KENWOOD

ALIGNMENT MANUAL

Model TS-820(S)

SSB TRANSCEIVER

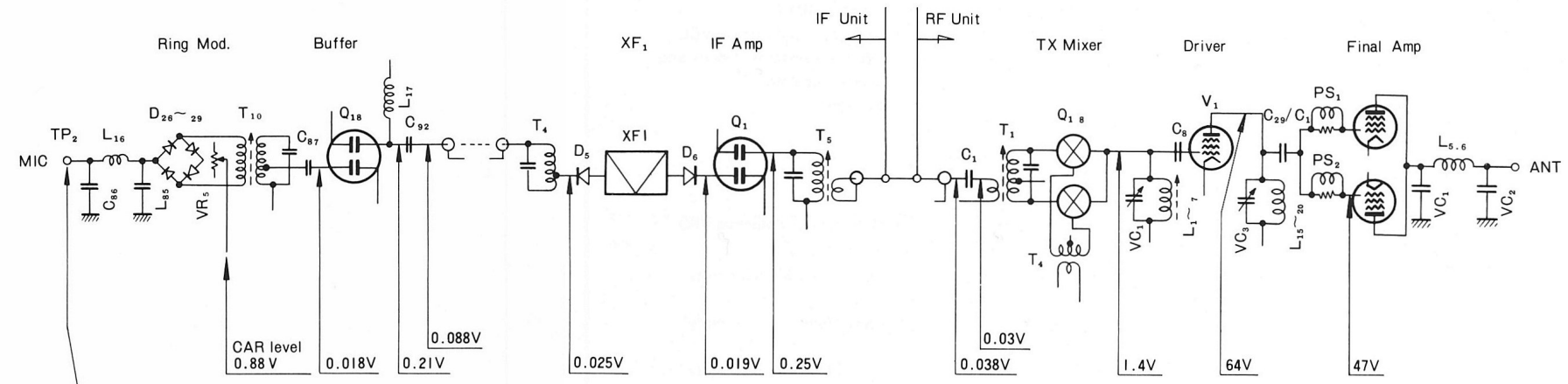
TS-820

LEVEL DIAGRAM

TRANSMITTER SECTION

MOD: CW
SG: OFF
Adjust CAR LEVEL for maximum indication of the ALC meter and measure signal level at each point.

NOTE:
When SG = ON, the level preceding the driver stage increases because of RF NFB.



DC voltage at reception

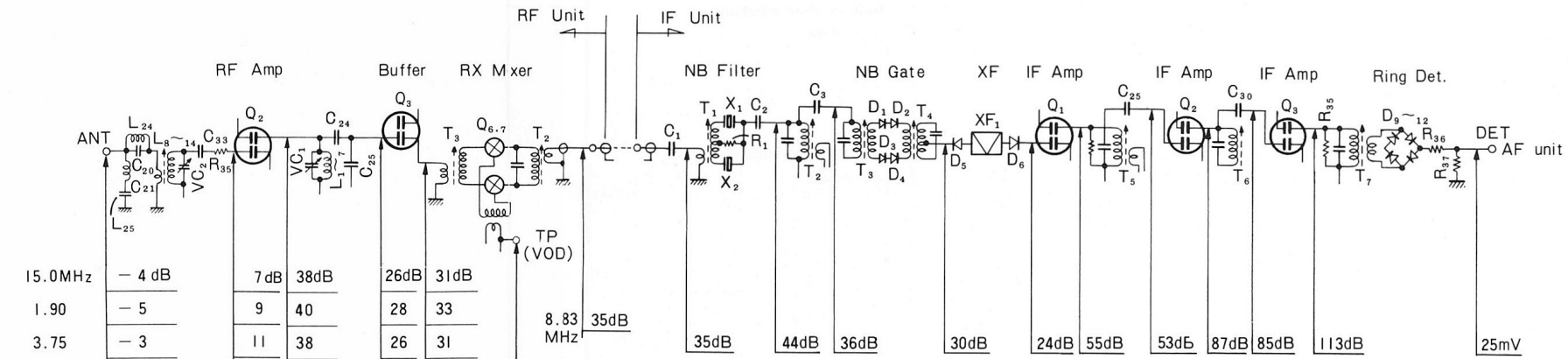
1.90	0.27V
3.75	0.24
7.15	0.27
14.175MHz	0.25
21.225	0.27
29.9	0.40

These levels are measured at 14.175 MHz

RECEIVER SECTION

MODE: CW
AGC: OFF
RF Gain: MAX

1. Apply the SSG signal (0 dBμ at 14.175 MHz) to ANT terminal. Adjust AF GAIN for 0.63V/8Ω AF output and keep it's position.
2. Connect SSG to each point and adjust SSG output for 0.63V/8Ω AF output. Next read out SSG output in dBμ. (50Ω SSG load open circuit voltage.)
3. In other band, measure the level in the same way.



15.0MHz	− 4 dB	7dB	38dB	26dB	31dB
1.90	− 5	9	40	28	33
3.75	− 3	11	38	26	31
7.15	− 7	10	37	25	29
14.175	− 0	10	40	27	32
21.225	− 4	9	37	24	29
29.0	8	5	32	26	30

VCO level

15.0 MHz	1.06V
1.90	0.94
3.75	1.10
7.15	1.17
14.175	0.95
21.225	1.13
29.0	0.87

ADJUSTMENTS

GENERAL

The contents of the adjustment procedures of this transceiver are classified into formal adjustment at service benches and simplified adjustment using a voltmeter, AF and RF vacuum-tube voltmeters AG, and dummy load (AF and RF). The following adjustments require high precision measuring instruments such as a frequency counter, SSG, and sweep generator and so on. Thus, if such measuring instruments are unavailable, it is necessary to bring the transceiver to a place where such instruments are available and make adjustment while taking care not to touch the parts to be adjusted.

1. 2-1 carrier frequency adjustment (adjustment inside the CAR unit).
2. 2-5 IF trap coil adjustment and 5-2-2 trap coil adjustment (L24 and L25 in coil pack unit and T12 in VCO unit).
3. 2-8 S meter sensitivity adjustment (VR2 in IF unit).
4. 3-1 Standard oscillator adjustment of counter (trimmer TC1 in counter unit).
5. 5-1-1 BPF adjustment of PLL (T1, T2 and T3 in PD unit).

TEST EQUIPMENT REQUIRED

1. Voltmeter

1) Input resistance: More than 1MΩ
2) Voltage range: FS = AC/DC 1.5 to 1000V

NOTE:

High-precision circuit testers may be used. However, be careful since accurate reading is not obtained in high-impedance circuit measurement.

2. RF vacuum-tube voltmeter (RF VTVM)

1) Input impedance: More than 1MΩ and less than 20pF
2) Voltage range: FS = 10mV to 300V
3) Measurable frequency range: More than 50 MHz

NOTE:

When special accuracy is not required during adjustment (such as input level or ca-rier oscillation output in PLL circuit), a voltmeter or circuit tester may be substituted for RF VTVM by connecting it to the output of detector as mentioned later.

3. AF voltmeter

1) Measurable frequency: 50 Hz to 10 kHz
2) Input resistance: More than 1MΩ
3) Voltage range: FS = 10mV to 30V

4. AF generator (AG)

1) Frequency range: 200 Hz to 5 kHz
2) Output: Maximum 1V

NOTE:

The distortion factor of AF generator should be small.

5. AF dummy load

1) Impedance: 8Ω
2) Power: More than 3W

6. RF dummy load

1) Impedance: 50 to 75Ω
2) Power: Endurable against power of more than 100W
3) Applicable frequency: 1.8 to 30 MHz

The above-mentioned instruments may be used for simplified adjustment. For the precise adjustment, the following measuring instruments are additionally necessary.

7. Oscilloscope

Select equipment that has as high sensitivity as possible and permits external synchronization.

8. Slow sweep generator

1) Center frequency: 8.83 MHz
2) Frequency deviation: Maximum ±5 kHz
3) Output voltage: More than 0.1V
4) Sweep rate: At least 0.5 sec/cm

9. SSG

1) Oscillation frequency: 1.8 to 30 MHz
2) Output: 0 dB/μV ~ 120 dB/μV

NOTE:

Select an equipment that the oscillation frequency is stable in non-modulation and there are small level of frequency modulation components.

10. Frequency counter

1) Minimum input voltage: 50mV
2) Measurable frequency range: More than 40 MHz

11. Noise generator

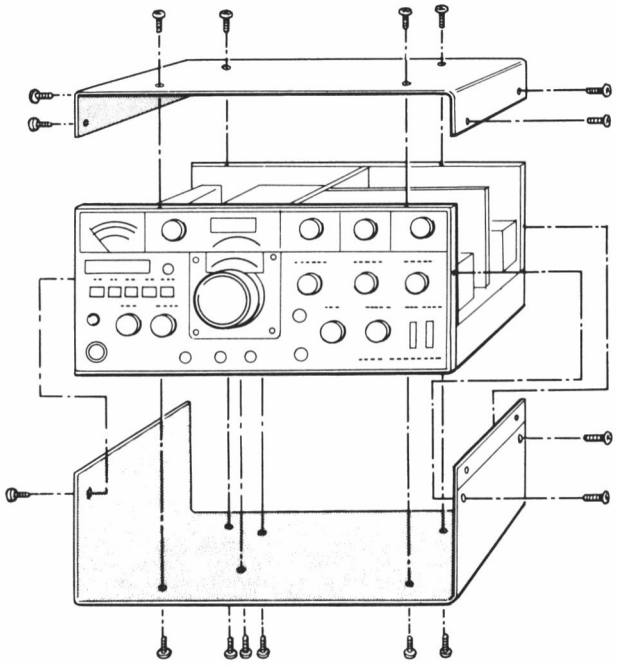
Select an equipment that generates ignition-like noise containing high harmonics up to 30 MHz or more.

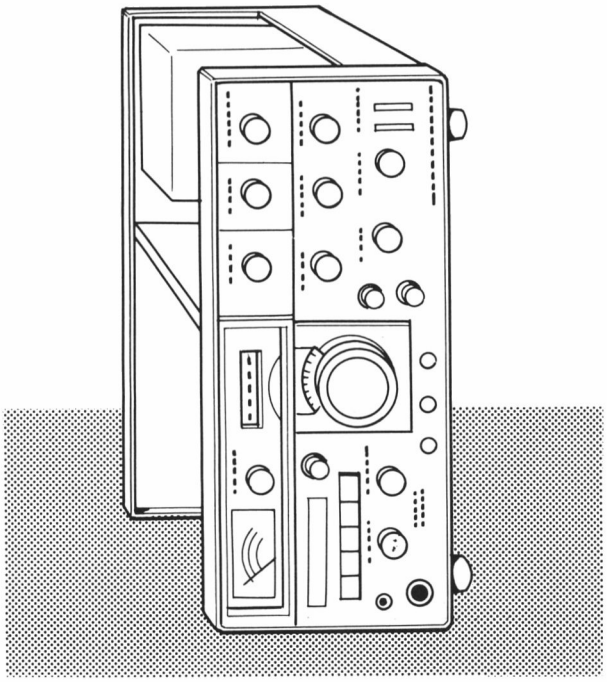
12. Directional coupler

ADJUSTMENTS

PREPARATORY WORK

1. Remove the upper and lower cases according to the figure below. When making adjustment with the side face of the set up, be sure to position the final stage at the upper side. Otherwise, the ventilation effect of the final stage, cooling effect, is deteriorated and the final tube may be deteriorated.





2. Unless otherwise specified, set the respective knobs to the following positions.
   1) Front panel

MODE	USB
FUNCTION	VFO
RF GAIN	MAX
HEATER	OFF
VOX	MAN
NB	OFF
MONI	OFF
AGC	FAST
PROCESSOR	OFF
RF ATT	OFF
RIT	OFF
IF SHIFT	O (Center)
DH	OFF
STBY	REC
POWER	ON

   2) Rear panel

SG SW	OFF
X VERTER SW	OFF

1. Adjustment of Power Supply

1-1. 9V adjustment

1. Measuring instrument used: Voltmeter
2. Adjusting procedure
   Connect the voltmeter between the 9V terminal and chassis on AF-AVR unit (X49-1080-00) and adjust VR4 on AF AVR unit until 9V is obtained (refer to **Fig. 20**).

AF-AVR

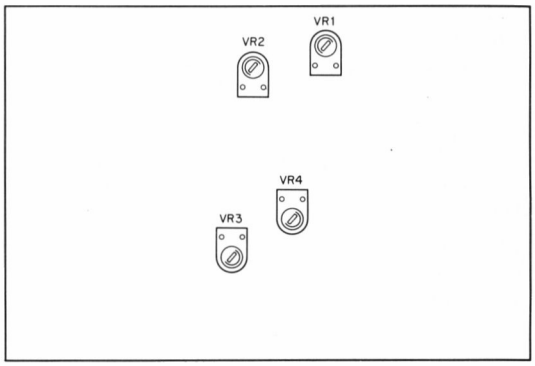


Fig. 20 AF-AVR unit

1-2. RF1 (3.3V) adjustment

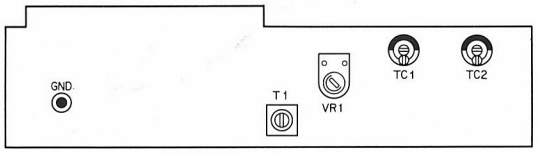
1. Measuring instrument used: Voltmeter
2. Adjusting procedure
   Connect the voltmeter between RF1 terminal and chassis on AF-AVR unit (X49-1080-00) and adjust VR1 on AF-AVR unit until the meter reads 3.3V.

2. Adjustment of Receiver Section

2-1. Carrier unit adjustment

1. Measuring instruments used
   1) RF VTVM
   2) Frequency counter
2. Adjusting procedure
   DRIVE: Center (12 o'clock position)
   1) Connect RF VTVM to TP5 in IF unit (X48-1150-00) and adjust oscillation coil T1 in CAR-1 unit (X50-1310-00) until the meter reads 50mV (refer to **Fig. 21**). (refer to **Fig. 24** IF unit)

CAR-1



CAR-2

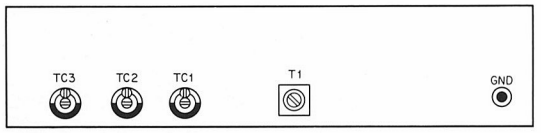


Fig. 21 CAR unit

   2) Set the MODE switch to CW and the STBY switch to SEND and adjust oscillation coil T1 in CAR 1 unit (X50-1320-00) similarly.
   3) Connect the frequency counter to TP5 in IF unit and make adjustment as shown below, while changing over the MODE and STBY switches.

MODE SW	STBY SW	ADJ	ADJ FREQ
USB	REC	USB(TC2)	8831.500KHz
LSB	REC	LSB(TC1)	8828.500 〃
FSK SPC	SEND	TC1	8830.700 〃
FSK NARRW MRK	SEND	TC2	8830.530 〃
FSK WIDE MRK	SEND	TC3	8829.850 〃

NOTE:
When changing over from FSK SPC to FSK MRK, or vice versa, open or short the RTTY key on the rear panel. For change-over from NARROW to WIDE, or vice versa, use the switching connector (E31-0037-05) in CAR ASSY unit (X60-1000-00) and after adjustment set it to NARROW (refer to **Fig. 11**).

2-2. Voltage adjustment of VCO

1. Measuring instrument used: Voltmeter
2. Adjusting procedure
   1) Connect the voltmeter to TP4 in VCO unit (X50-1330-00) of PLL unit (X60-1010-00) (refer to **Fig. 22**).
   2) Set VFO scale to 250 and check if the voltmeter reading is within 2.9 to 3.2V, while changing over bands.

NOTE:
For the detailed adjusting procedure, refer to the adjusting method of PLL ASSY unit described later.

VCO

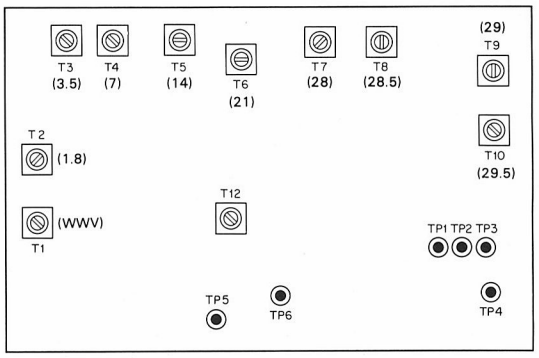


Fig. 22 VCO unit

2-3. Adjustment of antenna and MIX coil

1. Measuring instrument used
   SSG (or built-in marker)
   Since the tuned point may be deviated due to the shift of antenna impedance, be sure to terminate the antenna with 50 ohms.
2. Adjusting procedure
   DRIVE: Center (12 o'clock position)
   Apply SSG output (or marker signal) at 60 dB to the antenna terminal and adjust the coil pack unit (X44-1140-00) in the following procedure of bands for maximum AF output (S meter reading) and maximum sensitivity. Reduce the SSG output suitably as the sensitivity increases (refer to **Table 1**, **Fig. 23**).

ADJUSTMENTS

COIL PACK

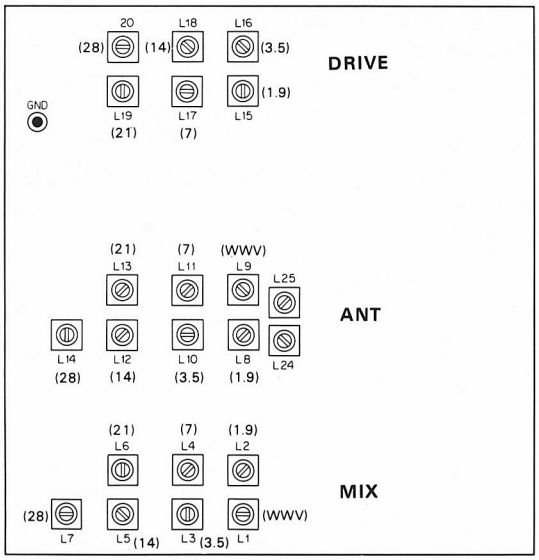


Fig. 23 Coil pack unit

Adjusting sequence	BAND	VFO scale
1	1.8	100
2	3.5	250
3	7	150
4	14	175
5	WWV	0 (15.0MHz)
6	21	225
7	28.5	500

Table 1

2-4. IFT adjustment

1. Measuring instrument used: SSG (or marker)
2. Adjusting procedure
   1) Apply a signal of 14.175 MHz at 40 dB (or marker) to the antenna terminal from SSG.
   2) Adjust T1 to T7 in IF unit (X48-1150-00) and T2 in RF unit (X44-1150-00) until S meter reads maximum value (refer to **Fig. 24** and **Fig. 25**).

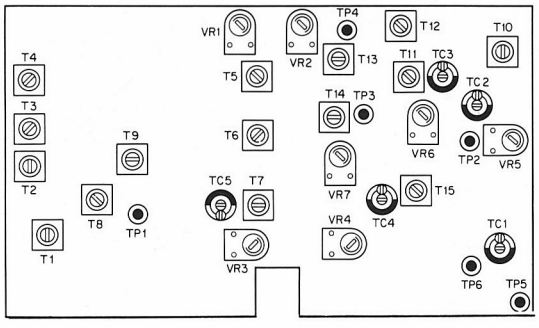


Fig. 24 IF unit

RF

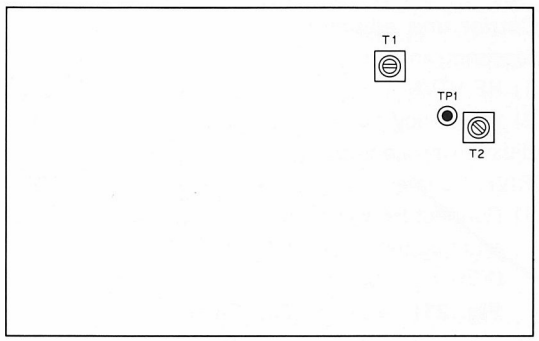


Fig. 25 RF unit

2-5. Adjustment of IF trap coil

1. Measuring instruments used
   1) SSG
   2) AF VTVM
   3) Dummy load for AF
2. Adjusting procedure
   BAND: 7 MHz
   VFO scale: 300
   1) Make connection as shown in **Fig. 26**, and adjust receiving sensitivity at maximum. Then, while applying a signal of 8830 kHz at approx. 100 dB from SSG, adjust L24 and L25 in the coil pack unit (X44-1140-00) alternately and repeat the same procedure two or three times. Until S meter reading becomes minimum. When S meter pointer does not deflect, make adjustment until AF output becomes minimum (refer to **Fig. 23** "Coil pack unit").

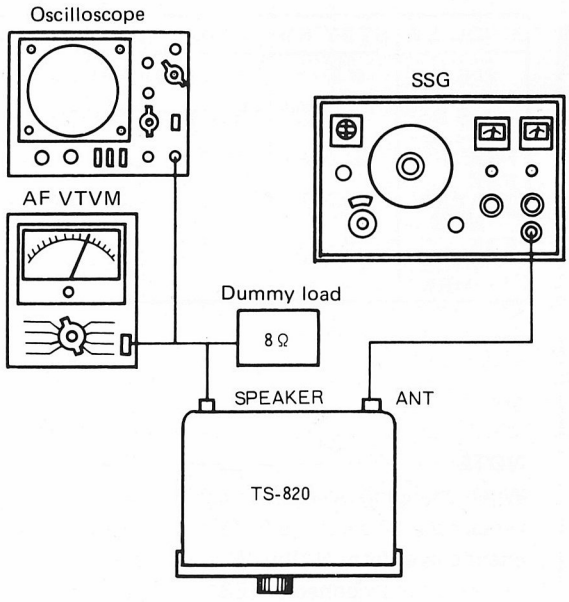


Fig. 26 Adjustment of IF trap coil

2-6. Carrier balance adjustment

1. Measuring instrument used: RF VTVM
2. Adjusting procedure
   IF SHIFT: O (center)
   1) Connect RF VTVM to IF OUT terminal on the rear panel.
   2) Turn the RF GAIN knob fully counterclockwise and adjust VR3 and TC5 in IF unit (X48-1150-00) alternately until the output becomes minimum (refer to **Fig. 24**).

2-7. Adjustment of noise blanker (NB) circuit

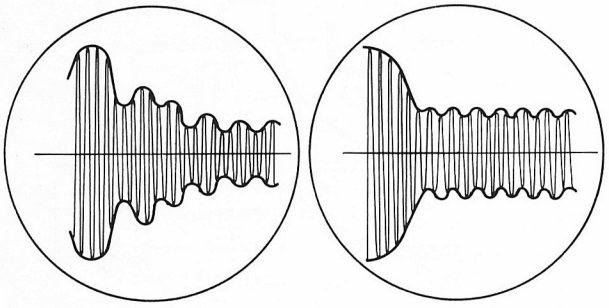
1. Measuring instrument used
   1) Voltmeter
   2) Noise generator
   3) Oscilloscope
2. Adjusting procedure

Simplified adjustment:

1) After receiving marker signal and turning ON NB switch, adjust T8 and T9 until the terminal voltage at TP1 on IF unit (X48-1150-00) becomes minimum (refer to **Fig. 24**).

Formal adjustment:

1) After making the simplified adjustment, connect the noise generator to the antenna and adjust drive VC until the noise output becomes maximum. In this case, set the S meter reading within S5 to S7.
2) Turn ON NB switch and connect the oscilloscope to the cathode side of D13 in IF unit. Adjust T1 in IF unit until the waveform changes from Figure A to Figure B (refer to **Fig. 27**).



(a) Before adjustment (b) After adjustment

Fig. 27 Adjustment of noise blanker

3) Then, fine adjust T1, T3, T8 and T9 so that noise from the speaker becomes small, while taking care not to make waveform on the oscilloscope deviate from that shown in Fig. B greatly.
4) Turn ON RF switch and ATT switch and further fine readjust T1, T3, T8 and T9. Even when the RF and ATT switches are ON, the noise blanker should be effective.
5) In final stage, make sure that the receiving gain is not reduced greatly.

2-8. Adjustment of S meter

1. Measuring instrument used: SSG
2. Adjusting procedure
   1) After adjusting each section until sensitivity becomes maximum, adjust VR1 in IF unit (X48-1150-00) under no signal condition, thus making zero point adjustment of S meter (refer to **Fig. 24**).
   2) Connect SSG to the antenna terminal and apply 0 dB input. Adjust T6 in IF unit until S meter just starts deflecting at 0 dB.
   3) Set the output of SSG to 40 dB and adjust VR2 in IF unit until S meter reads S9.

2-9. RIT adjustment

1. Measuring instrument use: Unnecessary (use the built-in marker)
2. Adjusting procedure
   1) Set the RIT knob just to O (center) and turn ON RIT switch.
   2) Receive the maker signal and turn VFO until a beat of approx. 1 kHz is generated.
   3) Turn OFF RIT switch and adjust VR2 in AF AVR unit (X49-1080-00) until the beat frequency is kept unchanged when RIT switch is turned ON and OFF (refer to **Fig. 28**).

AF-AVR

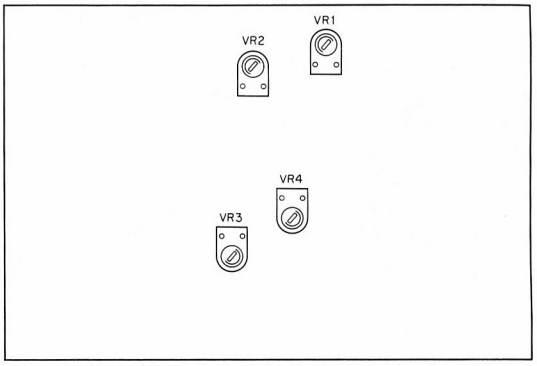


Fig. 28 AF • AVR unit

2-10. Adjustment of marker frequency

1. Measuring instrument used: Frequency counter
2. Adjusting procedure
   1) Connect the counter to the collector of Q4 in the marker unit (X52-0005-01) and open the MS terminal.
   2) Set the FUNCTION switch to CAL 25 kHz and adjust TC1 in the marker unit for 100,000 Hz ± 1 Hz (refer to **Fig. 29**).

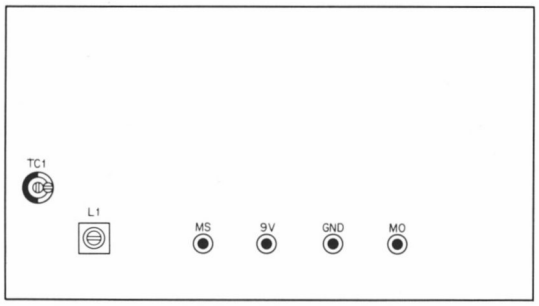


Fig. 29 MARKER unit

2-11. VFO adjustment

1. Measuring instruments used
   1) TF VTVM
   2) Frequency counter
2. Adjusting procedure

Adjustment of oscillation frequency

Set the FUNCTION switch to VFO and connect the frequency counter to VFO terminal (No. 13) on FIX VOX unit (X50-1350-00). Set VFO to 0 division and check if the oscillation frequency is 5.50 MHz. Then, set VFO to 500 division and check if the oscillation frequency is 5.00 MHz. If the frequency deviates from 5.50 MHz, correct it with TC1 in VFO unit; if the frequency deviates from 5.00 MHz correct it with L1 in VFO unit. Since TC1 and L1 affect mutual oscillation frequencies, repeat the above-mentioned adjustment three or four times (refer to **Fig. 30** and **31**).

Adjustment of output voltage

Set the VFO to the 250 division. Then, connect RF VTVM to VFO (No. 13) terminal in FIX-VOX unit and adjust trimmer TC2 in VFO unit until the output voltage becomes 0.6V.

FIX • VOX

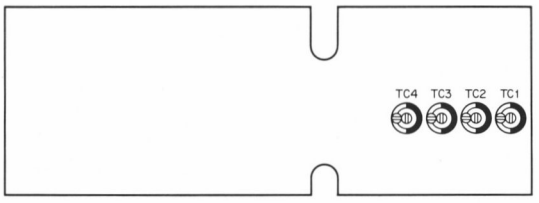


Fig. 30 FIX • VOX unit

VFO

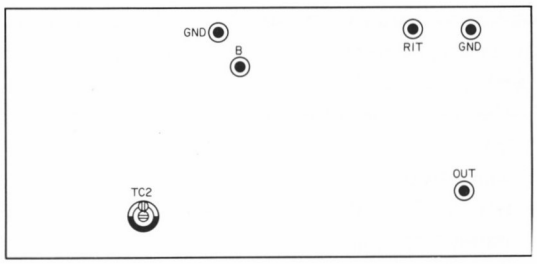


Fig. 31 VFO unit

3. Adjustment of Counter (DG-1: Optional)

3-1. Frequency adjustment of counter standard oscillator

Simplified adjustment:

1. Measuring instrument used: Counter and calibration cable
2. Adjusting procedure
   1) Insert the 1 pin plug side of the accessory counter calibration cable into X-VERTER IN terminal on the body rear panel and its 3-pin terminal side into the 3-pin terminal at the top of counter.

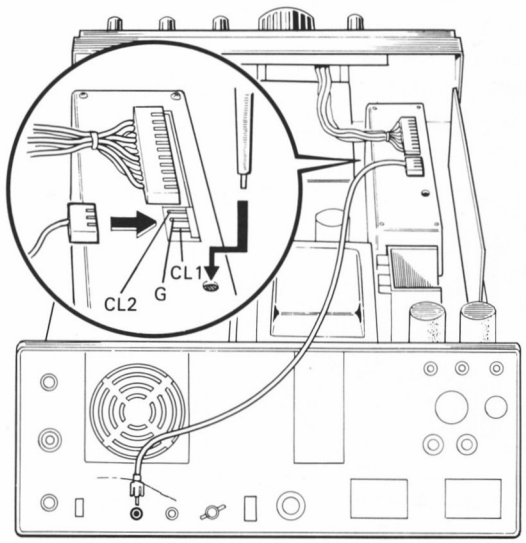


Fig. 32 Adjustment of counter standard oscillator frequency

   2) Set the BAND switch to WWV and connect the antenna to the set. While receiving a WWV signal of 15 MHz adjust trimmer TC1 at the top of the counter unit so that zero beat is obtained between this signal and 1 MHz signal connected in Item 1).

NOTE:

(1) Although zero beat can be checked through the speaker, adjustment by watching S meter reading is more accurate. S meter pointer vibrates on both near sides of the actual zero beat point. This corresponds to approx. 1 to 3 Hz. At the zero beat point, the pointer vibration becomes slowest.

(2) The adjustable range by TC1 is 1 MHz ± 20 Hz. In rough adjustment, receive a WWV signal of 15 MHz and set the counter reading within 15.000.0 and 14.999.9.

Formal adjustment:

1. Measuring instrument used: Frequency counter
2. Adjusting prrocedure
   1) Short circuit between CL2 and G in counter unit (X60-1020-00) and connect the output between G and CL1 to the frequency counter.
   2) Adjust the trimmer TC1 in the counter mix unit for 1 MHz ± 5 Hz (refer to **Fig. 33**).

COUNTER MIXER

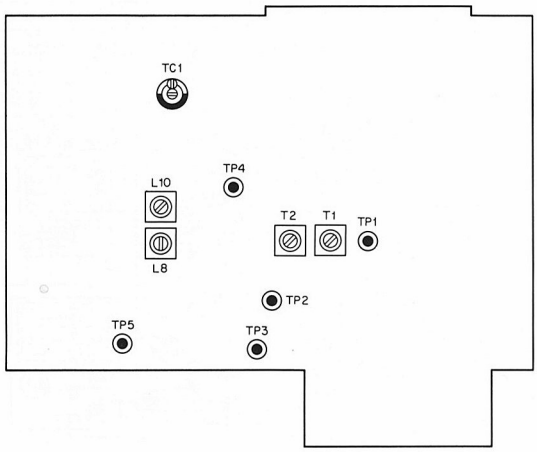


Fig. 33 Counter mixer unit (DG-1: Option)

3-2. Adjustment of counter input level

1. Measuring instrument used: RF VTVM
2. Adjusting procedure
   1) Connect RF VTVM to TP6 in IF unit (X48-1150-00) and adjust TC1 in IF unit for 0.1V (refer to **Fig. 24**).
   2) Connect RF VTVM to TP2 in the counter mixer unit (X48-1150-00) and adjust T1 and T2 in the same unit until the peak value is obtained (output is approx. 0.12 to 0.2V) (refer to **Fig. 33**).

NOTE:

In this case, apply a carrier voltage of 0.1V to the CCR terminal of the counter unit (by adjusting TC1 in IF unit).

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4. Adjustment of Transmitter Section

4-1. Adjustment of drive coil

1. Measuring instrument used
   RF dummy load (50Ω)
   Since the tuned point deviates due to shift of the antenna impedance, be sure to connect this unit.
2. Adjusting procedure
   MODE: CW
   DRIVE: Center (12 o'clock position)
   METER: ALC
   1) Set BAND switch to 1.8 MHz and set STBY switch to SEND. Adjust T10 in IF unit (X48-1150-00), T1 in RF unit (X44-1150-00) and 1.8 MHz band drive coil in the coil pack unit (X44-1140-00) until ALC meter reads maximum (refer to **Fig. 23**, **24**, **25**).
   2) Adjust the drive coil of each band until ALC meter reads maximum. The adjusting sequence and adjustment frequency are the same as in Item 2-3 "Adjustment of Antenna MIX coil".

NOTE:

Make this adjustment at the same time as the adjustment of the receiving coil pack until the peak values of transmitting and receiving signals do not deviate from each other.

4-2. BIAS adjustment

1. Measuring instrument used: Unnecessary
2. Adjusting procedure
   Set the meter switch to IP and adjust the BIAS VR on the rear panel to 60mA.

4-3. Adjustment of carrier suppression

1. Measuring instrument used
   1) RF VTVM
   2) RF dummy load
   3) Directional coupler
2. Adjusting procedure
   1) Make connection as shown in **Fig. 34** and adjust 14.175 MHz EW until full power is obtained.

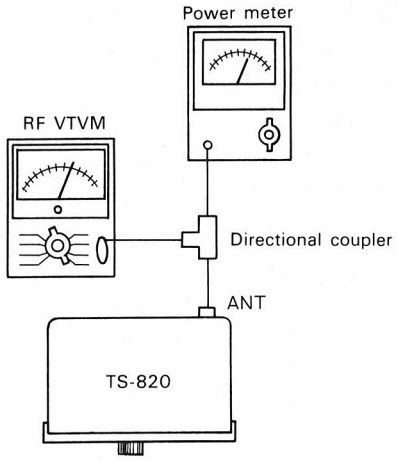

Fig. 34 Adjustment of carrier suppression

   2) Switch over MODE switch to USB and adjust VR5 and TC2 in IF unit (X48-1150-00) alternately until RF VTVM reads minimum. Also, make adjustment until the USB and LSB levels become the same (refer to **Fig. 24**).

4-4. Neutralization adjustment

1. Measuring instruments used
   1) RF VTVM
   2) RF dummy load

2. Adjusting procedure
   MODE: CW
   SG SW: ON
   Neutralizing variable capacitor: Half-inserted position
   1) In **Fig. 34**, make adjustment until maximum output is obtained at 21.225 MHz.
   2) Turn OFF the SG switch and adjust the neutralizing capacitor until RF VTVM reads minimum.

4-5. Adjustment of carrier point

1. Measuring instruments used
   1) AG
   2) RF VTVM
   3) RF dummy load
   4) Directional coupler
2. Adjusting procedure
   1) In **Fig. 35**, connect AG to MIC terminal and apply an input of 1500 Hz at 5 mV.

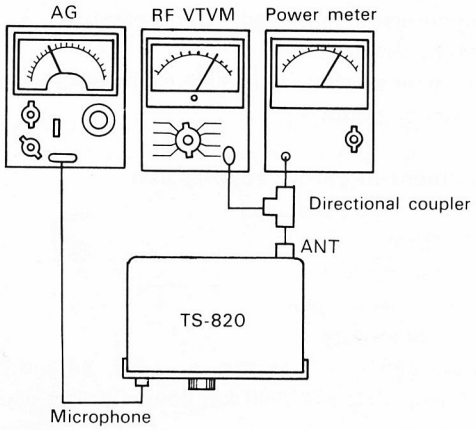

Fig. 35 Adjustment of carrier point

   2) Adjust DRIVE, PLATE and LOAD until maximum output is obtained.
   3) Adjust MIN GAIN until output becomes 50W and set the AG frequency to 250 Hz. Adjust VR1 in CAR1 unit (X50-1310-00) until RF VTVM reading is kept unchanged even when the MODE switch is changed over from USB to LSB and vice versa (refer to **Fig. 36**).
   4) Apply 5mV (at 1.5 kHz) signal to the microphone terminal and adjust MIC GAIN VR to obtain 50 Watts output. Then, shifting the signal frequency to 300 Hz or 2800 Hz and adjust TC1 (in LSB) and TC2 (in USB) so that RF VTVM reading is the same level.

CAR-1

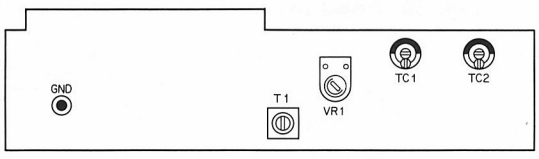

Fig. 36 CAR 1 unit

4-6. Adjustment of speech processor

1. Measuring instruments used
   1) AG
   2) AF VTVM
   3) Oscilloscope
   4) RF VTVM
   5) Frequency counter
2. Adjusting procedure
   1) MODE ..... USB
      COMP LEVEL .. Full clockwise
      PROCESSOR... PULL
      METER ..... COMP
      MIC GAIN .. Center
      SG SW..... OFF
      ST BY ..... SEND
   2) Connect a frequency counter to TP3. Adjust TC-4 to obtain the oscillation frequency of 451.4 kHz watching the counter readout.
   3) Apply a signal with the frequency of 1 kHz and the output of 0.3 mV into MIC JACK using an audio signal generator. Adjust T11, T12, T13, and T14 to obtain maximum level at TP-2.
   4) Set the audio signal generator to 1 mV, and adjust TC-3 and VR-6 to obtain maximum level at TP-2.

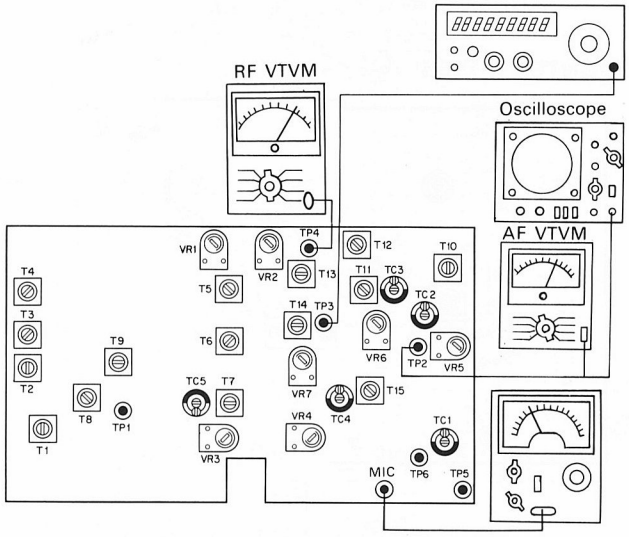

Fig. 37 Adjustment of speech processor

   5) Set the output of the audio signal generator to 0.3 mV at 1 kHz and make a note of the level at TP-2. Adjust finely TC-4 so that the level at TP-2 goes down to −6dB when the generator is set to 300 Hz. Adjust the oscillation frequency to below 451.5 kHz, and the level at TP-2 to become −6dB for the first time when the oscillation frequency is gradually increased from around 450 kHz.
   6) Give the MIC jack a signal with 10 mV at 1 kHz. Adjust VR-7 to obtain the same level at TP-2 regardless of whether the PROCESSOR switch is turned to NORMAL or PROCESSOR position.
   7) After completing these adjustments, set the generator output to 0.3 mV. When the generator frequency is swept from 400 Hz to 2 kHz, the TP2 level deflection from the level at 1 kHz should be within +1 dB ~ −5 dB. The noise level measured at TP2 should be 10 mV or less with the MIC input shorted-circuited by 47 kΩ.
   8) Confirm that the COMP LEVEL METER pointer indicates the range within 20 ~ 40 dB when giving MIC input a 10 mV − signal at 1 kHz.

4-7. Adjustment of monitoring level

1. Measuring instruments used
   1) RF dummy load
   2) AG
   3) AF VTVM
   4) AF dummy load
2. Adjusting procedure

Simplified adjustment:

1) Set the FUNCTION switch to CAL 25 kHz and take a beat of approx. 1000 Hz. Set AF variable resistor to a desired volume.
2) Apply a voice signal to the MIC terminal, turn ON the MON switch, and set STBY switch to SEND. Adjust VR4 in IF unit (X48-1150-00) until the monitor output level becomes nearly the same as the maximum output during calibration (refer to **Fig. 24**).

Formal adjustment:

1) If **Fig. 38**, make adjustment until full power is obtained at 14.175 MHz, CW, and set the MODE switch to SSBè (or LSB).

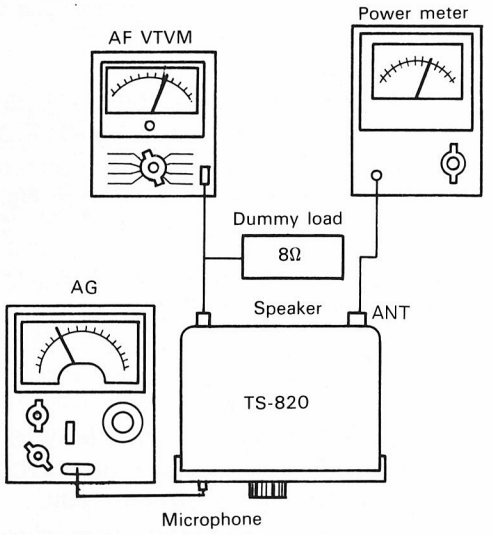

Fig. 38 Adjustment of monitor level

2) Apply a signal of 1000 Hz at 5 mV from AG to the MIC terminal and set the FUNCTION switch to CAL 25 kHz. Adjust AF GAIN until the AF output level becomes 0.63V when AGC is turned ON in receiving condition.
3) Then, turn ON the MON switch and set the STBY switch to SEND. Adjust VR4 in IF unit (X48-1150-00) until the monitor output level becomes 0.63V.

4-8. Adjustment of VOX operation

1. Measuring instruments used
   1) AG
   2) Microphone
   3) RF dummy load
2. Adjusting procedure
   SG SW: OFF
   VOX: ON
   MODE: SSB
   1) Connect AG to the MIC terminal and apply a signal of 1500 Hz at 5 mV. Adjust VOX GAIN VR until the relay is operated.
   2) Adjust VOX DELAY VR, and make sure that the time constant changes in VOX. Then, adjust the time constant for approx. 1 sec.
   3) Connect the microphone to the MIC terminal and keep the microphone approx. 10 cm or less away from the speaker. Set the FUNCTION switch to CAL 25 kHz and receive a signal. Turn ANTI VOX VR until VOX fluctuation is stopped.

4-9. Adjustment of side tone

1. Measuring instruments used
   1) AF VTVM
   2) Oscilloscope
   3) AF dummy load (8Ω)
   4) Key (shorting lead also usable)
2. Adjusting procedure
   SG SW: OFF
   MODE: CW
   AF VR: 12 o'clock position
   STBY: SEND
   1) In **Fig. 39**, adjust VR3 in AF • AVR unit (X49-1080-00) until AF output becomes 50 mW (0.63 V/8Ω) with the key down (refer to **Fig. 28**).

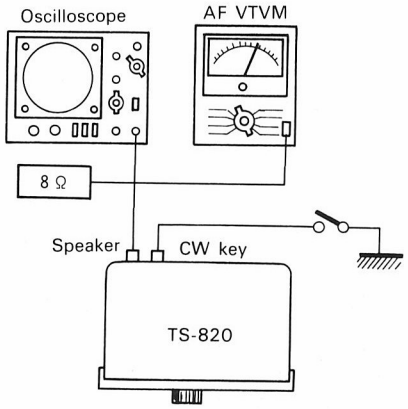

Fig. 39 Adjustment of side tone

4-10. Adjustment of RF meter

1. Measuring instrument used: RF dummy load
2. Adjusting procedure
   SG SW: ON
   MODE: CW
   BAND: 14
   1) Connect the RF dummy load to the antenna and make adjustment until the transmitting output becomes maximum at 14.175 MHz.
   2) Set the meter switch to RF and adjust RF VR on the rear panel until the RF meter reads 250 mA on the IP scale.

5. PLL Adjustment

5-1. Adjustment of PD unit

5-1-1. BPF adjustment

1. Measuring instruments used
   1) Oscilloscope
   2) Sweep generator
   3) Detector (refer to **Fig. 40**)

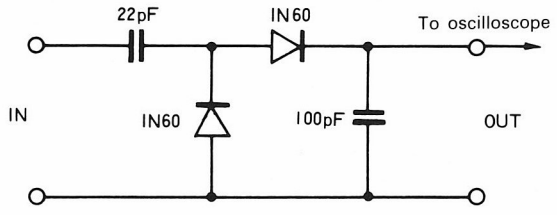

Fig. 40 Detector

2. Preparatory work
   Extract PLL unit from the body, remove the shield cover and disconnect connector PLL-1. When this connector is disconnected, the ground of the unit is floated partially. Thus, connect the shielding case in PD unit to the body (TS-820) with a suitable clip wire. Set the band to the desired position.
3. Adjusting procedure
   1) Connect the detector to TP1 (or TP2) in PD unit (X50-1340-00) and connect its output to the oscilloscope (refer to **Fig. 41**).
   2) Ground TP3 in PD unit and connect the sweep generator output to CIB-BND connector terminals.
   3) Adjust T1 (red), T2 (yellow) and T3 (red) in PD unit until the output waveform becomes as shown in **Fig. 42**.

PD

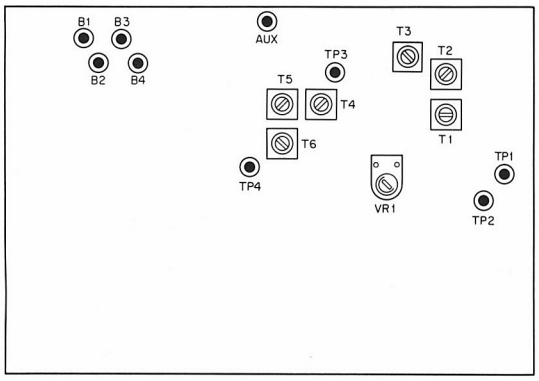

Fig. 41 PD unit

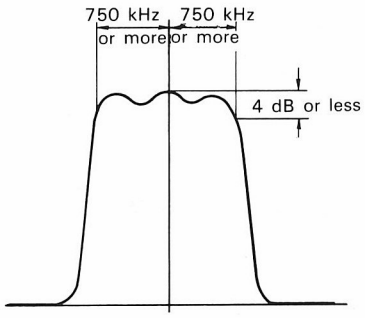

Fig. 42 Output waveform

NOTE:
(1) This band width should be 5.25 MHz ± 750 kHz or more and the valley depth should be 4 dB or less.
(2) Set the oscilloscope to maximum sensitivity and set the sweep output to as low output level as possible.

5-1-2. Adjustment of balance VR

1. Measuring instruments used
   1) SSG
   2) RF VTVM
2. Preparatory work
   1) Follow the same procedure as in 5-1-1.
   2) Disconnect connect PLL-3 and set the band to the desired position within 21 to 29.5.
3. Adjusting procedure
   Apply a signal of 8.83 MHz within 106 to 108 dB from SSG between connector terminals CIB and GND and adjust VR1 until the output of RF VTVM connected to TP1 (or TP2) becomes minimum dip (refer to **Fig. 41**).

5-2. Adjustment of VCO unit

5-2-1. Adjustment of VCO coil

Simplified adjustment:

1. Measuring instrument used: Voltmeter
2. Adjusting procedure
   1) Connect the voltmeter to TP4 in VCO unit (X50-1330-00). Keep the slide switch in VCO unit to NOR side (refer to Fig. 22).
   2) Set the VFO scale to 250 and adjust oscillation coils T1 through T10 until the voltmeter reads 3.2V.

NOTE:
(1) When VFO is changed from 0 to 500, the voltmeter reading should changed proportionally.
(2) In a band more than 21 MHz, there are two tuned points of 3.2V. The proper tuned point is obtained when the core is inserted into the printed circuit board side. In an improper tuned point, the voltage is kept unchanged regardless of turning of VFO.

Formal adjustment:

1. Measuring instrument used: Frequency counter
2. Adjusting procedure
   1) Turn the slide switch S1 in VCO unit (X50-1330-00) to TUN side and connect the counter between TP5 and TP6 (GND).
   2) Adjust the individual coils shown in the following list to the relevant set frequencies.
   3) Short circuit between TP1 and TP2 in VCO unit and measure frequency. Then, short circuit between TP2 and TP3 and readjust frequency, and check if the difference between two frequencies lies in the variable range shown in the following list.

Band	Coil	Set frequency	Variable range
WWV	T 1	24.08 MHz	±450 kHz or more
1.8	T 2	10.88 MHz	±330 kHz or more
3.5	T 3	12.58 MHz	±350 kHz or more
7	T 4	16.08 MHz	±400 kHz or more
14	T 5	23.08 MHz	±500 kHz or more
21	T 6	30.08 MHz	±500 kHz or more
28	T 7	37.08 MHz	±500 kHz or more
28.5	T 8	37.58 MHz	±500 kHz or more
29	T 9	38.08 MHz	±500 kHz or more
29.5	T10	38.58 MHz	±500 kHz or more
AUX	T11	Received signal +8.83 MHz	±500 kHz or more

Table 2

5-2-2. Adjustment of trap coil

1. Measuring instruments used
   1) SSG
   2) AF VTVM
2. Adjusting procedure
   1) Connect SSG through a capacitor to the cathode side (the line connected to R28, 47Ω) of diodes D1 to D11 in VCO unit (X50-1330-00) under receiving condition.
   2) Set the BAND switch to 29.5 position, and receive a signal of 8.83 MHz from SSG and then make arrangement so that a suitable beat comes out of AF output. Adjust TR in VCO unit until the beat output becomes minimum.

TS-820 MODIFICATION FOR MARINE BAND (2.134 MHz)

1. Receiver section
   Set the driver knob to the center position. Adjust the ANT coils and RF coils to obtain maximum sensitivity at 2.0 MHz. As a result, the frequency range of 1.80 MHz ~ 2.136 MHz can be covered.
2. Transmitter section
   1) Set the driver knob to the center position. Adjust the drive coil to obtain maximum output power at 2.0 MHz.
   2. Remove two capacitors C4 (390 PF) and C31 (12 PF) of the plate VC and install a 330 PF (3 kV) capacitor.
   3) Remove the load fixed capacitor C26 (220 PF). By these modifications, the frequency range of 1.86 MHz ~ 2.15 MHz can be covered.

REFERENCE DATA

Counter Mix Unit IC6 (μPB2490)

Truth Value List (8 segments)

	Input					Output							
	BI	D	C	B	A	a	b	c	d	e	f	g	h
B	L	×	×	×	×	L	L	L	L	L	L	L	L
0	H	L	L	L	L	H	H	H	H	H	H	L	L
1	H	L	L	L	H	L	L	L	L	L	L	L	H
2	H	L	L	H	L	H	H	L	H	H	L	H	L
3	H	L	L	H	H	H	H	H	H	L	L	H	L
4	H	L	H	L	L	L	L	L	L	L	H	H	H
5	H	L	H	L	H	H	L	H	H	L	H	H	L
6	H	L	H	H	L	H	L	H	H	H	H	H	L
7	H	L	H	H	H	H	H	H	L	L	H	L	L
8	H	H	L	L	L	H	H	H	H	H	H	H	L
9	H	H	L	L	H	H	H	H	H	L	H	H	L
10	H	H	L	H	L	L	L	L	L	L	L	L	L
11	H	H	L	H	H	L	L	L	L	L	L	L	L
12	H	H	H	L	L	L	L	L	L	L	L	L	L
13	H	H	H	L	H	L	L	L	L	L	L	L	L
14	H	H	H	H	L	L	L	L	L	L	L	L	L
15	H	H	H	H	H	L	L	L	L	L	L	L	L

× = H or L

Character shape