5-Band Communications Receiver

DX-200

OWNER'S MANUAL

PLEASE READ BEFORE USING THIS EQUIPMENT

REALISTIC®

CAT.NO. 20-205

CUSTOM MANUFACTURED FOR RADIO SHACK A DIVISION OF TANDY CORPORATION

... It All Comes Alive on Your Realistic DX-200 Communications 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.

Radio Amateurs, or "Hams" as they are called, constantly use short wave frequencies to communicate with one another through out 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-200 5-BAND COMMUNICATIONS RECEIVER covers 150 – 400 kHz and 520 kHz – 30 MHz. It's able to receive AM (Amplitude Modulation), CW (Continuous Wave [better known as "code"], and SSB (Single Side Band) signals.

The BAND SPREAD dial electronically expands the frequencies on 10 Short-wave bands, 5 amateur ("Ham") bands, and the CB band. This enables you to easily and accurately find the frequency of the station you're listening to (so you can find it quickly the next time you want to listen).

The DX-200 uses 13 transistors (including 5 FETs), 4 integrated circuits, 16 diodes, and 5 LEDs.

Your unit operates on 120 Volts AC, 60 Hz for USA/Canadian models and 220/240 Volts AC, 50 Hz for European/Australian models.

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 _____

Main Features Include:

* Frequency coverage from 150 – 400 kHz and 520 kHz – 30 MHz.
* Superheterodyne circuitry.
* Large, easy-to-read frequency display dials for both MAIN TUNING and BAND SPREAD.
* "FAST" and "SLOW" AGC (Automatic Gain Control) selector
* Variable BFO (Beat Frequency Oscillator) PITCH for reception of CW and SSB signals.
* ANTenna TRIMmer matches your antenna to the frequency band you're listening to.
* Five-element ceramic filter for outstanding selectivity (freedom from adjacent channel interference).
* Dual MOS FETs in the critical RF and mixer stages eliminate cross-modulation and RF distortion.
* All solid-state circuitry provides maximum efficiency with minimum noise.
* Integrated circuit audio amplifier for high-intelligibility.
* 500 kHz marker for calibration of MAIN TUNING and BAND-SPREAD.
* STANDBY switch and rear-panel MUTE contact for use in two-way ("Ham") installations.
* External speaker jack.

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

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

SPECIFICATIONS

SEMICONDUCTOR COMPLEMENT:	4 integrated circuits, 13 transistors, 16 diodes, 5 LEDs.
RECEIVING SYSTEM:	Single conversion
FREQUENCY COVERAGE:	0.15 – 0.40 MHz (150 – 400 kHz) 0.52 – 1.6 MHz (520 – 1600 kHz) 1.55 – 4.5 MHz 4.5 – 13 MHz 13 – 30 MHz
RECEPTION MODE:	AM, LSB, USB, CW
ANTENNA IMPEDANCE:	Lo-Z for 50 ohms antenna and HI-Z for long wire antenna.
SENSITIVITY (AM) (for 10 dB Signal-to-Noise ratio):	250 kHz 1 μV 1 MHz 1 μV 2.5 MHz 1 μV 7 MHz 1 μV 21 MHz 1 μV
IMAGE RATIO:	250 kHz 55 dB 1 MHz 40 dB 2.5 MHz 40 dB 7 MHz 30 dB 21 MHz 15 dB
SELECTIVITY:	– 6 dB 4 kHz –40 dB 8 kHz
INTERMEDIATE FREQUENCY:	455 kHz
SIGNAL-TO-NOISE RATIO:	45 dB at 7 MHz, 1 mV
S-METER SENSITIVITY:	S-9 = 30 μV at 7 MHz
AGC (at 7 MHz):	10 dB change in output for 80 dB change in input.
RF GAIN CONTROL RANGE:	80 dB at 7 MHz
BFO PITCH RANGE:	±3 kHz
FIDELITY RESPONSE: (AM) (1 kHz = 0 dB, 50 mW)	300 Hz –4 dB 2 kHz –8 dB
AUDIO OUTPUT:	1.5 W, 10% THD
THD (at 7 MHz, 1 mV):	3% at 30% modulation 5% at 80% modulation
HUM & NOISE:	Speaker output at minimum Volume, 3 mV Headphone output at minimum Volume, 0.3 mV
CALIBRATOR, ACCURACY:	500 kHz, 20 ppm
POWER REQUIREMENTS:	AC-120 V, 60 Hz for USA/Canadian models AC-220/240 V, 50 Hz for European/Australian models
DIMENSIONS:	5-3/4 x 14-1/2 x 8" HWD (145 x 360 x 200 mm)
WEIGHT:	4.1 kg

A QUICK LOOK AT YOUR DX-200

The Front Panel

BFO PITCH – (Beat Frequency Oscillator) Use for adjusting CW (code) signal pitch or to achieve proper pitch of an SSB signal.

SIGNAL STRENGTH Meter – Shows relative strength of received signal.

ANTenna TRIMmer – matches your antenna to the frequency band you're listening to.

AGC Switch – (Automatic Gain Control) Used to select the AGC rise time. Normally, leave it is SLOW. Use FAST for weak SSB signals.

BAND Selector & Indicator – Set to appropriate band.

BAND SPREAD Tuning & Dial – Provides fine tuning for any of the bands of operation.

Cursor – Use for calibrating the Main Tuning Dial.
See Band Spread and Dial Calibration

MAIN TUNING & DIAL – Used for tuning to the frequency you desire.

Speaker – Automatically disconnected when headphones are plugged in.

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

CALIBRATOR Switch – Use for calibrating the Main Tuning and Band Spread Tuning Dials.
See Band Spread and Dial Calibration.

Mode Selector – Determines mode of operation.

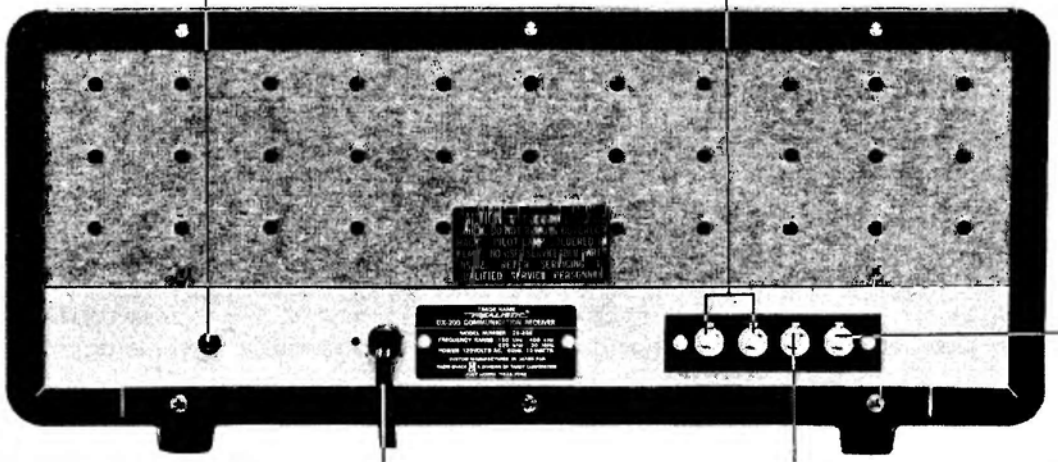
VOLUME/OFF Control – Use to turn Receiver "on" and adjust volume of sound.

RF GAIN Control – Use to adjust sensitivity of Receiver. (Normally left at maximum [10].)

The Rear Panel

EXTernal SPeaKeR Jack – Connect an external speaker to this jack (automatically disconnects built-in speaker).

Antenna Screw Terminals – Connect 1/2-wave dipole antennas to the LO-Z (low impedance) terminal and long wire antennas to the HI-Z (high impedance) terminal.



MUTE Screw Terminal – Can be used for remote muting of the Receiver (without using STANDBY Mode Selector position).

Power Cord – Plug into a standard AC outlet.

GrouND Screw Terminal – Connect a wire between this screw and a good electrical ground point.

INSTALLING YOUR RECEIVER

Your Realistic DX-200 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.

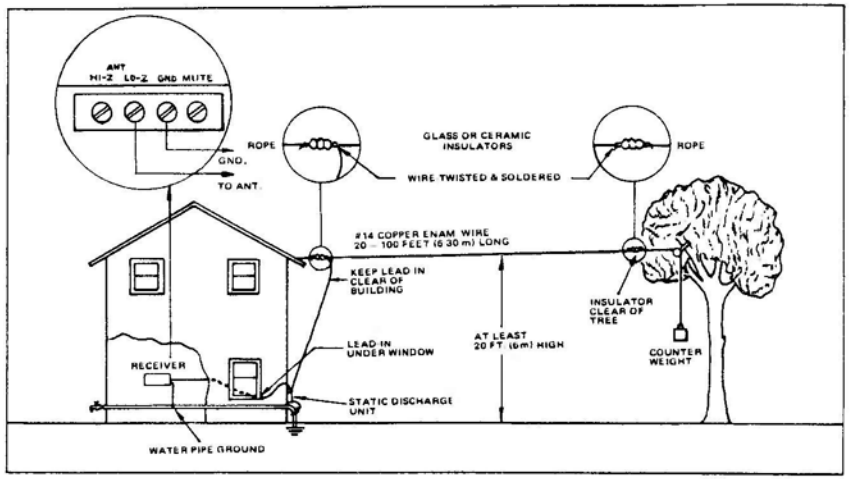
Decide where you want to set up the Receiver. In making your decision you should consider:

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. To realize 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 below. In any case, it should be an outside antenna.
3. YOUR GROUND. 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.

ANTENNAS

Your antenna is the MOST vital part of your Receiver Installation.
IMPORTANT: Your DX-200 will not receive any stations until an external antenna is connected to it.

Although there are many different types of antennas that you can use, there is no single antenna that can cover the entire frequency range of the DX-200 efficiently.
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. This type of antenna is called a half-wave dipole since its length is approximately half of the radio wave length at the particular frequency.

0.15 - 0.40 MHz	=	Antenna length, 1870 feet (570 m) (probably far too long for you to erect but you can obtain good reception even with shorter antennas).
0.52 - 1.6 MHz	=	Antenna length, 460 feet (140 m) (see above note)
1.55 - 4.5 MHz	=	Antenna length, 185 feet (56 m)
4.5 - 13 MHz	=	Antenna length, 67 feet (20 m)
13 - 30 MHz	=	Antenna length, 24 feet (7.3 m)

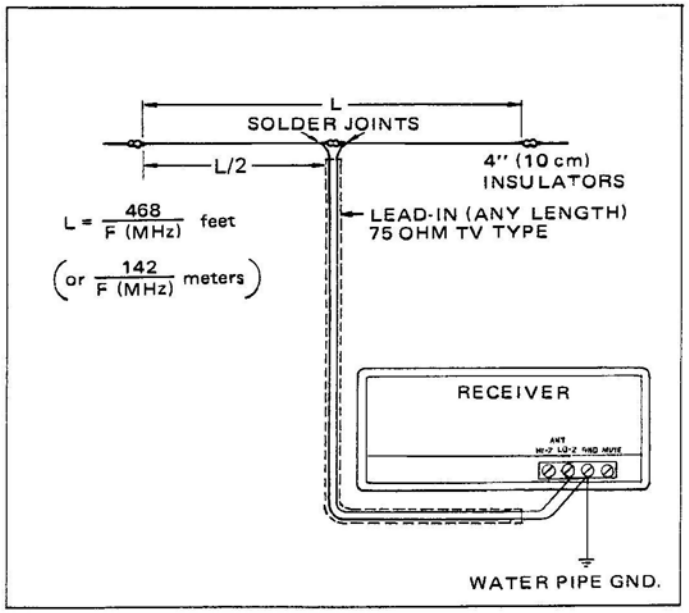
160 Meter Ham Band = Antenna length, 246 feet (75 m)
80 Meter Ham Band = Antenna length, 117 feet (35.6 m)
40 Meter Ham Band = Antenna length, 66 feet (20 m)
20 Meter Ham Band = Antenna length, 33 feet (10 m)
15 Meter Ham Band = Antenna length, 22 feet (6.7 m)
10 Meter Ham Band = Antenna length, 16 feet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

$$\text{Length of 1/2-wave antenna in feet} = \frac{468}{\text{Freq. in MHz}} = 26.5'$$

17.64

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



Half-Wave Dipole Installation

For example, if you want to pick up International Short Wave signals specifically in the 19 Meter band (15.1 to 15.45 MHz). Pick a frequency in that range, such as 15.35 MHz. Using the formula:

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

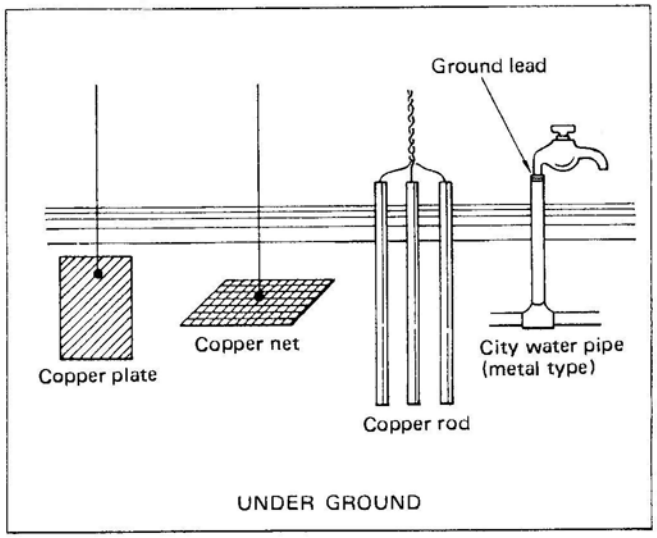
So, you would need to put up an antenna 30½ (9.3 m) long to get the best reception on the 19-meter band. (See the Installation Diagram above. A dipole antenna is made up of two pieces of wire, each half of the total length.)

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 the GND screw 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.



OPERATION

Before operating your DX-200, an antenna and ground must be connected. And, of course, the power cord must be connected to a standard AC outlet.

Since you're probably most familiar with the standard AM broadcast band, try your DX-200 there first.

1. Turn the Receiver on by rotating **VOLUME** Control clockwise.
2. Set **Mode** Selector to AM.
3. Set **BAND** Selector to 0.52 – 1.6.
4. Set **BAND SPREAD** Tuning to the "SET" position.
5. Set **AGC** Switch to SLOW.
6. Set **RF GAIN** Control to 10.
7. Adjust **MAIN TUNING** to the desired frequency as shown on the Main Tuning Dial and to obtain maximum S-Meter reading.
8. Adjust **ANT TRIM** for maximum reading on the S-Meter.
9. If noise is excessive, set Mode Selector to AM/ANL.

If you wish, you can use **BAND SPREAD** for fine-tuning, but the accuracy of the Main Tuning Dial will not be precise if BAND SPREAD is not set to the "SET" position.

Tuning LF Band [0.15 – 0.40 MHz]

Once you've become familiar with the DX-200 operation on the standard AM broadcast band frequencies, you can try the low frequencies from 150 kHz up to 400 kHz.

1. Set **BAND** Selector to 0.15 – 0.40.
2. Set **BAND SPREAD** Tuning to the "SET" position
3. Set **AGC** Switch to SLOW.
4. Set **RF GAIN** Control to 10.
5. Adjust **MAIN TUNING** to the desired frequency as shown on the Main Tuning Dial and to obtain maximum S-Meter reading of the signal you're listening to.
6. Adjust **ANT TRIM** for maximum reading on the S-Meter.
7. Adjust **MAIN TUNING** to the desired frequency as shown on the Main Tuning Dial and to obtain maximum S-Meter reading.

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, the frequency indicated on the Main Tuning Dial will not be accurate if the **BAND SPREAD** is not set to the "SET" position.

Tuning Frequencies Above 2 MHz

"Working" these bands (a term short-wave listeners and "hams" like to use) requires greater skill, precision, and patience. Here's where you'll use the versatile controls of your DX-200 to greatest advantage. It may take a while before you're an experienced SWLer (short-wave listener) and be able to use your Receiver to full advantage.

1. Set **BAND** Selector to the desired position.
2. Adjust **MAIN TUNING** to the desired frequency on the Main Tuning Dial. You probably will need to use BAND SPREAD to fine-tune the signals.
3. Adjust **ANT TRIM** for maximum reading on the S-Meter.
   Adjust **BAND SPREAD** Tuning for maximum S-Meter reading and/or most precise signal sound.
4. If you are tuning for SSB (single sideband) or CW (continuous wave, or "code" as the more common term is), set Mode Selector to SSB/CW and **AGC** Switch to FAST (if receiving signal is strong, set **AGC** Switch to SLOW). Adjust **BFO PITCH** to tune in the signal precisely.
5. If you are in the AM mode and noise is excessive, set Mode Selector to AM/ANL.

SPECIAL OPERATING NOTES

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.

MAIN TUNING Dial shows the frequency you are tuned to.

The red marks are calibration marks for Band Spread calibration. (See Calibration of the Dial Scales, page 11.)

The **BAND SPREAD** Dial is the "fine tuning" dial scale. It is accurate only when the **MAIN TUNING** control is used to set the dial pointer directly over one of the red Band Spread calibration points.

The AGC 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 AGC; this is best for code and SSB signals (if the SSB signal is strong, set **AGC** Switch to SLOW position), also for stations which seem to fade and flutter in strength. Use the position which results in the most steady signal sounds.

The **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.

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 broadcast and international short wave signals, use the AM position. For code or SSB signals, use the SSB/CW position. To help you decide whether to use USB (upper sideband) or LSB (lower sideband) see the chart on page 10. If pulse-type noise interferes with reception of AM signals, use the AM/ANL position. You may notice that with the AM/ANL (Automatic Noise Limiter) position, the signal reception seems to drop slightly; this is normal.

When tuning SSB and code signals, adjust the **BAND SPREAD** tuning control very slowly. In the Ham bands, much of the activity is in code or SSB. If an 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 when 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). Switch to the SSB mode (USB – LSB, See Page 10) and slowly adjust the **BAND SPREAD** Tuning and **ANT TRIM** for maximum meter reading. Now, very slowly and carefully adjust **BFO PITCH** 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 patience and practice.

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

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

The following chart shows you the normal SSB mode of operation for the Ham bands. (For receiving SSB on otherbands, try both USB and LSB until you're able to clarify the signal.).

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

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. (This is often used by "hams" while transmitting.) Thus, you can leave the Receiver on (to maintain maximum frequency stability) and yet are not disturbed by the audio. However, don't leave the Receiver in the STANDBY position for many hours.

The DX-200 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 **GND** will disable the Receiver. This muting function can be activated by remote switching (normally available via the transmitter).

A pair of headphones is necessary for serious SWLing. They make it much easier to hear and understand 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. 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.

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

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

There are many variables 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 out signals completely.

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

IMPORTANT: At certain times, some bands will be "dead" (no sound at all). This is a normal condition because of the variables in reception.

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.

CALIBRATION OF THE DIAL SCALES

For serious short-wave listening, it's important that dial scales be correctly calibrated for exact frequency readout. (You'll need exact frequencies for logs and getting acknowledgements [QSLs] from stations.) In this case, the dial scales should be calibrated on a regular basis. If you're not concerned with "exact" frequencies, you can skip calibration. (The dial will read very closely anyway.)

MAIN TUNING Calibration

NOTE: Calibration of the **MAIN TUNING** Dial Scale for the lower two bands (0.15 – 0.40 MHz and 0.52 – 1.6 MHz) is usually not necessary.

Proceed as follows for the other bands:

1. Set **BAND SPREAD** Tuning to "SET".
2. Set **BAND** Selector to the desired band.
3. Set **RF GAIN** Control to maximum (10).
4. Set **VOLUME** as desired.
5. Set **BFO PITCH** to 12-oclock (middle) position.
6. Set **CAL** Switch to "500 kHz.".
7. Switch **Mode** Selector to SSB/CW.
8. Set **MAIN TUNING** to the desired calibration frequency (must be an even multiple of 500 kHz, such as 10 MHz).
   NOTE: 500 kHz is the same as 0.5 MHz. A kilohertz (kHz) is 1000 Hertz; a megahertz (MHz) is 1,000,000 Hertz. So 1000 kHz = 1 MHz. More on this later.
9. Adjust **MAIN TUNING** until you hear a constant tone in the vicinity of the calibration frequency.
10. Move **MAIN TUNING** slightly in either direction until you hear a second constant tone.
11. Set **MAIN TUNING** to the lower tone. This is the correct "marker" frequency.
12. Slide and set the cursor exactly to your calibration frequency. In this position, it will indicate the exact frequency in the band (as long as **BAND SPREAD** is in the "SET" position).

BAND SPREAD Calibration

For frequencies on the **BAND SPREAD** dial to be read accurately, the dial should be periodically calibrated as follows:

EXAMPLE: Calibrating the 40 meter (7 MHz) **BAND SPREAD** dial.

1. Set **BAND** Selector to 4.5 – 13 MHz.
2. Set **RF GAIN** Control to maximum (10).
3. Set **VOLUME** as desired.
4. Set **BFO PITCH** to 12-oclock (middle) position.
5. Switch Mode Selector to SSB/CW.
6. Set **CALIBRATOR** Switch to "500 kHz".
7. Set **MAIN TUNING** to the appropriate red mark for 40-meters on the **MAIN TUNING** Dial Scale.
8. Set **BAND SPREAD** Tuning to 7.000 MHz. (The frequency used must be an even multiple of 500 kHz.)
9. Slightly adjust **MAIN TUNING** until you hear two constant "beat" tones.
10. Turn **MAIN TUNING** to the lower tone. When MAIN TUNING is in this position, the **BAND SPREAD** dial indicates the correct frequency.

    NOTE: From time to time during calibration, the signals from the marker may be interfered with by signals coming in from your antenna. If this presents a problem, temporarily disconnect your antenna while calibrating. (You may want to do this anyway since it makes for fewer distractions.)

FREQUENCY CONVERSION

Your Communications Receiver is calibrated in Megaherz (MHz) and Kilohertz (kHz) – as most communications-type receivers are. However there is one other term (meter) 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 word, 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) = 1,000 kHz (thousand)

Thus, to change 9.62 MHz to kHz, we multiply by 1,000.

$9.62 \times 1{,}000 = 9{,}620$ kHz

To go the other way, from kHz to MHz, divide by 1,000. Thus, a station at 3,780 kHz is

$$\frac{3{,}780}{1{,}000} = 3.780 \text{ MHz}$$

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?

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

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.

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-200 allows you to clarify a single side band signal with the built-in "product detector" circuit. The SSB/CW (USB or LSB See Page 10.) 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 MHz.

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 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 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/H 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 3.33, 7.335 and 14.67 MHz. Voice announcements are made every minute in both English and French over station "CHU".

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.

.15 – .4 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 (CW or AM). There are a number of aeronautical and marine radio beacons in these bands. You may even come across some weather sinals. 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.

.52 – 1.6 MHz (520 to 1600 kHz) is the standard 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 (reception condition) 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 MHz.

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 MHz.

4.5 – 13 MHz. This and the next band (13 – 30 MHz) are the best ones for Short Wave Listening. Certain times of the year and day, these bands are just full of signals.

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 (5.96 – 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/H and the last is CHU. If you can't get one, try another.

13 – 30 MHz offers more fine listening. WWV/H 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.

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/H 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.

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 throught that radio waves wound 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.

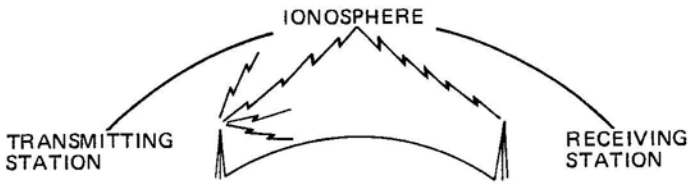
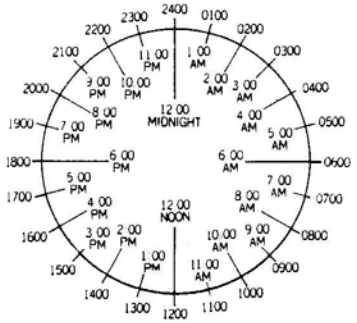


Figure 1

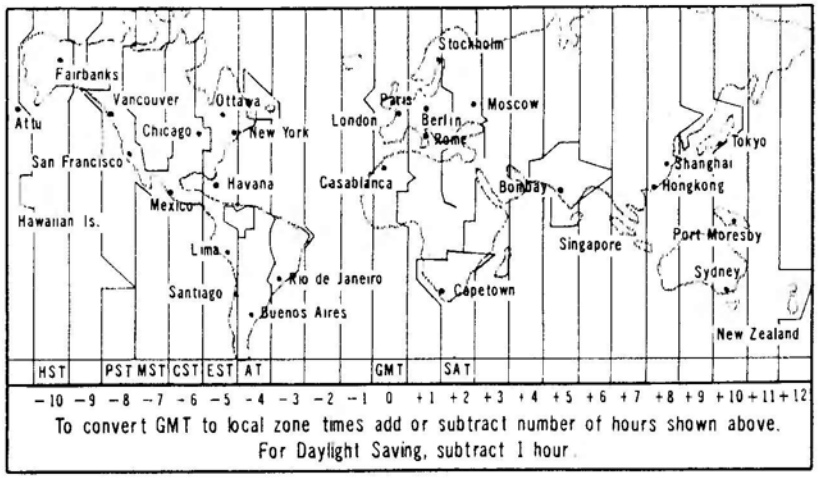
At different periods of the year, short-wave reception improves above the usual value between the receiving site and various areas in the world. As an example – the spring months bring the strongest signals from Australia and the South Pacific. In the fall months, signals from Europe and the Far East 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 1976 – 6. Maximum activity - best DX reception; minimum activity - inconsistent and/or poor DX reception. Thus, reception will vary from year to year.

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 (Coordinated 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 10:00 PM in London, Eng., 6:00 PM in New York or 8:00 AM in Tokyo (the next day).

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 – Standby.

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 regards

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	Standby (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	Letter Phonetic Sound	Dot-Dash Sequence
A di–dah	•–	T dah	–
B dah–di–di–dit	–•••	U di–di–dah	••–
C dah–di–dah–dit	–•–•	V di–di–di–dah	•••–
D dah–di–dit	–••	W di–dah–dah	•––
E dit	•	X dah–di–di–dah	–••–
F di–di–dah–dit	••–•	Y dah–di–dah–dah	–•––
G dah–dah–dit	––•	Z dah–dah–di–dit	––••
H di–di–di–dit	••••		
I di–dit	••	Numbers	
J di–dah–dah–dah	•–––	1 di–dah–dah–dah–dah	•––––
K dah–di–dah	–•–	2 di–di–dah–dah–dah	••–––
L di–dah–di–dit	•–••	3 di–di–di–dah–dah	•••––
M dah–dah	––	4 di–di–di–di–dah	••••–
N dah–dit	–•	5 di–di–di–di–dit	•••••
O dah–dah–dah	–––	6 dah–di–di–di–dit	–••••
P di–dah–dah–dit	•––•	7 dah–dah–di–di–dit	––•••
Q dah–dah–di–dah	––•–	8 dah–dah–dah–di–dit	–––••
R di–dah–dit	•–•	9 dah–dah–dah–dit	––––•
S di–di–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.

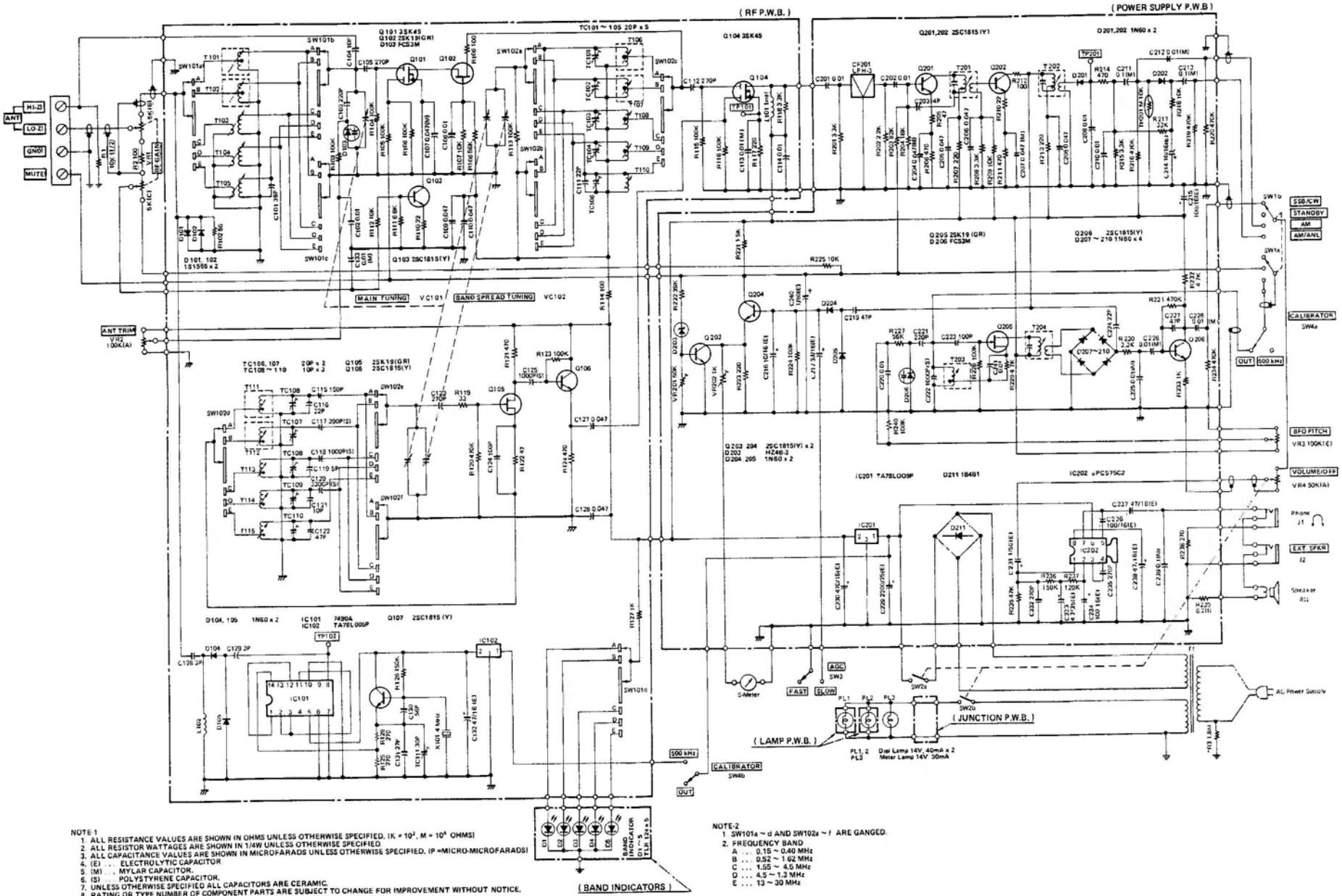
For a more complete or/and up-to-date list, check monthly periodicals on Short Wave Listening. There are many, many more stations and frequencies in constant use by all nations around the world – far more than we can list here.

CITY	COUNTRY	CALL	MHz	PROGRAM TIME HEAD
Monrovia	Liberia	ELBC	3.255	
Belize	British Honduras		3.300	
Accra	Ghana		3.366	
Jerusalem	Israel		5.900	
Sao Paulo	Brazil	ZTR226	5.955	
Ismaning	Germany		5.960	
Ciudad	Dominican Republic	Radio Caribe Republic	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 Zabad	Iraq		6.030	
Daventry	England	GWS	6.035	
	Monaco	3M3	6.037	
Naking	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	
Jerusolem	Israel		9.435	
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	
Rorna	Italy	RAI	9.575	
Montreal	Canada	CBC	9.585	
Lourenco Marques	Mozambique	CR7B1	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	

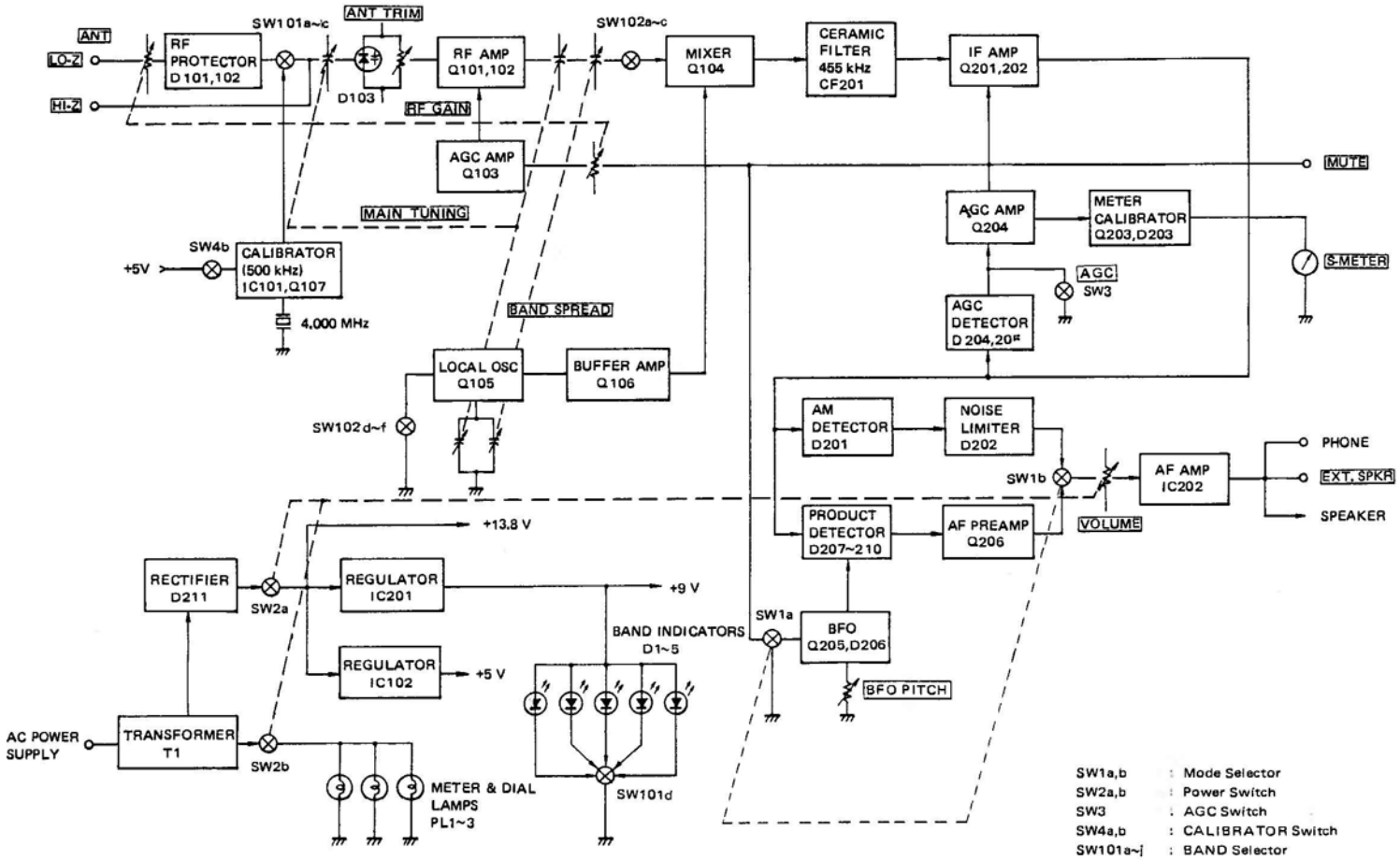
SCHEMATIC DIAGRAM



NOTE 1
1. ALL RESISTANCE VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE SPECIFIED. (K = 10^3, M = 10^6 OHMS)
2. ALL RESISTOR WATTAGES ARE SHOWN IN 1/4W UNLESS OTHERWISE SPECIFIED
3. ALL CAPACITANCE VALUES ARE SHOWN IN MICROFARADS UNLESS OTHERWISE SPECIFIED. (P =MICRO-MICROFARADS)
4. (E) . . . ELECTROLYTIC CAPACITOR
5. (M) . . . MYLAR CAPACITOR.
6. (S) . . . POLYSTYRENE CAPACITOR.
7. UNLESS OTHERWISE SPECIFIED ALL CAPACITORS ARE CERAMIC.
8. RATING OR TYPE NUMBER OF COMPONENT PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT WITHOUT NOTICE.
9. (*) DENOTES THAT FOR EUROPEAN/AUSTRALIAN MODELS R3 IS NOT USED.

NOTE-2
1. SW101a ~ d AND SW102a ~ f ARE GANGED.
2. FREQUENCY BAND
   A . . . 0.15 ~ 0.40 MHz
   B . . . 0.52 ~ 1.62 MHz
   C . . . 1.55 ~ 4.5 MHz
   D . . . 4.5 ~ 1.3 MHz
   E . . . 13 ~ 30 MHz

BLOCK DIAGRAM



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