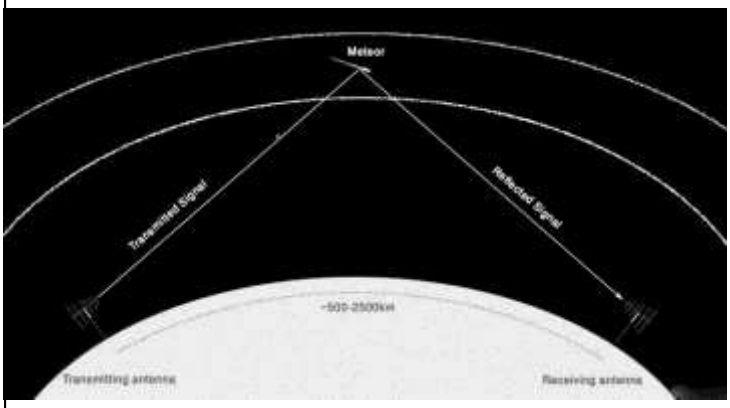
So you want to hear meteors? A basic how to guide

Michael Boschat

Well, it's overcast as usual and the big Perseid meteor shower is expected to produce 1000 meteors an hour. You were all ready with your camera to drive to a clear spot but everywhere is overcast. So, you can sit and watch TV or listen to this meteor shower and others as well. How do I do that? you ask... well it's pretty simple. I will describe how to do it in basic terms. I'm not an electronics expert but I will describe my way of listening to them.

The BASICS

We have all seen meteors flashing across the sky at night. They do the same in a daytime sky but we cannot see them with the eye, but we can hear and see them with radio methods. As the meteor burns up it leaves an ionized trail. It is from this trail that radio waves are reflected off, similar to a mirror reflecting light. A transmitter at a far distance, say 1000 Km, is broadcasting and one of the signals hits the ionized layer and gets reflected to you, where your radio will pick it up. See Figure 1 below.



▲ *Figure 1:* The FM signal is reflected off the ionized trail and is picked up by your radio receiver.

Back in the old days, TV stations used over the air transmissions (analogue) which we used to detect meteors and the signals were strong and all over the place, so meteor trails were reflecting a lot and we heard a lot. Enter technology, 90% of the nice analogue TV transmitters are now converted to digital. This saves money but produces less powerful transmissions. But they can still be used for our purposes.

GETTING STARTED - Radio, Antenna, Frequency

OK, what do I need to hear and "see" these meteors? Well, the main thing is a radio. Can I use my digital AM/FM one, well sort of, I will discuss that in brief later. A better type

▲ Michael's radio astronomy equipment *(Photo: Michael Boschat)*

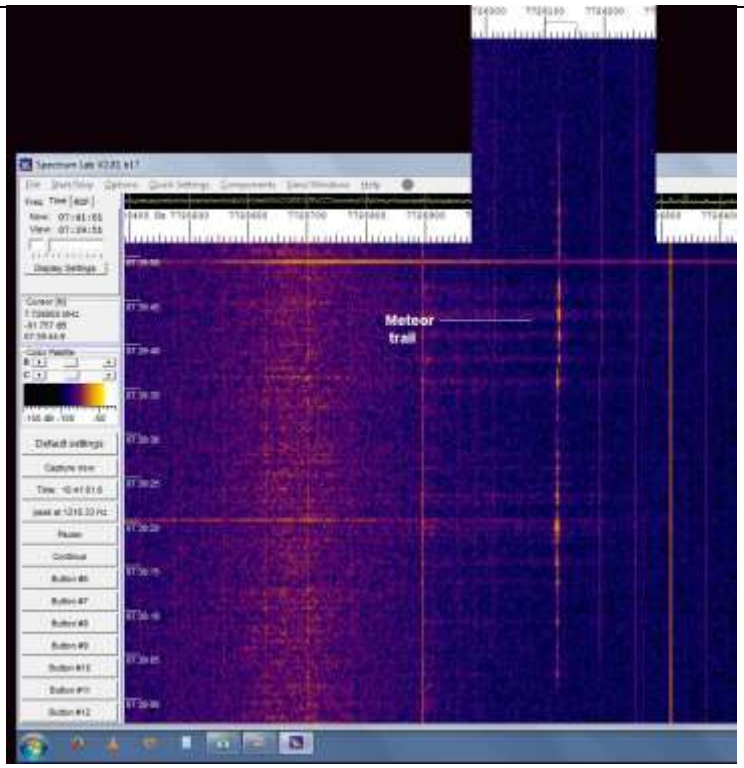
radio is what Ham or Amateur Radio people use. Yes, they are expensive, but you do not need one that transmits, just one that receives, and has the following modes, CW (Carrier Wave) Lower Sideband (LSB), and Upper Sideband (USB). In most cases I always use CW mode.

I use a hand held ICOM R-20 receiver I bought for $700. It has all the features needed. You can buy one (or another brand) from eBay, or check your newspaper or nowadays the internet want ads to look for one that you can afford. BUT--- you will need to watch what frequency they use. Some use only 144 MHz, you need one that will go from at least 50 MHz to 108 MHz. The other frequencies will not be needed as we will be working only from 50 Mhz to the 108 MHz, and mostly in the TV frequency range of 50-86 MHz. You really do not want to go above 108 MHz, as fewer meteors will be detected at the higher the frequencies.

You asked, "What about my digital FM radio?". OK, you can use it to some extent, but if you live in a city as I do you know how many FM stations there are walking over each other's signal. This is the big problem with trying to find FM radio meteors from a city. You may need to make or buy

some type of notch filter to eliminate the other stations from walking over a frequency you monitor.

The basics of FM radio meteor detection is to tune to a station frequency you know exists that you can either *just* hear or not hear. Now, you should have a clear static sound with very minimal noise in the background. When a meteor goes by the station will come in as either a brief period of talk or music. The longer the meteor trail, the longer the signal will last. The FM detection would work best away from the city and places like our mid Canadian Prairies with less population would be ideal. Of course getting away from the city would help also. One can always try with a radio to see what happens especially during a meteor shower to give the best results and let you get the feel of what it all would sound like.



▲ Spectrum Lab output 1 *(Photo: Michael Boschat)*

OK, you bought a used amateur radio with the mentioned features and you are ready to listen to meteors... not yet...

The next item you need is an antenna. Gezzz... how much? well you can make a simple dipole type out of wire or even two old TV extendable rabbit ears type, or a long piece of coax cut to the length of the frequency you will be using. Note, the shorter the frequency the longer the antenna.... but if you are in a small apartment and the long one will not be useable, it can be cut in half, or quarter.. thus the term, 1/2 and 1/4 wave. My dipole is a 1/4 wave with each element about 40 inches (100 cm) long. The dipole will have 2 elements, a director pointing towards the target transmitter, and a reflector. Both are separate and do not touch each other (see photo on previous page),

Some radio observers use the Yagi, it is more directional and at times can eliminate a bit more noise than the dipole. However, it is expensive and bigger so in this article I will assume we will use the dipole. Once you have the antenna connected to the radio you just point it towards the most populated area of transmissions. But, now we need a frequency to monitor.

Now, what frequency do I monitor? This depends on what transmitters are active in your area and a baseline of 1000 Km is maximum, that is why pointing to the most populous area of the country is recommended.

As you recall, 90% of the TV analogue transmitters died because of converting to digital TV but there are still a few active analogue transmitters about. Your problem is hitting a good one. You can also get digital frequency carriers and hear meteors, you just need to tune to one of their carrier frequencies, as listed below, 54.310, 60.310, 66.3190, 76.310 or 82.310 MHz. Do experiment by setting the frequency off a bit, say tuning to 76.309 MHz or 76.311 MHz. It is best to experiment during one of the major meteor showers to get a good frequency and note that down for future reference.

The basic frequencies for you to try and detect meteors are below, this is from my personal tests and shows what I have heard. Note that the 2nd frequency is from Digital TV carriers; as you can see for me TV channels 5 and 6 are my best ones. That because I live in a city and I am overwhelmed by other TV and FM stations. This means I need to use a notch filter to eliminate as much noise from them as possible while I monitor my frequencies.

Ch = channel, AN= Analogue, DIG = Digital. Frequencies are always in MHz

Ch AN DIG NOTES

2 55.25 54.310 --- Nothing heard
3 61.25 60.310 --- Tone heard but no meteors
4 67.25 66.310 --- Tone on VC + meteors heard on 67.2511 MHz. None heard on 66.310 MHz
5 77.25 76.310 --- Better one so far. Tone heard and meteors on 77.2511 MHz. Also heard on 76.3101 MHz. As of Aug. 24, very hard tone and other frequencies seem to be there, decided to drop to 77.25085 MHz still pick up meteors but tone is still there but will see what happens.
As of Aug.28 - turned dipole to about 320 degrees North magnetic, about 90 degree angle from tone, it reduced the noise OK and was able to get meteors. As of Aug. 29, moved to 77.25191 MHz, higher to get away from noise, meteors still seen and seem a bit brighter on reflections.
6 83.25 82.310 --- So far good, tone on 83.251 MHz and meteors. Also heard on 83.24 MHz. More on 82.3101 MHz.

You can do a Google search for FM stations in Canada and USA but let them be 500-1000 KM away from you. Also stay in the lower range FM, 87 MHz to 99 MHz, listen to the fre-

quency chosen to hear if other stations are walking over the frequency you picked. Keep trying till you can get clear static.

You can do one of two things now. With the radio on you turn the squelch off and listen to the static, when a meteor goes by you will hear a "PING" like some one hitting a tuning fork. Some meteors will make a hard "WHOMP" sound. The sound will last for 1/2 second up to 30-50 seconds.

The other method to hear and see them is to download a software program, the one I use is called Spectrum Lab. When downloading a program make sure it is compatible with your operating system, and read the installation instructions carefully.

Now that you are a radio meteor observer, you can send monthly reports to some places, these help in determining a meteor shower's progress. Sometimes you will get a lot the day before or after the main visual peak, plus a radio system can detect meteors to about 8th magnitude.

SITES OF INTEREST

The FCC list of what stations from channel 2-6 are active in Canada and USA:
http://transition.fcc.gov/fcc-bin/tvq?state=&call=&arn=&city=&chan=03&cha2=03&ser
http://transition.fcc.gov/fcc-bin/tvq?state=&call=&arn=&city=&chan=04&cha2=04&ser
http://transition.fcc.gov/fcc-bin/tvq?state=&call=&arn=&city=&chan=05&cha2=05&ser
http://transition.fcc.gov/fcc-bin/tvq?state=&call=&arn=&city=&chan=06&cha2=06&ser
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RADIO METEOR OBSERVERS BULLETIN: a site to send your reports, with contact person: http://visualrmob.free.fr/
Contact: Christian Steyaert—steyaert@vvs.be

SPECTRUM LAB
Introduction: http://www.qsl.net/dl4yhf/spectra1.html
Download: www.qsl.net/dl4yhf/speclab/install_speclab.zip

How to Use Your FM Radio to Detect Meteors
http://www.skyscan.ca/meteor_radio_detection.htm

ON YOUTUBE: type in: Meteor Scatter Using Over The Air DTV Pilot Signals
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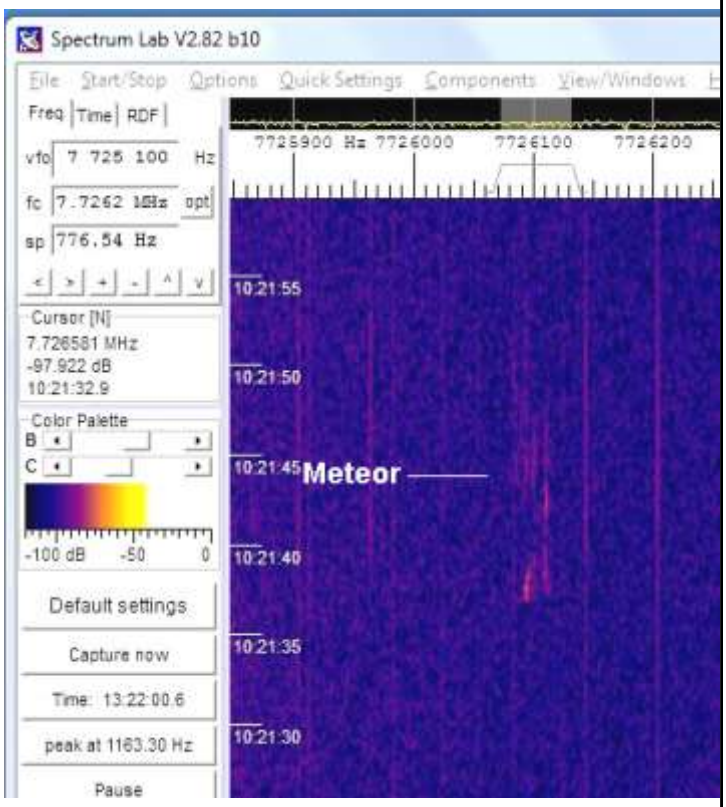
Amateur Dipole Antenna Calculator
http://www.csgnetwork.com/antennaedcalc.html

How To Build a 1/2 Wave Dipole
http://www.wcerc.org/Projects/dipole.asp

METEOR SHOWERS

Quadrantids Active January 1-10, peak January 3-4
Lyrids Active April 16-25, peak April 22-23
Eta Aquariids Active April 19-May 26, peak May 6-7
Delta Aquariids Active July 21-August 23, peak July 28-29
Alpha Capricornids Active July 11-August 10, peak July 27-28
Perseids Active July 13-August 26, peak August 12-13
Orionids Active October 4-November 14, peak October 21-22
Southern Taurids Active September 7-November 19, peak October 23-24
Northern Taurids Active October 19-December 10, peak November 11-12
Leonids Active November 5-30, peak November 17-18
Geminids Active December 4-16, peak December 13-14
Ursids Active December 17-23, peak December 21-22



▲ Spectrum Lab output 2 *(Photo: Michael Boschat)*

And in conclusion, one can always go to Youtube and type radio meteor and making a dipole antenna. There will be numerous videos on these subjects. And doing a Google search on the same above will yield lots of results with some plans and drawings on making a dipole. If you get gung ho type Yagi and try to make one of them also.

Clear skies and happy listening.....

Michael Boschat