

LOW POWER RADIO

Low Power Radio

In the Early Days of Radio, the FCC did not exist and many a Radio Station got started by making a home-made radio transmitter of 40 or 50 watts, putting up a wire antenna and doing business. In recent years, I met a man that began in business that very way. After his home-made transmitter burned down his "radio shack," he moved to Oklahoma and opened retail stores selling TV's and Appliances. The "seed money" for his successful businesses all came from his unlicensed Home Brew Radio Station. He never had a license, never dealt with the FCC, and never had anyone tell him he couldn't do it.

We have come quite a ways from "the good old days" when you could do as you pleased. These days, it is almost impossible to get started in low power Broadcasting. The FCC has enacted new Rules and Regulations in order to reduce interference levels in the A.M. Band for the benefit of properly licensed A.M. Broadcast Stations. A.M. Stations which are licensed by the FCC begin at 250 watts power and go up into the 50 KW. Range under certain conditions. If you desire to start a Station of 250 watts or more, you must go through all the Legal Procedures using a Consulting Engineer to do a Frequency Search, filing with the FCC and paying the necessary Fees and waiting for their approval.

EXCEPTIONS TO THE RULES

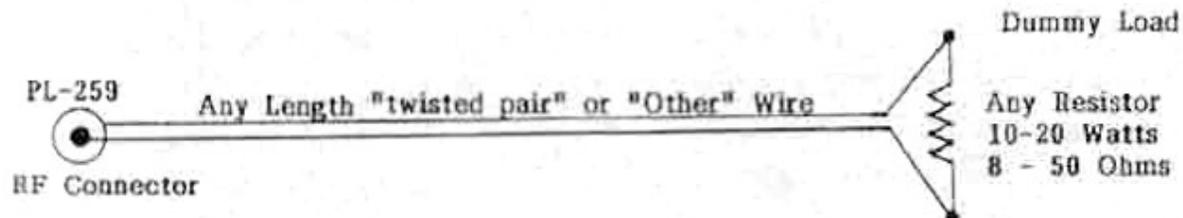
There are some exceptions to the general rules mentioned above. These include **CARRIER CURRENT OPERATIONS, COLLEGE STATIONS, BOARDING HOUSE STATIONS, REST HOME STATIONS, and Neighborhood Stations.** The level of Radiation is strictly controlled and limited, but can be enough to provide sufficient coverage. **The College Station is a Model for the Rest Home, etc.** In a College environment, the Students may build their own Radio Transmitter or buy an Approved Type. Various Antennas may be placed about Campus in order to cover all areas; but 100 feet outside the Campus Grounds, the Signal Level must comply to FCC Regulations of $24,000/f$ KHZ. at 100 feet. At the close of this Book, I also show techniques of Radio Broadcasting for use in Foreign Countries using low power Transmitters and long wire antennas!

The same Signal Strength Limitations also apply to Nursing Homes, Rest Homes, Apartment Housing, etc. In these cases, however, the Radio Station does not use and INTENTIONAL RADIATOR, but the wiring inside the house, apartment, etc. is used as the Antenna. If this is done, the FCC classifies the operation A CARRIER CURRENT STATION. In the case of a College Station, these are LOW POWER STATIONS, even though they may be Carrier Current. College Stations are not supposed to compete with Licensed Stations, and everything must be "verified" by Records kept in a Public Access File at the Station's Office. Any power may be used, any kind of transmitter and antennas needed to cover the Campus, but just 30 meters (100 feet) outside the Campus Grounds, the Field Strength must be limited to $24,000/F$ KHZ. Harmonics must be measured up to 30 MHZ and corrected if excessive. College Campus Stations are not to exceed 250 Microvolts of RF Feedback into the Power Lines. If CARRIER CURRENT is used, these guidelines do not apply. In any case, the RF Limits set by the FCC are not to be exceeded at 30 Meters outside the Campus Area. Filters may need to be installed to keep the RF down to legal limits where the transmitter connects to the Power Lines, in the cases where small INTENTIONAL RADIATORS ARE USED.

If a College Station uses the in-house wiring as an Antenna, they may feed as much power into the lines as is necessary to do the job, but at 100 feet outside the Campus, the Signal Strength must drop to below $24,000/F$ KHZ. The maximum amount of power normally permitted for CARRIER CURRENT is 50 watts, however COLLEGE STATIONS are allowed almost any power transmitter, any style antennas, etc.- but! Just outside the Campus, at 30 meters, the signal MUST comply with the Legal Limits set by the FCC! "VERIFICATION" can be done by a Certified Broadcast Engineer, or any other qualified person using a "calibrated" Field Strength Meter which is of the type Approved by the FCC.

There is also another application for Low Power Broadcasting inside the AM Band. This is inside Tunnels, Caves, Mines, or Buildings. A special "LEAKY CABLE" can be used, having controlled radiation characteristics. You may feed up to 50 watts RF Power into the System as long as Radiation LIMITS as stated above are not excessive at 30 meters outside the Tunnel, Mine, etc.

"POOR MANS" LEAKY CABLE DEVICE
Original Idea by Ken Van Prooyen



CARRIER CURRENT "LEAKY CABLE"

Any Twisted Pair can be used as a Leaky Cable Device when connected as shown, provided that it is not a "shielded" cable. I will cover "SHIELDED" later. Not only will Twisted pair wires work well for any distance of "Leaky Cable" System, but ordinary "ZIP" CORD, LAMP CORD, TELEPHONE LINE STYLE WIRE (1 pair only) and any "balanced" type wire is very good at carrying the RF Carrier along its entire length, be it a few feet or several miles! There is a "catch" to it (as shown above). The Wire Pair must be loaded at its far end by a resistor of no lower value than 8 ohms and no higher value than 50 ohms (under most situations). I have found that in special cases, up to 300 ohms will load, but generally you lose out by exceeding 50 ohms. The Transmitter is most effective at frequencies below 1 MHZ, but I have seen this method work even at 100 MHZ, under much shorter distances. The "MATCH" to the Cable may not be perfect, but by allowing for the right Resistive Value at the end of the line, this can usually be lowered to a safe level. If too much SWR is present at the "send" end, you may damage your Transmitter. The F.C.C. requires the same Compliance with this as with all other Part 15 Devices. Field Strength is to be measured at 100 feet (30 M) from the Cable and must not exceed 24,000 Divided by (F) Freq. in KILO Hertz. This will provide a figure in MICRO Volts Per Meter as the upper limit for Field Strength.

"SHIELDED" Wire can be used by making the "shield" the outer wire and use the Inner Wire for the Center (HOT) wire coming from the Center Contact of the Plug.

HOW TO FIND A FREQUENCY

The single most important thing you need to know is THE RIGHT FREQUENCY of operation for your Radio Station. In the world of HIGH POWERED STATIONS, this is difficult to ascertain, requiring expensive studies by experts, however this is not the case for your LOW POWER STATION! Since most A.M. low power stations are not expected to reach out over a few miles in any direction, you do not need any expensive frequency searches to determine the correct frequency of operation -IF- you follow these instructions:

Instructions

Obtain a DIGITAL A.M. RADIO. You may either buy or borrow one for your frequency search. Do not use the old fashioned slider dial radios as these may give FALSE READINGS. A digital radio such as the SONY WALKMAN or one of the RADIO SHACK DIGITAL radios will do a good job.

START at the bottom of the Band (about 535 KHZ) and WRITE DOWN ON A PAD EACH QUIET FREQUENCY. Now, SELECT A FREQUENCY THAT IS IN THE CENTER OF TWO OTHER QUIET FREQUENCIES. EXAMPLE: 1230: Quiet, 1240, Quiet, and 1250 Quiet. YOUR BEST CHOICE IS 1240! If you hear a station on the frequency just above or below the frequency you want to use, you will not be able to reach out well with your signal. BLEED OVER MODULATION from that distant station will block your frequency, even when it is on an adjacent channel. For best results, CHOSE A CENTER FREQUENCY that is quiet on the upper and lower channels, so your station's SIDEBANDS will carry your modulation in a correct manner.

WATCH OUT FOR THESE THINGS

If there is a strong HIGH POWERED STATION NEARBY, where you are doing your frequency search, IT MAY EASILY PRODUCE SEVERAL QUIET SPOTS ON THE RADIO ON SEPARATE BANDS DUE TO HARMONICS and its strong sidebands. Be sure you have a QUITE FREQUENCY where there is LOW "S" on a meter. A distant "weak" station will show you what a low "S" should sound like. If there is total silence, you probably have tuned in a strong Harmonic, free of modulation. Avoid such frequencies as they will not work.

THE COLLEGE STATION

The College Station is presented by the FCC as a "Model" for Low Power Radio. Where possible, these are licensed in the FM Service and usually run at least 100 Watts of power. This is the lowest amount of power which the FCC will usually License, and these frequencies are hard to find, due to "close spacing" between FM Stations.

UNLICENSED RADIO

The College Station may operate legally in an unlicensed manner when Part 15 of the FCC Rules are observed.

TRANSMITTER AND ANTENNA

Any Transmitter (AM or FM) may be used, regardless of its power, and any Antenna scheme is acceptable in order to cover the Campus Area.

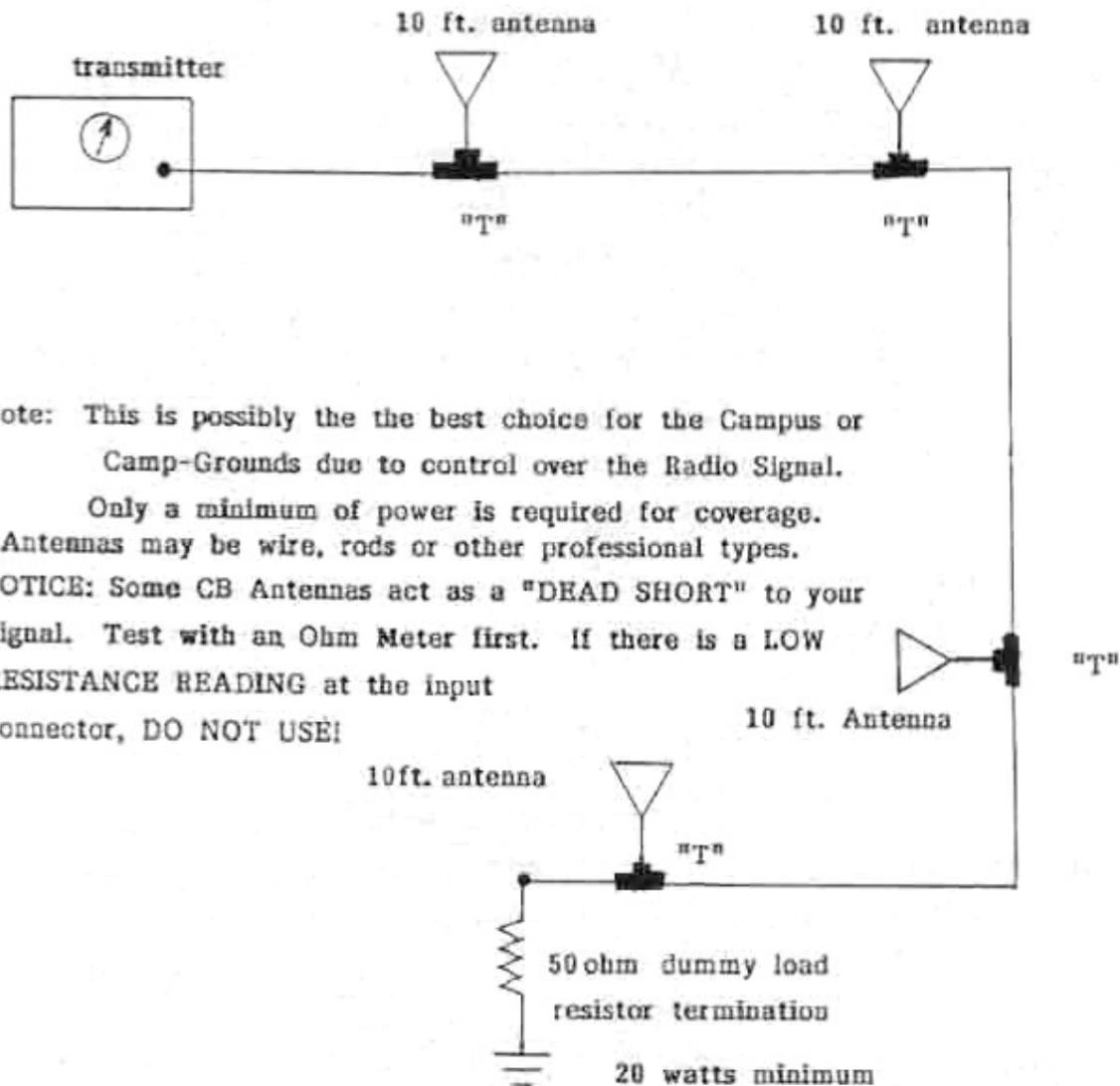
LIMITS

The Limits are on RADIATION LEVELS of both fundamental and harmonics. Signal Level must be measured just 30 Meters outside the Campus Area, and must comply with the formula I have previously given. This applies for both AM and FM Broadcasting.

THE MODEL

The Campus Station is THE MODEL. You may use UNLICENSED Low Power Radio at home, business, or at Church if these same guidelines concerning RADIATION LIMITS are observed. There must be a provision to turn down the power, if requested to do so by the FCC. Logs and appropriate Records must be kept at your Low Power Radio Office, in order to VERIFY your compliance with the FCC's Rules, in Part 15. Program Logs should be kept, along with Maintenance and Engineering Logs to show when and how regular Verification is provided. The Logs must be signed by the Person showing Verification that Part 15 of the Rules is being observed.

CONTROLLED CAMPUS ANTENNA SYSTEM



Note: This is possibly the the best choice for the Campus or Camp-Grounds due to control over the Radio Signal.

Only a minimum of power is required for coverage.

* Antennas may be wire, rods or other professional types.

NOTICE: Some CB Antennas act as a "DEAD SHORT" to your Signal. Test with an Ohm Meter first. If there is a LOW RESISTANCE READING at the input connector, DO NOT USE!

THE SYSTEM

Every 50 to 100 feet, a "T" is placed in the RG-58U Coax and a ten foot antenna is set in place to provide enough coverage for the Campus. The resistor load at the very end of the coax is necessary to prevent distortion. Use as many ten foot antennas as is necessary to cover the Campus. [PARTS: "T" - Radio Shack #278-198, Coax - R.S. # 278-1326, Load - Heathkit #HN-31-A (1-800-253-0570) and end Connectors - Radio Shack # 278-188]. Place antennas out of reach.

TRANSMITTER ON WHEELS

The Micro-Mini Transmitter has been used as an Advertising Tool by plugging into the Vehicles' 12 Volts Battery System and installing a small whip Radio Antenna on the Vehicle. A Sign or Bumper Sticker on the Vehicle may read: "FOR IMPORTANT INFORMATION TUNE YOUR RADIO TO 105.5 MHZ." When those following or alongside tune in, they may hear a Message like this: "Joes Plumbing is having a special on Service Calls this Week only. Call 555-222-5512 for our \$29.95 Weekend Service Call - etc." This allows for legal use in areas where there is no other reception on the frequency of use. The Power is .1 watt, just enough to reach out a few hundred feet.

REAL ESTATE THE "TALKING HOUSE"

Low Power FM Transmitters are also used by Real Estate Offices in the Sale of Homes. A Micro-Mini Transmitter is set up inside the House offered for sale. It operates on 120 VAC or from a small battery pack. Its antenna is no more than 2 or 3 feet of wire laying on the floor or hanging in the window of the House. The Signal Travels outward about 100 - 300 feet. A small Sign in front of the House, tells prospective Buyers to tune in on the Radio for Sales information. The Details on the House are played non-stop by pre-recorded Message, and whoever tunes in can hear the Sales Pitch and any other information offered by the Realtor. Units with up to a 3 minute "Chip" for recording can be purchased. Larger Real Estate Companies know where to purchase these Transmitters - or you can make your own, using "Kits" such as those provided by Ramsey (1-800-446-2295).

CHURCHES

Churches may wish to advertise their Services by Broadcasting the Singing or the Pastors Sermon to those outside in cars or in the nearby Homes. Just a small .1 Watt FM Transmitter on a clear frequency is all that is needed, along with a small Antenna. Distance of such transmissions is determined mainly by the height of the Antenna. For example, if the Church is located on a hill overlooking Town, a simple rooftop antenna will be very effective, even with a micro-mini transmitter.

KITS

There are several Companies offering "KITS" for the Unlicensed Broadcaster. Sold as Educational "Toys," these often have good sound quality and are used in Licensed Stations all over the world, except the USA, Canada and a few European Nations. These Kits are offered mostly in the FM Radio Band, and a few offer Kits for AM Radio. The AM Radio Kits tend to be unstable and without sufficient instructions for proper set up.

FM KITS

The FM Kits start at about \$20.00 going up to about \$1000 or so. Most of these are stable and provide 100 MW. Output, which is .1 watts. This is enough power to cover several blocks when used with a good antenna, which you can make yourself or buy. One Broadcaster, in the Midwest, uses 100 MW. coupled into a 50 ohm coaxial linear cable antenna (home made) and mounted at 100 feet height to cover THE ENTIRE CITY! There is no place within the city within a 8 mile Radius where the signal is not clear! Proper Set Up made this possible. The coaxial cable antenna (colinear) is used by Ham Operators, but is useful for FM Radio when made as shown on the following page. I can not guarantee that the SIGNAL STRENGTH will be legal - you will have to do that. The formula for figuring Unlicensed Legal Limits is: $124,000/f\text{KHZ}$. This figure must not be exceeded and is measured at a distance of 100 feet from the Antenna. If the FCC determines that you are running too much power, you will be required to turn it down or turn it off!

A "NO - NO"

Some of the Unlicensed Broadcasters try to run vast amounts of power, which can get them into trouble, but the number one "no - no" is ANTI-GOVERNMENT, ANTI-ESTABLISHMENT HATE BROADCASTING. Differences of opinion, opposing views are permissible, but no profanity, venomous hatemongering is permitted on the air waves.