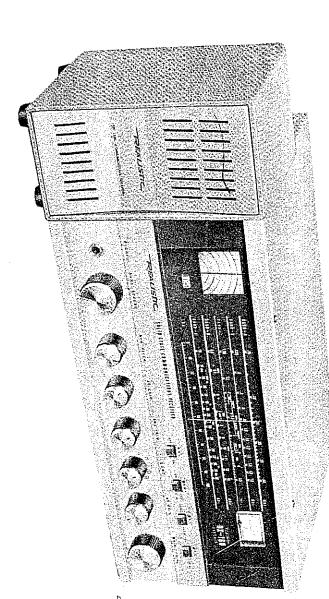
# 5–Band Solid State Gor lications Receiver

2/7/76



PLEASE READ BEFORE USING THIS EQUIPMENT

ALISTIC.

CAT.NO. 20-152

CUSTOM MANUFACTURED FOR RADIO SHACK 🧧 A TANDY CORPORATION COMPANY

### SPECIFICATIONS

<ul> <li>Tune in On Broadcasts From Far Off Places!</li> </ul>		<ul> <li>Long Wave to Short Wave Puts the World at Your Fingertips!</li> </ul>
	COVE 1505.	REQUEN
Band B = $535 \text{ to } 1600 \text{ kHz}$	19-4 MITZ)	Band A = 150 to 400 kHz

Hear Live-Action Drama as It Actually Happens Be Able to Tune in all Types of Communications—SSB/AM/

CW-Amateur, CB, International, Government......

#### Realistic DX-160 Communications Receiver ...It All Comes to Life on Your

ment and educational value. A good portion of international programming is transmitted in English from such distant cities as London, Tokyo, Paris, Rome, Berlin and Moscow. Today's busy airwaves are literally full of programs of entertain-

services contantly use short wave frequencies to communicate Many fascinating and important events occur every day on the long wave and short wave radio bands. You may hear the captain of a with one another throughout the world. provide a wealth of technical information during their contacts between aircraft, land bases and ships at sea. Radio Amateurs instituting rescue operations to aid a ship in distress. The armed fishing vessel radioing news of his catch... or the Coast Guard

week of the year. There is activity on these bands, day and night, every day, every providing thousands of listeners with an absorbing new hobby. The short wave bands encompass many, many interesting services,

Hunting on the airwaves! what a fascinating and wonderful world short wave really is. Happy This booklet has been prepared to help you discover for yourself

SENSITIVITY (10 dB S+N/N at approx. center of band):	
Band A = $50 \mu v$	Band B = 535 to 1600 kHz
Band B = $100 \mu v$	(.535—1.6 MHz)
Band C = $3 \mu v$	Band C = 1.55 to 4.5 MHz
Band D = $4 \mu v$	Band D = 4.5 to 13 MHz
Band E = $4 \mu v$	Band E = 13 to 30 MHz

LECTIVITY:	4 kHz at -6 dB 18 kHz at -40 dB
AGE RESPONSE	
at approx. center	Band B = $-65 dB$
of band):	

⋈

SELECTIVITY:

FREQUENCY RESPONSE: 300 to 3000 Hz, -6 dB

AUDIO OUTPUT: distortion 700 milliwatts at less than 10%

SEMICONDUCTOR COMPLEMENT: IMPEDANCE:

SPEAKER/HEADPHONE

8 ohms

6 Transistors 1 Integrated Circuit
5 Field Effect Transistors (FET's) 15 Diodes

POWER REQUIREMENTS: AC: 115/220-240V.50Hz 3-6 watts DC: 12 volts, negative ground, 30-180 ma

## HISTORY OF SHORT WAVE RADIO

The development of short wave radio involved such famous personalities as Hertz, Maxwell, Marconi, DeForest, Armstrong and many others. Each made significant contributions to the growth of radio and short wave... Maxwell developed new mathematical formulae; Hertz transmitted the first radio signals; DeForest invented the vacuum tube; Armstrong conceived and developed such radio circuitry as the superheterodyne and the FM receivers. Marconi, of course, transmitted the first transatlantic radio signal from England to Canada.

Marconi's feat was the more amazing because it was generally assumed the radio signals, like light rays, travelled in straight lines. It was thought that radio waves would shoot off into space—that they were incapable of curving around the earth.

Further transatlantic tests indicated an increase in distance from day to night operation. Two theorists—Kennely and Heaviside—working independently of one another, conceived the idea of an electrical region high in the earth's atmosphere that acted like a mirror on radio waves. Instead of heading into space, radio-wave energy was reflected back to earth where it could be received by a distant station. In tribute to the accuracy of the concept, the region was designated the Kennely-Heaviside Layer. Today it is more commonly called the ionosphere. The special behavior of this electrified region is largely responsible for international reception activity in the short wave radio bands.

"Ham" Operators also have contributed greatly to the development of short wave listening. Radio amateurs have been communicating across the "Pond" (the ocean) since the early 1920's on all the short wave bands available to them.

## HOW SHORT WAVE WORKS

A short wave radio signal is an invisible field of energy which travels at the speed of light (186,000 miles per second) as it carries a signal from the antenna of a station to the short wave set.

The electrical forces which produce a radio wave originate in the transmitter portion of the sending station. Electrical currents are made to surge back and forth at extremely high speeds. As these

currents progress through the various stages in the transmitter, they are amplified and boosted in power. This radio frequency power is then applied to the transmitting antenna thus generating the actual radio wave... the field of electrical energy which travels outward from the antenna. As described earlier, this wave travels upward toward outer space with some of the wave's energy reflected off the ionosphere and back to earth to a distant receiving station. See Figure 1.



Figure 1

At different periods of the year, short-wave reception improves above the usual value between the receiving site and various areas in the world. As an example—the spring months bring the strongest signals from Australia and the South Pacific. In the fall months, signals from Europe and the Far East dominate the bands. Also, as daylight changes into darkness each day between your receiving location and the transmitting station, so does the nature of the reception. Day-to-day variations are also present. Further, the sunspot cycle greatly affects the overall reception quality. Sunspot activity varies in an 11-year cycle. The last peak activity was about 1968; minimum activity will be about 1976. Maximum activity = best DX reception. Thus, reception will vary from year to year.

## WHAT TO LISTEN FOR

The Short Wave frequencies are your passport to a world of exciting adventure— $C_{\ell}$ 

AMATEUR RADIO Amateur (Ham) radio stations are operated by private citizens in more than 250 countries around the world. See Band Spread and Dial Calibration, also Notes on Operating on Each Band.

Hams talk to other amateur operators for personal pleasure or experimentation. No business or commercial transactions are permitted over stations operating in this service. Hams are allowed to operate on any frequency within assigned bands. The amateur bands are the 160-80-40-20-15 and 10 meter bands. The section on **Frequency Conversion** will give an explanation of the relationship between megahertz and meters.

SINGLE SIDE BAND When tuning your Receiver across the amateur bands, you will hear many single side band signals. This type of signal will sound distorted and unintelligible in an ordinary AM (Amplitude Modulated) receiver. The reason for this is the absence of a carrier in the transmission of a single side band signal. Your DX-160 receiver allows you to clarify a single side band signal through the use of a "product detector." The SSB-CW position on the MODE switch enables you to "re-insert" a carrier to a received SSB signal. The adjustment of the BFO PITCH and BAND SPREAD tuning will further clarify the received signal.

SHIP-TO-SHORE MOBILE RADIO TELEPHONE Essentially a telephone without wires. Operated by telephone companies and businesses who lease transmitters and receivers to individuals. Listen between 2 and 3 Megahertz.

AIRCRAFT Weather information, flight conditions, rerouting of planes in time of bad weather. Federal Aviation Administration communications between planes and stations on the ground. Signals in this service are found at approximately 2.6, 2.9 to 3.0, at 4.1 and at approximately 7.6 MHz.

**MILITARY** Air Force, Army, Navy, Marine and Coast Guard communications may be heard between ground stations and planes or vehicles 24 hours a day. These signals may be heard throughout the short wave frequency range.

MARITIME MOBILE Commercial vessels, fishing fleets, and pleasure craft regularly communicate routine and emergency messages on short wave. These may be heard in the ranges from 2 to 3 MHz, 4 to 4.4 MHz, 6.2 to 6.5 MHz and 7.9 to 8.8 MHz.

# INTERNATIONAL SHORT WAVE BROADCASTING

International broadcasting offers the most varied entertainment of all the services you will listen to on short wave. Many governments

operate powerful short wave transmitters (e.g. the U.S. Government's Voice of America) to keep the world informed of activities within their countries. Many countries also license commercial short wave stations and, in fact, many regions of the world conduct most of their daily brodcasting on short wave instead of on the standard broadcast band. For specific stations and frequencies consult your Country Log. Also, see Band Spread and Dial Calibration and Notes on Operating on Each Band.

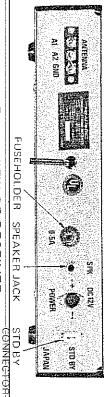
STANDARD TIME SIGNALS—WWV/H and CHU The United States Bureau of Standards broadcasts the correct time with voice as well as code identification. Other checks such as radio frequency, audio frequency and forecast of conditions which will affect radio reception are broadcast. WWV will be found at 2.5, 5.0, 10.0, 15.0, 20.0 and 25 MHz. The Canadian Government provides a similar service at 3.3, 7.33 and 14.67 MHz. Voice announcements are made every minute in both English and French over station "CHU".

## INSTALLING YOUR RECEIVER

Your Realistic DX-160 is a communications Receiver designed and manufactured to the most rigid quality standards. It has been packed to ensure safe arrival. Carefully lift the unit out of the shipping carton and inspect for any visible damage.

Decide where you want to set up the receiver. In making your decision you should consider:

- YOUR COMFORT. You will spend many hours with your receiver; be sure it is placed where you can enjoy it at any time.
- B. YOUR ANTENNA. In the beginning, you will doubtless use a long wire antenna. As you gain more experience and begin reaching out for more distant stations, you may want to set up an outside antenna. With this in mind, choose a location near a window or outside wall. A short wave antenna kit is available at your nearest Radio Shack store (Catalog Number 278-758).
- C. YOUR GROUND. If you set up on outside antenna, it is good practice to ground your set for safety. This will require running a ground wire from the ground connection on the back of the receiver to a cold water pipe or metal pipe driven into the earth.



BACK VIEW OF RECEIVER
Figure 2

Connect a lead-in wire to the antenna terminal marked A1 and the ground lead to terminal marked GND. Route the lead-in wire out through the window and up to your antenna.

For more information, see the ANTENNAS section

Plug the Speaker into rear panel jack marked SPK.

#### AC OPERATION

To complete the initial AC installation, plug the line cord into a source of 115/220-240v.50Hz AC power. Power consumption is about 10 watts.

### 12 VOLT DC OPERATION

You can also operate your DX-160 from a 12 volt DC supply. It must be a negative ground electrical system. 12 volts negative ground is standard for most U.S. cars. Or, you can use any other 12 volt DC source, such as eight 1-1/2-volt type D batteries (Catalog Numbers: 23-466, 23-451, 23-550 from your Radio Shack store).

A useful accessory is Radio Shack's Catalog Number 20-1501, which includes a cigarette lighter socket adapter, plus an 8-cell Battery pack (with 8 D cells).

NOTE: The dial lights do not function with 12 volt power. This conserves battery power when operating from 12 volt battery sources.

### WIRING THE DC PLUG

Unscrew the back of the plug provided (comes plugged into the

rear socket). Insert wires through the back of the plug, remove insulation from the ends of the wires and insert and solder into the pins as shown in Detail A. Replace the back and then plug into the socket.

NOTE: Be sure you connect wires with the correct polarity.



#### OPERATION

Before you start to use your Receiver, turn to pages 10 and 11 for a brief description of each control and its basic function.

Then, you might find it helpful to operate the Receiver for a while on Band B—the standard AM Broadcast band. You are most familiar with this band and will soon become confident to use the other bands too. You'll notice all the standard stations on the AM band—but you'll also discover other stations you have never heard before.

### **Preparing for Operation**

Be sure you have the Speaker plugged in, the Antenna and Ground connected and the line cord plugged into a source of 115/220-240v.50Hz Hz AC power. Or, if you are using 12 volt DC power, be sure you have made the proper connections as indicated above. For all tuning procedures, start with the following control settings.

- Turn "on" by rotating AF GAIN clockwise
- 2. Set MODE to AM.
- 3. Set OPR (operate) to REC (receive).
- Set BAND SPREAD maximum clockwise—the high end of the Band Spread Dial.
- 5. Set BAND to the desired band of operation.

- 6. Set RF GAIN maximum clockwise. For normal operation, leave RF GAIN set to maximum and adjust volume with AF GAIN. If you are near a very strong signal, you can use RF GAIN to reduce the volume; if you don't, the strong incoming signal can "swamp" the first stages in the Receiver and cause various types of distortion. Also, you should realize that the S-Meter is accurate only when RF GAIN is set to maximum.
- Set ANL to OFF and AVC to SLOW.

#### Tuning Band A

- Set BAND to A.
- Adjust MAIN TUNING for the desired frequency as shown on the Main Tuning Dial.
- 3. Adjust AF GAIN for the desired sound level.
- If signals are code, set MODE to SSB/CW, and AVC to FAST.
   Then adjust BFO PITCH for the best code tone or pitch.
- 5. Adjust ANT TRIM for maximum reading on the Meter.
- 6. If noise is excessive, you may want to set ANL ON.

In most cases you will not need to fine-tune with BAND SPREAD, although it does function on all bands. Use it if you desire. However, remember that the frequency indicated on the Main Tuning Dial will not be accurate if the BAND SPREAD is not set to the high end of the range (see Band Spread and Dial Calibration later on).

#### Tuning Band B

- Set BAND to B
- Adjust MAIN TUNING for the desired frequency as shown on the Main Tuning Dial. Adjust for maximum Meter reading.
- 3. Adjust AF GAIN for the desired level of sound. If signals are very strong, you may want to adjust RF GAIN also. On Band

- B, you may prefer to set RF GAIN to about midpoint, leave it there and then use AF GAIN for control of volume.
- Adjust ANT TRIM for maximum reading on the Meter.

Once again, if you want, you can use BAND SPREAD for fine-tuning, but remember the accuracy of the Main Tuning Dial will not be precise if BAND SPREAD is not set maximum clockwise.

### Tuning Bands C, D and E

These are the Short Wave Bands. Tuning these bands requires greater skill and precision. Here is where you'll have an opportunity to use each of the controls to the greatest advantage. We should caution you that it may take a few hours of tuning and even weeks or months of 'short wave listening' before you gain sufficient experience to fully utilize all the features and functions of your Receiver. Short wave listening is a lot of fun, but you will find it even more fascinating and fun after you have gained more experience. Get used to your Receiver. Use it at different hours of the day. Read magazines and books on the subject; your Radio Shack store has some helpful books and literature.

- Set BAND to the desired position.
- Adjust MAIN TUNING for the desired frequency on the Main Tuning Dial. You probably will need to use BAND SPREAD to fine-tune the signals—see Band Spread and Dial Calibration later on for additional pointers.
- Adjust AF GAIN for the desired sound level.
- Adjust ANT TRIM for maximum reading on the Meter. Adjust BAND SPREAD for maximum Meter reading and/or most precise signal sound.
- If signals are code or Single Side Band, set MODE to SSB/CW and AVC to FAST. Then, adjust BFO PITCH for the best code tone or proper voice sounds on Single Side Band.
- 6. If noise is excessive, set ANL to ON.

It might be a good thing to remind you again of some of the differences in Short Wave reception. Many things are beyond your control and yet they effect reception to a great extent. Some of these variables are:

Atmospheric conditions—conditions of weather, solar disturbances, etc. These may make a signal come through loud and clear, or make it fade in and out, or may even block out signals completely.

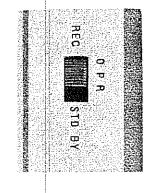
Time of the day, month and year—these greatly effect transmission of radio signals over great distances.

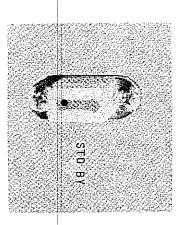
Your own skill will help to determine your success in receiving DX signals (DX stands for "distant transmissions"—meaning long-distance reception). Of course, there are a number of things you can do to improve your success—this instruction manual gives you a number of suggestions. Experience will help, other books and magazines can help, a good antenna will help, a DX or SWL club may help too.

### OPERATING NOTES

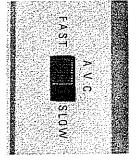
Your Receiver is a fine example of technical achievements in the field of communications equipment. It is simple to operate, and yet has all the most-wanted features and controls. Short Wave Listening is a great hobby—your skill will grow with experience and of course experience only comes with practice. This section has a number of hints relating to the proper use of your Receiver. We can't possibly turn you into an expert SWLer just by giving you thorough instructions—but these hints will help.

The OPR (operate) switch is a feature found only on high quality communications and Ham receivers. Its purpose is two-fold: one is to leave critical circuits on all the time, which provides maximum stability, and yet not be annoyed by the audio signal. The other purpose is for station set-ups which have a transmitter (as Hams do); when the transmitter is on, the Receiver must be non-operating (or radio frequency energy from the transmitter gets into the Receiver and causes all kinds of problems). For normal reception, set to REC position; for standby operation, use STD BY.





There are contacts on the back for remote control of the Receiver. If you have a station set up where you want to be able to control the Receiver from a remote position, use these contacts; a switch should close for Receive and open for Stand By. These contacts are vital for Hams who want to be able to turn their Receiver on and off together with their transmitters.

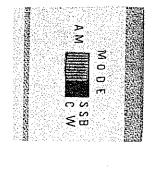


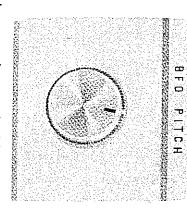
The AVC switch normally should be left in the SLOW position. This means that the internal automatic gain control circuit has a slow reaction time; this is best for normal AM broadcast signals which have relatively constant strength. The FAST position provides a fast reaction time for the internal automatic gain control; this is best for code and SSB signals, also for stations which seem to fade and flutter in strength. Use the position which results in the most steady signal sounds.

The ANL switch is a handy feature. Its primary purpose is to reduce electrical noise interference on the radio waves. However, you must realize that no ANL circuit can possibly remove all noise interference. There may be conditions where you just can't understand the radio signals because of too much noise and static—and ANL doesn't seem to solve the whole problem. This is normal. Also, in some cases, with ANL ON, the signal level may appear to drop slightly; this too is normal.

### Operating Notes—continued

The MODE switch determines the type of signal you can receive. For standard broadcast and international short wave stations, use the AM position. However, if you want to tune in to code or single side band signals, you must use the SSB/CW position.



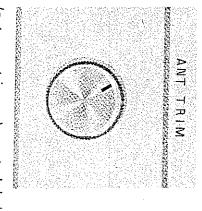


Single Side Band and Code signals must be tuned with care. Much of the activity on the Ham bands is in code or SSB (single side band). If you want to listen to these signals, set AVC to FAST and MODE to SSB/CW. Set BFO PITCH to the center position to start and then tune in the station.

If you are listening to a Morse Code signal, adjust BFO PITCH for the pitch of tone of code which best suits you.

If you are listening to an SSB signal, that takes more practice. If the MODE switch is in AM position, an SSB signal will only make a fluttering sound, you wont be able to understand anything. When you do come across such a sound, set MODE to SSB/CW. Then, very slowly and carefully tune BAND SPREAD and ANT TRIM for maximum meter reading. Now, very slowly and carefully adjust BFO PITCH to one side or the other until the voice sounds normal; when improperly adjusted, voices will have a low, gutteral, unintelligible sound or will sound like "donald duck". Tuning of SSB signals takes a little patience and practice.

If you attempt to tune a normal AM type signal with MODE set to SSB/CW, you will have a very annoying background tone which varies in frequency as you adjust the tuning controls. If this happens, just remember to set MODE to AM.



The ANT TRIM (antenna trimmer) control helps to adjust the Receiver circuitry to the antenna you are using. Since each frequency has its own particular optimum antenna length, and you can only have one antenna connected, the ANT TRIM control helps to match the Receiver to the antenna. Always check the adjustment of ANT TRIM; it sometimes can make quite a difference in reception. Any time you make a major change in tuning, recheck ANT TRIM setting.



The Meter is marked in S units. This stands for a relative indication of signal strength. Often you will hear SWLers and Hams talk about the strength of a signal in "S" units. The Meter is marked from 0 to S-9 and then +10 and +30 dB. The numbers below, 0-10, are just added for an additional reference.

Often, QSL cards and station signal reception reports have a place for indicating the strength of the signal; this is where the Meter comes in handy. The Meter is accurate only when the RF GAIN control is set maximum clockwise: if RF GAIN is set below maximum, the Meter does not indicate S-units accurately. So, whenever you want to check signal strength, set RF GAIN to maximum.

You can use 12 volts DC to power your Receiver. For example, if you want to mount the Receiver in a vehicle, or take it on a field trip, a source of 12 volts DC will operate it. Connect the 12 volt DC power to the connector on the rear; if you are using this in conjunction with a vehicle, be sure you use a 12 volt negative ground electrical system (almost all current U.S. vehicles use negative ground systems). Be sure you connect the external power leads with the correct polarity: + to + and - to -.

A good Antenna is an absolute necessity. We have said it before, but it doesn't hurt to remind you of that. You can have the finest receiver in the world—without an antenna you wont receive anything.

A pair of headphones is a great asset for serious SWLing. They make it much easier to hear and understand some of those weak and distant stations. We strongly suggest you consider purchasing a pair of communications headphones—8 to 2000 ohm impedance type. Your Radio Shack store has a couple of good choices.

The LOG scale on the Main Tuning Dial is a very handy tuning reference device. It is much easier to remember the number of the Log scale than it is to try to remember a number on one of the Band scales. Once you find a station on a particular band, note the band and the Log scale reading. If you want to return to that station at another time, just use the proper Band and then return to the same Log scale reading. When you enter notes in the Country Log (later on in the Manual), always note the Log Scale reading too.

Dial Scanning is a simple technique for quick tuning of the Short Wave Bands. As we have noted before, reception conditions vary on the different bands and according to the time of day, time of year and solar activity. Thus, you wont always find the same station at the same place; sometimes certain bands will be "dead" and others just jumping with activity.

To aid you in finding the best frequencies to listen to, do the following:

- Choose the band you want to check.
- Set BAND SPREAD maximum clockwise.
- Slowly turn MAIN TUNING across the band. In places you'll hear nothing, then squeals, code, music, voices, etc.
- When you have located sections of great activity, fine-tune the desired station(s) with BAND SPREAD.

Additional information on Short Wave Listening and using your Receiver is available from many sources. Many things you just must learn by experience; but, books and reference material can be of great help. Your Radio Shack store has a few books you should consider obtaining:

RADIO AMATEUR'S HANDBOOK by ARRL INTRODUCTION TO SHORT WAVE LISTENING AMATEUR CB/SWL RADIO STATION LOG BOOK

Each of these has helpful information and ideas. The Log book is an absolute must if you intend to do much serious SWLing. Other places to look are some of the periodicals specializing in Short Wave Listening and Communications. There are a number of fine SWL clubs and organizations which can be of further assistance. Also, your local library is a good source for reference and help.

when the MAIN TUNING control is used of the red Band Spread calibration points tuning" dial scale. It is accurate only Band Spread Dial This to set the dial pointer directly over one See Band Spread and Dial Calibrais the

tion. BAND SPREAD moves this dial.

er. Unless you have Phones connected, Speaker. you will hear the sounds through the the SPK jack on the back of the Receiv-Speaker Insert the Speaker plug into

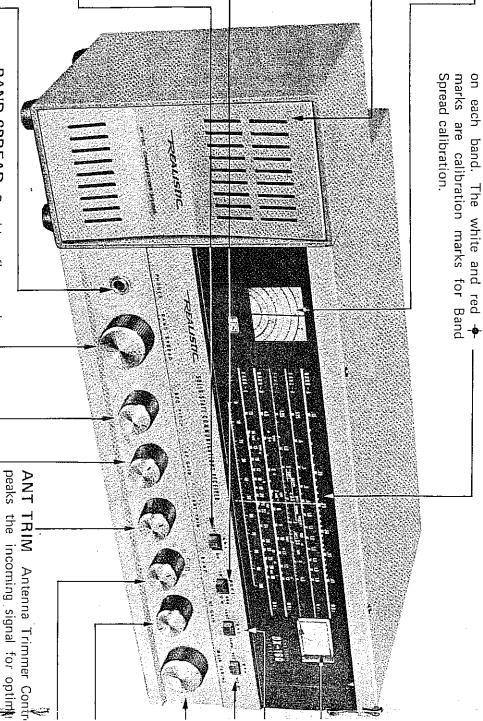
voice signals, use the AM (amplitude detection for the Receiver. For normal junction with BFO PITCH control. provides the necessary beat frequency code) position. The SSB/CW position Single Side Band signals, use the SSB/CW Code signals. Use this position in contone for receiving Single Side Band and (single side band/"continuous wave" or MODE Determines the proper mode of modulation) position. For Code and

switch helps to cut out annoying manposition. ON; for normal listening, use the OFF noise. When noise is a problem, set to made and other types of interfering The Automatic Noise Limiter

cially in areas where background noise is signals. When a plug is inserted, a problem. They also make it easier to provide for more precise listening, espejack for private listening. Headphones type 8-2000 ohm headphones into this PHONES Plug any communications-Speaker sound is automatically disconhear some of those hard-to-hear DX

> ices or bands of frequencies are indicated cy you are tuned to. Special radio serv-Main Tuning Dial Shows the frequen-

> > CONTROLS AND



**BAND SPREAD** Provides fine tuning for any of the bands of operation. It turns the Band Spread Dial.

S-Meter reading-you may have to reset each time you make major MAIN TUI

ING changes.

reception. Set it to provide maxima

signal. It functions only when MODE is proper voice sound of a Single Side Band tone of a code signal or to achieve BFO PITCH Beat in the CW/SSB position. lator Pitch Control is for adjusting the Frequency Oscil-

LAF GAIN is the Volume and powe counterclockwise to turn power OFF. and increase volume. control. Turn clockwise to turn power o Turn maximur

#### **FUNCTIONS**

S-Meter Shows the relative strength of signals. It is calibrated in "S" units and dB above S-9. Its calibration is accurate only when RF GAIN is set to maximum.

AVC Automatic Volume Control switch provides automatic volume control action as suitable for either AM or Code and Single Side band signals. Use FAST for Code and SSB; use SLOW for all other signals.

OPR Operate switch, when you set it to Receive (REC), you hear normal sound from the Phones or Speaker. In the Stand By (STD BY) position, the Receiver remains on, but voltage to the RF, IF and Audio circuits is disconnected—and so you wont hear any sound.

MAIN TUNING Use it to tune the Receiver to the desired frequency. It moves the pointer back and forth across the Main Tuning Dial. When you are going to use the BAND SPREAD for accurate tuning, set dial pointer to one of the + calibration marks.

RF GAIN Adjusts the sensitivity of the Receiver. For most sensitive reception, set to maximum. If signals are very strong (making the S-Meter move all the way to the right), reduce RF GAIN setting as required. Note that the S-Meter gives accurate S-unit readings only when RF GAIN is set to maximum.

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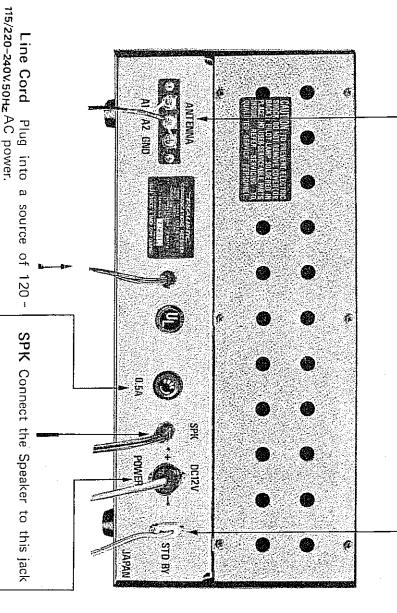
**BAND** This is the Band Selector switch. Set it to the desired band of operation.

num r on

#### REAR PANEL

ANTENNA Connect antenna wires to these terminals. For most antennas, connect to the A1-terminal. If you are using a balanced antenna, remove the jumper wire between A2 and GND and connect the antenna wires to A1 and A2. Connect a solid ground wire to GND screw terminal.

Receive control of the Receiver. Connect a\_remote\_set\_of\_switch\_contacts\_to\_the\_plug provided. Contacts should close for Receive; open the contacts for Stand By. When you use these remote control contacts, leave front panel OPR switch in STD BY position.



- <del>1</del>1 -

type.

blows, replace only with a 0.5 Amp

of excessive current drain.

If the Fuse

DC 12V

nect leads to the plug provided. Be sure

negative ground power source, con-

For operation from a 12 volt

to observe proper polarity.

Fuse Protects the Receiver in the event

## Band Spread and Dial Calibration

accurate tuning control too-BAND SPREAD is like a fine tuning control. But, it can be an

providing MAIN TUNING is set properly.

\_Ehe\_\_calibration\_\_of\_\_the\_\_Wain\_\_Tuning\_Dial\_is\_not\_accurate unless the Band Spread Dial is set maximum clockwise (high end of frequency).

You will notice that the Band Spread Tuning Dial has six scales on From the top down:

Log scale: 0 to 100

10-11M scale: CB channels 1-23 (11 meters) and 28 to 29.7

MHz

20M scale: scale: 21 to 21.45 MHz 14 to 14.35 MHz

scale: 7 to 7.3 MHz

scale: 3.5 to 4.0 MHz

pointer to the appropriate red + mark on the Main Tuning Dial Tuning Dial for these Bands, use MAIN TUNING to set the dial "Ham" Bands. To achieve proper calibration of the Band Spread These 10, 15, 20, 40 and 80 meter bands are all Amateur Radio or

For 80M, use Band C, For 40M, use Band D, red For 15M, use Band E, red For 20M, use Band E, red For 10-11M, use Band E, red + just to the left of 30. red + just above 4. between 7 and 8. between 14 and 15 just to the right of 22.

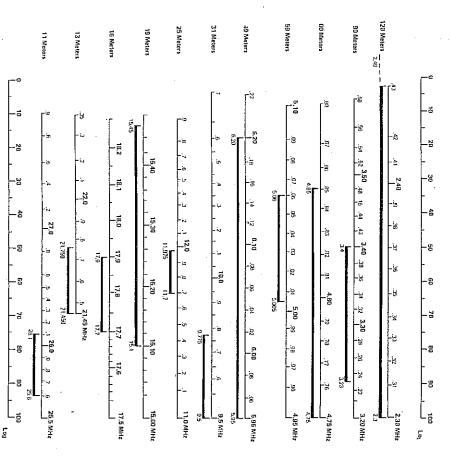
on the appropriate scale. will help) and line it up with the Log reading. Read the frequency scale and then look at the chart. Use a vertical straight line (a ruler desired station. To determine the precise frequency, read the Log MAIN TUNING to the appropriate white - mark on the Main Short Wave Bands, you can use the chart at the right. First, set If you want to accurately tune to frequencies in the International Dial Scale and then adjust BAND SPREAD to tune in the

point and identify the BAND SPREAD frequency coverage. the MAIN TUNING to the proper white (or red in three cases) + The following table will help you determine the correct Band, set

13 meters 22,35 (red) 11 meters 28.0		19 meters 15,45	25 meters   12.9	31 meters 10.7	41 meters 7.3 (red)	49 meters 6.22	59 meters 5.1	60 meters 4.88	75 meters 4.0 (red	90 meters 3.59	120 meters 2.43 MHz	To Tune the following International Set MAIN TUNING to # at (white Short Wave Band: except where noted)
(red)	:				ed)				ed)		MHz	TUNING t (white ere noted):
21.45-21.75 25.6-26.1	17.7-17.9	15.1-15.45	11.7-11.975	9.5-9.775	7.1-7.3	5.95-6.2	5.0-5.06	4.75-4.85	3.9-4.0	3.2-3.4	2.3-2.5 MHz	This International Short Wave Band Covers:
21.0-22.35 25.5-28.0	17.5-18.2	15.0-15.45	11.0-12.9	9.5-10.7	7.0-7.3	5.92-6.22	4.95-5.1	4.75-4.88	3.5-4.0	3.0-3.59	2.3-2.43 MHz	The Band Spread Dial Scale Covers:

For calibration of the Ham Bands, look at the previous table. For calibration of 75, 41 and 13 meters, see the Ham Band Spread Dial.

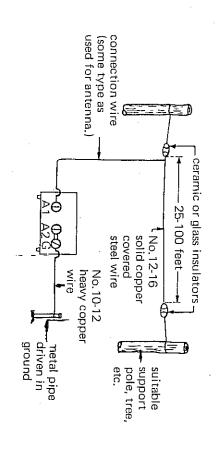
#### DX-160 CALIBRATION CHART INTERNATIONAL SHORT WAVE BAND SPREAD



#### ANTENNAS

will receive them. the antenna, the more signals you can receive—and the better you An antenna is a vital part of yqur Receiver installation. The better

antennas will give you good reception over all the bands. away from power lines, buildings and metal structures. These important that you mount the antenna as high as possible and packaged in a kit form. Either one will be fine. It is very Radio Shack store has a couple of short wave antennas already For a simple antenna, follow the illustration provided. Your local



specific band of frequencies, your antenna must be a certain length. Below we have listed two charts. The first chart gives an band. These antenna lengths are approximately 1/2-wave length for chart gives the antenna length best suited for a specific Ham Radio antenna length for best reception on any one band. The second However, if you want to obtain the very best reception on one the band noted.

> Band Ä Antenna length, 1870 feet (probably-far too long for with shorter antennas) you to erect—you can obtain good reception even

Band B = Antenna length, 470 feet (see above note)

Band D Band C = Antenna length, 185 feet

Band E = Antenna length, 24 feet Antenna length, 67 feet

80 Meter Ham Band = Antenna length, 125 feet

40 Meter Ham Band = Antenna length, 66 feet

20 Meter Ham Band = Antenna length, 33 feet 15 Meter Ham Band = Antenna length, 22 feet

10 Meter Ham Band = Antenna length, 16 feet

1/2-wave length required: frequency, you can use the following formula to If you are interested in putting up an antenna for a specific determine the

Length of 1/2-wave antenna in feet = Freq. in MHz

signals specifically in the 19 Meter band (15.1 to 15.450 MHz). Pick a frequency in that range, such as 15.35 MHz. Using the For example, if you want to pick up International Short Wave formula:

$$1/2$$
-wave antenna =  $\frac{468}{15.35}$  = 30.5 feet

So, put up an antenna 30-1/2 feet long; that will give you best reception for the 19 Meter International Short Wave Band.

Shack store. For lots more information about antennas, purchase a copy (of THE RADIO AMATEUR'S HANDBOOK from your local Radio

wire for this; connect the other end either to a cold water pipe to the GND screw on the back of the Receiver. Use a heavy gauge into the ground. (not hot water and not a natural gas pipe) or to a metal rod driven To insure good reception, you must always connect a Ground wire

store has them. This will protect your Receiver from damage and may even protect your house from fire in case of lightning strikes. Also, for lightning protection, we very strongly urge you to use a lightning protector/arrestor on your antenna. Your Radio Shack

## FREQUENCY CONVERSION

Your Communications Receiver is calibrated in Megahertz (MHz)—as most communications-type receivers are. However two other\_terms\_are\_used\_quite\_often—you\_should\_know\_what they are and how to convert from each one to the others.

First, Megahertz. This stands for millions-of-Hertz (or cycles-persecond as we used to call Hertz). A Megahertz is 1,000,000 Hertz (Hz for short) or 1,000,000 cycles-per-second. Mega means million.

Second, Kilohertz. This stands for thousands-of-Hertz. A Kilohertz is 1,000 Hertz. We use the abbreviation kHz; thus, 1 kHz. Kilomeans thousand.

Third, Meter. The term Meter, as applied to Short Wave Listening, refers to the wavelength of a radio frequency. In many parts of the world, frequencies are listed in Meters; for example, International Short Wave Stations in the 19 Meter band. European radio equipment and stations often refer to the wavelength of a station or band (in meters), rather than the frequency (in MHz or kHz).

The relationship of these three terms is:

1 MHz (million) = 1000 kHz (thousand)

hus, to change 9.62 MHz to kHz, we multiply by 1000.

 $9.62 \text{ MHz} \times 1000 = 9620 \text{ kHz}$ 

To go the other way, from kHz to MHz, divide by 1000. Thus, a station at 3780 kHz is

$$\frac{3780 \text{ kHz}}{1000} = 3.780 \text{ MHz}$$

To convert MHz to meters, use this formula:

Meters = 
$$\frac{300}{\text{MHz}}$$

Example: What is the wavelength of 7.1 MHz?

$$\frac{300}{7.1 \text{ MHz}} = 42.25 \text{ meters}$$

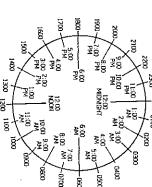
To convert meters to MHz, use this formula:

$$MHz = \frac{300}{meters}$$

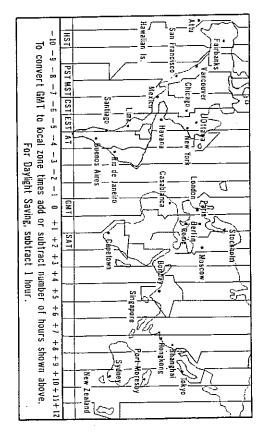
Example: What is the frequency of a station on a wavelength of 19.5 meters?

#### TIME CONVERSION

A 24-hour clock is used to tell communications time. One AM is 0100; four AM is 0400; Noon is 1200; 3:30 PM is 1530; 8:45 PM is 2045. This simple method precludes any confusion between AM and PM. (See Chart).



GMT (Greenwich Mean Time—the time at Greenwich Observatory, England) is the basis for telling time in International Broadcasting. To convert from GMT to local time or any other time zone, add or subtract the hours shown on the INTERNATIONAL TIME MAP (below).



Example: 2300 GMT is 1800 EST (Eastern Standard Time). This is equivalent to 11:00 PM in London, Eng., 6:00 PM in New York or 8:00 AM in Tokyo (the next day).

## NOTES ON OPERATING ON EACH BAND

This section will give you some specific ideas of what to look for on each band. It can be a helpful guide while operating the Receiver.

BAND A —.15 to .40 MHz (150 to 400 kHz) is not often found on Short Wave Receivers available in North America. There are a number of interesting signals down in this range. If you live near the ocean or a large lake or inland water-way, you will come across many ship and navigational signals. There are a number of aeronautical and marine radio beacons in these bands. You may even come across some weather signals. In Europe and Continental Asia this band is used for standard broadcast stations (these are termed long-wave stations). If you have a very fine antenna and conditions are just right, you may be able to hear these signals from North America.

BAND B—.535 to 1.6 MHz (535 to 1600 kHz) is the standard AM broadcast band. In most countries around the world these frequencies are very active with local radio stations. You are most familiar with this band, so we don't need to tell you much about it.

BAND C—1.55 to 4.5 MHz. There are many varied signals within this band. From 1.55 to 2 MHz you will hear many broadcast stations and if you are near the ocean or large bodies of water, you will pick up maritime signals (ship, ship-to-shore and navigational signals). In some areas you will pick up Ham Operators between 1.8 and 2.0 MHz; they are limited in power and to certain geographical areas, so you wont always be able to hear them.

Between 2 and 3 MHz, you should pick up some governmental services, marine and aircraft signals. Near 2.2 there is a distress calling channel. This band also includes the 120 meter International Short Wave band (see Band Spread and Dial Calibration).

At 2.5 MHz, the National Bureau of Standards transmits very precise time signals and gives periodic propagation reports. Many countries around the world have special time standard broadcasting signals at various other frequencies (both on this band and others)—for example, 3.33 MHz is a Canadian station, CHU; Australia has one at 4.5; Chile has one at 4.298; many European countries use 2.5.

The 90 and 75 meter International Short Wave bands are also here, plus the 80 meter Ham Band. Hams are fun to listen to—set the MAIN TUNING to calibrate the Band Spread Dial for 80 meters and try it. You'll hear code signals from 3.5 to 3.8 and voice from 3.8 to 4.0.

BAND D-4.5 to 13 MHz. This and Band E are the best ones for Short Wave Listening. Certain times of the year and day, these bands are just full of signals.

The technique of DX chasing (looking for distant station signals) requires a certain degree of electronic detective work. Although some activity always prevails on the bands, you will find your time more enjoyably employed if you spend time preparing before chasing DX. Check WWV stations for propagation reports, do some reading research, keep an up-to-date SWL Log Book and then review it regularly.

Later on, we have given you a brief list of International Short Wave Stations in the form of a Country Log. Look it over, follow it and use it.

The 59 and 60 meter bands (4.75-4.85 and 5.005-5.06 MHz) provide domestic broadcast signals for much of the world. However, you will be able to pick up many of these signals from wherever you are. This has been referred to as the **Tropical Band** since many of the stations are located in Central and South America. Sometimes, North American SWLers also pick up Africa too. Best reception is the winter months and in the early evenings.

The 49 meter band (5.95-6.2 MHz) has some very popular and strong International Broadcast stations and reception should normally be quite good.

The 41 meter band (7.1-7.3 MHz) is shared with two or three services, so you may run into interference between these services. Ham radio stations (40 meter Ham Band) and strong International Short Wave stations will be very prominent here.

## Notes on Operating on Each Band-continued

very good bands for both day and night reception. 31 and 25 meter bands (9.5-9.75 and 11.7-11.975 MHz) are

try another. You can pick up time standard signals at 5.0, 10 and 7.335 MHz. The first two are WWV and the last is CHU. If you can't get one,

good as some of the lower bands. greater the sun spot activity, the better the reception at these about in 1968 and the minimum is expected about 1976; the reception within this band. The peak of the present cycle passed the MHz. There are 4 Short Wave bands here, plus 3 Ham bands and standard signals at 15, 20 and 25 MHz; CHU has one at 14.67 BAND E-13 to 30 MHz offers more fine listening. WWV has time higher frequencies. So, don't be surprised if reception is not as CB frequencies. The sun spot cycle greatly effects DX

provides excellent daytime listening. Some night listening may be The 19 meter International Short Wave Band (15.1-15.45 MHz) noted during the summer.

reception is possible-especially during the day. During periods of sun spot activity, some really astounding DX The 16 meter International Short Wave Band (17.7-17.9 MHz).

25.6-26.1 MHz) are similar in reception conditions to the 16 and 19 meter bands. Reception may be superior with sun spot activity and 11 meter Short Wave Bands (21.45-21.75 and

meters (21.0-21.45 and 28-29.7 MHz) other times they will be 'dead'. that. DX will be most prominent near dusk and dawn. 15 and 10 always busy. You will hear code from 14 to 14.2 and voice above The Ham bands are very active. 20 meters (14.0-14.35 MHz) is at times will be very active,

There is always activity on the Citizens' Band (11 meters, channels 1 through 23 on the Band Spread Dial), especially in areas near large cities.

## MORSE CODE AND RADIO TERMS

#### volume control Familiar Short Wave and Amateur Radio Terms Gain Control-same DX—distant stations

ting signal is varied at an audio AM (Amplitude Modulation) —the amplitude of the transmit

er)-reduces impulse noises (ignition, static, crashes, etc.) ANL (Automatic Noise Limit

ANT-Antenna

gain on strong signals) cuits automatically (i.e. reduces trol)-controls the gain of the radio frequency amplifying cir-AVC (Automatic Volume Con-

signal so that CW (code) signals can be heard lator)—provides a special interna (Beat Frequency Oscil-

answers. Can also be used speci amateurs to establish contact CQ—a general call used by radio Chicago) only DX stations, or CQ Chicago, fically (CQ/DX, when calling Caller will talk to anyone who when calling stations only in

CW (Continuous Wave)—ungence is transmitted by interrupt modulated signal wherein intelliing signal to produce dots and

signals QRM-interference from the transmitting frequency is varied at an audio rate FM (Frequency Modulation) —

QRX-Stand-by QRN—interference static

specific transmission QSL-usually a card which verifies contact or acknowledges

stations QSO-a contact between

QSY—change quency operating fre-

sensitivity of the radio frequency cy gain control: controls the amplifier stage RF Gain Control-radio frequen-

signals) quality RST-readability, strength, tone (refers to a system of rating the of reception

SWL—short wave listener 73's-best regard

88's—love and kisses XYL-wife

SSB—Single Side Band YL—young lady

Ten-Signals List (Police, Fire, etc.) Associated Public Safety Communications Officers, Inc. Official

10-2		10-1	10-0
Signal good	location	Unable copy—change	Caution
10-6	10-5	10-4	10-3

10-6 10.2 Stop transmitting Busy-unless urgent Relay Acknowledgment (OK)

#### COUNTRY LOG

night. All broadcasts (unless otherwise specified) are in English. the world. The stations listed can be heard throughout the North The following listing will be useful in spotting and identifying American Continent. Transmission periods vary throughout day and International Short Wave Broadcasting stations in operation around

Columns are provided for LOCAL TIME HEARD (see TIME CONVERSION) and PROGRAM TYPE so that you may identify the number too. broadcast you heard. You might want to note the Logging scale

stations and frequencies in constant use by all nations around the world-far more than we can list here. periodicals on Short Wave Listening. There are many, many more For a more complete or/and up-to-date list, check monthly

Wanted/stolen indicated	10-98	10-33 EMERGENCY 10-34 Riot 10-99 Wanted/stolen indicated	10-34
	10-90	Man with gun	10-32
	10-89	Crime in progress	10-31
Chase in progress	10-80	Assignment completed	10-24
	10-78	Location	10-20
	10-70	Return to—	10-19
Hit and run (F, Pl, PD)	10-57	Quickly	10-18
Road blocked at	10-53	Civil disturbance	10-15
Ambulance needed	10-52	Prowler report	10-14
10-51 Wrecker needed	10-51	10-13 Weather-road report	0 3
	10-50	10-12 Stand by (stop)	10-12
	10-40	Fight in progress	10-10
Urgent-use light, siren	10-39	Repeat	10-9
	10-36	In service	10-8
Major crime alert	10-35	Out of service	10-7

NO! E: CBers use 10-Code signals similar to this one, but in some cases, the meanings are quite different. For information, refer to RADIO SHACK'S LOG BOOK.

## INTERNATIONAL MORSE CODE

S dididit	R di-dah-dit	Q dah-dah-di-dah	P di-dah-dah-dit	O dah-dah-dah	N dah-dit	M dah-dah	L di-dah-di-dit	K dah-di-dah	J di-dah-dah-dah	1 di-dit	H di-di-di-dit	G dah-dah-dit	F di—di→dah—dit	E dit .	D dah-di-dit -	C dah-di-dah-dit -	B dah-di-di-dit -	A di-dah .	Letter Phonetic Sound Se
•	į	!		1	•	ł	:	1		•	:	•	•		;	!		ı	Dot-Dash Sequence
0 dah-dah-dah-dah	9 dah-dah-dah-dit	8 dah-dah-dah-di-dit	7 dah—dah—di—di—dit	6 dah-di-di-dit	5 didididit	4 di-di-di-dah	3 di−di−di−dah−dah	2 di-di-dah-dah-dah	1 di-dah-dah-dah-dah	Numbers		Z dah-dah-di-dit	Y dah-di-dah-dah	X dah-di-dah	W di-dah-dah	V di-di-di-dah	U di-di-dah	T dah	Letter Phonetic Sound
- - - - - - - - - - - - - - -	•		1 : : :	:	:	:	•	1	1			:	\$1.* 1.* 1.*	:	1	:	;	1	Dot-Dash Sequence

	6.055		Poland	Warsaw
	6.050		Nigeria	Ibadan
	6.045	YDF	Indonesia	Djakarta
	6.040	BCA22	China	Nanking
	6.037	3M3	Monaco	
	6.035	GWS	≝ngland	Daventry
	6.030		Iraq	Abu Ghurais
	6.025		Morocco	Tangier
	6.020		Rhodesia	Salisburg
	6.015		Egypt	Abu Zabad
•	6.000	ORU	Belgium	Brussels
	5.990		Rumania	Bucharest
	5.980	4VB	Haiti	Cap Haitien
	5.980		North Borneo	Jesselton
			Republic	
	5.970	Radio Caribe	Dominican	Ciudad
	5.960		Germany	Ismaning
	5.955	ZTR226	Brazil	Sao Paulo
	5.060		Ethiopia	Addis-Ababa
	5,050		Tanzania	Dar-es-Salaam
	5,010	FBS	Singapore	
	4.810		S. Africa	Paradys
	3.366		Ghana	Accra
	3.300	•	British Honduras	Belize
	3.255	ELBC	Liberia	Monrovia
PROGRAM TIME HEARD	MHz	CALL	COUNTRY	CITY

Stockholm New Delhi	Cairo Bangkok Karachi	Moscow	, <	Peking /	Cuidad	Buenos Aires	Marques Stockholm	Lourenco	Montreal	Roma	Bucharest	St. George's	Prague	Wellington	Berne	Havana	Copenhagen	Peking	Sofia	Moscow	Prague	Berlin	Budapest Karachi	Naha	Brazzaville	Chiavi	Pyongyang	Pyongyang	Kaduna	Berne	Mexico City	Tokyo	London	Halifax	Minsk	Seckville N.B. Delhi	CITY
Sweden India	Egypt Thailand Pakistan	U.S.S.R.	U.S.S.R.	China	Dominican	Argentina	Sweden	Mozambique	Canada	Italy	Rumania	Windward Islands	Czechoslovakia	New Zealand	Switzerland	Cuba	Denmark	China .	Bulgaria	U.S.S.R.	Czechoslovakia	East Germany	Hungary	Okinawa	Congo	Taiwan	North Korea	North Korea	Nigeria	Switzerland	Mexico	Japan	England	Canada	U.S.S.R.	Canada India	COUNTRY
Radio Sweden	HSK9 11.674	Radio Moscow	Radio Moscow		Radio Caribe	LRA	Radio Sweden	CR7BI	CBC	RAI		WIBS	7 1	ZL2			OZF	-		Radio Moscow				VOA								m Z	ввс			CKR2	CALL
11.705 11.710	11,670	11.570	9.805	9.785	9.735	9.690	9.665	9.616	9.585	9.575	9.570	9.550	9.550	9.540	0 U	9.531	9.520	9.480	9.144			7.300	7.220	7.160	7.105	7.100	6.250	6.195	6.175	6.165	6.165	5.160	6.110	6.100	6.075	6.060 6.065	MHz
			67.9 Log			16.145	•			1 1										+ 450 8.01 B	; ; ; ; ;																PROGRAM 1
	101/2/60	T :(3:3	9,805	, , .							-		;			•														÷							TIME HEARD
									Lisbon	New York City	Seput	Cologne	New York City	Paris	Weihourna	Warsaw	Colombo	Tel Aviv	Stockholm	Taipei	Monrovia	Montreal	Tokyo	Teheran	Peking	Grazzaville	Manila	Elizabethville	Brussels	Moscow	Melbourne	Diakarta	Vatican City	Rabat	St. George's	Melbourne Hilversum	CITY
												-	<																				_				
									<u>=</u>		South Korea			France	Australia	Poland	Ceylon	Israel	Sweden Sugosiavia	Taiwan	Liberia	Canada	Japan	iran	China	Singanore	Philippines	Katanga	Belgium	U.S.S.R.	Australia	Canada		Morocco	Windward Islands	Australia Holland	COUNTRY
										U.S.A.	•	West Germany		France		2	Ceylon		y ugosiavia Sweden Radio Sweden	Taiwan BED3			Japan JOA15	fran 2PB		Singapore BBC-FFS	Philippines DZF2				Australia VLA	Canada CBC	Vatican	Morocco	Windward Islands	Australia VLA Holland	COUNTRY CALL
									CSA44	U.S.A. WRUL	HLK9	West Germany DMQ15	U.S.A. WRUL	ā	V - A	71.0				BED3	ELWA		JOA15	2P8		7	ines DZF2		ORU	Radio Moscow		CBC	Vatican HVJ			ш	

## SCHEMATIC DIAGRAM

