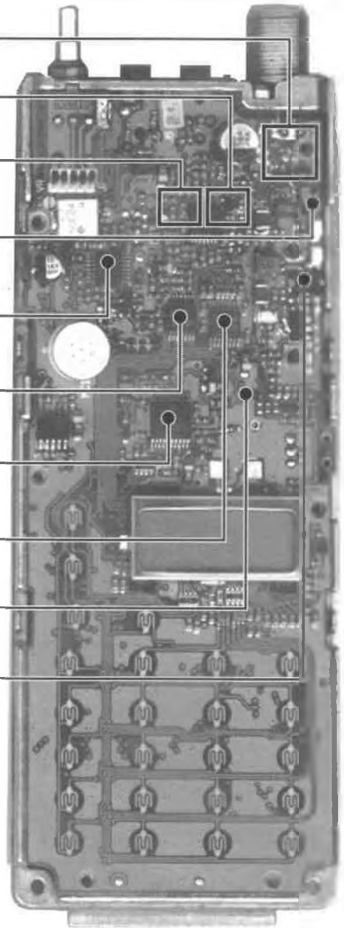
				IC-F3, IC-F3S	IC-F4, IC-F4S
GENERAL	Frequency coverage			136.000–150.000 MHz (L-band) 146.000–174.000 MHz (H-band)	400.000–430.000 MHz (L-band) 440.000–470.000 MHz (H-band)
	Mode			16K0F3E (W-type), 14K0F3E (M-type; IC-F3/S only), 8K50F3E (N-type)	
	Number of channels			32 (16 channels × 2 banks: 2-BANK version), 16 (16 channel version)	
	Power supply requirement			9.6 V DC (negative ground: supplied battery pack)	
	Current drain	Tx	at high	1.3 A	1.4 A
			at low	0.6 A	0.7 A
		Rx	rated audio	250 mA	250 mA
			stand-by	60 mA typ.	60mA typ.
	Frequency stability			±0.0005 % (EIA), ±2,000 Hz (ETS/CEPT; W, M-types), ±1,500 Hz (ETS/CEPT, N-types)	
	Usable temperature range			+22˚F to +140˚F (EIA) –25˚C to +55˚C (ETS/CEPT, N-types)	+22˚F to +140˚F (EIA) –20˚C to +55˚C (ETS/CEPT)
	Dimensions (proj. not incl.)			57 (W) × 140 (H) × 37 (D) mm ; 2 ¼ (W) × 5 ½ (H) × 1 15/32 (D) in	
	Weight (with BP-196)			390 g ; 13.8 oz	
TRANSMITTER	Output power			High 5 W Low 1 W	High 4 W Low 1 W
	Modulation system			Variable reactance frequency modulation	
	Max. frequency deviation			±5.0 kHz (W-type), ±4.0 kHz (M-type), ±2.5 kHz (N-type)	
	Spurious emissions			70 dB typ. (EIA) 0.25 µW (ETS/CEPT)	
	Adjacent channel power			70 dB (W-type, M-type) 60 dB (N-type)	
	Transmitter audio distortion Hum and noise			Less than 5 % at 1 kHz, 60 % deviation	
	EXT MIC. connector			3-conductor 2.5 (d) mm (1/10") / 2 kΩ	
RECEIVER	Receive system			Double-conversion superheterodyne system	
	Intermediate frequencies			1st 31.050 MHz 2nd 450 kHz	1st 46.350 MHz 2nd 450 kHz
	Sensitivity (typical)			0.25 µV for 12 dB SINAD 0.63 µV (emf) for 20 dB SINAD	0.3 µV for 12 dB SINAD 0.79 µV (emf) for 20 dB SINAD
	Squelch sensitivity (at threshold; typical))			0.25 µV	0.3 µV
	Adjacent channel selectivity			70 dB (W-type) 60 dB (N-type)	
	Spurious response rejection ratio			70 dB	
	Intermodulation rejection ratio			65 dB	
	Audio output power (at 9.6 V DC)			500 mW (typ) at 10 % distortion with an 8 Ω load	
	EXT SP connector			3-conductor 3.5 (d) mm (1/8") / 8 Ω	

Measurements made in accordance with EIA/TIA-152-C, 204D, 603 or ETS-300-086 or CEPT T/R 24.

All stated specifications are subject to change without notice or obligation.

TOP VIEW

BOTTOM VIEW



Low-pass filter circuit

APC control circuit

Microphone amplifier circuit

Antenna switching circuit (D1: MA77)

FM IF IC (IC2: TA31136FN)

Mute switch (IC4: BU4066BCFV)

PLL IC (IC1: μPD3140GS)

Expander IC (IC10: M62354GP)

T/R switching circuit (D3: MA77)

Power amplifier (Q1: 2SK2595)

Current detector circuit

RF amplifier (Q12: 3SK239)

T/R switching circuit (D4: MA77)

1st mixer circuit (Q13: 3SK166-2)

Crystal filter (FI1)

PLL reference oscillator (X1: CR-575, 15.3 MHz)

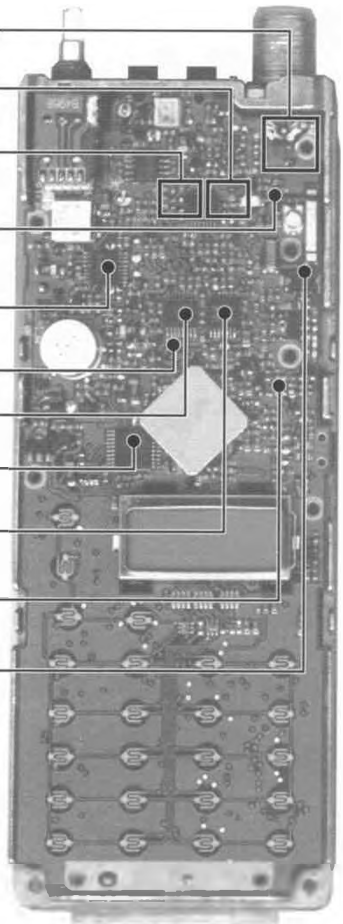
VCO circuit

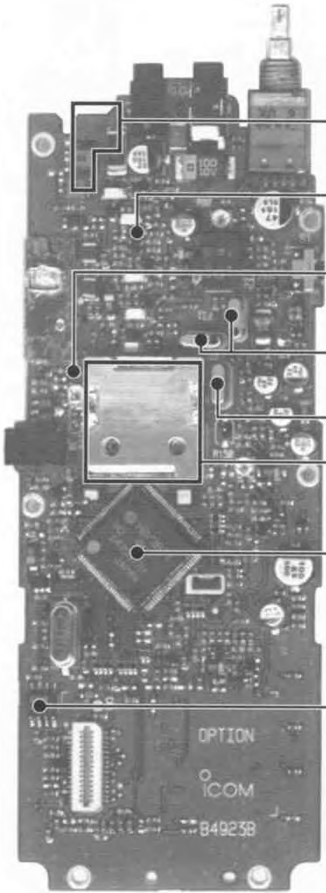
CPU (IC8)

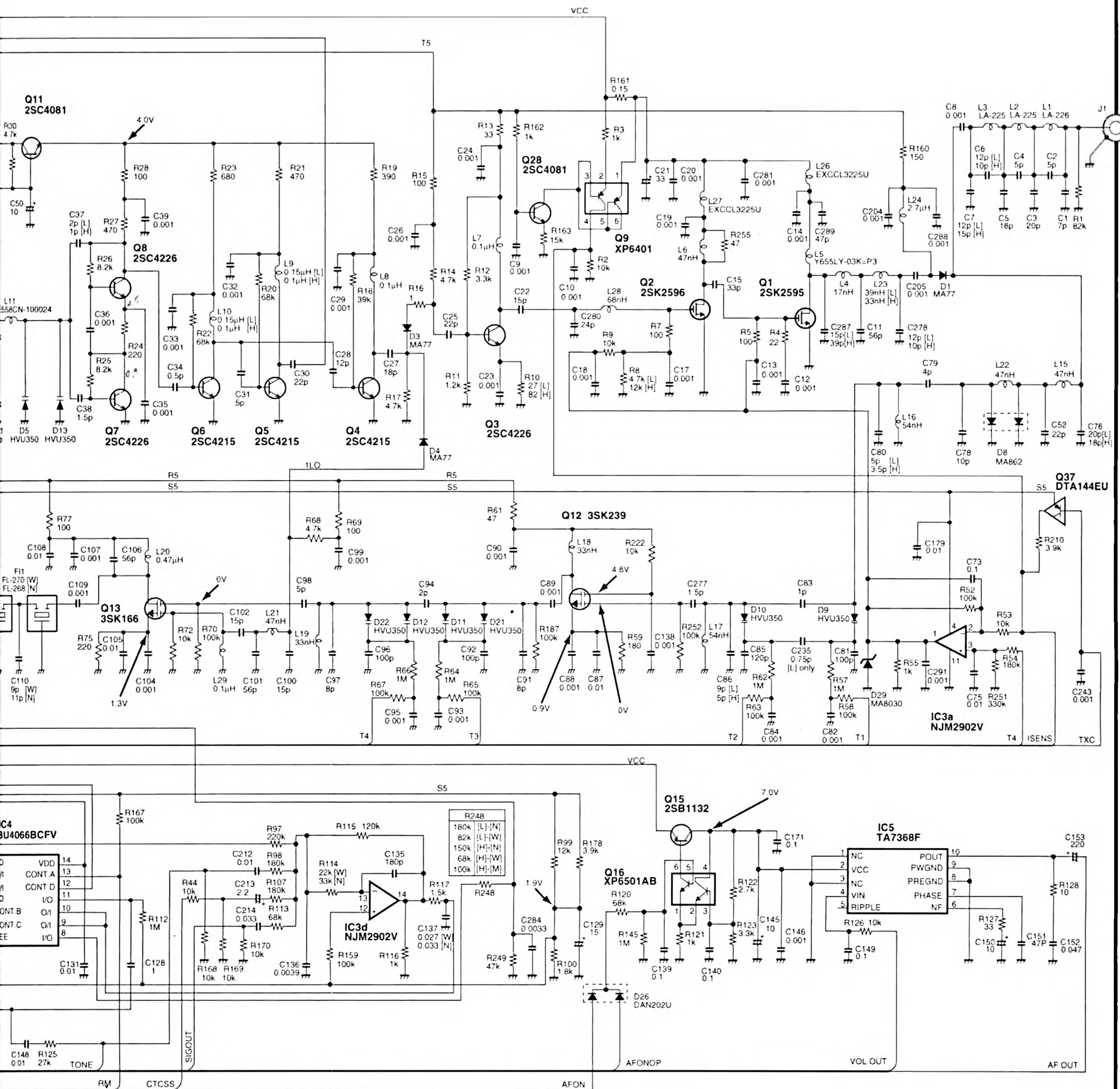
EEPROM (IC7)

TOP VIEW

BOTTOM VIEW






VCC
T5
Q11
2SC4081
4.0V
R30
4.7k
C50
10
R28
100
R27
470
C37
2p [L]
1p [H]
C39
0.001
Q8
2SC4226
R26
8.2k
C36
0.001
R24
220
R25
8.2k
C38
1.5p
C35
0.001
L11
6558CN-100024
D5
HVU350
D13
HVU350
Q7
2SC4226
R23
680
C32
0.001
R20
68k
L9
0.15μH [L]
0.1μH [H]
L10
0.15μH [L]
0.1μH [H]
R22
68k
C33
0.001
C34
0.5p
C31
5p
C30
22p
Q6
2SC4215
Q5
2SC4215
R21
470
R19
390
C28
12p
L8
0.1μH
C29
0.001
R18
39k
C27
18p
R17
4.7k
Q4
2SC4215
D4
MA77
R15
100
R16
1
D3
MA77
C26
0.001
R14
4.7k
C25
22p
R13
33
C24
0.001
L7
0.1μH
R12
3.3k
R11
1.2k
C23
0.001
R10
27 [L]
82 [H]
Q3
2SC4226
R161
0.15
R162
1k
R3
1k
Q28
2SC4081
R163
15k
C9
0.001
R2
10k
Q9
XP6401
C10
0.001
C22
15p
L28
68nH
C280
24p
R9
10k
R8
4.7k [L]
12k [H]
C18
0.001
C17
0.001
R7
100
Q2
2SK2596
C21
33
C20
0.001
C281
0.001
L26
EXCCL3225U
L27
EXCCL3225U
C19
0.001
R255
47
L6
47nH
C15
33p
R5
100
R4
22
C13
0.001
C12
0.001
Q1
2SK2595
R160
150
C204
0.001
L24
2.7μH
C288
0.001
C14
0.001
C289
47p
L5
Y655LY-03K=P3
C205
0.001
D1
MA77
L4
17nH
L23
39nH [L]
33nH [H]
C287
15p [L]
39p [H]
C11
56p
C278
12p [L]
10p [H]
C8
0.001
L3
LA-225
L2
LA-225
L1
LA-226
J1
ANT
C6
12p [L]
10p [H]
C4
5p
C2
5p
C7
12p [L]
15p [H]
C5
18p
C3
20p
C1
7p
R1
82k
C79
4p
L22
47nH
L15
47nH
L16
54nH
C80
5p [L]
3.5p [H]
C78
10p
D8
MA862
C52
22p
C76
20p [L]
18p [H]
1LO
R5
S5
R77
100
C108
0.01
C107
0.001
C106
56p
L20
0.47μH
FI1
FL-270 [W]
FL-268 [N]
C109
0.001
C110
9p [W]
11p [N]
Q13
3SK166
0V
1.3V
R75
220
C105
0.01
C104
0.001
R72
10k
R70
100k
L29
0.1μH
C102
15p
L21
47nH
C101
56p
C100
15p
L19
33nH
C97
8p
C98
5p
R68
4.7k
R69
100
C99
0.001
C94
2p
D22
HVU350
D12
HVU350
D11
HVU350
D21
HVU350
C96
100p
R66
1M
R67
100k
C95
0.001
C92
100p
R64
1M
R65
100k
C93
0.001
T4
T3
R61
47
C90
0.001
Q12 3SK239
L18
33nH
R222
10k
4.8V
C89
0.001
R187
100k
C91
8p
0.9V
C88
0.001
C87
0.01
0V
R59
180
C277
1.5p
C138
0.001
R252
100k
L17
54nH
C86
9p [L]
5p [H]
D10
HVU350
D9
HVU350
C83
1p
C85
120p
R62
1M
R63
100k
C84
0.001
C235
0.75p
[L] only
C81
100p
R57
1M
R58
100k
C82
0.001
T2
T1
C179
0.01
C73
0.1
R52
100k
R53
10k
R55
1k
C291
0.001
R54
180k
C75
0.01
R251
330k
D29
MA8030
IC3a
NJM2902V
R210
3.9k
Q37
DTA144EU
C243
0.001
T4
ISENS
TXC
VCC
S5
R167
100k
IC4
BU4066BCFV
VDD
CONT.A
CONT.D
I/O
CONT.B
O/I
CONT.C
O/I
EE
I/O
R112
1M
C131
0.01
C128
1
R44
10k
R168
10k
R169
10k
R170
10k
C212
0.01
R97
220k
R98
180k
C213
2.2
R107
180k
C214
0.033
R113
68k
C136
0.0039
R114
22k [W]
33k [N]
R115
120k
C135
180p
IC3d
NJM2902V
R159
100k
R116
1k
R117
1.5k
C137
0.027 [W]
0.033 [N]
R248
180k [L]-[N]
82k [L]-[W]
150k [H]-[N]
68k [H]-[W]
100k [H]-[M]
R99
12k
R178
3.9k
1.9V
C284
0.0033
R249
47k
R100
1.8k
C129
15
D26
DAN202U
Q15
2SB1132
7.0V
Q16
XP6501AB
R120
68k
R145
1M
C139
0.1
R121
1k
C140
0.1
R122
2.7k
R123
3.3k
C145
10
C146
0.001
C171
0.1
IC5
TA7368F
NC
VCC
NC
VIN
RIPPLE
POUT
PWGND
PREGND
PHASE
NF
R126
10k
C149
0.1
R127
33
C150
10
C151
47P
C152
0.047
C153
220
R128
10
C148
0.01
R125
27k
TONE
SIGOUT
CTCSS
RM
AFON
AFONOP
VOL OUT
AF OUT

5V
VCC
T5
R5
S5
FROQCON
CTCSS
LVIN
SCK
PLST
SO
UNLK
MODCON
DISCIN
AFOUT
PTTOUT
MIC
PTTIN
MICIN
MICOUT
VOL IN
BEEPOUT
NOIS
SD
DET
MM
RSC
RM
SIGOUT
TONE
TLO

R183 560
DS4 LNJ502R8ERA
R155 100
DS1 LM-14628
COM1
COM2
COM3
COM4
SEG1
SEG2
SEG3
SEG4
SEG5
SEG6
SEG7
SEG8
SEG9
SEG10
SEG11
SEG12
SEG13
SEG14
SEG15
SEG16
SEG17
SEG18
SEG19
SEG20
SEG21
SEG22
SEG23
SEG24
SEG25
SEG26
SEG27
SEG28
SEG29
SEG30
SEG31
SEG32
COM4
COM3
COM2
COM1

R51 470k
R50 100k
C71 0.1
R49 47k
C69 33p
R48 10k
C72 1
R150 50k
C70 0.01
D7 HVU17
X1 CR-575 CR-576 15.3 MHz
R45 100
C64 12p
C63 56p

R185 1k
TX 174 MHz 4.3V
RX 174 MHz 3.6V
Q34 2SK880
CP1
C234 0.001
R184 10k
R186 47k
C233 0.001
R175 1k
C211 0.001

R31 1k
C46 0.001
R151 47k
L11 MC152-E558CN-100024
C45 330p [L] 100p [H]
R29 1k
D6 MA77
C42 0.001
C44 0.001
C41 39p
D5 HVU350
D13 HVU350

Q11 2SC4081
4.0V
R30 4.7k
D19 MA111
C50 10
R28 100
R23 680
R21 470
C37 2p [L] 1p [H]
R27 470
C39 0.001
Q8 2SC4226
R26 8.2k
C36 0.001
R24 220
R25 8.2k
C38 1.5p
C35 0.001
C33 0.001
R22 68k
C34 0.5p
L10 0.15μH [L] 0.1μH [H]
C32 0.001
R20 68k
L9 0.15μH [L] 0.1μH [H]
C31 5p
C30 22p
Q7 2SC4226
Q6 2SC4215
Q5 2SC4215

R42 1k×4
C55 0.01
C59 47p
C58 47p
L14 47nH [L] 82nH [H]
R41 47 [L] 100 [H]
C60 0.001
C62 18p [L] 9p [H]
C61 18p [L] 9p [H]
C57 47p
C56 0.001
C54 0.001
IC1 μPD3140GS
VCC1 GND1 IN1 IN2 ENB VCC2 CLK XB DATA XI T1 XO LOK GND2 CP1 CP2 FI1 FI2 FO1 FO2

R35 2.2k
R34 10
R32 560
L12 2.7μH
R33 2.2k
C49 0.68
C48 2.2
C47 0.1
C218 0.001
D28 MA77
Q32 DTC144EU

R208 10k
C229 0.001
R209 10k

C51 15p
C65 4p
C67 10p
R84 390
3.6V
R85 1.5k
IC2 TA31136FN(D)
OSCIN OSCOUT MIXOUT VCC IFIN DEC FILOUT FILIN MIXIN GND N-REC N-DET RSSI IFOUT QUAD AFOUT
C117 0.001
R244 100k
X3 CDBCA450CX24
R82 1.2k [W] 2.7k [N]
2.3V
R61 1.5k
C290 15p
L13 1μH
C53 12p
C66 18p
L25 1μH
FI2 CFWM450E [W] CFWM450G [N]
C123 0.001
R88 120k
R91 390k [W] 100k [N]
R92 50k
R87 3.3k
C121 220p
R86 100k
C122 220p
C120 0.1
C119 1
C118 0.01
C116 82p [W] 100p [N]
R253 470
C115 0.01
C111 0.01
R80 100k
R79 560
C114 0.033
R83 470
C113 0.001
C112 0.001
Q14 2SC2714

R77 100
C108 0.01
C107 0.001
C106 56p
L20 0.47μH
FI1 FL-270 [W] FL-268 [N]
C109 0.001
0V
Q13 3SK166
C110 9p [W] 11p [N]
C104 0.001
1.3V
R75 220
C105 0.01
R72 10k
R70 100k
C102 15p
L21 47nH
L19 33nH
C98 5p
L29 0.1μH
C101 56p
C100 15p
R68 4.7k

R131 470
C154 10
W1
D
C147 0.1
R130 100k
W2
C
C209 0.1
C210 0.1
C132 0.01
IC3c NJM2902V
R177 1k
C125 0.0022
C124 0.01
C217 0.1
C126 0.0022
R95 1M
R96 47k
IC3b NJM2902V
R104 100k
R105 150
C133 0.1
C134 220p
R108 150k
R109 10k
R176 3.9k
R93 27k
R94 1M
C286 0.0022
R257 1M
R171 47k
C215 0.1
C148 0.01
R125 27k

R166 100k
R167 100k
IC4 BU4066BCFV
I/O O/I CONT B CONT C VEE VDD CONT A CONT D
R112 1M
C131 0.01
C128 1
R97 220k
C212 0.01
R98 180k
R44 10k
C213 2.2
R107 180k
C214 0.033
R113 68k
R170 10k
R168 10k
R169 10k
C136 0.0039

IC8
HD6433875A40H [16 ch.]
HD6433875A56H [2-BANK]

DS1
LM-1462B

Q25
2SC2712

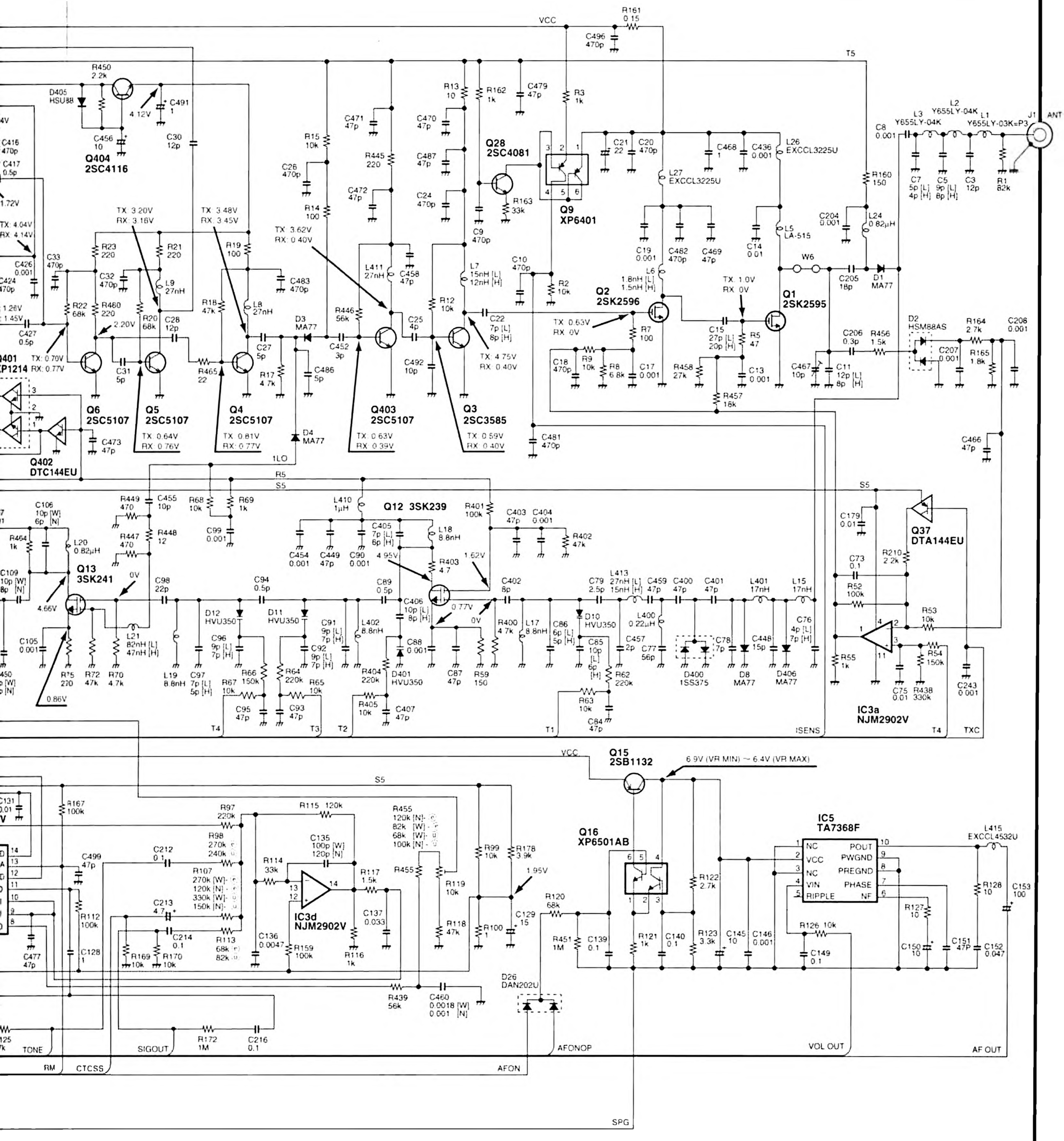
Q11
2SC4081

Q17
UN911H

IC1
µPD

5V
VCC
T5
R5
S5
FRQCON
CTCSS
LVIN
5V
PLST
SO
UNLK
MODCON
R5
S5
VCC
R5
S5
5V
TOUT
TOUT
PTTIN
MICIN
MICOUT
VOL IN
BEEPOUT
TONE
SIGOUT
MM
RM
CTCSS
R5C
AF
NOIS
SD
DET
1LO
T4
T3
T2

R51 470k
R50 100k
R49 47k
C69 33p
C71 0.001
C70 0.01
D7 HVU17
R150 50k
C72 4.7
R48 100k
C444 0.001
R440 120k
X1 CR-576
15.3 MHz
R45 100
C64 12p
C63 56p
C234 0.001
R185 1k
R184 10k
R186 47k
C233 0.001
C432 0.001
LV
Q34 2SK880
C410 11p [L] 7p [H]
C411 1.5p[L] 0.3p[H]
L11 MC152-E558ANA-100051=P3
D5 HVU350
L12 4.7µH
R409 10
R415 10
L407 4.7µH
C418 12p [L] 9p [H]
C419 1p [L] 0.75p [H]
C475 9.5p [L] 1.5p [H]
L405 MC152-E558ANA-100050
D403 HVU350
D404 1T365
R422 220k
C42 470p
R410 3.3k
R411 2.7k
R412 1
R413 4.7
C412 5p
C413 7p
C414 8p
C415 0.01
C416 470p
C417 0.5p
4.14V
2.26V
1.72V
L404 1.5µH
Q8 2SC4226
Q7 2SC4226
R416 3.3k
R417 3.3k
R419 4.7
C421 4p[L] 6p[H]
C422 7p
C423 6p
C424 470p
C426 0.001
C427 0.5p
R414 470
TX 4.04V
RX 4.14V
TX 1.26V
RX 1.45V
TX 1.82V
RX 1.92V
R42 1k x 4
C55 0.01
C59 100p
C58 100p
L14 15nH
R41 56
C60 0.001
C62 6p
C61 6p
C57 22p
C56 0.1
R46 1
C54 0.001
R34 1k
R32 6.8k
R33 4.7k
C443 0.047
C48 1
C47 0.1
C218 0.001
IC1 µPD3140GS
VCC1 GND1 IN1 IN2 ENB VCC2 CLK XB DATA XI T1 XO LOK GND2 CP1 CP2 FI1 FI2 FO1 FO2
R450 2.2k
D405 HSU88
4.12V
C491 1
C456 10
C30 12p
Q404 2SC4116
C33 470p
C32 470p
L9 27nH
R23 220
R21 220
R22 68k
R460 220
R20 68k
C28 12p
2.20V
TX 0.70V
RX 0.77V
Q401 XP1214
C31 5p
R465 22
R18 47k
L8 27nH
R19 100
C27 5p
R17 4.7k
D3 MA77
C483 470p
C486 5p
C452 3p
R446 56k
R15 10k
C26 470p
R14 100
C47 47p
TX 3.20V
RX 3.18V
TX 3.48V
RX 3.45V
TX 3.62V
RX 0.40V
Q6 2SC5107
Q5 2SC5107
TX 0.64V
RX 0.76V
Q4 2SC5107
TX 0.81V
RX 0.77V
D4 MA77
C473 47p
R420 270
R421 10k
L405 1.5µH
Q402 DTC144EU
C476 47p
R208 100k
C229 0.1
R209 100k
C211 4.7
C52 0.01
R44 1.2k
C65 4p
L403 1.5µH
C67 3p
R84 47
R85 1.5k
4.8V
IC2 TA31136FN(D)
OSCIN MIXIN OSCOUT GND MIXOUT N-REC VCC N-DET IFIN RSSI DEC IFOUT FILOUT QUAD FILIN AFOUT
C117 4.7
R424 100k
R82 1.2k [W] 2.2k [N]
X3 CDBCA450CX24
C115 100p
C116 56p [W] 100p [N]
R40 680k
L13 1µH
C53 5p
C66 4p
L25 0.82µH
FI2 CFWM450E [W] CFWM450G [N]
C51 10p
Q11 2SC4081
C121 220p
R88 120k
R86 120k [W] 100k [N]
C122 220p
C120 0.1
C118 0.001
C123 0.001
R92 50k
R90 33k [W] 10k [N]
R441 NTCCF20123NH
C490 220p
R89 10k
R87 1.8k [W] 3.3k [N]
C114 0.001
R83 330
C113 0.001
C112 0.001
D402 1SS375
L22 1.8µH
C408 470p
R408 1k
2.9V
R407 120k
R406 390 [W] 120 [N]
Q400 2SC4215
R77 100
C107 0.001
C108 0.01
C106 10p [W] 6p [N]
R464 1k
L20 0.82µH
Q13 3SK241
4.66V
0V
C98 22p
C94 0.5p
FI1 FL-271 [W] FL-267 [N]
C109 10p [W] 6p [N]
R469 2.7k
C451 8p [W] 20p [N]
C450 1p [W] 2p [N]
C105 0.001
R75 270
R72 47k
R70 4.7k
0.86V
L21 82nH [L] 47nH [H]
L19 8.8nH
C97 7p [L] 5p [H]
D12 HVU350
D11 HVU350
C96 9p [L] 7p [H]
C92 9p [L] 7p [H]
C91 9p [L] 7p [H]
R66 150k
R67 10k
R64 220k
R65 10k
C95 47p
C93 47p
R449 470
C455 10p
R447 470
R448 12
R68 10k
R69 1k
C99 0.001
L410 1µH
C454 0.001
C449 47p
C90 0.00
R449 470
C455 10p
R447 470
R448 12
C454 0.001
C449 47p
C90 0.00
R468 6.9k 12k
C493 0.047
R104 100k
C132 0.0047
C133 0.1
R105 270 [W] 470 [N]
R108 150k [W] 180k [N]
R109 10k
C134 150p [W] 220p [N]
IC3c NJM2902V
R452 1k
C125 0.0015
C124 0.01
C126 0.0039
C217 0.1
R95 1M
IC3b
R96 47k
R459 10k
R176 3.9k
R93 27k
R94 1M
R453 47k [W] 56k [N]
R454 1M 1
C465 0.0022
C464 0.001
C474 0.01
R166 100k
C131 0.01
IC4 BU4066BCFV
I/O VDD O/I CONT A O/I CONT D I/O I/O CONT B O/I CONT C O/I VEE I/O
C477 47p
R167 100k
C499 47p
R112 100k
C128 1
R97 220k
R98 270k 240k
R107 270k [W] 120k [N] 330k [W] 150k [N]
C212 0.1
C213 4.7
C214 0.1
R113 68k 62k
R169 10k
R170 10k
C136 0.0047
R159 100k
R116 1k
R115 120k
C135 100p [W] 120p [N]
R114 33k
IC3d NJM2902V
C131 0.01
C147 0.1
R130 100k
C154 10
Q17 UN911H
W1
W2
C209 0.1
C210 0.1
C497 47p
R171 47k
C215 0.1
C148 0.1
R125 27k
R172 1M
C216 0.1


VCC
R161 0.15
C496 470p
T5
R450 2.2k
D405 HSU88
C491 1
4.12V
C456 10
C30 12p
Q404 2SC4116
R13 10
R162 1k
C479 47p
R3 1k
C471 47p
C470 47p
R15 10k
R445 220
C487 47p
Q28 2SC4081
C26 470p
C472 47p
C24 470p
R14 100
R163 33k
Q9 XP6401
C9 470p
C21 22
C20 470p
C468 1
C436 0.001
L26 EXCCL3225U
L27 EXCCL3225U
L2 Y655LY-04K
L3 Y655LY-04K
L1 Y655LY-03K=P3
J1 ANT
C8 0.001
C7 5p [L] 4p [H]
C5 9p [L] 8p [H]
C3 12p
R1 82k
R160 150
C204 0.001
L24 0.82µH
L5 LA-515
W6
C205 18p
D1 MA77
C19 0.001
C482 470p
C469 47p
C14 0.01
L6 1.8nH [L] 1.5nH [H]
C10 470p
R2 10k
L7 15nH [L] 12nH [H]
TX: 3.62V RX: 0.40V
TX: 3.20V RX: 3.16V
TX: 3.48V RX: 3.45V
C33 470p
R23 220
R21 220
C32 470p
L9 27nH
C426 0.001
C424 470p
R22 68k
R460 220
R20 68k
C28 12p
R18 47k
L8 27nH
R19 100
C483 470p
C458 47p
L411 27nH
R446 56k
C25 4p
R12 10k
C22 7p [L] 8p [H]
D3 MA77
C452 3p
C492 10p
C427 0.5p
TX: 0.70V RX: 0.77V
2.20V
C31 5p
R465 22
C27 5p
R17 4.7k
C486 5p
TX: 4.75V RX: 0.40V
Q2 2SK2596
TX: 0.63V RX: 0V
R7 100
C18 470p
R9 10k
R8 6.8k
C17 0.001
TX: 1.0V RX: 0V
Q1 2SK2595
C15 27p [L] 20p [H]
R5 47
R458 27k
C13 0.001
R457 16k
C481 470p
C466 47p
D2 HSM88AS
R164 2.7k
C206 0.3p
R456 1.5k
C206 0.001
C207 0.001
R165 1.8k
C467 10p
C11 12p [L] 8p [H]
Q6 2SC5107
Q5 2SC5107
TX: 0.64V RX: 0.76V
Q4 2SC5107
TX: 0.81V RX: 0.77V
Q403 2SC5107
TX: 0.63V RX: 0.39V
Q3 2SC3585
TX: 0.59V RX: 0.40V
D4 MA77
1LO
Q402 DTC144EU
C473 47p
R5
S5
C106 10p [W] 6p [N]
R449 470
C455 10p
R68 10k
R69 1k
L410 1µH
Q12 3SK239
R401 100k
C403 47p
C404 0.001
R402 47k
R454 1k
L20 0.82µH
R447 470
R448 12
C99 0.001
C454 0.001
C449 47p
C90 0.001
C405 7p [L] 6p [H]
L18 8.8nH
4.95V
R403 4.7
1.62V
C109 10p [W] 8p [N]
Q13 3SK241
0V
C98 22p
C94 0.5p
C89 0.5p
C406 10p [L] 8p [H]
C402 8p
C79 2.5p
L413 27nH [L] 15nH [H]
C459 47p
C400 47p
C401 47p
L401 17nH
L15 17nH
4.66V
0.77V
0V
D12 HVU350
D11 HVU350
C91 9p [L] 7p [H]
L402 8.8nH
C96 9p [L] 7p [H]
C92 9p [L] 7p [H]
C88 0.001
R400 4.7k
L17 8.8nH
C86 6p [L] 5p [H]
D10 HVU350
C85 10p [L] 6p [H]
C457 2p
L400 0.22µH
C77 56p
C78 7p
C448 15p
C76 4p [L] 7p [H]
C105 0.001
L21 82nH [L] 47nH [H]
R75 270
R72 47k
R70 4.7k
L19 8.8nH
C97 7p [L] 5p [H]
R67 10k
R66 150k
R64 220k
R65 10k
R404 220k
D401 HVU350
C87 47p
R59 150
R62 220k
D400 1SS375
D8 MA77
D406 MA77
0.86V
C95 47p
C93 47p
R405 10k
C407 47p
R63 10k
C84 47p
T4
T3
T2
T1
ISENS
IC3a NJM2902V
T4
TXC
C179 0.01
Q37 DTA144EU
C73 0.1
R210 2.2k
R52 100k
R53 10k
R55 1k
C75 0.01
R438 330k
R54 150k
C243 0.001
S5
VCC
Q15 2SB1132
6.9V (VR MIN) ~ 6.4V (VR MAX)
R167 100k
R97 220k
R115 120k
R455 120k [N] 82k [W] 68k [W] 100k [N]
C135 100p [W] 120p [N]
R98 270k 240k
C212 0.1
C499 47p
R107 270k [W] 120k [N] 330k [W] 150k [N]
R114 33k
IC3d NJM2902V
R117 1.5k
R99 10k
R178 3.9k
1.95V
Q16 XP6501AB
R120 68k
R122 2.7k
IC5 TA7368F
L415 EXCCL4532U
R128 10
C153 100
R112 100k
C213 4.7
C214 0.1
R113 68k 82k
C136 0.0047
R159 100k
R116 1k
R119 10k
R118 47k
R100 1
C129 15
C137 0.033
R451 1M
C139 0.1
R121 1k
C140 0.1
R123 3.3k
C145 10
C146 0.001
R126 10k
C149 0.1
R127 10
C150 10
C151 47P
C152 0.047
C128 1
C477 47p
R169 10k
R170 10k
D26 DAN202U
R439 56k
C460 0.0018 [W] 0.001 [N]
R125 7k
TONE
SIGOUT
R172 1M
C216 0.1
AFONOP
VOL OUT
AF OUT
RM
CTCSS
AFON
SPG

J5
OPTION UNIT
MIC, AF, PTT, MM, RM, AFONOP, SIGOUT
PTT
Q17
PTT CONT
MIC
VCC
Q15
AF REG
IC5
AF AMP
SP
VR
5 V
DET
EXT. MIC
MIC JACK
AF OUT
SP
CLONE
SP JACK
Q31, D27
BUFFER
VCC
Q27
I. LIM
CHARGE
BATT
GND
POWER SWITCH
REF X1
IC1
PLL IC
R33, R34, C48
LOOP FILTER
Q7, Q8
VCO
Q6
BUFFER
Q4
BUFFER
Q5
BUFFER
D3, D4
T/R SW
Q3
BUFFER
Q2
PRE DRIVE
Q1
PWR AMP
D1, D8
ANT SWITCH
L1, L2, L3
LPF
ANT.
VCC
Q9
I. SENS
IC3a
APC
Q34
BUFFER
L13, L25
BPF
30.6 MHZ
IC2
DET
IF DET IC
SQL (INSIDE)
FI2
BPF
Q14
IF AMP
FI1
BPF
Q13
L18, L19
BPF
Q12
RF AMP
L16, L17
BPF
IC10
D/A
SD
NOIS
VCC
IC6
Q18
+5 REG
+5 CPU
5 V
CPU 5 V
R5
Q21
R5 REG.
S5
Q20
S5 REG.
T5
Q22
T5 REG.
IC3b
HPF
IC4
ANALOG SWITCH
R105, C133
PRE ENPHA
IC3c
MIC AMP
IC3d
LPF
RM
MM
CTCSS
TONE
IC11
RESET
Q33
LPF
Q35
LPF
CTCSS DTCS
Q36
BUFFER
DTMF
MTONE
IC8
CPU
X2
LCD
KEY MATRIX
EEPROM
IC7

COMMON LINE
Rx LINE
Tx LINE

J5
OPTION UNIT
MIC AF, PTT, MM, RM, AFONOP, SIGOUT
PTT
Q17
PTT CONT
MIC
VCC
Q15, Q16, D26
AF REG
IC5
AF AMP
DE ENPHA
SP
VR
5 V
DET
EXT MIC
MIC JACK
AF OUT
SP
CLONE
SP JACK
Q31, D27
BUFFER
VCC
Q27
I. LIM
CHARGE
BATT
GND
POWER SWITCH
15.3MHz REF
X1
IC1
PLL IC
LOOP FILTER
FROCON
Q8
Q7
Q6
BUFFER
Q4
BUFFER
Q5
BUFFER
MOD
VCO
D3, D4
T/R SWITCH
Q3, Q403
BUFFER
Q2
PRE DRIVE
Q1
PWR AMP
D1, D8, D406
ANT SWITCH
LPF
ANT
VCC
Q9
I SENS
IC3a
APC
D2
PWR DET
Q34
BUFFER
Q11
BUFFER
BPF
45.9 MHZ
IC2
DET
IF DET IC
SQL (INSIDE)
FI2
BPF
Q400
IF AMP
FI1
BPF
Q13
D11, D12, D401
BPF
TUNE
Q12
RF AMP
D10
BPF
TUNE
IC10
D/A
SD
NOIS
COMMON LINE
Rx LINE
Tx LINE
VCC
IC6
Q18
+5 REG
+5 CPU
5 V
CPU 5 V
R5
Q21
R5 REG
S5
Q20
S5 REG
T5
Q22
T5 REG.
IC3b
HPF
IC4
ANALOG SWITCH
IC3c
MIC AMP
PRE ENPHA
IC3d
LPF
RM
MM
CTCSS
TONE
IC11, Q23
RESET
Q33
LPF
Q35
LPF
CTCSS DTCS
Q36
BUFFER
DTMF
MTONE
IC8
CPU
5.8MHz
X2
LCD
KEY MATRIX
EEPROM
IC7

4-1 RECEIVER CIRCUITS

4-1-1 ANTENNA SWITCHING CIRCUIT

Received signals are passed through the low-pass filter (L1–L3, C1–C7 for IC-F3/S, L1–L3, C3, C5, C7 for IC-F4/S). The filtered signals are applied to the λ/4 type antenna switching circuit (D8 for IC-F3/S D406, D8 for IC-F4/S).

The antenna switching circuit functions as a low-pass filter while receiving. However, its impedance becomes very high while D8 (IC-F3/S)/D406 and D8 (IC-F4/S) is/are turned ON. Thus transmit signals are blocked from entering the receiver circuits. The antenna switching circuit employs a l/4 type diode switching system. The passed signals are then applied to the RF amplifier circuit.

4-1-2 RF CIRCUIT

The RF circuit amplifies signals within the range of frequency coverage and filters out-of-band signals.

The signals from the antenna switching circuit are amplified at the RF amplifier (Q12) after passing through the tuneable bandpass filter (D9, D10, C83 for IC-F3/S, D10, L413, C79 for IC-F4/S). The amplified signals are applied to the 1st mixer circuit (Q13) after out-of-band signals are suppressed at the tuneable bandpass filter (D11, D12, D21, D22, C94 for IC-F3/S, D11, D12, D401, C94 for IC-F4/S).

Varactor diodes are employed at the bandpass filters that track the filters and are controlled by the CPU (IC8) via the expander IC (IC10) using T1–T4 signals. These diodes tune the centre frequency of an RF passband for wide bandwidth receiving and good image response rejection.

4-1-3 1ST MIXER AND 1ST IF CIRCUITS

The 1st mixer circuit converts the received signal to a fixed frequency of the 1st IF signal with a PLL output frequency. By changing the PLL frequency, only the desired frequency will be passed through a crystal filter at the next stage of the 1st mixer.

The signals from the RF circuit are mixed at the 1st mixer (Q13) with a 1st LO signal coming from the VCO circuit to produce a 31.05 MHz (IC-F3/S) or 46.35 MHz (IC-F4/S) 1st IF signal.

The 1st IF signal is applied to a pair of crystal filters (FI1) to suppress out-of-band signals. The filtered 1st IF signal is applied to the IF amplifier (Q14 for IC-F3/S, Q400 for IC-F4/S), then applied to the 2nd mixer circuit (IC2, pin 16).

4-1-4 2ND IF AND DEMODULATOR CIRCUITS

The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal. A double conversion superheterodyne system (which converts receive signals twice) improves the image rejection ratio and obtains stable receiver gain.

The 1st IF signal from the IF amplifier is applied to the 2nd mixer section of the FM IF IC (IC2, pin 16), and is mixed with the 2nd LO signal to be converted to a 450 kHz 2nd IF signal.

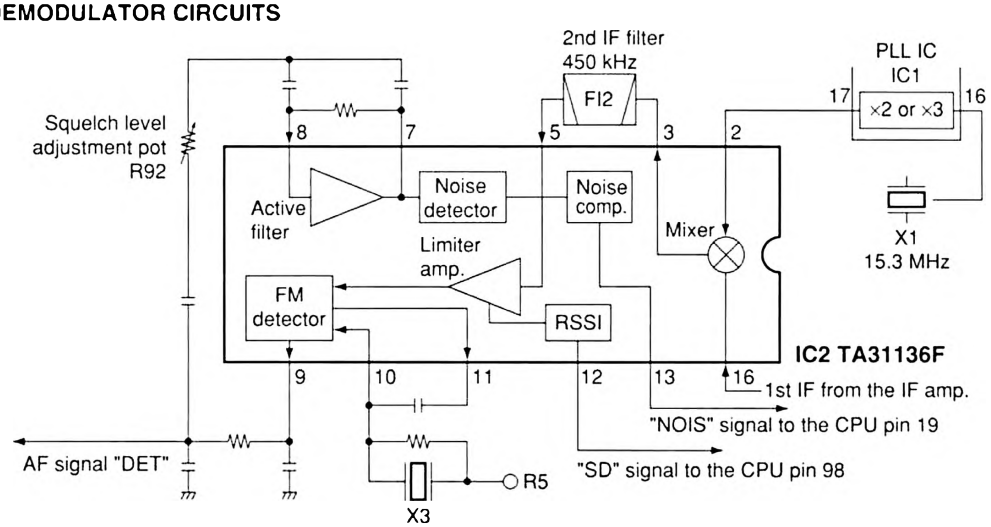
The FM IF IC contains the 2nd mixer, limiter amplifier, quadrature detector and active filter circuits. A 2nd LO signal (30.6 MHz for IC-F3/S, 45.9 MHz for IC-F4/S) is produced at the PLL circuit by dividing it's reference frequency.

The 2nd IF signal from the 2nd mixer (IC2, pin 3) passes through a ceramic filter (FI2) to remove unwanted heterodyned frequencies. It is then amplified at the limiter amplifier (IC2, pin 5) and applied to the quadrature detector (IC2, pins 10, 11) to demodulate the 2nd IF signal into AF signals.

4-1-5 AF CIRCUIT

AF signals from the FM IF IC (IC2 pin 9) are applied to the mute switch (IC4, pin 1) via the AF filter circuit (IC3b, pins 6, 7). The output signals from pin 11 are applied to the AF power amplifier (IC5, pin 4) after being passed through the [VOL] control (VR board, R1).

•2nd IF AND DEMODULATOR CIRCUITS



The signal output from the current sensor circuit (Q9, Q28; IC-F3/S) or the power detector circuit (D2; IC-F4/S) is applied to the differential amplifier (IC3a, pin 2), and the "T4" signal from the expander (IC10, pin 14), controlled by the CPU (IC8), is applied to the other input for reference.

When the driving current is increased, input voltage of the differential amplifier (pin 2) will be increased. In such cases, the differential amplifier output voltage (pin 1) is decreased to reduce the driving current.

4-3 PLL CIRCUIT

A PLL circuit provides stable oscillation of the transmit frequency and receive 1st LO frequency. The PLL output compares the phase of the divided VCO frequency to the reference frequency. The PLL output frequency is controlled by the divided ratio (N-data) of a programmable divider.

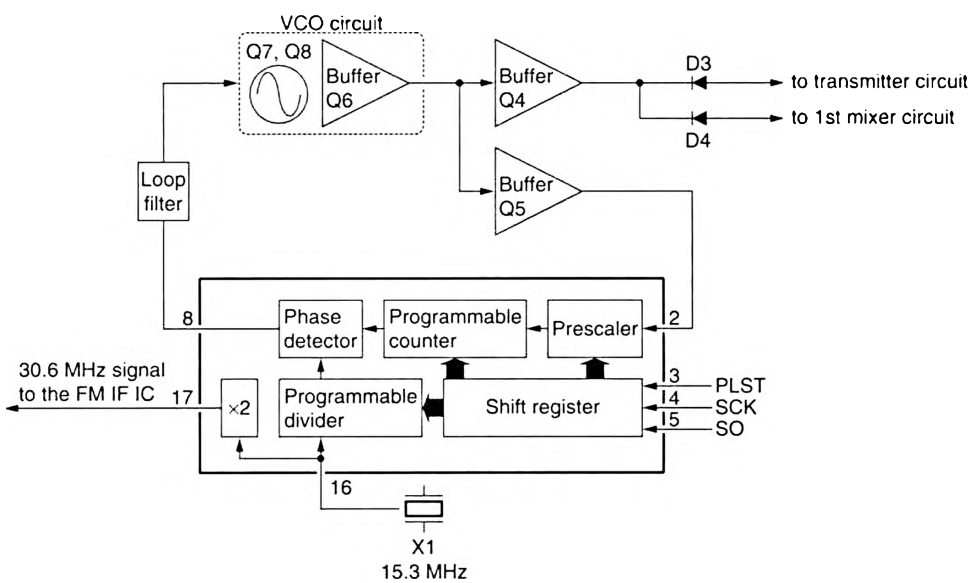
The PLL circuit contains the VCO circuit (Q7, Q8). The oscillated signal is amplified at the buffer-amplifiers (Q5, Q6) and then applied to the PLL IC (IC1, pin 2).

The PLL IC contains a prescaler, programmable counter, programmable divider, phase detector and charge pump, etc. The entered signal is divided at the prescaler and programmable counter section by the N-data ratio from the CPU. The divided signal is detected on phase at the phase detector using the reference frequency.

If the oscillated signal drifts, its phase changes from that of the reference frequency, causing a lock voltage change to compensate for the drift in the oscillated frequency.

A portion of the VCO signal is amplified at the buffer-amplifier (Q4) and is then applied to the receive 1st mixer or transmit buffer-amplifier circuit via the T/R switching diode (D3, D4).

• IC-F3/S PLL circuit



4-4 POWER SUPPLY CIRCUITS

VOLTAGE LINE

Line	Description
HV	The voltage from the attached battery pack.
VCC	The same voltage as the HV line (battery voltage) which is controlled by the power switch ([VOL] control).
CPU5	Common 5 V converted from the VCC line by the reference regulator circuit (IC6). The output voltage is applied to the CPU (IC8) and the 5V regulator circuit.
5V	Common 5 V converted from the VCC line by the 5 V regulator circuit (Q18, Q19) using the reference regulator (IC6).
T5	5 V for transmitter circuits regulated by the T5 regulator circuit (Q22).
R5	5 V for receiver circuits regulated by the R5 regulator circuit (Q21).
S5	Common 5 V converted from the 5V line by the S5 regulator circuit (Q20).
OPT	The same voltage as the 5V line for the optional HM-75A or HS-51 through a resistor (R132).

4-5 CPU PORT ALLOCATIONS

4-5-1 CPU (IC8)

Pin number	Port name	Description
1	CTCIN	Input port for CTCSS/DTCS signals for decoding.
11	CSIFT	Outputs reference oscillator for the CPU control signal.
12	SCK	Outputs clock signal to the PLL IC (IC1), EEPROM (IC7) and expander IC (IC10), etc.
13	SI	Input port for the data signals from EEPROM (IC7), etc.
14	SO	Outputs data signals to the PLL IC (IC1), EEPROM (IC7) and expander IC (IC10), etc.
15	UNLK	Input port for PLL unlock signal from the PLL IC (IC1). High level signal is applied during unlock.
18	PLST	Outputs strobe signals to the PLL IC (IC1).
19	NOIS	Input port for noise signals (pulse type) from the FM IF IC (IC2).
26	CONT	Outputs LCD contrast control signal. High: When normal level is selected
36–41 (IC-F3/S)	KS0–KS5	Output ports for key matrix.
40, 41 (IC-F4/S)	KS4, KS5	
42	MM	Outputs mic. mute control signal. Low: When DTMF or 2/5-tone signal is selected
43	RM	Outputs RX mute control signal. Low: When muted
44–47	KR0–KR5	Input ports for key matrix.
48	R5C	Outputs R5 regulator control signal. Low: While receiving
49	S5C	Outputs S5 regulator control signal. Low: While power is ON
50	TXC	Outputs T5 regulator control signal. Low: While transmitting
51	T5C	Outputs T5 regulator control signal. Low: While transmitting
52	LIGHT	Outputs LCD backlight control signal. High: Lights ON
53	AFON	Outputs the regulator circuit for the AF amplifier control signal. High: While AF amp. is activated.
54	DST	Outputs strobe signals to the expander IC (IC10).
60–62	CTDA0–CTDA2	Outputs CTCSS and DTCS encode signals (3-bit, D/A type).
63	DUSE	Outputs filter switch control signal for the CTCSS and DTCS (Q38). High: DTCS is activated.

CPU (IC8) — continued

Pin number	Port name	Description
90	MTONE	Output port for: Beep audio while receiving. 2/5-tone signals while transmitting.
91	DTMF	Output port for DTMF signals while transmitting.

4-5-2 OUTPUT EXPANDER IC (IC10)

Pin number	Port name	Description
2	DST	Input port for strobe signals.
3	SCK	Input port for clock signal.
4	SO	Input port for data signal.
11–13	T1–T3	Output tuneable bandpass filter control voltage.
14	T4	Outputs tuneable bandpass filter control signal while receiving. Outputs RF output power control signals while transmitting.

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 9.6 V DC Current capacity : 5 A or more	Audio generator	Frequency range : 300–3000 Hz Output level : 1–500 mV
RF power meter (terminated type)	Measuring range : 1–10 W Frequency range : 120–500 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Attenuator	Power attenuation : 40 or 50 dB Capacity : 10 W or more
		Standard signal generator (SSG)	Frequency range : 120–500 MHz Output level : 0.1 µV–32 mV (–127 to –17 dBm)
Frequency counter	Frequency range : 0.1–500 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	DC voltmeter	Input impedance : 50 kΩ/V DC or better
FM deviation meter	Frequency range : DC–500 MHz Measuring range : 0 to ±5 kHz	Oscilloscope	Frequency range : DC–20 MHz Measuring range : 0.01–20 V
Digital multimeter	Input impedance : 10 MΩ/V DC or better	AC millivoltmeter	Measuring range : 10 mV–10 V

■ TRIMMER ADJUSTMENT

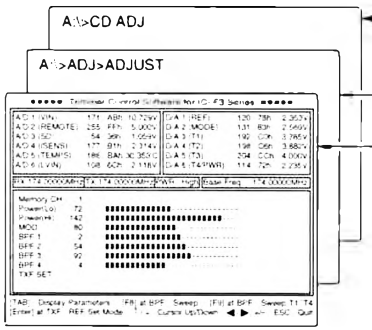
When you adjust the contents on page 5-4 or 5-8, TRIMMER ADJUSTMENT, the optional EX-1961 FIELD PROGRAMMING SOFTWARE (Rev. 2.0 or later) and OPC-478 CLONING CABLE are required.

• STARTING TRIMMER ADJUSTMENT

Turn ON power to the transceiver, connect a computer to the [SP] jack using the optional OPC-478 CLONING CABLE, then start up the "ADJUST" program in EX-1961.

• STARTING THE PROGRAM

① Boot up DOS.
② Insert the EX-1961 backup disk into drive A.
③ Type the following to start up the program:
ADJ>ADJUST [Enter]
• The adjustment screen appears after reading set data from the transceiver.
④ After the adjustment screen appears, set or modify the data as desired.

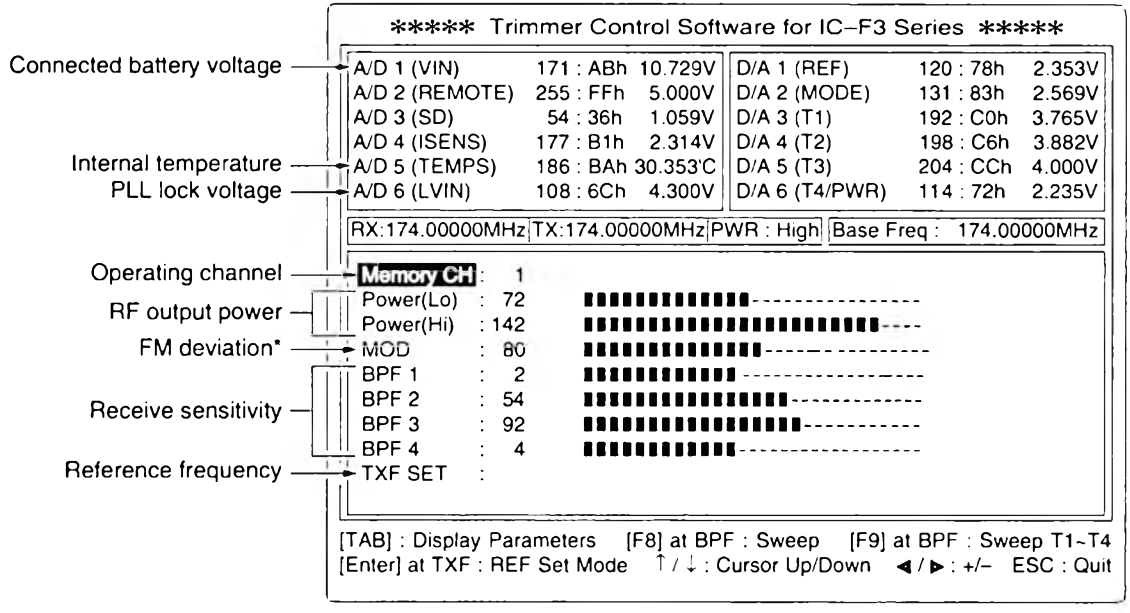


NOTE: When the EEPROM (IC7) is replaced or the transceiver displays an error message and beeps, the following operation is necessary before starting the ADJUSTMENT.

1. Download the programmed frequency data using the EX-1961 FIELD PROGRAMMING SOFTWARE (Rev. 2.0 or later) from an exact same version of the transceiver, then save it. (See the instructions for detailed operation.)

2. Return to DOS.
3. Copy the saved frequency data into the "ADJ" directory as follows:
A>COPY [file name].ICF A:\ADJ [ENT]
4. Connect the transceiver in which the EEPROM has been replaced, using the OPC-478 CLONING CABLE.
5. Change the directory to "ADJ", and type as follows:
A>CD ADJ [ENT]
A>ADJ>EEPROM [file name].ICF 1* [ENT]
When cloning is successful, the transceiver displays "CL GOOD".

*RS-232C port number. You have to type "A>EEPROM [file name].ICF 2" when the port number is set to "2". This setting can be confirmed in the SETUP window while EX-1961 is running.



NOTE:
The above values for settings are examples only. Each transceiver has its own specific values for each setting.

*__DO NOT__ change the value when adjusting the **IC-F4/S**. A value of 80 is necessary for the IC-F4/S.

• CONNECTIONS