In April 2005, I received a used F-Scan2

I was interested in the unit since I had similar ideas of building such a device myself 10 years ago. The idea is quite simple: If there exist pathogens in the human body that have specific resonant frequencies with which one can destroy them, then it should be, at least hypothetically, possible to detect them with some kind of electronic device. My initial idea was that one should be able to detect minute changes in the impedance of the body at those resonant frequencies.

A sort of spectrum analyzer for 'bugs'.

The other way that I thought possible was to use a combination of EAV (Electro-Acupuncture According to Voll) device and frequency generator. The same way a homoeopathist test his patients against a variety of homoeopathic remedies (or nosodes) an EAV device should be able to test those Rife- or Clark-frequencies.

About a year ago I entered some key-words into Google to see whether anyone had built such a device successfully, so I would not have to do it, and I found the F-Scan2. Soon I found this forum and read about the detailed discussions about the device. I was tempted to buy it earlier, however I found an article that wrote very critical about the F-Scan (not the F-Scan2) but then I decided to give it a try, getting it used there should not be such a big loss.

So I played with it for one day, looked at the electronic circuit and tested the device with an oscilloscope.

Circuit description

The device uses the Zilog Z84C1516 controller, a 50 MHz clock for frequency generation and a 16 MHz clock for the Zilog. It has a touch-screen display, which makes it very easy to use.

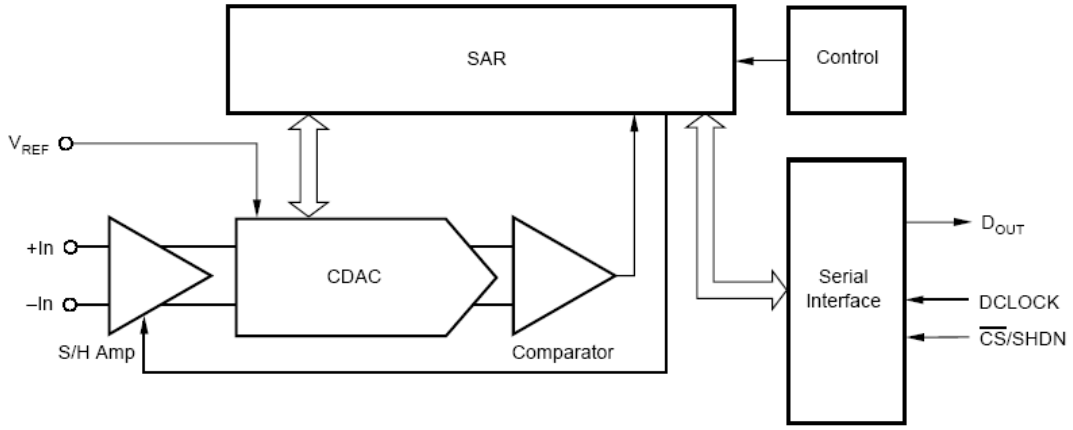
In the 'DIRP' mode, the F-Scan2 scans between a minimum and a maximum frequency with given step size, which can all be entered via the touch-screen. Maximum total samples: 1000.

For the DIRP mode, one has to use a hand electrode in the left hand (the one that provides the ~12Vpp sinusoidal signal with a +6V DC offset, the other hand electrode is grounded) and place a finger electrode on the right middle finger. This finger electrode has two contacts, one is ground and the other one goes to the detection circuit.

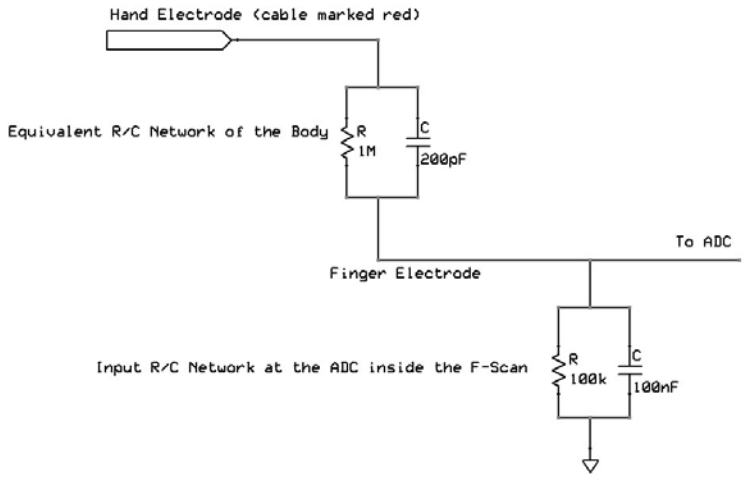
The manufacturer has erased the label of the first chip in the detection circuit but by tracing the PCB routes and measuring the signals on the chip it was easy for me to understand which type of chip was used and then to search for that chip with the right pin-out.

This chip is an analog-to-digital converter (ADC) from Texas Instruments or other manufacturer that makes the same type of chip. It is a successive approximation ADC, it has 12-bit resolution at 20ksamples/s and sends the 12-bits through a serial port, that's why it has only 8 pins. My best bet is that it is the ADS 1286.

http://focus.ti.com/docs/prod/folders/print/ads1286.html

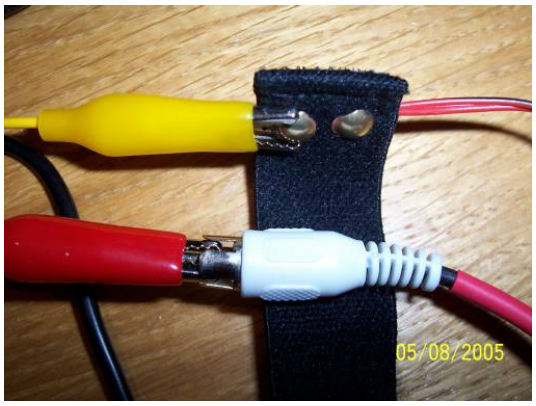


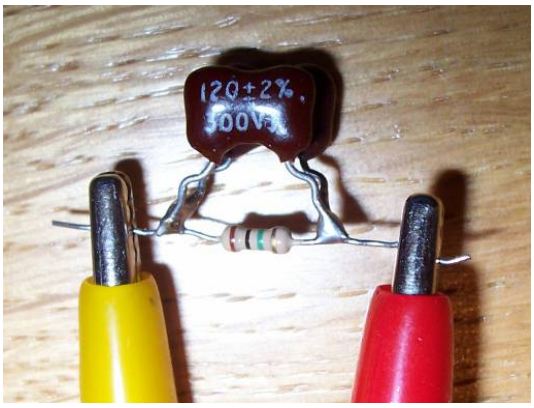
The chip receives a clock signal and a 'chip-select/shut-down' square-wave signal from the microprocessor. The ADS 1286 then sends its serial data to the microprocessor. The sampling frequency here is about 1365 Hz.



The input circuit of the F-Scan and the body resemble two R/C networks. With the cylindrical hand electrode and the small round contact of the finger electrode (the finger electrode has actually two contacts, one is on ground while the other one is the pick-up)

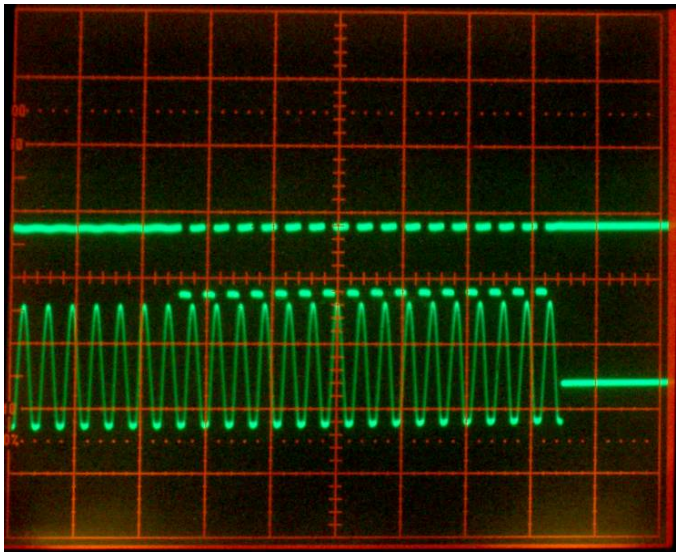
the body has approximately a 1MOhm DC resistance but there is also a capacitive coupling from the metal contacts through the skin to the less resistive inner part of the body, which may be represented with a capacitor of about 200pF. This is what I determined experimentally. So one can use a parallel network of a 1MOhm resistor with a 200pF capacitor and connect that between the RCA plug with the red cable and the pick-up contact of the finger electrode as shown in the picture below. Here, I used two 120pF capacitors in parallel, which makes 240pF.





You have to connect to the contact on the finger electrode that is furthest away from the cable; at least that's how my finger electrode is wired. Again, the other contact is ground. There is no risk in damaging the F-Scan or F-Scan2 if you hook this RC network up.

During the DIRP, the F-Scan2 sends out a burst of frequencies. The burst is about 210 ms long, then a pause of about 900 ms and then the next burst appears. Each time the frequency is incremented. During the bursts, the device takes 16 samples, probably for averaging noise.



In the picture above that I captured from my oscilloscope, I have set the DIRP frequency to the 1365Hz that causes these spurious peaks.

You can see that the sampling signal that is displayed on the top trace matches the 1365Hz burst shown in the lower trace. And that is what causes these spurious '1365Hz pattern' peaks. The top trace is the sampling signal for the ADC in the F-Scan2 (scope channel connected to the RESET pin on the ADC). Below is the end of the F-Scan2 frequency burst signal as measured from the F-Scan2 output. The horizontal deflection is 2 ms/div.

Now what exactly is sampled?? The sine-wave bursts have a 6 Volt DC offset, so the sinusoidal signal in the burst swings from 0 - 12 Volts. The hand electrode, the contacts on middle finger electrode, and the 100kOhm resistor at the input of the ADC represent a voltage divider. For a continuity value (CV) of 10% the ADC receives a 0.6 Volt DC signal. Not the amplitudes of the Rife- or Clark-frequencies are supposed to be sampled but the ***changes*** in the DC-level that these frequencies are inducing. With idea of an EAV detection circuit in mind, I guess.

The microprocessor then subtracts the 12-bit results from the two consecutive frequency samples and displays their absolute (positive) value on the touch screen, the MV values, probably it means 'millivolts'.

BUT: If the applied DIRP frequency is a multiple of the 1365Hz sampling frequency or very close to it than something strange happens, you get these spurious peaks. From the theory of signal processing it is well known that you should not sample a signal slower than twice the frequency of the sampled signal. That is known as the 'Nyquest theorem', therefore the maximum signal frequency is half the sampling frequency also called the Nyquest frequency. If you do sample a signal that is higher than that you get a funny effect, which is called 'aliasing'. That is what these spurious peaks are about. More on aliasing can be found here (you need to have Java installed in order to play with the Java applet, it is a free download):

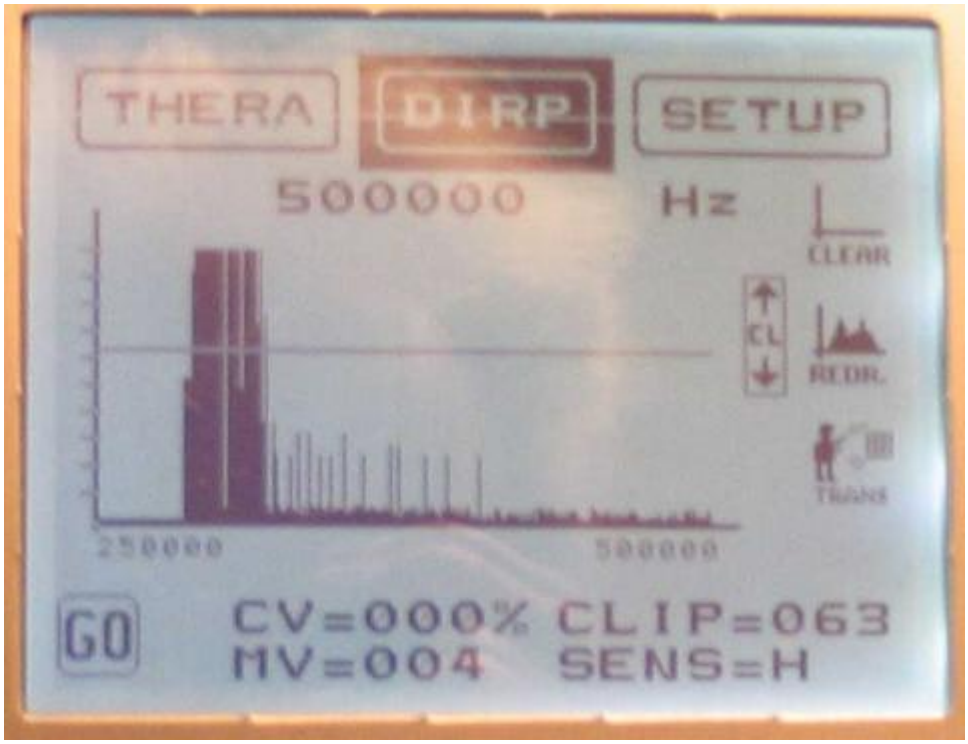
http://www.dsptutor.freeuk.com/aliasing/AD102.html

The F-Scan and F-Scan2 were not built to sample these higher frequencies but ONLY the changes in the applied DC bias. That is the key to understanding why these 1365Hz repeat pattern occur.

In order to circumvent this obvious design flaw, I came up with the idea of building a low-pass filter that would allow the slow changes in the DC bias pass through, which are the physiological responses of the body to the applied frequency but would block all higher frequencies that would corrupt the DC measurement. So I design a 4-pole Chebyshev filter using the Burr Brown (now Texas Instrument) filter chip UAF42.

First, I tried running the filter inside the F-Scan2 by using its +/- 12V power. However, the negative supply voltage is generated internally and the power drawn by the filter ICs was just a bit too high. As a result, the DIRPs showed a lot of peaks at the beginning of

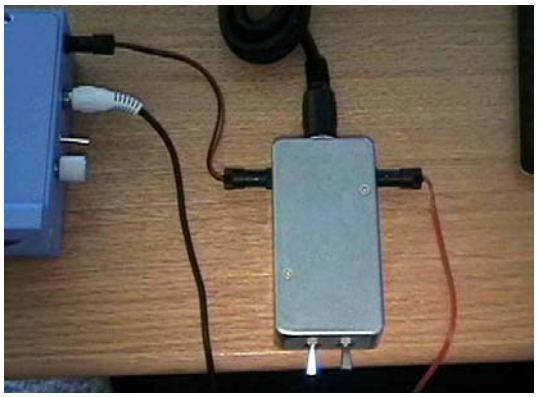
the scan due to power fluctuation in the negative supply voltage. That can be see in Dr. Nathan Berger's early test with his modified F-Scan2 that had the internal filter.

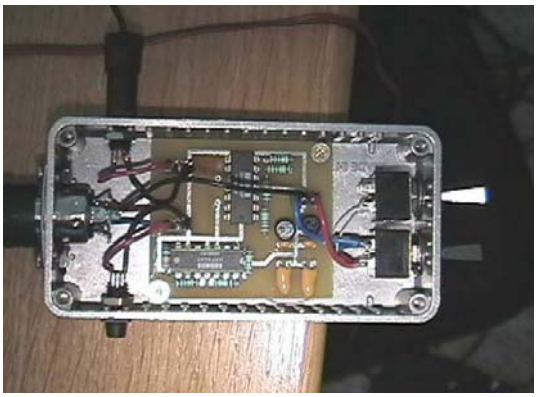


I also posted Excel files on my early results with the internal filter and they showed a bundle of peaks at the beginning of the scan. The files with 'Chebyshev':

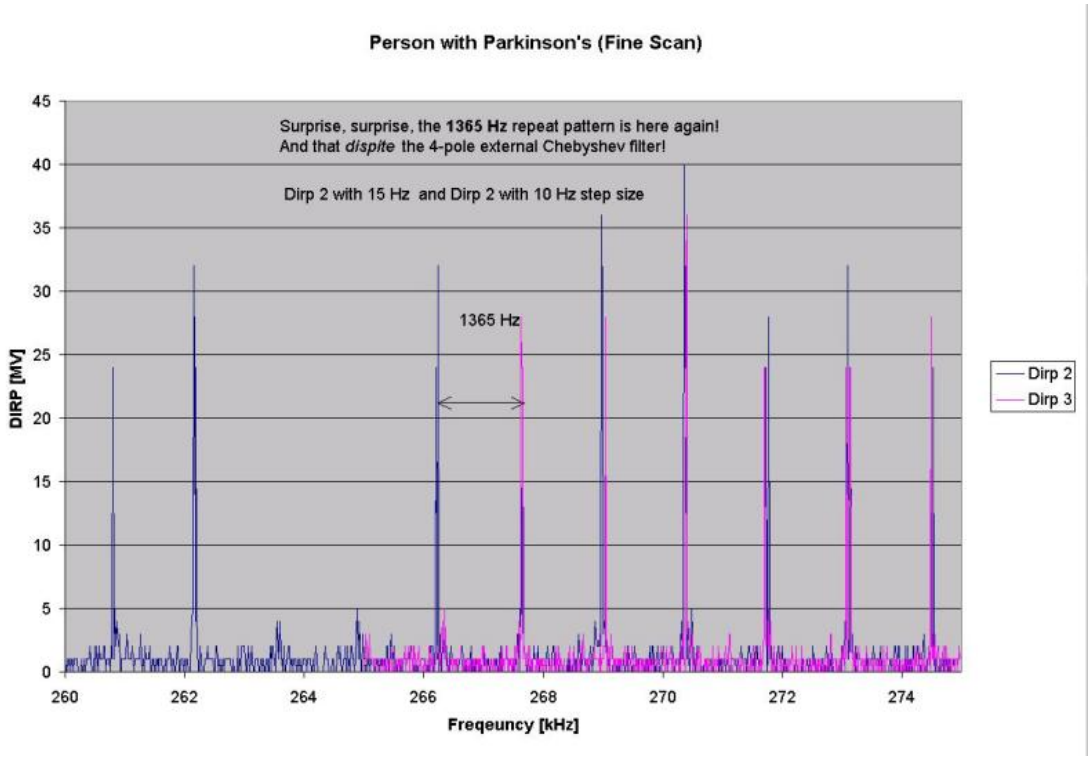
http://health.groups.yahoo.com/group/fscan/files/

So, since that was not useable I put the filter inside a small shielded case, searched and found the appropriate connecter from a German manufacturer and had an external power supply deliver the symmetrical power to the filter circuit.





The external filter worked very well, it successfully suppresses the spurious 1365Hz pattern in *almost* all my DIRPs. **Almost???** Yes, surprisingly I saw this pattern show up *despite* the filter in one DIRP scan! I wonder why. I wonder if that has to do with the limited bandwidth of the filter IC. Maybe at higher frequencies the filter starts to leak. It may also be that this only occurs in a certain frequency regime and that very high frequencies won't get through. I recorded one DIRP of a friend of mine that has Parkinson's.



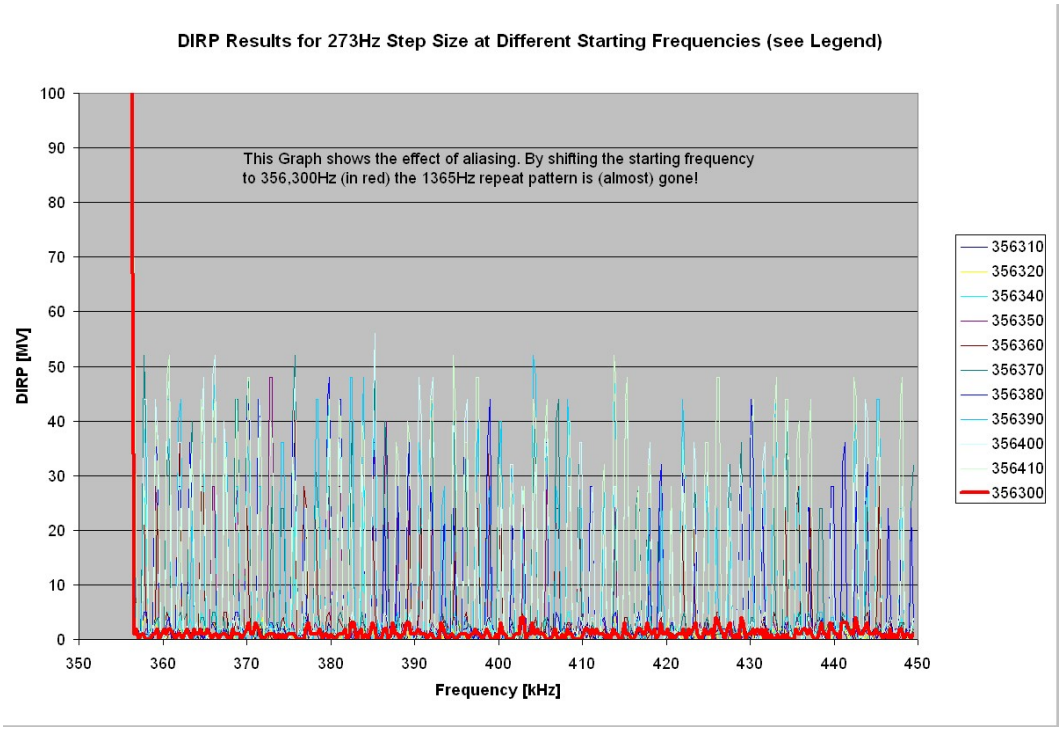
As you can see that happened around 267 kHz.

Avoiding the repeat pattern without a filter

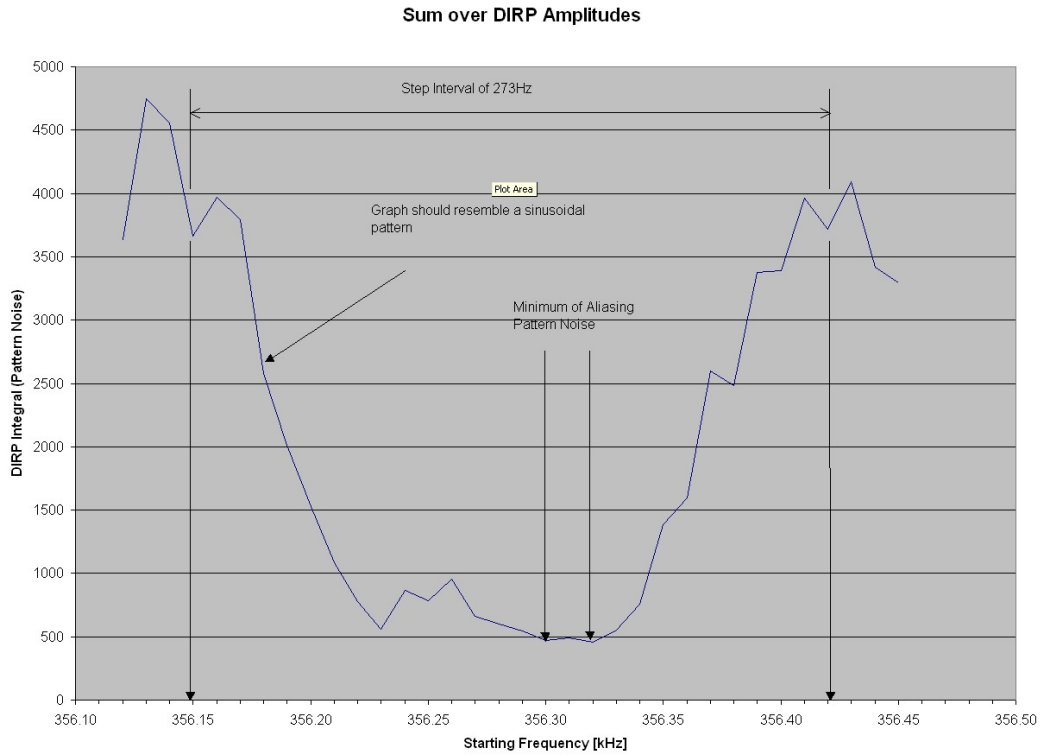
I posted also that you ***can*** avoid these repeat patterns if you step 'in-between' these peaks. The calculations on how to do that are a bit complicated and require the knowledge of the exact 'repeat-pattern' frequencies – where they occur. Someone else has posted information about that on the forum. Then you have to use either 1365 Hz or multiples or fractions of 1365Hz as your step size. Then you avoid hitting these peaks. That method is very good and it does not require a filter!

The picture below shows that if the right starting frequency is chosen, the spurious 1365 Hz pattern simply disappears! That frequency was 356,300Hz in this case, shown in red.

Notice that the step frequency was 273 Hz = $1/5^{th}$ of the repeat pattern frequency!



I also graphed the sum of all peak amplitudes as a function of the starting frequency and it shows that at the right starting frequency the sum has a minimum, i.e., the peaks vanish.



The spreadsheet can be found here: http://health.groups.yahoo.com/group/fscan/files/

Its name is '**Delta273Hz Series.xls**'. If you don't have Excel, you can download a free Excel viewer from Microsoft here:

http://www.microsoft.com/downloads/Browse.aspx?displaylang=en&categoryid=9

But my guess is that this is a bit too complicated for the average user and that an external filter would be a better choice.

When I scan myself (from 1Hz to 15 MHz in successive DIRP sessions with appropriate steps sizes), I flat-line, I get almost no peaks. And if I get a single peak once in a while, then it is not repeatable. I don't know why.

The other problem that I see in the F-Scan2 DIRP function is that it uses a DC-offset of 6 Volts during the scan. I think the body's feedback system immediately gets too polarized (or tired if you will) that it may not be able to give a good response at all. I would like to know how the EAV machines work and how that could be implemented to do a scan. I will have to experiment with this a little. I also would like to separate the biofeedback from the exposure to the frequencies. In the F-Scan they go together - the frequencies are scanned by an AC signal with a DC offset. The AC provides the frequency to be tested and the DC is there to test the body's response. Unfortunately a small portion of the AC leaks into the pick-up electrode and causes aliasing-type of behavior during digitization. Again, that's why you see these periodical peaks in the scan.

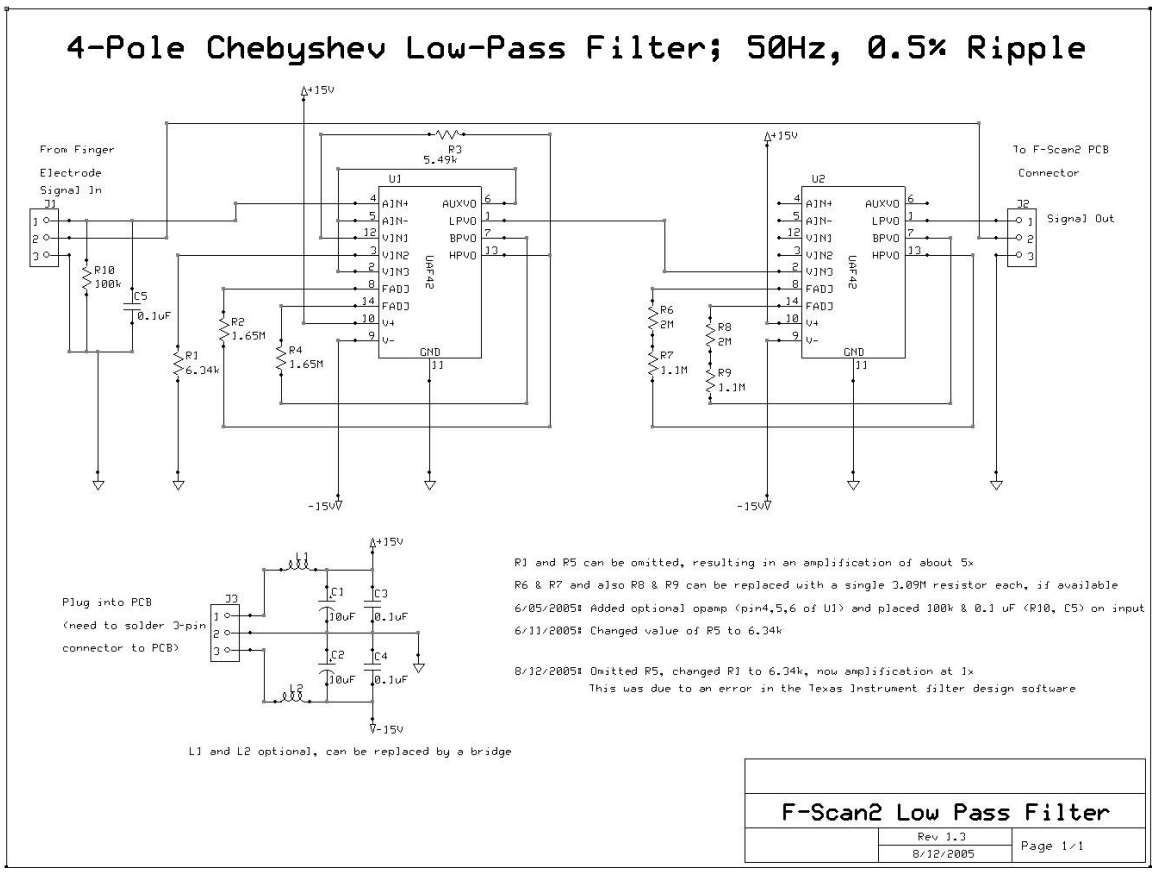
About the filter design

I used the Burr-Brown (now Texas Instrument) filter chip UAF42.

http://focus.ti.com/docs/prod/folders/print/uaf42.html

The upper frequency limit is 100kHz, maybe that is why I saw in one DIRP the notorious repeat pattern. At much higher frequencies the filter's opamps will simply swallow the higher frequencies but in the 200kHz range it may leak through.

To avoid that, one would have to build a low-pass filter with opamps that have a much higher bandwidth of up to 100MHz, since you have to have enough reserves to cut out frequencies of up to 15MHz that the F-Scan can produce if the upper frequency during a DIRP is that high. That can make the filter very expensive. Maybe a combination of an active multi-pole filter and simple RC filtering would do it. The active part suppresses the 'lower' frequencies, say, until 100kHz or so and an RC filter network can then pick up form there. I have to think about that a little more.

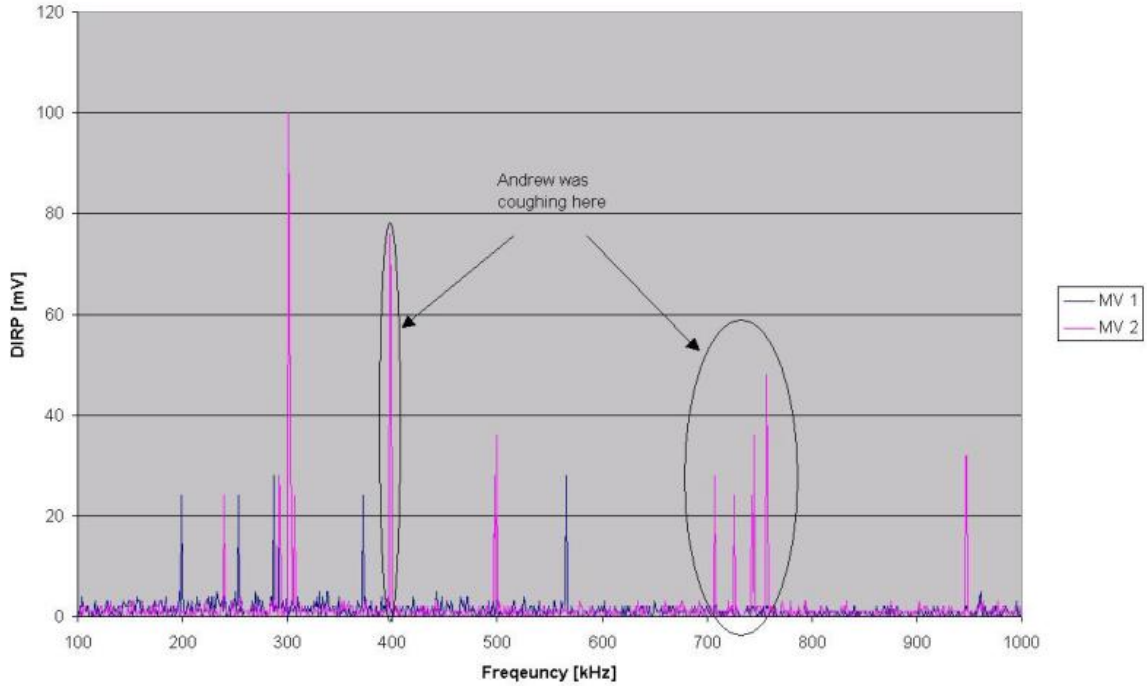


Here is the schematic diagram of the filter as I used it in the external filter unit. I found out 'the hard way' that the software to determine the correct resistor values for this filter that you can download from Texas Instrument had a bug! The result was that the filter didn't have unity gain and that the two stages had different amplification – not good. But in this diagram the corrected resistor values are given, resulting in a 1x amplification. In my external filter I added a switch that allows the user to boost the sensitivity of the DIRP by a factor of about 5x. That helps if you scan someone with a very low CV value (below 10%).

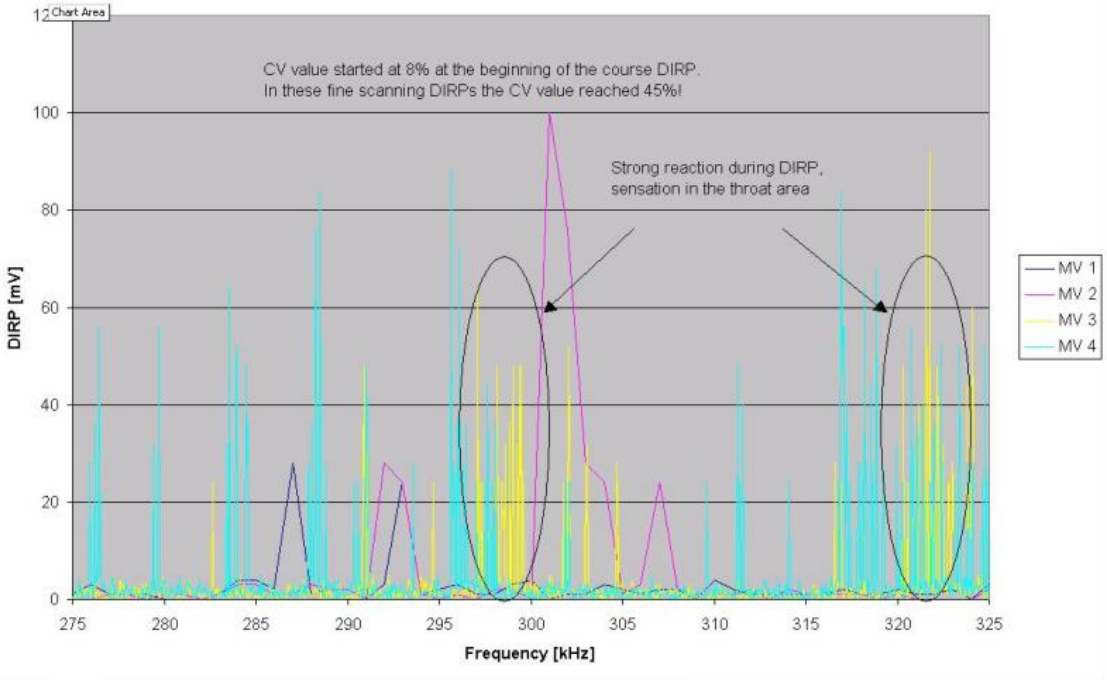
Some interesting results with the filter

I posted several interesting scans on the F-Scan forum. One is from a friend of mine that had a bad sore throat, accompanied by a fever. When I did a fine DIRP scan in an area where there were some hits, my friend had a phenomenal physiological response. His CV value rose from about 8% to over 40%! Then he noticed a sensation in his throat and tried to clear his throat. We ran the F-Scan in 'Treatment mode' around the frequency range where he had responded. The DIRP scans are shown below.

Andrew's Sore Throat Condition

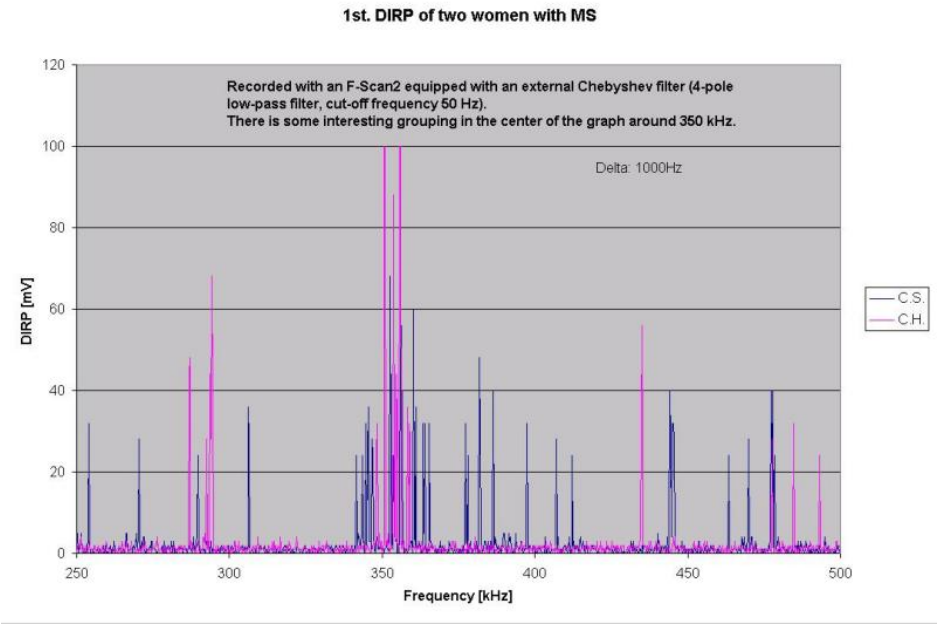


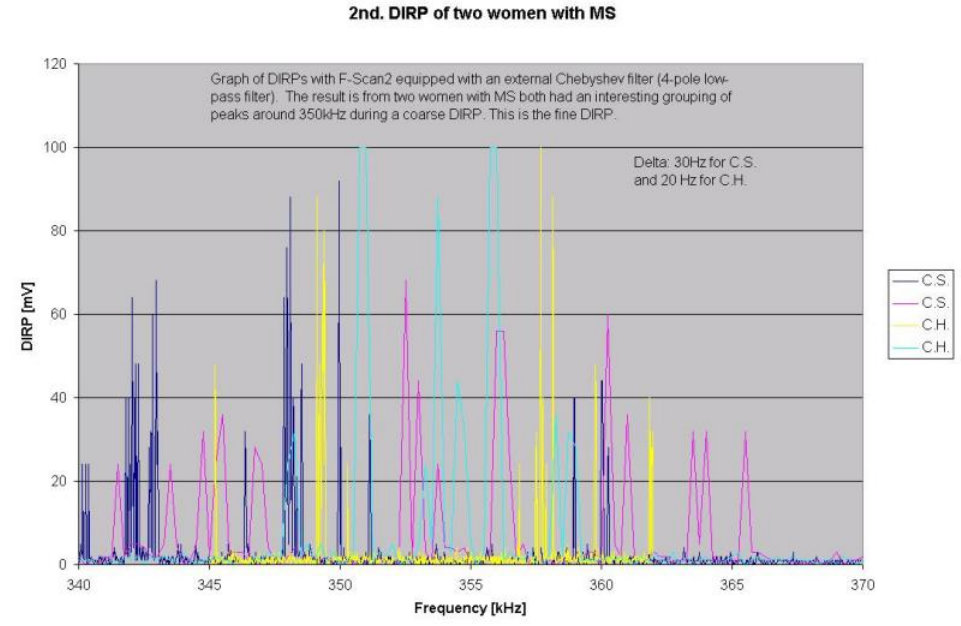
Fine Scan of Sore Throat



The next day my friend's fever broke but now the cold migrated into his chest. We did another DIRP and this time I had to stop because he jumped up, ran to the bathroom and coughed up a lot of phlegm! We ran the F-Scan2 in 'treatment' mode around the frequency range where he had this episode. The next day after that he was fine!

I also recorded the DIRP scans of two female volunteers (named 'C.S.' and 'C.H.') with MS:





You can see that there is a similarity in the two scans at around 355kHz where a bunch of hits occurred. Due to my limited experience with the F-Scan and other issues I did not ran the F-Scan in 'treatment mode' on these two MS cases but maybe practitioners with more experience could maybe see whether their clients with MS show similar responses.

These and more examples of DIRPs that I did with the external filter can be found on the F-Scan forum under:

http://health.ph.groups.yahoo.com/group/fscan/photos/browse/b0a8

I have also posted other information here:

http://health.ph.groups.yahoo.com/group/fscan/photos

http://health.groups.yahoo.com/group/fscan/files/

I hope that this summary of my findings and efforts to make the F-Scan2 more reliable will help others to understand the issues at hand much better and may stimulate the discussion in this forum. Maybe it will help to design a better version of the F-Scan series in the future?