

# PROMETHEUS RADIO PROJECT

FLAME FILCHING, WAVE SNATCHING, PEOPLE-POWERED RADIO!  
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## The Transmission Toolkit: *how to find the best location for your LPFM transmitter*

### What is a transmission site?

The transmission site, also known as the tower site or antenna site, houses the equipment that broadcasts your FM radio signal out to the world! The transmission site is often located at the same place as the broadcast studio. This makes it easy to send audio to the transmitter. However, it is not always practical or desirable to put your studio at the same place as your transmitter.

### What makes up the transmission site?

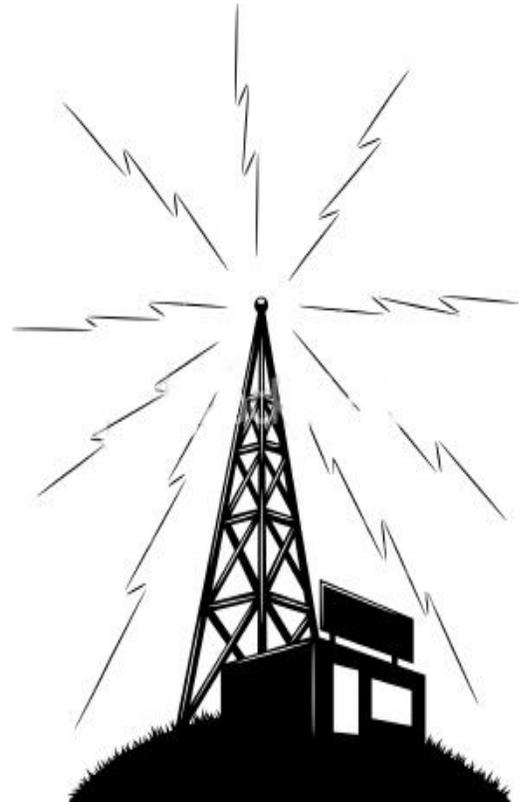
The transmission site has three components: a transmitter, an antenna, and a structure where the antenna will be mounted. The antenna is mounted on a structure—a tower, a mast, a building, a flag pole, a water tower, etc—and is connected to the transmitter with a long cable. The transmitter needs shelter from the elements, a power source, and a connection to the audio from your broadcast studio. The antenna does not need a power source because it is powered by the transmitter.

If your transmission site and broadcast studio are located in two different places, you will need a studio-to-transmitter link (abbreviated STL) to send audio from your main studio to the transmission site. For more information on studio-to-transmitter links, visit our guide *Sound Around Town* at [prometheusradio.org/transmission#sound\\_around\\_town](http://prometheusradio.org/transmission#sound_around_town).

### Where do I start?

Before you start looking for a specific location, you need to confirm that there are frequencies available in your general area. You can do this using a channel finder like Prometheus Radio Project's RFree. To get started with RFree, visit the RFree Users Guide at [radiospark.org/rfree](http://radiospark.org/rfree).

Next, you need to identify the communities and neighborhoods you want to cover with your broadcast. This step will help you and any engineer you work with determine the ideal location for your transmitter. It is helpful to create a map that shows the intersections and neighborhoods that you want your broadcast will cover. Creating maps is easy to do using free software like Google Maps. Follow our step-by-step guide to creating maps of the target audience for your LPFM at [prometheusradio.org/transmission#map\\_coverage](http://prometheusradio.org/transmission#map_coverage).



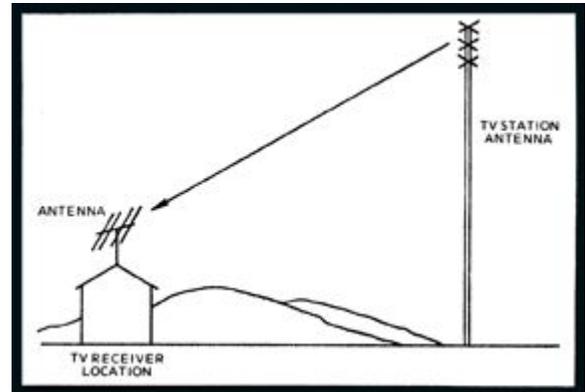
# Considerations

## Coverage

A Low Power FM station can be expected to broadcast up to 5 miles depending on the surrounding terrain. In flat rural areas, an LPFM can broadcast farther than 5 miles. And in a city with tall buildings, an LPFM's broadcast range can be reduced. Because of the limited broadcast range of LPFMs, you will need to carefully select a transmission site in order to reach a particular local area. As a general principle, your transmission site should be as close as possible to the center of the area you want to cover. There are some exceptions to this rule, particularly if there are nearby hills or other topographic features that will affect your transmission.

## Line-of-Sight

Radio waves in the FM band are best received when your radio has a “line of sight” to the transmitting antenna. Tall buildings or hills and mountains between your radio and the source will obstruct the transmission and degrade the signal. If there is a line of sight between the radio transmitter and receiver—there are no obstructions—the signal will be picked up strongly, even sometimes up to ten miles away. Therefore, the highest location in town is generally the best transmission site.

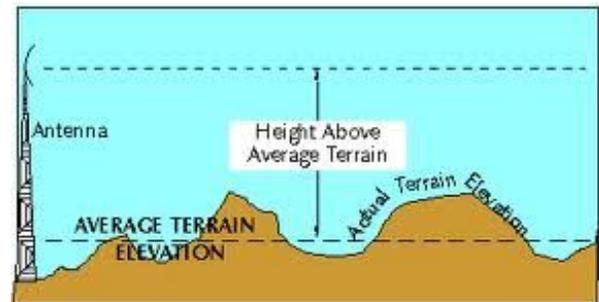


Example of line-of-sight transmission (TV shown)

## Power and height limits

LPFM stations are limited to a maximum of 100 watts of power with an antenna height of 30 meters Height Above Average Terrain (HAAT). See the sidebar for an explanation of HAAT.

In order to place your antenna higher than 30 meters—with an absolute limit of 450 meters HAAT—then you must reduce the transmitter power accordingly. For example, if you mount your antenna at 42 meters HAAT you must reduce your power to 50 watts. In most cases, however, a 30 meter high antenna broadcasting 100 watts of power will give you the best result.



antenna height above average terrain

**Height Above Average Terrain**, abbreviated as **HAAT**, refers to the antenna height relative to the average height of the area surrounding the antenna. The FCC calculates the HAAT by estimating the average altitude above sea level of the land in the surrounding area, and subtracting that from the height of the antenna above sea level.

## Radiation exposure limits

The FCC limits human exposure to radio frequency energy. Luckily, radiation from a 100W station is relatively small. There is generally no problem if your antenna is at least 20 feet away from anywhere people will be (living, working, walking by, driving by, etc). Otherwise, you will be required to do routine site evaluations.

## Blanketing interference

As a licensed FM station, you are responsible for correcting interference to other broadcasts in your immediate vicinity. For a 100-Watt station, the blanketing area is 1/8 km (approximately 400 feet). For example, if your transmission site is within 400 feet of Joe Shmoe's house and he is having

trouble tuning into his favorite commercial station because of interference from your LPFM, you might have to work with him to solve the problem. This could be as simple as helping Joe get a better radio. The easiest solution is to put your transmitter in an unpopulated location!

### **Localism rules**

To meet the FCC's localism rules, your transmission site must be within 10 miles of the headquarters of your nonprofit (or seventy-five percent of board members must live within 10 miles of nonprofit headquarters). Outside the top 50 US markets, you are permitted to be 20 miles away from your nonprofit headquarters.

## **Finding the Sweet Spot**

There are two types of locations to look for when siting your transmission setup. You can either rent space on an existing tower or find your own location where you can mount your antenna on a new tower or other structure.

### **Is it right under your nose?**

First, consider any buildings or properties that your organization already rents or owns. Can any of those locations reach your desired coverage area? Could you mount an antenna on the building or build a tower there? Can you get approval from the owner of the property?

### **Share a site or do your own thing?**

In general, it is easier to mount an antenna on an existing building or tower than to build a new tower. You can mount an antenna on the top or side of a building using a small tower or mast. However, smaller do-it-yourself towers (under 30 meters) can be constructed on the ground with the help of a big group of friends and neighbors and a knowledgeable amateur radio enthusiast or structural engineer.

Sharing space at an existing tower or other structure has benefits and drawbacks. Since existing sites are already used for radio transmissions, cell service, or other kinds of communications, they already have the necessary infrastructure to support your transmission (power source, grounding, Internet connection, etc). Existing sites also present the opportunity of pooling resources with other tenants to purchase engineering and maintenance services.

On the other hand, space on an existing tower can be expensive to rent and creates additional layers of bureaucracy to manage. Locating on a tower that is shared between multiple transmission devices can also cause unwanted interference. Interference between different transmitters in one location can be corrected with additional equipment that will add to your costs.

## **Finding Your Own Site**

In most cases, you won't find an existing tower right in the middle of the area your LPFM will cover. So, you will have to search that area for a building-top or piece of land that you can purchase, rent, or use pro bono. One important factor in site choice is the optimal height of your antenna at any given location (see HAAT explanation above). You will need to determine the HAAT of an antenna at each location you consider. This will allow you to determine whether a building's roof is too high or too low for your antenna or if building a new tower at a location makes sense. If you find a location where a small tower will be enough to get your antenna to 30 meters HAAT, building your own tower is usually a very good option.

If you choose to build a tower, be sure to check your local zoning laws and building codes. You might need a building permit from your city. In rare cases, you might need to file additional information with the FCC about the environmental impacts of your new tower. For example, you would need an Environmental Assessment of your site if it is located in an officially recognized wilderness area or wildlife preserve, threatens the habitat of endangered species, affects officially designated historic places, affects Native American religious sites, is located in a floodplain, or impacts wetlands. If you do have to submit an Environmental Assessment, keep in mind that a small tower for an LPFM is unlikely to have a significant environmental impact. For more information check out our guide Hang 'Em High at [prometheusradio.org/transmission#antennas\\_towers](http://prometheusradio.org/transmission#antennas_towers).

## Finding Shared Sites & Existing Towers

The FCC maintains several databases of all the radio towers and antennas in the United States. You can find all of the FCC databases at [fcc.gov/data/search-gallery](http://fcc.gov/data/search-gallery). Navigating the FCC's multiple databases looking for antennas or towers can be time consuming and difficult. Luckily, there are more user-friendly tools available that present the FCC databases all in one place with maps and simple search capabilities. Below are brief descriptions of three tools to help you find existing towers and antenna sites: RFree, AntennaSearch.com, and FCCinfo.com Google Earth database.

### RFree and the Share Existing Station feature

RFree, available at [rfree.radiospark.org](http://rfree.radiospark.org), is a channel finding software developed by Prometheus Radio Project. In addition to searching for available frequencies and potential transmission sites in your area, RFree allows you to test if you could place a new LPFM transmitter at any existing transmission sites.

**RFree - LPFM Antenna Location Search**

1. Change Location... 2. Frequency... 3. Elevation, Height 4. Review... More...

Map  
Latitude, Longitude  
Share Existing Station

Philadelphia, PA, US (40 4 15.8 N, 75 2 10.23 W) Cancel Save+Copy Save

**Northeast Philly**  
Philadelphia, PA, US  
40 4 15.8 N, 75 2 10.23 W  
Save and Search

**Show /hide:**  
Prohibited areas in red    
Waiver-required areas in yellow    
IF and OK 3rd-adjacent areas in grey

**Northeast Philly**  
LPFM (100W@30m)  
92.9 MHz  
40 4 15.8 N, 75 2 10.23 W  
Philadelphia, PA, US  
Delete

*Step 1. Select the Share Existing Station link found under the Change Location menu. This feature will search for existing towers and antenna sites close to your current location on the map.*

**RFree - LPFM Antenna Location Search**

1. Change Location... 2. Frequency... 3. Elevation, Height 4. Review... More...

### Locate Antenna at Existing Radio Station

If you plan to mount your antenna at the facilities of an existing radio station, enter the station's Facility ID below. ?

Facility ID

Nearby Stations

- None Selected
- None Selected
- W246AR-INPUT-FX-XI 10.4km @ 65.157° (7927)
- W246AR-FX-D 10.4km @ 65.157° (7927)
- WPEN-FM-B 12.4km @ 275.999° (47427)
- W245AG-INPUT-FX-XI 12.4km @ 275.988° (86419)
- W245AG-FX-D 12.4km @ 275.988° (86419)
- WISX-FM-B 12.4km @ 276.13° (53973)
- W236AF-INPUT-FX-XI 14.3km @ 85.0215° (85965)
- W236AF-FX-D 14.3km @ 85.0215° (85965)
- WRDV-FM-A 16.1km @ 338.037° (7931)**
- WRDV-FM-A 16.1km @ 338.037° (7931)
- W246AQ-INPUT-FX-XI 17km @ 218.503° (84808)
- W246AQ-FX-D 17km @ 218.503° (84808)
- WPHI-FM-FM-A 17.3km @ 220.417° (12211)

Cancel Save

Back to [RadioSpark.org](http://RadioSpark.org)

**Map**  
Northeast Philly  
LPFM (100W@30m)  
92.9 MHz  
40 4 15.8 N, 75 2 10.23 W  
Philadelphia, PA, US

Delete

Step 2. You will land on the Locate Antenna at Existing Radio Station page. Using the drop-down list, select a nearby facility in order to test that location for open frequencies. The list is made up of FM radio stations and FM translators. Each entry displays a station call sign, its distance from your current location on the map, the direction in degrees from your current position, and the FCC facility ID. As you can see, the FM translators have funny-looking call signs that include numbers.

**RFree - LPFM Antenna Location Search**

1. Change Location... 2. Frequency... 3. Elevation, Height 4. Review... More...

### Saved

### Details for Frequency ! 92.9 MHz

Below is a list of nearby stations that could potentially receive interference from your station or cause interference to your station on channel 92.9 MHz.

Select this Frequency Return to Frequencies Available

Nearby Station	Where?	Too Close? ?
<b>WMMR</b> 93.3 MHz More from <a href="#">FCC REC CMA</a>	↗ 27.06 km away	! Too close by 39.94 km
<b>WXTU</b> 92.5 MHz More from <a href="#">FCC REC CMA</a>	↖ 27.70 km away	! Too close by 39.30 km
<b>CHERRY HILL, NJ, US</b> 92.9 MHz More from <a href="#">FCC REC CMA</a>	↓ 22.35 km away	✓ Too close by 3.65 km <b>Not a problem(translator)?</b>
<b>WPAT-FM</b> 93.1 MHz More from <a href="#">FCC REC CMA</a>	↗ 102.31 km away	✓ Far enough away by 5.31 km
<b>WOBM-FM</b> 92.7 MHz More from <a href="#">FCC REC CMA</a>	↖ 69.96 km away	✓ Far enough away by 13.96 km

Back to [RadioSpark.org](http://RadioSpark.org)

**Map**  
Northeast Philly  
LPFM (100W@30m)  
92.9 MHz  
40 6 36.4 N, 74 55 32.6 W  
Philadelphia, PA, US

Delete

Step 3. Once you choose a nearby station and select "Save," you will be directed to a "Details for Frequency" page or a "Frequencies Available" page generated at the existing location you selected.

## AntennaSearch.com

AntennaSearch.com is a website that allows you to search the FCC database for existing towers and antenna sites within a 4-mile radius of any address. The site displays three types of results: existing large towers (over ~200ft high), pending applications for new large towers, and transmission sites where antennas are mounted on smaller towers, buildings, or other structures.

Welcome to AntennaSearch.com!

Your Free online source for ...

- Detailed information on over 1.9 Million Towers and Antennas in the US!
- Includes Google Maps, Ownership Details, Contact Information and more ...
- Pinpoint Existing Towers, Future Towers and even small, hidden antennas to determine Cell Phone coverage.

Start your search now ...

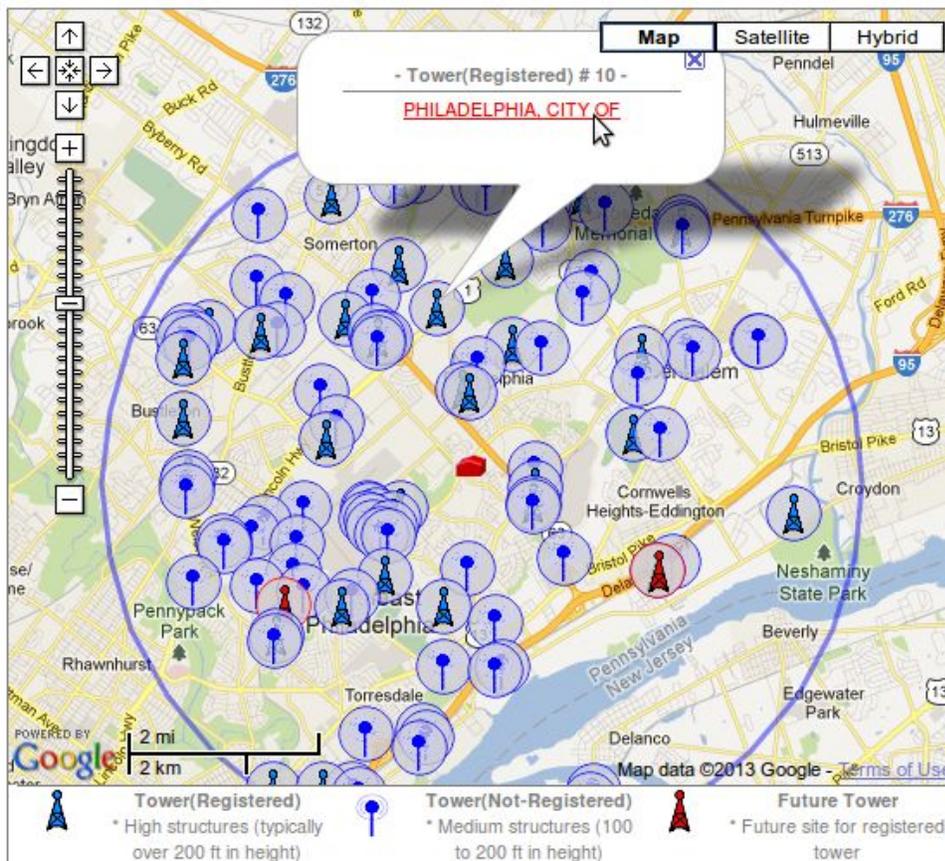
Street Address: 20 Comly Rd    City: Philadelphia    State: PA    Zip (Optional):    Go

- All Towers (Existing and Future) and Antennas within 4 miles of your address will be returned -  
( Database Last updated on: 4/7/2013 - 2,092,740 Towers and Antennas Online! )

Map powered by Google ...

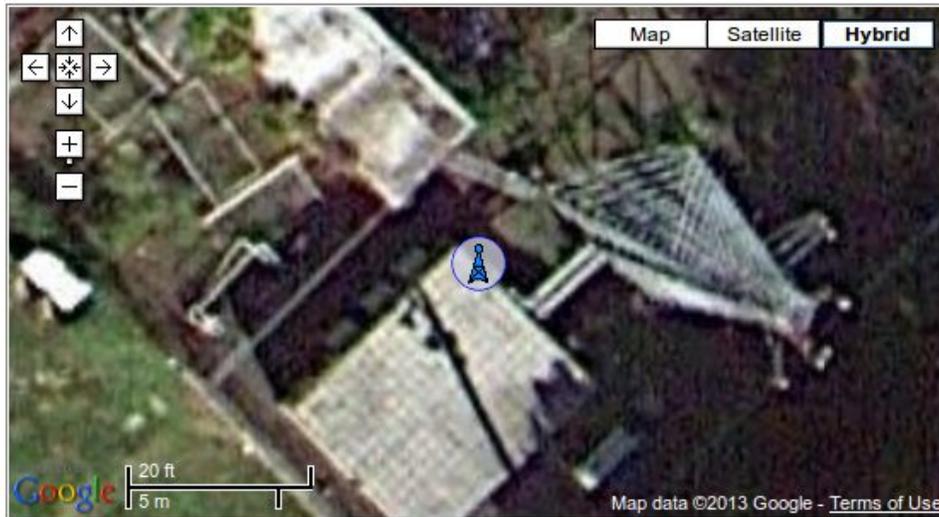
Step 1. Enter an address. The site will search for existing towers and antenna sites within a 4-mile radius.

### • Tower Structures - (Comly Rd, Philadelphia, PA 19154)



Step 2. Before reaching the results page, displayed on the left, you will need to confirm the address you are searching and choose whether to view the towers map or antenna map. The map to the left displays towers in Philadelphia. More information appears when you click on a tower.

 Registered Tower Detail - Tower (10)



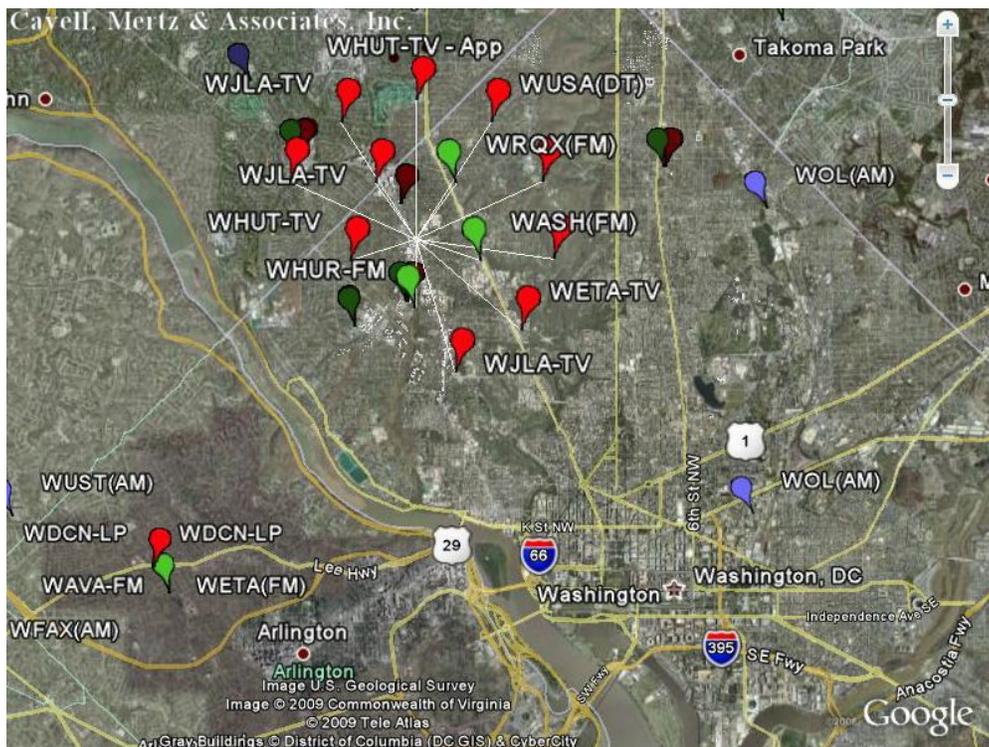
• Ownership Info

Rep	Company:		Address:	Not Recorded
	Contact:	Not Recorded		
	Phone:			
	Email:	Not Recorded		
Owner	Company:	PHILADELPHIA, CITY OF	Attn:	George Westermann
	Contact:	Not Recorded	Address:	City Hall, Rm 702
	Phone:	(215)686-4575		Philadelphia, PA, 19107
	Email:	Not Recorded		

*Step 3. By selecting a tower (or antenna) on the map, you can access the Tower Detail window that provides a satellite image of the tower, geographic coordinates and height of the tower, and contact information for the owner.*

### FCCinfo.com Google Earth database

[FCCinfo.com](http://FCCinfo.com) is a service run by the commercial broadcast engineering firm Cavell, Mertz & Associates, Inc. The free site allows you to search FCC databases without the hassle of actually visiting the FCC website! FCCinfo.com also hosts a version of the FCC database that can be opened in [Google Earth](http://Google Earth), a free mapping program. While AntennaSearch.com is an easy and accessible tool, FCCinfo's Google Earth database is a much more powerful tool that requires some additional computer know-how. You will need to download and install the Google Earth program on your computer and then download and import FCCinfo's database. You can find more information at [fccinfo.com/fccinfo\\_google\\_earth.php](http://fccinfo.com/fccinfo_google_earth.php).



## Renting & Reasonable Assurance

You may need to rent space on a roof or plot of land for your transmission site. In this case, you will have to convince the property owner that installing an LPFM tower will be no big deal. Luckily, LPFM antennas are small, light, and relatively unobtrusive in most situations. You can give your potential landlord our short guide on antennas and towers to alleviate any fear they may have: [prometheusradio.org/transmission#antennasupports](http://prometheusradio.org/transmission#antennasupports).

Before you rent a property, you need to make sure you will be able to install an antenna. This is particularly important if you're trying to install an antenna on a rooftop. You will need to check local zoning and building codes. You should also consult a local structural engineer to determine if installing a tower will be feasible and safe in that location. But to get started, here are some questions you can ask a property owner to help narrow down your options:

- Height of the building
- Nature of the roof (flat, concrete, shingled, etc)
- Availability of an enclosed space on the roof (or in the building) to house the transmitter
- Ability to bore holes in wall of the enclosed space, or down inside a building, in order to connect the transmitter to the antenna
- Availability of a devoted power circuit (on its own breaker circuit)
- Availability of surveys of building
- Availability of blueprints for building

You need to get a Reasonable Assurance Agreement from your potential landlord before submitting your LPFM application to the FCC. This Reasonable Assurance Agreement is a written promise from a property owner that says they will allow you to locate your transmission site on their property if you are granted an FCC license.

Securing this agreement in writing is *extremely important* and *absolutely necessary!* If you lose your transmission site after your application has been approved by the FCC, you will have start over, find a new transmission site, and file more paperwork with the FCC. This will take away from the time you will need to organize your community and build your station! Even if you plan to put your tower and antenna in your grandmother's backyard for \$1 a year, get her to sign an agreement!

Here is an example of a Reasonable Assurance Letter from a tower owner to an LPFM applicant:

Dear [LPFM APPLICANT ORGANIZATION],

Based on our discussion this confirms that, should your FCC construction permit application be granted for a low-power FM non-commercial authorization with antenna at coordinates [XX XX XX.X N XXX XX XX.X W], [I/WE] have space available at [MY/OUR] tower, and would be willing to enter into a lease of tower space with you, subject to final determination of a rental rate based on market conditions at the time.

Sincerely, \_\_\_\_\_ [INDIVIDUAL and/or OWNER]

On behalf of [FACILITY/TOWER OWNER/ORGANIZATION]

[FACILITY-ID ##### or ANTENNA ASRN #####]

Date: \_\_\_\_\_

## **You Can Do It!**

If you are overwhelmed with information at this point, you've done a good job reading this guide. As you now know, there are many different avenues to pursue in finding a transmission site that will work for you and your community. Consult with your neighbors, make connections, and give it a try!