switched in, and left in. This can give you music and programming that's unbelivably clean and quiet, without a hint of annoying distortion and noise. With the noise reduction features of the Asymmetrical Charge-Coupled FM Detector, FM stereo listening on cable feed, in many cases, will rival or exceed the noise performance of your tapes (cassettes, reel-to-reel, etc.), in terms of audio quality.

Muting Time

When either the NOISE REDUCTION or MULTIPATH REDUCTION switches are engaged, a logic system analyzes the signal for multipath and/or noise content. This process requires about ¾ of a second. Whenever a new station selection is made, the mute time is about ½ second. If a new station is selected **AND** either the NOISE REDUCTION or MULTIPATH REDUCTION switch is simultaneously engaged **OR** has already been engaged, the muting times are additive: ¾ + ½ = 1¼ seconds.

Antennas

Sending information through the air, as part of basic radio broadcasting, is a relatively simple process. At the broadcaster's end, the set-up includes a studio, transmitter, and transmitting antenna. The studio supplies program materials (music, drama, news, etc.) to the transmitter. Acting as a giant amplifier of sorts, the transmitter sends the signal at high power and a specific frequency on to the transmitting antenna in the form of alternating current. This creates an electromagentic field that propagates through the air. At your end, the listener's end, a length of wire is set up for use as a receiving antenna. When the electromagnetic field generated by the transmitter/transmitting antenna combination reaches the wire, a small AC current is induced in it. A tuner connected to this wire, or receiving antenna, translates this small current back into a "usable" form. In short, back into music, drama, and other programs for your enjoyment.

Of course, this description of what goes on in the transmission part of radio broadcasting has been greatly over-simplified. There's a lot going on in the actual transmission of stereo signals, and you'll soon discover there's a lot going on at your end when it comes to that "length of wire" or receiving antenna. This chapter is an in-depth discussion of how you can obtain the best signal possible for the TX-11b through selection and installation of an antenna system. At the same time, we offer some alternatives and ideas, so you can choose a system that's not only right for the TX-11b, but right for you and your locale.

We'll be looking at the three major topics that concern receiving antennas: antenna configurations, installing the antenna, and the feedline from the antenna to the TX-11b. Of course, if you've decided to have a company distribute TV and FM programming to your home via cable, the following information may be of passing interest only. Skip ahead to the CABLE section at the end of this chapter. If you'd like to know more about antennas, the benefits of a quality antenna, and some of the causes and cures for multipath, please read on!

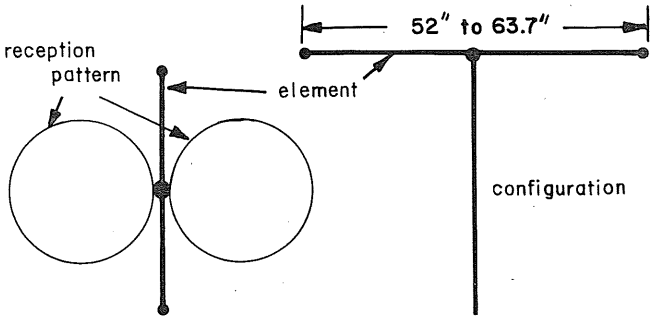
FM Antennas

Configurations

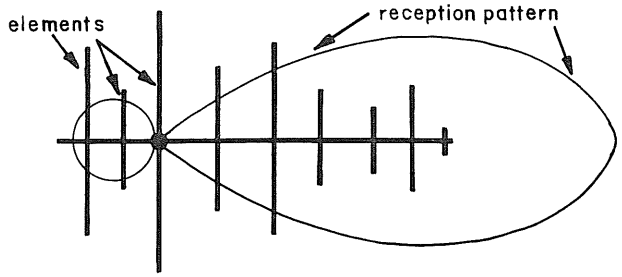
To begin this look at receiving antennas, we must first establish a reference for comparing different antennas. Our reference antenna will be a half-wave dipole, just like the one that came with the TX-11b. Antenna A is an illustration of this type of ribbon dipole antenna.

Notice the length of the "arm" or element. This is important because antennas are resonant (electrically sensitive) when their length is one-half the wavelength of the transmitted signal. Here's the formula: 5616 divided by the frequency in megahertz (MHz) = half a wavelength. The middle of the FM band is 98 MHz, so 57.3" is half a wavelength. As you can guess, this is why it's called a half-wave dipole.

Another antenna characteristic is its gain. This results from a focusing of the electromagnetic energy of a transmitted signal. The half-wave dipole that came with the TX-11b is bi-directional. If you were looking down on the dipole from above, the reception pattern would appear as it does in the diagram of Antenna A.



Now that you know the important characteristics of the reference dipole antenna, let's look at a common derivative, the Yagi (or Yagi-Uda, more correctly. It's named for the folks who invented it). The Yagi-type antenna is Antenna B in the diagram. These are multielement antennas where the driven element, the part that's connected to the feedline, is surrounded by reflectors behind it, directors in front. Look at the reception pattern in our diagram. Note the dramatic change in directionality from that of the dipole. The gain of a Yagi-type antenna depends on the number of elements, their lengths, and spacings. But compared to the reference half-wave dipole (where the gain equals "O dB",) Antenna B has a greater gain: from 6 dB to 20 dB — all other things being equal.



The practical consequences of changes in gain and directionality are several. First of all, while the reference dipole will usually deliver enough signals for good reception, is "good" good enough? Consider that the 19 kHz pilot signal the tuner uses to sense a stereo broadcast is transmitted at 1/10th the power of the signal carrier. If this pilot signal is lost, stereo goes away. If the pilot signal is degraded, so will be the stereo separation between the left and right channels. A strong signal is also necessary to reduce noise: noise associated with signal transmission, and noise from localized sources of interference. Directionality can also reduce the strength of signals coming in from elsewhere. This includes other FM stations, multipath reflections from the station you're listening to, even the blender in the kitchen.

Installations

This subject is pretty straightforward. All you really need to know is that the higher the antenna, the better. Height is important because radio waves travel in a straight line, or line-of-sight. If your antenna is free and clear of obstruction, it will perform better, and you'll gain signal strength.

Height is also important because radio waves bounce. They bounce off hills, buildings, even off the ground in front of your antenna. When a bounced wave gets to your antenna, it has travelled a slightly longer path than the line-of-sight wave, getting there slightly later. The result is phase distortion, usually the loss of stereo reception, in other words: the dreaded multipath.

The higher the antenna from the ground, the less susceptible it is to other interference, as well. A roof-mounted antenna is much less likely to "hear" vehicle ignition noise from the street, or induced interference within the home: from vacuum cleaners to the kitchen blender.

Feedlines

Feedlines can be compared, in a way, to the cables that interconnect the different components in your stereo system. If these cables and cords are of poor quality or condition, perhaps poorly installed, even the best audio components will not sound as good as they should. It's the same with antenna feedlines. You can cancel any advantage from height, or from having a multielement, high-gain antenna if the connections between the antenna and tuner aren't right. The two common feedline choices are 300 Ω twinlead (also known as "TV antenna wire"), and 75 Ω coaxial cable. There are some trade-offs when deciding which feedline is best to use with your antenna system.

300 ohm TWINLEAD

The major advantage to 300 Ω twinlead is that it's inexpensive, and if it's properly installed, signal losses within it are reasonable (about 1.25 dB per 100 feet at 100 MHz). However, if the twinlead is poorly installed, it can act like an antenna itself, degrading the performance of the rest of your set-up by picking up extra unwanted signals, and interference noise. Twinlead requires careful routing, and must be insulated from everything made of metal, like gutters, other wires, etc. Plus, if it rains in your neighborhood like it does in ours, signal losses go way up with wet twinlead.

75 ohm COAXIAL CABLE

Compared to average twinlead, 75Ω coaxial cable is more expensive, and it's a bit harder for signals to get through coax (about 3.5 dB loss per 100 feet at 100 MHz). The 75Ω impedence of the cable means a matching transformer will have to be installed at the antenna (not at the TX-11b; it has a 75 Ω connector on the rear panel). The real advantages to coaxial cable are that it's not prone to pick up extra noise and interference because it's shielded, and doesn't suffer much in wet weather. Also, you don't have to be as careful about routing, so installing coax is much easier.

Antenna Choices

As we've said, dipole antennas tend to be susceptible to noise because they aren't very directional, and because they're usually mounted inside the home. Depending on your specific area and location, signal strength will be adequate at best. This is due to the lack of directionality and, in most cases, height of the antenna. But there are some advantages, including low cost. In all fairness, the type of dipole antenna we provided will work well in many different places and situations. It should at least be used so you can start enjoying FM programming right away, before settling on another antenna system or commercial cable.

It should be pointed out that the ribbon dipole antenna that came with your tuner isn't the only style of dipole antenna. There are other dipoles which you install outdoors. These dipoles can overcome some of the problems which normally make the dipole a mediocre antenna choice.

RABBIT EARS

Unfortunately, rabbit ear antennas have the same disadvantages of the half-wave dipole. On the other hand, rabbit ears can be tuned by adjusting the "ears" to the wavelengths of the stations you listen to. Remember, a half wavelength at the bottom end of the FM band is 63.7"; at the upper end, it's 52". You can easily determine the right length of each "ear" needed for a particular station. Also, the orientation of rabbit ears is easy to change, unlike the dipole which is usually stuck to a wall somewhere. Moving rabbit ears around is simple. Changing antennas from one wall to another will work, but that isn't the whole story. Rabbit ear antennas have one more disadvantage: not as much gain as the dipole. Also, check to see if the rabbit ears have a FM trap to remove possible TV interference.

All things considered, rabbit ears will probably do a better job than the half-wave dipole included with your tuner.

INDOOR FM ANTENNAS

There are a number of "black box" or table-top FM antennas available. They're essentially rabbit ears: you can tune them for particular parts of the FM band; you can change their orientation (electrically). Losses in gain are about the same as rabbit ears, in comparison to the reference dipole antenna.

TV ANTENNAS

If a TV antenna is mounted high enough and connected with a properly installed feedline, it should result in more available signal than the antennas we've talked about so far. Perhaps not as much signal as a directional FM antenna because TV antennas are broadband (54 MHz to 216 MHz for a VHF model). However, some TV antennas have special provisions for receiving FM signals, while the rest of the antenna is used for VHF TV reception. That could be more money than you'd want to spend, unless you're using the antenna for both TV and FM reception.

If you already possess a TV antenna, or are planning to hook up to a master antenna system in an apartment building or condo, it might not work. Some TV antennas have an FM filter built-in to reject exactly the same signals you want to hear. If you fall into the group of people who already have TV antennas installed in their homes, there are still some things you may want to do before adding a splitter to supply signals for the TX-11b. You've overcome one of the costs in an antenna system by having the antenna, but possible reinstallation and new feedline may be desirable, even necessary, for proper performance. It will probably also require reaiming the antenna. That could create some problems which could degrade the TV reception. This means you'd have to install an antenna rotator. A rotator allows almost infinite realignment of the antenna to produce the best signal possible for stations you want to hear (and see) on a station-to-station basis.

OUTDOOR FM ANTENNAS

When mounted and connected properly, a directional outdoor FM antenna can provide the best signal of all, with the lowest interference and noise factor. The greatest disadvantage to this system is the cost of the antenna, mounting hardware, and a rotator. The rotator is an absolute necessity if you want to point these highly directional antennas in more than one direction. Most FM antennas of this type tend to be even more directional than a lot of VHF TV antennas, with or without special provision for FM reception. In any outdoor installation, the cost of a ground rod, feedline, and insulators must also be figured into the total price of the antenna set-up. The combined totals can quickly add up.

Other than directional FM antennas, there are outdoor dipole antennas that can provide many of the same benefits, at a somewhat lower cost. You're already familiar with the half-wave dipole which can also be called single dipole antennas. The dipole that came with the TX-11b is meant to be used indoors, and has just that one upper arm, or element. The virst variation on this dipole is an antenna that is really two single dipoles set at right angles. It works the same way as the single dipole but instead of picking up the majority of signals in two directions, the dual dipole will pick up signals in a modified omni-directional pattern.

Another outdoor variation is the S-curve omni-directional antenna. For all intents and purposes, the S-curve antenna is just a single dipole bent into a "S" shape. The change in the shape of the antenna makes its pick-up pattern a little more omni-directional than the reference dipole. Other than the changes in pick-up patterns, both these modified dipoles offer more gain than the reference dipole. On top of that, these antennas may be installed high enough to reduce the possibility of local interference, and some multipath interference problems.

When totalling up costs for hardware, these two outdoor dipoles eliminate the need of a rotator, but will still require the proper mounting hardware and feedlines. You must weigh and compare the costs and benefits of directional vs. omni-directional antenna systems installed outdoors on the results. It could be the omni-directionals will give superior coverage and signal quality in your area, making a directional antenna unnecessary. On the other hand, the directional FM antenna may be the only route to go because of severe localized noise and multipath interference problems. The point is that actual antenna selection, over and above the fact some antennas are "better" than others, must be made on an area-by-area basis. Terrain, transmitter locations, and your relation to them will be the deciding factors when figuring out which system will receive the signals the best.

Installation Choices

INDOOR INSTALLATION

For obvious reasons, indoor installations are the easiest to do. It doesn't involve much to stick the dipole that came with the TX-11b on a wall. But remember some of the drawbacks to indoor antennas: 1) height, and 2) possible problems with interference from cars on the street and small electrics in the kitchen. Plus, antenna height is essential to good signal strength and signal-to-noise ratio.

An indoor antenna can work just fine if you're in a taller building with good "line-of-sight" to the area's FM transmitting towers, or other places where you get clean signals from your favorite stations. If you've been listening to FM on another receiver in your home, you might get a very rough idea how many stations could be available.

However, your TX-11b is a tuner with impeccable performance, capable of making stations that were totally obnoxious due to noise and distortion, sound great! This alone will allow you to experience all the pleasure of FM stereo listening, with a less-than-ultimate antenna. If you can't get a truly listenable signal from a dipole or other type of indoor antenna, there are other options.

OUTDOOR INSTALLATIONS

Properly done, outdoor installations can offer vastly improved signal quality over indoor antennas. But there is the cost, and the actual effort of putting it all up. Another, perhaps most important consideration, is SAFETY. Safety is **very** important in planning, setting-up, and using your antenna system. With that in mind:

- Don't run the risk of having a bolt of lightning — natural or man made — join you, your tuner, and your stereo system in the living room:

A) Keep the antenna, mast, boom, guy wires, feedline, **whatever** away from **all** power lines. That includes the lines from the power pole to the house. DON'T EVEN THINK ABOUT PUTTING IT UP WHERE

IT COULD FALL INTO POWER LINES! B) Make sure the antenna, mast, and boom are properly grounded with a large conductor-wire running from the antenna to a ground rod in as short a path as possible.
NOTE: 10-gauge copper, 8-gauge aluminum, or 12-gauge copper-clad steel wire should do the job. However, the heavier the better. Certain masts can be grounded by a bar attachment to a ground rod, with a strap as a connector. This is a superior ground attachment if the mast's base rests on the ground, or special ground plate.
- Use stand off insulators to keep the ground wire away from the house. Space these insulators four to six feet apart where practical. It's a poor practice to staple the wire to your house.
- Use a proper antenna discharge unit or lightening arrestor, mounted as close as possible to where the feedline enters the house. Make sure the arrestor/discharge unit is securely attached to the ground rod with the heavy-gauge grounding wire, insulated with stand off insulators along the house.
- NEVER ground the antenna (or **anything**) to a gas pipe. Make sure any grounding scheme employing pipes in the house belong to the water system. A lightening strike, instead of being harmlessly routed to earth, can turn your home into an exploding sun.
- If your antenna and mast require the support of guy wires, make sure the wires use in-line insulators between the guy wire and roof. These insulators electrically isolate the support wires from the house. This isn't a bad idea even if the guy wires are anchored to the earth.
- NEVER, NEVER work on any part of (and best keep completely away from) your antenna system during an electrical storm! Remember to disconnect your TX-11b from the antenna during electrical storms, too.
- Another important item related to personal safety is, of course, to be careful when/if you start climbing around on roofs and the like. Don't make your antenna installation be the set up for a quick fall.

Ground Rod

When it comes to the ground rod we've been talking about, this metal rod should be driven **deeply** into the earth. A ground rod driven only two feet down usually has three to four times the resistance of a ground rod driven ten feet deep. That's the key: low resistance. The object of all this grounding is to give a lightening strike the easiest path to the earth, not your home. As we said, make sure you use a lightening arrestor or discharge unit that's attached to the ground rod with the same heavy-gauge wire used from the antenna to the discharge unit.

Between Antenna and Tuner: Feedlines

Last but not least in considerations for putting up an outdoor antenna is the feedline which "connects" it all together. Earlier in the chapter, we talked about the problems and merits of 300 Ω twinlead and 75 Ω coaxial cable. There are some additional things that could relate to your final choice between the two.

300 Ω TWINLEAD: Remember, it's less expensive and has the lowest line losses when dry, **and** properly insulated from the house and mast with stand off insulators specially designed for twinlead. Twinlead must also be kept away from metal gutters, window frames and other wires. Of course, it should be kept well away from power lead ins. There should be over an inch spacing between other wires in the home and stereo system — more is better. Avoiding the obstacles we've mentioned will add overall length to the lead in, and some of these detours will cause additional line losses when wet. Also remember that twinlead must be well insulated from the antenna mast, house, etc. with stand off insulators. These insulators are available in a variety of attachments: the shafts come terminated in screw-in units, masonry nails for brick and concrete, and nail-ins to suit any installation need. The stand offs should be used about every four feet with twinlead. In addition, special care should be taken when running twinlead through a wall, or bringing it indoors through a window frame. Use a wall tube or frame bushing to isolate and insulate the twinlead from the wall/frame materials. This can avoid possible signal loss and interference problems at this point in the installation. If the total run from the antenna to your TX-11b exceeds 300 feet, a preamp at the antenna might be needed to boost signals in the line.

75 Ω COAXIAL CABLE: Coaxial cable is the easiest of the two feedline choices to install, and has some distinct advantages. Obstacles that would seriously affect the performance of twinlead can be virtually ignored, and since coaxial cable is shielded, interference is much less of a problem. The only real drawback is the cost, and the need of a preamp to boost signal in runs over 120 feet. Actually, 120 feet is a pretty long way from your antenna to the tuner. Also, since coax is easier to install, the cost of cable and preamp (if needed) can be made up in a more effortless installation. Plus, the benefits of lowered losses when wet, and reduced interference can be an additional incentive to use coaxial cable. Coaxial cable can be easily brought into the house to the tuner without the need of special fittings or passages. Fewer stand off insulators can be used in an installation using coaxial cable as a feedline: one about every six to eight feet.

Some Additional Hints

- If you decided to chimney-mount the antenna, route the feedline away from the chimney outlet by at least three feet. Heat, smoke, and residue can break down the insulation of both twinlead and coaxial cable.

- If you're planning to attach your antenna system to a chimney, make sure the chimney has the structural strength to support it. Thoroughly inspect the chimney for loose bricks, broken mortar, cracks, or other conditions that could indicate a poor state of repair.

- DO NOT use a metal chimney stove pipe to support an antenna set-up. Other than the considerations of structural support, a lightening strike could turn your stove into a giant electrode. That can happen with a metal pipe chimney, even if the antenna itself has been properly grounded.

-For those who are located a considerable distance from any FM transmitting facility, a tower or mast may be necessary to obtain better line-of-sight and clearance for the antenna. If your outdoor installation fits into this category, pre-made masts and tower kits are available from many TV stores and electronic supply shops. Despite the cost, a 30-to-50 foot mast or tower, in combination with a good high-gain

antenna, can provide a quality signal for the TX-11b. Even in "fringe areas" where good reception is normally a real problem. Be sure any mast or tower set-up is properly secured with guy wire supports (if needed), and installed where it can't fall into power lines, the neighbor's greenhouse, or whatever.

Cable

When we talk about cable, we mean a master antenna system supplying high quality TV and FM signals to individual homes (or "subscribers"). The signals are sent via a distribution network of wires and line amplifiers. The wire, or cable portion of the system, can be likened to a telephone distribution set-up. The line amplifiers are used to boost signals at certain intervals in the lines, much like using an antenna preamp with long feedlines in your own antenna system.

Originally, community cable television (CATV) was a response to the problems of poor or nonexistant reception of TV signals broadcast "clear air." These problems could be caused by distance, terrain, or even just remote locations (out of range, or fringe area reception). The cable company chooses a high hilltop or other location where they can obtain the best line-of-sight to the area's transmitting towers. This site is known in cable parlance as the "head end." This is where high-gain antennas and amplifiers are used to receive distant, weak, or otherwise unreceivable signals. The signals are passed on to line transmitters, then to the distribution part of the cable system.

At your home, signals from the cable in the street are fed to your TV set. If you want FM as well as TV, the signals are split with one set going to the TV, the other to your TX-11b. Of course, you can be connected to just receive FM signals, without the video hook-up. An FM feed may use a special filter to remove TV interference, or to prevent you from illegally receiving FM signals from a single TV feed, an FM trap might be installed at the street. When the cable people connect your TX-11b to the system, any necessary filters are installed, any traps are removed from the line. This brings up something else again: it's not legal to tap into, or hook a commercial cable up yourself. It must be done by the cable company.

As mentioned earler in this manual, feedlines for cable TV are all 75 Ω coaxial cable, so connections can be made directly to the TX-11b's 75 Ω antenna input. However, the usual procedure is for the cable company installer to connect a tuner with a matching transformer (75 Ω to 300 Ω) to its 300 Ω inputs. As we suggested, ask the installer if it would be possible to use the TX-11b's 75 Ω input.

The benefits of using a commercial cable to supply high quality FM stereo signals for the TX-11b are many. For example, you don't have to worry about the cost and effort of installing a good outdoor antenna. You don't have to worry about the performance of such a system after all that work, either. As a rule, cable companies have a one-time installation charge, then a monthly fee. The cost of cable service can depend on many factors, and varies from system to system. Costs will run higher for a commercial cable feed for both TV and FM service, less for FM only.

Other than opening up a new world for enjoyment of FM programming, commercial cable can open a new world of audio for your TV set. Many cable systems program premium movie/film services with spectacular stereo soundtracks. The video portion (with standard audio carrier) is broadcast on the cable for the TV set. A separate stereo soundtrack is broadcast in the FM band. The TX-11b receives these signals and turns your living room into a real theater or concert hall. You not only see great artists performing your favorite music, but hear it like you were there. This set-up frees your TV from its burden of having a tiny, limited-response, internal audio amp and speaker.

AM Antennas

The Motorola CQUAM™ AM stereo system requires a stronger and cleaner signal to take full advantage of the benefits of AM stereo. Two AM antennas are included with your TX-11b: a long wire antenna and a loop antenna. We have detailed the benefits of each type to help you select the best antenna for your environment.

AM Wire Antenna

The long wire antenna is, under most circumstances, the preferred antenna. It is able to receive signals from farther away and will receive normally distant signals much stronger than the small loop antenna. This wire antenna is also more effective for eliminating noises that occur in in the atmosphere that is at a distance from the tuner. The long wire orientation is not particularly critical. Since this antenna is used for maximum sensitivity, if you live very close to a strong transmitter you may overload the front end of your tuner with this antenna and will want to try the loop antenna.

AM Loop Antenna

There are certain conditions in which the loop antenna works best. It has better noise rejection for locally generated noise – noises that are generated close to the tuner and may sound like buzzes or hum. It is able to reduce these noises for two reasons: 1) This antenna is directional, and 2) it has a lower driving impedance than the wire, so it tends to short circuit this kind of interference readily.

The loop antenna picks up the signal at right angle to an axis passed through the loop. If you want to pick up a radio station that is due north, orient an axis that passes through the loop at right angles to north. If you were holding this antenna as if it were a gun, you would point it at the station. Again, the loop antenna is for maximum rejection of locally generated interference.

Ultimate AM Antenna

For those of you who would like to take the time to build the ultimate AM antenna, we offer the plans that follow. This antenna incorporates the benefits of both the wire and the small loop. It will have the noise reduction capability of the small loop for locally generated noise, the noise reduction capability of the wire for atmospherically generated noise, it will be extremely sensitive, and it will be very directional.

This antenna is basically a home-built loop whose area is measured in square feet rather than square inches. To build this antenna:

1) Construct a wood cross frame that measures 12″ from point to

point.(17" each cross bar).

2) Secure frame to a base.

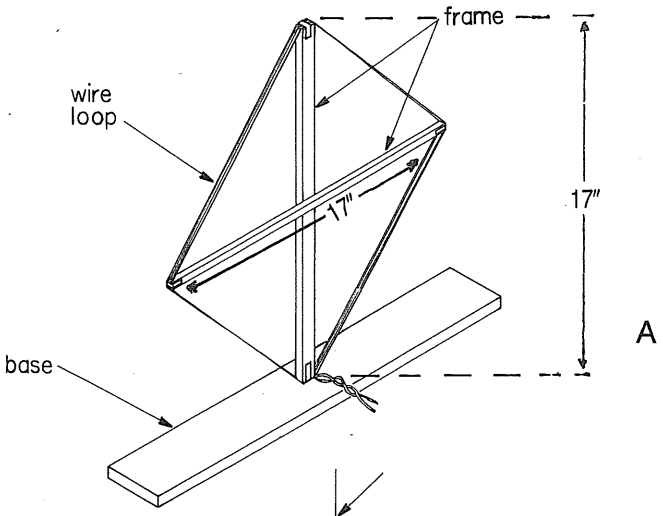
3) Wrap frame with four turns of the #22 insulated solid wire.

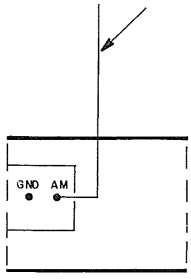
4) Twist wire ends together approximately 2 turns per inch.

5) Strip wire ends 1/2 inch and connect to AM terminals on back of TX-11b.

Drawing A shows a completed antenna.

Drawing B details connections for all 3 antennas. Don't be afraid to experiment to discover the best antenna for your location.





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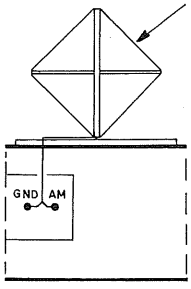
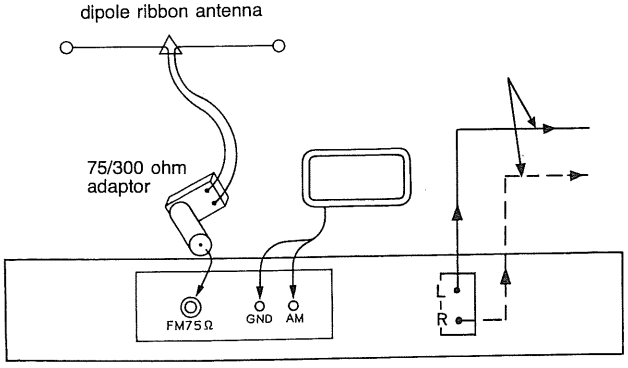




Some Other Thoughts

The bulk of this chapter has been devoted to explanations and comparisons of different antennas and antenna-system installation. We've provided information to help you make a decision on what can provide the best signal possible for the TX-11b, using your own antenna. It's pretty obvious that much time and attention can be spent in pursuit of a good signal by installing a good antenna. Especially if you live far away from radio stations, or in an area with classic reception troubles. Before throwing up your hands and despairing the thought of installing a more complex outdoor antenna, wait a minute! We'd like to remind you that the TX-11b has unique features and performance, making the choices of antennas, feedlines, and installation methods less critical than with virtually any other tuner.

Still, to realize the maximum quality of performance and programming excellence offered by stereo stations, you'll have to pull the best signal possible from the air for the TX-11b. For that reason, you may want to select one of the better antenna options.

If it comes down to the outdoor variety, with the effort and cost involved, you might be better off having the antenna system installed by professionals. These folks know all the ins and outs of quality signal reception for your specific area and circumstances. Plus, they do all the climbing around on the roof. A company that specializes in this type of work can give you an estimate of what they feel a job like it could cost, allowing for some further comparison of prices. A company that does this type of work often has a retail outlet that stocks good antennas, materials, and the hardware you'll need (if you decided to do-it-yourself). Take time to check these services out before giving in or giving up.

Appendix

SECTION 1
FM Stereo Signals and the Asymmetrical Charge Coupled FM Detector™ *

FM radio stations started life broadcasting a carrier frequency modulated by music. When you listen to "FM 108", what your tuner is receiving is that frequency — 108 MHz (megahertz, or millions of cycles per second) — modulated by a music spectrum from 30 Hz to 15 kHz (KiloHertz, or thousands of cycles per second). The Federal Communication Commission ensures (by law and threat of fine) that the rock music on one station won't interfere with classics on the next.

When radio stations came under pressure to deliver stereo sound, some system of broadcasting two signals, short of setting up another station, became necessary. Early experiments were actually tried with one channel on FM, the other on AM. Needless to say, some other solution had to be found. One constraint of the stereo broadcast system required that table radios get a usable mono signal — not just the left, or just the right channel. What was finally adopted and approved by the FCC was a broadcasting system where both channels (L + R) were available as usual. To supply stereo, a **difference** signal (L – R) was developed and used to modulate another carrier at 38 kHz.

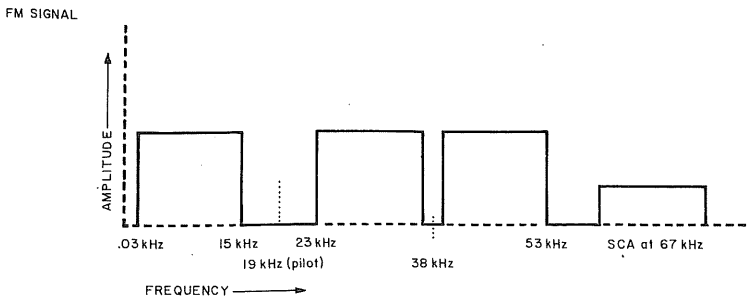
Now for the first complication. It turns out that broadcasting that signal in stereo required too much frequency deviation (the difference between the necessary signal and the carrier), so the 38 kHz L – R carrier is suppressed and a much smaller amplitude 19 kHz pilot is added.

Mono radios use only the first block of the signal. The SCA, or Subsidiary Communication Authority signal, is often leased to companies that specialize in commerical-free background music for stores, dentist's offices, plus special programming for the visually impaired — even foreign language broadcasts. To receive an SCA service, a special tuner is needed. These signals can't be picked up on the TX-11b.

The components of the transmitted FM stereo signal that concerns us are L + R signals, and most importantly, the L – R signals. The graphic representation of a sample FM signal shows the various relationships of the different signal components in frequency and amplitude.

There are two more things you should know: 1) actually, only 15% of the L – R signal is different than the L + R signal; 2) the L – R portion of the transmitted signal is very prone to mishaps between the transmitting tower and your TX-11b. It's this signal component that, when degraded, causes noise and distortion problems, usually induced by multipath reflections off hills, buildings, the ground . . . whatever.

The Asymmetrical Charge-Coupled FM Detector operates principally on the L – R signal components, improving it from 10 dB to 23 dB. However, it can only improve the L + R component by 1 dB. If you



receive the L + R signal components well, but suffer from poor L – R reception, the Asymmetrical Charge-Coupled Detector will drastically improve the reception. If the L + R signal is poorly received as well, the circuit can only help a little. Degraded L + R reception is often due to improper or inadequate signal strength. This could indicate a distant station, or the need of a better antenna system.

Almost all stereo FM reception problems can be traced to poor L – R signals. The Asymmetrical Charge-Coupled FM Detector is extremely effective in reducing the noise and distortion associated with this type of multipath interference. In short, it can provide stereo reception that is as noise-free as FM broadcast in mono. Because of the nature of the components of a transmitted FM signal, the circuit can't significantly improve a poor mono program.

SECTION 2
AM Stereo Signals and The Ultra High Fidelity Wide Band AM Stereo

This tuner is absolutely unique in that its basic AM performance capability is essentially equal to, and in some cases superior to, the performance that FM can deliver. AM is inherently immune to multipath distortion, the primary problem of FM. There is no fundamental limitation to frequency response, distortion or noise in AM. AM systems historically have fallen by the wayside until very recently, when manufacturers have typically added them as afterthoughts. The AM systems in most radios sound terrible because they have bandwidth that extends to 2 or 3kHz; they have signal to noise ratios in the 30s or 40s, instead of 60s, 70s, or 80s; they have distortion that is usually 3-8% – not high fidelity by any means. The distortion levels in this machine are orders of magnitude below that, the signal to noise ratio is far superior, and it also has AM stereo.

CQUAM™ AM stereo is a brand new system developed by Motorola. The way it works basically is that a signal is phase modulated, a sub carrier is phase modulated on top of the regular carrier, and a phase detector responsive to the phase deviation of that carrier separates out the left and the right channel signals.

The way it's done is; the L + R part of the stereo signal is broadcast as amplitude modulated AM, the L – R is broadcast on that same carrier as a phase modulated signal. It's actually FM because whenever you have a phase modulation you have a corresponding FM deviation and whenever you have an FM deviation, you have a corresponding phase modulation. So by modulating the phase and

having a phase detector, we're able to detect the L – R part of the signal. An AM detector is absolutely insensitive to phase modulation. An FM detector, when properly constructed, is insensitive to amplitude modulation, so the phase detector picks out the L – R because it's phase modulated and ignores the L + R component. The output of each detector then is composed of an L + R signal and an L – R signal. Those two signals are combined in an appropriate matrix to produce a left and a right output.

In addition to that there is a pilot tone that is broadcast at 25 Hz at 4% modulation to turn the stereo decoder on or off and light up an indicator light to let you know that you are listening to stereo.

The features that this tuner has of receiving AM stereo are vast. Our circuitry, unique to all circuits, has a 25 Hz pilot cancelling circuit. Most AM receivers, to eliminate the 25Hz from their output, will simply put in a bandstop filter and nothing below 25 Hz gets through. Our system is flat down to below 20 Hz by using a 25 Hz pilot cancelling signal so the pilot will be cancelled and will not appear at the output as a low frequency undesired rumble. In the absence of a 25 Hz pilot tone, the stereo decoder will switch off. This is desirable when the tuner is receiving a signal in mono, otherwise it would be somewhat noisier.

The difference in noise is theoretically about 3dB, in practice we find it's about 14dB. However, it's 14dB noisier whether the signal is strong or weak. It actually works out better than it does with FM. Because when the signal is low in FM, you can go from stereo to mono or go from an unlistenable condition in stereo to a listenable condition in mono. With AM that doesn't happen. In AM, the signal will remain eminently listenable, even when switching to stereo on a weak station.

This is the only AM tuner capable of 15 kHz response and bandwidth. The typical AM bandwidth is approximately 3 kHz; good enough for speech and not really good enough for high fidelity listening. High fidelity requires 15 kHz or more. This radio has a unique IF system (intermediate frequency). It has been carefully designed to be perfectly flat 15 kHz on either side of the IF carrier. Most other radios have a response that is flat maybe to 2 kHz and several dB down at 3 kHz; the best of them are usually 10dB down at 6 kHz. The TX-11b system is perfectly flat and you will immediately hear the difference. When you listen to an AM radio, you will hear sparkle, life-like timbres just the way you hear those sparkly, life-like high frequency tones when you listen to FM.

Why are all other tuners are only 3 kH wide? The main reason is that it is very difficult to design a wide band AM radio. It requires heroic efforts. It requires that the AM antenna be wide band with high selectivity; it requires a great many IF stages. It requires an IF tuning mechanism that tunes simultaneously: the oscillator, the antenna, and the IF must track; almost impossible to do with modern electronic varactic tuned systems. In the old days, the tracking was a matter of capacitor geometry (some of you might remember tuning capacitors that had serrated metal interleaved finger). It was relatively easy to make those track well up and down the band simple because it was a matter of doing the geometry right. They had an interesting quasi-eliptical shape to them as they rotated in and out of mesh. Modern varactic tuned systems are very difficult to make track properly, so difficult in fact that most AM radio manufacturers gave up and made the bandwidth very, very narrow.

By doing so, front end varactic mistracking was masked by the narrow bandwidth. Even oscillator mistracking, oscillator, IF and RF mistracking was almost totally masked. Even today with most radios you will find different frequency responses on different segments of the dial. The low end of the dial may have a higher audio frequency response when measured than the high end of the dial that is due to mistracking. What we had to do was to develop a very accurate tracking system for our varacters, and this included enclosing them in a very powerful feedback loop to make sure that they track and were in fact, also wide band. The goal was to make the bandwidth 15 kHz: same as FM.

Now an immediate question comes up; if the tuner is capable of such fine performance, what about the broadcast transmitters? A survey in the Seattle area immediately demonstrated that the majority of the AM transmitters are broadcasting signals out to 15 kHz. Almost all of them have signals that go out to at least 12 kHz, many to beyond 15 kHz. You will notice it immediately.

15 kHz is an accepted minimum for high fidelity, and the FM system that we use is limted to 15 kHz and it stops instantly at a brick wall at 15 kHz. The AM system is not quite that much of a brick wall and the response actually continues a little bit beyond 15 kHz. We can't make it 20 kHz becuse that would put the modulated carrier squarely on top of an adjacent channel. Channels in this country are spaced 20 kHz apart.

This tuner has incredible specifications. It has an AGC range that is approximately 10 times greater than a standard radio. That means that on a strong station, the output level from a strong to weak station will remain essentially constant; it'll behave in that regard like an FM system; a weak station won't drop in volume and it won't be susceptible to airplane flutter, won't be susceptible to fading the way a regular AM radio would be. That's No. 1. No. 2 of course, is the wide bandwidth which results simply in high fidelity because it picks up the high frequency components of the music.

SECTION 3
Specifications

FM

TUNING RANGE:	87.5 MHz - 108 MHz
ANTENNA TERMINALS:	75Ω coaxial input
INTERMEDIATE FREQUENCY:	10.7 MHz
FREQUENCY RESPONSE:	20 Hz to 15 kHz, ± 1 dB
SELECTIVITY (At 400 Hz):	90 dB (narrow); 35 dB (wide)
CAPTURE RATIO:	1.0 dB
AM SUPRESSION RATIO:	50 dB; 65 dB with CCD
IMAGE RESPONSE RATIO:	110 dB
IF RESPONSE RATIO:	110 dB
SPURIOUS RESPONSE RATIO:	100 dB
OUTPUT LEVEL (75 Hz deviation):	700 mV, 600Ω
SYSTEM:	PPL crystal-locked digital synthesizer

		MONO	STEREO WITHOUT CHARGE-COUPLED DETECTOR	STEREO WITH CHARGE-COUPLED DETECTOR
USABLE SENSITIVITY				
	75Ω:	11.3 dBf/1.0 μV	34 dBf/14 μV	16.3 dB/1.78 μV
50 dB QUIETING SENSITIVITY				
	75Ω:	16.1 dBf/1.7 μV	37 dBf/19 μV	21 dB/3.1 μV
SIGNAL/NOISE RATIO				
	75Ω:	82 dB @ 85 dBf	74 dB[1] @ 85 dBf	85 dB[2] @ 85 dBf
STEREO SEPARATION (wide):				
			1kHz: 45 dB	45 dB @ -10 dB
			100 Hz: 36 dB	30 dB @ -15 dB
			10 kHz: 36 dB	15 dB @ -23 dB

AM

TUNING RANGE:	520 kHz - 1710 kHz
SENSITIVITY TERMINAL:	20 μV
RADIATED:	250 μV/m for 20 dB S/N
DISTORTION (5mV/M)	0.9%
SELECTIVITY:	42 dB
IMAGE REJECTION:	45 dB
IF REJECTION:	34 dB
AGC FIGURE OF MERIT:	90 dB
AM STEREO SEPARATION (1 KHz):	40 dB
FREQUENCY RESPONSE:	20 Hz - 15 kHz, ± 1.0 dB
SIGNAL-TO-NOISE RATIO:	75 dB
POWER REQUIREMENTS:	120V, 60 Hz; 240V, 50Hz (optional)
POWER CONSUMPTION	15W
DIMENSIONS (w/h/d):	19"/3.9"/14"
WEIGHT:	11.9 lbs.

1. - Includes full carrier jitter of test instrumentation. 2. - Without carrier jitter.

Features and specifications subject to change without notice.

SECTION 4
Troubleshooting

The following chart is a guide to possible common faults that you can easily fix yourself. Most problems are the result of interference, signal reception troubles, or perhaps, operator error. Before even thinking that something is "wrong" with the TX-11b, take the time to check out this chart. Your TX-11b is superbly crafted and put together to last for years of trouble-free listening. If you encounter a problem, use this chart and/or refer to the appropriate section of this manual before doing anything else.

Problems and Troubles

1. NO POWER: With switch in, LED indicator doesn't light (See POWER).

2. NO SOUND: Power is on, but no sound (See INSTALLATION and CONTROL SETTINGS).

3. TUNING: Preset stations can't be tuned/Preset stations mistuned (See CONTROL SETTINGS and SIGNAL STRENGTH).

4. LESS-THAN-PERFECT SOUND: If you're getting sound, but it doesn't sound very good, the type of bad sound can be a clue to the problem.
A) CRACKLING: Possibly car ignition noise, or noise from electrical devices in the house, like motors, etc. (See ANTENNA INSTALLATION and INTERFERENCE).
B) DISTORTION: Probably multipath-induced; engage the MULTIPATH REDUCTION. If that doesn't work, you might have a very severe reflection problem (See SIGNAL STRENGTH).
C) HISS AND NOISE: Most likely caused by a weak signal; try both MULTIPATH and NOISE REDUCTION simultaneously. If that doesn't work see SIGNAL STRENGTH.
D) HUM: Possibly from cables connecting tuner and preamp (See INTERFERENCE and INSTALLATION).

5. NO STEREO: Check the STEREO indicator LED. If it's on, see CONTROL SETTINGS. If STEREO indicator is off, see SIGNAL STRENGTH or engage both MULTIPATH and NOISE REDUCTION. Could indicate either weak signal or mono station.

Possible Fixes and Cures

A) POWER: Check that the TX-11b's power cord is plugged **completely** into a working outlet. If it's plugged into a preamp or integrated amp convenience outlet, make sure it works. If there's still a problem, remove the TX-11b from your system's power, and plug it into a "known" working wall outlet. If this check doesn't pan out, contact your local Authorized Carver Service outlet, or the factory.

B) INSTALLATION: Check and thoroughly inspect the signal cable that runs between the TX-11b and the preamp. Make sure the connectors are firmly seated, and that no undue strain is being placed on the cable itself. If you still have a problem, use another "known" — a working cable from another part of your system — as a final check.

C) CONTROL SETTINGS: 1) Check all control settings on your preamp or integrated amp: Power On/Off, Source selectors, Stereo/Mono, Speaker On/Off (or Speaker selector), Volume or Gain controls. If there's still no sound, see INSTALLATION. 2) If Station Presets can't be tuned and TX-11b has been disconnected for more than three weeks, the memory has been cleared and you'll have to reprogram the tuner. Refer to the Station Log for your listing of favorite stations and program sources. It is also possible that a programmed station wasn't correctly punched in at the correct frequency. Confirm correct frequencies against your Station Log.

If the frequency is correct, switch the TX-11b to MANUAL TUNING and try again. If there's still a problem, see INTERFERENCE and SIGNAL STRENGTH.

D) INTERFERENCE: Depending on the nature of the interference, check the following suggestions:
1): Try IF BAND control on NARROW range first, otherwise;
2): Install the TX-11b farther away from transformers, motors, TV sets, and fluorescent lighting. Route the signal cable and antenna leads away from these possible sources of interference.
3): Make sure your signal cable between TX-11b and preamp is in good shape-and shielded.
4): Attach a noise suppressor to the electrical equipment causing the noise.

E) ANTENNA INSTALLATION: 1) Install the antenna farther away from heavy vehicle-traffic. 2) Use 75Ω coaxial cable for a feedline: it's shielded. 3) Review the chapter on ANTENNAS in this manual for more information.

F) SIGNAL STRENGTH: 1) Change the antenna orientation (reaim). 2) Avoid long runs of antenna feedline, or add an antenna preamp to your antenna system. 3) Use 75-Ω coaxial cable instead of 300-Ω twinlead for feedline. 4) If these first three items don't help, it might mean an improved antenna system or commercial cable. We urge you to review the chapter on ANTENNAS (that appears earlier in this manual) before giving in or giving up.

SECTION 5
Service Assistance

NOTE: Fill out and mail the WARRANTY REGISTRATION CARD which is enclosed in a separate envelope with the CARVER LIMITED WARRANTY.

If your CARVER product should require service, we suggest you contact the Dealer from whom you purchased your unit. Should the Dealer be unable to take care of your needs, you may contact CARVER Service Department by phoning (206)775-6245, or by writing CARVER CORPORATION, Service Department, P.O.Box 1237, Lynnwood, WA 98046. We will then direct you to one of our National network of factory trained and authorized Warranty Service Centers, or give you detailed instructions on returning the product to us for prompt appropriate action.

We suggest you read the LIMITED WARRANTY completely to fully understand what your warranty/service coverage is, and the duration. You must promptly complete and return the WARRANTY REGISTRATION CARD to validate your LIMITED WARRANTY.

We wish you many hours of musical enjoyment. If you should have questions or comments, please write to:

CARVER CORPORATION
Service Department
P.O.Box 1237
Lynnwood, WA, 98046
(206)775-6245

Ask your CARVER Dealer to show you the CARVER family of stereo components for your home audio reproduction.

Station Log

Preset	Freqency	Call Letters	Format/Source/Notes
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			