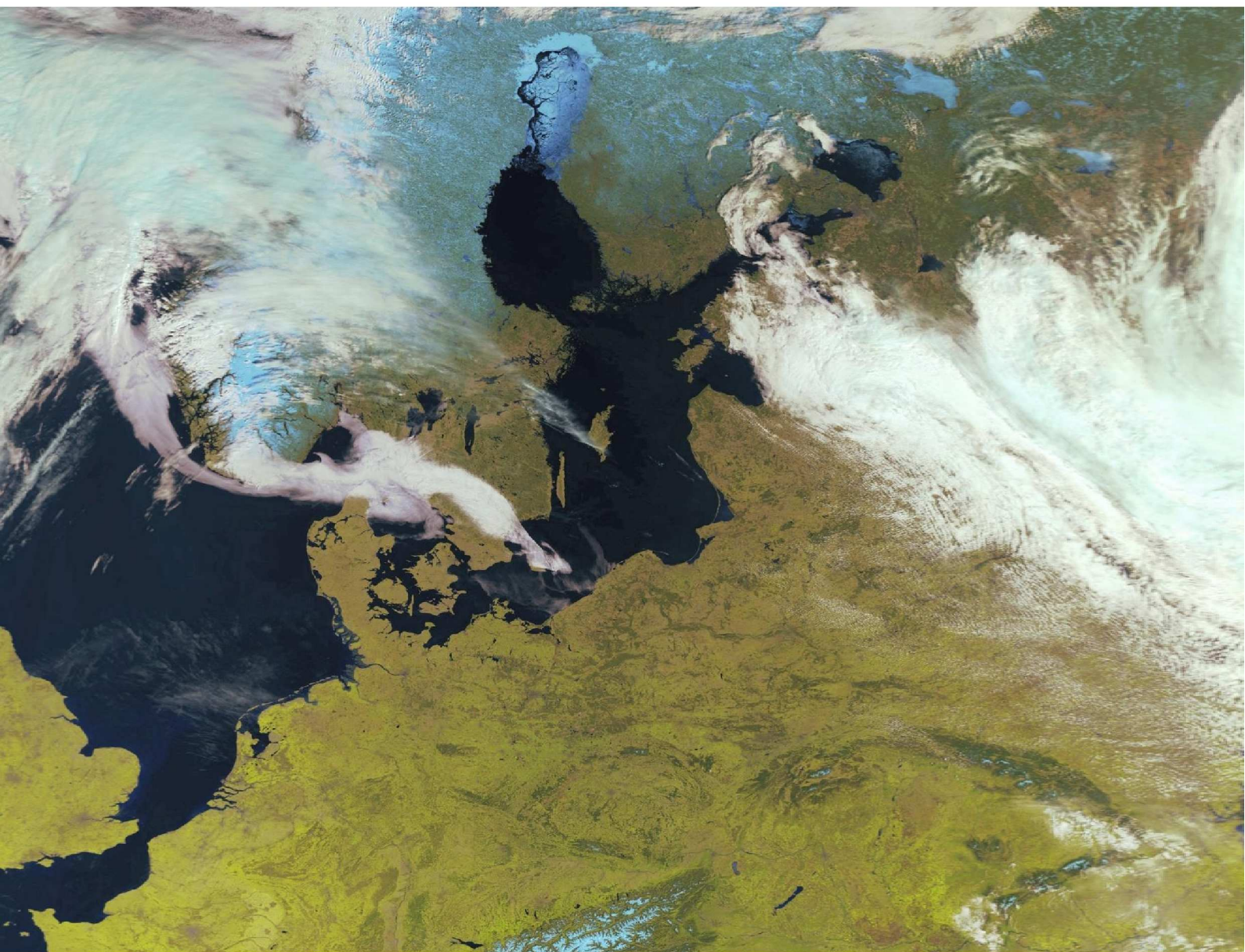


# DE KUNSTMAAN

Juni 2018 - 45<sup>e</sup> jaargang nr. 2

Uitgave van de Werkgroep Kunstmanen



In dit nummer o.a.  
Eerste en tweede plaatjes  
Nieuwe ontwikkelingen wsat  
Experimenten op de 7,8 GHz.  
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](http://www.kunstmanen.net)

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

Rob Alblas  
werkgroep Kunstmanen  
[kunstmanen@alblas.demon.nl](mailto:kunstmanen@alblas.demon.nl)

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Photo frontpage:

Nice picture of the Botnic Gulf, showing ice in the northern part. METOP, 2018, April 19 at 10:19.

## From the Chairman KM 2018-2

Ben Schellekens

### Preface

The regular meeting was well attended. Following the official part, there was a lot to do. We even interrupted the meeting for the live reception of the FengYun. For this occasion, Job had brought in his entire receiver installation.



*Live reception at the meeting!*

### The 7.8 GHz band

This new frequency challenges everyone to get started with it. It is not easy, but the first steps have been made. In this Kunstmaan my experiments, a signal generator and downconverter. But there is more to come. For example, Job is busy with a band converter for the 8GHz and several TV sat-LNBs were demolished in search for a usable one. The metal shop and plumber also do good business, making a feedhorn requires some expertise in metalworking.



*First try for a horn-antenna*

## **The Kunstmaan**

In this summer issue you see many user experiences from Fred and Rob. Rob, congratulations with your receiving station, 25 years after the start of your beautiful hobby it is working at last! His program "wsat" has been updated straight away. More about this in this issue of Kunstmaan. Fred has had to adjust his receiver all over again, without measurement transmitters, etc. It was successful, many people have contributed to this.

Sometimes I am asked to build a completely tuned receiver, or even worse "to market" it. The receiver Fred got was finished. Multiple QPSK satellites were received. The HRPT receiver is better than the one in the WRX1700. Then it turns out that when you put the receiver elsewhere it is not "plug-and-play". Dish diameter, helical and downconverter can nevertheless give such great differences that adjustment is necessary. A recipient for members of the building a workgroup can be arranged, but you must have knowledge of adjustments. I do not want to place receivers into the market. We have no possibility yet to give proper support. for now I wish everyone a nice summer, with lots of hobby fun. I hope to see everyone in September back at the meeting. The date is not yet known at this time. So keep an eye the website / newsletter.



## **Summary**

*My experiences with weather satellites etc. in Vietnam.*

## **APT**

Because I have not received any APT since my satellite PC crashed, I do not know whether this problem, which I have picked from the GEO-Subscribers forum, will also occur with me. I hope no one needs this:

*[“Wxtolmg - and the latest \(April 2018\) Windows 10 update.](#)*

*Wxtolmg failed with the "Error: waveInOpen failed" message. I noticed that the HdAudio driver had been updated, so suspected that, but it turned out to be the Settings/Privacy/Microphone which I had "off". Turning that on, and turning off all the listed individual apps (Wxtolmg wasn't listed) allowed Wxtolmg to work again.”*

## **HRPT**

The typhoon at the end of last year has, in addition to all the misery of, among other things, a bent dish, also provided an "advantage" that all trees, which impeded reception, had been blown away. Which means that I regularly have noise-free recordings from approx. 4-5 gr. elevation at the beginning to approx. 4-5 gr. elevation at the end of the arrival. Not really bad for a rotor that does not go below 10 gr. The new receiver is now also in use.

I started receiving HRPT. The how, what and why is in "First image", elsewhere in this Kunstmaan. That is partly due to the fact that this is only a very short story: almost all efforts have been put into the new receiver. But with success!

## Reception

Let me start with the highlight for me: a recording of Meteor on 2018-03-22 09:41. Perhaps the nicest I have ever received. In the north you can see a virtually cloudless Himalayas. See fig. 1 on the next page.

In order to know if there would be any known 8000-ers like Everest, Nanga Parbat, K2 etc. visible, I made a selection of the area with Google Earth. Unfortunately, it also showed that the Everest area (almost entirely left) is not clearly visible on the photo.

## **QPSK**

I had to spend a lot of time on that before it actually started working. This story is also extensively in "First Image".

## **AutoHotKey**

In De Kunstmaan [1] I explained the operation of the AutoHotKey script, which I used at that time to start receiving an HRPT satellite. That script is still used. But its character has changed somewhat. The reason is that two different types of satellites are now being received: HRPT and QPSK, each with its own peculiarities.

The main problem was that I did not really get AHK to work with the new version of wsat. When I spent too much time in it, I opted for a different setup. I now do some of the actions manually, eg downloading the Keplers and making the list of arrivals. There is then one command: "download Keplers". In fact, AHK is now partly acting as a sort of checklist, with the indication whether it is intended for H or Q. If everything works well, I'll check if I can

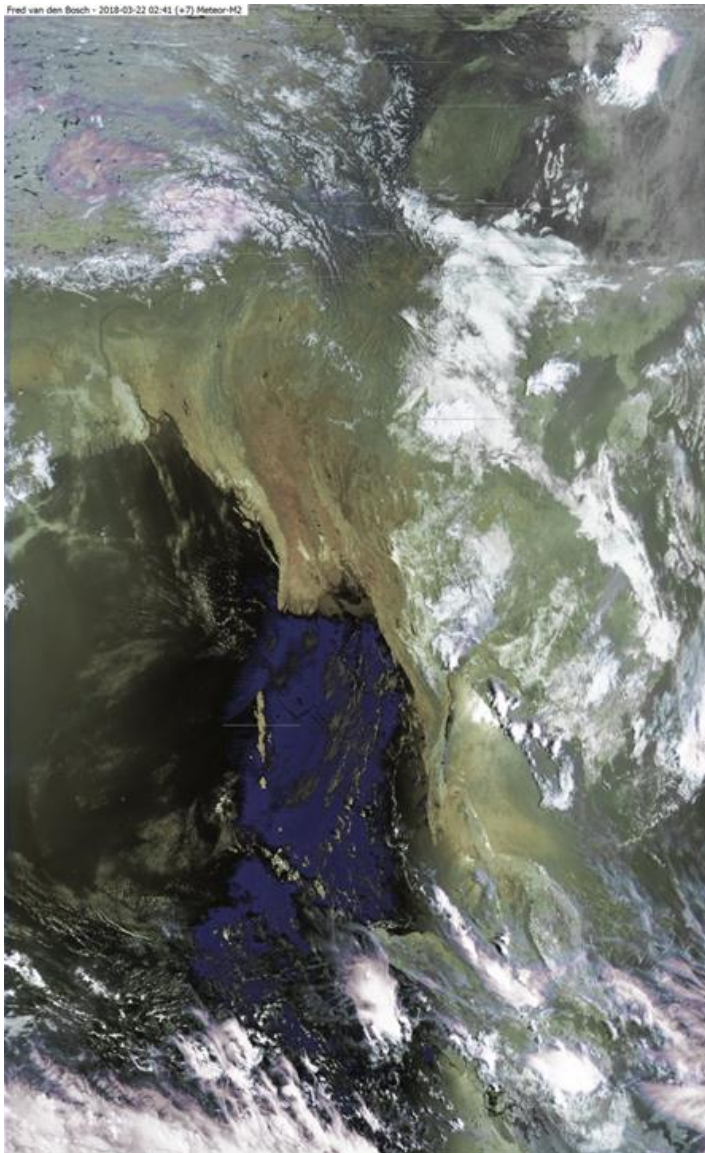
automate a little more. For now the script is enough not to forget things. Whoever wants to get started with this extremely versatile scripting language will find a comprehensive manual on [2] with lots of tips and tricks. And can of course send an e-mail to receive my scripts.

### **Wsat**

Elsewhere in the KM there is a story by Rob about all modifications. I also contributed to that in the form of introducing new wishes and tests. That has also meant that a number of rules from AHK could be deleted, because that functionality was included in wsat. As far as I am concerned, a good development. At the time of writing I am working on an attempt to create a script via AHK, with which I can make small changes to the photo. For the photographers: a very simple version of the Lightroom Development module. In the AHK script I can adjust the photo via Despeckle, Destrip, Channel Map and Luminance and save the new values for next time. If I get it working properly, this script is also available.

### **References**

- [1] De Kunstmaan, juni 2016, pag. 6.
- [2] AutoHotKey, tricks you ought to do with Windows, zie website



*Fig. 1: Meteor op 2018-03-22 09:41*

## **"First" Image**

***Fred van den Bosch***

### **Summary**

*The story of my "first" image.*

### **Preface**

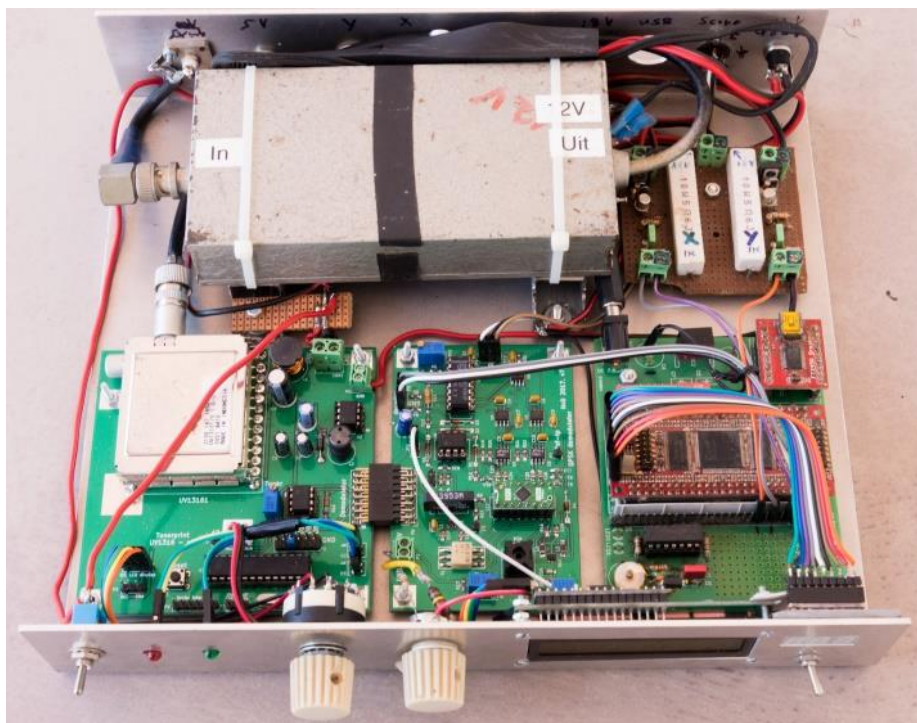
Or would second image here perhaps be a better title? Well, judge for yourself.

In [1] I had an extensive story about my first HRPT image in Vietnam. Then I received quite a few images with the WRX1700. When our genius design workgroup came up with a new receiver, I immediately thought: "I want that too, more daily tracks, so it's easier to pick one up".

Then I read about smd parts, thought of my bad eyes and also the adjustment of something like that and concluded: "unfortunately, that is not for me ..."

In the end I could take a working receiver from the Netherlands with me!

We are clearly a working group. Ben built the receiver and Harrie adjusted it. At Ben the receiver received a number of different satellites in my presence, so I knew that everything worked. Again a lot of thanks from this place.



### **Commissioning**

Because I live in Vietnam and I cannot easily take the receiver under my arm to have an expert look at it, I cannot afford any mistakes. That is why I had worked out a plan to install part after part in the cabinet supplied by Peter Kuiper. That way I could work with the loose WRX1700 and GODIL in case of problems. I had to connect the WRX1700 a couple of times if I did not know what the cause of "no signal" was.



I have been adjusting and measuring for a long time before I had everything in it in a way it fitted and the cables ran reasonably well. I had to mount the downconverter on two pipes and drill a series of holes. My order of installation:

Receiver with display (bottom left)

GODIL with rotor steering (bottom right)

Diseqc control (top right)

Downconverter (top left)

Test extensively after each step whether I could still receive HRPT. In the end everything was in the new cabinet and HRPT worked. But it took, "a few days". QPSK simply refused all services at that moment. A number of experiences for learning and refinement.

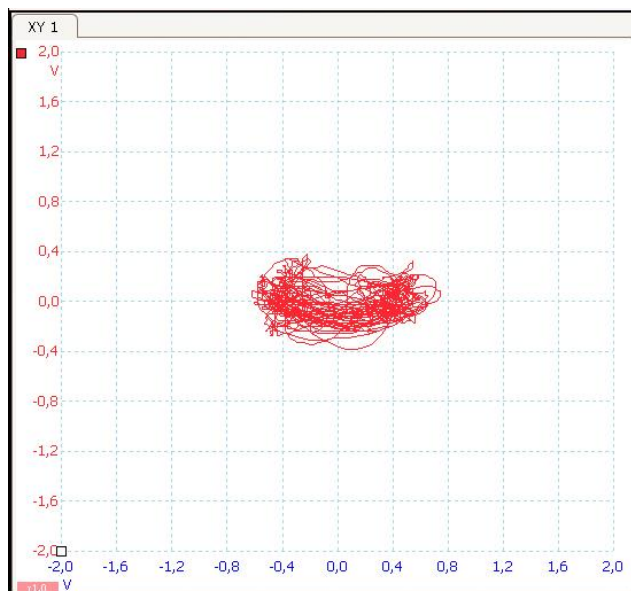
## HRPT

At first, HRPT did not work either. I twisted the trimmer of the VCO of GODIL a tiny bit and that "did the trick". Because due to the QPSK problems finally -structured and on the instructions of the experts – started to twist various institutions, I had to set everything once again.

## Scoop

A few years ago my pretty old 2-channel scoop, once purchased at Marktplaats, stopped performing. I then bought a PC scope from Pico, the 2204a. Despite a number of limitations, it ultimately proved to be a good service. On [2] you can see which types are offered. The PC program can also be downloaded, which works without hardware in a demo mode. This already gives a good impression of what is possible.

During the transfer of an HRPT satellite, two globules must be visible on the scoop image in the x / y view. See [3] how this should look like. The Picoscope shows the two dots more or less, but the half moon in between is quite prominent. Unfortunately, you cannot set the Pico so that only points are plotted, and not the lines between those points. See Rob's article on what it looks like on a "real" analogue scoop.



The answer of Pico about that: *"In answer to your question about XY plots, this is a plot of Channel A against Channel B data for the current buffer not including a time element and so can't change the persistence of the points on the display. Unfortunately the persistence mode*

*in the software does not support XY plots, although this is on the feature list for future development of the software."*

Once you know all that, you can still fine-tune HRPT. The two balls should come on a horizontal line. And if you have done that a few times, the adjustment is done quickly. This is the standard adjustment, as described in the Kunstmaan [3].

## **QPSK**

That was a completely different story. QPSK categorically refused to show anything.

## **GODIL**

First of all, it turned out that Generator Q of the GODIL was not working anymore. As a result, I could no longer check the VCO for capital letters when the generator was connected to the decoder. Because it was unclear whether the entrance was still good, Rob came with the proposal for a test.

*"To see if your Q-input works you could record a piece via: Record-> IQtest*

*Connect receiver, select METOP*

*check 'Ignore sync' and 'Save;'*

*Click on 2 MSymb / s*

*Record a small piece (1 or 2 secs) and send the file (or watch yourself with hexdump) You do not have to wait for a pick-up. Then soon enough to see if there is Q-data coming in."*

You check it in this way.

*"You have to look at the hex numbers. If all bits become 1 and 0 then it is good, and that seems to be the case.*

*Eg. first line:*

*00000000 55 49 41 6a d5 2a b0 12 17 fd 5e 1a bf 54 0a 01*

*| UIAj. \* .... ^ .. T .. |*

*1 hex number = 4 bits are: IQIQ, ie 2 consecutive IQ values.*

*At first number: 5, so 0101, so I is 2x 0 and Q 2x 1 2nd number also 5, again 0101 3rd number: 0100 4th number: 1001*

*If you now take the even bits, that is I, then you have: 00000010 Odd bits, Q: 11 11 10 01*

*So both I and Q move.*

*If you do not now connect Q, you will only see a '0' or '1' in the Q positions.*

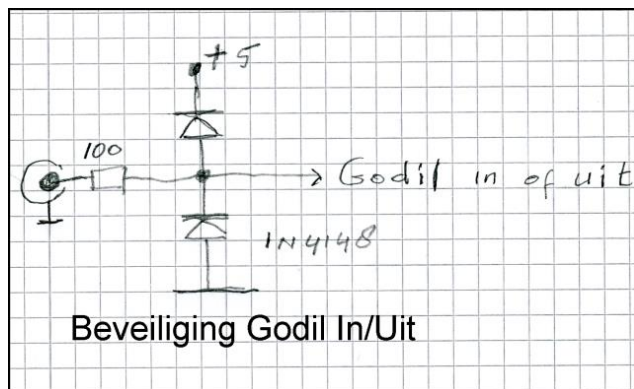
*And if you put I and Q on the same source you get:*

*0000 or 0011 or 1100 or 1111, so 0 or 3 or C or F."*

Rob was able to see from the export that the GODIL himself almost certainly worked well.

Harrie also had a few excellent suggestions.

*"At the time I supplied all the inputs and outputs of the Godil with diodes in-plug to GND and +5 volts. Especially during experiments it can just go wrong during connection via my Cinch connectors where unfortunately the centerpin makes contact rather than the shielding to GND. An ugly sketch of my standard security for all electronics with a connector to the evil outside world. It often goes wrong during experiments with "just" exchanging a cable.*



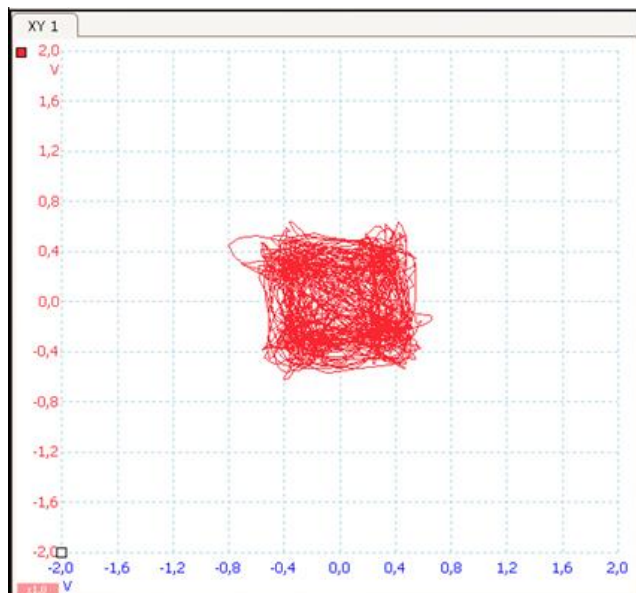
*I have also unfortunately had to find out that you really have to connect everything to a common point so as not to have a potential difference when connecting or measuring. Real earth is less important than that everything is stuck together via a ground contact and you no longer have potential differences between the equipment and the modules under test. My mistakes were very instructive, I can say. "*

### Receiving

Good, then try to receive something. But the receiver refused to lock. The lock LED did nothing, but according to Rob it is not really reliable.

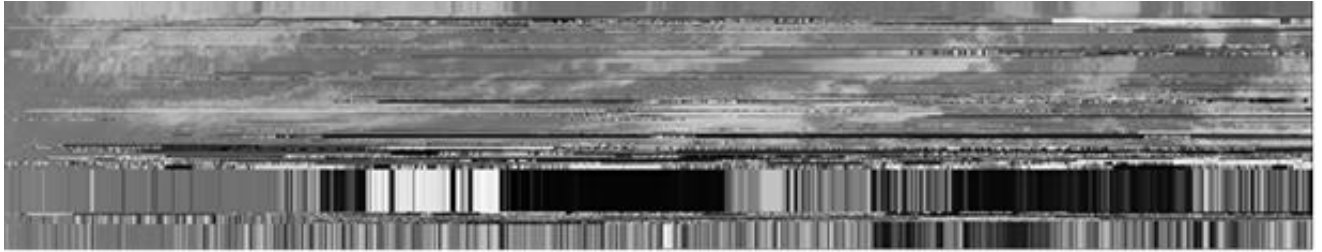
Then came the hint to set the Q / H switch to H, wait a second and then back to Q. For everyone it seems to force a lock. Well, not here.

One night, FengYun-3A almost passed straight over. The switch has become almost dumb of switching back and forth. The elevation was already below 30 gr. Then suddenly I thought of the hint of Ben not to have to take the switch every time, but to take hold of L1. And suddenly I saw this:



Surprise, that looks like 4 balls (with those miserable lines in between).

Then I saw a capital letter appear on the GODIL display. Switched to the View screen and **YES ... !!!** A piece of channel 5: it was already dark here.



FY3 18-04-17\_18:22 kanaal 5 UV

The big question for me was then: why does nothing happen when I switch the switch and it react when I touch the coil. Harrie had some tips for that too.

*"However, you do not need to put on your hand, the VCO voltage you see in QPSK mode is important if you just get noise. You then have to see a voltage above 4 volts otherwise the locking via switching to QPSK will not work.*

*Do you see a VCO voltage above 4 volts in QPSK mode on noise? If not, you have to turn on P2 until you see something higher than 4 volts on the display.*

*QPSK should be fine to lock when you just turn the switch, the VCO voltage should then be below 4 volts, otherwise turn the core of L1 still slightly further to the left to be rotated.*

*A VCO voltage (in lock) somewhere between 3 and 4 volts is fine. "*

And yes, with just 3 volts VCO voltage I was still well below the necessary 4 V.

So I ignored the nerves and turned RV2.

Carefully half a turn. Nothing.

Another half turn. Went from 3.04 to 3.05. Hmmm.

When I was at 15 turns I started to get close to the 4 and I stopped counting.

I stopped at about 4.06.

Then the switch worked to get in lock.

The next problem was a fast-flashing first display from the GODIL. Rob:

*"There are 3 things that have to "lock":*

- 1. Lock receiver.*
- 2. Lock VCO decoder.*
- 3. Recognize frame decoder.*

*Left display indicates point 3. If that flashes quickly, it can be because the conversion to bits does not go well enough because of too much noise. Or that the decoder often gets out of lock. Then the receiver can already be in-lock. It all has to do with each other; if the receiver gives a nice strong signal then the decoder also makes it a lot easier. I hope we can get a lot better with a VCXO. "*

## Optimizing

The assignment for the coming period is in any case clear: optimizing. The entire process. From dish to PC. Either from seeing if I can find the materials for an adjustable helical until buying a new satellite PC. Should it stop raining and thunderstorms...

The experiences of others are that METOP is better received than FengYun. And that is clear from the photo on the right after some first cautious adjustments to the installation. This is a picture of METOP-A from 12-5-18\_09: 06.

The upper and lower limit of the photo are both approx. 5 gr. elevation. Not bad for my rotors, which cannot go lower than 10 gr. It starts to come close to HRPT.



Note. Optimizing is Belgian for optimization. There has been a (genius) Belgian system engineer in my company for a while and since that time everyone was talking about "optimizing". Now the Workgroup ...

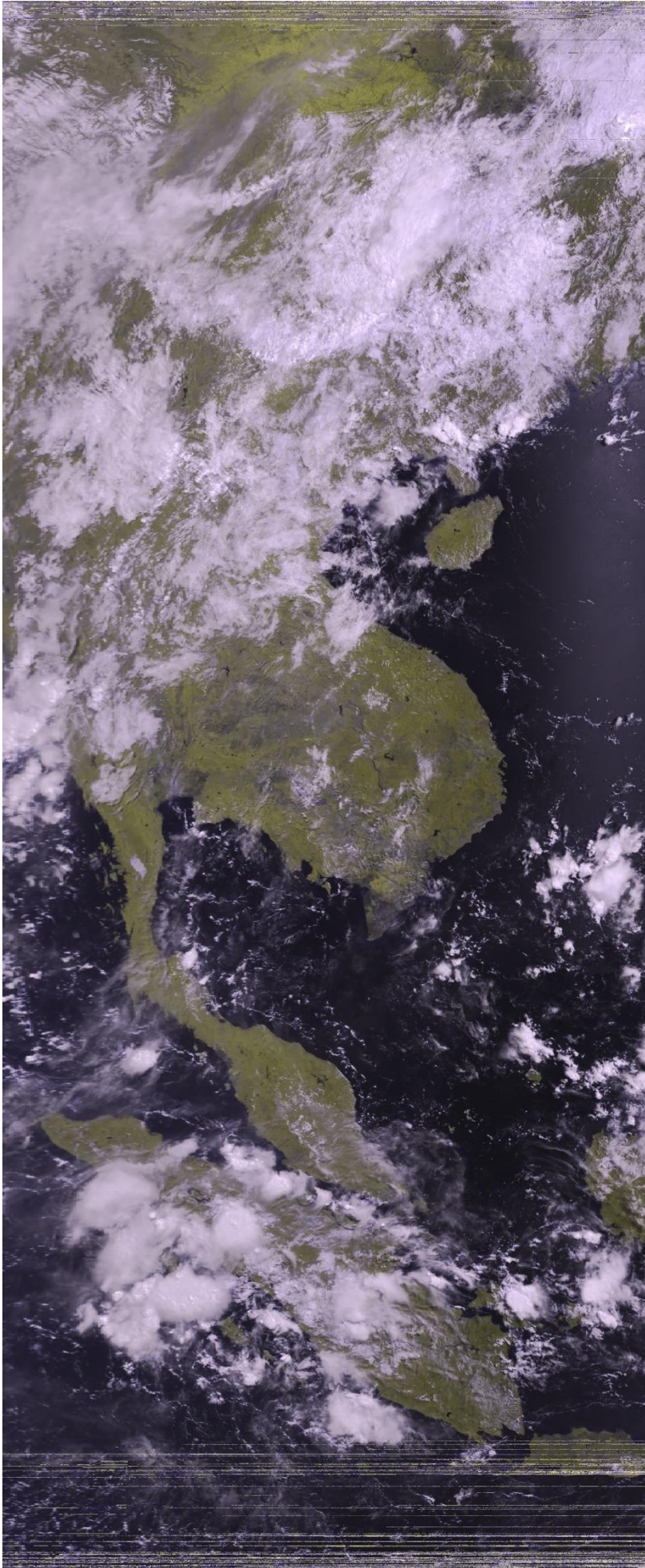
### **Word of thanks**

I am very grateful to (alphabetical) Ben, Harrie, Job and Rob for the continuous flow of tips and tricks. So much, that at a certain point, I was asked if I did not became crazy yet. On the contrary, it was always encouraging to continue looking.

With ultimately positive results.

### **References**

- [1] De Kunstmaan, maart 2016, pag. 8
- [2] Picoscoop, zie website
- [3] De Kunstmaan, december 2016, pag. 18



## ***My first picture.***

Summary: My first HRPT image.

*It is not easy to build an HRPT decoder, without having the necessary receiving equipment. I am still lucky enough to live close to the happy owner of the Timestep hardware and software. After having made the barren trip for the 2nd time with panniers packed with computer, power supplies, decoder etc. we waited tense for the arrival of one from the NOAAs ...*

This is how about 24 years ago the HRPT project [1] started with a decoder that could only handle HRPT from the NOAA satellites and with a hyper-advanced Amiga computer at the time (with up to 500 kbytes of RAM!)

With the text above I also started 7 years ago as an introduction to the new HRPT decoder [2]. A decoder that can handle not only HRPT from NOAA but also the Russian Meteor, and later also the European METOP and Chinese Fengyun-3. This decoder is built and used both inside and outside the Netherlands.

But who has never received anything at home with this decoder? I said the fool ... After a quarter of a century that had to change. I already had an X / Y rotor system from Arne v. Belle; I have been able to experiment with rotor drives. For that control the same module is used, which also takes care of the decoding [3]. With the aid of my tracker program 'xtrack', [4] which can also track the sun and moon, the targeting can then already be tested, that is, when the sun shines. With a normal dish (no offset!) I could get the shadow of the cup quite right in the middle of the dish. Perhaps this application is nice to bring water to the boil (see fig. 1) but that was not the intention.



Fig. 1. With a rotor you can boil water all day ...

So I built the new Harrie / Ben receiver. That should be done in two nights, but it took me a bit longer. SMD components soldering is still a precise job where you definitely have to take the time; if you sneeze, you will never find those components again. After assembling it was test time. Without any experience with reception and with a downconverter of which I was not sure whether it was good, I wanted to measure the

receiver with measuring equipment as much as possible. The working group has a measuring transmitter available so that I could offer a 150 MHz signal. (Skipping for the moment the downconverter that converts 1.7 GHz into about 150 MHz. The 150 MHz corresponds to the transmission frequency 1707 MHz of NOAA18 after downconversion.) For the QPSK part that is not so easy, but for HRPT you come a long way with a transmitter with FM modulation. Here the first problem popped up: I did not get the demodulator for HRPT in-lock. In the end, I went to Harrie v. Deursen (the designer of the receiver) with the receiver. The same problem did pop up, but the METOP part, proved to be OK; I had not tested that yet. We found that very little of the circuit remained where the problem was to be found. As a possible culprit, a capacitor in the low-pass filter of the PLL was soon designated, and it turned out to be: C14 was not well soldered (see fig. 2). A magnifying glass does not really help to check the solder connections; holding the soldering iron against it does, and then my receiver could already record the first HRPT images via the dish and decoder of Harrie. That was an expensive solder connection, with the necessary CO2 emissions (return Hilversum-Zoetermeer, 2x 60 km).

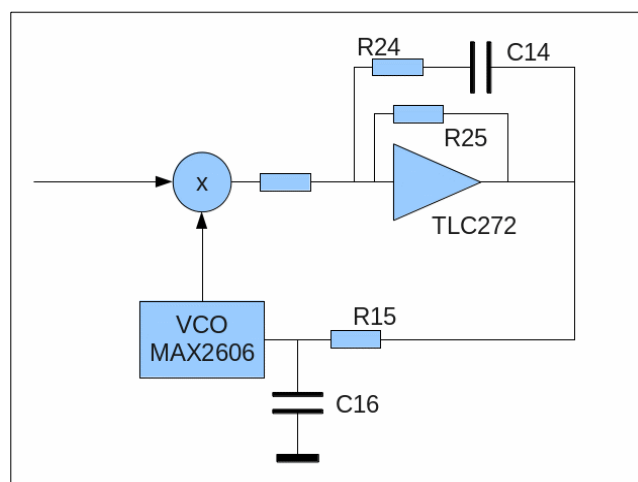


Fig. 2. Highly simplified scheme of the PLL for HRPT.

And now the time had come to finally receive something, with my own equipment at my own location. As far as reception of polar satellites is concerned, I am not exactly at the most favorable location. At the edge of a forest with trees of 20 meters and higher, there is little to expect from satellites that pass through the east. On the west side it is slightly better, especially towards the south. Not all the passes are therefore suitable; about half of them are unusable and for the other half I can only receive something from more than 15 degrees at best (see fig 3).

Fortunately, it was sunny weather, so I could check and align the rotor control with "sun shots" (tracking with xtrack the sun).

And after a number of failed attempts, yes, my first picture! (Fig. 4). Just NOAA19, but still. #Metoo!





Fig. 3. Receiving station Hilversum is far from optimal.

With that, not everything had been looked at. Apart from the limited reception, where halfway through a signal, the signal sometimes disappears due to a tree branch in the way, one of the motors of the XY rotor was found to disturb the reception. Resulting in jam marks every time the engines run for a while. Curiously, this is not visible in Fig. 4, I now see this article. Riddles. I am still working on that. So there is still something to do before I can put a higher mast. But the beginning is there.

Playing with receipt and my software I see a number of things that need improvement, so the software has also been tinkered. More about this in other articles.

As can be seen in Fig. 3, the dish is quite small: about 65 cm. The head that is in it is from Timestep, donated by a former member; that contains amplifier and downconverter. The advantage of the small dish is that it does not have to be aimed very accurately. After applying a few marks, I can pull the entire construction off the post and I can also put the case back in no time. There is no signal or sun needed for alignment, just turning until the whole is correct with respect to the marks. (My neighbor saw the construction for a rain gauge, but this "rain gauge" must go in when it rains, it is not yet waterproof.)

The disadvantage of the small dish is of course that the received signal is not so strong.

A great help in determining the quality of the signal is the constellation diagram. In an article by Harrie v. Deursen [5] you can see how this looks like on a digital scoop. In Fred's article, elsewhere in this KM, constellation diagrams can be seen as Picoscope shows. These pictures are somewhat more difficult to interpret, due to the limitations of this USB / PC-scoop. It gave me the irreverent remark that it looked like a scratch-drawing of a toddler. If the recipient does not want to lock it, it is very difficult if not impossible to see

what is going on. But it is certainly better than nothing.

In fig. 5-7 you can see what these diagrams look like for me, when using an old-fashioned "real" analogue scope in XY mode.

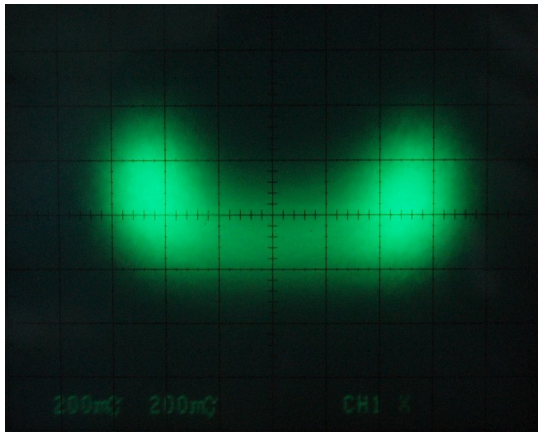


Fig. 5. Constellation PSK (HRPT, NOAA)

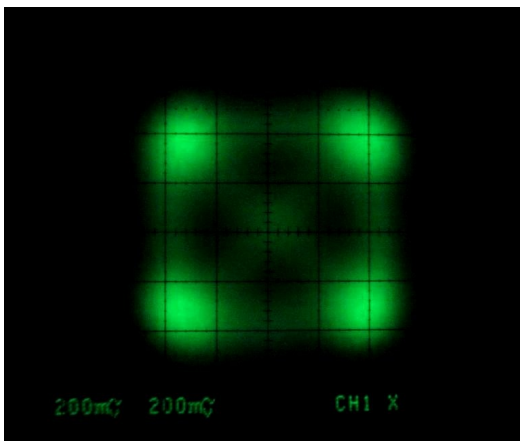


Fig. 6. Constellation QPSK (METOP)

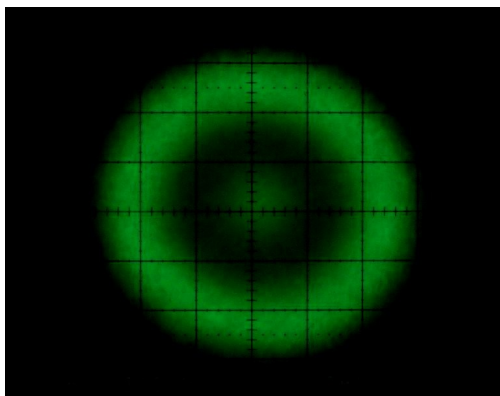


Fig. 7. "Constellation diagram" out-lock

Particularly in Fig. 6 it is nice to see how the bit pairs follow each other in the form of 4 phases. The 4 corner points represent the received bit pairs 00, 01, 10 and 11. The lines between those points, caused by a not infinitely fast scoop and electronics, show the transitions / sequences. From a random bit pair = vertex there are always 3 possibilities to another bit pair / vertex, visible as a connecting line.



Fig. 7 shows the situation where the demodulator is out of sync. The constellation diagram of fig. 6 now runs around quickly, giving the donut shape. That spot in the middle is the result of the spot in the middle of fig. 6. With an infinitely fast scoop and electronics you will not see that spot.

It would be nice if we had a screen on the receiver on which this diagram is visible, so that no separate scope has to be connected.

After a while of experimenting with reception, the reception turned out to be getting worse. At one point I checked the clock in the computer and it turned out to be 45 seconds to walk behind. Well, then you aim the dish very accurately behind the satellite instead of on it! Yet to connect an Internet connection to my garage, so that the PC can keep itself up to date. Even with a small dish of 65 cm, opening angle approx. 20 degrees, it is done with reception with a time deviation of more than half a minute.

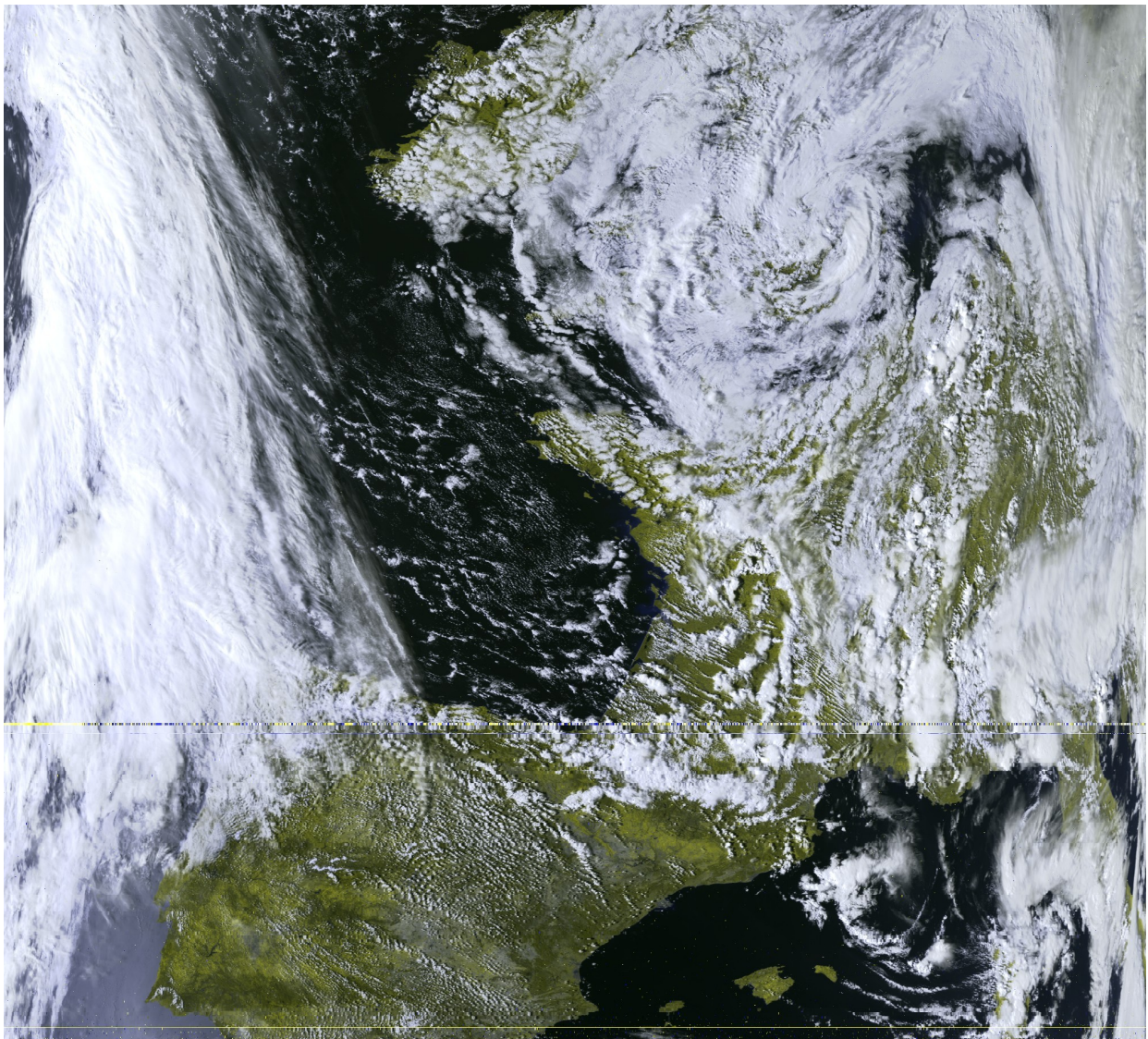


Fig. 4. First picture, NOAA19, 31-3, 09:23 UTC

#### References:

- [1] An HRPT decoder / generator for self-construction. de Kunstmaan no. 4, October 1994
- [2] A new HRPT decoder. de Kunstmaan nr. 1, March, 2011, page 11
- [3] Control of an X / Y rotor with DiSEqC. de Kunstmaan nr. 2, July 2014, page 57
- [5] the Kunstmaan 2016, no. 4, p. 18: constellation diagrams

## New developments wsat

With the self-receipt of polar satellites, the development of wsat has also gained momentum. Originated from the DOS program 'hrpt', from the nineties, little or nothing has changed for a long time.

With the reception of QPSK there has been movement again. Especially adding a tracker [1] gives new possibilities to automate things. Also combining tracker information and the synchronization state of the decoder can give interesting information, especially if you live in an environment like me, where reception is not possible in all directions from the horizon.

To wsat is certainly still something to do when it comes to "look & feel".

A new addition is that the tracker part and the part on which the received picture comes in separate windows so that they can be seen at the same time. Certainly easy if you have a larger screen.

Fig. 1 shows the tracker part.

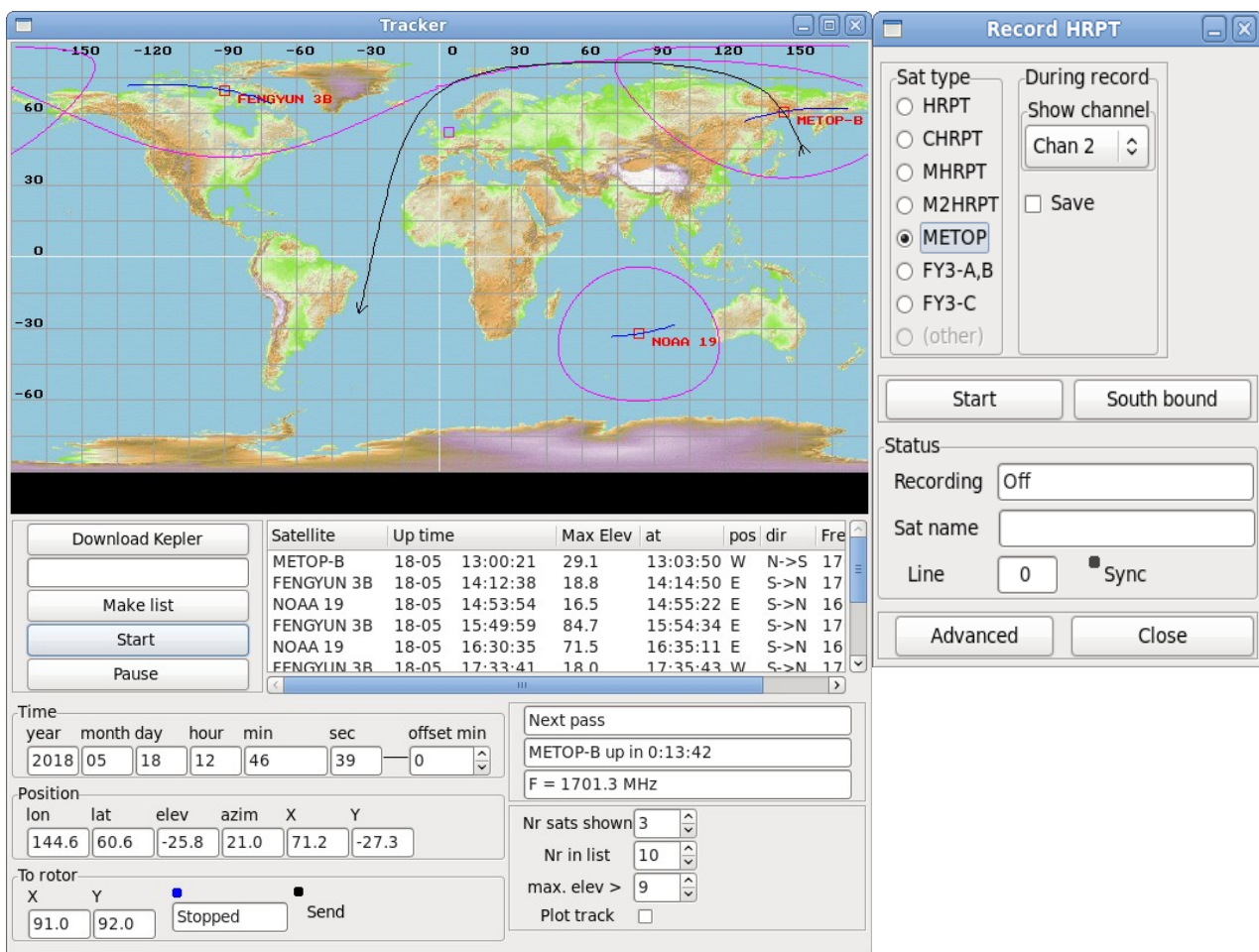


Fig. 1. Tracker part of wsat.

Fig. 2. Record window.

At the top is the world map-with-satellites, which is identical to xtrack. Below that you can see a list of satellites in order they come across. That list is made after clicking 'Make list', left. (Possibly preceded by retrieving fresh Kepler data with the button above.)

If 'Start' is now pressed, this list is 'finished', ie, as soon as the top satellite rises above the horizon,



the rotors start to follow the satellite. The correct decoder is also selected, as can be seen in the 'record' window (fig. 2). If 'Start' is also clicked there, the signal will be recorded automatically.

After the satellite has "gone down", the rotors will automatically turn to the storm position and the list will move one place up so that now (in this case) Fengyun-3B is at the top. The decoder is put in the relevant position and as soon as this satellite rises above the horizon the party starts again.

By clicking on a satellite in the list, eg NOAA 19, the satellites that are listed above that satellite are skipped. After the clicked satellite has been "finished", the list is finished in order again.

There are a number of buttons at the bottom right of the tracker window:

- Nr. sats shown: this allows the number of displayed satellites to be limited to the desired number, whichever comes first. With 8 satellites, the screen can become quite full.
- Nr. in list: the number of arrivals that are shown in the list. That does not have to be very much; the list is automatically supplemented at the bottom if one disappears at the top. A longer list does give you the possibility to skip more passes.
- Max. Elev: allows all trips that do not exceed a certain elevation to be filtered out. These are then not followed. This can also be recorded in Preferences, but with the button here it can be adjusted a little easier.
- Plot track: more about this later.

There is another point that is not done automatically: setting the tuner frequency. For that I have already made adjustments to the GODIL hardware so that the tuner frequency can also be transferred from PC to hardware. The GODIL hardware has thus got 3 functions; see fig. 3:

- decode
- control rotors (via DiSEqC signals)
- transmit tuner frequency

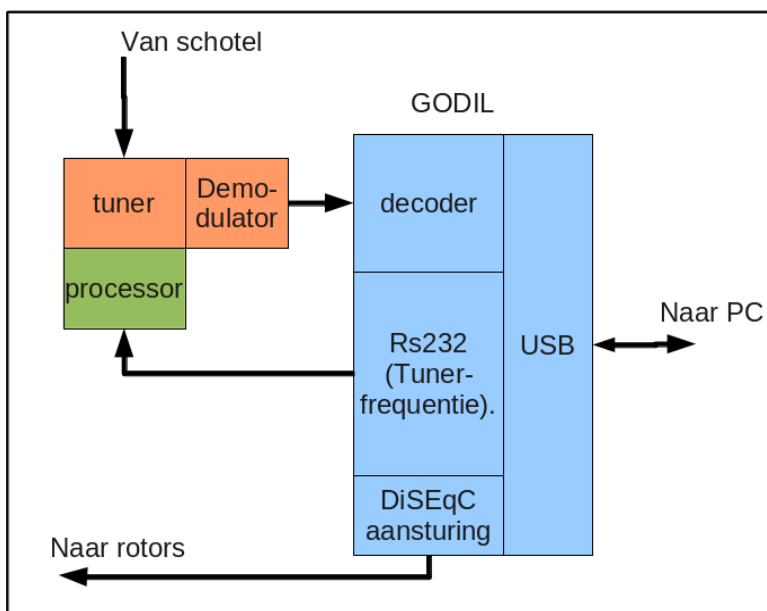


Fig. 3. The GODIL as interface between PC on the one hand and receiver and rotor control on the other.

The link to the processor / Arduino software, which takes care of the actual control of the tuner, has yet to be made, but if this is a fact, it is possible in principle to have unlimited polar satellites follow and record fully automatically.

If the rotors have to be controlled in a different way than DiSEqC then this must also be possible via the wsat tracker. This is not yet available, but it is already in the separate program 'xtrack'.

Another interesting option is combining received signal and position of the satellite. This is activated with the aforementioned 'Plot track'. A picture is then made with the tracks of received satellites as far as they actually indicate a useful signal. By combining the decoder with the position of the satellite in-sync one gets a picture like fig. 4.

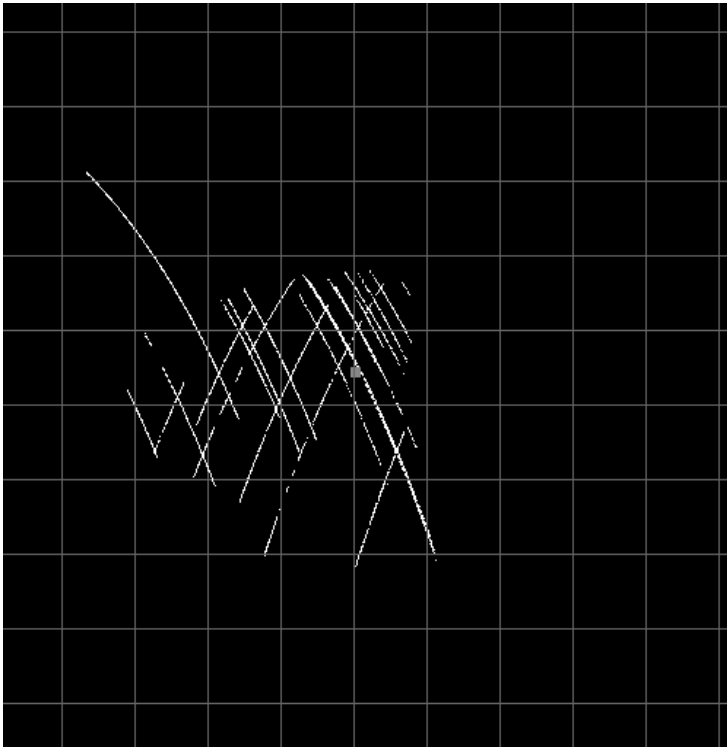


Fig. 4. Tracks of multiple satellites.

In the middle the position of the receiving station is indicated with a square. Around it the orbits of the satellites received so far. This is extended with every new transfer.

In this picture, taken at my location, it can be seen that especially on the east side not much to receive, because of trees and buildings (see fig. 3 in my other article in this KM, 'First picture'.)

By combining this picture with the world picture in fig. 1, it is nice to see what part of a transfer can actually be received.

At the top it can be seen that almost all jobs stop abruptly. That is because of the garage (fig. 3 'First picture'). I still have to reproduce the striking outlier of the runway to the northwest. As far as I can tell, it is a pass that can be followed just between buildings.

## References

[1] de Kunstmaan 2011 nr. 4, p.184: A combined HRPT decoder / tracker

## **The band converter**

### **Summary**

This article describes the design of a band converter. This device is an add-on for a spectrum analyser to extend the frequency range to 1500 - 2000 MHz.

### **Introduction**

It has been years since Harrie van Deursen in the September 2012 Kunstmaan wrote an article about the DSA815 spectrum analyzer Rigol and a band converter built with coaxial modules from Mini Circuits. I have always wished to use this band converter with its components on one PCB. It was now or never because nowadays you have already affordable spectrum analyzers that go up to 2.1 GHz. The Harrie band converter is working very well, but a build-up with everything on one print has the advantage of being cheaper and more compact. The advantage of an oscillator frequency of 1 GHz is that the spectrum analyzer is still easy to read, you must just have a "1" preceding the frequency read out.

### **Rigol DSA815**

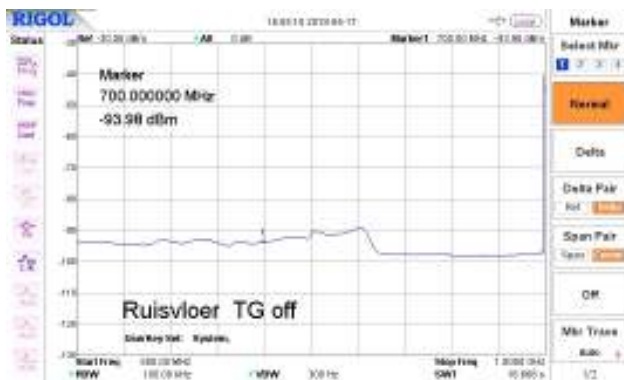
The DSA815 from Rigol is a spectrum analyzer (SA) ranging from 9 KHz to 1.5 GHz. Optionally, a tracking generator (TG) is available. With a tracking generator you get a signal source (with an output level of 0 to -20 dB) that goes with the SA. This is an indispensable tool if you want to measure filters, antennas, etc. The tracking generator is built-in in the SA.

You can also use a TG as a signal generator by fixing the frequency. The disadvantage is that you can not use the SA (which also looks at the fixed frequency). If you want to use the signal to test a receiver then you will still have to attenuate because -20 dBm is much too high. You will have to go towards the -60 dBm.

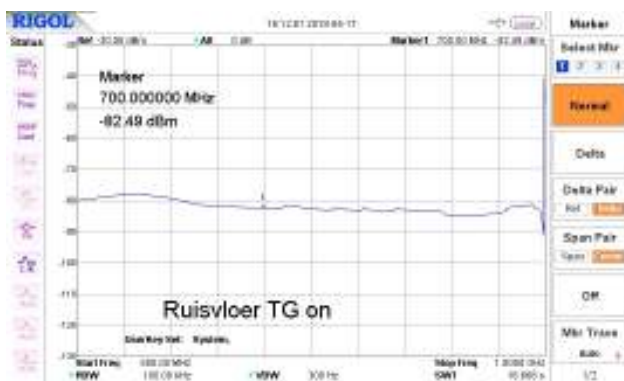
### **Crosstalk**

If you use the TG together with the SA then you have to deal with crosstalk. Also in the band converter there will be crosstalk. Crosstalk means that the output of the spectrum analyzer sees the output without anything connected to it. You want the crosstalk as low as possible, but it is a given fact in the SA. You can not do measurements below this level.

To measure the crosstalk you disconnect everything on the SA. The measuring bandwidth is at 100 kHz and the measuring range is 500 to 1000 MHz. The video bandwidth is 300 Hz. With the TG on you see a floor around -75dB, with the TG off then the floor is around -90dB. It does not matter whether the TG is at -20dBm or 0dBm. You see the crosstalk increase at higher frequencies.



*Noise floor with tracking generator off*



*Noise floor with tracking generator on. About 15 dB more.*

## Scheme

The block diagram from the September 2012 Kunstmaan is shown below. For explanation about the operation we refer to the article in the September Kunstmaan.



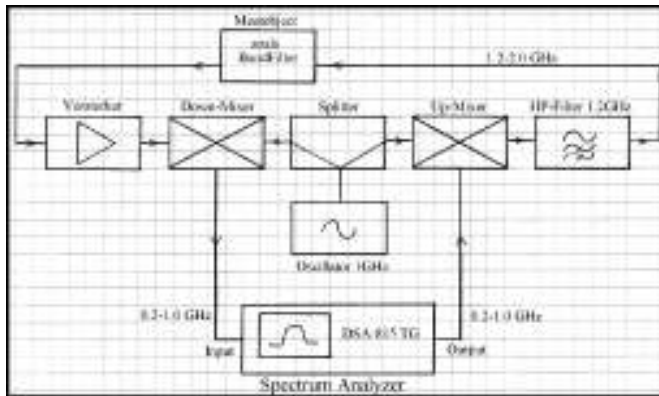
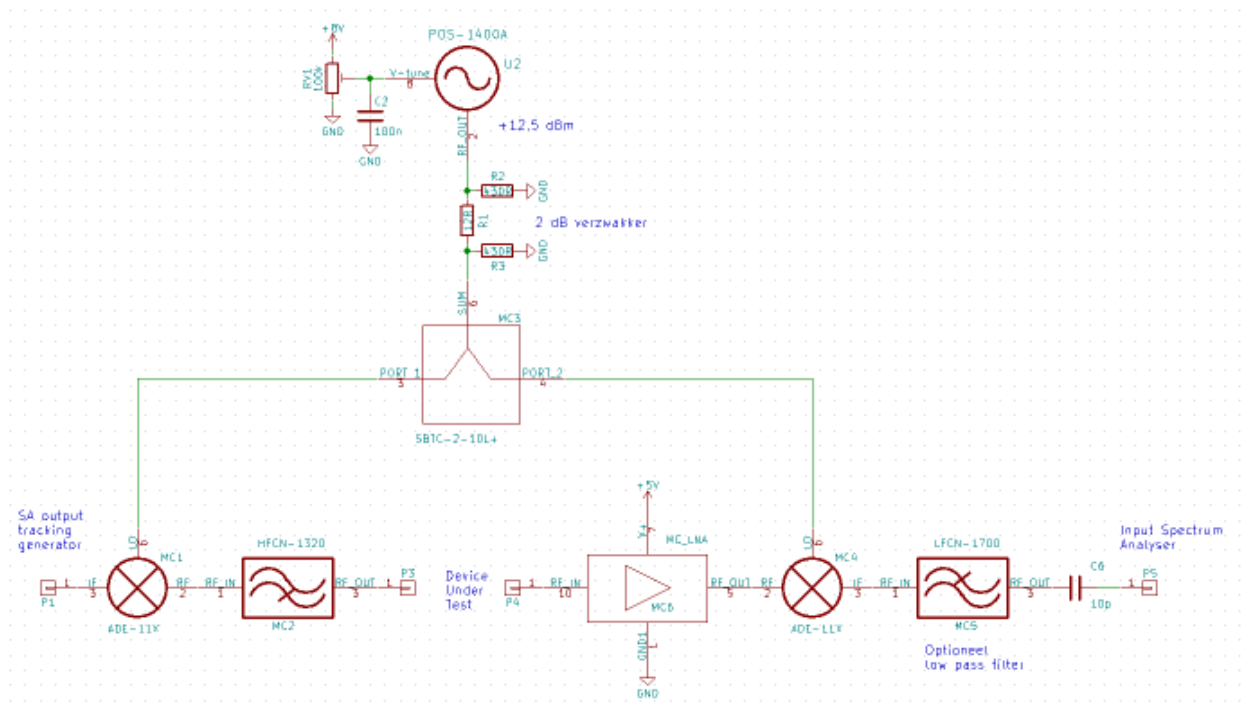


Fig 1 Blokscheme of the band converter. The output of the spectrumanalyser is the trackinggenerator.



The final scheme; a PCB has been made of it.

## Mixers

Two mixers are included, one for mixing up, the other for down. Our field of interest goes to the 1700 MHz. From the TG comes a 700 MHz and this is with a 1000 MHz mixed to the 1700 MHz. The signal passes through the object to be measured and is shown with 1000 Mhz down mixed to the 700 MHz and this is measured by the SA. It is as simple as that or not....

A mixer has two inputs and one output and the result is an addition and subtraction of the frequencies of the signals that are offered.

So in our example, when mixing up, signals will be created from  $1000 - 700 = 300$  MHz and  $1000 + 700 = 1700$  MHz (both signals are equally strong). When mixing down, signals will be created  $1700 - 1000 = 700$  MHz and  $1700 + 1000 = 2700$  MHz (here, too, both signals are equally strong). The unwanted 300 and 2700 MHz signals are called mirror frequencies. The 300 MHz mirror frequency must be filtered because they could appear as a mixed product on the frequency to be measured:  $2 \times \text{LO} - \text{RF} \Rightarrow 2 \times 1000 \text{ MHz} - 300 \text{ MHz} = 1700 \text{ MHz}$ . This contributes to the noise floor increasing.

Because there is a high pass filter at the output the signals below 1200 MHz are well suppressed (according to the datasheet 27 dB at 1060 MHz). At the input of the band converter a filter is not really needed because the SA anyway observes the correct frequency and not the mirror.

### The VCO

As a VCO I use the POS-1400A. Unfortunately, this VCO is out of production. Various dealers still have it in stock. The POS-1400A has a range of 975 to 1400 MHz. The supply voltage is unfortunately 8V. Do you want the 1400 MHz then you need a tuning voltage of 20V. For 1 GHz the voltage is around 5V. The output level is pretty high at 13 dB. After splitting (in which you lose more than 3 dB) is it high enough to control the mixers.

### Attenuators

After the VCO follows a 2 dB resistance attenuator to get around 7 dB that the ADE-11X mixer needs. From the VCO comes 13 dB, the splitting costs 3.5 dB. We have lost another 0.5 dB on the print tracks. Resistive attenuator networks can be divided into pi and T-networks. Electrically they are equal but they have a different structure.

Below a diagram of a pi and a T-attenuator. The resistance values are given for a 3dB attenuator with a 50 Ohm input and output impedance.

Below a table with some values for the pi attenuator

Att. in dB	R parallel in Ohm	R series in Ohm
1	5,8	870
2	12	430
3	18	300
6	39	150
9	62	100

In the internet there are many programs for calculating the resistance values [1]. You will not always have these resistance values available. So you can make a 300 Ohm resistor by putting 120R and 180R in series. To calculate the most optimal series or parallel values, the internet is your best friend again. On the site of qsl.net [2] is a calculator that calculates the most optimal value based on E12 or E24. The use of parallel resistors has a slight preference because you can easily solder them on top of each other. This works very well with SMD resistors. Besides checking the amplitude of the signal, attenuators are also used for impedance adjustments between components that are susceptible to mismatches such as amplifiers, filters and VCOs. On the site of Mini Circuits [3] is an interesting document about the application of attenuators to minimize impedance mismatches. If you look at the datasheets, you often see 50 Ohms. This does not mean that the components are 50 Ohm but that the specifications in the datasheet are measured with 50 Ohm. By using an attenuator you can make the mistake of mismatching. That is why when measuring an interdigital filter, at both the input and output, there is an attenuator of at least 6dB.

#### amplifier

To strengthen the weak signal, a TAMP-242GLN + is included. I use this amplifier in coaxial form as LNA. The gain is around 30 dB. An amplifier is needed if you want to do reflection measurements. For filtering down filters you have to weaken enough because otherwise the down mixer gets overloaded.

#### Construction

The construction of the band converter is a story by itself. When you go to frequencies of 2 GHz, you can not use a pinch print, that's why I specially designed a print. The band converter fits on a print of 35 x 72 mm that fits in a nice standard RF can. Instead of mounting two connectors on the side, I soldered semi-rigid cable with N-connector directly. With this I can mount the band converter directly on the SA. See the picture on the next page.



*band converter mounted on the spectrumanalyser*

## Applications

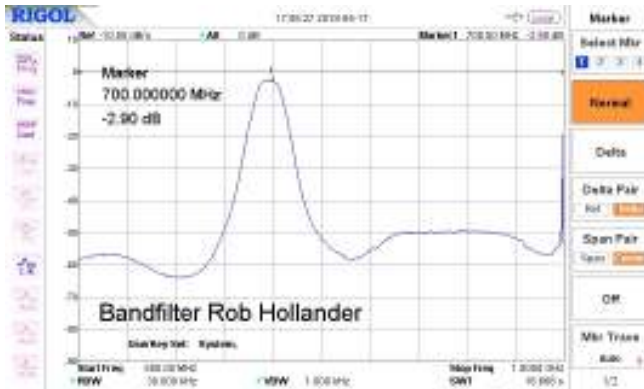
### General

Set the SA to the range 500 to 1000 MHz. With the band converter we look 1 GHz higher. This reads nicely, you have to add 1 GHz at the frequencies shown. The TG should not be higher than -20 dB, otherwise you run the risk that the up mixer will be overdriven .

### Filters

The main application for the band converter will be the sweeping of filters. Put a 10 dB attenuator on the output of the "band converter / TG" to make the adjustment to 50 ohms. At the output of the DUT, to the input of the "band converter / SA" insert at least a 6dB attenuator. First we have to normalize the system. All deviations / variations by the band converter (which also does not have a perfectly flat passage), cables, connectors can be calculated for by normalizing in the measurement. For this purpose, place a continuity as DUT, between the two attenuators. Switch on the TG on the SA and choose 90% in the Normalize menu. Then we can place the filter and see the picture below. This is what we made all the effort for.



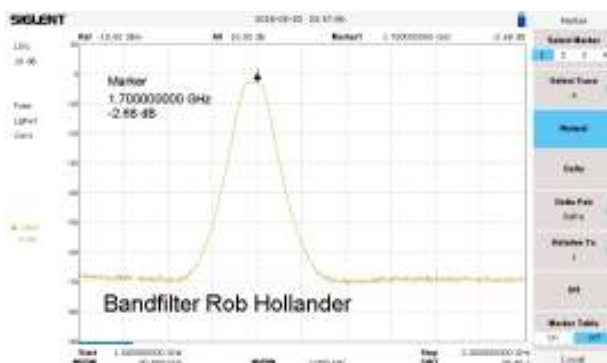


*The interdigital filter of Rob Hollander measured.*

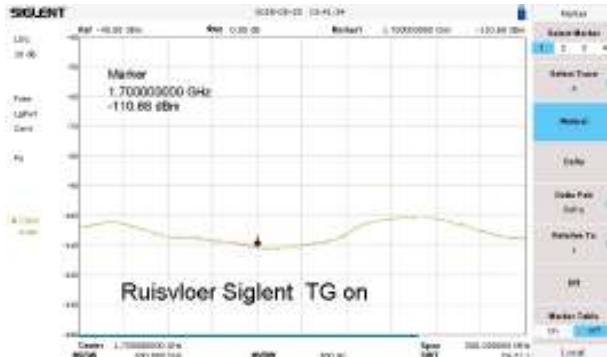
### 1700 MHz Measure transmitter

Because you need little signal you can insert an extra attenuator of 20 dB between the TG and the band converter. The mixer also attenuates another 8 dB. If you want the signal to be completely clean (this is often not necessary) then switch on a low pass filter like the VLF-1525 + of Mini Circuits after the attenuator. After the low pass filter you can record even more attenuators. Connect the unused input and output of the band converter with 50 Ohm terminators. Other frequencies The idea of the band converter is universal and this means that you also switch the band converter to see other frequencies. For example, you could think of the 13 cm band running from 2320 to 2450, by having the SA watch see 1 to 1.5 GHz. Do you want the 13cm in the middle of the measuring range, then you will have to set the VCO a little higher. I have not tested this variant. Maybe the mixers provide problems, which are only specified to 2 GHz.

In the last meeting Job has shown a band converter for the 8 GHz. Conclusion This story has been in the pipeline for a while and has partly been overtaken by technological developments. If you want to purchase a SA, choose one that can measure at least 2 GHz. If you still have an old one, this band converter can offer a solution to look a little higher. Below is a picture of the Siglent that measures the interdigital filter of Rob Hollander.



*The curve on the Siglent is much flatter and goes much deeper. Above 1800 MHz, more than 20 dB lower than the Rigol.*



*The noise floor of the Siglent is also much lower than the Rigol.*

## Links

[1] Calculating passive resistor network

<http://chemandy.com/calculators/matching-pi-attenuator-calculator.htm>

[2] Weerstandscalculator

<http://www.qsl.net/in3otd/parallr.html#>

[3] Fixed attenuators help minimize impedance mismatches

<https://ww2.minicircuits.com/app/AN70-001.pdf>

## Experiments on the 7.8 GHz

### Summary

This article describes small experiments on the 7.8 GHz. An ADF4351 module from eBay is used as a signal generator. To see the 2600 MHz on the Rigol DSA815 I designed a small downconverter.

### Preface

If you want to design a receiver for the 7.8 GHz, it is useful to have a signal generator that transmits at 7.8 GHz. It will have to be self-build because I have not been able to find affordable second-hand generators.

The higher the frequency, the more difficult it is to find measuring equipment. This also applies to my spectrum analyzer that goes up to 1.5 GHz. A simple down converter must offer the outcome.

The next step is to make an antenna. I'm going to try to build a helical, but this experiment is not finished yet.

### The ADF4351

I have written about this module before in the Kunstmaan of September 2017 [1]. The ADF4351 can generate a signal up to 4400 MHz, which is too low. What you do see in the spectrum is that it is full of harmonics.

The idea is to generate a 2600 MHz signal and then filter out the third harmonic on the 7800. The third harmonic is a lot weaker than the ground wave (with a level of -4dBm), but for our application this is not so bad.

To calculate the bytes needed by the ADF4351, I used the program "ADF435x" from Analog Devices.



### *Settings for the ADF4351 to program it for 2600 MHz*

Initially, I programmed the ADF4351 with the Cypress controller, as described in the article in the Kunstmaan. For a single test this is useful, but if the voltage is off you have to reprogram the whole thing again. So I made a script for the ATmega328 that sends the byte stream to the ADF4351.

### ATmega328-script

```
// Set ADF4351 at 2600 MHz
```

```
int nrbits = 31; //Always one lower: 24 bits -> 23
```

```
// ATmega328 ATmega328 -- select one
```

```
const int slaveSelect = 10;
```

```
const int dat = 11;
```

```
const int clck = 13;
```

```
boolean aanuit = true;
```

```
void sendCommand(long value)
```

```
{
```

```
    digitalWrite(slaveSelect,LOW); //chip select is active low
```

```
    delay(1);
```

```
    for (int i = nrbits; i >= 0; i--)
```

```
    {
```

```
        aanuit = bitRead(value, i);
```

```
        digitalWrite(dat,aanuit);
```

```
        //delay(1);
```

```
        digitalWrite(clck,HIGH);
```

```
        //delay(1);
```

```
        digitalWrite(clck,LOW);
```

```
    }
```

```
    digitalWrite(slaveSelect,HIGH); //release chip, signal end transfer
```

```
    delay(1);
```

```
}
```

```
void setup()
```

```
{
```



```
pinMode(slaveSelect, OUTPUT);
pinMode(dat, OUTPUT);
pinMode(clck, OUTPUT);

pinMode(LED_BUILTIN, OUTPUT);

digitalWrite(slaveSelect,HIGH); //deselect slave
delay(1000);

// 1. Write R5
sendCommand(0x580005);

// 2. Write R4
sendCommand(0x8C8024);

// 3. Write R3
sendCommand(0x4B3);

// 4. Write R2
sendCommand(0x4E42);

// 5. Write R1
sendCommand(0x8008011);

// 6. Write R0
sendCommand(0x340000);
}

void loop()
{
    digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)
    delay(100); // wait for a second
```

```
digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW
delay(100);                      // wait for a second
}
```

In itself it is not all that exciting. The subroutine `sendCommand ()` sends out a bit sequence. In the routine `setup ()`, `sendCommand ()` is called per byte. When starting the ATmega328, the `setup` is called once. After the `setup`, the ATmega328 enters an infinite loop in which the LED starts flashing, so that you know that the ADF4351 is on frequency.

It does not work

To see if 2600 MHz comes from the signal generator, I have made a simple down converter. See later in this article.

It is not that simple, there is no signal! With the Cypress controller there was a signal on the 2600 MHz, but not with the ATmega328. Then the problem lies in the bit stream coming from the ATmega328. So the logic analyzer connected and see what is sent over the line. This was right down to the bit. What is going on?

As so often, Google gives the answer. Searching for "ADF4351 Arduino" brought me to a website / presentation that rightly warned that the ADF4351 works on 3V3 and not 5V. My ATmega328 naturally ran at 5V and sent the bytes at 5V level to the ADF4351. Luckily the ATmega328 also runs on 3V3 so the problem was solved quickly and the ADF4351 did not suffer any permanent damage, fortunately, because with 20 Euro it is an expensive module.

### Signalgenerator as built



*On the left the ADF4351 module, in the middle the ATmega328 on a PCB and on the right a bandpass filter*

I mounted the ADF4351, the ATmega328 and the bandpass filter on a piece of PCB.

The power supply is 5V going to the ADF4351. This module contains a 3V3 regulator that supplies the ATmega328 with voltage.

The output of the ADF4351 goes via a piece of rigid coax to a bandpass filter. This filter I managed to win last day of the RadioAmateur. The type is "Reactel 7CII-8150-700". The center of the pass band is 8.15 GHz with a bandwidth of 700 MHz.

Signal on the 7.8 GHz

And then the question is whether a signal comes through the bandpass filter. My spectrum analyzer does not go as high and for a down converter to this range I did not have any parts.

But I do have a power meter, the NRP-Z11. It can measure up to 8 GHz, in a range of -67 dBm to 23 dBm. Mini Circuits also has a power meter that goes up to 8 GHz, in the March 2016 Kunstmaan I wrote about this. Recently, in the Elektor also a power meter stood that can measure up to 10 GHz [2].



*NRP-Z11 power sensor from Rohde & Schwartz. The USB connection is very handy because it saves a box on the desk again.*



It works! The supplied software shows a level of -28dBm. The frequency is not measured, but given the band pass filter you can assume that this is 7.8 GHz.

Downconverter

I wanted to see the 2600 MHz signal on my spectrum analyzer, which unfortunately only goes up to 1500 MHz. A very simple downconverter must offer a solution.

This downconverter should convert the frequency range of 1.5 - 3 GHz to 0 - 1.5 GHz. You do not need much for this: a VCO and a mixer.

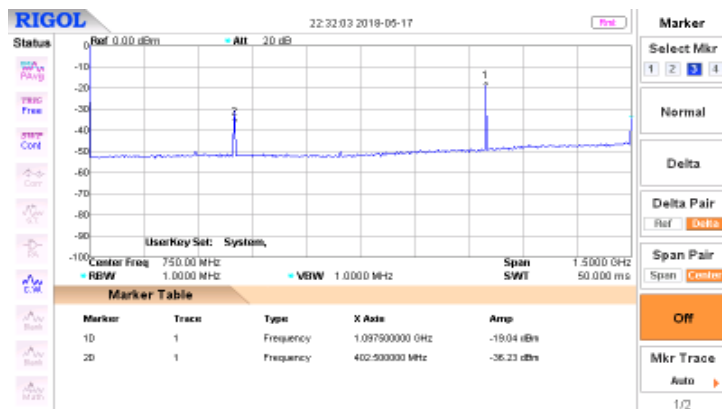
As VCO I used the ZX95-1750W, which can be tuned to the 1500 MHz with 7V. The supply voltage is inconvenient with 10V. The mixer is the ZX05-43 which can mix 750



Left the VCO, in the middle a print with the LM317 which converts the 12V to 10V, just goes. On the right the mixer with a high-pass filter (at the entrance).

The construction is not that exciting, just on a piece of PCB. What you see on the spectrum analyzer needs an explanation.

In addition to the 2600 MHz that is downgraded from  $2600 - 1500 = 1100$  MHz, you also see a signal at 400 MHz. This is a mixed product of twice the oscillator minus the input signal, so:  $2 \times 1500 - 2600 = 400$  MHz. This is a product from the mixer that you can not filter out.



*Signal on the 1100 MHz (expected) but also on the 400 MHz*

Such a downconverter is therefore nice to see if there is a signal on a certain frequency, but not much more than that.

## Antenna

Then you also want an antenna to be able to broadcast the signal. Incidentally, this is not allowed legally (even if you have a broadcasting license) because the 7.8 GHz is not in the amateur band. Unfortunately, otherwise there were many more designs of feedhorns, LNAs available.

On the internet I came across a helical design for the 5.8 GHz. This is used when



flying with drones, with which the video signals are transmitted. My idea is to scale this antenna to the 7.8 GHz. He will then be smaller.



*Helical for the 5,8 GHz*

On the Coppens site [3] I came across a program to calculate the helical dimensions for the 7.8 GHz. It will be a fiddle because the diameter is 13 mm.



*Copper wire wrapped around a 12mm copper tube gives exactly the diameter of 13mm that we need.*

When the antenna is finished, I want to measure it with a SWR bridge. At different frequencies you measure the reflected power with a power meter. At the frequency the antenna is tuned into, the least power will come back (because it is being broadcast)



*SWR-bridge fit for 1 tot 8 GHz.*

Probably the helical is only suitable as a transmitting antenna in a measurement setup because the radiation diagram is not as tight as with a horn. This looks much less over the edge of the dish and thus has less trouble with noise.

## Conclusion

The 7.8 GHz gives all kinds of fun new technical challenges. Hopefully all these experiments will lead to a reception system for the 7.8 GHz.

## Links

[1] ADF4351

De Kunstmaan, September 2017, page 17

[2] RF Power Meter, measuring up to 10 GHz

Elektor March / April 2018, page 42

[3] Helix antenna desing and construction details

<http://jcoppens.com/ant/helix/calc.en.php>

## Neosid 1690

### Summary

The Neosid helix filter 1690 has been tested using a spectrum analyzer.

### preface

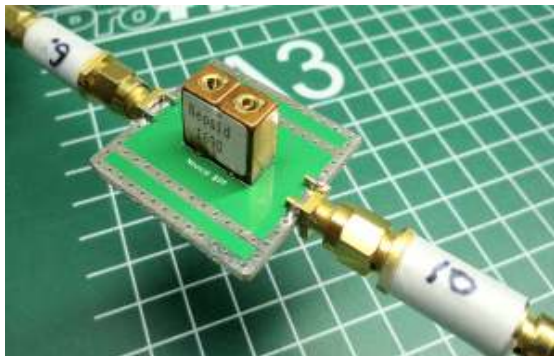
On eBay / internet you come across a Neosid band pass filter for the 1690 MHz. Just look for "Neosid Helix Filter 1690". On eBay it is Kuhne Electronic that offers the filter. Note: the price mentioned is per piece. But they go by two.

### Neosid 1690

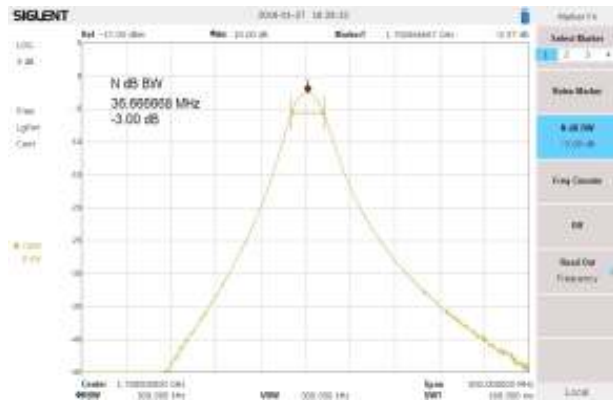
The filter consists of two copper housings that are attached to each other and mounted on printed circuit board. The dimensions are 15 mm x 7.5 mm and 12 mm high. The inputs and outputs are set to 50 Ohm.

The data sheet [1] indicates a bandwidth from 1640 to 1740 MHz. This is more than enough for our area of interest. In the transmission area the loss is approximately 2.5 dB.

The filters are fine-tuned, but would you still want to optimize something yourself, you can do this with a screwdriver. According to Neosid, this may even be done with a metal screwdriver.



*I have designed a small print that fits the filter*



*Filter on Harrie's spectrum analyzer. The marker is at 1700 MHz, bandwidth 36 MHz*

### Application

The transmission loss is too great to put the filter directly behind the helical. What you can try is to put a single stage HEMT (PGA103 or SPF-5189Z) directly behind the helical and behind this the filter. Hopefully the first stage will not be overloaded. After the filter you can still record a HEMT. This application has not yet been tested.

### Links

[1] Datasheet Neosid 1690

[https://neosid.de/import-data/product-pdf/neoHelixkreise\\_7\\_10.pdf](https://neosid.de/import-data/product-pdf/neoHelixkreise_7_10.pdf)



## **Report members meeting 19 May 2018.**

### **Summary:**

Report of our meeting at May 19.

### **Opening by the chairman.**

### **Explanation of the 2017 figures + statement of the Cash Control Committee**

The treasurer gives an explanation of the financial overview 2017 as published in the first Kunstmaan of this year. See the relevant article for this.

Peter Kuiper is not present at the cash control committee, but Job de Haas does. A small mistake has been found, this has been corrected by the treasurer. It has no further influence on the financial overview as published in the Kunstmaan. The cash control committee advises granting discharge, which is granted by the attendees.

### **Discharge management on the 2017 policy**

The members present also discharge the policy in 2017.

### **Budget 2018**

The treasurer provides an explanation of the budget for 2018. This can also be found in the financial overview 2017. The loss increases, however, the budget does not take into account any windfalls such as sales parts, which were often in previous years. For the moment we can handle this loss; there are still enough reserves to be able to intervene in time. It is noted that there has been no increase in the contribution for the past 25 (or more) years, apart from a small increase in the transition to euros (50 guilders to 25 euros).

### **Administrative affairs**

No changes.

Fred is currently working on the KM, but that is temporary. We are therefore looking forward to someone who can strengthen the editors.

Finding someone for the website remains difficult. Maintenance is currently minimal.

### **Satellite status**

Harrie v. Deursen indicates that Fengyun-3C is doing it again. NOAA 15 is very weak and actually unusable. Meteor is weak above the Netherlands and northern France, more to the south much stronger. The transmitting antenna apparently has a deviant radiation pattern.

Arne reports that Eumetcast is running well; there are no details to report.

## **Any other business**

Harm de Wit: shows an antenna analyzer using a "development board-with-touch-screen" from STMicroelectronics. On this board are connectors with which your own constructions can be connected. It is a compact unit with which impedances can be measured in a simple manner, whereby the results can be shown on the screen in eg Smith-diagram.

Job de Haas: Has established a one-man business: RFWerk. He also offers his services (which is not entirely clear) for members, at cost price.

Paul Baak: reports that the working group is subscribing to UKWBerichte. This is then available for inspection during meetings.

Arne: has bought a transmitter 23.5 MHz-6 GHz. Must still be properly built.

Rob Alblas reports that he can finally receive HRPT etc. at last. Developments in software have also become accelerated.

Ben Schellekens shows a number of (self-made) electronic items.

## **Closing**

After this, Ben, Peter, Job and Wim give a presentation about their findings regarding receiving 7.8 GHz. This mainly concerns the antenna and helical, and a downconverter that you can make yourself.

Wim Bravenboer has made a receiver for 7.8 GHz and tested it with a measuring transmitter. He also tried to receive NOAA20 with a 60 cm dish, but he did not succeed. The dish will be too small anyway.

Elsewhere in this KM, article "Experimenting on the 7.8 GHz", more can be found.

Rob Alblas  
(secretary AI)

Arne van Belle, as per 10 juni 2018

<b>POLAIR</b> (MHz)	<b>APT</b> (MHz)	<b>HRPT Transit</b>
NOAA 15	137.620	1702.5 morning/evening, on HRPT weak. High transits are usable
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 LHCP !
FengYun 3D	none	7820.0 X-band afternoon 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 Black image
METEOR M N2	137.100 LRPT	1700.0 LRPT on/MHRPT on
NPP	none	7812.0 X-band HRD 15 Mbps
JPSS-1/NOAA 20	none	7812.0 X-band HRD 15 of 30 Mbps

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

The LRPT signal from METEOR M N2 can be received with an SDR dongle.

NPP (NPOESS Preparatory Project) and JPSS-1 (NOAA-20) only transmit on the X-band with 15 Mbit / s. One recommends a tracking dish with a diameter of 2.4 meters! <https://goo.gl/1mXkAZ>  
<https://goo.gl/k6hAbi>

FengYun 3A, 3B and 3C broadcast AHRPT, which can only be received with the new QPSK receiver from Harrie and Ben. This AHRPT is not entirely

according to the standard so that even a Metop AHRPT receiver is not suitable for the FY-3 series! FengYun 3C also has a data rate other than 3A and 3B. Rob Alblas has expanded his GODIL decoder and can now demodulate HRPT, Meteor HRPT, METOP and FY3A / B and FY3C!

FY-3D was launched on November 15th, but this satellite, just like NPP and JPSS-1, only broadcasts on the X-band!

Sentinel-3A, the successor of Envisat, can not be received immediately, but images can be received via EUMETCast HVS-1. This data will soon move to Eumetcast TP2 transponder.

<b>GEOSTATIONAIRY</b>	<b>APT</b> (MHz)	<b>(SDUS)/PDUS</b> (MHz)	<b>Position in orbit</b>
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MET-11 (MSG-4)	1691 LRIT	1695.15 HRIT	0 degrees, operational
MET-10	1691 LRIT	1695.15 HRIT	9.5 degrees, W, RSS parallel operation
MET-9	1691 LRIT	1695.15 HRIT	3.5 degrees O, RSS
MET-8	geen LRIT	1695.15 HRIT	41.5° degrees O, IODC
GOES-E (no. 16)	1686.6 GRB	1694.1 HRIT	75.2 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 13	1691 LRIT	1685,7 GVAR	60 degrees W, Backup
GOES-17			137 degrees W, under test
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	no HRIT	140 degrees O, via HimawariCast
Himawari-9		no LRIT, no HRIT, Backup for 8	
Feng Yun 2E	-	-	86.5 degrees O
Feng Yun 2F	-	-	112.5 degrees O, Backup
Feng Yun 2G	-	-	105.5 degrees O
Feng Yun 4A	1697 LRIT	1681HRIT	99.5 degrees O, Operational

## Launches

Fen Yun 2H	Launch juni ? ( geostationairy)
MetOp-C	Launch 19 september
Elektro-L no 3	Launch 22 oktober

GOES-S was launched on March 1st, 2018 from Cape Canaveral. Launched GOES-17 after launch and with the same instruments as GOES-16, it will replace GOES-W by the end of 2018.

Unfortunately, DVB-S and most "DVB-S2 without VCM" receivers are no longer usable for EUMETCast. With a special driver some recent DVB-S2 receivers can still be made suitable for Basic Service Only. (only the TBS-5980 and Skystar 2 eXpress HD, unfortunately this does not apply to the Skystar HD USB box)

The signal at 10 degrees east has a larger bandwidth and is therefore weaker than before.

Recommended tray diameter is 80-90 cm for Basic Service and at least 120 cm for High Volume Service 1 and 2

The 2nd EUMETCast transponder T2 is on 11387.500 MHz Horizontal and transmits HVS-2. The Symbol Rate and mode is the same as HVS-1 (33000 kSym / s DVB-S2, CCM mode, MODCOD 16APSK2 / 3).

For good reception the same applies as for HVS-1, in good weather a 90 cm dish is sufficient but you actually need 120 cm.  
<https://goo.gl/Ak2GYA>

Users can receive GOES 16 data live on T2 / HVS-2 after request. Unfortunately this is in NetCDF format. In addition to SNAP, EUMETCastView by Hugo van Ruys can display this.  
<http://hvanruys.github.io/>

David Taylor has written an experimental netCDF reader:  
<http://www.satsignal.eu/software/NetCDFreader.zip>

Since July 2017 there have been strong signal strength variations on EUMETCast transponder T1 on 11263 MHz Horizontal.

Unexpectedly, Eutelsat, the satellite operator, has started another service at 11263 MHz Vertical!

Due to "congestion" in the TV satellite world, we see that more and more transponders are being used on Eutelsat 10A. For optimal signal quality (SNR) you have to turn the LNB (Skew) so that this vertical transmitter is attenuated as much as possible. A

LNB of moderate or poor quality can now suddenly give problems if it has poor attenuation for the vertical signals. This is called Cross-polarization isolation. This value should be better than 22 dB and indicates how much a vertical transmitter is attenuated when the LNB receives horizontally.

But also on neighboring satellites such as 7 East and 13 East, transponders are now active on or around 11263 MHz. Here you can do nothing with a better LNB, dishes smaller than 120 cm have a larger opening angle and will experience more interference from neighboring satellites.

Eumetsat recommends that you repeat the fine-tuning of your dish every year and pay attention to proper rotation (Skew) of LNB. If possible, also check the focus (sliding in and out towards the dish).

If the old SNR values are no longer feasible, it may be necessary to replace the LNB with one with better "Cross-polarization Isolation".

See "EUMETCast Europe Link Margins Explained" at <https://goo.gl/8bB4Jj>

In the coming weeks, Eumetsat will redistribute the distribution of the data on Transponder TP1 and TP2. Now the new GOES 16 data is on TP2 and Sentinel 3A data on TP1. Sentinel will move to TP2 where more Sentinel data will come in the future. The Goes 16 data and test data from NOAA20 goes to TP1.

Adjustment of the recv-channels file will be necessary.

Start Date	End Date	Description	Notes
18/06/2018	21/08/2018	Parallel phase for Sentinel-3A: data will be available on both TP1 and TP2	From 22/08/2018, Sentinel-3A data will only be available on TP2
22/08/2018	11/09/2018	Parallel phase for GOES-16 and NOAA-20: data will be available on both TP1 and TP2	From 12/09/2018, GOES-16 and NOAA-20 data will only be available on TP1