30 (15 in.) T30-6 (yellow) core
30m, 20m, 17m	primaries 11T bifilar #30 (2x8 in.) secondary 1.74uH 22T #30 (14 in.) T30-6 (yellow) core	primary 6T of #30 (10 in.) secondaries 3T bifilar of #30 (2x5 in.) BN-61-2402 core	primaries 3T bifilar of #30 (2x6 in.) secondary 5T of #30 (9 in.) BN-61-2402 core	1.6uH 21T #30 (14 in.) T30-6 (yellow) core
15m, 12m, 10m	primaries 8T bifilar #30 (2x6 in.) secondary 0.81uH 15T #30 (11 in.) T30-6 (yellow) core	primary 5T of #30 (10 in.) secondaries 3T bifilar of #30 (2x5 in.) BN-61-2402 core	primaries 3T bifilar of #30 (2x6 in.) secondary 5T of #30 (9 in.) BN-61-2402 core	2.1uH 24T #30 (15 in.) T30-6 (yellow) core

Bands	L2 and L3	C20	C21	C24, C26	C25	R42	C64, C66, C67, C68
160m	3.4uH 29T #26 (18 in.) T37-2(red) core	1000pF	270pF	2200pF	4700pF	omit	0.1uF size 1206
80m, 40m	1.4uH 19T #26 (13 in.) T37-2(red) core	220pF	220pF	470pF	820pF	omit	0.1uF size 1206
40m, 30m, 20m	0.8uH 16T #26 (11 in.) T37-6 (yellow) core	100pF	100pF	220pF	470pF	omit	0.1uF size 1206
30m, 20m, 17m	0.6uH 14T #26 (10 in.) T37-6 (yellow) core	82pF	82pF	150pF	330pF	use	0.1uF size 1206
15m, 12m, 10m	0.36uH 11T #26 (9 in.) T37-6 (yellow) core	47pF	22pF	100pF	180pF	use	0.01uF size 1206

Bands	C27	C39	L4	T5	T6	R55, R58
160m	390pF	5600pF	18.7uH, T30-2(red) core 66T #30 (35 in.)	1.4uH(primary), T30-2(red) core 18T #30 (12 in.) on primary 9T #30 (2x7 in.) on bifilar secondary	4T #30 (2x6 in.) bifilar BN-43-2402 core	49.9 ohm
80m, 40m	560pF	680pF	1.6uH, T25-6(red core 22T #30 (11 in.)	1.2uH(primary), T25-2(red) core 18T #30 (11 in.) on primary 9T #30 (2x6 in.) on bifilar secondary	4T #30 (2x6 in.) bifilar BN-43-2402 core	49.9 ohm
40m, 30m, 20m	330pF	470pF	0.9uH, T25-6(yellow) core 18T #30 (10 in.)	0.69uH(primary), T25-6(yellow) core 16T #30 (9 in.) on primary 8T #30 (2x7 in.) on bifilar secondary	4T #30 (2x6 in.) bifilar BN-61-2402 core	10.0 ohm
30m, 20m, 17m	180pF	220pF	0.78uH, T25-6(yellow) core 17T #30 (9 in.)	0.6uH(primary), T25-6(yellow) core 14T #30 (8 in.) on primary 7T #30 (2x6 in.) on bifilar secondary	4T #30 (2x6 in.) bifilar BN-61-2402 core	10.0 ohm
15m, 12m, 10m	82pF	330pF	0.53uH, T25-6(yellow) core 14T #30 (8 in.)	0.13uH(primary), T25-6(yellow) core 7T #30 (6 in.) on primary 4T #30 (2x 5 in.) on bifilar secondary	4T #30 (2x6 in.) bifilar BN-61-2402 core	10.0 ohm

External 80m, 40m and 30m LPF



Band	C200, C202	C201	L200, L201
80m	390pF	1000pF	2.5uH, 29T #26, (17in.) T37-6(yellow) core
40m	220pF	470pF	1.3uH, 18T #26, (12in.) T37-2(red) core
30m	100pF	330pF	0.9uH, 15T #26, (10in.) T37-2(red) core

SoftRock Projects

RXTX Ensemble

Tony KB9YIG | 7/12/10 |

Ensemble RXTX Inventorys

Home Bill of Materials Power Supply USB Power Supply Local Oscillator Dividers RF I/O and Switching RX Mixer (QSD) RX Opamps and Output TX Opamps TX Mixer (QSE) Driver/PA External Connections Comments Acronyms Inventory Revisions as of 3/21/2011 Components By Stage WB5RVZ Main Website

Component Inventory

This page provides a list of components and their maximum quantities to support your inventorying the kit as a whole. This is helpful for kits where the kit includes all parts necessary to build any particular band-specific option (there would, in such cases, likely be excess parts left over at the end of the build).
Once these quantities check out, you can sort the components out to their respective build stages.

Component Type	Category	Component	Qty
boardhdw	HDW	#4 nylon washer	1
boardhdw	HDW	4 X #4-40 hdw (nut, bolt, washer, spacer)	1
Capacitor	Ceramic	0.01 uF (103)	1
Capacitor	Ceramic	0.022 uF 5% (223)	4
Capacitor	Ceramic	0.047 uF 5% (473)	2
Capacitor	Ceramic	100 pF 5% (101)	4
Capacitor	Ceramic	1000 pF 5% (102)	3
Capacitor	Ceramic	150 pF 5% (151)	2
Capacitor	Ceramic	180 pF 5% (181)	1
Capacitor	Ceramic	22 pF 5% (22J)	1
Capacitor	Ceramic	220 pF 5% (221)	6
Capacitor	Ceramic	2200 pF 5% (222)	2
Capacitor	Ceramic	270 pF 5% (271)	1
Capacitor	Ceramic	330 pF 5% (331)	2
Capacitor	Ceramic	390 pF 5% (391)	2
Capacitor	Ceramic	4.7 uF 10% 16V X7R RAD (475)	7
Capacitor	Ceramic	47 pF 5% (47J)	1
Capacitor	Ceramic	470 pF 5% (471)	3
Capacitor	Ceramic	4700 pF 5% (472)	1
Capacitor	Ceramic	560 pF (561)	1
Capacitor	Ceramic	5600 pF 5% (562)	1
Capacitor	Ceramic	680 pF 5% (681)	1
Capacitor	Ceramic	82 pF (82J)	2
Capacitor	Ceramic	820 pF 5% (821)	1
Capacitor	Electrolytic	10uF/16 VDC	17
Capacitor	SMT 1206	0.01 uF ((smt))	11
Capacitor	SMT 1206	0.1 uF ((smt) black stripe)	22
Connector	BNC-RA	bnc connector pcb (rt-angle)	1
connector	Jack-RA	3.5mm stereo jack - PCB mount (rt-angle)	3
connector	Jack-RA	DC Power Jack PCB Mount (rt-angle)	1
connector	Jack-RA	USB-B pcb jack (rt-angle)	1
connector	Plug	DC Power Plug 5.5/2.1mm Pos Ctr	1
connector	Socket	socket, machine, 8 pin	1

Diode	Axial	1N4003 (1N4003)	2
Diode	Axial	BZX55C3V3 3.3V zener diode (BZX55C)	2
Heatsink	Misc	TO-220 heatsink Silpad	1
heatsink	TO-18	heatsink for driver transistor	1
Heatsink	TO-220	TO-220 heatsink for flat transistors	1
IC	DIP 8	ATtiny 85-20 PU w/V15.12 Firmware (AVR ATTINY85-20PU)	1
IC	DIP-4	LTV-817 Opto-Isolator (LTV 817)	1
IC	I2C	Si570 Programmable Oscillator (SiLabs 570)	1
IC	SOIC-14	74AC74 Dual D FF (74AC74)	1
IC	SOIC-16	FST3253 mux/demux switch (FST3253)	2
IC	SOIC-8	LT6231 dual op-amp (LT6231)	1
IC	SOIC-8	TLV2462CD dual opamp (TVL2462CD)	2
IC	SOT-23-5	LP2992AIM5-3.3V regulator (LFEA)	1
IC	TO-92	LM78L05 voltage regulator (LM78L05)	1
inductor	Binocular core	BN-43-2402 (no markings!) (none)	5
inductor	Binocular core	BN-61-2402 (no Markings!) (none)	3
inductor	Coil	0.9uH: 15T #26(10 in) on T37-2 (red) (red)	2
Inductor	coil	1.3uH: 18T #26(12in) on T37-2(red) (red)	2
inductor	Coil	2.5uH: 29T #26(17in) on T37-6 (yel) (yellow)	2
inductor	Toroid	T25-2 toroid core (red)	2
inductor	Toroid	T25-6 toroid core (yellow)	2
inductor	Toroid	T30-2 toroid core (red)	4
inductor	Toroid	T30-6 toroid core (yellow)	2
inductor	Toroid	T37-2 toroid core (red)	2
inductor	Toroid	T37-6 toroid core (yellow)	2
Resistor	1/4W	1 k 1/4W 1% (br-blk-blk-br-br)	3
Resistor	1/4W	10 k 1/4W 1% (br-blk-blk-r-br)	11
Resistor	1/4W	10 ohm 1/4W 1% (br-blk-blk-gld-br)	4
Resistor	1/4W	2.2 ohm 1/4W 5% (red-red-gld-gld)	2
Resistor	1/4W	2.21 k 1/4W 1% (r-r-br-br-br)	5
Resistor	1/4W	22.1 k 1/4W 1% (r-r-brn-r-br)	3
Resistor	1/4W	22.1 ohm 1% (red-red-brn-gld-brn)	1
Resistor	1/4W	221 1/4W 1% (red-red-brn-blk-brn)	3
Resistor	1/4W	3.32 k 1/4W 1% (ora-ora-red-brn-brn)	1
Resistor	1/4W	33.2 ohm 1% (ora-ora-red-gld-brn)	1
Resistor	1/4W	4.99 k 1/4W 1% (y-w-w-br-br)	5
Resistor	1/4W	475 1/4W 1% (y-v-grn-bl-br)	2
Resistor	1/4W	49.9 ohm 1% (yel-wht-wht-gld-brn)	8
Resistor	1/4W	56.2 1/4W 1% (grn-blu-red-gld-brn)	1
Resistor	1/4W	68 1/4W 5% (bl-gry-blk-gld)	1
Resistor	1/4W	68.1 1/4W 1% (blu-gry-brn-gld-brn)	1
Resistor	1/6W	1 M 1/6W 5% (brn-blk-grn-gld)	1
Resistor	1/6W	100 1/6W 5% (br-blk-br-gld)	2
resistor	1/6W	100k 1/6W 5% (brn_blk_yel_grn)	1
Resistor	1/6W	2.2k 1/6W 5% (red-red-red-gld)	4
Resistor	1/6W	4.7k 1/6W 5% (yel-vio-red-gld)	3
Resistor	1/6W	68 1/6W 5% (bl-gry-blk-gld)	3
SET	HDW	#6 screw, hex nut, starwasher	1
Transistor	TO-18	2N2222 NPN transistor	1
Transistor	TO-92	2N3904 NPN Transistor (2N3904)	2

Transistor	TO-92	2N3906 PNP transistor (2N3906)	2
Transistor	TO-92	BS170 N-Channel Enhancement Mode FET (BS170)	6

Home Bill of Materials Power Supply USB Power Supply Local Oscillator Dividers RF I/O and Switching RX Mixer (QSD) RX Opamps and Output TX Opamps TX Mixer (QSE) Driver/PA External Connections Comments Acronyms Inventory Revisions as of 3/21/2011 Components By Stage WB5RVZ Main Website

Ensemble RXTX designations

Home Bill of Materials Power Supply USB Power Supply Local Oscillator Dividers RF I/O and Switching RX Mixer (QSD) RX Opamps and Output TX Opamps TX Mixer (QSE) Driver/PA External Connections Comments Acronyms Inventory Revisions as of 3/21/2011 Components By Stage WB5RVZ Main Website

Component Designations By Stage

This page provides a list of component designations (e.g., R1, C1, L1, etc.) and the stage in which the component appears under the designation.
The page is sorted by stage, then by component. To find a component by its designation, just use your browser's "FIND ON PAGE" function.

Designation	Component	Stage
Cs2	0.01 uF (SMT 1206) - (smt)	Bill of Materials
Cs1	0.1 uF (SMT 1206) - (smt) black stripe	Bill of Materials
C38	4.7 uF 10% 16V X7R RAD (Ceramic) - 475	Power Supply
C40	4.7 uF 10% 16V X7R RAD (Ceramic) - 475	Power Supply
C28	10uF/16 VDC (Electrolytic)	Power Supply
C29	10uF/16 VDC (Electrolytic)	Power Supply
C30	10uF/16 VDC (Electrolytic)	Power Supply
C31	10uF/16 VDC (Electrolytic)	Power Supply
C32	10uF/16 VDC (Electrolytic)	Power Supply
C33	10uF/16 VDC (Electrolytic)	Power Supply
C34	10uF/16 VDC (Electrolytic)	Power Supply
C35	10uF/16 VDC (Electrolytic)	Power Supply
C36	10uF/16 VDC (Electrolytic)	Power Supply
C37	10uF/16 VDC (Electrolytic)	Power Supply
J5	DC Power Jack PCB Mount (rt-angle) (Jack-RA)	Power Supply
P1	DC Power Plug 5.5/2.1mm Pos Ctr (Plug)	Power Supply
D4	1N4003 (Axial) - 1N4003	Power Supply
U09	LM78L05 voltage regulator (TO-92) - LM78L05	Power Supply
R52	68 1/4W 5% (1/4W) - bl-gry-blk-gld	Power Supply
R50	22.1 k 1/4W 1% (1/4W) - r-r-brn-r-br	Power Supply
C01	4.7 uF 10% 16V X7R RAD (Ceramic) - 475	USB Power Supply
C02	4.7 uF 10% 16V X7R RAD (Ceramic) - 475	USB Power Supply
C54	0.01 uF (SMT 1206) - (smt)	USB Power Supply
C56	0.01 uF (SMT 1206) - (smt)	USB Power Supply
C53	0.1 uF (SMT 1206) - (smt) black stripe	USB Power Supply
J1	USB-B pcb jack (rt-angle) (Jack-RA)	USB Power Supply
U02	LP2992AIM5-3.3V regulator (SOT-23-5) - LFEA	USB Power Supply
C03	0.01 uF (Ceramic) - 103	Local Oscillator

C55	0.01 uF (SMT 1206) - (smt)	Local Oscillator
C50	0.1 uF (SMT 1206) - (smt) black stripe	Local Oscillator
C51	0.1 uF (SMT 1206) - (smt) black stripe	Local Oscillator
C52	0.1 uF (SMT 1206) - (smt) black stripe	Local Oscillator
C76	0.1 uF (SMT 1206) - (smt) black stripe	Local Oscillator
J2	3.5mm stereo jack - PCB mount (rt-angle) (Jack-RA)	Local Oscillator
SO01	socket, machine, 8 pin (Socket)	Local Oscillator
D1	BZX55C3V3 3.3V zener diode (Axial) - BZX55C	Local Oscillator
D2	BZX55C3V3 3.3V zener diode (Axial) - BZX55C	Local Oscillator
U01	ATtiny 85-20 PU w/V15.12 Firmware (DIP 8) - AVR ATTINY85-20PU	Local Oscillator
U04	LTV-817 Opto-Isolator (DIP-4) - LTV 817	Local Oscillator
U03	Si570 Programmable Oscillator (I2C) - SiLabs 570	Local Oscillator
T1-core	BN-43-2402 (no markings!) (Binocular core) - none	Local Oscillator
T1	2T Bifilar #30 (5") on BN-43-2402 (Xfrmr)	Local Oscillator
R11	475 1/4W 1% (1/4W) - y-v-grn-bl-br	Local Oscillator
R01	68 1/6W 5% (1/6W) - bl-gry-blk-gld	Local Oscillator
R02	68 1/6W 5% (1/6W) - bl-gry-blk-gld	Local Oscillator
R07	68 1/6W 5% (1/6W) - bl-gry-blk-gld	Local Oscillator
R05	2.2k 1/6W 5% (1/6W) - red-red-red-gld	Local Oscillator
R09	2.2k 1/6W 5% (1/6W) - red-red-red-gld	Local Oscillator
R10	2.2k 1/6W 5% (1/6W) - red-red-red-gld	Local Oscillator
R12	2.2k 1/6W 5% (1/6W) - red-red-red-gld	Local Oscillator
R03	4.7k 1/6W 5% (1/6W) - yel-vio-red-gld	Local Oscillator
R04	4.7k 1/6W 5% (1/6W) - yel-vio-red-gld	Local Oscillator
R08	4.7k 1/6W 5% (1/6W) - yel-vio-red-gld	Local Oscillator
R06	1 M 1/6W 5% (1/6W) - brn-blk-grn-gld	Local Oscillator
Q01	2N3906 PNP transistor (TO-92) - 2N3906	Local Oscillator
C57	0.01 uF (SMT 1206) - (smt)	Dividers
U05	74AC74 Dual D FF (SOIC-14) - 74AC74	Dividers
R13	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	Dividers
R14	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	Dividers
C24	160m: 2200 pF 5% (Ceramic - 222) 80, 40m: 470 pF 5% (Ceramic - 471) 40, 30, 20m: 220 pF 5% (Ceramic - 221) 30, 20, 17m: 150 pF 5% (Ceramic - 151) 15, 12, 10m: 100 pF 5% (Ceramic - 101)	RF I/O and Switching
C25	160m: 4700 pF 5% (Ceramic - 472) 80, 40m: 820 pF 5% (Ceramic - 821) 40, 30, 20m: 470 pF 5% (Ceramic - 471) 30, 20, 17m: 330 pF 5% (Ceramic - 331) 15, 12, 10m: 180 pF 5% (Ceramic - 181)	RF I/O and Switching
C26	160m: 2200 pF 5% (Ceramic - 222) 80, 40m: 470 pF 5% (Ceramic - 471) 40, 30, 20m: 220 pF 5% (Ceramic - 221) 30, 20, 17m: 150 pF 5% (Ceramic - 151) 15, 12, 10m: 100 pF 5% (Ceramic - 101)	RF I/O and Switching
C27	160m: 390 pF 5% (Ceramic - 391) 80, 40m: 560 pF (Ceramic - 561) 40, 30, 20m: 330 pF 5% (Ceramic - 331)	RF I/O and Switching

C39	30, 20, 17m: 180 pF 5% (Ceramic - 181) 15, 12, 10m: 82 pF (Ceramic - 82J) 160m: 5600 pF 5% (Ceramic - 562) 80, 40m: 680 pF 5% (Ceramic - 681) 40, 30, 20m: 470 pF 5% (Ceramic - 471) 30, 20, 17m: 220 pF 5% (Ceramic - 221) 15, 12, 10m: 330 pF 5% (Ceramic - 331)	RF I/O and Switching
L2	160m: 3.4 uH: 29T #26 on T37-2 (red) (17") (Coil - red) 80, 40m: 1.4 uH: 19T #26 on T37-2 (red) 12" (Coil - red) 40, 30, 20m: 0.8 uH: 16T #26 on T37-6 (yellow) (11") (Coil - yellow) 30, 20, 17m: 0.6 uH: 14T #26 on T37-6 (yellow) (10") (Coil - yellow) 15, 12, 10m: 0.36 uH: 11T #26 on T37-6 (yellow) (Coil - yellow)	RF I/O and Switching
L2core	160m: T37-2 toroid core (Toroid - red) 80, 40m: T37-2 toroid core (Toroid - red) 40, 30, 20m: T37-6 toroid core (Toroid - yellow) 30, 20, 17m: T37-6 toroid core (Toroid - yellow) 15, 12, 10m: T37-6 toroid core (Toroid - yellow)	RF I/O and Switching
L3	160m: 3.4 uH: 29T #26 on T37-2 (red) (17") (Coil - red) 80, 40m: 1.4 uH: 19T #26 on T37-2 (red) 12" (Coil - red) 40, 30, 20m: 0.8 uH: 16T #26 on T37-6 (yellow) (11") (Coil - yellow) 30, 20, 17m: 0.6 uH: 14T #26 on T37-6 (yellow) (10") (Coil - yellow) 15, 12, 10m: 0.36 uH: 11T #26 on T37-6 (yellow) (Coil - yellow)	RF I/O and Switching
L3core	160m: T37-2 toroid core (Toroid - red) 80, 40m: T37-2 toroid core (Toroid - red) 40, 30, 20m: T37-6 toroid core (Toroid - yellow) 30, 20, 17m: T37-6 toroid core (Toroid - yellow) 15, 12, 10m: T37-6 toroid core (Toroid - yellow)	RF I/O and Switching
L4	160m: 18.7 uH: 66T #30 on T30-2 (red) (35") (Coil - red) 80, 40m: 1.6 uH: 22T #30 on T25-2 (red) (10") (Coil - red) 40, 30, 20m: 0.9uH 18T #30 on T25-6(yellow) (10") (Coil - yellow) 30, 20, 17m: 0.78 uH 17T #30 on T25-6 (yellow) (8") (Coil - yellow) 15, 12, 10m: 0.53 uH 14T #30 on T25-6 (10") (Coil - yellow)	RF I/O and Switching
L4core	160m: T30-2 toroid core (Toroid - red) 80, 40m: T25-2 toroid core (Toroid - red) 40, 30, 20m: T25-6 toroid core (Toroid - yellow) 30, 20, 17m: T25-6 toroid core (Toroid - yellow) 15, 12, 10m: T25-6 toroid core (Toroid - yellow)	RF I/O and Switching
T5	160m: 1.4 uH: 18T/2x9T bifilar #30 on T30-2 (red) 11" (Xfrmr - red) 80, 40m: 1.2 uH: 18T/2x9T bifilar #30 on T25-2	RF I/O and Switching <

T5core	(red) 9" (Xfrmr - red) 40, 30, 20m: 0.69 uH: 16T/2x8T bifilar #30 on T25-6 (yellow) 9" (Xfrmr - yellow) 30, 20, 17m: 0.6 uH: 14T/2x7T bifilar #30 on T25-6 (yellow) 8" (Xfrmr - yellow) 15, 12, 10m: 0.13 uH: 7T/2x4T bifilar #30 on T25-6 (yellow) 5" (Xfrmr - yellow)	
	160m: T30-2 toroid core (Toroid - red) 80, 40m: T25-2 toroid core (Toroid - red) 40, 30, 20m: T25-6 toroid core (Toroid - yellow) 30, 20, 17m: T25-6 toroid core (Toroid - yellow) 15, 12, 10m: T25-6 toroid core (Toroid - yellow)	RF I/O and Switching
T6	160m: 4T bifilar #30 on BN-43-2402 (9") (xfrmr -) 80, 40m: 4T bifilar #30 on BN-43-2402 (9") (xfrmr -) 40, 30, 20m: 4T bifilar #30 on BN-61-2402 (9") (xfrmr -) 30, 20, 17m: 4T bifilar #30 on BN-61-2402 (9") (xfrmr -) 15, 12, 10m: 4T bifilar #30 on BN-61-2402 (9") (xfrmr -)	RF I/O and Switching
T6core	160m: BN-43-2402 (no markings!) (Binocular core - none) 80, 40m: BN-43-2402 (no markings!) (Binocular core - none) 40, 30, 20m: BN-61-2402 (no Markings!) (Binocular core - none) 30, 20, 17m: BN-61-2402 (no Markings!) (Binocular core - none) 15, 12, 10m: BN-61-2402 (no Markings!) (Binocular core - none)	RF I/O and Switching
C70	0.01 uF (SMT 1206) - (smt)	RF I/O and Switching
C65	0.1 uF (SMT 1206) - (smt) black stripe	RF I/O and Switching
C69	0.1 uF (SMT 1206) - (smt) black stripe	RF I/O and Switching
C72	0.1 uF (SMT 1206) - (smt) black stripe	RF I/O and Switching
J6	bnc connector pcb (rt-angle) (BNC-RA)	RF I/O and Switching
R53	10 ohm 1/4W 1% (1/4W) - br-blk-blk-gld-br	RF I/O and Switching
R54	10 ohm 1/4W 1% (1/4W) - br-blk-blk-gld-br	RF I/O and Switching
R37	22.1 ohm 1% (1/4W) - red-red-brn-gld-brn	RF I/O and Switching
R36	1 k 1/4W 1% (1/4W) - br-blk-blk-br-br	RF I/O and Switching
R61	1 k 1/4W 1% (1/4W) - br-blk-blk-br-br	RF I/O and Switching
R62	1 k 1/4W 1% (1/4W) - br-blk-blk-br-br	RF I/O and Switching

R34	4.99 k 1/4W 1% (1/4W) - y-w-w-br-br	RF I/O and Switching
R51	4.99 k 1/4W 1% (1/4W) - y-w-w-br-br	RF I/O and Switching
R63	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	RF I/O and Switching
Q03	2N3906 PNP transistor (TO-92) - 2N3906	RF I/O and Switching
Q09	BS170 N-Channel Enhancement Mode FET (TO-92) - BS170	RF I/O and Switching
Q10	BS170 N-Channel Enhancement Mode FET (TO-92) - BS170	RF I/O and Switching
Q11	BS170 N-Channel Enhancement Mode FET (TO-92) - BS170	RF I/O and Switching
R55	160m: 49.9 ohm 1% (1/4W - yel-wht-wht-gld-brn) 80, 40m: 49.9 ohm 1% (1/4W - yel-wht-wht-gld-brn) 40, 30, 20m: 10 ohm 1/4W 1% (1/4W - br-blk-blk-gld-br) 30, 20, 17m: 10 ohm 1/4W 1% (1/4W - br-blk-blk-gld-br) 15, 12, 10m: 10 ohm 1/4W 1% (1/4W - br-blk-blk-gld-br)	RX Mixer (QSD)
R58	160m: 49.9 ohm 1% (1/4W - yel-wht-wht-gld-brn) 80, 40m: 49.9 ohm 1% (1/4W - yel-wht-wht-gld-brn) 40, 30, 20m: 10 ohm 1/4W 1% (1/4W - br-blk-blk-gld-br) 30, 20, 17m: 10 ohm 1/4W 1% (1/4W - br-blk-blk-gld-br) 15, 12, 10m: 10 ohm 1/4W 1% (1/4W - br-blk-blk-gld-br)	RX Mixer (QSD)
C41	0.047 uF 5% (Ceramic) - 473	RX Mixer (QSD)
C42	0.047 uF 5% (Ceramic) - 473	RX Mixer (QSD)
C71	0.01 uF (SMT 1206) - (smt)	RX Mixer (QSD)
U10	FST3253 mux/demux switch (SOIC-16) - FST3253	RX Mixer (QSD)
C44	220 pF 5% (Ceramic) - 221	RX Opamps and Output
C45	220 pF 5% (Ceramic) - 221	RX Opamps and Output
C43	4.7 uF 10% 16V X7R RAD (Ceramic) - 475	RX Opamps and Output
C73	0.1 uF (SMT 1206) - (smt) black stripe	RX Opamps and Output
C74	0.1 uF (SMT 1206) - (smt) black stripe	RX Opamps and Output
C75	0.1 uF (SMT 1206) - (smt) black stripe	RX Opamps and Output
J4	3.5mm stereo jack - PCB mount (rt-angle) (Jack-RA)	RX Opamps and Output

U11	LT6231 dual op-amp (SOIC-8) - LT6231	RX Opamps and Output
R56	4.99 k 1/4W 1% (1/4W) - y-w-w-br-br	RX Opamps and Output
R59	4.99 k 1/4W 1% (1/4W) - y-w-w-br-br	RX Opamps and Output
R57	100 1/6W 5% (1/6W) - br-blk-br-gld	RX Opamps and Output
R60	100 1/6W 5% (1/6W) - br-blk-br-gld	RX Opamps and Output
JP2a	shunt wire (cut-off lead) (Cutoff)	RX Opamps and Output
JP2b	shunt wire (cut-off lead) (Cutoff)	RX Opamps and Output
C08	100 pF 5% (Ceramic) - 101	TX Opamps
C09	100 pF 5% (Ceramic) - 101	TX Opamps
C04	1000 pF 5% (Ceramic) - 102	TX Opamps
C05	1000 pF 5% (Ceramic) - 102	TX Opamps
C15	0.022 uF 5% (Ceramic) - 223	TX Opamps
C16	0.022 uF 5% (Ceramic) - 223	TX Opamps
C17	0.022 uF 5% (Ceramic) - 223	TX Opamps
C18	0.022 uF 5% (Ceramic) - 223	TX Opamps
C10	4.7 uF 10% 16V X7R RAD (Ceramic) - 475	TX Opamps
C06	10uF/16 VDC (Electrolytic)	TX Opamps
C07	10uF/16 VDC (Electrolytic)	TX Opamps
C11	10uF/16 VDC (Electrolytic)	TX Opamps
C12	10uF/16 VDC (Electrolytic)	TX Opamps
C13	10uF/16 VDC (Electrolytic)	TX Opamps
C14	10uF/16 VDC (Electrolytic)	TX Opamps
C58	0.1 uF (SMT 1206) - (smt) black stripe	TX Opamps
C59	0.1 uF (SMT 1206) - (smt) black stripe	TX Opamps
C60	0.1 uF (SMT 1206) - (smt) black stripe	TX Opamps
C61	0.1 uF (SMT 1206) - (smt) black stripe	TX Opamps
J3	3.5mm stereo jack - PCB mount (rt-angle) (Jack-RA)	TX Opamps
U06	TLV2462CD dual opamp (SOIC-8) - TVL2462CD	TX Opamps
U07	TLV2462CD dual opamp (SOIC-8) - TVL2462CD	TX Opamps
R25	49.9 ohm 1% (1/4W) - yel-wht-wht-gld-brn	TX Opamps
R26	49.9 ohm 1% (1/4W) - yel-wht-wht-gld-brn	TX Opamps
R27	49.9 ohm 1% (1/4W) - yel-wht-wht-gld-brn	TX Opamps
R28	49.9 ohm 1% (1/4W) - yel-wht-wht-gld-brn	TX Opamps
R21	2.21 k 1/4W 1% (1/4W) - r-r-br-br-br	TX Opamps
R22	2.21 k 1/4W 1% (1/4W) - r-r-br-br-br	TX Opamps
R15	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps
R16	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps
R17	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps
R18	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps
R19	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps
R20	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps
R23	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps
R24	10 k 1/4W 1% (1/4W) - br-blk-blk-r-br	TX Opamps

R-TEST	100k 1/6W 5% (1/6W) - brn_blk_yel_grn	TX Opamps
JP1A	shunt wire (cut-off lead) (Cutoff)	TX Opamps
JP1B	shunt wire (cut-off lead) (Cutoff)	TX Opamps
C20	160m: 1000 pF 5% (Ceramic - 102) 80, 40m: 220 pF 5% (Ceramic - 221) 40, 30, 20m: 100 pF 5% (Ceramic - 101) 30, 20, 17m: 82 pF (Ceramic - 82J) 15, 12, 10m: 47 pF 5% (Ceramic - 47J)	TX Mixer (QSE)
C21	160m: 270 pF 5% (Ceramic - 271) 80, 40m: 220 pF 5% (Ceramic - 221) 40, 30, 20m: 100 pF 5% (Ceramic - 101) 30, 20, 17m: 82 pF (Ceramic - 82J) 15, 12, 10m: 22 pF 5% (Ceramic - 22J)	TX Mixer (QSE)
C64	160m: 0.1 uF (SMT 1206 - (smt) black stripe) 80, 40m: 0.1 uF (SMT 1206 - (smt) black stripe) 40, 30, 20m: 0.1 uF (SMT 1206 - (smt) black stripe) 30, 20, 17m: 0.1 uF (SMT 1206 - (smt) black stripe) 15, 12, 10m: 0.01 uF (SMT 1206 - (smt))	TX Mixer (QSE)
L1	160m: 30 uH 83T #30 on T30-2 (red) (44") (Coil - red) 80, 40m: 4.7 uH 33T #30 on T30-2 (red) ("19") (Coil - red) 40, 30, 20m: 2.3 uH 25T #30 on T30-6 (15") (Coil - yellow) 30, 20, 17m: 1.6 uH 21T #30 on T30-6 (yellow) (14") (Coil - yellow) 15, 12, 10m: 2.1 uH 24T #30 on T30-6 (yellow) (15") (Coil - yellow)	TX Mixer (QSE)
L1-core	160m: T30-2 toroid core (Toroid - red) 80, 40m: T30-2 toroid core (Toroid - red) 40, 30, 20m: T30-6 toroid core (Toroid - yellow) 30, 20, 17m: T30-6 toroid core (Toroid - yellow) 15, 12, 10m: T30-6 toroid core (Toroid - yellow)	TX Mixer (QSE)
T2	160m: 7.1 uH 20T bifilar/40T #30 on T30-2 (red) (22") (Xfrmr - red) 80, 40m: 5.0 uH 17T bidfilar/34T #30 on T30-2 (red) (19") (Xfrmr - red) 40, 30, 20m: 2.43 uH 13T(bi)/26T #30 on T30-6 (18") (Xfrmr - yellow) 30, 20, 17m: 1.74 uH 11T bifilar/22T #30 on T30-6(yellow) (14") (Xfrmr - yellow) 15, 12, 10m: 0.81 uH 8T bifilar/15T #30 on T30-6 (yellow) (11") (Xfrmr - yellow)	TX Mixer (QSE)
T2-core	160m: T30-2 toroid core (Toroid - red) 80, 40m: T30-2 toroid core (Toroid - red) 40, 30, 20m: T30-6 toroid core (Toroid - yellow) 30, 20, 17m: T30-6 toroid core (Toroid - yellow) 15, 12, 10m: T30-6 toroid core (Toroid - yellow)	TX Mixer (QSE)
C19	4.7 uF 10% 16V X7R RAD (Ceramic) - 475	TX Mixer (QSE)
C62	0.1 uF (SMT 1206) - (smt) black stripe	TX Mixer (QSE)
C63	0.1 uF (SMT 1206) - (smt) black stripe	TX Mixer (QSE)
U08	FST3253 mux/demux switch (SOIC-16) - FST3253	TX Mixer (QSE)

R30	49.9 ohm 1% (1/4W) - yel-wht-wht-gld-brn	TX Mixer (QSE)
R31	49.9 ohm 1% (1/4W) - yel-wht-wht-gld-brn	TX Mixer (QSE)
R32	2.21 k 1/4W 1% (1/4W) - r-r-br-br-br	TX Mixer (QSE)
R33	3.32 k 1/4W 1% (1/4W) - ora-ora-red-brn-brn	TX Mixer (QSE)
R29	4.99 k 1/4W 1% (1/4W) - y-w-w-br-br	TX Mixer (QSE)
R35	22.1 k 1/4W 1% (1/4W) - r-r-brn-r-br	TX Mixer (QSE)
Q02	2N3904 NPN Transistor (TO-92) - 2N3904	TX Mixer (QSE)
C22	160m: omit for this band (Omit -) 80, 40m: omit for this band (Omit -) 40, 30, 20m: omit for this band (Omit -) 30, 20, 17m: 220 pF 5% (Ceramic - 221) 15, 12, 10m: 220 pF 5% (Ceramic - 221)	Driver/PA
C66	160m: 0.1 uF (SMT 1206 - (smt) black stripe) 80, 40m: 0.1 uF (SMT 1206 - (smt) black stripe) 40, 30, 20m: 0.1 uF (SMT 1206 - (smt) black stripe) 30, 20, 17m: 0.1 uF (SMT 1206 - (smt) black stripe) 15, 12, 10m: 0.01 uF (SMT 1206 - (smt))	Driver/PA
C67	160m: 0.1 uF (SMT 1206 - (smt) black stripe) 80, 40m: 0.1 uF (SMT 1206 - (smt) black stripe) 40, 30, 20m: 0.1 uF (SMT 1206 - (smt) black stripe) 30, 20, 17m: 0.1 uF (SMT 1206 - (smt) black stripe) 15, 12, 10m: 0.01 uF (SMT 1206 - (smt))	Driver/PA
C68	160m: 0.1 uF (SMT 1206 - (smt) black stripe) 80, 40m: 0.1 uF (SMT 1206 - (smt) black stripe) 40, 30, 20m: 0.1 uF (SMT 1206 - (smt) black stripe) 30, 20, 17m: 0.1 uF (SMT 1206 - (smt) black stripe) 15, 12, 10m: 0.01 uF (SMT 1206 - (smt))	Driver/PA
R42	160m: omit for this band (Omit -) 80, 40m: omit for this band (Omit -) 40, 30, 20m: omit for this band (Omit -) 30, 20, 17m: 68.1 1/4W 1% (1/4W - blu-gry-brn-gld-brn) 15, 12, 10m: 68.1 1/4W 1% (1/4W - blu-gry-brn-gld-brn)	Driver/PA
T3	160m: 6T/3T bifilar #30 on BN-43-2402 (12") (Xfrmr -) 80, 40m: 6T/3T bifilar #30 on BN-43-2402 (12") (Xfrmr -) 40, 30, 20m: 6T/3T bifilar #30 on BN-61-2402 (12") (Xfrmr -) 30, 20, 17m: 6T/3T bifilar #30 on BN-61-2402 (12") (Xfrmr -) 15, 12, 10m: 5T/3T bifilar #30 on BN-61-2402 (12") (Xfrmr -)	Driver/PA
T3-core	160m: BN-43-2402 (no markings!) (Binocular core - none) 80, 40m: BN-43-2402 (no markings!) (Binocular core - none) 40, 30, 20m: BN-61-2402 (no Markings!)	Driver/PA

T4	(Binocular core - none) 30, 20, 17m: BN-61-2402 (no Markings!) (Binocular core - none) 15, 12, 10m: BN-61-2402 (no Markings!) (Binocular core - none)	Driver/PA
	160m: 4T bifilar/5T #30 0n BN-43-2402 (12") (Xfrmr -) 80, 40m: 4T bifilar/5T #30 0n BN-43-2402 (12") (Xfrmr -) 40, 30, 20m: 3T bifilar/5T #30 0n BN-61-2402 (12") (Xfrmr -) 30, 20, 17m: 3T bifilar/5T #30 0n BN-61-2402 (12") (Xfrmr -) 15, 12, 10m: 3T bifilar/5T #30 0n BN-61-2402 (12") (Xfrmr -)	
T4-core	160m: BN-43-2402 (no markings!) (Binocular core - none) 80, 40m: BN-43-2402 (no markings!) (Binocular core - none) 40, 30, 20m: BN-61-2402 (no Markings!) (Binocular core - none) 30, 20, 17m: BN-61-2402 (no Markings!) (Binocular core - none) 15, 12, 10m: BN-61-2402 (no Markings!) (Binocular core - none)	Driver/PA
hs_wshr	#4 nylon washer (HDW)	Driver/PA
C23	10uF/16 VDC (Electrolytic)	Driver/PA
D3	1N4003 (Axial) - 1N4003	Driver/PA
PA-sil	TO-220 heatsink Silpad (Misc)	Driver/PA
Q06-hs	heatsink for driver transistor (TO-18)	Driver/PA
PA-hs	TO-220 heatsink for flat transistors (TO-220)	Driver/PA
RFC1-core	BN-43-2402 (no markings!) (Binocular core) - none	Driver/PA
RFC1	4T #26 on BN-43-2402 (6") (Choke)	Driver/PA
R48	2.2 ohm 1/4W 5% (1/4W) - red-red-gld-gld	Driver/PA
R49	2.2 ohm 1/4W 5% (1/4W) - red-red-gld-gld	Driver/PA
R41	33.2 ohm 1% (1/4W) - ora-ora-red-gld-brn	Driver/PA
R43	56.2 1/4W 1% (1/4W) - grn-blu-red-gld-brn	Driver/PA
R38	221 1/4W 1% (1/4W) - red-red-brn-blk-brn	Driver/PA
R46	221 1/4W 1% (1/4W) - red-red-brn-blk-brn	Driver/PA
R47	221 1/4W 1% (1/4W) - red-red-brn-blk-brn	Driver/PA
R45	475 1/4W 1% (1/4W) - y-v-grn-bl-br	Driver/PA
R39	2.21 k 1/4W 1% (1/4W) - r-r-br-br-br	Driver/PA
R44	2.21 k 1/4W 1% (1/4W) - r-r-br-br-br	Driver/PA
R40	22.1 k 1/4W 1% (1/4W) - r-r-brn-r-br	Driver/PA
hdw-hs	#6 screw, hex nut, starwasher (HDW)	Driver/PA
Q06	2N2222 NPN transistor (TO-18)	Driver/PA
Q04	2N3904 NPN Transistor (TO-92) - 2N3904	Driver/PA
Q05	BS170 N-Channel Enhancement Mode FET (TO-92) - BS170	Driver/PA
Q07	BS170 N-Channel Enhancement Mode FET (TO-92) - BS170	Driver/PA
Q08	BS170 N-Channel Enhancement Mode FET (TO-92) - BS170	Driver/PA

C200	80, 40m: 390 pF 5% (Ceramic - 391) 40, 30, 20m: 220 pF 5% (Ceramic - 221) 30, 20, 17m: 100 pF 5% (Ceramic - 101)	External Connections
C201	80, 40m: 1000 pF 5% (Ceramic - 102) 40, 30, 20m: 470 pF 5% (Ceramic - 471) 30, 20, 17m: 330 pF 5% (Ceramic - 331)	External Connections
C202	80, 40m: 390 pF 5% (Ceramic - 391) 40, 30, 20m: 220 pF 5% (Ceramic - 221) 30, 20, 17m: 100 pF 5% (Ceramic - 101)	External Connections
L200	80, 40m: 2.5uH: 29T #26(17in) on T37-6 (yel) (Coil - yellow) 40, 30, 20m: 1.3uH: 18T #26(12in) on T37-2 (red) (coil - red) 30, 20, 17m: 0.9uH: 15T #26(10 in) on T37-2 (red) (Coil - red)	External Connections
L200-core	80, 40m: T37-6 toroid core (Toroid - yellow) 40, 30, 20m: T37-2 toroid core (Toroid - red) 30, 20, 17m: T37-2 toroid core (Toroid - red)	External Connections
L201	80, 40m: 2.5uH: 29T #26(17in) on T37-6 (yel) (Coil - yellow) 40, 30, 20m: 1.3uH: 18T #26(12in) on T37-2 (red) (coil - red) 30, 20, 17m: 0.9uH: 15T #26(10 in) on T37-2 (red) (Coil - red)	External Connections
L201-core	80, 40m: T37-6 toroid core (Toroid - yellow) 40, 30, 20m: T37-2 toroid core (Toroid - red) 30, 20, 17m: T37-2 toroid core (Toroid - red)	External Connections
hdw1-4	4 X #4-40 hdw (nut, bolt, washer, spacer) (HDW)	External Connections

Home Bill of Materials Power Supply USB Power Supply Local Oscillator Dividers RF I/O and Switching RX Mixer (QSD) RX Opamps and Output TX Opamps TX Mixer (QSE) Driver/PA External Connections Comments Acronyms Inventory Revisions as of 3/21/2011 Components By Stage WB5RVZ Main Website