DE KUNSTMAAN

In dit nummer o.a.

EUMETCASTViewer

Fengyun

en nog veel meer

Dear member,

This pdf contains translated articles of our Dutch magazine "De Kunstmaan".
Translation for each article is mostly done by the author, using Google Translate. Mostly some corrections are done afterwards. But for sure these translations are not perfect! If something isn't clear please let u know.

Figures are added as much as possible, so the "paper" (Dutch) magazine is not always needed to have at hand.

Internet links mentioned in the articles can also be found at our website; see under menu 'Weblinks' at:
www.kunstmanen.net

I hope these translations will help you to understand the Dutch articles.

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Content

Photo frontpage: Dish designed by Peter Kuiper, tested by Harrie van Deursen. This dish is also used by Fred van den Bosch for receiving HRPT in Vietnam

Preface

In front of you is the last Kunstmaan of the year. Time flies, it has been a year since the new QPSK receiver was presented. Several members have reconstructed the recipient to great satisfaction.

Yet the developments do not stand still here either. We have found a new tuner and just designed a new tunerprint. More about this in this Kunstmaan.

Enough UV1316 tuners. Who releases me?

Did you finally QPSK receiver working then you want this also places in a single enclosure. Which often turns out to be a big bump. How often your own electronics brewing ends as a loose circuit board or at best on a wooden board? At least in my case.

Peter Kuiper has taken the initiative to design a beautiful cabinet and have it professionally produced. The enclosure consists of two aluminum U-shaped parts. The cut-outs for buttons, LCD-display have already been made with a laser cutter .

There is room for the tuner and display print in the enclosure. Furthermore, the HRPT decoder and the downconverter fits into it . The enclosure is available in two sizes, namely for the LNC1700 or for the new (smaller) downconverter.

Due to setup costs, the minimum number of copies is three. Tune in with Peter if you are interested .

In this Kunstmaan a lot about software. Hugo van Ruyskensvelde is the author of the EumetcastView program . The program offers many possibilities to present data from EUMETCast. In this Kunstmaan a description of EumetcastView .

The receipt of Metop and the FengYun can also be done with software, I wrote about it in the past. The developments in this area are not standing still. The software is getting better and faster. Realtime display of the image will be possible in the future, but you will need a very fast / heavy PC. Peter Kooistra describes what is needed to receive these QPSK satellites. The tracking of the antenna is effected by hand! This saves a lot of craft challenges.

We were afraid that Fred could not make a contribution from Vietnam . The typhoon Damrey has caused a terrible devastation. Fortunately, no personal accidents but a lot of material damage. And no electricity and internet, can you imagine anything? As it looks Fred will be at the meeting on January 6 and can tell us everything.

Job de Haas has been very enthusiastic about the reception of weather satellites. For example, he gave a presentation during the last meeting on how to make a transmitter with GNU Radio. In this Kunstmaan a story of his reception installation and his first tracking of a satellite!

Job self -assembly rotor , with 3D-printed parts and aluminum profiles.

In recent times Harrie and I have been busy with the down converter. The print design has been slightly modified. I expect that we will have the final print soon. Because of the high frequencies, building seems to be more difficult than initially thought. Probably the follow-up will take place in the March Kunstmaan.

Our librarian brings us back to the Christmas mood with his contribution.

With the launch of the JPSS-1, the question arises how we can receive frequencies of 7.5 GHz. Is this possible? The higher the frequency, the more difficult everything becomes. The dish must be more accurate. Due to cable losses, the downconverter needs to be in the dish of the dish.

Once you have realized all this , you still need a receiver that can handle a data rate of 30 - 50 Mbps . At this moment we get the 4.6 Mbps .

But it is possible! Just look at the twitter account of Oleg: https://twitter.com/MeteoOleg

Recording of the Terra satellite

In this way he already receives pictures from the FengYun 3D, Aqua and Terra satellites.

For those who want to receive something else than pictures of the earth, there is the Argos-3 system. The NOAA and Metop satellites transmit data from weather stations etc. on the 465 MHz.

You need a UHF NFM receiver and a sound card. Maybe an "old" WRX-1700 can be used? More information on: https://www.coaa.co.uk/argos3plotter.htm

Lecture January 6

The program wsat is indispensable for the reception of the (A) HRPT
recordings . Rob Alblas has invested a lot of time in recent years to
make wsat suitable for receiving the Metop and FengYun satellites . The one
who wants to get started with wsat for the first time sometimes does not see the wood
for the trees anymore. Rob will present the various options of wsat during the lecture .

Finally, I want to wish everyone, on behalf of the entire board, happy holidays. I
hope you to meet on January 6th at our meeting with New Year's drinks.

Sincerely,

Ben Schellekens

PS: We remind you to pay your contribution for 2018. We hold the contribution of 25
euros per year for members in the Netherlands and 30 euros for members
abroad. An important part of the contribution is spent on the dissemination of this
Kunstmaan, which we now publish in A4 format.

Weather satellites in Vietnam (26)   Fred van den Bosch

Summary
My experiences with weather satellites etc. in Vietnam.

HRPT
Satellite PC
Even before the previous magazine was in the post box of the members my weather satellite PC actually gave up. It turned out that the fasteners of the processor cooler, with which he was stuck in the motherboard, had broken down. I had a few options.
- Strolling through Nha Trang to see if I could buy a loose cooler somewhere. I am convinced that something like that was successful; I just did not feel like spending time and energy there.
- Buy a new PC. Will be the case soon, but if possible, I wanted to postpone it for a moment.
- Repair it by myself.

And that last point is what I finally did. In a really Vietnamese way. Just with bolts and nuts. I have disconnected the motherboard and partly removed it. Then I could put four bolts through the holes from below. Motherboard reattached, all the boards put back on, the cooler pushed over the bolts to the processor (unfortunately I did not have a thermal paste), plates, spring rings and nuts on it.

Then the big moment: power on. Help!!! A lot of error messages. After a number of recovery actions started by Windows, which all failed, I got the question: "if I wanted to go back to a previous system point". Of course!!!! Unfortunately, after a while: error message.

If I wanted to do something at admin level. Of course!!!! Unfortunately, no password.

Well, too bad of all the work. OK, restarting normally once. ANDHEDIDIT!
I'm curious how long he will last this time. Yet I will have a carefully look around for a successor.

Typhoon Damrey
I cannot avoid writing something about this. Damrey has had a huge impact. First of all, a lot of damage has been caused to us. Here I first had to invest a lot of time and money (a first global estimate> € 5,000). First the typhoon itself.

Notification
A day in advance, reports on the public sound system were announced throughout the day, both general news and specifically for our region.

I myself could follow the track via the HKWarnings app, which provides reports from Hong Kong about this region. And they were not really positive. A day earlier, the "tropical storm" had already been upgraded to a typhoon. And the track would go right across our region.

In the same afternoon, I turned on both my installations for the reception of weather satellites. The APT image has national borders and the home designation. The other picture without national borders is the HRPT picture, unfortunately with quite a few lines of interference. Possibly the wind had already moved the disc a little and the rain also played a role.
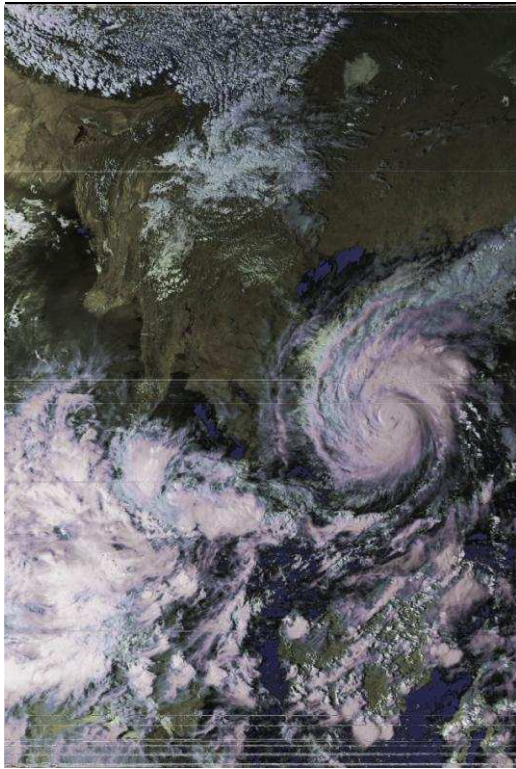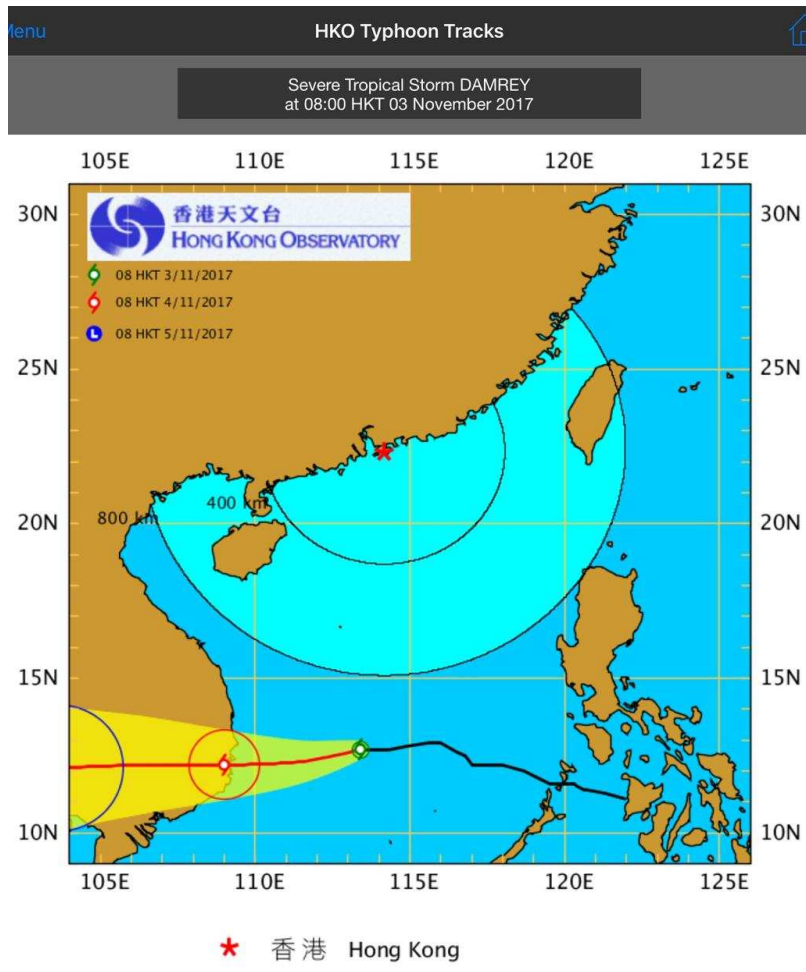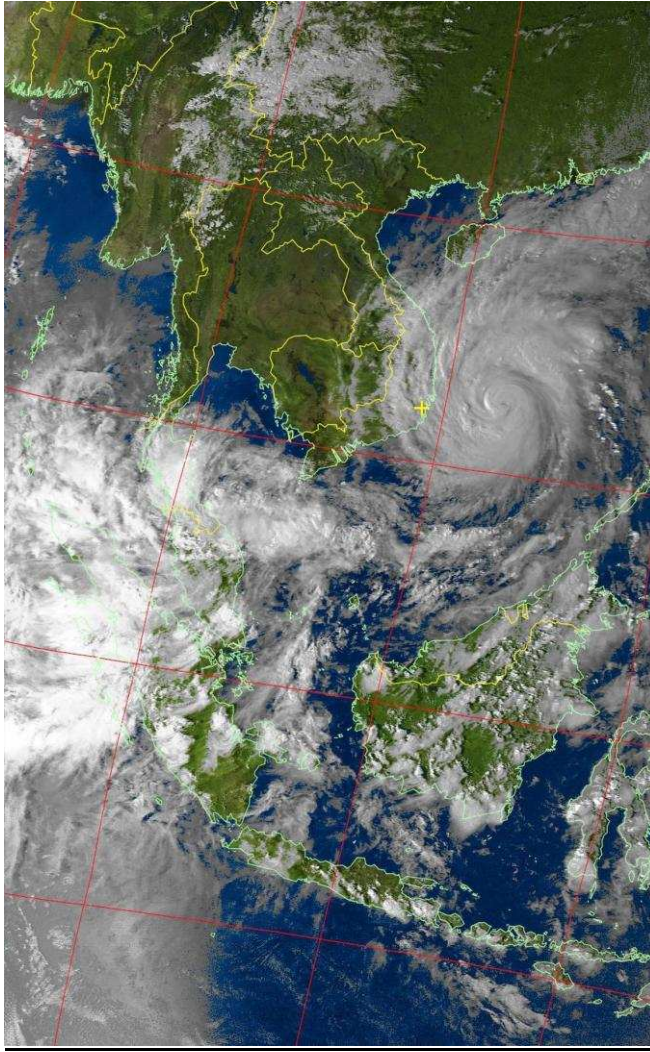
A heavy experience

On Saturday morning 4-11-2017, Damrey would land at 4:00 am, the center of the track according to the predictions roughly estimated at 20-30 km. north of Nha Trang and therefor also of our house. Either, we were literally in the middle of it. It started to blow pretty hard at that time.

Around 06:00 it really started to storm. You are completely powerless. You can see through the windows the neighbors' houses roof tiles and corrugated sheets are blown away, trees are cut down like matchsticks, you suddenly see at a certain moment that the wall around the garden has almost completely fallen over, etc.

Then all the drains of the terrace on the first floor were closed off by all flying branches, leaves and loose plastic covers of the outside lighting, so the water flowed in under the door. That was soon impossible to keep up. Because almost all floors on the first floor (of course) run to the wrong side, there is a lot of water damage to books and magazines. In the end, it turned out to be the most logical solution to let the water flow down the stairs and to sweep it out in the hallway under the door. There the floor actually went in the right direction. I think the only place in the house where this is the case.

The global damage

After a few hours we were able to record the first damage.

3

- Almost all roof tiles of the barn had been removed.
- The water pipes and part of the water filter installation were splinters because the roof tiles fell on them.
- The wall around the garden had almost completely blown away on three sides. Clearly the "better Vietnamese plaster job".
- The fiber optic internet cable was located under the wall at the back. That was there in two places demolished. For the rest, he was still there to my big surprise. Outside the wall, all the trees had apparently just fallen by.
- Most trees and shrubs in our garden were blown away.

Some more facts and problems
My weather station gave about 120 mm rain that day. Personally, I think that (much) more has fallen. I suspect that a lot of rain has been blown over or blown out by the storm.

We also had no electricity for a little more than a week. So telephones, iPads, flashlights, emergency lighting etc. could not be charged. Then just go to bed at 7 o'clock PM at the latest. Which was not fun either, because the fan and air conditioning do not work without some electricity.

No internet during .... Well, no idea at the time of writing. This is because the cable will be led over the wall again and it has to be built first. In that internetless period you really have no idea what happens elsewhere in the world. That world has suddenly become very small.

The antennas
That was a shock when I looked at the roof: it looked disastrous. First I put the disc up again. Then the brackets, with which he is attached to the support, turned out to be loose. And one weight was pushed inside. Furthermore, only one rib was dented, which, given the weight of the whole, was enormously noticeable. Possibly also because the disc rotated somewhat at the brackets. When there was finally electricity again and I could test it with a Meteor, I had from approx. 7 gr. instant image. The cheer cry must have been audible in the Netherlands, but in NL. it was in the middle of the night and everyone was asleep.

In the northern part of the track were only a few lines, which I myself find a giant performance. The disc was not yet completely aligned: the weight did not want to hang still in the wind. In addition, I worked due to lack of an internet connection with pretty outdated keplers and a non-synchronized time, which for an old laptop without a working battery is really shabby. The southern part was therefore one major noise line. But in time that would be improved (I assumed).

Well, unfortunately, not.

Because the rebuilding of the wall, partly due to rain, did not work out, we used a 3G dongle to use the internet temporarily. The disc is also better aligned with a somewhat heavier weight. But still many fault lines and a clearly lower signal level. When I went to see the antenna very closely, he had a somewhat bigger blow than I noticed at first. To make it easier to work, I removed the antenna from the rotor and looked from segment to segment to see whether there were deviations.

In the end I removed everything from the helical and turned the disc with the opening to the ground (for the older Dutch readers: just like Piggelmee [1] (the first 3 couplets I can still declamate effortlessly)). Carefully applied some pressure in strategic places until the whole seemed reasonably straight. Everything reassembled and pinned and the disc mounted on the rotor again.

The first tests between rain showers were not a success: many lines and sometimes it seemed that the rotors stood still for a moment. Then a somewhat larger step was made. I then removed all plugs (rickety Vietnamese quality) and cleaned them again. And yes, that did the trick. A recording, almost comparable to what I received before the typhoon. First better plugs and then some fine-tuning. But we are up-and-running again.

Peter Kuiper: my deep admiration and sincere compliments for this rather typhoon-proof construction! For all other members: RECOMMENDED!

The "good" news is also that all the trees, which were in the sight of the track, have been blown away. I now have a clear view from all sides up to the mountains. Good to see on the photo of the disc towards the south. An expensive solution.

The PADAT was even simpler. The lower mounting bracket had slid down. This was pushed around the pipe again and the antenna stood neatly upright again and again worked as usual.

Miscellaneous

Astrophotography

Anyone who wants to start astrophotography in a very simple way should definitely look on[2]. Here is explained how you can achieve quite spectacular results with a digital SLR camera and a free downloadable program.

Original photos from NASA

Auction House Skinner sells 445 rare photos made by astronauts. Among others, the original first photo made by Neil Armstrong from the moon is sold. [3}

References
[1] Piggelmee and the magic fish, see website
[2] Astrophotography, see website
[3] NASA photos, see website

Typhoon damage in Vietnam. All houses were damaged to a greater or lesser extent. Many trees fell, especially a lot of banana trees

QPSK receiver with UV916 Tuner. Update November 2017
Harrie v. Deursen

preface
For some receivers, the 33 volt inverter causes jitter in the PLL of the tuner.
You recognize it on a restless XY diagram.

Depending on the MC34063 chip and L2, ripple occurs on the 12 volt power supply because the inverter is "hopping". With a scoop you can see this on D1.
The best remedy is to have the inverter operate at 5 volts, which creates a higher switching frequency and reduces the peak currents.

1) Remove R11 and replace C11 with 22 uF or a higher value.
2) Connect C11 through 33 ohms with the +5 volt.
3) Place a C of 220 pF between pins 3 and 4 of the MC43063.

Then measure whether you see about 34 volts again on the cathode of D1.
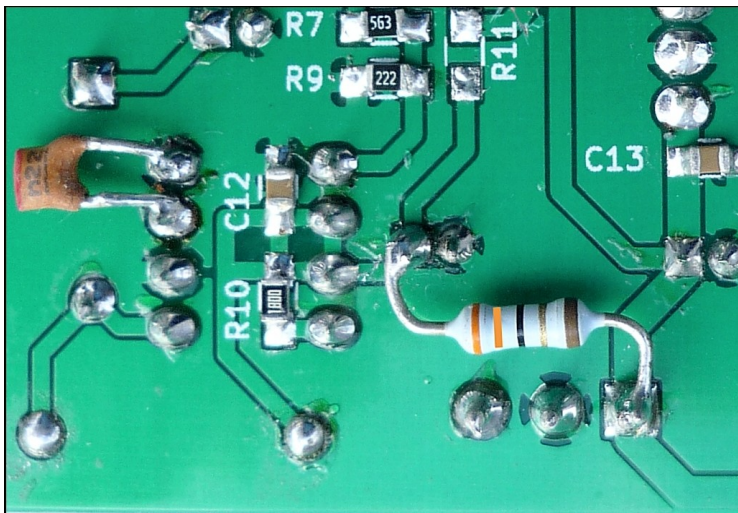
Modification of the 33V inverter

Tuner UV916, phase-jitter problems from the 12 volt power supply.
Ben had already discovered that there are many versions under the same name but internally very different. Especially the version with an F-connector appears super sensitive to ripple on the 12 volt connection caused by an external switching 12V power supply and the 5 volt inverter on the PCB.

The simplest solution is to replace the wire to pin 6 of the tuner with a resistor of 10 ohms and to connect an elco of 1000uF / 16V between pin 6 and the housing.
If you want even more protection against external switching power supplies, replace C9 with 1000uF / 16V.

External potentiometer for Tuning HRPT.
The optional tuning circuit on P5 serves to correct the temperature drift of the 73 MHz oscillator, the tuner and the downconverter. It is only active in HRPT mode.
On an XY scope you use this to set the two dots horizontally as a handy alternative for correcting L1 on the demodulator board.

Leave the connection on P5 loose until after the adjustment.
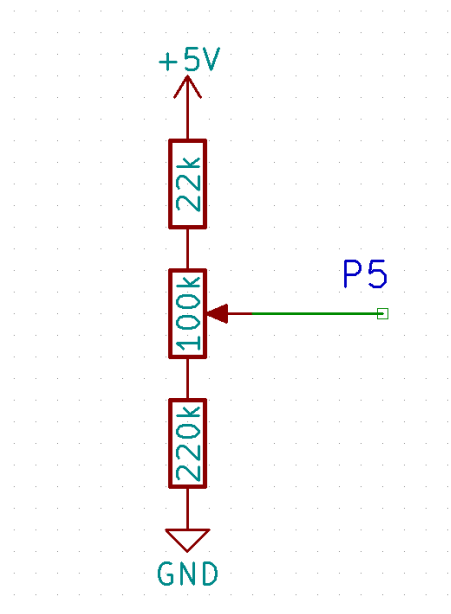
HRPT tuning circuit

Adjustment of the receiver.
To adjust the receiver, the following items are required:
A working antenna installation with dish-helical-LNA, the new downconverter to 700 MHz or the old LNC1700 to the 137 MHz band.
Connect a scoop in XY mode with 0.5v per DIV.

Test values for control.
Measure whether the supply voltages are 12V and 5V correct and whether you see approx. 2.5 volts DC on the scope outputs.
Switch in HRPT mode, you should see a VCO value between 3.5 and 3.9 volts on the display.
Note this value as "normal" reference for the HRPT Fine tuning potentiometer.

If everything seems to be successful, we will adjust with connected antenna and downconverter.

1) Turn the gain potentiometer RV1 on the demodulator board all the way to the left for minimal amplification of the LT5546 Chip.
2) Adjust the tuner board via RV1 on the tunerboard so that you can see 1 volt pp on the received noise level. The noise signal must be strong enough to also see a normally adjustable RF level on the display.
3) Adjust for noise RV2 so that the VCO level in QPSK mode will be slightly above 4 volts. If you do not, replace R35 with 100k (or solder 150k parallel)
4) Choose HRPT mode and receive a satellite like the NOAA on 1698 and 1707 MHz or the Meteor on 1700 MHz.
5) Adjust L1 so that when you receive it on the XY scoop you see two dots that have to come horizontally.
6) If the received signal from the dish and downconverter are too weak to reach 1 Volt pp, then use RV1 to increase the gain of the LT5546 on the decoder board so that you still reach 1 Volt pp on the Scoop outputs.
7) Connect potentiometer Tune HRPT to P5 and set to the reference VCO value.

The RF indication on the display depends on the strength of the incoming signal, where the basic noise level depends on LNA and downconverter, it will be somewhere between 15 and 60.
The RF indication shows the *reduction* of the tuner gain, so a low value means the highest gain.

If everything works well, you will see a higher noise level in the direction of the horizon because of the warm earth and all the junk we generate ourselves with those nice wireless connections.

Frequencies of interest are:
1698 MHz Noaa 19
1700 MHz Meteor
1701.3 MHz Metop A, Metop B and Fengyun 3C
1704.5 MHz Fengyun 3A and 3B
1707 MHz Noaa 18

QPSK trapping is done by switching from HRPT to QPSK (returns a VCO reset).
HRPT usually goes automatically and otherwise you can use the tune potentiometer.

In the future, we want to automate QPSK capture with a signal from Rob's decoder.

FengYun and Metop with SDR

Peter Kooistra

Summary
A description of receiving METOP / Fengyun using SDR.

Rob Alblas approached me to write a piece for De Kunstmaan after reading a publication in the Geo Quarterly in September about my FenYung reception with SDR.

I've looked for my salvation in the software solution, simply because my electronics knowledge is virtually absent, but I am pretty creative, and pretty handy with computers and software.
With respect and interest, however, I do follow the operations of Rob and his colleagues concerning the hardware-based Metop and FY reception.

SDR has boomed in recent years, not least because of the increased computing power of PCs and laptops. This means that things that were unthinkable for about 7 years ago are now available.

Exchange of experiences and software is mainly via the internet, especially think of Twitter, Youtube and specialized chat rooms and websites. The (international) exchanges and feedback ensure continuous progress. In the last 2 years I have built up a nice network with great patience.

How it started :

In 2011 I managed to create excellent APT-records with a simple RTL-SDR as receiver, from this there was a picture of me in De Kunstmaan. (KM no. 3, 2012)

A few years later I participated in the AMIGOS project as a tester, and a wonderful fully automatic, software-based reception system for MeteorMN-2 LRPT was realized based on SDR.

So time for a new challenge:
I was wondering if it would also be possible to receive and decode the HRPT variants. Vasili, the programmer behind the AMIGOS project, was unfortunately not interested, so I did scan the internet for possibilities.
A tiny Twitter message, gave hope: NOAA HRPT was done in 2013 with SDR, many details were not there, but the cries "Gnu-Radio, .RAW16 output and Hrptreader". This was just enough to puzzle with, more about that.

Of course I also need "hardware":
I had sniffed something on the L-band in the past, and received Inmarsat with a self-made gauze horn, but realized that a decent HRPT signal was needed.
So I looked up a parabola dish calculator on the internet, and I built a 1.1 meter mesh dish made of aluminum. (fig. 1)

Fig. 1 The (not quite finished) 1.1 meter mesh dish, which is now being prepared for "outdoor life".

Then I have immersed myself in Helix feeds, there is also a lot to find on the internet, and of course also in De Kunstmaan.

After a lot of experimenting, trial and error, the feed is now properly adjusted to the F / D of the dish, and the Helix has a decent return-loss at 1700 MHz.

Initially I used a LNA4ALL and received directly at 1700 MHz, with the SDR directly linked to the LNA4ALL, which in itself was linked to the Helix-feed.

The addition of a Mini-Circuit filter resulted in a further improvement, the VHF-1320 + was badly needed to suppress local GSM signals.

It went pretty well, but could be better, my hobby measure Cees Sol, "partner in crime" suggested to use a Meteosat downconverter. This converts the 1700 MHz to 137 MHz; the SDR performs better on that frequency.

On Ebay, I found an old Dartcom Meteosat LNC, probably from the early 80's, but without instructions.

I asked Les Hamilton, where I have excellent contacts, to place a call within
his network in England and within 2 hours someone offered to scan the stencils and email me, that was quickly arranged!

I mailed the stencils to KM member and microwave specialist Fons Buitelaar, with the request to analyze the schematics and so on. He gave me an explanation and the specifications; it turned out to be a great purchase.

Also in practice it was a hit! The reception improved drastically with the LNC, but also with this setup placement of previously mentioned MC filter was not a superfluous luxury.

SDR :
A crucial part of this branch of sport is of course the SDR (Software Defined Radio).
Although I now have a nice arsenal of these receivers, my favorite is the
Airspy-Mini, barely larger than a USB stick, and with a maximum bandwidth of 6 MHz, passively cooled, in a solid metal housing and a fine SNR.

The 6 MHz bandwidth makes it very suitable for Metop and FY, and with 3 MHZ, of course for NOAA and MeteorMN-2 HRPT.

(Want to know more about SDR receivers, then google on "SDR")

The Software :
I currently make an (IQ) Baseband recording in SDR # and later process this recording with *GNU Radio for Windows. The* practicality of this is that everything runs under Windows in this way. So no Linux installation is needed.
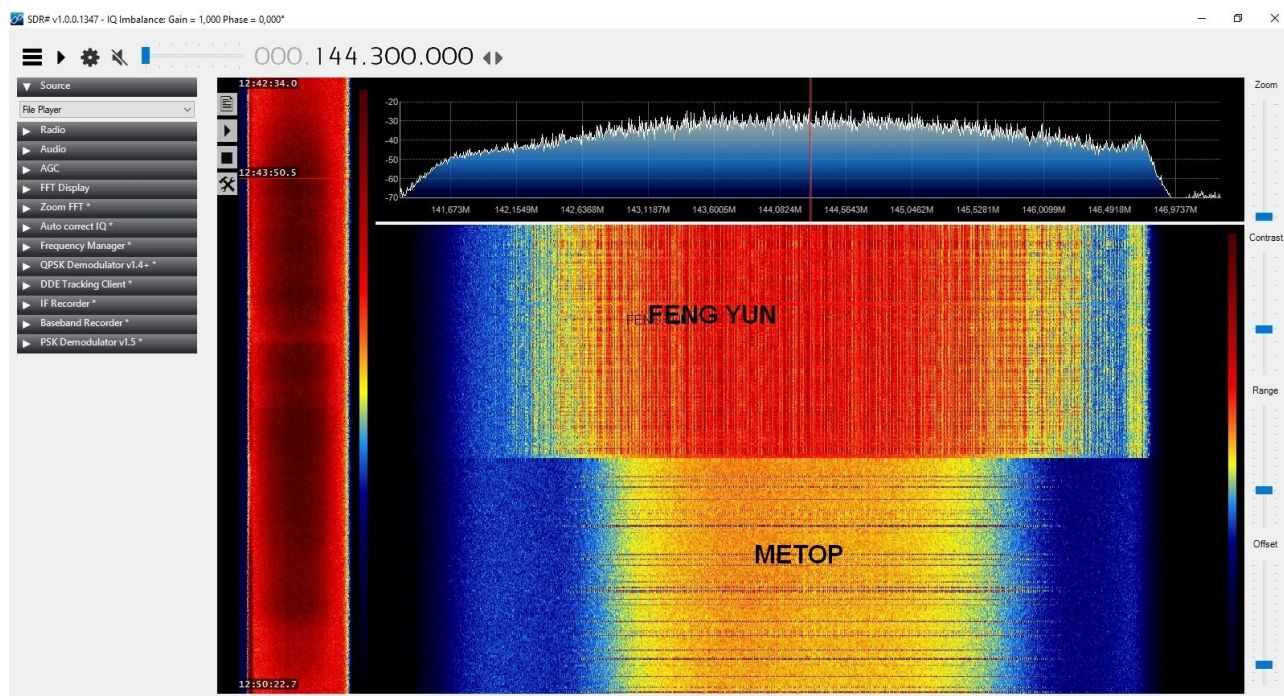

Fig. 2 Spectrum waterfall diagram of FengYun and METOP. Note that here the 1700 MHz has already been converted to 144 MHz.

For NOAA-HRPT there is already a standard decoder in GNURadio, for the other satellites there is a GRC file required from outside (Gnu Radio Companion: a program, in this case one decoder, which is loaded in Gnuradio).
I process also MN2 AHRPT completely in GNURadio, with a decoder from Martin Blaho.

FengYun and Metop
FengYun and Metop are only demodulated in GNURadio. The output is a .RAW file that is almost as large as the original Baseband recording, count on a small 1.5 GB per recorded minute signal of 6 MSPS (Mega Symbols per second, the sample rate of the SDR receiver))!
(NOAA and MN2 are included with 3 MSPS, so here you count half)

The demodulator for FengYun and Metop is the same, only the symbol rate has to be adjusted.

The .RAW file goes into a "DOS-like" decoder that is started from the CMD prompt. (fig. 3)

Fig. 3 Output of the achrpt decoder: convert the received I / Q symbols to a file that wsat or metfy3x can handle.

The output is a .BIN file that can go directly into Rob's latest WSAT program, or can be processed via Oleg's MetFY3X into a picture readable by HRPTReader. (See also fig. 4.)
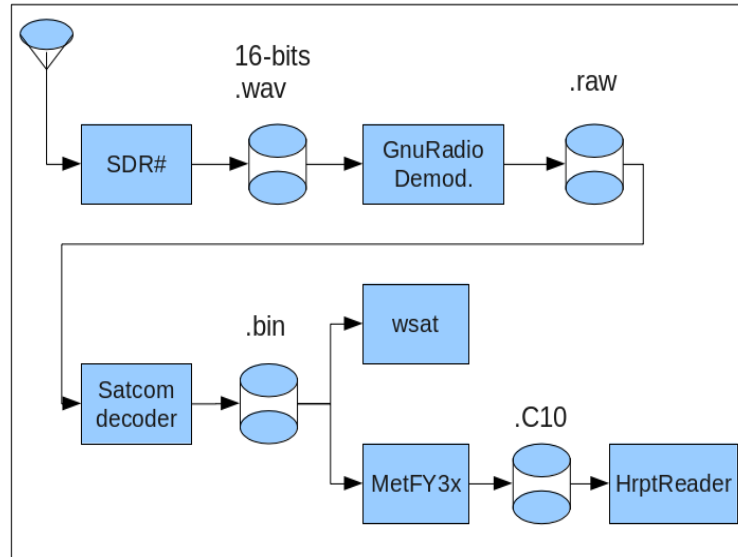
Fig. 4. Block diagram of the Metop / Fengyun receiver based on SDR, as used by the author.

I received the decoders for FY and Metop from USA_Satcom, as thanks for my cooperation in the demodulation part and the testing of the whole. (Fig 5.)
Soon this decoder will be included in its already existing HRPT decoder, so there will soon be one Windows-based program for all L-band weather satellites!
Note: this program is not free, because of the simple fact that previous free software was "hijacked" by others and sold.
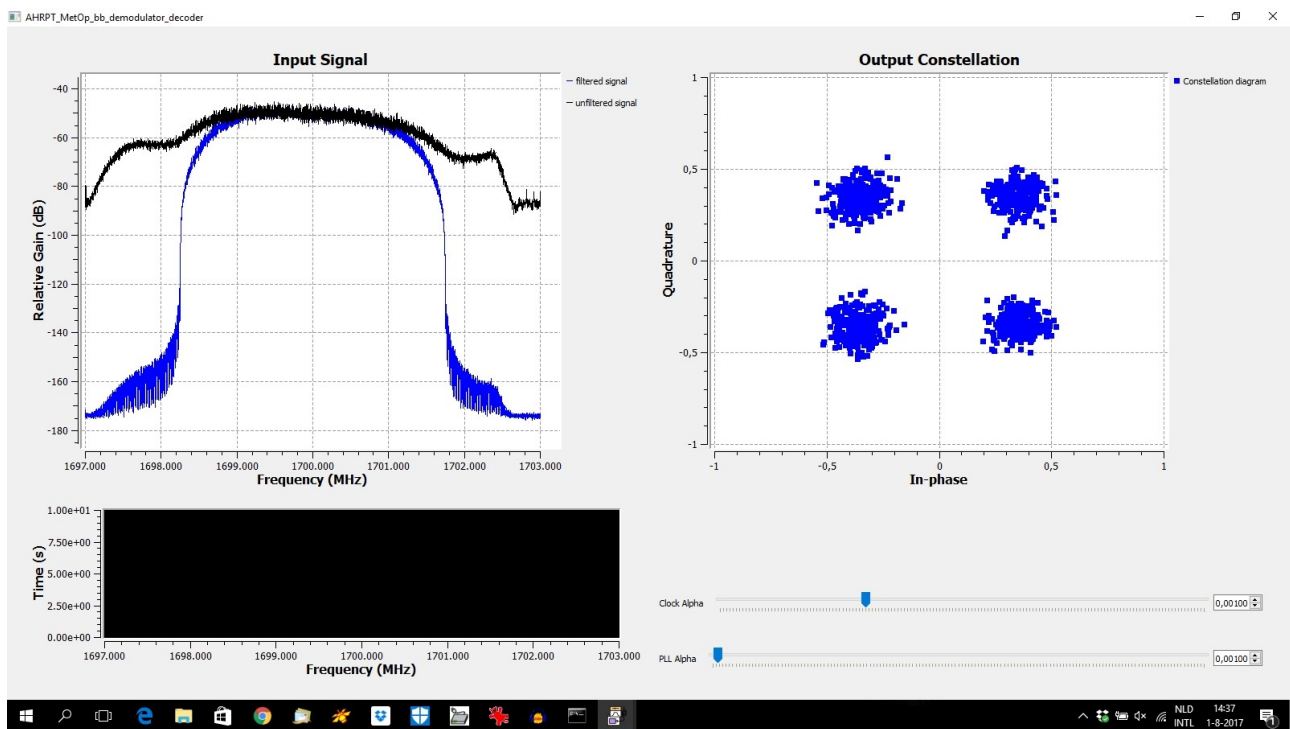
Fig. 5 Metop - FY demodulator in operation.

Realtime?

You will probably think that "realtime" decoding is not possible in this way. The last
tests from USA_Satcom show that this is going well, of course with a modern laptop or PC.
Think of an I7 processor and 16 GB of memory. The smart decoder can neatly distribute
the tasks over the processor cores, so that the process runs as efficiently as possible.
Personally, I have recently acquired such a laptop, but with my older I3 / 4GB I was able to
produce excellent records with a little more patience.

With the method in separate steps as I still use it at the time of this writing, it comes down
to the fact that I do about 15 minutes to process a recording of 7 minutes into an image.

Why such a short recording? That had not yet been discussed. So far I've been following
the satellites by hand, ie the mesh dish is on a camera stand in the backyard, with limited
view of the sky and the laptop is next to it, to have a view of the signal.
It is a sport in itself, but if you study the transition in advance in a program like Orbitron or
WX-Track, it is do-able after some practice.
However, it is important here to have a surplus of signal; tracking by hand is of course not
as precise as automatically following with an EL / AZ rotor, and that has forced me to get
the most out of feed and dish, but that does not hurt, of course.

Before I started this project, I obviously did not know if it would succeed. I had planned that
an EL / AZ rotor would only come if I were able to receive and decode all satellites. At that
point I have now arrived, and I will purchase a rotor in a while.
Self-construction, especially the electronic part, is unfortunately too much for me.

Finally :

I have not included all the details in this article, the aim is to get an impression of this way
of receiving and processing.

It was also possible to do MSG - LRIT in the "SDR-way", of course with a different decoder and with Rob's excellent XRIT2PIC. I unfortunately read that Eumetsat intends to leave April 2018 to stop the direct broadcast of LRIT; hopefully one will consider ...
Interested parties can possibly find and download the decoder with Google OSP (Open Satellite Project); it was developed for GOES but also works with MSG. OSP will also deal with the polar satellites in the course of next year!

If there are any questions or suggestions, please send an email to:
peterkooistra@kabelfoon.nl ,
our transactions can also be followed on Twitter via @petermeteor

My special thanks go to KM members Cees Sol and Fons Buitelaar and Joe Steinmetz alias Trango from USA_Satcom, for their indispensable contribution to this project!
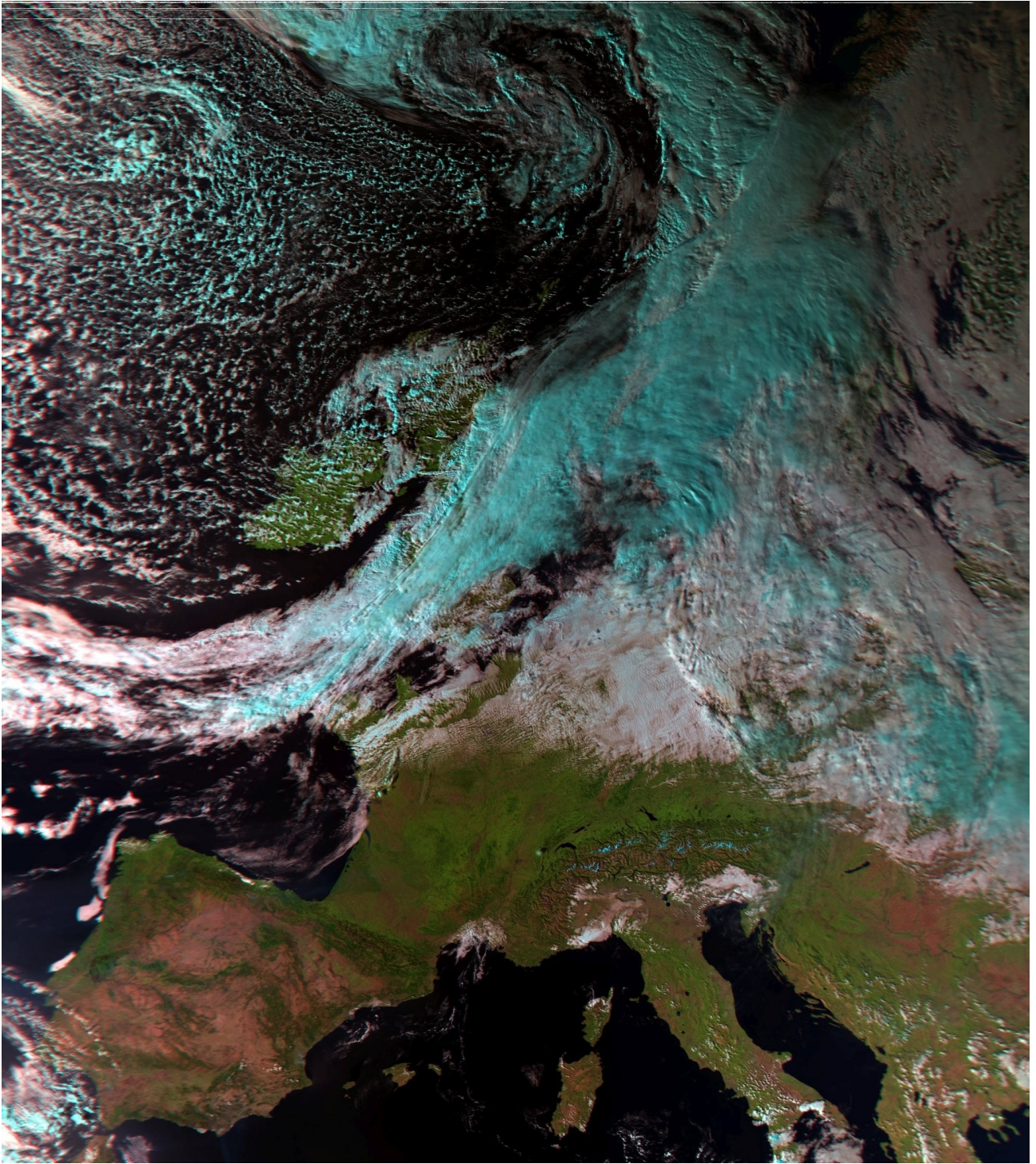
Fig. 6 Result receipt of FY3B on 11 October 2017, 14:17.

EUMETCastView - an EUMETCast Viewer

Hugo Van Ruyskensvelde

What is EUMETCast?

EUMETCast is a dissemination mechanism of meteorological data from different geostationary and polar satellites by EUMETSAT. The broadcasts are made via a geostationary satellite (EUTELSAT 10A) on two transponders. The protocol used is the DVB standard (IP over DVB) and a multicast distribution software (Tellicast).

Overview of the EUMETCastView software

EUMETCastView is an open source software that allows you to decode and manipulate the footage from EUMETCast broadcasts. It has been developed in C ++ with the Qt toolkit on Linux. Since the Qt toolkit is used, the software can also be compiled for Windows. It is an alternative to the software of David Taylor (http://www.satsignal.eu/software/wxsat.htm) and the xrit2pic software of Rob Alblas (http://www.alblas.demon.nl/wsat/software /index.html). For Sentinel-3 data it is an alternative to SNAP (http://step.esa.int/main/download/). As far as I know, there is no easy alternative to the CVIIRS data (SUOMI NPP and in the future NOAA-20). PyTroll (http://pytroll.readthedocs.io/en/latest/index.html) is another popular tool, but some knowledge of Python is required.

It is the intention of the software to be an integrated system for EUMETCast data, easy to use and capable of processing images from polar and geostationary satellites.
In addition to decoding the images, the software can also make map projections of the generated images. At present, three projection systems are possible:
- the Lambert Conformal Conic projection (LCC)
- the General Vertical Perspective projection (GVP)
- the Stereographic projection (SG)

System requirements

A modern PC with Windows 64-bit (Windows 7/8/10) with a simple graphics card that supports at least OpenGl 3.2 and ideally a video screen of 1920x1080 pixels. A memory of at least 6 GB is required and when processing OLCI images, 12 GB is not a luxury.
My system consists of two PCs (both with Ubuntu 16.04):
- a PC with the Tellicast software (Intel Pentium @ 3.0 GHz, 8 GB memory)
  Two SR1's from Ayecka are connected to that PC (one for each transponder)
- my development and image processing system (Intel i7 @ 2.67 Ghz, 12 GB memory)

There are users who run both Tellicast software and EUMETCastView on one powerful PC without any problem.

Which image material can EUMETCastView process?

At the moment EUMETCastView can decode the following image formats:

- Polar satellites
  - AVHRR and GAC from NOAA-19, Metop-A and Metop-B
  - CVIIRS (M-band and Day / Night Band) from SUOMI NPP
  - OLCI and SLSTR from Sentinel-3
- Geostationary satellites

- XRIT of Meteosat-10/-9/-8
- XRIT from Electro L2
- HDF5 from FengYun 2E/2G
- XRIT of GOES 13/15 (no GOES 13 data broadcasts more on EUMETCast after 14 December 2017)
- netCDF from GOES 16 (replacing GOES 13)
- XRIT of Himawari-8

In addition to the data broadcast by EUMETCast, the software can also process image material in HRPT format, generated by the Metop Manager of David Taylor.

EUMETCastView can also decode segments (OLCI EFR, OLCI ERR and SLSTR) that are received via Internet (Scihub and CODA). The selection of segments you want to download and decode is done in the same way as for EUMETCast segments (see below). For Sentinel-3 data you do not need an EUMETCast receiving system.

Installation on Windows

The latest release of EUMETCastView for 64-bit Windows systems can always be found on github (https://github.com/hvanruys/EUMETCastView/releases). The installation is very simple: unzip the file EUMETCastView_Windows_64bit_vx_y_z.zip (x_y_z is the version code, eg the latest version is now 1_2_8) to your hard drive and a folder 'EUMETCastView_Windows_64bit_vx_y_z / DeployEUMETCastViewQt5.5.0' will be created. In this folder you will find the programs EUMETCastView.exe and EUMETCastWatcher.exe (see below). So there is actually no installation procedure. To uninstall the software you only need to delete the folder 'EUMETCastView_Windows_64bit_vx_y_z' and its subfolders.

All necessary dlls are present in the zip file. The software is compiled with Qt 5.5.0. I make this distinction in the folder name because Qt 5.9 will be used in the future. The dll's for Qt 5.5.0 are different from those for Qt 5.9.

Short overview of the screens of EUMETCastView

When you launch EUMETCastView you will arrive at the 'Satellite Setup' screen
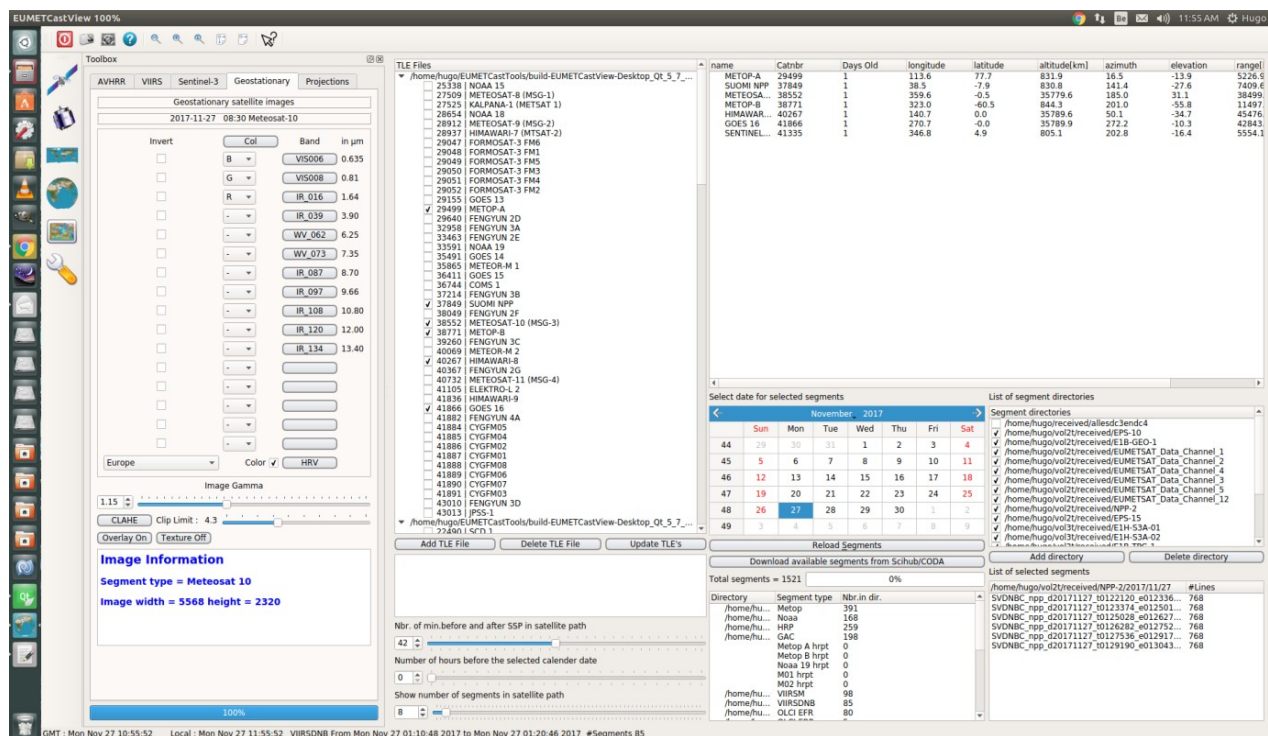
which contains a list of TLEs (Two Line Elements). TLEs are the necessary parameters (ephemeris) to calculate the orbit of a satellite and these are of course always different from satellite to satellite. These TLEs must be refreshed regularly to ensure the accuracy of the calculated positions of the satellites. This can be done by clicking the 'Update TLE's' button. You obviously need an Internet connection. Some selected satellites will then show 'Days Old' equal to zero.

With the buttons in the left-most vertical sidebar you can switch screens. The 'Geostationary satellites' button (fig. 2) shows the lists of the received segments of geostationary satellites.
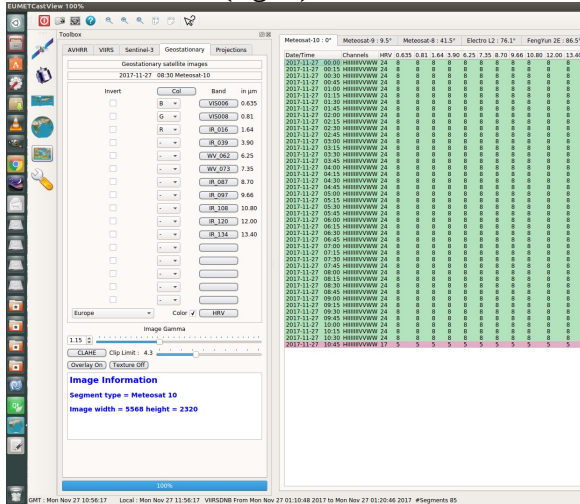
fig. 2

The 'Cylindrical Equidistant' button (fig. 3) shows a Carrée projection of the earth with the 'real time' positions of the selected satellites (if the TLEs are up to date of course).
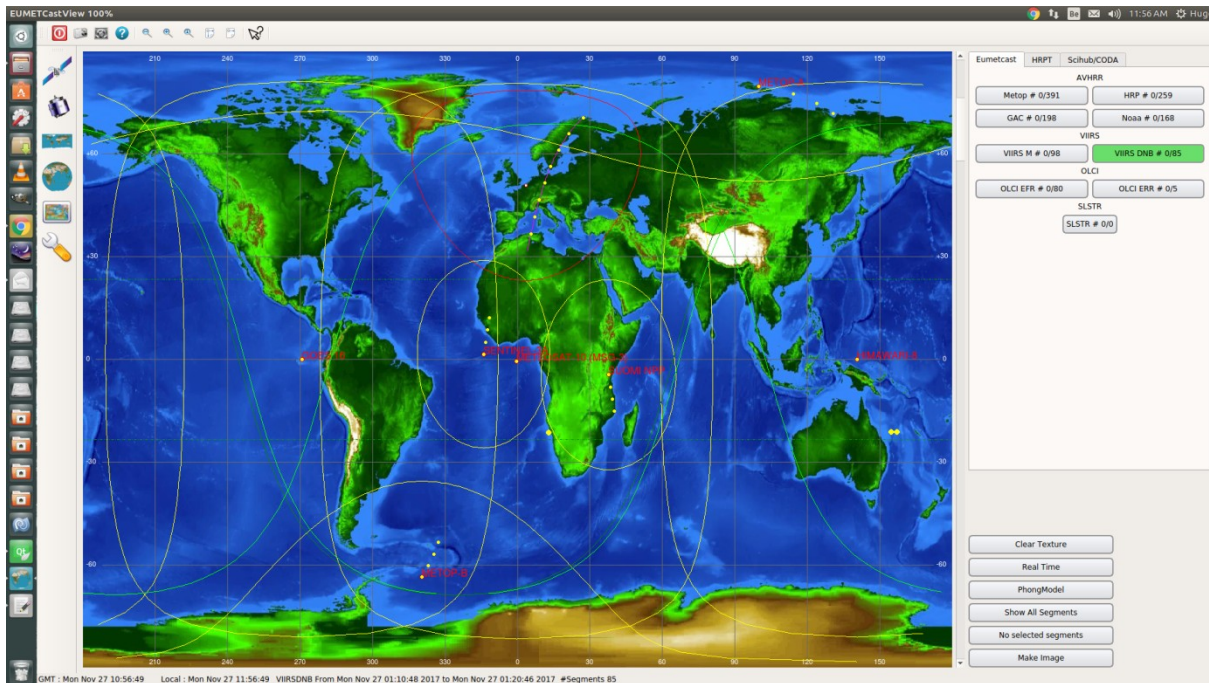
fig. 3

The '3D Globe' button (fig. 4) shows the same thing but in 3D. You can change the position of the earth by holding down the left mouse button and dragging the cursor over the earth.
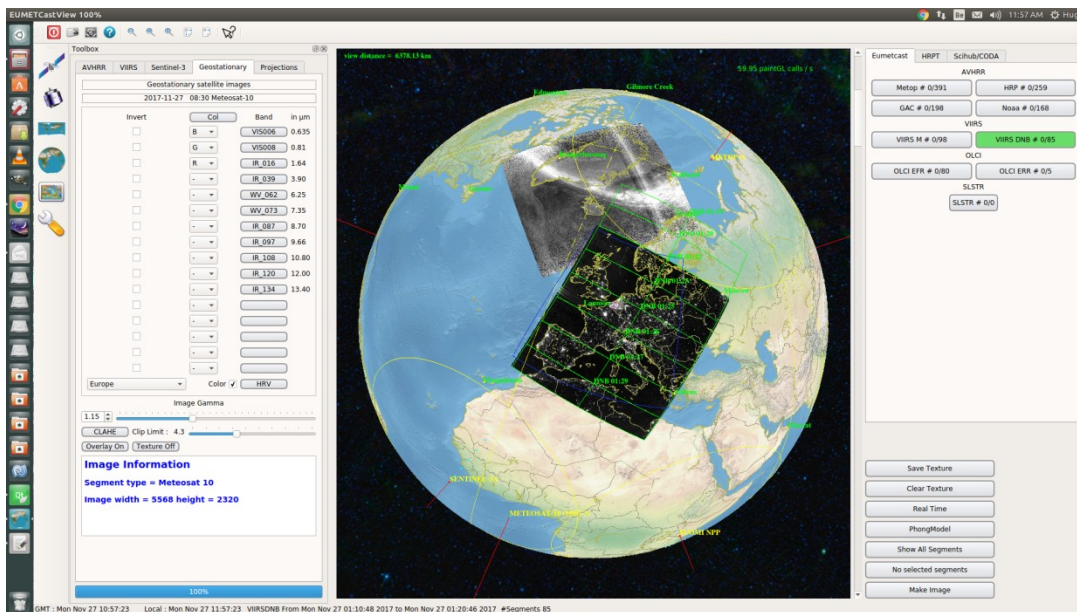
fig. 4

The 'Image' button (fig. 5) shows the decoded image of the satellite. The 'Toggle Toolbox' button displays the Toolbox screen or makes it disappear.
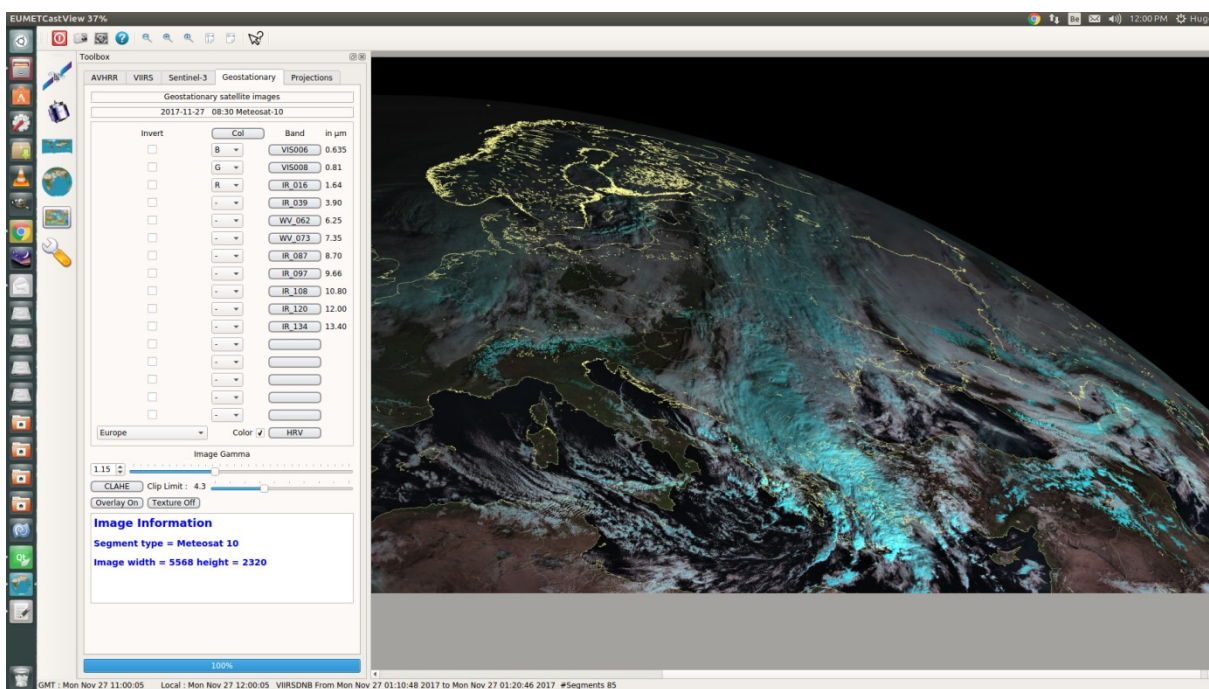
fig. 5

The 'Toolbox' screen allows you to choose which spectral bands you want to decode. This is possible for AVHRR, VIIRS, Sentinel-3 (OLCI or SLSTR) and the geostationary satellites. Depending on the choice of segments of geostationary satellites, the buttons will change with the available spectral bands.

At the screens 'Cylindrical Equidistant' and '3D Globe' you also have, at the far right, a screen with stacked tabs: 'Eumetcast / HRPT / ScihubCODA'. The 'Eumetcast' tab shows the number of segments received by EUMETCast by satellite. The 'HRPT' tab shows the same for the HRPT segments and the 'Scihub / CODA' tab allows to receive OLCI / SLSTR segments via the Internet.

Commissioning

Before segments can be decrypted, it is important that EUMETCastView knows where to find the received segments. On the 'Satellite Setup' screen you will find a list of segment folders at the bottom right: 'List of segment directories'. The buttons 'Add directory' and 'Delete directory' allow you to create a list of folder entries where the EUMETCast segments are received. For example :
D: / received / EUMETSAT_Data_Channel_1
D: / received / EUMETSAT_Data_Channel_2
D: / received / NPP
D: / received / EPS-10
etc.

Due to the large number of segments received by EUMETCast, it is advisable to create subfolders that contain the received segments per 24 hours.
These subfolders must have the form: YYYY / MM / DD, i.e. the 'Data Channel 1' folder would take the following form for November 1st, 2017:
'D:/received/EUMETSAT_Data_Channel_1/2017/11/01. The program 'EUMETCastWatcher' does this automatically.
Below I will give more explanation about this program.

By first selecting the desired day on the calendar or by clicking the 'Reload Segments' button, an overview of the available segments of that day is loaded.
The list of segments of the geostationary satellites can be found on the 'Geostationary satellites' screen. The received segments of polar satellites are shown on the 3D Globe.

Decoding of segments of geostationary satellites

Press the 'Geostationary satellites' button. For example, select the 'Meteosat-10' tab. The list shows all available segments of Meteosat-10 per 15 minutes. When the number of segments is complete, the background will be colored green. With an incomplete number of segments it is red. For Meteosat-10 there are 24 segments for HRV and 8 per spectral band. Selecting is done by clicking with the mouse on a row of the list. The 'Toolbox' tab will jump to 'Geostationary'. You can create a color composite photo by clicking the 'Col' button. The screen will automatically go to the 'Image' screen and the decoding will start. When the image is too dark you can experiment with the CLAHE button, which allows you to get more contrast in the image. The value of the 'Clip Limit' influences the contrast of the image.

Decoding of segments of polar satellites

The number of available segments is visible in the buttons of the right-hand tab (Metop/HRP/GAC/Noaa/VIIRS M/VIIIRS DNB/OLCI EFR/OLCI ERR for EUMETcast). By selecting a button with available segments, the boundaries (green colored) of the segment are visible on the globe. By pressing the 'Show All Segments' button, all available segments of a particular satellite are shown. For example, for the Metop A and B segments, about 927 segments are visible on the 3D globe in one day. The decoding of one or more segments of polar satellites is done by placing the cursor of the mouse in a segment and clicking with the right mouse button. The color of the boundaries of the segment goes from green to red. With many overlapping segments on the 3D globe, it is easier to turn off the "Show All Segments" button and use the vertical scroll bar located to the right of the 3D globe. By moving this slider, the program shows only a number of segments, determined by the value of 'Show number of segments in satellite path', on the 'Satellite Setup' screen. When the 'PhongModel' button is pressed, the 3D globe will show day and night at the time of the displayed segments. This is very useful if you want to know if the segment is on the night or day side.
By clicking the 'Make Image' button, the image will be built up on the 3D globe. The fully decoded

image can be seen on the 'Image' screen.

Projections

fig. 6

It is possible to make a projection of a specific area of each satellite image (geostationary or polar). In the 'Projections' tab in the Toolbox you first choose the 'Input Image' (fig. 6). The 'Output Map' determines how big the projection will be in pixels. The 'Projection Parameters' of the various projections can be changed on the tabs 'Lambert Conformal Conic', 'General Vertical Perpective' and 'Stereographic'. The 'General Vertical Perpective' is perhaps the easiest to use. By setting the 'Height' to 999999 an orthographic projection is obtained.
It is not always necessary to make a projection of a satellite image. The VIIRS sensor of the SUOMI NPP, however, exhibits a so-called "Bow-tie" effect, resulting in lines on the image that contain no information. A projection to LCC, GVP or SG will make these lines disappear in the projected image.

The EUMETCastWatcher program

fig. 7

EUMETCastWatcher is a program that runs on the receiver PC (with the Tellicast software) (fig. 7). The purpose of this simple program is to move the different segments to a subfolder in the YYYY/MM/DD format. These subfolders are automatically generated for the different Tellicast

folders (the target_directory in cast-client-channels.ini). This way, EUMETCastView does not have to go through folders with very many segments. The software will also delete files during the reception in which we are not interested. The software is based on templates (templates) when choosing to move or delete the received files. Templates can always be added or removed with new segment names.

Availability source code

The source code of the software is available on Github (https://github.com/hvanruys/EUMETCastView). The source code for decoding XRIT (the Wavelet decompression library for Meteosat images) is not in the zip-file. This can be obtained from Eumetsat itself (https://www.eumetsat.int/website/home/Data/DataDelivery/SupportSoftwareandTools/index.html) It only makes sense to compile the software for 64-bit systems, due to the 4 GB memory limit of 32-bit OSs.

In my EUMETCastView blog (http://hvanruys.github.io) I try to give an overview of the new features of the program with every new release.
You can always contact me via the Yahoo user group MSG-1 (https://groups.yahoo.com/neo/groups/MSG-1/info).

From the library

Pals, stop your wild roaring!

No, I'm not talking about Black Pete who always gets the blackpeck with blame to carry. And neither about the hooligans driving behind him or not. And really not to you, but to the switching power supplies. While listening to seasonal songs on the old FM tuner I wondered if there would be some activity still on the AM. I have not touched it for years. That's why I quickly rolled an antenna wire into the garden and listened. It was an unimaginable crackle, hiss and crap! Completely unusable. And worse, I am also guilty of it myself. There had to be a lot of devices from myself before it became somewhat quieter. In the distance I heard a desperate announcer in French. Then I just rolled up that wire and wrote something for you. Also quite useful after all.

The GEO has had its longest time on paper. I have some mixed feelings about it. It has been a beautiful glossy magazine for more than 50 editions, made with great dedication. Without exception a high quality, but that also makes it boring. Never even a nice thick irritating jam bar through a weather photo. I often got the tendency to browse through it and put it aside. For us, the road to the result is just as fun as the result and that first part I missed a bit. In recent years, the GEO has already partly been published in pdf. For the meetings I tried a few times to print the pdfs for the library table, but that was not a success. I simply pulled my toner cartridge empty, interrupted by jammers, because of all that soot the printer does not understand. It is therefore important to take steps onto new media, for us and the GEO; which continues as GEO Subscribers Yahoo group. It's the new time, just what you say. All previous editions are now available on pdf.

Jos Disselhorst's lecture on interdigital filters has inspired me. I decided to solder something together on a printed circuit board, without any substantiation or calculation and at the meeting to see what it yields. Informative! With the help of Arne van Belle and his handheld spectrum analyzer, I quickly saw that my two-circuit filter was too tightly coupled and that nothing could go wrong with an adjustable filtering effect. The two circuits simply moved up and down at a distance. That's why everything was quickly converted into a one-circuit filter and that turned out to be unintentionally a bad suction circuit. What is the point of all that? I already hear you say that. My intention was to get some feeling for what does and does not work, without much calculation beforehand. Of course you need calculation, but also some understanding. This kind of work can be done at our meetings. Come and take your hardware and software under construction.
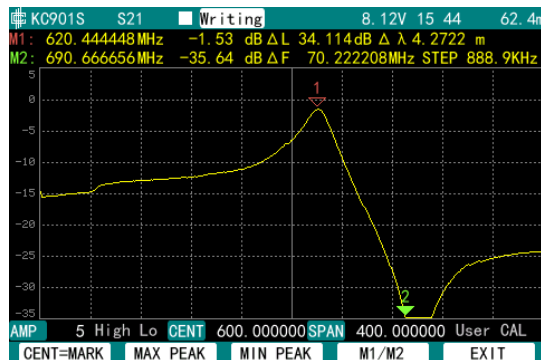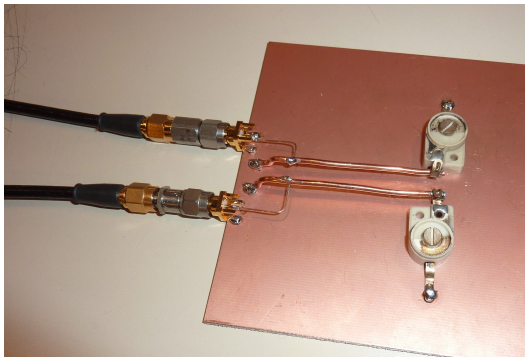

(Left: the double tuned circuit, right: the characteristic of the single tuned circuit)

Coincidentally, the Elektron of December 2017 rolls in with a follow-up article about UHF

connectors and the dB loss that air gap at the chassis causes. I have yet to read it fully, but if I read it correctly so far, the damage is not too bad. It is a reason to always keep an eye on the earth contact; a few dB makes a lot of difference for us.

Because I thought it was time to replace the old family PC for something more modern, my attention was drawn to PINE 64. It reminds me of a Raspberry, but it can also run Windows 10 apart from all kinds of Linux distributions, so it was advertised. Because Windows can not always be avoided, it seemed a good buy to me. It is not expensive, with built-in Wi-Fi and blue teeth, in an enclosure, of 80 euros. Of course, the obstacles or challenges did not take long. There is only HDMI on and I do not have that at home. Fortunately, a Velleman converter to VGA brought the solution. That does not go without saying: HDMI has multiple implementations, converters sometimes work and sometimes do not, and the order of connection also listens closely. Furthermore, the start of the Pine is deceptively slow, in the order of minutes, so I first thought that he was not working. I then started working on various Linux distributions. However, the promised Windows is an IoT version for industrial rather than home use. In principle we should be able to do something nice for our hobby: there are enough hardware ports. Evaluation is still ongoing and you will still hear.

In a previous article I permitted myself some positive-critical remarks about the programming language C. From an unexpected angle (namely the board) I pointed out that one can also have a different opinion. That's how it is! I realize that C can hardly be avoided, just because of all the libraries for the Arduino, all of which rely on C. If you want to program the Arduino in another language, the libraries such as LCD and I2C must be rewritten bit by bit (bit-banging). That is not impossible, but it is also not easy. I now warmly embrace C and read a book by a Mr. Purdum: Beginning C For Arduino. It clearly explains how you can deal with libraries in conjunction with Arduino. I am going to read it all the way to the end. I'll C you when I get there!
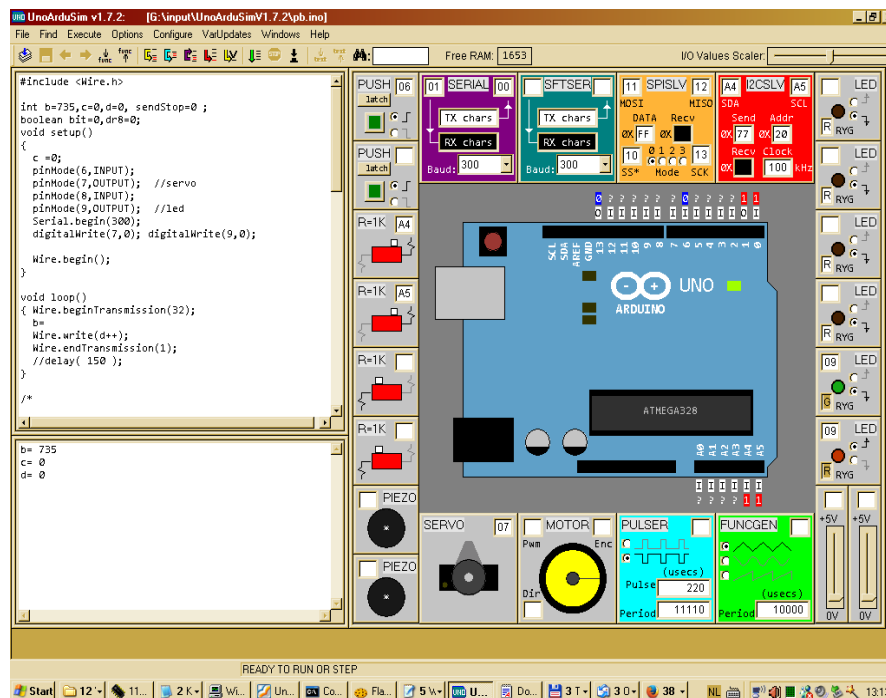
(above: main screen of the Arduino-emulator)

Read in an old Ruimtevaart (Spaceflight; magazine) from 2016: artistic impression of all kinds of very distant planets. Very nice on the wall, but how real is it? If there is something we have learned from all Voyagers, Mariners, other probes, but also our own weather satellites, it is that after research things are different than we think beforehand. But humanity needs dreams and ambitions to get ahead. As a child, I too drew all sorts of suns and planets as I certainly thought they would look like when I was coming in as an astronaut in my rocket.

Found on the internet, without much searching: an emulator for the Arduino [1]. Great for training, with the laptop on your lap, without having to connect a physical Arduino with accompanying hardware such as stepper motor, I2C slaves and LEDs. Installation is not even necessary, just an unzip, all arranged in one folder. When working out the self-invented issues you are faced with all kinds of small facts: you must not forget the pull-up (oh yeah) you should not forget the initialization and the bus release (oh yes) and even more oh yes. For those who want to change some aging dish motor control of an ELECTUUR board with BASIC into Arduino, there is a nice starting point here. I myself am digging in with I2C, followed by the theme of motor controls. Point of criticism of the emulator is also there: there is a help list with the library functions, but that is not complete. So just keep the official reference of Arduino.cc. Furthermore, it is called an emulator, but it is more of a simulator that internally does not imitate the behavior of an Arduino one-on-one. For example, interfering with registers with assembler is not possible.

Enough interesting things to do in the coming period. A nice little excuse to hide myself like the house cat at all those coming season events for

your librarian

[1} https://www.sites.google.com/site/unoardusim/services

Weather station in progress

Summary

In this article I describe how I made my first polar satellite contact with homemade equipment.

Introduction

Job de Haas

A year ago I became a member of the Werkgroep Kunstmanen. While browsing the Internet, searching for information about satellite reception, I had run into the Rob Alblas' website. And as a technician who wants to understand everything, you cannot escape a membership. Since that moment I have invested everything I need to get it done: receiving images from an overhead satellite.

On November 26th the first milestone was: the tracking of the NOAA-19! While I was adjusting the dish to the geostationary Meteosat-10, a Fengyun suddenly flew through the view. Confirmation that the receiver did it! The next one after that was the NOAA-19, so quickly turned on *xtrack* and yes, image of the BPSK modulation via my HackRF SDR and GQRX.

Just before that I had put my dish outside and adjusted it with the sun that happened to show itself. Also with *xtrack* I looked up the sun and with a level and a shadow spot, the antenna was nicely aligned. The question had been raised earlier about how we will do this without sunshine and soon without LRIT on Meteosat-10. I do not know that yet, but for now it works like this.

But maybe back to how it happened. At the beginning (a year ago) I had already determined that the items I needed were:

- rotor
- dish
- helical
- filter
- amplifier
- down-converter
- demodulator
- decoder

Rotor

Earlier I had run into the rotor design of Satnogs. A group that wants to receive all kinds of so-called cube-sats with Open Source solutions. The larger goal behind this is a worldwide network of ground stations and a central database with radio observations so that you as a cube-sat operator can benefit from global coverage.

Back to the rotor. The setup is Azimuth - Elevation. It consists of two identical drives with a worm gear and a stepper motor or DC motor of your choice. In the end I built the DC motor

variant because it uses an absolute magnetic sensor (AS5601) on the output shaft via a follower gear. The position is then controlled via a PID control. A PID controller is the most used form of regulation with feedback (see Wikipedia). Communication is via an RS485 line with the Easycomm II protocol. Important to mention: except for the aluminum profiles and bearings, the rotor only consists of 3D printed parts. I have mostly done with PLA and only ABS (ed. PLA and ABS are commonly used types of plastics for printing) for the main gear and the worm wheel used (due to strength).

The controller is an Arduino Pro Mini with a motherboard which also has a 2-channel DC motor control from Pololu. The software was available in raw form from the Satnogs repository, but I was not satisfied with it and decided to write it all over again with the most used Arduino PID library in an interrupt controlled loop (now 1kHz). Because of the heavy load that the dish is for this rotor, I have had to make a few adjustments. Firstly, balancing: the dish pushed the motor back through the worm wheel when it was de-energized. With some ballast that was remedied. Then I had to adjust the P, I and D terms (the coefficients of the controller) of the elevation separately for small (<2 degrees) and larger angular deviations. Otherwise things start to oscillate or the position did not reach fast enough. The azimuth control has a little less weight.

Despite the fact that the rotor is actually intended for 2 Yagi antennas at 2m / 70cm, it just manages to turn the dish around well. There is some flexibility in the construction, as a result of which light swabbing cannot be prevented. However, that does not matter much for 1700MHz.

Due to the heavy load and yet quite complicated construction of this, I intend to build a Diseqc rotor in XY configuration also.

Dish

The dish was built according to example by Peter Smits, Peter Kuipers and Harry Arends. At Peter Smits we rolled the U-profiles in the raw form and after that I finished it at home. That was still quite a job because I had started too inaccurately at first and then several

times decided that I wanted it a bit different. So I now have the helical feed on a central tube that protrudes from the heart of the dish. Through this voltage and coax cables are also led. For the mesh I had to dig a bit deeper in the pockets and purchased 2.8mm mesh by RF HamDesign. This is fastened with pop rivets.

Helical

The helical is based on a design by Harrie van Deursen. It is quite faithfully recreated and the only problem is the thickness of the copper wire. At first I had 3mm thick wire, but this was too stiff when adjusting. Now I have 2mm diameter wire, but that bends out of shape quickly if there is tension on the adjustment. Fortunately, it does not seem to matter much. For tuning I use a spectrum analyzer and a directional coupler of Mini-Circuits (ZNDC-18-2G-S +).

Helical with filter and LNA

Filter

At about 15 meters from my house is a GSM tower at 10m height. Everyone had told me that it was not going to work without a filter. So half a year ago I already dove into interdigital filter design and construction. I have now made 2 and the latter has an insertion loss of ~ 0.7 dB at 30MHz bandwidth. Luckily I have a lathe so I could perform all the

operations myself (e.g. turning the rods conically). Filter also adjusted just like the helical. During the setup of the rotor and dish, I measured without a filter and this was indeed useless. Without a filter, the entire spectrum around 1700MHz is full of signal and dances in all directions. With filter it is a nice quiet image with here and there a small peak. The only drawback is that the filter is still relatively heavy (~ 300 gr). It is made of aluminum tube of 50x30mm, 3mm thick. That gives a nice 44 mm inside size as according to the online calculation. But because it is directly on the helical, there is also a considerable moment of force on the dish and rotor. For this I am looking for something better.

Amplifier

The amplifier is the only component I have bought completely ready to date. The Mini-Circuits ZX60-242GLN-S +. Also recommended in the Kunstmaan. While measuring, I see about 31dB at 1700MHz. I still have to learn how to measure Noise Figure.

Demodulator

I built the QPSK modulator during the summer. There were some challenges that proved to be component dependent, but also a consequence of the first design. The MC34063 for 33V of the tuner was not always reliable, but thanks to a solution from Harrie van Deursen this has been resolved. Last meeting I showed how with an SDR like HackRF a test signal can be made to adjust the tuner / demodulator.

Decoder

The Godil decoder has also been built, but I have not yet been able to test it yet. That can happen in the coming weeks. Because I did not have a ready-made print, I built it on a pinhole print and with a slightly different USB interface print. After some debugging and fixing errors (easily 4 or more soldering mistakes were made) I could at least read the version string from the Godil.

Down-converter

The plan is to build the down-converter to design by Harrie van Deursen and Ben Schellekens as soon as it is available. So far I have none and all reception was done with SDR.

Further plans

From here I plan to continue until it is possible to successfully decode and show the reception of the various HRPT satellites. For this there is still wish to fully understand the FPGA code of Rob Alblas and to be able to program it. I also want to experiment with alternative LNA / filter constructions. For example, first an LNA with less amplification and then the filter mounted at the base instead of the helical and then the second LNA.

Links
https://wiki.satnogs.org/SatNOGS_Rotator_v3
https://gitlab.com/librespacefoundation/satnogs/satnogs-rotator-controller
https://gitlab.com/librespacefoundation/satnogs/satnogs-rotator
https://gitlab.com/librespacefoundation/satnogs/satnogs-rotator-firmware
http://ams.com/eng/Products/Magnetic-Position-Sensors/Angle-Position-On-Axis/AS5601
https://nl.wikipedia.org/wiki/PID-regelaar
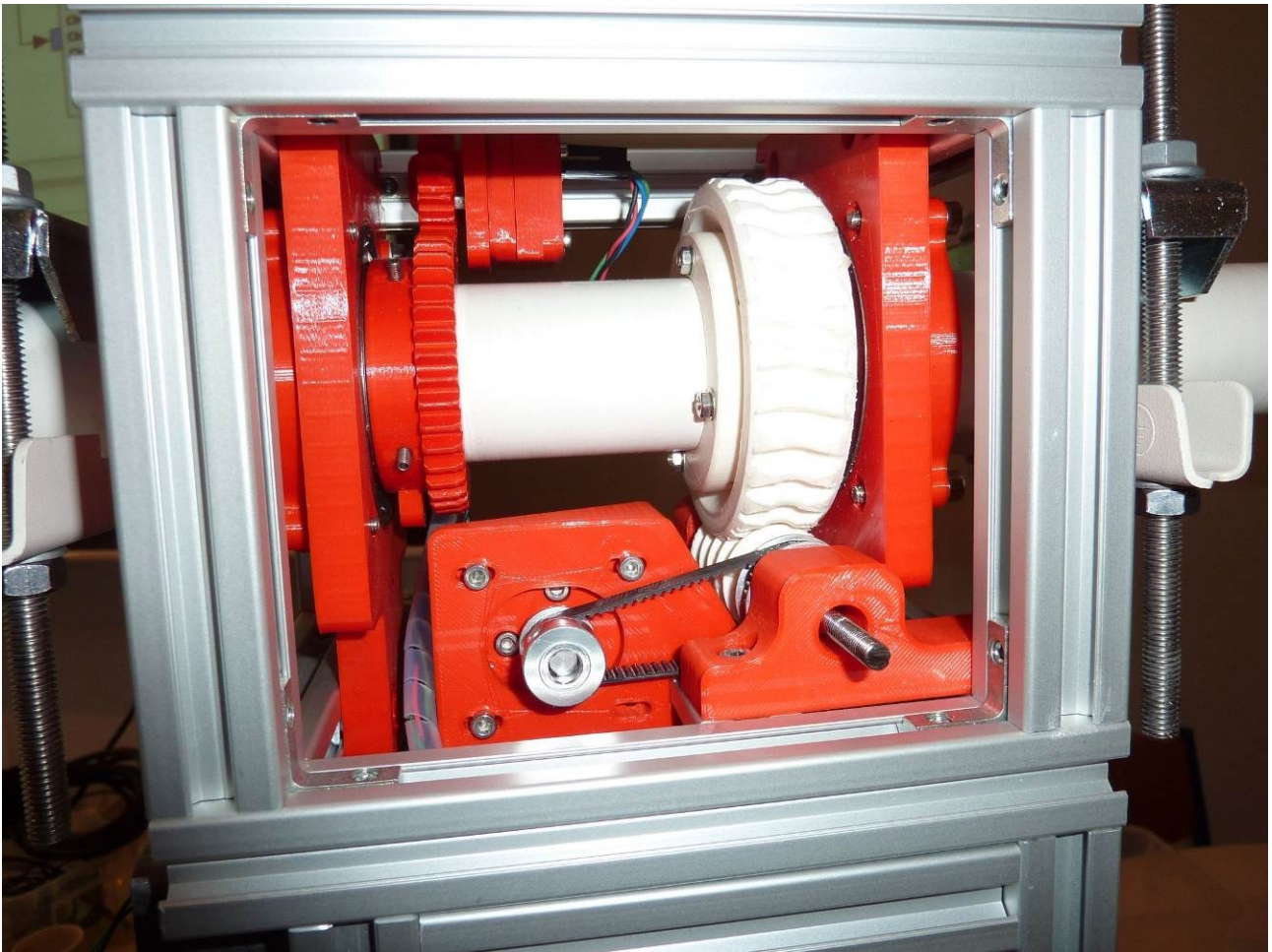
The Satnogs rotor design as built by Job de Haas clearly shows the 3D printed parts

Members' meeting report 11 nove mber 2017.

Summary:
Report of our meeting at November 11 .

Opening by the chairman.

On November 4 we were again in Apeldoorn on the Day of the Radio Amateur. It seemed that this year the number of participants in the DIY exhibition was bigger than last year. Hendrik unfortunately could not participate, it was improvising for a while.

We have made a few modifications to the tunerprint because it turned out that (at least) five different versions of the UV916 are in circulation. It looks like a kind of generic product. Furthermore, we have found a replacement for the UV916 in the UV1316. A new tuner print will be available in the future

Next meeting is on January 6.

Report meeting 9 September this was published in the September - kunstmaan.
There are no comments.

The agenda
No additions.

Administrative affairs
No changes in this area.

Satellite status
Given by Arne; see later in this Kunstmaan.

Any other business
Harrie v. Deursen explains the adjustment in the tuner print. The step-up to 33V must be powered from the 5V power supply because the 12V power supply line proves to be very sensitive to interference pulses. A resistor and an elco are the solution.

Arne shows all sorts of stuff that he has ordered from the Far East, including a super deluxe solder station with hot air, gradients etc. Furthermore, there are all kinds of PCBs for sale with LNAs, power meters, etc. It is becoming more and more plug-and-pray .

Arne shows all sorts of things

Wim Bravenboer wondered if someone has experience with the egg-beater antenna, which seems to be very suitable for satellite reception. Furthermore, he found on the marketplace notch filters that were probably used in GSM masts. Would these be suitable for us to suppress interference signals?

Job had taken his beautiful 3D-printed rotor with him.

Our librarian felt lucky and started soldereding and made a filter. He proudly shows his brew connected to Arne's network analyzer.
The lesson so far is free to a Chinese? proverb: the road to it is more fun than the destination. So the filter does not work at all. But it is an inspiration to tinker.

Elmar shows a very small PCB with an Arduino compatible microcontroller and a WiFi module. It can be programmed with the IDE of the Arduino and is for sale on eBay for a few Euro. Search on ESP8266 .
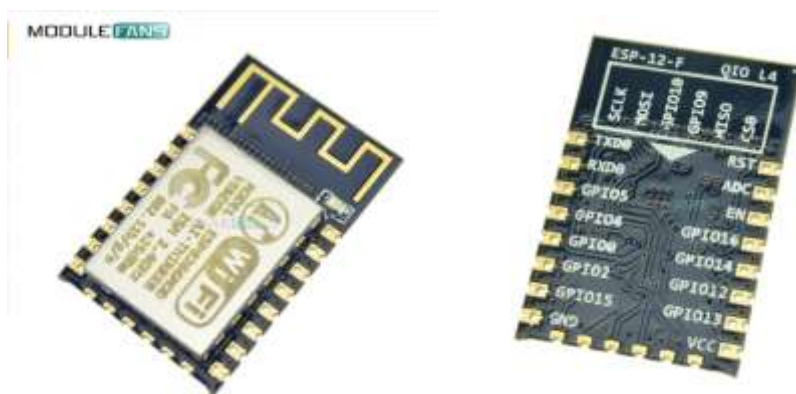
The undersigned had included a used programmable attenuator. It is a challenge to be able to manage this. For the enthusiasts of building enclosures themselves there were aluminum profiles of gie-tec. Furthermore, there was a Jaeger rotor

ordered in England. Given the packaging, it looks like these years have been in a dirty shed.

Closing

Lecture: QPSK receiver in GNU Radio

Job de Haas has given a lecture on how he has realized a measurement transmitter in GNU Radio. This turned out to be much more complex than initially thought. After a short introduction about what GNU Radio is, he looked at the different software layers to control hardware. There is not one layer that can control all hardware. To figure this out took too much time.
After the question of which signals should be generated, the various modulators in GNU Radio are discussed. Unfortunately, the documentation is missing.
We managed to make both a BPSK and a QPSK measuring transmitter. The next step is to replace the random bit pattern with a bit stream that results in a picture.

Ben Schellekens
(chairman)

satellietstatus

Arne van Belle, 28 november 2017

POLAIR	APT (MHz)	HRPT (MHz)	Overkomst
NOAA 15	137.620	1702.5	morning/afternoon, HRPT weak
NOAA 18	137.9125	1707.0	early morning/late afternoon
NOAA 19	137.100	1698.0	afternoon/night
FengYun 3A	none	1704.5	AHRPT 2.80 Msym/s
FengYun 3B	none	1704.5	AHRPT 2.80 Msym/s
FengYun 3C	none	1701.3	AHRPT 2.60 Msym/s
FengYun 3D	none	7820.0 X-band	noon MPT 60 Mbps
Metop-A	off(137.100)	1701.3	LRPT/AHRPT 2.33 Msym/s
Metop-B	none	1701.3	Only AHRPT 2.33 Msym/s
METEOR M N1	off(137.100 LRPT)	1700.0	No image
METEOR M N2	137.100 LRPT	1700.0	LRPT on / MHRPT on
NPP	none	7812.0 X-band	HRD 15 Mbps
JPSS-1	none	7812.0 X-band	HRD 15 of 30 Mbps nog geen beeld

NOAA 15, 18 and 19 are the last satellites that broadcast APT.

The LRPT signal from METEOR M N2 can be received with an SDR dongle.
See https://goo.gl/JySTwH

NPP (NPOESS Preparatory Project) and the recently launched JPSS-1 (NOAA-20) broadcast only on the X-band with 15 Mbit/s. A tracking 2.4 meter diameter dish is recommended ! https://goo.gl/1mXkAZ

https://goo.gl/k6hAbi

FengYun 3A, 3B and 3C broadcast AHRPT, only Ben Schellekens new QPSK receiver can handle these signals. This AHRPT is not entirely according to the standard so even a Metop AHRPT receiver is not suitable for the FY-3 series!

FengYun 3C also has a different data rate than 3A and 3B. Harrie van Deursen and Rob Alblas are busy receiving and demodulating these satellites. Rob has expanded his GODIL decoder and is now able to demodulate HRPT, Meteor HRPT, METOP and FY3A / B and FY3C!

FY-3D is successfully launched on November 15. Oleg already received signal on X-band. It is said that this satellite will only use X-band !

JPSS-1 is successfully launched on November 18 and only uses X-band!
Oleg has received signal and is trying to decode, follow https://twitter.com/MeteoOleg

Due to a human programming error in the flight plan, on November 28 the launch of Meteor M N2-1 and a number of sats has failed. Most likely the Soyuz ended in the Atlantic Ocean !

GEOSTATIONAIR	APT (MHz)	(SDUS)/PDUS (MHz)	Baanpositie
MSG-4 (MET-11)	1691 LRIT	1695.15 HRIT	3.4 degrees W, in testphase
MET-10	1691 LRIT	1695.15 HRIT	0 degrees W, operational
MET-9	1691 LRIT	1695.15 HRIT	9.5 degrees O, RSS
MET-8	geen LRIT	-	3.5 degrees O, Backup
GOES-E (no. 13)	1691 LRIT	1685,7 GVAR	75.0 degrees W via Eumetcast
GOES-W (no. 15)	1691 LRIT	1685,7 GVAR	135 degrees W via Eumetcast
GOES 14	1691 LRIT	1685,7 GVAR	105 degrees W, Backup
GOES 16			Is moving to 75 W to replace GOES-E
Elektro-L2	1691 LRIT	1693 HRIT	78 Degrees O, via Eumetcast
MTSAT-1R	1691 LRIT	1691 HRIT	140 degrees O, Backup for MTSAT2
MTSAT-2	1691 LRIT	1687.1 HRIT	145 degrees O, via Eumetcast
Himawari-8	geen LRIT	geen HRIT	Operational, only via HimawariCast
Himawari-9			no LRIT, no HRIT, Backup for 8
FengYun 2D	-	-	86.5 degrees O
FengYun 2E	-	-	104 degrees O, now via Eumetcast

| FengYun 2F | - | - | 112.5 degrees O, Backup |
| Fengyun 4-01 | 1697 LRIT | 1681HRIT | 99.5 degrees O, Operational |

MET-10 is now the operational satellite.

Lanceringen

Meteor M N2-1	Launch failed on 28 November !
MetOp-C	Launch October 2018
GOES-S	Launch planned for 1 March 2018

EUMETSAT plans to stop the direct LRIT broadcasts on 1691 MHz next April!
https://goo.gl/n4p3vQ
We will miss this signal at 1691 MHz, it is a useful reference for receivers and rotors!

Unfortunately you cannot use DVB-S and most "DVB-S2 without VCM" receivers any more for EUMETCast. Only using a special driver you can use the TBS-5980 and Skystar 2 eXpress HD for Basic Service Only !
The signal on 10 degrees East has larger bandwidth and shows up weaker than on DVB.
Recommended dish size is 80-90 cm for Basic Service and minimum 120 cm for High Volume Service 1 and 2

The 2nd EUMETCast transponder T2 was converted to full bandwidth on July 3 and shifted slightly to 11387.500 MHz Horizontal, The Symbol Rate and Mode is now the same as HVS-1 (33000 kSym/s DVB-S2, CCM mode, MODCOD 16APSK2/3). This transponder will only broadcast HVS-2 service.
Just like HVS-1, for good reception you can use a 90 cm dish (good weather) but you need a 120 cm for reception under rainy conditions.
https://goo.gl/Ak2GYA
User have to request live GOES 16 data on T2/HVS-2 via EO portal.
Goes 16 data is in NetCDF formaat. Apart from SNAP you can use EUMETCastView written by Hugo van Ruys to view.
http://hvanruys.github.io/
David Taylor also wrote a netCDF reader program:
http://www.satsignal.eu/software/NetCDFreader.zip

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From December 14 Goes 16 wil replace Goes 13.

Since July, there have been signal strength variations on EUMETCast transponder T1 at 11263 MHz Horizontal.
Unexpectedly, Eutelsat, the satellite administrator allowed another service at 11263 MHz Vertical!
Due to "congestion" in the TV satellite world, we are seeing increasing numbers of transponders on Eutelsat 10A being used. For optimal signal quality (SNR), you must rotate your LNB (Skew) to null out this vertical transmitter. A moderate or poor quality LNB can suddenly cause problems if it has a poor damping for the vertical signals. This is called cross-polarization isolation. This value should be better than 22 dB and determines how much the vertical signal is attenuated while the LNB receives horizontal.

But neighboring satellites such as 7 East and 13 East also use frequencies on or near 11263 MHz. A better LNB won't solve this, dishes smaller than 120 cm have a larger opening angle and will experience more disturbance from neighboring satellites.

EUMETSAT recommends repeating the fine alignment of your dish annually and double check for correct Skew of LNB. If possible, also check the focus (slide it in and out towards the dish).
If the old SNR values are no longer achievable, it may be necessary to replace the LNB with one that has better "Cross-polarization Isolation".
See "EUMETCast Europe Link Margins Explained" at https://goo.gl/8bB4Jj