Service Manual

Albrecht Electronic GmbH
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Model : SUPERSTAR-2400 Ord. No. 2612

Mobile 6-Mode 6-Band Transceiver

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PC Board Layout
- PCLD001S
- PCSW004S
- PCGW001S
- PCMA001S

Schematic Diagram

Repalcement Parts List

Specification

General

Frequency Composition	: PLL Synthesizer
Frequency Range	: A - 26.065 to 26.505 MHz B - 26.515 to 36.955 MHz C - 26.965 to 27.405 MHz D - 27.415 to 27.855 MHz E - 27.865 to 28.305 MHz F - 28.315 to 28.755 MHz
Channels	: 240
Frequency Space	: 10 kHz
Emission	: AM/FM/USB/LSB/CW
Power Source	: 13.8 V DC

Receiver

Sensitivity	: AM - 1 micro-V at 10 dB S/N FM - 1 micro-V at 20 dB S/N SSB/CW - 0.5 micro-V at 10 dB S/N
Selectivity	: 60 dB
Audio Output	: 2 W at 8 Ohm
Fine Tune Range	: ± 800 Hz
Coarse Tune Range	: ± 5 kHz
Squelch Range	: 0.5 to 300 micro-V
Intermediate Frequency	: AM/FM - 10.695 MHz/455 kHz SSB/CW - 10.695 MHz

Transmitter

RF Power Output :

	High	Mid	Low
SSB/CW	12 W	8 W	2 W
AM	7.5 W	4 W	1 W
FM	10 W	7 W	2 W

SSB Generation : Double-balanced modulator with crystal latice filter

Coarse Tune Range : ± 5 kHz

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Circuit Description

The transceiver is a 240 channel CB radio which uses a Phase Locked Loop [PLL] system of frequency synthesization to produce the crystal controlled channel and IF signals used in operation of the transmitter and receiver sections of the unit. The basic PLL system is comprised of a free-running voltage controlled oscillator (part of IC-2) a phase detector, a reference crystal oscillator (Q-1) and programmable divider (IC-1).

PLL Circuit

The voltage controlled oscillator[VCO] operates in the frequency range of 17.105 to 18.670 MHz in the AM/FM/USB modes and 17.102 to 18.668 MHz in the LSB mode, and is used to produce two output signals : #1, 36.760 to 39.45 MHz in the AM/FM/USB modes and 36.757 to 39.447 MHz in the LSB mode, #2, at 2.55 to 2.11 MHz. 2.10 to 1.66 MHz Reference frequency oscillator Q-2 oscillates at 19.655, 20.105, and 20.555 MHz in accordance with the Band Selector switch (1.5 KHz lower when LSB mode). Its output is fed through the bandpass filter[BPF]. This signal bests with the VCO free-running signal producing a 36.760 to 39.45 MHz in the AM/FM/USB modes and 36.757 to 39.447 MHz in the LSB mode, which is fed to the receiver first mixer Q-19 and also to IC-3 (on Main PC board PCMA001S), the transmitter mixer. The second VCO output signal, at 2.55 to 2.11 MHz is fed to the programmable divider IC-1. Simultaneously the 10.24 MHz output of Q-1 is applied to the programmable divider in IC-1 and divided dowen in 10 KHz steps. As channel is chosen by the Channel Selector switch, and 'N' code signal is applied to the terminals [pin No.10 to 15 of IC-1] on the programmable divider in IC-1, to preset the divider. THe two signals, the crystal oscillated signal [10.24 MHz] from Q-1, and the signal from the VCO via the lowpass filter [LPF] and buffer [in the IC-1] , are compared in the phasedetector of IC-1 and the phase detector produces a DC output voltage derived from the phase difference in the signals fed to it. This DC output is appkied throuh an LPF to the VCO, forming the phase loop. This DC voltage applied to the VCO causes it to shift frequency until its output signal licks up with the count-dowen frequency provied reference oscillator Q-1[when two signals are in phase] at which point no DC output is produced in the phase detector, and the VCO remains locked on frequency. When a new channel is selected a new 'N' code is applied to the programmable divider. The VCO is no longer because if the resulting phase difference in the phase detector, and it again shifts frequency to a locked condition, in turn producting 37 MHz output signals corresponding to

the new channel programmed by the 'N' code. In summary it will be seen that stable VCO frequency range will be produced, each specific frequency being determined by the 'N'code selected by the Channel Selector Switch.

Main Board Assembly (PCMA001S)

The crystal oscillator Q-10 is operating 10.695 MHz in the AM/FM/USB modes, and 10.692 MHz in the LSB mode, controlled by the crystal, X-6. This signal is #1: in the AM and FM modes of transmission, fed to the IC-3 to mixed with the first TX local oscillator frequency and result in 27 MHz transmitter frequencies, and #2: in the SSB modes of transmission, modulator through the balanced modulator IC-4 with the audio output signal from the microphone amplifier, IC-6. The resultant output of the balanced modulator is a couble sideband, suppressed carrier signal. The crystal filter XF, pass band is restricted to 3.5 kHz so that it allows only one sideband to pass through its output terminals, either USB or LSB mode, depending upon the Mode Selector Switch selection. The exact frequency of which was determined by the Channel Selector Switch selection and the PLL circuitry, as previously outlined, the resultant frequency, therefore, that is fed to the RF amplifier in IC-3, is the channel frequency on the channel selected [channel 1 through 240 over 26.065 to 28.755 MHz]. The 27 MHz RF amplifier output is coupled to RF predriver transistors, Q-5, Q-6 through T-3, T-4. The predrivers serve to isolate the oscillator and mixer stages from the output amplifiers, and at the same time provide a certain amount of power gain. Q-6 output is applied to the base input of Q-7, the RF driver stage and in turn to the Q-8, the RF power output stage of the transmitter. These stages amplify 27 MHz signal resulting in an output of 1/4/7.5 W in the AM mode, 2/7/10 W in the FM mode, and 2/8/12 W PEP [peak envelope power] in the SSB/CW modes.

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Modulation Circuit

AM: The microphone feeds voice audio through Q-29 to the power audio IC IC-6, and finally to collector of Q-7 and final RF power amplifier Q-8 through Q-30 thereby amplitude modulating the carrier in AM transmission.

FM: In the FM mode, IC-6 output is fed to the anode of the variable capacitor D-11 in IC-2 VCO circuit, varying its bias to change VCO signal phase component, finally giving deviation to PLL output frequency.

SSB/CW: The IC-6 output is directly fed to the balanced modulator IC-4, resulting in suppressed carrier double side band, which is in turn supplied to the crystal filter to carrier removal.

ALC: An audio ALC [automatic level control] voltage derived from the audio signal at Q-32 is fed to IC-6 to control the output of audio amplifier to prevent overmodulation. The transceiver is also equipped with the RF ALC circuit utilizing the RF output induced at the input of L-17 [in the SSB mode only]. The minus voltage detected through D-17 is applied to the DC plus bias circuit [pin No.7 of IC-2, TX mixer] thus reducing the gain of TX mixer as high level RF signal is observed L-17. This circuit is disabled in AM or FM mode of transmission. The ALC circuit [both audio and RF] accomplished very important function, not only preventing overmodulation, but in the view of harmonic and spurious suppression [especially in the SSB transmit mode].

Antenna Transmission Line

The lowpass filter between the antenna and collector of Q-8 serves to pass the 27 MHz signals, attenuating higher frequency signals. It also acts to match the antenna impedance to the output impedance of the transmitter output stage, this nominally being 50 Ohms.

Receiver

The RF signal, at frequency between 26.065 to 28.755 MHz, feed from the antenna through L-18, 17, 16 and T-8 to the 27 MHz RF amplifier Q-18. THen the amplified output signal from Q-18 is coupled through T-9 to first mixer Q-19 where it is beat with an injection signal from the VCO, IC-2. The frequency of the injection signal from IC-2 depends on the channel being selected as a signal of the 37 MHz range is programmed by the Channel Selector. The output of Q-19 is therefore, 10.695 MHz in the AM/FM/USB modes, and 10.692 MHz in the LSB mode, the first intermediate frequency and is the result of the RF input and mixing of IC-2 VCO singals. In case of the AM or FM receive mode, this 10.695 MHz first IF signal is then fed to the second mixer. Also fed to the second mixer is the second loacl oscillator signal, 10.24 MHz, from Q-1. Mixing of these two signals result in a signal at a frequency of 455 kHz in T-13. This is the second intermediate frequency for AM or FM mode of reception. In AM mode, the 455 kHz signal passes through the ceramic bandpass filter CF, and fed to IF amplifier Q-24 and Q-25, which include IF transformer T-14. The output of Q-25 is applied to D-38, AM diode detector, while in FM receiving mode, the 455 kHz signal amplified only through Q-24 is led to FM demodulating IC, IC-5 through T-15. Resultant demodulated audio is achieved from the IC pin #12 and input to AF gain control VR, VR-1. In the SSB mode of reception, the signal obtained as a result of the mixing of the RF input and IC-2 VCO signals, 10.695 MHz in the USB mode, 10.692 MHz in the LSB mode, is not converted down to lower intermediate frequency, but is passed through the crystal filter, XF, and fed to the SSB IF amplifiers Q-11, 14 and 15, which includes T-6 and T-7. The signal at the secondary side of T-7 is fed to Q-16, the product SSB detector and beat with the BFO [beat frequency oscillator] signal from the Q-10 and finally rectified to audio frequency signal.
The audio signal output from detectors (for AM [D-38], FM [IC-5], SSB [Q-16]), is passed through the AF Gain Control VR-1, to the input of the audio amplifier, IC-6. The audio output is coupled to the internal speaker through C-160, or to an external speaker through External Speaker Jack, J-4.

Squelch Circuit

Q-26, 27 and 28 are the squelch amplifier transistors. At low [or no] signal levels Q-28 collector conducts to ground and its output connected to pin #6 of IC-6 results in no signal output from the audio amplifier.
As the incoming RF signal increases it results in opening up the AF amplifier and output is activated. The level at which Q-28 cuts off is determined by setting of the Squelch Control, VR-2.

Noise Blanker

The noises contained in the RF signal at the output of RF amplifier, Q-18, is fed through C-122 to the base of Q-20. The amplified signal output of Q-20 is rectified by diodes D-34 and 35. The resulting DC voltage turns on Q-21 which in turn turns on Q-22. This causes the IF signal [10.695 MHz or 10.692 MHz] at T-11 and 12 to be conducted to ground through C-127 and Q-22 during the presence of the noise impulses, blanking out the noise from the audio output.

Clarifier (Fine)

The clarifier is operative only receive mode and changes the receive frequency regardless of the transmitting frequency. Clarifier VR acts to the plus bias voltage of Q-3 (DC switch). Thus, Q-2 oscillating frequency is pulled above (Clarifier VR clockwise rotated) or down (Clarifier VR counterclockwise rotated) its normal channel frequency.

Alignment Procedure

1. Measurement Condition

1) Reference Temperature : 25 °C

2) Reference Humidity : 65 %

NOTE: Unless otherwise specified, alignment may be conducted under the room temperature of 5 - 35 °C and the room humidity of 45 - 85 %.

3) Power Supply

DC 13.8 V ± 0.1 V.

2. Test Equipment

a) Audio Signal Generator	OSC	Sine wave, 10 Hz to 20 kHz
b) RF VTVM	VTVM	Probe type, 0.1 mV measurable
c) DC regulated Power Supply	DC	DC 4 A or higher, DC 0 - 20 V
d) Frequency Counter	FC	0 - 40 MHz, high input impedance
e) Synchroscope (or Oscilloscope)	CRT	0 - 100 MHz, high input impedance
f) RF Wattmeter	W	Thermo-coupled type, 50 Ohm, higher than 15 W, 100 kHz - 50 MHz
g) Standard Signal Generator	SG	1 kHz/400 Hz, 0 - 100 % mod. with FM
h) Speaker Dummy Load	R	8 Ohm, 5 W
i) Circuit Tester	T	DC 20 kOhms/V, high input impedance
j) Pulse Generator	PG	0 - 500 Hz, 0 - 1 V
k) Linear Detector	LD	

All test equipment should be properly calibrated.

3. PLL Circuit Alignment

3.1 [10.24 MHz] Reference Frequency Adjustment (Check)

Connect frequency counter to pin terminal #3 of IC-1.

Check counter reads 10.24000 MHz.

Tolerance within ± 200 Hz is acceptable. Otherwise, replace X-1 (10.240 MHz).

3.2 10.695 MHz Adjustment

Connect frequency counter to TP-4. Set the Mode Selector to USB.

Adjust CT-11 to 10.695 MHz, + 0, - 100 Hz.

Reset Mode Selector to LSB. Adjust CT-10 to 10.692 MHz, + 0, - 100 Hz.

3.3 Off-set Frequency Adjustment

1) Connect frequency counter to TP-1 (pin terminal #4 of IC-2).
2) Set the Mode Selector to USB, and the Fine Tune to center.
3) Set the Band Selector to position A.
4) Adjust CT-2 for 19.655 MHz ± 50 Hz.
5) Set the Band Selector to position C.
6) Adjust CT-3 for 20.105 MHz ± 50 Hz.
7) Set the Band Selector to position E.
8) Adjust CT-4 for 20.555 MHz ± 50 Hz.

3.4 LSB Off-set Frequency Adjustment

1) Set the Mode Selector to LSB, select band C.
2) Connect frequency counter to TP-1.
3) Adjust CT-5 to 20.1035 MHz.

NOTE: Check all off-set frequencies are 1.5 KHz lower than those obtained in step 3.3. Tolerance within ± 300 Hz is acceptable.

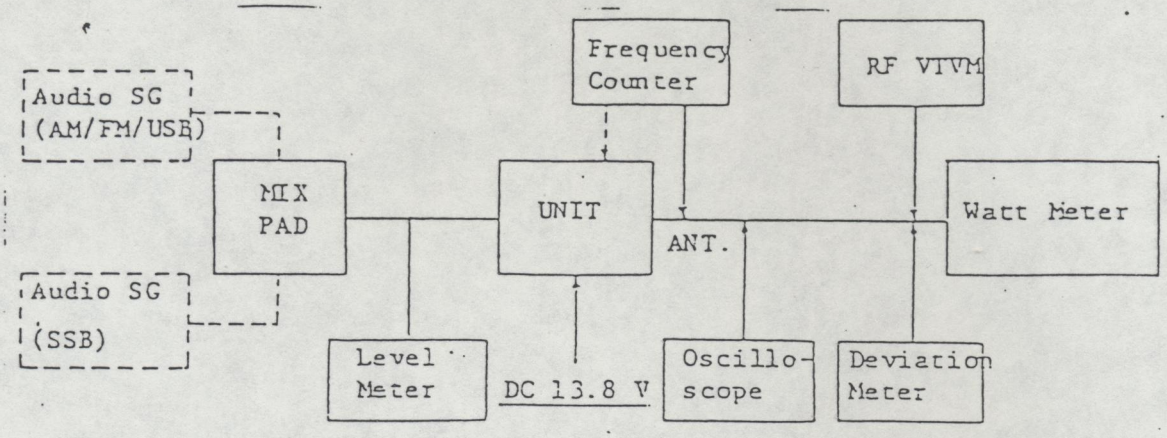
3.5 [VCO] Adjustment

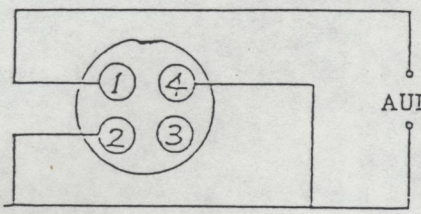
1) Set the Band Selector to F, and the channel Selector to 40 (240th).
2) Connect digital voltmeter or tester to TP-3.
3) Adjust core of VCO-unit-case to 0.8 V ± 0.1 V on tester.
4) Set the Band Selector to A, and the Channel Selector to 1.
5) Check tester reads less than 4.8 V.

4. Transmitter Alignment

4.1 Test set-up

Connect testing unit to the unit as shown:





AUDIO INPUT

Dummy microphone plug prewired.

Transmit mode.

4.2 RF Power Amplifier Adjustment

1) Set the Mode Selector to USB.
2) Apply 2,400 Hz 20 mV audio to microphone input circuit (use dummy microphone plug).
3) Set the Mode Selector to F. Channel Selector to 20.
4) Adjust T-1 and T-3 for maximum RF output.
5) Set the Mode Selector to D. Channel Selector to 20.
6) Adjust T-2 and T-4 for maximum RF output.
7) Repeat steps 3) through 6) until no further improvement is obtained.
8) Set the Mode Selector to B, Channel Selector to 20.
9) Adjust CT-6 and CT-8 for maximum RF output.
10) Set the Mode Selector to A, Channel Selector to 20.
11) Adjust CT-7 and CT-9 for maximum RF output.
12) Repeat steps 7) and 8) until further improvement is nor obtained.

* This alignment can be made easier with lower RF output condition approx. 2 W (adjust RV-6).

4.3 Carrier Leakage Adjustment

1) Set the Mode Selector to LSB.
2) Remove test audio.
3) Adjust RV-5 for minimum (ideally none) RF output (carrier leak).

4) Apply 2,400 Hz 10 mV audio to unit (use dummy microphone plug). Now the RF power output should be 40 dB greater than carrier-leak output.

5) Check step 4) in USB mode.

4.4 RF Power Stage Adjustment

After completing above, apply 2,400 Hz 20 mV audio to MIC input, USB mode. Rotate RV-3 and RV-6 fully counterclockwise. Select the Band Selector to F and channel 40 (240th). Adjust T-5 and L-16 for maximum RF output.

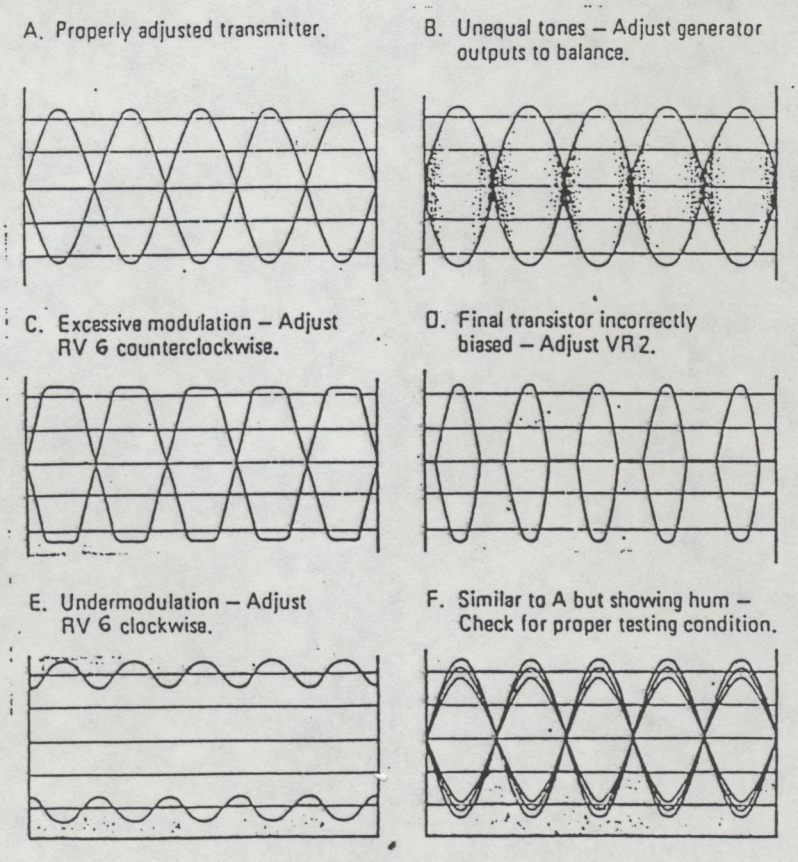
4.5 Two-Tone Adjustment

1) Apply 500 Hz and 2,400 Hz (20 mV) audio tones to the microphone input circuit at the same time. Use two audio signal generator sets with attenuators.

2) Adjust test audio levels of 500 Hz generator by means of attenuator on the generator so that the scope presents wave figure like 'A' as shown below.

3) Adjust RV-6 to 12 W p-p RF power output.

Reference – SSB Two-Tone Alignment



4.6 AM RF Power Output Adjustment

1) Set the Mode Selector to AM.
2) Select the Band Selector to C.
3) Select teh Channel Selector to 20 (100th).
4) Adjust RV-11 for 7.5 W RF power output.

4.7 AM Modulation Adjustment

1) Apply 2,400 Hz 7 mV audio to the unit.
2) Adjust RV-12 for modulation depth of greater than 90 %.

4.8 FM RF Power Output Adjustment

1) Set the Mode Selector to FM.
2) Adjust RV-3 to 10 W RF output.

   Check: RF output in all channels should be more than 9 W in FM mode.

4.9 FM Deviation Adjustment

1) Set the Mode Selector to FM.
2) Apply 1,250 Hz 20 mV audio to modulation circuit. Use dummy microphone plug.
3) Connect deviation meter (or linear detector) to antenna output on the unit.
4) Adjust RV-1 to obtain 2 - 3 kHz.

4.10 RF Power Meter Adjustment

1) Set the Mode Selector to AM.
2) Comparing the reading of external RF power and the built-in meter, Adjust RV-4 for equal indication on the unit power meter.

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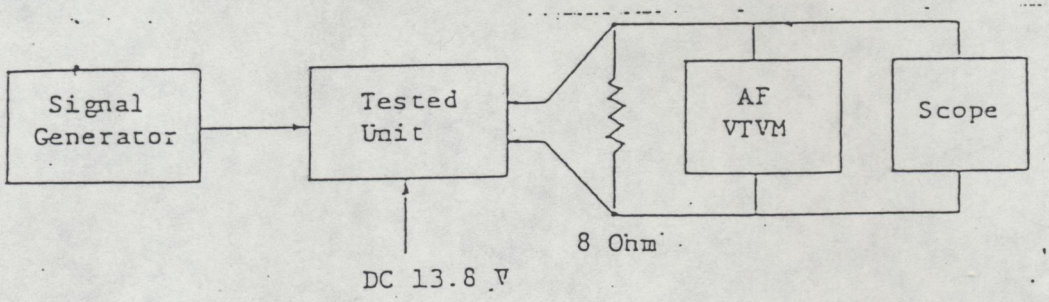
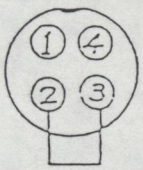
5. Receiver Alignment

5.1 Test set-up

Connect testing equipment to the unit as shown:





Dummy microphone plug

Receive mode

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5.2 [AGC (SSB)] Adjustment

1) Set the Mode Selector to USB (no signal condition).
2) Connect digital voltmeter to pin terminal #28 on main board (Q-18, Q-19 AGC input) and chassis ground.
3) Set DX/Mid/LOC switch (S-2) to DX position.
4) Adjust RV-7 for 2.0 V.

* Check 1.8 - 2.3 V in AM mode.

5.3 AM Sensitivity Adjustment

1) Set signal generator to 27.205 MHz with 1 kHz 30 % modulation.
2) Set the Channel Selector to Channel 20 in Band C.
3) Set the Mode Selector to AM.
4) Adjust T-8, T-9, T-10, T-11, T-12, T-13 and T-14 for maximum audio output from speaker output terminals (across dummy load).
   NOTE: Keep generator output level as low as possible to avoid AGC action.
5) After completing above, rotate T-8 approx. 1/2 turn in the direction of clockwise and T-9 1/2 - 1/4 turn in the direction of clockwise.

5.4 SSB Sensitivity Adjustment

1) Set signal generator to 27.205 MHz.
2) Set the Channel Selector to channel 20 in Band C.
3) Set the Mode Selector to USB.
4) Adjust T-6 and T-7 for maximum audio output.

* Set FINE (Clarifier) to center.

5.5 FM IF/Demodulator Alignment (FM Sensitivity Adjustment)

1) Select channel 20 in Band C, set the Mode Selector to FM.
2) Set unit to no signal condition.
3) Adjust T-15 and T-16 repeatedly to maximum (noise) output.
4) Apply FM signal (1 μV, 1.5 kHz deviation with 1 kHz audio) to unit.
5) Readjust T-15 and T-16 for maximum audio output.

IMPORTANT: When rotating T-16 core from top to end, maximum audio output is obtained at 3 points. Adjust to the highest peak of the 3 peaks.

5.6 Squelch Adjustment

1) Set teh Mode Selector to AM.
2) Set signal generator to provide RF input signal of 46 dB (200 μV), 1 kHz 30 % modulated, and rotate squelch control to the fully clockwise position.
3) Connect scope to speaker output terminal. Adjust RV-10 to a point at which audio output is critically disappeared on scope.

* Check the Squelch circuit will operate within 40 - 56 dB at all modes.

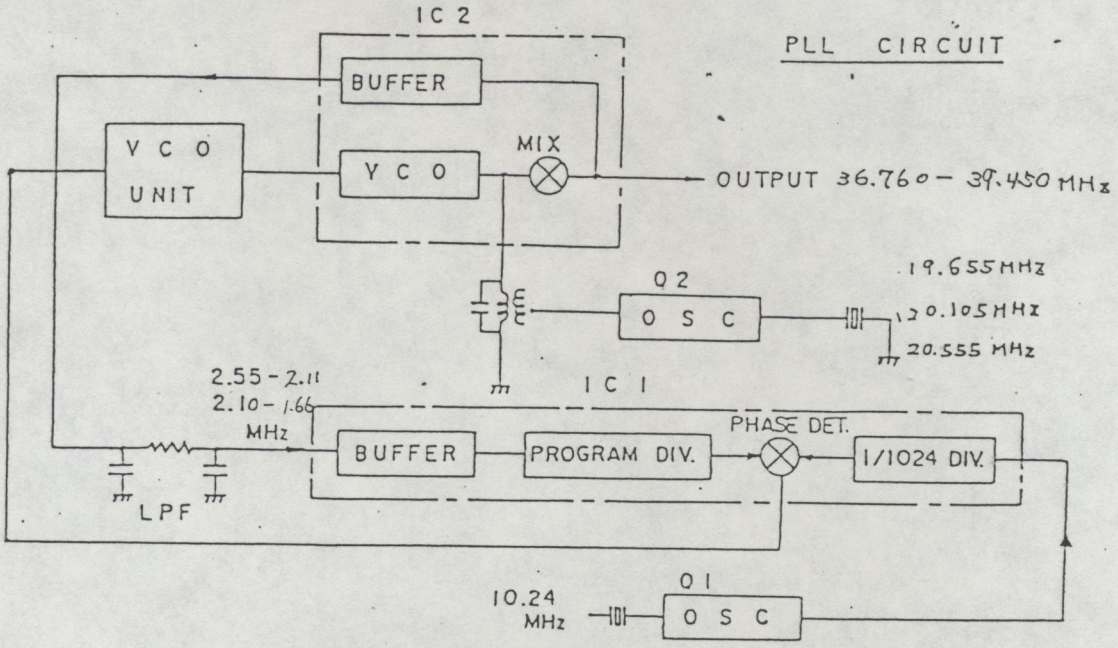
** SSB RX squelch is automatically adjusted by R-136 and requires no particular adjustment.

5.7 S-Meter Adjustment

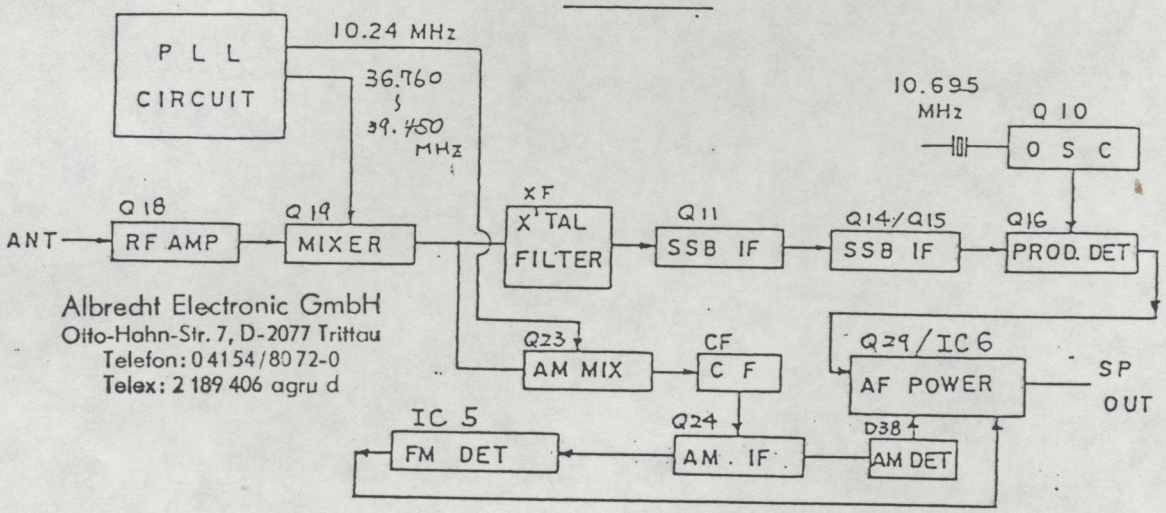
1) Set the Mode Selector to AM.
2) Adjust signal generator output to 40 dB (100 μV).
3) Adjust RV-8 so that S-meter indicates '9' on the unit meter scale.
4) Set the Mode Selector to USB.
5) Adjust RV-9 so that S-meter indicates '9'.

BLOCK DIAGRAM

PLL CIRCUIT



RECEIVER



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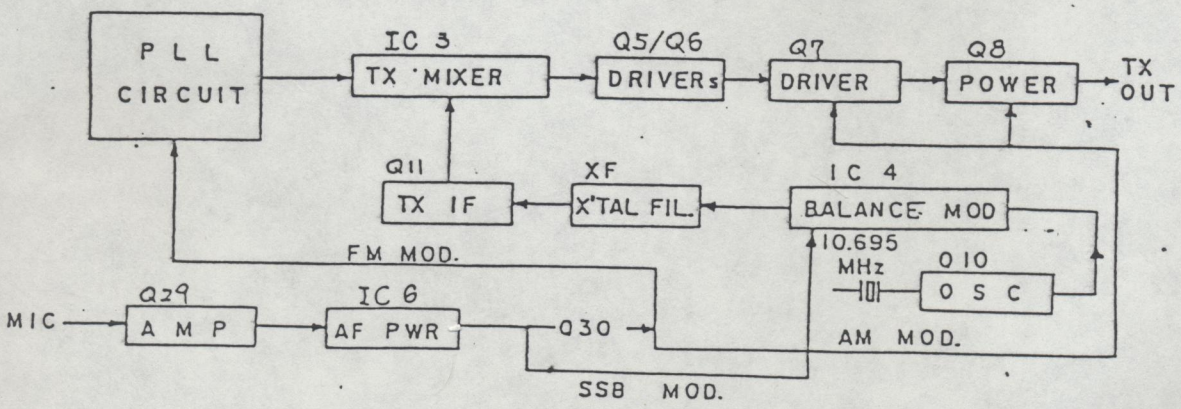
TRANSMITTER



Frequency Table

Channel	Channel frequency (MHz)	VCO output frequency (MHz)		PLL input frequency (MHz)
		AM/FM/USB	LSB	
Band A	Off-set frequency = 19.655 MHz.			
1	26.065	36.760	36.757	2.55
2	26.075	36.770	36.767	2.54
3	26.085	36.780	36.777	2.53
4	26.105	36.800	36.797	2.51
5	26.115	36.810	36.807	2.50
6	26.125	36.820	36.817	2.49
7	26.135	36.830	36.827	2.48
8	26.155	36.850	36.847	2.46
9	26.165	36.860	36.857	2.45
10	26.175	36.870	36.867	2.44
11	26.185	36.880	36.877	2.43
12	26.205	36.900	36.897	2.41
13	26.215	36.910	36.907	2.40
14	26.225	36.920	36.917	2.39
15	26.235	36.930	36.927	2.38
16	26.255	36.950	36.947	2.36
17	26.265	36.960	36.957	2.35
18	26.275	36.970	36.967	2.34
19	26.285	36.980	36.977	2.33
20	26.305	37.000	36.997	2.31
21	26.315	37.010	37.007	2.30
22	26.325	37.020	37.017	2.29
23	26.355	37.050	37.047	2.26
24	26.335	37.030	37.027	2.28
25	26.345	37.040	37.037	2.27
26	26.365	37.060	37.057	2.25
27	26.375	37.070	37.067	2.24
28	26.385	37.080	37.077	2.23
29	26.395	37.090	37.087	2.22
30	26.405	37.100	37.097	2.21
31	26.415	37.110	37.107	2.20
32	26.425	37.120	37.117	2.19
33	26.435	37.130	37.127	2.18
34	26.445	37.140	37.137	2.17
35	26.455	37.150	37.147	2.16
36	26.465	37.160	37.157	2.15
37	26.475	37.170	37.167	2.14
38	26.485	37.180	37.177	2.13
39	26.495	37.190	37.187	2.12
40	26.505	37.200	37.197	2.11

Channel	Channel frequency (MHz)	VCO output frequency (MHz)		PLL input frequency (MHz)
		AM/FM/USB	LSB	
Band B	Off-set frequency = 10.655 MHz			
1	26.515	37.210	37.207	2.10
2	26.525	37.220	37.217	2.09
3	26.535	37.230	37.227	2.08
4	26.555	37.250	37.247	2.06
5	26.565	37.260	37.257	2.05
6	26.575	37.270	37.267	2.04
7	26.585	37.280	37.277	2.03
8	26.605	37.300	37.297	2.01
9	26.615	37.310	37.307	2.00
10	26.625	37.320	37.317	1.99
11	26.635	37.330	37.327	1.98
12	26.655	37.350	37.347	1.96
13	26.665	37.360	37.357	1.95
14	26.675	37.370	37.367	1.94
15	26.685	37.380	37.377	1.93
16	26.705	37.400	37.397	1.91
17	26.715	37.410	37.407	1.90
18	26.725	37.420	37.417	1.89
19	26.735	37.430	37.427	1.88
20	26.755	37.450	37.447	1.86
21	26.765	37.460	37.457	1.85
22	26.775	37.470	37.467	1.84
23	26.805	37.500	37.497	1.81
24	26.785	37.480	37.477	1.83
25	26.795	37.490	37.487	1.82
26	26.815	37.510	37.507	1.80
27	26.825	37.520	37.517	1.79
28	26.835	37.530	37.527	1.78
29	26.845	37.540	37.537	1.77
30	26.855	37.550	37.547	1.76
31	26.865	37.560	37.557	1.75
32	26.875	37.570	37.567	1.74
33	26.885	37.580	37.577	1.73
34	26.895	37.590	37.587	1.72
35	26.905	37.600	37.597	1.71
36	26.915	37.610	37.607	1.70
37	26.925	37.620	37.610	1.69
38	26.935	37.630	37.627	1.68
39	26.945	37.640	37.637	1.67
40	26.955	37.650	37.647	1.66

Channel	Channel frequency (MHz)	VCO output frequency (MHz)		PLL input frequency (MHz)
		AM/FM/USB	LSB	
Band C : Off-set frequency = 20.105 MHz				
1	26.965	37.660	37.657	2.55
2	26.975	37.670	37.667	2.54
3	26.985	37.680	37.677	2.53
4	27.005	37.700	37.697	2.51
5	27.015	37.710	37.707	2.50
6	27.025	37.720	37.717	2.49
7	27.035	37.730	37.727	2.48
8	27.055	37.750	37.747	2.46
9	27.065	37.760	37.757	2.45
10	27.075	37.770	37.767	2.44
11	27.085	37.780	37.777	2.43
12	27.105	37.800	37.797	2.41
13	27.115	37.810	37.807	2.40
14	27.125	37.820	37.817	2.39
15	27.135	37.830	37.827	2.38
16	27.155	37.850	37.847	2.36
17	27.165	37.860	37.857	2.35
18	27.175	37.870	37.867	2.34
19	27.185	37.880	37.877	2.33
20	27.205	37.900	37.897	2.31
21	27.215	37.910	37.907	2.30
22	27.225	37.920	37.917	2.29
23	27.255	37.950	37.947	2.26
24	27.235	37.930	37.927	2.28
25	27.245	37.940	37.937	2.27
26	27.265	37.960	37.957	2.25
27	27.275	37.970	37.967	2.24
28	27.285	37.980	37.977	2.23
29	27.295	37.990	37.987	2.22
30	27.305	38.000	37.997	2.21
31	27.315	38.010	38.007	2.20
32	27.325	38.020	38.017	2.19
33	27.335	38.030	38.027	2.18
34	27.345	38.040	38.037	2.17
35	27.355	38.050	38.047	2.16
36	27.365	38.060	38.057	2.15
37	27.375	38.070	38.067	2.14
38	27.385	38.080	38.077	2.13
39	27.395	38.090	38.087	2.12
40	27.405	38.100	38.097	2.11

Channel	Channel frequency (MHz)	VCO output frequency (MHz)		PLL input frequency (MHz)
		AM/FM/USB	LSB	
Band D	Off-set frequency = 20.105 MHz			
1	27.415	38.110	38.107	2.10
2	27.425	38.120	38.117	2.09
3	27.435	38.130	38.127	2.08
4	27.455	38.150	38.147	2.06
5	27.465	38.160	38.157	2.05
6	27.475	38.170	38.167	2.04
7	27.485	38.180	38.177	2.03
8	27.505	38.200	38.197	2.01
9	27.515	38.210	38.207	2.00
10	27.525	38.220	38.217	1.99
11	27.535	38.230	38.227	1.98
12	27.555	38.250	38.247	1.96
13	27.565	38.260	38.257	1.95
14	27.575	38.270	38.267	1.94
15	27.585	38.280	38.277	1.93
16	27.605	38.300	38.297	1.91
17	27.615	38.310	38.307	1.90
18	27.625	38.320	38.317	1.89
19	27.635	38.330	38.327	1.88
20	27.655	38.350	38.347	1.86
21	27.665	38.360	38.357	1.85
22	27.675	38.370	38.367	1.84
23	27.705	38.400	38.397	1.81
24	27.685	38.380	38.377	1.83
25	27.695	38.390	38.387	1.82
26	27.715	38.410	38.407	1.80
27	27.725	38.420	38.417	1.79
28	27.735	38.430	38.427	1.78
29	27.745	38.440	38.437	1.77
30	27.755	38.450	38.447	1.76
31	27.765	38.460	38.457	1.75
32	27.775	38.470	38.467	1.74
33	27.785	38.480	38.477	1.73
34	27.795	38.490	38.487	1.72
35	27.805	38.500	38.497	1.71
36	27.815	38.510	38.507	1.70
37	27.825	38.520	38.517	1.69
38	27.835	38.530	38.527	1.68
39	27.845	38.540	38.537	1.67
40	27.855	38.550	38.547	1.66

Channel	Channel frequency (MHz)	VCO output frequency (MHz)		PLL input frequency (MHz)
		AM/FM/USB	LSB	
Band E	Off-set frequency = 20.555 MHz			
1	27.865	38.560	38.557	2.55
2	27.875	38.570	38.567	2.54
3	27.885	38.580	38.577	2.53
4	27.905	38.600	38.597	2.51
5	27.915	38.610	38.607	2.50
6	27.925	38.620	38.617	2.49
7	27.935	38.630	38.627	2.48
8	27.955	38.650	38.647	2.46
9	27.965	38.660	38.657	2.45
10	27.975	38.670	38.667	2.44
11	27.985	38.680	38.677	2.43
12	28.005	38.700	38.697	2.41
13	28.015	38.710	38.707	2.40
14	28.025	38.720	38.717	2.39
15	28.035	38.730	38.727	2.38
16	28.055	38.750	38.747	2.36
17	28.065	38.760	38.757	2.35
18	28.075	38.770	38.767	2.34
19	28.085	38.780	38.777	2.33
20	28.105	38.800	38.797	2.31
21	28.115	38.810	38.807	2.30
22	28.125	38.820	38.817	2.29
23	28.155	38.850	38.847	2.26
24	28.135	38.830	38.827	2.28
25	28.145	38.840	38.837	2.27
26	28.165	38.860	38.857	2.25
27	28.175	38.870	38.867	2.24
28	28.185	38.880	38.877	2.23
29	28.195	38.890	38.887	2.22
30	28.205	38.900	38.897	2.21
31	28.215	38.910	38.907	2.20
32	28.225	38.920	38.917	2.19
33	28.235	38.930	38.927	2.18
34	28.245	38.940	38.937	2.17
35	28.255	38.950	38.947	2.16
36	28.265	38.960	38.957	2.15
37	28.275	38.970	38.967	2.14
38	28.285	38.980	38.977	2.13
39	28.295	38.990	38.987	2.12
40	28.305	39.000	38.997	2.11

Channel	Channel frequency (MHz)	VCO output frequency (MHz)		PLL input frequency (MHz)
		AM/FM/USB	LSB	
Band F	Off-set frequency = 20.555 MHz			
1	28.315	39.010	39.007	2.10
2	28.325	39.020	39.017	2.09
3	28.335	39.030	39.027	2.08
4	28.355	39.050	39.047	2.06
5	28.365	39.060	39.057	2.05
6	28.375	39.070	39.067	2.04
7	28.385	39.080	39.077	2.03
8	28.405	39.100	39.097	2.01
9	28.415	39.110	39.107	2.00
10	28.425	39.120	39.117	1.99
11	28.435	39.130	39.127	1.98
12	28.455	39.150	39.147	1.96
13	28.465	39.160	39.157	1.95
14	28.475	39.170	39.167	1.94
15	28.485	39.180	39.177	1.93
16	28.505	39.200	39.197	1.91
17	28.515	39.210	39.207	1.90
18	28.525	39.220	39.217	1.89
19	28.535	39.230	39.227	1.88
20	28.555	39.250	39.247	1.86
21	28.565	39.260	39.257	1.85
22	28.575	39.270	39.267	1.84
23	28.605	39.300	39.297	1.81
24	28.585	39.280	39.277	1.83
25	28.595	39.290	39.287	1.82
26	28.615	39.310	39.307	1.80
27	28.625	39.320	39.317	1.79
28	28.635	39.330	39.327	1.78
29	28.645	39.340	39.337	1.77
30	28.655	39.350	39.347	1.76
31	28.665	39.360	39.357	1.75
32	28.675	39.370	39.367	1.74
33	28.685	39.380	39.377	1.73
34	28.695	39.390	39.387	1.72
35	28.705	39.400	39.397	1.71
36	28.715	39.410	39.407	1.70
37	28.725	39.420	29.410	1.69
38	28.735	39.430	39.427	1.68
39	28.745	39.440	39.437	1.67
40	28.755	39.450	39.447	1.66