FRG-9600

SERVICE MANUAL

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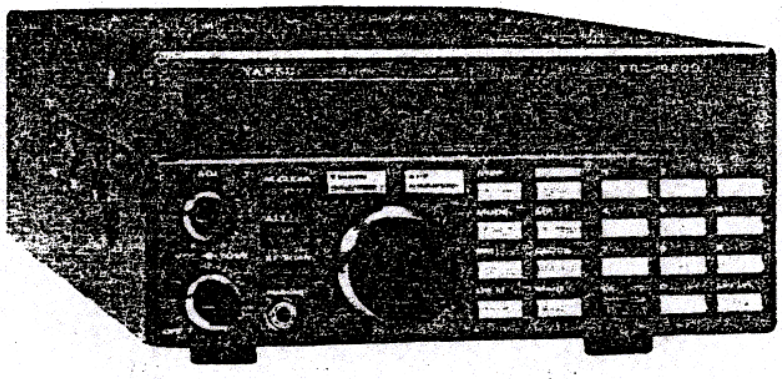
CONTENTS

FRG-9600 TECHNICAL SUPPLEMENT



This manual is intended to serve as a supplement to the FRG-9600 Operating Manual. Detailed information regarding functions, specifications, options and operation has been provided in the Operating Manual, and is not reprinted herein. Therefore, this supplement is not intended to serve as an independent reference, but to be used in conjunction with the information provided in the Operating Manual.

The FRG-9600 is designed to perform properly for many years without any need for internal adjustment. However, the complexity of the circuitry is such that tampering with the internal adjustments or components will void any warranty and may seriously degrade performance, and cause serious damage. Therefore we recommend that the FRG-9600 be referred to an authorized Yaesu agent for service or modification, if required.

While we believe the technical information in this manual is correct, Yaesu assumes no liability for damage that may occur as a result of typographical or other errors that may be present. Your cooperation in pointing out any inconsistencies in the technical information would be appreciated; however, Yaesu Musen reserves the right to make changes in the circuitry of this receiver, in the interest of technological improvement, without notification of the owners.

CAT TEST PROGRAM

```
]LIST

  5  REM  RESET FIF-65 I/O CHIP
 10  POKE 49345,0: POKE 49345,0: POKE 49345,0
 15  REM  INITIALIZE FIF-65 I/O CHIP
 20  POKE 49345,64: POKE 49345,207: POKE 49345,55
 30  HOME : PRINT "INPUT (0) - (7)    "
 40  PRINT "   (0).......FREQUENCY SET"
 50  PRINT "   (1).......FM-WIDE"
 60  PRINT "   (2).......FM-NARROW"
 70  PRINT "   (3).......AM-WIDE"
 80  PRINT "   (4).......AM-NARROW"
 90  PRINT "   (5).......USB"
100  PRINT "   (6).......LSB"
120  PRINT "   (7).......END": PRINT
130  INPUT " SELECT 1 - 7  >";A: IF A > 7 THEN 30
135  REM  CALL -958 CLEARS ALL BELOW CURSOR
140  PRINT : IF A = 7 THEN  HTAB 1: VTAB 1: CALL  - 958: END
150  IF A = 0 THEN N0 = 10: GOTO 1000
160  IF A = 1 THEN N0 = 23
170  IF A = 2 THEN N0 = 22
180  IF A = 3 THEN N0 = 21
190  IF A = 4 THEN N0 = 20
200  IF A = 5 THEN N0 = 17
210  IF A = 6 THEN N0 = 16
220  GOTO 2000
1000  REM  FREQUENCY SET
1010  PRINT "INPUT FREQ. (MHZ)"
1020  PRINT "    FREQ. RANGE 60.0 - 905.0 (MHZ) ": PRINT
1030  INPUT FR
1040  IF FR < 60.0 OR FR > 905.0 THEN  PRINT : PRINT " OUT OF RANGE !": PRINT
    : HTAB 10: PRINT "INPUT AGAIN !": FOR I = 0 TO 1000: NEXT : VTAB 14: CALL
    - 958: GOTO 1020
1050 FR = FR * 10000
1060 M1 =  INT (FR / 100000)
1070 M2 =  INT (FR / 1000) - M1 * 100
1080 M3 =  INT (FR / 10) - M1 * 10000 - M2 * 100
1090 L1 = M1 * 100000:L2 = M2 * 1000:L3 = M3 * 10
1100 M4 = FR - L1 - L2 - L3:M4 =  INT (M4 + .5) * 10
1110 N1 =  INT (M1 / 10) * 16 + M1 -  INT (M1 / 10) * 10
1120 N2 =  INT (M2 / 10) * 16 + M2 -  INT (M2 / 10) * 10
 130 N3 =  INT (M3 / 10) * 16 + M3 -  INT (M3 / 10) * 10
1140 N4 =  INT (M4 / 10) * 16 + M4 -  INT (M4 / 10) * 10
2000  REM   SEND 5BYTES VIA FIF-65 TO RCVR
2010  POKE 49344,N0: POKE 49344,N1: POKE 49344,N2: POKE 49344,N3: POKE 49
    344,N4
2020  GOTO 30

]
```

Operating Manual Errata

The second paragraph on page 34 of the Operating Manual is in error with respect to the polarity of the TTL signal levels. It should read, "(0V = "SPACE" and +5V = "MARK")" for serial data to the FRG-9600.

Also, on page 38, in line 20 of the program example, the programming codes in the third and fourth occurances of CHR$() should be 84 and 50, respectively, allowing for the conversion from hex to decimal as described in the text.

CAT Test Program

A listing of an Applesoft BASIC test program for the FRG-9600 CAT System with FIF-65 CAT Interface Unit is shown at the right. It can be used as is with an Apple II computer for elementary frequency and mode selection, but should be considered only as the basis for more sophisicated CAT operation with the addition of the user's scanning routines. The same program should work on other computers with appropriate replacements of the POKE and CALL statements. Refer to the CAT System Command Chart on page 39 of the Operating Manual for details of the command codes used in the program.

Lines 10 and 20 clear and initialize the I/O chip in the FIF-65, setting it for 4800 baud, 8 data bits, 2 stop bits and no parity. This port initialization will be different for other computers and interface units. For example, some computers include an I/O chip which can be programmed with BASIC commands such as OPEN COM ... Check the computer manual for the correct instructions under the OPEN command, or the serial I/O procedure.

Lines 30 to 130 print a simple command menu on the display, and accept keyed input of the Menu Selection for the desired command. The menu should be modified for commands added by the user, such as for scanning.

Line 135 just identifies the function of CALL -958, which is equivalent to ctrl-Z or PRINT CHR$(26) on many terminals.

Line 140 leaves a blank line below the menu, clears the screen and ends the program if menu selection 7 (END) is input.

Line 150 sets the Insruction Byte (NØ) to 10 for Frequency Set, and jumps to the corresponding routine beginning at Line 1000.

Lines 160 to 210 set the corresponding Instruction Byte (NØ), to the decimal value of that shown (in hex) in the Command Chart for the various modes. Line 220 then jumps to the sending routine starting at 2000.

Lines 1000 — 1050 comprise the input portion of the Frequency Set Routine. Lines 1010 to 1040 display the range and accept the keyed input (with a MHz decimal) if within the correct range of the receiver. Line 105[illegible] then eliminates the decimal. Notice that the variable FR must be single-precision in this case. Aside from that nothing here is critical; there are many ways to optimize this input procedure for simplification or operator preference, just as long as FR ends up as the desired new frequency in whole hundreds of Hz.

Lines 1060 to 1140 convert whole decimal number FR into hexadecimal Data Bytes N1 through N4. In Lines 1060 to 1100, M1 — M4 and L1 — L3 are intermediate variables used to separate out the four 2-digit decimal segments of FR. Lines 1110 to 1140 then convert each of the intermediate decimal segments into its hex equivalent. In many computers this entire process can also be done with strings and hex-conversion commands provided in some BASIC dialects. For scanning, it is most important to optimize this routine for maximum speed.

Lines 2000 to 2020 send bytes NØ through N4 to the receiver, and return to the menu. Notice that all five bytes are always sent, even if only the mode is being changed (and this sending routine is called by the jump from Line 220). As mentioned in the Operating Manual, only the first byte (Instruction Byte NØ) has any significance to the receiver when changing modes, but the remaining four bytes must still be sent if the command is to be accepted (their value is irrelevant in such cases, so the fre-

CIRCUIT DESCRIPTION

This description, together with the block diagram, is intended to provide a general understanding of the electrical functions of the circuits in the FRG-9600. Such an understanding is necessary for trouble-shooting the receiver. Refer to the schematic diagrams and parts list for specific component and wiring details.

"VHF" and "UHF", and "band selection" in the following description refer to 60 — 460 MHz (VHF) and 460 — 905 MHz (UHF).

Front End Stages

Signals from the antenna jack are delivered to the Main Unit for application to the Front End Module (VTY-1U103) according to VHF/UHF band selection by diodes D1005 and D1006 (both 1SS110). When the ATT button on the front panel is depressed, attenuator relay driver Q1001 (2SC458BTZ) inserts attenuation via RL1001.

The Front End Module itself contains pairs of RF amplifiers, varactor-tuned local oscillators (VCOs), local buffers and mixers, one each for VHF and UHF (this Module is not internally serviceable). Band selection control is from the Band Unit, and Varactor Control Voltage (VCV) for tuning is derived from the Local Output signal on the PLL Unit. The 1st IF Output from the Front End Module, at 45.754 MHz, is returned to post-mixer buffer Q1002 (2SC458BTZ) on the Main Unit for SSB, AM and narrow FM; and then passed through monolithic crystal filter XF1001 to remove unwanted mixer products. However, since this filter is too narrow (28 kHz BW) for wide FM and TV, the 1st IF Output is also passed to the WFM Unit and the optional Video Unit (if installed).

For SSB, AM and narrow FM the filtered 1st IF is applied to 2nd mixer Q1003 (3SK73GR), which also receives the 35.06 MHz 2nd local signal generated by TCXO/doubler X1001/Q1004 (2SC458BTZ). The 10.7 MHz product of the 2nd mixer is then delivered to the NFM Unit for filtering by dual monolithic crystal filter XF4001 (15 kHz BW) before application to oscillator/mixer/FM detector IC Q4001 (MC3357P). Crystal X4001 (10.245 MHz) provides the 3rd local signal, which is mixed with the filtered 2nd IF to produce the 455 kHz 3rd IF. This is passed through ceramic filter CF4001 (15 kHz BW), and delivered to the SSB/AM Unit for those modes. For narrow FM, the filtered 3rd IF is amplified by Q4002 (2SC1623T2BL6) and amplitude limited within Q4001 before FM detection by ceramic discriminator CD4001. D4001 (1SS106) rectifies high frequency noise present at the discriminator when no signal is present, to produce the FM squelch control voltage, for controlling squelch switch Q4003 (2SC1623T2BL6) via the front panel squelch control. Detected FM audio is passed through Q4003 when a signal is present, and delivered to the Mode/Scan Unit for selection.

For SSB and AM modes, the 455 kHz IF signal delivered to the SSB/AM Unit from the N.FM Unit is amplified by Q4505 (3SK73GR) and then passed on to the Fil/Car Unit, where the signal is passed through ceramic filter CF5001 (2.4 kHz BW) for SSB, or CF5002 (6 kHz BW) for AM. After filtering the 3rd IF signal is returned to the SSB/AM Unit for amplification by Q4501 and Q4502 (both 3SK73GR), and buffering by Q4507 (2SC1623T2BL6). Detection for AM and AGC is provided by D4501/D4502 (1SS106 x 2), and the resulting audio is delivered to the Mode/Scan Unit for selection. A sample of the rectified IF is buffered by Q4506 (2SC1623T2BL6) and fed back to IF amplifiers Q4501 and Q4502 to control their gain during fading. The amplified 3rd IF signal from Q4502 is also buffered by Q4503 (2SC1623T2BL6) and applied to diode ring Q4504 (ND487C2-3R) for detection. Q4504 also receives a carrier buffered by Q4508 (2SC1623T2BL6)at either 453.5 kHz (LSB) or 456.5 kHz (USB), generated by either ceramic oscillator CO5001/Q5001 or CO5002/Q5002, respectively, on the Fil/Car Unit. Q5001 and Q5002 are both 2SC945AP, selected by mode data controlling switches Q5003 and Q5004 (both 2SC1623T2BL6), respectively. The resulting demodulated SSB audio is delivered to the Mode/Scan Unit as for the other modes.

quency data can be left in these bytes).

Before adding more functions to this program, first key it in, with the appropriate changes to Lines 10, 20 and 2010 for your serial communications hardware (if not using the FIF-65 and Apple II). Then make sure that it runs as expected.

Next add your own scanning routine: program the keyboard to select the direction and start and stop scanning (use the INKEY$ command, or similar). Scanning up is done easily by incrementing FR after Line 1050 and recalling Line 1060, and scanning down by decrementing FR in the same way. It may help programming to make Lines 1060 to 2020 into a subroutine. Try adding programmable scan limits with auto-reverse or looping (you will need to connect the Scan Stop and-/or AGC lines to make use of these in your program. See below).

Memories can be added to the program by making FR into an array of 7-digit numbers.

If your computer includes a real-time clock you can link to various memories, so that your favorite stations will be selected at different times.

S-Meter Signal Interfacing

As mentioned in the Operating Manual, certain CAT Interface Units include an A/D (analog-to-digital) converter, which provides the computer with a numerical representation of the signal strength. Including this in your programming allows automatic scan start and stop routines, and automatic selection of the strongest signal among a number of different frequencies.

If the interface that you are using does not include an A/D converter, we suggest using one of the many single-chip devices available for this purpose (some computers already have an A/D converter built in to read joystick input). In most cases the easiest approach is an 8-bit parallel converter which can be connected directly to data bus, enabled by the desired I/O address, I/O request and the read line from the computer cpu. The S-meter output at pin 5 of the CAT jack ranges from zero volts when receiving no signal signal to approximately 2.5 volts when the S-meter reads full scale. Use a converter with high-impedance (>100k) input, or include a buffer. Using a parallel converter in this way allows signal strength sampling from BASIC with the INP command.

Squelch Interfacing

The SCAN STOP control signal at pin 6 of the CAT jack is a simple TTL-level on/off signal, which can be read by the computer without conversion. However, it is necessary to connect this pin to a TTL sensing port on the computer, such as a joystick port. The BUSY pin will be at high level when the squelch is open, and low when closed, which level depends on the setting of the front panel SQL control (which is not disabled during CAT control). This can certainly be implemented easier than the S-meter signal, but provides less information for programming.

Wideband FM

As mentioned previously, the 45.754 MHz 1st IF signal from the Front End Module is delivered to the W.FM Unit. This is applied to Mixer/FM detector IC Q3501 (MC3356), along with the 2nd local signal, after buffering by Q1005 (2SC458BTZ) on the Main Unit. Q3501 also scanning control via Q4302 (2SC1623T2BL6) and mode selection control via Q3503 (2SA812T2BM6). Wideband FM audio is delivered to the Mode/Scan Unit for selection as for the other modes.

Mode/Scan Selection and Control

The Mode/Scan Unit receives mode selection data from the cpu (r01 – r03), which is decoded by Q5501 (MC14028BCP) to provide switching control signals for the analog circuits. Audio from the detector for each mode is buffered by Q5503 – Q5506 (2SC1623T2BL6, exc Q5504, 2SC945AP), for AM, FM-W, FM-N and SSB, respectively. These buffers are controlled by Q5501 via Q5507 – Q5510 (all 2SC1623T2BL6), so that only the audio for the selected mode is returned to the Main Unit for final amplification by Q1013 (MB3713). The decoded mode selection data from Q5501 also selects the appropriate IF filters. The remaining transistors on the Mode/Scan Unit provide squelch and mute control signals for scanning and automatic scan stop.

Frequency Selection and Display

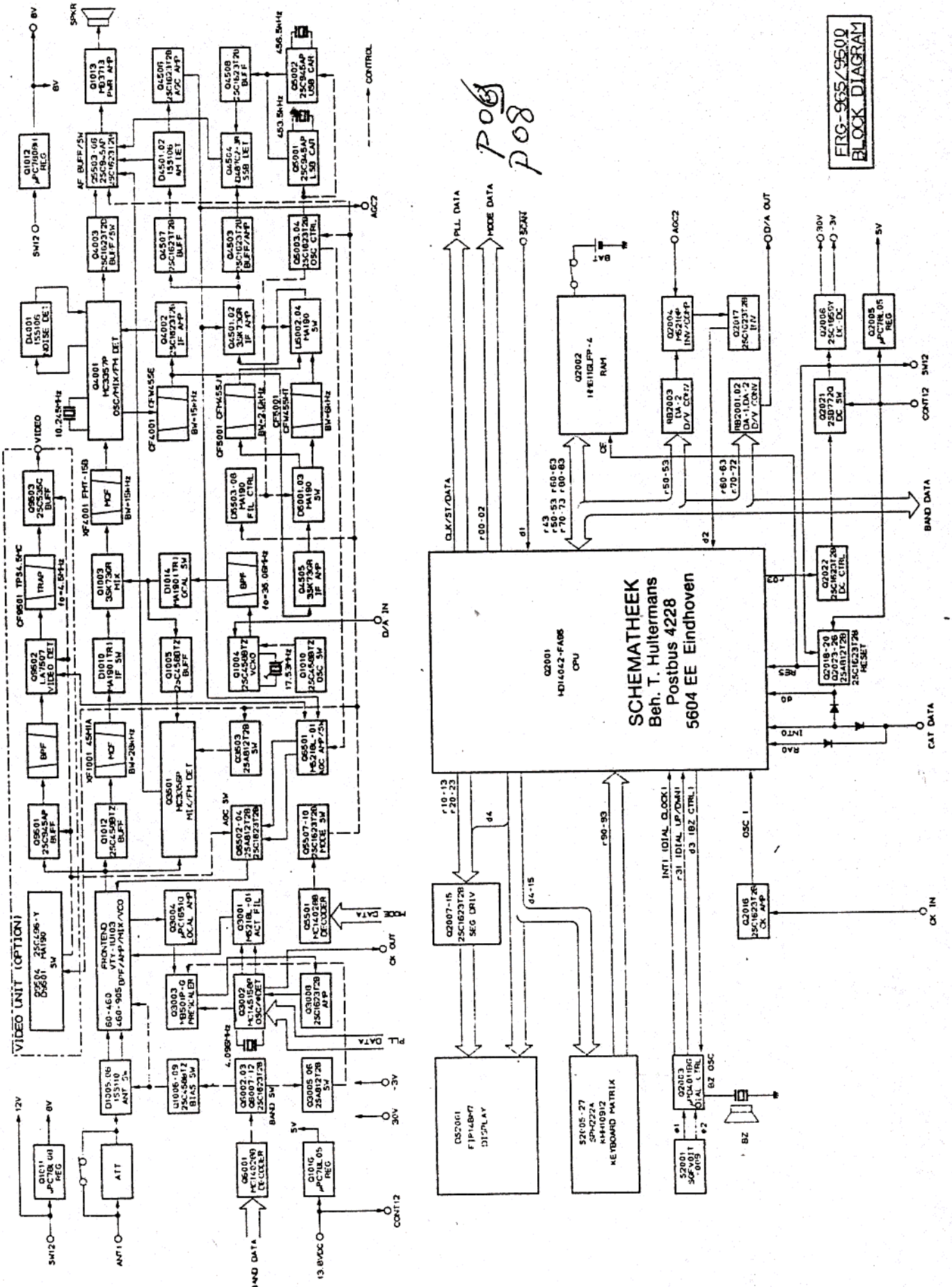
All frequency selection and display functions are handled digitally on the CPU Unit behind the front panel, by 4-bit custom LSI microprocessor Q2001 (HD614042-FA95). A 2-kilobyte memory for the cpu is provided by Q2002 (HM6116LFP-4). Display data at pins 1 - 11 is delivered via drivers Q2007 – Q2014 (all 2SC1623T2BL6) to fluorescent display tube DS2001 (FIP-14BM7). Negative voltage for the display is developed by DC/DC inverter Q2006 (2SC1959Y) in concert with L01.

One half of quad NAND gate Q2003 (uPD4011BG) provides dial tuning data from photo-interrupter S01 to pin 17 of Q2001, while the other half of Q2003 oscillates to drive beeper BZ01 when pin 51 of Q2001 goes high.

Dual op amp Q2017 (M5218) serves as an A/D converter in conjunction with D/A converter RB2003 to provide AGC data to Q2001 for scan-stop purposes in SSB and CW modes. The other D/A converters, RB2001 and RB2002, provide frequency data to the PLL in 100 Hz steps for the portion of the frequency below 12.8 kHz.

The remaining circuitry around Q19 – Q25 performs cpu and memory reset, backup and off/on timer switching functions.

BLOCK DIAGRAM



The high reliability of the chip components and robot assembly used for the FRG-9600 make it unlikely that repair or realignment will be required after it has left the factory. However, if damage does occur and some parts subsequently be replaced, realignment may be required afterwards. In the event of a sudden problem during normal operation, do not attempt realignment. Such problems are usually caused by the failure of a component, which must located and replaced before realignment is attempted.

Because of the complex digital control circuitry in this receiver we recommend that servicing be attempted only by authorized Yaesu service technicians who are experienced with the circuitry and fully equipped for repair and alignment. Therefore, if a fault is suspected, contact the dealer from whom the receiver was purchased for instructions regarding repair. Authorized Yaesu service technicians make all realignments and complete performance checks to ensure compliance with factory specifications after replacing any faulty components.

Those who do undertake any of the following alignments are cautioned to proceed at their own risk. Yaesu must reserve the right to change circuits and alignment procedures in the interest of improved performance, without notifying owners.

Under no circumstances should any alignment be attempted unless the normal function and operation of the receiver are clearly understood, the cause of the malfunction clearly pinpointed and any faulty components replaced, and the need for realignment determined to be absolutely necessary.

The following test equipment (and thorough familiarity with its correct use) is necessary for complete realignment. Correction of problems caused by misalignment resulting from use of improper test equipment is not covered under the warranty policy.

Alignment Equipment

Volt-Ohm-Ammeter (50-kilohm/V DC, 10-kilohm/V AC impedance)

AF millivoltmeter

RF standard signal generator (SSG)
0.1 to 450 MHz, with calibrated level and modulation (see note below)

RF voltmeter (VTVM or equiv.)
>5% accuracy at 450 MHz, 10 to 1000 dB

SINAD meter (SINADDER)

Frequency counter (0.02 ppm, 6-digit)

Oscilloscope (for signal tracing)

Linear Detector

Spectrum analyzer (HP-141T or equiv.)

Video Monitor (for optional Video Unit only)

Note : SSG levels referred to in the alignment procedure are based on 0dBu=1 uV at infinite impedance (unterminated).

Alignment Precautions

Correct alignment requires that the ambient temperature be the same as that of the receiver and test equipment, and that this temperature be held constant between 20° and 30°C (68° to 86°F). When the receiver is brought into the shop it should be allowed at least 2 hours for thermal equalization before alignment.

Alignments must not be made unless the oscillator shields and circuit boards are firmly affixed in place. Also, the frequency counter must be thoroughly warmed up before beginning. Perform all steps in the order given, as many are interdependent.

Remove the top and bottom covers from the chassis. The top cover is affixed by two screws on either side, plus a grounding clip, so after removing the screws it is necessary to lift the top cover slightly at the rear, and then slide it back about 1 cm. Disconnect the speaker wires before pulling the cover away.

The bottom cover is affixed by eight screws; two on either side and four on the bottom.

Connect the SSG to the ANT jack and the AF millivoltmeter in parallel with an 8-ohm speaker to the EXT SPKR jack.

1. PLL Reference Oscillator Frequency

Connect the frequency counter to TP3001 on the PLL Unit, and adjust trimmer TC3001 for 4.096 MHz ±10 Hz on the counter.

2. Front End

(This step should be skipped unless the front end module is being replaced)

(a) Remove the left side cover from the front end module, and connect the Hi-Z DC voltmeter to TP3002 on the PLL Unit.

(b) Tune the receiver for 106.999.9 on the display, and adjust the pitch of the coil indicated in Figure 1 for 26 ±1V at TP3002. Remove the meter and replace the cover on the module.

3. 2nd Local Oscillator Level

Tune the receiver for 80.000.0 on the display, and connect the RF voltmeter to Gate 2 of Q1003 on the Main Unit, shown in Figure 2. Adjust T1006 and then T1005 for peak RF voltage on the meter (approx 1.15 ±0.3 Vrms).

4. 2nd Local Oscillator Frequency

(a) With the receiver still showing 80.000.0, connect the frequency counter to TP1001 on the Main Unit and adjust T1004 for 35.06 MHz ±50 Hz on the frequency counter.

(b) Retune the receiver so 79.999.9 is displayed, and adjust VR1001 for 35.0473 MHz ±25 Hz on the counter.

5. LSB/USB Carrier (BFO) Frequency

(a) Connect the frequency counter to TP1002 on the Main Unit, set the receiver to the LSB mode, and adjust TC5001 on the FIL/CAR Unit for 453.5 kHz ±50 Hz on the counter.

(b) Switch the receiver to the USB mode and adjust TC5002 for 456.5 kHz ±50 Hz on the counter.

6. RF Signal Path

(Part 7 must be performed immediately after this part is completed.)

(a) Tune the receiver to 100 MHz, USB mode. Set the SSG output level to 0 dB, with no modulation, close enough to the receiving frequency to produce a heterodyne of about 1 kHz audible in the external speaker.

(b) Adjust T1001 — T1003 for peak audio output. (Adjust the VOL control, if necessary, to keep readings on the AF meter scale).

(c) Adjust the VOL control so the AF millivoltmeter indicates just full scale, and then preadjust VR1005 so that the AF millivoltmeter indicates 10dB lower than full scale. Now repeat the peaking of T1001 — T1003 two or three more times.

(d) If the front end module is being replaced, adjust the transformers indicated in Figure 2 for peak on the AF millivoltmeter.

7. Total System Gain

(a) Retune the receiver to 70.500 MHz, and tune the SSG nearby for a heterodyne.

(b) Connect the DC voltmeter (5V range) to TP1003 and set VR1005 fully CCW (The DC voltmeter should show approx 4V).

BOARD LOCATIONS

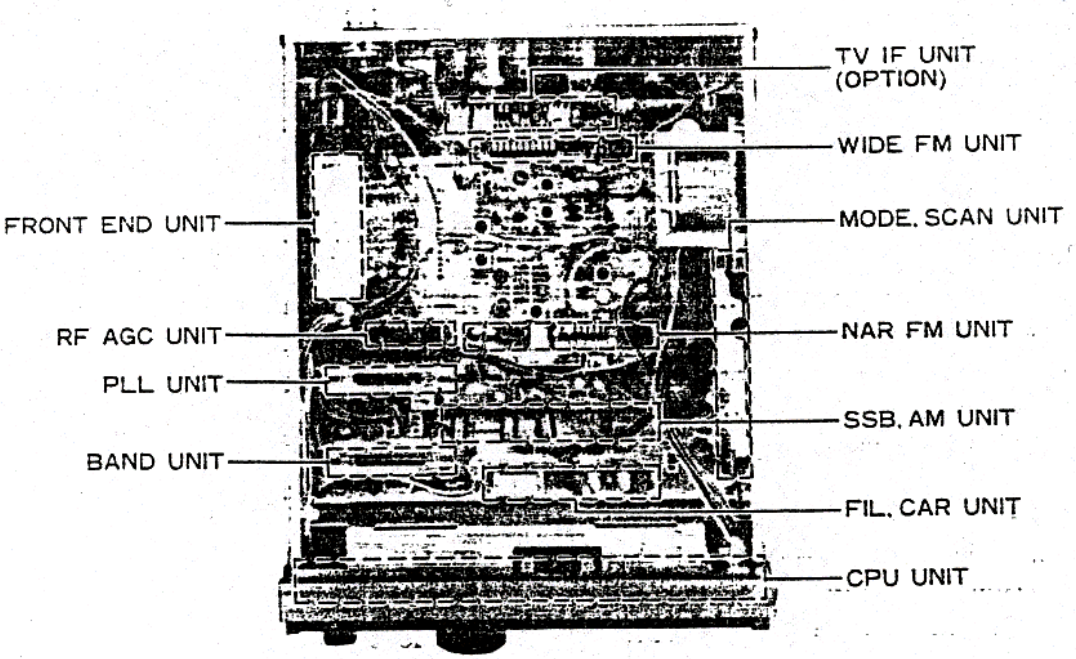
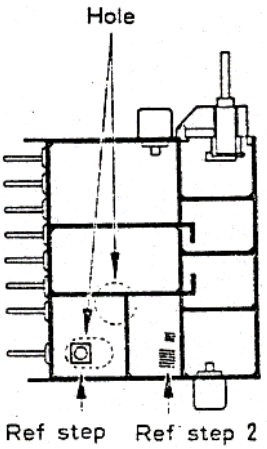


Figure 1

ALIGNMENT POINTS



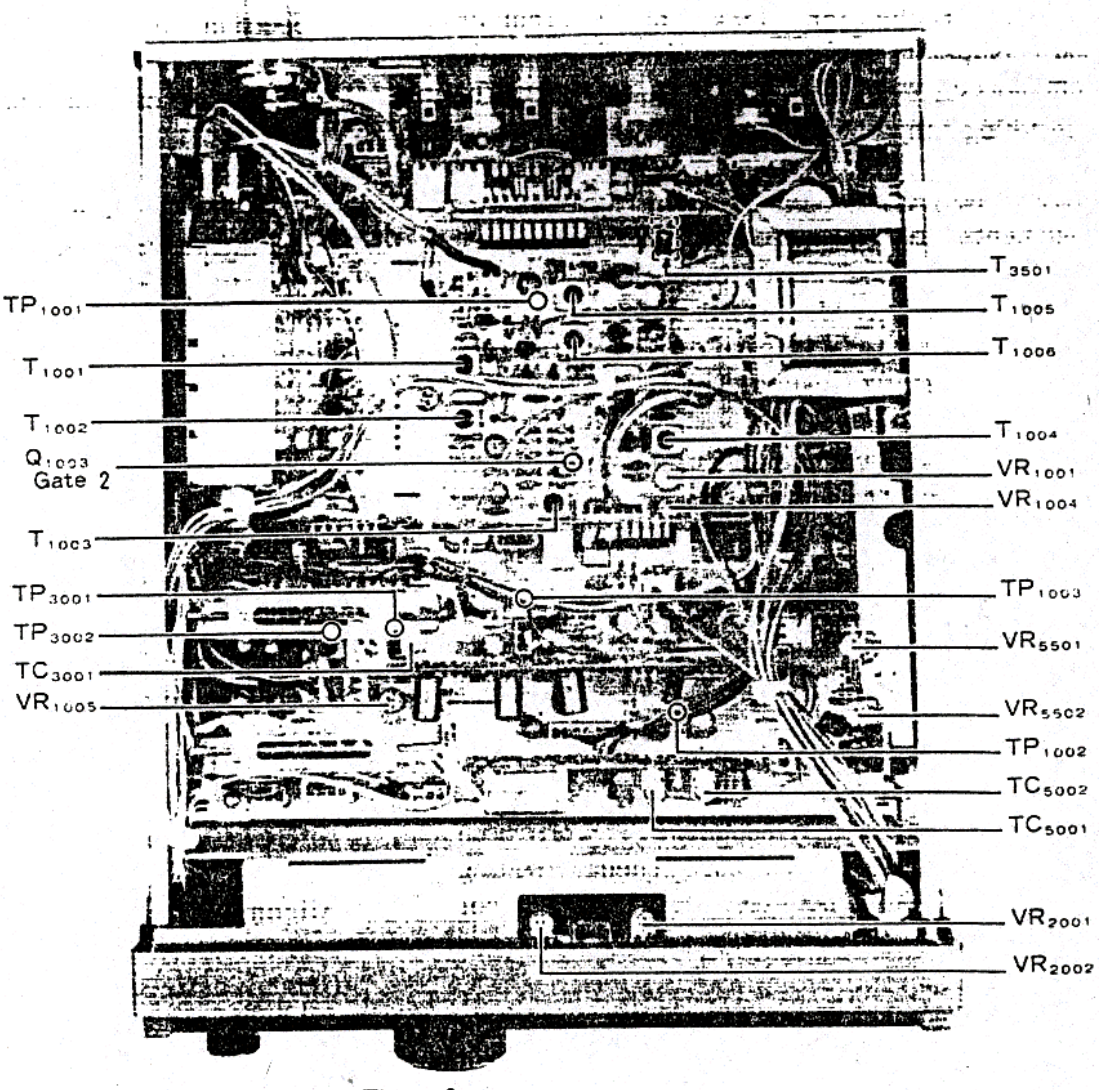
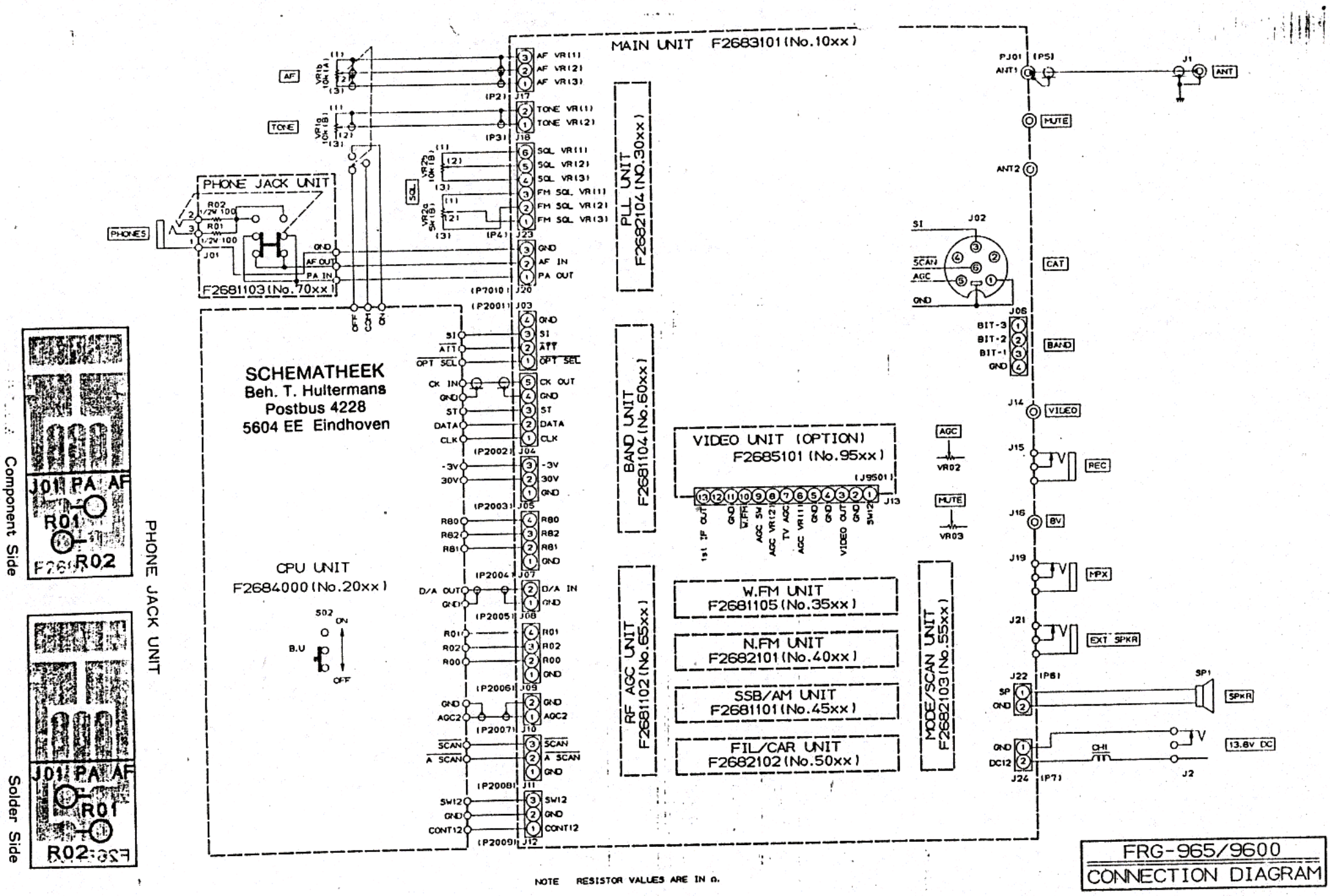
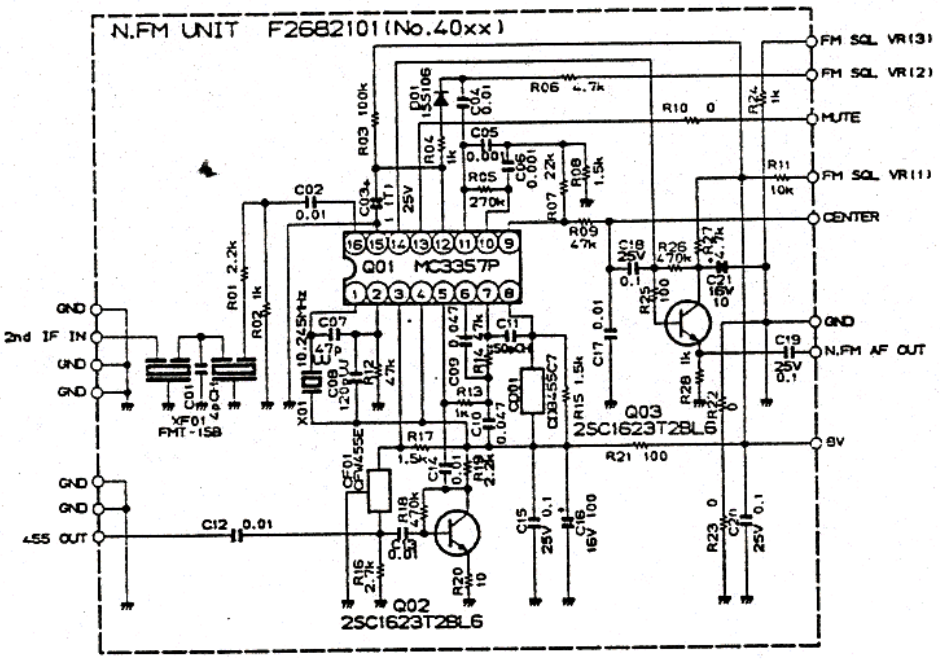


Figure 2


MAIN UNIT F2683101(No.10xx)
PHONE JACK UNIT
F2681103(No.70xx)
PHONES
AF
TONE
SQL
PLL UNIT F2682104(NO.30xx)
BAND UNIT F2681104(No.60xx)
RF AGC UNIT F2681102(No.65xx)
SCHEMATHEEK
Beh. T. Hultermans
Postbus 4228
5604 EE Eindhoven
CPU UNIT
F2684000(No.20xx)
VIDEO UNIT (OPTION)
F2685101(No.95xx)
W.FM UNIT
F2681105(No.35xx)
N.FM UNIT
F2682101(No.40xx)
SSB/AM UNIT
F2681101(No.45xx)
FIL/CAR UNIT
F2682102(No.50xx)
MODE/SCAN UNIT
F2682103(No.55xx)
ANT
MUTE
CAT
BAND
VIDEO
REC
8V
MPX
EXT SPKR
SPKR
13.8V DC
Component Side
Solder Side
PHONE JACK UNIT
NOTE RESISTOR VALUES ARE IN Ω.
FRG-965/9600
CONNECTION DIAGRAM

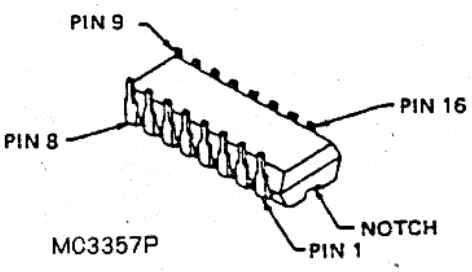


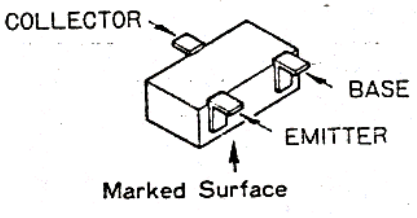
SCHEMATHEEK
Beh. T. Hultermans
Postbus 4228
5604 EE Eindhoven

VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	REMARKS
Q4001	7.3	7.0	7.1	7.4	1.0	1.0	1.0	7.4	
	9	10	11	12	13	14	15	16	
	2.6	1.9	1.9	0.7/0.5	0.5/6.5	1.6/0	0	1.9	SQL open/close

	E	C	B	REMARKS
Q4002	0	2.8	0.6	
Q4003	1.0/0	3.0/7.8	1.6/0	SQL open/close





2SC1623T2B (L6)

(c) Now increase the SSG level to 6dB and adjust VR1005 gradually to the point where the DC voltage at TP1003 just starts to fall.

8. Squelch Preset Level

Temporarily disconnect the SSG from the antenna jack for the following two steps.

(a) Select an SSB or AM mode, and set the SQL control on the front panel to the 12 o'clock position. Adjust VR5501 on the MODE/SCAN Unit so that receiver noise is just silenced.

(b) Select the FM-N mode and adjust VR1004 for the FM squelch threshold point.

9. Scan Stop Signal Level

(a) Reconnect the SSG to the ANT jack, and set for standard FM modulation (±3.5 kHz deviation of a 1 kHz tone). Set the level to 0 dB at 70.500 MHz.

(b) Set the receiver to the FM-N mode, with 5 kHz tuning steps. Tune the receiver to the same frequency as the SSG (peak on the AF millivoltmeter).

(c) Connect the DC voltmeter (10V range) to pin 6 of the CAT jack on the rear panel (which should be at about 5V), and tune the receiver one step up and one step down while adjusting VR5502 on the MODE/SCAN Unit, until the DC voltmeter shows a drop to near zero on each side of the center frequency.

10. FM Wide

(a) Set the SSG output to +30dB (at 70.500 MHz), and modulate with ±75 kHz deviation of a 1 kHz tone.

(b) Set the receiver to the FM-W mode and again tune for peak audio on the AF millivoltmeter. Then adjust T3501 on the W-FM Unit for peak deflection on the AF millivoltmeter.

11. S-Meter Full Scale

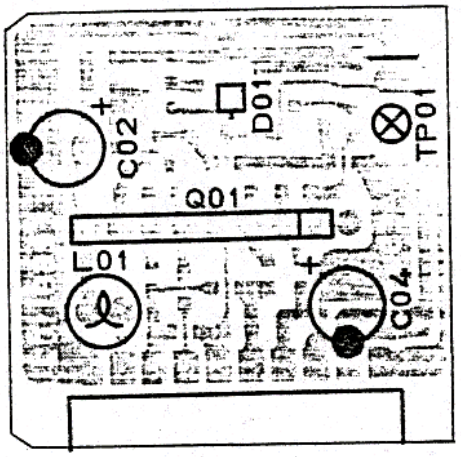
(a) With the receiver and SSG tuned to 70.500 MHz, set the receiver to USB mode and the SSG level to 0dB with no modulation. Tune the receiver for peak indication on the AF millivoltmeter.

(b) Preset VR2002 on the CPU Unit fully CCW, increase the SSG level to +30dB, and adjust VR2001 on the CPU Unit so that all segments of the S-Meter are just lit.

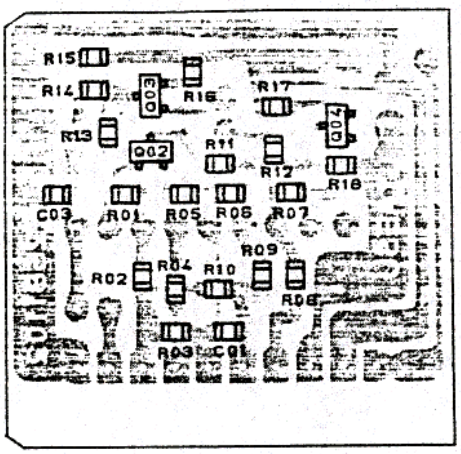
12. S-Meter Threshold

Reduce the SSG output to +10dB, and adjust VR2002 so that just the first two segments are lit. If too many segments remain lit, turn VR2002 fully CCW and then readjust it more slowly.

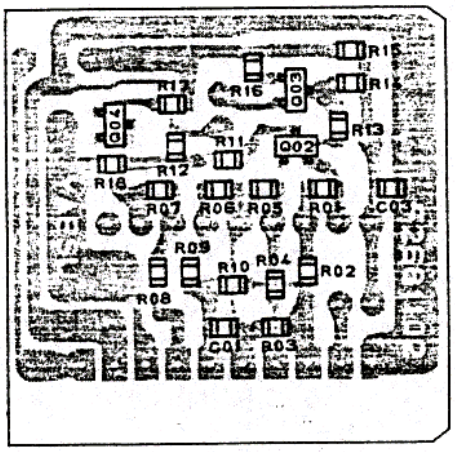
RF AGC UNIT PARTS LAYOUT



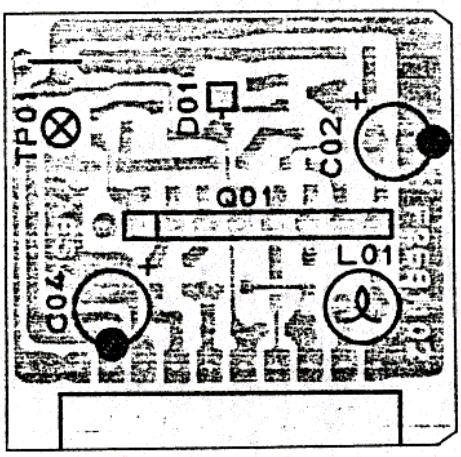
(obverse view of "component" side)



(reverse view of "chip-only" side)



(obverse view of "chip-only" side)



(reverse view of "component" side)

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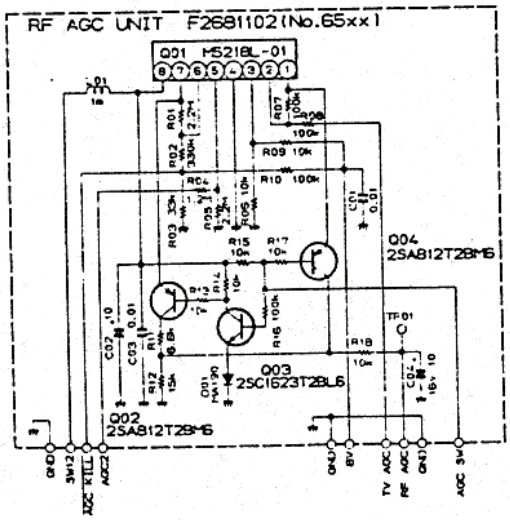
5604 EE Eindhoven

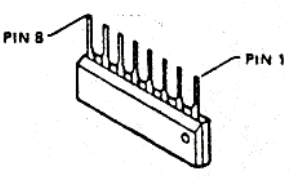


NOTE: ALL RESISTOR VALUES ARE IN Ω, 1/10W.
ALL CAPACITOR VALUES ARE IN μF, 50WV.
ALL INDUCTOR VALUES ARE IN H UNLESS OTHERWISE NOTED.

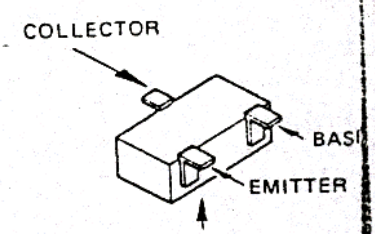
VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	REMARK
Q6501	3.9	3.9	3.9	0	2.8/2.9	2.2/3.1	12.6/10.5	13.7	SSB/0THE

	E	C	B	REMARKS
Q6502	12.6/10.5	12.6/10.5	11.8/9.8	SSB/0THERS
Q6503	0.7	0.8	1.4	
Q6504	3.9	8.6/7.2	12.5	SSB/0THERS



M5218L-01



Marked Surface
2SA812T2B (M6)
2SC1623T2B (L6)

C4003	K70140007	Tantalum 25WV 1µF (489D105x0025A1)
C4021	K40129012	Electrytic 16WV 10µF (ECE-A1CK100)
C4016	K40129038	" " 100µF (ECE-A1CK101)
		CONNECTORS
	P0090478	3094-07A
	P0090479	3094-08A
		TERMINAL POSTS
	Q5000036	TP-G
		SSB/AM UNIT
	F2681101	Printed circuit board
	C026811A	PCB with components
		FETs
Q4501, 4502, 4505	G4800730G	3SK73GR
		TRANSISTORS
Q4503, 4506–4508	G3316237F	2SC1623T2BL6
		DIODE QUAD
Q4504	G2090135	ND487C2-3R
		DIODES
D4503	G2070020	Si 1SS123T2B
D4501, 4502	G2090244	Schottky 1SS106
		THERMISTOR
TH4501	G9090022	SDT-09
		RESISTORS
R4502, 4510, 4511	J24205470	Chip RMC 1/10T 470J 47Ω
R4504, 4515, 4521, 4524, 4527, 4529, 4540	J24205101	" " 101J 100Ω
R4503, 4508	J24205471	" " 471J 470Ω
R4506, 4513, 4514 4516–4519, 4523, 4530, 4538	J24205102	" " 102J 1kΩ
R4520	J24205222	" " 222J 2.2kΩ
R4501, 4505, 4507, 4509, 4525, 4526, 4535, 4539, 4542	J24205103	" " 103J 10kΩ
R4537	J24205183	" " 183J 18kΩ
R4541	J24205223	" " 223J 22kΩ
R4534	J24205333	" " 333J 33kΩ
R4531	J24205683	" " 683J 68kΩ
R4522, 4528	J24205154	" " 154J 150kΩ
R4512	J24205334	" " 334J 330kΩ
R4532, 4533	J24205474	" " 474J 470kΩ
R4536	J24205105	" " 105J 1MΩ
		CAPACITORS
C4513	K22170204	Chip 50WV 3pF CH (C2012CH1H030CFA)
C4527	K22170211	" " 10pF " (C2012CH1H100DFA)
C4503, 4509, 4533	K22170235	" " 100pF " (C2012CH1H101JFA)
C4530	K22170805	" " 0.001µF B (C2012B1H102KFA)
C4501, 4502, 4505, 4506, 4510, 4514, 4515, 4520, 4522, 4524, 4525, 4529, 4531, 4535	K22170817	" " 0.01µF B (C2012B1H103KFA)
C4528	K22171008	" " 0.047µF F (C2012F1H473ZFA)
C4504, 4507, 4508, 4512, 4516–4519, 4523, 4526, 4532, 4534, 4536	K22141904	" 25WV 0.1µF D (C3216D1E104MFA)
C4511, 4521	K40129012	Electrolytic 16WV 10µF (ECE-A1CK100)
		INDUCTORS
L4501-4503	L1190040	S-4 1mH
		CONNECTORS
	P0090477	3094-09A
	P0090480	3094-12A
		FILTER/CARRIER UNIT
	F2682102	Printed circuit board
	C026822A	PCB with components
		TRANSISTORS
Q5001, 5002	G3309451P	2SC945AP
Q5003, 5004	G3316237F	2SC1623T2BL6
		DIODES
D5001–5005	G2090237	Si MA190
D5006, 5007	G2090118	Schottky 1SS97
		CERAMIC RESONATORS
CO5001	H7900090 (H7900240)	CSB 453.5A2 (or R453.5C)
CO5002	H7900100 (H7900250)	CSB 456.5A2 (or R456.5C)
		CERAMIC FILTERS
CF5001	H3900041	CFM 455J1
CF5002	H3900371	CFW 455HT
		RESISTORS
R5011	J01215103	Carbon film 1/8W 10kΩ TJ
R5005	J24205000	Chip RMC 1/10T 000J 0Ω
R5002, 5008, 5015, 5017	J24205101	" " 101J 100Ω
R5013, 5020	J24205222	" " 222J 2.2kΩ
R5001, 5003, 5004, 5007, 5009, 5010	J24205472	" " 472J 4.7kΩ
R5006, 5012, 5014, 5018, 5021	J24205103	" " 103J 10kΩ
R5016, 5019	J24205394	" " 394J 390kΩ
		CAPACITORS
C5008, 5014	K22170227	Chip 50WV 47pF CH (C2012CH1H470JFA)
C5012	K22170235	" " 100pF " (C2012CH1H101JFA)
C5010, 5016	K22170243	" " 220pF " (C2012CH1H221JFA)

C5009, 5015	K22170245	" " 270pF " (C2012CH1H271JFA)
C5001-5006, 5011, 5017	K22171008	" " 0.047μF F (C2012F1H473ZFA)
C5007, 5013	K40179001	Electrolytic " 1μF (ECE-A1HK010)
		TRIMMER CAPACITORS
TC5001, 5002	K91000130	ECV-1ZW 60x60 60pF
		CONNECTORS
	P0090478	3094-07A
	P0090480	3094-12A

MODE/SCAN UNIT

	F2682103	Printed circuit board
	C026823A	PCB with components
		IC
Q5501	G1090088	MC14028BCP
		TRANSISTORS
Q5511, 5513	G3108127F	2SA812T2BM6
Q5504	G3309451P	2SC945AP
Q5502, 5503, 5505-5510, 5512, 5514-5517	G3316237F	2SC1623T2BL6
		DIODES
D5501-5513	G2090237	Si MA190
		RESISTORS
R5503, 5507, 5508, 5510, 5512, 5523, 5536, 5538	J24205000	Chip RMC 1/10T 000J 0Ω
R5515, 5521, 5526	J24205101	" " 101J 100Ω
R5506	J24205102	" " 102J 1kΩ
R5514, 5517, 5520, 5527	J24205472	" " 472J 4.7kΩ
R5501, 5502, 5504 5505, 5509, 5511, 5513, 5524, 5528-5532, 5534, 5535, 5541, 5543	J24205103	" " 103J 10kΩ
R5540	J24205153	" " 153J 15kΩ
R5533	J24205104	" " 104J 100kΩ
R5516, 5518, 5522, 5525	J24205334	" " 334J 330kΩ
R5539	J24205105	" " 105J 1MΩ
R5537, 5542	J24205225	" " 225J 2.2MΩ
R5544	J01215564	Carbon film 1/8W 560kΩ TJ
		POTENTIOMETERS
VR5502	J50764103	H0622A 10kB 10kΩB
VR5501	J50764473	H0622A 47kB 47kΩB
		CAPACITORS
C5519	K13179008	Ceramic 50WV 0.01μF F (DD106F103Z50)
C5501, 5503, 5512 5514-5516	K22170817	Chip 50WV 0.01μF B (C2012B1H103MFA)
C5517	K22171008	" " 0.047μF F (C2012F1H473ZFA)
C5518	K22141904	" 25WV 0.1μF D (C3216D1E104MFA)
C5504-5506, 5508-5511	K40179001	Electrolytic 50WV 1μF (ECE-A1HK010)
C5502, 5507, 5513	K40129012	" 16WV 10μF (ECE-A1CK100)
		INDUCTORS
L5501, 5502	L1190017	FL5H-102K 1mH
		CONNECTORS
	P0090479	3094-08A
	P0090477	3094-09A

BAND UNIT

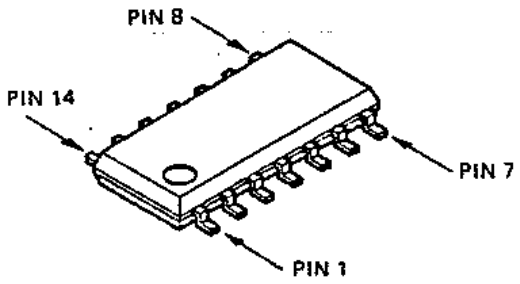
	F2681104	Printed circuit board
	C026814A	PCB with components
		IC
Q6001	G1090088	MC14028BCP
		TRANSISTORS
Q6002-6012	G3316237F	2SC1623T2BL6
		DIODES
D6001-6003	G2090237	Si MA190
		RESISTORS
R6012-6015	J01215103	Carbon film 1/8W 10kΩ TJ
R6007-6009	J01215334	" " " 330kΩ "
R6001, 6002	J24205000	Chip RMC 1/10T 000J 0Ω
R6003, 6004, 6016, 6017	J24205682	" " 682J 6.8kΩ
R6005, 6006, 6010, 6011	J24205103	" " 103J 10kΩ
		CAPACITOR
C6001	K22141904	Chip 25WV 0.1μF D (C3216D1E104MFA)
		INDUCTOR
L6001	L1190017	FL5H-102K 1mH
		CONNECTOR
	P0090477	3094-09A

RF AGC UNIT

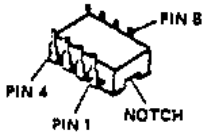
	F2681102	Printed circuit board
	C026812A	PCB with components
		IC
Q6501	G1090649	M5218L-01
		TRANSISTORS
Q6502, 6504	G3108127F	2SA812T2BM6
Q6503	G3316237F	2SC1623T2BL6
		DIODE
D6501	G2090237	Si MA190

04998-96496 W,C

		RESISTORS			
R6511	J24205682	Chip RMC 1/10T 682J 6.8kΩ			
R6506, 6509, 6513–6515, 6517, 6518	J24205103	" " 103J 10kΩ			
R6512	J24205153	" " 153J 15kΩ			
R6503	J24205333	" " 333J 33kΩ			
R6507, 6508, 6510, 6516	J24205104	" " 104J 100kΩ			
R6502	J24205334	" " 334J 330kΩ			
R6504	J24205125	" " 125J 1.2MΩ			
R6501, 6505	J24205225	" " 225J 2.2MΩ			
		CAPACITORS			
C6501, 6503	K22170817	Chip 50WV 0.01μF (C2012B1H103MFA)			
C6502	K40179014	Electrolytic " 10μF (50RE10)			
C6504	K40129012	" 16WV 10μF (ECE-A1CK100)			
		INDUCTOR			
6501	L1190017	FL5H-102K 1mH			
		CONNECTOR			
	P0090481	3094-10A			
		TERMINAL POST			
TP6501	Q5000036	TP-G			
		PHONE JACK UNIT			
	F2681103	Printed circuit board			
	C026813A	PCB with components			
		RESISTORS			
R7001, 7002	J01215101	Carbon film 1/2W 100Ω TJ			
		JACK/PLUG			
J7001	P1090435	HSJ0928-01-040			
7001 (with wire)	T9204997A				
		ACCESSORIES			
		ANTENNA			
	Q3000044	T-4144			
	R0102530	STAND A			
		DC POWER CORD			
	T9015799	FSK' 55-21-9.5			
		OPTIONAL AC-DC ADAPTER			
	D3000391	PA-4A 100VAC			
	D3000392	PA-4B 120VAC			
	D3000393	PA-4C 220-240VAC			



μPD4011BG



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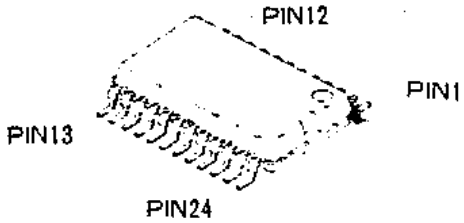

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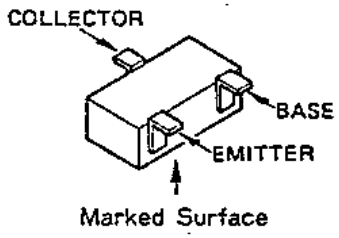

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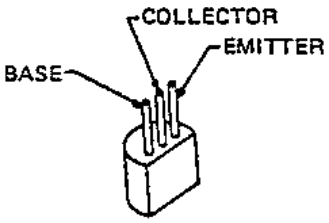
2SC1623T2B (L6)



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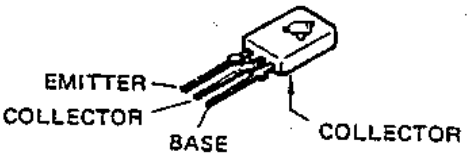
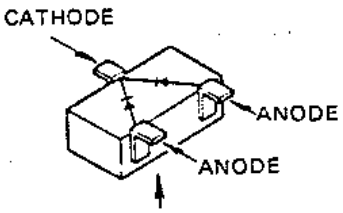


2SB772Q



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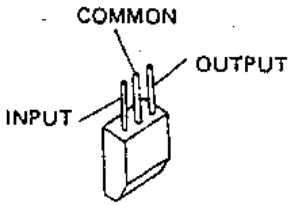
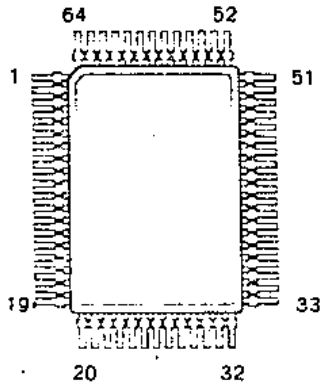


μPC78L05



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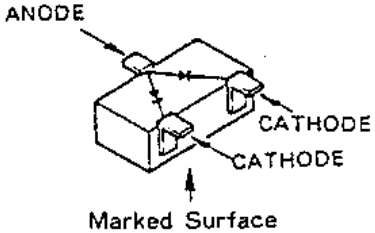
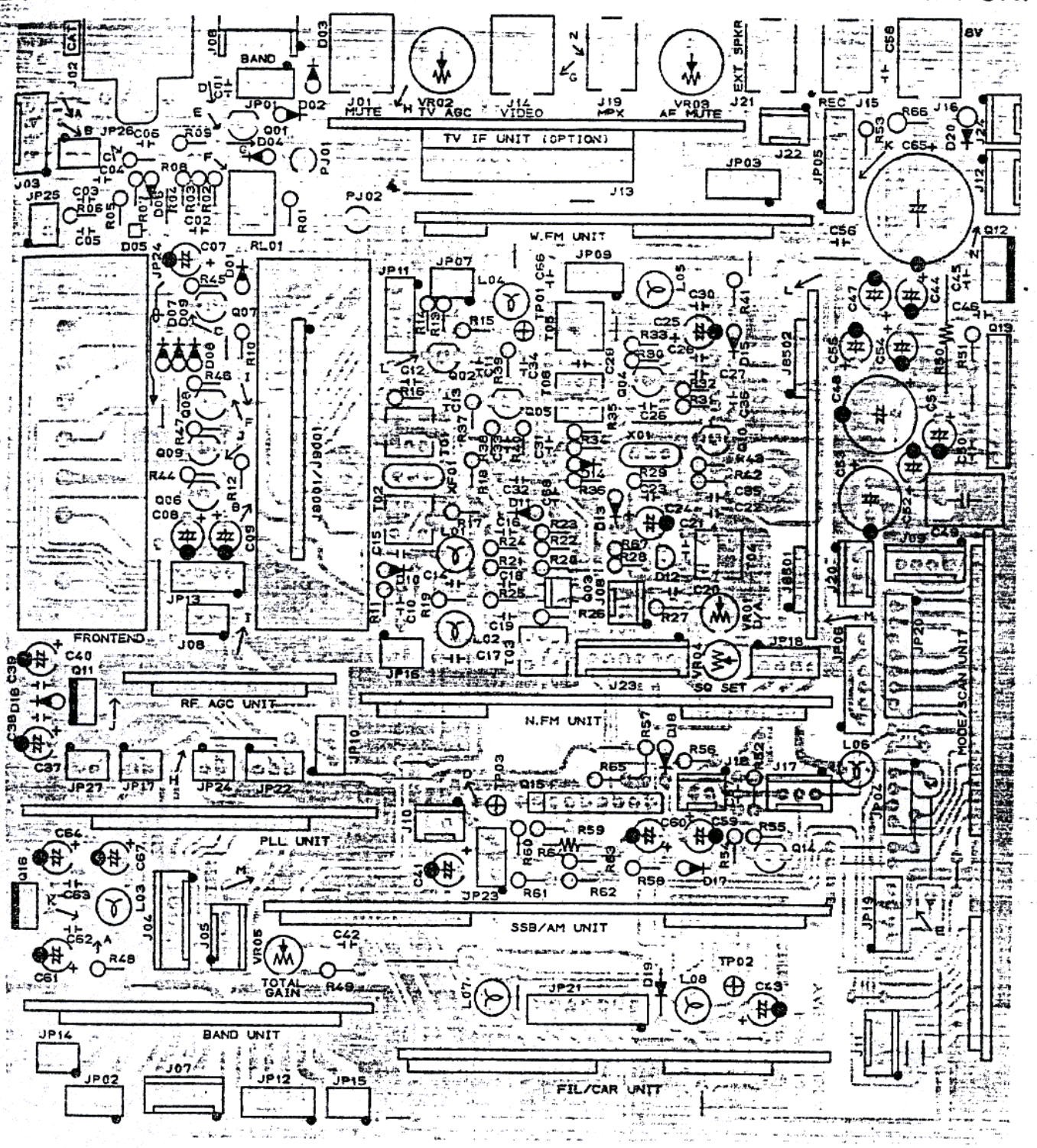


1S2836T2B (A4)

(viewed from component side)

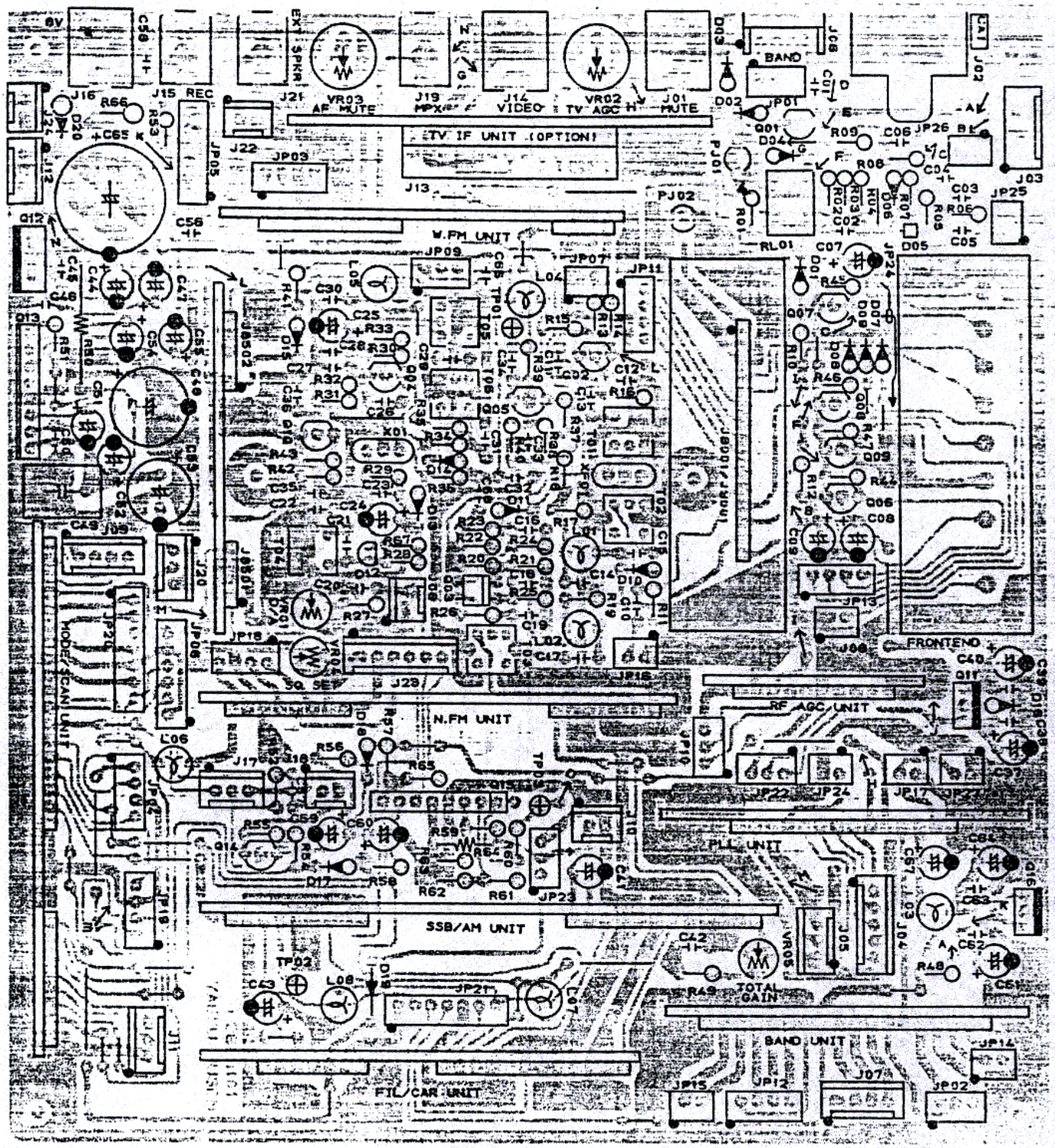
MAIN UNIT PA



	E(S)	C(D)	B(G1)	(G2)	REMARKS
Q1001	0.8/0	0.9/13.8	1.6/0		ATT SW OFF/ON
Q1002	3.5	7.6	4.2		
Q1003	1.9	7.4	1.8	2.5	
Q1004	2.2	7.2	2.6		
Q1005	3.3	7.6	4.1		
Q1006	8.0	7.9/0	7.2/8.0		Band VHF1/other Band
Q1007	8.0	8.0/0	7.3/8.0		UHF1/ 〃
Q1008	8.0	7.9/0	7.3/8.0		VHF3/ 〃
Q1009	8.0	7.9/0	7.3/8.0		VHF2/ 〃
Q1010	0	0	0.7		
Q1014	0	0	0.4/0.7		PLL LOCK/UNLOCK

T PARTS LAYOUT

(viewed from solder side)



SCHEMATHEEK
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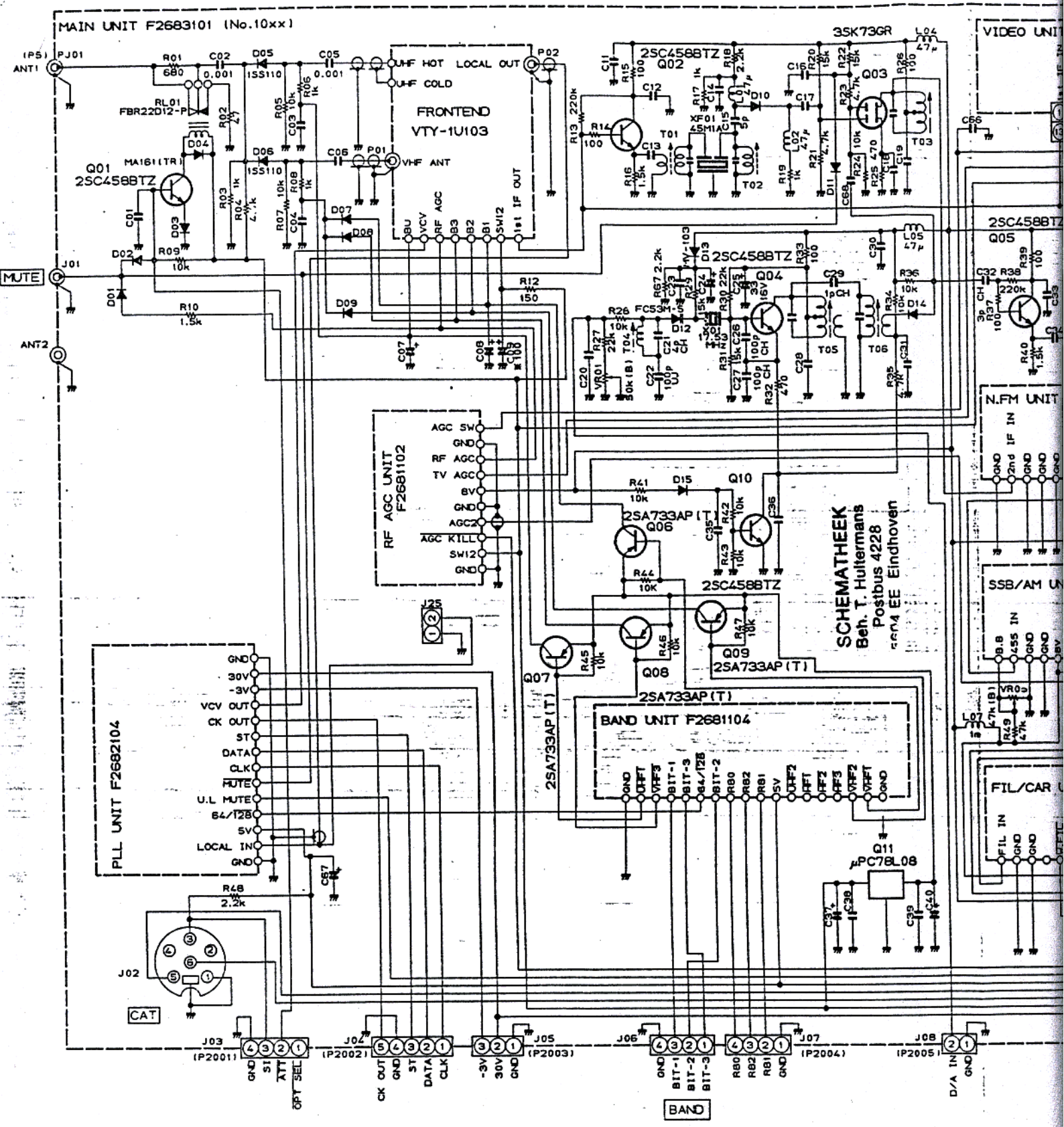
Postbus 4228
5604 EE Eindhoven

VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	REMARKS
Q1011	13.7	0	8.1						
Q1012	13.7	0	7.9						
Q1013	6.7	13.6	12.9	0	0	0	0.5	0.6	
Q1015	4.7	2.5	2.2	0	3.8	7.9	1.4	7.9	
Q1016	11.7/14.6	0	5.0						POWER SW ON/OFF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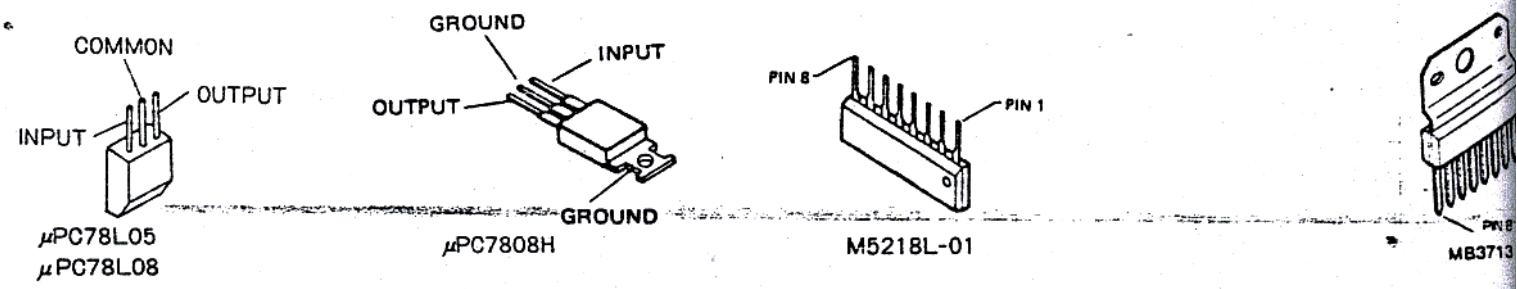
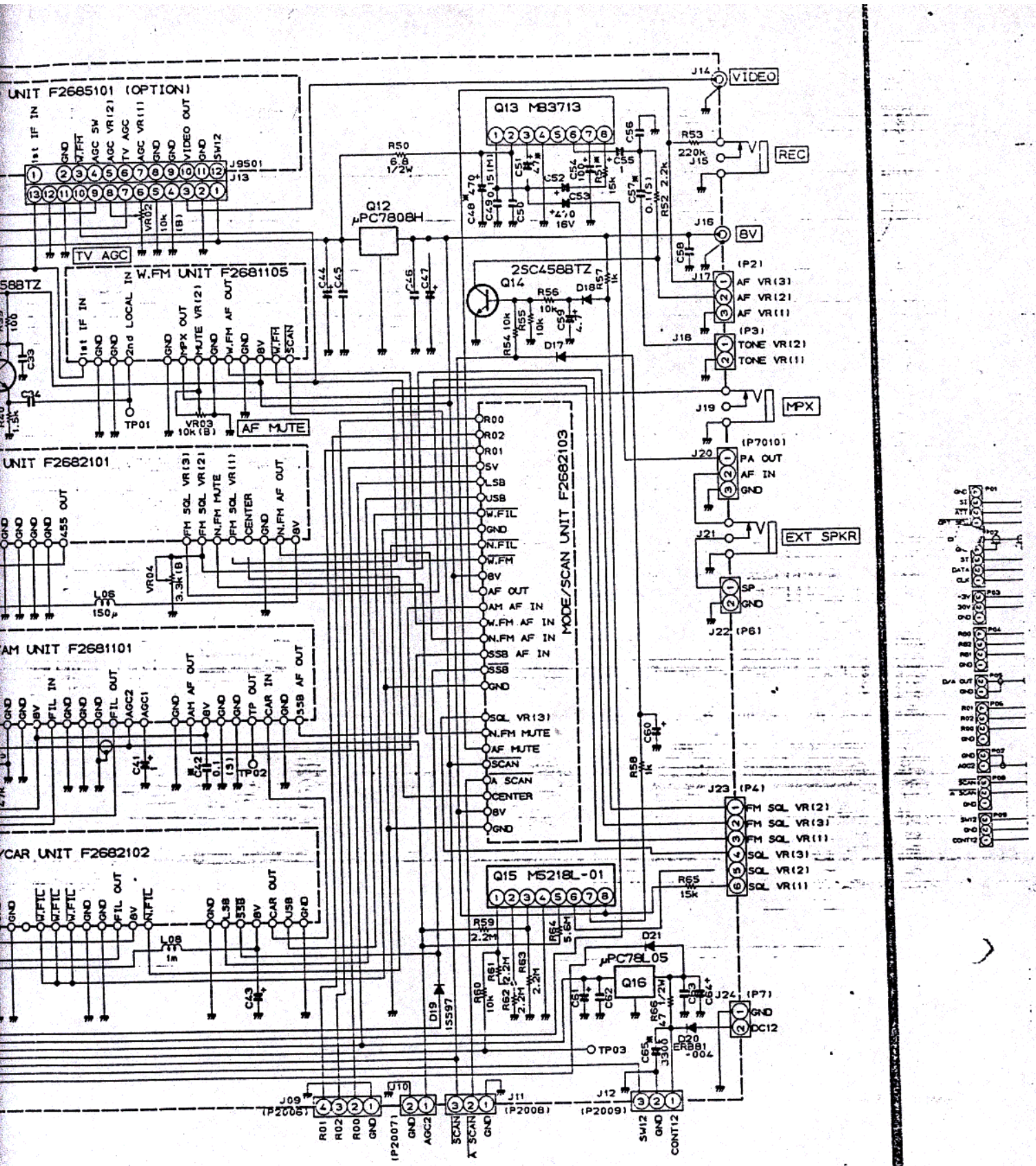
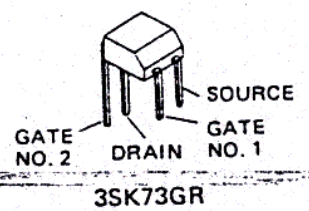
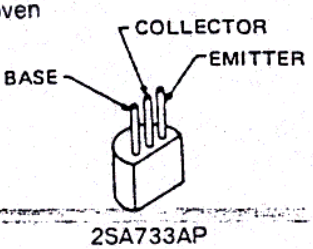
FRONTEND VTY-1U103
RF AGC UNIT F2681102
PLL UNIT F2682104
BAND UNIT F2681104
SCHEMATHEEK
Beh. T. Hultermans
Postbus 4228
5604 EE Eindhoven
CAT
BAND


COMMON
OUTPUT
INPUT
μPC78L05
μPC78L08
GROUND
INPUT
OUTPUT
GROUND
μPC7808H
PIN 8
PIN 1
M5218L-01
MB3713



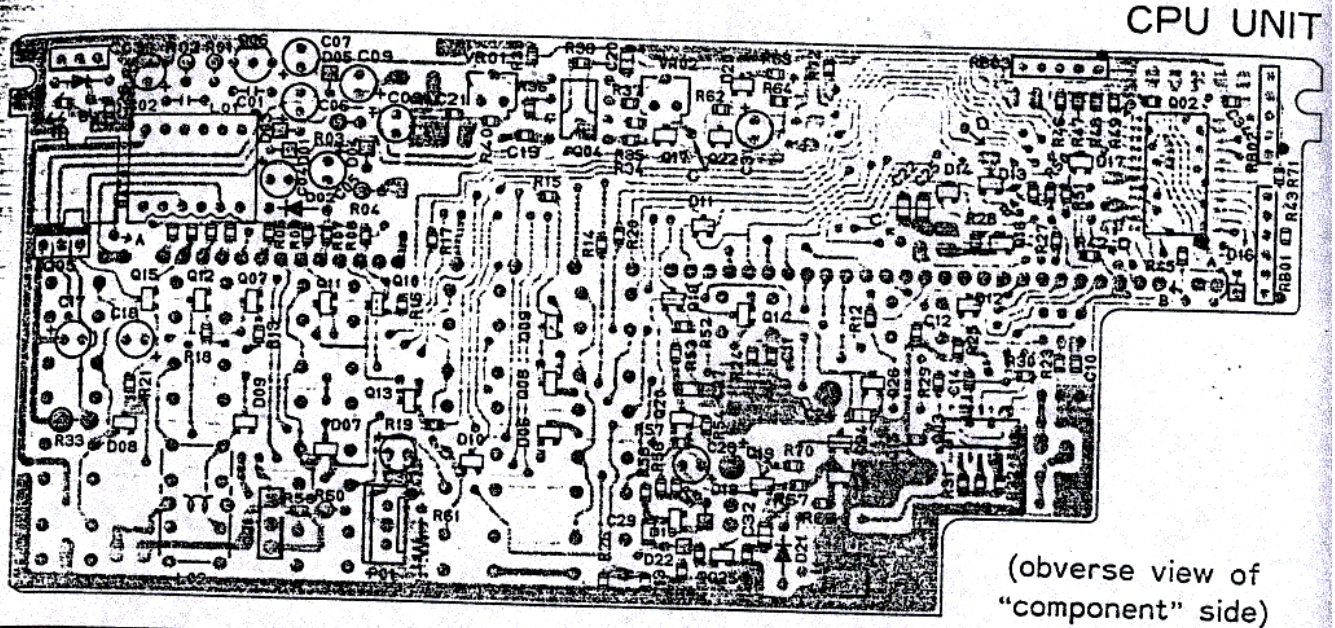


3SK73GR

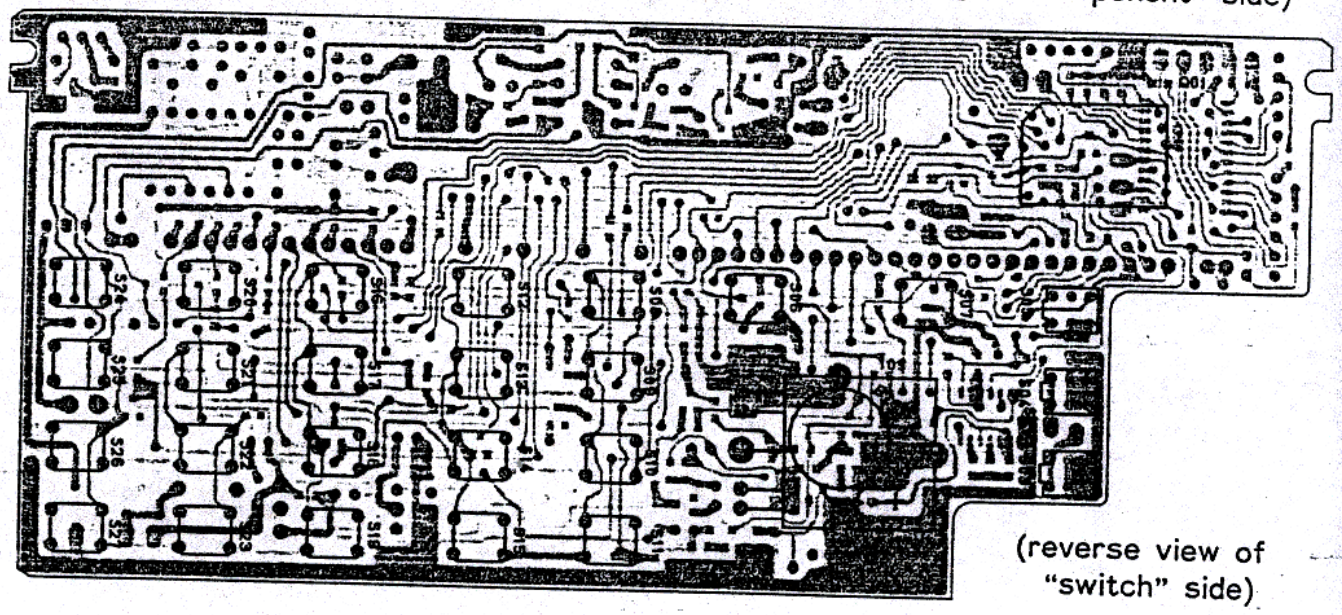


2SA733AP
2SC458B

CPU UNIT



(obverse view of "component" side)



(reverse view of "switch" side)

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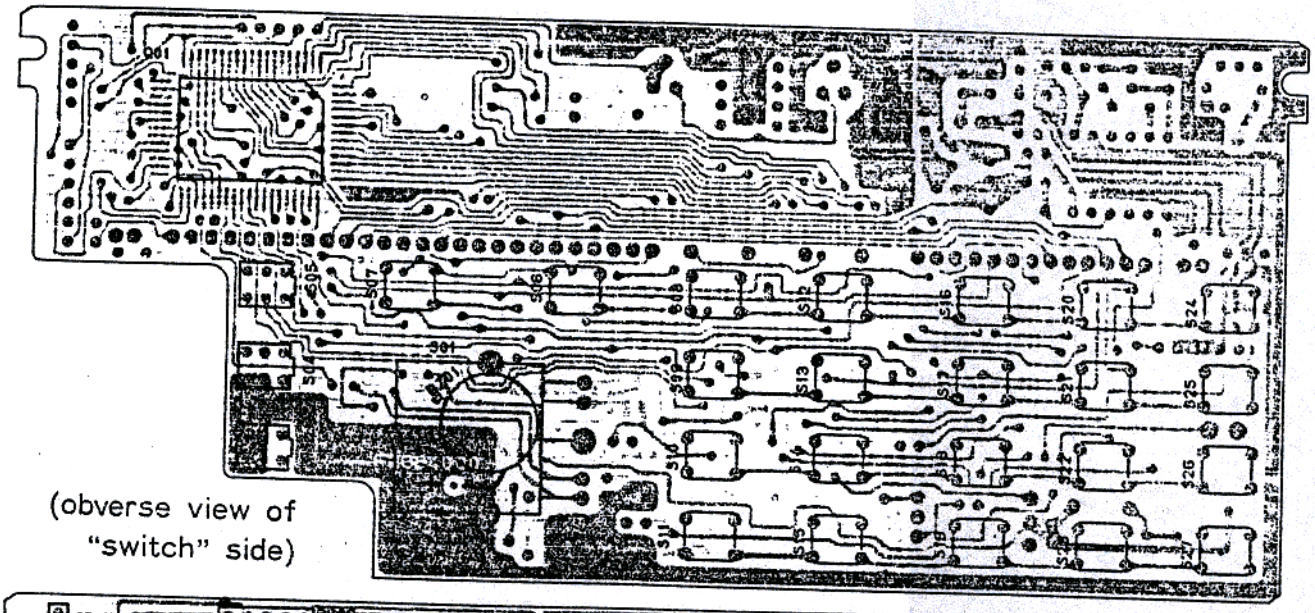
VOLTAGE CHART (DC VOLTS)

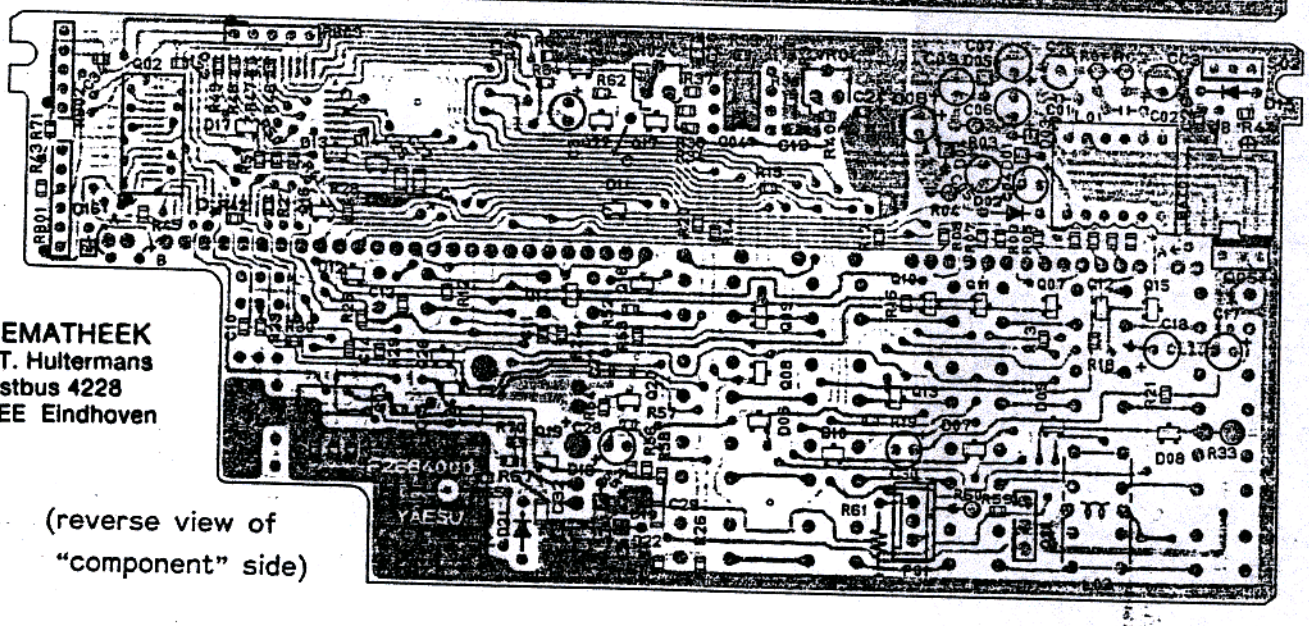
	E	C	B
Q2006	0	13.7	− 1.2
Q2007	−23.5	5.0	−23.5
Q2008	−11.9	5.0	−11.6
Q2009	−12.1	5.0	−11.9
Q2010	− 9.8	5.0	− 9.5
Q2011	−12.0	5.0	−11.8
Q2012	−12.0	5.0	−11.8
Q2013	−12.1	5.0	−11.8
Q2014	−23.9	5.0	−23.9
Q2015	−23.9	5.0	−23.9
Q2016	0	2.5	0.4

	E	C	B	REMARKS
Q2017	0	0	0.6	
Q2018	0	0	0.6	
Q2019	14.0/17.1	14.0/17.1	13.3/16.5	POWER SW ON/OFF
Q2020	0	13.4/16.5	0	〃 〃
Q2021	14.0/17.1	13.9/ 0.5	13.2/17.1	〃 〃
Q2022	0	0.1/ 0	0.6/ 0.2	〃 〃
Q2023	0	0	0.6	
Q2024	0	5.0/ 0	0	POWER SW ON/OFF
Q2025	0	0 / 0.6	0.6/ 0	〃 〃
Q2026	0	5.0/ 0	0 / 0.6	〃 〃

UNIT PARTS LAYOUT



(obverse view of "switch" side)



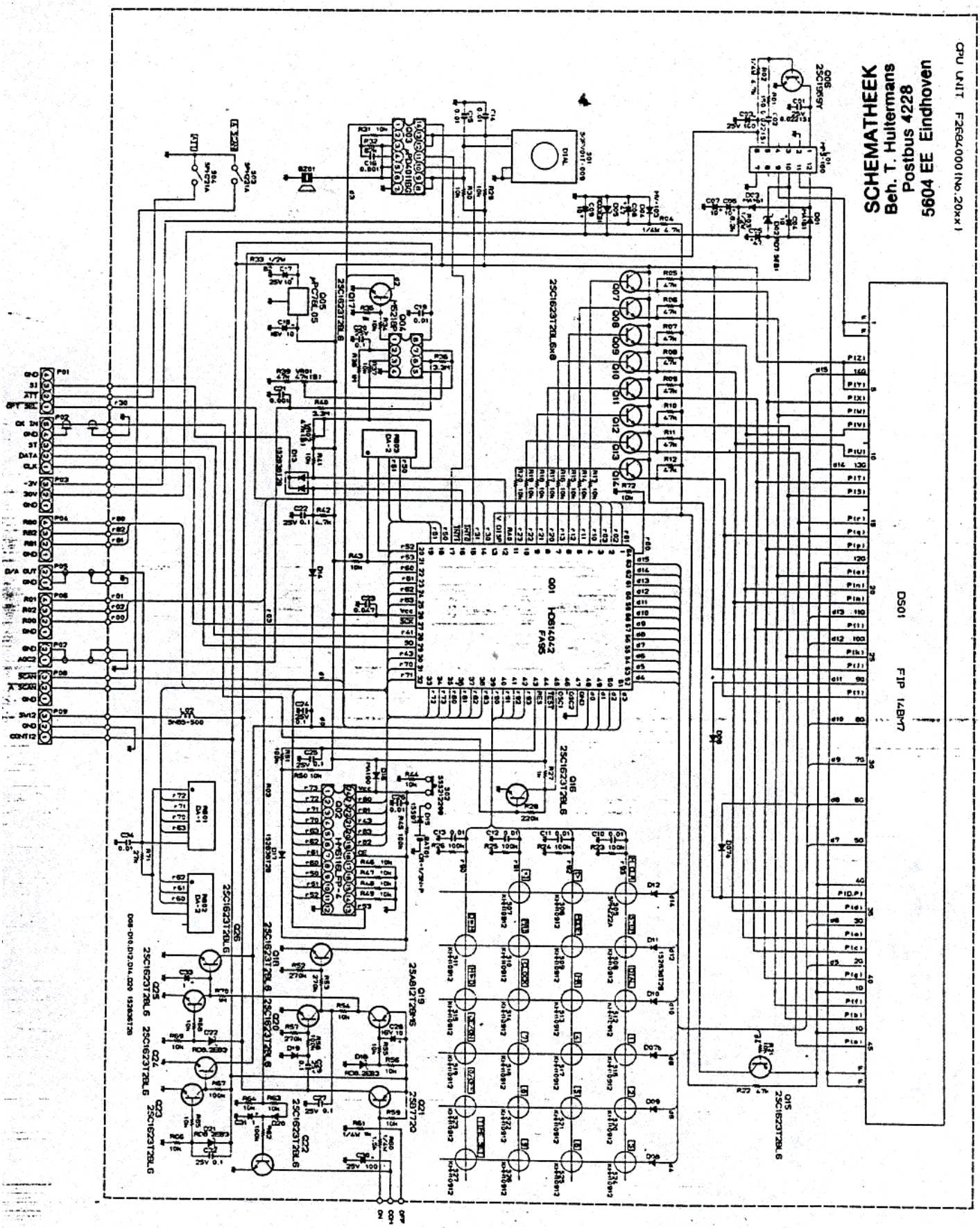
(reverse view of "component" side)

VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Q2001	0	0	4.8	−23.7	−11.6	−11.6	− 9.3	−11.6	−11.6	−11.6	−23.7	5.0	−26.2	5.0	0	5.0
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	0	4.6	0.1	0.1	0.1	0	0	0	0	5.0	5.0	0	0	5.0	0	0
	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
	5.0	0	5.0	5.0	0	5.0	0	0	0	0	0.5	5.0	2.5		0	5.0
	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
	5.0	0	0	−23.7	−23.7	−23.7	−23.7	−23.7	−23.7	−23.7	−23.7	−23.7	−23.7	−23.7	−23.7	4.8

	1	2	3	4	5	6	7	8	9	10	11	12	REMARKS
Q2002	0	5.0	0	0	0	0	0	0	4.6	0.1	0.1	0	
	13	14	15	16	17	18	19	20	21	22	23	24	
	0.1	0	0	0	0	0	0	5.0	5.0	5.0	5.0	4.1/2.9	Normal/Backup

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	REMARKS
Q2003	0	4.9	5.0	0	5.0	5.0	0	5.0	5.0	0	0	5.0	5.0	5.0	
Q2004	12.9	3.1	3.5	0	4.2	4.2	3.0	13.8							
Q2005	IN 10.9	COM 0	OUT 5.0												


CPU UNIT F2684000(No.20xx)
SCHEMATHEEK
Beh. T. Hultermans
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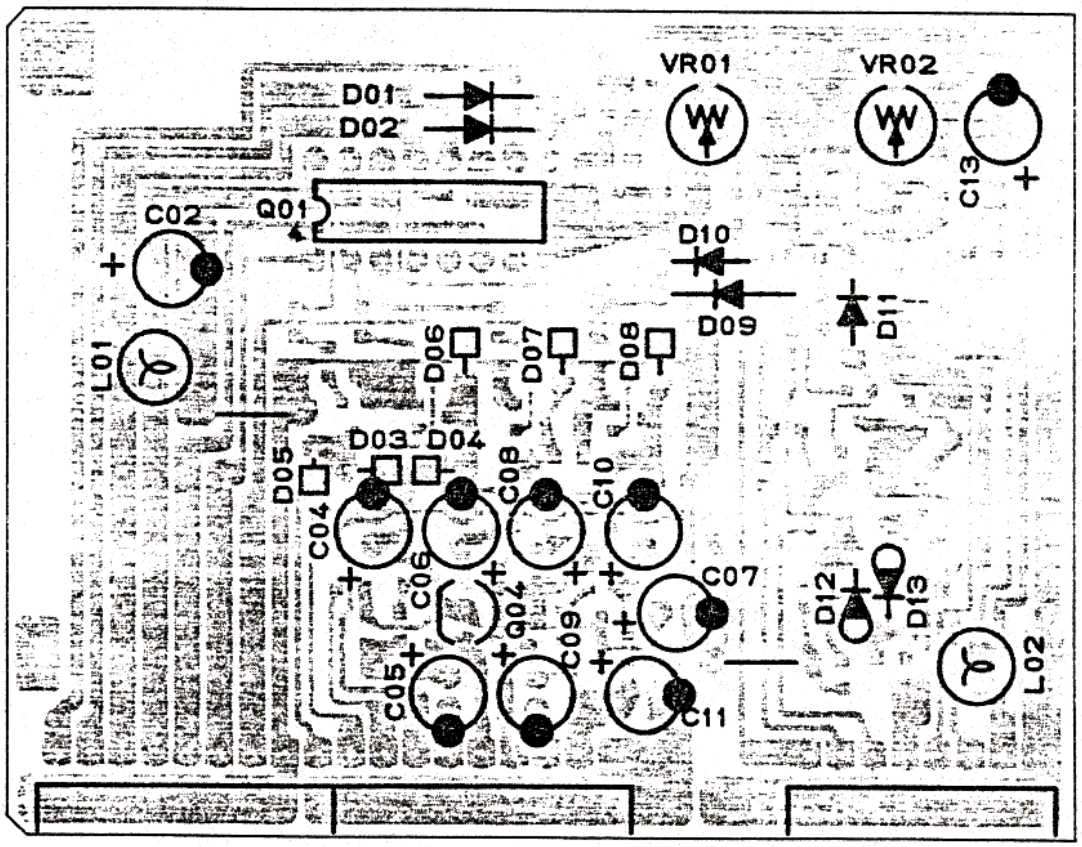
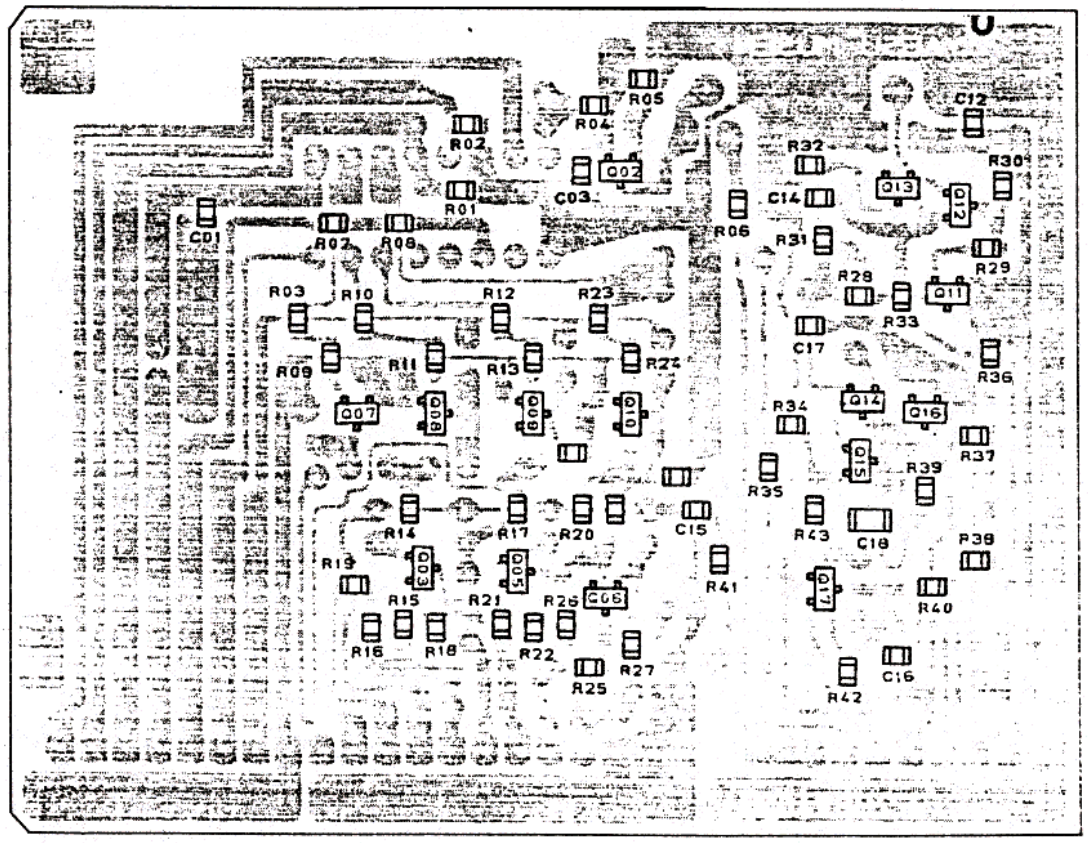
MODE, SCAN UNIT PARTS LAYOUT

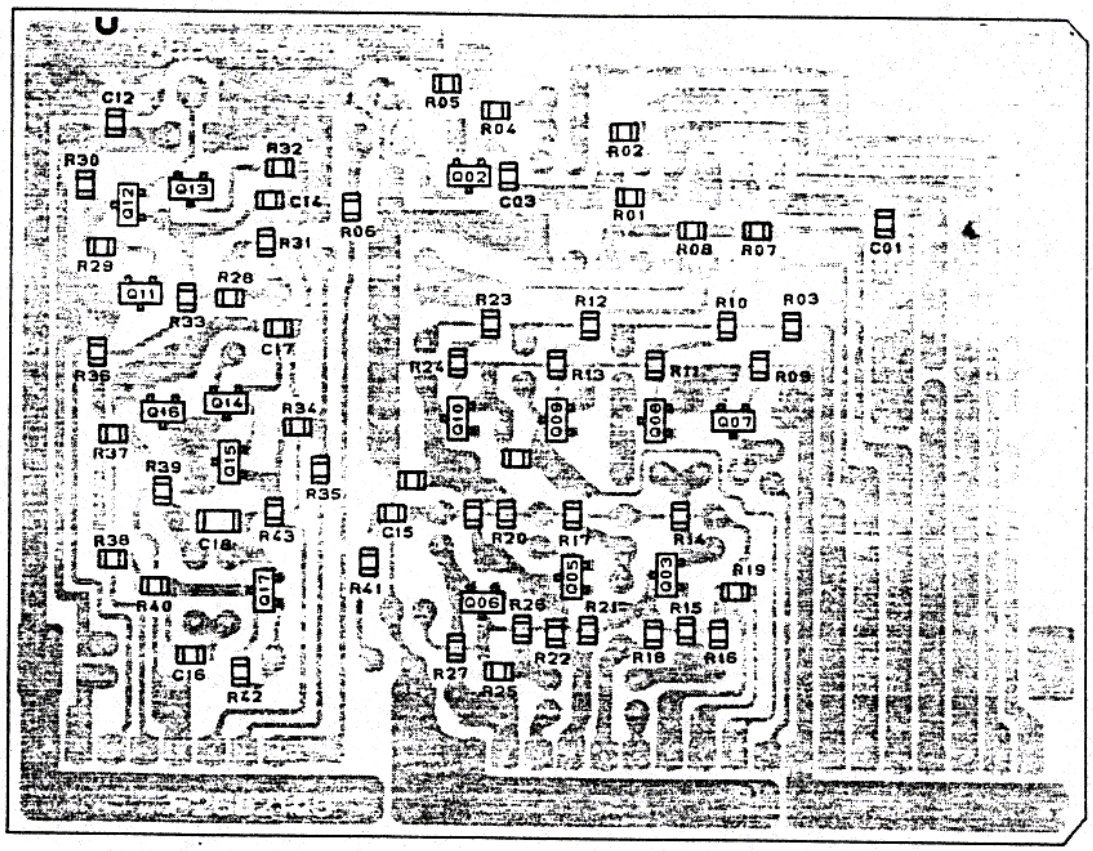


(obverse view of "component" side)

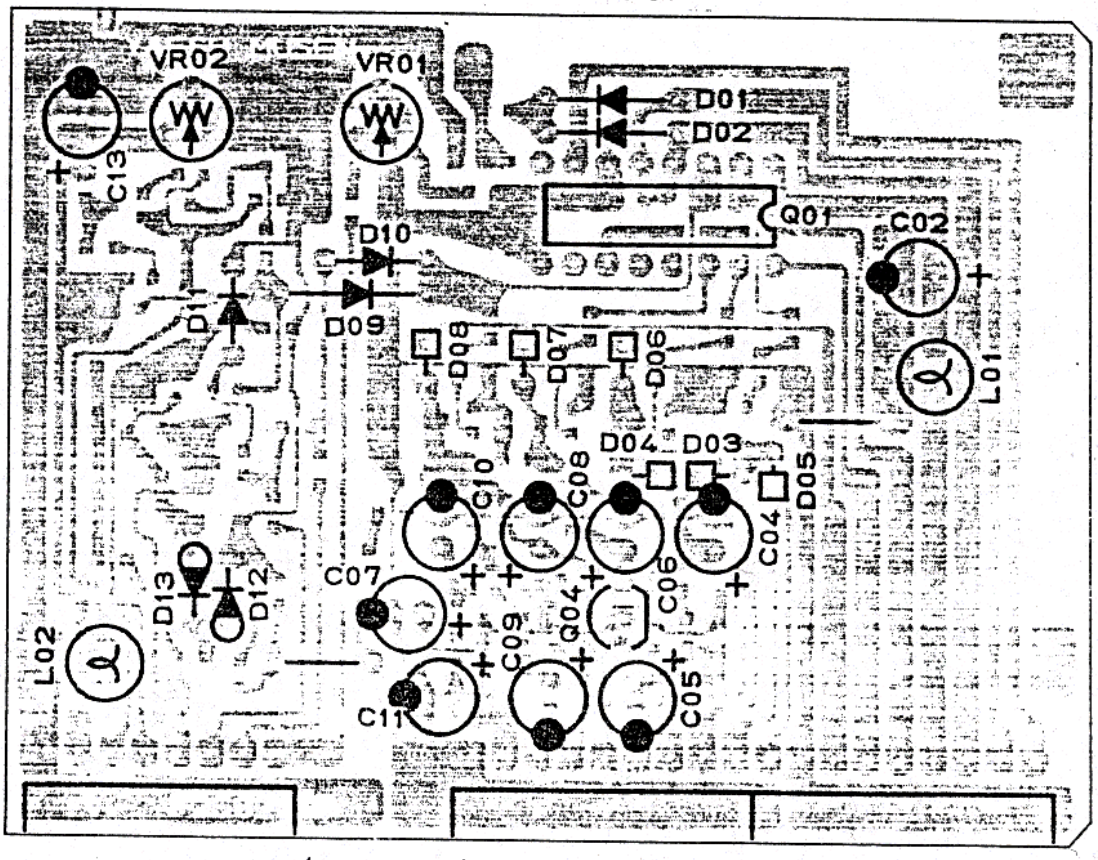


(reverse view of "chip-only" side)

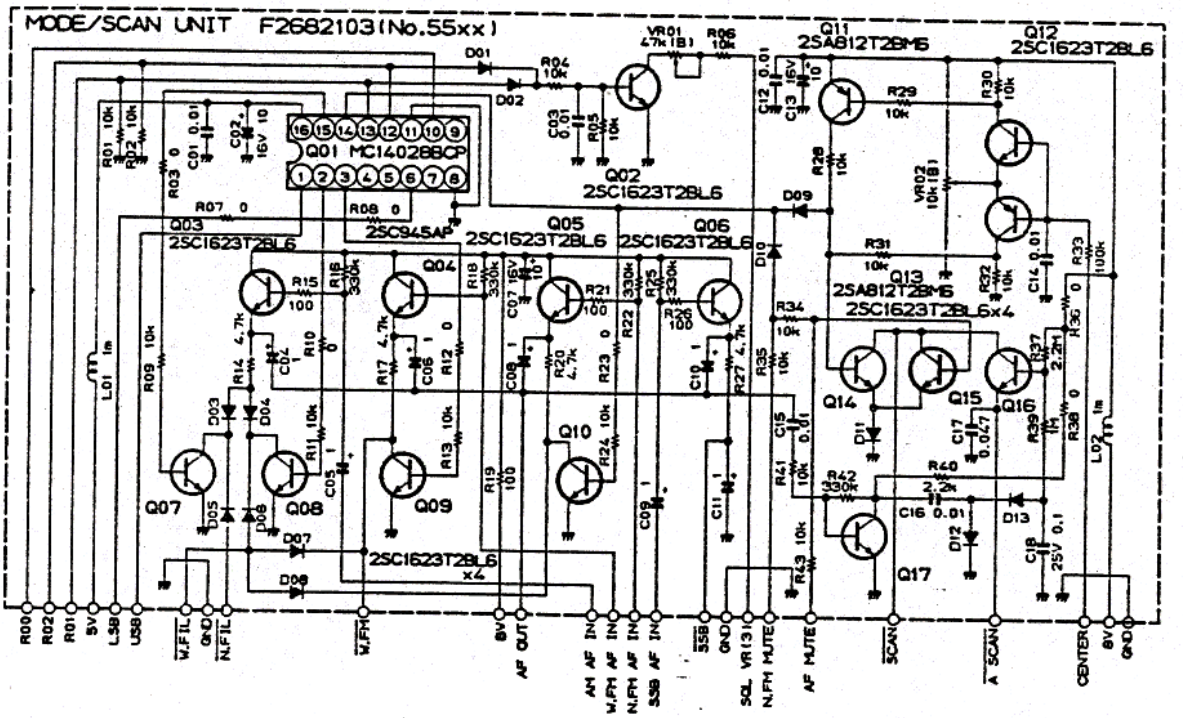
MODE. SCAN UNIT PARTS LAYOUT



(obverse view of "chip-only" side)



(reverse view of "component" side)

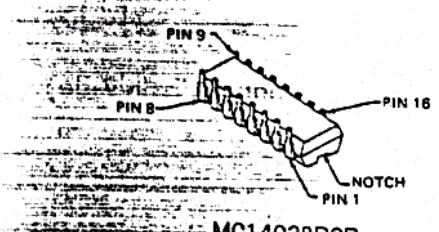


VOLTAGE CHART (DC VOLTS)

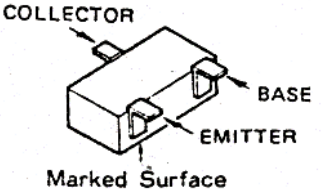
	Pin	VDC	REMARKS
Q5501	1	4.8/0	USB/other
	2	4.8/0	AM-W/other
	3	4.8/0	FM-W/ 〃
	4	0	
	5	0	
	6	4.8/0	LSB/other
	7	0	
	8	0	
	9	0	
	10	4.8/0	LSB·AM-N·FM-N/other
	11	0	
	12	4.7/0	SSB/other
	13	4.7/0	AM/other
	14	4.8/0	FM-N/other
	15	4.8/0	AM-N/other
	16	5.0	

	E	C	B	REMARKS
Q5502	0	7.8/0	0/0.6	FM /other
Q5503	6.1/7.5	7.7	6.6/7.5	AM / 〃
Q5504	5.9/7.5	7.7	6.4/7.5	FM-W/ 〃
Q5505	6.0/7.7	7.7	6.5/7.5	FM-N/ 〃
Q5506	6.0/7.5	7.7	6.5/7.5	SSB / 〃
Q5507	0	0/7.1	0.6/0	AM-N/ 〃
Q5508	0	0/7.1	0.7/0	AM-W/ 〃
Q5509	0	0/7.4	0.6/0	FM-W/ 〃
Q5510	0	0/7.4	0.7/0	FM-N/ 〃
Q5511	7.8	0	7.8	
Q5512	2.7	7.8	2.8	
Q5513	2.7	0	2.8	
Q5514	0.3/0.4(0.7)	5.0/5.0(0.7)	0	AF MUTE NORM/MUTING
Q5515	0.3/0.7	5.0/5.0(0.7)	0.6/0.9(1.3)	〃 〃
Q5517	0	2.6	0.6	

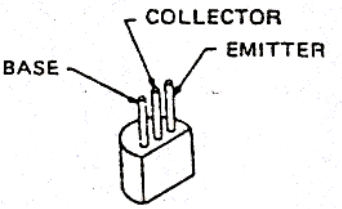
		LSB	USB	AM-N	AM-W	FM-N	FM-W	REMARKS
Q5516	E	2.5/0.7	2.5/0.7	1.8/0.7	0.3/0.4	0/0.7	0	SQ open/close
	C	5.0/0.7	5.0/0.7	5.0/0.7	5.0/0.7	5.0/0.7	5.0	〃
	B	2.7/1.2	2.7/1.2	1.9/1.1	0.5/0.6	−0.5/1.2	−0.4	〃



MC14028BCP

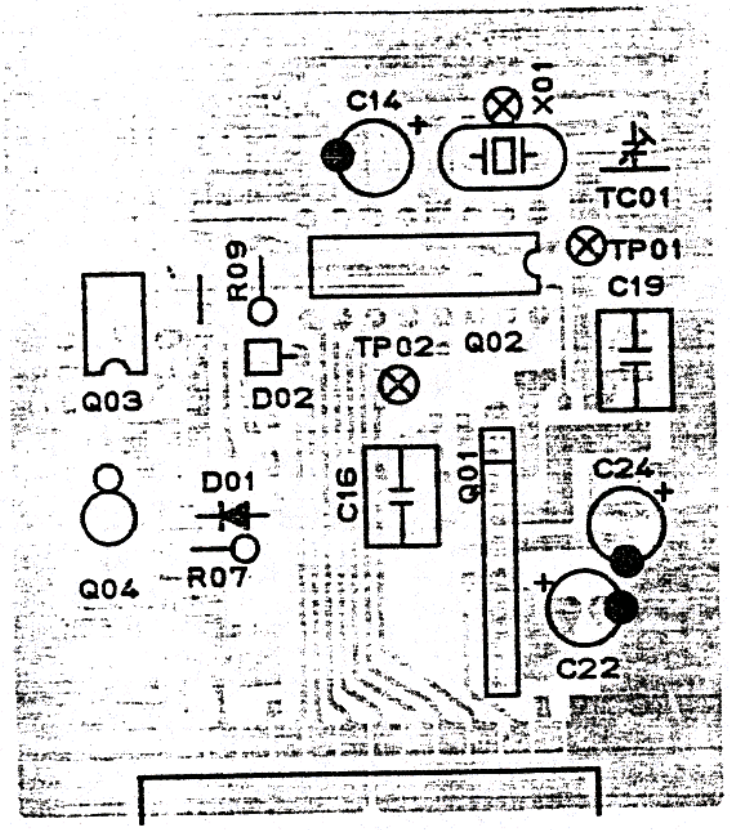


Marked Surface
2SA812T2B (M6)
2SC1623T2B (L6)

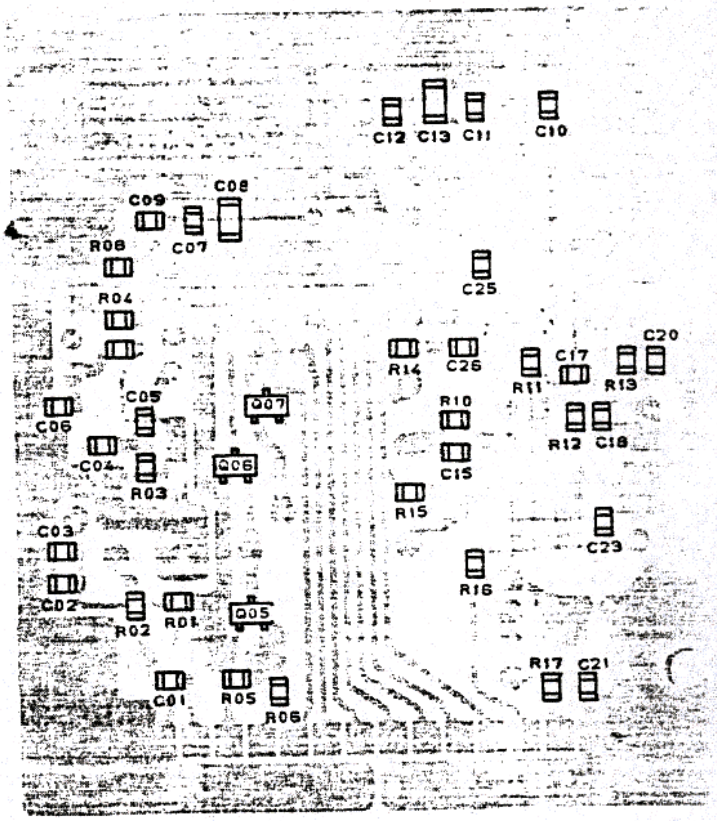


2SC945AP

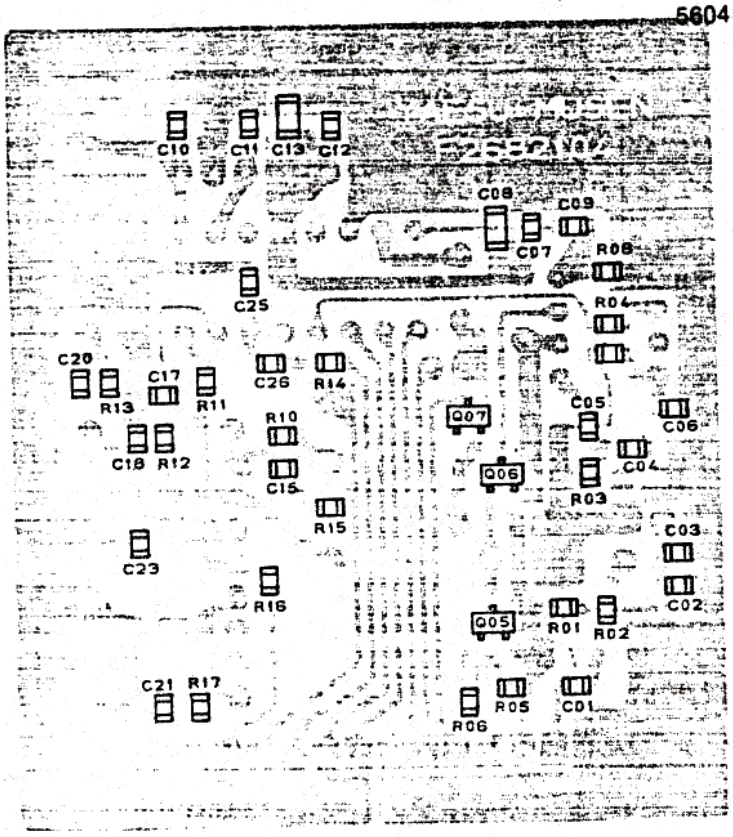
PLL UNIT PARTS LAYOUT



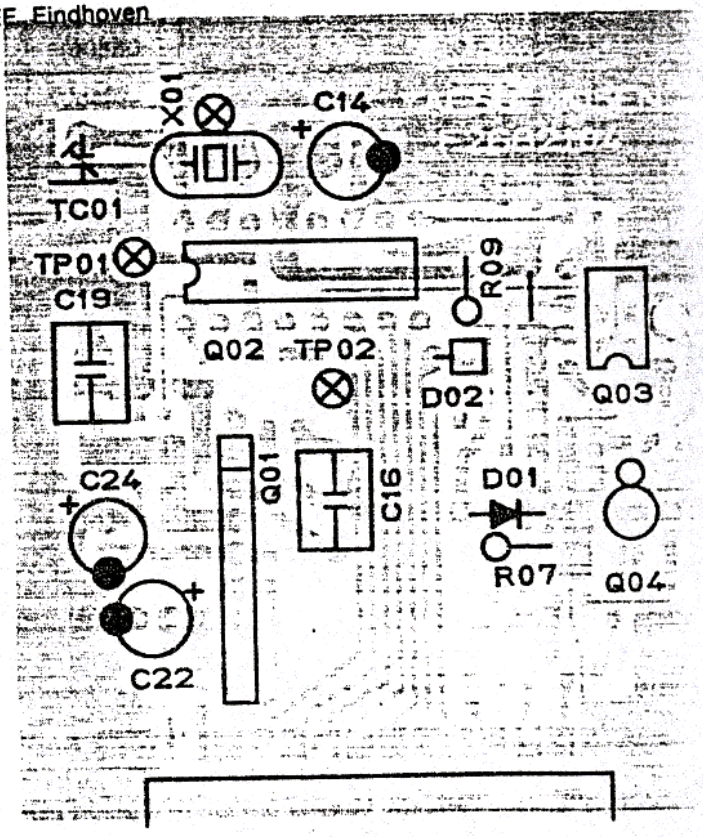
(obverse view of "component" side)



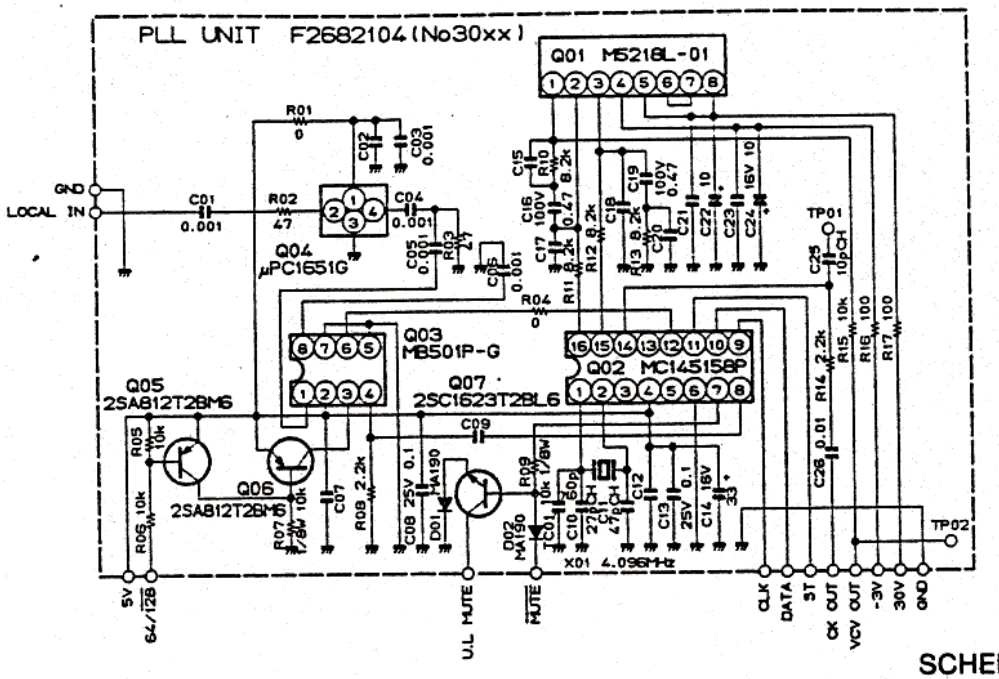
(reverse view of "chip-only" side)



(obverse view of "chip-only" side)



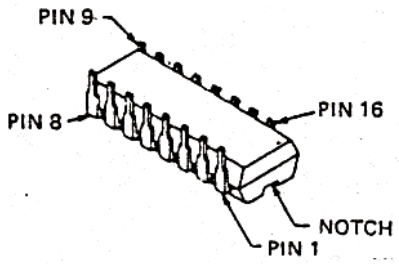
(reverse view of "component" side)



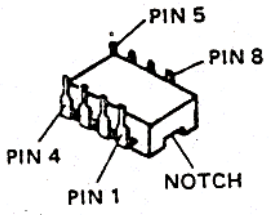
VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	REMARKS
Q3001	✡/12.2	4.9/4.2	4.9/4.4	−1.6/4.6	30.4/12.8	29.7/12.2	29.7/12.2	30.4/12.8	POWER SW ON/OFF
Q3003	2.1	4.6	4.6/0	2.3	0	✕	0	2.1	VHF1 · VHF2/VHF3 · UHF1
Q3004	4.9	0.9	0	2.9/3.1					POWER SW ON/OFF
Q3002	1.8	2.3	0	4.6	2.4/4.6	0	4.4/0	1.7/✕	
	9	10	11	12	13	14	15	16	
	5.0	0	0	✕	0	2.1	4.6	4.6/0	PLL LOCK/UNLOCK

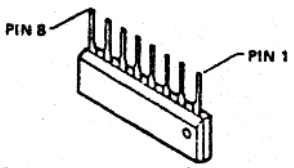
	E	C	B	REMARKS
Q3005	4.6	4.0/4.6	4.6/4.0	VHF1 · VHF2/VHF3 · UHF1
Q3006	4.6	4.6/0	4.0/4.6	〃 / 〃
Q3007	0.8/0/0.3	0.8/7.2/7.3	1.4/0/0.6	PLL LOCK/UNLOCK/MUTE



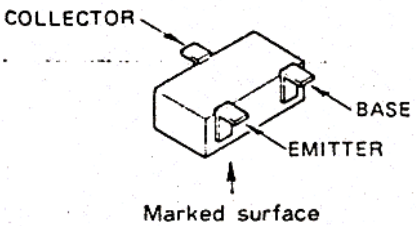
MC145158P



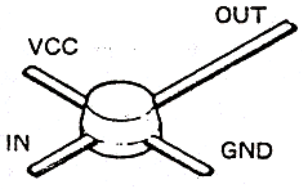
MB501P-G



M5218L-01

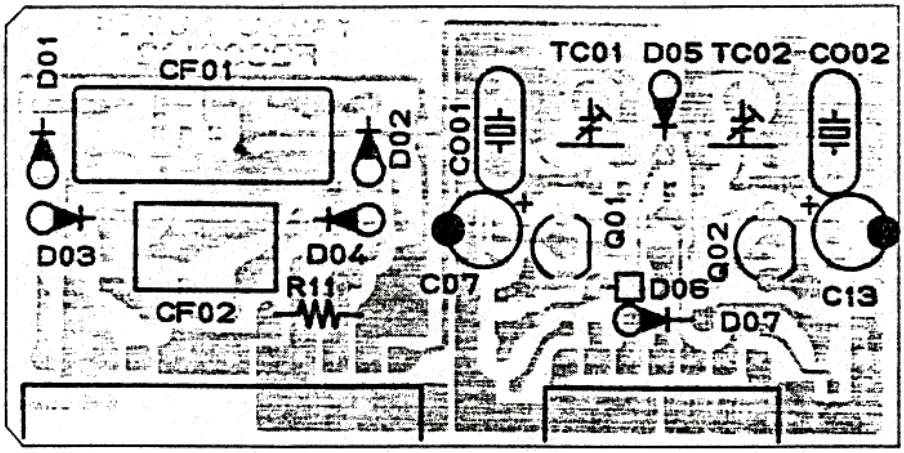


2SA812T2B (M6)
2SC1623T2B (L6)

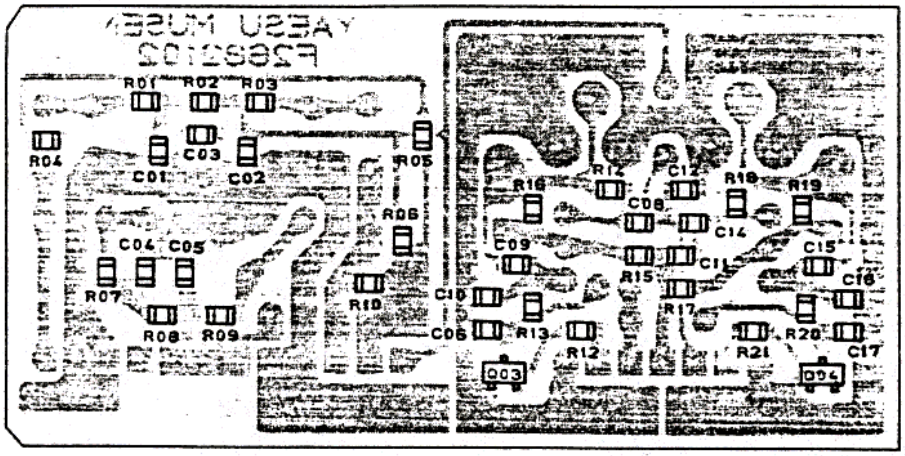


μPC1651G

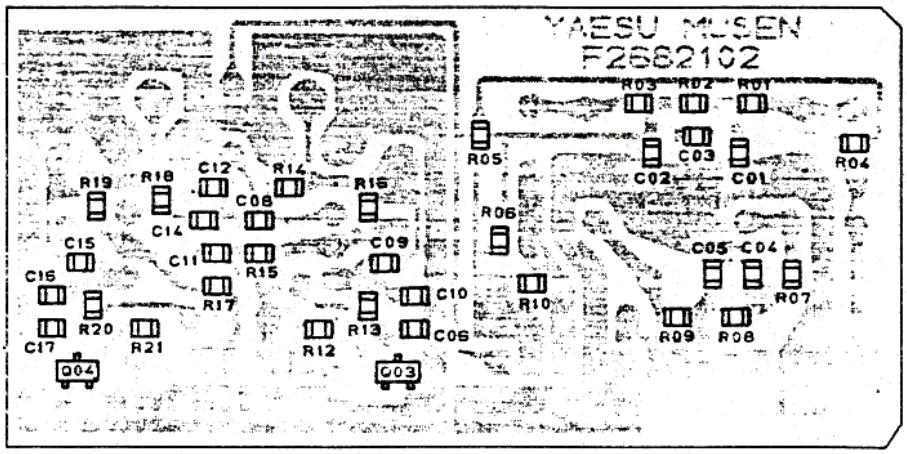
FILTER, CARRIER UNIT PARTS LAYOUT



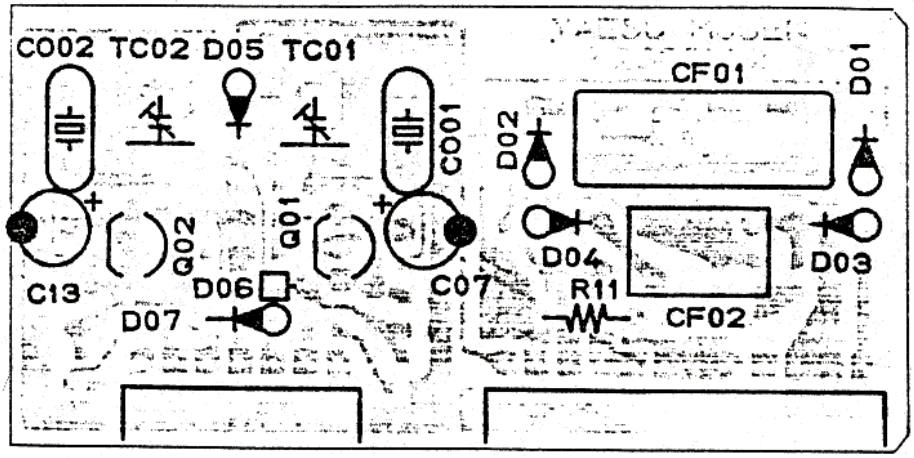
obverse view of "component" side



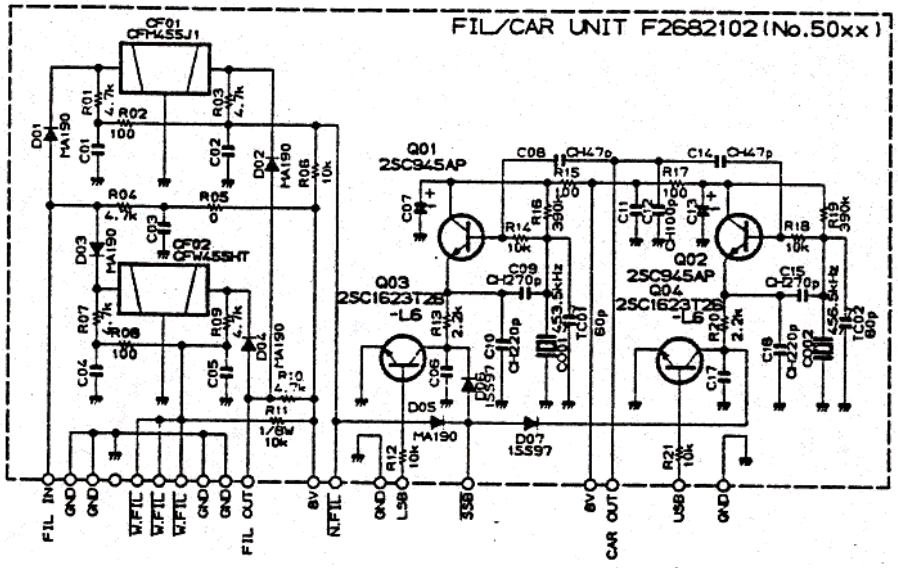
reverse view of "chip-only" side



obverse view of "chip-only" side



reverse view of "component" side



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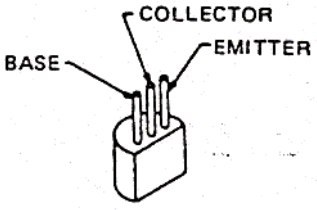
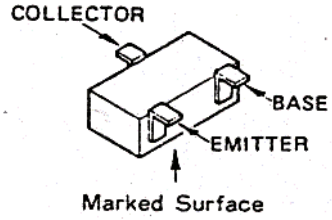
VOLTAGE CHART (DC VOLTS)

	E	C	B	REMARKS
Q5001	4.9/7.7/7.5	7.6/7.9/7.9	4.3/7.5/7.6	LSB / USB / OTHERS
Q5002	7.8/5.0/5.5	7.9/7.6/7.9	7.5/4.4/7.6	〃
Q5003	0	0/7.7/7.5	0.7/0/0	〃
Q5004	0	7.8/0/7.5	0/0.7/0	〃

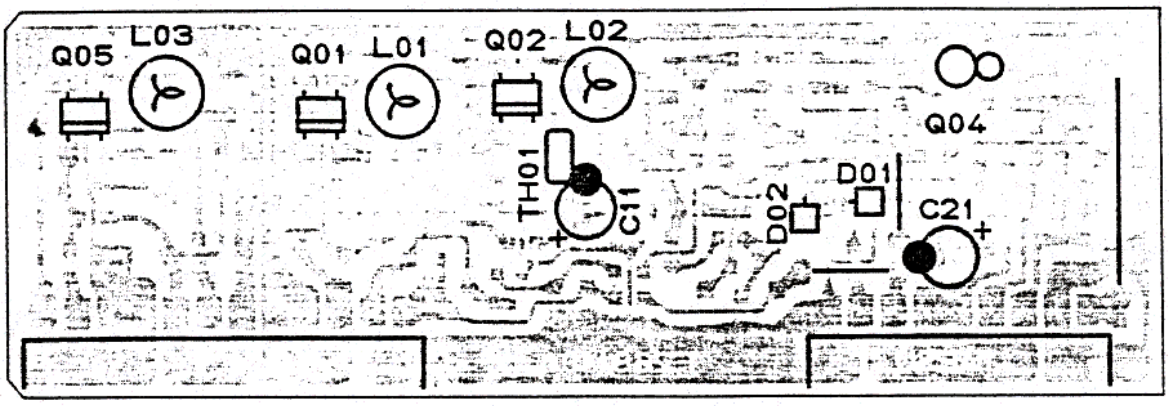


2SC945AP

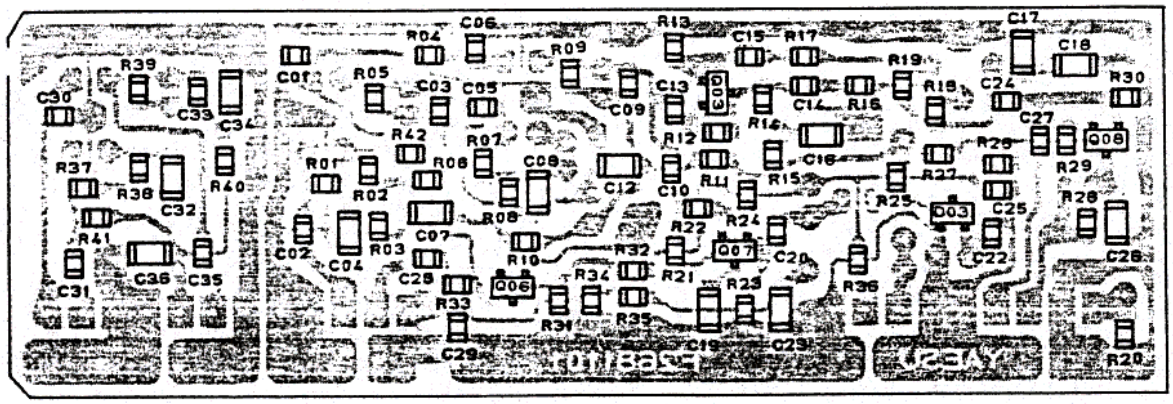


2SC1623T2B (L6)

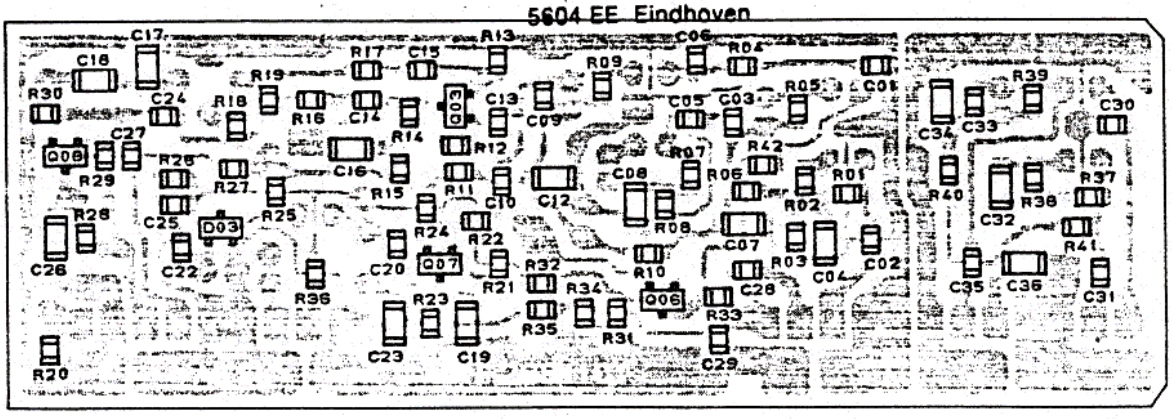
SSB, AM UNIT PARTS LAYOUT



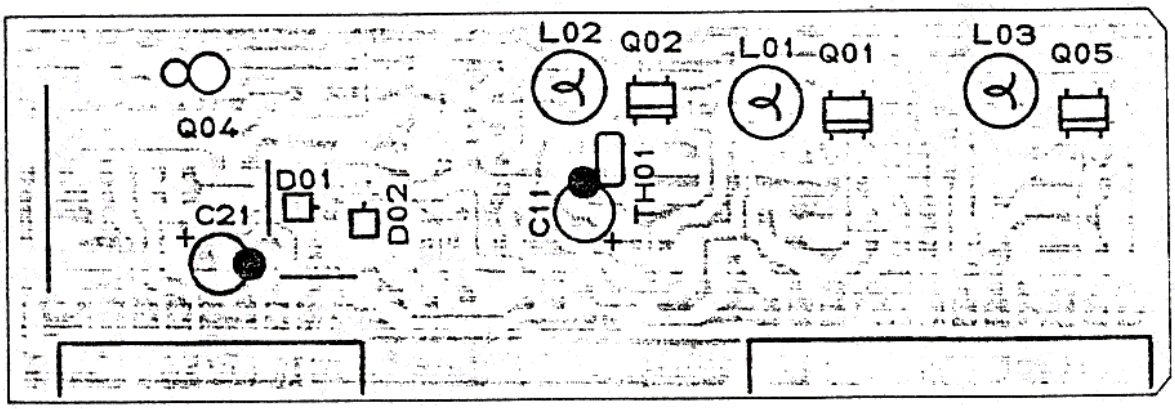
obverse view of "component" side



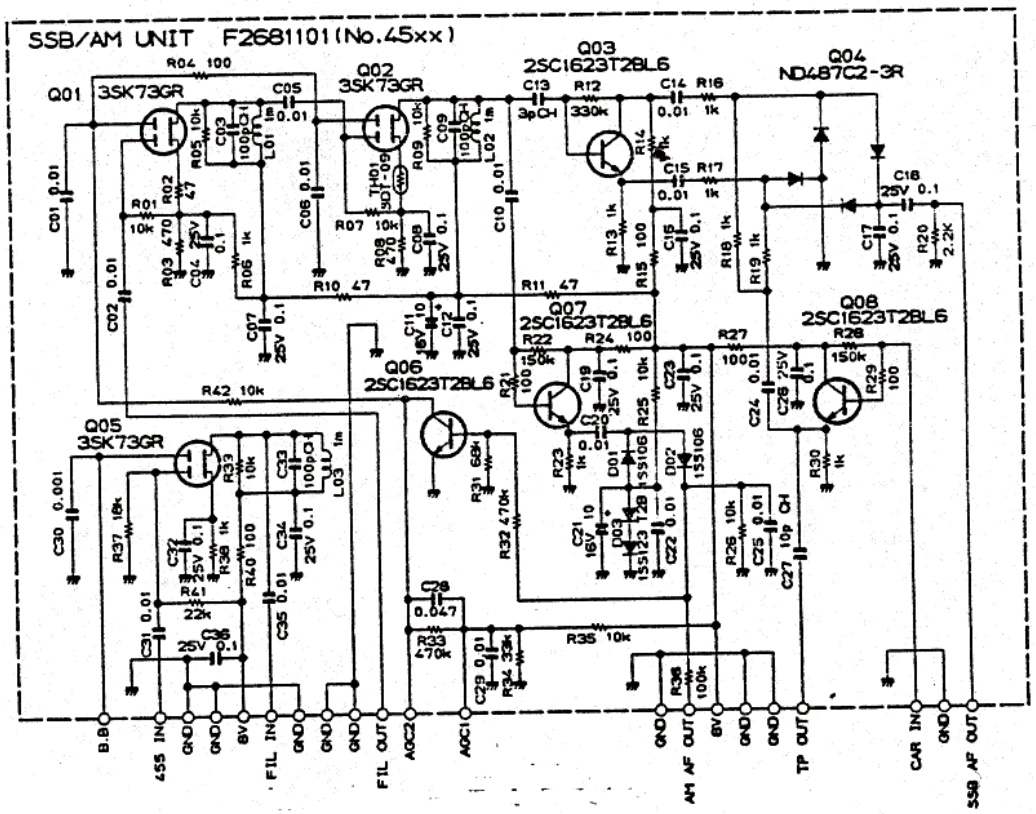
reverse view of "chip-only" side



obverse view of "chip-only" side

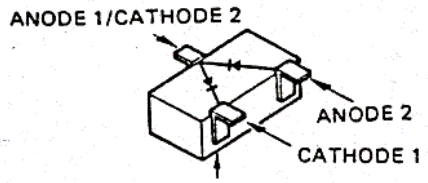


reverse view of "component" side



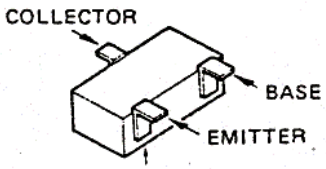
VOLTAGE CHART (DC VOLTS)

	E (S)	C (D)	B (G1)	(G2)
Q4501	2.0	7.1	1.7	4.5
Q4502	2.0	7.1	1.7	4.5
Q4503	2.3	5.0	2.9	
Q4505	2.2	7.4	3.4	2.0
Q4506	0	4.5	0.1	
Q4507	4.8	7.1	5.4	
Q4508	4.7	7.1	5.3	



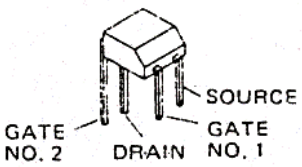
Marked Surface

1SS123T2B (A7)

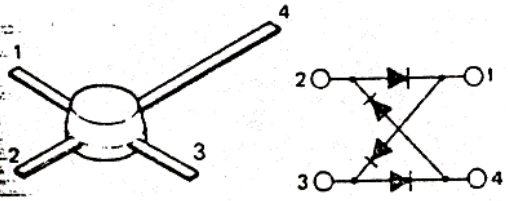


Marked Surface

2SC1623T2B (L6)

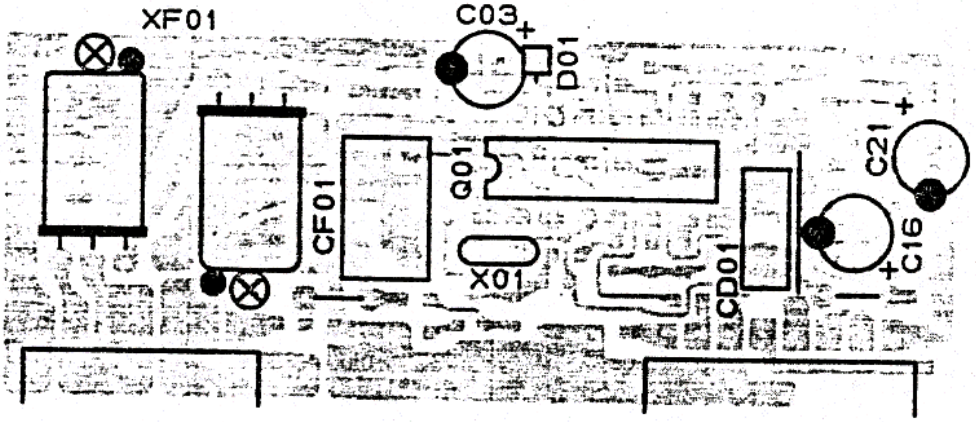


3SK73GR

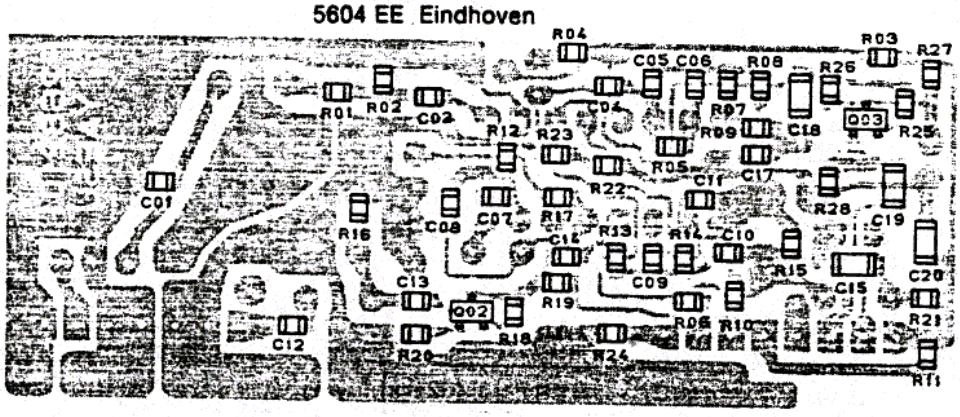


ND487C2-3R

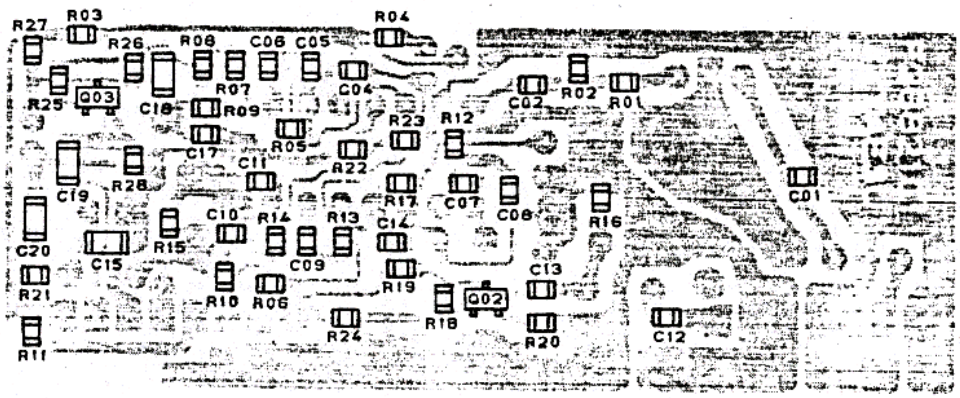
NARROW FM UNIT PARTS LAYOUT



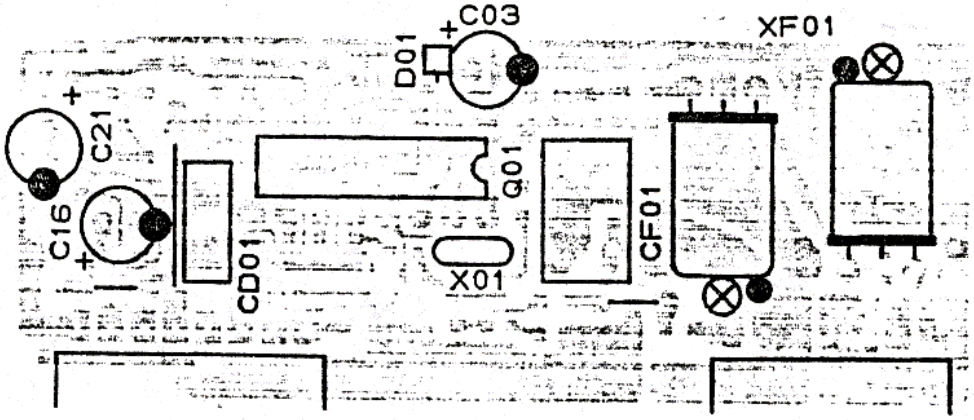
obverse view of "component" side



reverse view of "chip-only" side

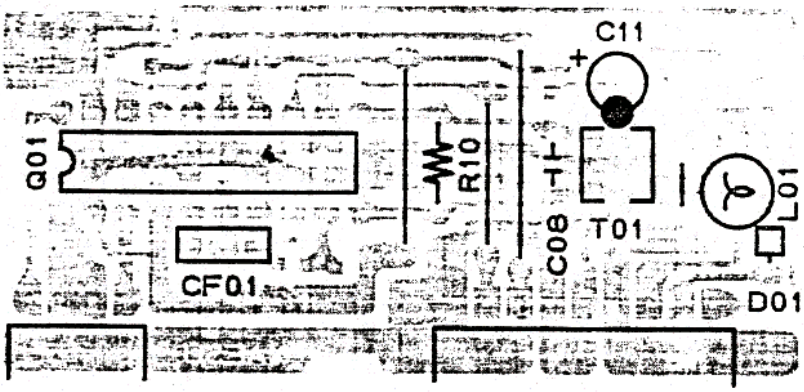


obverse view of "chip-only" side

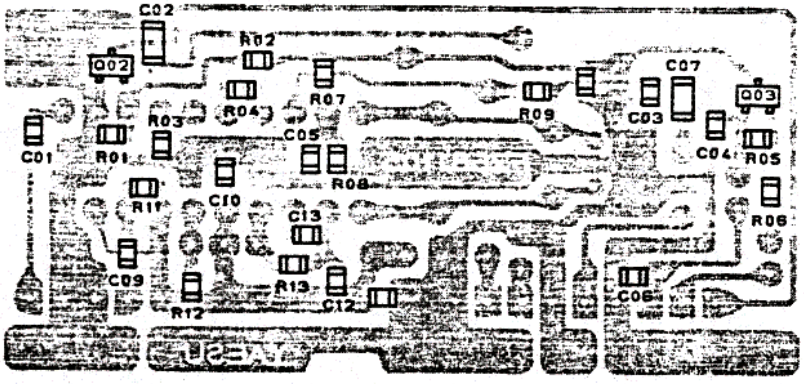


reverse view of "component" side

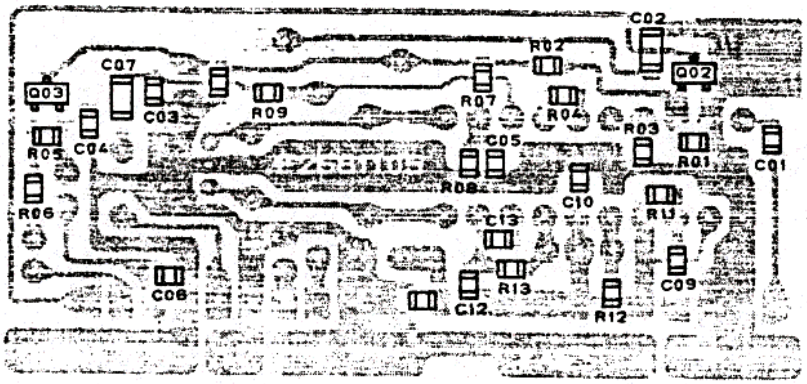
WIDE FM UNIT PARTS LAYOUT



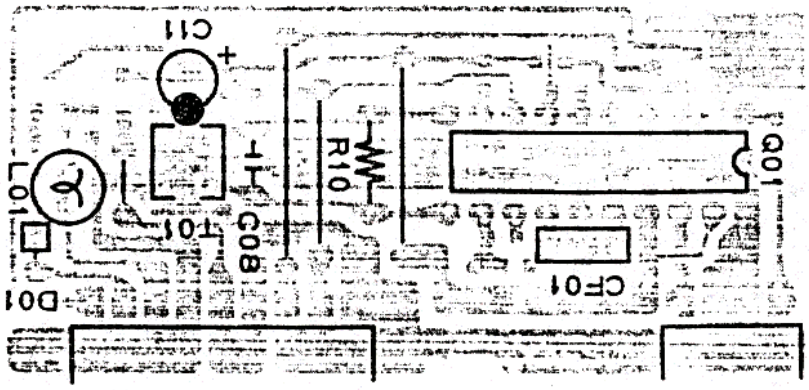
obverse view of
"component" side



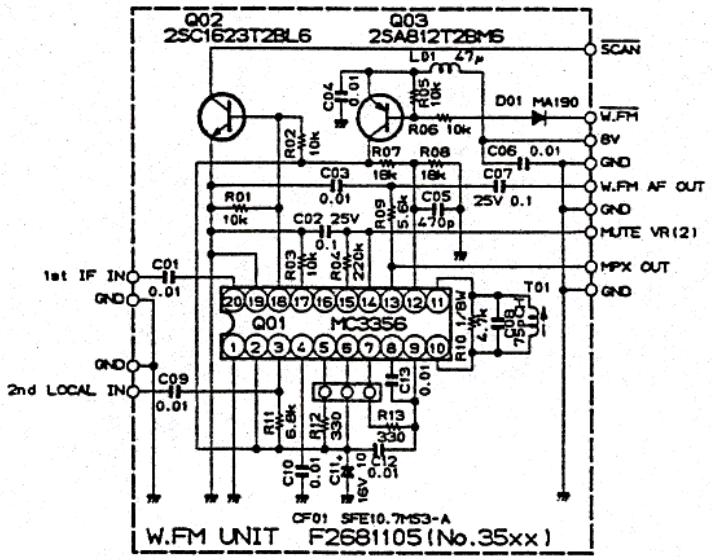
reverse view of
"chip-only" side



obverse view of
"chip-only" side



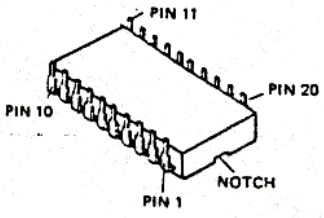
reverse view of
"component" side



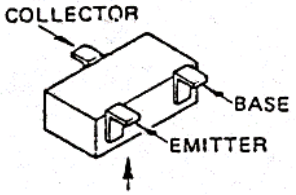
VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	9	10	REMARKS
Q3501	0	7.7	7.6	7.7	6.8	7.7	6.6	6.6	6.6	7.7	
	11	12	13	14	15	16	17	18	19	20	
	7.7	3.9	3.2	1.9/0	7.7/0	0.7/0	0.1/0	0.1/0.6	0	1.4	MUTE open/close

	E	C	B	REMARKS
Q3502	0	5.0/0	0.1/0.6	MUTE open/close
Q3503	7.9	7.7	7.1	



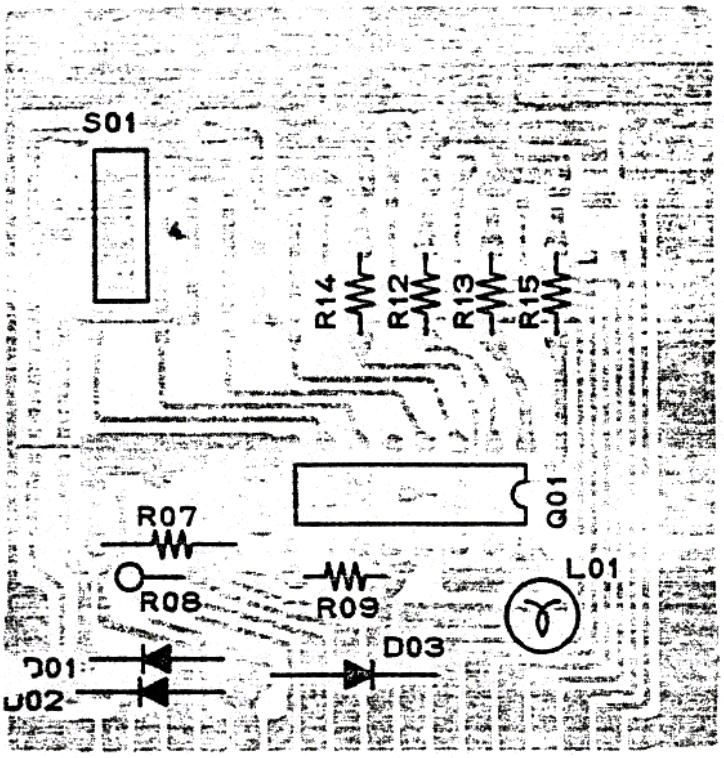
MC3356P



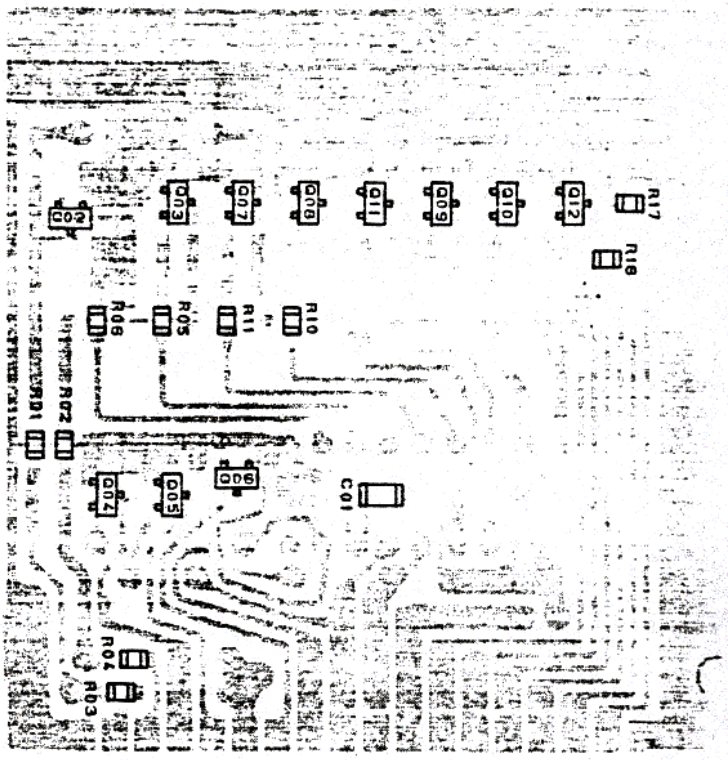
Marked Surface

2SA812T2B (M6)
2SC1623T2B (L6)

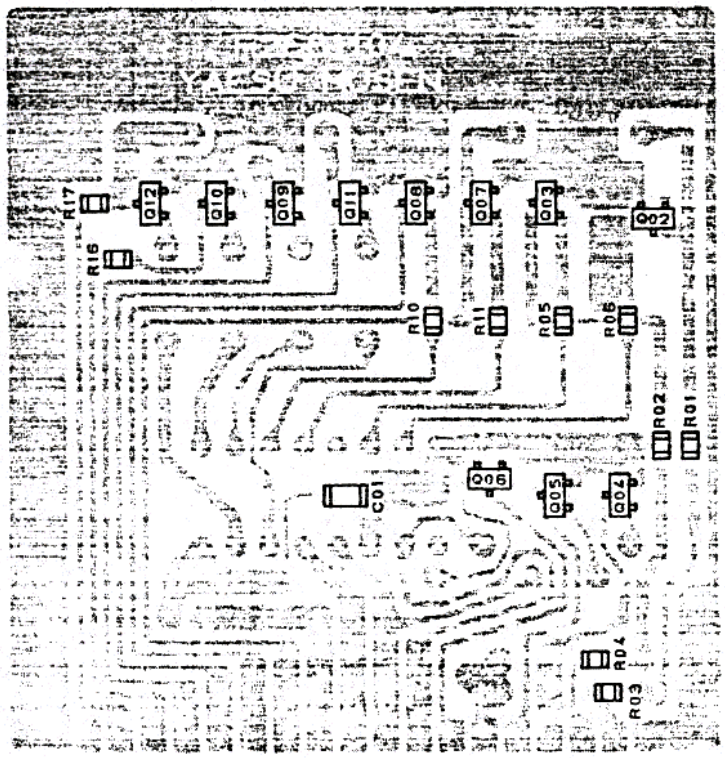
BAND UNIT PARTS LAYOUT



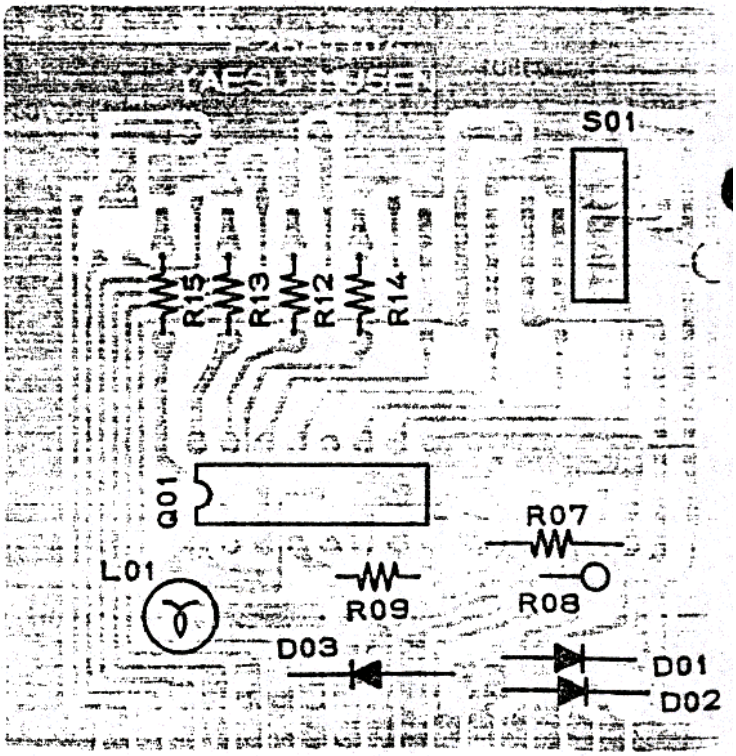
(obverse view of "component" side)



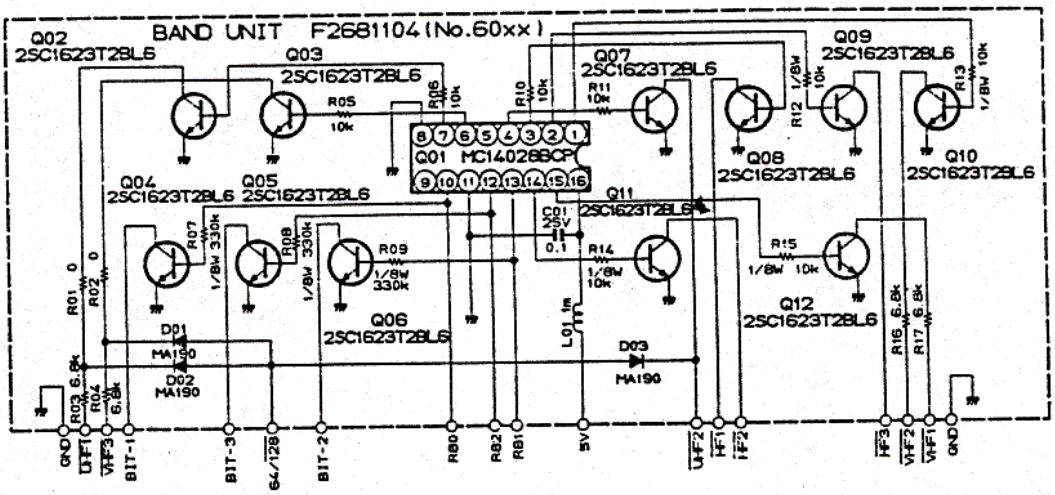
(reverse view of "chip-only" side)



(obverse view of "chip-only" side)



(reverse view of "component" side)

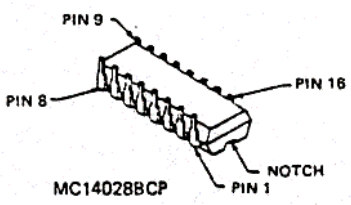


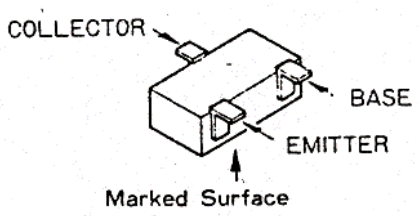
VOLTAGE CHART (DC VOLTS)

	Pin	VHF1	VHF2	VHF3	UHF1
Q6001	1	0	4.8	0	0
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0
	5	0	0	0	0
	6	0	0	4.8	0
	7	0	0	0	4.8
	8	0	0	0	0
	9	0	0	0	0
	10	5.0	0	5.0	0
	11	0	0	0	0
	12	0	5.0	5.0	5.0
	13	5.0	0	0	5.0
	14	0	0	0	0
	15	4.8	4.8	4.8	4.8
	16	5.0	5.0	5.0	5.0

	E	C	B	REMARKS
Q6002	0	0/8.0	0.6/0	UHF1 / other
Q6003	0	0/8.0	0.6/0	VHF3 / 〃
Q6004	0	OFF/ON	0/0.5	VHF2, UHF2 / other
Q6005	0	OFF/ON	0/0.5	VHF1 / other
Q6006	0	OFF/ON	0/0.5	VHF2,3 / other
Q6007	0	0.3/4.1	0/0	VHF3, UHF1 / other
Q6008	0	OFF	0	
Q6009	0	OFF	0	
Q6010	0	0/8.0	0.6/0	VHF2 / other
Q6011	0	OFF	0	
Q6012	0	0/8.0	0.6/0	VHF1 / 〃

VHF1 : 60~106.9999MHz
VHF2 : 107~229.9999MHz
VHF3 : 230~459.9999MHz
UHF1 : 460~905MHz



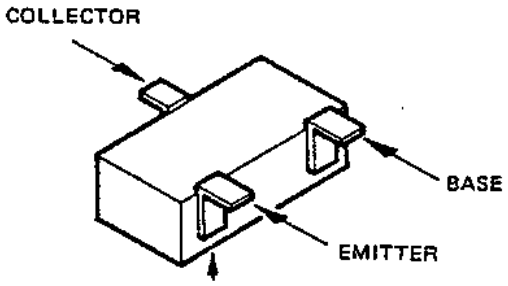


2SC1623T2B (L6)

CHIP DESCRIPTION AND MARKINGS

Bipolar Transistors

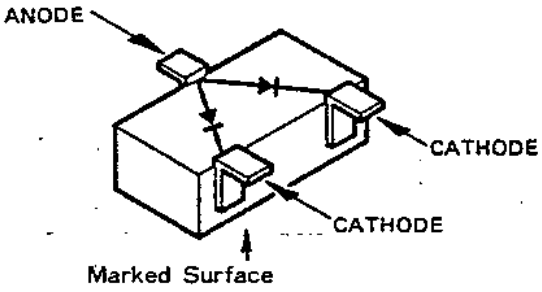
Part (Location) No.	Nomenclature	Marking
Q2019, 3005, 3006, 3502, 5511, 5513, 6502, 6504	2SA812T2BM6	M6
Q2007—2018, 2020, 2022, 2026, 3007, 3008, 3501, 4002, 4003, 4503, 4506—4508, 5003, 5004, 5502, 5503, 5505—5510, 5514—5517, 5512, 6002—6012, 6503, 9501	2SC1623T2BL6	L6



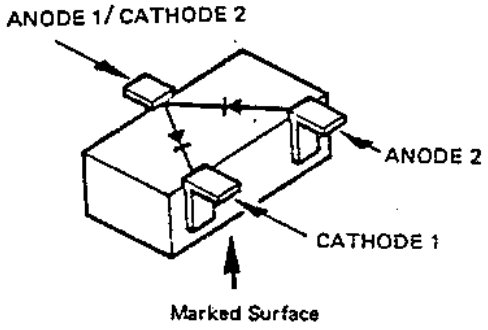
2SA812T2B (M6)
2SC1623T2B (L6)

Dual Diodes

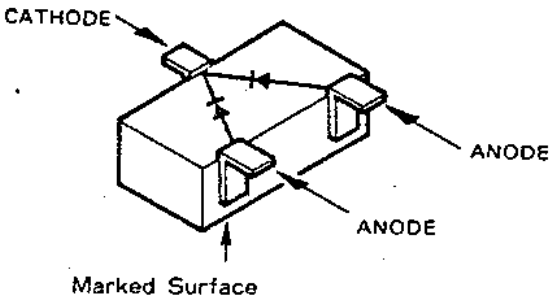
Part (Location) No.	Nomenclature	Marking
D2006—2010, 2012, 2014, 2020	1S2836T2B	A4
D2011, 2013, 2017, 2019, 9501	1S2838T2B	A6
D4503 — —	1SS123T2B	A7



1S2836T2B (A4)

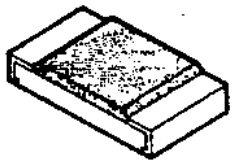


1SS123T2B (A7)



1S2838T2B (A6)

Resistors



Type RMC1/10W

Mark* A1 ..... Z6

Value code

A	1.0	N	3.3
B	1.1	P	3.6
C	1.2	Q	3.9
D	1.3	R	4.3
E	1.5	S	4.7
F	1.6	T	5.1
G	1.8	U	5.6
H	2.0	V	6.2
J	2.2	W	6.8
K	2.4	X	7.5
L	2.7	Y	8.2
M	3.0	Z	9.1

Multiplier code

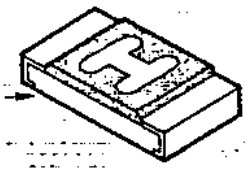
0	1
1	10^1
2	10^2
3	10^3
4	10^4
5	10^5
6	10^6

Examples :

A1 = 10Ω

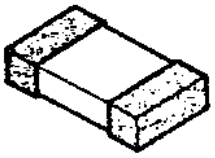
J3 = 2.2kΩ

S4 = 47kΩ



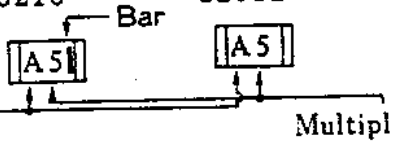
Jumper (0Ω) Chip

Ceramic Capacitors



Types: C2012
C3216

Mark* C3216 C2012



Value code

A	1.0	M	3.0	Y	8.2
B	1.1	N	3.3	Z	9.1
C	1.2	P	3.6	a	2.5
D	1.3	Q	3.9	b	3.5
E	1.5	R	4.3	d	4.0
F	1.6	S	4.7	e	4.5
G	1.8	T	5.1	f	5.0
H	2.0	U	5.6	m	6.0
J	2.2	V	6.2	n	7.0
K	2.4	W	6.8	t	8.0
L	2.7	X	7.5	y	9.0

Multiplier code

0	1
1	10^1
2	10^2
3	10^3
4	10^4
5	10^5
6	10^6
7	—
8	10^{-2}
9	10^{-1}

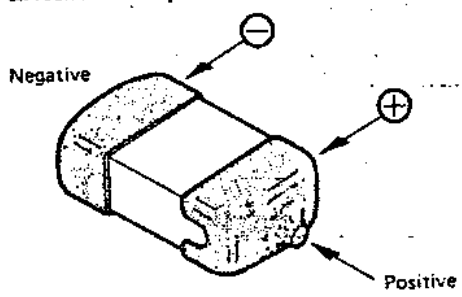
C3216 types use a bar marking for either thermal coefficient or tolereance ranking.(according to capacitors value range) as below.

SL ····· No bar

Temperture Compensating Types (low values)

NPO(CH)	N150(PH)	N220(RH)	N330(SH)	N470(TH)	N750(UJ)

Tantalum Capacitor



Polarized, Unmarked
(determine value from layout and Parts List)

Dielectric Constant (Hi K) types (high value)

B	D

F ····· No bar

Cap. Tolerance

B = 10%

D = 20%

F = +80%/−20%

Examples : A1 10pF NPO

J3 0.0022μF D

A3 0.001μF B

FRG-9600 PARTS LIST

MAIN CHASSIS

Symbol No.	Part No.	Name & Description
		POTENTIOMETERS
VR1 (with S1)	J62800086	K12B6102V-5N1212 10KA/10KB
VR2	J61800018	K12260020 5KB/5KB
		AF CHOKE COIL
CH1	L2030052	20mH 0.5A
		SPEAKER
SP1	M4090060	SS-77KB 8Ω 3W
		JACKS
J1	P1090194	FM-MR-M2
J2	P0090093	X-G9242
		MINI PLUGS (w/wire)
P2	T9204983A	
P3	T9204984	
P4	T9204985	
P5	T9313500B	
P6	T9204986A	
7	T9204987A	
		KNOBS
	R3109050	MAIN DIAL
	R7504490	
	R3108960	VOL
	R7108980	
	R3108970	SQL
	R7108980	
	R3073820B	TONE
	R3108910	0–9
	R3108911	CE
	R3108912	TIME SET
	R3108890	STEP, DIAL, MODE, MR, PRI, CLOCK, D M, M D
	R3108930	UP
	R3108920	DOWN
	R3108900	M CLEAR, ATT, AF SCAN

MAIN UNIT

	F2683101	Printed Circuit Board
	C026830A	PCB with components
		FRONT-END ASSY
	Q9000306	VTY-1U103
		ICs
Q1011	G1090080	μPC78L08
Q1012	G1090294	μPC7808H
Q1013	G1090494	MB3713
Q1015	G1090649	M5218L-01
Q1016	G1090084	μPC78L05
		FET
Q1003	G4800730G	3SK73GR
		TRANSISTORS
Q1006-1009	G3107331P	2SA733AP
Q1001, 1002, 1004, 1005, 1010, 1014	G3304580B	2SC458B

		DIODES
D1010, 1014, 1021	G2090237	Si MA190
D1001-1003, 1007-1009, 1011, 1015, 1017, 1018, 1021	G2015550	" 1S1555
D1004	G1090239	" MA161
D1005, 1006	G2090297	" 1SS110
D1012	G2090180	Varactor FC53M5
D1013	G9090005	Varistor MV109
D1019	G2090118	Schottky 1SS97
D1020	G2090249	" ERB81-004
		CRYSTAL
X1001	H0102664	HC-18/U3P 17.53 MHz
		CRYSTAL FILTER
XF1001	H1102093	45M1A
	H1102097	(or 45M28)
		RESISTORS
R1050	J01275689	Carbon film 1/2W 6.8Ω TJ
R1066	J01275470	" " " 47Ω "
R1002	J02245470	" " 1/4W 47Ω SJ
R1014, 1015, 1026, 1033, 1037, 1039	J02245101	" " " 100Ω "
R1012	J02245151	" " " 150Ω "
R1025, 1032	J02245471	" " " 470Ω "
R1001	J02245681	" " " 680Ω "
R1003, 1006, 1008, 1017, 1019, 1051, 1058	J02245102	" " " 1kΩ "
R1010, 1016, 1040, 1065	J02245152	" " " 1.5kΩ "
R1018, 1035, 1048, 1052, 1067	J02245222	" " " 2.2kΩ "
R1004, 1021, 1023, 1036	J02245472	" " " 4.7kΩ "
R1005, 1007, 1009, 1024, 1028, 1034, 1041–1047 1054–1056, 1060	J02245103	" " " 10kΩ SJ
R1020, 1022, 1029, 1031	J02245153	" " " 15kΩ "
R1027, 1030, 1053	J02245223	" " " 22kΩ "
R1049, 1057	J02245473	" " " 47kΩ "
R1013, 1038	J02245224	" " " 220kΩ "
R1059, 1061–1063	J02245225	" " " 2.2MΩ "
R1064	J02245565	" " " 5.6MΩ "
		POTENTIOMETERS
VR1001	J51737503	3321P-1-503KB 50kΩB
VR1002, 1003	J51757103	H1052C-10KB 10kΩB
VR1005	J51745473	H0651A017-47KB 47kΩB
VR1004	J51745104	H0651A019-100KB 100kΩB
		CAPACITORS
C1029	K02172010	Ceramic 50WV 1pF CH (DD104CH010C50)
C1032	K02172030	" " 3pF " (DD104CH030C50)
C1021	K02172040	" " 4pF " (DD104CH040C50)
C1015	K00172050	" " 5pF SL (DD104SL050C50)

C1026, 1027	K02175101	" " 100pF CH (DD107CH101J50)
C1022	K06175101	" " 100pF UJ (DD106UM101J50)
C1002,1005	K12170649	" " 0.001μF E (DD104-257E102P50)
C1001, 1003, 1004, 1006, 1011–1014, 1016-1020, 1023, 1028, 1030, 1031, 1033-1036, 1038, 1039, 1045, 1050, 1056, 1058, 1062, 1063, 1066, 1068	K13179008	" " 0.01μF F (DD106F103Z50)
C1046	K19149021	" 50WV 0.047μF (UAT08x473K-L45AE)
C1042, 1057	K19149025	" 25WV 0.1μF (UAT10x104K-L45AE)
C1049	K50177154	Mylar 50WV 0.15μF (50F2U154)
C1041,1055	K40179013	Electrolytic " 1μF (50RE1)
059	K40179012	" " 4.7μF (50RE4.7)
C1007, 1008, 1024, 1037, 1040, 1043, 1044, 1047, 1052, 1060, 1061, 1064, 1067	K40179014	" " 10μF (50RE10)
C1009	K40149028	" 25WV 100μF (RE2-25V101M)
C1025	K40129008	" 16WV 33μF (16RE33)
C1051	K40149022	" 25WV 47μF (25RE47)
C1054	K40149003	" " 100μF (25RE100)
C1053	K40129006	" 16WV 470μF (16RE470)
C1048	K40149002	" 25WV 470μF (25RE470)
C1065	K40149027	" " 3300μF (RE2-25V332M)
		INDUCTORS
L1001, 1002, 1004, 1005	L1190171	LHL06NA470K 47μH
L1006	L1190177	LHL06NA151K 150μH
L1007, 1008	L1190187	LHL06NA102K 1mH
		TRANSFORMERS
T1001	L0021514	
T1002	L0021515	
T1003	L0021516	
T1004	L0021519	
T1005, 1006	L0021517	
		RELAY
RL1001	M1190051	FBR22D12-P
		JACKS
J1001, 1014, 1016	P1090348	S-Q3097-1
J1002	P1090423	TCS4460-01-1111
J1003, 1007, 1009	P0090193	B4B-XHA
J1004	P0090194	B5B-XHA
J1005, 1011, 1012, 1017, 1020	P0090192	B3B-XHA
J1006	P0090205	S4B-XHA
J1008, 1010, 1018, 1022, 1024, 1025	P0090191	B2B-XHA
J1013	P1090043	3024-13CH
J1015, 1019, 1021	P1090350	S-G8035
J1023	P0090195	B6B-XHA
PJ1001, 1002	P1090210	TMP-IV
		PLUGS
P1001 (with wire)	T9204980A	
P1002 (")	T9204981A	
		TERMINAL POSTS
	Q5000036	TP-G
		CPU UNIT
	F2684000	Printed circuit board
	C026840A	PCB with components
		ICs
Q2001	G1090650	HD614042FA95
Q2002	G1090651	HM6116LFP–4
Q2003	G1090600	μPD4011BG
Q2004	G1090633	M5218P
Q2005	G1090084	μPC78L05
		TRANSISTORS
Q2019	G3108127F	2SA812T2BM6
Q2021	G3207720Q	2SB772Q
Q2007-2018, 2020 2022–2026	G3316237F	2SC1623T2BL6
Q2006	G3319590Y	2SC1959Y
		DIODES
D2001, 2003	G2090239	Si MA161
D2006–2010, 2012 2014, 2020	G2070024	" 1S2836T2B
D2011, 2013, 2017, 2019	G2070018	" 1S2838T2B
D2016	G2090237	" MA190
D2002	G2090154	Zener RD7.5EB1
D2005	G2090257	" RD33EB1
D2018, 2021, 2022	G2090042	" RD8.2EB3
D2015	G2090118	Schottky 1S97
D2004	G9090005	Varistor MV103
		FCD
DS2001	G6090052	FIP14BM7
		RESISTORS
R2033	J01275820	Carbon film 1/2W 82Ω TJ
R2001	J02245151	" 1/4W 150Ω SJ
R2061	J01245102	" " 1kΩ TJ
R2060	J01245152	" " 1.5kΩ "
R2002, 2004	J02245472	" " 4.7kΩ SJ
R2003	J01275822	" 1/2W 8.2kΩ TJ
R2027, 2035, 2051	J24205102	Chip RMC 1/10T 102J 1kΩ
R2042	J24205472	" " 472J 4.7kΩ
R2013–2021, 2031, 2034, 2037, 2041 2043, 2044, 2046–	J24205103	" " 103J 10kΩ

2050, 2054–2056, 2059, 2063–2066, 2068–2069, 2072					LITHIUM BATTERY
R2071	J24205273	" " 273J 27kΩ	BAT2001	Q9000248	CR-1/3N-P
R2005–2012, 2022 2039	J24205473	" " 473J 47kΩ			
R2032	J24205823	" " 823J 82kΩ			PLUGS
R2023–2026, 2029–2030, 2045, 2058, 2062, 2067	J24205104	" " 104J 100kΩ	P2001 (with wire)	T9204988A	
R2028	J24205224	" " 224J 220kΩ	P2002 (")	T9204989	
R2052, 2053, 2057	J24205274	" " 274J 270kΩ	P2003 (")	T9204990A	
R2038, 2070	J24205105	" " 105J 1MΩ	P2004 (")	T9204991A	
R2036, 2040	J24205335	" " 335J 3.3MΩ	P2005 (")	T9204992A	
			P2006 (")	T9204993A	
			P2007 (")	T9204994	
			P2008 (")	T9204995A	
			P2009 (")	T9204996	
				PLL UNIT	
		BLOCK RESISTORS		F2682104	Printed circuit board
RB2001	J40900022	DA-1		C026824A	PCB with components
RB2002, 2003	J40900023	DA-2			
					ICs
			Q3001	G1090649	M5218L-01
		POTENTIOMETERS	Q3002	G1090648	MC145158P
VR2001, 2002	J50764473	H0622A 47kB 47kΩB	Q3003	G1090652	MB501P-G
			Q3004	G1090653	μPC1651G
		CAPACITORS			
C2016, 2021	K22170805	Chip 50WV 0.001μF B (C2012B1H102MFA)			TRANSISTORS
			Q3005, 3006	G3108127F	2SA812T2BM6
C2010–2015, 2019, 2026, 2034	K22170817	" " 0.01μF B (C2012B1H103MFA)	Q3007, 3008	G3316237F	2SC1623T2BL6
C2023	K22171008	" " 0.047μF F (C2012F1H473ZFA)			DIODES
			D3001, 3002	G2090237	Si MA190
C2020, 2022, 2024, 2025, 2027, 2029, 2032	K22141904	" 25WV 0.1μF D (C3216D1E104MFA)			
					CRYSTAL
			X3001	H0102665	HC-18/T3P 4.096 MHz
C2001, 2002	K19149017	Ceramic " 0.022μF (UAT06X223K-L45AE)			
					RESISTORS
C2033	K40179001	Electrolytic 50WV 1μF (ECE-A1HK010)	R3007, 3009	J01215103	Carbon film 1/8W 10kΩ TJ
C2031	K40179013	Electolytic " 1μF (50RE1)	R3001, 3004	J24205000	Chip RMC 1/10T 000J 0Ω
			R3003	J24205470	" " 470J 47Ω
C2004, 2006, 2009, 2017	K40179014	" " 10μF (50RE10)	R3002, 3016, 3017	J24205101	" " 101J 100Ω
			R3008, 3014	J24205222	" " 222J 2.2kΩ
C2007	K40179015	" 50WV 10μF (ECE-A1HK100)	R3010–3013	J24205822	" " 822J 8.2kΩ
			R3005, 3006, 3015	J24205103	" " 103J 10kM
C2028	K40129012	" 16WV 10μF (ECE-A1CK100)			
C2005, 2008	K40179028	" 50WV 47μF (RE2-50V470M)			CAPACITORS
			C3025	K22170111	Chip 50WV 10pF SL (C2012SL1H100DFA)
C2003, 2030	K40149028	" 25WV 100μF (RE2-25V101M)	C3010	K22170221	" " 27pF CH (C2012CH1H270JFA)
C2018	K40129038	" 16WV 100μF (ECE-A1CK101)	C3011	K22170227	" " 47pF " (C2012CH1H470JFA)
		DC-DC CONVERTER TRANSFORMER	C3001, 3003–3006	K22170805	" " 0.001μF B (C2012B1H102KFA)
L2001	L3030077	MPS-160			
		CHOKE COIL	C3002, 3007, 3009, 3012, 3015, 3017, 3018, 3020, 3021, 3023, 3026	K22170817	" " 0.01μF B (C2012B1H103KFA)
L2002	L2190001	SN8S-500			
		BUZZER	C3008, 3013	K22141904	" " 0.1μF D (C3216D1E104MFA)
BZ2001	M4290001	EFBRE-25D02			
		SWITCHES	C3016, 3019	K54200002	Polyester film 100WV 0.47μF (B32560-A1474-J)
S2001	Q9000290	SGFV01T009 Rotary encoder			
S2002	N6090051	SSS212299 Backup			
S2003, 2004	N4090085	SPH221A A · SCAN, ATT			
S2005	N4090094	SPH222A M · CLR	C3022	K40179015	Electrolytic 50WV 10μF (ECE-A1HK100)
S2006–2027	N5090023	KHH10912 STEP			

C3024	K40129012	" 16WV 10μF (ECE-A1CK100)
C3014	K40129014	" " 33μF (ECE-A1CK330)
		TRIMMER CAPACITOR
TC3001	K91000130	ECV-1ZW 60x60 60pF
		TERMINAL POSTS
TP3001, 3002	Q5000036	TP-G
		CONNECTOR
	P0090475	3094-14A
WIDE FM UNIT		
	F2681105	Printed circuit board
	C026815A	PCB with components
		IC
Q3501	G1090591	MC3356P
		TRANSISTORS
Q3503	G3108127F	2SA812T2BM6
Q3502	G3316237F	2SC1623T2BL6
		DIODE
D3501	G2090237	Si MA190
		CERAMIC FILTER
CF3501	H3900375	SFE 10.7 MS3-A
		RESISTORS
R3510	J01215472	Carbon film 1/8W 4.7kΩ TJ
R3512, 3513	J24205331	Chip RMC 1/10T 331J 330Ω
R3511	J24205682	" " 682J 6.8kΩ
R3501–3503, 3505, 3506	J24205103	" " 103J 10kΩ
R3507, 3508	J24205183	" " 183J 18kΩ
R3504	J24205224	" " 224J 220kΩ
R3509	J24205334	" " 334J 330kΩ
		CAPACITORS
C3508	K02179018	Ceramic 50WV 75pF CH (DD107CH750J50V)
C3503	K22170241	" " 50WV 180pF CH (C2012CH1H181JFA)
C3505	K22170801	Chip " 470pF B (C2012B1H471MFA)
C3501, 3504, 3506, 3509, 3510, 3512, 3513	K22170817	" " 0.01μF B (C2012B1H103MFA)
C3502, 3507	K22141904	" 25WV 0.1μF D (C3216D1E104MFA)
C3511	K40129012	Electlytic 16WV 10μF (ECE-A1CK100)
		INDUCTOR
L3501	L1190029	FL5H-470K 47μH
		TRANSFORMER
T3501	L0021153	

		CONNECTORS
	P0090476	3094-04A
	P0090477	3094-09A
NARROW FM UNIT		
	F2682101	Printed circuit board
	C026821A	PCB with components
		IC
Q4001	G1090145	MC3357P
		TRANSISTORS
Q4002, 4003	G3316237F	2SC1623T2BL6
		DIODE
D4001	G2015550	1S1555
		CRYSTAL
X4001	H0102666	UM-1 10.245 MHz
		CRYSTAL FILTER
XF4001	H1102013	FMT-15B
	H1102096	(or 10M15B-Y)
		CERAMIC FILTER
CF4001	H3900200	CFW 455E
		CERAMIC DISCRIMINATOR
CD4001	H7900180	CDB455C7
	H7900260	(or D455C)
		RESISTORS
R4010, 4018, 4022, 4023	J24205000	Chip RMC 1/10T 000J 0Ω
R4021, 4025	J24205101	" " 101J 100Ω
R4002, 4004, 4024, 4028	J24205102	" " 102J 1kΩ
R4008, 4015, 4017	J24205152	" " 152J 1.5kΩ
R4001, 4019, 4013	J24205222	" " 222J 2.2kΩ
R4006, 4027	J24205472	" " 472J 4.7kΩ
R4011	J24205103	" " 103J 10kΩ
R4007	J24205223	" " 223J 22kΩ
R4012, 4014	J24205473	" " 473J 47kΩ
R4003	J24205154	" " 154J 150kΩ
R4005	J24205274	" " 274J 270kΩ
R4009	J24205334	" " 334J 330kΩ
R4026	J24205474	" " 474J 470kΩ
		CAPACITORS
C4001	K22170205	Chip 50WV 4pF CH (C2012CH1H040CFA)
C4007	K22170327	" " 47pF UJ (C2012UJ1H470JFA)
C4008	K22170337	" " 120pF " (C2012UJ1H121JFA)
C4011	K22170239	" " 150pF CH (C2012CH1H151JFA)
C4005, 4006	K22170805	" " 0.001μF B (C2012B1H102MFA)
C4017	K22170807	50WV 0.0015μF B (C2012B1H152MFA)
C4002, 4012–4014,	K22170817	" " 0.01μF B (C2012B1H103MFA)
C4009, 4010	K22171008	" " 0.047μF F (C2012F1H473ZFA)
C4015, 4018–4020	K22141904	" 25WV 0.1μF D (C3216D1E104MFA)