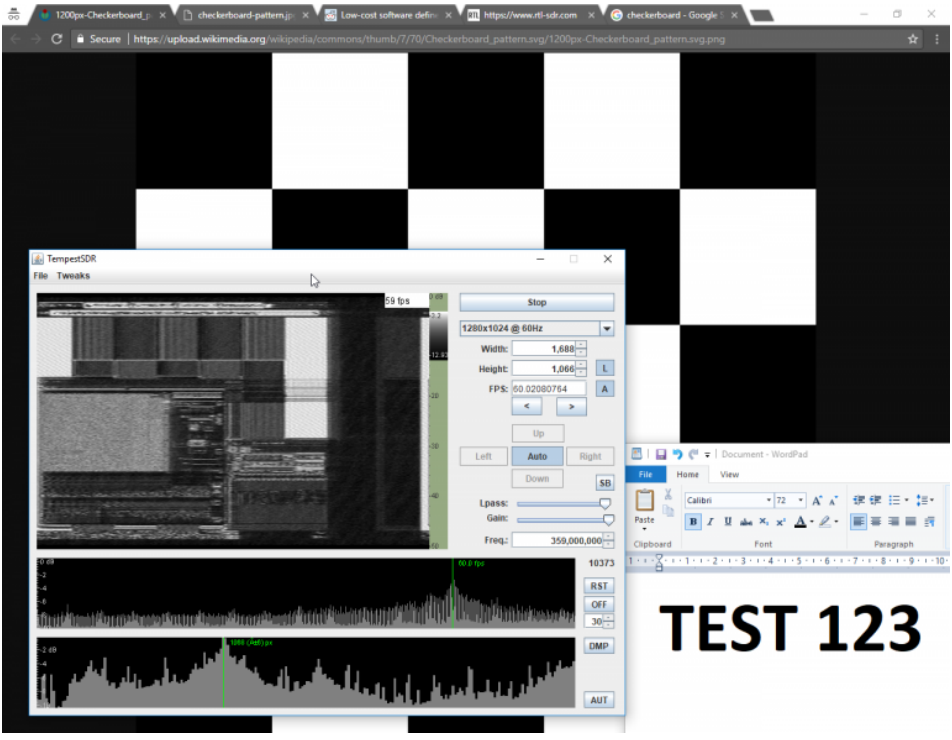
NOVEMBER 24, 2017

TEMPESTSDR: AN SDR TOOL FOR EAVESDROPPING ON COMPUTER SCREENS VIA UNINTENTIONALLY RADIATED RF

Thanks to RTL-SDR.com reader 'flatflyfish' for submitting information on how to get Martin Marinov's TempestSDR up and running on a Windows system. If you didn't already know by definition "TEMPEST" refers to techniques used by some spy agencies to eavesdrop on electronic equipment via their unintentional radio emissions (as well as via sounds and vibrations). All electronics emit some sort of unintentional RF signals, and by capturing and processing those signals some data can be recovered. For example the unintentional signals from a computer screen could be captured, and converted back into a live image of what the screen is displaying.

TempestSDR is an open source tool that allows you to use any SDR that has a supporting ExtIO (such as RTL-SDR, Airspy, SDRplay, HackRF) to receive the unintentional signal radiation from a screen, and turn that signal back into a live image. This can let you view what is on a screen without any physical connections. If a high gain directional antenna is used then it may be possible to receive images from several meters away as well.



TempestSDR showing what's on the screen via unintentional RF radiation from the monitor.

Although TempestSDR has been released now for a number of years it hasn't worked properly in Windows with ExtIO interfaces. In his email flatflyfish showed us how to compile a new version that does work.

> 1. You need to install a 32-bit version of the Java runtime. The 64-bit version won't work with extio's possibly because they are all 32-bit. Also install the JDK.

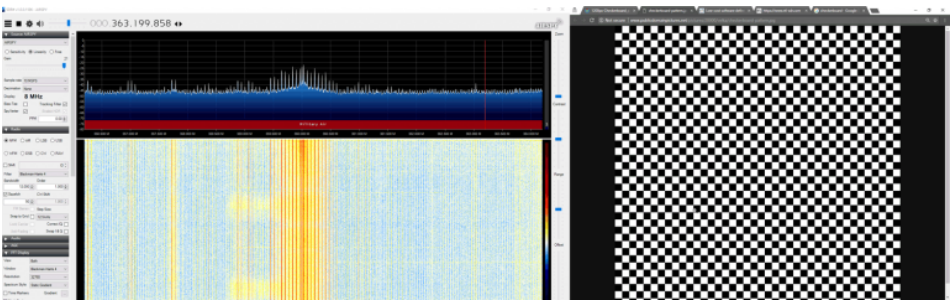
> 2. You need to install MingW32 and MSYS and put their bin folders in your Windows PATH.
>
> 3. Then when compiling I was seeing a lot of CC command unknown errors. To fix that I just added CC=gcc to the top of all makefiles. I also removed the Mirics compilation line from the JavaGUI makefile to make things easier as we're not using that sdr.
>
> 4. Originally my JDK folder was in Program Files. The makefile didn't like the spaces in the folder, so I moved it to a folder without spaces and it fixed the errors.
>
> 5. Lastly to compile it you need to specify the ARCHNAME as x86 eg "make all JAVA_HOME=F:/Java/jdk1.7.0_45 ARCHNAME=X86"
>
> After doing all that it compiled and I had a working JAR file. The extio's that are used normally with HDSDR work fine now and I get some images from my test monitor with an rtlsdr. ”

We tested compilation ourselves and were successful at getting a working program. To help others we've just uploaded a fork of the code with the makefile changes done, as well as a precompiled release ZIP available on the releases page so no compilation should be required to just use it. Note that to use the precompiled JAR you still need to install MingW32, and also don't forget to install the MingW /bin and msys /1.0/bin folders into the Windows PATH. You also do need to have the

32-bit Java runtime installed as the 64-bit version doesn't seem to work. On at least one Win 10 machine we also had to manually add a 'Prefs' folder to the Java path in the registry.

We've tested the software with the ExtIO for RTL-SDRs (available on the HDSDR downloads page) and confirmed that it works. Images from one of our older DELL monitors using DVI are received nicely, although they are a bit blurry. We also tried using an Airspy or SDRplay unit and this significantly improved the quality of the images a lot due to the larger bandwidth. The quality was good enough to make out large text on the screens. ExtIO's for the Airspy are available on this page, and for the SDRplay on the official SDRplay website. Note that for the SDRplay we were unable to go above 6 MHz, and on the RTL-SDR 2.8 MHz was the limit - anything higher on these SDRs did not produce an image possibly due to dropped samples.

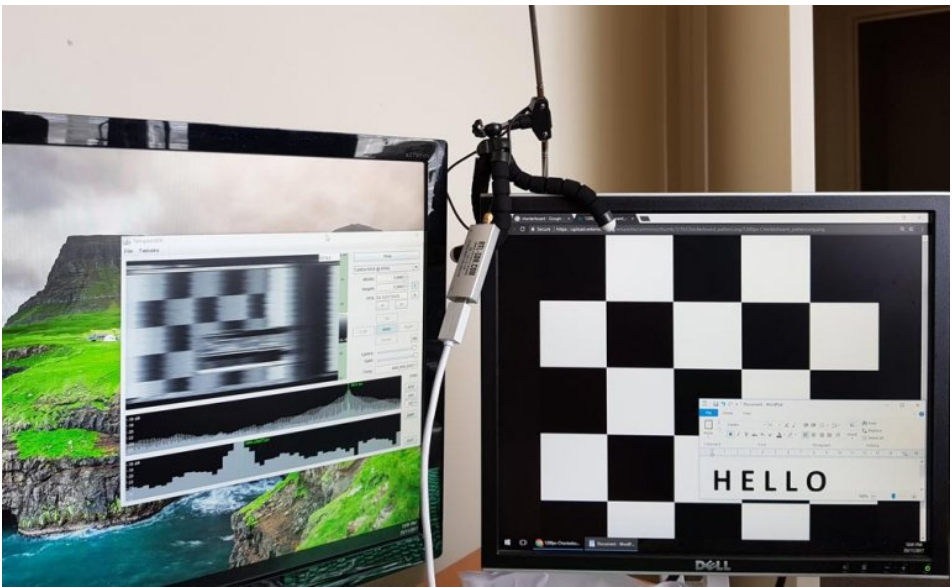
To use the software you should ideally know the resolution and refresh rate of your target monitor. But if you don't there are auto-correlation graphs which actually help to predict the detected resolution and frame rate. Just click on the peaks. Also, you will need to know the frequency that your monitor unintentionally emits at. If you don't know you can browse around in SDR# looking for interference peaks that change depending on what the image of the screen is showing. For example in the image below we show what the interference might look like. A tip to improving images is to increase the "Lpass" option and to watch that the auto FPS search doesn't deviate too far from your expected frame rate. If it goes too far, reset it by re-selecting your screen resolution.



Unintentionally radiated RF signal from computer screen shown in SDR#

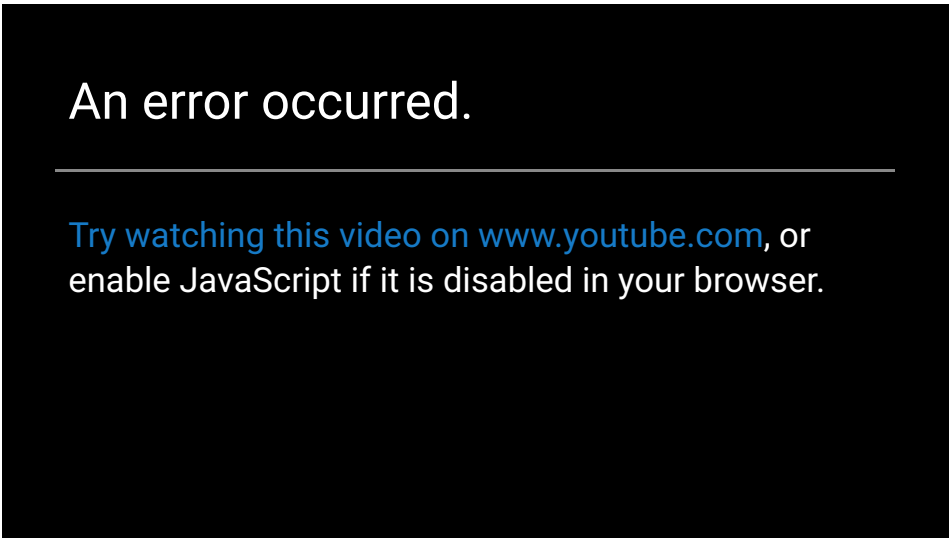
The best results were had with the Airspy listening to an older 19" DELL monitor connected via DVI. A newer Phillips 1080p monitor connected via HDMI had much weaker unintentional signals but images were still able to be recovered. A third AOC 1080p monitor produced no emissions that we could find.

Clear images were obtained with an antenna used in the same room as the monitor. In a neighboring room the images on the DELL monitor could still be received, but they were too blurry to make anything out. Possibly a higher gain directional antenna could improve that.



An example set up with RTL-SDR antenna and monitors

Below we've uploaded a video to YouTube showing our results with TempestSDR.



If you want to learn more about TEMPEST and TempestSDR Martin Marinovs dissertation on this software might be a good read (pdf).

Related Posts:

1. **Using the SDRuno EXTIO Edition with an RTL-SDR and other SDRs**
2. **SDR4Everyone: Getting Started with the RTL-SDR and SDRUno**
3. **A Tutorial on Decoding NOAA and Meteor M2 Weather Satellite Images in Ubuntu**
4. **Hak5: ADS-B on a Quadcopter carrying a Wifi Enabled Linux Computer, RTL-SDR and Coaxial Collinear Antenna**
5. **RTL-gopow: New heat map tool**

Written by admin — Posted in Airspy, Applications, RTL-SDR, SDRplay, Security — Tagged with airspy, rtl-sdr, rtl2832, rtl2832u, sdr#, sdrplay, tempest, TempestSDR

3 COMMENTS

NOVEMBER 25, 2017 - 9:47 AM

Anonymous

I can't open the java file, any help for a noob please?

Reply

NOVEMBER 25, 2017 - 11:52 AM

admin

Did you follow all the instructions in this post?

Try and open the jar file from the command line using 'java -jar JTempest.jar' and see what error it gives you.

Reply

NOVEMBER 24, 2017 - 7:59 AM

Tech Guy

> The best results were had with the Airspy

Interesting. I will try that next.

Reply

POST A COMMENT

Comment

You may use the following HTML:

```
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```

<code> <del datetime=""> <i> <q cite=""> <s> <strike>

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admin { Did you follow all the instructions in this post? Try and open the jar file from the command line using 'java -jar JTempest.jar' and see ... } – **Nov 25, 11:52 AM**

{ I can't open the java file, any help for a noob please? } – **Nov 25, 9:47 AM**

oldjackbob { Wasn't at all meaning to boss you around, I probably should have put a "please" after the "be specific" ... tonal inflection doesn't come across ... } – **Nov 24, 11:05 PM**

Bert { Sorry for not answering you fast enough, boss people around much ? Traditionally in that context I would assume that it would mean an approximation ... } – **Nov 24, 10:01 PM**

Jigga majigga { I likk my poopie } – **Nov 24, 9:55 PM**

oldjackbob { And it's not like they've done anything to keep it current. Point being, I wouldn't depend on that document to be an authoritative source of ... } – **Nov 24, 8:04 PM**

Bert { It is marked "Confidential", but every search engine shows it up, so it is not like they are doing anything to actually keep it Confidential. } – **Nov 24, 7:49 PM**

Older »

POLLS

What do you mainly use your RTL-SDR / SDR for?

- ADS-B
- AIS
- Trunked Radio
- Police/EMS Scanner (P25/TETRA/Analogue)
- Weather Satellites
- HF Reception
- Filter & VSWR Meter
- L-Band Satellites
- Radio Astronomy
- Air Traffic Control
- ACARS
- Weather Balloons
- Reverse Engineering
- Monitoring Pagers
- Amateur/Professional Research
- VHF Amateur Radio (APRS/Voice etc)
- Panadapter
- General Signal Browsing
- Passive Radar, Direction Finding, Coherent Experiments
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WHAT IS RTL-SDR

The RTL-SDR is an ultra cheap software defined radio based on DVB-T TV tuners with RTL2832U chips. The RTL-SDR can be used as a wide band radio scanner. It may interest ham radio enthusiasts, hardware hackers, tinkerers and anyone interested in RF.