UNIT COMPLEMENT

Unit	Prod. Lot (Serial Number) 1 (01xxxx)	2 (02xxxx)	3 (03xxxx)	4 (04xxxx)	5 (05xxxx)	6 & up (06xxxx)
RF	PB-2002 ↔	PB-2002A	PB-2002A ↔	PB-2002B	PB-2002B X	PB-2158
Local	PB-2003 ↔	PB-2003A	PB-2003A ↔	PB-2003B	PB-2003B X	PB-2159
Filter	PB-2004 ↔	PB-2004A	PB-2004A	PB-2004A ↔	PB-2004B	PB-2004B
IF	PB-2005 ↔	PB-2005A	PB-2005A ↔	PB-2005B ↔	PB-2005C	PB-2005C
AF	PB-2006 ↔	PB-2006A	PB-2006A ↔	PB-2006B	PB-2006B	PB-2006B
NB	PB-2007 ↔	PB-2007A	PB-2007A ↔	PB-2007B ↔	PB-2007C	PB-2007C
Lever SW	PB-2008 ↔	PB-2008A	PB-2008A	PB-2008A	PB-2008A	PB-2008A
VFO	PB-1440B	PB-1440B	PB-1440B	PB-1440B	PB-1440B	PB-1440B
RF Mother Board	PB-2009 ↔	PB-2009A	PB-2009A	PB-2009A	PB-2009A X	PB-2009B
CLAR SW	PB-2010A	PB-2010A	PB-2010A	PB-2010A	PB-2010A	PB-2010A
LED	PB-2011 ↔	PB-2011A	PB-2011A	PB-2011A	PB-2011A	PB-2011A
IF Mother Board	PB-2012 ←	PB-2012A	PB-2012A ↔	PB-2012B ↔	PB-2012C ↔	PB-2012D
100W PA	PB-2013 ↔	PB-2013A	PB-2013A	PB-2013A	PB-2013A	PB-2013A
LPF	PB-2014	PB-2014	PB-2014	PB-2014	PB-2014	PB-2014
PROTECTOR	PB-2015 ↔	PB-2015A	PB-2015A	PB-2015A	PB-2015A X	PB-2146
MEMORY MAIN	PB-2016B	PB-2016B	PB-2016B	PB-2016B	PB-2016B ←	PB-2016C
MEMORY VCO	PB-2045	PB-2045	PB-2045	PB-2045	PB-2045	PB-2045
VXCO	PB-2046 ↔	PB-2046A ↔	PB-2046B	PB-2046B	PB-2046B	PB-2046B
DIVIDER	PB-2084	PB-2084	PB-2084	PB-2084	PB-2084 ←	PB-2084A
DISPLAY	PB-2087	PB-2087	PB-2087	PB-2087	PB-2087	PB-2087
LSI COUNTER	PB-2086A	PB-2086A	PB-2086A	PB-2086A	PB-2086A	PB-2086A
COUPLER	PB-2056A	PB-2056A	PB-2056A	PB-2056A	PB-2056A	PB-2056A
AF BUFFER	PB-2064	–	–	–	–	–
MIC UP/DOWN CONTROL	–	–	PB-2108 ↔	PB-2108A	PB-2108A	PB-2108A
CONTROL	PB-2083A	PB-2083A	PB-2083A	PB-2083A	PB-2083A	PB-2083A

↔ Interchangeable

X Not interchangeable

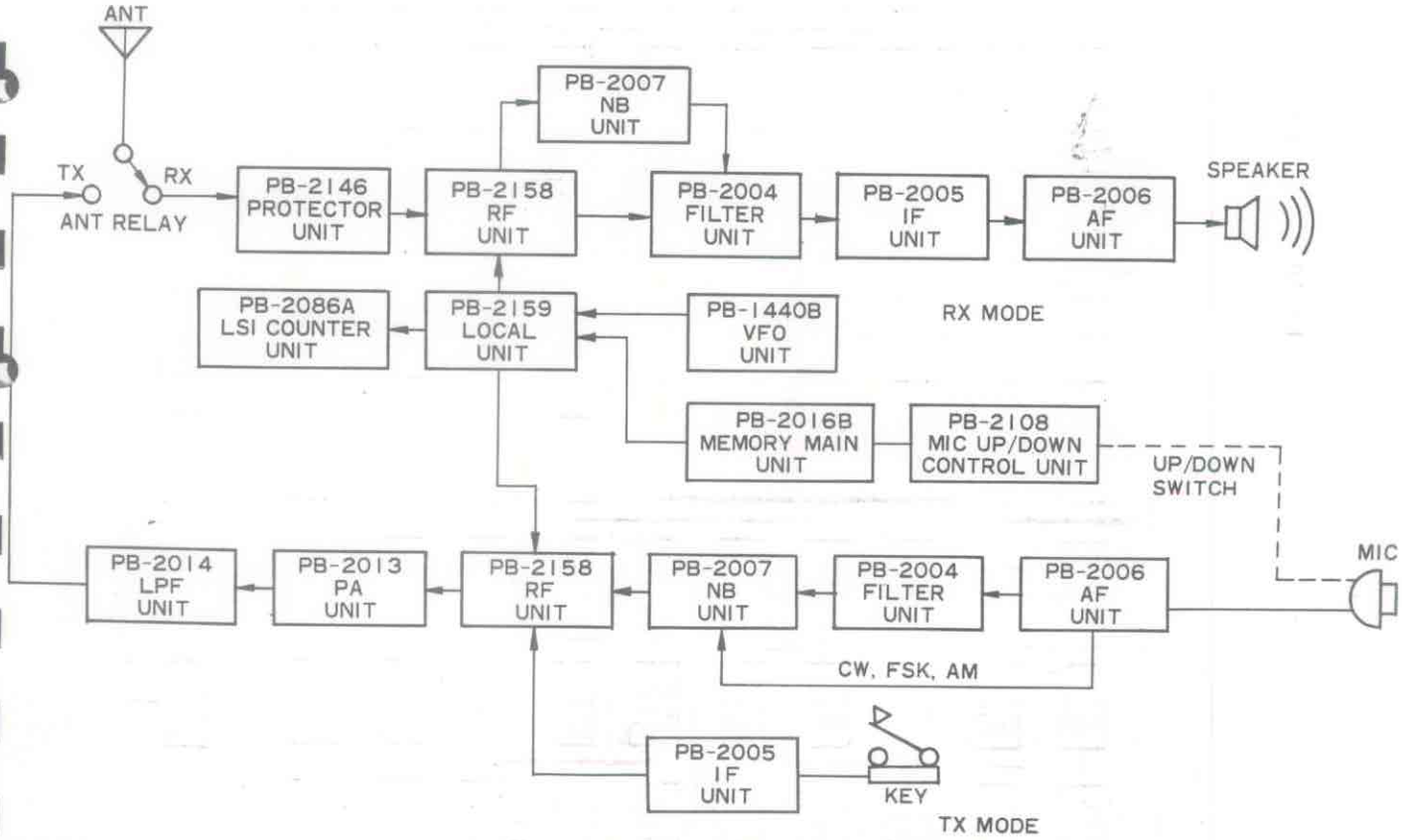
← Interchangeable in this direction

SIGNAL TRACING IN THE FT-107M

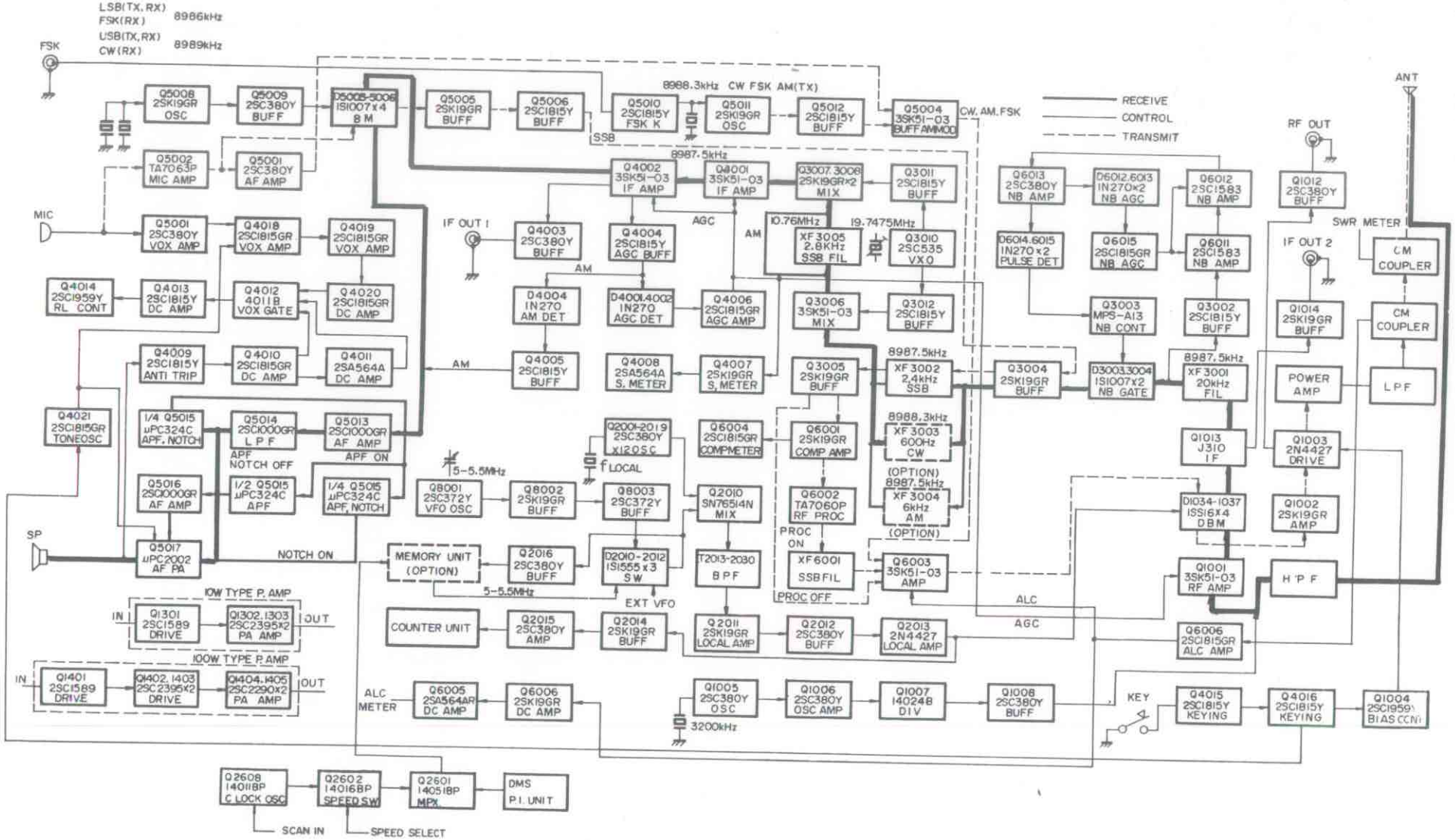
Because the signal path may change considerably when the mode is changed, we have included augmented block diagrams on page 2-4 through 2-8, in order to assist you in understanding the function of the FT-107M.

Below you will find a board-to-board block diagram, showing the TX and RX signal paths through the transceiver.

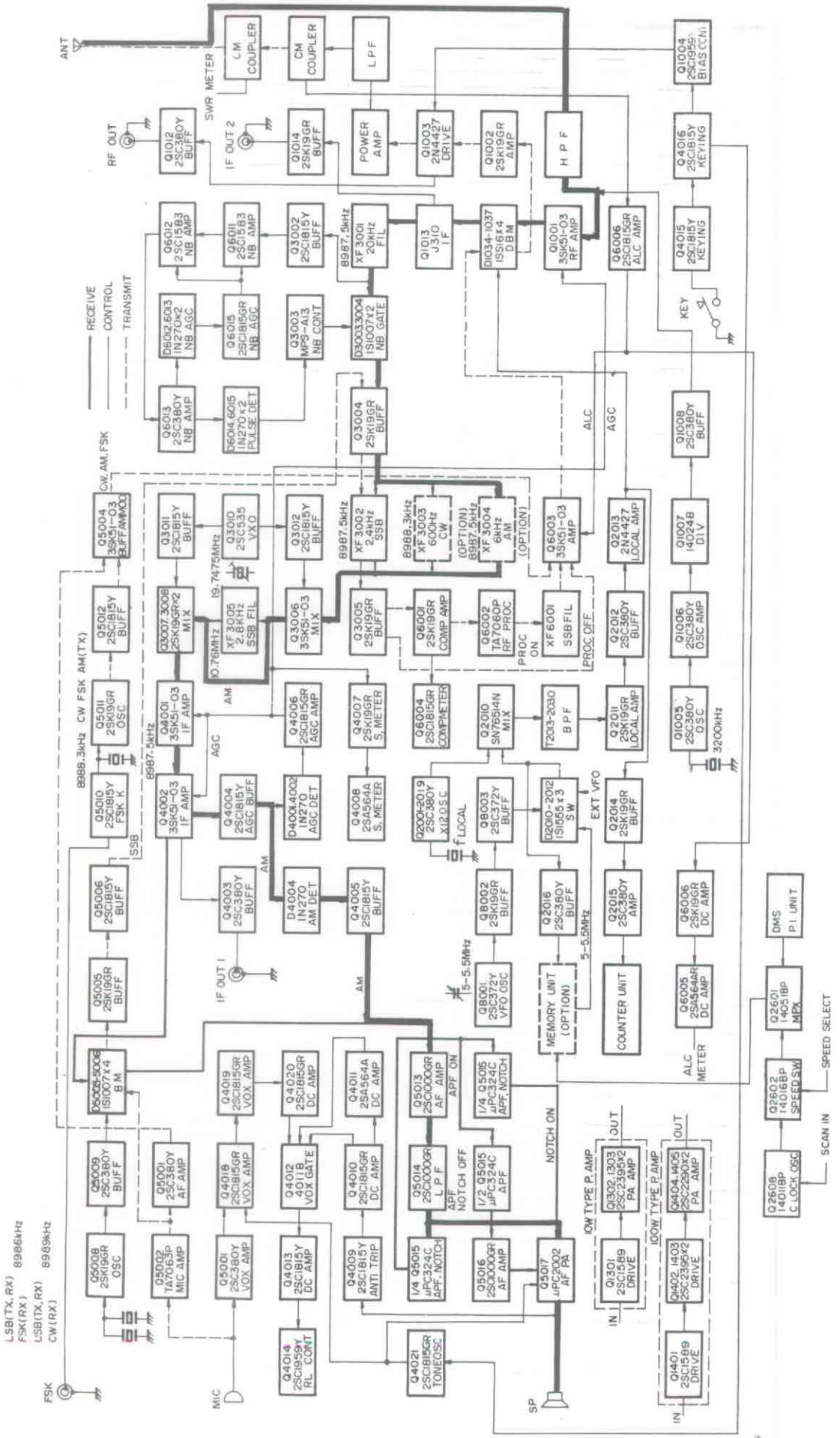
It should be noted that the internal calibrator (Marker) is an extremely useful signal for preliminary fault localization. In a properly functioning FT-107M, the S-meter should read approximately S9 + 20 dB. Minor variations from this number are not unusual, but a blown RF amplifier FET will cause this indication to be practically nil. By using the internal calibrator, an experienced technician can peak practically all circuits on the receiver side, without the use of an external signal generator.



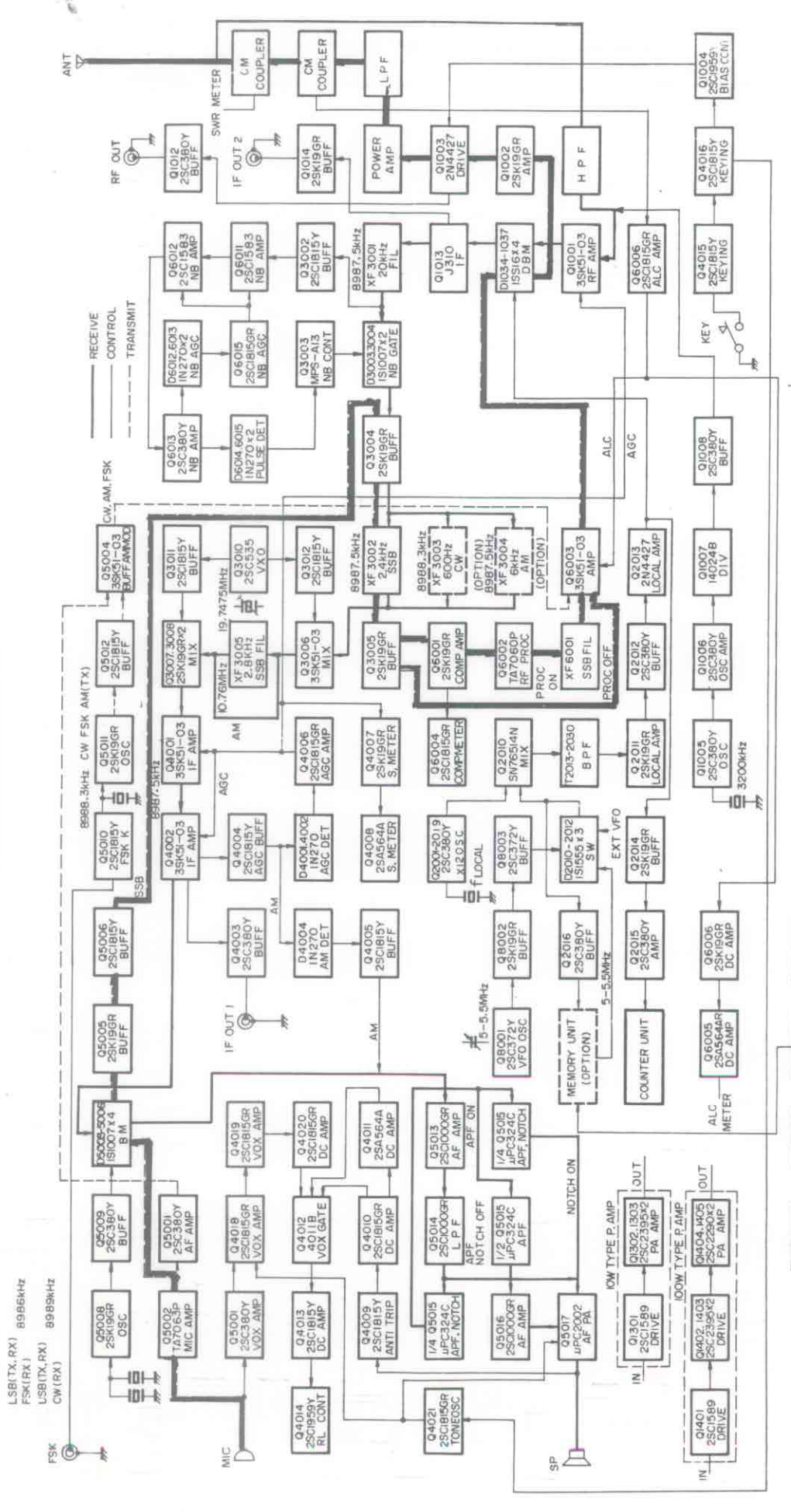
FT-107M SSB, CW, FSK MODE RX



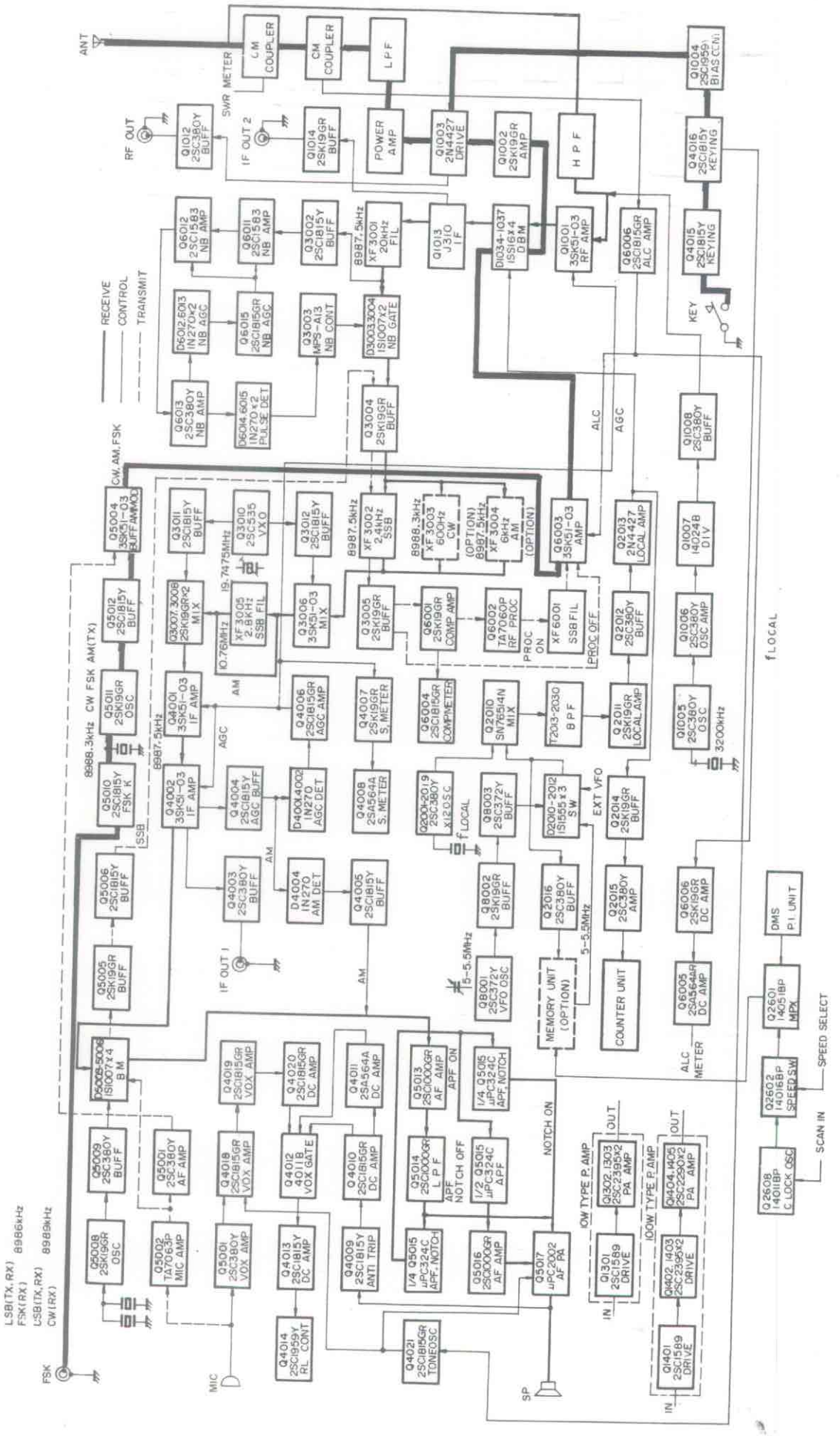
FT-107M AM MODE RX



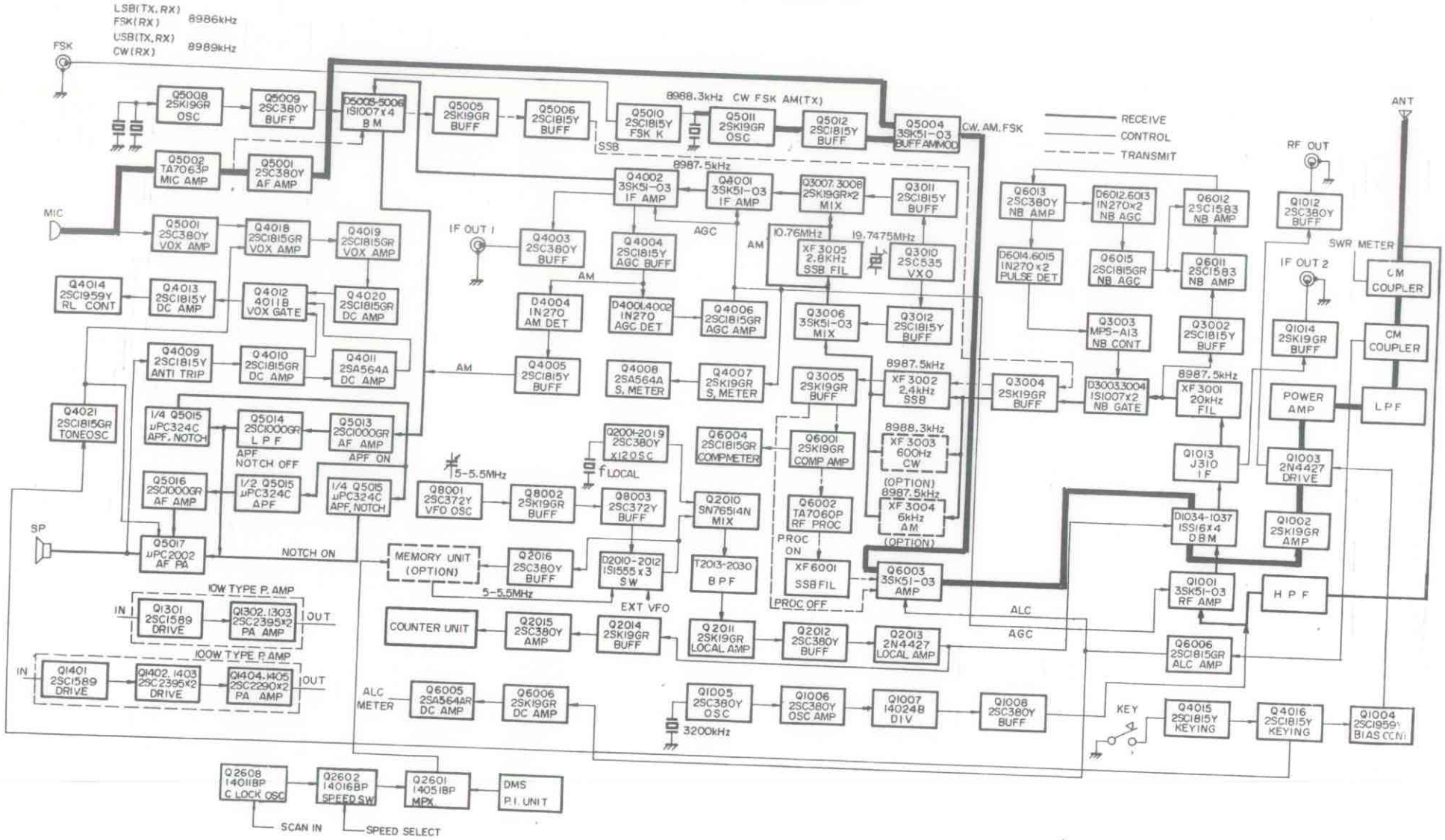
FT-107M SSB MODE TX



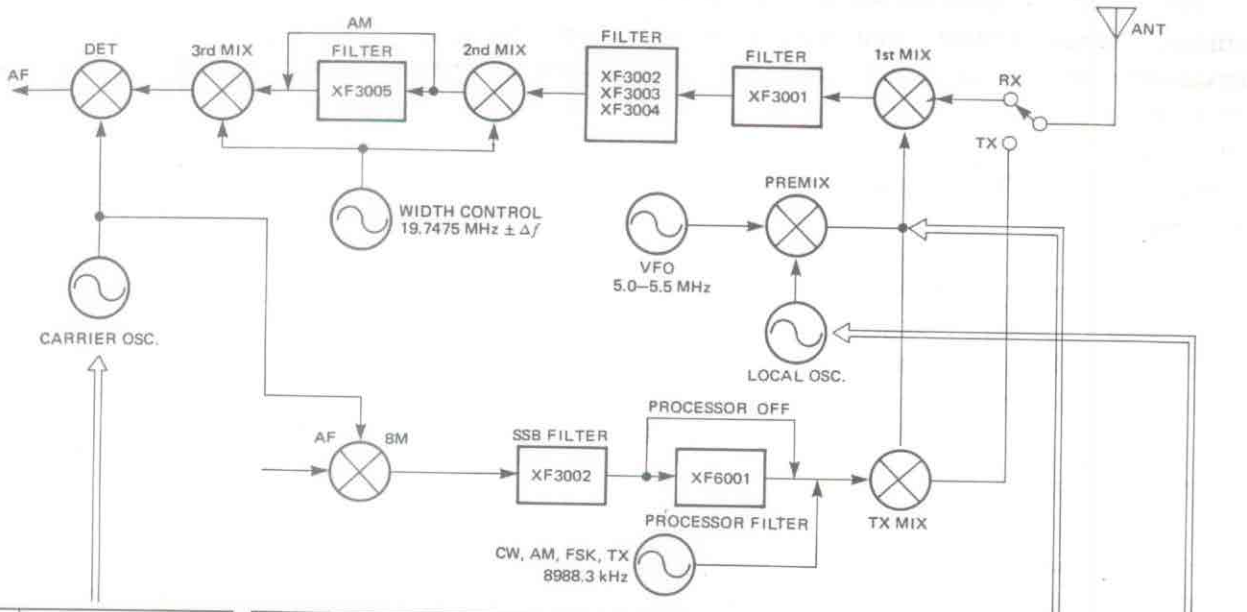
FT-107M CW FSK MODE TX



FT-107M AM MODE TX



FREQUENCY RELATIONSHIPS



MODE	CARRIER FREQUENCY	
	RX kHz	TX kHz
LSB	8986	8986
USB	8989	8989
CW	8989	–
FSK	8986	–

FILTER	CENTER FREQUENCY
XF3001	8987.5 kHz
XF3002	8987.5 kHz
XF3003	8988.3 kHz
XF3004	8987.5 kHz
XF3005	10.7 MHz
XF6001	8987.5 kHz

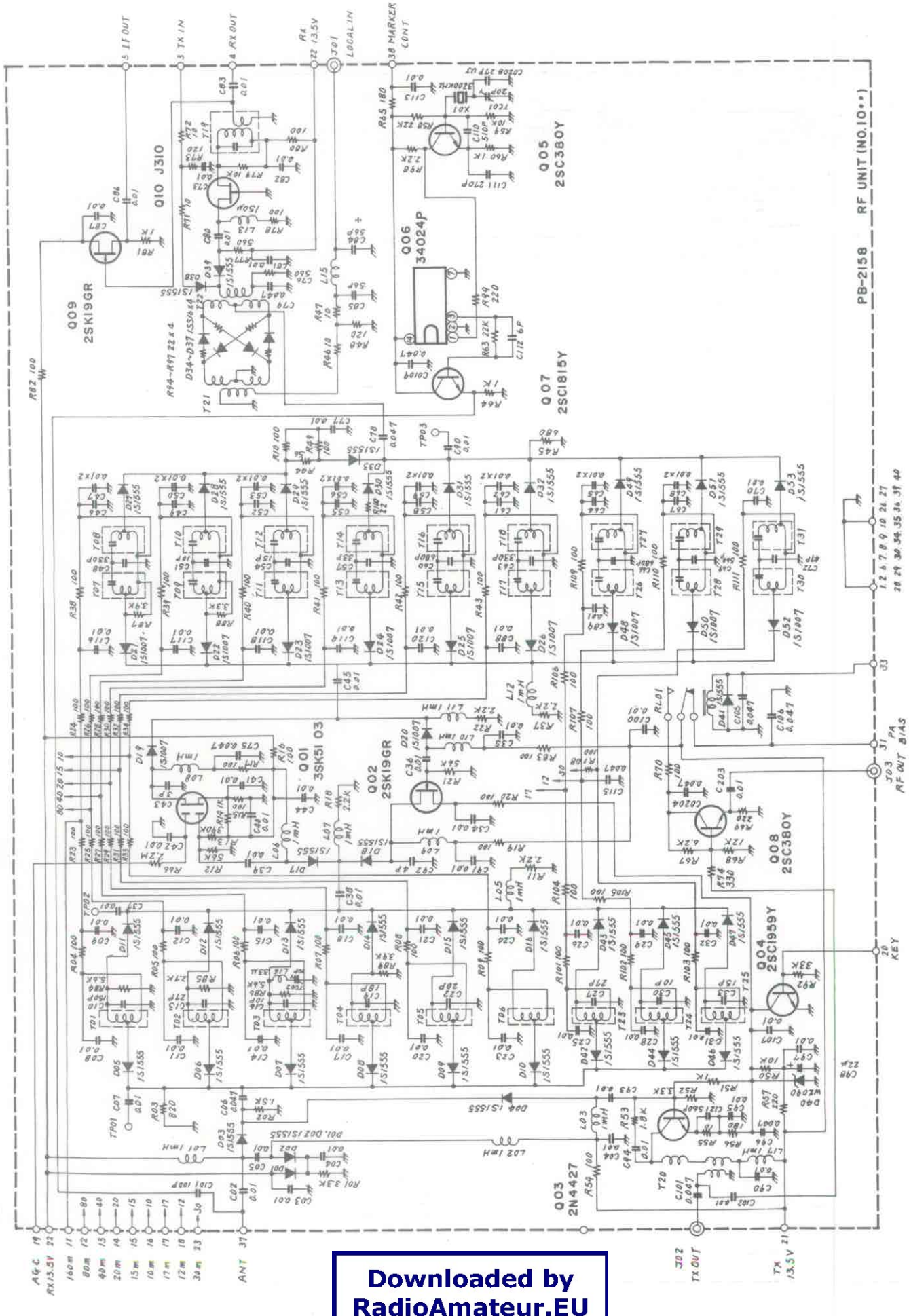
BAND	PREMIX OUT FREQUENCY MHz	LOCAL OSC. FREQUENCY MHz	BAND	PREMIX OUT FREQUENCY MHz	LOCAL OSC. FREQUENCY MHz
160 m	10.4875–10.9875	15.9845	15 m	29.9875–30.4875	35.4875
80 m	12.4875–12.9875	17.9845	*12 m	33.4875–33.9875	38.9875
40 m	15.9875–16.4875	21.4845	10 m A	36.9875–37.4875	42.4875
*30 m	18.9875–19.4875	24.4875	10 m B	37.4875–37.9875	42.9875
20 m	22.9875–23.4875	28.4875	10 m C	37.9875–38.4875	43.4875
*17 m	26.9875–27.4875	32.4875	10 m D	38.4875–38.9875	43.9875

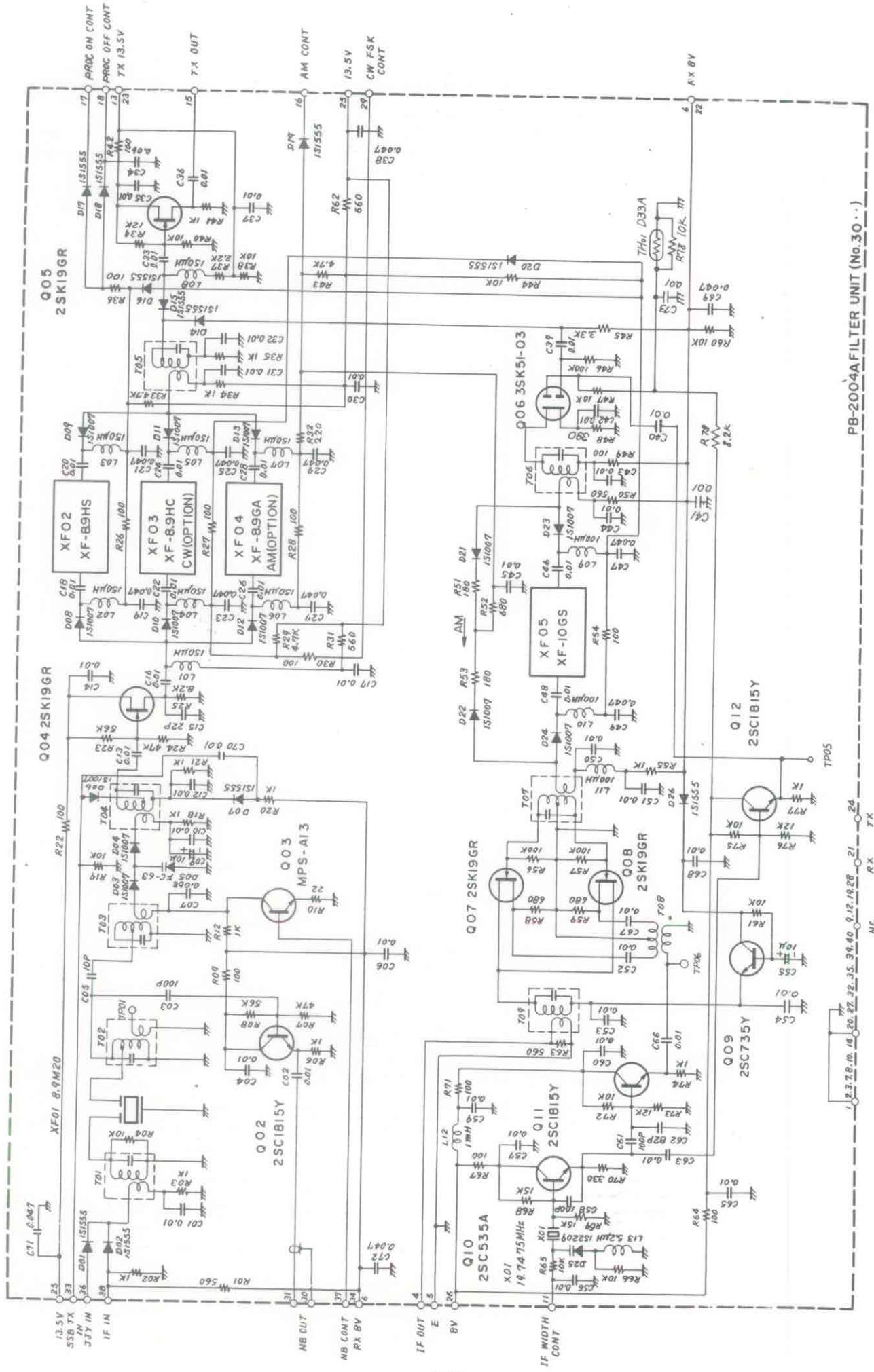
* After Proc. 6

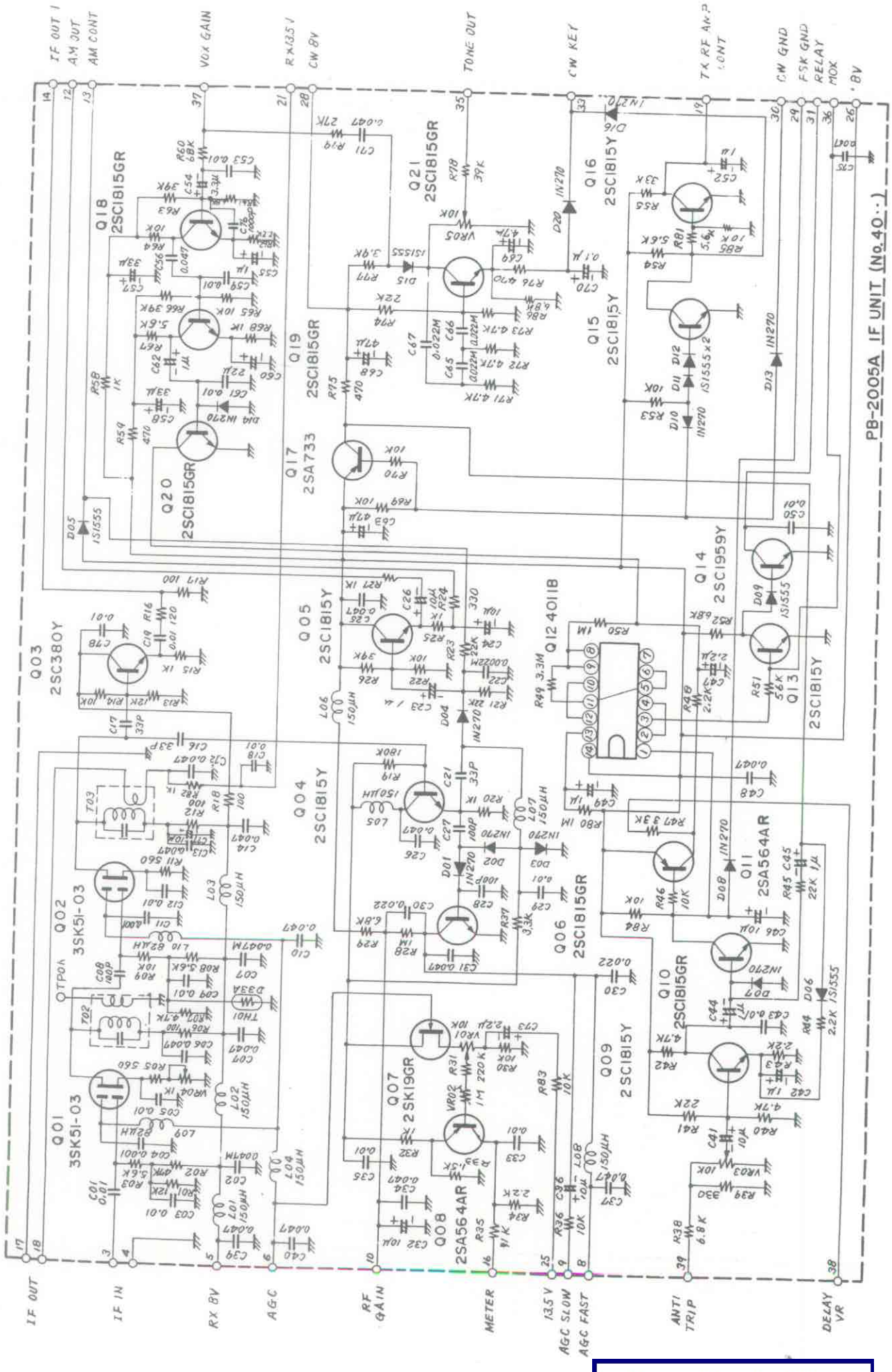
CRYSTAL DATA FT-107M

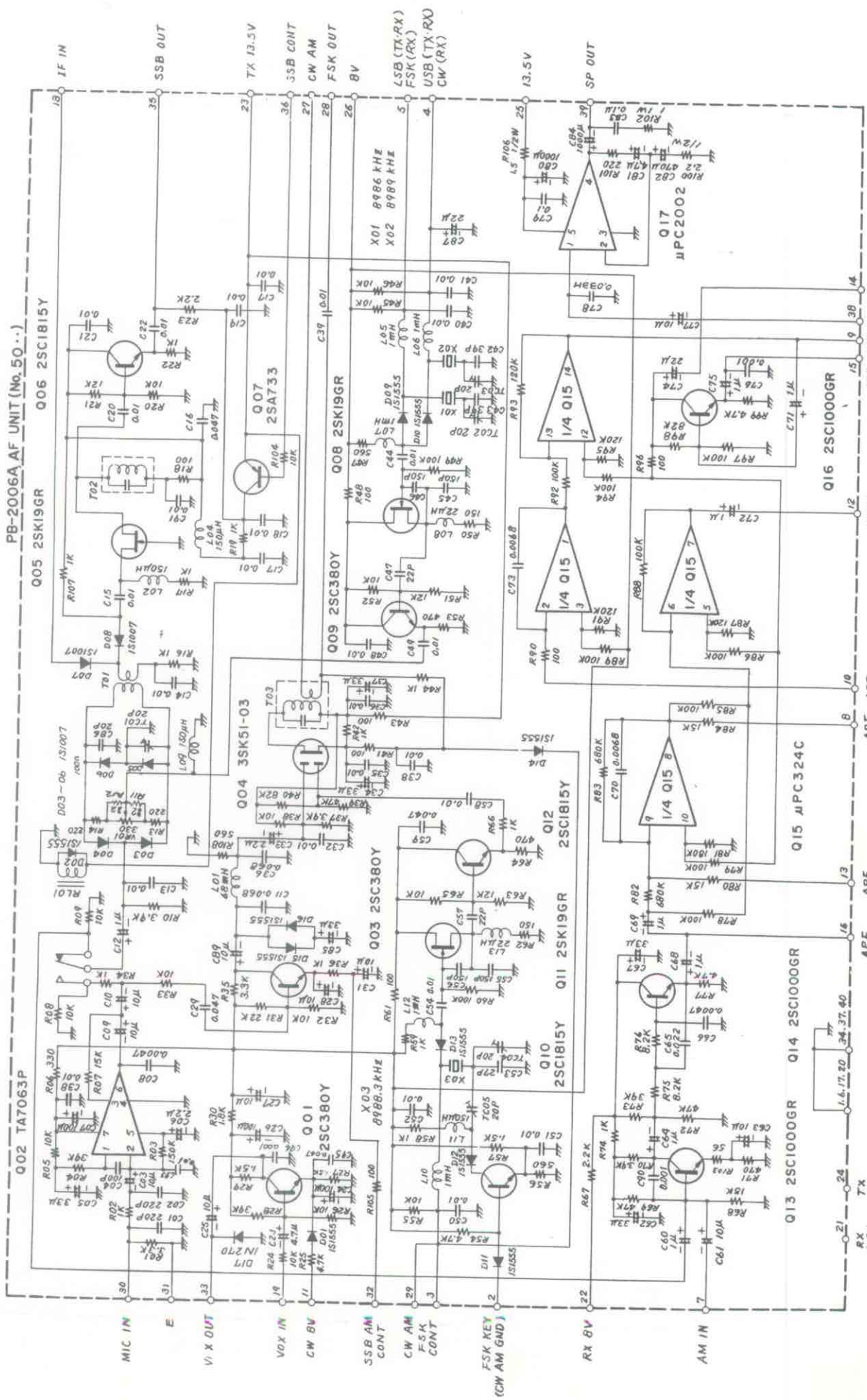
UNIT	FUNCTION	HOLDER	FREQUENCY (kHz)	MODE	LOAD C (pF)	EFFECTIVE RESISTANCE (ohms)	DRIVE LEVEL (mw)
LOCAL	160m	HC-18/U	15984.5	3rd overtone	20	80	2
	80m	〃	17984.5	〃	〃	60	〃
	40m	〃	21484.5	〃	〃	45	〃
	30m	〃	24487.5	〃	〃	40	〃
	20m	〃	28487.5	〃	〃	40	〃
	17m	〃	32487.5	〃	〃	40	〃
	15m	〃	35487.5	〃	〃	40	〃
	12m	〃	38987.5	〃	〃	40	〃
	10m(A)	〃	42487.5	〃	〃	40	〃
	10m(B)	〃	42987.5	〃	〃	40	〃
	10m(C)	〃	43487.5	〃	〃	40	〃
	10m(D)	〃	43987.5	〃	〃	40	〃
	WWV	〃	19487.5	〃	〃	50	〃
AF	LSB	〃	8986.0	Fundamental	30	35	10
	USB	〃	8989.0	〃	〃	〃	〃
	CW, AM, FSK	〃	8988.3	〃	〃	〃	〃
FILTER	Width	〃	※19747.5	Fundamental	35	15	2
DMS	Local	〃	20480.0	Fundamental	18.5	20	2
RF	Marker	HC-6/W	3200.0	Fundamental	23	50	5
LSI COUNTER	Clock	HC-18/U	6553.6	Fundamental	30	30	2

※ XCO FREQUENCY: 19743–19753kHz
Determined by circuit




PB-2004A FILTER UNIT (No.30··)
XF01 8.9M20
XF02 XF-89HS
XF03 XF-89HC CW(OPTION)
XF04 XF-89GA AM(OPTION)
XF05 XF-10GS
Q01 2SC535A
Q02 2SC1815Y
Q03 MPS-A13
Q04 2SK19GR
Q05 2SK19GR
Q06 3SK51-03
Q07 2SK19GR
Q08 2SK19GR
Q09 2SC735Y
Q10 2SC535A
Q11 2SC1815Y
Q12 2SC1815Y
PROC ON CONT
PROC OFF CONT
TX 13.5V
TX OUT
AM CONT
13.5V
CW FSK CONT
RX 8V
13.5V SSB TX IN
CW TX IN
IF IN
NB OUT
NB CONT
RX 8V
IF OUT
E
8V
IF WIDTH CONT
TX 8V
RX 13.5V
NC




PB-2006A AF UNIT (No.50**)
Q02 TA7063P
Q05 2SK19GR
Q06 2SC1815Y
Q07 2SA733
Q08 2SK19GR
Q09 2SC380Y
Q04 3SK51-03
Q03 2SC380Y
Q12 2SC1815Y
Q11 2SK19GR
Q10 2SC1815Y
Q01 2SC380Y
Q15 μPC324C
Q17 μPC2002
Q16 2SC1000GR
Q13 2SC1000GR
Q14 2SC1000GR
X01 8986 kHz
X02 8989 kHz
X03 8988.3 kHz
IF IN
SSB OUT
TX 13.5V
SSB CONT
CW AM
FSK OUT
8V
LSB (TX·RX) FSK (RX)
USB (TX·RX) CW (RX)
13.5V
SP OUT
APF OUT
APF 2 IN
NOTCH OUT
APF 4
APF 3
APF 1
APF SW
TX 8V
RX 13.5V
MIC IN
E
VOX IN
CW 8V
SSB AM CONT
CW AM FSK CONT
FSK KEY (CW AM GND)
RX 8V
AM IN

AF UNIT (PB-2006)

The incoming SSB/CW/FSK IF signal is fed through diode switch D_{5007} (1S1007), and delivered to the ring demodulator, consisting of D_{5003}–D_{5006} (1S1007), which demodulates the IF signal into audio using the carrier signal delivered from Q_{5009} (2SC380Y).

The carrier oscillator, Q_{5008} (2SK19GR), oscillates at 8986 kHz for LSB and FSK, and at 8989 kHz for USB and CW. Diode D_{5009} (1S1555) conducts to activate X_{5001} for LSB/FSK, while D_{5010} (1S1555) conducts to activate X_{5002} for USB/CW. The carrier signal from Q_{5008} is amplified by Q_{5009} for delivery to the ring demodulator.

The audio output from the ring is amplified by Q_{5016} and Q_{5017} (2SC1000GR), and delivered through the APF/NOTCH switch and AF GAIN control VR2a to the audio output amplifier, Q_{5017} (μPC 2002H), which delivers 3 watts of audio output to the speaker. The audio spectrum is shaped at Q_{5014} by a low-pass filter of f_o = 2.7 kHz, −12 dB/octave.

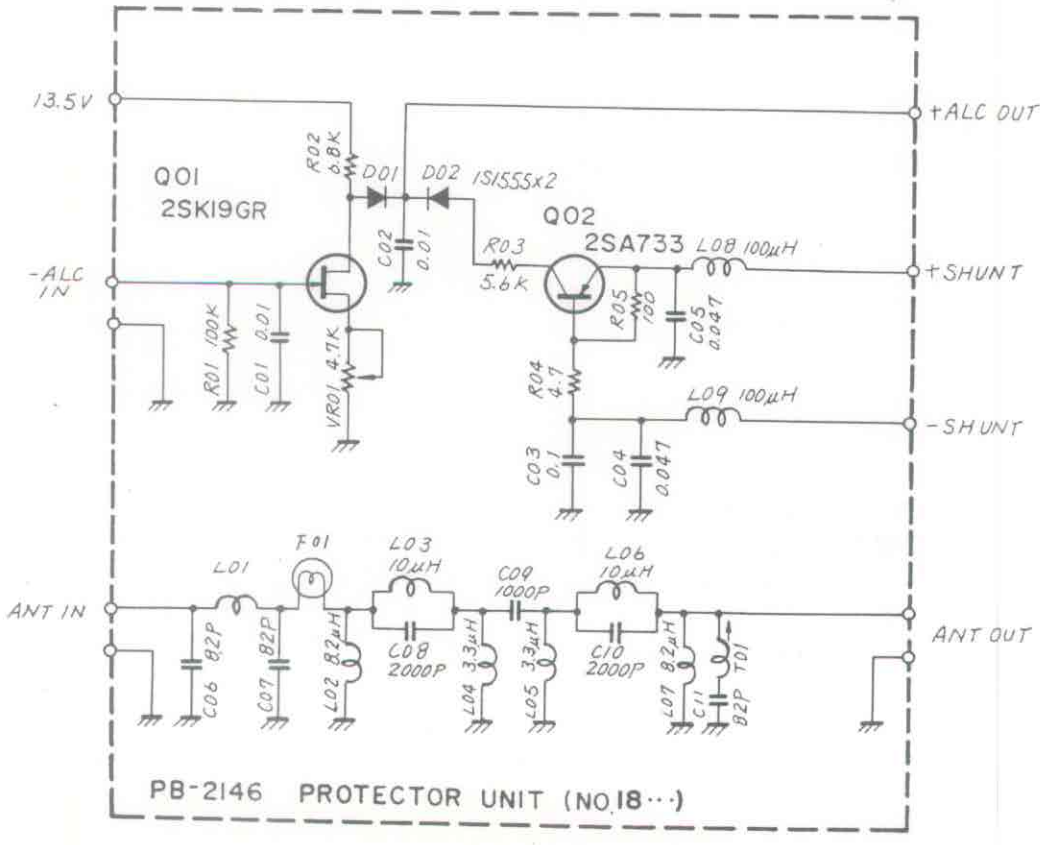
Operational amplifier Q_{5015} (μPC324C) is placed in the audio circuit by the APF/NOTCH switch on the front panel. For APF operation, a selective active filter is formed by two sections of Q_{5015}, and the output is amplified by Q_{5016} (2SC1000GR) prior to delivery to Q_{5017}. Two sections of Q_{5015} are also used for the high-Q notch filter. VR_3 provides for adjustment of the center frequency of the audio peak and notch filters.

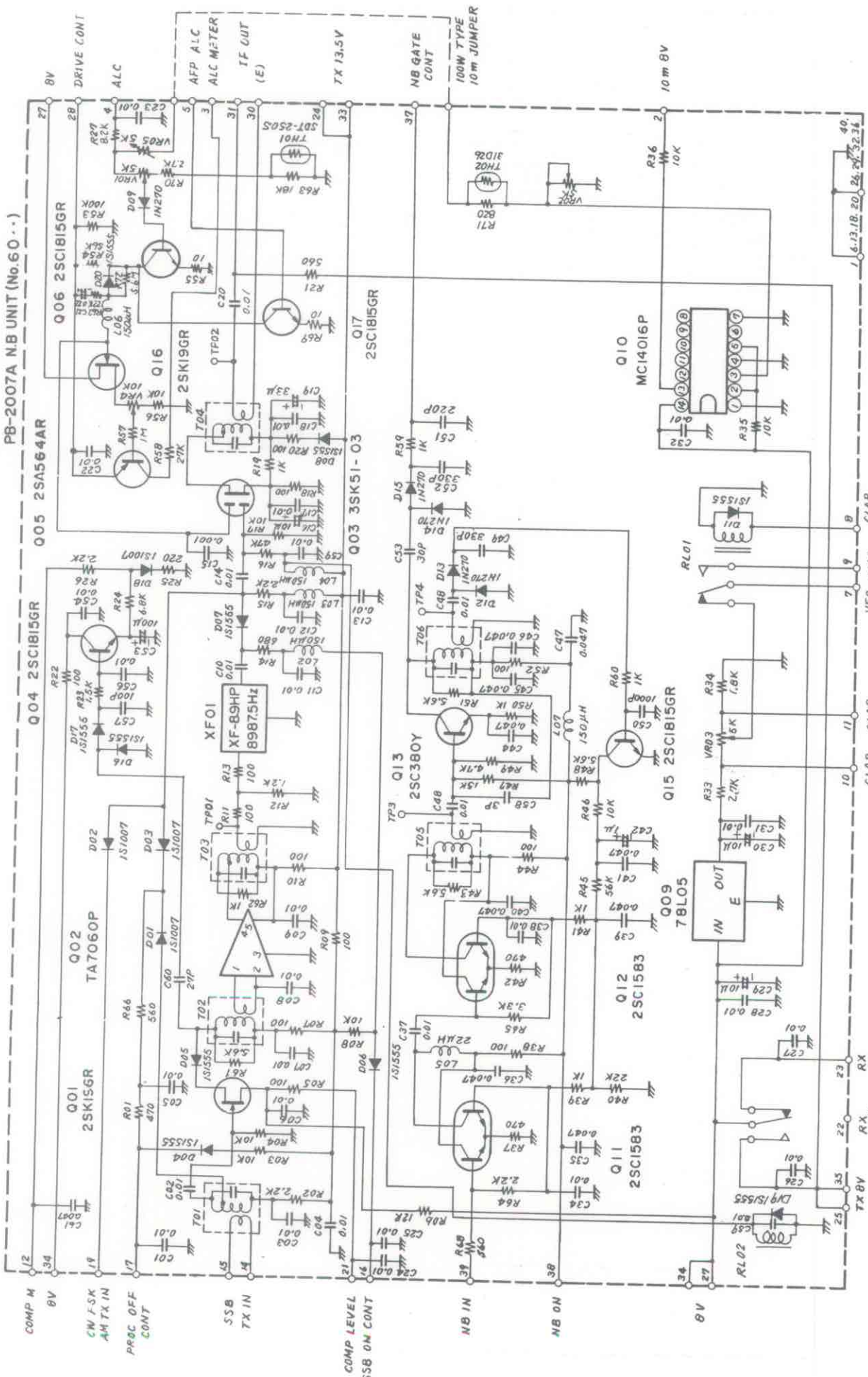
In the AM mode, the output from buffer Q_{4005} is fed to the base of Q_{5013} for amplification, in the same way as the signals on the other modes.

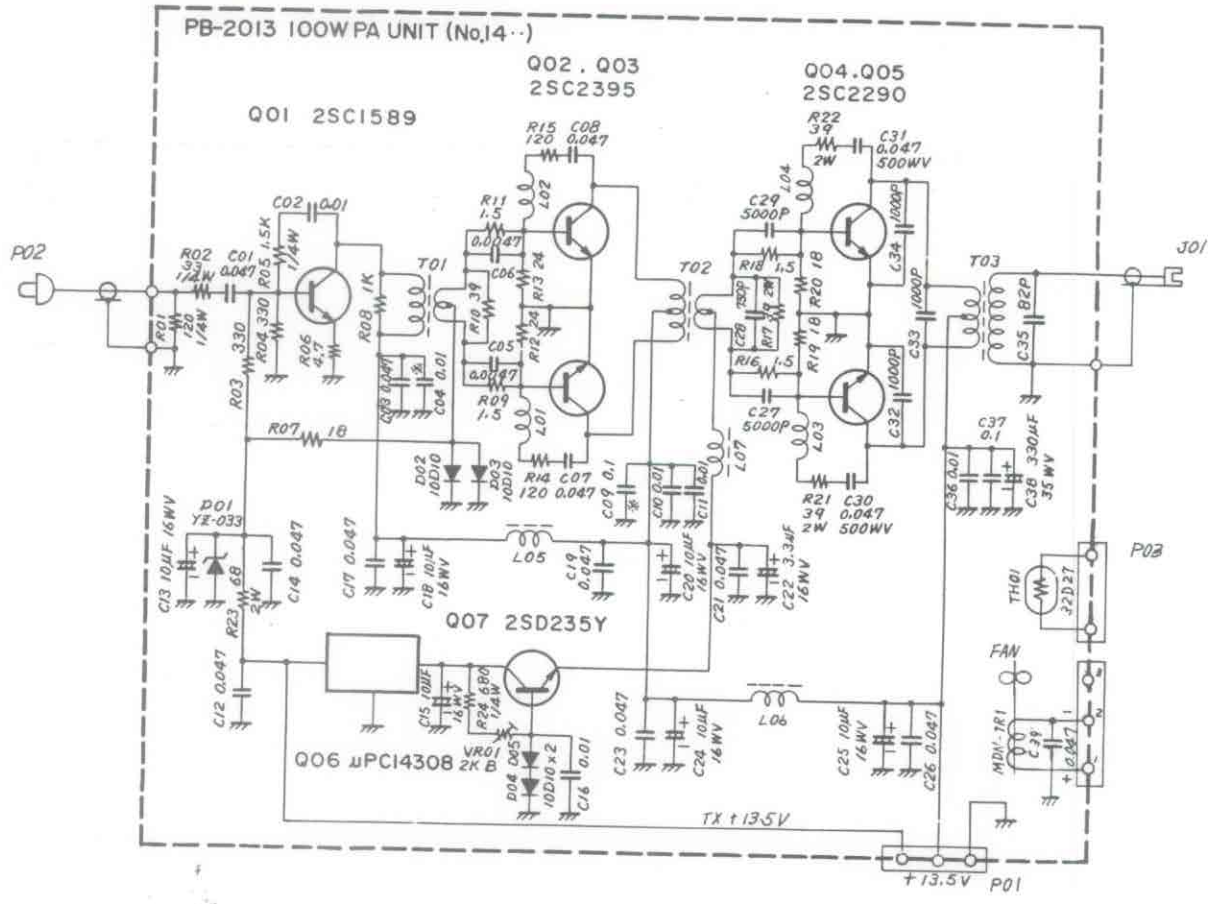
PROTECTOR UNIT (PB-2146)

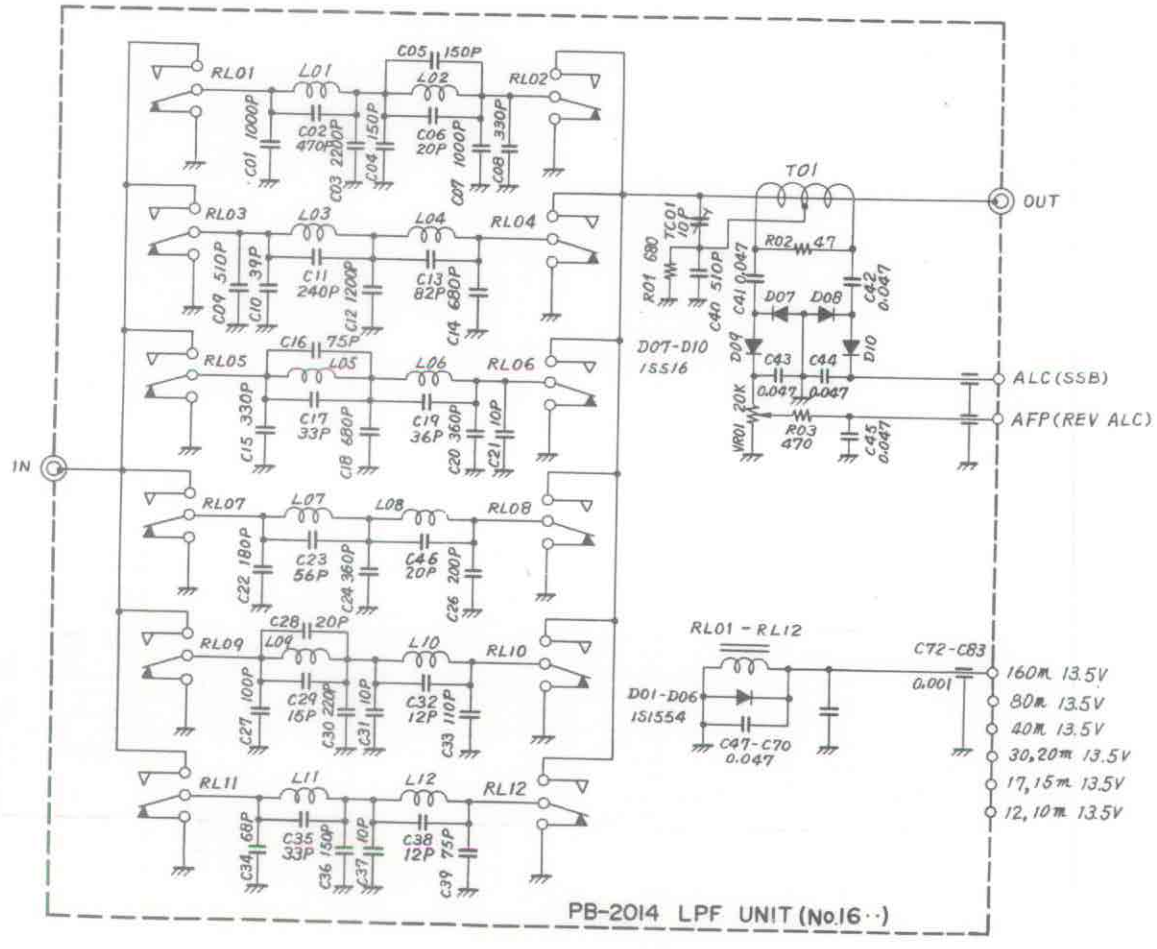
The incoming RF signal is fed to a 1.7 MHz high-pass filter through a lamp fuse which protects the RF amplifier and mixer against extremely strong signals. This signal is then fed to the RF Unit.

If an excessive current flows through the Power Amp Unit, Q_{1802} (2SA733) will act to reduce the drive level and to protect the Power Amp Unit.



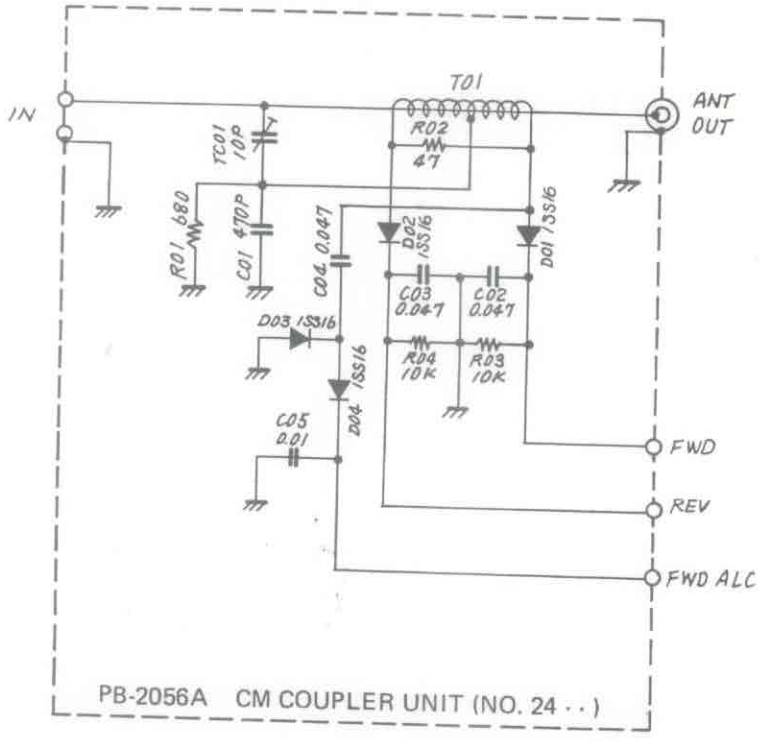

PB-2007A N.B UNIT (No.60 - -)
Q01 2SK152GR
Q02 TA7060P
Q03 3SK51-03
Q04 2SC1815GR
Q05 2SA564AR
Q06 2SC1815GR
Q09 78L05
Q10 MC14016P
Q11 2SC1583
Q12 2SC1583
Q13 2SC380Y
Q15 2SC1815GR
Q16 2SK19GR
Q17 2SC1815GR
XF01 XF-89HP 8987.5Hz
8V
DRIVE CONT
ALC
AFP ALC
ALC METER
IF OUT (E)
TX 13.5V
NB GATE CONT
100W TYPE 10m JUMPER
10m 8V
CLAR CONT
VFO CLAR 2
CLAR 2
CLAR 1
CLAR 3
RX 8V
RX 13.5V
TX 8V
COMP M
8V
CW FSK AM TX IN
PROC OFF CONT
SSB TX IN
COMP LEVEL
SSB ON CONT
NB IN
NB ON
8V


PB-2013 100W PA UNIT (No.14··)
Q01 2SC1589
Q02 . Q03
2SC2395
Q04.Q05
2SC2290
Q07 2SD235Y
Q06 μPC14308
P02
J01
P03
P01
TH01
FAN
TX t13.5V
+13.5V

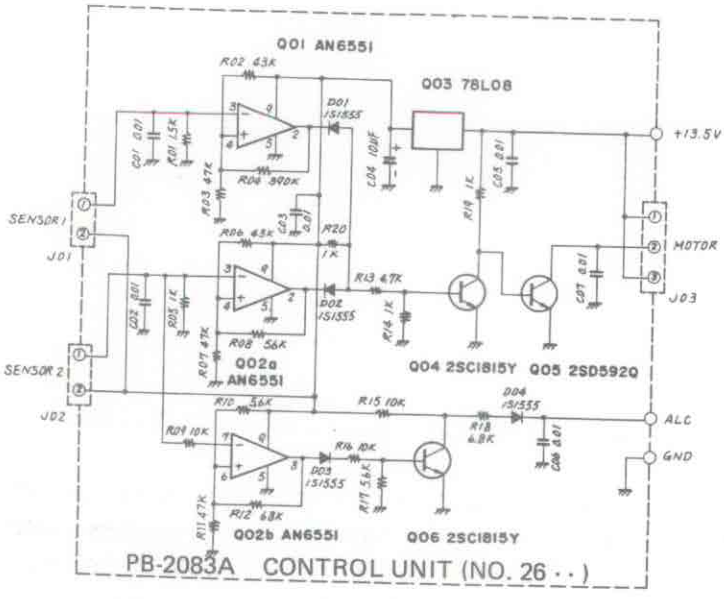

PB-2014 LPF UNIT (No.16··)
IN
OUT
ALC(SSB)
AFP(REV ALC)
RL01 - RL12
D01-D06
1S1554
D07-D10
1SS16
160m 13.5V
80m 13.5V
40m 13.5V
30,20m 13.5V
17,15m 13.5V
12,10m 13.5V

CM COUPLER UNIT (PB-2056)

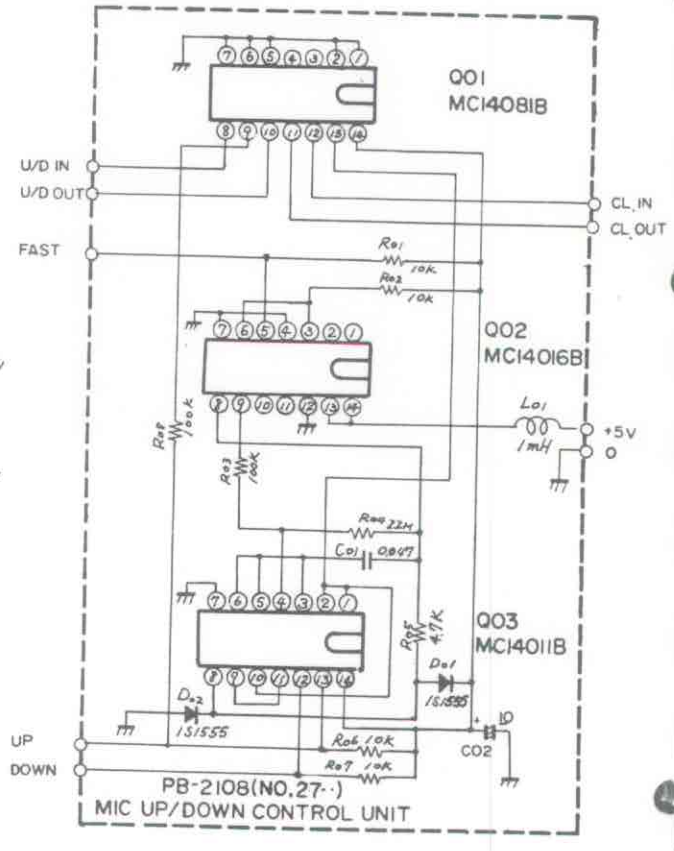
The output from the LPF Unit is fed to the CM COUPLER Unit, where a directional coupler provides for relative forward and reverse power indication on the front panel meter.



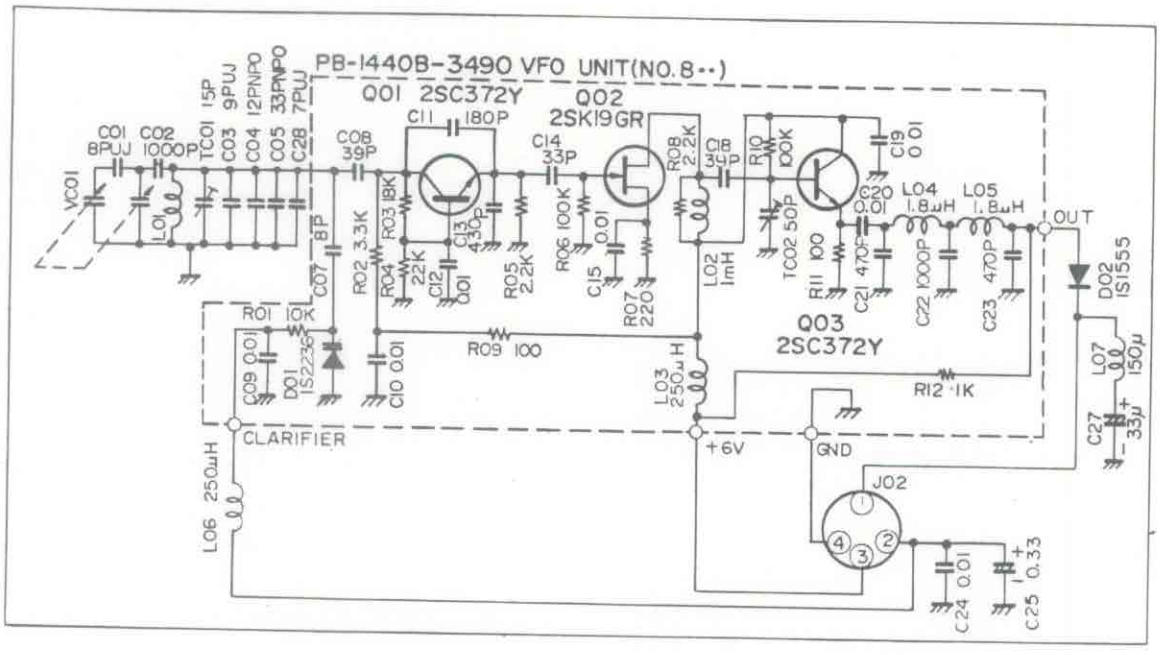
PB-2056A CM COUPLER UNIT (NO. 24 · ·)



PB-2083A CONTROL UNIT (NO. 26 · ·)



PB-2108(NO.27· ·)
MIC UP/DOWN CONTROL UNIT

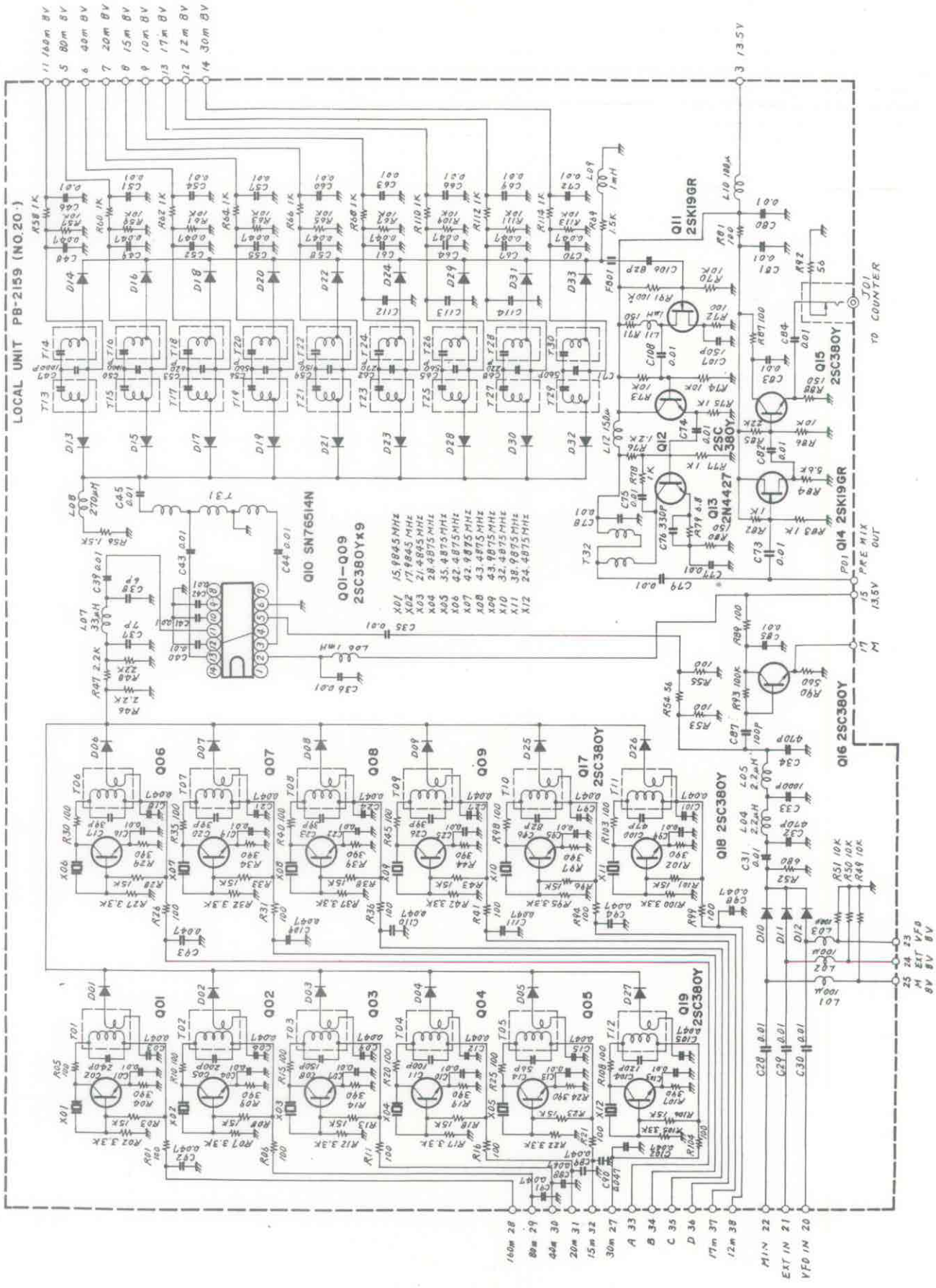


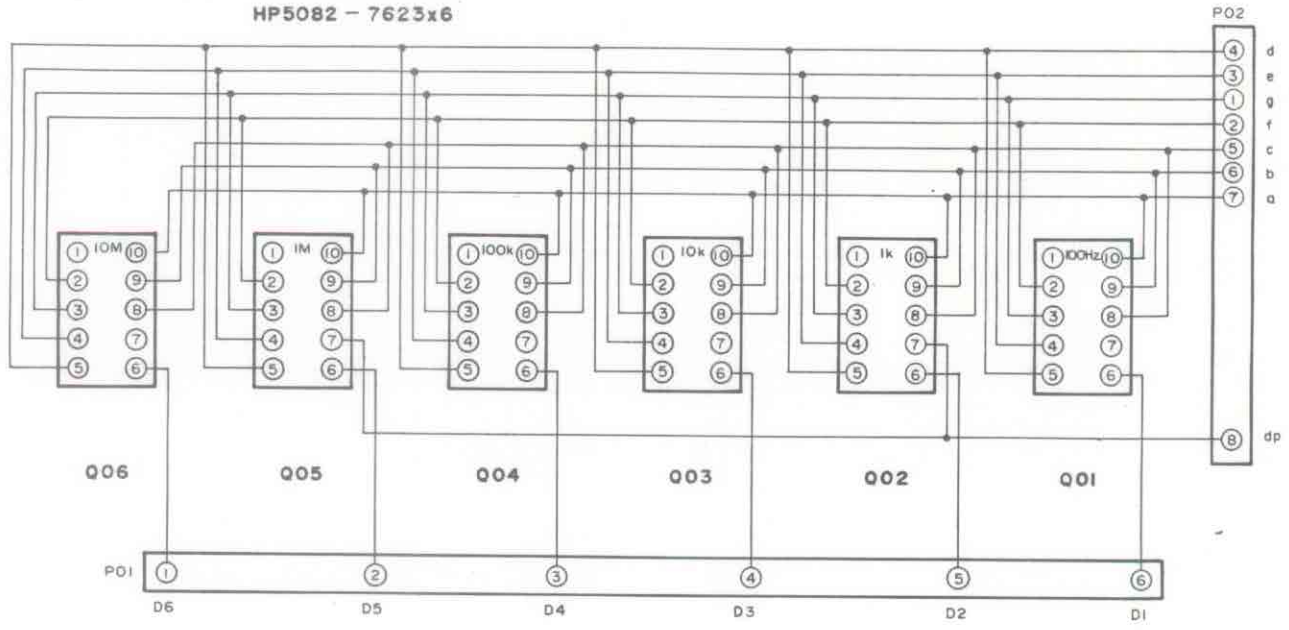
BAND	CRYSTAL	XCO Frequency	PREMIX OUT Frequency
160m	X_{2001}	15.9845MHz	10.4875~10.9875MHz
80m	X_{2002}	17.9845MHz	12.4875~12.9875MHz
40m	X_{2003}	21.4845MHz	15.9875~16.4875MHz
30m	X_{2012}	24.4875MHz	18.9875~19.4875MHz
20m	X_{2004}	28.4875MHz	22.9875~23.4875MHz
17m	X_{2010}	32.4875MHz	26.9875~27.4875MHz
15m	X_{2005}	35.4875MHz	29.9875~30.4875MHz
12m	X_{2011}	38.9875MHz	33.4875~33.9875MHz
10m A	X_{2006}	42.4875MHz	36.9875~37.4875MHz
10m B	X_{2007}	42.9875MHz	37.4875~37.9875MHz
10m C	X_{2008}	43.4875MHz	37.9875~38.4875MHz
10m D	X_{2009}	43.9875MHz	38.4875~38.9875MHz

Table 1

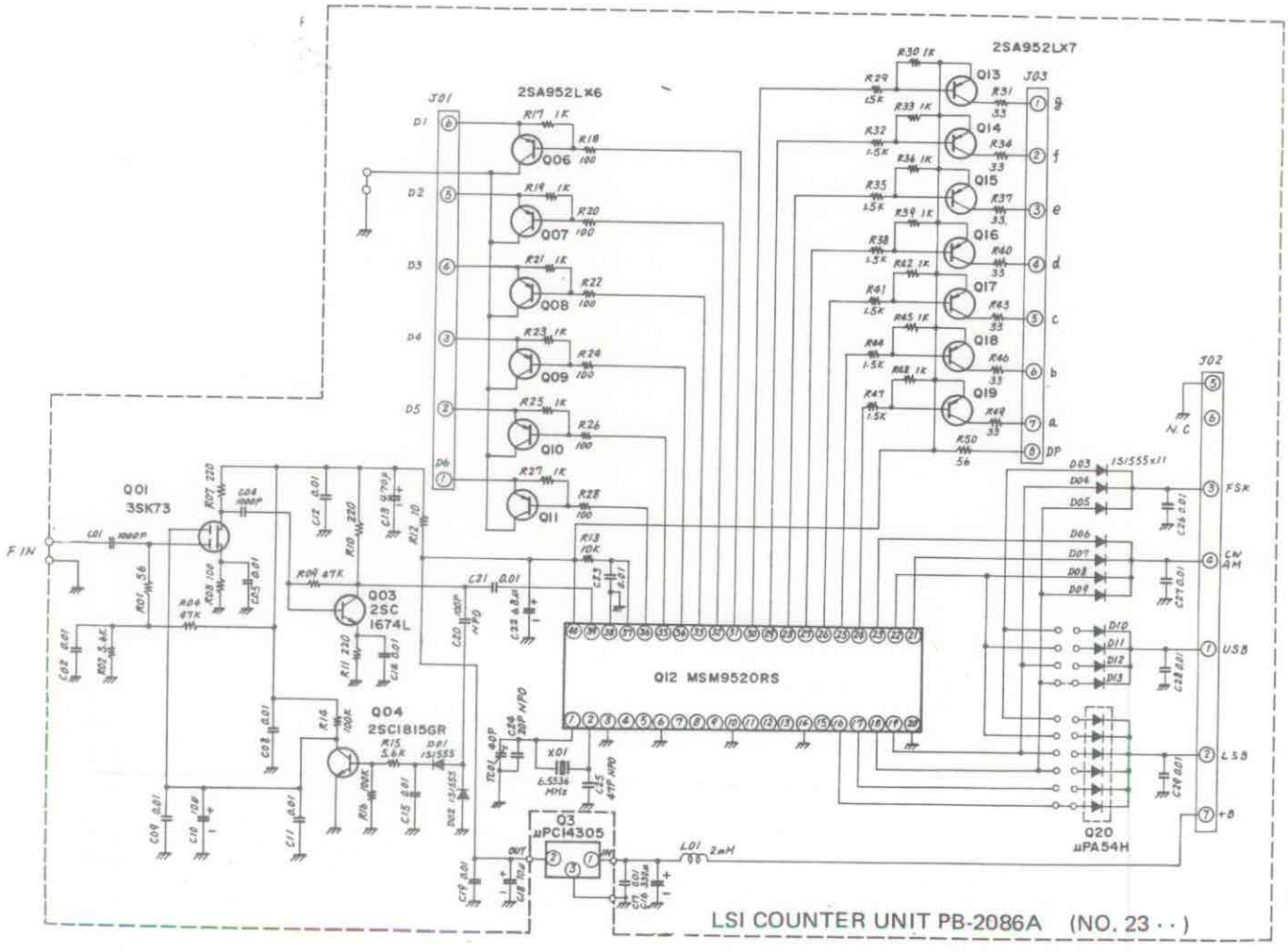
BAND	Nominal Premix Local Frequency	L S B	U S B	CW, AM
160m	10.4875—10.9875(MHz)	10.486—10.986(MHz)	10.489—10.989(MHz)	10.4883—10.9883(MHz)
80m	12.4875—12.9875	12.486—12.986	12.489—12.989	12.4883—12.9883
40m	15.9875—16.4875	15.986—16.486	15.989—16.489	15.9883—16.4883
30m	18.9875—19.4875	18.986—19.486	18.989—19.489	18.9883—19.4883
20m	22.9875—23.4875	22.986—23.486	22.989—23.489	22.9883—23.4883
17m	26.9875—27.4875	26.986—27.486	26.989—27.489	26.9883—27.4883
15m	29.9875—30.4875	29.986—30.486	29.989—30.489	29.9883—30.4883
12m	33.4875—33.9875	33.486—33.986	33.489—33.989	33.4883—33.9883
10m A	36.9875—37.4875	36.986—37.486	36.989—37.489	36.9883—37.4883
10m B	37.4875—37.9875	37.486—37.986	37.489—37.989	37.4883—37.9883
10m C	37.9875—38.4875	37.986—38.486	37.989—38.489	37.9883—38.4883
10m D	38.4875—38.9875	38.486—38.986	38.489—38.989	38.4883—38.9883

Table 2


LOCAL UNIT PB-2159 (NO.20)
Q01–Q09
2SC380Yx9
Q10 SN76514N
Q11 2SK19GR
Q12 2SC380Y
Q13 2N4427
Q14 2SK19GR
Q15 2SC380Y
Q16 2SC380Y
Q17 2SC380Y
Q18 2SC380Y
Q19 2SC380Y
TO COUNTER
PRE MIX OUT
13.5V
MIN
EXT IN
VFO IN



DISPLAY UNIT PB-2087 (NO.22··)



COUNTER UNIT (PB-2086A/PB-2087)

The local oscillator signal is applied to Large-Scale Integrated Circuit (LSI) chip for display on the front panel digital display.

The premix signal from the LOCAL Unit is applied to the F IN terminal and amplified by Q_{2301} **(3SK73)** The amplified signal is further amplified by Q_{2303} **(2SC1674)** and delivered to the LSI counter chip, Q_{2321} **(MSM9520RS)**. A portion of the output from Q_{2303} is amplified by Q_{2304} **(2SC1815Y)** and fed to gate 2 of Q_{2301} and Q_{2302}, controlling the gain of those amplifiers.

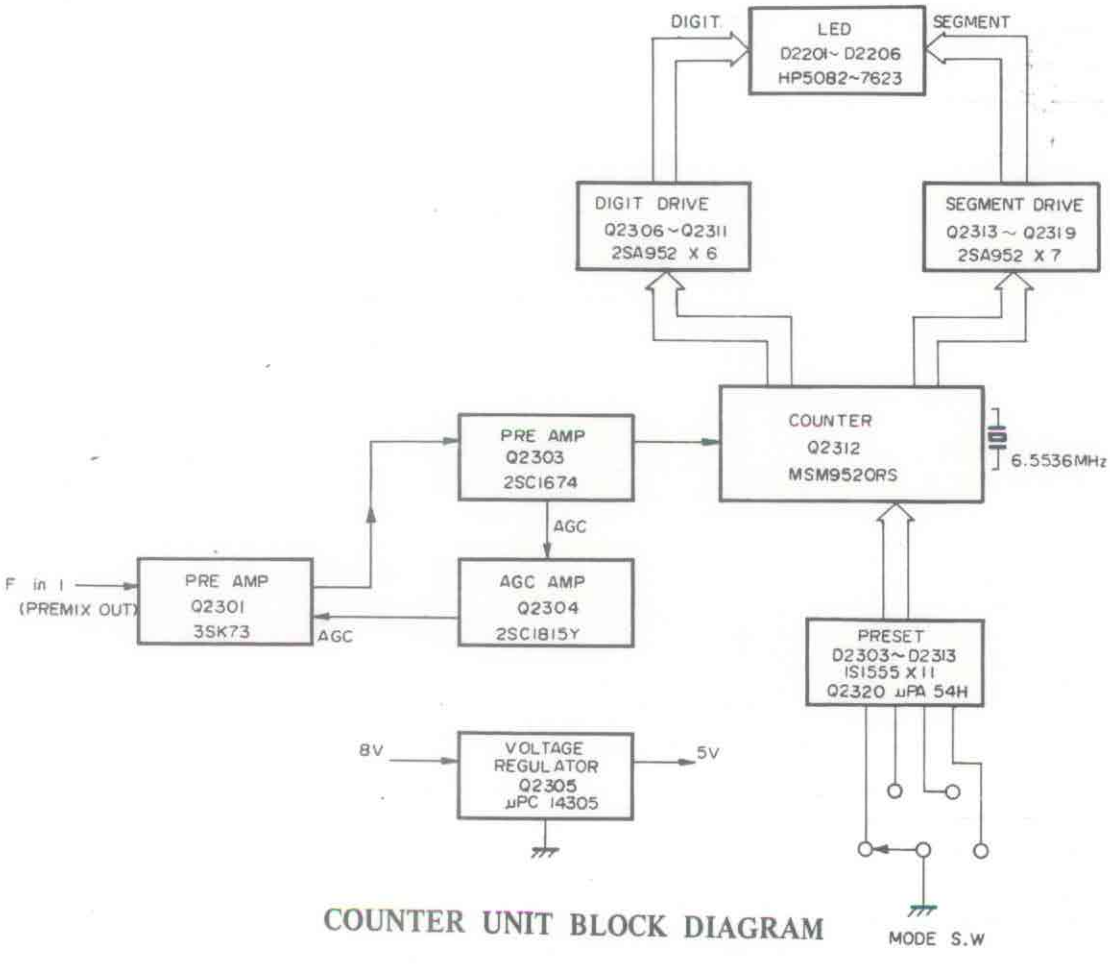
The output from the LSI is fed to the display. The output from pins 24 through 30 is delivered to segment drivers Q_{2313}–Q_{2319} **(2SA952L)** and digit drivers Q_{2306}–Q_{2311} **(2SA952L)** through a dynamic drive configuration. Display is performed by D_{2201}–D_{2206} **(HP5082-7623)**, seven-segment light-emitting diodes.

POWER SUPPLY

When the optional FP-107 AC Power Supply is installed, it will provide the required 13.5 VDC at 20 amps for the FT-107M. AC input voltages of 100/110/117/200/220/234 volts at 50/60 Hz may be used.

The output from the power transformer is rectified by a full-wave bridge rectifier. The rectified voltage is stabilized by a voltage regulator, consisting of Q_1 **(2N5685)** and Q_{202} **(2SA1012)**, while current limiting is provided by Q_{201} **(2SK19BL)**. The comparator function of the voltage regulator is performed by Q_{203} **(2SA950)**.

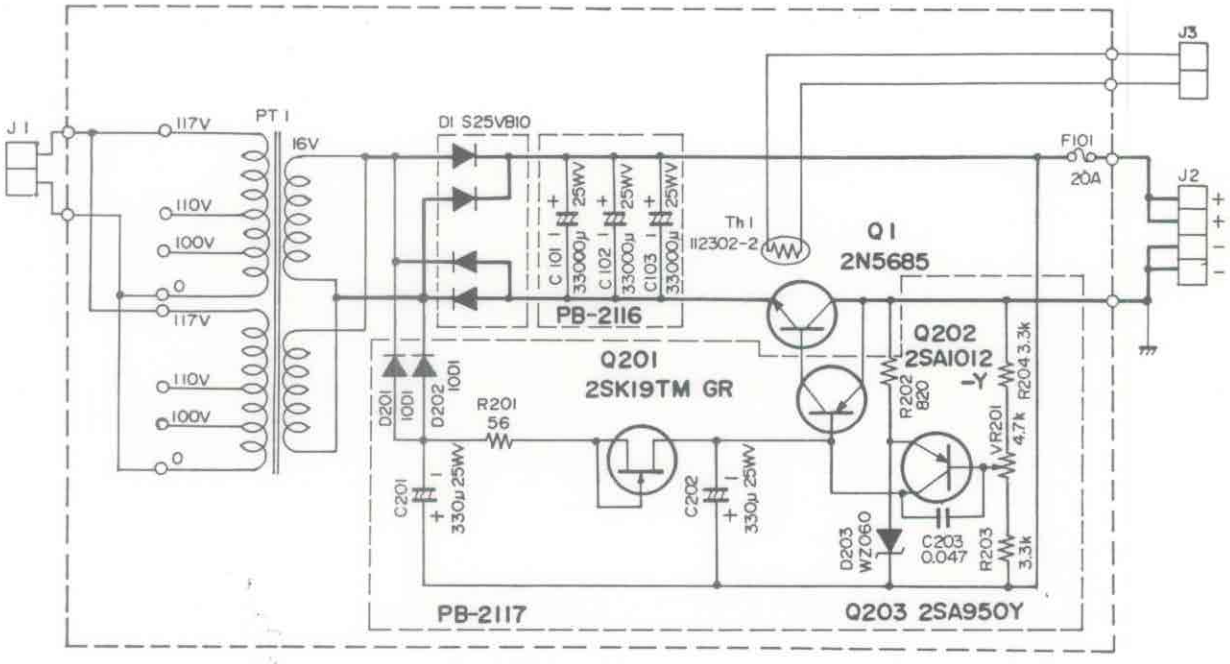
The input 13.5 VDC line from the FP-107 (or the external DC power line) is used for the PA Unit, the meter lamp, and for relay switching. RL_1 provides relay switching for the TX 13.5 V and RX 13.5 V lines.



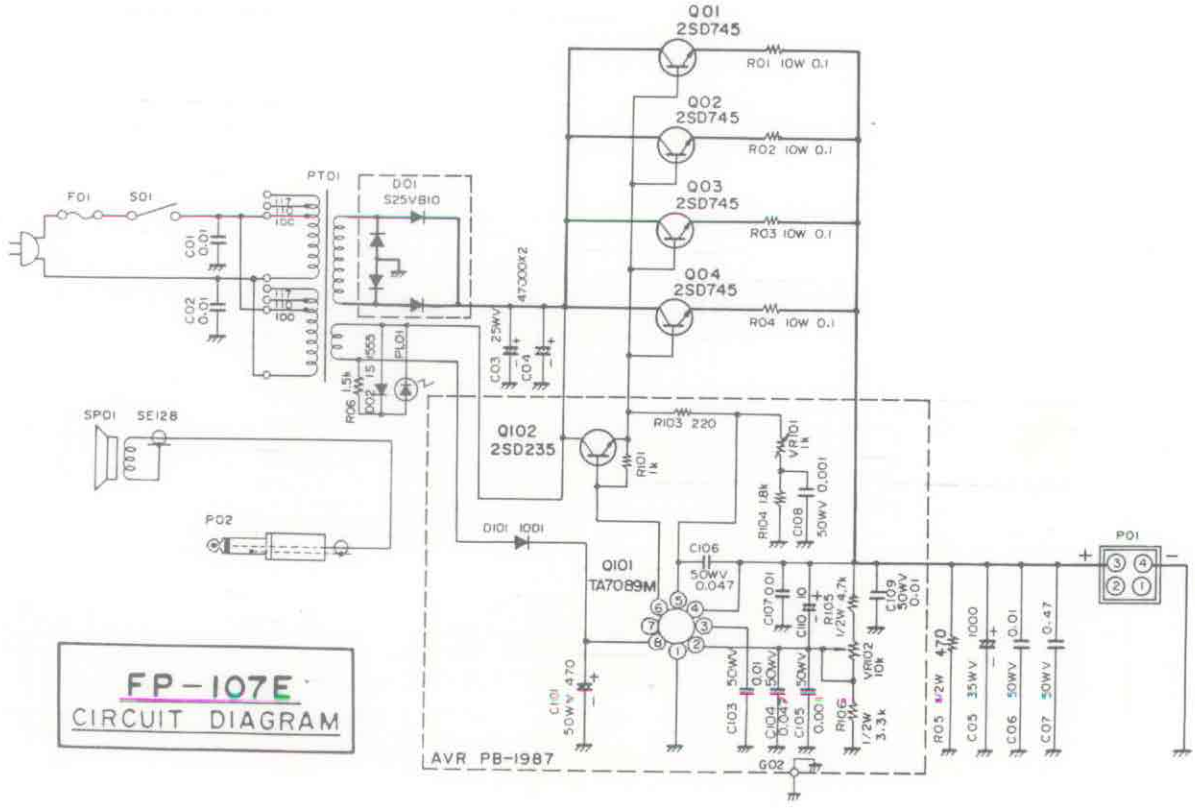
COUNTER UNIT BLOCK DIAGRAM

The 13.5 volt line is stabilized at 8 volts by Q_1 (μPC14308), for use in the transistor circuits. The 8 volt line is further stabilized by Q_2 (μPC-14308) for the VFO circuitry, which requires a highly stable power source.

Transistor switches Q_{6007}/Q_{6008} (2SC1959Y), located on the NB Unit, provide switched 8 volts for the transmit and receive circuits.



FP 107
CIRCUIT DIAGRAM



FP-107E
CIRCUIT DIAGRAM

DMS UNIT

While a complete description of the Digital Memory Shift and memory circuitry is beyond the scope of this manual, reference to the block diagram of the DMS, along with the following description, should provide the owner with a better understanding of this design technique.

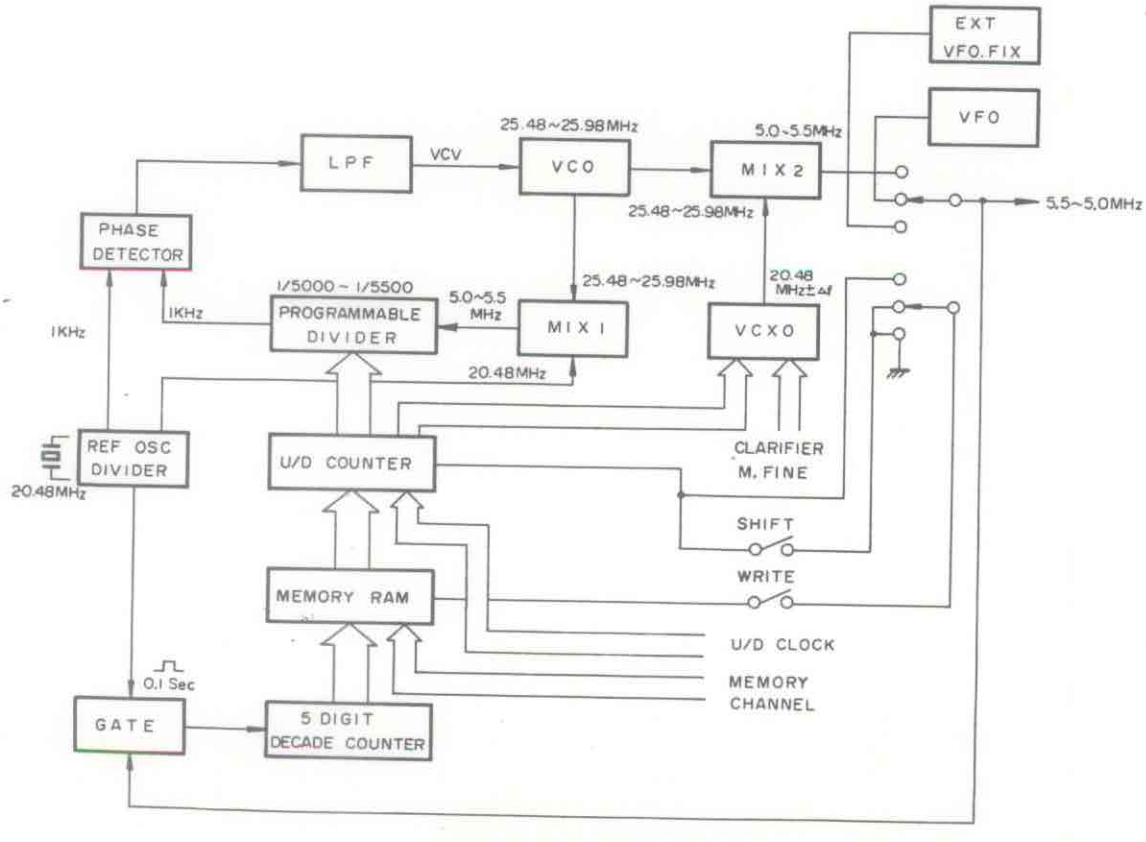
The 5.0–5.5 MHz VFO signal is fed to a counter gate, driven by a crystal controlled clock signal. The pulses which pass through the counter gate are fed to a five digit decade counter, which counts the VFO frequency. The digitally encoded output from the decade counter is delivered to the memory RAM for storage.

The output from the RAM is fed through an UP/DOWN counter to preset the programmable divider. On the DMS Unit, a 25.48–25.98 MHz signal is produced from the Voltage Controlled Oscillator (VCO). This signal is fed to a mixer, where the VCO signal is mixed with a 20.48 MHz reference signal, producing a 5.0–5.5 MHz signal, which is fed to the programmable divider.

The output from the programmable divider (at approximately 1 kHz) is fed to a phase detector, where the phase of the signal is compared to that of a 1 kHz reference signal, producing an error voltage. The error voltage is fed through a low-pass filter, which removes any ripple on the signal. The error voltage is then used to control varactor diodes in the VCO, locking it on the desired frequency.

When the memory frequency is recalled, the VCO output is fed to another mixer, where the 25.48–25.98 MHz signal is mixed with a 20.48 $\pm\Delta$f signal, resulting in a 5.0–5.5 MHz signal which is fed to the PLL (instead of the VFO signal). During memory fine tuning or clarifier operation (using the memory), the frequency of the 20.48 MHz voltage controlled crystal oscillator (VCXO) is varied, changing the 5.0–5.5 MHz output signal slightly in frequency.

During memory shift operation, the output pulses from the photo-interrupter circuitry are applied to the UP/DOWN so as to preset the programmable divider, thereby shifting the output from the memory RAM so as to provide the desired shifting the memory channel frequency.



DMS UNIT BLOCK DIAGRAM