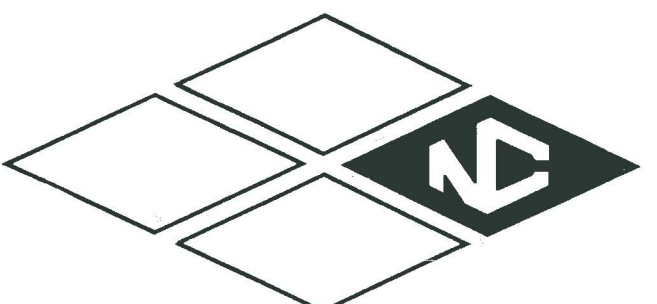
NC-121 RECEIVER

Instruction Manual



NATIONAL RADIO COMPANY

READ CAREFULLY BEFORE TURNING ON YOUR NEW NC-121

The following instructions are designed to allow you to immediately set up your new NC-121 for proper operation using AM, SSB or CW receiving techniques. They are ONLY intended to provide a quick reference for proper set-up procedure, and we strongly recommend that you study the detailed instructions of this manual as soon as possible.

AM OPERATION

1. Set BAND switch to desired band.
2. Set FUNCTION switch to REC
3. Set NOISE LIMITER switch ON or OFF as desired.
4. Set BFO switch to AM.
5. Turn SELECTIVITY control fully counter clockwise until switch snaps into BROAD position.
6. Turn RF GAIN control fully clockwise.
7. Turn AUDIO GAIN control clockwise to apply power to the receiver. Volume may then be adjusted with this control for a comfortable listening level.
8. Rotate BANDSPREAD control to set mark at the high frequency end of the scale.
9. The MAIN TUNING control is now properly calibrated and may be used to tune the receiver.

BROADCAST BAND RECEPTION

For broadcast reception the MAIN TUNING control and the AUDIO GAIN control correspond to the TUNING and VOLUME controls of any broadcast receiver and may be so used providing the rest of the receiver controls are adjusted as indicated below:

1. Set BANDSWITCH to B-CAST.
2. Set FUNCTION switch to REC.
3. Set NOISE LIMITER switch OFF.
4. Set BFO switch to AM.
5. Turn SELECTIVITY control fully counter clockwise until switch snaps into BROAD position.
6. Turn RF GAIN to 3 o'clock.
7. Set BANDSPREAD tuning to set mark at high frequency end of scale.

CW-SSB OPERATION

1. Set BANDSWITCH to desired band.
2. Set FUNCTION switch to REC.
3. The NOISE LIMITER switch is inoperative in this mode of operation and may be left in any setting.
4. Set BFO switch to CW/SSB.
5. Turn SELECTIVITY control to approximately 12 o'clock. After tuning a signal, the SELECTIVITY control may be advanced or retarded to narrow or broaden selectivity.
6. Set BFO control to approximately 10 or 2 o'clock. BFO control may be moved from this setting as desired to obtain a comfortable beat note.
7. Turn RF GAIN control fully clockwise.
8. Turn AUDIO GAIN control clockwise to apply power to the receiver. Volume may then be adjusted with this control for a comfortable listening level.
9. Rotate BANDSPREAD control to set mark at the high frequency end of the scale.
10. The MAIN TUNING control is now properly calibrated and may be used to tune the receiver.

USE OF THE S METER

The S Meter of the NC-121 receiver indicates relative signal strength in all modes of operation. For proper signal strength indication, the RF GAIN control should be adjusted fully clockwise to the maximum sensitivity position.

BANDSPREAD CALIBRATION

The crowded frequency spectrum of the shortwave bands makes tuning individual signals a difficult task unless some means of fine tuning (bandspread tuning) is provided. The bandspread knob and dial of the NC-121 provides this feature. As the BANDSPREAD control is tuned so that the pointer moves down the scale from the SET mark, the frequency to which the receiver is tuned will be reduced, just as though the MAIN TUNING control was tuned to a lower frequency. Rotation of the BANDSPREAD control makes this frequency change at a much slower rate than the MAIN TUNING control, thus making it possible to tune the crowded short wave bands with ease.

Approximate CALIBRATION SCALES ARE INCLUDED ON THE CENTER PAGE OF THIS BOOK. These scales are actual size and include the popular 80-, 40-, 20-, 15- and 10-meter amateur bands, the 49-, 41-, 31-, 25-, 19-, 16- and 13-meter foreign bands, and the citizens band. Proper indication of the Bandspread scale for these calibrations requires that the Main Tuning pointer be set at an exact frequency. Each calibrated scale has a note indicating the proper BAND switch and Main Tuning pointer setting. The Main Tuning pointer should be placed at this setting. All further tuning may then be done with the BANDSPREAD control; the frequency of the receiver will then be indicated on the appropriate bandspread scale. For extreme accuracy it is recommended that the Bandspread pointer be set to a known signal frequency or a calibrating signal frequency. Then adjust the MAIN TUNING to receive this signal. The BANDSPREAD scales are now properly calibrated provided the MAIN TUNING is not moved from this setting.

THE WORLD OF SHORT WAVE LISTENING

A world of adventure lies at your fingertips as you tune the NC-121 Receiver. The chimes of Big Ben, the call of a Bell Bird in New Zealand. The news in English from foreign nations, the cryptic messages of police, aircraft, and ships at sea, the gossip and friendly talk of amateur radio operators around the world can all be heard in the comfort of your armchair. This world of short wave listening is available to you through proper use of the National NC-121

Unlike regular broadcast stations that you hear any time of the day, short wave transmissions are subject to variation from day to day, time of day, season of the year and even such things as sunspot activity. These variations cause changes in the nature of the upper atmosphere of the earth, which acts like a giant mirror reflecting short wave radio signals. When conditions are right the radio signal may travel entirely around the world bouncing back and forth from the upper part of the atmosphere to the ground and back again. If the receiving antenna happens to be at one of the points of reflection then the signal may be heard as though it were located just next door.

Most of these variations follow definite patterns and as a result the short wave broadcasters schedule their times and frequencies of transmissions to take best advantage of transmitting conditions. Likewise the listener can take advantage of this information to achieve greatest satisfaction in pursuit of the hobby of short wave listening. In other words it is important to know where to look and when to listen.

A radio wave (like a wave in the ocean) goes through a repeated up and down motion. If this electrical signal varies up and down 100 times each second we say that its frequency is 100 cycles per sec. In the short wave spectrum tuned by the NC-121 this frequency may actually be measured as many millions of cycles, and it is therefore easier to divide the frequency by one million and call the result "megacycles". The dial of the NC-121 receiver is calibrated in megacycles, an expression of the frequency of the radio signal to which we are tuned. Thus when a station is listed as transmitting on a frequency of 8.61 megacycles (8,610,000 cycles) it may be tuned by setting the NC-121 dials to this same frequency. A chart showing approximate frequency limits for various types of transmission covered by the NC-121 tuning range is given below. Many of these transmissions are in code or teletype, others are in voice, making up the myriad tones and voices of short wave radio.

Many short wave listeners find that their main interest is tuning the many foreign broadcast stations. It is always helpful to keep a log of the station heard and the date and time, as well as the frequency of reception. Most of these foreign broadcast stations welcome reports from listeners and mail out interesting and colorful cards confirming the fact that the station was heard and providing information about the country and the station. The collection of these cards is in itself an interesting hobby. Generally speaking, the foreign shortwave broadcast stations are found in groups or bands of frequency. The shortwave broadcast listener will find the following chart useful as a guide to listening locations and times for best broadcast reception.

Band	*Frequency*	*Morning*	*Afternoon*	*Evening*
49 meters	5.9-6.3 mc.	good	poor	good
31 meters	8.6-10.0 mc.	poor	fair	good
25 meters	11.7-12.0 mc.	poor	fair	good
19 meters	14.6-15.4 mc.	fair	good	poor
16 meters	16.4-18.0 mc.	good	fair	poor
13 meters	21.5-22.0 mc.	good	fair	poor

These few words hardly scratch the surface of the hobby of short wave listening. For best results from the NC 121 Receiver the following pages on operation of the receiver should be carefully studied. In addition the following publications should prove useful in furthering enjoyment of the hobby.

Official Log—National Association of Armchair Adventurers—National Radio Company, Melrose, Mass.

The Radio Amateur's Handbook and other publications American Radio Relay League, West Hartford, Conn.

How To Listen To The World

World Radio TV Handbook
Gilfer Associates, Box 239, New York 17, N. Y.

World Radio Handbook — World Radio Publications, 47 Mounthaven Dr., Livingston, N. J.

In addition many periodicals and the Government printing office publish information on a regular basis.

ALL FREQUENCIES IN MEGACYCLES

Amateur	International Broadcast	Frequency Standard (WWV)	Citizens Band	Marine	Aeronautical	Police	Public Safety (Forestry Conservat'n, State Guard, Special Emergency, Highway Maint.)	Industrial
1.8 - 2.0 3.5 - 4.0 7.0 - 7.3 14 - 14.4 21 - 21.5 28 - 29.7	2.3 - 2.5 3.2 - 3.4 3.9 - 4.0 4.7 - 5.1 5.9 - 6.2 7.1 - 7.3 9.5 - 9.8 11.7 - 12.0 15.1 - 15.5 17.7 - 17.9 21.4 - 21.8 25.6 - 26.1	2.5 MC 5.0 MC 10.0 MC 15.0 MC 20.0 MC 25.0 MC	26.9 - 27.3 MC **Common Carrier (Telephone, Telegraph, Press)** 4.4 - 5.4 6.7 - 8.0 9.0 - 9.5 9.7 - 11.7 13.3 - 21 22.6 - 24.6 29.8 - 30.0	2.0 - 2.8 4.0 - 4.5 6.2 - 6.6 8.2 - 8.9 12.3 - 13.2 16.4 - 17.4 22.0 - 22.8	2.6 - 3.5 4.5 - 6.0 6.5 - 7.0 8.8 - 9.0 10.0 - 11.5 13.2 - 14.0 15.8 - 18.0	1.6 - 1.8 2.3 - 2.5 2.8 - 2.9 5.1 - 5.2 7.4 - 8.0	2.2 - 2.3 2.7 - 2.8 3.2 - 3.3 27.2 - 27.3 **Broadcast Auxiliary (Remote Pick-up)** 1.6 - 1.7 25.8 - 26.5	1.6 - 1.8 2.2 - 2.5 4.6 - 4.7 25.0 - 25.3 27.2 - 27.5 29.7 - 30.0

DESCRIPTION AND OPERATION

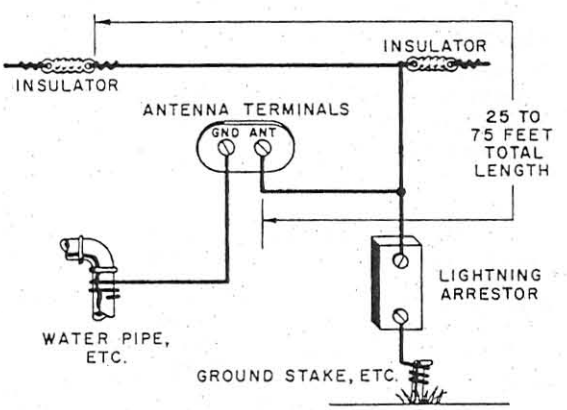
The following paragraphs describe briefly the recommended operating procedure for the National NC-121 Receiver and include a brief circuit description. Paragraphs in standard type concern operating instructions only, those in italics describe the circuits.

The National NC-121 Receiver is designed to match an unbalanced low impedance antenna transmission line. Individual antenna coils are used on each band. Impedance match is obtained by use of small primary coupling windings on the antenna coils.

THE ANTENNA

The NC-121 uses a two-terminal antenna strip suitably marked A (antenna) and G (ground). The simplest antenna is a single long wire antenna illustrated in the figure below. When this type of antenna is used, a suitable ground connection is recommended for best results. Generally speaking, an antenna between 15 feet and 40 feet long should provide ample signal pickup for most of the bands in use. When the receiver is to be used predominantly on any one band, better results can be obtained with one of the many types of tuned antennas. The subject of antennas, and of matching antennas to receivers, is in itself a major study. The owner of the NC-121 should consult many of the excellent references published by the American Radio Relay League and other organizations. In all cases where an external exposed antenna is used, suitable consideration should be given to lightning protection to insure the safety of the operator and the equipment.

The proper antenna coil is selected by means of the BAND switch which switches the primary and secondary windings of the desired coil into the receiver circuit.



Single Wire Antenna

For maximum performance the NC-121 should always be grounded by means of a lead from the *GND* terminal at the rear of the set to a waterpipe or ground rod driven into the earth.

BAND SWITCH

The BAND switch of the NC-121 is labeled in megacycles. The switch is simply placed in the desired band position as indicated by the markings B-CAST, 1.6-4.5, 4.0-12, and 11-30. When the BAND switch has been set for the band desired, the corresponding general coverage dial scale is used to indicate the frequency of receiver tuning.

The secondary of the antenna coil is used as a tuned circuit to achieve selectivity in the antenna stage of the receiver. This coil is tuned by means of the main tuning capacitor, the bandspread capacitor, and internal trimmers. The main tuning and bandspread capacitors determine the frequency to which the antenna, and oscillator coils are tuned.

MAIN TUNING

The MAIN TUNING knob adjusts the setting of the main tuning capacitor. The pointer of the slide-rule main tuning dial is coupled to the tuning capacitor to indicate frequency of operation. Proper frequency calibration of the main tuning dial depends on the setting of the Bandspread dial. The word SET appears at the high frequency end of the Bandspread scale. The Bandspread dial should be set so that this mark appears directly over the Bandspread pointer. When set in this manner, the general coverage dial may be freely used to tune the receiver and the frequency of operation will be that determined by the dial scale corresponding to the setting of the BAND switch.

The Bandspread capacitor is connected in parallel with the main tuning capacitor and acts as a vernier tuning control.

BANDSPREAD TUNING

The crowded frequency spectrum of the shortwave bands makes tuning individual signals a difficult task unless some means of fine tuning (bandspread tuning) is provided. The BANDSPREAD knob of the NC-121 Receiver provides this feature.

As the BANDSPREAD control is tuned from the Set mark, the frequency to which the receiver is tuned will be reduced, just as though the MAIN TUNING control was tuned to a lower frequency. Rotation of the BANDSPREAD control will make this frequency change at a much slower rate than can be accomplished through use of the MAIN TUNING control, thus making it possible to tune the crowded shortwave bands with ease. If it is desired to use the Bandspread dial for fine tuning the main tuning dial should be set just above the region of interest. The Band-

spread dial will now function as a fine tuning control in this frequency region.

Approximate CALIBRATION SCALES ARE INCLUDED ON THE CENTER PAGE OF THIS BOOK. These scales are actual size and include the popular 80-, 40-, 20-, 15- and 10-meter amateur bands, the 49-, 41-, 31-, 25-, 19-, 16- and 13-meter foreign bands, and the citizens band. Proper indication of the Bandspread scale for these calibrations requires that the Main Tuning pointer be set at an exact frequency. Each calibrated scale has a note indicating the proper BAND switch and Main Tuning pointer setting. The Main Tuning pointer should be placed at this setting. All further tuning may then be done with the BANDSPREAD control; the frequency of the receiver will then be indicated on the appropriate bandspread scale. For extreme accuracy it is recommended that the Bandspread pointer be set to a known signal frequency or a calibrating signal frequency. Then adjust the MAIN TUNING to receive this signal. The BANDSPREAD scales are now properly calibrated provided the MAIN TUNING is not moved from this setting.

The high frequency oscillator is a grounded plate Hartley oscillator using the cathode, grid and screen of the high frequency mixer. Sections of the main and Bandspread tuning capacitors tune the oscillator with the BAND switch again selecting the coil for the band in use. The high frequency oscillator operates 455 kilocycles above the signal on the three lowest frequency bands and operates 455 kilocycles below the signal on the highest frequency band.

The signal appearing at the plate of the mixer is coupled through a double tuned 455 Kc IF transformer to the grid of the first IF stage. The amplified signal at the plate of the first IF stage is fed to the primary of the Q multiplier coil. The secondary of this Q multiplier coil is tapped and connected to the second IF stage in a ground-plate Hartley oscillator circuit. The selectivity control is a variable resistance connected in the feed back path from the cathode of the second IF stage to the tap in the Q multiplier coil. As this resistance is lowered in value, the positive feed back is increased, thus reducing losses in the tuned circuit and increasing selectivity (narrowing bandwidth). The coupling in the Q multiplier coil is determined by a choke in the common return path. As the bandwidth is narrowed, the increase in Q results in a large increase of IF gain. A switch is incorporated on the selectivity control to shunt the coupling choke for narrow bandwidth reception so that the gain in the broad and narrow positions of the control is essentially constant.

SELECTIVITY CONTROL

The SELECTIVITY control of the NC-121 Receiver adjusts the bandwidth of the receiver. The bandwidth, or degree of selectivity used depends largely upon the mode of operation desired and signal conditions. The BROAD (fully counterclockwise position) normally is used for highest receiver fidelity. Under conditions of extreme signal interference, it is often desirable to reduce the bandwidth of the receiver and sacrifice fidelity in favor of less interference. In this case the control should be rotated clockwise until more satisfactory reception is obtained. As the control is turned from the BROAD position, the gain equalizing switch will click to the proper connection. When CW reception is desired, the SELECTIVITY control may be advanced to the point where the bandwidth becomes extremely narrow. If the control is advanced too far, it is possible for the IF system to actually begin to oscillate. The control should be adjusted just below this point. Note that for AM reception, the beat frequency oscillator should be turned off. For single sideband or CW operation, the beat frequency oscillator should be turned on. The beat frequency oscillator is discussed in later sections of the book.

The cathode of the first IF stage is returned through the RF gain control to provide a means of adjusting the receiver gain or sensitivity.

RF GAIN

The sensitivity of the receiver is adjusted by means of the RF GAIN control which adjusts the cathode bias on the first IF stage. When the control is rotated fully counterclockwise, the sensitivity of the receiver will be reduced so that no signal can be received. Clockwise rotation increases the sensitivity until maximum is reached at the full clockwise position. The RF GAIN control may be freely used as a means of sensitivity adjustment as the receiver is tuned from signal to signal, or it may be set to a comfortable sensitivity level and allowed to remain in this position. Adjustment of the RF GAIN control will have an effect on the S Meter reading. FOR PROPER INDICATION OF THE S METER the RF GAIN control must be advanced to full sensitivity (fully clockwise).

The S Meter is connected between the plate decoupling networks of the first and second IF stages. AGC voltage on the first IF stage changes the voltage drop in the first IF decoupling network causing the S Meter to read relative signal strength.

S METER

To adjust the S Meter disconnect the antenna, and increase the RF GAIN control for maximum sensitivity (fully clockwise). The receiver should be turned so that only background noise is heard. The S Meter zero adjust control should then be adjusted to obtain a reading of approximately S1 on the incoming noise level. This will assure proper S Meter reading. When properly adjusted, an S Meter reading of S9 will correspond to approximately 50 microvolts of signal at the antenna terminals.

If the RF GAIN control is rotated counterclockwise decreasing receiver gain or sensitivity, the S Meter will move up-scale from the zero setting. FOR PROPER S METER INDICATION THE RF GAIN CONTROL MUST BE IN ITS MAXIMUM SENSITIVITY POSITION (fully clockwise).

The signal at the plate of the second IF amplifier is coupled through a double tuned IF output transformer to the diode AM detector. AGC voltage is obtained from the top of the diode load and applied to the first IF amplifier and, in addition, to the mixer on the broadcast band only.

For single sideband or CW reception, the signal is coupled directly from the plate of the last IF amplifier to the triode product detector. This tube functions simultaneously as the beat frequency oscillator.

BFO SWITCH — PITCH CONTROL

The BFO switch turns the beat frequency oscillator on or off. When the BFO switch is turned off, (AM position) the beat frequency oscillator is disabled and the PITCH control will not function. When the BFO switch is turned on, (CW/SSB position) the PITCH control is used to adjust the frequency of the beat frequency oscillator which varies the pitch of the generated audio tone. When receiving CW signals, a mid-position setting of the PITCH control corresponds to a condition where maximum IF selectivity occurs at zero beat with the incoming signal and no audio tone will be heard at the point of maximum signal reception. It is then necessary to use the PITCH control to detune the beat oscillator in either direction, to provide a suitable audio tone which is comfortable to the operator and to obtain maximum amplitude of the desired beat note. During CW reception, it is often convenient to adjust the beat oscillator to phase an undesired signal to zero beat, thus eliminating it as an audible interfering signal.

Single sideband signals may be received by using the BFO and PITCH control. For this type of reception the PITCH control should be set to approximately 10 o'clock or 2 o'clock depending on the sideband being received. With the BFO switch in CW/SSB position, the sideband signal can be made intelligible when it is tuned to zero beat with the MAIN or BANDSPREAD TUNING controls.

The signal from the AM detector is coupled to a series gate automatic noise limiter which is designed to reject all impulse type signals exceeding the average modulation level.

NOISE LIMITER

The NOISE LIMITER switch turns the automatic noise limiter on or off. The automatic noise limiter will function only when the BFO control is set in AM position. In normal operation the noise limiter may be used at will, depending on incoming noise level and operating convenience.

NOTE

This automatic noise limiter is intended for use with impulse noise such as ignition interference or static. It will not appreciably improve performance on continuous high energy noise such as "hash", thermal or cosmic noise.

The signal from the product detector or the AM detector and noise limiter is coupled to the first audio amplifier through the audio frequency gain control. The setting of the BFO switch automatically connects the desired detector to the later circuits.

AUDIO GAIN

The AUDIO GAIN control is used to adjust the speaker or earphone level to comfortable listening volume. It is important not to confuse the function of the AUDIO GAIN control with the function of the RF GAIN control which controls the over-all receiver sensitivity. Normally, with the RF GAIN control advanced to provide proper S Meter reading, all additional variation of listening level is obtained with the AUDIO GAIN control. The RF GAIN control is sometimes used as the master sensitivity control and the AUDIO GAIN control is left set in a predetermined position. Proper balance between the two controls under this condition is normally a matter of individual operator preference and operating habits.

The amplified audio signal is coupled to the audio output stage and, in turn, through the audio transformer to the speaker terminals. The output signal is also coupled to a shorting type phone jack on the front panel.

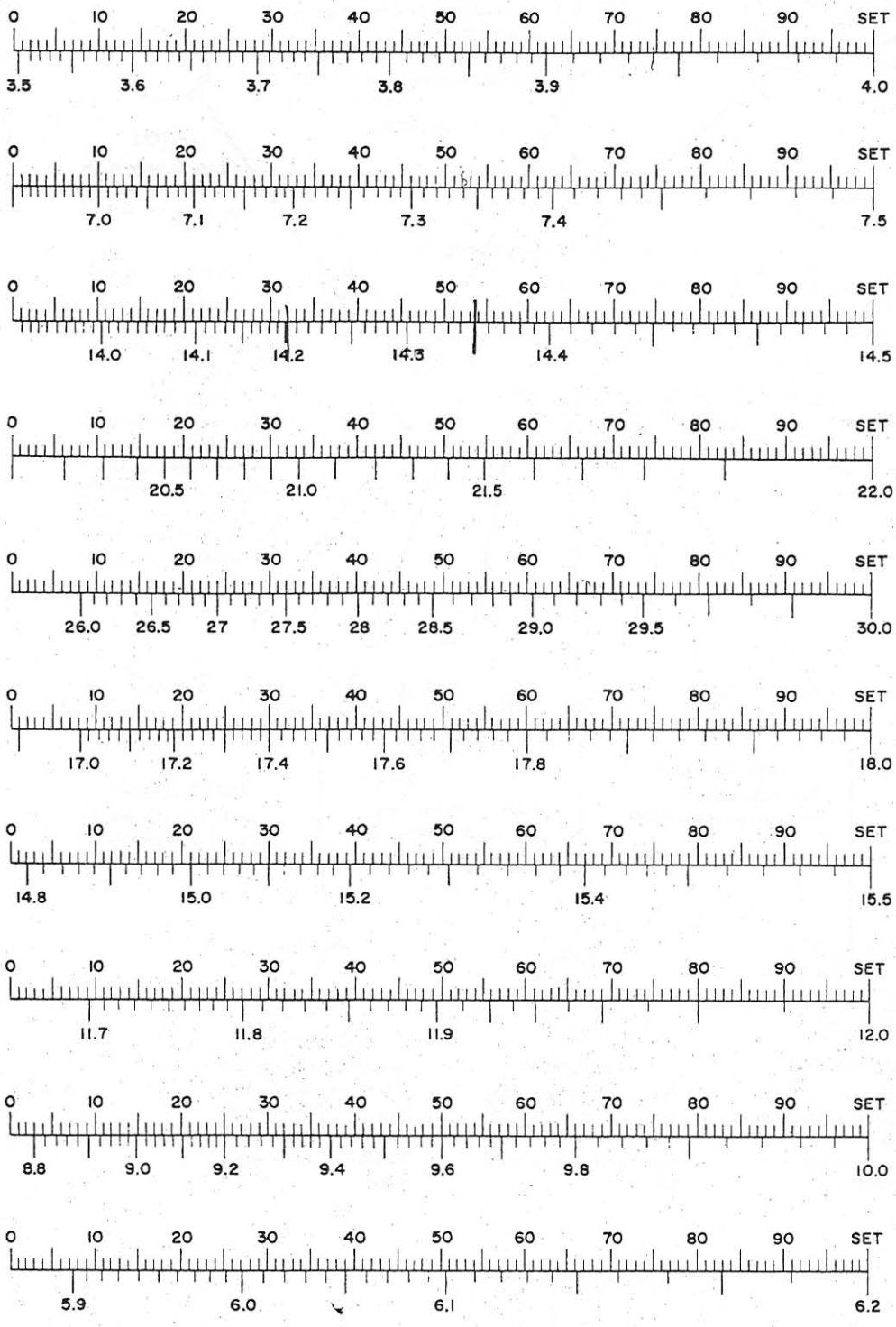
PHONE JACK

The head phone jack is located on the front panel and will accept any normal two-circuit phone plug. There is no DC voltage associated with the head phone circuit. Because of the low impedance of the audio transformer secondary, almost any type of head phone may be used with completely satisfactory results. Insertion of a standard phone plug will break the loudspeaker circuit and silence the speaker.

The audio signal from the AM or product detector is made available on a phone plug located on the rear apron of the NC-121 Receiver. This is a high impedance output circuit designed for connection to one of the tuner or auxiliary inputs of a hi-fi system. This output signal is controlled by the FUNCTION switch.

FUNCTION SWITCH

The FUNCTION switch provides for standby, receiver, or tuner operation. When this switch is set to STBY position the receiver is muted; when the switch is turned to REC or TUNER position the receiver instantly returns to normal operation. In the REC position, the receiver audio circuits are connected and output is through the internal speaker or phone jack of the receiver. In the TUNER position, the audio circuits are disconnected, silencing the internal speaker, and the detected audio signal is fed to the tuner output plug. All of the controls of the NC-121 Receiver will function normally when the tuner output is being used. The Hi-Fi Amplifier Loudness control should be set to a normal level. The AF GAIN control of the NC-121 can then be adjusted to a comfortable listening level. Additional level adjustments may be made with the NC-121 AF GAIN control while the receiver is being tuned.



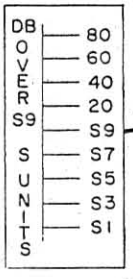
Dial Scale Calibration Chart

RF GAIN

Controls receiver signal sensitivity by adjusting the IF amplifier gain. Receiver automatically changes from automatic to manual RF GAIN control when RF GAIN is reduced from maximum. RF GAIN must be at maximum clockwise rotation for proper S Meter readings.

S METER

Signal strength meter and tuning indicator. When RF GAIN control is fully clockwise an "S-9" reading is approximately equivalent to a 50μV input at the antenna terminals. The S Meter will read correctly only when the RF GAIN is full on (extreme clockwise).

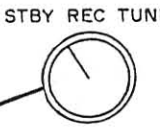


SELECTIVITY

Controls the receiver bandwidth to obtain the best selectivity for existing signal conditions. The BROAD position is recommended for Broadcast and other clear channel reception. To minimize adjacent channel interference a 1 o'clock to 3 o'clock position of the control is recommended.

PITCH

Adjusts the tuning of the beat frequency oscillator to control the pitch of CW signals.



FUNCTION

Silences receiver during standby periods. Instantly returns receiver to full operation with no warm-up time required. In tuner position, audio is available from rear-of-chassis jack for connection to external amplifier.

BANDSPREAD

Provides a fine tuning device. As the BANDSPREAD control is tuned from the Set Mark, the frequency to which the receiver is tuned will be reduced as if the main tuning control were tuned lower in frequency. The BANDSPREAD control will accomplish this frequency change at a much slower rate than the MAIN TUNING control making it possible to tune the crowded short wave bands with ease.

PHONE JACK

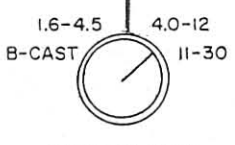
Earphone jack silences speaker when earphone plug is inserted.

MAIN TUNING

Selects the desired reception frequency as indicated on the Slide Rule Dial.

NOISE LIMITER

Turns the automatic noise limiter on or off to minimize impulse type noise.



BANDSWITCH

Selects the desired tuning range. The dial scale which corresponds to the selected range is used to indicate the receiver tuning range.

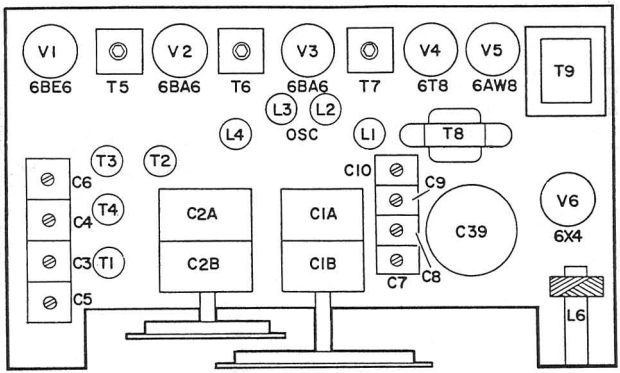
AUDIO GAIN

Controls the receiver output level by setting the gain of the audio amplifier. The switch turns the entire receiver on and off.

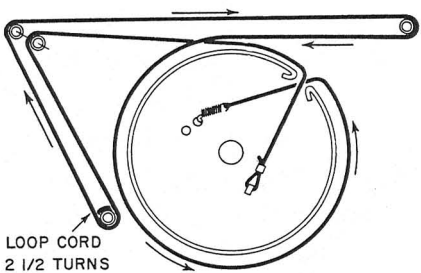
BFO SWITCH

Turns the beat frequency oscillator on and selects the triode product detector for single sideband and CW operation. In the AM position, the diode detector is used.

NC-121 Control Descriptions

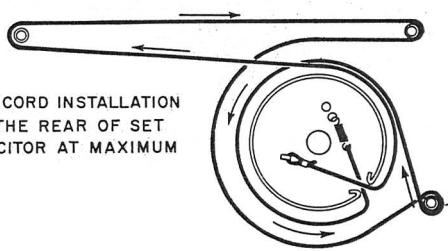


Alignment Locations



GENERAL COVERAGE DIAL CORD INSTALLATION AS VIEWED FROM THE REAR OF SET WITH TUNING CAPACITOR AT MAXIMUM MESH

LOOP CORD
2 1/2 TURNS
AROUND SHAFT



BAND SPREAD DIAL CORD INSTALLATION AS VIEWED FROM THE REAR OF SET WITH TUNING CAPACITOR AT MAXIMUM MESH

LOOP CORD
2 1/2 TURNS
AROUND SHAFT

Dial Cord Assembly

PARTS LIST

ALL READILY AVAILABLE RESISTORS AND CAPACITORS ARE OMITTED FROM THE FOLLOWING PARTS LIST, BUT ARE COMPLETELY IDENTIFIED ON THE SCHEMATIC.

T8	Output Transformer	B19435
T9	Power Transformer	C50561
C39	Electrolytic Capacitor	C19458-3
S6	BFO Switch	B50583-2
S5	Noise Limiter Switch	B50582-2
S4	STBY-REC-TUNER Switch	B50588-2
T6	Q Mult. Transformer	B50580
T5	IF Transformer	C17568-4
T7	IF Transformer	C17568-4
S1	Band Switch	B50563-2
	RF Gain Potentiometer	B50573-2
	Selectivity Potentiometer	B50574-2
	S-Meter Potentiometer	B50466
	Audio Gain Potentiometer	B20174-4
T1	B-Cast Ant. Coil	B50538
T2	1.6-4 Mc. Ant. Coil	B22051
T3	4-12 Mc. Ant. Coil	B22052
T4	10-30 Mc. Ant. Coil	B50584
L6	BFO Coil	B50560
	BFO Tuning Core	B50188-4
L1	B-Cast Osc. Coil	B22053
L2	1.6-4 Mc. Osc. Coil	B22054
L3	4-12 Mc. Osc. Coil	B22055
L4	10-30 Mc. Osc. Coil	B24083
R26	Resistor 2.2 Ω 1W	K-098-24
L5	Choke	A50603
C11	Capacitor MICA 620$\mu\mu$fd	NCS-20-621-J-5
C12	Capacitor MICA 1800$\mu\mu$fd	NCS-20-182-J-5
C13	Capacitor MICA 3900$\mu\mu$fd	NCS-30-392-J-5
	Main Tuning Pointer	B50576-2
	Bandspread Pointer	B50577-2
	Knob (Large)	A51002
	Knob (Small)	A51003
	Front Panel	D50987-3
	S-Meter	C50441-3
	Cabinet	D50979-5
	Speaker	C19610-3
	Large Mounting Feet	A50589
	Small Mounting Feet	A50281-2
	Adaptor — PITCH shaft	B50985
	Speaker Grille	C50984-2

ALIGNMENT INSTRUCTIONS

The NC-121 Receiver has been carefully aligned at the factory by specially trained and experienced personnel using precision equipment. Alignment of the receiver should not be attempted until all other possible causes of faulty operation have been investigated. Alignment should be made only by persons familiar with communications receivers and experienced in their alignment.

EQUIPMENT REQUIRED

1. Signal generator covering 455 Kc to 35 Mc.
2. Vacuum tube voltmeter (VTVM).
3. Output meter. The AC scale of the VTVM can be used.
4. Tuning Wand — General Cement No. 8278 or equivalent.
5. Hex alignment — General Cement No. 5097 or equivalent.

INITIAL CONTROL SETTINGS

FUNCTION	— REC	BANDSPREAD	Set
BFO	— AM	SELECTIVITY	BROAD
MAIN TUNING	1000KC	RF GAIN	max
AUDIO GAIN	max	PITCH	center
		NOISE LIMITER	OFF

455 KC IF ALIGNMENT

Signal Generator Connections	Signal Generator Frequency	BAND switch Setting	Output Connections	Remarks
High side directly to mixer section of tuning gang. Low side to chassis.	455 Kc (unmod.)	B-CAST	VTVM DC probe to junction of R8 and C24 Low side to chassis.	Adjust top and bottom of T5, T6 and T7 for maximum indication. Rotate selectivity control to just below point of oscillation. Retune top of T6 for maximum indication. Maintain approximately 2 V. reading on VTVM.

BFO ALIGNMENT

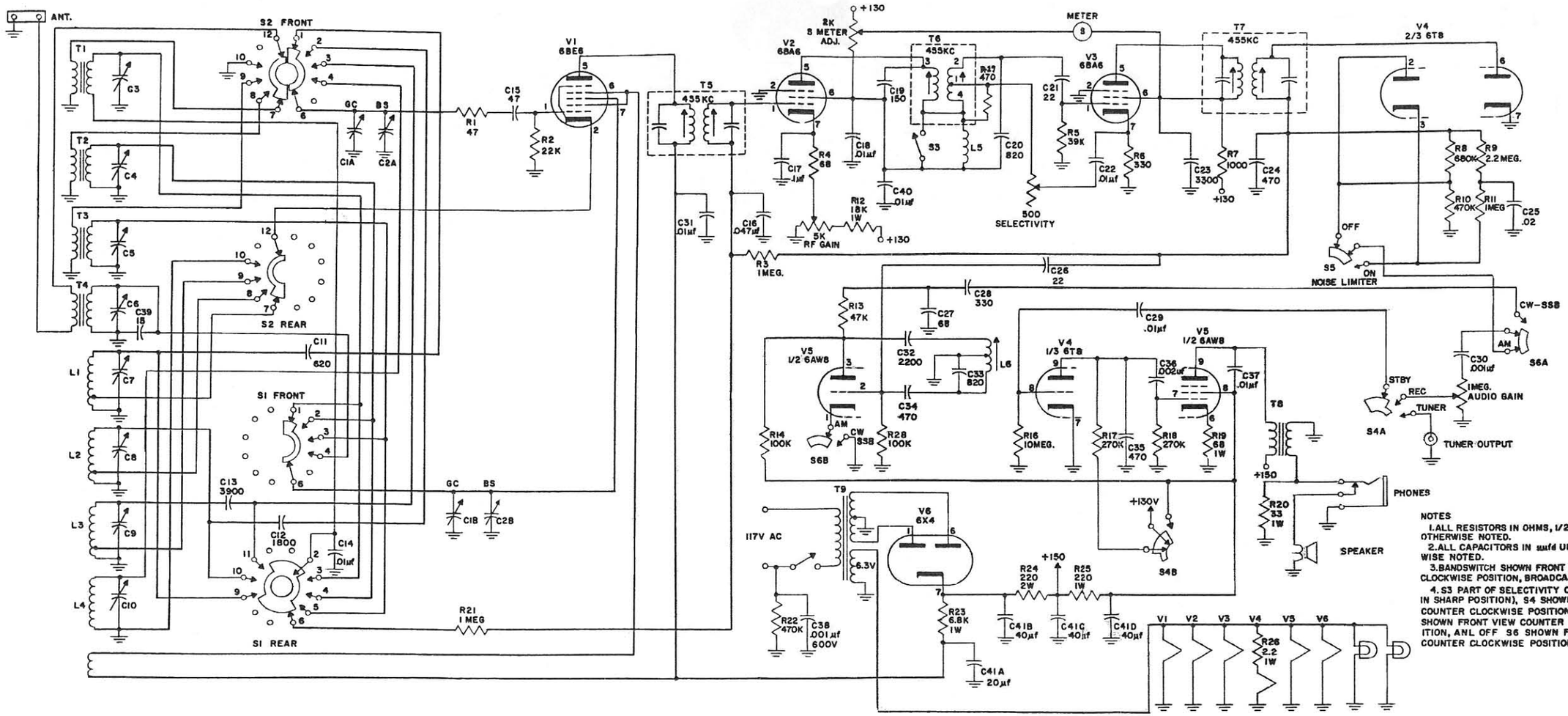
Signal Generator Connections	Signal Generator Frequency	BAND switch Setting	Output Connections	Remarks
High side directly to mixer section of tuning gang. Low side to chassis.	455 Kc (unmod.)	B-CAST	VTVM DC probe to junction of R8 and C29. Low side to chassis.	Set selectivity control just below point of oscillation. Maintain approximately 2V reading on VTVM. Set BFO switch on. Set BFO knob to center mark on panel. Loosen BFO knob set screw and adjust L6 to zero beat with screwdriver through hole in shield. Then tighten set screw and return BFO switch to Off position. Also return selectivity switch to Broad position.

RF ALIGNMENT

GENERAL INSTRUCTIONS. Before proceeding with RF alignment, check dial pointer for proper indexing. With tuning gang fully closed, set the pointer so that it reads exactly 10.5 on 11-30 MC Band. With bandspread capacitor fully closed, adjust pointer to 0 at the left end of the calibrated scale. Then open bandspread capacitor to "Set" mark.

Connect high side of generator to antenna (A) terminal through a 68Ω, ½W resistor. Connect low side to ground (G) terminal. The oscillator circuits should always be adjusted first for proper dial calibration at the specified frequencies on each band. Then the mixer circuits should be set for maximum output. A certain amount of interaction may occur between oscillator and RF adjustments. Final adjustment should be made for correct calibration. The trimmer adjustments should always be the final adjustment for each band. The oscillator frequency is on the high side of the signal frequency on the lowest three bands and above signal frequency on the 11-30 Mc band. Suitable precautions or checks should be used to insure these conditions except on the 11-30 Mc band.

Bandswitch Setting	Generator and Receiver Frequency	Adjustments
B-CAST	1.5 MC	C_7 for correct calibration C_3 for maximum output
1.6 - 4.5 MC	4.0 MC	C_8 for correct calibration C_4 for maximum output
4.0 - 12.0 MC	11.0 MC	C_9 for correct calibration C_5 for maximum output
4.0 - 12.0 MC	4.5 MC	L_5 for correct calibration
11 - 30 MC	28.0 MC	C_{10} for correct calibration C_6 for maximum output
11 - 30 MC	11.0 MC	L_4 for correct calibration T_4 for maximum output



NOTES

1. ALL RESISTORS IN OHMS, 1/2W UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN μμfd UNLESS OTHERWISE NOTED.
3. BANDSWITCH SHOWN FRONT VIEW IN COUNTER-CLOCKWISE POSITION, BROADCAST BAND.
4. S3 PART OF SELECTIVITY CONTROL (CLOSED IN SHARP POSITION), S4 SHOWN FRONT VIEW IN COUNTER CLOCKWISE POSITION, STANDBY. S5 SHOWN FRONT VIEW COUNTER CLOCKWISE POSITION, ANL OFF S6 SHOWN FRONT VIEW IN COUNTER CLOCKWISE POSITION AM.

NC-121 Receiver Schematic Diagram

NC-121 SPECIFICATIONS

The NC-121 Broadcast and Short Wave Receiver is a general coverage communications receiver featuring variable selectivity, bandspread tuning (with foreign broadcast and amateur band calibration charts), an edge reading illuminated S Meter, separate RF and Audio Gain controls, and Automatic Gain Control for all modes of broadcast and short wave reception.

Main Tuning Ranges	Special Calibration charts are provided for the following short wave bands: Foreign Broadcast	Amateur and Citizens Band
550 - 1600 KC	13 Meter Band	10 Meters
1.6 - 4.5 MC	16 Meter Band	15 Meters
4.0 - 12.0 MC	19 Meter Band	20 Meters
11.0 - 30.0 MC	25 Meter Band	40 Meters
	31 Meter Band	80 Meters
	41 Meter Band	
	49 Meter Band	Citizens Band

ANTENNA INPUT — 50-300 ohms.

I.F. SELECTIVITY (Q MULTIPLIER) — Adjustable from 5 KC to approximately 500 cycles by front panel control. 7 KC bandwidth for full fidelity broadcast reception in broad position.

AUTOMATIC GAIN CONTROL — Operates on all bands including Single Sideband (SSB), Code (CW), and AM reception.

S METER — Operates on AM, Single Sideband and Code reception. Calibrated in S units and in decibels above S-9.

NOISE LIMITER — High performance automatic series gate noise limiter for maximum impulse noise rejection without signal distortion.

Q MULTIPLIER — Highly efficient fixed-tuned peaking type to obtain maximum selectivity for any listening requirement. Continuously variable from 7 Kc to 500 cycles.

SEPARATE PRODUCT DETECTOR — Combination triode product detector-BFO circuit to assure optimum performance and minimum distortion during code and single sideband reception.

AM DETECTOR — A separate vacuum tube diode detector is used for AM reception.

TUNER OUTPUT — Audio output from either diode or product detector is available for use with an external Hi-Fi amplifier when the FUNCTION switch is placed in the TUNER position. Output level is set by the AUDIO GAIN control.

AUDIO SYSTEM — Built-in 5" speaker. 3.2 ohm output circuit for phones or external speaker available at front panel phone jack.

POWER SUPPLY — Full wave, transformer operated.

POWER REQUIREMENTS — 105-125 volts AC, 50-60 cycles.

POWER CONSUMPTION — 49 watts.

DIMENSIONS — 7⅞ high — 13½ wide — 8⅝ deep.

SHIPPING WEIGHT — 32 lbs.

Tuned to Tomorrow

NATIONAL RADIO CO.
37 WASHINGTON STREET, MELROSE, MASSACHUSETTS