Natural Radio

News, Comments and Letters About Natural Radio

March 2000

Despite a warm winter, geomagnetic storms, and high solar activity, all seems quiet on the whistler front – at least from my own experience and your correspondence. Even though much research has been done, we have barely scratched the surface in our understanding of all the factors that that cause and propagate natural radio emissions. There are many mysteries out there waiting to be solved, and the whistlers still defy prediction.

I have been going out each evening with my breadboard receiver and checking it against my WR-3. Sferics have been strong on some evenings, although tweeks seem to have diminished greatly since December, with some evenings being essentially "tweekless". In about a month of listening I have heard one weak whistler. Let's hope things will pick up for the equinox.

At this point, the circuit design for the receiver is not all that different from the WR-3 except for the addition of two cascaded -12 db per octave active filters for a slope of -24 db per octave with the knee somewhere around 350 Hz. The filtering in the receiver seems to be doing a good job, but I need to work on getting the RF out of the receiver. I am picking up audible interference (maybe NAA at 24 kHz.), and it is being demodulated, so I guess the front end needs some work.

The design currently is be a "two-box unit" with the front end in one box, and the filtering and amplifier in another case. This will allow an e-field or loop front end to be plugged into the amplifier box and also will allow placing the box in a quiet location, some distance away.

I am using an LM-324 quad opamp for the active filters, and will probably use one of the extra amps for a 10 kHz. lowpass filter.

Once I am sure that the bugs are out, and if the filtering provides improved performance over current designs, I'll publish the construction details. I haven't tried the comb filter yet, although I did find the chips at the last hamfest. Since my design skills are a bit rusty, the active filters have been keeping me busy enough, but the results have been encouraging.

Mike Mideke sent me a copy of his whistler hunter's guide and Bill Oliver sent me copies of Mikes excellent series of articles on whistlers. My reference library is growing and I am slowly trying to digest this massive amount of material.

Coordinated Listening for Spring Equinox

Winter is rapidly fading. Even though we had our biggest snowfall of the year yesterday, spring is on the way. So, what could be a better way to beat cabin fever and breathe some of that fresh spring air than doing a little coordinated listening at your favorite quiet location.

Experience and past data have indicated that whistler activity increases around the time of the equinoxes. Now, I'm not sure if there is a theoretical reason for this or not, but here's a

good chance to go out and do some listening. The chances are good that you just might hear something interesting.

Besides encouraging listening, our objective is to get some coordinated data at a time when whistlers and other atmospheric phenomenon are likely. If there is some interest here, we can do more events like this in the future and make our data collection a little more sophisticated and scientific.

Mike Mideke extensively discussed procedures for coordinated monitoring in the January and February 1993 issues of *The Lowdown*. These were well thought out, and I suggest we use them.

The dates are the weekends of March 18 - 19 and March 25 - 26. As a minimum, please monitor and record, if possible, the first six minutes of the hour beginning at 6:00 AM local time. This should be very close to local sunrise. You are encouraged to monitor up to three hours before and two hours after local sunrise.

If you are recording, begin each segment with an announcement of your name, date and location. Follow the announcement with a recording of WWV or CHU with their top-of-the-hour time announcement and marker tone. Then without stopping the recorder, transfer the recorder input to your VLF receiver and let it run through the start of minute 6. If you have a DAT, mini-disk, or stereo cassette recorder, its OK to record the time signals on the alternate channel -- but test the setup for crosstalk first. (I got all excited when recording one of the SEPAC tests from MIR and heard tones on my recording. Later analysis revealed that the tones were the WWV 1-minute mark tones bleeding through from the other channel.)

If you are not recording, it is important to keep an accurate log. The data will be most useful if it is timed accurately. Use WWV time signals and a stopwatch. Prepare a sheet of lined notebook paper with time and date indicated at the top. Allow 3 or 4 lines for each of the six minutes and mark them from 0 - 5 in the left margin. Start your stopwatch on the hour mark from WWV. Starting at the beginning of the “0” line record the second at which each event happens followed with a abbreviated description of the event such as “W” for whistler, “T” for tweek, and qualifiers such as big, hissy, long, many, etc. Continue down the line, but remember to move to the next section when minute “1” comes up. Leave space on the right for to indicate chorus, hiss, or any other signals that continue throughout the session. Don’t try to log every sferic unless you can write very fast and very small.

If you’ve recorded, please log your tapes in the manner indicated above.

Send in a copy of your log (please don’t send originals). If I receive enough logs to establish some coordination between them, I’ll publish a composite report in a future issue of *The Lowdown.* If there doesn’t seem to be any coordinated activity, or if the ionosphere doesn’t cooperate, I’ll publish the highlights of individual results.

So, that’s it, as simple as I could make it for this return to coordinated monitoring. Many thanks to Mike Mideke for thinking out these monitoring procedures. I am looking forward to doing this on a regular basis in the future.

Your Much Appreciated Correspondence

•**Walter Mahoney (wmahoney@ma.ultranet.com)** writes: “I work for a small municipal electric utility here in Massachusetts, and I'm also a long time experimenter in natural radio.”

“Most electric utilities here in the Northeast use a 13,800 v 3-ph. "Y" primary voltage. Often single-phase taps are taken off the three-phase to run down individual roads, and this phase-to-neutral voltage is 8,000v. Some older systems still use 4,160 v single-phase, but these are dying out. The "high lines" running through states are usually 115,000 "Y"”.

“If you look up at the three-phase running down the road, it will be one of two configurations: either open wire strung on crossarms with pin-type insulators, or a close bundle of 4 conductors with plastic separators every twenty-five feet or so. This latter is "Hendrix" (a trade name) wire, and that spacing between the conductors is not random; it's carefully calculated by the engineers at Hendrix to cancel out magnetic losses. Thus, the Hendrix system should put out less QRM, and I find that to be true in actual practice. It's pretty quiet in comparison with the open wire, which as you correctly point out is a giant antenna. Note how the open wire is tied on to the insulator--- that "tie wire" picks up a potential difference with the conductor, and it's always "buzzing". Leaky lightning arrestors and bad connections (esp. at the cans) add to the general racket. However, the impedance of modern transformers is very well matched to the line, in the interest of decreasing losses. At 60-Hz coupling is not a huge issue, anyway.”

“However, I still find that it's easier to get away from the "local" power line interference than it is the high-line noise. In my experience it makes ELF/LF listening an impossibility for miles around.”

“Re: whistlers, numbers seem to have fallen off in the past two months or so. I try to check for at least a few minutes each morning before dawn. I have a homebrew Rx mounted outside in a quiet location and run the audio in and DC out over 18-ga. shielded pair.”

•**Eric Vogel (evogel@pop.flash.net)** writes: “You have already touched on a topic near and dear to my heart - trying to hunt whistlers from home in the suburbs. The comb filter: I have thought about this for some time. There are two ways to do this I am aware of. The first is to use a delay line. A nice article on this can be found "Hickman's Analog & RF Circuits" pp. 79-86. I have not tried this. However, I have observed that what we really need to do, at least around where I live near Dallas, TX, is to suppress the fundamental and the odd harmonics. The even ones seem mostly absent. A second approach is to build an "all-pass" filter that shifts the phase 180 degrees every 60 Hz well above several kHz and then sum this with the unfiltered signal. Haven't tried that either. What I have tried, and it works well, is a passive notch filter at 60 Hz. You can see my approach at www.flash.net/~evogel.”

“Look at the schematic for the whistler receiver. The basic idea is to attack the 60 Hz fundamental *before* it gets into the front end. This keeps it from completely overloading the first stage (which it does in my neighborhood quite easily).You will also note a passive RF filter before the front-end. This works to suppress a monster BCB station in the area. Note that I have redesigned this somewhat for my next receiver, but this works quite well. I have made all the other filters switchable because on rare occasions I find sites that are really quiet. The overall quality of the reception is then much improved. The only thing I have done with this whistler receiver that I feel is a real improvement over designs -- at least for city listening - is the passive notch pre-filter.”

“My goal is to be able to monitor ELF and ULF from my home. Since I will be moving soon to a slightly quieter neighborhood, I will get to try this all again!”

"A different topic: When to listen for whistlers. Based on what I have read, for some months I have been monitoring the magnetic conjugate point in the southern hemisphere for my area. I do this by checking this link:
http://www.intellicast.com/LocalWeather/World/SouthAmerica/Argentina/BuenosAries"

"Much to my dismay, there is almost never any activity at what I believe the conjugate point is. On the two occasions when I have heard whistlers, I had not learned about the conjugate point. I also believe that on the first occasion the whistler was of local origin, though I find that hard to understand unless it was a two-hop fellow. Sadly, that one was not recorded, so there was no chance to go back and examine it. On the other occasion I recorded about 8 wispy whistlers that sounded like they had come from a long way off. I wish I had thought to check the conjugate point!"

•**Michael Mideke, Benson, AZ.** Mike writes that he has a new computer and will be on the Internet before long. In response to my question about the likelihood of hearing whistlers at a given time he replies – "As to the frequency with which the reception of whistlers can be anticipated -- I really don't know. Periods of high solar activity are in general more productive than periods of low solar activity. Sometimes (my subjective feeling is mostly, but others disagree) the midnight through dawn period seems to show the most activity. But sometimes there are periods when the late afternoon into early evening hours produce far more whistlers. Results differ with latitude and possibly could even be opposite during the same period (dawn activity at high latitude, dusk activity at low latitude). So I guess the main thing that can be recommended is that people listen when they have a chance and sooner or later the whistlers will come."

•**Dave Laida, Sierra Vista, AZ.** Dave had some good luck hearing whistlers on February 17. "The background had continuous moderate-level sferics, and virtually no tweeks. Russian Alpha was unusually weak and, of course, "attenuated" power line hum."

"All whistlers were pure tone, but heard very distinctly apart from the background. All were probably one hop originating at the conjugate point because their duration was short; about one second."

"…Looking forward to your filter developments. I'll be outdoors for the spring equinox!"

•**Brian Lucas, St. Helier, Jersey Channel Islands** Brian writes that his experimenting is still continuing with his ferrite loop receiver described in the September 1998 issue of *The Lowdown.* He has improved the circuit to the point that he is able to hear soft whistlers within his place of residence. The design uses the ferrite rod and coil to produce the bandpass, and has three transistors. *(Brian - we would welcome an article when the design is complete - MK)*

"Spheric activity is very low from mid November up to the present time… Europe overall has very little to report, some activity in Germany and almost none in Italy which I could always be sure to use as my reference for receiver sensitivity. Even Africa where I expect whistler ducting was not very active last year. Indeed, I will be monitoring the spring equinox and hope to report good activity."

"It might interest you to know, English schools that have an amateur radio club are to mount a coordinated atmospheric/weather activity this year. All received data will be sent via Radio links and Internet to a central hub in Germany."

S T E L A R # Science & Technology through educational links with Amateur Radio.
Richard Horton, E-Mail G3XWH@GB7CYM or g3xwh@amsat.org
steler@hlc.org.uk fax **-01423-871027

•**John Lauerman, WB7TQT, Issaquah, WA.** "I'd like to contribute to your natural radio log. Since you didn't set any frequency limits, I'm including recent SLF stuff as well as VLF. SLF here is >0 to 3 Hz." (*I was calling that section Whistler Reports, but I guess Natural Radio Log is more appropriate. Good idea, John. -MK*)

"By the way, Pc stands for pulsation continuous and are very regular sine waves, while Pi stands for pulsation irregular and are quite irregular in wave period (from 1 second to 40 seconds.)"

Natural Radio Log

Month Day	Time UTC	What Heard (whistlers/hour where applicable)	Listener ID Grid Square
02/06	1700-1800	Strong 100 millihertz (Pc2) waves	JL-CN87
02/07	1015-1025	Occasional tweeks & sferics. 1 whistler	JL-CN87
02/08	1400-1500	Irregular (<1 Hz.) Pi1 waves	JL-CN87
02/14	0530-0600	Strong sferics, few tweeks, 1 weak whistler	MK-EN52
02/17	0225-0330	Sferics, no tweeks, pure tone whistlers (13/hr.)	DL-DM41

DL - Dave Laida, Sierra Vista, AZ. Equipment - Homebrew 57 in. vertical whip and preamp described in Lowdown, July 1999, RC Hi-pass filter with 1200 Hz. cutoff, Radio Shack 32-2040 amplified speaker. Setup is earth grounded.

JL - John Lauerman, Issaquah, WA. Equipment - Homebrew VLF Receiver, 300 Hz - 20 kHz. Homebrew ELF/ULF/SLF Receiver 0.03 to 300 Hz., 47,000 turn loop.

MK - Mark Karney, N9JWF, Barrington, IL. Equipment - WR-3, LF Engineering loop, homebrew receiver with 40" whip and -24db/octave hi-pass active filter, 350 Hz. cutoff.

Check out that equipment for the spring equinox coordinated listening! Hopefully Mother Nature will bless us with good weather and excellent listening conditions, and Father Sun will bless us with loads of geomagnetic activity.