Quartz-Synthesized Communications Receiver

DX-300

OWNER'S MANUAL

PLEASE READ BEFORE USING THIS EQUIPMENT

REALISTIC®

CAT. NO. 20-204

... It All Comes Alive on Your Realistic DX-300 Communication Receiver

Today's busy airwaves are literally full of programs of entertainment 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.

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

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

The DX-300 QUARTZ-SYNTHESIZED COMMUNICATION RECEIVER covers 10 kHz through 30 MHz, and is able to receive AM (Amplitude modulation), CW (Continuous wave) and SSB (Single Side Band) signals.

The synthesized drift-cancelling triple-conversion mixer system provides thirty tunable ranges from 10 kHz to 30 MHz, and is derived from a single 4 MHz quartz oscillator. This results in precise frequency control and superior frequency stability. A stable low frequency kHz Tuning circuit covers the 1 MHz increments and the 5-digit display shows the **exact** frequency.

The DX-300 uses 37 transistors (10 of which are field-effect type), a Large-Scale-Integration IC frequency counter, 3 integrated circuits, 25 diodes, 5 seven-segment LED displays and six LEDs.

You can use the DX-300 at home (on 120 Volts AC or 12 V DC [8 "C" cells]) or in your car or recreation vehicle (12 Volts DC **negative ground**).

Main features are:

* Quartz controlled frequency synthesizer
* Continuous frequency coverage from 10 kHz to 30 MHz
* Large digital frequency display
* Triple conversion circuitry
* Six element ceramic filter provides outstanding selectivity (freedom from adjacent channel interference)
* Dual MOS Field-effect transistor in the critical mixer stage (freedom from cross-modulation and undesirable RF distortion)
* All-silicon solid-state circuitry for maximum circuit efficiency with minimum noise.
* Audio power IC provides high intelligibility sound.
* AC or DC (**negative** ground) operation.
* If the AC power should fail, an automatic circuit switches over to the battery power with no interruption of sound.

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

For your own protection, we urge you to record the Serial Number of this unit in the space provided. You'll find the Serial Number on the back panel of the unit.

Serial Number _____

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS RECEIVER TO RAIN OR MOISTURE.

SPECIFICATIONS

SEMICONDUCTOR COMPLEMENT: 1 LSI C-MOS Frequency Counter IC, 3 integrated circuits, 37 transistors, 25 diodes, 5 7-segment LED displays, 6 LEDs and 1 thermistor.

RECEIVING SYSTEM: Quartz controlled synthesizer, triple-conversion

FREQUENCY COVERAGE: 10 kHz to 30 MHz

PRESELECTOR BANDS:

0.01 – 0.15 MHz	(10 – 150 kHz)
0.15 – 0.5 MHz	(150 – 500 kHz)
0.5 – 1.6 MHz	
1.6 – 4.5 MHz	
4.5 – 12 MHz	
12 – 30 MHz	

FREQUENCY DISPLAY: Digital read-out in five 7-segment LEDs.

SENSITIVITY (for 10 dB Signal-to-Noise ratio):

AM	100 kHz	20 μV
	300 kHz	2 μV
	900 kHz	1 μV
	3.1 MHz	0.5 μV
	7.1 MHz	0.5 μV
	15.1 MHz	0.5 μV
	28.1 MHz	0.5 μV
SSB	100 kHz	10 μV
	300 kHz	1 μV
	900 kHz	0.5 μV
	3.1 MHz	0.3 μV
	7.1 MHz	0.3 μV
	15.1 MHz	0.3 μV
	28.1 MHz	0.3 μV

IMAGE RATIO:

100 kHz	80 dB
300 kHz	80 dB
900 kHz	80 dB
3.1 MHz	70 dB
7.1 MHz	70 dB
15.1 MHz	70 dB
28.1 MHz	70 dB

SELECTIVITY: ±3 kHz, –6 dB
±10 kHz, 70 dB

RECEPTION MODE: AM, USB, LSB, CW

I.F.:

1st	54.5 – 55.5 MHz
2nd	3 – 2 MHz
3rd	455 kHz

FREQUENCY STABILITY: Within 1 kHz per hour after 60 minutes warm up.
Within 2 kHz during 10 minutes after initial turn on.

AUDIO OUTPUT (8Ω): 1.5 watts maximum

ANTENNA IMPEDANCE: 50 ohms for coax connector
Hi-Z for long wire

POWER REQUIREMENTS: AC – 120 volts, 60 Hz (220/240 volts, 50 Hz for European/Australian models), 15 watts maximum
DC – 8 "C" cell or external 12 volts negative Ground only, 8 watts maximum

DIMENSIONS: 6 x 14-1/2 x 10" HWD
(146 x 362 x 252 mm.)

WEIGHT: 13-1/5 lbs. (6 kg)

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 triode 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 [300,000 km /sec] 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.

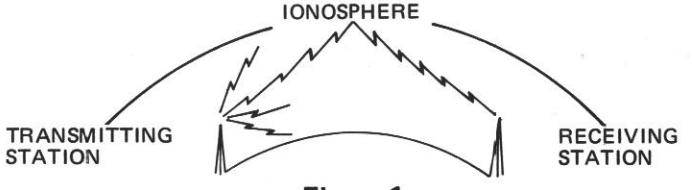


Figure 1

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 approximately 11-year cycles. The last peak activity was about 1969; minimum activity was about 1975-6. Maximum activity = best DX reception; minimum activity = inconsistent and/ or poor 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–

AMATEUR RADIO Amateur (Ham) radio stations are operated by private citizens in more than 250 countries around the world.

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 (Amplifier Modulated) receiver. The reason for this is the absence of a carrier in the transmission of a single side band signal. Your DX-300 allows you to clarify a single side band signal with the built-in "product detector" circuit. The LSB/CW, USB/CW position on the Mode switch enables you to "re-insert" a carrier to a received SSB 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 360 to 370 kHz and 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 anywhere 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 broadcasting on short wave instead of on the standard broadcast 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 and 15.0 MHz.
The Canadian Government provides a similar service at 3.3, 7.335 and 14.67 MHz. Voice announcements are made every minute in both English and French over station "CHU".

INSTALLING YOUR RECEIVER

Your Realistic DX-300 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:

1. YOUR COMFORT. You will spend many hours with your Receiver; be sure it is placed where you can enjoy it at any time.
2. YOUR ANTENNA. For immediate operation you can use any simple antenna. However, to realize the maximum performance, you will need a long wire short wave antenna (such as Radio Shack's 278-758) or a special antenna such as we discuss later on. In any case, it should be an outside antenna.
3. YOUR GROUND. If you set up an outside antenna, for safety you should connect a ground wire to the Receiver. This will require running a ground wire from the ground screw connection on the back of the Receiver to a metal cold water pipe or metal pipe driven into the earth.

CONTROLS AND THEIR FUNCTIONS

SIGNAL STRENGTH & Battery Meter
Shows relative strength of received signal (or Battery condition when BATT TEST is used).

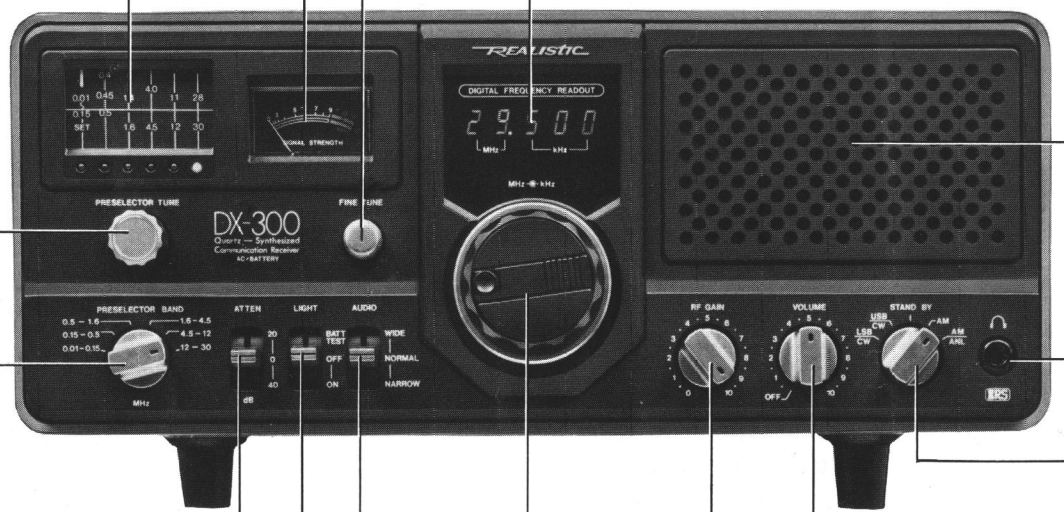
PRESELECTOR TUNE & Dial
Set to approximate frequency you want to tune to.

PRESELECTOR BAND Switch
Set to appropriate band when adjusting PRESELECTOR TUNE.

ATTENuator Switch
Use to attenuate strong local signals. (Does not function when using a long-wire antenna.)

LIGHT Switch
When using battery power, use to check battery condition (BATT TEST) or turn dial lights on (ON). With AC power, lights are always on.

AUDIO Switch
Set for least interference and best sound.



FINE TUNE
Use to fine tune signals (especially SSB signals).

Digital Frequency Readout
Show the precise frequency the Receiver is tuned to (in MHz and kHz).

Speaker
Receive sound comes from here (unless headphones are connected).

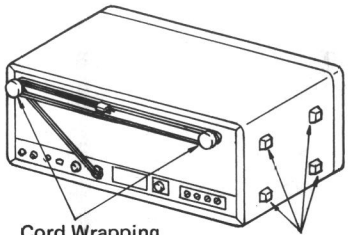
Jack
Connect headphones for private listening or for listening in high background noise locations.

Mode Switch
Determines mode of operation.

VOLUME/OFF Control
Use to turn Receiver "on" and adjust volume of sound.

RF GAIN Control
Use to adjust sensitivity of Receiver.

Main Tuning
Adjust outer knob to desired MHz range.
Adjust inner knob for precise kHz tuning.



Cord Wrapping Plastic Posts

Rubber Feet are provided in case you use the Receiver in portable operation. Peel off of paper backing and press onto Left hand side of Cabinet.

Cord Wrapping Posts
Use to wrap the AC Power Cord for storage or when operating from Battery power or external 12 V DC. (Screw posts into back of Cabinet.)

Battery Compartment
To operate from battery power, load 8 heavy-duty "C" Batteries here.

External Speaker Jack
Connect an external speaker to this jack (automatically disconnects built-in speaker).

KEY Jack
To practice Morse Code, plug a code key into this jack, tune Receiver to 1 or 2 MHz and set Mode to USB/CW or LSB/CW.

TAPE OUT Jack
Connect a tape recorder to this jack and record messages off-the-air.

Coax ANTenna Connector
Connect 50 – 75Ω antenna lead-in to this.

ANTenna Screw Terminal
Connect long wire antennas to this screw terminal.

GrouND Screw Terminal
Connect a wire between one of these screws and a good ground point. The other is for MUTE operation.

MUTE Screw Terminal
Can be used for remote muting of the Receiver (without using STANDBY Mode switch position). To Mute, connect to a GND screw.

Power Cord
Connect to a source of 120 Volts, 60 Hz AC power.

FUSE
Protects the unit from abnormally high current. Use only a 0.5 Amp type.

DC 12V Jack
For operation from an external source of 12 volts DC, connect red wire to + and black wire to –.

OPERATION

Before operating your DX-300, you should have an antenna and ground connected. (See that section later on.) And, of course, you must either have the power cord connected to a source of 120 volts AC or load 8 type C batteries (open Battery Compartment and install batteries as illustrated). Or, connect the DC power cord to a source of 12 volts DC.

Since you probably are most familiar with the standard broadcast band radio reception, you might prefer to use the DX-300 there first.

1. Turn the Receiver on by rotating **VOLUME** clockwise.
2. Set **Mode** Switch to AM.
3. Set **PRESELECTOR BAND** Switch to 0.5 – 1.6.
4. Set **ATTEN, LIGHT** and **AUDIO** to their center positions.
5. Set **RF GAIN** to 10.
6. Adjust **MHz** Tuning so 1. appears in the **Digital Frequency Readout.**
7. Use **kHz** Tuning to tune in a station above 1.000 MHz.
8. Adjust **PRESELECTOR TUNE** to the same frequency (adjust for maximum reading on the **Meter**).
9. To tune in stations below 1.000 MHz, adjust the **MHz** Tuning so a 0. appears in the **Readout**. Then adjust **kHz** Tuning for the desired station frequency. Once again, adjust **PRESELECTOR TUNE** to the same frequency (for maximum reading on the **Meter**).
10. You can adjust **FINE TUNE** to precisely tune-in the station (although you won't see much effect on these bands, for **FINE TUNE** is most handy when tuning in Short Wave stations and especially SSB [single side band] signals).
11. Sometimes you can peak-up the sensitivity by slightly readjusting the **MHz** Tuning. Try it.

See "Special Operating Notes" later on.

Tuning VLF and LF Frequencies

Once you've become familiar with the DX-300 operation on the standard Broadcast Band frequencies, you can try the low frequencies from 10 kHz up to 500 kHz.

1. Set **PRESELECTOR BAND** Switch to the appropriate position to cover the frequency you will tune. If you set to the 0.01 – 0.15 MHz position, set **PRESELECTOR TUNE** to the "SET" position.
2. Set **PRESELECTOR TUNE** to the approximate frequency you will tune to (unless tuning the 0.01 – 0.15 MHz spread [for this coverage, leave at "SET" position]).
3. Set **MHz** Tuning so 0. is displayed.
4. Set **kHz** Tuning to display the desired frequency.
5. Try readjusting **MHz** Tuning slightly for maximum sensitivity.
6. If not on 0.01 – 0.15 MHz position of **PRESELECTOR BAND**, adjust **PRESELECTOR TUNE** for maximum signal reception.

See "Special Operating Notes" later on.

Tuning Frequencies Above 2 MHz

The rest of the bands are quite easy to tune.

1. Set **PRESELECTOR BAND** Switch to the appropriate position.
2. Adjust **PRESELECTOR TUNE** to the approximate frequency you are going to tune to.
3. Adjust **MHz** Tuning to display the desired MHz number.
4. Adjust **kHz** Tuning to display the desired kHz number.
5. Adjust **PRESELECTOR TUNE** for maximum signal reception.
6. If you are tuning for SSB (single sideband) or CW (continuous wave, or "code" as the more common term is), set **Mode** Switch to LSB/CW or USB/CW. Adjust **FINE TUNE** to precisely tune in the signal.
7. Often for optimum sensitivity you'll find that it helps to make a slight readjustment of **MHz** Tuning.
8. If you are in the AM mode and noise is excessive, set **Mode Switch** to AM ANL position.

SPECIAL 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 – plus the fact that it is a continuous–coverage receiver (tunes **ALL** frequencies from 10 kHz to 30 MHz). 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 Antenna connection can affect reception in unusual ways on a Receiver of this design. Because the Preselector/RF stages are not automatically tracked with the oscillator, it is possible that strong local signals will produce spurious reception effects.

For example, long wires of 50 feet (15 m) or more connected to either of the **ANTenna** terminals can deliver a very high RF signal to the back of the set. The result is a tendency to overload the input and you tune spurious responses.

Solutions to this type of effect:

1. Use a shorter antenna when operating below 2 MHz. Or use no external antenna at all for these frequencies (the DX-300 has a built-in high-efficiency ferrite rod antenna to cover the standard AM broadcast band frequencies).
2. Try connecting the antenna to the other **ANTenna** connector (if you are using the coax connector, try the screw-terminal, or vice versa).
3. Try readjusting **MHz** Tuning very slightly.
4. Try switching in the **ATTEN** (use 20 dB position first, then 40 dB if necessary). **ATTEN** has no effect when your antenna is connected to screw terminals.
5. Try turning down the **RF GAIN** control.
6. Be sure **PRESELECTOR BAND** Switch is set to the appropriate position and that you tune **PRESELECTOR TUNE** for maximum signal reception.

Preselector setting and tuning is important for best sensitivity and maximum spurious signal rejection. Always be sure the **PRESELECTOR BAND** is set correctly for the frequency you are tuning to. If you detune the Preselector, the S-meter reading will drop. If you set the **PRESELECTOR BAND** Switch to the wrong position, you may not completely lose reception of the signal; but this does not imply that this signal will be received at another frequency. An improper setting of the Preselector may result in false signal tuning. Proper setting and tuning of Preselector will help to eliminate cross-band reception problems.

MHz Tuning does have a slight effect on the sensitivity of the Receiver. For optimum reception, tune for best sensitivity (and minimum spurious response). You'll note that above the extreme upper end of any given MHz spread, the kHz display will blank out, although you can still tune in signals for about 30 kHz. This allows you to tune both above and below the 1 MHz band "edges" without having to change MHz tuning. The same is true for below the extreme low end of each MHz spread.

Operation of the **RF GAIN** control effects the overall sensitivity of the Receiver. Normally you'll want to leave **RF GAIN** at maximum (10). If you are near a very strong signal, you can use **RF GAIN** to reduce the volume of the received signal; if you don't do this, the strong incoming signal can "swamp" the input stages of the Receiver and may result in unusual types of signal reception and distortion problems. Also, you should realize that the **S-Meter** is accurate only when **RF GAIN** is set to maximum.

The **Mode** Switch determines the type of signal that your Receiver recovers. For standard boradcast and international short wave signals, use the AM position. For code or SSB signals, use either USB/CW or LSB/CW position. If pulse-type noise interferes with reception of AM signals, use the AM ANL position. You may notice that with the AM ANL position (Automatic Noise Limiter), the signal reception seems to drop slightly; this is normal (thus it is best not to use the ANL mode unless noise is a serious problem).

When tuning SSB and code signals, adjust the **kHz** tuning control very slowly. In the Ham bands, much of the activity is in code or SSB. If the SSB signal is very strong, proper reception will be improved if you adjust **RF GAIN** away from maximum. If you tune through an SSB signal and you are in the AM mode, there will only be a fluttering sound (you'll be able to tell that a signal is there, but won't be able to understand anything). Use one of the SSB modes and slowly adjust the **kHz** Tuning and/or **FINE TUNING** until the voice sounds are normal. When improperly tuned, voices will have a low gutteral sound or will sound like "Donald Duck". Tuning of SSB signals takes a little patience and practice.

If you tune through AM signals while using the USB or LSB mode, you will have a very annoying background tone, which varies with the setting of the Tuning controls. If this happens, set **Mode** to AM.

As you have noticed, there are two Modes for SSB signals – LSB and USB (Lower Side Band and Upper Side Band).

The following chart shows you the normal SSB mode of operation for the Ham bands.

METERS	FREQUENCY	SIDEBAND USED
80	3.5 to 4.0 MHz	Lower
40	7.0 to 7.3 MHz	Lower
20	14.0 to 14.35 MHz	Upper
15	21.0 to 21.45 MHz	Upper
10	28.0 to 29.7 MHz	Upper

When receiving SSB signals, the precise frequency is display frequency +3 kHz if you are using the LSB mode. For the USB mode, the precise frequency of the transmission is the display frequency –3 kHz.

The Standby mode is always incorporated in high quality communications and Ham-type Receivers. Using this mode, you leave all the main circuits "on", but disable the audio portion. Thus, you can leave the Receiver on (to maintain maximum frequency stability) and yet are not disturbed by the audio. However, don't leave in the STANDBY position for many hours if you are operating from batteries (or batteries will wear out).

The DX-300 also provides for rear panel muting. Ham radio operators require this ability when operating a transmitter (while transmitting, the Receiver must be disabled). Connecting the **MUTE** screw terminal to ground will disable the Receiver. This muting function can be activated by remote switching (normally available via the transmitter).

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 ohm impedance type. Your Radio Shack store has some good choices.

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 won't always find the same station at the same place; sometimes certain bands will be "dead" and others just jumping with activity.

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.

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 books you should consider obtaining:

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.

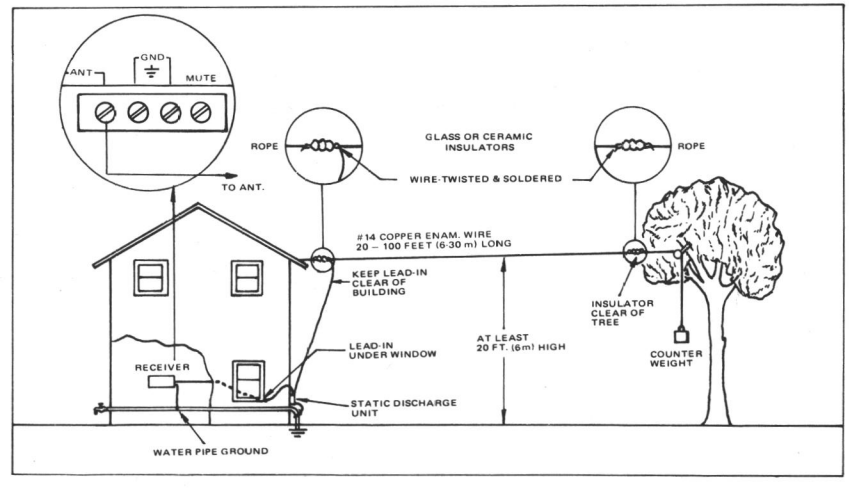
You can use 12 volts DC to power your Receiver. For example, if you want to mount the Receiver in a vehicle, or take it on a field trip, a source of 12 volts DC will operate it. Connect the 12 volt DC power to the connector on the rear using the connector cord provided; if you are using this in conjunction 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 —. (When external DC power is connected, the internal batteries are automatically disconnected.)

ANTENNAS

An antenna is a vital part of your Receiver installation. We've provided a simple back-of-the-set telescopic antenna. You'll find it provides acceptable reception for most signals. However, the better the antenna, the more signals you can receive — and the better you will receive them.

There are many different types of antennas which can be used. Unfortunately there is no single antenna which can cover the entire frequency range of the DX-300 (from 10 kHz to 30 MHz) with great efficiency.

For a simple, all-purpose antenna, follow the illustration provided. It is very important that you mount the antenna as high as possible and away from power lines, buildings and metal structures. This type of antenna will give you very good reception over all of the bands. (Your local Radio Shack store has a short wave antenna already packaged in a kit form.)



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

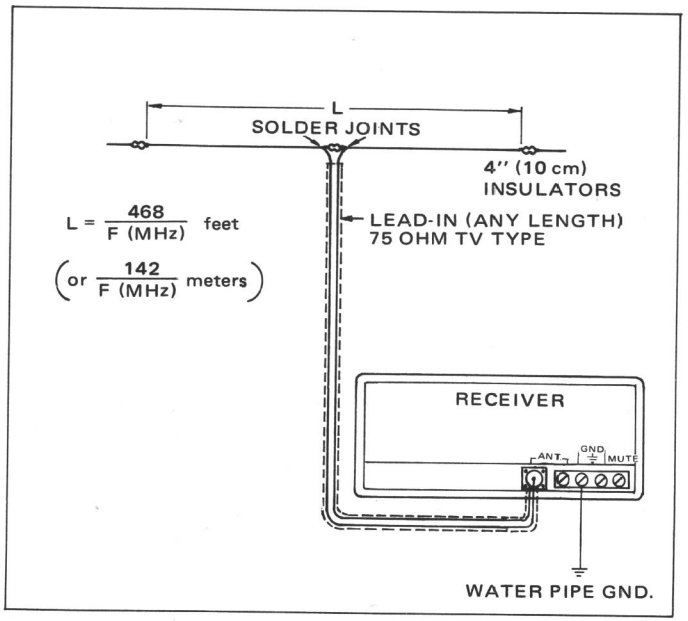
0.01 – 0.15 MHz	=	Antenna length 1-1/4 miles (2 km) (probably far too long for you to erect – you can obtain good reception even with shorter antennas)
0.15 – 0.5 MHz	=	Antenna length, 1440 feet (440 m) (see above note)
0.5 – 1.6 MHz	=	Antenna length, 490 feet (150 m) (see above note)
1.6 – 4.5 MHz	=	Antenna length, 153 feet (47 m)
4.5 – 12 MHz	=	Antenna length, 57 feet (17 m)
12 – 30 MHz	=	Antenna length, 22 feet (6.8 m)

160 Meter Ham Band	=	Antenna length, 246 feet (75 m)
80 Meter Ham Band	=	Antenna length, 117 feet (35.6 m)
40 Meter Ham Band	=	Antenna length, 66 feet (20 m)
20 Meter Ham Band	=	Antenna length, 33 feet (10 m)
15 Meter Ham Band	=	Antenna length, 22 feet (6.7 m)
10 Meter Ham Band	=	Antenna length, 16 feet (4.9 m)

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

$$\text{Length of 1/2-wave antenna in feet} = \frac{468}{\text{Freq. in MHz}}$$

$$\text{Length of 1/2-wave antenna in meters} = \frac{142}{\text{Freq. in MHz}}$$



For example, if you want to pick up International Short Wave 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 formula:

$$\text{1/2-wave antenna} = \frac{468}{15.35} = 30.5 \text{ feet} \quad \frac{142}{15.35} = 9.3 \text{ meters}$$

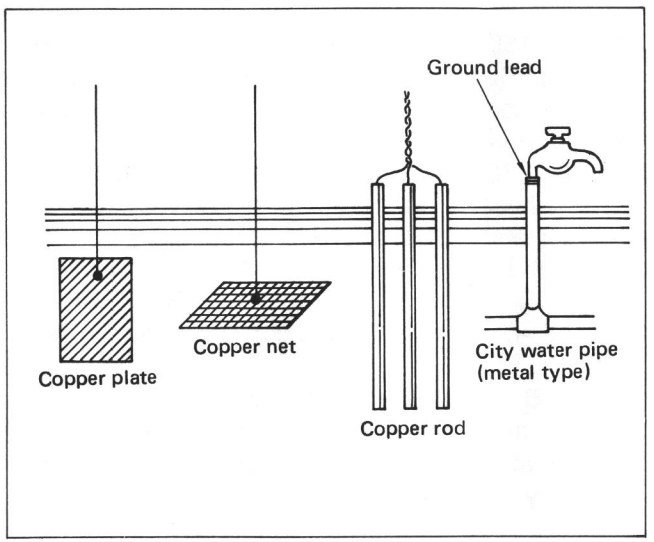
So, put up an antenna 30-1/2 feet (9.3 m) long; that will give you best reception for the 19 Meter International Short Wave Band.

For lots more information about antennas, obtain a copy of THE RADIO AMATEUR'S HANDBOOK by ARRL.

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

GROUNDING

To insure best reception, you must always connect a Ground wire to one of the **GND** screws on the back of the Receiver. Use a heavy gauge wire for this. Connect the other end either to a metal cold water pipe (**not** hot water and **not** natural gas pipe) or to a metal rod driven into the ground. Or, you can bury a copper plate or copper screen in the ground and make connection to it.



FREQUENCY CONVERSION

Your Communications Receiver is calibrated in Megahertz (MHz) and Kilohertz (kHz) – as most communications-type receivers are. However there is one other term used quite often – you should know these terms and how to convert from each one to the others.

First, Megahertz. This stands for millions-of-Hertz (or cycles-per-second 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. Kilo means 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)

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

9.62 MHz x 1000 = 9620 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:

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

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:

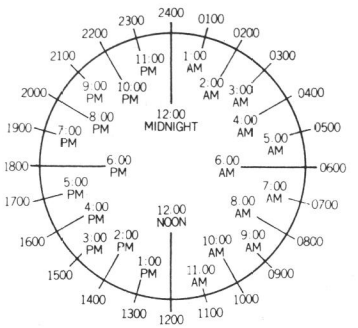
$$\text{MHz} = \frac{300}{\text{meters}}$$

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

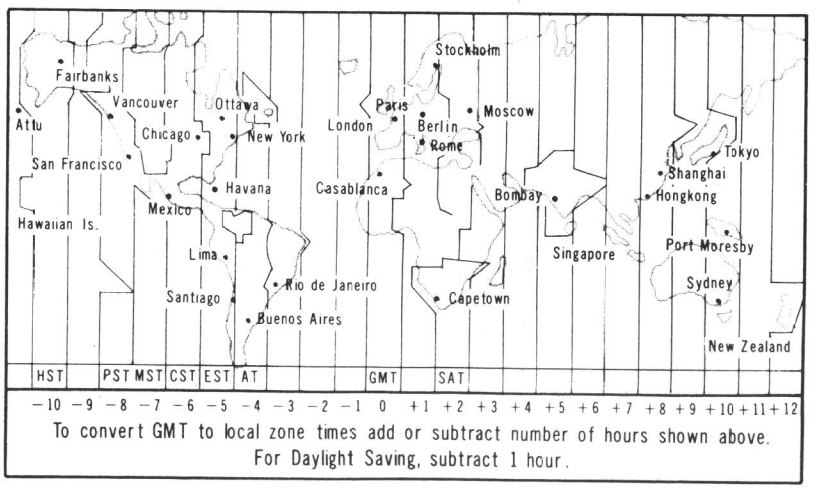
$$\frac{300}{19.5\ \text{meters}} = 15.385\ \text{MHz}$$

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). GMT is also termed "Z" or Zulu time. Or UTC (Co-ordinated Universal Time); UTC will become the standard term for this time within a few years – so get used to it.



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.

.01 to .15 MHz (10 to 150 kHz) is a relatively new band for radio communications work. About the only ones who are down here are various experimental stations and some military (primarily Navy) communications. Reception of any signals in this band of frequencies will depend entirely on your location.

.15 – .5 MHz (150 to 500 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 (CW or AM). 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.

.5 – 1.6 MHz (500 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.

1.6 – 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 won't 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.

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. You'll hear code signals from 3.5 to 3.8 and voice from 3.8 to 4.0.

4.5 – 12 MHz. This and the next band 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.

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

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, try another.

12 – 30 MHz offers more fine listening. WWV has time standard signals at 15, 20 and 25 MHz; CHU has one at 14.67 MHz. There are 4 Short Wave bands here, plus 3 Ham bands and the CB frequencies. The sun spot cycle greatly effects DX reception within this band. The peak of the last cycle passed about in 1969 and the minimum was about 1975-6; the greater the sun spot activity, the better the reception at these higher frequencies. So, don't be surprised if reception is not as good as some of the lower bands.

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

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

The 13 and 11 meter Short Wave Bands (21.45-21.75 and 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.

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

There is always activity on the Citizens' Band (11 meters, channels 1 through 40), especially in areas near large cities.

MORSE CODE AND RADIO TERMS

Familiar Short Wave and Amateur Radio Terms

AF Gain Control – same as volume control

AM (Amplitude Modulation) – the amplitude of the transmitting signal is varied at an audio rate.

ANL (Automatic Noise Limiter) – reduces impulse noises (ignition, static, crashes, etc.).

ANT – Antenna

AVC (Automatic Volume Control) – controls the gain of the radio frequency amplifying circuits automatically (i.e. reduces gain on strong signals).

BFO (Beat Frequency Oscillator) – provides a special internal signal so that CW (code) signals can be heard.

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

CW (Continuous Wave) – unmodulated signal wherein intelligence is transmitted by interrupting signal to produce dots and dashes (code).

DX – distant stations

FM (Frequency Modulation) – the transmitting frequency is varied at an audio rate.

QRM – interference from other signals

QRN – interference static

QRX – Stand-by

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

QSO – a contact between two stations

QSY – change operating frequency.

RF Gain Control – radio frequency gain control: controls the sensitivity of the radio frequency amplifier stage.

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

SSB – Single Side Band (USB = upper side band; LSB = lower side band)

SWL – short wave listener

73's – best regard

88's – love and kisses

XYL – wife

YL – young lady

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

10-0 Caution
10-1 Unable copy – change location
10-2 Signal good
10-3 Stop transmitting
10-4 Acknowledgment (OK)
10-5 Relay
10-6 Busy – unless urgent
10-7 Out of service
10-8 In service
10-9 Repeat
10-10 Fight in progress
10-12 Stand by (stop)
10-13 Weather – road report
10-14 Prowler report
10-15 Civil disturbance
10-18 Quickly
10-19 Return to –
10-20 Location
10-24 Assignment completed
10-31 Crime in progress
10-32 Man with gun
10-33 EMERGENCY
10-34 Riot
10-35 Major crime alert
10-36 Correct time
10-39 Urgent – use light, siren
10-40 Silent run – no light, siren
10-50 Accident (F, PI, PD)
10-51 Wrecker needed
10-52 Ambulance needed
10-53 Road blocked at
10-57 Hit and run (F, PI, PD)
10-70 Fire alarm
10-78 Need assistance
10-80 Chase in progress
10-89 Bomb threat
10-90 Bank alarm at
10-98 Prison/jail break
10-99 Wanted/stolen indicated

NOTE: 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

Letter	Phonetic Sound	Dot-Dash Sequence
A	di–dah	•–
B	dah–di–di–dit	–•••
C	dah–di–dah–dit	–•–•
D	dah–di–dit	–••
E	dit	•
F	di–di–dah–dit	••–•
G	dah–dah–dit	––•
H	di–di–di–dit	••••
I	di–dit	••
J	di–dah–dah–dah	•–––
K	dah–di–dah	–•–
L	di–dah–di–dit	•–••
M	dah–dah	––
N	dah–dit	–•
O	dah–dah–dah	–––
P	di–dah–dah–dit	•––•
Q	dah–dah–di–dah	––•–
R	di–dah–dit	•–•
S	di–di–dit	•••
T	dah	–
U	di–di–dah	••–
V	di–di–di–dah	•••–
W	di–dah–dah	•––
X	dah–di–di–dah	–••–
Y	dah–di–dah–dah	–•––
Z	dah–dah–di–dit	––••

Numbers

1	di–dah–dah–dah–dah	•————
2	di–di–dah–dah–dah	••–––
3	di–di–di–dah–dah	•••––
4	di–di–di–di–dah	••••–
5	di–di–di–di–dit	•••••
6	dah–di–di–di–dit	–••••
7	dah–dah–di–di–dit	––•••
8	dah–dah–dah–di–dit	–––••
9	dah–dah–dah–dah–dit	––––•
0	dah–dah–dah–dah–dah	—————

COUNTRY LOG

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

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

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

CITY	COUNTRY	CALL	MHz	PROGRAM TIME HEARD
Monrovia	Liberia	ELBC	3.255	
Belize	British Honduras		3.300	
Accra	Ghana		3.366	
Paradys	S. Africa		4.810	
	Singapore	FBS	5.010	
Dar-es-Salaam	Tanzania		5.050	
Addis-Ababa	Ethiopia		5.060	
Sao Paulo	Brazil	ZTR226	5.955	
Ismaning	Germany		5.960	
Ciudad	Dominican Republic	Radio Caribe	5.970	
Jesselton	North Borneo		5.980	
Cap Haitien	Haiti	4VB	5.980	
Bucharest	Rumania		5.990	
Brussels	Belgium	ORU	6.000	
Abu Zabad	Egypt		6.015	
Salisburg	Rhodesia		6.020	
Tangier	Morocco		6.025	
Abu Ghurais	Iraq		6.030	
Daventry	England	GWS	6.035	
	Monaco	3M3	6.037	
Nanking	China	BCA22	6.040	
Djakarta	Indonesia	YDF	6.045	
Ibadan	Nigeria		6.050	
Warsaw	Poland		6.055	
Seckville N.B.	Canada	CKR2	6.060	
Delhi	India		6.065	
Minsk	U.S.S.R.		6.075	
Halifax	Canada		6.100	
London	England	BBC	6.110	
	Monaco			
Tokyo	Japan	FEN	6.160	
Mexico City	Mexico		6.165	
Berne	Switzerland		6.165	
Kaduna	Nigeria		6.175	
Pyongyang	North Korea		6.195	
Pyongyang	North Korea		6.250	
Cairo	Egypt		7.051	
Chiavi	Taiwan		7.100	
Brazzaville	Congo		7.105	
Naha	Okinawa	VOA	7.160	
Budapest	Hungary		7.220	
Karachi	Pakistan		7.280	
Berlin	East Germany		7.300	
Prague	Czechoslovakia		7.340	
Moscow	U.S.S.R.	Radio Moscow	7.555	
Jerusalem	Israel		9.009	
Brussels	Belgium		9.144	

CITY	COUNTRY	CALL	MHz	PROGRAM TIME HEARD
Sofia	Bulgaria		9.255	
Peking	China		9.480	
Copenhagen	Denmark	OZF	9.520	
Havana	Cuba		9.531	
Lagos	Nigeria		9.535	
Berne	Switzerland		9.535	
Wellington	New Zealand	ZL2	9.540	
Prague	Czechoslovakia		9.550	
St. George's	Windward Islands	WIBS	9.550	
Bucharest	Rumania		9.570	
Roma	Italy	RAI	9.575	
Montreal	CAnada	CBC	9.585	
Lourenco Marques	Mozambique	CR7BI	9.616	
Stockholm	Sweden	Radio Sweden	9.665	
Buenos Aires	Argentina	LRA	9.690	
Cuidad	Dominican Republic	Radio Caribe	9.735	
Peking	China		9.785	
Moscow	U.S.S.R.	Radio Moscow	9.805	
Barbados	Windward Island	2NX50	11.475	
Moscow	U.S.S.R.	Radio Moscow	11.570	
Cairo	Egypt		11.665	
Bangkok	Thailand	HSK9	11.670	
Karachi	Pakistan		11.674	
Stockholm	Sweden	Radio Sweden	11.705	
New Delhi	India		11.710	
Melbourne	Australia	VLA	11.710	
Hilversum	Holland		11.730	
St. George's	Windward Islands		11.735	
Rabat	Morocco		11.735	

CITY	COUNTRY	CALL	MHz	PROGRAM TIME HEARD
Vatican City	Vatican	HVJ	11.740	
Montreal	Canada	CBC	11.760	
Djakarta	Indonesia		11.795	
Melbourne	Australia	VLA	11.810	
Moscow	U.S.S.R.	Radio Moscow	11.813	
Brussels	Belgium	ORU	11.850	
Elizabethville	Katanga		11.866	
Manila	Philippines	DZF2	11.920	
Brazzaville	Congo		11.925	
	Singapore	BBC-FES	11.955	
Peking	China		12.125	
Tehran	Iran	2PB	15.125	
Tokyo	Japan	JOA15	15.135	
Helsinki	Finland	O1X4	15.190	
Montreal	Canada		15.190	
Monrovia	Liberia	ELWA	15.198	
Taipei	Taiwan	BED3	15.225	
Belgrade	Yugoslavia		15.240	
Stockholm	Sweden	Radio Sweden	15.240	
Tel Aviv	Israel		15.250	
Colombo	Ceylon		15.265	
Warsaw	Poland		15.275	
Wellington	New Zealand	ZLA	15.280	
Melbourne	Australia	VLA	15.315	
Paris	France		15.350	
New York City	U.S.A.	WRUL	15.380	
Cologne	West Germany	DMQ15	15.405	
Seoul	South Korea	HLK9	17.745	
New York City	U.S.A.	WRUL	17.750	
Lisbon	Portugal	CSA44	17.870	

NOTES

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This equipment is warranteed against defects for 1 year from date of purchase. Within this period, we will repair it without charge for parts and labor. Simply **bring your sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover equipment subjected to misuse or accidental damage.

This Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

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