JUMA TRX2

High Performance 160-10 Meter SSB - CW Transceiver

Owner's Manual

Rev 2.6.5 March 21, 2008

Designed by
Juha Niinkoski OH2NLT and Matti Hohtola OH7SV
Manual by Pete Meier WK8S

Table of Contents

Introduction

JUMA TRX2 is a high performance HF transceiver for SSB and CW with high dynamic range. It uses a quadrature sampling technique for modulation and demodulation with a low noise phasing method. The JUMA TRX2 uses a DDS controlled VFO for excellent frequency stability and signal purity. An internal microcontroller is controlling all functions of the transceiver.

JUMA TRX2 is available as a kit with two kit alternatives:
1. The discrete kit with components and bare circuit boards.
2. The modular kit with assembled and tested boards.
The enclosure is machined and printed in both kit alternatives.
A completely assembled transceiver is also available with the help of JUMA community.

Additionally there will be two models: The two band model TRX2 for 80m and 40m ham bands and the all ham band model TRX2A with a general coverage receiver. The two band model can be upgraded any time into the all band model by adding related modules. Several add on option modules are also available for both models.

Features

The two band model frequency coverage is 2 MHz...8 MHz
The all band model has all ham bands, RX 100 kHz-30 MHz
Transmit modes LSB, USB, CW and tune
Output RF power 10 W
Built in keyer: Dot priority, Iambic A, Iambic B and straight modes
Click-less CW keying with adaptive 'VOX' time
Three filters: Wide, Medium and Narrow with a good shape factor
Filters are user adjustable
Outstanding Dynamic Range and good sensitivity.
Excellent AGC with slow and fast modes
Dual DDS controlled VFOs with a split TX/RX function
First class optical VFO encoder with 480 steps per revolution
7 digit frequency display, 10 Hz display resolution
Three selectable VFO tuning speeds Slow/Fast/Very Fast
VFO lock feature
RIT with it's own tuning knob
Graphical S-meter range S1...S9+40 dBm
Non volatile memory for VFOs, modes, settings and calibration

Configurable features

AGC Slow/Fast
LPF corner frequency setting
Speech Processor ON/OFF
Mic connector input level MIC/LINE
Keyer Dot priority/Iambic-A/B/Straight
RS232 mode TRX2/Yaesu CAT/Test functions
Display brightness/contrast

Option Modules

Voice memory plug in - Ext control unit for voice memory - Noise blanker plug in

Service/calibration mode

Reference oscillator software calibration
S-meter software scaling
FWD power meter software scaling
Acknowledge tones length setting
Reload factory settings

Firmware

The most recent software updates will be available and users can easily upgrade the firmware without any special tools with the build in flasher utility and a PC serial cable. The control software (firmware) is written in the C programming language. Source code will be available for experimenters.

Power supply

Nominal supply voltage 13.8 VDC (range 11 VDC...15 VDC)
Nominal supply current RX 0.4 A, TX 2.5 A

Dimensions:

Width 182 mm, Height 60 mm, Depth 185 mm

JUMA TRX2 and JUMA TRX2A SPECIFICATIONS* 2007-10-28

GENERAL

Frequency range, Two Band model TRX2:
RX: 2 MHz...8 MHz, TX: 2 MHz...8 MHz.

Frequency range, All Band model TRX2A:
RX: 100 kHz...30 MHz, TX: 1.8 MHz...30 MHz.

Tuning step sizes: 10 Hz, 100 Hz
(10 kHz @ very fast setting).

Modes: LSB, USB, CW.

VFOs: A and B VFOs with split function, one tuning knob.

Front panel connector: Jack stereo connector 3.5 mm for electret mic input or line level input (selectable by the CONFIC) and PTT.

Rear panel connectors: Phones/speaker output, CW-paddle/key/keyer input, RS-232, AUX for PTT in/KEY out or audio I/Q output. All connectors 3.5 mm stereo jack type sockets.

Antenna connection: BNC connector in the rear panel, nominal impedance 50 ohms.

Display: Blue/white LCD with adjustable contrast and brightness. Main display: S meter, MODE, FILTER, frequency, VFO, VFO step. Alternate display pages: RF output power, SWR, supply voltage, PA drain current.

General configurable functions: LCD contrast, LCD brightness, RS232 protocol select.

Service mode functions: Frequency, voltage meter, S meter, FWD/REV power, ID current calibration. Acknowledge beep settings. Factory settings restore.

Software updating: HEX files can be uploaded by means of the boot loader via RS232 interface.
Supply: Voltage 13.8 V (11 V...15 V)
Current TX 2.5 A typical, RX 0.4 A typical, depending on the LCD brightness.

Dimensions: Width 182 mm, height 60 mm, depth 185 mm.
Weight: 1.2 kg

*Specifications subject to change

RECEIVER

Sensitivity: Typical -130 dBm

IMD3 dynamic range: Typical range more than 100 dB.

S-Meter: Graphical LCD bar display, S9 = 50 uV, range S1...S9+40 dB (-121 dBm...-33 dBm).

Filters: Three adjustable filters, default bandwidths 2.3 kHz, 1.7 kHz and 700 Hz. Filters are independent of the transmit modes.

RIT: Tuning range ± 1 kHz. Separate RIT knob.

Image and IF rejection: No image frequency response, no IF frequency response. (baseband IF demodulation).

Configurable RX functions: Slow/fast AGC, adjustable filters, squelch function (alternative function of the CW speed knob).

TRANSMITTER

Output Power: Nominal 10 W

SSB transmit bandwidth: Nominal 2.4 kHz

CW Rise/Fall Time: Nominal 5 ms

SSB carrier suppression: Typically better than 60 dB.

Speech processor: Microphone audio processing with 6 dB/oct high frequency pre-emphasis.

CW offset/sidetone: Fixed 700 Hz

MIC/PTT: Front stereo 3.5 mm jack mic connector with electret excitation (tip), PTT (ring). Ext. PTT in rear panel (aux).

Configurable TX functions: Speech processor on/off, AF input mic/line, keyer: Dot priority, Iambic A, Iambic B and straight.

OPTIONS

TRX2-VM Voice Memory: 10 memory banks
Banks 1-9; Capacity 10 seconds each
Bank 10; Capacity 120 seconds

TRX2-KB1 External Keyboard,
TRX2-NB Noise Blanker.

Using This Manual

This manual uses a pictorial approach, same as the Juma TRX2 web pages, to aid the builder in constructing this radio. The Part Lists provide an inventory check-list and for some part lists, if noted, a logical order of assembly is suggested. Please note the printed circuit boards (PCB) may be revised over time. Be sure to note revision listing at the top of the Part Lists matches the PCB revision you are working with. Updates and additional information not provided in this manual such as building tips and hi-resolution pictures are available on the Juma TRX2 web pages at **http://www.nikkemedia.fi/juma-trx2/**

Assembly Suggestions

Tools needed to assemble JUMA TRX2

A temperature controlled anti-static soldering iron or soldering station with a small to medium tip.

Small to medium diameter (0.2...0.5 mm) solder wire with "no clean" type flux. Lead-free solder wire is ok but is not as easy to use as the conventional wire.

Small, straight or curved tweezers used for SMD Assembly.

Solder wick (e.g. width 1.5...3mm) for removing possible tin short circuits solder paths between pads and component legs.

Simple loop or forehead loop to see the details during soldering the SMD components

Small side cutter, small pliers, medium size Phillips screwdriver and small to medium adjustable wrench.

Digital multimeter with at least voltage, current and resistance ranges. Capacitance measuring is a "nice to have" feature.

Also consider using small containers such as empty butter containers or muffin pans to hold and organize the parts for each section as you build.

SMD Construction Tips and Techniques

Most hobbyists cannot afford the expensive tools and soldering equipment professionals' use for Surface Mount Device (SMD) construction. Thankfully, many low cost alternatives exist. Here we offer just a few.

SMD components can be extremely small and difficult to handle. Therefore, it is important you take into consideration your workspace. It needs to be well lighted. I suggest, if possible, you obtain a natural or full spectrum lamp which provides better color definition useful for such fine work. This type of lighting is sometimes called Tru-light such as the Ott-Lite brand and can be obtained at hobby or craft stores.

The next most important thing is to decide on your construction technique. Consideration must be given as to how you will control the small components as some are the size of a freckle or mole on the back of your hand.

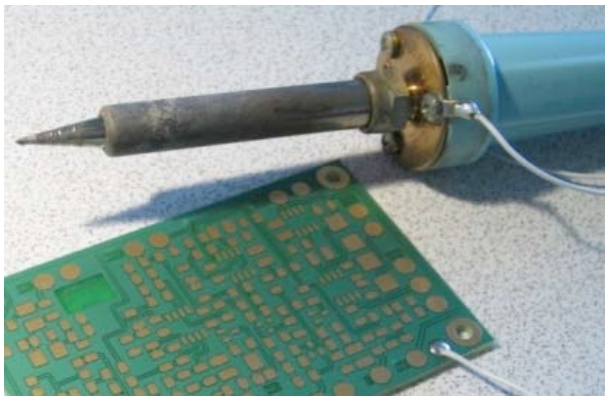
Toothpick and Bee's Wax Method

I have successfully used bee's wax and a wooden toothpick for several SMD projects. The principal here is to flatten the point of the toothpick then add a very tiny piece of bee's wax to the end to pick up and hold components. Here are the steps.

1. Tin the pc board pad(s) where you will be working. **Important**: use very little solder!
2. Pick up the component using the "waxed" end of the toothpick and place it on the pad.
3. Hold the component down with the toothpick and solder tack one side or leg of it.
4. The component should now be stable so put the toothpick aside and solder the **other side**.
5. Now return to the first side and re-solder if necessary.

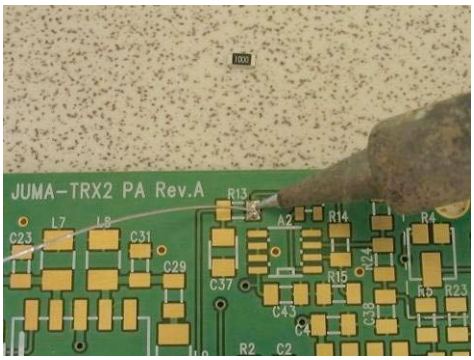
Tip: For ICs use the above technique but solder tack the **opposite corner pins** before setting the toothpick aside and soldering the remaining pins.

Tip: For non-ESD soldering irons the tip must be grounded to the pcb using the technique shown here. This will help avoid causing internal breakup of MOS devices.

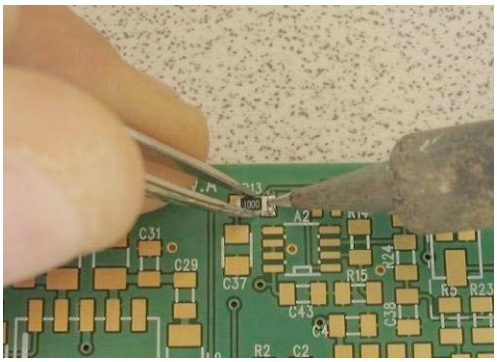


Tweezer Method

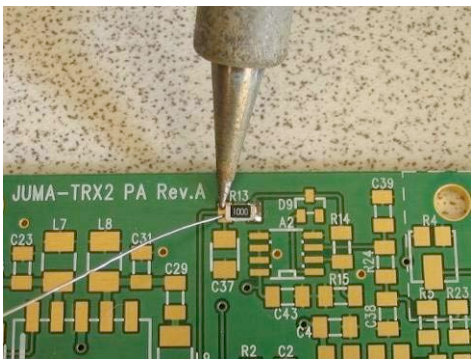
1. Pre-solder one pad (very lightly)



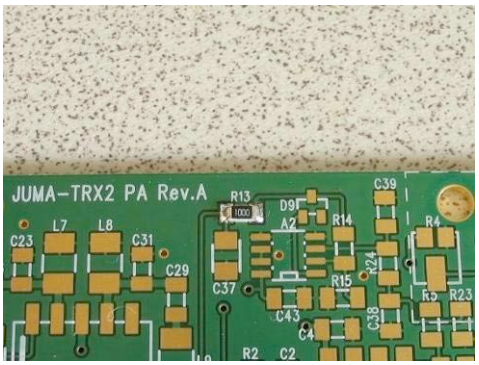
2. Hold with tweezers and melt solder again.



3. Solder the other end of component



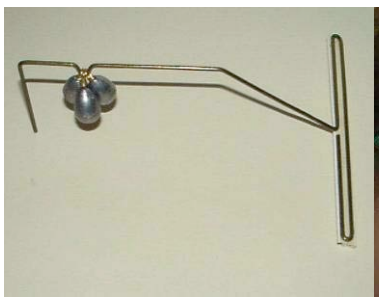
4. The SMD component is fully installed.



Tip 1: Use very fine (small gauge) solder, a narrow soldering iron tip and a **tiny amount of solder!**
Tip 2: Use **gentle** pressure on tweezers to avoid pinching and "shooting" the device across the room.
Tip 3: For ICs or transistors solder tack the **opposite corner pins** first before setting the tweezers aside and soldering the remaining pins.

Doofus Method

Using a doofus allows you to use both hands for soldering. The doofus is a home made device using a coat hanger or a fine wire and some weights to hold the component in place. The technique used is the same as Bee's wax method outlined above but you have both hands free for the solder work. Here are some pictures to give you a better idea. Notice the baking pan use to keep parts contained.



Here is just one of many good sites for such tips: http://www.al7fs.us/AL7FS5ATSprint2.html

Alternate methods of SMD construction.

The following method are mentioned as alternate means to building with SMD. These methods must be used with extreme caution to avoid permanent and un-repairable damage to circuit boards and components. These methods allow soldering of all components at one time by having you place the components on the pc board using solder paste and then "baking" the board to "flow" the solder.

Convection Oven and Solder Paste often called the Cash Olsen Method
http://www.hpsdr.com/Public/Projects/SMT/SMT.html
This method uses a convection oven and solder paste.
Pros: It's fast and clean with reduced chances of parts being lost in the carpet.
Cons: If not done correctly irreversible damage to both pc board and components can be done.

Electric beverage warmer (coffee cup heater) and Solder Paste
http://www.zianet.com/erg/SMT_Soldering.html
This method utilizes the same technique as the Convection Oven but uses safer, lower temperatures.
Pros: It fast with reduced chance of pc board or component damage (lower heat).
Cons: Still possible to damage pc board and components and requires additional purchase of a hot air embossing tool for secondary heating to complete solder flow.

Pictorial example of right and wrong application of this hot air & solder paste technique:
http://www.zianet.com/erg/Kisses_and_Pies.html

Hot Air Re-Work Station and solder paste
Using a hot air re-work station is another relatively inexpensive approach, similar to the above techniques. The method is the same but you work with fewer components at a time. It is more like normal soldering except you use solder paste instead of solder wire, hot air instead of a hot iron and need only one hand. The benefit of this method is you work at your own pace, do one or more components at a time, and take breaks whenever because the hot air tool heats up in about 30 seconds. Hot Air Re-Work Stations can be found starting under $100 on eBay and elsewhere.

Step 1: Place a small amount of solder paste on the component pads or a bead of paste across an IC's set of pads. (See http://www.zianet.com/erg/Kisses_and_Pies.html for details on correct method)

Step 2: Place component onto/into paste on top the pads. Don't worry about aligning the component perfectly, close is good enough. The components will 'magically' align themselves when the heated air is applied.

Step 3: Hold the hot air tool centered over the top of component at about 2 inches (or a little less) with the air stream flowing straight downward for about 3 seconds. Watch as the component wiggles into perfect alignment and the solder flows.

Step 4: Inspect your work. If a misalignment occurs or you need to change/ remove a part, simply re-heat the part while using a tool to grab and move it. Be very careful to keep your fingers out of the hot air stream.

Parts Inventory and Identification

As in any project, you need to gather your parts and inventory them. Since the parts in this kit are so small you will need the aid of a magnifying lens or jeweler's loop, a good light source and parts list found in this manual. The kit's parts will arrive packed in marked bags.

Tip: Keep the components in their marked bags until you are ready to install them.

Some bags will contain different type of components that will be identified by stickers that include both the corresponding marking codes such as resistors or semiconductors and their values e.g.:

1k5 = 1501	or	4k7 = 4701
BAV99 = A7	or	2N7002 = 702

It's important to understand the markings on the components (e.g. A7) may differ from kit to kit. This happens because different manufacturers use different marking codes and we may substitute a component with a compatible one from a different maker. Regardless, the code printed on the part's sticker will be valid for each kit

Hint: Using the Part Lists (with its component pictures) along with the bag stickers will help identify the uncommon and/or smaller unmarked parts such as capacitors and inductors.

Problems

Most problems will occur because of poor soldering (opens or shorts across pads), wrong component installed or the component was placed improperly (wrong polarity).

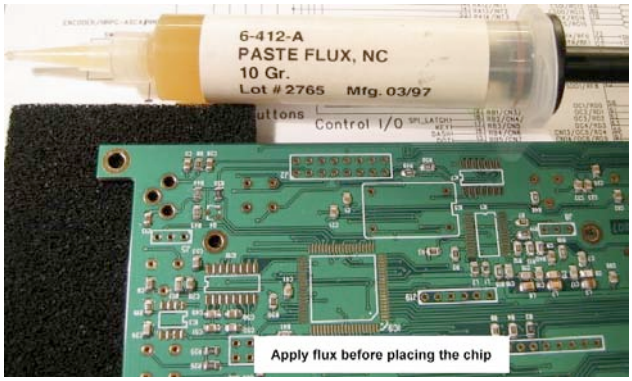
TIPS TO AVOID MISTAKES

Go slow and be systematic when soldering. Visually identify each component under good light and magnification and ensure its proper placement (e.g. polarity). Mark off the parts list for each component when you have completed its installation and visual check.

DDS – Control – Display Board

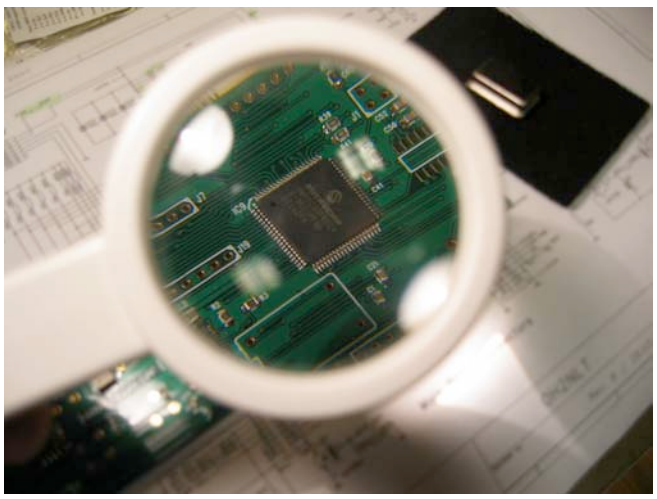
You may wish to begin solder work with the microprocessor and DDS chips. This will allow you more room to work at board level and it will be easier to inspect your work up close after soldering. Then proceed with resistors, capacitors, inductors, transistors, ICs and finish with the taller components.

Shown here are some hints to working with the DDS Board microprocessor. Begin by placing a tiny amount of liquid flux or flux compound over the pads to help hold the chip in place and to allow the solder to flow. Do not use any force on the soldering tip to the chips pins.



When finished soldering remove excess solder using a fine grade solder wick. Again, do not use any force.

The next step would be to wash away the excess flux using a solvent such as a good grade PCB cleaner or isopropanol alcohol. Use enough solvent to remove all residue.

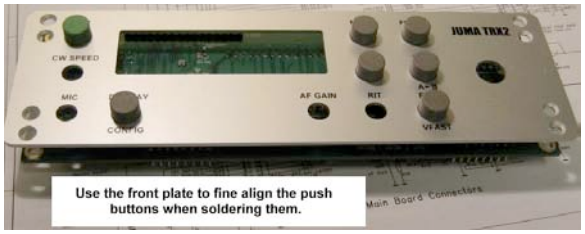


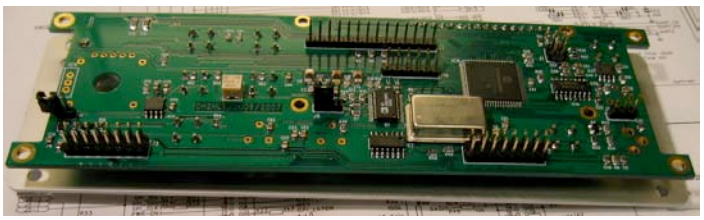
Carefully inspect your work under magnification and good lighting after the cleaning. If you have to do corrections, apply flux to the area that needs re-soldering or solder removal. Make all possible corrections before you install Oscillator IC5 and pin header J19.

Next you begin the install of the various switches, pushbuttons and DDS board connectors.

DDS – Control – Display Board

Push buttons mounting

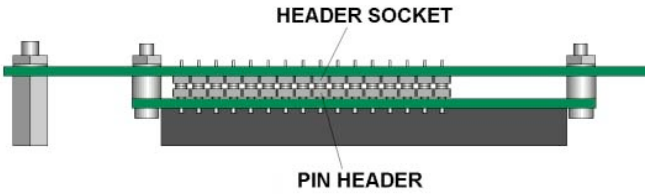




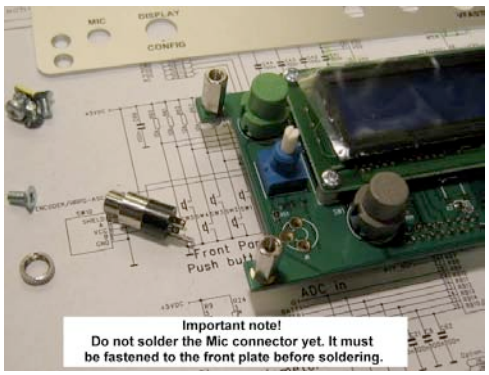
When ready to mount the push buttons, use the front plate to align the buttons before you begin to solder. Limit soldering time with the pin headers to avoid melting the plastic. Solder one pin then check pin header alignment before soldering the remaining pins.

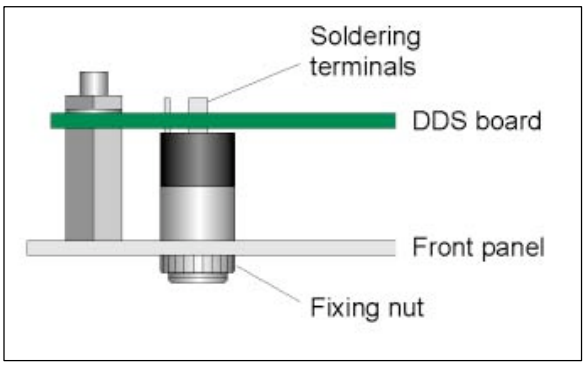
LCD module to DDS Board installation

First fix the LCD module mechanically to the DDS Board with the placed pin headers **before** soldering the pin headers to the boards. This is to allow correct spacing between the boards and to align the boards properly.



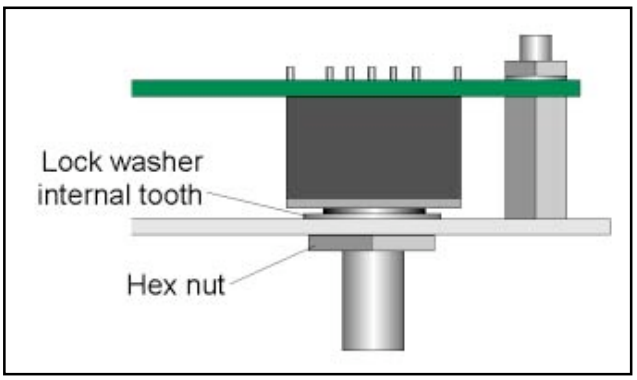
MIC socket mounting





Before soldering the MIC connector to the DDS board it must be fastened to the front plate.

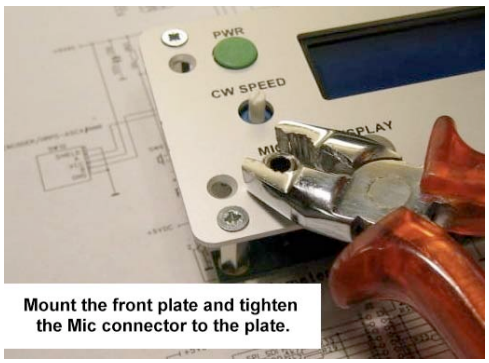
Encoder installation

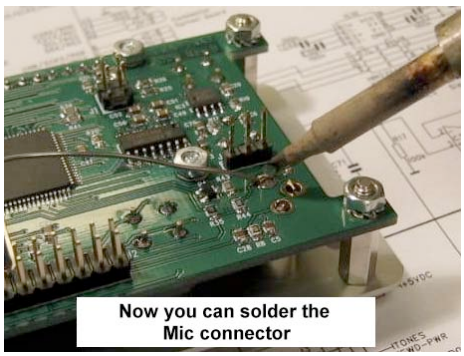


Before mounting the encoder, flatten the toothed washer to reduce its thickness. Use a hammer if needed. This washer will mount on the encoder shaft behind the front plate.

DDS – Control – Display Board

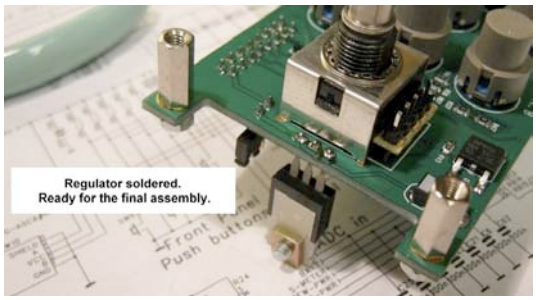
Front Plate mounting





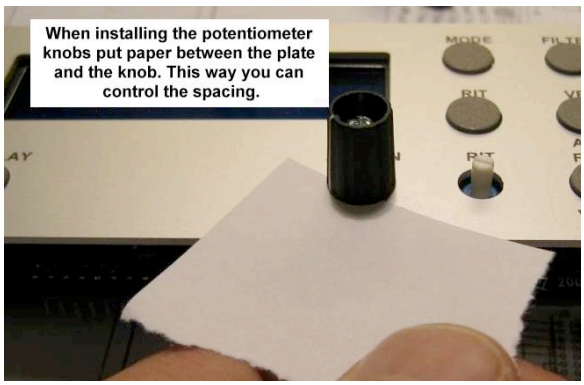
Mount the front plate and tighten the MIC connector to the plate. Also tighten the encoder-mounting nut. Before tightening the nut check the lock washer thickness that the encoder fits perfectly between the board and the front panel. When necessary uninstall the tooth washer and bang it slightly to a suitable thickness. Remember the flattened lock washer goes behind the front plate. Now you can solder the MIC connector and encoder.

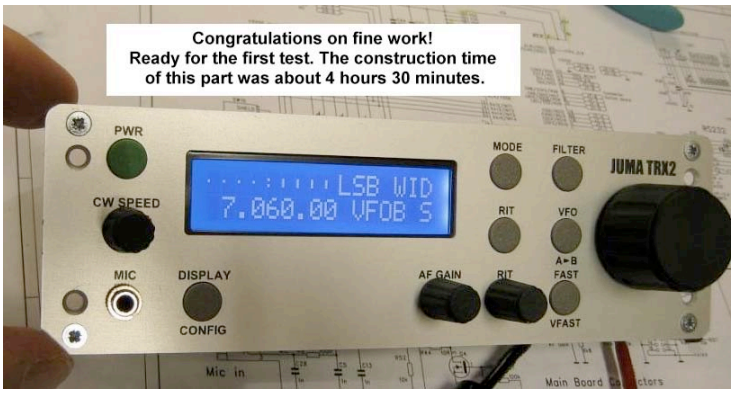
Regulator mounting



Prepare the power regulator for mounting as shown here bend the legs in a U shape. Solder as shown.

Knob mounting

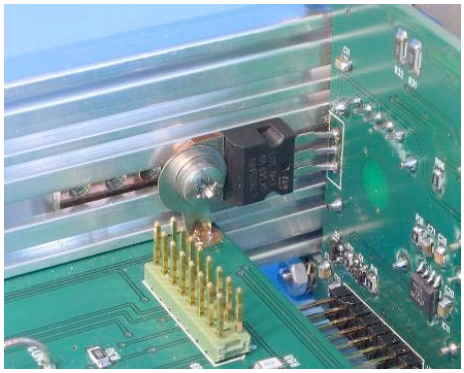




When installing the potentiometer knobs use a piece of paper between the plate and the knob.
This is an easy way to control spacing so the knobs rotate freely.

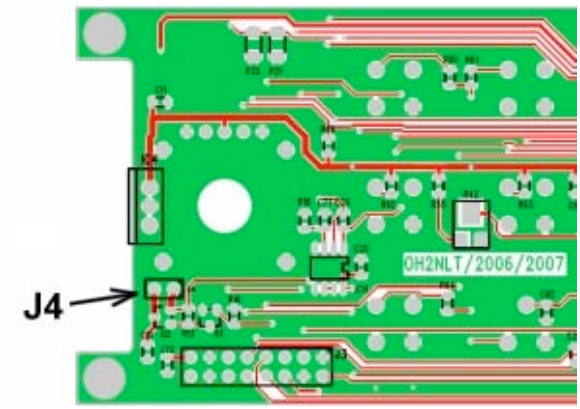
DDS – Control – Display Board

Regulator chassis mounting



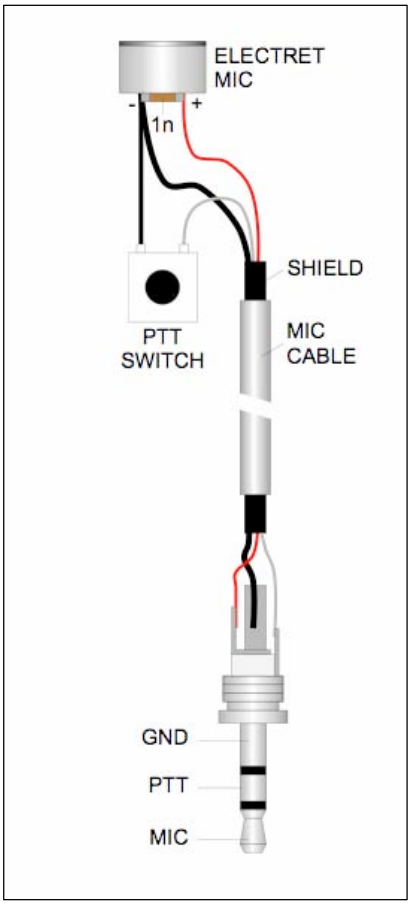
Audio Jumper position

If the Voice Memory option is not installed place a jumper into the pin header J8, use pins 1-2.



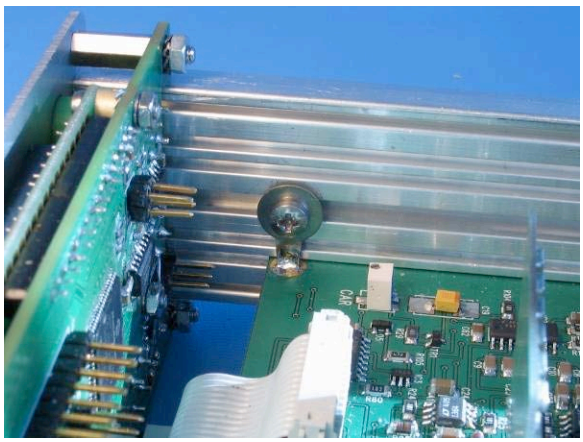
Do not install the jumper J4 for the normal use.
It is intended for the bootloader and test purposes.
If the jumper J4 is installed you can not switch OFF TRX2 with the PWR button.

Suggested MIC wiring

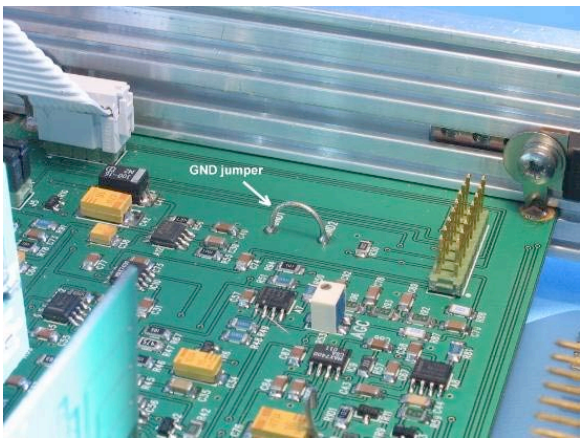


Main Board

There are a lot of parts to solder on the Main Board. You may prefer to begin with the ICs first to allow you more working room at the board surface, then proceed to resistors and caps and finish with the taller components. This board is not too densely populated which will make it easier to construct. Below are pictures of how you will mount the main board in the case. Note the crimp terminals are soldered to the board ground pads where holes are provided for them. Typically, the crimp terminals will fit nicely through the holes so they are just flush with the bottom of the pcb.



Mounting Main Board to side rails



Ground Jumper for test measurements

Tips:

A few things to which the builder must pay attention

Note in the picture (above on right) the DDS power regulator mounts to the Main board solder lug.

C22 and C23 are the larger 1206 size caps and positioned close together so use caution when installing so they do not short together.

Use caution when soldering the trimmer resistors at R26, R28 and R56. Do not use a hot air tool with these. The plastic bodies of these pots will not tolerate a stream of hot air from a rework station for long.

Always, keep the solder time short when installing the pin headers and sockets to avoid damaging their plastic.

Visual Inspection

Carefully inspect your work for any missed solder joints or solder bridges using a bright light under magnification. If all looks well proceed to the next board.

Filter Board

Construction of this board is not difficult and with fewer parts to solder. Proceed slowly and inspect your work as you go.

Tips
Here are some cautions for builders.

This board use **two** sets of 100n (0.1uF) capacitors which are different types. Don't mix them.
The parts bags are marked clearly but the builder may need to pay close attention to avoid mistakes.
C3, C5, C10, C12 are COG type and are physically thicker.
The second set is X7R type as the bag identifies them.
They are used for C16,C17, C18, C19, C20.

Polyphase Boards

These boards are also simple to construct and should not present problems.

Mount foam pads to top cover to secure Polyphase board.

Two Band PA Board

Solder the ICs first to allow you more working room at the board surface, then proceed to resistors and caps and finish with the taller components. There are two toroidal coils to wind for this board.

Both coils are 17 turn on T25-2 cores.
L3, L4 1uH, Core Amidon T25-2 (red) turns 0.4 mm enamel copper wire

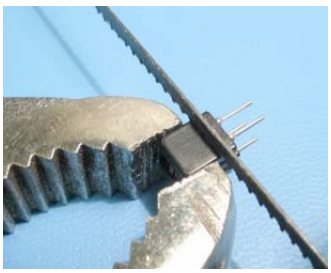
Additional instruction

1. Wind the coil

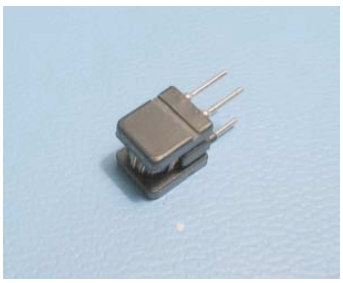
2. Presolder wires with a hot iron

3. Fold the wires for surface soldering

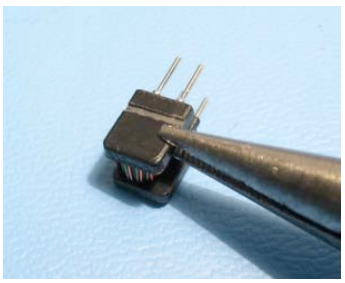
SWR transformer modification



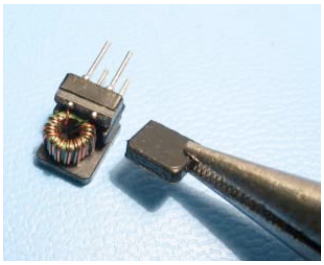
1. Saw or file slots on both sides



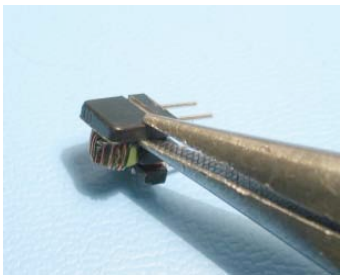
2. The slots are ready



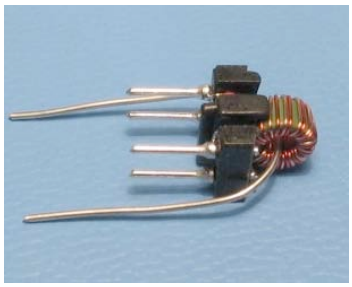
3. Break up the plastic wall off



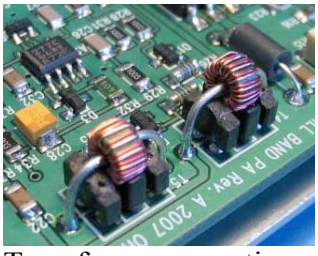
4. One plastic wall is now off



5. Break up the other plastic wall

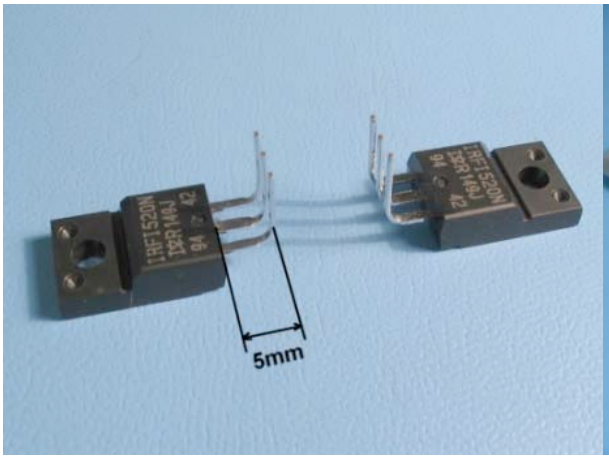


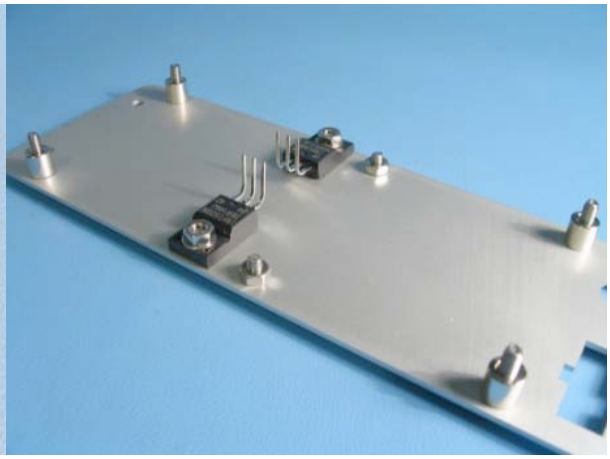
6.Thread wire through the toroid



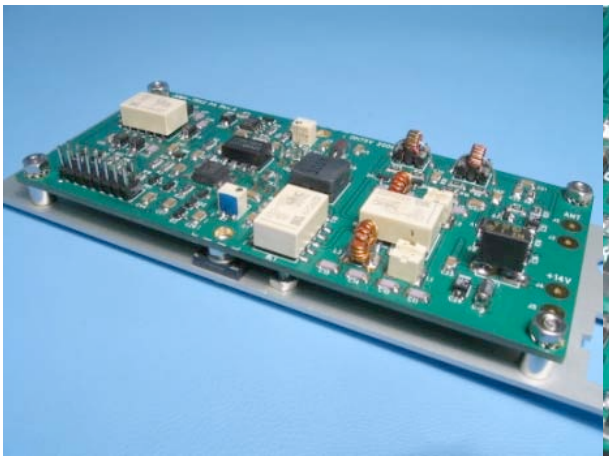
Transformer mounting

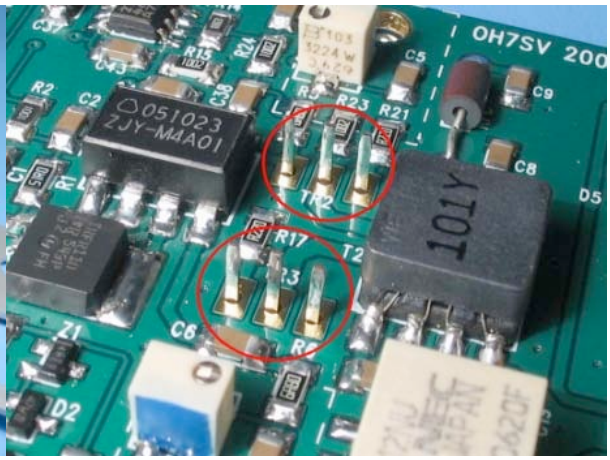
Two Band PA Mosfet Installation



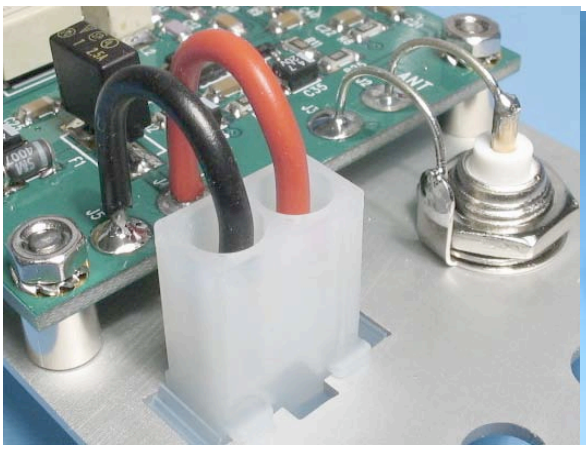


Bend legs as shown. Use a small screw driver shaft to help form the curved bends. Then mount the MOSFETs to the rear plate with the provided hardware as shown. The set of holes next to the MOSFETs (shown filled with screws and nuts) are for mounting the All Band PA MOSFETs and are not used here. Insert the provided screws and nuts to fill this hole.

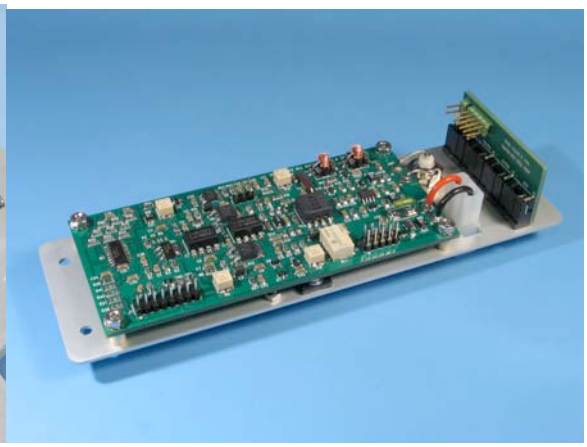




Attach the completed PA board to the rear panel and then solder the PA MOSFETs.



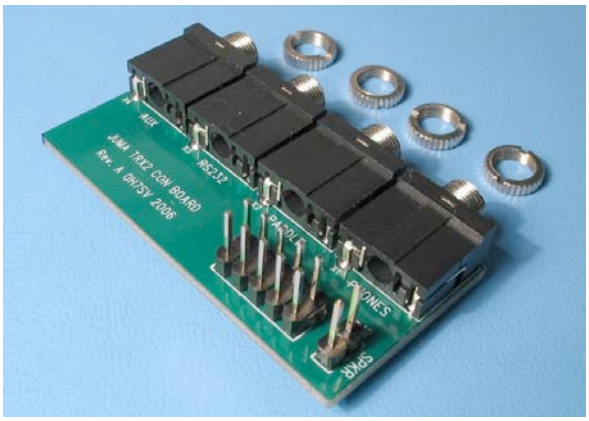
Solder the Power and RF wiring

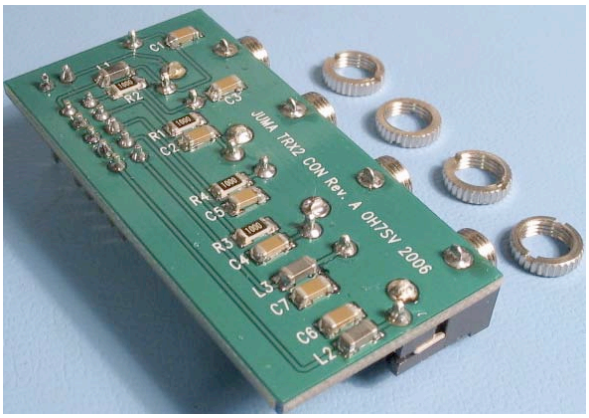


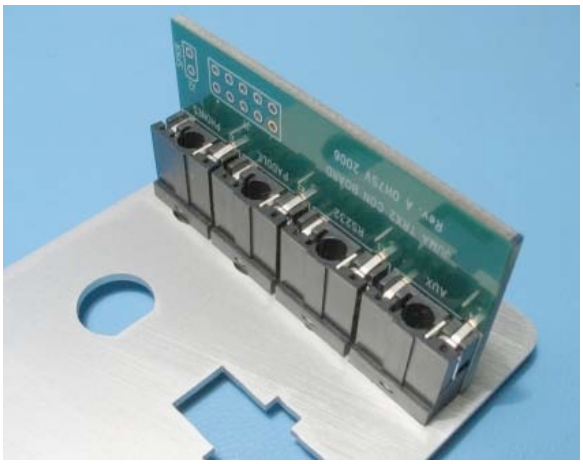
Completed Two Band PA and Connector board.

Connector Board

Fix the sockets to the rear panel before soldering to align with the plate.

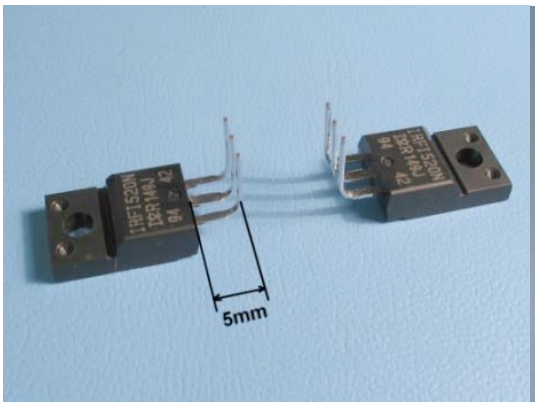


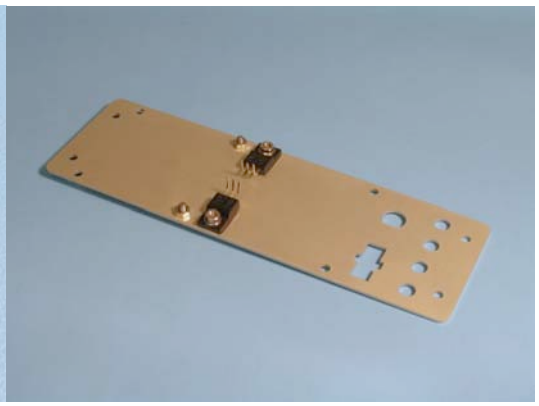




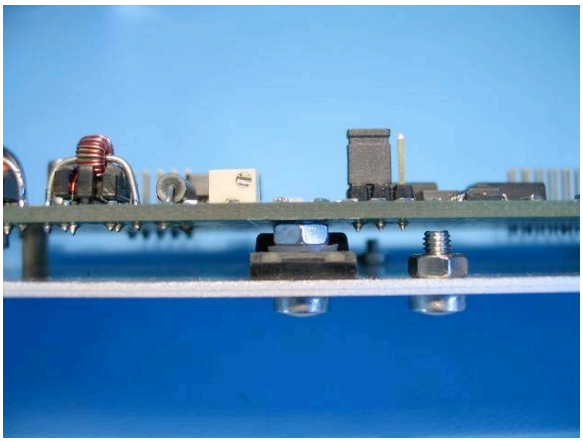
All Band PA Board

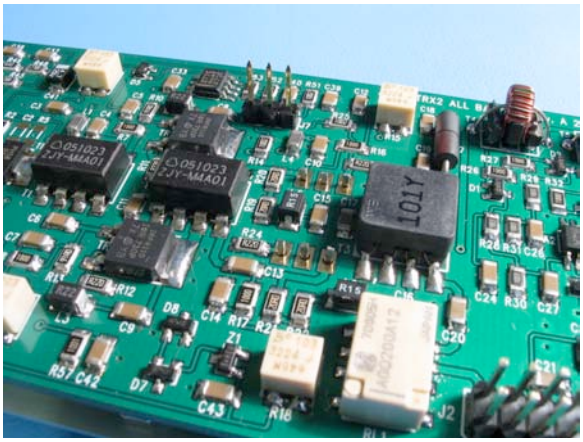
Construction is similar to the Two Band PA Board. Solder the ICs first to allow you more working room at the board surface, then proceed to resistors and caps and finish with the taller components.



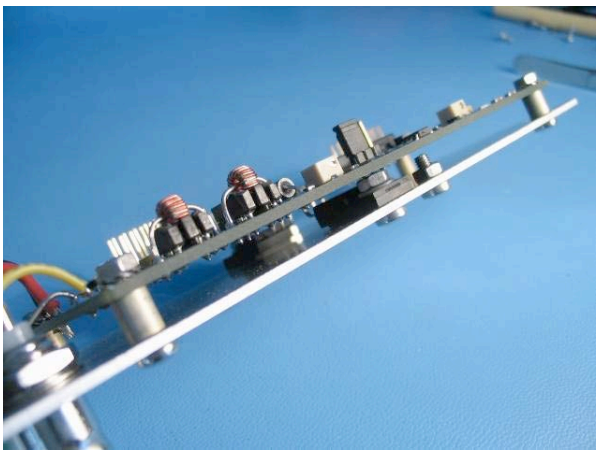


Bend legs as shown. Use a small screw driver shaft to help form the curved bends. Then mount the MOSFETs to the rear plate with the provided hardware as shown. The set of holes next to the MOSFETs (shown filled with screws and nuts) are for mounting the Two Band PA MOSFETs and are not used here. Insert the provided screw and nut to fill this hole.

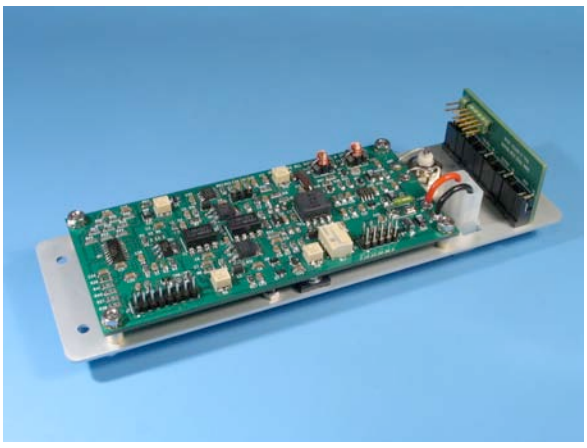




Mount the board to the rear panel and solder the MOSFETs PA.



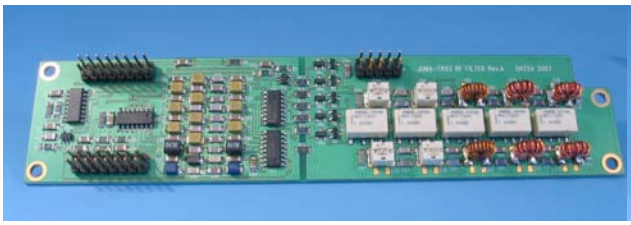
Another view of PA FET mounting.



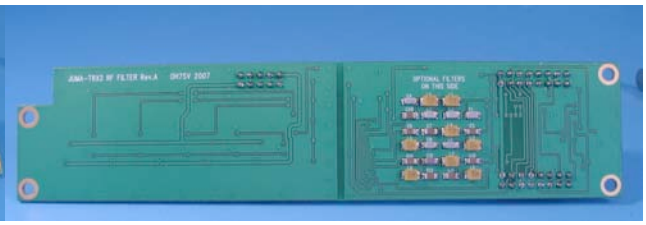
Completed All Band PA and Connector board..

RF Filter Board for All Bands

Solder the ICs first to allow you more working room at the board surface, then proceed to resistors and caps and finish with the taller components. Limit soldering time with the relays and use caution when soldering near them so not to melt their plastic casing. Solder only one pin of the pin headers, check for proper alignment then solder the remaining pins.



Front view of RF Filter Board



Rear view of RF Filter Board

There are six toroidal coils to be wind for the RF board, L28 – L33 on T25-2 cores.

L32 and L33

250nH, Core Amidon T25-2 (red)
9 turns 0.4 mm enamel copper wire

L30 and L31

500nH, Core Amidon T25-2 (red)
12 turns 0.4 mm enamel copper wire

L28 and L29

1uH, Core Amidon T25-2 (red)
17 turns 0.4 mm enamel copper wire

Additional instruction

1. Wind the coil (see details above)

2. Presolder the wires with a hot iron

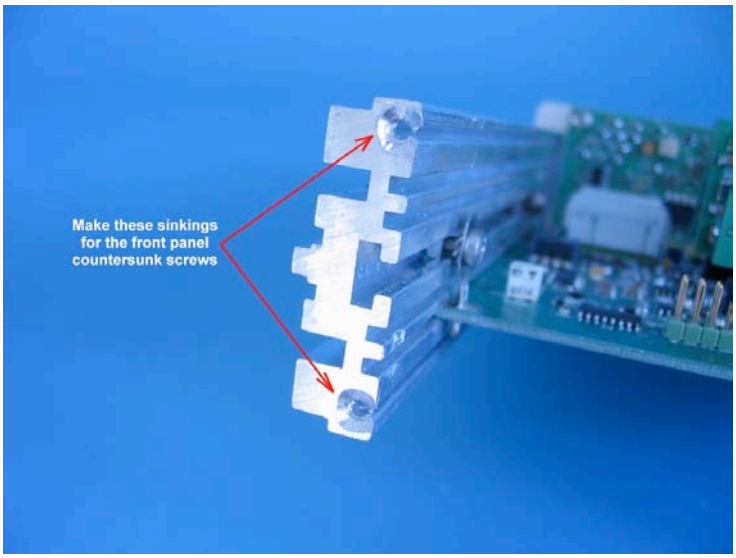
3. Fold the wires for surface soldering

Cabinet and Final Assembly

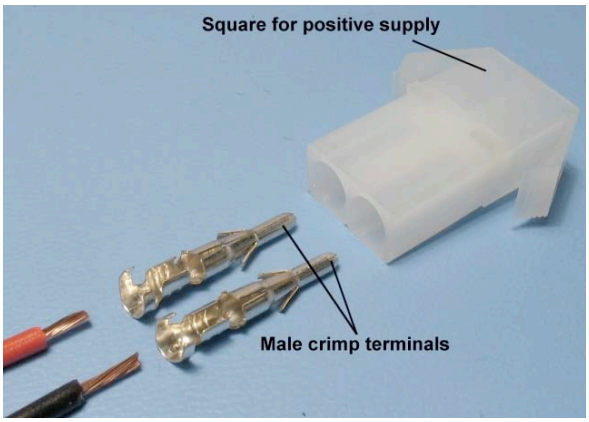
You may need to drill and countersink the necessary holes for the speaker including four (4) counter-sink holes for mounting the speaker. Refer to the Speaker Holes Drawing at end of Appendix D.

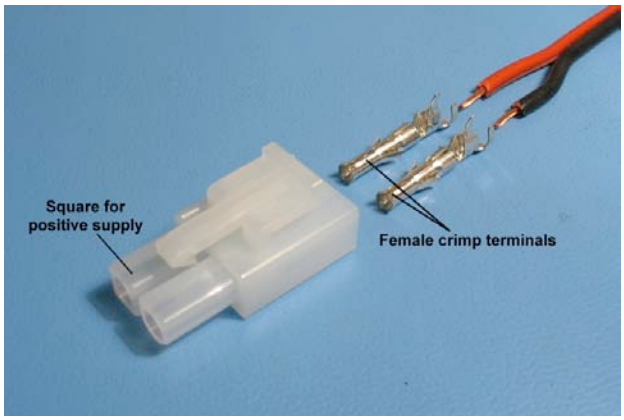
Tip: Proceed slow and careful when drilling the speaker holes to prevent scratching or chipping the top cover paint. A hand countersink tool can be use to finish the holes nicely.

You may need to drill countersink holes for the cabinet side rails for mounting the front panel which uses flat-head screws into countersunk holes.



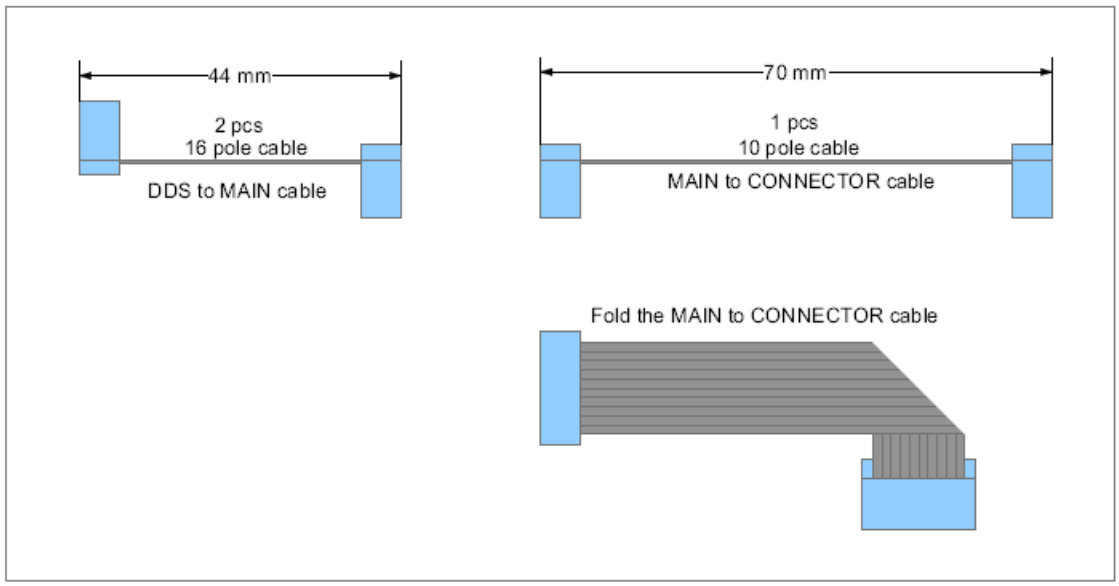
Crimp the power wire leads to terminals. Insert the terminals into the connectors until they lock in place. The red (positive) power wire/terminal goes into the “squared barrel” side of the connectors.



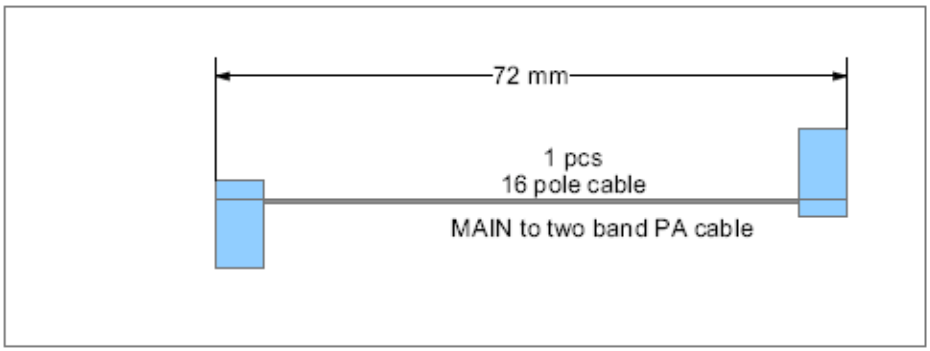


JUMA TRX2 Flat Cables with Dimensions 10-9-07

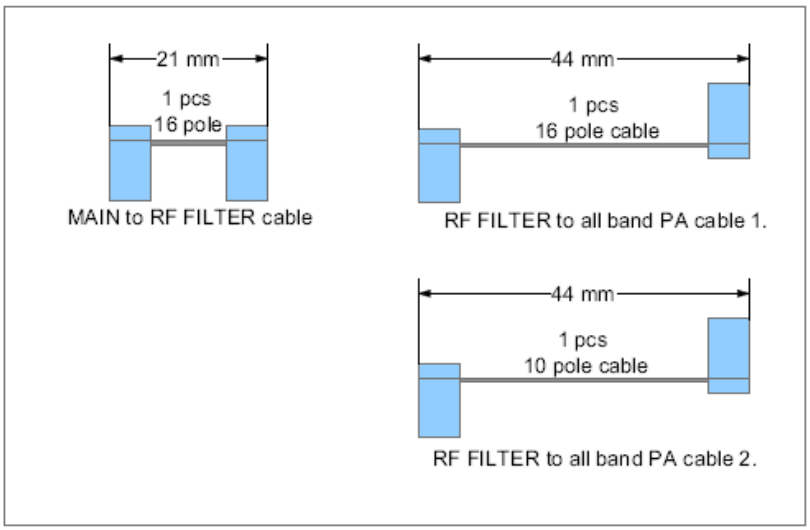
Measure and carefully cut ribbon cables to length before crimping the end connectors.
Note the position of the end connectors – some are on opposite sides of the cable.



The base flat cables for all Juma TRX2 models

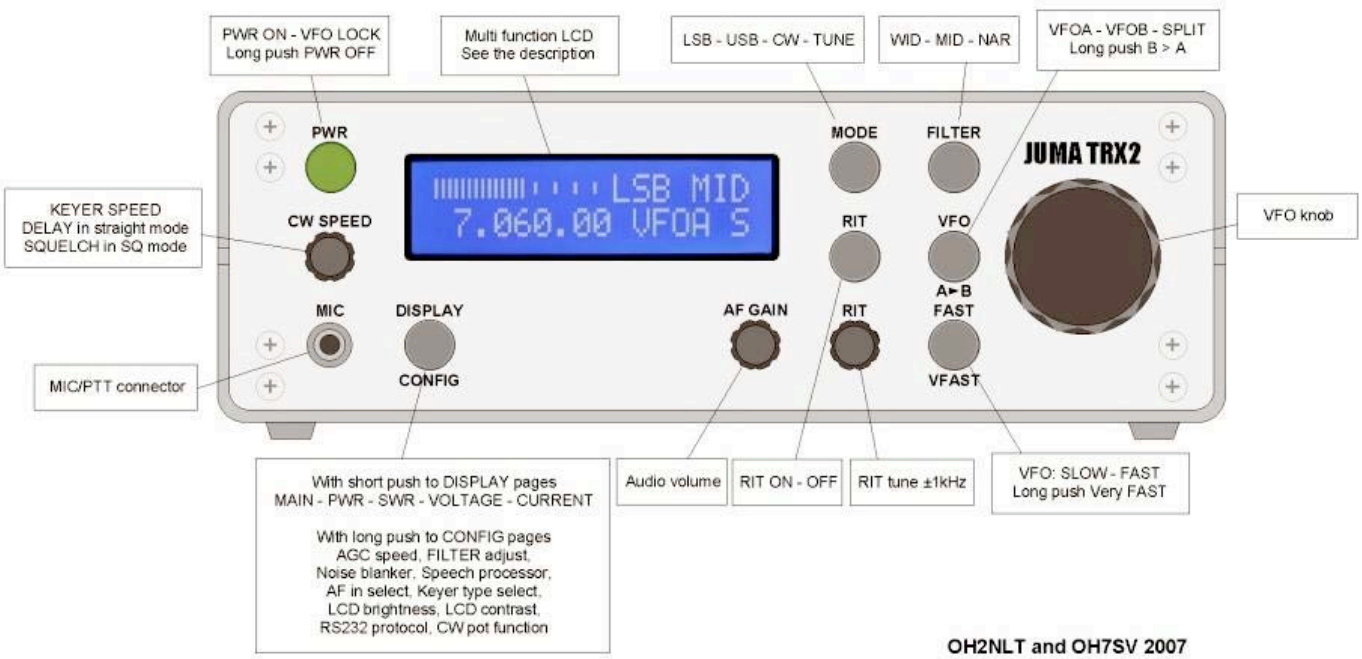


Two band cable – (note the connector positions)

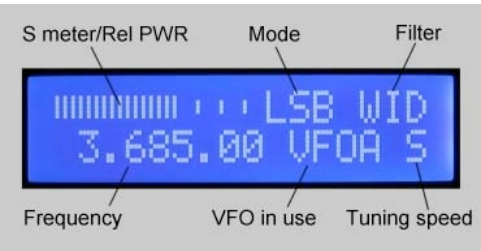


All band cables – (note the connector positions)

Operation



Main Display view



Shown here are some of the information the TRX2 LCD can display.

Middle Filter engaged in LSB mode

RIT engaged with Wide Filter

Narrow Filter engaged in CW mode

VFO B engaged in USB mode (notice no signal present)

Circuit Descriptions

JUMA-TRX2 DDS Control Board

General

Key functions of the JUMA-TRX2 DDS / Control board are:
- provide user interface functions with LCD display, buttons, and potentiometers
- generate user interface tones and CW side tone
- provide I/Q LO frequency to the JUMA-TRX2 main board
- provide clock frequency to main board SCAF filters
- measure analog input signals from main and PA board and
- read and process VFO encoder
- provide digital control signals for main and PA board control
- provide RS232 serial interface to external equipment
- provide CW keyer functions

Key components of the DDS / control board are dsPIC30F6014A microcontroller.
2*16 character LCD display, high resolution optical encoder, pushbutton switches, potentiometers, AD9851 DDS chip, 30MHz reference oscillator and RS232 driver chip.
These components and over 3000 lines of software code stored in dsPIC30F6014A
Flash memory form JUMA-TRX2 control unit.

Voltage regulator / power switch

Main operating voltage of the DDS / control board is +5VDC. The 5V is generated from the power feed (about +14VDC) with the linear regulator. The linear regulator's benefit is low noise emission. Less wanted characteristics are poor efficiency and high heat dissipation. In the JUMA-TRX2 the DDS board +5VDC regulator is mounted to the enclosure's aluminum frame to ensure maximum heat dispersion.
Power on is implemented with push button, FET switch and software. This combination enables us to use power switch button in multiple ways (see operating instructions). Software can detect the power switch push button state (PWR-SW signal). The push button also activates FET switch directly. This function is needed to get board power on and software running. When the software is running, the power FET switch is kept on with the power on digital output signal (PWR-ON). The power on signal is also connected to the main board to operate power switches there. When the user has decided to turn the JUMA-TRX2 off, software executes the power down tasks and then removes power on signal (PWR-ON).

LCD display

2 by16 character LCD module is used to implement the JUMA-TRX2 user interface display. A few special fonts are loaded into the LCD display's RAM character generator to allow graphic S-meter display. The LCD module power feed is filtered with a simple RC filter to reduce RF noise.
Contrast and backlight adjustment
The LCD module contrast voltage and LED backlight current are generated with a PWM type DAC. PWM DAC's are formed with software, dsPIC30F6014A PWM outputs and few other components; the RC filter and buffer amplifier (IC3A) for the contrast voltage and the RC filter and current generator (IC11A and Q3) for the LCD back light. Typical control voltage value is about 0,5V. Back light current can be adjusted from 0 to about 100mA. Normal value is between 20 to 50mA.

Push button switches

User interface push button switches SW1 to SW6 are connected to dsPIC30F6014A digital inputs. All of these inputs are kept high (1) with pull up resistors. When a switch is pressed input state goes low (0). The push button functions are defined in the software logic.

VFO encoder

High-resolution optical encoder is mounted to the DDS board. The main usage of this encoder is VFO tuning. The encoder is also used in various user interfaces configuration functions. The encoder generates two logic level signals, which are quadrature phased. Phasing allows software to detect the direction of rotation. Both encoder signals are connected to dsPIC30F6014A interrupt pins. Encoder processing is done in software with interrupts to get smooth and reliable operation even when encoder is rotated in high speed.

Analog inputs

Seven analog signals are measured with dsPIC30F6014A A/D converter. The A/D converters reference voltage is derived directly from AVDD +5V supply. The DDS board voltage regulator is a “generic” 7805 part. However, good quality parts should be used here to maintain analog measurement accuracy. The DDS boards +5V supply voltage should be 5V+/- 0,05V or better.
Signal descriptions

Potentiometer

Two front panel potentiometers (CW SPEED and RIT) are directly connected to dsPIC30F6014A analog inputs. With this arrangement software can read potentiometer positions in numeric format.

FWD-PWR and REW_PWR

The PA board contains SWR bridge, power peak detectors and a buffer amplifier. Amplifier outputs are scaled so that 10W are about 2,05V at analog input.

ID (drain current)

PA board contains measurement shunt resistors, power peak detectors and a buffer amplifier. Amplifier output is scaled to produce 1,21V/A at analog input.

S-METER

Main board audio AGC circuit generates S-meter voltage. S9 corresponds to about 1V at analog input.

BATT (JUMA-TRX2 power feed voltage)

This measurement is taken from DDS board power supply input with a voltage divider. 14V input generate 3,25V at analog input

Tone generator

User interface tones and CW side tone are generated with dsPIC30F6014A timer system.
Tone signal is delivered as a 5V-logic signal to main board where it is conditioned, filtered and summed to the audio chain.

SCAF filter clock generator

Switched capacitor (SCAF) filters are used in the JUMA-TRX2 RX and TX chains. The SCAF filter is a low pass filter which response is defined with filter clock frequency. Filter clocks are generated with dsPIC30F6014A timer system. See JUMA-TRX2 operating instructions for filter adjustments.

Digital control signals
Several digital control signals are read and generated by JUMA-TRX2 control software. Some of these signals are directly connected to dsPIC30F6014A general-purpose digital I/O pins. Additional digital siginal are generated locally in the main board and in the all-band model filter board. These digital outputs are controlled via the SPI bus.

Directly connected I/O signals

PTT in / out
From PPT_IN signal JUMA-TRX2 control software finds out when TX is on and performs needed operations. PTT_OUT signal enables software controlled TX. This is needed for CW keyer operation.

DASH / DOT
DASH and DOT are the key state inputs for keyer software. Inputs are sampled with 1ms interval.

KEY
Key output controls the CW modulator in the main board. CW keyer software and tune mode logic drives this signal.

SPI bus to main and PA boards
Four signals form the SPI bus. SPI_SDI, SPI_SDO, SPI_CLK and SPI_LATHC. SPI_SDI is not used. SPI signals are controlled by dsPIC30F6014A SPI I/O block and TRX2 control software. To minimize RF noise SPI bus is active only when a change is needed in the main or PA board outputs state.

Main board SPI bus controlled digital outputs
SSB/CW Select main board SSB or CW operating mode
SB-SELECT Select sideband LSB or USB
NAR Select SSB or CW band pass filter
FAST-AGC Select AGC speed
PROC-ON Select TX speech processor ON / OFF
NB Select noise blanker option ON / OFF
MIC/LINE Select Mic input signal level
7M Select 3,5 or 7 MHz RF filters in two-band PA board

All band Filter and PA board digital outputs
Output I/O register is located in the RF FILTER BOARD but two of the control signals are connected to the PA board.
B0, B1, B2 Three bit binary coded filter select. See filter board schematics for details
ATT-0, ATT-1 Two-bit binary coded RF attenuator control for the PA board,
See schematics for details.

DDS LO
The Analog Devices AD9851 DDS chip is used for LO frequency generation. The JUMA-TRX2 commutating mixer needs four different states (quadrants) per one LO cycle. AD9851 DDS digital output is 2 * LO frequency. AD9851 output and output complement signals are used to clock IC7A and IC7B flip-flops. Flip-flops are connected so that output is a quadrature signal (I/Q) for the RX and TX mixers. In the main board, analog switch IC8 is used to select the order of LO-A and LO-B signals going to the mixers. Order of the LO signals selects the desired sideband.

DDS LO (continued)

The AD9851 DDS chip is clocked with 30MHz reference oscillator. Reference clock frequency is multiplied by six to get the required 180MHz internal clock rate for the DDS chip. The DDS chip is controlled by the JUMA-TRX2 control software via the serial bus. For details see software source code and Analog Devices AD9851 data sheet. Analog Devices have also published very good application notes and DDS tutorials in their www pages.

30MHz Reference oscillator

A good quality crystal oscillator is needed for the 30MHz-reference frequency generation. Most important parameter is the phase noise of the oscillator. This is important because frequency and also errors are multiplied by a factor of 6 inside the DDS chip. Frequency accuracy is not so important because it can be corrected with the JUMA-TRX2 calibration setup. Good thermal stability is however required. There are two decals (places) in the DDS printed circuit board for 30MHz oscillators. One is for the surface mount version and another the through hole version. This makes easier to find good oscillator components. Of course only one is populated here. DsPIC30F6014A is also clocked with this reference oscillator. The current software version operates with a 30MHz clock. The 30MHz frequency is connected to the micro controller via 0R jumper R54. For future use there is the possibility to install a flip flop IC6 and get 7,5MHz external clock rate for the dsPIC30F6014A micro controller. This “low frequency” clock is needed if the dsPIC30F6014A internal PLL is used for clock frequency generation. With internal PLL , the 120MHz clock rate can be produced. This is needed if software performs heavy DSP operations.

Mic/line input

Microphone input is designed so that a electrete microphone can be directly connected into it. Microphone input can also accept other kinds of signal source. Input sensitivity level can be controlled with software. Microphone input is a 3,5mm stereo jack. The tip is the microphone and the Ring is the PTT signal.

RS232 interface

DsPIC30F6014A UARTs are buffered with RS232 transceiver IC10. UART #1 is connected via the main board and connector board to the JUMA-TRX2 back plane. This RS232 I/O can be used for PC/Terminal connection or for the JUMA External keyboard connection. See operation instructions and software source code for details. UART #2 is connected to pin header J1 and reserved for future use.

Option board connectors

Behind the DDS board there are connectors (pin headers) J5, J8 and J7. These connectors are for various option boards

Connector J5 provides access to microphone / line input circuit.

Connector J8 provides access to the audio out path. If no option board is installed there should be jumper between J8-1 and J8-2 connecting RX audio to AF gain potentiometer.

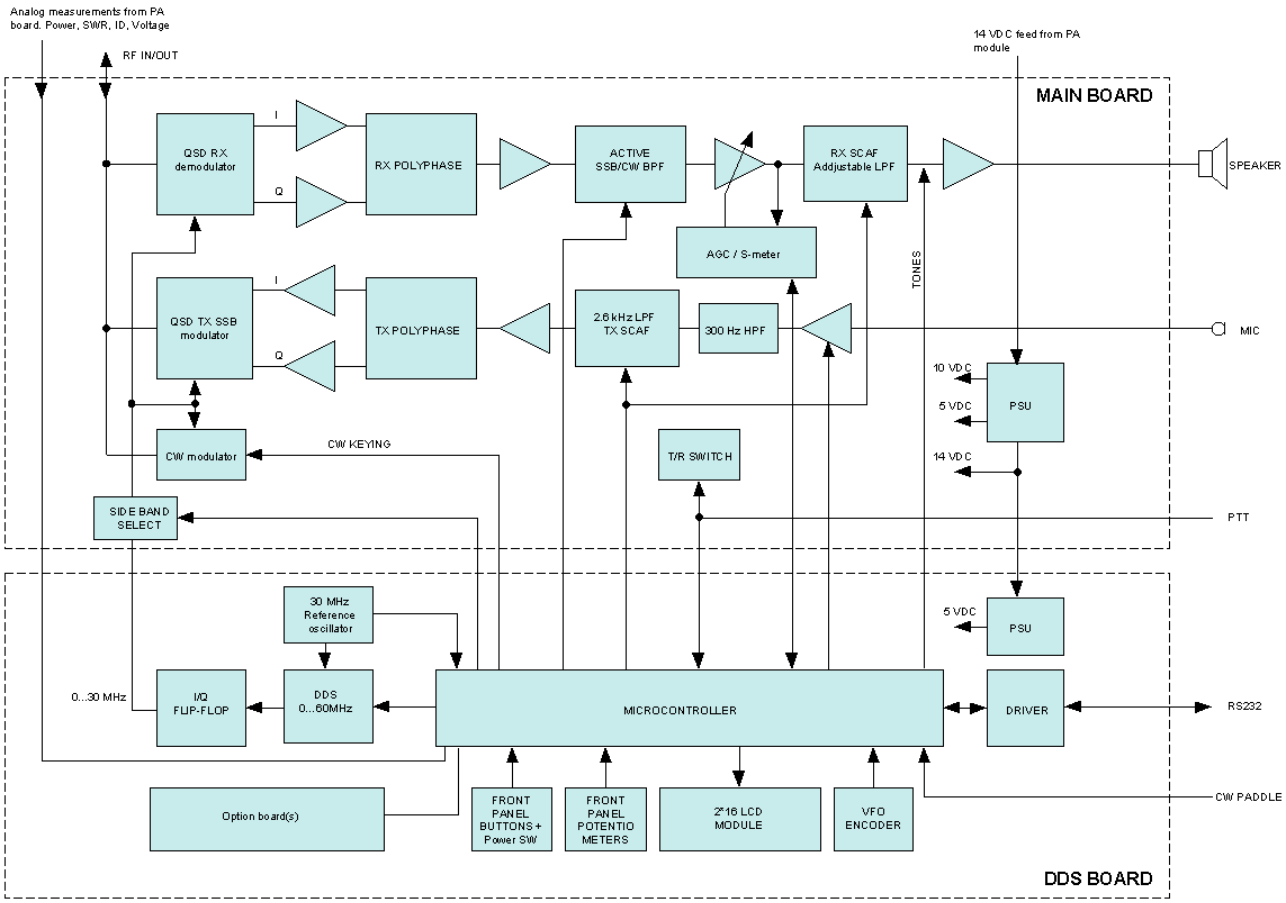
Connector J7 provides digital I/O control and supplies power to the option board. For future use the dsPIC30F6014A DCI interface (codec interface) is also wired to J7.

Connector J19 (ICD2 connector) is for the Microchip ICD2 debugger / programmer. ICD2 is needed if there is no on-board flasher available or if it is corrupted. See the Microchip www pages for details.

JUMA-TRX2 Main Board 11/25/07

General

JUMA TRX2 is using the quadrature sampling technique for demodulation and modulation with the low noise phasing method. The main board handles all the RF and AF exciter functions for reception and transmission.



Block diagram of the JUMA TRX2 exciter, the main board and the DDS board

RX section *(Refer to the main board schematics page 1)*
The antenna RF signal, without any RF amplification, goes directly to the wide band transformer T1 to achieve good dynamic range. The transformer T1 transforms the unbalanced 50 ohm antenna signal into the 200 ohm balanced signal. This signal is fed to the doubly balanced demodulator (RX mixer) IC1 which is a high speed, low ohmic analog multiplexer controlled by dual local oscillator signals which are shifted by 90 degrees. These local oscillator signals I and Q are coming from the DDS board. The demodulator IC1 is sampling the antenna signal into the four sampling capacitors C4, C5, C6, C7. The signals in these capacitors are in baseband frequency range i.e. < 15 kHz and all the capacitors have equal signal content, but the phase of these four signals are different, which are 0, 90, 180 and 270 degrees, called I and Q signals and their complement signals.

The I and Q signals are amplified in the differential preamplifiers A1 and A2. The gain of these preamplifiers are set precise to equal each other by using 0.1% feedback resistors R3 - R8. The preamplifiers are feeding the RX polyphase module which proportionally delays the Q signal by 90 degrees compared to the I signal. (Read more of the polyphase module in its own description). The signals after the polyphase is buffered and further amplified by the instrumentation type amplifier A3 and A4-A.

The output of the amplifier A4-A is demodulated SSB audio signal at the band width of 15 kHz. The signal is then filtered in the SSB/CW 1st filter module. This 1st filter has two band pass ranges, 300 Hz…2.5 kHz for SSB and 300 Hz…1kHz for CW. The width is selected by the pin 5 in the filter module. (Read more of the 1st filter module in its own description section).

After the 1st filter the signal is fed to the AGC circuit which consists of the variable gain amplifier A4-B, the full wave signal rectifier amplifier A6 and the AGC rise and fall timing components R44, R45, R46, R47, R67, C34 and C35. In the fast AGC mode the MOSFET TR6 is used to connect the resistor R67 in parallel with the timing circuit. The AGC control voltage which is coming from the timing components defines the resistance of the feedback FET TR4 and thus defining the gain of the AGC variable gain amplifier. Signal for the S meter is processed from the AGC control voltage by the DC amplifier A7. Nominal S meter output voltage is 1 V with a S9 (50uV) signal and 2 V with a S9+40 dB signal. The threshold of the AGC is defined by the trimmer resistor. The adjustment can be done by means of a 50uV (S9) antenna signal and by turning the trimmer R53 until the S meter reading is 1 V. S9 reading is in the middle in graphical LCD bar, marked with two dots.

The output audio level of the variable gain amplifier A4-B is regulated to the range of 5 mV…10 mV which is amplified by the post amplifier A5-A to a suitable 200 mV…500 mV level for the Switched Capacitor Filter (SCAF) IC10. The SCAF is a variable 8th-Order, Elliptic lowpass filter. The corner frequency is defined by the clock frequency coming from the CPU in the DDS board. Thus the final RX selectivity can be set by the user. The output from the SCAF is fed to the AF GAIN potentiometer located in the DDS board and fed back the speaker amplifier A12 in the main board.

The CW sidetone and the acknowledge tones coming from the DDS board are summed to the AF signal in the post amplifier by the resistor R52.

Additionally there are I/Q buffer amplifiers A13-A and A13-B for the I and Q signals at a bandwidth of ±15 kHz. This signal is available in the rear panel AUX connector by selecting corresponding AUX select jumper positions. The I/Q output can be used for a software demodulation by feeding the I/Q signals to a PC via a sound card input.

TX section *(Refer to the main board schematics page 2)*
The AF signal from the microphone is fed to the amplifier A8-A which acts also as user switch selectable speech processor. The mic input is designed for an electret type microphone with a direct two wire connection. The electret bias is fed by the resistors R62 and R61. If a dynamic microphone is preferred the bias should eliminated by adding a 470 nF capacitor in series with the dynamic microphone "hot" wire. The speech processor is using a soft clipping to form a logarithmic type of compressor. When the processor is engaged the high frequency pre-emphasis is magnified which will emphasize high tones to get a more penetrating SSB transmission. The mic input can be switched to the line signal level mode for e.g. digi-mode reception. The line signal level can be matched to the audio source e.g. sound card by changing the value of the resistor R82.

The audio signal from the mic amplifier is filtered by the highpass filter A8-B at 300 Hz and by the SCAF lowpass filter IC9 at 2.6 kHz. Then the signal is split into the differential signals by the amplifiers A9-A and A9-B. The gain of the SSB drive is adjusted by the trimmer resistor R26. Then the audio signal is the fed to the TX polyphase module which splits the signal in to the two phases I and Q and their complements. The I and Q signals are buffered by the TX driver amplifies A10 and A11. The gain of these TX drivers are set precisely to equal each other by using 0.1% feedback resistors R16, R17, R18, R21, R22, R23. The I and Q signals are fed to the SSB modulator IC2 (TX mixer) which is a high speed, low ohmic analog multiplexer controlled by dual local oscillator signals which are shifted by 90 degrees. The output of the modulator is SSB RF signal on the local oscillator frequency at the nominal level of 6 dBm (~4 mW)

The other half of the TX mixer IC2 is used for the CW modulator. It generates carrier on the local oscillator frequency. The carrier level is defined by the constant DC current generator TR1. The constant DC current level and thus the CW drive is defined by the trimmer resistor R28. The keying envelope is defined by the capacitor C19 with the reflected RF impedance of 100 ohms. Nominal rise/fall time is 5 ms. The CW rise and fall times can be customized by changing the value of the capacitor C19 if desired.

Control section *(Refer to the main board schematics page 3)*
The control section includes the power ON/OFF switch and the voltage regulators for 10 V and 5 V. The Power ON/OFF MOSFET switch TR7 is controlled by the DDS board via the MOSFET TR8. The rare 13.8 V (+V) is used directly for the speaker amplifier. The 10 volt from the low drop regulator REG2 is used for all the OPAMPS and the reference (midpoint 5 V) is made by the resistor divider R83 and R58 and filtered with the capacitor C76. The 5 volt from the regulator REG1 is used for all the logic circuits including the RX and TX demodulator muxers.

The functions of the main board are controlled by the shift register IC6. The functions are:

- Sideband selection
- 1st filter width
- AGC speed
- Speech processor ON/OFF
- Noise blanker ON/OFF (option board)
- AF input level (mic/line)
- 80 m / 40 m band selection in two band model (change point frequency 4 MHz)

The shift register is driven by the DDS board with the serial SPI bus including data, clock and latch signals. The clock signal is filtered with R95 and C91 and squared with the Schmitt trigger inverter IC7. The SPI signals with the cascade output are fed to the second shift register in the RF filter board for RF bandpass and PA lowpass filter selection. See more of the SPI principle in its own document

The analog muxer IC8 is used to swap the I and Q signals coming from the DDS board. The order of the I and Q signals defines the sideband (LSB or USB). The swapping is controlled by the shift register IC6 pin 1.

The quad NAND IC4 controls the transmit, receive and the mode of operation by using the PTT and sideband input signals.

The AUX selector jumper block defines the rear panel AUX connector signals. The alternatives are I/Q output or PTT in/KEY out, see schematics for the jumper positions. The PTT input can be used e.g. for a foot switch PTT. When the key input is grounded the rig switches to the TX state. The PTT signal is wired on the main board to the 5 volt via the 4k7 R71 and it requires 1 mA sink current to operate. The Key out can be used e.g. for a linear amplifier control. The key output is implement by the open drain MOSFET TR10 capable of sink max 0.1 A current at a max voltage of +50 V. Note, the key output can not be used in a negative voltage control.

The resistor and capacitor block marked "TONE LPF" is a passive lowpass filter for the sidetone and acknowledge tones coming from the DDS board. The resistors R87 and R88 keep the DC level in the middle during tone breaks to achieve a smooth audio tone output.

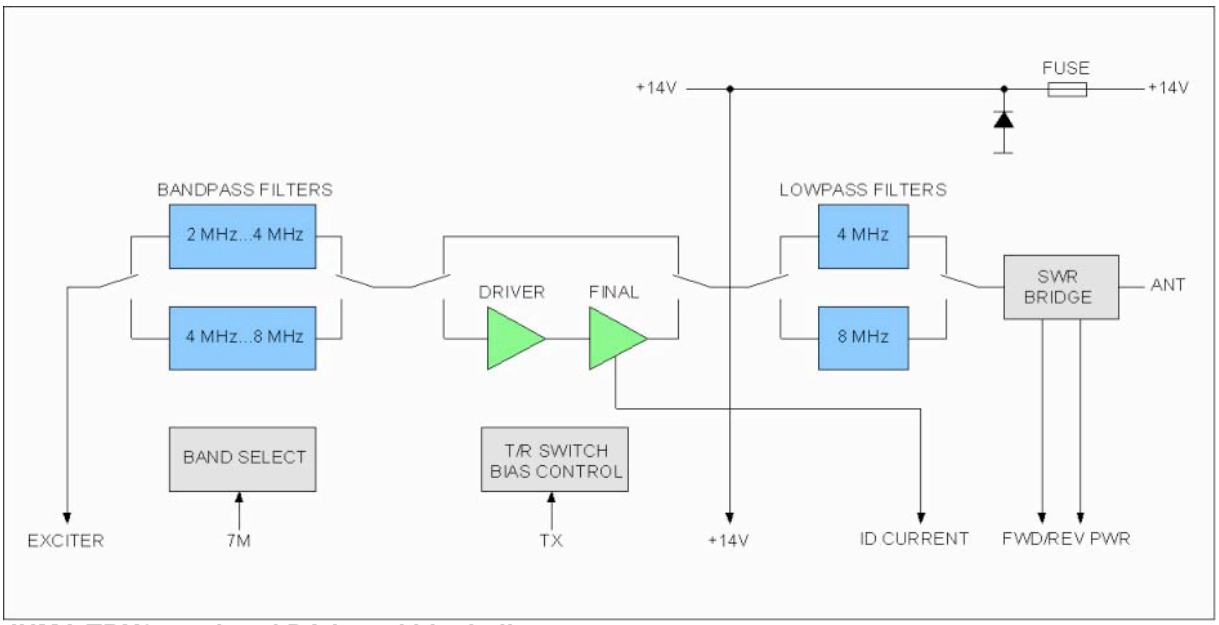
Adjustments

There are three trimmer resistors on the main board, the AGC threshold (R53), the SSB transmit gain (R26) and the CW carrier level (R28). See the instructions in the main board adjustment document.

Juma TRX-2 Two Band PA Board Description

General

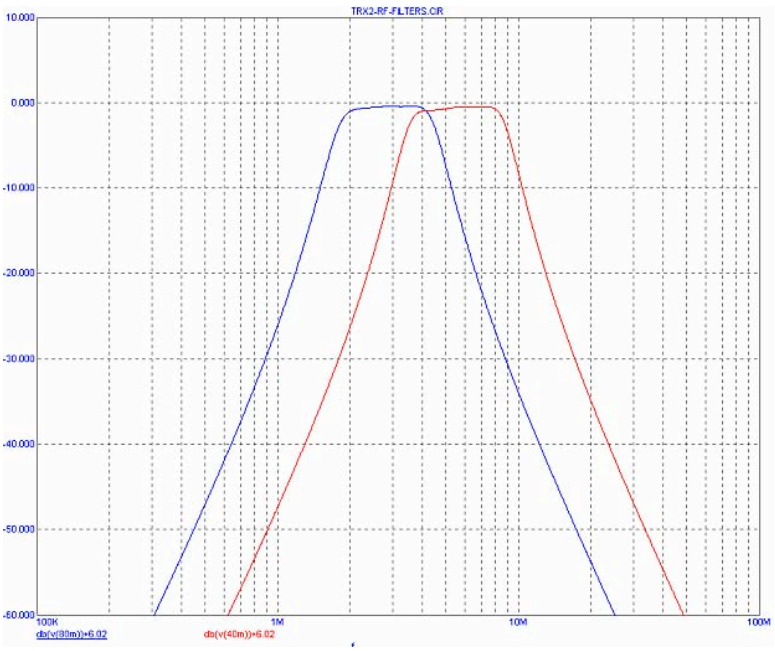
The JUMA TRX2 two band PA board is a 10 W linear amplifier for 80 m and 40 m ham bands. The board includes also the band pass RF filters, PA lowpass filters and SWR bridge.



JUMA TRX2 two band PA board block diagram

The bandpass filters

The band pass filters are used both in transmission and reception. The filters are implemented using SMD inductors and capacitors and switched by the SMD relay RL3. The band switching crossover frequency is 4 MHz and it is controlled with the MOSFET TR7 with "7M" signal coming from the DDS board. See the circuit diagram "BPF FILTERS".



Simulated response of the bandpass filters. Blue for 80 m, red for 40 m

The driver and the final amplifier

The input of the driver MOSFET TR1 is terminated with a 51 ohm resistor R1. The single ended driver operates in class A with the nominal bias current 130 mA which is regulated with NPN transistor TR6. The resistor R3 and the capacitor C3 in the source of the driver MOSFET are used to equalize the RF gain in both of the bands. The RF transformer T1 converts the driver output to the balanced signal which is feeding the final amplifier MOSFETs TR2 and TR3 in push-pull configuration. The nominal output power is 10 watts. The final stage bias current, nominal 100 mA per MOSFET, is adjusted by the trimmers R4 and R7. The resistors R17 and R21 in the sources of the final MOSFETs are used to sense the drain current. The voltage is across the sense resistor is proportional to the drain current. The sense voltage is amplified with the DC amplifier A2-A and fed to the AD converter in the DDS board, thus the drain current can be monitored with the LCD.

The lowpass filters

The final stage is followed by the lowpass filters for 80 m and 40 m. The corner frequencies are 4 MHz and 8 MHz correspondingly. These lowpass filters are also in the signal path during reception to provide additional filtering. The 80 m lowpass filters is implemented by using SMD inductors L1 and L2 and the 40 m filter is using two small iron powder toroids L3 and L4. The switching crossover frequency is 4 MHz.

The SWR bridge

The SWR bridge is between the lowpass filter and the antenna. The transformer T3 is sensing the output RF current and the transformer T4 is sensing the output RF voltage. These signals are combined and rectified for relative forward and reverse voltages. The DDS board calculates the forward RF power and the SWR which can be seen in LCD. The SWR indication is calculated and displayed regardless of the transmit mode, thus the SWR can be indicated also during SSB transmission.

T/R switching and the bias supply

The small MOSFETs TR4 and TR5 are driving the antenna relay RL1 and the bias supply. The bias supply voltage is regulated with the shunt regulator consisting of the reference diode Z1 and the diodes D2 and D3. The purpose of the diodes is to achieve a negative temperature compensation for the bias voltage.

DC supply input

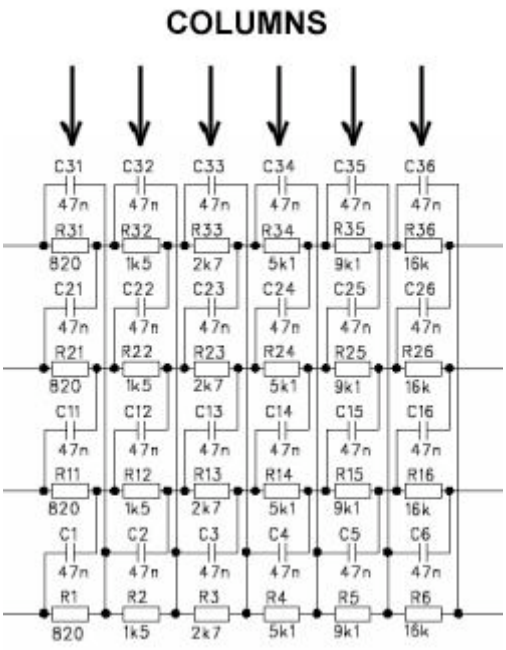
The DC supply for the TRX2 is coming via the PA board. The supply input is protected with the fuse F1 and with the diode D10 against over current and reverse polarity.

Adjustments

See the separate two band PA board adjustment instruction document; it includes **important notes** to avoid excessive MOSFET drain current and the fuse blow.

JUMA TRX2 Polyphase Board description

In the JUMA TRX2 there are two identical polyphase modules. Both of these plug-in modules are plugged into the main board. One module is in the RX section and the other is in the TX section. The purpose of the polyphase modules is to suppress the unwanted side band in the direct conversion method by means of phase shift. There are no adjustable parts. In the RX section the polyphase is fed by quadrature I - Q audio signals with the complement signals coming from the QSD muxer. The phases of these four fed signals are 0, 90, 180 and 270 degrees. The Q signal is delayed by 90 degrees from the I signal. After summing the signals the unwanted side band is in opposite 180 degree phase and thus suppressed. Correspondingly in the TX section the singe phase audio signal is split into the I - Q and the complement signals. These signals are fed to the commutating TX muxer which provides a SSB RF signal.

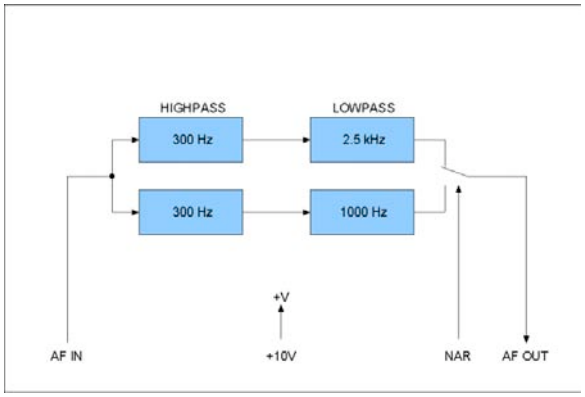


There are no adjustments to the polyphase module. The unwanted side band suppression is optimized for 300 Hz...3 kHz range by simulation. The absolute values of the components are not critical but the performance of the polyphase depends on the deviation of the components in each "column" within the circuit. The design is done so that when using the specified components the unwanted side band attenuation is very good (better than 50 dB). The deviation comes mainly from the capacitor, the resistors are the more accurate 1% type. The performance can be optimized, if desired, to a superb level (60 dB...70 dB) by screening close values of the components in each "column".

TRX-2 Filter Board Description

General

The JUMA TRX2 filter board is plug-in module on the main board. It is a low noise, wide dynamic range filter used as the 1st bandpass filter in the RX audio path. The gain is 0 dB. The total noise is 3 V rms and the maximum signal is 3 Vrms, thus the dynamic range is 120 dB. The filter board includes two filters, the wider for SSB and the narrow for the CW. The final selectivity in the JUMA TRX2 is defined by the post SCAF filter which is user adjustable.



JUMA TRX2 filter board block diagram

The circuit description (*See the filter board schematics)*

There are two similar circuits on the board, one for the wider filter and the other for the narrow filter. Only the component values are different in these two filters. The two filter inputs are driven in parallel and the output is selected by means of the analog muxer IC1. This selection is controlled by the "NAR" signal. The first filter stages (A1-A, A2-A) act as combined active highpass/lowpass filters and the next stages (A1-B, A2-B) are additional active lowpass filters. The 6 dB rolloff frequencies are 300 Hz for the highpass and 1000 Hz/2700 Hz lowpass respectively.

JUMA-TRX2 Voice memory option OH2NLT 22.08.2007

Function
The voice memory option is a JUMA TRX2 plug in module which includes audio record and playback functions. It can record from the microphone or from the receiver. Playback can be sent to the band or to the local speaker.

Purpose
The voice memory option can be used to transmit pre recorded voice messages e.g. in contest operation or in other similar situations. Recorded voice from the receiver can be listened afterwards via local speaker or the message can be transmitted back to the air.

Record/playback control
The record, playback and transmit functions can be controlled by means of the JUMA TRX2-KB external keyboard option or by means of the Windows software (Compatibility Win 9x, 2k, XP or higher). The license for the OH7SV Windows software is granted when purchasing the voice memory option kit.

Memory capacity
10 memory banks. Banks 1…9: Capacity 10 seconds each. Bank 10: Capacity 120 seconds.

General
Voice Memory option for the JUMA-TRX2 is an add-on board. The board can be attached behind the JUMA-TRX DDS/control board. The key component of the voice memory board is the ISD17240 voice recorder chip. Detailed description of the ISD17240 chip and its operation can be found from ISD17240 data sheet and application notes found at URL: http://www.winbondusa.com/en/content/view/160/290/
In the control software ISD17240 memory is divided into 10 sections. One is about 120s long and others are shorter, about 11s each. Control functions for al the memories are the same. In this application ISD17240 chip is clocked for 8kHz audio sample rate. The 8kHz sample rate is more than adequate for high quality SSB voice storage.

Operation
The JUMA-TRX2 voice memory board is powered from DDS board 5V regulated power supply. The key component of the voice memory board is Winbond ISD17240 voice recorder chip. The JUMA-TRX2 dsPIC30F6014A controller via the SPI bus controls the ISD17240 chip. Other components are CMOS switch and an operation amplifier. With these components and an internal ISD17240 features al required audio paths can be formed. In normal operation The JUMA-TRX2 RX audio is routed through ISD17240 chip to audio amplifier. ISD17240 internal microphone amplifier is connected in parallel with JUMA-TRX2 microphone input to allow recording from the microphone. Op amp and a CMOS switch is used to connect the JUMA-TRX 2 RX signal to the JUMA-TRX2 microphone input and override the microphone signal for RX recording. The same audio path is also used to TX selected memory location (play to the band). ISD17240 internal switches are used to break the audio path and play selected memory content to the JUMA-TRX2 speaker. The JUMA-TRX2 voice memory board also contains one led for debug purposes. Led LD1 shows which command ISD17240 has received and is executing. This indication is useful information in case of troubleshooting.

Commands
See JUMA-TRX2 control software documentation for available control commands.

JUMA KB1 External Keyboard description OH2NLT 17.01.2008

General
JUMA-KB1 is a device intended to use with JUMA-TRX2 voice memory option. Keyboard hardware is not limited to be used only with JUMA-TRX2 or control JUMA-TRX2 voice memory option. JUMA-KB1 operation depends on software loaded in to the keyboard microcontroller.

Operation
The circuit is designed to consume so little power that whole keyboard can be powered from serial (RS232) interface receive signal. Receive signal idle state is about –9VDC and active state about +9VDC. KB1 power supply is designed to utilize both polarity input voltages and produce about 4,5VDC regulated operating voltage for the microcontroller. Microcontroller is a low power PIC16F628A clocked with 1,832MHz clock. Microcontroller consumes about 700uA and rest of the circuit about the same amount of current. Please see circuit diagram for details.

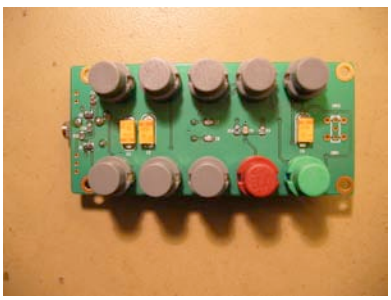
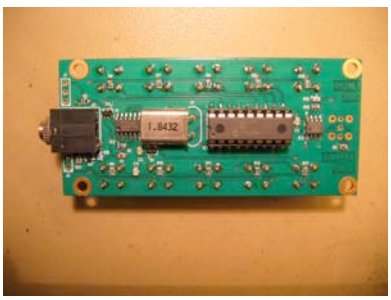
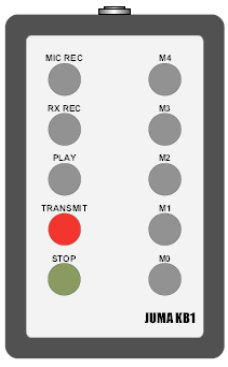
Software v1.01 for JUMA-TRX2 voice memory control
10 buttons + Shift are functional with this software version. Populating the shift button (SW11) is optional. Five left side buttons transmits JUMA-TRX2 voice memory commands. Five right side buttons transmits numbers from 0 to 4. If shift button (SW11) is installed and pressed right side buttons transmit numbers from 5 to 9. With external keyboard you can give all JUMA-TRX2 voice memory commands except E (erase all) command. Software source code is also available if you want to learn more about JUMA External Keyboard operation or modify it for your own needs.

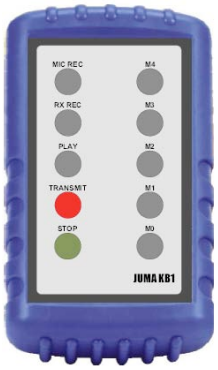
JUMA-KB1 Button functions

M	mic rec	4,	9 w shift
R	RX rec	3,	8 w shift
P	play message	2,	7 w shift
T	TX message	1,	6 w shift
S	Stop	0,	5 w shift

Please see voice memory documentation for voice memory operation.

The KB1 option is new and just being released. Here are some photos of the KB1 board and drawings of how it might look when completed. (See parts list for parts supplied)



Adjustments

JUMA-TRX2 DDS / Control Board Adjustments

I/Q phase balance trimmer
With trimmer R42 in the DDS board I/Q phase balance can be fine adjusted. I/Q phase balance has direct influence to the unwanted sideband rejection. Theoretically digital signals driving the mixer switch should be phased 90 degrees off each other. Order of I and Q signals (which is leading) selects LSB or USB. This switching is done in the main board. Practical circuits are not perfect and require I/O phase balance fine tuning to get the best possible unwanted sideband attenuation.

I/Q phase balance adjustment is simple:
Select your favorite operating band and feed a S9 (50uV) CW signal to the antenna connector. Switch to the other sideband. The signal should disappear. Adjust R42 to find minimum value. You may perform this check / adjustment also with other frequencies (bands). Adjustment is not exactly the same for all frequencies and you may have to compromise for which best suits your listening needs. I/Q balance also affects TX unwanted sideband rejection. It is enough to do this adjustment with the RX but if you wish you can check TX sideband rejection with a dummy load and another receiver.

Software adjustments (calibrations)
There are several adjustments or calibrations done in the DDS board control software. Calibration values are stored in the dsPIC30F6014A microcontroller non volatile memory (EEPROM). In the very first startup when the EEPROM memory is ”empty” default values are written to the EEPROM. These default values are so close that you can operate the JUMA-TRX2 without doing any calibration adjustments.

If you like to fine tune your JUMA-TRX2 continue reading.
Calibration adjustments possible:
Set reference oscillator frequency
Power supply voltage meter
Indicator tones (Beep) length
S-meter scaling
FWD Power meter scaling
Drain current (ID) meter scaling
Return to the ”factory default” values

Selecting Service Mode (do the calibrations)
When powering on the JUMA-TRX2 keep the PWR button pressed until you see the text **Service Mode** on the LCD display. Release the button. Now you are in the Service Mode. With the DISPLAY button you can walk through calibration menus. With the **FAST** button you can save calibration values and exit to normal operating mode. If you want to leave Service Mode without saving do a normal Power Off with the **PWR** button.

Set reference oscillator frequency
When doing this calibration the JUMA-TRX2 should be in its normal operating temperature.
Method 1.
Measure the 30MHz reference oscillator output with a precision frequency counter. Multiply the result by six (AD9851 internal clock) and dial this value in with the VFO knob. For example: If you measure 29.999.850Hz multiply this with 6 = 179.999.100Hz and dial this value in. Default value is 180.000.000Hz

Power supply voltage meter

Measure the JUMA-TRX2 supply voltage with an accurate DVM. With the VFO knob adjust the voltage reading on the LCD display as close to the DVM reading as possible. The Calibration value is also shown on the LCD display. Default Cal Mult (calibration multiplier) value is 132.

Example display on JUMA-TRX2:
Supply = 13.82
Cal mult = 132

Indicator tones (Beep) length

You can adjust the JUMA-TRX2 user interface indicator tone length. The long beep is always ten times longer than short. If you dial in 0 (zero) no tones are played. Maximum value is 100ms. Default value is 50ms.

S-meter scaling

S-meter adjustment is a iterative process where main board AGC threshold trimmer R53 and S-meter scaling values are adjusted to get correct and accurate S-meter reading. Please see main board adjustment procedure for details. If necessary you can check DDS S-meter board operation by applying 1VDC voltage to J3-pin8. S-meter should read S9 with this voltage. When this adjustment is done correctly your JUMA-TRX2 S-meter shows true S-units and decibels.

FWD Power meter scaling

With this adjustment you can fine tune the JUMA-TRX2 output power display to show actual RF power output. Connect accurate watt meter and dummy load to your JUMA-TRX2. Select first TUNE mode and then PWR meter display. Push PTT and read the JUMA-TRX2 display and the external Watt meter.
Example:
External meter reads 9W and the JUMA meter reads 8W and the calibration value is 23.
Divide 9/8 = 1,125 and correct the calibration value with this value.
The new calibration value is 23 * 1,125 = 25,875.
Go back into the Service Mode and dial in the new calibration value 26.
Save this and recheck the readings.

Drain current (ID) meter scaling

This adjustment is not necessary but if you like to check and calibrate your JUMA-TRX2 PA ID current display do the following: First go to normal operating TUNE mode and then select ID current display. Push PTT, read the JUMA-TRX2 ID current display and with a DVM measure the voltage across drain resistors R17, R21 (two band model) or resistor 23, 24 (all band model) on the PA board. All band PA board jumper J7 should be in the PA position. Calculate the actual drain current from the voltage = U / R. If you measured 0,209v divide it with the R17or R21 value. 0,209V / 0,11R = 1,9A. Go to the Service Mode again and, if necessary, correct the ID scaling Cal mult (calibration multiplier) value. This value is used to scale the voltage over drain resistors to drain current. This procedure is the same as in the power meter scaling. See also the PA board tuning instructions and particularly the bias current adjustments.

Return to the ”factory default” values

In case you want to return to ”factory default” values, select on the LCD display: Push
FAST long = Factory defaults. Press the FAST button for about five seconds (a long press).

JUMA TRX2 Main Board Adjustments Last update 2007-

Initially check the voltages on the main board with multimeter at a suitable DC voltage range. Connect the negative test lead to the GND jumper located on the main board.

1. Measure the supply voltage at capacitor C65. Nominal 13.8 V. Allowable variation is 12 V...15 V.
2. Measure the nominal 5 V regulator voltage at capacitor C63. Allowable variation is 4.8 V...5.2 V.
3. Measure the nominal 10 V regulator voltage at capacitor C64. Allowable variation is 9.5 V...10.5 V.

There are three adjustable trimmer resistors on the main board.

AGC threshold (trimmer R53 marked **AGC** on the board)

This adjustment sets the RX AGC operating point and the S-meter reading.
Initially listen the RX noise without an antenna and turn the trimmer to the point where the noise begins to attenuate. Fine adjustment is done by feeding a RF signal at S9 level (50 uV rms or -73 dBm) to the antenna connector with a RF signal generator. Listen to the carrier at approx 1 kHz pitch and turn the AGC trimmer so that the graphical S-meter reading in LCD indicates S9 (two dots in the middle of the S-meter bar). If a signal generator is not available the fine adjustment can be done by listening to a suitable signal on a band and comparing the S-meter reading to another RX.

Graphical S-meter reading S9

Notes for the Carrier gain and the SSB gain adjustments
Note 1. The PA board bias currents must be adjusted before these adjustments
Note 2. Connect a 50 ohm dummy load to the antenna connector
Note 3. The simple dummy load made by the resistors included in the kit can stand 10 W only 1 minute

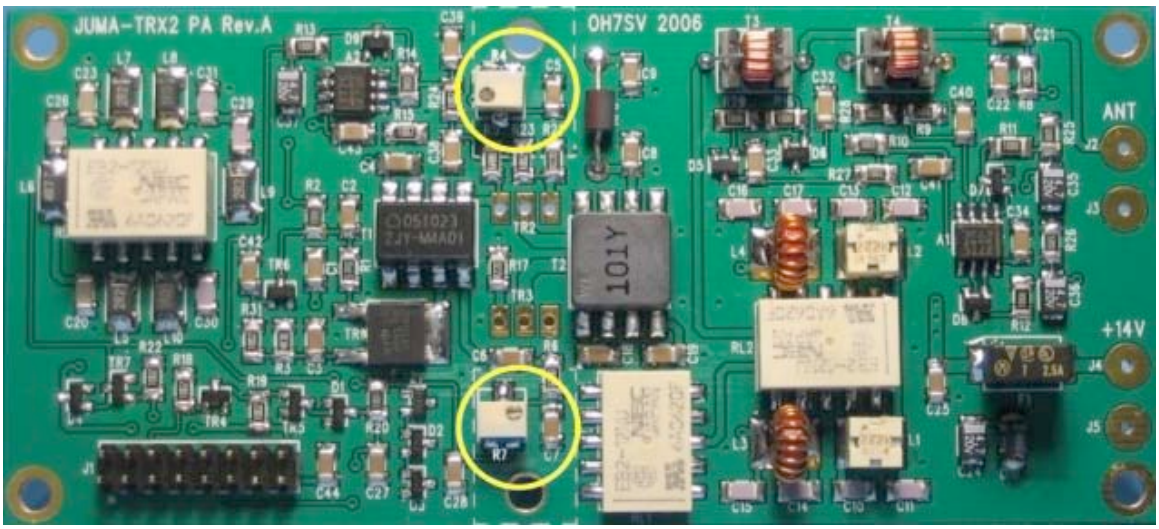
Carrier gain (trimmer R28 marked **CAR** on the board)
This adjustment sets the CW output power
1. Select Tune mode by pushing the MODE button
2. Select power output display (PWR--.-W) by pushing the DISPLAY button
3. Press the mic PTT to transmit carrier
4. Turn the CAR trimmer until the RF output power reading indicates 10 W ± 1 W

SSB gain (trimmer R26 marked **SSB** on the board)
This adjustment sets the SSB output power
1. Select LSB or USB mode by pushing the MODE button
2. Select power output display (PWR--.-W) by pushing the DISPLAY button
3. Press the mic PTT and vocalize aaaaaa... at a distance of 1 inch from the microphone
4. Turn the SSB trimmer until the RF output power reading indicates 10 W ±1 W

Power output reading 10 watts

JUMA TRX2 Two Band PA Board Adjustments (two band model) Last update 2007-10-14 OH7SV

There are two adjustable trimmer resistors (R4 and R7) on the two band PA board.
All the measurements during the adjustment is done by using the LCD current display
These trimmers define the bias current of the power amplifier MOSFETs.
The bias current is 0.10 A per MOSFET, totally 0.20 A.
Important notes before the adjustments, to avoid excessive MOSFET drain current and the fuse blow
- Keep the supply power OFF
- Initially turn the trimmers R4 and R7 fully counter-clockwise for zero bias
- Double-check the zero bias by measuring the resistance across C5 and C7 the reading should be below 10 ohms.



Bias adjustments trimmers (R4 and R7)
Note. The trimmers are multi-turn models. When turning the trimmers the bias current is not increasing in the beginning. Continue turning until you see an increase of the reading and then fine tune the bias current. Typical trimmer position is approximately in the middle.
1. Switch ON the power (Current limited power supply recommended)
2. Select CW mode by pushing the MODE button
3. Select Drain Current display (ID -.--A) by pushing the DISPLAY button
4. Press the mic PTT to activate the PA bias current
5. Turn the trimmer R4 clockwise until the LCD ID reading indicates 0.10 A ± 0.02 A
6. Turn the trimmer R7clockwise until the LCD ID reading indicates 0.20 A ± 0.02 A

The bias current reading 0.20 A after the adjustment

JUMA TRX2 All Band PA Board Adjustments Last update 2008-01-12 OH7SV

There are four adjustable trimmer resistors (R6, R9, R15, R18) on the all band PA board.
These trimmers define the bias current of the driver and power amplifier MOSFETs.
All the measurements during the adjustment is done by using the LCD current display.
The driver stage bias current is 2 x 0.03 A = totally 0.06A and the final stage bias current is 2 x 0.10 A = totally 0.20 A

Important notes before the adjustments, to avoid excessive MOSFET drain current and the fuse blow
- Keep the supply power **OFF**
- Initially turn the trimmers R6, R9, R15, and R18 fully counter-clockwise for zero bias
- Double-check the zero bias by measuring the resistance across C5, C7, C12, and C14, the reading should be below 10 ohms.

Driver stage bias current adjustment See the picture (next page)
Note. The trimmers are multiturn models. When turning the trimmers the bias current is not increasing in the beginning. Continue turning until you see an increase of the reading and then fine tune the bias current. Typical trimmer position is approximately in the middle.

1. Set the drain current selector jumper J7 (shown next page) on the board in to the DRV position
2. Switch ON the power (Current limited power supply recommended)
3. Select CW mode by pushing the MODE button
4. Select Drain Current display (ID -.--A) by pushing the DISPLAY button
5. Press the mic PTT to activate the bias current
6. Turn the trimmer R6 clockwise until the LCD ID reading indicates 0.03 A ± 0.01 A
7. Turn the trimmer R9 clockwise until the LCD ID reading indicates 0.06 A ± 0.01 A

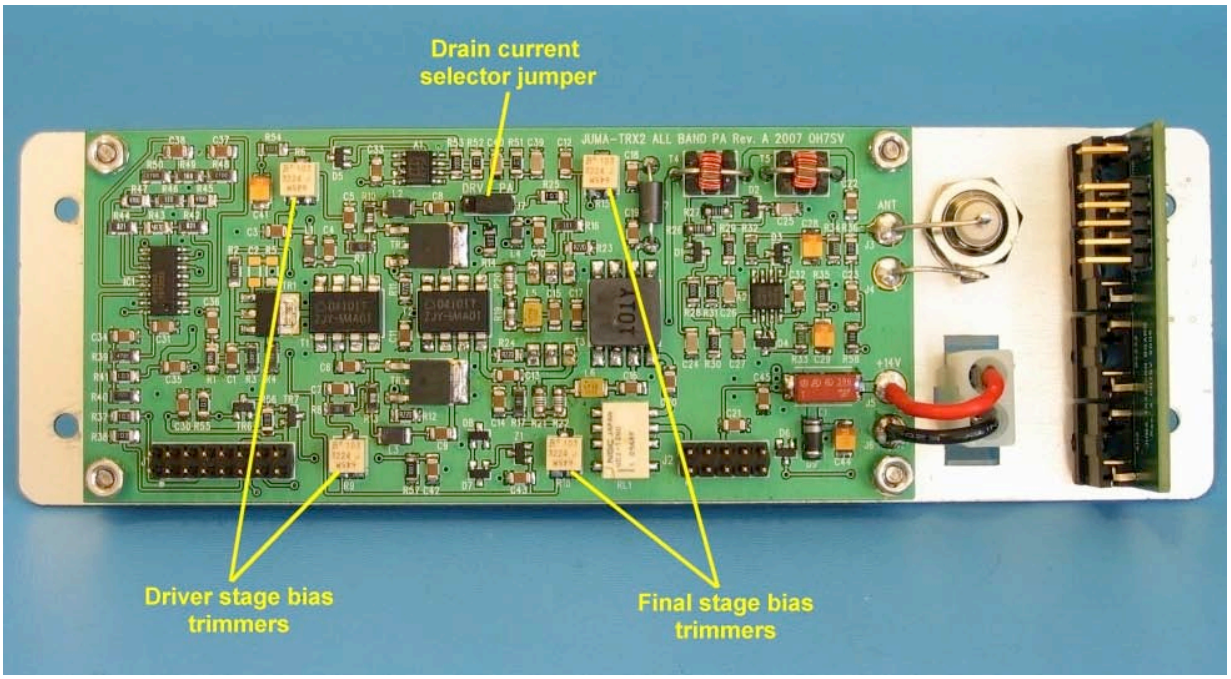
Driver stage bias current reading 0.06 A after the adjustment

Final stage bias adjustment See the picture (next page)
Note. The trimmers are multi-turn models. When turning the trimmers the bias current is not increasing in the beginning. Continue turning until you see an increase of the reading and then fine tune the bias current. Typical trimmer position is approximately in the middle.
1. Set the drain current selector jumper J7 (shown next page) on the board in to the PA position
2. Switch ON the power (Current limited power supply recommended)
3. Select CW mode by pushing the MODE button
4. Select Drain Current display (ID -.--A) by pushing the DISPLAY button
5. Press the mic PTT to activate the bias current
6. Turn the trimmer R15 clockwise until the LCD ID reading indicates 0.10 A ± 0.02 A
7. Turn the trimmer R18 clockwise until the LCD ID reading indicates 0.20 A ± 0.02 A

Finally leave the drain current selector jumper in to the PA position

Final stage bias current reading 0.20 A after the adjustment

JUMA TRX2 All Band PA Board Adjustments Last update 2008-01-12 OH7SV



Equalizing the RF output on each band

On the all band PA board there is an input attenuator (IC1 and related resistors), which can be adjusted individually on each band to equalize the output RF power. This can be done with the user interface.

1. Go to the desired band ?

2. Select Tune mode by MODE button

3. Select PWR display by DISPLAY button ?

4. While pushing the mic PTT keep PWR button (green) down. The LCD will show the current output power and the gain in decibels e.g. -1 dB ?

5. Turn the VFO knob until the LCD shows desired output RF power (approx. 10W) ?

6. Release the PTT and PWR buttons

This PA gain setting is saved individually at all 9 ham bands to the non-volatile memory when you switch OFF the TRX2A.

JUMA TRX2 Memory Option

JUMA-TRX2 Voice Memory option has the following features

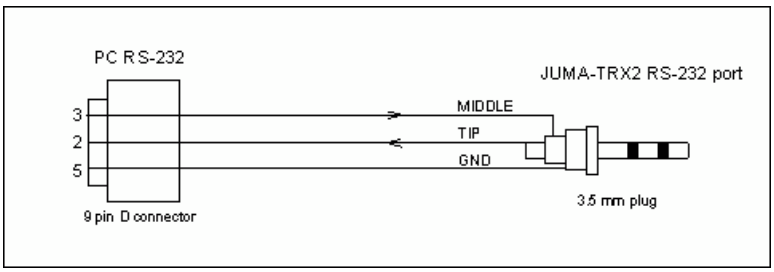
- Recording from microphone
- Recording from JUMA-TRX2 receiver
- Playing a recording with JUMA-TRX2 speaker as output
- Transmitting a recording in LSB or USB
- Stop an operation at any time

Memory capacity

- Memories 1...9 10 seconds capacity each Memory 10 120 seconds capacity

Hardware installation of the JUMA-TRX2 Voice Memory option

- Install JUMA-TRX2 Voice Memory option board into the pin headers on DDS board inside the JUMA-TRX2. Note, remove the audio jumper from pin header J8 (pins 1-2) before inserting the option board..
- Connect the RS-232 cable between the JUMA-TRX2 and the PC. See the cable wiring diagram.



JUMA TRX2 RS-232 cable wiring diagram

JUMA-TRX2 settings
Go to the JUMA configuration pages with a long CONFIG button push. Go to the RS232 page with short pushes and select "RS232 = VoiceMem" with VFO knob.

Instructions to use the JUMA-TRX2 Voice Memory control Windows control software

- Select a com port from the Com menu. Com setting will be saved for the next session
- Select a function (MIC record, RX record, Play or Transmit) by clicking the corresponding button
- Click a memory number to activate the operation
- Click Stop to cancel an operation if needed

A beep tone will be heard from Juma speaker when a command is received.
Alternatively all the operations can be activated by keyboard (small or caps)

- MIC record M
- RX record R
- Play P
- Transmit T
- Stop S
- Memory 1,2,3,4,5,6,7,8,9,0

Updating the Voice Memory Windows software version

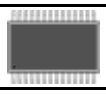
- Uninstall any older version of the software by using Windows Add/Remove Programs in Control Panel
- Install the new version by running setup of the new version

Appendix A Parts Lists

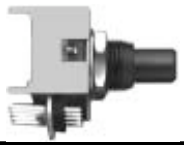
JUMA-TRX2 DDS board part list for PCB Rev. B, update 2007-12-04

Part number	Value / type	Qty	Description	Note
R54	0R	1	Resistor SMD size 0805	
R31, R32	10R	2	Resistor SMD size 1206	
R1, R21, R22, R44, R49, R50	10R	6	Resistor SMD 1%, 0805	
R45, R102, R38, R4, R5, R6, R7, R12, R8	100R	9	Resistor SMD 1%, 0805	
R10, R15	200R	2	Resistor SMD 1%, 0805	
R19, R20, R29	1k	3	Resistor SMD 1%, 0805	
R2	3k9	1	Resistor SMD 1%, 0805	
R23, R33	4k7	2	Resistor SMD 1%, 0805	
R46	6k8	1	Resistor SMD 1%, 0805	
R28, R16, R25, R51, R11, R3, R34, R60, R61, R62, R63, R64, R65, R52, R35, R48, R36, R37, R47, R26, R53	10k	21	Resistor SMD 1%, 0805	
R27, R55	33k	2	Resistor SMD 1%, 0805	
R17, R18, R13, R14, R39, R41, R43, R66, R67	100k	9	Resistor SMD 1%, 0805	
R40	470k	1	Resistor SMD 1%, 0805	
R42	100k	1	Multi turn SMD side adjust trimmer resitor, Bourns 3214J or 3224J series	
C16	1p	1	Ceramic 0805 C0G	
C8	2p2	1	Ceramic 0805 C0G	
C15	3p3	1	Ceramic 0805 C0G	
C17, C18	22p	2	Ceramic 0805 C0G	
C7,C19	10p	2	Ceramic 0805 C0G	
C30	100p	1	Ceramic 0805 C0G	
C28, C5, C13, C26	1n	4	Ceramic 0805 X7R or C0G	
C66, C44, C43, C42, C41, C48, C6, C62, C49, C50, C51, C52, C1, C31, C2, C3, C27, C12, C10, C11, C20, C29, C9, C4, C25, C24, C23, C22, C21	100n	29	Ceramic 0805 X7R	
C53, C65, C70, C71	2u2/16V	4	Ceramic 0805	
C67	4u7/6V Case style A	1	Tantalum Capacitor SMD	
C14	10V/35V Case style D	1	Tantalum Capacitor SMD	
L3, L7, L8	470nH, Q=35 EPCOS B82498B3471J	3	Inductor SMD Case size 0805	
L1, L2	600ohm @ 100MHz	2	Ferrite bead SMD Case size 0805	
D1	BAV70 SOT-23	1	Diode dual or similar SOT-23 common cathode Si-diode	
Q2	IRLML5203TRPBF SOT-23	1	or Si2307DS or Si2309DS MOSFET P-type Rds < 0.5 ohm	
Q1, Q4	2N7002 SOT-23	2	MOSFET N-type or similar, Rds < 10 ohm	
Q3	IRFR110 DPAK	1	MOSFET N-type	

JUMA-TRX2 DDS board part list for PCB Rev. B, update 2007-12-04

Part number	Value / type	Qty	Description	Note
IC7	74AC74, SO14	1	D Flip Flop	
IC3, IC11	LMV358 SO-8	2	Dual OPAMP	
IC1	AD9851BRSZ or AD9851BRS	1	DDS, package SSOP28	
IC6	74LVC2G80 SSOP	**0**	D Flip Flop	**Not assembled,** only for future use 7,5MHz clock for CPU PLL
IC10	HIN232ACB, Intersil or ST232CD ST Microelectronics, or MAX232ACSE Maxim	1	RS232 driver, SO16	
IC9	Microchip dsPIC30F6014A-30 I/PF	1	Microcontroller / DSP	
IC2	30MHz,5V, 91SMO package	0	Low noise oscilator	**Install IC2 or IC5, not both!**
IC5	30MHz, 5V, DIP14 package	1	Low noise oscilator	
J2, J3	2x8 e.g. snippet of Tyco Electronics 5-826632-0 or MOLEX 90131-0775	2	Pin header 2.54 mm pitch pin lenghth max 6.7 mm	
J1	2x2 e.g. snippet of Tyco Electronics 5-826632-0 or MOLEX 90131-0775	1	Pin header 2.54 mm pitch pin lenghth 6.7 mm	
J5, J8	1x3	2	Pin header 2.54 mm pitch pin lenghth max 6.7 mm	e.g. snippet of Harwin M20-9992046 or MOLEX 90120-0784
J19	1x6	1	Pin header 2.54 mm pitch pin lenghth max 6.7 mm	
J7	1x14	1	Pin header 2.54 mm pitch pin lenghth max 6.7 mm	
J4	1x2	1	For test/programming operations power on jumper.	
Jumper	Pitch 2.54 mm	2	Insert into J8 pins 1-2 For audio path back to board. **Second one is for J4. Do not instal it for normal operation.**	
LCD1	Everbouquet MC1602C8-SBLWU, Blue or Everbouquet MC1602C8-FBLWU, Black	1	LCD module 2 x 16 with LED back light 12'o clock type	

JUMA-TRX2 DDS board part list for PCB Rev. B, update 2007-12-04

Part number	Value / type	Qty	Description	Note
Nut	M2.5	4	For LCD mounting	
Low profile pin header	1 x 16, Samtec BBL-116-G-E	1	For LCD module connection, LCD side	
Low profile header socket	1 x 16, Samtec SL-116-G-19	1	For LCD module connection, DDS board side	
Tinned copper wire	0.5 mm, L approx 300 mm	1	Alternative LCD connection	For LCD module and DDS board interconnection
R9, R24, R30	100k Bourns 3310Y-001-104L	3	Miniature potentiometer	
SW10	Avago Technologies HRPG-ASCA#11R Resolution 120CPR	1	Optical Rotary Encoder	
SW1, SW2, SW3, SW4, SW5, SW6	ITT Cannon D6R10LFS	6	Push Button Switch	
SW7	ITT Cannon D6R50LFS	1	Push Button Switch	
Spacer screw	M3, L=12 mm e.g. Ettinger 05.13.123 or 05.13.121 or Harwin R30-3001202	4	For DDS board installation into the front panel	
Tooth lock washer	M3	4		
Nut	M3	4	For spacer screw	
J6	3.5 mm stereo jack socket Lumberg KBL4 or Schurter 4832.2300	1	**OBS!** Fix into the the front panel before soldering	
IC4	7805 TO220 Enclosure Al profile as heat sink	1	Voltage regulator	
Machine screw	M3 x 6	1	Phillips pan head For 7805 regulator mounting	
Square nut	M3	1	Or a snippet of rack nut list for IC4 7805 regulator mounting	
PCB	JUMA-TRX2-dds PCB Rev.B	1	PCB	

Total 182

JUMA-TRX2 main board part list for PCB Rev. B, update 2007-12-04

Part number	Value / type	Qty	Description	Note
R102 R103 R29 R56	4R7	4	SMD resistor 1% size 1206	
R45 R78 R89 R94 R97 R98 R99 R100 R106 R107	100R	10		
R19 R20 R24 R25 R104	180R	5		
R60	470R	1		
R44 R46 R55 R61 R95	1k	5		
R2	1k5	1		
R32 R33 R34 R35 R64 R65 R66 R84 R85 R86 R87 R88	2k2	12		
R1 R27 R40 R43 R62 R71 R105 R108 R109	4k7	9		
R39 R54 R58 R68 R69 R70 R72 R73 R74 R79 R80 R83 R101	10k	13		
R31	16k	1		
R57	27k	1		
R36 R92 R93 R96	47k	4		
R9 R10 R11 R12 R13 R14 R15 R30 R48 R49 R50 R51 R75 R76 R77 R81 R90 R91	100k	18		
R37	330k	1		
R38 R52 R59 R63 R82	470k	5		
R67	1M	1		
R41 R42	2M2	2		
R47	4M7	1		
R3 R6	200R/0.1%	2	SMD resistor 0.1% Case size Mini Melf MMA0204	
R4 R5 R7 R8 R16 R17 R18 R21 R22 R23	2k70/0.1%	10		
R28	100R	1	Multi turn SMD trimmer Bourns 3214W or 3214X or 3224W or 3224X series or Vishay TSM4YJ or TSM4YL series	
R26 R53	50k	2		
C29 C44	47p	2	Ceramic size 1206 X7R or C0G	
C28 C91	100p	2	Ceramic size 1206 X7R or C0G	
C88	220p	1	Ceramic size 1206 X7R or C0G	
C39 C47 C71	1n	3	Ceramic size 1206 X7R or C0G	
C93	4n7	1	Ceramic size 1206 X7R or C0G	
C3 C8 C9 C10 C11 C43 C67 C78 C79 C81 C82 C89 C92	10n	13	Ceramic size 1206 X7R	
C45	22n	1	Ceramic size 1206 X7R	
C1 C18 C20 C27 C30 C31 C32 C33 C37 C40 C48 C50 C51 C52 C53 C54 C55 C56 C57 C58 C59 C60 C61 C62 C65 C66 C68 C69 C70 C72 C73 C74 C75 C77 C80 C83 C84 C85 C86 C87	100n	40	Ceramic size 1206 X7R	
C21	220n	1	Ceramic size 1206 X7R	
C35	1u	1	Ceramic size 1206 X7R	
C4 C5 C6 C7 C12 C13 C14 C15	47n	8	Ceramic size 1206 C0G Murata GRM31M5C1H473JA01D Farnell code 8820201	
C22 C23 C24 C25	10u	4	Ceramic size 1206 Y5V/10V	

JUMA-TRX2 main board part list for PCB Rev. B, update 2007-12-04

Part number	Value / type	Qty	Description	Note
C2 C16 C17 C26 C36 C38 C46 C49 C63 C64 C94	4u7/16V	11	Tantal size B	
C34	10u/16V	1	Tantal size C	
C19 C42 C76	47u/16V	3	Tantal size D	
C41	100u/10V	1	Tantal size D	
D1 D2 D3 D4 D5	BAV99	5	Dual diode SOT23	
TR1	BC856B	1	PNP transitor SOT23	
TR3 TR4 TR5 TR9 TR11	SST112	5	JFET P-type SOT23	
TR6 TR8 TR10	2N7002	3	MOSFET N-type SOT23	
TR7	IRLML5203	1	MOSFET P-type SOT23	
IC9 IC10	MAX7400	2	SCAF filter SO8	
A1 A2 A3 A4	LT1113	4	Low noise JFET OPAMP SO8	
A5 A8 A9 A13	TL082	4	JFET OPAMP SO8	
A6 A7	TLC277	2	CMOS OPAMP SO8	
A10 A11	LT1364	2	High drive OPAMP SO8	
A12	LM386	1	SPKR AMP S08	
REG1 REG2	LP2951	2	Voltage regulator SO8	
IC3 IC7	NC7S14	2	Iinverter Schmitt SOT23-5	
IC4	74HC132	1	Quad NAND Schmitt SO14	
IC1 IC2 IC8	FST3253 Fairchild	3	Bus switch SO16 **OBS! 74CBT3253 can not be used**	
IC6	74HC595D	1	Shift reg SO16	
T1	WURTH 744-205	1	RF transformer (signal filter with 4 windings)	
POLYPHASE1 POLYPHASE2	Header socket 1x10	2	Snippet of Fisher BL5.36Z Farnell 9728910	
J6	Header socket 1x8	1		
FILTER1	Header socket 1x6	1		
J1 J2 J3	Pin header 2x8	3	Snippet of Tyco Electronics 5-826632-0, Farnell 3418560 or MOLEX 90131-0775, Farnell 9733680	
J4	Pin header 2x5	1		
J5	Pin header 2x3	1		
Jumper	Pitch 2.54 mm	2	For AUX output coding	
Snippet of tinned copper wire	Diameter 0.5-0.8mm Length 30 mm	1	U-jumper for measuring GND	
PCB JUMA TRX2	Main board Rev. B	1		
	Total parts qantity	**255**		

JUMA-TRX2 filter board part list for PCB Rev. B, update 2007-10-16

Part number	Value / type	Qty	Description	Note
R1 R8	470R	2	Resistor SMD 1% size 1206	
R12	620R	1		
R2	1k	1		
R9	1k2	1		
R5 R10	1k5	2		
R3	3k9	1		
R11	6k8	1		
R4 R15 R16 R17	10k	4		
R13 R14	13k	2		
R6 R7	33k	2		
R18 R19 R20	100k	3		
C7 C14	2n2	2	Ceramic SMD capacitor size 1206 C0G	
C4 C11	4n7	2	Ceramic SMD capacitor size 1206 C0G	
C6 C13	10n	2	Ceramic SMD capacitor size 1206 C0G	
C3 C5 C10 C12	100n	4	Ceramic SMD capacitor size 1206 C0G	
C16 C17 C18 C19 C20	100n	5	SMD capacitor size 1206 X7R	
C1 C2 C8 C9	470n	4	SMD capacitor size 1206 X7R	
C15	100u/10V or more	1	Tantal SMD capacitor size D	
TR1	2N7002	1	MOSFET N-type SOT-23 or similar Rds < 10 ohm	
A1 A2	LT1113	2	Opamp, J-FET, low noise, SO-8	
IC1	4052 or Philips 74HC4052	1	CMOS multiplexer SO16	
X1	1 x 6 pin header, e.g. snippet of Tyco Electronics 5-826631-0, Farnell 3418479 or Molex 90121-0784, Farnell 9733566	1	Angled pin header, pitch 2.54 mm, pin lenght 6.7 mm	
PCB	JUMA-TRX2-filter PCB Rev.B	1	PCB	

Total Qty 46

JUMA-TRX2 polyphase board part list for PCB Rev. A, update 2007-10-16

Part number	Value / type	pcs	Description	Note
R1 R11 R21 R31	820R 1%	4	Resistor SMD size 1206	
R2 R12 R22 R32	1k50 1%	4		
R3 R13 R23 R33	2K70 1%	4		
R4 R14 R24 R34	5K10 1%	4		
R5 R15 R25 R35	9K10 1%	4		
R6 R16 R26 R36	16K0 1%	4		
C1 C11 C21 C31 C2 C12 C22 C32 C3 C13 C23 C33 C4 C14 C24 C34 C5 C15 C25 C35 C6 C16 C26 C36	47n COG 5% MURATA GRM31M5C1H473JA01D Farnell 8820201	24	Ceramic SMD size 1206	
X1	1x10, e.g. snippet of Tyco Electronics 5-826631-0, Farnell 3418479 or Molex 90121-0784, Farnell 9733566	1	Angled pin header, pitch 2.54 mm, pin lenght 6.7 mm	
PCB	TRX2 FILTER PCB Rev. A	1	PCB	

Total 50

JUMA-TRX2 connector board part list for PCB Rev. A, update 2007-10-16

Part number	Value / type	pcs	Description	Note
R1 R2 R3 R4	100R	4	Resistor SMD size 1206	
C1 C2 C3 C4 C5 C6 C7	1n	7	Ceramic 1206 XR7 or NP0	
L1 L2 L3	>200 ohm @ 100MHz, I > 200 mA e.g. Murata BLM31B601S	3	Ferrite bead SMD Case size 1206	
J1	2x5 Pin Header e.g. snippet of Tyco Electronics 5-826632-0	1	Pin header 2.54 mm pitch pin lenghth 6.7 mm	
J2	1x2 Pin Header e.g. snippet of Tyco Electronics 5-826632-0	1	Pin header 2.54 mm pitch pin lenghth 6.7 mm	
X1 X2 X3 X4	**OBS!** Assemble into the the rear panel during soldering to align the connectors mechanically	4	3.5 mm stereo jack socket Schurter 4832-2320 or 4832-232, Farnell 152204	
PCB	JUMA-TRX2-connector PCB Rev.A	1	PCB	

JUMA-TRX2 Two Band PA board part list for PCB Rev. A, update 2007-12-04 (install the parts in this order)

Part number	Value / type	Qty	Description	Picture
R17 R21	0R22 e.g. Phycomp 235051912207	2	Resistor size 1206 / 0.5W Farnell 8067600	
R3	4R7	1	Resistor size 1206	
R5 R6	6R8	2		
R1	51R	1		
R11 R12 R13 R16 R29	100R	5		
R2, R20	1k	2		
R8 R15 R18 R19 R22 R23 R24 R31	10k	8		
R9 R10 R14 R25 R26 R27 R28	100k	7		
R4 R7	10k	2	Multi turn SMD trimmer Bourns 3214W or 3214X or 3224W or 3224X series or Vishay TSM4YJ or TSM4YL series	 Note! Turn the trimmers initially to zero bias, see instructions.
C14 C15 C16 C17 C29	390p	5	Ceramic size 1206 C0G	
C26	680p	1	Ceramic size 1206 C0G	
C10 C11 C12 C13 C30 C31	820p	6	Ceramic size 1206 C0G	
C32 C33 C38 C39 C40 C41	1n	6	Ceramic size 1206 X7R or C0G	
C20 C23	1n5	2	Ceramic size 1206 C0G	
C3	4n7	1	Ceramic size 1206 X7R or C0G	
C1 C2 C4 C5 C6 C7 C8 C9 C18 C19 C21 C22 C25 C27 C28 C34 C42 C43 C44	100n	19		
C24, C35, C36, C37	4u7/16V	4	Tantal SMD size B	
D1 D2 D3 D4 D5 D6 D7 D8 D9	BAV99	9	Double diode SOT23	
Z1	LM4040-2.5 SOT-23	1	Voltage Reference 2.5V or LM385M3-2.5 SOT-23	
TR4, TR7	2N7002	2	MOSFET N-type SOT23 or similasr Rds < 10 ohm	
TR5	BSS84	1	MOSFET P-type SOT23 or similasr Rds < 10 ohm	
TR6	BC846B	1	Transistor NPN or similar HFE > 150	
D10	LL4002G	1	Diode 1A, size melf Or similar 1A SMD diode	
TR1	IRFR110	1	MOSFET N-type D-PAK	
A1 A2	TLC277CD	2	OPAMP CMOS SO8	

JUMA-TRX2 Two Band PA board part list for PCB Rev. A, update 2007-12-04 (install the parts in this order)

Part number	Value / type	Qty	Description	Picture
L8 L10	1uH	2	SMD inductor size 1210 or 1812	
L5 L7 L9	2u2H	3	SMD inductor size 1210 or 1812	
L6	4u7H	1	SMD inductor size 1210 or 1812	
T1	TDK signal filter ZJYS51R5-M4PA or ZJYS51R5-M4PA-01	1	RF transformer Farnell code 9621334	
T2	Wurth signal filter type 744-205	1	RF transformer	
RL1 RL2 RL3	NEC EB2-12V or Omron G6H-2F-12V or Nais TQ2SA-12V or Takamisawa AS12W-K	3	SMD Relay	
L1, L2	2u2	2	SMD inductor size 2220	
J1	Snippet of Tyco Electronics 5-826632-0, Farnell 3418560 or MOLEX 90131-0775, Farnell 9733680	1	PIN HEADER 2 x 8	
F1	T 2.5A e.g. WICKMANN 19396 2.5A	2	PCB miniature fuse Note, another fuse is for spare **Bend the legs to L-shapes**	
RFC	Small ferrite bead e.g. Amidon FB-43-101 outer diameter 3.5 mm, inner diameter 1.3 mm, length 3.5 mm	1	RF choke, range 1uH…10uH (wire through a ferrite bead) **See pictures**	
T3 T4	Signal filter SBT-0180W Farnell 9265791	2	SWR transformer **See the modification instructions**	
L3, L4	1uH	2	Amidon T25-2 toroid core 17 turns 0.4 mm cu wire **See the winding instruction**	
Enamel copper wire	Diameter 0.4 mm (AWG 26 or 27)	1	80 cm enamel copper wire for the toroidal inductors	
TR2 TR3	IRFI520N	2	MOSFET N-type FULL-PAK Fixed to the rear Alu panel **See pictures for fixing**	
PCB		1	JUMA TRX2 PA PCB REV A	

JUMA-TRX2 All Band PA board part list Rev. A2, update 2008-03-10 (install the parts in this order)

Part number	Value / type	Qty	Description	Picture
R11 R12 R23 R24	0R22 e.g. Phycomp 235051912207	4	Resistor size 1206 / 0.5W Farnell 8067600	
R43	4R7	1	Resistor size 1206 1% (or 5%)	
R4 R46	12R	2		
R49	16R	1		
R1	47R	1		
R10 R13	91R	2		
R7 R8 R16 R17 R26 R27 R32 R33 R54 R58	100R	10		
R48 R50	270R	2		
R45 R47	470R	2		
R42 R44	820R	2		
R57	1k	1		
R40	1k5	1		
R3	3k3	1		
R2 R39	4K7	2		
R14 R25 R36 R37 R38 R41 R51 R52 R55 R56	10k	10		
R28 R29 R30 R31 R34 R35 R53	100k	7		
R5	NIL	0	Not installed	
R19 R22 R20 R21	33R	4	SMD resitor 1% Case size Mini Melf MMA0204	
R6 R9 R15 R18	10k	4	Multi turn SMD side adjust trimmer resistor Bourns 3214J, 3214G, 3224J or 3224G	 Note! Turn the trimmers initially to zero bias, see instructions.
C2	NIL	0	Not installed	
C24 C25 C26 C27 C39 C40	1n	6	Ceramic size 1206 X7R or C0G	
C1 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C30 C31 C32 C33 C34 C35 C36 C37 C38 C42 C43 C45	100n	34	Ceramic size 1206 X7R	
C28 C29 C41 C44	4u7/16V	4	Tantal SMD size B	
L1 L4	>200 ohm @ 100MHz, I > 200 mA e.g. Murata BLM31B601S	2	Ferrite bead SMD Case size 1206	
L2 L3 L5 L6	220nH	4	SMD inductor size 1210	
TR1	BFG591	1	Wide band NPN transistor SOT223	
D1 D2	BAT54S	2	Double Schottky diode SOT23	
D3 D4 D5 D6 D7 D8	BAV99	6	Double diode SOT23	
Z1	LM4040-2.5 SOT-23	1	Voltage Reference 2.5V or LM385M3-2.5 SOT-23	
TR6	2N7002	1	MOSFET N-type SOT23 or similasr Rds < 10 ohm	
TR7	IRLML5203	1	MOSFET P-type SOT23 or similasr Rds < 1 ohm	

JUMA-TRX2 All Band PA board part list Rev. A2, update 2008-03-10 (install the parts in this order)

Part number	Value / type	Qty	Description	Picture
D9	LL4002G	1	Diode 1A, size melf Or similar 1A SMD diode	
TR2 TR3	IRFR110	2	MOSFET N-type D-PAK	
A1 A2	TLC277CD	2	OPAMP CMOS SO8	
IC1	FST3253 Fairchild	1	Bus switch SO16	
T1 T2	TDK signal filter ZJYS51R5-M4PA or ZJYS51R5-M4PA-01	2	RF transformer Farnell code 9621334	
T3	Wurth signal filter type 744-205	1	RF transformer	
RL1	NEC UD2-12NU or Panasonic AGQ200A12	1	SMD Relay	
J1	Snippet of Tyco Electronics 5-826632-0, Farnell 3418560 or MOLEX 90131-0775, Farnell 9733680	1	PIN HEADER 2 x 8	
J2	Snippet of Tyco Electronics 5-826632-0, Farnell 3418560 or MOLEX 90131-0775, Farnell 9733680	1	PIN HEADER 2 x 5	
J7	e.g. snippet of Harwin M20-9992046 or MOLEX 90120-0784	1	PIN HEADER 1 x 3	
Jumper	Pitch 2.54 mm	2	Drain current selection jumper	
F1	T 2.5A wired fuse e.g. WICKMANN 19396 2.5A	2	PCB miniature fuse Note, another fuse is for spare **Bend the legs for soldering**	
L7	Small ferrite bead outer diameter 3.5 mm, inner diameter 1.3 mm, length 4…8 mm or two shorter	1	RF choke, inductance range 0.5uH…10uH (wire through a ferrite bead) **See pictures**	
T4 T5	Signal filter SBT-0180W Farnell 9265791	2	SWR transformer **See the modication instructions**	
Tinned copper wire	Diameter 0.5 mm - 0.8 mm		100 mm	For L7, T4 and T5
TR4 TR5	IRFI510G	2	MOSFET N-type FULL-PAK **Bent the legs and fix to the rear panel before soldering. See instructions**	
PCB		1	JUMA TRX2 ALL BAND PA PCB	

JUMA-TRX2 RF Filter Board part list for PCB Rev. A, update 2008-03-19 (Install in this order)

Part number	Value / type	Qty	Description	Note
R8	100R	1	SMD resistor size 1206	
R1 R4 R11 R12 R13 R14 R15 R16 R17	10k	9		
R3 R6	15k	2		
R2 R5	47k	2		
R7 R9 R10	100k	3		
C46	47p	1	SMD ceramic capacitor size 1206 C0G (NP0)	
C37	82p	1		
C75 C77 C78 C80	100p	4		
C32 C36 C38 C69 C71 C72 C74	180p	7		
C27 C31 C33 C63 C65 C66 C68	390p	7		
C22	680p	1		
C26 C28 C57 C59 C60 C62	820p	6		
C17	1n2	1		
C21 C23	1n5	2		
C51 C53 C54 C56	1n8	4		
C12	2n2	1		
C16 C18	2n7	2		
C7 C11 C13	4n7	3		
C1 C2 C3 C4 C6 C8	10n	6		
C5 C9 C10 C14 C15 C19 C20 C24 C25 C29 C30 C34 C35 C39 C40 C41 C42 C43 C44 C45 C47 C48 C49 C50	100n	24	Ceramic size 1206 X7R	
C52 C55 C58 C61 C64 C67 C70 C73 C76 C79	NIL	0	Not assembled	
L21 L23	330n	2	SMD inductor size 1210	
L18 L20	470n	2		
L22	680n	1		
L15 L17 L19	1u	3		
L12 L14 L16	2u2	3		
L9 L11 L13	4u7	3		
L6 L8 L10	10u	3		
L3 L5 L7	22u	3		
L1 L2 L4	47u	3		

JUMA-TRX2 RF Filter Board part list for PCB Rev. A, update 2008-03-19 (Install in this order)

Part number	Value / type	Qty	Description	Note
D1 D2 D3 D4 D5	BAV99	5	Double diode SOT23	
TR1 TR2 TR3 TR4 TR5	2N7002	5	MOSFET N-type SOT23 or similasr Rds < 10 ohm	
IC3 IC5	NC7S14	2	Iinverter Schmitt SOT23-5	
IC1 IC2	FST3253 Fairchild	2	Bus switch SO16	
IC4	74HC595D	1	Shift reg SO16	
IC6	4028	1	1-of-10 decoder SO16	
RL1 RL2 RL3 RL4 RL5	NEC UD2-12NU or Panasonic AGQ200A12	5	SMD Relay	
J3	Snippet of Tyco Electronics 5-826632-0, Farnell 3418560 or MOLEX 90131-0775, Farnell 9733680	1	PIN HEADER 2 x 5	
J1 J2	Snippet of Tyco Electronics 5-826632-0, Farnell 3418560 or MOLEX 90131-0775, Farnell 9733680	2	PIN HEADER 2 x 8	
L26 L27	2u2	2	SMD inductor size 2220	
L24 L25	4u7	2		
L32 L33	250n	2	Amidon T25-2 iron pwder core 9 turns diameter 0.4 mm cu	**See the instructions**
L30 L31	500n	2	Amidon T25-2 iron pwder core 12 turns diameter 0.4 mm cu	
L28 L29	1u	2	Amidon T25-2 iron pwder core 17 turns diameter 0.4 mm cu	
Enamel copper wire	Diameter 0.4 mm (AWG 26 or 27)	1	3 meters of copper wire for toroidal inductors	
PCB		1	JUMA TRX2 RF FILTER PCB	

JUMA-TRX2 voice memory part list for PCB Rev. C, update 2008-02-29

Part number	Value / type	pcs	Description	Note
R5	100R	1	Resistor SMD size 0805	
R2	1k	1		
R4	3k3	1		
R6 R7 R9 R16 R17	10k	5		
R12	18k	1		
R1	75k	1		
R3 R13 R22 R23	100k	4		
C6	1n	1	SMD capacitor size 0805 X7R	
C24 C25	47n	2	SMD capacitor size 0805 X7R	
C1 C4 C5 C7 C8 C13 C14 C20 C21	100n	9	SMD capacitor size 0805 X7R	
C3 C11	10u	2	SMD capacitor size 1206 Y5V	
C2 C17 C18	4u7/10V	3	Tanatlum SMD capacitor size B	
LD1	LGM670JM or similar type	1	Green LED, 0805	
IC2	TLC277	1	Dual opamp, CMOS SO-8 or TLC272	
IC1	ISD17240SY	1	Voice recorder, SO28	
IC4	4066 or Philips 74HC4066	1	CMOS switch SO14	
J5, J8	Header socket 1x3	2	Snippet of Fisher BL5.36Z Farnell 9728910	
J7	Header socket 1x14	1		
PCB	JUMA-TRX2-Voice Memory PCB Rev.C	1		

Total Qty 39

JUMA KB1 external keyboard partlist Rev. C, OH2NLT, 2008-02-29

Part number	Value / type	Qty	Description	Note
R2	0R / jumper	1	Resistor SMD size 0805	
R13 R20	1k	2		
R1 R14	10k	2		
R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R15 R17 R18	100k	13		
R16 R19	270k	2		
R21	1M	1		
C1 C10	1n	2	SMD capacitor size 0805 X7R	
C3 C5 C6 C11	100n	4	SMD capacitor size 0805 X7R	
C7 C8	33p	2	SMD capacitor size 0805 NP0	
C2 C4 C9	47u/10V or more	3	Tanatlum SMD capacitor size C	
D1 D2 D3	BAT54S	3	Shotky diode, SO23	
Q1	IRLML5203TRPBF SOT-23	1	or Si2307DS or Si2309DS MOSFET P-type Rds < 0.5 ohm	
Q2	2N7002	1	MOSFET N-type SOT-23 or similar Rds < 10 ohm	
IC3	LP2951	1	Voltage regulator SO8	
IC1	PIC16F628A-I/P	1	Microcontroller, DIP18	 Installed with socket, see pictures
IC2	CD40106	1	CMOS hex inverter, schmit trigger SO14	

JUMA KB1 external keyboard partlist Rev. C, OH2NLT, 2008-02-29

Part number	Value / type	Qty	Description	Note
X1	1,8432MHz Xtal	1	HC49	
J3	3,5mm jack	1	3.5 mm stereo jack socket Schurter 4832-2320 or 4832-232, Farnell 152204	
IC1 socket	18-pin DIP IC socket, flexible pins	1	See pictures	
SW9	ITT Cannon D6R50LFS	1	Push Button Switch Green	
SW4	ITT Cannon D6R40LFS	1	Push Button Switch Red	
SW1, SW2, SW3, SW5, SW6, SW7, SW8, SW10	ITT Cannon D6R10LFS	8	Push Button Switch Grey	
SW11 SW12	Not installed	0		
Enclosure	BOX Enclosures 40-12-NO-R-BL	1	40 Series Shell Case with End Panel	Farnell code 495-3654
Optional rubber boot (not icluded in the kit)	BOX Enclosures 40-RBT-LBL	1	Protective Boot w/Integrated tilt bar	Farnell code 495-3710
Countersunk machine screw	M3 x 20	4	Board to box fixing	
Nut	M3	12		
PCB	JUMA-KB PCB Rev.C	1		

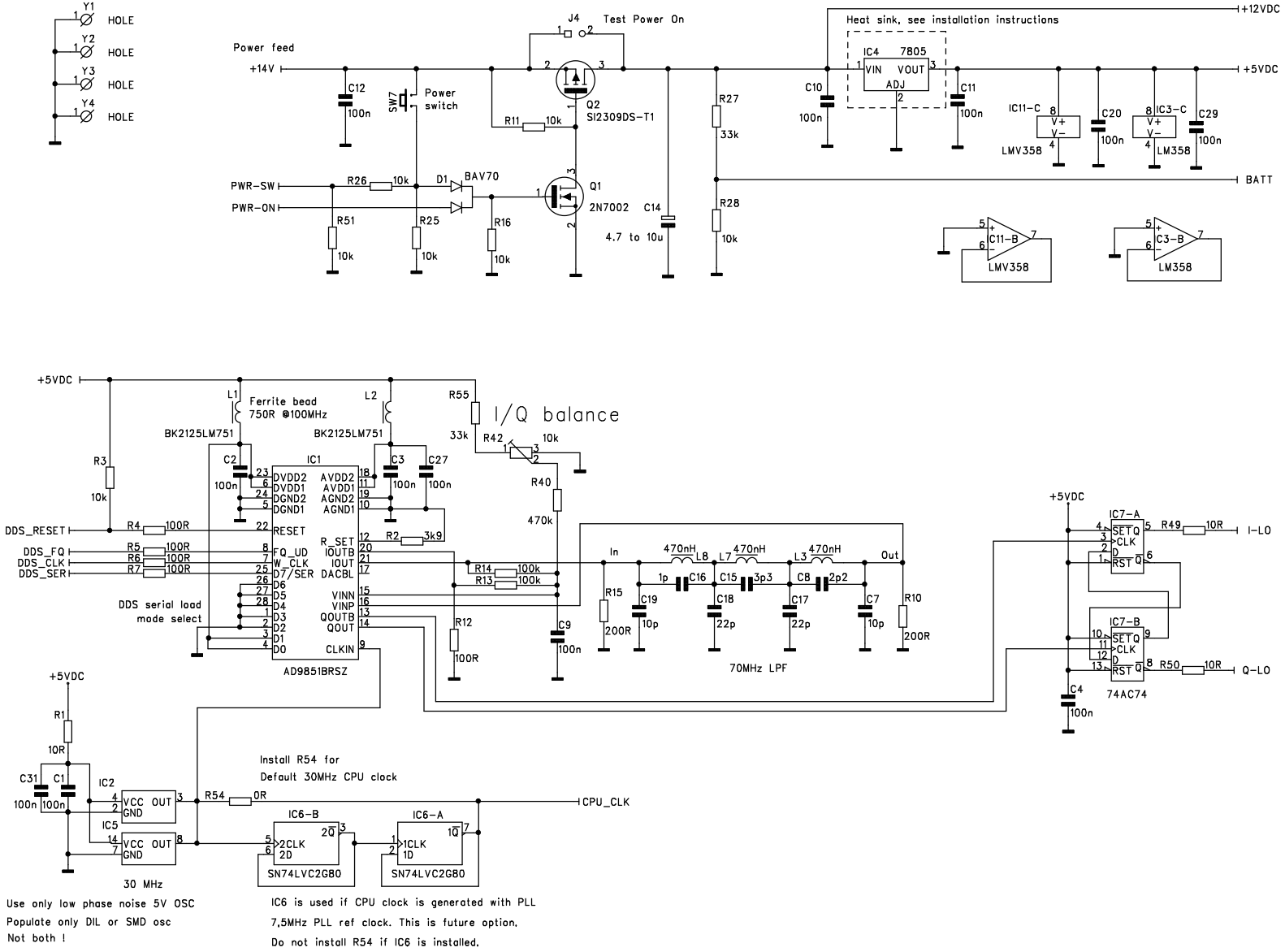
Total Qty 71

JUMA-TRX2 Electromechanical part list, update 2007-10-16

Part	Value	Qty	Description	Notes
Enclosure	Hammond 1402D	1	Housing Original front and rear pltes are not used.	
Front panel	Al 1.5 mm natural anodized	1	Milled and silk printed JUMA TRX2 front panel	
Rear panel	Al 1.5 mm natural anodized	1	Milled and silk printed panel JUMA TRX2 rear panel	
Antenna connector		1	BNC nut mount type with solder lug	
DC PWR connector	JST LR-02-2V	1	DC socket	
Male crimp pins	JST 0.5–2.0	2	for DC socket	
DC PWR connector	JST LP-02-1V	1	DC plug	
Female crimp sockets	JST 0.5–2.0	2	for DC plug	
Knob cap	Elma 040-1020	3	9 mm	
Knob	Elma 021-1220	3	9 mm, shaft 1/8"	
Knob cap	Bulgin KX30/28/10/3	1	28 mm	
Knob	Bulgin KX26/28/61/3	1	28 mm, shaft 1/4"	
Countersunk machine screw	M3 x 6 E.g. NETTLEFOLDS MS06030006081FA	8	Front panel to DDS board and speaker fixing	
Countersunk self tapping screw	NO4 x 1/4" E.g. NETTLEFOLDS 420004025081FA	4	Front panel to enclosure Al-profile fixing (rear panel is fixed to Al profile with original Hammond pan head self tapping skrews)	
Pan head machine screw Pozidriv No1	M3 x 6	8	PA mosfets to rear panel (two for extra holes) and main board to Al profile fixing	
Nylon washer	M3	2	PA mosfets fixing (or thin spring washer)	
Pan head machine screw Pozidriv No1	M3 x 12 mm	4	PA-board to rear panel fixing	
Circular spacer	Circular M3 x 6mm	4	PA-board to rear panel fixing	

JUMA-TRX2 Electromechanical part list, update 2007-10-16

Part	Value	Qty	Description	Notes
Tooth lock washer	M3	14		
Nut	M3	14		
Crimp terminal	M4 1.0-2.6 mm2 (A18-6)	4	For main board fastening into the side Al profile. See pictures	
Square nut	M3	4	For main board fastening into the side Al profile. See pictures	
IDC socket		6	2 x 8 pitch 2.54 mm	
IDC socket		2	2 x 5 pitch 2.54 mm	
Ribbon cable	length approx 200mm	1	16-way, pitch 0.05"	
Ribbon cable	length approx 100mm	1	10-way, pitch 0.05"	
Speaker	diameter 50 mm	1	8 ohm	
Connector	1 row 2 way	1	For internal speaker connector	
Crimp socket		2	For internal speaker connector	
Two pole cable	250 mm, 2 x 0.5mm2	1	For internal speaker cable	
Electret microphone	Capsule e.g. C6	1	With 1n cap solderd in the terminals	
Switch (PTT)	Closing contact	1	For PTT use in simple mic	
Vero board	15 mm x 100 mm	1	For simple mic mechanics	
Mic cable	2 wires + shield, 1 meter	1	Mic cable	
Plug	3.5 mm stereo	1	For mic cable	
Two pole cable	1.5 m, 2 x 1.5mm2	1	DC power cable Red-black	
Optional parts				
Power resistors for a dummy load	Solder 3 pcs 150 ohm resistors in parallel for 50 ohm dummy load. Do not use wire wound resistors	3	150 ohm 2W e.g. metal oxide resistor	

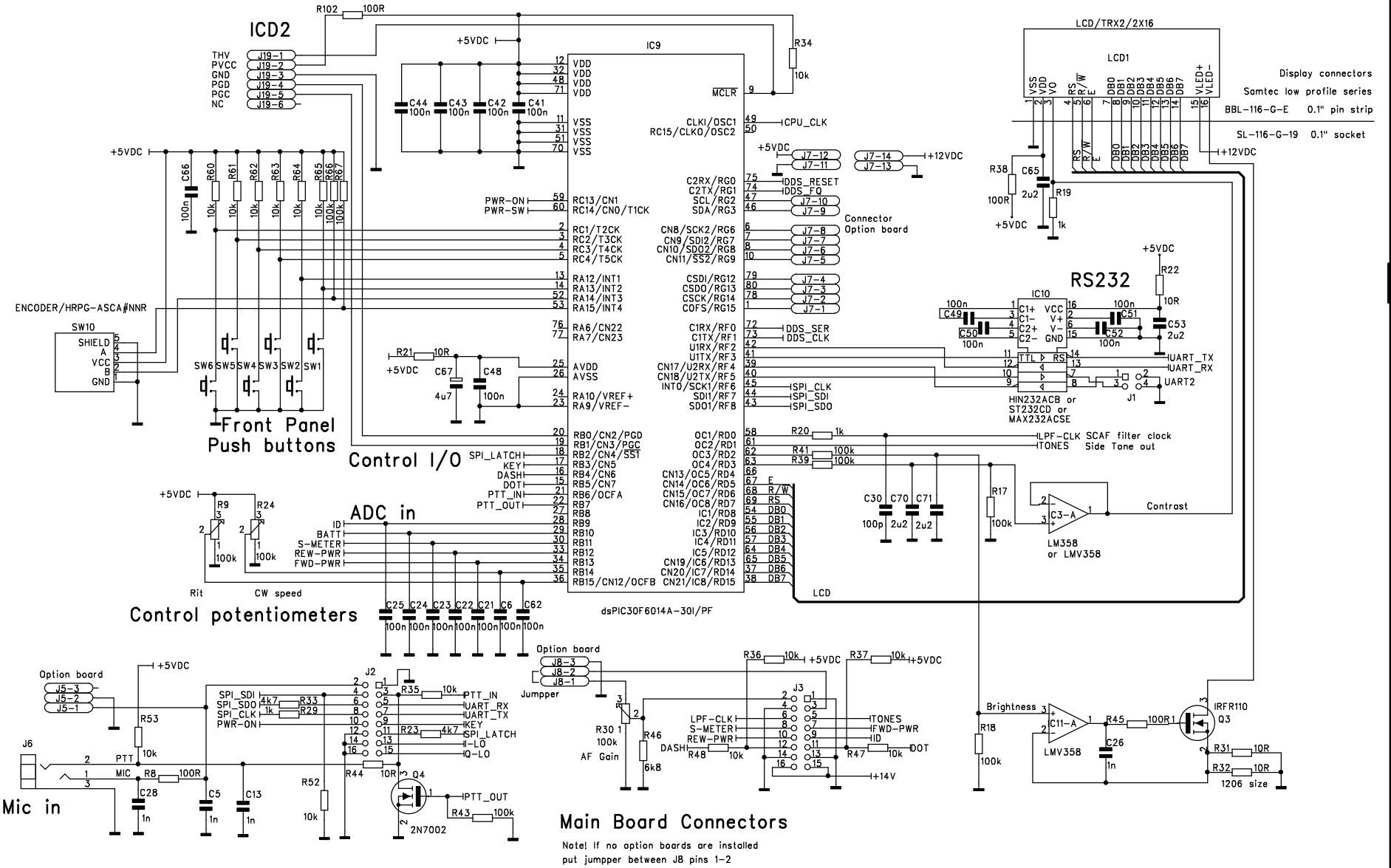


JUMA-TRX2 DDS board

DDS & PSU

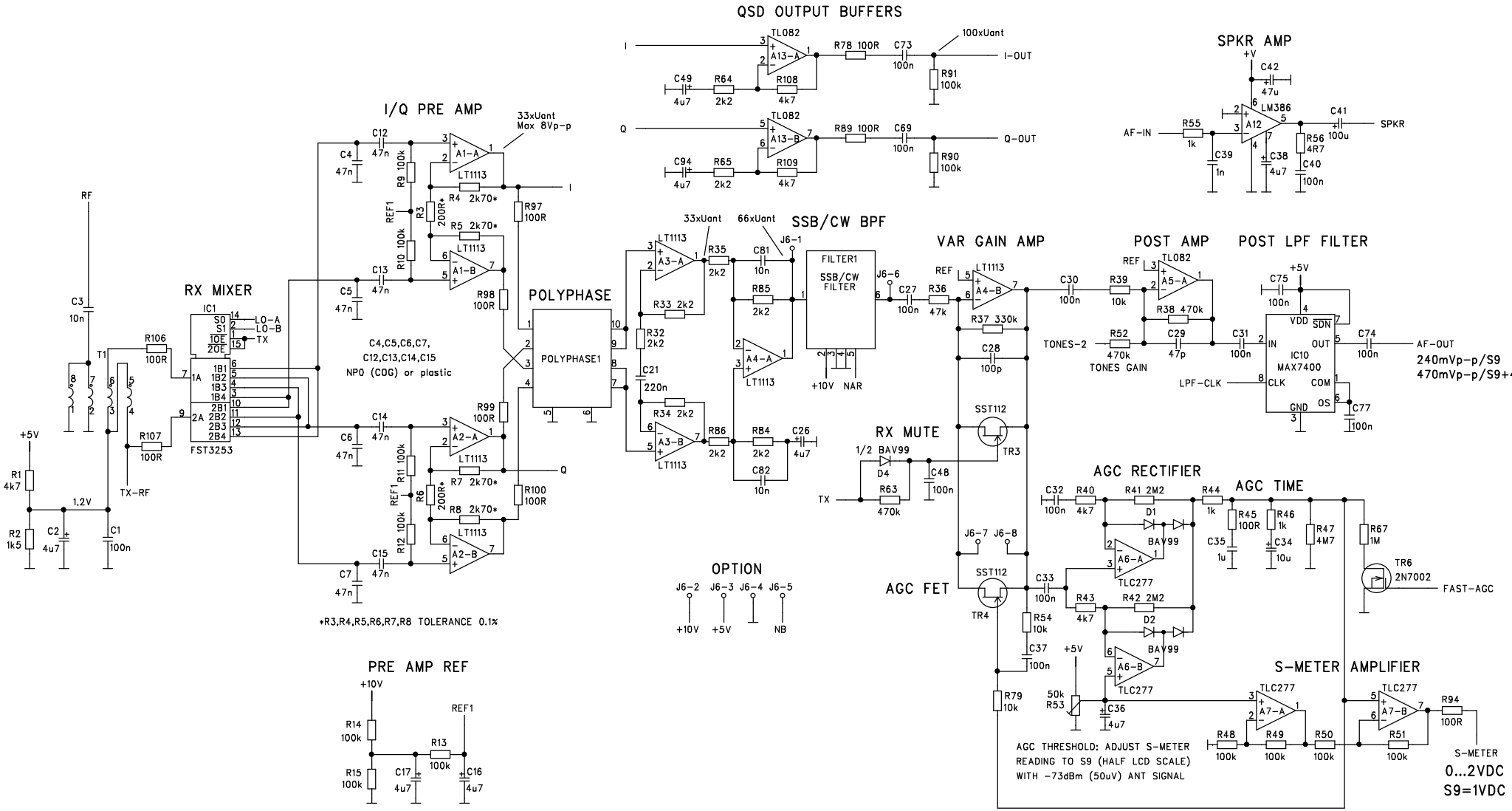
OH2NLT	Drawn	25.10.2006	Juha Niinikoski
DRAWING No. Rev. B / 30.10.2007	Appr.		Page 1/2

Schematics Appendix B



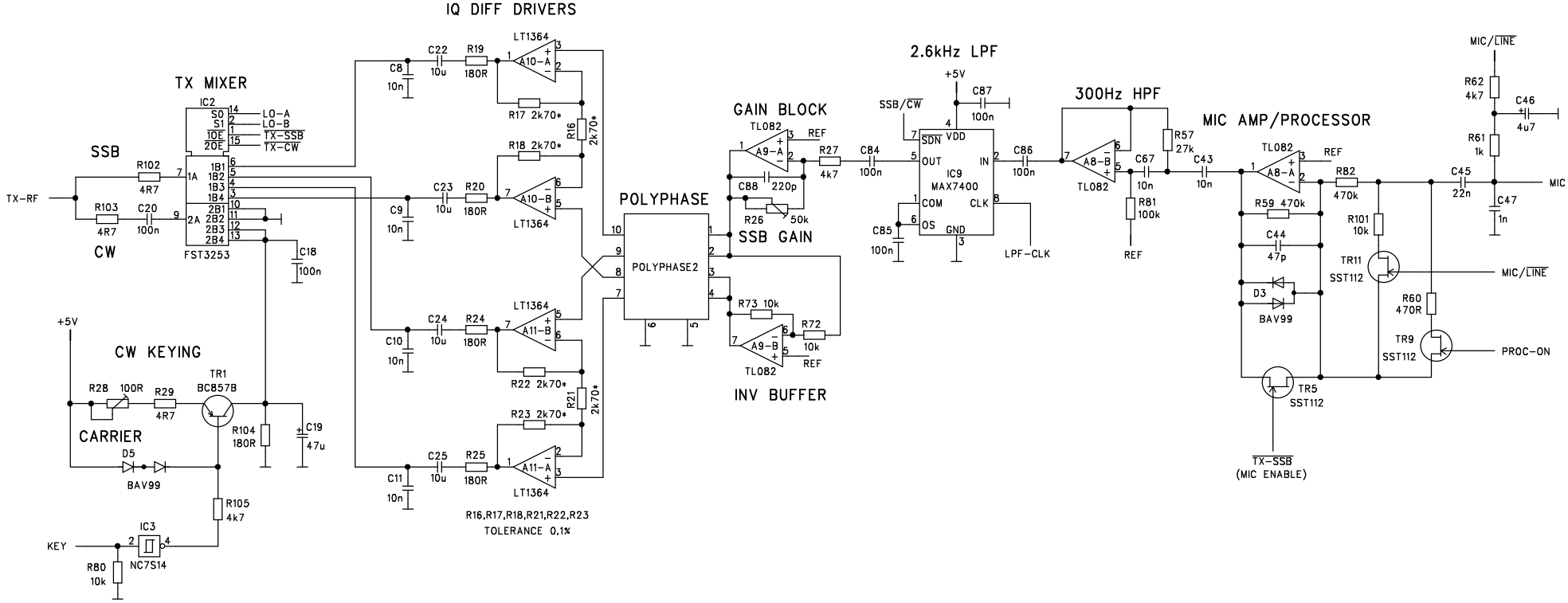
JUMA-TRX2 DDS board CPU & LCD	OH2NLT	Drawn	25.10.2006	Juha Niinikoski
Copyright Juha Niinikoski OH2NLT. This header must remain unaltered in all publications.	DRAWING No. Rev. B / 30.10.2007	Appr.		Page 2/2

Schematics Appendix B

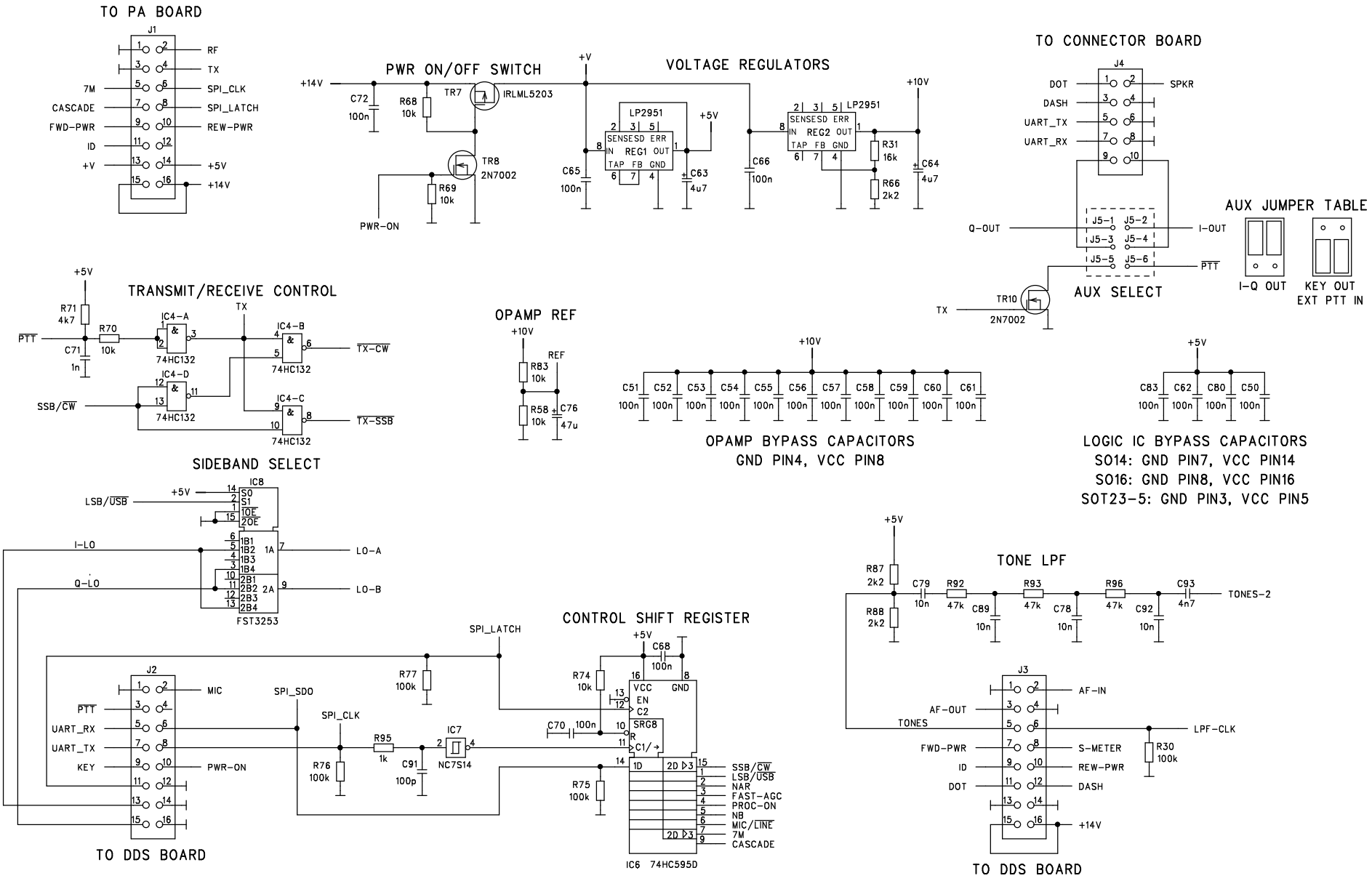


Drawn	2007-11-07	JUMA-TRX2 HF SSB/CW TRANSCEIVER	OH7SV
Design	OH7SV	MAIN BOARD	Rev B
Sheet	1/3	RX SECTION	

Schematics Appendix B

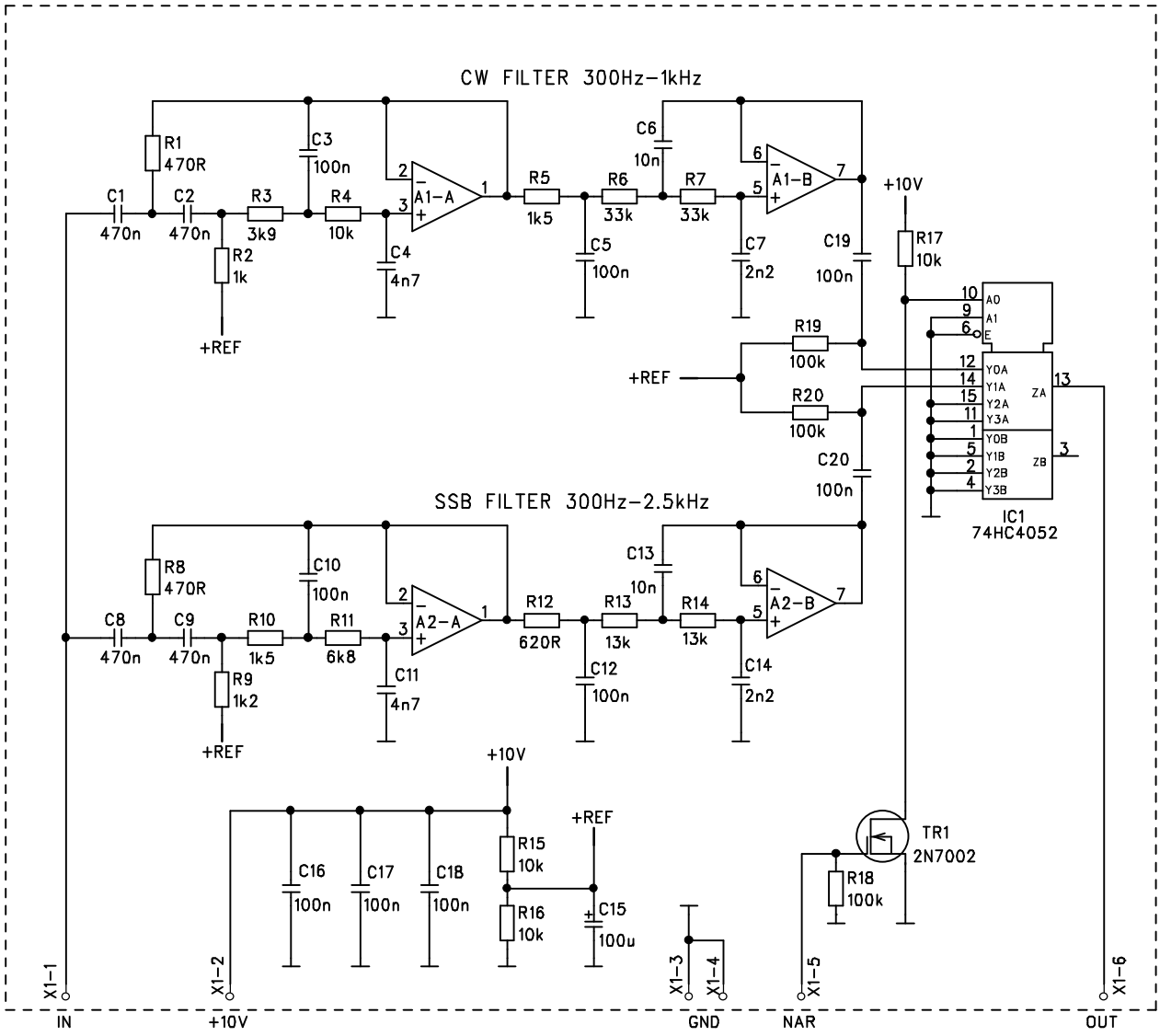


Drawn	2007-11-07	JUMA-TRX2 HF SSB/CW TRANSCEIVER	OH7SV
Design	OH7SV	MAIN BOARD	Rev B
Sheet	2/3	TX SECTION	



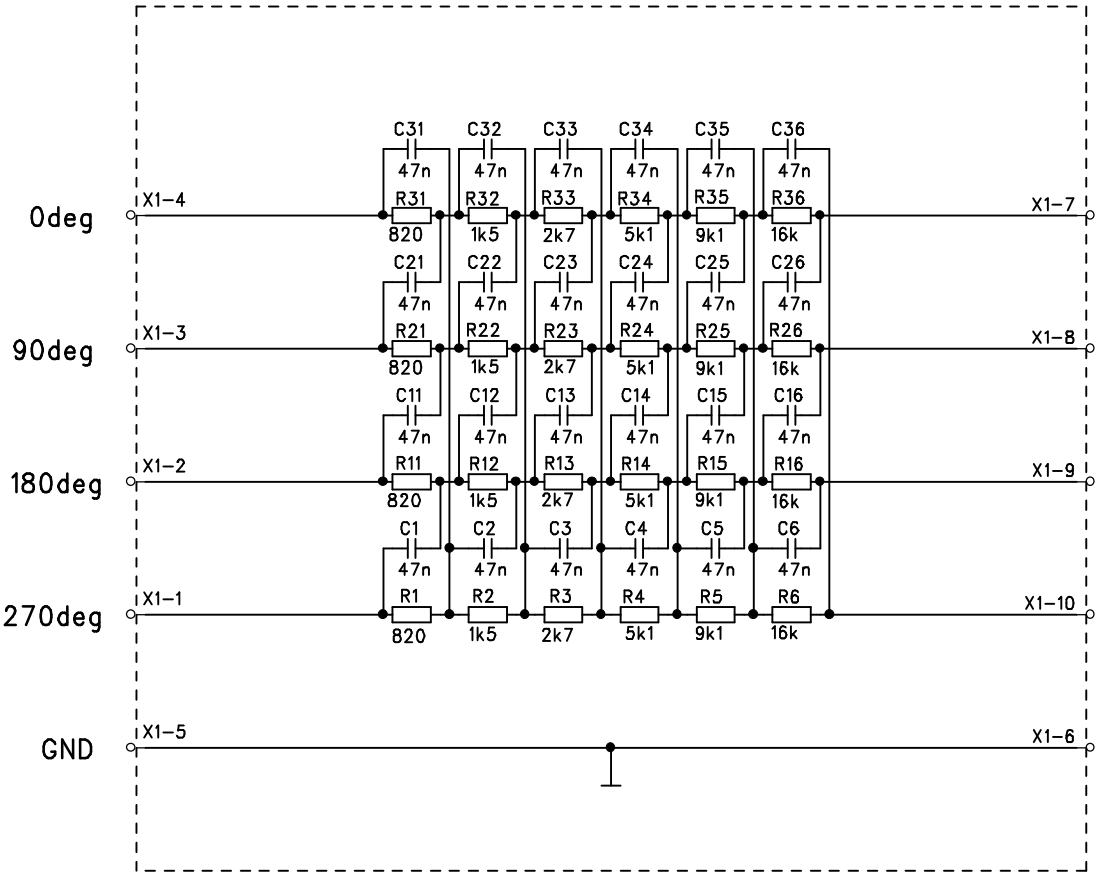
Drawn	2007-11-07	JUMA-TRX2 HF SSB/CW TRANSCEIVER	OH7SV
Design	OH7SV	MAIN BOARD	
Sheet	3/3	REGULATORS/CONTROL/CONNECTORS	Rev B

Schematics Appendix B



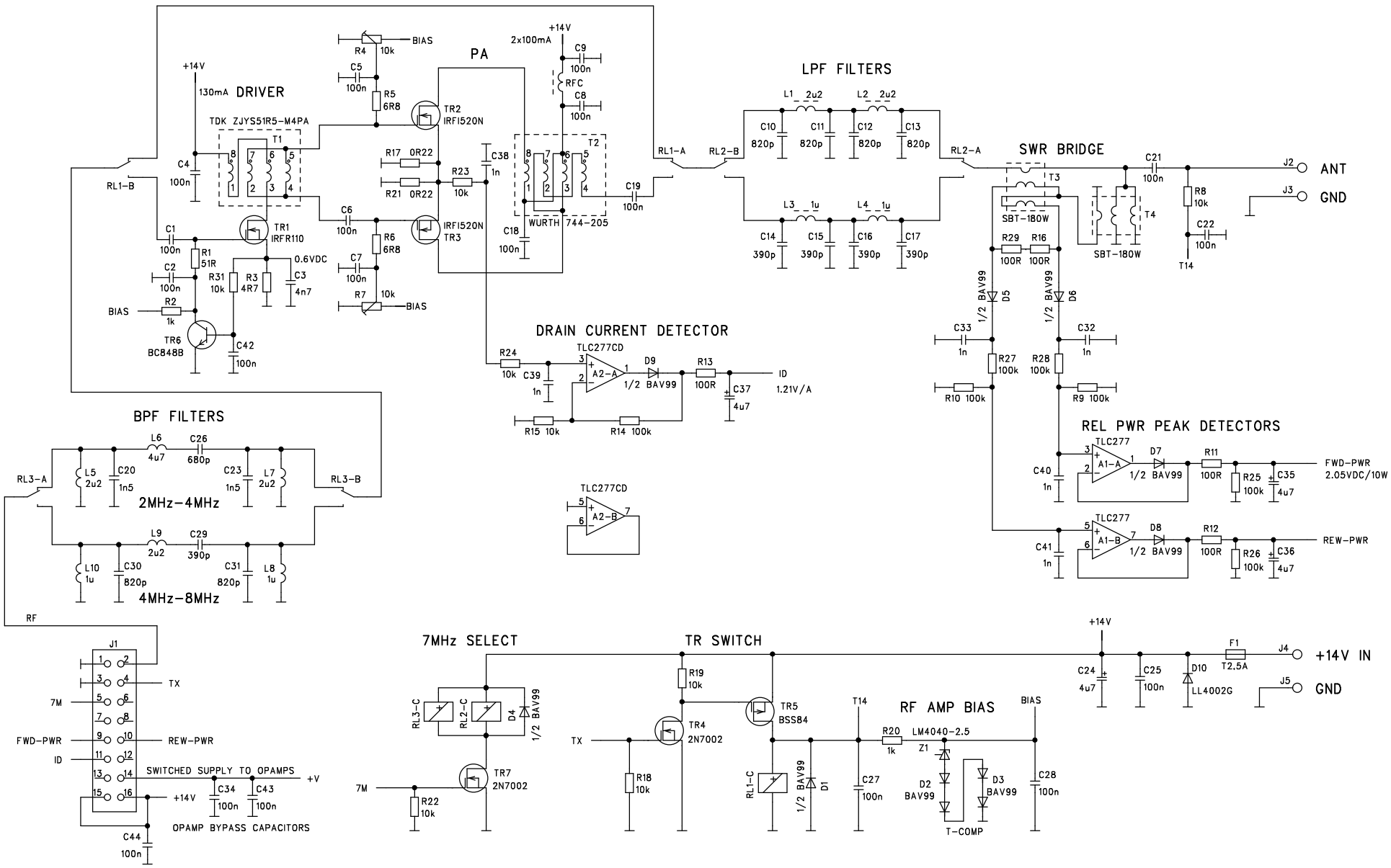
NOTE1: ALL OPAMPS LT1113, PIN4 GND, PIN8 +10V. IC1 PIN8 AND PIN7. GND, PIN16 +10v
NOTE2: INPUT MUST BE DRIVEN FROM LOW IMPEDANCE SOURCE
NOTE3: OUTPUT MUST BE AC COUPLED TO NEXT STAGE, MIN LOAD R 20kohm

Drawn 2007-03-08 OH7SV	Arch id	Serial no	Sheet	Cooperator's doc no
Review				
Appr	JUMA-TRX2 HF TRANSCEIVER			OH7SV
Design OH7SV / Scale	SSB/CW FILTER MODULE			Dwg no Rev / Rev B
Replaces	CIRCUIT DIAGRAM			
Replaced by				



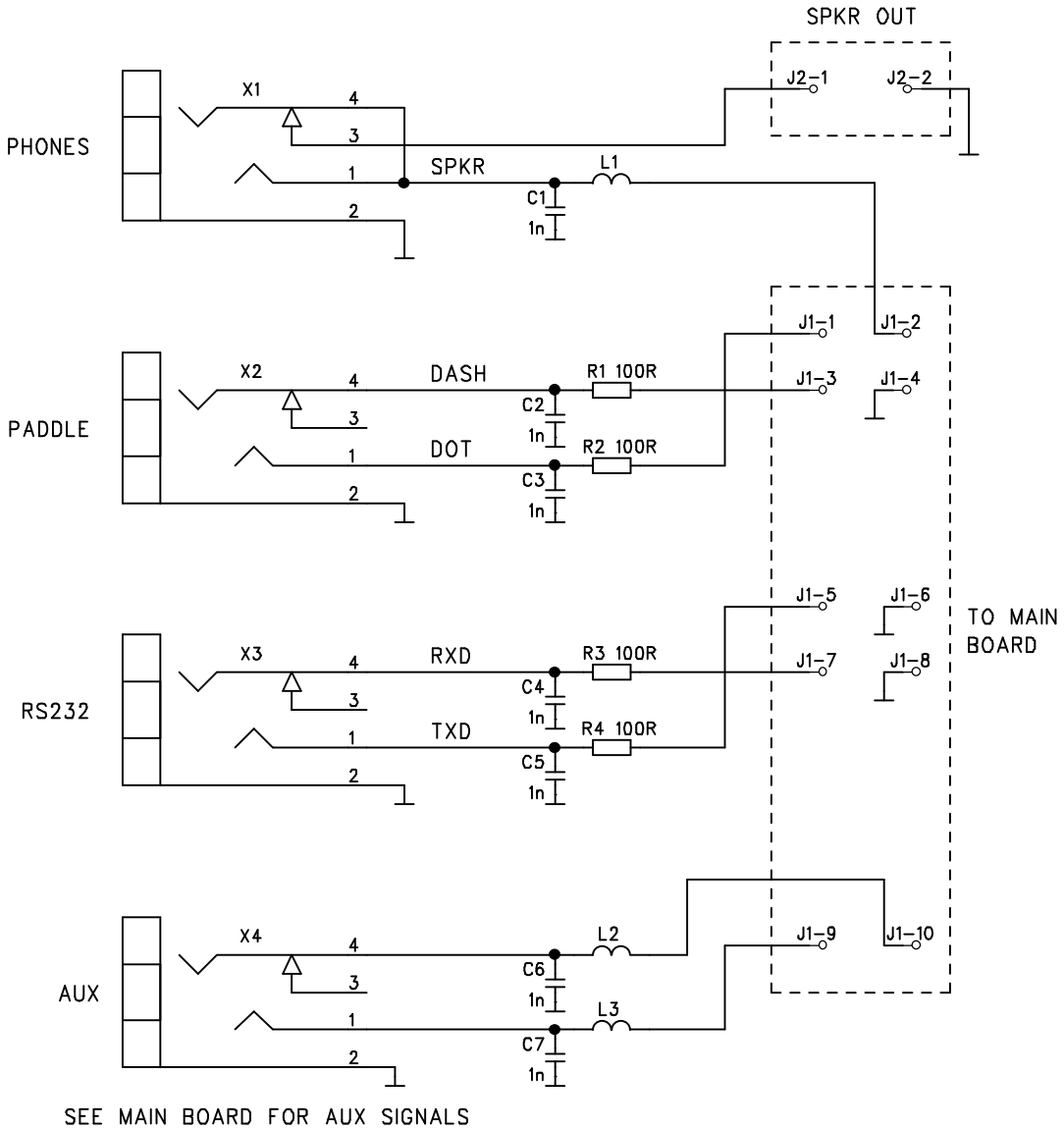
NOTE: ALL CAPACITORS 47n COG/NP0
MATCH UP RESISTORS AND CAPACITORS IN EACH COLUMN
BELOW 1% TO GET AN EXCELLENT SIDEBAND SUPRESSION
ABSOLUTE COMPONENT VALUES ARE NOT CRITICAL

Drawn OH7SV 2006-12-08	Arch id	Serial no	Sheet	Cooperator's doc no
Review	JUMA-TRX2 HF TRANSCEIVER			OH7SV
Appr	POLYPHASE NETWORK			
Design OH7SV / Scale	CIRCUIT DIAGRAM		Dwg no	Rev
Replaces				
Replaced by				



Drawn	2007-06-13	JUMA–TRX2 HF SSB/CW TRANSCEIVER	OH7SV
Design	OH7SV	10W POWER AMPLIFIER 80m/40m	Rev A
Sheet	1/1	CIRCUIT DIAGRAM	

Schematics Appendix B

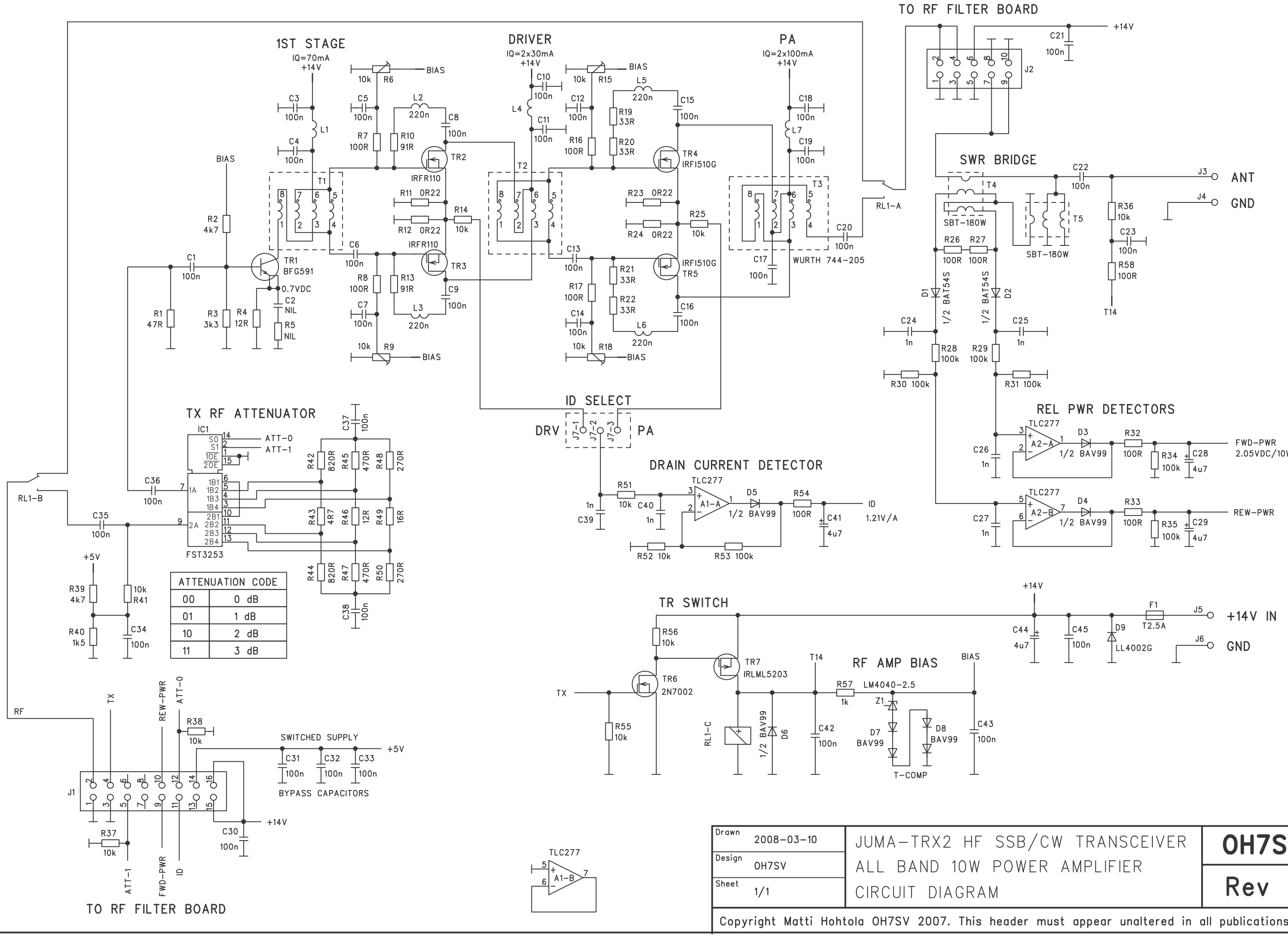


Drawn 2006-12-08 OH7SV	Arch id	Serial no	Sheet 1/1	Cooperator's doc no
Review				
Appr				
Design OH7SV				
Replaces				
Replaced by				

JUMA-TRX2 SSB/CW TRANSCEIVER
CONNECTOR BOARD
CIRCUIT DIAGRAM

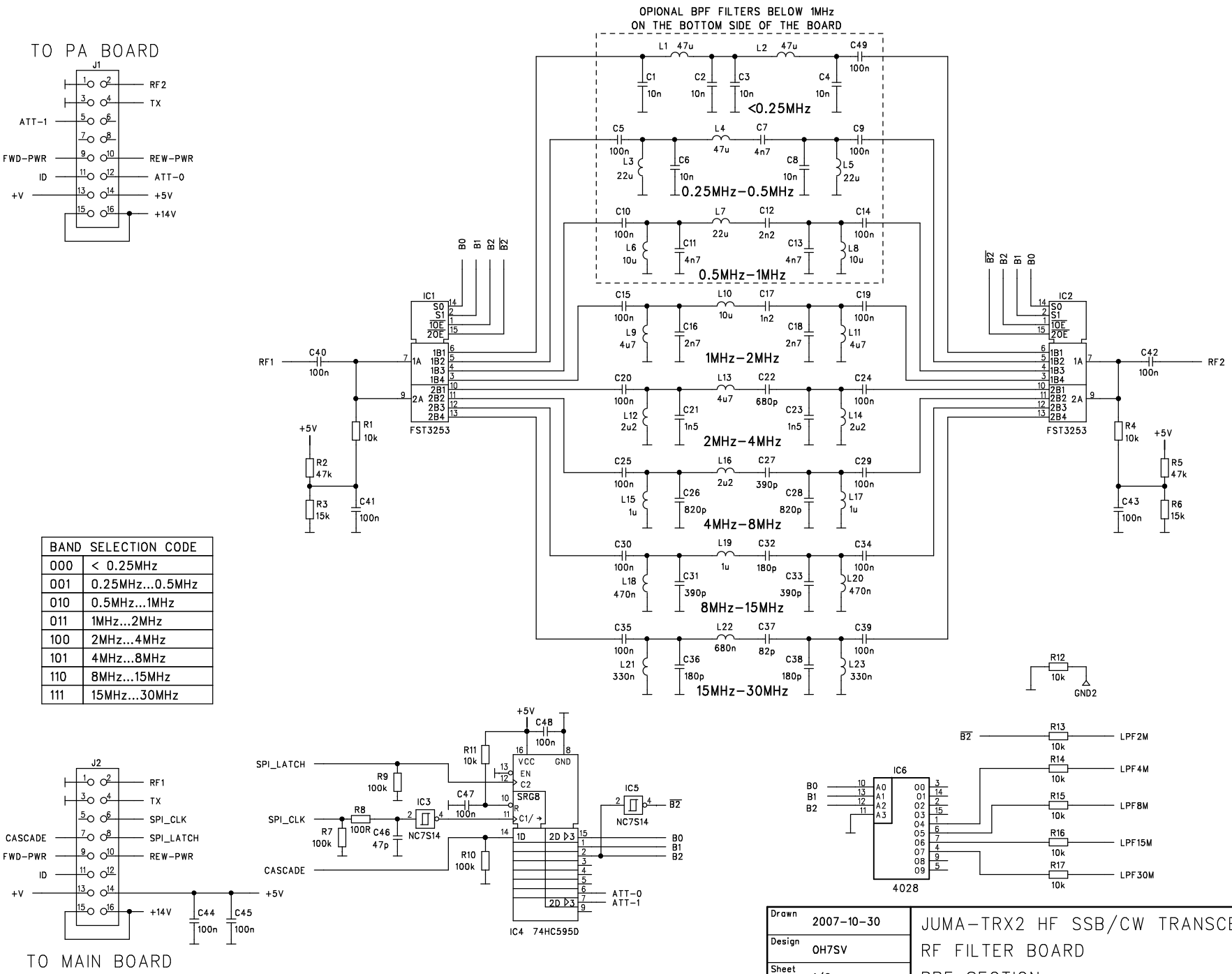
OH7SV

Dwg no **Revision** Rev **A**



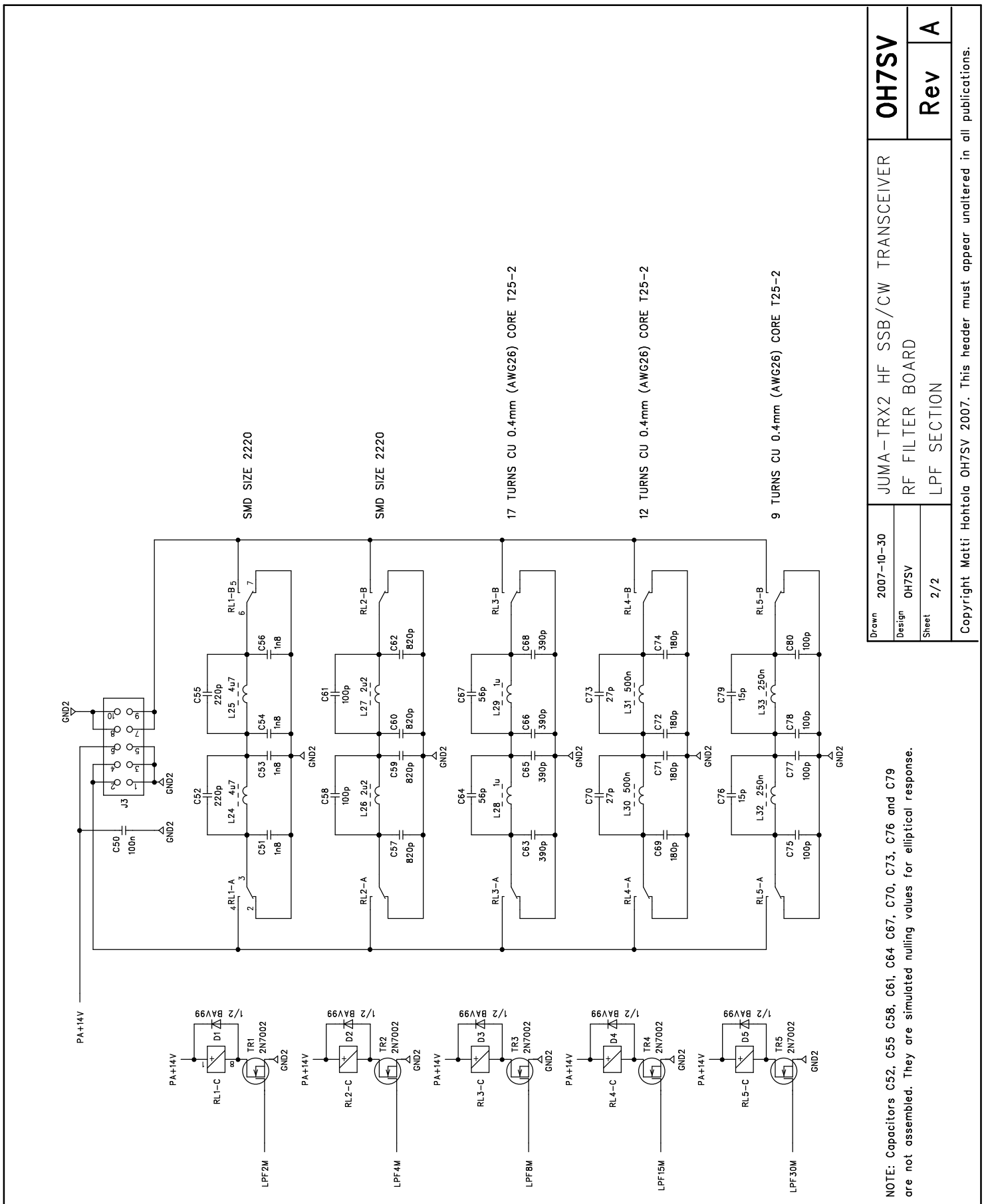
Schematics Appendix B

Drawn	2008-03-10	JUMA-TRX2 HF SSB/CW TRANSCEIVER ALL BAND 10W POWER AMPLIFIER CIRCUIT DIAGRAM	OH7SV Rev A2
Design	OH7SV		
Sheet	1/1		



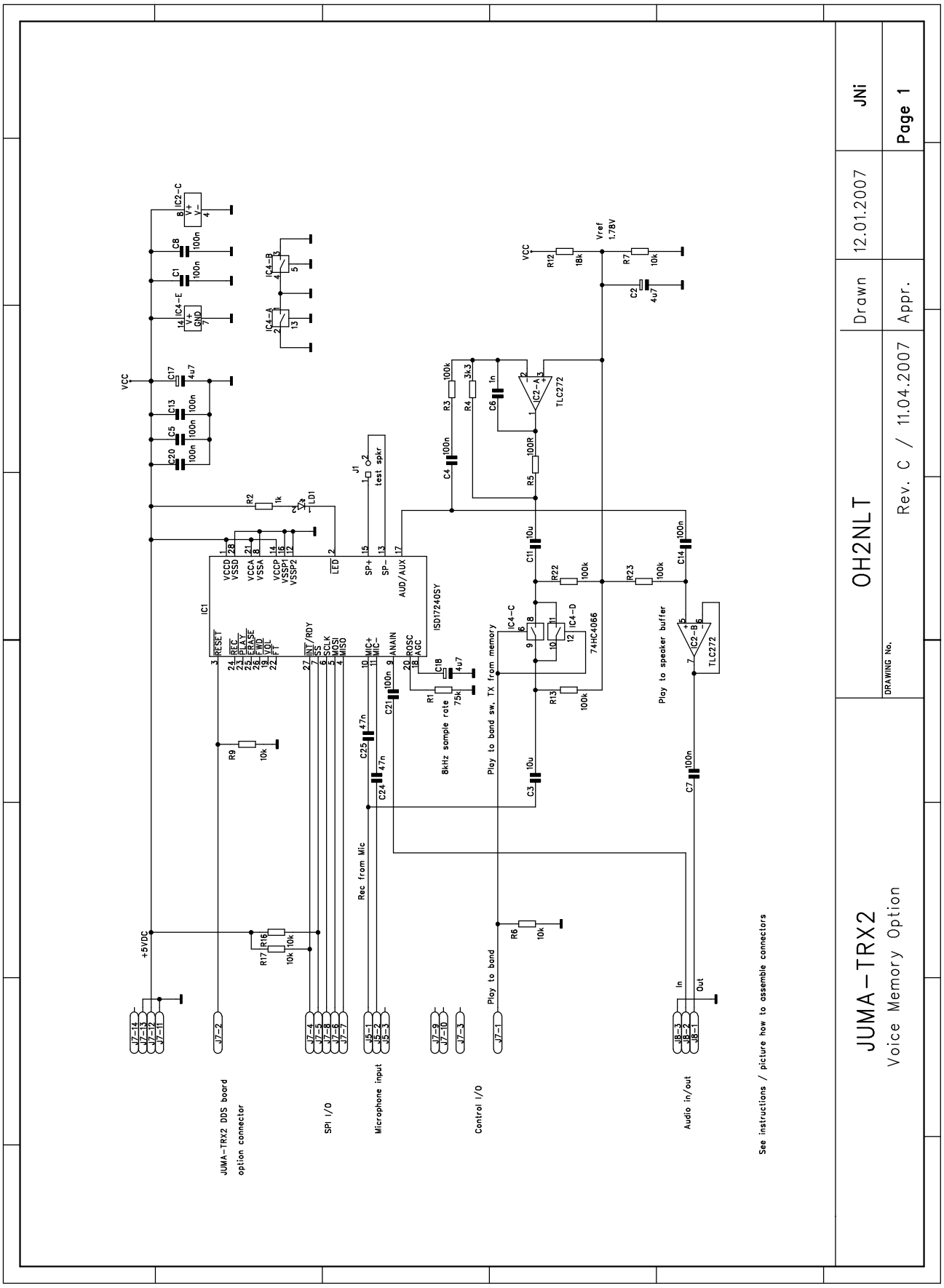
Drawn	2007-10-30	JUMA-TRX2 HF SSB/CW TRANSCEIVER	OH7SV
Design	OH7SV	RF FILTER BOARD	Rev A
Sheet	1/2	BPF SECTION	

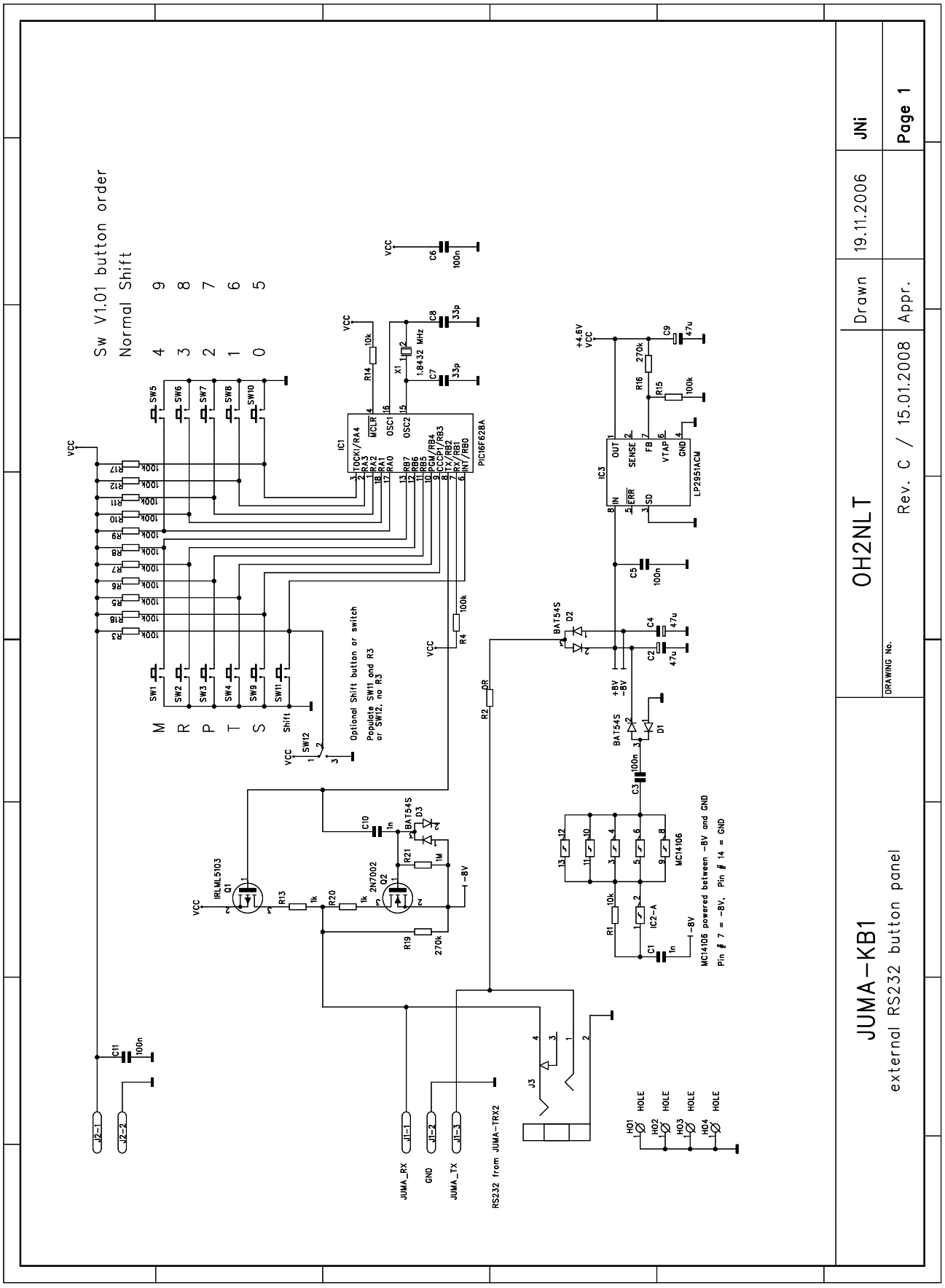
Schematics Appendix B

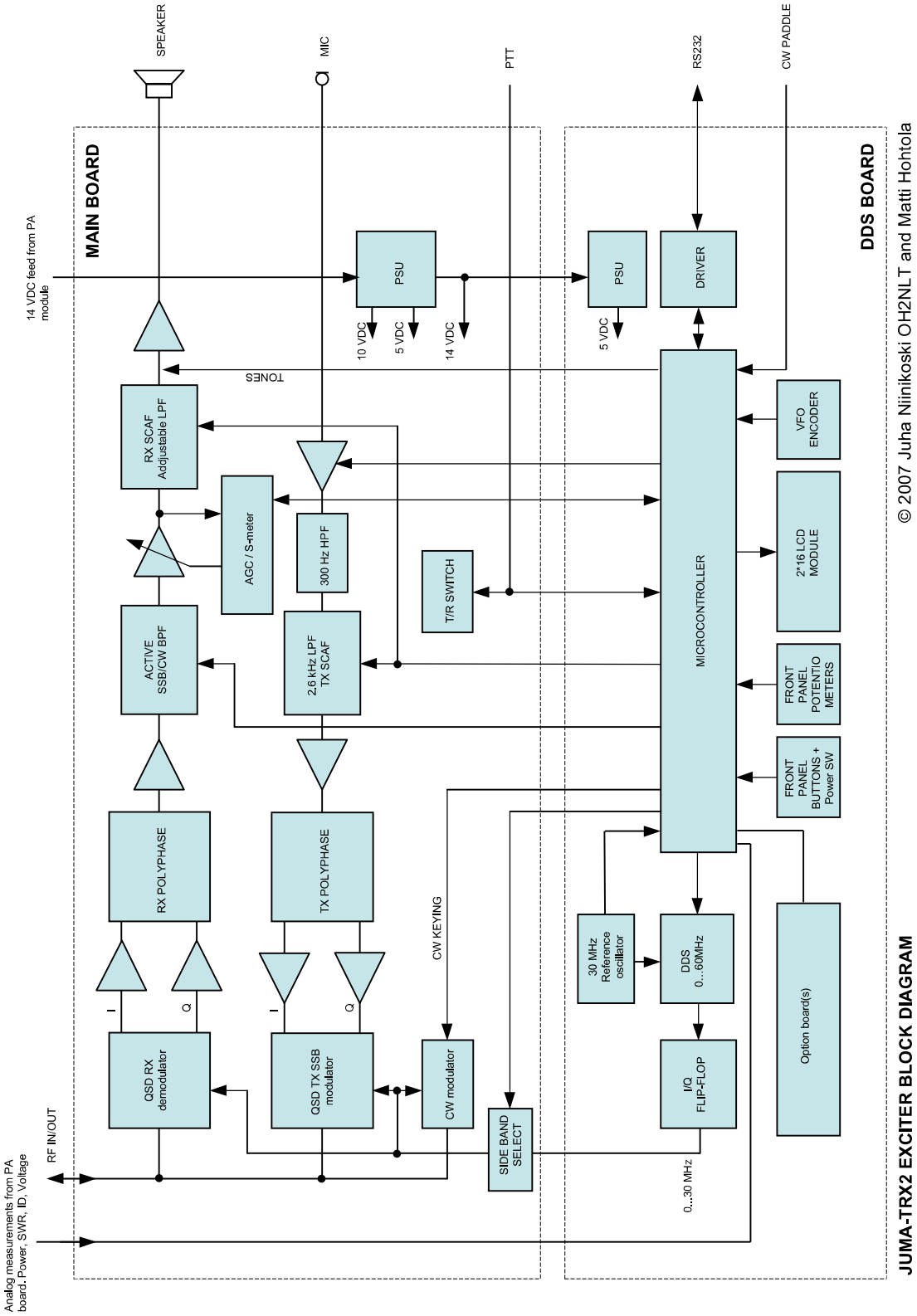


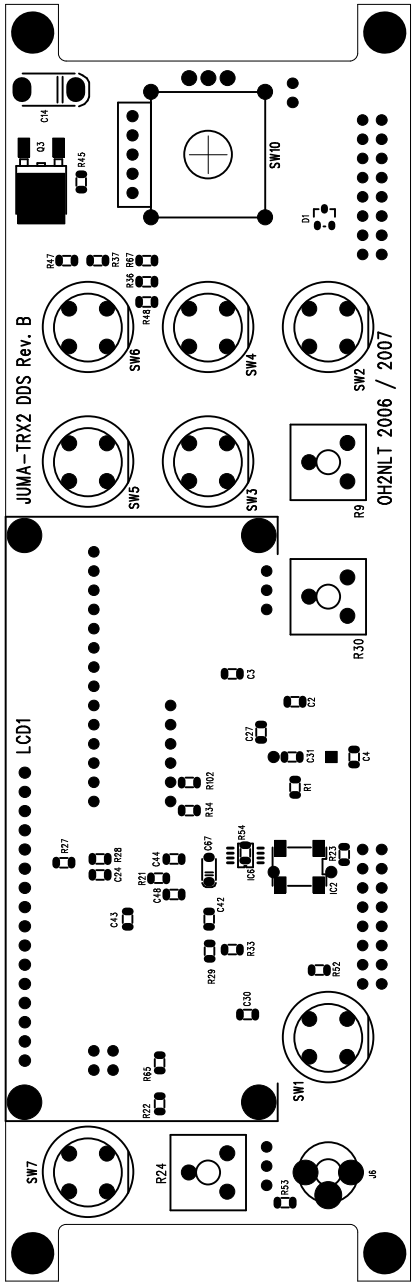
NOTE: Capacitors C52, C55 C58, C61, C64 C67, C70, C73, C76 and C79
are not assembled. They are simulated nulling values for elliptical response.

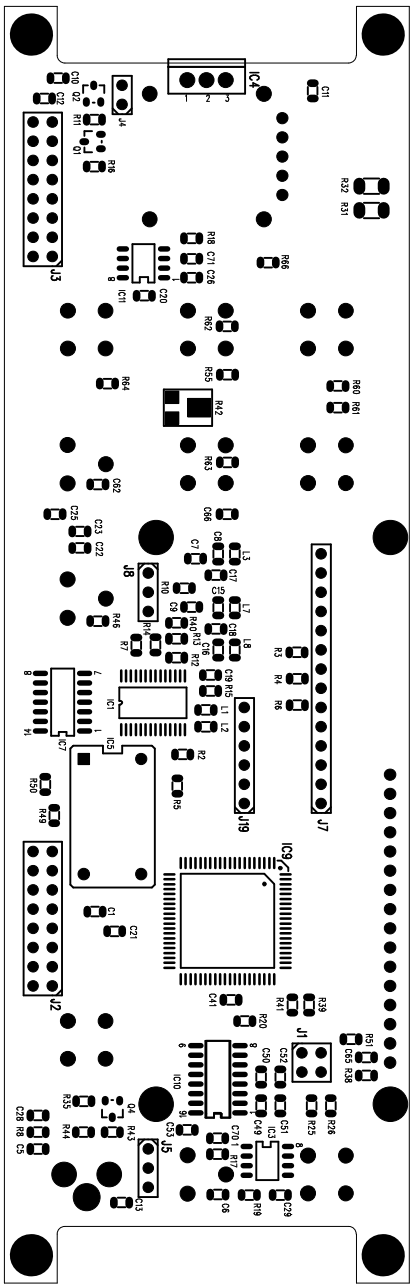
Drawn	2007-10-30	JUMA-TRX2 HF SSB/CW TRANSCEIVER	OH7SV
Design	OH7SV	RF FILTER BOARD	Rev A
Sheet	2/2	LPF SECTION	

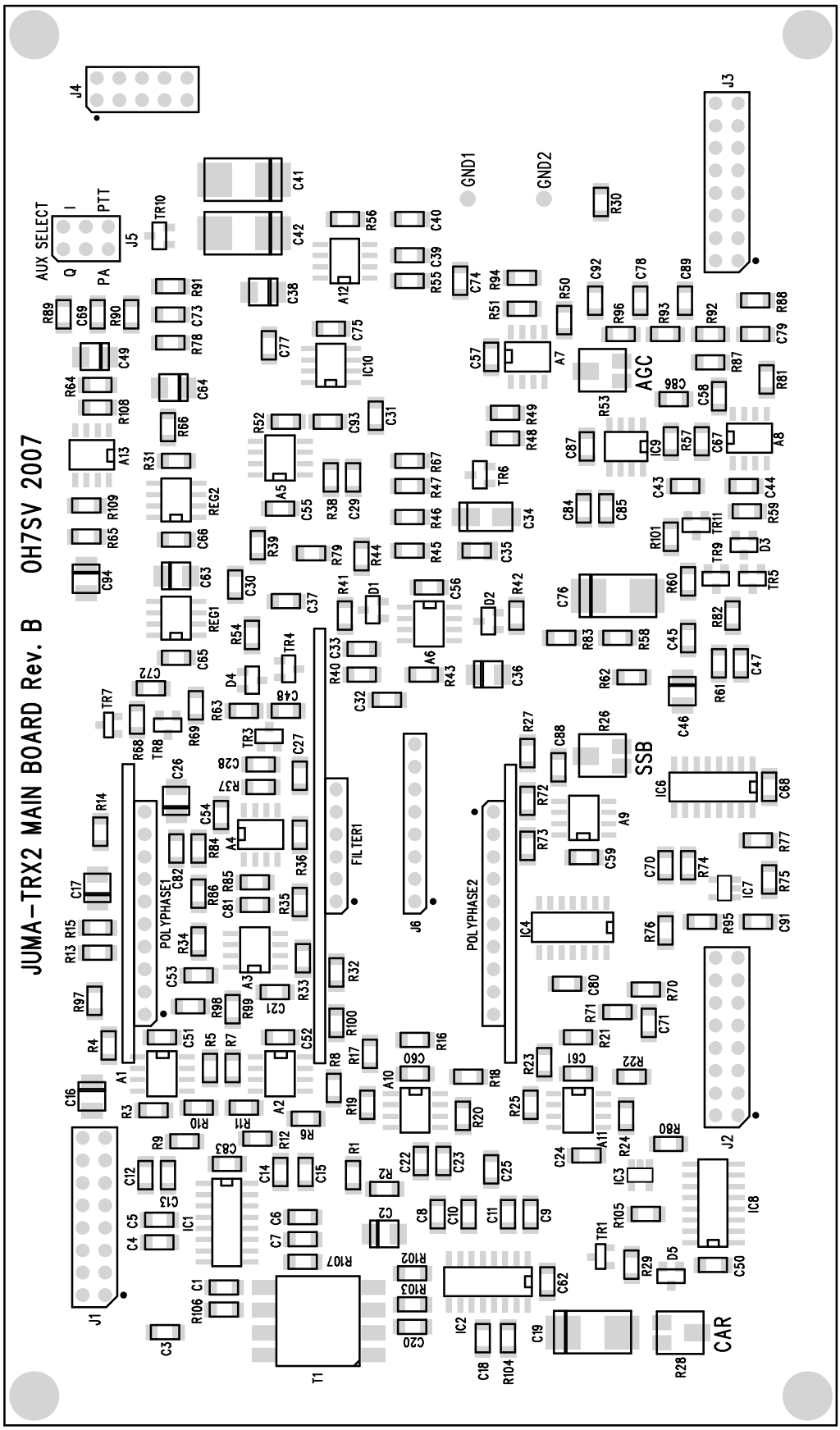


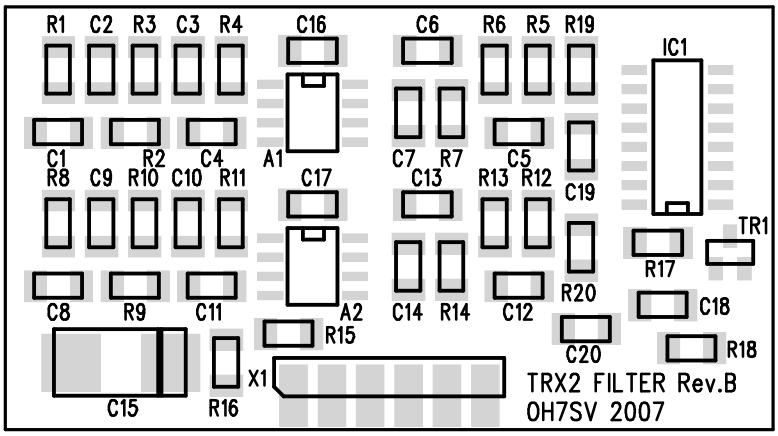


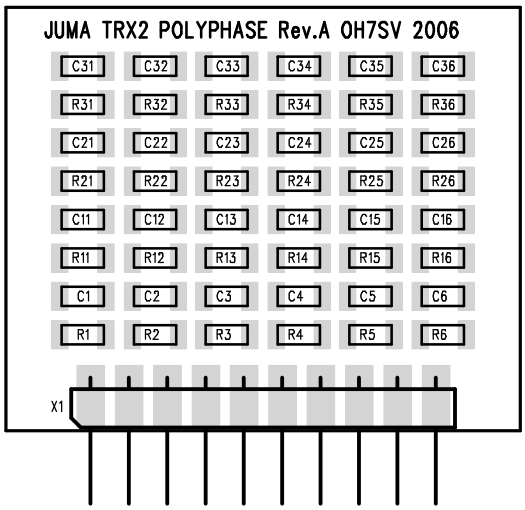


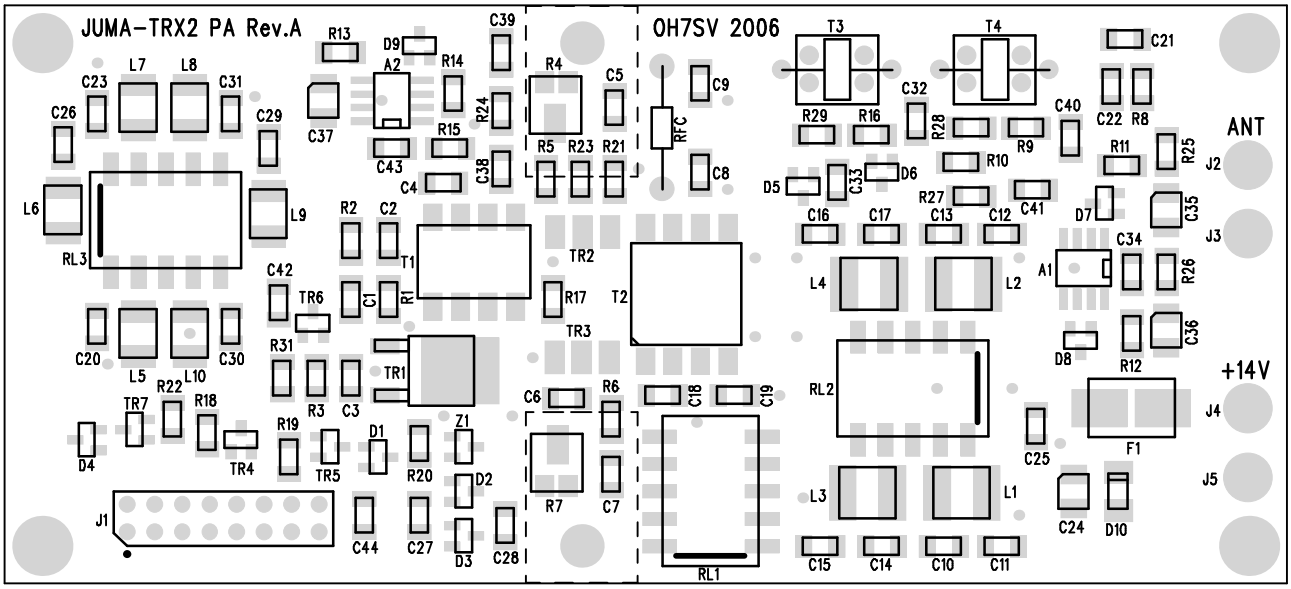

JUMA-TRX2 DDS Rev. B
OH2NLT 2006 / 2007
LCD1
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW10
R9
R30
R24
J6
JUMA-TRX2 DDS Rev.B / 22.03.2007

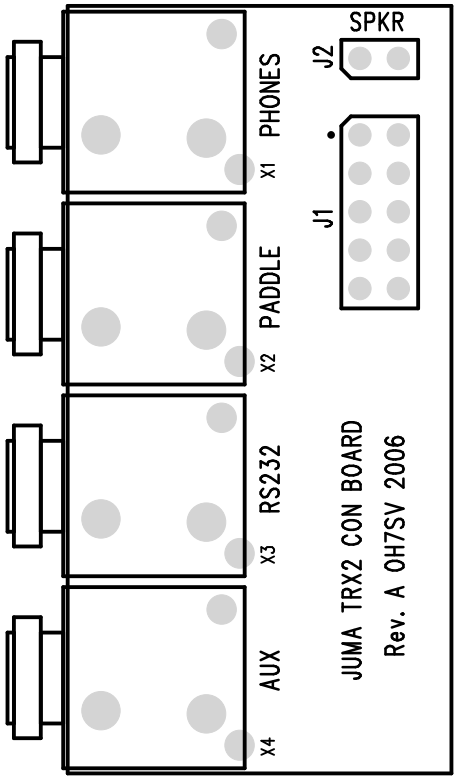


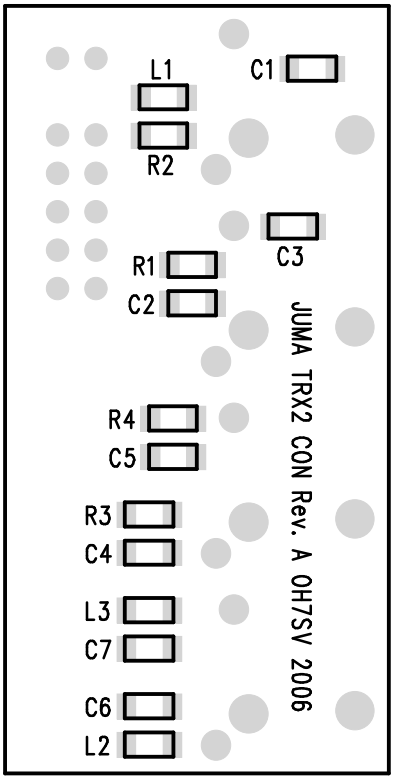

JUMA-TRX2 MAIN BOARD Rev. B OH7SV 2007
AUX SELECT
Q
I
PA
PTT
J5
J4
J3
J1
J2
J6
GND1
GND2
AGC
SSB
CAR
POLYPHASE1
POLYPHASE2
FILTER1
REG1
REG2
T1

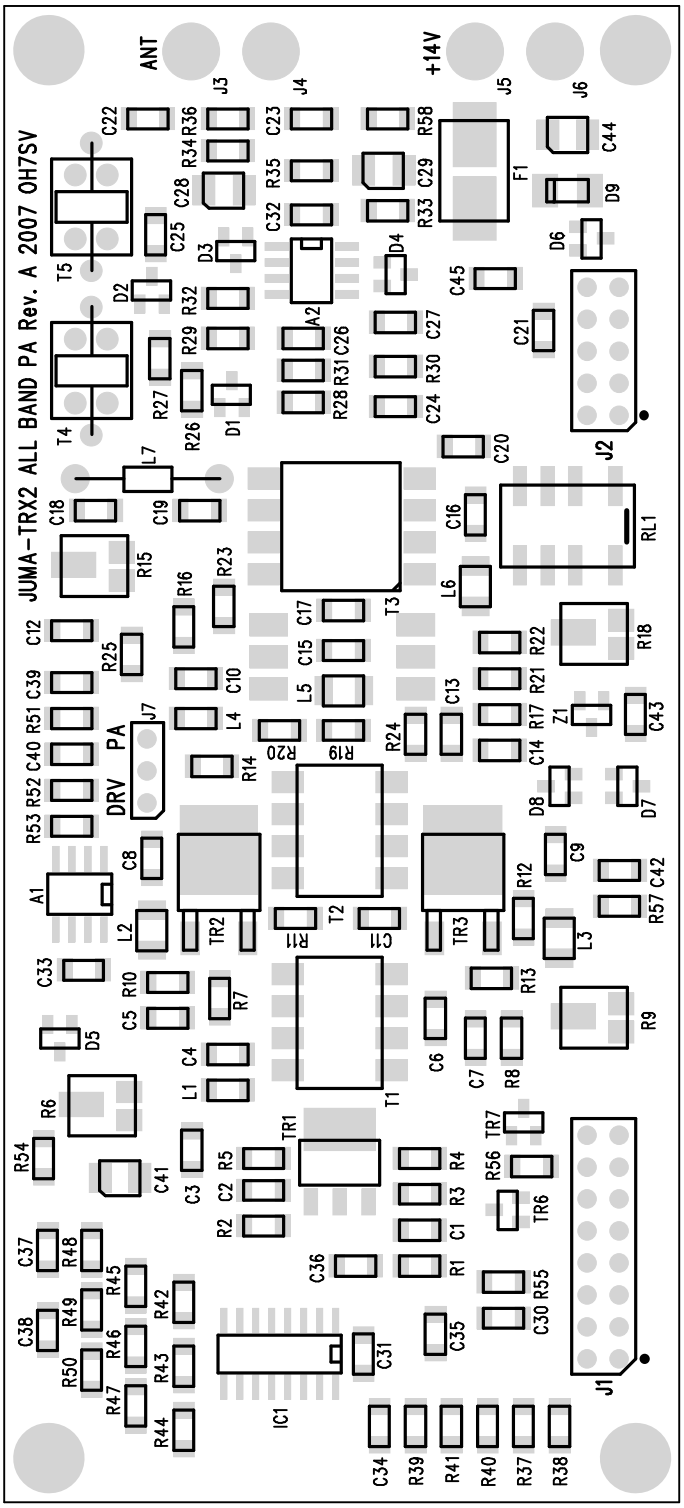

R1 C2 R3 C3 R4 C16 C6 R6 R5 R19 IC1
C1 R2 C4 A1 C7 R7 C5 C19
R8 C9 R10 C10 R11 C17 C13 R13 R12 TR1
R17
C8 R9 C11 A2 C14 R14 C12 R20 C18
R15 C20 R18
C15 R16 X1
TRX2 FILTER Rev.B
OH7SV 2007

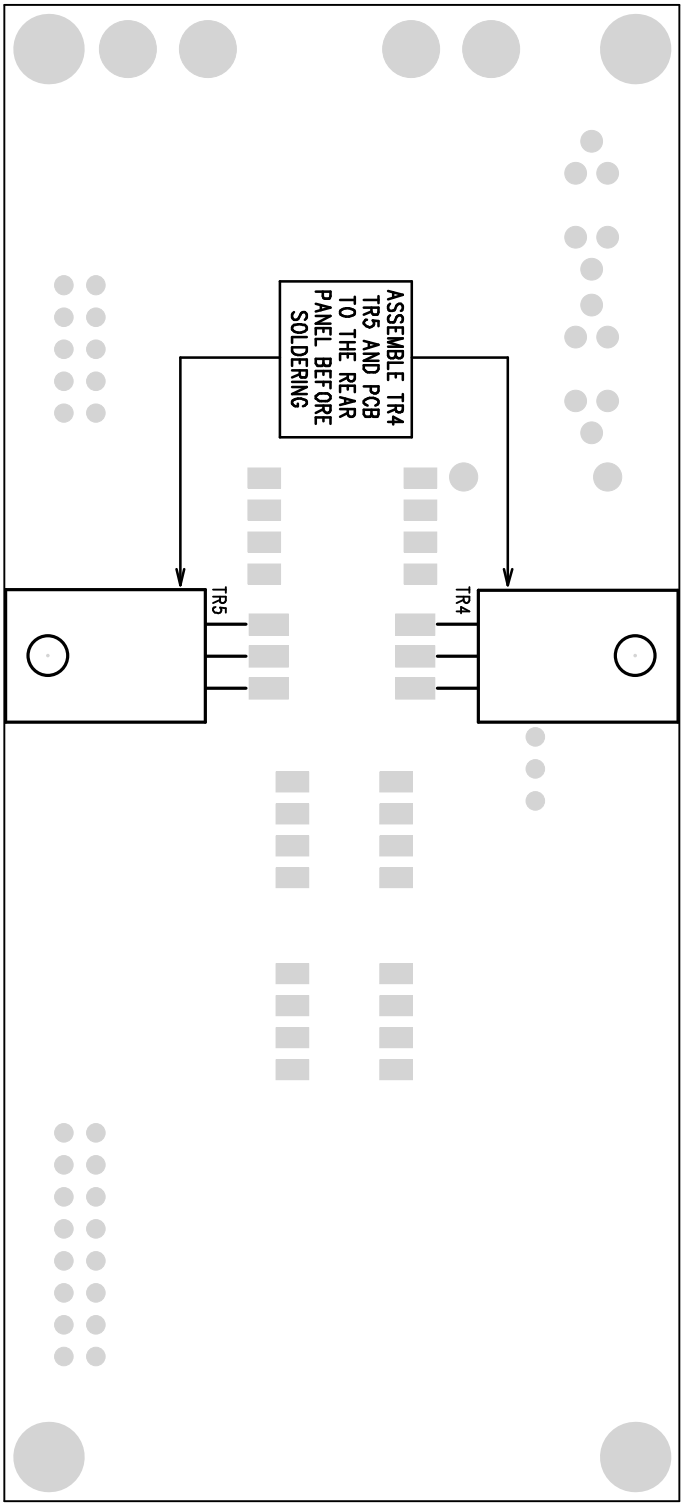

JUMA TRX2 POLYPHASE Rev.A OH7SV 2006
C31
C32
C33
C34
C35
C36
R31
R32
R33
R34
R35
R36
C21
C22
C23
C24
C25
C26
R21
R22
R23
R24
R25
R26
C11
C12
C13
C14
C15
C16
R11
R12
R13
R14
R15
R16
C1
C2
C3
C4
C5
C6
R1
R2
R3
R4
R5
R6
X1

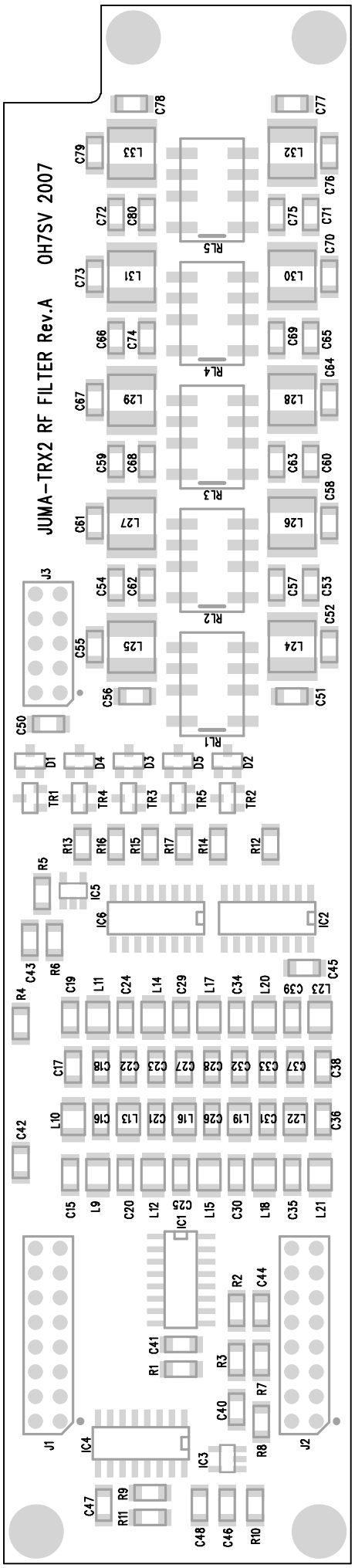

JUMA-TRX2 PA Rev.A
OH7SV 2006
ANT
+14V
J1
J2
J3
J4
J5
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
RL1
RL2
RL3
T1
T2
T3
T4
TR1
TR2
TR3
TR4
TR5
TR6
TR7
F1
A1
A2
RFC
Z1

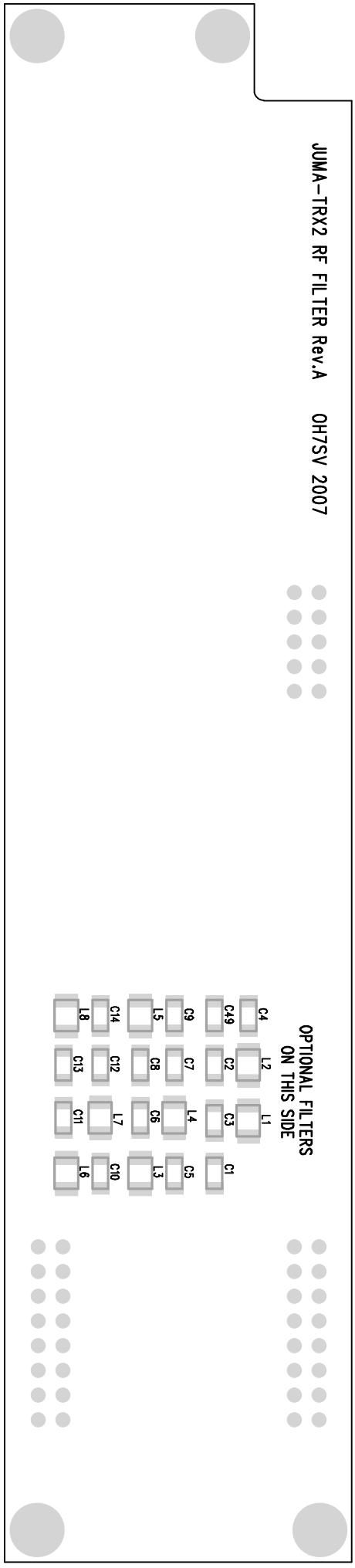

SPKR
J2
J1
PHONES
X1
PADDLE
X2
RS232
X3
AUX
X4
JUMA TRX2 CON BOARD
Rev. A OH7SV 2006

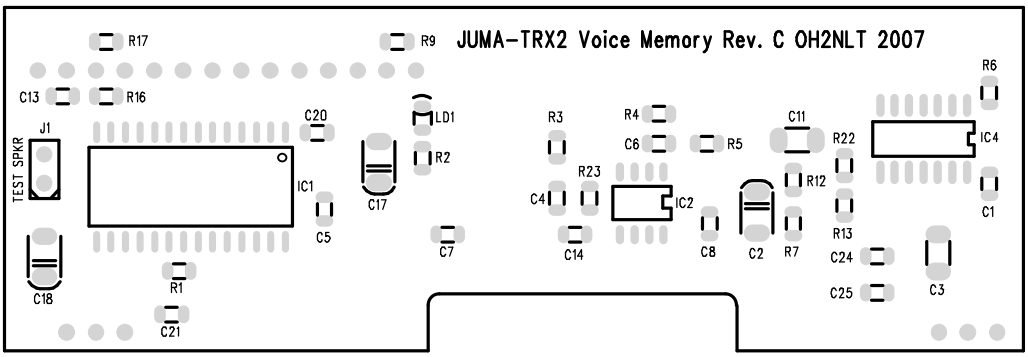

L1
C1
R2
C3
R1
C2
JUMA TRX2 CON Rev. A OH7SV 2006
R4
C5
R3
C4
L3
C7
C6
L2

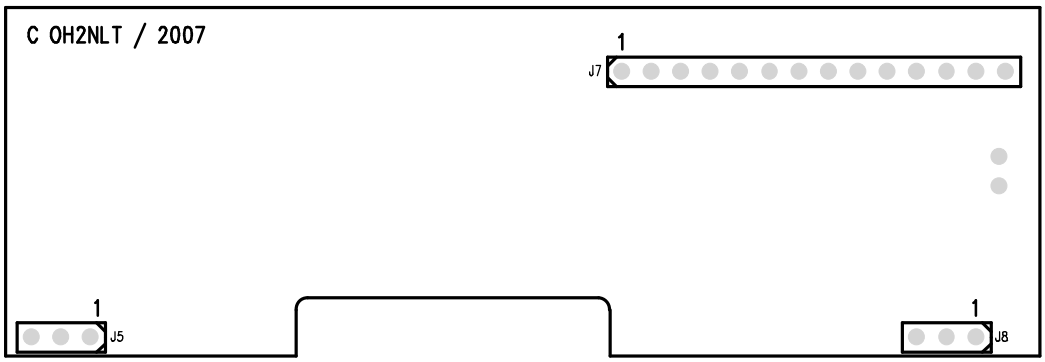

JUMA-TRX2 ALL BAND PA Rev. A 2007 OH7SV
ANT
+14V
DRV PA
J1
J2
J3
J4
J5
J6
J7
A1
A2
IC1
T1
T2
T3
T4
T5
TR1
TR2
TR3
TR6
TR7
RL1
F1
Z1
L1
L2
L3
L4
L5
L6
L7
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
C34
C35
C36
C37
C38
C39
C40
C41
C42
C43
C44
C45
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R12
R13
R14
R15
R16
R17
R18
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
R48
R49
R50
R51
R52
R53
R54
R55
R56
R57
R58
D1
D2
D3
D4
D5
D6
D7
D8
D9

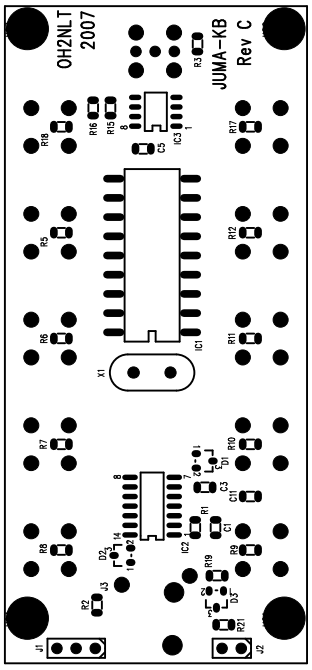

ASSEMBLE TR4
TR5 AND PCB
TO THE REAR
PANEL BEFORE
SOLDERING
TR5
TR4

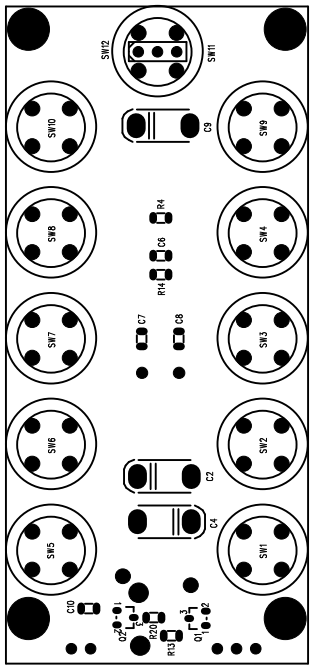

JUMA-TRX2 RF FILTER Rev.A OH7SV 2007


JUMA-TRX2 RF FILTER Rev.A OH7SV 2007
OPTIONAL FILTERS ON THIS SIDE
C4
C49
L2
C2
C3
L1
C9
L5
C7
C8
L4
C6
C5
L3
C1
C14
L8
C12
C13
L7
C11
C10
L6

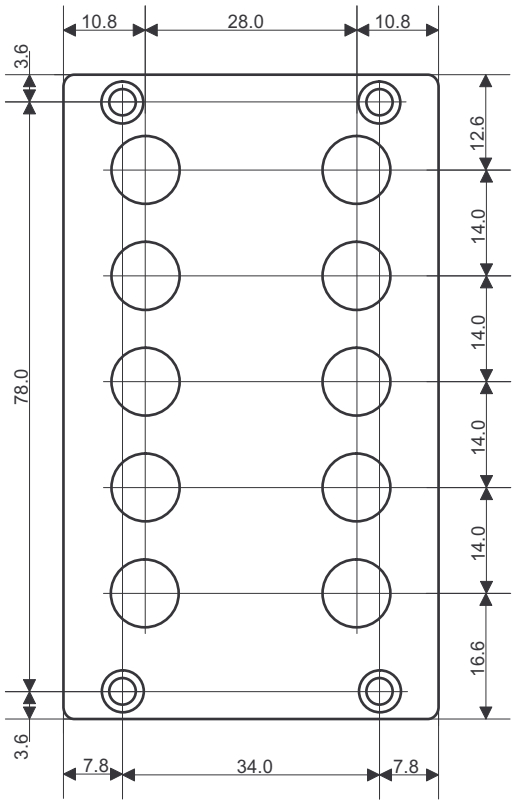

JUMA-TRX2 Voice Memory Rev. C OH2NLT 2007
R17
R9
C13
R16
J1
TEST SPKR
C20
LD1
R2
IC1
C17
C5
C7
C18
R1
C21
R3
R4
C6
R5
C11
R22
R12
R23
C4
IC2
C14
C8
C2
R7
R13
C24
C25
C3
R6
IC4
C1


C OH2NLT / 2007
1
J7
1
J5
1
J8


OH2NLT
2007
JUMA-KB
Rev C

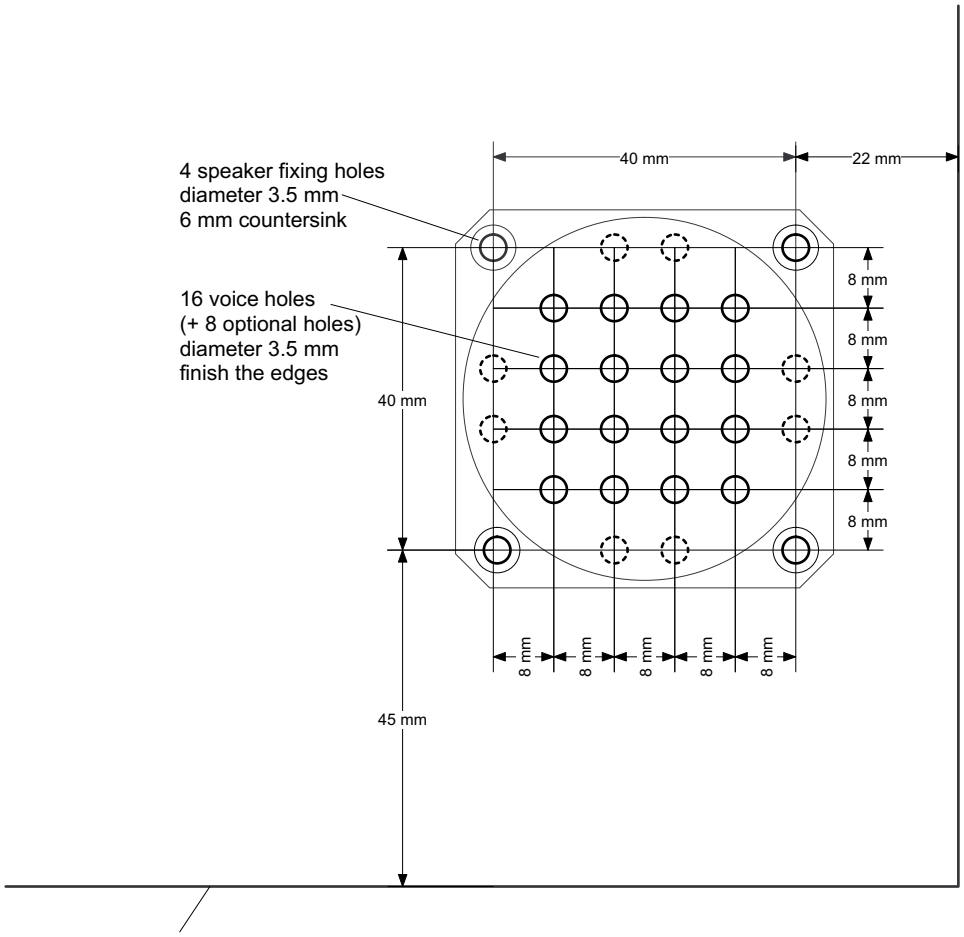


trx2_ext_buttons_c.pcb - Thu Aug 23 23:13:56 2007



4 countersunk holes D = 3.5 mm
10 holes D = 9.0 mm

JUMA KB1 holes drawing



JUMA TRX2 SPEAKER HOLES
TOP VIEW
2008-01-26 OH7SV

JUMA TRX2 Main board voltage table (last update 2008-02-07)

All values are typical DC voltages measures with a high ohmic (>1M) volt meter ("x" in table means don't care)
Conditions: Receive state, Mode LSB, f = 3.7 MHz, Filter WID, AGC slow, Speechproc OFF, NB OFF, MIC input, dummy load

	IN	OUT
REG	**Pin 8**	**Pin 1**
REG1	13-14	4.8-5.2
REG2	13-14	9.6-10.4

The "5" volt in OPAMP table is a half of the "10 volt" supply voltage,
e.g. if the REG2 out is 10.2 V, the "10" is 10.2 and the "5" is 5.1 V.

	OUT	IN-	IN+	GND	IN+	IN-	OUT	Vcc
OPAMP	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**
A1	5	5	5	0	5	5	5	10
A2	5	5	5	0	5	5	5	10
A3	5	5	5	0	5	5	5	10
A4	5	5	5	0	5	5	5	10
A5	5	5	5	0	5	5	5	10
A6	x	1-4	1-4	0	1-4	1-4	x	10
A7	2-8	1-4	1-4	0	1-4	1-4	<50mV	10
A8	5	5	5	0	5	5	5	10
A9	5	5	5	0	5	5	5	10
A10	5	5	5	0	5	5	5	10
A11	5	5	5	0	5	5	5	10
A13	5	5	5	0	5	5	5	10

NOTE!

It is recommended to use a series resistor in the positive lead to avoid possible RF influence to the reading. Suitable resitor value is 4k7…22k. The resistor in not needed when measuring pure DC signals.

				GND		Vcc		
AMP	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**
A12	1.3	0	0	0	6-8	13-14	7	1.3

* Depends on mode, config settings or band. See schematics.

								GND								Vcc
IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**	**Pin 9**	**Pin 10**	**Pin 11**	**Pin 12**	**Pin 13**	**Pin 14**	**Pin 15**	**Pin 16**
IC1	0	~2	1.2	1.2	1.2	1.2	1.2	0	1.2	1.2	1.2	1.2	1.2	~2	0	5
IC2	5	~2	x	x	x	x	x	0	x	0	0	x	x	~2	5	5
IC6	5*	0*	0*	0*	0*	5*	0*	0	x	5	5	0	0	0	5	5
IC8	0	5*	~2.5	x	~2.5	x	~2	0	~2	x	~2.5	x	~2.5	5	0	5

* Depends on mode. See schematics.

							GND							Vcc
IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**	**Pin 9**	**Pin 10**	**Pin 11**	**Pin 12**	**Pin 13**	**Pin 14**
IC4	5	5	0	0	0*	5	0	5	0	5*	0*	5*	5*	5

* Depends on SSB/CW

			GND	Vcc				
IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**
IC9	2.5	1.5	0	5	2.5	2.5	5*	~2.5
IC10	2.5	1.5	0	5	2.5	2.5	5	~2.5

			GND		Vcc
IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**
IC3	x	0	0	5	5
IC7	x	0	0	5	5

Conditions: Transmit state, Mode LSB, f = 3.7 MHz, Filter WID, AGC slow, Speechproc OFF, NB OFF, MIC input, dummy load

IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**	**Pin 9**	**Pin 10**	**Pin 11**	**Pin 12**	**Pin 13**	**Pin 14**
IC4	0	0	5	5	0	5	0	0	5	5	0	5	5	5

IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**	**Pin 9**	**Pin 10**	**Pin 11**	**Pin 12**	**Pin 13**	**Pin 14**	**Pin 15**	**Pin 16**
IC1	5	~2	x	x	x	x	1.2	0	1.2	x	x	x	x	~2	5	5
IC2	0	~2	1.2	1.2	1.2	1.2	1.2	0	x	0	0	0	0	~2	5	5

Conditions: Transmit state, Mode CW, f = 3.7 MHz, Filter WID, AGC slow, Speechproc OFF, NB OFF, MIC input, dummy load

IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**	**Pin 9**	**Pin 10**	**Pin 11**	**Pin 12**	**Pin 13**	**Pin 14**
IC4	0	0	5	5	5	0	0	5	5	0	5	0	0	5

IC	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**	**Pin 9**	**Pin 10**	**Pin 11**	**Pin 12**	**Pin 13**	**Pin 14**	**Pin 15**	**Pin 16**
IC1	5	~2	x	x	x	x	1.2	0	1.2	x	x	x	x	~2	5	5
IC2	5	~2	x	x	x	x	1.2	0	~0/0.7	0	0	~0/1.4	~0/1.4	~2	5	5
IC3	x	0/5	0	5/0	5											

(n/m = PTT/ Key down)

JUMA TRX2 Filter board voltage table (last update 2007-11-02)

All values are typical DC voltages measures with a high ohmic (>1M) volt meter ("x" in table means don't care)
Conditions: Receive state, Mode LSB, f = 3.7 MHz, Filter WID, AGC slow, Speechproc OFF, NB OFF, MIC input, dummy load

The "5" volt in OPAMP table is a half of the "10 volt" supply voltage,
e.g. if the 10 V supply is 10.2V, the "10V" is 10.2 and the "5" is 5.1 V.

	OUT	IN-	IN+	GND	IN+	IN-	OUT	Vcc
OPAMP	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**
A1	5	5	5	0	5	5	5	10
A2	5	5	5	0	5	5	5	10

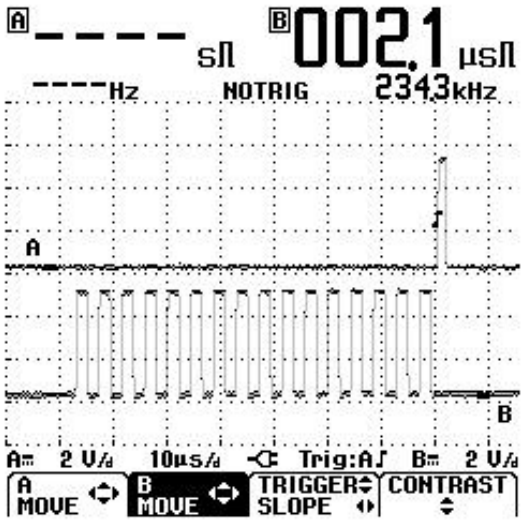
IC	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9	Pin 10	Pin 11	Pin 12	Pin 13	Pin 14	Pin 15	Pin 16
IC1	0	0	x	0	0	0	0	0	0	10	0	5	5	5	0	10
										0 (NAR)						

JUMA-TRX2 SPI bus signals

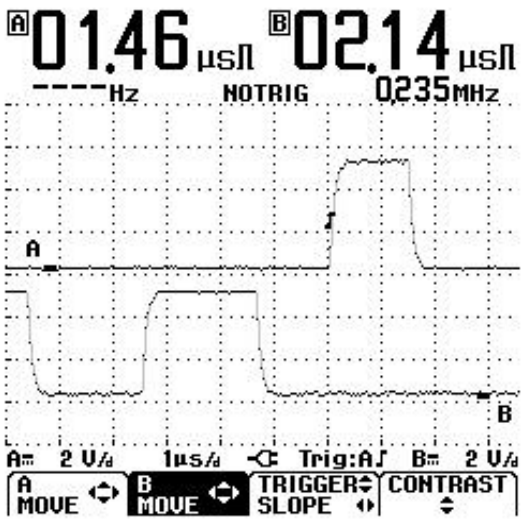
OH2NLT 29.10.2007

SPI serial bus is used in JUMA-TRX2 transceiver to transport several digital outputs from DDS/control board to the main board and to the all band filter board. Totally 16 bits are transmitted via SPI bus. Eight bits are used in the main board. IC6 74HC595 shift register / latch is used to receive and drive main board control signals. If all band RF filter board is present there is another 74HC595 shift register for the filter board control signals. See schematics and functional description for actual control output usage. JUMA-TRX2 SPI bus is active only when some output state changes. This way SPI bus generated interference can be minimized. Changing MODE or tuning very fast across whole coverage is the easiest way to generate SPI traffic for bus measurement purpose. Another way to generate continuous SPI traffic is via test commands. Set TRX-2 serial -mode to test (RS232=Test). Give command c (lower case c) from terminal. Response to the terminal should be: SPI Tx cont. Test can be interrupted with any key.

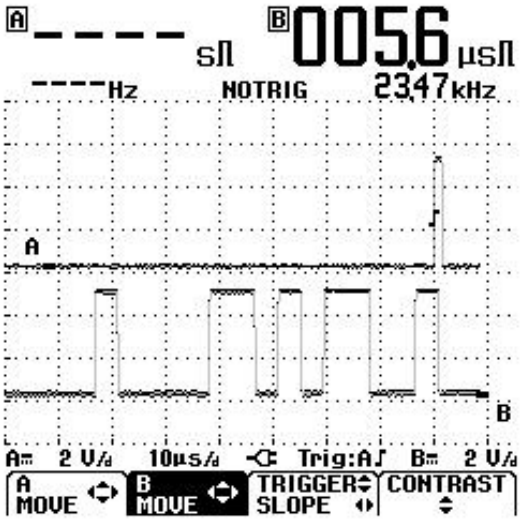
Some typical SPI bus waveforms for reference purpose.



Trace A = SPI bus latch-signal (SPI_LATCH), DDS board J2-11
Trace B = SPI bus clock signal (SPI_CLK),, DDS board J2-8

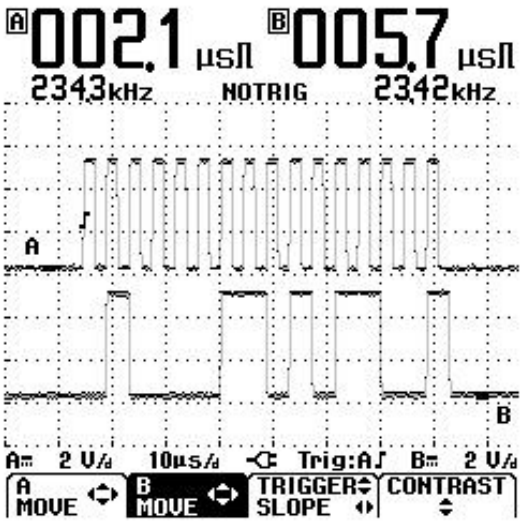


Trace A = detail view of the 1,46us wide SPI_LATCH signal
It is rather difficult to see without memory oscilloscope



Trace A = SPI bus latch signal (SPI_LATCH), DDS board J2-11

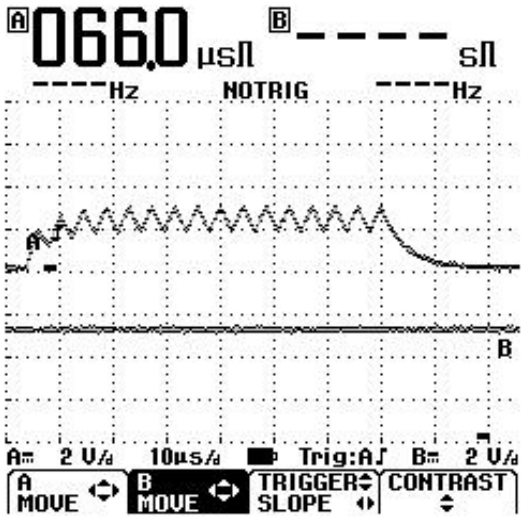
Trace B = SPI bus data signal (SPI_SDO), DDS board J2-6



Trace A = SPI bus clock signal (SPI_CLK), DDS board J2-8

Trace B = SPI bus data signal (SPI_SDO),, DDS board J2-6

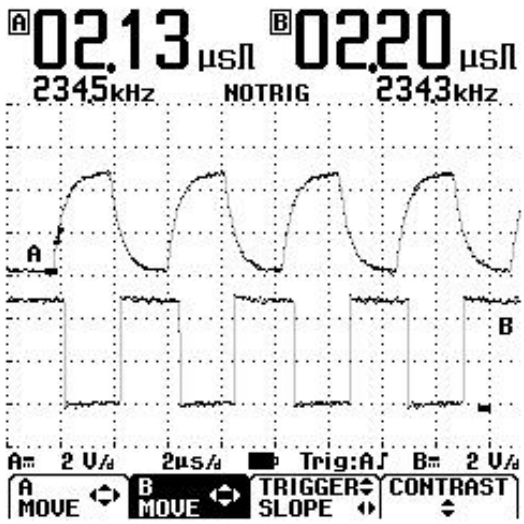
Note: Clock signal is filtered and inverted in the main board (IC7 and R95/C91) and in the RF filter board (IC3 and R8/C46). If you are doing fault finding clock signal should be checked also from 74HC595 pin # 11.



Example of bad SPI_CLK signal. Wrong (too high) value of capacitor C91.

Trace A = SPI bus clock signal (SPI_CLK), main board IC7-2

Trace B = main board IC7-4, no signal



Example of good SPI_CLK signal.

Trace A = SPI bus clock signal (SPI_CLK), main board IC7-2

Trace B = SPI bus clock signal (SPI_CLK), main board IC7-/ IC6-11

JUMA-TRX2 serial protocol description
OH2NLT 22.08.2007

JUMA-TRX2 serial interface protocol can be selected from TRX2 user setup. Long push of DISPLAY button gives setup menu for the user. Short pushes of the DISPLAY button walks through various JUMA-TRX2 setups. Stop at RS232 = xxxxx selection. Now you can select desired serial protocol with VFO knob. Long push of the DISPLAY button leaves the setup menu. All the setup changes are immediately effective and stored to the EEPROM memory during next power off sequence. In all serial protocol modes the default serial settings are 9600-8-n-1.

Available JUMA-TRX2 serial protocols
- JUMA-TRX2 protocol
- JUMA-TRX2 external keyboard protocol
- JUMA-TRX2 test commands
- Yaesu CAT emulation

Not yet defined and implemented in JUMA-TRX2 software version 1.01
- JUMA-TRX2 external keyboard protocol

This is simple one direction control protocol for JUMA-TRX2 voice memory option control. Commands can be sent to JUMA-TRX2 with JUMA external keyboard or a PC program. If voice memory option card is not installed these commands have no effect. Response messages are echoed to serial interface for debug purposes. This feature is useful if PC with a terminal program is connected to the JUMA-TRX2 serial interface. Voice memory action is also showed on the JUMA-TRX2 LCD display.

First a command is selected and then a memory location number where the action is addressed.

Available commands (capital letters) Actions and their definitions.

P Selects play mode. Stored message is played from JUMA-TRX2 speaker
T Selects transmit mode. Stored message is transmitted with current TX settings.
R Selects record mode. Audio with current RX settings is recorded (stored) to selected memory location.
M Selects record from microphone mode. Audio from JUMA-TRX2 microphone is recorded (stored) to selected memory location.
S Stops current action immediately. Play, TX and record commands can be stopped with this command before EOM (end of the memory) is reached.
E Erase all. This command is not normally used. Erase all command deletes all messages and removes all EOM markers.

Memory numbers
0 to **9** After an action is selected a memory number that can be from 0 to 9 defines the voice memory location and starts selected action.

Examples
Record message from microphone to memory location 1.
Select **M** for microphone input
Select **1** for memory #1 and start recording
Press **S** to stop recording

Play message from memory location 1.
Press **P** to play
Select **1** for memory #1 and start playback
Playback stops when whole message is played.
Playback action can also be stopped with **S** command.

JUMA-TRX2 test commands

Various different test commands are provided for JUMA-TRX2 hardware functionality testing. These commands are not needed or used during normal JUMA-TRX2 operation. Test commands are good help in troubleshooting. Below is a very brief description of available commands. User should see program source code listing for particular command functional details. Commands are single letter commands given from PC terminal. Please note that small and capital letters are different commands.

I info, SW version etc
A convert and print all analog inputs
E dump EEPROM content
C clear EEPROM factory default reset counter
W writes from PC terminal to JUMA-TRX2 LCD display
B LCD bar graph test
s mute audio, stop SCAF filter clocking
S audio on, start SCAF filter clocking
p print CW speed pot & S-meter A/D conversion values
d print some internal VFO select logic values
o print reference oscillator calibration value
m print internal timing ms counter value
t write test data to SPI bus
c continous test data write to SPI bus
+ increase multiband PA RF attenuator value
- decrease multiband PA RF attenuator value
f print SPI bus control data
Z intentional divide by zero, CPU error trap test
A convert and print all analog inputs
Do A/D conversion for all analog inputs and print raw conversion result values.
E dump EEPROM content
Dump EEPROM contents. Dump contains stored user defaults and calibration constants.
C clear EEPROM factory default reset counter

JUMA-TRX2 software keeps track how many factory default resets have occurred. This counter is shown (printed to the serial interface) on every start up. This counter can be reset to zero with this command.

W writes from PC terminal to JUMA-TRX2 LCD display

Write characters from PC terminal to the JUMA-TRX2 LCD display. W-command is useful help to test LCD compatibility and general operation. Test loop can be stopped with Esc character.

B LCD bar graph test

Runs bar graph display up and down on the JUMA-TRX2 LCD display. This test verifies LCD display module soft font compatibility. Any character from PC terminal will stop the test loop.

s mute audio, stop SCAF filter clocking

Mute JUMA-TRX2 audio. Stopping JUMA-TRX2 main board SCAF filter clocks generates mute.

S audio on, start SCAF filter clocking
Restart JUMA-TRX2 main board SCAF filter clocks. Opens the audio path.
p print CW speed pot & S-meter A/D conversion values

Print CW speed potentiometer value and S-meter value.

d prints some internal VFO select logic values

Print some internal variables used in VFO select logic.

o prints reference oscillator calibration value

Print DDS reference oscillator calibration value. Nominal value is 180000000Hz

m print internal timing ms counter value

Print internal 1ms tick counter value. Can be used to verify JUMA-TRX2 software timing.

t writes test data to SPI bus

Write once 0x5501 test data to the SPI bus. This command can be used to verify SPI bus I/O functions in the main board and multiband PA board.

c continuous test data write to SPI bus

Same as t-command but writes continuously increasing test data word to the SPI bus. Test loop can be stopped with sending any character from PC terminal.

+ increase multiband PA RF attenuator value
- decreace multiband PA RF attenuator value

Increase or decrease multiband PA board RF attenuator value.

f print SPI bus control data

Print current SPI bus control data. Data correspond current main board and multi band PA SPI I/O state.

Z intentional divide by zero, CPU error trap test

Performs intentional divide by zero that causes CPU error trap. Command is used to test error trap logic.

Some Yaesu CAT control protocol commands are implemented in the JUMA-TRX2 software. There is no exact 1:1 match in JUMA-TRX2 functionality and the original Yaesu FT897 CAT specification. Essential commands such as set frequency, read frequency, read s-meter, set mode etc are implemented. Implementation of these essential commands allows JUMA-TRX2 to be controlled by rig control programs. Particular rig control program must be set to Yaesu FT897 control mode.

Implemented Yaesu CAT commands

0x03 Read RX frequency and mode
0xE7 Read RX status (S-meter)
0xF7 Read TX status
0x02 Set split on
0x82 Set split off
0x81 Toggle VFO select
0x07 Set operating mode bits
0x01 Set operating frequency
0x08 PTT on
0x88 PTT off
0x00 VFO lock on
0x88 VFO lock off

For more details see JUMA-TRX2 software source code and Yaesu CAT specification.

JUMA TRX2 Boot loader **OH2NLT & OH7SV last update 26.01.2008**

General

The boot loader allows a user to update the JUMA-TRX2 firmware into the dsPIC30F6014A flash memory without any special tools. The firmware is programmed through the RS232 serial port. Only a PC with a serial com port, serial com cable and the PC software is needed.

How it operates

The boot loader is two part program.

1. The client part

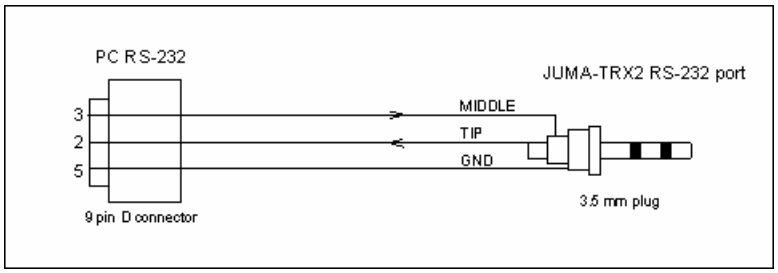
The client part is a piece of software programmed into the JUMA-TRX2 control processor (to the top part memory of the dsPIC30F6014A). The firmware coming with the JUMA TRX2 kit includes this client part. Every time the JUMA-TRX2 is powered on the boot loader checks if the VFO button is held down during the start up. This VFO button pressing is the signal for the boot loader to start the procedure. The message is written into the TRX2 LCD display and the boot loader starts to negotiate with the PC connection. If the connection is not established within few seconds the boot loader starts the normal control program. A start without pressing the VFO button transfers the control immediately to the TRX2 normal control program.

2. The PC side Graphics User Interface program

The user interface program (GUI) is located in the PC and it transfers the firmware file from the hard disk to TRX2 via the serial port. The PC side program (GUI) must be started before the JUMA-TRX2 boot loader. A successful communications between the PC and the JUMA-TRX2 is indicated on the PC screen. The user can select a firmware file (juma-trx2.hex) to load (flash programming) and start the programming cycle.

The preparations for programming a firmware

Get a PC with the Windows XP operating system and with a RS232 serial com port.



Get a serial com cable with a D9 female connector – JUMA-TRX2 3.5mm jack plug.
Get Ingenia dsPICbootloader PC software by downloading it from here (http://www.nikkemedia.fi/juma-trx2/bootloader/ingeniadsPICbootloader1.1.zip)

Install the dsPICbootloader PC software.

IMPORTANT!

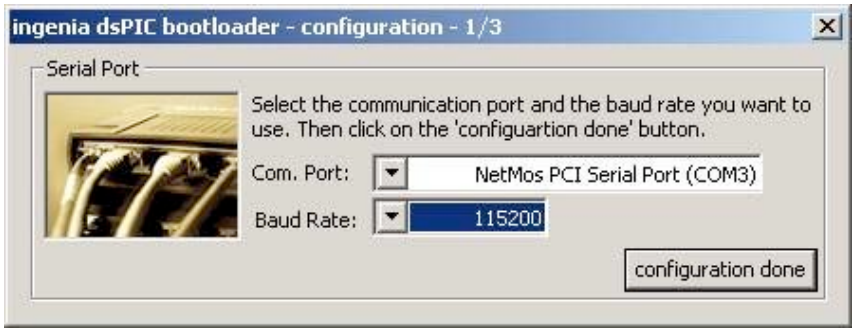
After installing the Ingenia bootloader into the PC **you must replace the original file** (ibl_dspiclist.xml) **with this file ibl_dspiclist.xml**
Note! This xml file is compatible only with the Ingenia bootloader version 1.1.
The xml file is typically located in the hard disk folder:
C:\Program Files\Ingenia\ingeniadsPICbootloader

Get a JUMA-TRX2 firmware hex file (juma-trx2_Vxxx.hex) what you like to program into your JUMA-TRX2. The latest firmware file can be downloaded from JUMA TRX2 site.
Connect the serial com cable between the PC and the JUMA TRX2.

Note! Before programming write down the Service Mode calibration parameters, because they might be set to the factory deafaults depending on the extent of the new firmware.
Go to the Service mode to write down the parameters:
- Switch off TRX2
- Push and keep the PWR button down as long as the Service Mode is displayed in the LCD
- Write down each parameter in each service mode page by pushing the DISPLAY button
- Finally switch off the TRX2

Firmware programming instructions (for GUI Version1.1)
Close any terminal or other program which can reserve the PC com port.
Start the ingenia dsPIC bootloader in your PC and follow the instructions.

Switch OFF the JUMA TRX2

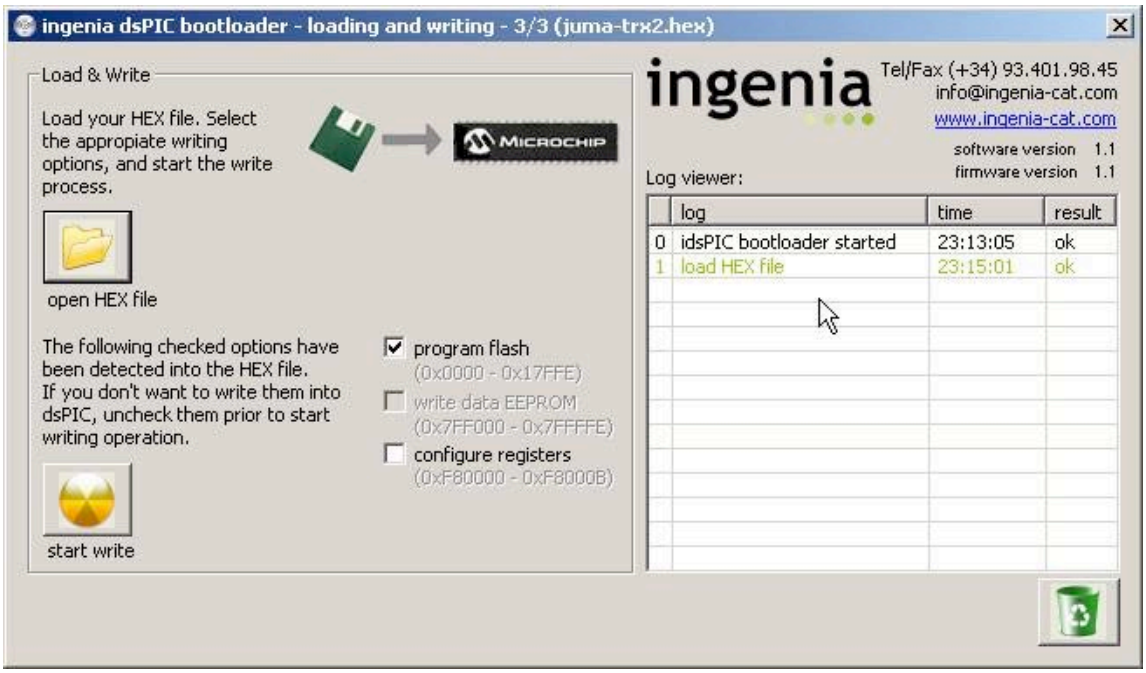


Configure the PC com port if needed. Normally the default baud rate of 115200 works fine but you can select a lower speed if needed. When ready with the com settings, click configuration done button.

Now the PC software is waiting the JUMA-TRX2 Flash Writer to be started.
Start up (power on) JUMA-TRX2 while **keeping VFO button pressed**.
You should see the text below in the JUMA TRX2 LCD display.

JUMA TRX2 Flash writer started

Successful communication between the PC software and JUMA-TRX2 brings the above screen visible.
Click the open HEX file button and select the hex file from your hard disk (for example juma-trx2.hex).



After selection of the hex file, the start write button appears. Click start write button to start the flash programming.
The programming should take about 5...15 seconds, depending on the baud rate.

Note! After successful programming you have to disconnect power from the power supply because the TRX2 green PWR button does not work in this state.

Finally switch on the JUMA TRX2 and test the new firmware.

Troubleshooting

How to test the serial communication
Start Hyperterminal or any other terminal program in your PC. Configure the com port in use to 9600-8-N. Connect RS232 cable to JUMA-TRX2. Power up JUMA-TRX2 (normal power on start). You should see following text at terminal screen:

JUMA-TRX2 Firmware v1.02, Test release / 230108 Copyright Juha Niinikoski, OH2NLT
System Clock = 7500 kHz
EEPROM checksums, Cal = 0, Def Cs = 0, Factory default resets = 1
TRX-2 voice memory option found (ISD17240 chip)
Select **RS232 = Test** from Juma TRX2 config pages. Now you can try commands from terminal.
I (capital I) should print the software version
E(capital e) should dump JUMA-TRX2 configuration EEPROM content
Other commands. See JUMA-TRX2 user manual and software source code listing.

JUMA-TRX2 boot loader software

Normally you don't need to program the boot loader software, because it is included in the TRX2 kit firmware. You need to program the boot loader only if you have an "empty" dsPIC30F6014A chip. The boot loader can be programmed into the dsPIC chip with Mplab ICD tool or equivalent programmer. Boot loader code is based on Ingenia dsPIC bootloader firmware but modified for the JUMA-TRX2. When programming an "empty" dsPIC30F6014A chip you should keep the PWR button pressed all the time or install Jumper J4 in the DDS board to keep power on during programming because the JUMA-TRX2 power switch is software controlled.

Some tips for your own firmware
If you are compiling your own firmware for JUMA-TRX2 special linking loader script for Microchip C30 compiler should be used. There must always be a jump to the user code start at absolute program memory address 0x100.

```
.text __CODE_BASE :
{
/*
** Generate extra goto __reset for boot loader. OH2NLT 050106
** Boot loader allways jump to start address 0x100
*/
SHORT(ABSOLUTE(__reset));
SHORT(0x04);
SHORT((ABSOLUTE(__reset) >> 16) & 0x7F);
SHORT(0);
*(.handle);
*(.libc) *(.libm) *(.libdsp); /* keep together in this order */
*(.lib*);
*(.text);
} >program
```

For more details see the provided JUMA-TRX2 source code and Mplab project files.

Alternative programming method
You can also program the JUMA-TRX2 firmware with Microchip ICD 2 tool or other programmer without the boot loader. However if you do this, the boot loader is erased from dsPIC30F6014A flash memory and it must be reprogrammed if needed later. For the initial loads a special hex file is available including both the boot loader and the firmware. See TRX2 technical page.