DE KUNSTMAAN

In dit nummer o.a.

Prototype nieuwe downconverter

QPSK Ontvanger

en nog veel meer

Dear member,

This pdf contains translated articles of our Dutch magazine "De Kunstmaan".
Google Translate is used; and mostly some corrections are done afterwards. Hoping that this will
give a usable translation. Translation for each article is mostly done by the author; pictures from the
original article are not always added. In that case please use the "paper" (Dutch) magazine together
with these translations.
Internet links mentioned in the articles can also be found at our website; see menu 'Weblinks' at:
www.kunstmanen.net

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

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Content

Photo front page:

For some members nothing is too crazy to find out the most ideal rotator / antenna combination. According to the builder, he received noiseless NOAA18, using the "umbrella-antenna-on-XY-rotor". How he did do this can be read in the next issue.

Preface

On Saturday, March 11th, we were back at the fair in Rosmalen. The stand crew consisted of Rob, Ben, Timo, Henry and first present Roel.

We could show live reception of MSG. There were some cable perils but they were quickly resolved. It was a great day with lots of interested parties for the Working Group. Several people have indicated to want to join.

So I came to the webmaster of http://electronicsandbooks.com. He is an avid scanner and already 200! meters of bookshelves are scanned. It is mainly data books scanned at a resolution of 600 x 600 dpi. The result is more than 16 TB of information. I want to make any mention of this site because this site can't be found via Google. Finally I found the datasheet of the UV916!

On March 18, we had a pleasant meeting. Very nice was that after the presentations live reception of NOAA19 was our new members Roel and Job. Roel used a V-dipole and a RTL dongle. Job used a homemade Quadrifilaire Helix antenna, design Rob Hollander, who could give explanations. The receiver Gqrx software under Linux. We heard the lady on high heels!

Live receipt of the NOAA19 quadrifilaire with a dipole antenna and a V-

In the presentation Rob mentioned the decoding of Metop Fengyun and he mentioned that he had "cracked" the code of Fengyun. With self-written software that does the following:

- I / Q split

- double punctured Viterbi - decoder

- differential decoder

- two streams recombining

- recognizing sync word

- descrambling

The first picture below.

The Fengyun first decoded image. Receiving the QPSK receiver, the datadumper in HRPT decoder and custom made software Rob Alblas

The challenge now is to translate the software into VHDL and fitting this in GODIL.

Component Packages for the QPSK receiver

We have quite some applications for the parts packages for the new QPSK receiver. The total parts package costs 120 Euro. Only demodulatorpcb costs 60 Euro.

Rules / points

- HRPT decoder and downconverter are not included

- UV916 tuner and SAW filter are ex-equipment and tested

- The LT5546 is soldered to an adapter plate and tested

- Arduino microcontroller is programmed

- A lot of 0805 SMD components. This is easy to soldering. There are also two SOT23-6 parts. This is also soldered, no coffee drink 24 hours in advance (just kidding).

- Adjustment to the NOAA19. You must have a working HRPT reception system!

- Furthermore, you must have a HRPT decoder. The current pcb for the decoder and USB interface from Sparkfun is unfortunately not available. We will have to create a new pcb if there is an alternative to the USB module. As long as the new pcb is not available, it can be on an experimental pcb, see March Kunstmaan 2011 on page 18. On eBay is a USB interface, see the December 2016 Kunstmaan page 3.

- Real-time decoding of the Fengyun satellites are not in the GODIL (yet)

More disclaimers I can't think of, other than the usual risks of DIY electronics projects.

To avoid my house is going to look like the warehouse of Mouser and me a fourth mortgage must include the request for a deposit to do 50 Euros (the total amount allowed) into the bank account of the Working Group, stating deposit QPSK receiver. Also send an email to the treasurer if you have made the payment.

Mouser Electronics warehouse

Dispatch

I am now busy with ordering parts. Thereafter, when soldering and program the testing to take place. My intention is to distribute all of the May meeting. The total amount must then be paid.

Are there people who are reluctant to see to build the receiver itself. Let me know, we can see if we find anyone who wants to build the receiver. A small gift to the Working Group is appreciated, it is quite a small day work.

Kunstmaan

This Kunstmaan is again filled with readable articles. Rob has made an effort to write the notes of the meetings and an article on the data format of the Metop. Harrie designed a new prototype of the downconverter. Fred suffers from large rats that have no respect for our hobby. Paul makes his contribution as a librarian. Arne has provided satellite status again. Thanks for all the contributions. Wish everyone a pleasant reading.

Lecture on interdigital filters on May 13

13 May General Assembly

The next meeting is on 13 May. This is our General Assembly. The figures for 2016 are in this Kunstmaan.

Presentation from Jos Disselhorst about interdigital filters, which was scheduled first on January 7, will take place.

Weather satellites in Vietnam (23)   **Fred van den Bosch**

Summary
My experiences with weather satellites, etc. in Vietnam.

APT
Rats ...
For a change this time with four legs and a tail.

I write a more or less daily post about Vietnam [1]. They have been mentioned a few times: fried in [2] or as a nibbler or the wiring in my motor bike[3].

This time the trouble started with a poor reception from the weather satellites. First of all checked: Receiver, plugs, cord to the computer, antenna on roof ...
Until I crawled with some difficulty under the workbench where the antenna cable around a half meter high disappers in a pipe to the roof. Sure enough, largely gnawed, the metal shield too.

After a few days I had finally made some sense to fix the issue. Because the ruined part was in the pipe, I had to go first to the roof to loosen the cables down so I would have more slack. I look in the pipe and & * ^% ^ # ^% * # $ & ^ $ #: ALSO eaten! The

little piece of enthusiasm was gone in no time. It is still not clear to me how these animals got there: the pipe up? In some way over the roof? No idea.

A few days later it was finally dry, so I decided to start the motor bike to make some enthusiasm to repair. (* & ^% * ^% * # $ ^ * &%) (* ^ BOTH HELMETS GNAWED THE INSIDE!

The following Sunday at appropriate reluctant anyway to work. Below a piece of cable is cut from it, and again brazed to each other. Above a whole lot cut out and soldered a plug to the cable again. And yes, the reception is back to normal. Sigh. Presumably both above and below somehow to protect the cables with gauze. The strange thing is that the cables from the HRPT-dish for months down loosely on the terrace and there is nothing at all.

But all this misery left me in doubt: does it make sense to buy a new motor when the rats might again devour the wiring? My current barrel is quite simple and so easy to repair itself. Another deep contemplate.

An additional reason is the superstition of all the people around here.

Our two dogs are quite active lately when it comes to catching rats. It seems they have agreed together. Previously, they pushed away each other in their zeal to catch them. If there is now a rat is in the storeroom, Bugi is in the doorway and Ruby 1- 1½ m. behind. If the rat passed Bugi it's the prey for Ruby. Is there one among the fridge they both choose another outlet where he can come along. They have catched the last few weeks already a bunch of them. And according to everyone rats come back for revenge if a fellow is killed.

When I see what is ruined here in a very short time, this could well be based very seriously on truth.

Actually, I discussed above against the Vietnamese use. In such cases these animals are never mentioned by name, but Vietnamese always say "Ông Mo Nhon" you can translate literally as "Mr. pointy snout. "

HRPT
<u>Rotor</u>
Because of bad weather, this project stopped for a while after my vacation: the rotor was not completely waterproof yet. Thereafter, first all the adjustments in WSAT are tested from front to back and back again, and, in particular, to the storm position. Rob explained in detail the simulation capabilities. Because this could be interesting for others, here is his -slightly changed- email:
"There are a number of possibilities in order to simulate a transition. In Xtrack: through predictable, possibly speed set at 10 or 20, to flush it through faster. The rotor can no longer keep up with that, but that's to see if redirected to the correct values are not so important. I see the end is indeed the storm position. You must be completely left under the 'satellite' button click to 'rot' (if you hover the mouse over this button brings up a helpje). Lets you determine which indicates the position: where the satellite or what is sent to the rotors.

The other method is by outside predictors to play with the minute button. It also works with the rotor (in so far as it can keep up with), and also with the storm position. Only you have to just look at the delay; if you eg. Repeat 1 sec. and have put one of the rotors has a delay of 10 seconds. Before he goes to storm position then you need 10x change over time.

With this you can conveniently click back time and coming over to do again. (Instead of the minute-button you can get others, but with sec. Click jump accident and hours of your course as an on coming back.)

In WSAT it's something else. The tracker tab see "test_offsetmin 'stand. This allows you to put forward or backward in steps of 5 minutes. A bit rough, but I'm fine. You look at the elevation to see if the satellite "to". You have a separate field for indicating what the rotors so that you will not have to adjust.

You increase the test_offsetmin so until the elevation> 0, watch 'To rotor ", increase test_offsetmin again so elevation <0 and look again at' To rotor. Here you see depends on delay set the X / Y jump one by one to the storm position.

Here you see the result on the display of the decoder. (In Xtrack I noticed, however, that there not be displayed positions, so that part you can look better with WSAT.)

Although the underlying routines and WSAT Xtrack equal (literally, the same source files) the gui is slightly different. In WSAT so is not a simulation as in Xtrack. The test_offsetmin is to still do something (would actually invisible in normal operation and must always be at 0).

The list provides information on the first-following on agreements to; the first is used and the rest is just to show what else follows.

Incidentally, I have now made an adjustment so that the test_offsetmin also affects the list. That is, you can then test_offsetmin time sequentially set in such a way that the upper satellite is "on", then you can increase test_offsetmin further (or to wait until it is done by itself) so that the upper satellite is again below. Then there is generated a matter of a new list, or the satellites slides 1 place upwards. (Now that only happens when the 'real' time beyond the on-time of the top sat. Is.)

Before you can use better Xtrack extensive testing of the rotor; test capability in WSAT only to have "something" to test the essentials. "

Tree
After returning from vacation was quite a tall tree finally cut down on the south side. Minh was there before asking essentially the owner. My biggest fear was that he would fall and land on our house. Given Vietnam's build quality was thinking corpse immediately uninhabitable.

The certainty with which some neighbors claimed that the tree would not fall, I did not share. Before that there were often too many dead leaves in the garden. But you could see them thinking: "not nag, that thing's never fallen." Oh yeah...

And, as an additional advantage for some tracks I also have a clear view to the south.

Antenna installation
The next stage is a complete project: disassemble, paint, lubricate, balancing, assembling and finishing, making rain jacket, testing, bring to the roof, assembly, testing, cable pulling down, down test and completely deploy. This was long ago worked out in a mind map. It is just one step to follow the schedule. At the time of submitting this article is all apart and painted. The following Kunstmaan I can hopefully tell you the end result.

The raincoat problem I move a bit more into the future. It's now of plastic, which Minh uses for a solid cover of the books of her library established for the children of the vicinity. And I can make a new poncho again very quick. Hopefully it will last a few months , so I have time to look for something better. And there is still almost a whole roll, so I can use more ...
Right now I am thinking about ordering a rescue blanket. [4] See if it is sufficiently strong. For the price I do not let it.

Miscellaneous

<u>iThoughts</u>

For a number of years I use iThoughts to create Mind Maps. Until recently this program was only for iOS (=iPad and iPhone) and the Mac. Recently, there is a Windows version. At time of writing it was still a beta version, but has become an official version with the opportunity to try it for 14 days. Who wants it can download it from [5].

<u>Electronica</u>

A Website with lots of diagrams and explanations [6].

References

[1] Daily Post about Vietnam, see website
[2] Fried rat, see website
[3] gnawing rat, see website
[4] Rescue Blanket, see website
[5] iThoughts, see website
[6] Electronics, see website

Dear people,

At a January meeting, you can expect anything. Snow, ice, slippery roads, New Year's reception, wine, piece of cheese. What you just won't expect: credits. "Nice" and "funny" was the least I got thrown at my head. Meanwhile no word about the high level of these writings. I was obviously very upset. I got close to crying. I've been trying for years now to get some doctorate of honor, or something from that Nobel guy from Oslo. The field of expertise does not even matter, it is just about the cash prize. But if you run giggling about my solid dissertations, I can forget about it. This notification is therefore present from now on strictly scientific and deadly dull.

Beautiful clouds picture! Made by the new GOES 16 of the NOAA, launched in November 2016 and the picture is on internet magazine Scientias.nl. It gives the impression as if you glide in a capsule over the clouds. Maybe it's because of the moon in the background, a bit like the famous Apollo 8 photograph but in reverse. Soon there will be the GOES 17 too. Scientias does have more items that appeal to our interests. Take those two Germans considering to send robots to the moon to inspect the landing area of the Apollo 17. I immediately wonder if we can capture those images also at the club itself. 60 Years ago they worked on 2+ Ghz; if they do so once again we have a chance. This would also free us from internet streams from the rickety internet providers today. This applies also for all other moon trip that is coming. SpaceX will send a few tourists to the moon, and hopefully for them, take them back as well. For us there might be a great chance to catch those communications.

In March Electron a method to avoid space debris: throw a wire, a few hundred meters ("tether") out of a cubicle (small satellite) and then create a short circuit and brake in the earth's magnetic field. It seems to work: it forces us to re-entry after the service. Original idea! It would not have entered my mind. The advantage is that all precious materials, albeit flawed, still remain on our planet. Everything that is shot in probes into deep spaces we loose.

At home with Arduino they were chasing each other for a while with pitchforks, shovels and garden timber axes. Fortunately, only virtual. This saves on hardware costs that can be high in a garden shop. Nevetheless, we, the users, still suffer. Previously two separate IDEs have been published, 1.6 and 1.7. They had nothing to do with each other, because they supported entirely different controller boards. Now there is a merged version 1.8, but this lacks support for some older platforms. Elektormagazine.nl, the gossipping and backbiting nephew of Elektor gives us this rather useful warning. So having one easy microcontroller platform is now again a bit out of view. We can only wait for this to be dealt with. Until then: just look out and don't discard your old versions before you have (working) new ones.

Tested for you: Digispark. I got one rather cheap. It comes from a small firm Digi Stump. I did not know even know what it was, but it aroused my childish curiosity and for a price I could not resist. Examine everything and keep the good, the apostle Paul says (who else). So at home that very small PCB 2 by 2 cm got immediately connected with USB. An encouraging LED welcomed me. Then reading on the site.

It is a miniature Arduino with ATtiny. But including a bootloader over USB, and PWM and ADC, SPI and I2C, but fewer I/O pins. Destined therefore for lighter work; calling it a USB development board, I think is overdone. There are two versions, 2 and 4, with a small but relevant difference in the pin-out. Such is the LED output to different ports. According to the website. But I had a version 3, and that surprised me at first. A consequence of my naivety. A long story and quest over the user forum: it is fake and not from Digi Stump at all and they are not amused.

Now the Digispark hardware itself is released under open source license, but the problem remains. Original product? Is fine. Clone openly announced as open source clone and approachable for information? Also fine. This one is neither, but suggests yes/no to be original or clone. Do you have a specific question, such as to the free and occupied pins, you have to experiment. However, you do not know what else you can expect to deviant behavior; users

report problems. When it comes to building an ultrasonic mosquito repeller or controlling an automatic cat door, then it is not critical. If you build such a thing in a satellite dish control or wheather probe and it does not work, then you will be angry. Meanwhile, I have not come to testing. That's gonna be done when my blood pressure has dropped.

In ElectricData, a magazine about new products especially in technical automation, I am amazed to look at the performance of modern oscilloscopes. The HDO9000 of Teledyne LeCroy gives 4 GHz bandwidth and sampling rates up to 40 GS / s. The latter will probably be done in parallel, otherwise I can not understand it. The numbers remain high. We could hang our receiving dishes directly to it. The price of the toy: think of 40,000 euro. And no, that is not a decimal comma. if you might hope. That reminds me of small private sorrow: I bought a year ago a fast USB SmartScope. That would even run over USB on my old XP laptop, but unfortunately, no success. And to buy a Win 10 there again ... then I loose the purchase benefit. So I'm facing a small job in the weekend. If it succeeds, more about that in my next article for you.

Real men fight with wild animals, dive in a ice holes in winter and use assembly language for programming. The latter is not so easy yet. But to put a machine entirely to my control has always fascinated me. Once on the Z80, 6502, 8086, PIC and now I felt the desire to throw myself on the Atmel Culture (engine of the real Arduino). ATtiny has not much memory, so assembler is still really useful here too. I could get a book for review called: Programming and Interfacing Atmel AVR Microcontrollers by Thomas Grace. Recommended! And now you want to know why. Well. It's always a little personal what you expect from a book. We often do not need to get explain what a bit, a resistor or an AND gate is. So I jump straight to Chapter 2 (architecture). The explanation holds a nice cross between a datasheet and too vast explanations in other books. Chapter 3 (hardware interfacing) and 4 (projects) the same approach - they do not need to read more than needed to get you working.

Meanwhile, I've just spoken with our three new members. None of them left the building afterwards loud screaming; therefore they are made of the right stuff. Good to see that people are attracted to our world of creating something together. Welcome! That they will be happy members of the club for years to come is the hopeful expectation of

your librarian

Prototype of a new down-converter for the 1700 MHz

Text Ben Schellekens / design Harrie van Deursen

summary

This article describes an initial design for a new down-converter from 1.7 GHz to 700 MHz. A PLL chip from Abracon is used as a VCO.

Introduction

For the reception of HRPT and AHRPT (Metop and Fengyun) in the 1.7 GHz band is a down converter is required in order to bring the signal down in frequency to an area which can be received by the UV916. The UV916 has a range of 46 to 860 MHz.

Importantly, the new design generation and certainly no difficult adjustment points. The first recording is provided below.

First recording with the new downconverter

LNC1700

With the old down converter, the intermediate frequency is around 137 MHz. This is a historic development. For years, weather satellite images are transmitted in the 137 MHz band by the polar satellites, these are the A(utomatic) P(icture) T(ransmission)
recordings. The first geostationary satellites (such as Meteosat-7 and its predecessors) transmit in the 1.7 GHz band WEFAX-signal. This signal is similar to APT. How useful is it to be able to use the existing 137 MHz APT receiver. You only need an antenna and downconverter to receive WEFAX.

Since the WRX-1700 uses the UV916 as a front end in the receiver the need to use the 137 MHz actually disappeared as intermediate frequency.

The LNC1700 was originally developed by SSB electronics in Germany. The design is public and can be built provided you are able to find the parts and print. Adjusting the multiplier stages is not easy and requires some instinct.

Principle of the downconverter

The principle is not exciting: the 1.7 GHz signal is mixed with the signal of the local oscillator in order to arrive at the lower frequency. Of course there is also a mirror that must be filtered.

Where with the LNC1700 the intermediate frequency is around 137 MHz, this is much higher in the downconverter, namely around 700 MHz. For the UV916 is no problem to receive. You will need a sketch in Arduino keeping this in mind.

Mirrors

In the LNC1700 runs the local oscillator at 1557 MHz. This means that the down-converter is also sensitive to 1557 - 137 = 1420 MHz. This is in relative terms is still close to 1700 MHz, and is therefore to be filtered less well off. In practice, this results in no problems because this is a quiet part of the spectrum.

The new downconverter has a local oscillator which operates at 1 GHz. The mirror is then 300 MHz and is very good to filter out.

Schema

After the (optional) bandpass filter the signal is fed into the TAMP-242GLN. This amplifier is the same as we use in the helical but in print / module footprint. The gain is around 30 dB. The question is whether in some cases this is not too high. When the 1800 MHz signal is not suppressed enough, this will also be amplified by 30 dB with all the risks of intermodulation and distortion. Perhaps the use of a PGA103 is better, to overdrive this is much harder.

Mixer

The diode mixer is the ADE-11X from Mini Circuits. The advantage of this type of mixer is the insensitivity to strong interfering signals (which then work as a local oscillator signal). The input and oscillator signal properly attenuated at the output.

Oscillator

In the LNC1700 is a crystal which brings to the 1557 MHz by three multiplier stages. Today, this has to be easier?

Initially we looked at products from Mini Circuits. They provide so-called synthesizers, small modules with VCO and PLL. In the past I have written about it. The disadvantage is that they are relatively large and require a microcontroller to put them on the right frequency. I also wonder about the security of supply because the synthesizers that I purchased for my experiments in the past are no longer available.

After long searches Harrie encountered products from Abracon. They have oscillators in a housing of 7 x 5 mm in which all occupants: crystal, VCO and PLL. These oscillators are not cheap, but you are done right. Another minor disadvantage is that they are not easy to obtain.

Abracon has this crystal oscillator in different versions. There are 1 and 1.5 GHz versions, disadvantage of the latter is the image frequency that lies close to the desired reception

frequency. You also have them at a fixed frequency (XO) and the VCXO where you can adjust the frequency of something. The latter we use in order to set the oscillator exactly at 1 GHz.

The differential output is around 350 mV, is around 1 dBm. For controlling the 7dBm mixer this is too little. A PGA103 is used as a buffer amplifier. The output is a square wave type. That means that there is mixed on the 3rd harmonic. In practice, we experienced no problems with it.

The LO level is easy to get value with the selection load resistor at the output of the VCXO, an attenuator is not needed!

Output

At the output of the mixer is an (optional) low-pass filter. This is certainly necessary when there are two PGA103 after each other. The low-pass filter is required for suppression of the local oscillator at 1 GHz and the mixing product at 2.7 GHz

The second PGA103 can be provided optional. Use you do not then you can bridge with a capacitor 100p.

Filter

There is an absolute necessity in order to filter the signal before it enters the down-converter or mixer. The signal levels of the 4G / LTE bands are so high that they are about to send LNA's and down converters. The problem frequencies are around 800 MHz and 1800 MHz.

Mini Circuits now makes beautiful little band pass - filters, such as the BFCN-1690 which is exactly the right frequency. The attenuation of 3 dB is unfortunately on the 1800 MHz too low. The 800 MHz is 45 dB well damped. Here's another solution will have to come to. An interdigital filter works very well.

Furthermore, you have the mixer output to the various mixing and the oscillator signal. This will have to be away filtered. In the design is here provided with a low-pass filter from Mini Circuits on the 630 MHz. This filter also suppresses the 1 GHz oscillator signal.

The next design is probably a bandpass filter with single coils and capacitors. We do not stick with the minimum order quantities Mini Circuits and it is much cheaper.

Experimental design of the downconverter. The PCB measuring 37 x 74 mm. To the left is the entrance

Construction

The construction should be no problem. The design fits in a standard tin can of 37 x 74 mm.

Adjusting the VCO is easy with the trimmer. This will need to or on the spectrum analyzer with a frequency counter. Did you not then you can also put the trimmer in the middle of the range, slackening it not all.

Epilogue

It is an initial draft. Love to hear from other any suggestions, improvements or additions. Let know if you are interested in this downconverter. The parts are not available on the street corner and we can start a procurement action. Hopefully we have a quick alternative to the LNC1700.

Direct reception of METOP (part 2)

Introduction.

In the previous Kunstmaan ([1]), I have described a decoder for METOP making is possible to directly display the received image. This decoder housed in the GODIL module with the old HRPT NOAA and METEOR decoders, is now operational.

In addition to the decoder it was also necessary to adapt the software, which is used to pick up the METOP data from the decoder. A significant difference in data flow between METOP and NOAA is that METOP uses AHRPT (Advanced HRPT), and NOAA HRPT. In HRPT, such as NOAA that transmits, the data consists almost entirely of a single type: AVHRR. This can be transmitted in a fixed manner.

With AHRPT multiple data-streams are sent. So it is necessary to detect and extract the desired data from the received data.

NOAA versus METOP

I will now try to explain how the METOP data is structured. In a serial bit stream, transmitted by both NOAA as METOP, it is actually a matter of counting in order to find the meaning for each bit. This will require a reference point from which to start counting.

That reference position is at NOAA simple: all the bits for a complete line are grouped together in a frame, and that frame begins with a synchronization word. From the beginning, for example, bit no. 7501, is the MSB of the first word of channel 1, and bit no. 109909 is the LSB of the last word of channel 5.

In METOP, it is somewhat more complex; the above-mentioned bit is not set to a fixed location in a METOP-frame. Besides the start of a METOP-frame there is a second reference point need to be taken into account; said second point indicates where a particular type of data (eg. AVHRR) begins. Ultimately it is also a matter of counting here.

The instrument by which the HRPT data is created, AVHRR, is for METOP the same as those contained in the NOAA's. That's it for equivalence between METOP and NOAA; METOP transmits much more data than just AVHRR. The data rate (after decoding) is therefore much greater: 3500 kb / s (NOAA: 665.4 kb / s) The AVHRR data needs to be extracted from this data. On average(!) the data rate of the AVHRR portion is equal between NOAA and METOP.
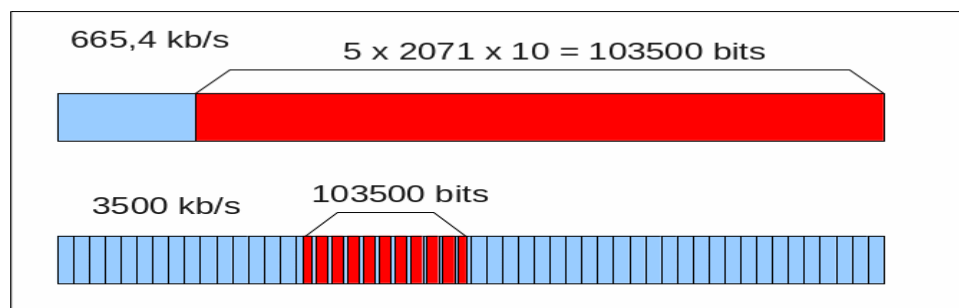
Fig. 1. NOAA and METOP-frame.

Fig. 1 shows very broadly the difference between NOAA and METOP.

For NOAA a single frame of 110900 bits is illustrated. The red part contains the AVHRR-data: 5 channels, 2071 words of 10 bits per channel. Of 2071 words, there are 2048 for the pixel values, the remaining 23 words contain calibration data.

The left part comprises the 60-bit synchronizing word, and some extra bits. This frame is transmitted every 1/6 second.

METOP shows a very different picture. Here about 70 frames of every 8192 bits are sent in the same time span. In a small part of it the AVHRR data is added, cut and spread over approximately 14 frames. The amount of bits in the red portion is at METOP and NOAA the same, but METOP dispatches it at a 5x higher rate.

Where HRPT in the extraction of the channels is very simple (an issue of bits counting), it is at METOP so much more complex. First, the AVHRR-pieces must be localized and concatenated to each other, so that in the end there is again formed a single block AVHRR data, just as with NOAA: 5 channels, 2071 words per channel and 10 bits per word. Together, this constitutes one image line for each of the 5 channels.

Summarizing:

NOAA: each frame contains exactly one line, all the bits are in fixed locations (for example, channel 1, first pixel, the first bit at position 7501).

METOP: multiple frames for one line, frame can also contain different than AVHRR data. No fixed locations for the bits in a frame.

METOP-frame

I will only mention here the issues that are important to obtain the AVHRR data.

Fig. 2. Structure-frame METOP

Fig. 2 shows a top plan METOP-frame.

The frame includes three parts:

- left: sync word (4 bytes)
- middle: the actual data (892 bytes)
- right: extra bytes serving error correction (Reed Solomon, 128 bytes)

The synchronization bytes have already done their job in the decoder; error correction is a separate story which I will leave out for the moment. The remaining 892 bytes are now featured in the middle part of Figure 2. In this section, are again two parts to be distinguished.:

- Left: control / control bytes (10 bytes)

- to the right of the actual data (882 bytes)

The 2nd byte of the left-hand part contains a code that indicates what type of data level in the underlying data block. Code = 9 indicates AVHRR.

A block AVHRR contains all of the data bits associated with one scanning line. This therefore corresponds to the data in one NOAA-frame. The 103500 bits, corresponding to about 12944 bytes (22 additional bytes are added, so a total of 12966 bytes), clearly does not fit in the data block of 882 bytes in the METOP-frame. The data must be distributed across multiple frames.

The beginning of a AVHRR-block does not have to coincide with the beginning of the data block in a METOP-frame. Here the aforementioned 2nd reference point is required; these are the 2 bytes at position 9 and 10. In Fig. 2 this is illustrated at the bottom. If these bytes represent the number 'n' then a new piece of data (eg. beginning AVHRR-line) begins at position n in the data-block. From that position, space of 882-n bytes are available for the start of the AVHRR data.

The remaining bytes are then in successive frames. In those frames the 2-bytes number shows '2047' which hasto be understood as a code: the entire data block is used for (in our case AVHRR) data.

Altogether, there are at least 12966/882 = 15 frames needed (rounded up). The AVHRR data is distributed as follows:

- 1st frame: 882-n bytes

- 2nd ... 14th frame: 13 frames in which the data block is entirely filled with AVHRR, therefore 882 * 13 = 11466 bytes

- 15th frame: the rest, so 12966-11466- (882-n) = 618 + n bytes

In the 15th frame the 2-bytes number points at 618 + n: the last part of the data block is equal to the start of a next block.

To summarize: With the combination AVHRR ID number (= 9) and the reference points, the entire AVHRR-block of 15 consecutive METOP-frames can be extracted.

Further processing AVHRR

Now the AVHRR data is extracted a new chapter begins; the story of frames etc. is from now on irrelevant.
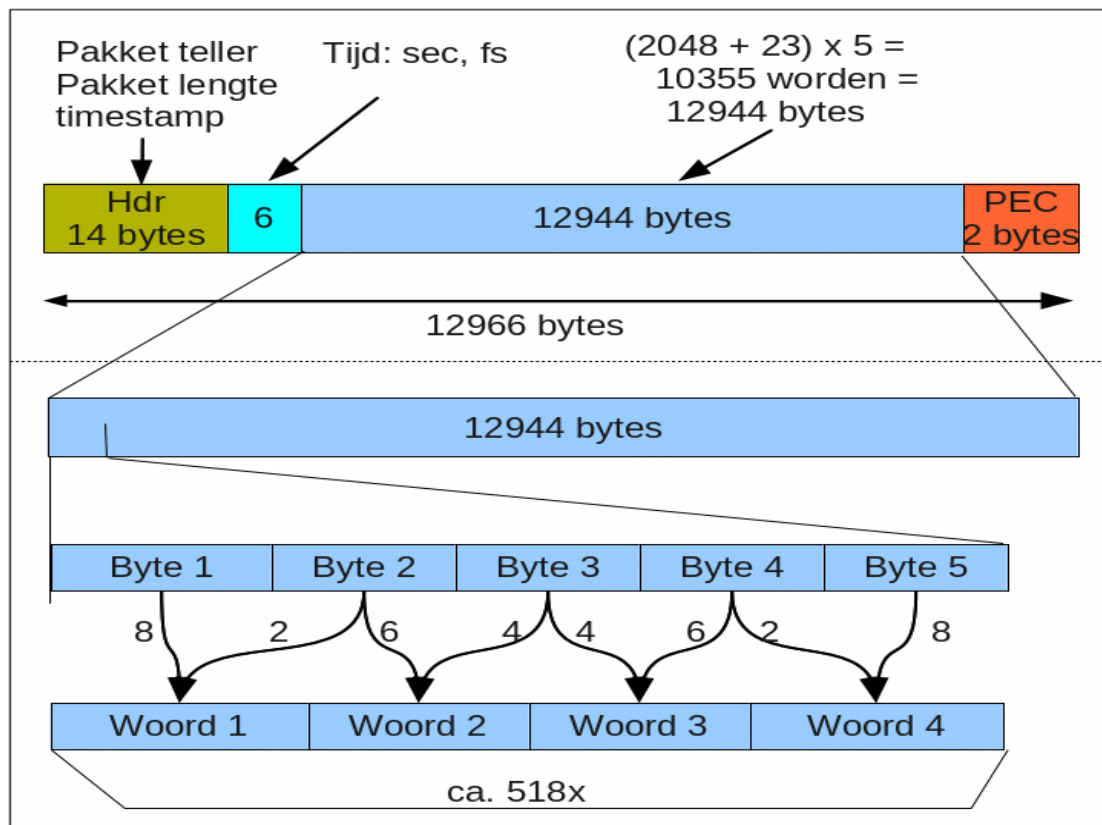
Fig. 3. Structure AVHRR package.

In FIG. 3 at top the complete data packet of 12966 bytes is shown. There are again a number of distinct parts:

- check bytes, including counters and a time indication (20 bytes)
- the actual AVHRR data (12944 bytes)
- check-bytes (a kind of parity bits) (2 bytes)

The check bytes can be used to determine the reliability of the data; correction is no longer possible here.

The original AVHRR data are 10-bit words, no 8-bit bytes. So the 12944 bytes should be converted to 10355 words (for the calculators: there still remain two bits about which nothing is done). This is per channel 10355/5 = 2071 words, each of 2048 words for the pixels, and 23 words for calibration etc. The latter conversion is shown in FIG. 3, shown at the bottom.

With 2048 words per channel now a single-line image can be constructed; AVHRR-consecutive blocks contain sequential lines which ultimately results in the image. There remains one point: the conversion of IR pixel values to temperatures, using the enclosed calibration numbers. For this purpose, serve the 23 extra words per channel:

- one word ... 10 "detector space view"
- 11 word: disaster calibration
- Word 12 ... 2059: 2048 pixel values
- Word 2060: IR target temp.
- Word 2061: Pach temp.

- word 2062 ... 2071: IR back scan

The descriptions match with what is used in NOAA / HRPT-documentation, only the order is slightly different. Because the AVHRR instrument on METOP is equal to that of the old NOAA's converting IR pixel values into temperature is also the same.

After all of the above-mentioned operations, the available AVHRR data structure of METOP equal to that of the NOAA's; the rest of the operations, such as making "false colour'-plates (assemblies of different channels, and displaying, on RGB) is not different than at NOAA-data. If desired, a program like HrptReader of David Taylor can be used to create the "final product". For this purpose WSAT can convert METOP-data to NOAA / HRPT format:

- the 6 sync words are placed at the beginning

- the time stamp is converted to 10-bit words (this part sits outside the AVHRR-data) This is important in order to be able to add the right Kepler-data.

- the AVHRR data is, after the described conversion into 10-bit words, put in the right place

- some things like the last one hundred words in a NOAA frame are not important and not available; which bits are put to '0'

In the end, there is now constructed in a NOAA frame format with which can be made a file directly.

In addition to the 10B-format WSAT can now also be generated a .hpt format. This is the standard format David Taylor uses as input / output for his software. (In the .hpt format 10-bit words are stored in 8-bit bytes in a manner as shown in Fig. 3, at the bottom).

Finally:

Are we done now? No, it can always be better. Currently no correction has been done with the 128 additional Reed Solomon bytes. This quality of the images can get some improvement.

And then there is still the Chinese Fengyun; given the strong signal of these polar satellites worthwhile to receive. Unfortunately, the Chinese have decided to do it completely differently, so there still needs some work to be done.

Literature

[1] Direct receipt of METOP. the Kunstmaan, 2016 no. 4, p. 7

[2] AHRPT data stream. Chapter 3: TD 18 Metop Direct Readout AHRPT Technical Description (see link on the website Kunstmaan)

QPSK receiver part 2

Summary

This article describes new developments of our new QPSK-HRPT receiver. The display pcb and the UV916 pcb are combined into one pcb.

Introduction

In the previous Kunstmaan is the description of the new receiver for HRPT and QPSK. The original design exists of three pcb's: UV916 the receiver, the QPSK demodulator and the display print.

After well have looked at the design it proved to be possible to combine the UV916 print and display print. The advantage is that it addresses the long ribbon cable, which has to be cut through in part, is no longer necessary.

Combined UV916 and display print

Modifications

On the next page, the diagram and parts list. Besides merging, there is not much changed:

- For the pcb design it was more easy to swap the AD-inputs 0 and 3.

- In addition, the connector P3 (this was P1) is extended by two GND pins.

To simplify the construction, many descriptions are included on the pcb with the connectors and trimmer.

Reference	Value	Footprint
SW1	SW_PUSH	Buttons_Switches_ThroughHole:SW_PUSH_6mm
C3, C6, C10, C12, C13, C15, C17, C19, C20	100n	Capacitors_SMD:C_0805_HandSoldering
C1, C4, C8	10n	Capacitors_SMD:C_0805_HandSoldering
C16, C18	22p	Capacitors_SMD:C_0805_HandSoldering
C14	10u	Capacitors_ThroughHole:C_Radial_D5_L11_P2
C2, C5, C7, C11	2u2	Capacitors_ThroughHole:C_Radial_D5_L11_P2
C9	100u	Capacitors_ThroughHole:CP_Radial_D8.0mm_P3.50mm
Y1	16MHz	Crystals:Crystal_HC49-U_Vertical
D1	1N5819	Diodes_ThroughHole:Diode_DO-41_SOD81_Horizontal_RM10
L2	100uH	Discret:R5

IC1	ATMEGA328-P	Housings_DIP:DIP-28_W7.62mm_Socket_LongPads
U2	MC34063	Housings_DIP:DIP-8_W7.62mm_LongPads
U4	TL272	Housings_DIP:DIP-8_W7.62mm_LongPads
L1	100uH	Inductors:INDUCTOR_V
UV1	UV916	KunstmanenKicad4:UV916hor
RV1	100k	Potentiometers:Potentiometer_Bourns_3296Y
U1	Recom R-78E5.0-0.5	Power_Integrations:TO-220
R15	100k	Resistors_SMD:R_0805_HandSoldering
R1, R2, R11, R13, R20	100R	Resistors_SMD:R_0805_HandSoldering
R17, R19, R22	10k	Resistors_SMD:R_0805_HandSoldering
R14	180k	Resistors_SMD:R_0805_HandSoldering
R10	180R	Resistors_SMD:R_0805_HandSoldering
R5	18K	Resistors_SMD:R_0805_HandSoldering
R3, R21	1k	Resistors_SMD:R_0805_HandSoldering
R4	1M	Resistors_SMD:R_0805_HandSoldering
R9	2K2	Resistors_SMD:R_0805_HandSoldering
R18	39k	Resistors_SMD:R_0805_HandSoldering
R8, R12	3k3	Resistors_SMD:R_0805_HandSoldering
R6	3k9	Resistors_SMD:R_0805_HandSoldering
R7	56k	Resistors_SMD:R_0805_HandSoldering
R16	68k	Resistors_ThroughHole:R_Axial_DIN0207_L6.3mm_Horizontal
D2, D3	LED	Sockets_MOLEX-KK-RM2-54mm_Lock_2pin_straight
CON1	CONN_01X02	Terminal_Blocks:TerminalBlock_Pheonix_MKDS1.5-2pol
P6	CONN_01X03	Terminal_Blocks:TerminalBlock_Pheonix_PT-3.5mm_3pol
P8	CONN_01X01	Pin_Headers:Pin_Header_Straight_1x01_Pitch2.54mm
P1, P5, P7	CONN_01X03	Pin_Headers:Pin_Header_Straight_1x03_Pitch2.54mm
P2	CONN_01X04	Pin_Headers:Pin_Header_Straight_1x04_Pitch2.54mm
P9	CONN_01X06	Pin_Headers:Pin_Header_Straight_1x06_Pitch2.54mm
P3, P4	CONN_01X08	Pin_Headers:Pin_Header_Straight_1x08_Pitch2.54mm

Report meeting January 7, 2017.

Opening by the Chairman.
The President wishes everyone a good 2017.
There are Twitter messages sent out about things we are doing, which also come reactions, so we go on.
2016 was a milestone for the group for the realization of receiving Metop with hardware and software made by the working group. We're going to look at Fengyun; the receiver we use is capable of receiving METOP.
There is a sign-up for components of the QPSK receiver: range of printing, the tuner UV916 and the required IC's and coils. (Including the small, readily available stuff like resistors, capacitors etc.) Then there is need for a downconverter (1700 MHz) and the decoder. As for the decoder, there is a problem related to the availability of the USB interface; SparkFun used version is no longer made. There are alternatives, but there is more "craft-work" required.
Ordered items may not exist for March because of the Chinese New Year.

Harm de Wit shows an interesting tuner type FM1216, which needs only 5V and SAW filters on board.

Regarding the rotor control: there must be easy to reconstruct rotor system are available.
There are several possibilities, as Yaesu, and DiSEqC types as Jaeger.
Furthermore, for the downconverter, an alternative must be available

Web site: Needs adaption.

There was a lecture scheduled for today, but the speaker, Jos Disselhorst, it did not dare to come because of the weather. The reading will be possibly in March.

Report meeting December 12,
No comments

Setting the agenda
No comments

administration
No changes; We are still looking for someone to website maintenance.

satellite Status
Little changed; see later in this Kunstmaan.

Any other business
Harry: About downconverter: instead of 137 MHz a MF of 700 MHz; is also possible; there are tuners suitable for this frequency. Then, it is therefore a matter of mixing 1700 MHz with 1 GHz. The relatively expensive crystals, for the oscillators to be mixed to 137 MHz, are then not necessary. Parts are getting easier; a simple passive mixer is sufficient. The oscillator is also easier to make. The temperature drift is low enough for this application. Furthermore Harrie has adapted the software for his rotor control.

The Jaeger-rotors appear via web stores still have enough in stock; They are 80 euros each. Drive system goes through a worm gear, so no chance that the rotor under the weight of the dish will turn by itself.

The electronics includes an old 8052, this must also be possible with an Arduino.

Incidentally, Harry Arends has its control of stepper motors also in operating.

Regarding the DiSEqC rotors must be said that they are actually used improperly, meaning an uncertainty about lifetime.

We conclude that a review should be the possible which rotor types we have now.

Harm de Wit makes us mindful of TV cards with print WinTV with Philips tuner type TSA55xx. This may be suitable as the basis of a receiver for weather satellites. Possible to get flea markets for just one euro.

Another type of tuner 1700MHz mixes directly back to 0 Hz. For this purpose, a SDR-like approach is necessary.

Roel: Is recently joined. His background is ICT, art school and working in education. He's starting ham.

Peter Smits:
Reports that is quite easy to make a rotor with a windshield wiper motor and gear.

Timo: makes our attention to a conference PA microvaves in Heelweg, on 14 January. There's now see a time-lapse video on their web site:
http://www.pamicrowaves.nl/website

Job: shows us some projects he is working on.

closure

Rob Alblas
(secretary AI)

Report meeting March 18, 2017.

Opening by the Chairman.
On this "rotormaniaday" many different rotors are exhibited.

We are working to put together the parts of the new receiver. A number of components must first be tested, in particular the UV916 tuner that is not a new one. The expensive components must be prepaid before there is going to be purchased. That will be 50 euros. Hopefully it can be ordered taken at the May meeting.

Last week we were at the flea market, which in turn has produced the necessary interest in our group. It has delivered at least one new member.

At the next meeting, May 13, Jos Disselhorst will give a lecture on designing filters.

Setting the agenda
No comments.

administration
We finally found some members for the website to improve it. Job de Haas and Roel Roscam Abbing, both recently joined, have thus already started working. The website will be possibly based on Wiki (MediaWiki); The intention is that the website can be used actively bu members to modify and extend.

satellite Status
Given by Arne; see later in this Kunstmaan.

Any other business
Harrie v Deursen:. Has built an alternative downconverter, which still needs to be tested.

Harm de Wit: is working to create a QPSK-generator, which can be used to test receivers. There is no beautiful constellation pattern of a connected receiver, so something is wrong here.

The BATC (British Amateur Digital TV) website describes how you can make digital TV. See Portsdown project.

Paul: bought at the flea market in Rosmalen an amplifier, 900 MHz.- 1.5G, for only 1 euro at van Dijken. The question is whether we can do something with it.

Dennis Sas, a new member introduces himself.

Elmar:
In October, the meteorological world expo will be held at the RAI in Amsterdam.
A call from Francis Bell / GEO for suggestions for a symposium. It is thought also to visit EUMETSAT in Darmstadt. (Usually the symposium will be held in Leicester.)

Job de Haas: Has made a quadrifilairantenne with the mold of Rob Hollander. He wondered how long the NOAA's remain in air; official that is until the end of 2017, but the satellites will (hopefully) continue working much longer. Moreover, the Russian Meteor can be received in the 137 MHz band, to which the antenna can therefore also be used.

The result is a brief discussion of polyester satellite dishes versus metal plates. The metal plates are particularly heavy because of the support structure to keep these antennas in the correct form. Polyester plates are more heavily but are much stiffer, so a light simple suspension structure will suffice,

Roel Roscam Abbing: has a V-dipole antenna; in conjunction with SDR (USB type) NOAA can be fairly well received. This antenna is very simple to make it by yourself.

closure

Lecture: Where are we now and Rotor Mania

Ben gives an overview of what it takes to receive weather satellites.
- Satellite TV standard dish or DIY; We have a kit.
- Rotor: azimuth / elevation or X / Y. Ready to buy is often cheaper than itself. There are even and made XY rotors for sale.
- An XY rotor has the advantage of flexible tracking of polar satellites, even if they come almost straight across. Mechanical balance is difficult.
- An azimuth / elevation rotor is simpler in terms of construction; follows harder satellites with high transit, but in practice this is not so bad.
- Helical: this topic is quite fully developed; see article in Kunstmaan December 2015.
- Preamplifier: A ready-to-use mini amplifier circuits is cheaper and better than self-building. Possibly there must be put a filter to prevent overload.
- Down Converter: Harry is working on a new DIY converter, which is much more compact than the old LNC1700.
- Receiver: Here are two possibilities:
  - WRX1700 as well APT needed
  - The new QPSK receiver also suitable for HRPT

Rob then tells about the different transmission methods; in particular a decoder for Fengyun is much more complex than for instance HRPT. He is now working to also program the decoder Fenyung into the GODIL module. Possibly some test generators need to be removee, to fit all into the FPGA of the GODIL.

Harrie: tells a bit about his past rotor. He has an elevation / azimuth system that works reliably for many years.

Hereinafter, the antennas of Job and Roel (quadrifilair and F-antenna) are tested outside, in the drizzle. They do both ...

Rob Alblas
(secretary AI)

Financial annual statement in 2016; budget 2017

This is a summary of income / expenditure for the calendar year 2016. The actual revenue / expenditure can (partially) be done in another year.

The balance also includes hardware issues that can still be sold.

The 2017 budget is also included here. The loss in 2016 is only slightly more than last year, because we got some hardware to sell. Unfortunately, it is expected that this loss will increase in 2017. For now we can bear this loss, but at some tome we need to do something.

Looking at the indispensable expenses 2017: printing / shipping KM, Nimeto and bank charges, then we arrive at an expenditure post 3080 euro. Income of members is 2525 euro. There is a structural gap of more than 550 euros! This corresponds to a "members deficit" of at least 20.

If there are any questions about this survey then let me know before the annual meeting (May 2017).

Uitgaven	2015	2016	2017		Inkomsten, bezit	2015	2016	2017
	Realisatie	Realisatie	Begroting			Realisatie	Realisatie	Begroting
Druk+verzendkosten K	€ 2.255,00	€ 2.255,00	€ 2.255,00		Contributie	€ 2.675,00	€ 2.555,00	€ 2.430,00
Huur Nimeto	€ 310,00	€ 319,00	€ 320,00		Info + kunstmaan verkoo	€ 11,00	€ 32,00	€ 0,00
beheerder Nimeto	€ 400,00	€ 400,00	€ 400,00					
Beurzen inschrijving	€ 178,00	€ 116,00	€ 120,00		Rente Zki spaar	€ 48,88	€ 21,10	€ 20,00
Beurzen onkosten	€ 0,00	€ 0,00	€ 50,00		verk. app. Schenkingen	€ 77,49	€ 132,00	
uitgaven werkprojecter	€ 0,00	€ 0,00	€ 50,00		verk. onderdelen proj.	€ 54,00	€ 25,50	€ 0,00
Abonnementen bibl.	€ 103,50	€ 103,78	€ 110,00		handboek inkomsten	€ 0,00	€ 8,00	€ 10,00
Internet abonnement	€ 49,75	€ 49,75	€ 50,00		vrijvallen huur Nimeto 20	€ 119,00	€ 0,00	
bank/paypal kosten	€ 122,68	€ 126,83	€ 130,00					
paypal kosten contr.	€ 6,54	€ 8,76	€ 7,00					
Kantoorbenodigdheden	€ 49,79	€ 0,00	€ 30,00					
handboek drukkosten	€ 0,00	€ 20,00	€ 20,00		Verliezen	€ 534,89	€ 650,52	€ 1.082,00
rest. contributie		€ 25,00						
Afschrijven hardware	€ 45,00	€ 0,00						
Resultaat uitgaven	€ 3.520,26	€ 3.424,12	€ 3.542,00		Resultaat ontvangster	€ 3.520,26	€ 3.424,12	€ 3.542,00

Balance 31-12-2016

Activa	2015	2016	Passiva	2015	2016
ZKI spaarrekening	€ 9.354,50	€ 8.625,60	Eigen vermogen	€ 9.348,25	€ 8.699,86
Bank	€ 1.409,25	€ 1.045,26	contributie volgend jaar	€ 1.560,00	€ 1.090,00
Kas	€ 0,00	€ 0,00			
hardware	€ 119,00	€ 119,00			
hardware betaald 2016	€ 25,50				
Totaal	€ 10.908,25	€ 9.789,86	Totaal	€ 10.908,25	€ 9.789,86

Overview hardware to sell; end 2016

Aantal	product	Waarde p.s.	Tot. waarde
0	GODIL	€ 70,00	€ 0,00
0	Sparkfun USB	€ 17,00	€ 0,00
0	switched stab.	€ 8,50	€ 0,00
3	HRPT print	€ 5,00	€ 15,00
8	WRX1700 print	€ 13,00	€ 104,00
Tot.			€ 119,00

Overview bankaccounts end-year.

	2011	2012	2013	2014	2015	2016
Spaarrekeningen	€ 10.625,00	€ 10.101,44	€ 10.220,41	€ 9.905,62	€ 9.354,50	€ 8.625,60
Betaalrekeningen	€ 1.656,02	€ 1.533,93	€ 1.675,72	€ 1.628,19	€ 1.409,25	€ 1.045,26
Kas		€ 8,82	€ 1,82	€ 1,82	€ 0,00	€ 0,00
Totaal	€ 12.281,02	€ 11.644,19	€ 11.897,95	€ 11.535,63	€ 10.763,75	€ 9.670,86

These are the amounts of the various accounts at the end of a calendar year.

Overview members and revenue.

	Realisatie 2015		Begroting 2016		Realisatie 2016		Begroting 2017	
	aantal	inkomsten	aantal	inkomsten	aantal	inkomsten	aantal	inkomsten
Nederland	83	€ 2.075,00	77	€ 1.925,00	77	€ 1.925,00	72	€ 1.800,00
Buitenland	20	€ 600,00	20	€ 600,00	21	€ 630,00	21	€ 630,00
Speciale leden	9	€ 0,00	9	€ 0,00	9	€ 0,00	9	€ 0,00
tijdelijk vrij	0	€ 0,00	0	€ 0,00	0	€ 0,00	0	€ 0,00
Totaal	112	€ 2.675,00	106	€ 2.525,00	107	€ 2.555,00	102	€ 2.430,00

The number of members continues to decline. In 2017 5 members have terminated their membership, so we are now at 104 members. Of these, at the time of this writing, still 1 member needs to pay. (Yet to be recovered: 25 euros)

The following table shows the attrition seen in the last five years.

jaar	af	bij (tot nu toe)	aantal leden
2017	-5	2	104
2016	-6	1	107
2015	-8	2	112
2014	-10	9	118
2013	-19	7	119

Rob Alblas

treasurer

Arne van Belle, per 31 maart 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	morning/afternoon
FengYun 3A	none	1704.5	AHRPT new high speed format
FengYun 3B	none	1704.5	AHRPT new high speed format
FengYun 3C	none	1701.3	AHRPT new high speed format
Metop-A	uit(137.100)	1701.3	LRPT/AHRPT
Metop-B	none	1701.3	Only AHRPT
METEOR M N1	uit(137.100 LRPT)	1700.0	Black image
METEOR M N2	137.100 LRPT	1700.0	LRPT / MHRPT
NPP	none	7.75-7.85 GHz X-band met 15Mbits/s	

Fengyun 3A, 3B and 3C only transmit AHRPT out, this is not to be received with a standard HRPT receiver and decoder. Unfortunately, this AHRPT is not fully according to the standard so that even a Metop AHRPT receiver is not suitable for the FY-3 series!

Fengyun 3C has different data rate than 3A and 3B (3.9 Mbps). Harrie van Deursen is receiving and demodulating these satellites.

Unexpectedly Meteor M N1 was active again after it suddenly failed in September 2014. Unfortunately, there are problems with the stabilizer so that the images were often useless and probably is the satellite therefore expelled since March 21.

NPP (NPOESS Preparatory Project) only transmit on the X-band of 15 Mbit / s. It is recommended a tracking dish with diameter of 2.4 m! The successor JPSS-1 will transmit only on the X-band.
http://npp.gsfc.nasa.gov/sciencedocs/2015-06/JPSS-1SpacecraftHRDtoDBSRFICDRev-May302012-470-REF-00184.pdf
Sentinel-3A is successfully launched, this long-awaited successor Envisat will not receive directly but via EUMETCast.
http://www.esa.int/dut/ESA_in_your_country/The_Netherlands/Sentinel-3A_met_succes_gelanceerd

After almost 20! years of service on March 31 took the Meteosat 7 from the air

GEOSTATIONAIR	APT (MHz)	(SDUS)/PDUS (MHz)	Baanpositie
MSG-4 (MET-11)	1691 LRIT	1695.15 HRIT	3.4 graden W, in testfase
MET-10	1691 LRIT	1695.15 HRIT	0 graden W, operationeel
MET-9	1691 LRIT	1695.15 HRIT	9.5 graden O, RSS
MET-8	geen LRIT	-	3.5 graden O, Back-up
GOES-E (no. 13)	1691 LRIT	1685,7 GVAR	75.0 graden W via Eumetcast
GOES-W (no. 15)	1691 LRIT	1685,7 GVAR	135 graden W via Eumetcast
GOES 14	1691 LRIT	1685,7 GVAR	105 graden W, Backup
GOES 16			launced on 19-11-2016
Elektro-L1	1691 LRIT	1693 HRIT	76 Graden Oost, via Eumetcast
MTSAT-1R	1691 LRIT	1691 HRIT	140 graden O, Backup voor MTSAT2
MTSAT-2	1691 LRIT	1687.1 HRIT	145 graden O, via Eumetcast
Himawari-8	geen LRIT	geen HRIT	Operationeel, only via HimawariCast
Himawari-9			launched op 2-11-2016
FengYun 2D	-	-	86.5 graden O
FengYun 2E	-	-	104 graden O, nu via Eumetcast
FengYun 2F	-	-	112.5 graden O, Backup

MET-10 is now the operational satellite can be received via EUMETCast.

Lanceringen	
FengYun 3D	launch in 2017
MetOp-C	launch in oktober 2018
JPSS-1	(NOAA 20 after commisioning) 23 september 2017

EUMETCast since Dec 31, 2014 receive only DVB-S2 VCM Eutelsat 10A at 10 degrees East!
In order to further growth of the amount of data transmitted via EUMETCast in the future to allow for EUMETSAT is proceeded in August 2014 to DVB-S and DVB-S2 with VCM mode.
The new transponder sits on Eutelsat 10A, 11263 MHz H and which is positioned 10 degrees East.
The broadcasting standard DVB-S2 8PSK 3/5 VCM (Basic Service) or 16APSK 2/3 (High Volume Service) with a symbol rate of 33 Msps. Unfortunately, DVB-S and most of the "DVB-S2 without VCM" recipients no longer usable. With a special driver, some recent DVB-S2 receivers to make more suitable for Basic Service Only. (only the TBS-5980 and Skystar 2 eXpress HD, unfortunately this is not true for the Skystar HD USB box)
The signal at 10 degrees East has higher bandwidth and therefore weaker than before.
Recommended dish diameter is 80-90 cm for Basic service and at least 120 cm for High Volume Service.

During heavy rains, the signal will disappear sooner and longer.
The reception of EUMETCast data for amateurs free of annual fee, you must, however, register at EUMETSAT. Once you have software (60 Euro) and purchase key (40 Euros).
In the EO Portal can EUMETCast users log on and access their personal data and settings and adjust if necessary. Also, registration as a new user and extending the license is possible here. You can choose online which products you want to receive your EKU.
The new improved Tellicast Client is finally out. You can receive this via EUMETCast "Info Channel 1". Only on request Eumetsat will send a new CD. Incidentally, the new client is only really necessary if you want to receive High Volume Service faultless.
Thanks to David Taylor and Douglas Deans for the info.