



High Performance Software Defined Radio
Open Source Hardware and Software Project
Project Description: <http://openhpsdr.org>

ALEX (Alexiares)

*Installation and Operation
Instructions*



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Introduction

ALEXIARES (or ALEX for short) is a combination RF Preselector for use with Mercury or any other SDR, as well as a transmitter low pass filter bank for a transmitter such as Penelope, and optionally, with an associated RF power amplifier up to 100 watts peak.

As a receiver preselector, the purpose of ALEX is to reduce the level of out-of-band signals at the input of a receiver, and importantly, to suppress any signals at the sampling image or alias frequencies.

As a transmitter low pass filter, ALEX will suppress the harmonic energy typically generated by an RF power amplifier, as well as the images or aliases that appear at the sampling clock frequency (122.8 MHz) plus/minus the operating frequency. The transmit low pass filters will also be used for additional MERCURY receiver input band limiting.

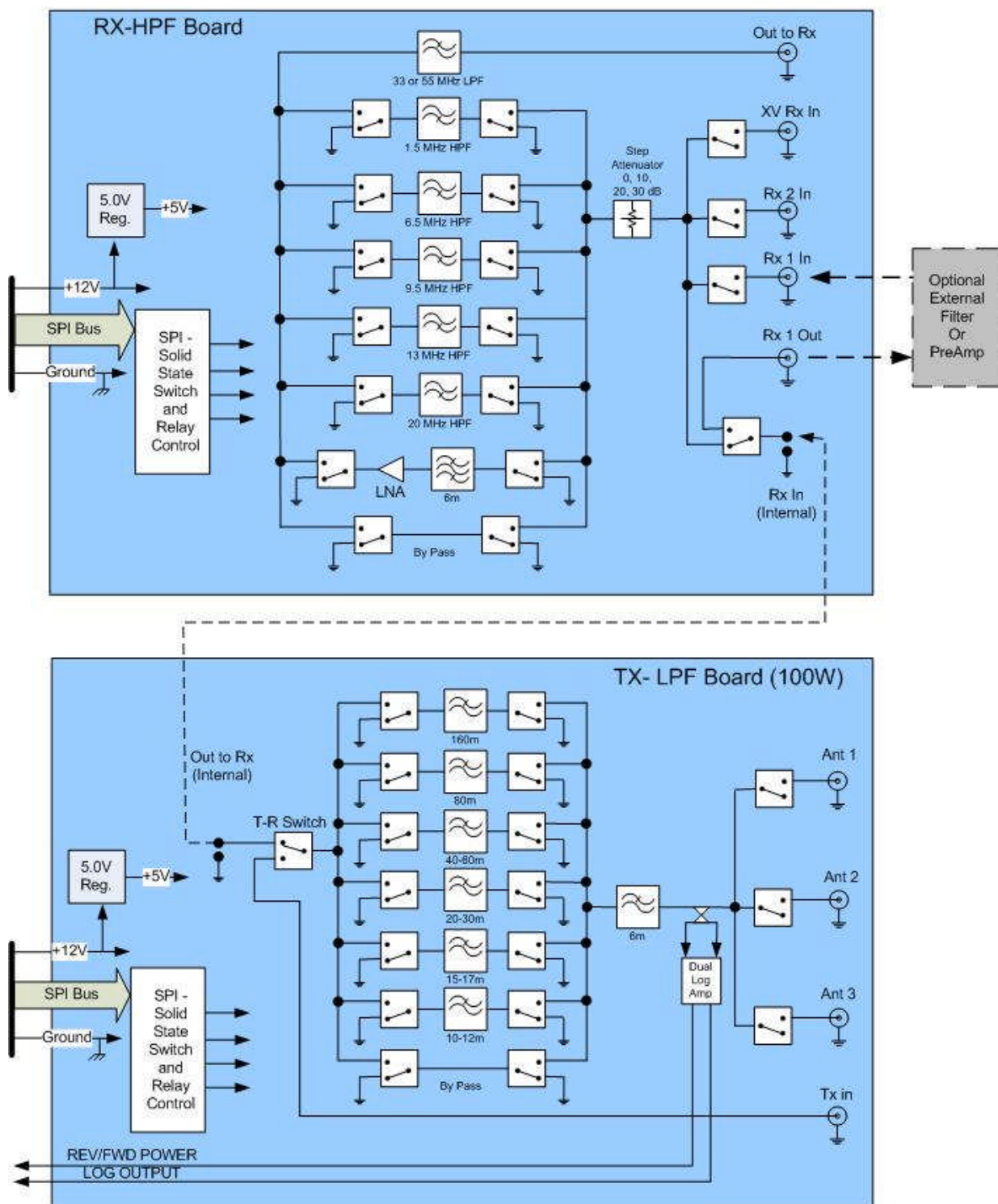
You will normally "pair" one of the low pass filters on the transmit board with one of the high pass filters on the receiver board to form a bandpass filter for receiving. There is an additional 33 or 55 MHz low pass filter on the receiver board, plus the 6 Meter transmit low pass filter that are in-line at all times to help suppress VHF images.

Why Alexiaries?

Alexiaries and his twin brother Anicetus - were the Greek Gods of Defense, in particular the defense of fortified towns and citadels.

Both were sons of Hercules (Herakles), born after the Hercules' ascension to Olympus and his marriage to the goddess Hebe, the Goddess of Youth. Alexiaries and Anicetus helped serve as the gatekeepers of Olympus, assisting their father, Hercules in this role which was commonly assigned to him.

Alexiares (ALEX) – Block Diagram



ALEX_Ver. 6.6 -- 1 December 2007 / KE9H

Description

ALEX consists of two Euroboard sized PC boards (10 cm by 16 cm). They are intended to be mounted in a commercial Euroboard extruded aluminum housing. The target commercial housing is a Hammond 1455N1601 extruded aluminum case (or equivalent.)

ALEX does not plug into the ATLAS bus, but is intended for separate mounting, and is controlled by an SPI bus. There are nine BNC connectors that will extend through to the outside of the filter housing cover plate, or the HPSDR “Pandora” housing.

The first PC board is the Receiver/HPF board. It has a 55 MHz 7th order Low Pass Filter that is always in line with the receiver.

There is a 6 meter low noise preamp with mild bandpass filtering; selectable 20 MHz, 13 MHz, 9.5 MHz, 6.5 MHz and 1.6 MHz high pass filters, plus a bypass function. It has five external BNC connectors, as shown in the block diagram.

The receiver board also contains a switchable front end attenuator, configurable for 0 dB, 10 dB, 20 dB or 30 dB loss.

The second PC board is the Transmitter/LPF board. It consists of seven relay switched low pass filters for transmitter harmonic suppression, that are also used in conjunction with the receiver high pass filters to provide a flexible variable bandwidth receiver input filter function. It has four external BNC connectors, as shown in the block diagram.

Each active board contains three LEDs, so that an indication of power and proper control and SPI bus operation can be seen.

ALEX is controlled by an SPI bus. This SPI bus should NOT be shared with other devices, in that it is intended that the data and clock lines should not be transitioning except when a command is being sent to one of the ALEX boards. In other words, if the clock or data lines are operated while receiving, noticeable noise will be introduced into the received signals. PowerSDR has been properly configured to not drive the clock or data lines, except when changing bands or attenuator states. There are two analog voltage outputs providing an indication of transmit forward and reverse power. There are no oscillators or continuously running clocks anywhere inside of ALEX.

The forward and reverse power sensors will put out from 0 to 3.3 Volts DC, corresponding to forwards and reverse power, respectively. The output from the transmit card will indicate 0.00 or 0.01 Volts with no transmit power. 3.00 Volts corresponds to 100 Watts.

The directional couplers provide power readings, and should be readable from about 100 mW to 125 Watts, according to the formula

$$P(\text{Watts}) = (V * V) / 0.09$$

where V is the DC Voltage output on the directional coupler output lines.

Specifications

On frequency insertion loss is variable according to frequency, but typically will not exceed 2.0 dB total for receive paths, and 0.5 dB for transmit paths.

Power handling capability - The transmit harmonic filter banks and associated relay switches are intended to handle up to 100 watts, peak power with a CW or SSB duty cycle. For continuous transmit operation, power levels should be reduced.

Contribution to Receiver IP3 performance – No significant degradation of native Mercury IP3 performance.

Total power consumption for ALEX can vary over a range of 90 to 180 mA., all from the +12 volt supply. 90 mA is with 12.0 Volt supply, minimum number of relays active. 180 mA is with 13.8 Volt supply, 50 MHz transmit, 50 MHz preamp. on, all LEDs on, and both receive attenuators active.

External Connections -

Receiver Board - five ea. BNC female connectors.

- * Receiver Out (to MERCURY input)
- * Transverter Input (receive only)
- * Receiver AUX input 1 (receive only)
- * Receiver AUX Input 2 (receive only)
- * RX AUX Output (for looping in an external filter or preamp)

Transmit Board - four ea. BNC female connectors to extend through the case.

- * Antenna 1 (transmit-receive)
- * Antenna 2 (transmit-receive)
- * Antenna 3 (transmit-receive)
- * Transmitter In (From PENELOPE or associated RF PA)

Internal RF connections -

One SMB to SMB cable for connection of the Transmitter and Receiver Card.

Control - 10 pin polarized ribbon cable connector

+12V, GND, SPI Data, SPI Clk, SPI LoadRX, SPI LoadTX, Forward PWR,
Reverse PWR.

All receiver inputs that could be connected to an antenna have voltage transient protection.

Installation

ALEX is designed to be operated inside a metal enclosure, such as the Hammond enclosure available from TAPR. This enclosure can be used as a standalone sub system, or installed in the predetermined position inside the “Pandora” HPSDR housing.

If mounted inside the “Pandora” case, set aside the supplied front panel, and use the front panel screws to attach the Hammond housing inside the Pandora case, with the BNC connectors protruding through the provided holes. A special rear panel with a mounting “foot” provides a rear brace for ALEX. The foot of the rear panel is designed to match the 2 PEM nuts in the bottom of Pandora. Screws matching the PEM nuts are supplied.

With the TX board, TAPR supplies two cables:

Coax cable, 6" SMB to SMB, RG-174 cable, for connecting the two boards internal to the Hammond case, and

SWR cable, 6" Molex KK 4-pin (Mercury end) to 8-pin (Penelope/Pennylane end), 3 discrete wires

With the RX board, TAPR supplies one cable:

10-pin ribbon cable for Mercury-to-AlexTX-to-Alex RX, 3-connector daisy-chained serial control cable.



The Control bus and power are provided by a 10 wire ribbon cable that connects on the ALEX end to both 10 pin connectors, and on the other end, to the ten pin connector on the front of Mercury.

The DC voltages from the RF Power Directional Couplers on the ALEX transmit board are provided both inside the ten wire ribbon cable, as well as on the separate four pin

connector. These are also connected on the Mercury card to the four pin Molex connector between the coax connector and the ten pin ribbon cable connector. The power sense jumper cable supplied by TAPR can be connected from this connector on Mercury to the 8 Pin rectangular connector on Penelope, between the DB-25 and the mike connector. The 8 pin end should be connected with the black wire closest to the DB-25 connector, and the Green and Yellow away from the edge of the board.

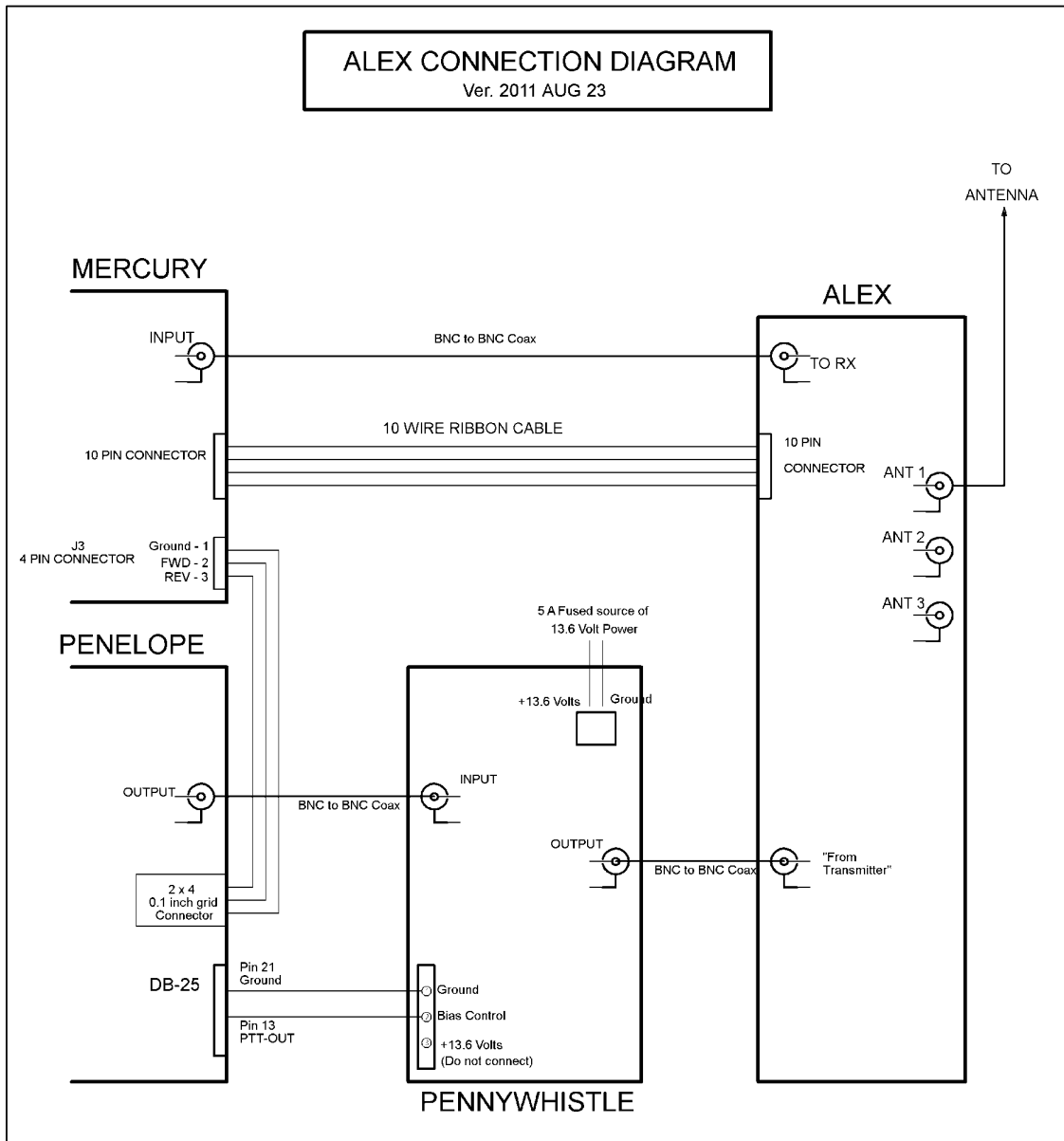


As an alternative to the RF Power cable supplied with the transmit board, the forward and reverse power voltage sense wires are also available on Pin 20 (forward) and Pin 7 (reverse) of the DB-25 connector.

BNC jumper cables must be used to connect ALEX to its respective Transmitter Output and Receiver Input functions. One BNC jumper should go from the connector labeled “To RX” on ALEX to the receiver input on Mercury.

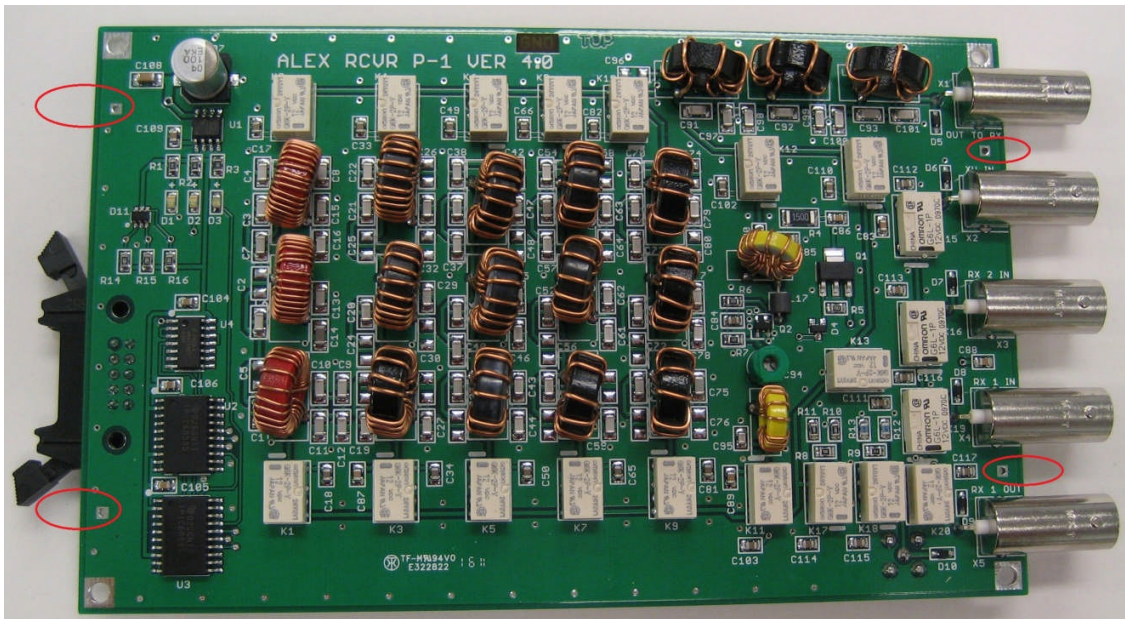
Another BNC cable should connect the ALEX connector labeled “From TX” to the appropriate transmitter output. This could be the output connector on Penelope for 0.5 Watt QRP operation, or the output connector on PennyWhistle for 16 to 20 Watt operation, or an amplifier of up to 100 Watts peak output with appropriate gain to match the Penelope output.

ALEX provides for the connection of up to three different antennas, with selection provided inside of PowerSDR. Alternatively, the unit can work with separate receive antennas, connected to “RX 1 IN” or “RX 2 IN” or “XV RX IN.” The associated transmitter function should remain on “ANT 1,” “ANT 2” or “ANT 3.”

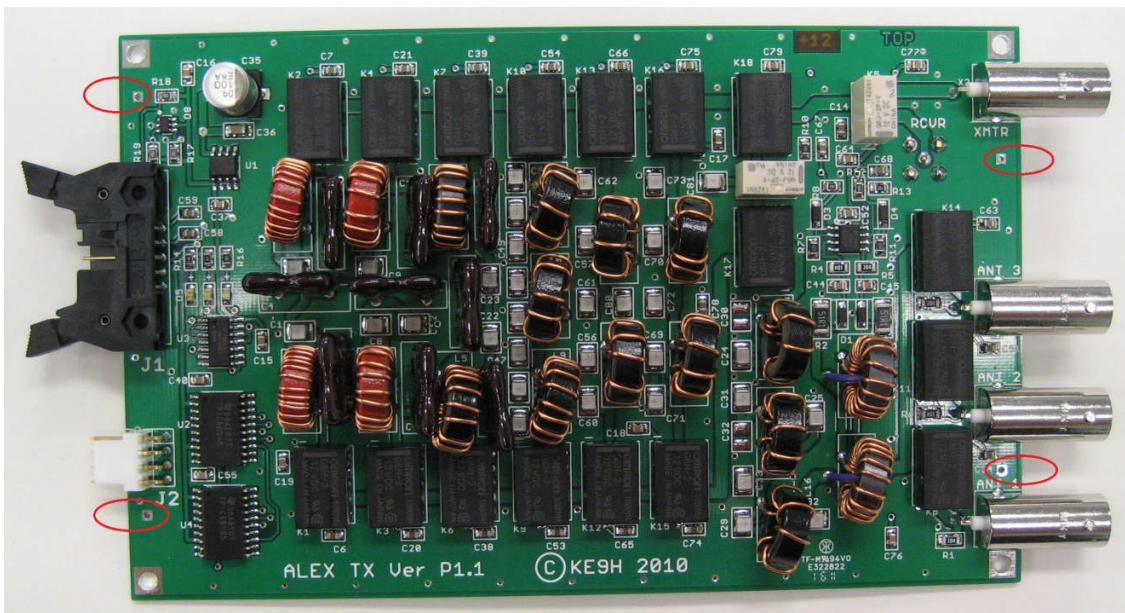


For maximum performance, particularly with respect to the rejection floor of the filters at frequencies above 30 MHz, the ground planes of the Alex transmit and receive boards should be connected directly to the Hammond case or the mounting screws for the case. Holes in the PC boards have provided this purpose. Rejection at VHF frequencies, such as in the FM band can be maximized by soldering a ground wire from one or more of the solder holes shown below to one of the nearby mounting screws, or other convenient grounding location. In this way, the grounds for the PC boards are connected directly to the case ground, and ground currents on the coax cable shields are reduced.

ALEX Receiver Board



ALEX Transmitter Board



Optional holes for ground wires to housing ground shown inside red ovals.

Adjustment

There is only a single adjustment, the tuning capacitor for the 6 Meter bandpass filter. The 6 Meter bandpass filter has some selectivity, such that the filter is one dB below peak sensitivity at +/- 1 MHz from center, and 3 dB below peak at +/- 2 MHz from center.

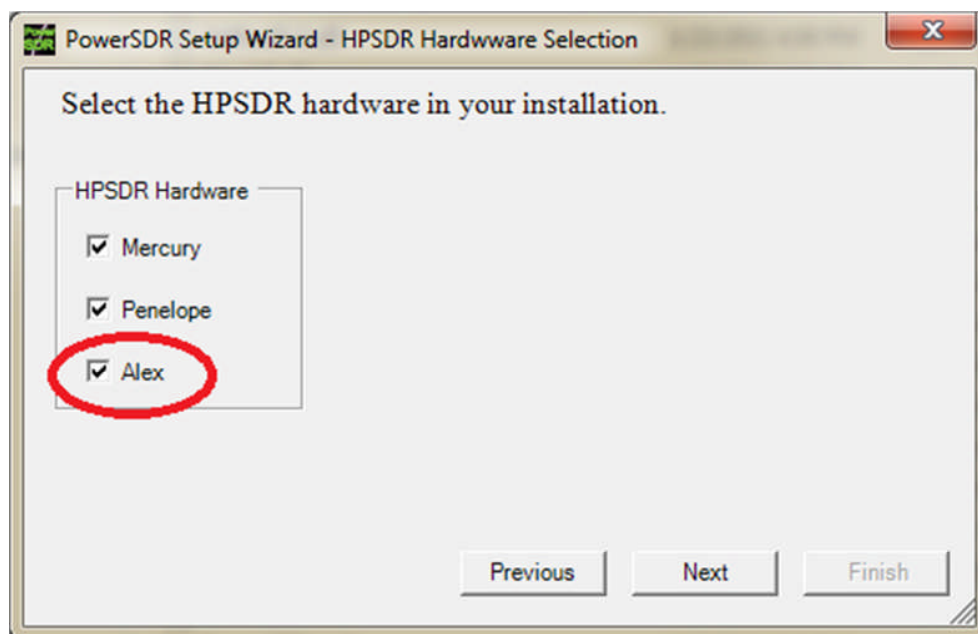
For weak signal work on 6 Meters, it would be recommended to peak the capacitor on a signal around 50.5 MHz, or centered on your sub-band of interest. For more general coverage operation on 6 Meters, the filter might be centered on 51.0 MHz.

The capacitor has been factory adjusted to center the preamp filter at 51.0 MHz.

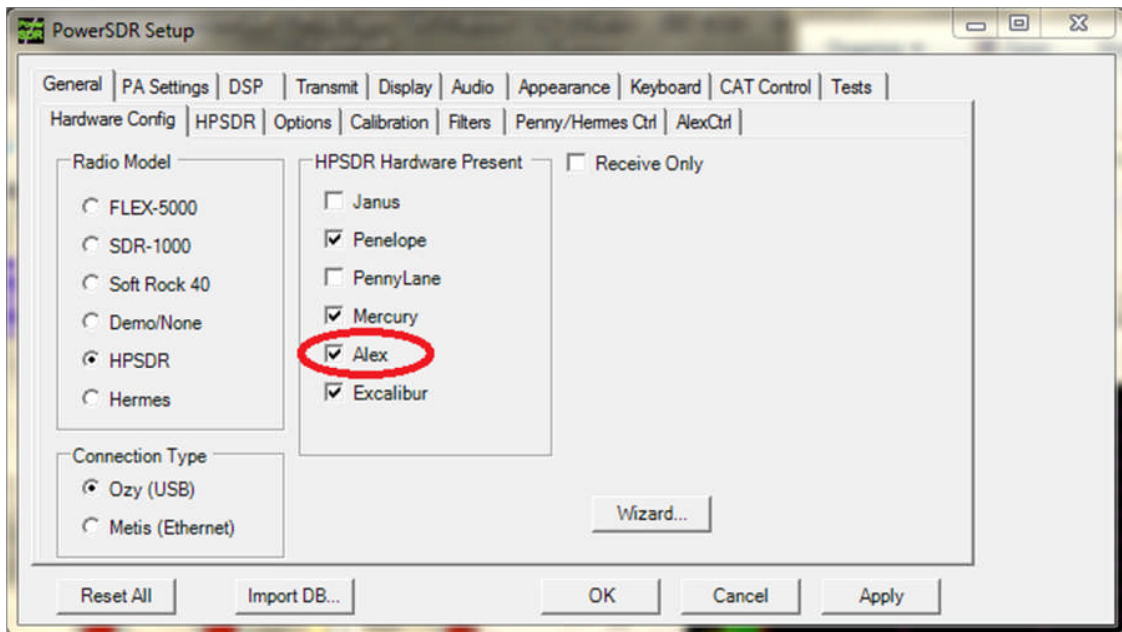
PowerSDR Settings

All screen snapshots that follow are from PowerSDR Version 1.10.4 running under Windows 7. Under other versions or operating systems, the appearance of the windows may vary.

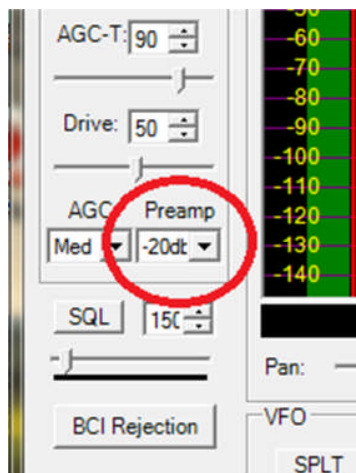
If you are configuring a version of PowerSDR for the first time, then at first startup when you enter the PowerSDR Setup Wizard, check ALEX as part of your startup configuration.



If you already have a configured version of PowerSDR, and are just adding ALEX at this time, go to PowerSDR_Setup\General\Hardware_Config and check Alex as being present. If you used the Setup Wizard shown above, then the ALEX check box should already be checked.



The Attenuator controls will now be integrated into the PowerSDR front panel controls for the Preamp. The menu will now allow you to select Attenuator settings of 0, 10, 20 and 30 dB in the Preamp window, in addition to turning the Mercury PreAmp On and Off.

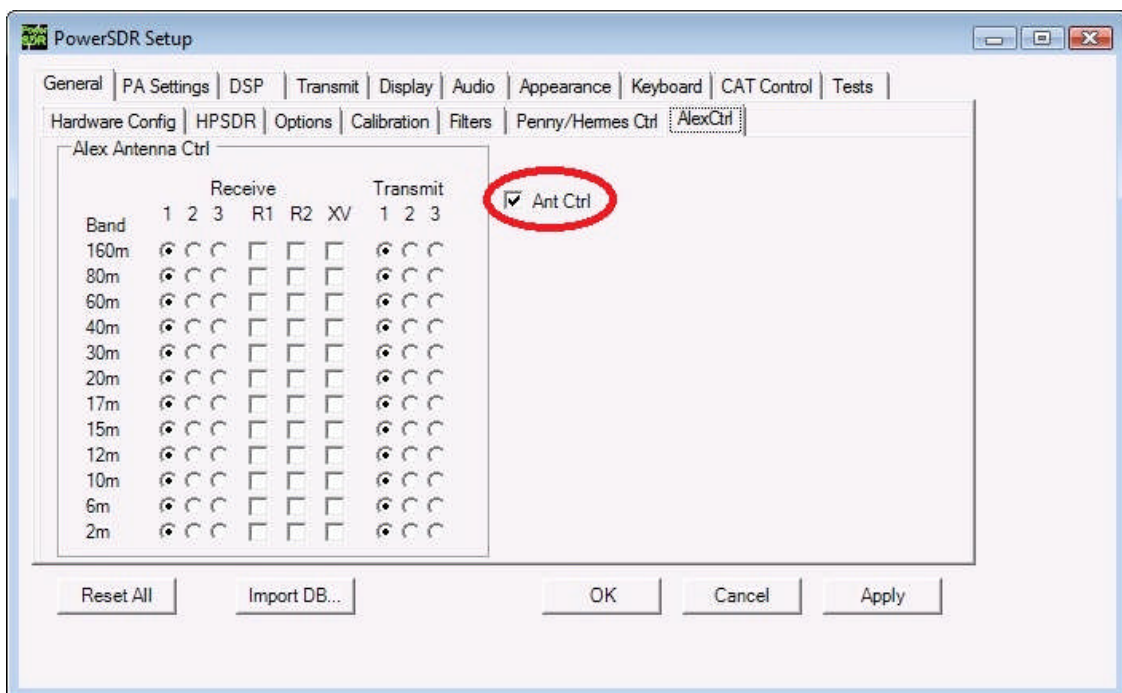


To control the Antenna and Receiver selection on ALEX, go to

PowerSDR Setup\General\AlexCtrl

The defaults are set to Transmit and Receive on Antenna 1.

If you wish to select a different antenna connector, automatically switch antennas by band, or run split transmit and receive antennas, check the “Ant Ctrl” box, which will enable the form for custom configuration.



Appendix Information

Appendix "A" contains the schematic and Board Top View, showing all part locations. This Board Top View should be used for part locations. Some of the photographs used for illustration are from earlier versions of the board, and the schematic reference number for the parts may have changed. In case of conflict, the "Board Top View" in Appendix "A" should be considered correct, and will correspond to the silkscreen printing on the PC board.

Appendix "B" contains the Board Top View, showing all part locations.

Appendix "C" contains the Schematics and Bill of Materials for the assemblies as supplied by TAPR.

Appendix "A"

ALEX Control Documentation

ALEX Control Description (P1) (Ver.4.0) GGH Ver. - 08/05/2008

Control Documentation

The ALEX-TX and ALEX-RX SPI control lines are compatible with either a 3 volt CMOS, or 5 volt TTL, or 5 volt CMOS logic level control inputs.

They also include 10K pull-up resistors to +5 Volts, so they can also be driven with open collector inputs, provided that the open collector can tolerate +5 volts isolated by a 10K resistor.

The serial data and clock lines for the Transmit and Receive Boards are common.

There are separate TX and RX board "Load Strobe" lines for ALEX. The data is sent to both boards in parallel, but is only loaded into the intended board by use of the appropriate "Load Strobe." Unless otherwise noted, control functions are positive logic, that is, they are active "High = 1 = ON"

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ALEX TRANSMIT BOARD

The TX Board is controlled by a 16 bit word sent over the SPI bus. Bit 00 is the first bit sent, Bit 15 is the last bit sent. It is up to the programmer to understand the sent bit order (that is, most significant bit first or least significant bit first) of his SPI controller and deal with the control word/bytes/bits accordingly.

There are not necessarily standard conventions across multiple suppliers of SPI bus controller hardware or software implementations of transmitted bit and byte order.

(The Relay driver ICs map most significant bit as first received.)

Two LEDs, one controlled by each relay driver IC have been provided as a visual debug aid, as well as a way to indicate to the end user that the ALEX is under active control.

Bit 15 -	N.C.	U2 - D0	All are active "High"
Bit 14 -	N.C.	U2 - D1	
Bit 13 -	N.C.	U2 - D2	
Bit 12 -	YELLOW LED	U2 - D3	

Bit 11 -	30/20 Meters	U2 - D4	
Bit 10 -	60/40 Meters	U2 - D5	
Bit 09 -	80 Meters	U2 - D6	
Bit 08 -	160 Meters	U2 - D7	
Bit 07 -	ANT #1	U4 - D0	
Bit 06 -	ANT #2	U4 - D1	
Bit 05 -	ANT #3	U4 - D2	
Bit 04 -	T/R Relay	U4 - D3	Transmit is high, Rec Low
Bit 03 -	RED LED	U4 - D4	
Bit 02 -	6 Mtrs(Bypass)	U4 - D5	
Bit 01 -	12/10 Meters	U4 - D6	
Bit 00 -	17/15 Meters	U4 - D7	

Suggested uses for the ALEX-TX RED and YELLOW LEDs.

The GREEN LED is on, whenever there is +5 volts present on the board. Since the +5 is derived from +12 on board, it implies that the board is fully powered up.

Both the RED and YELLOW LEDs are controlled by their own dedicated bits on the SPI bus.

I suggest that the YELLOW LED be lighted (bit 12 = high) on all SPI packets sent, so that a YELLOW LED means that the board is seeing, or at least has seen, valid SPI packets.

I suggest the RED LED be lighted whenever the TRANSMIT-RECEIVE antenna relay is in the active TRANSMIT mode. That is, the RED LED (bit 3) is active whenever bit 4 is active.

ALEX RECEIVE BOARD

The RX Board is controlled by a 16 bit word sent over the SPI bus. Bit 00 is the first bit sent, Bit 15 is the last bit sent. It is up to the programmer to understand the sent bit order (that is, most significant bit first or least significant bit first) of his SPI controller and deal with the control word/bytes/bits accordingly.

There are not necessarily standard conventions across multiple suppliers of SPI bus controller hardware or software implementations of transmitted bit and byte order.

Two LEDs, one controlled by each SPI decoder IC have been provided as a visual debug aid, as well as a way to indicate to the end user that the ALEX is under active control.

Bit	Function	I.C. Output	
-----	-----	-----	
Bit 15 -	YELLOW LED	U2 - D0	All are active "High"
Bit 14 -	13 MHz HPF	U2 - D1	
Bit 13 -	20 MHz HPF	U2 - D2	
Bit 12 -	6M Preamp	U2 - D3	
Bit 11 -	9.5 MHz HPF	U2 - D4	
Bit 10 -	6.5 MHz HPF	U2 - D5	
Bit 09 -	1.5 MHz HPF	U2 - D6	

Bit 08 -	N.C.	U2 - D7	
Bit 07 -	XVTR RX In (Note 1)	U3 - D0	
Bit 06 -	RX 2 In (Note 1)	U3 - D1	
Bit 05 -	RX 1 In (Note 1)	U3 - D2	
Bit 04 -	RX 1 Out (Note 1)	U3 - D3	Low = Default Receive Path
Bit 03 -	Bypass	U3 - D4	
Bit 02 -	20 dB Atten.	U3 - D5	
Bit 01 -	10 dB Atten.	U3 - D6	
Bit 00 -	RED LED	U3 - D7	

Note 1.) The RX 1 OUT switch also controls the default input path for the normal receive function (that is, receiving from the same antenna port as you are transmitting on.) In the event that it is desired to receive through XV IN, RX 2 IN, or RX 1 IN, then RX 1 OUT should be turned ON, so as to disconnect the normal (default) receive path from the transmit antenna port. If an external filter is to be placed in the normal receive path, then both RX 1 OUT and RX 1 IN should be turned on, and the filter connected between the RX 1 OUT and RX 1 IN BNC connectors.

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Suggested uses for the ALEX-RX RED and YELLOW LEDs.

The GREEN LED is on, whenever there is +5 volts present on the board. Since the +5 is derived from +12 on board, it implies that the board is fully powered up.

Both the RED and YELLOW LEDs are controlled by their own dedicated bits on the SPI bus from different ICs. The programmer is free to use them for any purpose.

I suggest that the YELLOW LED be lighted (bit 15 = high) on all SPI packets sent, so that a YELLOW LED means that the board is seeing, or at least has recently seen, valid SPI packets.

I suggest that the RED LED be lighted whenever the 6M Preamp is turned on. That is, Bit 00 is active whenever Bit 12 is active.

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SPI Bus operation

There are separate TX and RX board "Load Strobe" lines for ALEX. The data is sent to both boards in parallel, but is only loaded into the intended board by use of the appropriate "Load Strobe." Unless otherwise noted, control functions are active "High."

The first bit of data is set up on the data line. High = 1, Low = 0.

The clock line is raised then lowered.

The second bit of data is set up on the data line.

The clock line is raised then lowered.

Repeat until all 16 bits have been entered.

Raise then lower the "TX Load Strobe" or "RX Load Strobe", to make the entire control word active on the intended board.

Data bits are loaded on the rising edge of the SPI clock. The entire control word becomes active on the rising edge of the "load strobe."

The ALEX SPI bus is totally asynchronous, and no regular timing is assumed. I normally run at a bit transfer rate of 1.25 mega-bits per second.

The parts specs would indicate a transfer rate in excess of 5 mega-bits per second, but I have not found this to be the case with controllers and decoders on separate boards, and signals transferred through multi-wire cables with uncontrolled impedance and shielding.

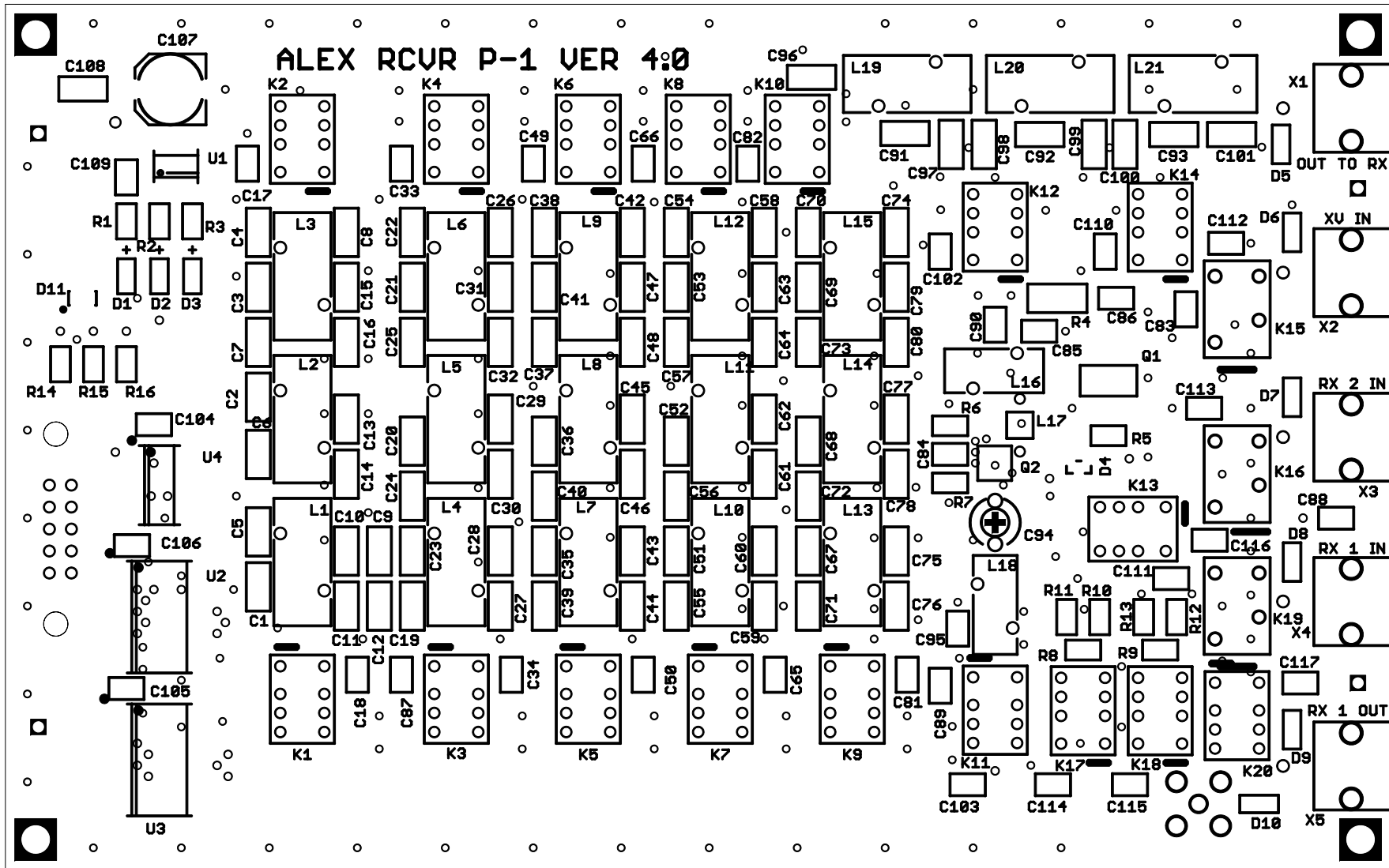
The data clock is not a continuously running clock. It should only transition when entering data into ALEX. Therefore, the ALEX SPI control bus should be dedicated to ALEX, and not have its data and clock lines in parallel with other functions, to prevent injecting noise onto the ALEX boards except when specifically changing data inside ALEX.

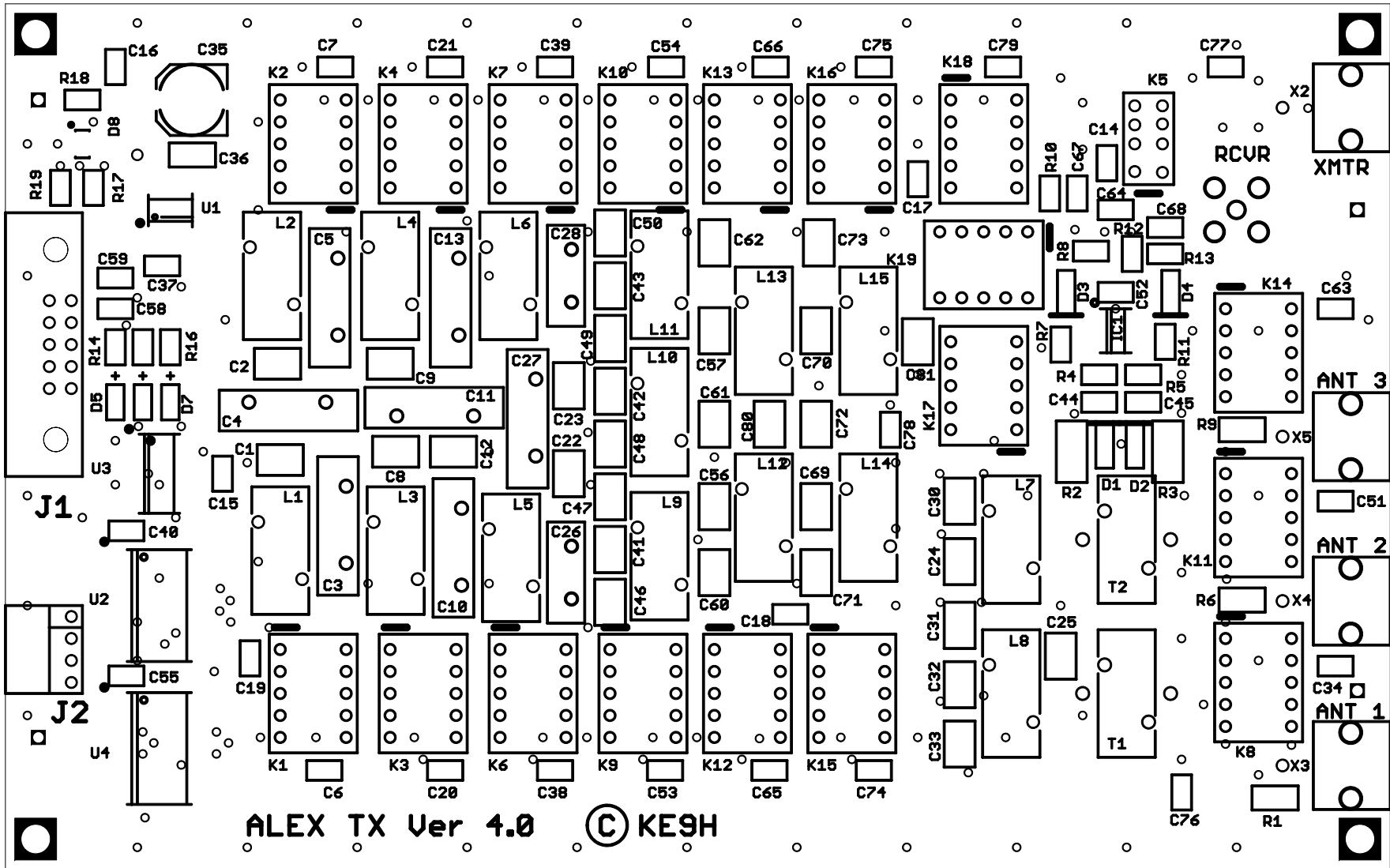
If you need specific set-up and timing specifications, refer to the spec sheets for TPIC6B595 (Texas Instruments) relay driver. But if you allow at least 0.4 us set up times and transfer data at or below 1.25 megabits per second, everything will be quite robust.

ALEX Control Connector Pin Outs - for Alpha-3 Version
-- Polarized 10 pin, 3M # 3793-5002RB (Mouser 517-N3793-5002RB)
0.1 inch on centers, 0.025 square pins, two rows of 5 pins each
Pin #1 as defined by manufacturer drawing, then in ribbon wire order

Pin	Name	Description/Function
1	Ground	Ground
2	+12V	+12 Volt Power
3	SPI SDO	SPI Serial DATA
4	SPI SCK	SPI CLOCK
5	SPI RX Load Strobe	SPI RX Board Load Strobe
6	SPI TX Load Strobe	SPI TX Board Load Strobe
7	Analog Fwd Pwr	0-3 Volt Analog Output
8	Ground	Ground
9	Analog Rev Pwr	0-3 Volt Analog Output
10	Ground	Ground

Appendix "B"
Board and Component Views





Appendix "C"

Schematics and Bill of Materials

For

Boards as Supplied by TAPR

ALEX Production Release Version P1.41

Date: March 27, 2011

by: Graham --- KE9H

Special Manufacturing Notes:

Installation of the relays is position critical. Observe the position mark on both the relay housing and the board silkscreen for proper orientation. In particular, the transmit board relays can be installed in two directions, one of which won't work, and they are extremely hard to unsolder without an oven.

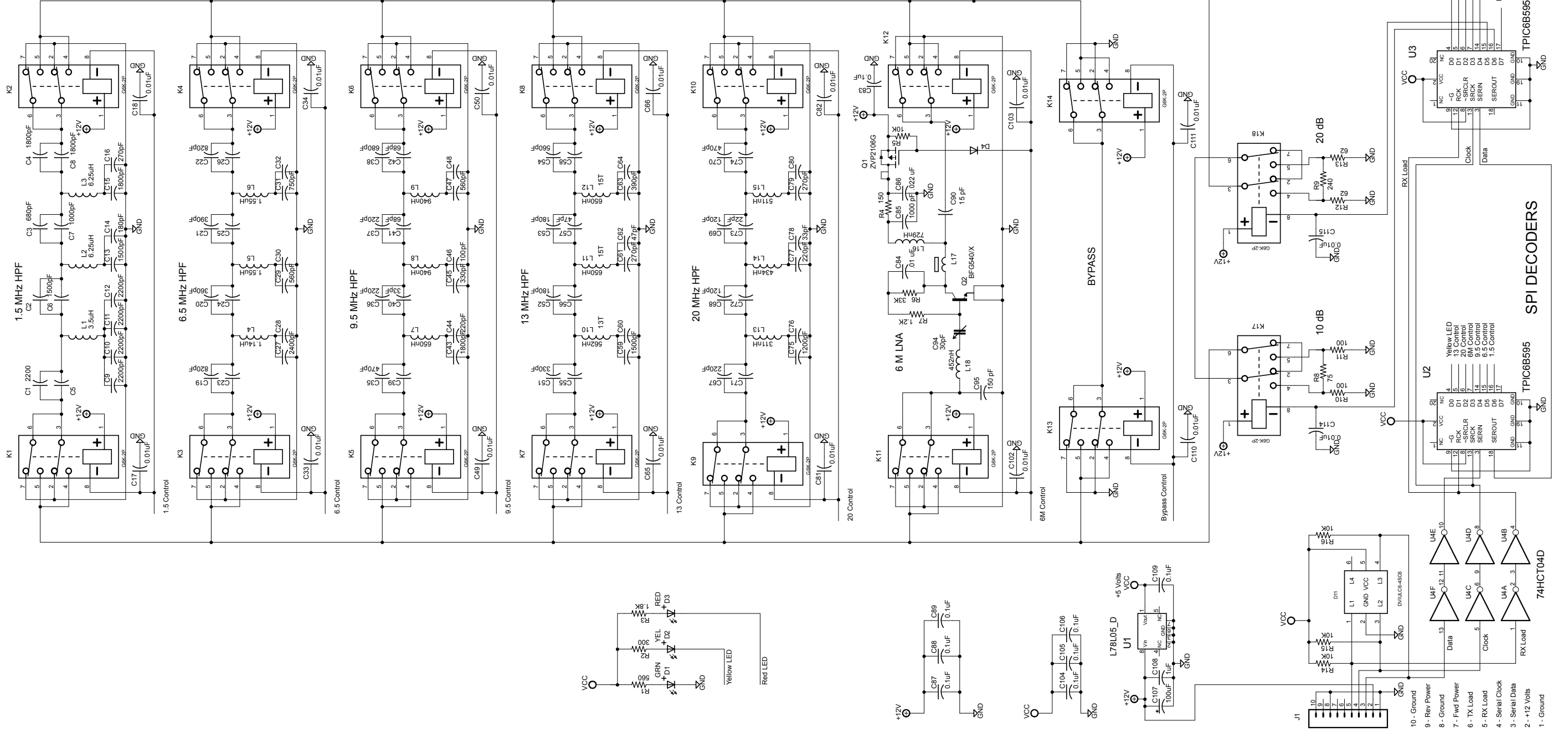
The LEDs are polarity sensitive, and the RED LED has opposite mechanical polarity to the GREEN and YELLOW LEDs. For Green and Yellow LEDs, the two green dots which are on either side of the LED die are on the negative end. For Red LEDs, the two green dots, which are either side of the die, are on the positive end. **Builder Beware!**

The right angle SMB connectors are installed on the **BACK SIDE** of the PC Boards.

The Receive board ribbon cable is to be installed on the **BACK SIDE** of the PC board. The Transmit board ribbon cable is to be installed on the **FRONT SIDE** of the PC board. The Transmit board auxiliary 4 pin connector goes on the top side of the board. **OBSERVE THE SILKSCREEN FOR POSITIONS OF THESE CONNECTORS.**

The electrical values for the inductors are measured... at 4 MHz for RED cores, at 10 MHz for BLACK cores, and 20 MHz for YELLOW cores. Expected tolerance is +/- 5 percent for the BLACK cores and +/- 10 percent for the RED and YELLOW cores.

The PCBs have a different stack-up order for the inner layers. Refer to the "READ-ME" files included in the PCB ".zip" packages. There are "cut-out" windows which allow viewing test on the inner layers after PCB fabrication. If the text is not viewable through the windows, or is backwards, then the boards were not built correctly. The bottom side solder paste stencil Gerbers are empty. Throw them away if present. There are no surface mount parts on the bottom of either of the boards.



ALEX RECEIVE
VERSION P-1.0.4
2011 MAR 27

Copyright 2008-2011, Graham Haddock, KE9H
 and Phil Harman, VK6APH.

Released under TAPR Non-commercial
 Hardware License
<http://www.tapr.org/NCL>

- 10 - Ground
- 9 - Rev Power
- 8 - Ground
- 7 - Fwd Power
- 6 - TX Load
- 5 - RX Load
- 4 - Serial Clock
- 3 - Serial Data
- 2 - +12 Volts
- 1 - Ground

NP = Do Not Populate

Part	Value	Description	Footprint/ Package	Library	Manu	Part No.	Vendor	Part No.	Notes
C001	2200pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C222J5GACTU	Mouser	80-C1206C222J5G	Must be NPO/C0G
C002	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C003	680pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C681J5GACTU	Mouser	80-C1206C681J5G	Must be NPO/C0G
C004	1800pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C182J5GACTU	Mouser	80-C1206C182J5G	Must be NPO/C0G
C005	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C006	1500pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C152J5GACTU	Mouser	80-C1206C152J5G	Must be NPO/C0G
C007	1000pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C102J5GACTU	Mouser	80-C1206C102J5G	Must be NPO/C0G
C008	1800pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C182J5GACTU	Mouser	80-C1206C182J5G	Must be NPO/C0G
C009	2200pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C222J5GACTU	Mouser	80-C1206C222J5G	Must be NPO/C0G
C010	2200pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C222J5GACTU	Mouser	80-C1206C222J5G	Must be NPO/C0G
C011	2200pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C222J5GACTU	Mouser	80-C1206C222J5G	Must be NPO/C0G
C012	2200pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C182J5GACTU	Mouser	80-C1206C182J5G	Must be NPO/C0G
C013	1500pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C152J5GACTU	Mouser	80-C1206C152J5G	Must be NPO/C0G
C014	180pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C102J5GACTU	Mouser	80-C1206C102J5G	Must be NPO/C0G
C015	1800pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C182J5GACTU	Mouser	80-C1206C182J5G	Must be NPO/C0G
C016	270pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C271J5GACTU	Mouser	80-C1206C271J5G	Must be NPO/C0G
C017	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C018	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C019	820pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C821J5GACTU	Mouser	80-C1206C821J5G	Must be NPO/C0G
C020	360pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C361J5GACTU	Mouser	80-C1206C361J5G	Must be NPO/C0G
C021	390pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C391J5GACTU	Mouser	80-C1206C391J5G	Must be NPO/C0G
C022	820pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C821J5GACTU	Mouser	80-C1206C821J5G	Must be NPO/C0G
C023	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C024	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C025	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C026	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C027	2400pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C242J5GACTU	Mouser	80-C1206C242J5G	Must be NPO/C0G
C028	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C029	560pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C561J5GACTU	Mouser	80-C1206C561J5G	Must be NPO/C0G
C030	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C031	750pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C751J5GACTU	Mouser	80-C1206C751J5G	Must be NPO/C0G
C032	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C033	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C034	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C035	470pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C471J5GACTU	Mouser	80-C1206C471J5G	Must be NPO/C0G
C036	220pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C221J5GACTU	Mouser	80-C1206C221J5G	Must be NPO/C0G
C037	220pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C221J5GACTU	Mouser	80-C1206C221J5G	Must be NPO/C0G
C038	680pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C681J5GACTU	Mouser	80-C1206C681J5G	Must be NPO/C0G
C039	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C040	33pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C330J5GACTU	Mouser	80-C1206C330J5G	Must be NPO/C0G
C041	68pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C680J5GACTU	Mouser	80-C1206C680J5G	Must be NPO/C0G
C042	68pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C680J5GACTU	Mouser	80-C1206C680J5G	Must be NPO/C0G
C043	1800pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C182J5GACTU	Mouser	80-C1206C182J5G	Must be NPO/C0G
C044	220pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C221J5GACTU	Mouser	80-C1206C221J5G	Must be NPO/C0G
C045	330pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C331J5GACTU	Mouser	80-C1206C331J5G	Must be NPO/C0G
C046	100pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C101J5GACTU	Mouser	80-C1206C101J5G	Must be NPO/C0G
C047	560pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C561J5GACTU	Mouser	80-C1206C561J5G	Must be NPO/C0G

C048	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C049	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C050	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C051	330pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C331J5GACTU	Mouser	80-C1206C331J5G	Must be NPO/C0G
C052	180pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C181J5GACTU	Mouser	80-C1206C181J5G	Must be NPO/C0G
C053	180pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C181J5GACTU	Mouser	80-C1206C181J5G	Must be NPO/C0G
C054	560pf	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C561J5GACTU	Mouser	80-C1206C561J5G	Must be NPO/C0G
C055	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C056	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C057	47pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C470J5GACTU	Mouser	80-C1206C470J5G	Must be NPO/C0G
C058	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C059	1500pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C152J5GACTU	Mouser	80-C1206C152J5G	Must be NPO/C0G
C060	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C061	270pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C271J5GACTU	Mouser	80-C1206C271J5G	Must be NPO/C0G
C062	47pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C470J5GACTU	Mouser	80-C1206C470J5G	Must be NPO/C0G
C063	390pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C391J5GACTU	Mouser	80-C1206C391J5G	Must be NPO/C0G
C064	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C065	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C066	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C067	220pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C221J5GACTU	Mouser	80-C1206C221J5G	Must be NPO/C0G
C068	120pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C121J5GACTU	Mouser	80-C1206C121J5G	Must be NPO/C0G
C069	120pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C121J5GACTU	Mouser	80-C1206C121J5G	Must be NPO/C0G
C070	470pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C471J5GACTU	Mouser	80-C1206C471J5G	Must be NPO/C0G
C071	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C072	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C073	22pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C220J5GACTU	Mouser	80-C1206C220J5G	Must be NPO/C0G
C074	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C075	1200pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C122J5GACTU	Mouser	80-C1206C122J5G	Must be NPO/C0G
C076	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C077	220pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C221J5GACTU	Mouser	80-C1206C221J5G	Must be NPO/C0G
C078	33pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C330J5GACTU	Mouser	80-C1206C330J5G	Must be NPO/C0G
C079	270pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C271J5GACTU	Mouser	80-C1206C271J5G	Must be NPO/C0G
C080	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C081	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C082	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C083	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C084	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C085	1000pF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C102J5GACTU	Mouser	80-C0805C102J5G	Must be NPO/C0G
C086	0.022uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C223K5RACTU	Mouser	80-C0805C223K5R	50volts X7R
C087	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C088	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C089	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C090	15pF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C150J5GACTU	Mouser	80-C0805C150J5G	Must be NPO/C0G
C091	4.7pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C479K5GACTU	Mouser	80-C1206C479K5G	Must be NPO/C0G
C092	22pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C220J5GACTU	Mouser	80-C1206C220J5G	Must be NPO/C0G
C093	15pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C0805C150J5GACTU	Mouser	80-C0805C150J5G	Must be NPO/C0G
C094	6.5-30pF	Trimmer Cap	TRIM_GKG_0G_RCL	Sprague	GKG30015		Mouser	659-GKG30015	
C095	150 pF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C151J5GACTU	Mouser	80-C0805C151J5G	Must be NPO/C0G
C096	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C097	91pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C910J5GACTU	Mouser	80-C1206C910J5G	Must be NPO/C0G
C098	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C099	91pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C910J5GACTU	Mouser	80-C1206C910J5G	Must be NPO/C0G
C100	NP	-----	C1206	0G_RCL	----	-----	----	-----	Position Not Used
C101	39pF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C390J5GACTU	Mouser	80-C1206C390J5G	Must be NPO/C0G

C102	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C103	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C104	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C105	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C106	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C107	100uF	CPOL-USF	ANASONIC_	0G_RCL	United CC	EMKA250ADA101MHA0G	Mouser	661-MKA25VC101M	Electrolytic
C108	1uF	Chip Cap C1206	C1206	0G_RCL	Kemet	C1206C105K3RACTU	Mouser	80-C1206C105K3R	X7R Dielectric
C109	0.1uF	Chip Cap C0805	C0805	0G_RCL	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	25volts X7R
C110	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C111	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C112	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C113	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C114	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C115	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C116	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C117	0.01uF	Chip Cap C0805	C0805	0G_RCL	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating

D01	Green	GRN LED	LED0805	0G_LED_TVS	Lite-On	LTST-C170GKT	Mouser	859-LTST-C170GKT	See Special Assembly Note
D02	Yellow	YEL LED	LED0805	0G_LED_TVS	Lite-On	LTST-C170YKT	Mouser	859-LTST-C170YKT	See Special Assembly Note
D03	Red	RED LED	LED0805	0G_LED_TVS	Lite-On	LTST-C170CKT	Mouser	859-LTST-C170CKT	See Special Assembly Note
D04	Diode	1N4148A	SOT23	0G_Regulators	Fairchild	MMBD4148	Mouser	512-MMBD4148	
D05	GBLC03C	3.3 Volt TVS	SOD323	0G_LED_TVS	ProTek	GBLC03C	ProTek	GBLC03C	Transient Voltage Supsressor
D06	GBLC03C	3.3 Volt TVS	SOD323	0G_LED_TVS	ProTek	GBLC03C	ProTek	GBLC03C	Transient Voltage Supsressor
D07	GBLC03C	3.3 Volt TVS	SOD323	0G_LED_TVS	ProTek	GBLC03C	ProTek	GBLC03C	Transient Voltage Supsressor
D08	GBLC03C	3.3 Volt TVS	SOD323	0G_LED_TVS	ProTek	GBLC03C	ProTek	GBLC03C	Transient Voltage Supsressor
D09	GBLC03C	3.3 Volt TVS	SOD323	0G_LED_TVS	ProTek	GBLC03C	ProTek	GBLC03C	Transient Voltage Supsressor
D10	GBLC03C	3.3 Volt TVS	SOD323	0G_LED_TVS	ProTek	GBLC03C	ProTek	GBLC03C	Transient Voltage Supsressor
D11		Voltage Clamp	SOT23-6L	0G_LED_TVS	STM	DVIVLC6-4SC6	Mouser	511-DVIVLC6-4SC6	4 Way Transient Voltage Clamp

J1	10 Pin	Polarized 0.1 inch		0G_Connectors	3M	3793-5002RB	Mouser	517-N3793-5002RB	See Special Assembly Note
J1A	Extractors	Extractors & Pins	--	--	3M	3505-3	Mouser	517-3505-3	
J1B	Extractors	Extractors & Pins	--	--	3M	3505-3	Mouser	517-3505-3	

K1	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K2	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K3	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K4	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K5	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K6	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K7	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K8	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K9	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K10	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K11	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K12	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K13	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K14	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K15	SPST	G6L-1P	G6L-1P	0G_RELAYS	Omron	G6L-1P-DC12	Digikey	Z1229-ND	
K16	SPST	G6L-1P	G6L-1P	0G_RELAYS	Omron	G6L-1P-DC12	Digikey	Z1229-ND	
K17	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K18	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	
K19	SPST	G6L-1P	G6L-1P	0G_RELAYS	Omron	G6L-1P-DC12	Digikey	Z1229-ND	
K20	DPDT	G6K-2P-Y	G6K-2P-Y	0G_RELAYS	Omron	G6K-2P-Y-DC12	Mouser	653-G6K-2P-Y-DC12	

L1	3.5uH	T50-RED, 28T	T50-1W	0G_RF_Magnetics	Chinese	T50-RED	Chinese	AL-T20	28 Turns # 24
L2	6.25uH	T50-RED, 37T	T50-1W	0G_RF_Magnetics	Chinese	T50-RED	Chinese	AL-T24	37 Turns # 24
L3	6.25uH	T50-RED, 37T	T50-1W	0G_RF_Magnetics	Chinese	T50-RED	Chinese	AL-T24	37 Turns # 24
L4	1.14uH	T50-BLK, 19T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T14	19 Turns #22
L5	1.55uH	T50-BLK	T50-1W	0G_RF_Magnetics	MicroMetals	T50-BLACK	MicroMetals	AL-T29	
L6	1.55uH	T50-BLK	T50-1W	0G_RF_Magnetics	MicroMetals	T50-BLACK	MicroMetals	AL-T29	
L7	.650uH	T50-BLK	T50-1W	0G_RF_Magnetics	MicroMetals	T50-BLACK	MicroMetals	AL-T30	
L8	.940uH	T50-BLK	T50-1W	0G_RF_Magnetics	MicroMetals	T50-BLACK	MicroMetals	AL-T31	
L9	.940uH	T50-BLK	T50-1W	0G_RF_Magnetics	MicroMetals	T50-BLACK	MicroMetals	AL-T31	
L10	.562uH	T50-BLK, 13T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T11	13 Turns #22
L11	.650uH	T50-BLK	T50-1W	0G_RF_Magnetics	MicroMetals	T50-BLACK	MicroMetals	AL-T30	
L12	.650uH	T50-BLK	T50-1W	0G_RF_Magnetics	MicroMetals	T50-BLACK	MicroMetals	AL-T30	
L13	.311uH	T50-BLK, 9T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T07	9 Turns #22
L14	.434uH	T50-BLK, 11T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T09	11 Turns #22
L15	.511uH	T50-BLK, 12T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T10	12 Turns #22
L16	.729uH	T37-YEL, 15T	T37-1W	0G_RF_Magnetics	Chinese	T37-YELLOW	Chinese	AL-T02	15 Turns #24
L17	Bead	FB-61-101	LP-CHOKE	0G_RF_Magnetics	Fairite	FB-61-101	Amidon	FB-61-101	1 pass thru center #22
L18	.452uH	T37-YEL, 12T	T37-1W	0G_RF_Magnetics	Chinese	T37-YELLOW	Chinese	AL-T01	12 Turns #24
L19	.196uH	T50-BLK, 7T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T05	7 Turns #22
L20	.165uH	T50-BLK, 6T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T04	6 Turns #22
L21	.165uH	T50-BLK, 6T	T50-1W	0G_RF_Magnetics	Chinese	T50-BLACK	Chinese	AL-T04	6 Turns #22
Q1	ZVP2106G	FET Transistor	SOT223	0G_Transistors	Zetex	ZVP2106GTA	Mouser	522-ZVP2106GTA	
Q2	BFG540/X	BFG540/X	SOT143B	0G_Transistors	NXP	BFG540/X T/R	Digikey	568-1983-1-ND	
R01	560	Chip Res R0805	R0805	0G_Passives	Xicon	260-560-RC	Mouser	260-560-RC	
R02	300	Chip Res R0805	R0805	0G_Passives	Xicon	260-300-RC	Mouser	260-300-RC	
R03	1.8K	Chip Res R0805	R0805	0G_Passives	Xicon	260-1.8K-RC	Mouser	260-1.8K-RC	
R04	150	Chip Res R2010	R2010	0G_RCL	Vishay/Dale	CRCW2010-150-E3	Mouser	71-CRCW2010-150-E3	1/2 Watt
R05	10K	Chip Res R0805	R0805	0G_Passives	Xicon	260-10K-RC	Mouser	260-10K-RC	
R06	33K	Chip Res R0805	R0805	0G_Passives	Xicon	260-33K-RC	Mouser	260-33K-RC	
R07	1.2K	Chip Res R0805	R0805	0G_Passives	Xicon	260-1.2K-RC	Mouser	260-1.2K-RC	
R08	75	Chip Res R0805	R0805	0G_Passives	Xicon	260-75-RC	Mouser	260-75-RC	
R09	240	Chip Res R0805	R0805	0G_Passives	Xicon	260-240-RC	Mouser	260-240-RC	
R10	100	Chip Res R0805	R0805	0G_Passives	Xicon	260-100-RC	Mouser	260-100-RC	
R11	100	Chip Res R0805	R0805	0G_Passives	Xicon	260-100-RC	Mouser	260-100-RC	
R12	61.9	Chip Res R0805	R0805	0G_Passives	KOA Speer	RK73H2ATTD61R9F	Mouser	660-RK73H2ATTD61R9F	~62 Ohms
R13	61.9	Chip Res R0805	R0805	0G_Passives	KOA Speer	RK73H2ATTD61R9F	Mouser	660-RK73H2ATTD61R9F	~62 Ohms
R14	10K	Chip Res R0805	R0805	0G_Passives	Xicon	260-10K-RC	Mouser	260-10K-RC	
R15	10K	Chip Res R0805	R0805	0G_Passives	Xicon	260-10K-RC	Mouser	260-10K-RC	
R16	10K	Chip Res R0805	R0805	0G_Passives	Xicon	260-10K-RC	Mouser	260-10K-RC	
U01	5 Volts	5 V Regulator	SO08	0G_Regulators	STM	L78L05ACD	Mouser	511-L78L05ACD	
U02	6B595	Relay Driver	SO20W	0G_Regulators	TI	TPIC6B595DW	Mouser	595-TPIC6B595DW	
U03	6B595	Relay Driver	SO20W	0G_Regulators	TI	TPIC6B595DW	Mouser	595-TPIC6B595DW	
U04	74HCT04D	Hex Inverter	SO14	0G_Logic	Fairchild	MM74HCT04M	Mouser	512-MM74HCT04M	Do not substitute 74HC04D

X1	BNC	BNC Connector	SD-73100 0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105
X2	BNC	BNC Connector	SD-73100 0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105
X3	BNC	BNC Connector	SD-73100 0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105
X4	BNC	BNC Connector	SD-73100 0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105
X5	BNC	BNC Connector	SD-73100 0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105
X6	SMB	SMB Connector	BU-SMA-V 0G_DDS-Controller	Molex	73100-0103	Mouser	538-73100-0103

PCB-RX RX-HPF PCB

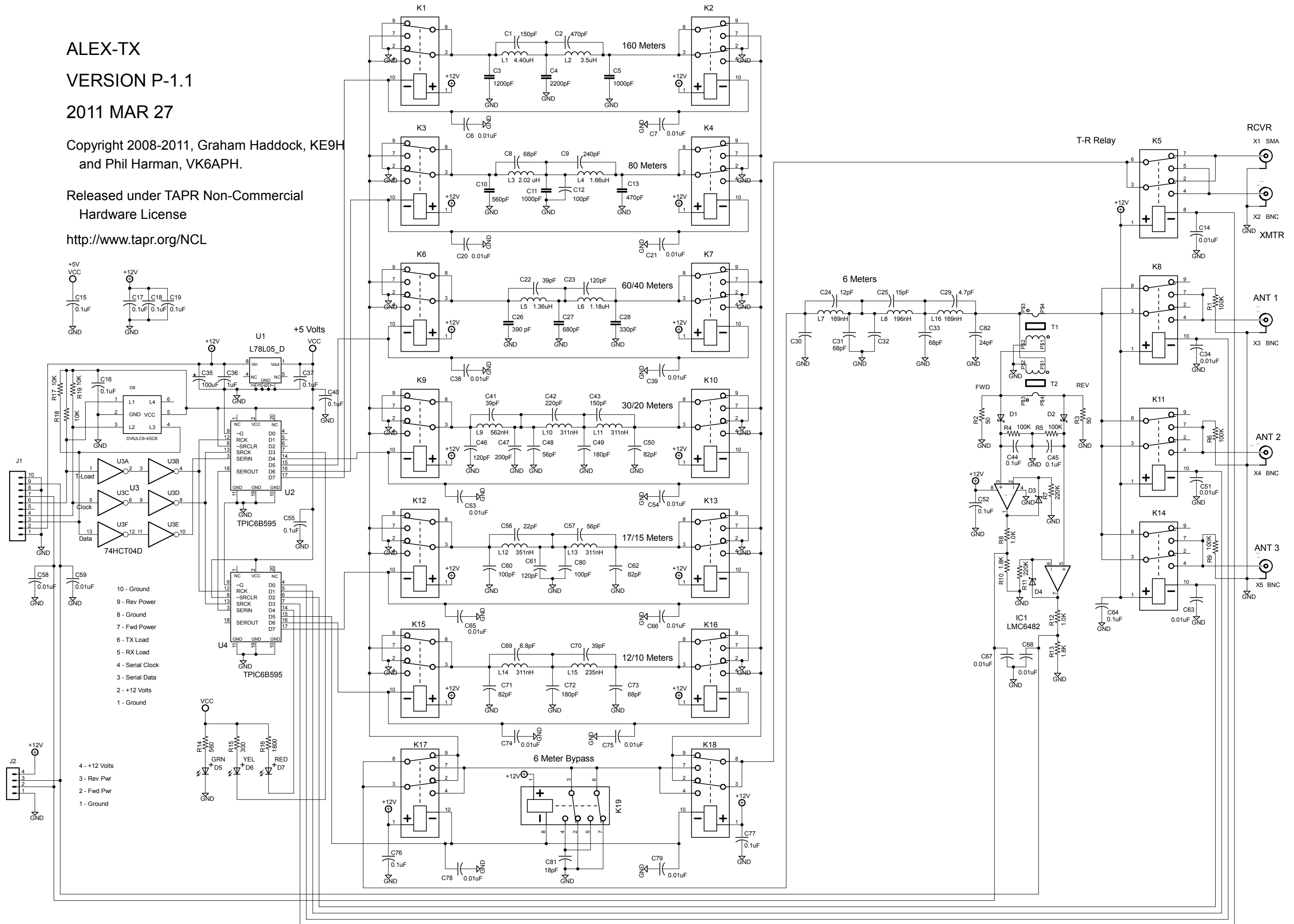
See Special Assembly Note

ALEX-TX
 VERSION P-1.1
 2011 MAR 27

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- 10 - Ground
- 9 - Rev Power
- 8 - Ground
- 7 - Fwd Power
- 6 - TX Load
- 5 - RX Load
- 4 - Serial Clock
- 3 - Serial Data
- 2 - +12 Volts
- 1 - Ground

- 4 - +12 Volts
- 3 - Rev Pwr
- 2 - Fwd Pwr
- 1 - Ground

ALEX P1.41-TX BOM

Version

3/27/2011

DOC

NP = Do Not Populate

Part	Value	Description	Footprint/ Package	Library	Manu	Part No.	Vendor	Part No.	Notes
C01	150pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M151JAJME	Digikey	478-2653-1-ND	Must be NPO/COG
C02	470pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB2M471JAJME	Digikey	478-2662-1-ND	Must be NPO/COG
C03	1200pF	Silver Mica CD19	CD19	0G_Passives	Cornell Dubilier	FD122J03	Mouser	5982-19-500V1200	Silver Mica
C04	2200pF	Silver Mica CD19	CD19	0G_Passives	Cornell Dubilier	FD222J03	Mouser	5982-19-500V2200	Silver Mica
C05	1000pF	Silver Mica CD19	CD19	0G_Passives	Cornell Dubilier	FD102J03	Mouser	5982-19-500V1000	Silver Mica
C06	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C07	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C08	68pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M680JAJME	Digikey	478-2649-1-ND	Must be NPO/COG
C09	240pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB2M241JAJME	Digikey	478-2657-1-ND	Must be NPO/COG
C10	560pF	Silver Mica CD19	CD19	0G_Passives	Cornell Dubilier	FD561J03	Mouser	5982-19-500V560	Silver Mica
C11	1000pF	Silver Mica CD19	CD19	0G_Passives	Cornell Dubilier	FD102J03	Mouser	5982-19-500V1000	Silver Mica
C12	100pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M101JAJME	Digikey	478-2651-1-ND	Must be NPO/COG
C13	470pF	Silver Mica CD19	CD19	0G_Passives	Cornell Dubilier	FD471J03	Mouser	5982-19-500V470	Silver Mica
C14	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C15	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C16	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C17	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C18	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C19	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C20	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C21	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C22	39pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M390JAJME	Digikey	478-2646-1-ND	Must be NPO/COG
C23	120pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M121JAJME	Digikey	478-2652-1-ND	Must be NPO/COG
C24	12pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M120JAJME	Digikey	478-2637-1-ND	Must be NPO/COG
C25	15pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M150JAJME	Digikey	478-2638-2-ND	Must be NPO/COG
C26	390pF	Silver Mica CD15	CD15	0G_Passives	Cornell Dubilier	FD391J03	Mouser	5982-15-500V390	Silver Mica
C27	680pF	Silver Mica CD19	CD19	0G_Passives	Cornell Dubilier	FD681J03	Mouser	5982-19-500V680	Silver Mica
C28	330pF	Silver Mica CD15	CD15	0G_Passives	Cornell Dubilier	FD331J03	Mouser	5982-15-500V330	Silver Mica
C29	4.7pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M4R7CAJME	Digikey	478-2632-1-ND	Must be NPO/COG
C30	NP	Chip Cap C1210	C1210	0G_Passives	-----	-----	-----	-----	Position not used
C31	68pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M680JAJME	Digikey	478-2649-1-ND	Must be NPO/COG
C32	NP	Chip Cap C1210	C1210	0G_Passives	-----	-----	-----	-----	Position not used
C33	68pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M680JAJME	Digikey	478-2649-1-ND	Must be NPO/COG
C34	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C35	100uF	Electrolytic SMT	PANASONIC	0G_RCL	United CC	EMKA250ADA101MHA0G	Mouser	661-MKA25VC101M	
C36	1uF	Chip Cap C1206	C1206	0G_Passives	Kemet	C1206C105K3RACTU	Mouser	80-C1206C105K3R	
C37	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C38	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C39	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating

C40	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C41	39pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M390JAJME	Digikey	478-2646-1-ND	Must be NPO/C0G
C42	220pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB2M221JAJME	Digikey	478-2656-1-ND	Must be NPO/C0G
C43	150pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M151JAJME	Digikey	478-2653-1-ND	Must be NPO/C0G
C44	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C45	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C46	120pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M121JAJME	Digikey	478-2652-1-ND	Must be NPO/C0G
C47	200pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M201JAJME	Digikey	478-2655-1-ND	Must be NPO/C0G
C48	56pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M560JAJME	Digikey	478-2648-1-ND	Must be NPO/C0G
C49	180pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M181JAJME	Digikey	478-2654-1-ND	Must be NPO/C0G
C50	82pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M820JAJME	Digikey	478-2650-1-ND	Must be NPO/C0G
C51	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C52	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C53	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C54	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C55	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C56	22pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M220JAJME	Digikey	478-2641-1-ND	Must be NPO/C0G
C57	56pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M560JAJME	Digikey	478-2648-1-ND	Must be NPO/C0G
C58	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C59	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C60	100pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M101JAJME	Digikey	478-2651-1-ND	Must be NPO/C0G
C61	120pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M121JAJME	Digikey	478-2652-1-ND	Must be NPO/C0G
C62	82pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M820JAJME	Digikey	478-2650-1-ND	Must be NPO/C0G
C63	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C64	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C65	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C66	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C67	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C68	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C69	6.8pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M6R8CAJME	Digikey	478-2634-1-ND	Must be NPO/C0G
C70	39pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M390JAJME	Digikey	478-2646-1-ND	Must be NPO/C0G
C71	82pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M820JAJME	Digikey	478-2650-1-ND	Must be NPO/C0G
C72	180pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB9M181JAJME	Digikey	478-2654-1-ND	Must be NPO/C0G
C73	68pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M680JAJME	Digikey	478-2649-1-ND	Must be NPO/C0G
C74	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C75	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C76	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C77	0.1uF	Chip Cap C0805	C0805	0G_Passives	Kemet	C0805C104K3RACTU	Mouser	80-C0805C104K3R	
C78	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C79	0.01uF	Chip Cap C0805	C0805	0G_Passives	Murata	GRM216F51H103ZA01D	Mouser	81-GRM40Y103Z50D	Must be 50 V or higher rating
C80	100pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M101JAJME	Digikey	478-2651-1-ND	Must be NPO/C0G
C81	18pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M180JAJME	Digikey	478-2639-1-ND	Must be NPO/C0G
C82	24pF	Chip Cap C1210	C1210	0G_Passives	AVX	SQCB7M240JAJME	Digikey	478-2642-1-ND	Must be NPO/C0G

D1		Schottky Diode	SOD-123	0G_LED_TVS	Diodes, Inc.	1N5711W-7-F	Mouser	621-1N5711W-F	
D2		Schottky Diode	SOD-123	0G_LED_TVS	Diodes, Inc.	1N5711W-7-F	Mouser	621-1N5711W-F	
D3		Schottky Diode	SOD-123	0G_LED_TVS	Diodes, Inc.	1N5711W-7-F	Mouser	621-1N5711W-F	
D4		Schottky Diode	SOD-123	0G_LED_TVS	Diodes, Inc.	1N5711W-7-F	Mouser	621-1N5711W-F	
D5	Green	GRN LED SMT	LED0805	0G_LED_TVS	Lite-On	LTST-C170GKT	Mouser	859-LTST-C170GKT	See Special Assembly Note
D6	Yellow	YEL LED SMT	LED0805	0G_LED_TVS	Lite-On	LTST-C170YKT	Mouser	859-LTST-C170YKT	See Special Assembly Note
D7	Red	RED LED SMT	LED0805	0G_LED_TVS	Lite-On	LTST-C170CKT	Mouser	859-LTST-C170CKT	See Special Assembly Note
D8		Voltage Clamp	SOT23-6L	0G_LED_TVS	STM	DVIVLC6-4SC6	Mouser	511-DVIULC6-4SC6	4 Way Transient Voltage Clamp
IC1		Dual Op Amp	SO8	0G_Analog_ICs	National Semi	LMC6482IM/NOPB	Digikey	LMC6482IM-ND	
J1	10 Pin	Polarized 0.1 inch	--	0G_Connectors	3M	3793-5002RB	Mouser	517-N3793-5002RB	See Special Assembly Note
J1A	Extractors	Extractors & Pins	--	--	3M	3505-3	Mouser	517-3505-3	
J1B	Extractors	Extractors & Pins	--	--	3M	3505-3	Mouser	517-3505-3	
J2	4 Pin	Polarized 0.1 inch	--	0G_Connectors	Molex	22-12-2044	Mouser	538-22-12-2044	See Special Assembly Note
K01	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K02	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K03	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K04	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K05	DPDT	T-R Relay	G6J-2P-Y	0G_RELAYS	Omron	G6J-2P-Y-DC12	Mouser	653-G6J-2P-Y-DC12	See Special Assembly Note
K06	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K07	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K08	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K09	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K10	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K11	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K12	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K13	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K14	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K15	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K16	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K17	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K18	DPDT	G6H-2 Relay	G6H	0G_RELAYS	Omron	G6H-2-DC12	Mouser	653-G6H-2-DC12	See Special Assembly Note
K19	DPDT	T-R Relay	G6J-2P-Y	0G_RELAYS	Omron	G6J-2P-Y-DC12	Mouser	653-G6J-2P-Y-DC12	See Special Assembly Note
L01	4.4uH	T50-RED, 31T	T50-1W	G_RF_Magnetic	Chinese	T50-RED	Chinese	AL-T21	31 Turns #24
L02	3.5uH	T50-RED, 28T	T50-1W	G_RF_Magnetic	Chinese	T50-RED	Chinese	AL-T20	28 Turns # 24
L03	2.02uH	T50-RED, 22T	T50-1W	G_RF_Magnetic	Chinese	T50-RED	Chinese	AL-T18	22 Turns #22
L04	1.66uH	T50-RED, 20T	T50-1W	G_RF_Magnetic	Chinese	T50-RED	Chinese	AL-T17	20 Turns #22
L05	1.36uH	T50-BLK, 22T	T50-1W	G_RF_Magnetic	Chinese	T50-BLACK	Chinese	AL-T16	22 Turns #22
L06	1.18uH	T50-BLK	T50-1W	G_RF_Magnetic	MicroMetals	T50-BLACK	MicroMetals	AL-T32	
L07	0.169uH	T50-BLK, 6T	T50-1W	G_RF_Magnetic	Chinese	T50-BLACK	Chinese	AL-T04	6 Turns #22
L08	0.196uH	T50-BLK, 7T	T50-1W	G_RF_Magnetic	Chinese	T50-BLACK	Chinese	AL-T05	7 Turns #22

L09	0.562uH	T50-BLK, 13T	T50-1W	G_RF_Magnetic	Chinese	T50-BLACK	Chinese	AL-T11	13 Turns #22
L10	0.311uH	T50-BLK, 9T	T50-1W	0G_RF_Magnet	Chinese	T50-BLACK	Chinese	AL-T07	9 Turns #22
L11	0.311uH	T50-BLK, 9T	T50-1W	0G_RF_Magnet	Chinese	T50-BLACK	Chinese	AL-T07	9 Turns #22
L12	0.351uH	T50-BLK, 10T	T50-1W	G_RF_Magnetic	Chinese	T50-BLACK	Chinese	AL-T08	10 Turns #22
L13	0.311uH	T50-BLK, 9T	T50-1W	0G_RF_Magnet	Chinese	T50-BLACK	Chinese	AL-T07	9 Turns #22
L14	0.311uH	T50-BLK, 9T	T50-1W	0G_RF_Magnet	Chinese	T50-BLACK	Chinese	AL-T07	9 Turns #22
L15	0.235uH	T50-BLK, 8T	T50-1W	G_RF_Magnetic	Chinese	T50-BLACK	Chinese	AL-T06	8 Turns #22
L16	0.169uH	T50-BLK, 6T	T50-1W	G_RF_Magnetic	Chinese	T50-BLACK	Chinese	AL-T04	6 Turns #22
R15	300	Chip Res R0805	R0805	0G_Passives	Xicon	260-300-RC	Mouser	260-300-RC	
R14	560	Chip Res R0805	R0805	0G_Passives	Xicon	260-560-RC	Mouser	260-560-RC	
R16	1.8K	Chip Res R0805	R0805	0G_Passives	Xicon	260-1.8K-RC	Mouser	260-1.8K-RC	
R12	1.0K	Chip Res R0805	R0805	0G_Passives	Xicon	260-1.0K-RC	Mouser	260-1.0K-RC	
R8	1.0K	Chip Res R0805	R0805	0G_Passives	Xicon	260-1.0K-RC	Mouser	260-1.0K-RC	
R10	1.8K	Chip Res R0805	R0805	0G_Passives	Xicon	260-1.8K-RC	Mouser	260-1.8K-RC	
R13	1.8K	Chip Res R0805	R0805	0G_Passives	Xicon	260-1.8K-RC	Mouser	260-1.8K-RC	
R4	100K	Chip Res R0805	R0805	0G_Passives	Xicon	260-100K-RC	Mouser	260-100K-RC	
R5	100K	Chip Res R0805	R0805	0G_Passives	Xicon	260-100K-RC	Mouser	260-100K-RC	
R17	10K	Chip Res R0805	R0805	0G_Passives	Xicon	260-10K-RC	Mouser	260-10K-RC	
R18	10K	Chip Res R0805	R0805	0G_Passives	Xicon	260-10K-RC	Mouser	260-10K-RC	
R19	10K	Chip Res R0805	R0805	0G_Passives	Xicon	260-10K-RC	Mouser	260-10K-RC	
R11	220K	Chip Res R0805	R0805	0G_Passives	Xicon	260-220K-RC	Mouser	260-220K-RC	
R7	220K	Chip Res R0805	R0805	0G_Passives	Xicon	260-220K-RC	Mouser	260-220K-RC	
R1	100K	Chip Res R1206	R1206	0G_Passives	Xicon	263-100K-RC	Mouser	263-100K-RC	
R6	100K	Chip Res R1206	R1206	0G_Passives	Xicon	263-100K-RC	Mouser	263-100K-RC	
R9	100K	Chip Res R1206	R1206	0G_Passives	Xicon	263-100K-RC	Mouser	263-100K-RC	
R2	51.1	Chip Res R2010	R2010	0G_Passives	Vishay/Dale	CRCW201051.1-E3	Mouser	71-CRCW201051.1-E3	
R3	51.1	Chip Res R2010	R2010	0G_Passives	Vishay/Dale	CRCW201051.1-E3	Mouser	71-CRCW201051.1-E3	
T1	--	FT50-43, 20T #22	T50-2W-DC	0G_RF_Magnet	Fair-Rite	5943000301	Fair-Rite	AL-T23	20 Turns Secondary, Wire staple Primary
T2	--	FT50-43, 20T #22	T50-2W-DC	0G_RF_Magnet	Fair-Rite	5943000301	Fair-Rite	AL-T23	20 Turns Secondary, Wire staple Primary
U1	5 Volts	5 V Regulator	SO08	0G_Regulators	STM	L78L05ACD	Mouser	511-L78L05ACD	
U2	6B595	Relay Driver	SO20W	0G_Regulators	TI	TPIC6B595DW	Mouser	595-TPIC6B595DW	
U3	74HCT04	Hex Inverter	SO14	0G_Logic	Fairchild	MM74HCT04M	Mouser	512-MM74HCT04M	
U4	6B595	Relay Driver	SO20W	0G_Regulators	TI	TPIC6B595DW	Mouser	595-TPIC6B595DW	
X1	SMB	SMB Connector	BU-SMA-V	0G_DDS-Contr	Molex	73100-0103	Mouser	538-73100-0103	See Special Assembly Note
X2	BNC	BNC Connector	SD-73100	0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105	
X3	BNC	BNC Connector	SD-73100	0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105	
X4	BNC	BNC Connector	SD-73100	0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105	
X5	BNC	BNC Connector	SD-73100	0G_Connectors	Molex	73100-0105	Mouser	538-73100-0105	

PCB-TX

TX-LPF PCB

ALEX Mechanical Parts List Version 2/28/2010

Part	Value	Description	Footprint/ Package	Library	Manu	Part No.	Vendor	Part No.	Notes
M1		Case	--	--	Hammond	1455N1601	Mouser	546-1455N1601	
Custom Front and back panels									
Jumper Cable (Board to Board to Mercury)									
P1	End	Connector Body	--	--	3-M	3473-6610	Mouser	517-3473-6610	Cable End Connector
P1-SR		Strain Relief	--	--	3-M	3448-3010	Mouser	517-3448-3010	Cable End Strain Relief
P2	Middle	Connector Body	--	--	3-M	3473-7610	Mouser	517-3473-7610	Middle Connector with Strain Relief
P3	End	Connector Body	--	--	3-M	3473-6610	Mouser	517-3473-6610	Cable End Connector
P3-SR		Strain Relief	--	--	3-M	3448-3010	Mouser	517-3448-3010	Cable End Strain Relief
	Wire	.050" 10CONDUCT 28AWG		--	3-M	3302	Mouser	517-3302/10FT	Ribbon Cable
	Coax Jumper Board to Board								
		6" SMB to SMB Cable Assembly			?	?	JameCo	175169	RG174, .5ft
For Reference Only, Mating connector for 4 pin VSWR Output									
P3	4 Pin	Connector Body			Molex	22-01-3047	Mouser	538-22-01-3047	
P3A		Pins			Molex	08-65-0816	Mouser		Crimp pins

Toroid Manufacturing Table							2011 MAR 27			
Part	Expected		Core					Total		
Number	Value uH	Core Size	Manu	Color	Turns	Wire	NOTES	Usage	Location(s)	Location(s)
									RECEIVE	TRANSMIT
AL-T01	0.452	T37	Chinese	YELLOW	12T	# 24	20 MHz	1	L18	
AL-T02	0.729	T37	Chinese	YELLOW	15T	# 24	20 MHz	1	L16	
AL-T04	0.165	T50	Chinese	BLACK	6T	# 22	10 MHz	4	L20, L21	L07, L16
AL-T05	0.196	T50	Chinese	BLACK	7T	# 22	10 MHz	2	L19	L08
AL-T06	0.235	T50	Chinese	BLACK	8T	# 22	10 MHz	1		L15
AL-T07	0.311	T50	Chinese	BLACK	9T	# 22	10 MHz	5	L13	L10, L11, L13, L14
AL-T08	0.351	T50	Chinese	BLACK	10T	# 22	10 MHz	1		L12
AL-T09	0.434	T50	Chinese	BLACK	11T	# 22	10 MHz	1	L14	
AL-T10	0.511	T50	Chinese	BLACK	12T	# 22	10 MHz	1	L15	
AL-T11	0.562	T50	Chinese	BLACK	13T	# 22	10 MHz	2	L10	L09
AL-T14	1.135	T50	Chinese	BLACK	19T	# 22	10 MHz	1	L04	
AL-T16	1.38	T50	Chinese	BLACK	21T	# 22	10 MHz	1		L05
AL-T29	1.55	T50	MicroMetals	BLACK	23T	# 22	10 MHz	2	L05, L06	
AL-T30	0.650	T50	MicroMetals	BLACK	14T	# 22	10 MHz	3	L07, L11, L12	
AL-T31	0.942	T50	MicroMetals	BLACK	17T	# 22	10 MHz	2	L08, L09	
AL-T32	1.18	T50	MicroMetals	BLACK	19T	# 22	10 MHz	1		L06
AL-T17	1.66	T50	Chinese	RED	20T	# 22	4 MHz	1		L04
AL-T18	2.02	T50	Chinese	RED	22T	# 22	4 MHz	1		L03
AL-T20	3.5	T50	Chinese	RED	28T	# 24	4 MHz	2	L01	L02
AL-T21	4.4	T50	Chinese	RED	31T	# 24	4 MHz	1		L01
AL-T24	6.25	T50	Chinese	RED	37T	# 24	4 MHz	2	L02, L03	
AL-T23	NA	FT50-43	FairRite	DULL GRAY	20T	# 22	Plus a separate single turn winding, #18 teflon insulated thru center	2		T1, T2

NOTES										
See attached note and diagram about toroid winding conventions. (Direction of winding)										
All toroids assume equally spaced turns for values shown.										
An inductance value tolerance of +/- 5 percent is assumed for black cores.										
An inductance value tolerance of +/- 10 percent is assumed for red or yellow cores.										
Test frequencies for inductance values: RED = 4 MHz., BLACK = 10 MHz., YELLOW = 20 MHz.										
An inductance test meter that tests at sub 1 MHz frequencies will give very different values.										