Understanding and Programming your RT85

VK4TCS (updated)

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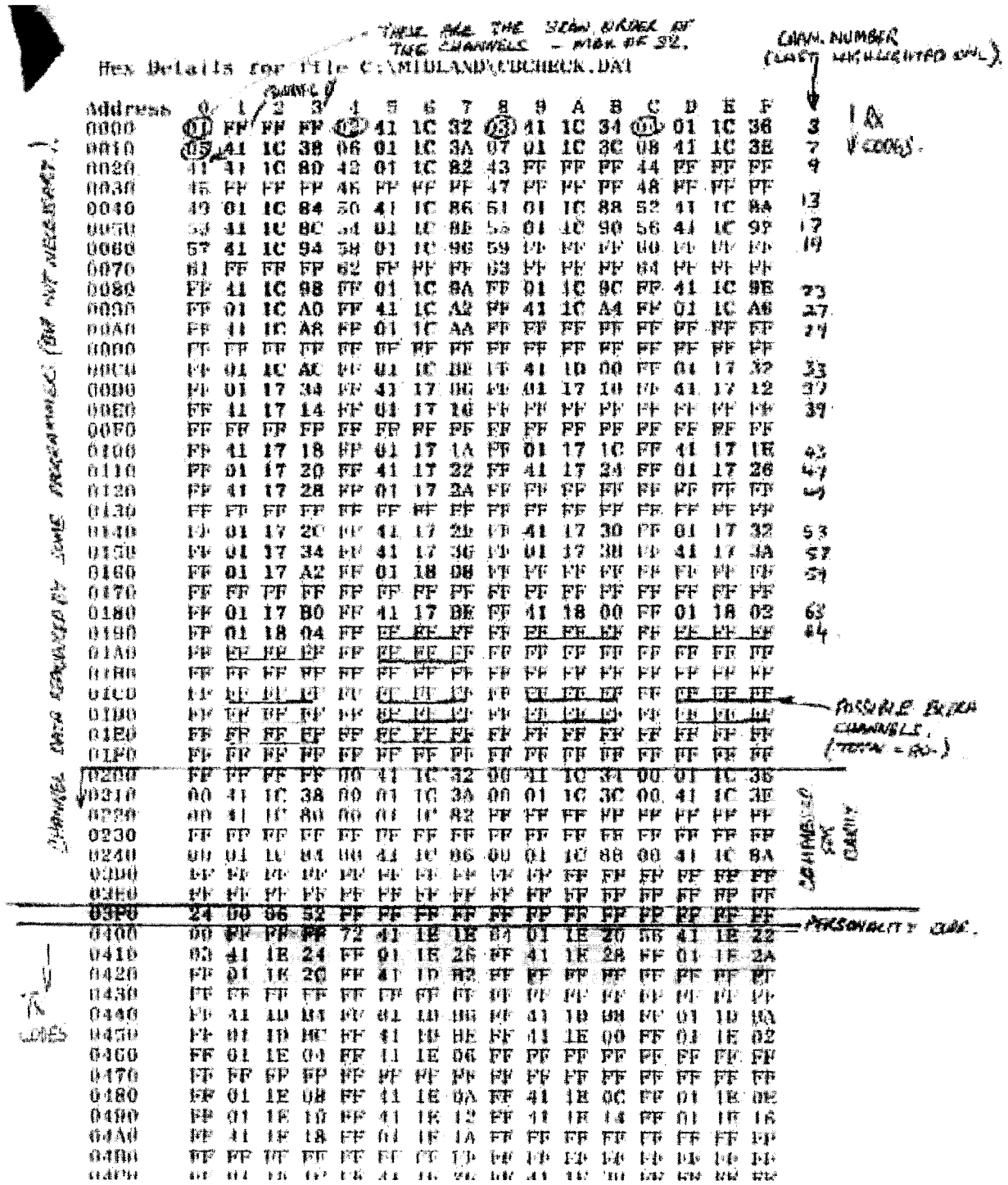
This exercise started when I was "given" an RT85 for my 2 metre Amateur station several years ago , I decided to work them out , hope this helps..
The frequency data is stored in eprom and is divided into 2 groups which consist of a 3 byte sequence (24 bits) . 17 bits are used by the PLL and the remaining 7 bits for "aux" information. The first block starting at 0001H is channel 0 reciever data. The data block finishes at 03EFH. Theoretically there is enough room for 80 channels. The next 16 bytes are reserved for personality information - 03F0H to 03FFH . (See the programming sheet that AWA used to give to the customers, to aid them in "programming" the radio) . Starting at 0400H is the transmitter data and it is arranged identically to the recieve data block. Starting at 0000H is the "scan" channel sequence, and this data fits between the PLL data and there can be a maximum number of 32 channels scanned. This first drawing will hopefully assist you in understanding what I just said. (I'm sorry for the jpg size, but b&w didn't show up the highlighter)



Looking at the personality codes, the first byte holds the radios programmed channel number , ie 64 ,80 whatever , this is entered in "decimal", the next 3 bytes are made up of bits that are designated "options" for the radio, and the chart below will make this clear .

41 1C 32.

0001 1100 0011 0010 bits Even - 90

41 1C 36

0001 1100 0011 0100 bits Even - 90

EPROM PROGRAMMING SCHEDULE
AVA CARPHONE RT-85

CUSTOMER: ..... DATE .....

TYPE NO: ..... REF NO: .....

FREQ. BAND VHF (LB) 1 ☐ VHF (HB) 2 ☐ UHF 3 ☐ (Tick box required)

CHANNEL	1 RX FREQUENCY (MHz)	2 RX CTCSS/AUX CODES	3 TX FREQUENCY (MHz)	4 TX CTCSS/AUX CODES
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

SCAN ORDER

CH	CH
0	11 .....
1	12 .....
2	13 .....
3	14 .....
4	15 .....
5	16 .....
6	17 .....
7	18 .....
8	19 .....
9	20 .....
10	21 .....

PERSONALITY CODES

3F0 .....

3F1 .....

3F2 .....

3F3 .....

Use link sheet if more than 20 channels required

Note: See other side for information on personality codes and Rx & Tx CTCSS/Auxiliary Codes.

Other Comments:

3F0 Maxim

3F1 CTCSS Busy Selca Progr Digit 1 Digit 2 Stat Inhit Inhit Code No:

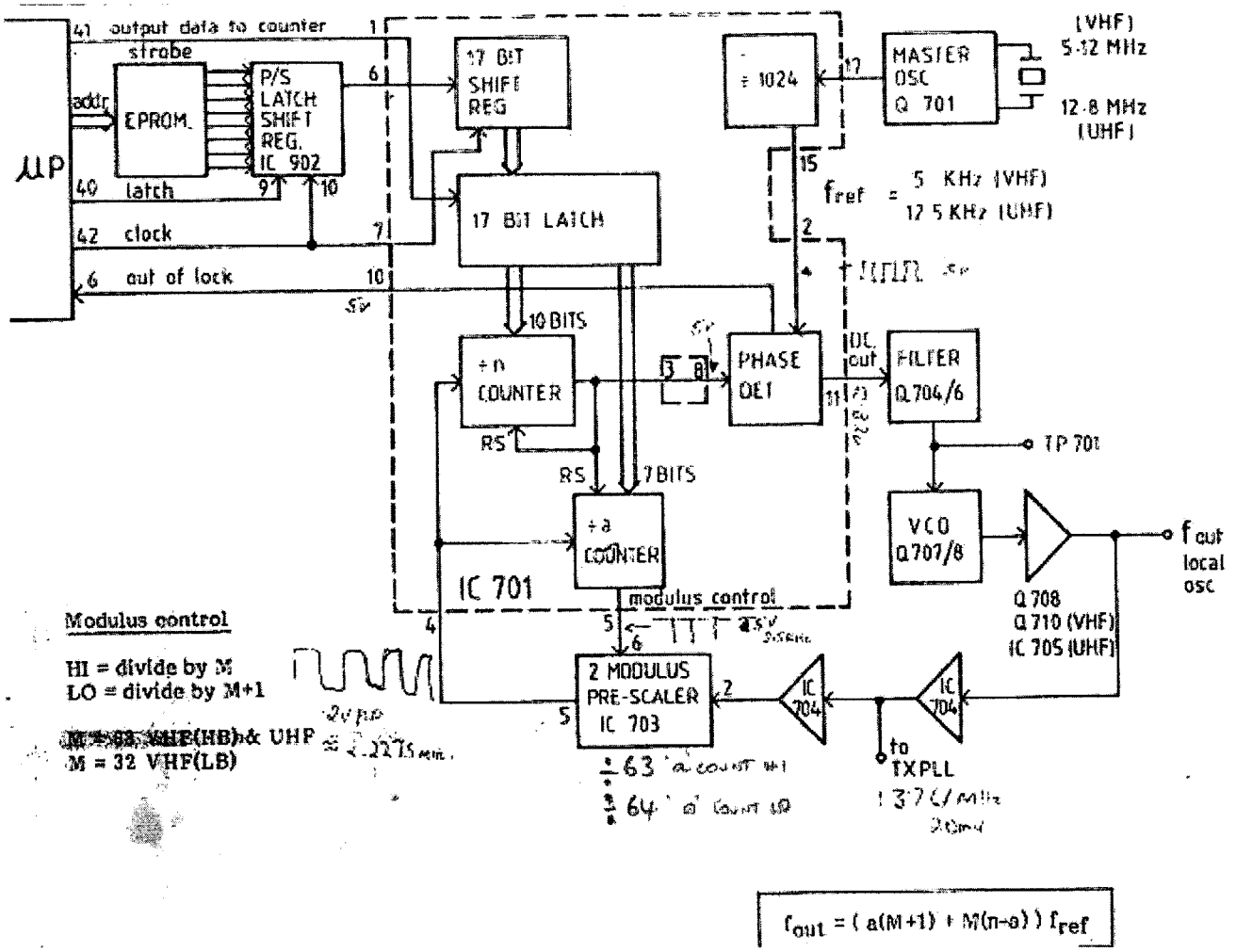
3F2 PTT Hold- Code Digit 1 Digit 2 Tx T part Code

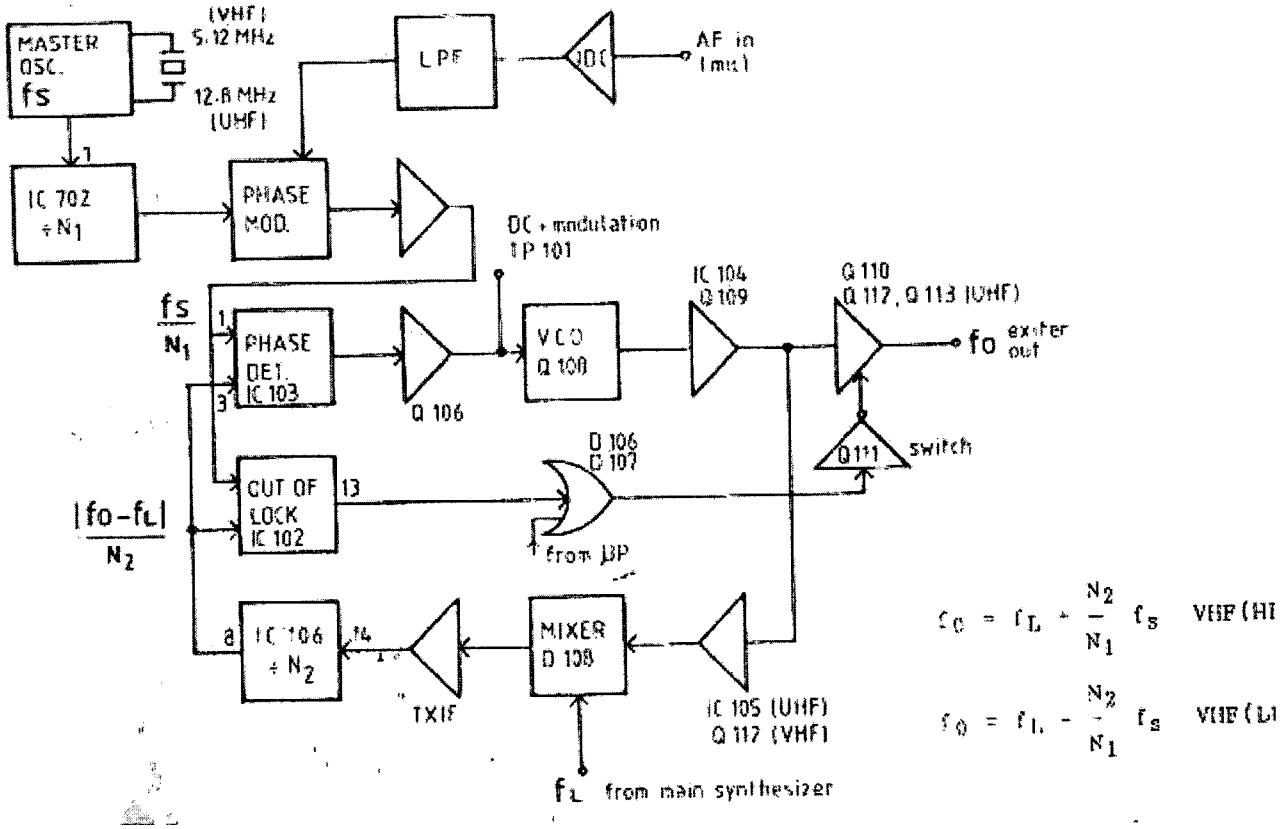
3F3 SCAN Scan dela CODE No: Use

Fig. F-1 Blank EPROM Programming Schedule

Operation - The 17 bits are loaded into the PLL IC701, 7 bits to the "a " counter which controls the prescaler divider and 10 bits for the "n" counter. There are 2 PLL systems which are interconnected. A reference of 5.12Mhz is divided by 4 (or 8) for the Tx side and by 1024 for the "main" PLL. The Tx reference after division is 1.28 Mhz and applied to the phase detector (IC103) . The error signal holds the VCO (Q108) on frequency to produce Fo. This is amplified by the PA. The o/p is fed back to a mixer with the main PLL FI to

produce a difference (+/-) of 20.48 Mhz. (Tx IF) This is divided by 16 (IC106) and fed back to the phase detector (1.28Mhz) and lock is found. The "main " PLL after the reference is divided by 1024 produces 5Khz reference to it's phase detector. The error from this holds a VCO (Q707/708) on frequency to produce FI for the other PLL via the mixer and for the Rx ccts. This FI is fed back through the prescaler (/63 or /64) , through the programable dividers and back to the phase detector to hold the frequency selected. The "a " counter on the count changes the pre-scaler divisor, the "n" counter being the "main" counter. See diag below

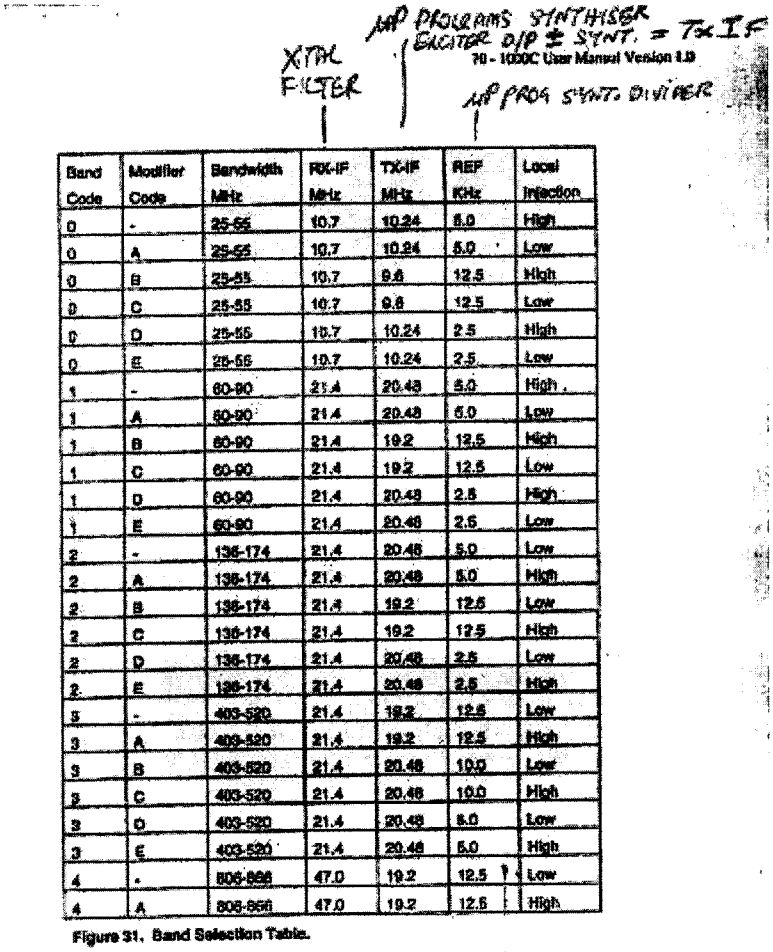




There are a number of programmers about for RT85's , The original AWA , an EAY-06EK ; there has been one somebody did in "Basic"and there is an " exicom MRP70", which I think is the best, (If you have the lastest version software) I don't recomend hand coding an entire eprom, like I did the first time, as you could be sitting at a calculator for hours, but if you need to change a channel or two it is fairly easy . Look at the data of one that is close (or several) , you will most probably see the second byte is the same and won't require changing , (and see note at bottom) The 3rd byte will need to be changed ; just work out the offset and add or subtract it off your "close" frequency . An example might be ; (radio has no modifiers - ie not narrow band etc.) 147.825 Mhz Rx, is 40 C5 85 and we want to go up 25Kc to 147.850 Mhz Rx , then add 5 to the third byte and the data becomes 85 to 8A. Doing a bit check we find that the first byte is 40H. So the new frequency is 40,C5,8A . A bit check you say? , first byte will need to be an 00 or 40H . This can be worked out by writing out the 2nd and 3rd bytes in bit format and if it is even the number is 40H , if odd its 00H . (If the radio beeps at you , you got it wrong! try the otherway, or possibly the "data" is incorrect.) . The Tx is the same , going from 147.225 to 147.250 Mhz . 147.225 data is 00 C6 05, adding 5 to it gives C6 0A, checking the 1st byte we find it's still even so the new data is 00 C6 0A. The offset value will be may be different for other radios with different "modifiers" like narrow band , different reference freq, etc. By examining the frequencies and the data you should be able to work out whats happening.

Getting hold of a programmer makes life easy , the basic program is useful as it can give you a dump of the new data, even the software of the mrp70 is useful as it will give you that dump too, the hardware that comes with it makes it easy by not having to unsolder any eproms . (Incidently - if you want to put a socket on your daughter board, use a low profile machine socket and re-solder the "inline" connectors with a strip of veroboard under them to space them off the surface a bit.) The next drawing is a table from the MRP70 booklet, which I will include to show you some of what versions of "RT85" are about. (Quite apart from the RT85 A , B, C's which are still basically the same , but have a different micro and eprom , there is as well the "midlands" which are a copy of the RT as well, and I have seen

an "exicom" version as well . - it seems they were considered a pretty good radio by the number of copies about!)



Band Code	Modifier Code	Bandwidth MHz	RX-IF MHz	TX-IF MHz	REF KHz	Local Injection
0	-	25-55	10.7	10.24	5.0	High
0	A	25-55	10.7	10.24	5.0	Low
0	B	25-55	10.7	9.6	12.5	High
0	C	25-55	10.7	9.6	12.5	Low
0	D	25-55	10.7	10.24	2.5	High
0	E	25-55	10.7	10.24	2.5	Low
1	-	60-90	21.4	20.48	5.0	High
1	A	60-90	21.4	20.48	5.0	Low
1	B	60-90	21.4	19.2	12.5	High
1	C	60-90	21.4	19.2	12.5	Low
1	D	60-90	21.4	20.48	2.5	High
1	E	60-90	21.4	20.48	2.5	Low
2	-	136-174	21.4	20.48	5.0	Low
2	A	136-174	21.4	20.48	5.0	High
2	B	136-174	21.4	19.2	12.5	Low
2	C	136-174	21.4	19.2	12.5	High
2	D	136-174	21.4	20.48	2.5	Low
2	E	136-174	21.4	20.48	2.5	High
3	-	403-520	21.4	19.2	12.5	Low
3	A	403-520	21.4	19.2	12.5	High
3	B	403-520	21.4	20.48	10.0	Low
3	C	403-520	21.4	20.48	10.0	High
3	D	403-520	21.4	20.48	5.0	Low
3	E	403-520	21.4	20.48	5.0	High
4	-	806-866	47.0	19.2	12.5	Low
4	A	806-866	47.0	19.2	12.5	High

Figure 31. Band Selection Table.

The current settings for the Band is shown in the CHANNELS window of the 70-1000C software, as can be seen in Figure 29.

3.4.2 Modifier

When selecting the Modifier option, the following screen is displayed.

I have also modified half a dozen low band (70-85Mhz) RT's for operation on 6 metres. I have had a complaint that one was deaf, and needs re-alligning , but the one I have in my shack seems to work fine, (I have another 2 spares and I haven't heard from the others..) The 6 metre eprom file can be obtained from this link. It has 64 channels and basically covers everything in the 6M band for FM (which isn't much !). The modifications are below for getting your RT85 on 6. . . . . The Tait 499 are also modifiable for 6 metres, here are the 2 roms for that. - Rom 1 / Rom2

PROJECT MEMO

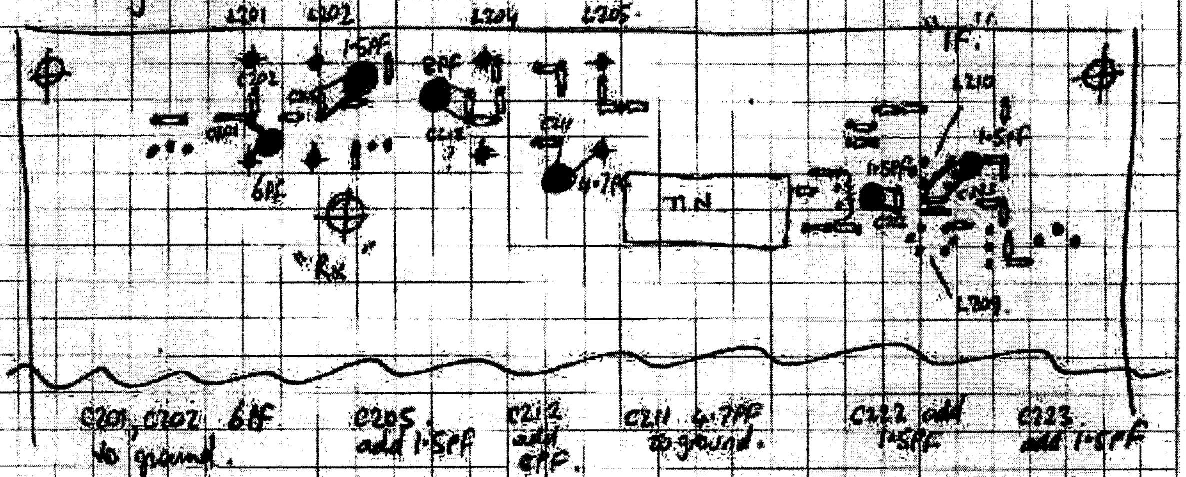
TAB 900

FROM: Receiver Board	Page of pages
TO:	File No: VK4TGS -
SUBJECT:	Date:

*1

Remove cans & coils in succession, winding 7½T .25 dia wound.
L201, L202, L204, L205.

Modify the back of board

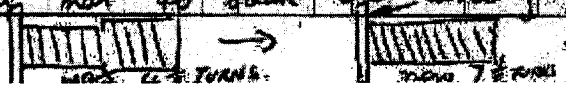


* Mods to the IF C222, 223 are needed to tune L209 L210 sufficiently to get the sensitivity up.

* With everything tuned up .15µV can be expected, and .2µV should be easy to get!

(2) * Hot glue windings onto formers works better than melting plastic to hold windings.

(1) This is probably done best with a new coil, but if you're going "deep", * Coils are "moulded" so moulding needs to be cut away, as well file away "top" of former so it is now the same dia as the bottom. (be careful not to break the "winding"), save some of the "cut away" as you may need it to "glue" things together. (2)



PROJECT MEMO

TAB 600

FROM:	P.A. Mods
TO:	(should get easily 30w o/p.)
SUBJECT:	
Page of copies	
File No.	VK4TCS.
Date	

L114
7.5T

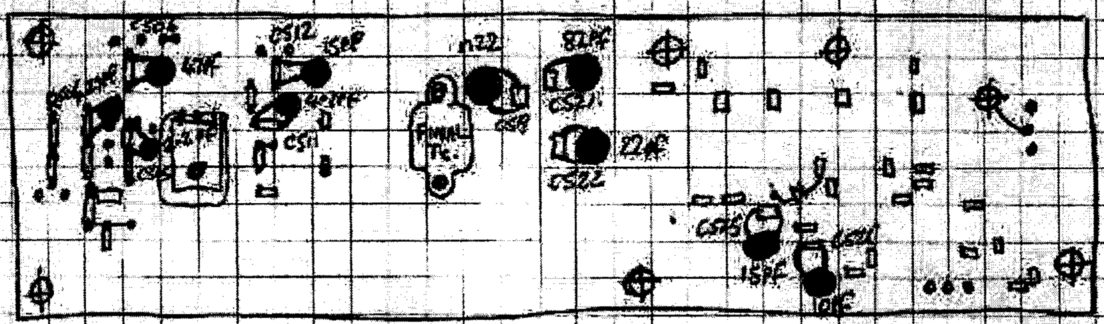
* Remove L501, L502, L503, L504, ~~L505~~, L506, L507, L515.
(L516, 517, 518, 519. if your keen!)

* Replace.

L501.	2½T.	35'	same dia
L502	6½T	35'	"
L503	3½T	35'	"
L504	6½T	35'	"
L506	3½T	35'	"
L507	3½T	35'	"
L515.	6½T	45'	"

(L516, 517, 518, 519. 6½T 45'. same dia).

* Mod back of board below as shown.



C506. +47PF.	C511 +4.7PF.	C519. +n22.	C525 +15PF.
C505 +2.2PF.	C512 +15PF.	C521. +82PF.	C526. +10PF
R504. +27PF.		C522 +22	

Tuning: More work needs to be done with the Rx isolation (C526, L515, C523) as this is absorbing output power & should be ∞ at working frequencies. Even so expect about 45w. output, properly tuned up. Some playing may need to be done. (L501 may need a shunt cap, try a 120PF instead of 82PF on C521.)

PROJECT MEMO TAB-B0U

TAB

FROM: Synthesiser Board

TO:

SUBJECT:

Page / File No. VK4TCS.

Date:

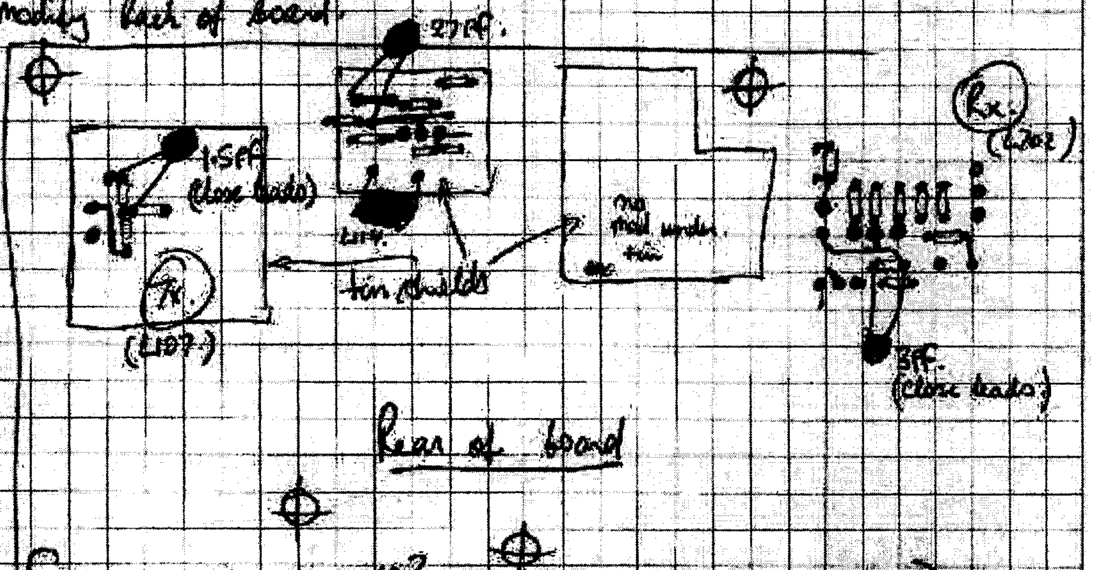
* Remove. L702 from Rx shielding box, (cut away silicon to make room for new formers)
L107 from Tx " "

* replace L702 with new green former ① and wind 5½T on. (28')
L107 with " bakelite " ② and wind 5½T on close wound (25')
(hot glue into place).

* replace L114 with 5½T (25' enam). (same dia).

* install new eprom data board and tune up as usual Ⓐ.

* modify back of board.



Tuning note — Low o/p?
L114 make 6½T with 47pF in parallel to produce sufficient o/p. on J366. — (10v P/P, o.c.) at least.

Formers ① Used "tait" T199 green Rx block formers ≈7mm OD. (5mm slug).

② 6mm high 5mm OD bakelite former (3.5mm slug.). (see samples)
(with slugs + formers).

Notes. Ⓐ VCO bandwidth can be narrow, tune CV102 before any o/p can be found. (guide is about 10v P/P on CC4)
(whatsoever) (max the better?)

Good luck Chris.

{ Note: - The programmed values correspond to a bit pattern that is applied to the counters. Some bit patterns are not valid which means that the second byte must be incremented and the third byte is reset to it's lowest valid bit pattern. It may be possible to get 2 valid solutions to a frequency. (Also the first byte maybe 01 or 41 combinations or others , depending on if the channel has tone or other options { Eg, the above example 147.225 Mhz , a 91.5Hz tone on Tx would be 42 C6 05)} Unfortunately I never was able to get any spec. sheets on the counters as they were priviledged information. If anybody has the specs , email it to me please and I will write the procedure to program it , without any "maybes" . If you have a lot to do it is really best to get hold of some programmer software.}

ALLIGNMENT (briefly)

Synthesizer - Ensure 13.8 volts is being supplied. With Test Point 701 monitor the voltage. Less than 1.7 or greater than 6 volts indiates the PLL is unlocked. A tone and "95" may be displayed as well. Pick a channel that is mid-point frequency from your list, and adjust L702 for a TP701 voltage of around 3.5. This is done to symetrically centre ALL the channels PLL voltages. The Tx side , remove the exciter coax (J366) and operate PTT. Adjust L107 monitoring TP101 for around 3.5 volts for theTx, using a Tx mid frequency. Re-check the Rx and Tx test points again for symetry around a centre frequency for all channels. Connect a freq. counter to J365 and adjust CV701 for

f = (RX freq - 21.4Mhz) +- 200Hz . . . . for VHF (HB) and UHF

f = (RX freq + 21.4 Mhz) +- 200Hz . . .for VHF (LB)

(Usually by selectng a "mid" frequency channel all the other channels fit into the PLL capture bandwidth, it is only when trying to fit for example, CB and police bands (UHF), that are relatively wide apart, that special attention may be needed to shoe horn them all in)

Reciever allignment - all coax's re-connected, Ensure 13.8 volts is being supplied.

Connect a voltmeter to CM202 pin 4 (pin 2 is a missing "key" pin), select the centre frequency channel. Connect a freq. generator to the antenna input with the same Rx frequency. Use a minimum signal strength to obtain results. Adjust L209 and L210 (VHF) or CV202 and VC203 (UHF) for a maximum reading. Connect a voltmeter to pin 3 and adjust L201,202,204,205 (VHF-low) or L201,202,204,205,206 (VHF-high), or L201,202,203,204,205,206 (UHF). Adjust for a maximum reading, the voltage may be negative until sufficently tuned. Gradually lower the injected RF signal voltage into the Rx, re-adjusting all for a max voltage (and good tone if your freq gen modulates audio as well). A reciever sensitivity of 0.2uV should be possible, lower is better.

Transmitter allignment

Connect a 50w power meter to the antenna with a 50 ohm load. Select the mid frequecy channel. Set RV502 fully clockwise. Ensure 13.8 volts is being supplied. Operate the PTT and adjust CV501, 502,503 for maximum power output. (UHF also do CV504). Re-adjust until they are all peaked. Adjust RV502 for an output of 25 watts. - power high . {A lousy PA strip may only give you 15 watts but I have seen better than 45 watts}. If de-power is used (p302 and p303 on back of remote shorted), adjust RV501 for required output. CV102 on the synth board may need re-peaking if insufficent output is obtained, or you may be able to

sneak a little bit more.

Deviation and mic gain.

With a dummy load on the antenna output, use a deviation meter to set a deviation of a MAX of 5Khz with your normal voice and mic distance. A good start is to have both the mic gain RV102 and deviation RV101 set midway to start with. It is good to have another Rx , scanner etc monitoring your transmitted voice quality so you can lift the loudness, cut out background noise etc. Mic gain will affect the deviation level, adjust the two inconjunction. RV103 sets the aux Tx audio level (CTCSS tone). Too much deviation will result in reciever distortion. Too

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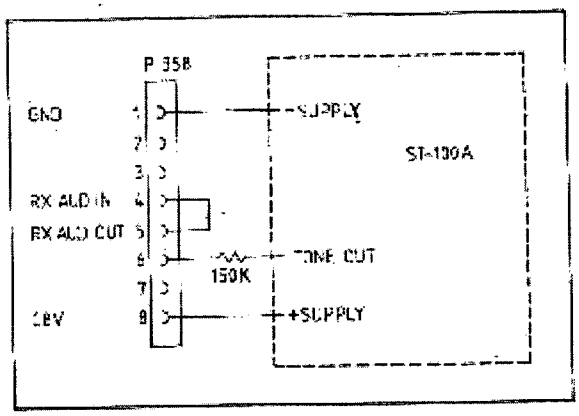
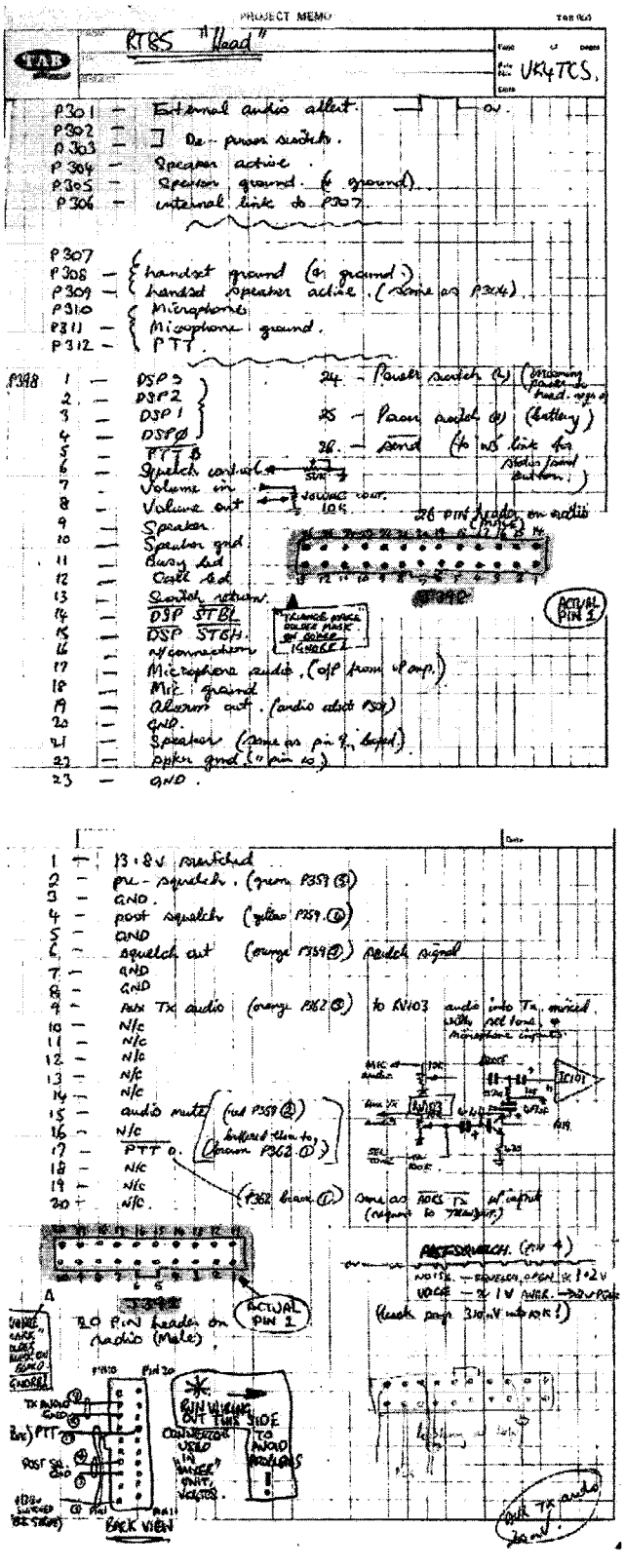
TONE



A number of tone boards were used with the RT85 , the simplist was an un-programmable "fixed tone" version that injected into P358 , pin 6. The programmable version allowed the selected channel to apply a different tone. It had another connection to the eprom board as well. Further variations to connections were required if "selcall" was used as well. Selcall was a coded data stream to alert another radio that you wish to make contact.

Below is the pin-outs of J398 and 391 .



Some Links . . . . . .

Phil's RT85 page - If you got a low band 85 and want to get on to 6 there's some good info here, as well as a programmer.
NSW Emergency services - Col has some info and pictures of 85's, as well as work

related pictures.
VK3BIZ's RT85 page - Information , source code and links etc.
VK3BYY's RT85 page - Some more info, etc
VK3TAE's RT85 page - Some hints and tips, schematics, bin files etc.
Mr Skinnys RT85 page - More info and pictures etc.

<
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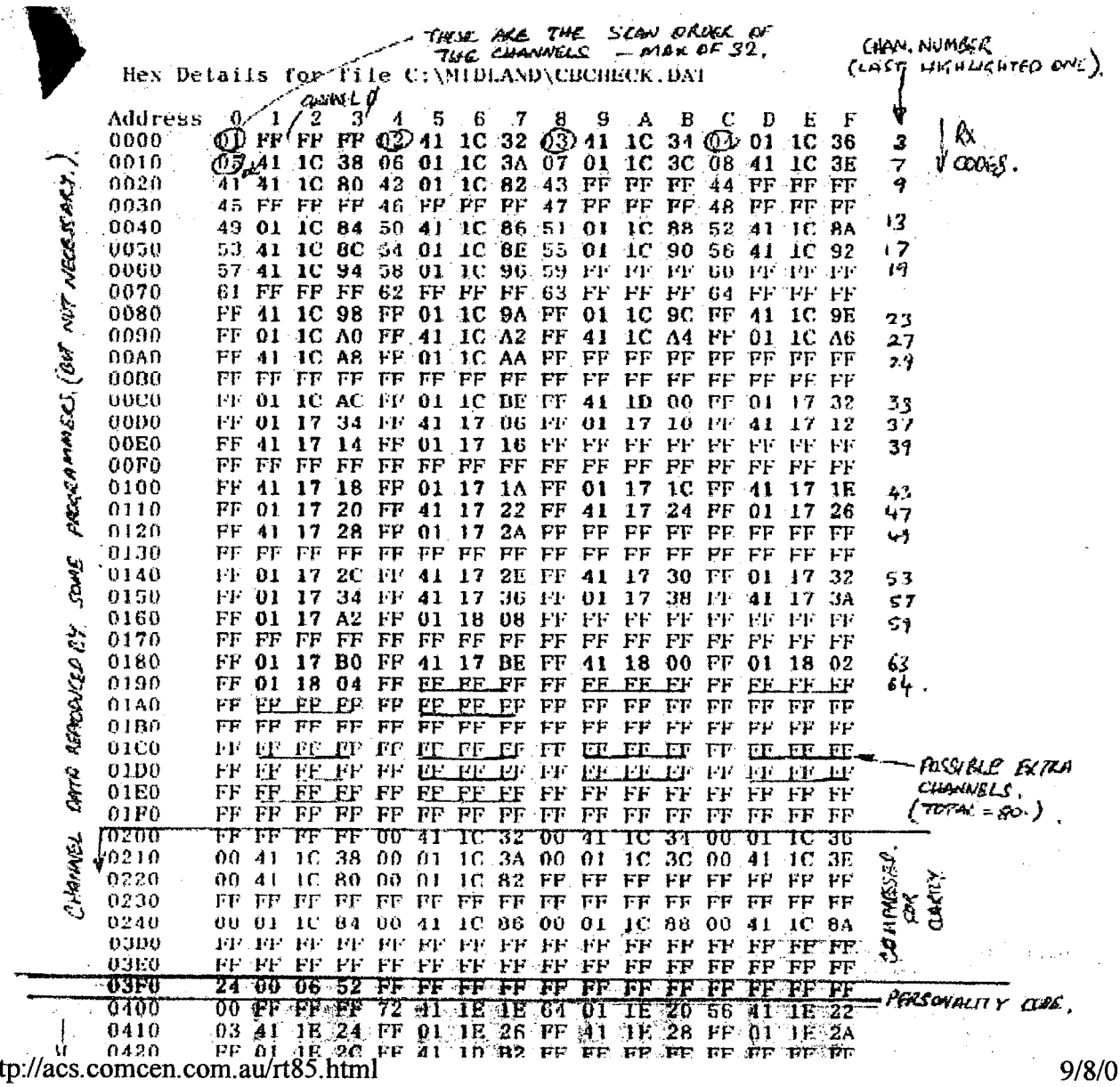
Understanding and Programming your RT85

VK4TCS (original notes)

This exercise started when I was "given" an RT85 for my 2 metre Amateur station several years ago , I decided to work them out , hope this helps..
The frequency data is stored in eprom and is divided into 2 groups which consist of a 3 byte sequence (24 bits) . 17 bits are used by the PLL and the remaining 7 bits for "aux" information. The first block starting at 0001H is channel 0 reciever data. The data block finishes at 03EFH .Theoretically there is enough room for 80 channels. The next 16 bytes are reserved for personality information - 03F0H to 03FFH . (See the programming sheet that AWA used to give to the customers, to aid them in "programming" the radio) . Starting at 0400H is the transmitter data and it is arranged identically to the recieve data block. Starting at 0000H is the "scan" channel sequence, and this data fits between the PLL data and there can be a maximum number of 32 channels scanned. This first drawing will hopefully assist you in understanding what I just said. (I'm sorry for the jpg size, but b&w didn't show up the highlighter)



Tx CODES

```
0430  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0440  FF 41 1D B4 FF 01 1D B6 FF 41 1D B8 FF 01 1D BA
0450  FF 01 1D BC FF 41 1D BE FF 41 1E 00 FF 01 1E 02
0460  FF 01 1E 04 FF 41 1E 06 FF FF FF FF FF FF FF FF
0470  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0480  FF 01 1E 08 FF 41 1E 0A FF 41 1E 0C FF 01 1E 0E
0490  FF 01 1E 10 FF 41 1E 12 FF 41 1E 14 FF 01 1E 16
04A0  FF 41 1E 18 FF 01 1E 1A FF FF FF FF FF FF FF FF
04B0  FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
04C0  FF 01 1E 1F FF 41 1E 21 FF 41 1E 30 FF FF FF FF
```

Looking at the personality codes, the first byte holds the radios programmed channel number , ie 64 ,80 whatever , this is entered in "decimal", the next 3 bytes are made up of bits that are designated "options" for the radio, and the chart below will make this clear .

EPROM PROGRAMMING SCHEDULE

AHA CARPHONE RT-85

CUSTOMER:..... DATE .....

TYPE NO: ..... REF NO: .....

FREQ. BAND VHF (LB) 1 ☐ VHF (HB) 2 ☐ UHF 3 ☐ (Tick box required)

CHANNEL	1 RX FREQUENCY (MHz)	2 RX CTCSS/AUX CODES	3 TX FREQUENCY (MHz)	4 TX CTCSS/AUX CODES
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

SCAN ORDER

Ch	Ch
0	11 .....
1	12 .....
2	13 .....
3	14 .....
4	15 .....
5	16 .....
6	17 .....
7	18 .....
8	19 .....
9	20 .....
10	21 .....

PERSONALITY CODES

3F0 .....

3F1 .....

3F2 .....

3F3 .....

Use link sheet if more than 20 channels required

Note: See other side for information on personality codes and Rx & Tx CTCSS/ Auxiliary Codes.

Other Comments:

3F0 Max

3F1 Digit 1 — CTC Bus Sel Pro

Digit 2 — Sta Inh Inh Cod No:

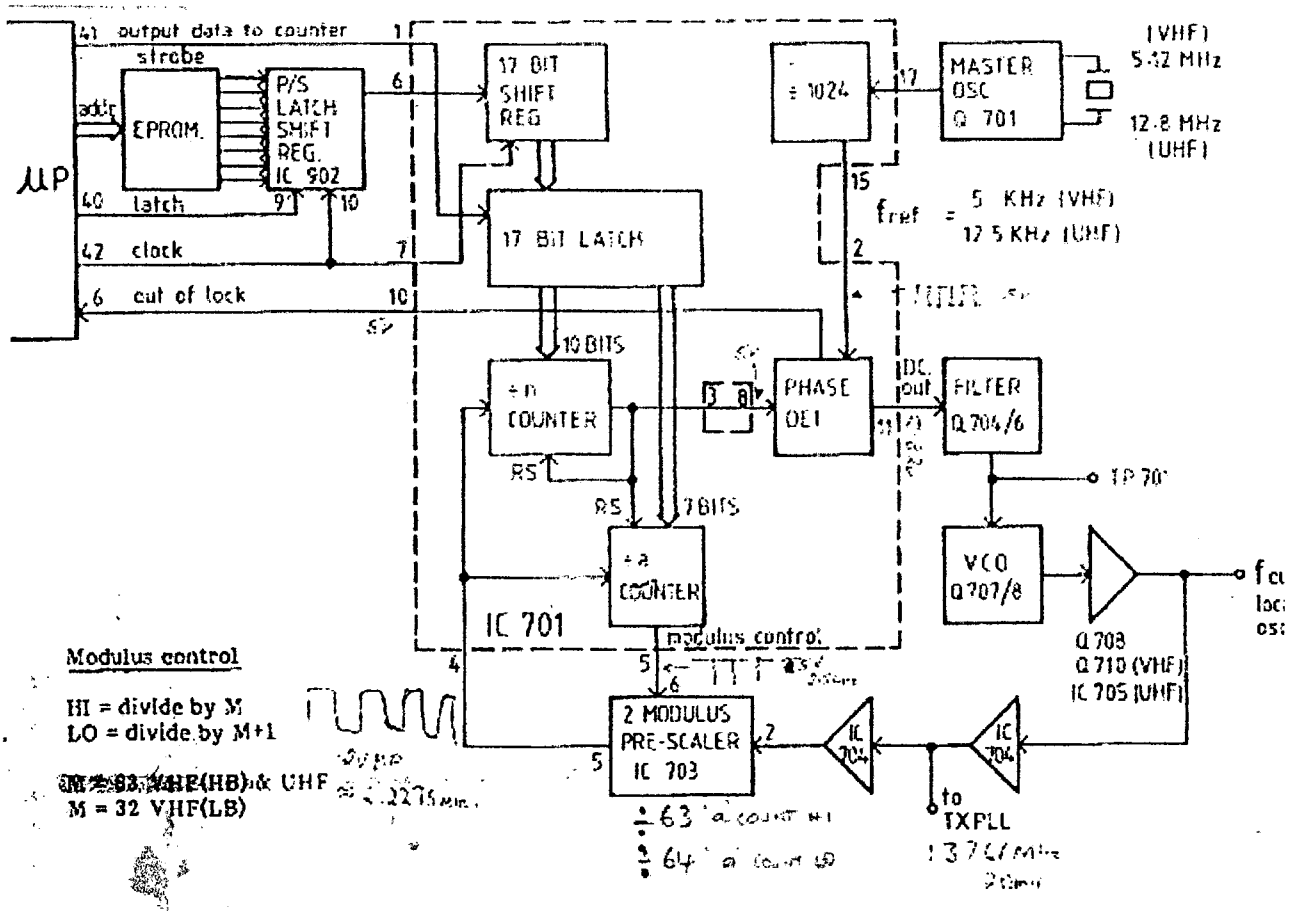
3F2 Digit 1 — PTT hol Cod

Digit 2 — Tx per Cod

3F3 SCA Sca del COD No:

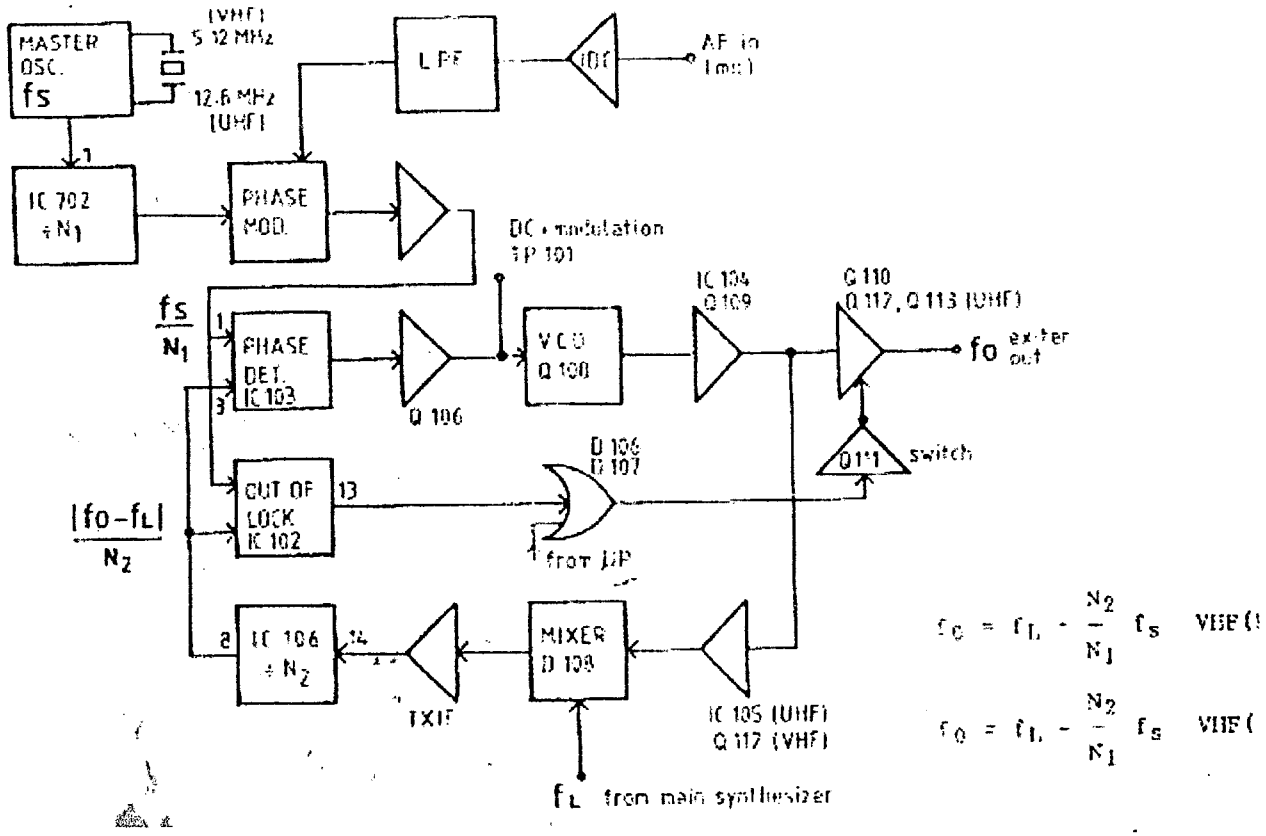
Fig. F-1 Blank EPROM Programming Schedule

Operation - The 17 bits are loaded into the PLL IC701, 7 bits to the "a " counter which controls the prescaler divider and 10 bits for the "n" counter. There are 2 PLL systems which are interconnected. A reference of 5.12Mhz is divided by 4 (or 8) for the Tx side and by 1024 for the "main" PLL. The Tx reference after division is 1.28 Mhz and applied to the phase detector (IC103) . The error signal holds the VCO (Q108) on frequency to produce Fo. This is amplified by the PA. The o/p is fed back to a mixer with the main PLL FI to produce a difference (+/-) of 20.48 Mhz. (Tx IF) This is divided by 16 (IC106) and fed back to the phase detector (1.28Mhz) and lock is found. The "main " PLL after the reference is divided by 1024 produces 5Khz reference to it's phase detector. The error from this holds a VCO (Q707/708) on frequency to produce FI for the other PLL via the mixer and for the Rx ccts. This FI is fed back through the prescaler (/63 or /64) , through the programable dividers and back to the phase detector to hold the frequency selected. The "a " counter on the count changes the pre-scaler divisor, the "n" counter being the "main" counter. See diag below



$$f_{out} = (a(M+1) + M(n-a)) f_{ref}$$

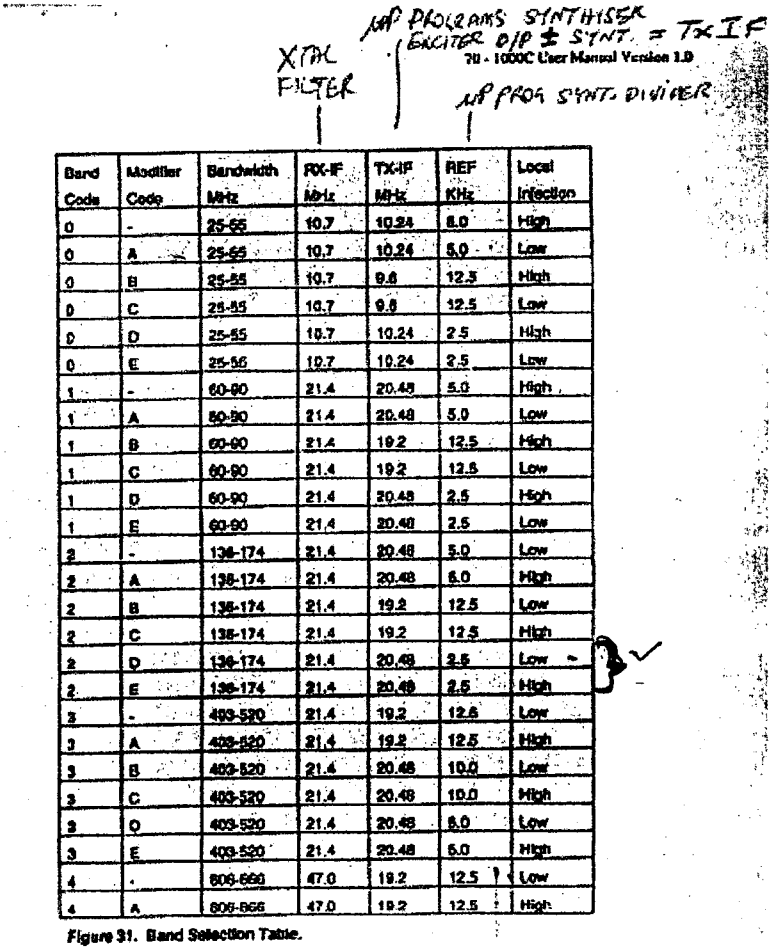
$(50 \times 63 \times (32+1)) + 32($



There are a number of programmers about for RT85's , The original AWA , an EAY-06EK ; there has been one somebody did in "Basic"and there is an " exicom MRP70", which I think is the best, (If you have the lastest version software) I don't recomend hand coding an entire eprom, like I did the first time, as you could be sitting at a calculator for hours, but if you need to change a channel or two it is fairly easy . Look at the data of one that is close (or several) , you will most probably see the second byte is the same and won't require changing , (and see note at bottom) The 3rd byte will need to be changed ; just work out the offset and add or subtract it off your "close" frequency . An example might be ; (radio has no modifiers - ie not narrow band etc.) 147.825 Mhz Rx, is 40 C5 85 and we want to go up 25Kc to 147.850 Mhz Rx , then add 5 (decimal) to the third byte and the data becomes 85 to 8A. Doing a bit check we find that the first byte is 40H. So the new frequency is 40,C5,8A . A bit check you say? , first byte will need to be an 00 or 40H . This can be worked out by writing out the 2nd and 3rd bytes in bit format and if it is even the number is 00H , if odd its 40H . (If the radio beeps at you , you got it wrong! try the otherway, or possibly the "data" is incorrect.) . The Tx is the same , going from 147.225 to 147.250 Mhz . 147.225 data is 00 C6 05, adding 5 to it gives C6 0A, checking the 1st byte we find it's still even so the new data is 00 C6 0A. The offset value will be may be different for other radios with different "modifiers" like narrow band , different reference freq, etc. By examining the frequencies and the data you should be able to work out whats happening.

Getting hold of a programmer makes life easy , the basic program is useful as it can give you a dump of the new data, even the software of the mrp70 is useful as it will give you that dump too, the hardware that comes with it makes it easy by not having to unsolder any eproms . (Incidently - if you want to put a socket on your daughter board, use a low profile machine socket and re-solder the "inline" connectors with a strip of veroboard under them to space them off the surface a bit.) The next drawing is a table from the MRP70 booklet, which I will include to show you some of what versions of "RT85" are about. (Quite apart from the RT85 A , B, C's which are still basically the same , but have

a different micro and eprom , there is as well the "midlands" which are a copy of the RT as well, and I have seen an "exicom" version as well . - it seems they were considered a pretty good radio by the number of copies about!)



Band Code	Modifier Code	Bandwidth MHz	RX-IF MHz	TX-IF MHz	REF KHz	Local Injection
0	-	25-55	10.7	10.24	5.0	High
0	A	25-55	10.7	10.24	5.0	Low
0	B	25-55	10.7	9.8	12.5	High
0	C	25-55	10.7	9.8	12.5	Low
0	D	25-55	10.7	10.24	2.5	High
0	E	25-56	10.7	10.24	2.5	Low
1	-	60-90	21.4	20.48	5.0	High
1	A	60-90	21.4	20.48	5.0	Low
1	B	60-90	21.4	19.2	12.5	High
1	C	60-90	21.4	19.2	12.5	Low
1	D	60-90	21.4	20.48	2.5	High
1	E	60-90	21.4	20.48	2.5	Low
2	-	136-174	21.4	20.48	5.0	Low
2	A	136-174	21.4	20.48	5.0	High
2	B	136-174	21.4	19.2	12.5	Low
2	C	136-174	21.4	19.2	12.5	High
2	D	136-174	21.4	20.48	2.5	Low
2	E	136-174	21.4	20.48	2.5	High
3	-	403-520	21.4	19.2	12.5	Low
3	A	403-520	21.4	19.2	12.5	High
3	B	403-520	21.4	20.48	10.0	Low
3	C	403-520	21.4	20.48	10.0	High
3	D	403-520	21.4	20.48	5.0	Low
3	E	403-520	21.4	20.48	5.0	High
4	-	806-866	47.0	19.2	12.5	Low
4	A	806-866	47.0	19.2	12.5	High

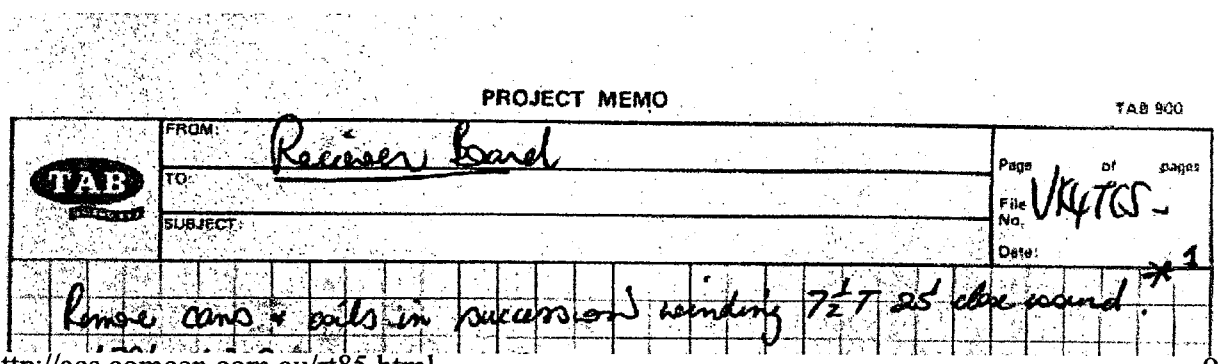
Figure 31. Band Selection Table.

The current settings for the Band is shown in the CHANNELS window of the 70 - 1000C software, as can be seen in Figure 29.

3.4.2 Modifier

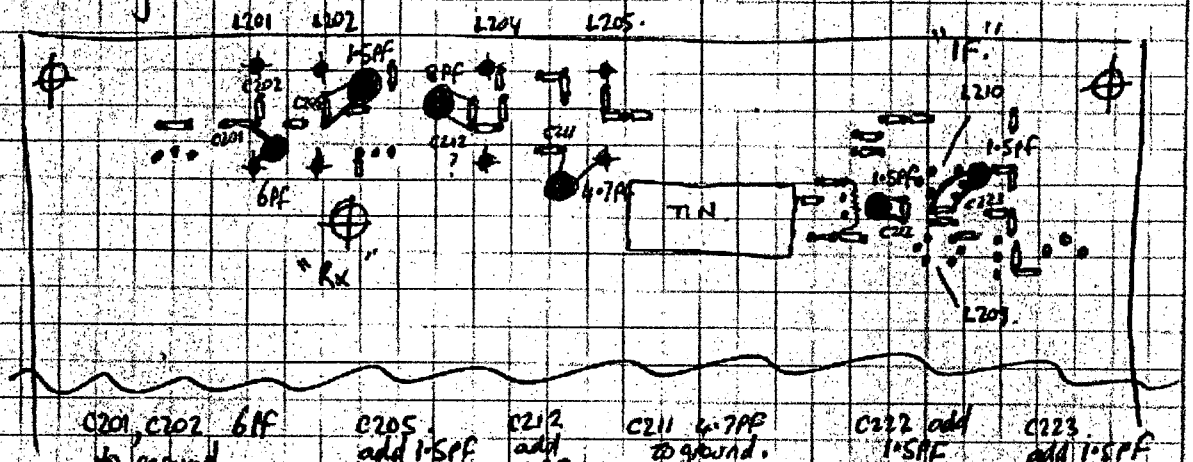
When selecting the Modifier option, the following screen is displayed.

I have also modified half a dozen low band (70-85Mhz) RT's for operation on 6 metres. I have had a complaint that one was deaf, and needs re-alligning , but the one I have in my shack seems to work fine, (I have another 2 spares and I haven't heard from the others..) I'll put the eprom data in the "Gershwin - ACS " directory as "6mRT85.dat" when I get about to tidying that up. It is 64 channels and basically covers everything in the 6M band for FM (which isn't much !). In the mean time here are the modifications to the RT85 to get you going on 6, with what I reckon are not too bad a radio (If anybody offered me a Tait 2020, I would stoop however !).



L201, L202, L204, L205.

Modify the back of board



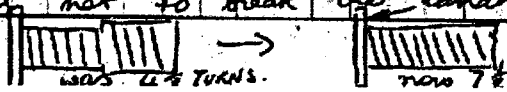
C201, C202 6PF to ground. C205 add 1·5PF. C212 add 8PF. C211 4·7PF to ground. C222 add 1·5PF. C223 add 1·5PF

* Mods to the IF C222, 223. are needed to tune L209 L210 sufficently to get the sensitivity up.

* With everything tuned up ·15μV can be expected, and ·2μV should be easy to get!

(2) * Hot glue windings onto formers works better than melting plastic to hold windings

(1) This is probably done, but with a new coil, but if you going "deep", * Coils are "moulded" so moulding needs to be cut away, as well file away "top" of former so it is now the same dia as the bottom, (be careful not to break the "landing", save some of the "cut away" as you may need it to "glue" things together. (2)



PROJECT MEMO

TAB 900

TAB

FROM: PA. Mods

TO:

SUBJECT: (should get easily 30w o/p.)

Page of pages

File No. VK4TCS

Date

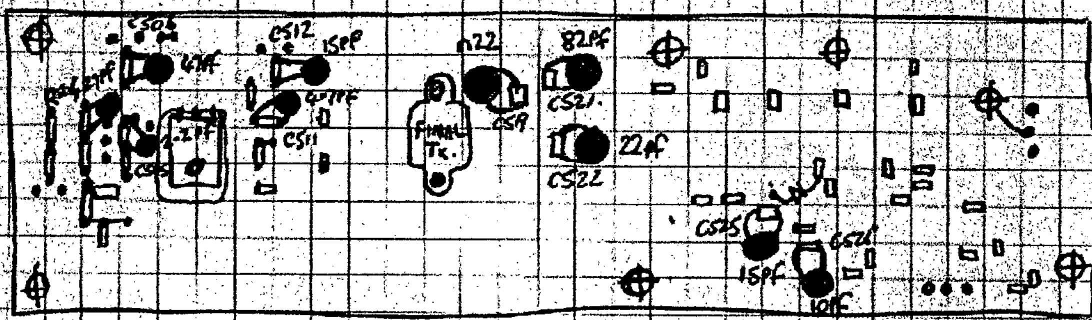
* Remove L501, L502, L503, L504, ~~L505~~, L506, L507, L515. (L516, 517, 518, 519. of your kwen!)

* Replace. L501. 2½T. 35¹ ·ome dia

L502 6½T 35¹ "

L503 5½T 35' "
L504 6½T 35' "
L506 3½T 35' "
L507 3½T 35' "
L515. 6½T 45' "
(L516, 517, 518, 519. 6½T 45'. same dia).

* Mod. back of board below as shown.



C506. +47PF.
C505 +2.2PF.
R504. +27PF.
C511 +4.7PF.
C512 +15PF.
C519. +n22.
C521. +82PF.
C522 +22
C525 +15PF.
C526 +10PF

Tuning: More work needs to be done with the Rx isolation (C526, L515, C523) as this is absorbing output power & should be ∞ at working frequencies. Even so expect about 45W. output, properly tuned up. Some playing may need to be done. (L501 may need a stretch) (try a 120pF instead of 82PF on C521.)

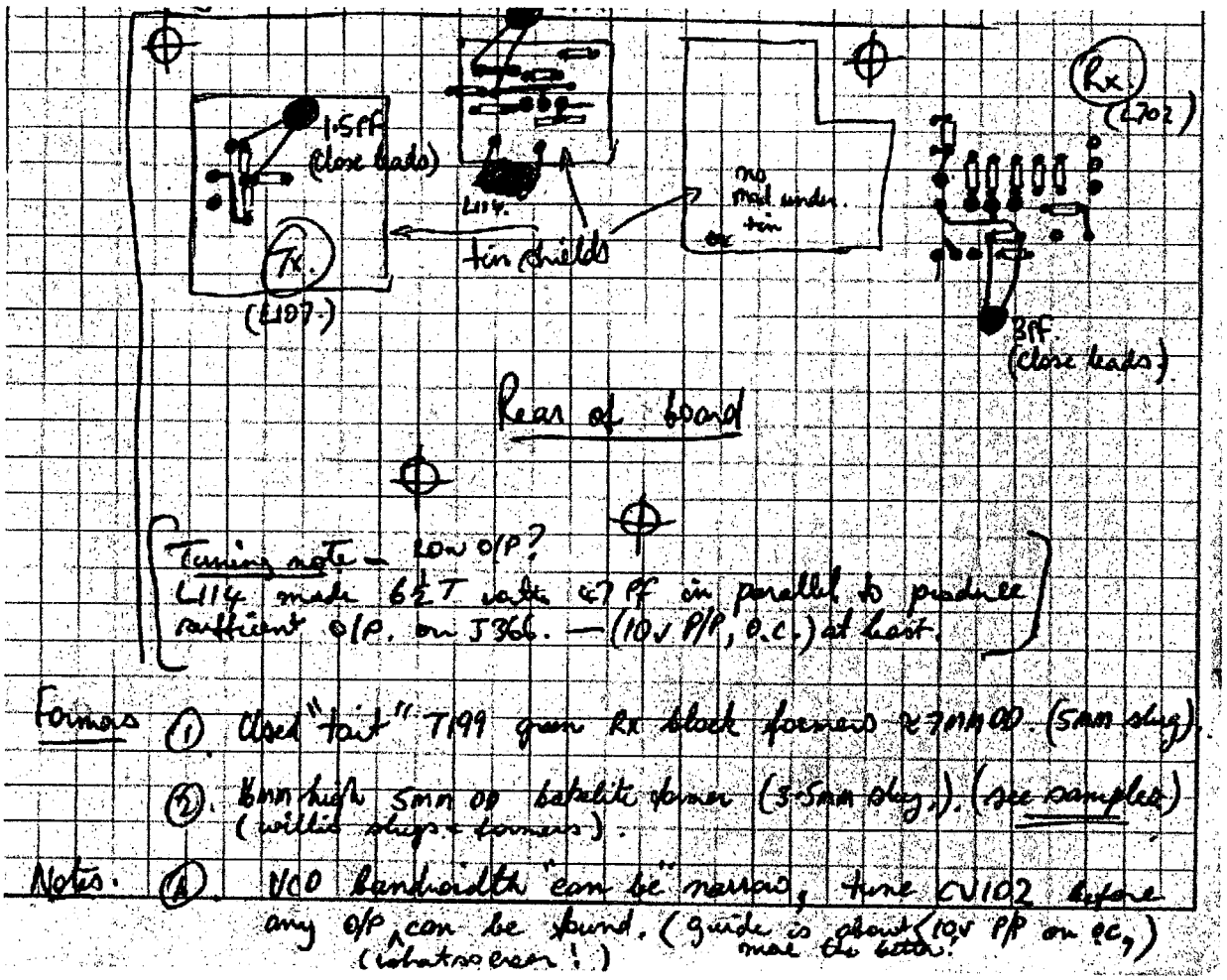
PROJECT MEMO

TAB 900

TAB	FROM: Synthesiser Board TO: SUBJECT:	Page of pages File No. VK4TCS. Date:

* Remove. L702 from Rx shielding box., (cut away silicon to make room for new formers)
L107 from Tx " "
* replace L702 with new green former ① and wind 5½T on, (35')
L107 with " bakelite " ① and wind 5½T. on. close wound (35')
(hot glue into place).

* replace L114 with 5½T (35' enam). (same dia).
* install new eprom data board and tune up as usual Ⓐ.
* modify back of board. 27PF.



Good luck Chris.

{ Note: - The programmed values correspond to a bit pattern that is applied to the counters. Some bit patterns are not valid which means that the second byte must be incremented and the third byte is reset to it's lowest valid bit pattern. It may be possible to get 2 valid solutions to a frequency. (Also the first byte maybe 01 or 41 combinations or others , depending on if the channel has tone or other options { Eg, the above example 147.225 Mhz , a 91.5Hz tone on Tx would be 42 C6 05)} Unfortunately I never was able to get any spec. sheets on the counters as they were priviledged information. If anybody has the specs , email it to me please and I will write the proceedure to program it , without any " maybes " . If you have a lot to do it is really best to get hold of some programmer software. }

<

Back to projects page!

Converting an AWA RT85 LOW BAND Transceive to 6 Metres

by Roger Baker VK3BKR and Mark Detering VK3TLW

Notes apply to the RT85. NOT the RT85A,B, or C

REPROGRAMMING THE EPROM

Either, we can programme your EPROM for you with OUR channels, or, you are on your own.

The RX VCO.

- Add 10p to C709. (6pf) ✓I used 22pf here.

TX VCO.

- Add 10p to C137 (9pf) ✓I used 22pf here temp remove/lift Tin cover

The EXCITER

- Remove original L114 and keep (for use in PA Board); replace with 7.5 turns 0.5mm wire (4.5T) — temp remove/lift tin cover to solder)

The RECEIVER

- Add 10p to C202(9pf) - - - I used 22pf here ✓
- Add 22p to C205.(9pf)
- Add 22p to C208. (47pf)
- Add 22p to C212. (10pf)
- Add 4p7 to C220. (5pf)

Also:- Added 1.5pf to C222(5pf)
Added 1.5pf to C223(5pf)

P.A. BOARD.

- Add 22p to C512. (was 3.5T) ✓ (4.5T)
- Remove original L501 and keep; replace with original L114 (fom the Exiter board) L501 → 4.5T
- Remove original L503 and keep; replace with original L501.(3.5T) L503 → 3.5T
- Remove original L507 and replace with original L503. L507 → 2.5T
- Remove original L513 and keep, replace with 2.5 turns 1.25mm wire. L513 → 2.5T
- Remove original L512 and replace with original L513. L512 → 1.5T

RX VCO

- The RX VCO will probably be out of lock when the radio is first powered up. The display will show "95" and the speaker will beep.
- Connect a multimeter to TP701 and adjust for approximately 4.7 volts. It should now be possible to change channels up and down.
- Set the radio to Channel 18 (53.975MHz highest Rx), and adjust L701 for 4.70 volts.
- Set the radio to channel 37 (52.500MHz lowest Rx) and check that the voltage is NOT less than 1.6 volts.

TX VCO

- Set the radio to channel 36 (53.975 MHz highest Tx) and connect a multimeter to TP101. Operate the PTT and adjust L107 for 4.70 volts.
- Set the radio to channel 37 (52.500 MHz lowest Tx) and operate the PTT and check that the voltage is NOT less than 1.6 volts

LO Injection

- Connect a multimeter to pin 4 on CM202 on the Receiver board. Adjust L209 and L210 for maximum indication on the meter (about 0.5 volts).

RX Tuning

- Using a suitable signal source, adjust the RX front end slugs for best bandpass

TX Tuning

- Connect multimeter to TP101 and adjust L107 for 3.5v on a centre channel
- Adjust CV102 for max RF output
- Set RV502 to fully clockwise position
- Adjust CV501, 502 AND 503 for Maximum Power output
- Re-adjust RV502 for approx 25W (or slightly less than whatever power is attained in the previous step as this enables your PA protection circuitry).
- Set Deviation at 4.5khz using RV501
- L101 and L102 may be adjusted slightly to give deviation symmetry

These mods should result in the receiver having a sensitivity of approx 0.25uV and a Tx power of at least 25Watts

Our Channels are

Ch	Rpt Rx	Ch	Rpt Rx
	53.550	19	52.550
2	53.575	20	52.575
3	53.600	21	52.600
4	53.625	22	52.625
5	53.650	23	52.650
6	53.675	24	52.675
7	53.700	25	52.700
8	53.725	26	52.725
9	53.750	27	52.750
10	53.775	28	52.775
11	53.800	29	52.800
12	53.825	30	52.825

Ch	Simplex	Ch	Simplex
37	52.500	55	53.400
38	52.525	56	53.425
39	53.000	57	53.450
40	53.025	58	53.475
41	53.050	59	53.500
42	53.075	60	53.525
43	53.100		
44	53.125		
45	53.150		
46	53.175		
47	53.200		
48	53.225		

12	53.825	30	52.825
13	53.850	31	52.850
14	53.875	32	52.875
15	53.900	33	52.900
16	53.925	34	52.925
17	53.950	35	52.950
18	53.975	36	52.975

49	53.250		
50	53.275		
51	53.300		
52	53.325		
53	53.350		
54	53.375		

Converting the Midland LMR70 or AWA RT85 to 53 MHz.

Introduction.

VK2EK's notes.

This report describes modifying a Midland LMR70-076B to 53 MHz amateur. The AWA RT85 low band is very similar to these transceivers, but is not the same. I have based the modifications presented here on Roger Baker and Mark Detering's report. I have assumed that anyone attempting these modifications has a copy of the circuits and is familiar with this type of equipment. I do not have a manual for the 70-076B, but the circuit of the RT85 is close enough for the purpose.

This is not a newby project. You should be competent at soldering, including surface mount components. You should also have access to a DVM, a frequency counter, an accurate power meter, a dummy load, and a weak signal source – not an off air signal. A power operated solder sucker (desoldering station) will make the work much easier and board damage less likely. An experienced RF person may be able to get away with less, but this depends on the persons skill.

Before commencing it is a good idea to check out the transceiver on its commercial frequency into a dummy load. Quite a few of the ex commercials I have run across come complete with faults, its nice to know that they are working before you commence !

Programming.

Programming the transceiver requires an eprom programmer. The eprom is soldered on to a small circuit board that plugs into the synthesizer board, originally a purpose built programmer was used, but these are a rare item today, if you have one, use it.

Desolder the 2716 eprom from the circuit board, be careful doing this as 2716's are getting hard to obtain ! I use a power desoldering tool to do this – it makes the job much less painful. Erase and reprogram the eprom with a suitable file such as XCT-53N.dat. For the RT85 use rt85-53N.dat. I use a home made eprom programmer that was sold as a kit through DSE, but anything suitable would do. A listing of the channel plan is in 6M-70-066.xls .

You can either resolder the eprom back onto the board or place a socket onto the board, the trick here is to find a really low profile socket, if you can find one. You can use a standard socket, but again it takes some fiddling. To use a standard socket, fit the socket to the board and then carefully desolder the two header connectors. Replace the header sockets but with a gap between the board and the socket, a piece of veroboard makes a suitable spacer. When the eprom board is fitted with an eprom and plugged into the synthesiser board it should "feel" like the connectors have mated correctly. If you are going to use the transceiver mobile I suggest that you place some packing material between the eprom board and radio outer cover to prevent the board working loose.

The Synthesizer Board.

RX (main) VCO, add 15pF to C709.

TX (offset) VCO, add 15pF to C137, located under VCO cover on the track side of the board. Some transceivers may require more.

RX buffer amp, add 5.6pF to primary of L709

TX buffer, remove L114 and keep for use on the PA board; replace with 7.5 turns of 0.5mm wire, same diameter former.

You should be able to apply power with the eprom board in, and the RX LO output and TX exciter output disconnected. Use the correct alignment tool – the ferrite slugs are easily broken. Connect a

frequency counter to the RX LO output J365 and a DVM to TP701. Carefully adjust L702, the the RX (main) VCO, so that the synthesizer locks. Set it such that the DVM reads about 4.5 V mid channel. The counter should now read the RX frequency plus 21.4 MHz.

Connect the counter to the TX exciter output J366 and the DVM to TP101. Key the transmitter and adjust L107, the TX (offset) VCO for lock and about 4.5 V mid channel. The counter should read the TX frequency.

The Receiver Board.

Front end.
Add 22pF to C202, C205, and C212.
Short C210.
Add 1.5pF to C203 and C211.
Add 8.2pF to C201, C206, and C213.

LO tuned buffer.
Add 5.6pF to C220 and C223.

Receiver tune up is straight forward. Monitor CM202 pin 4 with a DVM and peak L209 and L210 on a mid frequency channel. A typical reading is 0.4 V. A common problem with these transceivers is lack of LO injection if they are not modified and tuned correctly.

On a mid frequency channel (53.250) feed a signal in from a signal generator. Monitor CM202 pin 3 with a DVM and peak L201 to L205 for maximum while remaining in the linear range. An alternative method is to use a Sinad meter or tune for maximum quieting. When correctly aligned the sensitivity is typically 0.35uV for 12db sinad over the range 52.5 to 54 MHz.

The PA Board.

Remove L501 and keep; replace with original L114 from the synthesizer board.
Remove L503 and keep; replace with original L501.
Remove L507; replace with original L503.
Remove L513 and keep; replace with 2.5 turns 1.25mm wire, same diameter former.
Remove original L512; replace with original L513.

Remove L515, L516, L517, L518 and L519; replace with 6.5 turns 0.63mm wire, same diameter former. Since these coils will not be reused, use sidecuters to cut them in half and then remove the pieces by heating the joint from the underside and carefully removing the part coil from the top.

Add 33pF to CV501 and CV502 on the underside of the board.
Add 100pF between B and E of Q502 on the component side of the board as per the photo.
Add 1000pF between B and E of Q503 on the component side of the board as per the photo.
Add 1.5pF to the RF sensor circuit (C554) on the underside of the board as per the photo. On the RT85 this capacitor is already fitted.

Adding the capacitors B-E on the driver and PA transistor is required to stabilize the amplifier. It is necessary to replace the coils in the LPF to get the second harmonic output of the transmitter down to an acceptable level.

Having made the modifications, reassemble the PA and apply power. Terminate the output in a good dummy load with a power meter – **not an antenna !** Set RV502 fully clockwise for maximum power out. Key the transmitter and adjust for maximum power starting from the output end and working back towards the synthesizer. Don't forget CV102 on the synthesizer board. After modification and

tuning it is normally possible to get 50W out of the transmitter with no sign of instability, do not run it at this power for long – there is not enough heatsink on the PA. When you have maximum power out adjust RV502 for no more than 30 Watts out.