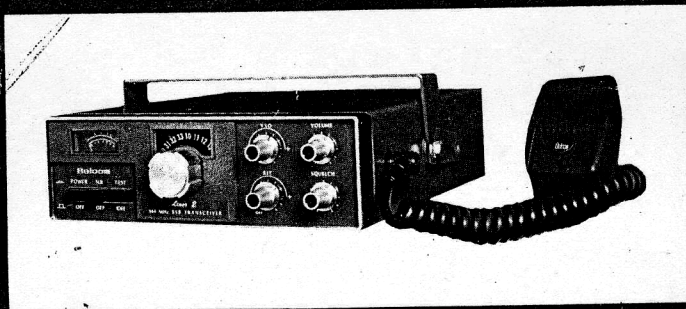


Belcom



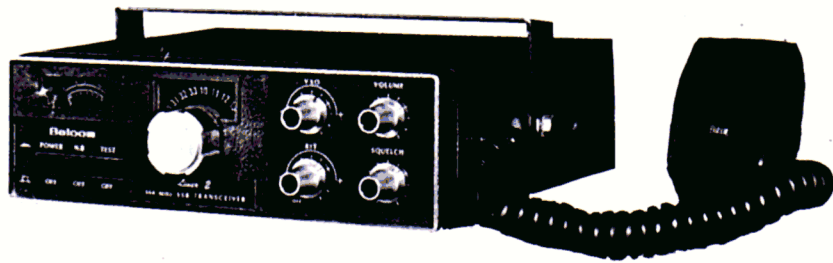
Nihon Dengyo Co., Ltd.

NO. 4-10, 1-CHOME KAGA, ITABASHI-KU, TOKYO, JAPAN.

PHONE: 962-5087 TELEX: BELCOM J24523

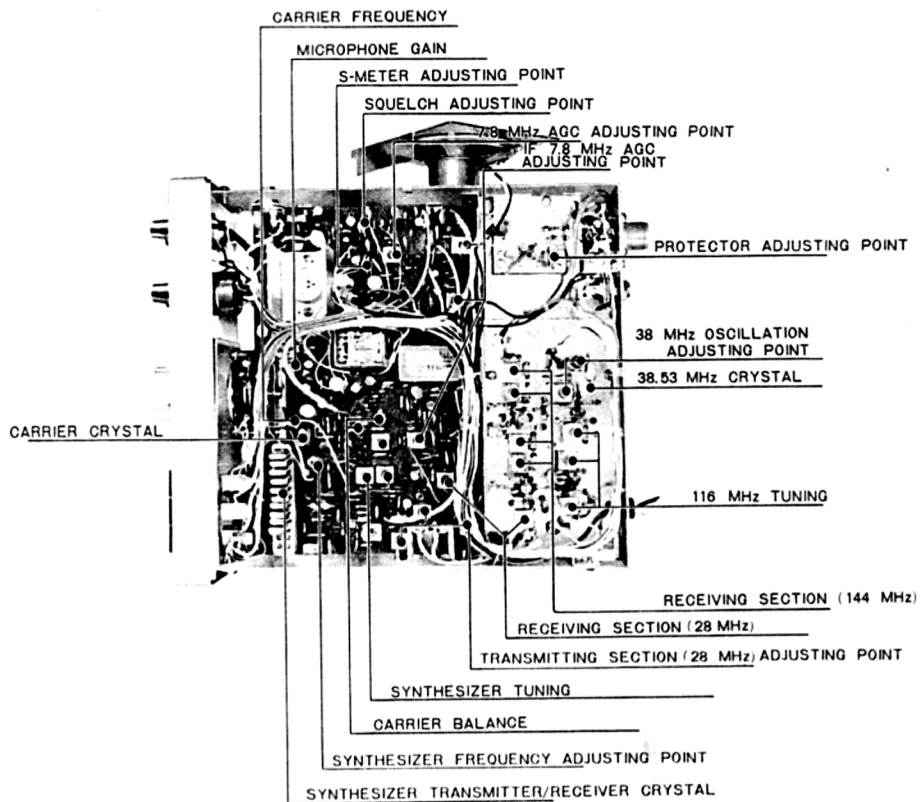
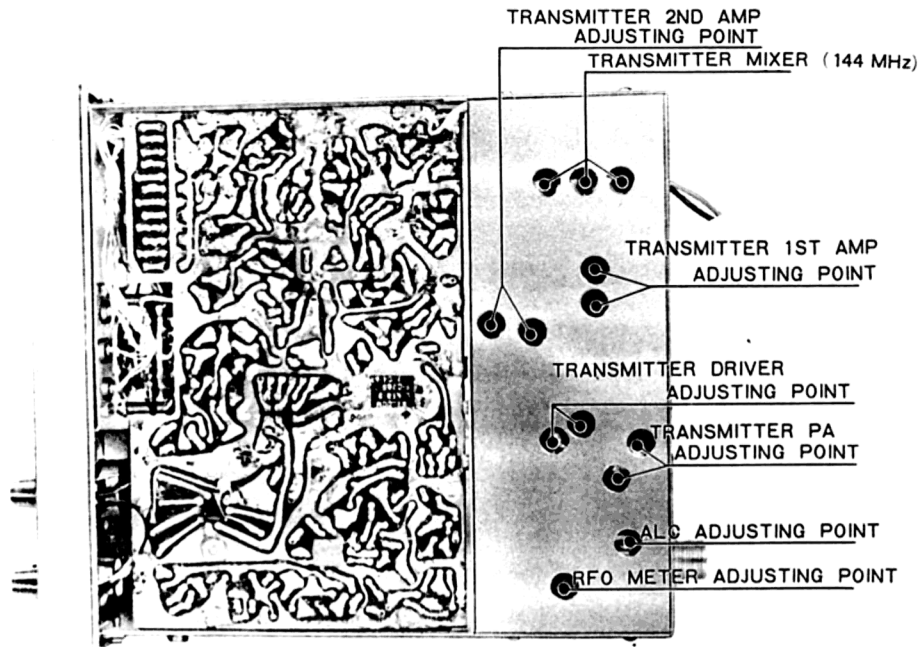
CABLE ADDRESS: BELCOMDENGYO TOKYO

Thank you very much for your purchase of Belcom Model Liner 2 which was manufactured by Nihon Dengyo Co., Ltd. on the basis of its high-level technical knowhows, long experience and severe inspection test, so as to meet ham's requirements satisfactorily. In case you find damage or defect on the product, resulting from troubles during transportation or from other reasons, please do not hesitate to contact us or our local dealer to that effect.



MAIN FEATURES OF Liner 2

- Due to the perfect solid-state circuits, your Liner 2 is so compact in construction, efficient in power consumption (30W at maximum for transmission; 6W at maximum for reception) and light in weight (approx. 3 Kg.)
- It produces such a high transmission output as more than 10W that is a limit for the beginner's apparatus and very high for an SSB transceiver of the VHF band.
- It is of semi-channel system employing the synthesizer system, and the entire channels adopts crystal oscillators completely.
- With VXO and RIT being employed, frequencies can be continuously covered in the same manner as those employing VFO.
- Any frequency besides standard frequencies can be switched to a desired one. By replacing one crystal, it is possible to change 4 channels which cover 40 KHz in width.
- Ignition noises of automobiles are perfectly eliminated by the built-in noise blanker.
- Though compact in construction, it employs SSB so as to make long-distance communications possible.
- Handling is very simple, enabling even the beginner to operate it easily. It can be operated with the same degree of operating skill required for FM and AM receivers.



BEFORE YOU OPERATE Liner 2

1. Accessories

- (1) Microphone (dynamic type) 1 pc.
- (2) Microphone support 1 pc.
- (3) Bracket for car mounting 1 pc.
- (4) Bracket screw 2 pcs.
- (5) Washer 2 pcs.
- (6) Spare fuse (3A) 1 pc.
- (7) DC cord (with fuse plug) 1 pc.
- (8) Warranty card 1 pc.

2. Installation Place

When Liner 2 is used as the fixed station, it is desired to be installed at the dry and humid-proofed place protected from direct sunlight. In case of using it in the car, it should be fixed to somewhere under the dashboard by using the bracket and screws.

3. Power Source Connection

When operated as the fixed station, the optional power supply R-114 for exclusive use will be used. Connect the red wire to the (+) terminal and the black wire to the (-) terminal of the power supply unit. In the case of mobile-mounting, no special power supply is required. Just connect the wires to the cigarette lighter outlet or other appropriate outlet of the car.

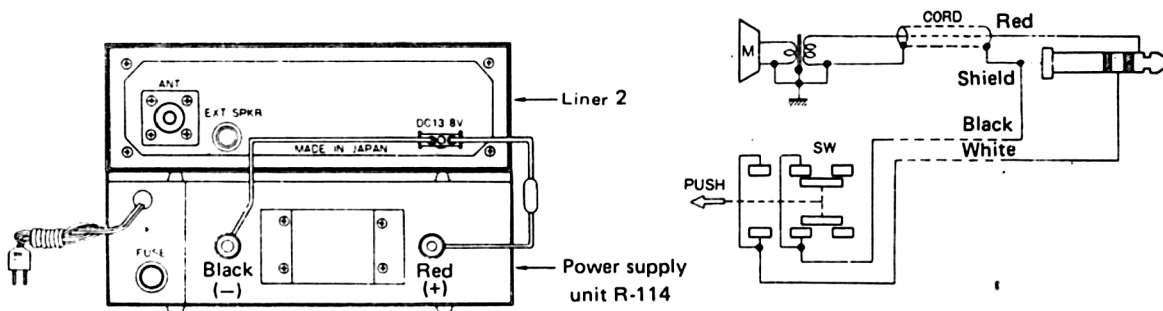
4. Antenna Connection

The antenna impedance is 50Ω . Use a 50Ω antenna in case the transceiver is mounted on the car. It is recommended, for enjoying better QSO, to use a good antenna. Use such 50-ohm cables as 3D-2V, etc. while the cable length being kept as short as possible.

5. Microphono

Use the microphone provided as an accessory. The impedance of this microphone is 600Ω .

CONNECTION DIAGRAM



(This diagram shows connection at the OFF position)

NAMES AND OPERATION METHOD OF EACH PART

1. POWER ON-OFF Switch

One push of this switch turns power on and another push turns it off. When power is switched on, the meter and the channel indicator panel are lit up, showing that the transceiver is in the state of operation.

2. Noise Blanker (NB) Switch

In case receiving noises such as pulse noise and car pulse noise are too loud, repress the NB switch, and then the clear communications free of noises will be obtained.

3. TEST Switch

This switch is provided for adjustment of the antenna. By depressing it, the transceiver enters in the state of transmission, and carrier waves will be transmitted. The switch can be utilized for adjustment of the antenna and also for clarifying frequencies.

4. VOLUME Knob

When this VOLUME control knob is turned clockwise, sound volume increases.

5. VXO (Variable X'tal Oscillator) Knob

If the CHANNEL switch only is used, frequency coverage is not continuous, i.e., a frequency interval being 10 KHz. Therefore, it is necessary to supplement this shortcoming by continuously varying frequencies. For this purpose, the VXO is designed so as to vary in the range of ± 6 KHz.

6. Main Knob

This is a channel switching knob which can rotate in either direction, clockwise and counter clockwise. A total of 24 channels can be switched by this knob.

7. Frequency Indicator Bezel

Frosted glass (semi-transparent acryl) is used for the indicator cover glass, so that the indicator can be seen only when power is on. The indicator shows figures from 10 to 33. These figures are on a place of 100 KHz, e.g., if the red figure in the center is Number 12, it means 144,120 MHz, and if it is 33, it means 144,330 MHz. These frequencies, however, are those with RIT OFF, VXO knobs set on the center positions.

8. RIT Knob

In the transceiver-type communications, the same frequency is used for both transmission and reception. The receiving frequency, however, can be shifted by using RIT, leaving the transmission frequency as it is. If tuning is adjusted by using VXO when the frequency of other station is shifted during QSO, your transmitting frequency, too, will shift simultaneously. In such a case, RIT will be used.

9. SQUELCH Knob

The method of using SQUELCH in SSB communications is a little different from that of all channel system in FM communications. But, if speaker noises are too loud at the stand-by position, you may be irritated. In such a case, turn slowly the SQUELCH knob clockwise up to a point where noises just start to fade away. When it is turned clockwise too much, the transceiver does not work even when the signals are introduced. Care must be taken so that no excessive turning takes place.

10. Microphone Jack

Plug the accessory microphone into this jack, and repress the microphone switch to start transmission.

11. Meter

This meter is automatically switched to serve as the S-meter in reception and as the power meter in transmission.

12. Bracket

In case of mounting the transceiver in the car, use the bracket to fix it to the dashboard of the car. In case of using it as the fixed station, use it as the supporting stand.

13. ANT Connector

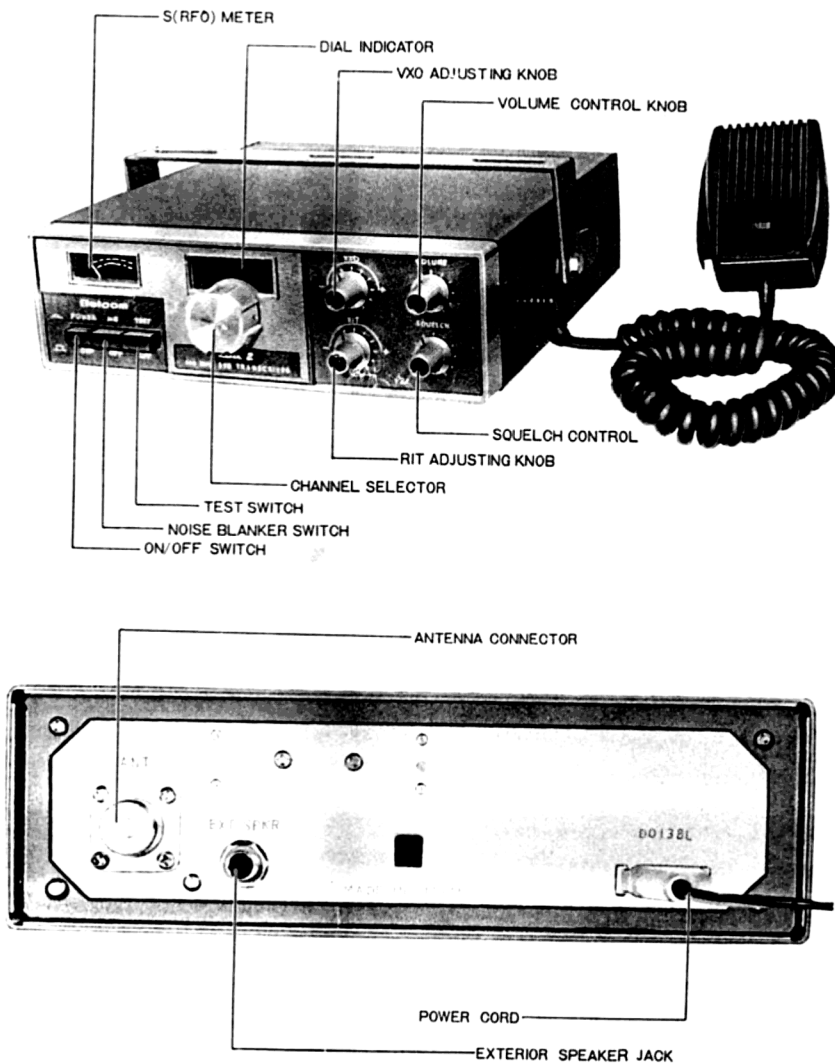
The impedance of this antenna connector is 50Ω.

14. DC Input Connector

Use the accessory power cord (with fuse). The standard voltage is 13.8V, but Liner 2 normally operates on the voltage range from 11V to 16V.

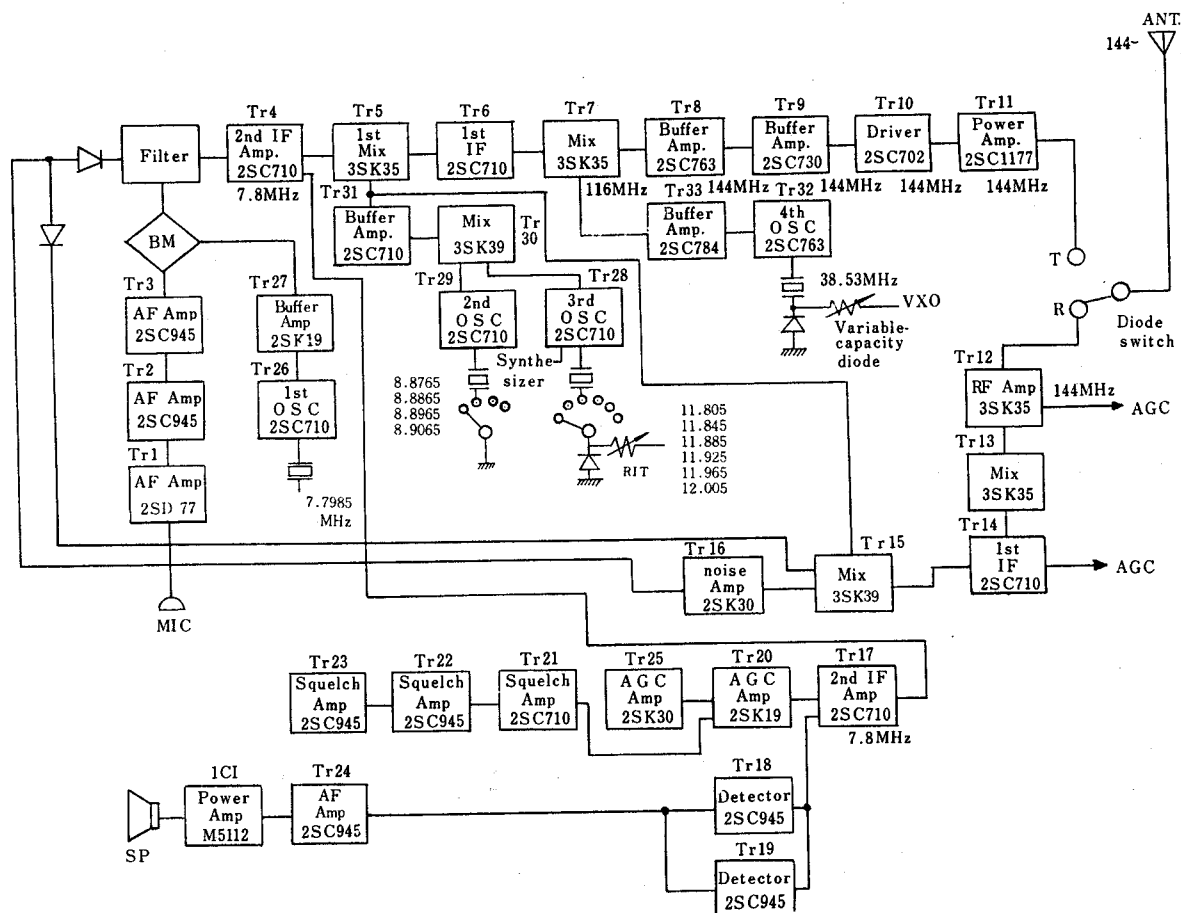
15. EXT SP Jack

When an external speaker or an earphone is used, plug it in this jack.



SPECIFICATIONS

- Operating frequency range: 2m band, ~~144,100~144,340~~ ^{145,250~145,490} MHz (Transmitter/Receiver)
- Mode of operation: SSB (A3J)
- Final input: 20W (10W PEP output)
- Antenna impedance: 50Ω
- Carrier suppression: More than 45 dB
- Side band suppression: More than 45 dB
- Spurious radiation intensity: More than -60 dB
- Microphone: 600Ω dynamic microphone
- Transmitting frequency characteristics: 300~2,700 Hz (-6 dB)
- Receiving sensitivity: Antenna input 0.5μV S/N more than 10 dB
- Selectivity: 2.4 KHz (-6 dB)
±3 KHz (-60 dB)
- Image ratio: More than 60 dB
- AF output: More than 2W (built-in speaker 4Ω)
- AF output impedance: O T L, More than 4Ω
- Power consumption: 30W at maximum for transmission
6W at maximum for reception
0.6W in stand-by
- Semiconductors: 27 transistors, 6 FETs, 1 IC, 44 diodes
- Power source: 12~16V DC (2.5A at maximum)
13.8V DC (standard)
- Size: 220 (W) × 70 (H) × 250 (D) mm
- Weight: 3 Kg



CIRCUIT CONSTRUCTION

As shown in the block diagram, this transceiver is of all solid-state, employing 27 transistors, 6 FETs, 1 IC and 43 diodes.

TRANSMITTING UNIT

Voice signal coming in the microphone is amplified by Tr₁ (2SD77) and Tr₂ (2SC945), converted to low impedance by Tr₃ (2SC945) and then connected to Balanced Modulator (BM), D₁₋₄ (IN60). Tr₆ (2SC710) works as a carrier wave oscillator that is of crystal oscillation system of 7,7985 MHz. This frequency is passed through the Buffer Tr₇ (2SK19) and then mixed at Balanced Modulator. The oscillation of the frequency 7,7985 MHz works as BFO in reception.

The signal made as a result of mixture of the audio signal and the carrier wave frequency is the DSB signal, becoming the perfect SSB signal after passing the filter which follows the balanced modulator BM. After its IF-amplification by Tr₄ (2SC710), it is converted at the 1st convertor or mixer (3SK39) to the frequency in the 28 MHz band.

The signal of the 28 MHz band is amplified by Tr₆ (2SC710) and, by means of local oscillations of 38,533 x 3 and 115.6 MHz, it is converted by the 2nd convertor or mixer to become the SSB signal of the 144 MHz band. Finally, the signal is passed through 4 amplifiers Tr₈ (2SC763), Tr₉ (2SC730), Tr₁₀ (2SC702) and Tr₁₁ (2SC1177) so as to reach the rated output of 10W.

The antenna circuit is adjusted at our factory to be of 52-ohm antenna impedance, and no further adjustment of the antenna is recommended.

ALC detects a part of the output and feeds it back to the gate of the AGC amplifier Tr₂₅ (2SK30) of the receiving unit, thereby controlling the gain of Tr₄ (2SC710) in the same manner as AGC in the receiving unit.

RECEIVING UNIT

As seen in the block diagram, the receiving unit is of double conversion superheterodyne system which employs crystal control. The 1st IF belongs to the 28 MHz band, and the 2nd IF to the 7.8 MHz band.

The signal coming in through the antenna is amplified by the RF amplifier Tr₁₂ FET (3SK35) and, by means of the local oscillation frequency 115.6 MHz of the 4th oscillator, converted to the 1st IF in the 28 MHz band. The 1st IF in this band is amplified by Tr₁₄ (2SC710) and then, with the aid of the synthesizer output frequency, is converted to the 2nd IF of 7.8 MHz. A part of the 2nd IF signal is noise amplified by Tr₁₆ (2SK30) for the noise blanker in order to control the diodes for the noise blanker. The noise blanker circuit operates only when the NB switch on the front panel is set to the ON position.

When noise inputs (pulsatile inputs) take place, the diodes D₆ (IN60) and D₇ (IN60) on the IF path circuit cut off the portion of noise inputs only.

The filter is the crystal type common to both transmission and reception. The filter characteristics are so designed to meet requirements for professional communication apparatus. Therefore, this ideal characteristics of the filter guarantee you to enjoy communications of superb tone quality. The 2nd IF amplifier Tr₄ (2SC710) is also common to both transmitting and receiving units, and applies AGC for reception and ALC for transmission. The 2nd IF signal is amplified again by Tr₇ (2SC710) before the product detectors Tr₁₈ (2SC945) and Tr₁₉ (2SC945) extract the audio signal which is led to the AF amplifier.

A portion of the 2nd IF signal output is amplified by the AGC amplifier Tr₂₀ (2SK19) so as to be partially led to AGC and Squelch.

The AGC of this transceiver has excellent characteristics and is provided with adequate time constants for SSB communications. Even if fading of signals takes place, you can make QSO communications easily with powerful local stations in the nearby areas.

The AGC controls gains of the gate voltage of Tr₅ FET (2SK30) and the 2nd gate voltage of the RF amplifier Tr₁₂ (3SK35), by negating the voltage depending on the intensity of the input signal. The deviation of the source voltage of the FET Tr₅ is used as the AGC voltage for the 2nd IF amplifier Tr₄.

Squelch is employed as one of the features of this transceiver. Tr₂₁ (2SC710) controls the 2nd IF amplifier while Tr₂₂ (2SC945) and Tr₂₃ (2SC945) as DC-amplifiers controls the bias voltage of the base side of the AF amplifier Tr₂₄.

The output circuit of the AF section employs an IC. Because the output circuit is of OTL, the output impedance is optional. The AF outputs of more than 2 watts and 1.5 watts are available for 4Ω and 8Ω impedances, respectively. The built-in speaker is 4Ω and produces abundant AF output.

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OSCILLATOR UNIT

1. 1st Oscillator Section

Tr₂₆ (2SC710) oscillates the crystal having the frequency of 7.7985 MHz. This oscillation is required to be very stabilized since it is a base of the carrier wave. This oscillator section including the buffer amplifier Tr₂₇ (2SK19) is highly stabilized because the temperature characteristics for this section are also taken into consideration.

2. Synthesizer Section

Tr₂₉ (2SC710) oscillates the crystal of the 8 MHz band, and at the same time Tr₂₈ (2SC710) oscillates the crystal of the 11 MHz band, the addition of these bands' frequencies is taken out by the mixer Tr₃₀ (3SK39). Standard channels and frequencies are shown in the Table. In case you desire to change frequencies, replace the crystal of the 11 MHz band with the one that you wish so that frequencies covering 40 KHz in width can be changed. For example, suppose that you do not use the upper-side frequencies of 144.29, 144.30, 144.31 and 144.33, but that you desire to use the lower-side frequencies of less than 144.10 MHz. In such a case, replace the crystal of 12.005 MHz with the one of 11.765 MHz so as to obtain a frequency range from 144.06 to 144.28 MHz.

3. Fourth Oscillator Section

Tr₃₂ (2SC763) oscillates the crystal of 38.533 MHz between the base and the emitter of this transistor and the collector of the transistor picks up the 3-fold frequency of 116 MHz. Tr₃₃ (2SC784) amplifies the frequency 116 MHz in order to add it to the convertor section of both transmitting and receiving units.

X

STANDARD CHANNELS AND FREQUENCIES

(unit: MHz)

Channel (MHz)		Synthesizer oscillation frequency (MHz)	Synthesizer output (f_1)	$f_1 + 7,7985$ (f_2)	$f_2 = 38,533 \times 3$ $f_2 + f_1 = F$ 115.6
1	144,100	12,005 11,805 + 8,8965	20,7015	28,500	144,100
2	144,110	" + 8,9065	20,7115	28,510	144,110
3	144,120	" + 8,9165	20,7215	28,520	144,120
4	144,130	" + 8,9265	20,7315	28,530	144,130
5	144,140	11,845 + 8,8965	20,7415	28,540	144,140
6	144,150	" + 8,9065	20,7515	28,550	144,150
7	144,160	" + 8,9165	20,7615	28,560	144,160
8	144,170	" + 8,9265	20,7715	28,570	144,170
9	144,180	11,885 + 8,8965	20,7815	28,580	144,180
10	144,190	" + 8,9065	20,7915	28,590	144,190
11	144,200	" + 8,9165	20,8015	28,600	144,200
12	144,210	" + 8,9265	20,8115	28,610	144,210
13	144,220	11,925 + 8,8965	20,8215	28,620	144,220
14	144,230	" + 8,9065	20,8315	28,630	144,230
15	144,240	" + 8,9165	20,8415	28,640	144,240
16	144,250	" + 8,9265	20,8515	28,650	144,250
17	144,260	11,965 + 8,8965	20,8615	28,660	144,260
18	144,270	" + 8,9065	20,8715	28,670	144,270
19	144,280	" + 8,9165	20,8815	28,680	144,280
20	144,290	" + 8,9265	20,8915	28,690 7	144,290
21	144,300	12,005 + 8,8965	20,9015	28,700 7	144,300
22	144,310	" + 8,9065	20,9115	28,710 7	144,310
23	144,320	" + 8,9165	20 9215	28,720 7	144,320
24	144,330	" + 8,9265	20 9315	28,730 7	144,330

XTAL CONVERSION = 12.0045 MHz

or 13.595 MHz = 145.89 - 145.92

TROUBLE SHOOTING

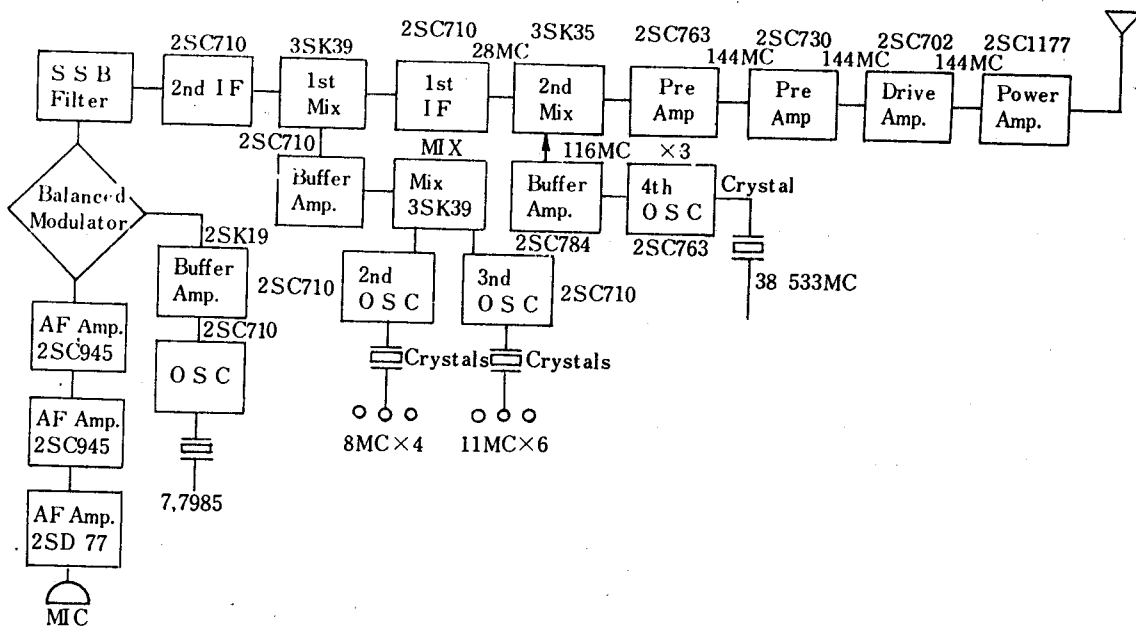
No adjustment except manipulation of the knobs is required for Liner 2, because it is the completely-adjusted finished product. For the precise adjustment of each unit and component, high-performance measuring instruments and measuring knowledges are necessary. So, it is requested not to turn or fumble adjustment points without measuring instruments.

The symptoms shown in the following table are not real troubles of the transceiver itself. In case there still exist troubles after you treat according to the instructions in the table, please contact us or our local dealer.

Syraptom	Cause	Disposition
No lamp lights up and no sound comes out from the speaker, even when power is switched on.	(1) Incomplete connection of the power cord (2) Blown-up fuse	(1) In case of the fixed station, insert the AC power plug perfectly into the AC power receptacle. (2) Connect perfectly both red and black wires to the appropriate terminals. (3) Replace the fuse with a new one after confirming its plus and minus marks (if the fuse is blown up again, there exists a trouble).
No transmission is possible though the antenna is connected.	(1) The antenna cable is short- or open-circuited. (2) The VSWR of the antenna is very poor.	(1) Check if the antenna cable is short- or open-circuited, and repair it if necessary. (2) Adjust the antenna to reduce the VSWR.
The S-meter is swinging but no receiving sound is obtained.	The Squelch knob is turned clockwise to the full.	Excessive turning of the Squelch knob prevents AF output from being produced. Turn the knob counter-clockwise.
No output and no swing of the RF meter	Incomplete insertion of the microphone into its jack, or poor connection of the microphone plug	Insert the microphone perfectly by referring to the instruction sheet.

VOLTAGE TABLE (unit : VDC)

NO	Collector	Base	Emitter	NO	Drain	Gate	Source	
Tr1	4.6 V	1.35 V	1.25 V	Tr20	6.0	0	0	
2	5.0	1.4	0.9	25	6.6	0.04	2	
3	8	3.8	3.2	27	9.0	1.05	2.5	
4	8	2.0	1.5	16	3.0	0	0.3	
5								
6	7.5	0.9	0.3	NO	Drain	Gate 1	Gate 2	Source
7				Tr5	8 V	0	0	0.16 V
8	13.5	0.7	0.4	7	13.5	0	1.15	0.75
9	13.5	0.7	0	12	5.5	0	0.15	0.8
10	13.5	0.66	0	13	8.2	0	0	0.6
11	13.5	0.69	0	15	8.5	0	0	0.65
				30	8.8	0	0	0.3
14	8.2	1.7	1.4	<p>The values on this table are based upon the measurements under the conditions with no output from the transmitting section, and with Volume and Squelch knobs turned fully counterclockwise for the receiving section.</p>				
17	8.3	1.5	0.9					
18	4.0	1.1	0.6					
19	4.0	1.1	0.6					
21	8.0	1.5	0.9					
22	0.05	0.5	0.02					
23	4.0	0	0					
24	7.2	1.5	1.0					
26	8.8	1.9	2.5					
28	8.8	2.2	2.15					
29	9.0	2.2	2.2					
31	8.0	1.4	0.8					
32	7.7	1.9	1.4					
33	8.0	1.5	0.9					



25C945

