The ARC 51 BX

The ARC-51BX is a compact UHF military aircraft transceiver, made by Rockwell-Collins around 1969. The transceiver has 3500 Xtal controlled channels between 225MHz and 400MHz.
Channel distance is 50kHz, audio bandwidth is 6kHz, and the modulation is AM.

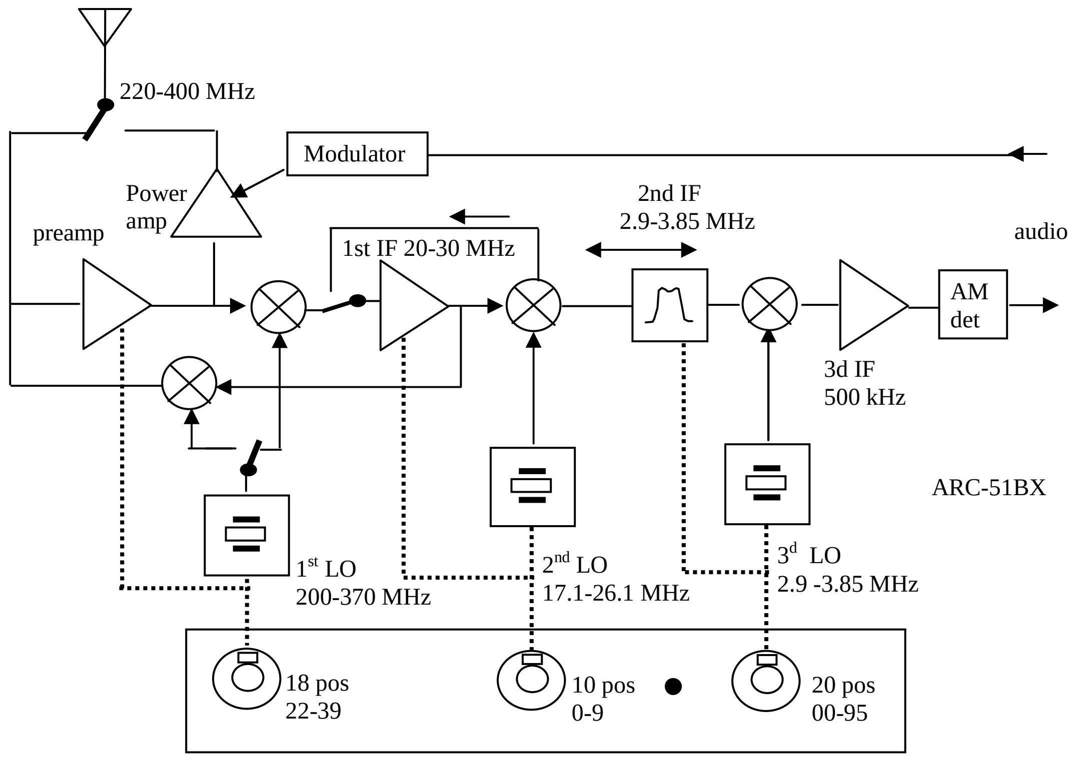
Frequency control

Three rotary knobs on the remote control panel select the tens of MHz (18 positions), units MHz (10 positions) and kHz (20 positions, in 50kHz steps)
Each rotary switch position is transferred by 5 contacts to the ARC51-BX.

The receiver is a triple superhet, the first knob controls the first local oscillator (LO) , etc.
There are 18 + 10 + 20 = 48 Xtals, selecting 18 x 10 x 20 = 3600 channels.

The dials can be set anywhere from 220.00 ..399.95, so 3600 channels, however the first 100 channels (up to 225 MHz) are not used in the official spec. MIL-R-22659D.

During transmit (key down), the oscillator frequencies are added backward from third to first LO using the same IF filters as in the receive mode. This requires a lot of relays.



The RF preamp	is mechanically tuned from	225 - 400 MHz	BW	3 MHz
The 1e IF	is mechanically tuned from	20 – 30 MHz	BW	300 kHz
The 2e IF	is mechanically tuned from	2.9 - 3.9 MHz	BW	100 kHz
The 3e IF	is fixed, centered around	500 kHz.	BW	40 kHz (480-520 kHz)

With all dials at minimum, the receive frequency is 200 + 17.1+ 3.40 – 0.5 = 220.00 MHz
and the transmit frequency is 200 + 17.1+ 2.90 = 220.00 MHz
With all dials at maximum, the receive frequency is 370 + 26.1+ 3.35 + 0.5 = 399.95 MHz
and the transmit frequency is 370 + 26.1+ 3.85 = 399.95 MHz

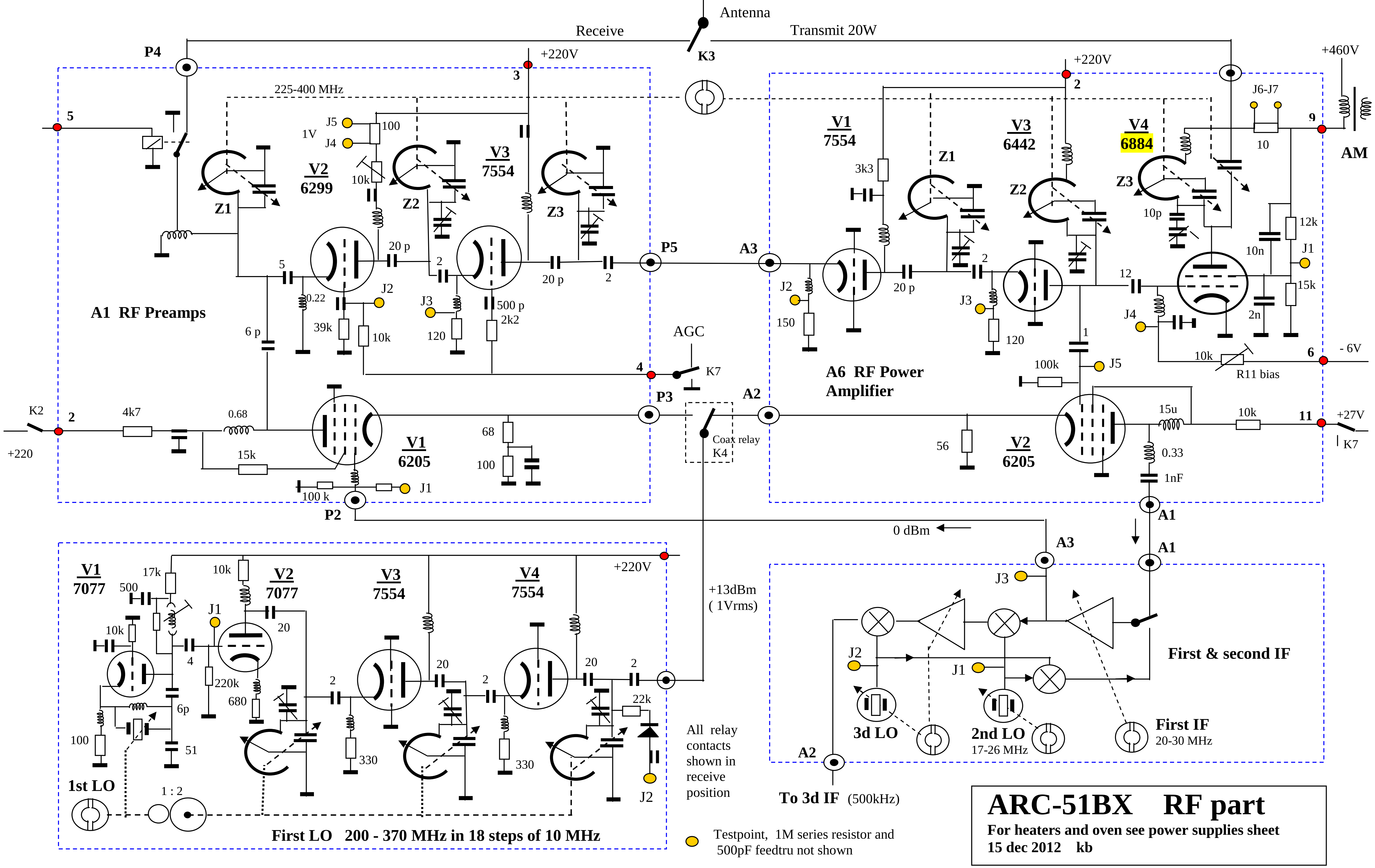
MODULES

The ARC51BX has a modular construction with a vertical septum in the middle, with modules on each side.
The septum distributes all signals, cooling air, and motion to the tuned elements and crystal selector switches.

The modules are

A1 Rcvr / RF preamp
A2 First and second IF amplifier
(with 2nd and third local oscillator)
A3 Third IF amplifier
A4 Modulator / Audio amplifier
A5 Spectrum Generator (First local oscillator)
A6 RF power amplifier
A7 Guard receiver
A8 Power Supply
A9 Mechanical Tuning

More on next pag



ARC 51 BX   UHF part

The UHF part of the ARC51 has 3 modules:

A1 The RF Preamp
A6 The RF Power Amplifier
A5 The Spectrum generator (First LO)

These 3 modules are the only ones with tubes, most planar (ceramic) triodes. All have tuned circuits, driven by the mechanical tuner.
All relays in the UHF parts diagram are controlled by the Push To Talk (PTT) switch, and all are drawn in the receive position.

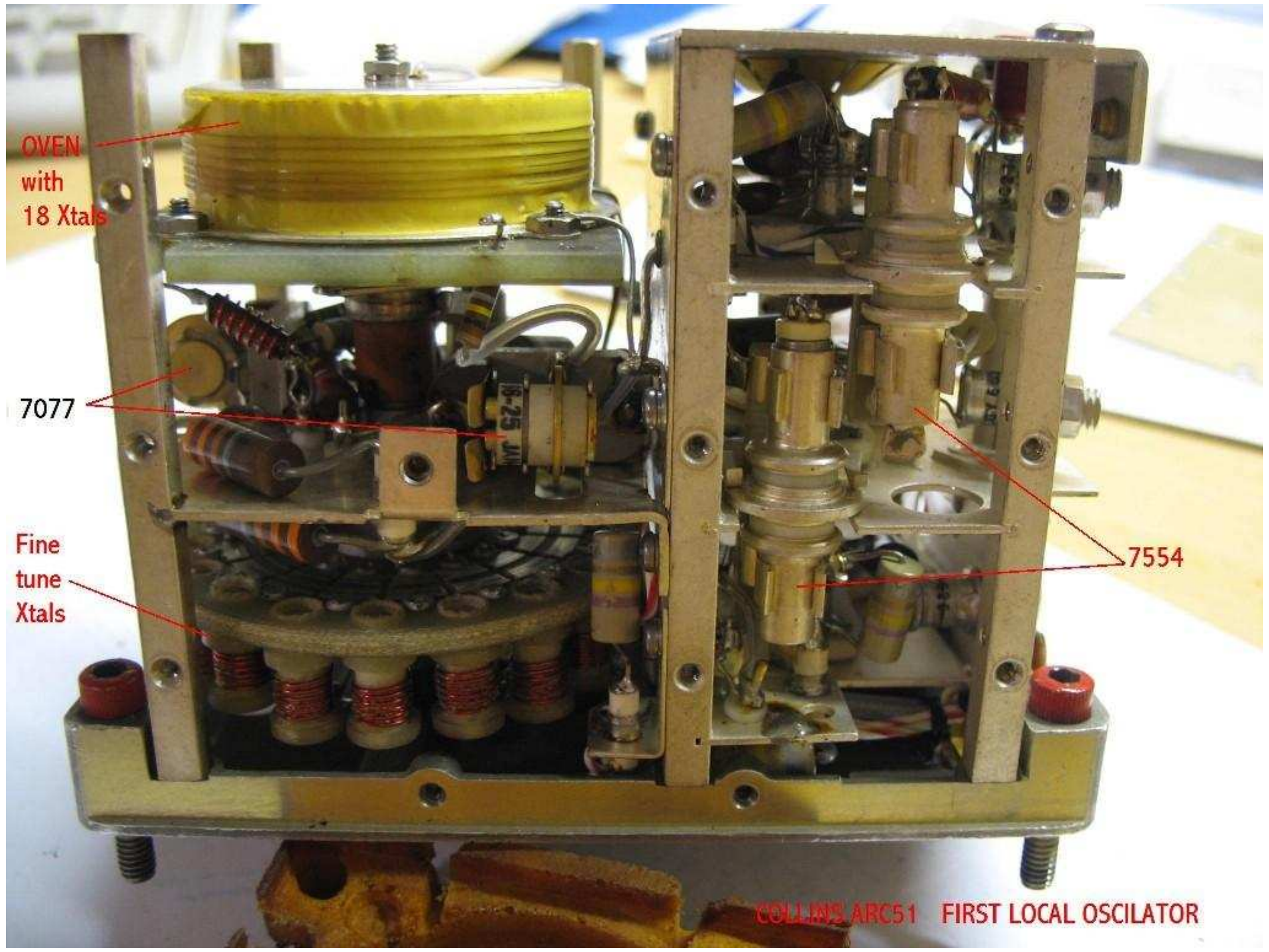
Frequency control
Three rotary knobs on the cockpit panel select the tens of MHz (18 positions), units MHz (10 positions) and kHz (20 positions, in 50kHz steps) Each rotary switch position is transferred by 5 contacts to the ARC51-BX.

The receiver is a triple superhet, the first knob controls the first local oscillator (LO) , etc.
There are 18 + 10 + 20 = 48 Xtals, selecting 18 x 10 x 20 = 3600 channels.

The dials can be set from 220.00 ..399.95, so 3600 channels, but the first 100 channels (up to 225 MHz) were not in the military communications band

During transmit (key down), the oscillator frequencies are added backward from third to first LO using the same RF and IF filters as in the receive mode. This requires a lot of relays.

First Local Oscillator.
Also called Spectrum Generator The first LO is tuned from 200MHz to 370MHz in 10MHz steps. The 18 Xtals are placed in a temperature controlled oven.(yellow box on top of the picture, isolation removed). Each Xtal can be trimmed individually over 5kHz.. The First LO has 2 planar triodes type 7077 as oscillator and tripler or quadrupler, followed by two pencil triodes 7554 to filter side products. The output level is +13dBm (1V rms)



Picture of the first local oscillator

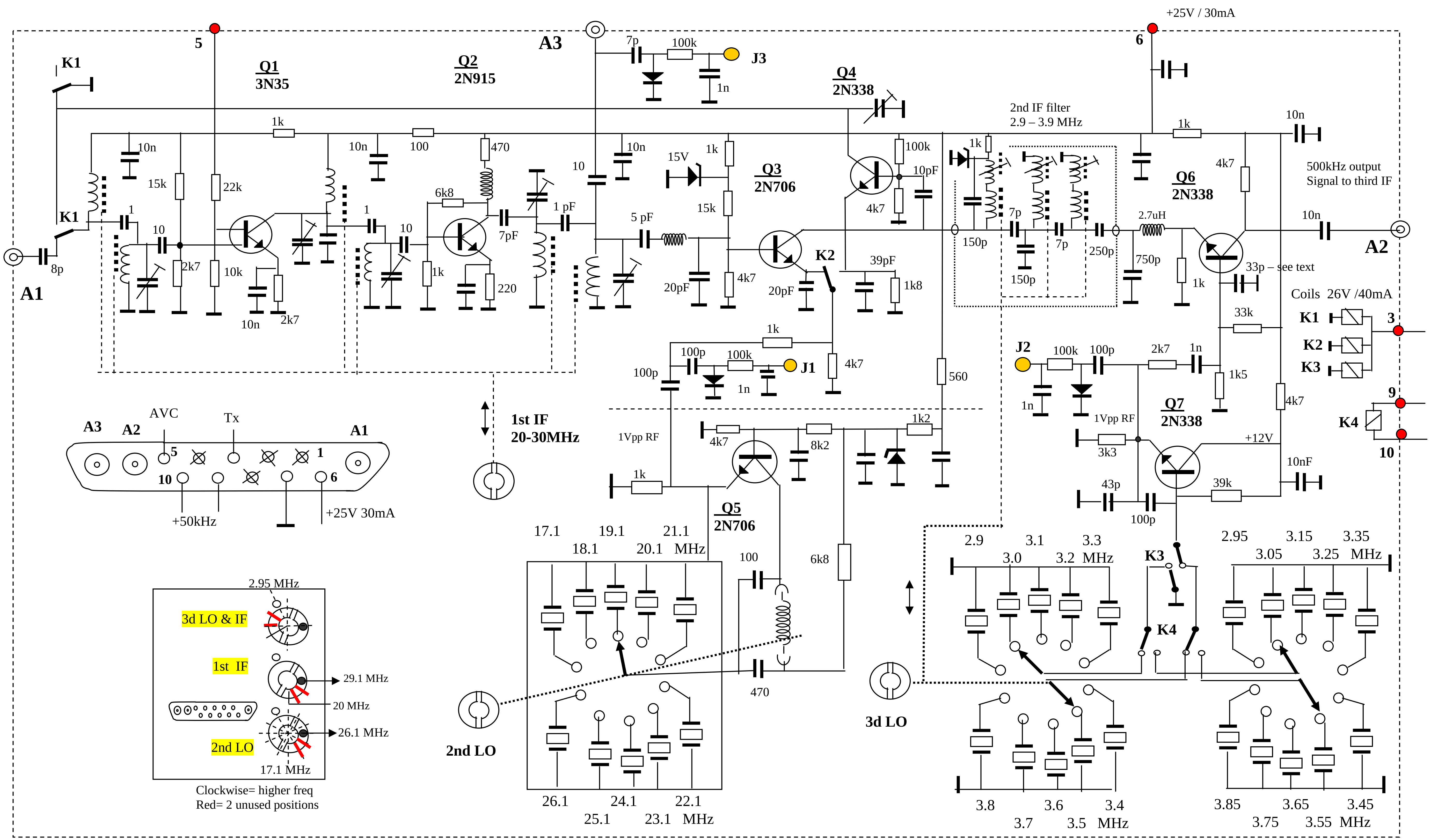
Knob	Xtal	LO frequency
22	66.66 MHz	200 MHz
23	70	210
24	73.33	220
25	76.66	230
26	80	240
27	83.33	250
28	86.66	260
29	90	270
30	70 *	280
31	72.5	290
32	75	300
33	77.5	310
34	80 *	320
35	82.5	330
36	85	340
37	87.5	350
38	90 *	360
39	92.5	370

RF Pre Amplifier.
In receive mode, this module has the first two stages to amplify the antenna signal (between 1uV and 0.1V), and to provide mirror rejection. The next two stages are in the RF power amplifier module.
In transmit mode, V1 is the mixer from a) the first local oscillator and b) the sum of second and third LO. The RF preamp amplifiers filter the carrier signal for the final amplifier.
The tuned UHF circuits have a constant impedance, as both the capacitor *and* the single turn inductor are variable. This way, each has to vary only 1:2 for the 225-400MHz tuning range.

RF Power Amplifier

The Power amplifier is driven by the carrier signal from the RF preamp module.
Each stage has about 10dB gain, providing 3W drive level to the final 6884 tetrode.
The output level to the antenna is approx. 20W (not less than 16W at 27.5Vdc supply voltage)
The final amp is amplitude modulated on the anode and g2 voltage, the latter is a divided copy of the anode voltage. The average anode voltage is 480V, the average g2 voltage is 219V. The CW anode current is 140mA.

The anode is coupled to the antenna by a variable capacitor. This is a strip of flexible copper, moved by an individual made camwheel to maintain constant output power over the entire band.



ARC-51BX First and second IF amplifier

19 feb 2011 kb

ARC51   First IF Amplifier

This module sets the MHz and 0.1MHz with :
- The first IF amplifier (tuned, at 20-30 MHz)
- The second Local Oscillator (17.1 – 26.1 MHz)
- The second mixers for receive and transmit
- The second IF filter, tuned at 2.9-3.85 MHz
- The third Local oscillator, at 2.9-3.85 MHz
- The third mixer for receive and transmit.

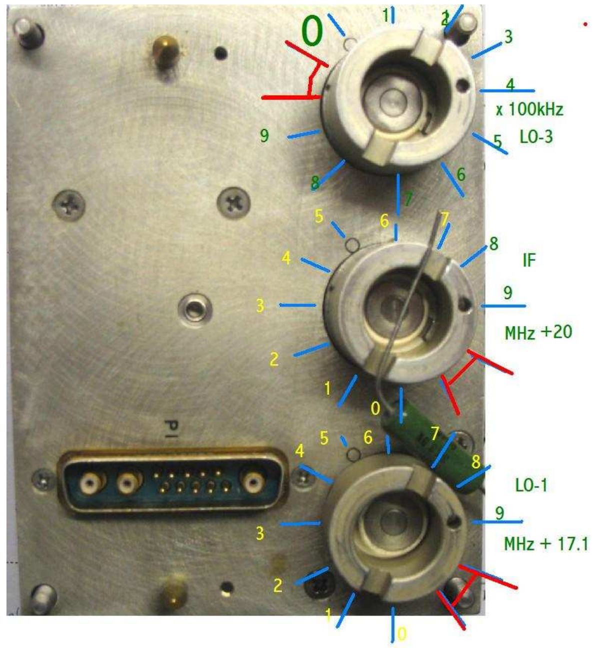
Mechanical tuning

The 3 wheels on the rear side of the module set the tuning elements . All 3 rotate freely in either direction. From the full turn, only 300 degrees are active. The remaining 60 deg, marked red in the picture below, are used to return the permeability tuning cores to other extreme position.

From top to bottom the wheels are:
- Third LO   (30 º steps)
- First IF   (3 º steps)
- Second LO (30 º steps)

Each LO wheel selects Xtals.
The second LO wheel also drives a rotary switch for individual tuning of the corresponding Xtal.
The third LO wheel also tunes the second IF bandfilter.

The indications in the picture below refer to the index hole. This hole points to the printed "0" when the dials are set for XX5.00 MHz



The various tuned filters and Xtal oscillators realize the MHz,- and sub MHz dials at the cockpit control panel. Three relays reconnect the IF filters in transmit mode, in order to add the local oscillator frequencies to compose the carrier frequency.
To make the transmit frequency equal to the receive frequency, the first, second and third LO frequencies shall be added to the last IF frequency of 500kHz.
To circumvent the 500kHz addition, the third LO Xtal bank is split in two halves that are swapped during transmit. This trick shifts the third LO frequency by 0.5MHz with respect to the dials, as required.

IF circuits

First IF

This 2-stage amplifier is permeability-tuned with 6 coils between 20 and 30MHz with 2% bandwidth (0.6MHz –6dB). The gain is 20dB when the AVC line is below 5V .   The first IF stage is a 3N35, NPN transistor with a dual base connection. The extra base connection is used to decrease the gain when the AVC voltage rises to +8V

Second LO

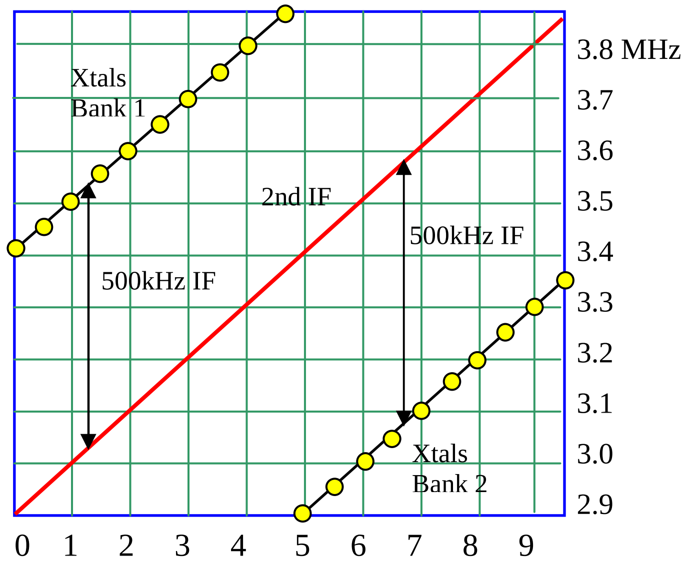
The 2nd LO has 10 Xtals from 17.1 to 26.1 MHz in 1MHz steps. Each Xtal frequency can be shifted individually over 4 kHz.   The 1Vpp second LO signal is applied either to the second receiver mixer Q3 or the second transmitter mixer Q4.

Second IF

The second IF is only a bandfilter, with a high input impedance and low output impedance. The filter is used from left to right in receive mode, and from right to left in transmit mode, as the third LO frequency is then in the middle of its passband.

Third LO

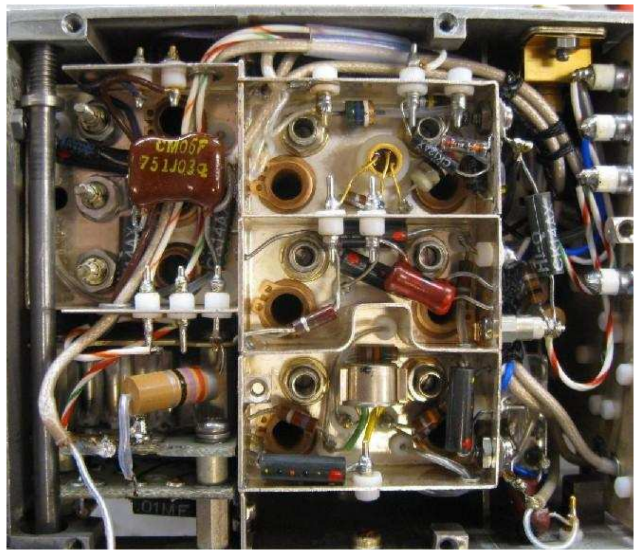
In the original ARC51X, the third LO had 10 Xtals for 1750 channels. With the introduction of the ARC-51 **A and B types** having 3500 channels, a second bank with 10 Xtals was added for the interposed 50kHz channels. Selection between these is done with relay K4, controlled by the last digit (either 0 or 5) of the selected frequency.



Horizontal in this plot is the position of the 0.1MHz digit on the control panel. Vertical are the 20 Xtal frequencies of the third LO (yellow dots) and the permeability tuning of the second IF bandpass filter (red line), all in MHz.
As can be seen, the LO frequency is either 500kHz above or below the second IF in receive mode.
During transmit, the upper and lower Xtal banks are swapped, bringing all third LO frequencies in the middle of the passband of the second LO bandfliter.

Dial	Xtal 3d LO	K4 on	2nd IF
XXX.00	3.40 MHz		2.90 MHz
XXX.05	3.45	x	2.95
XXX.10	3.50		3.00
XXX.15	3.55	x	3.05
XXX.20	3.60		3.10
XXX.25	3.65	x	3.15
XXX.30	3.70		3.20
XXX.35	3.75	x	3.25
XXX.40	3.80		3.30
XXX.45	3.85	x	3.35
XXX.50	2.90		3.40
XXX.55	2.95	x	3.45
XXX.60	3.00		3.50
XXX.65	3.05	x	3.55
XXX.70	3.10		3.60
XXX.75	3.15	x	3.65
XXX.80	3.20		3.70
XXX.85	3.25	x	3.75
XXX.90	3.30		3.80
XXX.95	3.35	x	3.85

In this picture of the open unit you see from left to right:
- The third IF bandfilter and third LO
- The first IF in the middle
- The second LO is just outside the right side of the picture, beyond the feed-thru capacitors .



Testpoints

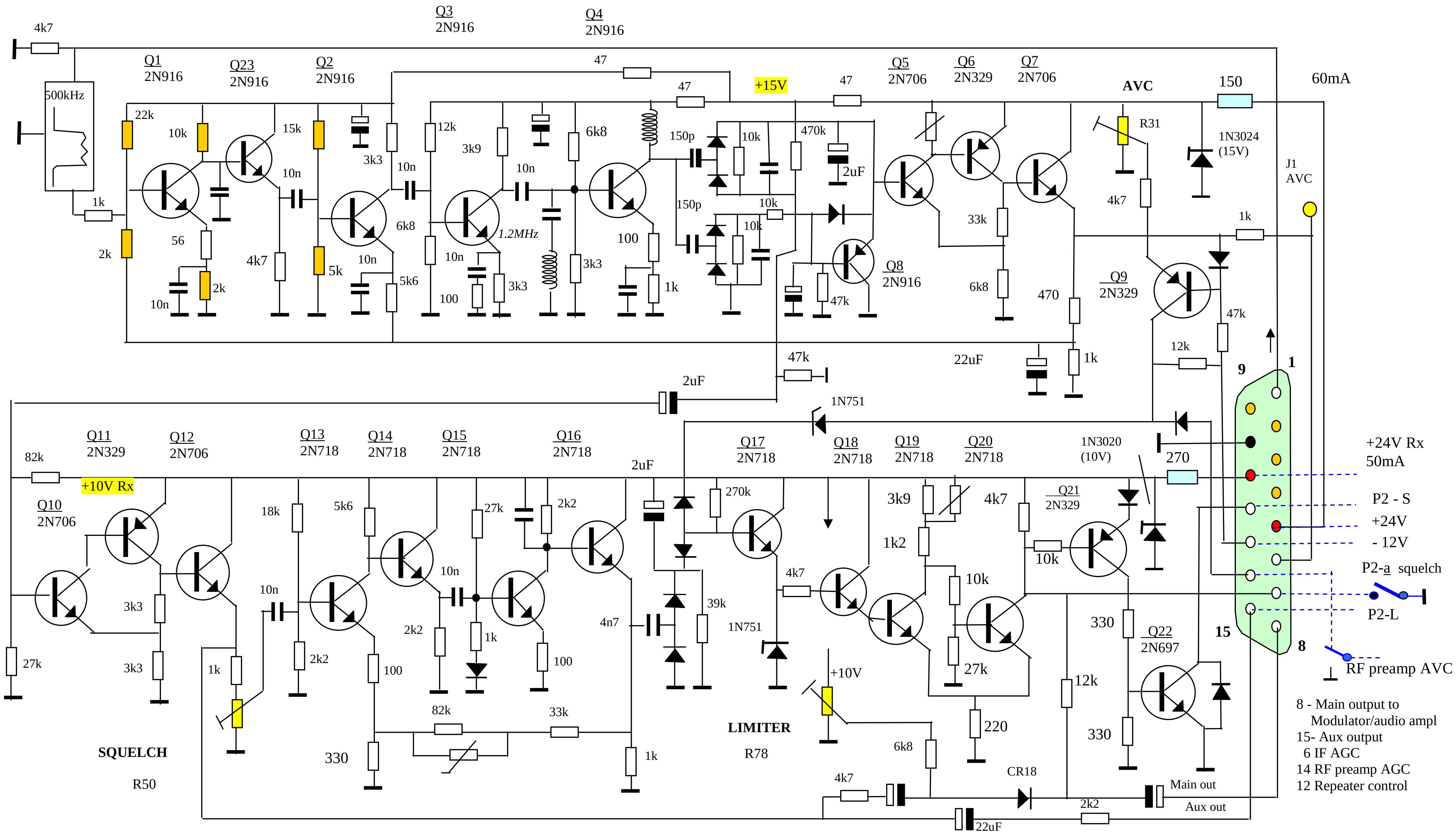
A rectified sample of the output of the LO's is available on J1 and J2, and should be approx. –1.5V dc in all Xtal selections.
A rectified sample of the sum of LO2 and LO3 is available on J3 in transmit mode. After adding the LO-1 frequency, this will be the Xmit carrier frequency. With keydown, –2V is present at J3.

Problems

a) The four yellow, hermetic-sealed relays have pure-tin coatting on the inside, and might develop tin whiskers over 40 years In my unit, the base of Q7 was shorted to ground by several whiskers inside K3, I measured 200 ohms to case both from the contacts and from each coil end !

b) There was 300 ohms series resistance between the 3.05MHz Xtal and the rotary switch. The “plated-thru” was not soldered well.

c) The third mixer Q6 oscilates on some channels at 550kHz. This gives sidebands in the trans-mission.   33pF from its base to ground helps.



All diodes 1N unless otherwise noted

ARC51BX 3d IF AMPLIFIER
4 Januari 2010 / kb

ARC 51 Third IF amplifier module

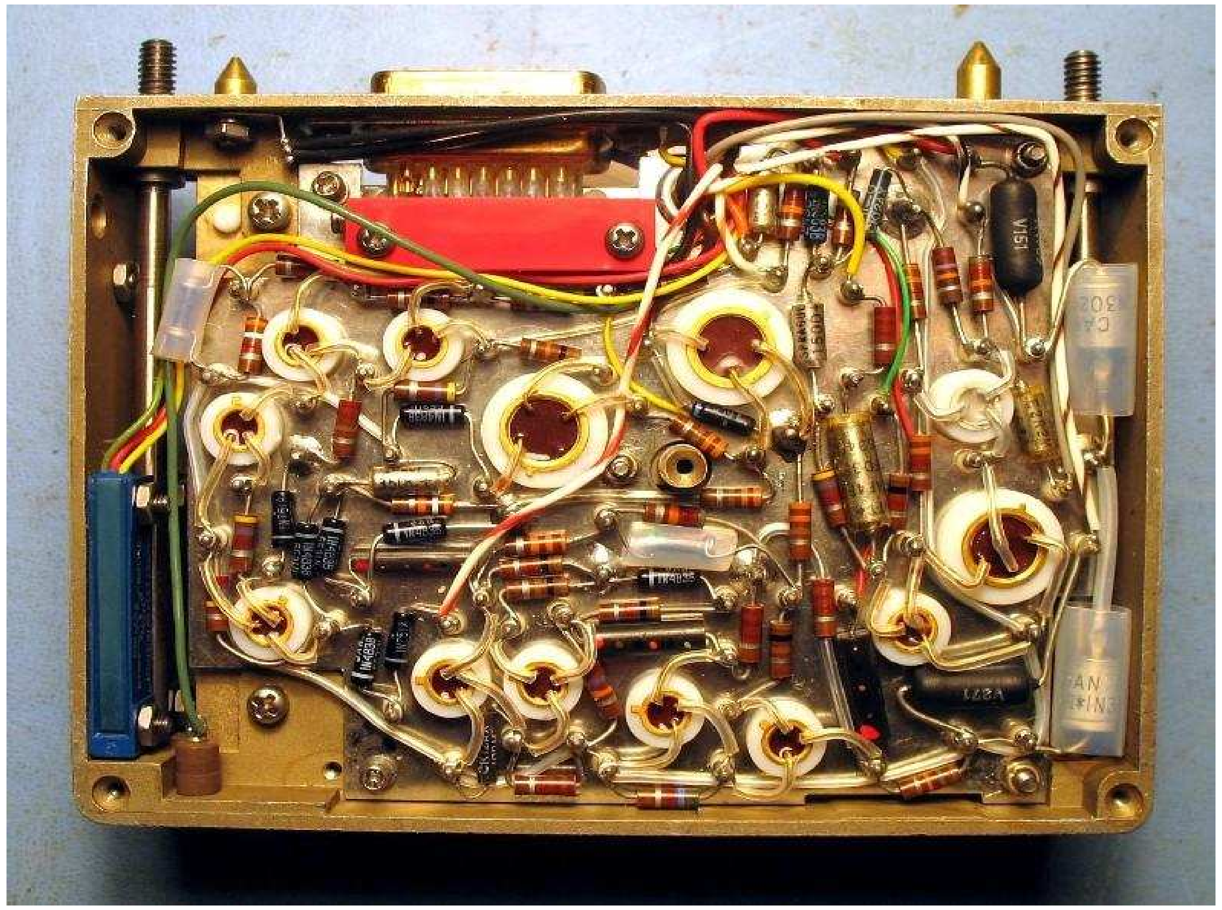
The third IF amplifier provides the majority of the gain of the ARC-51 receiver. The module includes the third IF amplifier at 500kHz, and the squelch circuits.
On each side of the module there is a circuit with components soldered directly on posts. One side has the IF amplifier, detectors and AVC circuit. This part is always powered by 24V. The circuits on the other side are the audio preamplifier and squelch circuits. These circuits are powered only during receive.

The IF amplifier has no tuning elements. The amplifier starts with a Collins mechanical filter at 500kHz with 40kHz bandwidth (480-520 kHz). This is sufficient to separate the next channel, 50kHz higher or lower, and gives 15kHz audio bandwidth at the auxiliary output. The headset audio bandwidth is further limited to 4 or 6kHz by a second order filter in the modulator audio amplifier

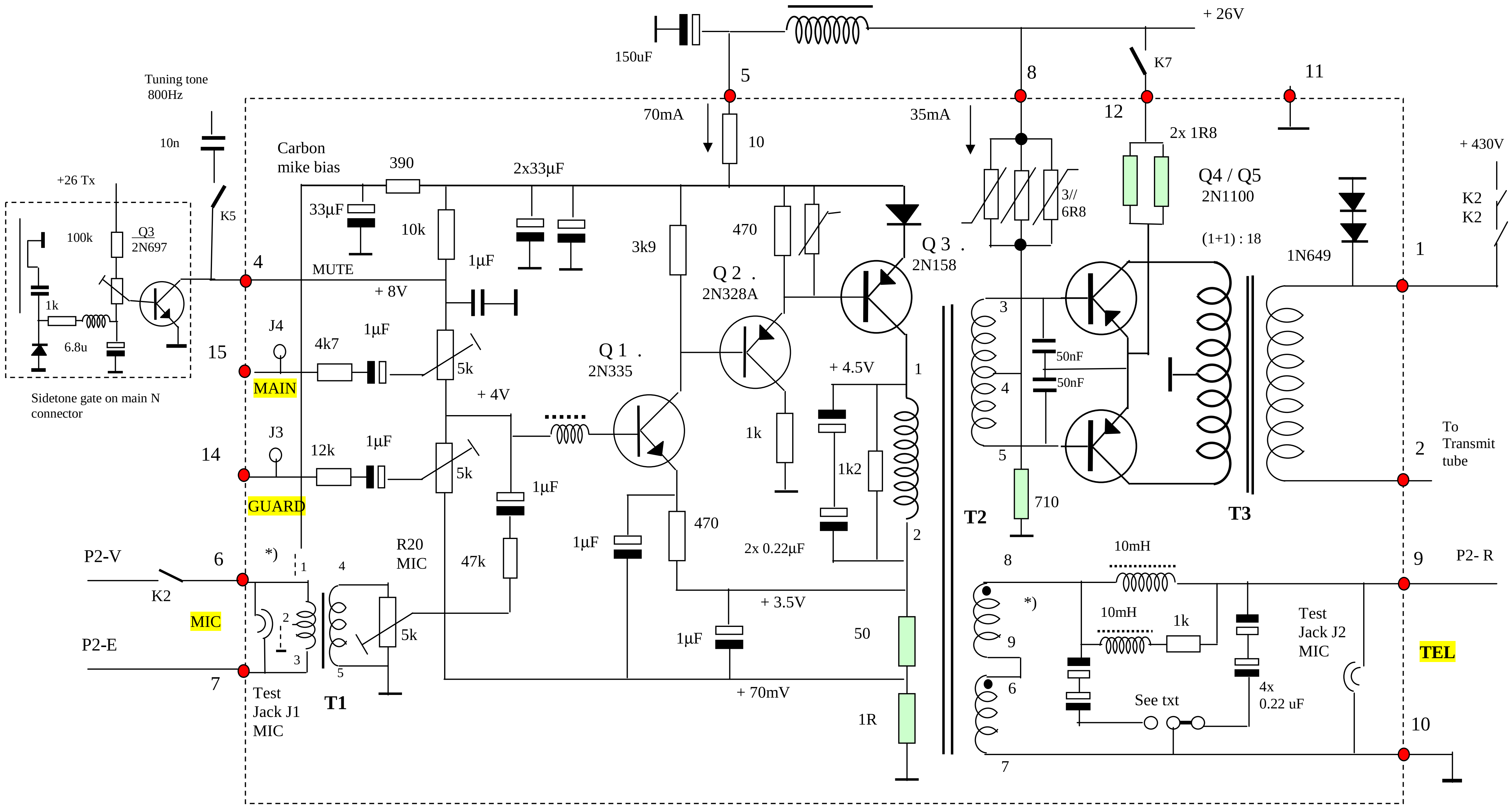
An input signal of 20uV is amplified to 5V on the collector of Q4, and when 100% amplitude modulated, gives 2Vpp audio on the main and auxiliary audio outputs of this module

AVC
The x5 amplifier Q5-Q6-Q7 provides the AVC control signal. On testpoint J1, this signal is 4.5V without RF signal, +5V at –100dBm RF signal, rising to +8.8V with –20dBm RF signal. The AVC control signal reduces the gain in the first and third IF asmplifiers. With more than –50dBm input, Q9 stops conducting, and a negative voltage on pin 14 reduces the gain of the RF preamplifer as well.

Audio amplifier
The x2 amplifier Q10-Q11-Q12 is not powered in transmit mode .
Its output is the auxiliary output (P2-L), and the squelched output to the modulator/audio amplifier.



Squelch circuit
Diode CR18 is the squelch audio switch. With sufficient RF signal, Q17-Q18 and Q19 are off, and Q20 is on. In this case, or when the squelch is disabled, the cathode of CR18 is low, and CR18 conducts, transferring the received signal to the audio amplifier.
Also, Q21 and Q22 conduct, pulling the carrier detect pin P2-S low.
An automatic retransmit station can be made with <u>two</u> ARC51 sets when each carrier detect output P2-S is connected to the key-down input P2-P of the other set., and the audio in/out signals are cross-connected.



*) connections drawn for ARC51–BX (dynamic MIC, 600 Ω headset, 4kHz)
MIC impedance   82 Ω   (carbon)   or   150 Ω (dynamic)
Headset impedance   150 Ω or 600 Ω
Audio bandwidth   4kc or 6 kc

ARC 51BX MODULATOR
1 jan 2010 kb

ARC51 Modulator

This module is the audio amplifier in both receive and transmit modes. In Transmit mode, it provides the plate modulating signal to the RF power amplifier, and a side tone to the headset.

Inputs

- ***Main***: is a 2Vpp audio signal from the third IF module. In Transmit mode and during tuning, this signal is blanked
- ***Guard***: a 2Vpp audio signal from the guard receiver, blanked during tuning and transmit

- ***Mike***: This balanced input is Xformer coupled. The sensitivity can be set from 0.1Vpp to 2Vpp with R20. Normal setting is 1Vpp for a carbon microphone or 0.7Vpp for a dynamic mike.

- ***MUTE.*** This input is open in receive, but shorted to ground in transmit mode without carrier. This way, the pilot does not hear his own voice (the sidetone) in the headset, indicating a fault in the transmitter.

Tuning tone.
During tuning, an 800Hz signal from the inverter enters the MUTE input.

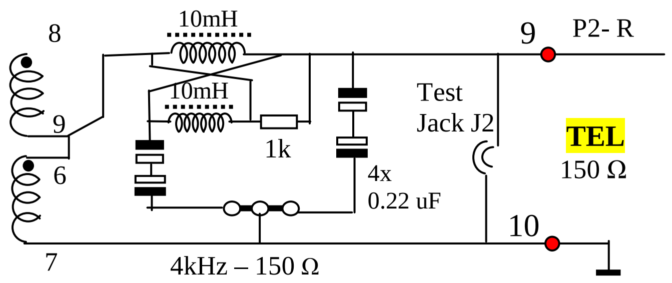
Audio amplifier.
Transistors Q1, Q2 and Q3 form the audio amplifier with two outputs: 1) for the headset telephone, 2) for the modulator

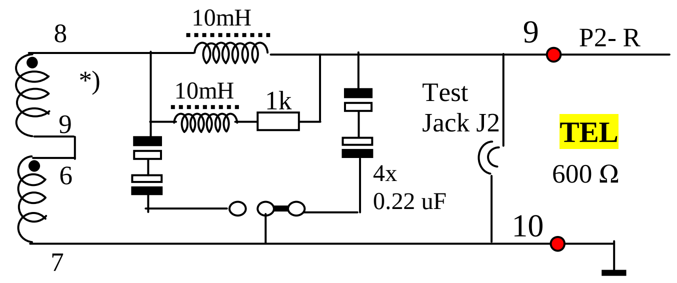
The amplifier has heavy feedback, stabilizing the *current* in Q3. The DC feedback sets I-Q3 at 60mA. The AC feedback reproduces every mVac at the base of Q1 into 1 mA ac in the primary side of the audio transformer T2. With a load of 600Ω on 6-7 + 8-9, the gain is 600 x 2.9 /(1.8+1.8) = 483x. With the turns ratio of T1, setting of R20 and 47k series R to Q1, the voltage gain was 35x.
The maximum current variation in Q3 is 70mApp, giving 34Vpp (12Vrms) into a 600 ohm load is 0.25W as specified. *Without* a load, the signal is heavy distorted.

Modulator
Operated in Class B. Output peak power is 25W, peak input dc current is 2.1A.

Transformer data
T1 Microphone transformer
Winding 1/ 2/ 3 4/ 5
Ratio (1+1) : 7
Resistances (6+6) : 170 Ω
Remark: allows 50mA dc primary current from a carbon mike

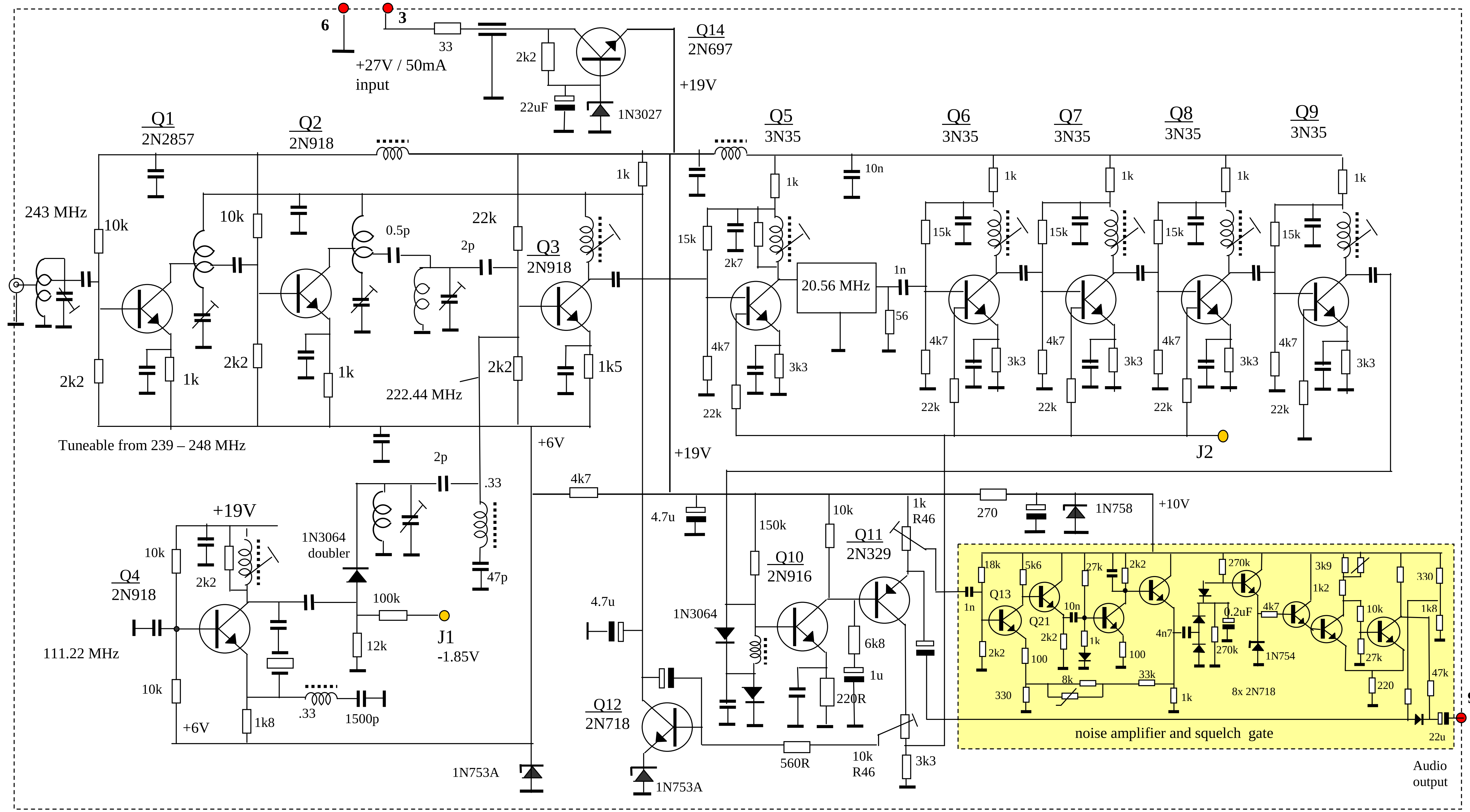
T2 Audio output e transformer
Winding 1/ 2 3/4/5 6/7 8/9
Turns ratio 2.9 : (1+ 1) : (1.8+1.8)
Resistance 14 (2.5+2.5) (26+26) Ω
Remark: allows 50mA dc primary current from class A driver Q3





T3 Modulator transformer
Winding 1/ 2/ 3 4/ 5
Ratio (1+ 1) : 18
Resistances (0.3 + 0.3) 80Ω
Remark: allows 170mA dc sec. current from RF power amplifier.
Nominal load impedance 3 k Ω

Audio bandwidth filter
The headset output filter is one of two circuits above, depending on headset impedance. The filter is flat until 6 kHz (option)



RT-742 / ARC-51 BX Guard Receiver (A7)

5 April 2010 kb

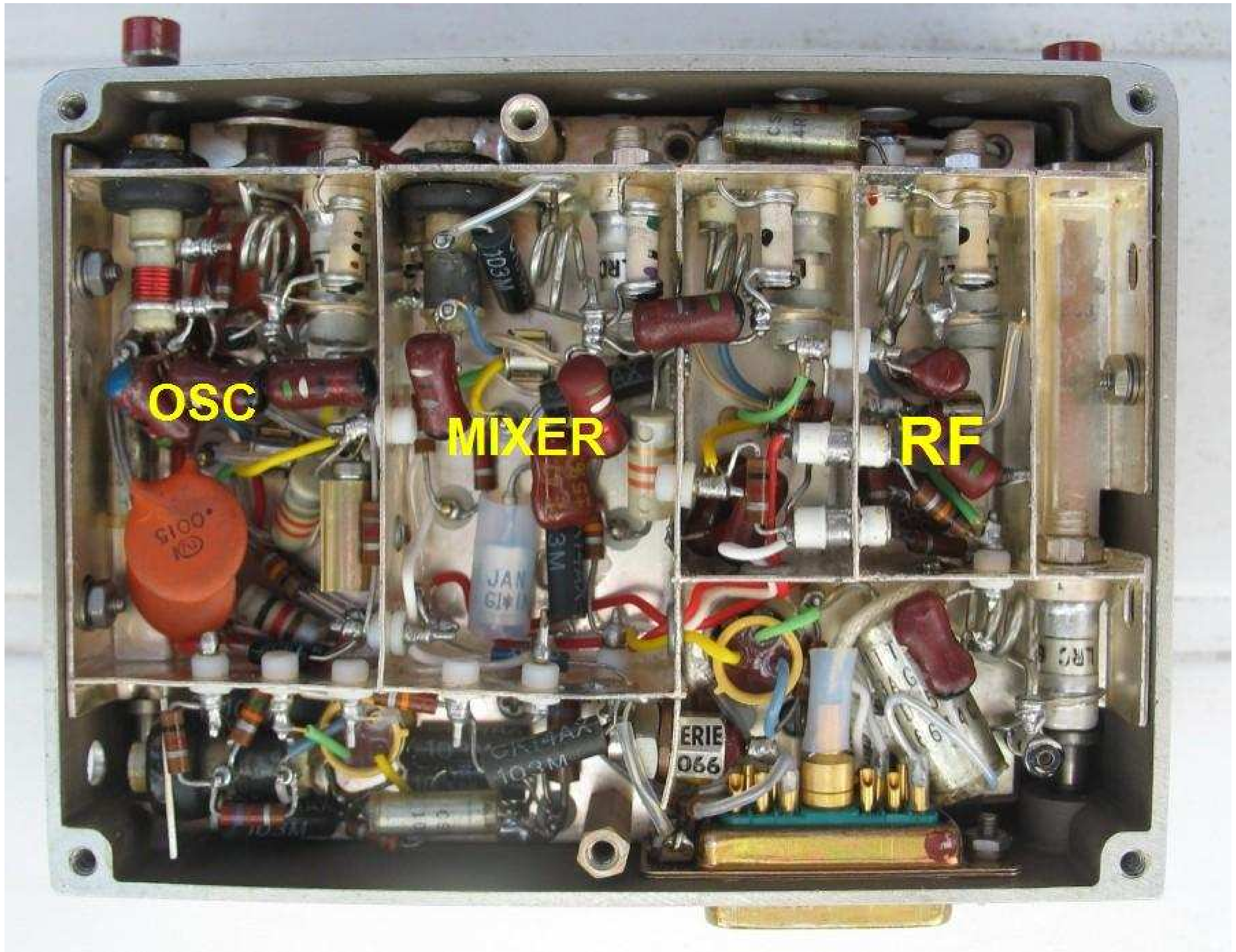
ARC 51 BX
Guard Receiver

This is one of the first fully solid state UHF receivers, a masterpiece from Collins.
The guard (emergency) receiver is switched on and off with a relay in the supply line; its audio output is permanent connected to the modulator/audio amplifier module.

The receiver is a single conversion superhet, with 2 RF stages, a mixer and 5 IF stages at 20.55 MHz.
The oscillator has a 111.22MHz Xtal, a doubler provides the 222.45MHz local oscillator frequency.
The gain of the RF stages and the mixer is controlled by the Vce of the transistors.

IF amplifier
The IF stages operate at 20.55 MHz and have the rare 3N35 dual base transistors.
One of the base connections is used to control the gain of the 1-4 th IF stage.
After detection, a dc-coupled audio amplifier provides the audio signal as well as the gain control signals for the RF and the IF stages.
For low input signal, the RF gain is not reduced. Above a certain level, set with R46, the RF gain is reduced to prevent blocking with strong input signals.

Noise amplifier and squelch gate
This circuit is identical to that in the third IF amplifier of the main receiver, but built into a much smaller submodule.



ARC51 Mechanical tuning system

The ARC51 can be tuned from 220.00 to 399.95 MHz in 3600 steps of 50kHz each. The first 100 steps (until 225 MHz) are not part of the military UHF band.

The control head transmits each digit of the frequency with contacts (28V/1Adc). The first decimal is 2 or 3 (2 contacts), the 10MHz, 1MHz and 0.1MHz decimals each are sent as a 2-out-of-five code, and the last digit is a single contact, representing either 0 or 5, making a total of 18 contacts.

The ARC51 is a triple superhet, with 3 local oscillators and 3 IF frequencies.
The first two decimals set the **first** local oscillator in 18 steps of 10MHz each, the middle digit sets the **second** LO in 10 steps of 1MHz each, and the last two digits set the **third** LO in 20 steps of 50kHz each.

The mechanical tuner provides 5 rotating shafts. Three control the local oscillators; their positions are compared with the manual settings of the control panel. The remaining 2 shafts are a linear combination of the LO shafts, and tune the RF and first IF frequencies. The second IF is tuned together with the third LO, and the third IF is fixed at 500 kHz.

The mechanical tuner has one dc motor, and three electromechanical clutches. When a decimal is changed on the control head, the corresponding clutch is activated, and an auxiliary contact of the clutch starts the motor to rotate the output shaft. When the codes coincide, the clutch is deactivated, but the motor rotates until the next click-stop of that output shaft.

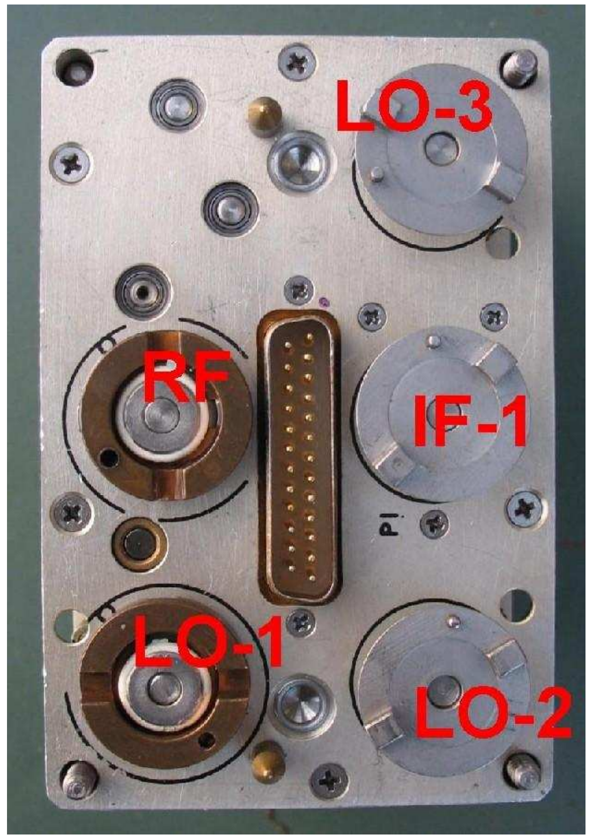
<u>Two turn ambiguity</u>
The RF shaft makes *one* complete turn, of which half is used to set the variable capacitors in the RF preamp and RF power amplifier. The LO-1 shaft makes *two* complete turns, of which one turn is used to select the Xtals in the spectrum generator and (after 2:1 reduction) to set the variable capacitors. The other half turn of RF and the other full turn of LO-1 are skipped automatically, adding a few seconds to the tuning time.

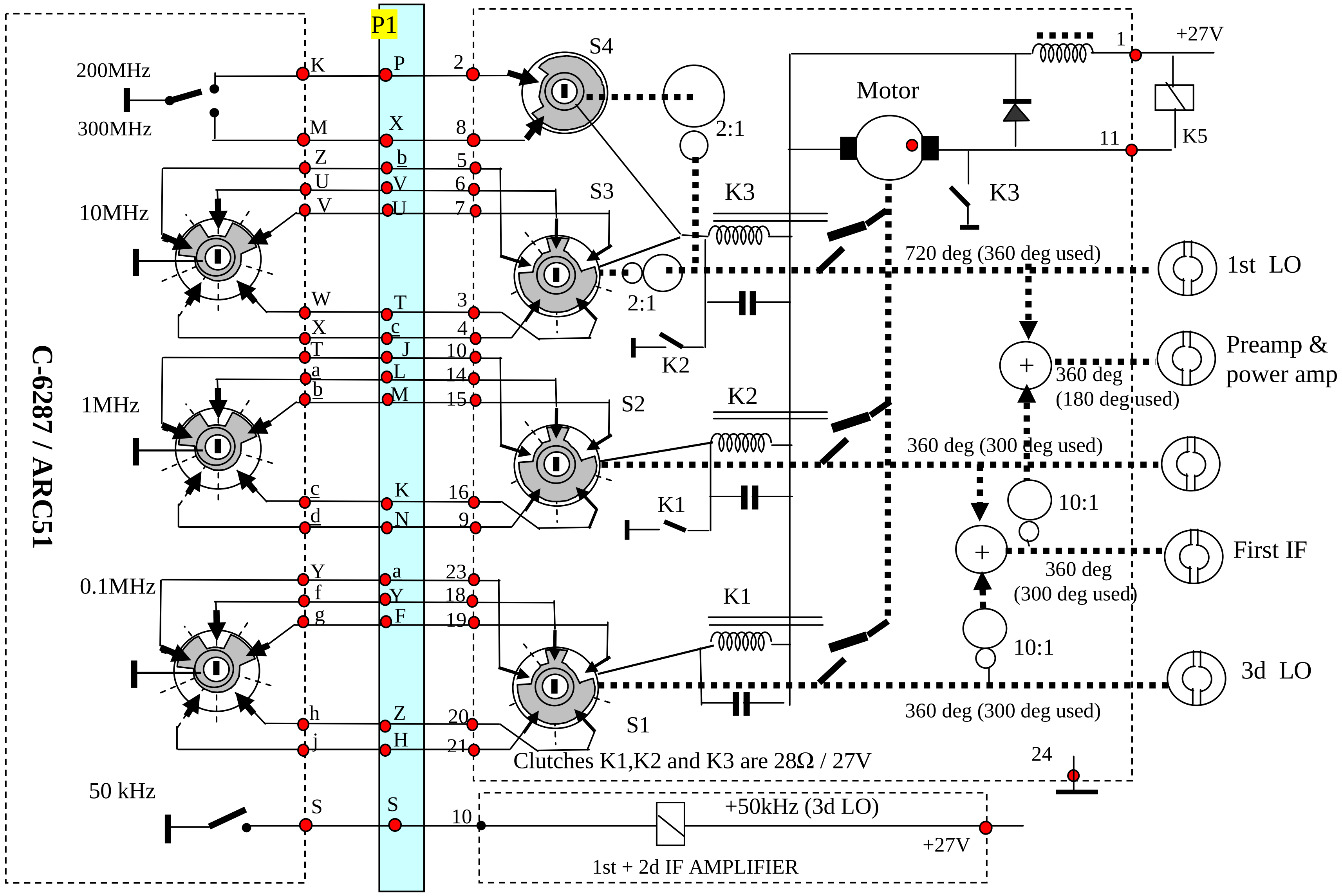
The LO-2, IF-1 and LO-3 shafts make one full turn, of which 300 degrees are used.
Both LO2 and LO3 shaft positions are divided in 12 click stops, of which 10 are used. The LO-3 shaft selects the 0.1MHz steps. The 50kHz steps in-between are made with a separate relay.
The IF-1 shaft is a copy of the LO-2 shaft, the 30º steps are filled in with 3º microsteps, reduced from the LO-3 shaft.

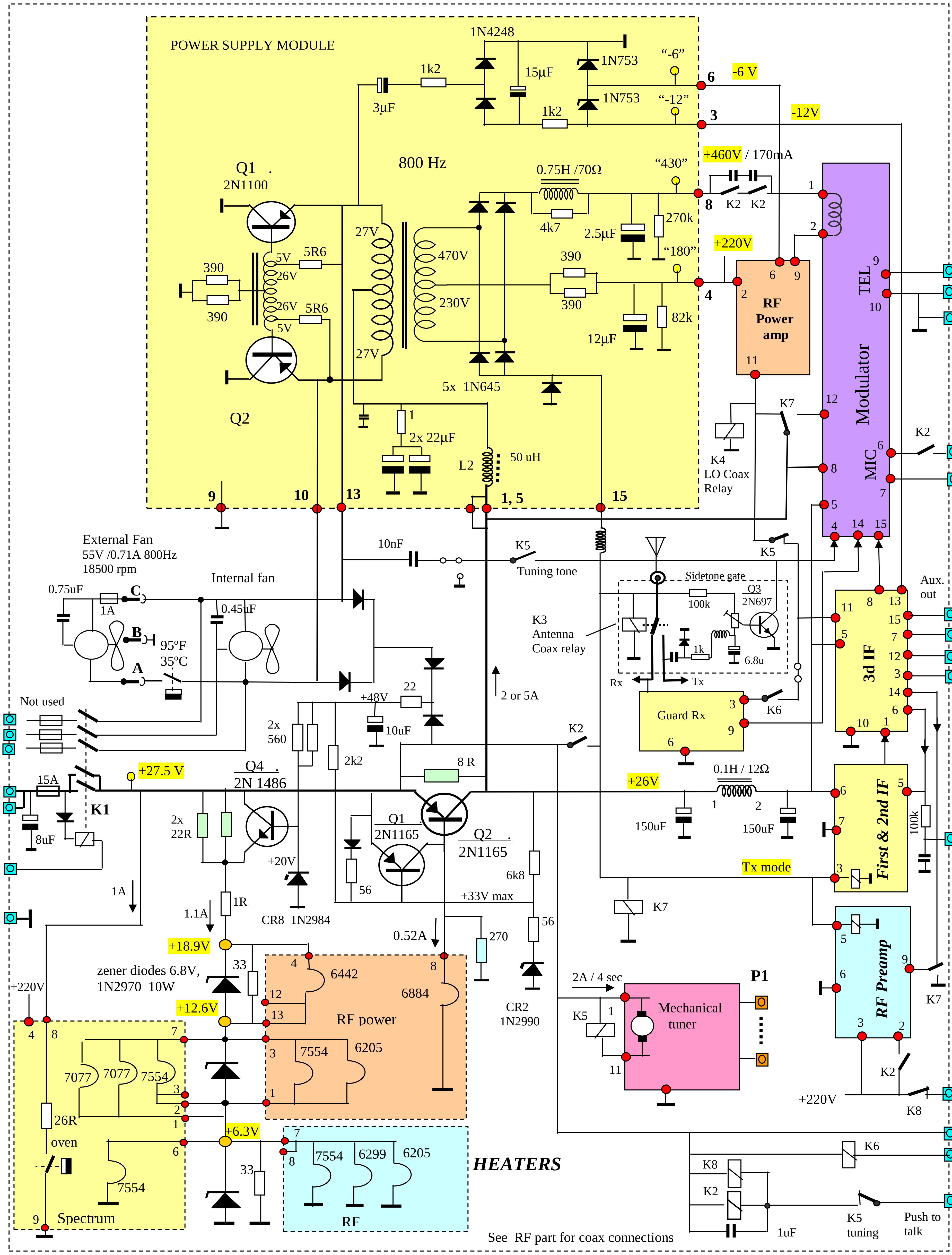
The RF shaft is a 2:1 reduced copy of the LO-1 shaft. The 20º steps are filled-in with a 10:1 reduced copy of the IF-1 shaft

Waterfall control
Changing the 10MHz setting activates clutch3. Changing the 1MHz setting activates clutch 2, and clutch 3 as well. When you change the 0.1MHz setting, all 3 clutches are activated, giving the longest tuning delay.

Warning
The index pin is sufficient to locate all shafts, except for LO-1. .When replacing the mechanical tuning unit or the spectrum generator, make sure that the variable capacitor in the spectrum generator is at maximum capacitance when the index pin is in the marked zero position.







P2 connector pin

RFI filters not shown

ARC 51BX POWER SUPPLIES

28 - 12- 2009 / kb

ARC51 Internal wiring and power supply.

The ARC-51BX is powered by 27.5 +/-0.5V.dc
With the oven off, the dc input current is:
- Receive: 4 A
- Transmit (CW) 8 A
- Transmit 80% AM 11 A

Tuning forces receive mode, and adds 2A for a few seconds.
The guard receiver + K6 adds 0.1 A
The Xtall oven adds 1A for 10 sec. every minute to maintain the constant temperature of the first LO Xtalls.
The external fan runs when the internal chassis temperature rises above 95F (35 C). This adds another 0.8A to the dc current.

Operation is possible down to 23Vdc input, but with reduced RF output power and modulation depth.

Modules

A1	Rcvr / RF preamp
A2	First and second IF amplifier (with 2nd and third local oscillator)
A3	Third IF amplifier
A4	Modulator / Audio amplifier
A5	Spectrum Generator (First local oscillator)
A6	RF power amplifier
A7	Guard receiver
A8	Power Supply
A9	Mechanical Tuning

Heater circuit
The 11 tubes have the following heater data :
Heaters: **6205** 0.15A; **6299**: 0.3A; **7077** : 0.24A;
7554: 0.225A; **6442**: 0.9A , all at 6.3V,
and for the **6884**. 0.52A at 26.5V
Current in the heater chain is 1.08 A, supplied from the 20V constant voltage source Q4
There are testpoints at the 6.3V, 12.6V and 18.9V level.
The heater current for the RF power amplifier tube is the base current of Q2 (Q1 is normally off)
Three 6.8V/10W power zeners save heaters when a module is removed for tests or in case of a broken filament. Without heaters, the zener current is 0.4A. With all modules placed, the zener current is zero, and the heaters current is 1.1A

Transient blanker
The aircraft DC grid might have severe overvoltages, typical up to 50V for 0.5 sec. The transient blanker Q1+Q2 prevents damage in this case.
Transistor Q2 is normally fully conducting, passing the 27V input directly to the main dc rail in the chassis.
Transistor Q1 is normally off. When the input voltage rises above 33V, Q1 starts to conduct, blocking Q2. Reception during such a surge is still possible, while the 2A loadcurrent is supplied via the 8 ohm bypass resistor, giving 16V drop from up to 50V input is 33V
Transistors Q1 and Q2 (2N1165) are germanium PNP types for 35V/ 20A.

Dc/dc inverter
The inverter runs on 800Hz, defined by the saturation of the driver transformer. The output voltages are +470V for the RF PA, +220V for all other tubes, -12V for the RF preamplifier AVC, and -6V as bias for the RF PA.
The dc high voltage outputs are boosted by 26V during transmit to compensate for the extra load current. This way, the dc voltages stays constant at 220V and 470V dc.

The 800Hz ac voltage (55V square wave) is used for both the internal and external fans, for a tuning tone, and to make +48V for the transient blanker.

Relay circuits

Relays in chassis	Coil	**Contacts**
K1 Power-on relay	450Ω	5 x make, 6A / 250V contacts
K2 Transmit relay	450Ω	5 x make, 6A / 250V contacts
K3 Antenna T/R	190Ω	1 x change over, coax
K4 First LO relay	600Ω	1 x change over, coax
K5 Tuning in progress	500Ω	4 x change over (3 used)
K6 Guard Rx enable	600Ω	2 x change over, 1x make used
K7 AGC and modulator	600Ω	2 x change over
K8 External ADF ampl.	600Ω	1 x HV change over.

Relays in modules , all gold plated

A1 K1 disconnect antenna	600Ω	2 x change over, 1x make used
A2 K1 input first IF	600Ω	2 x change over
„ K2 select a 2nd mixer	600Ω	2 x change over, 1x make used
„ K3 swap 3d LO Xtal	600Ω	2 x change over
„ K4 +50kHz relay	600Ω	2 x change over

T/R switching
K2 is powered by the Press-To-Talk switch, as long as there is no tuning in progress. K2 switches the HT for the RF power amplifier, completes the microphone circuit, gives a 26V boost to the plate voltages, reconfigures the IF amplifiers to add all local oscillator frequencies, and actuates relay K7.

Relay K7 enables the modulator, disables received audio signals from the main and guard receivers, and disables the first mixer in receive mode in the RF power amplifier module.

Relay K8, operated in parallel with K2, applies 220Vdc plate voltage for the AN/ARA-25 directional antenna, or is used for a testset.
To prevent overload of the power supply during transmit, the 220vdc is only available in receive mode.

Coax relay K4 connects the first LO output to the transmit mixer, or, when energized, to the receive mixer in the RF power amp module.
K4 is the only energized relay in receive mode.

Audio signals are switched with relay contacts, by application or removal of dc supply voltage to the relevant circuit parts.

Modulator/audio mute
A small detector is attached to the antenna T/R switch, including transistor Q3. When key-down does not result in sufficient carrier signal to the antenna, then Q3 will turn on, shutting down the complete modulator. The pilot will not hear his own voice then as sidetone, warning for a malfunction in the ARC51.

The mute input is also used to present an 800Hz tone to the headset during tuning.

ARC51A and ARC51B
These non-X versions have a 3-phase, 115V-400Hz power supply for the fans, the high voltage and the tuning tone.

The power supply module has a 3-phase transformer instead of the inverter.
All heaters and the oven are still supplied from the 28Vdc bus, like the relays and other electronics.