INSTRUCTION MANUAL
FOR
MODEL-NRD-1EL/1EH ALL WAVE RECEIVER

JRC *Japan Radio Co., Ltd.*

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FOR
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JAPAN RADIO CO., LTD.

TABLE OF CONTENTS

C A U T I O N S

1. For BK cord connection, see paragraph 3.3. page (13) .
2. After connecting the BK cord to the console, switch on the BK power supply of the console. Otherwise, the equipment will not work.
3. When the interference from the transmitting antenna to the receiving antenna is strong, take the measure described in paragraph 3.1.1, page (8).
4. Parts which are sealed with white paint should not be turned unless absolutely necessary.
5. When the band selector switch "MHz" is not placed in an exact notch position the receiver will become inoperative by the function of the limiter control circuit. In this case, the S meter shows a swing greater than half of the scale.

Classification by Model Number

Model NRD-1EL	Standard desk type (With outer casing)
Model NRD-1EL	Standard console and rack type (Without outer casing)
Model NRD-1EH	Special desk type (With outer casing and 500 Hz crystal filter built in)
Model NRD-1EH	Special console and rack type (Without outer casing and 500 Hz crystal filter built in)

1. FEATURES

Features of the receiver are:

(a) High Stability

- The receiver employs the multiplex superheterodyne system with the crystal controlled 1st local oscillator and a frequency stabilized variable frequency second local oscillator (abbreviated as VFO).

(b) Wide Frequency Range

- The frequency range of this receiver is from 90 kHz up to 30 MHz.

(c) Easy and Quick Tuning

- The tuning dial can be quickly brought in the neighborhood of a desired position either manually or by push button motor-driven operation.
- For the purpose of easy viewing, the large size horizontal dial scale is provided with "MHz" and "100 kHz" graduations in white indexes and bright spot indexes.

(d) IF Limiter System

- The intensity of the telegraph tone output can be kept practically constant, irrespective of the receiving radio field intensity, by means of the IF limiter. Thereby the disagreeable tone due to the fluctuation of intensity is eliminated.

o Impulsive noises such as atmospherics are suppressed.

(e) A New System in Antenna Input Circuit

o The newly designed antenna input circuit eliminates the necessity of the antenna trimmer.

(f) Free Selection of Tone for A1 Reception

o For A1 radio telegraph reception, the beat tone can be changed by "BFO PITCH" and hard or soft tone can also be selected as desired.

(g) Sharp Selectivity

o Built-in mechanical filters with 3 kHz and 1 kHz bandpass widths, one each, provides very high selectivity. (Model NRD-1EH has a 500 Hz crystal filter in addition to the above filters.)

(h) Stable SSB Reception

o The mark "SSB" is indicated in the panel "BFO PITCH". The AGC circuit is specially designed for SSB reception.

(i) No Key Click

o The specially designed BK circuit produces no key click.

(j) Compact Size and Light Weight

o Full considerations are given in the designing of all mechanisms and casing structures for the purpose of minimizing the size and weight of this equipment.

2. CONSTRUCTION

Construction differs between the desk type receiver and the console or rack type receiver.

A. Desk Type

(1) Main unit 1

(2) Outer casing and mounting tray 1

(3) Speaker box (SP-101) 1

(4) Power cable (standard, KC-1133A) 1

(5) BK cord (standard, KC-143A) 1

(6) Instruction manual .... 3 copies

B. Console or Rack Type

(1) Main unit 1

(2) Speaker box (SP-101) 1

(3) Power cable (standard, KC-1134A) 1

(4) BK cord (standard, KC-143A) 1

(5) Instruction manual .... 3 copies

Any of the items listed below will be supplied for customer's option.

(1) Headphone (600-ohm)

(2) External loudspeaker box

type BX-517A (with magnet rubber)

type BX-517B (wall-mounted)

(3) Pretuner (NXA-1532)

(4) FS converter (NHC-1)

(5) Spare parts (the following two groups available)

a. Routine spare

Vacuum tubes (same in quantity as actual), fuses, pilot lamps (same in quantity as actual)

Fixed resistor, fixed capacitor, variable resistor, BK relay (one each)

b. Standard spare

Vacuum tubes (one each)

Fuses, pilot lamps (twice the quantity as actual)

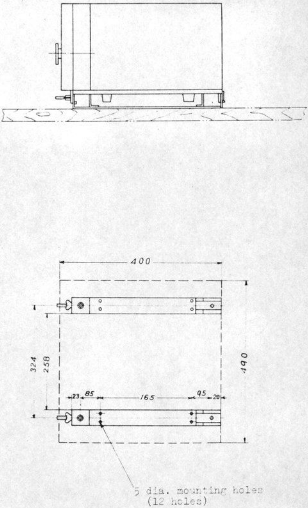


Fig. 3-1 Mounting Tray and Mounting Dimensions

3. INSTALLATION

The equipment shall be installed with reference to the outline and mounting dimensions view (attached drawing) and the mounting reference (Fig. 3-1).

3.1 Preparations

Perform the following test and check before installation.

3.1.1 Measurement of Inductive Interference from Transmitting Antenna to Receiving Antenna.

When the receiver is used in combination with a transmitter, there may be the cases where high voltages are induced into the receiving antenna, sometimes burning the receiver. Therefore, before installation, operate the transmitter and check the induced voltage in the receiving antenna. For this purpose, connect a 100W lamp to the receiving antenna output terminal as shown in Fig. 3-2, and check the induced voltage for the whole transmitter frequency range.

If the lamp does not light, it shows that slight or no induction exists. If the lamp lights in red, the induction is less than 1 A (ampere). And if the lamp lights incandescently, the induction is higher than 1A.

(1) Receiving antenna

(2) Lead-in cable

(3) 100W lamp

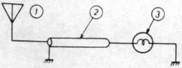


Fig. 3-2

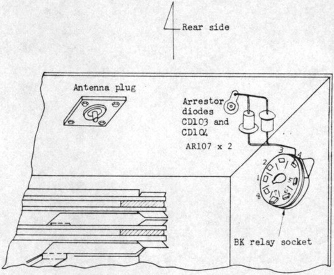
In Model NRD-1EL Receiver, the receiver antenna circuit is grounded by means of a BK relay during the radiation of the transmitted wave, but sometimes the transmitted wave forms will become discrepant to the working time of the BK relay, and some portion of the transmitted wave will enter the receiver. For the protection of the receiver, an arrester comprising diodes is inserted in the antenna circuit of this receiver. (See Fig. 3-3) However, this will increase the cross modulation when a strong radio field, for example, a strong field due to a nearby broadcast station, exists.

Therefore, the induction to the receiving antenna shall be confined as low as possible even with these protecting devices.

If there is no induction for the whole transmitting frequency range, these diodes are unnecessary.

An induction of 1A or higher will burn the arrester diodes.

When 1A or higher induction exists, change the antenna spacings or, as shown in Fig. 3-4, connect a 100W lamp or an AW-118B induction protective lamp box in series between the antenna and the receiver.



Arrestor Diodes Connecting Point

Fig. 3-3

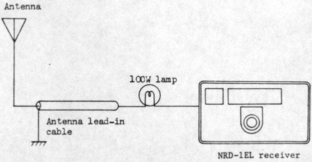


Fig. 3-4

3.1.2 Checking

The receiver is carefully examined before shipment, but for caution's sake check that tubes are seated properly and no foreign substances is remaining in the receiver when the receiver is brought out for installation.

3.2 Mounting (for the equipment with its outer casing provided)

(a) As shown in Fig. 3-5, the equipment requires the clearance and floor space for its installation. Avoid the site where there is abnormal vibration or high temperature and humidity which may appreciably shorten the life of the equipment.

(b) Securely fix the mounting tray at spacings shown in Fig. 3-1 through the mounting holes, six each on the right and left.
Face the side with a thumbscrew toward the front. The thumbscrew must be kept loosened.

(c) Carefully lift the main unit horizontally with the panel surface faced frontward and place it on the mounting tray. The groove between L-metals on the lower front of the main unit is to be engaged in the thumb-screw on the mounting tray and the L-metal on the lower rear of the main unit is to be engaged in the groove backward the mounting tray.

(d) Maintaining the above condition, push the main unit slowly backward, and the L-metal will be engaged into the hole on the mounting tray. Now tighten the thumb-screw properly.

3.3 External Terminal Connection

a. Connect the power supply cord into connector "AC" located on the rear side of the main unit. The power supply of this equipment is AC 90-120V.

b. Connect the antenna cable to the coaxial connector "ANT" located on the rear side of the main unit.

c. Leave the cable connected between "PRE TUNER IN" and "PRE TUNER OUT" as it is. (If a pretuner is connected externally, connect the pretuner in the place of this cable. See Fig. 3-6)

d. If a break-in relay circuit is used, connect the BK cord to 6P connector "BK & LINE" on the rear side of the main unit.

Caution: Since in this equipment BK circuit voltage controls also a BK control circuit besides the conventional BK relay, a mistake of the BK circuit voltage polarities (plus and minus mistaken) will cause the BK control circuit inoperative.

Check the following points before connecting the BK cord.

o In Fig. 3-7, the voltage between the console body and termianl (1) on the terminal board (for KC-156, 6P connector terminal (1)) should be +24V or +8V when the key is opened and 0V when the key is closed.

o The lead wires from the terminal of console or rack to the key should be moderately designed to prevent line drop exceeding 0.1V between the console body and terminal (1) on the terminal board when the key is closed.

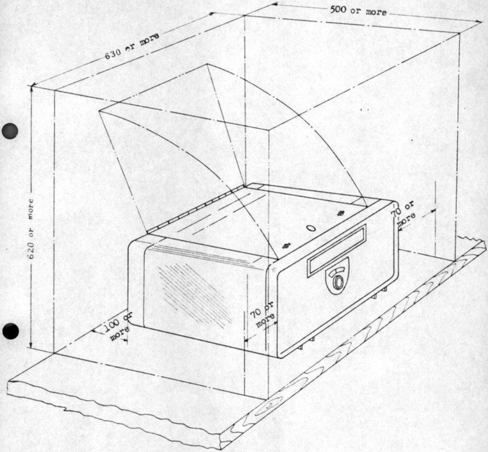
o The voltage between the console body and terminal (2) on the terminal board (for KC156, 6P connector terminal (2)) should always be +24V or 8V irrespective of open or close of the key.

If the connection is mistaken the set will not work at all or key clicks will increase considerably.

o In case of the BK circuit supply voltage 8V - DC, the interconnection of receiver's BK circuit should be charged referring to note 2 in Fig. 6-11, page 62.

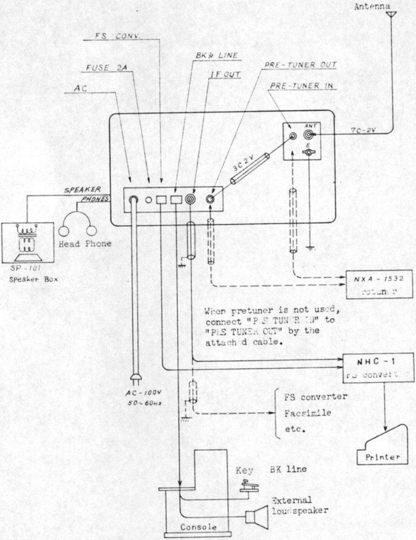
e. Connect the grounding wire to terminal "E" on the rear side of the receiver.

f. For connection to FS converter power connector "FS CONV" and coaxial connector "IF OUT" are provided on the rear side of the receiver. For these connections refer to Fig. 3-6.



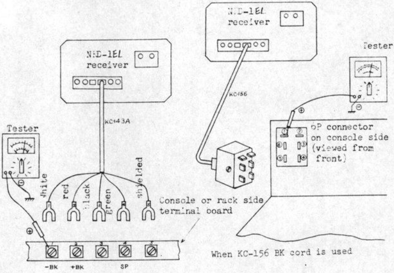
Clearance Required for Receiver Installation

Fig. 3-5



Rear Side Connector Connections

Fig. 3-6



When KC-156 BK cord is used

When KC-143A BK cord is used

Method of Confirming BK Line Polarities

Fig. 3-7

4. OPERATION

4.1 Operation on Panel

(a) "POWER"

The "POWER A" switch (S211) switches on and off the AC power supply to the receiver.

Place the "METER" switch (S208) at "SOURCE". Turn the "POWER A" switch from "OFF" to "A". The equipment is energized and the working voltage is indicated on the meter. If the pointer is not within the red mark showing 100±5V, open the upper lid of the equipment and turn the "VOLT REGU" switch located on top of the right sideplate center to bring the pointer within the red mark.

Next, after sufficient filament warmup, set the "POWER B" switch (S207) from "OFF" to "B".

It is necessary to turn the power switch on at least 30 minutes before starting of reception for stable operation (elimination of initial frequency drift).

(b) MHz

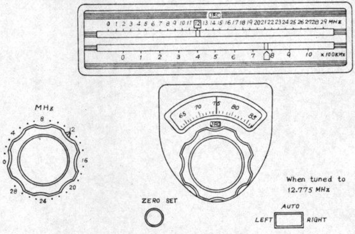
Intended for changing the receiving frequency range, this dial has 30 equal graduations, one for 1-MHz. By selecting the dial, a desired frequency MHz is indicated on the panel in engraved figures and, at the same time, on the horizontal dial upper column by the white index and a bright spot index.

It should be noted that the dial be not turned by a greater force than necessary. Strong collision with the stopper or unexact positioning should be avoided.

(c) Tuning Dial

The large dial located under the fan-shaped window in the center of the panel is the tuning dial. A desired frequency of the 100 kHz, 10 kHz and 1 kHz orders can be selected with this tuning dial.

One revolution of the tuning dial is equivalent to one graduation (100 kHz) on the horizontal dial by the index. The rotary scale in the fan-shaped window indicates less than 10 kHz frequencies, one graduation showing 1 kHz.



Frequency Readings

Fig. 4-1

(d) "AUTO"

The "AUTO" push button is driven by a motor and is used for quickly bringing the tuning dial indication near the desired frequency. When the button is pushed for "RIGHT" or "LEFT", the tuning dial shifts clockwise or counter-clockwise from its stop position.

The pointer is designed to stop automatically at each end of the dial, thus being protected from collision against the stopper. It takes about 5 seconds to move the pointer through a whole scale of 1 MHz.

(e) "RF GAIN"

This is the gain control for RF and IF amplifiers. Generally speaking, when high sensitivity reception is desired, the "RF GAIN" control is turned to its maximum with the volume adjusted by the "AF GAIN" control. However, high "RF GAIN" will cause the output distortion, when a high input signal is received.

(f) "AF GAIN"

This is the gain control for AF amplifiers. Sound volume in reception is adjusted mainly by this "AF GAIN".

(g) "AGC"

The "AGC" switch, switching the RF and IF automatic gain control circuits, is used dependent on the type of received waves, as explained in the followings:

"OFF"

This position is used mainly for A1 reception. Since the AGC circuit is off, gains are controlled by the "RF GAIN". Because of the IF limiter, the A1 beat sound can be received practically in a constant volume irrespective of the input signal intensity. With the "AGC" switch placed at "OFF", the beat is heard softer in tone than at "T".

"T"

In this position, the AGC circuit is off, as with the case of the position "OFF", but the A1 beat is heard harder. Thus this notch is used when it is desired to change the beat tone in A1 reception or to discriminate the beat from that of other receivers.

Notch "T" cannot be used for A3 or SSB reception.

"S"

Mainly used for A3 reception or for A1 reception affected by fading. The AGC circuit is operated and its time constant is 0.5 sec.

"L"

This notch is used chiefly for SSB reception. Thus the AGC time constant is selected as approperiate for SSB reception.

(h) "BFO"

This switch is turned on when A1 or SSB waves are received.

(i) "BFO PITCH"

With this switch, the BFO frequency is changed to 455 ± 3 kHz. When A1 is received, the index is to be turned off by one graduation either clockwise or counterclockwise from the center.

When receiving a lower side-band SSB, place the index in the "SSB" position.

(j) "BAND WIDTH"

Bandpass widths are selected by this switch (S205). The bandpass widths are generally used according to the type of reception, which is as follows:

0.5 kHz	A1	(NRD-1EH only)
1 kHz	A1, A2	
3 kHz	A3H, A3J	(SSB)
6 kHz	A3	

Since it is difficult to catch transmitted waves in a narrow band, first receive them through a broad band width and then, if there is noise or interference, use a narrow band to avoid such interference. Reception through a narrow bandpass width will reduce noise and maintain the signal level, resulting in the improvement of signal-to noise ratio.

(k) "CALIBRATE"

This switch is used for frequency scale calibration. Normally, set the "CALIBRATE" switch at "OFF". Under this condition, the 100kHz calibration oscillator is stopped. It generates calibration signals when the switch is placed at "CALIBRATE".

Incidentally, this frequency calibration should be performed with the "BFO PITCH" index set in the center of the scale or at the center frequency 455 kHz, to prevent errors in indication. For the method of frequency calibration, see 4.3.

(l) "ZERO ADJ"

This control is used for adjustment of the pointer on the kHz dial, when frequency calibration is carried out.

To read a received frequency correctly, make calibration at a point nearest that frequency every time when the band is selected, and turn the "ZERO ADJ".

(m) "ANT ATTENUATOR"

This attenuator is used when reception is made in the 0 or 1 band. Where powerful cross modulation is induced into the received frequency, the attenuator decreases signals or interfering waves to reduce such cross modulation.

When the dial is turned clockwise, the attenuation increases. When the dial is turned counter clockwise and the switch is turned off, a filter through which the frequency 0 - 535 kHz alone passes is automatically inserted to reduce cross modulation (especially cross modulation from strong radio broadcast waves) and lower frequency waves can be received with reduced interference. Note that, if higher frequencies than 535 kHz is received under that condition. The receiver gain is decreased remarkably.

(n) "METER"

This is a change-over switch of the meter circuit. The meter works as an AC voltmeter in the "SOURCE" position and as an input signal level meter in the "S" position. When making this selection, the "AGC" switch should be turned to either "S" or "L", with the "RF GAIN" control set at a maximum. When an input signal enters the antenna, the meter indicates a value corresponding to the antenna input voltage. The meter is calibrated on the basis of 1μ V = 0 dB.

(o) "SPEAKER"

The receiving output is available with 600Ω impedance. Connect the speaker box SP-101.

(p) "PHONES"

Connect headphone to this jack, then output to "speaker" is off.

4.2 Reception

4.2.1 A1 Reception

Operate the receiver in the following sequence.

a. Turn the "AGC" switch to "OFF".

b. Place the "BAND WIDTH" switch at "3kHz".

c. Place the "BFO" switch at "BFO".

d. Place the "BFO PITCH" dial in the center position.

e. Turn the "RF GAIN" dial clockwise to obtain a proper noise output.

f. Set the MHz-dial in the desired frequency position.

g. Turn the kHz-dial to make setting of the frequency in 100 kHz, 10 kHz and 1 kHz orders, and make zero beat of the signal. Turn the "BFO PITCH" dial by one graduation either clockwise or counterclockwise to obtain the best tonality.

i. Select the "BAND WIDTH" for "1 kHz".

j. Turn the "AF GAIN" to obtain an optimum volume.

Where there is any other receiver nearby receiving A1 waves from other stations or where A1 waves are received for a long period and tone change is desired, turn the "AGC" switch to "T".

Then the tone is changed from soft to hard.

4.2.2 A3 Reception

a. Set the "AGC" switch at "S".

b. Set the "BAND WIDTH" switch at "6 kHz".

c. Turn the "BFO" switch to "OFF".

d. Set the MHz-dial in the desired frequency position.

e. Turn the kHz-dial manually or by pushing the "AUTO" button to make setting of the frequency at 100 kHz. 10 kHz and 1 kHz orders.

f. Turn the "RF GAIN" dial clockwise to obtain the best reception, and then turn the "AF GAIN" to have an appropriate volume.

A3 cannot be received with the "AGC" switch at the "T" notch. Too high an RF gain with the "AGC" switch at "OFF" will sometimes cause the AF output distorsion. In such a case, decrease the RF gain properly.

4.2.3 SSB Reception

a. Set the "AGC" switch at the "L" notch

b. Set the "BAND WIDTH" at "3 kHz".

c. Turn the "BFO" switch to "BFO".

d. Set the "BFO PITCH" at "SSB".

e. Turn the "RF GAIN" dial clockwise to obtain proper noise output.

f. Turn the MHz-dial in the desired frequency position.

g. Turn the kHz-dial either manually or by pushing the "AUTO" button to make correct setting of the frequency at 100 kHz, 10 kHz and 1 kHz orders.

h. Now SSB reception is ready. If good tone is not attained, turn slightly the kHz-dial and the "BFO PITCH" dial. However, the "BFO PITCH" must not be far off from the "SSB" position.

i. Turn the "AF GAIN" to obtain an appropriate volume.

4.2.4 Reception of Frequencies below 2 MHz

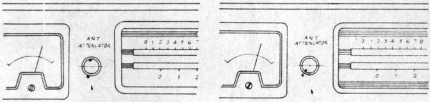
a. Reception of Frequencies below 535 kHz (see Fig. 4-2)

Turn the "ANT ATTENUATOR" dial to its counterclockwise limit, and place the switch at "ON". Under this condition, a filter attenuating frequencies above 535 kHz is automatically inserted in the antenna circuit. Thus cross modulation due to radio broadcast waves can be reduced remarkably.

b. Reception of Frequencies 535 kHz - 2,000 kHz

Turn the "ANT ATTENUATOR" dial clockwise, remove the white mark of the dial from that of the panel, and turn the switch to "OFF". Under this condition, by turning the dial clockwise, the input signal is attenuated by the attenuator inserted in the antenna circuit, resulting in the reduction of cross modulation. However, note that the attenuator will attenuate the signals at the same time, and take care not to turn the dial more than necessary.

Caution: In respective operations described in (a) and (b), turning of the "ANT ATTENUATOR" dial to its counter-clockwise limit will cause the signals to be attenuated, sometimes resulting in the difficulty in reception.



When dial mark comes off panel mark in clockwise direction, attenuator is working.

When dial mark is positioned in coincidence with panel mark, 535kHz cut-off LPF is inserted in anttenna circuit.

Fig. 4-2 Operation of Antenna Attenuator

4.2.5 Reception with Interference

The receiver IF section is provided with 3 kHz and 1 kHz mechanical filters with good selectivity. Where there in an interfering frequency very near to the desired frequency, place this wave at the band end of the mechanical filter by turning the tuning dial, as shown in Fig. 4-3, and let the interfering wave located outside the band, and attenuated.

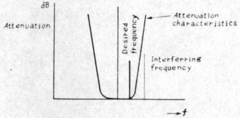


Fig. 4-3

The Fig. 4-3 shows the case where the desired frequency is placed at the upper end of the filter band and the interfering frequency is located outside the band. If a second interfering frequency lower than the desired exists, it seems, in the Fig. 4-3, that either of the two interfering frequencies cannot be located outside the pass band. Practically, reception of the desired frequency with good selectivity even though there are two such interfering frequencies in positions lower and higher the desired frequency is possible by adjusting the "BFO PITCH".

That is, in such a case where two interfering frequencies are mixed, in change the "BFO PITCH" toward the right or the left from the center and make reception where the interfering frequency beat becomes the same as the desired frequency beat. A combination of the filter selectivity and the effective selectivity of the operators ear will result in better reception irrespective of the "BFO PITCH" position.

In this procedure, turn the tuning dial slowly so that the desired frequency may be brought at the end of the filter band, as shown in Fig. 4-3.

Fig. 4-4 and 4-5 illustrate the effective attenuation curve obtained through the above-described operation.

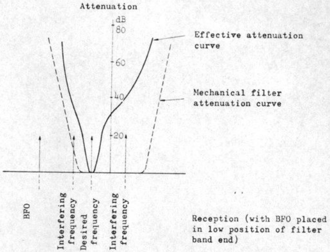


Fig. 4-4 Effective Attenuation Curve in A1

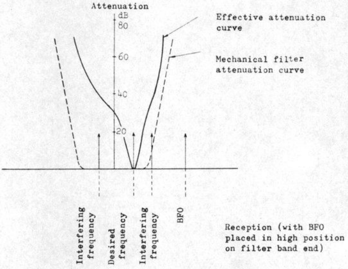


Fig. 4-5 Effective Attenuation Curve in A1

4.2.6 Operation of NXA-1532 Pretuner

When it is difficult to prevent cross modulation during 90 kHz - 2 MHz reception though all the procedures mentioned in the above paragraphs is taken, the NXA-1532 pretuner is to be used in the following manners.

Referring to Fig. 3-6 "Rear Side Connectors Connections", connect coaxial connector "IN" (on the rear side of the pretuner) to coaxial connector "IN" (on the rear side of the receiver) and pretuner connector "OUT" to receiver connector "OUT", but the coaxial cables attached to the pretuner.

Turn the selector switch on the right panel of the pretuner to "OFF" and adjust the receiver to a desired frequency. Then change the selector switch over to the frequency band of the desired signal, and turn the pretuner tuning dial to set the white mark on the dial in the neighborhood of the desired frequency graduation. Then turn slowly the tuning dial clockwise or counterclockwise until the cross modulation mixed in the received signal is reduced and the desired frequency is clearly received.

For the construction and connections of the pretuner, see the pretuner connection diagram attached.

4.3 Calibration

4.3.1 Calibration of 100 kHz Oscillator

(a) Let the receiver receive the standard frequency JJY (any one of 2.5 MHz, 5 MHz, 10 MHz and 15 MHz).

(b) Turn the "BFO" switch to "OFF" and "CALIBRATE" to "CALIBRATE".

(c) Turn the "RF GAIN" control to adjust the best volume.

(d) Open the set upper lid, move the trimmer CV104 located adjacent to the "100 kHz XTAL" in the RF section on the chassis left, and obtain a zero of the double beat.

4.3.2 Calibration of BFO

o Simple Method

(a) Remove the antenna, and turn the "BFO" switch to "BFO" and the "CALIBRATE" to "OFF".

(b) Place the "RF GAIN" at a maximum "BFO PITCH" in the center, and "BAND WIDTH" at "1 kHz".

(c) Under this condition, move slightly the BFO coil (L205) core and lock it in the center where the set noise changes in tone.

o More Precise Method

(a) Remove the antenna out of the equipment.

(b) Place the "BFO PITCH" in the center and the "CALIBRATE" at "CALIBRATE".

(c) Turn the MHz -dial and kHz-dial to obtain a zero beat at 9.1 MHz. (when the BFO is not accurate 9.1 MHz may not coincide accurately on the kHz dial. Obtain a zero beat irrespective of this discrepancy.)

(d) Obtain a piece of polyvinyl chloride wire about 70 cm long and remove the covering slightly from both ends to prepare the test lead. Open the upper lid of the equipment, and insert one end of the test leadwire incorporated into the chassis to the antenna terminal and the other end into J207 located near V208.

(e) Now a weak beat will be generated. Adjust the volume of this beat by means of the "RF GAIN". (keep the "AF GAIN" at a maximum. Too high a RF gain will cause the equipment to start oscillation.)

(f) Turn the L205 dust core to obtain a zero beat. (Two different beats will be obtained by turning the core. Make a zero beat of the weaker one.)

(g) Take off the test leadwire connecting J207 with the antenna terminal.

(h) Then another beat is generated again. Turn the kHz-dial slightly to obtain a zero beat. (Don't turn the "BFO PITCH".)

(i) Connect again the antenna terminal to J207 by using the test leadwire. (Then another beat is generated.)

(j) Repeat the procedures mentioned in (e) through (i) until no beat is generated irrespective of the connection or disconnection of the test leadwire between the antenna terminal and J207.

4.3.3 Calibration of Dial Scale

(a) Place the "CALIBRATE" at "CALIBRATE" and the "BFO" at "BFO".

(b) Set the "BFO PITCH" index in the center position.

(c) Turn the tuning dial to a 100 kHz point nearest the frequency to be received, and obtain a zero beat.

(d) Turn the "ZERO ADJ" to set the index at zero of the kHz-scale.

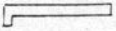
4.3.4 Calibration of VFO

In the above-mentioned scale calibration, if the zero beat at the 100 kHz point comes off at the band upper end or lower end, calibrate the VFO in the following sequence.

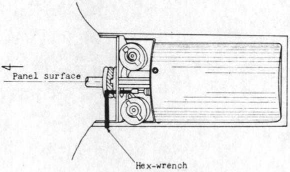
(a) Turn the MHz-dial to select the 2 MHz band.

(b) Place the "BFO" at "BFO", the "CALIBRATE" at "CALIBRATE", and the "BFO PITCH" in the center.

(c) Turn the tuning dial clockwise to obtain a zero beat at 3 MHz. Then correct the pointer deviation from "0" on the kHz-dial by turning the "ZERO ADJ".

(d) Turn the tuning dial counterclockwise, select a received frequency of 2 MHz and set the kHz-dial at "0". Then a beat is generated indicating the VFO deviation. Now open the upper lid of the equipment, and insert the 3mm hex-wrench (the slender one of  -shape) fitted on the chassis left side, into the VFO trimmer to obtain a zero beat. (See Fig. 4-6.)

(e) Repeat the procedures mentioned in (c) and (d) until the graduation accords with the zero beat at both ends of the band.



VFO Adjustment

Fig. 4-6

5. SPECIFICATIONS

(a) Frequency Range

30 bands (one band for 1 MHz) in the range 90 kHz-30 MHz

Band ⓪ 90 kHz - 1000 kHz

Band ① 1000 kHz - 2000 kHz

Band ② 2 MHz - 3 MHz

Band ③ 3 MHz - 4 MHz

Band ④ 4 MHz - 5 MHz

.
.
.
.

Band ㉙ 29 MHz - 30 MHz

(b) Reception System

Band ⓪ and ① Triple superheterodyne

Band ② ③ ④ ⑤ and ⑥ Triple superheterodyne

Band ⑦ - ㉙ Double superheterodyne

(c) Type of Reception

A1, A2, A3, A3J and A3H (F1 and F4 by use of adaptors)

Sensitivity

	A1	A3
Band ② - ㉙	below 2μV	below 6μV
Band ⓪ and ①	below 30μV	below 100μV

(at 20 dB S/N and 100 mW output)

(d) Selectivity

"BAND WIDTH" notch	6 dB band	60 dB band
*0.5 kHz	0.5 - 0.8 kHz	below 1.8 kHz
1 kHz	1 - 1.5 kHz	Below 4 kHz
3 kHz	3 - 4 kHz	below 11 kHz
6 kHz	6 - 7 kHz	below 42 kHz

* NRD-1EH only

(e) Image Ratio

Bands ② - ⑬ above 70 dB

Bands ⑭ - ㉙ above 50 dB

(f) AGC Characteristics

AF output variation for 3μV - 100 mV input variation .... below 10 dB

(g) AF output

1W or more

(h) Intermediate frequency output

0.1V or more (at 75 ohms)

(i) Power supply

AC 50 - 60 Hz, 90 - 120V, approx. 120VA

(j) Weight

Desk type .... 30 Kg

Console or rack type .... 19 Kg

(k) External View and Construction

See attached drawing "Outline and Dimensions".

6. PRINCIPLES OF OPERATION

6.1 General

6.1.1 Block Diagram

The circuit construction of the receiver is as shown in the block diagram. As illustrated, the triple superheterodyne system is adopted in bands 90 kHz - 6 MHz, and the double superheterodyne system is used in bands 7 - 30 MHz. An antenna trimmer circuit is omitted from the input circuit and RF amplifier circuit.

For the purpose of covering the whole frequency band with a single variable pitch coil, a trimmer coil and a tuning capacitor are connected by selection with a turret in parallel with the 2 - 3 MHz basic coils. (For details of this coil, refer to later explanations.)

The 1st local oscillator is a crystal oscillator, which has 16 quartz oscillators covering the whole frequency range. Also, to receive the whole frequency on a continous and variable basis, the receiver is provided with 3 - 2 MHz variable frequency amplifiers and 3.455 - 2.455 MHz variable frequency oscillators, and these being interlocked mechanically with the RF tuning mechanism.

The fixed IF amplifier is at 455 kHz, its bands being changed over to 3 stages, i.e., 6 kHz, 3 kHz and 1 kHz including mechanical filters and being amplified by three tubes.

Noise is limited by the balanced limiter (IF limiter) arranged at the final stage of IF amplifiers, and this circuit also acts as a BK control circuit.

The automatic gain control circuit is amplifier type AGC circuit.

A circuit changing tones is arranged in the AF amplifiers, which can provide two different tones during A1 reception.

6.1.2 Construction of 90 kHz - 2 MHz Section

The circuit for the 90 kHz - 2 MHz bands is triple superheterodyne system in which the input circuit is not tuned, as shown in Fig. 6-1.

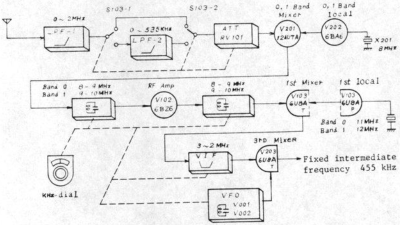


Fig. 6-1 90 kHz - 2 MHz Band Block Diagram

The LPF (Low Pass Filter) in the input circuit has a bandpass width of 0 - 2 MHz. Signals of 2 MHz or more is attenuated by this filter and no spurious signal is mixed in the 8 - 10 MHz intermediate frequency range from the antenna.

The LPF, changed over by S103-1 and S103-2, has a bandpass width of 0 - 535 kHz to eliminate cross modulation due to powerful BW during reception of 500 kHz or lower frequencies. The 12AU7A tube (V201) is a balanced modulator used exclusively for the bands 0 and 1. The 6BA6 tube (V202) is a local oscillator consisting of an 8 MHz crystal oscillator and used exclusively for the bands 0 and 1. Signals are converted here to 8 - 10 MHz 1st intermediate frequencies.

The signals then are amplified by the 6BZ6 (V102) and are converted to 3 - 2 MHz 2nd intermediate frequencies by the triode 6U8A (V103). This local oscillator consists of the pentode of 6U8A (V103).

The 3 - 2 MHz signals pass the variable IF filter (VIF) and are converted to the 455 kHz fixed intermediate frequency by the 6U8A (triode, V203). The local oscillator voltage injected to V203 is from a highly stable variable frequency oscillator consisting of V001 and V002, whose oscillation frequency changes between 3.455 and 2.455 MHz by mechanical interlocking with the VIF and L104, L105, L108.

6.1.3 Construction of 2 - 6 MHz Section

The circuit of the 2 - 6 MHz circuit is also constructed of triple superheterodyne system, which is shown as follows:

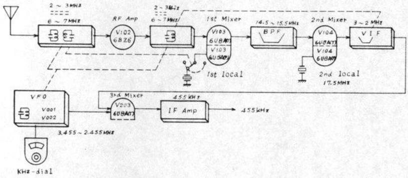


Fig. 6-2

As illustrated in the above block diagram, the input circuit is of double tuning type. Use of this circuit can Eliminate the antenna trimmer. V102 (6BZ6) is an RF amplifier tube, and the signal first amplified there is converted to 14.5 - 15.5 MHz first intermediate frequencies by the triode (V103, 6U8A) with the output of the crystal oscillator consisting of the pentode of V103. The signal then passes the BPF (bandpass filter) having a bandpass width of 14.5 - 15.5 MHz and is applied to the 2nd mixer (V104, 6U8A). The 2nd mixer local oscillator is a crystal oscillator consisting of the pentode of V104.

The signal having passed through the 2nd mixer is then converted to a 3 - 2 MHz signal, passes through the VIF, and is applied to the triode of the 3rd mixer (V203, 6U8A). The local oscillator signal applied to V203 is a high stability variable frequency.

The frequency changes between 3.455 and 2.455 MHz by mechanical interlocking with the L104, L105, L108 and L113, L115, L117 and is also directly coupled to the kHz-dial. The input signal from the 3rd mixer is converted to the 455 kHz fixed intermediate frequency and is applied to the following circuits.

6.1.4 Construction of 7 - 30 MHz Section

The circuit for 7 MHz - 30 MHz range is of double superheterodyne system, which is as follows:

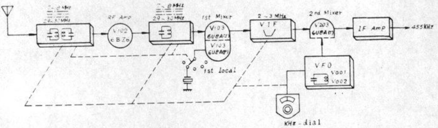


Fig 6-3

As if easily understood by comparing with the description given in 6.1.3, the circuit construction of the 7 - 30 MHz bands is practically the same with the triple superheterodyne from the antenna circuit to the 1st mixer. Only the difference is that the frequency converted by the 1st mixer is 3 - 2 MHz, which passes through the VIF and is applied to the 3rd mixer (V203).

6.2 Circuit Descriptions

6.2.1 Antenna Input Circuit

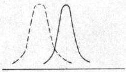
This circuit is an unbalanced low impedance circuit which is connected to 1P jack J101 on the rear side of the receiver. The input is applied through the S101-1 switch to the LPF in the case of bands 0 and 1, and to the antenna tuning circuit at the terminal of the capacity dividers of the tuning circuit in the bands 2 - 29.

A BK relay is inserted in the antenna circuit. The BK relay works when a signal is transmitted in break-in communication, and the antenna and receiver antenna input circuit thus are grounded. Near the antenna connector are diodes CD103 and CD104, which are connected to the circuits to protect the receiver from transmitted wave induction.

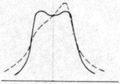
6.2.2 RF Amplifiers

In bands 2 - 29, a tube 6BZ6 performs 1st RF amplification. The double tuning circuit on the input side and the single tuning circuit on the inter-stage side suppress image signals and other spurious signals. As mentioned previously, no antenna trimmer is provided in this reciver equipment, which can be realized by the adoption of the double tuning circuit on the input side.

The double tuning circuit can appreciably limit detuning of the circuit due to antenna impedance variation, or the resonance characteristic. Fig. 6-4 shows bandpass variations when the single and double tuning circuits are detuned by the antenna.



Single tuning



Double tuning

The solid line shows when the antenna and impedance are matched, while the dotted line indicates when the impedance is not matched and the tuning circuit is detuned.

Fig. 6-4

Basically, the RF tuning system is such that a variable pitch solenoid coil is used as the tuning coil and the tuning frequency is changed by moving up and down the dust core in the coil.

(This system is called μ-tuning.) With this system alone, however, it is impossible to cover the whole frequency band 90 kHz - 30 MHz with a single variable pitch coil. For this reason, the conventional μ-tuning system receiver are provided with a few variable pitch coils which are selected mechanically, resulting in a complicated construction.

In Model NRD-1EL Receiver, coils and tuning capacitors are arranged in parallel for each band in one variable pitch coil (2 - 3 MHz rating), and a desired frequency and its linearity can be obtained with the moving range of the variable pitch coil dust core held constant over the whole bands.

Shunt coils and tuning capacitors connected to the basic coil are arranged in a radial shape on the wafer of the printed switch (S101 ~) so that the wafer moves every one band to connect necessary coils and capacitors to the variable pitch coil.

As for the connection of the double tuning circuit on the antenna input side, C-connection and M-connection are used for the band 2 and the bands 3 - 29, respectively. For connections, see Fig.s 6-5 and 6-6.

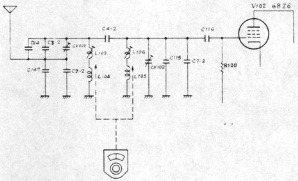


Fig. 6-5 Double Tuning Circuit for Band 2 (2 - 3 MHz)

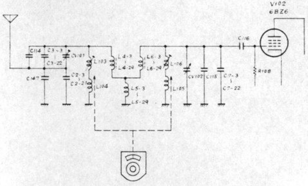


Fig. 6-6 Double Tuning Circuit for Bands 3 - 29

6.2.3 1st Mixer

This is a triode mixer circuit using the triode part of V103 (6U8A). The output signal from RF amplifier V102 (6BZ6) is mixed with the local oscillator signal from the 1st local oscillator consisting of the pentode part of V103, and frequencies 0 - 2 MHz and 7 - 30 MHz is converted to 3 - 2 MHz and frequencies 2 - 7 MHz is converted to 14.5 - 15.5 MHz.

The signal thus converted is applied to the VIF through S101-13 and S101-14 in the case of bands 0 and 1 and bands 7 - 29, or to the BPF having a width of 14.5 - 15.5 MHz through S101-13 in the case of bands 2 - 6. In order to prevent the Q-value of the grid coil from being reduced due to a V103 grid current caused by an excessively high local oscillating voltage, diode CD102 is connected between the V103 cathode and 1st grid, thereby keeping the bias voltage higher than the local oscillating voltage.

6.2.4 2nd Mixer

The signal from the BPF (14.5 - 15.5 MHz rating) is converted to 3 - 2 MHz by this 2nd mixer, consisting of the triode part of V104 (6U8A). A local oscillator signal is produced by the 17.5 MHz crystal oscillator at the pentode part of V104. The signal converted to 3 - 2 MHz is applied to the VIF via S101-14.

6.2.5 1st Local Oscillator

This crystal oscillator, consisting of the pentode part of V103 (6U8A), is furnished with 16 crystal oscillators on a turret wafer, each being selected according to the band. (see Table 6-1.) The circuit is of PG pierce type in which crystal oscillators are connected between the screen grid and 1st grid. The frequency taken out of the plate tuning circuit (basic frequency or doubled frequency) is applied to the 1st mixer from the tuning circuit secondary. The tuning capacitor in the tuning circuit is arranged on a turret wafer for each band, and is slected every time of turret selection. The generated frequency from the crystal oscillator is set correctly to the center frequency by means of the trimmer variable capacitor fitted on the turret wafer (S101-10).

6.2.6 2nd Local Oscillator

This circuit is a crystal oscillator consisting of the pentode part of V104 (6U8A) and generating a frequency of 17.5 MHz. The generated frequency is applied to 2nd mixer V104, and the frequency 14.5 - 15.5 MHz is converted to 3 - 2 MHz.

Table 6-1 Local Oscillating Frequencies

Band	Frequency range	Mixer of bands 0 and 1: Local oscillating f	Mixer of bands 0 and 1: Mixer output f	1st local oscillator: Crystal f	1st local oscillator: Local oscillating f	2nd mixer: Input f	2nd mixer: Local oscillating f	Variable intermediate f (VIF)	VFO	IF
0	MHz 0.09 ~ 1	MHz 8	MHz 8.09 ~ 9	MHz 11	MHz 11			MHz 2.91 ~ 2	MHz 3.365 ~ 2.455	kHz 455
1	1 ~ 2	8	9 ~ 10	12	12			3 ~ 2	3.455 ~ 2.455	"
2	2 ~ 3			12.5	12.5	MHz 14.5 ~ 15.5	MHz 17.5	"	"	"
3	3 ~ 4			11.5	11.5	"	"	"	"	"
4	4 ~ 5			10.5	10.5	"	"	"	"	"
5	5 ~ 6			9.5	9.5	"	"	"	"	"
6	6 ~ 7			8.5	8.5	"	"	"	"	"
7	7 ~ 8			10	10			"	"	"
8	8 ~ 9			11	11			"	"	"
9	9 ~ 10			12	12			"	"	"
10	10 ~ 11			13	13			"	"	"
11	11 ~ 12			14	14			"	"	"
12	12 ~ 13			15	15			"	"	"
13	13 ~ 14			16	16			"	"	"
14	14 ~ 15			8.5	17			"	"	"
15	15 ~ 16			9	18			"	"	"
16	16 ~ 17			9.5	19			"	"	"
17	17 ~ 18			10	20			"	"	"
18	18 ~ 19			10.5	21			"	"	"
19	19 ~ 20			11	22			"	"	"
20	20 ~ 21			11.5	23			"	"	"
21	21 ~ 22			12	24			"	"	"
22	22 ~ 23			12.5	25			"	"	"
23	23 ~ 24			13	26			"	"	"
24	24 ~ 25			13.5	27			"	"	"
25	25 ~ 26			14	28			"	"	"
26	26 ~ 27			14.5	29			"	"	"
27	27 ~ 28			15	30			"	"	"
28	28 ~ 29			15.5	31			"	"	"
29	29 ~ 30			16	32			"	"	"

The circuit is of Gluen type, and the generated frequencies are fed to V104 via the plate tuning circuit.

6.2.7 Mixer of Bands 0 and 1

This mixer is a balanced mixer using 12AU7A (V201). The signal 90 - 2000 kHz is mixed with 8 MHz local oscillating frequency in this mixer, thereby being up-converted to 8.09 - 10 MHz. RV205 is a variable resistor which balances the two triodes to minimize the leakage of the local oscillating frequency into the output side.

6.2.8 Local Oscillator of Bands 0 and 1

This 6BA6 (V202) Gluen type crystal oscillator oscillates a frequency of 8 MHz, which is applied to V201 (12AU7A) from the plate tuning circuit secondary. The grid leak in this circuit is split into R208 and R209. When any other band than 0 or 1 is used, a minus voltage is supplied to V202 via S101-2, resulting in the stoppage of the 8 MHz oscillation. When band 0 or 1 is used, the minus voltage is grounded through S101-2, resulting in the oscillation of V202.

6.2.9 VIF

The variable intermediate frequency filter circuit consists, like the RF amplifier, of a dust core mechanism which moves up and down in the variable pitch coil by a specially designed cam. The signal from the 1st mixer (bands 0 and 1 and bands 7 - 29) via S101-13 and S101-14 and the signal from the 2nd mixer (bands 2 - 6) via S101-14 are converted to 3 - 2 MHz at the same time and then applied to the VIF. This VIF is composed of variable pitch coils L113, L115, L117 and trimmer coils L112, L114, L116 (all these being the same in construction as variable pitch coils L104, L105, L108 and trimmer coils L103, L106, L107 used in the RF amplifier). It interlocks with the tuning mechanism of the RF amplifier and tunes to 3 - 2 MHz (i.e. works reversely to the movement of the RF amplifier core) to select a desired frequency. The VIF output is applied to the grid of the triodes of 3rd mixer V203 (6U8A).

6.2.10 3rd Mixer

The 3rd mixer consists of the triode part of V203 (6U8A). A VIF output signal of 3 - 2 MHz is applied to grid and a VFO output signal of 3.455 - 2.455 MHz, to the cathode. These signals are then converted to the 455 kHz fixed intermediate frequency.

6.2.11 VFO

The local oscillating frequency of 3.455 - 2.455 MHz is applied to the 3rd mixer by this variable frequency oscillator. (JRC's Model NW-1C VFO is employed.) The circuit consists of two 6BA6 tubes, V001 and V002, and a variable pitch coil, L001.

The frequency 3.455 - 2.455 MHz is changed linearly by the core moving in the coil. The core is coupled directly to the kHz-dial, and moves with the lead screw rotating with the kHz-dial. The VFO output is applied to the 6U8A 3rd mixer cathode from the V002 plate via C009.

In Model NRD-1EL Receiver, very stable 1st and 2nd local oscillation is obtained by the crystal controlled oscillator, and the frequency stability depends largely on the VFO. For this reason, the coils and other moving parts are covered with cylindrical aluminium cases to protect them from dust and humidity. Also, respective components used in the circuit were fully examined at the factory. Thus note that their replacement by the user be avoided.

6.2.12 Fixed IF Amplifier

The signal converted to 455 kHz via the 3rd mixer (V203) is amplified by this fixed IF amplifier, which consists of V204, V205 and V206 (6BA6). The frequency band can be changed by S205 to 0.5 kHz (Model NRD-1EH only), 1 kHz, 3 kHz and 6 kHz (6 dB down). 0.5 kHz is obtained through a crystal filter and 1 kHz and 3 kHz is obtained through a mechanical filter, and 6 kHz, through an LC filter.

Each amplifier stage is stabilized by current feedback. RV201 is furnished at the V204 cathode to perform gain calibration of about 10 dB to compensate against aging.

6.2.13 IF Limiter

This is a balanced type limiter circuit consisting of four diodes CD203 - CD206 arranged between T210 and T211. Bias currents are supplied to respective diodes from the +200V line via R241 and R239 and R240. Signals below this level pass but those signals or noises above this level are cut off. Since the signal level when the AGC circuit works is lower than the limiter level, any noise whose time constant is shorter than that of the AGC and which has an excessively high peak value can be cut off when A3 is received with the AGC placed at "ON".

With the AGC set at "OFF", most signals are cut off at their peak by the limiter and they become equalized in magnitude. Thus in A1 reception the AF output is kept constant irrespective of the intensity of the signal unless it is extremely faint.

For the BK line control by means of the limiter, see 6.2.19 "Limiter Control".

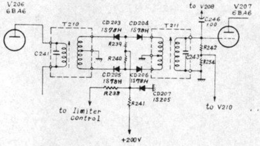


Fig. 6-7

6.2.14 Detector

Detection is made by V208 (one half of 12AX7A). A3 signals are detected by the plate detection system, while A1 signals are detected by the beat detection system in which the BFO output is applied to the cathode.

6.2.15 BFO

The electronic coupling type oscillator using 6BA6 (V211) generates a frequency of 455 kHz ± 3 kHz by turning the BFO switch at "ON". Any A1 beat may be selected within the range of 3 kHz by means of the "BFO PITCH".
When the "BFO PITCH" is set on the mark "SSB", the BFO generates a frequency of 453.5 kHz, providing stable SSB reception.

6.2.16 AF Amplifier and AF Output Circuit

Detected output is amplified in this circuit to actuate the loudspeaker or the headphone.

It consists of one half of 12AX7A (V208) and 6AQ5A (V209). The gain is adjusted by the "AF GAIN" (RV202) located at the V208 grid (PIN 7).

The signal from the output transformer (T214) actuates the loud speaker via jack J201 ("speaker") and headphone via jack J208 ("phones") on the 600-ohm line or via jack "BK & LINE" (on the rear side of the receiver). Connecting headphone to this jack, output to "speaker" is off. Output is given to headphone through an attenuator.

6.2.17 Tone Changing Circuit

The tone changing circuit is arranged between V208 (12AX7A) and V209 (6AQ5A), consisting of relay K201 and diodes CD209 and CD210 and transformer T213. The circuit changes the tone of A1 signals.

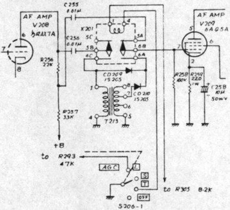
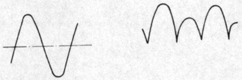


Fig. 6-8 Tone Changing Circuit

When the panel AGC switch is set at any other notch than "T", the AF signal is applied to G1 of V209 via C255 (0.01 μF) and K201 contacts. In this case, the signal undergoes no shape forming.
When the AGC switch is set at "T", the relay works and the AF signal is applied from C256 to T213. If the signal applied to T213 is an A1 beat signal, its waveform is near to a sine wave. Since T213, CD209 and CD210 forms a full-wave rectifying circuit, the signal from T213 through CD209 and CD210 has a waveform proportionate to the winding ratio of primary to secondary as shown below. This signal contains the original component and higher harmonic components.
The sound which contains the original frequency component and higher harmonic components becomes a tone which sounds somewhat harder than the original sine wave.



Original signal — Signal from shape forming circuit

Fig. 6-9

The signal from the shape forming circuit can be discriminated from the original signal, which serves to prevent false reception due to fatigue when A1 is simultaneously received with many receivers or for a long time.

6.2.18 AGC Circuit

The AGC circuit used in the Model NRD-1EL Receiver is of amplifier type. V207 (6BA6) is the IF amplifier used exclusively for the AGC circuit, and amplifies IF signals from the limiter, which in turn is detected by the T212 secondary connected to the plate. The AGC time constants are about 0.5 second when the switch is set at "S" and about 5 seconds when it is set at "L", each being selected by S206-2.

When the switch is set at "T" or "OFF", the output side of diode CD208 is short-circuited to turn the AGC off. One half of 12AT7 (V210) is a DC amplifier of the AGC voltage.

When the AGC switch is set at "S" or "L", the AGC detected output is applied between the V210 grid and cathode. Then the output, after being amplified there, is applied to the four tubes, V102 (RF amplifier), V204, V205 and V206 (the latter three being IF amplifiers).

It should be noted that only RF amplifier tube V102 (6BZ6) is so arranged that it is operated under delayed AGC through the use of diode CD101 (1S205) and resistors R134 and R135. Under this arrangement the RF amplifier tube is operated without AGC voltage because of diode CD101 kept in a shorted condition until such a negative AGC voltage is generated that is large enough to cancel the positive bias voltage developed by voltage dividing the +200V with resistors R134 and R135. This is intended to have the RF amplifier tube operate with its maximum gain for a weak antenna input signal of 40 dB or less so as to make the receiver offer a high sensitivity.

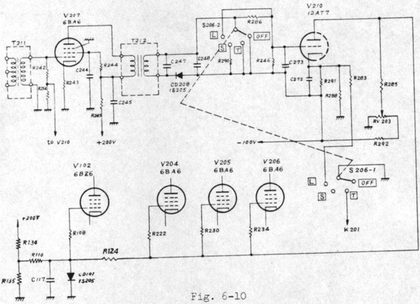
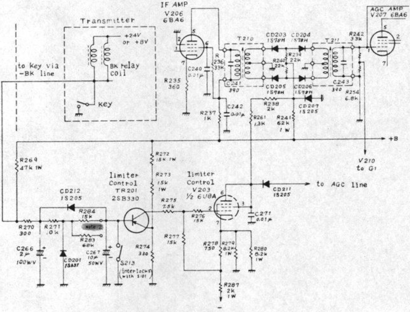


Fig. 6-10

6.2.19 Limiter Control

In break-in communication, key clicking is a trouble with the conventional receiver system. To eliminate this trouble, the Model NRD-1EL Receiver has a circuit, as shown in Fig. 6-11, consisting of a pentode of 6U8A (V203) and 2SB 330 (TR201).

In this circuit, the BK relay is actuated by turning the return side of the BK line with a key. That is, when the key is set at "ON", the BK relay is energized and the BK relay return side is grounded resulting in zero potential. When the key is set at "OFF", the BK relay is opened and a potential of +24V or +8V is supplied to the return side (-BK) of the BK relay.



Note 2: When the BK voltage is 8V, the R284 15K and R283 68K are connected in parallel.

Fig. 6-11

When the key is "ON" (i.e., when signals are transmitted), the limiter line is reversely biased with a negative voltage applied to the AGC line, thus decreasing the gain of the RF amplifier and IF amplifier. In Fig. 6-11, TR201 (2SB330) is a switching transistor, which is usually cut off because the base bias voltage from the +200V line through R270, CD271 and R284 is higher than the emitter voltage supplied from the same +200V line by dividing it with R272, R273 and R274. A minus voltage is supplied to the TR201 collector from the -100V line via R287, R277 and R275. This voltage is nearly -76V when TR201 is cut off. A bias voltage divided by R287, R278 and R279, R280 from the -100V line is supplied to the V203 cathode, while the gride is connected to the contact of R275 and R277 through R276. Under normal conditions, TR201 is cut off, and therefore the grid voltage is -76V, much lower than the cathode voltage. Thus no current flows across V203. If the key is set on, the TR201 base is grounded through CD212. R270 and TR201 is "ON", while the collector voltage is nearly zero. In consequence, the V203 grid voltage increases and V203 is in the state of conduction. Thus current runs across R261 and R238 on the plate side. Diode CD207 has a potential reverse to positive, thereby having a high resistance to the positive voltage, but showing a low resistance to the negative voltage. For these reasons, when current starts running across R238, a slight reverse bias is always applied to the limiter circuit, with the result that the limiter is in the off state and no signal passes through it.

Furthermore, the negative voltage is supplied to the AGC line from V203 via CD211, and therefore both RF amplifier and IF amplifier are totally cut off.

Next, when the key is set to OFF, bias is applied again to the base circuit according to a time constant determined by the R270, C266, R271, R284 and C267, and the receiver is gradually reset. S213, connected to the TR201 base, interlocks with the turret wafer and actuates the limiter control circuit the instant the turret wafer S101 is changed over thereby suppressing noise. The S meter circuit of this receiver is designed for reading the AGC voltage so that the AGC line is driven deep into the negative potential at the time of keying or band switching. For this reason, the S meter shows a swing greater than half of the full scale.

6.2.20 IF Output Circuit

The fixed intermediate frequency of 455 kHz is taken out from this IF output circuit, which uses a half of 12AT7

(V210) as the cathode follower. The signal from the limiter, after being divided by R242 and R254, enters the V210 grid and then is sent out to the IF output terminal "J202" at an impedance of 75 ohms from the cathode. Such a signal is used for a facimile or a teletype reception.

6.2.21 Meter Circuit

The meter circuit is used for the source voltage and S-meter by selection. In the case of the AC power line, the voltage between terminals ① and ③ on the transformer primary is read through a rectifier. For the S-meter, the AGC line voltage is read.

6.2.22 Power Circuit

DC voltages of +200V, +150V and -100V, a heater voltage of 6.3V and an FS adaptor voltage of 36V are obtained from the AC 50 - 60 Hz, 90 - 120V line. Power for the oscillator circuit is supplied from the +200V line by the V212 VR150MT voltage requlator tube. In order to achieve the stability, current is set flowing even during stand-by operation.

6.3 Mechanical Descriptions

Roughly divided, the Model NRD-1EL Receiver consists of the MHz selecting mechanism, VFO and cam rider driving mechanism, and motor driving mechanism.

6.3.1 MHz Selecting Mechanism

With this mechanism, the 30-throw turret switch (S101) having 14 turret wafers is changed over. The turret wafer shaft is coupled directly to the MHz-dial, one revolution of which can select the whole bands 0 - 29. Indication of each band position is made by the MHz-dial scale and the horizontal dial white index or bright spot index on the upper column.

6.3.2 VFO & Cam Rider Driving Mechanism

This mechanism drives the VFO and the cam rider interlocking with the kHz-dial. See Fig. 6-12. ① is the kHz-dial knob. On the same shaft of ① are kHz-dial scale plate ② , gear ③ , ten-turn stopper ⑳ and VFO ⑲ . The rotation of the kHz-dial is connected to the shaft of cams ⑬ , ⑭ , ⑮ and ⑯ , all coupled by coupling ⑫ , via gears ④, ⑤ and ⑥. The rotation also produces the rotation of motor cam ⑦ at the same time, with a gear ratio of 1: 11. Ten revolutions of ① displaces cam riders ⑰ and ⑱ by 25.4 mm through cams ⑬ , ⑭ , ⑮ and ⑯ . Thus the core connected to the cam riders is moved in and out thereby changing the inductance of the variable pitch coil. The VFO frequency 3.455 MHz - 2.455 MHz changes linearly through the ten rotations of ①, and therefore the VFO interlocks completely with the RF amplifier variable pitch coil and the VIF to obtain a desired oscillating frequency.

The 100 kHz order of the tuning frequency is conveyed to the lower column of the horizontal dial by means of a stainless wire via pulley (21), and is indicated by the white index and bright spot index. The 10 kHz and 1 kHz orders are indicated on round scale plate (2).

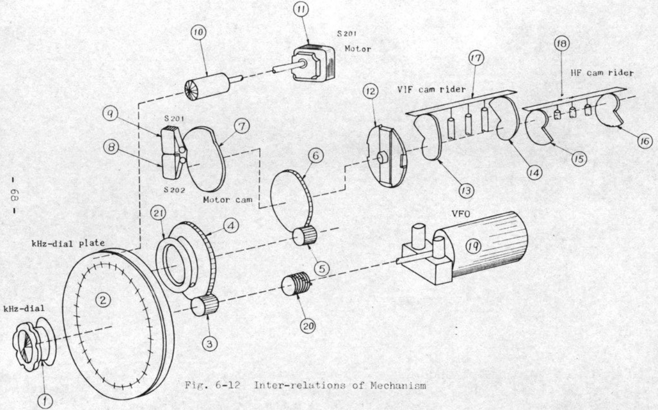


Fig. 6-12 Inter-relations of Mechanism

6.3.3 Motor Driving Mechanism

With this mechanism, the kHz-dial is automatically turned. Induction motor B201 rotates the kHz-dial through the "O" ring connected around its scale plate, thus actuating the VFO and cam riders.

In Fig. 6-12, (11) is the motor and (10) is the friction shaft connected to the motor shaft. When the motor starts rotating, the motor shaft projects as shown in Fig. 6-13 to make the rollet at the friction shaft tip to contact with the "O" ring fringe, thus producing the kHz-dial rotation.

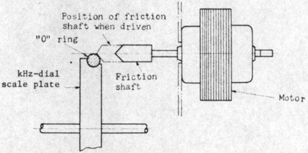


Fig. 6-13

To prevent the kHz-dial from colliding with the stopper at the end of the dial, a stop mechanism using micro-switches ⑧ and ⑨ and cam ⑦ is provided. S201 and S202 in Fig. 6-12 are the microswitches. When micro-switch ⑧ (S202) or ⑨ (S201) is turned off by means of cam ⑦, the motor cannot be rotated in the same direction even though the "AUTO" button is pushed. It will rotate only when the button is pushed in the reverse direction.

The control circuit of motor is shown in Fig. 6-14.

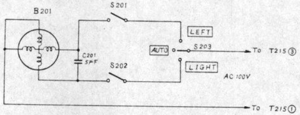


Fig. 6-14

7. MAINTENANCE AND CHECKING

Routine checkings and servicings are very important to keep the receiver in the best condition in a long life. For proper, correct checking or servicing, it is necessary to be well acquainted with the functions of each component and the actual operation of the set itself.

7.1 Cleaning

The first step to take in good maintenance is cleaning. Open the upper lid of the equipment or take out the equipment from the console, and clean and wipe off dust at the chassis top and bottom surfaces and other accessible parts by using soft, clean cloth or a brush free from oil. Such cleaning should be carried out on a regular basis.

7.2 Checking and Servicing

(a) Check screws, tubes for proper seating.

(b) Check dials, switches or controls on the panel against loosening.

(c) Turn the MHz-dial from band 0 to band 29, and check for torque evenness. If the dial is felt heavy at a certain notch, loosen the bearing mounting screw on the rear side of the receiver to obtain evenness.

(d) Push the "AUTO" button to "RIGHT" or "LEFT", and see that it stops right before the stoppers.

Examine that, while in rotation, lest the dial stops suddenly or changes in torque.

(e) Lubricate the gears, motor and cam riders in their friction part. Lubrication is, of course, necessary when abnormal rotation is found, and at regular intervals of at least once in a half year.

Cautions:

a. Never lubricate the gear teeth. Lubricate the gear bearings only.

b. Never lubricate the motor friction shaft. Lubricate the motor bearings only.

c. Lubricate the bearings, detent balls and holes in which the balls fall, of the MHz-turret. Never apply oil to the wafer or never touch the wafer with hands stained with oil.

d. For lubrication to the cam riders, see Fig. 7-1.

e. Don't lubricate the switches.

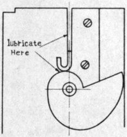


Fig. 7-1

A very slight quantity of oil should be used for lubrication, and apply no oil to unnecessary parts.
In disassembling for lubrication, see Fig. 7-3.

(f) Remove the chassis cover and check the interior.
If finding any component burnt, cracked or swollen, replace it with a new one. For replacement, refer to a separate maintenance manual of NRD-1. Otherwise, advise our service engineer or agent to perform the replacement work.

(g) If finding the "FULL GAIN" deteriorated through long years' service, open the upper lid of the equipment and turn RV201 clockwise, and it will increase by about 10 dB. However, note that excessive turning of RV201 will cause the set noise increase.

(h) For remedies of gain reduction, sound output reduction or burnt components, refer to "NRD-1 Maintenance Manual". Otherwise, consult our service engineer or agent for that purpose. For reference, a table of standard pin voltage is given.

(i) Disassembling.
For disassembling of the receiver for the purpose of replacing a control or checking a mechanism, see Figs. 7-3.
For the dial string mounting, see Fig. 7-4.

7.3 Maintenance of turret wafer

7.3.1 Removal of turret wafer

(a) Take the receiver chassis out of the receiver case. Turn the MHz switch to band 15.

(b) Remove the bottom plate of the RF unit.

(c) Unscrew 3 setscrews from the turret shaft bearing, located on the rear side of receiver. Slowly pull the bakelite turret shaft out of its hole at the rear side of the receiver.

(d) Remove the turret wafer to be checked from the turret as described below. Prior to this work, however, keep the direction and position of the turret fully in mind.

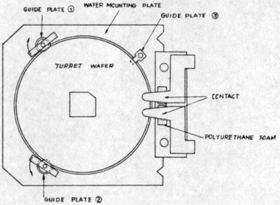


Fig. 7-2

Disengage guide plates ① and ② from the turrent wafer by pushing them out of the circumferential wafer groove in the directions shown by the arrows through the use of a screwdriver and the like.

78

With the turret wafer held between a pincette, draw the wafer out of its position gently while taking care not to exert unwanted force to the contacts. In doing this, pay special attention not to damage the mounted parts (specifcally coil).

(e) Never manipulate the contact section of the turret by fingers. The contact section may suffer from an improper contact or corrosion if it is stained with brine or oil. Hence, mind to put on clean gloves on your hands whenever you manipulate the contact section of the turret.

(f) Check the drawn-out turret for improper part. If any, replace it with a proper one.
When replacing a part, unsolder or solder the part from or to the wafer in a quick motion by using a thin soldering iron of about 20 watts having a tapered tip. Never use paste for soldering. Also, be careful not to pull the part forcedly before solder is melted enough. Otherwise, the printed wiring may be damaged.

(g) Upon the completion of inspection or replacement of part, clean the turret contacts and the contact section of the wafer mounting plate and apply contact oil to them. Impregnate the polyurethane foam of the contact section of mounting plate enough with contact oil.

(h) Insert the turret wafer into its mounting plate after checking the wafer for normal direction and position. The

Wafer should be inserted with its side having a printed marking of S101-faced towards the panel. During this work, also check to see that the wafer placed between the contacts and that guide plate 3 is placed completely in the circumferential wafer groove.

(i) Insert guide plates (1) and (2) into the circumferential wafer groove.

(j) Gently insert the bakelite shaft into its hole. Fix the turret shaft bearing in position on the rear side of receiver with 3 setscrews.

(k) While turning the MHz switch from band 0 to band 29, check to see that the switch rotates with uniform torque. If the switch seems to offer a heavier torque at a specific point of its rotating range, loosen the setscrews for the shaft bearing and re-tighten them so that the switch offers an uniform torque over the entire range of its rotation.

(l) Close and seal the bottom cover of RF unit.

7.3.2 Maintenance of turret wafer contact surface

The turret section is hermetically sealed and contact oil is coated to reduce contact wear and to stabilize contact of contacts.

After approximately 50,000 times operations, there may occur a phenomenon of contact failure. In such a case, remove the bottom of the RF section and check the contact surface of

80

the turret wafer. If the contact oil on the wafer contact surface is dry (Wipe the wafer contact surface with a piece of paper and see that no oil except black stain sticks to the paper), refill contact oil by the following procedure. Even if black stain sticks considerably to the paper, nothing matters if the contact surface is moist with contact oil.

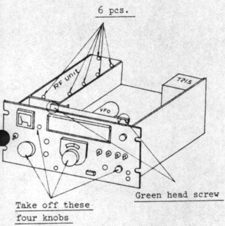
a. Clean the contact surface with clean gauze.

b. If black stain is clinging to the contact surface, moisten the gauze with contact oil and clean the surface.

c. Coat the contact surface with contact oil provided in the bottom cover of the RF section. Coat the contact surface with more than an amount of contact oil which makes the contact surface appear to be moist.

81

Top View



Bottom View

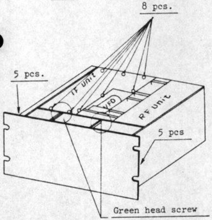


Fig. 7-3 Disassembling

1. Remove the equipment from its case or console by taking off the 4 screws on the front panel.
2. Remove the top lid of the RF unit (on the upper left side of the set) by taking off the 6 screws.
3. Take off the green head screw (in the circle marked) with the + driver.
4. Place the equipment with its upside down, and take off the eight screws to remove the IF and AF cover plate.
5. Take off the green head screw (in the circle marked) in the same manner as given in 3.
6. Take off the 5 screws on the both side panel.
7. Finally, remove the MHz, kHz, ATT and BAND WIDTH knobs with the hex-wrench in the set, and the panel can be drawn out. In this procedure, take care not to disconnect any wiring.

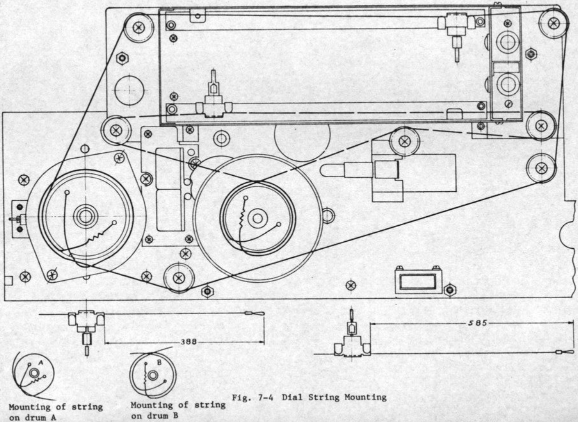


Fig. 7-4 Dial String Mounting

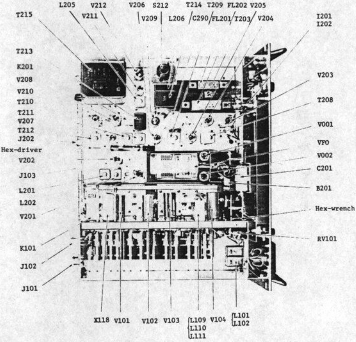


Fig. 3 Top Parts Arrangement

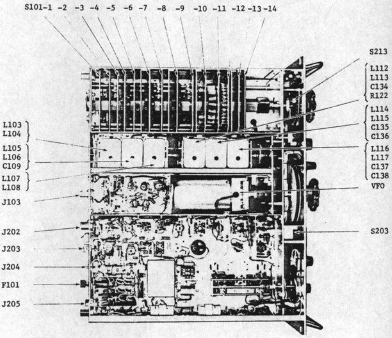


Fig. 4 Bottom Parts Arrangement

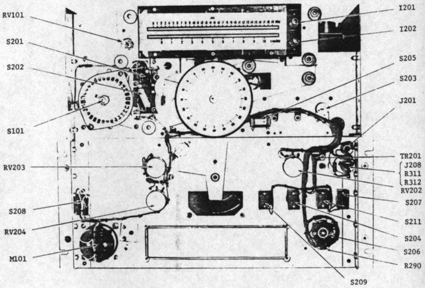


Fig. 5 Rear Panel Parts Arrangement

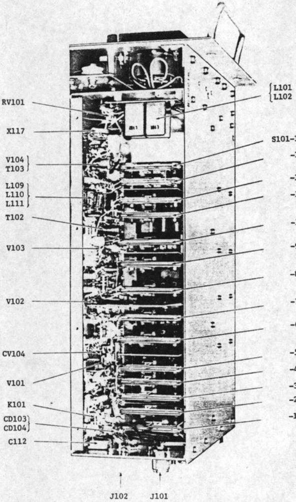


Fig. 6 RF Unit Parts Arrangement

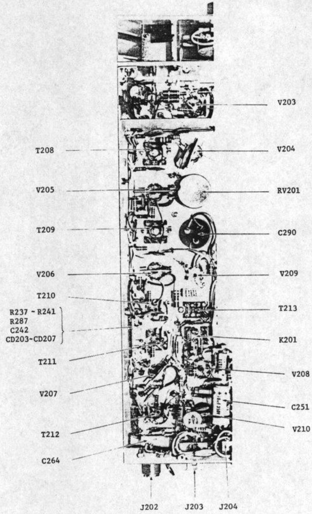


Fig. 7 IF & AF Units Parts Arrangement (1)

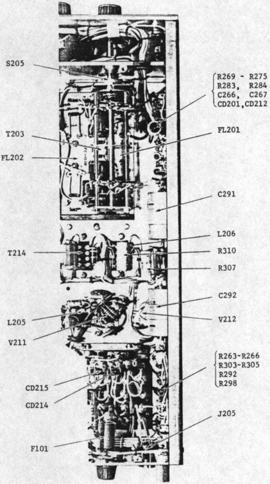


Fig. 8 IF & AF Units Parts Arrangement (2)

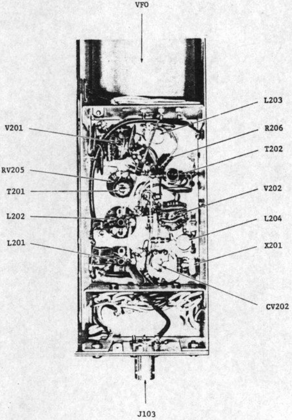
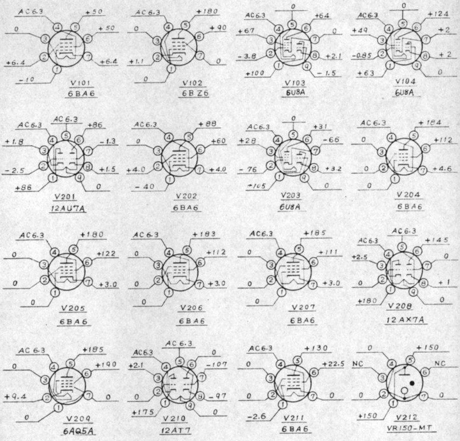
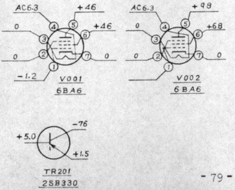


Fig. 9 Band 0 and 1 Converter Parts Arrangement

A Table of Pin Voltages

Fig. 1





Data obtained by using DC VTVM.
(Thus the data may differ from that measured by a tester.)

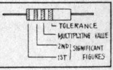
+200V line	: +190V
+150V line	: +150V
-100V line	: -107V

Source voltage: 100
AGC : Off
RF GAIN : Full
BFO CAL : On when measured
Measuring band: Band 2 (Band 0 for V201 and V202)
SP : Off
AF GAIN : Min.

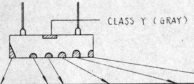
Fig 2

1 SOLID RESISTOR COLOR CODES

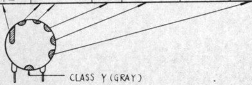
INDICATION \ COLOR	BLACK	BROWN	RED	ORANGE	YELLOW	GREEN	BLUE	VIOLET	GRAY	WHITE	GOLD	SILVER	NO COLOR
1ST SIGNIFICANT FIGURES	0	1	2	3	4	5	6	7	8	9			
2ND SIGNIFICANT FIGURES	0	1	2	3	4	5	6	7	8	9			
MULTIPLYING VALUE	1	10	10^2	10^3	10^4	10^5	10^6	10^7	10^8	10^9	0.1	10^{-2}	
TOLERANCE											5%	10%	20%



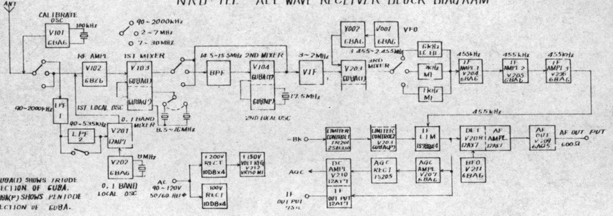
2 FIXED CERAMIC CAPACITOR COLOR CODES



COLOR	CHARACTERISTICS (TEMP. COEFFICIENT $\times 10^{-6}/°C$)	CAPACITY: 1ST, 2ND SIGNIFICANT FIGURES	CAPACITY: MULTIPLYING VALUE	TOLERANCE: 10PF or Lower	TOLERANCE: 10PF or higher	RATING VOLTAGE (V)
BLACK	C (0)	0	1	G(± 2PF)	M(±20%)	
BROWN	H (- 30)	1	10		F(± 1%)	
RED	L (- 80)	2	100		G(± 2%)	250
ORANGE	P (-150)	3	1000			
YELLOW	R (-220)	4	—			
GREEN	S (-330)	5	—	D(±0.5PF)	J(± 5%)	500
BLUE	T (-470)	6	—		P($^{+100}_{-0}$%)	
VIOLET	U (-750)	7	—			
GRAY	B (+ 30)	8	0.01	C(±0.25PF)		
WHITE	SL (-330±750)	9	0.1	F(±1PF)	K(±10%)	
GOLD	A (+100)	—	—			
SILVER	YY & YZ	—	—			



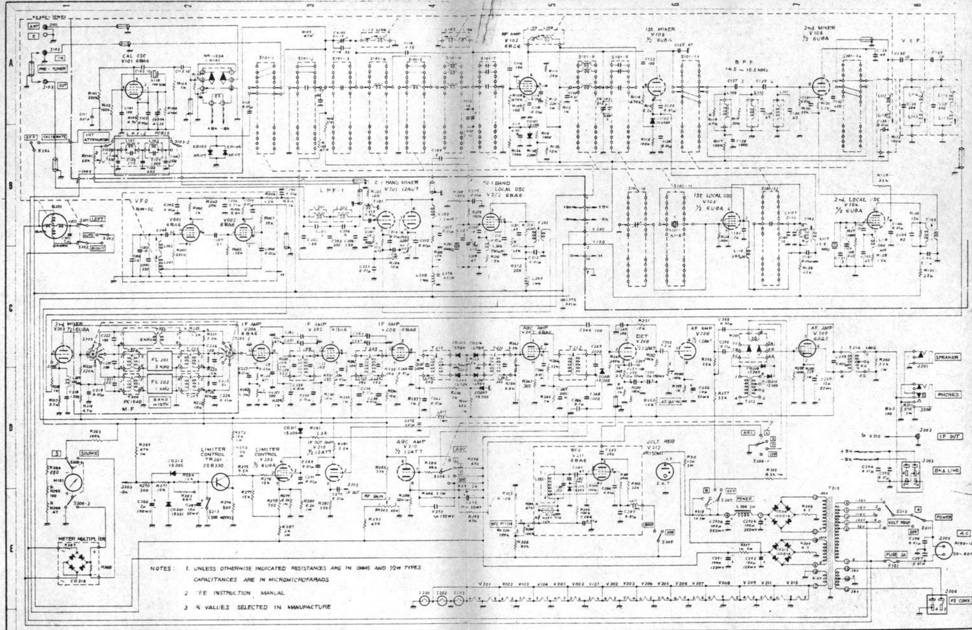
NRD-1EL ALL WAVE RECEIVER BLOCK DIAGRAM



NOTE : 6U8A(T) SHOWS TRIODE SECTION OF 6U8A.
6U8A(P) SHOWS PENTODE SECTION OF 6U8A.

BAND	FREQ RANGE	0.1 BAND MIXER X TAL FREQ	0.1 BAND MIXER OUT PUT FREQ	1ST LOCAL X TAL FREQ	1ST LOCAL LOCAL FREQ	2ND MIXER IN PUT FREQ	2ND MIXER LOCAL FREQ	VIF	VFO	IF
0	0.09 ~ 1MHz	8MHz	8.09-9MHz	11MHz	11MHz			2.91 ~ 2MHz	3.365-2.455 MHz	455kHz
1	1 ~ 2	8MHz	9~10MHz	12	12			3 ~ 2	3.455-2.455	"
2	2 ~ 3			12.5	12.5	14.5-15.5 MHz	17.5MHz	"	"	"
3	3 ~ 4			11.5	11.5	"	"	"	"	"
4	4 ~ 5			10.5	10.5	"	"	"	"	"
5	5 ~ 6			9.5	9.5	"	"	"	"	"
6	6 ~ 7			8.5	8.5	"	"	"	"	"
7	7 ~ 8			10	10			"	"	"
8	8 ~ 9			11	11			"	"	"
9	9 ~ 10			12	12			"	"	"
10	10 ~ 11			13	13			"	"	"
11	11 ~ 12			14	14			"	"	"
12	12 ~ 13			15	15			"	"	"
13	13 ~ 14			16	16			"	"	"
14	14 ~ 15			8.5	17			"	"	"

BAND	FREQ. RANGE	1ST LOCAL X TAL FREQ	1ST LOCAL LOCAL FREQ	VIF	VFO	IF
15	15 ~ 16 MHz	9 MHz	18 MHz	3 ~ 2MHz	3.455-2.455 MHz	455kHz
16	16 ~ 17	4.5	19	"	"	"
17	17 ~ 18	10	20	"	"	"
18	18 ~ 19	10.5	21	"	"	"
19	19 ~ 20	11	22	"	"	"
20	20 ~ 21	11.5	23	"	"	"
21	21 ~ 22	12	24	"	"	"
22	22 ~ 23	12.5	25	"	"	"
23	23 ~ 24	13	26	"	"	"
24	24 ~ 25	13.5	27	"	"	"
25	25 ~ 26	14	28	"	"	"
26	26 ~ 27	14.5	29	"	"	"
27	27 ~ 28	15	30	"	"	"
28	28 ~ 29	15.5	31	"	"	"
29	29 ~ 30	16	32	"	"	"

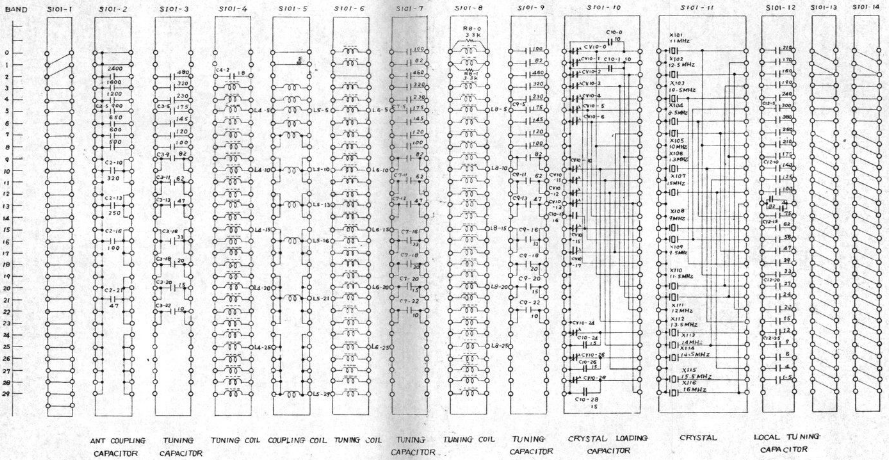


NOTES:
1. UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS AND 1/2W TYPES CAPACITANCES ARE IN MICROMICROFARADS
2. SEE INSTRUCTION MANUAL
3. ※ VALUES SELECTED IN MANUFACTURE

Drawn		Third angle projection	Title NRD-1EL ALL WAVE RECEIVER SCHEMATIC DIAGRAM
Checked			
Approved		Scale	
Sec. chief		Date	Dwg. No. E6828EL 1/2

Japan Radio Co., Ltd. JRC

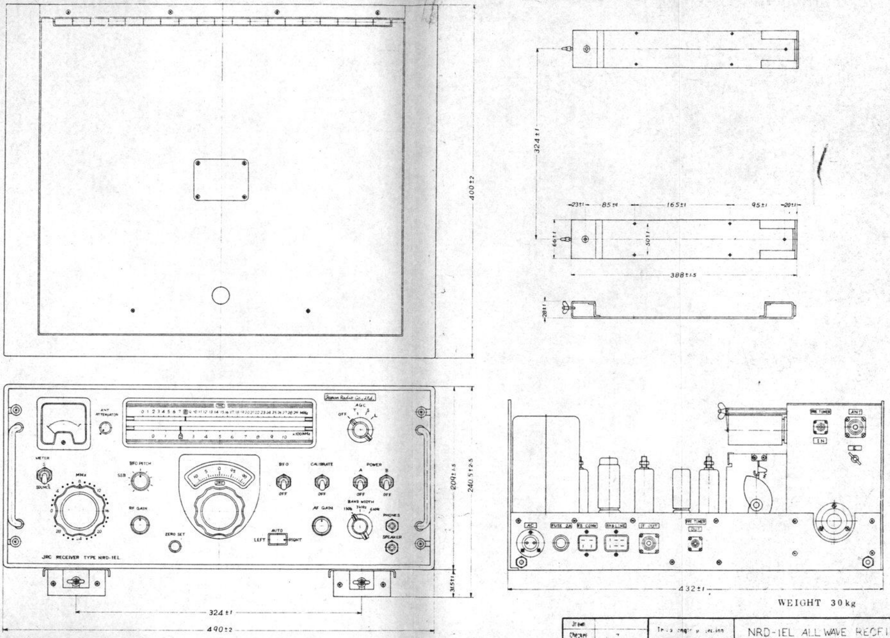
94



Drawn		Third angle projection	Title NRD-1EL ALL WAVE RECEIVER SCHEMATIC DIAGRAM
Checked	S. Mit…		
Approved	S. Funabiki	Scale	
Sec.chief	M. Suzuki	Date	Dwg. No. E6828EL 2/2

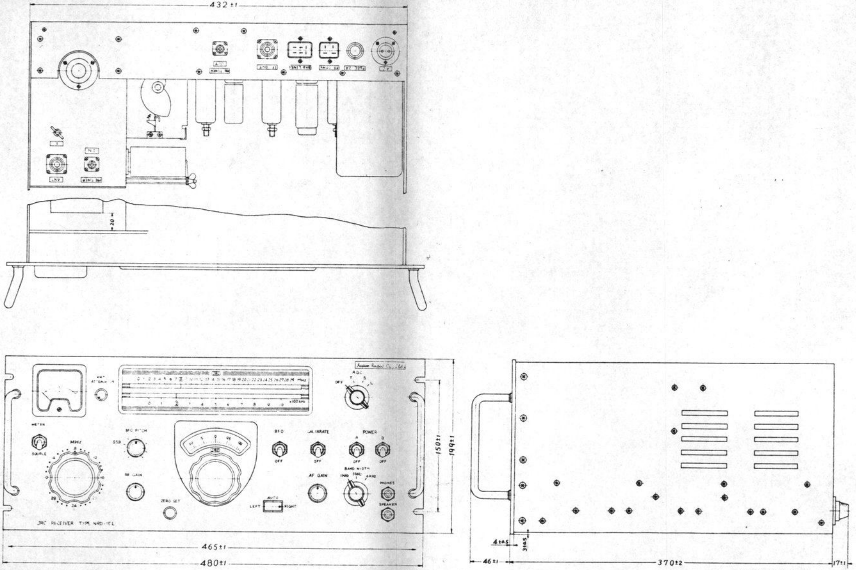
Japan Radio Co., Ltd. JRC

Print OSTRICH



WEIGHT 30kg

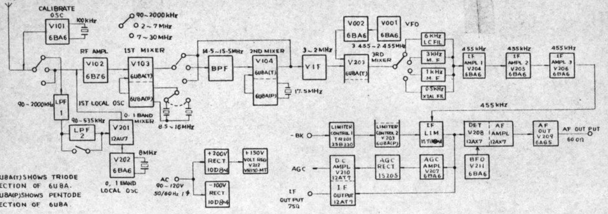
Drawn		Third angle projection	NRD-1EL ALL WAVE RECEIVER OUT SIDE VIEW
Checked			
Approved		Scale ½ : m/m	
			E6828EL
Japan Radio Co., Ltd. JF			



WEIGHT 19kg

Drawn		Third angle projection	Title NRD-1EL ALL WAVE RECEIVER OUT SIDE VIEW
Checked			
Approved		Scale ½ : m/m	
Sec.chief	/ /	Date	Dwg. No. E6828EL
Japan Radio Co., Ltd. JRC			

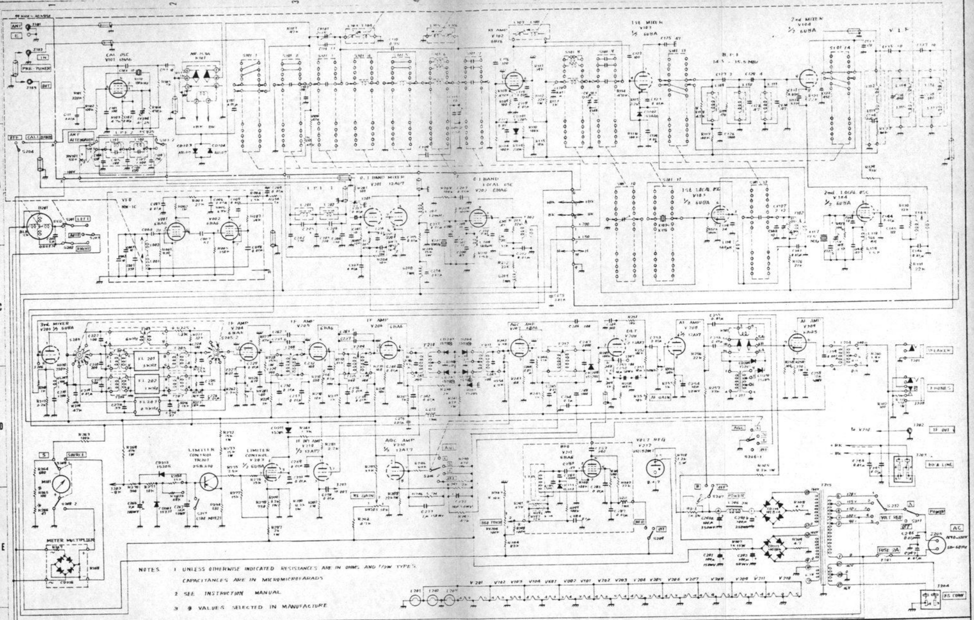
NRD-1EH ALL WAVE RECEIVER BLOCK DIAGRAM



NOTE : 6U8A(T) SHOWS TRIODE SECTION OF 6U8A.
6U8A(P) SHOWS PENTODE SECTION OF 6U8A.

BAND	FREQ. RANGE	0, 1 BAND MIXER		1ST LOCAL		2ND MIXER		VIF	VFO	IF
		XTAL FREQ	OUT PUT FREQ	XTAL FREQ	LOCAL FREQ	IN PUT FREQ	LOCAL FREQ			
0	0.09 ~ 1 MHz	8 MHz	8.09~9MHz	11 MHz	11 MHz			2.91 ~ 2 MHz	3.365-2.455 MHz	455 kHz
1	1 ~ 2	8 MHz	9~10MHz	12	12			3 ~ 2	3.455-2.455	〃
2	2 ~ 3			12.5	12.5	14.5-15.5 MHz	17.5 MHz	〃	〃	〃
3	3 ~ 4			11.5	11.5	〃	〃	〃	〃	〃
4	4 ~ 5			10.5	10.5	〃	〃	〃	〃	〃
5	5 ~ 6			9.5	9.5	〃	〃	〃	〃	〃
6	6 ~ 7			8.5	8.5	〃	〃	〃	〃	〃
7	7 ~ 8			10	10			〃	〃	〃
8	8 ~ 9			11	11			〃	〃	〃
9	9 ~ 10			12	12			〃	〃	〃
10	10 ~ 11			13	13			〃	〃	〃
11	11 ~ 12			14	14			〃	〃	〃
12	12 ~ 13			15	15			〃	〃	〃
13	13 ~ 14			16	16			〃	〃	〃
14	14 ~ 15			8.5	17			〃	〃	〃

BAND	FREQ. RANGE	1ST LOCAL		VIF	VFO	IF
		XTAL FREQ	LOCAL FREQ			
15	15 ~ 16 MHz	9 MHz	18 MHz	3 ~ 2 MHz	3.455-2.455 MHz	455 kHz
16	16 ~ 17	9.5	19	〃	〃	〃
17	17 ~ 18	10	20	〃	〃	〃
18	18 ~ 19	10.5	21	〃	〃	〃
19	19 ~ 20	11	22	〃	〃	〃
20	20 ~ 21	11.5	23	〃	〃	〃
21	21 ~ 22	12	24	〃	〃	〃
22	22 ~ 23	12.5	25	〃	〃	〃
23	23 ~ 24	13	26	〃	〃	〃
24	24 ~ 25	13.5	27	〃	〃	〃
25	25 ~ 26	14	28	〃	〃	〃
26	26 ~ 27	14.5	29	〃	〃	〃
27	27 ~ 28	15	30	〃	〃	〃
28	28 ~ 29	15.5	31	〃	〃	〃
29	29 ~ 30	16	32	〃	〃	〃



NOTES
1 UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS AND 1/2W TYPES
CAPACITANCES ARE IN MICROMICROFARADS
2 SEE INSTRUCTION MANUAL
3 * VALUES SELECTED IN MANUFACTURE

Drawn		Third angle projection	Title NRD-1EH ALL WAVE RECEIVER SCHEMATIC DIAGRAM
Checked			
Approved		Scale	
Sec. chief		Date	Dwg. No. 1/2

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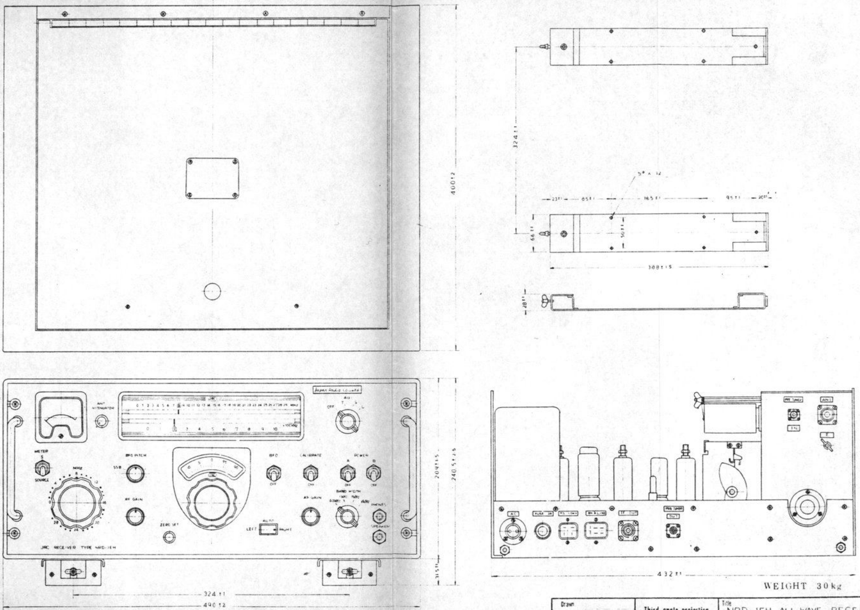
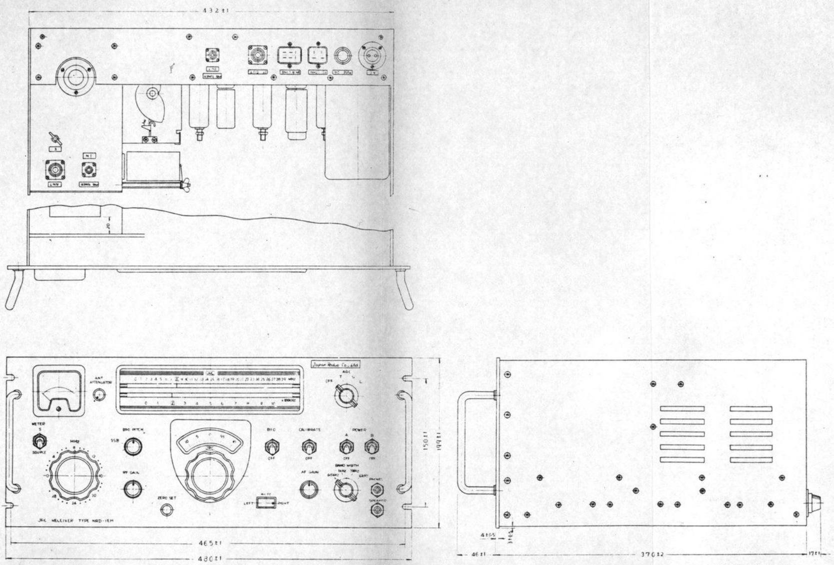


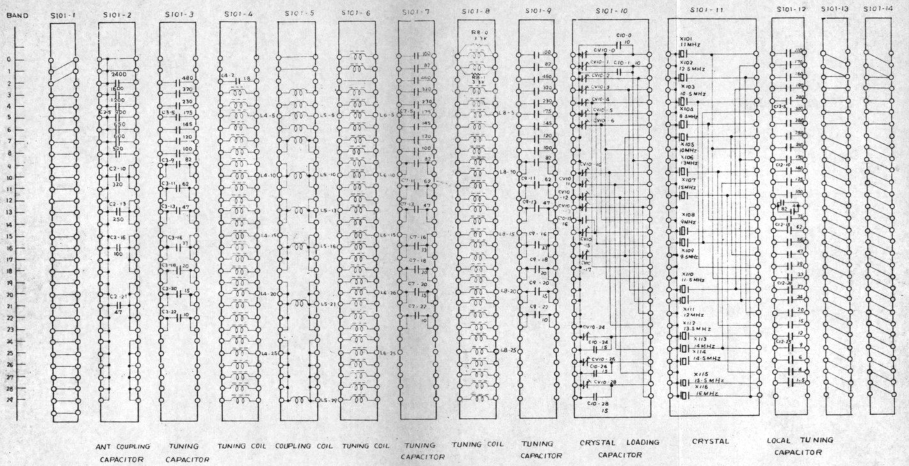
WEIGHT 30kg

Drawn Checked S. Abe, Approved Sec. chief	Third angle projection Scale 1/2 m/m Date	Title NRD-1EH ALL WAVE RECEIVER OUT SIDE VIEW
Japan Radio Co., Ltd. JRC		Dwg. No.



WEIGHT 19kg

Drawn	Third angle projection	Title NRD-1EH ALL WAVE RECEIVER OUT SIDE VIEW
Checked	Scale 1/2 : m/m	
Approved	Date	Dwg. No.
Sec.chief		
Japan Radio Co., Ltd. JRC		



Drawn		Third angle projection	
Checked			
Approved		Scale	
Sec.chief		Date	

Title NRD-1EH ALL WAVE RECEIVER SCHEMATIC DIAGRAM

Dwg. No.

Japan Radio Co., Ltd. JRC

102

For further information contact:

JRC *Japan Radio Co., Ltd.*

Since 1915

HEAD OFFICE & SALES DEPT.
2-17-22, Akasaka, Minato, Tokyo.
Telephone : Tokyo(03)584-8750
Telex : 0242-5420 JRCTOK J
Cable Address : "JAPAN RADIO TOKYO"

SALES OFFICE
1-4-28, Dojima Hama, Kita, Osaka.
Telephone : Osaka(06)344-1631
Telex : 0523-6605 JRCOSA J

MAIN FACTORY
5-1-1, Shimorenjaku, Mitaka, Tokyo.
Telephone : Musashino(0422)45-9111
Telex : 0282-2351 JRCMTK J