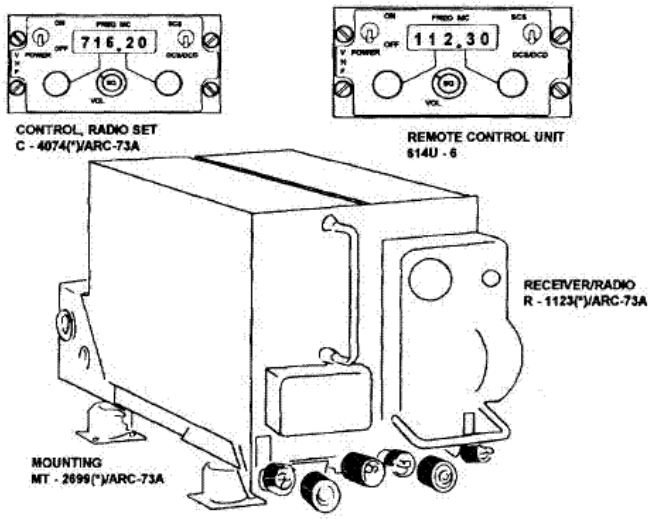
AN/ ARC-73 or 51X-2B + 17L7



AN/ARC-73 Radio Set

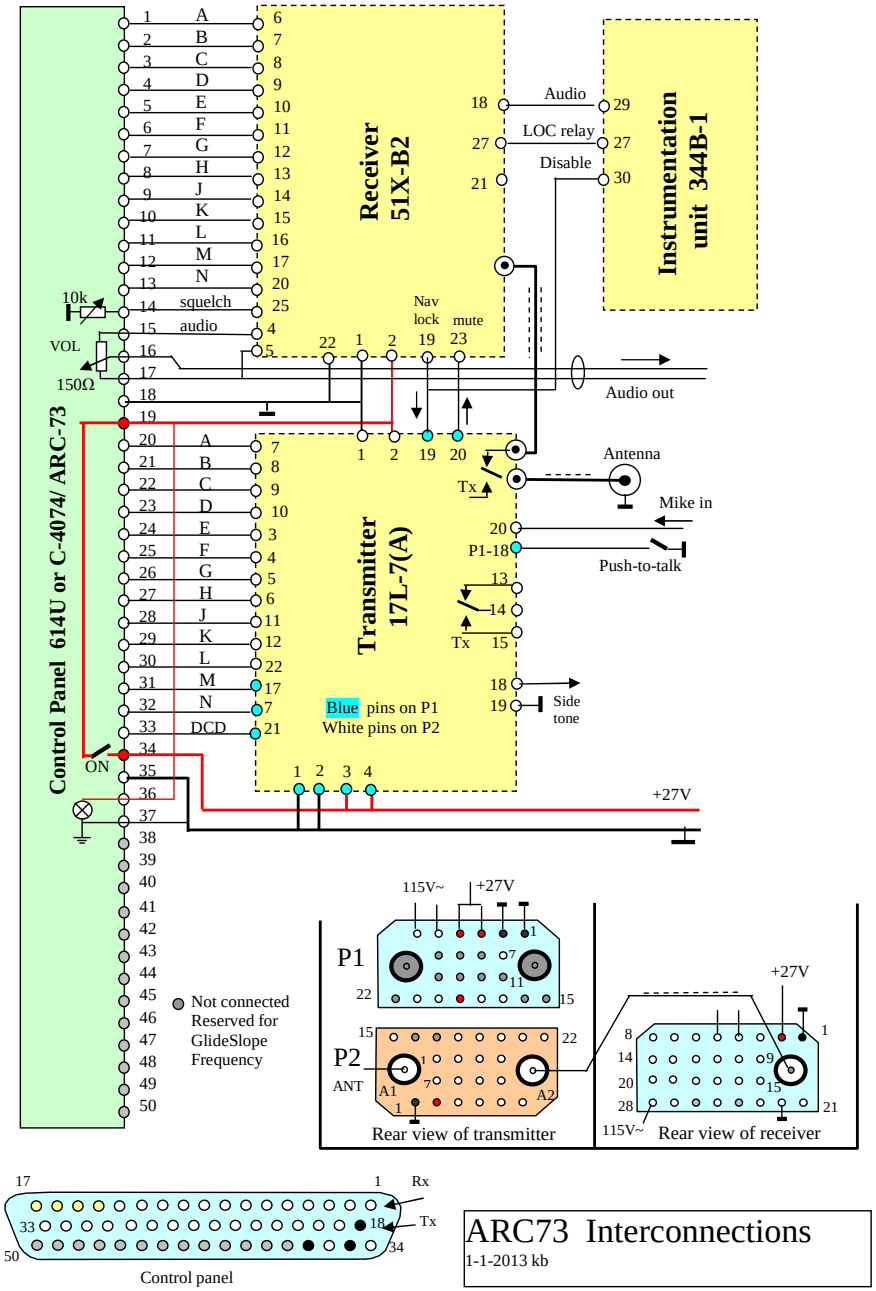
Air band transceiver, built by Collins Radio Co.
AN/ARC-73 Radio set, 116-151.95MHz, 720 chan, 50KHz step, 80 preset, AM, 20 W, 28 VDC at 8 Amps,
Major components: T-879, R-1123 and C-4074.
AN/ARC-73A Radio set, 116-149.95MHz TX, 108-151.95MHz RX, 50KHz steps, AM, 20 W, 28 VDC at 8 Amps,
Major components: T-879, R-1123 and C-4074.

The ARC73 radio set consists of:

ARC-73 part	COLLINS nr	
R-1123A	(51X-2B)	receiver,
T-879	(17L-7)	transmitter,
C-4074	(614U-)	control unit and
MT-2699	(390E-2)	dual shockmount

The ARC73 will transmit/receive at:
17L7 Transmits on 118 ... 151.95 MHz in 50kHz steps (680 channels)
17L7A Transmits on 116 ... 149.95 MHz in 50kHz steps (680 channels) = MIL version ARC-73A
51X-B(2) Receives 108 ... 151.95 MHz in 50kHz steps (880 channels)
The control panel has internal moveable end-stops for both minimum and maximum frequency :
MIN stop at 108 or 118 MHz, and **MAX**. stop at 135.95 of 151.95 MHz.

The receiver has two outputs. One for audio with a speech filter of 300Hz … 3900Hz,
the second output is for NAV signals like VOR or LOC with full bandwidth of 20Hz to 11 kHz.
The transmitter has a carbon microphone input for 1Vrms with a bandwidth of 300 - 3500Hz.



ARC73 Interconnections
1-1-2013 kb

VHF Control Panels 614U -1, 2, 3, 5, 6, 7 or C4074/ARC-73

The 614U panel has two independent 13-wire frequency control switches, one for 51X-2 receiver and one for the 17L-7 transmitter.

Switch pos.			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
			---------- NAV ----------					--------- COMM ---------									---------- EXTENDED ----------								Skip	
Even MHz		M	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150	152	154
Odd MHz		J	109	111	113	115	117	119	121	123	125	127	129	131	133	135	137	139	141	143	145	147	149	151	153	155
TRANSMIT	P2-7	A			X	X?		X				X	X		X		X				X	X		X		
17L-7 pin	P2-8	B				X			X				X	X		X		X				X	X		X	
	P2-9	C					X			X				X	X				X				X	X		X
	P2-10	D	X					X			X				X	X	X			X				X	X	
	P1-7	N															X	X	X	X	X	X	X	X	X	X
RECEIVE	6	A	X	X	X			X				X	X		X		X	X			X	X	X		X	
51X-2 pin	7	B		X	X	X			X				X	X		X		X	X			X	X	X		X
	8	C	X		X	X	X			X				X	X		X		X	X			X	X	X	
	9	D		X		X	X	X			X				X	X		X		X	X			X	X	X
	20	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X										

Pink area not accessible Green area 108-117.95 Rx only accessible in 614U-3 or 3A

Pin nr on 614U control panel

		Rx	Tx	
MHZ select	A	1	20	
	B	2	21	
	C	3	22	
	D	4	23	
Fract. MHz select	E	5	24	
	F	6	25	
	G	7	26	
	H	8	27	
Odd MHz	J	9	28	
50 kHz	K	10	29	
00 kHz	L	11	30	
Even MHz	M	12	31	
Extended	N	13	32	
10kΩ Squelch pot		14	33	DCD
150 Ω Vol.pot top		15	34	power switch to 19
Vol.pot wiper		16	35	**gnd**
Vol pot cold		17	36	Dial lamps
gnd		18	37	Dial lamps gnd

Fractional MHz control lines E,F,G,H (same code for Rx and Tx) :

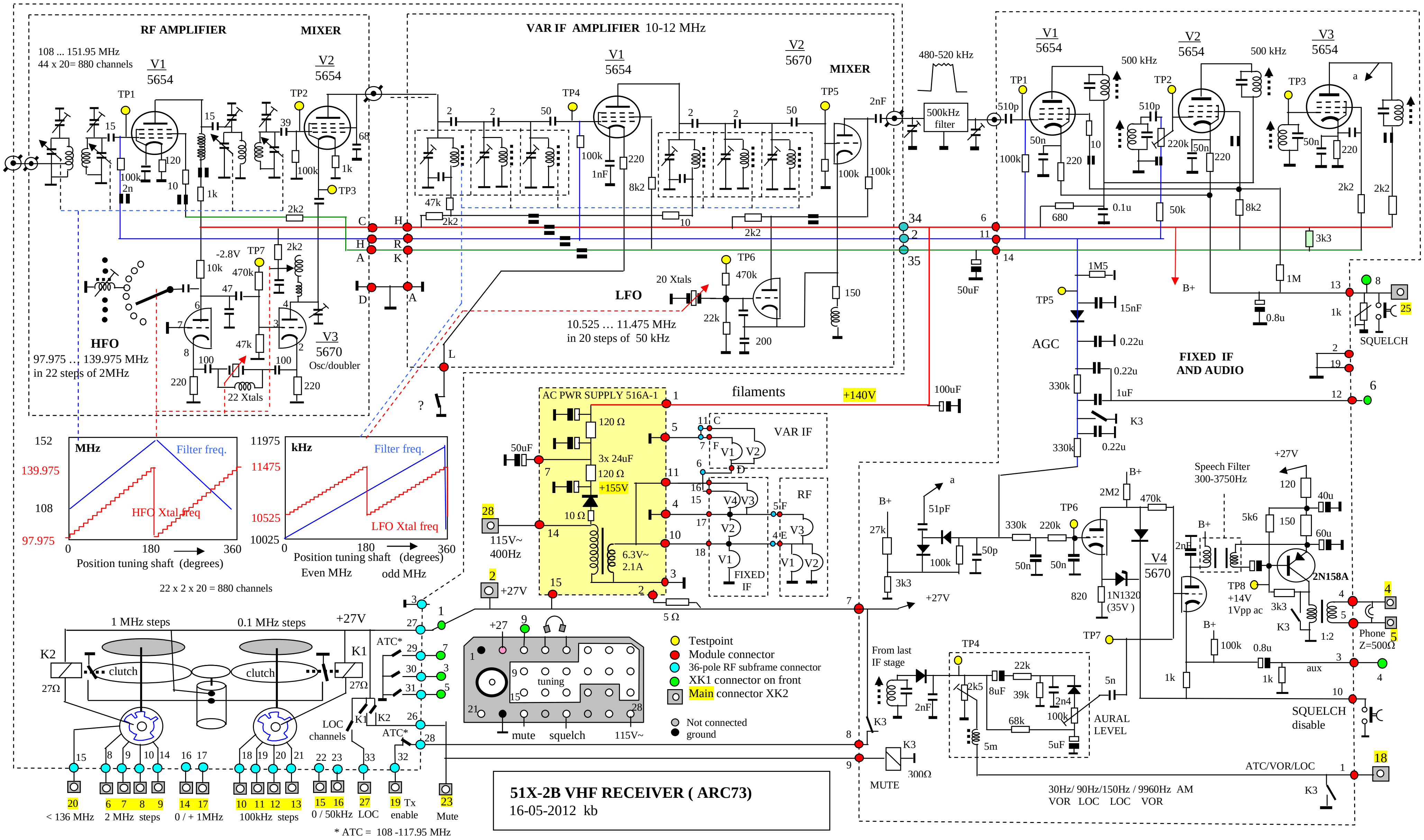
Line	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	**Rx** pin 51X-2B	Tx pin 17L-7
E	X		X			X	X				10	P2 -3
F		X		X			X	X			11	P2 - 4
G			X		X			X	X		12	P2 - 5
H				X		X			X	X	13	P2 - 6

J-line to Rx Pin 14 resp. Tx pin P1-17 connected to ground for odd MHz
K-line to Rx Pin 15 resp. Tx pin P2-12 connected to ground for .x0 MHz
L-line to Rx Pin 16 resp. Tx pin P2-22 connected to ground for .x5 MHz
M line to Rx Pin 17 resp. Tx pin P2-11 connected to ground for even MHz
N-line to Rx Pin 20 resp. Tx pin P1-7 X connected to ground for extended MHz

pin 33 connects to ground when DCD selected and freq= 118,119,120,127,128 or 129 MHz
pin 34 connects to pin 19 when powerswitch is “ON”

Positions marked “X” above are connected to ground in the control panel
Postions **not** marked “X” are interconnected in the control panel and not to ground.

614U-6 has extra outputs for Glideslope receiver channel selection when freq=108 or 109.xx mc
614U-7 has extra outputs for DME transceiver channel selection when freq= 110 … 117.xx mc



RF AMPLIFIER
MIXER
108 ... 151.95 MHz
44 x 20= 880 channels
V1
5654
V2
5654
V3
5670
Osc/doubler
HFO
97.975 ... 139.975 MHz
in 22 steps of 2MHz
22 Xtals
VAR IF AMPLIFIER 10-12 MHz
V1
5654
V2
5670
MIXER
LFO
20 Xtals
10.525 … 11.475 MHz
in 20 steps of 50 kHz
480-520 kHz
500kHz filter
500 kHz
V1
5654
V2
5654
V3
5654
AGC
FIXED IF
AND AUDIO
SQUELCH
MHz
Filter freq.
HFO Xtal freq
152
139.975
108
97.975
0
180
360
Position tuning shaft (degrees)
kHz
Filter freq.
LFO Xtal freq
11975
11475
10525
10025
Position tuning shaft (degrees)
Even MHz
odd MHz
22 x 2 x 20 = 880 channels
AC PWR SUPPLY 516A-1
filaments
+140V
+155V
115V~
400Hz
6.3V~
2.1A
VAR IF
RF
FIXED IF
Speech Filter
300-3750Hz
V4
5670
2N158A
1N1320
(35V)
TP8
+14V
1Vpp ac
Phone
Z=500Ω
aux
SQUELCH
disable
AURAL
LEVEL
From last
IF stage
MUTE
ATC/VOR/LOC
30Hz/ 90Hz/150Hz / 9960Hz AM
VOR LOC LOC VOR
1 MHz steps
0.1 MHz steps
+27V
K1
K2
clutch
clutch
LOC
channels
ATC*
mute
squelch
115V~
tuning
Testpoint
Module connector
36-pole RF subframe connector
XK1 connector on front
Main connector XK2
Not connected
ground
< 136 MHz
2 MHz steps
0 / + 1MHz
100kHz steps
0 / 50kHz
LOC
Tx
enable
Mute
* ATC = 108 -117.95 MHz
51X-2B VHF RECEIVER (ARC73)
16-05-2012 kb

51X-2B VHF RECEIVER

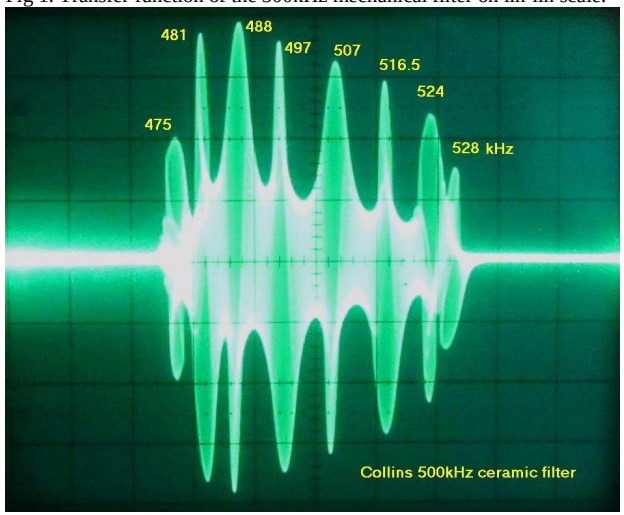
MIL name **R-1123A / ARC-73**

The receiver covers 108-151.95 MHz in 50 kHz steps, 880 channels
Input Sensitivity 3uV Antenna impedance 52 Ω.
Output 100mW into 500 Ω (7Vrms)

The receiver is a double superhet, with one RF stage.
The RF stage is tuned with a four-fold variable capacitor
1st LO 97.975 - 139.975 MHz in 2 MHz steps (22 Xtals) ,
first IF 10-12 MHz, variable, permeability tuned
2nd LO 10.525 - 11.475 MHz in 50kHz steps (20 Xtals)
In total 22 x 20 x 2 = 880 channels
second IF 500kHz fixed

The Xtals of the second LO are used twice: once 500kHz below the first IF signal, and in a second turn of the selector at 500kHz above the first IF signal. The result is a 500kHz signal that is filtered in a **Collins mechanical filter**. The transfer function on a linear scale is shown below. On a log scale, the passband ripple is 6dB, the signal is 60dB down outside 460 … 540 kHz.

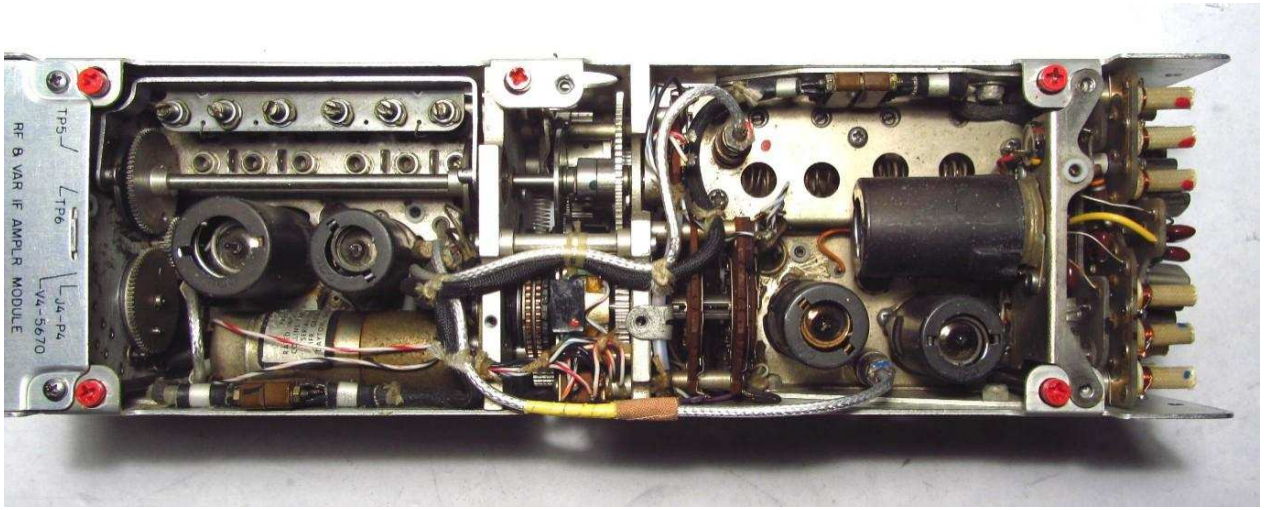
Fig 1. Transfer function of the 500kHz mechanical filter on lin-lin scale.



The ripple in the passband is possibly too high due to the 50 ohm generator impedance, instead of 5k as specified by Collins. Load was 100k as specified.

AGC

Automatic gain control is fast for the communication signals, but must be slow for navigation as the modulation frequency is low, 30Hz for the VOR, 90Hz or 150Hz for LOC. This is done automatically when pins 6 and 7 on the noval socket XK1 on the front are interconnected.



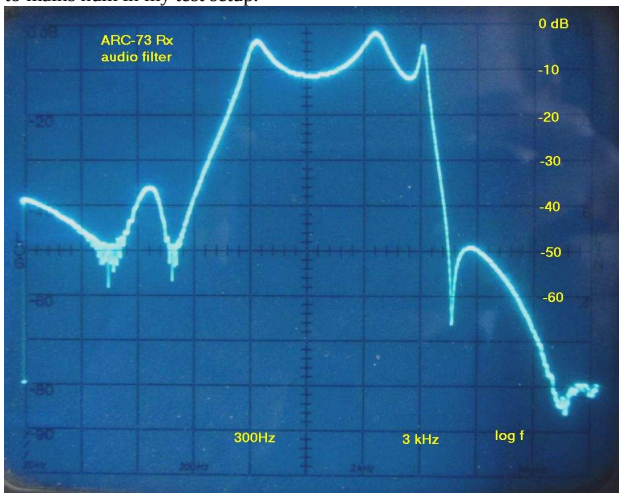
The AGC voltage on TP5 with squelch adjusted at 5uV is ..V at -80dBm input and …V at -20dBm input.

ATC output.

The receiver has a wide-band output for the VOR signals (30Hz and 11kHz) or LOC signals (90 and 150Hz). This output is not squelched nor clipped. Three contacts are available that close to ground on the ATC channels (108-117.95 MHz), one can be used to slow down the AGC response, another to select horizontal (VOR/LOC) or vertical (comm.) antenna

Squelch and audio

The squelch tube is controlled by the AGC voltage. The audio stage has a sharp speech filter with 300 – 3700 Hz passband (see below).
The filter peaks are at 320, 1400 and 3000 Hz. The peak at 50Hz was due to mains hum in my test setup.



Speachfilter response on log-log scale

Front connector XK1

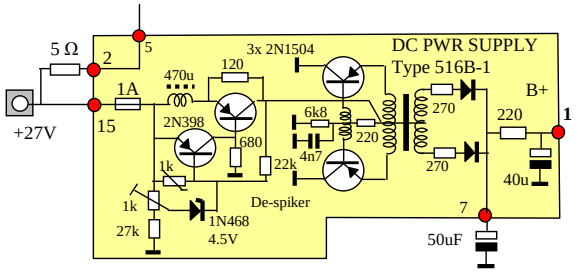
A 9-pin noval connector is used in conjunction with an external VOR/LOC decoder like the Collins 344B-1 Instrumentation Unit.

Rear connector XK2

28 pin DPA connector with one coax input for the antenna signal. Connects to the remote control panel and power source.

Power supplies, filaments

The 51X-2 was available with either AC input (115V/400Hz) or DC-only input. The only difference is the power supply module
All filaments are in parallel in the AC version, but in the DC version they are connected series/parallel. A 5 ohm dropper resistor is mounted in the main chassis to reduce the 27.5V to 4 x 6.3 = 25.2V.
The DC supply has a de-spiker to block spikes up to 70V on the DC input, and a 5W inverter to provide 150V/45mA.

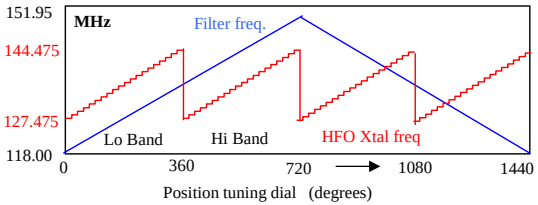


You can mail me at a.k.bouwknegt –at- home.nl

ARC-73 (Collins 17L-7) Transmitter tuning

Mechanical Tuning Unit

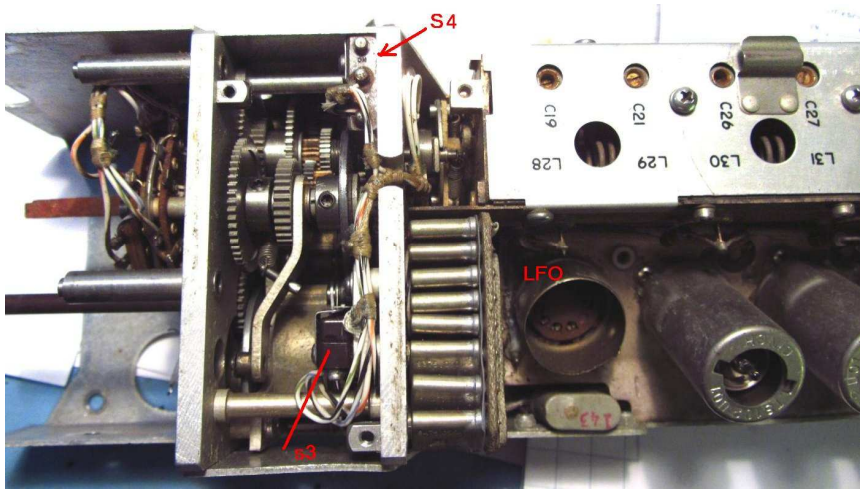
The mechanical tuning system is the backbone of the RF module of the 17L-7. It consists of a 27Vdc motor, two electromechanical clutches K2 and K3 to transfer motion to the crystal selector shafts of the high frequency oscillator (HFO) and the low Frequency oscillator (LFO).
The 18 HFO crystals are in 1 MHz steps, the 20 LFO crystals have 50 kHz steps.
The LFO and HFO signals are mixed, and a multistage tuned filter selects the carrier signal from the result. The variable capacitor (varco) shaft of this filter is driven from a mix of the HFO and LFO shafts.

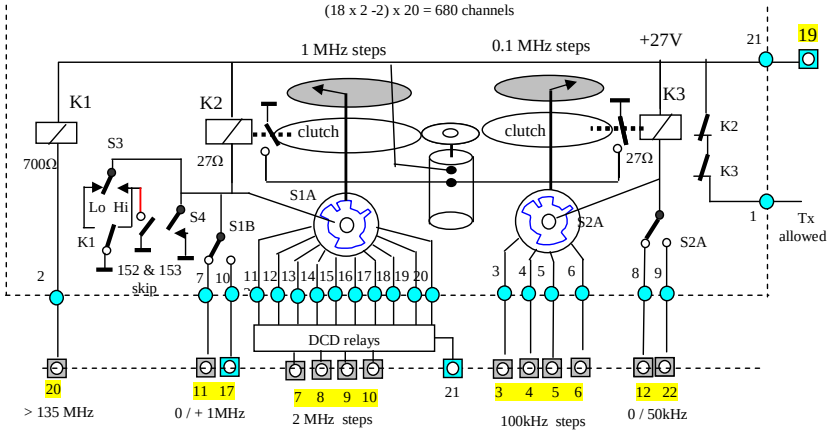


The 18 crystals of the HFO are used twice: once above the Tx frequency (Lo band), and once below the Tx frequency (Hi Band).

Over the whole Lo + Hi band, the varco of the tuned filters makes only a half turn.

So, the HFO crystal selector makes 4 turns for **one** full turn of the varco.
Microswitch S4 is on the varco shaft and forces the motor to skip the unused half turn.
Microswitch S3 is on a shaft with twice the speed, and used to select LoBand or HiBand.
In HiBand, the last two positions (152 and 153 MHz) are skipped.
In Lo Band, the LFO frequency is *decreasing* with increasing transmit frequency, while in Hi Band, the LFO frequency is *increasing* with increasing transmit frequency.
Relay K1 near the LFO crystals reverses the sequence in the Loband case.





The DCD relay connects MTU pins via the rear plug to the control panel, depending on the SCS / DCS mode. When P1-21 is left open, normal mode is selected (same frequency for receive and transmit). When P1-21 is connected to ground (Dual channel mode) then the transmit frequency is 6 MHz above the receive frequency for the first 6 columns in the table below, or 12 MHz lower in case of the last 3 columns. The control panel allows 118-119-120-127-128-129 MC (Rx) only for DCD, so all transmit 6MHz above the receive frequency.
The coding of the MHz switch S1A is as follows. "X" means no connection (that output is open.)

dial S1A input:	11	12	13	14	15	16	17	18	19	20
118/119/136/137	X	X	X	X		X			X	
120/121/138/139		X	X	X	X		X	X		
122/123/140/141			X		X		X		X	X
124/125/142/143			X	X	X	X	X			
126/127/144/145	X	X				X	X		X	
128/129/146/147	X	X	X					X		
130/131/148/149	X				X	X		X		X
132/133/150/151	X	X		X		X	X			X
134/135/-----/----		X		X		X	X	X	X	

Rear connector Pin of P2	Normal	Dual Chann
7	11 & 12	14 & 17
8	18	19
9	20	12 & 13
10	14 & 16	15

Table 2 DCD relay

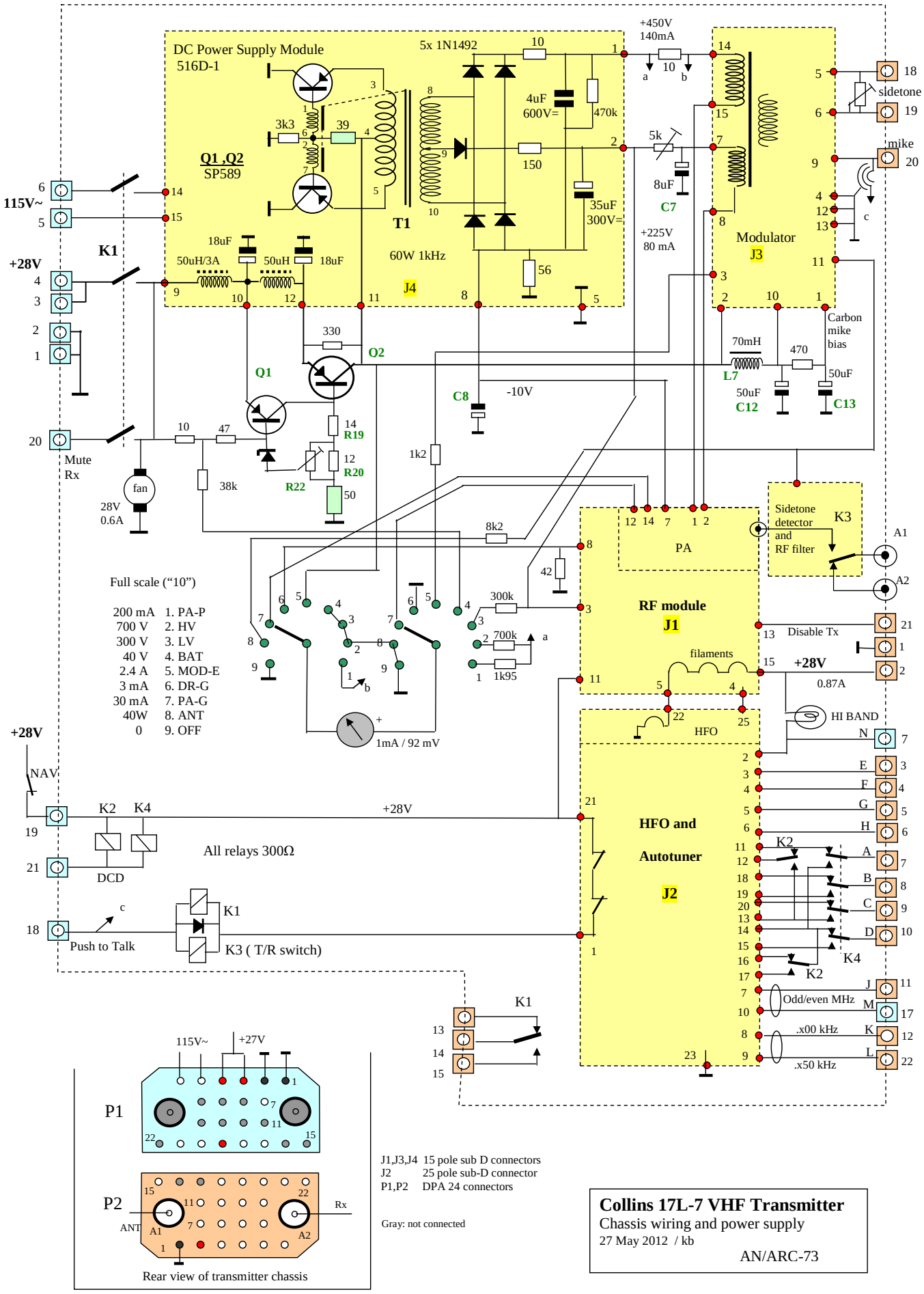
Example: in normal mode, with line A connected to ground in the control panel, the motor stops when both MTU pins 11 and 12 are open, i.e. at 118, 126, 128 and 132 etc MHz.

m c	118 119 136 137	120 121 138 139	122 123 140 141	124 125 142 143	126 127 144 145	128 129 146 147	130 131 148 149	132 133 150 151	134 135 - -	MTU Pins used in normal mode	Pin on P2 Rear side connector
A	X				X	X		X		11 & 12	7
B		X				X	X		X	18	8
C			X				X	X		20	9
D	X			X				X	X	14 & 16	10

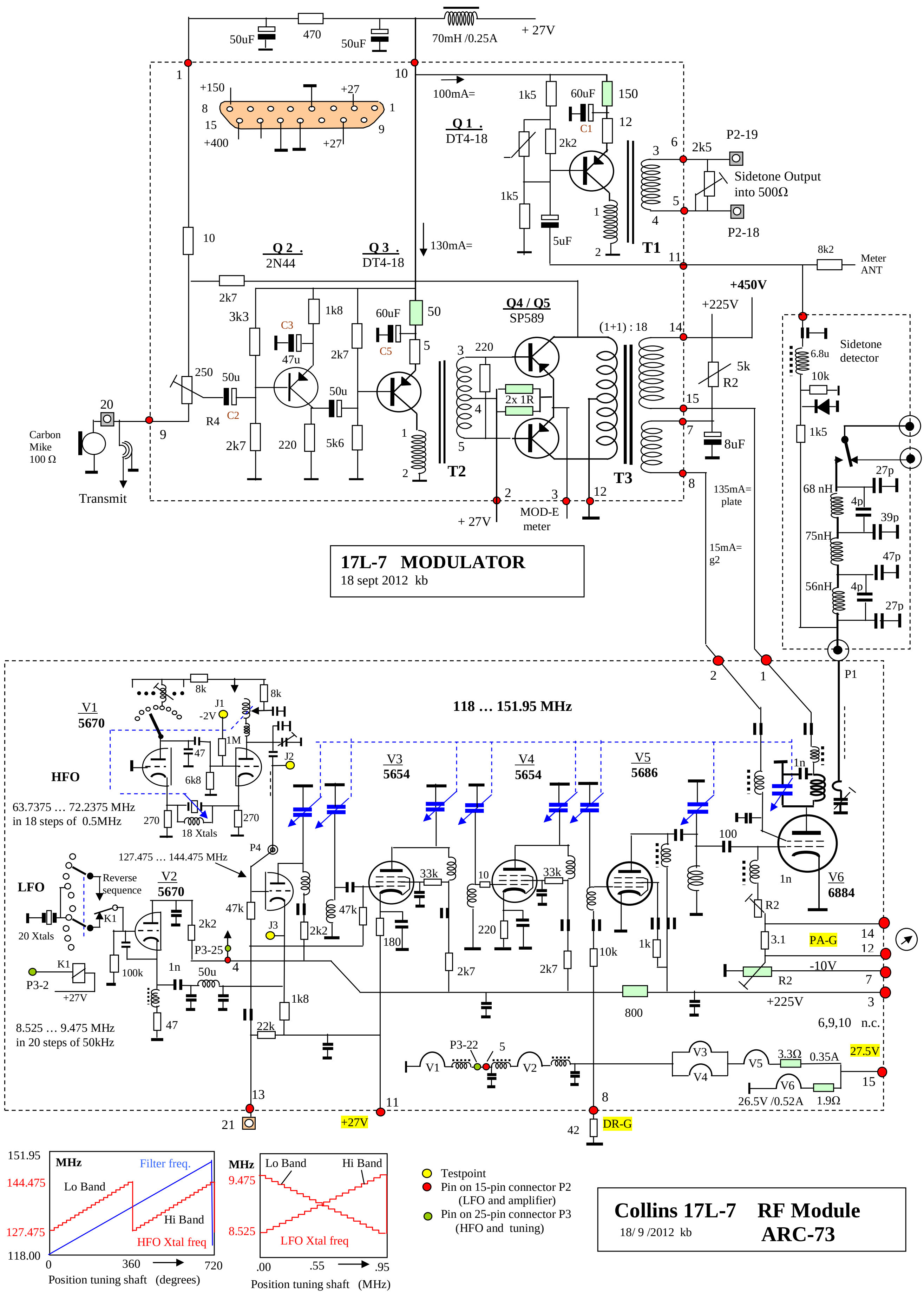
m c	118 119 136 137	120 121 138 139	122 123 140 141	124 125 142 143	126 127 144 145	128 129 146 147	130 131 148 149	132 133 150 151	134 135 - -	MTU Pins used in Dual chann mode	Pin on P2 Rear side connector
A		X		X				X	X	14 & 17	7
B	X		X		X				X	19	8
C	X	X				X				12 & 13	9
D		X	X	X			X			15	10

Example: Control set at 124MHz dual channel -> receive 124, Transmit at 130 MHz

AN /ARC-73 Transmitter (Collins **17L-7)** Power supply and chassis wiring



Collins 17L-7 VHF Transmitter
Chassis wiring and power supply
27 May 2012 / kb
AN/ARC-73


17L-7 MODULATOR
18 sept 2012 kb
Q 1
DT4-18
Q 2
2N44
Q 3
DT4-18
Q4 / Q5
SP589
T1
T2
T3
(1+1) : 18
+ 27V
70mH /0.25A
50uF
470
100mA=
130mA=
Sidetone Output
into 500Ω
P2-19
P2-18
Meter
ANT
8k2
+450V
+225V
135mA=
plate
15mA=
g2
Sidetone
detector
Carbon
Mike
100 Ω
Transmit
MOD-E
meter
118 … 151.95 MHz
V1
5670
HFO
63.7375 … 72.2375 MHz
in 18 steps of 0.5MHz
18 Xtals
127.475 … 144.475 MHz
LFO
Reverse
sequence
V2
5670
20 Xtals
8.525 … 9.475 MHz
in 20 steps of 50kHz
V3
5654
V4
5654
V5
5686
V6
6884
PA-G
-10V
+225V
6,9,10 n.c.
27.5V
26.5V /0.52A
DR-G
+27V
P1
MHz
Filter freq.
Lo Band
Hi Band
HFO Xtal freq
151.95
144.475
127.475
118.00
0
360
720
Position tuning shaft (degrees)
9.475
8.525
LFO Xtal freq
.00
.55
.95
Position tuning shaft (MHz)
Testpoint
Pin on 15-pin connector P2
(LFO and amplifier)
Pin on 25-pin connector P3
(HFO and tuning)
Collins 17L-7 RF Module
18/ 9 /2012 kb
ARC-73