Short and Updated guide for receiving Meteor-M N2 LRPT. September 2nd, 2014
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A "Windows only" procedure (slow)

In order to view imagery, first we need to record a baseband I/Q WAVE file. It is recommended to use a 0.900 MSPS sample rate at the RTL2832U dongle and maximum (192 KHz) for the Funcube Dongle (FCD), or something near 130 or 150 KHz if you use a different SDR. You may use your favorite SDR program but I prefer SDRSharp (http://sdrsharp.com/). The satellite downlink frequency 137.100 or 137.900 has to be chosen as **center frequency**, it doesn't matter what audio mode, volume or VFO frequency is chosen because we are recording base-band data **centered** on the main downlink, **there is no need neither to do Doppler tracking**. Always use "Correct IQ" and off-set tuning if available.

To improve constellation quality a lesser bandwidth is recommended if you are using an RTL. In order to do it we can use the free audio handling software Audacity (http://audacity.sourceforge.net/). Open the recorded WAV file with it, and then at the left-bottom side change the sample rate to 130000 (130 KHz). We can also remove and crop sections at the beginning and end of the recording where signal was low if required. To save the file, proceed to the File menu, hit Export, select WAV as format, and save it. We can then delete the original file to save space on hard disk (a 12 minute pass at 900 KHz sample rate takes more than 1GByte of space). This step is not needed for the FCD, or other SDR with a sample rate lower than 200 KHz.

To process the WAV file we need to download this file:

https://www.dropbox.com/s/qq1fjyitpa3j14o/software.zip

Now we open LrptRx.exe (the other two programs are not needed), load the new wav file (in some cases Swap I/Q should be selected, at least when recording with SDRSharp it has been always required). We hit run and manually move the progress slider to the center where signal should be the best. If we obtain a well defined 4 dots constellation, everything is OK, close the program, re-open it and process the entire file. If at the middle the constellation looks like an X or a square, try changing symbol rate from 72000 to 80000, if constellation is achieved with 4 dots, then the satellite is on 80K mode and therefore no decoding can be done with Paul's programs. It is important to know that when reached the end of the file LrptRx will run forever, unless we manually stop it, so keep an eye on the progress slider.

We can change the destination and name of the RAW file if desired; otherwise the program will save it on hard disk letter C:

To extract image from the RAW data we need Oleg's decoder version 6 or higher and it can be found here:
http://meteor.robonuka.ru/soft/

Oleg's program produces superb color images that can be saved in high resolution. Under some conditions it may be a good idea to check the "Ignore RS fatal error" option. Then hit 72K or 80K button depending of the received symbol rate. Browse for the RAW file and open it. If you don't find the file, you can select "All (*.*)" in the file type filter. Now the program will begin to process the file. After finish the processing, you can click on the "Generate RGB"

button to see the result. In the new window hit “Save” to keep the image, it will be stored in the same folder that contains the raw file.

However, this process can be slow and take some time because there are multiple steps. First record the entire pass into a WAV file (10 to 15 minutes). Second, re-sample if using an RTL (7 minutes, or not needed if using less than 200 KHz bandwidth). Third, extract symbols, which take around half the length of WAV file (usually 7 minutes). And finally process imagery (up to 5 minutes).

If you want to remove some steps and proceed direct to real-time reception and store symbol data you can use a simple Linux based receiving program. The process takes much less time because steps of recording, re-sampling and symbol extraction are done at the same time during the satellite pass.

A “Linux/Windows” procedure (fast):

First we need a Linux version that already has all the required libraries pre-installed:

http://downloads.gnuradio.org/releases/gnuradio/iso/

After downloading the ISO file we need to install it into a 4GB or bigger flash drive with this program:

http://www.pendrivelinux.com/universal-usb-installer-easy-as-1-2-3/

It is recommended to add a persistence file to store and save the changes; otherwise the configurations will be lost every time we boot. Calculate the size of the file depending of your flash drive capacity and the fact that Linux will take at least 2.5GB

Then copy the .PY files contained on this ZIP to your hard drive or a **different** flash drive.

https://www.dropbox.com/s/par34n42m1r68k3/meteor_rx.zip

Connect the Linux flash, and reboot computer, command your PC to boot from the USB and wait for Ubuntu to load. It will said after booting that some error was detected, just click cancel and proceed to the indicated steps in the readme.txt file found inside the meteor_rx.ZIP

After running the app you should see a spectrum in the window showing data, if no signal or spectrum is shown, probably the RTL or FCD was not recognized.

The programs are my own edited version from a script written originally by Martin Blaho, I changed some parameters and things to adapt it to my station conditions, so in case of problems it is my fault, but I guess that it should run equally good in other stations. Main concern is regarding the frequency correction ppm value of each RTL dongle and proper gain value for FCD, so probably in other people computer, the downlink frequency can by 5 to 10 KHz up or down the nominal, or a different gain should be needed.

When the signal to noise ratio in the spectrum from Meteor satellite transmission is above 5 dB, go the second panel and look at the constellation, if it looks like a circle, increase PLL alpha, as soon as it is formed by four dots (even if spread), reduce the PLL alpha until reach value “1m”, if you suddenly lose lock and it become a circle again then increase it, but always

try to keep it as low as possible. There is no need to change Clock alpha. Keep receiving until the end of the pass, and then close the program.

The soft-decision symbol file and a WAV file (only needed for debugging and testing purposes) are saved in Linux desktop. To be able to open the file, we have to copy the .s file to our hard disk or second flash drive, and then we can re-start the computer without Linux flash and open Oleg's program decoder to extract the images and build the color composite.

In the first icon at the top left section we can search other installed Linux programs. You can look for "gpredict" which is a satellite tracker, after downloading a fresh set of keplers and updating our coordinates and adding Meteor-M N2 satellite to the list we will be able to see the time of satellite pass as well as its current position. All of these steps will be lost if we didn't created a persistence file.